

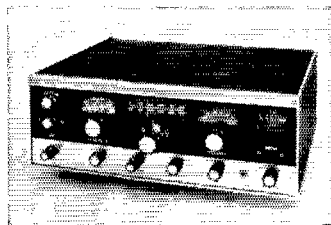


Recent Equipment



To acquaint you with the technical features of current amateur gear.

Galaxy R-530 Receiver



A PRODUCT that seems to have resulted from an extremely "ambitious" engineering effort, the Galaxy Electronics R-530 receiver is designed to give continuous coverage from 0.5 to 30 MHz. in 500-kHz. steps. Each 500-kHz. range is broken down into 1-kHz. increments which are read out on the skirt of the main-tuning dial. Though there are no integrated circuits used in this equipment it does use 52 transistors — bipolar and JFETs — and 35 diodes in its all-solid-state lineup. It is designed to receive upper- and lower-s.s.b., c.w., RTTY, and a.m. signals. Provisions exist for using four crystal filters, switchable from the front panel of the receiver. These filters are available in bandwidths of 0.5, 1.5, 2.1, and 5 kHz.

Though the R-530 could be classed a laboratory-type instrument it is likely to be a strong

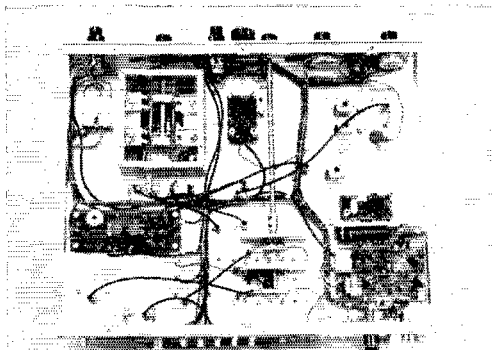
contender in the communications receiver market, both for commercial and ham radio applications. It is ruggedly built, and its cabinet is adaptable to rack-and-panel mounting should this be a requirement. It is supplied for table-top installation unless the rack-and-panel conversion kit, RPA-530, is specified by the purchaser.

Modular construction is used throughout the R-530, making servicing of the ten individual circuit boards a reasonably simple task. A voltage chart for the transistors is included in the operator's manual. If need be, any defective circuit board can be sent to the factory for repair or replacement, thus avoiding the necessity to ship the entire receiver. This feature saves wear and tear on the equipment while greatly reducing the shipping costs. Each module is shielded by its own metal box except for the audio/regulator and calibrate/a.v.c. boards. The signal-carrying leads between the modules are of coaxial cable and the interconnecting power leads are filtered at each subassembly by means of r.f. chokes or decoupling resistors, and feedthrough capacitors. The foregoing measures are important in the reduction of spurious responses.

