

92X1950-4

Fig. 1. Hallicrafters TVI Proofof Radio Transmitter Model HT-20

HALLICRAFTERS MODEL HT-20 TVI PROOFED RADIO TRANSMITTER

GENERAL DESCRIPTION

The Model HT-20 is a precision built radio transmitter covering the frequency range of 1.7 mc to 30 mc and supplying 100 watts carrier power, with high level modulation (class AB₂), at any frequency in its operating range. Provision is made for frequency control either by means of ten built-in crystal holders for fixed frequency operation or by means of an external VFO (variable frequency oscillator). Switching is accomplished from the front panel enabling the operator to shift frequency without the use of plug-in coils. The entire unit is ruggedly constructed and built to the same high precision standards that have made Hallicrafters the world leader in the radio communication field.

TVI (TELEVISION INTERFERENCE)

Exceptional engineering ingenuity has been employed throughout the design and construction of the HT-20 to eliminate spurious and harmonic radiations that may cause television interference. The TVI problem was given full consideration in the design of every circuit as well as in the selection and layout of parts.

The tuned circuits are specially constructed to provide low impedance paths to ground for all harmonic frequencies. Many of the components were selected to avoid self resonance at harmonic frequencies and arranged to eliminate parasitic oscillation. The final amplifier tube was chosen partly because of its suitability for connection to low-impedance circuits. A unique balanced bridge arrangement provides fixed neutralization of the buffer stage and parasitic suppressors are strategically placed in the circuit. All of these measures tend to eliminate TVI by preventing the generation of interfering signals.

Two important TVI proofing features are employed in the output coupling circuits. The tuned output circuit is basically a pi network that has inherently excellent harmonic suppression ability. This network may be connected directly to the high impedance output connector that will permit the use of antenna systems having an impedance in the range of from 50 to 600 ohms. For use in locations where TVI is especially serious a second 50 ohm output connector has been provided. This coconnector is coupled to the pi network through a special Hallicrafters low pass filter. For maximum efficiency it is important that the antenna be sufficiently well matched so that the standing wave ratio on the 52 ohm coaxial line is less than 1.5. With proper matching all harmonics above 40 mc will be attenuated by at least 90 db in the output coupling circuits without fundamental power loss.

In addition to all of the above measures to prevent TVI special construction or filters have been employed in all connecting leads to the transmitter including the microphone input circuit.

The Model HT-20, as received from the factory, has had every advantage of Hallicrafters advanced engineering to minimize television interference. There are however some types of TVI that cannot be prevented within the transmitter itself. For example when a television receiver is located in the immediate vicinity of the radio transmitter it is entirely possible that a fundamental signal will reach the input grid of the receiver in sufficient strength to cause interference. In such cases it will be necessary to install a filter or trap at the television receiver. If the interfering signal does not enter the television receiver through the antenna, special shielding or filters on the TV receiver may be necessary. For a discussion of measures that may be used to handle these special television interference problems refer to the booklet entitled "TELEVISION INTERFERENCE", written and published by The Remington Rand Laboratory of Advanced Research, Norwalk, Conn.

OTHER FEATURES

Many features have been included on the Model HT-20 to permit maximum versatility for either amateur or commercial use. Phone or CW operation may be selected by means of a single switch on the front panel. The "Send - Receive" switch has been provided with an extra set of contacts that are conveniently wired to a terminal strip on the rear of the chassis. These may be used to operate an antenna switching relay, the standby circuit on a receiver or other associated equipment that the operator may wish to switch simultaneously. The self-contained power supply operates from a power source of 105 - 125 volts 50-60 cycles AC. A special power socket (standard octal socket) is also included on the rear of the chassis to supply plate, bias, and filament voltage for an external VFO. A single meter, mounted on the front panel, may be switched to any of the various circuits required for tuning purposes. The appropriate meter shunt is automatically connected during the single switching operation. A special germanium rectifier circuit has been included to permit use of the same meter as a relative carrier level indicator during operation. This feature is a special value in determining transmission line loading. If rack mounting is desired the transmitter may be removed from its cabinet and will fit in the standard 19 inch radio relay rack.

Read the installation and operating instructions carefully. They are provided to insure you of the fine performance you have a right to expect from any Hallicrafters precision built product.

INSTALLATION INSTRUCTIONS

UNPACKING - Check all shipping tags and labels for further instructions before removing or destroying them.

LOCATION - The HT-20 Radio Transmitter is provided with a built-in power driven fan for cooling purposes. The transmitter may be placed in any location that will permit free circulation of air through the cabinet openings.

RACK MOUNTING - If rack mounting is desired remove the four screws at each side of the front panel and slide the transmitter from the cabinet. The slots near the edges of the front panel are properly spaced to accommodate mounting screws in a standard 19 inch rack. The shielding that remains attached to the chassis is adequate for TVI proof operation with the cabinet removed.

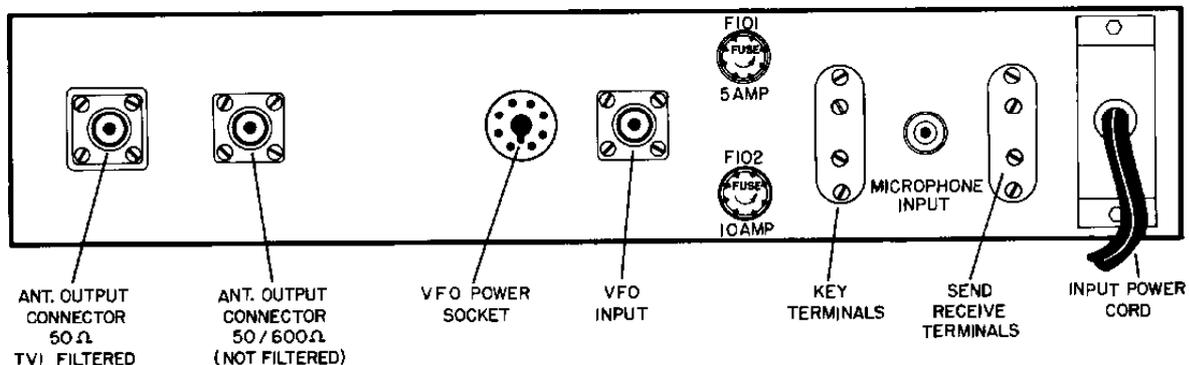


Fig. 2. Connections to Rear of Chassis

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REAR CHASSIS CONNECTIONS

All external connections to the transmitter are made to the sockets and terminals provided on the rear of the chassis.

MICROPHONE INPUT - The microphone input will accommodate any high impedance microphone that has an output level of -56 db or higher (.004 volts across 250,000 ohms and 180 mmf at 400 CPS for 100% modulation). The microphone cable should be fitted with an Amphenol Type 75-MC1F connector.

KEY - Two screw type terminals are provided for connecting the key. One section of the EMISSION switch shorts across these terminals to close the keying circuit when set to the "AM" position.

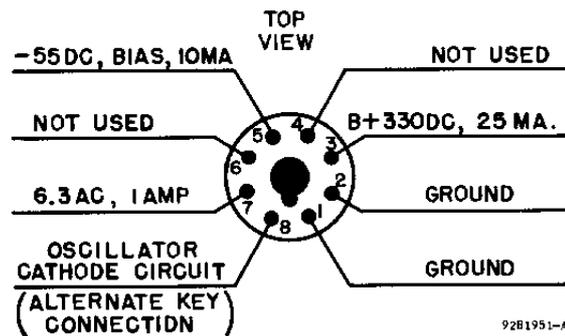
SEND — RECEIVE TERMINALS - The send-receive terminals are connected to an extra pair of contacts on the "SEND-RECEIVE" switch located on the front panel. These contacts are closed when the switch is in the "SEND" position. This feature was included to provide a convenient method of controlling the switching of an antenna relay, receiver standby circuit, or other equipment that the operator may desire to switch simultaneously with the transmitter.

