

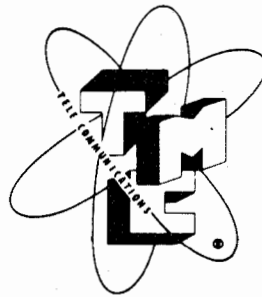
NAVSHIPS 93112

UNCLASSIFIED

TECHNICAL MANUAL

for

**SINGLE SIDEBAND CONVERTER
CV-591/URR
MODEL MSR-1**



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y.

OTTAWA, ONTARIO

BUREAU OF SHIPS
DEPARTMENT OF THE NAVY

★
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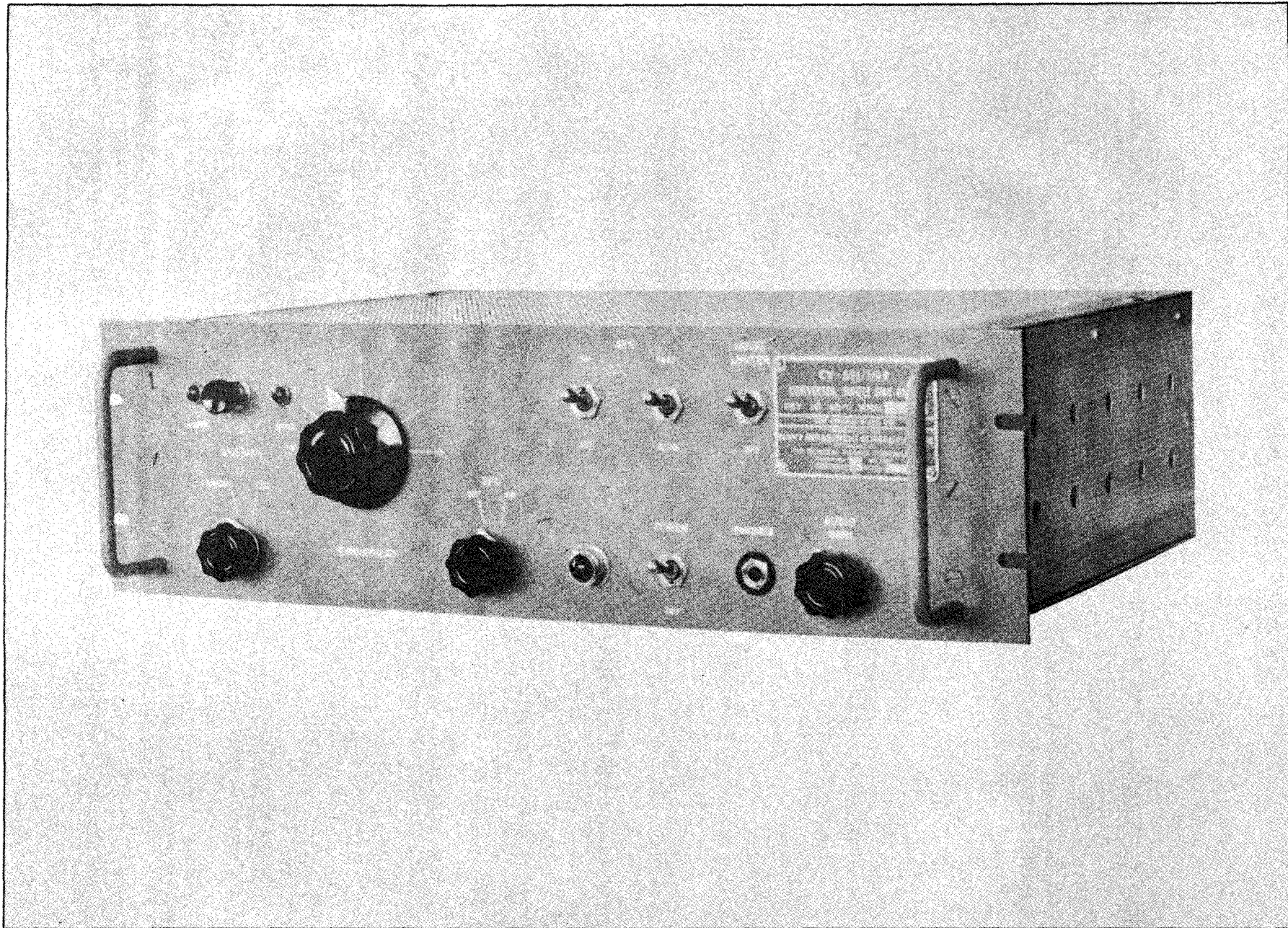
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Figure 1-1. Front View Model MSR-1

SECTION I

GENERAL DESCRIPTION

1. PURPOSE AND BASIC PRINCIPLES

The TMC Model MSR-1, Mode Selector Receiving will, in a number of ways, improve operation of certain radio receivers for various modes of operation. The overall skirt selectivity of most receiving systems is greatly sharpened, rejecting unwanted adjacent signals or interference with no detrimental effect to the desired signal. The tuning of single sideband signals is greatly simplified since the final tuning is done at the MSR-1, not the receiver. A mechanical and electrical bandspread tunes over the I. F. bandpass. This effective vernier easily tunes SSB or exalted carrier AM signals within cycles of correct tone. Either sideband is selectable, either with the bandpass tuning feature or by inverting the osc. separation. CW, MCW and FS signals are easily tunable with the bandspread feature.

For extreme stability, the first oscillator is switched to crystal control for both upper and lower sideband positions.

The local or remote tuned VFO feature of the MSR-1 permits operation with any receiver having an I. F. nominally centered at 455 kc. However, when the oscillator is switched to crystal control and the proper crystals inserted, most any receiver I. F. may be accommodated. The required I. F. connection between the receiver and MSR-1 through a low loss coaxial cable is as follows:

FFR to MSR-1, BNC connector to BNC.

GPR-90 to MSR-1, Phono connector to BNC.

The audio output is available for either a loudspeaker, a zero level 600 ohm line output or a high level 600 or 8 ohm output.

Terminals at the rear panel provide the simple connections for remote control of the main features of the MSR-1 without modifications or the use of additional lines or tones when used in the TMC RCR system. By this means it is possible to remotely or locally tune the MSR-1 across the receiver I. F. passband, select sidebands with a remote indication of which sideband is in use, and still retain all of the remote control features of the RCR system.

2. DESCRIPTION OF UNIT

The Model MSR-1 is shown in Figure 1-1. The panel is 3/16 inch thick by 19 inches long by

5-1/4 inches high and finished in TMC grey enamel. The chassis extends 13-1/2 inches behind the panel and is self supporting.

All operational controls are located on the front panel. These controls are similar in function and effect to those found on any receiver. The BANDSPREAD control tunes the MSR-1 over a limited frequency range. A MANUAL/XTAL switch sets the first oscillator to either variable or fixed crystal operation. The BFO, AVC and AUDIO GAIN controls perform similar functions as on a receiver.

Input and output connections are made on the rear apron.

3. TECHNICAL SPECIFICATIONS

Types of Reception:

- SSB-Selectable Sideband
- CW-MCW
- AM-Selectable Sideband
- Exalted Carrier AM
- Simultaneous AM-FS

Sideband Selection:

Upper or Lower Sideband by means of Crystal or Calibrated Bandspread Oscillator.

Remote Control Features:

- Selection of Upper or Lower Sideband
- Selection of Mode of Operation
- AM-CW-MCW-SSB and Exalted Carrier
- ± 3 kc Bandspread Tuning
- AVC ON/OFF
- BFO ON/OFF

Remote Control Facilities:

May be used with AN/FRA-19 (V) or AN/FRA-501-Remote Control Systems and AN/FRR-49 (V) or AN/FRR-502-Receiving Systems without any system modification.

Input Frequency Range:

- (a) 452-458 (when MSR oscillator is variable or normal crystal is used).
- (b) 225 kc to 1.5 mc when MSR-1 oscillator is crystal controlled only.

Input Voltage Range:
0.1-10 Volts RMS.

Input Impedance:

470 K ohms, 25 uuf

Filter Characteristics:

3.2 kc at 3 db Points

5.2 kc at 45 db Points

AVC Characteristics:

With 40 db change in input, output remains constant within 9 db.

AVC Speeds:

SLOW/FAST

Noise Limiter:

Balanced Type

Output:

1-1/2 watts-600 ohms

Zero Level-600 ohms

Output Impedances:

Loudspeaker 8 ohms

Line 600 ohms

Head Set-High or Low

Front Panel Control:

POWER/OFF

AUDIO GAIN Control

SIDEBAND UPPER/LOWER Switch

SIDEBAND Indicator Lighting

MANUAL/XTAL Switch

BANDSPREAD Control

AVC ON/OFF Switch

AVC FAST/SLOW Switch

NOISE LIMITER ON/OFF Switch

BFO ON/OFF Switch

PHONES Jack

Power Indicator

Rear Panel Facilities:

IF Input Jack

Threshold Control

AC Power Input

Audio Output Terminal

Remote Control Terminal

Input Power Requirements:

110/220 Volts 50/60

Cycles, 65 watts

Size:

5-1/4" high x 19" wide x 11-1/4" deep

Mounting:

Standard WE Rack

Weight:

24 lbs. net

Tube Complement:

12AU7 Relay Driver

12AU7 Amplifier and Reactor

12AU7 17 kc Oscillator & Audio Amplifier

6J6 Reactance Tube

6AG5 1st Oscillator

6BA6 IF Amplifier

6BE6 1st Mixer

6BE6 2nd Mixer

6AL5 Noise Limiter

6AQ5 Audio Power Amplifier

5U4GB Power Rectifier

OA2 Voltage Regulator

Components and Construction:

Equipment manufactured in accordance with JAN/MIL Specifications wherever practicable.

SECTION II

THEORY OF OPERATION

1. GENERAL DESCRIPTION OF CIRCUITS

The combination of a specially designed filter circuit and a frequency bandspread oscillator provides sharp discrimination between a desired signal and undesired adjacent interference. This is accomplished by easy tuning of the bandspread oscillator. The BANDSPREAD control tunes this oscillator over a restricted range of ± 3 kc from its center frequency. Remote tuning of this function is accomplished with a reactance circuit. The frequency of the 1st oscillator is centered on 472 kc for reception of the upper sideband and 438 kc for reception of the lower sideband. These frequencies can be made more stable by switching in crystals with the MANUAL/XTAL control.

The selection of upper or lower sideband is made through a relay. Operation is accomplished with a front panel push-button or through remote control of the relay driver stage. The indication of the sideband selected is shown by front panel lamps or remotely by tone pitch.

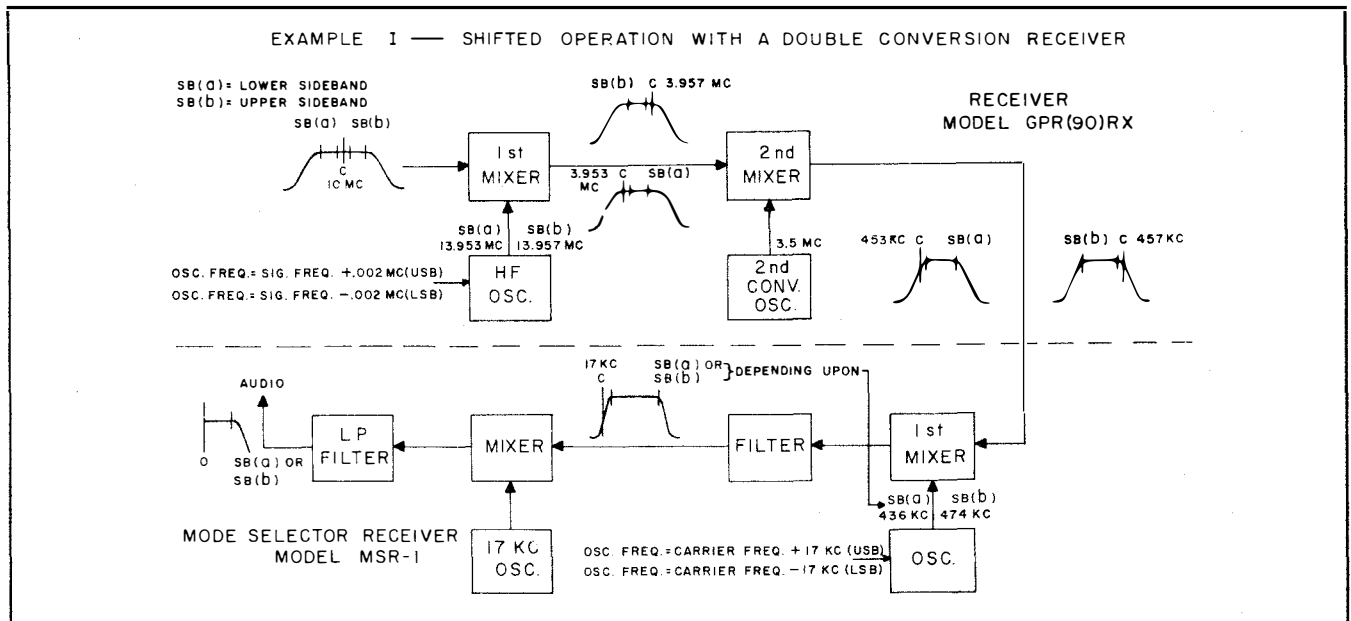
The carrier for SSB, exalted AM, or CW is reinserted at the second mixer by the BFO. This fixed oscillator is turned on or off by a relay which is operated either with the front panel BFO switch or a remotely controlled switch. A low pass filter passes the desired products which are now at audio frequency. A noise limiter reduces the noise on

both sides of the audio wave. The audio amplifier stages provide a high or low level 600 ohm output for line or output for loudspeaker or headset use.

A simplified picture of how the MSR-1 operates in combination with a double conversion receiver is shown in Figure 2-1. The incoming signal is shown to be the conventional double sideband with carrier type. However, the same simple arithmetic applies if either sideband and/or the carrier are dropped out as would be the case in single sideband reception.

The illustration chosen is one in which the receiver 1st I. F. is 3.955, however, other combinations are also useable. For example, had the receiver 1st I. F. been 2.5 mcs and the incoming signal still centered at 10 mcs, the H.F. oscillator would have been at 12.5 mcs. Still further, had the receiver been of the single conversion type (such as the TMC Model FFR) then the H. F. oscillator would have been at $10 + .455$ or 10.455 mcs. In each case, the end result is the injection of a signal centered at 455 kc into the MSR-1. The MSR-1 then beats its internal 1st oscillator with the input signal so that the imaginary or real carrier appears at 17 kc and one or the other sideband fits within the filter limits.