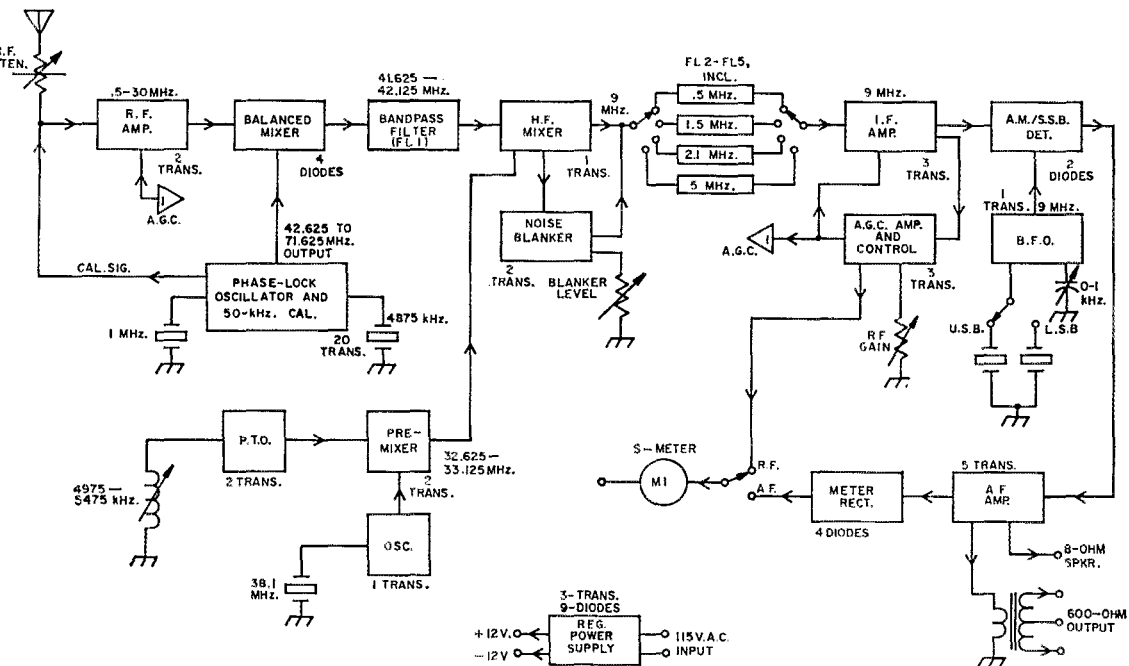
Specifications

The manufacturer states that no more than 100 Hz. of drift occurs from the time the equipment is turned on, including any change in line voltage under 20 percent. Backlash is rated as less than 100 Hz., and the sensitivity is said to be 0.1 μv . for signal-plus-noise-to-noise ratio for s.s.b. reception. A 0.05- μv . signal is required for c.w. for the same conditions, and a 0.5- μv . signal is required for comparable performance during a.m. reception.

The R-530 comes equipped with a 2.1-kHz. crystal-lattice filter for s.s.b. reception. Its shape factor is 1.8:1. The three additional filters shown on the block diagram are available as accessories. Front-end overload is rated at 0.1 volt for 10 percent distortion on the signal. Third-order intermodulation distortion is suppressed in excess of 50 db. according to the specification chart. In excess of one watt of audio output is available with less than 10 percent distortion



Some of the module covers have been removed to expose the circuit boards in this bottom view of the receiver. The p.t.o. board is at the top center. The small board at the right-center area of the chassis is part of the phase-lock oscillator. Directly below it is the large audio amplifier and power-supply regulator board. It, and the calibrate-a.v.c. board at the left-center of the chassis, do not have shield covers. Coax cable connects the various modules and reduces radiation and spurious responses.



Block diagram of the Galaxy R-530 receiver. This drawing has been simplified for reasons of clarity. Filters FL₂ through FL₅ are wired differently than shown (see text and footnote 1). The S meter is used in a balanced circuit for both audio and r.f. measurements. The number of transistors in each section is listed near each box.

The frequency response of the audio channel is rated at 250 to 3000 Hz., plus or minus 3 db.

A Look at the Circuit

Referring to the block diagram and Fig. 1A, the input stage uses two transistors in a reverse-gain-controlled r.f. amplifier. Arranged as a differential amplifier, the two bipolar transistors are emitter-coupled. The first transistor operates as a common-collector stage and provides a high input impedance to the tuned circuit. The second transistor operates in a common-base hookup to establish a high output impedance for the collector tuned circuit. Since this type of circuit is inherently stable, there is no need for it to be neutralized. A.g.c. voltage of negative polarity is applied to the emitters of the transistors. As the received signal increases in level, the a.g.c. voltage becomes less negative by virtue of the voltage drop across the collector load resistor in the a.g.c. control transistor, Fig. 1A, thus reducing the forward bias on the two r.f. amplifier transistors. As the forward bias is decreased, so is the gain of the stage. The a.g.c. voltage was measured between no-signal and maximum-signal (10,000 μ v.) levels and varied from zero volts to -5.25 volts. One stage of the 9-MHz. i.f. amplifier is wired identically to the r.f. amplifier. A.g.c. voltage is applied to it also.

