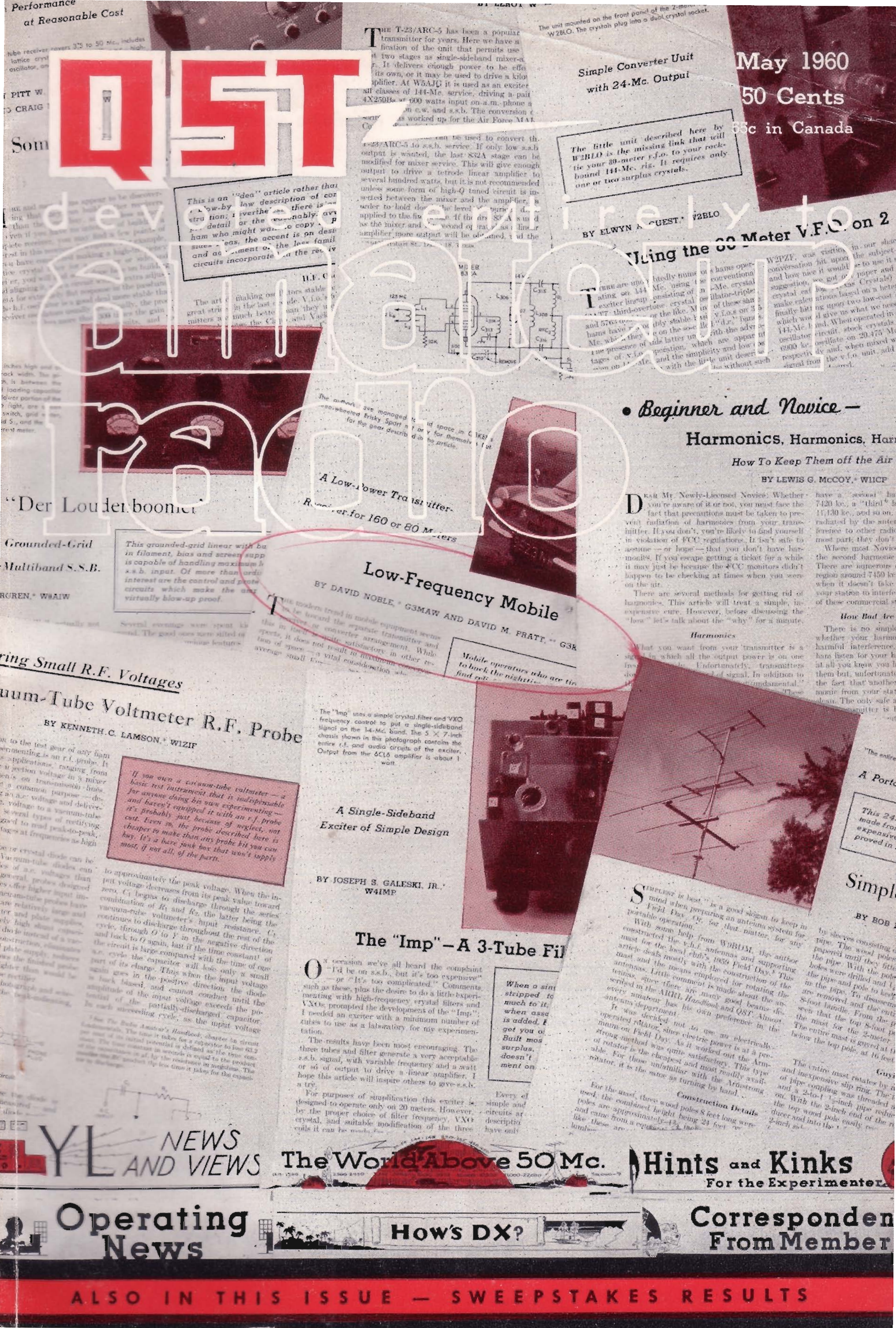
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Simple Converter Unit with 24-Mc. Output
Using the 80 Meter V.F.O. on 2
• Beginner and Novice —
Harmonics, Harmonics
How To Keep Them off the Air
BY LEWIS G. McCOY, W1ICP
"Der Louderbooner"
A Low-Power Transmitter-Receiver for 160 or 80 Meters
Low-Frequency Mobile
BY DAVID NOBLE, G3MAW AND DAVID M. PRATT
Measuring Small R.F. Voltages
Vacuum-Tube Voltmeter R.F. Probe
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A Single-Sideband Exciter of Simple Design
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The "Imp" — A 3-Tube Fi
YL NEWS AND VIEWS
The World Above 50 Mc.
Hints and Kinks For the Experimenter
Operating News
How's DX?
Correspondence From Members
ALSO IN THIS ISSUE — SWEEPSTAKES RESULTS