VFO - An external variable-frequency oscillator may be used to control the frequency of the transmitter. The connecting cable should be fitted with an Amphenol type 83-1SP connector or its equivalent. The VFO should have an adjustable output and be capable of developing at least 10 volts across 300 ohms at the VFO input connector. For information concerning appropriate frequencies, refer to the instructions under "VFO OPERATION" on page 8.

VFO POWER SOCKET - A standard octal tube socket on rear of the chassis is provided to supply operating voltages for the external VFO. Use a standard octal plug to make connections. Refer to Fig. 3 for connections, and voltages and currents available. Pin #8 provides an alternate keying connection and is connected to the oscillator cathode circuit. When the EMISSION switch is set to the "CW" position, completion of the circuit from pin #8 to ground will key the transmitter.

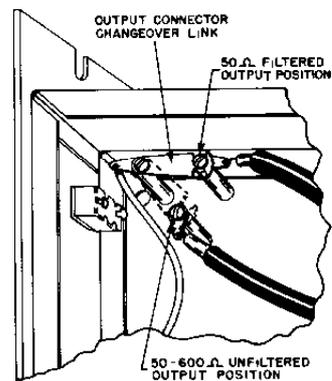
OUTPUT CONNECTOR (50 OHM) - Use of the 50 ohm TVI filtered output is recommended at all locations that are considered to be in television areas. The connecting cable (52 ohm coax) should be fitted with an Amphenol type 83-1SP connector or its equivalent. The selection of the type of antenna and coupling will depend upon the frequencies used and the purpose of operation. Refer to the ARRL ANTENNA HANDBOOK for detailed information concerning transmitting antennas.

OUTPUT CONNECTOR (50 to 600 OHM) - A connecting link located on the underside of the chassis near the POWER-OFF switch must be changed in position to permit the use of the 50-600 ohm output. Refer to Fig. 4. The 50-600 ohm output connector is coupled directly to the pi type tuning network in the power amplifier and the TVI filter is not used in this circuit. In areas where there is no TVI problem, the use of this output permits a wider selection as to the impedance range of the antenna system. The output connector is designed for use with a coaxial cable fitted with an Amphenol Type 83-1SP connector or equivalent. The impedance of the coaxial cable should match the impedance of the antenna system being employed.



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Fig. 3. VFO Power Plug Connections



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Fig. 4. Output Connector Changeover Link

CRYSTAL INSTALLATION

NOTE

Quartz crystals are not supplied with the Model HT-20 Radio Transmitter or stocked by the Hallicrafters Co. Most of the standard types commercially available are satisfactory for use in this equipment. Oscillator specifications that will be useful when close frequency tolerance quartz crystals are required are given on page 12.

Provision has been made for the installation of ten crystals mounted in flat rectangular crystal holders having a pin spacing of .486" and a pin diameter of .093". These crystals are individually switched to control the oscillator frequency by means of the "CRYSTAL SELECTOR" switch on the front panel. In addition, an eleventh crystal holder socket has been provided to accommodate a crystal holder having a pin spacing of .750" and a pin diameter of .125". This socket is wired in parallel with socket number 10 of the group of sockets designed to receive the smaller type of crystal holder. Either socket number 10 or the larger socket may be used; but both cannot be used simultaneously.

The crystal holder sockets are located on the top of the chassis directly beneath the access cover that has been provided in the metal shielding. To gain access to the crystals, open the hinged cabinet top and remove the access cover.

OPERATING INSTRUCTIONS

FUNCTION OF OPERATING CONTROLS

POWER — OFF - The POWER-OFF switch is connected in series with the primary windings of the power transformers, and controls all input power to the transmitter.

OUTPUT - The OUTPUT control is a three position rotary switch which is connected in series with the screen grid of the power amplifier. This control permits removal or reduction of screen voltage so that tuning may be accomplished with either reduced or no output from the power amplifier stage.

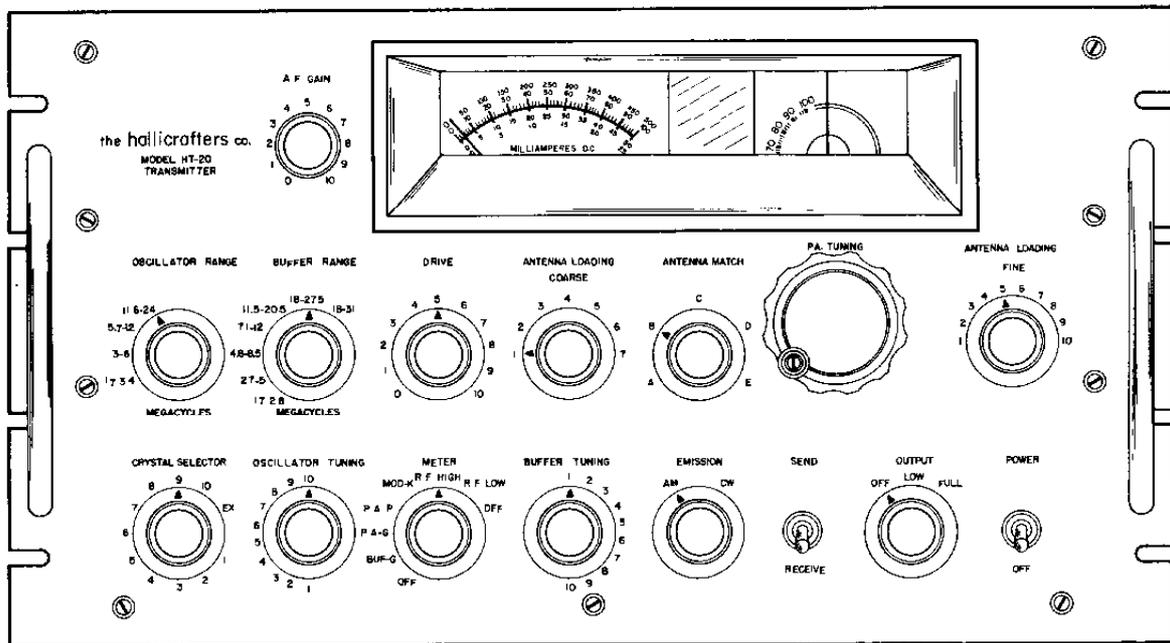
SEND — RECEIVE - The SEND-RECEIVE control is a 3pst switch. One set of contacts is connected in series with the primary winding of the high voltage plate transformer. The second set of contacts is connected in series with the B+ lead from the low voltage power supply. All plate and screen voltages are therefore removed from all tubes when this control is set to the "RECEIVE" position. The remaining two contacts are connected across the SEND-RECEIVE terminal on the rear of the chassis.

EMISSION - The EMISSION switch permits selection of either AM or CW operation. When changing from AM to CW, this switch shorts the secondary winding of the modulation transformer, removes all B+ from the modulator, opens the oscillator cathode circuit to permit keying, and reduces the screen voltage to the power amplifier.