The r.f. stage is followed by a 4-diode balanced mixer. The main feature of this circuit is its ability to produce the desired i.f. output signal, 41.625 to 42.125 MHz., with a minimum amount of the input and oscillator signal appearing in

the output. This circuit greatly aids in the reduction of "birdies" and other unwanted responses in the receiver's tuning range. Oscillator injection to the first mixer is supplied by a phase-locked frequency synthesizer consisting of 20 transistors. Fifty-nine individual oscillator signals are generated from the harmonics of a single-stage crystal-controlled 1-MHz. oscillator. The 59 output frequencies occur at 500-kHz. intervals from 42.625 MHz. to 71.625 MHz. This complex circuit contains gating and sensing circuits in addition to a high-frequency oscillator which is phase-locked to the harmonics from the 1-MHz. crystal oscillator. It is adjusted from the front panel of the receiver by means of a tuning control, and has a dial-type readout. The phase-lock oscillator is set for the desired 500-kHz. interval which permits tuning the desired portion of the 0.5- to 30-MHz. input-signal range. If the phase-lock control is not set exactly on frequency, a red warning light is illuminated, and a beat-note audio tone is heard in the receiver's output, thus indicating an error in tuning.

The balanced first mixer is followed by a bandpass filter, then a second mixer (h.f. mixer) which receives its oscillator injection from a pre-mixer and amplifier. The pre-mixer gets its input signals from a p.t.o. which operates from 4.975 to 5.475 MHz., and from a 38.1-MHz. crystal oscillator. The h.f. mixer operates with an oscillator injection frequency of 32.625 to 33.125 MHz. A noise detector, amplifier, and gating circuit comprise the noise-blanker which follows the h.f. mixer. The blanker has a threshold