The authors have managed to find space in G3KEP's three-wheeled Frisky Sport not only for themselves but for the gear described in the article.

A Low-Power Transmitter-Receiver for 160 or 80 Meters

Low-Frequency Mobile

BY DAVID NOBLE,* G3MAW AND DAVID M. PRATT,** G3KEP

Mobile operators who are tired of trying to buck the nighttime QRM on 75 may find relief in going to 160. Not only is the theoretical ground-wave coverage better on the lower-frequency band, but the power-level restriction in force at the present time also makes competition less severe. For those who prefer it, the unit is easily adapted to 75.

The modern trend in mobile equipment seems to be toward the separate transmitter and receiver or converter arrangement. While this in itself is quite satisfactory in other respects, it does not result in maximum conservation of space — a vital consideration where the average small European car is concerned. For this reason, it was decided to make the receiver, modulator and transmitter in a single cabinet, with a vibrator power supply in the trunk. The complete unit is assembled on a 10 × 7 × 2¼-inch chassis which fits into a 11 × 8 × 7-inch cabinet. (Closest U.S. sizes are 10 by 8 by 2½ inches, and 14½ by 8 by 8¼ inches.)

Because of the limited battery capacity, low power was essential. On 160 meters the maximum input power permitted in the United Kingdom is 10 watts. Therefore, this band was chosen because of the proportionately low competitive QRM level. Coil dimensions for the 75-meter band will also be included for those who prefer this band.

Transmitter

The transmitter is primarily crystal controlled, although provision is made for feeding in an external v.f.o. The oscillator comprises a 6BA6 in a Pierce circuit. Six crystals are provided, the desired one being selected by means of a seven-position, two-pole rotary switch, S_1. The seventh position is taken to a coaxial socket, J_5, at the rear of the chassis for connection to an external v.f.o. if this is desired. The power amplifier is a 5763. The pi-network output coupling is designed to feed directly into the whip antenna. Because of the comparatively low power involved, ordinary broadcast-type variable capacitors are adequate in the output circuit.

Modulator

Heising modulation of the plate and screen of the 5763 is effected by means of an audio section common to transmitter and receiver. The modulation inductor L_4 may be any small choke

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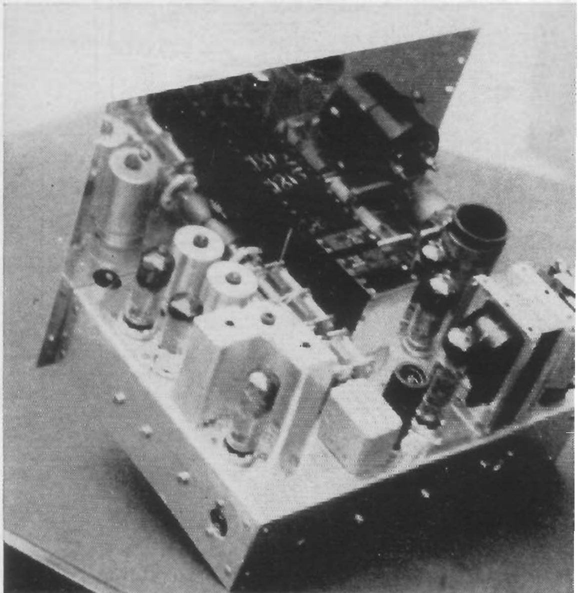

In this view, the receiver section is on the left and transmitter on the right, with the audio section at the rear of the chassis. A row of crystals occupies the central area.

