INSTRUCTION BOOK

for

75A-1 AMATEUR RECEIVER

Manufactured By

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

520 9305 00

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LIST OF ILLUSTRATIONS

GUARANTEE

This radio equipment, which you have purchased, is licensed only for amateur use and shall carry the following guarantee *provided notice of the purchase of the equipment with identifying serial numbers and date of purchase is given Collins promptly,* and in any event within nine (9) months following delivery of the equipment to the dealer.

"Guarantee. Radio transmitters are guaranteed to deliver their full rated radio frequency power output at the antenna lead (s) when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range. Collins Radio Company agrees to repair or replace, without charge, any equipment, accessories or parts manufactured by or for Collins Radio Company on its specifications which are defective as to design, workmanship or material, and which are returned to Collins Radio Company at its factory in Cedar Rapids, Iowa, transportation charges paid, within a period of ninety (90) days from the date of delivery by the Company or its authorized dealer."

Before returning any item believed to be of defective material, workmanship or manufacture, a detailed report must be submitted to the Company giving exact information as to the nature of the defect. The information shall include, in as much detail as possible, all subject material listed under instructions for replacement of parts. Upon receipt of the report by the Company, and if considered justified, a returned equipment tag will be forwarded to the shipper without delay. *The returned equipment tag must accompany all shipments of defective parts. No action will be taken on any equipment returned to the Company unless the shipment includes the return tag.*

IMPORTANT! It is necessary that the attached business reply card be filled out and mailed to the Company promptly in order for this guarantee to be effective.

COLLINS RADIO COMPANY

PURCHASER MUST fill out this card and mail to Collins in order to assure full coverage under the guarantee

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD
First Class Permit No. 236 (Sec. 510 P. L. & R.) Cedar Rapids, Iowa

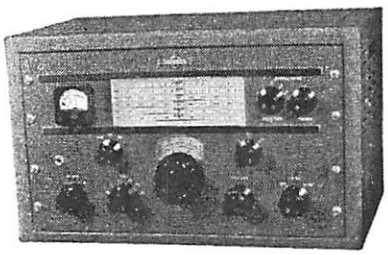
COLLINS RADIO COMPANY

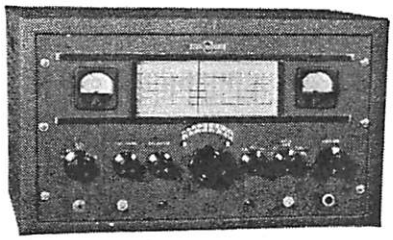
CEDAR RAPIDS,

IOWA

COLLINS EQUIPMENT OF HIGHER QUALITY FOR DISCRIMINATING AMATEURS

The 75A Double Conversion Amateur Band Receiver.

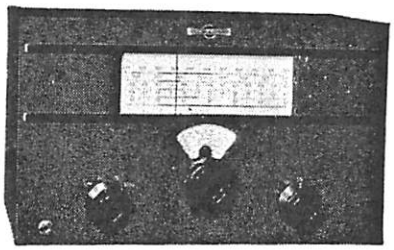




The 32V 150 Watt Bandswitching Transmitter. Permeability Tuned Oscillator Control.

The 30K 500 Watt Bandswitching Transmitter.

The 310A Exciter Unit (for the 30K). Single Dial Tuning. Permeability Tuned Oscillator Control. Bandswitching.



Gentlemen: Date_____

I have purchased the following unit of Collins Amateur Radio Equipment:

Model No._____

Date Purchased_____ Serial No._____

Purchased From:

Dealer's Name:_____

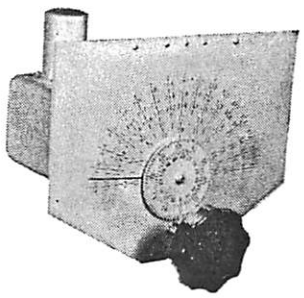
Dealer's Address:_____

I am familiar with the Collins Radio Co. Guarantee as printed in the instruction book and request that you register ownership of the above described equipment in my name.

Owner's Name_____ Call_____

Address _____

Please send



The 70E-8 Permeability Tuned Oscillator. 1600-2000 kc.

REPLACEMENT OF PARTS

In case a replacement under the guarantee is desired, a full report must be submitted to the company. This report shall cover all details of the failure and must include the following information:

(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. # 444
(H) Serial number of the complete equipment.
(I) Nature of failure.
(J) Cause of failure.
(K) Remarks.

When requisitioning replacements parts, the following information must be furnished:

(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.

NOTE: Blank Service Report form will be found in the appendix of this instruction book.