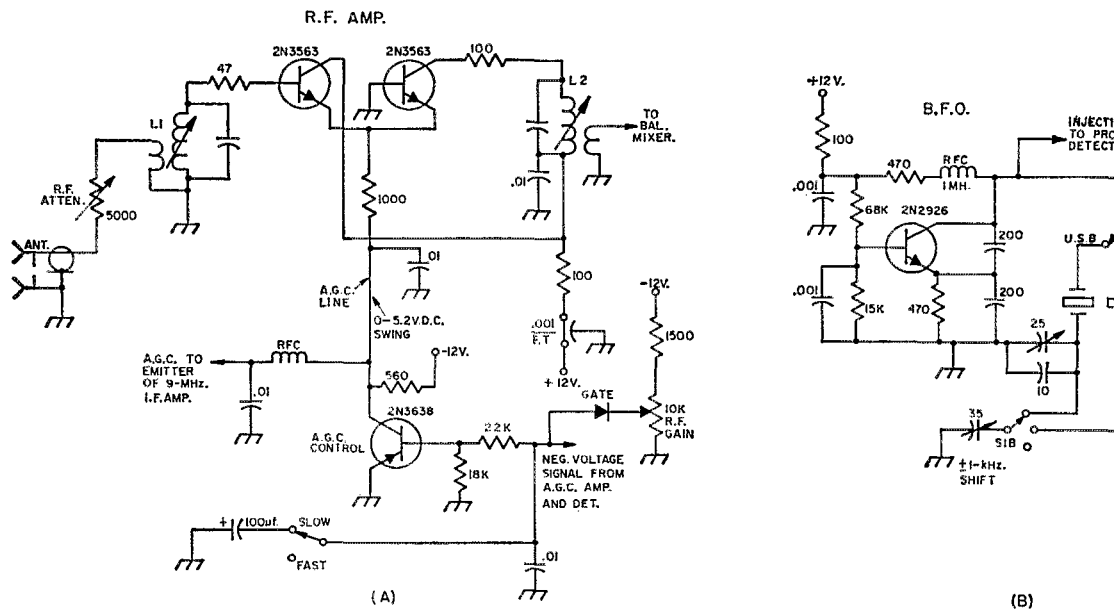


Fig. 1—At A, the r.f. amplifier, its input and output circuits, and the a.g.c. control stage. L_1 and L_2 are selected by a band switch. They are ganged and are permeability-tuned. A 47-ohm base resistor and a 100-ohm collector resistor act as parasitic suppressors to stabilize the amplifier. Slow a.g.c. is made possible by switching a 100- μ f. capacitor in parallel with the bias line to the a.g.c. control transistor. The r.f. gain control varies the bias on the a.g.c. control stage, thus changing the gain of the r.f. amplifier. At B, circuit details for the 9-MHz. b.f.o. A 35-pf. variable capacitor is adjustable from the front panel to permit a \pm 1-kHz. "rubbering" of the b.f.o. crystal in use. This provides passband tuning.

control which is adjustable from the front panel. Under normal conditions the blarker is disabled.

I.f. selectivity is provided by any one of four crystal-lattice filters which follow the h.f. mixer. These filters are selectable from the front panel of the R-530. Each filter is used independently except for the 0.5-kHz. unit. When it is switched into the circuit it is placed in series with the 2.1-kHz. filter, and a filter-amplifier stage is connected in the line also.¹ The amplifier is used to compensate for the insertion loss caused by

¹ Not shown as series-connected on the block diagram for reasons of simplification in the drawing.

the addition of the extra filter. By placing the two filters in series the spurious responses adjacent to the skirt of the response curve of the 0.5-kHz. filter are knocked down to an acceptable level. A three-stage 9-MHz. i.f. amplifier follows the filters, and one stage is a.g.c.-controlled, as mentioned earlier.

A two-diode product detector is used for c.w., RTTY, and s.s.b. reception. It receives its b.f.o. signal from a crystal-controlled 9-MHz. oscillator. The b.f.o., Fig. 1B, has crystals for upper- and lower-sideband reception, plus a variable capacitor which "pulls" either crystal over a

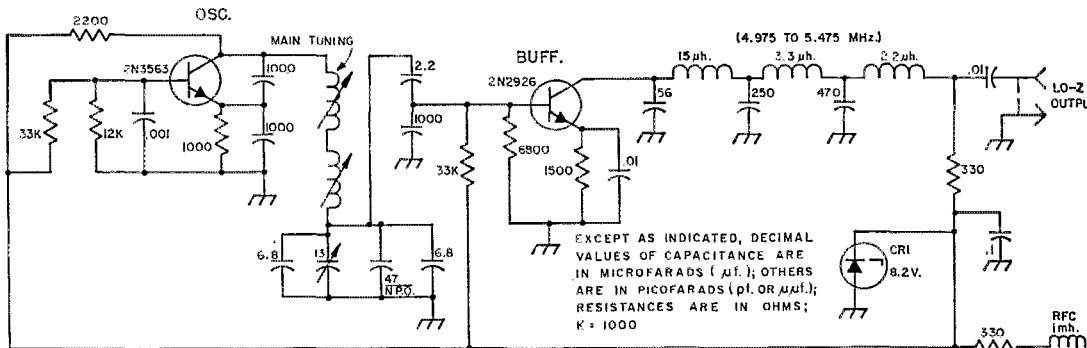


Fig. 2—The circuit shows how Galaxy reduces the spurious output from its p.t.o. The collector tank of the buffer stage consists of a double pi-section tuned circuit which is followed by an L-network. This low-pass filter attenuates harmonic currents by 35 db. or more, providing pure output at the desired frequency. R.m.s. output from this p.t.o. was measured at approximately 0.1 volt using a Heath v.t.v.m. and r.f. probe.

± 1-kHz. range to provide passband tuning. This capacitor is adjustable from the front panel of the receiver. During a.m. reception the b.f.o. is disabled, as is one of the detector diodes, to permit normal reception of that type of signal. Output from the detector is amplified by a four-stage RC coupled audio circuit which uses a complementary-symmetry pair in its output. The audio circuit has outputs for 8 ohms, unbalanced, and 600 ohms, balanced.