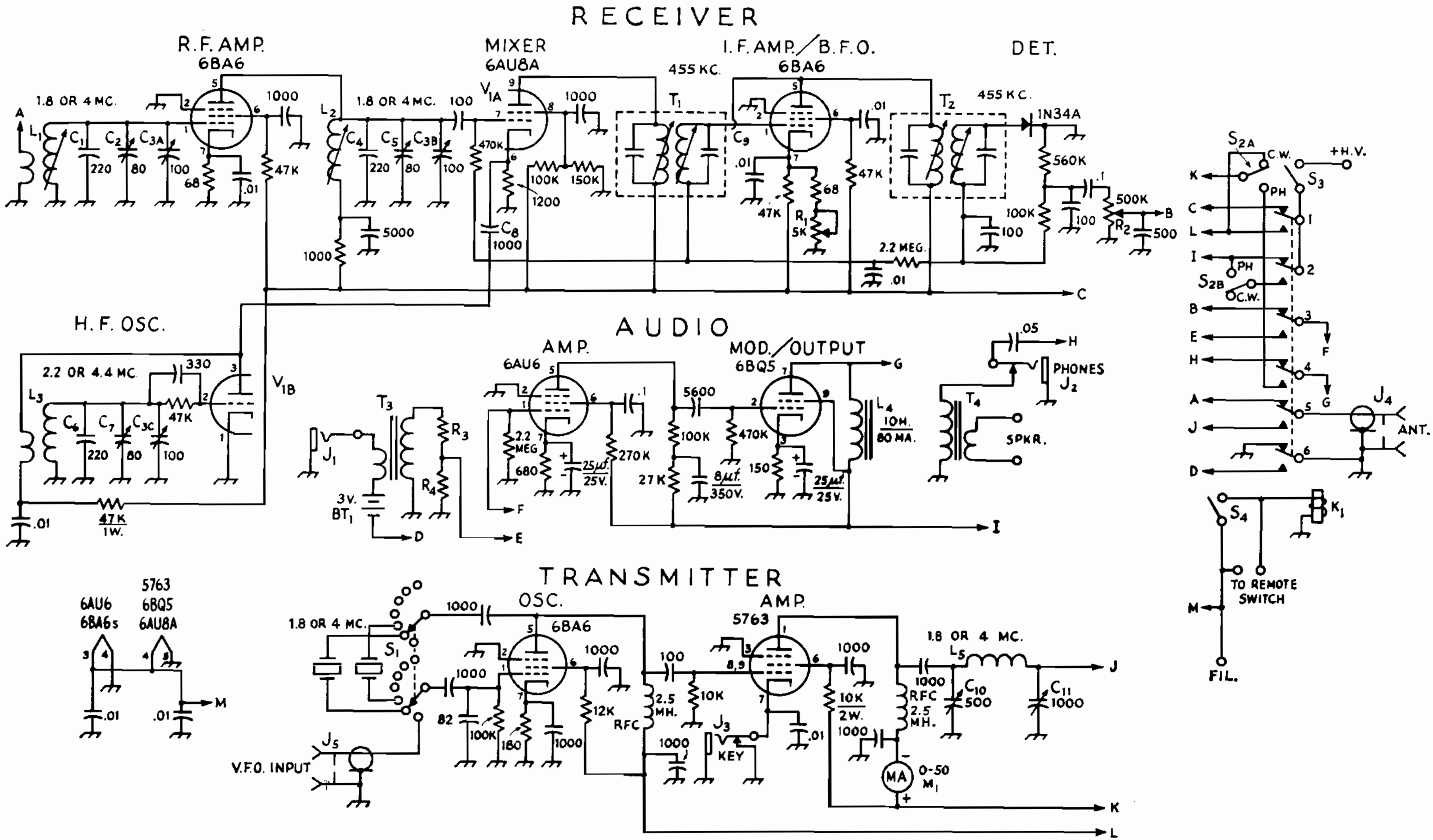
RECEIVER
R.F. AMP.
6BA6
MIXER
6AU8A
I.F. AMP./B.F.O.
6BA6
DET.
455 KC.
1.8 OR 4 MC.
1N34A
H.F. OSC.
2.2 OR 4.4 MC.
AUDIO
AMP.
6AU6
MOD./OUTPUT
6BQ5
10H.
80 MA.
PHONES
SPKR.
3V.
TRANSMITTER
OSC.
6BA6
AMP.
5763
RFC
2.5 MH.
KEY
V.F.O. INPUT
ANT.
0-50
TO REMOTE SWITCH
FIL.
+H.V.
C.W.
PH
6AU6
6BA6s
5763
6BQ5
6AU8A

