

The World Radio Laboratories

Galaxy 300 Transceiver

WORLD Radio Laboratories has reversed the trend of rising amateur equipment costs with the Galaxy 300 s.s.b. transceiver. Not only is it relatively low priced, but it also provides a transmitter which packs a solid punch at 300 watts p.e.p. input. This is an attractive asset for those desiring a good amount of power without the additional expense of a linear amplifier.

As with many transceivers currently being marketed, coverage is limited to the 20, 40 and 80 meter phone bands; however, unlike some, the selection of either upper or lower sideband operation for each range has been included, thereby maintaining the full potentialities of s.s.b. In this respect, the use of either sideband should be encouraged, since restriction to a particular sideband throws away useable channels and does away with an advantage to be gained through s.s.b. operation.

The transceiver also may be operated on a.m. using a single sideband with a peak power input of 300 watts, equivalent to a regular a.m. transmitter with 75 watts of carrier. C.w. can be used too at 300 watts power, but such operation is limited to within the phone bands, except on 40 where c.w. use is possible from 7050 to 7200 kc.

V.o.x. operation is available with an optional plug-in module at extra cost. This is a justifiable arrangement for keeping the initial cost of the unit down inasmuch as many operators do not care to use v.o.x. anyway. Besides this, v.o.x. is seldom handled as it should be for true break-in operation, its use being confined mostly to a method of turning the transmitter on and off in a push-to-talk fashion which can be done a lot cheaper and almost as handily with a microphone button.

The Galaxy 300 may be used as a fixed station or in a mobile setup. Power is obtained from a separate unit which for home use is the PSA-300

console a.c. power supply with a self-contained loudspeaker. An optional electric read-out type clock and timer is also available. The mobile power supply for 12-volt d.c. operation is the G-300 DC.

Circuitry

A block diagram of the transmitter section is shown in fig. 1. Two stages of speech amplification are provided by two cascaded sections of a 6D10 Compactron triple triode, V_{14A} and V_{14B} . The audio is then fed to the balanced modulator, V_{15} , which is a 7360. A crystal-controlled carrier frequency of 9099.939 kc for one sideband, or 9103.144 kc for the other sideband is also fed into the balanced modulator from the sideband-switching oscillator, V_{5A} , which is the pentode section of another Compactron, a 6M11. The carrier is nulled out in the balanced modulator and the two sidebands are passed on to the 9.1 mc crystal lattice filter which has a bandpass of approximately 2.7 kc.

The s.s.b. signal is then amplified by V_{16} and is applied to a 6BA7 mixer, V_4 , where it is combined with signals from the v.f.o., V_{6A} , which for 20 and 80 operates in the 5100 to 5300 kc region. The sum frequencies, 14200 to 14400 kc are used for 20; the difference frequencies, 3800 to 4000 kc for 80. For 40 meter operation a different v.f.o., V_{6B} , is switched in. This v.f.o. operates from 5383.3 to 5483.3 kc. A frequency multiplier, V_7 , triples to the 16150 to 16450 kc region. The difference with the 9.1 mc s.s.b. signals then covers the 40 meter band from 7050 to 7350 kc.

The two v.f.o.'s are mounted in the same box, each using a separate half of a 6J11 Compactron. The oscillators are gang-tuned to a common dial calibrated in 5 kc increments. The drive mechanism for this arrangement provides a tuning-ratio choice of 12:1 or 72:1. Due to the fact that the sum and difference frequencies are used on different bands, the calibration and tuning on the 80 meter band are in the opposite direction to those for the 20 and 40 meter bands.

When the carrier generator crystals, Y_1 and Y_2 , are switched for changing sidebands, the v.f.o. frequency must be shifted at the same time. This is done by means of diode switches, CR_1 and CR_2 , which control the insertion of appropriate padders C_1 and C_2 .

Driver and Final

The transmitter mixer is followed by V_3 , a 6CL6 driver which pushes a paralleled pair of 6HF5 TV horizontal deflection type tubes to 300 watts p.e.p. The plate potential used is 800 volts. A conventional Pi-network matches the



The Galaxy 300 s.s.b. transceiver for operation on the 20, 40 and 80 meter phone bands with selection of either upper or lower sideband at 300 watts p.e.p. input.

