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TECHNICAL MANUAL

for

SOLID STATE RECEIVER

MODEL SMR-1

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, CANADA

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IN-3010 ISSUE DATE: 8 OCT., 1965

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

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TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

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No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conduct r devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

SOLID STATE RECEIVER

MODEL SMRA-1

1. DESCRIPTION

Solid State Receiver, Model SMRA-1 is the same as Model SMR-1, differing only in the automation of the CHANNEL selector switch and the addition of a corresponding rear-panel connector receptacle. This difference enables the receiver to function with remote controlling capabilities.

2. FUNCTION

The substitution of the CHANNEL selector switch, from a manual selection capability (SMR-1) to an automated and manual selection capability (SMRA-1), enables receiver channel selection from a remote controlling device or manually.

Manual selection is the same as for the SMR-1, i.e., manually setting the CHANNEL selector switch at the desired channel position.

Remote selection is accomplished by receiving an externally generated signal voltage from an associated remote control unit, via connector J1534. The remote generated signal voltage is applied to the CHANNEL rotary switch solenoid S1519, causing it to rotate and search for the corresponding switch setting initiated at the remote control unit. The rotary switch S1519 therefore acts as a slave stepping switch, positioning the SMRA-1 front-panel CHANNEL selector switch to the same position as the master selector switch at the remote control unit. See figure A for SMRA-1 automated circuitry.

PARTS LIST
for
MULTI-CHANNEL RECEIVER, MODEL SMRA-1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR1501	SEMICONDUCTOR DEVICE, DIODE.	1N547
J1501 thru J1533	NOT USED	
J1534	CONNECTOR, RECEPTACLE, ELECTRICAL: 5 male contacts; voltage breakdown 1,900V RMS at sea level; sub-miniature type.	JJ242-7P
S1501 thru S1518	NOT USED	
S1519	SWITCH-SOLENIOD, ROTARY: 1 section, 12 positions; 30° angle of throw; current rating 5 amps carry, break amps resistive 2.5 amps at 24 VDC or 0.5 amps at 115 VDC.	SW373

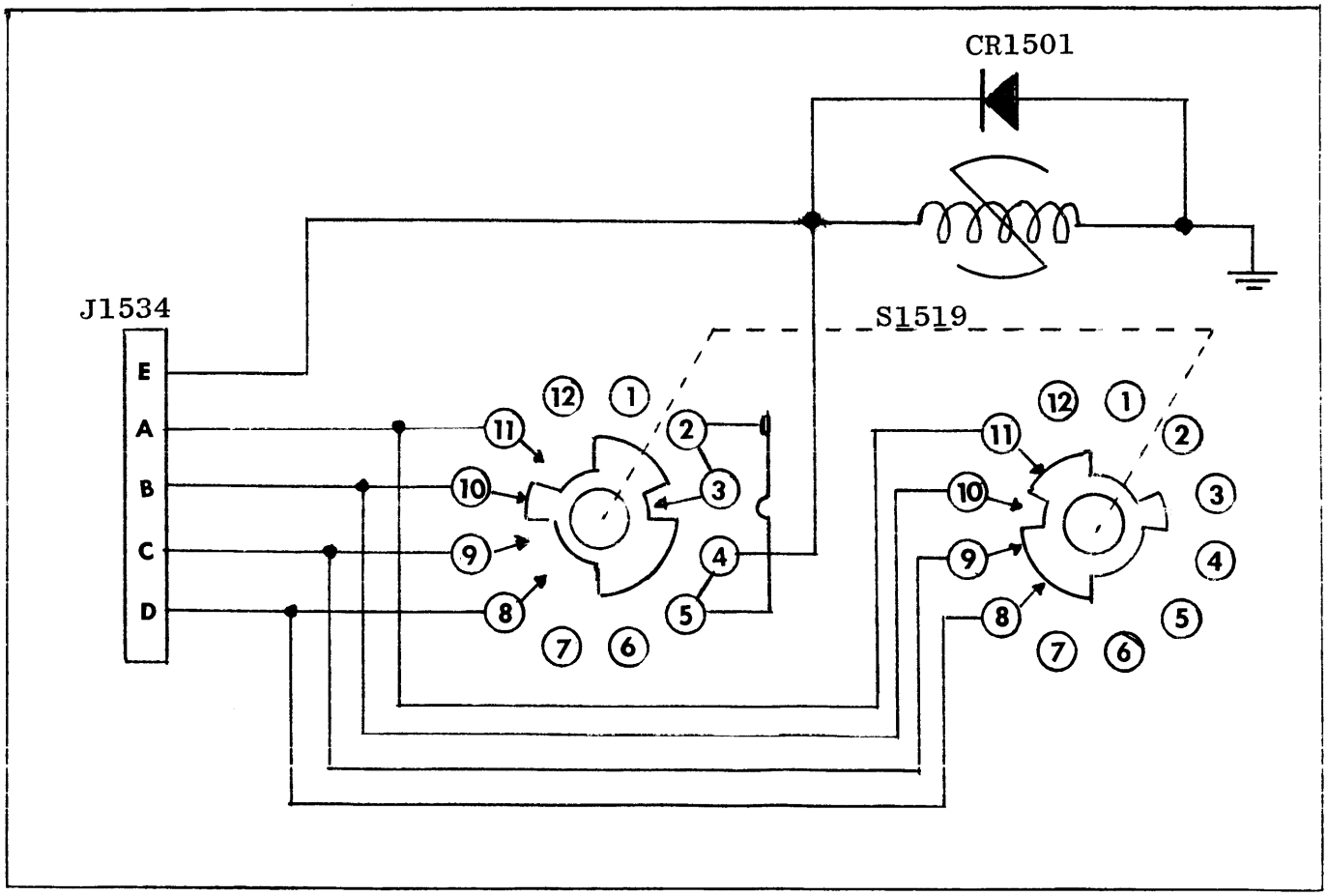

Figure A. SMRA-1 Automated Circuitry

CHANGE NO. 1 SMR-1

INSTRUCTION BOOK CHANGE NOTICE

Date 11/4/65

Manual affected: Solid State Receiver, Model SMR-1 IN -3010

Page 1-3. Table 1-1.

Change Table 1-1 as indicated below.

TABLE 1-1. EQUIPMENT SUPPLIED

NAME	DESCRIPTION	FUNCTION	QUANTITY
Solid State Receiver	SMR-1	Communications Receiver	1
Cable assembly*	CA-555-4	A-c power cord	1
Fanning strip	TM-105-16AL	Aid for rear panel wiring	1
Rf connector plug	UG/88U	Facilitates coaxial cable connection to rf input jack	1

*This cable can be ordered with terminations other than the 115 V polarized plug normally provided. Cable is not provided when SMR is shipped as part of a system.

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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Figure 1-1. Solid State Receiver, SMR-1

SECTION I

GENERAL DESCRIPTION

1-1. FUNCTIONAL DESCRIPTION.

Solid State Receiver, Model SMR-1 (figure 1-1) is a completely transistorized superheterodyne communications receiver that operates on any one of eight selectable crystal-controlled channels in the range of 2 to 32 mc. It can be used alone or as part of a communications system.

The SMR is capable of receiving amplitude modulation equivalent (AME), continuous wave (CW), facsimile (FAX), frequency shift keying (FSK), modulated continuous wave (MCW), and single sideband (SSB) transmissions. It can also receive one sideband of amplitude modulation (AM) or independent sideband (ISB) transmissions, even though it is not really an ISB receiver.

NOTE

Converter equipment is required to process FAX and FSK signals.

Operating frequencies for the r-f section of the SMR are obtained from fixed-tuned, crystal-controlled, plug-in modules (model TTRR). Various combinations of these modules may be used to provide frequency coverage in accordance with operating requirements (refer to paragraph 1-4). Each TTRR module employed in the SMR has two selectable, local oscillator frequencies that permit transmission on either of two frequencies (F1 or F2) within the r-f bandpass of the module, without necessitating realignment. Field change to new operating frequencies is easily accomplished (refer to

section 5 and to the TTRR manual). Other features of the SMR include:

a. High sensitivity for good reception under weak signal conditions.

b. A sharp cutoff bandpass filter for optimum selectivity.

c. Double conversion for a high image rejection.

d. Local or remote selection of LSB or USB reception.

e. An adjustable squelch circuit that mutes the audio output (except for the 600-ohm line output) when no input signal is being received. This circuit also provides an external output (for alarm purposes) to indicate that the receiver is squelched.

f. A built-in meter for monitoring the r-f and audio signal levels.

g. Low power consumption and subsequent low heat dissipation.

h. External oven supplies can be connected for crystal ovens that operate on voltages other than the unit's primary a-c supply.

The SMR produces two separate audio outputs. These are 500 milliwatts into 4 ohms for speaker or front-panel phone jack, and 1 milliwatt into a 600-ohm balanced load. The 600-ohm output level can be adjusted by means of a LINE LEVEL control. The speaker and earphone output levels can be varied by means of a VOLUME control. The speaker is automatically disconnected when the phone jack is used.

Performance specifications and other reference data for the SMR are given in paragraph 1-3. Table 1-1 lists the equipment supplied with the SMR.

TABLE 1-1. EQUIPMENT SUPPLIED

NAME	DESIGNATION	FUNCTION	QUANTITY
Solid State Receiver	SMR-1	Communications Receiver	1
Cable assembly*		A-c power cord	1
Fanning strip		Aid for rear panel wiring	1
Rf connector plug		Facilitates coaxial cable connection to rf input jack	1

* This cable can be ordered with terminations other than the 115 V polarized plug normally provided.

1-2. PHYSICAL DESCRIPTION.

a. EXTERNAL. - The SMR is designed for mounting in a standard 19-inch rack or in a sturdy metal case. Two handles are located on the front panel for ease of handling. Dust covers protect the unit when it is rack mounted.

All of the operator's controls are located on the front panel, and are described and illustrated in section 3 of this manual. A terminal board mounted on the rear panel provides for most input and output connections. A BNC connector is provided at the rear panel for connecting the r-f input coaxial cable. In addition, the rear panel contains power connectors, input power and power supply fuses, and an oven power-source selector switch. Figure 2-2 illustrates the rear panel components.

b. INTERNAL. - Most of the smaller components in the SMR are located on printed circuit boards that are mounted to the chassis. There are four of these boards not including those in the TTRR modules; refer to figure 5-1. These are the receiver i-f board, the receiver audio board, the power supply board, and the meter board. The larger components of the receiver are chassis-mounted.

The semi-conductor complement of the receiver is given in table 1-2.

TABLE 1-2. SEMICONDUCTOR COMPLEMENT

REFERENCE DESIGNATION	TYPE	FUNCTION
CR302 and CR303	1N34A	Audio detectors
CR910 and CR911	1N547	Rectifiers
CR912	1N3022B	Voltage reference
CR913 and CR914	1N547	Rectifiers
CR915	1N3022B	Voltage reference
CR1500	1N294	Gate
CR601 through CR1604	1N34A	Audio detector
CR1605 through CR1607	1N68	Agc detector
Q1601	2N2084	I-f amplifier
Q1602	2N2084	Mixer
Q1603 and Q1604	2N1370-4	1st audio amplifier

TABLE 1-2. SEMICONDUCTOR COMPLEMENT (CONT)

REFERENCE DESIGNATION	TYPE	FUNCTION
Q1605	2N2084	Buffer amplifier
Q1606	2N2084	Beat frequency oscillator
Q1607	2N2084	Lower sideband oscillator
Q1608	2N2084	Upper sideband oscillator
Q1609	2N2084	Buffer amplifier
Q1610	2N1190	I-f amplifier
Q1611	2N1308	First amplifier
Q1612	2N697	2nd agc amplifier
Q1613	2N1370-4	2nd audio amplifier
Q1614 and Q1615	2N1370-4	3rd audio amplifier
Q1616 and Q1617	2N1032	Push-pull audio power amplifier
Q1618	2N1370-7	Line amplifier
Q1619 and Q1620	2N1370-4	Bistable amplifier
Q1621	2N2001	Relay driver

1-3. TECHNICAL SPECIFICATIONS.

Frequency range — 2 to 32 mc divided into four bands using the following TTRR modules.