Fig. 1—Circuit diagram of the low-frequency mobile transmitter-receiver. Resistances are in ohms, and resistors are ½ watt unless otherwise indicated. Disk ceramics are recommended for fixed capacitors having values from 1000 μμf. to 0.01 μf. Fixed capacitors of smaller values, not listed below, should be mica or stable ceramic; larger values should be paper, except for capacitors marked with polarity which are electrolytic.

BT_1—3-volt A battery, or flashlight cells.
C_1, C_4, C_6—Silver mica.
C_2, C_5, C_7—Mica trimmer.
C_3—Triple-gang 100-μμf. variable (Bud MC-888).
C_8—1000-μμf. mica.
C_9—See text.
C_{10}—Midget superhet variable, broadcast replacement type, sections in parallel (Allied 61 H 008).
C_{11}—Dual t.r.f. variable, broadcast-replacement type, sections in parallel (Allied 61 H 059).
J_1—Open-circuit jack.
J_2, J_3—Closed-circuit jack.
J_4, J_5—Chassis-mounting coaxial receptacle (SO-239).
K_1—6-volt d.c. six-pole double-throw relay (see text).
L_1, L_2—1.8 Mc.—Approx. 23 μh. on iron-slug form (Miller 21A225RB1). Antenna coil 28 turns No. 28 at ground end of L_1.
—4 Mc.—Approx. 6 μh. on iron-slug form (Miller 21A686RB1). Antenna coil 5 turns No. 28 at ground end of L_1.
L_3—1.8 Mc.—Approx. 15 μh. on iron-slug form (Miller 21A155RB1). Tickler 20 turns No. 28 at ground end of L_3.
—4 Mc.—Approx. 4.6 μh. on iron-slug form (Miller 21A476RB1). Tickler 5 turns No. 28 at ground end of L_3.
L_4—Filter choke (see text).
L_5—1.8 Mc.—Approx. 54 μh.—80 turns No. 24, 1-inch diam., 2½ inches long (B & W 3016 or Airdux 832T).
—4 Mc.—Approx. 27 μh.—40 turns 1¼ inches long, same as above.
M_1—50-ma. d.c. meter.
R_1—Linear potentiometer.
R_2—Audio-taper potentiometer.
R_3, R_4—See text.
S_1—Two-section 11-position rotary switch, 7 positions used (Centralab PA-2005).
S_2—D.p.d.t. toggle switch.
S_3, S_4—S.p.s.t. toggle switch.
T_1—Standard or miniature 455-kc. permeability-tuned i.f. transformer, input (Miller 12-C1).
T_2—Same as T_1, but for output (Miller 12-C2).
T_3—Carbon-microphone transformer.
T_4—Universal speaker output transformer, 4500-ohm primary, 8 watts (Stancor A3825).

having an inductance of about 10 henrys with a d.c. rating of 80 ma. A carbon breast microphone is used because of the lower amount of acoustical background noise associated with this type of microphone. Two spring clips under the chassis retain the 3-volt energizing battery for the microphone, and this is made accessible without removal of the rig from the car through an opening in the bottom of the cabinet. The battery is connected via the change-over relay to the chassis. No audio gain control is provided as this was thought unnecessary and the modulation level is preadjusted by means of the potential divider R_3 and R_4. The total value of the potential divider should be about 500K, and the individual resistor values should be predetermined by experiment.