CRYSTAL SELECTOR - The CRYSTAL SELECTOR is an eleven position switch that connects the desired crystal to the grid circuit of the oscillator. When set to the "EX" position, all crystals are removed from the circuit and the VFO connector on the rear of the chassis is connected to the oscillator grid circuit. The frequency is then controlled by means of an external VFO. The oscillator thus becomes a buffer stage which may also be used for frequency multiplication when desired.

OSCILLATOR RANGE - This control varies the inductance of the oscillator tank coil in steps by means of taps provided on the coil. This determines the frequency range over which it is possible to resonate the oscillator tank circuit. The four ranges are indicated in megacycles on the front panel.

OSCILLATOR TUNING - This control is a variable capacitor in the oscillator tank circuit and will resonate this circuit at any desired frequency within the range selected by the setting of the OSCILLATOR RANGE control.



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Fig. 5. Operating Controls

BUFFER RANGE - This control varies the inductance of the buffer tank coil in steps by means of taps provided on the coil. This determines the frequency range over which it is possible to resonate the buffer tank circuit. The seven frequency ranges are indicated in megacycles on the front panel.

BUFFER TUNING - This control is a variable capacitor in the buffer tank circuit and will resonate the circuit at any desired frequency within the range selected by the BUFFER RANGE control.

DRIVE - The DRIVE control is a potentiometer connected in the screen voltage supply to the buffer tube. Variation of the screen voltage will control the power output from the buffer stage and consequently vary the grid drive to the power amplifier. This control should be set so that the grid current of the power amplifier does not exceed 20 ma with the OUTPUT control set to the "OFF" position. Refer to the detailed operating procedure on pages 10 and 11 for specific grid drive requirements.

ANTENNA MATCH - The ANTENNA MATCH control switches additional inductance into the power amplifier tank for operation of the transmitter between 1.7 and 3.5 megacycles.

P.A. TUNING - The P.A. TUNING control simultaneously varies both the capacity and inductance of the power amplifier tank circuit. This permits continuous tuning over the entire frequency range of the transmitter while maintaining an optimum LC ratio at all frequencies. The control also drives the calibrated dial.

ANTENNA LOADING (COARSE) - This control varies the loading capacity of the output tuning network in steps. This is accomplished by means of a seven position switch that connects an additional capacitor into the circuit as the switch is advanced to each succeeding position. The approximate desired value of loading capacitance may be obtained by the use of this control.

ANTENNA LOADING (FINE) - This control serves as a vernier between the steps of loading capacity selected by the ANTENNA LOADING (COARSE) control. The ANTENNA LOADING (FINE) control is a variable capacitor which has sufficient range to obtain the desired value of effective capacitance between any two of the steps. It is used as the final adjustment for maximum antenna loading.

A. F. GAIN - This control is a potentiometer connected in the plate circuit of the microphone pre-amplifier stage. It has sufficient range to permit adjustment for any desired percentage of modulation. No other audio adjustments are required during phone operation.

METER - The meter control is an eight position switch that connects the meter to any one of six circuits wherein the reading will be useful during tuning or operation. The meter is calibrated in four convenient scales and the appropriate shunt is automatically connected as the METER control position is changed. The metered circuits together with typical normal readings are summarized in the chart below.

TYPICAL METER READINGS

METER Controls Setting	Meter Connected To	Typical Normal Readings (MA)	Meter Range
BUF - G	Buffer grid circuit.	0.5 - 3.0	0 - 5.0
P.A. - G	Power amplifier grid circuit.	10	0 - 25
P.A. - P	Power amplifier plate circuit. Measures plate and screen current when EMISSION switch is set at AM and plate current only when EMISSION switch is set at CW.	260 (CW) 320 (AM)	0 - 500
MOD - K	Modulator cathode circuit.	120	0 - 500
R.F. HIGH	R.F germanium diode circuit. Reading is proportional to output voltage.	2.5 (300 or 600 ohm output)	0 - 5.0
R.F. LOW	Same as above but a more sensitive scale.	2.5 (50 or 72 ohm output)	0 - 5.0

FREQUENCY MULTIPLICATION

Both the oscillator and buffer tank circuits may be tuned for either "straight through" operation or frequency doubling. In addition, the buffer stage may also be operated as a frequency tripler. In general, however, it is recommended that the crystal frequency be chosen so that it is not necessary to more than double the frequency in either the oscillator or buffer stages. When it is desired to double or triple the crystal frequency, it is suggested that the oscillator be tuned for "straight through" operation and that the frequency multiplication take place in the buffer stage. For optimum performance, use a crystal whose frequency is below 8 megacycles.

VFO OPERATION

The transmitter may be controlled from a separate VFO (variable-frequency oscillator). The information given in the preceding paragraph concerning crystal frequencies applies equally to the choice of VFO frequencies.

*SUGGESTED CRYSTALS AND FREQUENCY MULTIPLICATION for AMATEUR BAND OPERATION

XTAL or VFO (Meters)	Transmitter Output (Meters)					
	160	80	40	20	15	11 & 10
160	O - 1X B - 1X	O - 1X B - 2X	O - 2X B - 2X			
80		O - 1X B - 1X	O - 1X B - 2X	O - 2X B - 2X	O - 2X B - 3X	
40			O - 1X B - 1X	O - 1X B - 2X	O - 1X B - 3X	O - 2X B - 2X

*NOTES

- 1X, 2X, 3X - indicates frequency multiplication
- "O" - oscillator tank circuit
"B" - buffer tank circuit

INITIAL CONTROL SETTINGS

Control	Initial Setting																					
POWER-OFF	Set at "OFF".																					
OUTPUT	Set at "OFF".																					
SEND-RECEIVE	Set at "RECEIVE".																					
EMISSION	Set for type of operation desired. For CW operation, the key must be closed to complete the oscillator cathode circuit.																					
CRYSTAL SELECTOR	To the position that corresponds to the crystal holder socket number that contains the desired crystal. To "EX", if an external oscillator is to be used.																					
OSCILLATOR RANGE	Set to the range that includes the crystal frequency for "straight through" operation or to the range that includes 2 times the crystal frequency if doubling is required in the oscillator stage.																					
OSCILLATOR TUNING	Refer to Fig. 6 on page 11 for the approximate setting of this control. Use the curve that corresponds to the setting of the OSCILLATOR RANGE control.																					
BUFFER RANGE	Set to the range that includes the desired output frequency.																					
BUFFER TUNING	Refer to Fig. 7 on page 12 for the approximate setting of this control. Use the curve that corresponds to the setting of the BUFFER RANGE control.																					
DRIVE	Set at "10".																					
ANTENNA MATCH	<p>The setting of the ANTENNA MATCH control depends upon both the output frequency and the output impedance. See chart below for setting of this control.</p> <table border="1" data-bbox="635 1137 1347 1379"> <thead> <tr> <th>Transmitter Output Frequency</th> <th>Output Impedance (Ohms)</th> <th>ANTENNA MATCH Control Setting</th> </tr> </thead> <tbody> <tr> <td>1.7 - 3.5 MC</td> <td>50</td> <td>A</td> </tr> <tr> <td>1.7 - 3.5 MC</td> <td>72</td> <td>A</td> </tr> <tr> <td>1.7 - 3.5 MC</td> <td>300</td> <td>C</td> </tr> <tr> <td>1.7 - 2.5 MC</td> <td>600</td> <td>C</td> </tr> <tr> <td>2.5 - 3.5 MC</td> <td>600</td> <td>D</td> </tr> <tr> <td>3.5 - 31.0 MC</td> <td>50 to 600</td> <td>E</td> </tr> </tbody> </table>	Transmitter Output Frequency	Output Impedance (Ohms)	ANTENNA MATCH Control Setting	1.7 - 3.5 MC	50	A	1.7 - 3.5 MC	72	A	1.7 - 3.5 MC	300	C	1.7 - 2.5 MC	600	C	2.5 - 3.5 MC	600	D	3.5 - 31.0 MC	50 to 600	E
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1.7 - 3.5 MC	50	A																				
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1.7 - 2.5 MC	600	C																				
2.5 - 3.5 MC	600	D																				
3.5 - 31.0 MC	50 to 600	E																				
METER	Set at BUF-G.																					
P.A. TUNING	The setting of this control depends upon both the output frequency and the output impedance. Refer to Fig. 8 on page 13 for the approximate setting of this control.																					
ANTENNA LOADING (COARSE)	This control should be initially set for minimum loading to prevent damage to the transmitter during the tune-up procedure. Set it to position "1" if the output frequency is between 1.7 and 3.5 megacycles or to position "7" if the output frequency is between 3.5 and 31 megacycles.																					
ANTENNA LOADING (FINE)	This control should be initially set for minimum loading to prevent damage to the transmitter during the tune-up procedure. Set it to position "1" if the output frequency is between 1.7 and 3.5 megacycles or to position "10" if the output frequency is between 3.5 and 31 megacycles.																					
A.F. GAIN	Set at "0".																					

