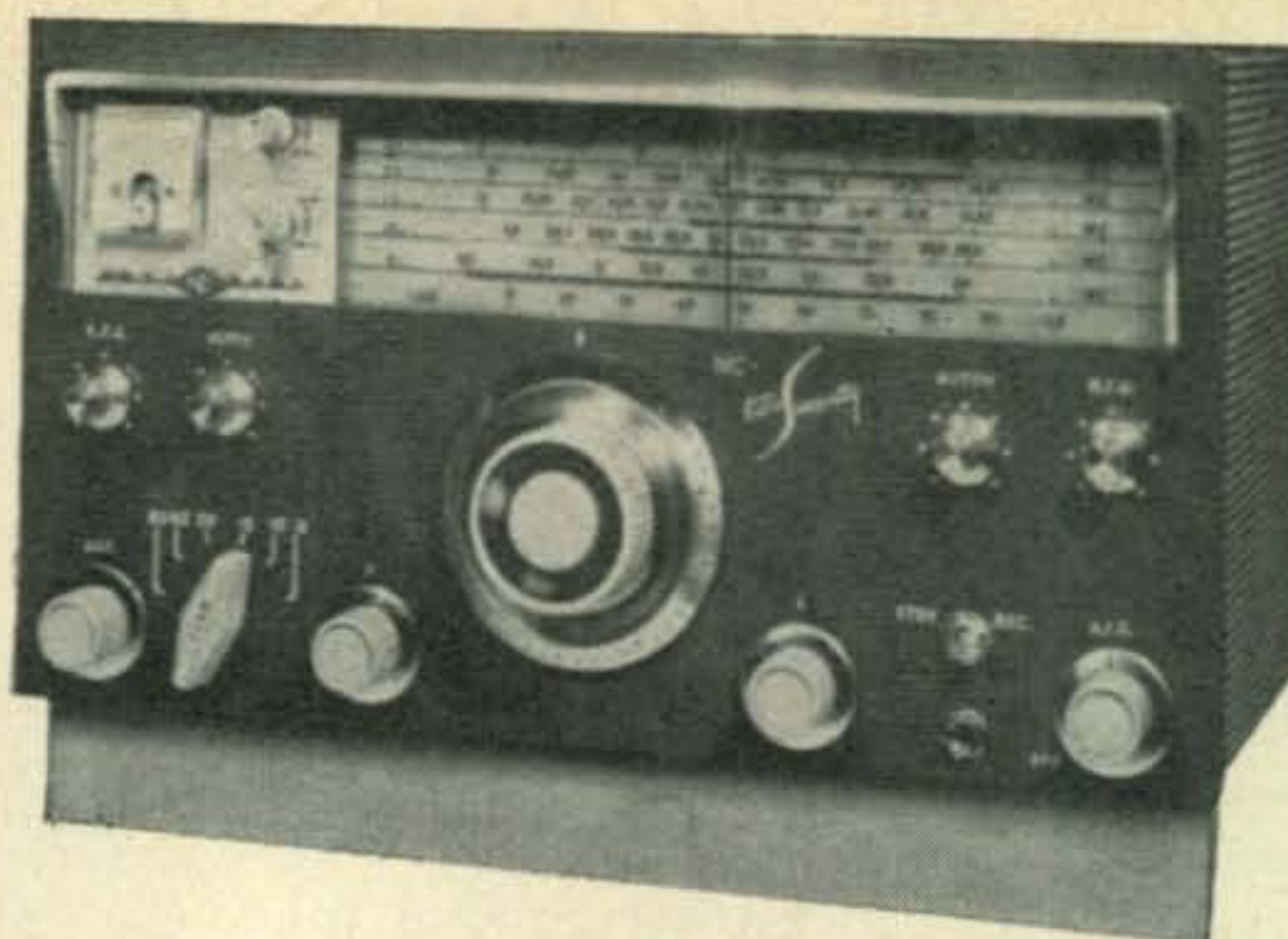


The National NC-270

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Technical Editor, CQ



FOR THE past several months your reviewer had had the opportunity to operate and critically examine the new National "Cosmic Blue" NC-270 ham band receiver. It really didn't take that long to arrive at a decision about this receiver; it was just difficult to stop playing with it long enough to write this review.

The NC-270 retains all the "feel" of the more expensive receivers for which this company is known, and does it with fewer tubes and simpler circuitry, without sacrificing performance or operator convenience. There are, in fact, some features not found in receivers priced considerably higher.

