INSTRUCTION BOOK

# GENERAL PURPOSE COMMUNICATIONS RECEIVER

## MODEL CR-88-B

RCA RADIOMARINE CORPORATION of AMERICA
A SERVICE OF RADIO CORPORATION OF AMERICA
75 VARICK STREET • NEW YORK 13, N. Y.

F-AIEO

1930


*Figure 1 - Front View of CR-88-B Receiver*

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# GENERAL PURPOSE COMMUNICATIONS RECEIVER

## MODEL CR-88-B

## TECHNICAL SUMMARY

### Electrical Characteristics

**Frequency Range - total 6 bands**........ 535 to 32,000 kc
- Band 1........ 535 to 1,610 kc
- Band 2........ 1,600 to 4,700 kc
- Band 3........ 4,500 to 12,000 kc
- Band 4........ 11,900 to 16,500 kc
- Band 5........ 16,000 to 22,900 kc
- Band 6........ 21,900 to 32,000 kc

**Maximum Undistorted Output** - approximately 6 watts.

**Output Impedance** - 3.2 ohms and 600 ohms.

### Power Supply Requirements

Line Rating........117.5 or 235 volts, ±10%, 50/60 cycles.
Power Consumption - 100 watts.

### Tube Complement

- R-F and I-F Amplifiers........ 4 RCA-6SG7
- 1st Detector (mixer)........ 1 RCA-6SA7
- Oscillator........ 1 RCA-6J5
- 2nd Detector........ 1 RCA-6H6
- Noise Limiter........ 1 RCA-6H6
- A-F Amplifier and Inverter........ 1 RCA-6SL7-GT
- Power Amplifier........ 2 RCA-6K6GT
- Beat Frequency Oscillator........ 1 RCA-6J5
- Rectifier........ 1 RCA-5U4G
- Voltage Regulator........ 1 RCA-OD3/VR-150
- Calibrator........ 1 RCA-6J5

### Mechanical Specifications

Overall Dimensions........19¼ inches wide x 11 inches high x 19¼ inches deep

## PERFORMANCE DATA - TABLE I

(Approximate Values - Taken on Sample Receiver, See Section V)

| Band No. | Megacycles | Antenna Input in Microvolts for 6DB Signal-Noise Ratio | Sensitivity in Microvolts for 4 volts across diode load | Image Ratio |
|---|---|---|---|---|
| 1 | 0.6 | 2 | 1 | Greater than 1,000,000 |
| | 1.0 | 3 | 7 | |
| | 1.5 | 3 | 7 | 1,000,000 |
| 2 | 1.8 | 0.5 | 1 | 50,000 |
| | 3.0 | 0.5 | 1 | |
| | 4.5 | 0.5 | 1 | 2,000 |
| 3 | 5.0 | 0.5 | 2 | 30,000 |
| | 8.0 | 0.5 | 2 | |
| | 11.5 | 0.5 | 3 | 500 |
| 4 | 12.5 | 0.5 | 3 | 1,500 |
| | 16.0 | 0.5 | 2 | 500 |
| 5 | 16.5 | 0.5 | 6 | 500 |
| | 22.5 | 0.5 | 7 | 150 |
| 6 | 23.0 | 0.5 | 7 | 60 |
| | 31.5 | 0.5 | 2 | 60 |

I-F rejection at 600 kc is greater than 80 db.

**AVC Action** - Less than 14 db change in audio output for 100 db change in R-F input.

# GENERAL PURPOSE COMMUNICATIONS RECEIVER

# I
# INTRODUCTION

In the design of a high frequency radio receiver, there are four important qualities for consideration:

1. Usable sensitivity.
2. Selectivity.
3. Frequency stability.
4. Reliability.

The sensitivity of the CR-88-B receiver is limited only by the tube noise originating in the first tube and its associated circuits. A large part of this noise is due to "shot" effect and thermal agitation in the first tuned circuit. A signal, to be readable, must produce a voltage on the grid, of the same or greater order of magnitude than this inherent noise voltage. Therefore, an efficient coupling system between the antenna and the first R-F tube of the receiver is of great importance. This has been the subject of considerable development, and the system used on this receiver gives optimum coupling with antenna or transmission line impedances of 300 ohms, over the entire frequency range of the receiver, except on the broadcast band. On the broadcast band, a low frequency primary is used, resonating well below the band with a 200 mmf antenna.

The second quality of a receiver, selectivity, is necessarily a compromise with fidelity of the reproduced signal. The CR-88-B receiver is designed to have three degrees of selectivity, two of which include a crystal filter.

To secure good frequency stability, rugged construction of parts and wiring in the high frequency heterodyne oscillator circuit has been included in the design. This, together with voltage stabilization of the oscillator plate supply, temperature compensation, and proper oscillator excitation, provides a high degree of stability.

Reliability depends to a large extent on the quality of material and workmanship. Throughout the CR-88-B receiver the best material obtainable is used for each particular purpose and all workmanship is of the best.

The following instructions should be studied before the installation or operation of the equipment described in this book is attempted, in order that optimum performance may be obtained.

# II
# EQUIPMENT

The equipment described in this book is intended for rack or table mounting and includes the cabinet, control panel, and tubes necessary for operation.

Additional equipment required includes headphones or loudspeakers, an antenna system, and an AC source of power. The loudspeaker is not supplied with the equipment, unless specially ordered. It may be obtained separately as RCA MI-8303-F. Headphones RCA MI-5803-6 are recommended.

# III
# DESCRIPTION

The CR-88-B receiver covers short wave, standard booadcast, and CW service; its principal use is for short wave communications. It is designed to withstand severe climatic and line voltage variations without appreciable impairment of performance.

Its features include:

- Mechanical Band Spread with Single Control for ease of tuning a previously logged station.
- Automatic Noise Limiter which automatically limits interference to a percentage of modulation determined by the Noise Limiter Control.
- Noise Limiter Control for setting Noise Limiter to operate at any desired percent modulation.
- Noise Limiter Switch for switching Noise Limiter on or off.
- Audio Frequency Tone Control for High or Low Tone.
- Antenna trimmer for circuit alignment.
- Optional single-channel crystal control for fixed frequency applications.
- Crystal Filter for ultra-sharp selectivity when required.
- Crystal Phasing Control on front panel.
- Tuning Meter for indicating relative strength of incoming signals.
- Exceptionally good oscillator stability through normal variations in line voltage.
- Eight tuned I-F Circuits giving a very high degree of selectivity.

Beat Frequency Oscillator adjustable for audio tone on CW reception.
Temperature compensated oscillator circuits on all bands.

Tuning Lock for service under extreme conditions of vibration.
500 kc Crystal Calibrator for checking accuracy of tuning dial.

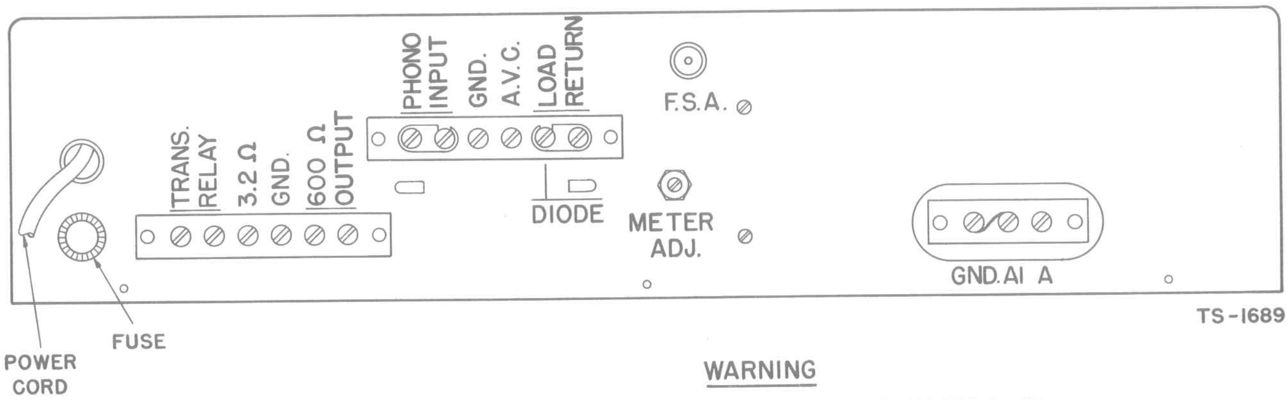
# IV
# CIRCUIT ARRANGEMENTS

The circuit is shown schematically in Figure 14. It consists of two stages of R-F amplification, first detector, first heterodyne oscillator, two stages of I-F amplification, second detector, noise limiter, second heterodyne oscillator, A-F amplifier stage, output power stage, 500 kc calibrator and power supply system.

**Input Coupling** - The antenna coupling system is designed to provide optimum coupling from a 300 ohm balanced transmission line or a 75 ohm unbalanced line, except in the broadcast band. The first tuned circuit is provided with a trimmer capacitor adjustable from the front panel. This insures the proper tuning of this circuit with various antenna systems.

For the standard broadcast band, conventional antenna and ground connections should be used.

The antenna terminal board is provided with three terminals (see Figures 2 and 6), two of which may be joined together with a link. When a single wire antenna is used, the link should be closed and the antenna connected to "A." If a ground is used, it should be connected to "GND." If a transmission line or balanced input is used, the link should be opened and the line connected to terminal "A" and the center terminal, "A 1".




WARNING

REMOVAL OF BUS WIRE BETWEEN TERMINALS ON ANTENNA TERMINAL BOARD WILL RESULT IN OSCILLATOR RADIATION IN EXCESS OF F.C.C. LIMITS FOR USE ON BOARD SHIP.

*Figure 2 - Diagram of Rear of Chassis*

**IMPORTANT** - Receivers are shipped from the factory with a permanent link connection on the rear of the antenna terminal board, between the center and ground terminals. If balanced input operation with open link is required, this connection on the rear of the antenna terminal board must be removed.

**R-F Amplifier** - The R-F Amplifier is designed to provide ample selectivity ahead of the first detector for minimizing cross modulation and blocking effects from strong interfering signals and for obtaining a high degree of image signal suppression. The amplification is adjusted to provide optimum signal-to-noise ratio by making noise contributions of circuits following the first tube negligible in comparison with the noise contributed by the first R-F grid circuit; that is, each tuned circuit in the receiver contributes some noise voltage, but by making the gain of the first tube as high as practicable, the noise contributed by succeeding circuits is unimportant.

**Band Spread** - The mechanical band spread with single control knob enables the operator to quickly tune a previously logged station. The log scale on the main dial and the separate vernier dial provide for exact logging and tuning.

**First Heterodyne Oscillator** - The first heterodyne oscillator is aligned to track with the R-F Amplifier at 455 kc higher than the signal frequency, thus producing a 455 kc intermediate frequency in the first detector plate circuit which is amplified further in the I-F stages. The oscillator voltage is regulated by the RCA VR-150 regulator rube to provide maximum frequency stability under conditions of variations in power supply voltage.

A socket and switch are provided so that a crystal may be inserted and the receiver operated as a crystal controlled fixed-frequency facility.

**Intermediate Frequency Crystal Filter** - The first detector plate circuit is tuned to the intermediate frequency and is coupled to the first I-F grid circuit through the balanced secondary circuit of the first I-F transformer. The selectivity switch in the SHARP position connects a 455 kc crystal in series with the first I-F grid. A phasing capacitor, connected in the other arm of the I-F transformer secondary circuit, balances out the capacity of the crystal. In the MEDIUM position, the selectivity switch cuts down the selectivity by inserting a crystal loading circuit. In the BROAD position, the selectivity switch shorts out the crystal giving the normal selectivity of the tuned I-F transformer circuit.

**Intermediate Frequency Amplifier** - Two stages of I-F amplification are used; RCA-6SG7 tubes are used in both stages and an RCA-6H6 tube is used for AVC and second detector. The first I-F Transformer has its primary and secondary tuned, and is coupled through the crystal filter circuit. The second I-F Transformer is composed of four tuned circuits. The third I-F Transformer has two tuned circuits.

The second I-F stage is not connected to the AVC nor to the manual volume control. Therefore, a good AVC characteristic with little overload distortion is obtained. This also permits the CW oscillator to be coupled to the grid circuit of this stage, giving a comparatively high detector excitation voltage with small electrical coupling between the oscillator circuit and the I-F stage.

**Second Heterodyne Oscillator** - The second heterodyne (CW) oscillator is a triode RCA-6J5 tube which is electrostatically coupled to the final I-F stage. A panel control is provided by means of which the frequency of the heterodyne oscillator and resultant audio beat note may be varied.

Particular care has been taken in the design of the circuit constants to minimize oscillator harmonics.

**Automatic Volume Control** - The AVC voltage is obtained from the second detector, an RCA-6H6 tube. A variable delay is obtained depending on the setting of the R-F gain control for phone reception.

**Manual Volume Control** - Two manual volume controls are provided; an audio gain control which is employed to obtain the desired output level, and an R-F gain control.

**Noise Limiter** - The noise limiter circuit utilizes an RCA-6H6 tube and limits the noise interference to 100% or lower modulation values.

A noise limiter switch, in conjunction with AVC, provides for use of the noise limiter on CW or on modulated reception when interference is present.

**Crystal Calibrator** - A 500 kc crystal oscillator using an RCA-6J5 tube is provided for use in calibrating the receiver tuning dial at 500 kc intervals. The 500 kc CAL. switch on the front panel energizes the oscillator to feed harmonic signals of 500 kc to the input of the receiver.

**Output Circuit** - The push-pull output stage using two RCA-6K6GT tubes is resistance coupled from the A-F amplifier, one half of an RCA-6SL7GT tube, and an inverter, the other half of the 6SL7GT. Output is fed to the output transformer which has windings for matching into a 3.2 or 600 ohm load. Terminals are provided on the rear apron for the 3.2 and 600 ohm impedances. The output from the 600 ohm winding is fed directly to the 600 ohm terminals, neither of which is grounded. This winding may be used to feed a balanced 600 ohm line. The output from the 3.2 ohm tap is fed to the 3.2 ohm terminals through a phone jack mounted on the panel. When the phone plug is pushed into the jack, the phones are connected to the 3.2 ohm winding and the 3.2 ohm output is cut off from the rear terminals. If no load is connected to the 3.2 or 600 ohm output terminals, the phones should always be used, as under this condition a load resistor is shunted across the 3.2 ohm winding to maintain impedance matching of the system. A TONE switch on the front panel allows a choice of HIGH or LOW tone.