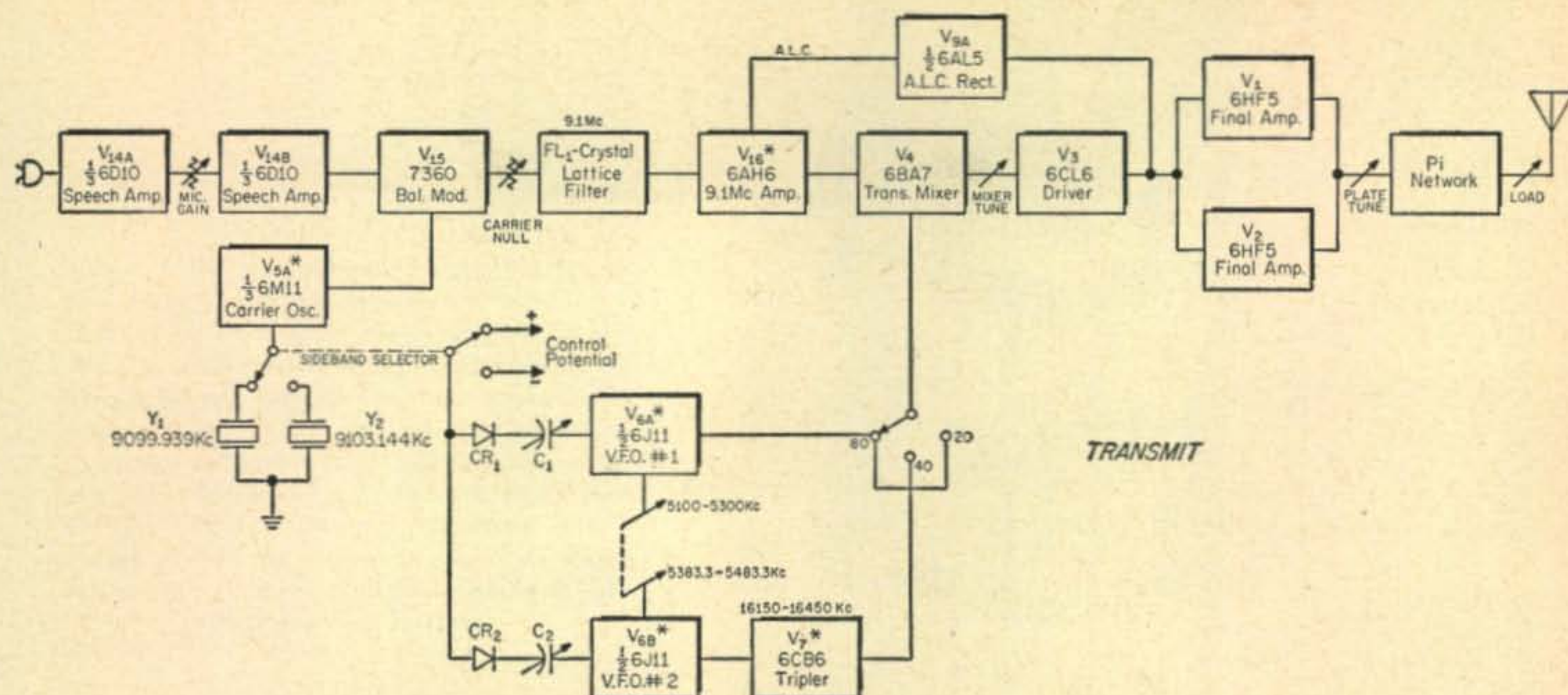


Fig. 1—Functional block diagram for the transmitter section of the Galaxy 300 Transceiver. Elements common to both transmit and receive are marked (*). Driver (V_3) output circuit is bandswitched with fix-tuned circuits.

final to resistive loads of from 25 to 100 ohms. Well regulated screen potential for the final tubes is obtained from an 0A2 regulator tube.

A.l.c. is obtained through V_{9A} , a 6AL5, which rectifies any excessive potential developed at the grids of the final. The resulting d.c. is applied as a bias to V_{16} to control its gain.

For a.m., a carrier is inserted with a panel control. Carrier is also inserted for c.w. work with grid-blocked keying applied to V_3 , V_4 and V_{15} .

Receiver Section

The receiving arrangement is indicated in fig. 2. The r.f. stage, V_{10} , is a 6BZ6 pentode the input side of which is coupled through a 10 mmf capacitor to the Pi-network of the transmitter final amplifier.