DETAILED OPERATING PROCEDURE

1. Set all controls to their starting position as shown in the table on page 9.

CAUTION

If you wish to change the position of the ANTENNA MATCH control, ANTENNA LOADING (COARSE) control, or EMISSION control while the transmitter is in operation, first set the OUTPUT control at "LOW" or "OFF".

2. Set the POWER-OFF switch in the "POWER" position. Allow at least one minute for the tubes to reach operating temperature.
3. Set the SEND-RECEIVE switch in the "SEND" position.
4. With the METER control in the "BUF-G" position, adjust the OSCILLATOR TUNING control for maximum buffer grid current.
5. Set the METER control to the "P.A.-G" position, turn the DRIVE control to "10" (maximum drive), and adjust the BUFFER TUNING control for maximum P.A. grid current, backing off the DRIVE control if the grid current exceeds 20 ma (0-25 ma meter scale). Retouch the OSCILLATOR TUNING control for maximum P.A. grid current and then reset the DRIVE control for approximately 20 ma.
6. Set the OUTPUT control in the "LOW" position and the METER control to the "P.A.-P" position. Then adjust the P.A. TUNING control for minimum P.A. plate current.
7. Set the OUTPUT control in the "HIGH" position.

CAUTION

Always set the OUTPUT control at either "LOW" or "OFF" before changing the position of the ANTENNA LOADING (COARSE) control.

8. Adjust the ANTENNA LOADING (COARSE) and the ANTENNA LOADING (FINE) controls in steps, each time re-tuning the P.A. TUNING control for minimum P.A. plate current until maximum loading is obtained (approximately 280 ma for CW operation and 320 ma for phone (AM) operation).

IMPORTANT: To avoid false loading indications, the coarse antenna loading setting should be established before any fine antenna loading adjustment is attempted.

When the output frequency is between 1.7 and 3.5 megacycles, increased loading is obtained by turning the ANTENNA LOADING (COARSE) control from "1" to "7" and the ANTENNA LOADING (FINE) control from "1" to "10" (increasing capacity). When the output frequency is between 3.5 and 31 megacycles, increased loading is obtained by turning the ANTENNA LOADING (COARSE) control from "7" to "1" and the ANTENNA LOADING (FINE) control from "10" to "1" (decreasing capacity).

9. Set the METER control at "P.A.-G" and adjust the DRIVE control for a reading of 10 ma on the 0-25 ma meter scale.
10. For phone operation, advance the A.F. GAIN control until the desired level of modulation is obtained.
11. If the type of emission is changed, (i.e., from AM to CW or from CW to AM) it may be necessary to repeat step 8 for proper antenna loading.

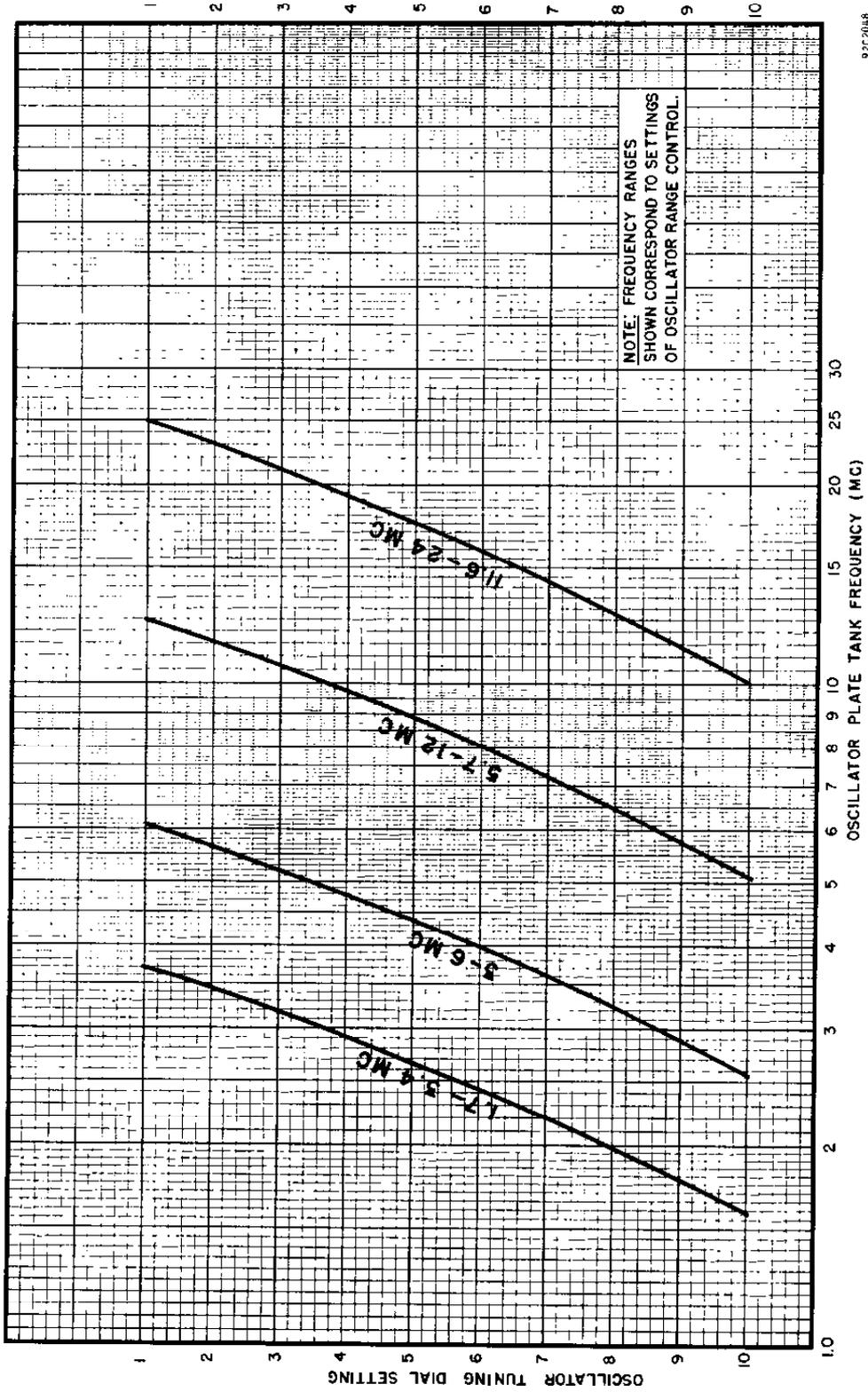
CAUTION

The P.A. plate current, read with the METER switch at "P.A.-P", must never exceed 280 ma. for CW operation or 320 ma for phone operation. Continuous operation above these values will shorten tube life.

