COLLINS

INSTRUCTION BOOK

for

51 J-2 COMMUNICATIONS RECEIVER

INSTRUCTION BOOK

INSTRUCTION BOOK

for

51 J-2 COMMUNICATIONS RECEIVER

Manufactured By

COLLINS RADIO COMPANY
Cedar Rapids, Iowa

520 9515 00

TABLE OF CONTENTS

SECTION 1 - GENERAL DESCRIPTION

SECTION 2 - INSTALLATION

SECTION 3 - ADJUSTMENT AND OPERATION

SECTION 4 - CIRCUIT DESCRIPTION

SECTION 4 - CIRCUIT DESCRIPTION (Cont'd.)

SECTION 5 - MAINTENANCE

SECTION 6 - PART LIST

LIST OF ILLUSTRATIONS

GUARANTEE

The equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts or accessories which are defective as to design, workmanship or material, and which are returned to Collins at its factory in Cedar Rapids, Iowa, transportation prepaid, provided that the foregoing shall not be applicable to.

(a) Equipment or accessories as to which notice of the claimed defect is not given Collins within one year from date of delivery;

(b) Equipment and accessories manufactured by others than Collins, tubes and batteries, all of which are subject only to such adjustment as Collins may obtain from supplier thereof;

(c) Equipment or accessories which shall fail to operate in a normal or proper manner due to exposure to excessive moisture in the atmosphere or otherwise after delivery, any such failure not being deemed a defect within the meaning of the foregoing provisions.

Collins further guarantees that any radio transmitter described herein will deliver full radio frequency power output at the antenna lead when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range of said apparatus.

The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins.

Notice of any claimed defect must be given to Collins prior to return of any item. Such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. Upon receipt of such notice, Collins will promptly advise respecting return of equipment. Failure to secure our advice prior to the forwarding of goods for return may cause unnecessary delay in the handling of such merchandise.

No other warranties, expressed or implied, shall be applicable to said equipment, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements in this paragraph contained. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any cause.

HOW TO ORDER REPLACEMENT PARTS

When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable:

Address: Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

Information Needed:

(A) Quantity required
(B) Part number of item
(C) Item number (obtain from Parts List or Schematic Diagram)
(D) Type number of unit
(E) Serial number of unit
(F) Serial number of equipment

HOW TO RETURN MATERIAL OR EQUIPMENT

If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

Address: Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

Information Needed:

(A) Date of delivery of equipment
(B) Date placed in service
(C) Number of hours in service
(D) Part number of item
(E) Item number (obtain from Parts List or Schematic Diagram)
(F) Type number of unit from which part is removed
(G) Serial number of unit
(H) Serial number of the complete equipment
(I) Nature of failure
(J) Cause of failure
(K) Remarks

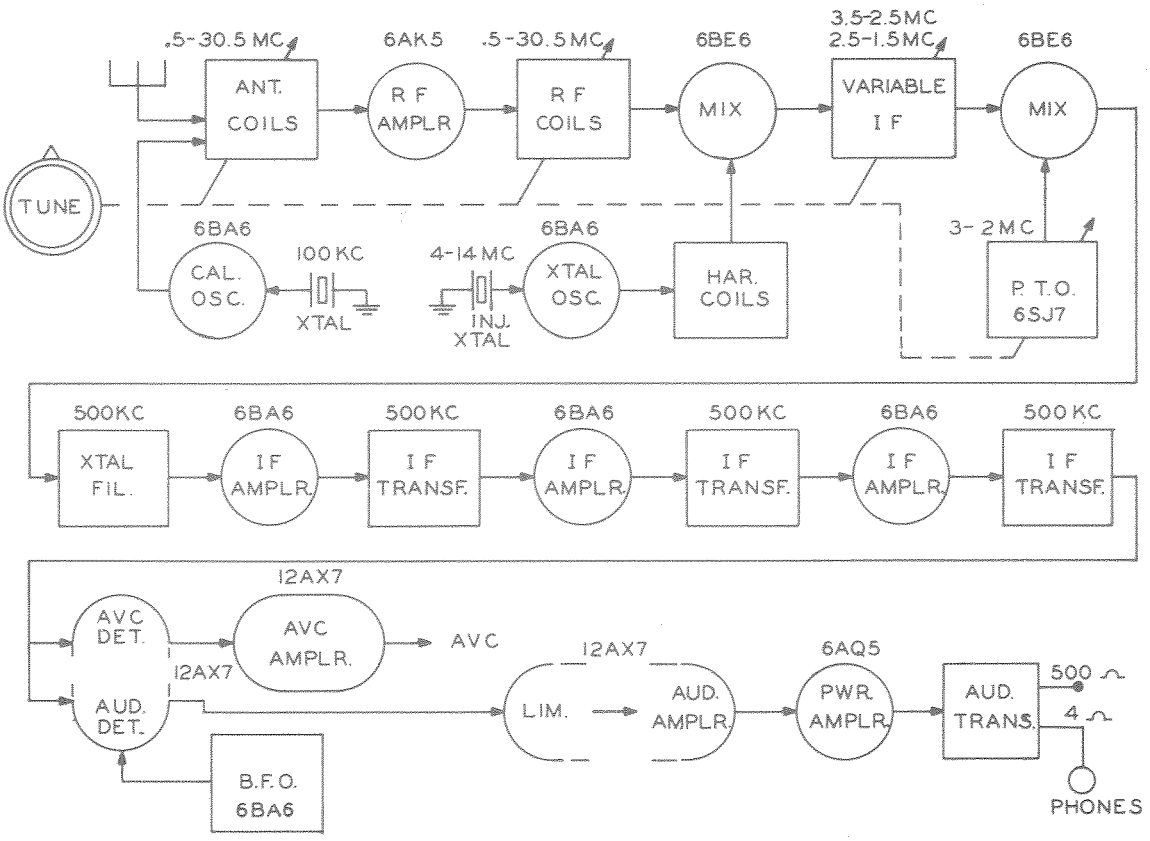


Figure 1-1 51J Receiver, Front View and Block Diagram

SECTION 1

GENERAL DESCRIPTION

1.1. GENERAL.

1.1.1. PURPOSE OF BOOK. - This instruction book has been prepared to assist in the installation, operation, and maintenance of the Collins Model 51J Radio Communications Receiver.

1.1.2. PURPOSE OF EQUIPMENT. - The Model 51J Receiver is designed for communication applications where stability and dial accuracy of the highest order are the prime requisites. Under normal operating conditions, the receiver tunes the range of 0.5 to 30.5 mc with a total setting error and drift of less than 1 kc at any frequency within its range. The receiver is designed for amplitude modulated and continuous wave reception although its accuracy and stability make it suitable for many applications where it is desired to receive or set definite frequencies without searching or frequent adjustments.

1.1.3. DESCRIPTION. -

(a) MECHANICAL. - The 51J receiver is constructed in a panel and shelf assembly suitable for mounting in a standard rack cabinet. Overall dimensions are 19 inches panel width, 10-1/2 inches panel height, and 13 inches depth behind the panel. Damage from dust and other foreign matter is prevented by a dust cover removable from the rear, which fits over the top of the chassis. Optionally the 51J can be supplied in a table mounting cabinet and there is also a matching speaker available but not furnished. The outside dimensions of the cabinet are 21-1/8" wide, 12-1/4" high, and 13-7/8" deep. The speaker cabinet is 13" wide, 11" high and 7" deep. St. James Gray wrinkle finish is used on both the receiver cabinet and front panel as well as on the speaker cabinet.

The following controls are located on the front panel:

R-F GAIN	CRYSTAL FILTER SELECTIVITY
AUDIO GAIN	CRYSTAL FILTER PHASING
BFO ON-OFF	OFF-ON-STANDBY
CALIBRATER ON-OFF	MEGACYCLE TUNING (BAND SWITCH)
BFO PITCH	KILOCYCLE TUNING
AVC ON-OFF	ZERO ADJ
LIMITER OUT-IN	METER OUTPUT-INPUT
	CAL (100 KC ADJUSTMENTS)

The tuning range .5 to 30.5 mc is divided into 30 one-megacycle bands selected by the band switch knob and indicated by a slide rule dial

having graduations at one-tenth megacycle (100 KC) intervals. The main tuning control covers each of these megacycle ranges with 10 turns of a 100 division dial calibrated at one kilocycle intervals. The frequency stability of the receiver is consistent with this finely divided calibration even at the highest frequencies.

A headphone jack is provided on the front panel with the four ohm speaker output disconnected when the headphones are used. In addition to the speaker terminals, a 500 ohm audio output, a 300 ohm r-f input, and terminals for standby operation are provided on the rear of the chassis. A spare terminal is provided to allow other functions to be brought out as required for special applications. A heavy duty a-c power cord extends from the rear of the chassis.

(b) ELECTRICAL. - The Model 51J Communications receiver uses, where advantageous, single, double, or triple conversion in tuning the entire frequency spectrum of .5 to 30.5 mc. 16 tubes, three of which are dual tubes, are employed in the receiver. With the exception of the rectifier tube and the variable frequency oscillator tube, all are of the miniature type. The tuning range of the 51J Receiver, .5 to 30.5 mc, is divided into 30 one-megacycles bands by a system of switches and coils which form the r-f amplifier and first mixer circuits. Changing bands consists of moving powdered iron "slugs" into the coils in one megacycle steps until the inductance limits of the coils are reached then changing coils and repeating. Injection voltage for the first mixer is obtained from the fundamental or harmonic output of an oscillator, the frequency of which is controlled by one of ten quartz crystals selected by the MEGACYCLE band switch. The main tuning control is a vernier dial calibrated in 100 one Kilocycle divisions which operates through a differential mechanism to move the band change "slugs" in the coils by an amount sufficient to cover the range between the one megacycle band change steps. Thus the Band Switch selects coils and crystals and also roughly positions the tuning slugs while at the same time, one of the two ranges (1.5 to 2.5 mc or 2.5 to 3.5 mc) of the variable i-f channel is selected and tuned along with the r-f coils.

The crystal frequencies for first mixer injection are so chosen that the frequency produced by the first mixer will always fall in the 1.5 to 2.5 mc or 2.5 to 3.5 mc range of the variable i-f channel.

Exceptions to the operation just described are bands 1, 2, and 3. Band 1 (.5 to 1.5 mc) uses an intermediate mixer between the first mixer and the variable i-f coils. This mixer accepts frequencies in the range 10.5 to 11.5 mc from the first mixer. A 12 mc signal developed by the crystal controlled oscillator is applied to the first mixer to determine these frequencies. The crystal controlled oscillator also applies an 8 mc voltage to the intermediate frequency mixer to produce a signal within the range of the i-f amplifier which tunes from 2.5 to 3.5 mc. Bands 2 and 3, which cover 1.5 to 2.5 mc, and 2.5 to 3.5 mc respectively, are identical in span to each band of the variable frequency i-f coils and thus feed through to the second mixer without utilizing the first mixer.

Following the variable i-f and the second mixer are the crystal filter and a three stage fixed intermediate frequency amplifier. Conversation to the fixed i-f of 500 kc is accomplished by injecting a signal from a Collins 70E-15 oscillator between 2 and 3 mc to produce a difference of 500 kc from the frequency existing in either band of the variable i-f amplifier. Tuning of the 70E-15 oscillator is done by the "kilocycle" tuning control in step with all other circuits.

Stability of the 70E-15 oscillator is assured by temperature compensated components operating in a sealed and moisture proofed housing.

Separate rectifier are used to produce the audio and automatic volume control voltages. D-C amplification of the automatic volume control voltage is provided to obtain essentially uniform input to the detector. Audio power output is held within 10 db over signal input voltage ranges of five microvolts to one volt at the antenna terminals. A series type noise limiter clips the modulation at 30 percent. This allows good reception in the presence of strong noise pulses.

1.2. VACUUM TUBE TABLE.

The following table lists the tubes employed in the circuits just described. The tubes are listed in numerical order according to the circuits symbol designation.

SYMBOL DESIGNATION	TUBE TYPE	FUNCTION
V-101	6AK5	Radio frequency amplifier
V-102	6BE6	First mixer
V-103	6BE6	Broadcast mixer
V-104	6BA6	Calibration oscillator
V-105	6BA6	High frequency crystal oscillator
V-106	6BE6	Second mixer
V-107	6BA6	First 500 kc i-f amplifier
V-108	6BA6	Second 500 kc i-f amplifier
V-109	6BA6	Third 500 kc i-f amplifier
V-110	12AX7	Detector and AVC rectifier
V-111	12AX7	AVC amplifier
V-112	12AX7	Noise limiter and first audio amplifier
V-113	6AQ5	Audio power amplifier
V-114	6BA6	Beat frequency oscillator
V-115	5V4	Power rectifier
V-001	6BA6	Variable frequency oscillator
V-002	6BA6	Oscillator feedback amplifier

1.3. REFERENCE DATA

FREQUENCY RANGE: 500 kc to 30.5 mc.
TYPE OF RECEPTION: MCW, CW or Voice
CALIBRATION: Direct reading in megacycles and kilocycles
TUNING: Straight line frequency with uniform bandspread
FREQUENCY STABILITY: Overall stability within 2 kc at any frequency within the operating range
TEMPERATURE RANGE: -20°C to +60°C.
SENSITIVITY: 3 micro volts gives 500 M.W. with 6 db s/n
*SELECTIVITY: Approximately 6.5 kc at 6 db down and 19 kc at 60 db down (total bandwidth). With crystal filter in operation, at 6 db down, the bandwidth is 0.2 kc and at 60 db down it is 4 kc.
SPURIOUS FREQUENCY RESPONSE: Down at least 50 db.
AUTOMATIC VOLUME CONTROL: Less than 6 db increase in audio power output with an increase in r-f signal from 5 to 100,000 /uv.
S METER: Meter calibrated in 20, 40, 60, 80, 100 db signal level and 10 to +6 db audio level (6 mw reference).
NOISE LIMITER: Series type ahead of the first audio stage, effective in cw.
AUDIO POWER OUTPUT: 2-1/2 watts at 1000 cps with distortion less than 10%.
**AUDIO FREQUENCY RESPONSE: (Overall): ±3 db from 100 cps to 2500 cps.
OUTPUT IMPEDANCE: 4 and 500 ohms impedance.
R.F. INPUT IMPEDANCE: Balanced or unbalanced, 300 ohms (±100 ohms) resistive.
POWER REQUIREMENTS: 85 watts at 115 volts 45/70 cps. Same power demand when connected for 230 volt 45/70 cps operation.
DIMENSIONS: Panel - 10-1/2" high, 19" wide, notched for standard rack mounting.
Metal Cabinet - 21-1/8" wide, 12-1/4" high, 13-7/8" deep.
Speaker in metal cabinet - 13" wide, 11" high, 7" deep.
WEIGHTS: Receiver - 35 pounds, cabinet 20 pounds.
Speaker - 9 pounds.

* These figures are for the 520 4746 005 Receiver. The 520 4746 002 Receiver is as follows: Approximately 9 kc at 6 db down and 23 kc at 60 db down (total bandwidth).

** 100 to 3500 for the 520 4746 002 Receiver.

SECTION 2

INSTALLATION

2.1. UNPACKING.

2.1.1. PROCEDURE. - The model 51J receiving equipment is packed in a number of heavy cartons. Refer to the packing slip for a list of all equipment supplied on the order. Open cartons carefully to avoid damage to the units within. Remove the packing material and carefully lift the units out of the cartons. Search all of the packing material for small packages. Extra pilot light bulbs and fuses are supplied with each equipment. Inspect each unit for loose screws and bolts. Be certain all controls such as switches, dials, etc. work properly. All claims for damage should be filed promptly with the transportation company. If a claim is to be filed, the original packing case and material must be preserved.

2.2. INSTALLATION.

2.2.1. GENERAL. - The receiver is intended primarily for rack mounting. Refer to figure 2-1 for outline and mounting dimensions. The front panel is slotted for mounting at 1-1/2, 3-3/4, 6-3/4, and 9 inches from the bottom. The panel height is 10-1/2 inches while the panel width is 19 inches for rack mounting.

The cabinet in a table mounted installation measures 21-1/8" wide, 12-1/4" high and 13-7/8" deep. Rubber mounting feet are provided on the receiver cabinet and the speaker cabinet. The speaker cabinet is 13" wide, 11" high, and 7" deep.

When choosing a position for the receiver, consideration should be given to convenience of power, antenna, and ground connections, to the placement of cables, and to convenience in servicing the equipment.

2.2.2. ANTENNA AND GROUND CONNECTIONS. - The antenna connection is made by means of a coaxial fitting type 83-1SP which is a single conductor plug suitable for use with RG-8/U type coaxial cable.

A grounding stud is provided between the two terminal strips. A good ground should be connected to this stud when the receiver is used alone. If a group of these receivers is used in a diversity system, the receivers can be connected together by means of the grounding studs and a good external ground connected to one of the studs, also.

Where the receiver is used for communications in the vicinity of a strong transmitter, a grounding type antenna relay should be used to protect the input coils in the receiver.

2.2.3. OUTPUT CONNECTIONS. - Viewing the receiver from the rear, the OUTPUT terminal strip is at the right hand edge of the chassis. The terminal marked C is the common audio termination. The terminal marked "4" is intended for exciting a speaker voice coil while the terminal marked "500" can be used to feed an audio line. The output circuit is ungrounded.

2.2.4. REMOTE CONNECTIONS. - The left terminal strip on the rear of the chassis is used to connect the AVC circuit to the combining panel. If one set is to be operated along, terminals 1 and 2 must be jumpered together. The terminal marked 6.3 is provided to supply 6.3 volts to the meter lights in the diversity combining panel. A ground connection is provided between the terminal strips to tie all the units together.

2.2.5. POWER CONNECTION. - The power connection is made by means of a 6 foot permanently attached rubber covered cord equipped with a standard A.C. plug. If 230V operation is desired, the power transformer should be reconnected as indicated in figure 7-3.

2.2.6. HEADPHONES. - Headphone connections are made by means of a panel jack and a standard 1/4" dia. plug. 500 ohm headphones work best, however, any higher impedance phones will be quite satisfactory.

2.2.7. TUBES. - Before turning the equipment on for the first time inspect the tubes and see that they are in their correct position and that they are firmly seated in their respective sockets.

2.2.8. FUSE. - The fuse is located on the chassis and can be removed for inspection by turning the cap of the fuse post to the left and pulling straight up until the cap and the fuse comes free. This fuse should have a rating of 1 ampere.

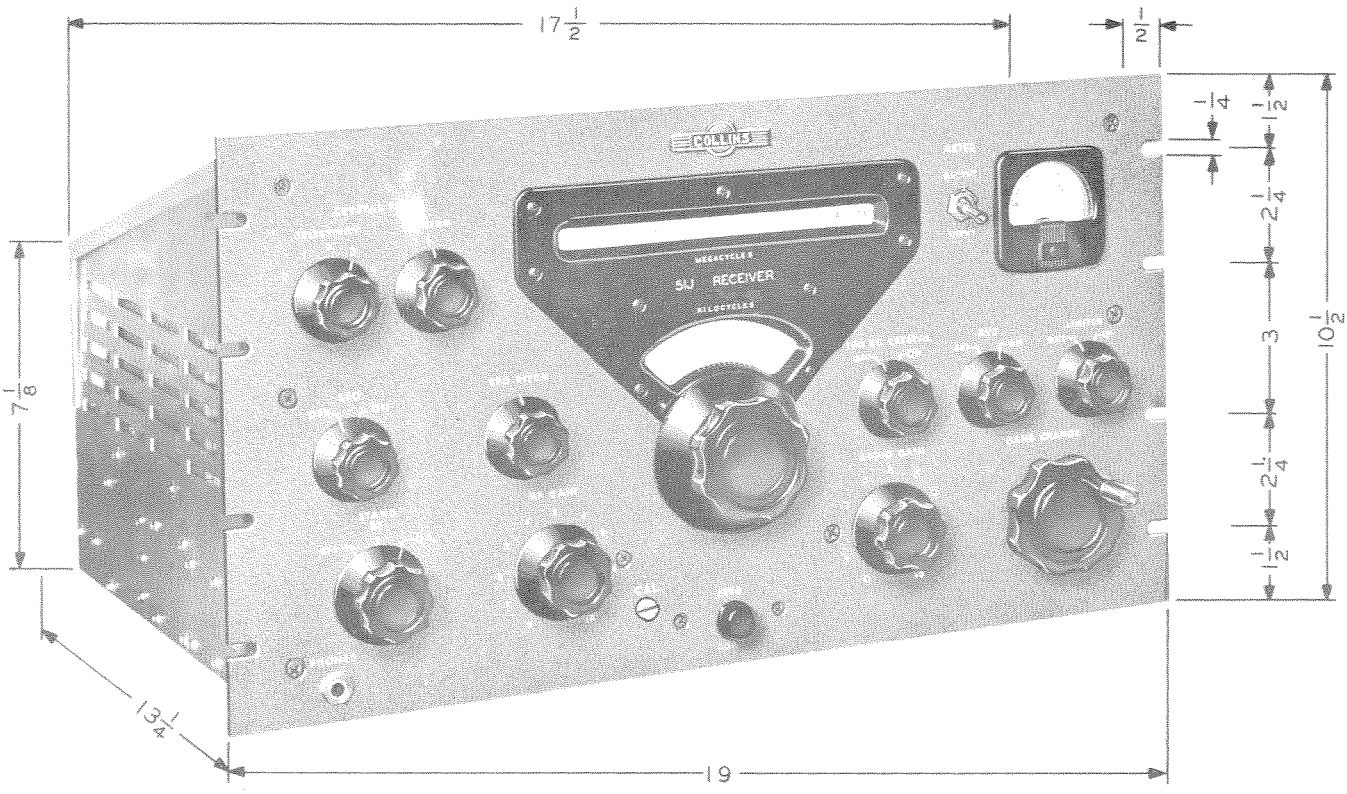


Figure 2-1 51J Receiver, Mounting Dimensions

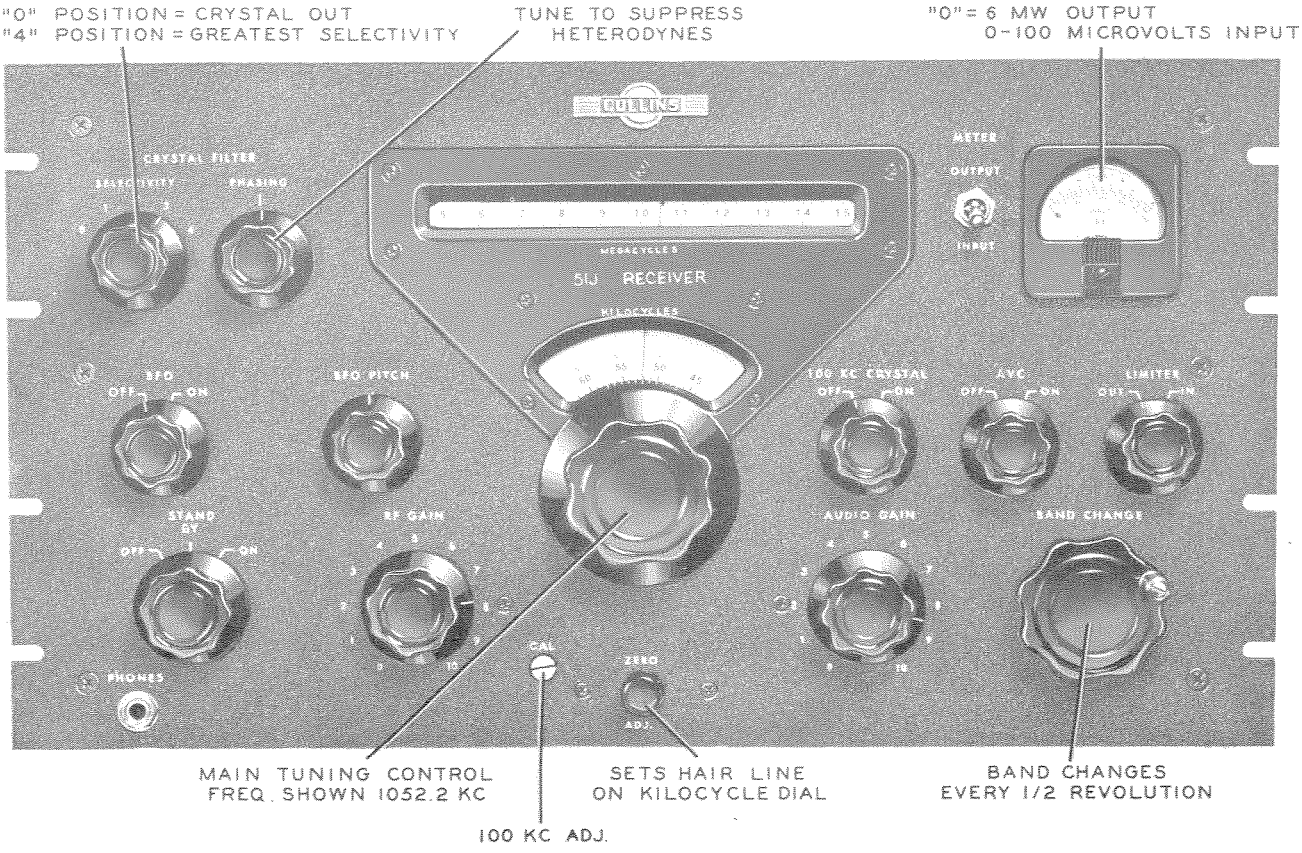


Figure 3-1 51J Receiver, Operating Controls

SECTION 3

ADJUSTMENT AND OPERATION

3.1. ADJUSTMENT.

3.1.1. GENERAL. - Other than the "S" meter zeroing adjustment, there are no pre-operational adjustments necessary. Should the "S" meter require zeroing, the receiver should be turned on after which the BFO should be turned OFF, the AVC control turned ON, the 100 KC CRYSTAL turned OFF and the RF GAIN full on. With the antenna terminals short circuited, turn the meter zeroing control, located just ahead of the chassis, until the "S" meter reads zero.