The same result can be obtained with the internal frequency except that now the MSR-1 1st



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Figure 2-1. Block Diagram (Example I) MSR-1/GPR-90

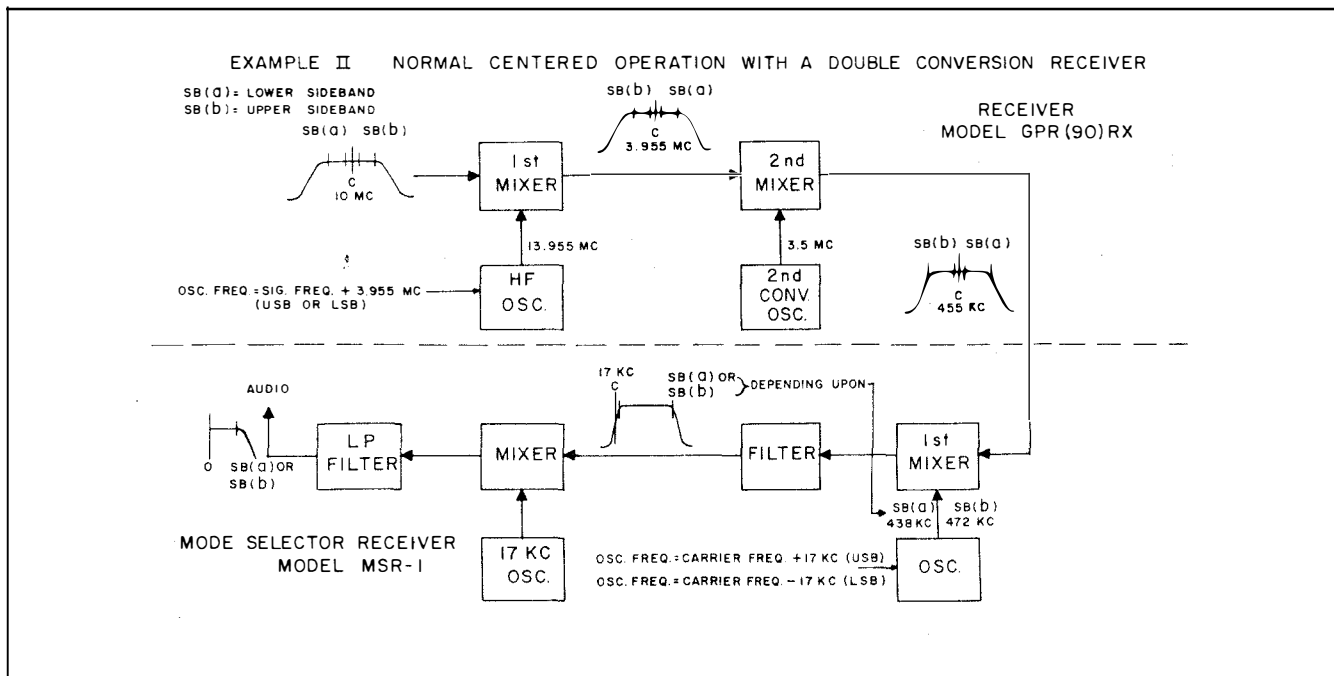
oscillator has to be shifted to a new point which will still result in the real or imaginary carrier appearing at 17 kc. Since the MSR-1 oscillator, in the VAR position, will produce products in the filter region only when the signal input is near 455 kc, it cannot be used with other I. F. 's. However, in crystal position, a crystal may be chosen which will permit operation with almost any I. F. (Using the equations of Figure 2-1 or 2-2).

Each mixer, in both the receiver or MSR-1, operates in such a way that a whole "slot" or band of frequencies representing the carrier and its sidebands is simply shifted so that they appear within the bandpass of the circuits which follow. If the receiver has a wide I. F. (perhaps ± 4 kc at the 3 db points) then the system bandpass will be that of the MSR-1 filters (-3 db at 350 cps and 3.2 kc). If, on the other hand, the receiver is of the Navy I. F. type (perhaps ± 2.5 kc at the 6 db points) then the system bandpass becomes that of the receiver I. F. because it is the narrowest. The MSR-1 filter accepts only one sideband at a time, therefore, the other sideband is simply occupying receiver I. F. space which is not being used. In the case of single sideband, this waste of receiver bandwidth is even more apparent because a segment of the receiver I. F. is completely unoccupied. If, on the other hand, the receiver is tuned so that the unused sideband slides off the edge of the bandpass curve and the desired sideband occupies the center of the bandpass, then the most efficient use is being made of the spectrum available. In this case, more information may be transmitted and received (for example, in the form

of more F. S. channels) or improved audio quality will result. It has been determined that for a combination of the Model FFR or GPR-90 with the Model MSR-1, the optimum shift is 2 kc and an illustration of such a set-up is shown in Figure 2-2.

1. For upper sideband reception.
 - A. Receiver - choose the oscillator injection frequency (variable or crystal) to be 2 kc above the normal injection frequency.
 - B. MSR-1 - use 474 kc crystal in socket Y2 or set BANDSPREAD tuning dial 2 kc above center.
2. For lower sideband reception.
 - A. Receiver - choose the oscillator injection frequency (variable or crystal) to be 2 kc below the normal injection frequency.
 - B. MSR-1 - use 436 kc crystal or set BANDSPREAD tuning dial 2 kc below center.

For example, suppose normally centered operation (Figure 2-1) is desired with a double conversion receiver having a 1st I. F. of 3.5 mcs, a 2nd I. F. of 350 kc, and the received signal is centered at 10 mcs, the H. F. oscillator must then be at $10 + 3.5$ or 13.5 mcs. The second oscillator must be at 3.15 mcs to produce the 350 kc 2nd I. F. Then, in order to bring the real or imaginary carrier to 17 kc, a 367 kc ($350 + 17$) or a 333 kc ($350 - 17$) crystal must be inserted in the MSR-1 to produce the upper or lower sideband.



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Figure 2-2. Block Diagram (Example II) MSR-1/GPR-90

In all the preceding paragraphs, the assumption has been made that the real or imaginary carrier will appear at 17 kc within the MSR-1. This will be so in all cases of single sideband or exalted carrier operation. However, in normal AM, CW, or FS operation, the incoming signal must be shifted for several reasons:

1. In Normal AM Operation:

In this case, the 17 kc local oscillator within the MSR-1 is turned off and the signal must supply its own carrier. If the carrier were brought in at 17 kc, it would be down on the slope of the filter and the proper sideband to carrier amplitude relationship would be disturbed. For this reason, the carrier must be off-set by about 400 cps (to 17.4 kc). This may be done by means of the variable 1st oscillator within the MSR-1 or by shifting the receiver by the same amount if xtals are used in the MSR-1.

2. CW Operation:

If the signal were centered at 17 kc, a zero beat would result with the MSR-1 17 kc oscillator and nothing would be heard. For this reason, either the receiver oscillator or the MSR-1 oscillator must be shifted by an amount equal to the beat note required (usually about 1 kc).

3. F. S. Operation:

As in CW operation (above), the receiver oscillator or MSR-1 must be shifted but in this case, by an amount which will produce a space at 2125 cps and a mark at 2975. Then standard mark and space beat tones are used and the amount of oscillator shift will, of course, be determined by the tones required.

2. CIRCUIT ANALYSIS

The Block Diagram Figure 2-3 presents a simplified outline of the functions of the MSR-1 and how they are accomplished.

THE AVC SYSTEM (V1A, B). - The AVC Amplifier and Rectifier provides two kinds of control on the first amplifier. A fast time constant is used to control signals which have an ever present component, i. e. AM, MCW, FS. A slow time constant will hold the amplifier gain steady for a longer period for SSB and CW signals. The gain of the amplifier is wide open when the AVC is OFF.

THE FIRST MIXER (V3). - The incoming signal is mixed with the First Oscillator to place

it in proper position relative to the bandpass filter. Since the filter extends from 17.3 kc to 20.5 kc and the 17 kc BFO follows, the signal carrier position must be placed at 17 kc to produce the correct tone.

THE FIRST OSCILLATOR (V8). - Provides the tunable frequency source for correctly tuning the signal in the bandpass filter. It may be either variable or crystal controlled. When variable it is tuned with the frontpanel BANDSPREAD control or with the reactance control.

THE REACTANCE MODULATOR (V9). - The reactance placed across the first oscillator tuned circuit is varied to change frequency. A ± 4.5 VDC input to the reactance stage is sufficient to vary the oscillator ± 3 kc. The voltage is obtained from the BFO channel of the TMC Model RCR Remote Control Receiver System.

RELAY DRIVER (V10A). - As the R. F. gain control on the RCR system is turned to reduce the gain of the FFR receiver the required voltage out of the RSD performing this action reaches a certain level. When the level is such that the receiver is fully silent its negative level will be sufficient to cut off the relay driver (V101A) and deenergize K3. This action in turn trips the sideband two step relay K2.

SIDEBAND SELECTOR RELAY (K2). - Operation of the relay driver or the front panel push-button advances the sideband selector relay one position. This changes the first oscillator frequency from upper to lower sideband selecting frequency or vice versa.

BANDPASS FILTER (Z1). - After the First Mixer, the filter passes a band of frequencies between 17.3 kc and 20.5 kc. The skirts provide the sharpness required for attenuation of undesirable adjacent signals. See Block Diagram Figure 2-3.

THE SECOND MIXER (V4). - The signal passed by the bandpass filter is demodulated in either of two ways. If a carrier is normally present and allowed to pass through the filter, such as AM, normal demodulation will take place. If no normal carrier is present, such as SSB, a carrier is reinserted.

THE BFO (V6A). - A stable 17 kc oscillator provides the reinserted carrier for SSB, exalted AM and produces the beat note for CW and FS signals.

THE BFO RELAY (K1). - The BFO is turned on or off by proper actuation of the relay. The

front panel BFO switch or a remote paralleled switch actuates the relay.

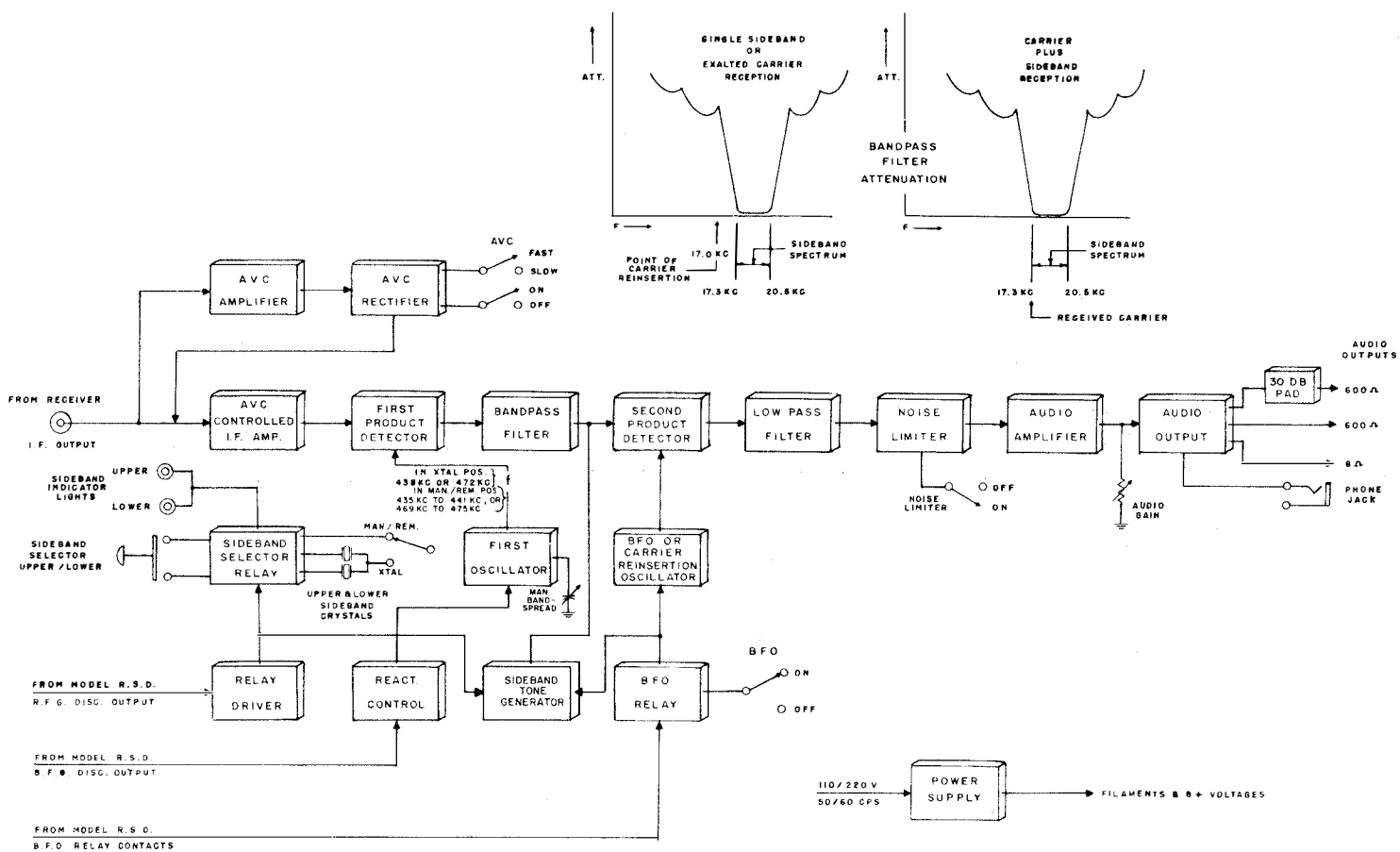
SIDEBAND TONE GENERATOR (V10B). - By proper manipulation of the R. F. gain control of the RSC this circuit generates a tone, high or low, which will indicate to the remote operator which sideband (upper or lower) is in use. The tone becomes strong enough to be heard only after the R. F. gain has succeeded in fully silencing the normal receiver action.

LOW PASS FILTER (Z2). - Following the second mixer the low pass filter attenuates any products above 5 kc. The resultant is the desired audio.

NOISE LIMITER (V5). - A noise limiter before the audio amplifying stages prevents them from being blocked by noise pulses. The limiter clips the pulses on both sides of the audio wave.

AUDIO AMPLIFIER (V6B). - Normal full output is provided for loudspeaker or 600 ohm line or a relative 0 dbm level to prevent overloading the telephone lines. A PHONES jack on the front panel permits monitoring of the output without disabling it.

POWER SUPPLY (V11). - The power supply is self contained and provides the necessary AC filament and DC B+ voltages. A regulated +150 V. stabilizes the First Oscillator and BFO.



NOTE -
 USED WITH AN/FFR-502 IN AN/FRA-501 SYSTEM
 AND AN/FFR-49(V) IN AN/FRA-19(V) SYSTEM.