**Power Supply** - The power supply, mounted on the receiver chassis, consists of a power transformer, rectifier tube RCA-5U4G, filter, and voltage regulator tube RCA-OD3/VR-150. The voltage regulator controls the voltage on the plate of the first heterodyne oscillator and on the screens of the R-F mixer and first I-F tubes. The power transformer has two primary windings, connected in series for 235 volt 50/60 cycle operation or in parallel for 117.5 volt operation.

**Shielding** - Necessary shielding is provided to insure stability under all operating conditions and to minimize oscillator radiation. Complete external shielding prevents coupling to any portion of the circuit except through the antenna circuit.

**Tuning Meter** - The tuning meter on the front panel, calibrated in db's above one microvolt, indicates the accuracy of tuning and the comparative strength of signals received.

**Terminals for external control** - Terminals are provided on the rear apron for connection of two or more receivers for diversity operation. Additional terminals are provided for connection of a phonograph pickup and a jack for connection of the I-F output to a Frequency Shift Adapter is included.

# V
# PERFORMANCE

The performance data under technical summary and the data for the various curves, are approximate values taken on a sample receiver. Variations in these values are to be expected because of practical manufacturing tolerances. The data were taken with an I.R.E. Standard artificial antenna for band 1 and 75 ohms resistance for bands 2 to 6 inclusive. The signal was modulated 30% at 400 cycles per second. The output was measured across a resistance of 600 ohms connected across the line winding of the output transformer. The selectivity switch was placed in the BROAD position.

# VI
# INSTALLATION

**Power Supply** - The power supply circuit is integral with the receiver. Determine line voltage and frequency and check with the rating of the receiver. The power transformer primary may be connected with the two windings in series for 235 volt 50/60 cycle operation or in parallel for 117.5 volt operation. See Figure 14 for actual connections.

**Tubes** - Inspect the chassis before applying power to see that all tubes are firmly seated in their respective sockets.

**Antenna** - The input impedance at the antenna terminals is designed to match a 300 ohm transmission line except on the broadcast band where a low frequency primary is used. For general use it is recommended that a straight wire antenna between 25 and 50 feet long be used.

**Speaker** - Terminals for connection of a loudspeaker are indicated in Figures 2 and 6. The output transformer is designed to match a speaker having 3.2 ohms impedance.

**Headphones** - A jack is provided on the right of the front panel for plugging in a pair of headphones.

**Crystals** - Two crystals are furnished with the receiver. Check that these are in place.

1. The I-F filter crystal (455 kc) is located beneath the chassis near the center-front. See Figure 9.
2. The calibrator crystal (500 kc) is located beneath the chassis at the front left corner as viewed from the bottom. See Figure 9.

For fixed-frequency operation, a third crystal (455 kc higher than the desired operating frequency) is used. To install, remove the small plate at the lower left of the front panel and insert the RCA Model RC-2b crystal, or equivalent, into the crystal socket behind the panel.

**Mounting** - The instrument may be placed on a table or mounted on a rack. For rack mounting, loosen the panel mounting screws and remove the panel and chassis complete from the cabinet. The panel is equipped with standard slots for rack mounting.

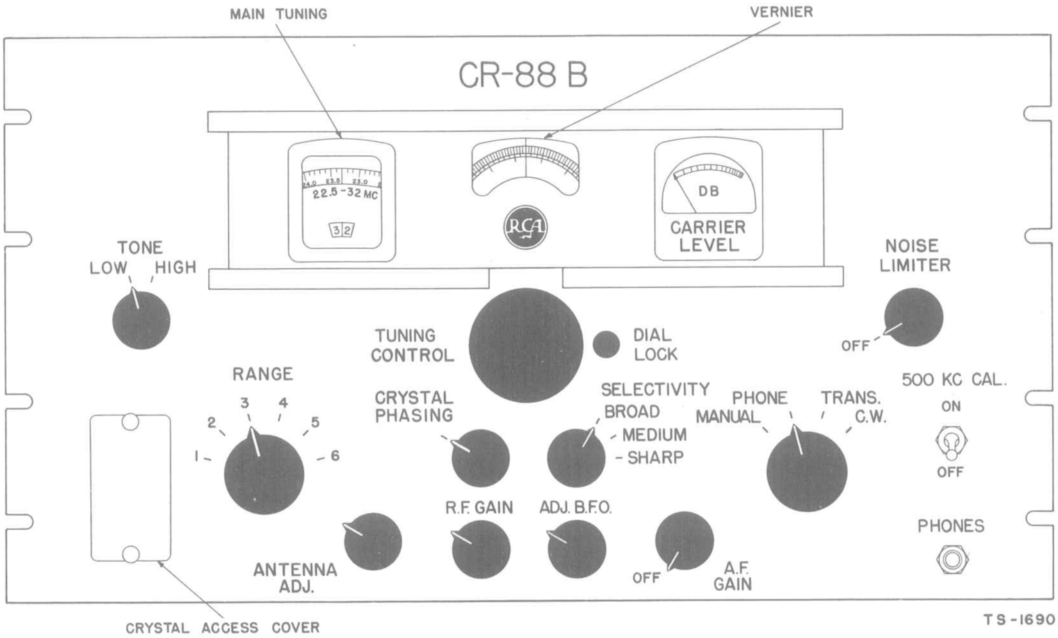



*Figure 3 - Diagram of Front Panel*

# VII
# OPERATION

Figure 3 illustrates the dials and control knobs.

## DIALS AND INDICATORS

**The Main Tuning Dial** is on the left and consists of a disc with seven scales, one for each of the six bands and a log scale. The Standard Broadcast Band is calibrated in kilocycles and the other five bands in megacycles.

**The Vernier Tuning Dial** is in the center and has a scale with arbitrary calibrations for exact tuning and log records of particular communication stations. It is used in conjunction with the log scale on the main tuning dial to give additional figures for logging.

**The Tuning Meter** is on the right and is calibrated in db's above one microvolt. It is used to indicate accuracy of tuning and also gives an indication of the strength of the signal being received.

## CONTROLS

**Mode of Operation Switch** - This is a four-position switch. Starting from fully counterclockwise these positions are:

1. MANUAL - AVC out - Manual gain only - for Modulated Reception with weak signals.
2. PHONE - AVC on - For Modulated Reception with strong signals.
3. TRANSMIT position which energizes tube filaments, cuts off audio amplifier, and shorts terminals for transmitter relay on the speaker terminal board on the back of the chassis. Connect relay to these two terminals for transmitter operation. See Figure 2.
4. CW - BFO on, partial AVC on - Manual gain - for CW reception.

**RANGE Switch** - This switch selects the desired one of the six frequency bands within the receiver coverage.

**ANTENNA ADJustment** - This control is used to match the input of the receiver to the signal.

**SELECTIVITY Switch** - This is a three-position switch and the band widths and control of selectivity are illustrated in the curves of Figure 11. The three positions are:

1. BROAD - I-F band width for High Fidelity, modulated reception.
2. MEDIUM - Crystal Filter in - for CW telegraph or sharp modulated signal reception.
3. SHARP - Crystal Filter in - for sharper CW telegraph reception.

**CRYSTAL PHASING Control** - This control may be set to reject adjacent interfering signals under relatively unfavorable conditions.

**R. F. GAIN Control** - This continuously variable sensitivity control is for use in conjunction with the audio gain (Volume) control for all manual gain operation. With AVC on, it should as a rule be set to its fully clockwise position or may be turned to eliminate interference.

**A. F. GAIN Control** - This control is used to set the audio output to the desired value. It is provided with a switch for OFF-ON control of the receiver.

**NOISE LIMITER Control** - This control sets the instrument for operation at the required percentage value of Noise Limitation. Normally, the fully clockwise position will be used, but under extreme conditions of interference a balance point should be found for maximum intelligibility of signal with best modulation and least noise.

**ADJ. BFO (Beat Frequency Oscillator Adjustment)** - This control is used for CW code signals. It should be adjusted to give the desired audio pitch after the signal has been accurately tuned.

**500 K.C. CALibrator Switch** - This switch, in the ON position, energizes the calibration oscillator which feeds 500 K.C. and harmonic signals into the receiver for dial calibration purposes.

**TONE Switch** - This is a switch for reducing H-F audio response. In the HIGH position, the full tone is obtained and in the LOW position the H-F audio response in cut down. Set it to suit the particular tonal conditions for the signal being received.

**PHONES Jack** - Allows either low or high impedance phones to be used instead of a speaker.

# TUNING

For functions of controls see the foregoing paragraphs.

1. Turn receiver on and set the Mode of Operation Switch for the required type of operation.
2. Set Range Switch for band required.
3. Set Antenna Adj. Control for maximum background noise.
4. Set Selectivity Switch for the required operating conditions - See Selectivity Curves - Figure 11.
5. Adjust Crystal Phasing Control for CW operation when required.
6. Set Noise Limiter Control for the required operating conditions.
7. Set R-F Gain Control fully clockwise.
8. Set A-F Gain Control about halfway.
9. Tune in the station.
10. Reset A-F Gain Control to give desired volume.
11. Reset Selectivity and Sensitivity (R-F Gain) Controls and Noise Limiter Control in accordance with requirements due to interference, station transmission, and other conditions.
12. Set Tone Switch for preferred tone.
13. On CW operation set Mode of Operation Switch to "CW" (position 4) and set BFO Control to give desired pitch.
14. If the receiver is subject to vibration, the tuning may be locked by turning clockwise the knurled screw alongside the tuning knob. Turning the screw moderately tight will lock the tuning.

**Fixed Frequency Operation** - To operate the receiver as a crystal-controlled fixed-frequency facility, remove the small cover plate at the lower left of the front panel, Figure 3, insert a crystal as explained under Installation, turn the screw-driver operated switch adjacent to the crystal to the left and replace the cover plate. Tune the receiver to the operating frequency as above. It will be noted that tuning appears broader and that signals on other than the operating frequency are not heard.

**Phonograph Operation** - Move the link across the first two terminals (marked PHONO INPUT) on terminal board TB-1 (Figure 2) to the second and third (GND) terminals. Connect the high side of the phono pick-up to the first terminal and the low side to the second terminal on TB-1.

**Diversity Reception** - Connect together the terminals marked "Diode Return" and the terminals marked "AVC", Figure 2, on two or three of these receivers. Remove the links between terminals marked "Diode Load" and "Diode Return" on all but one of the receivers so as to use the A-F amplifier of only one receiver. Receivers require separate spaced or polarized antennas. The R-F gain controls on all receivers should be adjusted to the same level.

**Frequency Shift Operations**- For operation with frequency shift keyed signals connect the receptacle marked "FSA" on the rear apron to the input of a Frequency Shift Adapter.

# VIII
# MAINTENANCE

The CR-88-B receiver should maintain its correct factory adjustments over a reasonably long period of time. Causes of trouble and the probable sequence of their development are outlined in the following paragraphs:

1. **Vacuum Tubes.**- A noticeable decrease in the sensitivity of the receiver usually indicates worn out vacuum tubes. If the sensitivity is low, remove and check the tubes in a reliable tube tester or substitute new tubes one at a time. See Technical Summary, and Schematic Diagram Figure 14. Tube socket voltages are given in Table 2 following this section.
2. **Range Switch** - A switch may operate defectively on certain positions after long periods of inoperation. Usually rotating the switch back and forth several times will clean the contacts and operation will become normal.

   A bad range-switch contact is likely to cause a change in the sensitivity of the receiver, or the frequency of a received signal, as the switch is moved back and forth slightly in a certain frequency hand position. A further check is to turn the switch off and on at one particular frequency band several times and note the apparent sensitivity of the receiver each time the switch comes into position. The sensitivity should be the same each time and may be adequately judged for this test by listening to the receiver background noise.
3. **Automatic Volume Control and Tuning Meter.** - The AVC voltage is obtained from the second detector. It controls the first and second R-F and first I-F tubes. The tuning meter is connected in the cathode circuit of the 1st I-F tube and thus records changes in cathode current caused by changes of AVC voltage applied to the grid. The tuning meter

should normally give a low scale reading when no signal is being received. To adjust this meter, tune the receiver to a point free of signals; turn the R-F Gain Control to maximum; rotate the Mode of Operation switch to PHONE position and the Selectivity switch to position 2. Then turn the antenna trimmer off resonance and adjust the potentiometer (R-14 at the back of the receiver) to the position at which the meter pointer just coincides with the mark at the low end of the scale. The meter pointer will usually deflect upward when the antenna trimmer is tuned to resonance.

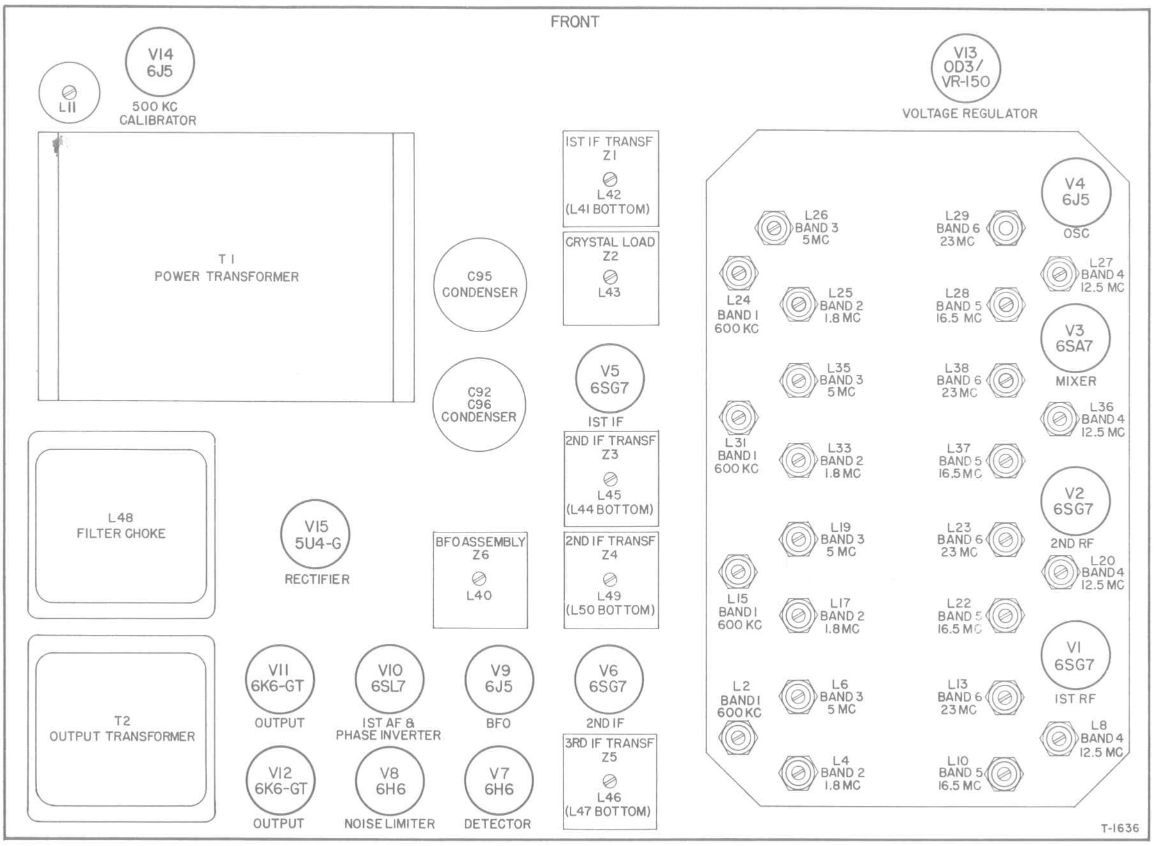



*Figure 4 - Diagram of Top of Chassis*

**I-F Alignment** - The intermediate frequency is 455 K.C. The most satisfactory method of I-F alignment is by means of a vacuum tube voltmeter. Follow the sequence as given below.