3.2. OPERATION.

3.2.1. FUNCTION OF CONTROLS. - Operation of the 51J receiver is exceedingly simple, once the functioning of the controls is understood. The following paragraphs present an explanation of each of the controls on the front panel of the receiver.

(a) OFF-STANDBY-ON. - In the OFF position, this control opens the primary power circuit to turn the equipment completely off. In the STANDBY position the power transformer is excited producing filament and plate voltage, however, blocking voltage is applied to the control grids of several of the tubes to disable the receiver. This position is used usually during transmitting periods (if used for communication purposes). If a standby relay is used, this control is always placed in this position (STANDBY) when receiving to allow the standby relay to take control of the output of the receiver. When this control is placed in the ON position, the receiver is completely operative.

(b) RF GAIN. - The RF GAIN control is located in the cathode circuit of the final mixer and has a limited attenuation of about 25 db and is only intended to equalize the gain of the receivers when used in diversity operation.

(c) AUDIO GAIN. - The AUDIO GAIN control is also operative at all times and controls the amount of audio produced by the receiver.

(d) BAND CHANGE. - Any one of the 30 bands may be selected at 1/2 revolution intervals with this knob. A stiff detent accurately positions the band switches on each band.

(e) MEGACYCLE. - The MEGACYCLE scale is on the slide-rule type dial. This scale is calibrated in 10 100 KC divisions each of which

equal one full turn of the circular KILOCYCLE dial. The 1.5 to 2.5 mc and 2.5 to 3.5 mc bands are printed in red indicating that the red scale on the KILOCYCLE dial must be used when operating on these bands. Beginning with the 3.5 mc band, the amateur bands from 3.5 mc to 29.7 mc are indicated by green stripes on the MEGACYCLE scale. The pointer on the MEGACYCLE dial is operated by the KILOCYCLE control while the scale is changed by operation of the BAND SWITCH.

(f) KILOCYCLE. - The KILOCYCLE dial is the main tuning control on the 51J receiver. Each division on its circular face represents 1 kilocycle. One full turn of the dial represents 100 kilocycles or one division of the MEGACYCLE scale.

When reading the tuning dials, it is only necessary to combine the figures of the MEGACYCLE dial with those of the KILOCYCLE dial to arrive at the frequency in kilocycles. For example, a reading of 14.1 on the MEGACYCLE dial and a reading of 78 on the KILOCYCLE dial would indicate a frequency of 14178. The scale for the 1.5 to 2.5 mc and 2.5 to 3.5 mc bands is in reverse order to the scale for the rest of the bands and is printed in a red color similar to the respective scales on the MEGACYCLE dial.

(g) ZERO ADJ. - The ZERO ADJ moves the indicator line on the KILOCYCLE control a few divisions in either direction for calibration purposes. The receiver may be calibrated against any receivable station whose frequency is known or against the internal calibration oscillator. The internal calibration oscillator emits a harmonic at every 100 KC in the tuning spectrum. An example of how the receiver may be calibrated using the internal calibration oscillator follows. If, for instance, the signal whose frequency is desired is about 14,100 KC, turn the 100 KC CRYSTAL and the BFO ON and tune to zero beat with the 100 KC marker at 14,100 KC, then move the ZERO ADJ. control until the hair line is exactly on 14,100 KC. The dial now reads very accurately in this region and the receiver may be set within a few hundred cycles of the desired frequency.

When reading frequency, remember that the BFO PITCH control must be in the same position when reading frequency as it was when calibrating.

A ten division scale (five divisions either side of center), is engraved on the lower edge of the escutcheon opening for the KILOCYCLE dial and is used to log the calibrated position of the hair line on the various bands in lieu of recalibrating each time the band is used.

(h) METER. - The METER switch is a momentary spring return type toggle switch. In the normal or INPUT position the meter is connected as an "S" meter. In the OUTPUT position, the meter is connected in the audio output circuit as a db meter.

(i) BFO. - This control turns the beat frequency oscillator on the CW reception. In the OFF position, this control grounds the screen grid of the beat frequency oscillator tube.

(j) BFO PITCH. - The BFO PITCH control varies the frequency of the beat frequency oscillator to change the pitch of the audio tone produced by the combination of the beat frequency oscillator and the incoming signal. A range of about ±1500 cycles can be obtained with this control. Special BFO coils are available to give ±6 KC.

(k) CALIBRATE. - This ON-OFF switch is in the cathode of the 100 kc oscillator tube V104 and turns the 100 kc oscillator on or off. For a more detailed explanation on how to use the 100 kc oscillator, see paragraph (g) ZERO SET above.

(l) AVC. - The AVC OFF-ON switch turns the AVC on or off. In practically every instance, the AVC control is in the ON position for both phone and CW reception but may be placed in the OFF position for CW if desired.

(m) LIMITER. - The automatic noise limiter is useful in both phone and CW reception. Where noise is not a problem, it is recommended that the LIMITER switch be placed in the OUT position since the distortion will be somewhat less in this position. Where noise of the impulse type is being received, the LIMITER control should be placed in the IN position.

(n) CRYSTAL FILTER:

SELECTIVITY. - In position 0 of this control, the crystal filter is not used and the selectivity of the receiver is determined by the tuned circuits of the receiver alone. In positions 1 thru 4, the crystal filter is in the circuit with the selectivity increasingly greater as position 4 is approached. Position 4 will give a selectivity in the order of 200 cps.

PHASING. - The PHASING control is used primarily to assist in rejecting unwanted heterodynes. The control, when positioned on the panel mark (straight up), is properly set for crystal phasing with no rejection notch. In the event a high frequency heterodyne is interfering with the reception, the control should be moved back and forth in the vicinity of the panel mark until the heterodyne is attenuated. If the heterodyne is of lower frequency, the control should be moved farther out from the panel mark on either side. The notch can be moved from 1 to 3 KC off center.

(o) TUNING METER. - The tuning meter is calibrated in 20, 40, 60, 80, and 100 db when reading input. When reading output, the meter is calibrated (on the lower scale) -10 to +6 db with the "0" being 6 milli-

watts into a 500 ohm load.

(p) CAL. - For supreme accuracy it is desirable to check the frequency of the 100 kc oscillator against WWV or some other station whose frequency is known to be very accurate. The frequency of the 100 kc oscillator is variable within small limits by turning the CAL control with a screw driver. Additional range can be obtained by turning C169 located just behind the 100 kc crystal.

SECTION 4

CIRCUIT DESCRIPTION

4.1. MECHANICAL DESCRIPTION.

4.1.1. BAND CHANGE. - The 51J Receiver covers the radio frequency spectrum 0.5 to 30.5 mc in 30 bands: 0.5 to 1.5, 1.5 to 2.5, 2.5 to 3.5 mc and so on up to 30.5 mc — each band being one megacycle wide. The circuits affected in changing bands are the r-f amplifier grid, first mixer grid, second mixer grid, third mixer grid, crystal selection, and crystal harmonic tuning circuits. The third mixer is switched in only on band 1 (.5 to 1.5 mc). See figure 4-1.

The mechanical aspects of changing bands consists of selecting the proper coils in the above circuits with tap switches and changing the position of the r-f amplifier and first mixer slug tables. (All stages are permeability tuned with powdered iron slugs). The r-f amplifier and first mixer slug tables change position to equal a full megacycle in tuning each time a band is changed. This is true of all three slug tables (tuning L-101 thru L-113) however the tap switch selects the proper set of coils for the frequency desired.

The slug tables are driven from two sources; namely, the main tuning dial and the band-change knob. These two driving sources are connected to the slug table through a differential gear mechanism. This is necessary since the coils for bands 4 to 7, 8 to 15 and 16 to 30 are designed to cover these tuning ranges with one complete excursion of the tuning slugs. For instance, the band 4 to 7 slug table tunes the associated coils through four megacycles; in one megacycle jumps when operated by the band switch and in complete "in between" coverage when operated by the tuning knob. An interesting feature of the differential gearing is its ability to combine the movements of the two driving sources so that the slug table is moved exactly one megacycle in each band change. The other slug tables operate similarly to the 4 to 7 table except the band 8 to 15 table tunes the associated coils through 8 mc and the 16 to 30 tunes its associated coils through 15 mc. The three slug tables associated with the r-f stage and the mixer stage are moved simultaneously by means of separate cams.

The switch sections of the band switch are ganged with the slug tables described above through an over-travel coupler. This over-travel coupler drops the band switch at band 16 (going from low to high bands) since the band 16 coils are used for all suceeding bands through band 30. On the way back down, the band switch is picked up again at band 16 and is operated one position for each band, as usual. Refer to figure 4-2. This mechanical diagram shows the gearing and

connecting shafts associated with band change and tuning. The shafts associated with changing bands are F-C-E-G-J-K-L-M and the differential shafts H and I. On Band 1 the radio frequency coils L-101 and L-110 are switched by means of the band switch through shaft F-E. On bands 2 and 3, the r-f coils are selected by the BAND SWITCH knob through shafts F-E and F-G (the variable i-f coils L-116, L-117, L-118 and L-119 being used as additional r-f coils on these bands). On bands 4-7, the coils are selected by the BAND SWITCH through shafts F-E while the position of the slug table is changed through shafts F-J-K and the differential shafts, H-I and the variable i-f channel is changed from one i-f channel from one i-f frequency to the other through shafts F-J-N. On these bands (4-7), the same coils are used for all four bands; band change being accomplished by moving the tuning slug in the coil to equal one megacycle in frequency. Mechanical movement of the slug in the coil amounts to .250" for one megacycle change. On bands 8 to 15, the r-f coils are changed by shafts F-E and the position of the coil slug table is changed one megacycle per band through shafts F-J-K-L and the differential shafts H-I. The movement of the slug table for one megacycle change is .125". On bands 16 to 30, the r-f coils are switched through shafts F-E to band 16 where the band switch remains for bands 16 to 30 (due to the use of 18 contact switch pies) while the over-travel coupler allows shaft D to rotate through to the 30th band. The slugs in the r-f coils are driven through shafts F-J-K-M and the differential shafts H-I. The slugs travel .0625" in changing bands. When operating on any band from band 4 to 30 the variable i-f channel is alternated from one variable i-f channel to the other by shafts F-G. Crystals are selected by operation of the BAND SWITCH through the 6 position Geneva system and shafts F-C.

4.1.2. TUNING. - All r-f mixer, and variable i-f coils, as well as the high frequency oscillator coil are permeability tuned with powdered iron slugs (cores). While tuning, these slugs move in and out of the coils at a rate determined by a cam or (in the hfo) lead screw. Four slug racks or tables are used in the 51J receiver to perform the functions of tuning the r-f, mixer, and variable i-f stages. The group of three slug tables in the rear portion of the chassis tune the r-f and first mixer stages when the receiver is operating in the 3.5 to 30.5 mc frequency range (bands 4 to 30). The fourth slug table, located at the right hand edge of the receiver tunes the r-f stage, the first mixer grid, the third mixer grid and the variable i-f coils when receiving in the range 0.5 to 1.5 mc. It tunes the r-f stage and the variable i-f coils L-116, L-117, L-118 and L-119 when receiving in the range 1.5 to 2.5 and 2.5 to 3.5 mc. When receiving in the range 3.5 to 30.5 mc, this slug table tunes the variable i-f coils L-116, L-117, L-118, and L-119 only. The positions of the slug tables are varied in tuning by a system of gears and cams, see figure 4-2. On band 1 (0.5 to 1.5 mc) coils L-101 and L-110 are tuned over this frequency range by the main tuning knob through shafts A-B-N. On bands 2 and 3 (2.5 to 1.5 and 3.5 to 2.5), the tuning is done by the main tuning knob through the same shafts (A-B-N). On bands 4 to 7, the main tuning knob tunes coils L-104, L-107, and L-111 over one-fourth of their tuning range through shafts A-B-J-K and the differential, (shafts H and I). The band switch knob

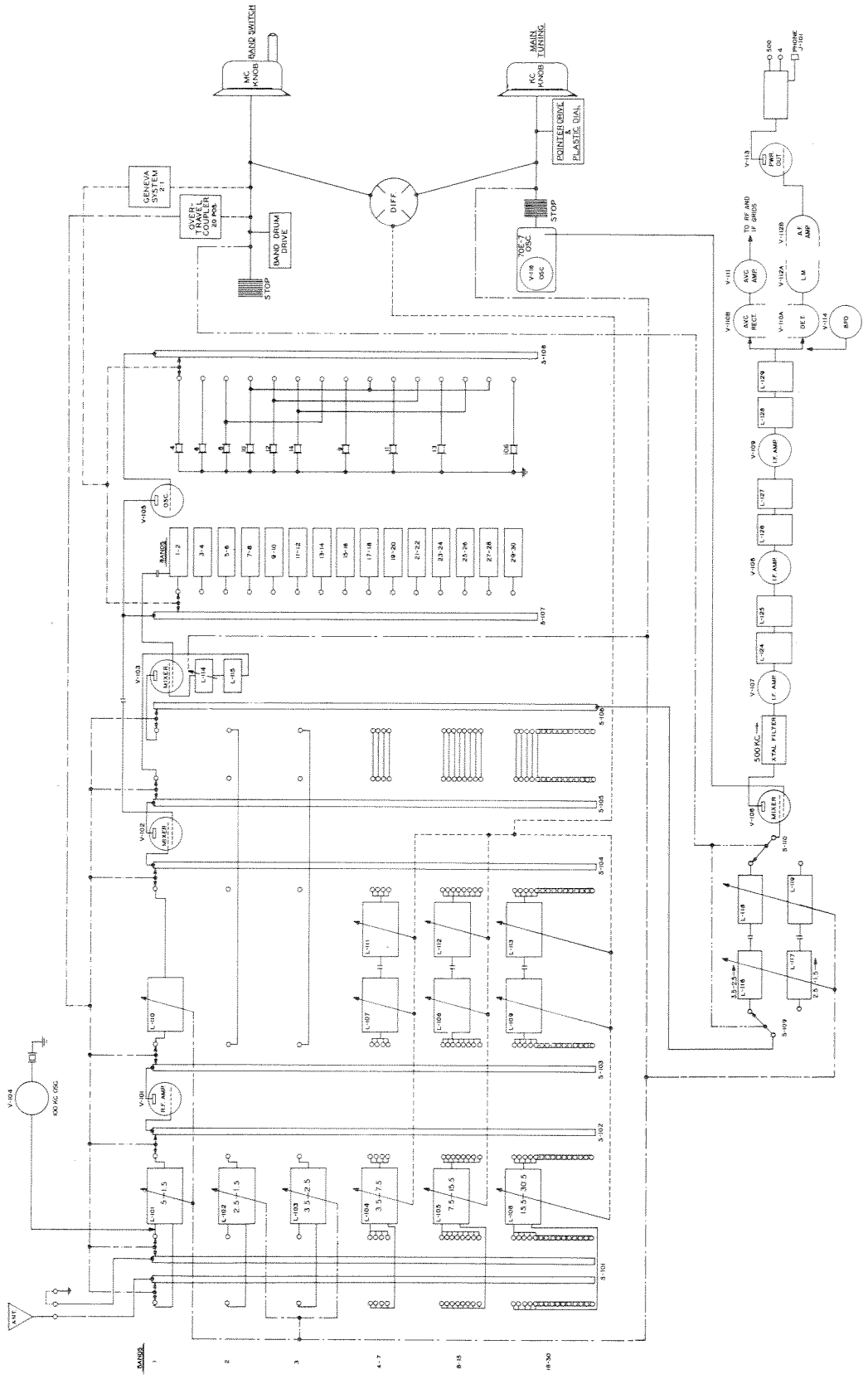


Figure 4-1 Band Change and Tuning System, Block Diagram

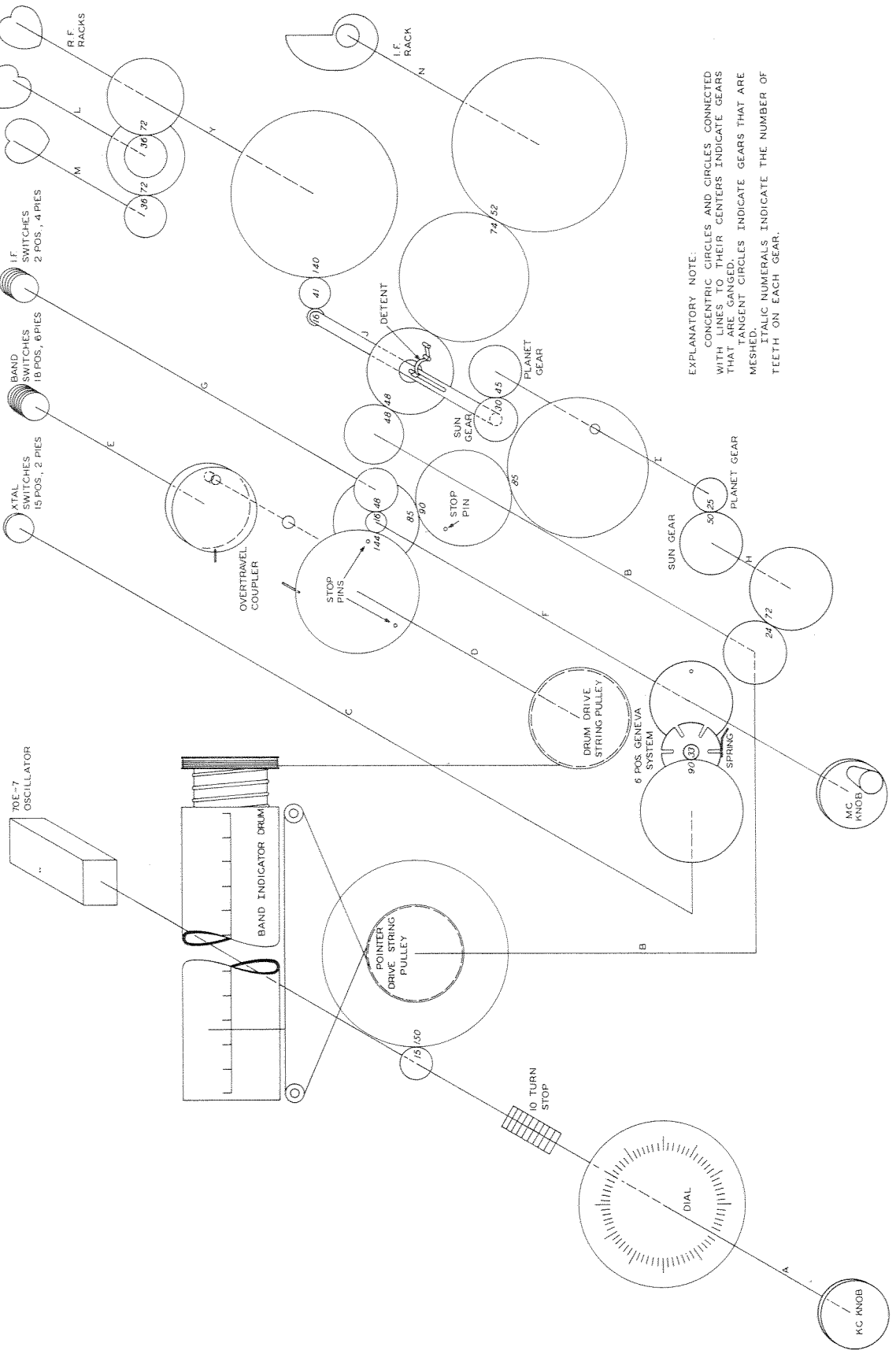


Figure 4-2 Mechanical Block Diagram

moves this same rack through shafts F-I-J-K and the differential in four steps each equal to one-fourth of their tuning range and each positioned by means of the detent. Thus L-104, L-107, and L-111 are tuned in one megacycle steps by the band switch and between these steps by the main tuning knob. On bands 8 to 15, coils L-105, L-108, and L-112 are tuned through shafts A-B-J-K-L and the differential. Bands 16 to 30 are tuned through shafts A-B-J-K-M and the differential. The two variable frequency i-f channels each cover one megacycle range and are tuned by means of the main tuning knob through shafts A-B-N; the proper channel is selected by the band switch knob through shafts F and G.

4.1.3. FREQUENCY INDICATION. - The band on which the receiver is operating is indicated on the drum dial that is rotated by the band switch through shafts F-D. 100 kc divisions are indicated by the pointer on the slide rule dial. This pointer is driven from the main tuning knob through shaft A. The kilocycle divisions are indicated by the plastic dial mounted on shaft A. Two scales are necessary on this dial as bands 2 and 3 run in opposite directions. Mechanical stops are mounted on the control shafts to prevent overtravel.

4.2. ELECTRICAL DESCRIPTION.

4.2.1. GENERAL. - The 51J Receiver is a complete coverage superheterodyne receiver capable of receiving AM phone and CW signals in the frequency range of 0.5 to 30.5 megacycles. Single, dual, and triple conversion is employed in various portions of the tuning spectrum. Three stages of 500 kc intermediate frequency amplification and a crystal filter are employed to produce the desired degree of selectivity. The receiver features a low impedance AVC, a good noise limiter, two stages of audio amplification, and a 100 kc frequency spotter or calibrator.