Figure 2-3. Block Diagram Model MSR-1

DESIGNATION

NOMENCLATURE

FFR	AN/FRR-49 (V)
RCR	AN/FRA-501
RSC	C-5027 thru C-5031/FRA-501
GPR-90	R-840/URR
RSD	CV-5013 thru CV-5017/FRA-501
MSR-1	CV-591/URR

LIST OF CROSS REFERENCES BETWEEN COMMERCIAL
DESIGNATIONS AND GOVERNMENT NOMENCLATURE

SECTION III INSTALLATION AND OPERATION

I. INSTALLATION

A. UNPACKING

The TMC Model MSR-1, Mode Selector, Receiving has been designed for ease of installation and minimum effort in operation. The unit is packed in an individual shipping container and should be carefully unpacked. A close visual inspection should be made to determine any physical damage due to rough handling during shipment. If damage is found notify carrier immediately.

B. POWER SUPPLY

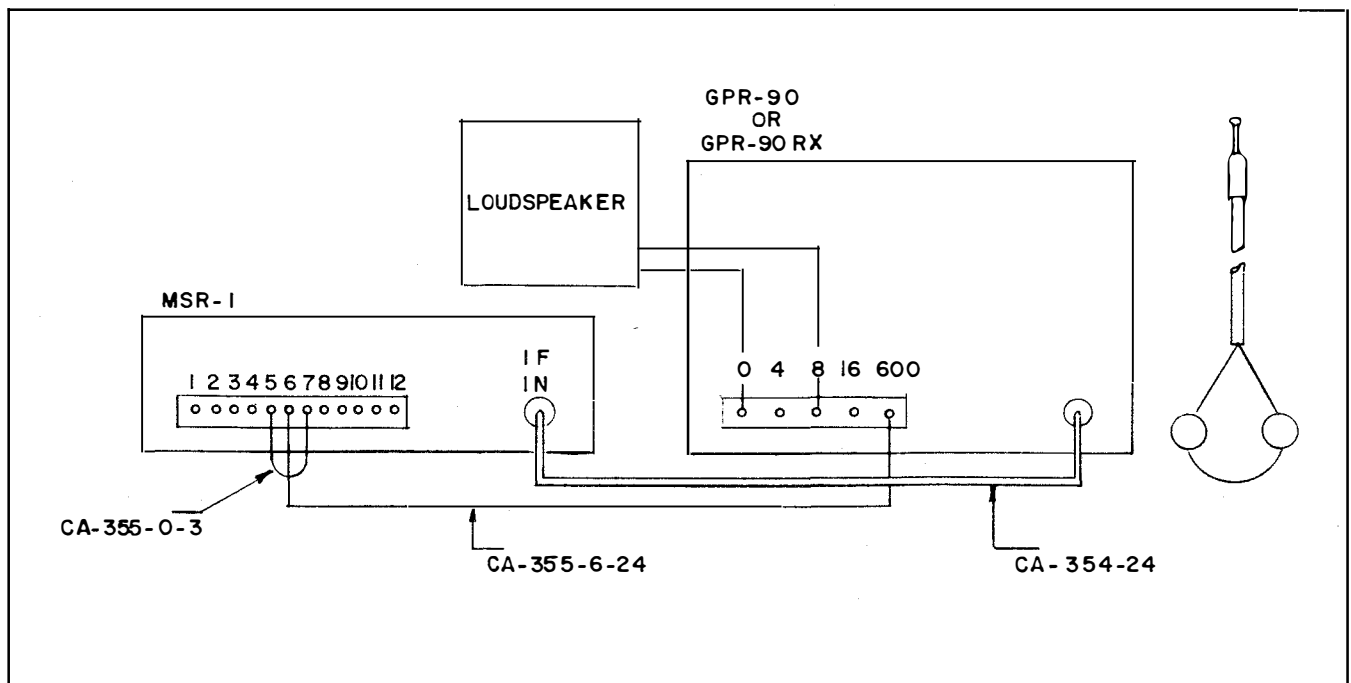
The unit is designed for operation from 110 volts, 50/60 cycle source, unless specifically ordered for 220 volt, 50/60 cycles. The unit is shipped wired for 110 volt AC operation. A simple wiring change in the tapped primary circuit of the power transformer is necessary to change the Model MSR-1 to 220 volt AC operation see Figure 5-5. This change is made directly on the power transformer terminal lugs as follows:

Remove switch lead from terminal 2 of T5 and connect it to terminal 3. Change fuse value to 1-1/2 amp.

C. ELECTRICAL CONNECTIONS

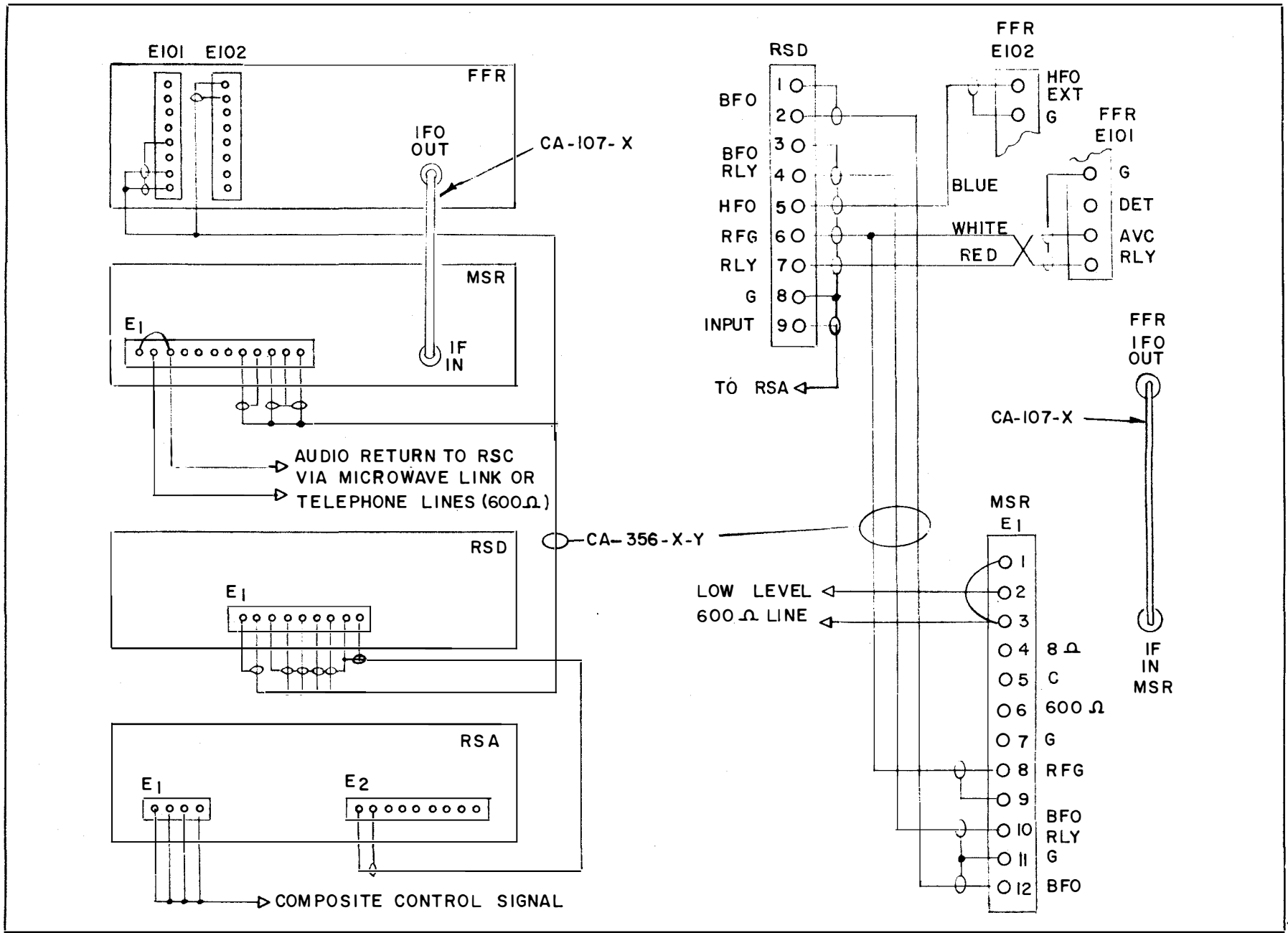
The proper electrical connections are made at the rear of the chassis. A lowloss coaxial cable is required to connect the I. F. output of the receiver into the MSR-1. If no I. F. output jack is available on the receiver, the proper connection may be made at the plate of the last I. F. amplifier through a 47 mmfd capacitor.

The audio output connections are made at the terminal strip E1 located on the rear apron. The output transformer has an 8 ohm tap for loudspeaker. Connect the speaker to terminals 4 and 5 of E1. Single loudspeaker operation for both the MSR-1 and the receiver is possible by paralleling the output connections of either the 600 ohm or loudspeaker tap. The output impedance has now been halved. Therefore, to match the impedance correctly it must be connected to the next higher impedance on the receiver. The output is then determined by the adjustment of the audio gain control on either unit. See Figure 3-1. The high level line connections are made at terminals 5 and 6 while low level line may be connected simultaneously at terminals 2 and 3. If only the low level line is required then connect terminal 1 to 3 to properly load output transformer.



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Figure 3-1. Cabling Connections Models MSR-1/GPR-90
for Single Loudspeaker Operation



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Figure 3-2. Cabling Connections Models MSR-1/FFR/RSD/RSA

The control voltages for remote operation may be obtained from the TMC Model RCR, Remote Control Receiver System which controls the TMC Model FFR, Communication Receiver. The following leads are removed from the Model FFR and connected to the Model MSR-1.

See Figure 3-2 for proper cabling.

1. Remove the BFO relay leads on terminals 5 and 6 of E102 of the FFR and replace to terminals 9 and 10 of E1 of the MSR-1.

2. Remove the BFO control leads on terminals 7 and 8 of E102 of the FFR and connect to terminals 11 and 12 of E1 of the MSR-1.

3. A shielded lead is connected from terminal 3 of E102 of the FFR to terminal 8 of the MSR-1.

2. OPERATION

A. DESCRIPTION OF CONTROLS

All operating controls are located on the front panel and perform similar functions to those found on any receiver.

BANDSPREAD - Tunes incoming signals across the band of the bandpass filter. Interfering signals are easily placed off the edge of the filter.

MANUAL/XTAL-The bandspread oscillator is variable either with the BANDSPREAD control or remotely when this switch is in MANUAL position. In XTAL position the oscillator is fixed to the frequency of the crystal within the unit.

UPPER/LOWER SIDEBAND-Either sideband is selected by pushing and releasing the button. A panel light indicates which sideband will pass through the filter.

BFO ON/OFF-This switch controls the second oscillator which reinserts the carrier for suppressed carrier operation or the tone for CW operation.

AVC ON/OFF-This switch permits control of signal either with or without carrier. For SSB, CW or FS signals the switch is set to SLOW. For AM or MCW signals the switch is set to FAST.

NOISE LIMITER OFF-This switch permits reduction of pulse type noise peaks when in the up position. Switch should be OFF when minimum distortion is required.

AUDIO GAIN-This control adjusts the output of the audio amplifier.

PHONES-This jack permits monitoring the audio output without cutting off the output.

POWER/OFF-This switch applies power to the unit.

B. TUNING PROCEDURE

(1) NORMAL TUNING OF RECEIVER TO SIGNAL FREQUENCY.

This method is used when the receiver bandwidth is sufficient to pass the sideband with no decrease of sideband amplitude. Employ the normal oscillator frequency equations as described in the receiver instruction manual (FFR or GPR-90) to tune the receiver to the signal frequency. If the receiver bandwidth is 5 kc or lower and the unimpaird passage of the desired sideband is required, then the receiver must be tuned off the signal frequency. This method is described in (2) below.

(a) Reception of Single Sideband Signals.

1. Tune receiver to signal frequency.
2. MSR-1 and receiver AVC ON and SLOW.
3. MSR-1 BFO switch ON.
4. MSR-1 MANUAL/XTAL switch on MANUAL.
5. Upper Sideband reception.
 - a. MSR-1 on UPPER.
 - b. Tune MSR-1 BANDSPREAD control to zero center position for intelligibility.
 - c. For crystal operation set MANUAL/XTAL switch on XTAL and place a 472 kc crystal in socket Y2.
6. Lower Sideband reception.
 - a. MSR-1 set on LOWER.
 - b. Tune MSR-1 BANDSPREAD control to zero center for intelligibility.
 - c. For crystal operation set MANUAL/XTAL switch on XTAL and place a 438 kc crystal in socket Y2. Tune receiver for intelligibility.

(b) Reception of AM Signals.

1. Tune receiver to signal frequency.
2. MSR-1 and receiver AVC ON and FAST.
3. MSR-1 BFO switch OFF.
4. MSR-1 MANUAL/XTAL switch on MANUAL.
5. Reception of both sidebands.
 - a. MSR-1 set on UPPER.
 - b. Tune MSR-1 BANDSPREAD control +2 kc above zero center.

- c. For crystal operation use a 474 kc crystal in socket Y2 with MANUAL/XTAL switch on XTAL.
- 6. Reception of Upper Sideband.
 - a. MSR-1 set on UPPER, MANUAL/XTAL switch on MANUAL.
 - b. Tune MSR-1 BANDSPREAD control +.4 kc above zero center.
 - c. Xtal operation use a 472 kc crystal in socket Y2 with MANUAL/XTAL switch on XTAL. Retune receiver .4 kc below the signal frequency. If receiver is crystal controlled pull the crystal frequency approximately 400 cps. with the crystal adjust control.
- 7. Reception of Lower Sideband.
 - a. MSR-1 set on LOWER, MANUAL/XTAL switch on MANUAL.
 - b. Tune MSR-1 Bandsread control -.4 kc below zero center.
 - c. Xtal operation use a 438 kc crystal in socket Y1 with MANUAL/XTAL switch set on XTAL. Retune receiver .4 kc above the signal frequency. If receiver is crystal controlled pull the crystal frequency approximately 400 cps with the crystal adjust control.

(c) Exalted Carrier Operation.

- 1. Tune receiver to signal frequency.
- 2. MSR-1 and receiver AVC ON and FAST.
- 3. MSR-1 BFO switch ON.
- 4. MSR-1 MANUAL/XTAL switch on MANUAL.
- 5. Tune MSR-1 as for SSB.

(d) CW and FS Operation.

- 1. Tune receiver to signal frequency.
- 2. MSR-1 and receiver AVC ON and SLOW.
- 3. MSR-1 BFO switch to ON.
- 4. MSR-1 MANUAL/XTAL switch on MANUAL.
- 5. Tune MSR-1 BANDSPREAD control to obtain desired pitch of signal.
- 6. Crystal operation - with MSR-1 set on UPPER and MANUAL/XTAL switch set on XTAL, use a 474 kc crystal in socket Y2 for a 2 kc CW note. Tune receiver for any other desired beat note.

(2) OFF CENTER TUNING OF RECEIVER.