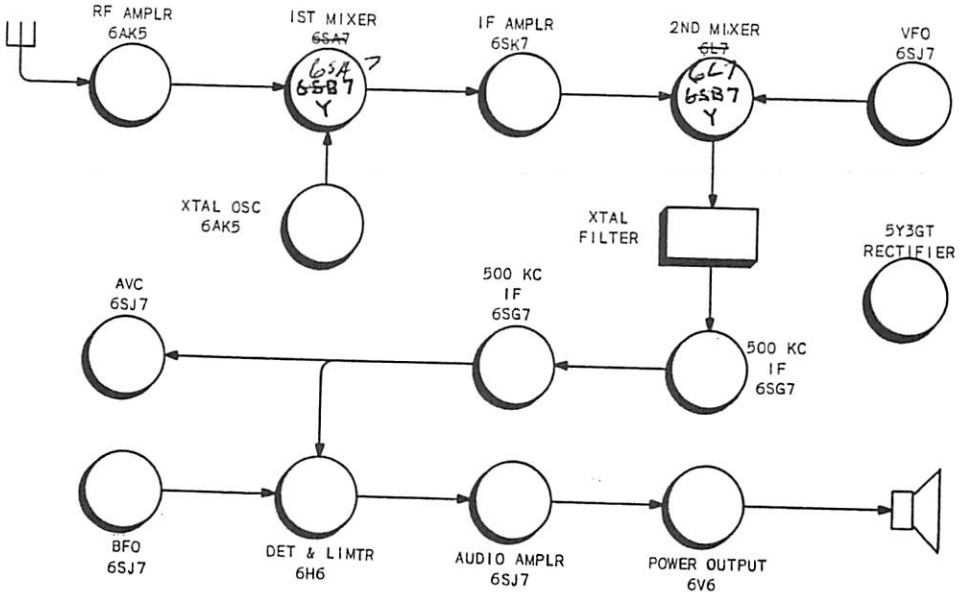


FIGURE 1-1 MODEL 75A RECEIVER

SECTION I

GENERAL DESCRIPTION

1-1. GENERAL.

This handbook has been prepared to aid in the installation, adjustment, operation, and maintenance of the Collins Model 75A Amateur Receiver.

1-2. PURPOSE OF EQUIPMENT.

In recent years, the number of licensed amateurs has been increasing at an accelerated rate. The recent war has introduced a great many people to our great hobby. With the advent of undreamed numbers of amateur stations on the most popular amateur bands, it is apparent that a receiver capable of extreme selectivity and with a high degree of accuracy and stability will be necessary to maintain a high percentage of 100% QSO's. With this in mind, the Collins engineers designed a receiver especially for the amateur which solves the reception problems of the modern amateur better than any other receiver. In addition to superb selectivity and stability, the 75A receiver has a sensitivity which satisfies the most critical of DX hounds. The AVC, image rejection, and cross modulation characteristics are in line with modern commercial practices. Embodying many new electrical and mechanical features never before used in an amateur receiver, it has been described as "The first really new amateur receiver since the advent of the superheterodyne circuit." This is the receiver you amateurs have been waiting for.

1-3. DESCRIPTION.

1-4. FREQUENCY COVERAGE. - The Amateur Bands are covered as follows:

80 meters - 3.2--4.2 mc	15 meters - 20.8--21.8 mc
40 meters - 6.8--7.8 mc	11 meters - 26.0--28.0 mc
20 meters - 14.0--15.0 mc	10 meters - 28.0--30.0 mc

1-5. BANDSPREAD. - An entirely new system of permeability tuning provides linear calibration on all bands. Ten turns of the vernier tuning dial cover the ranges shown above. Each division of the vernier dial (which has 100 divisions) represents 1 KC on 80, 40, 20 and 15 meters, and 2 KC on the 11 and 10 meter bands.

1-6. ACCURACY AND STABILITY. - Extreme stability and precise calibration assure visual tuning accurate to within 1 KC (one dial division) at 21 mc or 2 KC (one dial division) at 27 and 30 mc. This accuracy and stability is accomplished by the use of: (1) quartz crystals in the first conversion circuit, (2) the inherent accuracy and stability of the VFO in the second conversion circuit, and (3) linearity and absence of backlash in the tuning mechanism. The stability is such that on CW reception extreme variation in

The supply voltage causes a change of only a few cycles in the note. Furthermore, the CW note is absolutely independent of all except the tuning controls. Physical shock will not disturb the frequency unless the shock is severe enough to change the dial settings. This outstanding stability is available as soon as the receiver is turned on.

1-7. IMAGE AND IF REJECTION. - The modern circuit design of the 75A has inherently high rejection to spurious frequencies. Image rejection is a minimum of 50 db, even on 10 meters. IF rejection is 70 db minimum.