Band 1: 2-4 mc, TTRR-1
Band 2: 4-8 mc, TTRR-2
Band 3: 8-16 mc, TTRR-3
Band 4: 16-32 mc, TTRR-4

Number of channels	8 (each having a separate TTRR module).
Tuning System	Each TTRR module is fixed-tuned to a particular frequency within its band. The receiver is tuned by selecting one of the different modules (channels).
Frequency control	Crystal-controlled oscillators are used throughout the receiver.
Types of reception	AME, CW, FAX, FSK, MCW, and SSB (upper or lower). AM and ISB signals can also be received, but this feature is generally not used.
Sensitivity	1 microvolt input for 15-db signal signal-plus-noise to noise ratio.
Audio bandwidth	2.75 kc $\pm$ 2 db between 250 and 3000 cps.
I-f frequency	Double conversion from 1.75 mc to 250 kc on all bands.
Image rejection	A minimum of 50 db from 2-to 28-mc, a minimum of 40 db from 28-to 32-mc.
Intermodulation	Intermodulation products are down a minimum of 40 db from PEP of a two tone test with 100 microvolts at the antenna.
AGC	With a 100 db increase in the signal input from 1 microvolt, the output level will not rise more than 6 db.
Hum and noise level	At least 40 db down from full output.
Antenna input impedance	50 ohms (nominal) unbalanced.

Audio output	1. 500 milliwatts into 4 ohms for speaker or earphone. 2. 1 milliwatt in 600-ohm balanced load.
Temperature range	0^{o} C (32^{o} F) to 50^{o} C (122^{o} F).
Dimensions	Depth: 16 inches. Width: 19 inches. Height: 7 inches.
Weight, uncrated	Rack mounted: 50 pounds. Cabinet mounted: 70 pounds.

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

Each SMR is thoroughly checked at the factory prior to shipment, and is carefully packaged to prevent damage during transit. Upon receipt of the equipment, inspect the packing case and its contents for damage that might have occurred during transit. Unpack the equipment carefully, and inspect all packing material for parts that may have been shipped as loose items. With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-2. POWER REQUIREMENT.

The SMR operates on 104, 115, 208, or 230 volts a-c power. The receiver is normally shipped for operation with 115 vac +10%. If the receiver is to operate from a power source other than 115 vac, the wiring of power transformer T902 must be modified (see figure 2-1). It is recommended that a .125 ampere fuse be used with 104 and 115 volts, and a .062 ampere fuse be used with 208 and 230 volts.

NOTE

If ovens are used in the TTRR modules, the voltage rating of the ovens must be the same as the main power input, or an external oven supply is required. It is most important to make sure that the oven supply power is correct before energizing the unit.

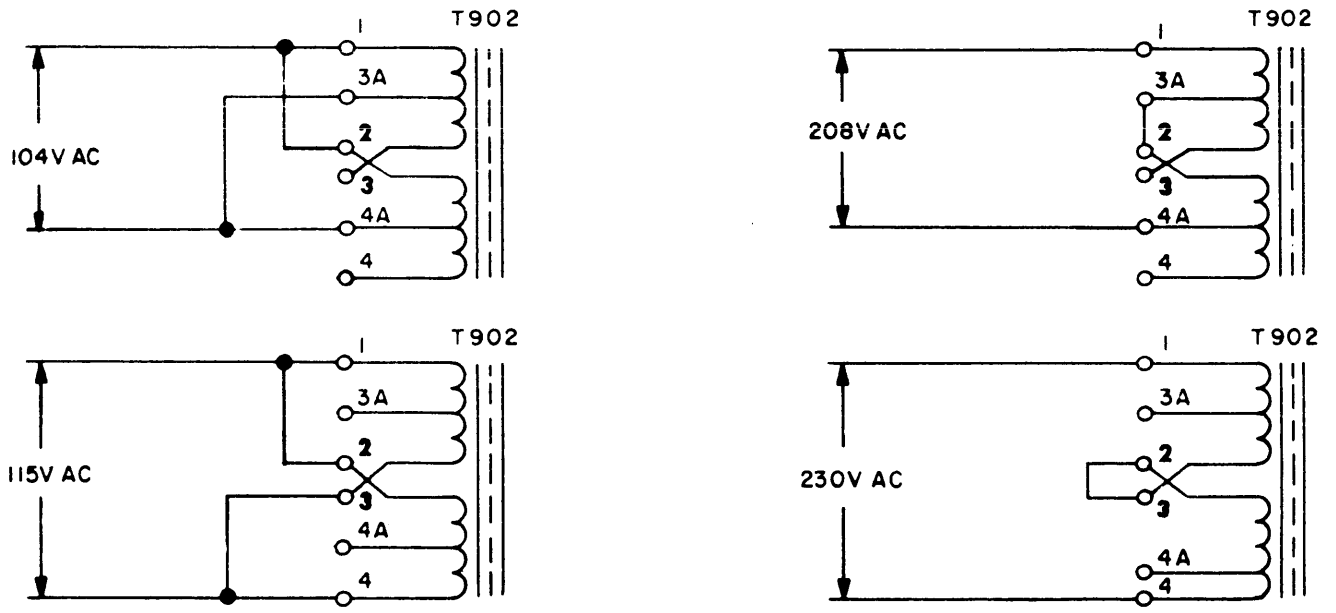


Figure 2-1. Power Transformer Wiring

2-3. MECHANICAL INSTALLATION.

Regardless of whether the SMR is contained in a cabinet or is intended for rack mounting, sufficient clearance in back of the unit for access to rear-panel connections and sufficient space for withdrawal of the unit from the rack for servicing are prime considerations when determining ultimate location. The SMR is equipped with a standard 19 inch wide front panel, and is 7 inches high and 16 inches deep.

When the SMR is supplied as part of a rack-mounted system, tilt slide mechanisms are provided. To install the SMR, proceed as follows:

(1) Set SMR chassis slide mechanism in tracks.

(2) Slide chassis in tracks until rearward release finger engages holes in track.

(3) Make necessary cable and electrical connections as described in paragraph 2-4.

(4) Press forward release fingers and slide chassis into cabinet; secure front-panel of SMR to rack with screws.

2-4. ELECTRICAL INSTALLATION. (Figure 2-2)

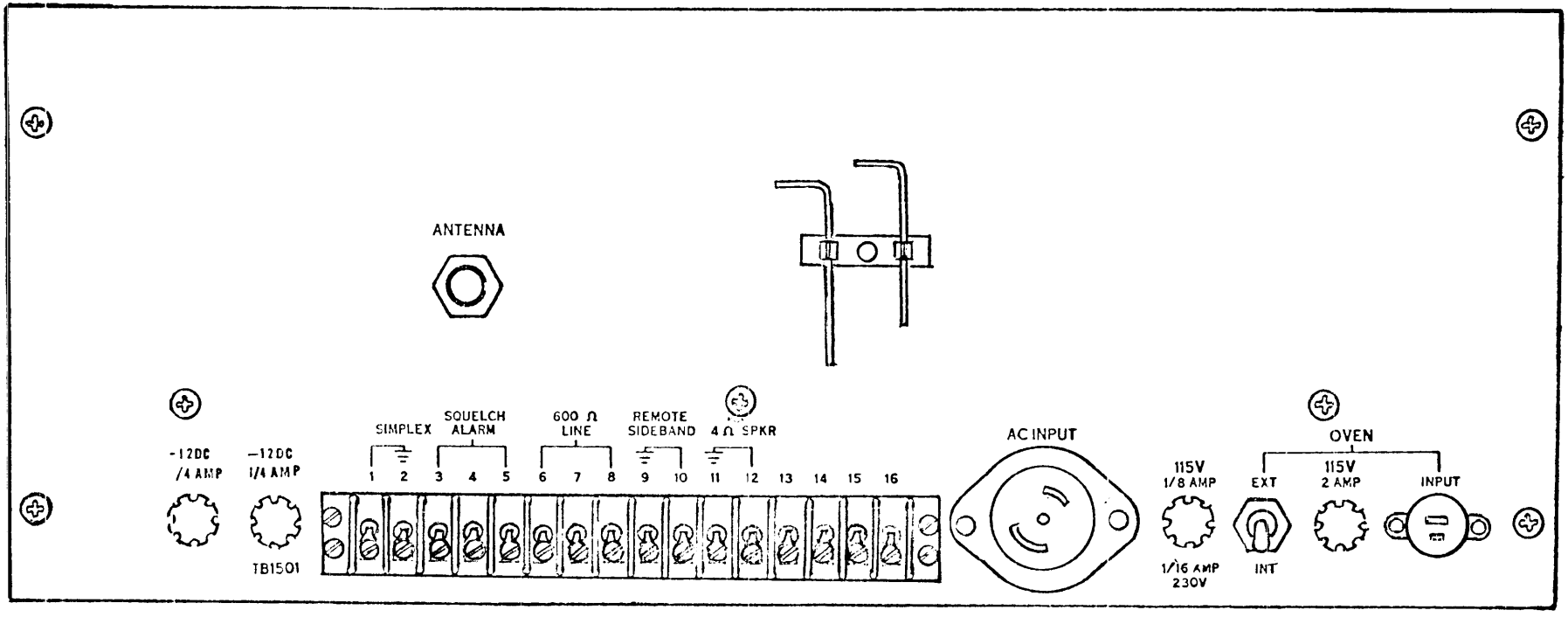
All connections to the SMR are made at the rear of the unit; proceed as outlined below. If the SMR is employed as part of a receiver system, refer to the applicable system cabling diagram while making connections.

a. Connect a-c power cable to POWER INPUT jack.

NOTE

Ovens mentioned in step b below are optional equipment. Refer to TTRR instruction manua.

b. If ovens in TTRR modules are compatible with primary a-c line voltage, set OVEN switch at INT. If ovens in TTRR modules are not compatible with primary a-c line voltage, set OVEN switch at



3010-2

Figure 2-2. Rear View, SMR

EXT, and connect appropriate oven supply to OVEN INPUT jack.

c. Using 50-ohm coaxial cable, connect antenna to ANTENNA jack.

d. In accordance with operational requirements, make following connections at terminal block TB1501.

(1) Terminals 6 and 8 of TB1501 are provided for connection of a 600-ohm telephone line or similar audio load; if the line is balanced, terminal 7 should be grounded.

(2) For remote sideband selection, connect remote selector switch between terminals 9 and 10 of TB1501.

(3) For simplex operation, connect associated transmitter's muting relay contacts to terminals 1 and 2 of TB1501.

(4) Connect a 4-ohm loudspeaker or 3.2-ohm resistor between terminals 11 and 12 of TB1501.

(5) For remote squelch alarm, connect alarm device across terminals 3 and 4 or across terminals 4 and 5 of E1501; SMR provides dry contacts for operating alarm device.

2-5. PERFORMANCE CHECK.

Immediately after the SMR has been installed, it should be checked for proper operation by attempting to receive signals on each channel; refer to the operating procedures given in section 3 of this manual. When signals are received, LSB and USB reception and the operation of the VOLUME, LINE LEVEL, and SQUELCH controls should be checked.

SECTION 3

OPERATOR'S SECTION

3-1. CONTROLS AND INDICATORS.

Before attempting to operate the SMR, the operator should familiarize himself with the controls and indicators listed in table 3-1 and shown in figure 3-1. It is important to stress that descriptions given in table 3-1 are not operating instructions; for specific operating instructions, refer to paragraph 3-2.

NOTE

Operating instructions for the TTRR modules are included in this section as part of the overall operating procedure for the receiver.

Table 3-1. Operator's Controls and Indicators

Item No. (Figure 3-1)	Designation	Function
1	F1/F2 switch (one on each TTRR module)	Selects operating frequency in conjunction with CHANNEL switch (item 3).
2	Meter (M1501)	Indicates r-f input level or 600-ohm audio output level as selected by METER switch (item 8).
3	CHANNEL switch (S1515)	Selects operating frequency with F1/F2 switches (item 1).
4	PHONES jack (J1516)	Permits connection of headphones to receiver; when phones are used, the speaker output is disabled.

