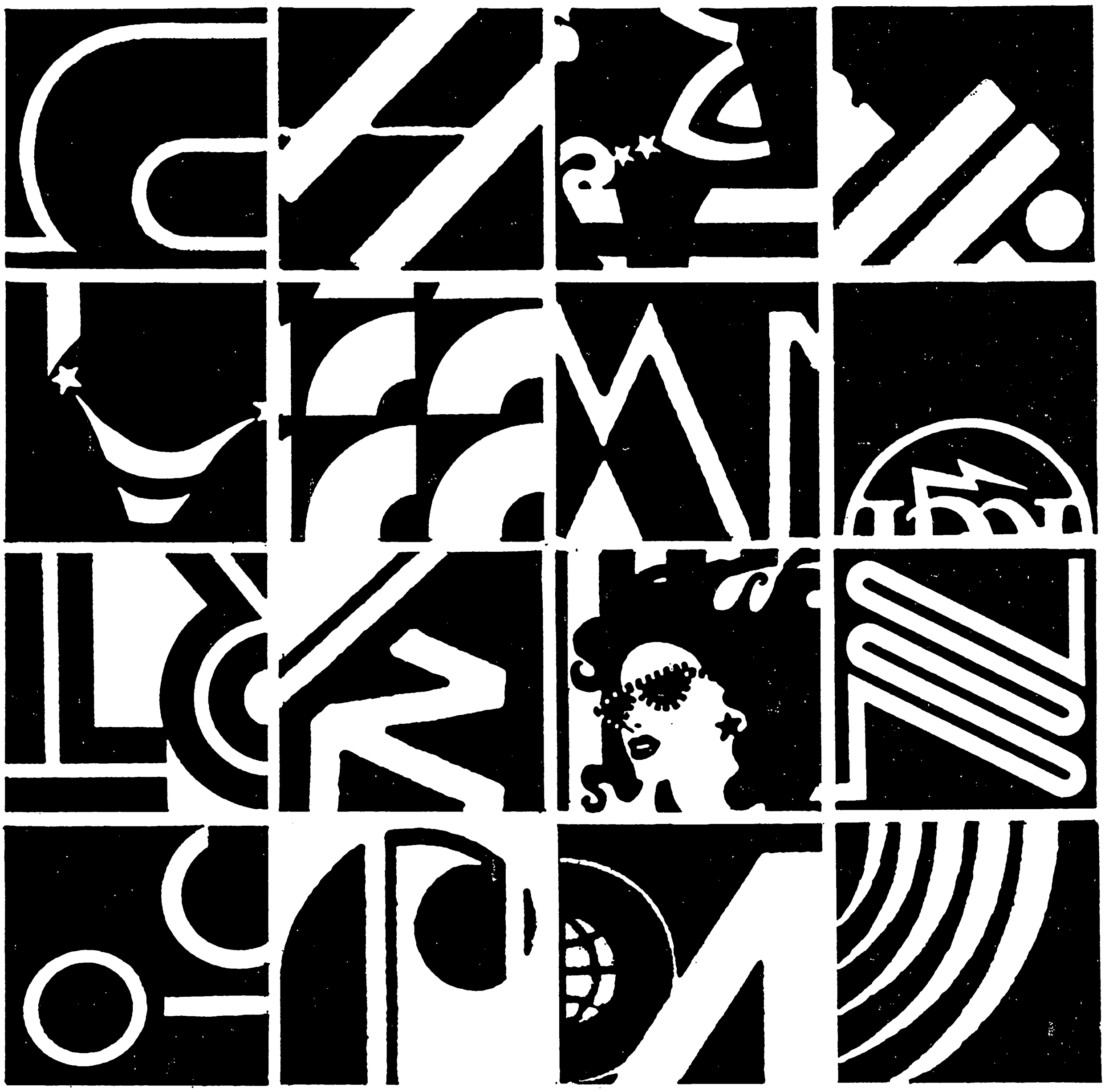

fine tuning's

PROCEEDINGS 1992 1993

COVER DESIGN

The front cover image this year was created by Staffer John Bryant. It is a puzzle. Most of the puzzle's mosaic images were created from portions of logos from electronic manufacturers or from pennants or stickers sent to listeners by international SW broadcaster stations. For example, the second element from the top on the far the right-hand side is a portion of the familiar RCA logo turned upside-down. Why not turn back to the front and see how many of the other elements you can identify? In total, there are images from eight equipment manufacturers and four international broadcasters. The "answers" to the puzzle will be found on the last page of one of the articles in *Proceeding 1992-1993*.

International Standard Book Number application has been filed.

fine tuning

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THE FIFTH ANNIVERSARY EDITION

Welcome to the Fifth Anniversary Edition of Fine Tuning's *Proceedings*. As many of our readers know, *Proceedings* grew out of a survey of FT members in 1987. That survey identified a need for specialized in-depth articles about the many aspects of hobby radio of interest to "senior" radio enthusiasts. In general, the radio hobby commercial press must serve the needs of the beginner and intermediate hobbyist. This is usually true of the hobby club bulletins, as well. Further, both forms of journalism have rather severe page count limits that discourage and/or eliminate lengthy articles.

Proceedings' "founding fathers" Mitch Sams and John Bryant also hoped that *Proceedings* could raise the level of discourse about all hobby-related aspects of radio. This has been accomplished through the mechanism of rigorous peer review of all articles, and by focusing the articles on the small population of life-long radio enthusiasts.

From the beginning we also hoped that *Proceedings* would act as an intellectual bridge between the various radio hobbies. Simply put, we had noticed really valuable pockets of knowledge in the MW DXing hobby and in amateur radio that were not being tapped by the SWBC DXing hobby (and visa versa). We believe that *Proceedings* is succeeding in this goal as well. *Proceedings* is now widely read in all the listening hobbies and is being purchased by senior radio amateurs. as well. Leading members of each hobby are also involved in the creation of each *Proceedings* as both authors and editors.

Proceedings has always been an international effort, with participation in all phases of the work by North American radio enthusiasts on both sides of the Canadian/US border. We are also pleased to report that we have readers on every continent and in the following countries: Australia, Papua New Guinea, Indonesia, Malaysia, New Zealand, Japan, Taiwan, Korea, Sri Lanka, Canada, USA, Cayman Islands, Ecuador, South Africa, Israel, Italy, Switzerland, France, Belgium, Netherlands, Germany, Denmark, Finland, Norway, Sweden and Great Britain.

In this edition, we welcome HCJB's Rich McVicar as our second overseas author. In future years, we hope to have more authors from other continents join in our efforts.

Indeed, in five years *Proceedings* seems to have become a radio hobby institution. We hope that it adds depth and pleasure to your enjoyment of the wonderful world of radio.

OUR BIENNIAL FUTURE

bi·en·ni·al (bī en′ē əl)

As you may have detected from the cover, we are introducing you to *Proceedings 1992-1993*. Since the inception of *Proceedings* we have maintained a constant focus on the quality of editorial content. We do think that those of you who own every volume will have observed progressive improvements in graphics, printing and consistency of presentation. Now, with the collective experience of five volumes behind us, we think that *Proceedings* has attained a professional standard in all respects. Since the articles are, we believe, the best our hobby has to offer, we feel strongly that both our authors and our readers deserve this correspondingly high quality of printing and graphics.

As you might imagine, the laser-printing, half-tone pictures, professionally drawn charts and illustrations found in recent our editions have added immensely to our overall staff workload. So, while the preparation of each volume has been very much a "labor of love", the truth of the matter is that reality has caught up with us. Simply stated, we have recognized the need for an adjustment.

At our annual staff meeting in August, with many, many hours of "finishing touches" still ahead before we could bring you this edition, we reflected on the matter very carefully. Collectively, we determined that **effective with this fifth edition**, a biennial publication cycle would be the best approach. Apart from rationalizing the planning and production workload of the staff, this will also allow more time for authors' research and development of "cutting edge" articles that you, our readers, have come to recognize as the hallmark of *Proceedings*.

In the field of European fashion and product design and art, very special international exhibitions are held every two years. Since a *Biennale* exhibition is necessarily limited in scope, only the very best works are accepted for exhibit. Art and design patrons eagerly look forward to each event from one cycle to the next. We hope that each biennial edition of *Proceedings* will be a *Biennale* experience for all of us.

TO THE NEW READER

If you are new to *Proceedings*, you should be aware that the process of creating *Proceedings* is unique in the radio hobbies. Each article goes through a nine month long gestation period that is modeled on the process used by most scholarly journals. That process, though cumbersome and complex, insures that each article is accurate, as complete as space will allow, and worthy of publication.

A description of the process and a list of the members of the Editorial Review Board are found in the section called "Editorial Process." An appendix at the back of this book contains brief biographies of authors, editors and staff members. For the first time, we are also listing the mailing addresses of the authors for your convenience.

You should be aware that *Proceedings* is intentionally a potpourri of articles ranging broadly across the spectrum of hobby radio. It is intended as a long term reference. Like our staff and long-time readers, we expect that you will find some articles more interesting than others. Also like the rest of us, you will probably find yourself rereading some of those "not so interesting" articles several years hence as your own interests change. Enjoy!

Finally, you may not be aware of Fine Tuning as an organization. The section called "About Fine Tuning" details our range of activities. It also contains the addresses for subscribing and contributing to the Fine Tuning SWBC DX newsletter, or purchasing further editions of *Proceedings*.

The staff extends a special welcome to new readers. We hope that *Proceedings* is of real benefit to you as you pursue your own interests in the world of radio. We would enjoy hearing any feedback that you might offer to help us improve succeeding editions.

COSTS AND SUCH

It should have come as no surprise that the total cost of *Proceedings* has gone up about 10% this year. Fortunately, this is our first price increase since 1989.

Looking back over the past five years, *Proceedings* sales have grown about 400%. That growth has allowed us to achieve some economies of scale. For a while, these economies off-set our gradual increase in unit costs. Everything from postage to paper to printing seems to increase every year. This same rapid growth in readers very quickly drove the scale of some of our production tasks beyond the size that our unpaid volunteer staff could handle.

Two years ago we began paying NON-staff people to handle the shipping, answer the many general inquiries and do the bookkeeping. All of this is being done for the flat rate of $2.00 US for each book shipped. So, since the beginning of the 1990 issue, our true shipping and handling cost have been $4.05 for US orders (postage + padded envelope = $2.05 for US orders). For the first year of this new arrangement, we were able to absorb this $2.00 cost increase through those "economies of scale." However, increasing costs caught up with us in 1991/92 and we actually lost money. Unfortunately, now our other costs have risen to the point that we MUST pass the true complete shipping and handling costs along to each of you.

We should also reiterate that each of our staff continues to serve in a totally unpaid volunteer mode. The staff, the Editorial Review Board and, indeed, each author continues to pay full price for their personal copies of *Proceedings*. This somewhat unusual arrangement is an effort to keep the costs to the reader at a "true cost" level. We regret this increase but have little choice, since neither the FT organization nor *Proceedings* have any other source of income or subsidy.

PROCEEDINGS 1992-93

As you will see, this edition has produced another group of truly excellent articles. Each will be of major benefit to many readers. You will find one expanded element in the *Proceedings 1992-93* mix. For the past several years, our staff has been aware of the growing interest in the "Roots" of radio and in older radio gear. We began to address this burgeoning interest last year with Match Sams' great article on SWBC in the 1980s. This timer, Jerry Berg takes us to the other end of the spectrum with a superb article on our "Roots" in the '20s and '30s. That article is accompanied several other articles featuring some of the most prominent radio receivers of the past: The HRO series, the Hallicrafters S-38 series, the Collins 51S-1 and the Hallicrafters SX-28. Although you may have slept through "History" in school, we think that you will enjoy these features.

You will also find reviews of the two most popular current major receivers, the Drake R-8 and the JRC NRD-535. *Proceedings* could have published reviews of these receivers last year. However, we view *Proceedings* reviews as the definitive USER reviews. As such, we think that the reviewers should use the equipment for at least a year before making definitive evaluations. We trust that you will find the long wait worthwhile.

IN APPRECIATION

First we would like to thank our readers for their enthusiastic support. That support, expressed through letters, conversations at meetings and the increasing number of readers, makes all of the work worthwhile. Thank you very much for your continued support.

We would also like to thank several prominent individuals and organizations for their help and support in the *Proceedings* effort: Jonathan Marks of Radio Nederland, Glenn Hauser, Rich McVicar and the staff of HCJB, Harold Sellers and the entire staff of ODXA, Bob Brown and Bill Oliver of NASWA, Ed Janusz of SPEEDX, Arthur Ward of World Radio Club, Larry Magne, Phil Bytheway of IRCA, and of course, Gerry Dexter and Don Jensen.

Most of all, we would like to thank the authors of *Proceedings 1992-93*. It continues to be a wonderful experience to work with some of the best minds in the hobby as they wrestle with the difficult task of writing. It is exciting to watch rough ideas turn into thoroughly developed and clearly written articles. We are sure that many of these articles will be helpful to the hobby for years to come.

WELCOME TO PROCEEDINGS 1992-1993!!!

John Bryant   Fritz Mellberg   Guy Atkins   David Clark   Elton Byington

editorial process

editorial process

Since the editorial process of *Proceedings* is unique in hobby journalism, it may be of interest to readers. First, where do the authors and articles come from? Mostly, they are recruited by the staff, though some of our very best articles also come from volunteers or arrive unsolicited. Authors submit rough drafts in March. Those rough drafts then take a twin track through the editorial process. One track runs through Hawarden, Iowa, where Fritz Mellberg edits all rough drafts for style, conciseness and clarity. A journalist before answering a higher call, Fritz is responsible for helping us communicate intelligibly with each of you. Please note, however, that Fritz works his magic at the **Rough Draft** stage! Since many of the articles are extensively rewritten for the Final Draft, grammatical errors, a few typos and some few instances of murky style creep back into the published articles. As with most scholarly journals, each author is entirely responsible for those matters in the final draft. We hope that you will understand and forgive us a few imperfections.

The second editorial track for Rough Drafts runs through suburban Toronto. There, David Clark assigns six or so members of the Editorial Review Board and at least two of the five Staff to review each article. David assigns these review responsibilities very carefully. He selects one or two members of the Review Board for their own expertise in the subject matter of that article; he chooses several to represent the "average" reader and one who neither knows nor cares much about the subject at hand. The Editorial Review Board is responsible for maintaining the standard of excellence for which *Proceedings* is known. The second and probably more important role of the Review Board is to assist each author with constructive suggestions so that the final article may have the benefit of the ideas of several experienced DXers. Most authors perform major revisions and incorporate many of the Board's suggestions and Fritz's markings in their final draft.

Guy Atkins has staff responsibilities for all of our publicity, including creating the striking and legible announcements and press releases that you have seen. His very professional work is a source of pride for the entire Staff. Guy also alternates with John Bryant as designer of the front cover. Elton Byington joined the staff in 1991 and has become our resident staff expert in several important areas. His career in both journalism and the technical aspects of telecommunication and his broad interests in virtually every aspect of radio afford "Bi" insights which have been very valuable to us all. John Bryant continues to be our straw boss or 'designated worrier', running the finances and generally overseeing operations. However, John wants it known that as *Proceedings* has matured, editorial decisions, big and small, are almost entirely made by the collective Staff. Except for the still computer-less Fritz, we are all in almost daily contact via Compuserve E-mail during the nine-month long gestation period of each edition. *Proceedings* is truly a collective effort.

The "peer review" process of *Proceedings* is, we believe, unique in hobby journalism. We patterned our process on the quality control peer review system used by most respected scholarly and learned publications. We believe that this elaborate, expensive, and rather ego-deflating process insures that the articles finally published in *Proceedings* are truly the best the hobby has to offer. We hope you agree.

Service on the Editorial Review Board is a difficult and thankless task. Each member must sit in sometimes rather harsh judgement of work done by fellow radio enthusiasts. The work of the Board is time consuming and must be done to a short and very rigid time schedule. *Proceedings* as an institution and each of its readers owes a very real debt to the members of the Review Board.

EDITORIAL REVIEW BOARD

about fine tuning

about fine tuning

fine tuning is an organization dedicated to supporting the hobby of Shortwave Broadcast DX. Founded in 1977 by well known DXer Dan Ferguson, FT originally published a bi-weekly newsletter of rare and difficult DX heard by leading shortwave enthusiasts throughout North America. To shorten the time between reception and publication, and to keep the work load manageable, membership in **fine tuning** was kept small and "by invitation." After several years, Dan turned over the editing and publishing chores to Larry Yamron who continues to serve as FT's publisher. In 1986, FT merged with the Ozark Mountain DX Club, a fully public DX newsletter founded and published by Mitch Sams. Mitch is now the Managing Editor of **fine tuning**. With the merger, FT adopted the "open organization" philosophy of OMDXC and continues today to welcome all radio enthusiasts interested in rare and difficult DX. Also in 1986, FT established its Special Publications arm led by John Bryant.

THE NEWS LETTER

The newsletter portion of **fine tuning's** services is published weekly during the DX season and bi-weekly during the North American summer. The newsletter, also called **fine tuning**, is a journal emphasizing rare and difficult DX. The bulletins feature SWBC news but also contain news of unusual merit from the medium wave, long wave, ham, utility, or TV DX communities.

There are five people currently involved in the production of the weekly issues of **fine tuning**. Four outstanding DXers serve as editors, each being responsible for two issues before handing off to the next editor. The weekly editors are: Dave Valko, Larry Yamron, Mitch Sams and Mike Nikolich. The back-up editor is John Wilkins. Managing Editor Mitch Sams also maintains FT subscriptions, finances and responds to sample requests. Publications of FT is handled by Larry Yamron.

Cost per issue of the **fine tuning** newsletter is 65 cents per issue in the US, 70 cents (U.S.) in Canada and overseas is 80 cents via AIRMAIL. Minimum order of 30 issues. Make checks or money orders payable to FINE TUNING

FINE TUNING
c/o Mitch Sams
779 Galilea Ct.
Blue Springs, MO
64014 USA

Sample copies of the **fine tuning's** newsletter may be obtained from Headquarters in Blue Springs for $1.00 US.

SPECIAL PUBLICATIONS

The Special Publications of **fine tuning** was established in 1986. This arm of the organization has published a number of well received geographically oriented *DXers Guides*. The *DXers Guide to Latin America*; *The DXers Guide to Indonesia*; *The DXers Handbook: Indonesia* and the bi-annually published FT/OZDX *Survey of SWBC Activity in Indonesia*. However, the main effort of Special Publications is the publication of the widely acclaimed *Proceedings* of **fine tuning**. *Proceedings* is a now biennial collection of indepth articles and papers on all aspects of radio. Although its main orientation is toward the SWBC DXing community, *Proceedings* intentionally serves as a bridge for cross-fertilization of knowledge from MW DXing and the radio amateur community. Currently, Special Publications is committed to maintaining stocks of all back issues of *Proceedings*. Further information on *Proceedings* or other FT Special Publications may be obtained for an SASE from:

FINE TUNING'S SPECIAL PUBLICATIONS
c/o John H. Bryant
Rt. 5, Box 14,
Stillwater, OK
74074 USA

antennas

COMPARISON TESTING
EIGHT ACTIVE OUTDOOR ANTENNAS
Bill Bowers

INTRODUCTION

A number of articles have been written on the various technical aspects of active antennas. Lawrence Magne in his White Paper on the subject[1] lists the gain versus frequency, 3rd order intercept and the noise figure of the electronics. Ted Benson[2] in his Antenna Survey gives an excellent description of the performance of a number of active antennas. The U. S. Army Electronics Command[3] publishes a pamphlet on "Electrically Small Antennas" which covers in depth all of the factors involved in active antenna design performance. With all of this information and the detailed manufacturers description given in the short wave equipment catalogs, it would seem like a simple matter to choose the "best" active antenna. This is not the case!

Several years ago, in Houston, Texas, four active antennas were placed in a large attic space (no outside antennas permitted) and equal leads run to a four position switch and on to the receiver. With this set-up, it was very easy to find the best performing antenna in a subjective way. The procedure was that the antennas were switched around to find the one that gave the best signal. In many cases there would be one antenna that was significantly better than the others. The antenna that produced the best results was not always the one with the most impressive technical specifications or with the highest price tag.

Having now moved to Oklahoma with plenty of space the comparison testing of active antennas was repeated and expanded to include seven active antennas. Again they were set up through switches so that a direct comparison of performances could be measured and judges. In this new series of tests in Oklahoma a passive eighty foot sloper antenna was added to the test set up as a good accepted reference antenna.

TEST SET-UP

Some preliminary testing was done to find out how close the antennas could be placed without affecting their performance. It was surprising to find that the whips could be as close as two (2) feet without any noticeable change in reception. This test was not extensive or carefully controlled so to be on the safe side the antennas were mounted about six feet apart.

A 32 foot 2 by 6 inch board was placed across the garage roof, supported level, and running generally North and South. This board was about 17 ft. above the ground. The antennas were then secured to this board at equal intervals. The DATONG AD-370 dipole was mounted in a vertical manner at one end of the board.

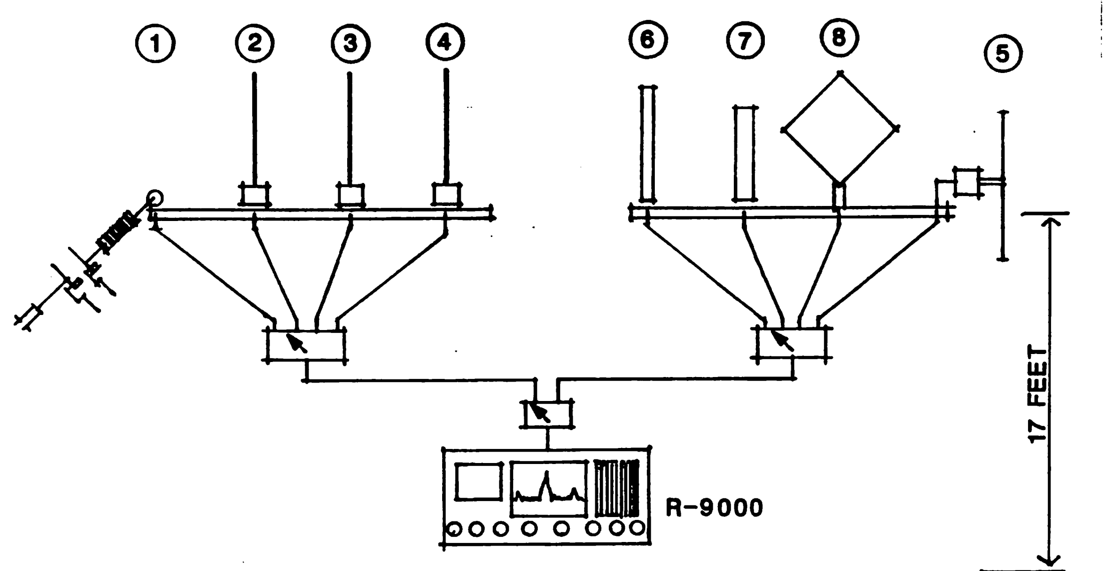


FIGURE 1. TEST CONFIGURATION

All mounting was temporary so that in the end, antenna positions could be changed to be sure there was not bias in the location.

Equal forty foot lengths of RG 8-X were used to connect the antennas to the switch boxes. Four antennas each were connected to a Daiwa CS-401 switch and the output of these two switches connected to a Daiwa CS-201 which was connected to the receiver. (Figure 1)

For the receiver a R-9000 was chosen over others simply because it has a 10 db. and 20 db. antenna input attenuator which was felt might be necessary with all the gain in some of the active antennas. The R-9000 also has a very large S-Meter and a spectrum display. These features helped in measuring signal and noise strength. Experience quickly proved it was very difficult to measure numerically the values of signal and noise on the S-meter so the spectrum display proved to be the best way to compare relative signal and noise values. (Figure 2)

CALIBRATION

Since the test of these antennas was to be a comparative one, it was not necessary to obtain an absolute calibration of the set up. A simple calibration of the spectrum scope deflection was carried out. This was done by selecting a strong signal and adjusting the R. F. gain to give a deflection of exactly 5 large divisions on the scope. The antenna attenuators were switched to give 10, 20 and 30 db attentuation. With each change of 10 db, the signal deflection decreased on the scope by one large division. This indicated that the scope was logarithmic and that each large division was 10 db.

Because the scope deflections were logarithmic then the ratio of two reading is their arithmetic difference ie: (S+N)/N db = [(deflection signal) - deflection of noise)] x 10 db.. [Remember from your algebra log A/B = log A - log B]

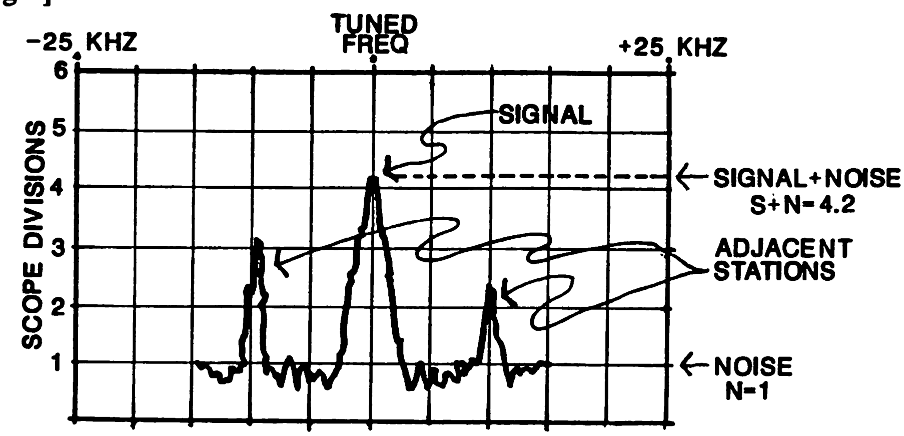


FIGURE 2. R-9000 SCOPE DISPLAY

TESTING

The tests were carried out on two different types of signals to cover the different interests in SWL. Test I was on signals of listening quality. This was usually S-5 or better. The second series, Test II, was for the DX'er who is trying to pull some intelligence out of a cesspool of noise.

PROCEDURE TEST I

The test procedure was quite straight forward. The R-9000 was set on AM, narrow IF, fast AGC and unless indicated, the antenna attenuator was at 0 db. A station was tuned in and then the strength and noise were observed on the scope and the deflections recorded. With the spectrum display, it was easy to observe the height of the signal and the height of the noise deflections either side of the signal. (Figure 2)

The antenna selector switches were than moved to the next antenna and the signal and noise again recorded. This procedure was repeated through all the other antennas. After all 8 antennas were measured, the switches were then returned to the first antenna and the readings taken again. If the second reading of the first antenna differed by more than 1/4 scope division, all readings were repeated. If the propagation conditions were changing so rapidly that repeatability could not be achieved, then the test on that station was abandoned until a later date.

Time stations were used for most of the measurements, because of their uniform modulation and narrow band width. This allowed for enough space between adjacent signals to get a good noise reading.

In all cases, the antennas were operated at maximum gain, where adjustment was provided. At this test location there are no nearby AM, FM, or TV stations that could overload the amplifiers.

DATA TEST I

The measurements below are in units of deflection on the R-9000 scope. As explained previously these deflections are logarithmic; therefore the difference between the two readings is the ratio of (S+N)/N and since each unit of deflection was 10 db, then multiplying this difference by 10 gave the (S=N)/N value in db.

F-MHz	.060-WWVB			0.512 XKQ			KTOK 1.0-5KW-50 MILES			2.5-WWV		
UTC	19:00			19:47			20:15			20:28		
ANT	S+N	N	(S+N)/N db	S+N	N	(S+N)/N db	S+N	N	(S+N)/N db	S+N	N	(S+N)/N db
1	0.2	0	2	0.7	0	7	3.3	0	33	3.5	0.2	33
2	2.0	0.5	15	2.1	0.1	20	3.0	0.1	29	4.6	1.5	31
3	0.5	0	5	1.7	0.1	16	3.5	0	35	3.5	1.0	25
4	3.1	1	21	3.3	0.7	26	5.3	0.5	48	6.0	2.5	35
5	2.1	0.7	14	3.5	1.0	25	6.0	0.5	55	6.0	3.0	30
6	0	0	0	0	0	0	0.3	0	3	2.0	0	20
7	3.0	3.0	0	2.0	0.3	17	4.0	0.1	39	5.5	2.0	35
8	3.5	2.0	15	2.2	0.5	17	3.0	0.1	29	4.5	1.5	30

F-MHz	3.330-CANADA			5.00-WWV			7.335-CANADA			10.00-WWV		
UTC	02:38			02:50			03:11			18:33		
ANT	S+N	N	(S+N)/N db	S+N	N	(S+N)/N db	S+N	N	(S+N)/N db	S+N	N	(S+N)/N db
1	3.0	1.5	15	6.0	1.5	45	3.5	1.5	20	5.0	0	50
2	3.0	1.0	20	5.2	1.0	42	3.0	0.5	25	4.1	0.1	40
3	3.0	1.0	20	5.0	1.0	40	3.0	1.0	20	5.0	0	50
4	4.0	2.0	20	6.5	1.5	50	4.0	2.0	20	5.5	0.9	46
5	5.0	3.0	20	6.5	1.5	50	5.0	2.0	30	6.0	1.0	50
6	0.5	0	5	3.0	0.1	29	2.0	0.1	19	3.0	0	30
7	4.0	2.0	20	4.0	1.0	30	4.0	1.2	28	5.2	0.1	51
8	4.2	2.0	22	4.5	1.0	35	4.0	1.5	25	5.5	0.2	53

F-MHz	14.670-CANADA			15.00-WWV			20.00-WWV		
UTC	18:25			19:23			20:10		
	S+N	N	(S+N)/N db	S+N	N	(S+N)/N db	S+N	N	(S+N)/N db
1	2.5	0	25	2.8	0.1	27	1.0	0	10
2	3.5	0.5	30	3.0	1.0	20	2.0	0.3	17
3	2.8	0	28	2.2	0.1	21	1.0	0	10
4	3.5	0.6	29	3.0	1.0	20	1.5	0.2	13
5	4.0	0.8	32	3.0	0.5	25	2.0	0.6	14
6	2.8	0.1	27	2.0	0	20	0	0	0
7	3.0	0.8	28	2.7	0.6	21	1.0	0	10
8	2.0	0.2	18	1.7	0.1	16	0.5	0	5

RESULTS TEST I

There is no clear cut winner in these tests. There are however several important general conclusions that can be made:

1. Antenna # 6 (Diamond D-707) has very low sensitivity and it provided a usable signal only between 5 to 15 megahertz. The gain of this antenna was so low that it was double checked. The co-ax cable was changed, the amplifier was changed and finally a second antenna was installed, but the results were the same. Unless you have excessive gain in your receiver, this antenna would not be a good choice.

2. Antenna #5 (Datong-370) and #4 (MFJ-1024) followed closely by #2 (McKAY DAMEK DA-100D) and #7 (DRESSLER ARA-60) gave the best performance across the frequency test range. These antennas appear to be the best over all in gain and signal to noise ration. The choice of the best suited for a particular set up might be in the different features in the control boxes and price. (See Appendix)

PROCEDURE TEST II

To test antennas for Dx'ing, a <u>barely</u> readable signal was tuned in using the reference antenna and then each other antenna was switched in rapidly to determine if the signal was "the same", "better", or "worse", or not readable at all.

For this test the reference antenna would be No. 1 (Alpha-Delta Sloper) and then each antenna would be rated as: S, the same; -1, poorer, but readable; 0, not readable at all; or +1 and +2 as better than S. This type of test is very subjective and no numerical signal valves can be measured at these levels as the signals are well below the S-meter readings, but the results are meaningful.

In looking at the results, keep in mind that the Alpha-Delta Sloper is an excellent outside antenna so that an S or even a -1 rating of an active whip antenna is a good performance.

The receiver used in this series of tests was a RACAL-6793A. This receiver is extremely stable, has a low noise front end, wide dynamic range and tunes in 1 Hertz steps. It was set in the AM mode, fast A.G.C. and a 3.2 khz IF filter.

No attempt was made to stay on a station long enough to identify it as it was important to switch antennas rapidly before propagation conditions changed.

DATA TEST II

B	LF	MW	120	80	75	60	49	41	31	25	21	19	16	13	11
F	.206	.720	2.390	3.250	3.913	4.800	6.090	7.27	9.540	11.655	13.666	17.63	17.63	21.45	25.9
UT	01:56	04:00	12:15	12:20	12:30	02:28	12:50	12:55	13:00	02:48	13:10	12:20	12:45	13:00	13:30
1	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
2	+1	+1	+1	S	S	S	S	S	S	+1	S	S	+1	S	+1
3	+1	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4	+1	+1	S	S	S	S	S	S	S	S	-1	S	S	-1	S
5	+1	+1	S	S	S	S	S	S	S	+2	S	S	+1	+1	+1
6	0	0	-1	0	-1	-1	-2	-1	S	-1	-1	-1	-1	0	-1
7	0	S	S	S	S	S	S	S	S	S	S	S	-1	S	S
8	+1	+1	+1	S	S	S	S	S	+1	+1	S	S	S	S	-1

B-Band In Meters, Except: LF=.15 to .5 MHz, MW=.50 To 1.7 MHz; F-Frequency In MHz; UT-Time In UTC

RESULTS TEST II

The S rating is a station received on the Alpha-Delta Sloper that was <u>barely</u> distinguishable in the noise.

This data indicates that active antennas compare favorably with and outside antenna. In fact, some active antennas surpassed the sloper antenna in several frequency ranges. It is important to <u>remember</u> that a +1 or +2 rating means that as the antenna switch was flipped back and forth between the active antenna and the reference antenna, there was a <u>definite</u> improvement in signal readability.

CONCLUSIONS

For general SW listening, all of the active antennas, with the possible exception of NO. 6, provided very good performance. The best choice would probably depend on the frequency range of interest, the features of the control box and of course, the price.

For DX hunting, three of the antennas; McKay Dymek DA-100D (2), MFJ-1024 (4), and Datong AD-370 (5), regularly produce signals as good or sometimes better than the long wire sloper.

If I were to pick one active antenna as being the overall best, it would be the DATONG AD-370. It gave top performance in both series of test, however it is pricey and lacks many control box features that could be important to someone else.

One other factor that is important to consider in the choice of an active antenna is overloading. If these antennas are used near a strong AM station, the system can be overloaded at both the antenna amplifier input and the receiver input. The receiver input problem is easily solved with a filter or attenuator, but there is no nice solution to the problem of antenna amplifier overload. The problem of overload was not included in these tests. If you live in a strong signal area you should also consider the information in the references.

APPENDIX

After a thorough search through the literature, the following seven active antennas were chosen as apparently the highest quality available on today's market. Only antennas suitable for outside mounting were considered.

1. ALPHA DELTA DX-SWL SLOPER*
   Frequency range - 0.5 to 30 mhz
   Output impedance - 50 ohm
   Antenna length - 60 feet
   Universal Radio - $67.95

2. McKAY DYMEK DA-100 D
   Frequency range - 0.5 to 30 mhz
   Output impedance - 50, 100, 500 ohms
   Attenuator - 0, 10, 20 db
   Gain Control - none
   Antenna height - 56 inches
   Universal Radio - $179.95

3. SONY AN-1
   Frequency range - 0.15 to 30 mhz
   Output impedance - 50, 75 ohms
   Attenuator - 0, 20 db
   Gain Control - none
   Antenna height - 59 inches
   Universal Radio - $84.95

4. MFJ-1024
   Frequency range - 0.05 to 30 mhz
   Output impedance - 50 ohms
   Attenuator - 0, 20 db
   Gain Control - none
   Antenna height - 54 inches
   Universal Radio - $129.95

5. DATONG AD-370
   Frequency range - 0.2 to 30 mhz
   Output impedance - 50 ohms
   Attenuator - none
   Gain Control - 0, 12 db
   Antenna height - 2 X 4 in., dipole
   E. E. B. - $149.95

6. DIAMOND D-707
   Frequency range - 0.5 to 1500 mhz
   Output impedance - 50 ohms
   Attenuator - none
   Gain Control - 0 to 20 db
   Antenna height - 37 inches
   Universal Radio - $149.95

7. DRESSLER ARA-60
   Frequency range - 0.2 to 30 mhz
   Output impedance - 50 - 75 ohms
   Attenuator - none
   Gain Control - 0 to 10 db
   Antenna height - 37 inches
   Gilfer - $189.95

8. R. F. SYSTEMS DX-1
   Frequency range - 0.05 to 50 mhz
   Output impedance - 50 ohms
   Attenuator - 0, 6, 10, 20, 30, 40 DB
   Gain Control - none
   Antenna height - 48 inches
   Universal Radio - $359.95

ENDNOTES

[1] Magne, Lawrence *"RDI Evaluates Active Indoor Antennas"*, Radio Data Base International

[2] Benson, Ted WA6BEJ *"The SWL Antenna Survey"*, Tiare Publications

[3] Goubau, G. and Schwering, F. *"Proceedings of the ECOM-ARO Workshop on Electrically Small Antennas"*, U. S. Army Electronics Command

LISTENING TO A DREAM

Don Moman, VE6JY

When someone mentions a high frequency log periodic antenna, one thinks of massive arrays on embassy buildings or at government and military monitoring stations. They are also used by the maritime and aeronautical services, as well as by anyone with the need to communicate over a variety of distances and frequencies in the HF spectrum. They maintain their gain and other electrical properties more or less uniformly over the design range of the antenna, without any need for traps, mechanical switching or antenna tuners. The log-periodic design is characterized by a logarithmic taper in both element length and spacing from one end of the antenna to the other. You can see many smaller examples of the log-periodic design if you live in an area where "all-band" TV antennas are popular.

Several years ago, most likely in the early eighties, I recall seeing an abandoned log-periodic antenna in an industrial area on the south side of Edmonton. It was massive, sitting on a wooden pole that must have been ninety feet tall and three feet across at the base. For someone with a small city lot and no supporting structure heavier than a collection of wooden poles, it was preposterous to even think about such a monster. Since it really was abandoned, I recall bringing a new receiver along one day and hooking it up to the severed coaxial cable. The receiver was the Radio Shack DX-300 and the result was complete overloading of the front end rendering the entire zero to thirty megahertz spectrum useless. All that accomplished was to convince me of the tremendous signal gathering properties of the log-periodic as well as the inadequacies of the DX-300.

Several years later, I found that a radio club in British Columbia had a very similar log periodic for sale. It had been donated to them by an oil company in Calgary and was too large for the tower the radio club had; so I wound up purchasing it. Without any paperwork or specifications, it's hard to be certain but evidence points to the antenna as being manufactured by Telrex and covering 9 to 16 mhz using a 46 foot long tubular boom. It was a start but what I really wanted was something that covered at least 6 to 30 mhz.

It was about then that I got real lucky! A local amateur acquired exactly what I had been dreaming about - a large log-periodic array covering the 4 to 30 mhz region. The boom length was over 60 feet, the largest element was over 80 feet long and the entire array weighed over 1000 pounds. It was not new but it had never been assembled, and was still in the original shipping crates with all the hardware and instructions. It even was complete with the matching rotator. The story I heard was that the antenna was originally ordered from Sabre Communications [1] by Imperial Oil as a replacement for a similar antenna which had just been destroyed by an ice storm in Alaska.

This was apparently the "foul weather" version, strengthened to survive under the worst conditions. The project then was cancelled and the antenna sat around in a warehouse in Edmonton for several years. To make a long story short, which isn't possible at this stage, I convinced him I needed the log-periodic more than he did and purchased it from him. The rotator stayed behind to turn a massive 50 Mhz Moon Bounce antenna array.

It's a good thing the blueprints were still enclosed because it really was a gigantic meccano construction set. The boom of the log-periodic is a 18 inch triangular tower, made entirely of aluminum and bolted together, not welded or riveted. Apparently the blueprints were not for the version I had, since they showed a welded boom. After a few trial and error sessions all 62.5 feet of tower/boom was assembled. Even at this early stage of construction, it was already too heavy to move about by hand. By the time one adds the 19 elements and the mounting hardware, the entire antenna weighs in excess of 1100 pounds. The log-periodic that failed in the arctic broke in half due to severe icing conditions. Even though mine was the heavy duty version, I decided it would be wise to install a truss support for the boom. The elements are not trussed so there is a fair bit of sag in the larger elements, but they are constructed of very substantial aluminum tubing, starting at 3 inch OD with .25 inch wall thickness and tapering down to .5 inch at the very ends. The first 4 elements use loading coils to increase their electrical length to resonate in the 4 to 6 mhz region. Overall, the first 5 elements are 82.5 feet long, with the other elements progressively shorter, with the nineteenth element only being about 6 feet long. In total, nearly 1000 feet of aluminum tubing is used in the antenna. You should stand under the tower with a stiff wind blowing and listen to the wind in the rigging!

Installation of such a heavy and cumbersome antenna is best accomplished with a large hydraulic crane. The manual shows a "simple" way to erect the log-periodic on an eighty foot tower with a winch and gin pole arrangement. It doesn't look that simple. In my situation, with the 120 foot tower already in place, the crane was the quickest, simplest and the safest. The log-periodic is bolted to a saddle arrangement that is bolted to a short section heavy mast. The crane picked up the entire assembly and merely lowered the mast into the thrust bearings already mounted in the tower. The process took less than 45 minutes, the culmination of weeks of preparation and years of dreaming. The log-periodic is installed 121 feet above ground level, on fairly high ground which provides a good takeoff angle in all directions. The tower is situated about 150 feet away from the house and the antenna is fed by 300 feet of 1/2 inch low loss heliax cable. All control and signal cables run underground from the tower to the radio room.

As one can imagine, a rotator capable of turning, stopping and holding this array has to be a substantial unit. The specifications indicate a wind area of 40 square feet, but that is for the original version. As mine uses much wider bracing material, plus with the added truss hardware, I'd estimate the wind area to be at least 50 or 60 square feet. Initially I used a large Wilson 1000 rotor, rated for 40 square feet, as a 8temporary measure. I kept shearing the bolt that either joined the two sections of mast inside the tower or the one that pinned the mast to the rotator. After shearing a 1/2 inch grade 8 bolt, I decided that the next thing to go would be the brake and gears in the rotor, so I got busy and installed the unit that is still in use now, and which has been essentially trouble free. A large worm gear with a 60:1 ratio was installed at the 80 foot level. It is driven by a 3/4 horse, reversible, electric motor and connected to the worm gear with some reduction pulleys. Overall turning speed is set to make one complete revolution in just over 2 minutes. No brake mechanism is required as the worm gear design provides its own braking action. The motor has plenty of torque to get the system turning, even at -30 degree temperatures with a 80 km breeze. Getting the performance at -30 degrees and even colder meant draining the oil from the gearbox and replacing it with kerosene!

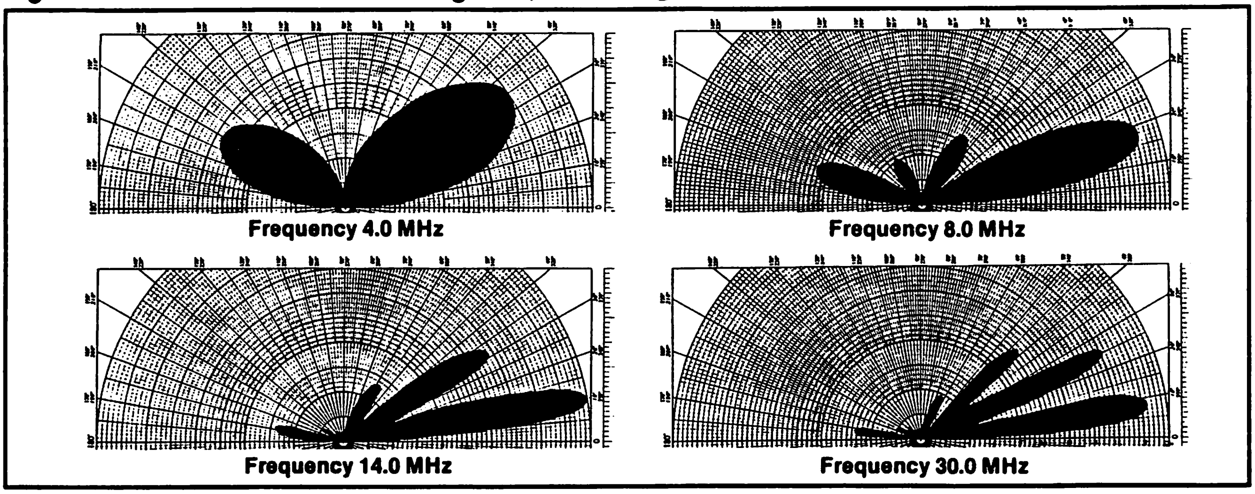
Figure 1 Installation using a crane

PERFORMANCE

According to the manufacturer's literature, the Sabre MLP-4 has a rated gain of 9 db at 4 mhz, increasing to 13 db at 8 mhz and above. Front to back ratio, never a strong point of the log-periodic design, is rated at an average of only 12 db. Since no db reference is given, such as dbi or dbd, one cannot compare these figures directly with other antenna specifications which are usually referenced to the gain of a dipole, dbd. I was told by someone knowledgeable about such things, that they usually added in a 5 or 6 db "ground reflection gain" to arrive at the above figures. The antenna is a compromise in both spacing and element length at the lower end of its coverage. The literature states that the "MLP-4 is a fore shortened log-periodic array covering the 4.0 thru 30 Mhz frequency band continuously with a reduced physical size of approximately one-half that of a full scale array."

The arrival angle of signals can have a dramatic effect on the performance of any antenna. Looking at the plot for the vertical radiation pattern at various frequencies one can see there is a main lobe at a fairly low angle plus, depending on the frequency, one or more other high angle responses. These plots are for an antenna 80 feet high, mine is at 120 feet so the main lobe of my antenna will be at a slightly lower angle. In between these are angles where the gain of the antenna is very low, and in some cases, the response of the beam in a certain direction might be better if the back of the antenna was pointed at the signal! In the real world I have noticed large variations in the front to back and front to side performance of the antenna, especially below 8 mhz. Sometimes the antenna can be rotated through 360 degrees and the signal hardly changes at all. Other times the signal will rise out of the noise floor to S9 plus, real armchair copy. It all seems to depend on the arrival angle, a difficult entity to measure or predict.

Figure 2 Vertical Patterns over average soil, Antenna @ 80 feet



As a good friend of mine is always telling me, having one antenna is like only having one idea - how do you know if it's any good? The log-periodic has been up since June 15, 1989. It has been compared and tested thousands of times against other antennas, both receiving and transmitting. Other antennas include: 5 element 20 meter monobander at 72 feet, Cushcraft ATB-34 10/15/20 meter triband beam at 50 feet, various wire antennas including 80 meter inverted Vees and delta loops, 160 meter inverted Vee, 132 foot transmitting vertical for 160 and 80 meters, a 60 meter sloping dipole oriented toward Africa, and assorted beverage antenna. All the wire Vees and dipoles were hung at various points off the 120 foot tower that also supports the log-periodic.

Going back through my logbook for the summer of 1989, I noticed I had jotted down a few quick signal comparisons. In the "Other" column I used whichever of my other beams and wire antennas that gave the best signal. Meter readings are from a reasonably well calibrated Kenwood TS-440 transceiver.

Station		Log	Other
2500	WWV	S2	S9+10
4880	S. Africa	S1-2	S1, poor (60m)
4890	PNG	S2	het, no audio
5020	Solomons	S9+10	S2, not listenable
		S2 with	beam at 90 degrees
6080	CKFX	S5	just detectable
6160	CKZU	S8	S1-2, noisy, fading
7255	Nigeria	S9+10	S7

Station		Log	Other
14918	Kiribati	S2	S2 (5 el 20m)
15010	Vietnam	S5	S7 (5 el 20m)
15084	Iran	S5	S2, noisy
15171	Tahiti	S7	S5 (5 el 20m)
15175	Denmark	S7	S6 (5 el 20m)
17705	New Zealand	S6	S1
21810	BRT Belgium	S4	S2 (triband)
25730	Norway	weak, clear	nothing

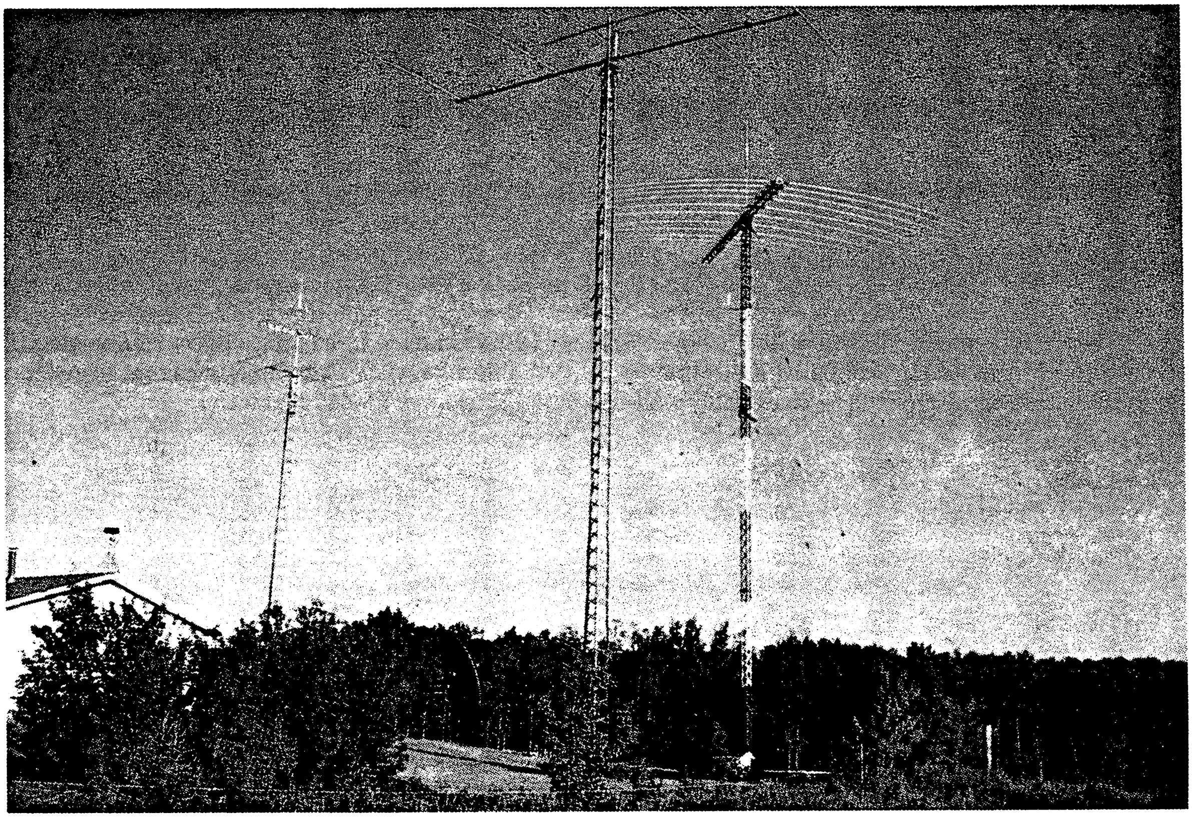
In many cases and especially so on the 60 and 49 meter bands, the advantage of the log-periodic is even greater than the simple advantage in S meter readings, due to the reduction in QRM and noise due to the directional characteristics. On the higher SWBC bands, the log-periodic is often able to separate two co-channel signals, as long as they are arriving from two directions differing by 60 degrees or more. The overall improvement in signal readability using the log versus other non directive wire antennas, is often enough to make the difference between comfortable listening and just being able to tell there is something there. Beams designed for the amateur bands usually perform well on adjacent SWBC bands, for example the 20 meter monobander performs very well on 19 meters. Trapped beams usually have more of a narrow response, the 10/15/20 meter tribander I have performs reasonably well on the 13 meter band but poorly on 19 meters.

The lower limit of the log-periodic is rated as 4 mhz and as such performs poorly on the 120 and 90 meter bands. Recently I have become keenly interested in 80 meter ham band DX, where the SSB DX window is around 3790 to 3800 khz. The log-periodic exhibits a very high SWR below about 3950 khz so I can't use it for transmitting down at 3800, but it does prove to be a superb listener there. It acts just like a beverage, the background atmospherics, static crashes and even local powerline noises are often reduced dramatically in relation to the desired signal. The log does exhibit a bit of directionality down this low, but with very minimal front to back. At this frequency, it's likely acting more or less as a rotatable dipole. About 99% of the time it is the best 80m DX receiving antenna I have. On rare occasions, the Vee or delta loop will exhibit the same signal to crud ratio as the log-periodic, but usually they are far noisier. On certain nights the beverages work well, and I remember only a couple of instances where they were superior to the log, hence the other 1% goes to them. For non DX 80 meter contacts the inverted Vee is usually the winner.

On the higher amateur bands, the log has proven to be a very good performer. No other 40 meter beams are presently in use here, but tests with other amateurs show comparable performance to other 2 and 3 element monobanders. On 20 meters, the log often gets compared to the 5 element monobander, which is at a lower height. The two are quite often even in performance but occasionally one or the other shows a significant advantage. This is most likely due to the difference in heights favouring a certain arrival angle. On 15 meters and especially on 10 meters, the log-periodic is often too high and is easily outperformed by the tribander at 50 feet! However on certain paths, or during unusual or transitional propagation conditions, the extra height helps. Although not a very scientific result, I seem to have noticed that while the received signal may be the same or even lower than the tribander, I am heard a lot better when using the log. This has been observed in many contest and pileup situations, after calling with no response many times on the other antennas, I'll rotate the log around and get through on the first or second call.

For those interested in pursuing their own dream antenna, the manufacturers [1],[2],[3] listed at the end of this article are among the ones that produce "small" log-periodic arrays with lower frequency limits of 6 Mhz.

Figure 3 Final Installation at 120 feet



Finding, installing and using the log-periodic has been quite an adventure, from the beginning to the present. It has also been quite an education! I had no significant formal or practical knowledge about erecting large guyed towers or dealing with rotating such a large array. I do now. Was it worth it all? Yes. Would I do it again? Yes, and I probably will. Lately, I've been thinking about what I could do with say, 160 acres of antenna land. Rosettes of beverages, arrays of rhombics..... then the dream ends. Or perhaps it is just beginning... again.

[1] Sabre Communications Corporation, 3400 Hwy 75 North, P.O. Box 536, Sioux City, Iowa 51102. (712) 258-6690 fax (712) 258-8250

[2] KLM/Mirage Communications, PO Box 1000, Morgan Hill, CA (408) 779-7363

[3] TELEX/Hy-Gain, 9600 Aldrich Ave So., Minneapolis, MN 55420

GROUNDS FOR IMPROVED RECEPTION

Nick Hall-Patch, VE7DXR

It's usually recommended that a receiver be attached to a "good ground", often without much detail as to what this consists of or why one should do it. This article will define a ground, discuss the difference between powerline and RF grounds and describe how each works, enlarge upon the reasons for using a ground, describe methods of grounding, and, after giving the results of some experiments using different ground systems, will provide some pointers to what sort of ground to use in specific situations. It will be assumed that the reader has an initial mental picture of a "ground" as a copper rod or water pipe in soil, although other approaches will be described later.

WHAT IS A GROUND?

A ground is a point of zero potential, a reference point. For example, the chassis of a receiver is regarded as a ground by the circuits of the receiver. However, the zero reference point for the "live" side of the AC powerline is the earth itself. An external ground is an attempt to place a body of metal (the pipe or rod), and the receiver chassis to which it is connected, at the same potential as the earth itself. This approach will be described first, then it will be decided if that is what is really required for improved medium wave and tropical band reception.

The electrical resistance between the system and the earth itself is known as ground resistance and can be easily measured (see Appendix I). Ideally it should be zero; practically it may be in the tens to hundreds of ohms. The bulk of this resistance occurs between the surface of the ground rod or pipe and the soil itself and is dependent upon soil conductivity.

Conductivity is the ability of a material to pass electric current. The more conductive the soil is, the greater the chance of getting that chunk of metal to nearly the same potential as the earth. Conductivity increases with soil moisture, soil temperature and soluble mineral content. Unfortunately, surface soil moisture and temperature vary throughout the year, causing varying conductivity. The traditional ground system uses rods of six feet or more to take advantage of the more stable soil moisture and temperature at those depths.

Local ground conductivity can be improved by keeping the soil moist around a rod but a more radical difference can be made by the periodic addition of a handful of rock salt or Epsom salts to the area. Only the immediate area (within a foot of a rod) need be treated with salt, as the concentric layers of soil immediately around the rod are the most important so far as total ground resistance is concerned. Salts can sterilize soil so keep them away from valuable plants. Also, watch out for corrosion of the rod at the surface. Finally, salt will be leached away over time and will need to be renewed periodically.

Incidentally, surface ground conductivity can be measured with simple equipment. See Jerry Sevick's "Measuring Ground Conductivity" in March 1981 QST, p. 38; also see the ARRL Antenna Book but note that an AC isolation transformer was found necessary. A way of deducing ground conductivity from ground rod resistance is found in Appendix I of this paper.

POWERLINE GROUNDS AND RF GROUNDS

A ground which is designed only for minimum DC resistance from ground rod to earth will be described here as a powerline ground, as it is the type of ground used at a building's main breaker panel to keep one side of the 110 volt AC line at earth potential. A powerline ground should provide a low impedance path from the equipment to earth at DC and low AC frequencies. Therefore ground rods should have a low resistance to earth and though length of the connecting cable from equipment to the rods isn't that important, it should have low DC resistance.

The household electrical ground could act as a receiver RF ground but noise problems are likely. Also an RF ground lead must be electrically short, i.e. much less than a quarter wavelength. At 5 MHz, "short" should be under 10 feet, and though longer runs might be tolerable at lower frequencies, most house wiring will not provide a short enough connection to provide a good ground. For a receiver RF ground, the connection could be made of large diameter stranded copper wire (#10 or better). Copper braid is supposed to have lower impedance and the braid from junked coaxial cable (the bigger the better) is an inexpensive substitute. Also, copper strip (copper flashing) or 1/4" copper tubing works well if the ground clamp will accept them. Ground clamps should be clean, placed over shiny metal, and be weatherproofed once attached. Low ground resistance continues to be important, though for higher frequencies and greater soil conductivity, resistance to the surface soil is more important. Also, the capacitance of the rod to earth becomes significant at higher frequencies as capacitive reactance decreases.

An RF ground is used with an unbalanced antenna such as a vertical, a random wire (inverted "L" or "T") or a Beverage, and its purpose is to complete the circuit at a receiver's input. A radio wave can induce a current flow in the antenna towards the receiver, but an equal amount of current must flow away from the receiver. In a dipole for example, the current flows toward the other half of the dipole. A vertical antenna or random wire[1] is normally modelled as one half of a vertical dipole, while the RF ground acts as the other half of the dipole. In this case, the equal amount of current is induced in the soil (and from the ground rod) by the portion of the radio wave which is travelling under the earth's syrface. (Note that half a cycle of the radio wave later, current will flow out of the earth, through the receiver, and into the antenna).

Because radio waves cannot penetrate deeply in conductive soil, especially at higher frequencies, the bulk of the earth currents are generated within five feet of the surface, implying that a short ground rod may be all that is needed at shortwave frequencies, as long as it has low resistance to the surface soil. (See Figure 1)

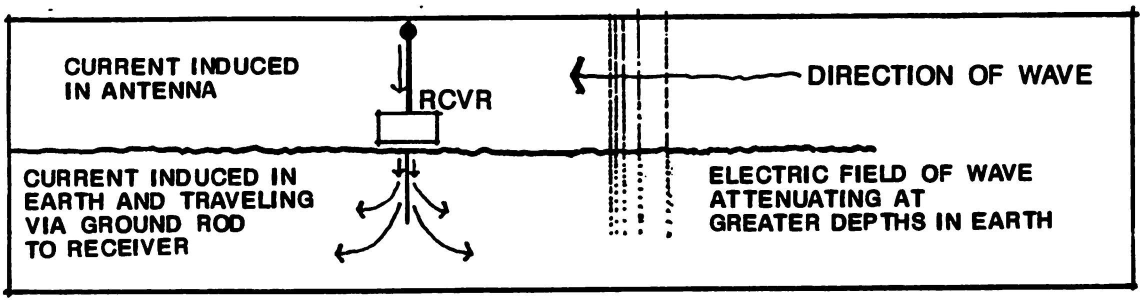


FIGURE 1. Illustration assumes a vertically polarized wavefront with no tilt and no slowing down of wavefront in the earth.

With a Beverage antenna, the RF ground also completes the antenna circuit, but in this case, the earth (as coupled to by the RF ground) is acting as the other side of a two-conductor transmission line.

One class of RF "grounds" has so far been left out of the discussion altogether: the radial system. Radials are lengths of wire laid on or under the ground to which the ground terminal of a receiver or transmitter is connected; they radiate outwards from the base of a vertical antenna. Notice that this type of "artificial ground" may have an infinite ground resistance if there is no DC connection with the earth, but they still complete the antenna circuit, the same way that the other half of a dipole does. Ground rods can be part of a radial system, and are often used at the base of an antenna.

WHY DO WE USE EXTERNAL GROUNDS?

The reasons for using an external ground are safety, reduction of received electrical noise, and for increased received signal strength. The last of these reasons is probably the most important for the diehard DXer, but the other two should also be considered.

GROUNDS FOR SAFETY

DXers' equipment is normally powered by household AC, and if a (rare) receiver fault occurs which puts household AC voltage on its chassis, it could subject the user to a shock. If the receiver chassis is placed at earth potential and the same receiver fault occurs, the resulting short circuit (remember that one side of the 110 volt line is at earth potential) will blow a fuse.

The third pin on AC power outlets is connected to the building's power line ground and if the receiver uses a 3-pin plug, it is likely grounded for safety. One needs to be cautious about connecting an external ground to the chassis of a receiver which uses a 2-pin AC plug. In vacuum tube receivers particularly, there may be a type of line filter which forms an AC voltage divider; as a result, current could flow between the chassis and an external ground. One can test for this potential danger by connecting a light bulb between the chassis and external ground; if it lights, there is a problem. Even if it doesn't light, check for current flow with an AC milliammeter. If there's no flow, you can connect the chassis to ground. However, if a recently-made unmodified receiver has an underwriters' approval sticker on it, then it is probably as safe as it needs to be, even if it uses a two pin AC plug.

Another concern is the safe discharge of static electricity, which can be built up on a wire antenna by precipitation or wind, thereby endangering sensitive receiver circuitry. On older receivers, such static charges were bled off to ground via inductive coupling to tuned RF amplifiers, but newer receivers rarely use that kind of circuit. It's therefore advisable to connect the antenna to ground outside the receiver via a 10k resistor and a neon bulb as suggested by Don Moman elsewhere in this book. Again, the third pin of the AC power plug should provide an acceptable ground for this sort of protection.

Although a ground can bleed off static electricity from an antenna, one should not trust a simple ground to protect your antenna or receiver against lightning. Elaborate low-resistance systems based on multiple ground rods and plenty of connective cabling have been used in commercial and amateur transmitting stations (cf Altman in the December 1987 CQ, pp. 76ff, or the treatment of the subject found in the ARRL Antenna Book), but the best and easiest protection for the listening post is to configure the antenna lead-in so that it can be easily disconnected where it enters the building. When lightning threatens, the antenna lead-in may be grounded externally to the building or it may be left hanging. It is also advisable at this time to pull out the AC power plugs to your equipment.

GROUNDS FOR NOISE REDUCTION

Man-made electrical noise is the only type which is affected by the type of external ground used with the receiver. Unfortunately, connecting an external ground to a receiver may make such noise problems worse than if one used no external ground at all.

To understand why such noise problems should develop, picture the live side of the AC powerline either as an antenna picking up electrical noise or as a conductor of electrical noise from elsewhere. The noise signal covers many frequencies, including the one being monitored, and can be capacitively coupled from the powerline to the receiver chassis. If an external ground is connected to the chassis, the noise signal will travel to earth through the ground resistance.

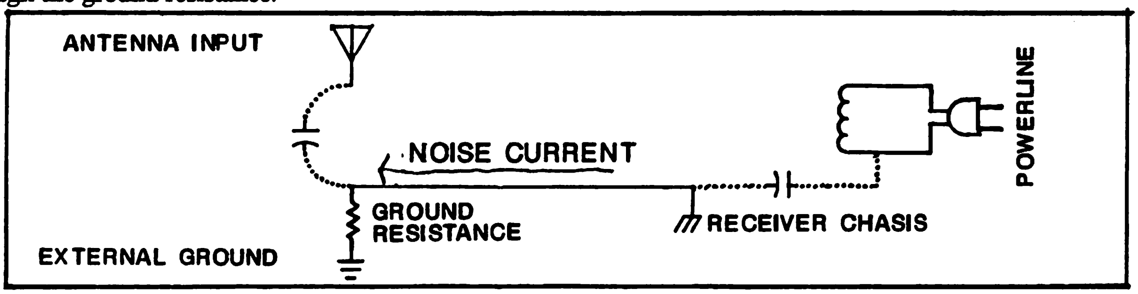


FIGURE 2. The ground resistance must be very low, otherwise the noise voltage developed across it may be capacitively coupled to the receiver antenna input. A "good" ground cuts down on the developed noise voltage which weakens the strength of received noise.

In some cases, local noise problems may mean that it is not practical to connect an external ground, particularly a mediocre one, to the receiver chassis. One possibility not tried here is to wrap the powerline around a ferrite rod just before it enters the receiver, providing an RF choking effect. Another possible solution is to use an input isolation transformer using a separate ground from receiver or powerline ground. The beverage matching transformer found in *Proceedings 1988* will work well; see diagram below.

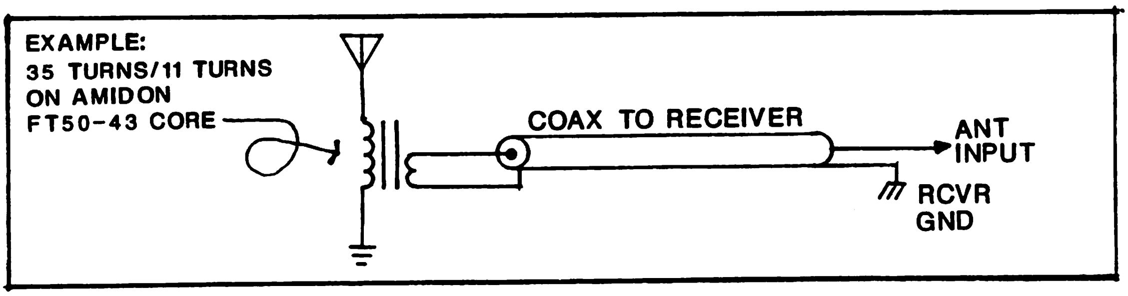


FIGURE 3. Note that this set-up also provides a path to ground for static discharge from the antenna.

GROUNDS FOR IMPROVED SIGNAL STRENGTH

Many DXers have found that connecting an external ground to a receiver has not improved receiver signal strength, yet Patrick Martin in Seaside, Oregon found that MW signal strength on his SP-600 improved as he added more ground rods to his system. For most of us however, the household power line ground seems to be as good an RF ground as anything that we are able to put into the earth ourselves.

Patrick's success with additional ground rods was probably due to his very conductive Pacific coast soil, but for the rest of us it is perhaps time to look at practical RF grounding systems to discover which are likely to deliver improved signal strength.

PRACTICAL GROUNDS

The use of a cold water pipe or copper rod as a ground have often been described before here and in other literature, but a brief recap is in order. If a copper water line enters a building near the receiver, it can be used as a ground connection, simply by attaching a short length of suitable cable (see "RF Grounds" above) from the receiver to a grounding clamp fitted onto the pipe.

Water pipe grounds may not work well if a joint underground is threaded, or mates with plastic pipe. The rest of the building's water system may also act as an antenna which could contribute to increased electrical noise or spurious signals.

Copper coated steel rods made for powerline grounding are available and are commonly 1/2" in diameter by six or eight feet long. Such a rod can be pounded into the ground near the receiver location, and again be attached to the receiver via a grounding clamp and suitable cable. Length of a ground rod is more important than diameter; doubling the diameter reduced ground resistance to earth by less than 10%, while doubling length reduced resistance by 40%.

If the local soil is dry or rocky, or if only short rods are available, or one simply wants the lowest ground resistance possible, then a multiple rod system might be the way to go. Such a system inexactly parallels the resistance to ground from each rod with the ground resistance of all the other rods. The classic arrangement has the rods spaced at 6' or more from each other, usually in series. These are connected together with braid, cable or copper tubing via ground clamps, and one end of the system is connected to the receiver with as short a conductor as possible.

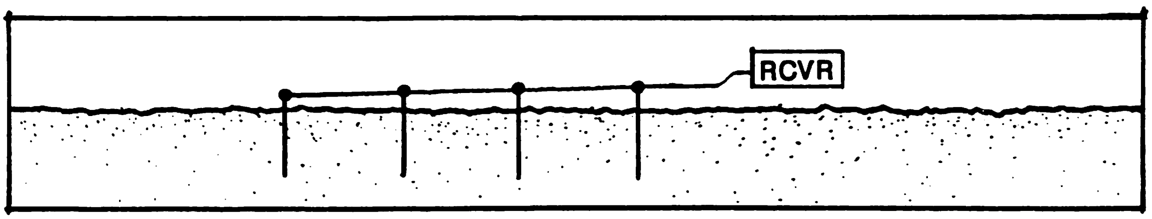


FIGURE 4. The SWG ground.

A variant of the multiple rod ground is the surface-wire ground (SWG) developed by the U.S. Army Signal Corps. It is 70 feet of 1/8" diameter wire configured in a loop on the ground around the radio equipment and held in place by 15 to 18 specially formed ground rods only 10 inches long. The loop is connected to the equipment by three equidistantly spaced cables.

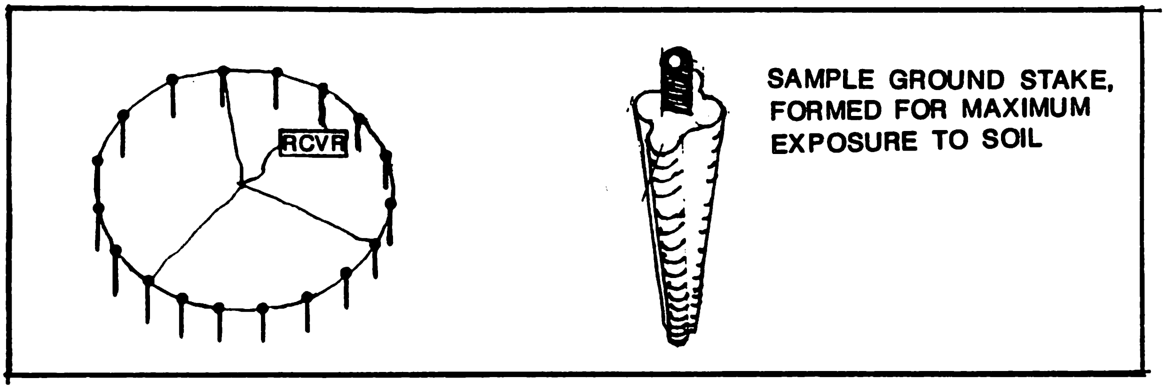


FIGURE 5.

One might contemplate using radials as a receiver ground, but the FCC requirements of a "minimum of 120 buried radials each 1/4 wavelength long" for AM broadcast stations would certainly be discouraging. However, those figures are for use with a 1/4 wavelength vertical; most low-band DXers use antennas with vertical segments much smaller than that. Fortunately, radio amateur researchers[2] have found that an antenna only a fraction of a wavelength long needs many fewer radials (no more than 40; even 4 or 6 gave reasonable results), that they need be no longer than 0.2 wavelength, and can be different lengths to fit the available space. A yet more efficient system was created when the ends of the radials were joined together. It was recommended that radials should be insulated and not be buried more than a couple of inches due to poorer penetration of radio waves through conductive soil as frequency increased. In fact, a counterpoise system (radials raised to six feet above ground) was the system of choice. It seems likely that a simple radial or counterpoise system could make a reasonable RF ground for receiving. In fact, a simple system may not look that much different from the SWG described above.

SOME OBSERVATIONS

I got the idea for this article when I realized that, although I was using very poor grounds on Beverage DXpeditions, I was getting quite reasonable signal strengths at the receiver. The soil at the expedition sites was damp but not particularly conductive; its rocky texture also meant that I was very lucky to get a rod into the ground more than 18 inches or so.

Indeed, experiments during July 1991 showed that a really minimal ground rod (8") in gravel and treated with salt water, delivered MW signals only one or two dB down from those heard using a 3 foot rod in salt treated mud. A Beverage matching transformer was used between antenna and receiver, as in Figure 3 above. Later, Don Moman told me that his Beverages with matching transformers delivered as much signal using a 6" ground rod in swampy soil as when using a 3 foot rod. Further experiments are needed to compare these "poor" grounds with a really low resistance ground once I can design one. But it did encourage me to find out whether "poor" grounds could also be successful with the more common random wire.

Similar experiments were attempted at home using a random wire made of a horizontal loop about 130' circumference at 15' high (using a 15' downlead). For frequencies up to a few MHz, this corresponds to a short vertical with a sizeable capacity hat. The reference ground system was four series-connected 6 foot long ground rods each separated by about 6 feet and directly connected to receiver ground as in Figure 4.

The following results were observed while using a Beverage matching transformer to couple the antenna/grounds to the receiver, as in Figure 3 above.

"Ground system" was the same as the multiple rod system used for reference, but was used with a matching transformer as indicated above. --local ground is clay loam; this was late summer 1991, and the soil surface was generally dry; 8" rod was in an area that had been watered. --"rod with salt" observations took place after the area had been treated with salt water.

f (kHz)	Ground System	8" Rod	8" Rod with salt
530	+ 9 dB	+ 7 dB	+ 8 dB
830	+ 8 dB	+ 4 dB	+ 6 dB
1560	0 dB	- 4 dB	- 1 dB
2500	0 dB	0 dB	0 dB
5000	+ 4 dB	+ 2 dB	+ 6 dB
10000	0 dB	+ 3 dB	---
15160	0 dB	+ 3 dB	---

NOTES:
"Ground system" was the same as the multiple rod system used for reference, but was used with a matching transformer as in Figure 3 rather than directly connected as in Figure 4.

Local ground is clay loam; this was late summer 1991, and the soil surface was generally dry; 8" rod was in an area that had been watered.

"Rod with salt" observations took place after the area had been treated with salt water.

No local electrical noise problems were noted when small rod was used.

For MW, a homebrew receiver was used, described in IRCA Reprint M56. It has a 50 ohm input, and due to inductive coupling to its first tuned circuit, provides a DC path from antenna to ground. Powerline ground is coupled -to chassis ground via stray capacitance.

For SW the Drake SPR-4 was used. It has a 50 ohm antenna input, also with a DC path from antenna to ground. Powerline ground is directly connected to chassis ground.

Early in 1992, similar experiments were performed, only this time, antenna and ground were connected directly to the receiver rather than via a matching transformer. The same reference ground was used as in the above set of tests and additional types of grounds were also evaluated.

f (kHz)	Receiver	Powerline Ground	Small Rod	6 Random Radials	SWG
530	Homebrew	-3 dB (noisy)	-3 dB (noisy)	-3 dB (noisy)	-3 dB
530	2010	-5 dB	-3 dB	0 dB	-5 dB
830	Homebrew	-1 dB	---	-9 dB	-5 dB
830	2010	-8 dB	-4 dB	-4 dB	0 dB
1560	Homebrew	-12 dB	-9 dB	-4 dB	+2 dB
1560	2010	-22 dB	-8 dB	+3 dB	-10 dB
2500	2010	-20 dB	0 dB	-6 dB	-8 dB
2500	SPR-4	-8 dB (noisy)	-7 dB	-4 dB	-8 dB
3360	SPR-4	0 dB (noisy)	0 dB	0 dB	0 dB
5000	2010	0 dB	0 dB	+3 dB	0 dB
5000	SPR-4	0 dB	0 dB	0 dB	0 dB
10000	2010	0 dB	-2 dB	+3 dB	---
15160	2010	0 dB	0 dB	0 dB	---

NOTES:

"Powerline ground" is whatever path to the AC powerline ground offered by the receiver in question.

Random radials varied in length from 14 to 35 feet arranged every 20 degrees over 100 degrees lying on the ground underneath the horizontal loop. An optimum system would have longer radials for the lower frequencies, cover the full 360 degrees, and be joined at the far ends.

SWG is surface wire ground as described above, (Figure 5) but ground rods were lengths of 3/4 inch copper pipe rather than the ground stakes.

When the 8" rod was used, little change in the results occurred when the area around the rod was treated with a salt solution.

Local soil is clay loam, damp at the time of the tests, likely with good conductivity. Ground resistance of various systems as derived by the set-up in Appendix I:

Multiple rod ground system	3.5 ohms
Small rod (8")	575 ohms
SWG	24 ohms
6 radials	infinity

2010 is the SONY ICF-2010, which does not have a DC path from antenna to ground; input impedance varies from 75 to over 200 ohms. Powerline ground is likely coupled to radio's DC ground via stray capacitance in its wall transformer.

Where "noisy" is parenthetically noted, local electrical noise was heard that was not observed using the reference ground system.

The above observations verify conventional wisdom, as long as the antenna and ground are connected directly to the receiver. The ground with the lowest resistance to earth (the collection of 6' ground rods), delivered the best signal strength with the lowest electrical noise, at least through 2500 kHz. Above 2500 kHz, that ground quickly lost its advantage.

The results were quite different when a matching transformer was used. A short ground rod delivered nearly as much signal as the larger system, with no worse response to local electrical noise. This is a particularly striking observation when the amount of work put into making the respective systems is compared. Note also that these observations took place when the surface ground conductivity was likely poorest, and therefore worst case for this area. In addition, the matching transformer with a "poor" ground almost always delivered a stronger signal than the best ground system did when it was connected directly to the receiver using the same antenna. Finally, the matching transformer provides a static bleed-off path and minimizes noise response if it is connected to a ground isolated from receiver and powerline ground. These experiments point out that the matching/isolating transformer is a powerful tool for those who cannot build the best possible ground system.

EXPLANATIONS

These are somewhat tentative, but are included for those who might investigate this subject further.

Why should the input transformer make such a radical difference? As far as rejection of electrical noise is concerned, it is important to isolate RF ground from chassis ground to prevent noise currents circulating through the chassis and being coupled to the antenna. The matching transformer does this very well.

Why does the Beverage work well with a poor ground and a matching transformer? The Beverage antenna can be modelled as a generator with a 500 ohm internal impedance; the load for this generator is provided by the input winding of the matching transformer and the resistance to earth of the ground rod. All these impedances can be modelled as resistances at medium and low frequencies; capacitive and inductive reactance exist but can be ignored. At higher frequencies, the capacitive reactance of the rod to earth in parallel with the ground resistance becomes significantly small, reducing ground resistance further.

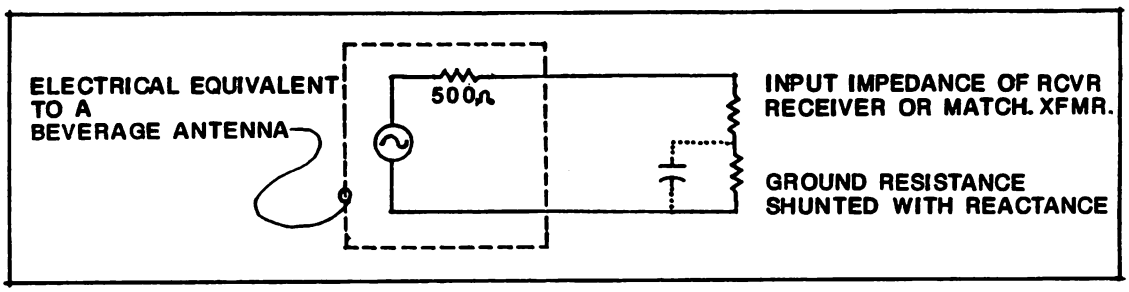


FIGURE 6.

Using voltage divider theory we will find that with a ground resistance of zero, half the voltage generated on the antenna will appear across the input winding of the matching transformer. But with a "poor" ground's resistance of 500 ohms, fully one-third of the voltage generated at the antenna will appear across the matching transformer winding. This is 3 dB down from the voltage developed with a ground resistance of zero....one half an S-unit. Such a difference might be significant in logging weak signals at dawn, but for temporary installations, the relative ease of setting up a "poor" ground may be more important than the loss in signal strength.

The explanation for why a poor ground and matching transformer should work well with a random wire is essentially the same, but the model of a random wire and ground is somewhat more complicated.

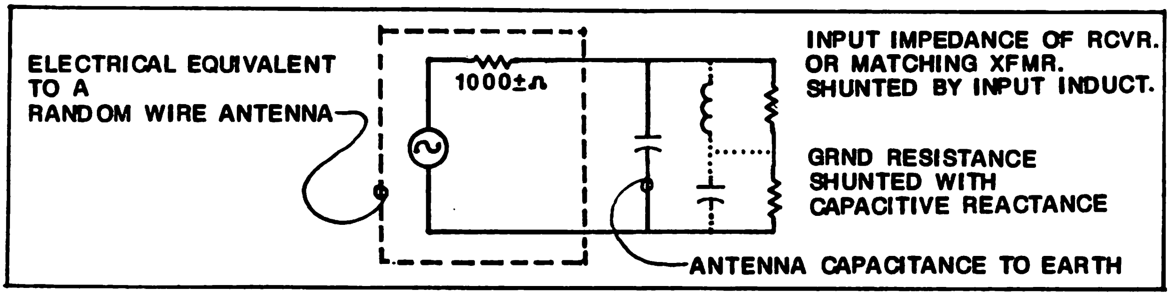


FIGURE 7

In this case, the random wire may look like a generator with an effective resistive impedance of well over 1000 ohms. The load is the inherent capacitance of the random wire to earth in parallel with the voltage divider formed by the input impedance of the receiver in series with ground resistance. Once again, capacitive reactance of receiver ground to earth can be ignored except at higher frequencies, where its low value is beneficial. Although the impedances involved are more complex in the case of a random wire, the basic voltage divider between the input of the receiver and ground resistance still exists. When a high impedance receiver input is used (such as is found when using a matching transformer), the voltage drop across a higher ground resistance becomes less significant, and relatively greater signal is delivered to the receiver.

In both the situations above, a receiver input of 50 ohms will have a correspondingly lower voltage dropped across it compared with the voltage dropped across the ground resistance. When using a low impedance receiver input, it is therefore important that ground resistance be low.

It is important to note that the Beverage matching transformer is not optimized for use with a high impedance (at medium frequencies) random wire. Further observations should be made using a 1000 or 2000 to 50 ohm transformer to see if yet greater signal strength results when using a poor ground.

CONCLUSIONS

A) The traditional emphasis in ground system design has been to get as low a resistance to earth as possible, implying deeply driven multiple ground rods. Although AC powerline grounds, transmitting grounds and lightning protection systems require a low resistance to earth, it is not essential for improved radio reception, unless one is listening at lower frequencies with a low impedance input receiver and with the ground system connected directly to the receiver chassis.

B) Safety considerations might seem to require a low resistance path to earth from a receiver chassis, but:

--Newer receivers need to have passed various underwriters' safety tests to be allowed on the market; if a safety ground is required, it will be provided via a 3-pin power plug.

--Older receivers should be assessed on a unit by unit basis before external grounds are connected; there may be a potential difference between chassis and earth, which would require that an external RF ground be connected via an isolating transformer.

--Direct Connection of an external ground may actually increase receiver response to local electrical noise.

--Bleeding off static charge from an antenna does not require a low resistance path to earth, simply a DC path. Other safety grounding requires a low resistance path to earth.

C) Using a matching transformer with an antenna and isolating the earth ground on the antenna side of the transformer from chassis ground on the receiver side will meet most DXers' requirements for improved reception with low response to electrical noise, especially below 2 or 3 MHz, even when using a "poor" ground.

MEASURING RESISTANCE OF GROUND ROD TO EARTH AND EARTH RESISTIVITY

One requires (in addition to the rod being measured): two ground rods of two or three feet length; a voltage source, I've used 6 and 12 volt batteries; a milliammeter (an inexpensive digital multimeter may be preferable to a VOM, as measured current may be quite small); ten feet or more of insulated wire.

Pound the two rods into the ground at least ten feet from each other and from the ground rod to be measured, in a triangular arrangement:

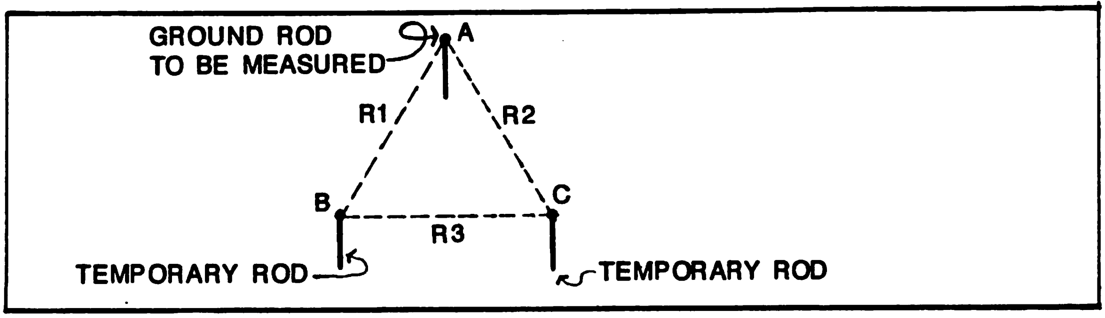


FIGURE 8. Connect one battery terminal to the ground rod to be measured (A), and connect the other (through the milliammeter and length of wire) to ground rod B. Using the voltage of the battery, the current through this circuit, and Ohm's law (R=V/I), calculate the resistance between the rods. This will be R1. Repeat the observation and calculation between rods A and C for R2, then for rods B and C for R3.

The ground rod resistance to earth (Rg) is found from the following formula:

$$Rg = \frac{(R1 + R2 - R3)}{2}$$

(I have not seen the following documented elsewhere, nor have I tried it, but the Sankosha Corporation in *San-Earth Technical Review* suggests finding ground resistivity using ground resistance (Rg) and the length of a ground rod (L) and its diameter (d):

$$\text{Resistivity} = \frac{2.75 \, Rg \, L}{\log \, (4L / d)} \quad \text{in ohms-meters}$$

The inverse of the above is ground conductivity.

Acknowledgement: My thanks to John Bryant, David Clark and Don Moman for providing some of the background material for this article.

D) A "poor" ground might be due to low soil conductivity, a short ground rod or both, but should still be connected to a matching transformer using as short a wire length as possible.

E) Soil conductivity can be improved by moistening the soil in the immediate vicinity of a rod, especially if salt is added. Improved surface conductivity seems to be improve signal strength, particularly below 2 or 3 MHz.

F) Unless the soil has very poor conductivity, ground rod depth becomes less important at higher frequencies, even if the rod is connected directly to the receiver. At these frequencies, the bulk of the ground currents generated by an incoming wave are close to the earth's surface. Above 5 MHz, an external ground doesn't seem to be of much use. Radials may help, but should not be buried more than a few inches. In fact they could be placed high enough to qualify as a counterpoise. For reception purposes, radials can be fewer and shorter than are the standards for AM broadcasting.

G) With a loop or dipole as a receiving antenna, an external ground does not appear to improve signal strength or response to electrical noise.

ENDNOTES:

[1]The sort of random wire which can fit on a city lot is modelled as a vertical for frequencies below 5 MHz, as the bulk of the signal pickup is on the vertical portion of the "L" or "T", with the horizontal portion acting as a "capacity hat", giving the antenna greater capacitance to earth.

It should also be pointed out that an RF ground is unlikely to improve the signal pickup of a balanced antenna such as a loop or a dipole. I haven't noticed any improvement in rejection of electrical noise using earth ground with these antennas either.

[2]Doty, Frey, and Mills, "Efficient Ground Systems for Vertical Antennas", QST, February 1983, pp.20-25
--Frey, "The Minipoise", CQ, August 1985 pp.30-39

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receivers

THE COLLINS 51S-1

AN 'S' LINE CLASSIC

David Clark

"All the major communications receiver manufacturers were in deep trouble during the second postwar decade, 1955-65...Collins lasted longer than the others because they were leaders and correctly judged the future shape of communications equipment.

"So, in 1957, as the old-line manufacturers [Hallicrafters, Hammarlund and National being the majors] made bigger and heavier receivers, Collins introduced the KWM-1, a complete 175 watt SSB transmitter and receiver, less power supply, in a package...weighing 15 pounds!

"Collins continued to push the new, small concept in 1958 when they replaced the 75A series with the 75S-1 receiver. They introduced their new 'S' line of ham equipment in November, 1958, with four page, full colour advertisements...its new long and low appearance can still be recognized in most receivers and transceivers to this day. The general coverage 'S' line receiver was the 51S-1 which was manufactured from 1959 to 1972." - Raymond S. Moore [1]

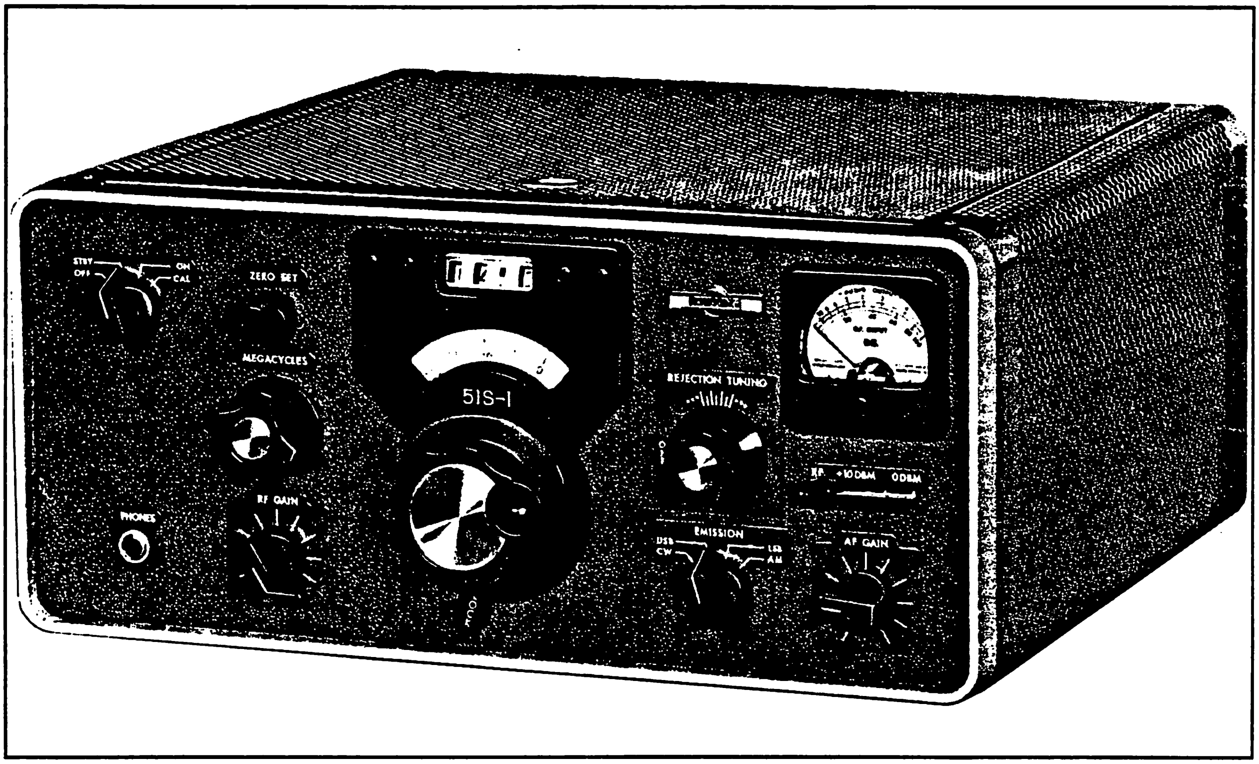

Figure 1. Illustration of the Collins 51S-1 Receiver

UNVEILING THE MYSTIQUE

Raymond Moore's research work indicates that there were two prototype designs preceding the release of the 51S-1. He notes that only one copy of a prototype model 51J-5 was ever produced. In 1957, the 51J-6 was conceived and appeared in a 1958 Collins catalogue. It seems that it was probably never produced but it did look very much like the forthcoming 51S-1. [2]

Both the 75S series and the 51S-1 were upgraded over the years and remained in production into the mid-1970's. What is the mystique that made this Collins series so desirable and enduring...or is it mystique? As one reviewer put it in 1969:

> *"There are special features in this equipment that were originally developed or pioneered by Collins for the attainment of a high order of frequency stability, calibration and readout, as well as RF and IF selectivity. These, along with soundly engineered design principles, have largely contributed to the success of much of the present-day [S-Line] equipment...The fine construction and workmanship found in the Collins gear, along with its refinements and excellent performance (as well as the cost) have instilled many to call it the Cadillac of amateur equipment. While this may be a matter of personal opinion, there does appear to be something about this equipment that makes one feel he is handling a product that bespeaks of rich quality". [3]*

As compared with the fine but more popularly-priced general coverage receivers available to hobbyists through the 1960's from manufacturers such as Hammarlund, National and Hallicrafters, very few of the vastly more expensive Collins receivers found their way into the hands of SWBC DXers. The majority were delivered to military markets and other government agencies. Although it's design was not originally mandated by military specifications as was the case for the earlier R-390 series, there are specific military designations for various versions of the 51S-1. In addition, a number of original manufacture 51S-1's were modified for the US military by another defense contractor. Limited quantities of this somewhat different-looking version appeared some years ago as surplus.

The 51S-1 was first available to the public in 1961 and sold for a hefty $1828. The 1963 selling price was already almost $2600...big bucks for any hobbyist in those days! The 51S-1 was listed for the last time in the 1979 edition of Popular Electronic's annual Communications Handbook with a "commercial class" price-tag of $4770!! By that time, Collins was no doubt selling off the remainder of the last production run from several years earlier. Raymond Moore says total production of the 51S-1 was 8,500 units. [4]

The 51S-1 was clearly designed as a top-of-the-line general coverage communications receiver. Actually, it is quite a bit more sophisticated (and expensive!) than its 'S' line amateur band brethern, the 75S-1/2/3, which appeared between 1958 and 1964.

Fifteen or twenty years ago, a used 51S-1 commanded roughly $1200. Today with the renaissance of interest in hollow state communications gear among both hams and SWL's, the 51S-1 is one of the hottest collector's items on the market. A receiver in clean condition easily fetches $700 or more. The trend indicates the price is heading back up.

A search of old North American DX bulletins uncovered only one brief user review of the 51S-1. In a submission to the April, 1972 edition of the North American Short Wave Association's FRENDX, Frank Peters explained that after some correspondence with Collins, he was able to obtain and install a 3.1 kHz mechanical filter for improved AM/ECSS reception. With that modification, Mr. Peters rated the 51S-1's performance as "fairly close" to the Hammarlund HQ-180 which he characterized as "the best DX-receiver on the market".