1-8. SENSITIVITY AND SIGNAL TO NOISE RATIO. - A one microvolt r-f input signal provides 1 watt audio output with approximately 6 db of signal to noise ratio at 300 ohms antenna impedance with a bandwidth of 4 kc.

1-9. SELECTIVITY. - The crystal filter controls provide a bandwidth that is variable in 5 steps from 4 kc to 200 cycles at 2 times down (6 db down from the peak of the resonant frequency). There is no loss in gain caused by use of the crystal filter with the exception of the extremely sharp position which gives about 6 db loss.

1-10. AUTOMATIC NOISE LIMITER. - The 75A receiver contains a new series type noise limiter developed during the war. It automatically adjusts itself to all signal levels.

1-11. AUTOMATIC VOLUME CONTROL. - Constant output within 5 db is obtained for a change in r-f input from 5 microvolts to 0.5 volt. AVC is applied to the r-f stage and three i-f stages. The proper amount of AVC delay is employed for maximum sensitivity on weak signals.

1-12. SIGNAL STRENGTH METER. - The S-meter is calibrated from 1 to 9 in steps of approximately 6 db each, and for 20, 40 and 60 db above S9. Two external adjustments are provided, one for zero adjustment, and one for adjusting the sensitivity to compensate for variations in antenna installations.

1-13. AUDIO OUTPUT. - 2.5 watts of power are available.

1-14. TERMINAL IMPEDANCES.

a. INPUT. - The antenna input circuit is designed for a nominal 300 ohms impedance but will accommodate a wide variety of antennas both balanced and unbalanced without serious loss.

b. OUTPUT. - 500 ohm and 4 ohm terminals are provided as well as a low impedance output for headphones.

GENERAL DESCRIPTION

1-15. CONTROLS. - The following controls are on the front panel to provide complete operation of the receiver:

Tuning Control	ON-OFF Standby switch
Band Switch	Crystal Selectivity Switch
RF Gain Control	Crystal Phasing Control
Audio Gain Control	AVC-Manual-CW Switch
CW Pitch Control	Noise Limiter Switch

1-16. CIRCUIT. - Refer to figure 1-1. The double conversion circuit of the 75A employs fourteen tubes, including rectifier. The use of double conversion avoids the compromise always made in conventional receivers, i.e., a high IF is desirable for image rejection and a low IF is best for selectivity. The 75A uses two intermediate frequencies and has both features. Because of the high frequency of the first IF, only one stage of r-f amplification is needed to give extremely high image rejection. Additional stages are unnecessary and unwarranted. Following the r-f stage the incoming signal is mixed with the output of a crystal oscillator to produce the first IF. The first IF is amplified and mixed with the output of the variable frequency oscillator to produce the 500 KC second IF. The crystal filter is incorporated in the 500 KC second IF circuit. The audio is then removed from the carrier, passed through the automatic noise limiter, amplified, and fed to loudspeaker or headphones. BFO output is applied to the second detector. AVC voltage is obtained from the same point and fed to the controlled stages.

Permeability tuning is employed in the radio frequency, first and second mixer, and first IF stages. Gang tuning is accomplished by the use of a variable platform to which the powdered iron cores of the coils in the above stages are attached. The variable frequency oscillator is also permeability tuned and ganged to the above assembly, however, a precision lead screw acts upon the tuning core of the oscillator core to vary the frequency of the oscillator. Permeability tuned transformers are also employed in the second IF stages. A separate tube is used to rectify the carrier voltage for AVC bias. Two audio stages provide ample amplification and power output for normal amateur requirements.

1-17. TUBE COMPLEMENT.

SYMBOL	TUBE TYPE	FUNCTION
V1	6AK5	RF Amplifier
V2	6SA7 OR 6SB7Y	First Mixer
V3	6SK7	IF Amplifier
V4	6L7 ~~6L7~~ ~~6SB7Y~~	Second Mixer

SYMBOL	TUBE TYPE	FUNCTION
V5	6AK5	Crystal Oscillator
V6	6SG7	500 KC IF Amplifier
V7	6SG7	500 KC IF Amplifier
V8	6H6	Detector and Noise Lim
V9	6SJ7	AVC Tube
V10	6SJ7	Beat Frequency Oscilla
V11	6SJ7	First Audio Amplifier
V12	6V6	Audio Power Amplifier
V13	6SJ7	Variable Frequency Osc
V14	5Y3GT	Rectifier

1-18. POWER SOURCE. - The power supply is self contained and well filtered. It requires a 115 volt 50/60 cps source. Power consumption is 80 watts.

1-19. DIMENSIONS AND CABINET DESIGN. - 21-1/8" wide, 12-1/4" high, 13-7/8" deep overall. The chassis is mounted on a standard 19" panel and can be removed from the cabinet and mounted in a standard relay rack.