Dummy Antenna................................Insert in series with generator output, 0.01 mfd.
Connection of Generator Output Lead....................................See chart below
Connection of Generator Ground Lead........................................To chassis
Position of Mode of Operation Switch..............................Position 1 (MANUAL)
Position of R-F Gain Control...........................................Fully clockwise
Position of Selectivity Switch....................................Position 1 (BROAD)
Position of Noise Limiter Control..................................................Off
Disable Oscillator by removing tube V-4.

## LOCATION OF PARTS AND ALIGNMENT ADJUSTMENTS ON CHASSIS

| Steps | Generator Connections | Coil Adjustments (See Fig. 4) | Function |
|---|---|---|---|
| 1 | 6SG7 - 2nd I-F Grid | L-46, L-47 | 3rd I-F Transformer |
| 2 | 6SG7 - 1st I-F Grid | L-44, L-50, L-45, L-49 | 2nd I-F Transformer |
| 3 | 6SA7 - 1st Det. Grid(pin 8) | L-41, L-42 | 1st I-F Transformer |
| 4 | 6SA7 - 1st Det. Grid | L-43 | Crystal Loading Coil |

**Suggested Methods of Taking Individual Stage Measurements** - Since only the 3rd I-F Transformer works into a diode and, therefore, only the 3rd transformer has a rectified D.C. output, individual I-F readings on the other transformers cannot be taken without a diode rectifier. A way to take individual curves on each transformer is with a manually operated signal generator and a vacuum tube voltmeter. The signal generator is connected to the grid of the tube which is ahead of the transformer. If this is done, however, the transformers will be mis-aligned when the tube voltmeter is removed, by an amount representing the capacity of the tube voltmeter. One way to avoid this is to connect the tube voltmeter across a resistor which is connected in the plate circuit of the following tube in place of the usual I-F transformer, as shown in the following simplified schematic diagram Figure 5.

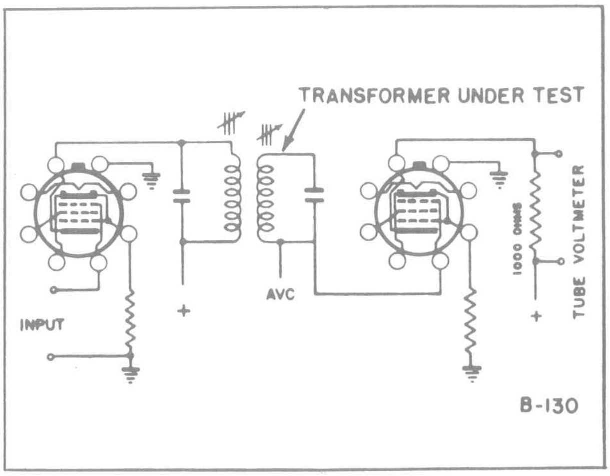



*Figure 5*

*Diagram for Tube Voltmeter Connections*

With the method suggested, the transformer under test may be completely aligned and tested, and the connections then shifted to another stage. For aligning the 3rd transformer, the tube voltmeter could be loosely coupled to the diode with a capacity of approximately one micromicrofarad. An alternate method for aligning the 3rd transformer is to connect a high impedance d. c. voltmeter, similar to the RCA Voltohmyst, from R-19 to ground.

The second and third transformers are not affected by the selectivity switch except that the crystal filter is switched in for positions 2 and 3. The step by step procedure for aligning the I-F transformers is given in the following paragraphs.

When aligning these transformers with the vacuum tube voltmeter method, it will be found that the first and second are easily aligned since they are sharply peaked. The third, however, is more difficult, since it is double peaked. When aligning the third as an individual transformer, the best method is to proceed as follows:

With the signal generator output at 455 KC (crystal frequency) and the selectivity switch in position 2 MEDIUM, feed signal to pin 8 of V-3 and align all adjustments for maximum output on the tube voltmeter. (This gives an approximate alignment only.)

### STEP 1.

Change the Selectivity switch to position 1, BROAD. Feed signal at 455 K.C. from the signal generator to the grid, pin 4, of V-6. Place a 10,000 ohm resistor across terminals A and C of I-F transformer Z-5. Connect a Voltohmyst from terminal A to ground. Peak coil L-46 in I-F transformer Z-5 using the iron-core adjustment.

Remove the 10,000 ohm resistor and connect it across terminals D and F at coil L-46 in I-F transformer Z-5. Peak coil L-47.

### STEP 2.

Feed 455 K.C. signal to the grid, pin 4, of tube V-5. Peak coils L-44 and L-45 of I-F transformer Z-3 and then coils L-49 and L-50 of I-F transformer Z-4. If it is desired to tune these I-F transformers individually, disconnect the primary (L-46) of I-F transformer Z-5 and substitute a 1000 ohm resistor (connected from plate to +300 volts). Place R-F voltmeter probe on plate, pin 8, of tube V-6 and peak the transformer coils of Z-4 and Z-3 in succession.

### STEP 3.

Place Crystal Phasing capacitor C-14 in mid position. Feed the 455 K.C. signal to the grid, pin 8, of tube V-3. Peak coil L-41 and then coil L-42 of I-F transformer Z-1. If it is desired to peak this transformer individually, substitute the 1000 ohm resistor for the primary of I-F transformer Z-3 and place the VTVM probe on the plate, pin 8, of tube V-5. Then peak the transformer coils Z-1.

### STEP 4.

Place Selectivity switch in position 2, MEDIUM. Adjust coil L-43 (crystal loading) for maximum output.

**500 K.C. Calibrator Alignment** - With the receiver set for CW reception tune in a signal from WWV or some other standard frequency which is a multiple of 500 K.C. Place 500 K.C. CAL switch ON and Mode of Operation switch in position 1, MANUAL. Tune capacitor C-60, located beneath the chassis near the rear corner opposite the R-F unit, Figure 9, to zero beat with the standard frequency.

**R-F Alignment** - A signal generator covering a range from 535 K.C. to 32 megacycles, and an output voltmeter, are required. It is desirable to connect a speaker across the output terminals. The output voltmeter should then be connected across the speaker voice coil. The output impedance is 3.2 ohms. Remove the cover from over the R-F unit by loosening the four knurled screws and lifting off.

Output Meter Connections............................................Across speaker voice coil
Dummy Antenna............................................See following chart
Generator Modulation............................................30% at 400 cycles
Position of Tone Control Switch............................................HIGH
Position of Antenna Trimmer............................................See following chart
Position of Mode of Operation Switch............................................Position 1 (MANUAL)
Position of Range Switch............................................See following chart
Position of R-F Gain Control............................................Fully clockwise
Position of Audio Gain Control............................................Fully clockwise
Position of Noise Limiter Control............................................Off
Position of Selectivity Switch............................................Position 1 (BROAD)

## LOCATION OF PARTS AND ALIGNMENT ADJUSTMENTS ON CHASSIS

| Oper. ation No. | Range Switch Position | Set Dial and Generator Frequency to | Dummy Antenna | Position of Antenna Trimmer | Trimmer and Core Adjustments for Max. Peak Output See Figs. 4 and 9. | Trimmer and Core Function |
|---|---|---|---|---|---|---|
| 1 | 1 | 600 K.C. | 200 mmf | - | L 24 | Low end osc. |
| 2 | 1 | 1,500 K.C. | 200 mmf | - | C 61 | High end osc. |
| 3 | Repeat 1 and 2 until frequencies are as indicated. | | | | | |
| 4 | 1 | 1,500 K.C. | 200 mmf | Max. output | C 37, C 47 | 1st & 2nd R-F |
| 5 | 1 | 600 K.C. | 200 mmf | Untouched | L2, L15, L31 | Ant. & 1st and 2nd R-F |
| 6 | Repeat 4 and 5 until circuits remain in alignment over the band. | | | | | |
| 7 | 2 | 1,800 K.C. | 75 ohms | - | L 25 | Low end osc. |
| 8 | 2 | 4,800 K.C. | 75 ohms | - | C 62 | High end osc. |
| 9 | Repeat 7 and 8 until frequencies are as indicated. | | | | | |
| 10 | 2 | 4,800 K.C. | 75 ohms | Max. output | C 38, C 48 | 1st & 2nd R-F |
| 11 | 2 | 1,800 K.C. | 75 ohms | Untouched | L4, L17, L33 | Ant. & 1st and 2nd R-F |
| 12 | Repeat 10 and 11 until circuits remain in alignment over the band. | | | | | |
| 13 | 3 | 5,000 K.C. | 75 ohms | - | L 26 | Low end osc. |
| 14 | 3 | 11,500 K.C. | 75 ohms | - | C 63 | High end osc. |
| 15 | Repeat 13 and 14 until frequencies are as indicated. | | | | | |
| 16 | 3 | 11,500 K.C. | 75 ohms | Max. output | C 39, C 49 | 1st & 2nd R-F |
| 17 | 3 | 5,000 K.C. | 75 ohms | Untouched | L 6, L19, L35 | Ant. & 1st and 2nd R-F |
| 18 | Repeat 16 and 17 until circuits remain in alignment over the band. | | | | | |
| 19 | 4 | 12,500 K.C. | 75 ohms | - | L 27 | Low end osc. |
| 20 | 4 | 16,000 K.C. | 75 ohms | - | C 64 | High end osc. |
| 21 | Repeat 19 and 20 until frequencies are as indicated. | | | | | |
| 22 | 4 | 16,000 K.C. | 75 ohms | Max. output | C40, C50 | 1st & 2nd R-F |
| 23 | 4 | 12,500 K.C. | 75 ohms | Untouched | L8, L20, L36 | Ant. & 1st and 2nd R-F |
| 24 | Repeat 22 and 23 until circuits remain in alignment over the band. | | | | | |
| 25 | 5 | 16,500 K.C. | 75 ohms | - | L 28 | Low end osc. |
| 26 | 5 | 22,500 K.C. | 75 ohms | - | C 65 | High end osc. |
| 27 | Repeat 25 and 26 until frequencies are as indicated. | | | | | |
| 28 | 5 | 22,500 K.C. | 75 ohms | Max. output | C41, C51 | 1st & 2nd R-F |
| 29 | 5 | 16,500 K.C. | 75 ohms | Untouched | L10, L22, L37 | Ant. & 1st and 2nd R-F |

| Oper. ation No. | Range Switch Position | Set Dial and Generator Frequency to | Dummy Antenna | Position of Antenna Trimmer | Trimmer and Core Adjustments for Max. Peak Output See Figs. 4 and 9. | Trimmer and Core Function |
|---|---|---|---|---|---|---|
| 30 | Repeat 28 and 29 until circuits remain in alignment over the band. | | | | | |
| 31 | 6 | 23,000 K.C. | 75 ohms | - | L 29 | Low end osc. |
| 32 | 6 | 31,500 K.C. | 75 ohms | - | C 66 | High end osc. |
| 33 | Repeat 31 and 32 until frequencies are as indicated. | | | | | |
| 34 | 6 | 31,500 K.C. | 75 ohms | Max. output | C42, C52 | 1st & 2nd R-F |
| 35 | 6 | 23,000 K.C. | 75 ohms | Untouched | L13, L23, L38 | Ant. & 1st and 2nd R-F |
| 36 | Repeat 34 and 35 until circuits remain in alignment over the band. | | | | | |

On all bands the oscillator tracks above the signal frequency.
If more than one peak is obtainable on oscillator, use the higher frequency peak.

**Adjustment of Beat Frequency Oscillator** - Tune in a signal either R-F or I-F to exact resonance with Mode of Operation Switch at MANUAL. (Fig. 3). Turn on beat frequency oscillator by turning switch to "CW". If zero beat does not fall within the range of the BFO control, adjust BFO Coil L-40 core (see Fig. 4) until zero beat occurs at the mid-point setting of the BFO control.

# IX
# MECHANICAL CONSTRUCTION

The receiver has been designed to be very rugged so that it will stand up under severe conditions of use, and have all parts available for replacement. All component parts such as transformers, chokes, filter and by-pass capacitors, etc., are mounted with screws and nuts rather than with rivets. All wiring other than that involving high frequency circuits is made up in the form of a laced cable so that no loose leads are left floating which might cause damage or change capacity to various portions of the circuit. The tuning capacitor is mounted so as to be rigid with respect to the tuning unit, and yet is flexible with respect to the chassis. This prevents distortion of the chassis from having any appreciable effect on the stability of the oscillator.