Apart from that submittal, a scan of the 52,000+ entry radio amateur bibliographical database ('FBTO') revealed just one minor profile of the 51S-1. [5] So, there is precious little documentation concerning the 51S-1 to be found in the hobby press.

TECHNOLOGY IN TRANSITION

The success of the Collins Radio Company through the years was due to its leadership role in developing "state of the art" equipment. The 51S-1 is evidence of this, for although it is generally classified as a tube-type receiver, it was in fact an early hybrid. In addition to its impressive lineup of 17 tubes, it also utilizes 1 germanium transistor and 20 semi-conductor diodes. Remember - this was 1959!

To put this into context, it wasn't until late 1964 that the National Radio Company released the first, all solid-state high performance general coverage receiver - the famous HRO-500. Two years later, R L Drake released its first hybrid (partially solid state) receiver called the model 2-C.

It is also interesting to note that the 51S-1 was, I believe, the first commercially produced receiver to incorporate a Q-multiplier for variable rejection tuning. It was subsequently introduced into the 75S line with the 75S-3 in 1961. Other manufacturers produced only a handful of receivers utilizing a built-in Q-multiplier, although it certainly became popular for quite some years as an outboard device.

We should not overlook the fact, however, that Collins did not abandon its pioneering accomplishments first manifest in 1946 with the introduction of the 75A series. The last of that line, the 75A-4 (1955-58) is still considered by many to have been 'the' classic tube-type amateur band receiver. It was the immediate predecessor of the 'S' Line.

Throughout the decade of the 50's and even through most of the 60's, other receiver manufacturers continued to utilize a tuned HFO (high frequency oscillator) with a crystal controlled second oscillator to achieve double conversion in an otherwise conventional superheterodyne circuit. No-so with Collins as Raymond Moore explains...

> *"This receiver [the 75A] introduced the multi-conversion fixed HFO circuit which eventually became the basis for most quality receivers well into the 1980's, until the step-tuned, fully synthesized receiver took over. In the 75A the HFO was crystal controlled and the tuning done with a permeability tuned VFO. The result was a degree of frequency stability and readout accuracy never before approached." [6]*

It is significant that the 51S-1 and its 75S brethern retained the same basic conversion scheme of their 75A ancestry.

GETTING TO KNOW THE 51S-1

Specifications from the very thorough Collins Instruction Manual are reproduced in Figure 2 below. Figure 3 on the next page is a block diagram of the 51S-1. It shows the principles of operation for this sophisticated receiver. Several tube substitutions in this diagram are indicative of later productions runs of the 51S-1, probably after 1964.

51S-1

FREQUENCY RANGE:
2-30 mc continuous coverage. Additional coverage from 0.2 to 2.0 mc for limited monitoring or laboratory use. With 55G-1 Preselector, 0.2-2.0 mc can be used for communications.

TYPE OF RECEPTION:
USB or LSB, AM, CW and RTTY.

CALIBRATION:
1 kc per dial division. Direct reading in megacycles and kilocycles. Circuit compensation for crystal finishing tolerances minimizes the need for recalibration when switching bands.

TUNING:
Frequency range, divided into linear one megacycle bands.

FREQUENCY STABILITY:
After 90 minute warm-up, frequency stability will be nominally within 100 cps per week, at normal room temperature.

SENSITIVITY:
SSB and CW — 0.6 uv for not less than 10 db carrier on-carrier off (2-30 mc); 3 uv for not less than 10 db carrier on-carrier off (0.5-2.0 mc); 4 uv for not less than 10 db carrier on-carrier off (0.2-0.5 mc). With 55G-1, 1.0 uv (0.2-2.0 mc).
AM — 3 uv for not less than 10 db S+N/N (2-30 mc); 15 uv for not less than 10 db S+N/N (0.5-2.0 mc); 20 uv for not less than 10 db S+N/N (0.2-0.5 mc). With 55G-1, 5.0 uv (0.2-2.0 mc).

SELECTIVITY:
SSB — 2.75 kc mechanical filter, 2.4 kc optional.
CW — 800 cps crystal filter, 300 cps optional.
AM — 5 kc (normal IF transformers), 6 kc with mechanical filter optional.

AGC TIME CONSTANTS:
Rise time — 0.8 millisecond.
Decay time — 0.1 second.

AGC CHARACTERISTICS:
Audio output variation less than 6 db for RF inputs from 5-50,000 uv. Not more than 3 db change in audio output with RF signals from 50,000 uv to 1 v.

REJECTION NOTCH:
Not less than 40 db.

BFO:
Supplied by 500 kc crystal.

RF INPUT:
50 ohms unbalanced.

CROSS MODULATION: (2-30 mc)

Desired Signal	Interfering Signal uv and % Removed 1%	2%	4%
5 uv	25,000	100,000	300,000
50 uv	50,000	150,000	800,000
500 uv	100,000	300,000	1 v

SPURIOUS RESPONSE:
Not less than 70 db (2-30 mc) except for 4.8-5.2 mc which is not less than 40 db. Image rejection is not less than 50 db (2-25 mc) and not less than 40 db (25-30 mc) measured at midband.

UNDESIRED RADIATION:
Antenna radiation is less than 500 picowatts across 50 ohms resistive (2-30 mc).

INPUT-OUTPUT METER:
Input calibrated in decibels above AGC threshold. Output level calibrated for either 0 dbm or +10 dbm.

IF OUTPUT:
500 kc; not less than 50 millivolts at 50 ohms with 5 uv RF input signal.

AUDIO OUTPUT:
4 ohms and 600 ohms unbalanced 1.0 watt, distortion less than 10%. Separate 600 ohm balanced output for connection to telephone line, distortion less than 1.2% at 0 dbm.

AUDIO FREQUENCY RESPONSE:
SSB — within 3.5 db, 350-3050 cps, line output; within 3.5 db, 350-3050 cps, local output.
AM — within 6 db, 100-2500 cps, line output; within 6 db, 200-2500 cps, local output.

AMBIENT TEMPERATURE RANGE:
0°-50° C.

AMBIENT HUMIDITY:
Up to 90%.

POWER REQUIREMENTS:
125 watts. 115 v or 230 v, 50-60 cps. 400 cps operation with reduced hum specification at full audio output. For 28 v dc operation, the internal ac supply unit is replaced by an optional dc unit.

DIMENSIONS:
Rack mounted — 19" W, 8¾" H, 15" D (48.26 cm W, 22.23 cm H, 38.10 cm D).
Cabinet mounted — 14¾" W, 7¾" H, 14" D (37.47 cm W, 19.69 cm H, 35.56 cm D).

WEIGHT:
28 lbs. (12.69 kg).

Figure 2. Specifications of the Collins 51S-1 Receiver

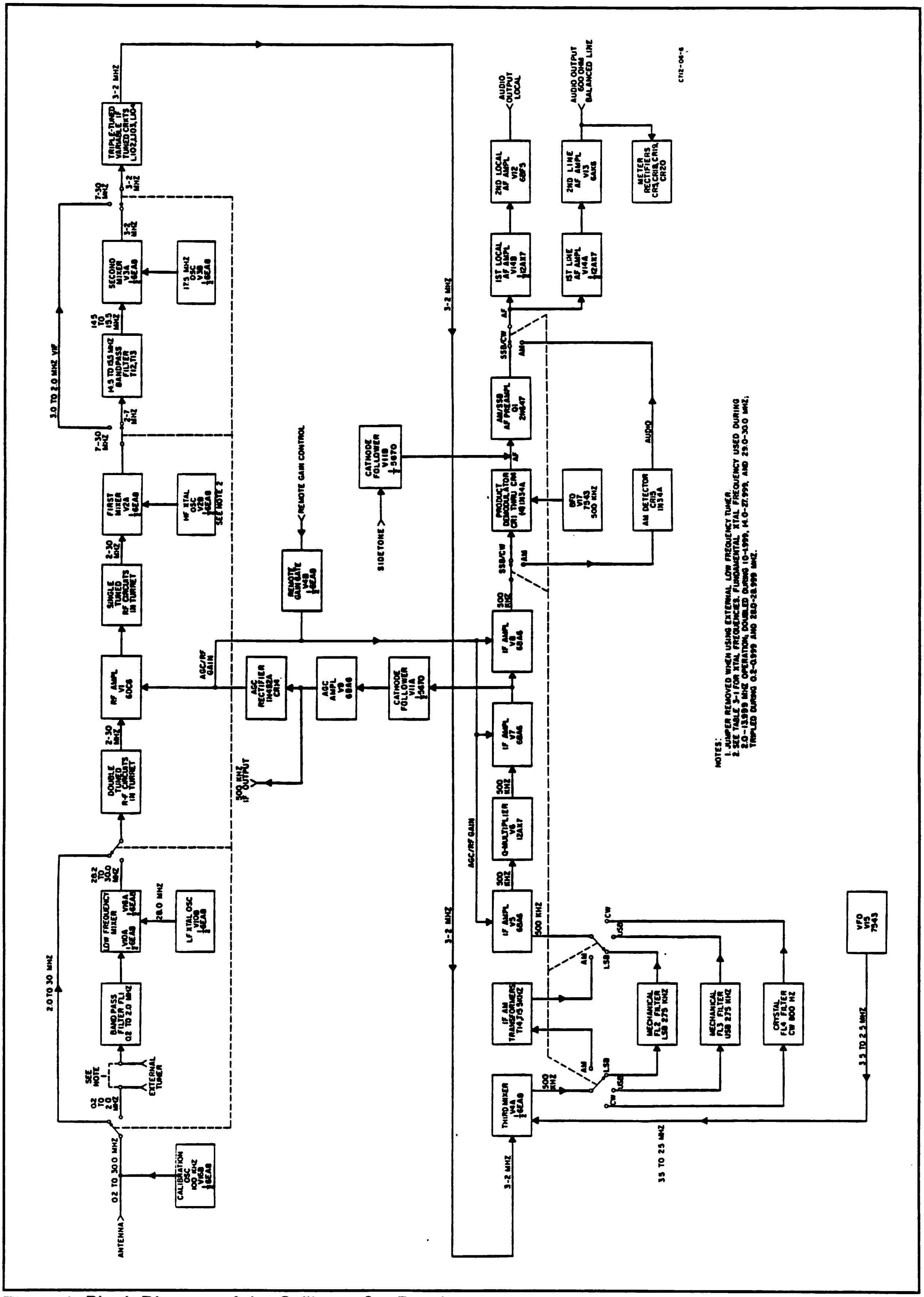

Figure 3. Block Diagram of the Collins 51S-1 Receiver

GENERAL DESCRIPTION AND FEATURES

Primary frequency coverage of the 51S-1 is 2 to 30 MHz in twenty-eight linear 1 MHz ranges. The desired range is determined by the Megacycles Selector Switch. (Refer to the Figure 1 illustration for identification of the front panel operating controls.) Direct frequency readout is provided with an odometer-type counter. The MHz Counter and the Tenth MHz (100 kHz) Counter which is ganged to the Main Tuning Control appear in the upper window. One kHz divisions (0 to 100 continuous) appear on the kHz dial window. Interpolation to within 500 Hz is possible when the Zero Set Control is used to align the hairline marker at the nearest 100 kHz point with the built-in Crystal Calibrator. A variable capacitor adjustment is accessible on the upper chassis to zero beat the calibrator to WWV. A Dial Lock slide switch is provided immediately below the main tuning knob.

A low frequency converter/bandpass filter combination is used to provide additional coverage, "for laboratory applications and broadcast monitoring" in the .2 to 2 MHz range, making for thirty ranges in all. An optional 55G-1 preselector (with built-in 4 ohm 5 x 7 inch speaker) must be connected for communications-grade performance below 2 MHz. The preselector provides for manual peaking of the signals in two switchable ranges - 200 to 600 kHz and 600 to 2000 kHz, and there is a bypass position. To date I have not be able to locate a 55G-1 and I suspect it is a mighty scare item.

The Instruction Manual specifies that "51S-1 series receivers require a good antenna with 50 ohm unbalanced feed". The RF front-end features an impedance-matching transformer and double-tuned antenna inductors to minimize spurious signal response and adjacent channel interference. As distinct from the less sophisticated 75S receivers, a preselection control (antenna trimmer) is not required since "band-to-band frequency coincidence" is achieved for each frequency range.

Image rejection characteristics are governed by the use of triple conversion for the .2 to 7 MHz bands and double conversion for the 7 to 30 MHz bands at a 500 kHz intermediate frequency. (The 75S series receivers used the more common 455 kHz IF.) As for frequency stability, the permeability tuned oscillator is claimed to limit drift to a nominal 100 Hz PER WEEK - after warmup at normal room temperatures, of course! The PTO is said to be "medium temperature-compensated", although there is no crystal oven.

The 51S-1 is capable of receiving USB/LSB, AM, CW and RTTY modes and selectivity at the output of the Third Mixer stage is governed by mode as selected with the Emission Switch. The AGC circuit is not switchable but is capable of providing automatic gain control to the RF and IF amplifiers such that AF output varies by not more than 6 db across a wide range of RF input voltages. Relative RF input levels can be observed on the high quality meter when the Meter Switch is set to 'RF'. Instructions specify that calibration should be adjusted to indicate 40 db for a 100 microvolt signal.

I think it's fair to say the 51S-1 was optimized for SSB reception. Upper and lower sideband are individually selectable with INDEPENDENT 2.75 kHz mechanical filters, so oscillator shifting is not required. Skirt-to-nose selectivity (60 to 6 db down) is unstated but probably a nominal 2 to 1, typical of Collins filters. The fast attack, slow-release time constants of the AGC seem tailored to optimize SSB reception too. An 800 Hz crystal lattice filter is provided for normal CW reception.

Standard AM selectivity is very wideband (5 kHz at -6 db; 22 kHz at -60 db), being governed solely by two coupled 500 kHz IF transformers. This is a serious limitation for AM mode DXing and even progam listening, except for strong, in-the-clear signals. It is interesting to note that the 51S-1 Instruction Manual suggests invoking the ECSS mode in circumstances of selective fading or adjacent QRM. However, for some reason Collins was never very interested in passband tuning - it would have been a welcome adjunct.

A switchable, series-type Q-multiplier between the first and second IF stages provides a bridged T-rejection notch filter centred at 500 kHz. It can be moved through the IF passband with the Rejection Tuning Control to deliver a minimum notch depth of 40 db for heterodyne rejection.

The Instruction Manual contains a special caution applicable for use of the Q-multiplier in AM mode:

> *"During AM reception with an interfering signal present, the resulting heterodyne may be tuned out by either of two settings of the Rejection Tuning Control. However, only one of the settings will allow the desired signal to be detected properly. Select the Rejection Tuning setting which yields the better intelligibility".*

In a review of the Collins 75S-3B which incorporated the same Q-multiplier circuit, Wilfred Scherer offers another useful tip:

"It should be noted that during on-the-air operation, the maximum effectiveness of the rejection notch (and sideband suppression) occurs when the RF gain is turned down, so that little or no AGC is in operation; otherwise the AGC may tend to defeat the purpose. This applies to other receivers as well". [7]

The AM mode diode detection is conventional but the Product Detector for SSB/CW modes is unique. It consists of four diodes in a diode-ring configuration. Here a 500 kHz crystal is used to inject the signal from the Beat Frequency Oscillator. The BFO is crystal controlled and not tunable. The aforementioned transistor is used in a SSB/CW preamplifier stage to provide impedance matching and gain between the output of the Product Detector and the first of the two-stage audio amplifiers. Notice that there is an identification error on the block diagram - it is labelled as an 'AM/SSB AF Preampl', whereas the circuit path correctly shows that output from the AM detector is fed directly to the audio output stages.

Two separate (two-stage) AF amplifiers are provided. The local amplifier provides 1 watt of audio output for an external speaker (either 4 or 600 ohms, unbalanced) and headphones - apparently 4 ohms although this is not specified. Plugging in headphones disables a speaker connected to the 4 ohm audio output. Rated audio frequency response is tailored to optimize voice intelligibility.

The line amplifier (600 ohms, balanced) provides a very low distortion 1 mw output, typically intended for remote monitoring devices or connection to a telephone line. As with other hollow state receivers having provision for a line output in the 500-600 ohm range, I use this to feed a tape recorder. The line AF gain, as indicated on the meter when the Meter Switch is set to the 0 or 10 DBM position, can be tailored with a set-screw adjustment located in the centre of the local AF Gain Control.

On the rear panel (see Figure 4), provision is made for a variety of external connections, most of which are mated with RCA phono plugs. Notice that there is provision for external RF gain control (by simplexing the audio output line) and an external VFO connection which allows for use of an external stabilized master oscillator for fixed channel selection purposes - these provisions would typically accomodate certain military or commercial installations. Although not mentioned in the Instruction Manual, the necessary provisions are available to "slave" two 51S-1's for diversity reception, either by frequency or by antenna spacing.

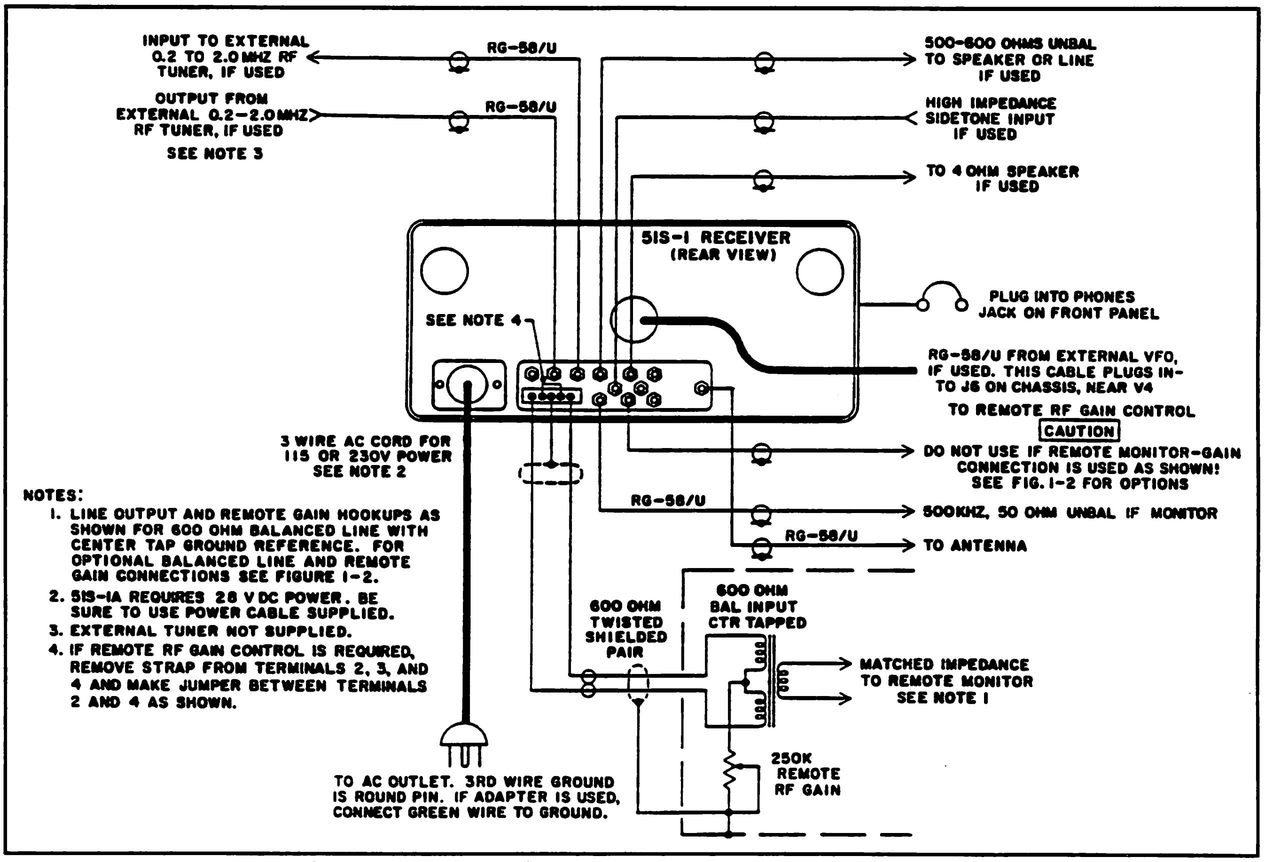

Figure 4. 51S-1 Rear Panel External Connections

The power connection to the 51S-1 is provided through a large, nine-pin connector which accomodates either 115 or 230 volts AC (28 VDC in the case of model 51S-1A). Separate colour-coded power cable kits (gray chord for 115 volts; black chord for 230 volts) were originally supplied with the receiver. Unfortunately, my second-hand receiver came without a power cable and a suitable mating plug was not to be found at any surplus dealer in Toronto. It was necessary to have a technician friend trace the power supply circuit and replace the chassis connector with a standard, three-wire AC cord for 115 volt operation. Buyer beware! Power consumption is rated at 125 watts.

OPTIONS AND ACCESSORIES

An optional rack mount was available for both the 51S-1 and the (optional) 55G-1 preselector. An optional S-Line station speaker, model 312B-3 was also available in a rack mounted version. For high vibration (mobile) applications, a base shock mounting kit was available.

Several optional IF filters were available for the 51S-1. For each of USB and LSB, the standard 2.75 kHz mechanical filters could be replaced by a 2.4 kHz bandwidth, the latter being the standard in most military configurations. Later advertising cited a 3.1 kHz mechanical as another option. A sharper (300 Hz maximum) crystal lattice filter was an option for CW. Only a 6 kHz mechanical filter was listed as an option for AM mode but this would have been highly desirable in lieu of the wideband IF transformers - unfortunately my receiver is not so-equipped.

VARIATIONS AND CONFIGURATIONS

The following table shows the information I have concerning the various commercial and military configurations of the 51S-1:

MODEL	MILITARY DESIGN'N	SSB FILTERS	RACK MOUNT	NOTES
51S-1	-	2.75	N	Standard Model
51S-1	R 1122/GR	2.40	N	
51S-1B	?	2.75	N	Military Connectors
51S-1F	R 1156/GR	2.40	Y	
51S-1F	R 1156A/GR	2.75	Y	
51S-1A	R 1430/UR	2.40	N	28 VDC
51S-1AF	?	2.40	Y	28 VDC
51S-1F	G133F	2.40	Y	LTV Modified

The G133F is a 51S-1F which was specially modified for the US Air Force by LTV Electrosystems of Greenville, Texas (now E-Systems Inc). According to the manual revisions, the G133F was supplied between 1964 and 1978. The principal modification was the addition of an "electronic package" that enabled processing by external equipment to determine the tuned frequency of the receiver and included a video output for spectrum analysis. In addition, a switch-selected AM-BFO was provided with variable frequency tuning up to 15 kHz on either side of 500 MHz. The stated purpose was to provide a means of varying the tone of CW signals being received.

Some years ago, the G133F was available from Fair Radio Sales in Lima, Ohio, in "used/checked" condition for $975. I am not aware of the quantities that were released as surplus or whether this military version is currently available.

PERFORMANCE

The greatest pleasure that I experience in using the 51S-1 comes from its obvious look and feel as a quality piece of communications gear. Everything about the way it handles feels "solid". I really do ENJOY operating the 51S-1! But quite frankly, you don't have to spend the kind of money the 51S-1 commands to get better DXing and serious SWLing performance.

Sensitivity on the HF bands is certainly good enough, although effective sensitivity is limited somewhat by internal noise - the noise floor is not as low as I might have expected. In that respect it reminds me of the R-390A. For weak signal reception, I find that switching on the Rejection Control from its 6 o'clock 'off' position and setting it somewhere between 7 and 9 o'clock usually helps to cut down the internal noise and QRN without significantly muting the audio response. There is no noise limiter or noise blanker provided with this receiver.

The audio quality in AM mode, especially on strong, clear signals, rivals that of the better hollow state receivers. The audio response of an HQ-180 is somewhat more bassy but weak signal intelligibility with the '180' holds up very well - better than the 51S-1. Neither the 51S-1 nor the HQ-180 is as quiet as the Hammarlund SP-600 but then the SP-600 has remained virtually in a class by itself over the years, at least in my opinion.

Still, the audio clarity of the 51S-1 is definitely superior to that of a top-rated, solid state DX receiver such as the Drake R-7. I find it hard to compare the audio of most hollow state receivers, including the 51S-1, with the fine audio of the new Drake R-8. They're quite different, but who's to say which is better? The Collins audio is crisper; the R-8 audio is smooth and mellow but also very intelligible. I guess I have always be a fan of "tube" audio. Who wouldn't be, considering the disgraceful audio we've put up with from most of the solid state Japanese imports over the past ten years?

The 51S-1's rejection notch seems to sweep across the IF passband as it is moved between about 9 o'clock and 3 o'clock. Adjustment of the rejection tuning for the best balance between audio intelligibility and rejection of background QRM or noise is somewhat tricky. While it does help in cutting heterodynes and sideband splatter, the audio response is muted quite appreciably, certainly more-so than with the T-notch circuit in the HQ-180.

Apart from the Rejection Control, the only procedure requiring some finesse is tuning in SSB signals or AM signals in ECSS mode. While the Main Tuning Control is very smooth (except for the detents as it clicks over every 100 kHz), zero beating for natural audio is a bit of a chore and requires a steady hand. A tunable BFO would have been helpful here.

It is apparent that my receiver is not in tip-top shape because any tuned frequency will not hold with sufficient stability to allow unattended taping in sideband mode. Even after an extended warmup, the receiver tends to waver by about 50 cycles, more than enough to render audio reproduction of a sideband signal unacceptable. So, unfortunately I cannot confirm the vaunted stability of the receiver that is supposed to make it suitable for unattended monitoring. Elton Byington provides a better testimony. He says that stability was one of the prime reasons that a new 51S-1 was purchased for the Associated Press engineering lab in 1972. Elton recalls that the unit was rock solid - *"it would remain perfectly tuned for months of continuous use on one of AP's RTTY frequencies!"*

Notwithstanding the stock provision of independent upper and lower sideband mechanical filters, the biggest drawback with the 51S-1 is the lack of flexibility inherent in the selectivity arrangement. As noted, selectivity is governed by the mode that is currently selected. This means that the 2.75 kHz mechanicals cannot be used for AM reception and one is stuck with the wideband selectivity curve of the IF transformers - nice audio for listening to the BBC but grossly inadequate for Tropical Band DXing. I imagine the previously mentioned optional 6 kHz mechanical filter would be a vast improvement. The IF filters (apart from the transformers) are shielded within a metal can which I have not attempted to remove. I imagine that incorporation of the mechanical filter for AM mode would require some adept rewiring. The Instruction Manual provides no clues for installing the optional filter.

Even if I had the 6 kHz mechanical which would have been fine for relatively wideband audio for the stronger signals, it is obvious to me that this filter would not be satisfactory for most serious DXing applications in AM mode. Unfortunately there are no 'blank' filter slots so only the one selectivity position is available for AM mode reception.

Another limitation derives from the non-standard 500 kHz IF frequency that Collins engineers selected. IF filters for a variety of bandwidths remain commonly available for the more standard 455 kHz IF but not for other, less common intermediate frequencies. So, while I would love to install a mechanical filter of about 3.1 kHz for AM DXing, I don't believe such can be found, except perhaps by pilfering a filter out of an old "junker" Collins 51J-4 which also utilized this 500 kHz IF frequency.

While the mode-derived selectivity limits SSB/ECSS reception to only the one bandwidth, I must say that the stock 2.75 kHz filters are quite nice for ECSS reception except when tighter selectivity is required. On balance, however, the optional 2.4 kHz filters would likely be preferable for DXing purposes.

The 500 kHz IF also means that neither the MAP (Version I) nor the recently-available cascaded IF filter modules from KIWA Electronics [see James Goodwin's review in this edition of *Proceedings*] can be used with the 51S-1.

In spite of these limitations, all is not lost! There is at least one other way to enhance the performance of the 51S-1 and that is with the Hammarlund HC-10 Converter. Fortunately, the HC-10 is tunable to accomodate receiver IF's between 450 and 500 kHz. The upper boundary of the HC-10's IF range adjustment just fits with the IF of the 51S-1. The HC-10 is essentially the IF and AF stages of the HQ-180. It provides vastly improved flexibility in terms of the selectivity required for digging out those difficult DX signals. Every owner of the 51S-1 would be well-advised to invest about $150., the typical going price for a used HC-10. The required IF output for connecting the HC-10 is provided on the rear panel of the receiver.

EVOLUTION OF THE 'S' LINE

When radio hobbyists think or speak of the S-Line, what usually comes to mind is the well-known 75S series of receivers still beloved by many radio amateurs. Now we know that the general coverage 51S-1 was very much a part of that line, even though its widest application was not in the hobby market. There were other receivers that followed and, at least in terms of their nomenclature, kept the S-Line alive.

In 1970, while the 51S-1 was still in production, Collins released the 651S-1, a solid state design with electronic, digital nixie tube frequency readout. This receiver was "space-age" design in its time and was a complete departure from traditional Collins design. The $4000+ price-tag increased to five figures by 1980. It's obvious the market was almost exclusively confined to military and commercial applications. I'm not sure that it would be correct to characterize the 651S-1 as the general coverage successor to the 51S-1.

In 1982, Collins, which by this time was a subsidiary of Rockwell International, released the 451S-1. It replicated the style of the KWM-380 transceiver which came on the market in 1979. A full-page ad promoting the 451S-1 appeared on page 35 of the 1982 WRTH. An improved version of the receiver section of the KWM-380 formed the basis for the 451S-1 and in his preliminary review, Larry Magne characterized the 451S-1 as being "*intended to replace the 51S-1*". [8]

The 451S-1 sold for just less than $5000, excluding options, and featured a couple of departures from traditional Collins design: all-mode passband tuning for one, as well as provision for up to five crystal filter selectivity postions. Apparently some number of this receiver was produced but nothing more was heard of it in the hobby press and I can only surmise that the 451S-1 may be close to impossible to find in the used market.

CONCLUSION

"The 51S-1 is probably the last American-made general coverage receiver of its quality that will be available for Amateurs and SWL's for a long, long time." [9] That was the view in 1975 by the author of the only review of the 51S-1 in CQ Magazine I was able to find. In some respects he was certainly right, although it must be said there are better, and in some cases less expensive choices for the diehard DXer or the program listener. The 51S-1 would best be classified as a durable monitoring receiver.

Still, for the serious collector of classic hollow state gear, the 51S-1 has become a "must have" item. This sentiment, reflecting a strong rebirth of interest in tube-type communications receivers, is the driving force behind today's market interest.

For a long time I'd yearned for a 51S-1 and now that I've invested in it, I have no intention of letting it go. While it lacks some of the features and flexibility of better DXing receivers, the mystique - that special feeling, if you will - is rekindled every time I switch it on. The 'S' Line, perhaps especially the 51S-1, will retain a special place in the hearts and minds of hollow state fans for many more years to come.

COLLINS

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A NEW METHOD OF RECALIBRATION OF RECEIVERS, BFO'S, ETC.

Bennett Basore, W5ZTN

Many short wave and amateur receivers and VFO's are stored in attics and sheds over the country, having been replaced by modern digital synthesized receivers and tranceivers. But the older gear is still of interest to those who restore old equipment as well as those who are just getting started in amateur radio and aren't prepared to fork out the price of a digital rig. A common problem with the older equipment is that, as a result of aging, tube substitution, or mis- adjustment, they are no longer accurately calibrated. Because standard recalibration techniques involve tedious and often confusing (even divergent) repetitions of adjustment, the needed recalibration is often left undone, or worse, attempted to the point of giving up as the techniques seem to lead nowhere.

The availability of counters and hand calculators makes possible the use of a calibration technique that the author devised and believes to be original. This method shortens the calibration process by several steps, sometimes even an order of magnitude. In particular, the slowly converging process of adjusting inductor and capacitor trimmers at the top and bottom frequencies of the dial can be reduced to as few as three adjustments! (The method is not intended for use with receivers with a padding capacitor for adjusting the low end of the dial.)

RECEIVER ALIGNMENT

With even a cheap RF generator connected to a frequency counter to provide calibration signals, one can begin. The following steps are in the context of variable-capacitor tuning, but are applicable to variable-inductor tuning by simply interchanging references to capacitors and inductors. Before attempting alignment of the oscillator and RF stages of the receiver, be certain that the IF stages are properly aligned on the original IF, modified only if the crystal filter (if any) has drifted off a few hundred hertz. Next, make sure that the dial is properly fixed to the variable capacitor shaft. Usually there is a mark that corresponds to the fully meshed position. It is also necessary that the capacitor plates be relatively free of dust or grime so that the capacitance is close to what it was originally for each setting of the dial.

First, set the receiver dial to the lowest frequency of interest on the band being aligned. Set the calibration signal to this frequency. For example, on the broadcast band, set the dial and the signal generator (as measured on the counter) to 550 khz. This frequency is designated fa. Trim the inductor for the oscillator stage to pick up the calibration signal as accurately as possible. Next, tune the receiver dial to the desired high-end frequency, which is designated fb. In our example, this might be 1550 khz. Now adjust the signal generator until it comes in "on the nose". Read the counter, recording the frequency at least out to the nearest Khz. This frequency is designated f1, and generally will not be equal to the desired frequency, fb. If it is, stop now; the receiver is in calibration on this band!

The three frequencies now provide enough information to reset the inductor and capacitor trimmers to the values needed for accurate calibration. Using the formula below, compute f2.

$$(f_2 \pm IF) = (f_1 \pm IF)\sqrt{\frac{(f_b \pm IF)^2 - (f_a \pm IF)^2}{(f_1 \pm IF)^2 - (f_a \pm IF)^2}}$$

Use the (+ IF) as shown if the local oscillator frequency is above the received signal, but subtract it (- IF) if it is below.

Suppose f1 in our example turned out to be 1562 khz. Then inserting the three frequencies into the formula, each having been increased by the 455 khz IF, we get f2 = 1546 khz.

Set the signal generator to f2 as read on the counter, again to the nearest khz or closer. Without adjusting the receiver dial, trim the capacitor trimmer to bring in f2 as accurately as possible. Next, adjust the trimmer capacitors on the RF and ANT stages for maximum signal to be sure they do not affect the tuning of the calibration signal. (Chances are they will to some extent.) Readjust the OSC trimmer if necessary. As the last step, set the signal generator and the receiver dial to the low frequency, fa, and readjust the inductor to tune in this calibration signal. This step should complete the calibration of the dial, and only adjustment of RF and ANT stage inductors should be needed to finish alignment on this band. Check the dial at several frequencies to see. If mid-range frequencies are off but the end frequencies are exact, it means that either the tuning capacitor is not properly aligned with the dial, or that the capacitor has actually changed its capacity-versus-position curve since the dial was originally calibrated. Some older tuning capacitors have bendable outer plate segments that could be adjusted somewhat. (This mid-range problem could also result from poor quality control at the time of manufacture.)

VFO ADJUSTMENT

The technique works equally well with VFO's. Connecting the counter to the VFO output provides accurate frequency data, so that no signal generator is necessary. The addition or subtraction of the intermediate frequency is also unnecessary, and the formula becomes:

$$f_2 = f_1 \sqrt{\frac{f_b^2 - f_a^2}{f_1^2 - f_a^2}}$$

This technique can be justified theoretically, and is exact for ideal inductors and capacitors. It is also quite accurate where some distributed capacitance is present in the inductor and its wiring, and some inductance in the capacitor wiring, as long as these minor contributors do not change as the capacitor changes position.

JUSTIFICATION

Resonant frequency is inversely proportional to the product of the inductance and the capacitance. Thus a variable capacitor "tunes" the frequencies that correspond to the changing capacity, which is the sum of the trimmer capacity and the variable capacity. Adjustment at any point on the dial to make the received frequency equal to the dial frequency merely makes the error in the adjusted parameter (L or C) equal, percentagewise, to the error in the other. Because the percentage error in the capacity is larger at the high end than at the low end of the dial, adjusting the inductor at the low end after adjusting the capacitor at the high end will begin a series of adjustments which eventually converge to the desired end state. Knowing this, experienced technicians will overadjust at the high end in hopes of converging more rapidly to the correct values.

Figure one illustrates a situation where, after step one, the inductor error is positive and the compensating capacity error is negative. Thus, at the high-frequency end of the dial, the capacity error is greater, percentagewise, than the inductor error, and the LC product is smaller than needed, leading to a higher tuned frequency than indicated on the dial.

Also shown in the figure is the computed frequency. f2, that would be tuned in if the capacity error were zero, but the inductor error remained positive. Note that it is below the desired frequency fb, thus in the direction of an overadjustment at the high end. It is precisely the needed overadjustment to remove all the error in capacity. Next, at any frequency on the dial, the inductance error can be tuned out. But by doing so at the low end of the band, the residual capacity error that may have remained after adjusting the capacity trimmer will be a minimum percentage error, and yield a commensurate error in the inductor setting.

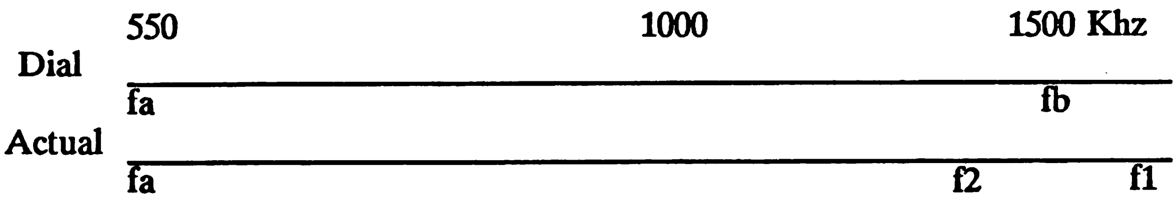


Figure 1

In step one, the LC product is adjusted to correspond to the desired value for fa. Thus, assuming that L, Cmax and Cmin are the precise values needed for exact calibration, and that dL and dC are the errors, dL and dC offset each other after completing step one, and

$$(L + dL)(C_{max} + dC) = LC_{max} = k/f_a^2$$

Then, at step two, by tuning to the dial frequency fb, and reading the actual frequency f1, we obtain the frequency that corresponds to the product.

$$(L + dL)(C_{min} + dC) = k/f_1^2$$

while

$$LC_{min} = k/f_b^2$$

Manipulating these three equations for the product (L + dL)Cmin, which is defined as k/f2**2, we can use that frequency to zero out dC without changing the dial, and finally, returning to fa, zero out dL!

When the local oscillator is being adjusted, each of the dial freqencies is increased (or decreased if the LO is below the dial frequency) by the IF frequency. Thus the formula follows.

TWO BRITISH BOXES

LOWE'S HF-225 & HF-150 RECEIVERS

Elton Byington, N2KXT

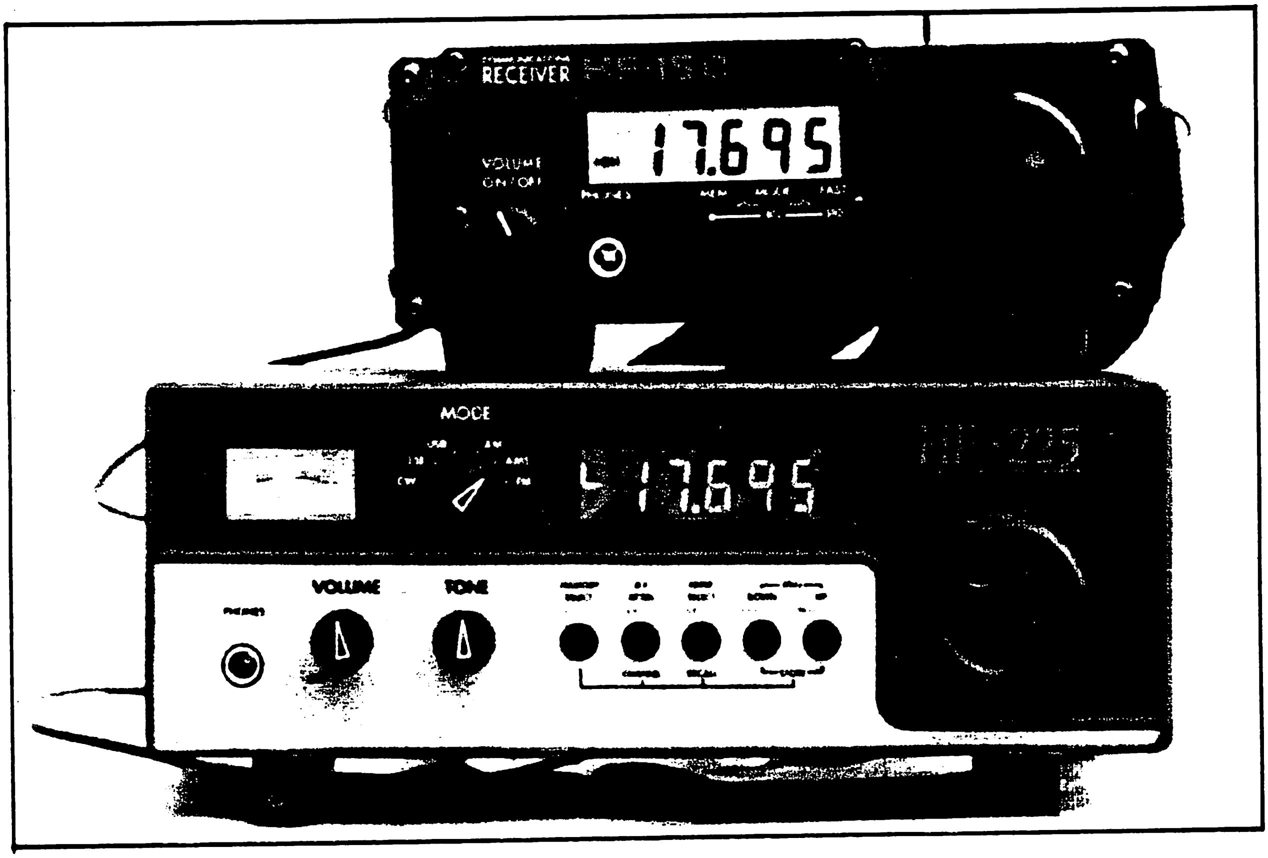
Lowe Electronics, Ltd., a major shortwave retailer in the United Kingdom, manufactures two very interesting general coverage receivers, primarily for the European market. Lowe recently appointed two distributors in the United States, so the receivers no longer need be ordered directly from the factory in England.

My HF-225 was delivered in March, 1991. I was so impressed with the receiver's performance that I ordered Lowe's latest radio, the HF-150, soon after it was announced.

I can state categorically: ***the Lowe receivers are the best sounding shortwave radios I have ever heard.***

Lowe receivers are not for everyone, but if you suspect a shortwave broadcast could sound better than it does on your radio, you're probably right.

Unless you already ***own*** a Lowe.



WANTED: AN EAR OPENER

The object of shortwave listening and DXing is to hear distant radio stations, ones that can't be picked up on the radio you carry to the ballpark. The quality of that reception is what separates a great receiver from a mediocre one.

Most of the qualities that make up a great receiver can easily be quantified: sensitivity, selectivity, unwanted signal rejection, stability, tuning accuracy. These goals are met by virtually all modern table top receivers, and by a large number of portables.

But there's a common failing that afflicts almost all these receivers: they sound bad. The manufacturers of these radios go to great lengths to make their products as sensitive and selective as possible, but when it comes to the audio section, they drop the ball.

What's the use of hearing a distant station if you can't understand what's being said? What good comes from hearing a station if the very act of listening is so fatiguing you have to tune out before you get that elusive ID?

The folks at Lowe Electronics heard their retail customers complaining about how lousy shortwave radio sounds and they decided to prove a point: there's no reason why a shortwave radio must sound bad.

The result of their efforts is the HF-225 and its siblings, the commercial HF-235 and the tiny HF-150, introduced this year. All three receivers deliver superb audio which makes shortwave listening a real pleasure.

LITTLE BOXES, BIG FEATURES

The Lowe HF-225 is a double conversion superheterodyne receiver that provides AM, SSB, and CW reception from 30 kHz to 29.999 MHz in 7.8 hertz steps. Selectivity is supplied by ceramic filters in bandwidths of 10, 8.8, 5.9, and 2.2 kHz. There's a 200 Hz audio filter, centered on 800 Hz, for CW reception. Frequency readout is only to the nearest kilohertz. There are two VFOs and 30 memories in the receiver to store favorite frequencies. Modes are not stored. A noise blanker is included which does a decent job of removing ignition noise. It's always on and it's not adjustable.

Lowe offers two options for the HF-225 which I feel are essential: an external keypad for easy tuning and a PLL synchronous detector for AM. The "AMS" detector has drawbacks, but its benefits far outweigh its shortcomings. The same board is used for narrow-band FM reception. When the AMS mode is in use the 10 kHz bandwidth becomes 12 kHz, suitable only for local broadcasts or the clearest shortwave signals.

The HF-225 is housed in an aluminum box measuring 10 x 7 x 4.25 inches, and it's built like a tank. This radio can stand a lot of handling, especially when fitted with the optional leather carrying case. It can be fitted with an optional NiCd battery pack and a whip antenna and impedance-matching amplifier for portable operation. The radio is powered from an external 12-volt power pack.

HF-150

The lower-priced HF-150 is also a double conversion set and has two IF filters, nominally 6.5 and 2.6 kHz. Unlike the filters in its big brother, however, the ones in the HF-150 are selected by mode, so you cannot "open up" the selectivity when in SSB. This is not a big problem because the set's PLL synchronous detector will lock on the weakest of signals and it allows selection of filter width. The HF-150 has no noise blanker.

The "AMS" detector in the HF-150 is much better than in the older radio. For one thing, it allows selection of upper or lower sideband. It also hangs onto the carrier for dear life! The radio will lock onto the weakest carriers, too. It's also standard equipment. The external keypad costs extra, but it's worth it.

The HF-150 is only about half the size of its big brother, measuring just 7.25 x 3.125 x 6.25 inches. Its case is made of heavy-gauge extruded aluminum, so the receiver will take a lot of banging around. The HF-150 is powered by 8 penlight batteries and a new set of alkalines only lasts about 5 or 6 hours, because of the heavy current drawn by the set. An AC adaptor is supplied with the radio.

A TOUR AROUND

The HF-225's front panel is simple and uncluttered, with only four knobs (volume, tone, mode, and tuning) and five pushbuttons which serve multiple purposes. The frequency display is in the center and there's a small S-meter in the upper left corner. The frequency display and the S-meter are illuminated by three green LEDs which are on whenever the radio's on. The light they give is adequate while not being intrusive in a dark room. There's also a 1/4-inch jack for monaural or stereo headphones.

The set's rear panel contains an SO-259 coax connector for a 50 ohm antenna, compression type connectors for a high impedance antenna, a three-position antenna selection switch (Lo-Z, Hi-Z, Whip), a squelch control for NBFM, a center-positive concentric socket for the power supply, and 1/8-inch jacks for the keypad, an external speaker and a recorder. There's also a mysterious hole marked "AUX," which appears to serve no purpose.

HF-150

The HF-150's front panel, like the radio itself, is very compact. There's the same frequency display and tuning knob as on the other receiver, but is has only three pushbuttons, a volume control, and a headphone jack. The display isn't lighted and there's no S-meter or tone control.

One important control has been banished to the back of the HF-150: the 20 dB attenuator. Since the new set doesn't have RF bandpass filters like its older sibling, it can easily be overloaded by strong SW and MW signals.

MY CONFIGURATION

My HF-225 sits on my bedside table and gets more use than all my other receivers combined. The radio is fed by a 35-foot indoor antenna on the ground floor of a frame house that has aluminum siding. There's a 50kW mediumwave transmitter (WQXR-1560 kHz) less than a quarter mile from my home. Those are the facts of DX life at my home, and I must live with them.

I can switch in a Palomar P-408 preselector or a Palomar BCB loop antenna, if need be. The preselector is very rarely used, but it comes in handy for extremely weak stations, like VNG on 16 MHz or AIR, Aligarh, on 7412 kHz. These stations can be received "barefoot," but the preamp gives a little better signal to noise ratio. It also gives better front end selectivity for rejection of my high-powered neighbor.

The preselector is essential with the HF-150 at my location, because it contains a highpass filter that suppresses the MW band. For MW reception on either radio, an external loop antenna is ideal.

The output of the HF-225 feeds a Realistic Minimus-7 loudspeaker and an inexpensive stereo tape deck for recording Media Network and other interesting stuff.

PERFORMANCE

When hooked up as listed above, the HF-225 really cooks, especially in the tropical bands, where its extremely low noise level makes the signals jump out of the speaker. It's also a joy to use on mediumwave, because its sensitivity is undiminished in that region.

One thing you notice immediately is that there is no **"chuffing"** on these receivers as with many other digital radios, including the Drake R8. If you tune rapidly you'll hear a sort of raspy whine, but the level is so low as to be almost imperceptible.

Hard as it is for me to believe, I think the HF-150 is even hotter than the HF-225. Lowe gives the sensitivity as 1.8 microvolts (10 dB s+n/n, AM carrier, 60 percent modulation) from 50 kHz to 500 kHz, and 0.8 microvolts above that, which includes the MW band. This seems an astounding figure, but it seems to be true!

A real test of a receiver's selectivity is how it copes with the 49 meter band at night and the HF-225 is surprising in that regard. I usually use the 5.9 kHz filter (which displays as "4") and tune around in the straight AM mode. If a station is being crowded from one side or the other, I can tune off-center in the opposite direction and generally eliminate the interference. As long as the station's carrier remains within the radio's passband, the audio distortion stays quite low. If the QRM is still too strident, the 2.2 kHz filter can be switched in, yet the audio remains quite listenable.

The HF-225's superb tone control has so much latitude that it's almost as good as having passband tuning. Its effect is hard to describe, but it's a definite plus when trying to dig through the QRM, especially when a station's audio is muffled.

The HF-150's two IF filters don't allow the latitude of control enjoyed when using the older receiver, but they are quite good, nonetheless. I've had little trouble separating 49 meter band signals with the new set, and the radio's AMS detector often makes listening somewhat easier.

For really tough cases, you can switch to USB or LSB and tune the station in ECSS. The HF-225's unusually small (7.8 Hz) tuning steps make it a snap to zero-beat a carrier. And, since all bandwidths are available in any mode, you can open up the passband to obtain the best overall audio.

But where the HF-225 really shines is when tuned to a signal that's in the open. There, you can turn on the AMS detector, sit back, and listen for hours on end. The detector will occasionally lose its lock on the incoming carrier, but that rarely results in the kind of "bending" of the audio so often heard on the Drake R8 as the Drake's PLL hunts around trying to regain the carrier. **The HF-150 sounds just as good as its big brother, and in some cases better!**

In "Proceedings 1989" John Bryant remarked on how the Kiwa Electronics Multiband AM Pickup (MAP) made normally mushy-sounding Indonesian broadcasters seem to leap out at him. He attributed this to the MAP's superior handling of transients and sibilances. He should hear this radio! I often listen to Radio New Zealand International late at night, with the HF-225 in the AMS mode. The audio is so clear I can hear the scratches on their records. This detector is a revelation when listening to stations in the tropical bands and on mediumwaves. The only fault I can find with the HF-225's synchronous detector is that it doesn't allow you to select sidebands.

That's the biggest advantage of the HF-150: selectable sidebands. I asked Lowe's John Thorpe if they planned to make a similar detector as an option for the HF-225, but he said it couldn't be done. John says they've "run out of switching options" on the older radio.

I say, take out the little used FM mode and give us a sideband selector!

(Speaking of FM reception, the HF-225 was the only receiver I own that produced listenable results during RFPI's misguided attempt to utilize NBFM in the 41 meter band. Neither the Drake R8 nor the JRC NRD-525 could match the Lowe's performance.)

AGC on the Lowe receivers switches automatically by reception mode, and its time constants are a good compromise between slow and fast. A static burst will deafen the radio momentarily, but recovery is fast enough so you don't miss anything. It's also slow enough to avoid the "pumping" heard when you tune SSB with most portables. The AGC cannot be defeated and there is no manual RF gain control.

I usually listen to the ANARC SWL Net with the HF-225 and I can hear all but the weakest stations. A good antenna would do wonders!

PERFORMANCE AS PORTABLES

With the optional whip installed, the HF-225 performs fairly well, except on mediumwave or when near a powerful radio transmitter.

I'd never really had the chance to use the HF-225 as a portable until the Winter SWL Festival in Kulpsville, Penna., last March. I was quite surprised and delighted to find the little radio pulling in stations just as well as a new Sony ICF-SW77, using just the whip antenna and its associated impedance-matching amplifier. The little box drew quite a crowd when I turned it on at the end of the hall near the hospitality suite!

The radio performs dismally if you try to use the whip antenna without turning on the amplifier, and in a high-RF environment the whip amplifier overloads badly.

But the HF-225 really shines when you hook up a random wire antenna. In that regard -- as well as in the realm of audio -- the HF-225 behaves like the best tube-type radios, most of which were notoriously dead when using short antennas.

After the Kulpsville meeting I phoned John Thorpe, designer of the HF-225, and asked him about the whip's amplifier. Thorpe said he could understand my difficulty at home, what with that RF factory down the block, and said he'd had like reports from others in similar receiving situations. Thorpe said there was no plan afoot for redesigning the amplifier, however.

This radio should be a good candidate for a DXpedition, where it could be coupled to an antenna that would do it justice. I'd LOVE to hook this thing up to a beverage!

The HF-150 is a far better portable receiver than its older brother. Besides being considerably smaller, the radio's built-in whip amplifier is far less susceptible to intermodulation and overload than the earlier version, offered as an option for the HF-225.

About the only drawback I can find is that the radio is somewhat microphonic, so a thump on the bottom of the cabinet can produce a "ping" in the audio. High audio levels can also cause feedback if you're using the internal speaker. The manual warns about this and suggests using an external loudspeaker or headphones because of it.

The microphonics are traceable to the receiver's mixer stages, which are operated near their optimum design points. Transistor-ring mixers of the type used in the HF-150 are notorious for being sensitive to vibration, but the "ringing" isn't detrimental to the set's operation.

The HF-150's lack of RF input filters can cause problems when the set is operated near a powerful radio transmitter. Use of the attenuator helps considerably, but the set really needs a MW input filter when used in an urban area, I think.

Neither of the Lowe receivers works well on MW frequencies in an urban area unless you use a tuned loop antenna. With a loop, active or passive, they are among the most sensitive receivers available.

WHAT I MISS

Among the other receivers I use daily are a Drake R8, a JRC NRD-525 with Kiwa MAP, a Drake R-4B, and a National HRO-50T1. Each of these radios has features I really like; none is perfect. Of the features I enjoy using on these other sets the only ones I'd add to the HF-225 are passband tuning, a tunable notch filter, and selectable sidebands for synchronous AM reception.

The only feature I really miss is passband tuning.

On the HF-150 I miss the S-meter and the tone control.

HOW THEY HANDLE

If you bought an HF-225 and didn't buy the optional keypad, you're missing a lot. Without the keypad, the radio's cumbersome to tune. You must use UP and DOWN buttons to select the MHz range (although the receiver tunes continuously, it does not wrap around from 29999 to 30 kHz), then zero in with the fairly small (1 5/8-inch diameter) tuning knob.

The tuning steps depend on your choice of mode, too. If you have the radio set to the AMS mode, the receiver tunes only 1.6 kHz per revolution of the tuning knob. In other modes, the steps vary according to how fast you turn the knob. The slow-tuning rate in AM is 9 kHz per revolution, for SSB and CW, it's 1.6 kHz.

One advantage of the glacial tuning rate in AMS mode is when you are tuning around hunting for hets in the tropical bands. **You'll never miss a het with this radio.** And, once you've found one, you'll usually get usable audio out of it. Tuning in AMS produces a heterodyne that descends in frequency as you near the carrier. Once you're within locking range (about 100 Hz each side of the carrier), the detector locks on and an "L" appears in the display.

The "mode" switch also selects a default bandwidth for each position. Switching to AM or AMS switches in the 8.8 kHz filter (which shows up in the display as "7"); the default for CW or SSB is 2.2 kHz. You can change these bandwidths and they become "sticky," so that when you return to that mode, your chosen bandwidth returns. Trouble here is that they revert to the factory defaults when you switch the receiver off.

The bandwidths are chosen with a single pushbutton in a carousel arrangement. But, since the "mode" switch is rotary, this arrangement isn't nearly as annoying as it is on the Drake R8. The button itself is also bigger and there's plenty of room around it.

The multi-purpose pushbuttons also allow you to switch in a 20 dB attenuator, switch VFOs or duplicate their contents, and lock the radio's tuning.

On the HF-150, the modes and bandwidths are selected by pushbuttons in a (gasp!) carousel arrangement. Press the MODE button and the display changes to show the mode in use. You can then press the right or left buttons to move from mode to mode:

LSb <-> USb <-> An <-> A <-> ASd <-> ASF <-> ASL <-> ASu <-> LSb
<----- Narrow Filter ----> <--------- Wide Filter --------> <----- Narrow Filter ----->

Unlike the Drake R8, however, this carousel moves in both directions.

The AM (A), synchronous double-sideband (ASd) and "HiFi" (ASF) modes all use the wider filter; the remaining modes utilize the narrower filter. The ASd mode is similar to that found on the HF-225 and is best for "normal" listening. The ASL and ASu modes produce very pleasant audio, even though they utilise the narrow filter. Their rejection of the unwanted sideband is quite adequate, although I haven't measured it.

When a signal is in the clear, however, switching to the "HiFi" ASF mode yields wonderful results. This mode uses the same, wide IF filter as ASd, but changes the BFO injection frequency to recover more high-frequency information. Lowe rates the audio frequency response in ASF mode at 20 Hz to 5.5 kHz, about as good as AM radio gets.

Moving from band to band on the HF-150 is easier than on the older receiver, too. A press of the FAST button causes the radio to tune in 100 kHz steps, during which the two rightmost digits in the display are blanked. If you're tuned to Athens on 9395 kHz and decide to see how London's doing on 12095 kHz, press the FAST button and whip the dial around to 12.0, then press FAST again. Voila! 12.095 MHz. The rightmost digits are preserved when you QSY in this way.

Both sets employ variable-increment rate (VIR) tuning, so that rapid turning of the tuning knob can cause you to overshoot your target frequency. Slow and steady tuning prevents this, of course.

Rapid tuning of the HF-150 also causes the radio to switch from synchronous mode to straight, envelope-detected AM. After you settle on a new frequency for a few seconds, the synchronous detector kicks back in again. This can prove a little disconcerting at times, because the radio's likely to emit a loud heterodyne whistle until the new station is properly tuned. Even so, I like Lowe's method better than the one used in the Drake R8, where you must re-engage the synchronous detector after retuning.

MEMORIES

The HF-225 has 30 memories that store only frequencies, its little brother, the HF-150, is more precocious, having 60 memories that store the receiver's mode as well as the frequency. Frequencies are stored to the full resolution of the receivers (7.8 Hz), so if you tune a UTE, then store the frequency, the radio will return to that precise frequency when the memory is recalled. The two radios handle their memories in different ways, however.

The HF-225 has two memory modes, called "channel" and "preview." In "channel" mode, the radio works like the Drake R8: as you rotate the tuning knob, the radio tunes each memory in rapid succession. This is ideal for checking for the best frequency of several parallels. It's like having 30 crystal-controlled single-channel receivers.

As memories are selected, the display shows the number of the memory, followed a second later by the frequency it contains.

In "preview" mode, the memories are selected in the same way as before, however the receiver is **not** tuned to the stored frequencies until the RECALL button is pressed. Pressing RECALL transfers the memory's contents to the VFO.

Storing frequencies requires you to press two buttons simultaneously.

If the optional keypad is installed, it can be used to access only the first 10 memories. This is a bit of a pain, but was fixed in the HF-150.

The HF-150 has only one memory mode, called "preview," and it works like the "preview" mode on the HF-225: you must press the RECALL button to tune the set to the stored frequency. However, the keypad is much more useful on the newer set: punching in any number between 1 and 60 and pressing the pound sign (#) will tune the radio to the frequency and mode stored in that memory.

Unlike its older brother, the HF-150 requires you to press only one button to store the radio's settings in a memory.

THAT FABLED KEYPAD

It's the size of a pack of cigarettes, weighs only a couple of ounces and connects to the radio with a 2-foot piece of wire that has a miniplug on the end. It resembles a telephone DTMF pad but it uses pulses rather than tones.

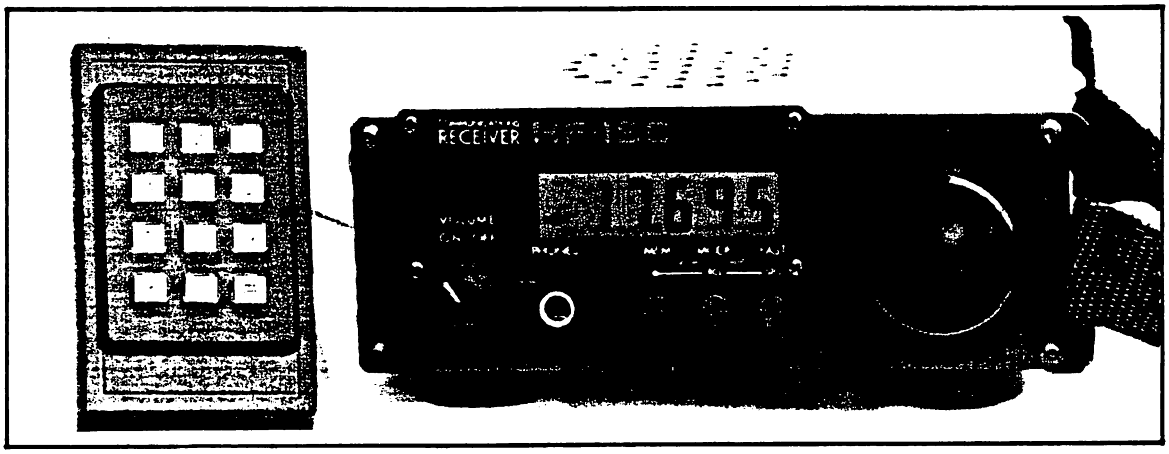
It's the external keypad for the Lowe receivers and it's a winner!

This thing is so easy to use you can almost use it in your sleep.

Want to tune the radio to the BBC on 5975 kHz? Press 5-9-7-5 and you're there! No "enter." No decimal points. (To be fair, if you want to tune below 3 MHz, you'll have to hit the pound sign (#) too, but that's the only time.) If you make a mistake, just hit the asterisk (*).

This keypad is the fastest manual means of entering a frequency I've ever seen. It's absolutely wonderful to be able to jump around a frequency list as fast as your finger can poke, and the fact that it lies flat on the table makes it still easier to use.

This is the greatest single accessory I've ever used. Every communications receiver should have one. Drake?



INSIDE THE HF-225

Following a modern design concept it shares with the Drake R8, the HF-225 dispenses with the potentially noisy and intermod-prone RF amplifier stage, instead feeding the antenna's signal through a bank of six switched bandpass filters, directly to the first mixer. There, the signal gets mixed with the tunable local oscillator and is upconverted to a first IF of 45 MHz.

This IF is passed through a 15 kHz crystal filter to the second mixer, where it's downconverted to 455 kHz and passed on to the first of the selectable passband filters, in this case 2.2 or 8.8 kHz, then on to an IF amplifier stage.

The output of this IF amplifier drives the 5.9 kHz filter or a passive attenuator network that exhibits the same loss as the 5.9 kHz filter, so there's no difference in signal level whether the filter is in or out of the circuit. Another stage of IF amplification follows, which then feeds the receiver's detector circuits, through the always present 10 kHz IF filter.

This means that, unless you are listening with the ultra wide 10 kHz filter, there are at least two 455 kHz IF filters in the signal path, thus enhancing the receiver's selectivity. If you have selected the 5.9 kHz filter position, you're utilizing not only that filter, but the 8.8 and 10.0 kHz filters, as well.

If the AMS/NBFM detector is in use, the IF signal is picked off before it reaches the 10 kHz filter, then it's passed through a 12 kHz filter on the optional board. This very wide filter is needed for NBFM reception.

The IF signal is demodulated by a normal envelope detector for AM or by a product detector for SSB and CW. The synchronous AM detector board contains a PLL-controlled carrier oscillator that supplies a regenerated carrier to a product detector. NBFM detection is by a one-chip discriminator.

The radio's noise blanker operates by detecting noise bursts at the AM detector, then applying a muting voltage to the audio amplifier's input. Thanks to the rapid switching characteristics of solid-state devices, this circuit is much more effective than the similar "ANL" or automatic noise limiter circuits found in old tube receivers. It's not as effective as an adjustable IF noise blanker, but side-by-side tests with other receivers prove it works.

Audio from the detectors is fed to a preamplifier, then through the volume and tone controls to the input of a single IC output amplifier, delivering two watts into 4 ohms.

All critical stages are fully isolated in shielding cans, and all the radio's digital circuitry goes into a "static idle" state when the set's not being tuned. This helps eliminate the digital "hash" that plagues many modern receivers, especially when using nearby loop antennas.

INSIDE THE HF-150

Unlike its big brother, the HF-150 has no RF bandpass filters to aid its front end selectivity. This causes problems when the radio is used near a powerful MW or SW transmitter. Since I live in such a location I've found it necessary to front-end the receiver with a tunable preselector. An external MW filter such as the Palomar Amplifilter or the NCP MW filter should work just as well. The receiver has more than enough sensitivity throughout its frequency range so that an amplifying preselector or preamp isn't necessary. I use a Palomar P-408 simply because I have one on hand.

Signals from the antenna are passed through a switchable 20 dB attenuator and a 30 MHz low-pass filter to the RF port of a transistor-tree mixer, where the RF signal is mixed with a local oscillator to upconvert it to the first IF of 45 MHz.

This first IF is passed through a PIN attenuator (for AGC), then through a 15 kHz crystal filter and on to the second mixer's input port. Here, the 45 MHz signal is mixed with a heterodyne oscillator that tunes between 44.544 and 44.545 MHz in 128 steps, giving an effective tuning rate of 7.8 Hz per step. The resulting 455 kHz IF is passed directly to the selectable IF filters.

These filters, nominally 6.8 and 2.5 kHz, are selected by diode switches controlled by the radio's microprocessor. The radio's first IF amplifier follows these filters.

The HF-150 has two IF amplifiers, each feeding a separate 6.8 kHz IF filter, so there are three IF filters in the circuit at all times.

The output of the IF chain is sent to an envelope detector for normal AM reception and to a product detector for SSB and synchronous AM detection. A fixed-frequency BFO supplies carrier for detection of SSB or CW signals, while the BFO's frequency is varied by a control loop that's phase-locked to the received carrier, for synchronous AM reception.

Lowe performs a neat trick here, too: by increasing the BFO's offset frequency in the ASF "HiFi" mode, the same IF filters can be audibly "widened," thus producing more treble in the output.

Audio from the detectors (including the noise blanker) is handled just as in the HF-225, except that there's no tone control as on the older radio.

ATTENTION TO DETAIL

Throughout the design and assembly of both receivers, the people at Lowe Electronics had three goals in mind: build a competent shortwave radio that sounds good and do it at a competitive price. They succeeded, admirably, by paying strict attention to detail.

Great care was taken in the choice of ceramic IF filters and in impedance matching for them. The end result is better selectivity than one would expect from filters of this width. The filters' shape factors are all on the order of 1:1.6. (There's also virtually no level change between filters or modes, on either receiver.)

The same care was applied to the mixers and their surrounding components. This resulted in exceptionally good image and spurious signal rejection.

All amplifiers in the receiver are operated very conservatively, their operating parameters adjusted for minimum distortion with the least amount of circuit noise.

Lowe claims an overall distortion figure of less than one percent, and I have no reason to doubt them.

SUMMARY

In the year since I bought my HF-225 I've grown to appreciate its ease of handling and its superb audio. The receiver's performance in the tropical bands and in the mediumwave broadcast band is also superb. Lowe's attention to detail in the design and construction of the radio is obvious to anyone who has used one.

In the short time I've had it, the HF-150 seems to offer much of the performance of its older brother, and has the added advantage of synchronous, selectable sideband reception.

To use either of the Lowe receivers for mediumwave DXing requires the use of a tuned loop antenna. Both radios are extremely sensitive in the MW band, but they need the extra selectivity afforded by a loop antenna. You cannot DX the MW band with a long wire in an urban area, because neither receiver's front end is selective enough to allow this.

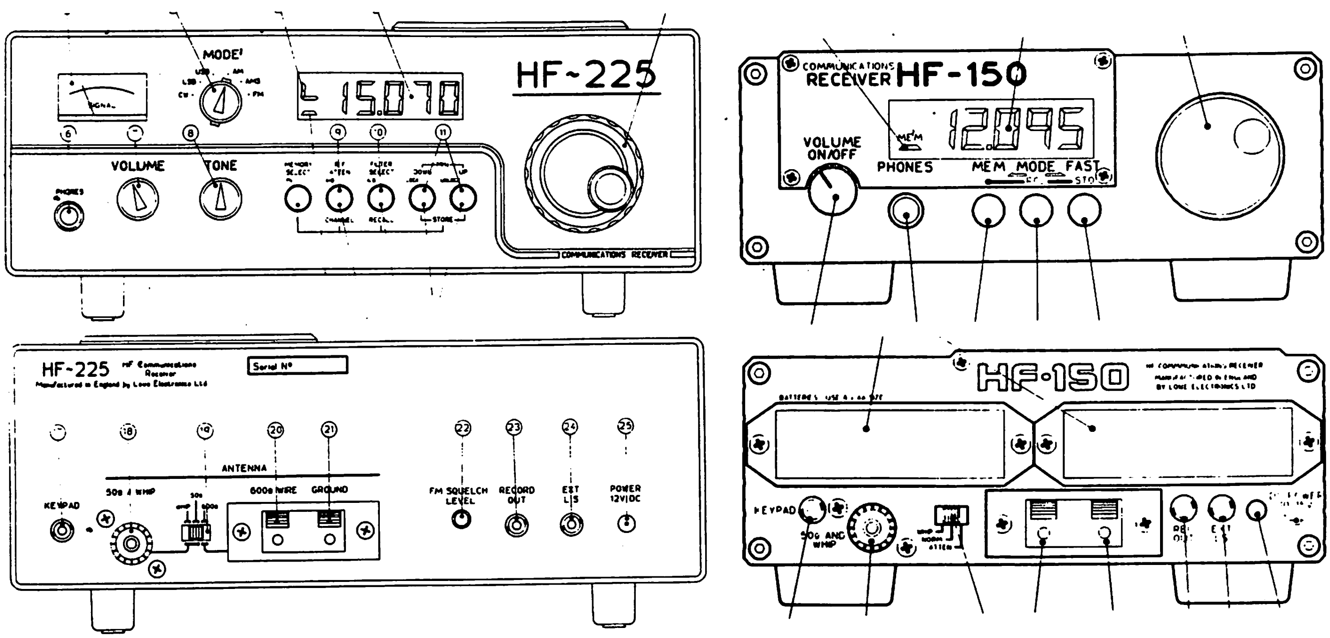
The HF-150 overloads very easily, so a MW attenuator or preselector that incorporates one is a must when the set is used near a powerful MW transmitter.

The Lowe keypad option is in a class by itself. It's the best accessory of any kind I have ever used.

My use of the receivers as tunable IF strips and detectors with my other radios is an extra advantage. It really makes the search for obscure carriers a snap.

In their portable configuration with the whip antenna both receivers perform well, but strong MW stations can and do overload the HF-150. When I take them out into the countryside and hook them up to a random hunk of wire, both Lowes will blow away any portable I've used, including the Sony ICF-2010.

As I said at the start, the Lowes are my favorite receivers. The folks at Lowe Electronics have produced two sets that could qualify as the best program listener's receivers of all time.



FRONT AND REAR VIEWS -- The only way to tell these radios are built by Lowe Electronics is to look at their backsides. Come on, Lowe! You can be proud of these machines! You don't have to hide your name! Everything is plainly marked on these diagrams, so I don't feel I have to identify them further. One thing that ISN'T shown is the mysterious "Hole to Nowhere" on the back of the HF-225. It's in the lower right-hand corner, but doesn't show up on Lowe's diagram.

SIDEBAR -- *The Lowe Listeners' Guide*

Packed along with each Lowe receiver is a little gem of a book called *The Lowe Listeners' Guide*, which serves as an introduction to DXing without attempting to provide one of those frequency lists that's invariably outdated.

This little book covers an awful lot in its 60-odd pages, and does it with a dry, refreshing wit. I've been DXing for more than 40 years, yet I found things in the little Lowe book that I'd never tried.

It begins with some pointers on antennas, then moves on to a guided tour of the spectrum from ELF through 30 MHz. Here's a sample of what you'll find "off the beaten track:"

"If you really want to frighten yourself, a couple of transistors and a few large coils can be cobbled into an ELF receiver. Around 10 kHz or so the action of static discharges anywhere in the atmosphere, coupled with changes in the earth's magnetic field, create "Whistlers," not unlike the cry of a rogue whale. Very eerie all this. All worthy of John Carpenter..."

While it's written from a European perspective, with a distinctly British accent, the information contained in Lowe's wonderful little *Listeners' Guide* is perfectly valid anywhere on earth.

Like the receivers it accompanies, *The Lowe Listeners' Guide* is for shortwave connoisseurs. Priced at only £1.95 (about $3.50), it would make an ideal stocking stuffer for any shortwave aficionado.

THE JAPANESE RADIO CORPORATION
NRD-535

Bob Evans

INTRODUCTION

Japan Radio Company's NRD-535D communications receiver was first introduced to the North American marketplace in April of 1991. Despite its level of sophistication and quality, there were some initial design flaws with the original model. AM mode bandwidth was too wide, the AGC suffered from overshoot, the variable bandwidth control was not available for some of the bandwidths and the owner's manual was poorly written.

Fortunately for the radio enthusiast, JRC, through its New York office, heeded the criticisms of the shortwave community. The net result is that today's model comes with a better AM filter, an all-mode (FM excepted) variable bandwidth control operable in all modes and a completely rewritten owner's manual. Design and preliminary testing are currently underway to correct the AGC problem.

CONFIGURATION

The NRD-535 is produced in two configurations, standard and deluxe. The standard model is manufactured primarily for the European marketplace, where price was an obvious consideration.

In North America, the receiver is currently only available as the deluxe model, the NRD-535D. It includes the basic NRD-535 with the addition of the narrow CFL-233 1 kHz bandwidth crystal IF filter, the CMF-78 ECSS (Exalted Carrier Selectable Sideband) detector board and the CFL-243W BWC (variable Band Width Control) unit.

For the purposes of this article, the new "improved" NRD-535D will be reviewed.

ELECTRONICS

The NRD-535D utilizes a 35 MHz low-pass filter followed by a diode-switched, seven-band tuner that feeds the first mixer via a second 35 MHz low-pass filter and RF amplifier. Employing triple conversion, the first IF frequency of 70.445 MHz is amplified and passed to the second mixer to produce a second IF frequency of 455 kHz. Main IF filtering and signal processing take place here. With the exception of narrow FM, a third IF frequency of 98 kHz is employed before demodulation. The AGC control voltage is generated here. Advanced synthesizer techniques are utilized to supply the local oscillator feeds. Discreet components are used in preference to integrated circuits to achieve better performance, especially where critical RF signal processing circuits are concerned.

The receiver uses a variable tuning system (electronic tuning by capacitor diodes) in the front end of its double tuning circuit. The center frequency of the double tuning circuit is continuously controlled by a microprocessor to vary with the received frequencies. A phase-locked ECSS system provides selectable-sideband AM reception. Maximum IF flexibility is achieved through the Variable Bandwidth Control circuit (now available for all reception modes except FM).

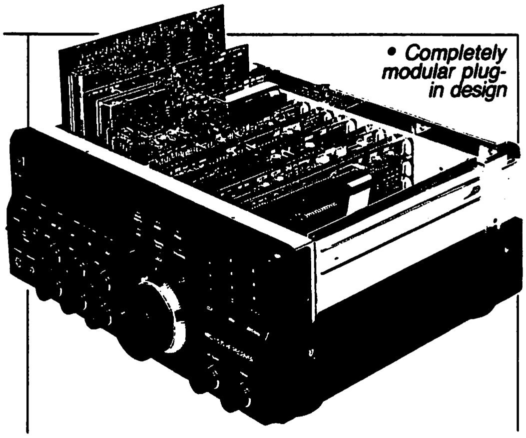
CONSTRUCTION

The NRD-535D is manufactured with a complete modular design concept. All the printed circuit boards employ surface-mounted components and are plugged into the motherboard. When initially shipped, a protective foam strip holds the modular unit boards in place. The user must unscrew the top cover and remove the foam strip, otherwise the potential for overheating and fire is present.

The NRD-535D is an extremely cool running radio, thus ensuring long life for its electronic components.

The metal cabinet, with its stylish black sloping front, is a composite of the military ruggedness of the NRD-515 and the sleek plastic-looking shell of the NRD-525. All things considered, this is an elegant-looking radio.

The numeric keypad features large solid buttons with a better response and feel than the NRD-525 or the Drake R-8. Weighing in at 20 pounds, the NRD-535D is a first class contender in its category.



POWER SUPPLY

The receiver operates from 100/120, 220/240 VAC, 50/60 Hz, 35VA or less or 12 to 16 DC (13.8VD nominal) 25W or less. The supplied DC cable, complete with fuse, permits in-the-field operation from your car battery or other portable power source. Voltage settings are selectable from a dial incorporated within the main fuse housing.

Two DC outputs are provided on the rear of the set. The first DC output jack (RCA phono plug type) provides 10.8VDC at approximately 30MA maximum. It is coupled to the receiver's main on-off power switch. (The writer uses it as a power source for his Datong FL-3 audio filter, which is conveniently turned on or off with the receiver.) The second is a timer-out (three-screw position) terminal that may be used in conjunction with the radio's clock/timer for relay control of an external tape recorder. Contact capacity is rated at 24VDC, 3A.

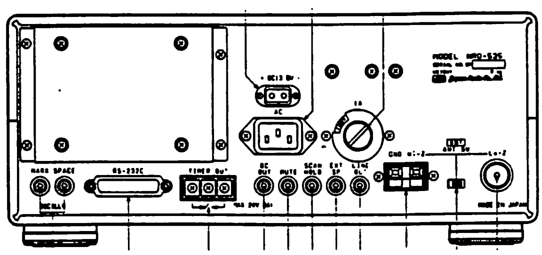
ANTENNA TERMINALS

Two antenna terminals and a separate grounding connector are provided. The LoZ (50 Ω Low Impedance) connector uses a PL-259 coaxial connector. The HiZ (300 to 600 Ω High Impedance) connector permits the direct connection of the antenna wire to the set. An antenna switch on the back of the receiver selects the appropriate antenna.

Front end circuitry employs varactor-tuned bypass filters which act as tracking preselectors to improve front end selectivity and help reduce antenna mismatch impedance effects.

EXTERNAL CONNECTORS

External connectors (RCA phono plug jacks) located on the rear of the set are used for Line Out (fixed audio level), Scan Hold (temporarily pauses SCAN/SWEEP operations when grounded), External Speaker (4 Ω), Mute (disables receiver when used in conjunction with a transmitter/transceiver) and DC Out (discussed elsewhere). Mark and Space jacks permit an oscilloscope hook-up for RTTY work.



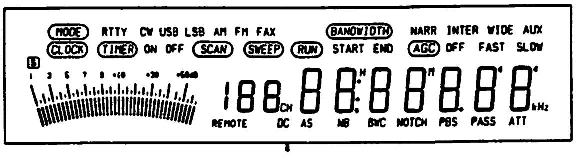
On the front panel, the headphone jack (standard quarter inch phone plug) mutes the internal or external speaker when headphones are used. Stereo headphones may be used without modification. The Record jack also provides a fixed level output (600 Ω impedance) for a tape recorder. Since the Record and Line Out jacks appear to be connected in parallel, some NRD-535D owners have experienced unwanted interaction (in the form of howls) between external audio processing and tape recording devices.

FREQUENCY RANGE/OPERATING MODES

The operating range provides continuous coverage between 100 Hz and 30 MHz. The NRD-535D operates in the following user-selectable modes: AM, USB, LSB, CW, RTTY, FAX and FM narrow. In addition, the ECSS unit supports AM USB and AM LSB. All modes are readily selectable from individual push buttons on the front of the receiver.

The reason for the inclusion of separate CW, SSB, RTTY and FAX modes is not immediately apparent, but directly affects the frequency range of the demodulated audio signal. For SSB reception, the displayed (carrier) frequency is required to produce a zero beat. For FAX reception, the displayed frequency needs to create a 1900 Hz audio tone. When resolving RTTY, a 2100 Hz audio tone is needed. CW requires a 850 Hz tone. The production of these different tones with the same displayed frequency is achieved by automatic adjustment of the local oscillator. The primary advantage of this method is that the received signal is always kept in the center of the IF passband, allowing the user to make the best use of selectable filters.

DISPLAY



When turning the set on for the first time, you cannot help being impressed with the front panel display. Compared to the NRD-525, the frequency display is "billboard" in size and can be read from up to ten feet away. Lighted indicators easily identify when the PBS, BWC, Notch, Squelch and Noise Blanker circuits are engaged.

A three-position dimmer setting is selectable (but there is no display "off" setting).

Frequency display is user-selectable to two or one decimal positions, allowing the suppression of the 10 Hz digit. For SSB operations, the user may elect to display the shifted (sideband) or the center (carrier) frequency.

The S-meter features a curved 40 segment digital fluorescent bar indicator with measurements in S units. Signal strength may be displayed as a solid moving bar or a moving single line (similar to an analog unit). The NRD-535D's S-meter is a vast improvement over that of the NRD-525 and does not exhibit the spastic movements of its predecessor. If anything, it tends to be under-sensitive. (A signal under S5 [3 microvolts] doesn't record at all.)

TUNING

The second feature you're bound to like, after the front panel fluorescent display, is the feel of the tuning dial. Located just to the right of center is an excellent large tuning knob with a rubber rim, a fixed (non-rotating) tuning dimple and just enough mass for some fly-wheel effect when you turn the knob.

The frequency synthesizer employs a Direct Digital Synthesis (DDS) chip that permits digital tuning in 1 Hz steps, even though the frequency display resolves only to the nearest 10 Hz. The manual tuning knob tunes in user-selected, 1 Hz, 10 Hz or 100 Hz steps. In addition the user can select either 250 or 1000 steps per revolution of the main tuning knob. The UP and DOWN buttons shift frequencies in 10 Hz, 100 Hz or 1000 Hz steps.

Over time and constant usage many NRD-535D owners (the writer included) have found that the tuning knob has loosened and is just too sensitive (one NRD-535D reviewer stated that a light breeze in his shack was enough to spin the dial). The degree to which the knob had loosened became immediately apparent when operating side-by-side with a newer modified NRD-535D supplied by JRC New York for this review. Some owners have resorted to using the dial/controls lock feature when not tuning, others like the writer, have placed a felt washer at the back of the dial face and the tuning shaft. A set screw to adjust tension would be a welcome addition.

MEMORY CHANNELS

The NRD-535D supports 200 user-programmable memory channels (0 to 199) of C-MOS RAM. Memory contents are backed up through an internal lithium battery (5 year life rating).

In addition to storing frequency, each channel also stores mode, AGC time constant, IF filter bandwidth and ATT on or off status. With the optional CMH-530 RTTY unit installed, the baud rate, shift width and polarity settings may be stored for RTTY mode.

Frequencies may be entered in kHz or MHz. Memory channels may be programmed in random order. They can be accessed through direct channel number entry via the numeric keypad, through the UP or DOWN buttons, or by activating the memory channel SCAN feature.

Memory channel entry has been reduced from the major engineering exercise required on some receivers to a more simple procedure for this set. Unused channels can be cleared and set to blank.

All 200 memory channels may be tuned as VFO's (i.e. frequency, bandwidth, etc. can be changed without dumping the original memory settings). Unfortunately, when switching from a VFO frequency (one entered through the keypad or dial which is not stored in memory) to an occupied memory channel, the VFO frequency is lost unless a jumper resistor (RJ5) on the CPU board is cut. (This will not void your warranty.)

Many NRD-535D owners would like to have seen JRC include the traditional dual VFO's whose contents are generally more volatile and need not be saved when the set is switched off. In JRC's defense, they have provided 200 tunable VFOs — how many more do you want?

When switching from memory channel to memory channel through the UP and DOWN buttons, the radio goes dead for about a quarter of a second. While of no concern to the broadcast listener, RTTY and FAX monitors will loose some data when switching between memories used to store parallel frequencies.

STABILITY

The NRD-535D ranks as one of the most stable receivers the writer has had the good fortune to operate in over 30 years of DXing. The receiver often sits on idling Time Division Multiplex signals for hours on end and together with an RTTY decoder manages to capture perfect copy of the brief 10 second Circuit Ids. (Off-frequency tolerance is under 10 Hz for these stations.) Factory specifications rate receiver stability at ± 10 parts per million after 5 minutes and ± 2 p.p.m. after 1 hour. An optional highly stable Crystal Oscillator Kit (CGD-135) is available which improves frequency stability to within ± 0.5 p.p.m for those who require this precision.

SENSITIVITY

Sensitivity is the measurement of a radio's ability to "hear" more signals. That fact that the NRD-535D is a more sensitive radio than its predecessor doesn't mean that you'll necessarily hear more stations. At levels below one microVolt (1μV) HF signals become obscured in atmospheric noise.

Between 1.6 MHz and 30.0 MHz in AM mode, the NRD-535D is sensitivity-rated at 6dBμ (6 decibels relative to one microVolt measured at 10dB signal-to-noise ratio). Sensitivity rapidly drops off below 1.6 MHz. For most shortwave DXers, this is of no concern. Mediumwave AM listeners must content themselves with a rating of 16dBμ for frequencies between 500 kHz and 1600 kHz, while utility beacon chasers are reduced to 24dBμ under 500 kHz.

Below about 50 kHz, only the interference generated by the radio's internal synthesizer is audible. All microprocessors generate some RFI (Radio Frequency Interference). To confirm this fact, hold a portable AM radio (tuned off-station) to the front panel display of your receiver. Earlier models of the NRD-535D generated considerably more RFI, especially between 50 and 250 kHz.

AUDIO/DYNAMIC RANGE

Broadcast audio fidelity has never been the mainstay feature of any of the Japanese communications receivers and JRC's NRD-535D is no exception. Notwithstanding this, the NRD-535D has a vastly superior sound when compared to the NRD-525. The wideband audio hiss that plagued the NRD-525 is totally absent. Distortion is relatively low, running about 2% across all the bands. To a certain extent, broadcast audio fidelity and the shortwave medium are mutually exclusive. Audiophiles who require superior sound when listening to international broadcasters would do well to seek out the high-end tube receivers of yesteryear.

The NRD-535D is not a radio designed for the casual international broadcast listener. What it is though, is a superb DX machine for the Utility SSB monitor, with more than adequate audio quality for its purpose. True, you can use it to listen to megawatt broadcasters for hours on end, but when it comes to extracting the station Id of a 1 kilowatt SSB transmitter from the ionospheric muck, that's where it excels. Unfortunately, audio quality is only average for broadcast listening, and at low signal levels, voice intelligibility really suffers.

As with all table-top receivers, audio is greatly enhanced with the addition of an external speaker.

BANDWIDTH/SELECTIVITY

The NRD-535D currently ships with the following stock IF filters: NARR 1.0 kHz (CFL-233 crystal filter), INTER 2.0 kHz (mechanical type filter designed for SSB), and a WIDE 5.5 kHz (CFL-D6S ceramic filter designed for AM). The AUX position defaults to 12.0 kHz (unless an optional filter installed).

Optional filters available from JRC include the following: CFL-231 330 Hz, CFL-218A 1.8 kHz, CFL-232 500 Hz and CFL-251 2.4 kHz.

The NRD-535D originally came with a stock 8 kHz WIDE filter that was just was just too wide for the crowded broadcast bands. Since variable bandwidth control was not available at this IF bandwidth, severe signal interference could occur from other stations that were 5 kHz above or below the desired signal. While this problem could generally be rectified by using ECSS mode, there were times when this was either not possible or desirable.

Realizing this shortcoming, JRC New York has subsequently issued a replacement, the CFL-D6S ceramic 5.5 kHz filter. This filter now ships in all current production models. For owners of original sets, it is available free of charge from JRC New York. (It is also included with the Variable Bandwidth Control upgrade kit).

Variable bandwidth is now available in all modes (excluding FM) including ECSS with all filter combinations. On earlier models, it only functioned in sideband with the INTER bandwidth.

The 2.0 kHz INTER bandwidth is an excellent choice for CW/RTTY/FAX work when used in conjunction with variable Bandwidth Control. The UP/DOWN buttons may be user-programmed to switch bandwidths between WIDE and INTER without requiring cycling through the other bandwidth positions.

AGC CHARACTERISTICS

The Automatic Gain Control (AGC) button on the NRD-535D is used to select the time constants of the radio's AGC circuit. The timings are FAST, SLOW and OFF and work in all modes with the exception of FM. The FAST setting is normally used when tuning through the bands and for general broadcast listening. SLOW was designed for receiving relatively strong signals in SSB mode. Tropical Band DXers will appreciate the OFF setting as it prevents the radio from desensitizing itself during thunderstorm static bursts. JRC states that the AGC circuit provides 10dB or less AF output variation for an antenna input signal change from 3μV to 100μV.

For most general listening conditions, the attack time of the two settings is adequate. However, sudden strong signals, such as static crashes, cause the ACG circuit to severely overshoot, resulting in a momentary loss of signal. When combined with a slow release time (both in SLOW and FAST modes), the results are particularly bothersome. The slow release time can also be a problem when scanning across the band as weak signals may be muted when tuning past strong ones.

Stepping through the AGC settings form FAST to SLOW to OFF also results in a mighty blast of distortion at the OFF position. If you do this frequently enough, you'll soon learn to ride the RF gain. In fairness to JRC, they have provided two methods to avoid this. The first is to program the UP/DOWN keys to switch between FAST and SLOW. The second method, which is more drastic, requires the jumper resistor (RJ6) mounted on the CDC-493AD CPU board to be removed. This will permanently disable the OFF setting.

As a result of owner feedback, JRC has come up with a short-term modification to correct the AGC overshoot problem. It requires some minor surgery to the IF Amp circuit board (trace cutting, jumper wires, etc.). JRC's New York office will send complete details of the modification to anyone who requests it (along with a Warranty Disclaimer).

GAIN CONTROLS

The AF GAIN control adjusts the volume of the speaker or headphones. The RF GAIN control manually adjusts the gain of the first and second IF amplifiers. As gain is decreased, the S-meter deflects. By the time the S-meter reads S9, the amplifiers have been reduced by approximately 40 dB. Receiver sensitivity is so high that many NRD-535D owners generally operate their sets with the RF GAIN at 50%. Reduction of the gain appears to quieten the set.

The ATT (Attenuator) is a relay-switched one that unfortunately has only one setting (20 dB). Neither the ATT or the RF GAIN affect the receiver's intermodulation performance. An intermediate ATT setting (10 dB) would be a welcome addition.

INTERFERENCE REJECTION

The interference rejection capabilities of the NRD-535D place this radio in a class by itself. To achieve this objective, the NRD-535D makes maximum use of the following interference rejection techniques: Exalted Carrier Selectable Sideband (ECSS), Variable Bandwidth Control (BWC), Passband Shift Control (PBS), IF Notch Filter (NOTCH) and Noise Blanker (NB).

ECSS

The Exalted Carrier Selectable-Sideband (ECSS) unit is designed to improve reception of standard AM (DSB - double sideband with carrier) signals. JRC uses the term "ECSS" rather freely as a true ECSS circuit utilizes a user-controlled BFO and a Product Detector. The NRD-535D's ECSS is really a PLL Synchronous Detector with selectable side band.

The NRD-535D's ECSS module is an elaborate plug-in circuit board containing a special IF amplifier and a phase-locked-loop (PLL) with various decoders and shifters. In keeping with JRC's design philosophy for this radio, this is accomplished with discrete components instead of a dedicated PLL integrated circuit. For the listener, the end result is one sideband, demodulated into audio, with a very wide bandwidth, very low distortion and a reduction of fading effects.

The PBS and NOTCH controls alter the 97 kHz IF, while the ECSS circuit requires an exact 97 kHz signal. In order to work, the radio must be tuned to within 1 kHz of the signal's carrier frequency. Synchronous lock occurs very quickly (generally within about two seconds and is fairly stable. The ECSS circuit was designed to be used with the WIDE IF filter.

It is generally good practice to reduce the set's AF gain before engaging the circuit as the accompanying initial howl or whine may cause the family dog to exhibit strange fits of behaviour. A better solution is to set the RF Gain manually (with the AGC in the OFF position) to keep the ECSS unit from misbehaving with AGC variations. This proves to be the best method and keeps the receiver locked on much better than when the AGC is ON. Even if the AGC is left on, if the RF Gain is cut back, the unit will lock much better.

On extremely deep signal fades, lock is lost and the whine is back, however relock occurs almost immediately once the signal comes back up. The ECSS unit may not operate if the signal is very weak or if more than one carrier is present within the selected IF filter passband. For medium to strong AM signals, audio quality is significantly improved, although some base tone is sacrificed.

The ECSS circuit will eventually lose lock if the PBS or NOTCH filters are engaged, but there seems to be some latitude with these controls before this occurs. JRC New York has suggested using the PBS to offset the passband when in ECSS mode, but cautions that is does take some "tweaking". For example: on 5975 kHz in ECSS mode you would offset the main tuning by about ± 1 kHz and adjust the PBS accordingly to compensate. The ECSS unit will then lock with no problem and the passband will be shifted to achieve the desired AF response.

VARIABLE BANDWIDTH CONTROL

The Variable Bandwidth Control (BWC) varies the pass-bandwidth of the receiving IF filter, thereby reducing adjacent interference. The original BWC unit (CFL-243) supplied with the radio allowed continuous narrowing of the receiver's passband from a maximum of 2.4 kHz to a minimum of approximately 500 Hz, without changing the frequency of the passband. This feature was available only from the INTER filter position and did not support AM, ECSS or FM reception modes. The control performed admirably for the utility SSB listener, but did nothing for the shortwave broadcast DXer.

JRC has subsequently provided a BWC upgrade kit (CFL-243W) for owners of the older NRD-535D and now incorporates the new unit for those radios in current production. The BWC upgrade kit extends variable bandwidth control to operate in AM mode with the WIDE filter, thereby allowing continuous narrowing of the passband from 5.5 kHz to 2.0 kHz.

The kit is available to all North American owners of the NRD-535D with serial numbers below BR56006. List price is $169.00 (U.S.) from authorized JRC dealers. The kit consists of a new crystal filter for the BWC circuit board and two new PROM IC's to update the set's firmware (microprocessor's controlling software). A replacement ceramic filter is also included to improve the WIDE filter bandwidth. Competent technical skills are required as delicate surgery must be performed on several of the circuit boards. (JRC New York also makes this 5.5 kHz filter, the CFL-D6S, available free of charge to any NRD-535D owners in North America who require one - you do not have to purchase the optional BWC unit.)