1-20. WEIGHT. - 57 lbs.

1-21. FINISH. - St. James Grey wrinkle.

1-22. ACCESSORIES.

1-23. MODEL 270G-1 SPEAKER. - An external speaker is available, mounted in a matching cabinet. The speaker cabinet measures 13" wide, 10-19/32" high, 6-5/8" deep and the speaker and cabinet weigh 9 lbs.

1-24. HEADPHONES. - Any good headphone may be used.

1-25. ANTENNA. - Any good antenna may be used; however, a balanced antenna, well in the clear, connected to the receiver terminals through a 300 ohm transmission line is recommended.

SECTION II

THEORY OF OPERATION

2-1. MECHANICAL

2-2. GENERAL. - The 75A receiver is constructed in two major units, the receiver unit and the speaker unit. The receiver is constructed on an aluminum chassis. The receiver and speaker cabinets both are constructed of heavy gauge steel. The receiver cabinet has a hinged cover utilizing inside hinges. Ventilation openings are punched in the sides and rear of the cabinet. The front panel is recessed and trimmed for neat appearance. Both the receiver and the speaker cabinets are finished in a hard St. James Grey wrinkle finish.

2-3. TUNING. - The first completely permeability tuned amateur receiver to reach the market, the 75A, contains many new tuning principles and ideas. The vernier tuning dial is directly coupled to the lead screw of the variable frequency oscillator thus eliminating any possibility of back-lash. The iron cores which tune the r-f, first mixer, first i-f and second mixer stages are all mounted on a moveable platform. This platform is geared and belted to the vfo shaft by means of split gears and metal belts thus giving ganged tuning. The slide rule dial pointer is cord driven. The BFO coil is placed for most efficient operation and a long shaft is used to connect the tuning control with the panel knob. All other stages are fixed tuned with iron cores and variable ceramic capacitors.

2-4. BAND SWITCH. - Band switching of r-f stages is accomplished by means of a multiple section switch gang. Each switch section with its accompanying components is completely shielded from the others. In addition to r-f circuits, the band switch selects crystals and dial illumination lamps for the various bands.

2-5. ELECTRICAL THEORY.

2-6. GENERAL. - Refer to block diagrams of the receiver, figures 1-1 and 2-1. The general plan of the 75A receiver is a result of efforts to give to the amateur a receiver which has a stability and calibration accuracy never before obtainable in any amateur receiver. In addition, the receiver features an image rejection ratio, selectivity and sensitivity not found in many receivers of modern design. Improved AVC and noise limiter circuits are incorporated to complete the long list of desirable features of the equipment. How these features are obtained is explained in subsequent paragraphs.

2-7. CIRCUIT. - As shown in the block diagram, figure 1-1, the receiver has one stage of pre-selection. A high gain 6AK5 tube is used here because of its excellent electrical characteristics and desirable physical features. Following the r-f stage is the first mixer of the double detection system.

The signal grid of this tube, a 6SA7, is tuned to the received frequency, the injection grid receives voltage from the high frequency oscillator circuits at a frequency within a band 2.5 to 1.5 mc or 5.5 to 3.5 mc removed from the received frequency. This oscillator voltage is supplied by a 6AK5 crystal oscillator tube. Since the high frequency oscillator frequency is fixed (by the quartz crystals) the output frequency of the first mixer tube varies. This necessitates a variable i-f channel for the first intermediate frequency. A type 6SK7 tube is used in the variable frequency i-f stage. The second mixer is a type tube, the signal grid of which is tuned to the frequency of the variable i-f. To produce the second i-f frequency of 500 kc (fixed), the output of a precision variable frequency oscillator is fed into the injection grid of the second mixer tube. This oscillator employs a 6SJ7 tube in a highly stabilized, temperature compensated circuit. The output of the second mixer tube is amplified by a 500 kc i-f channel composed of two 6SG7 tubes. A 6H6 as a detector and noise limiter follows the i-f channel. The audio thus produced is amplified by a 6SJ7 voltage amplifier and a 6V6 power amplifier. AVC bias is produced by a 6SJ7 in a controlled rectifier circuit. A type 6SJ7 tube is used in a BFO circuit coupled to the detector input for cw reception.

2-8. TUNING. - Tuning of the r-f stage, the first mixer, the variable i-f stage, the second mixer, and the VFO is accomplished by changing the inductance of the tuned circuits by means of a powdered iron core varied within the magnetic field of the coils involved. The tuning cores of all of the above stages are ganged together and are varied as one unit. The inductance of each coil is trimmed with a similar iron core whereas the capacitance trimming of each coil is done with a ceramic capacitor.