Receiver

To obtain good selectivity, and the high sensitivity advantageous in mobile work, a superhet design is employed. This is of conventional circuitry and consists of a 6BA6 r.f. amplifier, 6AU8A mixer-oscillator, 6BA6 i.f. amplifier and 1N34A germanium crystal diode detector. The r.f. and oscillator coils are British Denco noval-based plug-in coils, but these, of course, may be replaced by any other suitable types. A three-gang 100-μμf. variable capacitor C_3 is used with sufficient padding to spread the 1.8-Mc. band over the whole of the capacitance swing. The i.f. transformers T_1 and T_2 are ordinary 465-kc. broadcast receiving types. A variable resistor in the cathode of the i.f. amplifier stage is used as an i.f. gain control. When this control is turned fully clockwise (toward ground), oscillation of the stage occurs, so providing facility for c.w. reception.

The degree of regeneration is predetermined by varying the input-to-output capacitance of the 6BA6. This is done by connecting a small length of insulated wire to the plate pin and bending it toward the control-grid wiring (C_9).

The output from the i.f. amplifier is fed to the semiconductor diode detector, and thence via the change-over relay to the audio section. An a.f. gain control is provided at the output of the detector. The headphone jack is so wired that the loudspeaker is disconnected upon insertion of the plug of the high-impedance headphones.

Change-Over Switching

Transmit-receive switching is done by means

The 160-meter mobile unit installed in the compact car of one of the authors. Below the meter are the controls for the pi network—tuning capacitor, left, and loading capacitor, right. Along the bottom of the panel, from left to right, are the send-receive switch S_4, the + B switch S_3, the c.w./phone switch S_2, key jack, crystal switch S_1, two microphone jacks (one for each operator), headphone jack, a.f. gain control and regeneration control R_1.

of a six-pole change-over relay.[1] This is operated from the heater supply and may be switched by either of two toggle switches — the first on the chassis itself (S_4), and the other on the dash for easy accessibility. In the receiving position (shown in Fig. 1), Pole 1 of K_1 (with S_3 closed) connects plate voltage to the receiver, and Pole 2 connects plate voltage to the audio section. Pole 3 connects the input of the audio amplifier to the detector output. Pole 4 connects the output of the audio section to the headphones and speaker transformer T_4. Pole 5 connects the antenna to the receiver input. Pole 6 is shorted to ground.

With K_1 energized through S_4 (or the remote switch), Pole 1 connects plate voltage to the transmitter oscillator and to S_{2A}. S_{2A} connects the plate-supply input terminal of the final amplifier to the supply either directly for c.w. operation, or via Pole 4 and L_4 for phone. Pole 2 applies plate voltage to S_{2B} which is open in the c.w. position but which applies plate voltage to the modulator in the phone position. Pole 3 connects the microphone transformer T_3 to the input of the audio section. Pole 4 connects the modulator output circuit to the r.f. amplifier when S_2 is in the phone position as mentioned above. Pole 5 transfers the antenna to the receiver, and Pole 6 closes the microphone circuit.

The unit requires 300 volts at about 90 ma., and 6 volts at 3 amp. The antenna is a loaded 12-ft. whip mounted at the rear. The car, incidentally is only a bit over 9 ft. long!

[1] If a six-pole relay is not available, two relays having poles totaling six may be substituted.

25 Years Ago this month

May 1935

. . . The issue 25 years ago was devoted to details of new receiver circuits and tubes. George Grammer discussed various 10-meter rigs as the 28 Mc. band took an upswing after nearly four years of silence on DX. . . . CT2BK reported on his excellent results with a reflector system on his antenna . . . James Lamb gave readers a look at outstanding technical features on latest manufactured models of superhets.

. . . The DX Contest report chortled that all previous records were smashed to smithereens. More than 90 countries participated and ON4AU worked Ws and VEs on five bands, running up a score of 23,500 — the highest continental score in early reports.

. . . The final report on the 1934 Sweepstakes also proclaimed all records shattered. 970 operators participated and "scores were of previously unheard magnitude . . . nineteen over 70,000!" W9HKC won the affair with a score of 113,679.