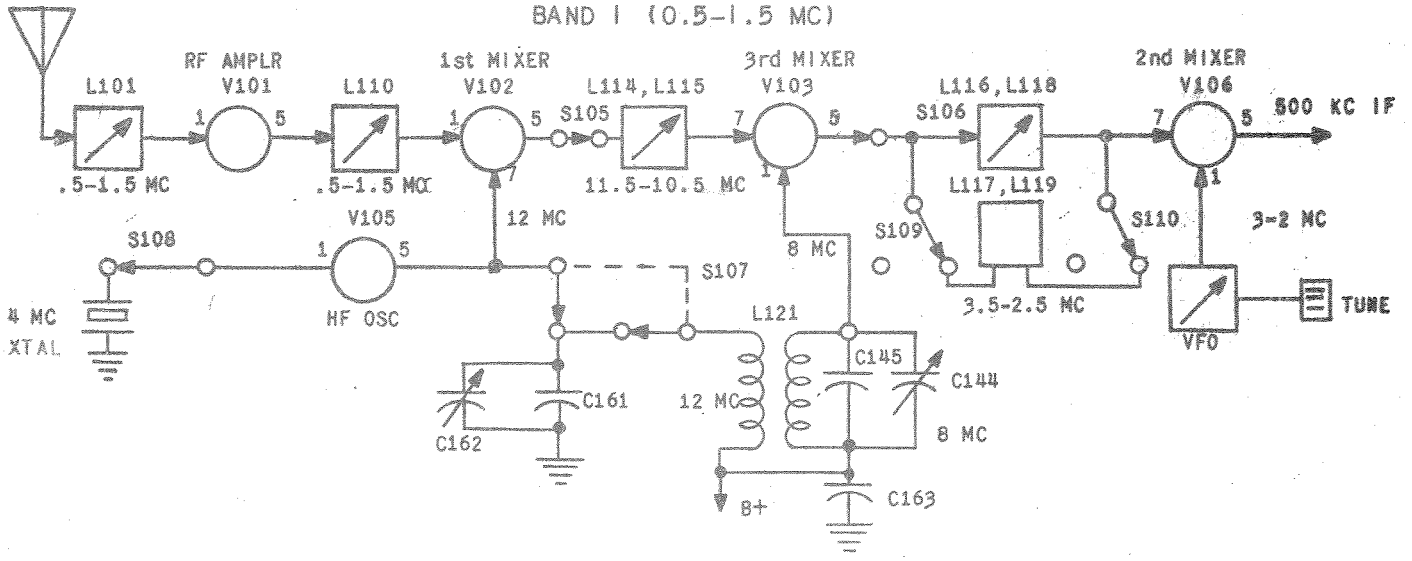
The receiver is built around a dual conversion scheme with variations to obtain full coverage in the most economical fashion. On bands 4 to 30 full dual conversion is employed (these are the bands in which are image rejection problem is best solved by dual conversion). The bands are numbered using the center frequency of the band, therefore, band 1 actually covers .5 to 1.5 mc and band 2 covers 1.5 to 2.5 mc and so on. On bands 2 and 3, where single conversion is adequate the first mixer is disabled and the output of the r-f stage goes directly to the variable i-f coils. The simplest way to work the .5 to 1.5 mc band into the tuning scheme employed for the other bands is to employ an additional mixer stage and use triple conversion for band 1. In this arrangement, the .5 to 1.5 mc band is beat against a 12 mc signal to produce a 11.5 to 10.5 signal which is beat against an 8 mc signal to produce the variable i-f of 3.5 to 2.5 mc (which is then beat against the variable oscillator output to produce the 500 kc fixed i-f signal in the usual manner). The functioning of the various receiver circuits is outlined in more detail in the following paragraphs. Read, also, the receiver description in the first section of this book.

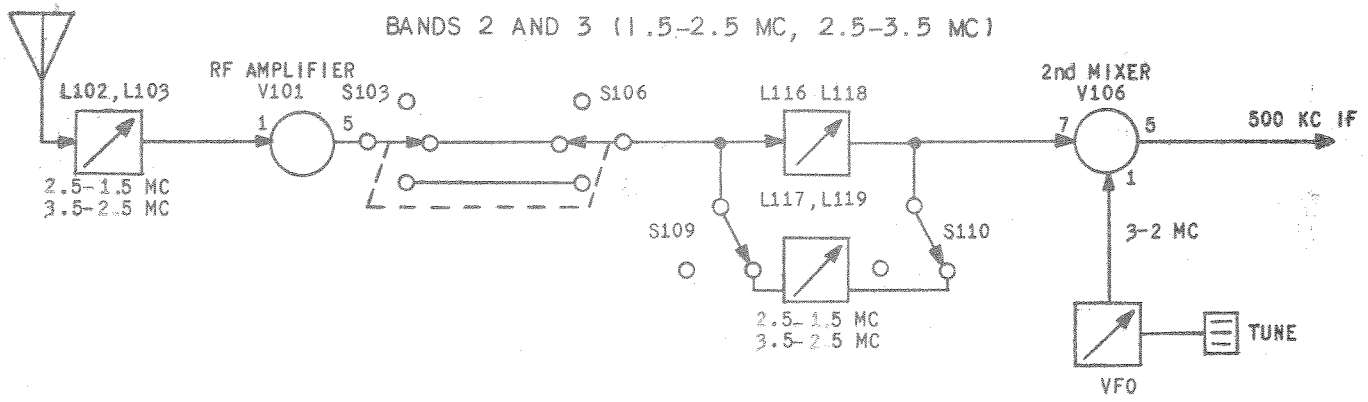
4.2.2. RADIO FREQUENCY AMPLIFICATION. - Refer to the block diagram, figure 4-1. one stage of radio frequency amplification is (V-101) used on all bands. A type 6AK5 miniature r-f pentode is employed in this stage for its low noise and good sensitivity characteristics at high frequencies. The antenna is transformer coupled to the grid of the r-f stage on all bands with a resulting antenna termination impedance of 300 ohms. The r-f coils for bands 1, 2, and 3 are mounted in the variable i-f group and are tuned by slugs mounted on the variable i-f slug table which is at the extreme right hand edge of the receiver as viewed from the front. The coils for bands 4 to 30 are clustered at the rear of the chassis and are tuned by slugs mounted on the three r-f mixer slug tables.

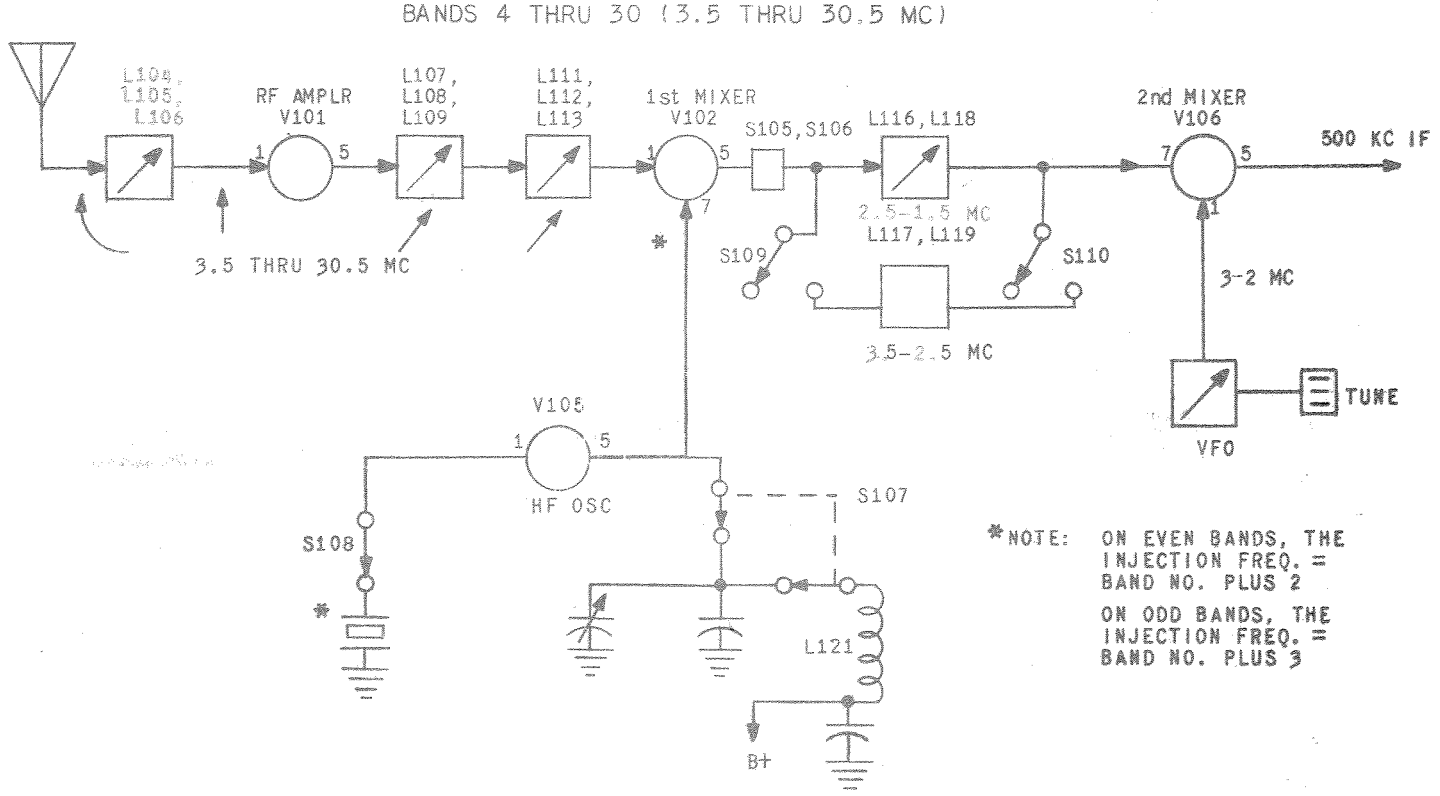
When operating in the American broadcast band (band 1), the plate circuit of the r-f tube is impedance coupled to the grid circuit of the first mixer tube with resistor R-105, capacitor C-117, and inductor L-110. On bands 2 and 3 the plate of the r-f amplifier tube V-101 is switched directly to the primary coils of the variable i-f tuner where additional selectivity is obtained; single conversion being used on these two bands. When operated on bands 4 to 30, the plate circuit of the r-f stage is tuned and transformer coupled to the grid of the first mixer stage.

4.2.3. MIXER STAGES:

(a) FIRST MIXER. - The first mixer stage consists of a type 6BE6 miniature converter tube. This stage is used on band 1 and bands 4 to 30 i.e. 0.5 to 1.5 mc and 3.5 to 30.5 mc but not on bands 2 and 3 (2.5 to 1.5 and 3.5 to 2.5). In the range .5 to 1.5, the grid circuit of this tube is tuned by L-110 and C-118 and C-119. Transformer coupling between the plate of the r-f stage and the grid of the first mixer stage is employed on bands 8 to 15 and 16 to 30. On bands 4 to 7 transformer coupling plus a small amount of capacity coupling, to obtain uniform amplification across the band, is employed. The plate circuit of the first mixer tube V-112 is tuned to either 2.5 to 1.5 mc or 3.5 to 2.5 mc depending upon the band on the receiver which is operating (bands 4 to 30) but is tuned to the 11.5 to 10.5 mc spectrum when the receiver is tuned to the American broadcast band (band 1). On bands 4 to 30, the heterodyning signal for the first mixer is obtained from the crystal oscillator stage, V-105, through the proper crystal oscillator plate tuning coils. On these bands the output of the first mixer is always between 1.5 to 2.5 mc or 2.5 to 3.5 mc. When used on band 1, the first mixer is supplied a 12 mc heterodyning signal from the oscillator tube, V-105, and the output of the first mixer is 10.5 to 11.5 mc which when mixed with an 8 mc signal form the crystal oscillator in the third mixer, produces a 3.5 to 2.5 mc voltage for presentation to the variable i-f coils. The output of the first mixer is switched from the variable i-f coils to the grid of the third mixer by means of switch pies S-105 variable i-f coils to the grid of the thrid mixer by means of switch pies S-105 and S-106.







Frequency Conversion Circuits in the 51J

(b) SECOND MIXER STAGE. - The second mixer stage, V-106 employes a 6BE6 miniature converter tube also. The input to this stage is always either 3.5 to 2.5 mc or 2.5 to 1.5 mc from the variable i-f coils L-116/L-118 and L-117/L-119. The 3 to 2 mc output of the permeability tuned oscillator is fed into the second mixer tube at grid number one to heterodyne against the input signal to produce a 500 kc intermediate frequency. This mixer stage is always used for all bands.

(c) THIRD MIXER STAGE. - The third mixer stage is used only when receiving on band 1. A type 6BE6 miniature converter tube is used in this application also. Grid number 3 of this tube is excited with a 11.5 to 10.5 mc signal from the plate circuit of the first mixer tube, V-101 and grid number one is excited with a heterodyning 8 mc signal from the crystal oscillator. The output of the third mixer is then 3.5 to 2.5 mc which is then fed to the grid of the second mixer through the variable i-f coils; this, of course, only takes place when receiving in band 1 since this stage is not used on the other bands.

4.2.4. HIGH FREQUENCY OSCILLATOR. - The high frequency oscillator uses a 6BA6 remote cut-off miniature pentode tube in a modified Colpitts oscillator circuit. No tuned coils are necessary to make the circuit oscillate, the in-phase feedback voltage being produced across r-f choke L-120. Ten quartz crystals are used to control the frequency of the output of the oscillator for the various bands; at the minimum, each crystal is used for two adjacent bands i.e. 1-2, 3-4, 5-6 and so on, while the harmonics of certain crystals are used additionally for other (higher) bands. For instance, the crystal for bands 5 and 6, and 8 mc crystal, is used for bands 13 and 14 by utilizing its second harmonic at 16 mc. In those instances where harmonic operation is used, a tuned circuit is used to pick off the correct harmonic. This tuned circuit is in the plate circuit of the oscillator tube, V-105 and consists of the primary coil of L-121 and a number of tuning capacitors which are selected for the proper band by switch pie S-107. The secondary of coil L-121 is tuned to 8 mc and is used when operating on band 1 to furnish the third mixer with an eight mc heterodyning signal (second harmonic of the 4 mc crystal): at the same time, the primary of L-121 is tuned to 12 mc (third harmonic of the 4 mc crystal) to furnish the first mixer with the required 12 mc heterodyning signal. A list of the crystals and the bands upon which they function is outlined below:

CRYSTAL FREQUENCY	RECEIVER FREQUENCY	BAND	INJECTION FREQUENCY
4	0.5 to 1.5	1	8 and 12
	1.5 to 2.5	2	4
	2.5 to 3.5	3	6
6	3.5 to 4.5	4	6
8	4.5 to 5.5	5	8
	5.5 to 6.5	6	8
	12.5 to 13.5	13	16
	13.5 to 14.5	14	16
10	6.5 to 7.5	7	10
	7.5 to 8.5	8	10
	16.5 to 17.5	17	20
	17.5 to 18.5	18	20
	26.5 to 27.5	27	30
	27.5 to 28.5	28	30
12	8.5 to 9.5	9	12
	9.5 to 10.5	10	12
	20.5 to 21.5	21	24
	21.5 to 22.5	22	24
14	10.5 to 11.5	11	14
	11.5 to 12.5	12	14
	24.5 to 25.5	25	28
	25.5 to 26.5	26	28
9	14.5 to 15.5	15	18
	15.5 to 16.5	16	18
11	18.5 to 19.5	19	22
	19.5 to 20.5	20	22
13	22.5 to 23.5	23	26
	23.5 to 24.5	24	26
10.6	28.5 to 29.5	29	32
	29.5 to 30.5	30	32

4.2.5. VARIABLE INTERMEDIATE FREQUENCY. - The variable intermediate frequency section consists of two channels, one for a frequency of 2.5 to 1.5 mc and the other for 3.5 to 2.5 mc, each of which contains two tuned circuits. The 2.5 to 1.5 mc i-f is used on the even numbered bands where double conversion is employed and the 3.5 to 2.5 mc i-f is used on the odd numbered bands where double conversion is employed. The 2.5 to 1.5 mc i-f is also used on band 2

as an additional tuned r-f circuit. The 3.5 to 2.5 variable i-f is used on band 3 as an additional tuned r-f circuit and on band 1 in the usual application as a variable i-f for the odd numbered bands. Using two variable i-f channels in this manner cuts the number of crystals necessary in the high frequency oscillator in half, since each crystal fundamental frequency or useful harmonic thereof is used for two bands. Inductors L-116 and L-118 are the lower frequency i-f coils (2.5 to 1.5) and are the coils in which the tuning slug travels. The 3.5 to 2.5 mc i-f frequency is obtained by shunting L-116 with L-117 and L-118 with L-119 to lower the inductances of L-116 and L-118. Switch sections S-109 and S-110 alternately switch in and switch out the shunting coils as the band switch is rotated. The variable i-f coils are in the grid circuit of the second mixer stage.

4.2.6. VARIABLE FREQUENCY OSCILLATOR. - The receiver circuits described so far have the function of receiving the spectrum in 1 megacycle bands which are presented to the grid of the second mixer. The scheme for obtaining high stability is completed by a method of heterodyning the signals to a lower, fixed intermediate frequency. In this application, a highly stabilized 3 to 2 mc permeability tuned oscillator, the Model 70E-15, is employed to heterodyne against the 2.5 to 1.5 and the 3.5 to 2.5 mc output of the variable frequency i-f. The resulting 500 kc signal is amplified by the 500 kc second i-f amplifier.

The coil in the oscillator is cam wound to produce extremely linear frequency change with linear movement of the tuning slug. The circuit is temperature compensated and the components sealed against changes in humidity. Ten turns of the oscillator lead screw produce a linear frequency change of one megacycle. The inductance of the oscillator coil is trimmed by a series inductor, value of which is adjusted with an iron slug. This adjustment is made at the factory and sealed.

A type 6BA6 is used for isolation purposes following the oscillator tube. This isolation tube, V-002, is an integral part of the oscillator chassis.

4.2.7. CRYSTAL FILTER. - The selectivity of the 51J receiver is improved greatly by the use of a crystal filter in the 500 kc i-f system. The filter functions as follows. Refer to figure 7-3. The 500 kc i-f channel input transformer T-101 has a tuned 500 kc primary. The secondary on this transformer is a low impedance coil, the center tap of which is grounded. One stator of phasing capacitor C-188 is attached to one end of this secondary winding while one side of the filter crystal is attached to the other end. A bridge circuit is formed by attaching the rotor or the phasing capacitor to the opposite side of the crystal. This point of attachment must return to ground (or center tap of the secondary coil) to complete the bridge circuit. This is done by means of the selectivity control resistors R-130, R-131, and R-132 and through i-f coil T-102. The bridge circuit is necessary to bal-

ance out the capacity of the crystal holder to prevent the signal from bypassing the crystal. If the point of attachment of the rotor of C-188 and the output plate of the crystal was returned directly to ground, the Q of the crystal would be at its greatest value and the selectivity of the circuit would be too high, therefore, resistors R-130, R-131 and R-132 are placed in series with the crystal at various setting of the selectivity control to vary the Q of the crystal. When the selectivity control is in the "0" position, the crystal is short circuited and the receiver selectivity is determined by the receiver circuits only. When the SELECTIVITY control is in position "1", the crystal Q is at its lowest point because of the return circuit through T-102 (a parallel tuned circuit having high impedance). When the SELECTIVITY control is set at "2", the Q of the crystal circuit is improved because of the lower value of series resistance (R-130 shunting T-102) and so on through positions 3 and 4 until at position 4 the series resistance is at the lowest usable value and the crystal Q is highest with a resultant high degree of selectivity.

Because the phasing capacity is across T-102, detuning of T-102 would normally occur when changing the setting of the phasing condenser. To neutralize this effect, an additional set of stator plates has been placed upon the phasing capacitor which compensates for this detuning effect.

4.2.8. SECOND INTERMEDIATE FREQUENCY. - The second intermediate frequency is fixed tuned to 500 kc. It consists of three stages and employes 6BA6 tubes in all three stages. The input tube V-107 is excited from the crystal filter output coil T-102. Permeability tuned transformers with the output taps taken off the secondary coils near the ground end are used to produce the desired i-f selectivity. All three stages are supplied with AVC voltage.

4.2.9. DETECTOR. - The detector in the 51J receiver consists of one half of a 12AX7 dual triode tube, V-110 (pin numbers 6, 7, and 8). The tube is used as a diode with rectification taking place between the plate and cathode, the grid being connected to the plate. R-150 and R-151 serve as load resistors for the detector while C-202 provides R.F. filtering.

4.2.10. NOISE LIMITER. - A series type noise limiter is used in the 51J receiver. This limiter employes one half (pins 1, 2, and 3) of a type 12AX7 dual triode tube, V-112. Refer to figure 4-3. Due to AC loading of the second detector, heavy noise impulses are automatically clipped from the positive audio peaks in the detector. The noise appearing on the negative side of the audio cycle is clipped by the noise limiter. In operation, a negative voltage produced by rectification of the carrier, is developed across capacitor C-210. This voltage cannot change rapidly due to the size of C-210 and R-152 through which C-210 charged. This negative potential is placed upon the cathode of the noise limiter tube through R-153. The cathode is then negative in respect to the plate of the noise limiter tube and current flows. This current is modulated by the audio which then appears on the noise limiter cathode (to which the grid of the audio amplifier section of V-112 is connected). The noise limiter diode will conduct as long as the