A unique method of band change is employed in the 75A receiver. In the r-f and first mixer stages, the inductance of only one set of coils, the 80 meter, is varied by the tuning slugs. To change bands, the 80 meter coils are paralleled with a tuned circuit having characteristics which will combine with the 80 meter coils to produce a tuned circuit suitable for the new frequency range. Five sets of tuned circuits are used, one set for each band. In each case, however, the 80 meter coil is the only coil in which the inductance is varied by the tuning apparatus. Refer to the complete schematic, figure 5-4. The two frequency ranges of the variable i-f channel are produced in like manner.

The tuning ranges of the coils in both the r-f portion and the variable i-f portion are 1000 kc in the 80, 40, 20 and 15 meter bands and 2000 kc in the 11 and 10 meter bands.

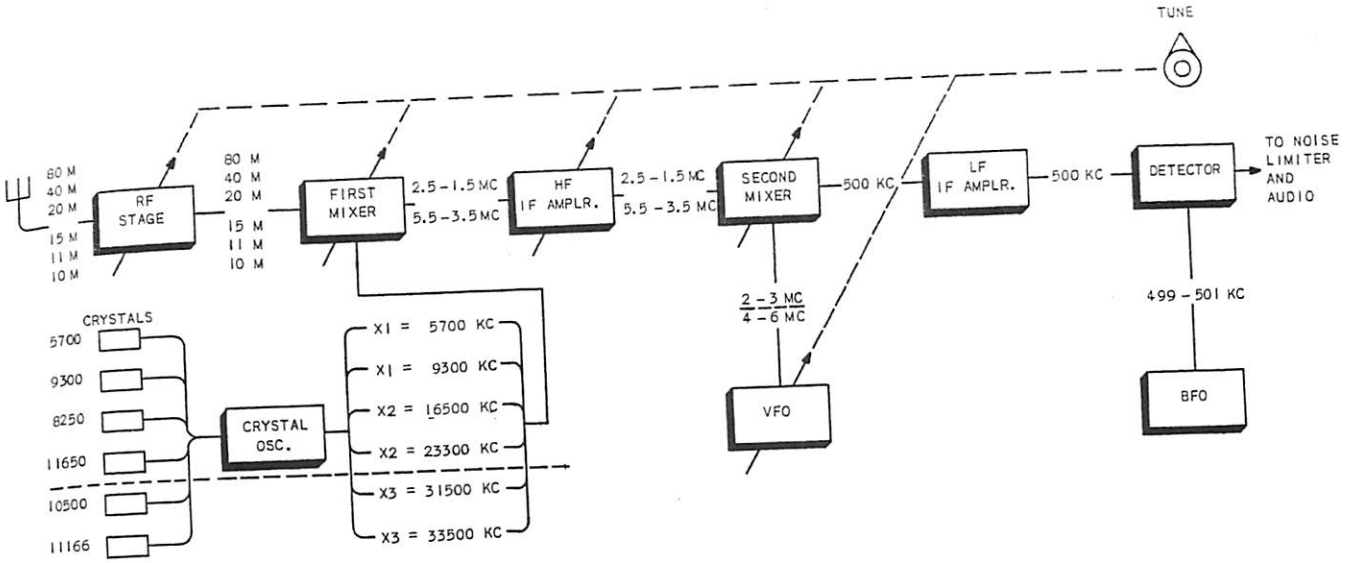


FIGURE 2-1 BLOCK DIAGRAM OF TUNING CIRCUITS

BANDS	80	40	20	15	11	10
XTAL	5.7	9.3	8.25	11.65	10.5	11.166
XTAL OUTPUT	5.7	9.3	16.5	23.3	31.5	33.5
DIAL READINGS	3.2	6.8	14.0	20.8	*26*	*28*
	3.3	6.9	14.1	20.9	*26.2*	*28.2*
	3.4	7.0	14.2	21	*26.4*	*28.4*
	3.5	7.1	14.3	21.1	*26.6*	*28.6*
	3.6	7.2	14.4	21.2	*26.8*	*28.8*
	3.7	7.3	14.5	21.3	*27*	*29*
	3.8	7.4	14.6	21.4	*27.2*	
	3.9	7.5	14.7	21.5	*27.4*	
	4.0	7.6	14.8	21.6	*27.6*	*29.6*
	4.1	7.7	14.9	21.7	*27.8*	*29.8*
	4.2	7.8	15.0	21.8	*28*	*30*

