

The COMMUNICATION RECEIVER

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THE NATIONAL COMPANY'S "AGS" A COMMERCIAL COMMUNICATIONS RECEIVER

INTRODUCTION

In October, 1932, the National Company of Malden, Massachusetts, carved a niche in radio history when they introduced the AGS short wave communications receiver. This superlative device was a product of the conceptual engineering genius of James Millen and his development team combined with the unique manufacturing capabilities of the National Company.

Inside and out, the AGS was a marvel of mechanical and electrical design. The front panel was balanced in appearance with only a minimum of controls. All fabrication work was of the highest quality, fully reflecting the accumulated experience and machine-shop approach of the National people to the manufacture of communications receivers. Each receiver was hand-crafted with precise frequency calibrations built-in.

A parallel can be drawn with the rapid advances in present-day computer technology. The AGS in its various forms lasted for only two years and then was displayed by newer designs, using more modern components and concepts, from National as well as its competitors in the rapidly expanding field.

More important to the National Company, however, was that during the brief lifespan of the AGS it served as a proving ground for the concepts and techniques which appeared in at least two of National's later receivers, the FB-7 and the very famous and long-lived HRO.

Charles Fisher, by his very fortunate acquisition of a complete AGS-X in remarkably good condition, has been inspired to write the following article.

This historic set was developed for the U.S. Department of Commerce for A-irport G-round S-ervice and similar professional applications, and was National's first venture into products of such quality. It was introduced in the fall of 1932, and in due course was widely advertised in the jobber catalogs and QST as the ultimate ham set, available with band-spread coils. Most specimens

were probably bought for commercial use, and it is a rare set today.

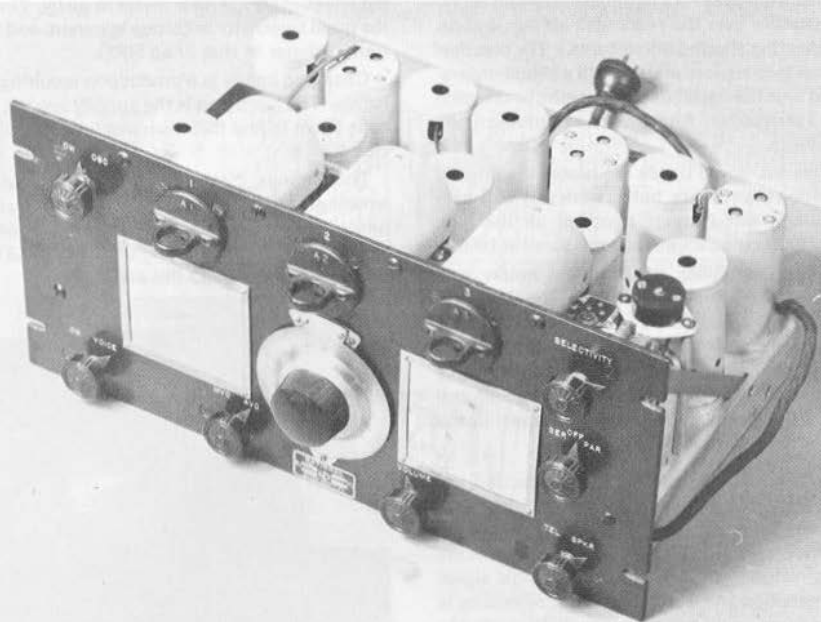
The only limitation on wide sale of the AGS was the price - a bit over \$200 complete with the power supply and coil storage panel. The crystal filter option cost an additional \$18.

The AGS design had much in common with the "Single-Signal Super" described by J. J. Lamb in QST of August and September of 1932. Notable and perhaps unique in a short-wave set for the date were the IF of 500 kc, a tuned radio frequency stage ahead of the first detector, and automatic volume control - controlled by a separate tube - on four stages. Elegant mechanical design permitted calibration and alignment to be virtually 'built-in' at the factory. Outwardly the emphasis was on simplicity of operation.

The receiver is of massive construction. The 3/16" aluminum rack panel is bolted to a 1/8" bathtub chassis; the bottom panel and tuning condenser shield structure are of 3/32" aluminum. The three tuning condensers are ganged by rack and pinions with spring-loading for anti-backlash. Tube sockets, shields, and hand-labeled resistors familiar in other National sets are used, with the exception that the 1 mfd non-inductive by-pass condensers were made in Germany by Flechtheim, not marked as Tobe-Deutschman imports.

There were several versions of the AGS:

1. The "original" model has the maker's label... almost 4" long... with the U.S. Government notation. No BFO adjustment control. Frequency range 2000 kc to 15,000 kc. Tubes: 7-36's; 1-37; 1-89 (not including the 80 in the power supply).
2. As above, but with a short plain National label.
3. As above, with the BFO adjustment added to the upper left corner of the front panel.
 - At some early stage the coil ranges were changed to 1500 kc to 20,000 kc.
4. Crystal filter option, designated the AGS-X, with controls added at the upper right of the panel.