Off center tuning of receiver to increase receiver bandwidth to sideband reception. This

method will permit the maximum bandwidth of the system to pass the sideband of the desired signal in the I. F. passband by detuning the receiver 2 kc in the appropriate direction, above the signal frequency for the upper sideband and below the signal frequency for the lower sideband. The MSR-1 must also be adjusted accordingly to realign the signal. The correct method follows:

(a) Reception of Single Sideband Signals.

- 1. MSR-1 and receiver AVC ON and SLOW.
- 2. MSR-1 BFO switch ON.
- 3. MANUAL/XTAL switch on MANUAL.
- 4. Upper Sideband Reception.
 - a. Tune receiver 2 kc above signal frequency.
 - b. Tune MSR-1 BANDSPREAD control +2 kc above zero center for intelligibility.
 - c. Crystal operation - set MANUAL/XTAL switch on XTAL and place a 474 kc crystal in socket Y2. Tune receiver for intelligibility.
- 5. Lower Sideband Reception.
 - a. Tune receiver -2 kc below signal frequency.
 - b. Tune MSR-1 BANDSPREAD control to -2 kc below zero center for intelligibility.
 - c. For crystal operation set MANUAL/XTAL switch on XTAL and place a 436 kc crystal in socket Y1. Tune receiver for intelligibility.

(b) Reception of AM Signals.

- 1. MSR-1 and receiver AVC ON and FAST.
- 2. MSR-1 BFO switch OFF.
- 3. MSR-1 MANUAL/XTAL switch on MANUAL.
- 4. Reception of Upper Sideband.
 - a. Tune receiver 1.6 kc above signal frequency.
 - b. MSR-1 set on UPPER.
 - c. Tune MSR-1 BANDSPREAD control +2 kc above zero center.
 - d. For Xtal operation place MANUAL/XTAL switch on XTAL and insert a 474 kc crystal in socket Y2. Retune receiver 1.6 kc above the signal frequency.
- 5. Reception of Lower Sideband.
 - a. Tune receiver 1.6 kc below signal frequency.
 - b. MSR-1 set on LOWER.
 - c. Tune MSR-1 BANDSPREAD control -2 kc below zero center.

- d. For Xtal operation place **MANU-AL/XTAL** switch on **XTAL** and insert a 436 kc crystal in socket **Y1**. Retune receiver 1.6 kc below the signal frequency.

(c) Exalted Carrier Operation.

1. **MSR-1** and receiver **AVC** **ON** and **SLOW**.
2. **MSR-1** **BFO** switch **ON**.
3. Reception of sidebands. See **B-(2)-(a)** above.

3. REMOTE OPERATION

A. FUNCTIONS.

The **TMC Model RCR Remote Control Receiver System** will control the **MSR-1** in conjunction with the **TMC Model FFR Communication Receiver** in a remote installation.

The **HFO** control on the **RSC** tunes the **HFO** of the **FFR** within a limited range. There is no change of its function or range.

With the **RSC's AVC** switch **ON**, the **FFR** gain is being controlled by its own **AVC**. With the **RSC's AVC** switch **OFF**, the **RF GAIN** control determines not only the gain of the **FFR** but with proper manipulation operates the **MSR-1** sideband selector and indicates proper sideband.

The **MSR-1** sideband selector is operated as follows:

- (1) Turn **RSC AVC** switch to **OFF**.
- (2) Turn **RF GAIN** control fully clockwise to 10. This advances the switching relay to the next sideband.
- (3) Turn **RF GAIN** control fully counter-clockwise to zero and hold for one second. This releases the sideband switching relay. Switching is now completed.
- (4) Return control to normal position for desired gain.

The sideband in use is indicated in the loudspeaker as an audible tone; low pitch for lower sideband, high pitch for upper sideband. The tone becomes audible as the **RF GAIN** is turned clockwise past 5. The tone increases in volume as the control is advanced until the switching sequence is performed. The tone changes pitch as soon as the switching occurs. Returning the control to zero removes the tone.

B. REMOTE TUNING

Remote operation of the **MSR-1** in the **RCR System** requires that the **RSC**, **MSR-1** and **FFR** be aligned correctly to the desired signal. In setting up the system, the methods described in the **RCR** instruction manual are followed, keeping in mind, the functions of the various controls on the **RSC** which operate the **MSR-1**. When it is determined that the **RCR** system is operating correctly, align the **RSC**, **MSR-1** and **FFR** to receive the desired signal. At the control site set the **RSC** control as follows:

HFO control - Centered at 0

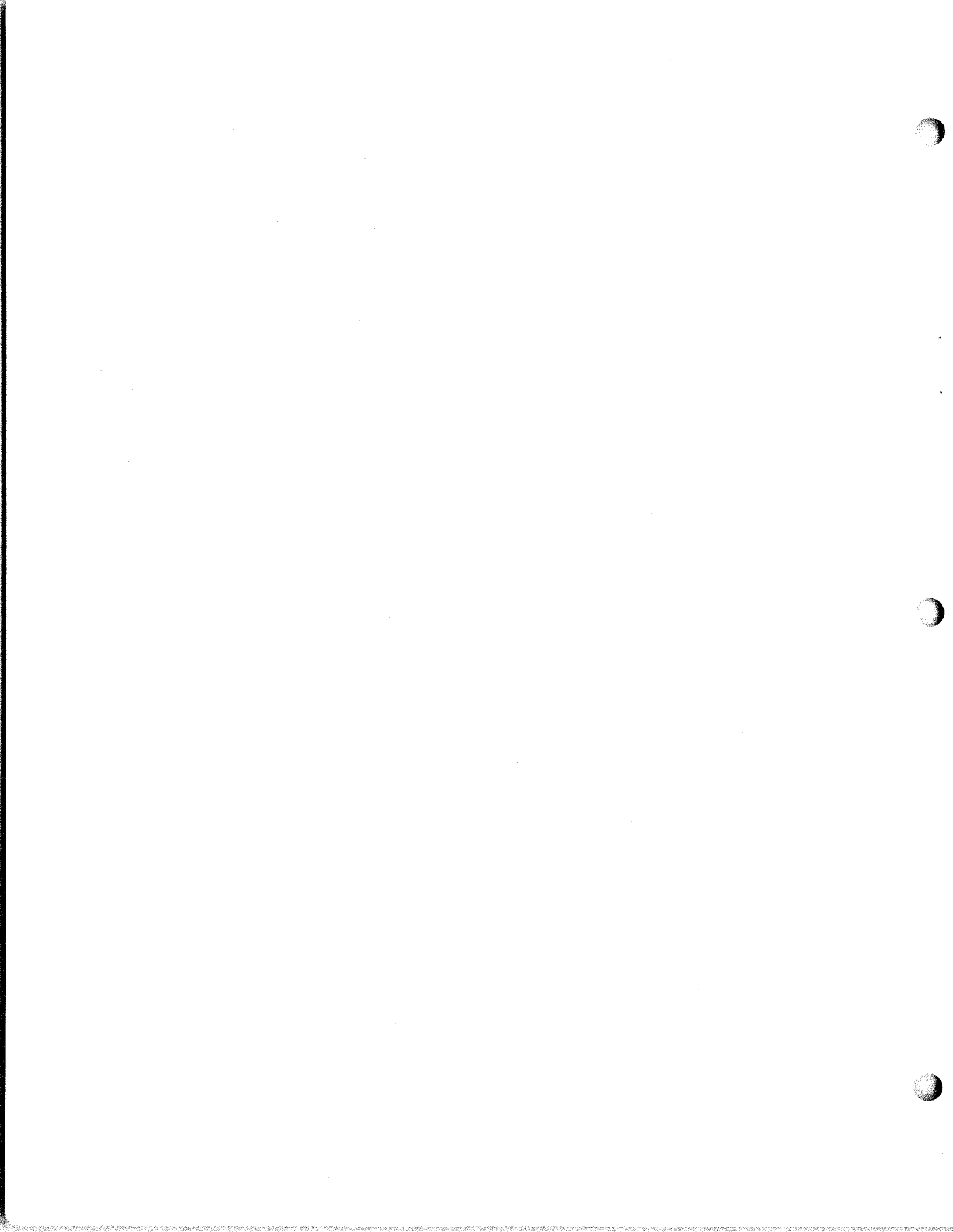
BFO switch - **ON**

BFO control - Centered at 0

AVC switch - **ON**

At the remote site, tune the **MSR-1** and the **FFR** receiver as described in the tuning procedure. Once the receiver is tuned, lock its tuning dial in position. Control of the equipment is now returned to the control site.

At the control site, the **RSC** controls now perform the functions as described in **Functions Part A** above. When receiving **AM** signals, the **MSR-1 BANDSPREAD** control is inoperative since the **BFO** switch is **OFF**. Operation of the **HFO** control is required to tune the desired **AM** signal into the **MSR-1**.



SECTION IV MAINTENANCE

1. SERVICE MAINTENANCE

A. GENERAL

The Model MSR-1 has been designed for long term trouble free duty. Little attention beyond normal maintenance is required. It is recommended that any maintenance to the equipment be performed by a competent technician.

Should normal operation procedure produce unsatisfactory results, a quick check of the power supply will very often determine the cause of the trouble. A pilot light indicates when power is being applied to the unit. Should the pilot lamp fail to light then the UPPER/LOWER SIDEBAND switch should be operated as an alternate means of checking since the sideband switching relay operates directly off of the 110 volt line. If no power is evident then check the fuse on the rear apron. A blown fuse should be replaced with one of equal value. If the fuse blows again the unit should be checked for shorts. The most common cause of operational failure is usually tube failure. Checking the tubes will often save many hours of unnecessary troubleshooting.

B. PREVENTIVE

All components in this unit have been carefully selected to assure maximum efficiency in operation. If the sensitivity should drop and tube failure is suspected, test each tube in a reliable tube tester. The measured characteristics of the tube should be within the manufacturers tolerances (usually $\pm 20\%$ from tube manual tolerances). No special selection is necessary in the event of tube replacement, but the operator should remember that tubes of the same type will vary slightly in their individual characteristics.

Failure may occur due to breakdown of capacitors or resistors. Test all AC and DC voltages as indicated on Tube Voltage and Resistance charts, and investigate any serious discrepancies.

A faulty capacitor may cause overload of associated resistors, which should be checked for any change in resistance value. A shorted resistor may be detected by scorching or discoloration marks on the surface of the resistor. An open capacitor may cause unwanted oscillations and may be checked by connecting a good capacitor across it.

In order to prevent failure of the equipment due to corrosion, dust, and other destructive ambient conditions, it is recommended that the inside of the chassis be thoroughly inspected for signs of dirt, dampness, molding, charring or corrosion every 6 months. Correct any defect with cleaning agent of proven quality. When placing the unit in the rack, the operator should make certain that all terminal screw connections are tight.

2. CIRCUIT ALIGNMENT

The oscillators have been aligned to their correct frequencies at the factory. Readjustment will only be required if the performance of the unit is impaired as when the bandspread oscillator is off scale with a signal centered on 455 kc. The oscillators may be aligned either with an accurate signal generator or with a receiver as the signal source.

A. ALIGNMENT WITH SIGNAL GENERATOR

Equipment Required

RF Signal Generator

Audio Generator

Vacuum Tube Volt Meter

Oscilloscope

DC Source 0 to ± 10 volts.

1. Alignment of Bandspread Oscillator-Upper Sideband.
 - a. Feed a 472.00 kc signal from the RF signal generator to the IF input jack J1.
 - b. Connect the oscilloscope to pin 5 of V3 the 1st Mixer.
 - c. Switch sideband to UPPER.
 - d. To assure a zero potential at terminals 12 of E1, short terminals 11 and 12.
 - e. Set BANDSPREAD control to zero.
 - f. Adjust the core of T2 for a zero beat on scope (steady horizontal trace).
2. Alignment of Bandspread Oscillator-Lower Sideband.
 - a. Switch sideband to LOWER.
 - b. Set RF signal generator to 438.00 kc.
 - c. Adjust C29 for a zero beat on scope (steady horizontal trace).
 - d. Remove short from terminals 11 and 12 of E1.
3. Bandspread Oscillator Remote Control.

- a. Connect the variable DC supply to terminal 12 of E1.
 - b. Varying the DC voltage ± 4.5 volts should produce a balanced shift of approximately ± 4 kc in either upper or lower sideband position. If not reasonably balanced, adjust Reactance Balance Control, R48 for proper balance.
4. Alignment of 17 kc Oscillator.
- a. Feed a 17.00 kc audio signal to pin 7 of V4 the 2nd Mixer.
 - b. Connect the scope to pin 5 of V4.
 - c. Set the BFO switch to ON.
 - d. Adjust the C40 (mounted on top of Z4) for a zero beat on the scope.
5. Sideband Selector Remote Operation.
- a. Connect the variable DC source to terminals 7 and 8 of E1 with negative lead on 8.
 - b. Vary the DC voltage from zero to -9.0 volts. Switching should occur between -7.5 and -8.0 volts. If not adjust R54 accordingly.
6. Alignment of Side Tone Generator.
- a. Set BFO switch to ON.
 - b. Connect the VTVM to pin 7 of V4.
 - c. Vary the DC supply connected to pins 7 and 8 of E1 from zero to -9.0 volts. As the DC voltage approaches -5.0 volts the side tone oscillator should just start. Decreasing the voltage to -9.0 volts should increase the output of the oscillation to approximately 2.5 volts.

- NOTE: Oscillator will start at two positions of threshold. Correct position produces increased output as control voltage goes more negative.
- d. Set sideband to UPPER.
 - e. Adjust C55 on Z5 for a 2 kc note.
 - f. Set sideband to LOWER.
 - g. Output frequency should be approximately 500 cps.

B. ALIGNMENT WITH RECEIVER

Tune in a stable signal so that its carrier passes through the center of the IF. If the receiver has a selective IF filter, it should be used in its narrowest position to determine correct placement of the carrier on 455 kc. Place the sideband oscillator of the MSR-1 in the XTAL position at either 472 kc or 438 kc.

- (1) Set BFO to ON.
- (2) Tune 17 kc oscillator (C40) to obtain a zero beat.
- (3) Set BANDSPREAD control to zero.
- (4) Set sideband to UPPER.
- (5) Switch from XTAL to MANUAL.
- (6) Adjust T2 of Z3 to obtain a zero beat.
- (7) Set sideband to LOWER.
- (8) Adjust C29 to obtain zero beat.

The side tone generator is checked as in A (6) above since no input signal is required.