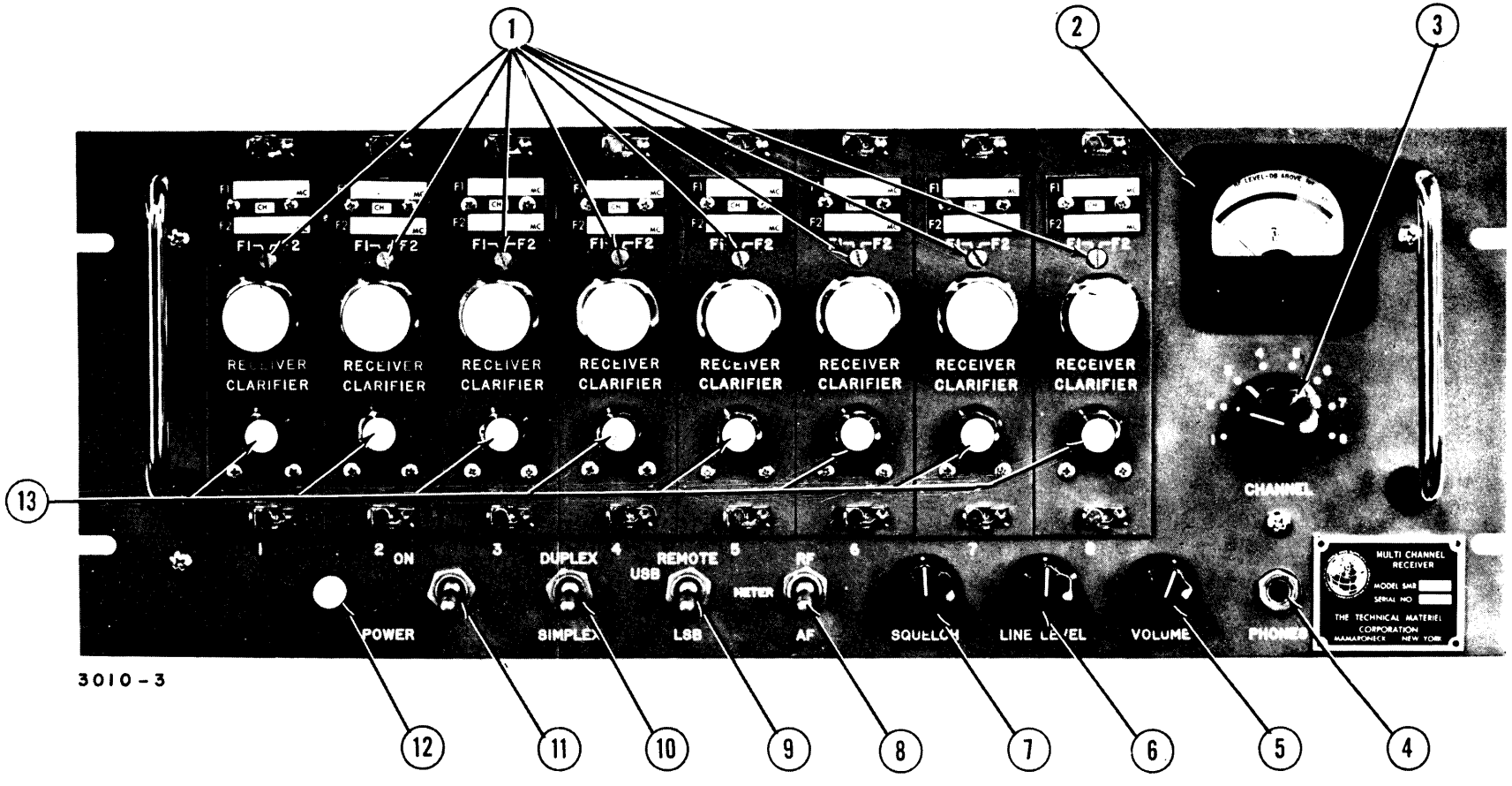


Figure 3-1. Front View, SMR

Table 3-1. Operator's Controls and Indicators

Item No. (Figure 3-1)	Designation	Function
5	VOLUME control (R1515)	Controls level of audio signal applied to speaker and PHONES jack.
6	LINE LEVEL control (R1518)	Controls level of audio signal applied to 600-ohm output.
7	SQUELCH control (R1547)	Determines level of r-f input signal required to enable loudspeaker and phone audio output circuits.
8	METER switch (S1516)	Connects meter (item 2) to indicate r-f input level or 600-ohm audio output level.
9	LSB/USB REMOTE switch (S1513)	Selects lower sideband or upper sideband reception; when set at USB REMOTE, sideband may be selected remotely.
10	SIMPLEX/DUPLEX switch (S1514)	When set at SIMPLEX, enables remote controlled receiver muting circuit; when set at DUPLEX, disables muting circuit.
11	POWER switch (S901)	When set at ON, energizes receiver power supply circuit.
12	POWER lamp (DS1501)	Lights when receiver's power supply is energized.
13	RECEIVER CLARIFIER control (one on each TTRR module)	Permits fine tuning of HFO in TTRR module.

3-2. OPERATING PROCEDURES.

a. TYPES OF RECEPTION. - The SMR receives AME, CW, FSK, MCW, and SSB signals and also one sideband of AM and ISB transmission. All of the above signals are received as if they were SSB transmissions. Procedures for receiving each of the signals are given in the following paragraphs.

b. VOICE RECEPTION. - The following procedures describe the reception of voice signals that are transmitted as AME or SSB. It is also possible to receive one sideband of AM or ISB transmission using the same method.

(1) Set controls at positions given below:

CONTROL	SETTING
SIMPLEX/DUPLEX switch	Depends upon type of operation desired.
LSB/USB REMOTE switch	Sideband to be received. If sideband to be received is not known, set at USB REMOTE. If sideband is to be selected remotely, set at USB REMOTE.
SQUELCH control	Fully clockwise.
LINE LEVEL control	Fully counterclockwise.
VOLUME control	Fully counterclockwise.
CHANNEL switch	Channel to be received.
F1/F2 switch	At appropriate position to receive incoming signal.
RECEIVER CLARIFIER control	Any

(2) Turn VOLUME control clockwise until comfortable signal level is obtained.

NOTE

If no signal is obtained, reduce the volume and set LSB/USB REMOTE switch to LSB. Repeat Step (2).

(3) Adjust SQUELCH control by waiting until no signal is being received, and then turning control slowly counterclockwise until noise from the speaker disappears.

c. CW AND MCW RECEPTION. - CW and MCW signals are received in exactly the same manner as voice signals (paragraph b.). For these signals, however, the RECEIVER CLARIFIER control is used to vary the pitch of the audio tone.

NOTE

For CW reception, the operating frequency (F1 or F2) of TTRR should be slightly higher or lower in frequency (0.4 to 1 kc) then the transmitted signal.

d. FAX RECEPTION. - In receiving facsimile, the setting of the RECEIVER CLARIFIER control is critical. Proceed as follows:

NOTE

The selected reception frequency (F1 or F2) must be displaced from the transmitted signal an amount equal to the FAX terminal equipment's center frequency (usually 1900 cps).

(1) Turn receiver on and set controls as outlined in paragraph 3-2b. step (1).

(2) Connect 600-ohm line output of receiver to vertical input of an oscilloscope.

(3) Connect an audio oscillator to horizontal input of oscilloscope.

(4) Set oscillator frequency at 1500 cps.

(5) Turn LINE LEVEL control clockwise until a Lissajous pattern appears on oscilloscope.

(6) Adjust RECEIVER CLARIFIER control to obtain an unsteady, but circular (1:1) Lissajous pattern. This corresponds to white or black areas of picture, depending upon positive or negative reception.

NOTE

A similar pattern, corresponding to the other limit of shift of the picture, will be obtained if the oscillator frequency is set at 2300 cps.

(7) Adjust LINE LEVEL control for desired line output level as indicated by the meter.

e. FSK RECEPTION. - In receiving frequency shift keying, the setting of the RECEIVER CLARIFIER control is critical. The procedure given below is one method of tuning the receiver for FSK reception. Most FSK converters have built-in indicating devices that allow accurate receiver tuning without the necessity for an external scope and oscillator.

NOTE

The selected reception frequency (F1 or F2) must be displaced from the transmitted signal an amount equal to the FSK terminal equipment's center frequency (usually 2550 cps).

(1) Turn receiver on and set controls as outlined in paragraph 3-2b. step (1).

(2) Connect 600-ohm line output of receiver to vertical input of an oscilloscope.

(3) Connect an audio oscillator to horizontal input of oscilloscope.

(4) Set oscillator frequency at mark frequency. This frequency is generally 2125 cps, but another is sometimes specified.

(5) Turn LINE LEVEL control clockwise until a Lissajous pattern appears on oscilloscope.

(6) Adjust RECEIVER CLARIFIER control to obtain an intermittent, but circular (1:1) Lissajous pattern. This corresponds to a mark.

NOTE

A similar pattern can be obtained if the oscillator is set at the space frequency (generally 2975 cps).

(7) Adjust LINE LEVEL control for desired line output level as indicated by the meter.

3-3. CHANGING TTRR MODULES.

a. Deenergize SMR.

b. Slide catches located on each end of module to left to release module.

c. Pull module out of SMR. A knob is provided in the center of the module for this purpose.

CAUTION

Before continuing, be sure that voltage rating of crystal oven (if used) in TTRR module to be inserted is same as voltage rating for crystal oven in TTRR module just removed.

d. Insert new module.

e. Slide catches located on each end of module to right to lock module in place.

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL.

The SMR comprises six major assemblies: main chassis assembly, receiver converter module (TTRR), receiver i-f assembly, receiver audio assembly, meter board, and the power supply. Circuit analysis given in this manual for the TTRR module is limited to inputs, outputs, and generalized information. Detailed circuit analysis for the TTRR can be found in the TTRR instruction manual.

4-2. CIRCUIT ANALYSES. (See Figures 4-1 and 7-1)

a. GENERAL. - The SMR is primarily a single-sideband receiver, and all signals received by it are treated as SSB transmissions. The SMR can receive AME, CW, FAX, FSK, MCW, and SSB; it can also receive one sideband of AM and ISB.

b. INPUT CIRCUITS. - The r-f input to the SMR is supplied from ANTENNA jack J1502 to one of eight possible TTRR plug-in r-f modules through a normally closed contact of simplex/duplex relay K1502 and CHANNEL switch S1515. Each TTRR module is fixed-tuned to a different frequency so that the SMR can receive signals on any one of eight frequencies (determined by the TTRR module selected by S1515). Additional sections of switch S1515 provide operating voltages and delayed agc voltage to the selected TTRR module.

In simplex operation, the normally open contact of the transmit/receive relay in an associated transmitter is connected across

terminals 1 and 2 of TB1502 so that relay K1502 is energized whenever the transmitter is keyed. When relay K1502 is energized and SIMPLEX/DUPLEX switch S1514 is set at SIMPLEX, the antenna input is interrupted, the receiver input is grounded, and the operating voltages for the receiver are interrupted. Thus, the receiver is muted. When S1514 is set at DUPLEX, the operating voltages are not interrupted. For duplex operation (or use without an associated transmitter), no connection is made to terminals 1 and 2 of TB1502. Thus, relay K1502 is always deenergized so that the antenna is connected to the receiver input and operating voltages are present.

c. TTRR PLUG-IN MODULES. - The TTRR module (comprising three r-f amplifiers, a mixer and a local oscillator) amplifies the selected r-f signal and converts it to the first i-f frequency. Figure 4-2 shows the input and the output of a TTRR module; both sidebands are shown although only one might be received in actual practice. The bandwidth of the r-f amplifiers is sufficient to pass both sidebands of a received signal (if both are present). The local oscillator is tuned 1.75 mc above the carrier frequency of the received signal. Thus, the spectrum of the received frequencies is inverted (the highest frequencies in the sideband(s) produce the lowest difference frequency) as shown in the illustration. The carrier frequency of the i-f output from a TTRR module is 1.75 mc.

d. I-F AND MIXER STAGES. - I-f amplifier Q1601 receives a 1.75 mc signal from the TTRR module selected by switch S1515,