The R-F unit which consists of the tuning capacitor, tuning unit, range switch, tubes, and all of the R-F and oscillator coils and trimmers, is mouneed on a separate base which bolts to the main base. The various coils on this base may be easily replaced by means of a single nut which screws on the individual mounting bushings. Trimmers are mounted on strips and can be removed individually. However, if a major repair is to be made such as replacement of the range switch, it is necessary first to remove the complete R-F unit from the receiver. To do this the following procedure should be observed:

1. Remove all connections from the rear of the receiver.
2. Remove the chassis from the cabinet by removing the four panel mounting screws and sliding the chassis forward out of the cabinet.
3. Remove the top dust cover from the R-F section and the dust-cover supporting spacers.
4. Loosen the coupling between the four-gang capacitor and the tuning unit.
5. Loosen the set-screws on the coupling between the range switch and the drive gear shaft.
6. Slide the coupling forward on the shaft until it clears the range switch shaft.
7. Remove the crystal from its socket.
8. Remove the lower dust cover from the R-F section.
9. Remove the Antenna Adjustment capacitor extension shaft by loosening it at the coupling in the R-F unit.
10. Remove the crystal switch shaft extension by loosening set screws.
11. Disconnect the six wire leads and the two coaxial leads which connect the R-F unit to the main chassis. These leads are as follows:
    (a) The two wires (red and brown) connected to the terminal strip adjacent to tube socket X-13 on the main chassis in front of the R-F unit.
    (b) The three wires at tube socket X-13 as follows; the red-black wire to pin 7, the red wire to pin 6 and the green-black wire to pin 4.
    (c) The coaxial cable lead at terminal F of I-F transformer Z-1 located

alongside the R-F unit near the front of the main chassis.

(d) The coaxial cable at the rear of the R-F unit from the terminal strip which is connected to the coupling capacitor C-72.

(e) Remove the brown lead from pin #2 of socket X-7.

13. The R-F unit may now be removed from the bottom by first sliding it back and then lifting it out from the bottom very carefully. After the unit has been repaired it may be reassembled by following the above procedure in reverse order.

# TUBE SOCKET VOLTAGES – TABLE 2

| Tube | Type | Function | Voltages - Pin Numbers | | | | | | | | R-F Gain Control Position |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| V1 | 6SG7 | 1st R-F Amp. | 0 | 0 | 0 | -20.0 | 0 | 140 | 6.0 AC | 290 | Minimum |
| | | | 0 | 0 | 0 | - 1.4 | 0 | 90 | 6.0 AC | 270 | Maximum |
| V2 | 6SG7 | 2nd R-F Amp. | 0 | 0 | 0 | -19.0 | 0 | 140 | 6.0 AC | 290 | Minimum |
| | | | 0 | 0 | 0 | - 1.25 | 0 | 90 | 6.0 AC | 270 | Maximum |
| V3 | 6SA7 | Mixer | 0 | 6.0 AC | 270 | 175 | -2.65 | 2.9 | 0 | 0 | Minimum |
| | | | 0 | 6.0 AC | 260 | 175 | -2.5 | 2.9 | 0 | 0 | Maximum |
| V4 | 6J5 | R-F Oscillator | 0 | 0 | 95 | 0 | -9.2 | 0 | 6.0 AC | 0 | Min. or Max. |
| V5 | 6SG7 | 1st I-F Ampt | 0 | 6.0 AC | 0 | -22 | 0 | 150 | 0 | 290 | Minimum |
| | | | 0 | 6.0 AC | 1.1 | - 1.5 | 1.1 | 150 | 0 | 260 | Maximum |
| V6 | 6SG7 | 2nd I-F Amp. | 0 | 6.0 AC | 2.0 | 0 | 2.0 | 130 | 0 | 270 | Minimum |
| | | | 0 | 6.0 AC | 1.9 | 0 | 1.9 | 120 | 0 | 260 | Maximum |
| V7 | 6H6 | Detector & AVC | 0 | 6.0 AC | -23.5 | 0 | -1.2 | 0 | 0 | 0 | Minimum |
| | | | 0 | 6.0 AC | - 1.3 | 0.20 | -1.4 | 0 | 0 | 0 | Maximum |
| V8 | 6H6 | Noise Limiter | 0 | 6.0 AC | - .5 | 0 | - .8 | -2.9 | 0 | 0 | Minimum |
| | | | 0 | 6.0 AC | - .5 | - .40* | - .40* | - .40* | 0 | - .40* | Maximum |
| | | | | | | 0 | -1.0 | -2.4 | | 0 | |
| V9⊕ | 6J5 | B-F Oscillator | 0 | 0 | 32 | 0 | -1.65 | 150 | 6.0 AC | 0 | Min. or Max. |
| V10 | 6SL7 | 1st A-F Amp. & Inverter | 0 | 110 | 1.35 | 20 | 220 | 45 | 6.0 AC | 0 | Min. or Max. |
| V11,V12 | 6K6 | Power Output | 0 | 0 | 320 | 285 | -21.5 | 0 | 6.0 AC | 0 | Minimum |
| V13 | OD3/VR150 | Voltage Regulator | 0 | 0 | 150 | -19 | 150 | 150 | 150 | 0 | Min. or Max. |
| V14□ | 6J5 | 500 kc Calibrator | 0 | 0 | 86 | 0 | -12 | 0 | 6.0 AC | 0 | Min. or Max. |
| V15 | 5U4G | Rectifier | 0 | **4.9 | 0 | -23 | 0 | -23 | 0 | **4.9 | ------- |
| | | | | 330 volts DC - Output | | | | | | | |

All voltages read to chassis with Voltohmyst Jr.
Band 2 condenser closed - Manual Position
** AC voltage between pins 2 and 8

*Noise Limiter at Maximum
⊕Switch on C-W
□Switch On

# X
# PARTS LIST

| Symbol | Function | Description | Type |
|---|---|---|---|
| | | **INDICATORS** | |
| A-1 | Meter Light | Lamp, 6-8 v, .25 amp, G3-1/2 bulb, clear, miniature bayonet | Westinghouse #51 (K-61114-11) |
| A-2 | Dial Light | Lamp, 6-8 v, .25 amp, T3-1/4 bulb, clear, miniature bayonet. | Mazda #44 (K-61114-15) |
| A-3 | Dial Light | Same as A-2 | |
| | | **CAPACITORS** | |
| C-1 | Ant. Adj. | Air, variable, 3 to 25 mmf. | (M-253132-16) |
| C-2 | V-1 Screen Bypass | Paper, 5000 mmf, +40 -20%, 40v. | Tobe DPC-005 (P-727896-127) |
| C-3 | Bypass V-1 Plate | Same as C-2 | |
| C-4 | Coupling to V-2 | Mica, 220 mmf, ±10%, 500 v. | CM25D221K (P-727863-131) |
| C-5 | AVC Bypass | Paper, 0.01 mmf, +40 -20%, 400 v. | Tobe DPC-01 (P-727896-131) |
| C-6 | V-2 Screen Bypass | Same as C-2 | |
| C-7 | Bypass V-2 Plate | Same as C-2 | |
| C-8 | Coupling to V-3 | Ceramic, 7 mmf, ±10%, 500 v. | Centralab DA-318-015 (K-90581-363) |
| C-9 | V-3 Cathode Bypass | Same as C-5 | |
| C-10 | V-3 Grid Bypass | Same as C-5 | |
| C-11 | Z-1 Tuning | Mica, 620 mmf, ±5%, 300 v, char. B, part of Z-1. | |
| C-12 | V-3 Plate Bypass | Same as C-5 | |
| C-13 | Z-1 Tuning | Same as C-11, part of Z-1 | |
| C-14 | Crystal Phasing | Air, variable, 3-14 mmf, ±10% | Hammarlund 4093 (M-442716-3) |
| C-15 | Z-2 Tuning | Mica, 150 mmf, ±5%, char. B, part of Z-2 | |
| C-16 | Coupling to V-5 | Mica, 680 mmf, ±5%, 300 v. | CM25B681J (P-727856-243) |
| C-17 | V-5 Cathode Bypass | Paper, 0.1 mf, +40% -20%, 400 v. | Tobe EPC-10 (P-727895-138) |
| C-18 | V-5 Screen Bypass | Same as C-5 | |
| C-19 | Z-3 Tuning | Same as C-11, part of Z-3 | |
| C-20 | V-5 Plate Bypass | Same as C-5 | |
| C-21 | I.F. Coupling | Paper, 0.1 mf, ±10%, 400 v. | Tobe EPC-10 (P-727895-168) |
| C-22 | Z-4 Tuning | Same as C-11, part of Z-4 | |
| C-23 | V-6 Screen Bypass | Same as C-5 | |
| C-24 | V-6 Cathode Bypass | Paper, 0.1 mf, +40 -20%, 400 v. | Tobe EPC-10 (P-727895-138) |
| C-25 | Z-5 Tuning | Same as C-11, part of Z-5 | |
| C-26 | Z-5 Tuning | Same as C-11, part of Z-5 | |
| C-27 | BFO Coupling | Mica, 22 mmf, ±5%, 500 v. | CM25B220J (P-727861-207) |
| C-28 | V-6 Plate Bypass | Same as C-5 | |
| C-29 | AVC Filter | Same as C-24 | |
| C-30 | L-8 Tuning | Mica, 33 mmf, ±10%, 500 v. | El Menco CM15B330K (P-727851-111) |
| C-31 | L-10 Tuning | Same as C-30 | |
| C-32 | L-13 Tuning | Same as C-30 | |
| C-33 | Main Tuning | Air, variable, ganged, four sections | RCC 821048 (P-925201-1) |
| | Ant. Section | C-33 0-315 mmf<br>C-34 0-70 mmf | |
| | 1st R.F. Section | C-43 0-315 mmf | |

| Symbol | Function | Description | Type |
|---|---|---|---|
| | 2nd R.F. Section | C-44 0-70 mmf<br>C-53 0-315 mmf<br>C-54 0-70 mmf | |
| | Osc. Section | C-79 0-315 mmf<br>C-80 0-70 mmf | |
| C-34 | Antenna Tuning | See C-33 | |
| C-35 | Padder 1st R.F. | Mica, 10 mmf, ±10%, 500 v. | CM 25B100K<br>(P-727861-102) |
| C-36 | Padder 1st R.F. | Mica, 220 mmf, ±5%, 500 v. | CM 25D221J<br>(P-727863-231) |
| C-37 | L-15 Tuning | Mica, variable, 2-20 mmf | Electromotive<br>(M-446622-2D) |
| C-38 | L-17 Tuning | Same as C-37 | |
| C-39 | L-19 Tuning | Same as C-37 | |
| C-40 | L-20 Tuning | Ceramic, variable, 7-45 mmf | Erie N-500<br>(M-446622-1) |
| C-41 | L-22 Tuning | Same as C-40 | |
| C-42 | L-23 Tuning | Same as C-40 | |
| C-43 | 1st R.F. Tuning | See C-33 | |
| C-44 | 1st R.F. Tuning | See C-33 | |
| C-45 | Padder 2nd R.F. | Same as C-35 | |
| C-46 | Padder 2nd R.F. | Same as C-4 | |
| C-47 | L-31 Tuning | Same as C-37 | |
| C-48 | L-33 Tuning | Same as C-37 | |
| C-49 | L-35 Tuning | Same as C-37 | |
| C-50 | L-36 Tuning | Same as C-40 | |
| C-51 | L-37 Tuning | Same as C-40 | |
| C-52 | L-38 Tuning | Same as C-40 | |
| C-53 | 2nd R.F. Tuning | See C-33 | |
| C-54 | 2nd R.F. Tuning | See C-33 | |
| C-55 | BFO Adjustment | Air, variable, 6-75 mmf | (M-253132-14) |
| C-56 | Coupling to V-9 | Mica, 56 mmf, ±5%, 500 v., char. B, part of Z-6 | |
| C-57 | L-40 Tuning | Mica, 3300 mmf, ±5%, 500 v., char. D, part of Z-6 | |
| C-58 | V-9 Plate Bypass | Same as C-5 | |
| C-59 | V-8 Plate Bypass | Same as C-24 | |
| C-60 | Y-1 Crystal Adjustment | Ceramic, variable, 4.5-25 mmf. | Centralab<br>DA822-103 |
| C-61 | L-24 Tuning | Ceramic, variable, 3-13 mmf | Erie N-300<br>TS2A |
| C-62 | L-25 Tuning | Ceramic, variable, 5-50 mmf | Erie N-650<br>TS2A |
| C-63 | L-26 Tuning | Ceramic, variable, 1.57 mmf, NPO | Erie<br>(M-446622-2-A) |
| C-64 | L-27 Tuning | Ceramic, variable, 3-12 mmf | Erie NPO<br>TS2A |
| C-65 | L-28 Tuning | Same as C-64 | |
| C-66 | L-29 Tuning | Same as C-64 | |
| C-67 | Osc. Cathode Coupling | Mica, 470 mmf, ±2%, 500 v. | CM 25D471G<br>(P-727863-339) |
| C-68 | 500 Kc Tank Tuning | Mica, 82 mmf, ±5%, 500 v. | CM 25D820J<br>(P-727858-221 |
| C-69 | Osc. Cathode Coupling | Mica, 560 mmf, ±2%, 500 v. | CM 25D561G<br>(P-727863-341) |
| C-70 | 500 Kc Output Voltage Divider | Mica, 1000 mmf, ±5%, 300 v. | CM 25B102J<br>(P-727856-247) |
| C-71 | Osc. Cathode Coupling | Mica, 2700 mmf, ±2%, 500 v. | CM 30D272G<br>(P-727868-357) |
| C-72 | 500 Kc Coupling to V-1 | Ceramic, 2 mmf, ±0.5 mmf, 500 v, -750 ppm/°C, non-insulated | Elec Reac<br>(K-90581-355) |
| C-73 | Osc. Cathode Coupling | Mica, 4700 mmf, ±2%, 500 v. | CM 35D472G<br>(P-727868-363) |