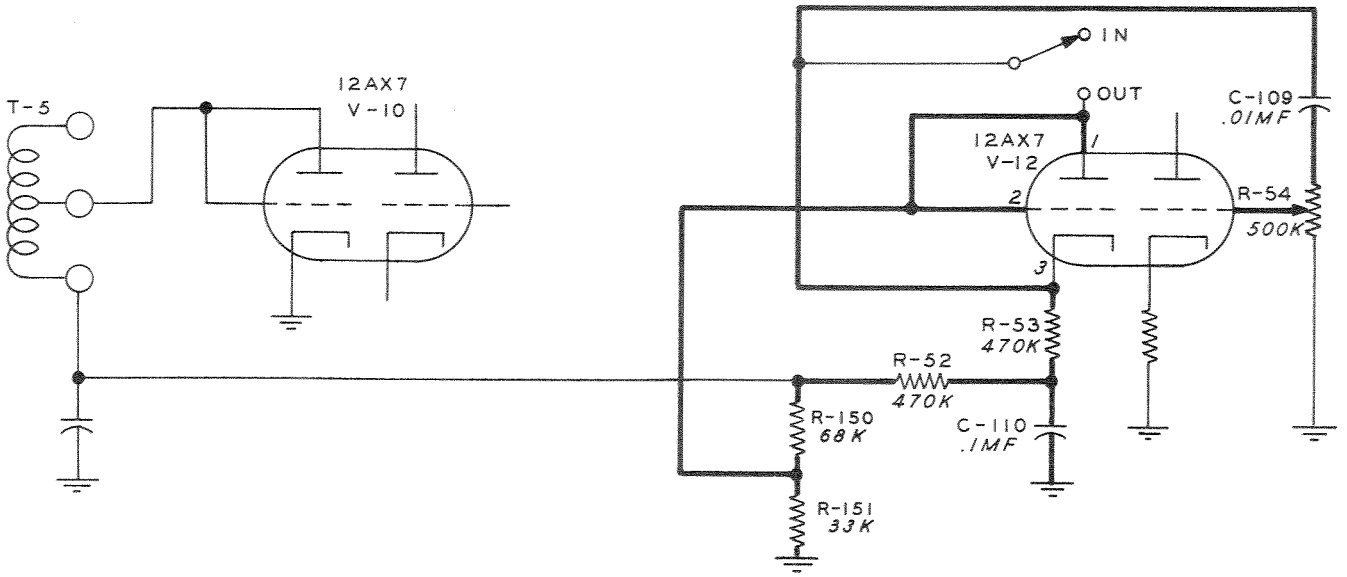


Figure 4-3 Noise Limiter

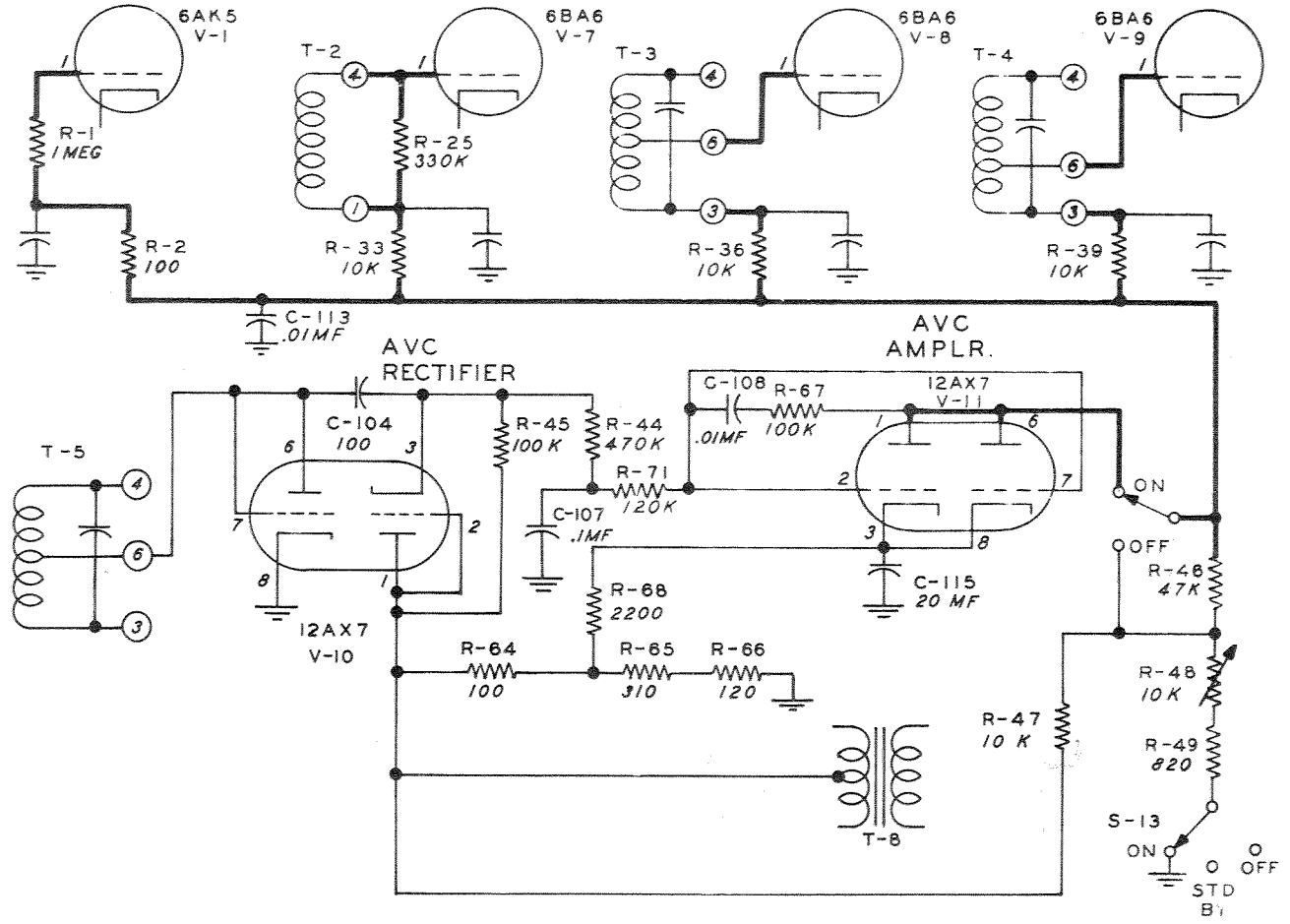


Figure 4-4 AVC Circuit

cathode is negative in respect to the plate, however, should a heavy noise impulse be received, the plate would be driven negative faster than the cathode can follow; (due to the time constant of R-152 and C-210). If the plate is driven more negative than the cathode, the tube will cease to conduct and no audio will reach the grid of the following audio tube. The audio cannot reach the cathode of the limiter tube directly from the bottom of the detector transformer because of the filtering action of R-152 and C-210. The value of modulation at which the limiter clips can be adjusted by changing the value of some of the components in the circuit. In this receiver, limiting starts at approximately 30 percent modulation. Switch S-116 bypasses the signal around the noise limiter when receiving conditions do not require its use.

4.2.11. AUTOMATIC VOLUME CONTROL. - The problem of blocking due to strong signals or heavy static is eliminated by the use of an amplified AVC system and a low impedance AVC line. Refer to figure 4-4. The second triode section of V-110 is used as an AVC rectifier to produce the control voltage for the AVC amplifier tube V-111 which is a dual triode with both sections tied in parallel. The AVC voltage applied to the grids of the controlled tubes is produced by the voltage drop across resistor R-146 when plate current flows through the AVC amplifier tube V-111. Plate voltage for V-111 is obtained from the voltage drop across resistors R-164, R-165 and R-166 which are in series with the center tap of the power transformer to ground. V-111 will not draw plate current, however, with no signal input to the receiver because of approximately 11 volts of bias placed upon its grid by the voltage drop through R-164. This bias voltage for V-111 is taken from the end of R-145 through which the rectified carrier flows in opposition to the bias voltage. Thus, when the rectified carrier becomes strong enough to overcome the bias voltage on V-111, V-111 will draw plate current and produce a voltage drop across R-146 thereby producing AVC voltage in proportion to the strength of the received signal. The bias on the grid of V-111 is high enough to produce adequate delay in the generation of AVC voltage to allow the receiver to function at full sensitivity on weak signals. Resistors R-144 and capacitor C-207 form the time constant in the AVC circuit. R-171, C-208, and R-167 are used in a degenerative circuit to prevent the AVC amplifier tube from responding to low audio frequencies. The AVC is turned off by opening the plate circuit of the AVC amplifier tube V-111. Tubes controlled by the AVC bias include V-101, the r-f amplifier, and V-107, V-108 and V-109 the 500 kc i-f amplifier tubes. Connections are provided at the rear of the chassis so that the current drawn by V-111 can be measured and the AVC systems of two or three receivers may be tied together.

4.2.12. AUDIO AMPLIFIER. - Two stages of audio amplification are employed in the 51J receiver. The first stage utilizes the second triode section of V-112 in a resistance coupled amplifier arrangement. A type

6AQ5 miniature pentode power amplifier tube is used in the audio output stage. This stage has fixed bias obtained from the voltage drop produced across R-166 in the center tap lead of the high voltage transformer secondary. The 500 ohm secondary of the audio output transformer is tapped at 4 ohms to excite the voice coil winding of a speaker directly. Both the 500 ohm and the 4 ohm outputs are terminated on the rear of the chassis at terminal strip E-103. Headphone connections are also made to the 4 ohm tap.

4.2.13. 100 KC CALIBRATOR. - Where extreme accuracy of calibration is wanted (in the order of 200 cycles) a 100 kc calibrator included with the receiver is used. The calibrator utilizes a 6BA6 tube in a Pierce Circuit. The low drift 100 kc crystal is placed between the control grid and the screen grid of the tube, V-104. A 5-25 uuf capacitor C-169 is placed between the grid and ground with which small frequency corrections can be made to set the calibrator zero beat with a primary frequency standard. A variable capacitor, C-224, located on the front panel (CAL) provides vernier frequency adjustments. The calibrator is coupled to the grid of the r-f amplifier tube V-101 and is turned on by operation of S-111 the CALIBRATOR ON-OFF switch.

4.2.14. POWER SUPPLY. - The receiver is designed for A.C. operation only and is furnished connected for 115 volt source. The power supply is capable of 220 volts output at 100 ma. A two section choke input filter is used following a 5V4 high vacuum rectifier. The filter consists of a 3 henry input choke and a 5 henry output choke plus two 35 mfd filter capacitors. B+ for the audio output stage is taken from the junction of the two chokes. The ON-OFF switch for the receiver is located in the primary circuit of the power supply along with a 1 ampere fuse.

The receiver is designed to operate on 230 volts by reconnecting the primary of the power transformer as shown on the schematic, figure 7-3.

6.3 volts a-c are furnished for the tube filaments and dial lights from a winding on the power transformer. 6.3 volts are also available on a connector at the rear of the chassis to supply voltage for the pilot lights in a combining panel.

SECTION 5

MAINTENANCE

5.1. INSPECTION.

5.1.1. GENERAL. - This radio equipment has been constructed of materials considered to be the best obtainable for the purpose and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, a certain amount of checking and servicing will be necessary to maintain efficient and dependable operation. The following section has been written to aid in checking the equipment.

5.1.2. ROUTINE INSPECTION. - Routine inspection schedules should be set up for periodic checks of this equipment. This inspection should include examination of the mechanical system for excessive wear or binding and of the electrical system for electrical defects and deterioration of components.

If the routine inspection of the equipment is carried out faithfully, the chances of improper operation of the equipment are greatly minimized. It is, therefore, important that this inspection be made as frequently as possible and it should be sufficiently thorough to include all major electrical circuits of the equipment as well as the mechanical portion.

5.1.3. CLEANING. - The greatest enemy to uninterrupted service in equipment of this type is corrosion and dirt. Corrosion itself is accelerated by the presence of dust and moisture on the component parts of the assembly. It is impossible to keep moisture out of the equipment in certain localities, but foreign particles and dust can be periodically removed by means of a soft brush and a dry, oil-free jet of air. Remove the dust as often as a perceptible quantity accumulates in any part of the equipment. It is very important that rotating equipment such as variable condensers and tap switches be kept free from dust to prevent undue wear.

One of the greatest sources of trouble in equipment located in a salt atmosphere is corrosion. Corrosion resulting from salt spray or salt laden atmosphere may cause failure of the equipment for no apparent reason. In general it will be found that contacts such as tap switches, tube prongs, cable plug connectors and relay contacts are most affected by corrosion. When it is necessary to operate the equipment in localities subject to such corrosive atmosphere, inspection of wiping contacts, cable plugs, relays etc., should be made more frequently in order to keep the equipment in good condition.

5.1.4. VACUUM TUBES. - Make a check of emission characteristics of all tubes. After the emission check, examine the prongs on all tubes to make sure that they are free from corrosion. See that all tubes are replaced correctly and firmly seated in their sockets, and a good electrical contact is made between the prong of the tube and the socket. Before a tube is discarded, make certain that the tube is at fault and the trouble is not a loose or broken connection within the equipment. A complete set of tested tubes of the same type specified should be kept on hand at all times. If faulty operation of the equipment is observed and tube failure suspected, each tube may be checked by replacing it with a tube known to be in good condition. Defective tubes causing an overload in power circuits may usually be located by inspection. It will be found that excessive heating or sputtering within the vacuum tubes is a good indication of a fault in the tube circuit.

If tubes have been in use for a period of time equal to or exceeding the manufacturers tube life rating, it is suggested that they be replaced. A marked improvement in the performance of the equipment is usually noticeable after the weak tubes have been replaced.

5.1.5. TUBE REPLACEMENT PRECAUTIONS. -

(a) All tubes are removed by pulling straight up on them.

(b) Before a tube is inserted, make certain that the type of tube is correct for the socket into which it is being placed.

5.1.6. TUBE TABLE. -

RECEIVER:

Symbol	Type	Function
V101	6AK5	RF amplifier
V102	6BE6	First mixer
V103	6BE6	Third mixer
V104	6BA6	Calibration oscillator
V105	6BA6 6AK5	Crystal h-f oscillator
V106	6BE6	Second mixer
V107	6BA6	500 kc i-f amplifier
V108	6BA6	500 kc i-f amplifier
V109	6BA6	500 kc i-f amplifier
V110	12AX7	Detector and AVC rectifier
V111	12AX7	AVC amplifier
V112	12AX7	Noise limiter and 1st audio
V113	6AQ5	Audio power amp.
V114	6BA6	Beat frequency oscillator
V115	5V4	Power rectifier
V001	6BA6	Variable frequency oscillator
V002	6BA6	Oscillator isolation amplifier
V116	OA2	

5.2. TROUBLE SHOOTING.

5.2.1. GENERAL. - The most general cause of improper operation of radio equipment is tube failure. Refer to paragraph 5.1.4. in this section for comments concerning vacuum tube replacement. Defective tubes causing an overload in power circuits may usually be located by inspection. Corrosion resulting from operating the equipment in a salt laden atmosphere may cause failure of the equipment for no apparent reason.

In general, trouble encountered in radio apparatus may be isolated by means of various tests and measurements, and the section of the equipment determined in which the trouble is located. If this is done, the components in the associated circuit may be checked and the trouble located. Refer to the table of resistance and voltage measurements.

NOTE

NO ONE BUT AN AUTHORIZED AND COMPETENT SERVICE MAN EQUIPPED WITH PROPER TEST FACILITIES SHOULD BE PERMITTED TO SERVICE THIS EQUIPMENT.

5.2.2. FUSES. - This equipment is supplied with a fuse of the correct rating. Fuse failures should be replaced with spares only after the circuit in question has been carefully examined to make certain that no permanent fault exists. Use 1 ampere fuses only.

5.3. ALIGNMENT.

5.3.1. GENERAL. - Should the receiver get out of alignment, the following procedures may be followed to return it to satisfactory performance.

5.3.2. EQUIPMENT AND TOOLS USED FOR ALIGNMENT. -

(a) 500 kc to 30.5 mc signal generator.

(b) Vacuum tube voltmeter.

(c) Oscilloscope.

(d) Detuning network consisting of a .01 mf capacitor and 4700 ohm resistor in series with slip leads.

(e) Fiber or bakelite adjusting tool, 1/8" diameter with screwdrive type bit.

(f) Fiber or bakelite adjusting tool, 5/16" diameter with screwdriver type bit.

(g) Small screwdriver.

5.3.3. OSCILLATOR TRIMMER ADJUSTMENT. -

(a) Trimmer C-167, marked XTAL on chassis, should be adjusted to provide an input capacity of 32 mmf across the crystal holders. If this capacitor is badly mistuned, the crystals will be off frequency and low in output.

(b) Connect a 470k ohm resistor to pin 7 of V-102. Connect VTVM between free end of 470k ohm and chassis. (Resistor is used to reduce capacity of meter probe).

(c) In all of the following adjustments the trimmers should be peaked if the indicated voltage is not more than 2 volts. If more than 2 volts, detune trimmer toward minimum capacity, until voltage reads 2. See figure 5-1.

(1) Repeat, tuning trimmer marked 30, with bandswitch on band 30.

(2) Repeat, tuning trimmer marked 28, with bandswitch on band 28.

(3) Repeat on bands 26 thru 14 tuning correspondingly marked trimmers.

(4) Repeat, bandswitch on band 1. Adjust trimmer labeled B.C. that is nearer V-105.

(d) Remove 470k ohm resistor V-102. Connect the resistor to pin 1 of V-103. Connect VTVM, between free end of resistor and chassis.

(e) Place bandswitch on band 1. Tune trimmer, marked B.C. that was not previously tuned.

5.3.4. 100 KC OSCILLATOR ALIGNMENT. - Calibrate the 100 kc crystal oscillator by means of the CAL trimmer, C-169, using a secondary frequency standard, D.C. grid voltage on V-104, 15-30 volts minimum.

5.3.5. SECOND I.F. AMPLIFIER ALIGNMENT. - Connect signal generator between grid (pin 7) of V-106 and chassis. Connect one end of a clip lead to output of crystal oscillator, C-173. Hold other end near grid of V-106. Set signal generator to zero beat at 500 kc. Turn off 100 kc oscillator and remove clip lead. Connect detuning network (.01 mf in series with 4700 ohm resistor) from plate of V-107 to chassis. Connect VTVM from diode load resistor, R-151 to chassis. Place S-114 in "0" position.

(a) Tune secondary (bottom) slug of T-103 for maximum indications. Keep diode load voltage below 3 volts by adjusting signal generator output.

(b) Connect detuning network from terminal number 4 of T-103 to chassis. Tune primary (top) slug for maximum indication.

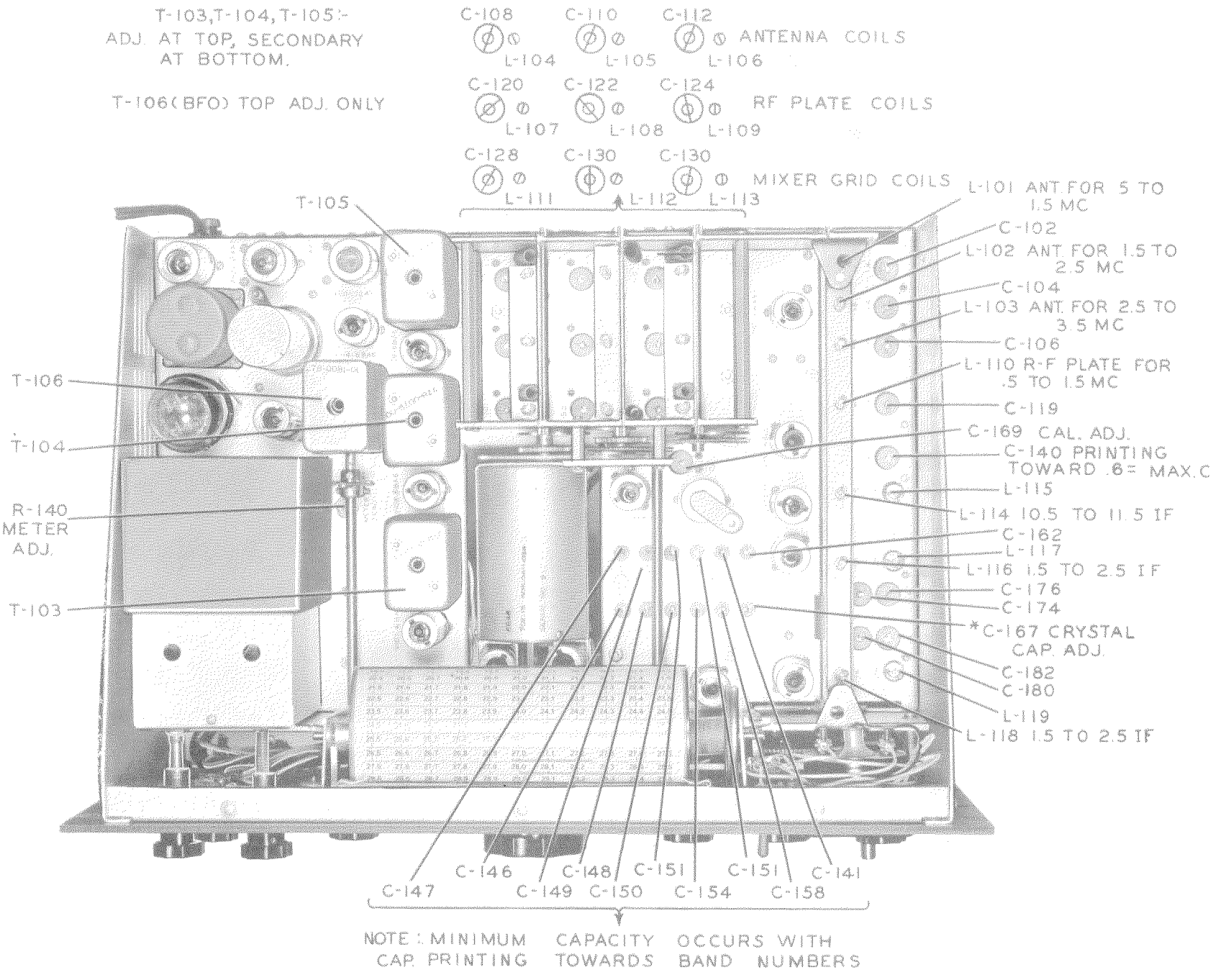


Figure 5-1 Alignment Adjustments

(c) Connect detuning network from plate of V-108 to chassis. Tune secondary of T-104 for maximum indication.

(d) Connect detuning network to terminal 4 to T-104. Tune primary of T-104 for maximum indication.

(e) Connect detuning network to plate of V-109. Tune secondary of T-105 for maximum indication.

(f) Connect detuning network to terminal 4 of T-105. Tune primary of T-105 for maximum indication.

(g) Tune T-101 for maximum VTVM indication.

(h) Turn BFO switch ON, set VFO PITCH condenser capacitor to mid-range. Set index on BFO PITCH knob to index line. Adjust tuning core in T-106 for zero beat.

(i) Align T-102, using a sweep generator and oscilloscope as follows.

(1) Connect signal generator lead to V-106, 6BE6, pin 7. Connect scope lead to diode load resistor, R-151.

(2) Set crystal selectivity switch to position four. Place AVC switch in OFF position. LIMITER switch on OUT. AUDIO GAIN control at minimum.

(3) Place scope BEAM switch ON. Sweep generator should be operating. Synchronize oscilloscope.

a. Two peaks should appear on the scope screen. Rotating the crystal phasing control a quarter turn left and right should split the peaks causing each peak to appear as two peaks.

b. Adjust T-102 until the split peaks appear symmetrical as the phasing control is rotated to the left and right of zero.

5.3.6. SECOND IF AMPLIFIER PERFORMANCE MEASUREMENTS. -

(a) Sensitivity. - The input to V-106 at 500 kc should be within 15-30 uv for 4.0 volts at the diode load.

(b) Selectivity. -

(1) Adjust the output level of the signal generator for 4V at the diode load. Note the AVC voltage on the VTVM and the output level of the signal generator, which are the reference voltages.

(2) Increase the output level of the signal generator 6 db (2X) and determine the bandwidth by noting how far off resonance on each side the signal must be detuned to lower the diode voltage to equal the reference voltage.

(3) Repeat the step for 60 db (1000X) increase in signal input level.

(4) The overall selectivity specifications are:

a. Minimum selectivity

6 db	4.0 kc min	5.0 kc max.
60 db	13.0 kc min	16.0 kc max.

b. Maximum selectivity (crystal filter)

6 db	0.2 kc min	0.3 kc max.
60 db	0.2 kc min	8.0 kc max.

5.3.7. ALIGNMENT OF DIAL AND M.O. - Refer to paragraph 5.3.14 (c) also.

(a) Loosen two front set screws on the 70E-35 oscillator coupler. Turn the oscillator shaft by hand to the extreme clockwise position. DO NOT FORCE.

(b) Turn MC knob to band 1.5 - 2.5. Turn KILOCYCLE knob to set MEGACYCLE pointer at 2.0 mc. Turn zero set KC pointer at center of index line. Loosen set screws in the round kc dial and set to zero-zero. Tighten set screws.

(c) Connect one end of clip lead to pin 7 of V-106. Connect other end to output of 100 kc oscillator (C-173). Turn 100 kc oscillator on.

(d) Rotate 70E-35 oscillator shaft counterclockwise by hand, noting beat note once every revolution. Stop on 6th beat note and carefully set to zero-beat. Tighten oscillator coupler screws.

5.3.8. VARIABLE IF ALIGNMENT. -

(a) Connect signal generator with a 270 ohm series resistor in the lead between terminal 2 and ANT term board and chassis. Jumper terminal 1 to ground on terminal board. Connect VTVM between diode load, R-151 and chassis. Set bandswitch to band 1.5 - 2.5 set dial to read 1.6 mc.