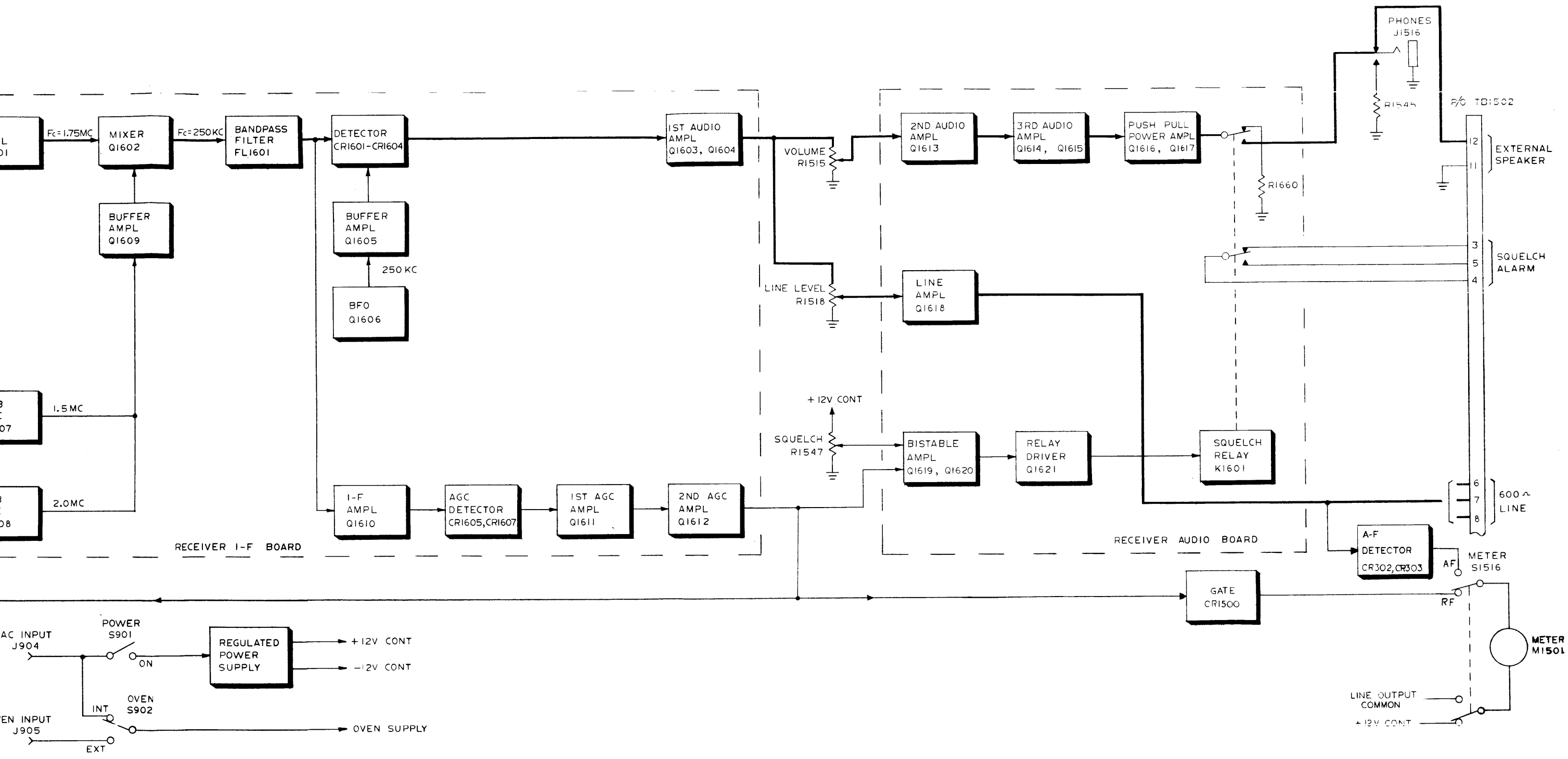
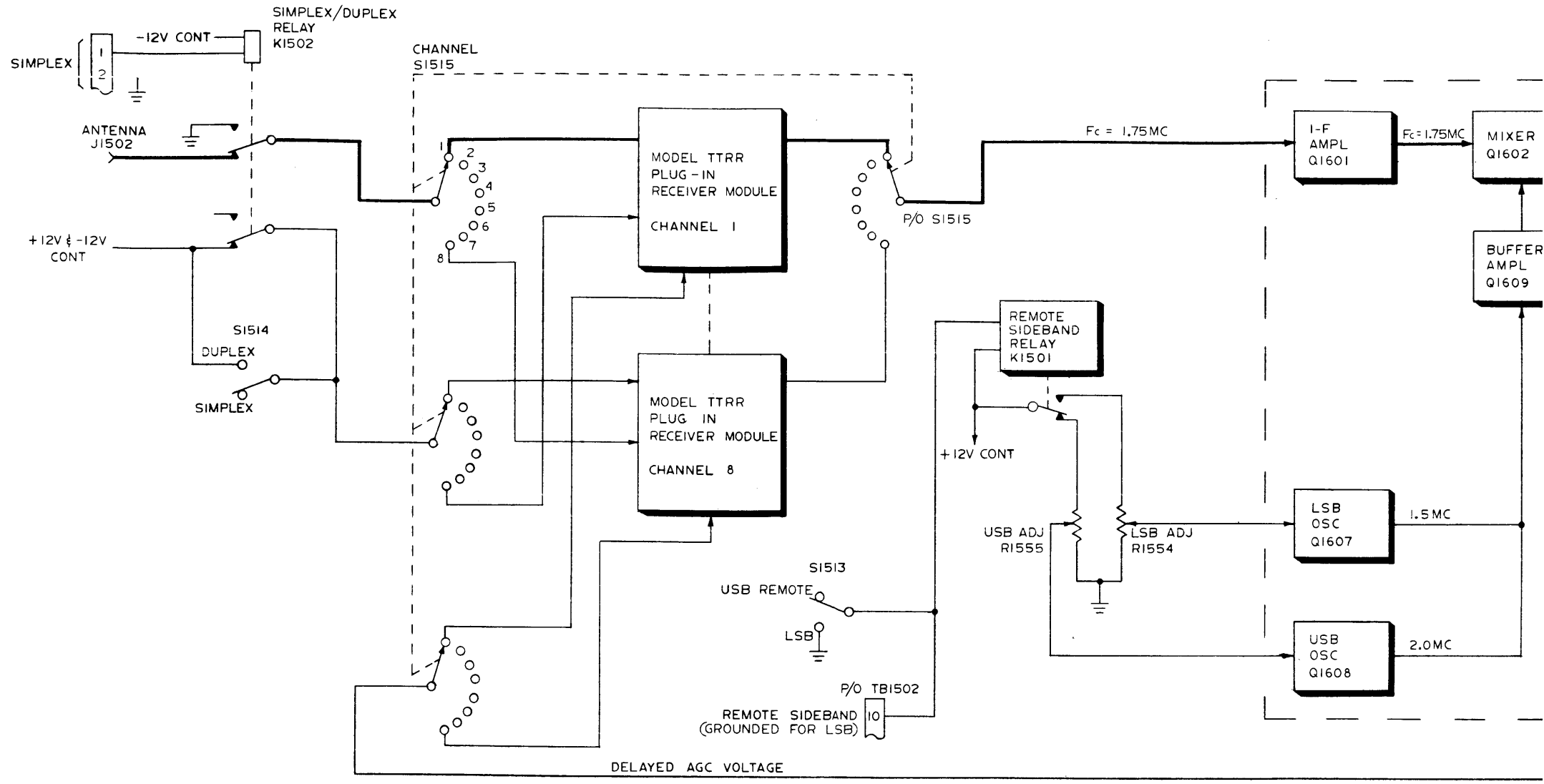
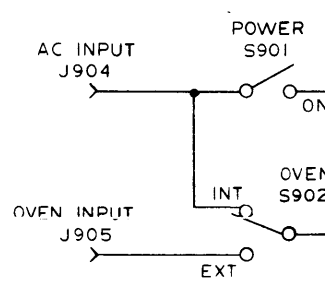


Figure 4-1. Block Diagram, SMR


SIMPLEX/DUPLEX
RELAY
K1502
-12V CONT
SIMPLEX
1
2
CHANNEL
S1515
ANTENNA
J1502
+12V & -12V
CONT
S1514
DUPLEX
SIMPLEX
1
2
3
4
5
6
7
8
MODEL TTRR
PLUG-IN
RECEIVER MODULE
CHANNEL 1
MODEL TTRR
PLUG IN
RECEIVER MODULE
CHANNEL 8
P/O S1515
Fc = 1.75MC
I-F
AMPL
Q1601
Fc=1.75MC
MIXER
Q1602
BUFFER
AMPL
Q1609
REMOTE
SIDEBAND
RELAY
K1501
+12V CONT
USB ADJ
R1555
LSB ADJ
R1554
LSB
OSC
Q1607
1.5MC
S1513
USB REMOTE
LSB
USB
OSC
Q1608
2.0MC
P/O TB1502
REMOTE SIDEBAND
(GROUNDED FOR LSB)
10
DELAYED AGC VOLTAGE


AC INPUT
J904
POWER
S901
ON
OVEN
S902
INT
OVEN INPUT
J905
EXT

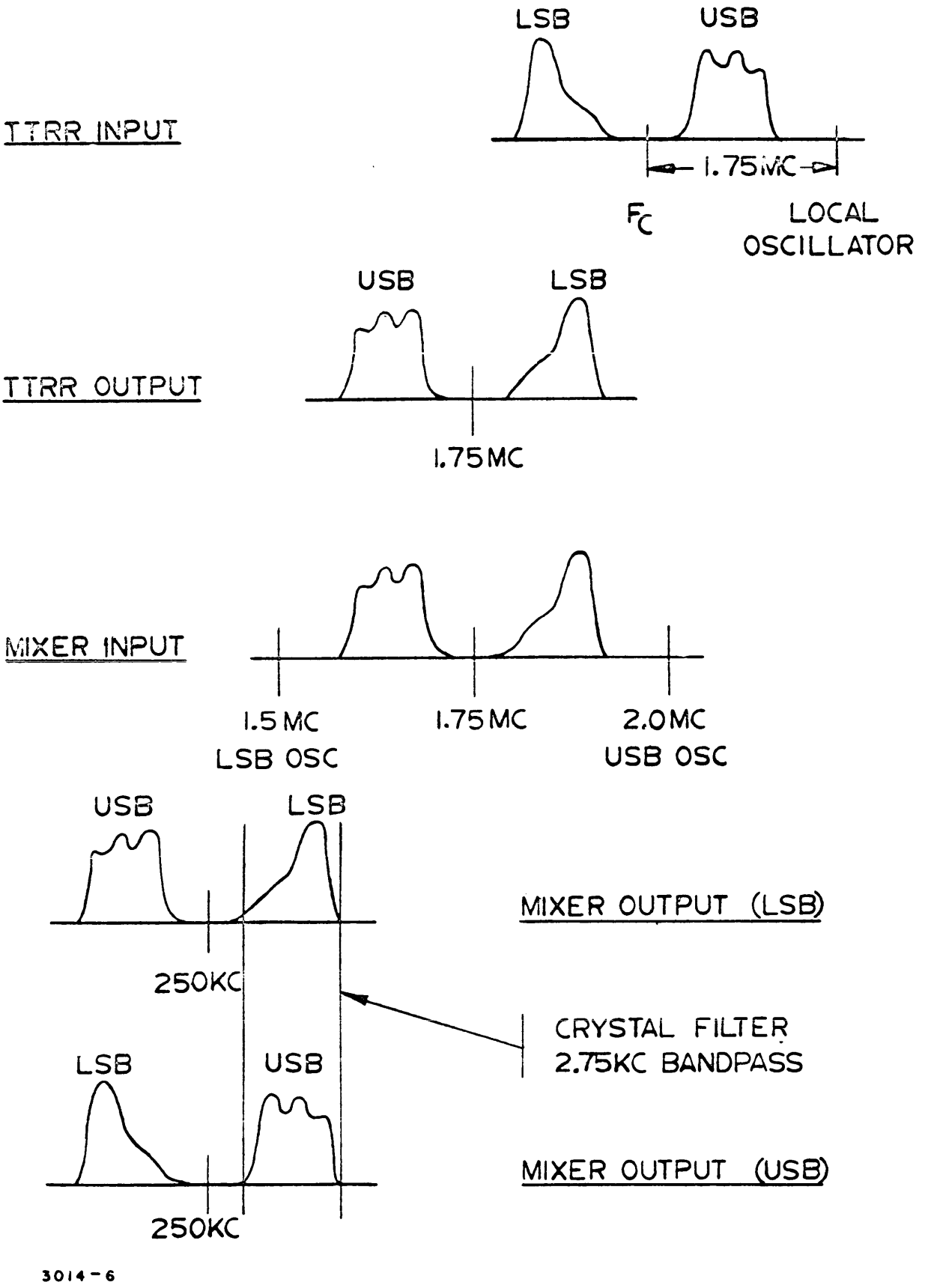


Figure 4-2. Frequency Inversion in SSB Reception

amplifies the signal and supplies it to mixer Q1602. Mixer Q1602 also receives the output of either the LSB oscillator (1.5 mc) or the USB oscillator (2.00 mc) depending upon whether REMOTE SIDEBAND relay K1501 is energized or deenergized. Figure 4-2 shows the input and two possible outputs of mixer Q1602. If the LSB oscillator output (250 kc below the carrier frequency of the i-f signal) is supplied to the mixer, the frequency spectrum of the input signal is not inverted. If the USB oscillator output (250 kc above the carrier frequency of the i-f signal) is supplied to the mixer, the frequency spectrum of the input signal is inverted. Filter FL1601 passes only a band of frequencies above 250 kc; therefore reception of the desired sideband depends upon which oscillator output is supplied to the mixer.

LSB oscillator Q1607 and USB oscillator Q1608 are modified Colpitts oscillators (see figure 7-1, sheet 2); Q1607 is tuned to exactly 1.5 mc by C1629 whereas Q1608 is tuned to exactly 2.0 mc by C1631. The output of each oscillator is taken from its base. When LSB/USB REMOTE switch S1513 is set at LSB, relay K1501 is energized, and +12V CONT is applied through LSB ADJ R1554 to the emitter of Q1607; Q1607 is then forward biased. Oscillator Q1608 is not forward biased and is cutoff. The magnitude of the emitter voltage determines the magnitude of the oscillator output; maximum output occurs when the oscillator is biased at its maximum gain point. When S1513 is set at USB REMOTE and no remote sideband input (from TB1502) is present, K1501 is deenergized and +12V CONT is applied across USB ADJ R1555. Thus, Q1608 is forward

biased and Q1607 is cutoff. If ground is supplied as a remote sideband input, K1501 is energized, and oscillator Q1607 is activated.