. . . Most of the Editor's correspondents 25 years ago were complaining bitterly about phone harmonics and conversation of phone men.

. . . The Editor commented on bootleg operation in the five-meter band with non-hams buying cheap sets from mail-order houses and giving themselves a thrill by going on the air. Radio clubs and individual amateurs were urged to tackle dealers and non-licensed operators.

. . Technical articles included notes on the V-doublet noise-reducing receiving antenna . . . progress in ultra-high-frequency gear . . . receiver selectivity characteristics . . . push-pull-push oscillator circuits for 15-watt second-harmonic output . . . and three pages of hints for the experimenter.

. . . And in the back of the book, an eager fellow offered to trade an adding machine and a 23-jewel watch for teleplexes.

Quist Quiz

We trust you didn't allow yourself to be misled last month by the four loop currents. Redrawing the circuit and properly labelling the *three* loop currents, you should have obtained an answer of $E_{out} = 3.7$ volts.

Silent Keys

It is with deep regret that we record the passing of these amateurs.

W1JIM, Homer B. Smith, Gloucester, Mass.
W1JZF, Durward L. Tracy, North Troy, Vt.
W1LL, Earl C. Batchelder, North Attleboro, Mass.
W2BCW, Larry Spector, Brooklyn, N. Y.
K2DAR, Dr. W. Richmond Moyer, Lockport, N. Y.
K2ERM, John J. Hale, Valley Stream, N. Y.
W2FVX, Louis J. Rogers, Brooklyn, N. Y.
K2HF, William J. Robinson, Camden, N. J.
K2ZAS, George W. Rust, Bronx, N. Y.
W3BIA/5, Albert K. Poole, Philadelphia, Pa.
W3EFS, W3LAI, Dr. W. L. Belton, Philadelphia, Pa.
W3NW, Joseph T. Marsden, Royersford, Pa.
W3ONH, Dr. Willard P. McNeill, Spencerville, Md.
W3RYF, Didrik J. Osdale, Landover Hills, Md.
K4ABB, W4PZT, Ulmer J. Ezell, Okeechobee, Fla.
ex-W4CIS, Henry G. Sandifer, Danville, Ky.
W5BDX, Andrew J. Burton, Enid, Okla.
W5GGR, Jerrold Oliver Hills, Rule, Texas
W5MIU, Louis H. Hudson, Natchitoches, La.
W5OEQ, Harry A. Carlson, Jamestown, N. Y.
K6ALT, George C. Hermann, La Canada, Calif.
K6BPC, Alpha A. Webber, West Covina, Calif.
W6DVU, G. Manley Cole, Corona, Calif.
K6JHL, Arnold L. Harrington, South San Francisco, Calif.
W6OPP, Donald B. Tallman, Bakersfield, Calif.
W6SKZ, Carl E. Sann, San Diego, Calif.
W6SOW, Alexander H. Gies, Los Angeles, Calif.
W6STS, Ford L. McGraw, Glendale, Calif.
W6WUO, Frederick O. Hoffman, Santa Monica, Calif.
W7TLY, Bennett S. Hyde, Flagstaff, Ariz.
W7UHK, Edgar M. Woods, Oswego, Oregon
W8FXN, Herbert H. Mills, Reynoldsburg, Ohio
W8GGC, Harry B. Richards, Princeton, W. Va.
W8HTP, Brooks M. Walker, Zanesville, Ohio
W8ND, Carl H. Wesser, Presque Isle, Mich.
W9ATG, Philip N. Macy, Greenfield, Ind.
W9GZK, Walter H. Wickstrom, Kenilworth, Ill.
W9JYA, Howard V. Chamness, Beech Grove, Ind.
W9STB, Ernest K. Newlin, Terre Haute, Ind.
WØPTK, Richard C. Edstrom, Springfield, Colo.
KL7BMZ, Harry C. Sprague, Kodiak, Alaska
LU9EV, Colin H. Grattan, Buenos Aires, Argentina
VE3AL, A. H. Keith Russell, Toronto, Canada
VE7TT, Frederick George Bonsall, Chemainus, British Columbia