TUBE	TYPE	FUNCTION	SOCKET PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V1	12AU7	AVC AMP-RECT.	-0.6	-0.6	0.4	6.3*	6.3*	104	0	3	6.3*
V2	6BA6	I.F. AMP.	0	2.1	6.3*	6.3*	240	92	2.1		
V3	6BE6	1st MIXER	-11.2	2.2	6.3*	6.3*	255	66	0		
V4	6BE6	2nd MIXER	-4	0.7	6.3*	6.3*	170	42	0		
V5	6AL5	NOISE LIMITER	0.70	0	6.3*	6.3*	0.70	NC	0		
V6	12AU7	2nd OSC.-AUD. AMP.	134	-27	0	6.3*	6.3*	85	0	3.7	6.3*
V7	6AQ5	AUDIO OUT.	NC	22	6.3*	6.3*	240	260	0		
V8	6AG5	1st OSC.	-1.7	0.44	6.3*	6.3*	60	83	NC		
V9	6J6	REACT. MOD.	60	60	6.3*	6.3*	0	0	1.8		
V10	12AU7	RELAY DRIVER-SIDE TONE GEN.	60	0	1.4	6.3*	6.3*	148	30	58	6.3*
V11	5Y3	RECTIFIER	NC	365	NC	365*	NC	365*	NC	365	
V12	0A2	VOLT. REG.	150	NC	NC	NC	150	NC	0		

CONDITIONS:

ALL MEASUREMENTS TAKEN WITH V.T.V.M.

BFO - ON

SIDEBAND - MANUAL

NOISE LIMITER - OFF

AUDIO GAIN - CLOCKWISE

AVC - OFF

AVC - FAST

NO SIGNAL

NC = NO CONNECTION

* = AC VOLTAGE

AC LINE VOLTAGE - 115 V.

ALL VOLTAGES TO GROUND EXCEPT AC

FILAMENT VOLTAGES - ACROSS FILAMENTS

CH-156

Figure 4-1. Voltage Chart Model MSR-1

TUBE	TYPE	FUNCTION	SOCKET PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V1	12AU7	AVC AMP-RECT.	1.2M	1.2M	150K	0	0	80K	430K	680	0
V2	6BA6	I.F. AMP.	470K	220	0	0	44K	100K	220		
V3	6BE6	1st MIXER	22K	220	0	0	50K	63K	470K		
V4	6BE6	2nd MIXER	9	120	0	0	150K	90K	20K		
V5	6AL5	NOISE LIMITER	2.2M	12K	0	0	2.2M	NC	12K		
V6	12AU7	2nd OSC.-AUD. AMP	inf.	100K	1.2	0	0	140K	470K	2.2K	0
V7	6AQ5	AUDIO OUT.	NC	560	0	0	38K	38K	1M		
V8	6AG5	1st OSC.	2.2K	120	0	0	72K	72K	NC		
V9	6J6	REACT. MOD.	90K	90K	0	0	590K	33K	1.2K		
V10	12AU7	RELAY DRIVER- SIDE TONE GEN.	52K	inf.	3.9K	0	0	inf.	220K	30K	0
V11	5Y3	RECTIFIER	NC	38K	NC	100	NC	100	NC	38K	
V12	0A2	VOLT. REG.	38K	NC	NC	NC	38K	NC	0		

CONDITIONS:
 OHMMETER - SIMPSON 260 OR EQUIVALENT
 RESISTANCES TO GROUND
 AUDIO GAIN - CLOCKWISE

NC = NO CONNECTION
 K = THOUSAND
 M = MILLION

CH-157

Figure 4-2. Resistance Chart Model MSR-1

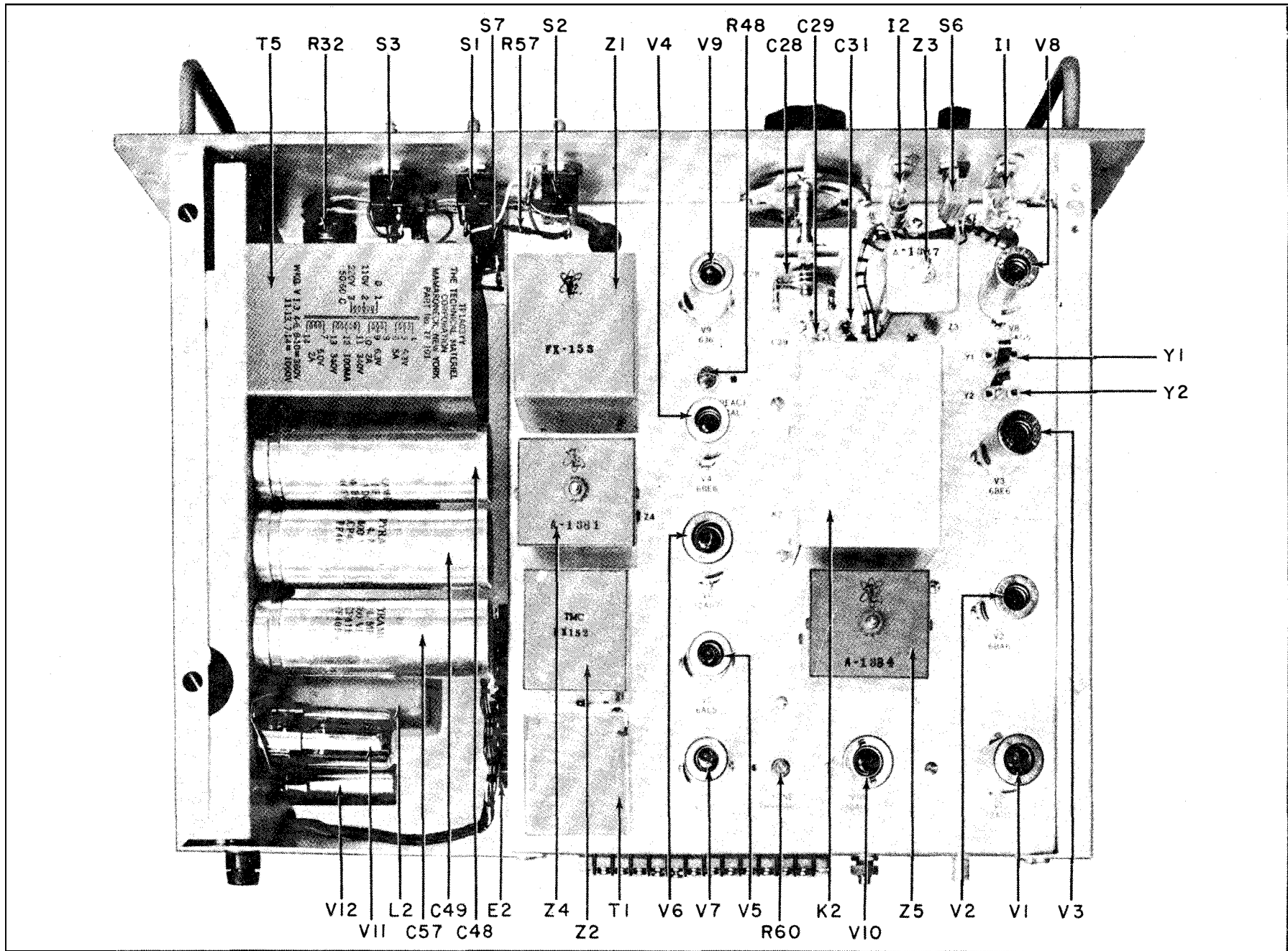
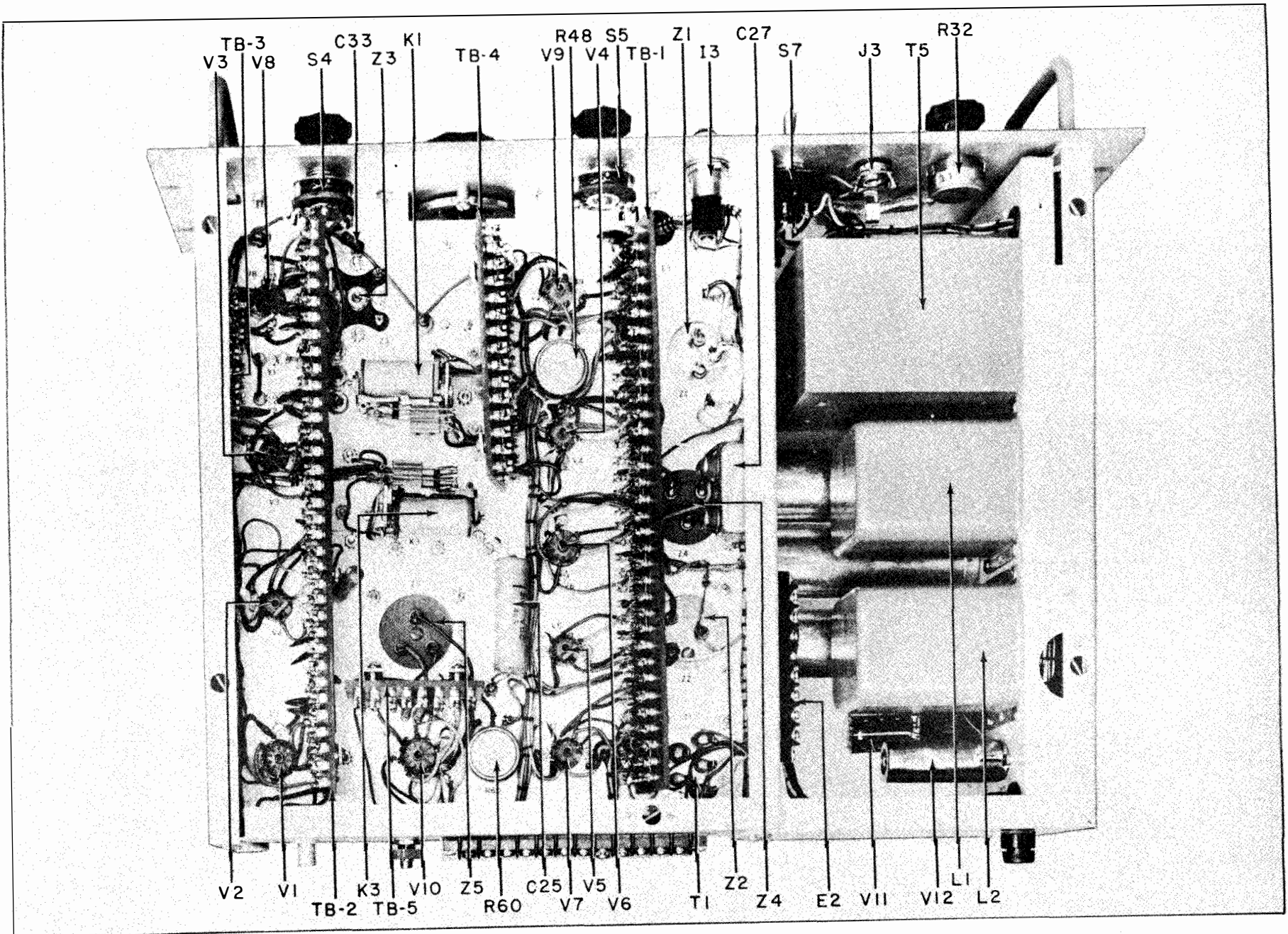


Figure 5-1. Top View Model MSR-1



PH-620

Figure 5-2. Bottom View Model MSR-1

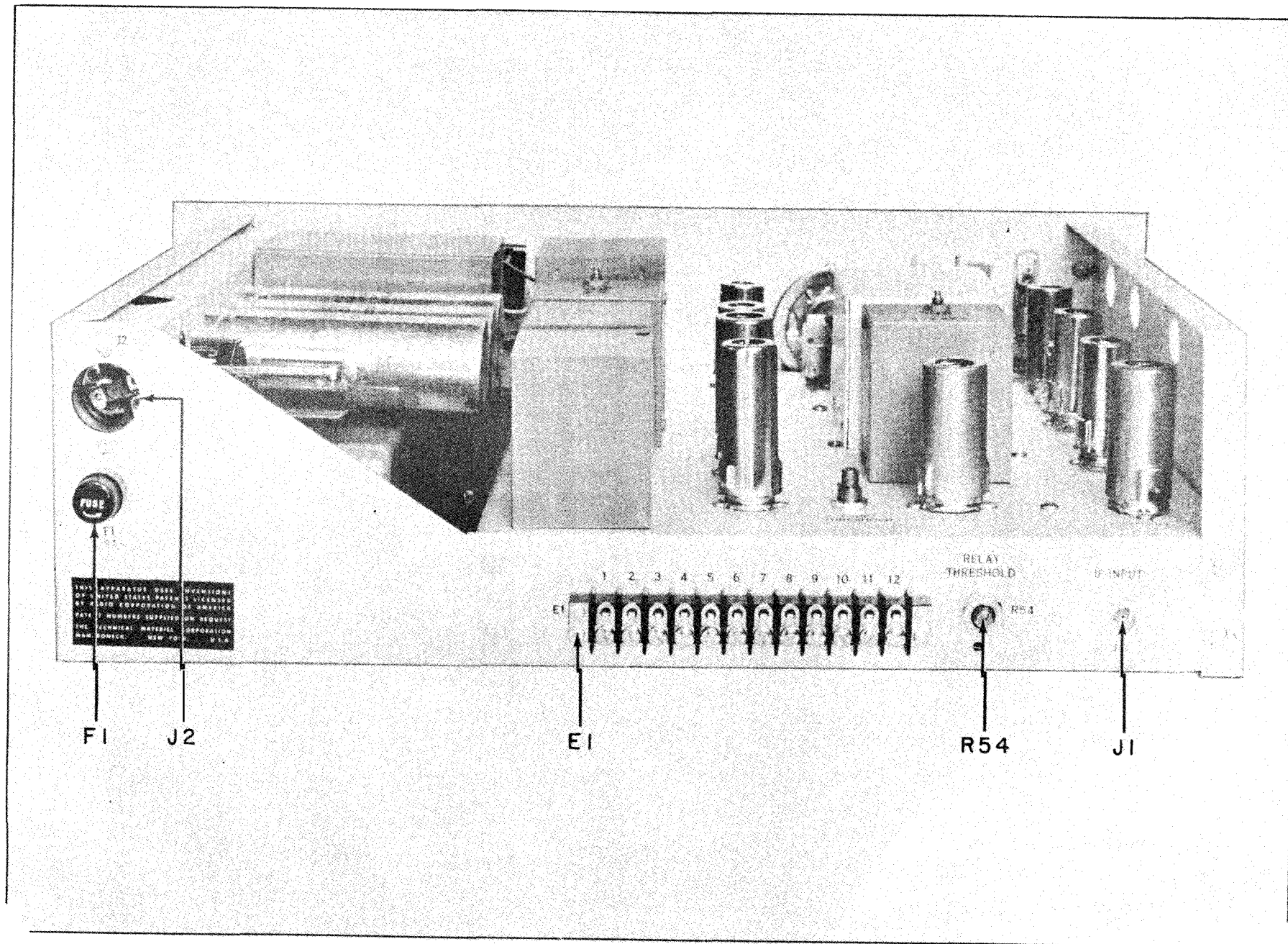
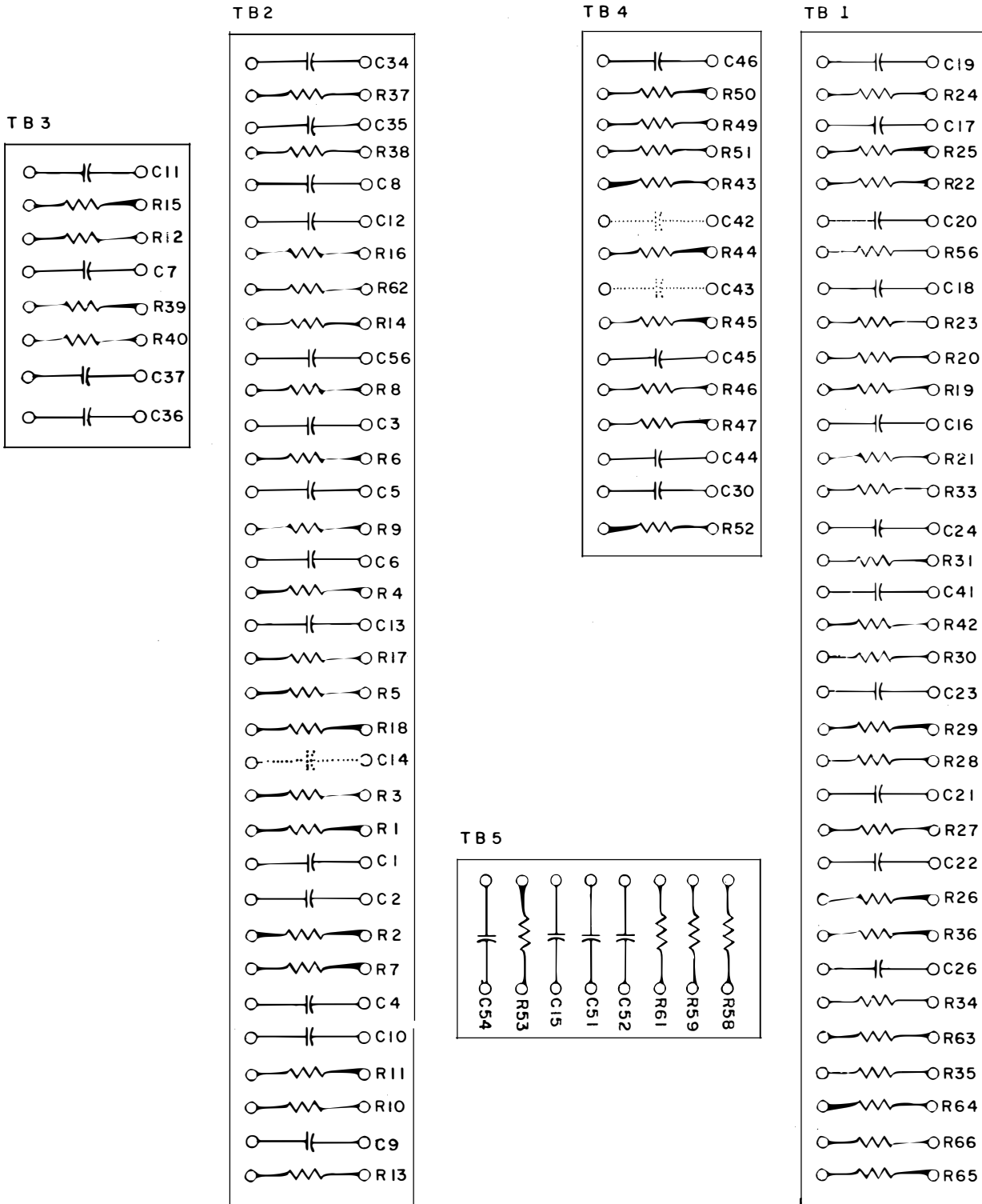