12. To use the meter as a carrier indicator, set the METER control at "R.F. HIGH" if the output impedance is 300 or 600 ohms and at "R.F. LOW" if the output impedance is 50 or 72 ohms.

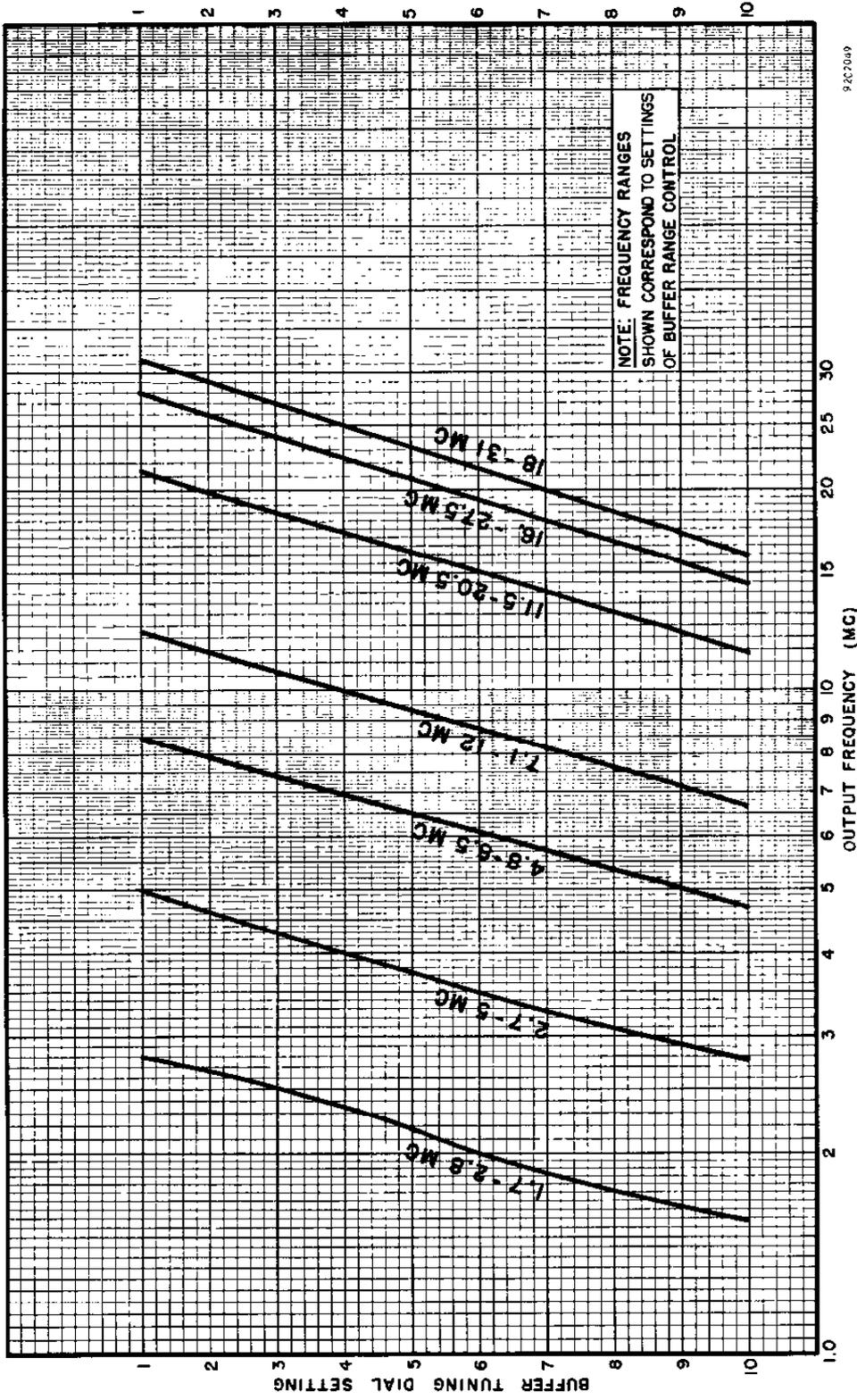
IMPORTANT

The "LOW" position of the OUTPUT control is intended only for use in tuning the transmitter and should not be used for reduced power operation.



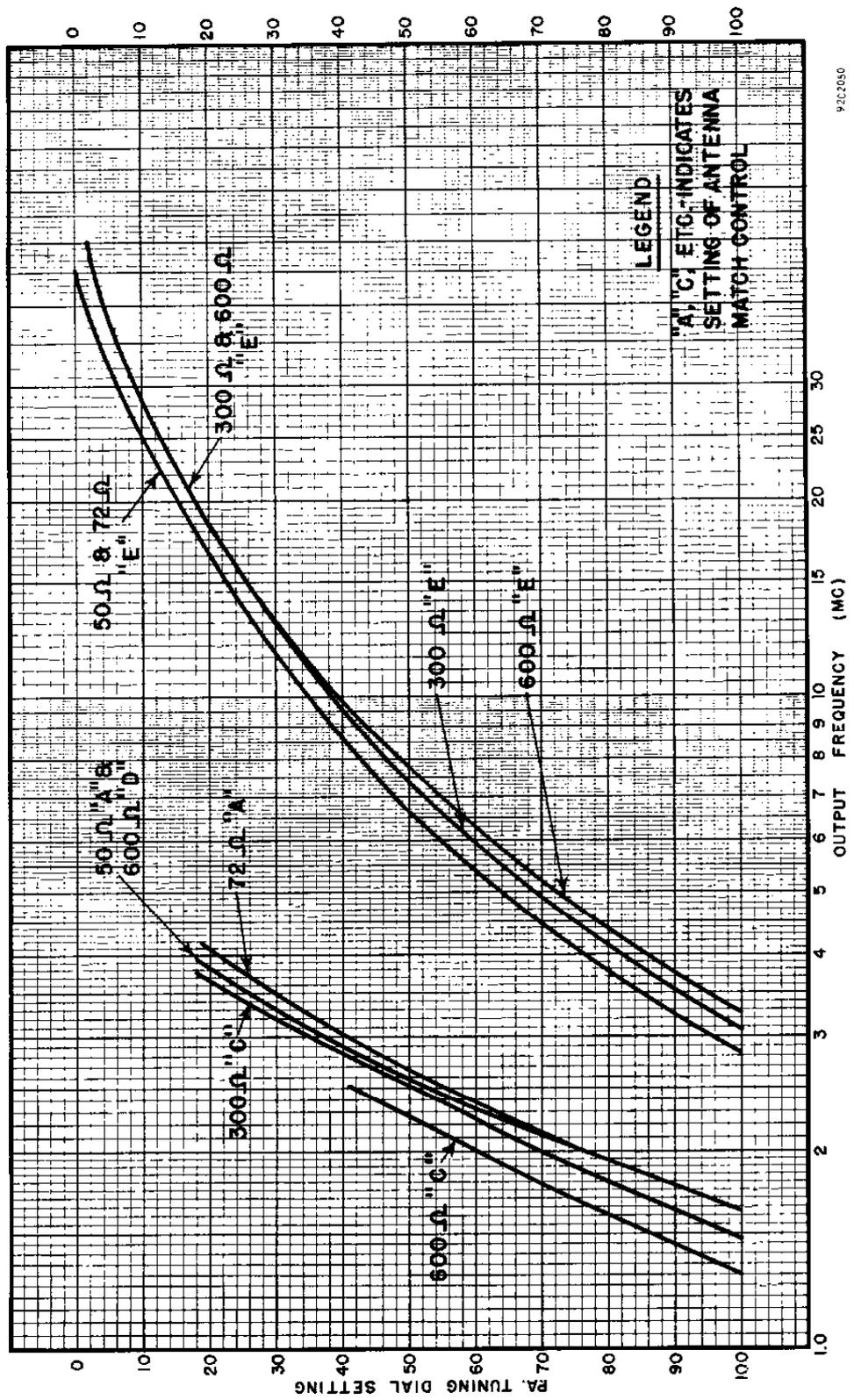
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Fig. 6. Tuning Curves for Oscillator Tuning Control