The converter section of a 6X8, V_{11A} , is used next as a mixer for the incoming signals and the frequencies from the transmitter v.f.o. which is cathode coupled to the mixer through the triode section of the 6X8. Following the mixer

are the 9.1 mc crystal filter and two 9.1 mc amplifiers V_{16} and V_{17} . The triode section of a 6M11 Compactron, V_{5C} , is used as a product detector in which the 9.1 mc s.s.b. signals are combined with the sideband carrier frequencies from V_{5A} to produce an audio component which is amplified by V_{5B} and V_{14C} . The a.f. output stage is a 6AQ5. During transmission periods V_{10} , V_{11} and V_{17} are made inoperative by removal of screen potential. The last two a.f. stages are also disabled.

A.G.C.

A.g.c. for the receiver is obtained by rectifying the audio signal (by V_{9B}) which appears at the output of V_{14C} and then applying the resulting d.c. bias to the two 6BZ6 stages, V_{10} and V_{17} . A slow release time-constant provides smooth a.g.c. action without pumping.

Controls

Besides the v.f.o. dial, the panel controls are the MIC and AUDIO GAIN concentrically grouped

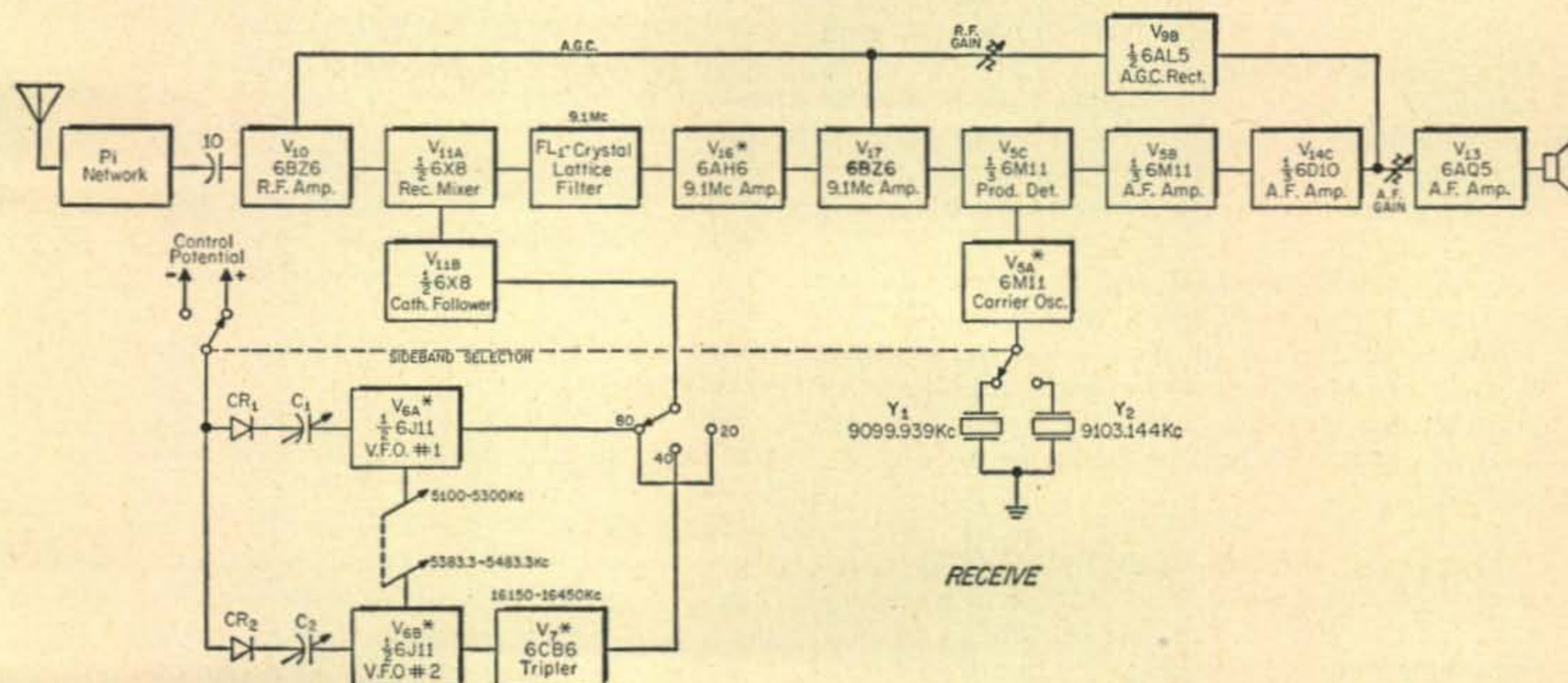
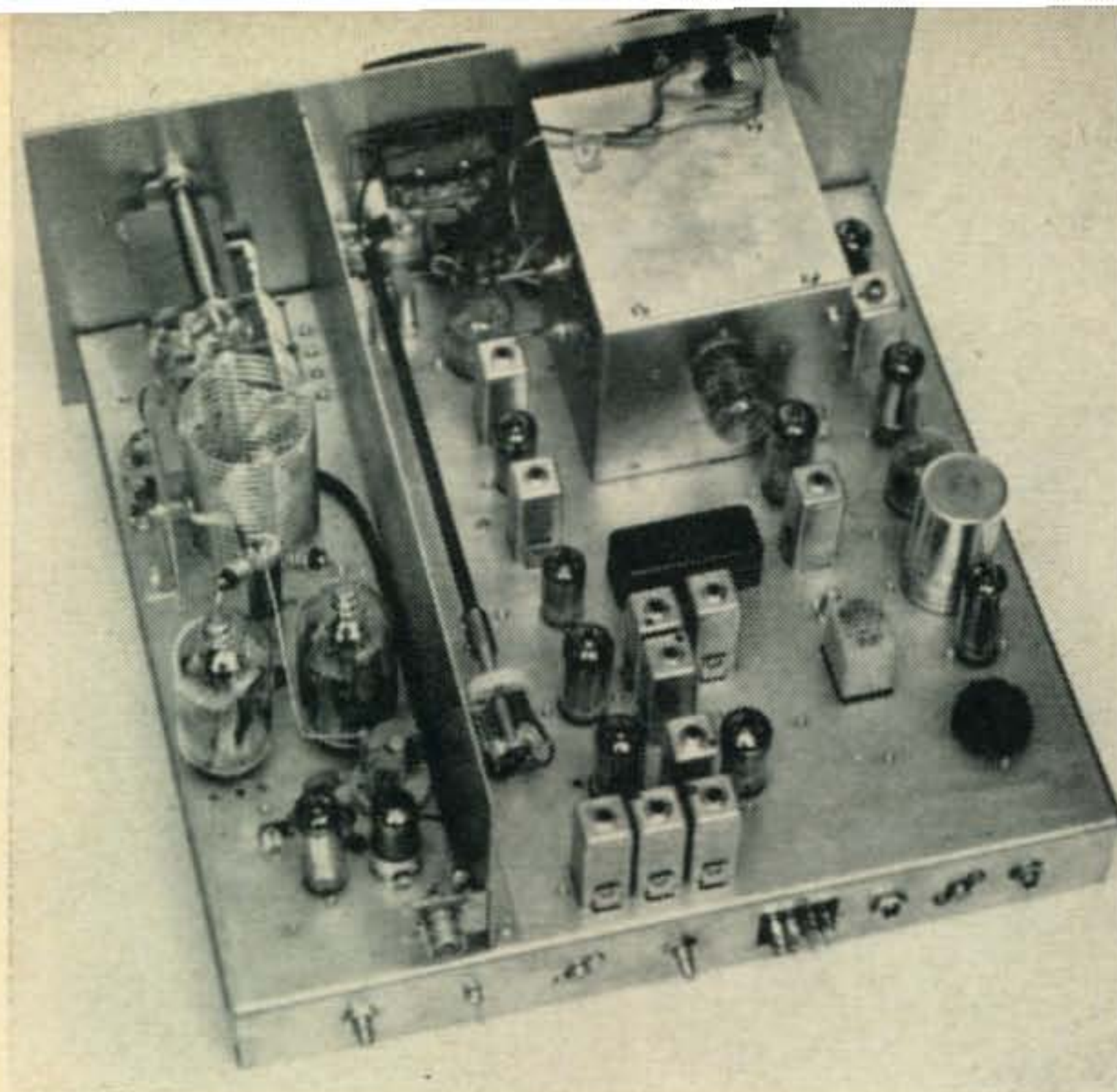


Fig. 2—Functional block diagram for the receiver section of the Galaxy 300 Transceiver. Elements common to both transmit and receive are marked (*). Receiver mixer (V_{11A}) input circuit is bandswitched with fix-tuned circuits.