All versions to here have **two** RF trimmers and short (3") IF cans with side-by-side compression trimmers.

– By mid-or late 1933 tall round IF cans with air trimmers, as in the early FB7-A's and the early HRO's, were incorporated. (Note: In the *QST* articles referred to above, Lamb advocated air trimmers in IF transformers for stability reasons.)

5. The AGS-X with a 78 in the RF stage and only one RF trimmer. It included the taller IF's and was pictured in *QST* for June 1934.

6. A 1935 catalog (see comment at end of article) lists the AGS and AGS-X with 3 type 78's.

The nine tubes of the receiver proper have the following functions: TRF stage or preselector; oscillator; first detector; 1st and 2nd IF's; 2nd detector; AVC control; audio output. The use of sharp cut-off 36's in an AVC system suggests that the AGS was far advanced in development by early 1932, since the remote cut-off 39 with similar power requirements was available as early as February, 1932. Two possibilities might be, first, that there was a hum problem similar to that which prevented the use of the early 6C6 and 6D6 in the first AC-powered HRO's, and second, that the National people had an important body of experience with the reliability of the 6-volt 36 tetrode.

The AGS-X which inspired this article surfaced just recently after 50 years under one roof. Before that it was reportedly used by the old Tropical Radio Company, as subsidiary of the United Fruit Company. It was in fine condition except for the usual troubles with National power supplies ... in

this case the transformer as well as the electrolytics. With the set was an original **typed carbon-copy** instruction manual, and an original copy of James Millen's 1933 promotional booklet on the AGS. The set was healthy, with every component original and OK, generating the temptation to 'peak it up'.

RF alignment of the AGS is unusual in that there is only **one** trimmer for each band, in the oscillator coil. Assuming the IF alignment is correct, these oscillator trimmers are adjusted to give the correct calibration for each range according to the chart on the front panel. Next, one of the two high bands is tuned near the top of its range, and the trimmers on the RF and mixer stages adjusted for maximum output. The instructions assert that the L's and C's are so precisely adjusted at the factory as to assure that **this is it**. RF trimming, once done for one set of coils, must be assumed to be right for all! The Millen booklet gives persuasive supporting detail. Complete alignment instructions, incidentally, may be found in *Riders*, Volume VIII.

In this late AGS-X the 2nd detector trimmer has been eliminated from the design (see *QST* photo, June 1934). It was evidently decided that the constants could be so exactly factory-tuned as to require only tuning the IF's, calibrating each oscillator to the non-adjustable mixer, and trimming the RF stage. In fact this still works, with the reservation that, as in most old radios, some constants have mysteriously changed ... in this case, loss of inductance. (This is perhaps due to

National's low-loss R39 material becoming slightly conductive over the years with air-borne salts, and reflecting shorted micro-turns.) The practical solution is to explore around with a signal generator and tune the oscillator to locate the best tuning of the 1st detector. After that one trimming of the RF suffices.

In this set, some bands are nearer the original calibration than others, but all work very well, with surprisingly good image rejection on the high bands; better than 25 db was measured at 18 mc.

The original Bliley BC-3 crystal holder was marked "522 kc - 75 degrees". The IF's were found to be tuned to 522 kc, but the original crystal was cracked. A miniature modern crystal blank (WW II surplus - 250 kc) was temporarily fitted and after the IF's were retuned, the performance of the circuit - the same as shown in the Lamb article - was observed.

The filter is definite and aggressive in action, the only adjustment being SELECTIVITY, which has about the same effect as on an early HRO. With the mode switch set at SER (series), extreme 'peaky' selectivity prevails, ideal for single signal code reception and exact logging. If selectivity is at minimum, speech is readable. With the mode switch in PAR (parallel), the selectivity curve has a deep and narrow rejection notch on center. An interfering heterodyne on a broadcast signal can be 'notched out', with critical operation of the main tuning dial, so that the wanted signal is readable. There is no phasing control, but in spite of that the circuit works very well.

Although the AGS alignment instructions call for an IF of 500 kc, we feel that 522 or 525 is correct for the AGS-X. Lamb suggests 525 kc as a precaution to assure that no BFO harmonics land inside a ham band. In the straight AGS, the user can put the IF where he pleases (within design limitations) but not so when there is a crystal filter. Another reason to avoid the 500 kc might be to prevent interference with another set tuned to the international distress channel. The authors would appreciate learning crystal frequencies in other AGS-X sets.

NOTE: Calculation and experiment show that for tracking and calibration there is no no observable difference between 500 and 525 kc, except at the bottom of the lowest band.

To one accustomed to operating a well-aligned early HRO, a comparable AGS offers surprises.

There is only one gain control. In the MVC (manual volume control) position it takes the output from silence to deafening with very small motion; it's almost useless except for very low general signal levels. By contrast, on AVC the control is very flat and manageable.

Selectivity at first seems broad, but this is the result of the powerful AVC which flattens the tun-

ing effect. There is no S meter to go by. On MVC the good selectivity becomes apparent, and is not much inferior to that of an HRO.