# PARTS LIST (Continued)

| Symbol | Function | Description | Type |
|---|---|---|---|
| C-74 | Osc. Cathode Coupling | Ceramic, 680 mmf, ±2%, 500 v. -750 ppm, /°C, non-insulated | Elec. Reac CC45UJ681G (P-722441-422) |
| C-75 | Osc. Cathode Coupling | Mica, 5600 mmf, ±5%, 500 v- | CM35B562J |
| C-76 | Osc. Trimmer, Band 3 | Ceramic, fixed, 3±0.5 mmf., N-4700 coeff. | Elec. Reac CN-1 |
| C-77 | Osc. Cathode Coupling | Mica, 8200 mmf, ±5%, 300 v. | CM 35B822J (P-727866-269) |
| C-78 | Osc. Plate Blocking | Same as C-36 | |
| C-79 | Osc. Tuning | See C-33 | |
| C-80 | Osc. Tuning | See C-33 | |
| C-81 | Decoupling V-4 Plate | Same as C-2 | |
| C-82 | Osc. Trimmer, Band 4 | Ceramic, 27 mmf, ±5%, 500 V, P-100 | Elec. Reac CN-7 |
| C-83 | Line Filter | Same as C-24 | |
| C-84 | Tone Adjustment | Same as C-73 | |
| C-85 | Z-4 Tuning | Same as C-11, part of Z-4 | |
| C-86 | Z-3 Tuning | Same as C-11, part of Z-3 | |
| C-87 | Coupling to 1st Audio | Same as C-5 | |
| C-88 | V-7 R.F. Bypass | Mica, 180 mmf, ±5%, 500 v. | CM25B181J (P-727861-229) |
| C-89 | V-10 Output Coupling | Same as C-24 | |
| C-90 | 1st B.F. Coupling | Same as C-36 | |
| C-91 | Audio Coupling | Same as C-24 | |
| C-92 | Decoupling Filter V-10 Plate | Electrolytic 10 mf, part of C-96, plug-in. | |
| C-93 | Audio Output Loading | Paper, 4000 mmf, ±10%, 1000 v. | Micamold (P-727895-276) |
| C-94 | Audio Output Loading | Same as C-93 | |
| C-95 | Filter B+ | Electrolytic, 40 mf, - 10 ±50%, 450 v, plug-in | Aerovox AEP (M-449618-2) |
| C-96 | Filter B+ | Electrolytic, 40 & 10 mf, 450 v, C-96 40 mf, C-92 10 mf, plug-in, -10 +50% | Aerovox AEP (M-449618-4) |
| C-97 | Filter, Bias Section | Electrolytic, 50 mf, 100 v. | Aerovox LS-EP (K-895054-8) |
| C-98 | Osc. Trimmer, Band 5 | Ceramic, 10 mmf, ±0.5 mmf NPO | Erie Style A or Elec. Reac CN-1 |
| C-99 | R.F. Grounding, Z-1 Tap | Paper, 0.01 mf, 20%, 400 v. | Micamold (P-727895-131) |
| C-100 | Osc. Trimmer, Band 6 | Ceramic, 12 mmf, ±5%, 500 v. NPO, non-insulated | CC20CH120J |
| C-101 | Audio Coupling | Same as C-24 | |
| C-102 | L-18 to L-19 Coupling | Same as C-72 | |
| C-103 | L-34 to L-35 Coupling | Same as C-72 | |
| C-104 | Osc. Trimmer, Band 6 | Ceramic, 5 mmf, ±0.5 mmf., P-100 coeff. | Erie Style A or Elec Reac CN-1 |
| C-105 | Osc. Trimmer, Band 5 | Ceramic fixed, 10 ±0.5 mmf., P-100 coeff. | Erie Style A or Elec Reac CN-1 |
| | | **FUSE** | |
| F-1 | Protection, AC Input | Cartridge 3AG type, non-renewable, 1.6 amp, 125 v. | Bussman Fusetron Symbol MDL |
| | | **JACKS** | |
| J-1 | Phone Output | Phone type, SPDT, make before break on normally open contact | Switchcraft #35-1024-SF (K-8871545-3) |
| J-2 | FSA Output | Single contact, threaded plug holder | (M-253979-2) |

## PARTS LIST (Continued)

| Symbol | Function | Description | Type |
|---|---|---|---|
| | | **COILS AND REACTORS** | |
| L-1, L-2 | Ant. Coupling Band 1 | Transformer, c/o two RF coils, single iron core tuned | TS-1610-6 |
| L-3, L-4 | Ant. Coupling Band 2 | Transformer, c/o two RF coils, single iron core tuned | TS-1610-1 |
| L-5, L-6 | Ant. Coupling Band 3 | Transformer, c/o two RF coils, single iron core tuned | TS-1610-2 |
| L-7, L-8 | Ant. Coupling Band 4 | Transformer, c/o two RF coils, single iron core tuned | TS-1610-3 |
| L-9, L-10 | Ant. Coupling Band 5 | Transformer, c/o two RF coils, single iron core tuned | TS-1610-4 |
| L-11 | 500 Kc Calibrator Tank | RF coil, part of Z-7, iron core tuned | |
| L-12, L-13 | Ant. Coupling Band 6 | Antenna transformer, c/o two RF coils, single iron core tuned | TS-1610-5 |
| L-14, L-15 | Band 1 Coupling to 2nd RF | First RF Interstage transformer, c/o two RF coils, single iron core tuned | TS-1609-1 |
| L-16, L-17 | Band 2 Coupling to 2nd RF | First RF Interstage transformer, c/o two RF coils, single iron core tuned | TS-1609-2 |
| L-18, L-19 | Band 3 Coupling to 2nd RF | First RF Interstage transformer, c/o two RF coils, single iron core tuned | TS-1609-3 |
| L-20 | Band 4 Coupling to 2nd RF | First RF Interstage coil, iron core tuned | RS-237-1 |
| L-21 | | Reserved | |
| L-22 | Band 5 Coupling to 2nd RF | First RF interstage coil, iron core tuned | RS-237-2 |
| L-23 | Band 6 Coupling to 2nd RF | First RF interstage coil, iron core tuned | RS-237-3 |
| L-24 | Band 1 HF Osc. Tank | RF coil, single tap, iron core tuned | TS-1609-4 |
| L-25 | Band 2 HF Osc. Tank | RF coil, single tap, iron core tuned | TS-1609-5 |
| L-26 | Band 3 HF Osc. Tank | RF coil, single tap, iron core tuned | TS-1609-6 |
| L-27 | Band 4 HF Osc. Tank | RF coil, single tap, iron core tuned | RS-237-4 |
| L-28 | Band 5 HF Osc. Tank | RF coil, single tap, iron core tuned | RS-237-5 |
| L-29 | Band 6 HF Osc. Tank | RF coil, single tap, iron core tuned | RS-237-6 |
| L-30, L-31 | Band 1 Coupling to Mixer | Second RF interstage transformer, same as L-14, L-15 | |
| L-32, L-33 | Band 2 Coupling to Mixer | Second RF interstage transformer, same as L-16,L-17 | |
| L-34, L-35 | Band 3 Coupling to Mixer | Second RF interstage transformer, same as L-18, L-19 | |
| L-36 | Band 4 Coupling to Mixer | Second RF interstage coil, same as L-20 | |
| L-37 | Band 5 Coupling to Mixer | Second RF interstage coil, same as L-22 | |
| L-38 | Band 6 Coupling to Mixer | Second RF interstage coil, same as L-23 | |
| L-39 | Output for FSA | IF coil, part of Z-5 | |
| L-40 | BFO Tank | RF coil, single tap, iron core tuned, part of Z-6 | |
| L-41, L-42 | 1st IF Interstage | IF transformer, c/o two coils, each iron core tuned, part of Z-1, L-42 is tapped | |

## PARTS LIST (Continued)

| Symbol | Function | Description | Type |
|---|---|---|---|
| | | **COILS AND REACTORS** | |
| L-43 | Crystal Load Tank | IF coil, part of Z-2, iron core tuned | |
| L-44, L-45 | 2nd IF Interstage | IF transformer, c/o two coils, each iron core tuned, part of Z-3 | |
| L-46, L-47 | 3rd IF Interstage | Diode IF transformer, c/o two coils, each iron core tuned, part of Z-5 | |
| L-48 | Filter | Reactor, 400 ohms, 13 henries | (K-901433-1) |
| L-49, L-50 | 2nd IF Interstage | IF transformer, c/o two coils, each iron core tuned, part of Z-4 | |
| L-51 | 500 Kc Output Load | 2.5 mh, 4 pies, stud mounted in ceramic cone | National R-100U |
| | | **METER** | |
| M-1 | Carrier Level | Calibrated from .6 to 100 db above 1 microvolt | (#42242) |
| | | **RESISTORS** | |
| R-1 | V-1 Grid | Comp, 2.2 megohms, ±20%, ½w. | RC20BF225M (P-727834-33) |
| R-2 | V-1 Screen Voltage Divider | Comp, 56,000 ohms, ±10%, 2w. | RC40BF563K (P-727838-83) |
| R-3 | Decoupling at V-1 | Comp, 2200 ohms, ±20%, ½w. | RC20BF222M (P-727834-15) |
| R-4 | V-2 Grid | Same as R-1 | |
| R-5 | V-2 Screen Voltage Divider | Same as R-2 | |
| R-6 | Decoupling at V-2 | Same as R-3 | |
| R-7 | V-3 1st Grid | Comp, 27,000 ohms, ±10%, ½ w. | RC20BF273K (P-727834-79) |
| R-8 | V-3 Cathode Bias | Comp, 150 ohms, ±10%, ½w. | RC20BF151K (P-727834-52) |
| R-9 | V-3 Screen Voltage Dropping | Comp, 18,000 ohms, ±10%, 1 w. | RC30BF183K (P-727836-77) |
| R-10 | Decoupling at Z-1 | Same as R-3 | |
| R-11 | V-5 Grid | Comp, 1 megohm, ±20%, ½ w. | RC20BF105M (P-727834-31) |
| R-12 | Transmit Receiver Bias | Comp, 10,000 ohms, ±10%, ½ w. | RC20BF103K |
| R-13 | Decoupling at Z-3 | Same as R-3 | |
| R-14 | DB Meter Adjustment | Variable, 100 ohms, ±10%, 2 w, slotted shaft for screw driver adjustment | RA20A2SA101AK (P-722397-51) |
| R-15 | V-6 Cathode Bias | Comp, 180 ohms, ±5%, ½ w. | RC20BF181J (P-727834-141) |
| R-16 | V-6 Screen Voltage Dropping | Comp, 56,000 ohms, ±10%, ½ w. | RC20BF563K (P-727834-83) |
| R-17 | Decoupling at Z-4 | Same as R-3 | |
| R-18 | AVC Filter | Same as R-1 | |
| R-19 | Noise Limiter | Potentiometer, 100,000 ohms, ±20%, ½ w, variable, mtd with S-10 | CTS Type VF (P-737814-1) |
| R-20 | Noise Limiter Plate | Comp, 180,000 ohms, ±10%,½ w. | RC20BF184K (P-727834-89) |
| R-21 | Diode Load divider | Comp, 47,000 ohms, ±10%, ½ w. | RC20BF473K (P-727834-82) |
| R-22 | | Reserved | |
| R-23 | RF Gain | Potentiometer, 100,000 ohms, 10%, 1 w. | CTS Type 35 (K-183206-13) |

## PARTS LIST (Continued)

| Symbol | Function | Description | Type |
|---|---|---|---|
| R-24 | Bias Voltage Divider | Comp, 5600 ohms, ±10%, ½ w. | RC20BF562K (P-727834-71) |
| R-25 | L-16 Loading | Same as R-24 | |
| R-26 | L-14 Loading | Comp, 1000 ohms, ±10%, ½ w. | RC20BF102K (P-727834-62) |
| R-27 | L-32 Loading | Same as R-24 | |
| R-28 | L-30 Loading | Same as R-26 | |
| R-29 | V-9 Grid | Same as R-34, Part of Z-6 | |
| R-30 | V-9 Plate | Comp, 100,000 ohms, ±20%,½ w. | RC20BF104M |
| R-31 | V-8 Plate | Comp, 560,000 ohms, ±10%,½ w. | RC20BF564K (P-727834-95) |
| R-32 | AVC | Comp, 680,000 ohms, ±20%,½ w. | RC20BF684M (P-727834-30) |
| R-33 | V-10A Cathode Bias | Comp, 560 ohms, ±10%, ½w. | RC20BF561K (P-727834-59) |
| R-34 | Bias Voltage Divider | Comp, 120,000 ohms, ±10%,½ w. | RC20BF124K (P-727834-87) |
| R-35 | Output Loading | Wire wound, 3 ohms, ±10%, 10 w. | Clarostat (K-844908-42) |
| R-36 | Audio Gain | Potentiometer, 1 meg, -20% ½ w, used with S-11 | CTS (P-737801-10) |
| R-37 | V-10A Grid | Same as R-31 | |
| R-38 | V-14 Plate | Comp, 22,000 ohms, ±5%, ½ w. | RC20BF223J (P-727834-191) |
| R-39 | V-14 Grid | Comp, 100,000 ohms, ±5%, ½ w. | RC20BF104J (P-727834-207) |
| R-40 | 500 Kc Output Loading | Comp, 560,000 ohms, 5%, ½ w. | RC20BF564J |
| R-41 | V-10b Cathode | Comp, 39,000 ohms, ±5%, ½w. | RC20BF393J (P-727834-197) |
| R-42 | V-10b Cathode | Comp, 1000 ohms, ±5%, ½w. | RC20BF102J (P-727834-159) |
| R-43 | V-10b Grid | Same as R-11 | |
| R-44 | Audio Decoupling | Comp, 4700 ohms, ±10%, 1 w. | RC30BF472K (P-727836-70) |
| R-45 | V-10a Plate | Same as R-31 | |
| R-46 | V-10b Plate | Same as R-41 | |
| R-47 | V-12 Grid | Comp, 100,000 ohms, ±10%, ½ w. | RC20BF104K (P-727834-86) |
| R-48 | V-11 Grid | Same as R-47 | |
| R-49 | V-4 Grid | Same as R-16 | |
| R-50 | Decoupling at V-4 | Same as R-26 | |
| R-51 | V-4 Plate | Comp, 10,000 ohms, ±10%, 1 w. | RC30BF103K (P-727836-74) |
| R-52 | Bias Voltage Divider | Wire wound, 50 ohms, ±10%,10w. | (K-844908-4) |
| R-53 | Bias Voltage Divider | Wire wound, 100 ohms, ±10%, 10 w. | (K-844908-30) |
| R-54 | V-13 Current Limiting | Wire wound, 3500 ohms, ±10%, 10 w. | (K-844908-22) |
| R-55 | V-1 Screen Voltage Divider | Same as R-16 | |
| R-56 | V-2 Screen Voltage Divider | Same as R-16 | |
| R-57 | AVC | Same as R-47 | |
| R-58 | Meter Voltage Divider | Comp, 100 ohms, ±5%, ½ w. | RC20BF101J (P-727834-135) |
| | | SWITCHES | |
| S-1 to S-8 | Range Selection | Rotary, 8 section, 6 position plated brass spacers, shafts spring grounded | Centralab #CRL-28CHX1 (P-736400-1) W2C11434 |
| S-1 Front | Osc. Coil Shorting | | |
| S-1 Rear | Osc. Coil Selector | | |