In the area of operator convenience; the "flip foot" that tilts the receiver to meet the operator, the large, smooth-operating tuning knob, the knife-edge dial pointer, front panel headphone jack, and horizontally adjustable dial scale, all rate a bow from here.

The receiver also appears to be one of the first of the lower priced models to recognize that modern amateurs make wide use of coaxial line. The antenna input is designed for 52 ohm unbalanced line, and peaking on each band is accomplished by means of a trimmer control on the front panel.

Receiver Circuitry

The receiver employs double conversion on all bands and uses eight tubes plus one full wave rectifier and one voltage regulator.

From the antenna circuit, signals are fed to the 6BZ6 r.f. stage. A.g.c. is applied here to adjust the gain of this tube to a suitable level. R.f. stage output is capacitively coupled to the primary of the mixer coil for 40 and 80 meter operation and is directly coupled to the tuned inter-stage coil on all other bands. The secondary of the mixer coil is tuned to further add to the r.f.

selectivity. The signal is now fed to the signal grid of the 6BE6 first converter. The tunable local oscillator is a part of this converter tube. The antenna circuit and mixer stage, as well as this oscillator, are all gang-tuned by means of the main tuning knob on the front panel. A 6BE6 functions as the local oscillator and first converter tube. The oscillator is fully temperature compensated to provide an extremely high degree of stability. The oscillator frequency is always 2215 kc above the signal frequency, thereby generating a 2215 kc first i.f.