Figure 5-3. Rear View Model MSR-1



NOTE: COMPONENTS SHOWN IN DOTTED LINES ARE ON REAR OF BOARD.

Figure 5-4. Terminal Board Layout Model MSR-1

SECTION V ELECTRICAL PARTS LIST

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
C1	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc.	IF Input Coupling Cap., J1	CC-100-16
C2	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	AVC Blocking Cap., V1A	CC-100-16
C3	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Plate Bypass Cap., V2	CC-100-16
C4	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Cath. Bypass V1A	CC-100-16
C5	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Screen Bypass V2	CC-100-16
C6	CAPACITOR, fixed: ceramic; 120 mmfd, ±24 mmfd; 500 wvdc.	Coupling Cap., V2-V3	CC-101-4
C7	CAPACITOR, fixed: ceramic; 47 mmfd, ±10%; 500 wvdc.	Coupling Cap., V3-V8	CC21SL470K
C8	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Plate Bypass Cap., V3	CC-100-16
C9	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Coupling Cap., V1A-V1B	CC-100-16
C10	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Plate Decoupling Cap., V1A	CC-100-16
C11	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Cath. Bypass Cap., V3	CC-100-16
C12	CAPACITOR, fixed: ceramic .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Screen Bypass Cap., V3	CC-100-16
C13	CAPACITOR, fixed: ceramic; .001 mfd, ±200 mmfd; 500 wvdc.	Plate Bypass Cap., V1B	CC-100-9
C14	CAPACITOR, fixed: plastic; .1 mfd, ±5%; 200 wvdc.	AVC Filter Cap., V1B	CN108C1003J
C15	CAPACITOR, fixed: ceramic; 47 mmfd, ±10%; 500 wvdc. (same as C7)	Coupling Cap., V4-V10	CC21SL470K
C16	CAPACITOR, fixed: ceramic; 220 mmfd, ±10%; 500 wvdc.	Coupling Cap., V4	CC-101-3
C17	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Plate Bypass Cap., V4	CC-100-16
C18	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Cath. Bypass Cap., V4	CC-100-16
C19	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Screen Bypass Cap., V4	CC-100-16
C20	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Coupling Cap., V4-V5	CC-100-16

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
C21	CAPACITOR, fixed: ceramic; .001 mfd, ± 200 mmfd; 500 wvdc. (same as C13)	Filter Cap., V5	CC-100-9
C22	CAPACITOR, fixed: ceramic; .001 mfd, ± 200 mmfd; 500 wvdc. (same as C13)	Plate Bypass Cap., V5	CC-100-9
C23	CAPACITOR, fixed: ceramic; .001 mfd, ± 200 mmfd; 500 wvdc. (same as C13)	Coupling Cap., V5-V6B	CC-100-9
C24	CAPACITOR, fixed: ceramic; .001 mfd, ± 200 mmfd; 500 wvdc. (same as C13)	Coupling Cap., V6B-V7	CC-100-9
C25	CAPACITOR, fixed: plastic; 2 mfd, $\pm 10\%$; 200 wvdc.	Cath Bypass Cap., V7	CN108C2004K
C26	CAPACITOR, fixed: ceramic; .001 mfd, ± 200 mmfd; 500 wvdc. (same as C13)	Audio Bypass Cap., V7	CC-100-9
C27	CAPACITOR, fixed: electrolytic; 10 mfd, 300 wvdc.	P.S. Filter Cap., V7	CE64C100N
C28	CAPACITOR, variable: air; 2.8-16 mmfd, 1200 v. rms.	Bandsread Cap.	CB-135-4
C29	CAPACITOR, variable: ceramic; 7-45 mmfd, 500 wvdc.	Bandsread Adj. Cap.	CV11C450
C30	CAPACITOR, fixed: ceramic; 100 mmfd, $\pm 5\%$; 500 wvdc.	Coupling Cap., V9	CC32CH101J
C31	CAPACITOR, fixed: mica; 51 mmfd, $\pm 5\%$; 500 wvdc.	Bandsread Comp. Cap.	CM20E510J
C32	CAPACITOR, fixed: mica; 430 mmfd, $\pm 2\%$; 500 wvdc.	p/o Bandpass Filter, Z3	CM20D431G
C33	CAPACITOR, fixed: ceramic; 47 mmfd, $\pm 5\%$; 500 wvdc.	Coupling Cap., S4	CC32CH470J
C34	CAPACITOR, fixed: ceramic; 30 mmfd, $\pm 5\%$; 500 wvdc.	Grid Bypass Cap., S4	CC21SL300J
C35	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Cath. Bypass Cap., V8	CC-100-16
C36	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Screen Bypass Cap., V8	CC-100-16
C37	CAPACITOR, fixed: ceramic; 150 mmfd, $\pm 10\%$; 500 wvdc.	Screen Bypass Cap., V8	CC-101-2
C38	CAPACITOR, fixed: mica; .001 mfd, $\pm 2\%$; 500 wvdc.	p/o 17 Kc Osc. Tank, Z4	CM20D102G
C39	CAPACITOR, fixed: mica; 1500 mmfd, $\pm 2\%$; 500 wvdc.	p/o 17 Kc Osc. Tank, Z4	CM20D152G
C40	CAPACITOR, variable: mica; 100-550 mmfd, 250 wvdc.	17 Kc Osc. Adj., Z4	CV-100-304

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
C41	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Plate Bypass Cap., V6A	CC-100-16
C42	CAPACITOR, fixed: plastic; .1 mfd, ±5%; 200 wvdc. (same as C14)	Filter Cap., V9	CN108C1003J
C43	CAPACITOR, fixed: plastic .1 mfd, ±5%; 200 wvdc. (same as C14)	Filter Cap., V9	CN108C180J
C44	CAPACITOR, fixed: ceramic; .001 mfd, ±200 mmfd; 500 wvdc. (same as C13)	Plate Coupl. Cap., V9	CC-100-9
C45	CAPACITOR, fixed: ceramic; 22 mmfd, ±5%; 500 wvdc.	Screen Bypass Cap., V9	CC21SL220J
C46	CAPACITOR, fixed: ceramic; .001 mfd, ±200 uuf; 500 wvdc. (same as C13)	Cath. Bypass Cap., V9	CC-100-9
C47 A, B	CAPACITOR, fixed: ceramic; two section; .01 mfd, 500 wvdc ea. section.	AC Line Filter Cap.	CC-100-23
C48	CAPACITOR, fixed: paper, 4 mfd, +20 -10%; 600 wvdc.	PS Filter Cap. V11	CP41B1FF405V
C49	CAPACITOR, fixed: paper, 4 mfd, +20 -10%; 600 wvdc.	PS Filter Cap. V11	CP41B1FF405V
C50	CAPACITOR, fixed: mica; .001 mfd, ±2%; 500 wvdc. (same as C38)	p/o 17 Kc Osc. Tank, Z4	CM20D102G
C51	CAPACITOR, fixed: mica; 680 mmfd, ±5%; 500 wvdc.	Grid Bypass Cap., V4	CM20D681J
C52	CAPACITOR, fixed: mica; .001 mfd, ±2%; 500 wvdc. (same as C38)	Grid Coupl. Cap, V10B	CM20D102G
C53	CAPACITOR, fixed: mica; 1100 mmfd, ±2%; 500 wvdc.	p/o Side Tone Gen. Tank, Z5	CM20D112G
C54	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Bypass Cap., Z5	CC-100-16
C55	CAPACITOR, variable: mica; 100-550 mmfd, 250 wvdc. (same as C40)	Side Tone Gen. Adj., Z5	CV-100-304
C56	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. (same as C1)	Coupling Cap., V3	CC-100-16
C57	CAPACITOR, fixed: paper; 4 mfd, +20 -10%; 600 wvdc. (same as C48)	PS Filter Cap., V11	CP41H1FF405V
E1	TERMINAL BOARD, barrier type: plastic; 12 terminals, screw w/feed thru solder lug type.	Input Term. Board	TM-100-12
E2	TERMINAL BOARD, barrier type: plastic; 8 terminals, screw w/feed thru solder lug type.	Inter. Term. Board	TM-100-8

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
E3	TERMINAL BOARD, phenolic: 2 terminals, solder lug type	Chassis Term. Unit	TM-117-10
E4	TERMINAL BOARD, phenolic: 12 terminals, right angle spade lug type (supplied as loose item).	Fanning Strip	TM-105-12-AL
F1	FUSE, cartridge: 3 amp; 250 v; instantaneous.	Line Fuse	FU-100-3
I1	LAMP, incandescent: 6-8v; 150 ma; T3-1/4 clear bulb; bayonet base.	Sideband Indicator	BI-101-47
I2	LAMP, incandescent: 6-8v; 150 ma; T3-1/4 clear bulb; bayonet base. (same as I1)	Sideband Indicator	BI-101-47
I3	LAMP, incandescent: 6-8v; 150 ma; T3-1/4 clear bulb; bayonet base. (same as I1)	Power Indicator	BI-101-47
J1	CONNECTOR, receptacle: electrical; 1 female contact; 52 ohms; BNC type.	IF Input Jack	UG-625/U
J2	CONNECTOR, receptacle: electrical; 2 male contacts; 10 amp at 250 v.	AC Line Input Jack	JJ-115
J3	JACK, telephone: tip and sleeve; bushing mounted; fits plug PJ-055.	Phones Jack	JJ-034
K1	RELAY, armature: DPDT; 80 v. d. c., .32 w; 20,000 ohms.	BFO Relay	RL-105
K2	RELAY, armature: impulse type; 4 PDT; 115 v. a. c; 60 cps.	Sideband Selector Relay	RL-118-17A115-60-A
K3	RELAY, armature: DPDT; 80 v. d. c., .32 w; 20,000 ohms. (same as K1)	Side Tone Selector Relay	RL-105
L1	REACTOR, fixed: 15 henries; 85 ma d. c.; 285 ohms d. c.; 2500 v. rms test.	PS Filter Choke, V11	TF-5000
L2	REACTOR, fixed: 15 henries; 85 ma d. c.; 285 ohms d. c.; 2500 v. rms test. (same as L1)	PS Filter Choke, V11	TF-5000
P1	CONNECTOR, plug: electrical; 1 male contact; BNC type. (supplied as loose item)	AC Line Input Plug	UG-260/U
R1	RESISTOR, fixed: composition; 22 ohms, $\pm 10\%$; 1/2 w.	Grid Limiting Res., V2	RC20GF220K
R2	RESISTOR, fixed: composition 470,000 ohms, $\pm 10\%$; 1/2 w.	Grid Res., V1A	RC20GF474K
R3	RESISTOR, fixed: composition 470,000 ohms, $\pm 10\%$; 1/2 w. (same as R2)	Grid Res., V2	RC20GF474K