A db. meter is included in the circuit of the R-530 and is operated by a d.c. amplifier which is controlled by the a.g.c. voltage. The meter is calibrated from 0 to 80 db. in steps of 10 decibels for r.f. purposes. It can be switched to read audio and is calibrated for -6 to +4 dbm.

An a.c.-operated power supply is included in the receiver and delivers a regulated plus and minus 12 volts. For d.c. operation it is necessary to provide a positive and a negative 18-volt supply which can be attached to the receiver at the rear apron of the chassis. The R-530 can be operated from the 230-volt mains by changing the wiring in the power plug.

Physical Characteristics

In this writer's opinion, this receiver reflects a new and significantly improved appearance for the Galaxy line. Housed in all-metal cabinet, this ruggedly-built piece of equipment should be durable enough to withstand many years of normal use. Its removable side panels are made from 1/8-inch thick aluminum plate. The top and bottom covers are fashioned from heavy-gauge aluminum sheeting. The main cabinet parts are painted with black wrinkle finish, while the front panel is set off in gloss black with satin-aluminum and gold trim. The knobs are black and have aluminum inserts. All things considered, the equipment has a very professional appearance.

Some Other Features

Fast and slow a.g.c. response can be selected from the front of the receiver. Also adjustable from the front of the equipment is an r.f. attenuator control which is in series with the antenna at the input of the R-530. This provision gives the operator some 0 to 20 db. of control over the input signal *before* it reaches the front end, a most useful feature when dealing with extremely strong local signals.

Accessible from the rear of the receiver are some spare jacks, v.f.o. input and output jacks, a detector output jack, and terminals for receiver muting, a.g.c., and 12 volts d.c., both plus and minus.

Peaking of the front end is accomplished by the PRESELECTOR TUNING control. This is a high-Q, ganged, permeability-tuned system which has a dial presentation calibrated in MHz. A band switch selects the desired tuning range. A very pronounced increase in sensitivity is noted when the tuning control is properly adjusted.

The main tuning dial has a fast and a slow

Galaxy R-530 Receiver

Height: 6 inches.

Width: 17 inches.

Depth: 14 inches.

Weight: 25 pounds.

Power Requirements: 115 or 230 volts a.c., 50-60 Hz., 25 watts, or 18 volts d.c., 600 ma.

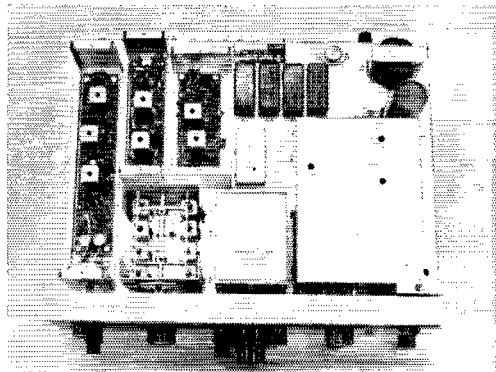
Price Class: \$700.00.

Manufacturer: Galaxy Electronics, Council Bluffs, Iowa.

tuning rate. The smaller knob is the vernier control. Both knobs are somewhat smaller in size than one would expect if complete ease of tuning were a major consideration. Both knobs turn quite stiffly, which may be somewhat of a deterrent when it is necessary to tune rapidly from one end of a 500-kHz. segment to the other. Also, the fiduciary, which is located above the fast-tuning knob, can easily be bumped out of calibration by the operator's fingers during rapid tuning excursions if the fast-tuning knob is not carefully engaged.