The new filter skirt measurements for the CFL-243W carry the following factory specifications.

FILTER	BWC MAXIMUM SETTING			BWC MINIMUM SETTING		
	-6dB	-60dB	Ratio	-6dB	-60dB	Ratio
WIDE	5.53 kHz	7.30 kHz	1.3:1	2.00 kHz	4.55 kHz	2.3:1
INTER	2.22 kHz	3.35 kHz	1.5:1	0.49 kHz	2.60 kHz	5.3:1

The above figures suggest the new BWC is more effective with the WIDE filter. (In the WIDE setting, the control is actually in the off position.) It seems to be extremely useful for voice bandwidth, for which it was originally designed. Some concurrent adjustment of the PBS control may be required to maintain maximum voice intelligibility during SSB mode reception.

Although JRC suggests CW/RTTY monitors install a filter narrower than 1 kHz in the AUX position, the writer finds that the INTER bandwidth with the BWC control narrowed to about 750 Hz is quite acceptable.

PASSBAND SHIFT CONTROL

The Passband Shift Control (PBS) allows the center frequency of the selected IF filter to be adjusted ± 1 kHz without changing its overall bandwidth. (One oddity of this set is that the PBS range is doubled when using a computer interface to ± 2 kHz). The control is useful in suppressing adjacent channel interference and can help reduce the effects of deep fades. PBS works in all modes, with the exception of FM. The control is normally set at the 12 o'clock position. When receiving USB, it is rotated counterclockwise to cut the higher frequency components of the received signal. The reverse is true for LSB reception. The radio does not take kindly to moving this control to either extreme during ECSS reception.

IF NOTCH FILTER

The IF Notch filter provides a 40dB notch that can be adjusted across the IF passband. It can be used attenuate a single frequency. This provides an effective means of eliminating an interfering carrier or signal that is close enough to the operating frequency to be within the passband of the selected bandwidth filter. The NOTCH control is rotated clockwise until the offending signal is attenuated. Unfortunately, the NOTCH filter is not effective in AM or ECSS mode.

NOISE BLANKER

The NRD-535D features a two-position Noise Blanker. NB1 is effective for ignition type noise from automobiles, etc. NB2 is effective against wide-band noise such as OTH "woodpeckers" The blanking level for either button is set by the NB LEVEL rotary dial control. The NB circuit is very effective for localized QRM, but naturally has little effect on ionospheric noise and static.

CLOCK/TIMER OPERATIONS

The NRD-535D features an internal clock with a single event timer. Clock and frequency display are mutually exclusive; a sore point with may set owners. In addition, the clock does not display seconds, unless a jumper is cut. Nor is the clock visible when the receiver is off. The receiver continues to draw a small amount of power in the off state to maintain the clock. If disconnected from the power source, the clock must be reset the next time the set is turned on. A user-programmable option permits changing the display characteristics of the colon (:) found between the hours and minutes digits. You may set the colon to remain on constantly or have it blink once per second. (Was this feature really necessary?)

The event timer will switch the receiver on and off and engage or disengage the relay contacts of the DC Timer Out terminal, thus starting and stopping a tape recorder.

SCAN/SWEEP OPERATIONS

At first glance, scanning capability on an HF receiver appears to be almost a contradiction in terms, given the nature of background QRM and the workings of Squelch circuitry. The NRD-535D's SCAN function can be used to automatically step through all or specified consecutive memory channels. Through the alternate function selection, start and end channel numbers can be entered. The RUN button starts and stops the scan.

For SCAN, the user may select a delay period from between 0.05 and 5.0 seconds per channel on which the receiver will pause. If the AS (Auto Stop) feature is enabled, the radio will pause during the SCAN operation whenever a signal stronger than the Squelch threshold is detected.

The SWEEP feature is used to scan a specified range of frequencies. After entering the lower and upper frequency limits, the receiver will automatically increment the frequency according to the current tuning rate settings. Auto Stop and Squelch work in the same manner as in SCAN mode. For SWEEP operations, the Auto Stop period ranges from 0.05 to 0.5 seconds per frequency.

USER-DEFINABLE OPTIONS

The NRD-535D features 16 user-programmable options. Two of these user-defined items not previously mentioned in this review include:

1) Bypass Front End Tuning Filters — facilitates the reception of extremely weak signals by allowing the user to bypass the variable bandpass tuning filter in the receiver's front end. (Requires experimentation as it may also increase interference from strong out-of-band signals.)

2) BFO Offset Frequency — permits the BFO (Beat Frequency Oscillator) to be offset by ± 5000 Hz for CW work (the default is 800 Hz).

COMPUTER INTERFACE

More and more personal computers are finding their way into listener's shacks. Until recently, they focused primarily on database log management. But all that has changed - a new breed of software has emerged that not only performs logging chores, but actually controls the receiver from the computer itself. Until the arrival of the NRD-535D, computer control of the receiver was a manufacturer-supplied but non-supported option that required a certain amount of "black magic" to make it work. JRC broke tradition by making the computer interface a standard feature, not an option. The "hocus-pocus" surrounding programming was dispelled through a user-friendly ROM interface and detailed examples in the Instruction Manual.

A 25 pin (DB-25) serial RS-232-C connector on the rear panel of the set connects the receiver to your personal computer through a serial cable. The interface operates at 4800 baud, 1 start bit, 8 data bits, no parity bit and 1 stop bit; 10 bits per character.

No less than 36 separate operational receiver functions can be controlled from the computer. Nor is communication restricted to a one-sided computer-to-receiver dialog. The NRD-535D can be polled by the computer to provide frequency, memory channel, mode, bandwidth, AGC, ATT, clock time, signal strength and squelch status. About the only thing it can't tell your computer is the name of the station to which it's tuned. Even this shortcoming is easily overcome with the excellent logging/control software that has emerged. Features such as downloading and sampling all of one broadcaster's frequencies with automatic date/time/signal strength logging are commonplace for many of these reasonably priced commercial programs. Want to develop your own speciality control programs? The NRD-535D's ROM interface makes that easy. A BASIC statement like PRINT#1, "W0500" & RETURN sets the bandwidth control to the narrowest setting of 500 Hz. The statement PRINT#1, "D7" & RETURN places the receiver in ECSS USB mode. A value of "D8" would select ECSS LSB mode. Perhaps the greatest boon to computer interfacing is that you now have virtually limitless numbers of memory channels. Want to see which "Africans" are coming through this afternoon? Sort your database for appropriate stations/ frequencies and have your computer download and sample each frequency. The actual channel memory contents of the receiver are not disturbed in any way. How about "Indonesians" at dawn or "Europeans" after dinner — the possibilities are endless.

The writer used his Macintosh SE as a diagnostic tool to confirm many of the NRD-535D's measurements for this article.

RECEIVER ADJUSTMENTS & MAINTENANCE

As with most receivers in this quality category, very little is required in terms of adjustments and maintenance. A recessed screw pot on the bottom of the set controls the volume of the receiver's Beep tone. The Reference Oscillator frequency can be user-adjusted on a trimmer capacitor, but the writer is not aware of any set owner who has found this necessary. The AC fuse is easily changed, although after 1000 hours of use, the fuse has not failed on the writer's set.

A lithium battery cell backs up the receiver's memory channels when the radio is off. Its rated life is five years. Judging from the Instruction Manual, removal and replacement is straightforward.

DOCUMENTATION

The English Instruction Manual that shipped with the original NRD-535D sets was an obvious attempt at a literal translation from the Japanese, and an unsuccessful one at that. Fortunately, Paul Lannuier of JRC New York quickly rewrote the offending document.

The current Instruction Manual (approximately 50 pages) is well illustrated with diagrams and photographs. Text is brief, but to the point. Many of the NRD-535D's features would not be self-evident if you did not read this manual. Almost four full pages are devoted to programming commands for operating your receiver from a personal computer. Armed with this information, even a novice programmer could write a rudimentary control program.

The optional Service Manual (30 pages) presents a brief, but adequate description of the set's unit blocks and circuits with a concise illustrated guide to receiver adjustments and calibration.

MATCHING EXTERNAL SPEAKER

NVA-319 is the model designation for the NRD-535D's matching speaker. As it was not initially available when the set was first introduced, the writer used the JRC NVA-88, designed for the NRD-525.

After several months, the matching speaker finally arrived. Unfortunately, it was a case where the anticipation was greater than the realization. For its price and performance the NVA-319 is a bit of a disappointment (it sells for three times the price of an NVA-88 with only marginal sound improvement).

Push Button Switch	ATTENUATION		
	-6dB	-10dB	-16dB
High Cut A	8.0 kHz	15.0 kHz	26.0 kHz
High Cut B	3.0 kHz	6.0 kHz	12.0 kHz
High Cut A + High Cut B	2.7 kHz	5.5 kHz	11.0 kHz
Low Cut	250 Hz	130 Hz	60 Hz

True, it does feature three selectable passive filters, but their effectiveness, particularly for broadcast band listening seems to be fairly subjective from listener to listener. Filter effects are more noticeable with headphones (a jack is supplied on the speaker that is placed after the filter circuits). Filter effects are more subtle in SSB mode. This speaker initially shipped without any documentation — nothing to even indicate filter characteristics. Full filter specifications are now shipped with the speaker. They appear in the table to the upper right.

Compared to the NVA-88, this speaker exhibits slightly more base. (The writer generally keeps the Low Cut filter engaged at all times for best sound). The speaker also features a jack for a second audio input source and a front panel switch for selection between the two sources. Despite its price, JRC New York can't keep enough of these units in stock to supply current North American demands.

RTTY DEMODULATOR

With the optional CMH-530 RTTY Demodulator installed, you can receive radioteletype (baudot) signals, decode them and output the data through the RS-232C port to a personal computer or printer.

Speed, shift and polarity of the signal are set through the alternate function keys and are stored in memory channels with RTTY mode. Fine tuning of the Space filter is accomplished with the Tone control. An outboard LED unit plugs into the Mark and Space jacks on the rear of the receiver to provide a visual tuning aid.

MODIFICATIONS

Currently, there are not many third-party modifications available for the NRD-535D. Lowe Electronics in England offers a slightly enhanced version, adjusting filter characteristics, the locking ability of the ECSS option and the addition of a more powerful audio amplifier. JRC authorized dealers in North America such as Universal and Electronic Equipment Bank offer Collins mechanical filters. Sherwood Engineering has a modification to the IF filter board that will increase the rejection of the stock filters by about 20 dB. Kiwa Electronics also offers user-installable filter modules that can be used with the radio.

NRD-525 - THE IN-HOUSE COMPETITOR

For serious Utility monitoring, a multiple receiver set-up is a must. Before the NRD-535D arrived on the scene, the writer's sets included a NRD-515 and two NRD-525's. For the past 17 months, the NRD-535D has been utilized in conjunction with a "loaded" NRD-525. Five months ago the writer's NRD-535D was upgraded to the "new improved" version. Through the use of a solid-state antenna multicoupler, instant A/B comparisons can be made between the receivers on the same antennas.

Just how well does this "new kid on the block" stack up against its predecessor? First impressions are that the NRD-535D looks and "feels" better. Once you get past the "cosmetics" you begin to realize that there have been some significant changes in circuitry. The new receiver undoubtedly fares better in increased dynamic range and sensitivity and improved intermodulation distortion rejection.

The new tuning rates on the NRD-535D (1, 10 and 100 Hz on the main tuning dial and 10, 100, and 1000 Hz on the Up/Down tuning buttons) make the NRD-525 appear sluggish by comparison. The writer prefers to generally use the 10 Hz dial rate for both utility (voice/digital) and broadcast monitoring. The tuning knob itself has a better dampened feel on the NRD-535D. The keypad is a joy to use compared to the non-precise touch of the NRD-525's keys. Nearly all of the good features of the NRD-525 have been retained, such as PBS (Pass Band Shift) tuning and the IF Notch to combat Interference. There are still only 200 memory channels, but the amount of information they can now "memorize" has been expanded.

The front panel display is markedly larger than its predecessor and LED indicators confirm when various optional circuits have been engaged - this is certainly a welcome change from the lack of a PBS indicator on the NRD-525.

The NRD-535D lacks the front panel BFO offset control found on the NRD-525. Instead, this function has been relegated to keypad programming. The method used to tune CW signals on the NRD-525 was both cumbersome and time-consuming. The NRD-535D now makes this task a "snap" to accomplish.

Similar to the NRD-525, the NRD-535D's AGC decay times and filter bandwidths are selected by push button switches. Unlike the NRD-525, there is no need to cycle through so many unwanted settings. Indeed, the Up/Down buttons can be programmed to cycle between the user's most common choices.

The ECSS circuit (albeit JRC's interpretation of ECSS) is a standard feature on the NRD-535D. The corresponding ESKAB option for the NRD-525 continues to remain expensive.

Perhaps the most significant new feature is the addition the Variable Bandwidth Control - operational in all modes (except FM) and with all bandwidths. To achieve the same result on the NRD-525, several optional mechanical filters at about $169.00 per filter would be required. Unfortunately, the number that could be installed at one time is rather limited.

The NRD-525 features an event timer and two clocks, while the NRD-535D has only one. (Any clock display that requires the user to press a function key to replace the frequency display with the time and then press another key to return to the frequency, is in this writer's opinion, an option which will never be used. (JRC please take note).

The NRD-525's audio hiss is totally absent. SSB audio is so good that the only time the writer uses his Datong FL-3 audio filter is to quieten severe "hets". (On the contrary, the FL-3 on the NRD-525 is engaged at all times). While certainly not discernable from a comparison of receiver specifications, the NRD-535D has the edge on "hearing" more signals. Performing A/B comparisons by utilizing the Receiver 1/Receiver 2 inputs on the Universal M-7000 decoder has consistently shown the NRD-535D to be superior in resolving RTTY and other digital mode signals. There is absolutely no question in the writer's mind that the NRD-535D outperfoms the NRD-525 in SSB, RTTY, CW and FAX modes.

The RS-232-C interface is a standard feature on the NRD-535D. Over four pages of the User Manual are devoted on how to write code to interface it with your personal computer. The interface board is an optional extra for the NRD-525, and although many programming commands are similar, no documentation exists to aid a would-be programmer.

Unfortunately nothing in this world of ours is perfect. In addition to improving on and adding to many of the NRD-525's features, the NRD-535D has also perpetuated some of its predecessor's shortcomings.

The AGC is still prone to static crashes and overshoots, resulting in temporary loss of signal. The Decay Attack Rate still is too slow. Medium Wave performance continues to remain poor for sets of this calibre. There are no facilities to select multiple antennas from the front panel and the receivers themselves have no means of elevating the front for ease of table-top operation.

Despite its faults, the NRD-535D continues to remain the writer's primary receiver for all types of monitoring, with the NRD-525 being relegated to stand-by frequency monitoring. The tuning rate, improved audio and increased "hearability" being the chief deciding factors.

The NRD-535D has not yet achieved absolute receiver perfection, but it is a marked improvement over the NRD-525. Given its added features, the price is more than reasonable.

THE BOTTOM LINE

Is the performance of the NRD-535D good value for its cost? As a NRD-525 owner, should you invest in upgrading your current machine or replace it with a NRD-535D? If you're considering a better table top receiver, how does the Drake R-8 compare in value for the dollar spent? If you have an older model NRD-535D, should you install the upgrade kit? For most of us the bottom line focuses on quality versus price, with price as the major limiting factor.

As of the time of writing, these three receivers may obtained at the following prices (U.S. dollars).

RECEIVER	STOCK MODEL	MATCHING SPEAKER	TOTAL PRICE	PERCENT
NRD-525	899.95	59.95	959.90	51%
DRAKE R-8	959.95	48.95	1008.80	54%
NRD-535D	1699.00	179.95	1878.95	100%

A stock model NRD-525 with matching speaker is now available at a price that is approximately one half the cost of a new NRD-535D. This represents about a $200.00 discount on the original price of this receiver. A stock model Drake R-8 retails for just over $1000.00 or 54% of the cost of a NRD-535D. The street price of the NRD-535D was raised by $110.00 when the "new improved" model was introduced.

Asking which receiver is best is much like deciding what car you should drive. For some, economy and efficiency are paramount, for others luxury and comfort are the rule, still others respond to performance and advanced engineering. Yet in the long run, each one is simply a mode of transportation.

Which receiver is best is generally a matter of personal preference tempered by what application it is intended to serve. As primarily a Utility DXer, it is this writer's belief that the "new improved" NRD-535D represents the finest communication receiver ever yet manufactured for this type of monitoring. Speaking as a former Broadcast Band DXer, it is an excellent top contender in this category (although some might consider it a bit pricey). Mediumwave DXers would do well to invest their dollars elsewhere. Mediumwave is generally just an adjunct on most shortwave receivers anyway, not their prime function. In this respect the NRD-535D is no different.

No, the NRD-535D is not a perfect radio, but then show me one that is. It comes close enough though, that after proof reading this review, in at least one shack there will be a "loaded" NRD-525 for sale soon to be replaced by another NRD-535D.

ACKNOWLEDGEMENT

Special thanks to Paul Lannuier of JRC New York for providing the "new improved" version of the NRD-535D for review purposes before it was released in the North American marketplace. Paul continues to provide a valuable "life-line" service to NRD-535D owners. While others might have a proverbial "axe to grind" in his position, Paul continues to be a source of unbiased information. Indeed, the improvements now reflected in JRC's latest model, are in no small part due to Paul's efforts in response to NRD-535D owners' suggestions and criticisms.

THE DRAKE R-8 RECEIVER
THROUGH DXERS' EYES AND EARS
Compiled by Elton Bylngton, N2KXT

The introduction of a major new communications receiver is always a happy event. But to have one brought to market by an American company with a reputation for building solid and innovative equipment makes it something special.

The re-entry of the R.L. Drake Co. into the shortwave marketplace was just such an event, and the receiver they produced has become a welcome addition to many a DXer's shack.

This review gives DXers the opportunity to tell, in their own words, what they like and dislike about the new Drake R8, the first new American DX machine in many a year, hopefully the harbinger of great things to come.

INTRODUCTION

From the late 1950s until the early 1980s radio receivers built by the R.L. Drake Co. were highly prized by DXers, SWLs, and hams alike. Many of the Ohio company's radios were acknowledged classics of receiver design and performance, with the final units in the series, the R7A and its commercial cousin the R-4245, thought by many to be the best DXing receivers ever built.

The Drake Co. left the shortwave radio field in the early 1980s to concentrate on the emerging market for satellite television equipment, eventually becoming a leader in that burgeoning industry.

But, even as the company's name slowly faded from the memories of shortwave aficionados, a core of Drake employees harbored a desire to return to the high frequency bands. By the end of the 1980s Drake's engineers and marketers were well on the way to building a receiver they hoped would compete head to head with the sophisticated radios from Japan that were then flooding the North American market. Could Drake pull it off?

Indeed they could, and proved it by launching the R8 communications receiver at the Dayton HamVention in April, 1991.

The new receiver introduced at Dayton sure doesn't look like a Drake. Its appearance has been described variously as "austere" and "high-tech;" some say it looks like a high-end stereo receiver and "would be right at home in my living room." It's generally accepted that one thing the Drake R8 does *not* look like is a serious shortwave receiver. Drake's years in the satellite receiver business are very evident in the looks of the new radio.

"Some may find the front panel design too stark, but I like the R8's aesthetics just as it is. I guess I like the 'stealth' look." -- Guy Atkins

"It's clean and well laid out -- you don't have indicators and colors all over the place, meaningless controls, etc. You get the sense that you are really operating this thing, not just pushing buttons." -- Jerry Berg

Looks are deceptive, for behind that sleek black panel is the heart of a fine DX receiver.

FEW CONTROLS, MANY FUNCTIONS

The front panel measures 13 1/8" (334 mm) wide by 4 11/16" (119 mm) high. There are seven rotary controls, 26 pushbuttons, and a mono/stereo headphone jack on the lower half of the panel. The upper half contains a green LED to show that the radio's synchronous detector is in use, an S-meter, and an LCD display that measures 5 3/8" (137 mm) by 1 3/8" (35 mm.)

Besides a rather small tuning knob (1 9/16", 39 mm), the rotary controls are small concentric knobs for volume/RF gain, squelch/passband offset, and tone/notch tuning.

"One of my dislikes about the radio is the stock tuning knob. I replaced the knob on my R8 with the stock knob from an Icom R-72A. It cost me $18 directly from Icom America." -- Guy Atkins

Drake's use of concentric knobs for other analogue functions has come in for criticism, as well:

"The center concentric knobs are of adequate size and feel, but the rear knobs are terribly under-proportioned -- they're practically hidden behind the center knobs, making them unnecessarily awkward to operate. With all the spare room on the R8's front panel, it's a shame Drake didn't spread things out a bit. I also wish the tone control were behind the notch, rather than the other way 'round. It would make it much easier to operate. The same thing applies to the rarely used squelch control and the often used passband offset." -- David Clark

When you turn the receiver on, the LCD tells you virtually everything about the radio's conditions: VFO in use, frequency, bandwidth, mode, RF preamp or attenuator, AGC time constants, which of the two selectable antennas is in use. It also tells you if the notch filter or noise blanker is turned on, or if the radio's timer is set.

The LCD also shows whether the receiver's in the memory or scan mode, and tells you what type of scanning it's set up to do. It even tells you if you've poked the wrong button.

A major gripe with the R8's LCD display is that there's no indication of the sub-kilohertz digits. Frequencies are displayed as XX.XXXXX, when they could more easily be read as XX.XXX:XX. The colon (:) for the radio's clock is in exactly the right spot and, I think, Drake could easily turn it on with a PROM change. If tuning isn't too critical, the display can be set to read fewer digits, to three or four decimal places: XX.XXX or XX.XXXX.

Along the bottom edge of the LCD are six labels that match up with the six small black pushbuttons directly below. Pressing the F (function) key changes the labels and the functions the buttons perform.

When the R8 is off, the LCD gives local or UTC time in 24-hour format, but there's no leading zero for times before 10:00 hours.

MULTI-PURPOSE KEYPAD

Just as the radio's LCD gives you a lot of information and the concentric knobs give the receiver a less cluttered look, so the radio's pushbuttons perform multiple functions.

Each button in the keypad has its secondary function labeled in orange. These functions are accessed by pressing the F key, followed by the appropriate button. If you make a mistake while entering a frequency, pressing the F key and the dot (.) will clear the error.

"Some have complained about the feel of the keypad buttons and the six under-the-display pushbuttons, but I kind of like them. The former have a good, solid feel, and the latter respond quickly, 'on the fly.' However, the on-off switch has a strange, soft feel to it, which I don't like." -- Jerry Berg

AUDIO PERFORMANCE

Here's an area where everybody agrees: The R8 sounds *GREAT!*

This radio puts the lie to the old wives tale that a shortwave radio -- especially a solid-state one -- must sound miserable. The audio it produces is smooth and ample, and it puts one in mind of the great tube receivers of the past.

I use mine side-by-side with a National HRO-50T1 and they sound remarkably alike, even though the HRO puts out more than 8 watts -- more than twice the R8's audio power. (Neither the R8 nor the HRO can match the superb audio of my Lowe HF-225, though. That radio is as close to hi-fi as an AM set can get.)

"Let it be said that the R8 sounds great! The intelligibility and crispness of its audio is by far the best I've heard from any solid-state communications receiver. The absence of muddy lows typical of 'Japanese audio' is very refreshing.

"This is a receiver that can make DXing in AM mode enjoyable again. The clean, low distortion and relatively wideband audio with the 4 kHz filter is amazingly good, and even at 2.3 kHz, voice response in AM is not nearly as muddied as we have learned to tolerate over the last ten years." -- David Clark

"The R8's audio is very good, even with the built-in speaker. But if you're a real 'speaker DXer,' as I am, you should use an outboard speaker for maximum performance." -- Jerry Berg

"The audio on the R8 is easily the best I've heard from any solid-state receiver. It's remarkably similar to the audio I've come to expect from a good tube-type radio." -- Dallas Lankford

Drake offers an optional outboard loudspeaker for the R8, called the MS8. David Clark says it works very well. I usually use a Minimus-7 speaker from Radio Shack, but occationally hook my R8 to the superb MS-4 that matches my old R-4B. The speaker accentuates voice frequencies.

"This receiver sounds so good I have found myself becoming more of a program listener than I used to be. And when it comes to DXing, every little bit of intelligibility helps." -- Guy Atkins

Several users have maligned the R8's tone control, saying it does next to nothing. Drake's Steve Whitefield replies: "I wanted to call it a bass-boost control rather than a tone control, but the marketing boys wouldn't let me!"

The R8's tone control really works -- and the radio's audio amplifier has the power to back it up.

My only gripe with Drake's design is that the tone control also affects the line-level outputs, so it can really tax your stereo amplifier, tape recorder, or RTTY decoder.

If you use the line-level outputs for taping, be sure that the tone control is NOT turned to the "morning" side of its travel. Keep it at 1 or 2 o'clock, otherwise you're likely to overload your tape recorder, amplifier, or speakers with excessive bass. This is *especially* true in ECSS tuning or when using the synchro mode!

Drake's putting two line-level outputs on the R8 was very thoughtful and is very welcome, especially for those of us who use RTTY decoders and do a lot of taping. It also makes hooking up an external audio filter a snap.

SYNCHRONOUS (PLL) DETECTOR

The R8's PLL synchronous detector is a marvel. It'll lock on to most very weak signals and does an excellent job of reducing audio distortion.

"It can make a big difference even on DX-level signals. Sometimes it locks on instaneously, other times it takes a little while. But I have noticed that it tends to go out of phase momentarily on strong signals with broad fade characteristics." -- Jerry Berg

Returning from a short DXpedition to the Washington State coast, **Guy Atkins** reported:

"The R8's synchronous detector successfully locked onto perhaps 90 percent of all signals, weak or strong, and improved the audio quality and readability of the signal in most cases. Tuning for MW DX signals was best accomplished in LSB/USB [ECSS] modes, however. On the stronger medium wave catches, I switched to the synchronous AM mode with good results."

Guy had his receiver examined by his friend and associate **Craig Siegenthaler**, developer of the Kiwa MAP. He says, *"Craig fell in love with the performance of the R8's synchronous detector. He says it's very nearly a perfect PLL type. Craig was VERY impressed with its response on DX signals in particular. Only when there's another carrier in the passband does the detector [understandably] get confused."*

I've noticed the same thing Jerry Berg mentioned -- that the PLL tends to lose lock on a broadly fading signal. This proves disconcerting, especially when listening to music. The music seems to "bend" in pitch when the PLL unlocks.

My Lowe HF-225 doesn't do this as readily as does the R8, and I think it's a function of the time constants used in the PLLs of the two receivers' detectors. When the PLL loses lock on the HF-225, the oscillator it controls tends to remain on frequency; the one in the R8 seems to try to snap back to its center frequency, waiting for the PLL to re-acquire the carrier.

"Another quirk of the R8's PLL detector shows up when the receiver is switched from a sideband mode into the AM mode and the 'synchro' button is pressed: the radio emits a piercing HOWL, that descends in frequency as the PLL's oscillator 'homes in' on the received carrier. Sometimes the frequency of this heterodyne is so high it's inaudible -- there's no audio at all. Pressing the synchro button a couple of times clears it up, but it's still annoying. This only happens when you switch from SSB to AM-synchro; if you're tuning around in AM mode and switch on the synchro detector it locks right in." -- Guy Atkins

"The R8's 'synchro' detector is extremely effective when it stays in lock. But I can't help feeling Drake should take another look at the design to make it less likely to lose lock." -- Dallas Lankford

PASSBAND OFFSET

The R8's **passband offset** system shifts the receiver's 50 kHz IF carrier to one side or the other of the IF filters' passband. This is done by varying the frequency of the 2nd local oscillator, which provides input to the 45 MHz to 50 kHz mixer. This is simple and effective, but there's a potential problem with this system:

If you're using a relatively wide filter and shift the carrier out to its edge in order to eliminate interference from an adjacent frequency, then switch to a narrower filter, the carrier of the station you were tuned to may then lie completely outside the receiver's passband. The result is a drop in audio level and an increase in audio distortion. To cure it, you'll have to readjust the passband offset control to bring the carrier back into the filter's passband. David Clark points out that the R8 isn't alone in requiring the operator to readjust the passband offset when going to a narrower filter. He comments that the R7's PBT does the same thing.

"I really like the performance of the R8's passband offset control. It can make a dramatic difference in signal intelligibility. In my opinion it is at least equal and likely superior to the R7's vaunted PBT, except that the R7 allows the user to 'slide' easily from one sideband to the other. It takes the mode key to accomplish this on the R8.

"The notch filter and passband offset are very helpful for extracting useful audio from 'messy' frequencies. I've been surprised more than once by the results achieved on what appeared to be a hopelessly buried signal." -- Guy Atkins

"Using passband offset with ECSS is powerful. When you find a station and go into USB or LSB, then move the PBT right or left, you are really getting a lot out of the signal. Only rarely must I go to a 2.3 kHz bandwidth; 4 kHz in USB/LSB usually does the job nicely. When I do use 2.3, however, audio remains usable as long as I don't tune too far off center." -- Jerry Berg

Bob Brown commented that he was displeased when he went from a wider filter to a narrower one, mainly because the audio level dropped. He said he was annoyed that he had to re-center the PBT control in these cases. I concur with Bob's observation, but I don't feel it's a real design fault.

IF BANDWIDTH FILTERS

Unlike most other communications receivers, the R8 is supplied with a full range of IF filters in widths of 6.0, 4.0, 2.3, 1.8, and 0.5 kHz. They are remarkably effective and their widths are well chosen for shortwave or mediumwave use.

"When the receiver was first announced, I was puzzled as to how it could possibly provide a range of five selectable bandwidths, nominally the same as for the [$2,000] R7, with reasonably good shape factors ... for a price of less than $1,000. Once the details of the receiver became known, the answer became clear. Drake has cleverly dusted off the L/C [inductance/capacitance] tuned circuit technique and has used it in the low (50 kHz) second IF.

"These are the same 'electrical' bandwidth filters that were used in the 1950s and 1960s to provide excellent selectivity characteristics, combined with inherently superior audio -- especially voice reproduction -- in the top-grade tube receivers such as the Hallicrafters SX-88 and the Hammarlund HQ-180 series, not to mention Drake's own R4 line.

"L/C tuned circuitry is obviously an idea whose time has come again -- providing very good, if not razor-sharp, selectivity for a small fraction of the cost of crystal or mechanical filters.

"However, I feel that 2.3 kHz is too close to 1.8 kHz -- I would haven preferred 2.8 or 3.0 kHz between the 1.8 and 4 kHz steps. The 3 kHz Sherwood filters in my R7s proved that to me." -- David Clark

"Some receiver users claim that L/C filters provide better audio response for listening to broadcast stations [than do mechanical or crystal filters.] From a performance standpoint, I wouldn't have known the R8 had L/C filters if I hadn't read about them in the Owner's Manual." -- Jim Kearman, writing in ***QST***, March 1992.

"The Drake's 1.8 kHz filter is good, but it doesn't come close to the ultimate selectivity of the Collins 1.8 filter I had installed in an NRD-525 (my previous main DX rig.) Many times while MW DXing I noticed audio from a nearby (1 to 3 kHz away) domestic MW channel bleeding through to a split frequency I was DXing. The excellent passband tuning helped, but it could not provide the results that the Collins 1.8 can give." -- Guy Atkins

Of course, Guy should have mentioned that that Collins mechanical filter costs upwards of $150.

Peter Hart, G3SJX, gives the following chart in **Radio Communications**, the journal of the Radio Society of Great Britain:

Filter	Bandwidth -6 dB	Bandwidth -60dB	Shape Factor
6.0 kHz	6070 Hz	10800 Hz	1:1.8
4.0	4260	7450	1:1.7
2.3	2510	4860	1:1.9
1.8	1970	3970	1:2.0
0.5	550	1170	1:2.1

AGC CHARACTERISTICS

Here's one of those facets of shortwave reception that has as many answers as there are listeners. This wrangling's been going on since the early 1930s, when AGC was called "automatic *volume* control."

Most DXers like their AGC fast; program listeners generally like it to work at a more leisurely pace. Both groups are likely to find the time constants used in the R8 to their liking. This is something just short of a miracle.

Drake has specified the R8's AGC attack time as 1 mS; release times are said to be 300 mS for fast, 2 seconds for slow. The AGC threshold is specified to be 0.8 microvolt, although Larry Magne found his receiver's to be 0.6 uv, and the one tested by Peter Hart in Radio Communications measured an astounding 0.25 uv.

"I think the R8's AGC characteristics are the best available on any receiver today. If you're willing to experiment, the JRC NRD-525's AGC can be made to be just as good, but it takes a lot of work." -- Dallas Lankford

Suffice it to say the R8 is not "deafened" by loud static bursts -- a major gripe with the NRD-525. The AGC can also be defeated, which is especially helpful when listening in the tropical bands during the summer.

"One thing worthy of note is that the R8 has a minor AGC attack problem that's most pronounced with strong CW signals and fast AGC. The AGC pops at the onset of each keyed element, making copying such signals fatiguing. Slow AGC and weaker signals help, but the true fix would be improved AGC attack characteristics." -- Jim Kearman, in QST

When the R8 was introduced the AGC time constants were chosen by defaults set at the factory and DXers hollered. Drake's current PROM chip takes care of that gripe by allowing the user to select his favorite AGC timing for the mode in use. It makes a big difference!

Through the aforementioned miracle, everybody who responded to my questionnaire said the AGC was "just about right."

THE CAROUSELS FROM HELL!

Having reached a consensus on the R8's audio and AGC, I decided to press my luck, and promptly stepped into quicksand. There's consensus here, too, but it seems to be that the R8's method of selecting modes and bandwidths was devised by Stephen King while in the throes of a particularly nasty hangover.

Whatever the motivation, which I'm sure was well intentioned, the R8's mode and bandwidth selectors are, to be kind, frustrating.

"Let's say that your favorite LSB bandwidth is 2.3 kHz, day in and day out. However, Voice of the Mangoes from Haiti (4697.5 kHz) is hemmed in tightly by a FEMA CW station on 4699.8 kHz. To combat the tough interference, you switch the bandwidth to the 1.8 kHz setting. Great! Perfect copy for a reception report.

"Some time later, you change the receiver to AM mode and seek other juicy DX to conquer. Aha! Just in time to catch the full ID of that new clandestine, Voice of the Confused Ayatollahs, broadcasting in Special Farsi. You quickly change to LSB, fully expecting to use your 'preprogrammed,' favorite 2.3 kHz bandwidth for that mode. But wait, there's MORE!!

"The PROM 'remembers' what setting you used THE VERY LAST TIME you were in LSB, so it switches to that narrower 1.8 kHz bandwidth. Arrrgh! In this DXing instance, Voice of the Confused Ayatollahs sounds too muffled in the 1.8 kHz bandwidth, and you just missed an ominous reading of your name on their new Hit List of North American Traitor/DXers.

"Unfazed, you go about your life blissfully ignorant of your danger in the days ahead -- and all because of a poorly implemented PROM chip from the R.L. Drake Co." -- Guy Atkins

Most DXers would prefer to be able to change modes and bandwidths independently, without having the radio decide its other settings for them. They'd also prefer to be able to cycle through the selections in both directions, perhaps by using the large UP/DOWN slewing buttons.

The R8 is not alone in having a "carousel" arrangement for choosing bandwidths. The Lowe receivers from England do the same thing. It's less annoying with the Lowe HF-225 because it uses a rotary knob to select its modes, rather than another "carousel." The Lowe HF-150 isn't likely to be used for real DXing, so mode switching is less of a problem, and besides, the HF-150's carousel works in both directions.

Drake's Steve Whitefield explained the company's reasoning with a simple statement: "We never expected real DXers to *BUY* the R8!"

Guess we fooled them, eh?

Fortunately, since the R8's operating system is contained in a replaceable PROM, nothing about the radio's operation is "graven in stone." When asked about the possibility of Drake's compiling a special "DXer's PROM" for the R8 and selling it as an option, Steve Whitefield said he thought the company might go for it.

But the "stock" R8 will remain as it now is, quirks and all. Drake feels it's easier for newcomers to the hobby to have the radio make some of the more arcane decisions for them. Maybe so, but it sure is frustrating for the rest of us.

As it is, the current PROM is a vast improvement over the original version, which *always* forced a factory-chosen bandwidth when changing modes.

NOTCH FILTER

The R8 has a tunable notch filter, but it acts in the audio frequency range, rather than at the IF. The low frequency allows the notch to be very narrow and quite deep, but many users have remarked that it's difficult to adjust, as a result.

One other problem with an audio-based notch is that the interfering heterodyne you're trying to remove has already affected the receiver's AGC by the time you've squashed it with the notch filter.

Most users say they'd have preferred an IF-based notch, and a couple said that one reason for using a low-frequency IF, like the R8's, is that a notch filter can easily be built for the 50 kHz range. One user stated that he felt it was inexcusable for Drake to have failed to build the notch filter at IF.

Dallas Lankford disagrees: *"When a het that's gotten through the receiver's IF is strong enough to affect the radio's AGC it's already as strong or stronger than the signal you're trying to hear. Slicing it out at that point could cause an overload in the RF-IF amplifier chain, leading to an increase in intermod."*

The bottom line is performance, and the R8's notch filter is superbly capable of slicing out a bothersome whistle.

NOISE BLANKERS

The R8 has two noise blankers, called wide and narrow, but there's no threshold control for adjusting their action. The wide one is designed to be effective against the old Soviet "Woodpecker" over-the-horizon radar. I say "old" because the Woodpecker was shut down several years ago and, with the dissolution of the USSR, it isn't likely to reappear.

The narrow noise blanker works well, especially if your neighbors drive Model Ts. A comparison with another receiver proves its effectiveness. It's designed to remove ignition noise, but most of us would prefer that its threshold level were adjustable.

"Some users have complained that the R8's noise blanker seems to operate intermittently. The reason is that the blanker samples the noise in the 1st IF stage, at 45 MHz, which is before the selective, 50 kHz IF. The bandwidth there is 12.5 kHz at -6 dB, and any signal within that passband that's stronger than the noise will desense the blanker. When it isn't inhibited in this way, the blanker works very well indeed." -- Dallas Lankford

BFO OFFSETS FOR CW AND RTTY

The R8 reads the correct frequency of a CW signal only when the radio's set for zero beat. The trouble here is that you cannot hear a CW signal when you tune for zero beat. This is a major pain, and it affects the R8's performance on RTTY, too.

"On the NRD-525, you have a BFO control. When you set the radio up, you set the BFO to neutral position. Set the mode to CW. Tune to a CW signal, for example, CFH on 10945. When the BFO is in neutral position, the CW tone will be zero beat. Adjust the BFO control 1.5 divisions clockwise and now you hear the 800 Hz tone of the CW note. Once set up, you no longer have to touch it. Now when you tune CW, you tune to the 800 Hz CW note and you have the exact frequency of the station on the readout.

"On the R8, there is no way to do this. To copy CFH on 10945 properly, that is by listening to the 800 Hz tone, you must tune the receiver to 10944.2. If you are sitting on 10945 you will be zero beat, but I don't know anyone who copies CW by listening to zero beat.

"This is ESPECIALLY annoying when trying to DX CW beacons on longwave. You will have many CW stations occupying the same bandwidth, and trying to identify them when the frequency readout is correct is tough enough, much less when the offset isn't accounted for.

"All the above applies to RTTY as well." -- Bob Brown

MEMORIES

Having a microprocessor in the guts of your receiver is a mixed blessing. If they're not well shielded they can cause you headaches, because the beasts generate a lot of RF noise which can wipe out weak DX signals. But the chips also allow your radio to store frequencies in memories, and the R8 gives you 100 to play with.

The R8's memories can be partitioned into blocks of ten, called lists, numbered 0 through 9. You can page through them in various ways, too, by using the large UP and DOWN buttons, the keypad itself, or by turning the main tuning knob.

"Being able to page through the memory channels with the main tuning knob is one of my favorite features. Sometimes I'll enter a station's parallel frequencies into contiguous memories, then just dial back and forth among them to determine which is best. There's no switching noise as you go from one to another, just the change in signal quality itself." -- Jerry Berg

The receiver's memories store not only frequencies, but also all the receiver's other settings, except for the adjustments to analogue controls such as passband offset, notch tuning, and volume.

"In the course of checking for mediumwave hets and audio, I discovered that I very much like the R8's method of memory channel entry. If an interesting signal or het is present and I want the radio to remember it for a future check, a single press of the V>M (VFO to MEMORY) button, followed by a two-digit number is all that's needed to do the trick. The receiver automatically reverts to VFO mode for continued manual tuning. This is VERY handy and quick when doing a bandscan." -- Guy Atkins.

As with any memory scheme, there are compromises. What Jerry Berg and I find especially useful -- the ability to "spin" through the stored frequencies with the main tuning knob -- makes the receiver's memories a nuisance to others, because the memories are not directly tunable. You must first transfer the contents from a memory to a VFO in order to adjust its frequency to compensate for a "variable" transmitter.

"I think the R8's memories are a nuisance, compared to those in the NRD-525 and R-71A, especially for DXers who want to program for DX signals in the tropical bands, which are often somewhat unstable in frequency. It's a pain to have to get out of memory mode, re-tune, then re-store when you find the station has shifted frequency slightly. I think Guy's comments tend to understate this consideration." -- David Clark

This is one of those no-win situations for the folks at Drake. Some of us like having a "channelized" radio that works like the R8; others would prefer a receiver with 100 "VFOs." But you can't have it both ways!

"Unlike most radios, the R8 stores all control settings and memory locations in non-volatile EEPROM (electronically erasable PROM) which has the major advantage over a battery-backed memory system [in] that there is no battery which needs replacing in the future." -- Peter Hart, in *Radio Communications.*

SCANNING

I have yet to find a receiver that does a good job of scanning a shortwave band. There's simply not a high enough signal-to-noise ratio on the HF bands to do what you want. The R8 is better than most, but it's still inadequate. It's the nature of the beast, I suppose.

For those who find scanning useful, the R8 offers several choices of both "mode" and "method."

Under the "mode" heading are three choices: scan all memories, scan all memories within a block or blocks, or scan upwards from the frequency in VFO-A to the frequency in VFO-B.

The "methods" are: stop scanning at the first carrier detected, stop at each carrier for five seconds, or stop at a carrier and remain there until the carrier drops, then move on.

Drake's excellent Owner's Manual gives helpful pointers on how properly to set the squelch and other controls to get the radio to scan as you want, but the scan *rates* are somewhat arbitrary.

"I tried using the scanning abilities on MW, to 'look' between the domestic 10 kHz-spaced frequencies for international MW DX. When scanning this way in a sideband mode, the R8 scanned either too slow or way too fast for my tastes. The scanning rate is adjustable by a change of the STEP rate, but neither speed was suitable for me. The NRD-525 with its fully variable scanning speed is better, but I've yet to find a receiver with scanning that was useful for serious DX when scanning from frequency to frequency." -- Guy Atkins.

As are most HF receivers, the R8 is fighting a losing battle in its valiant attempt to scan from one frequency to another. Scanning memories, however, can work quite well, as several users pointed out.

SENSITIVITY AND OVERLOAD CHARACTERISTICS

In this day of 500-kilowatt shortwave transmitters, a receiver's sensitivity isn't the problem it once was. But a radio's ability to hear weak stations sandwiched between these powerhouses becomes more of a problem every day.

The R8 has more than enough sensitivity to hear the weakest signals on the air, yet its ability to dig through the megawatts to pull out a flea-powered beanshooter from Indonesia or Africa is outstanding. This is quite an accomplishment, as we shall see.

Following the modern practice, Drake has dispensed with a tunable preselector in the R8 and has used nine, diode-switched bandpass filters in the radio's front end. Once it knows the frequency you want to tune to, the set's microprocessor selects the appropriate filter for that band segment. The system is simple and effective.

RF from the front end filters is applied either to the switchable preamplifier or directly to the first mixer, if the preamp's switched out. The first mixer is the key to the R8's RF performance, and Drake has struck a good compromise between sensitivity and interference rejection.

The following chart is taken from a review of the R8 by **Peter Hart, G3SJX**, that appeared in the RSGB's **Radio Communications** for February, 1992. Measurements below 1.8 MHz were taken on my own receiver. International convention calls for an S-meter reading of S9 for a potential difference (a voltage) of 50 uv across 50 ohms, so the R8's S-meter reads high.

Frequency	**Sensitivity (SSB 10dB s+n:n)**		**Input for S9**	
	Preamp IN	**OUT**	**Preamp IN**	**OUT**
0.1 MHz	---	0.35 uv	--	47 uv
0.5	---	0.32	--	45
1.0	---	0.28	--	45
1.8	0.18 uv	0.28	11 uv	35
3.5	0.18	0.28	11	35
7.0	0.18	0.28	11	35
10.0	0.18	0.28	11	40
14.0	0.20	0.32	13	45
18.0	0.20	0.32	11	45
21.0	0.22	0.35	13	45
24.0	0.25	0.35	14	45
28.0	0.22	0.32	14	40

As you can see, the R8 has sensitivity to spare. But the hottest radio in the world is useless if its dynamic range and image rejection fall flat. The R8 is no slouch in this department, either.

Larry Magne's *RDI White Paper* gives the receiver's dynamic range as 71 dB for a signal that's 5 kHz away and 90 dB for a signal that's 20 kHz away from the one you're tuned to. The ARRL Lab measured the blocking dynamic range at 20 kHz spacing as 123 dB (3.5 MHz) and 118 dB (14 MHz) with the preamp off; 112 dB (3.5 MHz) and 114 dB (14 MHz) with the preamp on. (The discrepancies between the two lab's readings are due to the method used in making the tests. Both indicate essentially the same result.)

The third-order intercept point at 20 kHz was measured by ARRL at 6 dBm at 3.5 and 14 MHz with the preamp off, and 0.5 dBm (3.5 MHz) and -8.5 dBm (14 MHz) with the preamp on. With this measurement, the higher the figure the better. Drake's specs claim 5.0 dBm or greater at 20 kHz spacing. For reference, the NRD-525 has a claimed 3rd-order IP of 13.0 dBm.

"Rejection of the 45 MHz IF was around 90 dB with the primary image rejection well over 100 dB. The second mixer image occurs 100 kHz below the on-tune frequency and rejection of this signal was close to 80 dB on all bands. This is remarkably good ... The receiver was also remarkably clear of other responses and particularly good close-in, where many rigs tend to show up problems. No other [spurious] response was worse than about 100 dB down. -- Peter Hart, in *Radio Communications*

Here are some reports from the "real world:"

"I don't know how it stacks up in laboratory tests, but I have the sense that 'if it's there,' this set will pull it out, especially in ECSS with the PBT." -- Jerry Berg

"I was impressed with its strong-signal handling capacity and the ability to pull a weaker, adjacent channel out of the slop. It's BETTER than my race-prepared Icom!" -- Werner Funkenhauser, who used the R8 on mediumwave.

"I'm very impressed with the R8's dynamic range. The radio is exceptionally quiet, yet it handles extremely strong signals with ease. I measured the noise floor on my receiver at 0.125 microvolts for AM and 0.025 microvolts for CW/SSB (using the 6 kHz filter.) It's somewhat quieter than my R-390A, and I keep that radio in top condition." -- Dallas Lankford, whose measurements were taken on the MW band.

I can attest to the R8's ability to handle strong local signals, because I live only about a quarter mile from a 50kW AM broadcast transmitter (WQXR-1560 kHz) and in the station's antenna's major lobe. The RF floating around my apartment doesn't bother the R8 in the least, except on mediumwave when using a long wire. This is no problem, because I always use a loop antenna on the MW band.

A PEEK INSIDE -- WHAT MAKES THE R8 TICK?

The Drake R8 contains four major circuit boards, interconnected by multi-conductor cables and miniature coax. All the cables plug into sockets for easy circuit board removal, and Drake's left enough slack in the cables so that the receiver can be operated with the boards pulled out for servicing.

"Particularly impressive is the extensive ground-plane grid that helps the receiver achieve such a low noise floor. A fine grid of metallic traces can be found going under and around nearly all components on all circuit boards in the R8." -- Guy Atkins

The four main boards are divided as to their functions, with the RF front end board on top. This board also contains the first IF stage at 45 MHz and the second mixer that converts it to the second IF at 50 kHz.

Directly below that is the second IF board, which holds the selectivity producing L/C filters, the demodulators, the audio stages, and part of the power supply.

The front panel components are attached to a third circuit board, which mounts vertically.

The R8's frequency synthesizer and microprocessor circuitry is mounted on a fourth circuit board. This one, mounted above the radio's bottom cover, is isolated from the R8's other components by a hefty aluminum chassis, effectively shielding the radio from internally generated computer noise.

"I'm impressed by how quiet the R8 is from an RF standpoint. I was able to use the radio for MW DX using a McKay-Dymek amplified loop antenna that was only inches from the receiver's front panel. My Icom R-71A makes the use of a loop anywhere near the receiver impossible." -- Werner Funkenhauser

"The R8's LCD's quietness makes it ideal for use with a nearby loop antenna. For the MW DXer, the R8 is THE receiver to own." -- Dallas Lankford

I use my loops in the same way as Werner and Dallas and have had the same results. MW DXing is impossible when my NRD-525 is turned on -- there's simply too much RF hash radiated from the radio.

"We designed the R8 to minimize RF leakage from the radio's microprocessor and display. Indeed that's one of the main reasons we opted for an LCD display over a fluorescent." -- Steve Whitefield

Nearly everyone who owns an R8 has remarked that the receiver runs warm. It even stays warm when it's turned off. There are good reasons for this:

First, even when it's off, many of the R8's circuits continue to work, including the internal clock/timer and the LEDs that illuminate the LCD display. As a result, the power supply must be operating as well.

Because the radio's front panel is made of heavy extruded aluminum, Drake uses it as a heat sink for an LM317 voltage regulator IC that controls the voltage for the front panel LEDs. That voltage regulator seems to be the major source of heat. Since there are 52 LEDs for the main display, they draw quite a bit of current. And they're always ***on***, even when the set's turned off.

If you turn the LEDs off and rely on ambient light for viewing the LCD, the R8 runs cool.

INNOVATIVE CIRCUITRY

The Drake R8 contains a number of surprising, innovative circuits that enhance the receiver's performance. These include the use of a *synchrophase AM detector*, similar to that used in the Drake R7 and the Kiwa MAP, for "normal" AM reception, and an intriguing image-reject mixer, which converts the 45 MHz first IF to the low, 50 kHz IF used in the selectivity stages.

Images, the appearance of radio signals at points on the dial far from where they belong, have plagued designers of superheterodyne receivers since the day Major Armstrong built the first one, during World War One. The engineers at Drake have incorporated in the R8 an elegant solution to the image problem, called an *image-reject mixer.*

This innovative circuit takes the 45 MHz signal from the receiver's 1st IF amplifier and splits it two ways. One of the split signals is fed directly to a diode-ring mixer in the traditional way. The other half of the signal, however, is fed through a *90-degree phase-shifting network*, then on to a second diode-ring mixer.

Now it gets interesting! The local oscillator signal, necessary for converting the 45 MHz IF signal to 50 kHz for the R8's 2nd IF strip, is fed *in phase* to both mixers. Then, the outputs of the two mixers are re-combined through a second phase-shifting network, this time at 50 kHz.

In this way, any frequency other than the wanted signal gets shifted more or less than 90 degrees, and gets routed away from the 2nd IF strip, into a loading resistor.

Thus, the images wind up in a 47k resistor, instead of in your loudspeaker!

One problem that has plagued DXers and program listeners forever is the audio distortion produced by a traditional AM envelope detector when the received carrier fades.

When a distant radio signal passes through the ionosphere, portions of the signal are delayed more than others, so they arrive at your receiving antenna out of phase with one another. This produces fading, sometimes called QSB. When an AM station's carrier wave arrives at your receiver at a lower level than the modulation-carrying sidebands, distortion results. It's directly analogous to overmodulating the transmitter.

The R8 attacks this problem by using two separate types of synchronous AM detection. The radio's "normal" AM detector is an adaptation of the *synchrophase* detector Drake developed for the R7 series receivers. And the R8 contains a *phase-locked synchronous detector* that replaces the received carrier completely, eliminating many of the effects of fading completely.

The receiver's PLL synchronous detector is a key to its excellent audio performance. When the detector stays in "lock," which is most of the time, the R8's audio distortion is exceptionally low. When it falls out of "lock," ECSS techniques can make listening a very pleasurable experience.

A full discussion of synchronous AM detection is beyond the scope of this article, but the subject is covered thoroughly in Craig Siegenthaler's excellent piece in *Proceedings 1990*.

PLEASURES AND PAINS

Anything as complex as a communications receiver is bound to have features that one user likes and another finds annoying. The R8 is no exception.

When the receiver was first released, Drake took a lot of heat about the way the radio would choose such things as bandwidth, AGC time constants, tuning steps, etc., depending on the mode switch setting. After several strong complaints the company saw the light and recompiled the radio's operating system, retrofitting older receivers with a new PROM.

There are still some features of the radio that are irksome, some of which cannot be fixed by replacing a chip. One of these is the receiver's clock. The R8's clock will keep accurate time for two time zones, but when the radio's turned on you can't see either one, except for a fleeting glimpse when you press a couple of buttons.

This is a real mistake, I think, and one that's not easily corrected, because the LCD has no means of displaying the time and the frequency simultaneously.

Another annoyance, especially for those who like to drag their radios along on DXpeditions, is that the power cord is not detachable. Several users have griped about this one.

I, for one, feel that the terminal block supplied for connection to a DC source is too flimsy for the job. I don't relish the idea of a pair of wires, carrying a couple of amps of DC at 12 or more volts, coming in contact with one another. Better it were a Molex connector of some sort, with a *fused* cable supplied.

Many others have complained about the relatively small tuning knob used on the receiver, but the knob options Guy Atkins outlined got around that problem for me and a few others. The trouble here is there's just not enough room between the encoder shaft and the small mode and bandwidth selection buttons to allow fitting a larger knob. As it is, it's far too easy to bump the tuning knob when you go for one of those buttons.

And, speaking of tuning, the R8's synthesizer produces a moderate amount of "chuffing," which sounds like muffled clicks whenever the kilohertz digit changes. It's not loud enough to be obnoxious, but it's there, nonetheless.

Dallas Lankford has discovered a number of "birdies" and other spurious responses in the R8, but he says they are no more numerous or bothersome than on any other synthesized receiver he's used. He has compared notes with other R8 owners to be certain that the artifacts are not unique to his radio.

Drake provides for complete software control of the R8 via a computer port on the radio's rear apron. Besides being available directly from Drake, others have produced software packages for the radio. A check of DX hobby magazines and telephone bulletin board systems reveals several control programs for the radio. Jim Frimmel has adapted his WRTH Award-winning *Shortwave Navigator* for the Apple Macintosh to the R8, and programs for IBM computers, some using Microsoft *Windows*, are widely available.

But everybody's biggest gripe is still those damned mode and bandwidth selection "carousels." It's an issue that just won't go away, and it'll continue to rankle for as long as the R8 exists, I guess.

To be frank, I now find it almost automatic to do a lot of poking when changing modes. The revised PROM really helps, but it's still a nuisance.

And, when it comes to *real DXing*, this is not a small matter. Those two buttons can mean the difference between getting an elusive ID and missing it.

A LOT OF RADIO FOR THE MONEY

Despite its quirks and small annoyances, Drake did so much *right* in designing and building the R8 that *we users want it all!*

"In today's marketplace, I feel that the R8 is the best value around in a communications receiver. Performance is the bottom line, isn't it? This receiver is a well-balanced machine that has no glaring faults in any area. The three S's of Stability, Sensitivity, and Selectivity are all found to a high degree in the R8. Add to these the quality audio and flexibility the radio provides, and you have a very useful receiver." -- Guy Atkins

Guy's statement about sums up the consensus I found among R8 owners, myself included. Other receivers may exceed the R8's performance in certain areas, but the folks in Miamisburg have produced a radio of which they, and all Americans, can be proud.

ACKNOWLEDGEMENTS and THANKS!

I want to thank all those DXers who took time away from their radios to respond to my questions.

But first, I want to extend a special note of thanks to **Steve Whitefield, WA3OJX,** of Drake, for giving freely of his time during the Winter SWL Festival to answer the questions Dave Clark and I fired at him. His help was invaluable and I'm looking forward to the next Drake receiver!

ANARC's North American Shortwave Broadcast DXer of the Year, Jerry Berg, was especially helpful. His wonderful article for the *NASWA Journal,* **"Rip Van Winkle Meets the Drake R8"** (Dec. '91), was a real treat, and his personal correspondence was above and beyond the call.

Guy Atkins took time out to give me a West Coast perspective, and set me to dreaming about long, l-o-n-g wire antennas.

ODXA President David Clark, a DXer who has at least one copy of every radio built in the last 50 years, supplied a Canadian view of the R8. Does wonders for Free Trade, eh?

A mediumwave view from Canada was supplied by **DX Ontario's MW editor, Werner Funkenhauser,** who confesses he's unable to purchase an R8 right away because he's planning a trip to Europe this summer. He'll have one before next DX season, though.

Although primarily a mediumwave DXer, **Dallas Lankford** is well versed in all aspects of receiver design. Dallas is currently working on a number of enhancements for the R8.

NASWA's Executive Director Bob Brown, KW3F, was not only a great host at the Winter SWL Fest last March, but contributed some very cogent commentary about the new receiver.

My friend and associate, **Mike Musielski,** worked many hours developing a computer program to run the R8 and passed on a lot of valuable comments. Fortunately for this review and for the **R8TUNER** program, the weather during a northeast winter isn't conducive to flying an open-cockpit biplane.

And thanks to **Jim Frimmel** for telling me about his great **Shortwave Navigator** program for the R8 and other receivers. If I ever buy a Macintosh, his program will be the first software I install.

FURTHER READING

In the year since it was released, the Drake R8 has been reviewed in virtually all the hobby publications. It's impossible for me to provide a fully comprehensive list simply because I haven't seen all the reviews. With that in mind, here's a list of the domestic reviews I *have* read:

Both *Passport to World Band Radio* and the *World Radio TV Handbook* covered the R8 in their 1992 editions. The reviewers, **Larry Magne** for *PWBR* and **Jonathan Marks** for *WRTH,* present divergent views of the receiver that reflect the suitability of the radio for use in different locales. Magne, writing from the Philadelphia area, liked the receiver; Marks, whose base is in northwestern Europe where signal strengths tend to be very high, thought the receiver was overpriced in Europe. It should be noted that both of these reviews were prepared before the current PROM was released by Drake. The *PWBR* review was published in September 1991; the *WRTH* review, in January 1992. The *WRTH* review is a virtual transcript of a review broadcast on **Radio Nederland's** *Media Network* on September 19, 1991.

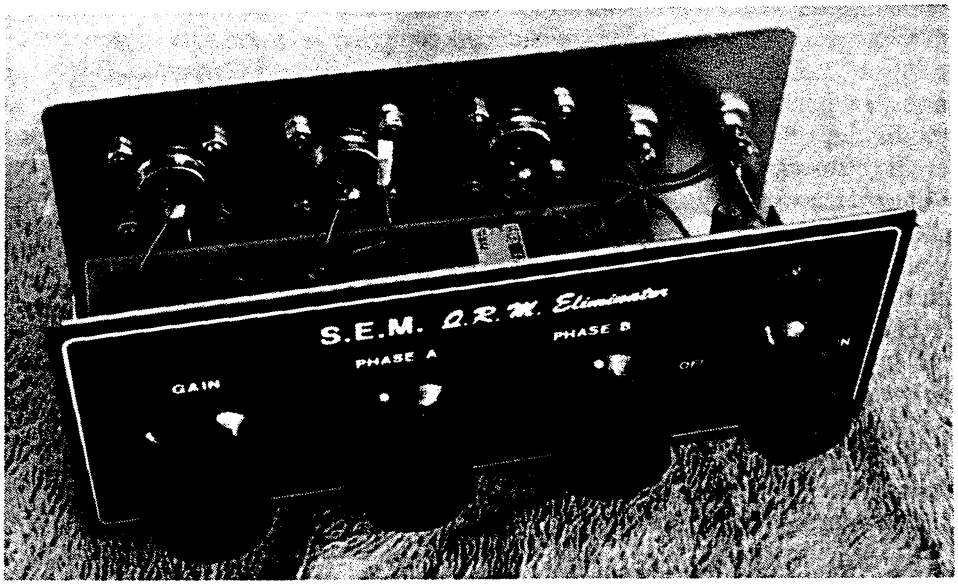
Larry Magne's *RDI White Paper* on the Drake R8 was released in January 1992 and contains extensive test data, as well as a complete revision of the review that appeared in *PWBR*, to reflect the most recent PROM changes. It costs $6.95 postpaid from: **Passport RDI White Papers, Box 300, Penn's Park, PA 18943.**

Other reviews appeared in *QST,* March 1992; *CQ,* February 1992; *Monitoring Times,* October 1991; and *Popular Communications,* October 1991. Of these, the *CQ* and *QST* reviews are most thorough.

peripheral equipment

THE S.E.M. QRM ELIMINATOR

Bob Eldridge, VE7BS



There are many ways of dealing with interference, most of them acting within the receiver or between the receiver and the headphones or loudspeaker. The 'QRM Eliminator', manufactured by S.E.M. on the Isle of Man, U.K., reduces or eliminates the interfering noise or signal BEFORE it reaches the antenna terminals.

There is a lot to be said for this approach, because apart from the unpleasant intrusion into the audio, the presence of the interference within the set may upset the detector action, the automatic gain control and other internal functions.

Remember that if your receiver is connected to the AC power line, local noise may be picked up by direct conduction. The Eliminator is designed to reduce radiated interference coming in via the antenna.

GENERAL DESCRIPTION

The aluminum case is black, 6" x 2" x 3" deep (15 cm x 5 cm x 8 cm), with silk-screened panel markings. Except for the controls and connectors, all components are mounted on a 4" x 2" (10 cm x 5 cm) foil board.

The back panel has three SO-239 coaxial connectors (MAIN ANTENNA, RECEIVER and AUXILIARY ANTENNA) and two RCA phono type sockets (DC INPUT +10-15V 150 mA, and CONTROL).

The unit tested is a Mark 2, with three transistors, four diodes and good quality tantalum and mica capacitors. The CONTROL point is diode-protected, the cathode (positive) connected to the CONTROL terminal.

The frequency range is specified to be 100 kHz-60 MHz. There is a LORAN-C station a few hundred miles from me, so I confirmed that it works at 100 kHz, but I could only test it to 30 MHz.

The MAIN antenna, a separate AUXiliary antenna and the RECEIVER are connected to the Eliminator. The interference is received by both antennas but it arrives first at one and then at the other, depending on the direction from which it comes . The signals from the main antenna go straight through to the receiver. Those from the auxiliary antenna pass through the phase-changing circuits. The controls are adjusted to delay the interference picked up by the auxiliary antenna and apply it at the receiver antenna terminal to cancel out the interference picked up by the main antenna.

USING THE ELIMINATOR

If the interference is coming in from one general direction it really does cancel out, usually completely.

There are three variable controls (GAIN, PHASE A, and PHASE B) and an on-off switch, all on the front panel. With the GAIN at maximum, the two PHASE controls are adjusted to minimize the interference. (Turn one to reduce it, the other to reduce it more). If it is still audible, the GAIN is adjusted, and a final tweaking of the phase controls may be necessary. If the interference is from a local source that's all there is to it, and the controls can be left alone. If it is coming via sky wave the setting will not stay constant when the vertical angle of arrival changes. It is very effective and stable in taking out groundwave interference from a broadcasting station. During the tests it has always been possible to reduce or eliminate local noise, whether impulse or hash, strong or weak. By careful adjustment an S9 hash can often be completely suppressed, with little or no effect on the desired signal. Sometimes the adjustment is sharp, sometimes quite broad.

Although the device is called a QRM Eliminator, it is intended to remove QRN (manmade or natural noise). But it often works on undesired radio signals too, if they are arriving from a direction other than that of the desired signal. For example I sometimes listen after dark to hockey commentaries broadcast on CKNW 980 kHz, located about 130 km from me. With the Eliminator I can 'phase out' a troublesome heterodyne, and often remove an interfering station that is zero-beat. One or other of the phasing controls has to be shifted once in a while, but it will improve the audio from chaos to acceptability. It is easy to check the effectiveness, because switching to 'OFF' connects the main antenna directly to the receiver and grounds the auxiliary pickup antenna.

If the interference is coming from the same direction as the signal it can be phased out, but the signal may be phased out as well. Occasionally the Eliminator INTRODUCES noise, when the auxiliary antenna picks it up but the main one does not.

Most of the testing was done using a Yaesu FRG-7700. The main antenna was a 600 ft horizontal loop about 60 ft high. For auxiliary antenna I tried other antennas (a 600 ft vertical Delta, a three element Yagi, a trapped vertical groundplane), unused coax feeders coiled up just outside the shack, random wires laid on the ground. Sometimes one arrangement worked best, sometimes another. Everything worked to some extent.

S.E.M. does not provide a schematic, but did send a sketch (Figure 1) to show the principle on which the design is based. Details of bypass switching are not shown.

To bypass, two relays are used to route the signal from the main antenna straight past the Eliminator, at the same time grounding the auxiliary antenna.

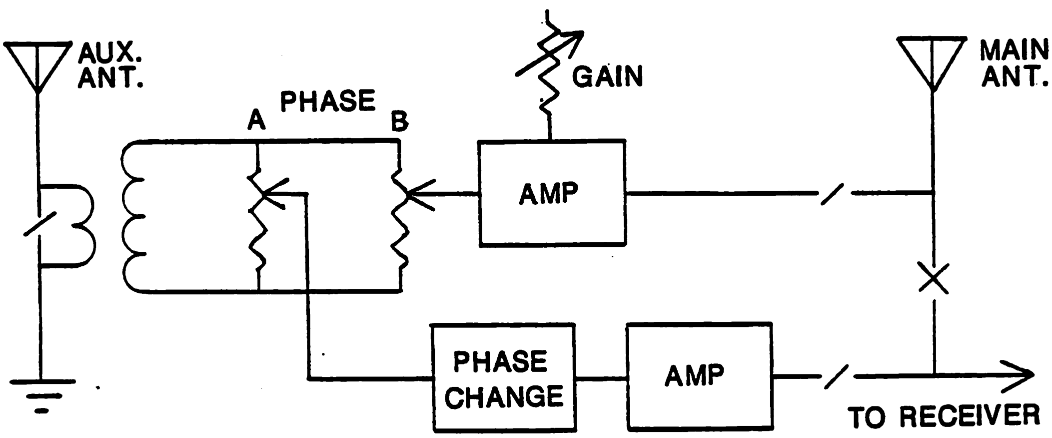


FIGURE 1 PRINCIPLE OF OPERATION OF THE S.E.M. 'ELIMINATOR'

Switching the unit off, removing the 12V DC, or applying a ground to the control terminal will put the unit in this bypass condition. So at the point marked X there is an open circuit when the unit is in operation, a closed circuit when in 'bypass'. Other contacts on these relays make or break connection to wide band amplifiers in the antenna circuits.

There are no tuned circuits. The input from the auxiliary antenna is coupled through a wideband toroidal transformer. The amplifiers are n-channel J-FETs.

ANTENNAS

The circuit presents a 50 ohms load to the main antenna except when in the bypass mode. Then it allows the receiver to do the terminating.

S.E.M. says almost anything can be used as an auxiliary antenna for noise pickup because local interference can be picked up well with a poor antenna. An unused HF or VHF antenna, even a length of unused coax or a random length of wire indoors or outdoors will do. The AUX input impedance is not critical, and S.E.M. recommends that if a coax cable is used on the AUX antenna, just the center pin should be plugged into the AUX socket, with the ring of the plug making no contact. S.E.M. says that polarization of the AUX antenna is not important. The only essential is that the AUX antenna be physically separated from the main antenna.

I thought a vertical AUX antenna should be better than a horizontal, reasoning that a horizontal wire does not have such a specific position in space. One part of it may be closer to the source of noise than another part. But S.E.M. says it does not matter, and indeed in testing the unit there was no advantage in having a vertical AUX antenna. Whatever the shape or size of the antenna, there seems to be a single effective 'center' that determines the phase of the signal, and if there is any difference in the effectiveness of pickup it can be compensated for with the gain control. If there is a known source of noise, a power line transformer for example, a short whip close to the transformer works well and has the advantage that it does not pick up noise from other more distant sources.

Of course if you want to phase out interfering distant signals, the AUX antenna has to be good enough to hear them. This is an interesting thing to play with, because the combination of two good antennas and the Eliminator works as a directional array with a variable null. You can't have everything though. You can't phase out local interference from one direction and also phase out a distant signal coming in from another direction!

I figured that if the unit could cancel a signal by antiphasing it, it could enhance it by cophasing. Maybe it does and maybe it doesn't. I just haven't been able to make up my mind. The gain control affects the strength of the signal passed on to the receiver, so at some gain settings it is acting as a preamplifier.

USING WITH A TRANSMITTER

The Eliminator may be connected in the antenna feeder of a transceiver with up to 200 watts output. The CONTROL terminal is then switched to ground on transmit (making sure the ground occurs before the transmitter develops power). Alternatively the Eliminator can be switched off or the 12V input removed before transmitting. The switching relays fail safe, so in all these cases the AUX input is grounded for transmit. An r-f sensing circuit is fed from the RCVR terminal and switches the relays to BYPASS mode if r-f power appears. If a power amplifier is used with the transmitter the Eliminator goes in the feed from transceiver to amplifier.

Another way to use the device would be to feed the MAIN ANTENNA terminal from the receive side of the T/R switching in the transceiver, and connect the RECEIVER terminal to the transceiver receiver section input. Bandpass filters are normally between the T/R switching and the antenna in solid state transceivers, and would prevent overloading from strong local signals under some circumstances.

PRODUCT CHANGES

My unit, bought in mid-1991 is a Mark 2. I have not had the opportunity to test it in a location near powerful broadcasting transmitters. One bought more recently has two more transistors in the r-f sensing circuit, making the circuit more sensitive. Used a few miles from medium wave broadcasting stations, the user reports hearing intermodulation from them when listening on 1.8 MHz without a medium-wave-rejection filter. He also reports that if he removes both antennas and switches the unit on he hears white noise above the noise floor of the receiver, audible but not strong enough to move the S-meter needle. I tried this with my unit, on a receiver with .25 uV sensitivity (a Ten-Tec Corsair 2), but could not discern any difference between on and off. But when using it on the FRG-7700 below the M-W broadcast band some added white noise is audible.

While testing with the Eliminator in the coaxial cable between transceiver and linear amplifier I blew the amplifier transistors in the Eliminator (S.E.M. replaced them). Maybe the more sensitive sensing circuit in the later model would have saved them, although I still don't know why they blew.

PRICE, DELIVERY ETC.

The address of the manufacturer is S.E.M., Union Mills, Isle of Man, United Kingdom. Telephone: Marown (0624) 851277 or 662131. The price in early 1992 was 85 Pounds Sterling including VAT (Value Added Tax) and delivery in the U.K. (about $150 U.S. or $180 Cdn at the time of writing). For export to North America the VAT is not added, but the extra cost of carriage and insurance outweighs the saving in VAT exemption. Credit card orders are accepted.

S.E.M. ships very promptly, and responds willingly and promptly to queries or problems. Circuit details are not provided, but nothing is encapsulated and the circuit board is easy enough to trace out. S.E.M. says thousands have been sold. I do not know of any plans to distribute through a North American outlet.

CONCLUSION

Although I seldom suffer any harmful local interference, I am glad I bought this device. It is interesting to play with it as a 'pseudo-directional-antenna-array'. I am well equipped with selective filters and audio processors, but sometimes the more effective place to deal with a problem is before the signal gets to the receiver.

THE CCI TK-1 DIGITAL READOUT

James Goodwin

Some among us are properly enthusiastic about the exotic radio receivers of the vacuum-tube era. Enthusiasm is muted though when thoughts turn to frequency determination with analog-dial receivers. Who among us remembers happy hours spent with bandspread logging scale, graph paper and pencil? Maybe one or two?

Some old receivers, like the Collins and Drake products, owe part of their appeal to their high degree of readout accuracy. Other oldies with inadequate analog dials would be more popular today if one could read the frequencies better. That of course is where the outboard electronic digital readout comes in. These devices were the subject of much interest a decade or two ago when a most DXers and SWLs were still struggling with analog dials. Now the subject is of interest to those of us who cling to those wonderful oldies.

The TK-1 is one digital readout that is still around. Marketed by Torrestronics back in the mid-Eighties, it has been made for the last four years by Communication Concepts Inc. of Ohio. This company makes components such as RF amplifier modules for the ham radio market.

As a satisfied buyer of three TK-1's in the last two years, I have noted the slow increase in serial numbers. When I asked someone at their office recently whether CCI was going to continue making the product, she said, "Yes, there are always old-timers around who like using it."

DIGITAL READOUT BASICS

Digital frequency readout is possible because most receivers have a high-frequency oscillator with a measurable frequency output that varies in a set relationship with the frequency the receiver is tuned to. The difference between the two frequencies is the intermediate frequency of the receiver at that stage in its circuitry. The oscillator's frequency may track either higher or lower than the received radio frequency, depending on the design choice.

If, for example, the intermediate frequency is 455 kHz, the oscillator is on the high side and the receiver is tuned to 4800 kHz, the oscillator's frequency will be the sum of the two, 5255 kHz. If the oscillator is on the low side, its frequency will be the difference, 4345 kHz. A person who has a digital frequency counter can couple its input to the receiver oscillator circuit and read the oscillator frequency. This procedure means though that the listener has to make a tedious subtraction or addition for every station frequency determination. (Might as well go back to a chart!) The first essential feature in any digital readout is the capacity to permit the user to program into it a preset figure, equal to the intermediate frequency. This figure will be the constant addition to or subtraction from the oscillator frequency count.

One possible variant to allow for in the design is that the receiver may use a second intermediate frequency on one or more bands, necessitating in that case a different addition or subtraction. Less common is the situation where the oscillator varies inversely, that is, its frequency decreases as the radio frequency is tuned higher.

The commercial receiver manufacturer can take these variations into account in his design; the listener need never be aware of all that his receiver's frequency readout circuit is automatically doing. The home builder can to do the same, but at a cost. In 1975 I built from a magazine article a full frequency counter for an HQ-180A. Methods have been somewhat simplified since, but my readout was half as big as the receiver and cost more than half as much. The two were linked by seven coaxial cables. I thought I was on the cutting edge of technology. No more guessing!

TK-1 DISPLAY AND PRESET METHOD

A digital frequency readout designer has to weigh the costs in deciding how many variables to allow for. Possible steps for simplicity and cost reduction are omitting the megahertz digits from the readout and providing for an add-only preset rather than a subtraction preset too. This is what the designer of the TK-1 did. The display is of four digits, giving the frequency to tenths of a kilohertz but omitting any megahertz digit. The listener can glance at the receiver analog dial for the megahertz figure and read the rest of the frequency from the digital readout. If a subtraction preset is called for, its arithmetical complement is programmed in as an addition instead. The method of determining the presets is logical and well covered in the TK-1 operating manual.

THE TK-1 UNIT

The TK-1 readout comes fully assembled. It is in a two-piece metal enclosure measuring 6.4 in. W. x 2.4 in. H. x 6.0 in. D. In addition to the display, the front panel has two controls, a toggle switch for the power on/off and another for choosing either one of two preset additions which are labeled A and B. On the back are the AC cord, two RCA jacks in parallel for inputs from two receivers, and a third toggle switch. This last is for setting in reverse the direction of the count for the few receivers in which the receiver oscillator frequency decreases as the received frequency is tuned higher.

DISPLAY

The TK-1 reads out frequencies to the nearest 100 Hertz, showing four digits. The first three digits are red, while the last, the decimal fraction of a kHz, is yellow. Their height of .3" makes for excellent visibility. In the latest models, the decimal fraction digit is smaller.

INSTRUCTIONS

The TK-1 comes with an operating manual and a separate guide for mating the readout to a receiver. In the latest manual I have, step-by-step home-assembly instructions take up almost half of its 22 pages. The construction kit, however, is no longer available. The remainder of the book explains circuit principles, programming the presets, re-calibration and trouble-shooting.

In the 30-page mating guide are instructions for connecting any one of about two dozen analog receivers and transceivers of the last thirty years. Receivers specifically covered include the Collins 'S' line, the Drake SPR4 and R4 series, the Hammarlund SP-600 and HQ-180(A) series, the National HRO-60 and the Yaesu FRG-7. In addition, there is a special mating circuit suggestion for "very old receivers" which include the Hammarlund HQ-129X, and the Hallicrafters SX-28 and SX-42.

FREQUENCY PRESETS

The TK-1 can be preset with two constants for addition, each selectable by the user by flicking the toggle switch on the front of the TK-1. A preset addition is displayed while the unit is turned on and is not receiving input from a receiver. At the moment I make use of two presets for each of a Hallicrafters SX-42, a Hammarlund SP-600J and a Hammarlund HQ-180C. With the first, it is a matter of the highest SW band having the oscillator on the low side, while with the other two the higher bands have a higher i.f.

Each of the readout's four digital display units has a corresponding internal surface-mounted eight-position DIP switch which is used for the presetting of an addition digit. On each switch, the even-numbered positions are set in a particular on/off configuration to establish a digit for addition when the external toggle switch is in the "A" position, while the odd-numbered ones similarly establish the digit added when the toggle is in the "B" position. Removing two screws allows access to the DIP switches.

SENSITIVITY

The stated sensitivity is better than 5 mV. RMS at 4.3 MHz and 25 mV. RMS at 50 MHz. It will operate at a specified sensitivity from 100 kHz to 50 MHz, with reduced sensitivity a little beyond those extremes. The maximum signal strength permitted is 3 volts over the lower part of the BC/SW range, dropping to 1 volt toward the top end. CCI provides in the mating instructions a graph of the unit's maximum and minimum sensitivity limits across the frequency spectrum.

FREQUENCY STABILITY

Because the unit is totally enclosed to minimize RF radiation, there is a warm-up temperature rise and a consequent frequency drift. The maker states, however, that the absolute readout accuracy during the first hour is within 200 Hz at 21 MHz, with minimal further change. The drift at lower frequencies is commensurately less. I find the drift in my units, by rough measurement against WWV on 20 MHz, to be about 200 Hz in the first couple of hours. There is no noticeable frequency change later.

MATING RECEIVER AND TK-1

The link from the TK-1 must be shielded r.f. coax, such as either RG-58 or the smaller RG-174, connected to the receiver chassis by a connector such as a RCA plug to a jack. A further coax run inside the receiver is made to a point near the receiver's variable oscillator. The mating instructions, while they deal with numerous individual receivers, come down in most cases to a single means of connection to the receiver circuit. One lead of a small disk capacitor, in a range of 22 pf. to 68 pf., is connected to a circuit point in the oscillator/mixer area, and the other end is joined to the center wire of the coax cable. For lighter coupling, one can twist a short insulated hook-up wire several times around the capacitor lead and connect to the coax center wire.

This final connection to the receiver is a matter of possible difficulty from the performance standpoint. Linking any new component to or near the oscillator/mixer circuits may well add a new fixed capacitance which will lower the frequency tuned to and upset the degree of tracking between stages. The frequency may be lowered by as much as 100 to 200 kHz. The higher the coupling capacitance, the greater this negative effect. A touch-up of the receiver alignment can largely restore dial calibration etc. at lower frequencies, but oscillator-stage core and trimmer capacitor adjustment limitations may not permit full corrections, especially at higher frequencies.

On the other hand, obtaining a desirable low capacitance through very light coupling can mean a weaker oscillator signal to the counter that is not adequate to trigger a readout. The display digits will vary randomly or just stay at the resting preset addition readout. This often manifests itself first at the high SW end, i.e. over 20 MHz, and then at the low BC end. Blind spots though can occasionally develop in a receiver band. Substituting another oscillator tube may make a difference. With any one of my three receivers connected, a scope shows a high oscillator voltage amplitude into the TK-1 at frequencies up to about 5 MHz. At higher frequencies there is a gradual drop off down to near 10 mV. which is borderline for reading the high SW frequencies. Anyone who is interested only in tropical band frequency displays may need only very light coupling for satisfactory results.

For receivers that give rise to serious match-up problems, even to the point of oscillator failure through loading, the mating instructions booklet shows a schematic and p.c. template for a small buffer circuit with a quasi-emitter follower. This very small unit is installed in the host receiver. The 6 to 12 V.AC or DC power requirement can be tapped from the 6.3 V.AC filament supply in most tube receivers.

Nothing is predictable in this area. My newest TK-1 recently appeared to be insensitive because it was not fully responding to what has been my most powerful receiver for oscillator output. At the same time, my most sensitive TK-1 was becoming unresponsive on certain frequencies while linked to my weakest receiver. I changed the partners, expecting one good match to result, but the weak with the insensitive now perform together just as well as the supposedly stronger pair.

BIRDIES AND INTERFERENCE

Under this title, CCI says birdies can occur outside the ham bands. Usually, I take birdies to mean rather innocuous heterodynes. Some of the ones here though, when not dealt with, can be large pulsing signals more than 50 kHz wide. Where they will appear depends on the degree of receiver and antenna shielding, line cord filtering and the receiver's i.f configuration. Every receiver and readout pair seem to produce different results. The last unit I bought is, for whatever reason, the quietest. One of the best steps to take is to put a few ferrite chokes on the readout's line cord and coax cable, both at the points of exit from the readout enclosure. I use the type sold by vendors like MFJ and Radio Shack. When dealing with this problem, the use of RG-174 coax may be better than RG-58 with equivalent shielding. More turns of the smaller diameter RG-174 can be wound around the ferrite units, thus affording greater absorption of interfering signals. With a little effort, most interference can be eliminated.

USE AS A COUNTER

Other radio-frequency equipment with analog displays can perform better when a TK-1 is attached and used as a counter. I have two signal generators which benefit in this way. Although the TK-1 with its frequency resolution to 100 Hz is not up to the most exacting requirements, it's still a lot better than an analog dial.

CONCLUSION

I am not aware of any other units in this price range that are available to hobbyists. The TK-1's performance satisfies me, notwithstanding the fact there may be mating problems with certain receivers. To my mind, adding an accurate frequency readout capability to an analog-dial receiver can often convert the latter from a museum piece into useful equipment.

At present, the TK-1 is available ready to use for $149.95 plus shipping from Communication Concepts Inc., 508 Millstone Drive, Beavercreek, Ohio 45434-5840. (513)220-9677 or (513)426-8600. Fax (513)429-3811.

THE KIWA I.F. FILTER MODULE

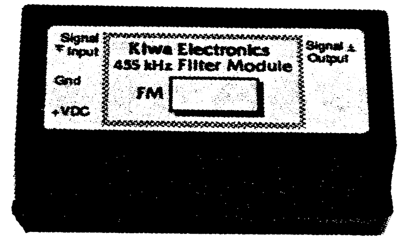
James Goodwin

A complaint many shortwave receiver owners have is the inadequate skirt selectivity in their equipment. This is not just a problem in old or inexpensive units. The skirt selectivity of even some modern, top-priced receivers is less than what it could be for dealing with current crowded band conditions.

Mechanical filters are often expensive, and they may need accompanying resonating capacitors. Sometimes a good drop-in substitute filter can be found; otherwise installation may be difficult. Even with a new filter successfully in place, an insertion loss can result because of impedance mismatch. Such a loss, averaging 6 dB, is not important for strong signals, but for weak ones it makes all the difference in readability.

Now, Kiwa Electronics, well known for its Multiband AM Pickup Unit, has come out with the Filter Module, a product that can provide an inexpensive answer to many skirt selectivity problems. It is ideally suited to be a filter replacement in a solid-state receiver. It also works well in tube receivers. The module, however, can be used only in an intermediate frequency circuit of 455 kHz.

FIGURE 1.
Kiwa Electronics filter module is shown at approximate full size.



THE FILTER MODULE

The main components of the module are three cascaded ceramic filters placed between two buffer amplifiers. The three filters greatly improve the skirt selectivity over what one filter can provide, while the amplifiers offset losses arising from the filters' insertion in the receiver's i.f. circuit.

The filter and amplifier components are embedded in electronic potting compound inside a small, black polystyrene case. Coming out of the unit are two miniature shielded coaxial cables, one marked for i.f signal input and the other for output, plus a black insulated grounding wire and a red insulated wire for amplifier power. The case's dimensions are 0.9 in. (23mm) W. x 1.9 in. (48mm) L. x .75 in. (19mm) H. All the leads are about 12 in. (300mm) long.

Typical bandwidths of the different 455 kHz filter module types are as follows:

Module Type	-6dB BW	-60dB BW
FM 3.5	3.5 kHz	5.8 kHz
FM 4	4.0	6.6
FM 4.5	4.5	7.4
FM 5	5.0	8.2
FM 5.5	5.5	9.1
FM 6	6.0	9.9

A 2.8 kHz (-6dB) filter can be created by cascading two FM 3.5 Modules. An FM 3.5 and an FM 4 similarly placed in series will provide a 3.0 kHz (-6dB) bandwidth. The -60/-6dB shape factor of all is typically 1.8 or less. Wider bandwidths are available upon special request. Ultimate rejection is typically 75dB.

Kiwa offers two special filter modules as replacements for the narrow and broad band filters in the popular Sony ICF-2010/2001D. These have been designed to operate on the relatively lower voltages available in this receiver. The first, the FM 3.5/S, has the same bandwidths as the standard FM 3.5 module; it improves on the selectivity provided by the Sony narrow filter. Guy Atkins has installed this module in his ICF-2010 and he says it works admirably. The broad filter module has a bandwidth of 8 kHz at -6dB, in comparison to the 11 to 12 kHz width of the Sony broad filter. The installation instructions accompanying each module are clear and show the PC board layout.

Returning to the standard module, the voltage requirement for the built-in amplifiers is anything from 4.5 VDC to 36 VDC, although, for "head room", something like a minimum of 9 VDC is preferred. The current for one module runs at about 10 to 12 milliamperes. This power can be taken at a convenient access point in most solid-state receivers without placing any undue strain on the receiver.

Each module comes with a small instruction book, a 10K ohm resistor, cable tie and self-adhesive Velcro for fastening the module in place in the receiver. The instructions understandably have to be limited and general because of the large number of receiver models the module can be placed in. There is a prominent warning about the dangers of high voltages to the module and the installer. Suggestions are given for soldering and desoldering on a printed circuit board. It is explained that the 10K ohm resistor may have to placed in series with the signal input wire if there is apparent distortion resulting from signal overload of the module. To date, only the ICOM R-71 has needed this modification.

Kiwa emphatically warns against installing the module in a tube receiver. The purchaser attempting this assumes the entire responsibility for any consequences. The voltages of 110 VAC and 200 to 300 VDC that are present in the live chassis of a tube receiver can be fatal to the experimenter who is either careless or not knowledgeable about working on such a chassis.

I did proceed on my own in trying out the module in a solid-state receiver and in two hollow-state ones. My description of the first installation is rather brief, largely because it involved only a straightforward filter substitution. This will be the situation with many solid-state receiver installations. On the other hand, there is much more to say about putting the filter module in a tube receiver with its incompatible voltages.

INSTALLATION IN A SOLID-STATE RECEIVER

I installed a filter module in a Kenwood R-1000, a receiver dating from the early 1980's. This receiver has three stock ceramic filters, being, at -6dB/60dB, AM Wide 12/25 kHz, AM Narrow 6/18 kHz and SSB/CW 2.7/5 kHz. Three external push buttons select these, but the owner can make an internal cable switch so that AM Wide selects the 6/18 kHz filter and AM Narrow selects the 2.7/5 kHz. The owner decided to replace the 6/18 kHz filter with a Kiwa FM 4 Module which would give a much improved selectivity of 4/6.6 kHz.

Obviously, anyone working on a receiver needs to have a schematic - important here because the particular filter for removal could not be identified visually, and the input and output points for it on the PC board had to be determined for proper installation of the module. I'd never seen a R-1000 before, but I had the service manual which showed the way with both an electrical schematic and a layout of the PC board.

A 27-watt iron and .10 inch desoldering braid made the removal of the old filter easy. The vacant space left had just the right holes - for signal in, signal out and three grounds. I used a jeweler's loupe with a 2-inch focal length. This was very handy for spotting the last bit of the old retaining solder and for avoiding a solder bridge with the new. However, with a narrow field of vision and the soldering iron tip coming in at 3 o'clock, loss of nose was an ever-present risk.

The module was fastened with the Velcro to the back receiver wall, about 5 inches away from the signal wires solder points, and the power wire was soldered to a nearby 12 VDC i.f. stage supply point. The instructions advise using such a clean power source rather than a possibly noisy one associated with the logic circuitry.

The performance of this filter module has been very satisfying. There has been no signal strength loss. The main benefit has been the much improved skirt selectivity where the previous -60dB bandwidth of 18 kHz has been reduced to 6.6 kHz. The 5 kHz hets from close SW AM signals are gone; splatter from a strong neighbor is either eliminated or greatly reduced. The bandwidth up at -6dB, changed from 6 kHz to 4 kHz, contributes to a good AM audio that is not obtainable from the other narrow filter alternative, the "SSB" filter with 2.7/5 kHz bandwidths.

For the interested experimenter, Kiwa now has available a schematic for a diode-based filter module switch to handle the switching of two modules in a solid-state receiver. The components are few and easily obtained.

INSTALLATION IN A VACUUM-TUBE RECEIVER

When I first read of the filter modules, I thought they might be good as 455 kHz filter additions in two boat-anchor tube receivers I have. These are a 1946 Hallicrafters SX-42, modified, with three dual 455 kHz/10.7 MHz i.f. stages, and a 1951 Hammarlund SP-600J, partially double conversion, also with three 455 kHz i.f. stages. Each has six selectivity positions - three rather wide L/C ones for AM and three crystal ones for CW. The third position in each is the basic "narrow" L/C. Here, the -6/-60dB band widths for the SX-42 are about 4/21 kHz and for the SP-600J about 3/18 kHz - good in their respective times, but most inadequate for today's conditions.

I told Craig Siegenthaler of Kiwa I felt comfortable about assuming the risk and experimenting with these tube receivers. The SX-42 had been the object of repairs and modifications for 36 years while the SP-600 had recently had all its tubular capacitors replaced. Both have features common to many receivers built from the 1930's to the 1960's.

Some obvious questions arose:

1. Where should a filter module be inserted in the circuit?
2. What would be the power source for the amplifiers?
3. Should there be a switch to place the module either in or out of the i.f. circuit? If yes, should the switch be independent of the existing selectivity switch? If yes, what kind of switch?

CHOOSING THE FILTER MODULE PLACEMENT

The 455 kHz i.f. transformer functions are almost identical in the two receivers, but I am showing the relevant section in the SP-600 in Figure 1 as the example because its partial double conversion feature allows a couple of additional filter placement alternatives.

Following the first mixer tube, transformers in T1 develop intermediate frequencies of 3955 kHz and 455 kHz. When the receiver is set to one of bands 4, 5, or 6, i.e. 7 MHz up, switching mechanisms select the 3955 kHz signal as the i.f. at this stage. The signal passes through T2 to the 2nd mixer tube where it and the output from the 3.5 MHz oscillator tube combine to produce a 455 kHz i.f. for input to the primary of T3. Alternatively, if the receiver is set to one of bands 1, 2 or 3, i.e. below 7 MHz, the 455 kHz signal from T1 is selected, and it passes through the gate tube to the input of the T3 primary.

The selectivity switch selects the different band widths (-6dB) - 13, 8, 3, 1.3, .5 and .2 kHz - by varying the circuit configurations in the secondaries of T3, T4 and T5. T3 has one 3 kHz L/C filter in place for all six selectivity positions, but its secondary incorporates a variable crystal filter for the three crystal positions of 1.3, .5 and .2 kHz. T4 and T5 have broadening secondary and tertiary windings to provide the 8 and 13 kHz widths.

Anyone wishing to consider alternative filter insertion points might want to read Dallas Lankford's article in *The Hollow State Newsletter No. 15*. He wrote about the placement of a mechanical filter in the HQ-180(A) and SP-600 receivers which for frequencies of 7 MHz and up both have a higher frequency i.f. stage preceding the 455 kHz one. Dr. Lankford said his concern was to obtain the best broadcast band performance by placing the filter as close as possible to the first mixer. He suggested *A* in Figure 1 as the place of insertion if the user would be satisfied with a filter usable only when the receiver was set at band 1, 2 or 3. For a filter usable on all bands, he recommended point *B*.

WARNING. Filter insertion at *B*, a point of high B+ voltage, would be fatal to a filter unless there are wiring modifications made beforehand. Point *B* is only safe and usable after the B+ line has been routed away from the T3 primary, according to Dallas Lankford's plan, and goes instead directly to the plates of the 2nd mixer and gate tubes. This plate circuit is then connected through a DC voltage blocking capacitor to the filter which in turn is linked to the primary of T3.

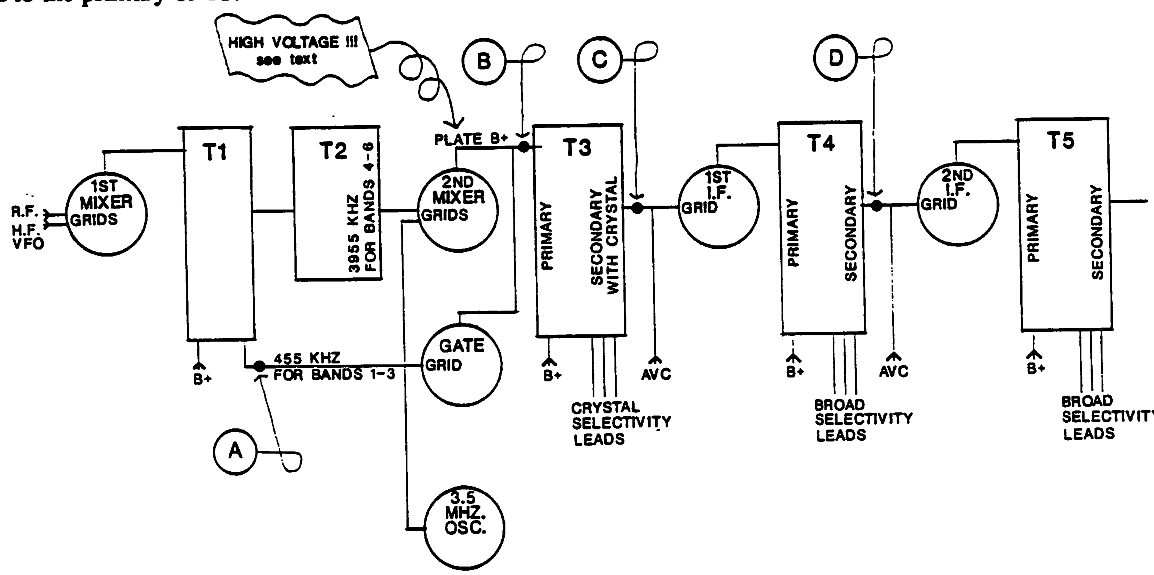


Figure 1
ALTERNATE FILTER ATTACHMENT POINTS FOR HAMMARLUND SP–600

I don't listen to the lower frequencies, and thus had no compelling reason to choose insertion at *A* or *B*. Craig Siegenthaler confirmed that the filter modules include protective blocking capacitors to handle up to 50 VDC. This was fine for my purposes because any installation would likely be only at an i.f. transformer secondary's output where there would be nothing other than a very low r.f. signal voltage and possibly a low AVC voltage.