(b) Turn BFO on and set signal generator to zero beat at 1.6 mc. Turn BFO off. Adjust output of signal generator to give some value of diode load voltage below 5 volts. Tune adjustments marked 1.6 (slugs in L-116, L-118 and L-102) for a maximum indication, adjusting signal gen-

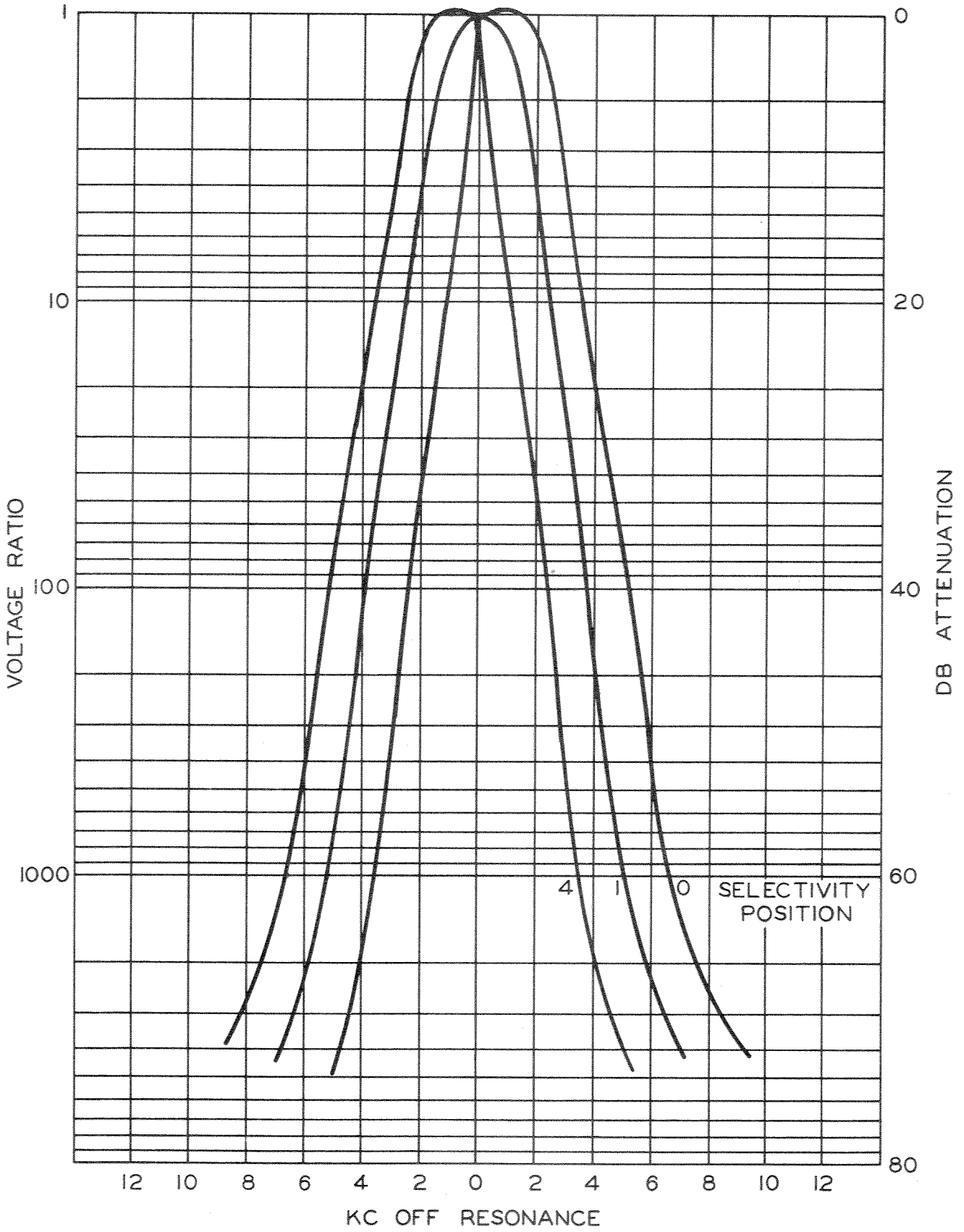


Figure 5-2 Selectivity Curve

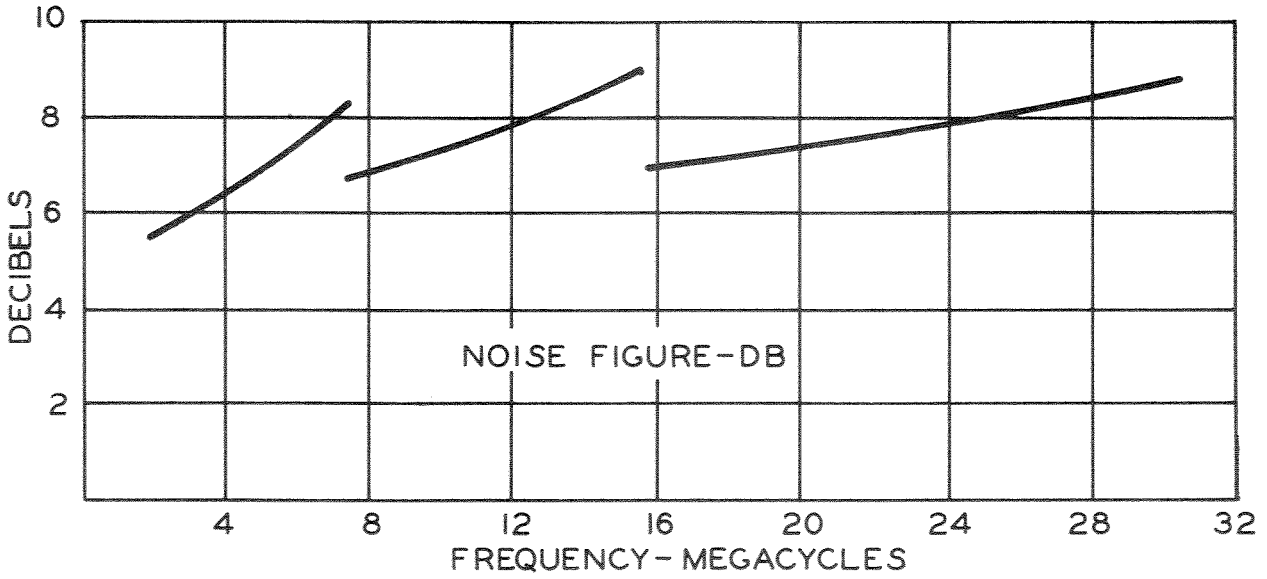


Figure 5-3 Noise Figure Curve

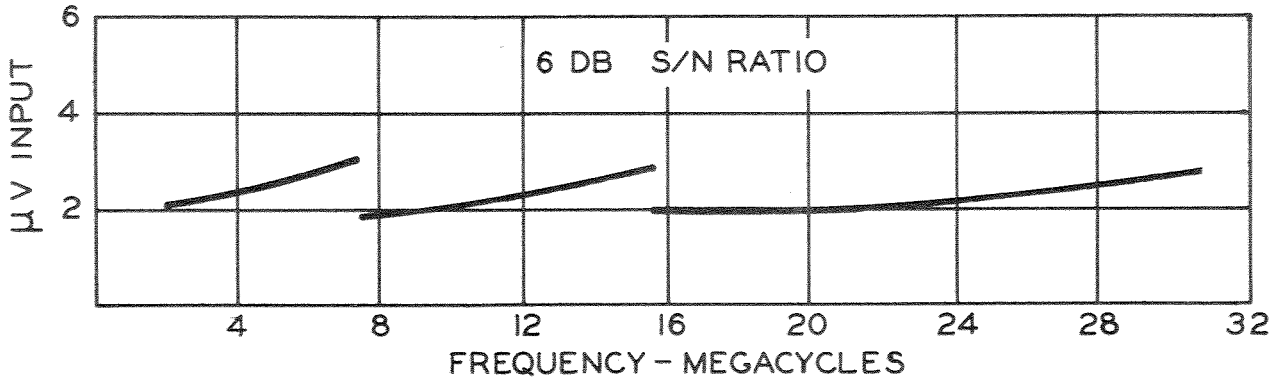


Figure 5-4 Sensitivity Curve

(c) Set dial to read 2.4 mc. Set generator to zero beat at 2.4 mc with BFO. Tune adjustments marked 2.4 (trimmer capacitors C-174, C-180 and C-104) for a maximum indication, keeping diode load voltage below 5 volts.

(d) Repeat tuning procedures at 1.6 and 2.4 mc until no further increase in output can be obtained.

5.3.9. RF ALIGNMENT BAND 3.

(a) Connect the signal generator and VTVM as in step 5.3.8.(a).

(b) Set dial to read 2.6 mc. Set signal generator to zero beat at 2.6 mc with BFO. Adjust adjustments marked 2.6 (tuning cores in L-117, L-119, and L-103) for a maximum indication.

(c) Set dial to read 3.4 mc. Set signal generator to zero beat at 3.4 mc with BFO. Adjust trimmer capacitors marked 3.4 (C-176, C-182, and C-106) for a maximum indication.

5.3.10. RF ALIGNMENT BANDS 4-7.

(a) Connect signal generator and VTVM as in step 5.3.8.(a). Set bandswitch to band 3.4 - 4.5.

(b) Set dial to read 4.0 mc. Set signal generator to zero beat at 4.0 mc with BFO. Adjust tuning cores marked 4.0 (in L-104, L-107 and L-111) for maximum indication.

(c) Set bandswitch to band 6.5 - 7.5. Set dial to read 7.0 mc. Set signal generator to zero beat at 7.0 mc with BFO. Tune trimmer capacitors (marked 7.0) C-108, C-120 and C-128 for maximum indication.

(d) Repeat tuning procedures at 4.0 mc and 7.0 mc until no further increase in output can be obtained.

5.3.11. RF ALIGNMENT BANDS 8-15.

(a) Connect signal generator and VTVM as step 5.3.8.(a).

(b) Set bandswitch to band 7.5 - 8.5. Set dial to 8.0 mc. Set signal generator to zero beat with BFO at 8.0 mc. Tune trimmer capacitors marked 15(C-110, C-122 and C-130) for maximum indication.

(c) Set bandswitch to band 14.5 - 15.5 Set dial to read 15.0 mc. Set signal generator to zero beat with BFO at 15.0 mc. Tune trim-

mer capacitors marked 15(C-110, C-122 and C-130) for maximum indication.

(d) Repeat tuning procedures at 8.0 mc and 15.0 mc until no further increase in output can be obtained.

5.3.12. RF ALIGNMENT BANDS 16-30.

(a) Connect signal generator and VTVM as in step 5.3.8. (a).

(b) Set bandswitch to band 15.5 - 16.5 Set dial to 16.0 mc. Set signal generator to zero beat with BFO at 16.0 mc. Adjust tuning cores marked 16 (in L-106, L-109 and L-113) for a maximum indication.

(c) Set bandswitch to band 29.5 - 30.5 Set dial to 30.0 mc. Set signal generator to zero beat with BFO at 30.0 mc. Adjust trimmer capacitors (C-112, C-124, and C-132) for a maximum indication.

(d) Repeat tuning procedures at 16.0 and 30.0 mc until no further increase in output can be obtained.

5.3.13. RF ALIGNMENT BAND 1.

(a) Connect signal generator and VTVM as in step 5.3.8. (a).

(b) Set bandswitch to band .5 - 1.5 mc. Set dial to 0.6 mc. Set generator to zero beat with BFO at 0.6 mc. Adjust core in L-114 so that it is in approximately the same position in the inductor as the cores in L-116 and L-118. Adjust cores in L-101 and L-110 (marked .6) for a maximum indication. Adjust trimmer capacitor C-440 (marked .6) for a maximum indication.

NOTE

TWO PEAKS MAY BE FOUND WHEN TUNING C-140. USE THE PEAK THAT REQUIRES THE HIGHER VALUE OF CAPACITY. See figure 5-1.

(c) Set dial to 1.4 mc. Set signal generator to zero beat with BFO at 1.4 mc. Tune trimmers C-102 and C-119 (marked 1.4) for a maximum indication. Adjust core in L-115 (marked 1.4) for a maximum indication.

(d) Repeat tuning procedures at 0.6 and 1.4 mc until no further increase in output can be obtained.

5.3.14. OSCILLATOR ALIGNMENT.

(a) GENERAL. - Due to both the inherent stability of the quartz crystals and the careful design of the VFO employed in this receiver, it is quite unlikely that the dial calibration will become inaccurate through

normal use or treatment. However, should the dial calibration become inaccurate, the following paragraphs will enable a service technician with adequate facilities to correct the dial calibration.

(1) If the slide rule calibration (only) is off in the same direction on all bands, follow instructions in paragraph (b).

(2) If the Vernier dial calibration is incorrect by the same amount for all bands follow instructions in paragraph 5.3.14.(c).

(b) DIAL POINTER. - The dial pointer on the slide rule dial can be corrected by grasping the dial cord and sliding the pointer along the dial cord until the correct position for the pointer is found.

(c) VFO ADJUSTMENT. -

(1) GENERAL: -

Warning: Do not attempt to remove outer cover. This is a hermetically sealed unit and the operation will be impaired seriously if the seal is broken. The unit must be returned to the factory for adjustment in case of trouble. The only exceptions would be tube change, which can be effected without breaking the seal, and realignment.

Alignment should be undertaken only as a temporary measure since it breaks the hermetic seal and will effect future stability.

The following will explain the method of alignment of the VFO.

A crystal controlled frequency standard with outputs at 2 mc and 3 mc and with an accuracy of .015 percent may be used. If such is not available, a signal generator tuned to 500 kc may be employed, using the fourth harmonic (2000 kc) and the sixth harmonic (3000 kc). If this is done the thirtieth harmonic of the generator should be set to exact zero beat with WWV at 15 mc. The CAL. oscillator in the 51J may also be used.

If the vernier dial reading is off only 2 or 3 kc in the same direction at both ends of the dial, the VERNIER ADJ. line can be moved to correct this error. If the reading is more than 3 kc in the same direction, the correction can be made by loosening the set screw in the VFO coupler. However, if the error is greater than 3 kc or is not in the same direction by the same amount at both ends of the dial, proceed as follows.

Remove the receiver front panel and remove the oscillator mounting screws. Loosen the set screws in the flexible coupler then slide the coupler hubs apart. Pull the oscillator out and allow it to hang on the connecting wires. Mount a small 0-100 linearly calibrated dial on the oscillator shaft and mount a small wire for use as a pointer on one of the mounting screws. One division of the dial will equal one kilocycle.

There is only one adjustment on the VFO. This is a screw adjustment covered by a threaded hex cap on the front of the oscillator.

To turn the adjusting screw, remove the hex cap, insert the special locking tool, see figure 5-8, unlock the adjustment by turning the tool counterclockwise, insert a screw driver inside the locking tool and make the adjustment. Be sure and lock the adjustment screw after each adjustment. (See figure 5-1). The main object in aligning the VFO is to make the 2 mc and 3 mc points fall exactly ten turns of the vernier dial apart, after which the dial may be loosened, and the dial calibration corrected. Be sure the 500 kc i-f channel is aligned.

(2) PROCEDURE. -

a. Turn the receiver ON and adjust for CW reception, with the VFO in the zero position, in the 3.5 to 4.5 mc band. (Be sure the BFO is aligned as indicated in paragraph 5.3.5.(h) or proper results will be difficult to obtain.)

b. Couple the signal generator to grid number 1 of V-106.

c. Turn the vernier dial and the oscillator dial to the vicinity of 4.5 mc and find the beat note.

d. Write the dial calibration down and turn both dials exactly 10 turns in the opposite direction. There should be another beat note at exactly 10 turns from the first. If this beat note is to either side of the 10 turn figure, take the difference frequency (between the actual beat note reading and the reading where it should have appeared) and multiply it by 1.5. Add this figure to the actual beat note dial setting if the beat note was less than 10 turns or subtract it if the beat note occurred at more than 10 turns. Now set the oscillator dial to this new frequency, remove the hex plug from the front of the oscillator, and turn the adjustment, until zero beat is again reached. The high and low end beat notes should be exactly 10 turns apart. If such is not the case, repeat the above procedure, remembering that a new reference point at the high end of the dial will likely be necessary each time.

Examples of above operations:

Example #1

Beat note at high end of dial	=4499 kc
Reading at which dial should appear after 10 turns	=3499 kc
Actual dial reading	=3498 kc
Difference frequency (3499 - 3498 kc)	= 2 kc
Multiplied by 1.5	= 3 kc
Added to 3498 kc (Since beat note occurred at less than 10 turns)	=3501 kc
After setting dial to 3501 kc and zero beating oscillator and turning the dial back 10 turns to the high frequency end, the high frequency beat note should appear at 4501 kc	

Example #2

Beat note on high end of dial	=4501 kc
Reading at which dial should appear after 10 turns	=3501 kc
Actual dial reading	=3503 kc
Difference frequency (3503 - 3501)	= 2 kc
Multiplied by 1.5	= 3 kc
Subtracted from 3503 kc (Since beat note occurred at more than 10 turns)	=3500 kc

After setting dials to 3500 kc and zero beating oscillator and turning the dials back 10 turns to the high frequency end of the band, the high frequency beat note should appear at 4500 kc.

e. Replace the oscillator in the receiver and replace the front panel. Adjust the oscillator and dial pointer as indicated in paragraph 5.3.7.

NOTES

CHECK THE FREQUENCY OF THE SIGNAL GENERATOR AGAINST WWV SEVERAL TIMES DURING THE VFO ALIGNMENT TO BE SURE IT DOES NOT CREEP.

It will not be necessary to readjust the r-f and i-f amplifiers for small changes in the VFO adjustment.

5.3.15. ADJUSTMENT OF L-124. - This adjustment is reached from the bottom of the chassis. Adjust as follows:

(a) Tune in the spurious signal (whistle) at 1250 kc.

(b) Adjust L-124 for greatest attenuation of the spurious signal.

5.4 VFO REMOVAL.

In event the VFO has to be removed for servicing, the following procedure is recommended.

(a) Remove the front panel and allow to swing forward on wires. (See paragraph 5.6.2.)

(b) Loosen the set screws in the flexible coupler. Pull the coupler apart and remove the center disc from the coupler.

(c) Unsolder the connecting wires.

(d)Remove the three screws holding the oscillator to the chassis.

(e) Slide the VFO unit back and tip the rear downwards.

(f) Pull the VFO from the receiver.

5.5. DIAL BULB REPLACEMENT.

The dial lights for the slide rule dial are mounted in clip type sockets which are clipped to the metal structure above the dial. To

replace these bulbs, slide the clips off the metal structure and pull the sockets out of their respective enclosures. Press down on the bulb slightly and turn it a fraction of a turn counterclockwise. The dial light for the KILOCYCLE dial is also mounted in a clip type socket which can be removed by reaching under the drum of the slide rule dial and grasping the frame of the dial light socket. Slight pressure on the sides of the frame will cause it to release from the receiver structure and it can then be pulled back far enough to replace the bulb.

5.6. DIAL AND BANDSWITCH GEAR MAINTENANCE.

5.6.1. GENERAL. - The replacing and synchronizing of the gears in the dial and band change mechanism of this receiver can be a difficult job. It is recommended that the unit be sent to the factory for servicing should any major repairs be required.

WARNING

IF DISASSEMBLY OF THE GEAR UNIT IS CONTEMPLATED, BE SURE TO MARK THE GEARS SHOWN ON FIGURE 5-5 AS NUMBERS "1, 2, and 3" WITH A CONTINUOUS SCRIBE MARK FROM ONE GEAR TO THE MATING GEAR OR WITH TWO SPOTS OF PAINT, ONE ON EACH GEAR. WITHOUT THIS MARKING, PROPER SYNCHRONIZING OF THE GEARS UPON REASSEMBLY WILL BE IMPOSSIBLE.

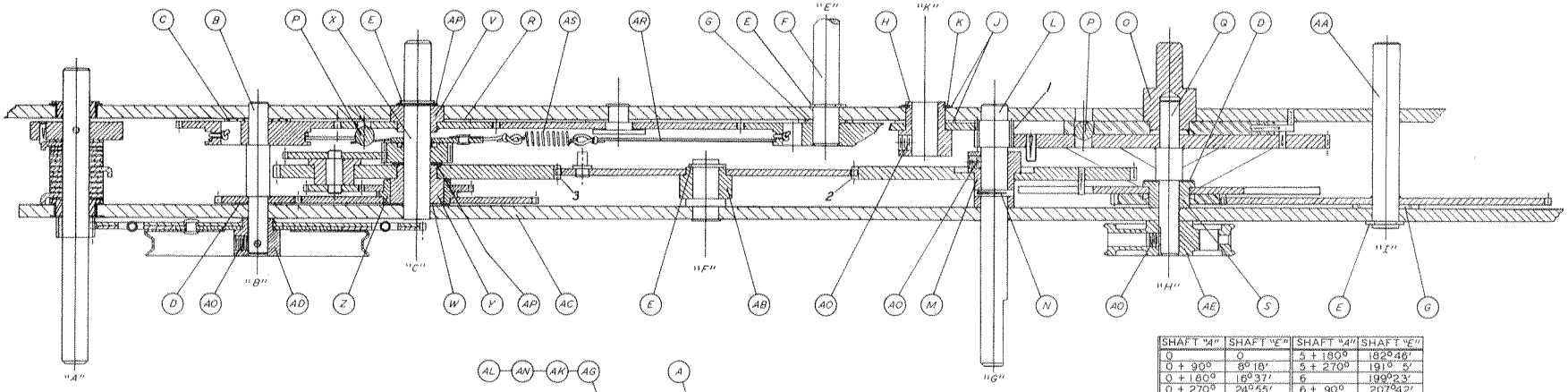
Certain gears have been pinned to the associated shafts in the gear unit and unpinning them is highly impractical. For this reason, the marking of the gears as indicated in the warning above is necessary. The pointer pully assembly gear is split and spring loaded to prevent backlash; when reassembling, extend the take-up springs to lengths of 3/4 inch before meshing the teeth with the mating pinion.