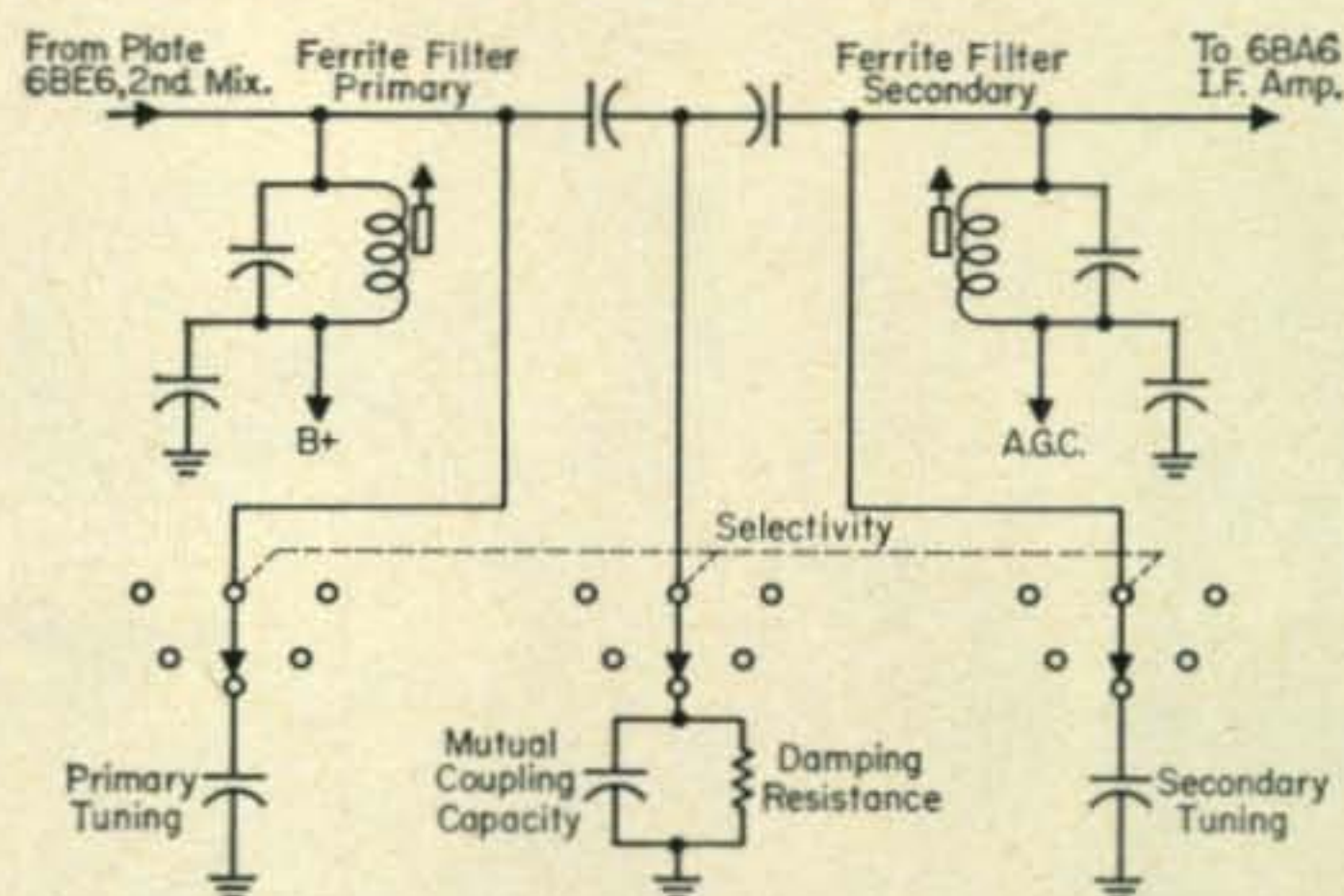


Fig. 2—Simplified circuit of the Ferrite Filter using coils with a Q of 500 each. Changing the coupling impedance varies the bandwidth from 600 cycles to 5 kc.

After going through a conventional double-tuned i.f. transformer, the new signal is fed to the signal grid of another 6BE6, the second converter tube. Considerable primary and secondary image rejection is obtained by the first i.f. stage. The primary image is reduced by the high i.f. frequency and secondary image by the excellent selectivity. The second converter oscillator is crystal controlled. It produces a second con-

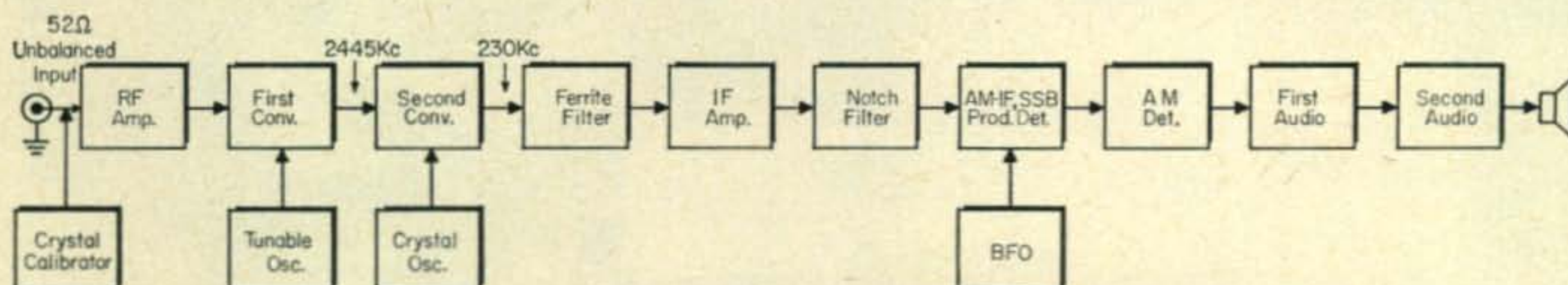


Fig. 1—Block diagram of the NC-270 receiver. It is a double superhet with a patented Ferrite Filter, a Bifilar "T" Notch circuit, a product detector and an S meter.