The output of the selected oscillator (Q1607 or Q1608) is supplied to mixer Q1602 through buffer amplifier Q1609, which minimizes the loading of the oscillator so that its frequency and output magnitude are stable. The output of mixer Q1602 is the second i-f frequency and is supplied to crystal bandpass filter FL1601. Filter FL1601 is a highly selective filter (with a bandpass of 2.75 kc) that rejects frequencies below 250.25 kc and above 253.0 kc. Thus, only the sideband whose frequency range is above 250 kc will be passed by the filter while all noise and signal frequencies outside of the selected sideband are eliminated. The output of the filter is supplied to two stages: the detector comprising diodes CR1601 through CR1604 and i-f amplifier Q1610 in the agc circuit.

e. DETECTOR AND BEAT-FREQUENCY OSCILLATOR (BFO). - The selected sideband from filter FL1601 and the 250-kc output of bfo Q1606 are beat together in the detector (CR1601 through CR1604) to produce an audio signal which is then applied to the first audio amplifier (Q1603 and Q1604).

Bfo Q1606 (figure 7-1, sheet 2) is a modified Colpitts oscillator; its output is supplied through buffer amplifier Q1605 to potentiometer R1663. Potentiometer R1663 is used to provide equal magnitudes of the bfo signal at the anodes of CR1601 and CR1604, which are the two input points to the detector.

The bfo signal controls the switching of the diode network. The balanced i-f signal from FL1601 is supplied to the detector through C1610 and C1611. The amplitude of the i-f signal is small compared to the bfo signal so that the bfo signal does not lose control of the diode switching.

The bfo signal does not contribute to the output of the detector because it appears at the output as a sine wave shose average value is always zero. The detector output is filtered by C1613 and C1614 to remove the i-f and any residual bfo components from the audio signals.

f. AUDIO AMPLIFIERS. - First audio amplifier Q1603 and Q1604 accepts the balanced output from the detector (CR1601 through CR1604) and provides an amplified single-ended output to VOLUME control R1515 and LINE LEVEL control R1518. The signal developed across R1518 is further amplified by line amplifier Q1618 and is supplied as the balanced 600-ohm line output (see figure 7-1, sheet 3). The signal developed across R1515 is further amplified by second audio amplifier Q1613, third audio amplifier Q1614 and Q1615 (a combined phase-inverter and push-pull amplifier), and push-pull power amplifier Q1616 and Q1617. The output of the power amplifier is supplied through a contact of squelch relay K1601 (when K1601 is energized) to the 4-ohm speaker terminals and to the phone jack. The phone jack is wired so that if phones are used, the speaker terminal is disconnected from the audio amplifiers.

g. AGC AND SQUELCH CIRCUITS. - I-f amplifier Q1610 amplifies the output of crystal filter FL1601; the output of Q1610 is then applied to agc detector CR1605 through CR1607. The agc detector produces a delayed dc agc voltage which is supplied through first and second agc amplifiers Q1611 and Q1612 to the squelch circuit, and to the operating TTRR module through S1515.

Bistable amplfier Q1619 and Q1620 controls relay driver Q1621, which in turn, controls squelch relay K1601. When a signal above a predetermined level is being received, the bistable amplifier is held in its unsquelched state by the agc voltage and relay driver Q1621 is on. When the signal level decreases, the agc voltage drops. At a point selected by SQUELCH control R1547, the bistable amplifier changes to its squelched state and the relay driver Q1621 turns off.

When relay driver Q1601 is on, relay K1601 is energized, and the output of the audio power amplifier is connected to the speaker terminal and the phone jack. When relay driver Q1621 is off, relay K1601 is deenergized, and the output of the audio power amplifier (Q1616 and Q1617) is disconnected from the speaker terminal and PHONES jack J1516 and is connected instead to dummy load R1660. Thus, the receiver output is muted when a received signal is not present and only noise is being generated by the receiver. The other set of contacts of K1601 can be used to provide squelched and non-squelched indications for external-alarm circuitry.

h. METER CIRCUIT. - Meter M1501 can indicate the level of

either the r-f signal input or the 600-ohm line output depending upon the position of METER switch S1516. When S1516 is set at RF, the agc voltage produces a current through diode gate CR1500 and M1501 that causes a meter deflection proportional to the agc voltage and, hence, the r-f signal level. When S1516 is set at AF, a portion of the 600-ohm line output is full-wave rectified by CR302 and CR303 to produce a current through the meter. This current causes a meter deflection proportional to the output level.

i. POWER SUPPLY. - The power supply produces regulated +12 vdc and -12 vdc outputs for the operation of the SMR. The power supply is energized by POWER switch S901. OVEN switch S902 permits the selection of an externally generated oven supply voltage connected to OVEN input jack J905.

SECTION 5

MAINTENANCE

5-1. PREVENTIVE MAINTENANCE.

Preventive maintenance of the SMR consists of routine visual inspection and cleaning. Cleaning is necessary, because dust may accumulate on certain components and not only reduce the efficiency of the SMR, but also increase component wear. Either a vacuum cleaner or a compressed air hose is the quickest and most effective method of cleaning the unit.

Visually checking the unit when it is opened for cleaning can prevent downtime due to component failure. Often a deteriorating component will look bad before it actually affects the operation of the unit. Some indications of trouble are: discolored components, leaking transformers and capacitors, dirty or pitted switch and relay contacts, warped printed circuit boards, and damaged wiring. Any components found in this condition should be replaced. In addition, all hardware should be checked for tightness.

5-2. TROUBLESHOOTING.

Test equipment required for troubleshooting the SMR is listed in table 5-1. Refer to figures 5-1, 5-2, and 5-3 to locate components on the printed circuit boards or chassis of the SMR.

a. QUICK TESTS USING FRONT PANEL CONTROLS.

(1) CHANNEL TEST. - Try to operate the receiver on all eight frequencies selected by the CHANNEL switch. If the receiver

operates on some but not all channels, the TTRR module for the inoperative channel is probably defective.

(2) SIDEBAND TEST. - Try to receive signals with the LSB-USB/remote switch alternately set at both of its positions. If reception is possible on lower sideband only, the USB oscillator is probably defective.

b. SYSTEMATIC TROUBLESHOOTING.

(1) Disconnect all wiring from TB1501 and the antenna jack.

(2) Terminate the audio line output (terminals 6 and 8 of TB1501) with a 600-ohm resistor; terminate the speaker audio output (terminals 11 and 12 of TB1501) with a 3.2 ohm resistor.

(3) Set LSB/USB REMOTE switch at LSB. Check signal at emitter of Q1602. Level should be approximately 1.2 V peak-to-peak; if this level is not observed, check LSB oscillator Q1607 and buffer Q1609.

(4) Set LSB/USB REMOTE switch at USB REMOTE. Signal at emitter of Q1602 should be approximately 1.2 V peak-to-peak; if this level is not observed, chekc USB oscillator Q1608.

(5) Check signal at arm of potentiometer R1663. Level should be approximately 1.5 V peak-to-peak; if this level is not observed, check bfo Q1606 and buffer Q1605.

(6) Connect r-f signal generator to ANTENNA jack. Ground terminal 3 (secondary) of T1602 with a clip lead. Adjust generator to deliver operating frequency (F1 or F2) of receiver at 15 microvolts. Set LSB/USB REMOTE switch at LSB and remove

crystal Y1603. Check signal level at pin 1 of i-f board; level should be at least 1 mv rms. If this level is not obtained, check TTRR module.

NOTE

Before troubleshooting TTRR module, chekc AGC voltage at terminal 9 of the i-f board. A voltage above 1.8 vdc indicates a fault in the AGC circuit.

(7) Check signal level at the base of Q1602; level should be at least 20 mv rms. If this level is not obtained, check first i-f amplifier of Q1601. Remove ground jumper from T1602 secondary.

(8) Replace crystal Y1603 and tune signal generator approximately 1 kc below receiver's operating frequency.

(9) Check signal level at collector of Q1610; level should be at least 1 v. If this level is not obtained, check mixer Q1602 and i-f amplifier Q1610.

(10) Check signal level at output (terminal 11) of the i-f board; level should be approximately 10 mv rms. If this level is not obtained, check detector and first audio amplifier.

(11) Rotate SQUELCH, VOLUME, and LINE LEVEL controls fully clockwise and check for the following signal levels in the audio circuit.

BASE OF Q1618	10mv rms.
COLLECTORS OF Q1614 & Q1615	1 v peak-to-peak
COLLECTORS OF Q1616 & Q1617	10 v peak-to-peak
SPEAKER OUTPUT	1.4 v rms.
LINE OUTPUT	0.78 rms.

TABLE 5-1. TEST EQUIPMENT REQUIRED

ITEM	MANUFACTURER
R-f Signal Generator	Hewlett-Packard Model 606A, or equivalent
Oscilloscope	Tektronix Model 545A, or equivalent
A-C VTVM	Ballantine Model 314, or equivalent

5-3. REPAIR.

In most cases, repair of the SMR will consist of the replacement of an electrical component. Although no special instruction is required to accomplish this, the following hints are provided to ensure that the repairs are completed properly.

a. Always replace a defective component with its exact duplicate.

b. Always place a new component in the same position as the one it replaces. In general, never change the existing chassis layout, whether in the routing of wiring or component replacement.

c. Never use a soldering iron with a high power rating in order to avoid damage to printed circuit boards. Use a pair of long-nose pliers as a heat sink to protect components while soldering.

d. Always double check any solder joints made. Cold or loose solder connections can cause trouble at a later time.

5-4. ALIGNMENT.

Test equipment required for SMR alignment is listed in table 5-1. Refer to figures 5-1, 5-2, and 5-3 for component

location.

a. Disconnect all external wiring, except power input, from rear of SMR. Terminate audio-line output (terminals 6 and 8 of TB1501) with a 600-ohm resistor; terminate speaker audio output (terminals 11 and 12 of TB1501) with a 3.2 ohm resistor.

b. Turn SMR on with VOLUME control. Set LSB/USB REMOTE switch at LSB. Connect oscilloscope to emitter of Q1602; adjust R1554 to obtain maximum signal at emitter of Q1602.

c. Set LSB/USB REMOTE switch at USB REMOTE. Adjust R1555 to obtain maximum signal at emitter of Q1602. Remove Y1602.

d. Connect signal generator to terminal 1 of i-f board; adjust generator to deliver 1750 kc at 1 mv (1,000 μv). Connect a-c VTVM to base of Q1602. Adjust C1602 and C1604 to obtain maximum signal.

e. Connect a-c VTVM to collector of Q1610. Adjust R1663 to obtain minimum signal at the point (approximately 110 mv rms).

f. Replace Y1602. Adjust generator to deliver 1749 kc at 260 μv; use counter to determine generator output frequency accurately.

g. Connect a-c VTVM to terminal 9 of i-f board. Adjust C1655 and C1656 to obtain maximum voltage at terminal 9.

h. Connect frequency counter to terminal 9 of i-f board; adjust C1631 until counter indicates 1,000 cps ± 2 cps.

i. Set LSB/USB REMOTE switch at USB REMOTE. Adjust C1629 to obtain 1,000 cps as in step h.

j. Rotate LINE LEVEL control fully clockwise. Connect r-f signal generator to ANTENNA jack; adjust generator to deliver 1 μv at 1 kc above receiver's operating frequency.

k. Connect a-c VTVM across 600-ohm resistor at line audio output. Adjust R1612 until meter indicates 780 rms.

l. Set METER switch at AF. Adjust R1551 until front-panel meter indicates 0 DB on AF scale.

m. Set METER switch at RF. Adjust R1548 until front-panel meter indicates 0 DB on RF scale.

n. Disconnect all test equipment and replace covers of equipment.