## PARTS LIST (Continued)

| Symbol | Function | Description | Type |
|---|---|---|---|
| S-2 Front | Osc. Coil Shorting | | |
| S-2 Rear | Osc. Coil Selector | | |
| S-3 Front | 2nd RF Shorting | | |
| S-3 Rear | 2nd RF Secondaries | | |
| S-4 Front | 2nd RF Shorting | | |
| S-4 Rear | 2nd RF Primaries | | |
| S-5 Front | 1st RF Shorting | | |
| S-5 Rear | 1st RF Secondaries | | |
| S-6 Front | 1st RF Shorting | | |
| S-6 Rear | 1st RF Primaries | | |
| S-7 Front | Ant. Shorting | | |
| S-7 Rear | Ant. Secondaries | | |
| S-8 Front | Ant. Pri. or Grid | | |
| S-8 Rear | Ant. Primaries | | |
| S-9 | 500 Kc Off-On | DPST, bat handle, 3 amp, 250 v, single hole mt. | Koehler #81024-BR (M-418677-10) |
| S-10 | Noise Limiter Off-On | Switch on R-18, SPST, 3 amp, 125 v. | |
| S-11 | On-Off | Switch on AF Control R-36, SPST, rotary, 3 amp, 125 v. | |
| S-12 | VF Osc. FF Osc. Selector | Rotary, single section, two position, slotted shaft | Oak (M-442389-8) |
| S-13 to S-14 | Mode of Operation Selector | Rotary, 4 position, 2 section | Oak (M-449044-1) |
| S-13 | AVC Control | | |
| S-14 Front | BFO | | |
| S-14 Rear | Transmit | | |
| S-15 | Tone Selector | SPST, single section, rotary 2 position | Oak (M-442389-9) |
| S-16 | Selectivity | Rotary, 3 position, single section | Grisby-Allison (M-449043-1) |
| | | **PLUGS** | |
| P-1 | Power Input | 2 prong male, part of line cord | Gavitt #18/2 SJ (K-811638-1) |
| | | **TERMINAL BOARDS** | |
| TB-1 | Input Connections | Six screw terminals and six solder lugs | Cinch 14399 (M-253669-7) |
| TB-2 | Output Connections | Six screw terminals and six solder lugs | Cinch 14501 (M-253669-8) |
| TB-3 | Ant-Grid Connections | Three screw terminals and three solder lugs | Cinch S-1506 (M-254373-10) |
| | | **TRANSFORMERS** | |
| T-1 | Plate and Filament Power | Power, electrostatically shielded<br>Pri: 117.5/235 v, 43 to 60 cyc.<br>Sec.#1: 5 v, 3.5 amp<br>Sec.#2: 660 v AC ct, .25 amp DC<br>Sec.#3: 6.3 v, 8 amp | (M-449007-1) |
| T-2 | Audio Output | Audio, matches push-pull 6K6-GT's to 600 and 3.2 ohm secondaries | (M-449008-1) |

## PARTS LIST (Continued)

| Symbol | Function | Description | Type |
|---|---|---|---|
| | | **TUBES** | |
| V-1 | 1st RF | H.F. Amplifier Pentode | RCA 6SG7 |
| V-2 | 2nd RF | Same as V-1 | |
| V-3 | RF Mixer | Pentagrid Converter | RCA 6SA7 |
| V-4 | Oscillator | Amplifier Triode | RCA 6J5 |
| V-5 | 1st IF | Same as V-1 | |
| V-6 | 2nd IF | Same as V-1 | |
| V-7 | Detector | Twin Diode | RCA 6H6 |
| V-8 | Noise Limiter | Same as V-7 | |
| V-9 | BFO | Same as V-4 | |
| V-10 | | Twin-triode Amplifier | RCA 6SL7-GT |
| V-10a | 1st AF | | |
| V-10b | Phase Inverter | | |
| V-11 | Audio Output | Power Amplifier Pentode | RCA 6K6-GT |
| V-12 | Audio Output | Same as V-11 | |
| V-13 | Voltage Regulation | Gas Voltage Regulator | RCA OD3/VR150 |
| V-14 | 500 Kc Calibrator | Same as V-4 | |
| V-15 | Rectifier | Full wave high vacuum rectifier | RCA 5U4-G |
| | | **CRYSTALS** | |
| Y-1 | Calibration | Quartz, 500 Kc, solder lugs | Bliley VX-4 |
| Y-2 | Local Oscillator | Not supplied | RCA RC-2b |
| Y-3 | Selectivity | Quartz, 455 Kc, solder lugs | Bliley VX-4 |
| | | **IMPEDANCES** | |
| Z-1 | IF Coupling | Aluminum can containing C-11 L-41, L-42 and C-13 | RS-235-1 |
| Z-2 | Crystal Load | Aluminum can containing L-43 and C-15 | RS-235-5 |
| Z-3 | IF Coupling | Aluminum can containing C-19, C-86, L-44 and L-45 | RS-235-2 |
| Z-4 | IF Coupling | Same as Z-3 containing L-49, L-50, C-85 and C-22 | |
| Z-5 | Diode Input | Aluminum can containing C-25, C-26, L-39, L-46 and L-47 | RS-235-3 |
| Z-6 | BFO Housing | BFO assembly, aluminum can containing C-57, C-56, L-40 and R-29 | RS-235-4 |
| Z-7 | 500 Kc Calibrator Tank | Aluminum can containing L-11 | RS-235-6 |

Note: Numbers in parentheses under Type refer to RCA Victor drawings and part numbers.