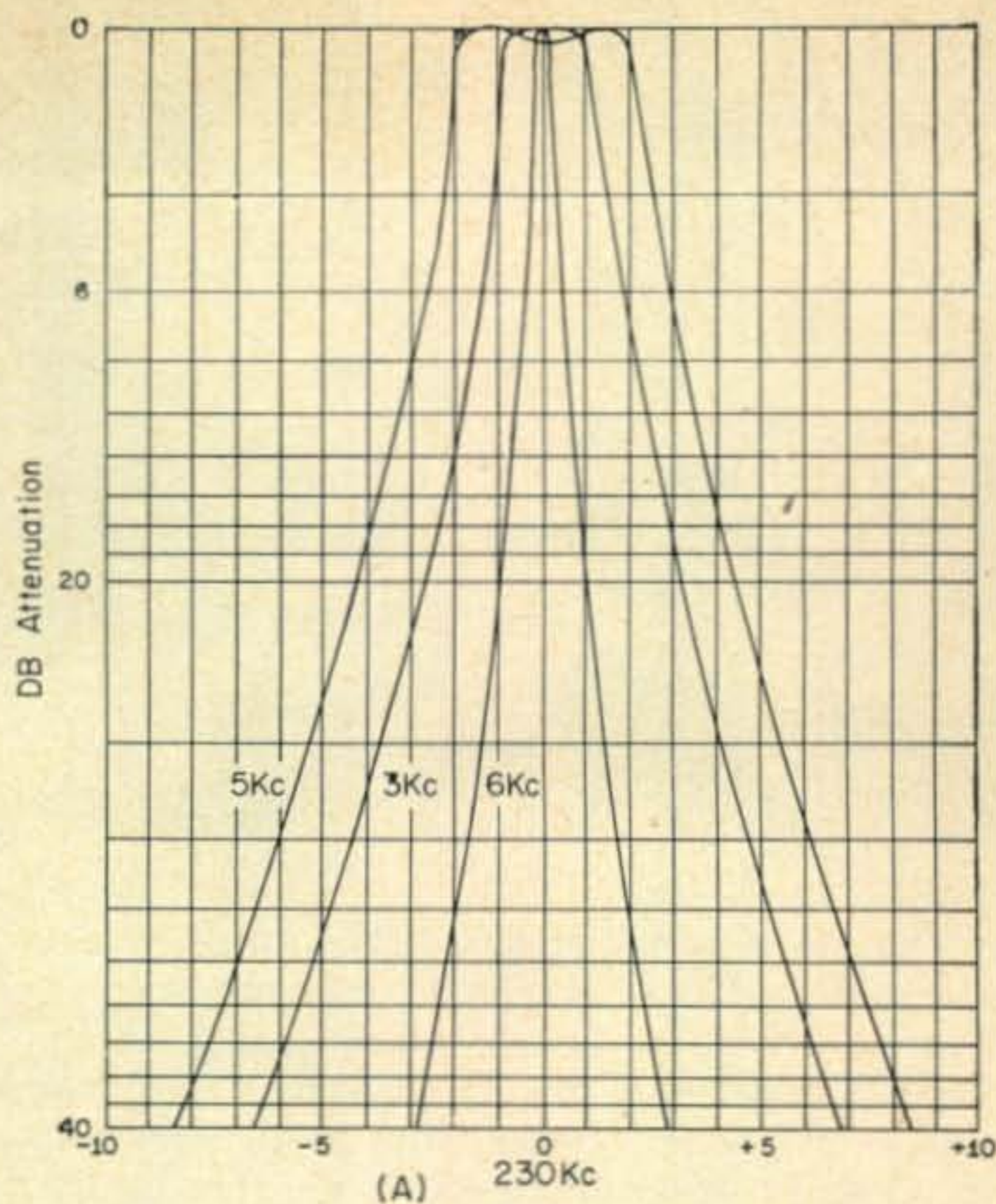
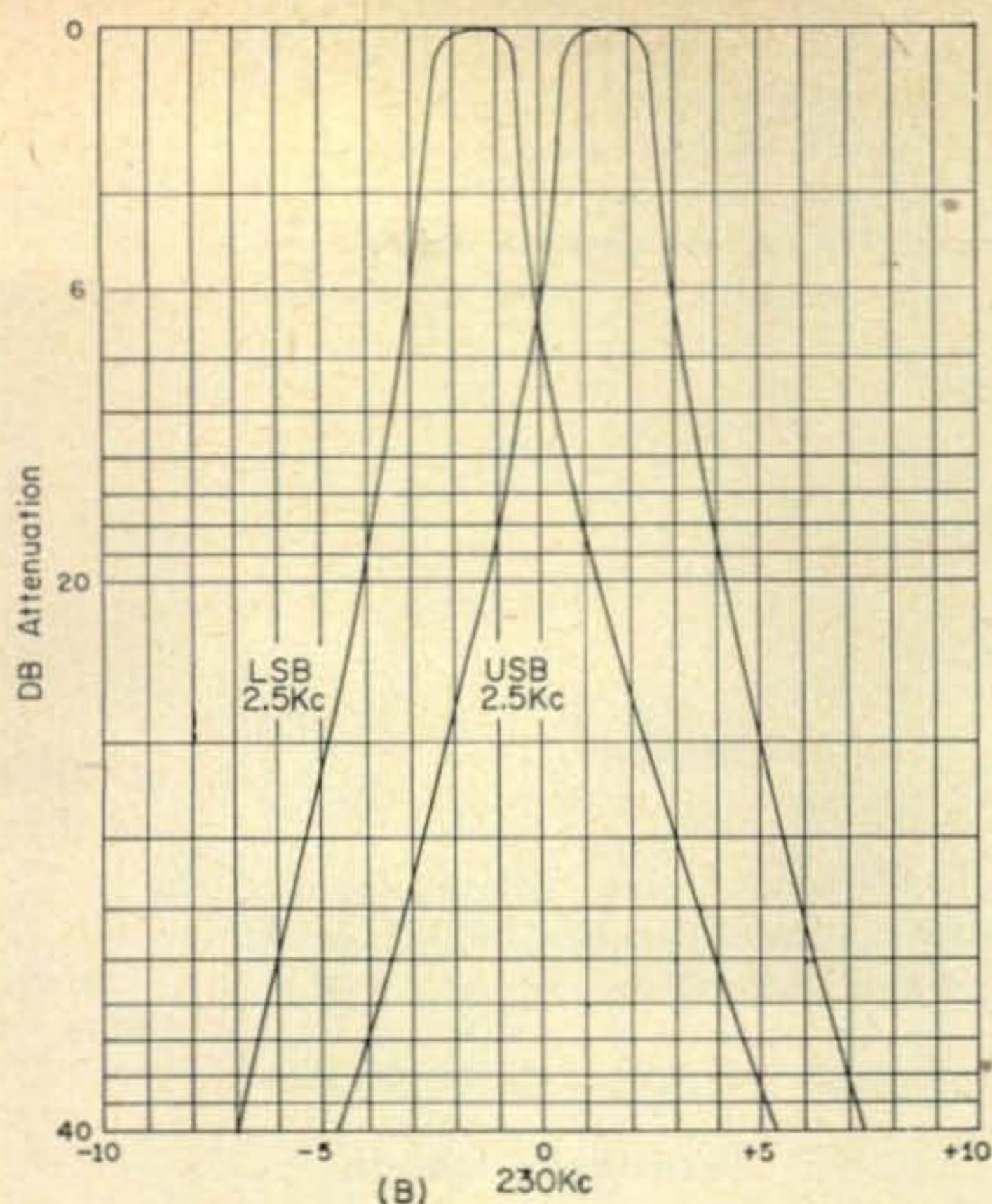