Changing bands is a production requiring both hands. The good part is the spooky way the three coils seem to find their own way into the receptacles.

The famous National Velvet Vernier dial is amazingly serviceable. It works smoothly, with no rubberiness, and can actually be read to half divisions, giving a scale of 3000 units - not bad when compared to the HRO PW dial.



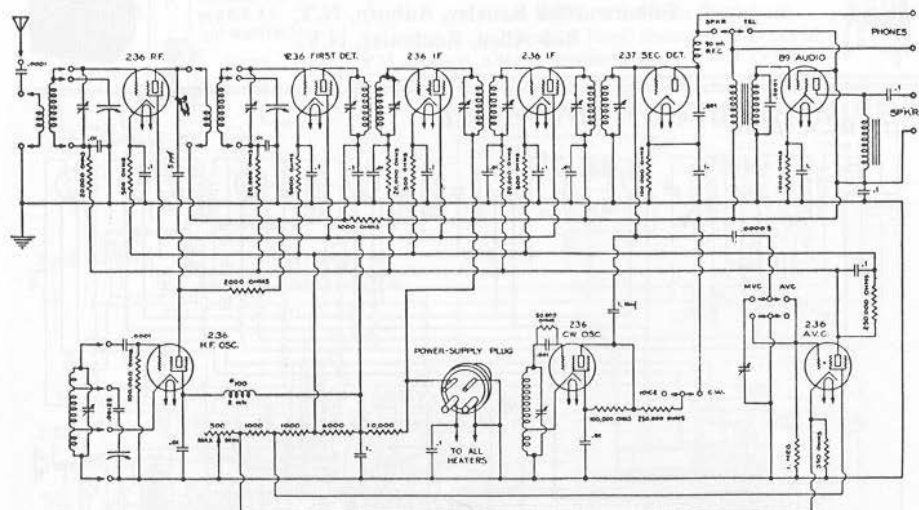
A quaint feature of the AGS, which is a very serious professional looking piece of equipment, is the style of the small knobs. They are the same as on the earlier low-priced National sets, "decorator" modeled and detailed, incongruous on the AGS panel.

Finally, a word of caution when operating an AGS with the earphones plugged in. The terminals are **always** at B-plus, regardless of the position of the TEL-SPKR switch.

We are speculating that the AGS was manufactured between the extreme limits of October, 1932, and the end of 1934. As soon as the HRO was available, the AGS was eclipsed.

We further speculate, on the basis of the few serial numbers available to us, that about 500 sets were made. The walnut box accessory (QST June 1934) suggests a desperate effort to unload foreseen end-of-production merchandise to the carriage trade. The beautifully made shielded box, by the way, is styled exactly like those enclosing General Radio test equipment of the same and later periods.

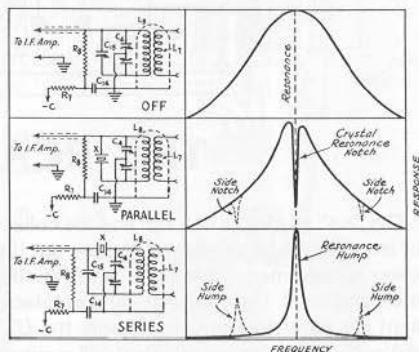
Charles P. Fisher



EDITOR'S COMMENT:

It is difficult to cover a feature story in the space allotted to a column, and there is more information regarding the AGS which will be presented later. In the meantime, if owners of these receivers would care to send in descriptive information, such as the serial number, a physical description, and the IF crystal frequency in the case of the AGS-X, we will be glad to compile a list of pertinent information following the same approach as with the HRO survey currently in progress. The information will be made available to all contributors, with the exception that the names of the owners will be kept strictly confidential.

- K3ZJW



THE SELECTIVITY CHARACTERISTIC OBTAINED WITH FILTER SWITCHING

(Continued from page 12)

with a look into some corruption. The issues involved in a new industry are examined, as well as the usual government intervention. The RCA monopoly is presented in detail and the subsequent inquiry of the Federal Trade Commission.

Rivalries between stations in acquiring audiences through network hookup was a major concern, but the bottom line remained the stockholders' profit.

The final chapter deals with federal standardizing and the assignment of wave lengths to prevent interference. Advertising costs on the air ranged then from \$150 to \$500 per hour, a far cry from the \$10,000 or more a minute now demanded by TV networks.

An appendix covers the last twenty-five pages, revealing the formation and cross-licensing agreements between the companies which made up RCA. It describes in detail the consolidation of patents held by different companies, resulting in radio manufacture with little patent interference. A radio historian would be delighted with this section alone.

The History of Radio to 1926 deserves a place on every radio collector's bookshelf. Encompassing the development of radio in chronological order, it aids one in research of inventions and certain time slots. I would highly recommend the book equally to a beginning collector or an advanced historian.

(Ed. note: The book can be found in large public libraries and bookstores specializing in early technical publications.)