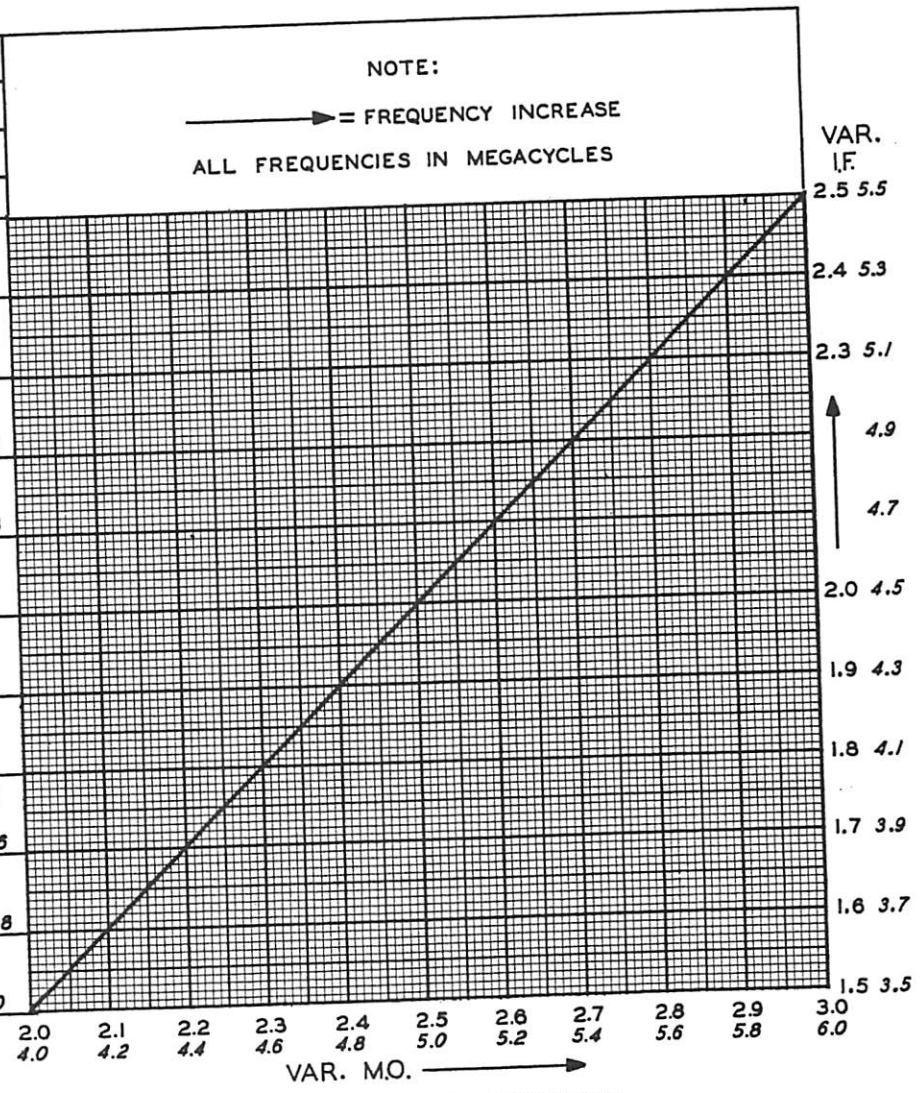


CHART OF CIRCUIT FREQUENCIES VS DIAL READINGS

THEORY OF OPERATION

The frequency coverages of the r-f stages are:

80 meters = 3.2 to 4.2 mc
40 meters = 6.8 to 7.8 mc
20 meters = 14.0 to 15.0 mc
15 meters = 20.8 to 21.8 mc
11 meters = 26.0 to 28.0 mc
10 meters = 28.0 to 30.0 mc

The frequency coverages of the variable i-f are:

80, 40, 20, 15 meter bands = 2.5 to 1.5 mc
11 and 10 meter bands = 5.5 to 3.5 mc

In order to produce heterodynes suitable for amplification by the variable frequency i-f stage i.e. 2.5 to 1.5 mc or 5.5 to 3.5 mc, fixed frequency high frequency oscillator outputs are necessary. These are obtained by the use of a crystal oscillator and six crystals (one for each band). Since it is impractical to get crystals with fundamental frequencies as high as is necessary for the higher frequency bands, low frequency crystals and harmonic operation is employed.

Crystal frequencies vs harmonic output frequencies are shown below:

BAND	CRYSTAL FREQ (kc)	MULTIPLIER	OUTPUT FREQ (kc)
80	5700	1	5700
40	9300	1	9300
20	8250	2	16500
15	11650	2	23300
11	10500	3	31500
10	11166	3	33500

In each case, the high frequency oscillator harmonic output is higher in frequency than the received signal by 2.5 to 1.5 mc or 5.5 to 3.5 mc depending upon which band is being used.