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Fig. 7. Tuning Curves for Buffer Tuning Control



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Fig. 8. Tuning Curves for P.A. Tuning Control

SERVICE OR OPERATING QUESTIONS - For further information concerning operation or servicing this equipment contact your Hallicrafters dealer. The Hallicrafters Co. maintains an extensive organization of Authorized Service Centers where factory type service will be performed at nominal charge. All HALLICRAFTERS AUTHORIZED SERVICE CENTERS display the sign shown to the right. For the location of the one nearest you consult your local dealer or telephone directory. Make no service shipments to the factory as the Hallicrafters Co. will not accept responsibility for unauthorized shipments.



The Hallicrafters Co. reserves the privilege of making revisions in current production of equipment and assumes no obligation to incorporate these revisions in earlier models.

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SERVICE INSTRUCTIONS

SPECIFICATIONS

CABINET SIZE	20 X 12 1/4 X 17 1/4 inches
RELAY RACK MOUNTING PANEL	19 X 10 1/2 inches, 16 inches deep
CHASSIS DIMENSIONS	17 X 16 X 3 1/2 inches
WEIGHT:	
SHIPPING	125 pounds
IN CABINET	105 pounds
CHASSIS	90 pounds
VOLTAGE INPUT	105 - 125 volts, 50 - 60 cycle AC.
POWER INPUT:	
AM (Zero modulation)	490 watts
CW (key down)	435 watts
STANDBY	147 watts
POWER OUTPUT	100 watts AM carrier 115 watts CW
FREQUENCY RANGE	1.7 to 30 megacycles
MODULATION	High Level (class AB ₂)
TUBES	11 tubes (refer to listing on page 17)
AUDIO FREQUENCY CHARACTERISTICS	Frequency response $\pm 1\frac{1}{2}$ db from 265 to 3000 c.p.s. Hum and Noise not less than 40 db below 100% modulation
SERVICE	AMATEUR or COMMERCIAL. All transformers have less than 50 degree C rise when used in continuous operation
OSCILLATOR:	
TUBE TYPE	6AG7
CIRCUIT	Pierce, Electron Coupled
CIRCUIT AND INTERELECTRODE CAPACITY FROM GRID TO GROUND	34 mmf.
CAPACITY FROM SCREEN GRID TO GROUND	43 mmf.
(with crystal & holder removed)	
VOLTAGES MEASURED AT THE TUBE SOCKET TERMINALS	Refer to Fig. 10

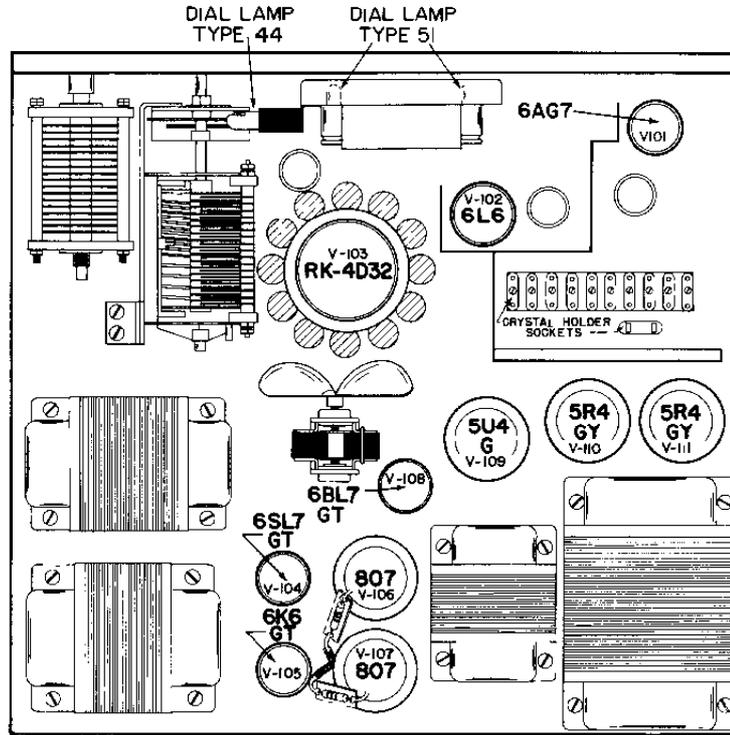


Fig. 9. Location of Tubes, Crystal Sockets, and Dial Lamp

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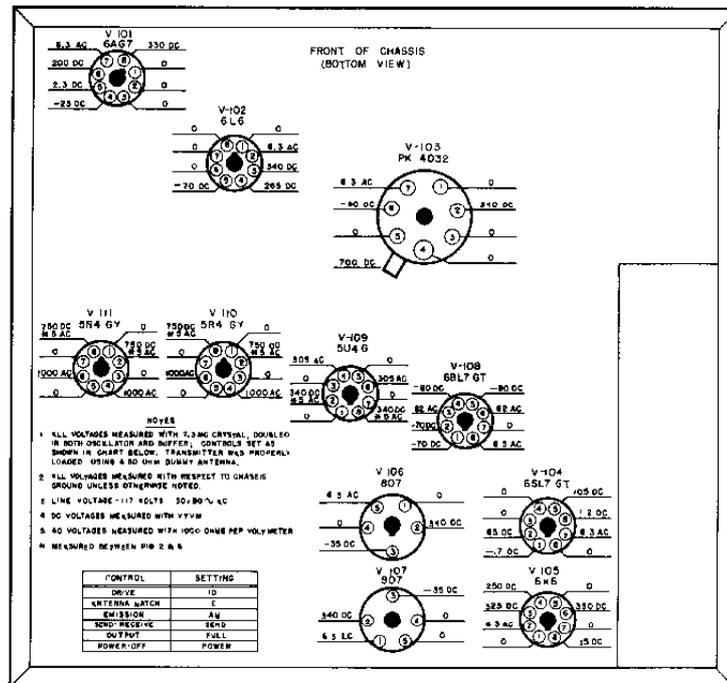