Observations

As might be expected of any communications receiver which employs the multiple-conversion technique, some spurious responses showed up in the tuning range. There are two "birdies" in each 500-kHz. tuning range, both occurring at the same dial settings in each range. Fortunately, they are low enough in amplitude so as



The covers have been removed from some of the modules to expose the circuit boards in this top-chassis view of the R-530. The 9-MHz i.f. strip can be seen along the left side of the chassis. Immediately to its right, near the front panel, are eight permeability-tuned transformers which are gang-tuned from the front panel for preselector peaking. To the right of the i.f. strip, at the rear of the chassis, is the premixer assembly. The h.f. mixer circuit board is to the immediate right of the premixer. Four crystal-lattice i.f. filters are visible at the rear-center of the chassis. The three modules with their covers still in place are the balanced mixer (center), p.t.o. (front center), and the phase-locked oscillator (lower right of photo).

to pass almost unnoticed in the presence of normal atmospheric noise when the antenna is connected.

On-the-air tests indicated that the manufacturer's performance claims were well justified. Good sensitivity, image rejection, and outstanding frequency stability were noted. Laboratory tests further substantiated the manufacturer's performance specifications.

This receiver should appeal to v.h.f. and u.h.f. operators because of its excellent frequency stability, low-noise characteristics, 500-kHz. tuning ranges, and good sensitivity. The availability of the 5-kHz. i.f. filter should appeal to those operators who are using a.m. Few modern-day receivers have provisions for good a.m. reception, while at the same time providing for c.w. and s.s.b. selectivity. During tests with a 2-meter converter (28-MHz. i.f.), all indications were that this was one of the best receivers for the application to be tried by this writer. The noise blanker, of course, is another major consideration if good v.h.f. reception is to be had.

The instruction book carries a complete set of specifications for the receiver, a troubleshooting/alignment section, and a complete parts list. The explanation of the circuit and how it operates is quite vague, the major discussion being centered around the phase-lock frequency synthesizer. Some difficulty was encountered in trying to identify the various transistors, as to their function, while tracing the circuit on the diagram furnished with the unit. This large blueprint could be made less difficult to decipher if more labels were added to it.

Whether used as a piece of laboratory test equipment, or as a full-fledged communications receiver, this unit should satisfy most requirements set by either type of user. — *WICER*

Strays

Feedback

Unfortunately, a letter disappeared somewhere along the line from the call of a "Silent Key" that ran in the March 1969 issue of *QST*. Edward B. Yorty's call should read K8JQP, not K8QP.

In the article, "The W50MX Communications Receiver," January 1968 *QST*, the second crystal frequency listed in the table for Y₁ in the 10-meter range, should be 32.5 MHz., instead of 33.5.

The labels on S₁ in Fig. 1 of the article "A 2-Meter Transmatch With S.W.R. Indicator," March 1969 *QST*, were inadvertently reversed. Change fwd. to rev. and vice versa.

If you're having trouble getting enough control range in the gated amplifier of the frequency counter described in October 1968 *QST*, Fig. 7 on page 15, lift the 1_{2B} 50K cathode resistor from ground and connect the lower end to pin 3 of V_{2A}. Also, a 6200-ohm 1-watt resistor between the negative terminal of C₂ and the lower end of the 4000-ohm control will "bandsread" the control action. These changes are from the author, VE3CUS.