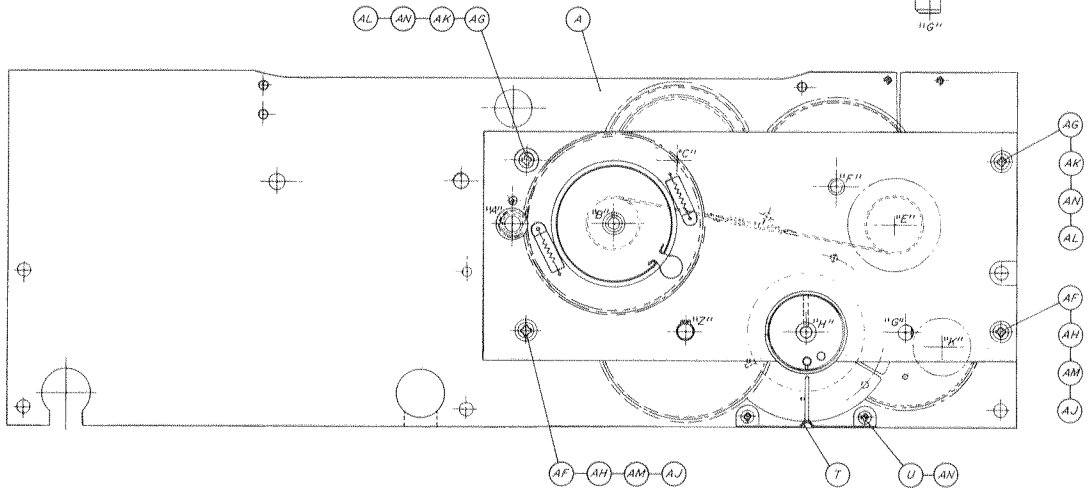
5.6.2. DISASSEMBLY OF GEAR BOX. - In most cases the gear box can be worked on by setting the receiver up on its back and removing the receiver front and right side panels and the front plate of the gear box. If the gear box is to be returned to the company for servicing, the front and the right side panels will have to be taken off and the gear box removed completely. To do this, remove the crystal selectivity, crystal phasing, BFO pitch, band change knobs, the "COLLINS" insignia and the panel screws. Lift the panel off and allow it to hang to one side on the cable wires. Loosen the set screws in the couplers on the oscillator, r-f slug rack, and i-f slug rack shafts. From the under side of the chassis, do the same on the band switch shafts. Remove the oscillator mounting screws and the gear box mounting screws and lift the gear box from the receiver. If repairs are to be made by removing the front plate of the gear box only, remove the two dial cord pulleys first, (dial cord pulley on shaft "B" is pinned to shaft) then remove the retaining ring from shaft "I". Mark the relative positions

ITEM NO.	QUANTITY	PART NO.	PART NAME
A	1	504 3142 003	BACK GEAR PANEL ASSY
B	1	504 3111 002	REV. GEARS & SHAFT ASSY
C	1	504 2973 001	WASHER
D	2	500 2112 002	WASHER
E	4	340 0025 00	RETAINING RING
F	1	504 3014 001	I.F. DRIVER GEAR & SHAFT ASSY
G	2	500 1081 003	WASHER
H	1	504 3004 001	GEAR ASSY-SWITCH, I.F.
J	2	500 1109 003	WASHER
K	1	340 0013 00	RETAINING RING
L	1	504 2956 001	MC KNOB SHAFT
M	1	504 3013 001	KNOB GEAR & HUB ASSY
N	1	311 1122 30	GROOVE PIN

O	1	504 3006 001	SHAFT ASSY-BAND SWITCH
P	2	309 5200 00	BALL-3/16 DIA.
Q	1	504 3012 001	SHAFT ASSY-GENEVA WHEEL
R	1	504 2972 001	THRUST BEARING
S	1	504 3015 001	HUB ASSY-GENEVA WHEEL
T	1	504 2932 001	CENTERING SPRING
U	2	343 0165 00	6-32 X 1/8 PBH SCREW
V	1	504 3018 001	HUB ASSY-DETENT GEAR
W	1	504 2974 001	WASHER
X	1	504 3025 001	DETENT SPRING ASSY
Y	1	504 3020 001	CENTER PLANET-GEAR & HUB ASSY
Z	1	504 3016 001	HUB ASSY-FLOATING
AA	1	504 3005 001	SHAFT & GEAR ASSY
AB	1	504 3009 001	STOP IDLER GEAR HUB ASSY
AC	1	504 3141 003	FRONT GEAR PANEL ASSY

AD	1	504 3024 001	POINTER PULLEY ASSY
AE	1	504 2954 001	PULLEY-DRUM
AF	2	504 2960 001	STANDOFF-LOWER
AG	2	504 2991 001	STANDOFF-UPPER
AH	4	343 0186 00	8-32 X 5/16 SCREW
AJ	4	310 6360 00	WASHER #8 FLAT
AK	4	343 0167 00	6-32 X 1/4 SCREW
AL	4	310 6360 00	WASHER #6 FLAT
AM	4	373 0003 00	WASHER #8 SHAKE
AN	6	373 0001 00	WASHER #6 SHAKE
AO	6	328 0002 00	6-40 X 1/8 SET SCREW
AP	4	500 1112 003	WASHER
AR	1	432 1009 00	LOADING CORD FT.
AS	1	502 1158 002	SPRING

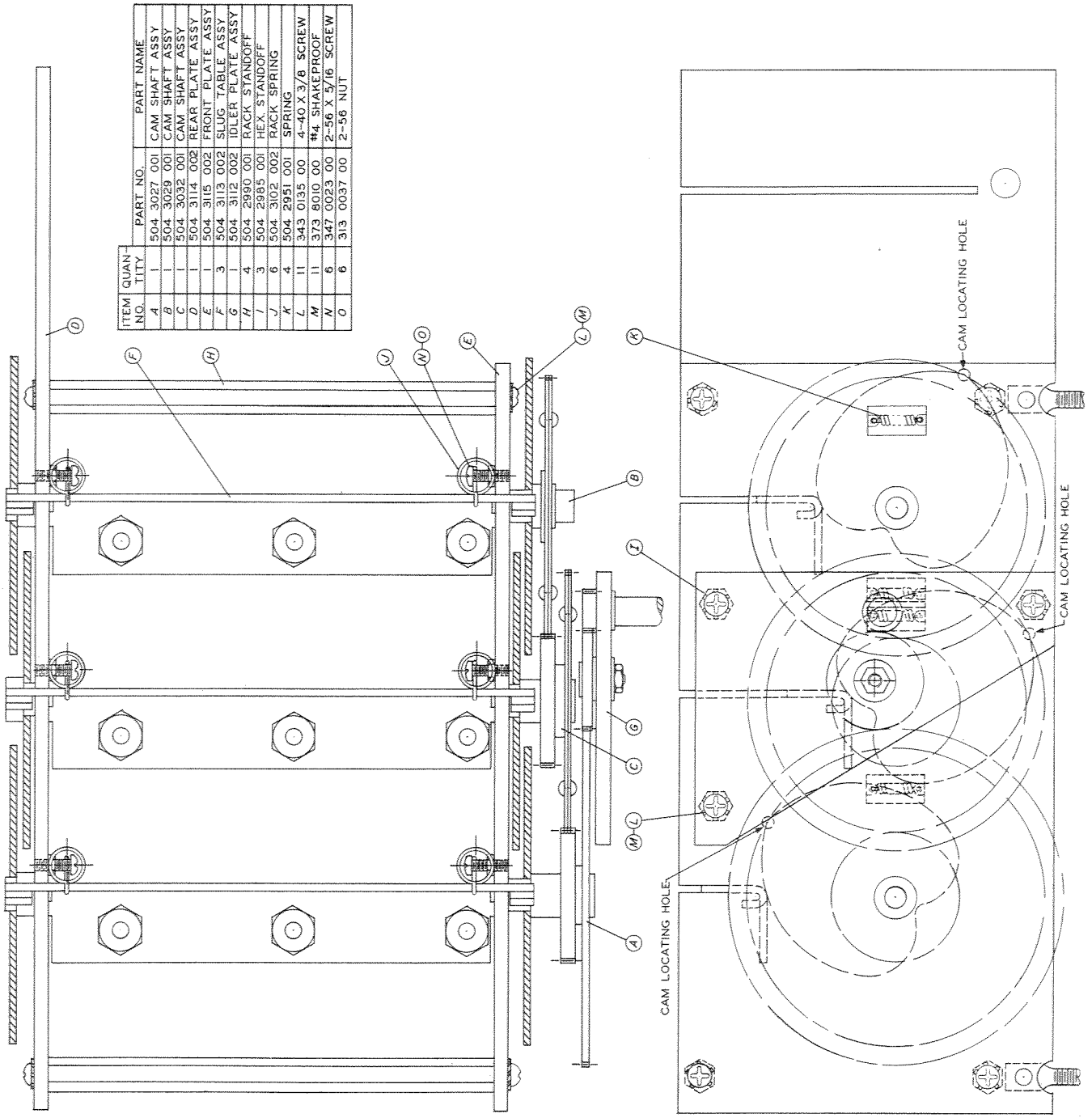




SHAFT "A"	SHAFT "E"	SHAFT "A"	SHAFT "E"
0	0	5 + 180°	182° 46'
0 + 90°	8° 18'	5 + 270°	191° 5'
0 + 180°	16° 37'	6	199° 23'
0 + 270°	24° 55'	6 + 90°	207° 42'
1	33° 14'	6 + 180°	216°
1 + 90°	41° 32'	6 + 270°	224° 18'
1 + 180°	49° 51'	7	232° 37'
1 + 270°	58° 9'	7 + 90°	240° 55'
2	66° 28'	7 + 180°	249° 14'
2 + 90°	74° 46'	7 + 270°	257° 32'
2 + 180°	83° 5'	8	265° 51'
2 + 270°	91° 23'	8 + 90°	274° 9'
3	99° 42'	8 + 180°	282° 28'
3 + 90°	108°	8 + 270°	290° 46'
3 + 180°	116° 18'	9	299° 5'
3 + 270°	124° 37'	9 + 90°	307° 23'
4	132° 55'	9 + 180°	315° 42'
4 + 90°	141° 14'	9 + 270°	324°
4 + 180°	149° 32'	10	332° 18'
4 + 270°	157° 51'	10 + 90°	340° 37'
5	166° 9'	10 + 180°	348° 55'
5 + 90°	174° 28'	10 + 270°	357° 14'

POSITION OF SHAFT "A" GIVEN IN NO. OF TURNS PLUS DEGREES FROM CCW STOP. SHAFT "E" MUST POSITION WITHIN 27' OF ITS SPECIFIED FIGURE FOR EACH INCREMENT OF ROTATION ON SHAFT "A" SETTINGS ON "A" (EXCEPT END POSITIONS) TO BE APPROACHED IN BOTH CW & CCW DIRECTIONS.

Figure 5-5 Dial and Bandswitch Gear Box



ITEM NO.	QUANTITY	PART NO.	PART NAME
A	1	504 3027 001	CAM SHAFT ASSY
B	1	504 3029 001	CAM SHAFT ASSY
C	1	504 3032 001	CAM SHAFT ASSY
D	1	504 3114 002	REAR PLATE ASSY
E	1	504 3115 002	FRONT PLATE ASSY
F	3	504 3113 002	SLUG TABLE ASSY
G	1	504 3112 002	IDLER PLATE ASSY
H	4	504 2990 001	RACK STANDOFF
I	3	504 2985 001	HEX. STANDOFF
J	6	504 3102 002	RACK SPRING
K	4	504 2951 001	SPRING
L	11	343 0135 00	4-40 X 3/8 SCREW
M	11	373 8010 00	#4 SHAKEPROOF
N	6	347 0023 00	2-56 X 5/16 SCREW
O	6	313 0037 00	2-56 NUT

Figure 5-6 R-F Slug Rack Drawing

of the gears at positions "2" and "3" (See WARNING on preceding page). Remove the screws from the front plate and, without disturbing the positions of the shafts, lift the front plate off the gear box and carefully mark the position of the gears at "1". Preceed to make repairs as necessary. Note the condition of the loading cord "AIR" and replace if in poor condition.

5.6.3. ASSEMBLY OF GEAR BOX. - Use AN-G-25 or equivalent grease on all bearing surfaces during assembly. The assembly procedure given here is essentially the procedure used at the factory; the service man should use the steps where they apply. Assembly as shown in figure 5-5. The various shafts can be located in the front view by referring to the letters in quotation marks. The washers, item (W), on shaft "C" and item (D) on shaft "H" are shims and should be used in quantity required to keep end play of respective pieces at resonable minimum.

(a) The loading cord, item (AR) should be cut in half and one end of each piece should be knotted so as to form a small loop for the spring. During assembly, the other end of the cord should be pushed through the hole in the proper drum and knotted. The lengths of the cord (5" between knots) and the amount around each drum should be such that is will allow the stops on shaft "A" to operate before the spring, Item (AS), moves to either drum. The spring may be loaded by disengaging a gear in the affected group and the cord wound up on a drum until the spring exerts a force of 3 inch pounds on shaft "B". Coat the knots with Duco cement.

(b) The centering spring, item (T), should be located so as to hold the slots in the wheel on shaft "H" in the path of the driving pin on shaft "G".

(c) On shaft "H", theradial pin in shaft assembly, item "O", should be placed approximately 60° clockwise from the pin in the rear plate. After the ball, item (P), is assembled, the shaft, item (Q) is assembled with the pin in the gear against the radial pin of item (O) and on the clockwise side. Shim shaft "C" with washers (AP) as shown. Shim so torque of 6 in. lbs. min. is required on shaft "G" for detent disengagement.

(d) With shaft "H" assembled as explained, the two stop pins will be in position shown: one pin up toward shaft "E" and the other 120° clockwise from it. The stop idler gear, item (AB), should be rotated counter-clockwise until its pin approaches the pin on shaft "H" as shown, with the ball detent on shaft "C" in its hole or detented position and with the pin in the gear on shaft "G" directly under the shaft as shown.

(e) Shaft "G" when turned clockwise must hit the stop after approx. 45° rotation. The ball on shaft "C" will now detent shaft "G" every 180°. When shaft "G" rotates counterclockwise 7-1/2 revolutions or 15 detent positions, the pin in the gear on shaft "H" and the radial pin on the shaft assembly, item (O) must have rotated clockwise until the radial pin is just touching or about to touch the pin in the rear plate. Further rotation of shaft "G" will cause the pin in the gear to leave the radial pin stopped by the pin in the rear plate, thus the gear shaft assembly, item (Q) will rotate with the shaft assembly item (O) for 15 detent positions of shaft "G". Shaft "G" should rotate a minimum of 14-1/2 revolutions or 29 detent positions. If the stop pins intersect before this they should be adjusted by changing phase relations of the gears at points "1", "2", and "3".

5.7. BANDSWITCH SLUG RACK MAINTENANCE.

5.7.1. GENERAL. - The bandswitch slug rack will require very little maintenance however, should it be taken apart for any reason, the following information will indicate the correct positions of the cams.

POSITION OF CAMS. - Three alignment holes have been placed in the front plate of the slug rack assembly as indicated in figure 5-6. For correct synchronism of the cams, the tips of the front cams should be directly opposite these holes. It may be necessary to use a dental mirror to obtain an accurate inspection of the cam tips in respect to the holes, however, if one is not available, the positions and operation of the cams may be checked in the following manner.

(a) Turn the BAND SWITCH to band 30 and turn the KC dial to the extreme clockwise position.

(b) Viewing the right hand slug moving cam from the front, the slug table cam rider should be approximately 1/16" to the right of the tip of the cam. The cam rider should descend the right hand edge of the cam.

(c) Operate the BAND SWITCH to band 16 and the KC dial to the extreme counterclockwise position. The cam rider should be on the descending portion of the cam and not bottomed in the low spot of the cam.

(d) Operate the BAND SWITCH to band 15 and the KC dial to the extreme clockwise position.

(e) Viewing the center cam from the front, the cam rider should be positioned about 1/16 inch to the left of the tip of the cam. The cam should descent on the left side of this cam.

(f) Turn the BAND SWITCH to band 8 and the KC dial to the extreme counterclockwise position. The cam rider should be on the descending

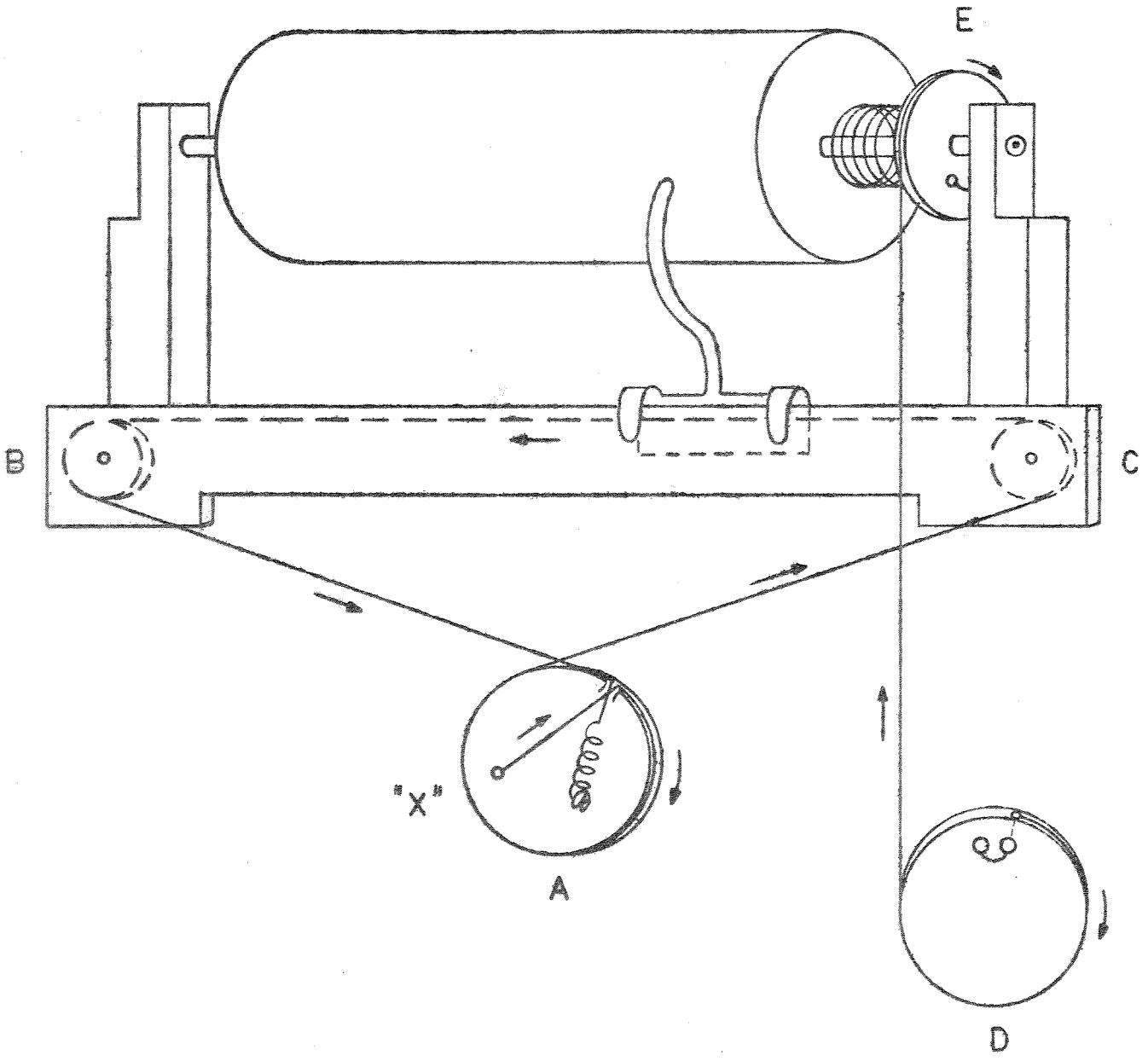


Figure 5-7 Dial Cord Drawing

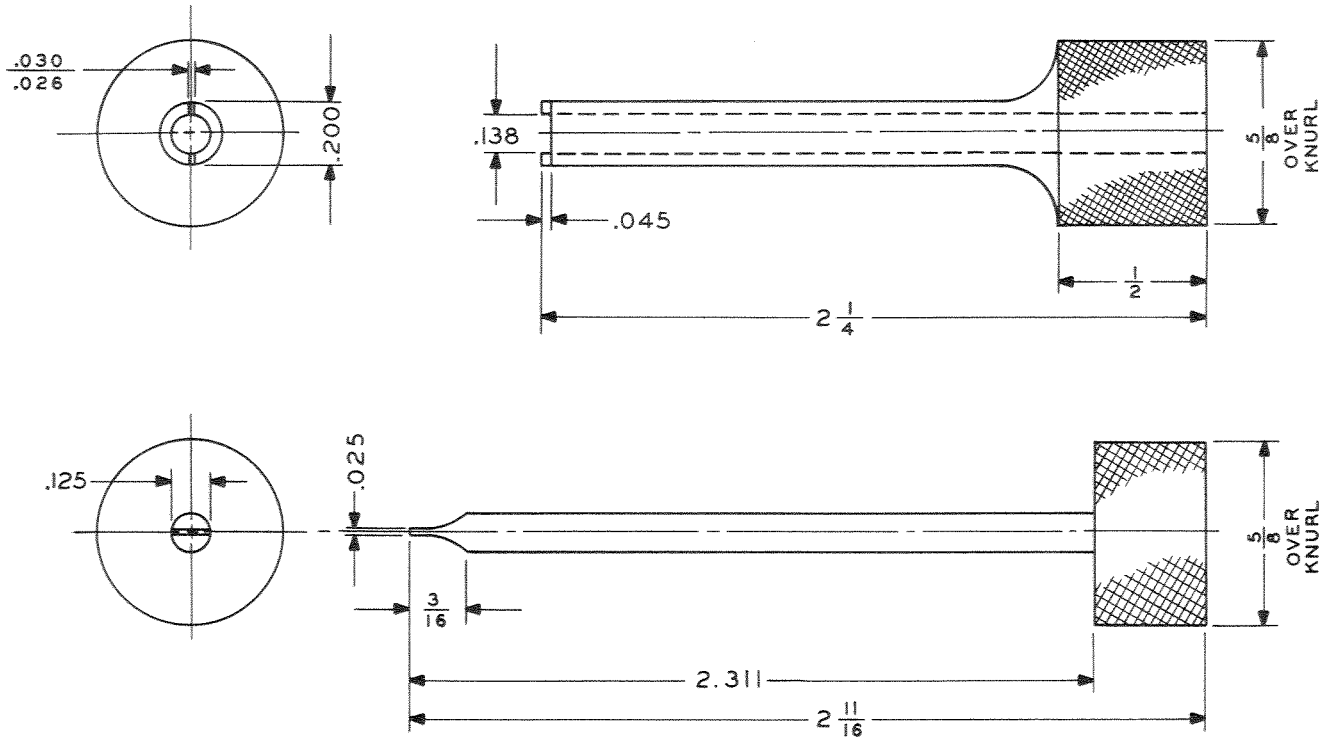


Figure 5-8 VFO Adjustment Tool

portion of the cam and not bottomed on the low spot on the cam.

(g) Repeat the same operations (steps (a) through (c)) using bands 7 and 4 while checking the left hand cam table viewed from the front. The cam rider should descend the right side of the cam.

The cam tables can be synchronized with the band switch by loosening the set screws in the driving coupler.

The electrical alignment of the stages affected by any repair operations should be investigated before the receiver is put into operation again.

5.8. DIAL CORDS.

5.8.1. POINTER CORD. - Refer to figure 5-7. Remove the front panel as outlined in paragraph 5.6.2. If the cord is to be replaced, a 36-5/8" length of Collins number 432 1009 00 nylon covered cord is necessary.

(a) Turn pully "A" counterclockwise to the top.

(b) Tie a loop in the cord. Start at point "X" in the drawing.

(c) Make approximately two turns clockwise on pully "A", continue cord on pully "C", pointer, and pully "B".

(d) Terminate cord on spring on pully "A" with spring at full tension.

(e) Replace panel.

5.8.2. DRUM CORD. - If the drum cord has jumped the pullys, it may be replaced without removing the panel. If the cord is broken, the front panel must be removed as in paragraph 5.6.2. A 27" length of Collins 432 1009 00 nylon covered cord is necessary.

(a) Turn bandswitch to 30 mc band. (Pully "D" clockwise to stop.)

(b) Turn pully "E" approximately 1/2 turn and hold tension of spring.

(c) Loop cord in pully "D". Make approximately 3/4 turn.

(e) Replace panel.

(f) Loosen set screw in drum hub and align dial calibration to 30 MC band, then tighten set screw.