The first object of experiment was the SX-42. It has one mixer/oscillator, followed by three 455 kHz i.f.'s that correspond in functions to the SP-600's T3, T4 and T5. Each of these i.f. cans also contains, wired in series, a transformer for a 10.7 MHz i.f. that serves for the SX-42's bands 5 and 6 which tune from 27 to 110 MHz. As a person of tube upbringing, I was convinced the powerful pulsations from the 1930's/40's system might well overwhelm the new filter module, in this case an FM 5. For that reason, I inserted the module at the early low-signal-level Point *C*, almost on top of the SX-42's crystal filter. My fears were groundless because the highest generator signals through the module produced no distortion on a scope. And gone were all those irritating 5 kHz hets on the SW broadcast bands.

For a receiver with a crystal filter, a point to consider here is a possible frequency mismatch of the 455 kHz module and the receiver's crystal. Decades ago, there was no point in a manufacturer's buying close-tolerance crystals for consumer-grade receivers. A nominally 455 kHz i.f. strip could be aligned to a crystal frequency of anything between 450 and 460 kHz and work just as well. My SX-42 has a 453 kHz crystal. I could look for a new one, but receiver realignment to 455 kHz now means only that the crystal peaks 2 kHz off center. Used mainly for CW, the crystal circuit, including the phasing control, still performs with just as high a Q. A problem is unlikely to arise in SP-600J/JX receivers with their JAN specifications because the crystal frequency would have to be very close to 455 kHz to permit use of the receiver with ancillary equipment.

I learned subsequently in talking to Craig that he prefers a module insertion after the second i.f. can in order to have a little more prior filter action. So, when I went to the SP-600, a module insertion was made at Point *D*. Again, no distortion and no hets.

POWER SOURCE

I first tried out a module in the SX-42 by powering it with 18 volts from two 9-volt cells. The current was confirmed at 11 milliamperes for one module, and 22 milliamperes for two cascaded. For a permanent source, the required voltage minimum indicated one might rectify and smooth the power from a tube receiver's 6.3 VAC filament supply. However, Craig thought a voltage more dependably higher than the minimum could be obtained at little cost by access to the receiver's B+ supply through dropping resistors and a regulating Zener diode. His suggested power circuit is included in Figure 2.

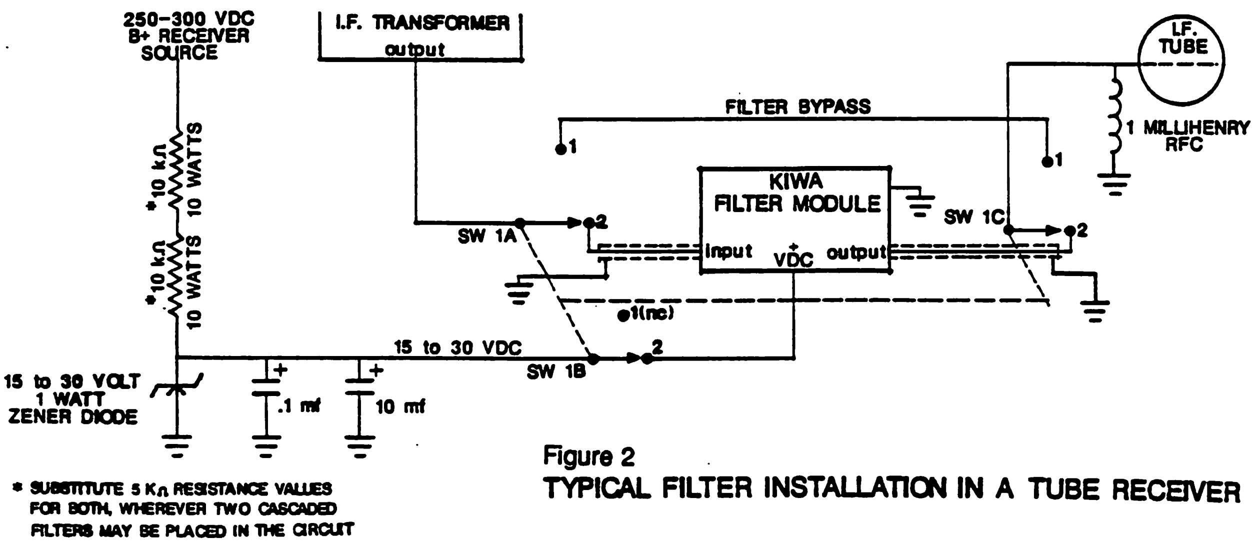


Figure 2
TYPICAL FILTER INSTALLATION IN A TUBE RECEIVER

If there will be no more than one filter in the circuit at a time, a dropping resistance of 20K ohms, 10 watts, is satisfactory. For this, two 10K ohm resistors in series are preferable for better heat dissipation. In my case, where two cascaded filters would be in the circuit from time to time, the dropping resistance was halved, i.e. the resistors are two of 5K ohms because of the doubled 22 ma. draw. The one-watt 24-volt Zener diode holds the final voltage at 24, whether either one or two modules are drawing power. Although the filter module power requirement is low, the extent of the voltage drop required in tube receivers with this method means that most of the power consumed is wasted in heat.

A cooler but slightly more expensive power alternative for a tube receiver would be a small independent 110 VAC transformer. This would put out a low AC voltage which a bridge rectifier, smoothing capacitors and voltage regulator would convert to low DC. This alternative may be desirable where the receiver's power supply is already either running very hot or running an output current in excess of its design level.

SELECTIVITY SWITCHING

In some circumstances, a user may be satisfied with having an unswitchable in-circuit filter module in the i.f. However, where a receiver has provided a number of bandwidth choices, albeit wide ones, I like to maintain that choice. The fixed-filter option in any event was not possible in the SX-42 because the 10.7 MHz i.f. signal used on the 27-110 MHz bands passes through the same i.f. line used for the 455 kHz signal on lower frequencies. The module was going to have to be switched in and out. Although 455 kHz is considered to be near the upper limit for effective i.f. mechanical switching, it seemed right to go that old way because I had the parts for a three-wafer six-position rotary switch (successively made under the Centralab and CRL labels). Spaced rotary switch wafers afford a little more separation of input and output signals than do other types of unshielded mechanical switches. Since I did this work, Kiwa has come out with the previously mentioned diode-switch schematic. Some tube receiver experimenters may want to consider adapting this alternative.

Figure 2 shows the simple in/out filter switch arrangement I used. In fact, I have ended up with three module switch positions because I put in a 5 kHz, 4 kHz and a 2.8 kHz module (i.e. 2 x 3.5 kHz cascaded). RG-174 coax was used for the lines from the switch to the i.f. transformer and tube respectively because the runs were each about 8 inches and passed close to earlier circuit stages. This meant there were many shields and ground wires to ground to the chassis at one central point. The new coax cable attachments added a capacitance to the 455 kHz secondary preceding the filter and caused some detuning. A small core adjustment brought it back to normal. However, in a situation unique to the SX-42, the associated 10.7 MHz secondary with its small 45 pf. capacitor was detuned far more and will require a very low-value capacitor substitution to restore alignment.

I was concerned about degraded filter action because of signal leak-through at the switch. The two spaces between the three wafers are each about .5 inches, with the middle wafer being chosen as the power on/off switch. Craig Siegenthaler thought that the resultant one-inch space between the in and out signal wafer switches would be quite adequate. I'd allowed for putting in a shield, but, from subsequent performance, this doesn't seem necessary.

As for the SP-600, it has temporarily in its chassis side a single-wafer three-pole rotary switch. I want to retain the old wide bandwidths in the SP-600; without them, it wouldn't be the same receiver. One possibility is to remove the send/receive switch and in its place run a switch shaft extension back to a 1" diameter 3-section wafer switch at the second i.f. stage filter insertion point. This "two selectivity switches" set-up would emulate that in the SX-42. On the other hand, the SP-600, like many other receivers, has a relatively simple selectivity switch wiring arrangement. The more ambitious experimenter could combine in one new switches-and-shaft set the control of both the original system and a filter module or modules.

A matter comes up for consideration if one is putting in either an unswitchable filter module or a single combining selectivity switch. In either case, a filter module will be linked permanently with a receiver L/C filter. This latter filter should be the one that will best preserve the module's filtering action without allowing through avoidable broadband i.f. noise. We can take the example of the SP-600 with its three L/C filters - the "3", the "8" and the "13." For a signal to pass through with the Kiwa's desirable trapezoidal response shape, that shape should come as close as possible to fitting within the more pyramidal response shape of the SP-600 L/C filter. This arrangement is the same as the existing system in the SP-600 where the crystal filter, when in use, passes a signal through the 3 kHz L/C filter, the narrowest one available.

The FM 5 module for example, with its 5.0/8.2 kHz widths, could not be matched well with the "3" with its 3.0/18 kHz widths because the 3 kHz width at -6dB would cut off the "top corners" of a module-shaped signal passing through, thus altering the shape to one derived from the two filters. In theory at least, the resultant hybrid bandwidths would be 3.0/8.2 kHz. On the other hand, the FM 5 could not be matched with the "13" because the latter is excessively wide - 13/35 kHz - and does allow through perceptibly too much broadband i.f. noise. The "8" therefore with its 8/26 kHz widths is left as the best match for a FM 5.

INSERTION LOSS OFFSET

The module amplifiers do balance off any signal loss quite well. In the SX-42, the filter-on status adds one or two dB to signal strength in comparison with filter bypass. The opposite is true in the SP-600. The variations in either case are no more than those that exist among the receivers' L/C filters. It surprised me that the modules, even two cascaded ones taken as one, are absolutely equal to each other from the point of view of resultant signal strength.

CONCLUSION

I have had excellent results with the modules. They are just what was needed to take care of common skirt-selectivity problems. In addition, Craig Siegenthaler has given me every assistance, just as he does, I'm sure, all Kiwa's customers.

A Filter Module costs $40.00, plus $4.00 shipping, and is available from Kiwa Electronics, 612 South 14th Avenue, Yakima, WA 98902. (509) 453-KIWA.

REFERENCE:

Lankford, Dallas, "Collins Disc-Wire Mechanical Filters, Part 3," *The Hollow State Newsletter No. 15*, Fall 1986. Earlier parts appeared in issues 11 and 12. *The Hollow State Newsletter* is published by Ralph Sanserino, 11300 Magnolia #43, Riverside, CA 92505. Back issues available for $1.25 each.

EDITORS' NOTE:

Just before press time, we received notification from Craig Seigenthaler, the creative force behind Kiwa, that they were now offering a PC board unit to hold and control two filter modules. We asked author James Goodwin's permission to append this note, so that you could be made aware of this most welcome new product.

The new unit, called FMX, contains the loaded PC board plus a toggle switch and appropriate metalized polyester labels. The FMX unit, loaded with two FM filter modules measures 2.7" x 3.8" x .75". That is small enough to fit in an out-of-the-way place in most table top receivers. In a modern solid state receiver, one would connect the module to any open filter position. Choice between the two Kiwa filter modules would then be controlled by the toggle switch which would be mounted conveniently on the receiver. Along with the photo which follows, Craig sent several others showing a FMX unit with two filter modules aboard fitting nicely to the under side of the chassis of a ICOM R-71A.

The new FMX unit is priced at $36.00 from Kiwa. Therefore, an FMX board plus two FM filter modules of your choice would total $116 + $5.00 shipping (U.S.) See above for Kiwa's address. Of course, the filter modules continue to be available singly, as well.

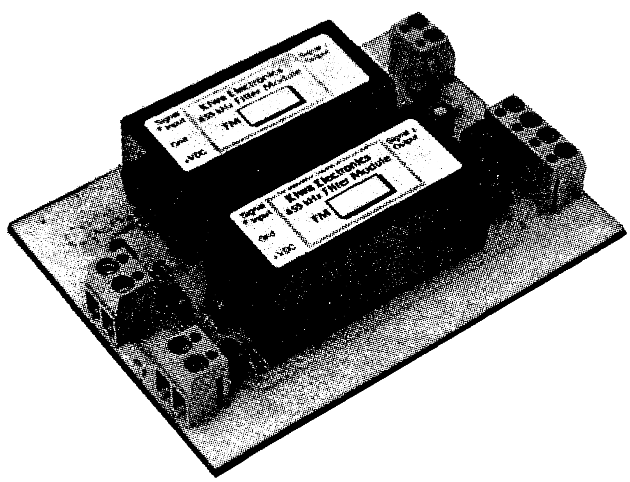


FIGURE 2. The new Kiwa FMX unit is shown loaded with two FM filter module units. Note the solderless screw terminals.

SMALL CONSTRUCTION PROJECTS
FOR EXPERIENCED DXERS
Don Moman, VE6JY

Editor's Introduction

There has been an absence of listening-oriented construction projects of interest to serious SWBC and, to a lesser degree, MW DXers for the past several years. In seeking to fill that gap, the Proceedings staff asked well known DXer and *CIDX Messenger* Technical Column Editor, Don Moman to investigate and describe several projects, each of which can make a very real difference in our DXing and listening pleasure. The following project series covers several approaches to impedance transformers for listening antennas, a passive outboard RF notch filter, an audio/input receiver/recorder switch box, a static protection device for solid state receivers and an audio impedance transformation box. Each of these devices is very simple to construct and very useful/effective.

LISTENING ANTENNA IMPEDANCE TRANSFORMERS

In this section I will be taking a practical look at extracting better performance out of various listening antenna, especially the beverage, using a variety of wind your own toroidal transformers and commercial RF transformers from Mini-Circuits of Brooklyn, NY [1]. The design procedure for winding your own matching transformers has been well covered in previous issues of Proceedings but I will quickly run through the basics. These baluns are designed to transform 500 ohms, a "good guess" for a typical beverage, down to match your 50 ohm coaxial feedline. The transformer will be reasonably broadband when the impedance of the primary winding is 4 times the antenna impedance at the lowest design frequency, in this case 500 khz. To achieve a 2000 ohm impedance at 500 khz we need an inductance of .637 millihenries.

Desired L = 2000 / (6.28 x Frequency in khz) = 2000 / 3141.59 = .637 mH

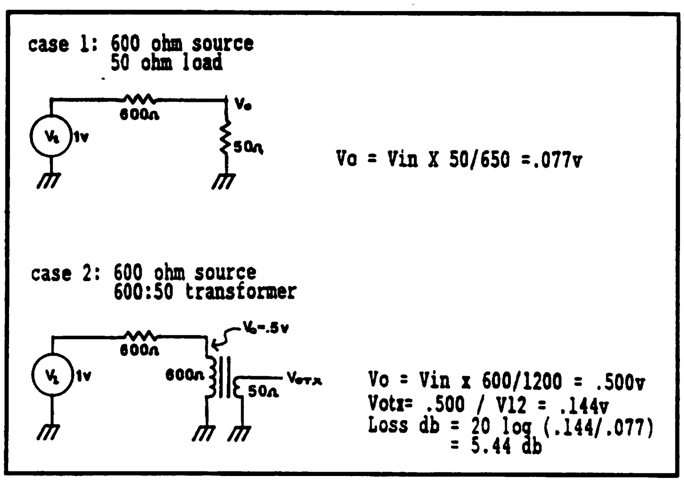
From this we look up the Amidon data for the core and use the following formula to determine the number of turns needed: Number of turns = 1000 x square root of (desired L in Mh divided by Al (mH per 1000 turns). This is the primary winding. For the secondary winding we can work through the above, using 50 ohms this time, or simply divide the number of turns in the primary by the square root of the ratio of input to output impedance. For these examples, that would be the square root of 500 divided by 50 or about 3.16.

Some practical beverage matching transformers:

Core	Al	Primary Turns	Secondary
FT 50-43	523	35	11
FT 50B-43	1140	24	7.5
FT 82-77	1170	23.5	7.5
FT 114-73	603	32.5	10

Expected losses due to impedance mis-match

How much signal improvement should we expect when we use the proper matching transformer? That depends on the degree of mismatch. With a source impedance of 200 ohms, we can expect a loss of 1.93 db using a 50 ohm load vs a 200 ohm load. If that 200 ohm load is the primary of a 4:1 transformer, and if the losses in the transformer are small, we can expect to recover nearly all of that 1.93 db loss. In a simple bench test, this was confirmed. The loss in the 4:1 transformer at 1 Mhz was too small for me to measure. If the source impedance is raised to 600 ohms, the loss will increase to 5.44 db. If the length of coaxial lead in is long there may be additional losses due to the mis-matched condition as well. A nearly 6db gain, achievable so easily just by matching, should not be overlooked!



An inexpensive source of ready made matching transformers is available from the previously mentioned Mini-Circuits. Their model MCL T9-1 has a 9 to 1 transformation ratio with less than 3 db loss over the .15 to 200 Mhz range. The MCL T4-6 has a 4 to 1 ratio over the .02 to 200 Mhz range. They are tiny, about a .25 inch cube. I mounted them on small scraps of PC board, as the leads are also quite delicate. They are available in a wide variety of impedance ratios and case styles. They are not designed to handle much power, 250 milliwatts maximum, so don't even think about trying to transmit through them! Some of the home made cores, such as the FT 82-77, are capable of handling considerably more power, I used 100 watts into such a transformer and beverage last summer on an listening expedition to complete my first two way contact on 160 meters with several amateurs in Australia.

Test Conditions

A 1000 foot, non-terminated beverage antenna, 5 to 6 feet above ground and running through fairly dense bush, is connected via a relay to the input of one of the two matching units under test. Either 50 ohm output is selected by a BNC coaxial relay. The signal then travels 700 feet via coaxial cable, much of it underground, to the radio room. Decibel values are derived from a previously calibrated S meter on a Yaesu FT-1000 transceiver. The relays are remotely switchable, allowing frequent A/B comparisons to counter the effects of fluctuating signal levels.

The various cores and transformers were mounted in small diecast aluminum boxes, with BNC connector output and binding post inputs. A "dummy" box was also constructed, with nothing in it but connecting wires to facilitate a direct antenna to 50 ohm connection.

Results

The first test was to confirm in practise what theory and Nick Hall-Patch have been telling me - there is a loss of approximately 6 db by just feeding the beverage directly into 50 ohm coaxial cable. Checking on a variety of signals from 100 khz to 15 Mhz, with most of the checks performed throughout the MW band, showed an approximate 6 db advantage with the MCL T9-1 unit over the dummy box. One exception was 5 Mhz where the MCL T9-1 unit was nearly 11 db better. In several cases, on weak daytime MW signals, the MCL T9-1 unit made the difference between no audio and readable audio.

A number of other transformers were tested, including handwound FT 114-43, FT 50B-43 and FT 82-77 units, and the various Mini-Circuits devices including the T4-6, T9-1, T16-1 and T36-1. The differences between any of the transformers were very slight, and were mostly due to the impedance variations of the beverage as the test frequencies varied. Values between 200 and 800 ohms all provided overall good performance, with higher impedance designs occasionally working well on a narrow range of frequencies, at which I'm sure the actual impedance of the beverage was quite high. Throughout all the testing, one result seemed consistent - the handwound transformer designs all showed a small advantage, typically 1 db at mid-band mw frequencies. Some of units were configured in combinations to provide other transformation ratios. Two MCL T4-6 transformers were wired in tandem to provide an impedance ratio of 16 to 1 or in this case, 800 ohms to 50 ohms. In actuality, tests showed it is not really this high in this and the following cases, more on the measured impedance later. At 100 khz, the T4-6 combination was 5 db better than the single T9-1. At 200 khz, the T9-1 was about 2 db better but that advantage was soon lost. Up to about 1000 khz the T4-6 combination was better by about 1 db, from 1000 khz to 20 Mhz I could find no differences. Wiring a T9-1 and a T4-6 in tandem yields a ratio of 36:1 or 1800 ohms to 50 ohms. This would seem to be getting a little high but the two units performed almost identically through most of the mw band. At 200 khz the T9-1 was better by 6 db, gradually loosing its advantage by 540 khz, and then gradually regaining about a 3 db advantage by 1400 khz, and maintaining that up into the SW spectrum. Wiring 2 of the T9-1 units for a 81:1 ratio (4050 ohms) showed a loss of 3 db through most of the mw band , with losses rising to 6 db or more at the extremes.

Wiring two of T4-6 units back to back gives a 1:1 ratio, but does it perform the same as the "dummy" box with no transformers? Yes it does, showing a consistent 6 db loss, compared to the T9-1 unit, from 200 khz to 15 Mhz. About the only reason for such a combination would be use it as an isolation transformer in a 50 ohm system, using separate grounds, which can be of some benefit in reducing noise and preserving the pattern of the antenna. On the test bench, this combination of T4-6 units showed negligible loss through the mw band, perhaps .5 db at 5 Mhz, 1 db at 10 Mhz, 2 db at 20 Mhz and increasing to 3 db at 30 Mhz. The dummy box still showed negligible loss at 30 Mhz, so all of the loss in the T4-6 setup was due to the transformers, not the layout.

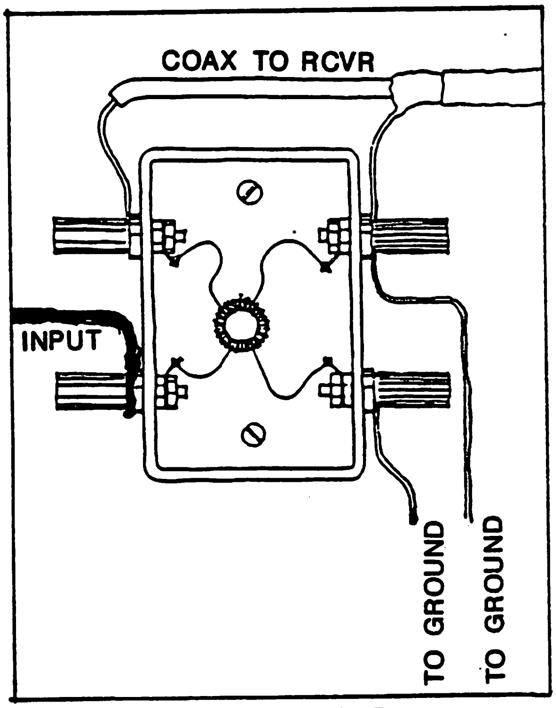
Next I used a isolated ground on the MCL T9-1 unit. The ground consisted of two 4 foot copper rods in moist soil. Signal strength results were typically identical to the non isolated test but with a few variances. A very significant noise reduction, in favour of the isolated MCL T9-1 was observed below about 300 khz. A fairly strong (S3) 60 hertz buzz, caused by my station's 12 volt DC power supply was just about eliminated. Other random noises, like static crashes also seemed to be reduced. The other thing I noticed was rather curious. Typically throughout the MW band the FT 114-43 was 1 db better than the MCL T9-1 unit, but on locals 630 and 680 khz it was 10 db worse. On 700 and 740 khz, the FT 114-43 suddenly was 10 db better! With other locals on 580, 790, 880 and 930 there was no difference.

So far, all of the listening tests have been using the same 1000 foot beverage. To sum up, almost anything other than a direct hookup will typically get you 6 db of more signal. Transformation ratios from a low of 4:1 (200 ohms) to a high of 36:1 (1800 ohms) were always a better choice than a direct connection. The "roll your own" baluns, using the larger cores showed a small but repeatable advantage, approximately 1 db in the MW band.

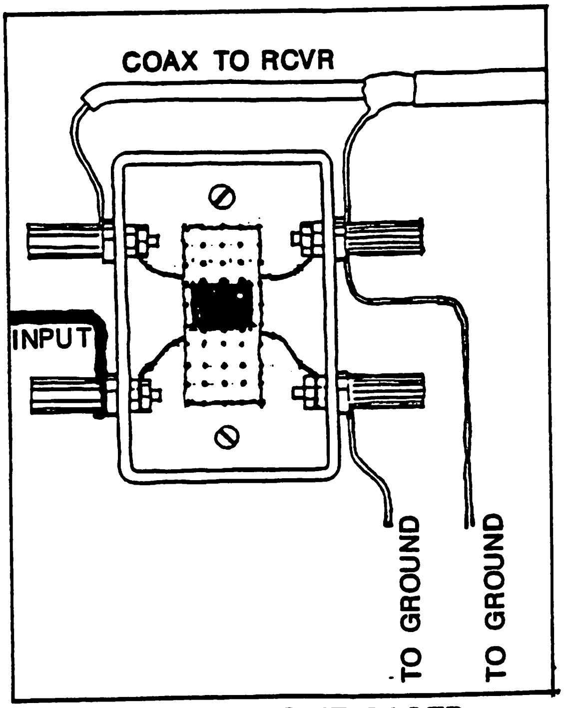
Matching Transformers with other Antennas

I thought it might be informative to try these transformers on my inverted L antenna, which has 60 feet of wire vertical and 70 feet horizontal. The ground system consisted of 4 ground rods in a very swampy area and 10 radials, mostly 100 to 125 feet long. It was roughly intended to be a quarter wave on the 160 meter band. On a variety of frequencies in the lower mw band, the T9-1 unit showed an average 6 to 10 db advantage over the dummy box. The advantage was down to 3 db by 1200 khz, 0 db at 1500 khz and above. By 5 Mhz and above, the T9-1 had regained a slight 1 or 2 db advantage. Comparing the T9-1 to T4-6, I found very few differences, with an occasional 1 to 2 db advantage going to the T9-1 below 900 khz.

These transformer designs would be very suitable for use with the T2FD antenna covered in the 1990 edition of Proceedings. This antenna is often designed around a 10:1 ratio transformer, although other values, such as the more common 4:1 unit would also work well in a receive only design.



TOROID-BASED
IMPEDANCE TRANSFORMER



MICRO-CIRCUIT BASED
IMPEDANCE TRANSFORMER

Bench Measurements of the Actual Impedance Values

As I hinted at earlier, it is not valid to assume that various transformers can be combined to maintain the various impedance ratios one might possibly assume from the products of their turns ratio. A test setup was constructed to measure the impedances of the various units. The output of the signal generator was fed through a variable resistor to the high impedance end of the transformer. The resistor was adjusted so that half of the generator voltage appeared across the transformer. At that point, the internal resistance of the generator (50 ohms) can be added to the variable resistors value, the sum of which must equal the transformers impedance . The test frequency was 1000 khz, although 3 Mhz was also tried, with very similar results. The T9-1 units showed a consistently lower impedance, 365 +/- 10 ohms as opposed to the expected value nearer to 450 ohms. The T4-6 units measured right on 200 ohms, and my other baluns all measured fairly close as well. At this stage I cannot explain the difference in the T9-1 values. In an earlier series of tests for Proceedings on the Mini-Circuit transformers as well as other home made types, Bill Bowers measured values of 444 and 490 ohms for his T9-1 units tested. To check my test procedure, I substituted a 470 ohm resistor for the balun and came up with 473 ohms. With a digital meter the resistor also read 473 ohms!

The Bottom Line

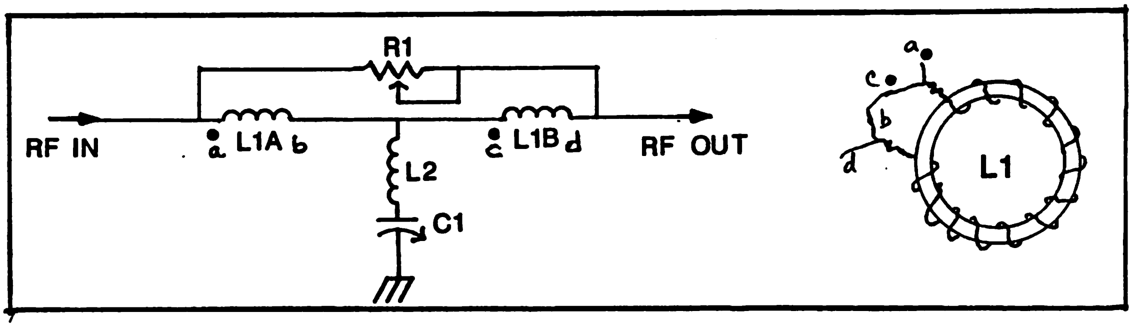
It seems that, for most receiving antennas, some form of matching transformer is a very good idea. The choice is yours, but it appears that whether you build or buy, it is hard to make a poor choice. Build a couple boxes with coax connectors and binding post inputs and see for yourself! Try them on whatever antennas you might have. Even if the antenna is designed to be resonant on a certain band, we often find ourselves using it on other frequencies where the impedances may be considerably higher. A matching transformer may often improve the signal, and virtually never harms the signal.

Balun	Impedances Measured
T4-6	200
T9-1	365
FT114-43	535
FT 82-77	465
T16-1	575
T4-6 x 2	640
T4-6/T9-1	1030
T36-1	1300

The tiny Mini-Circuit transformers come in many configurations including center tapped primary and secondary windings, and even some trifilar types with three isolated windings. It seems to me that these could be very useful in building phasing units and steerable two wire beverages.

My one concern about using these units are their delicate nature. Rated at only 250 mw of RF and 30 ma DC it seems possible that strong RF fields from nearby broadcast stations or even your own amateur radio transmitter could easily exceed their ratings. Induced energy from lightning strikes is often blamed for destroying the terminating resistor of the beverage so it's likely the transformer might also be damaged.

[1] Mini-Circuits, P.O. Box 350166, Brooklyn, New York 112325-0003 phone (718) 934-4500 or fax (718) 332-4661 [2] Amidon Associates, 2216 E Gladwick St., Dominguez Hills, CA 90220 phone (310) 763-5770



RF NOTCH FILTER

Many receivers are equipped with a notch filter, either in the audio or the IF stage of the set. An audio notch is useful to remove a fairly low level tone or heterodyne. The drawback is that this is done in the audio stage so if the offending signal is strong enough to activate the receivers automatic gain control (AGC) you will still find the desired signal will be desensed by the carrier, even though you may have removed all the audible tone. If the notching is done in the IF stage then you can remove the offending signal before it gets into the AGC. This is, by far, the most desirable of the two methods. But even the IF notch leaves the front end of the receiver, the RF amplifier and mixer stages subject to the strong signal and subsequent possible overloading and/or desensing. A tuneable RF notch filter in the antenna lead could be used to attenuate the strong signal before it gets to the receiver. If you are fortunate enough to have only one super strong signal bothering you, an RF notch may be a very useful gadget. I recall several listening expeditions where I managed to find a desirable location to set up beverages, only to find that there must have been a local AM station or longwave beacon just a few miles away! One super strong signal, along with the normal signals on the band, is all it takes to produce all sorts of spurious and mixing products, one of which is sure to interfere with what you want to hear. In this situation, the RF Notch filter would have been very handy. Preselectors and antenna tuners may also serve useful, but I want something I can set once and forget. It has always seemed very ironic to buy the lastest set with all the frequency agility provided by dual VFO's, 100 memory channnels, keypad tuning and then have to spend time adjusting the tuner or preselector.

The article that lead to me build an RF Notch filter was in the December 1983 issue of DX Australia's "DX'ers Calling", with an article written by Sam Dellit. He describes a notch filter constructed from information given in the August, September and October 1979 issues of "Wireless World". The article is titled "Passive Notch Filters" by G. Kalanit. From the design information presented in the article, the following configuration was derived.

L1 = 50 turns # 26 on Amidon FT 240-43 bifilar wound; L2 = 50 turns # 26 on Amidon FT 240-61;
R1 = 100 or 500 ohm carbon potentiometer; C1 = 365 pf variable capacitor

For L1, "bifilar" means twisting 2 wires together and then winding the coil, as in the above diagram. Twisting the wire together is easily done by inserting the ends of the wire in the chuck of a small drill Secure the far ends and then run the drill until the wires are nice and tight. The wire we are using is #26 gauge magnet wire which comes with a very thin but tough varnish that provides the insulation. Even after you twist the wires together you shouldn't be able to measure any continuity between the two strands. Be sure to observe the polarity when connecting the coils. According to the article, with these values, the unit covers the 531 to 1602 AM band very nicely. Sam reported a 3 db bandwidth of 15 khz, better than 60 db of attenuation with a bandwidth on the order of 100 hertz or less. Insertion loss was 5 db in a 50 ohm system and was very constant across the AM band.

I choose not to build this version as I did not have the FT 240 cores handy. They are quite large, 2.4 inches in diameter, since I had numerous other but smaller cores I came up with a combination that worked very well. I used the FT-50B-72 for L1, squeezing a maximum of 25 bifilar turns on that core. For L2, I first tried 50 turns on the FT-50B-61. C1 was a dual 365 variable. With this combination, the filter tuned from 250 to 1100 khz. A few more turns and one could cover the entire longwave and lower AM bands. Final adjustment of C1 and R1 are very touchy. The unit was built in a metal cabinet, and with the grounded capacitor design, no hand capacitance effects are noted. The leads from L1 were wired to back of a small DPDT toggle switch to allow the circuit to be bypassed. I used 100 ohms for R1, the 500 ohm version was just too delicate to adjust. This is a good point to interject that R1 must be of the non inductive type, so carbon is specified. Wirewound pots, fine in audio circuits, have far too much inductance to be used in RF designs like this. I also added a small panel mount trimmer across C1, likely a .5 to 15 pf type, size not critical. At the null point, the entire unit turns quite microphonic, so good solid wiring is a must. Don't set it near the radio's speaker, or there will be feedback.

I also experimented using a core with a higher Al value, which would result in fewer turns required for the same frequency range. I tried the FT-50B-43 with 13 turns and while it covered the proper frequency range, the null depth was very shallow. Nick Hall-Patch points out that the type 43 material is not especially high Q, whereas the type 61 and 72 cores I used initially are specifically mentioned in Amidon literature as being useful in high Q circuits.

Reducing L2 to 25 turns on the same FT-50B-61 core allowed the unit to tune from 600 khz up to about 2800 khz. On the test bench, notch depths varying from 40 to 55 db were noted. Insertion loss was typically 1.5 to 2 db throughout the SW bands. Insertion loss was only about .5 db at the 500 khz. Connecting the unit into the real world antenna, I found that it took a bit of practise to find the nulls. It actually worked best to switch the receiver to the CW narrow mode which uses a 250 hz filter, center that over the carrier and then tune for the null. R1 and trimmer across C1 should start at the approximate center of their travel, and C1 should then be adjusted slowly to find the notch. The notch may be quite shallow at this point, but with careful adjustment of R1 and C1 (use the trimmer for fine tuning) - it is an iterative process as both controls interact, the notch will deepen. Keep in mind what I said about the notch width at the null point, it is very sharp. It can remove the carrier from a local signal, to the point of severe distortion, but the sideband splash will not be eliminated. It will be reduced several db, a step in the right direction. I have several strong locals that contribute to mixing products showing up in the 160 meter ham band. In most cases, notching one of the strong signals at its fundamental will also remove the product. Using a vernier or at least some type of calibrated dial, would be a useful addition in a case like this, to make it easier to find the ballpark settings to notch the fundamental frequency.

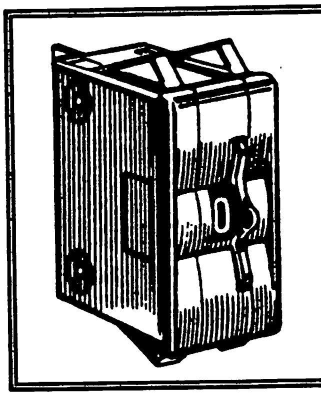
Notch Response

Test frequency was 1413 khz.

Frequency	Loss(db)
1413	55
1414	20
1418	10
1423	4
1433	3
1463	1.5
1513	1.5

This circuit could also be used to add an IF notch to a receiver, as long as the higher impedance, typically several thousand ohms, of the ceramic filter stages were accounted for in the design process. This circuit could be used to good advantage with a modern set using a high first IF with a 455 khz second IF. With the compactness of modern receivers, finding the room to add this circuit inboard would be nearly impossible, so one would have to break the signal path in the 455 khz IF stage and bring the connections out to the real panel. This quickly moves out of the realm of the simple construction project but it would be something to experiment with anyway, if you feel ambitious.

AUDIO INPUT/OUTPUT RECEIVER/RECORDER SWITCH BOX



I have built many different audio routing panels over the years, and each design has always been quickly outgrown, or for some other reason has fallen into disfavour.

The patch panel design, has all outputs and inputs brought into a panel or matrix of jack, then a number of short patch cords are then used to route each signal, much like the old telephone switchboards. The one advantage is good isolation between sources, but the disadvantages are numerous. They look messy with all the cords plugged in the front, switching sources isn't that handy, they take up a lot of room, and it's difficult to route one source to more than one output.

Rotary switches are fairly common, and for quite a few years I used a number of six position switches to route things around. It proved to be a fairly usable design and fed 6 receivers to 3 outputs. It was fairly large though, and by the time one wired up all the switches, you had a real tangle of wires back there. Isolation between channels also suffered unless you took extra pains to use shielded wiring and even then, all the connections to the various switches contributed to a fair bit of crosstalk.

My latest unit can switch 8 sources to any, all or any combination of 4 outputs. The front panel measures 5 inches wide by 1 inch high, and the unit is only about 2 inches deep. Wiring the complete unit only took about 5 minutes! The main ingredients are 8 BCD thumbwheel switches. These switches come in a great variety of configurations, the ones in my junk box were the 16 position BCD 1-2-4-8 type. They only have five solder terminals on the rear, the common, plus the 1,2,4 and 8 terminals. These switches are designed to stack side by side, so all you do to wire them up is slip a length of bare wire through all the "1" terminals, and so on till the "8"s are done. In my case, these were the four outputs to various tape recorders, RTTY decoders etc. The common terminal on each switch goes to one of the 8 audio sources. I used multiple RCA phono jack strips and soldered them to the back of the switches with very short lengths of bare wire. Simple, neat and compact! For those of you that know what a BCD switch does internally, you can skip ahead a paragraph! If you don't, stick with me. Lets go through the positions, obviously starting with "0" which means no connection. Position "1" connects the common to #1. Position "2" connects the common to #2. Simple so far, but here comes the difference. Position "3" connects the common to BOTH 1 and 2. Position "4" connects common to #4. Position "5" connects common to both #1 and #4. By now you should be seeing the pattern. Whatever number shows on the front of thumbwheel means the various output terminals that add up to that number are all connected to the common terminal. This is what gives the flexibility of the switch, any combination of the 4 outputs can be selected using one of the 16 positions. The only drawback is that a bit of mental gymnastics is required in the higher numbers to remember what is being connected. As I said, I used these switches because I had them, and I mention the BCD configuration because this is quite a common item to find surplus. If I had a choice, and especially if I was ordering some switches, I would opt for them in a "1 pole decimal" configuration. This is a 1 pole 10 position switch so the internal connections of the switch are obvious. Again, you would wire each of #1's together, #2's, etc. These would be your audio sources. Each of the common terminals would go to your various tape recorders, etc. With 9 switches, you could direct 9 inputs to 9 outputs. With a 9x9 matrix available, I'd suggest using some of the inputs as high level fixed tape outputs from the various receivers, and then wiring speaker level audio to some of the other inputs. In the same vein, some of the outputs could be wired to various speaker and headphones. The one unit could handle virtually all the audio switching that needs to be done,

Switch Pos'n	OUTPUTS 1	2	4	8
0				
1	x			
2		x		
3	x	x		
4			x	
5	x		x	
6		x	x	
7	x	x	x	
8				x
9	x			x
10		x		x
11	x	x		x
12			x	x
13	x		x	x
14		x	x	x
15	x	x	x	x

Inputs	Outputs 1 2 3 4 5 6 7 8 9
1	Receiver 1 tape out
2	Receiver 2 tape out
3	Receiver 3 tape out
4	Scanner 1 tape out
5	Spare
6	receiver 1 speaker out
7	Receiver 2 speaker out
8	Receiver 3 speaker out
9	Scanner 1 speaker out

1	2	3	4	5	6	7	8	9
Tape	Tape	Tape			Left	Right	Left	Right

Typical Configuration

with a minimum of complexity and space. The key here is complete flexibility. If you frequently need to connect two audio sources to one output, then you could solder two (or more, if needed) of the common terminals together to the one output.

Lest you get too carried away with all this convenience, and decide that this might be the perfect way to distribute all your antennas to your various sets, let me throw some cold water on that idea! They will switch your antennas but the isolation between the various antenna would only be minimal, and any directive properties would certainly be deteriorated. Even at audio frequencies, the isolation is only just adequate.

STATIC PROTECTION FOR SOLID STATE RECEIVERS

The components used in the front end stages of solid state receivers are quite easily damaged by high voltages. These voltages can be generated and find their way into the antenna input in many ways: nearby lightning strikes, precipitation static (rain, snow, and even sand particles blowing across the antenna), or static discharge as you walk across the carpet and touch the antenna. All of these have the potential to damage the set. The Sony ICF 2010 is one the best (or worst, depending on your point of view) examples of this, its RF stage FET was easily destroyed by static charges. It's impossible to safeguard against any damage but there are a few simple ways of reducing the possibility of static damage. Keep in mind that this is not even close to being a substitute for proper lightning protection. Protection against a lightning strike involves low inductance grounds, proper common bonding of all equipment chassis, plus some form of over voltage protection device in the antenna lead. After you do all this, unplug the radio, set it in the corner and perhaps then it would be safe!

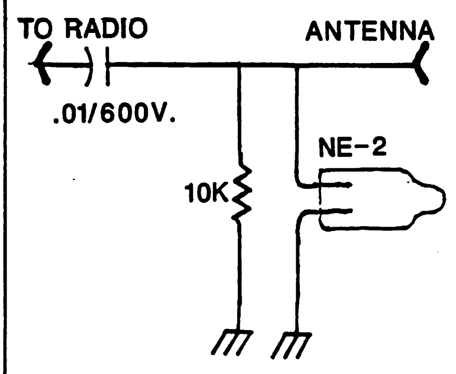
The level of protection I'm talking about is more suitable for those times when a storm comes by suddenly and you've forgotten to unplug or ground your antenna. The storm doesn't even have to look very serious, the weather can be bright out, but under the right conditions a static charge in the thousands of volt range can accumulate on your antenna. What we need is a way to remove the voltage without affecting the RF signals on the same wire.

An inductor placed from the antenna to ground will present a DC path for the static charges and prevent them from building up. The inductor's value is chosen so it presents a high impedance at the lowest frequency the antenna will be used for. The ICOM R-7000 VHF-UHF receiver uses this method, with a small coil placed directly across the input antenna connection.

Many HF receivers use a tiny light bulb in series with the antenna connection. This acts as a fuse, since the filament of the bulb is very thin and easily separated if any significant amount of current passes through it. The filament, if blown, usually physically pulls apart, leaving a fairly large air gap, which may prevent subsequent damage. This fuse is usually followed by a DC blocking capacitor and an inductive path to ground.

Another method, which may be used in conjunction with the above, is to place diodes across the antenna line. The plan here is that the diodes won't conduct until .7 volts is reached, or more if there are several diodes in series. This is a quite popular technique, I recall my shiny new Japan Radio NRD 515 produced garbled local broadcast station audio everywhere as soon as it was connected to my longwire. There was enough RF on the antenna to cause the diodes to conduct and rectify the RF. This will produce a mixing action which results in the signals showing up where they aren't supposed to be. A quick clip of the diode and all was well. However, the protection devices cannot prevent anything if they're not connected. If you have to remove these diodes, it would make sense to replace them with an alternate form of protection.

I can't recall where I first read about putting a neon bulb across the antenna to protect the receiver, but it has been something that has worked very well for me. The bulb, usually a type NE-2 or NE2-H (Radio Shack # 272-1101 or 272-1102) comes with wire pigtails and is best soldered across the input of each radio you have, and across the lead of each antenna. If it is a coaxial lead in, the bulb just goes across the inner and outer conductors. If it is a single wire lead in, or TV type twin lead, one bulb should fitted from each conductor to ground. No external resistor is required or desired for this application. The neon bulb acts like a completely open circuit until its firing voltage, usually about 70 volts, is reached. It then conducts heavily until the voltage drops, and then goes open. Typically, during high static conditions you can see the bulb start to flash as the storm is nearby, increasing to a steady glow as things get closer. One of my antenna switch boxes has a NE-2 mounted so it is visible, as a visual warning that it's about time to think about disconnecting everything! If the glow gets bright enough so that it turns pinkish, look out! Lots of static is being drained off and you are in danger of a very nearby lightning strike. This is the time when it's not smart to disconnect your equipment. You should have done that before! Speaking for myself, I'm not interested in being the one holding the "just disconnected with no place to go but through me" piece of coax, just as the



TYPICAL INSTALLATION

lightning strikes! The neon bulb still allows a 70 volt charge to be built up, although I have never seen a case where this damaged anything, it still is a fairly large potential as far as solid state devices are concerned. A small 10K ohm resistor in parallel with the NE-2, the value isn't at all critical, will serve to bleed off any slowly accumulating static, with the larger surges handled by the neon bulb. A series capacitor, to block any DC voltage, can also be used after the NE-2/10K combination. Any value in the .01 uf to .1 uf range with a voltage rating of several hundred volts would do just fine. It's just one additional small piece of protection.

Nothing about this costs much money. The neon bulbs are common and cheap, easy to install and provide a good level of protection against anything but a very near or direct hit. They are especially useful on DX listening trips with beverage antennae, which are very effective at gathering up static charges! My advice is to install these everywhere you can, and then forget about them. Use commercial lightning arrestor units outdoors, install them properly, and disconnect your equipment whenever prudent. Just perhaps, the time you forget to do all this, these little devices might save your radio!

AUDIO IMPEDANCE TRANSFORMATION BOX

Many older communications receivers made for the military use a 600 ohm audio output. Hooking this directly to a normal 4 or 8 ohm speaker can result in poor audio performance. A proper matching transformer is not an especially common item to find, especially if you are looking for one marked "600 ohms/8 ohms". Fortunately, the audio transformers used in public address and audio distribution systems will do the job just fine. Such a transformer can be purchased from a local Radio Shack store, the part number is 32-1031.

These transformers come with multiple taps on both the inputs and outputs. The output taps are marked as 4, 8 or 16 ohms. Pick whichever matches your speaker impedance, usually 8 ohms. It really isn't that critical. The input taps are marked in various wattages. These are the wattages that will be drawn from the 70 volt audio distribution line and delivered to the speaker. These windings have a specific impedance, not given but easily calculated. In the case of the Radio Shack transformer, I measured the impedance of the 10 watts tap (to the "common" terminal) as being approximately 550 ohms at 1000 hz. Audio response was essentially flat across an 8 ohm load from 100 to well over 10,000 hertz. The 5 watt tap measured nearly 1200 ohms and the 2.5 watt tap measured about 2200 ohms. For most receivers the 10 watt tap would the ideal value. Incidentally, this would apply to any other 70 volt PA type transformer. If it has a 10 watt tap, it will be near 500 or 600 ohms. If you come across a 25 volt type, it can be used as well. Here the 1 watt tap will work out to an impedance of 625 ohms.

$$R = V^2/R = \frac{70.7 \times 70.7}{10} = 500 \text{ ohms}$$

If you do a lot of experimenting with old sets, it might be handy to build a transformer and speaker into a small box, and bring all the primary taps to a jack or a selector switch, and then you'll be well equipped to handle anything!

features

IT'S IN THE FAMILY
ECUADOR ON SHORTWAVE
Richard McVicar, HC1JMN

When one pulls the atlas off the shelf and examines Ecuador, one sees that this Andean republic on the equator is a relatively small country. When one begins to *experience* Ecuador, however, the country seems to grow. Each area is so different from the next. For example, it is sometimes possible to roll a fair-sized snowball together at the pass near Papallacta and, an hour later, be sweating under the tropical heat near Baeza patiently waiting to spot a toucan. A restless traveller who enjoys inspiring scenery and incredible change could spend months (at least) in Ecuador before wanting to move on.

The DXer knows that each country's broadcasting service has its own identity. Likewise in Latin America, each country has this distinct broadcasting "flavour". The more one listens to the stations between the Río Grande and Base Esperanza, the sharper one's taste will become. It is my hope that the pages ahead will help you sense the special flavour of Ecuadorian radio--a family of broadcasters in turn largely run by broadcasting families.

THE BEGINNING
THE CORDOVEZ FAMILY: RADIO EL PRADO

The history of Ecuadorian radio is a fascinating tapestry of pioneerism and family relationships. It was within the Cordovez family, and with Carlos Cordovez in particular, that the first radio waves in this Andean nation were launched.

Carlos Cordovez Borja was brought up in Riobamba where his family made a comfortable living operating the El Prado mill. The means were available for Carlos to go to the U.S.A. and gain a degree in engineering at Yale. Before returning to Ecuador, the young man worked several years as an engineer with RCA.

Soon after his return home in 1924, one of the professors at Riobamba's San Felipe High School proposed an interesting scientific experiment--building a small shortwave transmitter and receiver. The transmitter would be installed at the El Prado factory and the receiver at the high school. Students from the school took part in the experimental broadcast and were heard clearly at the receiving end by parents, officials and interested listeners. This took place early in 1925 and was the first shortwave transmission in Ecuador. The transmitter was rated at 25 watts and operated on a frequency in the 60 meter band.

After getting on the air with a stronger shortwave transmitter in 1929, Carlos invited local music groups to come to the El Prado mill and perform on the lawn just outside the radio room. Having no equipment to record music, Carlos carried his microphone outside and broadcast the music around the world for a few hours each week. In this way Cordovez turned his amateur station into a broadcasting service. *Radio Estadio El Prado* made its transmissions official on June 13 1929. Several dignitaries were present at the ceremony, including María Elvira Campi de Yoder, president of the Red Cross, and Coronel Alberto Enríquez Gallo, chief of the Riobamba military district. The call letters were SE1FG (Ecuador had not yet been assigned the *HC* call).

Radio El Prado was extremely popular around Riobamba, as well as in other parts of Ecuador and even outside of the country. Carlos' wife, Judith Nolivos de Cordovez, became the first female radio announcer and amateur radio operator in Ecuador. She was especially loved and, it is said, her sweet voice moved several distant listeners to send in marriage proposals. (If you have issues of *Radiò News* magazine from back then, you'll find loggings of *Radio El Prado* on 6200 kHz and on "approximately 19 meters" each Sunday from 4 to 5 PM EST. Reports indicated that a certain Sunday's programming would be directed towards certain countries.)

Radio El Prado had an important part in helping HCJB get on the air for its first program on Christmas Day, 1931. On Christmas Eve, during some of the final tests, a power rectifier tube burned out and there were no spares anywhere in Quito. The only hope was at *Radio El Prado* in Riobamba, about 120 miles away. A messenger was sent on the 12-hour drive to see if Carlos could supply a replacement. Carlos took the tube from his own transmitter and loaned it to Clarence Jones, one of HCJB's co-founders. The *Voice of the Andes* was able to go ahead with its inaugural program as scheduled. (HCJB was the first regularly licensed broadcasting station in Ecuador.)

Radio El Prado closed down in 1939 when the owners settled in the United States. The *Radio El Prado* of today, also in Riobamba, signed on in the late 1950s. At first there was some disagreement concerning rights to the famous name, but both parties worked out a settlement where the *El Prado* name could live on. The current *Radio El Prado* is owned and managed by the Vizcaino family and operates with 1 kw on 980 kHz.

During his remaining years in Ecuador, Carlos Cordovez lived near Quito and was well-known throughout the world for his amateur radio activity. The "pioneer of Ecuadorian radio" passed away in 1972. His nephew, Diego Cordovez, is the Ecuadorian Foreign Minister at the time of this writing.

THE ORIENTE
THE QUINGA FAMILY: RADIO CUMANDA

One of Ecuador's most fascinating shortwave broadcasters is *Radio Cumandá*--intriguing because of its location--far from Quito in the eastern jungles of Napo province. The name of the town it's in is officially called *Puerto Francisco de Orellana* (named after an explorer,) but more commonly known as *Coca.*

Motorized canoe, the major means of transport on the Napo river.

Coca is an eight-hour drive from Quito in the heart of Ecuador's oil-producing region in the *Oriente* (East). There are a number of small villages on the way, including Santa Rosa, home of *Radio Interoceánica*, and El Dorado, home of one of Ecuador's largest and highly invisible *sleeping policemen* (a speed bump). As with the worst of speed bumps, the dusty serpentine monster at El Dorado is located next to a roadside cafe. This is (I speculate) to provide entertainment to patrons: As the unknowing *Quiteño* traverses this bump at 50 mph, diners at the café are visibly entertained by the sight of strangers having their heads whacked against the roof of the vehicle. (A rear wheel spring may clank to the road three miles later.)

The presence of the oil industry in the region becomes apparent as soon as one starts south on the road from Lago Agrio to Coca. Oil coats the highway--not a polite smattering to keep the dust down, but rather a gooey sludge that has been known to almost completely cover vehicles if there has been a recent rain. A sizeable snake or two may be seen winding its way across this road. The scenery is gorgeously green as one passes houses on stilts, a few villages and the odd oil well where a bright orange flame burning off gas looks like sunset through the trees. Two rivers to cross are the *Aguarico* and the *Coca*. Good bridges pass over both of these large waterways.

Ecuador's major tributary into the Amazon, the *Napo*, borders Coca on the south, while the Coca river runs by to the east of town. From a bridge going over the Napo, one can see where the two wide Amazon-bound rivers meet.

On the road into Coca, the first-time visitor is surprised to discover huge corporate buildings owned by the oil companies. The contrast is striking: After having driven through miles of jungle, one passes luxurious mowed lawns, tennis courts and the odd swimming pool.

Radio Cumandá is on the western edge of town in a long wooden building that is also a radio repair store and a home. It's not easy to find at night, as there is very little lighting on the street. Two of my HCJB friends and I decided to go on a weekend adventure and arrived there on a Friday night around eight. There were three employees present, along with Señora Mercedes Araujo de Quinga, the wife of *Radio Cumandá's* owner, and mother of *Radio Cumandá's* manager, Marco Quinga. We enjoyed a "summer evening at the cottage with Mom" kind of evening as one broadcaster played records and the rest of us sat around having a good chat. (They even interviewed us on the air!)

Radio Cumandá is, at this writing, the newest shortwave operation in Ecuador, having gone on the air August 1, 1990. The station had actually been a dream of the Quinga family for over a decade. José J. Quinga and his family live just south of Quito in the Andean town of Machachi. About 12 years ago, they had a wish to start a radio station in Coca, Coca being an area they liked to visit. The station, to be called *Ecos de Orellana* was built in Machachi and there were several on-air tests made. During this testing stage, the station was very well-liked by the residents of Machachi. Enjoying their new radio station, the townsfolk expressed their desire that *Ecos de Orellana* not be moved to Coca. At the same time, the Quingas were having second thoughts about locating the station in far-

Announcer Angel Bonilla.

away Coca as the new jungle town really didn't have sufficient commercial establishments to sustain a radio station. The outcome: *Ecos de Orellana* would remain in Machachi. That is how a station with a name associated with Ecuador's *Oriente* came to be located high in the Andes, almost under Mount Cotopaxi's shadow. It is now called *Radio Orellana* and operates on 1580 kHz with 1 kw. Señora Quinga said *Radio Orellana* has a very fancy QSL certificate.

Radio Cumandá is named after the novel *Cumandá*, written by Ecuadorian Juan León Mera and first published in 1879. (León Mera also penned the Ecuadorian national anthem.) It's a beautifully sad tale about a family in the jungles of eastern Ecuador where the heroine, Cumandá, becomes lost and...well, that's another story.

Programming on *Radio Cumandá* is both musical and cultural. There are "mini-programs" especially dedicated towards the health of children, womens' rights, the protection of nature, as well as music. A typical day's schedule looks like this:

— 6 AM sign on to 8 AM---Ecuadorian folk music.
— 8-Noon--pop and "tropical" music (salsas, cumbias, etc.) mixed with short programs as those described above.
— Noon-1 PM---news, including a broadcast of HCJB's Spanish news. (Many stations around Ecuador tune in HCJB's midday news at 12:30 on 6050 kHz, patch this through their own control boards and broadcast it over their own station. José "Chema" Reinoso, director of HCJB's Spanish language service comments, "If they're listening to HCJB somehow, amen!")
— 1-to sign off around 10 PM---various types of music, mixed with more mini-programs.

Radio Cumandá first began operating on 3332 kHz, 90 meters, and later changed to 3351 kHz (their assigned frequency is 3350 kHz). Señora Quinga and her son Marco believe that most of their listeners live outside of the actual town of Coca. Within town limits, radio owners are more accustomed to mediumwave (their competition is *Radio Francisco de Orellana* on 1030 kHz) and FM (a couple of FM stations in Lago Agrio are audible.) *Radio Cumandá* does have plans to add an FM frequency at some future date when the station is better established. There are no plans to operate on mediumwave.

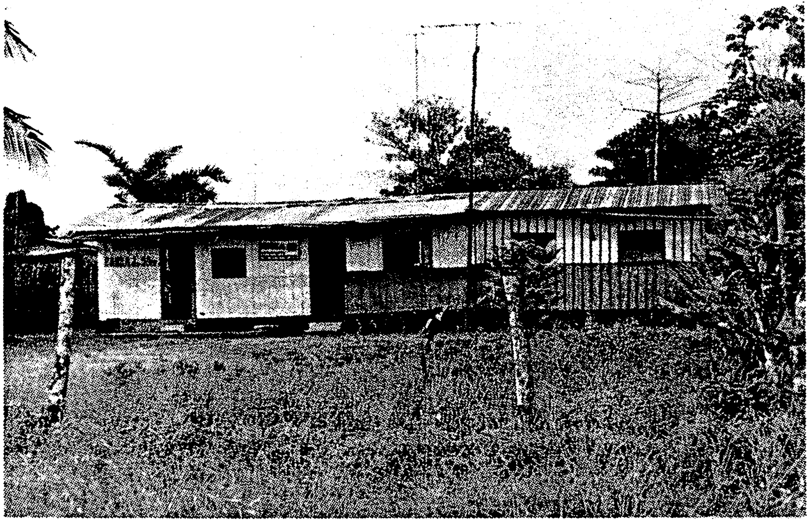
In a shack about three blocks away from the studio, an Ecuadorian-made shortwave transmitter quietly hums as it produces a signal on 3351 kHz. Marco estimated the power to be 800 watts. A voltage surge in the autumn of 1991 burned-out part of *Cumandá's* transmitter but the station has been back on irregularly since the beginning of 1992. The 90 meter band dipole antenna is supported on one side by a lofty eucalyptus pole. The other end is affixed to a not-so-lofty eucalyptus pole which is strapped to the top of a tall power line pole to make up the difference. (A tall new eucalyptus pole for this latter end patiently leans on the transmitter shack waiting to be put up.)

The Quinga's are optimistic that Coca, quickly growing with the oil industry, will soon contain enough stores and businesses to help give *Radio Cumandá* a


Sra. Quinga, son Marcos and Angel at the transmitter building.

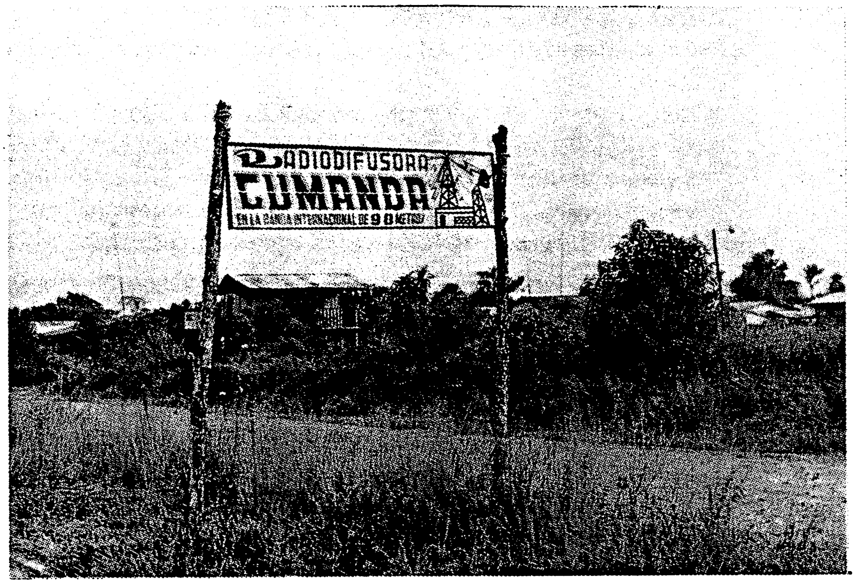
stronger economic foothold. At the moment though, *Radio Cumandá* is still a hobby of the Quinga family. Mom and Dad take care of the larger *Radio Orellana* in Machachi while son Marco looks after the fledgling broadcaster in the jungle.

Reception reports have arrived from Costa Rica, Brazil, Florida and Quito. Marco now knows exactly what a DXer is and what we...er...*enthusiastic* hobbyists are asking for. The surest way to get a letter to *Radio Cumandá* is to send your report via *Radio Orellana* in Machachi. As she was doing during our visit, Señora Quinga makes bi-monthly flights to Coca to check-in on her son at *Cumandá* and takes the station's mail with her. Here is the address:



The *Radio Cumandá* building.

Radio Cumandá
c/o Radio Orellana
Luis Cordero 226
Machachi
Provincia de Pichincha
Ecuador



Radio Cumandá sign near the highway.

RADIO "CUMANDA"

COMUNICACION ALTERNATIVA AL SERVICIO DEL ECUADOR

MUSICAL - NOTICIOSA - CULTURAL Y DEPORTIVA

ONDA LARGA

ONDA CORTA 3.350 Khz. En la banda de 90 mts.

Teléfonos: 315-089 - 315-286

Prov Napo Cantón Fco. Orellana (Coca)

THE SIERRA
THE MENA FAMILY: LA VOZ DE SAQUISILI-RADIO LIBERTADOR

The Andes run through the middle of Ecuador from north to south and are made up of two main ranges. Between these two ranges is a high valley, named the *Avenue of the Volcanos* by German explorer Alexander von Humboldt. A traveller passing through the Ecuadorian Andes would agree that this is the perfect name as, going from Colombia towards Peru, he would on his left side pass such volcanic, snow-covered giants as *Cayambe* , *Antisana* , *Cotopaxi* , *Tungurahua* , *El Altar* and *Sangay*. On his right, going from north to south are *Cotacachi*, *Pichincha*, the *Ilinizas*, *Carihuairazo*, and *Chimborazo* (the highest, at 20,703 feet). All through the central valley are lively, colourful towns and one of the liveliest (and most colourful) is Saquisilí.

Saquisilí is known throughout Ecuador for its Thursday market. People from many hard to reach villages travel to Saquisilí to buy and sell animals, vegetables, fruits and just about any household item one could think of. In the large *18 de Octubre* plaza, townsfolk and tourists examine everything from plantains to beautiful woven bags and wall hangings to hammers and other tools. What stood-out to us the most was a row of about eight male tailors sitting at their sewing machines right out in the middle of the plaza.

La Voz de Saquisilí-Radio Libertador is right across the street from this plaza. From the station's balcony, one can look east over the market and beyond to the cold snows of the highest active volcano in the world, Cotopaxi. On a favourable day, one can also see the white alpine-like peaks of the Ilinizas to the north.

My wife, Lisa, our baby daughter, Rachel and I visited the station on a Thursday just after lunch. Not finding the actual studios right away (only a sign hanging across the road), I poked my head into a small grocery store and asked directions. The kindly woman running the store turned out to be the wife of the station's owner, Professor Vicente Arturo Mena Herrera. *La Voz de Saquisilí-Radio Libertador* was right over the store in the same building. Professor Mena took us upstairs for a good chat, some *Fruit* (an Ecuadorian soft drink) and a tour of the station. (With that soft-drink reminder, you may be wondering how often an Ecuadorian drinks *Inca Kola*, the yellow Andean pop drink famous throughout the SWBC DXing community. Well, not very often, at least in Quito. Nudged-out of the local market by *Coke* and *Fanta*, *Inca Kola* is no longer available in northern Ecuador. If the *Quiteño* DXer is simply *salivating* over the thought of 10 ounces of the bubble-gum-flavoured stuff, he can travel to Guayaquil or Cuenca for a bottle.)

One word that comes to mind when thinking of Professor Mena is *energy*. A native of Saquisilí, the professor is also larger than most Ecuadorians, accentuating his prominent role in the town as a teacher at the local high school and broadcaster. It was this same Professor Mena who founded *La Voz de Saquisilí* 28 years ago. The station went on the air using the single frequency of 4900 kHz, the same shortwave frequency they use today. Immediately successful, *La Voz de Saquisilí* added to the thriving economy of the town, both a market and a tourist center.

Professor Mena in the studio.

Ever since the beginning, it has been the intention of *La Voz de Saquisilí* to reach all parts of the country. Professor Mena explains, "There are a group of Saquisilí natives who now live all over Ecuador and they were very happy to be able to begin tuning in to their home town." Another reason for starting the station was to put people in touch with one another, as there weren't any telephones. "The people were *very* ready to listen to our new station!"

Three years after *La Voz de Saquisilí* went on the air, another broadcaster, *Radio Libertador*, signed on using the mediumwave frequency of 600 kHz. Later, about 12 years ago, it moved to 1235 kHz. The

RADIODIFUSORAS
"La Voz de Saquisilí y Libertador"

two stations were a partnership between Professor Mena and his relative Arcillo Corrales. When Corrales pulled out of the arrangement in the late 1970's, Mena made arrangements to buy *Radio Libertador* and unite Saquisilí's two stations. Both would then carry the same programming and retain a combined name.

Saquisilí's shortwave broadcaster has definitely been a family operation over the years. In 1979, when Clayton Howard interviewed Professor Mena, he also met the professor's son, Byron, who was announcing. Two other children, Edwin and Vicky, also took turns in the studio.

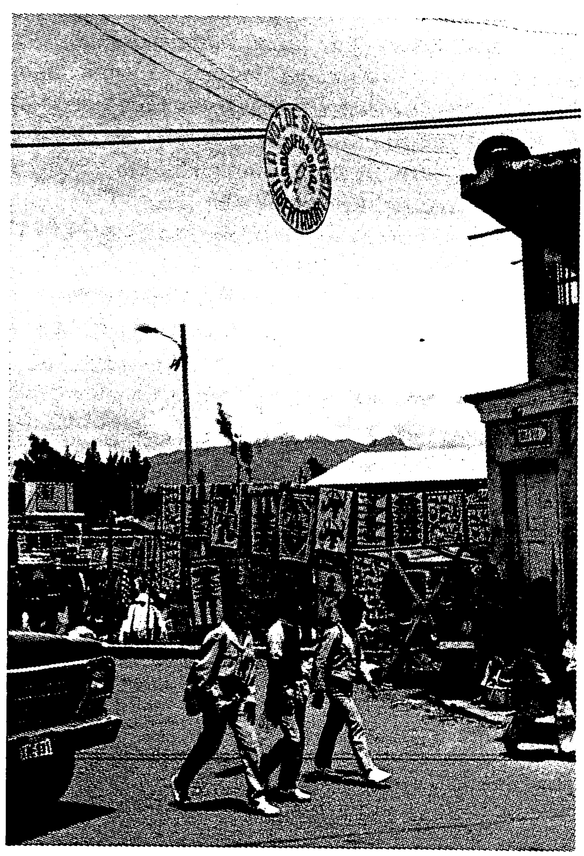
La Voz de Saquisilí-Radio Libertador begins the day with *El Alegre Amanecer* (the happy wake-up) with Ecuadorian folk music. There are also messages from one family to another and many commercials. (One hears Professor Mena himself on the air most mornings doing both live announcing and taped commercials.) Later, they have news followed by pop music. At 12:30 PM the station airs HCJB's midday Spanish news. There is a little bit of everything in *Saquisilí's* programming--sports, commercials, and religious broadcasts. 1235 kHz is on the air from 6 AM until 10 PM. 4900 kHz is usually on only until 10 in the morning. On special occasions, they will leave the shortwave transmitter on all day.

The shortwave transmitter runs at about 1 kw while they use 500 watts on 1235 kHz. Professor Mena said the 4900 kHz transmitter has better equipment and puts out a more reliable signal. Both transmitters were assembled in Quito by a local engineer, Fred Simon. The transmitters are based outside of Saquisilí and are connected to the studios by private landlines.

Professor Mena is familiar with the DXing hobby and appreciates the letters, tapes, unused Ecuadorian stamps and US dollars that the station receives. The staff is very small, however, and we noticed only one small desk with a typewriter in the office. (What I'm leading to is that it may take patience and several follow up reports before being rewarded with a verification letter.)

With Professor Mena's energy and interest in reaching all of Ecuador with *La Voz de Saquisilí-Radio Libertador's* signals, I think DXers will be able to listen to this Andean broadcaster for years to come.

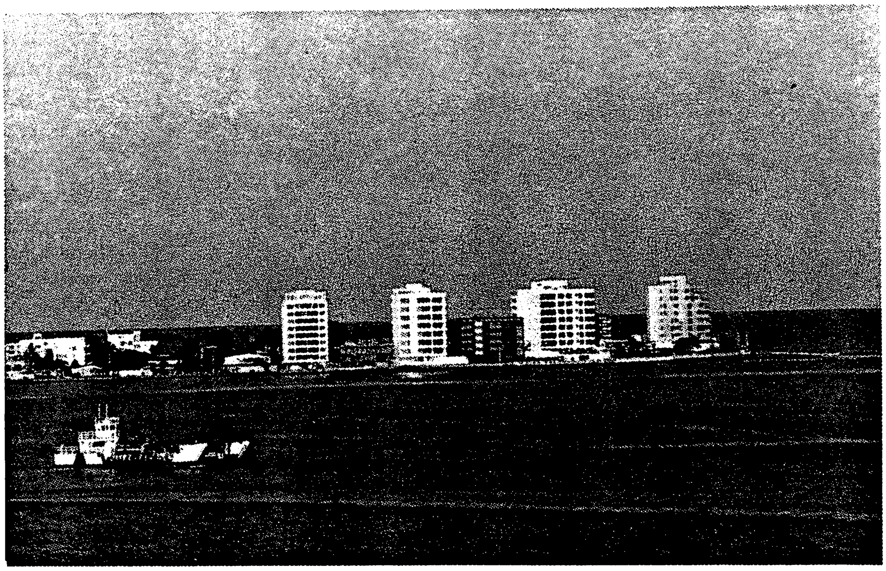
La Voz de Saquisilí y Libertador
Calle 24 de Mayo No. 675
Saquisilí
Provincia de Cotopaxi
Ecuador



At *La Voz de Saquisilí* one sees Mount Cotopaxi overlooking the Saquisilí Market.

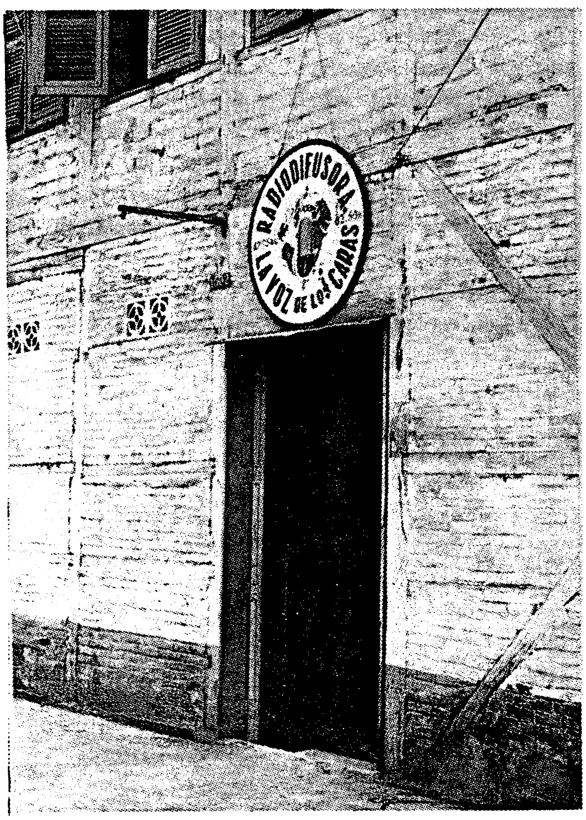
THE COAST
THE NEVAREZ FAMILY: LA VOZ DE LOS CARAS

Bahía de Caráquez is a beautiful small port of about 13,000 inhabitants located where the Chone River meets the Pacific Ocean. Behind the houses on the road heading toward Bahía, are what could be described as "water fields"- square areas boxed in by stones. These are shrimp farms and one certainly has the opportunity to taste their product in the local restaurants. Several islands in the Chone River are *covered* with thousands upon thousands of birds--storks, gulls and, boasting an enormous bright red mating pouch, the frigatebird (usually associated solely with the Galapagos Islands.) Playful dolphins and hungry pelicans often make friends with the fishermen in the smaller boats on the Río Chone.



Bahía de Caráquez, as seen from San Vicente.

At the main dock in Bahía, the importance of the fishing industry is apparent by the number of fishing boats, nets and the smell of fresh fish in the humid air. If one stands here and looks north across the Río Chone, one sees the more rustic village of San Vicente. Turning around, he is again surrounded by the business of Bahía life--grocery stores, pharmacies, banks, restaurants, auto-repair shops and so on. To the left of the dock and across the street is the *Casa Americana*, a long building with several unmarked doorways. However, there is one doorway that has a bright, round sign and is as noticeable to a DXer as an airmail envelope amidst advertising fliers. That doorway leads to *La Voz de los Caras.*



The entrance to La Voz de los Caras.

La Voz de los Caras was named after the Caras Indians, one of the two dominant tribes in Ecuador about 900 years ago. They are known as *La Patria de la nacionalidad Ecuatoriana* (The fathers of the Ecuadorian people) and lived in this coastal region of the country.

In the early 1940's, Bahía de Caráquez, then a very remote fishing village, was able to boast of having a network of transmitters used for medical purposes. This network was put together by a Dr. Parker, who was also an amateur radio operator. One of these transmitters operated on 4710 kHz with 120 watts. In 1946, after Dr. Parker had passed away, the equipment was purchased by a group of six men, including Alejandro Nevárez Pinto. It was with this purchase that the actual radio station *La Voz de los Caras* began. Their first day on the air was June 21, 1946 and the frequency was 4795 kHz, the same frequency they use today. Señor Nevárez was the one partner in *La Voz de los Caras* who was truly interested in the radio medium and he eventually bought-out the other original investors. The station has always been in the same building.

Father and son: Alejandro and Marcelo Nevárez.

Señor Nevárez explains that, back then, operating such a radio station was a hobby. Bahía didn't have the businesses to sustain a commercial station. As with the Saquisilí area, there were no telephones in the region and people were happy to have the station to relay messages from family to family, friend to friend. The station has always operated on shortwave with the purpose of covering the immediate area as well as Manabí province and indeed all of Ecuador.

La Voz de los Caras operated solely on shortwave for 43 years, having added FM (95.3 mHz) in 1991. When asked about the feasibility of using shortwave, Señor Nevárez explained that most people in the villages and farms in their main target area are still more familiar with shortwave than with FM. He added that they wouldn't really know what "60 meters" meant, but that it was just a type of radio that they were used to. Señor Nevárez is confident that this will be the case for a number of years to come. Unlike many broadcast stations in Ecuador, *La Voz de los Caras* has people who consider their shortwave frequency a top priority and quickly repair the transmitter if something goes wrong. I think the main reason for this is Señor Nevárez and his son, Marcelo. Marcelo is the station's director and engineer. Both he and his father really know their stuff, the two having gained experience in solid state electronics in New Orleans. Marcelo is full of the same kind of enthusiasm and love for radio as his father.

The shortwave transmitter operates on 4795 kHz with five kilowatts and is Ecuadorian-made. An inverted V-dipole is used for an antenna and, together with the transmitter, is located on a hill overlooking the city. *La Voz de Los Caras* has a relatively well-equipped studio containing a Peavy console, several CD players and turntables.

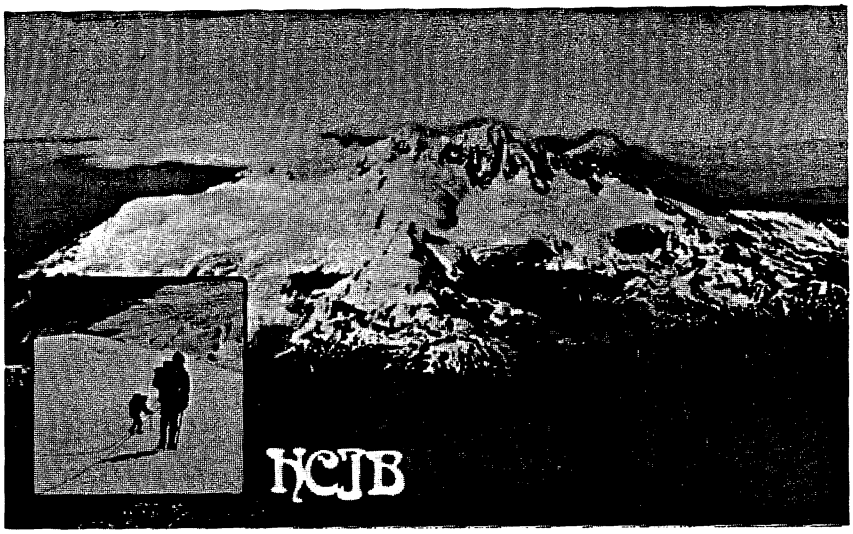
Daily programming at *La Voz de los Caras* consists of such programs as *News of the Shore*, *Hermano Pablo* and the BBC's *Science of the Day* in the morning. Afternoon shows include *Musical Tablecloth*, *Listeners Club* and *A Talk with the People of the Country*(Agricultural). After the evening meal you can catch *Refreshing Waters*, the news, *Musical Impacts*, *Melodías de Arrabal* (Tangos) and the BBC News. A popular weekend program is *Remembranzas*, an oldies request program where listeners call in from all over the country. At one time Señor Nevárez tried airing folk music from the Andes but listeners complained. They said it was too depressing.

On the walls of the office are all kinds of banners and postcards from DXers worldwide. Reception reports are a pleasure for them to receive. (Again though, patience is needed for a reply.)

The address is:
La Voz de los Caras
Apartado Postal 608
Bahía de Caráquez
Provincia de Manabí
Ecuador

ACTIVE SHORTWAVE STATIONS IN ECUADOR

Since station schedules tend to bend and stretch a lot, I haven't been too careful in listing every sign on and sign off time. Sign on is often at 1100 UTC, although some stations start their day earlier. If the station doesn't stay on SW all day, they will probably fire up the SW transmitter again around 2100-2300 UTC and keep it going until sign off anywhere from 0100 to 0500 UTC. Unless otherwise noted, each station is on SW during both local mornings and evenings.



3220 HCJB (Pifo) (10 kw), Casilla 17-17-691, Quito; Director of Quichua Services: José Naula. (*Quichua* is how one spells the language in Ecuador.) The world's pioneer missionary broadcaster first went on the air Christmas Day, 1931. Today, missionaries and staff from over 20 countries serve at HCJB in Quito. This Christian multi-denominational station is funded by interested churches and individuals around the world. In 1978, a delegation of Christian Quichuas requested more than the 50 program hours a week in Quichua that HCJB was able to supply. They and others who wished to help, raised the funds to build two 10 kw transmitters especially for the Quichua service, one on 90 meters (3220) and one for 49 meters (6080). Final assembly was completed in 1979. Programs include *Mixed Grains*, a popular breakfast show at dawn, local and international news, Bible reading and studies, history of the ancestors of the Quichua people, and music.

3240 *Radio Antena Libre* (1 kw), Casilla 65, Esmeraldas, Prov. de Esmeraldas; Director: Señor Luis E. Velasco León; Owned by the Roman Catholic Church, this station began broadcasting in December 1978. Some of their programs have included *Here, those of the countryside, Latin America sings, Bible space*, radio dramas or novelas, and newscasts. Because of technical problems, *Radio Antena Libre* was off 3240 kHz for all of 1991. In February 1992 they returned with a few sporadic tests but haven't been heard here in Quito since then.

3270 *Ecos del Oriente* (1 kw), Mariscal Sucre 148 y 12 de Febrero, Lago Agrio, Prov. de Sucumbíos; Director: Marcelo Velástegui F.; A commercial broadcaster, *Ecos del Oriente* is on the air mornings and evenings with both pop and folk music and plenty of commercials. They are interested in DX reports and have a *Certificado de Honor* QSL that demands framing!

3280 *La Voz del Napo* (2.5 kw), Misión Josefina, Tena, prov. del Napo; Director: P. Rostagno. The "Voice of the Napo," is Catholic-run and broadcasts religious and cultural programming to listeners in the Ecuadorian east. *La Voz del Napo* has traditionally been DXer-friendly and has a winner of a pennant.

3286 ***La Voz del Río Tarqui*** (350 watts), La Mar y Montalvo, Cuenca, Prov. de Azuay; Director: Manuel Pulla C. This commercial station has been very active during the first half of 1992, but has been known to be off SW for months at a time. They usually pull the plug about 0100 UTC without any prior announcement.

3290 ***Radio Centro-Estación 112***, (500 watts), Casilla 18-01-0574, Ambato, Prov. de Tungurahua; Director: Luis A. Gamboa Tello. *Radio Centro* has been on SW since December 22,1989. They are on all night: 2200-1300 UTC on 3290 kHz. Programming is varied with *News of the new day, Centro Sports, Midnight-Ecuador , Ecuador sings its songs* and *Dear Mother*, a program of romantic Ecuadorian music. There are also sports programs.

3325 ***Ondas Quevedeñas*** (1.5 kw), 12va. Calle No. 207, Quevedo, Prov. de Los Ríos. Director: Humberto Alvarado P. A burnt-out transformer kept this station off the air for all of 1991. They returned around the beginning of May 1992.

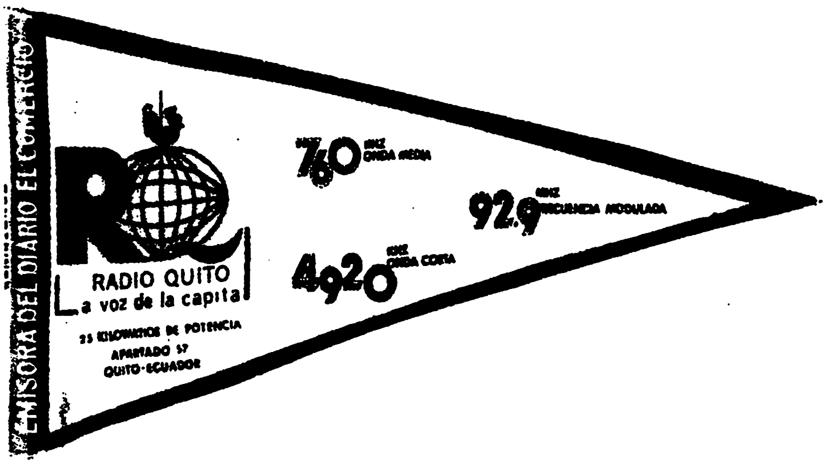
3351 ***Radio Cumandá*** (around 800 watts), c/o Radio Orellana, Luis Cordero 226, Machachi, Prov. de Pichincha. Director: Marco Quinga. (See separate article.)

3395 ***Radio Católica-Santo Domingo*** (10 kw), Calles Ibarra y Babahoyo, Santo Domingo de los Colorados, Prov. de Pichincha. Director: Padre Cesario Tiestos. In the autumn of 1991, *Radio Zaracay* sold its MW (965 kHz) and SW (3395 kHz) transmitters and frequency rights to the growing *Radio Católica* network. (*Radio Zaracay* continues on FM from Sto. Domingo and Quito, but from different studios.) Programs on 3395//965 are often the same as on *Radio Católica Nacional* in Quito on 5030//880, but there are also programs direct from Santo Domingo with the above ID. At the moment, they only seem to be on in the local evening (typically around 2300-0300 UTC) when they are on SW at all.

4679 ***Radio Nacional Espejo*** (5 kw), Apartado 352, Quito; Director: Marco Caicedo A. One of the long-timers in Ecuadorian broadcasting, R-N-E began in 1949. The station has a tradition of *radionovelas*, radio soap operas. If you tune in to them today, chances are you will hear husbands and wives having arguments, threats, revelations, gossip and melodramatic organ riffs. Was off the air on SW for more than half of 1991 and currently (July/92) is on only occasionally.

4795 ***La Voz de los Caras*** (5 kw), Apto. 608, Bahía de Caráquez, Prov. de Manabi; Director: Marcelo Nevárez F. (See separate article.)

4800 ***Radio Popular Independiente*** (5 kw), Avenida Loja 2-408, La Gloria, Cuenca, Prov. de Azuay; Director: Manena E. de Villavicencio. This station has been on the air for 32 years, using both 1220 MW and 4800 SW straight through the day. *Radio Popular Independiente's* studio is located on the second floor of the house of the



station's owner. The folk and pop music played is strictly Ecuadorian.

4840 ***Radio Interoceánica*** (1 kw), c/o Iglesia del Pacto Evangélico del Ecuador, Casilla 17-01-11294, Quito. (or, *Radio Interoceánica*, Santa Rosa, Cantón el Chaco, Prov. de Napo.) Director: Byron Medina. Located where the Andes meet the jungle, *Radio Interoceánica* is owned by the Swedish Covenant church. They began broadcasting on 1450 MW on May 24, 1984. However, in 1987, missionary engineer Olaf Hegmuir rebuilt the old RCA 1 kw transmitter for shortwave. He also constructed two "Lazy-H" dipole antennas, a type of antenna which sends the signal straight up, allowing it to cover the region like an umbrella. This antenna pattern, together with their low power, makes *Radio Interoceánica* a very tough DX catch. Programs consist of Bible teaching, sports, health concerns, science, agriculture and news, including rebroadcasts of HCJB news. On Sundays, a full worship service is broadcast in Quichua. Quichua is broadcast daily from 1115 to 1200 UTC, with Spanish the rest of the day. They also use 96.3 mHz FM. The station was destroyed in a strong earthquake in 1987, but completely rebuilt.

4851 ***Radio Luz y Vida*** (2 kw), Casilla 222, Loja, Prov. de Loja; Director: Eloy Torres P. *Radio Luz y Vida* (Light and Life) has been around for many years now. The station is operated by the *Comunidad de Misioneras Sociales de la Iglesia*, a community of nuns. Programming includes news, music, sports and culture. They are often heard on weekends around 0100 UTC but can be gone from SW for weeks at a time.

4890 ***Centinela del Sur*** (5 kw), Casilla 196, Loja, Prov. de Loja; Director: Jose Coronel Illescas. News, commercials and some music. For a while, they were alternating back and forth between 4890 and 4899 kHz. *LV de Saquisilí* is back on 4900. CDS continues to use two frequencies though. Since April/92 they have been using 4899 during local mornings and 4871 at night. This might be to avoid interference from Peru's *Radio Chota* on 4890. (*Radio Chota* is very strong in Quito.) Swedish author and DXer Henrik Klemetz gives two tips on helping DXers improve chances of a QSL from this broadcaster: 1) Include technical descriptions of your equipment in your report and 2) Thank them for your QSL afterwards. Sr. Coronel told Henrik he stopped answering most reports because no one ever wrote back to say they received his reply.

4900 ***La Voz de Saquisilí-Radio Libertador*** (1 kw), Calle 24 de Mayo No. 675, Saquisilí, Prov. de Cotopaxi; Director: Prof. Arturo Mena Herrera. On the air during the local morning only. (See separate article.)

4920 ***Radio Quito*** (5 kw), Apartado 57, Quito, Prov. de Pichincha. Director: Gonzalo Ruiz. The "Voice of the Capital" has been on since 1940 and is owned by the Quito daily *El Comercio*. *Radio Quito* is respected as one of the leading news voices in Ecuador. They broadcast on SW and 760 MW from 1045 straight through to 0500 UTC.

4950 *Radio Bahái* (1 kw), Apartado 14, Otavalo, Prov. de Imbabura. Directora: Señora Nooshin Burwell. The only Andean station in Ecuador north of Quito, *Radio Bahái* is owned and operated by the Bahái assembly in Ecuador. Programming often consists of the distinctive music of the *Otavaleño* Indian people interspersed with Bahái religious messages. There are also programs dedicated to rural development. They have plans to increase the power on SW to 10 kw. SW is on the air from 0850-1100 UTC and 2300-0100 UTC only. The antenna for 4950 is a rhombic supported by eucalyptus poles.

4961 *Radio Federación Shuar* (5 kw), Federación de Centros Shuar, Domingo Comin 1738, Sucua, Prov. de Morona Santiago. (or, Apto. 4122, Quito.) Director: Albino Ututia J. *Radio Federación* broadcasts to the *Shuar*, or *Jivaro* Indians of southeastern Ecuador. This people group is famous for something they did to their enemies as recently as two generations ago: shrinking their heads. The aim of the *Radio Federación* is to educate the Shuar through school programs, providing features on farming and health, and to give the Shuar a sense of their identity by reminding them of their history and heritage. Most of the programming is in the Shuar language but there are also programs in slow Spanish. They also use 5980 kHz with different programming.

5010 *Escuelas Radiofónicas Populares del Ecuador* , Casilla 47 55, Riobamba, Prov. de Chimborazo; Director: Juan Perez Sarmiento. The name of this station, "Radio Schools of the People of Ecuador," tells one what this broadcaster is all about. According to their printed QSL folder, *Escuelas Radiofónicas Populares* "was created to help its listeners gain a sense of identity, to evangelize and to teach listeners how to read and write. The final aims are to help the listener become a self-developed person, to become a useful member of his community and a citizen conscious of his duties and rights." Many of the programs are in the Quichua language and DXers can hear the beautiful music of these people on 5010 kHz. There are also lessons on mathematics, history and agriculture, as well as news and sportscasts and religious programs. Besides broadcasting, the station also provides a hostel where Indians, making a long trip to Riobamba on market days, may spend the night and receive medical help if necessary.

5020 *Emisora "Voz del Upano"* (10 kw), Misión Salesiana, 10 de Agosto s/n, Macas, Prov. de Morona Santiago; Directora: Sor Dolores M. Palacios C. Owned by a large Catholic mission, *Voz del Upano* airs educational programs with different radio classes taking place on several frequencies at the same time. They also air Ecuadorian folk and various types of pop music and you might even hear the occasional commercial. 5020 kHz has become a regular frequency just recently. The other frequencies are 5040, 5965 and 6000 kHz. One usually finds a completely different program on each frequency.

5030 *Radio Católica Nacional* (10 kw), Casilla 540-A, Quito, Prov. de Pichincha; Director: R.P. Antonio Arregui Y. On the air since the 1940's, *Radio Católica* is the official voice of the Catholic church in Ecuador. Many programs are, of course, religious in nature. A good deal of airtime is also devoted to broadcasts of classical and adult-contemporary music. The programs are of high quality, helping the station to maintain a wide listenership.

5040 *Emisora Voz del Upano* (10 kw), See 5020 kHz.

5050 *Emisora Jesus del Gran Poder* (5 kw) ,(Radio Jesus of the Great Power) Casilla 133, Quito, Prov. de Pichincha. Director: R.P. Jorge Enríquez Silva. Located in the Quito's oldest convent of San Francisco, this station has operated since 1961 and began SW transmissions in 1966. In 1974, its founder, Padre Francisco Fernandez, passed away and a 5-year court battle over the station's ownership followed between his family and the Franciscan monks. The Franciscans won and they were assigned a new frequency and allowed higher power. *Emisora Jesus del Gran Poder* returned to the air in 1979 on their present shortwave frequency. They are also on MW and have less formal programming with a separate broadcast on FM called *Francisco Estéreo*. All programming is varied, with time devoted to religious broadcasts, music, culture and sports. Their pennant is one of the largest ever to decorate the walls of a DXer's radio room.

5062 *Radio Nacional Progreso* (2 kw), Casilla Letra "V," Loja, Provincia de Loja; Director: Efraín Herrera Guerrero. This commercial broadcaster has been on the air since 1958 with programs of culture, news, sports and music.

5965 *Emisora "Voz del Upano"* (10 kw),See 5020 kHz.

5980 *Radio Federación Shuar* (5 kw),See 4960 kHz.

6000 *Emisora "Voz del Upano"* (10 kw) See 5020 kHz.

6080 *HCJB* (Pifo); (See 3220 kHz).

International bands: HCJB broadcasts for Latin America and most areas of the world.

RADIO INTEROCEANICA

IGLESIA DEL PACTO EVANGELICO DEL ECUADOR
CASILLA 11294 - TELEFONO 248-910

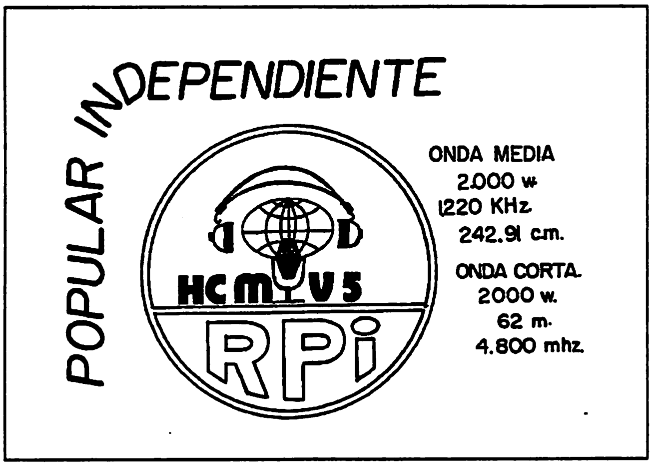
FUNDACION FACE
QUITO, ECUADOR - S. A.

Unofficial Stations:

4212 *Radio Susudel*, Ona, Azuay province. Señor Marco Martinez, a reporter with ERPE in Riobamba, provided the following information to the Japanese DX publication *Relámpago DX*: Sr. Martinez found that *Radio Susudel* made its first transmissions in May 1991. The station was to broadcast educational programs for people living in the country. It operated with a 500-watt transmitter made in Ecuador. In fact, the transmitter was previously used by ERPE. (I'm guessing, but perhaps this was ERPE's old 3985 kHz transmitter-RM) *Radio Susudel* did not have an official government license and they also transmitted on an out-of-band frequency. Apparently there were complaints from other services such as aeronautical stations and in February 1992, *Radio Susudel* was prohibited from making further broadcasts. Sr. Martinez says they will probably return to the air on another frequency with the government's blessing. The director is Herman Donaula. Try this address: *Radio Susudel*, Correo Central, Oña, Provincia de Azuay, Ecuador. (*Relámpago DX* # 38)

Radio Susudel often broadcast the educational program *In-house Teacher* which has lessons on everything from algebra to soup recipes. During local mornings they play music and have commercials.