Refer to figure 2-1. In order to get a 500 kc heterodyne for the second, or fixed, i-f amplifier stages, it is necessary to introduce another signal to beat against the variable i-f. Since the output of the variable i-f does change from 2.5 to 1.5 mc or 5.5 to 3.5 mc, the output frequency of this new signal must also be variable in the ranges 2.0 to 3.0 mc and 4.0 to 6.0 mc. These requirements are met by the use of a Collins 70E-7 precision oscillator. The fundamental output frequency range of this oscillator is 2.0 to 3.0 mc. The second harmonic therefore, would be 4.0 to 6.0 mc, the 4.0 to 6.0 mc output being used when the variable i-f is 5.5 to 3.5 mc (when tuning in the 11 and 10 meter bands).

This 500 kc difference frequency is amplified by two stages of fixed i-f amplification, the output of which is detected and sent through the noise limiter and audio amplifiers.

The beat frequency oscillator employed in this receiver is highly stabilized and the dial used in varying the frequency is calibrated +1 and -1 kc. This feature is useful in cw work, for reading frequency. If the dial is set at +1 kc, add 1 kc to the vernier dial reading for the exact frequency of the received station or if the dial is set at -1 kc, subtract 1 kc.

Summarizing the above description of the tuning scheme of the 75A receiver, it can be seen that the received signal beating against the output of a crystal oscillator produces an intermediate frequency which varies across the band. Therefore, a variable i-f amplifier is used, following the first mixer tube, which covers the frequency range of the beat note of this intermediate frequency. Now in order to get a 500 kc beat note, the output of a variable oscillator is beat against the output of the variable i-f stage. The 500 kc heterodyne thus produced is amplified by a fixed tuned amplifier.

The unequalled stability of the receiver is obtained because of the inherent stability of the quartz crystals in the first oscillator and the highly stabilized output of the 70E-7 variable frequency oscillator which operates in a frequency range more readily controlled.

Linear tuning is accomplished by the use of a cam wound oscillator coil which has the coil turns spaced non-linear in such a manner that linear movement of the tuning slug within the coil produces a linear frequency output of the oscillator. In addition, a mechanical frequency correcting mechanism is attached to the tuning slug. All coils which are tuned by movement of the tuning dial are wound in similar fashion.

The high degree of selectivity obtainable with this receiver is due to an efficient crystal filter circuit in addition to the many tuned circuits.

2-9. CRYSTAL FILTER. - Refer to figure 5-4. The crystal filter in the 75A receiver functions as follows. The 500 kc i-f channel input transformer T1 has a tuned primary which is tuned to the intermediate frequency. The secondary on this transformer is a low impedance coil, the center tap of which is grounded. One stator of phasing capacitor C71 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 of the phasing control 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