TABLE 5-1

51J-2 TUBE SOCKET RESISTANCE AND VOLTAGE

READINGS FROM SOCKET PIN TO GROUND, A.V.C. ON, NO SIGNAL INPUT

READINGS TAKEN WITH VACUUM TUBE VOLT METER

TUBE	PIN	RESISTANCE	VOLTAGE
V101	1	1,150,000	-1.35
	2,7	GND	0
	3	GND	0
	4	FIL	6.3 AC
	5	58,000	63 BAND 1 (165 ALL OTHERS)
	6	79,000	90
V102	1	2	0
	2	470	+1.5
	3	GND	0
	4	FIL	6.3 AC
	5	40,000	160
	6	90,000	50
	7	330,000	VARIES WITH XTAL INJECTION (-0 to -2V)
V103	1	100,000	0
	2	1500	+4.8
	3	GND	0
	4	FIL	6.3 AC
	5	40,000	175 BAND 1 (0 ON ALL OTHERS)
	6	70,000	90
	7	.1	0
V104	1	68,000	-15 WITH XTAL CALIBRATOR ON
	2,7	4700 WITH 100 Kc OSC. ON	+46 WITH CALIBRATOR OFF +6.5 WITH CALIBRATOR ON
	3	FIL	6.3 AC
	4	GND	0
	5	270,000	70 WITH CALIBRATOR ON 180 WITH CALIBRATOR OFF
	6	150,000	55 WITH CALIBRATOR ON 180 WITH CALIBRATOR OFF
V105	1	100,000	VARIES WITH XTAL (-3 to -10V)
	2,7	9	+.1
	3	GND	0
	4	FIL	6.3 AC
	5	90,000 BAND 2 40,000 BAND 3	18 BAND 2 160 BAND 3
	6	75,000	98 BAND 3 / 92 BAND 2

TUBE	PIN	RESISTANCE	VOLTAGE
V106	1	100,000	-.1
	2	470	+2.0
	3	GND	0
	4	FIL	6.3 AC
	5	38,000	200
	6	70,000	60
	7	.3 BAND 3 .4 BAND 2	0
V107	1	58,000	-1.5
	2,7	GND	0
	3	GND	0
	4	FIL	6.3 AC
	5	35,000	190
	6	24,000	52
V108	1	58,000	-1.5
	2,7	GND	0
	3	GND	0
	4	FIL	6.3 AC
	5	35,000	190
	6	22,000	55
V109	1	58,000	-1.5
	2,7	38,000	+ .3
	3	GND	0
	4	FIL	6.3 AC
	5	35,000	190
	6	85,000	85
V110	1	500	-52
	2	500	-52
	3	100,000	-50
	4	FIL	6.3 AC
	5	FIL	6.3 AC
	6	100,000	-4.0
	7	100,000	-4.0
	8	GND	0
	9	GND	0

TUBE	PIN	RESISTANCE	VOLTAGE
V111	1	470,000	-1.5 AVC ON
	2	700,000	-45
	3	2700	-42
	4	FIL	6.3 AC
	5	FIL	6.3 AC
	6	470,000	-1.5 AVC ON
	7	700,000	-45
	8	2700	-42
	9	GND	0
V-112	1	70,000	-.4
	2	70,000	-.4
	3	70,000 LIMITER OUT 1 MEG. LIMITER IN	-.8 LIMITER IN
	4	FIL	6.3 AC
	5	FIL	6.3 AC
	6	25,000	150
	7	0 500,000 A.F. GAIN	0
	8	3300	+1.8
	9	GND	0
V-113	1	BLANK	0
	2	GND	0
	3	GND	0
	4	FIL	6.3 AC
	5	35,000	210
	6	35,000	210
	7	100,000	-12
V-114	1	90,000	-.5
	2	GND	0
	3	GND	0
	4	FIL	6.3 AC
	5	150,000	200
	6	GND BFO OFF 370,000 BFO ON	0 33
	7	.1	0
V-115	4.6	600	400 AC
	8.2	3500	240

51J-2 RECEIVER

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C-101	L-101 padding	CAPACITOR: mica, 910 mmf ±1%, 500 WV	912 0547 00
C-102	L-101 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-103	L-102 padding	CAPACITOR: mica, 510 mmf ±2%, 300 WV	912 0544 00
C-104	L-102 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-105	L-103 padding	CAPACITOR: mica, 300 mmf ±2%, 500 WV	912 0526 00
C-106	L-103 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-107	L-104 padding	CAPACITOR: mica, 220 mmf ±2%, 500 WV	912 0517 00
C-108	L-104 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-109	L-105 padding	CAPACITOR: mica, 75 mmf ±5%, 500 WV	912 0485 00
C-110	L-105 trimming	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-111	L-106 padding	CAPACITOR: Not used	
C-112	L-106 trimming	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-113	V-101 grid coupling	CAPACITOR: mica, 100 mmf ±5%, 500 WV	912 0494 00
C-114	V-101 grid decoupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-115	V-101 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-116	V-102 grid coupling	CAPACITOR: ceramic, 1.0 mmf ±1/4 mmf, 500 WV	916 4368 00
C-117	V-101 plate coupling, band 1	CAPACITOR: ceramic, 2.0 mmf ± 1/4 mmf, 500 WV	916 4373 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C-118	L-110 padding	CAPACITOR: mica, 910 mmf ±1%, 500 WV	912 0547 00
C-119	L-110 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-120	L-107 trimming	CAPACITOR: Variable ceramic, 8-50 mmf,350 WV	917 1038 00
C-121	L-107 padding	CAPACITOR: mica, 220 mmf, ±2%,500 WV	912 0517 00
C-122	L-108 trimming	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-123	L-108 padding	CAPACITOR: mica, 75 mmf ±5%, 500 WV	912 0485 00
C-124	L-109 trimming	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-125		CAPACITOR: Not used	
C-126	V-101 plate by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-127	L-111 padding	CAPACITOR: mica, 220 mmf, ±2%,500 WV	912 0517 00
C-128	L-111 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-129	L-112 padding	CAPACITOR: mica, 75 mmf ±5%, 500 WV	912 0485 00
C-130	L-112 trimming	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-131	L-113 padding	CAPACITOR: Not used	
C-132	L-113 trimming	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-133	V-102 grid coupling, band 4-7	CAPACITOR: ceramic, 1.5 mmf ±1/4 mmf, 500 WV	916 4370 00
C-134	V-102 cathode by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-135	V-102 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-136	V-102 injection coupling	CAPACITOR: ceramic, 100 mmf, 350 WV	912 0494 00

PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C-137	L-114 to L-115 coupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-138	V-102 plate by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-139	L-115 padding	CAPACITOR: ceramic, 20 mmf, ±5%,500 WV	916 4420 00
C-140	L-115 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-141	V-103 cathode by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-142	V-103 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-143	V-103 injection coupling	CAPACITOR: mica, 100 mmf ±5%, 500 WV	912 0494 00
C-144	L-121 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-145	L-121 padding	CAPACITOR: mica, 150 mmf ±5%, 500 WV	912 0506 00
C-146	Bands 29, 30 harmonic tuning	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-147	Bands 27, 28 harmonic tuning	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-148	Bands 25, 26 harmonic tuning	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-149	Bands 23, 24 harmonic tuning	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-150	Bands 21, 22 harmonic tuning	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-151	Bands 19, 20 harmonic tuning	CAPACITOR: ceramic, 15 mmf ±5%, 500 WV	916 4412 00
C-152	Bands 19, 20 harmonic tuning	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-153	Bands 17, 18 harmonic tuning	CAPACITOR: ceramic, 36 mmf ±5%, 500 WV	916 4448 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C-154	Bands 17, 18 harmonic tuning	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-155	Bands 15, 16 harmonic tuning	CAPACITOR: ceramic, 47 mmf ±5%, 500 WV	916 4463 00
C-156	Bands 15, 16 harmonic tuning	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-157	Bands 13, 14 harmonic tuning	CAPACITOR: ceramic, 68 mmf ±5%, 500 WV	916 4309 00
C-158	Bands 13, 14 harmonic tuning	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-159	Spurious filter tuning	CAPACITOR:	912 0506 00
C-160		CAPACITOR: Not used	
C-161	Bands 1, 2 harmonic tuning	CAPACITOR: mica, 200 mmf ±2%, 500 WV	912 0514 00
C-162	Bands 1, 2 harmonic tuning	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-163	V-105 plate by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-164	V-105 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-165	Osc. feedback network	CAPACITOR: ceramic, 15 mmf ±5%, 500 WV	916 4412 00
C-166	Osc. feedback network	CAPACITOR: mica, 220 mmf ±5%, 500 WV	912 0518 00
C-167	Osc. grid circuit capacity trimmer	CAPACITOR: variable ceramic, 3-12 mmf, 350 WV	917 1035 00
C-168		CAPACITOR: Not used	
C-169	Freq. standard adjusting	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-170	V-104 cathode by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-171	V-104 screen by-pass	CAPACITOR: mica, 220 mmf ±5%, 500 WV	912 0518 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C-165	Osc. feedback network	CAPACITOR: ceramic, 15 mmf ±5%, 500 WV	916 4412 00
C-166	Osc. feedback network	CAPACITOR: mica, 100 mmf ±5%, 500 WV	912 0494 00
C-167	Osc. grid circuit capacity trimmer	CAPACITOR: variable ceramic, 3-12 mmf, 350 WV	917 1035 00
C-168		CAPACITOR: Not used	
C-169	Freq. standard adjusting	CAPACITOR: variable ceramic, 5-25 mmf, 350 WV	917 1036 00
C-170	V-104 cathode by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-171	V-104 screen by-pass	CAPACITOR: mica, 100 mmf ±5%, 500 WV	912 0494 00
C-172	V-104 plate decoupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-173	Freq. standard coupling	CAPACITOR: ceramic, 10 mmf ±1 mmf, 500 WV	916 4406 00
C-174	L-116 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-175	L-116 padding	CAPACITOR: mica, 180 mmf ±2%, 500 WV	912 0511 00
C-176	L-117 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-177	L-117 padding	CAPACITOR: mica, 300 mmf ±2%, 500 WV	912 0526 00
C-178	V-3 plate by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-179	L-118 padding	CAPACITOR: mica, 180 mmf ±2%, 500 WV	912 0511 00
C-180	L-118 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-181	L-119 padding	CAPACITOR: mica, 300 mmf ±2%, 500 WV	912 0526 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C-182	L-119 trimming	CAPACITOR: variable ceramic, 8-50 mmf, 350 WV	917 1038 00
C-183	V-106 cathode by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-184	V-106 grid by-pass	CAPACITOR: mica, 100 mmf ±5%, 500 WV	912 0494 00
C-185	V-106 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-186	V-106 plate by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-187	Filter crystal parallel	CAPACITOR: ceramic, 2.0 mmf ±1/4 mmf, 500 WV	916 4373 00
C-188	Filter crystal phasing	CAPACITOR: variable air, midget, dual section, 10 mmf ±1 mmf max per section	504 7338 001
C-189	V-107 grid decoupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-190	V-107 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-191	V-107 plate by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-192	T-103 top coupling	CAPACITOR: ceramic, 2 mmf ±1/2 mmf, 500 WV	916 4374 00
C-193	V-108 grid decoupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-194	V-108 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-195	V-108 plate by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-196	T-104 top coupling	CAPACITOR: ceramic, 3 mmf ±1/2 mmf, 500 WV	916 4377 00
*C-196	T-104 top coupling	CAPACITOR: ceramic, 5 mmf ±1/2 mmf, 500 WV	916 4385 00
C-197	V-109 grid decoupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
	* wide band sets		

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C-198	V-109 cathode by-pass	CAPACITOR: paper, .1 mf ±10%, 150 WV	931 0333 00
C-199	V-109 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-200	V-109 plate by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-201		CAPACITOR: ceramic, 3 mmf ±1/2 mmf, 500 WV	916 4377 00
*C-201	T-105 top coupling	CAPACITOR: ceramic, 4 mmf ±1/2 mmf, 500 WV	916 4381 00
C-202	Detector filter	CAPACITOR: mica, 330 mmf ±2%, 500 WV	912 0529 00
C-203		CAPACITOR: Not used	
C-204	AVC rectifier coupling	CAPACITOR: mica, 100 mmf ±5%, 500 WV	912 0494 00
C-205	Back bias r-f filter	CAPACITOR: paper, .1 mf ±10%, 150 WV	931 0333 00
**C-206	BFO coupling	CAPACITOR: ceramic, 20 mmf ±5%, 500 WV	916 4420 00
*C-206	BFO coupling	CAPACITOR: mica, 100 mmf ±5%, 500 WV	912 0494 00
C-207	AVC amp. stabilizing	CAPACITOR: paper, .1 mf ±10%, 150 WV	931 0333 00
C-208	AVC amp. stabilizing	CAPACITOR: paper, .1 mf ±10%, 150 WV	931 0333 00
C-209	Audio coupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-210	Noise limiter filter	CAPACITOR: paper, .1 mf ±10%, 150 WV	931 0333 00
C-211	Audio coupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-212	Audio output equalizer	CAPACITOR: mica, 3300 mmf ±10%, 350 WV	935 4074 00
C-213	AVC time constant	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-214	HF oscillator B+ filter	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
	* Wide band sets ** Narrow band sets		

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C-215	V-111 cathode by-pass	CAPACITOR: dry electrolytic, 20 mf, 150 WV.	184 6509 00
C-216	Back bias filter	CAPACITOR: dry electrolytic, 20 mf, 150 WV	184 6509 00
C-217	C-217A and C-217B	CAPACITOR: dry electrolytic, dual section, -10% +250%, 450 WV	184 5000 00
C-217A	Power supply filter	CAPACITOR: 35 mmf, section of C-217	
C-217B	Power supply filter	CAPACITOR: 35 mf, section of C-217	
C-218	V-114 screen by-pass	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-219	V-114 screen decoupling	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
C-220	Variable i-f coupling	CAPACITOR: ceramic, 4.0 mmf ±1/4 mmf, 500 WV	916 4380 00
C-221	Variable i-f coupling	CAPACITOR: ceramic, 2.0 mmf ±1/4 mmf, 500 WV	916 4373 00
C-222	Power supply r-f filter	CAPACITOR: paper, .1 mf ±10%, 400 WV	931 0299 00
C-223	B+ isolation capacitor	CAPACITOR: dry electrolytic, 8 mf, 350 WV	184 6515 00
C-224	Calibration osc. panel adj.	CAPACITOR: variable air, 6-100.5 mmf	922 0024 00
*C-225	V-112 cathode	CAPACITOR: ceramic, 10,000 mmf, 350 WV	913 0566 00
CR-101	Audio level meter rectifier	RECTIFIER: dry disc, instrument type	353 3000 00
E-101		BOARD: Not used	
E-102	Relay terminal	BOARD: terminal, 3 solder lug term	306 0158 00
E-103	Audio output connector	BOARD: terminal, 3 solder lug term	306 0158 00
F-101	Primary power fuse	FUSE: cartridge, 1 amp slow-blow	262 4280 00
I-101	Dial illuminating	LAMP: pilot light, miniature bayonet base bulb, T-3-1/4 bulb	262 3240 00
I-102	Dial illuminating	LAMP: pilot light, miniature bayonet base bulb, T-3-1/4 bulb	262 3240 00
I-103	Dial illuminating	LAMP: pilot light, miniature bayonet base bulb, T-3-1/4 bulb	262 3240 00
I-104	Meter illuminating	LAMP: dial light, 6-8 v, miniature bayonet base bulb, (part of M-101)	
J-101	Headphone output	JACK: phone, 2 circuit, for use with 0.250" diam plug	360 0025 00
J-102	Antenna input connector	RECEPTACLE: Coaxial assembly	357 9005 00
	* An wide band only.		

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L-101	Band 1 antenna	COIL ASSEMBLY: 2 windings, 1st winding asymmetrically wound, 75 turns, secd winding close spaced, 15 turns	504 3038 001
L-102	Band 2 antenna	COIL ASSEMBLY: 2 windings, 1st winding asymmetrically wound, 48 turns, secd winding close spaced, 7 turns	504 3042 001
L-103	Band 3 antenna	COIL ASSEMBLY: 2 windings, 1st winding asymmetrically wound, 42.9 turns, second winding close spaced, 3 turns	504 3045 001
L-104	Band 4 to 7 antenna	COIL ASSEMBLY: 2 windings, 1st winding asymmetrically wound, 20 turns; second winding close spaced, 3 turns	504 3049 001
L-105	Band 8 to 16 antenna	COIL ASSEMBLY: 2 windings, 1st winding asymmetrically spaced, 20 turns second winding close spaced 1-5/6 turns	504 3053 001
L-106	Band 17 to 30 antenna	COIL ASSEMBLY: 2 windings,1st winding asymmetrically wound, 20 turns, second winding close spaced, 1-5/6 turns	504 3054 001
L-107	Band 4 to 7 mixer primary	COIL ASSEMBLY: RF, single winding, 27 turns asymmetrically wound	504 3060 001
L-108	Band 8 to 16 mixer primary	COIL ASSEMBLY: RF, single winding, 20 turns, asymmetrically wound	504 3061 001
L-109	Band 17 to 30 mixer	COIL ASSEMBLY: RF, single winding, 20 turns, asymmetrically wound	504 3062 001
L-110	Band 1 mixer	COIL ASSEMBLY: RF, single winding, 75 turns, asymmetrically wound	504 3056 001
L-111	Band 4 to 7 mixer secondary	COIL ASSEMBLY: RF, single winding, 75 turns asymmetrically wound	504 3060 001
L-112	Band 8 to 16 mixer secondary	COIL ASSEMBLY: RF, single winding, 20 turns asymmetrically wound	504 3061 001

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L-113	Band 17 to 30 mixer secondary	COIL ASSEMBLY: RF, single winding, 20 turns, asymmetrically wound	504 3062 001
L-114	Band 1, 11.5 to 10.5 mc i-f coil	COIL ASSEMBLY: IF, single winding, 48 turns, asymmetrically wound	504 3064 001
L-115	Band 1, 11.5 to 10.5 mc i-f coil	COIL ASSEMBLY: RF, single winding, 16 turns	504 3057 00
L-116	Variable i-f coil primary	COIL ASSEMBLY: IF, single winding, 48 turns, asymmetrically wound	504 3064 001
L-117	Variable i-f coil primary	COIL ASSEMBLY: single winding, 46 turns	504 3066 001
L-118	Variable i-f coil secondary	COIL ASSEMBLY: IF, single winding, 48 turns, asymmetrically wound	504 5347 001
L-119	Variable i-f coil secondary	COIL ASSEMBLY: single winding, 46 turns	504 3066 001
L-120	Crystal oscillator cathode choke	COIL ASSEMBLY: 500 uh, 3 sections of 112 turns each	503 4535 001
L-121	Crystal oscillator harmonic selector	COIL ASSEMBLY: oscillator plate, single winding, 46 turns	504 3074 001
L-122	Input choke	REACTOR: filter, 3.0 hy 0.120 amp, 100 ohm, 90/140 cps	678 0324 00
L-123	Output choke	REACTOR: filter, 5.0 hy 0.080 amp, 300 ohm max, 90/140 cps	678 0323 00
L-124	Spurious filter	COIL: 46 turns #28 wire	504 6646 00
M-101	Signal level and db meter	METER: Signal level, 1 ma, 46 ohm (Includes I-104)	458 0192 00
P-001	VFO Power Connector	BOARD: oscillator terminal, 5 solder lug term	504 5010 00
P-101	AC plug and cord	CORD: 6 ft lg, with 2 conductor AC position	426 1003 00
R-101	V-101 grid return	RESISTOR: 1 megohm ±10%, 1/2 w	745 1212 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R-102	V-101 grid decoupling	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-103		RESISTOR: Not used	
R-104	V-101 screen dropping	RESISTOR: 33,000 ohm ±10%, 1/2 w	745 1149 00
R-105	V-101 plate load, band 1	RESISTOR: 10,000 ohm ±10%, 1/2 w	745 1128 00
R-106	V-101 plate decoupling	RESISTOR: 6800 ohm ±10%, 1/2 w	745 1121 00
R-107	V-102 cathode	RESISTOR: 470 ohm ±10%, 1/2 w	745 1072 00
R-108	V-102 grid 1 return	RESISTOR: .33 megohm ±10%, 1/2 w	745 1191 00
R-109	V-102 screen dropping	RESISTOR: 47,000 ohm ±10%, 1/2 w	745 1156 00
R-110	V-102 plate decoupling	RESISTOR: 2200 ohm ±10%, 1/2 w	745 1100 00
R-111	V-103 cathode	RESISTOR: 1500 ohm ±10%, 1/2 w	745 1093 00
R-112	V-103 grid 1 return	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-113	V-103 screen dropping	RESISTOR: 33,000 ohm ±10%, 1/2 w	745 1149 00
R-114	V-105 screen dropping	RESISTOR: 33,000 ohm ±10%, 1/2 w	745 1149 00
R-115	V-105 grid leak	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-116	V-103 plate load	RESISTOR: 470 ohm ±10%, 1/2 w	745 1072 00
R-117	V-103 plate load	RESISTOR: 47,000 ohm ±10%, 1/2 w	745 1156 00
R-118	V-104 grid leak	RESISTOR: .68 megohm ±10%, 1/2 w	745 1205 00
R-119	V-104 cathode	RESISTOR: 4700 ohm ±10%, 1/2 w	745 1114 00
R-120	V-104 screen dropping	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-121	V-104 plate dropping	RESISTOR: .22 megohm ±10%, 1/2 w	745 1184 00
R-122	V-104 plate, screen decoupling	RESISTOR: 10,000 ohm ±10%, 1/2 w	745 1128 00
R-123	VFO plate, screen decoupling	RESISTOR: 33,000 ohm ±10%, 1/2 w	745 1107 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R-124	V-103 plate decoupling	RESISTOR: 2200 ohm ±10%, 1/2 w	745 1100 00
R-125	V-107 grid load	RESISTOR: .33 megohm ±10%, 1/2 w	745 1191 00
R-126	V-107 screen dropping	RESISTOR: 27,000 ohm ±10%, 1/2 w	745 1146 00
R-127	V-106 cathode	RESISTOR: 470 ohm ±10%, 1/2 w	745 1072 00
R-128	V-106 screen dropping	RESISTOR: 33,000 ohm ±10%, 1/2 w	745 1149 00
R-129	V-106 plate decoupling	RESISTOR: 2200 ohm ±10%, 1/2 w	745 1100 00
R-130	Crystal filter selectivity	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-131	Crystal filter selectivity	RESISTOR: 22,000 ohm ±10%, 1/2 w	745 1142 00
R-132	Crystal filter selectivity	RESISTOR: 4700 ohm ±10%, 1/2 w	745 1114 00
R-133	V-107 grid decoupling	RESISTOR: 10,000 ohm ±10%, 1/2 w	745 1128 00
R-134	V-107 screen bleeder	RESISTOR: 47,000 ohm ±10%, 1/2 w	745 1156 00
R-135	V-107 plate decoupling	RESISTOR: 2200 ohm ±10%, 1/2 w	745 1100 00
R-136	V-108 grid decoupling	RESISTOR: 10,000 ohm ±10%, 1/2 w	745 1128 00
R-137	V-108 screen bleeder	RESISTOR: 47,000 ohm ±10%, 1/2 w	745 1156 00
R-138	V-108 plate decoupling	RESISTOR: 2200 ohm ±10%, 1/2 w	745 1100 00
R-139	V-109 grid decoupling	RESISTOR: 10,000 ohm ±10%, 1/2 w	745 1128 00
R-140	"S" meter zero adjust	RESISTOR: variable wire-wound, 100 ohm ±10%, 2 w	377 0104 00
R-141	V-109 screen dropping	RESISTOR: 47,000 ohm ±10%, 1/2 w	745 1156 00
R-142	V-109 plate decoupling	RESISTOR: 2200 ohm ±10%, 1/2 w	745 1100 00
R-143	BFO injection load	RESISTOR: 10 ohm ±10%, 1/2 w	745 1002 00
R-144	AVC amp. stabilizing	RESISTOR: .47 megohm ±10%, 1/2 w	745 1198 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R-145	AVC rectifier load	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-146	AVC amp load	RESISTOR: 47,000 ohm ±10%, 1/2 w	745 1156 00
R-147	AVC amp plate dropping	RESISTOR: 27,000 ohm ±10%, 1/2 w	745 1146 00
R-148	R-F gain control	RESISTOR: variable, 10,000 ohm ±20%, 1/2 w	376 3522 00
R-149	R-F gain control, fixed	RESISTOR: 820 ohm ±10%, 1/2 w	745 1083 00
R-150	Detector load	RESISTOR: 68,000 ohm ±10%, 1/2 w	745 1163 00
R-151	Detector load	RESISTOR: 33,000 ohm ±10%, 1/2 w	745 1149 00
R-152	Limiter filter	RESISTOR: .47 megohm ±10%, 1/2 w	745 1198 00
R-153	Limiter filter	RESISTOR: .47 megohm ±10%, 1/2 w	745 1198 00
R-154	Audio gain control	RESISTOR: variable, .50 megohm ±20%, 1/4 w	376 4499 00
R-155	V-112 cathode, audio section	RESISTOR: 3300 ohm ±10%, 1/2 w	745 1107 00
R-156	V-112 plate load, audio section	RESISTOR: .22 megohm ±10%, 1/2 w	745 1184 00
R-157	V-113 grid load	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-158	Feedback resistor	RESISTOR: 1 megohm ±10%, 1/2 w	745 1212 00
R-159		RESISTOR: Not used	
R-160	V-114 screen dropping	RESISTOR: .33 megohm ±10%, 1/2 w	745 1191 00
R-161	V-114 plate load	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-162	V-114 plate dropping	RESISTOR: 10,000 ohm ±10%, 1/2 w	745 1128 00
R-163	"S" meter series	RESISTOR: 160 ohm ±5%, 1/2 w	745 1053 00
R-164	Back bias dropping	RESISTOR: wire-wound, 100 ohm ±5%, 8 w	747 0031 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R-165	Back bias dropping	RESISTOR: wire-wound, 310 ohm ±5%, 8 w	747 0036 00
R-166	Back bias dropping	RESISTOR: wire-wound, 120 ohm ±5%, 8 w	747 0032 00
R-167	AVC amp stabilizing	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-168	V-111 cathode	RESISTOR: 2200 ohm ±10%, 1/2 w	745 1100 00
R-169	V-108 screen dropping	RESISTOR: 27,000 ohm ±10%, 1/2 w	745 1146 00
R-170	"S" meter bridge	RESISTOR: 100 ohm ±10%, 1/2 w	745 1044 00
R-171	AVC amp stabilizing	RESISTOR: 120,000 ohm ±10%, 1/2 w	745 1174 00
R-172	Static drain	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
R-173	Audio voltage dropping	RESISTOR: 2200 ohm ±10%, 1/2 w	745 1100 00
R-174	B+ isolation resistor	RESISTOR: 1000 ohm ±10%, 2 w	745 5086 00
*R-175	I-F loading	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
*R-176	I-F loading	RESISTOR: .10 megohm ±10%, 1/2 w	745 1170 00
S-101	Antenna coil selecting	SWITCH: rotary, 1 circuit, 18 position	269 1273 00
S-102	R-F coil selecting	SWITCH: rotary, 1 circuit, 17 position	269 1271 00
S-103	RF amp plate coil selecting	SWITCH: rotary, 1 circuit, 17 position	269 1271 00
S-104	Mixer grid coil selecting	SWITCH: rotary, 1 circuit, 17 position	269 1271 00
S-105	Mixer plate circuit selecting	SWITCH: rotary, 1 circuit, 18 position	269 1273 00
S-106	Mixer plate circuit selecting	SWITCH: rotary, 1 circuit, 18 position	269 1273 00
S-107	Crystal osc harmonic selecting	SWITCH: rotary, 2 circuit, 15 position	269 1272 00
S-108	Crystal selecting	SWITCH: rotary, 1 circuit, 17 position	269 1271 00