Fig. 3—NC-270 selectivity curves. Curves shown in A are 0.6, 3 and 5 kc for a.m. and c.w. The curves shown in B are for sideband. Each has a bandwidth of 2.5 kc and is centered symmetrically about the i.f. of 230 kc.

version frequency of 2445 kc that beats with the 2215 kc signal to arrive at the 230 kc i.f. output frequency. This low frequency i.f. signal is then coupled to National's patented Ferrite Filter. Shown here in fig. 2 is a simplified form of the filter and its two tuned circuits, each with a "Q" of about 500. A selectivity switch changes the coupling between the two coils and thereby varies the bandwidth from the wide 5 kc position to the narrow 600 cycle position in five steps which include two 2.5 kc positions for upper and lower sideband. The upper and lower sideband can be selected with shifting the oscillator frequency.

From the secondary of the Ferrite Filter the signal is fed to the first 6BA6 i.f. stage, which operates in the conventional manner. Output from this tube, at 230 kc, is coupled to the Bifilar "T" Notch circuit. This circuit employs primary and secondary tuned circuits tuned by series capacitors and the impedance of the Bifilar choke and notch frequency circuit. Front panel NOTCH and DEPTH controls tune this circuit. The circuit is so arranged that there is effective coupling throughout the i.f. bandpass except at the notch frequency. The DEPTH control provides a resistive balance and governs the depth of the notch. To a certain degree, these controls must be used together. By a proper combination of both, it is possible to achieve a rejection of greater than 50 db. This is deep and sharp enough to remove the carrier from a a.m. signal and cause it to appear as a d.s.b. signal. It is unusual to see a front panel NOTCH DEPTH control in this price class of receiver. The effectiveness of a T notch filter can be cancelled by tube and component aging as well as shift of the notch frequency. All can be compensated for by the

control, making it a worthwhile addition to the front panel. When not in use, the notch control is left in the full-clockwise "OFF" position. In this position, the notch is removed from the i.f. passband.