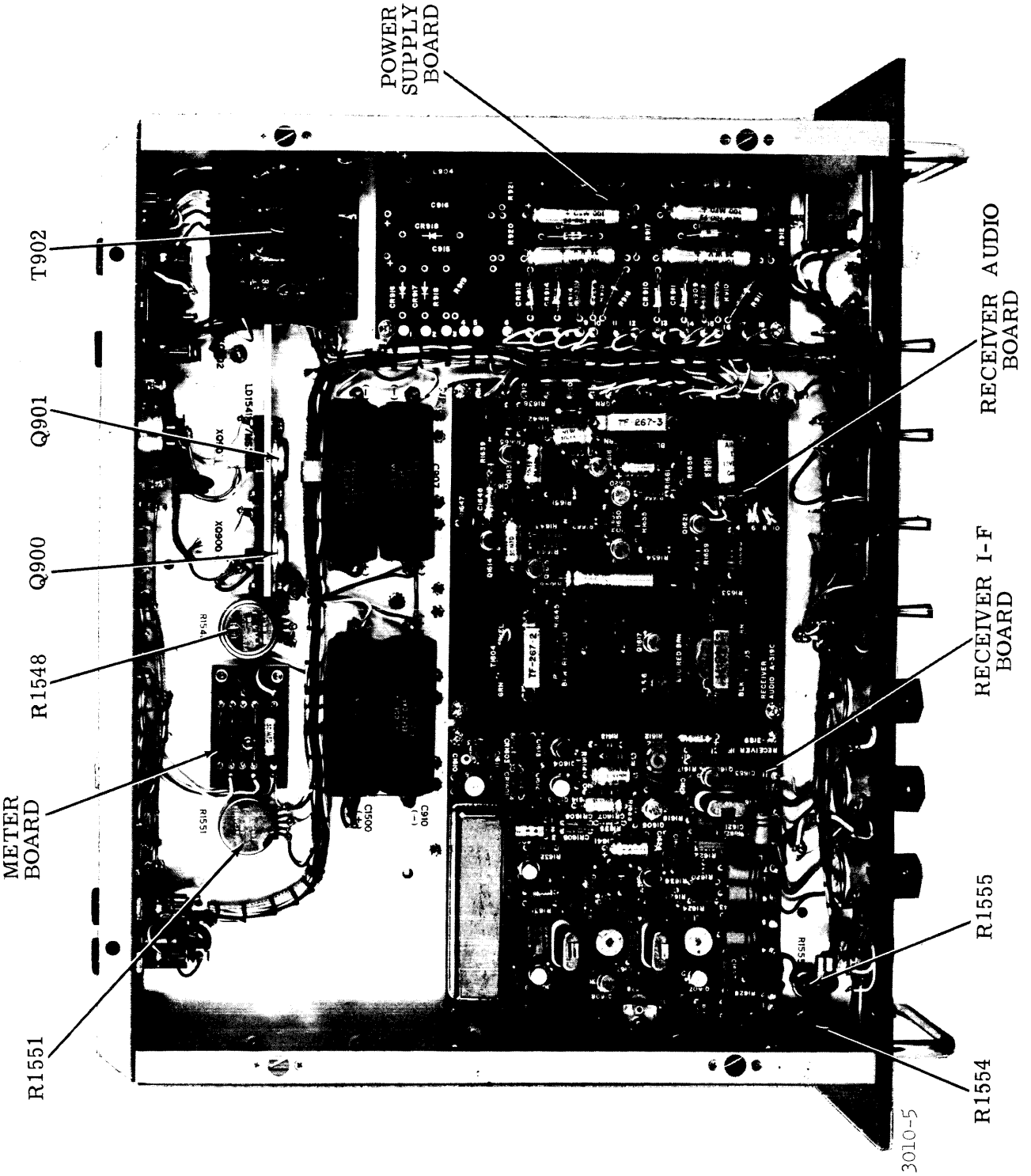


Figure 5-1. Bottom View, SMR

652.18-4

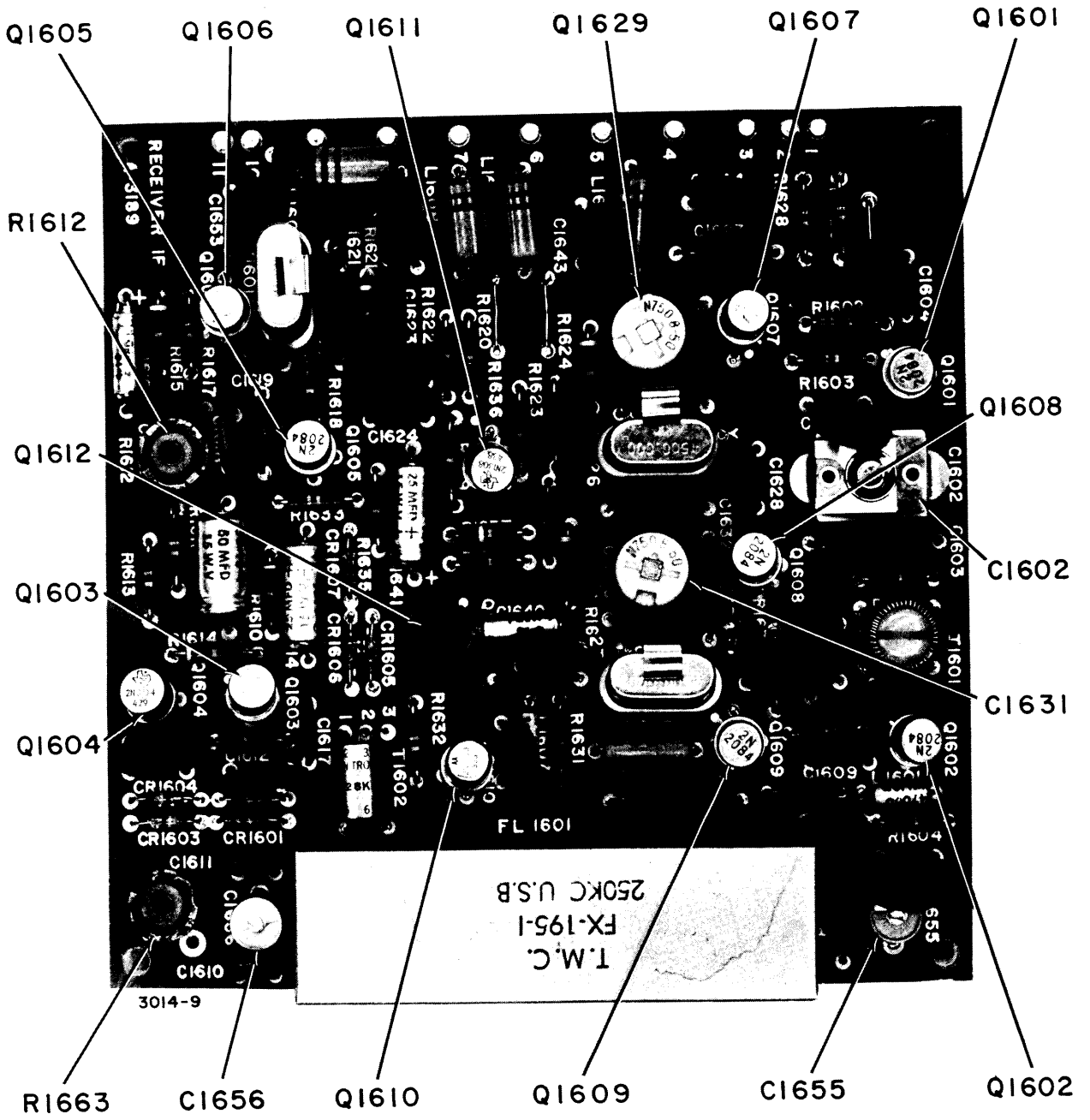


Figure 5-2. Receiver I-f Board, Top View

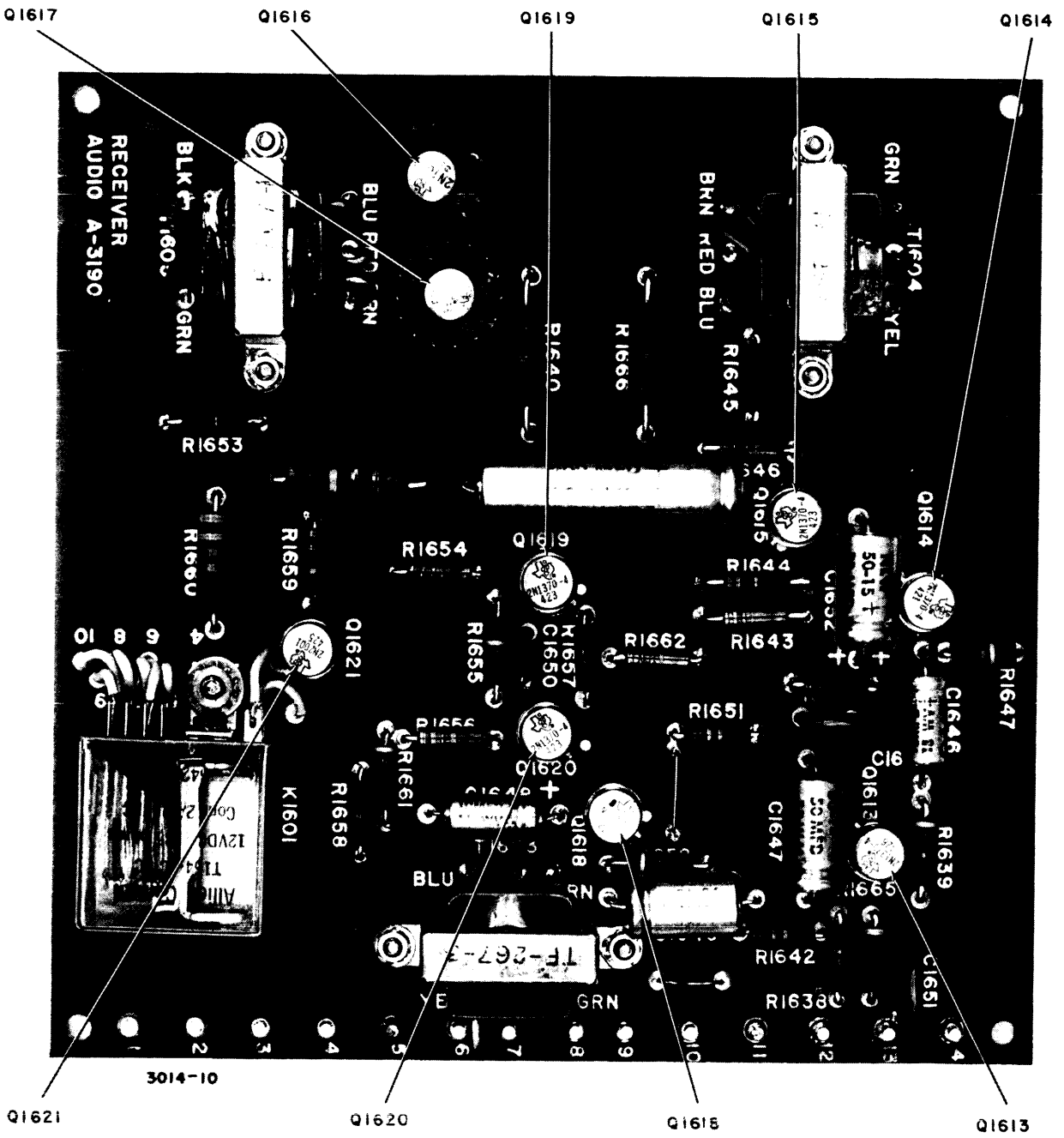


Figure 5-3. Receiver Audio Board, Top View

SECTION 6

PARTS LIST

6-1. INTRODUCTION.

The parts list presetned in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part nubers stamped on them.

To expedite delivery when ordering any part, specify the following:

a. Generic name.
b. Reference designation.
c. TMC part number.
d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation
Attention: Sales Department
700 Fenimore Road
Mamaroneck, New York

PARTS LIST

for

METER PRINTED CIRCUIT BOARD

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C300 thru C306	NOT USED	
C307	CAPACITOR, FIXED, ELECTROLYTIC: 50 uf, -10% +150% at 120 cps at 25°C; 15 WVDC; polarized; insulated tubular case.	CE105-50-15
CR300	NOT USED	
CR301	NOT USED	
CR302	SEMICONDUCTOR DEVICE, DIODE: germanium; max. peak inverse voltage 60 V; continuous average forward current 50 ma; max. peak forward current 150 ma; max. surge current 500 ma; max. inverse current 500 ua at 50 volts or 30 ua at 10 volts.	1N34A
CR303	Same as CR302.	
R300 thru R311	NOT USED	
R312	RESISTOR, FIXED, COMPOSITION: 2,200 ohms, ±5%; 1/2 watt.	RC20GF222J
R313	Same as R312.	