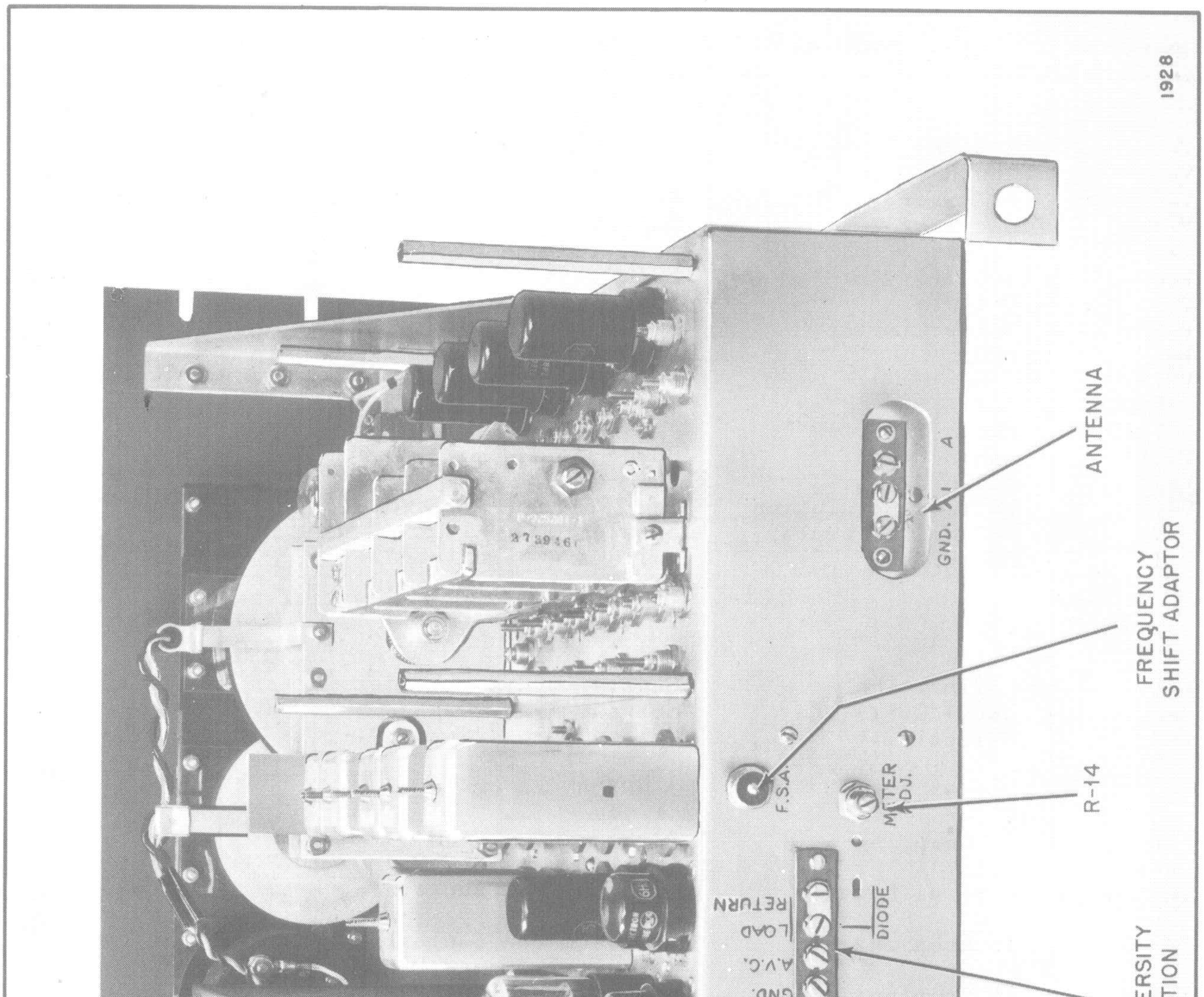



*Figure 6 - CR-88-B Chassis (Covers Removed)*

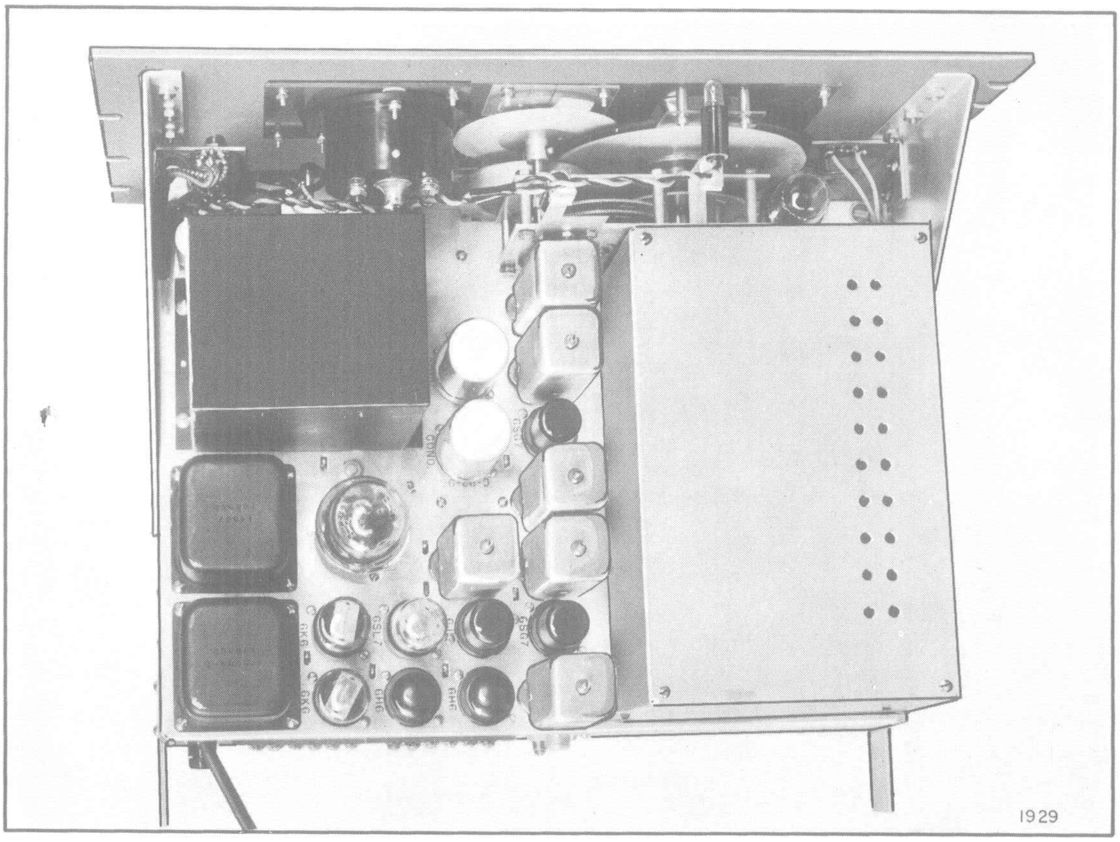



*Figure 7 - Top View of Chassis*

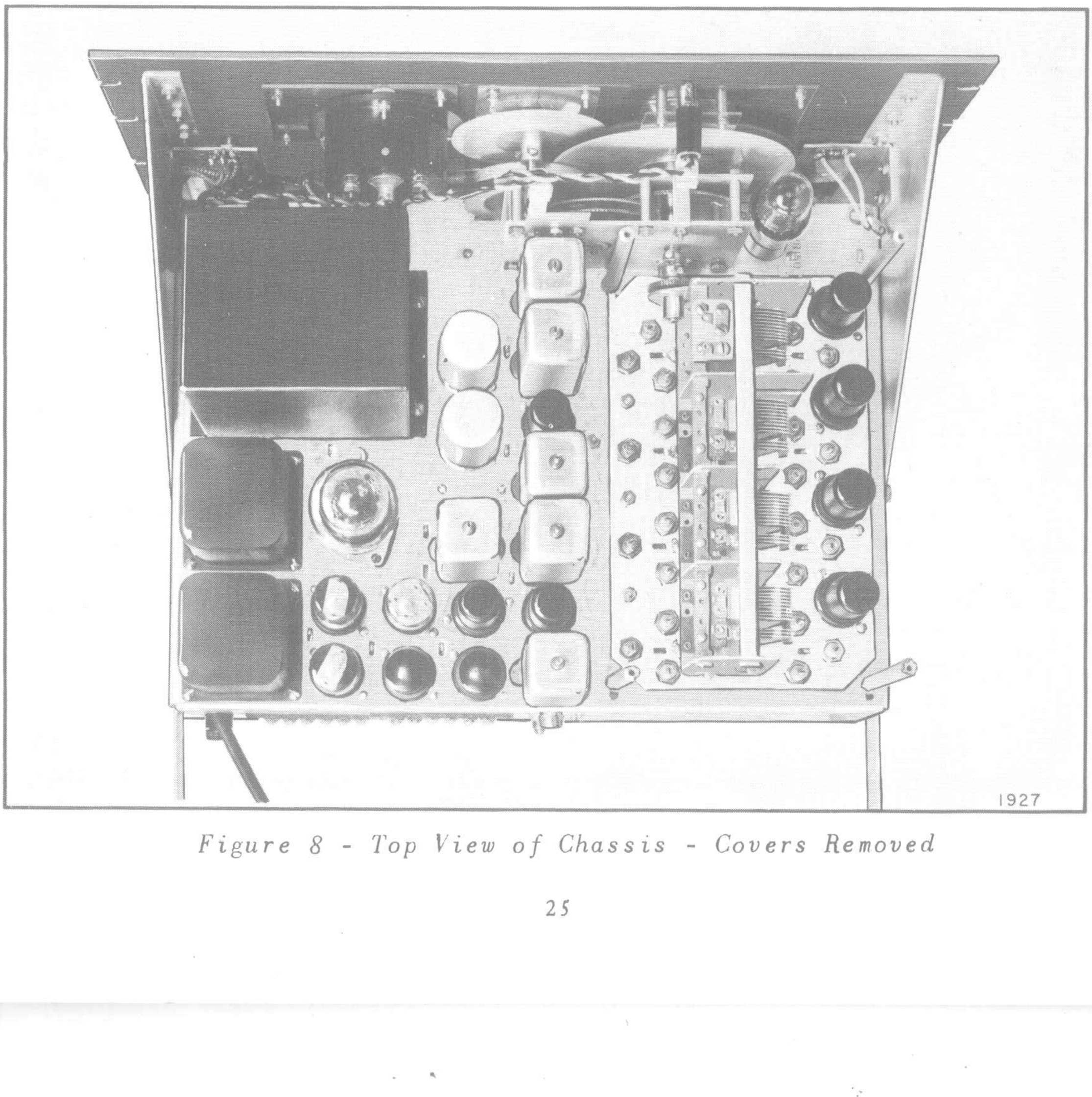



*Figure 8 - Top View of Chassis - Covers Removed*

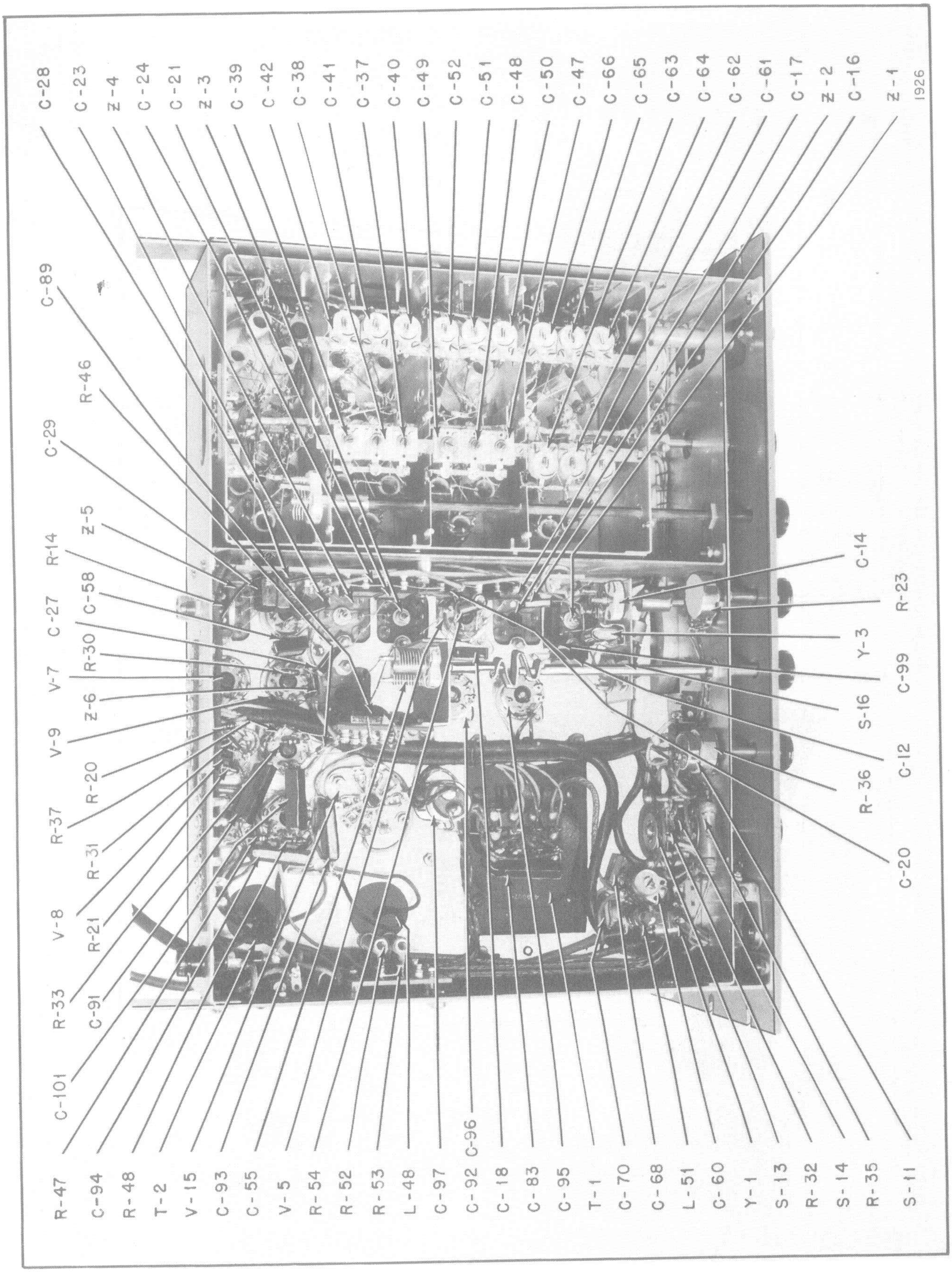



*Figure 9 - Bottom View of Chassis*

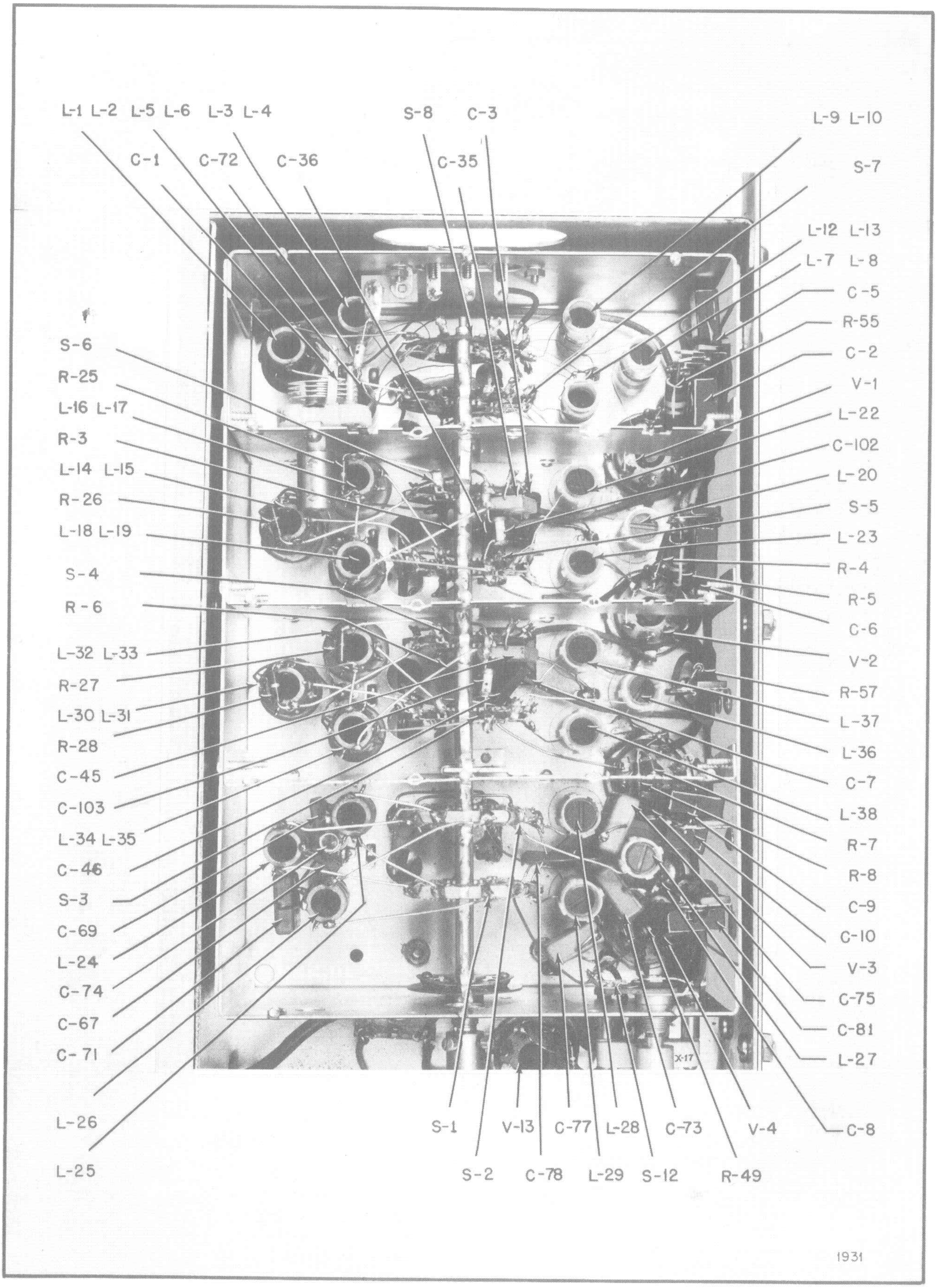



*Figure 10 - R-F Unit - Trimmers Removed*

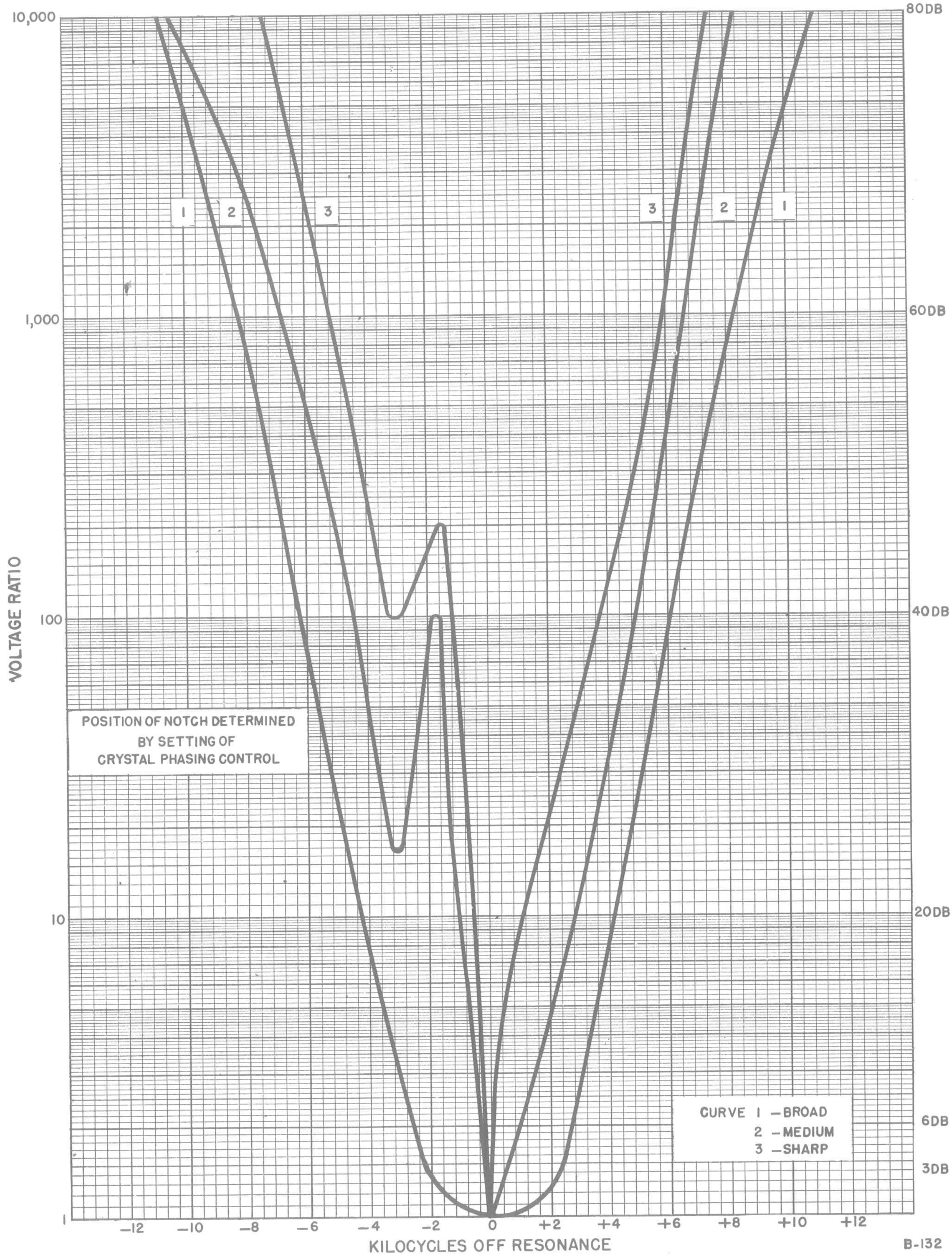



*Figure 11 - Selectivity Curves*

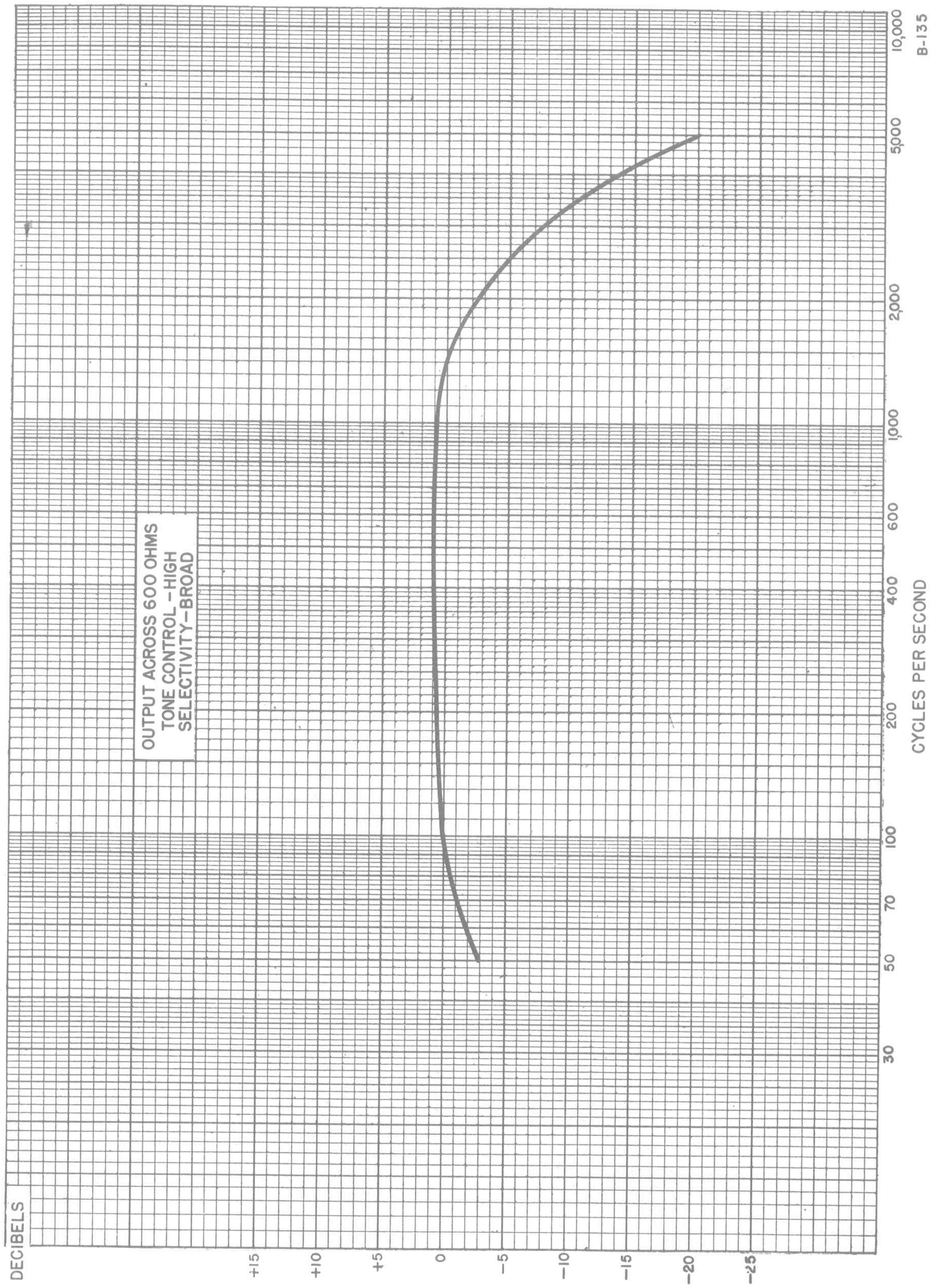
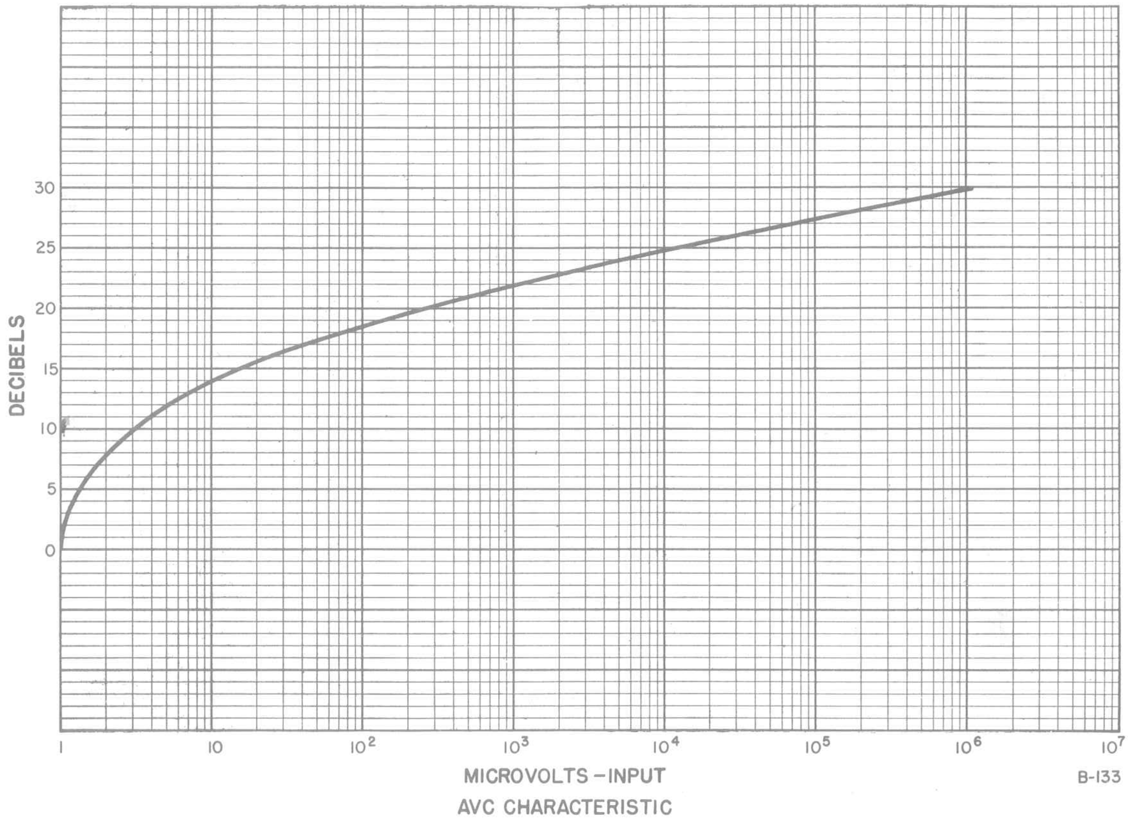



*Figure 12 - Fidelity Curve*



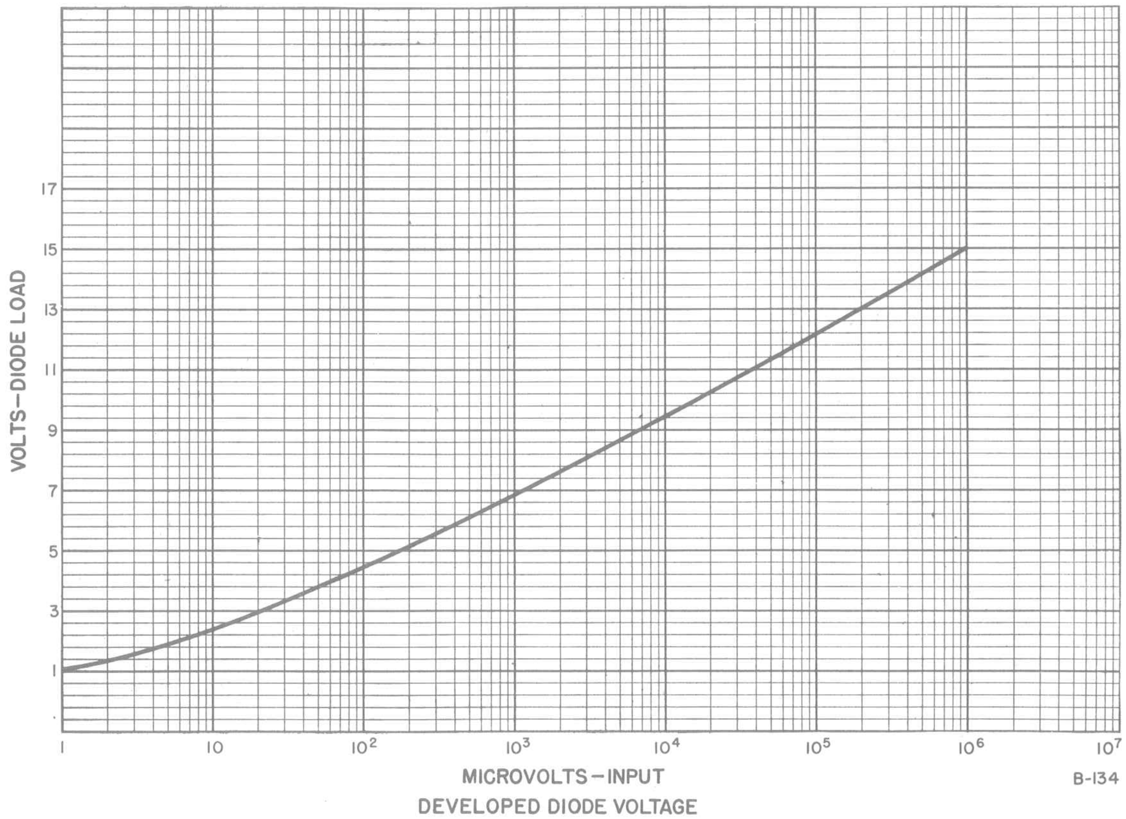




*Figure 13 - AVC Curves*

Manufactured by

**RADIOMARINE CORPORATION of AMERICA**

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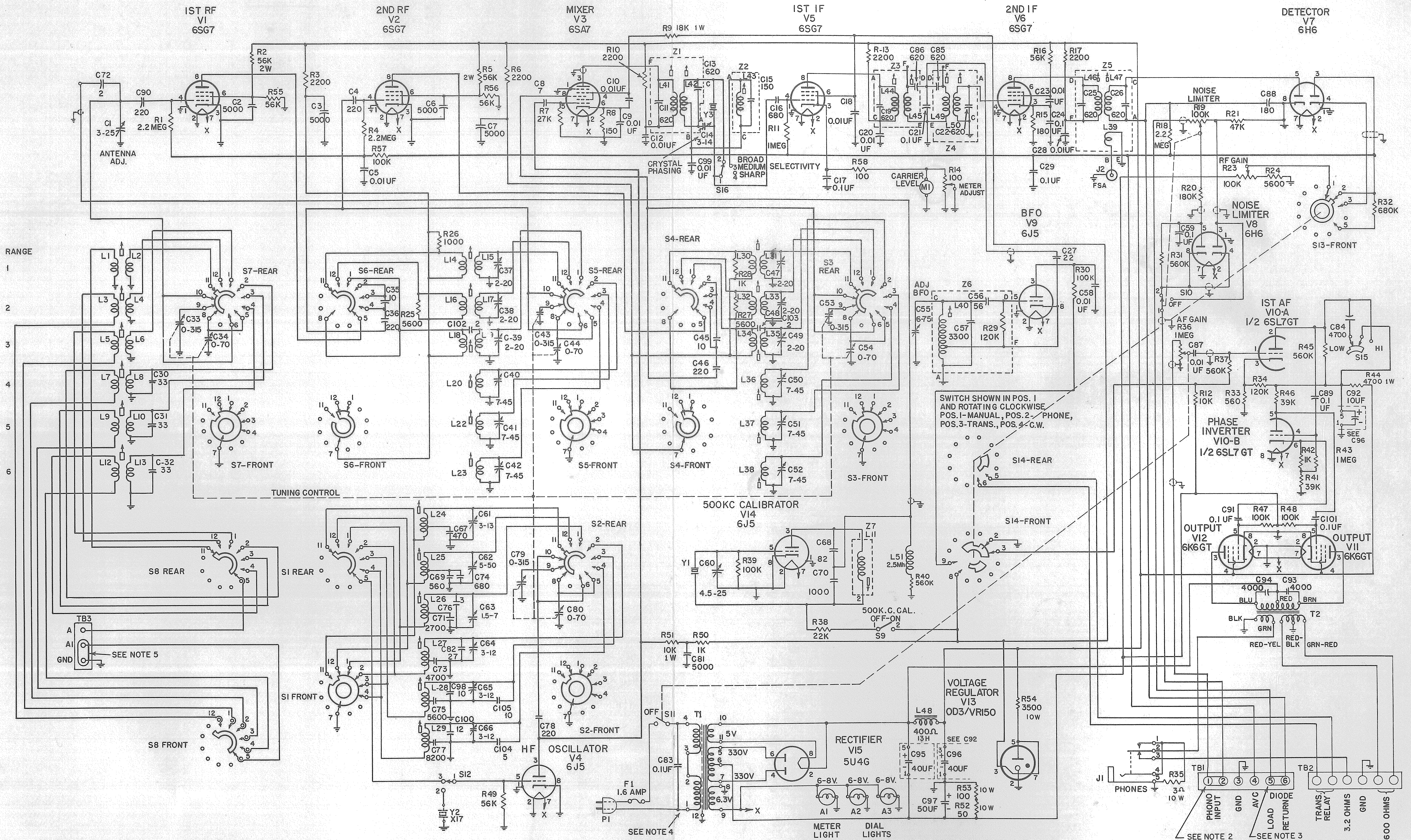


NOTES:
1. RANGE SWITCHES SI TO S8 ARE SHOWN FROM FRONT OF CHASSIS IN POSITION 1. ROTATION IS CLOCKWISE.
2. FOR PHONO OPERATION, LINK BETWEEN TERMINALS 1 AND 2 SHOULD BE MOVED TO CONNECT TERMINALS 2 AND 3 ON TB1.