4271 *Radiodifusora Gonzanamá*, Casilla 379, Loja, Prov. de Loja; Director: Miguel A. Mendieta. This station has been around for nearly ten years, coming on the air irregularly. A good time to try is Friday or Saturday around 0000-0400 UTC. They play lots of pop music and there are many commercials. They are still active as of this writing (July/92).



WHAT ABOUT THE OTHER STATIONS ONE SEES LISTED?

3255 *La Voz del Triunfo* (Sto. Domingo); Señor Edison Yanez says they have no plans to return to SW.

3260 *La Voz del Río Carrizal* (Calceta) Henrik Klemetz notes that in a list published by *Publidatos S.A.* in October 1991 that *LV del Río Carrizal* is not listed on 3260, their former shortwave frequency. This probably indicates that they have no plans to return to shortwave.

3315 *Radio Pastaza* (Puyo); Their SW transmitter is in sad shape. The station, owned and operated by the Professional Drivers' Union of Pastaza Province, has no one who can fix the transmitter and there is no money to hire a qualified engineer. Some members of the union want to sell the station altogether. (Detailed article in March-April 1992 ANDEX bulletin.) Doubtful if they will be back on SW.

3322 *Radiodifusora Sangay* (Macas); no information available.

3370 *Radio Nacional Limon* (Limon Indanza); A puzzle. In December 1991 the station verified a tentative report sent to them by a DXer in Sweden. Later, the DXer discovered that the station he heard was actually in Bolivia. I've never been able to hear any sign of *Radio Nacional Limon* either here in Quito nor in Shell (not too far from Limon Indanza). No other information available.

3380 *Radio Iris* (Quito, formerly in Esmeraldas); No plans to return to SW.

4760 *Sistema de Emisoras Atalaya* (Guayaquil); They had planned to return to SW during June/92.

4810 *La Voz de Galápagos* (Pto. Baquerizo Moreno); At least two DXers have visited this station recently, Maarten van Delft and J.C. Moreno. Both report that the shortwave transmitter, inactive since 1989, looks pretty bad. At the moment, *La Voz de Galápagos* cannot afford to repair it.

4820 ***Radio Paz y Bien*** (Ambato); According to their director, Padre Leon, *Radio Paz y Bien* will not be back on 4820 kHz. They have a well-established FM audience and are directing their efforts on expanding the station's network of FM repeaters. They also use 1340 MW.

4870 ***Radio Río Amazonas*** (Macuma); This station was completely dismantled in the summer of 1991 after 29 years of broadcasting. The reasons for doing so were both economic and political. Studio equipment was reportedly purchased by *Radio Amazonas* (unrelated station) in Lago Agrio.

4911 ***Emisoras Gran Colombia*** (Quito); On the air since August 1944, (SW since 1956) this station is located in a beautifully renovated building in colonial Quito. Programs specialize in news, music, culture and, most importantly, sports. They haven't been on SW for months but are expected to return at any time.

4930 ***Radiodifusora de la Casa de la Cultura Ecuatoriana*** (Quito); Long-time DXers may remember this station being on 60 meters and being a pretty good verifier as well. Henrik Klemetz was in touch with the station and found that they have no plans to return to shortwave.

4940 ***Radio Nacional del Ecuador*** (Quito); *Radio Nacional* hasn't been on this frequency for many years, but they do have plans to return. At last word, they were awaiting the importation of a brand new transmitter. *Radio Nacional* has been paying for the rights to this frequency ever since their old transmitter broke down. In the meantime, you can log them via HCJB. They air a program called *Carta Para Los Ecuatorianos Ausentes* (Letter to Absent Ecuadorians) which is broadcast Monday-Friday 1730-1800 UTC, currently on 15350 kHz.

4971 ***Radio Tarqui*** (Quito); Manager Gustavo Herdoiza told Henrik Klemetz that they have no plans to reactivate their shortwave frequency.

Aside from the information gathered during visits to many of the stations above, much of the data comes from the sources listed below. I'd like to thank Don Moore for sharing some interesting data gathered during his own station stop-ins here in Ecuador. Rob Rachowiecki's *Ecuador & the Galapagos Islands, a travel survival kit*, is recommended to help you get a current-day feel for the towns and cities you can listen to and, although written three-quarters of a century ago, Harry Franck's *Vagabonding Down the Andes* is invaluable in helping a DXer understand why several attempts are necessary at securing an Andean QSL.

Volumes could be written on the history of Ecuadorian radio. Happily, one book has been written which goes into detail on Ecuadorian radio stations both past and present. The book is *Radiodifusión en la Mitad del Mundo* (Radio in the Middle of the World) and was written by broadcaster Alvaro San Felix. (Much of my information is from that book.) At the moment it is not easily obtainable and is only in Spanish. One of HCJB's Ecuadorian broadcasters has tentative plans to write his own book on Ecuador's radio history. If he does, there will be an English translation.

A comparison between WRTH's from the '60s and the latest edition will show that shortwave is slowly on the wane here in Ecuador. FM with its clear sound and repeaters are taking its place. I hope that these books and articles (maybe even the one you just read) will help you hear and enjoy the stations that remain. Most of all, I hope to meet you down here some day. We're looking for a nice beverege-on-the beach site right now!

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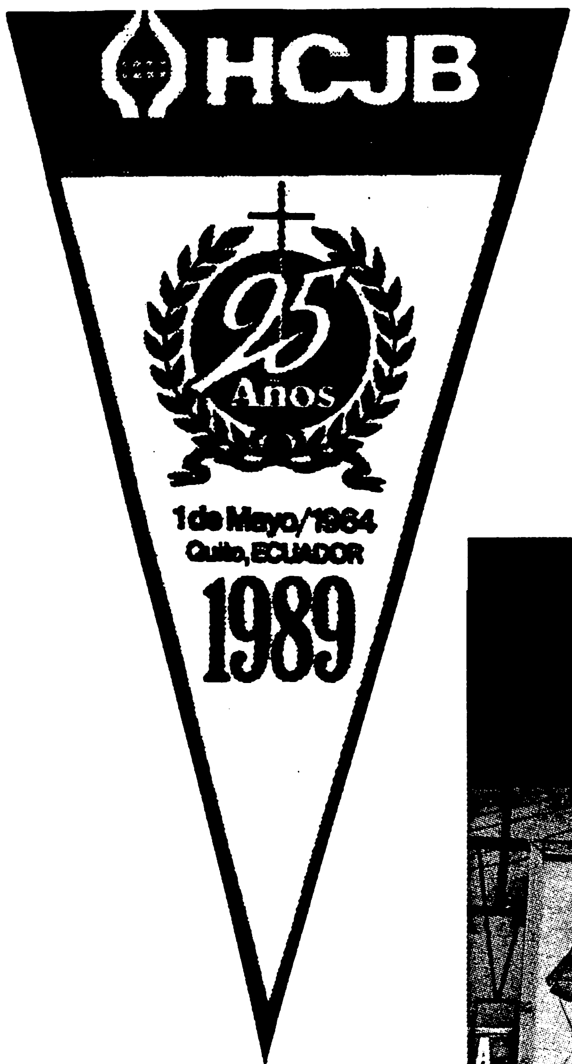
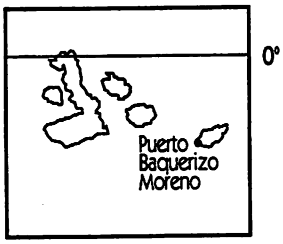
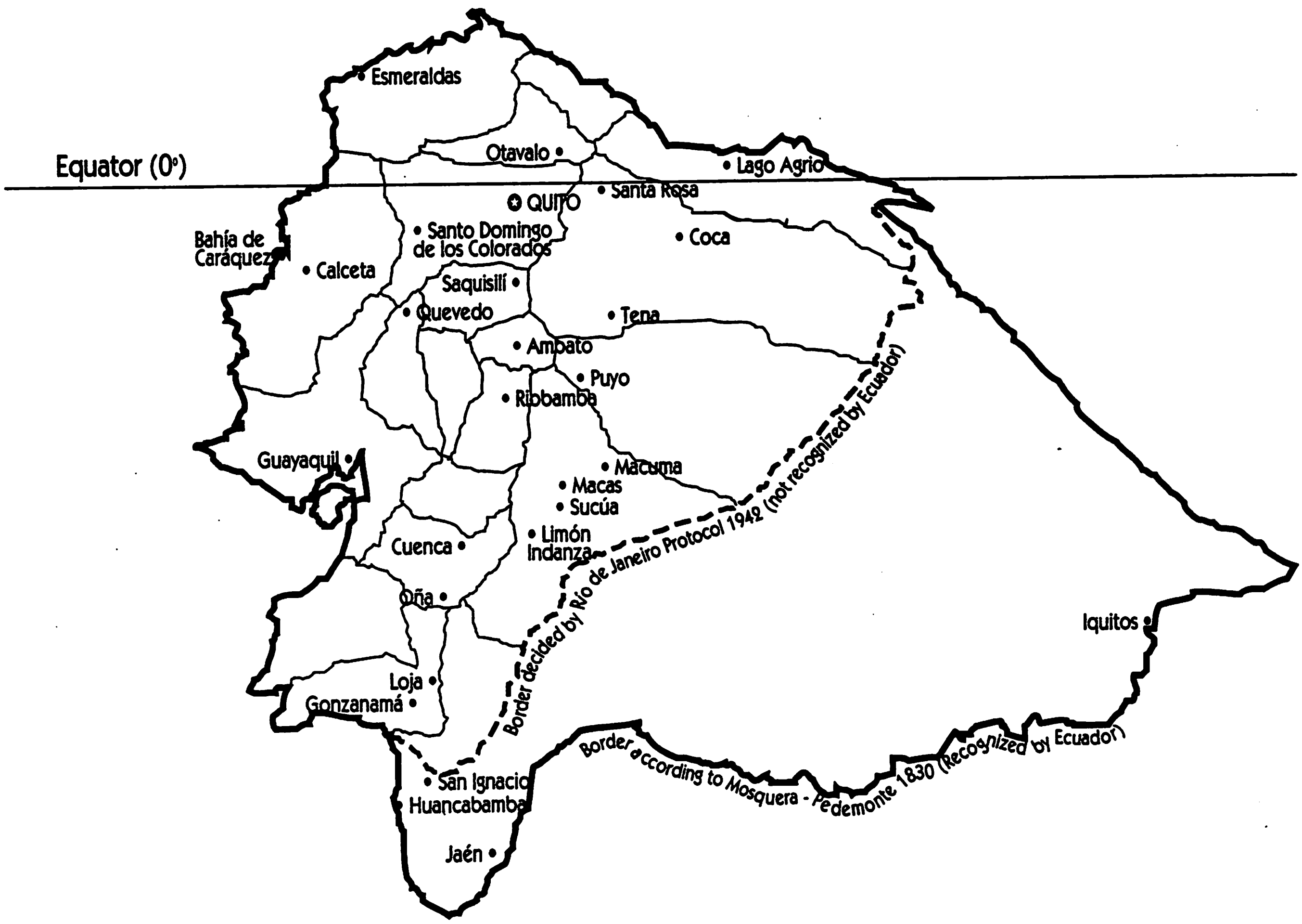


The author, his wife Lisa and baby daughter Rachel.
(Photo: Prof. Arturo Mena)

CITIES AND TOWNS WITH SHORTWAVE BROADCASTING STATIONS IN ECUADOR



Galápagos Islands
(600 miles due west of the mainland)



LIFTING THE VEIL

DXING THE CLANDESTINE STATIONS OF IRAN,IRAQ AND KURDISTAN

Hans Johnson

American interest in Iraq and her neighbors reached an all-time high during the Gulf Crisis. Maps sellers quickly exhausted their supply of Middle Eastern maps and sales of shortwave radios soared. Yet in spite of all of the attention, Americans still have a difficult time understanding this area of the world. Although shortwave listeners certainly do not represent the typical American, even they have trouble and this is evident in the loggings section of any shortwave publication. A quick review will reveal generalizations and inaccuracies such as "Middle Eastern language", "presumed Arabic", and "chants". Yet according to Mathias Kropf[1], this region contains the greatest concentration of clandestine activity in the world. Would it not be great to know enough to identify the many clandestine stations operating here as well as the regulars? In addition to technical information such as time and frequencies, this article will also examine the politics, religion, and languages of this area. By applying this information DXers will be able to log clandestine stations of Iran, Iraq and Kurdistan and understand what is going on both in front of and behind the microphone. Of all the veils, the one covering languages is perhaps the most opaque.

LANGUAGE

The difficulties most shortwave listeners face in logging stations of the Middle East are most evident by the manner in which the languages of the region, some of which are not even from the same language family, are routinely lumped together in loggings as though they were as closely related as Dutch and German. Yet there are only three languages used by the clandestine stations of this region: Arabic, Farsi (Modern Persian) and Kurdish. The bottom line is that unless a shortwave listener can routinely recognize and distinguish each of the above languages he will not progress very far in the field of Middle Eastern Dxing. The below chart shows how the three languages relate to one another:

Language	Language Family	Group
Arabic	Hamito-Semitic	Semitic
Farsi	Indo-European	Indo-Iranian
Kurdish	Indo-European	Indo-Iranian

Arabic is the most widely used of these three languages with an estimated 150 million speakers. The Arabic usually heard on shortwave is Modern Standard Arabic or "Fusha" Arabic. "Fusha" Arabic is also the language heard during Koranic recitations. (Koranic recitations is a more accurate term than chanting.) Muslims believe that the Koran (Quran is another widely used transliteration) was passed from God via the Angel Gabriel to Muhammad. It was necesary at this time (7th Century A.D.) for Arabic to remain unaltered so that the various religious practices decreed in the Koran could continue to be practiced accurately. Thus "Fusha" Arabic is the language that Mohammad spoke, which was the dialect of Arabic used in the city of Mecca, Saudi Arabia in the 7th Century. Some of the programming such as dramas and impassioned speeches will be in the various dialects. Every Arab country has at least one dialect and often many others. The Arabs would have us believe that a Kuwaiti will have no trouble understanding Tunisian dialect. Such is not the case. An Iraqi professor related to me that when she and her Algerian friend got together they spoke in French! However for the purpose of shortwave listening the various dialects are quite close to Fusha Arabic and there is no chance of a listener confusing one of the dialects with Farsi or Kurdish.

Farsi or Modern Persian is the language of Iran and is spoken by 50 million Iranians. In addition to the dialects spoken within Iran, there are two dialects spoken outside of Iran that are often mistaken for being separate languages: Dari and Pashto, which are chiefly spoken in Afghanistan.

Kurdish is the language of 18 million Kurds living in the Middle East, Commonwealth of Independent States, and Turkey. After Arabic, Farsi, and Turkish it is the most widely used language in the Middle East. According to David Mcdowell, "Unlike the Arabs, the Kurds have not yet evolved a single systematized written or spoken language. To this day the Kurds are divided into dialect groups which cannot communicate freely with other Kurds in their mother tongue, although they all share a northwestern Iranian linguistic origin. . . the use of radio and printed material, and the unifying effect of education are bound to improve the ease of communication consierably, and may even produce an eventual 'literary' style for broadcasting and writing."[2]

The most effective technique a DXer can use in improving his ability to deal with these languages is to make a reference tape of each. The opportunities to hear both Arabic and Farsi on the radio are numerous and the VOA recently started a Kurdish service. Listeners having trouble tuning in VOA in Kurdish can listen to this language via Iraq on 6560 khz signing on at 0230 UTC (0130 UTC in summer). Having a tape of each of the languages allows the DXer to compare the various langauages and get a feel for them. The tape will also serve as a handy reference to be compared to a tape of a log in order to determine the language. In time the DXer will become as familiar with these language as most are with Portuguese and Spanish. Appendix I is a vocabulary list of words from our three languages that are commonly heard on the clandestine stations of the Middle East.

RELIGION

Compared to languages, the veil covering religion is a bit thinner. The main religion of this area is Islam and while there are various religious minorities, none are involved in any clandestine radio activity. Unfortunately, although terms such as "fundalmentalists" and "Shiites" have appeared for over a decade in the western press, the press never seems to have gotten around to explaining the history behind these terms. There are two main sects in Islam: Sunni and Shi'ite. Sunni Moslems are often thought of as "orthodox" Muslims and they represent the majority. Technically, a Sunni Muslim is devoted to one of the four standard "rites" of Islamic law.[3] The split of Islam into two main sects occured over the issue of sessession. After Muhammad's death, a few close relatives succeeded him as caliph, that is as head of the Islamic empire. A struggle broke out over the order of succession during the reign of the third caliph, Ali. With Ali's death, men other than direct desendents of Muhammad occupied the caliphship. Shiites (a word meaning followers of Ali) considered these subsequent caliphs to be usurpers and they believed that Ali's descendants to be the true caliphs. Having said that, it is important to note that these affliations are as much political as they are religious. It is worth noting that although Iran is the only country with a Shiite majority, Iraq has a sizable Shiite minority living in the southern Iraq.

RECENT HISTORY

1979 was a milestone year for both of these countries. In that year, Saddam Hussein became president of Iraq and the Islamic revolution occurred in Iran resulting in the rise to power of the Ayatollah Khomenei. A year later, the two countries entered into a protracted conflict that was to engulf them until 1988. Both sides supported religious and political proxies which led to an expansion of clandestine activity as well as jamming that continued even after the two sides stopped fighting. Best described as a cold war, they remained antagonists even after Iraq invaded Kuwait on August 2, 1990. While Iraq and the Allies used jamming and clandestine stations before the war the air campaign destroyed much of Iraq's transmitting capability as the Allied clandestine activity continued unabbetted. On the heels of defeat by the Allies in Desert Storm, insurgencies broke up in both northern and southern Iraq. In the Shia' south of Iraq, the insurgents received material support as well as support on the airwaves with at least one Iranian-backed clandestine station going on the air. The Iraqis regained control of the cities in the south although insurgent activity continues in the numerous marshes of southern Iraq. At the same time the largest Kurdish insurgency ever, broke out in northern Iraq. The Kurds gained control of some of the largest cities in the north. But the subsequent Iraqi counterattack resulted in a mass civilian exodus from the cities. Faced with a civil disaster that some say the Allies caused, the Allies declared a safe haven for Kurds north of the 36 parallel. Fighting continued, albeit on a much reduced scale. Subsequent to the uprisings, Iraqi broadcasting efforts have concentrated on transmitting Kurdish and Arabic broadcasts, jamming, and provided support for clandestine stations. Iran continued to experience internal turmoil throughout this period but that did not preclude it from jamming and support for numerous clandestine broadcasts. Much of the clandestine broadcasting and jamming undertaken by Iran and Iraq relates to their support for the other's Kurdish minority. Therefore, a closer look at the Kurds, their history and their politics is in order.

THE KURDS

With a total population of 18 million in the Middle East, the Kurds easily eclipse the population of countries such as Syria and Iraq.[4] Geography has both blessed and cursed the Kurds (see map). The mountainous terrain of Kurdistan has allowed the Kurds a certain measure of freedom yet it is this same location that has resulted in the Kurds being a sizable minority in several nations but a majority in none. Tribalism is the essential element in Kurdish society, although this is less true in urban areas. Tribalism has given great strength to past Kurdish uprisings but it has also been a weakness as some tribes at times have sided with the central government (be it Iranian or Iraqi) against their fellow Kurds. Tribalism also eclipses nationalism in Kurdish society. Leftist ideologies have made some headway, particularly in the cities.[5] The Kurdish struggle for a nation state started after the First World War. The collapse of the Ottoman Empire, which had ruled Kurdistan until the war, allowed the British to expand their sphere of influence. The Treaty of Sevres (1920), was the first attempt by Britain and Turkey (the successor state to the Ottoman Empire) to achieve a peace settlement. This treaty would have granted local autonomy to the Kurds in eastern Anatolia. In addition independence would be granted to the Kurds in eastern Anatolia as well as the wilayat of Mosul (the northern area of Iraq) after one year if they so desired. This Treaty was unacceptable to Turkey however, and she continued to struggle against the British. Britain and Turkey finally signed a peace treaty in 1926. A lot had changed in those six years, however; eastern Anatolia was to remain under Kurdish control and the wilayat (province) of Mosul had been incorporated into the new state of Iraq. While failing to create a Kurdish state, the British had suceeded in waking up the force of Kurdish nationalism. The Kurds continued to struggle for freedom but it took another world war for them to achieve any success.

During the Second World War, the USSR and Britain occupied Iran obstensibily to protect the oil there as well as provide protection for supply convoys of Western aid to the USSR. Both sides were to withdraw shortly after the war, but the Soviet troops remained. Kurds living in and around the city of Mahabad, Iran, seeing an opportunity in Iran's preoccupation with the Soviet troops, formed the Republic of Mahabad on January 22, 1946. In addition to some Soviet support, the new Republic had been bolstered when the entire Barzani tribe, led by Mulla Mustafa Barzani, fled Iraq and sought asylum in Mahabad. The Mahabad Republic was short-lived and Iranian troops quickly occupied the Republic after Soviet troops left northwest Iran. The leaders of the Republic were hanged while the fighters of the Barzani tribe fled to the Soviet Union. Thus ended the only republic the Kurds have ever had. With the Iraqi revolution of 1958 Mulla Barzani returned from exile; his Kurdish Democratic Party (KDP) became the predominate Kurdish party. A pattern emerged that has continued until the present day of alternating periods of fighting and autonomy negotiations with the Iraqi government. In the early 1970s and with substansial Iranian backing, the Kurds achieved a great deal of success on the battlefield. Iran and Iraq sought to solve their bilateral problems through the Algiers agreement of 1975. As a result, Iranian support of the Iraqi Kurds ended and the Kurdish insurgency collapsed. Mulla Mustafa Barzani went into exile in the United States where he died in 1979. 1976 saw the emergence of a rival to the KDP in the form of the Patriotic Union of Kurdistan (PUK) led by Jalal Talabani, who had broke away from the KDP in the 1960s. Iran did not witness the same intensity of insurgencies that occured in Iraq until after the Islamic revolution of 1979 when the Kurdish Democratic Party of Iran (KDPI), the party that had led the Mahabad Republic, once again tried to assert itself in this area but was defeated by the Iranian army. Support for each other's Kurds by Iran and Iraq resumed with Iran-Iraq war of 1980.

The KDP, now led by one of Mustafa Barzani's sons Masoud, once again received Iranian support but in addition to fighting the Iraqi army in northern Iraq it was fighting KDPI in northern Iran. As expected, the KDPI was receiving Iraqi support. The PUK, which had received substanial Syrian support, evenutally sided with the Iraqi government and fought against the KDP. The KDPI did not gain much success as Iraq seemingly channeled most of its support to other groups. Indirectly cooperating against Iraq toward the end of the war, the PUK and the KDP created an enclave under their control in northern Iraq. The end of the war in August 1988 allowed the Iraqi army to concentrate against the Kurds and substantially reduce this enclave. The latest Kurdish uprising was after the Gulf War in 1991 as previously mentioned. Having covered the Kurds, a look at some of the other groups involved in clandestine broadcasts is in order.

OTHER GROUPS

The Iranian resistance group that has received the most Iraqi support over the years is the Mujaheddin-e Khalq (People's Warriors). But with support often comes control. The group is believed by some observers to be a mere puppet of Baghdad. During the Iran-Iraq war, Mujaheddin-e Khalq fighters fought with the Iraqi army and have continued to commit acts of sabatoge and carry out asssasinations in Iran. Saddam has supplied the group with heavy weapons such as tanks and these constitute the core of the National Liberation Army based in eastern Iraq.[6] The remaining Iranian and Iraqi opposition groups will only be mentioned with their particular station.

CLANDESTINE STATIONS

In general, reception of Middle Eastern clandestines is limited to our local evenings (0230+) as they sign on for their morning transmissions.

Jamming-has a large role in the clandestine broadcasts of this region. The jamming is described as bubble jamming and the term is used genericly, but the Iraqi and Iranian types of jamming each have a distinctive sound. Once again, a reference tape will be quite handy. Start by making a tape of the jammer on 4750 khz that is jamming Iraq's Arabic service and presto, you have a copy of an Iranian bubble jammer. Now contrast this with the jamming used against the Voice of the Iraqi People. When you hear an unidentified station you can often rapidly narrow down the possiblities if you recognize the type of jamming being used against it. Finally, in trying to listen to a broadcast through jamming try both sidebands as the jammers will at times be operating in only one of them. The below is not comprehensive, but rather lists stations that can be logged in North America: [7]

CLANDESTINE STATIONS BROADCASTING TO IRAQ

Iraqi Republic Broadcasting from Baghdad, Voice of the Iraqi People (Arabic-Itha'at Al-Jumhuriya Al-Iraqia min Baghdad, Sowt Ash-Shab Al-Iraqi). This Western and Arab backed station started broadcasting to Iraq shortly before the Gulf War under the name Voice of Free Iraq. After the failed insurgencies against Saddam Hussein in early 1991, the station changed its name to the Voice of the Iraqi Opposition. In yet another name change last fall the station changed its name to the above. A full Id is a must in logging this station as the first part of its Id is essentially Iraq's Arabic service Id. The station also plays the Iraqi national anthem at sign on and off and also uses Iraq's Arabic service news theme. Monitoring has confirmed that Egypt is one of the transmitter sites and QSLs have confirmed Saudi Arabia as another. Programing is in standard Arabic with some Iraqi dialect. Some Kurdish programs were noted in the past, but not in the last year. The station's message has been consistent in spite of the name changes: "Attention Iraqi army-conditions in Iraq are deplorable, overthrow Saddam Hussein." Try around 17957, 15650 and 9985 khz shortly before 2315 (2215 summer) sign off. This station is almost always jammed. Write Saudi broadcasting for a QSL.

Voice of Rebellious Iraq (Sowt Al-Iraq Ath-tha'air). This station has ties to a Shiite umbrella organization, the Supreme Council for the Islamic Revolution in Iraq (SCARI with council sometimes translated as assembly). The group operates from Damascus and seeks to establish an Islamic state in Iraq. The transmitter is most likely in Iran. Only logged once tentatively in North America. 6330 khz at 0430 sign on, but formerly used 7085 khz.

Voice of Iraq (Sowt Al-Iraq). Operating from a Syrian site, this station apparently does not have any ties to a particular group but is simply a Syrian way of irritating Iraq and is consequently almost always jammed. Programming in standard Arabic and Iraqi dialect. 9950 khz at 0400.

KURDISH CLANDESTINES FROM GROUPS OPERATING IN IRAQ

Iraqi Kurdistan Radio (Radyo Kurdestana Iraqia-Kurdish) (Itha't Al-Kurdistan Al-Iraqi-Arabic). Formerly known as Voice of Iraqi Kurdistan, this is the station of the Kurdish Democratic Party (KDP) led by Massoud Barzani. The KDP is the largest Kurdish group within the Kurdistan Front, a coalition of Kurdish groups. Programming is mostly in Kurdish with some Arabic and supports the KDP's call for Kurdish autonomy within Iraq. 4175 khz with 10kw signs on at 0430 with a second 400 watt transmitter operating on 6295khz with both transmitters broadcasting from Sala'deen in northern Iraq.[8] No jamming has been noted against this station.

Voice of the People of Kurdistan (Aira Dangi Gelli Kurdistan-Kurdish) (Sowt Sha'b Kurdistan-Arabic) belongs to the Patriotic Union of Kurdistan (PUK), led by Jalal Talabani. The PUK is the second largest group in the Kurdistan Front. 7085v and 4930v khz at 0400 sign on with no jamming noted.

Voice of the Kurdistan Revolution Radio (Ith'at Sowt Kurdistan Ath-thawra). The Kurdish People's Democratic Party (KPDP), a small Marxist party, is behind this station. The party used to operate from London. Noted by BBC-MS on 6716 khz at 0550 with Arabic programming.

Voice of Unity (Sowt al-Tawhid-Arabic) is the voice of the minor Kurdish Socialist Party (KSP), which broadcast at.0300 on 4130 khz according to BBC-MS.

CLANDESTINE STATIONS BROADCASTING TO IRAN

Voice of the Mojahed (Seda-ye Mojahed-Farsi) is operated by the Iraqi-backed Mojahideen Khalq organization that was formed in 1965. This leftist group has resisted the Islamic republic as much as it did the Shah. Programming is in Farsi and frequencies constantly change in order to avoid heavy jamming. Check 48 and 59 meters at 0230 (0130 summer) sign on. QSIs have been received from A. Hossein, Secretary, MISS, P.O. Bx 9720 London WC1N, 3XX, Great Britain.[9]

Radio Freedom Radio Azadi operating from an Egyptian transmitter site this is the station of exiled group National Movement of Iranian Resistance that was led by former Prime Minister Shahpur Bakhtiar until his assassination in Paris in 1991. The Farsi language programs are jammed. 9400 khz at 0230 (0130 summer).

Iran's Flag of Freedom Radio. This station broadcasts IDs in a number of languages including English at the start of its transmissions. Subsequent programming in only in Farsi; however, and the station is often jammed. A little known organization called the Front for the Liberation of Iran led by a former Prime Minister is behind the station which transmites from Egypt at 0330 (0230 summer) on 15556, 11470, 9250 and 9045 khz. QSL hunters can write to: Flag of Freedom, Reza Farhadi, P.O. 19740 Irving, CA 92714.[10]

KURDISH ORGANIZATIONS BROADCASTING to IRAN

Voice of Iranian Kurdistan (Aira Dangi Kurdistani Irana-Kurdish) (Seda-ye Kurdistani Iran-Farsi) is the station of the Iranian Kurdish Democratic Party (IKDP), the largest Kurdish party in Iran. Programs are in both Kurdish and Farsi and the station opens with about 15 minutes of Kurdish music. 0330 (0230 summer) on 4065 khz. This station is unjammed.

CONCLUSION

Accurately logging the above stations can be a daunting task. I feel that some Dxers believe that most of my success in logging these stations is due to the fact that I speak some Arabic. Keep in mind that Farsi and Kurdish are not even closely related to Arabic and I am able to id these stations on a regular basis. While I have pointed out some techniques that are perhaps particular to Dxing these stations, such as taping jammers, most of the techniques I use are also used by Dxers every day in logging stations from regions such as Indonesia and South America. Factors such as language recognition skills, station knowledge, and propagation all play a role in successful Dxing. Any DXer is capable of Dxing these stations and although it requires some practice and study, the rewards are great.

ENDNOTES:

The following was used for background information: *Political Handbook of the World,* Arthur S. Banks, CSA Publications, Binghamton, NY 1991; *Kurdish Dictionary,* Joyce Blau, Brussels 1965; *The Combined New Persian-English English-Persian dictionary,* Abbas and Manoochehr Aryanpur Kashani, Mazda Publishing 1986.

Much thanks to John Bryant and George Zeller for their support.

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2 David Mcdowell, *The Kurds,* Minority Rights Group, London 1985, p. 14

3 Arthur Goldschmidt, Jr., *A Consise History of the Middle East,* Westview Press, Boulder CO 1983, p. 79

4 Stephen C. Pelletiere, "The Kurds: An Unstable Element in the Gulf", Westview Press, Boulder CO, 1984

5 Anthony Hyman, "Elusive Kurdistan The Struggle for Recognition", Center for Conflict Studies, London. 1988.

[6]*International Defense Review,* September, London, 1991, p. 16

[7]Finn Krone, *Clandestine List,* Danish Shortwave Club International, Greve Danmark 1991; numerous issues of *World Broadcasting Information* from 1991 and 1992.

[8]*Media Network,* Radio Netherlands, May 21,1992

[9]"Onda Corta" via *DX South Florida,* #273

[10]Pete in Michigan on the ANARC SWL Net, October 1991

APPENDIX I

A short vocabulary list for Arabic, Kurdish and Farsi:

ENGLISH	ARABIC	KURDISH	FARSI
communist	shua ' wi	kommunist	kommunist
fighter	fedaeen	pesh merga	mujahed
freedom	tahrir	azadi	azadi
opposition	mua ' rada	dijati	maqawamet
party	hizb	----	hizb
people	sha ' b	gelli	khalq
radio	itha ' t	radyo	radio
republic	jumhuriya	----	jumhuri
resistance	mua ' rada	dijbir	baidari
revolution	thawra	----	inkelab
struggle	nidal	khabati	satiz
voice	sowt	aira dangi	seda-ye

THE HALLICRAFTERS S-38
1935 TO 1962

Chuck Dachis, WD5EOG

PART ONE: GENEALOGY

Wait a minute, the title of this article can't be right! Everyone knows the S-38 wasn't produced until 1946! Well technically that is correct, however Hallicrafter's idea to produce an inexpensive introductory general coverage receiver began in late 1935 with the production of the 5-T Sky Buddy.

The other communications receiver manufacturers of the time were producing high quality very expensive receivers for serious (and wealthy) Hams. Hallicrafters had its share of this market too with top end units such as the SX-9, SX-10, SX-11, and SX-12.

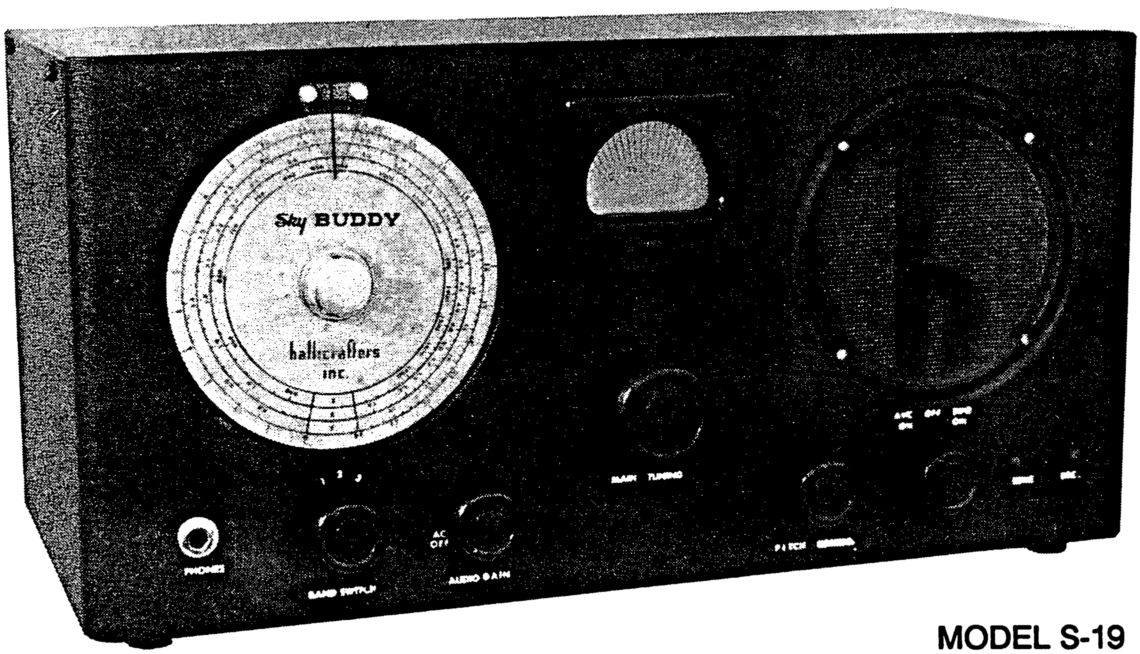
Bill Halligan the founder of Hallicrafters realized this practice was excluding many Hams and others interested in short wave radio who were still reeling from the effects of the Depression and couldn't afford $100.00 plus. So Hallicrafters produced a radio for less than $30.00, the 5-T Sky Buddy. Even though no immediate profit would be realized by producing this inexpensive introductory radio (it was actually sold at cost), the price alone would sell a lot of radios. This approach would get people hooked on short wave radio and create future costumers for the more profitable higher end units. If you didn't have $30.00 you could buy them with time payments sending in just $2.50 per month. At the end of 12 months your new Sky Buddy would arrive. The cash price of the 5-T was $29.50.

MODEL 5-T (early)
Sky Buddy

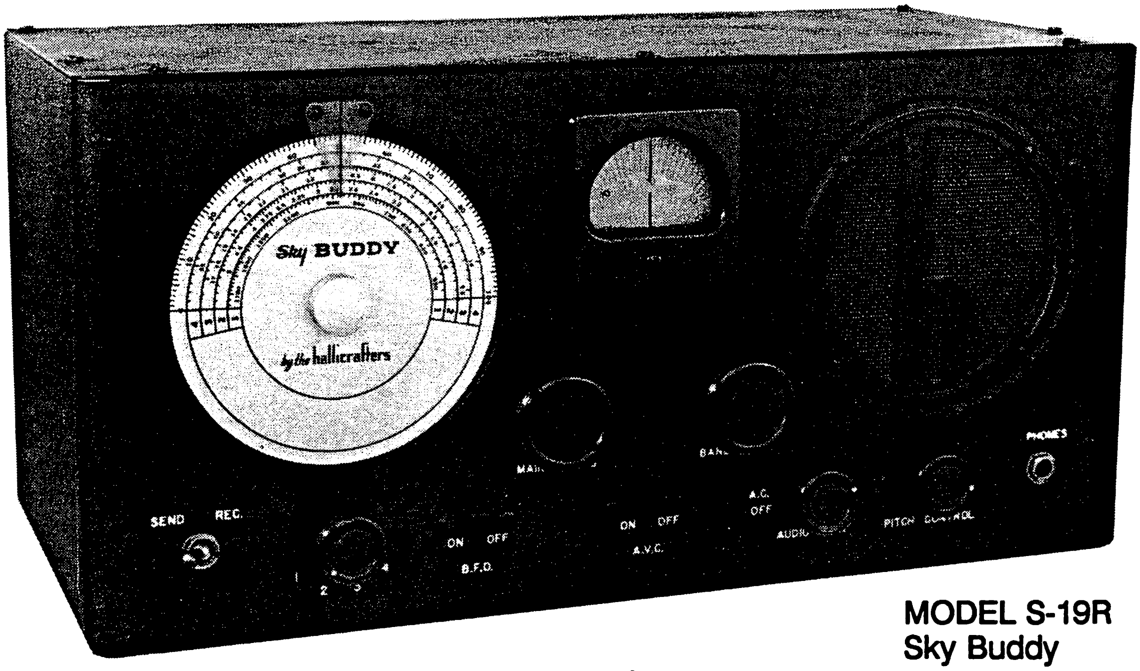
MODEL 5-T (late)
Sky Buddy

THE 5-T SKY BUDDY: (1935-1936)

The first production run of the 5-T had a picture of a boy sitting at a desk with a set of head phones on his head and his hand on a telegraph key as part of the artwork on the celluloid dial. The story goes that Bill had a neighbor who's young son was very interested in short wave radio but couldn't afford an expensive commercial set. The boy's name was Buddy. Bill dedicated this first introductory radio to him naming it "Sky Buddy". Buddy may have also been the inspiration of the idea to produce beginners radios, a practice that Hallicrafters would continue through the years. The 5-T was produced just before Hallicrafters obtained its own license to built radios under RCA patents and may actually may have been manufactured by The Howard Radio Co. I believe the S-14 Sky Chief, the Super Seven, and the S-8A were also produced by Howard.



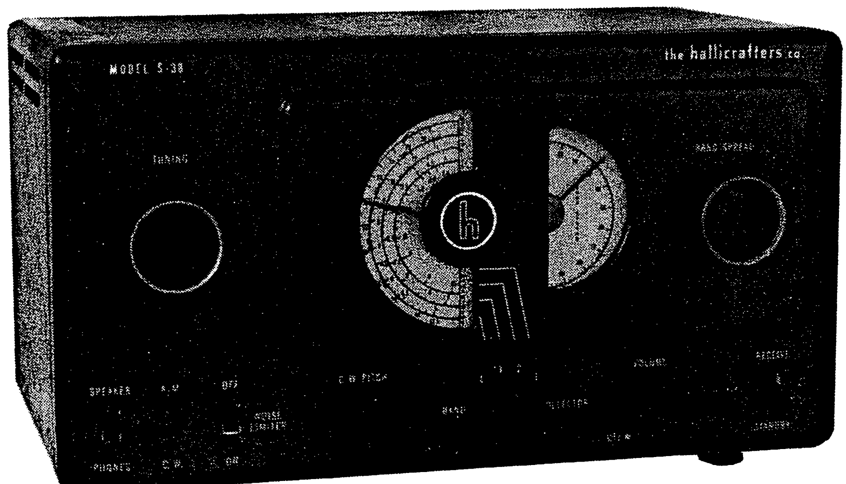
MODEL S-19
Sky Buddy



MODEL S-19R
Sky Buddy

THE S-19 AND S-19R SKY BUDDY: (1938-1941)

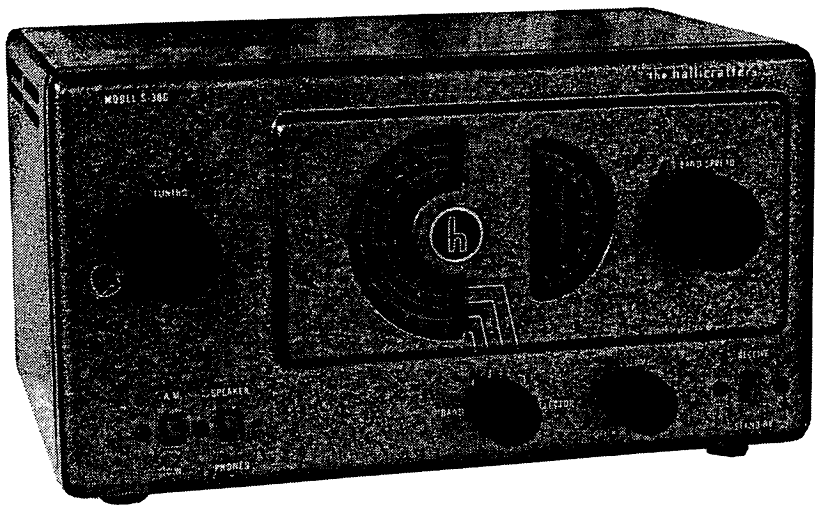
Those of us who got started in ham radio just prior to the Second World War may remember the S-19 Sky Buddy, which was a repackaging of the 5-T using octal tubes. The S-19 was produced for a short time in late 1938 and is quite rare today. More will likely remember the S-19R which was introduced in 1939. Similar in appearance to the S-19, it was a totally re-designed radio with expanded frequency coverage and band spread. The S-19R receiver is what most of us think of when talking about the Sky Buddy. It had a large production run, kept a lot of us in-tune with world events during the War and is still common today. The selling price of the S-19 and S-19R was also $29.50.



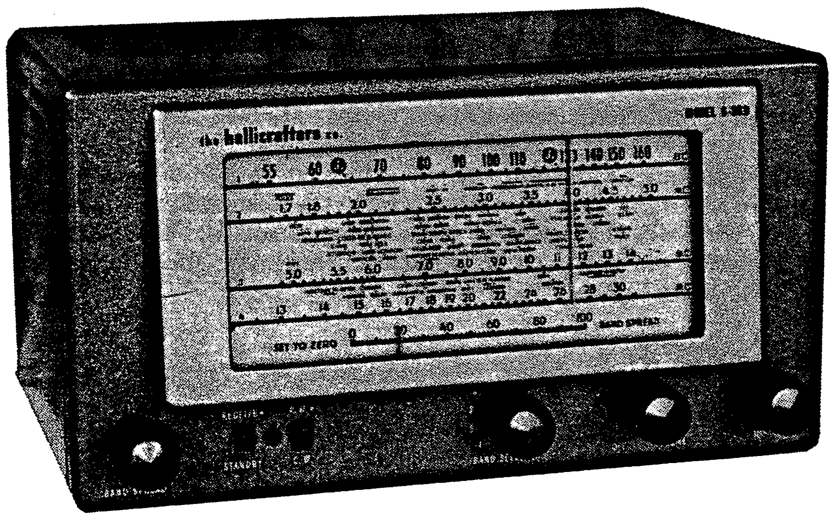
MODEL S-38

THE S-38: (1946-1961)

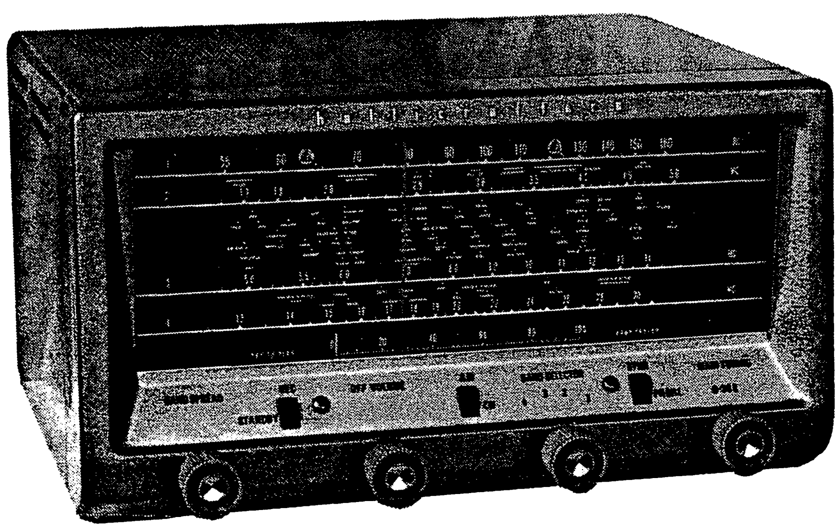
Now, finally, the War is over and it's time for the S-38 that you have been patiently waiting for me to discuss! After the War a new product line with "modern" design was needed to compete with the glut of war surplus electronics. Bill enlisted the services of Raymond Loewy to give the product line its new look. The first Loewy designed radio was the S-38, produced in 1946. It was specifically designed to replace the Sky Buddy and take its place as the beginners radio, selling for $47.50. Most of us younger radio buffs got our start on one of the S-38 series. For me it was the S-38C in 1955. The S-38 series was produced from 1946 through 1961 starting with the S-38 and culminating with the S-38E. The price went from $47.50 to $59.95 in keeping with inflation.



MODEL S-38C

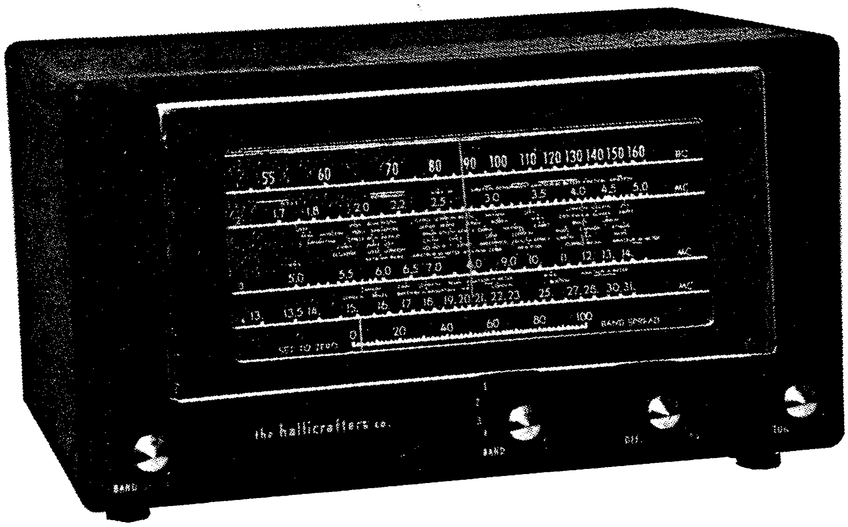


MODEL S-38D



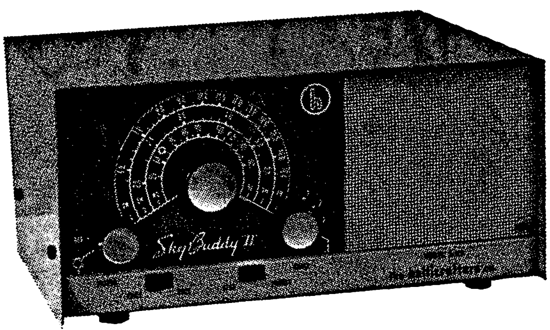
MODEL S-38E

Hallicrafters had a secondary line of beginners radios produced under the Echophone name. The EC (Echophone Commercial) and the EC-1 series were produced from 1941 through 1946. These sets were aimed at getting inexpensive short wave radios to the general population during the war years. The S-41G and S-41W (Sky Rider Jr.) were the same radio as the EC-1 and were produced in 1945 just prior to the introduction of the S-38. The EC line became known as "The Poor Mans Hallicrafters". Even though produced on the same assembly line, their price was lower because they bore the relatively unknown name of Echophone Radio Co. Between 1941 and 1946 the price went from $19.50 to $29.50. In 1951 the consumer electronics division of Hallicrafters produced another spin-off of the S-38 series for the general public. It was the 5R10, and 5R100. These radios are almost identical to the S-38D in appearance except for a chrome dial escutcheon, a black case, and no BFO, stand-by or speaker-phones switches and related circuitry.

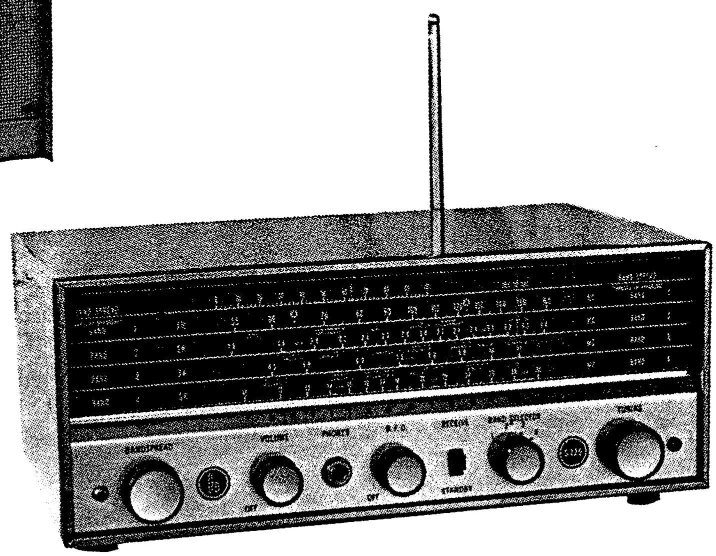


MODEL 5R10

In 1961 the model number next in line for production use was S-119. For whatever reason, possibly that this number was the 100th model since the S-19, The S-119 was termed a commemorative radio and was given the name of Sky Buddy II. It sold as a kit for $39.95, or wired for $49.95. Production also began in 1961 on the S-120 which was a direct replacement for the S-38 series and sold for $69.95. This ends the genealogy of the S-38.



MODEL S-119



MODEL S-120

PART TWO: THE TECHNICAL STORY

For those interested in specific tube functions, the following is a list of tubes used in these models, their functions, and type of construction. If you are not interested in this issue you may skip the next four paragraphs!

Tube construction has changed numerous times since radio tubes were first invented. From 1935 to 1961 there were three basic styles. The first being the "prong" type [P]. These tubes had hollow "prongs" ranging from 1/16th inch to 1/8th inch in diameter and 5/8th inch in length, mounted in a Bakelite base. Each prong was connected to a separate element inside the tube. Depending on the number of elements in the tube they may have from 4 to 8 prongs. The tube sockets had the exact number of "holes" of proper diameters to accept a particular tube in only one orientation. You could not put a 4 prong tube in a 6 hole socket, and you could not install the tube so that the wrong prongs were in the wrong holes.

The second style was the "octal" type [O]. These tubes had hollow pins of smaller diameter than the prong type. They were all the same diameter and were mounted around the periphery of a Bakelite base with a quarter inch diameter "key" in the center. Again the number of pins was determined by the number of elements. The tube sockets were all uniform having 8 equally spaced holes of the same diameter, and a quarter inch diameter center hole that was keyed to accept the key of the tube for proper orientation.

The third style was the "miniature" type [M] which had either 7 or 9 solid pins of smaller diameter than the octal type. These pins extend directly from the glass envelope of the tube in a circular arrangement with one pin missing to form a "flat" spot in the circle for orientation. There was no Bakelite or plastic base. The sockets were ether 7 or 9 hole in the same arrangement.

TUBES USED IN THE 5-T THROUGH THE S-120:

TUBE TYPE:	FUNCTION:	CONSTRUCTION:
6A7, 6K8, 12SA7, 6BE6, 12BE6	Oscillator/Mixer/1st Detector	P, O, O, M, M
6F7, 6L7	IF Amp/BFO	P, O
6K7, 12SK7, 6BA6, 12BA6	IF Amp	O, O, M, M
6CM8	IF AMP/DET/AUDIO	M
75, 6Q7, 6SQ7, 12SQ7, 12AV6	2nd Det/AVC/1st Audio	P, O, O, O, M
76	BFO	P
41, 42, 6K6, 35L6, 50L6, 50C5	Audio power output	P, P, O, O, O, M
80, 35Z5, 35W4	Rectifier	P, O, M

THE 5-T SKY BUDDY: (1935)

The model number "5-T" was probably derived from this being a 5 tube set. It was produced just before the "S" line of numbers was firmly in place. It had a BFO (Beat Frequency Oscillator for code reception), built-in speaker, and "airplane" dial. The frequency coverage was .55 Mhz to 16 Mhz in three bands. Its tube compliment was a 6A7, 6F7, 75, 42, and 80, all "prong" type tubes.

THE S-19 SKY BUDDY: (1938)

There were a number of significant differences in the S-19 but it was basically a re-packaged 5-T. The S-19 also had 5 tubes, the same frequency coverage as the 5-T, with BFO and built-in speaker. The significant differences were the use of octal tubes rather than prong type (except for the 80), a different chassis layout, and a new cabinet design with the exterior "silver" dial. The tube complement was a 6K8, 6L7, 6Q7, 6K6, and 80. The cabinet design was the first of a new appearance that would be used on several models over the next few years.

THE S-19-R SKY BUDDY: (1939)

The S-19R was a completely different radio having 6 tubes, a frequency coverage of .55 Mhz to 46 Mhz in 4 bands, and electrical band spread. The cabinet style and dial was the same as the S-19, but the chassis was painted black and an integral part of the cabinet, not separate as with the 5-T, S-19 and most other models. This "unitized" painted chassis, panel and cabinet was used on only one other Hallicrafters model, the SX-23.

There were two production runs of the S-19R using different tubes. The first run used a 6K8, 6K7, 6Q7, 76, 41, and 80. The second run used a 6SK7 in-place of the 6K7 and a 6SQ7 in-place of the 6Q7. Both runs had the strange mixture of prong and octal style tubes. The mixture of prong and octal tubes seems a step backwards, but is understandable. The octal tubes (introduced in 1935) were the latest advance in tube construction, the prong type were being phased out and were much less expensive. I theorize the prong tubes were used to keep the ever increasing cost of production down enabling the end price to remain lower.

THE S-38: (1946)

The S-38 was a 6 tube radio with a variable pitch BFO, audio noise limiter (ANL), electrical band spread, and built-in speaker. Its frequency coverage was .55 Mhz to 30.0 Mhz in 4 bands. To cut costs it had an AC-DC power supply rather than the familiar transformer operated AC supplies of the 5-T, S-19, and S-19R. The tube complement was a 12SA7, 12SK7, two 12SQ7s, 35L6, and 35Z5. The tube filaments were series wired. The smooth finish charcoal gray cabinet was smaller than the earlier Sky Buddies and esthetically pleasing. The two green "half moon" dials with black lettering and red dial pointers and the well balanced control panel were impressive and would set the style for the next several years.

The S-38A (1946-47) was a 5 tube radio with fixed frequency BFO and no ANL. Its other features and appearance were the same as the S-38 except it had no BFO pitch control or ANL switch. The tube complement was a 12SA7, 12SK7, 12SQ7, 50L6, and 35Z5. Varying the pitch of an incoming CW signal was accomplished by de-tuning the set to one side or the other of the incoming signal rather than varying the frequency of the BFO as in the S-38.

The S-38B (1947-53) was virtually the same radio as the S-38A with exception of the cabinet finish which was a grainy textured flat black. There were also some minor electrical differences including an interlock on the AC line cord.

The S-38C (1953-55) was again the same radio as the S-38A with a "hammertone" gray finish and a black dial with white lettering rather than the green with black lettering. It was also the last of the traditional styling of the S-38. The S-38D would have many changes.

The S-38D (1955-57) was again electrically the same radio as the A through C model but had a totally different front panel, dial, and control design. Its slide-rule dial behind glass covering about 80% of the front panel listed many of the countries, sites, and uses of frequencies such as Ham, police, etc. above the frequencies. The controls were across the bottom of the panel with exception of the speaker-phones switch which was moved to an inconvenient location on the back apron of the chassis. The finish of the cabinet was "hammertone" gray, and its size was the same as the A through C models. The styling of the S-38D was taken from the 5R10 mentioned earlier.

The S-38E (1957-61) was the last of the S-38 series. It incorporated several electrical changes over the earlier models, but its features were the same. It used miniature rather than octal tubes, and had a BFO "injection" control on the back apron of the chassis. This control was used to set the strength of the BFO signal input. The tube complement was a 12BE6, 12BA6, 12AV6, 50C5, and a 35W4. The front panel design was similar to the D model, but had a larger slide-rule dial covering about 90% of the panel. The controls were again across the bottom of the panel, and the speaker-phones switch was returned to the front panel where it belongs! There were three cabinet finishes to choose from; "hammertone" gray, beige, and mahogany wood grain. Each of these finishes had a different model designation. The S-38E was "hammertone" gray, the EB was beige, and the EM was mahogany.

THE S-120: (1961-1964)

The S-120 replaced the S-38 series. It was a totally different radio, although its features were the same as the S-38 series with BFO, band spread, and a frequency coverage of .55 Mhz to 30 Mhz in 4 bands. It was a 4 tube set with a selenium rectifier. The tubes used were 12BE6, 12BA6, 12AV6, and 50C5. The chassis and cabinet were sleek and of a smaller stature than the S-38 series. It had a telescoping whip antenna mounted with clips on the back panel for use on shortwave, and a built-in ferrite loop for standard broadcast. These antennas were a real improvement in convenience of operation, as was the use of a standard "shorting" phone jack on the front panel which eliminated the need for the speaker-phones switch, and an improvement over the two hole pin type phone jack of the S-38s.

THE S-119 SKY BUDDY II: (1961)

The S-119 was a 3 tube set with a selenium rectifier. The frequency coverage was the same as the 5-T and S-19 (.55 to 16 Mhz) in 3 bands. The tubes used were a 6BE6, 6BA6, and 6CM8, and it had a AC operated transformer power supply. It was smaller in size than any of the other beginners radios, and its appearance was unique. It is interesting to note that the dial of this radio was similar to the S-19 which had a rotating circular silver dial and a stationary clear plastic pointer. The S-119 had a stationary circular dial with a rotating clear plastic pointer! The set also had a BFO and provision for use of ear phones. This set did not sell well, had a limited production run and is difficult to find today.

PERFORMANCE:

Even though the 5-T through the S-120 were beginner's radios their performance has never failed to amaze me, considering the minimal parts used and type of construction. Hallicrafters always produced radios that did exactly what they were advertised to do and did it well at a reasonable cost.

I have had the opportunity to use all of these models in restored condition. What I find is they are very sensitive on the lower frequencies (.55 to 16 Mhz) receiving hundreds of stations with just a twelve foot "inverted l" antenna. From 16 to 30 Mhz the sensitivity tends to drop off, and there can be "images" of local high power broadcast stations, but I have been able to listen to CB'ers on 11 meters and amateurs on 10 meters! The audio quality is exceptional for the size speakers, and volume is ample. On CW reception the BFOs tend to be a bit unstable, but work well. The calibration of the dials is good and it is possible to "guess" the frequency of a station on the standard broadcast band with good accuracy. On the short wave bands it is more difficult because the width of the pointer can be a couple hundred KC depending on the frequency band. The band spread not being calibrated also makes frequency identification more difficult. But who cares! You can hear the world!

ACKNOWLEDGMENTS:

I wish to thank John Bryant for all the prodding and enthusiastic support he has given me on this and other projects. John took all of the photographs for this article and did the page layout. He has done an excellent job. He also made me privy to certain information about the company he obtained from Bob Samuelson (chief engineer for Hallicrafters from 1938 to 1945) which helped from a historical archival aspect. Last (but not least) I wish to thank the entire staff of "Proceedings" through who's effort in editing I continue to learn and improve my writing.

THE HALLICRAFTERS SX-28

THE CLASSIC SHORTWAVE RECEIVER

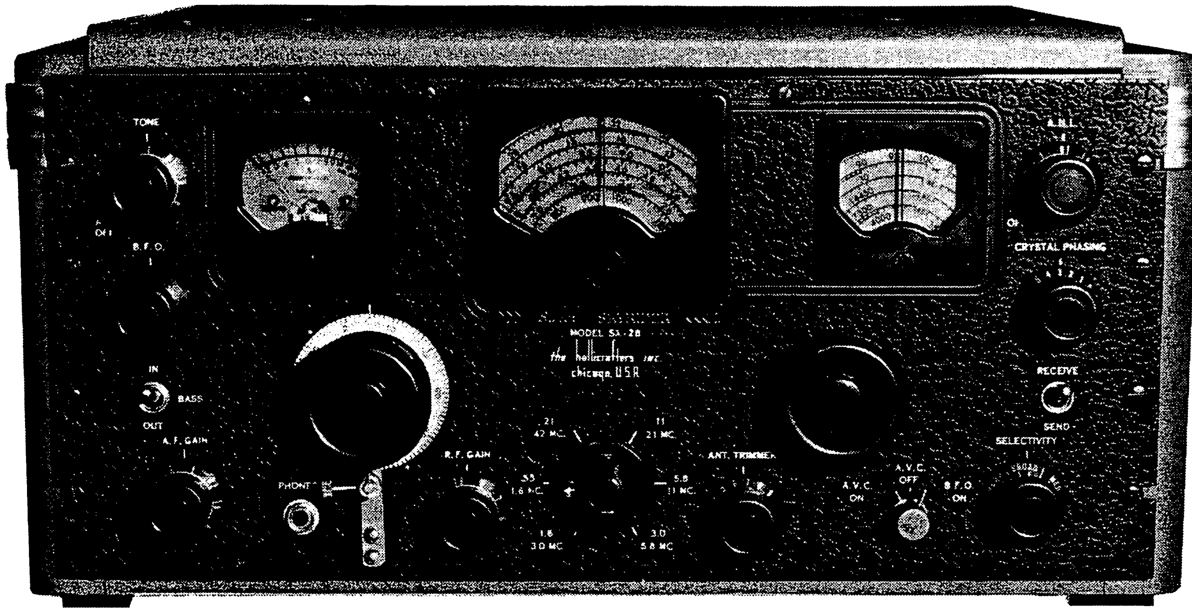
John Bryant

FIGURE 1.

Few products of our technological age become recognized as true classics of design. By look, styling, technical excellence and configuration they evoke an entire era. In the automotive world, the open Mercedes touring cars of the late 30's, the 1955 and 1957 Chevrolets and the 1957 Thunderbird define the meaning of "classic" automotive design for their eras.

In the world of tube-era shortwave receivers many aficionados would argue that there is only one true classic receiver: the SX-28 Super Skyrider by Hallicrafters. The SX-28 cabinet and front panel are superb examples of late 1930's Art Deco design. The circuitry is equally the epitome of state-of-the-art, spare no cost, communications receiver design at the very beginning of WWII. At the time of its introduction in 1940, the SX-28 was the largest and heaviest mass produced communications receiver ever built. The major competitors of the SX-28 in 1940 were variants of the-long-in-the-tooth National HRO "Senior" first introduced in 1935 and the Hammarlund SP-200 (BC-779) Super-Pro series, produced from 1939-1945.

The SX-28 is a 15 tube, single conversion, super hetrodyne receiver that provides continuous coverage from 550 kHz to 42 MHz in six bands. It is 19 1/2" wide (plus cabinet), 10" high, 15" deep and weighs 75 lbs., including cabinet. Internally, the receiver provides a two stage RF amplifier/preselector. Only one stage is engaged on the lower two bands (.55 MHz - 1.6 MHz and 1.6 MHz to 3.0 MHz.) Both RF stages are used above 3.0 MHz to boost sensitivity and image rejection. There are six separate IF filter combinations selectable from the front panel - three tuned L-C circuits for AM reception and three phased crystal filter positions primarily for CW reception. The front panel contains AF and RF Gain controls, a BFO, a very effective Tone control and a Bass Boost control that operates like those found on modern stereos. (Wonderful!) The panel also contains a switchable AVC Control and adjustable and effective Noise Blanker which uses a Lamb circuit. The six-position band switch and those two wonderful large bakelite 'steering wheel' tuning knobs that drive the tuning capacitors through a silken smooth system of brass gears and flywheels.



AT THE DIALS: GETTING TO KNOW THE SX-28

As you settle in front of the SX-28, the first impression is of visual delight. Certainly, it is the best looking receiver produced prior to the Raymond Loewy designed SX-42, introduced in 1946. It is a real pleasure to sit at the SX-28 hour by hour DXing or SWLing and just LOOK at the front panel. As you examine the receiver more closely, you begin to realize that this radio was designed by and for people who were VERY serious about their radios. All of the lettering and the leatherette finish of the front panel is embossed right into the 1/8" thick steel! This attention to detail continued throughout the design of the panel. The smaller knobs carry wide numbered skirts, allowing accurate pre-setting of the various controls; handy and beautifully executed.

What attracts most of us to the SX-28 are the giant spoked (steering wheel) main dial and bandspread knobs. They have been designed to fit the hand well during long hours of use. Giving either of these knobs a spin is a sensual thrill. Each gear train has just the right amount of inertia. Today, after 50 years, there is ZERO "play" or backlash in the tuning system. Those knobs and the machinery behind them should have received a gold medal for industrial design and mechanical engineering long ago. The only American receiver that approaches the feel of an SX-28 is one designed to replace it in government service: the Hammarlund SP-600.

It is extraordinarily easy to tune the SX-28 to a desired frequency or to determine the frequency of an unknown station. This critical ability for any serious receiver is greatly aided by three design innovations that first appeared on the SX-28 [1]. The first is a main dial tuning index (zero to 100) located as a skirt on the main (left-hand) tuning knob. Moving from one end of the dial to the other involves 15 turns. The main dial logging scale of zero to 100 is there for 1500 individual loggable increments. The bandspread dial also has a 0 to 100 logging scale. Each scale may easily be interpolated to the one and two-thirds points (e.g. 48.33.)

The second design innovation first used on the SX-28 is the main dial lock. This mechanism, seen as the vertical bar directly below the main knob, pinches the metal knob skirt very firmly, locking the skirt and the main tuning capacitor.

The final innovation for frequency read-out is the index line itself in both the main dial and bandspread windows. The SX-28 was the first receiver (and one of the few ever) to provide a three-dimensional "blade" index to aid in dial reading. This 1/32" wide by 1/4" deep vertical blade assures the operator that he is looking at the dial markings STRAIGHT ON.

Combining the two logging scales, the dial lock and the blade index, it is possible to return to any previously dialed frequency instantly and accurately. For instance, if you wish to return to an unknown signal logged in the area around 4 MHz, you flip the bandswitch to band #3 (3.0 to 5.8 MHz) and spin the main dial to the region of 4 MHz. Then, you check your log book and find the index location of this unknown signal-when you first logged it; you jotted down of "48.33/35." You move the main dial to read 48.3 on the skirt index and LOCK it in place. You rotate the bandspread to 35 and THERE is your unknown signal. It is easily possible to reverse the process and develop a graph for a particular band of frequencies. Using this method, the operator locks the main knob at a certain number and reads the zero to 100 bandspread logging scale. A homemade graph then converts the logging scale number to kHz. This method allows near single kilohertz resolution on all of the Tropical Bands!

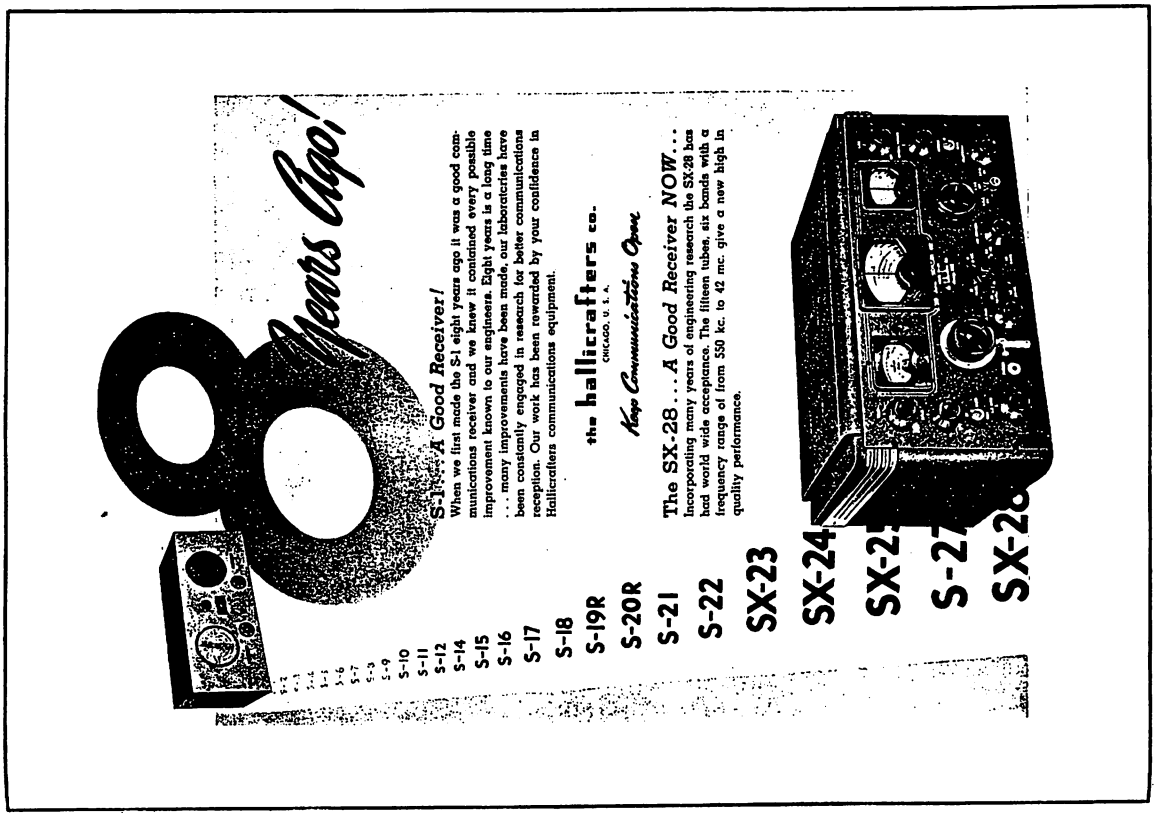


FIGURE 4.

These advertisments are reproduced through the courtesy of QST magazine.

FIGURE 3.

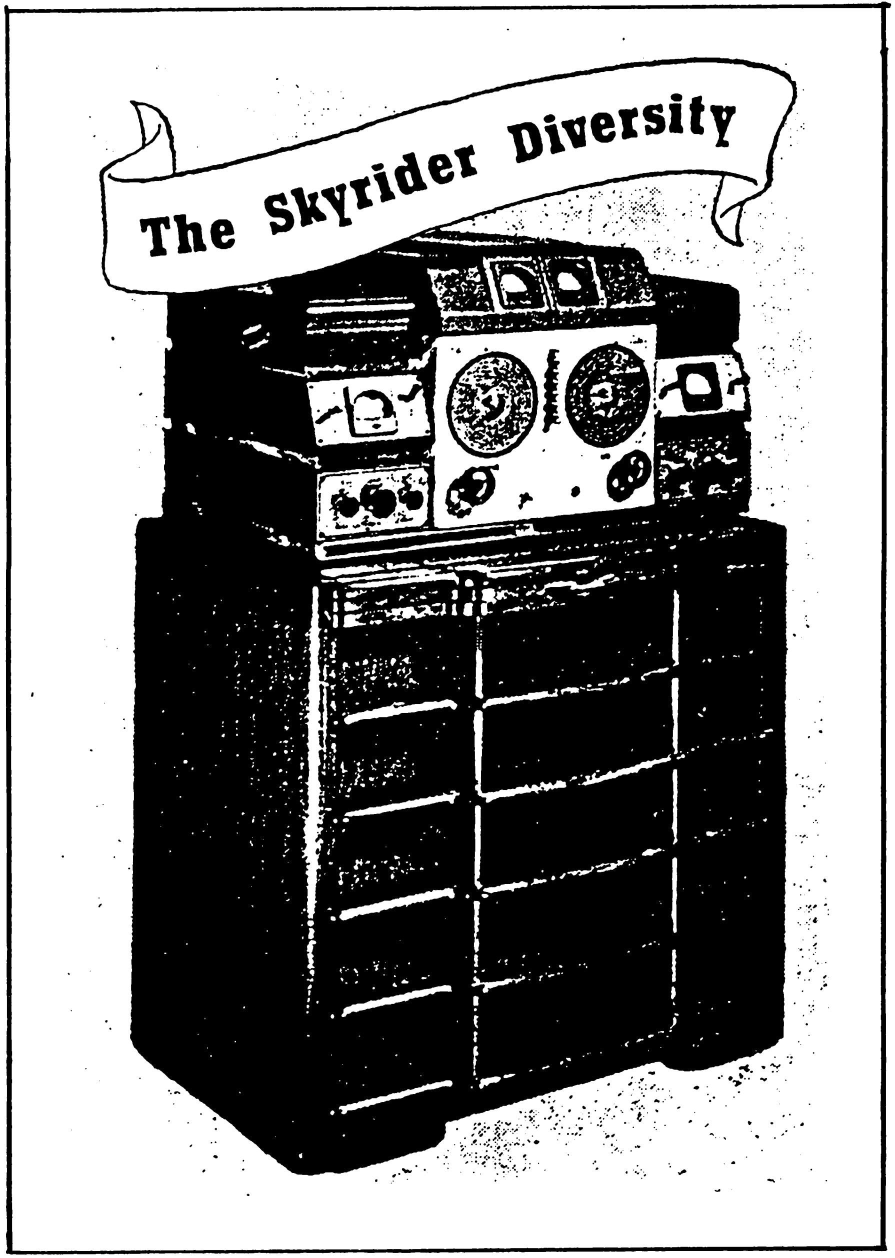


FIGURE 5.

FIGURE 6.

These advertisments are reproduced through the courtesy of QST magazine

FIGURE 7. The Hallicrafters management team is shown in a photo from Christmas 1939 that was taken in Bill Halligan's office. From left to right: Fred Stromatt - SX-32 receiver engineer, Royal Higgins - Sales, Ed Corcoran - Purchasing, Bill Halligan - President, Loren Toogood - Production Engineer, Ray Durst - Vice President, Joe Frendries - Controller, Herb Hartley - Production Manager, Bob Samuelson - Chief Engineer, J.L.A. McLaughlin - DD-1 Engineer and Designer. Not shown: Ferd Schor - Lead Receiver Engineer.
Photo courtesy of Dr. Robert Samuelson.

THE SX-28 SUPER SKYRIDER: Lineage [2]

The Hallicrafters company, led by Bill Halligan, burst on the communications scene in the mid-1930's. The other established manufacturers, most notably National and Hammarlund, had been around for almost a generation, first as component manufacturers and then as manufacturers of major communications receivers. Each of these companies concentrated on producing a single 'top of the line' receiver and refining it over a period of years. Bill Halligan developed a completely different design and marketing concept. Hallicrafters prospered based on the idea of creating completely new receiver models in rapid succession, each incorporating the latest engineering developments. Early on, the company also began offering a wide range of models and prices to enable the radio enthusiast to obtain the best receiver he could afford.

The rapid research and product development of Hallicrafters in the 1930's is stunning even from the perspective of the change-oriented 1990's. The advertisement from June 1942 *Radio* magazine (Figure 4) indicates that even Hallicrafters was aware of how far and how quickly they came in the 1930's.

Bill Halligan introduced the first Hallicrafters receiver in 1933. It was a regenerative TRF receiver called the Skyrider and it became known later as the S-1. In the next year, the S-2 and S-3 were developed and marketed. Each was a TRF set and each was called the 'Skyrider'. In late 1934, Hallicrafters introduced the S-4, one of the first mass produced superhetrodyne communications receivers. The S-5, S-6 and S-7 followed in rapid succession. Each was a superhetrodyne circuit and each was called the 'Super Skyrider'. In 1936, specialized models began to proliferate, but the top-of-the-line receiver being marketed at any particular point continued to be called the 'Super Skyrider'. The 1936 Super Skyriders were the S/SX-9. The S/SX-9 was followed in that same year by the S/SX-16 and the S/SX-17, each also known as the Super Skyriders. These latter receivers, especially the models with crystal filters and therefore carrying the 'x' in their title, remained as top of the line for several years. [3]

The SX-16 and its immediate upgrade the SX-17, Super Skyrider (Figure 3) are worthy of brief discussion, for these were nearly modern major communications receivers. The SX-17 had 13 tubes, covered .54 to 61 MHz in six bands, had bandspread, a BFO, S-meter, and a switchable automatic noise limiter. The selectable IF band width was based on L-C and phased crystal circuits. The SX-16/17 also sported entirely new and very modern late Art Deco exterior styling. The SX-16/17 marks the first introduction of the large bakelite 'steering wheel' tuning knobs, rounded front corners of the cabinet and the decorative chrome trim pieces on each end of the receiver. These receivers also mark the first introduction of the 'half moon' escutcheon. This beautiful escutcheon was used for S-meters and band spread dial openings on almost every major Hallicrafters receiver from the SX-16 to the end of WWII. Several authors, including me, have postulated that Hallicrafters must have retained a professional industrial designer to provide the massive aesthetic upgrade represented by these receivers. This was not the case. The motivating force behind these and most other improvements in the appearance of Hallicrafters products was Bill Halligan himself. Unlike the other radio manufacturing barons of the day, Mr. Halligan had a career-long commitment to creating visually pleasing radio equipment. He reasoned that many radio buffs would like to move their gear from the garage/shack into the house.

The detailed design of the visual upgrades for the SX-16/17 was probably done by J. L. A. McLaughlin. Mr. McLaughlin was an artist/designer and a self-taught RF engineer. Mr. Halligan hired him away from Collins Radio, where he had been doing some product styling. He was hired by Mr. Halligan in 1936-37 to further develop his diversity receiver brainchild. Under the guidance of Mr. Halligan, this McLaughlin dream eventually became the legendary Hallicrafters Dual Diversity DD-1 receiver (Figure 5) [4]. With the stunningly beautiful DD-1 as evidence, most authorities would wager that Mr. McLaughlin was a fully educated product designer as well as a professional RF engineer.

In March 1939, Hallicrafters introduced what was intended to be the "ideal communications receiver," the SX-23. This receiver had started life as an unofficial "ideal but impractical" receiver put together by several Hallicrafters engineers in the design lab. [5] Mr. J. L. A. McLaughlin was responsible for the styling of the SX-23. (Figure 6) It was the last receiver that he designed for Hallicrafters. The SX-23 required several unique manufacturing processes and had a very unusual dial and front panel. The SX-23 proved too costly to produce and went out of production after only two runs of 500 sets each. [6]

THE SX-28 SUPER SKYRIDER: Design Perspectives

By the time that the SX-23 was introduced, both Bob Samuelson and Ferd Schor had joined Hallicrafters. Mr. Samuelson was originally hired away from Collins to design transmitters. Mr. Schor was hired as Lead Receiver Engineer from Ultramar Manufacturing Company where he had designed several receivers of outstanding performance. After being with the company about two years, Mr. Samuelson was made Chief Engineer of Hallicrafters. These two men along with RF engineer Fred Stromatt designed the SX-28. (Refer to Figure 7.)

Compare the case, control layout, knobs and dial escutcheons of the SX-28 to those of the SX-16/17. It is easy to see that the SX-28 design team abandoned the 'new direction' established by the SX-23 and returned to the extremely successful SX-16/17 as a jumping off point. The escutcheons, trim and cabinet design established by the SX-16 were followed quite closely in the SX-17, SX-18, S-19, S-20, S-21, S-22, S-24, S-25, S-26 and S-27.

Unlike the previous 10 receiver designs, however, there were several departures in the exterior detailing and appearance of the SX-28. The 28 along with the S-27 were the first mass-produced Hallicrafters designed as rack-mounted receivers. The SX-28 designers also developed a beautiful full blown Art Deco metal case to accept the rack mount chassis. For the first time since the SX-16, the configuration of the dial and S-meter escutcheons was also modified. Although the new shapes are clear outgrowths of the SX-16/17 lineage, it again appears that the hand of a professional product designer was involved; again, this was NOT the case.

Bob Samuelson, now retired and living in Phoenix was kind enough to record the development of the SX-28 design for us:

The time was ripe in late 1939 or early 1940 for a new 'Super Skyrider' to replace the SX-17. The war in Europe had started, and many new demands for off-the-shelf communication receivers were appearing. One example: the FCC had the responsibility of monitoring the air waves to track down and locate sources of radio signals (possibly of espionage nature), and planned to equip monitor vehicles for this purpose. Our UHF S-27 was already in the works, and covered the range 27-145 mc. and a shortwave/general coverage companion receiver was needed.

Ferd Schor and his other receiver engineers had already decided on circuit innovations and improvements on the SX-17, so we now embarked on the design of the SX-28. I injected myself into the process, by taking over the mechanical design. My college degree was BSc ME from the University of Minnesota in 1933 to which I had added some studies toward a MSc in EE. One of my innovations was to replace the earlier string drives for the two tuning dials with precision, anti-backlash gear drives. This now made possible the addition of the logging dial on the main tuning knob. I wanted the tuning dial to be behind the panel, but felt that use of separate metal escutcheons might lead to a tinny appearance - I got the idea of using a large black bakelite dial escutcheon to be a companion to the S-meter and bandspread dial escutcheons.

I had been thinking for some time about designing a good gearing arrangement for the SX-17, and had done some sketching. As electrical design proceeded with the SX-28, I laid out a gear assembly to fit. We made one sample laboriously in the shop and then turned the design over to Crowe Nameplate Co. to produce. (They already made our dials.)

Almost all of the large magazine advertisements for the SX-28 carried a banner headline: "Designed to government specifications!" Before I contacted Bob Samuelson, I thought that maybe the U.S. military or the FCC might have put out a set of specifications for what became the SX-28. This might have been in the form of a "Request for Proposal" (RFP) as is the modern practice. My supposition is an example of the dangers that historians run when they infer too much! I was completely in error! Bob's answer to my query clarifies the issue:

"DESIGNED TO GOVERNMENT SPECIFICATIONS!"

By 1940, we had reviewed many government specs. for various radio and electronic equipments. We found that most of these had strong similarities in "standard paragraphs" which covered such things as choice and rating of parts, tolerances, moisture proofing, etc. We took it on ourselves to adopt all that applied, although I don't remember any actual "Specification for SX-28." However, the set was actually designed using gov't specs. that we felt did apply.

After building and testing our first engineering model, we build 10 more as a 'pilot run'. These were snapped up by the FCC, and we then proceeded with a longer production run.

One amusing experience had to do with the shipping container. We had been having some trouble with our sets being damaged in shipment, even [when using] wooden crates. We contacted a professional packing design company, who came up with a package for the SX-28 using corrugated cardboard! It had inner and outer boxes, with protective inserts at critical places. To test this out, we took our SX-28 (one of the first run) which had just passed our final test bench, packed it in the new package, and took it up to the 8 floor of our loft building, in the rear, to the top of the spiral set of wooden steps. We actually rolled this poor SX-28 in its box, end over end, down to the basement! Then took it back upstairs, unpacked it, and returned it to final test. Believe it or not, the set met all its performance specs; no change. There was one little dent in a crossbar in the top of the cabinet, but this was easily fixed.

The design of the cabinet simply grew as a suitable package to accept and protect the radio assembly itself; we didn't think of it as an artistic triumph; just part of the job. Bill Halligan was close to us, particularly in the final stages. He might have made suggestions regarding trim stripes, ventilation grilles, "feel" of the knobs etc. I can only say that we looked on the final package as "Form follows Function."[6]

With the arrival of the SX-28, the Hallicrafters design team had produced the right radio at the right time: the leading state-of-the-art receiver at the beginning of WWII.

the Cruise of an SX-28

Recently we received a letter from an owner praising the performance of an SX-28. The letter, five pages long, is too lengthy to re-print in its entirety so we are re-printing the paragraphs most interesting to communications performance.

"This letter will deal with the voyage from San Francisco to the Philippines, then to the Far East namely Shanghai and Hong Kong and back to the Philippines then down through the inside passage from the Philippines down through the islands past Thursday Island then down the Australian coast inside the Great Barrier Reef to Newcastle. From Newcastle to Brisbane then almost due east across the Pacific until we approached Pitcairn Island when we turned to about northeast and headed for the Canal, then from the Canal to New York with coast-wise ports enroute. Roughly, the total mileage for this trip was about 32,000 and involved a period of about six months.

". . . for about 3 months the ship was in tropical weather, the radio room was very hot, all port holes and doors were open almost continuously day and night. The Hallicrafter SX-28 was exposed to the elements almost as if it were outside, much of the high tropical humidity penetrated the room where the SX-28 was operating.

"We traveled through tropical heat of 120° into the cold slashing gales of the China Sea and remained in extreme cold weather, then back down to the tropical heat again . . . most receivers are prone to develop all kinds of troubles in these varying climates . . . I was busy, at times, repairing other sets breaking down due to the humidity, but the SX-28 went merrily along its receptive way.

". . . the SX-28 was almost continuously subject to vibration, one kind of vibration at one depth of load, another at another depth—increasing until the whole ship vibrates when the load was light. At times when receiving short wave the SX-28 was vibrating so that it was actually jiggling back and forth in short, quick jerks as the whole ship vibrated, yet no effect was noticeable on reception . . . I had all kinds of trouble with my regular equipment, yet the SX-28 ran the gauntlet unharmed and unaffected.

". . . my listeners of whom I had a regular public at news times have remarked 'the program would fade out and sparks would flip a switch and back in it would come with a bang' . . . the pay-off though is the code reception. With signals weak, static at Woolworth bargain counter proportions of jamming, and code signal interference the ANL circuit jumped into effect in an astounding way. . . . one remarkable comparison was XSG Shanghai who comes in with a bang all over a wide space on the dial on the 36 meter band. He was right on top of WCC and would blot him out. A twist of ANL and in comes XSG, a flick of the crystal control and in comes WCC with a bang and out goes XSG. . . . In Shanghai I was offered $350 in gold for my SX-28.

"I have opened receivers for repair of standard brands and found variable condensers covered with green whiskers from corrosion, coils broken in windings from salt corrosion, bus wires even eaten off inside insulation due to the same corrosion . . . so all in all I think it a high tribute to the Hallicrafter workmanship in this receiver that it has survived a period of two trips now and is still going strong."

FIGURE 8.

FIGURE 9.

These advertisments are reproduced through the courtesy of QST magazine.

THE SX-28 IN WWII:

Figures 8 and 9 are typical advertisements from radio magazines during the war years and give some idea of the uses of the SX-28 just before and during WWII. Bob Samuelson believes the story told in Figure 10 to be true. Advertising of the era indicates that over 50,000 SX-28's and SX-28A's were produced from 1940 to 1947. As the major state-of-the-art receiver at the beginning of the war, the SX-28 saw service in every theater of operations. Its general coverage HF design and its weight probably dictated that most uses were in more or less fixed base communication. Even the ham station at Fort Monmouth, N. J., (Signal Corps headquarters) was equipped with SX-28's. [10]

One of the most interesting facets of the World War II uses of the SX-28 was related in a recent letter from Bob Samuelson. Bob refers to a one-time-only advertisement in *QST*, May 1941, for an RSC #1, "the complete radio receiving station: a rack mount/cabinet holding an S-22R, S-27B and an SX-28. This unit tuned continuously from "110 kc to 145 mc."(Figure 12.) Bob states: *"I know that we sold a number of these units to government agencies. I suspect that the OSS, precursor of the CIA bought several. Bill Halligan was very good friends with one of the top men in the OSS - both had attended West Point."*[11]

The outcome of World War II in the Pacific hinged on the performance of the aircraft carriers of the Japanese Navy and those of the U.S. Pacific Fleet. The Battle of the Coral Sea took place in May 1942 just east of New Guinea. This American victory halted the advance of the Japanese juggernaut at the cost of the loss of *USS Lexington* and heavy damage to the *USS Yorktown*. The damaged carrier was quickly repaired and joined the carriers *Enterprise* and *Hornet* at the pivotal battle of WWII in the Pacific: The Battle of Midway. This great American victory was accomplished entirely by the airmen flying from the three American carriers. The USS *Enterprise* went on to assist almost all of the battles of the Pacific, from Guadalcanal in 1942 to Iwo Jima in mid-1945.

Surely one of the most ringing testimonials for a piece of equipment ever written was received at Hallicrafters in late 1943. It was immediately reproduced in the Hallicrafters 'Tuner'.

WUP167 GOVT LG=CT WASHINGTON DC
NOV 3 1943 251P
TO THE MEN AND WOMEN OF
HALLICRAFTER CO INC=

YOUR SX28 RECEIVER ON THE "USS ENTERPRISE" RECEIVED CONSTANT USE DURING THIS FAMOUS CARRIERS EXTENSIVE ACTIONS AGAINST THE JAPS IN THE SOUTH PACIFIC. TUNED TO RECEIVE MESSAGES FROM HER PLANES ON MISSION AND FROM FIGHTER PLANES PATROLLING THE FLEET YOUR RECEIVER EFFICIENTLY KEPT THE "ENTERPRISE" INFORMED OF THEIR ACTIVITIES. THIS INFORMATION WAS USUALLY TRANSLATED INTO ACTION AGAINST THE JAPS -- TO THEIR SUBSEQUENT SORROW AS THE "ENTERPRISES" RECORD OF 185 PLANES DESTROYED, 27 SHIPS SUNK AND 16 DAMAGES WILL ATTEST=

=E L COCHRANE
REAR ADMIRAL USN
CHIEF OF THE BUREAU OF SHIPS. [12]

At present, I have no information on the radio equipment aboard the other main battle carriers of the Pacific Fleet. Given the usual way that military equipment is acquired, it is fair to guess that all of the carriers were equipped with similar radio equipment. If such is the case, the SX-28 must be credited with playing a very significant role ion the American victory in the war in the Pacific.

Finally, Ferd Schor wrote, *"We had the production line going on the SX-28 and the SX-28A all during World War II and the services could not get enough of them. The reports I had from service men were excellent. Many of them took one home to use* (at the close of WWII.) [13]

THE SX-28 AND THE FCC:

During WWII, the primary responsibility for radio-oriented counter intelligence was given over to the Radio Intelligence Division of the FCC. The RID also had primary responsibility of guiding lost aircraft back to base, using their nationwide direction finding capabilities.

RID had about 300 radio personnel and operated twelve primary monitoring stations located strategically throughout the USA and its possessions.

The work of the RID was featured in a *QST* article published in late 1944 following a visit to the Allegan, Michigan monitoring station. This 200 acre facility housed both the RID and the FCC's Field Division Monitoring Station. There were two main monitoring rooms, the Cruising Room and the Intercept Room, and both were packed with SX-28's and S-27's. General use antennas included a 'wagon wheel' of eight rhombics, three Beverage antennas, a dozen folded dipoles and miscellaneous other antennas spread across the entire site.

The Cruising Room was the heart of the Monitoring Station (Figure 10) with six SX-28's and three operators scanning the bands constantly. The operators of all twelve stations were linked by dedicated teletype system. Within each station, the Cruising Room operators were also linked via an intercom to a remote site (also with SX-28's) where direction finding (DFing) was done using a rotatable Adcock array (Figure 11). By teletype coordinated DFing between several scattered Monitoring Stations, the RID could virtually pinpoint the location of a mystery transmitter or lost aircraft. In mid-1944, the Station Supervisor stated that they had never had to make a major repair on any of their SX-28's since their acquisition in 1941. They had been in day and night continuous service for more than three years.

Hallicrafters also developed a special selectable independent sideband version of the SX-28 for use by the FCC and possibly by the OSS. This unit, known as the SSR-202, was designed by Jim McLaughlin and had an additional IF channel. One of the two IF channels was aligned 5 kH above the normal IF, one 5 kH below. The incoming signal was split at the first detector and selectively sent down one of these channels. Each channel was highly selective and had a very sharp cut-off. If one sideband of the incoming signal was distorted, the operator threw a switch to select the other. The article states: "We predict that after the war, when full construction details can be given, this refinement will come into universal use in the stations of most hams." [8] the ideas developed in the SSR-202 version of the SX-28 did not reach the general use for another 40 years!

FIGURE 10. The Crusing Room

Photos courtesy of Dr. Robert Samuelson.

FIGURE 11. Adcock Array DFing Hut

FIGURE 10 and FIGURE 11:
These figures are reproduced from an issue of *The Hallicrafters Tuner*, the internal company magazine. This issue was published in late 1944 or early 1945. The caption used was:

Above right: Operators patrolling the ether use Hallicrafters SX-28 receivers which must operate unerringly 24 hours a day, month after monhth. One of our frequency standards may be seen in the photograph as well as an S-27 receiver. Below: Operator, within hut of Adcock direction finder, rotates large wheel directly under the H antenna while listening to signals from an unidentified station through his Hallicrafters SX-28 receiver.

FIGURE 12.

FIGURE 13.

These advertisments are reproduced through the courtesy of QST magazine.

F30.11

THE SX-28 VARIATIONS

According to Ferd Schor, there is only a minor electrical difference between the SX-28 and the SX-28A. He wrote "The SX-28A is the same set except that the set used a molded RF coil form with mica trimmer attached and was cheaper to produce."

One legend currently around the radio hobby is that the front panel of the SX-28 said only "SX-28" whether it was the original or the "A" version. At best, this is only partly true. I have seen an SX-28A in Chuck Dachis' collection that has "SX-28A" stamped in the proper place on the front panel. There is also one in Mike O'Brian's collection and that of the Hammond Radio Museum.

Figure 13 is one of only two known advertisements showing the SX-28/S-35 combination. Today, the S-35 is one of the rarest Hallicrafters products. It is a panoramic receiver designed to show receiver response curves and wave forms of the transmitted signal. It is a safe assumption that the S-35 was built for intelligence and monitoring use and was not produced in great numbers.

You should note that the Hallicrafters introduced a less expensive 'first cousin' of the SX-28 known as the SX-32. The differences are these: the SX-32 has no audio Bass Boost control and no lock for the main dial knob skirt. The 32 also has only a switchable (on-off) ANL where the 28 has an ANL gain control pot and knob (upper right control). There are a few internal economies as well.

THE SX-28 TODAY: USER NOTES

The only recent review of the SX-28 was that written by Bill Kleronomos, KD0HG, and published in his 'Vintage Product Review' column in the June 1990 issue of *Electric Radio.* [14] Bill did a beautiful 'bench test' review and I will rely on his findings for the numerical portion of these comments.