* Wide band set

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S-109	Variable i-f selecting	SWITCH: rotary, 1 circuit, 2 position	269 1270 00
S-110	Variable i-f selecting	SWITCH: rotary, 1 circuit, 2 position	269 1270 00
S-111	Calibrator ON-OFF	SWITCH: rotary, 2 circuit, 2 position	259 0380 00
S-112	BFO ON-OFF	SWITCH: rotary, 2 circuit, 2 position	259 0380 00
S-113	Receiver ON-Standby-OFF	SWITCH: band change, 2 circuit, shorting, 3 position	259 0381 00
S-114	Selectivity Switch	SWITCH: band change, 1 circuit, shorting, 5 position	259 0379 00
S-115	AVC ON-OFF	SWITCH: rotary, 2 circuit, 2 position	259 0380 00
S-116	Noise limiter IN-OUT	SWITCH: rotary, 2 circuit, 2 position	259 0380 00
S-117	Meter Switch	SWITCH: toggle; DPDT, 30 amp continuous	266 3062 00
T-101	Crystal filter input	TRANSFORMER: crystal filter, frequency range 490-510 kc	278 0080 00
T-102	Crystal filter output	COIL ASSEMBLY: crystal filter grid, frequency range 490-510 kc	278 0078 00
T-103	First I-F	TRANSFORMER: IF diode, frequency range 490-510 kc	278 0079 00
T-104	Second I-F	TRANSFORMER: IF diode, frequency range 490-510 kc	278 0079 00
T-105	Third I-F	TRANSFORMER: IF diode, frequency range 490-510 kc	278 0079 00
T-106	BFO	TRANSFORMER: BFO, for use with 500 kc IF amplifier	278 0081 00
T-107	Audio output transformer	TRANSFORMER: Audio, pri 600 ohm, secd 30,000 ohm CT, 1000 TV	677 0057 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS COLLINS NUMBER
T-108	Power transformer	TRANSFORMER: pri 115 v, secd #1: 5.0 v, secd #2: 6.3 v, secd #3: 700 v CT, 2500 TV, 45/70 cps	672 0326 00
V-101	R-F Amp.	TUBE: Type 6AK5, pentode JAN COMMERCIAL	254 0121 00 257 0040 00
V-102	First mixer	TUBE: Type 6BE6, pentagrid JAN COMMERCIAL	254 0799 00 257 0048 00
V-103	Third mixer	TUBE: Type 6BE6, pentagrid JAN COMMERCIAL	254 0799 00 257 0048 00
V-104	Crystal calibrator	TUBE: Type 6BA6, pentode JAN COMMERCIAL	254 0787 00 255 0185 00
V-105	Crystal oscillator	TUBE: Type 6BA6, pentode JAN COMMERCIAL	254 0787 00 255 0185 00
V-106	Second mixer	TUBE: Type 6BE6, pentagrid converter JAN COMMERCIAL	254 0799 00 257 0048 00
V-107	First I-F	TUBE: Type 6BA6, pentode JAN COMMERCIAL	254 0787 00 255 0185 00
V-108	Second I-F	TUBE: Type 6BA6, pentode JAN COMMERCIAL	254 0787 00 255 0185 00
V-109	Third I-F	TUBE: Type 6BA6, pentode JAN COMMERCIAL	254 0787 00 255 0185 00
V-110	Detector and AVC rectifier	TUBE: Type 12AX7, twin triode JAN COMMERCIAL	254 0790 00 255 0201 00
V-111	AVC amplifier	TUBE: Type 12AX7, twin triode JAN COMMERCIAL	254 0790 00 255 0201 00
V-112	Noise limiter - first audio	TUBE: Type 12AX7, twin triode JAN COMMERCIAL	254 0790 00 255 0201 00
V-113	Audio output	TUBE: Type 6AQ5, pentode JAN COMMERCIAL	254 0788 00 255 0195 00
V-114	BFO	TUBE: Type 6BA6, pentode JAN COMMERCIAL	254 0787 00 255 0185 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
V-115	Power supply rectifier	TUBE: Type 5V4G, rectifier JAN COMMERCIAL	254 0102 00 255 0081 00
XC-217	Socket for C-217	SOCKET: Tube, octal, mtg plate molded in	220 1850 00
XF-101	Holder for F-101	HOLDER: fuse, extractor post, for single 3AG fuse	265 1002 00
XI-101 XI-102	Holders for I-101, I-102	SOCKET: lamp, pilot light bracket, miniature bayonet base	262 1210 00
XI-103	Holder for I-103	SOCKET: lamp, pilot light assembly, miniature bayonet base	262 0150 00
XV-101 XV-102 XV-103 XV-104 XV-105 XV-106 XV-107 XV-108 XV-109	Socket for V-101, V-102, V-103, V-104, V-105, V-106, V-107, V-108, V-109	SOCKET: tube, 7 contact miniature shielded	220 1069 00
XV-110 XV-111 XV-112	Socket for V-110, V-111, V-112	SOCKET: tube, 9 contact shielded	220 1087 00
XV-113	Socket for V-113	SOCKET: tube 7 cont miniature shielded	220 1069 00
XV-114	Socket for V-114	SOCKET: tube, 7 cont miniature shielded	220 1069 00
XV-115	Socket for V-115	SOCKET: tube, octal, mtg plate molded in	220 1850 00
XY-101 thru XY-110	Socket for Y-101 thru Y-110	BOARD: crystal, accom 10 type CR-18/U crystals	504 5009 00
XY-111	Socket for Y-111	SOCKET: crystal, for 100 kc crystal	292 0055 00
Y-101	Bands 29 and 30 crystal	CRYSTAL: Type CR-18/U, 10.67 mc	291 6608 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
Y-102	Bands 23 and 24 crystal	CRYSTAL: Type CR-18/U, 13.00 mc	291 6613 00
Y-103	Bands 19 and 20 crystal	CRYSTAL: Type CR-18/U, 11.00 mc	291 6609 00
Y-104	Bands 15 and 16 crystal	CRYSTAL: Type CR-18/U, 9.00 mc	291 6612 00
Y-105	Bands 11 and 12, 25 and 26 crystal	CRYSTAL: Type CR-18/U, 14.00 mc	291 6611 00
Y-106	Bands 9 and 10, 21 and 22 crystal	CRYSTAL: Type CR-18/U, 12.00 mc	291 6610 00
Y-107	Bands 7 and 8, 17 and 18, 27 and 28 crystal	CRYSTAL: Type CR-18/U, 10.00 mc	291 6607 00
Y-108	Bands 5 and 6, 13 and 14 crystal	CRYSTAL: Type CR-18/U, 8.00 mc	291 6605 00
Y-109	Bands 3 and 4 crystal	CRYSTAL: Type CR-18/U, 6.00 mc	291 6602 00
Y-110	Bands 1 and 2 crystal	CRYSTAL: Type CR-18/U, 4.00 mc	291 6601 00
Y-111	Calibration crystal	CRYSTAL: Special, 100 kc	291 5954 00
Y-112	Filter crystal	CRYSTAL: Type CR-7, 500 kc	291 5175 00
70E-7A		This unit has been dehydrated and hermetically sealed, and should be returned to the Collins Radio Company, if servicing is required.	

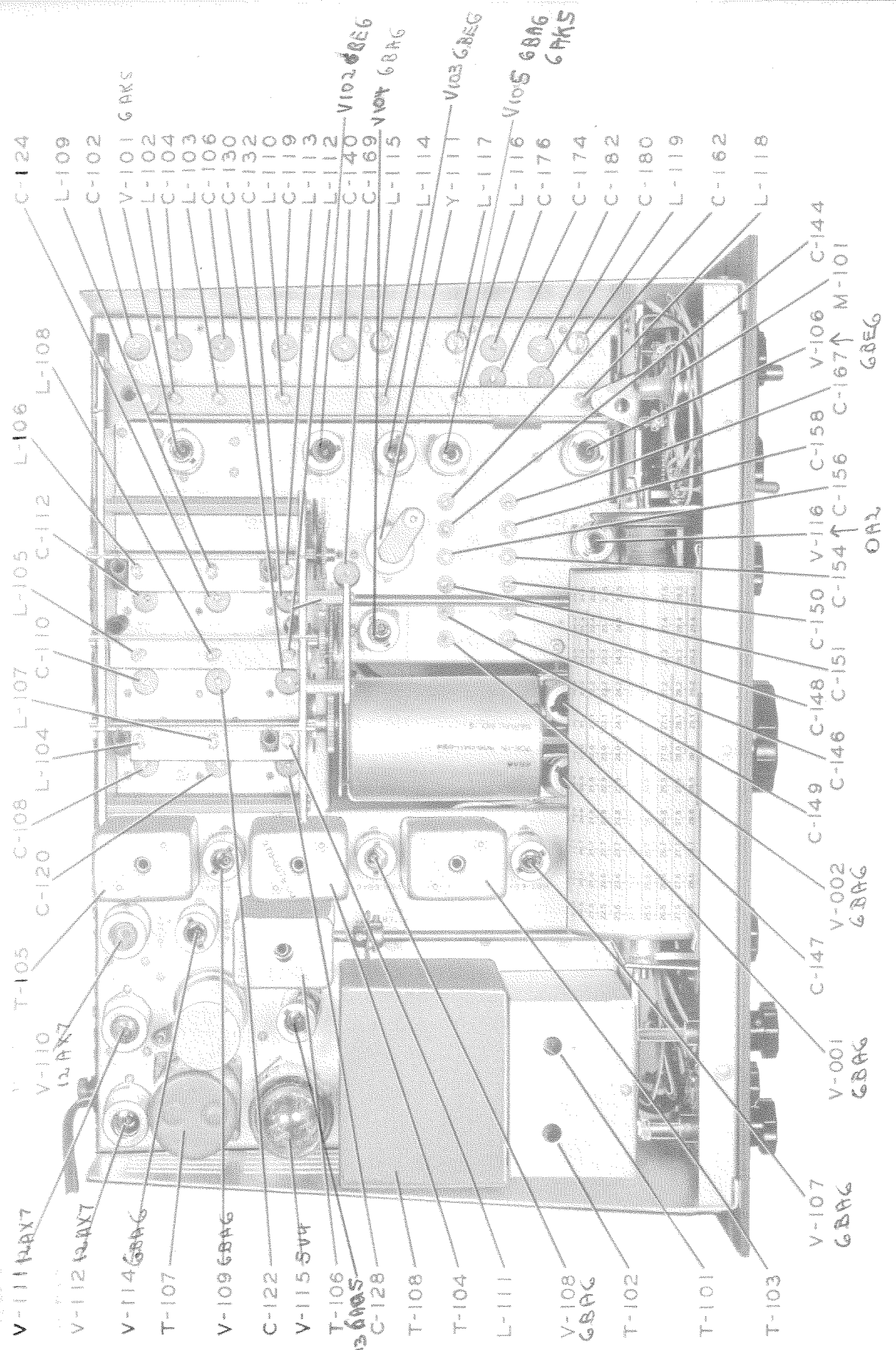


Figure 7-1 51J, Top View

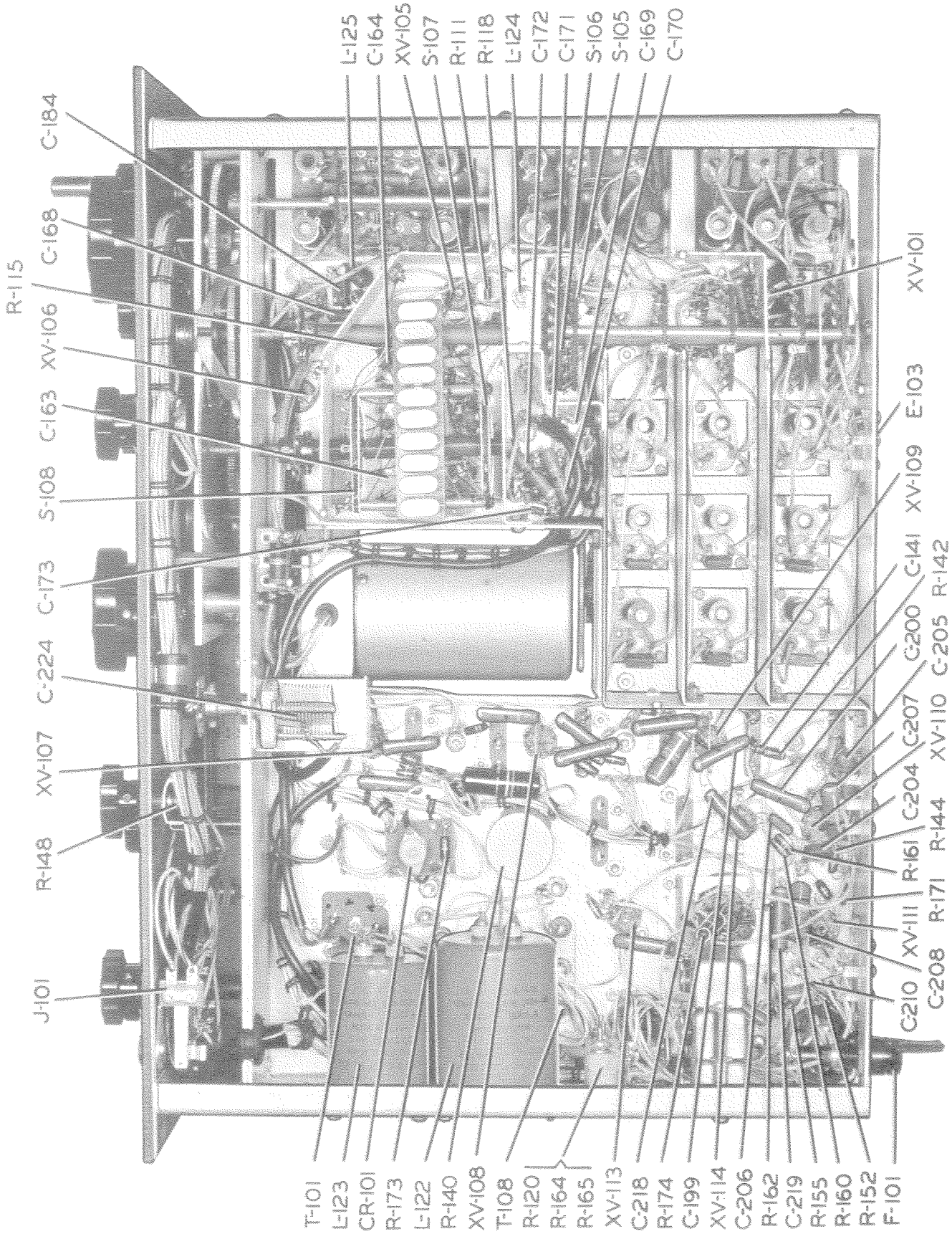


Figure 7-2 51J, Bottom View (Page 1 of 2 Pages)

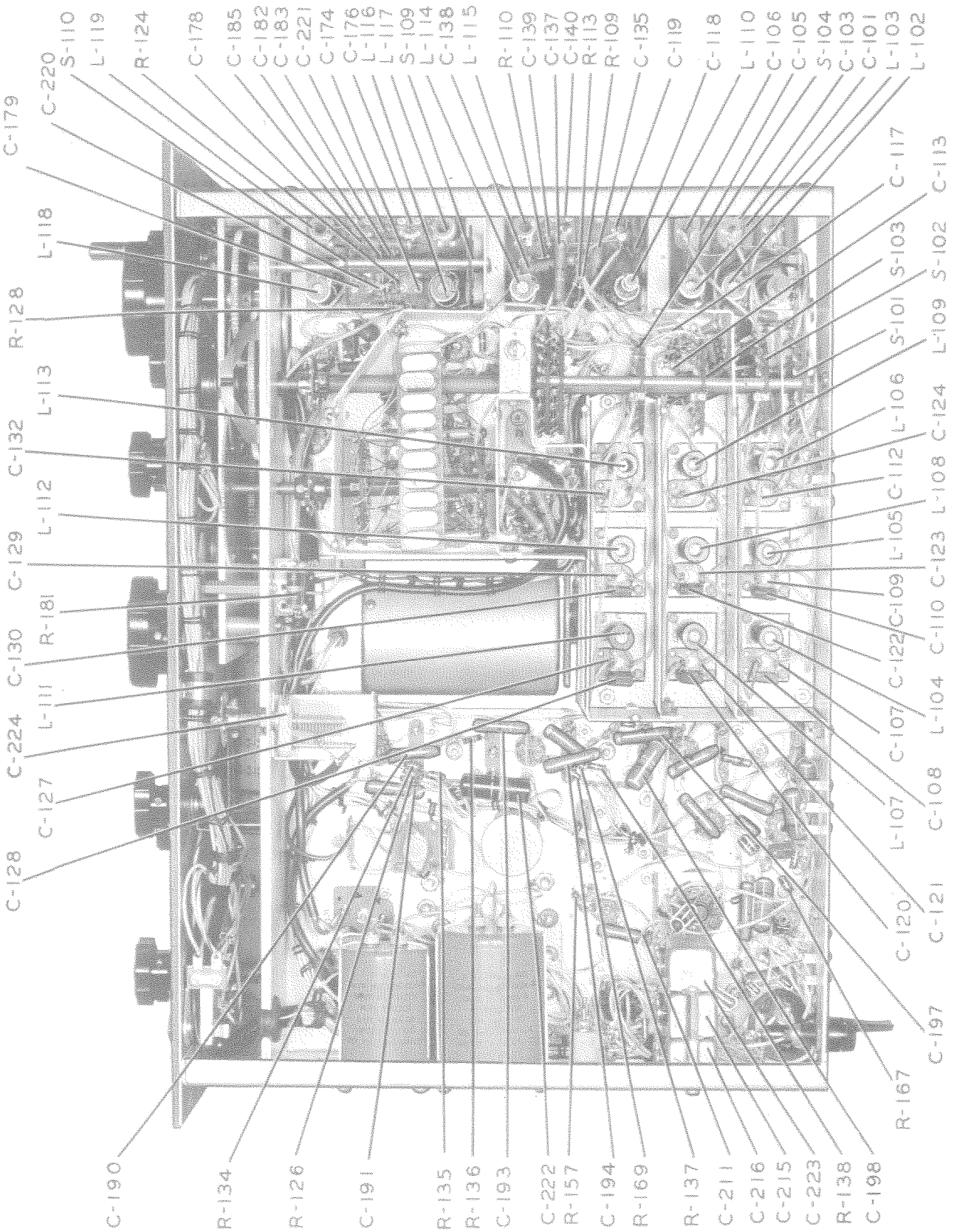


Figure 7-2 51J, Bottom View (Page 2 of 2 Pages)

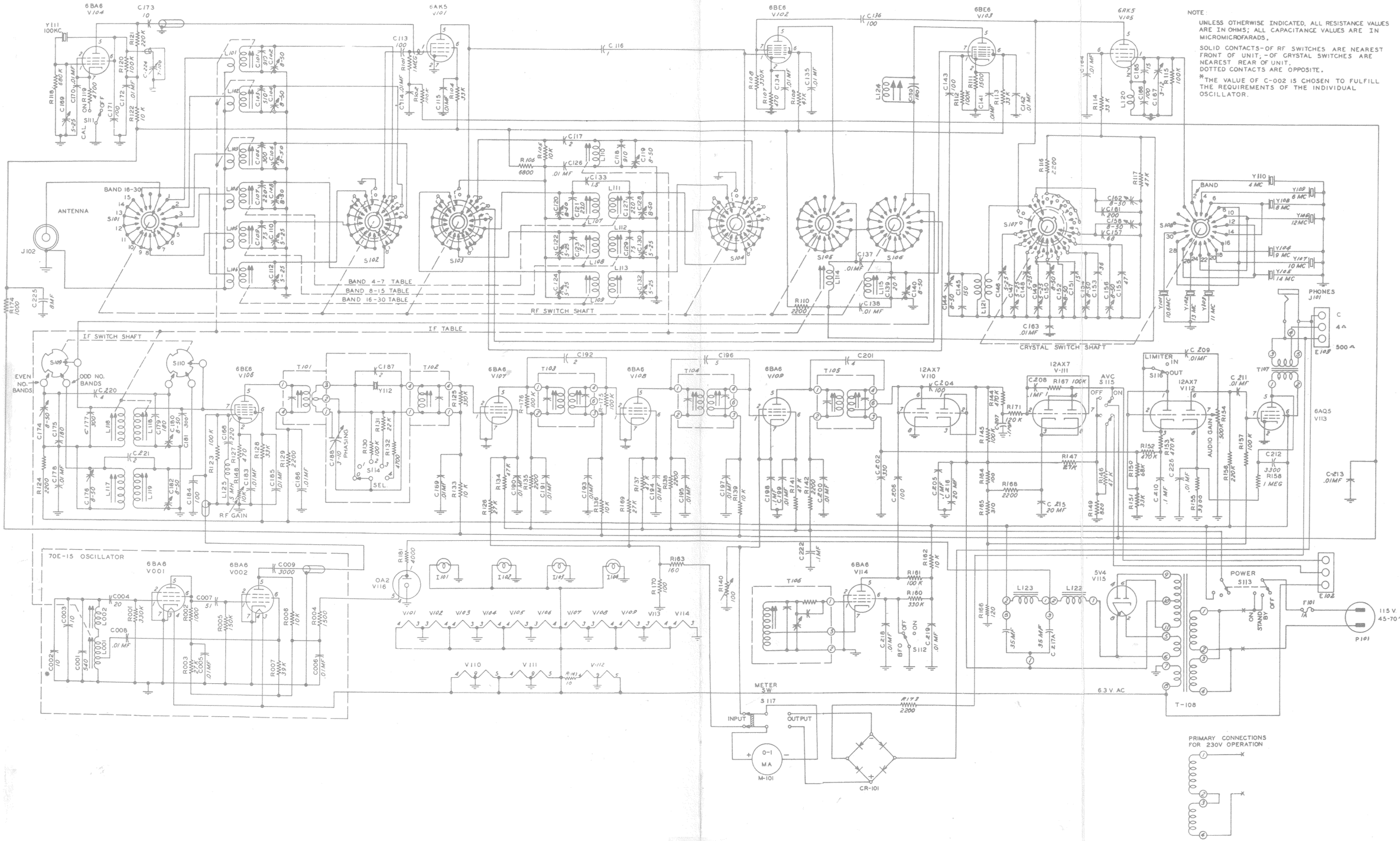


Figure 7-3A 51J-2 Broad Band (520 4746 002) Schematic