Silent Keys

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

- ex-1CSM, Winthrop R. Martin, Littleton, Mass.
- W1GCF, John F. Howard, Peabody, Mass.
- K1MVA, Julian Rickett, Manchester, N. H.
- W1SEO, Dr. John F. Daly, Richmond, Vermont.
- K2CEM, Kurt Treptau, Palm Harbor, Florida.
- W2CSC, Thomas B. Millspaugh, Nyack, N. Y.
- W2DH, Haines Lippincott, Morristown, N. J.
- W2EEB, Donald M. Stephens, Rochester, N. Y.
- W2JHF, Stanley P. Bird, Scotch Plains, N. J.
- W2LHN, Harold Dann, Lakewood, N. J.
- W2NWM, Dr. Z. John Vaclavik, Binghamton, N. Y.
- ex-W2UC, 3IF, Earle Godfrey, Margate City, N. J.
- W2UY, Wilbur B. Sommer, Beachwood, N. J.
- W3EEY, D. C. Schattschneider, Bethlehem, Pa.
- W3GBE, J. Curtis Crawford, Rochester, Pa.
- W4HTD, Terence Biggs, Orlando, Florida.
- K4FH, Tom G. Seese, Sr., Savannah, Georgia.
- K4HKN, Rev. Wallace Lesley, Seneca, S. C.
- W4KWB, Oscar L. Miller, Seneca, S. C.
- K4LC, Glenn W. Curtiss, Holiday, Florida.
- W4LYN, Thomas Lookabill, Thomasville, N. C.
- W5AOX, Clarence W. Standridge, Lexington, Okla.
- WA5ISH, C. R. Sandlin, Harlingen, Texas.
- WA5NDW, Emick J. Lantier, Lafayette, La.
- K5QEE, James Smith, Enid, Oklahoma.
- W5WE, Henry W. Hall, Sr., Beeville, Texas.
- W6NAL, Roy E. Butler, San Diego, California.
- W6AZQ, Edward E. Hall, Oildale, California.
- W6DSN, William P. Corbett, Fullerton, Calif.
- W6IFE, Donovan L. Thompson, Corona, California.
- W6JSY, Elwin L. Johnson, Eureka, California.
- K6RAJ, Charles H. Zaverl, Arlington, California.
- WA6YFP, Carlos Swenson, Fresno, California.
- W7ANL, William Cooper, Shelton, Washington.
- W7FCJ, Francis E. Hall, Spokane, Washington.
- W7GBJ, William R. Hirt, Orinda, California.
- W7LUN, Wilbur O. Boswell, Tucson, Arizona.
- K7RYZ, John Givens, Seattle, Washington.
- K7YMB, Howard Pate, Bellingham, Washington.
- W8BV8, Ray Arnold, Sutton, West Virginia.
- W8CSN, Dr. Walter C. Breth, Chillicothe, Ohio.
- W8GXX, Paul Guenther, Canton, Ohio.
- K8JID, Oralace Lavender, Coldwater, Michigan.
- W8SIW, Herbert E. Strong, Brecksville, Ohio.
- W8TIN, Darrell W. Hagan, Clio, Michigan.
- K8UJX, Raymon Hamer, Ovid, Michigan.
- W8VDF, Valentine Breynak, Tiffin, Ohio.
- K8YQB, Grant K. Eaton, Coldwater, Michigan.
- K8YVZ, William Green, Canton, Ohio.
- W9AFG, John Sabol, Jr., Calumet City, Ill.
- W9CZN, Harry W. Stingley, Chicago, Ill.
- W9HOV, William Roberts, Dolton, Ill.
- W9REA, John Handel, Plainfield, Ill.
- W9SIE, John J. Mazurkiewicz, Kenosha, Wisc.
- K9ZLQ, Charles E. Mattern, Plymouth, Indiana.
- K9BEC, William Crawford, Cedar Rapids, Iowa.
- W9LYV, Mike T. Harney, Louisville, Colorado.
- G6CL, John Clarricoats, London, England.
- VE3FKH, Rev. C. C. Gilbert, Beamsville, Ontario, Canada.
- KP4BZ, Victor D. Cifuentes, Rio Piedras, San Juan, Puerto Rico.
- VE5CQ, Gerald H. Paul, Melfort, Saskatchewan, Canada.
- VE5FG, Donald L. Shelton, Moose Jaw, Saskatchewan, Canada.
- VE5HW, Raymond Lasco, Yorktown, Saskatchewan, Canada.
- VE5NJ, Joseph Foster, Kerrobert, Saskatchewan, Canada.
- 6Y5GG, Gregory LaGrenade, Kingston, Jamaica.
- VE7AD, J. G. Riley, West Vancouver, B. C., Canada.