Sensitivity:

The sensitivity on the higher bands where both RF Stages are engaged seems more than adequate. The less satisfactory sensitivity at Tropical Band and MW frequencies is really not that noticeable. However, I am currently restoring a RME DB 22-A preselector that should be a welcome addition to my equipment line-up for 'nostalgia DXing' on the Tropical Bands.

Bill used the 10dB S+N/N method. His figures for AM sensitivity were 2uV at MW and Tropical Bands frequencies and 1uV or less from 14 MHz up. This was measured with the slightly hotter 6AC7 in place of the stock 6AB7 as 1st RF amplifier. CW and SSB signals needed to be .25uV or better at 14 MHz to be readable.

Selectivity:

The SX-28 offers six selectivity positions. The first three are for AM reception and are labeled Broad, Medium and Sharp IF. These selections engage various tuned L-C circuits. At the 6 dB down points, Bill measured "Broad" as 14 kHz wide and Sharp came in at 5 kHz. The three crystal filter positions were impressive, with the narrowest measuring 30 Hertz (Yes!) Using the Crystal Phasing Control and the Xtal Broad position (3 kHz), Bill notes that it is possible to "notch out" the 5 kHz beat note from an adjacent strong SWBC station.

My own experience tends to confirm Bill's findings empirically. However, from the point of view of an SWL, these findings are extremely misleading. It is possible to DX AM signals with the Xtal Broad filter invoked, normally riding on one side of the carrier or the other to receive an intelligible audio spectrum. THAT IS NOT THE PROBLEM! The problem is that the shape factor of the L-C circuit IF filters is such that the receiver is very annoying to use for program listening on the very crowded 6, 9 or 11 mHz International Broadcast Bands. The L-C filter skirts are so wide at 30 to 50 dB down that virtually every signal, no matter how strong, has a 5 kHz hetrodyne in the audio background. This whine is generated if even moderate level signals present 5 kHz above or below where the receiver is tuned. This high pitched whine is even audible in the background of such local powerhouses as BBC on 5975 kHz in the evenings and 9580 kHz Radio Australia in the mornings. It is true that the 5000 Hz tone can be removed from the audio by an outboard audio filter. However, doing so also removes some of the high notes and general brightness from the otherwise marvelous audio of this receiver.

I might note that this 5000 Hz hetrodyne note is the Achilles heel of most older major tube receivers - from a program listening point of view. This same problem exists with my totally remanufactured SP-600, and with my SX-42 and SX-62 as well. Only the HQ-180A, the 51J4, the R-390A and a few other major post-war tube receivers seem to have the broad filters with steep skirts necessary for high fidelity reception of modern International Band signals. This Achilles heel is what has made me most excited about applying KIWA Electronics new filter module to my older receivers. (Refer to the article by James Goodwin elsewhere in Proceedings 1992.)

Audio Quality:

My intuitive feelings about audio quality are generally enthusiastic, Bill's bench findings show good frequency response and little distortion. He closed with the comment, "The SX-28 has darn good audio for a communications receiver." I am lucky enough to use a Hallicrafters PM-23 speaker enclosure with the original

10" speaker. On a 50,000 watt semi-local MW station, I can open the IF to 14 kHz, crank the AF gain about 1/3 of the way and enjoy wonderful audio. The only noticeably better AM audio that I have ever heard is from a few rare and expensive console radios from the late 1930's. Absolutely superb audio!

Image Rejection:

Bill's tests showed relatively poor image rejection with readings from 55 dB at 7 MHz to 30 dB at 30 MHz. These numbers are predictable for a single conversion receiver and are what popularized the tunable RF preselector/preamps for use with receivers of this general era. I have had no 'image problems' in my use of the SX-28.

Stability:

Bill ran a series of stability tests on his SX-28 at 7 MHz and 14 MHz. He found that the stability that he measured at 14 MHz was "unsurpassed by any tube type receiver that I've ever used except perhaps a Collins 32S3 (S-Line)." My experience is not quite so good, though my SX-28 is totally unrestored and still running with its original capacitors.

Noise Blanker:

Both Bill and I were surprised at the effectiveness of the noise blanker. The SX-28 was designed with the 'Lamb type' noise blanker rather than the much more common (and less expensive) noise limiters or ANL circuits. The gain of this blanker circuit is controllable from the front panel. Careful adjustment of the circuit can usually ELIMINATE power line hash, motor, dimmer and ignition noise.

General Weaknesses:

For some people, the lack of a digital frequency read-out is the major weakness of almost every tube receiver. For pedal-to-the-metal DXing, most of us would agree. You should also note the lack of single-side band capability and the lack of pass band tuning and a notch filter. If you want to be technically competitive with the NRD 535's of the world using a 50 year old receiver, attach a CCI digital readout and use a Hammarlund HC-10 (the IF and AF of an HQ-180A) accessory unit. That will nearly get you there... BUT WHY? As previously mentioned, though, the Achilles heel of this and similar receivers (from an SWL's point of view) is the damnably wide lower skirts of the L-C circuit-based IF filters. This is only a serious problem on the International Broadcast bands. However, it is a very serious weakness when trying to enjoy the otherwise awesome audio of this marvelous old war horse. Finally, the size and weight of the SX-28 have to be considered weaknesses. With the Art Deco case, this beauty tips the scale at nearly 80 lbs. and occupies more or less a 2 foot square on your radio table. Do you really want to lug one of these things around in your "declining years??"

MODIFYING THE SX-28:

The only major article published detailing modifications to the SX-28 appeared in the May 1959 issue of CQ magazine. The author, B.A. Briskman, K2IEG, detailed installing a 'S-9er' (also covered in the May 59 CQ) to increase sensitivity as well as adding another IF section to improve selectivity. He also details adding a voltage regulator for the HF and BF oscillators and building a product detector for SSB operation.

The same May 1959 issue of CQ has a receiver mod question-and-answer column which covers further modifications to the SX-28. This group of mods (noise limiter, adding a crystal calibrator and attaching a pan adaptor unit) were developed at the Hallicrafters plant.

THE MODERN BOTTOM LINE:

In good conscience, I can not recommend the SX-28 as a primary DX receiver. The HQ-180A, 51J-4 and R-390A are each superior DX machines and can be obtained for about the same general price. However, if your primary hobby is listening to the International Bands, or, if you can afford to own a 'listening radio' as well as a DXing radio, the SX-28 is just your cup of tea. If you would just enjoy owning the absolute classic tube-era shortwave receiver, buy one NOW! It is a thoroughly beautiful radio... beautiful to look at, beautiful to operate and, most of all, beautiful to listen to...

Be the last kid on your block to ride the sky with the last of the Super Skyriders.

endnotes

[1] Supposition by the author based on careful examination of all major preceding Hallicrafters (owned by Chuck Dachis) and examination of other contemporary receivers using Moore's book as a reference.

[2] The development of the SX-28 is one of the more interesting stories to come out of the halcyon days of radio in the late 1930's. Bits and pieces of the story have appeared in print in recent years, often with regrettable errors or omissions. Through Chuck Dachis, The Hallicrafters Collector, I was extraordinarily fortunate to contact Mr. Robert Samuelson and Mr. Ferd Schor. They were, respectively, Chief Engineer and Lead Receiver Engineer at Hallicrafters in the late 1930's and throughout WWII. They were each kind enough to exchange several letters with me in early 1992 concerning the development and use of the SX-28.

[3] Refer to *Communications Receivers, The Vacuum Tube Era: 1932-1981 2nd Edition* by Raymond S. Moore; pub. RSM Communications, 1991.

[4] Refer to articles in *QST*: McLaughlin and Lamb, May 1936 and McLaughlin and Miles, March 1938. Both articles detail diversity reception.

[5] Quoting introductory SX-23 advertisements in *QST* and other magazines.

[6] Samuelson letter #1 to Bryant, 1992.

[7] *"Hams in the RID, the FCC's Radio Intelligence Division in Action"* *QST* magazine, October 1944.

[8] The AWA Review, Volume 5, 1990, contains the nearly official history of the FCC's R.I.D. in a wonderful article by the R.I.D, war-time head, George E. Sterling, W1AE

[9] From Hallicrafters internal magazine *"Tuner"* in about April 1943, courtesy of Robert Samuelson.

[10] Rough draft notes from Mr. Schor indicates that he had primary responsibility for design of the S-22 and S-27.

[11] Samuelson letter #2 to Bryant, 1992.

[12] From Hallicrafters internal magazine *"Tuner"* in November 1943, courtesy of Bob Samuelson.

[13] Schor letter #1 in 1992.

[14] *Electric Radio*, No. 14, June 1990, copies of this and all other issues maybe obtained from the publisher for $3.00 each from *Electric Radio*, P.O. Box 57, Hesperus, CO, 81326. *Electric Radio* is a publication by and for radio enthusiasts interested in "hollow state" tube radio. Subscriptions are US $20.00 (Second Class) or $30.00 (First Class.)

[15] Three relevant articles on SX-28 modifications, *CQ Magazine*, May 1959

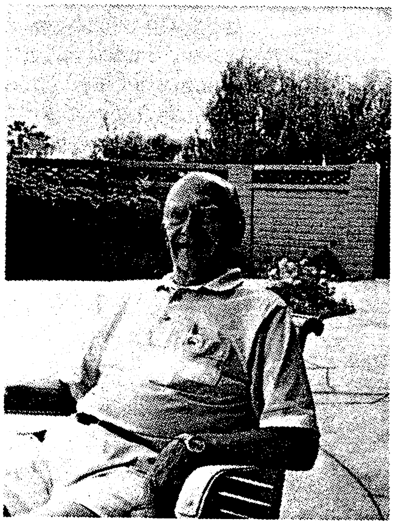


FIGURE 14. Dr. Robert Samuelson, Summer 1992.

At the close of WWII, Bob Samuelson left Hallicrafters and entered the graduate program in Electrical Engineering at Northwestern University. After obtaining his doctorate at Northwestern, he began a long and productive career with Motorola Electronics in Phoenix, AZ. Dr. Samuelson retired as a senior executive in Motorola in 1980. Today he and his wife Marcy enjoy a very active retirement, spliting their time between the family home near Camelback mountain in Phoenix and their new condomenium in California.

Receiver Designer Ferd Schor remained with Hallicrafters for many years and designed over 50 of the company's receivers. He, too, has enjoyed a long and active retirement in California.

HRO: PORTRAIT OF A CLASSIC

Elton Byington, N2KXT

For those who grew to love shortwave radio in the 1950s, as I did, few modern receivers inspire the awe that was attached to a few older radios of legendary performance: the **Hammarlund** ***Super Pro*** and ***HQ-129X***, and the **National** ***HRO-50***. All three had their roots in the depths of the Great Depression, and all three could serve as models of superb radio engineering, even today.

However, faced with the prospect of using one of these relics for serious DXing, a newcomer might very well forget about radio and take up gardening, instead. For these are formidable machines, festooned with knobs and dials bearing arcane names, like *Crystal Phasing* and *BFO Pitch*. But somehow, the HRO-50 seems more out-of-date than the others, probably because it uses plug-in coils to change bands.

Indeed the HRO-50 was an anachronism when it was introduced in 1950, fifteen years after the first receiver in the HRO line. The series would continue for another twenty years, well into the era of the "modern" receiver.

With the HRO-50, the National Company yielded two points to "modernity:" they put the power supply inside, and they added a calibrated tuning dial. Before the HRO-50, all HROs were tuned by referring to nomograph-like tuning charts attached to the plug-in coils. These radios were built before "ergonomics" entered the language.

From the beginning, the HROs were held in high esteem by hams, DXers, and professional monitors because these radios are among the most sensitive ever produced. Used properly, even the oldest HRO can give a fine accounting of itself, especially on the tropical bands and below.

BIRTH OF THE COMMUNICATIONS RECEIVER

All radio people should be familiar with the name of **Edwin Howard Armstrong** and with his great contributions to modern communications. Armstrong's fertile mind brought forth the concept of *regeneration*, which vastly increased the amplification of the three-element *audion* tube, invented by **Dr. Lee deForest**, by a process called *feedback*, where a portion of the tube's output was fed back into its input for reamplification. (1,2)

Armstrong found that a properly controlled amount of feedback made the audion, which we now call a *triode*, extremely sensitive to the radio waves received by an antenna. If he increased the feedback just slightly, the triode began to *oscillate*, in other words, it became a *transmitter*. A key difference between Armstrong's oscillating vacuum tube and the emissions from the spark transmitters of those days was that the oscillator produced *continuous waves*, or *CW*. He made this discovery before World War I, but it wasn't brought into regular use until about 1920, with the advent of broadcasting.

During the war, Armstrong developed several innovative radio circuits, including one that became the foundation of virtually every receiver today, the *superheterodyne*. Today it seems preposterous to hear that the superhet was looked upon at the time as an interesting novelty, of little value in communications.

The early superhets were well adapted for such things as radiotelephone reception in homes or for spark-transmitted Morse, which produced a raspy buzz in the receiver. These were both *wide-bandwidth* signals that could be heard with a hunk of galena in a crystal set.

But with the introduction of continuous waves, the superhet had real disadvantages. Although it was very sensitive and stable, especially when compared to the regenerative receivers of the day, it lacked adequate *selectivity* to cope with crowded shortwave bands -- ***and it was stone deaf to CW!***

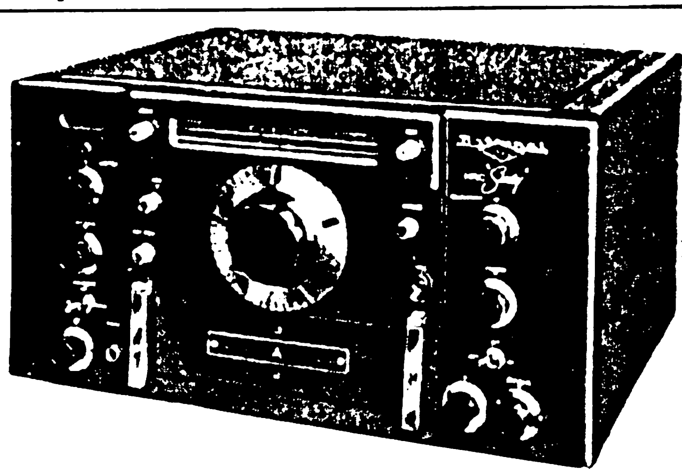


FIGURE 1.
The HRO-60 was the last of the tube-type radios in the HRO line. The receiver was introduced in 1952 and remained in production until 1965.

ENTER JAMES LAMB

In an article called "**What's Wrong With Our CW Receivers?**" that appeared in the American Radio Relay League's magazine *QST* for *June 1932,* technical editor James Lamb argued that the regenerative receivers then in use were woefully inadequate for "modern" band conditions, and that the superhet would need a lot more work before it could fill the bill.

Lamb soon supplied answers to the questions he'd posed with an article describing what he called the "**Single-Signal Superhet,**" published in *QST* for *August 1932.*

The single-signal superhet contained a *beat frequency oscillator (BFO)* that allowed the listener to hear a musical note when tuned to a CW transmission. And it contained a simple, elegant circuit that paved the way for the true communications receiver: the *crystal lattice filter.*

Lamb's filter -- a quartz crystal cut to resonate at the intermediate frequency (IF) of the receiver, bridged and bypassed by a couple of variable capacitors to make it adjustable -- became the key to the selectivity the ordinary superhet lacked. When brought near resonance, the filter produced a pronounced peak in response, often only a few hertz wide. This allowed an operator to peak his receiver on one signal, rejecting all others.

Within six months several receivers hit the market using Lamb's basic principles, including the direct forebear of the HRO, the National AGS-X. One could argue, with justification, that James Lamb was the father of the modern communications receiver. (3)

EARLY AIRLINES AND RADIO -- THE NATIONAL AGS

Despite the Depression, the early 1930s saw the birth of an industry that would eventually shrink the world: scheduled commercial passenger service by airplane. Air travel then was only for the adventurous (or foolhardy) and wealthy. It was risky, partly because air-to-ground communications were rudimentary, at best.

Because the technology of the day was built around fragile vacuum tubes, the equipment was cumbersome and heavy. And, because the early radiotelephone transmitters were enormously complicated and difficult to operate, simple CW rigs were used. An airplane carried a simple CW transmitter and a regenerative receiver. Both were small and reasonably easy to operate.

But there was an economic problem at work here: because they used CW, these simple rigs required the full-time attention of a trained radio operator, one who knew how to send and receive in Morse Code. The operator added weight to the plane's load, so it could carry fewer paying passengers.

The Department of Commerce, which oversaw the development of the airlines as well as of radio, recognised the problem and moved to overcome it. The department proposed the development of an entirely new system of aircraft communications, one that would use radiotelephone, so that the plane's pilot could do the communicating.

The contract for the receivers to be used at the ground stations was awarded to the National Company of Malden, Mass., and the delivered product was called the AGS, for *Aviation Ground Station.* (3,4)

National's AGS was a 9-tube superhet that used four sets of three plug-in coils to cover the frequency range of 2.4 to 20 MHz. It had a BFO for CW reception and a circuit called *automatic volume control (AVC)* for 'phone. The AVC detected changes in the strength of incoming signals and automatically adjusted the RF gain of the receiver to avoid overload. *(Today, we call this circuit automatic gain control or AGC.)*

Variations in the basic AGS receiver extended its coverage down to 1.5 MHz, introduced a variable BFO pitch control, and incorporated Lamb's crystal filter in the final version, the AGS-X, produced in 1933.

To change frequency bands on the AGS, the operator had to fumble with six separate plug-in coils, one each for the RF amplifier, the mixer, and the high-frequency oscillator stages of each frequency range. The coils were marked A1, A2, and A3 for one range, B1, B2, and B3 for another, continuing through the C-, D-, and E-series coils for progressively lower bands. Plug the coils in in the wrong order and you were asking for trouble! Clearly, there had to be a better way.

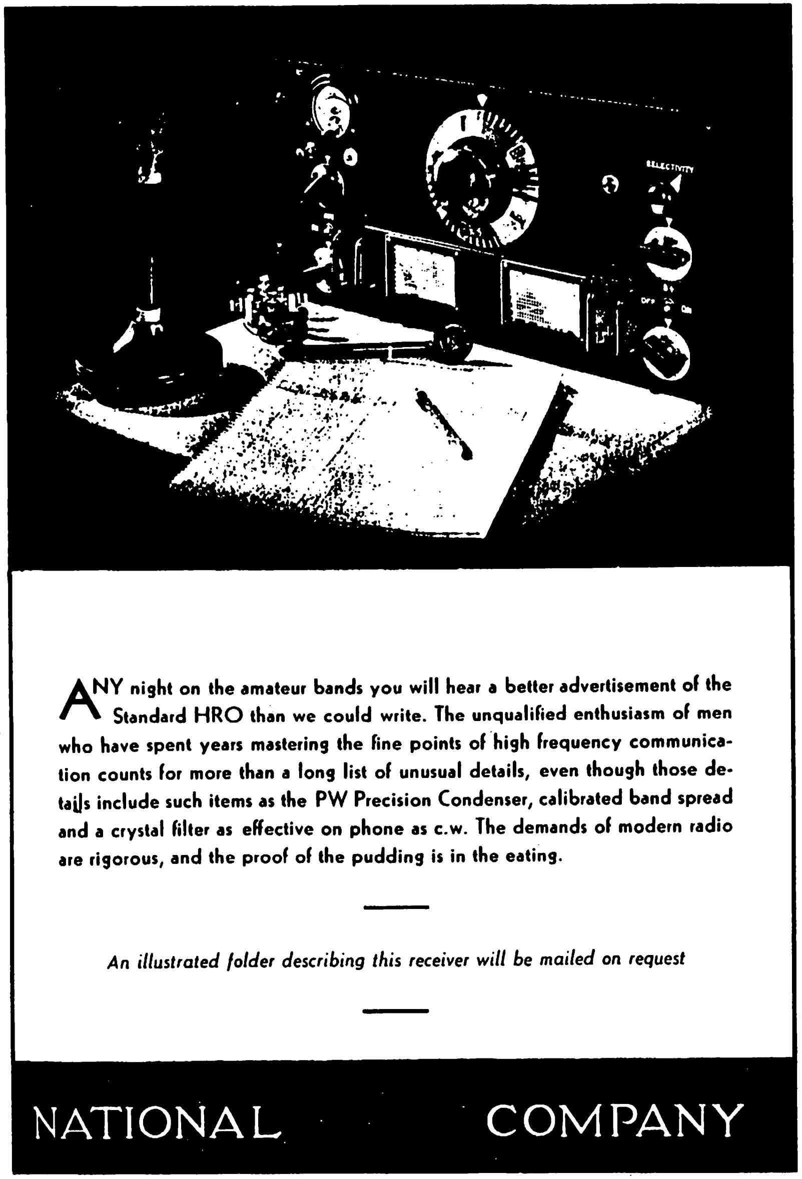
JAMES MILLEN, MECHANICAL ENGINEER

National's chief engineer at the time, James Millen, was a ham radio operator and a mechanical engineer by training. His solution to the coil problem reflects his background: he devised a way to gang the coils together in the proper order, so that it was impossible to mix them up. (4)

Then he designed a special right-angle worm-gear drive and attached it to a precision four-gang variable tuning capacitor.

And finally, Millen designed the unique "PW" tuning dial that would be a distinguishing feature of HRO series receivers until the introduction of the last version, the HRO-600, in 1970. The micrometer-like PW dial is 4 1/2 inches in diameter and has five windows in its skirt that allow the operator to see numbers that change as the dial is turned: 0-10-20-...-490-500. This results in an effective dial scale length of nearly 12 feet! It's probably the most precise mechanical tuning dial ever devised.

These advertisements are reproduced through the courtesy of QST magazine.



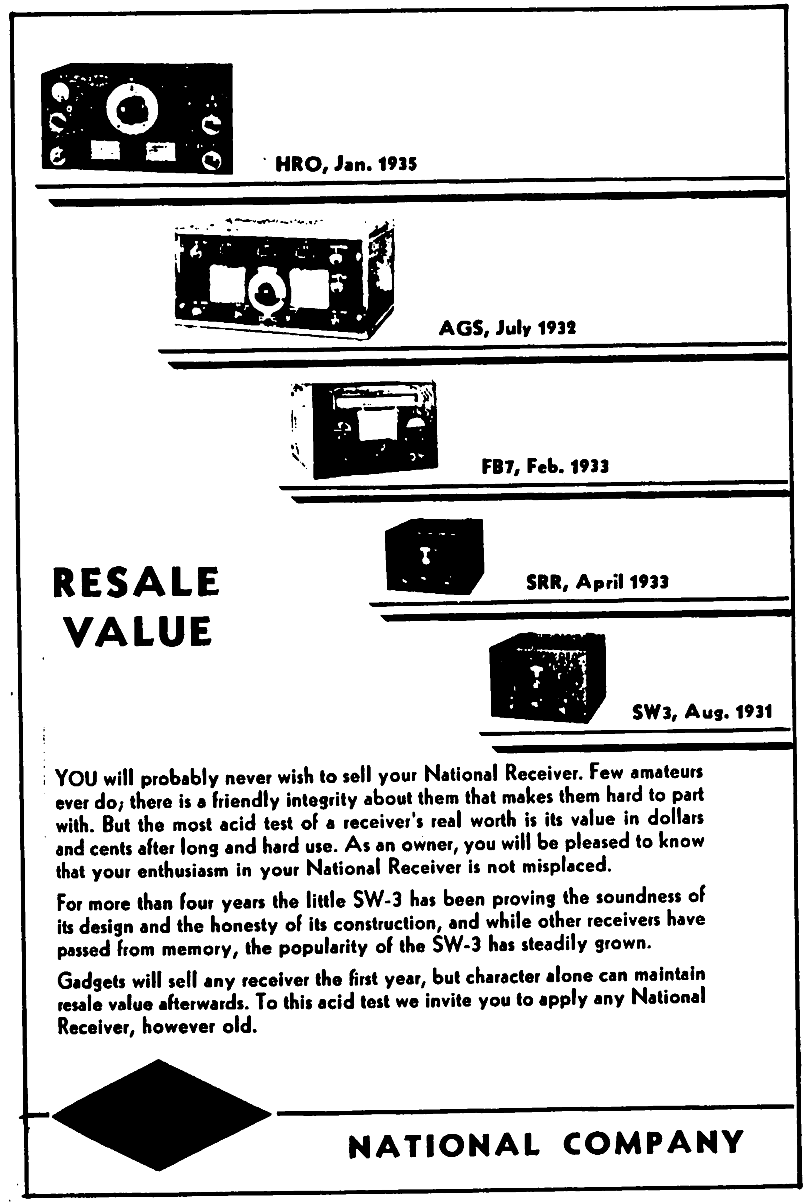
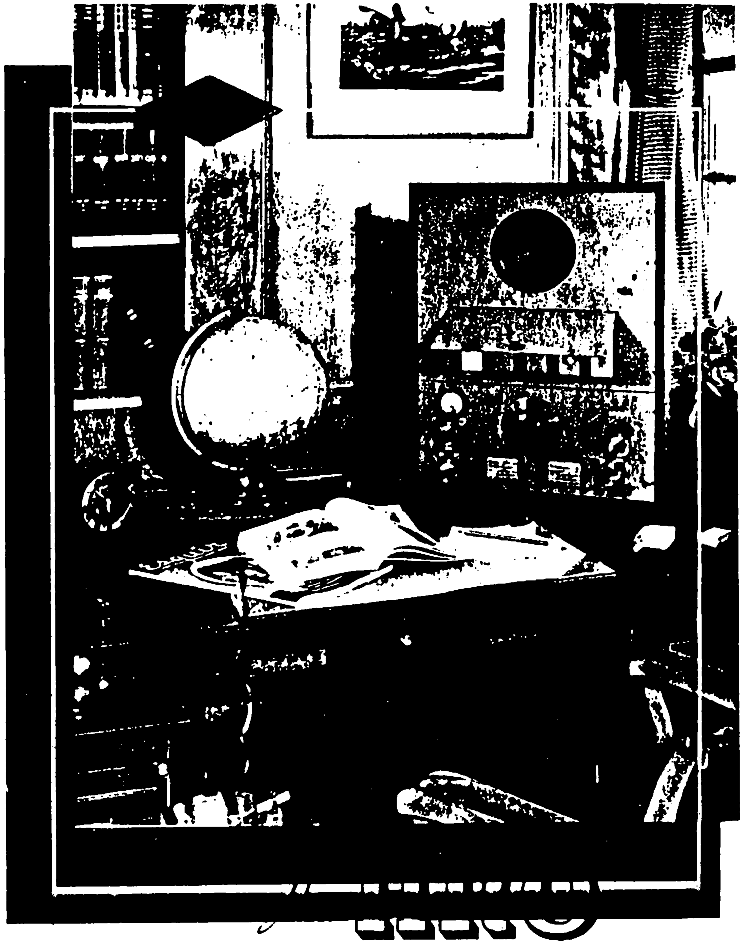


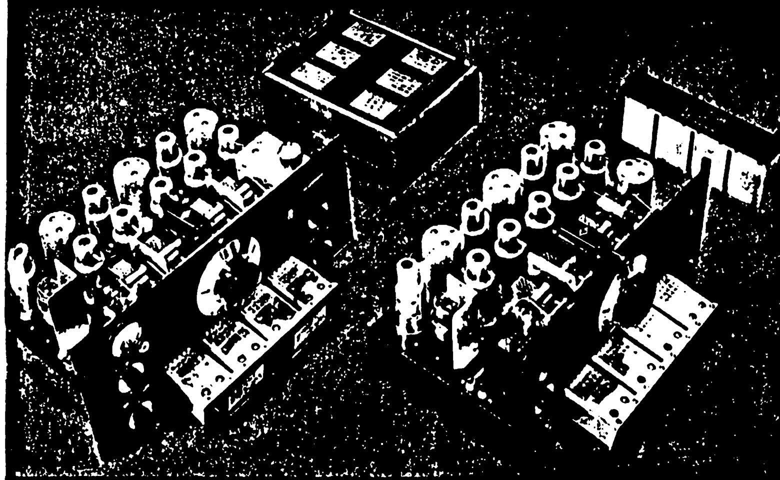
FIGURE 2A. For more than 30 years, advertisements from the National Company graced the pages of QST magazine. These ads amount to a chronicle of the HRO series from it,s introduction in December 1934 to the end of its run in the 1970s. Shown here is an early HRO ad from 1935 and one showing the major steps from the regenerative SW-3 of 1931 to the HRO in 1935.



IN REPLY to professional demand, a Combination Panel consisting of a spare-coil cabinet, matched speaker and power supply is now offered as an auxiliary to the HRO Receiver. Making a compact well-appointed receiver with its speaker properly segregated to prevent annoying mechanical feed-back. Your choice of finish, either rich grey or black leatherette. Retail prices are. HRO receiver, relay rack type, with coils covering 1.7 to 30 megacycles $179.70; Combination Panel type SPC $52 50; Table-model Relay Rack type MRR $13 50.

ATIONAL COMPANY

IFFERENT ONLY IN VERSATILITY AND IN PRICE



THE STANDARD HRO :: THE HRO JUNIOR

ANNOUNCING THE HRO JUNIOR

For those who need the high performance of the HRO, but do not require its extreme versatility, a Junior model is offered. The circuit details of both receivers are identical in every respect, but the lower priced model has been greatly simplified by omitting the crystal filter and the S-meter, and by designing coils for "continuous band spread" only.

Although these omissions do not greatly restrict its usefulness, they make it possible to price the Junior HRO at a very attractive figure. A complete description of the HRO Junior and of the Standard HRO will be mailed on request.

HRO Junior	*List*	*Amateur Net*
With tubes, one set of coils, 10 to 20 meters (2 amateur bands)	$165.00	$99.00
Additional HRO Jr. coils — per range — (2 amateur bands)	16.50	9.90
5897 AB Power Pack — for above — less tube	26.50	15.90

NATIONAL COMPANY

These advertisements are reproduced through the courtesy of QST magazine.

FIGURE 2B. Shown here is another ad from 1935 illustrating the Table-model Rack type MRR. The second ad is the introductory ad for the HRO Junior (1936).

HELLUVA RUSH ORDER!

James Millen and his crew were working 'round the clock in 1934 to design a receiver that would combine the best features of the AGS and eliminate its drawbacks. They worked under pressure to meet a Department of Commerce prototype deadline set for midyear. It was still more difficult because the electronic design was being carried on at the other end of the country, in Pasadena, California!

Overseeing the project was Herbert Hoover, Jr., son of the former president and also a ham, W6ZH. Hoover had been president of the ARRL and was an electrical engineer. His electronic design team was composed of engineers from Western Electric, part of the Bell System. (3,4)

Hoover's specifications called for superior image rejection, more precise tuning, improved AVC, better frequency stability, and superb selectivity. The first criterion was met by including two tuned RF amplifiers ahead of the receiver's mixer; Millen's superb PW dial took care of the mechanical part of the second, and James Lamb's crystal filter provided the last. Much experimentation was required to fine tune the receiver's AVC, but it eventually became quite effective.

The matter of frequency stability or "drift," however, would go on to plague the HRO and other vacuum tube receivers until Arthur Collins devised the dual-conversion 75A receiver, with its crystal-controlled HF oscillator and permeability-tuned second oscillator, in 1946. The vacuum tube HRO receiver never overcame that problem. They ALL drift.

James Millen's team's mad rush to finish the new receiver on time led National's workers to dub the project the **HOR**, for "hell of a rush." In those more temperate times, however, cooler heads prevailed, and the new radio was rechristened the **HRO**. It was first advertised in the December 1934 issue of **QST**, and delivery began the following March. (4,5)

DESIGN CONCEPTS

From the start, James Millen designed the HRO as a no-compromise receiver, both mechanically and electrically. The radio is built on a welded steel chassis, all wiring is painstakingly laced into place, critical RF and IF leads are made as short as possible, and component selection is extremely conservative.

The key to this superb design is the HRO's unique coil drawer or "catacomb," as National called it. The four coils are ganged together in such a way that they rest directly below their associated section of the tuning capacitor. Each coil is encased in an aluminum can and each section of the tuning capacitor is separated from its neighbors by a Faraday shield.

Leads from the coils are brought out to silver-plated contacts embedded in a ceramic terminal strip atop the coil can, where they mate with spring-loaded contacts beneath the tuning capacitor sections. When you plug in a coilset, it makes sure, firm contact.

In the "classic" HRO, each coil is tapped to allow the receiver to be used for general coverage or for bandspread on the ham bands only. The option was selectable by the operator by moving a screw, on the early receivers, or by twisting a butterfly valve-like switch on later models.

Each coil was designed to cover two amateur bands when in general coverage mode, so one coil would cover 80 and 40 meters with bandspread on 40, the next one would cover 40 and 20 meters with bandspread on 20, etc.

The radio and its coilsets were manufactured as a unit and were aligned that way. They were meant to be kept together, so trading coilsets with your ham buddy was not a good idea. Your coilsets would work in his HRO, but the receiver would not track properly. Remember this if you're looking for HRO coilsets at a local hamfest! If you have the option, ***buy the entire receiver***, rather than separate coilsets! (5)

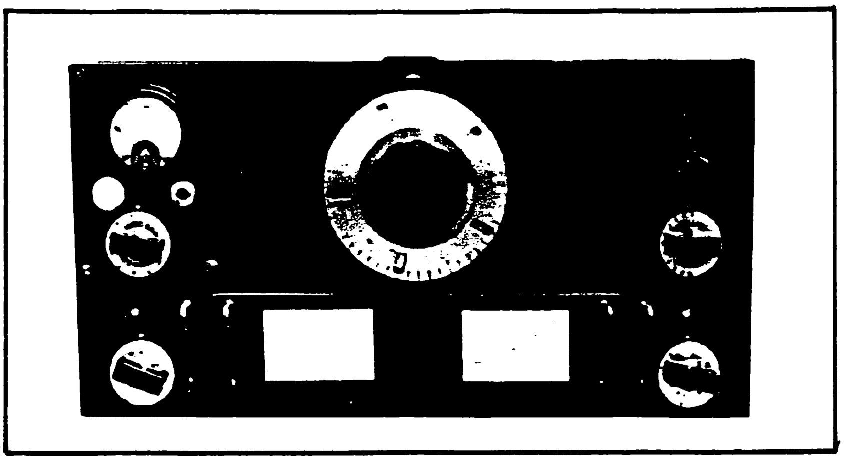
There are exceptions to this rule, however. The original HRO was supplied with four coilsets, covering 1.7 to 30 MHz. National also sold coilsets that extended the receiver's coverage down through VLF range, to 175 kHz. These sets were NOT supplied with the receivers and they are exceedingly hard to find. Alignment on these accessory coilsets is only approximate, but is usually quite adequate. The two coils that cover the broadcast band are also very hard to find. ***They are well worth finding!***

The original HRO had nine tubes. There were two RF amplifier stages, a mixer (called a first detector in those days,) a high-frequency oscillator, two 456 kHz IF amplifier stages, a demodulator/AVC detector/1st AF amplifier stage, a separate tube for the BFO, and an AF output stage. The power supply was in a separate box because the engineers believed it would contribute to hum, noise, and heat if built into the radio. It contained a type 80 rectifier tube.

The original receiver came in two variations as well: 2.5 volt and 6.3 volt, referring to the heater voltage of its tubes. For this reason, it is important to get the right power supply for the radio. They should always be sold as a unit. (Later HROs all had 6.3-volt tubes.)

FIGURE 3.

The "Classic" HRO was often called the "HRO Senior" after National began making a "Junior" version, in 1936.



SEVERAL VERSIONS

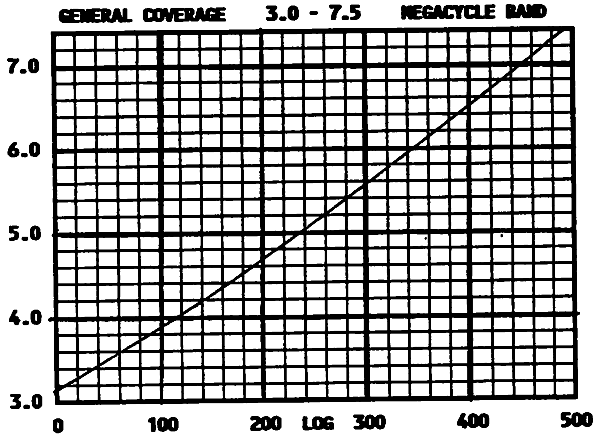
In his excellent book, *Communications Receivers, The Vacuum Tube Era: 1932-1981*, Raymond Moore lists more than ten different versions of the "classic" HRO. Most of the changes were incremental and internal. Some were for receivers built to unique specifications for the military. Other models were contained in rack-mount cabinets, complete with loudspeaker and power supply, and a place for storing unused coilsets.

A few months after the introduction of the original HRO, the National Company began producing a stripped-down version, aimed at the amateur radio market. The **HRO-Junior,** as it was called, dispensed with Lamb's crystal filter and the S-meter, and it didn't have provision for bandspread on the ham bands. The coilsets were aligned for an "average" receiver, not for each radio. (5) It sold for $99.50, as opposed to the $168.50 of the HRO, itself. Even that was a lot of money in those days, when a good job (if you could find a job at all) paid something like $25 a week, and a new car could be bought for about $500.

Of special interest to anyone searching for a "classic" is the HRO-5, built in the thousands for the military during World War II. Its distinguishing feature is that it does NOT include bandspread for the ham bands. Many of these receivers wound up on the surplus market in England for some reason, where they were advertised through the early 1960s in the British magazine *Wireless World.* The HRO-5, like all the others, has a separate power supply. (This receiver is often referred to as the HRO-M.)

Another version, built for a couple of years just after the war, has an automatic noise limiter control between the tuning dial and the S-meter. It controls the triggering level of a shunt diode (a tube) that bypasses received noise bursts around the detector. The "ANL" concept never worked very well, although it held on through the 1950s.

The last "classic" HRO didn't really look like one, except for the distinctive PW tuning dial. It was the HRO-7, introduced in 1947. The HRO-7 had 12 tubes, including a voltage regulator that tried to stabilize the receiver's frequency drift, and it was packaged in a sleek, streamlined cabinet. Make no mistake, though, for lurking behind that pretty face was the same basic receiver that had been in production since 1935.



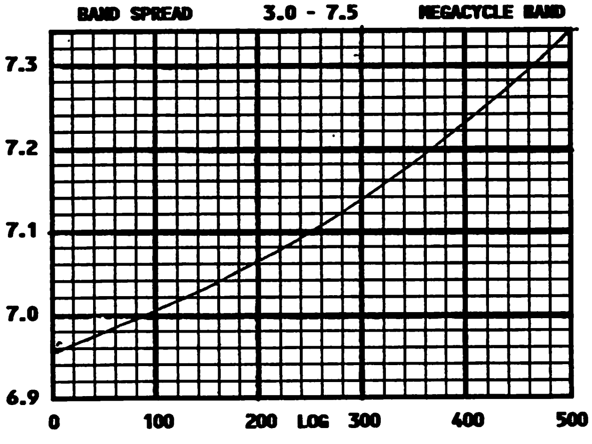


FIGURE 4. Until the advent of the HRO-50, every receiver in the series was tuned with the aid of charts like these, attached to each coilset. The tuned frequency is plotted vertically and the corresponding PW dial readings are plotted horizontally. To find the frequency your receiver was tuned to, you read the PW dial, looked up the reading on the horizontal axis, then followed the line straight up to where it met the calibration line. Next, you'd look left along the horizontal line that intersects at that point and eventually find your frequency! The chart at left is for general coverage; the one at right is for ham band bandspread.

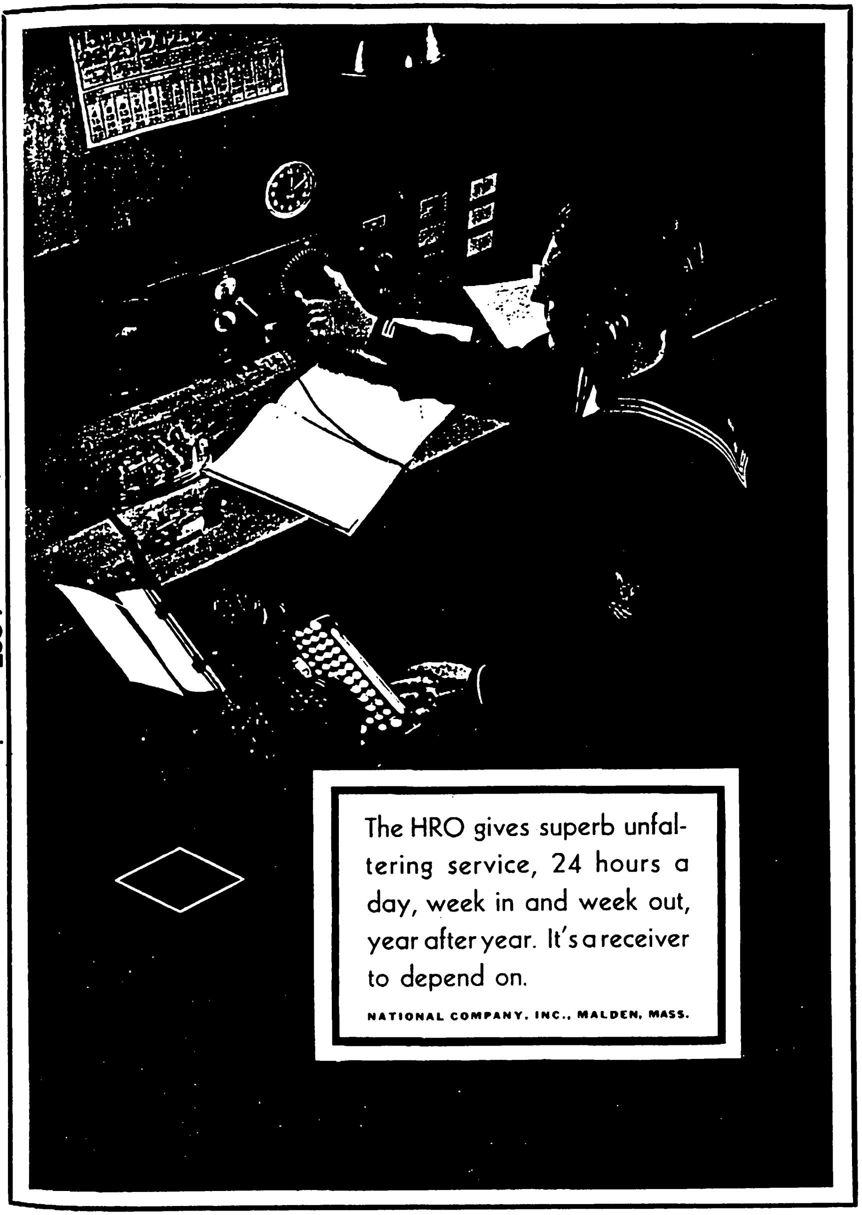
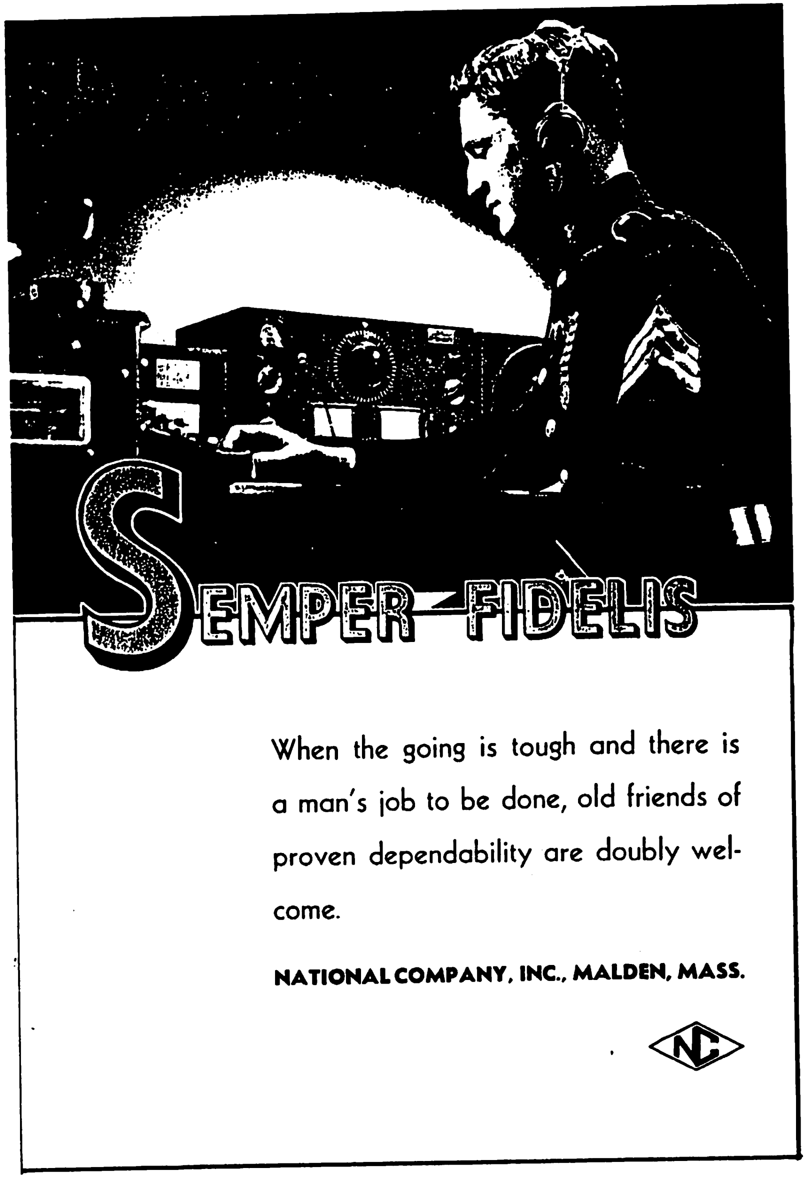


FIGURE 5A. THE HRO GOES TO WAR. When the United States entered WWII, the National Company got the word: "Start building HROs; we'll tell you when to stop!" During the War, the Company's workforce increased tenfold, from about 250 to 2500 people. (5)



These advertisements are reproduced through the courtesy of QST magazine.

FIGURE 5B. Another WWII ad for the HRO indicates the relation of the National Company and the HRO to the War effort. One does wonder how many US Marines stood radio watch in their dress blues. The second ad illustrates the immediate post-War offering of the HRO-5A1 to the amateur market.

TIME FOR A CHANGE

World War II did two things for America: it ended the Great Depression and it pushed the United States to the cutting edge of technology. In the euphoria that followed the war, at least until Korea put the brakes on, it seemed Americans could do no wrong.

Television was revolutionizing the way we lived, jobs were abundant, the economy was booming. The Marshall Plan was in full swing, helping Europe rebuild from the war's destruction. America had ***The Bomb***, and nobody was going to push us around!

Shortwave radio was experiencing a postwar boom, too, with stations signing on from the far corners of the earth. A guy in Denmark named **Jens Frost** was putting together a pamphlet called the *World Radio Handbook* and publishing it every year.

Automobiles, too, were getting sleeker, less boxy, and suddenly, the radio receivers we'd used since the '30s seemed hopelessly dated and tired. Change was in the air, and radio manufacturers, using advanced techniques developed during the war, were ready to change with the times.

Up in Malden, Mass., the National Company saw in these booming times a chance to remake a winner, and the **HRO-50** was born.

PRIDE OF BREED

Beautiful, streamlined, heavy, the HRO-50 was everything its boxy progenitor was not. If the classic HRO looked like a Model T, its offspring looked like a new Cadillac.

Gone were the separate, clunky power supply and the arcane, difficult tuning charts. The new receiver had a regular power cord and, wonder of wonders, *a direct-reading, sliderule dial!* It was surprisingly accurate, too.

The new set's innards were state-of-the-art, too, if you could disregard the fact that you still had to swap coils to change bands. Many of the set's 15 tubes were of the new, rugged, miniature type, developed during the war. And it had a push-pull audio output stage that delivered a hefty eight watts -- enough to blow the doors off the shack!

Almost everything in the set had been miniaturized, with the exception of the coil catacomb and the tuning capacitors. The huge IF transformers of yore had given way to modern, ferrite slug-tuned cans, yet the internal construction was very similar to the prewar models; everything was laced into place and built to last.

Introduced in 1950 and selling for $349, the HRO-50 was followed a year later by what was probably the ultimate extension of the single-conversion superhet concept, the **HRO-50T1**. (The "T" meant it was a table model; the same receiver mounted in a rack was called an HRO-50-1. When new, it sold for $383.50.)

THE GOLDEN AGE

With its three 455 kHz IF stages, comprising 12 cascade-tuned circuits, as well as two redesigned RF amplifier stages, the HRO-50T1 was then, and remains, possibly the best single-conversion receiver ever built. It is an awesome performer, capable of uncovering the weakest signals.

The radio handles well, sounds great, weighs a ton, and drifts like crazy. (Not as bad as other versions of the tubed HROs, though.)

Frequency drift had always been a problem with the HRO, and operators had long before developed a method of minimizing its effects: keep the coilsets warm! Stick the unused sets on the radiator in the winter or put 'em in a sunlit window in summer. I've heard of guys actually sticking them in the oven for a few minutes before a DXing session! This applies to all HRO coilsets.

The HRO-50T1 is a superb receiver for AM and CW signals, easily the equal of more modern sets, especially in the tropical bands and below. Its tuning dial will drive you whacky and its drift will have you reaching for the ICF-2010, but for down and dirty DX, there's nothing that can match it.

It's a ***man's radio***, not for the faint of heart.

IMAGES: OR "WHY IS GUYAQUIL INTERFERING WITH WWV?"

Image rejection was one of the prime reasons for using two tuned RF amplifiers in the original HRO. All superhets are susceptible to images, because the action of the mixer stage produces two distinct products, one above, the other below the local (HF) oscillator's frequency.

So, if you are tuned to 10,000 kHz with a receiver that has a 456 kHz IF as did the early HROs, your local oscillator is producing a frequency of 10,000 plus 456, or 10,456 kHz.

Now, let's assume a strong utility station cranks up on a frequency of 10,912 kHz. It hits your mixer along with the station you want to hear, WWV on 10 MHz.

The arithmetic is simple: 10,456 minus 456 equals 10,000 kHz; but 10,456 plus 456 equals 10,912 kHz, too, and the result is an "image" of the utility station, heard along with WWV.

There are two ways of combatting a superhet's images: use a tuned RF preselector so that the signal from the interfering station is reduced to the point where it can't be heard, or use multiple mixers and oscillators in a multiple conversion scheme.

The traditional HRO, up to and including the HRO-50T1, used the former method and it worked quite well. The main problem with the scheme is the difficulty of getting the resonance of each tuned circuit to occur at the same points throughout the frequency range of the receiver. That's called *tracking a superhet*, and it's almost a black art.

But when you go to multiple conversion, things start to get complicated. All of a sudden you have mixing products showing up at very odd places, mixing among themselves and producing other, still stranger, images.

That's what happened with the last of the vacuum tube HROs, and it's not a pretty story.

A NEW WRINKLE: DOUBLE CONVERSION

Art Collins refined it, but its roots go back to the early 1930s. By the early '50s, the ham radio bands were abuzz with tales of the great advances in store for the next generation of shortwave radios, chief among which was a thing called *double conversion*, which few understood.

The consensus among hams and manufacturers was that this double conversion thing *must* be a great advancement, *because it was so damned hard to understand!* After all, how many people understood how the Atom Bomb worked, and look at what a big advancement that was!

Wishing to remain up to date (while retaining those anachronistic plug-in coils), the folks at National decided to create the ultimate receiver by building upon the success of the past.

The result was the fabulously expensive ($100 more than the HRO-50T1) **HRO-60**, using double conversion above 8 MHz, and it was less than perfect.

"I probably lost more sleep over the HRO-60 than any two things National made, except for the first NCL-2000 linear amplifiers, which were prone to very interesting self-destruction," says **Frank Gilmore, K0JPJ (ex-W5PVX)**, a long-time National dealer and warrantee repairman. (6)

"When a customer paid the kind of money the 60 was bringing back then (almost $700), they were expecting a wondrous receiver, which the HRO-60 was not," he continues.

"In point of fact, the HRO-50T1 was the best of the whole series, and the engineers at National knew this and tried feverishly to come up with a fix.

"The 50T1 was was more sensitive on high frequencies, was more stable, and had a superior crystal filter.

"The HRO-60 was prettier in a cosmetic way, and it actually had a higher grade of components, but it just didn't perform as well."

Gilmore went on to describe some of the quirks he encountered when working on the HRO.

"The only HRO series receiver that I found had severe alignment problems was the HRO-7. By later versions is was very primitive. The HRO-5 was a joy to work on because of its simplicity, and it was really a very good receiver.

"The HRO Senior and Junior receivers were not that great by more modern standards, although for their day they were the top of the heap."

TRICKS OF THE TRADE

I've already mentioned the old trick of keeping your HRO coilsets warm to lessen the receivers' drift, but modern hams and SWLs might not realize another fact of shortwave life, up through the 1960s: ***accurate frequency readout wasn't all that important.***

Most of the great receivers of the day were designed for commercial operations and for hams. The commercial sets were used to tune relatively small segments of the spectrum, and their associated transmitters were usually crystal controlled. This made the job of the receiver that much easier: you simply tuned around until you heard the station you wanted to copy, then read the dial and logged its reading for future reference. The accuracy was all at the transmitter end.

Hams used a similar method, but they usually had crystal-controlled marker oscillators to warn them of the band edges.

For really accurate frequency measurements, we had to rely on surplus BC-221 series frequency meters sitting beside the receiver. These World War II relics used frequency charts similar to those found on the early HROs, but enabled you to make far more accurate readings. You'd tune the receiver, then zero-beat the BC-221 and read your tuned frequency from the meter's dial and chart. It was quite accurate.

If you couldn't afford a BC-221, which cost about $75 in those days, you could make your own tuning charts for your particular receiver. This was a laborious and time consuming task that involved tuning to known stations and logging the readings from your receiver's tuning dial.

Eventually, you were able to "map" your receiver's calibration, although with many receivers the charts you'd made were way off frequency the next time you returned to that band. The HRO was far superior to other receivers in that regard, mainly because of James Millen's superb mechanical design.

One side benefit of taking the time to "map" your radio is something a modern DXer often misses: ***you were forced to "learn" the bands.*** Certain signals served as "signposts" on each band, and an experienced DXer knew what they were, without even looking at his or her dial.

Knowing these "signposts" is what separates the DX pro from the DX novice. There is no shortcut to this knowledge, either. It takes years of daily listening to gain the experience, and no receiver, no matter how accurate its frequency readout, can supplant experience as the prime tool of the successful DXer.

In the world of shortwave DXing, that axiom belongs right up there with *caveat emptor.* It cannot be stressed too much.

THE "MODERN" ERA

By the middle 1960s, the HRO and other receivers of its type were becoming hopelessly long in the tooth. Many hams and DXers felt the firecrackers of old had overstayed their welcome, and they began demanding smaller, lighter, more accurate receivers.

The National Company heard their pleas, and in 1965 announced the first of the "modern" receivers, the **HRO-500.**

Here was a set that was fully transistorized, weighing a mere fraction of the HRO-60, yet it featured digital frequency readout, provided by neon "nixie tubes," and covered the whole mediumwave and shortwave spectrum in 1 MHz bands.

It was the first receiver of its type to reach the amateur market and it found ready acceptance, despite its fabulous price tag of $1,500.00.

The HRO-500 was built around a new concept called *crystal synthesis*, which provided crystal-controlled accuracy and stability to every frequency the receiver tuned. It was truly a radical departure from earlier receivers, and remains a superb DX machine.

Early samples of the HRO-500 had numerous problems with their synthesizers. "Birdies" and other artifacts abounded. Some of the early sets suffered from a lack of sensitivity above 15 MHz, too, but these problems were largely overcome in later production runs.

The HRO-500 was the last of the series to be built for you and me. It was also the last to have James Millen's incomparable PW dial.

But the boys in Malden weren't ready to give up the ghost. And the most famous series of radio receivers ever produced wasn't quite ready to end.

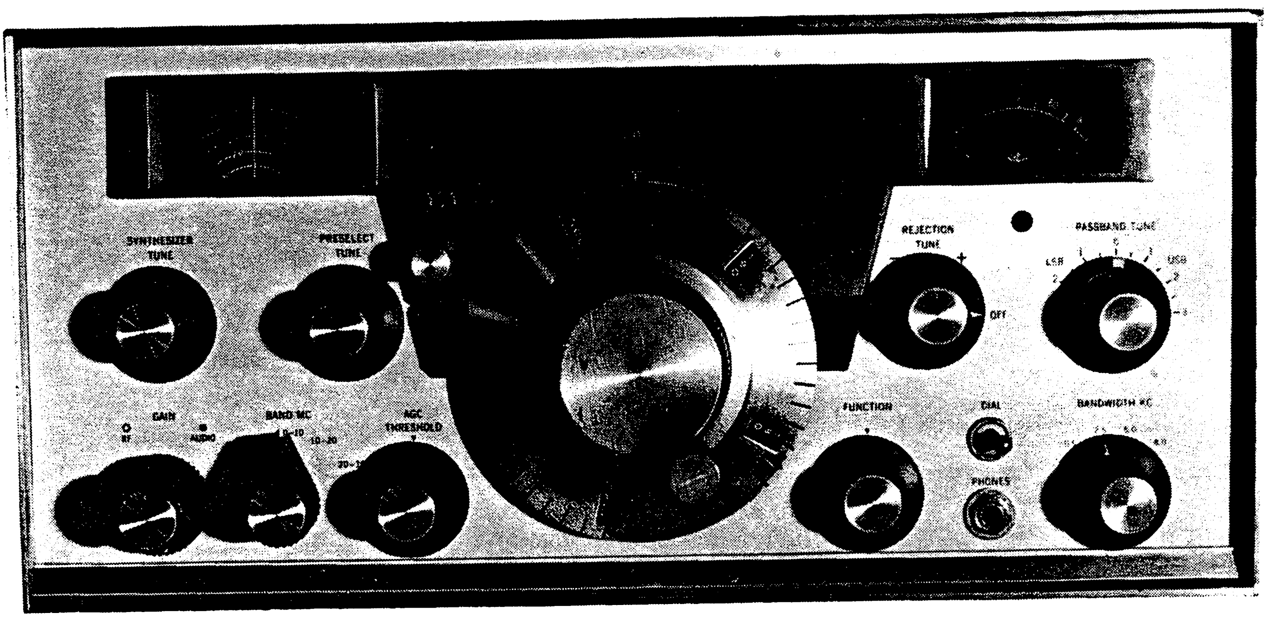


FIGURE 6. The HRO-500 was the last of the line that was built for ordinary mortals like you and me. When it was introduced in 1965, the receiver was truly state-of-the-art, using an advanced tuning scheme called *crystal synthesis* that made every frequency it tuned as stable as if it were crystal controlled. Crystal synthesis differs from the phase-locked loop arrangement common today in that frequencies are produced by heterodyning crystal oscillators against one another. It's a purely analogue technique that's inherently quieter than the digital schemes used today. This fine specimen belongs to David Clark.

A CLASSIC END-GAME

By the early 1970s the tide of radio technology had shifted to the far shores of the Pacific, as Japanese receivers, at first imitating and later surpassing American designs, began their inexorable progress toward domination of the amateur market.

Like most other American radio companies, National was caught between the jaws of an economic vise. Because National's method of production was extremely labor-intensive, it cost too much to build a superb modern receiver for the amateur market on these shores. Instead of abandoning the field entirely, National switched gears and produced yet another version of their premier receiver, calling it the **HRO-600.**

The HRO-600 didn't look like an HRO at all. Gone was the classic PW dial with its micrometer-like windows that had served generations of DXers so well.

Its place was taken by a plebeian plastic knob or a series of plastic thumb-wheel switches, set in the middle of a 5-inch relay rack panel.

With its "nixie tubes" intact, this redesigned HRO-500 was designed strictly for the needs of the commercial market, and its $5,000 price tag provided assurance that few, if any, of the new radios would reach the amateurs.

Two models were produced: one with continuous tuning, the other with discrete thumb-wheels for each tuning digit, and National continued to produce the HRO-600 until about 1980, when the economic realities of today's marketplace forced them under.

SIC TRANSIT GLORIA

By the early 1980s the once great National Company was dead, a victim of outmoded production techniques. It had reached its zenith during World War II and had continued to produce superb, if somewhat dated, communications equipment right up until the end.

The spirit of National lives on today in the hearts and minds of many who worked there during its heyday. They still have annual company picnics, and a National Ham Radio Net meets on 75 meters each week.

It's firm in the minds of the participants, and in the hearts of the many thousands who've owned and cherished National receivers over the years, that for four eventful decades the National Company of Malden, Mass., built the best radio ever made. And they called it the HRO.

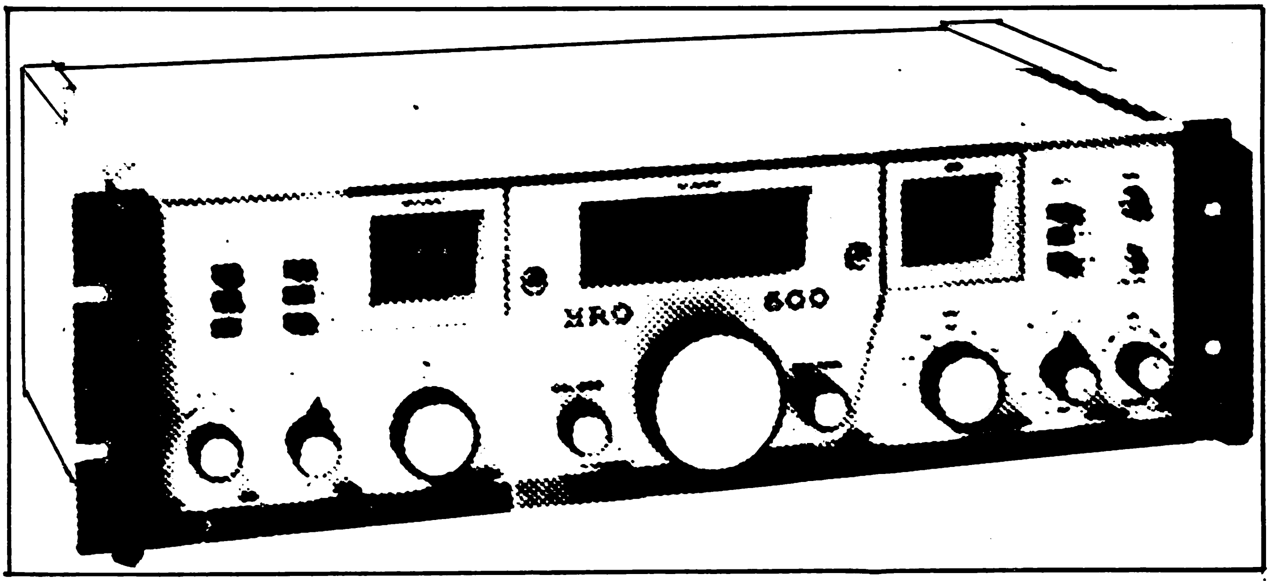


FIGURE 7. The last of the HRO breed, the commercial-grade HRO-600, came in two models, one with continuous tuning, the other with thumb-wheel switches for each tuning digit. These receivers were built until the late 1970s, when the National Company went into bankruptcy.

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(2) -- *Empire of the Air,* Tom Lewis, New York: HarperCollins Publishers, 1991, pp 70, et seq.

(3) -- *Communications Receivers, The Vacuum Tube Era: 1932-1981,* Raymond S. Moore, Walpole, MA: RSM Communications, 1991, pp 78-85.

(4) -- *The Wonderful HRO Receiver,* William I. Orr, W6SAI, *CQ,* May, 1975, pp 17, et seq.

(5) -- *A Brief History of the National Company,* John J. Nagle, in *The A.W.A. Review,* vol. 1, Holcomb, NY: Antique Wireless Association, 1986, pp 65, et seq.

(6) -- Recollection contained in a FidoNet message.

THE NEWFOUNDLAND 1991 MEDIUM WAVE DXPEDITION

Mark Connelly, WA1ION

Editor's Introduction

Late in the summer of 1991, well known MW DXer Mark Connelly began to organize a DXpedition to commemorate Marconi's famous Trans-Atlantic experiments of almost a century ago. It was Mark's idea to travel to St. John's, Newfoundland with a few other experienced DXers to erect an array of Beverage antennas and to log as much Trans-Atlantic MW DX as possible. The expedition did occur and the results were far beyond the wildest fantasies of us all. Mark and his two compatriots happened to be at exactly the right place and time. Surely, in numbers of countries logged (65) and numbers of Trans-Atlantic stations logged, their DXpedition must have been the most productive MW DXpedition of all time. Their experiences have been covered in detail in the MW hobby press. However, we are rather sure that many *Proceedings* readers have not read of the Newfoundland '91 DXpedition. For that reason, we asked Mark to prepare the following narrative and compressed log of their DXpedition. Further information may be obtained from the article reprint services listed at the end of Mark's article.

NEWFOUNDLAND 1991

In November of 1991, just before the 90th anniversary of Marconi's first Trans-Atlantic communication from Signal Hill, St. John's, Newfoundland, a three-person DXpedition set out in the St. John's area with objectives not unlike those of Marconi. The DX team consisted of Jean Burnell, a chemistry professor at Memorial University in St. John's; Mark Connelly, an electrical engineer from the Boston area; and Neil Kazaross, a former engineer turned stock options trader. Neil was living near San Francisco at the time, so his trip to NF was by far the longest. Neil had previously lived in Maine and in Rhode Island; he still retained his superb knowledge of Trans-Atlantic and Brazilian DX. All three DXers specialize in hearing foreign DX on medium wave - the standard AM broadcast band thought by many to offer only local and regional reception. Mark has developed many "gadgets" to improve long-haul medium wave reception; these include regenerative preamplifiers, antenna phasing units, and remotely-tuned loops and whips. Some of these homebrew units were employed on the DXpedition.

Foreign DX on medium wave can be enhanced as much by location as by any of the other traditional factors such as receiver quality, antenna gain / directivity, and operator skill. While the best VHF location may be a mountain-top, the best medium wave location is next to the ocean. Salt water has a tremendously beneficial effect on reception. Also, being away from interference (local stations) and noise (power lines) helps a lot. With these considerations in mind, Jean did some scouting about and found two sites for Beverage aerials - one near the lighthouse in Renews, NF and one at the lodging place (Lawlor's), 5 miles down the coast in Cappahayden. The two sited are about 50 miles south of St. John's and are just outside the "overload zone" of local AM'ers like CJYQ-930. A long wire and three Beverages were erected with the goal of optimizing Trans-Atlantic and South American / Caribbean reception. The longest of these wires was 3000 feet long - this "RF gun" was pointed straight at Brazil. The main receivers were Icom's: R70 and R71R; a Sony 2010 did back-up duty.

The DX effort went into full swing from the 7th to the 10th of November 1991. The MW propagation during the DXpedition was heavily auroral, with reception conditions strongly favoring the southern routes to Africa instead of northern ones to Europe. As the countries list shows, a multitude of Africans and Brazilians were logged. The most remarkable of these were the many very-low-powered stations heard - including Angola and Ascension Island at 1 kW and Azores and Brazilian high-band "graveyarders" running a paltry 250 watts! Lesotho on 1197 grabbed the distance record: 7265 miles. Deep South Americans such as Uruguay and Argentina were good. Serious DX started way before local sunset and ran till after dawn. The DXpedition participants got very little sleep! DX at midday was even possible: ground waves from Azores - 693/626/836, Morocco - 1044, and Portugal - 1035 were heard. Also noted at noon were USA stations WHDH-850, WBZ-1030, and WSSH-1510 from Boston and WCBS-880 from New York. A technique that greatly assisted in the sorting out of the incoming tidal wave of Trans-Atlantic DX was the use of parallel frequencies, both on medium wave and on tropical-bands shortwave. Jean's tropical-bands expertise and multilingual abilities were indispensable.

As dawn arrived on the 10th of November, the three DXers set out for home, weary but satisfied with a DXpedition well done. Three overnight DX sessions had netted 65 countries between 520 and 1620 kHz.

More detailed reports of the DXpedition activities and loggings have appeared in the National Radio Club's "*DX News*" and in the International Radio Club of America's "*DX Monitor*". Also February 1992 "*Monitoring Times*" and the UK's "*Medium Wave News*" have featured articles on the trip. In subsequent months, Jean has continued DXing from seaside sites near his St. John's home. He's heard additional medium wave countries including exotic Middle Eastern and former Soviet republics that had been "aurora'ed out" during the November 1991 DX effort. He has also logged and verified St. Helena - 1548 (450 watts!). The success of the NF DXpedition is likely to spur future trips to the area, possible with longwave, shortwave, and two-way amateur DX goals in addition to continued medium wave work.

THE 1991 NEWFOUNDLAND DXPEDITION:
COUNTRIES LOGGED

November 7-10, 1991

[Jean Burnell, Mark Connelly, Neil Kazaross]

1)	Algeria	549, 666, 891, 981, 1422
2)	Angola	945, 1088, 1115, 1188, 1232, 1313, 1367, 1502a
3)	Anguilla	690, 1610
4)	Antigua	620, 1100, 1165
5)	Argentina	680, 870, 1030
6)	Ascension Island	1485, 1602
7)	Azores	693, 828, 836 (now 837), 1259, 1503, 1566
8)	Balearic Islands	909
9)	Barbados	900
10)	Benin	1475
11)	Bermuda	1160
12)	Brazil	600, 620, 640, 680, 690, 700, 720, 730, 740, 760, 780, 810, 820, 860, 870,
	"	880, 890, 900, 950, 960, 980, 990, 1000, 1010, 1030, 1040, 1050, 1060,
	"	1080, 1090, 1100, 1110, 1120, 1130, 1150, 1160, 1190, 1200, 1220, 1240,
	"	1260, 1280, 1290, 1300, 1300.6, 1320, 1330, 1360, 1370, 1380, 1390, 1400,
	"	1430, 1440, 1450, 1460, 1468.8, 1470, 1480, 1490, 1500, 1510, 1520, 1530,
	"	1540, 1550, 1560, 1570, 1590
13)	Burkina Faso	747
14)	Cameroon	1152, 1286
15)	Canada	540, 560, 590, 640, 690, 710, 720, 740, 780, 800, 810, 920, 930, 960, 970,
	"	1070, 1090, 1230 (now 1210), 1270, 1320, et al
16)	Canary Islands	621, 720, 747, 837, 882, 1008, 1215?, 1269, 1341
17)	Central African R.	1440
18)	Colombia	840
19)	Cuba	810, 860, 900
20)	Egypt	819, 1107
21)	England	882, 909, 1548
22)	France	675, 945, 1071, 1161, 1206, 1242, 1377, 1467, 1557
23)	French Guiana	1070
24)	Gabon	1554
25)	Gambia	909.8
26)	Germany	1593
27)	Grenada	535
28)	Guadeloupe	640
29)	Guinea	1386, 1404
30)	Guyana	760
31)	Italy	846, 900
32)	Ivory Coast	1493a
33)	Jamaica	700, 850
34)	Lesotho	1197
35)	Libya	648, 828, 1053, 1208.5, 1251
36)	Luxembourg	1440
37)	Madeira Islands	531, 1530
38)	Martinique	1090
39)	Mauritania	1349
40)	Melilla	1359
41)	Morocco	612, 657, 702, 711, 774, 819, 936, 999, 1026, 1044, 1080, 1188, 1197, 1233,
	"	1325

42)	Mozambique	872
43)	Nevis	895
44)	Niger	1125
45)	Nigeria	909, 918, 1170, 1395
46)	Portugal	594, 630, 666, 720, 783, 828, 963, 981, 1035, 1062, 1170, 1251, 1332, 1377
47)	Puerto Rico	1480
48)	Saudi Arabia	1440, 1521
49)	Senegal	765, 1222.4, 1287, 1335.8
50)	Spain	531, 576, 585, 603, 639, 657, 684, 702, 729, 747, 774, 792, 801, 810, 837,
	"	855, 900, 918, 954, 972, 990, 1008, 1017, 1026, 1044, 1053, 1107, 1116,
	"	1134, 1152, 1179a, 1224, 1260, 1296, 1305, 1314, 1395, 1413, 1458, 1484.9,
	"	1521, 1538.8, 1575, 1584, 1602
51)	Spanish Morocco	990, 1355
52)	St. Kitts	825
53)	St. Lucia	660
54)	St. Pierre & Miq.	1375
55)	St. Vincent	705
56)	Sudan	1296
57)	Togo	1394
58)	Trinidad	610, 730
59)	Turks & Caicos	1570
60)	Uruguay	850
61)	USA	660, 680, 770, 850, 880, 1010, 1030, 1050, 1130, 1260, 1280, 1510, 1560,
	"	1600
62)	USSR (Kal.)	1386
63)	Vatican	1530
64)	Venezuela	640, 750, 860, 880, 970, 1020, 1170, 1200, 1210, 1290, 1470, 1490, 1520,
	"	1540
65)	Zambia	818

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unID TA: 558, 567, 656, 657, 746, 756, 782, 801, 818, 909, 990, 1106, 1125, 1160, 1169, 1170, 1232, 1286, 1295, 1305, 1331, 1422, 1458.2, 1602
unID South Americans: 720, 850, 1030

NOTE: Many northern Europeans that are normally heard well were blanked by auroral conditions. These include stations from Belgium (1512), Czechoslovakia (1521), Holland (747), Ireland (567/612), Norway (1314), Poland (1503), Sweden (1179), Switzerland (1566), and Yugoslavia (1125/1134/1143). If an opening had materialized in that direction, the country count could have easily gone beyond 80.

A catalogue of article reprints covering this DXpedition and other international MW DX may be obtained for $1.00 from either of the following:

NRC Publications
P.O. Box 164
Mannsville, NY
13661-0164

and/or

IRCA Reprints
c/o Steve Ratzlaff
295 Pettis
Mountain View, CA
94041

AT RIGHT: DXers Jean Burnell, Neil Kazaross and Mark Connelly, from left to right.

SWBC TRANSMITTER SITES
WESTERN HEMISPHERE
FT Staff

The following database of SWBC transmitter sites in the Western Hemisphere is intended to complete the database published in Fin Tuning's Proceedings 1991. The following is, by far, the most complete listing of Latin American transmitter sites ever published. It was compiled by John Bryant and Don Moore who referred, primarily, to detailed maps published in the countries in question. You will note a format change from the Eastern Hemisphere database. To save precious space, we have eliminated the cross referencing between the modern name of the country, and the names used in the NASWA and EDXC Radio Country lists. We felt this change was appropriate since there are very few differences in nomenclature among the three lists. Please also note the discussion of sites not yet found which follows the South American list.

N*O*R*T*H A*M*E*R*I*C*A

ALASKA

Anchor Point	59.75	151.75

CANADA

Calgary	51.05	114.08
Halifax	49.66	63.62
Montrea	45.52	73.58
Sackville	45.90	64.33
Toronto	43.65	79.35
Vancouver	49.26	123.11

GREENLAND

Nuuk/Godthab	64.16	51.75

USA

Bethany	39.34	84.34
Bethel	40.50	76.30
Cypress Creek	32.68	87.02
Dallas	33.22	96.88
Delano	35.75	119.27
Dixon	38.35	121.75
Greenville	35.60	77.40
Miami	25.77	80.16
Nashville	36.15	86.78
New Orleans	29.85	90.11
Noblesville	40.01	85.95
Okeechobee	27.45	80.93
Rancho Simi	34.25	118.65
Red Lion	39.90	76.60
Redwood City	37.83	120.22
Salt Lake City	40.75	111.90
Scotts Corners	45.12	68.58

C*E*N*T*R*A*L AND C*A*R*I*B*B*E*A*N A*M*E*R*I*C*A

BELIZE

Belmopan	17.25	88.73

COSTA RICA

Alajuela	9.95	84.21
Cahuita	9.80	82.80
Cartago	9.83	83.88
Ciudad Colon	9.89	84.23
Irazu	9.92	83.95
Puerto Limon	10.00	83.04
Puntarenas	9.97	84.85
San Jose	9.90	84.08
San Pedro	9.90	84.05

CUBA

Habana	23.15	82.30

DOMINICAN REPUBLIC

Santiago	19.50	71.10
Santo Domingo	18.50	69.90

GRENADA

St. George's	12.01	61.75

GUATEMALA

Barillas	15.77	91.31
Cabrican	15.06	91.68
Chiquimula	14.79	89.55
Coban	15.47	90.31
Guatemala City	14.61	90.51
Jocotan,Chiquimula	14.80	89.39
Las Casas	15.41	90.43
Nahuala	14.81	91.32
San Sebastian	15.38	91.63
Santiago Atitlan	14.65	91.22

HAITI

Cap Haitien	19.75	72.20

HONDURAS

Comayagua	14.40	87.59
La Ceiba	15.76	86.80
La Entrada	15.09	88.75
Puerto Lempira	15.22	83.75
San Luis	15.16	88.45
Santa Barbara	14.85	88.24
Tegucigalpa	14.09	87.22

MEXICO

Ciudad Mante	22.71	98.91
Hermosillo	29.00	111.00
Linares	24.83	99.55
Merida	21.00	89.70
Mexico City	19.40	99.16
San Luis de Potosi	22.10	100.90
Veracruz	32.37	115.08

NETHERLANDS ANTILLES

Bonaire	12.16	68.48

NICARAGUA

Bluefields	12.00	83.72
Managua	12.17	86.28
Puerto Cabezas	14.10	83.45

S*O*U*T*H A*M*E*R*I*C*A

ARGENTINA

Buenos Aires	-34.57	58.43
Malargue	-35.45	69.56
Mendoza	-32.85	68.79
Rio Gallegos	-51.61	69.22
Viedma	-40.77	63.00

BOLIVIA

Bermejo	-31.58	67.63
Camargo	-20.63	65.23
Camiri	-20.06	63.49
Catavi	-18.10	66.50
Chocaya	-20.90	66.50
Cobija	-11.03	68.71
Cochabamba	-17.39	66.16
Guanay	-15.45	67.83
Guayaramerin	-10.77	65.37
Huanuni	-18.26	66.81
La Paz	-16.50	68.16
Llica	-19.83	68.27
Monteagudo	-19.79	63.98
Montero	-17.32	63.25
Oruro	-17.98	67.16
Padilla	-19.31	64.32
Potosi	-19.56	65.75
Pulacayo	-20.40	66.65
Quime	-17.04	67.25
Reyes	-14.31	67.37
Riberalta	-10.98	66.09
Rurrenabaque	-14.47	67.55
Samiapata	-18.10	63.90
San Borja	-14.79	66.81
San Ignacio de Mox	-14.90	65.55
San Ignacio de Vela	-16.40	60.95
San Jose de Chiquit	-17.82	60.78
San Jose, Oruro	-17.98	67.16

BOLIVIA (con't)

San Ramon de La	-23.14	64.32
Santa Ana de Yacu	-13.80	65.50
Santa Cruz	-17.79	63.17
Santa Rosa De Yac	-14.20	66.80
Siglo Veinte	-18.10	66.50
Sucre	-19.04	65.28
Tarabuco	-19.10	64.90
Tarija	-21.51	64.75
Tazna	-20.90	66.50
Trinidad	-14.80	64.80
Tupiza	-21.43	65.65
Uyuni	-20.47	66.80
Villa Tunari	-16.88	65.40
Villamontes	-21.25	63.50
Yacuiba	-22.03	63.75

BRAZIL

Altamira	-3.18	52.18
Anapolis	-16.32	48.97
Aparecida	-22.80	45.24
Aquidauana	-20.50	55.79
Araguaia	-7.20	48.10
Araraquara	-22.00	48.00
Barra do Garcas	-16.00	52.40
Belem	-1.42	48.47
Belo Horizonte	-19.88	43.89
Benjamin Constant	-4.34	70.04
Boa Vista	2.60	60.50
Borborema	-21.60	49.10
Braganca	-1.05	46.73
Brasilia	-15.77	47.88
Caceres	-16.07	57.65
Cachoeira Pauli	-22.64	45.02
Campinas	-22.87	47.08
Campo Grande	-20.43	54.59

BRAZIL (con't)

Campos	-21.75	41.29
Coari	-4.08	63.15
Congonhas	-23.61	43.61
Corumba	-19.02	57.63
Crato	-7.24	39.37
Cruzeiro do Sul	-7.50	72.50
Cuiaba	-15.56	56.08
Curitiba	-25.40	49.25
Descalvado, SP	-22.50	47.50
Dourados	-22.22	54.77
Fiera de Santana	-12.25	39.00
Florianopolis	-27.56	48.55
Fortaleza	-3.69	38.48
Foz do Iguacu	-25.55	54.56
Goiania	-16.64	49.26
Gov. Valadares	-18.81	41.89
Guajara Mirim	-10.77	65.35
Guarulhos	-23.45	46.53
Humaita	-7.51	63.04
Ibitinga	-21.72	48.79
Itacoatiara	-3.14	58.40
Jatai	-17.85	51.72
Limeira	-22.56	47.39
Lins	-21.64	49.72
Londrina	-23.37	51.16
Macapa	0.03	51.05
Manaus	-3.11	60.02
Marilia	-22.20	49.95
Natal	-5.90	35.00
Obidos	-1.88	55.51
Osasco	-23.53	46.76
Parana	-12.55	47.83
Parintins	-2.57	56.74
Petrolina	-9.45	40.50
Pocos de Caldas	-21.77	46.55
Porto Alegre	-30.07	51.18
Porto Velho, RO	-21.80	42.53
Presidente Prudente	-22.11	51.35
Ribeirao Preto	-21.17	47.77
Rio Branco	-9.96	67.77
Rio de Janeiro	-22.87	43.24
Rondonopolis	-17.47	54.61
Salvador	-12.98	38.51
Santarem	-2.41	54.67
Sao Gabriel da Cach	-0.01	67.00
Sao Luis	-2.51	44.26
Sao Paulo	-23.53	46.59
Sena Madureira	-9.07	68.64
Sorocaba	-23.49	47.43
Souza	-7.00	38.10
Taubate	-23.04	45.55
Tefe	-3.35	64.67
Teresina	-5.08	42.79
Vitoria	-20.20	40.20
Xapuri	-10.63	68.51

CHILE

Calama	-22.48	68.89
Concepcion	-36.80	73.04
Coyhaique	-44.70	71.98
Santiago	-33.43	70.64
Temuco	-38.74	72.57

COLOMBIA

Arauca	7.08	70.72
Bogota	4.57	74.08
Bucaramanga	7.19	73.15
Cucuta	7.87	72.49
Florencia	1.57	75.57
Ibague	4.45	75.16
Medellin	6.25	75.56
Neiva	2.90	75.30
Puerto Asis	0.40	76.60
Puerto Carreno	6.10	67.75
Puerto Inirida	3.85	67.95
Quibdo	5.67	76.66
Samaniego	1.03	77.56
San Jose del Guaviare	8.87	64.16
Tumaco	1.79	78.76
Turbo	8.09	76.65
Valledupar	10.50	73.25
Villavicencio	4.16	73.59
Yopal	5.33	72.37

ECUADOR

Ambato	-1.25	78.62
Bahia de Caraquez	-0.57	80.40
Calceta	-0.81	80.17
Catacocha	-4.07	79.61
Cuenca	-2.85	78.96
El Coca	-0.45	76.95
Esmeraldas	0.96	79.67
Isla San Cristobal	-0.90	89.50
Lago Agrio	-0.30	77.00
Limon	1.15	79.10
Loja	-4.00	79.22
Macas	-2.31	78.11
Otavalo	0.24	78.26
Pifo	0.24	78.33
Puyo	-1.55	78.00
Quero	-1.50	78.51
Quevedo	-1.04	72.49
Quito	-0.22	78.50
Riobamba	-1.66	78.61
Saquisili	-0.81	78.64
Sto.Dom.de Los Colo	-0.22	79.18
Sucua	-2.47	78.17
Tena	-0.98	77.79

FALKLAND ISLANDS

Port Stanley	-51.67	57.81

FRENCH GWANA

Cayenne	-4.89	52.32
Montsinery	5.00	53.00

GUYANA

Georgetown	6.77	58.17

PARAGUAY

Asuncion	-26.26	57.64
Encarnacion	-27.32	55.87
Pedro Juan Caba	-22.56	55.58
Villarica	-25.75	56.41

PERU

Abancay	-13.56	72.72
Acari	-14.30	73.40
Andahuaylas	-13.64	73.34
Arequipa	-16.40	71.50
Atalaya	-10.80	73.90
Ayacucho	-13.10	74.18
Ayaviri	-14.81	70.56
Bagua	-5.64	78.47
Bambamarca	-6.65	78.53
Bambamarca	-6.75	78.30
Banos del Inca	-8.63	70.18
Bellavista	-7.02	76.53
Cailloma	-15.20	71.80
Cajabamba	-7.60	78.00
Cajamarca	-7.17	78.49
Callao	-12.07	77.16
Cangallo	-13.53	74.20
Caraz	-9.00	77.80
Celendin	-6.90	78.20
Cerro de Pasco	-10.65	76.26
Chachapoyas	-6.75	77.80
Chillia	-8.08	77.27
Chota	-6.53	78.63
Contumaza	-7.35	78.75
Cutervo	-6.35	78.81
Cuzco	-13.49	71.96
Huancabamba	-5.10	79.40
Huancavelica	-12.77	75.03
Huancayo	-12.07	75.24
Huanta	-12.89	74.25
Huanuco	-9.88	76.24
Huaraz	-9.51	77.51
Huayllay	-11.02	76.33
Iquitos	-3.73	73.25
Jaen	-5.67	78.76
Jepelacio	-6.11	76.95
Juanjui, San Martin	-7.10	76.70
Juliaca	-15.50	70.14
Junin	-11.17	76.20
La Merced	-11.05	75.31
La Oroya	-11.53	75.87
La Peca	-5.70	78.50
Lambayeque	-6.80	79.80
Lima	-12.05	77.05
Lircay	-13.00	74.95
Llapa	-7.00	78.90
Mendoza	-6.25	77.30
Merced	-37.22	120.47
Moyobamba	-6.05	56.96
Nuevo Progreso	-18.62	92.29
Oxampampa	-10.55	75.41
Oyon	-10.63	76.75
Pacasmayo	-7.50	79.70
Pampas	-12.39	75.87
Pandalle	-6.35	78.81
Piura	-5.20	80.60
Pucallpa	-8.37	74.53
Puerto Maldonado	-12.57	69.18
Puno	-15.80	70.04
Quillabamba	-12.79	72.69

PERU (con't)

Rioja	-6.08	77.16
Rodriguez de Mendo	-6.25	77.30
S.Pedro de Coris	-12.38	74.30
San Ignacio	-5.20	79.00
San Miguel	-7.00	78.90
San Pablo	-7.15	78.80
Santa Cruz	-6.67	78.95
Santa Rosa	-6.40	77.30
Santiago de Chuco	-8.10	78.10
Saposoa	-6.95	76.75
Satipo	-11.26	74.59
Sicuani	-14.26	71.22
Socota	-6.25	78.75
Soritor	-6.10	77.10
Sorochuco	-6.92	78.27
Tacna	-18.02	70.25
Tarapoto	-6.50	76.40
Tarma	-11.40	75.67
Tayabamba	-8.28	77.29
Tocache	-8.20	76.50
Trujillo	-8.11	79.04
Tuman, Chiclayo	-6.80	79.70
Uchiza	-8.49	76.37
Yurimaguas	-5.87	76.08

SURINAM

Paramaribo	5.80	55.17

URUGUAY

Artigas	-30.40	56.46
Las Piedras	-33.73	56.22
Montevideo	-34.85	56.18

VENEZUELA

Barcelona	10.15	64.68
Barinas	8.60	70.27
Barquisimeto	10.08	69.42
Caracas	10.50	66.89
Carora	10.18	70.08
Ciudad Bolivar	8.11	63.52
Cumana	10.50	64.22
El Tigre	8.88	64.81
Elorza	7.04	69.49
Maracaibo	10.64	71.59
Maturin	9.75	63.19
Merida	8.60	71.14
Ocumare del Tuy	10.00	66.90
San Antinio	7.84	72.33
San Cristobal	7.76	72.24
San Felipe	10.46	68.70
Santa Barbara	7.74	71.14
Tovar	8.32	71.76
Trujillo	9.35	70.47
Valencia	10.18	68.00
Valera	9.31	70.59
Villa de Cura	10.04	67.49

DXers of Latin America, Please Note:

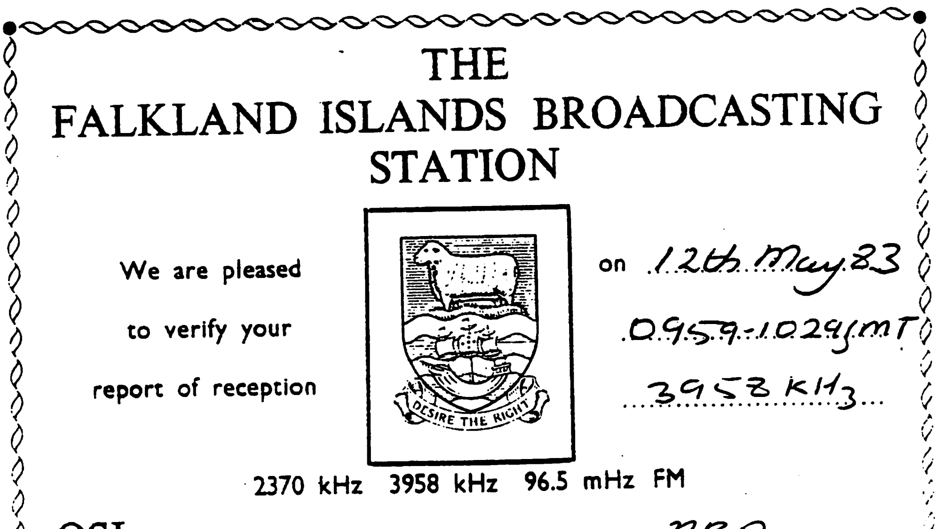
We have been unable to locate seven transmitter sites in South America. If you have QSLed any of these stations, please see if any of your information could help us tie down the exact location of these near mystery stations. Any clues would be warmly received. Please contact: John Bryant, RT. 5, Box 14, Stillwater, OK 74074, USA.

Bolivia: A miners union station was reported several years ago on 4808.9 at "Centro Miners"; "Radio Viloco" in Viloco has been reported for several years on 3340. We understand that Viloco is a mountain village fairly near La Poz and was the site of a major airline crash some years ago.

Brazil: "Radio Amarela" on 4775 and located in Rolim de Moura is listed as F.Pl in 1991 Tropical band Survey (TBS) and elsewhere. "Radio Transamazonica" is listed on 2410 in Senador Guiomard in TBS. We can locate neither site on our best Brazilian maps.

Peru: Three station sites are currently not found. A F.Pl. station "LaMerced in Barranca, Peru" was listed on 3205 in the Third Edition of Latin American Radio World. The same source lists" Nuevo Horizonte, Caramoriza, Caj, Peru" on 5719.9. Several sources have listed a Peruvian station at "Tongol" on 3752v. We can find no geographic references for Barranca, Caramoriza, Caj. or Tongol, Peru.

CX 44 QSL
EL ESPECTADOR
SORIANO 1287 2.° P. - MONTEVIDEO - URUGUAY


THE
FALKLAND ISLANDS BROADCASTING
STATION

We are pleased to verify your report of reception on 12th May 83 0959-1029GMT 3958 KHz

DESIRE THE RIGHT

2370 kHz 3958 kHz 96.5 mHz FM

QSL
No.... 219

BROADCAST SECRETARY

SHORTWAVE BROADCAST DXING
THE FOUNDATION YEARS
Jerry Berg

"IN THE BEGINNING . . ."

To explore the history of SWBC DXing in the 1930's is to enter the golden age of shortwave broadcasting. Because the 30's were so near in time to the very beginnings of broadcasting, and because radio was so different then, a little stage setting is in order.

Before 1912. We usually think of *broadcasting* as starting with KDKA in 1920. The history of *radio* goes back much farther, however. Although the landscape of radio's pre-1912 history is strewn with many now-obscure devices, like the spark gap transmitter, the coherer and decoherer, the audion and the variocoupler, radio's early days were as much a tale of entrepreneurship, corporate intrigue and personal egos as of technical advancements.

Companies came and went, along with patent battles, stock swindles and fierce personal and professional competition. The inventors and their wireless companies--the National Electric Signalling Company, the Marconi Company, the DeForest companies--were big players on the radio scene. In addition to vying for a competitive advantage, they were out to prove the usefulness and commercial viability of the new medium. Other important players were the U.S. Navy, the first major organization to try to integrate radio into its work, and the amateurs, or "experimenters," who were in the game for the fun of it and to see how far the technology could be pushed.

Things were pretty laissez faire back then, especially with the amateurs. You just chose a frequency and did your thing, which was usually sending code to other amateurs. It is hard to believe today that virtually all transmitting in the early days, by everyone and for all purposes, was in the area *below* 1500 kHz.--in what we think of as the long and medium wave bands. As a result, huge generators, large antennas and tremendous power were needed for long distance communication. The belief that long distance required long wavelengths, i.e. low frequencies, was one of the great scientific mistakes of radio's infancy.

1912-1919. The first major attempt to bring order to the radio spectrum was in 1912. Although there was still much argument over both the theory and usefulness of wireless, as a practical matter a high level of interference had developed, and it was getting worse. Ship-to-shore contact was one of radio's major early uses, and shipboard safety an important issue. The cavalier attitude toward wireless on some vessels, including several which could have stemmed the loss of life on the Titanic, plus the interference, rumors and misleading messages that filled the air from unknown sources during that event (the amateurs were suspected), engaged the public's interest and galvanized the government to action.

Despite anti-regulatory lobbying by the wireless companies and the amateurs, both of whom were still relatively disorganized and ineffectual, Congress enacted the Radio Act of 1912. For the first time, wavelengths were apportioned to particular services, a radical step at a time of minimalist government and free enterprise spirit.

Although the act was mainly maritime in nature, one of its most important provisions was to deny amateurs their freedom to roam. They were relegated to the range below 200 meters, bands that were largely unknown and thought to be of little value. The navy attributed most interference to the amateurs and was happy to see them on the road to a hoped for extinction. From the amateurs' viewpoint, their subsequent development of the shortwave spectrum was less a love affair than a shotgun marriage, at least in the beginning.

In the years between 1912 and 1920, radio technology was monopolized by the military and the big corporations. There was huge growth in the amateur ranks as well, with the number of licensed amateurs growing from 322 in 1913 to 10,279 in 1916. Around this time the government published the first amateur call book, revealing to the experimenters for the first time their actual numbers. Other publishing efforts began as well. The American Marconi Company commenced publication of *Wireless Age* in 1913, and in 1915 the ARRL was formed and began publishing *QST*.