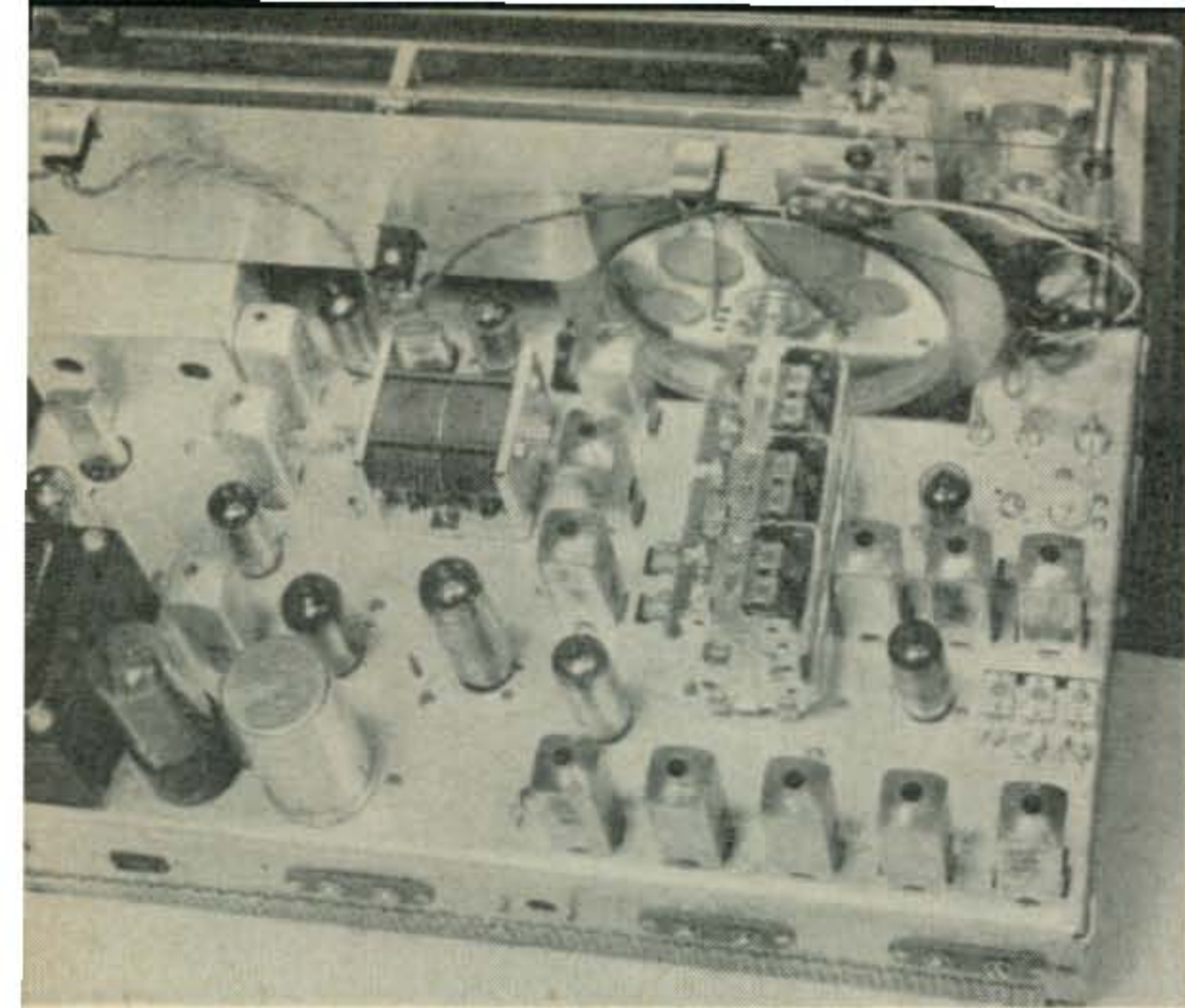
Signal output from the Bifilar "T" Notch is capacity coupled to the grid of the last 6BA6 i.f. stage. As well as the output of the b.f.o. When receiving s.s.b. signals this stage acts as a product detector with the audio signals taken from an RC network in the plate circuit. When receiving a.m. signals this stage is a conventional i.f. amplifier feeding the diode detector, a section of the 6T8.