Fig. 10. Tube Socket Voltage Chart

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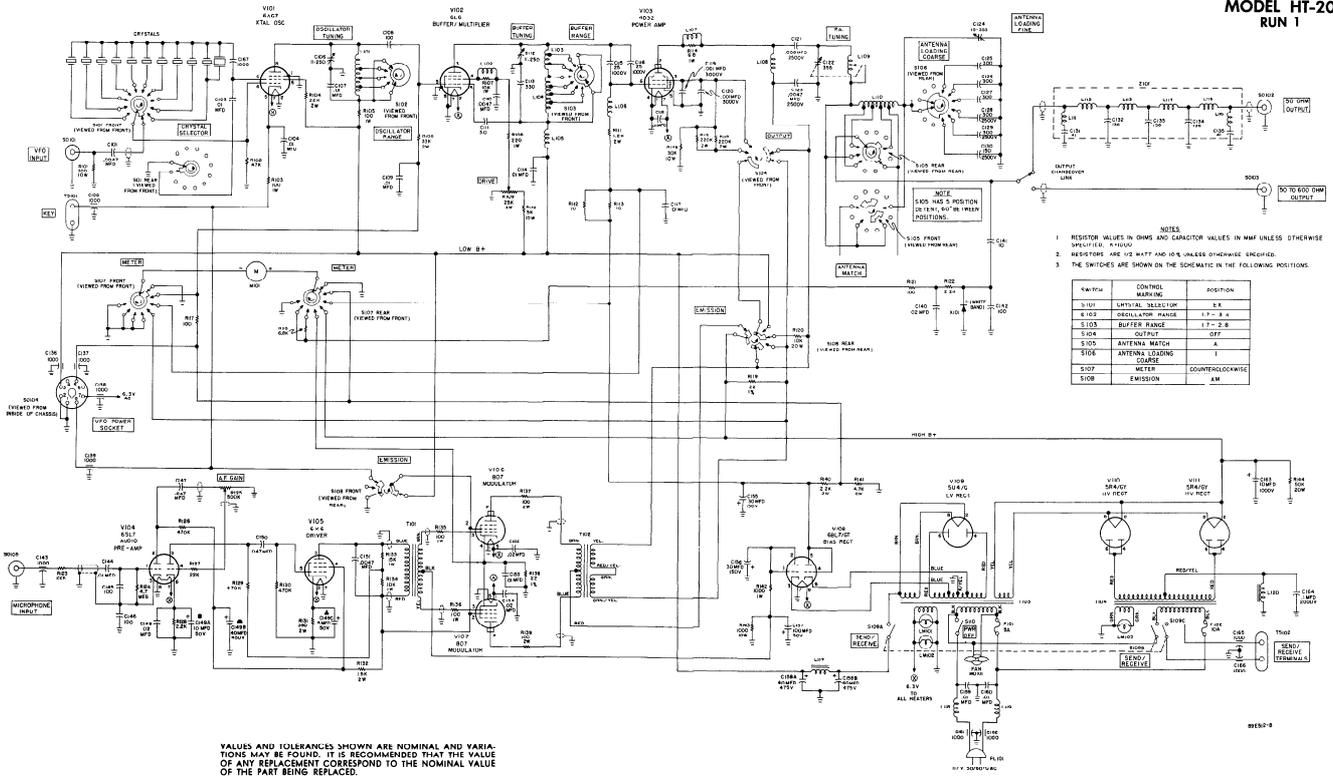
SERVICE PARTS LIST

Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number
CAPACITORS			RESISTORS (Cont.)		
C-101,110,151	.0047 mfd. 10%, 500V., mica	47X35B472K	R-111	1200 ohms 10%, 2 watt; carbon	23X40X122K
C-102,136,137,138,139,143,165,166	1000 mmf. 500 V., feedthru capacitor	47B219	R-112,113 R-114	10 ohms 10%, 1/2 watt; carbon 6.8 ohms 10%, 1 watt; carbon	23X20X100K -----
C-103,104,105,107,109,114,117,118,144,153,159,180	.01 mfd. +80 -20%, 450 V.; ceramic disc	47A224	R-115,118 R-117,121 R-118	220,000 ohms 10%, 2 watt; carbon 100 ohms 10%, 1/2 watt; carbon 6800 ohms 10%, 1/2 watt; carbon	23X40X224K 23X20X101K 23X20X682K 53B275
C-106,112	11-250 mmf., variable air; Buffer Tuning and Oscillator Tuning controls	48C301	R-119,138 R-120	.22 ohms 1%; meter shunt 10,000 ohms 10%, 20 watt; wirewound	24BH103E
C-108,142	100 mmf. 10%, 500V.; mica	47X20B101K	R-122,128	2200 ohms 10%, 1/2 watt; carbon	23X20X222K
C-111	3 mmf. 500V., ceramic	47X20UK030K/D	R-123,127	22,000 ohms 10%, 1/2 watt; carbon	23X20X223K
C-113	330 mmf. 10%, 500V. mica	47X25B331K	R-124	4.7 megohms 10%, 1/2 watt; carbon	23X20X475K
C-115,116	25 mmf. 10%, 1000V.; N470, ceramic	47A312	R-125	500,000 ohms, variable; A.F. Gain control	25B586
C-119,120	.001 mfd. 3000V., ceramic disc	47A311	R-126,129,130	470,000 ohms 10%, 1/2 watt, carbon	23X20X474K 23K40X391K
C-121	.002 mfd. 10%, 2500V.; mica	47X50B202K	R-131 R-132	390 ohms 10%, 2 watt; carbon 15,000 ohms 10%, 2 watt; carbon	23X40X153K
C-122 and L-109	P.A. Tuning capacitor and rotary inductor coil assembly; complete with gears and coupling	48D306	R-133	15,000 ohms 10%, 1 watt; carbon	23X30X153K 23X40X101K
C-123	.0047 mfd. 10%, 2500V.; mica	47X50B472K	R-137,139 R-140	100 ohms 10%, 2 watt; carbon 2200 ohms 10%, 2 watt; carbon	23X40X222K
C-124	15-353 mmf., variable air; Antenna Loading Fine	48D299	R-141	4700 ohms 10%, 2 watt; carbon	23X40X472K
C-125,126,127	300 mmf. 10%, 500V.; mica	47X20A301K	R-142,143	1000 ohms 10%, 10 watt; wirewound	24BG102E
C-128,129	300 mmf. 10%, 2500V.; mica	47X45B301K	R-144	50,000 ohms 10%, 20 watt; wirewound	24BH503E
C-130	150 mmf. 10%, 2500V.; mica	47X45B151K	R-145	30,000 ohms 10%, 10 watt; wirewound	24BG303E
C-131,132,133,124,135	Feedthru capacitors (see Miscellaneous Parts for part numbers of teflon insulators)	-----	L-101	Coll, oscillator	51C1587
C-140,148,152,154	.02 mfd. +80 -20%, 500V.; ceramic disc	47B242	L-102	Coll, buffer peaking	51B1599
C-141	10 mmf. 10%, 500V., ceramic	47X20UJ100K	L-103	Coll, buffer; low frequency	51C1595
C-145,146	100 mmf. 10%, 500V., ceramic	47X20UK101K	L-104	Coll, buffer; high frequency	51B1596
C-147,150	.047 mfd. 5%, 600V.; molded tubular paper	48BS473J6	L-105,106 L-107	Choke, R.F.; 2.5 mh Suppressor, paramitic (wound on 6.8 ohm, 1 watt resistor)	53A150 53B273
C-149	5 mfd. 50V., 10 mfd. 50V., 40 mfd. 450V.; electrolytic	45B227	L-108	Choke, plate; 4.3 mh, 0.6 amps, 12 ohms	53C272
C-155,156	30 mfd. 150V., electrolytic	45A090	L-109	Rotary inductor coil (see C-122 under Capacitors)	-----
C-157	100 mfd. 50V., electrolytic	45A115	L-110	Coll, antenan match	51C1598
C-158	80-40 mfd. 475V., electrolytic	45B228	L-111,118	Coll, LP filter; 5 turns	51B1602
C-161,162	1000 mmf. 500V., feedthru capacitor	47B310	L-112,115	Coll, LP filter; 7 turns	51B1601
C-163	10 mfd. 1000V., oil filled paper	45C228	L-113,114 L-117	Coll, LP filter; 8 turns Choke, filter; LV supply; 2.5H, 200 ma, 80 ohms	51B1600 56C160 53C278
C-164	.1 mfd. 20%, 2000V.; molded paper	46A224	L-118,119 L-120	Choke, filter; AC line Choke, filter; HV supply; 10H, 350 ma. 75 ohms	56D149 55C201 55C200
C-167	1000 mmf. 10%, 500V.; mica	47X25B102K	T-101 T-102 T-103	Transformer, driver Transformer, modulation Transformer, power; low voltage supply	52C264 52C262
RESISTORS			T-104	Transformer, power; high voltage supply	52C262
R-101	300 ohms 10%, 10 watt; wirewound	24BG301E			
R-102	47,000 ohms 10%, 1/2 watt; carbon	23X20X473K			
R-103,105,135,136	100 ohms 10%, 1 watt; carbon	23X30X101K			
R-104	22,000 ohms 10%, 2 watt; carbon	23X40X223K			
R-106	33,000 ohms 10%, 2 watt; carbon	23X40X333K			
R-107,134	10,000 ohms 10%, 1 watt; carbon	23X30X103K			
R-108	220 ohms 10%, 1 watt; carbon	23X30X221K			
R-109	25,000 ohms 4 watt, variable wirewound; Drive control	25B1055			
R-110	5000 ohms 10%, 10 watt; wirewound	24BG502E			