3. FOR DIVERSITY OPERATION, USING TWO OR MORE CR-88B RECEIVERS, LINK ON TERMINALS 5 AND 6, TB1, CAN BE REMOVED AND A 0-300 MICROAMMETER PLACED ACROSS THESE TERMINALS TO INDICATE DIODE CURRENT.
4. NORMALLY CONNECTED FOR 235V., 43 TO 60 CYCLE OPERATION. FOR 117.5V. OPERATION, OPEN CONNECTION T1-2 AND T1-3. CONNECT T1-2 TO T1-4 AND T1-1 TO T1-3.
5. LINK USED BETWEEN A1 AND GND ON TB-3 FOR UNBALANCED ANTENNA INPUT. REMOVE FOR BALANCED ANTENNA.
6. CONNECTIONS TO SWITCHES S2 TO S7 SIMILAR TO S1 FRONT AND REAR.
7. ALL VALUES EXPRESSED IN MICRO-MICROFARADS, MICROHENRIES AND OHMS UNLESS OTHERWISE SPECIFIED.
8. FIXED RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.

| RANGE SWITCH | |
|---|---|
| POSITION | FREQUENCY |
| 1 | 535 TO 1,610 KC |
| 2 | 1,600 TO 4,700KC |
| 3 | 4,500 TO 12,000KC |
| 4 | 11,900 TO 16,500KC |
| 5 | 16,000 TO 22,900KC |
| 6 | 21,900 TO 32,000KC |

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*Figure 14 - Schematic Diagram*