A.g.c. derived from the diode detector is applied directly to the grid of the 6BA6 i.f. tube. A second diode in the 6T8 serves to provide delayed a.g.c. so that the r.f. stage may function at maximum gain on weak signals and still receive a.g.c. potential under strong signal conditions.

The FUNCTION switch on the front panel provides a choice between a variety of combinations of a.g.c. and a.n.l. The a.n.l. circuit in the NC-270 is exceptionally good, and there is practically no detectable difference in the signal itself when the a.n.l. is activated. There is no reduction in audio level and no distortion of the signal being copied. The average listener, I'll wager, will not be able to tell whether the limiter is in or out except by the noise level.

The amount of impulse noise to reach the a.n.l. has been reduced by careful choice of RC time constants in the i.f. so that i.f. limiting action occurs on s.s.b. and c.w. signals.

The power supply of the receiver uses a 5Y3GT full-wave rectifier and an 0B2 voltage regulator. With no antenna connected, and the audio gain at maximum, there is no audible hum



Top view of the new National NC-270. The Ferrite Filter can be seen just left of center on the chassis. The notch and b.f.o. coils (L_{12} & L_{13}) are located in the small shield can at the left just rear of the panel. The calibrator crystal and tube can be seen in front of the power transformer.

in the audio output.

The STANDBY/RECEIVE switch is somewhat of a departure from "accepted" amateur practice. The two position switch, when placed in the Standby position, mutes the receiver by removing plate and screen voltages from most tubes, and shorts a pair of terminals on the rear apron. The idea is that these terminals may be used to control an external relay circuit and in that way activate the transmitter and the antenna change-over relay. For the amateur who still wishes to control his station operation from the transmitter it is a simple matter to reverse the wires on this switch. When this is done, the receiver may then be disabled by an external relay.

Calibrator

The receiver includes a 100 kc crystal calibrator which utilizes one half of a 12AU7. The plate of this calibrator circuit contains a choke shunted with a resistor. It is peaked at 14 mc and provides ample output on this band. Sufficient output is also available on 3.5 mc, perhaps due to the great receiver sensitivity in this region. On 7 mc it can be difficult to find the 100 kc signal, though it can be heard if no other signals are present. The signal is adequate on 21 mc, and it is just audible on 28 mc. On 50 mc it just is not there.

Stability

Some of the outstanding features of the receiver are not apparent from the circuit description. One of the more important features this receiver exhibits is stability, both mechanical and thermal.

The thermal stability can be attributed to several facts. First, tubes are operated at a B+ of 145 volts, (except for the plate of the audio output which is at 165 volts) thus reducing operating temperatures. (This should also tend to prolong tube life.) Second, the bulk of the tuning capacity in the oscillator section, on each band, is a close tolerance zero temperature coefficient capacitor. Third, the cabinet is *fully* perforated giving excellent ventilation. The first conversion oscillator and the b.f.o. are also voltage regulated.

Mechanical stability is also impressive. It is possible to tune to a s.s.b. signal on one of the

high frequency bands, lift the front of the receiver up several inches and let go. Unless the main tuning knob moves, the signal will still be there. This appears to be due to husky oscillator components and the 1/8" steel front panel.

Secondary Image

A popular approach to selectivity in receiver design is double conversion with a 2 mc first i.f. and a 50 kc second i.f. This usually results in images from signals located 100 kc away from the desired signal. (Plenty of these in today's crowded bands.) For example, assume that the second conversion oscillator is fixed at 2050 kc. The first conversion produces a 2 mc signal that beats with the 2050 kc oscillator to produce a 50 kc last i.f. A signal 100 kc away from the desired signal is subject to only minor attenuation in the receiver front end and therefore appears at the second mixer 100 kc away from the desired signal; 2100 kc. This signal also beats with the second conversion oscillator at 2050 kc and the difference is 50 kc, appearing as a secondary image.

The '270 uses a 230 kc i.f. and thus the secondary image frequency copied is 460 kc away from the desired signal. The front end attenuation 460 kc removed is very adequate to eliminate the signal. The Ferrite Filter more than makes up the selectivity sacrificed by moving to a higher second i.f.

Instruction Manual

The instruction manual is also unusual in its organization. A detailed circuit analysis of the receiver is given in the usual step by step fashion. However at each point that a control function is mentioned the description is interrupted and the control function is analyzed. Digestion of the instruction manual content will give the operator a thorough knowledge of the receiver control operations as well as a short course in receiver circuitry.