SERVICE PARTS LIST (Cont.)

Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number
SWITCHES			MISCELLANEOUS PARTS (Cont.)		
S-101	Crystal Selector	60C519		Dial Scale Assembly, P.A. Tuning	83B426
S-102	Oscillator Range	60C512		Escutcheon, meter and P.A. tuning dial	7D416
S-103	Buffer Range	60C513		Foot, mtg.; rubber	16A029
S-104	Output	60C562		Front panel	68D215
S-105	Antenna Match	60C566		Fuse, 5 amp 250V.; type 3AG	39A313
S-106	Antenna Loading Coarse	60C516	F-101	Fuse, 10 amp, 260V.; type 3AG	39A380
S-107	Meter	60C514		Grommet, rubber	16A125
S-108	Emission (AM-CW)	60C517		Handle	30B192
S-109	Send-Receive; 3pst toggle	60C518	F-102	Holder, fuse	6A451
S-110	Power-Off; spst toggle	60A138		Hood; for 50 to 600 ohm output coaxial connector; AN type UG-106/U	10A055
TUBE COMPLEMENT				Insulator, feed-thru; steatite; 5/8" lg overall, 1/2" od, .143" id	8A1014
V-101	6AG7: crystal oscillator	90X6AG7		Insulator, feed-thru; steatite; 3/8" lg overall, 1/2" od, .143" id	8A1015
V-102	6L6: buffer multiplier	90X6L6		Insulator, standoff; phenolic; 1-1/2" lg, 3/8" od, 6/32" id	8A1975
V-103	4D32: power amplifier	90X4D32		Insulator, teflon; 1-3/4" x 2" x .015"; used in LP filter box	8A1976
V-104	6SL7: audio pre-amplifier	90X6SL7		Insulator, teflon; 1-1/8" x 1-7/8" x .015"; used in LP filter box	8A1977
V-105	6K6: driver	90X6K6		Insulator, teflon; 1" x 1" x .015"; used in LP filter box	8A1978
V-108,107	807: modulators	90X807		Knob, A.F. Gaia control	15B258
V-108	6BL7: bias rectifier	90X6BL7		Knob, control; with skirt	15B383
V-109	5U4: low voltage rectifier	90X5U4		Knob, P.A. Tuning	15B570
V-110,111	5R4GY: high voltage rectifiers	90X5R4GY		Lamp, pilot; type 44; P.A. tuning dial	39A003
CONNECTORS				Lamp, pilot; type 51; meter	39A030
PL-101	Line cord and plug	87A481		Lock, line cord	76E756
SO-101,102, 103	Coanector, coaxial; female; AN type SO-239; VFO laput 50-Ohm Output, 50-600 Ohms Output	10A056 29A043		Meter, DC; 0-5 ma	82D227
SO-105	Connector, Microphone laput Socket assembly, dial lamp; meter	86B107		Motor, blower; less fan blade	20A050
	Socket assembly, dial lamp; P.A. Tuning dial	86A137		Pointer, dial	83B232
	Socket, crystal; 1/2" pin spsttag	6A346	LM-103	Rectifier, germanium type 1N64	19B1864
	Socket, crystal; 3/4" pin spsttag	6A240	LM-101,102	Screen, escutcheon	69C538
	Socket, tube; 5 pla	6A009		Shaft, insulated; phenolic; 1-1/4" lg, 1/4" d	6A1993
	Socket, tube; giant 7 pla	6A210	M-101	Shield, dial lamp	66A037
	Socket, tube; octal	6A317	MO-101	Shield, tube; miniature 7 pin	69A065
TS-101,102	Terminal strip, Key and Send-Receive	88A020		Shield, tube; octal	69A356
MISCELLANEOUS PARTS				Spacer, fiber; .5" od, .144" id, .375" h	8A717
	Blade, fan	80B004		Washer, flat insulating; phenolic; .1875" id, .625" od, .125" thick	4A1128
	Cabinet; less front panel	66E878		Washer, flat insulating; teflon; 609" od, .169" id, .03" thick; used in LP filter box	4A1168
	Cap, modulator grid	76A071			
	Cap, power amplifier plate	76A008			
	Clamp, octal tube	76A1067			
	Clip, mtg.; for L-118 and L-119	76A866			
	Clip, mtg.; V-104 tube shield	76A1023			
	Cover, access; crystal	63C903			
	Cover, chassis bottom	66D882			
	Cover, chassis top front	66D581			
	Cover, chassis top rear	69D557			

MODEL HT-20
RUN 1



- NOTES
1. RESISTOR VALUES IN OHMS AND CAPACITOR VALUES IN MMF UNLESS OTHERWISE SPECIFIED. V1000
 2. RESISTORS ARE 1/2 WATT AND 10%, UNLESS OTHERWISE SPECIFIED.
 3. THE SWITCHES ARE SHOWN ON THE SCHEMATIC IN THE FOLLOWING POSITIONS:

SWITCH	CONTROL MARKING	POSITION
S101	ANTENNA SELECTION	R-R
S102	OSCILLATOR RANGE	1.7 - 8.4
S103	BUFFER RANGE	1.7 - 2.8
S104	OUTPUT	OFF
S105	ANTENNA MATCH	I
S106	ANTENNA LEADING COILS	I
S107	METER	COUNTERCLOCKWISE
S108	EMISSION	AM

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.