Top chassis view of the Galaxy 300. The dual v.f.o. is in the box at the upper right with the Compactron oscillator tube protruding from one side of it. The crystal filter is in the small black box just behind the v.f.o. The capacitor with the long shaft tunes the transmitter mixer. The final amplifier compartment is at the left. The two 6HF5 tubes are at the center with the 0A2 regulator and the 6BZ6 r.f. amplifier toward the chassis apron. The final bandswitch is inside of the lower part of the tank coil.

on one shaft. The R.F. GAIN and CARRIER NULL are likewise mounted. Other controls are: BAND SELECTOR, FINAL GRID TUNING, FINAL PLATE TUNE and FINAL LOADING. Upper or lower sideband operation is selected with a toggle switch. Another toggle switch is a three-position one which selects the functions of receive, tune or transmit. In the TUNE position full carrier is applied for tuning the transmitter to rated input. In the TRANSMIT position the carrier null control is used either to balance out the carrier for s.s.b. work or to insert the amount of carrier needed for a.m. or c.w. operation.

During receive, the panel meter indicates signal level in S-units; during transmit it indicates final cathode current.

An adjustable hairline fiducial is provided for setting the dial calibration to frequency; however, no crystal calibrator is supplied, so calibration must be made against an external source of known frequency.

Performance

In regard to the receiver section, sensitivity was measured at an average of $0.5 \mu\text{V}$ for a 20 db signal-to-noise ratio. Sideband suppression at 1 kc was found to be 45 db on one sideband, 40 db on the other. This probably could be equalized by readjustment of the 9.1 mc oscillator trimmers. A.v.c. action is smooth without annoying pumping effects. Like many transceivers, a noise limited for mobile work has not been included.

Audio quality is good and the high ratio of the v.f.o. drive mechanism provides easy and comfortable tuning of s.s.b. signals. Relative S-meter readings below S-8 were found to be considerably less than 6 db per S-unit, but calibrations at the top half of the range were good.

Stability

Frequency stability both mechanically and electrically is excellent. The short term warm-up drift for the first 15 minutes, starting at normal room ambient, was found to be within 500 c.p.s., after which it settled down to a negligible amount. From the alignment instructions, dial calibra-

tion accuracy at its worst should be within 5 kc; however, the unit under test was good to within 1.5 kc.

Subjecting the Galaxy to a drop and vibration test did not produce even the slightest quiver of the frequency.

Transmitter

No problems were encountered in tuning up the transmitter following the instructions furnished. Using the a.c. power supply and with the transmitter adjusted for 300 watts p.e.p. input, the output was measured as 190 watts, at which point good linearity was obtainable. Although the a.l.c. prevents severe flat topping, some still exists before the a.l.c. takes hold. Sideband suppression, of course, was the same as experienced in the receiving position, with carrier suppression down near -45 db when using either sideband. The audio quality sounds clean and pleasant.

The 6HF5 final amplifier tubes give a good account of themselves with no indication of overheating when operated with a carrier input of 300 watts over extended periods.

On-the-air reports of a.m. operation indicated good performance. On c.w. keying was excellent, but from an operational standpoint, a beat note cannot be obtained from a received c.w. signal unless the transceiver is tuned slightly off frequency.

The Galaxy 300 is mounted in a perforated gold-colored cabinet, size 15" w. $\times$ 13½" d. $\times$ 7" h. The panel is an anodized gold-colored finish with black knobs and panel markings. The meter is an edgewise-mounted type. Weight is 22 pounds.

The PSA-300 a.c. power supply is the same size as is the transceiver and is likewise finished. It weighs 44½ pounds.

The Galaxy 300 is priced at \$299.95 and the v.o.x. module is \$24.95. The PSA-300 a.c. power supply is priced at \$119.95 with the clock and timer and \$99.95 without. The G-300 DC 12 v.d.c. supply is also \$119.95. The manufacturer is World Radio Laboratories, 3415 West Broadway, Council Bluffs, Iowa.—W2AEF