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
R4	RESISTOR, fixed: composition; 4700 ohms, $\pm 10\%$; 1/2 w.	Plate Load Res., V2	RC20GF472K
R5	RESISTOR, fixed: composition; 220 ohms, $\pm 10\%$; 1/2 w.	Cath. Bias Res., V2	RC20GF221K
R6	RESISTOR, fixed: composition; 68,000 ohms, $\pm 10\%$; 1 w.	Screen Grid Res., V2	RC30GF683K
R7	RESISTOR, fixed: composition; 680 ohms, $\pm 10\%$; 1/2 w.	Cath. Bias Res., V1A	RC20GF681K
R8	RESISTOR, fixed: composition; 2200 ohms, $\pm 10\%$; 1/2 w.	Plate Decoupling Res., V2	RC20GF222K
R9	RESISTOR, fixed: composition; 470,000 ohms, $\pm 10\%$; 1/2 w. (same as R2)	Grid Res., V3	RC20GF474K
R10	RESISTOR, fixed: composition; 22,000 ohms, $\pm 10\%$; 1 w.	Plate Load Res., V1A	RC30GF223K
R11	RESISTOR, fixed: composition; 22,000 ohms, $\pm 10\%$; 1 w. (same as R10)	Plate Decoupl. Res., V1A	RC30GF223K
R12	RESISTOR, fixed: composition; 22,000 ohms, $\pm 10\%$; 1/2 w.	Grid Res., V1B	RC20GF223K
R13	RESISTOR, fixed: composition; 150,000 ohms, $\pm 10\%$; 1/2 w.	Cath. Bias Res., V1B	RC20GF154K
R14	RESISTOR, fixed: composition; 10,000 ohms, $\pm 10\%$; 1/2 w.	Plate Load Res., V3	RC20GF103K
R15	RESISTOR, fixed: composition; 220 ohms, $\pm 10\%$; 1/2 w. (same as R5)	Cath. Bias Res., V3	RC20GF221K
R16	RESISTOR, fixed: composition; 2200 ohms, $\pm 10\%$; 1/2 w. (same as R8)	Plate Decoupl. Res., V3	RC20GF222K
R17	RESISTOR, fixed: composition; 1.5 megohm, $\pm 10\%$; 1/2 w.	AVC Load Res., V1B	RC20GF155K
R18	RESISTOR, fixed: composition; 10 megohms, $\pm 10\%$; 1/2 w.	AVC Time Constant Cap.	RC20GF106K
R19	RESISTOR, fixed: composition; 10,000 ohms, $\pm 10\%$; 1/2 w. (same as R14)	Grid Res., V4	RC20GF103K
R20	RESISTOR, fixed: composition; 10,000 ohms, $\pm 10\%$, 1/2 w. (same as R14)	Grid Res., V4	RC20GF103K
R21	RESISTOR, fixed: composition; 20,000 ohms, $\pm 10\%$; 1/2 w.	Grid Res., V4	RC20GF203K
R22	RESISTOR, fixed: composition; 100,000 ohms, $\pm 10\%$; 1/2 w.	Plate Load Res., V4	RC20GF104K
R23	RESISTOR, fixed: composition; 120 ohms, $\pm 10\%$; 1/2 w.	Cath. Bias Res., V4	RC20GF121K

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
R24	RESISTOR, fixed: composition; 47,000 ohms, $\pm 10\%$; 2 w.	Screen Decoupl. Res., V4	RC42GF473K
R25	RESISTOR, fixed: composition; 10,000 ohms, $\pm 10\%$; 1 w.	Plate Decoupl. Res., V4	RC30GF103K
R26	RESISTOR, fixed: composition; 12,000 ohms, $\pm 10\%$; 1/2 w.	Grid Res., V5	RC20GF123K
R27	RESISTOR, fixed: composition; 2.2 megohms, $\pm 10\%$; 1/2 w.	Noise Limiter Filter Res., V5	RC20GF225K
R28	RESISTOR, fixed: composition; 2.2 megohms, $\pm 10\%$; 1/2 w. (same as R27)	Noise Limiter Filter Res., V5	RC20GF225K
R29	RESISTOR, fixed: composition; 220,000 ohms, $\pm 10\%$; 1/2 w.	Noise Limiter Filter Res., V5	RC20GF224K
R30	RESISTOR, fixed: composition; 470,000 ohms, $\pm 10\%$; 1/2 w. (same as R2)	Grid Res., V6B	RC20GF474K
R31	RESISTOR, fixed: composition; 2200 ohms, $\pm 10\%$; 1/2 w. (same as R8)	Cath Bias Res., V6B	RC20GF222K
R32	RESISTOR, variable: composition 1 megohm, $\pm 20\%$; 2 w; log taper.	Audio Gain Control, V7	RV4ATRD105D
R33	RESISTOR, fixed: composition; 100,000 ohms, $\pm 10\%$; 1/2 w. (same as R22)	Plate Load Res., V7	RC20GF104K
R34	RESISTOR, fixed: composition 560 ohms, $\pm 10\%$; 2 w.	Cath. Bias Res., V7	RC42GF561K
R35	RESISTOR, fixed: composition 3900 ohms, $\pm 10\%$; 1/2 w.	Imp. Match. Res., J3	RC20GF392K
R36	RESISTOR, fixed: composition; 1000 ohms, $\pm 10\%$; 2 w.	Decoupling Res., T1	RC42GF102K
R37	RESISTOR, fixed: composition; 22,000 ohms, $\pm 10\%$; 1/2 w. (same as R12)	Grid Res., V8	RC20GF223K
R38	RESISTOR, fixed: composition; 120 ohms, $\pm 10\%$; 1/2 w. (same as R23)	Cath Bias Res., V8	RC20GF121K
R39	RESISTOR, fixed: composition: 39,000 ohms, $\pm 10\%$; 1/2 w.	Plate Load Res., V8	RC20GF393K
R40	RESISTOR, fixed: composition: 39,000 ohms, $\pm 10\%$; 1/2 w. (same as R39)	Screen Grid Res., V8	RC20GF393K
R41	RESISTOR, fixed: composition; 100,000 ohms, $\pm 10\%$; 1/2 w. (same as R22)	p/o 17 Kc Osc Tank Z4	RC20GF104K

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
R42	RESISTOR, fixed: composition; 2200 ohms, $\pm 10\%$; 1/2 w. (same as R8)	Plate Load Res., V6A	RC20GF222K
R43	RESISTOR, fixed: composition; 470,000 ohms, $\pm 10\%$; 1/2 w. (same as R2)	Grid Filter Res., V9	RC20GF474K
R44	RESISTOR, fixed: composition; 470,000 ohms, $\pm 10\%$; 1/2 w. (same as R2)	Grid Filter Res., V9	RC20GF474K
R45	RESISTOR, fixed: composition; 470,000 ohms, $\pm 10\%$; 1/2 w. (same as R2)	Grid Filter Res., V9	RC20GF474K
R46	RESISTOR, fixed: composition; 120,000 ohms, $\pm 10\%$; 1/2 w.	Grid Res., V9	RC20GF124K
R47	RESISTOR, fixed: composition; 82,000 ohms, $\pm 10\%$; 1/2 w.	p/o Phase Circuit, V9	RC20GF823K
R48	RESISTOR, variable: composition; 2500 ohms, $\pm 10\%$; 2 w; linear taper.	React. Bal. Control V9	RV4ATSA252A
R49	RESISTOR, fixed: composition; 180 ohms, $\pm 10\%$; 1/2 w.	Cath. Degen Res., V9	RC20GF181K
R50	RESISTOR, fixed: composition; 1000 ohms, $\pm 10\%$; 1/2 w.	Cath. Bias Res., V9	RC20GF102K
R51	RESISTOR, fixed: composition; 33,000 ohms, $\pm 10\%$; 1/2 w.	Grid Res., V9	RC20GF333K
R52	RESISTOR, fixed: composition; 56,000 ohms, $\pm 10\%$; 1/2 w.	Plate Load Res., V9	RC20GF563K
R53	RESISTOR, fixed: composition; 390 ohms, $\pm 10\%$; 1/2 w.	Cath. Bias V10A	RC20GF391K
R54	RESISTOR, variable: composition; 1 megohm, $\pm 20\%$; 2 w.; linear taper,	Relay Thresh. Control	RV4ATXA105B
R55	RESISTOR, fixed: wire wound; 4500 ohms, $\pm 5\%$; 10 w.	B+ Dropping Res.	RW-109-47
R56	RESISTOR, fixed: composition; 56,000 ohms, $\pm 10\%$; 2 w.	B+ Dropping Res., K1	RC42GF563K
R57	RESISTOR, fixed: composition; 1 megohm, $\pm 10\%$; 1/2 w.	AVC T. C. Res., S1-S2	RC20GF105K
R58	RESISTOR, fixed: composition; 47,000 ohms, $\pm 10\%$; 1/2 w.	Plate Load Res., V10B	RC20GF473K
R59	RESISTOR, fixed: composition; 470,000 ohms, $\pm 10\%$; 1/2 w. (same as R2)	Grid Res., V10B	RC20GF474K
R60	RESISTOR, variable: composition; 100,000 ohms, $\pm 10\%$; 2 w linear taper.	Tone Thresh. Control	RV4ATSA104B
R61	RESISTOR, fixed: composition; 470,000 ohms, $\pm 10\%$; 1/2 w. (same as R2)	Grid Voltage Div. Res., V10B	RC20GF474K

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
R62	RESISTOR, fixed: composition; 22,000 ohms, $\pm 10\%$; 2 w.	Screen Grid Res., V3	RC42GF223K
R63	RESISTOR, fixed: composition; 820 ohms, $\pm 10\%$; 2 w.	30 db pad Res., T1	RC42GF821K
R64	RESISTOR, fixed: composition; 1500 ohms, $\pm 10\%$; 2 w.	30 db pad Res., T1	RC42GF152K
R65	RESISTOR, fixed: composition; 470 ohms, $\pm 10\%$; 1/2 w.	30 db pad Res., T1	RC20GF471K
R66	RESISTOR, fixed: composition; 120 ohms, $\pm 10\%$; 1/2 w. (same as R23)	30 db pad Res., T1	RC20GF121K
S1	SWITCH, toggle: SPST; 3 amp at 250 v; bat type toggle.	AVC FAST/ SLOW Switch	ST-12A
S2	SWITCH, toggle: SPST; 3 amp at 250 v; bat type toggle. (same as S1)	AVC ON/OFF Switch	ST-12A
S3	SWITCH, toggle: SPST; 3 amp at 250 v; bat type toggle. (same as S1)	NOISE LIMITER Switch	ST-12A
S4	SWITCH, rotary: 1 section; 2 position; 2 moving contacts; 6 fixed contacts.	XTAL/ MANUAL Switch	SW-193
S5	SWITCH, rotary: 1 section; 2 position; 1 moving contact; 2 fixed contacts.	BFO ON/OFF Switch	SW-194
S6	SWITCH, push: SPST; 1 amp at 250 v; normally open.	SIDEBAND Switch	SW168SPST2NOBB
S7	SWITCH, toggle: DPST; 2 amp at 250 v; bat type toggle.	POWER/OFF Switch	ST-22K
T1	TRANSFORMER, audio frequency: plate coupling type; primary: 5000 ohms, 35 ma; secondary: 600 ohms, tapped at 8 ohms; 5 w. max. operating level.	Audio Output Transformer	TF-100
T2	TRANSFORMER, radio frequency: 225 microhenries, Q-75; tapped at 115 microhenries, Q-50; tuning core included.	p/o Bandpass Filter, Z3	p/o A-1387
T3	TRANSFORMER, audio frequency: input type; 43.5 millihenries; Q-20; 10.5 ohms; 2 taps.	p/o Second Osc. Tank, Z4	A-1382
T4	TRANSFORMER, audio frequency: input type; 43.5 millihenries; Q-20; 10.5 ohms; tapped.	p/o Side Tone Gen. Tank Z5	A-1383
T5	TRANSFORMER, power: step-down and step-up; primary: 110 or 220 v, 50 to 60 cps; secondary: 5 v. at 2 amps, 6.3 v. at 5 amps, center tapped, 340 v. at 100 ma d.c. center tapped.	Power Transformer	TF-101

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
V1	TUBE, electron: medium-mu duo triode; 9 pin miniature.	AVC Ampl. Rect.	12AU7
V2	TUBE, electron: remote cutoff RF pentode; 7 pin miniature.	IF Amplifier	6BA6
V3	TUBE, electron: heptode converter; 7 pin miniature.	First Mixer	6BE6
V4	TUBE, electron: heptode converter; 7 pin miniature. (same as V3)	Second Mixer	6BE6
V5	TUBE, electron: duo diode; 7 pin miniature.	Noise Limiter	6AL5
V6	TUBE, electron: medium-mu duo triode; 9 pin miniature. (same as V1)	Second Osc- Audio Ampl.	12AU7
V7	TUBE, electron: beam power amplifier; 7 pin miniature.	Audio Output	6AQ5
V8	TUBE, electron: sharp cutoff RF pentode; 7 pin miniature.	First Osc.	6AG5
V9	TUBE, electron: duo-triode; 7 pin miniature.	React. Mod.	6J6
V10	TUBE, electron: medium-mu duo triode; 9 pin miniature. (same as V1)	Relay Driver- Side Tone Gen.	12AU7
V11	TUBE, electron: full-wave rectifier; octal base.	Power Rect.	5Y3GT
V12	TUBE, electron: voltage regulator; 7 pin miniature.	Volt. Reg.	OA2
W1	CABLE ASSEMBLY, power: electrical; 2 conductor; 6 ft. lg; w/integral male plug one end, and female plug the other end. (supplied as loose item).	AC Line Cord	CA-103
XF1	FUSEHOLDER, extractor post type: 250 v, 15 amp.	Socket for F1	FH-100-2
XI1	LIGHT, indicator: w/green faceted lens; for miniature bayonet base T3-1/4 bulb.	Socket for I1	TS-129-2
XI2	LIGHT, indicator: w/green faceted lens; for miniature bayonet base T3-1/4 bulb. (same as XI1)	Socket for I2	TS-129-2
XI3	LIGHT, indicator: w/red frosted lens; for miniature bayonet base T3-1/4 bulb.	Socket for I3	TS-106-1
XV1	SOCKET, electron tube: 9 pin miniature.	Socket for V1	TS103P01
XV2	SOCKET, electron tube: 7 pin miniature.	Socket for V2	TS102P01