PARTS LIST

for

POWER SUPPLY, MAIN CHASSIS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C900 thru C906	NOT USED	
C907	CAPACITOR, FIXED, ELECTROLYTIC; 2,000 uf; 25 WVDC; max. temperature range 0°C to +85°C; polarized; hermetically sealed aluminum case with clear vinyl plastic sleeve.	CE116-5VN
C908	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf, -10% +150% at 120 cps at 25°C; 25 WVDC; polarized; insulated tubular case.	CE105-100-25
C909	Same as C908.	
C910	Same as C907.	
C911	Same as C907.	
C912	Same as C908.	
C913	Same as C908.	
C914 thru C918	NOT USED	
C919	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +80% -20%; 500 WVDC.	CC100-24
C920	Same as C919.	
CR900 thru CR909	NOT USED	
CR910	SEMICONDUCTOR DEVICE, DIODE: silicon; 600 V max. peak inverse voltage; 0.75 max. DC forward amperes at 150°C.	1N547
CR911	Same as CR910.	
CR912	SEMICONDUCTOR DEVICE, DIODE: silicon; 12 volts; max. power dissipation 1 watt at 25°C; current rating 21 ma; max. impedance 90 ohms; hermetically sealed metal case.	1N3022B
CR913	Same as CR910.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR914	Same as CR910.	
CR915	Same as CR912.	
F900 thru F906	NOT USED	
F907	FUSE, CARTRIDGE: 1/8 amp; time lag; 1-1/4" long x 1/4" dia.; slow blow. (For 115 V operation)	FU102-.125
F907	FUSE, CARTRIDGE: 1/16 amp; time lag; 1-1/4" long x 1/4" dia.; slow blow. (For 230 V operation)	FU102-.062
F908	FUSE, CARTRIDGE	*FU100-( )
F909	FUSE, CARTRIDGE: 1/4 amp; quick acting; 1-1/4" long x 1/4" dia.	FU100-.250
F910	Same as F909.	
J900 thru J903	NOT USED	
J904	CONNECTOR, RECEPTACLE, ELECTRICAL: male; AC power; 2 contacts; 250 volts at 10 amps, 125 volts at 15 amps; polarized; twist lock.	JJ175
J905	CONNECTOR, RECEPTACLE, ELECTRICAL: 2 male prong, flat contacts, straight type.	JJ119-1
L900	NOT USED	
L901	NOT USED	
L902	COIL, RADIO FREQUENCY: fixed; 3 PI; 1 mh inductance; 23 ohms, ±10% resistance; current rating 75-100 ma max.	CL101-2
L903	Same as L902.	
Q900	TRANSISTOR: germanium; base 50 V; emitter 40V; power dissipation 90 watts at 25°C; normal operating temperature range -65°C to +100°C; load resistance 2.2 ohms, collector current 3 amps, base current 0.013 amps; 1.56" long x 1.05" wide x 0.32" high; male plug-in type.	2N350A

* Value for fuse F908 will be dependant upon the type of OC-100 oven specified by customer.

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Q901	Same as Q900.	
R900 thru R908	NOT USED	
R909	RESISTOR, FIXED, WIREWOUND: 10 ohms, ±5%; 3 watts.	RW123-100J
R910	Same as R909.	
R911	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%; 1 watt.	RC32GF101K
R912	Same as R911.	
R913	NOT USED	
R914	Same as R909.	
R915	Same as R909.	
R916	Same as R911.	
R917	Same as R911.	
S900	NOT USED	
S901	SWITCH, TOGGLE: DPST; rated at 6 amps, 250 VAC; 28° angle of throw, solder lug terminals.	ST22K
S902	SWITCH, TOGGLE: DPDT; rated at 6 amps, 250 VAC; 28° angle of throw, solder lug terminals.	ST22N
T900	NOT USED	
T901	NOT USED	
T902	TRANSFORMER, POWER, STEP-DOWN: primary input (#1) 104/115 or 208/230 VAC; secondary (#1, #2) 24 volts at 300 ma, (#3) 80 volts at 100 ma, CT; 15 solder lug type terminals; open frame case.	TF298
XF900 thru XF906	NOT USED	
XF907	FUSEHOLDER: extractor post type; accommodates cartridge fuse 1-1/4" long x 1/4" dia.; rated for 15 amps, 250 volts max.; o/a length 1-3/4"; bushing mounted.	FH103

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XF908 thru XF910	Same as XF907.	
XQ900	SOCKET, SEMICONDUCTOR DEVICE: 2 pin contact accommodation, 0.040 or 0.050 dia.; polarized; 1 terminal lug grounding strap; o/a dimensions 1-37/64" x 1" max.	TS166-S1
XQ901	Same as XQ900.	

PARTS LIST

for

MAIN CHASSIS, SMR-1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1500	CAPACITOR, FIXED, ELECTROLYTIC: 2,000 uf; 25 WVDC; max. temperature range 0°C to +85°C; polarized; hermetically sealed aluminum case with clear vinyl plastic sleeve.	CE116-5VN
CR1500	SEMICONDUCTOR DEVICE, DIODE: germanium; min. peak inverse voltage for zero dynamic impedance 70 V; continuous reverse working voltage 60 V; average forward current 60 ma; recurrent peak forward current 150 ma; forward surge current (1 sec) 500 ma.	1N294
DS1500	NOT USED	
DS1501	LAMP, INCANDESCENT: single contact, rated for 28.0 VAC/VDC, 0.04 amps; T-3-1/4 bulb.	BI110-7
J1500	NOT USED	
J1501	NOT USED	
J1502	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round female contact, straight type; series BNC to BNC.	JJ172
J1503 thru J1515	NOT USED	
J1516	JACK: phone	JJ315-1
J1517	CONNECTOR, RECEPTACLE, ELECTRICAL: printed circuit board type; 20 female contacts, 5 amps continuous current rating; 600 V RMS.	JJ287-20
J1518 thru J1524	Same as J1517.	
K1500	NOT USED	
K1501	RELAY, ARMATURE: miniature; coil -200 ohms DC resistance, nom. voltage 12.6 VDC, min operating amps 0.034, dissipation 1 watt at 125°C or 1.5 watts at 25°C; DPDT type contacts rated for 3 amps, 26.5 VDC, contacts resistance 0.030 ohm max. per contact; solder hook type terminals; hermetically sealed; back filled with dry nitrogen.	RL143-3
K1502	RELAY, ARMATURE: 4PDT; 185 ohms, ±10% DC resistance; operating voltage 12 VDC; current rating 60 ma; 700	RL156-2

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
K1502 (cont)	mu at 25°C; 14 contacts rated for 2 amps at 20 VDC resistance; clear high impact styrene dust cover case.	
M1500	NOT USED	
M1501	METER: AF/RF; 50 ua movement; approx. resistance 2,000 ohms; standard rectangular steel case.	MR182
R1500 thru R1514	NOT USED	
R1515	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms, ±10% 2 watts; taper A.	RV4NAYSA103-AYY
R1516	NOT USED	
R1517	NOT USED	
R1518	Same as R1515.	
R1519	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, ±5%; 1/2 watt.	RC20GF102J
R1520 thru R1533	NOT USED	
R1534	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, ±5%; 1/2 watt.	RC20GF472J
R1535 thru R1544	NOT USED	
R1545	RESISTOR, FIXED, COMPOSITION: 3.3 ohms, ±5%; 1 watt.	RC32GF3R3J
R1546	NOT USED	
R1547	RESISTOR, VARIABLE, COMPOSITION: 5,000 ohms, ±10%; 2 watts; taper A.	RV4NAYSA502-AYY
R1548	RESISTOR, VARIABLE, COMPOSITION: 50,000 ohms, ±10%; 2 watts; taper A.	RV4LAYSA503A
R1549	Same as R1519.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1550	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, ±5%; 1/2 watt.	RC20GF104J
R1551	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms, ±10%, 2 watts; taper A.	RV41LAYSA103A
R1552 and R1553	NOT USED	
R1554	RESISTOR, VARIABLE, COMPOSITION: 50,000 ohms, ±10% continuous power rating 0.5 watt at 70°C; 350 V RMS; linear taper.	RV106UX8B503A
R1555	Same as R1554.	
R1556	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, ±5%; 1 watt.	RC32GF333J
S1500 thru S1512	NOT USED	
S1513	SWITCH, TOGGLE: DPDT; rated at 6 amps, 250 VAC; 28° angle of throw, solder lug terminals.	ST22N
S1514	SWITCH, TOGGLE: SPST; rated at 6 amps, 125 VAC; 28° angle of throw, solder lug terminals.	ST12A
S1515	SWITCH, ROTARY: 5 section, 8 position, 30° angle of throw; 360° rotation, no stops; 5 non-shorting and 5 silver plated brass type contacts; rated for 28 VDC, 115 VAC max., 1 amp DC, 1.5 amps AC.	SW368
S1516	Same as S1513.	
TB1500	NOT USED	
TB1501	TERMINAL BOARD, BARRIER: 16 terminals; 6-32 thd. x 1/4" long binder head screws; phenolic blackbakelite	TM100-16
XDS1500	NOT USED	
XDS1501	LIGHT,INDICATOR: with white translucent lens; subminiature type.	TS153-5
XK1500 and XK1501	NOT USED	
TK1502	SOCKET, RELAY: with retainer; 12 contacts; solder type terminals; black pheriolic socket.	TS171-3

PARTS LIST

for

IF AND AUDIO RECEIVER BOARDS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1600	NOT USED	
C1601	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 100 WVDC.	CC100-28
C1602	CAPACITOR, VARIABLE, MICA DIELECTRIC: 280 uuf max. when tight, 25 uuf max. at 3 turns; 175 WVDC.	CV114-1
C1603	CAPACITOR, FIXED, MICA DIELECTRIC: 1,800 uuf, ±2%; 500 WVDC.	CM100-13
C1604	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 10-75 uuf; operating temperature range -55°C to +85°C; 350 WVDC.	CV109-8
C1605	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200,000 uuf, +80% -20%; 25 WVDC.	CC100-33
C1606	Same as C1601.	
C1607	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 25,000 uuf, +80% -20%; 500 WVDC.	CC100-25
C1608	CAPACITOR, FIXED, MICA DIELECTRIC: 68 uuf, ±2%; 500 WVDC; char. C.	CM15C680G
C1609	CAPACITOR, FIXED, MICA DIELECTRIC: 510 uuf, ±5%; 500 WVDC; char. B.	CM15B511J
C1610	CAPACITOR, FIXED, MICA DIELECTRIC: 180 uuf, ±2%; 500 WVDC; straight wire leads.	CM111D181G5S
C1611	Same as C1610.	
C1612	Same as C1607.	
C1613	Same as C1607.	
C1614	CAPACITOR, FIXED, ELECTROLYTIC: 25 uf, -10% +150% at 120 cps at 25°C; 15 WVDC; polarized; insulated tubular case.	CE105-25-15
C1615	CAPACITOR, FIXED, ELECTROLYTIC: 50 uf, -10% +150% at 120 cps at 25°C; 15 WVDC; polarized; insulated tubular case.	CE105-50-15
C1616	CAPACITOR, FIXED, ELECTROLYTIC: 4 uf, -10% +150% at 120 cps at 25°C; 15 WVDC; polarized; insulated tubular case.	CE105-4-15