Spark transmitters were the standard prior to World War I, but they were unsuitable for voice transmission. It was the development of transmitting tubes and amplitude modulation which permitted broadcasting as we know it. More and more amateurs were supplementing code with voice, along with occasional impromptu music broadcasting. The major radio interests considered these low level "entertainment" transmissions frivolous, but they persisted until 1917 when the amateur stations were closed down for the duration of World War I, not to reopen until September 1919. Many amateurs answered the wartime call for skilled radio operators.

1920 and after. Spark gap transmitters faded into history after the war. Amateurs who were able to get their hands on the new (and expensive) transmitting tubes resumed talking over the air and playing a bit of music as well. One of the most famous of the amateurs was Frank Conrad, a Westinghouse engineer who had been an amateur operator before the war. When he resumed his amateur activities, he talked to other amateurs and played records over his station, 8XK (the "W" and "K" prefixes were largely ignored in those days). He also broadcast concerts, including some live performances.

In September 1920, in order to boost sales of electronic gear, the Joseph Horne Department Store in Pittsburgh ran an ad, informing the public that radio sets capable of receiving Frank Conrad's programs were available for $10. Westinghouse was the first to perceive a potential market that went beyond merely the technically inclined. They authorized Conrad to build a more powerful "broadcasting" station right at the Westinghouse plant. This was KDKA, generally recognized as the first non-experimental broadcaster. On November 2, 1920, KDKA made history by being the first radio station to carry the results of a presidential election (that of Warren G. Harding).

The "radiotelephony" (broadcasting) boom was on. As of March 23, 1922 there were 98 licensed BCB stations. Among the station owners were newspapers, churches, department stores, municipalities, manufacturers, radio shops, colleges and the Y.M.C.A.[1] By August the number had grown to 253[2], and by October it had leaped to 502[3]. The Department of Commerce, which was in charge of licensing, was receiving three or four applications a day.

The programming of the time was pretty basic:

"Most of [the stations] commence broadcasting at 11:00 A.M., play one or two selections on the Victrola, and possibly give a weather forecast. At noon the time signals from the Navy Station at Arlington are received and relayed by some of the radiophone stations so that the radio audience may correct their time pieces. At one o'clock some general news is sent out and more selections of music. Each hour, thereafter, a brief program is sent out. In the evening speeches by well known men and women are made on various topics, and musical concerts of one or two hours duration broadcasted. The music is provided by artists of the opera and stage. Vocal and instrumental music is enjoyed nights by thousands."[4]

You didn't need digital readout because all broadcasting stations operated on one of two wavelengths. The main channel was 360 meters (833 kHz.), used for news, lectures and entertainment. A second channel, 485 meters (619 kHz.), was used for government sponsored market and weather reports. Some stations used both. Channels were referred to by their wavelength, i.e. in meters, not kilocycles.

A listener described the QRM on 360 meters:

"In regard to the broadcasting wavelengths, cannot something be done? Monday night, April 3 [1922], I invited a few friends to listen to KDKA, but we didn't. I just got him nicely tuned in, and in came WWJ, and in a few minutes along came KYW, and I could not tune them out because they were all on 360 meters. . . . Why can't the different broadcasting stations split up on a five meter difference?"[5]

The problem was partially addressed in August 1922 when a special "Class B" license was authorized for "super" broadcasters, the larger, well established stations that could meet more stringent technical requirements and that featured "high class entertainment" ("mechanical music" was forbidden).[6] Class B stations were moved to 400 meters (750 kHz).

The interference wasn't eliminated, however. Within a few months, congestion developed on 400 meters in the large population centers, and time sharing was instituted. In May 1923, after the navy agreed to free some of its frequencies, a broadcast band extending from 550 to 1350 kHz. was established, with stations classified according to power, frequency and type of programming.

The authority of the Secretary of Commerce to allocate frequencies, a discretionary power he had assumed since 1912, was successfully challenged in court by WJAZ in 1926 and resulted in a temporary moratorium of station licensing and a general free for all. Stations took to the air without benefit of license and changed frequency at will. These were the first pirates. The chaos came to an end with the passage of the Radio Act of 1927, which, among other things, established a Federal Radio Commission to allocate frequencies. By this time there were over 700 stations in operation and another 200 under construction.

WHAT IT WAS LIKE

Understanding the broadcast band activity of the day is necessary because the roots of shortwave DXing are firmly planted in the world of medium wave. Shortwave DXing developed from BCB DXing as the properties of the shortwave spectrum were discovered.

Indeed, before anyone had thought of the term "SWL," the phrase "BCL," for "broadcast listener," was in wide use. It deserved its own acronym because, at first, the use of radio for *broadcasting*--transmitting news, entertainment and the like--was considered a novelty. Until KDKA, radio was thought of mainly in point-to-point terms: a particular transmitter sending to a particular receiver for a specific purpose. The notion that someone might want to transmit generally into the ether for whoever might be listening was a concept that developed only after 1920. And it was not without its critics. Phonograph and theater interests were vigorous opponents of entertainment broadcasting, fearful that the new medium would displace their share of the market (just as the entertainment industry recently opposed digital recording).[7]

Many ordinary people spent a lot of time tuning the standard broadcast band, trying to see how far their receivers could pick up. What we would call "DXers" were referred to quaintly as "fans." Serious DXers were "DX fiends" or "DX hounds." Long distance reception was news even in the non-radio press. From *Scribner's Magazine*, 1923:

"One of our visitors remarked that it is about as much fun hearing the announcements, and thereby finding where you are among the red spots on the map as it is listening to programmes. And it is even so. This fishing in the far away with the radio hook and line is rare sport. The line is long, the fishing is getting better all the time, and it usually does not take many minutes to find out what you have on the hook."[8]

The distinction between program listening and DXing was already being drawn. As one commentator put it: "Some day, perhaps, I shall take an interest in radio programs. But at my present stage they are merely the tedium between call letters."[9]

There were some amazing demonstrations of medium wave DXing prowess in the 1920's. One was by E. H. Scott, founder of the world famous receiver line of the same name. Scott's success in DXing North American medium wave stations from New Zealand in 1925 using his homemade "World's Record Super 9" superhet receiver was what got the company started. Around the same time, Jack Moskovita of San Pedro, California had confirmed loggings of 287 stations, 66 of them outside the United States. His best DX was a 140-watt Australian, and he had regular reception from Japan and Australia.

Ollie Ross of Vallejo, California was probably the world's champion BCB DXer in 1931, boasting 1,309 stations logged, many of them in foreign countries. He claimed to have DXed over four years from 36 states, sometimes listening 22 hours a day. Commenting on the questioning of such claims by some readers, a *RADEX* editor observed: "At first I, too, felt some skepticism about the Vallejo log, as I could not find enough stations to accord with it, but the great mass of verification reports convinced me. . . . Mr. Ross has just forwarded to me another large consignment of astonishing, even bewildering, verification reports. They are in all sorts of foreign languages . . . ."[10] Doubting the veracity of others' reports was a fairly frequent occurrence on the early BCB DX scene.

An example of how different broadcasting was then is an event that is almost beyond comprehension today: the international radio broadcast tests, which were held annually from 1923 through 1926. During these tests, nearly all U.S. BCB stations closed down at an agreed upon hour each night for a week in order to give U.S. DXers a better chance to log foreign medium wave stations. Although the results seem not to have matched the level of pre-test promotion, that nearly the entire broadcasting industry would cooperate in such a venture is a measure of the seriousness that was attached to long distance radio listening.

The equipment environment for the BCL was, of course, very different from what we are familiar with today. Prior to the appearance of the superheterodyne receiver in the mid to late 1920's, radios were of the regenerative type. Called "bloopers," they often generated oscillations so loud as to interfere with reception on other receivers in the neighborhood. Then came the tuned radio frequency (T.R.F.) set, the more stable neutrodyne, and finally the superhet.

There was a fascination with circuitry. The literature was filled with endless versions of receiver "hook ups" bearing colorful names: the Globe Trotter, the Pentode Four ("four" being the number of tubes), the Explorer Eight, the Periphone Master, the Universal Two, the Professional Nine, the Triplex Two, the Candy Box Special, the Wyeth All-Wave Six, the DX Super, and on and on. Each variation was heralded as important for one reason or another, all part of the search for the little things that would make a difference.

Most early receivers were homemade, either from a kit or from a circuit diagram taken from a magazine and constructed with parts bought separately. They were battery operated and built on a wooden base, hence the term "breadboard." The earliest sets had the wiring on the underside of the board. During the radio boom there were 30,000 dealers in the country handling radio equipment, with countless advertisements promoting all manner of radio parts companies, each promising more than its competitors.[11] Many radio aficionados became custom set builders, making radios for others on a full-time or part-time basis.

THE ARRIVAL OF SHORTWAVE

Marconi had done some experimenting with shortwave spark transmitters as early as 1901. These transmitters operated around a frequency of 2.5 MHz. (considered a "high" frequency at the time), and were intended only as an alternative means of *short* range transmission. The distance potential of shortwave was not suspected until around 1920, and it took several more years of experimenting before shortwave propagation at various times and frequencies, along with the directionality of shortwave, started to be understood.

Once this occurred, however, a surprising amount of experimental shortwave broadcasting developed in America. Although it would be many years before the United States would be a major international shortwave broadcaster, it was the pioneer of the medium. Just as KDKA was first on the broadcast band, so it was also first in shortwave broadcasting. In 1920, Frank Conrad began experimental shortwave transmissions from his home in Pittsburgh on 2 MHz. using the call 8XS. He started keeping a more or less regular schedule, relaying KDKA on wavelengths as high as 60 meters. This led to the construction by Westinghouse of station KFKX in Hastings, Nebraska, whose purpose was to pick up the KDKA shortwave signal transmitted by 8XS on 3.2 MHz. and relay it on medium wave, for local use, and on shortwave, for rebroadcast by west coast medium wave station KGO. KFKX started operation in 1923, marking another chapter in the on again, off again story of "national" broadcasting in the United States. The KDKA shortwave signals were also picked up and rebroadcast by medium wave stations in England and South Africa.[12] 8XS eventually became W8XK. (The 8XS callsign was returned to the government, and Frank Conrad transferred his historic "amateur" call of 8XK to Westinghouse for their future shortwave broadcasting efforts. The "W" was added later.)

Other U.S. stations followed suit. In 1924, General Electric began shortwave relays of WGY by way of shortwave transmitters W2XAF and W2XAD at its Schenectady plant. The same year, The Crosley Corporation obtained a license to relay the BCB programming of WLW over its shortwave transmitter, W8XAL (later WLWO). In 1925, RCA and NBC joined forces to relay WJZ by way of a 50 kw. shortwave transmitter in Bound Brook, New Jersey. CBS carried WABC programming over shortwave station W2XE in Wayne, New Jersey beginning in 1928.

Overseas, the startup year was 1927, with both PCJ, Eindhoven, the Netherlands, and 5SW, Chelmsford, England coming on the air on the still-familiar frequencies of 9590 and 11750 kHz. respectively. TI4NRH in Costa Rica began broadcasting the following year.[13] In April 1928, increased interest in shortwave led *Radio News* to begin "On the Short Wave," which was one of the first, if not *the* first, shortwave broadcast column in a mass circulation publication. It lasted about a year.

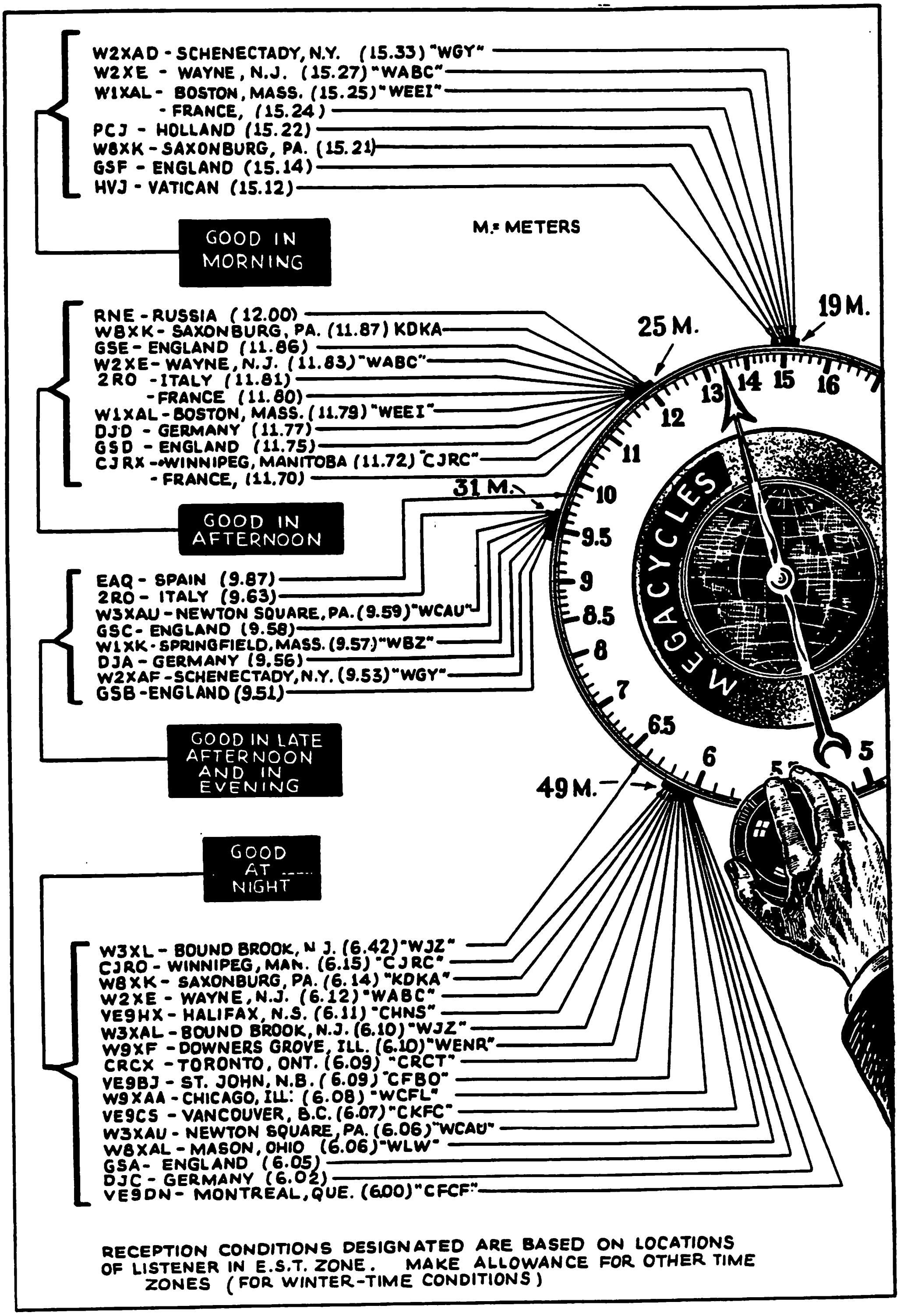
Shortwave broadcasts remained experimental partly because there were few shortwave receivers available. The first A.C. radios appeared in the late 1920's and usually covered only the broadcast band. These receivers were much more sensitive than the earlier, battery designs, but they were also vulnerable to heavy line noise interference, especially on shortwave. Thus early shortwave fans usually had to be content with battery operation.

Shortwave first became available to the general public by way of AM radio converters. These were not satisfactory, however, and special shortwave receivers soon began appearing. A 1931 article in the Pilot Radio and Tube Corp. house journal, *Radio Design,* explained the problems of shortwave receiver development in those days.

"Short-wave broadcasting, as distinctly distinguished from amateur short-wave telegraphy, began attracting the interest of radio experimenters about two years ago, and quickly developed into an indoor sport of considerable proportions. It lured back to the radio fold many former DX fans of the 1920-1925 period who had dropped out of the "game" because chain broadcasting and high power had robbed it of its early glamor. The mere possibility of hearing voice and music from Europe and the Antipodes revived the old fever, and soon thousands were hanging breathlessly on vernier dials, swearing at the fading and the interference, and enjoying themselves thoroughly.

"At first these people were satisfied with "junk box" receivers operating on batteries and possessing hand capacity and many of the other troubles associated with elementary regenerative sets. However, they had been spoiled by the efficient all-electric broadcast receivers already on the market, and they began to demand comfort with their thrills. In an effort to fill their needs, radio engineers spent some effort on the receiver problem, and in quick succession there appeared a series of improved sets. First, the simple regenerative tuner took on an untuned screen-grid R.F. stage and a little shielding. Then a tuned screen-grid job with double shielding made

Where the Stations Appear on Your Dial



its commercial appearance. Batteries still remained a nuisance to those people who had outgrown the spilling-acid-on-the-rug stage, but A.C. short-wave operation, when successful at all, was usually a laboratory accomplishment and therefore unfit for the public. Finally David Grimes and John Geloso, Pilot engineers, discovered the source of the mysterious tunable hums that caused so much trouble, wiped them out with a few simple expedients, and produced the A.C. Super-Wasp, the first completely A.C. operated short-wave receiver on the market. Brought out in September, 1929, this set has enjoyed a phenomenal sale throughout the world, its popularity strengthening its sponsor's conviction that the short-wave fan was maturing and that his ranks were being increased by new converts who were never fans before but who were adopting the short-wave hobby because it was interesting.

"There was still one feature of short-wave operation that caused concern, and that was the matter of plug-in coils. The early receivers used a maximum of three coils, which could be inserted and removed without much trouble because the sets were wide open. However, as the benefits of shielding became evident and the number of coils per set rose to as high as ten (five pairs to cover a range from 15 to 500 meters), the coils themselves became a nuisance. Getting them in and out of necessarily tight shield cans was an operation that tested the temper and bruised the knuckles, and left the set owner in no mood to make delicate adjustments on hair trigger dials. "[14]

The article went on to explain how these problems had been solved with Pilot's new Universal Super-Wasp A.C. shortwave receiver, one of the first commercial shortwave sets on the market and a classic among today's antique radio collectors.

Shortwave got an important boost in the early 1930's with the introduction of "all wave" A.C. sets. These receivers permitted tuning either BCB or shortwave without changing coils, and were a major technological breakthrough. Today, with shortwave broadcasting largely unknown to the general public, it is hard to believe that Hugo Gernsback was correct in 1938 when he said that "practically all radio sets that you may purchase in the open market are built for broadcast and short wave reception."[15] This is borne out by the numbers, however. In 1933-34, 66% of the new receivers sold had a shortwave capability. By 1936, almost 100% of the new, large model radios and 65% of the table models were able to receive shortwave.[16]

From the start, shortwave reception had been a natural byproduct of the exploration of the new wavelengths below 200 meters. Those who engaged in it were experimenters at heart, and the early development of shortwave radio reception was sustained by them. However, with the rapid advances in receiver design of the 1930's, which included improved selectivity, better sensitivity, easier tuning, enhanced fidelity, etc., shortwave reception became less an experimental marvel and more an ordinary fact of life.

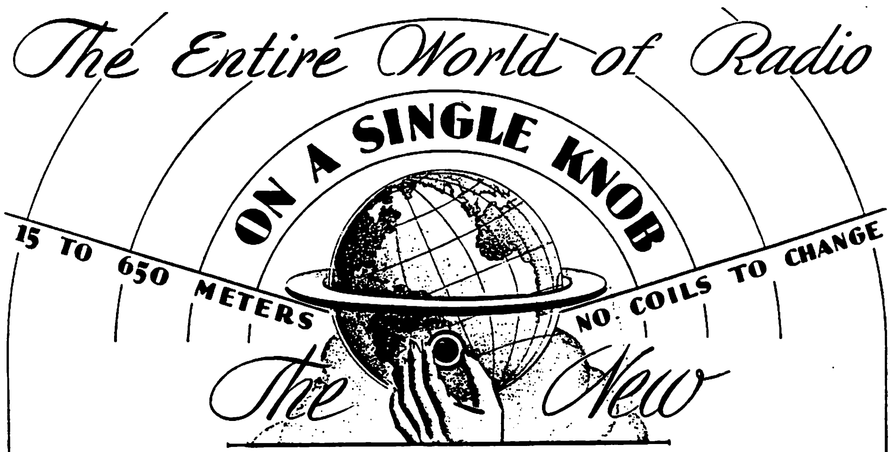
The potential for shortwave as an information and entertainment medium was widely touted, and the public's interest in it grew. Shortwaves were the "thrill bands." Magazines devoted exclusively to shortwave listening could be found on the newsstands, along with others that offered shortwave news in smaller doses. New York's "Radio Row," the most famous radio shopping center in the world, went shortwave. "The windows are full of the latest short-wave and all-wave receivers and the sidewalks during lunch hour and on Saturday afternoons are again crowded with little knots of fans who discuss their international DX accomplishments and swap circuit 'dope,' station verifications, etc."[17]

As early as 1928, Gernsback was predicting that shortwave would completely replace regular BCB broadcasting. In 1933 he spoke of a DX renaissance:

*"When people were building their own sets, in the early '20's, the favorite pastime was a one-tube set with which you could listen to stations hundreds of miles away. People used to sit up all night trying to get the distant stations. Then, at the end of the '20's, the DX interest lagged somewhat, and by 1930 it seemed to have completely died down, except for a few professionals who kept at it with unabated vigor. * * * [O]nce again editors of radio publications are beginning to be flooded with DX accomplishments which, this time, are of no mean order. A few hundred paltry miles are no longer of any interest. Your present DX listeners, and I am now speaking of broadcast listeners only, are going out for REAL distance. Listening from one end of the country to the other means nothing. * * * On the short waves, DX listening is, of course, commonplace; because a good two-tube set will bring in stations from the maximum distance on this planet, i.e., 12,500 miles; and these records are so common that every schoolboy in the United States today who owns a short-wave set thinks nothing of listening to stations in Australia and other parts of the world.* "[18]

Despite the initial enthusiasm, however, widespread interest in shortwave as a popular radio medium could not be sustained. Among the non-technical general public it fell victim to the massive growth of high power and high quality BCB broadcasting. Who could be bothered with shortwave? It could not provide the reliability, fidelity and ease of tuning that people were demanding (and getting used to) on the broadcast band. American

Pilot Achieves Radio's Greatest Sensation!



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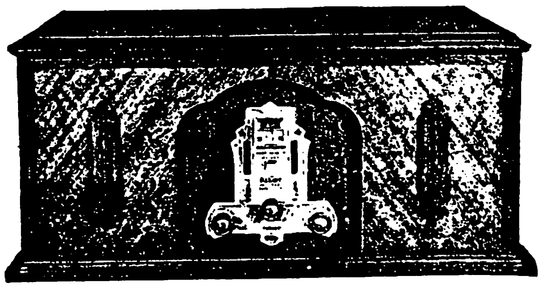

Pilot's wonderful wave band changing switch, incorporated in the new Universal Super-Wasp, revolutionizes the short wave art. No longer need numerous coils be changed to cover the various wave bands. No longer need dial settings change each time the same distant stations are tuned in. You can log permanently all the stations you can get throughout the world, you can tune from the short waves to the high ship waves without removing your hand from the single control knob.

Universal Features Revolutionizing the Short Wave Art

Complete coverage all wave bands from 15 to 650 meters *without coil changing*. Complete A.C. operated *chassis in cabinet*. (Also available in battery model) . . . All *Metal* Chassis . . . Highly sensitive and selective circuit . . . Screen Grid TRF amplifier *plus* Screen Grid *Detector* . . . 227 First Audio Stage . . . Two 245's in push-pull output stage . . . Stations can be logged *permanently on dial* . . . Regeneration control does not alter tuning . . . Provision for *Phonograph Pick-up* . . . Earphone Jack on *Front Panel* . . . Illuminated Dials . . . Handsome Walnut Cabinet . . . Most advanced construction yet used for short wave work . . . In kit form for easy home assembly; no drilling or cutting, all parts fully prepared.

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OFFICES IN PRINCIPAL COUNTRIES OF THE WORLD ethnocentrism in matters of news and information probably played a part too. Who really cared what was going on in all those foreign places anyway?

In addition, American shortwave stations were discovering what some of their modern counterparts are rediscovering--that it isn't easy to make shortwave pay. This was particularly true in the early days when, at various times, the government either greatly restricted or completely forbade commercial advertising on U.S. shortwave. By the time Uncle Sam took over shortwave broadcasting in November 1942, most of the private American shortwave broadcasters were glad to give it up.

The 1930's were indeed the golden age of shortwave broadcasting. It was a time of development of both the medium and the hobby. There were also lots of shortwave sideshows in the 30's. The world was not as small as it is today, and shortwave found a special niche in speeding the reporting of events. The Pilot company was there when the Graf Zeppelin arrived in 1929, providing live transmissions to WOR, and shortwave helped speed news of the verdict in the Lindbergh kidnapping trial.

Shortwave also facilitated communication with people in remote areas. Maintaining radio contact with the Byrd Antarctic expedition was big news. Pilot promoted the fact that its equipment was on both the Byrd expedition and the 1929 Dickey Orinoco expedition to the Venezuelan interior. Radio provided contact with excursions to other far away places, like the MacGregor Arctic Expedition and the round-the-world jaunt of the windjammer Seth Parker. Shortwave's role in speeding police or physician response in emergencies was also emphasized, and *Short Wave Craft* magazine even theorized that Amelia Earhart might have survived had she had different radio gear aboard her plane.

The Byrd expedition was the subject of frequent comment.

*"The Byrd 'mailbag,' as it has come to be known, is broadcast regularly to Little America through the facilities of [G.E.] short-wave station W2XAF at Schenectady, N.Y. . . . Practical advice on various matters has become more the rule of late, crowding out the more routine comments on the weather and the penguins which predominated in early letters. Some time ago, when a member of the airplane crew was injured in a fall, W2XAF broadcast a prescribed treatment from a chiropractor on the Pacific Coast. Only recently, when it was made known that Admiral Byrd's flapjacks were sticking in the pan, seasoned advice on what to do about it was forthcoming from a number of housewives. . . . * * * Birthdays are the occasion for a flood of messages from relatives and friends and the broadcast takes on the semblance of a party. . . . * * * The most striking feature of the short-wave broadcasts to date has been the practically perfect reception of the messages reported by the expedition. The listeners, totally enclosed by the Antarctic night, say that the voice of the broadcaster comes through as clearly as if it were in the next room."*[19]

Shortwave radio not only covered the news--sometimes it was the news. How the natives responded to seeing radio for the first time during the Terry-Holden expedition into the Amazon jungles of British Guiana, and the role of radio in the 1931 "Trader Horn" movie making expedition in Kenya, were events that were described with relish. Pilot even staged a special international goodwill flight of its "flying radio laboratory" to South America, and promoted it widely.

It was in news and entertainment that shortwave broadcasting, with its ability to instantly put us in touch with other peoples and cultures, was expected to excel. These were the days before prepackaged, international entertainment and live, worldwide TV news. The gulf between peoples was wide, and it was natural that shortwave should try to bridge it. How successfully this was done is open to question, but more than a little news about the artists and entertainment on particular shortwave stations could be found. The bi-monthly *Official Short Wave Listener Magazine* gave prominence to shortwave programming, and some publications, like the national AM radio weekly, *Radio Guide*, had a special page describing the programs to be heard on international shortwave during the coming week.

THE STATIONS OF THE 30's

In 1985, Canadian DXer Tom Williamson reminisced about what it was like listening to shortwave in England 50 years earlier.

*". . . [I]t is very difficult to imagine what a thrill it was all those years ago to 'hear America.' Even on shortwave . . . it was not a regular daily event to tune in the U.S.A., and even the radio hams of that time used to refer to 'getting across the pond' when they made Transatlantic contacts. . . . * * * The usual Europeans were heard, as in modern times, including Radio Moscow. Switzerland was heard on various channels with call signs like HBJ, HBQ and HBO, and the slogan 'Radio Nations' (it was the site of the League of Nations). France was one of my favorite sources of jazz music, but mainly on AM from Radio Paris. Each Saturday we could tune in to a period of musical history in the form of the 'Hot Club de France,' which featured a session of toe tapping hot*

rhythms from the immortal Stephane Grappelli (still playing that fabulous violin in the U.S. today), and Django Reinhardt and others. They really set the air waves jumping.

"From the good old U.S.A. we had the era of big band swing. My generation was brought up on this, and I well remember the orchestras of Artie Shaw, Glenn Miller, Benny Goodman and others. 'Swing And Sway With Sammy Kaye' was a favorite, heard over W3XAU, Philadelphia. Many happy 'small hours' were spent listening to W4XB. 'By the palm fringed shores of blue Biscayne Bay in tropical America' was their slogan, and they had 5 kw. output on 6040 kHz. Operated by the Isle of Dreams Broadcasting Co., they relayed WIOD, Miami, still on the air on 610 kHz. . . . . From the northern region, familiar voices were VONG, St. Johns, Newfoundland, then not yet part of Canada, and the amazing, low power CHNX, Halifax, Nova Scotia, still using only 500 watts on the same old frequency of 6130 kHz."[20]

Europe. Europe was the home of many of the biggest international broadcasters. The BBC transmitter site at Daventry had eight transmitters and 18 antennas, and would remain in service until its eventual close on March 29, 1992. Two frequencies were used on each of five beams, some of them still familiar BBC channels, e.g. 15260 (GSI), 11750 (GSD) and 9510 (GSB). (In the early days of shortwave, individual transmitters were often assigned their own call letters.) The World Service was known as the Empire Service back then.

From Holland, Eddy Startz was already the principle host on "The Happy Station" program over PCJ, the historic Philips station at Eindhoven. PCJ programs were intended mainly for the Dutch East and West Indies, but they were heard worldwide. "Shortwave signal magnificent," read a telegram from Bandung.

The main Axis station was Deutscher Kurzwellensender, Zeesen, Germany, which also used two frequencies in parallel and boasted four transmitters. With calls like DJD, DJN and DJQ, it was the first station to have a highly developed directional antenna system. One listener noted: "[W]e've danced here several times to music from DJD. They broadcast a German orchestra one evening playing 'Stormy Weather' and we just had to dance."[21]

Ente Italiano Andizone Radiofoniche (E.I.A.R.), station 2RO, in Rome transmitted with 25 kw. (increased to 100 in the late 30's) on 9635 and 11810 kHz., usually rebroadcasting the daily program of Italian longwave stations but also presenting special programs for the Americas.

Other regular Europeans included Radio Colonial, Pontoise, France on 11710, 11900 and 15250 kHz.; EAQ, Radiodifusion Ibero-Americana, Madrid, Spain, which used 20 kw. and was well heard on 9870 kHz.; Belgian station ORK, 10330 kHz. in Ruysselde, used both for broadcasting and for point-to-point communication with the Belgian Congo; and 12 (later 50) kw. station HVJ, Vatican City. "HVJ is easily recognized by the announcement, 'Radio-Vaticano,' and by the ticking of a clock in the studio."[22] And you didn't need pirates to hear Ireland; the Irish shortwave station at Athlone broadcast on 17840, 15120 and 9595 kHz.

Portugal boasted both a government station, CT1AA, 9600 kHz. (also called Radio Colonial), and a private station, CT1GO, Radio Clube de Portugal, Parede, on 6200 and 12400 kHz. The Hungarian stations HAS and HAT, "Radio Labor, Station of the Royal Hungarian Post," were widely heard and sent a QSL card with a little photograph pasted in the middle.

The Soviet Union was a major player in the shortwave game of the 1930's. Stations heard in mid-decade were RV15 in Khabarovsk, said to be an easy log on 4273.5 kHz., and Moscow channels RV59, 6000 kHz., RAN, 9600 kHz., RNE, 12000 kHz., RKI, 15145 kHz., and RV96, 15183 kHz. "I was turning the dials this afternoon around 1:45 and I heard a station on 25 meters, something new to me, playing violin music. The music stopped and a voice, 'This is Moscow calling . . .' He talked entirely in English, asking for reports of reception, giving the address as Radio Station RNE, Gorki St., No. 17, Moscow, U.S.S.R. It signed off before 2 p.m. Reception was QSA5, R7/S/N. They are experimenting with the United States."[23]

Africa. There were some stations here, but in radio terms it was still an unknown continent. Many stations in Africa and elsewhere were not dedicated broadcasters but combination utility and broadcast senders. They would carry regular broadcast programming, or handle government or commercial traffic, depending on the need. One such was CNR, Radio Maroc, which transmitted on 8036 and 12825 kHz. VQ7LO, "Kenya Colony," was on 6060 kHz. It was located at Kabete, five miles from, and 1,000 feet above, Nairobi. Programs consisted of music, twice daily news bulletins and relays of the British Empire Service.

An oft heard station was CR6AA, 7170 kHz., in Lobito, Angola. In South Africa there was the African Broadcasting Co., Ltd., with the same address--P.O. Box 4559--as today's Radio RSA. An interesting station was EA9AH, Tetuan, Spanish Morocco, a combination amateur-broadcast station that was one of Franco's key propaganda outlets during the Spanish Civil War. Radio Tananarive was also on the air. "The transmissions begin with a piece of recorded music entitled 'Ramona,' and end with the French National Anthem. The station operates on 6000 kcs. with a power of 400 watts antenna. We transmit every day except Monday, programs consisting of musical selections rendered by artists, or recordings, as well as news flashes."[24]

Nearly all short-wave broadcasting stations in operation today use what is known as the "characteristic" or "interval" signal, which may consist of various oral phrases or musical notes. These are used solely for the benefit of the listener, enabling him to readily identify the station, even though he may not hear the call letters clearly. For instance FYA, Pontoise, France, plays the "Marseillaise" at the beginning and the end of each broadcast; CT1AA, Lisbon, Portugal, uses three calls of the cuckoo. If you hear a constant "ticking" as of a clock, you will know that this is HVJ of the Vatican City, Italy. Many other signals and phrases are used and they are given in the following list.

How You Can Identify Foreign Stations by "Signatures"

Call.	Location.	Identification.	Remarks.
GSH........	Daventry, England....	(See GSB). [Stations appear in order of frequency]	
PMC........	Bandoeng, Java.......	(See PLF).	
LSY........	Buenos Aires, Argentina	Begins transmissions by sounding E, E, G sharp, and A, on xylophone.	
PLF........	Bandoeng, Java.......	Begins transmissions with three tone auto horn. Notes are F, D, C.	
GSG........	Daventry, England....	(See GSB).	
DFB........	Nauen, Germany......	Sounds three tone whistle at beginning of transmissions. Notes are D, C, G.	
DJB........	Zeesen, Germany......	(See DJC).	
GSF........	Daventry, England....	(See GSB).	
GSE........	Daventry, England....	(See GSB).	
I2RO........	Rome, Italy...........	Woman announcer announces "Radio Roma Napoli."	
DJD........	Zeesen, Germany......	(See DJC).	
GSD........	Daventry, England....	(See GSB).	
PHI........	Huizen, Holland.......	Announces "This is Huizen."	
FYA........	Pontoise, France.......	Plays the "Marseillaise" at beginning and end of transmissions.	
ORK........	Brussels, Belgium......	Plays Belgium national hymn at close of programs.	
EAQ........	Madrid, Spain.........	Announces "Ay-ah-coo, transradio Madrid."	
CT1AA.....	Lisbon, Portugal.......	Sounds the cookoo calls between selections.	
VK2ME.....	Sydney, Australia......	Laugh of Kookaburra bird at beginning and end of transmissions.	
HBL........	Geneva, Switzerland...	(See HBP).	
DJA........	Zeesen, Germany......	(See DJC).	
GSC........	Daventry, England....	(See GSB).	
VK3ME.....	Melbourne, Australia...	Opens programs with clock chimes.	
GSB........	Daventry, England....	Big Ben Chimes on quarter hours. Announces "London calling on—(stations and wavelengths)." Begins and ends transmissions by playing "God Save The King." This song has the same tune as our "America."	
IAC........	Pisa, Italy...........	Calls "Pronto, pronto—(name of ship)."	
PSK(PRA3)	Rio de Janeiro, Brazil..	Plays chimes like the NBC chimes when signing off.	
CNR........	Rabat, Morocco.......	Announces "Radio Rabat dans Maroc." Uses metronome between selections.	
HBP........	Geneva, Switzerland...	Announces "Hillo, hillo. radio nations."	
TIEP........	San Jose, Costa Rica...	Announces "La Voz del Tropico."	
HC2RL......	Guayaquil, Ecuador....	Plays the Ecuadorian National Anthem at beginning and end of transmissions.	
PRADO.....	Riobomba, Ecuador....	Announces "Estacion el Prado, Riobomba, Ecuador."	
HJ1ABB....	Barranquilla, Colombia.	Announces "Achay-hota-uno-ah-bay-bay."	
HJ5ABD....	Cali, Colombia........	Announces"Achay-hota-thinko-ah-bay-bay."	
HI1A........	Santo Domingo.......	Plays "Anchors Aweigh" at start and finish of programs.	
YV3RC......	Caracas, Venezuela.....	Announces "Ee-vay-trays-erray-say." Plays bells on the hour.	
W2XE......	Wayne, New Jersey....	Announces in English, German, French, Spanish and Italian.	
YV2RC.....	Caracas, Venezuela.....	Announces "Ee-vay-dos-erray-say." Sounds four strokes on chimes every fifteen minutes.	
VE9HX.....	Halifax, Nova Scotia...	Sounds four strokes on a gong at beginning of transmissions.	
OXY........	Skamleback, Denmark..	Midnight chimes at 6 P. M. E. S. T.	
VE9CS......	Vancouver, B. C.......	Sounds two bells between selections.	
GSA........	Daventry, England....	(See GSB).	
DJC........	Zeesen, Germany......	Announces in German, and English. Eight notes of old German song played over and over at beginning of transmissions.	
XEBT......	Mexico City, Mexico...	Sounds auto horn after each selection.	
RV59........	Moscow, U. S. S. R....	"International" is played at beginning and end of transmissions.	
HVJ........	Vatican City, Italy.....	Announces "Pronto, pronto, radio Vaticano." Clock ticking.	
TGX........	Guatemala City. S. A..	Two tone high frequency signals.	
YV5RMO	Maracaibo, Venezuela..	Strikes gong before announcing.	
HCJB......	Quito, Ecuador........	Sounds 2-tone chime after announcements.	

● The editors will be glad to have readers of this magazine send us information concerning new musical and other station signatures which they may hear and which do not appear in the above list We wish to publish every bit of information we can obtain which will aid you short-wave listeners in quickly identifying any *foreign* station which you may happen to tune in. A great many *foreigns* use the Spanish alphabet in pronouncing their call letters and the following phonetic Spanish alphabet will prove valuable to many short-wave listener "Fans."

A is pronounced as ah; B as bay; C, say; D, day; E, ay; F. effray; G, hay; H, ah-cheh; I, ee; J, hota; K, Kah; L, ellay; M, em-may; N. en-nay; O. oh; P, Pay; Q, koo; R, air-ray; S, es-say; T, tay; U, oo; V, vay; W, doh-bleh-vay; X, eckis; Y, ee-griega; Z, theta; Numerals: One, oono; Two, dos; Three, trehs; Four, quatro; Five, thing-ko; Six, sase; Seven, see-ate; Eight, ocho; Nine, noo-ay-ve; Ten, diez.

FYA, the French station, opens and closes its program with the *Marseillaise* played by an orchestra. Their famous slogan is "Ici, Paree (Paris)."

Courtesy N. Y. Sun

K.V.96.

Radio Centre, Solyanka, 12, Moscow, U. S. S. R.

Dear Listener,

We are glad to verify that you heard our broadcast on . Sunday June 7th 1936 . . at . 9.30p.m o'clock, M.T. on a wave length of . .19.76. . . metres.

We shall always be glad to hear from you and to have reports of reception. We shall also welcome criticisms of our programs and suggestions for improvement in the future.

Yours truly,
Inna Marr—Chief Editor.

2000 Watts **CJRX** 11,720 kc. — WINNIPEG, MANITOBA CANADA — 2000 Watts **CJRO** 6150 kc.

Canada's Pioneer Short Wave Stations

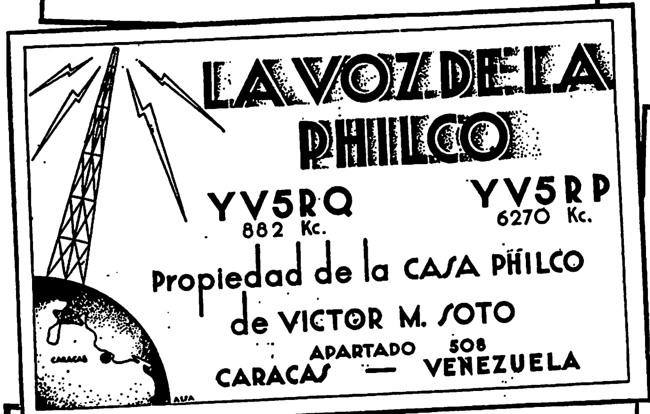
We are pleased to verify your reception of CJRX ~~CJRO~~ *on* April 4, 1938 *as stated in your communication, and are glad to receive your report.*

JAMES RICHARDSON & SONS, LTD.
Grain Merchants since 1857

Mitchell

CJRO and CJRX operate on following schedule: 5-11 p.m. CST carrying Canadian Radio Commission programs.

CJRX, CJRO, CJRC — Winnipeg
CJGX, Yorkton
CJRM, Regina



World Wide Broadcasting Foundation
UNIVERSITY CLUB - BOSTON, MASS. - U. S. A.

DEDICATED TO ENLIGHTENMENT — W1XAL

W1XAL VERIFIES YOUR RECEPTION REPORTED ON

Feb. 9, 1939 Date

11.79Mc 5.30 EST AM PM

Thank you and please write us again.

Do you know this is a non-profit Station supported by gifts and voluntary contributions? Won't you become a part of this Station by joining our WORLD WIDE LISTENERS' LEAGUE? Write for our leaflet.

Programs of
LITERATURE — NEWS
SCIENCES — MUSIC
WORLD PEACE — DRAMA
ECONOMICS — TRAVEL
and
Special International Good Will Broadcasts. 15.25 — 6.04 — 11.79 — 21.46 — 11.73 — 15.13 Mc.

E. I. A. R.

ENTE ITALIANO AUDIZIONI RADIOFONICHE

SHORT-WAVE STATION — 2RO 3 — 5 VIA MONTELLO, ROME

Dear Sir:

We are very pleased to verify your reception of the following transmission from our short-wave station 2RO 3 ....(year) 36 (month) March (day) 5th (at) 5.45pm E.S. (~~Central European~~ Time)

Yours sincerely,

E. I. A. R.

RADIOSTATION: **RADIONATIONS**

Callsign	Wavelength	Power & Aerial	Emission
HBL	~~32.10 m., 9345 k.c.~~ 31.27 m., 9595 k.c.	20 k.w. omnidir.	Official bulletin
HBP	38.47 m., 7797 k.c. 26.31 m., 11402 k.c.	20 k.w. direction.	Information Section, L.o.N.
HBO ✓	~~26.35 m., 11385 k.c.~~	20 k.w. omnidir.	International Labour Office
....	....	....	Radio-Suisse (private)

Your report of April 3rd .... received and checked with our transmission, found correct and hereby verified.

Date May 11th 1938

League of Nations - Geneva

RADIONATIONS

THE PENANG WIRELESS SOCIETY
PENANG, STRAITS SETTLEMENTS

The Penang Wireless Society, which is an amateur organisation, thanks you for your report of reception of its Broadcasting Station ZHJ on ..... June 27th ..... 193.. The details given in your report are correct and further reports will be appreciated.

A weekly programme sheet is enclosed and an illustrated guide to Penang has been forwarded under separate cover.

The power of Station ZHJ is ....

13 - 8 - 1939

President

ZHJ Penang

Latin America. As would be true for many years to come, there were many shortwave stations in Latin America. By 1940 there were 32 stations on the air in Venezuela, 23 in Colombia, 10 in Peru, even two in Bolivia (the still familiar R. Illimani and R. Fides).[25] Then, as now, Latin America was the preserve of private rather than governmental broadcasting, much of it out of band.

Slogans were in common use, but stations were often referred to by their call letters alone. Among the more familiar were YV2RC, Broadcasting Caracas, 5800 kHz., YV3BC, Radiodifusora Venezuela, Caracas, 6145 kHz., and YV5RMO, Ecos del Caribe, Maracaibo, 6070 kHz. "Every Monday evening we broadcast operas or other classical music and the rest of the week is dedicated to lovers of the more popular variety, especially local music. Our programs open and close with the playing of the 'Blue Danube March.' YV5RMO announces as 'Ecos del Caribe' (Echoes of the Caribbean), and one stroke on a gong usually precedes this announcement."[26]

Other widely reported stations included HJ1ABG, Emisora Atlantico, 6042.5 kHz., Barranquilla, Colombia, HJ7ABD, Radio Bucaramanga, 9630 kHz., and HJ4ABL, Manizales. "At the present time, HJ4ABL announce their schedule as Saturday nights only, from 11 until about 11:30 p.m., EST, at which time they broadcast a program for English-speaking people, although announcements are made in Spanish, German and Dutch as well as English. HJ4ABL uses the slogan 'Ecos del Oriente' (Echoes of the West) and was heard using an automobile horn a few times as an identification signal."[27]

LSX, Transradio Internacional, Buenos Aires, Argentina broadcast on 10350 kHz. and often relayed programs from the Byrd Expedition to Little America. The 1930's also saw the birth of HCJB. It started broadcasting on Christmas Day, 1931, with 200 watts on 4107 kHz. A medium wave channel was soon added, as was a 10 kw. transmitter on 12455 kHz. The rest, as they say, is history.

Founded in 1932, HC2JSB, Ecuador Radio, on 7850 kHz., claimed to be the first commercial broadcaster in the country. Other out of band Ecuadorians included Station PRADO in Riobamba on 6620 kHz., and HC2RL, Guayaquil, on 6670 kHz. "Their regular schedule is Sundays from 5:45 to 7:45 p.m. and Tuesdays from 9:15 to 11:15 p.m., EST. These programs open and close with the playing of the Ecuadorian National Hymn, and the expression 'Quinta Piedad' is used often in the announcements [Marie Piedad Castillo de Levi was the station owner]. The January 14 [1934] program from this station will feature primarily Ecuadorian national music, and as Dr. Levi [station director Roberto Levi] has planned to have artists from the National Conservatory of Music and the Academia de Artistas Nationales, we believe the program will be a very interesting one."[28]

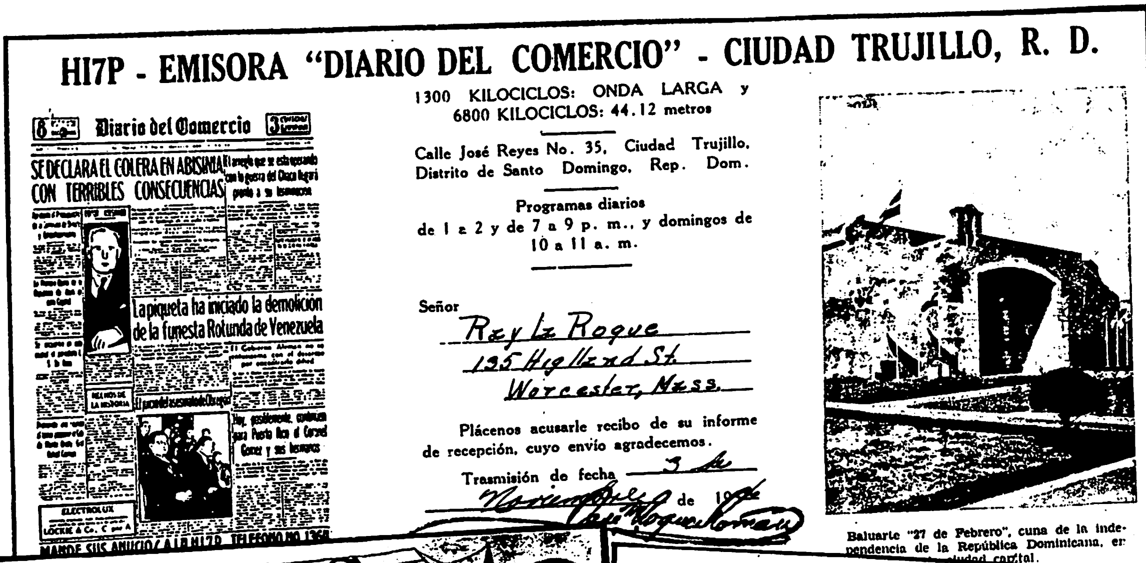
Peru didn't have anywhere near the number of stations it has today, but it could boast nine by 1937, including the widely heard OAX4J, R. Internacional, on 9520 kHz. Bolivia had 1 kw. CP5, R. Illimani, La Paz on 6080 kHz. Brazilians were not as plentiful as Spanish stations, but one that was well heard was PSH, Radio Internacional do Brazil, Rio de Janeiro, on 10220 kHz. Others included Short Wave Radiotelephone Station PRF5, Rio de Janeiro, on 9501 kHz., and PRA8, Radio Clube de Pernambuco, on 6040 kHz.

Many Central American stations and loads of Cubans and Mexicans simulcasted on shortwave. There was HP5, R. Miramar, Panama on 6030 kHz.; HI1A, La Voz del Yaque, Santiago, Dominican Republic, 6185 kHz.; TIPG, La Voz de la Victor, San Jose, Costa Rica, 6410 kHz.; TIGPH, Radio Alma Tica, also in San Jose, 5830 kHz.; TGTQ, Radio Internacional, "La Voz de la Capital," Guatemala City, 6285 kHz.; the widely heard 200 watter TGW, Radiodifusora Nacional, 9450 kHz., also in Guatemala City; HI9T, Broadcasting Tropical, Puerto Plata, Dominican Republic; and many others.

Among the Cubans were COBZ, Radio Salas, 9030 kHz.; COCX, La Voz del Radio Philco, 11435 kHz.; COCW, The Voice of the Antillies, 6330 kHz.; Transradio Columbia, 9833 kHz.; CO9GC, Laboratorio Radio-electrico, 6150 kHz.; etc., etc. COCD, La Voz del Aire, operated on 6130 kHz. "This station relays the programs of CMCD from the Palace Hotel and is heard most regularly between 2200 and 2400. Announcements are nearly always in Spanish, English being used only once in a while. Four chimes precede the announcements, as a rule, and Ted Lewis' familiar 'Good Night Song' closes the programs at midnight."[29]

Mexico boasted XEBR-XEBH, Radio Difusora de Sonora, on 11820 kHz.; XEFT, La Voz de Veracruz, 9510 kHz.; XEBT, El Buen Tono, 6010 kHz.; XEWW, 9500 kHz.; and many others. It was from another early Mexican that one of the hobby greats, the late August Balbi, received his very first QSL. This station was XETE, Empreso de Telefonos Ericsson, broadcasting on 6130 and 9600 kHz. and logged by Balbi on June 15, 1933. "XETE tends to remind one of that other popular Mexican station, XEW, which has been missed for a long time. Some of the most beautiful programs ever heard on short waves were transmitted from XEW, and XETE seems to be continuing the good work . . . ."[30]

The most famous Central American was TI4NRH, San Jose, Costa Rica. Starting out with a power of 7.5 watts in 1928 (increased to 500 watts during the 1930's), the station's owner, Sr. Amando Cespedes Marin, gained worldwide recognition for his promotion of friendship and understanding among peoples. A renaissance man of his day, he carried on extensive correspondence with hobbyists in all corners of the globe. He was a well known personality among DXers, dedicating special programs to radio clubs and going the extra mile for shortwave


HI7P - EMISORA "DIARIO DEL COMERCIO" - CIUDAD TRUJILLO, R. D.

Diario del Comercio

SE DECLARA EL COLERA EN ABISINIA CON TERRIBLES CONSECUENCIAS

La piqueta ha iniciado la demolición de la funesta Rotunda de Venezuela

1300 KILOCICLOS: ONDA LARGA y
6800 KILOCICLOS: 44.12 metros

Calle José Reyes No. 35, Ciudad Trujillo,
Distrito de Santo Domingo, Rep. Dom.

Programas diarios
de 1 a 2 y de 7 a 9 p. m., y domingos de
10 a 11 a. m.

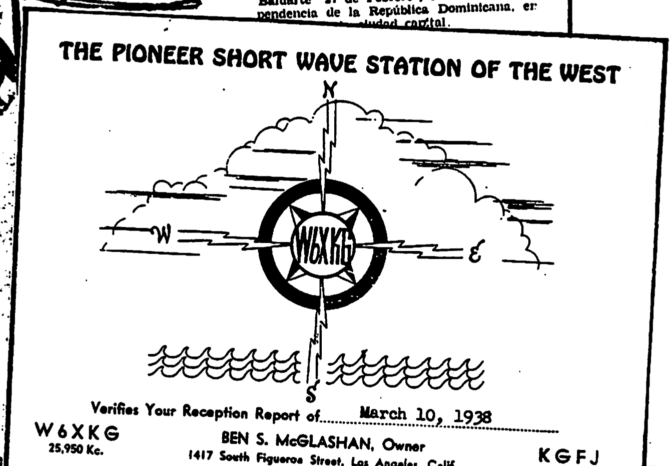
Señor Ray Le Roque
135 Highland St.
Worcester, Mass.

Plácenos acusarle recibo de su informe de recepción, cuyo envío agradecemos.

Trasmisión de fecha 3 de Noviembre de 193

Baluarte "27 de Febrero", cuna de la independencia de la República Dominicana, en ciudad capital.


YNLG
RADIOEMISORA
RUBEN DARIO
MANAGUA NIC. C. A.


THE PIONEER SHORT WAVE STATION OF THE WEST

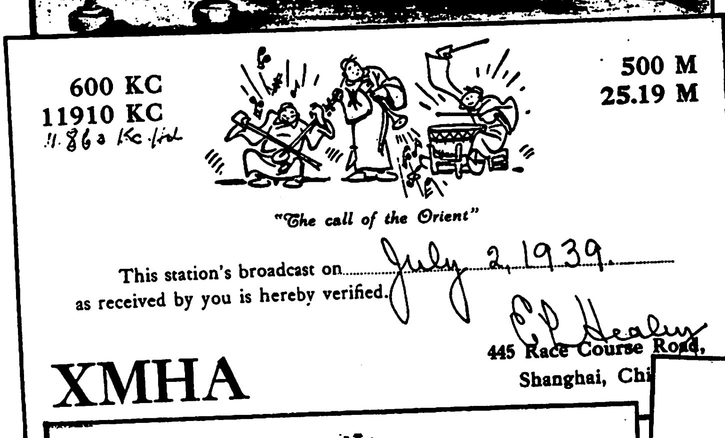
N
W
E
S
W6XKG

Verifies Your Reception Report of March 10, 1938

W6XKG
25,950 Kc.

BEN S. McGLASHAN, Owner
1417 South Figueroa Street, Los Angeles, Calif.

KGFJ


600 KC
11910 KC
11.863 Kc. fal

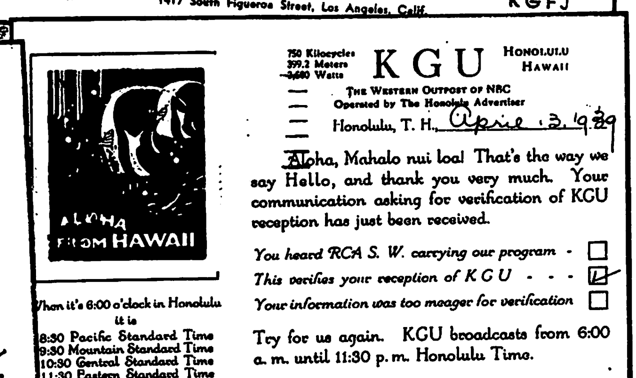
500 M
25.19 M

"The call of the Orient"

This station's broadcast on July 2, 1939.
as received by you is hereby verified.

445 Race Course Road,
Shanghai, China

XMHA


ALOHA FROM HAWAII

When it's 6:00 o'clock in Honolulu it is
8:30 Pacific Standard Time
9:30 Mountain Standard Time
10:30 Central Standard Time
11:30 Eastern Standard Time

750 Kilocycles
399.2 Meters
2,500 Watts

KGU

HONOLULU HAWAII

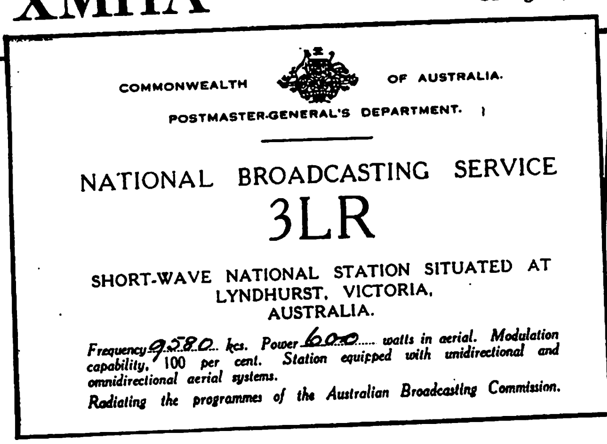
THE WESTERN OUTPOST OF NBC
Operated by The Honolulu Advertiser

Honolulu, T. H., April 3, 1939

Aloha, Mahalo nui loa! That's the way we say Hello, and thank you very much. Your communication asking for verification of KGU reception has just been received.

You heard RCA S. W. carrying our program - ☐
This verifies your reception of KGU - - - ☑
Your information was too meager for verification ☐

Try for us again. KGU broadcasts from 6:00 a. m. until 11:30 p. m. Honolulu Time.

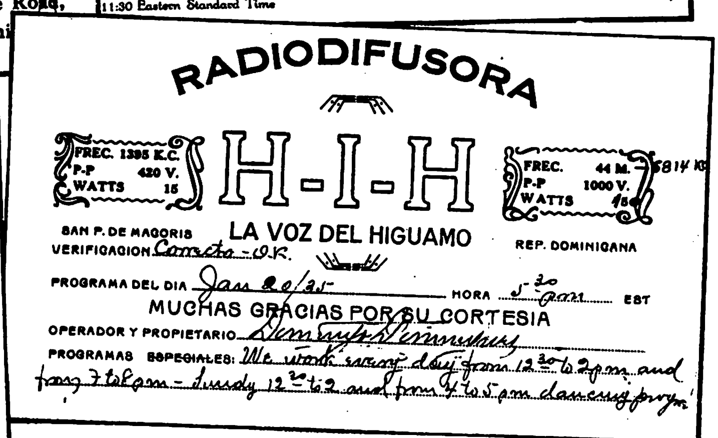

COMMONWEALTH OF AUSTRALIA.
POSTMASTER-GENERAL'S DEPARTMENT.

NATIONAL BROADCASTING SERVICE
3LR

SHORT-WAVE NATIONAL STATION SITUATED AT LYNDHURST, VICTORIA, AUSTRALIA.

Frequency 9580 kcs. Power 600 watts in aerial. Modulation capability, 100 per cent. Station equipped with unidirectional and omnidirectional aerial systems.

Radiating the programmes of the Australian Broadcasting Commission.


RADIODIFUSORA

FREC. 1395 K.C.
P-P 420 V.
WATTS 15

H-I-H

FREC. 44 M. 6814 KC
P-P 1000 V.
WATTS 45

SAN P. DE MACORIS
LA VOZ DEL HIGUAMO
REP. DOMINICANA

VERIFICACION Correcto - OK.

PROGRAMA DEL DIA Jan 20/35 HORA 5-30 p.m. EST

MUCHAS GRACIAS POR SU CORTESIA

OPERADOR Y PROPIETARIO Domingo Dominguez

PROGRAMAS ESPECIALES: We work every day from 12.30 to 2 pm and from 7 to 9 pm - Sunday 12.30 to 2 and from 4 to 5 pm dancing prog.

listeners. Sr. Marin's station issued some of the most impressive QSL's of all time--oversized, multi-colored certificates that put to shame almost any other QSL ever issued, before or since.[31]

North America. There would be no Voice of America or equivalent in the United States--no international government broadcaster--until 1942. All U.S. shortwave broadcasting was in private hands.

Entrepeneurial spirit led to a large variety of American shortwave outlets, most of them simulcasting their parent BCB stations. Some smaller stations went on shortwave just to satisfy an engineer's desire to dabble in a new medium. Others ventured into international broadcasting to reach listeners directly, or provide programming for rebroadcast via local BCB stations in other countries. The latter point is important. Although today we think of shortwave in terms of direct broadcasting, the intention in the early days was often to get the signal to the target area for pick up and rebroadcast by local medium wave stations. At the end of the decade the comparative effect of U.S. vs. Axis shortwave broadcasting, especially to Latin America, was evaluated in part by the number of local rebroadcasting arrangements that each side had entered into.[32]

America's shortwave broadcasters were the offspring of the giants of the American radio industry. A complete examination of this era requires a study of the alphabet soup of call letters of the day (the experimental "X" calls were exchanged for regular four-letter calls in 1939). In addition to KDKA, Westinghouse operated W2XK (later WBOS) in Boston. There was NBC's W3XAL (WBOU) in Bound Brook, New Jersey, General Electric's W2XAF (WGEO) in Schenectady and W6XBE (KGEI) in San Francisco, Crosley's W8XAL (WLWO) in Cincinnati, and CBS's W2XE (WCBX), Wayne, New Jersey and W3XAU (WCAU), Philadelphia. Boston's World Wide Broadcasting Foundation, W1XAL (WRUL), was the most serious attempt to produce educational programming specifically for shortwave. The station had an extensive program development department, and boasted a news connection with the Christian Science Monitor.

Among the lesser stations were W4XB (WIOD), the "Wonderful Isle Of Dreams" station in Miami; W9XAA (WCFL), the Chicago Federation of Labor station in Chicago; and W9XF (WENR-WMAQ), Downer's Grove, Illinois. All contributed to the growing interest in shortwave broadcasting in America.[33]

In Canada, numerous shortwave broadcasters likewise changed calls and metamorphosized over the years. James Richardson & Sons, Ltd. of Winnipeg, Manitoba, purveyors of stocks, bonds and grain since 1857, was the first shortwave broadcaster in Canada, starting out with 2 kw. as VE9JR (11720 kHz.) and VE9CL (6150 kHz.), later becoming CJRX and CJRO, and then (in 1943) CKRX and CKRO. There were many others: CFCX (on 6005 kHz. even back then), VE9HX (later CHNX) on 6110 kHz., CJCX on 6010 kHz., and CFRX on 6070 kHz. A popular station was 200 watter VE9GW, Bowmanville, Ontario which simulcast CKGW's programming over 6095 kHz. until its demise in 1933. Newfoundland had VONH, the Broadcasting Corporation of Newfoundland, 5970 kHz.. It was eventually absorbed by the CBC, becoming first CBNX and then CKZN.

In the United States, the 30's also saw the inception of FM broadcasting in the shortwave bands. In the early 40's, before being allocated their present frequencies, FM stations operated in the 41-50 MHz. band. Before that, in the mid to late 30's, these stations were allowed to experiment in the 11 meter band, 25-27 MHz. W9XTC, Minneapolis simulcast WTCN-1250 on 26050 kHz. W6XKG transmitted from Los Angeles on 25950 kHz., 24 hours a day. W9XJL, Superior, Wisconsin, 26100 kHz., was the foremost performer of them all. "The power is only 80 [later 250] watts, but . . . reports have been received from 11 countries. At this writing, 20% of the received mail has come from England!"[34] There were so many 11 meter "FMers" that in December 1937, the magazine *All-Wave Radio* began a column about the FM bands. Called "Ultra-High," it was edited by a young man who would eventually become a friend to many of us: the late Oliver "Perry" Ferrell, founder, with his wife Jeanne, of Gilfer Shortwave.

Asia. The Asian continent was a happily mysterious place on shortwave.

In Japan, NHK controlled all broadcasting activity. Hour-long programs were beamed to all parts of the globe from 20 and 50 kw. facilities of the International Wireless Telephone Company of Japan in Nazaki. (Reception on the east coast was reported as fair at best.)

There was some interesting activity from Manchuria, known as Manchukuo after the Japanese takeover in 1932. There had been intermittent broadcasting from Manchuria telephone and telegraph stations JQAK and JDY at Dairen on the Kwantung Peninsula, but from July 1939, MTCY, the Central Broadcasting Station in Hsinking, began regular international shortwave broadcasts, including an English program to western North America at 0630-0720 GMT on 11775 kHz., 20 kw.

The Chinese broadcasting scene was confusing, and would become more so during the next decade. At first the main station was XGOA, located at the pre-war capital of Nanking, but when the war started at the end of the decade the Chinese government moved to Chungking. From there shortwave broadcasting became the responsibility of the Central Broadcasting Station, commonly known as XGOY. There were numerous other "X's" operating under various authorities in the 1930's: XPSA at Kweiyang; XTC, Shanghai; XTJ, the China

Information Committee station, Hankow; XMHA, "The Call of the Orient," Shanghai; XTPA, the Canton Broadcasting Station; the "Station Radiophonique Francaise 'Art et Culture,'" Shanghai; etc. Many of these stations were heard in the United States.

Indonesia, a Dutch colony at the time, had several stations. The Netherlands Indies Broadcasting Co., Ltd., "NIROM" as it was called, was located in Batavia (Djakarta). Distant precursor to Radio Republik Indonesia, it broadcast from various locations in the islands. Java Wireless Station PLP, Bandoeng, was also often heard relaying broadcast programming over its 1.5 kw. transmitter.

India started shortwave broadcasting in May 1934 but VUB, Bombay, on 9570 kHz. (4.5 kw.) and VUC, Calcutta, on 6110 kHz., appear to have been not particularly well heard. Southeast Asia and the Malayan Peninsula boasted some exotic stations, including HSP in Bangkok on 17750, and FZS, Saigon, on 11990. The 6 MHz. band in this area was interesting, and included several stations in what were then known as the "Straits Settlements": ZHJ, The Penang Wireless Society, on 6080 kHz.; ZGE, Kuala Lumpur on 6130 kHz.; and ZHI, Singapore on 6010 kHz. A well heard station from the area was ZHP, the British Malaya Broadcasting Corp., on 9690 kHz.

The Pacific. Australia boasted the first major shortwave stations in the Pacific, the Amalgamated Wireless twins, VK3ME, Melbourne, 2 kw. on 9510 kHz., and 20 kw. VK2ME, 9590 kHz., in Sydney, both of which were widely heard by U.S. listeners. These stations were soon followed by another, VK3LR, Lyndhurst, on the frequency of--what else?--9580 kHz., and VK6ME in Perth. The Kookaburra interval signal first came into use in the 1930's.

Another widely heard Pacific station was the Amalgamated Wireless station VPD in Suva, Fiji. Less often heard but still reported and verified occasionally was VK9MI aboard the M/V Kanimbla. Promoted as the first shipboard broadcasting station, it was owned by McIlwraith McEacharn Ltd. and operated at 1200 GMT on 6010 and 11710 kHz., using 200 watts. "They have three studios facing the ballroom--beautifully fitted out and artistically furnished in green, cream and chromium. A quartet of girl singers live permanently on board and under the direct control of Miss [Eileen M.] Foley, who claims the distinction of being the only woman in the world in full charge of a broadcasting station. The Kanimbla quartet render musical programs for the benefit of the passengers in addition to broadcasting from the ship."[35]

It was also in the 30's that shortwave was first used as a propaganda weapon. Within a week after the start of the Spanish Civil War in July 1936, every major broadcasting station in Spain was directly controlled by either the Rebels or the Loyalists. Many operated on shortwave, and some could be heard in the United States. The broadcasting scene was as chaotic as the fighting, but a DXer's delight.

As the threat from the Axis powers escalated in the latter part of the 1930's, shortwave propaganda grew on a grand scale. It was at that time that some of the now familiar propaganda techniques were first developed: use of mailbag programs, favorable interviews with visiting tourists, and announcers speaking with the accent of the target population. Truth, as they say, was an early victim. South America was a favorite target of the Axis countries, particularly Germany and Italy. American shortwave broadcasting was still in private hands, and, although transmission times were increased, there was no serious, coordinated effort to counter Axis broadcasting until much later.

It was also during the 1930's that jamming was first used. In the Spanish Civil War it consisted of sending an open carrier on the target station's frequency. Things soon got more sophisticated, however, with German "Storsenderen" emitting music, code and shrieking whistles.

DXing

Gernsback said it well in 1926: "I can not imagine any greater thrill than that which comes to me when I listen, as I often do, to a station thousands of miles away. It is the greatest triumph yet achieved by mind over matter . . . ."[36]

The thrill was even greater if you were young. Well known shortwave enthusiast Jack Jones remembers when the DX bug bit him. It was 1928, and he was 12 years old.

"In 1927 [my father] got another Atwater-Kent (single dial) and late one afternoon--very probably October or November 1928--we heard [medium wave] KDKA relay 5SW, Chelmsford, England, 5:30 to 6:30 p.m. CST. I distinctly recall the midnight chimes of Big Ben and the announcer saying, '5SW, the experimental station of the Marconi Company, closing down. Good night everybody, good night.' This really got me hooked, and I started reading about radio and those remarkable short waves. I started a campaign to get dad interested in a shortwave adapter I saw advertised, but he kept stalling until one day he said that Mr. Jess Huffman (two houses down, and a radio bug) wanted to show me his shortwave receiver! I didn't even know there was one within 100 miles of Tupelo, Mississippi! This was probably late 1929. Needless to say I hurried down to see Mr. Jess. There I

found a Pilot Super Wasp four-tube shortwave set! I had seen them in magazines and approached his with the respect and awe due royalty. He plugged in the yellow ring coil and got 8XK on its 60 meter wave, 2XAF on 31 meters and HKD [Columbia] on 49 meters (orange ring coil). I was absolutely enthralled. To top it off, he called me early one morning and said he had Australia. All the homes on our street had hedges, and I either ran through them or jumped over them getting down to his house. Sure enough, 3ME, Melbourne, was heard. I visited Mr. Jess often and he'd sit at the Super Wasp and fiddle around. Finally he'd say, 'Jack, I can't get anything. Get over here and see what you can do.' Mr. Jess would stomp out of the room in a bad humor and I'd be in seventh heaven."[37]

Today's DXer would feel relatively at home in the 30's. By the start of the decade the principles of shortwave propagation were well understood, including sky waves vs. ground waves, the reflective properties of the ionosphere (then called the Kennelly-Heaviside layer), skip, the sources of signal distortion, the seasonality of reception, the relationship of sunspots to radio propagation--even diversity reception.

Likewise there was much knowledge of antennas. Most often used were wire antennas, like the inverted-L, the T-aerial and the inverted-V, all connected to the receiver by a single wire lead in, or "Hertzian" antennas (dipoles) connected by a twisted pair. DXers also understood the properties of vertical antennas and the concepts of directionality, antenna length, grounds, etc.

The biggest factor in the growth of shortwave in the 30's was the development of the superheterodyne receiver. Although basic superhet technology was understood in the early 1920's, its growth was retarded for almost ten years by R.C.A.'s withholding of its superhet patents from receiver manufacturers, leaving early superhet development to the experimenters and custom set builders. Once this problem was overcome, the new technology transformed the shortwave receiver from an experimenter's instrument to a common household device. It also led to the development of the communications receiver. The full story of the communications receiver is beyond the scope of this article.[38] Suffice it to say that it brought with it for the first time such things as calibrated dials, bandspread, S-meters, antenna trimmers, AVC, multiple conversion, etc.

It was the era of the grand old names in radio receivers--Philco, Hammarlund, Hallicrafters, McMurdo Silver, National, Scott--as well as some lesser ones, like Howard, Lincoln, Midwest, Lafayette, Patterson and RME. There were receivers for every taste and pocketbook--those that were "little more than broadcast receivers repackaged in metal communications-type cabinets"[39], modest radios like the Hallicrafters Sky Buddy and Sky Champion, better sets like the Hallicrafters Sky Rider and the Hammarlund Comet Pro and Super Pro, and high enders like the short lived Hallicrafters Skyrider Diversity, a 25-tube, IF notch-equipped, high fidelity receiver advertised as reducing fading to "negligible proportions," and the prestigious, chrome plated all wave sets manufactured by E. H. Scott Laboratories.

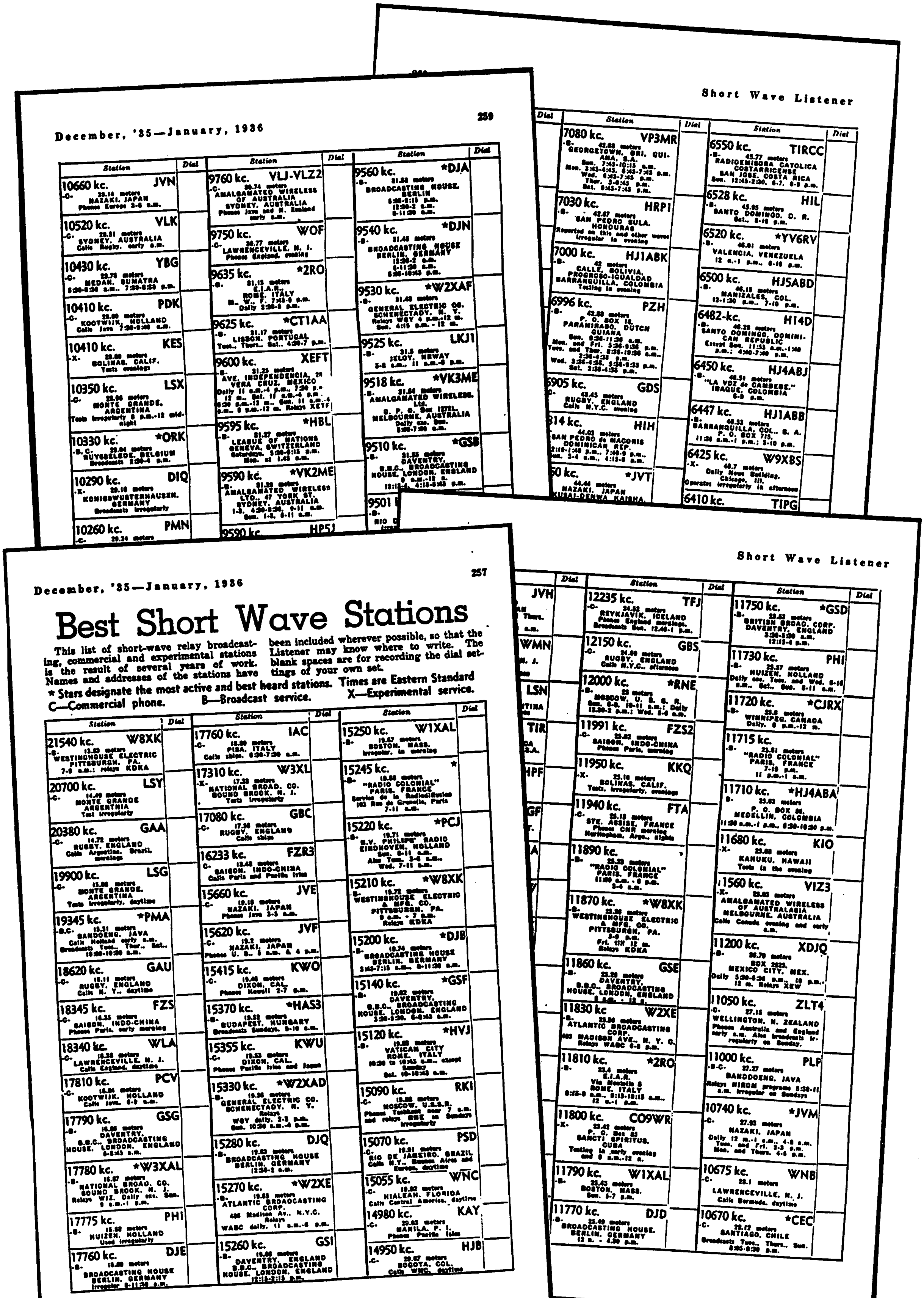
That there is nothing new under the sun seems applicable to the early days of shortwave. The shortwave broadcasting bands were basically the same as they are today, except that there was much more out of band broadcasting, and the 60 meter band was not used for broadcasting to any significant degree until the *end* of the 1930's. People already longed for the good old days. They complained about band overcrowding, stations that didn't verify, and countries that didn't accept IRC's. The International DXers Alliance already had a mint stamp service in operation by 1935.

The casual home tape recording of today was a long way off, but, for the most serious listener, equipment was available to record programs on celluloid or aluminum records. The process in 1930 was described as follows:

"*Go to your local phonograph dealer and get a diamond point used for the purpose of recording, and also get some blank recording records, which come in different sizes to suit the amount of reproduction desired. Substitute the recording point for the present reproducer, which is attached to the movable arm connecting to the horn or sound chamber. Then place your radio speaker directly in front of the phonograph horn and when the radio program comes in, start the turntable with a recording record on it, at the proper speed, and set the recording point on the record in the same way that the records are ordinarily played. The volume of the radio should be quite loud but not distorted.*"[40]

Although the art advanced some by mid-decade, disk cutting was still the only way of making recordings. It was expensive, but one DXer reported making extensive use of recorded reception reports. "Usually, I send at least one record to the station heard as a form of report requesting verification. In most cases, the response is almost immediate. Often, the station plays the record on one of its local programs and, occasionally, there is a newspaper write-up about the event. I have quite a few clippings from different corners of the globe. * * * [T]he expense is usually terrific. The biggest item is the wastage of records. . . . I hate to think of the pile of wasted disks I have around the house."[41]

An author's description of Latin American DXing in 1935 also sounds familiar. "The numerous



Station	Dial	Station	Dial	Station	Dial
10660 kc. JVN		9760 kc. VLJ-VLZ2		9560 kc. *DJA	
10520 kc. VLK		9750 kc. WOF		9540 kc. *DJN	
10430 kc. YBG		9635 kc. *2RO		9530 kc. *W2XAF	
10410 kc. PDK		9625 kc. *CT1AA		9525 kc. LKJ1	
10410 kc. KES		9600 kc. XEFT		9518 kc. *VK3ME	
10350 kc. LSX		9595 kc. *HBL		9510 kc. *GSB	
10330 kc. *ORK		9590 kc. *VK2ME		9501 [illegible]	
10290 kc. DIQ		9590 kc. HP5J			
10260 kc. PMN					

Station	Dial	Station	Dial
7080 kc. VP3MR		6550 kc. TIRCC	
7030 kc. HRP1		6528 kc. HIL	
7000 kc. HJ1ABK		6520 kc. *YV6RV	
6996 kc. PZH		6500 kc. HJ5ABD	
6905 kc. GDS		6482 kc. H14D	
6814 kc. HIH		6450 kc. HJ4ABJ	
6750 kc. *JVT		6447 kc. HJ1ABB	
		6425 kc. W9XBS	
		6410 kc. TIPG	

Best Short Wave Stations

This list of short-wave relay broadcasting, commercial and experimental stations is the result of several years of work. Names and addresses of the stations have been included wherever possible, so that the Listener may know where to write. The blank spaces are for recording the dial settings of your own set.

* Stars designate the most active and best heard stations. Times are Eastern Standard
C—Commercial phone. B—Broadcast service. X—Experimental service.

Station	Dial	Station	Dial	Station	Dial
21540 kc. W8XK		17760 kc. IAC		15250 kc. W1XAL	
20700 kc. LSY		17310 kc. W3XL		15245 kc. *	
20380 kc. GAA		17080 kc. GBC		15220 kc. *PCJ	
19900 kc. LSG		16233 kc. FZR3		15210 kc. *W8XK	
19345 kc. *PMA		15660 kc. JVE		15200 kc. *DJB	
18620 kc. GAU		15620 kc. JVF		15140 kc. *GSF	
18345 kc. FZS		15415 kc. KWO		15120 kc. *HVJ	
18340 kc. WLA		15370 kc. *HAS3		15090 kc. RKI	
17810 kc. PCV		15355 kc. KWU		15070 kc. PSD	
17790 kc. GSG		15330 kc. *W2XAD		15055 kc. WNC	
17780 kc. *W3XAL		15280 kc. DJQ		14980 kc. KAY	
17775 kc. PHI		15270 kc. *W2XE		14950 kc. HJB	
17760 kc. DJE		15260 kc. GSI			

Station	Dial	Station	Dial	Station	Dial
JVH		12235 kc. TFJ		11750 kc. *GSD	
WMN		12150 kc. GBS		11730 kc. PHI	
LSN		12000 kc. *RNE		11720 kc. *CJRX	
TIR		11991 kc. FZS2		11715 kc.	
HPF		11950 kc. KKQ		11710 kc. *HJ4ABA	
GF		11940 kc. FTA		11680 kc. KIO	
		11890 kc.		11560 kc. VIZ3	
		11870 kc. *W8XK		11200 kc. XDJQ	
		11860 kc. GSE		11050 kc. ZLT4	
		11830 kc. W2XE		11000 kc. PLP	
		11810 kc. *2RO		10740 kc. *JVM	
		11800 kc. CO9WR		10675 kc. WNB	
		11790 kc. W1XAL		10670 kc. *CEC	
		11770 kc. DJD			

Official Short Wave Listener Magazine

They say you CAN'T, but I say you get Enjoyable Programs Every day of

E. H. SCOTT
Pioneer Designer of 'round the world broadcast receivers.

Seven years ago, newspaper and magazine editors gave columns and columns of space to the amazing performance of a theretofore unknown receiver. They heralded the advent of transoceanic reception, on the broadcast band (200-550 meters) as the greatest radio achievement of the age. They named the receiver "World Record Super," because it brought in 117 programs from 19 stations, ALL OVER 6000 miles away, and WITHIN THE SHORT SPACE OF 13 WEEKS.

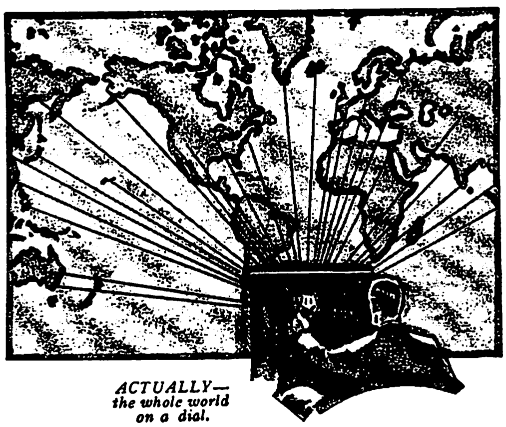
This receiver was the work of E. H. Scott, who believed that a radio set designed in accord with certain advanced ideas of his own, and engineered to micrometric precision, would do things no other receiver was ever able to do. These sets were built in the laboratory. Not even a screw was touched by an unscientific hand, and the radio industry was given a new target.

During the following years, E. H. Scott set still higher standards for radio's performance. Today, as the culmination of these efforts, he offers the Scott All-Wave, a hand-built instrument of scientific precision that is sold with a guarantee of regular, 'round the world reception, or YOUR money back.

MANY prominent radio engineers STILL contend that dependable daily reception of extremely distant foreign stations is impossible.

"It can't be done!" they shout. They insist that the distance is too great—that atmospheric conditions are too variable—that signal strength is insufficiently constant—that if foreign reception is to be obtained at all, an ideal location must be had—and, last, that there is no receiver generally available today that is sensitive enough to bring in foreign stations regularly.

Many of those making these statements are receiver manufacturers; men who have been forced to conclude that mass production methods cannot produce receivers capable of regular foreign reception. Seeming disbelief in the practicability of foreign reception is therefore the result of someone's failure. The only reason for *sincere* disbelief is ignorance of the facts.



ACTUALLY— the whole world on a dial.

You are entitled to the truth. It is your privilege to know the FACTS, because the most interesting—the most enjoyable world of radio is to be found between 15 and 200 meters. Hence, I have written this answer to disbelievers and to the unadvised, and I am spending my own money to publish these four pages of FACTS.

You will find in them a full explanation of what foreign reception is; how regularly it comes in; what the programs are and how they sound. In addition—you'll find undeniable PROOF that the Scott All-Wave 15-550 meter Superheterodyne is certain to give you enjoyable round the world reception every day of every month of the year. Yes, EVERY day, even during the summer months! I say, "You CAN do it!" E. H. Scott

(*Turn the page, please*)

9535 Detailed Logs *by* SCOTT tell *What You hear*

See preceding pages

and prove the absolute Dependability of the Scott All-Wave

Clarity

THE detail contained in this log, submitted by Mr. Roye Bilheimer of Pennsylvania, demonstrates the clarity with which the Scott All-Wave brings in foreign stations 10,000 miles away. This log was made Feb. 28, 1932, and while only 30 minutes of it are shown here, the log, as submitted, covered the entire 2 consecutive hours of the broadcast.

6:00 a.m. E.S.T.—Chimes are heard striking the hour of 9:00 p.m., and you say, "Just 9:00 o'clock, Sunday evening." You go on to say, "VK2ME, 47 York Street, Sydney, Australia, would be pleased to receive reports from those overseas relating to the reception of these programs. Our next record is rather an interesting broadcast. I am going to play for you, a record recorded in Chicago. This record was picked up by Mr. Scott of Chicago, an ardent listener of VK2ME. It was then recorded on his home recording set, on aluminum discs, and then sent to VK2ME, and we will now play this record over for you, which will give you some idea of the reception in the United States, especially in Chicago. This is a musical selection by the Band of His Majesty's ———— Guards. Stand by a second, please."

6:05 a.m. E.S.T.—VK2ME, Sydney, Australia. The record you have been listening to was one made in Chicago by Mr. Scott, an ardent listener to VK2ME. The original recording was transmitted some time ago and Mr. Scott received that recording, and cut in the record on his home recording set, and forwarded this to VK2ME. That was the record which has just arrived in Sydney and we have just played it for you, to see how you will receive it. I shall now play for you the laugh of the "Kookaburra," that was also picked up in Chicago by the same gentleman.

6:06½ am. E.S.T.—Laugh of the "Kookaburra." Now you say, "That was the laugh of the 'Kookaburra,' reproduced in Chicago again after receiving the original recording from VK2ME. We should be glad to receive reports from other listeners as to how they receive these recordings." A talk of the day is entitled "Australia Commences the Travel Idea," prepared by Charles Holmes, Director of the Australian National Travelers' Association. Now you continue with the talk:

"Set in the sunshine of southern seas, Australia is the world's littlest continent. Australia is a continent that is different from other lands in its appearance, its geographic formation, and its strange animals, as well as its age-old peoples. Then, too, the remainder of the native race that originally inhabited Australia are a stone-age people, but now I wish you could see them in the Government Reservations, and in the far-back places of the continent, where many still lead their primitive lives.

6:12 a.m. E.S.T. — They were entertained by Australian aborigines who are located in a settlement there. They were amused to see them throw their boomerangs, that strange wooden weapon which, when thrown by a person, returns to the thrower, and the visitors had an amusing time practicing among themselves. Rudolph Friml gazed at a group of black fellows who were playing a tune with the leaf of the eucalyptus tree, "Rose Marie," from the famous play he had written.

6:14 a.m. E.S.T.—You are now speaking of native bears, and say: "Here the visitors saw the quaint and lovable little bears. 'Living toys,' one visitor called them. One gentleman wanted to buy them outright, so enthused was he by these little native animals. Some of the ladies brought honey and candy, and were greatly disappointed when their gifts were refused by the bears. They prefer to get their own sweets from the eucalyptus tree.

"Australia welcomes the visitor. We want the world to know us better, and we, ourselves, seek a greater knowledge of people of other lands. In these days, travel is more than a great pleasure maker—it is a great peace maker, and that is what the world today is most in need of. This concludes my short talk, entitled 'Australia Commences the Travel Idea,' prepared by Charles Holmes, Director of the Australian National Travelers' Association."

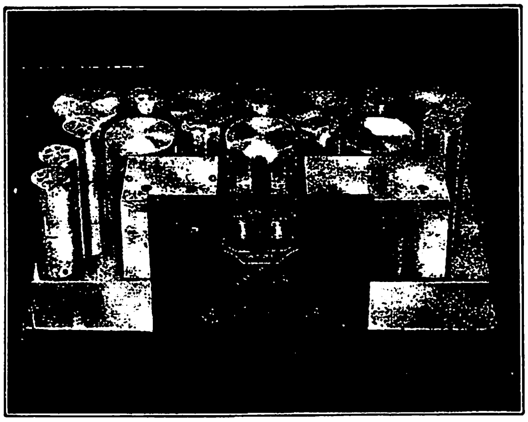
6:15 a.m. E.S.T.—The Band of His Majesty's Air Force will play "Washington Braves," arranged by Victor Herbert.

6:18 a.m. E.S.T.—VK2ME, Sydney, Australia. You now give the time as 18 minutes past 9:00 Sunday evening. Contralto solo, "God Shall Wipe Away All Tears," by Sullivan.

6:22½ a.m. E.S.T.—VK2ME, Sydney, Australia. An organ solo, "Just Imagine," by Leslie James. This is coming through with fine volume and clarity, although the weather here is very bad. It is very foggy and rainy.

6:25 a.m. E.S.T.—VK2ME, Sydney, Australia. The time is 26 minutes past 9:00 Sunday evening. You now announce the next selection, a waltz.

6:30½ a.m. E.S.T.—VK2ME, Sydney, Australia. The band of His Majesty's Guards directed by R. G. Evans, playing "Intermezzo," by Reeves



9,535 Detailed logs of foreign programs have been sent to us since January 1st, 1932. All of these logs are complete—proving that the reception was not only *heard,* but that the *clarity* was *perfect.* Two of these logs are reproduced (in part only, for lack of space) on these pages. Think of it! 9,535 logs from 186 stations in 40 different foreign countries! It is difficult to understand, how anyone after reading these logs, could believe that dependable, day in, day out foreign reception is anything but a complete, and thoroughly satisfactory actuality.

What Countries Will You Hear?

Any Wednesday, Saturday or Sunday morning you can tune in the Australian stations and listen to a three hour program, in English, of course. Then if you wish something with a decidedly foreign flavor, you can dial Saigon, Indo-China, and listen to the weirdest, Eastern music you have ever heard.

Right after breakfast, most any morning, you can tune in the Radio Colonial at Paris, France—or Chelmsford, England, from which station comes an English version of the World's latest news.

From 11:30 A. M. until 5 P. M. you have your choice of musical programs, talks, plays, etc. from Italy, France, Germany or England. In the late afternoon, the offerings from Portugal will be found very entertaining.

In the evening you may have your choice of a dozen or more different stations including Colombia and Ecuador in South America. Then, too, there is Spain, and Cuba.

Is this all?—Indeed not!—These are just a few of the many foreign stations that will be found on the dial of the Scott All-Wave. A complete list showing the exact time to tune dozens of foreign stations, is furnished with the receiver.

What Will You Hear?

From a large number of these foreign stations you'll hear news in English, and you'll delight in the variety of aspect the different countries give to an item of international interest.

You'll hear music from everywhere. Weird chants from Indo-China, and in contrast, a tango from the Argentine. From Rome you'll hear the real Grand Opera—you'll hear the voice of the Pope, the Vatican Choir and solo voices mellowed in Italian sunshine. From Germany you'll hear political speeches, music and news. From France, Spain and Portugal you'll hear a wonderful musical program that will thrill you hour after hour. From England you'll hear plays—drama—comedy and musicales; delightful presentations, refreshingly different from those to which you are accustomed. You'll never tire of foreign reception, because it never loses its novelty.

Will the Reception Be Clear?

Foreign stations are tuned easily and smoothly with a Scott All-Wave. As the dial is turned to the correct spot, the station comes on, in most cases, with the same naturalness, clarity, and roundness of tone that characterizes *domestic* reception.

# of Foreign Reception Owners and *How You hear it*

Usually, you can have more volume than you wish, which means simply that the sensitivity may be lowered beneath the noise level, thereby permitting the program to come through with truly enjoyable bell-like clarity. There's no doubt about it. Dependable foreign reception is here; yours to thrill to; yours to enjoy as you have never enjoyed radio before.

Read These Logs*

The log reproduced at the right represents one day that E. B. Roberts of Massachusetts spent with his Scott All-Wave. During the day he journeyed from France to England, to Italy, back to France and in the evening to South America. The other log is that sent in by Mr. Roye Bilheimer of Pennsylvania who made a point of logging every word put on the air by VK2ME, Sydney, Australia, February 28, 1932. If you have any doubt concerning the authenticity of these two logs or the others sent to us, see the auditors' report herewith. Read these logs—then consider that 9,533 more detailed logs bear witness to the new world of radio pleasure opened to YOU by the Scott All-Wave 15-550 meter Superheterodyne.

THE SCOTT WELLINGTON

Typical of the many excellent models of Scott Consoles, the Wellington is a beautiful example of deluxe cabinet artistry. Fashioned from burl walnut and finished to go with the finest furniture. The center drawer contains the optional phonograph equipment, which, when wanted, is supplied with an automatic ten record changer.

Prove to yourself the practicability of Short Wave foreign reception

These four pages have told the story of short wave foreign reception in no uncertain terms. They have PROVED that clear, enjoyable reception of foreign stations can be enjoyed by anyone irrespective of the state or country in which he lives. And we want to prove to you, right in your own home—that YOU can tune 'round the world whenever you choose and enjoy every program you hear. To do that, we'll build a Scott All-Wave 15-550 meter superheterodyne to your order; we'll test it on reception from London, Sydney or Rome—and give you the exact dial readings. If you don't get enjoyable foreign reception from these stations—if the receiver does not eclipse every statement made for it, you may return it and your money will be refunded. The coupon below will bring full particulars of this offer—also the technical details of the Scott All-Wave. Clip the coupon—mail it now.

The E. H. SCOTT RADIO LABORATORIES, INC.

4450 Ravenswood Ave., Dept. SW 62 Chicago, Ill.

The E. H. Scott Radio Laboratories, Inc.,
4450 Ravenswood Ave., Dept. SWC 62
Chicago, Ill.

Send me full particulars of the Scott All-Wave Superheterodyne.

Name ....

Street ....

Town.............................. State..................

*AUDITORS' REPORT

We hereby certify that we have examined and counted 9,535 logs of programs reported by purchasers of Scott All-Wave Receivers from 186 stations, foreign to the country in which received, during the months of January, February, March, 1932.

CHESNUTT, MURPHY, POOLE & Co.
Certified Public Accountants

News and Music From Four Foreign Countries Received in One Day

THESE logs, made March 7, 1932, and submitted by E. B. Roberts of Massachusetts, indicate the variety of foreign programs that may be heard with a Scott All-Wave. For lack of space, only a portion of each log appears here.

NEWS FROM FRANCE
STATION RADIO COLONIAL—PONTOISE

8:44½ a.m. E.S.T.—"This is Radio Colonial from Paris calling. Wavelength 19.68 meters."
News in English from the Continental Daily Mail, Great Britain—The financial recovery of Great Britain has aroused the interest of the world.

8:45 a.m. E.S.T.—Chimes.
From N. Y., Sunday—The U. S. view is that the world economic crisis is behind. Sterling reflected by rising to a new high.
From Geneva, Sunday—Small nations are not willing that the League's authority be flaunted even if the larger nations are.
From N. Y., Sunday—Bulletin on the death of Bandmaster Sousa.