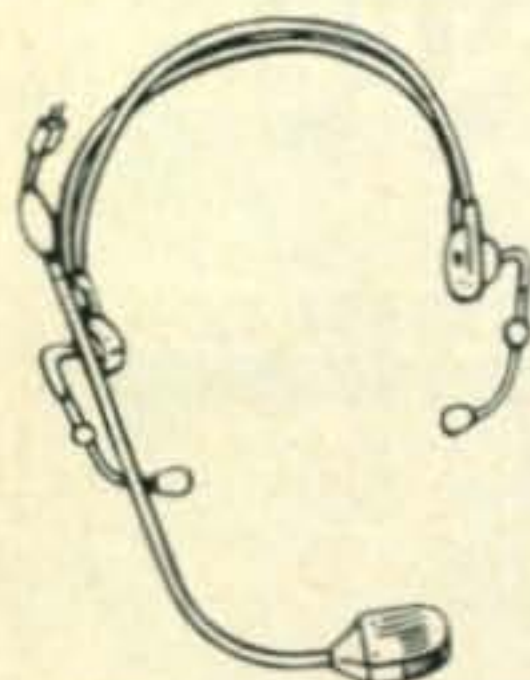
Another bow to National for knowing some of the foibles of the average amateur. They have included, with the receiver, a control location and function chart which gives enough information to enable proper operation but which can

[Continued on page 104]

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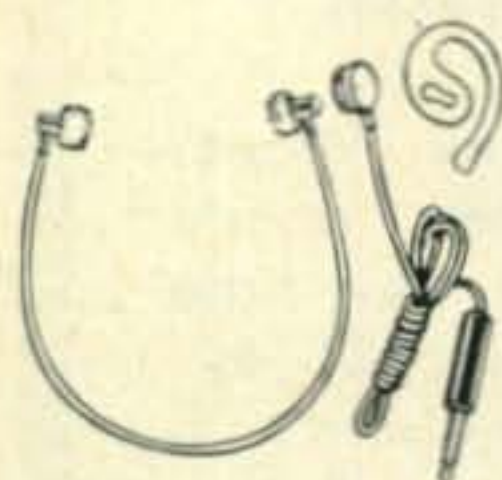
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committee puts on an entertaining program. Besides introductions and speakers, added attractions keep hamfesters guessing. For instance, if the wind is right and his plane in flying shape, good-natured K9JAW, Sonny Hindson, showers tickets from the sky entitling finders to collect a variety of prizes. Of course, the big stuff is distributed at the last hour drawing, and thanks to an active committee and cooperating dealers and manufacturers, jubilant hams carry off valuable prizes including perhaps a beam, tower, receiver, or transmitter.

"We don't try to make money," says W9QLZ. "We just like to break even and see that everyone has a good time."

And if you don't believe it, just drop over to Ottawa on June 4; you won't be disappointed. ■

NC-270 [from page 60]

be read in 10 minutes. I suppose there are very few hams who would read 18 pages of data before operating their new receiver.

Your reviewer was disappointed not to find an accessory socket on the rear apron. This feature would be particularly useful since the excellent sensitivity of this receiver on 50 mc could be expected to encourage 220 mc, and higher, enthusiasts to utilize the 4 mc coverage of this band.

For a period of months this receiver has been operated on all bands from 3.5 mc to 50 mc, as well as on 144 mc by means of a converter, and on a.m., c.w., and s.s.b. It is an extremely stable and sensitive receiver with many operating conveniences and is capable of performing well in any mode of communication. ■

160 Vertical [from page 53]

at the high impedance point) due to various resonances of guy wires, cables etc. The proper dip is one which is smooth as you go through resonance, not one which will pull the grid dipper out of oscillation.

This same scheme can be used for 80 and 40 meters using shorter gamma rods and smaller gamma capacitors. Why let a perfectly good vertical go to waste? ■

Solid State [from page 33]

zation in the direction of maximum signal should be determined by rotating the receiving antenna about its axis. When measuring antennas, the unit should, of course, be oriented to produce the desired polarization.

Total power drain is about 18 mw (6v @ 3 ma), so with normal use the batteries can be expected to last their shelf life. Naturally, with this low power input, you won't get an indication on a field strength meter. But with any receiver worthy of the name, you'll have plenty of signal at distances around a few hundred feet. If more signal is required, the unit may be placed at the focus of a parabolic reflector. ■