SYM.	DESCRIPTION	FUNCTION	TMC DWG OR PT NO.
XV3	SOCKET, electron tube: 7 pin miniature. (same as XV2)	Socket for V3	TS102P01
XV4	SOCKET, electron tube: 7 pin miniature. (same as XV2)	Socket for V4	TS102P01
XV5	SOCKET, electron tube: 7 pin miniature. (same as XV2)	Socket for V5	TS102P01
XV6	SOCKET, electron tube: 9 pin miniature. (same as XV1)	Socket for V6	TS103P01
XV7	SOCKET, electron tube: 7 pin miniature. (same as XV2)	Socket for V7	TS102P01
XV8	SOCKET, electron tube: 7 pin miniature. (same as XV2)	Socket for V8	TS102P01
XV9	SOCKET, electron tube: 7 pin miniature. (same as XV2)	Socket for V9	TS102P01
XV10	SOCKET, electron tube: 9 pin miniature. (same as XV1)	Socket for V10	TS103P01
XV11	SOCKET, electron tube: octal.	Socket for V11	TS101P01
XV12	SOCKET, electron tube: 7 pin miniature. (same as XV2)	Socket for V12	TS102P01
XY1	SOCKET, crystal: 2 contacts; 0.486 in. spacing for .050 in. pin diam; steatite body.	Socket for Y1	TS-104-1
XY2	SOCKET, crystal: 2 contacts, 0.486 in. spacing for .050 in. pin diam; steatite body. (same as XY1)	Socket for Y2	TS-104-1
Y1	CRYSTAL UNIT, quartz; 438 kc, $\pm 0.01\%$ includes holder HC-6/U.	438 kc Crystal	CR-46/U-. 4380-P
Y2	CRYSTAL UNIT, quartz; 472 kc, $\pm 0.01\%$ includes holder HC-6/U.	472 kc Crystal	CR-46/U-. 4720-P
Z1	FILTER, bandpass: 19.1 kc; 3.4 kc bandwidth; 10,000 ohms impedance.	Bandpass Filter	FX-153
Z2	FILTER, low-pass: 3500 cps cut-off frequency.	Lowpass Filter	FX-152
Z3	TRANSFORMER, radio frequency: 790 kc; (consists of C32, & T2)	First Osc. Tank	A-1387
Z4	OSCILLATOR NETWORK, audio frequency: 17 kc; (consists of C38, 39, 40, 50, R41, & T3)	Second Osc. Tank	A-1381
Z5	OSCILLATOR NETWORK, audio frequency: 43.5 millihenries (consists of C53, 55, T4)	Side Tone Gen. Tank	A-1384

STOCK NUMBER IDENTIFICATION

MODE SELECTOR, RECEIVING MODEL MSR-1 (CV-591/URR)

REF. DESIG.	FEDERAL STOCK NUMBER	REF. DESIG.	FEDERAL STOCK NUMBER
C1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 18, 19, 20, 35, 36, 41, 54, 56	*N5910-636-2339	C53	N5910-543-0779
C6	N5910-248-2230	E1	*N5940-258-5881
C7, 15	N5910-112-8210	E2	*N5940-171-0246
C13, 21, 22, 23, 24, 26 44	*N5910-665-0252	E3	N5940-512-5634
C14, 42, 43	N5910-543-0780	F1	N5920-281-0209
C16	N5910-644-6313	I1, 2, 3	G6240-155-8706
C25	N5910-636-2496	J1	N5935-280-2928
C27	*N5910-112-7839	J2	*N5935-644-6737
C28	N5910-547-4214	J3	N5935-283-1269
C29	N5910-112-8248	K1, 3	N5945-259-0653
C30	*N5910-248-2217	K2	N5945-588-7015
C31	*N5910-264-9426	L1, 2	N5950-647-6496
C32	N5910-191-1844	P1	*N5935-173-5895
C33	*N5910-256-1586	R1	*N5905-279-3519
C34	*N5910-197-1569	R2, 3, 9, 30, 43, 44, 45, 59, 61	*N5905-279-2515
C37	*N5910-299-2251	R4	*N5905-279-3504
C38, 50, 52	*N5910-636-2092	R5, 15	*N5905-279-3513
C39	N5910-264-9443	R6	*N5905-299-2010
C40, 55	*N5910-264-9494	R7	*N5905-195-6791
C45	*N5910-197-1566	R8, 16, 31, 42	*N5905-279-1876
C47 A, B	N5910-643-9110	R10, 11	*N5905-299-2022
C48, 49, 57	*N5910-129-9237	R12, 37	*N5905-171-2004
C51	*N5910-644-5957	R13	*N5905-195-9483
		R14, 19, 20	*N5905-185-8510
		R17	*N5905-279-1754

* Indicates: "For replacement use FSN"

REF. DESIG.	FEDERAL STOCK NUMBER	REF. DESIG.	FEDERAL STOCK NUMBER
R18	*N5905-279-1865	R62	*N5905-239-0568
R21	*N5905-192-0649	R63	*N5905-279-2286
R22, 33, 41	*N5905-195-6761	R64	*N5905-279-2530
R23, 38, 66	*N5905-252-5434	R65	*N5905-192-3973
R24	*N5905-195-6754	S1, 2, 3	N5930-050-2627
R25	*N5905-279-1719	S4	N5930-588-7016
R26	*N5905-279-3502	S5	N5930-588-7017
R27, 28	*N5905-190-8885	S6	*N5930-296-6961
R29	*N5905-192-0667	S7	N5930-050-2635
R32	N5905-279-1829	T1	N5950-647-6974
R34	*N5905-253-1233	T3	N5950-588-6611
R35	N5905-279-3505	T4	N5950-588-6616
R36	*N5905-256-3361	T5	N5950-647-5131
R39, 40	*N5905-279-3497	V1, 6, 10	N5960-166-7663
R46	*N5905-192-3981	V2	*N5960-193-5139
R47	*N5905-195-9451	V3, 4	*N5960-264-3002
R48	N5905-174-7131	V5	*N5960-262-0185
R49	*N5905-279-3514	V7	*N5960-248-3089
R50	*N5905-195-6806	V8	*N5960-284-7502
R51	*N5905-171-1998	V9	*N5960-262-0160
R52	*N5905-171-1986	V11	*N5960-272-9178
R53	*N5905-279-1890	V12	*N5960-262-0964
R54	N5905-158-5792	W1	N5995-666-1948
R55	*N5905-174-3712	XF1	*N5920-156-9233
R56	*N5905-192-0450	X13	*N6210-299-7501
R57	*N5905-192-0390	XV1, 6, 10	N5935-160-1365
R58	*N5905-254-9201	XV2, 3, 4, 5, 7, 8, 9, 12	*N5935-259-1944
R60	N5905-263-0577	XV11	*N5935-331-3141

* Indicates: "For replacement use FSN"

REF. DESIG.	FEDERAL STOCK NUMBER	REF. DESIG.	FEDERAL STOCK NUMBER
XY1, 2	N5935-201-7119	Z1	N5915-588-6617
Y1	N5955-553-7159	Z2	N5915-588-6618
Y2	N5955-553-5718	Z3	N5950-588-6619

* Indicates: "For replacement use FSN"

STOCK NUMBER CROSS-REFERENCE

MODE SELECTOR, RECEIVING MODEL MSR-1 (CV-591/URR)

FEDERAL STOCK NUMBER	REF. DESIG.	FEDERAL STOCK NUMBER	REF. DESIG.
*N5905-158-5792	R54	*N5905-279-1719	R25
*N5905-171-1986	R52	*N5905-279-1754	R17
*N5905-171-1998	R51	*N5905-279-1829	R32
*N5905-171-2004	R12, 37	*N5905-279-1865	R18
*N5905-174-3712	R55	*N5905-279-1876	R8, 16, 31, 42
*N5905-174-7131	R48	*N5905-279-1890	R53
*N5905-185-8510	R14, 19, 20	*N5905-279-2286	R63
*N5905-190-8885	R27, 28	*N5905-279-2515	R2, 3, 9, 30 43, 44, 45, 59, 61
*N5905-192-0390	R57	*N5905-279-2530	R64
*N5905-192-0450	R56	*N5905-279-3497	R39, 40
*N5905-192-0649	R21	*N5905-279-3502	R26
*N5905-192-0667	R29	*N5905-279-3504	R4
*N5905-192-3973	R65	N5905-279-3505	R35
*N5905-192-3981	R46	*N5905-279-3513	R5, 15
*N5905-195-6754	R24	*N5905-279-3514	R49
*N5905-195-6761	R22, 33, 41	*N5905-279-3519	R1
*N5905-195-6791	R7	*N5905-299-2010	R6
*N5905-195-6806	R50	*N5905-299-2022	R10, 11
*N5905-195-9451	R47	*N5910-112-7839	C27
*N5905-195-9483	R13	N5910-112-8210	C7, 15
*N5905-239-0568	R62	N5910-112-8248	C29
*N5905-252-5434	R23, 38, 66	*N5910-129-9237	C48, 49, 57
*N5905-253-1233	R34	N5910-191-1844	C32
*N5905-254-9201	R58	*N5910-197-1566	C45
*N5905-256-3361	R36	*N5910-197-1569	C34
N5905-263-0577	R60		

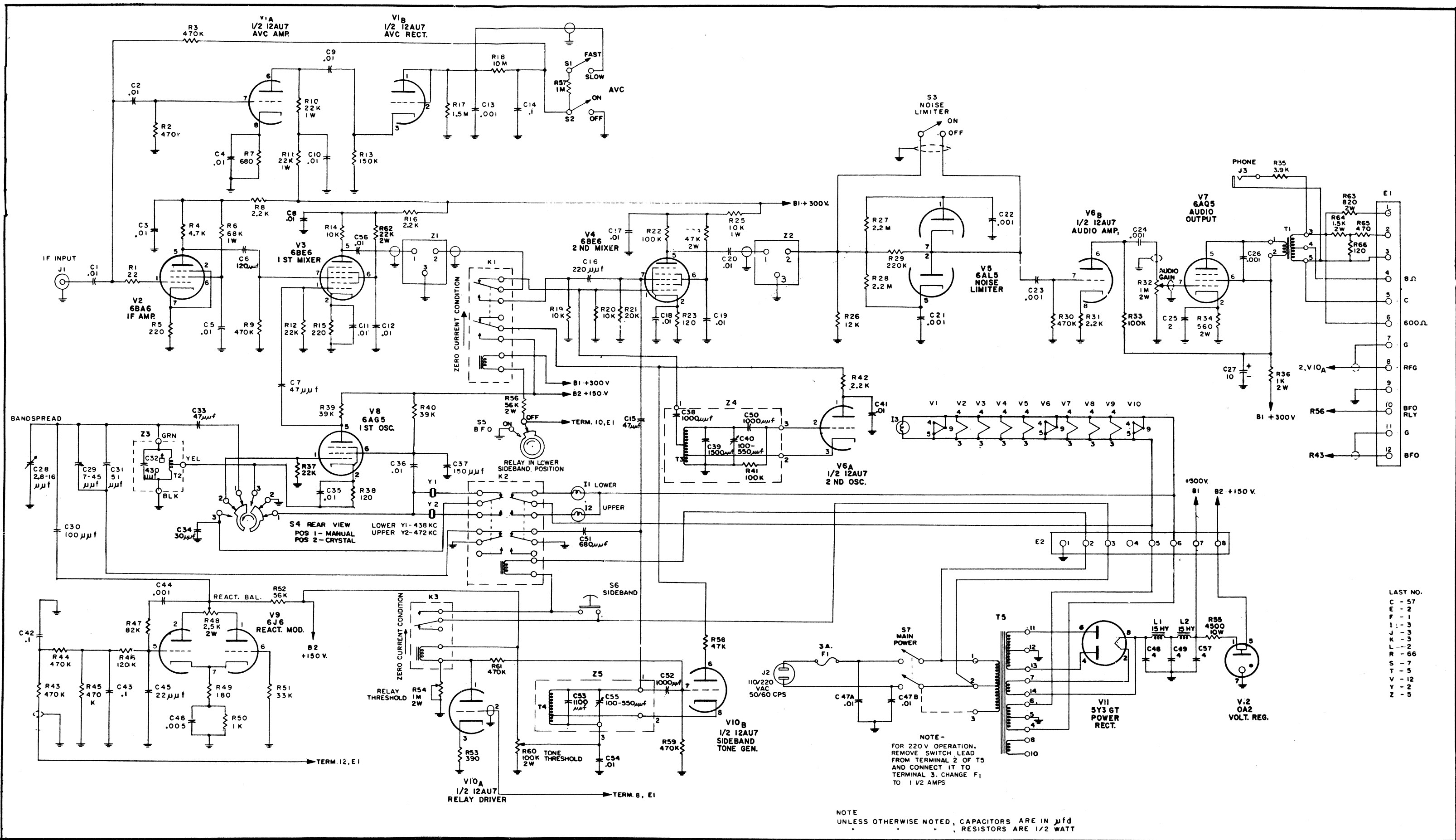
* Indicates: "For replacement use FSN"

FEDERAL STOCK NUMBER	REF. DESIG.	FEDERAL STOCK NUMBER	REF. DESIG.
*N5910-248-2217	C30	*N5935-201-7119	XY1, 2
N5910-248-2230	C6	*N5935-259-1944	XV2, 3, 4, 5, 7, 8, 9, 12
*N5910-256-1586	C33	N5930-280-2928	J1
*N5910-264-9426	C31	N5935-283-1269	J3
N5910-264-9443	C39	*N5935-331-3141	XV11
*N5910-264-9494	C40, 55	*N5935-644-6737	J2
*N5910-299-2251	C37	*N5940-171-0246	E2
N5910-543-0779	C53	*N5940-258-5881	E1
N5910-543-0780	C14, 42, 43	N5940-512-5634	E3
N5910-547-4214	C28	N5945-259-0653	K1, 3
*N5910-636-2092	C38, 50, 52	N5945-588-7015	K2
*N5910-636-2339	C1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 18, 19, 20, 35, 36, 41, 54, 56	N5950-588-6611	T3
N5910-636-2496	C25	N5950-588-6616	T4
N5910-643-9110	C47 A, B	N5915-588-6617	Z1
*N5910-644-5957	C51	N5915-588-6618	Z2
N5910-644-6313	C16	N5950-588-6619	Z3
*N5910-665-0252	C13, 21, 22, 23 24, 26, 44	N5950-647-5131	T5
N5920-281-0209	F1	N5950-647-6496	L1, 2
*N5920-156-9233	XF1	N5950-647-6974	T1
N5930-050-2627	S1, 2, 3	N5955-201-7119	XY1, 2
N5930-050-2635	S7	N5955-553-5718	Y2
*N5930-296-6961	S6	N5955-553-7159	Y1
N5930-588-7016	S4	N5960-166-7663	V1, 6, 10
N5930-588-7017	S5	*N5960-193-5139	V2
*N5935-160-1365	XV1, 6, 10	*N5960-248-3089	V7
*N5935-173-5895	P1	*N5960-262-0160	V9
		*N5960-262-0185	V5

* Indicates: "For replacement use FSN"

FEDERAL STOCK NUMBER	REF. DESIG.	FEDERAL STOCK NUMBER	REF. DESIG.
*N5960-262-0964	V12	N5995-666-1948	W1
*N5960-264-3002	V3, 4	*N6210-299-7501	X13
*N5960-272-9178	V11		
*N5960-284-7502	V8	G6240-155-8706	I1, 2, 3

* Indicates: "For replacement use FSN"



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Figure 5-5 Schematic Diagram Model MSR-1