8:51½ a.m. E.S.T.—From Berlin, Sunday—Speeches regarding the election next Sunday. Will Hindenburg or Hitler be elected only question.

8:55 a.m. E.S.T.—From N. Y., Sunday—The Lindberghs have turned to the underworld for help as the authorities seem helpless.

NEWS AND MUSIC FROM ENGLAND
STATION G5SW—CHELMSFORD

1:15 p.m. E.S.T.—Chimes.
1:15½ p.m. E.S.T.—This is the British Broadcasting Corp. calling short wave listeners of the British Empire through G5SW. G5SW broadcasts on a wave of 17,550 kilocycles or 25.53 meters.
1:16 p.m. E.S.T.—Programs to be radiated today.
1:17 p.m. E.S.T.—Programs to be radiated tomorrow, March the 8th.
1:18 p.m. E.S.T.—News Bulletins for the Middle Zone. World copyrighted.
Briand died today. An ardent advocate of peace.
Bulletin regarding the Indian Budget.
Far East Bulletin—Dr. Yen announced that China is ready to enter negotiations to restore peace. The Japanese have no intention of advancing further.
Bulletin regarding the kidnaping of the Lindbergh baby—no news as yet.

NEWS AND MUSIC FROM ITALY—STATION I2RO ROME

2:49 p.m. E.S.T.—Telling in Italian of the results of the six-day bicycle race in Madison Square Garden, which was won by the team of McNamara-Peden.
2:52 p.m. E.S.T.—Now talking about Primo Carnera and Young Stribling.
2:54 p.m. E.S.T.—"Raddio Roma-Napoli."
News bulletins from the U. S. A., Shanghai and Tokio.
News regarding the Lindbergh baby.
2:59 p.m. E.S.T.—Announcement.
3:01½ p.m. E.S.T.—Announcement. Gave names of Italian cities. Music by orchestra between announcements.
3:02 p.m. E.S.T.—Orchestra selection.

MORE MUSIC FROM FRANCE
STATION RADIO COLONIAL—PONTOISE

3:57 p.m. E.S.T.—"The Marseillaise."
3:59 p.m. E.S.T.—"Hilo, Hilo, Ici. Paree. Station Radio Colonial."
4:00 p.m. E.S.T.—Piano and violin selection.
4:06 p.m. E.S.T.—Announcement.
4:08 p.m. E.S.T.—Instrumental selection.
4:15 p.m. E.S.T.—Announcement.
4:16 p.m. E.S.T.—Cello solo.
4:21 p.m. E.S.T.—Announcement.

MUSIC FROM SOUTH AMERICA—STATION HKF BOGOTA, COLOMBIA

8:25 p.m. E.S.T.—Vocal solo. Man singing native selection.
8:28 p.m. E.S.T.—Announcement.
Baritone solo, with choruses singing.
8:33 p.m. E.S.T.—Announcement.
Vocal duet.
8:46 p.m. E.S.T.—Announcement.
8:47 p.m. E.S.T.—Native instrumental selection.
8:50 p.m. E.S.T.—Announcement.
8:53 p.m. E.S.T.—Dance music. Waltz.
8:57 p.m. E.S.T.—Announcement.
Baritone solo.
9:02 p.m. E.S.T.—Announcement.
9:03 p.m. E.S.T.—Native dance selection.
9:06 p.m. E.S.T.—Announcement.
9:00 p.m. E.S.T.—Station announcement. "HKF, in Bogota, Colombia, South America."
9:10 p.m. E.S.T.—Instrumental selection.
Volume very good. Some fading.

Spanish-speaking stations of South and Central America are, without doubt, the source of the average fan's most difficult identification problems! Few of these stations ever give English announcements; many of them shift wavelength at will, and new ones are appearing almost daily, to add to the listeners' confusion."[42]

Tom Williamson observed that "the biggest single difficulty in the hobby was getting accurate information about stations in respect to address and wavelengths used at different times of the day."[43] From this need there developed an active hobby press. DXers had to get their information where they could, but once the need was established there was no absence of publications seeking to meet it.

THE HOBBY PRESS

Magazines: The Gernsback Trilogy. The biggest name in early radio magazines was Hugo Gernsback, founder of two of the most important shortwave publications of the day, *Radio News* and *Short Wave Craft*, and their shortwave "little brother," *Official Shortwave Listener Magazine*. (Gernsback also published *Radio Craft*, a widely read magazine which carried occasional shortwave news but concentrated on technical topics.) Often described as the father of science fiction, Gernsback was an "author, inventor, scientific prophet, magazine publisher and broadcast pioneer"[44]--an eccentric to some, a visionary to others. His penchant for mixing fantasy with art led to interesting magazine covers which depicted electronic gadgetry and futuristic machines of all kinds. And his descriptions often came true.

Of all the early radio magazines, *Radio News* was probably the most widely read, with an advertised circulation of 400,000 by 1925. What set *Radio News* apart was the breadth of its coverage. It had something for everyone: electronics, amateur radio, equipment, antennas, broadcasting, radio servicing, DXing and program listening. It had contests, humor, extensive advertising for all kinds of parts, receivers and other equipment, plus monthly Gernsback editorials on every conceivable radio subject. Another interesting feature was its short stories, wherein radio always played the decisive role in saving a damsel in distress, averting a natural disaster or bringing a scoundrel to justice.

Radio News' first major foray into shortwave came in 1933 with the "DXer's Corner" column. Laurence M. Cockaday, *Radio News* Editor and a major inventor-developer in radio's early days, edited the column himself.

"What was only a year ago considered a fad, the reception of long-distance short-wave transmissions from the far corners of the earth, is now taking hold among a much larger group of listeners than heretofore thought possible. Thousands of new recruits have joined the ranks of the short-wave listeners during the last few months in America and they are persons in all walks of life. . . . [They] have been 'bitten by the bug' and have purchased the finest type of equipment they could find for this purpose. . . . With a good short-wave set today it is possible to sit down and pull in stations 3,000 to 12,000 miles distant and receive them enjoyably and comfortably. If one knows how to tune, there is certainly more thrill and adventure on the short waves in a half hour than on the broadcast waves in many hours' listening."[45]

BCB DXers might disagree with that last statement, but it illustrates the potential which shortwave was thought to have.

Cockaday's column was impressive. It featured a monthly "World Short Wave Time-Table" showing the stations that operated each hour of the day. It also had loggings, "best bets" and station news supplied by readers and "Official *Radio News* Short Wave Listening Post Observers." Later it included DXers' photos, pictures of QSL's, feature articles, distance maps and club news, plus extensive shortwave station lists that contained addresses, ID texts and interval signals.

In August 1934, *Radio News* supplemented its shortwave coverage with "Captain Hall's Short-Wave Page," an interesting monthly world tour of shortwave broadcast (and sometimes amateur) DX activity. Captain Horace L. Hall was a well known hobby personality who had written for another excellent albeit short lived hobby magazine, *Short Wave Radio*. He lived in Manhattan and got started in shortwave as an offshoot of his post-merchant marine retirement vocation--building museum-quality ship models. He worked best in the late night hours, and during breaks he would smoke and listen to the radio, discovering shortwave stations after the BCBers signed off. For a few months in 1934 and 1935, Hall also edited a column, "Capt. Hall's Short-Wave Page," for *The Globe Circler*, bulletin of the International DXers Alliance (more on the IDA below).

In October 1933, *Radio News* actually changed its name to reflect the increased attention to shortwave. It became *"Radio News and the Short-Waves"* through December 1934, and *"Radio News and Short-Wave Radio"* from January 1935 through June 1938, when the "shortwave" was dropped. In April 1938, the magazine took on a slicker, modernized look. Cockaday joined the navy and his column was replaced with "Short Wave Flashes" by Charles A. Morrison, President of the International DXers Alliance. The column was dropped in 1939, in part a victim of the magazine's growing emphasis on amateur radio. Shortwave coverage would not resume until 1944 when, as a result of "many requests received from . . . readers," the "International Short-Wave" column began under the editorship of Kenneth R. Boord.

The second in the Gernsback trilogy was *Short Wave Craft*. Hugo Gernsback caught the mood of the times in his introduction to the first issue in 1930:

"Today's widespread enthusiasm for the great and unlimited possibilities of short waves recalls, in many ways, the days of 1921-1922 when the first real boom in radio had arrived.

"Just now, short-wave activities are certainly the hotbed of new radio developments. There are no longer revolutionary possibilities in the highly-standardized medium-wave broadcasting, or in the commercial receiving set of today, which has tended more and more to reduce radio to automatic reception of local stations.

"But radio history, in the present cycle, is repeating itself. There are over 100,000 short-wave enthusiasts, in the United States and Canada alone, who are daily listening to short-wave voice and music broadcasts from . . . 10,000 miles away and more . . . . Then, there are in this country alone some 20,000 radio amateurs who are in regular telegraphic communication with each other in all parts of the globe.

"But short waves are very much more than just a hobby--they are important from a commercial standpoint. Television in the home, toward which our largest commercial laboratories are feverishly working, is possible by no other means than through the use of short waves. The trans-oceanic telephone, to Europe and to liners at sea, depends upon short waves; which are also relied upon to bring all sorts of international events to us for rebroadcasting over our American networks on the higher waves. Airplane radio cannot do without short waves today; for they are essential to make flights safe for passengers and property. Explorers in our days find it absolutely necessary to carry with them short-wave equipment. The success of Admiral Byrd cannot very well be imagined without short waves for his communication during his entire stay in the Antarctic."[46]

Short Wave Craft ran a regular station list, "Short-Wave Stations of the World," which included all known shortwave stations, arranged by frequency. "When To Listen In," a short column of SWBC station information by Robert Hertzberg (and later M. Harvey Gernsback), was another feature in the early years, as were loggings from readers. In November 1936, *Short Wave Craft* inaugurated "Let's 'Listen In" with Joe Miller. It was a high quality, well illustrated column featuring narrative news of serious DX value, mostly SWBC but with a little utility and ham news as well.

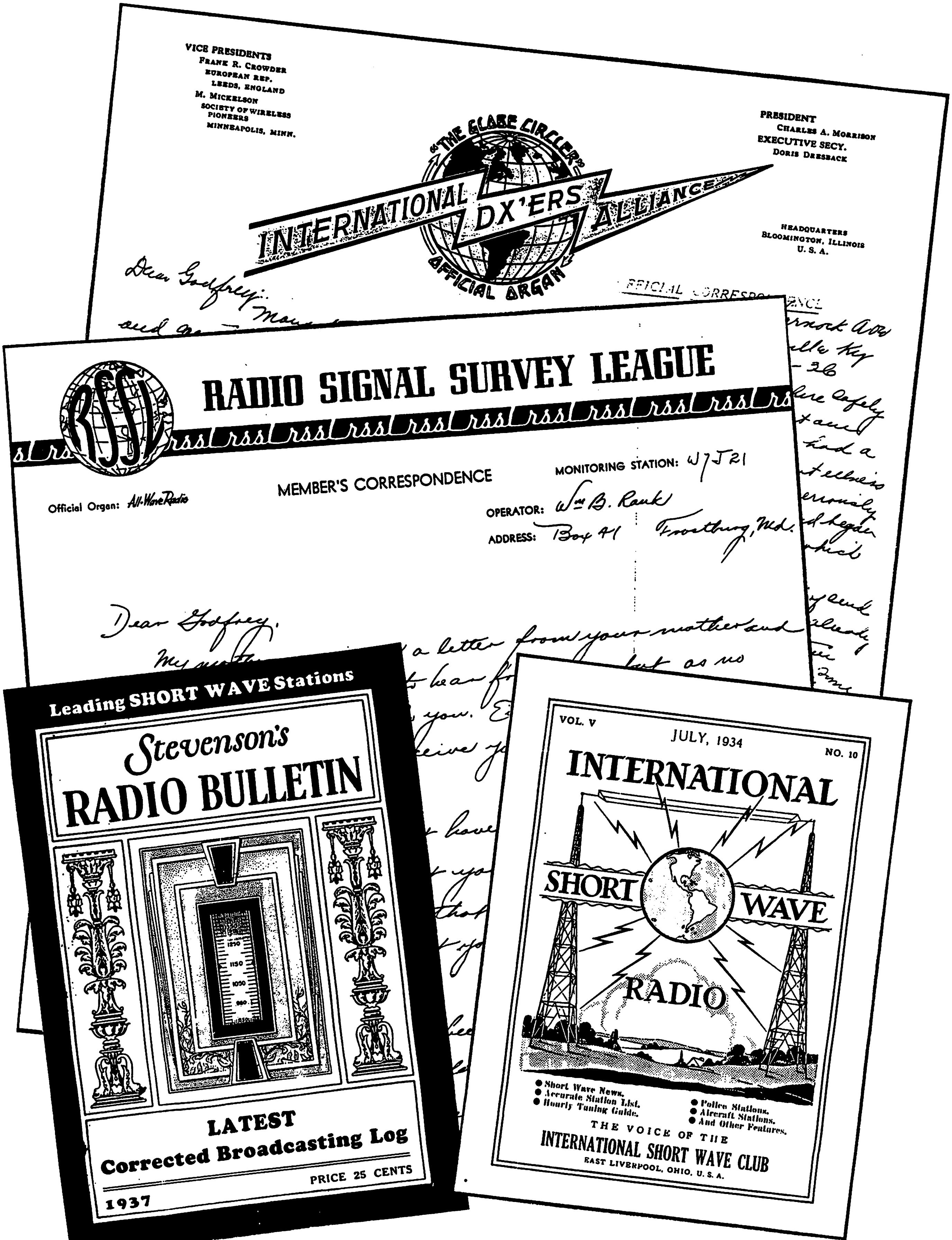
In January 1937 the magazine changed its name to *Shortwave and Television*, and in June it upgraded the format and content of the monthly "World Short-Wave Station List," turning it into probably the most authoritative list of its day. It was arranged by frequency and showed station name and call, operating times, and some addresses. Occasional supplemental lists provided valuable information on station ID's.

In October 1938 the magazine changed its name again, this time to *Radio and Television*. A new emphasis on amateur radio was announced, the notion of experimentation and set building having gradually lessened among listening enthusiasts. Joe Miller's column bit the dust at the end of 1939. He returned briefly in June 1941, inquiring as to reader interest, but nothing further materialized.

Radio and Television merged into *Radio Craft* in the November/December 1941 issue of the latter. These were the war years. The market was shrinking, resources for publishing were becoming scarce, advertising was down and amateur radio and TV development were at a standstill. Rather than run two magazines at a loss, Gernsback decided to try one at a profit. It was promised that *Radio and Television* would eventually resume publication as a separate magazine, but it didn't, and *Radio Craft* itself became *Radio-Electronics* in 1948.

The third of the Gernsbacks was the much shorter lived *Official Short Wave Listener Magazine*. This general circulation, newsstand magazine devoted exclusively to SWBC listening was published every other month beginning in late 1934. It was non-technical, concentrating on station lists, tuning information (antennas, ID's, interval signals, etc.), and station and program information. It was the latter that made OSWL unique. The magazine featured articles and photos about shortwave programs and shortwave radio personalities. Some examples of OSWL articles:

- "London Calling"
- CT1GO, Station of the Portugal Radio Club
- The Short-Wave Voice from Germany
- W8XAL--The Short-Wave Outlet for WLW Programs
- How NBC Broadcasts on Short Waves
- Short Wave Beauties from Holland
- When Moscow Turns On the Short Waves
- New Stations In Latin America
- 3LR's Short-Wave Voice from "Down Under"
- Bright Spots in U.S.S.R. Programs


VICE PRESIDENTS
FRANK R. CROWDER
EUROPEAN REP.
LEEDS, ENGLAND
M. MICKELSON
SOCIETY OF WIRELESS PIONEERS
MINNEAPOLIS, MINN.
"THE GLOBE CIRCLER"
INTERNATIONAL DX'ERS ALLIANCE
OFFICIAL ORGAN
PRESIDENT
CHARLES A. MORRISON
EXECUTIVE SECY.
DORIS DRESBACK
HEADQUARTERS
BLOOMINGTON, ILLINOIS
U. S. A.
Dear Godfrey:
RSSL
RADIO SIGNAL SURVEY LEAGUE
MEMBER'S CORRESPONDENCE
MONITORING STATION: W7J21
Official Organ: All-Wave Radio
OPERATOR: Wm B. Rank
ADDRESS: Box 41 Frostburg, Md.
Dear Godfrey,
Leading SHORT WAVE Stations
Stevenson's
RADIO BULLETIN
LATEST
Corrected Broadcasting Log
PRICE 25 CENTS
1937
VOL. V
JULY, 1934
NO. 10
INTERNATIONAL
SHORT WAVE
RADIO
Short Wave News.
Accurate Station List.
Hourly Tuning Guide.
Police Stations.
Aircraft Stations.
And Other Features.
THE VOICE OF THE
INTERNATIONAL SHORT WAVE CLUB
EAST LIVERPOOL, OHIO, U. S. A.

F34.24

- Musical Artists from Australia
- Hungarian Short-Wave Artists
- Novel Programs from India

It was the first time anyone had thought that there might actually be a group of shortwave *program* listeners out there. Unfortunately, OSWL's short life (it was absorbed by *Short Wave Craft* in June 1936) did not prove that an exclusively SWL magazine could make it, but OSWL was very nice while it lasted.

Other Magazines. A great little DX magazine--perhaps the greatest ever published--was *RADEX*. For most of its life, from 1924 through February 1942, *RADEX* was issued ten times a year (monthly except for a single June-July-August issue). Each issue contained 100 pages.

One of the grand old names of DX, Carleton Lord, described *RADEX's* beginnings:

*"It was intended for [BCB] listeners who did not have access to a newspaper with daily listings of programs. The listener would check the evening programs in RADEX, select those he would like to hear, and then note the nearest stations that would be carrying them. During the late 20's, many listeners would report the distant stations they had heard, and this led to a growing section for 'Letters to the Editor.' * * * Editor/Publisher Fred C. Butler boasted that monthly letters ran from a few hundred to over 1,000 and, of those requiring a reply, every one received a note in the magazine or a personal response."*[47]

RADEX's appeal in the 1920's was its organization of station information. Each issue carried a list of BCB stations arranged in frequency order, with three blank boxes next to the frequency for entering one's receiver dial settings (in those days, sets typically had two or three separate tuning controls with 0-100 markings). Interpolation between known frequencies permitted you to know roughly what channel you were tuned to. The magazine also contained separate station listings by call letters and state. From these listings came the magazine's official name, *Radio Index*, which was abbreviated *RADEX*.

Besides the indices, *RADEX* carried articles about stations, receivers, antennas, radio servicing and many other topics. There were questions from readers, editorials, crossword puzzles, contests, and an hour-by-hour calendar of network programs. The titles of the columns were great--"Riding the Ether Waves," "With the Midnight Marauders," "Monthly Gathering of the Clan," "In the Wee Hours With the RADEXers," "Stories of the Log Builders."

RADEX carried commentary on many topics, like obnoxious advertising, reminiscences of the "early" days of radio, and various metaphysical aspects of QSLing. The entire magazine was written in a chatty, informative, "DXer's" style. It was more like a club than a magazine, and in fact a "*RADEX* Club" was established in 1938. If you could have had only one DX magazine, it would have been *RADEX*.

Through the pre-shortwave 20's, *RADEX's* orientation was, naturally, toward the broadcast band. Late in 1930 it started carrying some shortwave information, and in June 1932 it presented its first list of shortwave stations of the world, soon to be a regular feature. *RADEX* belonged to DXers, especially BCB DXers, but it was on its way to earning the deserved appellation, "the DXer's bible," among shortwavers too. Letters from DXers in foreign countries began appearing, along with more articles about shortwave--"Breaking Into the Short Waves," "What's On the Short-Waves," "Coming Treats On the Short Waves," etc. Some columns spanned both BCB and shortwave, like "Leaves From A DXer's Scrapbook" by "Count de Veries" (Carleton Lord).

An interesting *RADEX* anomaly was the magazine's cover, or "frontispiece." As the emphasis on DXing grew, *RADEX* carried less and less program information, but every cover still featured the picture of a female radio personality of the day--Clara Bow, Mary Nolan, Frances Langford, "Annette Hanshaw, Van Heusen program Contralto," "Alice Joy of the Prince Albert Quarter Hour" ("she has a mellow voice of low register"), and dozens of others.

Likewise, throughout the magazine proper were many photographs of radio entertainers placed smack in the middle of articles that had absolutely nothing to do with them. There was Guy Lombardo in the middle of an article about radio salesmen, the "Cuckoo Hour" gang in the middle of a discussion of volume controls, Lowell Thomas in the midst of some DX tips, Ed Wynn surrounded by aerials and grounds, etc. The photos lasted through 1938 and the cover ladies through September 1939, long after *RADEX* had become basically a DX publication.

Publication of *RADEX* was suspended after the February 1942 issue, another victim of wartime instability. During its almost 20-year history, however, it set a new standard in DX publishing.

All-Wave Radio would have been my second favorite magazine. It was published from September 1935 to mid-1938, when it was absorbed by *Radio News*. The main shortwave column was called "Globe Girdling" and was edited by J. B. L. Hinds, a resident of Yonkers, New York and an accountant with the New York Central

Railroad. Like *Radio News'* Captain Hall, Hinds had also written for *Short Wave Radio* magazine. He started DXing in 1930 with a Pilot Super Wasp, and by the time he started editing for *All-Wave Radio* had graduated to a Hammarlund Pro, one of the early communications receivers. He knew the shortwave scene well. His columns were full of loggings and DX news, and were illustrated with numerous QSL's from his own collection. Supplementing his column was one of the most extensive monthly station lists of the day, showing frequencies and hours of operation for both broadcast and utility stations, plus separate, periodic lists of station addresses. *All-Wave Radio* knew what DXing was all about.

Other Literature. Beginning in the 20's and lasting into the 30's there developed something called the "radio log and callbook." Today when someone says "callbook" we think of amateur radio, but in the early days there were many "callbooks" which covered medium wave and shortwave broadcast stations exclusively.

The callbook publications were basically station lists, arranged in different ways. They came in several forms. Some were standalone publications which were updated and republished on a recurring basis. One such was *White's Radio Log*, which was published as a standalone booklet into the 1950's, eventually being incorporated into *Radio-TV Experimenter* magazine and, from 1971 to 1981, *Communications World*. It was last published in 1985. There were several other publications like *White's*.

Many "radio logs and call books" were issued as one-time or "occasional" publications, usually in the form of pocket- or magazine-size pamphlets. Often they were distributed as promotional items by radio manufacturers and other businesses. In addition to the station information, they often contained advertising.

Some magazines had "call book" or "log" in their title, sometimes as a result of mergers with other publications. Although they also carried station lists, their main orientation was usually on the technical side--circuits, schematics, construction, radio theory, etc. Included here were publications like *Radio Call Book Magazine and Technical Review* (absorbed by *Radio News* in December 1932), *Citizens Radio Call Book Magazine and Scientific Digest*, and *Radio Listeners' Guide and Call Book*.

ORGANIZING

There was a lot of organizing by both clubs and magazines in the 1930's.

Just as there had been many amateur radio clubs in the days of the experimenter, so there were now many listener clubs. The Great Lakes Radio Club, the New England Radio Club, the Transcontinental Radio DX Club, Canadian DX Relay, the North American Radio Club, the United States Radio DX Club--all are gone now. Magazines like *Radio News* and *RADEX* offered the clubs generous publicity.

Most of the clubs were small, ranging from 15 to 125 members, and concentrated on BCB DX. Often they issued "tip sheets," sometimes on a weekly basis. A major activity of many clubs was arranging, through their courtesy programs committees, special broadcasts dedicated to the club's members from BCB stations. (Although special programs were arranged occasionally for shortwave listeners, especially by *RADEX* and the International DXers Alliance, it was primarily a BCB activity.)

Many hundreds of these special programs were arranged each season--so many that numerous scheduling conflicts developed. This led to sharp practices. Some clubs would ask stations to dedicate to them a portion of a program arranged by another club, others would not publish information on special programs arranged by other clubs, etc. Inter-club sniping abounded, and periodic efforts toward inter-club cooperaton seemed to go nowhere.

The only survivor of these early clubs is the National Radio Club, established in 1933 as an exclusively BCB club. Most of the smaller clubs merged into larger ones, and the larger clubs eventually got into shortwave. Most shortwave activity was oriented toward the east and central United States.

Then, as now, radio club bulletins were an important source of information. Of the clubs that carried shortwave information in the 1930's, the big three were the Newark News Radio Club, with its early publication, *The Dialist*, precursor of the *NNRC Bulletin;* the International DXers Alliance, publisher of *The Globe Circler;* and the Universal Radio DX Club, which published *The Universalite.*

The NNRC was formed in 1927 and had 1,800 members by 1933, making it the largest of the clubs. Dues were $2 the first year, $1 thereafter. In its early days the NNRC was principally a MW club, and the vehicle for publishing DX information was the Newark News newspaper itself, which carried various club features written by members under *nommes de plume* such as "Roamer," "Dial Twister," and "Air Raider." In 1934 the club commenced publication of *The Dialist*, a magazine of about 40 pages that bore a distant resemblance to *RADEX*. It was commercially printed, with a glossy cover, and it featured club news, station information, articles about DXing, gossipy items about radio personalities of the day, and a monthly list of U.S. BCB stations (again a la *RADEX*). Unfortunately, its demise came at the early age of one year when it found itself in competition for advertising with its sponsoring parent, the Newark News. The less glitzy and non-commercial *NNRC Bulletin* started up soon thereafter and was published continuously until the club closed its doors in April 1982.

The International DXers Alliance was formed in 1932 by well known Bloomington, Illinois DXer Charles A. Morrison. Known over the years as the IDA, it emphasized foreign DX, mainly MW at first. Dues were $1 a year. The monthly bulletin, *The Globe Circler,* started out as a four-page mimeographed affair which was distributed to about 50 persons. Interest in shortwave started developing, and in August 1934 the club went "all wave." By 1935 the bulletin had grown to a 16-page pamphlet more closely resembling today's club bulletins, with loggings, station news, new member info, club chapter news, etc. It was sent to over 1,200 persons in 50 countries. There were also several IDA regional district bulletins, and a *British Globe Circler* published in England for the club's 100 European members. The IDA deserves much credit for the many important hobby activities in which it was engaged.

The Universal Radio DX Club was another well known club (not to be confused with the Universal DX Club which was absorbed by the NNRC in 1938). It was headed by Charles C. Norton. Upon its founding in 1933 it began issuing a DX "tip sheet" every 10 days. Dues were 85 cents a year. By the late 30's its weekly bulletin, *The Universalite,* was well known. It contained BCB tips and station changes, shortwave information, a special report on DXing in Japan from a URDXC member there, and members' letters. The URDXC continued in existence into the 60's with Charles Norton still at its head. (Norton died in 1991 in Vallejo, California.)

The first major shortwave-only club was the International Short Wave Club, headquartered first in Klondyke, Ohio, then in East Liverpool, Ohio. It commenced operation in 1929. Annual dues were $1. The bulletin, *International Short Wave Radio,* was a 5 x 7", 20-40 page, professionally printed bulletin containing interesting DX items, station lists, station photos and advertising. At first the coverage was primarily utility stations, but it soon moved into SWBC, which became its concentration.

Another noteworthy club was the Quixote Radio Club. Formed in 1933, it issued a weekly bulletin, *The Short Wave Reporter.* Encouraging activity by club members was a concern even back then. Active QRC members (those who submitted at least one report weekly) received 20 issues of *The Reporter* for $1. Inactive members received only 10 issues.

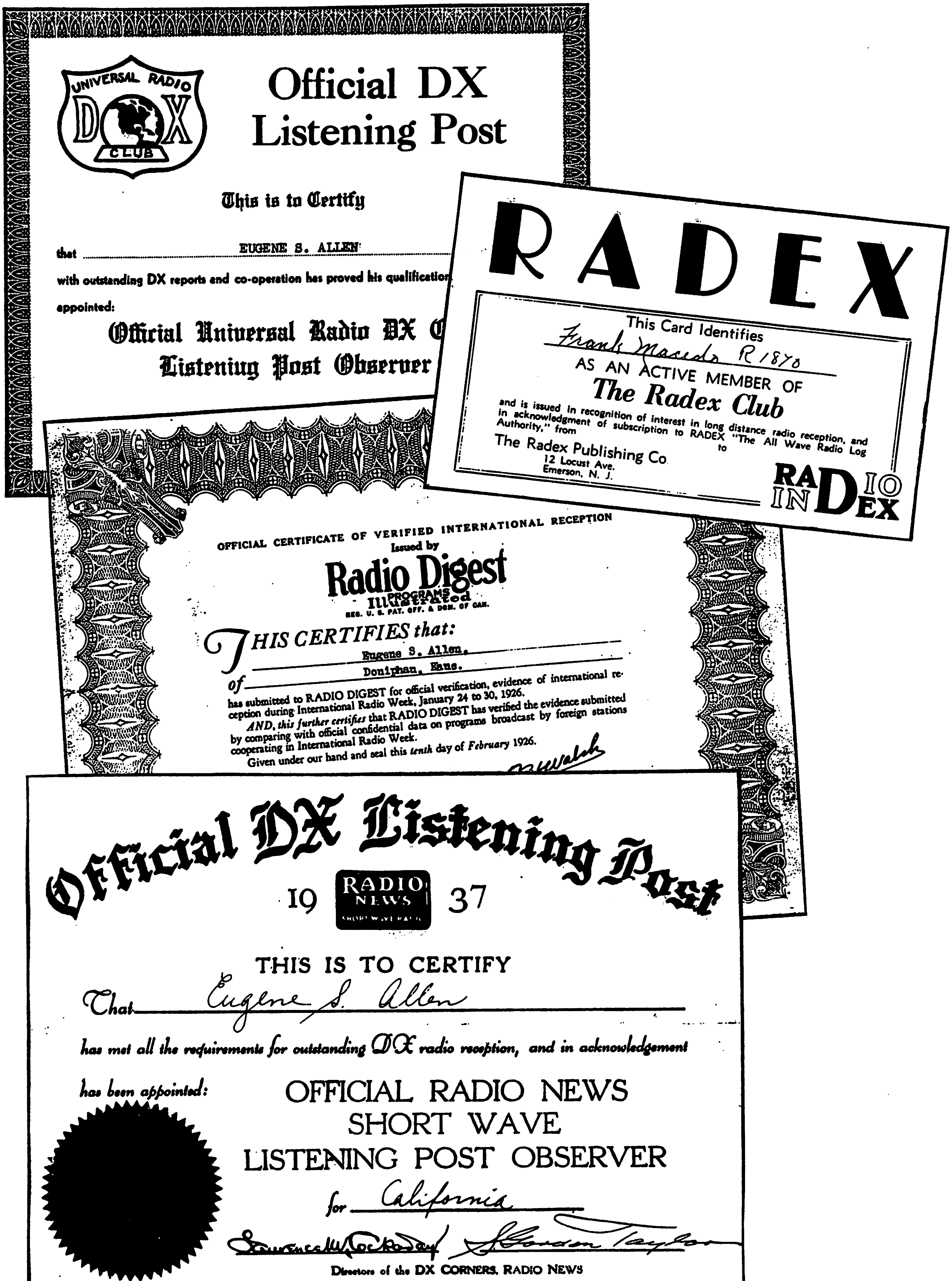
There were some less serious "clubs" as well, like the Before Breakfast Short Wave Club. "There are no dues, meetings, minutes or other parliamentary nuisances. It is merely a friendly, fraternal and not too serious organization of early birds who believe in the old adage about catching the worm."[48] A membership certificate was sent upon receipt of two QSL's from shortwave stations 1,000 miles distant that were logged between 5 and 9 a.m.

Radio magazines also played a role in hobby organizing. *Short Wave Craft* sponsored something called the Short Wave League. Although it seemed preoccupied mainly with the issue of whether to abolish the amateur code requirement below 5 meters, it was promoted as "a scientific membership organization for the promotion of the short wave art." Members received a membership certificate and could purchase stationery, maps, globes, seals, etc., and the official Short Wave League button (enamel 35 cents, "solid gold" $2).

Another *Short Wave Craft* project was the Short Wave Scouts, whose purpose was "to bring to headquarters reliable information on the operation of the various short-wave stations of the world." A monthly Short Wave Scouts silver trophy was awarded to the person who submitted the log containing the greatest number of shortwave stations verified during a 30-day period. The first silver trophy was awarded in January 1934. It was "designed by one of New York's leading silversmiths. It is made of metal throughout, except the base, which is made of handsome black Bakelite. The metal itself is quadruple, silver-plated, in the usual manner of all trophies today. It is a most imposing piece of work, and stands from tip to base 22-1/2". . . . The work throughout is first-class, and no money has been spared in its execution. It will enhance any home, and will be admired by everyone who sees it."[49]

All-Wave Radio attempted to organize DXers through the Radio Signal Survey League, which was introduced in February 1937 and given its own column most months. The purpose of the R.S.S.L. was to improve domestic and international radio transmission and reception conditions through a worldwide network of monitors who would conduct organized monitoring surveys for stations requesting it. There were five divisions: BCB, SWBC, amateur phone, amateur CW and "noise survey," the latter intended to help alleviate man-made electrical interference in local areas. There was an R.S.S.L. section manager in each state, and local chapters were encouraged. Members reported their survey results on forms which showed reception conditions in a graphic format. The R.S.S.L. also offered listener supplies (survey forms, stationery and R.S.S.L. metalette seals), and "DX Reception Citations" (certificates attesting to one's verification totals).

There was much organizing surrounding the R.S.S.L., perhaps too much, and when all was said and done, there had been a lot more said than done. The level of survey participation was not what had been hoped for. When *All-Wave Radio* was taken over by *Radio News* in August 1938, the R.S.S.L. faded into history. Still, the experiment was important as an organized, hobby-oriented attempt not just to exchange DX tips but to actually improve international reception and thus make shortwave radio more attractive to non-technical people.



UNIVERSAL RADIO DX CLUB

Official DX Listening Post

This is to Certify

that EUGENE S. ALLEN

with outstanding DX reports and co-operation has proved his qualification

appointed:

Official Universal Radio DX C

Listening Post Observer

RADEX

This Card Identifies

Frank Macedo R 1870

AS AN ACTIVE MEMBER OF

The Radex Club

and is issued in recognition of interest in long distance radio reception, and in acknowledgment of subscription to RADEX "The All Wave Radio Log Authority," from to

The Radex Publishing Co.
12 Locust Ave.
Emerson, N. J.

RADIO INDEX

OFFICIAL CERTIFICATE OF VERIFIED INTERNATIONAL RECEPTION
Issued by

Radio Digest
PROGRAMS
Illustrated
REG. U. S. PAT. OFF. & DOM. OF CAN.

THIS CERTIFIES that:
Eugene S. Allen,
of Doniphan, Kans.
has submitted to RADIO DIGEST for official verification, evidence of international reception during International Radio Week, January 24 to 30, 1926.

AND, this further certifies that RADIO DIGEST has verified the evidence submitted by comparing with official confidential data on programs broadcast by foreign stations cooperating in International Radio Week.

Given under our hand and seal this *tenth* day of *February* 1926.

Official DX Listening Post

19 RADIO NEWS SHORT WAVE RADIO 37

THIS IS TO CERTIFY

That Eugene S. Allen

has met all the requirements for outstanding DX radio reception, and in acknowledgement has been appointed:

OFFICIAL RADIO NEWS
SHORT WAVE
LISTENING POST OBSERVER

for California

Laurence M. Cockaday   S. Gordon Taylor

Directors of the DX CORNERS, RADIO NEWS

Growth of the clubs meant that DXers, and their reputations, started getting known. Among the big names of the shortwave listening scene of the 30's were many we don't remember, like Oliver Amlie of Philadelphia, Ray LaRocque, Robert Skyten and Gil Harris of Massachusetts, John J. Oskay of New Jersey, Page Taylor of Detroit, and Anthony C. Tarr of Seattle. Others we can recall a bit more easily, like August Balbi of Los Angeles, Larry Lundberg of Minneapolis, Art Hankins of Greensburg, Pennsylvania, Carroll Weyrich of Baltimore, and the man who is surely the dean of American shortwave DXers, Roger Legge. And there were some even bigger names. In October 1934, *RADEX* reported that Bing Crosby and Dick Arlen were going to stage a week-long DX battle from their Hollywood homes. They would use identical McMurdo Silver receivers, and the one who logged fewer stations would write a check for $1,000 to a children's charity.[50]

Although distance discouraged the kind of national conventions we are used to today, it was in 1939 that the IDA sponsored one of the first national shortwave DX meetings, the Golden-Gate DX Festival, July 8-11, 1939 in San Francisco, site of the International Golden Gate Exposition. There were special broadcasts over G.E.'s "Treasure Island" (San Francisco) shortwave station, W6XBE (later KGEI). There was also an IDA barbecue, plus displays, lectures, etc. It was noted that "$15 or $20 should carry anyone thru the entire four days of the Festival and Exposition nicely, and that covers all expenses: registration, meals, hotel, sightseeing, etc. Many could do it for less than that by careful planning."[51] The IDA bulletin contained instructions for reaching the convention site by train, bus and auto, and urged members to take the special "Globe Circler Tour," a seven-day railroad trip from Chicago to San Francisco by way of Oregon aboard the Northern Pacific Railway's "North Coast Limited." The round trip train fare, including sleeper coach, was $89.90-$98.90 per person, including some side trips and ferries. "Excellent meals, 50 cents, 75 cents, $1. Also 'off the tray items', 5 cents to 25 cents." Those were the days.

COMPETING

There were many opportunities, big and small, to distinguish oneself. Magazines were always offering a few dollars or a free subscription for the best operating tips, or "kinks," as they were called. *RADEX* offered a radio map or a copy of their magazine to the winner of the monthly puzzle contest. *Official Short Wave Listener Magazine* offered a silver trophy for the best listening post photo.

Short Wave Craft ran a contest for the best article about a homemade shortwave receiver or converter wherein you had to not only write the article but also send in the set! First prize was $50. Another time, *Short Wave Craft* offered over 100 prizes to readers who submitted the best captions for a *Short Wave Craft* cover depicting an angry wife sitting up in bed shaking her finger at her spouse, who was in another bed with his headphones on. The winner of the grand prize (a Pilot 11-tube Super Dragon receiver): "There 'Antenna' Justice" ("There Ain't Any Justice"--get it?). The second prize winner was "The Ethernal Triangle"; 14th prize winner, "Radio Raises Spain But Wifey Raises Cain." I guess you had to be there.

There was also some serious contesting. DX contests developed first among medium wavers. In 1934, the IDA ran the Randolph Trophy contest for verifying the largest number of medium wave stations at least 2,000 miles distant during a six month period. The grand prize went to a Hawaiian DXer with 114 stations. First prize was a 40"-high trophy, with several smaller but equally impressive trophies going to other winners.

A big shortwave contest in the mid-1930's was the International Short Wave Club's Denton Trophy Contest, named after Clifford E. Denton, well known shortwave engineer of the day. The winner was the person who obtained the largest number of SWBC veries from stations logged during a six-month period. First prize was a silver trophy, second prize a medal. Other winners received engraved scrolls.

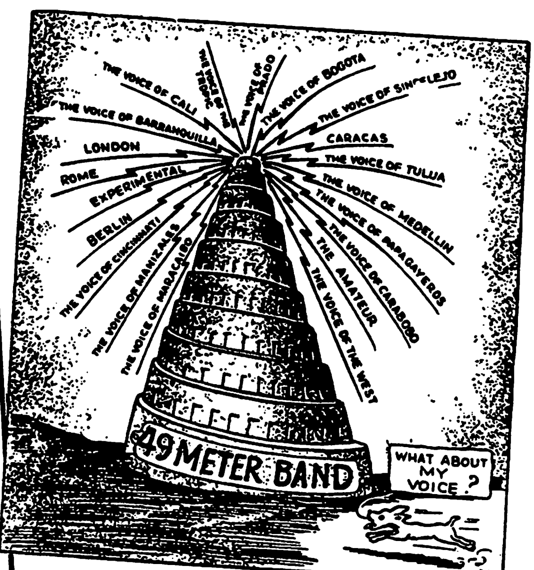
Clubs issued various kinds of awards, just as they do today. In August 1935 the IDA announced the "Doctor of Short Waves degree" (D.S.W.) which required 100 shortwave veries from at least 25 countries besides the applicant's own (and including at least three QSL's from each continent). Clubs, as well as *RADEX*, had "singleton" contests wherein you "registered" a veri from a station which you believed no one else in North America had. Once entered, it could be "eliminated" from the list by someone else with the same veri.

An interesting DX artifact from the 30's was the radio map, basically a map which also contained station information. An offshoot of the radio map was the radio atlas, a booklet combining maps, station lists and information about the various stations and countries. There were many variations on this theme, with radio maps sometimes being used by electronics houses as promotional items.

One reason maps were popular was that reception *distance* was a recognized yardstick of DXing prowess. Much was made of being able to log stations 12,000 miles away, and advertisements contained letters from satisfied customers attesting to the distance feats that were possible with a particular receiver. Likewise, DX contests sometimes had a mileage component to them. You might have to log a given number of stations in various distance categories, or the point value of a logging might be dependent on its distance.[52] In the Denton Trophy Contest, for example, ties were broken based on total number of reception miles represented by the contestant's logs.

A DX REPORT

W J Y Shenectoday.
General store
New york
state
sir
i am gide for hunter man wot come at dis place lac-des ilse for hunting deer dese hunter man bring it wit him machine for heer you spik from far place i lissen wit him sunday nite also tuesday nite i heer song bout my ole modder dats long tam i dont see my modder an i ting date dame fine song also i heer oder song i dont no de nam tuesday nite storie for de small boy and girl bout mak de star shine for dem if dey is good boy and girl hunter man laff lak hell an tole me ax you how we mak some moon shine
i heer you spik jus de same lak your at me place i ting you have good machine i lissen more nex wick
tank you and much oblige
gide Camille Rou[illegible]
[illegible] P.O. [illegible] Canada



THE NEW TOWER OF BABEL.

VERIFICATIONS

In 1933 a listener suggested that "verification collections will some day be valued as a phase of what other collectors call Americana, since radio is yet in a comparative infancy."[53] While the efforts of the Committee to Preserve Radio Verifications were still more than 50 years away, the station-listener relationship produced some interesting memorabilia from the very start. During the 1920-25 period, for example, when stations were interested in knowing who was listening and what they thought of the programs, listener comments were commonly called "applause." This was before the days of listener research, even before most commercials. Artists were seldom compensated for performing on the air, and neither they nor the station knew who, if anyone, was listening.

Enter the "Applause Card," a "fill in the blanks" postal card which the listener sent to the station or artist, expressing appreciation for the broadcast--a kind of "reverse QSL," if you will. Generic applause cards were issued by radio companies and other commercial firms. Some individual listeners designed their own.

True verification cards were exchanged among hams even before the days of AM radio, so, considering the broadcasters' additional need for program comments, it is not surprising that QSLing took hold among BCB stations as well. The additional elements of geographic and cultural distance between broadcaster and listener made QSLing a natural for shortwave stations.

The rules of QSLing were the same in the 30's as they are today. So was the question of what it all meant. "I send for every verification that I can, and when my pop sees me writing out a dozen or so he wants to know what's the sense of it all. He says it does no good to have a letter from a station saying that they were broadcasting that time and that they were glad that I heard the program. I'm quite at a loss to argue with him except to say that it is an interesting hobby. He claims that it is a waste of stamps."[54]

Reception reports were not of higher quality in "the good old days." Many BCB reports were sent on postcards. An announcer who had set up various DX broadcasts at two BCB stations complained that most DXers were deficient in reporting signal quality, which was the main interest of the station. He said that in only 88 of 4,387 reports received was signal quality adequately reported. In the rest it was a sketchy technical report, often just a few words. "I have a number of friends associated with foreign short wave broadcast stations," he reported, "and letters from them indicate that the number of slip-shod reports is astonishing. I find that even 'fake' reports are received by these stations in numbers that make the situation rather serious."[55] The New Zealand DX Radio Association released data indicating some faking of reception reports. In one case, 30 people reported a station which had been off the air for two months. In another, NZDXRA-published details of a fictitious broadcast produced glowing reports from some listeners.

All-Wave Radio kept track of stations that did not verify, and, as today, DXers tried everything to get QSL's. After nine attempts to QSL 2RO in Rome, Captain Hall sent a registered letter to Il Duce himself. In response, he received a letter from the Italian Consul General in New York, requesting his presence. The Consul informed the captain that, as a result of his letter, Mussolini had conducted a thorough investigation of the conditions at 2RO. "Premier Mussolini thanks you so much for writing him, because he is interested in just these things. His policy is to investigate the smallest complaints." Hall informed the Consul that many SWL's had blackballed 2RO because it was a notorious non-verifier. Three months later he had a second visit wherein the Consul informed him that things had been cleaned up at the station and that, among other things, they had hired an Englishman to answer correspondence. Hall's next report was answered in 21 days.[56]

And there were the usual disappointments, such as the non-verification letter from 500 watter CQN, Macao which J. B. L. Hinds received in response to his report. It turned out that the station didn't broadcast on Sundays, the day when various DXers thought they were hearing it. "All of us who thought we had the station on any Sunday were mistaken, as that station never has broadcast on Sunday, and the station we did have was H1X, in [the Dominican Republic]."[57]

One thing that was different about QSLing was the cost. The 1934 postal rate to the Americas was three cents an *ounce* (not a half ounce), five cents to the rest of the world. Of course, air mail to many areas became available only late in the decade. Registering a letter added 15 cents to the postage. An International Reply Coupon cost nine cents. And you had to be careful how you addressed reports. Letters addressed to "Russia," not the "U.S.S.R.," were returned. (Some things really *have* changed.)

A lot of energy went into the issue of what did or did not qualify as a bona fide QSL--whether it was an actual verification, only an acknowledgment, etc. This was partly because contests were often based on verified loggings, and the QSL's usually had to be submitted as proof. The 30's were also witness to some rather heated debates pertaining to QSLing. One had to do with what were known as "monitored veries." It started out fairly benignly on the BCB side in 1936 but came to full boil on shortwave.

By way of their general manager, two jointly owned and usually non-verifying BCB stations, WJRD, Tuscaloossa, Alabama and WMFO, Decatur, Alabama, gave an Indianapolis DXer written permission to verify reports on their frequency tests for them. The DXer pledged to personally monitor the tests, and he prepared a

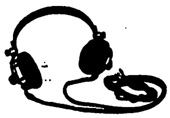
POST CARD
RADIO APPLAUSE CARD

Place 1 or 2 Cent Stamp Here

Radio Station K F N F

Henry Field Seed Co.,

Shenandoah, Iowa



Gentlemen:

I want to express my appreciation with this APPLAUSE CARD, of the Program received from your station on Nov. 9th. (Date)

I wish to especially commend the following:

"Really A Musical Instrument"
Price $24.50
No extra batteries required

"I Gathered a Rose"

Maria Gertrude Healy

Listener Henry E Delaney

Address 478 Colvin Pky.

City Buffalo State N.Y.

Say it with "APPLAUSE CARDS"

Copyright 192_, Dictograph Products Corporation, New York City

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A Word of Appreciation from Hartford, Conn.

We are glad to advise you that we enjoyed your program on the evening of Nov. 9th 1924

We enjoyed particularly the selection by

Miss. Maria Gertrude Healy.

Name Mr. + Mrs. A.J. Elmer.

Address 214 Blue Hills Ave.

Hartford Conn.

Compliments of The Hartford Times
Connecticut's Greatest Newspaper

APPLAUSE CARD

BROADCASTING STATION WBZ City Boston

State Mass On Sunday Mar 8 1925 at

I heard your station broadcasting the following: Mrs E.C. Healy and Daughter Marie Gertrude Healy's singing period. Enjoyed the singing very much. Congratulations. Hoping we may be favored with their singing again in the future. Respectfully Emmett J Dane.

My set is home made 1 tube regenerative. Aerial: 78 ft. long. 15 to 21½ ft. high.

Emerett J. Dane, Route No. 5., Cortland, N. Y.

WESTINGHOUSE EXPERIMENTAL STATION KFKX
HASTINGS, NEBRASKA

THE FIRST RE-BROADCASTING STATION IN THE WORLD.
Wave Length—286 Meters Power—Variable
LOCAL PROGRAMS EVERY MONDAY and THURSDAY
Re-broadcasting programs from KDKA at East Pittsburgh
Schedule not definitely determined.
Broadcasting from the studio of the Gaston Music & Furniture Co., at Hastings, Nebraska.

Dear Friend:—

We regret that we are unable to answer your kind communication in more personal form. That, however, is impossible because of the number of letters received We wish, never-the-less, to express our appreciation for the time and trouble you have taken to commend our programs and assure you that your support will help us in planning better programs for the future.

Trusting to receive further suggestions and encouragement from time to time.

Gratefully yours,
THE WESTINGHOUSE ELEC. & MFG. CO.
STATION KFKX

RADIO ACKNOWLEDGMENT CARD

Date Dec. 12 192 4

Station -K Q V- begs to acknowledge your Letter

Reporting on Program and Transmission of Apr. 4. 1924

Our Artists and the Personnel of the Studio greatly appreciate this attention and hope to hear again from you during the season.

Daily Programs—(except Sun.) 10.30 A.M. and 3.P.M.
Evening Programs—(except Sun.) 8.00 to 10.00 P. M.
Monday—Wednesday and Friday.
Tues.—Thur.—Sat. and Sun. Eve. "SILENT".

275.2
270 Meters

Eastern Standard Time

DOUBLEDAY-HILL ELECTRIC CO.
719-21 Liberty Ave Pittsburgh Pa.

(Miss) Frances Miller Studio Director

STUDIO PHONE
GRANT 5594

8:45 A.M.—Market Report
12 Noon—Weather and Opening Cotton Market.
3 P.M.—Weather, Market and Crop Bulletins.
500 Meters

WMC

Midnight Frolics 11 P. M. Tuesday and Friday.
8:30 P. M.—Musical Programme, 500 Meters.

THE COMMERCIAL APPEAL BROADCASTING STATION

Wednesday Night Is WMC's Silent Night

Memphis, Tenn., MAR 11 1924

WMC Thanks You for Acknowledgment of Reception of Its Programme

Remarks

GEO. D. HAY ("The Solemn Old Judge"), Director
P. G. ROOT and J. E. KABAKOFF, Operators
Equipment: Western Electric 500-Watt 1-A Radio Broadcasting Transmitter.

Programmes Printed Daily in The Commercial Appeal
(Central Standard Time)

RADIO BROADCASTING STATION

WGY

SCHEDULE FOR JANUARY & FEBRUARY

MUSICAL PROGRAMS 360 *Meters*
Every Monday, Tuesday, Thursday and Friday afternoon 2:00 to 2:30; evening 7:45
Special late program Friday evenings at 10:30.

SUNDAY PROGRAMS
10:30 a.m. and 4:30 p.m.

CHILDREN'S STORIES
Every Friday evening at 6:30

WEEKLY HEALTH TALKS
Every Friday evening at 7:40

NEWS BULLETINS
Daily, except Saturday and Sunday, 6:15 p.m.

N. Y. STOCK EXCHANGE REPORTS
Daily, 12:30 p.m. except Sunday.
Daily, 6:00 p.m., except Saturday and Sunday

General Electric Company Band

U. S. NAVAL OBSERVATORY TIME SIGNALS
Daily, 11:55 a.m. and 9:55 p.m. Wednesday and Saturday, 11:55 a.m. only. No time signals Sunday

OFFICIAL WEATHER FORECAST
Daily, except Sunday, 12:45 p.m., on 485 meters

TIME REFERENCE
Eastern Standard. Changes in schedule announced by Radio-phone

N. Y. PRODUCE MARKET REPORTS
Daily, except Saturday and Sunday, 12:30 and 6:00 p.m.

GENERAL ELECTRIC COMPANY, Schenectady, N. Y., U. S. A.

January, 1923

PC-244-10th Edition

special two-color verie which he offered to DXers submitting to him directly a correct report and a postage stamp. It was an unusual arrangement but it prompted few complaints.

In the 30's the BBC had the same policy which it followed (with occasional exceptions) for many years thereafter: it did not verify reports. In 1936, two well known DXers started monitoring the BBC Daventry station at pre-announced dates and times and issuing "QSL's" for correct reports accompanied by five cents to cover costs. They did this, they said, to stimulate interest in the hobby. Reports had to be mailed within 24 hours and had to contain the names of at least two songs or an accurate description of talks.

The process was well publicized in the hobby press, and the two public spirited DXers commended for doing a splendid job. Unfortunately, despite the organizers' apparent care in their releases to hold themselves out only as third-party monitors and not official BBC representatives, the QSL's implied something else: "Dear radio friend: Your report of reception of . . . transmitter on [date] has been carefully checked and found correct. Please accept this card as your verification of reception. Many thanks for your report. THE BRITISH BROADCASTING CORP. Checked by:____________. Verified by:____________." It was postmarked U.S.A., but the front looked mighty authentic.

This prompted the BBC to demand an end to the practice. Soon an enormous controversy arose within the hobby, with much questioning of the motives of those involved. (Around the same time another DXer established a similar arrangement for "verifying" reception of ZBW, Hong Kong, which had ceased QSLing.) Although some 400 Daventry reports were "verified" in this way, with no indication that the process was other than completely honest, the whole thing was thought subject to abuse and the organizers voluntarily ended it. At heart, it looked too much like DXers buying QSL's from other DXers.

Of a similar genre were the "dime veries." In 1937 the Quixote Radio Club inaugurated a system whereby club headquarters accumulated reports for certain Latin American stations which suffered from QSL lethargy and forwarded them to the stations as a group. With your report you sent 13 cents--three cents to cover the cost of getting the report to the station and ten cents for the return postage.

The Quixote program started out with HRN in Tegucigalpa, Honduras, but soon the QRC had 15 stations, including some relative non-verifiers, agreeing to honor reports submitted in this way. Unlike Daventry, the stations sent their own QSL directly to the reporter--the club was involved only in getting the report to the station. The service was available to QRC members and non-members alike.

The difficulty was that some of the stations adopted the practice of verifying *only* reports received in this way, ignoring others or returning them unverified with instructions to resubmit through the QRC. Some DXers were concerned that if the QRC program caught on, stations might insist that all reports be sent by way of such services and stop accepting direct reports altogether. Other DXers complained that, prior to commencement of the service, the "difficult" stations involved did verify some reports and that those who submitted proper reports and got them verified were being disadvantaged by this homogenized reporting process. Probably more because the service developed around the same time as the Daventry controversy, the QRC abandoned it.

These novel approaches to QSLing went the route of their BCB big brother, the EKKO stamp. Created by the EKKO Company of Chicago in the mid-1920's, EKKO stamps were engraved, postage-stamp size stamps carrying a picture of an eagle (for Canadian stations, a beaver), the letters "E-K-K-O" in the corners and the call letters of the station. They came in different colors. For $1.75 you could buy an EKKO stamp album which contained spaces assigned to the various stations, just like a postage stamp album. The album came with a supply of "Proof of Reception" cards, basically card-size reception reports. You sent the station either one of these cards or a regular reception report, enclosed a dime, and the station sent you back its EKKO stamp, along with a QSL card or letter if they had one. Some people kept the stamps in the album, others affixed them to the veries. (Some stations had their own, non-EKKO verification stamps, and some did not use stamps at all.) Later, the EKKO Company started selling the stamps directly to any listener who sent in a QSL from a station. The EKKO stamp fad ended when listeners started trading them. They remained an interesting radio collectible, but they lost their value as true verifications.

AT DECADE'S END

In the mid-1930's, IDA President Charles A. Morrison wrote a four part series in *Radio News* about the future of shortwave.[58] We were on the verge of a new "international unity," he said. Shortwave would annihilate distances and bring with it peace among nations. In addition to the need for better equipment, better development of the medium's commercial potential, and better frequency allocations ("[t]he present congestion of the 49-meter band is a good example of the need for action on this line," he wrote), Morrison spoke of the desirable growth of "national radio voices" (and bemoaned the absence of such a voice in the United States).

The development of shortwave in the 1930's had indeed been breathtaking. For the first time, live radio broadcasting could take place with relative ease over great distances. All that was needed was the wisdom to use this new resource properly.

Unfortunately, although the globe was shrinking, man had grown no wiser. War clouds were gathering, and instead of shortwave increasing international understanding, just the opposite was happening. On the international bands the Axis stations had seized the high ground, broadcasting propaganda of hitherto unknown proportions. Their activities were being carefully watched. The BBC Monitoring Service was already in operation, and in November 1939 the Princeton University School of Public Affairs set up the Princeton Listening Center, the object of which was to study international broadcasting in wartime and record the texts of broadcasts originating from the Axis countries. It wasn't until 1941 that NBC and CBS set up their own monitoring stations to obtain overseas news and the F.C.C. established the Foreign Broadcast Monitoring Service.[59]

Shortwave listening hobby activity decreased at the end of the decade and continued at a slow pace as the war's demands on the home front increased. Equipment and information would soon be in short supply, as would DXers themselves, many of whom would join the service, putting the hobby aside as they and the rest of the world turned their attention to more serious matters.

END NOTES:

[1] *Radio News*, Vol. 3, No. 12, p. 1136 (June 1922).

[2] *Radio News*, Vol. 4, No. 2, p. 314 (August 1922).

[3] *Radio News*, Vol. 4, No. 5, p. 867 (November 1922).

[4] "Methods of Transmission Used in Broadcasting Stations," *Radio News*, Vol. 3, No. 10-11, p. 946 (April-May 1922).

[5] *Radio News*, Vol. 4, No. 2, p. 235 (August 1922).

[6] *Radio News*, Vol. 4, No. 6, p. 1087 (December 1922).

[7] "Radio Threatening the Phonograph and Theater?" *Radio News*, Vol. 3, No. 12, p. 1081 (June 1922).

[8] Orange Edwards McMeans, "The Great Audience Invisible," *Scribner's Magazine*, No. 73, p. 410 (April 1923).

[9] Howard Vincent O'Brien, "It's Great To Be A Radio Maniac," *Collier's*, p. 15 (Sept. 13, 1924).

[10] *RADEX*, No. 50, p. 4 (Mid-Summer 1931).

[11] *Radio News*, Vol. 9, No. 10, p. 1097 (April 1928).

[12] "Eighteen Years of S.W. Broadcasting," *Short Wave and Television*, Vol. 9, No. 4, p. 200 (August 1938); "Radio KFKX, Repeating Station At Hastings," *Radio Journal*, Vol. 4, No. 3, p. 111 (March 1924); "Re-Broadcasting, A New Era In Radio," *Radio News*, Vol. 5, No. 9, p. 1242 (March 1924).

[13] "Eighteen Years of S.W. Broadcasting," *Short Wave and Television*, Vol. 9, No. 4, p. 200 (August 1938).

[14] "The New Pilot Universal Super-Wasp," *Radio Design*, Vol. 3, No. 4, p. 4-5 (1931).

[15] *Radio and Television*, Vol. XIX, No. 6, p. 325 (October 1938).

[16] Michael Kent Sidel, *A Historical Analysis of American Short Wave Broadcasting, 1916-1942* [Ph.D. dissertation], Northwestern University (1976), p. 128-130.

[17] "'Radio Row' Goes Short Wave," *Short Wave Radio*, Vol. 1, No. 9, p. 9 (July 1934).

[18] *Radio Craft*, Vol. IV, No. 11, p. 647 (May 1933).

[19] *Short Wave Radio*, Vol. 1, No. 10, p. 9 (August 1934).

[20] Reminiscences of 1935 by Tom Williamson, Peterborough, Ontario, Canada, 1985.

[21] *RADEX*, No. 72, p. 18 (October 1933).

[22] *RADEX*, No. 75, p. 19 (January 1934).

[23] *RADEX*, No. 74, p. 29 (December 1933).

[24] *RADEX*, No. 76, p. 18 (February 1934).

[25] *RADEX*, No. 137, p. 13-16 (May-June 1940).

[26] *RADEX*, No. 86, p. 35 (February 1935).

[27] *RADEX*, No. 88, p. 9 (April 1935).

[28] *RADEX*, No. 75, p. 15 (January 1934).

[29] *RADEX*, No. 91, p. 11 (September 1935).

[30] *RADEX*, No. 71, p. 26 (September 1933).

[31] For more on TI4NRH, see Dr. Adrian M. Peterson, "The Tiniest Radio Station in the World," *Popular Communications*, Vol. 8, No. 9, p. 36 (May 1990). DXer Don Moore of Big Rapids, Michigan expects soon to publish his observations on a recent visit to the site of TI4NRH.

[32] Charles L. Rolo, *Radio Goes To War* (New York: G. P. Putnam's Sons, 1942), p. 237-239.

[33] For a detailed treatment of the early days of American shortwave broadcasting, see Michael Kent Sidel, *A Historical Analysis of American Short Wave Broadcasting, 1916-1942* [Ph.D. dissertation], Northwestern University (1976).

[34] Perry Ferrell, Jr., "Ultra-High," *All-Wave Radio*, Vol. 4, No. 3, p. 136 (March 1938).

[35] *All-Wave Radio*, Vol. 3, No. 7, p. 358 (July 1937).

[36] *Radio News*, Vol. 7, No. 10, p. 1395 (April 1926).

[37] Reminiscences by Jack Jones, Jackson, Mississippi, 1990.

[38] For a complete description of the development of the communications receiver, see Raymond S. Moore, *Communications Receivers, 1932-1981*. (Walpole, MA: RSM Communications 1991).

[39] Raymond S. Moore, *Communications Receivers, 1932-1981*. (Walpole, MA: RSM Communications 1991), p. 7.

[40] *RADEX*, No. 43, p. 16 (November 1930).

[41] *RADEX*, No. 91, p. 51-52 (September 1935).

[42] H. S. Bradley, "New Stations in Latin America," *Official Short Wave Listener Magazine*, Vol. 1, No. 6, p. 107 (June/July 1935).

[43] Reminiscences of 1935 by Tom Williamson, Peterborough, Ontario, Canada, 1985.

[44] Daniel Stashower, "A Dreamer Who Made Us Fall In Love With the Future," *Smithsonian*, Vol. 21, No. 5, p. 44 (August 1990).

[45] *Radio News*, Vol. XIV, No. 10, p. 580 (April 1933).

[46] *Short Wave Craft*, Vol. 1, No. 1, p. 5 (June-July 1930).

[47] *The National Radio Club, 50th Anniversary, 1933-1983*, p. 147 (1983).

[48] *Short Wave Radio*, Vol. 1, No. 9, p. 42 (July 1934).

[49] *Short Wave Craft*, p. 529 (January 1934).

[50] *RADEX*, No. 82, p. 32 (October 1934).

[51] IDA "Stop Press Sheet," June 1939.

[52] The *RADEX* 1937 Mystery DX Contest (medium wave) involved logging as many participating BCB stations as you could at 0200-0600 EST on February 20, 21 and 22, 1937. You received 2.5, 5 or 10 points, depending on distance, for an "identification report" (an announcement or one selection heard), and 10, 20 or 30 points for a "complete report" (three successive selections or 10 minutes of program details). Participating stations transmitted special programs, and the goal of the organizers was to have five broadcasts every hour. Some 36 stations actually participated, but contestants did not know which ones they would be, or the frequencies. Entries had to be mailed by midnight February 24. First prize was a 23-tube Scott receiver.

[53] *RADEX*, No. 74, p. 42 (December 1933).

[54] *RADEX*, No. 88, p. 15-16 (April 1935).

[55] Morton W. Blender, "What About Reports?" *RADEX*, No. 109, p. 13 (May 1937).

[56] *Short Wave Radio*, Vol. 1, No. 5, p. 32 (March 1934).

[57] *Short Wave Radio*, Vol. 1, No. 10, p. 11 (August 1934).

[58] Charles A. Morrison, "The Future of International Short-Wave Reception," *Radio News*, Vol. XVI, No. 10, p. 599 (April 1935); Vol. XVI, No. 11, p. 674 (May 1935); Vol. XVI, No. 12, p. 745 (June 1935); Vol. XVII, No. 1, p. 27 (July 1935).

[59] Rolo, p. 260-268; Harold N. Graves. Jr., *War On the Short Wave* (New York: The Foreign Policy Association, "Headline Books," 1941), p 64.

appendix A
subject index
proceedings 1988 thru 1993

overall index

fine tuning's PROCEEDINGS

sorted by subject category

RECEIVERS:SOLID STATE (con't)

90	R.16	KENWOOD R-5000	(6)	MOORE+WILLIS
92	R.26	LOWE 150 & 225	(8)	E. BYINGTON
91	R.22	MCKAY-DYMEK DR-333	(11)	J. BRYANT
91	R.21	PHILLIPS DC-777	(7)	PALMERS+GRIMLEY
90	R.17	MODIFYING THE SONY 2010	(16)	G. DARLING
89	R.08	YAESU FRG-8800	(2)	G. BISHOP

RECEIVERS: GENERAL

90	R.14	USING A BFO TO ECSS	(3)	G. PEARSON
90	R.15	SYNCHRONOUS DETECTION	(7)	C.SIEGENTHAL

PERIPHERAL EQUIP: TUNER/PRE-AMP

88	PE.01	ANTENNA TUNERS	(6)	J. TOW
88	PE.02	BUILD A ANTENNA TUNER	(5)	C. BOLLAND
88	PE.03	AMECO PRE-AMPS	(4)	STRAWMAN+BRY

PERIPHERAL EQUIP: RCVR RELATED

89	PE.11	AMSD-1 SYNCH.DETECTOR	(4)	D. LANKFORD
89	PE.12	SHER'D SE-3A PLL DETECTOR	(2)	G. PEARSON
89	PE.10	ESKAB/EDVIS PLAM BOARD	(4)	C. BOLLAND
89	PE.13	KIWA MAP UNIT	(6)	G. ATKINS
91	PE.19	UNIV.M-1000 RTTY READER	(8)	C. YARBROUGH
88	PE.07	HEATH HO-13 HAMSCAN	(3)	J. STRAWMAN
90	PE.14	KEYPAD CONTROLLER	(6)	G. ATKINS
92	PE.21	C.C.I. DIGITAL READOUT	(4)	J. GOODWIN
92	PE.22	KIWA IF FILTER MODULES	(6)	J. GOODWIN

PERIPHERAL EQUIP: GENERAL

88	PE.05	AUDIO FILTERING, THEORY OF	(4)	J. TOW
88	PE.06	AUTEK QF-1A	(3)	J. STRAWMAN
89	PE.09	DAIWA AF-606 FILTER	(3)	C. MITCHELL
90	PE.16	DATONG FL-3 FILTER	(4)	R. ARCHER
91	PE.17	NIR-10 DIGITAL FILTER	(5)	G. ATKINS
91	PE.18	DYMEK FC-11 FOGCUTTER	(2)	J. BRYANT
92	PE.20	S.E.M. NOISE PHASER	(3)	B. ELDRIDGE
88	PE.04	2 MARANTZ TAPE RECORDERS	(17)	MELL+RIP+BRY
90	PE.15	WALKMAN PRO WM-D6C RCDR	(3)	C. MITCHELL
88	PE.07	ULTIMATE SHACK CLOCK	(2)	J. BRYANT
92	PE.23	SMALL CONSTRUCTION PROJECTS	(10)	D. MOMAN

COMPUTERS

88	C.01	MINI-PROP & LOW BAND	(10)	M. SAMS
88	C.02	RECEPT. REPORTS W/COMPUTER	(12)	J. BERG

FEATURES

88	F.01	DXing NEW GUINEA	(29)	CON+RIP+BRY
88	F.02	R. SOUTHERN HIGHLANDS	(5)	J. BATA
89	F.05	DXing JAVA	(15)	W. SPARKS
89	F.08	QSLing THE LATINS	(9)	D. MOORE
90	F.19	DXing CENTRAL AMERICA	(18)	R. D'ANGELO
91	F.21	DXing BOLIVIA	(21)	K. ATKINS
89	F.07	DXing BRAZIL	(12)	J. FISHER
92	F.27	DXing ECUADOR	(17)	R. MCVICAR
90	F.20	DXing SAHARA+SAHEL	(11)	H. CONES
89	F.06	DXing THE ARAB WORLD	(8)	H. JOHNSON
92	F.28	DXing CLAN. KURDS+IRAN+IRAQ	(7)	H. JOHNSON

FEATURES (con't)

89	F.09	CARING FOR YOUR QSLS	(6)	J. BERG
88	F.03	CPRV UPDATE	(8)	J. BERG
89	F.10	COUNTING COUNTRIES	(6)	D. JENSEN
90	F.17	DXing ON THE ROAD	(12)	R. ARCHER
90	F.18	DXPEDITIONS	(13)	N.HALL-PATCH
92	F.32	ST.JOHNS DXPEDITION 1991	(3)	M. CONNELLY
91	F.23	INTERVIEW W/HANK BENNETT	(7)	H. CONES
91	F.24	SWBC AS TEACHING TOOL	(12)	C.YARBROUGH
89	F.12	TIPS & TECHNIQUES FOR DXers	(14)	D. CLARK
88	F.04	MW ARTICLES FOR SW DXer	(13)	J. BRYANT
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about authors and editors

about authors and editors

GUY ATKINS — ISSAQUAH, WA

Guy is 36 and married twelve years to Rochelle. They are kept amused by their one year old daughter (and future DXer) Melanie. Guy is in a lead position with the Quality Assurance Dept. of Zetec, a manufacturer of nuclear powerplant safety inspection systems used worldwide. Prior to Zetec, he spent nine years in graphic arts.

A battered Sears Silvertone portable was responsible for Guy's first enthusiasm in radio at age 13. His DXing interests began in 1982 when he met other SWBC hobbyists in the Seattle area. In the late 1980's he promoted the hobby through publication of the Cascade Mountain DX Club's newsletter and DX-Northwest's *Grayline Report*. Guy has also hosted get-togethers for area DXers and organized DXpeditions. He is currently is on staff with Fine Tuning's *Proceedings*.

R390A and Drake R8 receivers assist Guy in roaming the Tropical Bands for favorite targets from the South Pacific. He also enjoys antenna experimentation and currently uses a 90 meter T2FD and a terminated 380 ft. mini-Beverage aimed at the Solomon Islands and Eastern Papua New Guinea.

Guy is enthusiastic about ethnic music from nearly everywhere and can often be found camped on 2265 kHz enjoying Radio Milne Bay's native "sing-sings".

BENNETT L. BASORE, W5ZTN — 229 N. KNOBLOCK #26, STILLWATER, OK 74075

Born in 1922 in Oklahoma City, OK, Bennett spent four years in the Navy during WWII, most of it on the USS Hoe, SS258. Following graduation as a BSEE from OSU, he received the ScD from MIT in 1952. After spending ten years working on nuclear weapons ordinance, he was a bureaucrat in Washington D.C. for nearly five years before beginning a career as an EE professor in 1967, retiring in 1990. His amateur call is W5ZTN.

JERRY BERG — 28 EASTERN AVENUE, LEXINGTON, MA 02173

Jerry is 48 years old, married, and has two children, Evan, 21, and Laurie, 18. He is a graduate of Temple University and Georgetown University Law School, and is the court administrator for the Massachusetts District Court system. Jerry has been a SWBC DXer since 1958. He is a member of the NASWA Executive Council, author of various articles, and chairman of ANARC's Committee to Preserve Radio Verifications, a project designed to archive QSLs of former DXers and save such material from loss or destruction. He was recently selected as ANARC's 1992 North American Shortwave DXer of the Year.

JOHN H. BRYANT — RT. 5, BOX 14, STILLWATER, OK 74074

John is 51 and has been married to Linda for 27 years. John is a professor of architecture at Oklahoma State University and a widely known expert on the traditional architecture of East and Southeast Asia. In the mid-1970's, the Bryants spent a year in Japan where John was a Senior Fulbright Research Scholar. John has traveled extensively in China, both as a member of official US delegations and as a lecturer at a number of Chinese universities.

John has had 2 careers in the DX hobby. The first was as a teenager in 50's. John began in 1952 as a SW DXer but spent most of that era as a "medium waver." His best catch was 1YZ, Rotorua, New Zealand on 800 KHz in the winter of 1959. His second career, mostly SW this time, began in 1979-80 with the purchase of a Sony 2001. He currently operates a highly modified NRD-525 and a re-manufactured Hammarlund SP 600 coupled with a semipermanent 450' Beverage antenna array. Although he is enthusiastic about DX from anywhere, John couples his "real world" interests with his DX interests by being absolutely obsessed by DX from East and Southeast Asia. His other radio interests include antenna and propagation experiments. His current total are 205 countries heard/186 countries verified from the "modern era." John is the Editor of Special Publications for Fine Tuning.

ELTON BYINGTON, N2KXT 60-88 FLUSHING AVE., MASPETH, NY 11378

Elton is 49 and has been listening to shortwave broadcasts since 1948. Although he is primarily a program listener, over the years he has heard and confirmed nearly 200 countries. An electrical engineer by training, Elton works as an Operations Manager for The Associated PRess in New York. Since his wife died in 1986, Elton embarked upon a quest to discover the "ultimate" SWL's receiver. To that end he has acquired several modern receivers to add to the National HRO-50T1 he's been carrying around since 1960. Elton is also a ham radio operator, N2KXT. Elton's lifelong love of music (he is a classically trained cellist and composer) has added immeasurably to his enjoyment of short- and mediumwave listening.

DAVID M. CLARK RT #3, ST. JOHNS SIDE ROAD, NEWMARKET, ON L3Y 4W21

David is 46 years old, a university graduate in history and geography, and works as a Director of Systems Development for a major trust company in Toronto. He and his wife Elena have four children and reside on a 10 acre wooded property in the country, site of Clark's infamous "DX Barn" and Beverage farm.

David's main focus is on Tropical Band Asian DX from Indonesia and the Indian sub-continent, although chasing trans-Pacific DX on Medium Wave is of special interest during occasional DXpedition visits to the Pacific Northwest. In conjunction with John Bryant, he is continuing a long term study of seasonal reception phenomena associated with short and long-path Tropical Band propagation.

Primary DXing gear is from Drake: The R8 and two R7's. These are complemented by a collection of tube-type equipment, mostly of Collins or Hammarlund origin. David's interest in DXing spans more than 30 years and he has taped SWBC reception from more than 200 countries.

David is the Chairman of the Ontario DX Association and edits the "World Radio Report" column for the club bulletin - DX Ontario. He is also a member of CIDX, NASWA, NU and FT, while serving on the staff of *Proceedings* since 1989.

HAROLD CONES NEWPORT NEWS, VA

Dr. Harold "Dr. DX" Cones is a Professor of Biology and Chairman of the Department of Biology, Chemistry and Environmental Sciences at Christopher Newport College in Newport News, VA. Trained as a biological oceanographer and benthic specialist, Dr. Cones classifies himself as a Field Biologist and prefers to spend his teaching time outdoors rather than in a classroom. He conducts 10-day extended ecology field trips (camping) to Maine in the spring, and Florida in the winter. He is 49, has been married to a high school librarian for 27 years, and has two daughters ages 20 and 17.

Harold began DXing in 1957 with a BC-312 tank radio, dropping in and out of the hobby until 1983 when he again began DXing in earnest. He uses a Hammarlund HQ 180A, a Yaesu FRG-7700 and a Drake R-4B, and loves to DX on old tube equipment including the Knight Kit Space Spanner, Ocean Hopper and Star Roamer. Harold's favorite area of DX specialization is the far Pacific, however he will chase anything in the Tropical Bands. He has earned 42 FRENDX awards, heard 225 NASWA countries, and verified 216. Harold conducts the North American DX Championships each year and is the program chairman for the Annual Winterfest. In addition to NASWA, Harold is a member of the Great Circle Shortwave Society, FT, NU, and the Old Dominion DX Association.

MARK CONNELLY WA1ION 30 WILLIAM ROAD, BILLERICA, MA 01821-6079

Mark recently turned 43 and has DX'ed MW, LW, and SW on and off since 1960, the year he set up his first "DX Lab", in Arlington, MA, for homebrewing devices to enhance reception. He's been active as a ham (WA1ION) since high school days in 1967. Early radio interests led to an EE degree from Boston's Northeastern University and to a career in the Automatic Test equipment (ATE) industry; presently he works at Raytheon designing software and hardware to test complex circuit cards and modules. Mark lives with his wife Mary Lou and his 10-year old son Michael in the suburbs 15 miles northwest of Boston. Medium-wave DXpeditioning to coastal sites is a major interest; in November of 1991 he teamed up with Jean Burnell and Neil Kazaross to run a highly-successful DX session from Newfoundland. 65 countries were logged on MW in three nights of DXing on seaside Beverages. The main receivers used at home are the R390A, a Drake R8, and a Sony ICF-2010. Mark's other hobbies include photography, many kinds of music, gardening and tree-cultivation, travel, computers, architecture, exercise-related activities, and "lightwave DX" with binoculars and telescopes. Mark regrets that AM radio doesn't mean as much to young people today as it did to '60s youth and that DX hobby interests are down as a result.

RICHARD A. D'ANGELO — WYOMISSING, PA

Rich is 43 years old, a native of Brooklyn NY, and has been married to Susan for 20 years. They have 2 children, Adam and Jennifer. Rich received a BS in Economics from Brooklyn College in 1972 and his MBA in Finance from Pace Univ. in 1976. He is employed by Metropolitan Edison Company, an electric utility, as a Manager in the Rate Department.

Rich began DXing in 1964 when he discovered his brother's Hallicrafters S-85 in the basement. His current receiver is an Icom R-70. Rich has been an active member of many DX clubs over the years and has been a member of NASWA since 1966. He was the first Manager of the NASWA Company Store and is a past Chairman of the Awards Program Chairman. Rich has also served in a variety of capacities for SPEEDX--a member of the Board of Directors; a member of the Editorial Committee and as ANARC Representative. Rich is the World DX Club's North American Representative and writes a column for the club's bulletin about the North American radio scene. Other club/hobby affiliations include ODXA, NRC, A*C*E, DSWCI, OZ DX, DX Australia, FT and NU. He is currently chairman of the joint NU/FT Special Transmissions Committee. The Association of North American Radio Clubs appointed him Interim Coordinator of ANARC in December 1991.

Rich focuses primarily on shortwave broadcast DXing. His major listening interest is Latin America although Africa and the Pacific region have been favorites over the years.

CHUCK DACHIS, WD5EOG — 4500 RUSSELL DRIVE, AUSTIN, TX 78745

Chuck's involvement in radio and electronics has been life long, mostly self taught, and is instinctive in nature. He was born October 4th, 1942 in Minneapolis, Minnesota, at the Zenith of classic radio production. His family moved to Silver Spring, Maryland in 1949 where he received his first Ham radio license in 1957. He graduated from Montgomery College with an Associated of Arts degree in electronics in 1963, and moved to his current QTH in Austin, Texas in 1973.

Chuck has been collecting and restoring classic radios for years but began his exclusive collection of Hallicrafter products in 1974. Since then he has developed a world wide reputation as "The Hallicrafter Collector", and the leading authority on the Hallicrafters Company and its equipment. He is also documenting historical information on the company and products in preparation for writing his book on Hallicrafters, which will contain interesting and previously unknown information about the company and its products.

GERRY L. DEXTER — LAKE GENEVA, WI

Gerry has been a SW enthusiast for nearly 40 years. His main areas of interest are Latins, clandestines and QSLing. He just recently passed 1400 SWBC stations QSL'd (using NASWA guidelines). Gerry has written widely about aspects of the hobby including several books on QSLing techniques. Dexter writes the "*Listening Post*" and "*Clandestine Confidential*" columns monthly in *Popular Communications* as well as feature articles for that and other magazines and also edits a newsletter covering clandestine stations.

After a career in commercial broadcasting, Gerry transitioned to full time writing, editing and publishing. Since the early 1980s, he has operated Tiare Publications which has published nearly three dozen books on SW listening, ham radio, and scanner and satellite monitoring.

When not involved in radio, Gerry can often be found with his extensive collection of Stan Kenton records. Gerry and Sharon have one son, Don who is an electronic/computer engineer.

BOB ELDRIDGE, VE7BS — ERICKSON RD., PEMBERTON, BC V0N 2L0

Bob is 71, and was born and educated in England. He met Claire in Belgium in 1944 and married her in 1947. They have a son, a daughter and an 18-year-old granddaughter. Bob served in RAF Signals from 1940 to 1950, and the rest of his working life in communications until retirement in 1982 to a property with lots of room for big antennas in a mountain valley 70 miles north of Vancouver BC. He represented Canada at many CCIR conferences and at WARC-79. He was awarded the Diploma of Honor for outstanding contributions to the work of CCIR.

Bob helped his father build a Lissen Hi-Q Five about 1930, joined the British Short Wave League and built an "Artificial Aerial" transmitter. From 1946, he operated as D2GQ at Luebeck and G3AGQ in England. He came to British Columbia in 1953 and was licensed as VE7BS before collecting his checked baggage from the railway station! He operates on all HF Amateur bands, mainly on CW, but is dedicated to 160 meters. His main interest is propagation across the Pacific, but dabbles in writing, chess, music and the computer.

BOB EVANS 8 ROANOKE RD., #701, DON MILLS, ON M3A 1E6

A bachelor in his 48th year, Bob lives in Don Mills, a suburb of Toronto. A graduate of St. Augustine's College, Ryerson Polytechnical Institute and the University of Toronto, Bob taught Business and Computer Studies at the college level for 15 years. For the past decade he has worked as an MIS consultant to North American automotive manufacturers and dealers. He has authored several technical manuals for IBM, GM, Ford and Porsche Cars North America.

Bob has been monitoring the shortwave spectrum for the last 30 years. Interest in Utility DXing, particularly aeronautical, was kindled at an early stage in his SWL career. In 1987 he published the "Aeronautical Utility Guide", which was followed in 1989 by his major tome-"The Aeronautical Communication Handbook - AF Edition". This was followed by the "Worldwide Aeronautical Communications Frequency Directory" in 1991. An active member of ODXA, Bob is also co-editor of the Universal quarterly newsletter - The RTTY Listener. Current monitoring pursuits include the logging of Cyrillic RTTY transmissions from over 1200 vessels of the former Soviet Maritime Fleet.

An accomplished studio and nature photographer, his other passions include: Egyptology, Astronomy, Classical Music and Wine Tasting and Appreciation. He has travelled extensively and has conducted educational/archeological tours in the Egypt and photographic/wildlife safaris in East Africa.

WERNER FUNKENHAUSER 75 SILVERCREEK PKWY, #403, GUELPH, ON N1H 7R9

Werner is 51 years old and is a college Professor of Computer Applications. He has been DXing since 1956 when a neighbor gave him a 1938 General Electric "All-Wave" receiver. Later he graduated to a Knight-Kit "Ocean Hopper" regenerative radio. Since then, he has been in and out of the hobby and returned most recently in 1985.

Werner is a dyed-in-the-wool MW DXer and rarely listens on other bands. He is editor of "Medium Wave International," ODXA's Foreign Medium Wave column. When not DXing, he spends some of his hobby time building and modifying air-core loop antennas. A few years ago he acquired a Connelly longwire/loop antenna phasing unit and is especially interested in the effects of phasing with longwire/loop antenna combinations.

JAMES GOODWIN 44 CHARLES ST. W., #2807, TORONTO, ON M4Y 1R7

James was born in Toronto 60 years ago; he is unmarried and retired. He started DXing the broadcast band in 1928 and three years later discovered the BBC on shortwave. RTTY and fax became the exclusive interests for a twenty-year period starting in 1970. A home-brew fax machine which produced clouds of acrid, blue smoke brought pointed suggestions that broadcast DXing would be healthier for everyone in the vicinity. Nowadays, James is a very casual listener, tuning in mainly to Asian marine CW and Arabic programs. Numerous receivers on hand are more for pulling apart than for reception.

James has been a travel agent and has been employed in life insurance administration and as a government bureaucrat in taxation and in small business development incentives. Present volunteer activities include work in hospital records maintenance and as ODXA's membership secretary.

He worked for a few years in four European countries. There he discovered once when penniless that shortwave can be a life saver. Having learned an anti-Red form of spoken Spanish from the VOA in the late 1940's, he was able to get and hold a job in Franco, Spain under security police surveillance. During the frequent interviews, the police were most satisfied with the subject's quick, politically correct answers.

NICK HALL-PATCH, VE7DXR 1538 AMPHION ST., VICTORIA, BC V8R 4Z6

Nick is in his early 40's and is married to Susan, a piano teacher. She, along with their two daughters, Lucy and Clare, count tolerance among their qualities, not only because Nick DXes, but because he has spent the last couple of years pursuing a diploma in electronics engineering technology. As part of his studies, he is presently working on a deep-sea instrumentation package at a Canadian government research institute near Victoria.

An ongoing interest in improving MW DX reception has marked Nick's DX career since the mid-60's, when he first started to experiment with receivers and antennas. He has been technical editor of the International Radio Club of America since 1978, and was editor of IRCA's "A DXer's Technical Guide," published in 1980 and 1983, and in German translation in 1987. He is also a member of CIDX and LWCA, and is a radio amateur, VE7DXR. Mongolia and Bulgaria are among the better MW catches from his QTH, but most good DX is now heard using Beverage antennas on expeditions to the Pacific coast. He prides himself on never having seriously DX'd with a stock receiver, and now uses a receiver of his own design and construction.

DON JENSEN KENOSHA, WI

Don has been an active DXer since 1947, when, at the age of 11, he was introduced to radio by his father, a sometimes bootleg "ham." Even at that tender age he was intrigued by geography and far-away places. He found it a marvelous adventure to sit at home and tune in places like Quito, Ecuador, and Bern, Switzerland, his first two DX catches. While he dabbled in different aspects of the listening hobby over the years, his primary interest has remained SWBC. He has been active in the hobby in numerous ways. In 1964, he founded and was the first executive secretary of the Association of North American Radio Clubs (ANARC). He has held editorial and administrative posts in a number of radio clubs, including NASWA for nearly three decades. From 1969 through 1989, he published and co-edited the *Numero Uno* DX weekly, and remains editor emeritus of that publication. He has been a freelance magazine writer since 1963, and currently is contributing editor of POPULAR ELECTRONIC's "DX LISTENING" column. For more than a quarter century his columns and articles have appeared in a number of radio magazines.

Don formerly was employed in broadcasting, in television and, later, as a radio news director. For 30 years he has been a newspaper editor and writer. He is married to Arlene, also a journalist, and they have three children, ages 24 to 36. They live in Kenosha, WI.

HANS D. JOHNSON 7529 RED CRAVAT COURT, COLUMBIA, MD 21046

Hans started DXing in 1976 and has been especially active over the 3 years or so. In addition to being a member of NASWA and ODXA, he is also a subscriber to NU, FT and DXSF. Hans first wrote an article for *Proceeding 89*, "DXing the Arab World, a few tips." In addition to DXing Middle Eastern stations, he also enjoys DXing Latin America, sharing phone tips with Dave Valko and DXpeditions at Gifford Pinchot State Park.

RICHARD MCVICAR, HC1JMN C/O HCJB, CASILLA 17-17-691, QUITO, ECUADOR

A native of Prescott, Ontario, Rich is 32. He and his wife, Lisa, have been married for about four years and are busy enjoying their first baby, Rachel Anne.

Richard entered this hobby as a TV DXer around the age of seven. He also twiddled around with Dad's RCA 67QR77 searching for those pretty tinkly melodies that shortwave stations play before sign on. In 1974, one of Don Jensen's articles in *Communications World* sparked Rich into writing for QSLs and he's been thoroughly hooked ever since. NASWA country totals are 217 HIC, 192 VIC.

With a background in English Literature and broadcasting, Rich entered the commercial broadcasting field in Canada. After meeting (and marrying) Lisa, the two joined the ministry of HCJB in Quito. Rich's ham call is HC1JMN and he uses a Kenwood TS 450 S for both hamming and SWBC DXing. He now enjoys playing tinkly melodies for other DXers as host of *DX Partyline*.

FRITZ MELLBERG HAWARDEN, IA

Fritz is 47 and is a pastor of the United Church of Christ congregation in Hawarden, Iowa, a small town north of Sioux City. He is married and has 2 teenage girls. He grew up in Menasha, WI and worked for the Appleton (WI) Post Crescent while in college at the Univ. of Wisconsin. He worked as a writer and PR person for his denomination's office of communication in New York City where he learned to edit by being ruthlessly edited by others on the staff.

Among his current hobbies are woodworking, sculpting, and collecting old radios, parts and literature. He has a large collection of old tubes as well as a few working Atwater Kents and Philcos, and enjoys learning to repair these old classics.

He bought his first SW radio to keep up with the Green Bay Packers while in India back in 1968, but it wasn't until 1979 that he began to DX seriously. He has been a member of the major DX clubs and currently spends his time DXing on the broadcast band. He advocates tape collecting as an alternative to QSLing, but admits he is not a purist and proudly displays his 3 QSLs!

DON MOMAN, VE6JY #61-52152 RANGE RD. 210, SHERWOOD PARK, AB T8G 1A5

Don is 38 and earned a BSc degree in Electric Engineering in 1975. His hobby interest started in his early teens with MW DX, and graduated quickly to SW using the usual 5 tube AC/DC specials until finally acquiring a "decent" set, an old RCA GR-10 WWII receiver, but in a quiet, rural location and lots of wire, reception was great!

The hobby was put on hold during the education and career years, but like many of us, he got back into it with a better radio and a poorer location. That's about the time he discovered DXpeditioning. He then got involved with CIDX as a SWBC editor and later became its secretary/publisher. Finding the career interfering with the hobby, it was time to retire (the career, that is!) and move out in the country to grow (or raise?) antennas.

Don's interests have been varied, but certainly Foreign BCB DX is at the top of the list. From his far inland location, any DX can be a challenge, with some pretty dry years between, which leaves lots of time for the rest of the bands including SWBC and utility DXing. Recently, as VE6JY he has been more active in the DXing and contesting areas of amateur radio. Current totals on SWBC (NASWA) are 165 heard (not many verified--usually he is content just to hear and tape them nowadays), and over 260 ARRL ham countries worked including 85 on 80 meters. Like on the SWBC bands, he finds DX on the "tropical" ham bands to be his main interest and challenge, especially on 160 meters!

Don is also very interested in the technical side of the hobby, receiver modifications, antenna building and experimenting, etc. This led to starting Shortwave Horizons, a specialty SWL mail order outlet that is till alive but not that active--again, it was just taking too much time from the hobby! His main (and favorite) receiver is the Yaesu FT-1000 transceiver; other units to choose from in the shack include the R-5000, ICOM R71 and R7000, Racal Ra-17, and a Collins 51S-1. The main antenna is a large rotatable HF (4-30mHz) log-periodic on a 120' tower plus various dipoles, delta loops, beverages, etc. Four other towers hold multiple arrays of yagi beams specifically for the amateur bands.

DON MOORE DAVENPORT, IA

Don is 34 years old. Originally from PA, he received a BS from Penn State in 1980. From 1982-84 he worked with the Peace Corps in a rural Honduran high school. While there, Don made several trips to Guatemala and Mexico, and met his wife, Theresa Bries, also a Peace Corps worker. In 1985 they spent 6 months traveling in South America. In 1989 they received MA's in Linguistics/TEFL at Ohio Univ. Don recently moved to Iowa and now teaches English as a Second Language at Teikyo Marycrest University in Davenport. He is looking forward to buying a house and settling down in one place. They have a two-year old daughter, Rebecca.

Don began DXing in 1971, and has been more or less active ever since. Although he dabbles in just about everything, his main interests are SWBC and MW, especially Latin American stations. During his Latin American travels, he has visited over 100 radio stations. He enjoys QSL collecting from both big and small stations, and is especially proud of his collection of over 120 different HCJB QSLs. He has over 1000 SWBC stations heard and over 500 verified. Other interests include folk music of all types, history, science-fiction, gardening and camping.

BRUCE PORTZER, N7ECJ SEATTLE, WA

Bruce is 41 years old and has been DXing since 1964. He has listened to just about every part of the radio spectrum at one time or another, but his favorite part of the spectrum is the medium wave broadcast ban. He has logged over 2300 MW stations for 45 states to 70 countries. From 1979 to 1989 he was editor in chief of "*DX Monitor*", the weekly bulletin of the International Radio Club of America, one of North America's leading MW DX clubs. Bruce's receiving setup at home includes the Racal RA-17 described in an article in *Proceedings 1991*, plus a Yaesu FRG-7 and a Radio West loop antenna. However, he prefers to DX with the FRG-7 on Beverage antennas along the coast of Washington or British Columbia. An electronics engineer, he works for a consulting firm that designs security and communication systems for major architectural projects. He and his wife, Evelyn, have been married 17 years and have two children, Theresa, age 5, and Steven, 1 1/2 years.

MITCHELL A. SAMS BLUE SPRINGS, MO

Mitch is 32 years old, married to Sherri and the father of Matthew (6) and Molly (3). Mitch received a BSEE from the Univ. of Arkansas in 1983 and works as a Radar Systems Project Manager for Wilcox Electric in Kansas City, MO.

Mitch began DXing in 1972 when, as a Florida 5th grader, he was given a Revell SW radio kit as a birthday present. He's been fascinated ever since! Currently, he uses a modified FRG-7 and a modified HQ-180A. Mitch founded Ozark Mountain DX Club in 1980. OMDXC merged with Fine Tuning in 1986. Mitch now serves as Managing Editor of Fine Tuning. Using the NASWA radio country list, Mitch's totals stand at 223 heard and 175 verified. He especially enjoys DXing Indonesia and Asia. However, as his loggings show, Mitch enthusiastically DX's all areas of the world, occasionally spending time on MW, as well.

HAROLD SELLERS, VE3SSH NEWMARKET, ON

Harold is 41 years of age. He has been married to Linda for 16 years and they have two young children, Raelene and Brent. His training is as an electronics technologist and he works as a Communications Maintenance Specialist in Air Traffic Control Systems for the Canadian government's Department of Transport. His work takes him around the province of Ontario. Living in Newmarket, a town of 42,000 people 40 km north of Toronto, Harold finds this to be a good DXing location and it is actually very close to his childhood home where the DX bug first bit.

Harold has been DXing since 1968 and presently specializes in SWBC DX, both tropical and international bands. Approximately 190 countries have been heard, with over 150 verified. He has been a club editor and/or executive for over 20 years and presently serves as the Managing Editor and General Manager for the Ontario DX Association. Harold is one of the founders of the ODXA and served as Chairman of the club from its founding in 1974 to 1990. The receiver at present is a Japan Radio NRD 515.

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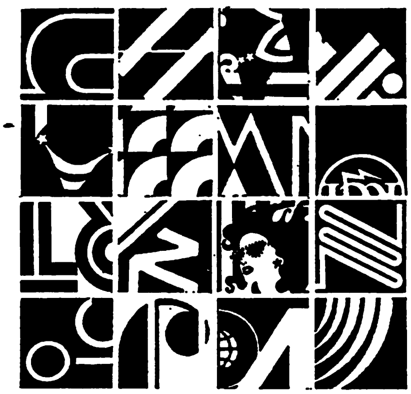

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