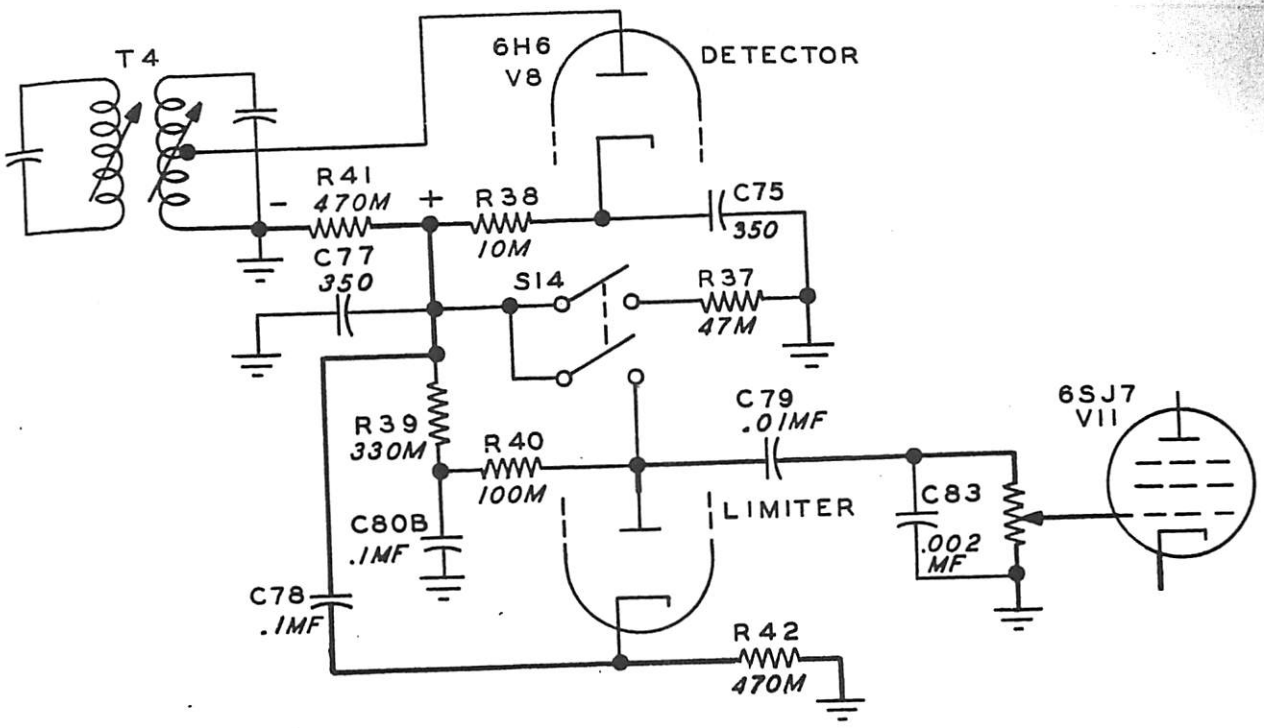


Figure 2-2 Noise Limiter Circuit

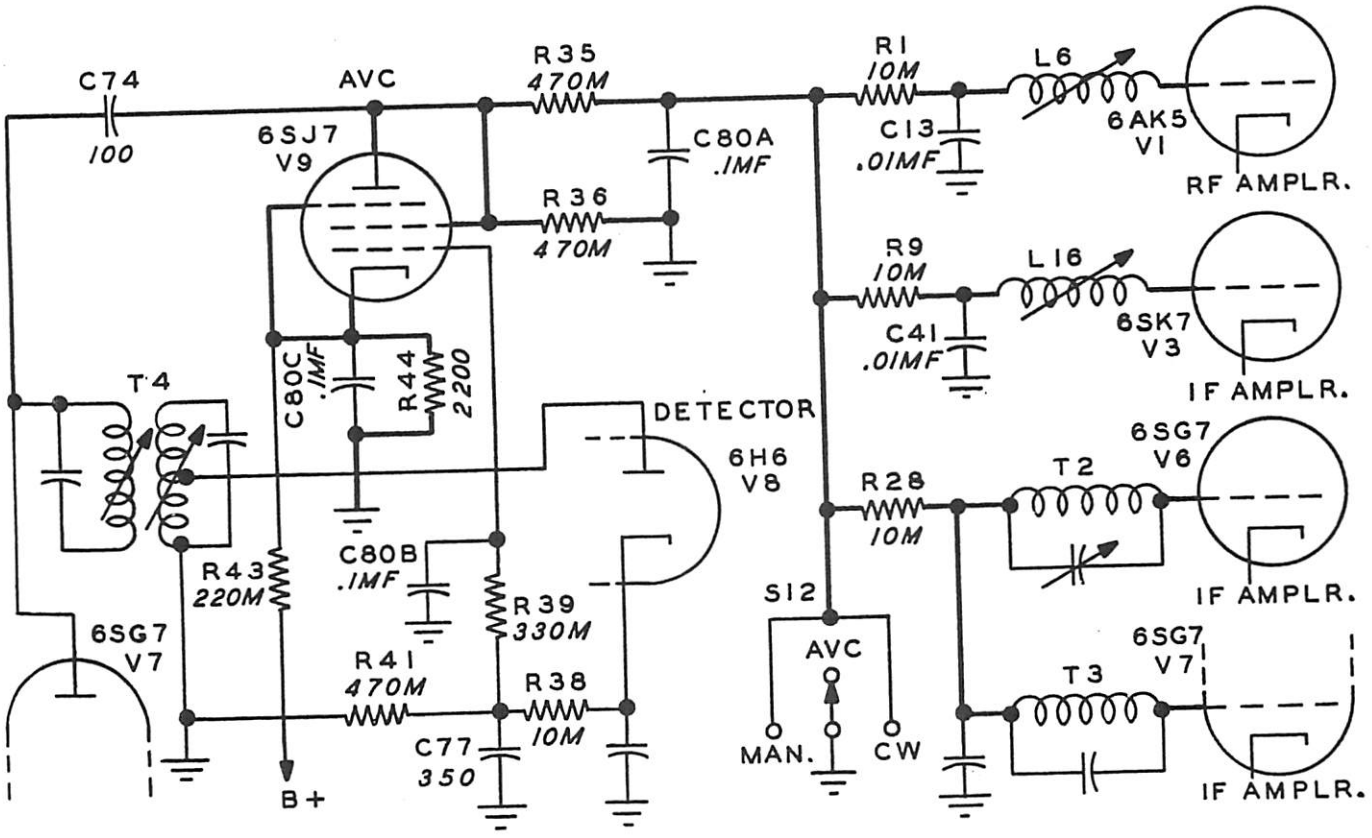


Figure 2-3 Automatic Volume Control Circuit