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1617	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, GMV; 500 WVDC.	CC100-16
C1618	Same as C1605.	
C1619	Same as C1605.	
C1620	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 5,000 uuf, GMV; 500 WVDC.	CC100-15
C1621	CAPACITOR, FIXED, MICA DIELECTRIC: 270 uuf, ±5%; 500 WVDC; char. C.	CM15C271J
C1622	Same as C1617.	
C1623	CAPACITOR, FIXED, MICA DIELECTRIC: 47 uuf, ±5%; 500 WVDC; char. C.	CM15C470J
C1624 thru C1626	Same as C1601.	
C1627	Same as C1621.	
C1628	Same as C1605.	
C1629	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 8-50 uuf; operating temperature range -55°C to +85°C; 350 WVDC.	CV109-6
C1630	CAPACITOR, FIXED, MICA DIELECTRIC: 24 uuf, ±5%; 500 WVDC; char. C.	CM15C240J
C1631	Same as C1629.	
C1632	Same as C1630.	
C1633	Same as C1621.	
C1634	Same as C1605.	
C1635	Same as C1601.	
C1636	Same as C1601.	
C1637	Same as C1617.	
C1638	Same as C1605.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1639	Same as C1617.	
C1640	CAPACITOR, FIXED, ELECTROLYTIC: 6 uf, -10% +150% at 120 cps at 25°C; 15 WVDC; polarized; insulated tubular case.	CE105-6-15
C1641	Same as C1614.	
C1642	Same as C1617.	
C1643	Same as C1601.	
C1644	Same as C1601.	
C1645	CAPACITOR, FIXED, MICA DIELECTRIC: 1,000 uuf, ±2%; 500 WVDC; char. F.	CM20F102G
C1646	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf, -10% +150% at 120 cps at 25°C; 15 WVDC; polarized; insulated tubular case.	CE105-10-15
C1647	Same as C1615.	
C1648	Same as C1646.	
C1649	Same as C1615.	
C1650	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1,000 uuf, GMV; 500 WVDC.	CC100-29
C1651	Same as C1601.	
C1652	Same as C1615.	
C1653	Same as C1601.	
C1654	Same as C1605.	
C1655	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 9-35 uuf; operating temperature range -55°C to +125°C; 100 WVDC.	CV112-2
C1656	Same as C1655.	
C1657	Same as C1601.	
C1658	CAPACITOR, FIXED, MICA DIELECTRIC: 10 uuf, ±5%; 500 WVDC; char. C.	CM15C100J
C1659	NOT USED	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1660	CAPACITOR, FIXED, ELECTROLYTIC: 200 uf, -10% +150% at 120 cps at 25°C; 15 WVDC; polarized; insulated tubular case.	CE105-200-15
C1661	CAPACITOR, FIXED, MICA DIELECTRIC: 680 uuf, ±5%; 500 WVDC; straight wire leads.	CM111E681J5S
CR1600	NOT USED	
CR1601	SEMICONDUCTOR DEVICE, DIODE: germanium; max. peak inverse voltage 60 V; continuous average forward current 50 ma; max. peak forward current 150 ma; max. surge current 500 ma; max. inverse current 500 ua at 50 volts or 30 ua at 10 volts.	1N34A
CR1602 thru CR1604	Same as CR1601.	
CR1605	SEMICONDUCTOR DEVICE, DIODE: silicon; forward current 5 ma at 1 volt; reverse current 625 ua at 100 volts, 25°C.	1N68
CR1606	Same as CR1605.	
CR1607	Same as CR1605.	
EQ1600 thru EQ1615	NOT USED	
EQ1616	HEAT SINK: transistor heat dissipating element.	HD101
EQ1617	Same as EQ1616.	
FL1600	NOT USED	
FL1601	FILTER, BANDPASS: operating frequency 250 Kc; bandwidth, 250.350 - 253.350 Kc; input and output impedance 100K ohms nom.; hermetically sealed brass case.	FX195-1
K1600	NOT USED	
K1601	RELAY, ARMATURE: 4PDT; 185 ohms, ±10% DC resistance; operating voltage 12 VDC; current rating 60 ma; 700 mw at 25°C; 14 contacts rated for 2 amps at 20 VDC resistance; clear high impact styrene dust cover case.	RL156-2
L1600	NOT USED	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L1601	COIL, RADIO FREQUENCY: fixed; 47,000 uh, ±5%; 452 ohms DC resistance; current rating 27 ma; molded case.	CL275-473
L1602	COIL, RADIO FREQUENCY: fixed; 0.220 uh, ±10%; current rating 200 ma; molded case.	CL140-6
L1603	NOT USED	
L1604	Same as L1602.	
L1605	Same as L1602.	
L1606	NOT USED	
L1607	COIL, RADIO FREQUENCY: fixed; 1,000 uh, ±5%; 16.0 ohms DC resistance; current rating 140 ma; molded case.	CL275-102
L1608	Same as L1602.	
L1609	NOT USED	
L1610	COIL, RADIO FREQUENCY: fixed; 150 uh, ±5%; 3.3 ohms DC resistance; current rating 315 ma; molded case.	CL275-151
Q1600	NOT USED	
Q1601	TRANSISTOR: germanium; PNP; JEDEC type 2N2084 transistor with a controlled hfe limit of 100-150; JEDEC type TO33 case.	TX109/2N2084
Q1602	Same as Q1601.	
Q1603	TRANSISTOR: germanium; PNP; JEDEC type 2N1370-4 transistor with a controlled hfe limit of 60-75; JEDEC type TO9 case.	TX107/2N1370-4
Q1604	Same as Q1603.	
Q1605 thru Q1609	Same as Q1601.	
Q1610	TRANSISTOR: germanium; PNP; collector to base voltage 45 V; collector to emitter voltage 30 V; emitter to base voltage 15 V; collector current (continuous) 500 ma DC; collector dissipation 200 mw; junction storage temperature range -65°C to +100°C.	2N1190

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Q1611	TRANSISTOR: NPN; silicon mesa; collector to base voltage 60 V; collector to emitter voltage 40 V; emitter to base voltage 5 V; collector current 175 ma; power dissipation 2 watts at 25°C; junction temperature 175°C; hermetically sealed metal case.	2N697
Q1612	TRANSISTOR: germanium; NPN; JEDEC type 2N1308 transistor with a controlled hfe limit of 80-150; JEDEC type TO5 case.	TX106/2N1308
Q1613	Same as Q1603.	
Q1614	Same as Q1603.	
Q1615	Same as Q1603.	
Q1616	TRANSISTOR: germanium; PNP; collector to base and collector to emitter voltage 60 volts; emitter to base voltage 20 volts; collector current 3 amps, base current 1 amp; junction and storage temperature -55°C to +100°C; power dissipation 20 watts at 25°C.	2N1039
Q1617	Same as Q1616.	
Q1618	TRANSISTOR: germanium; PNP; JEDEC type 2N1370-7 transistor with a controlled hfe limit of 120-150; JEDEC type TO5 case.	TX108/2N1370-7
Q1619	Same as Q1603.	
Q1620	Same as Q1603.	
Q1621	TRANSISTOR: germanium; PNP; germanium; PNP;max. collector dissipation 300 mw; Fab. equals 6 mc; collector current 1 ma; collector cut-off current 100 ua; hfe limit 80.	2N2001
R1600	NOT USED	
R1601	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, ±5%; 1/2 watt.	RC20GF102J
R1602	RESISTOR, FIXED, COMPOSITION: 220 ohms, ±5%; 1/2 watt.	RC20GF221J
R1603	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, ±5%; 1/2 watt.	RC20GF103J

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1604	Same as R1601.	
R1605	Same as R1603.	
R1606	NOT USED	
R1607	NOT USED	
R1608	Same as R1601.	
R1609	Same as R1601.	
R1610	RESISTOR, FIXED, COMPOSITION: 470 ohms, ±5%; 1/2 watt.	RC20GF471J
R1611	Same as R1603.	
R1612	RESISTOR, VARIABLE, COMPOSITION: 500 ohms, ±10%; nom. power rating 0.25 watt at 70°C; linear taper.	RV111V501A
R1613	Same as R1603.	
R1614	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, ±5%; 1/2 watt.	RC20GF472J
R1615	Same as R1614.	
R1616	RESISTOR, FIXED, COMPOSITION: 22 ohms, ±5%; 1/2 watt.	RC20GF220J
R1617	Same as R1603.	
R1618	RESISTOR, FIXED, COMPOSITION: 3,300 ohms, ±5%; 1/2 watt.	RC20GF332J
R1619	Same as R1601.	
R1620	Same as R1601.	
R1621	Same as R1614.	
R1622	Same as R1601.	
R1623	Same as R1601.	
R1624	Same as R1614.	
R1625	Same as R1603.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1626	Same as R1601.	
R1627	Same as R1614.	
R1628	Same as R1603.	
R1629	RESISTOR, FIXED, COMPOSITION: 560 ohms, ±5%; 1/2 watt.	RC20GF561J
R1630	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, ±5%; 1/2 watt.	RC20GF682J
R1631	Same as R1601.	
R1632	Same as R1603.	
R1633	Same as R1603.	
R1634	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, ±5%; 1/2 watt.	RC20GF272J
R1635	Same as R1601.	
R1636	Same as R1602.	
R1637	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, ±5%; 1/2 watt.	RC20GF104J
R1638	Same as R1603.	
R1639	Same as R1614.	
R1640	RESISTOR, FIXED, COMPOSITION: 22 ohms, ±5%; 2 watts.	RC42GF220J
R1641	Same as R1618.	
R1642	Same as R1603.	
R1643	Same as R1618.	
R1644	Same as R1618.	
R1645	RESISTOR, FIXED, COMPOSITION: 680 ohms, ±5%; 1/2 watt.	RC20GF681J
R1646	RESISTOR, FIXED, COMPOSITION: 10 ohms, ±5%; 1/2 watt.	RC20GF100J

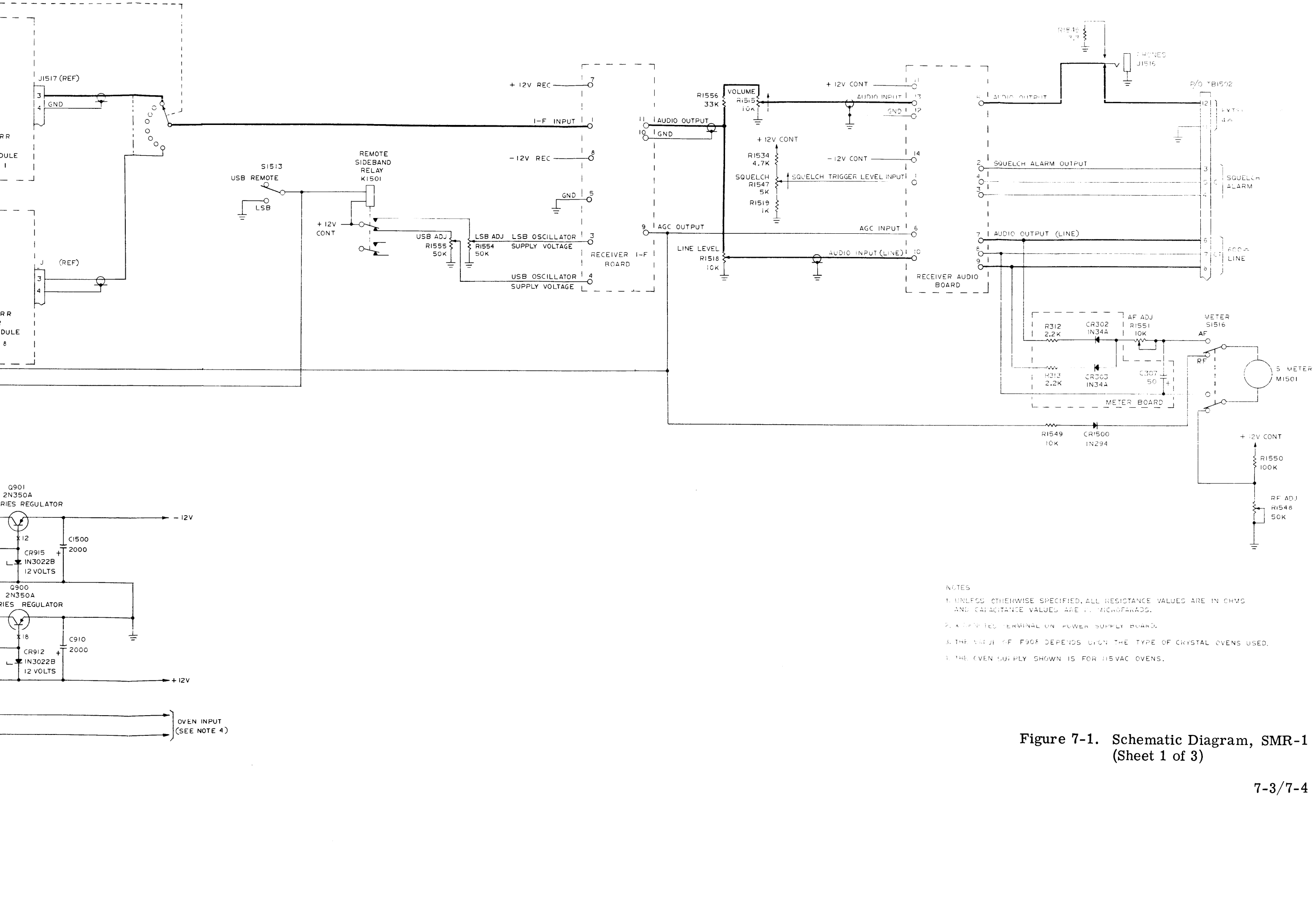
REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1647	Same as R1637.	
R1648 thru R1650	NOT USED	
R1651	Same as R1603.	
R1652	RESISTOR, FIXED, COMPOSITION: 3,900 ohms, ±5%; 1/2 watt.	RC20GF392J
R1653	RESISTOR, FIXED, COMPOSITION: 2,200 ohms, ±5%; 1/2 watt.	RC20GF222J
R1654	Same as R1601.	
R1655	Same as R1637.	
R1656	Same as R1618.	
R1657	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, ±5%; 1/2 watt.	RC20GF223J
R1658	Same as R1653.	
R1659	RESISTOR, FIXED, COMPOSITION: 33 ohms, ±5%; 1/2 watt.	RC20GF330J
R1660	RESISTOR, FIXED, COMPOSITION: 3.3 ohms, ±5%; 1 watt.	RC32GF3R3J
R1661	Same as R1610.	
R1662	RESISTOR, FIXED, COMPOSITION: 1,800 ohms, ±5%; 1/2 watt.	RC20GF182J
R1663	Same as R1612.	
R1664	NOT USED	
R1665	Same as R1614.	
R1666	Same as R1640.	
R1667	RESISTOR, FIXED, COMPOSITION: 27 ohms, ±5%; 2 watts.	RC42GF270J
R1668	Same as R1601.	
T1600	NOT USED	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T1601	TRANSFORMER, INTERMEDIATE FREQUENCY: fixed; operating frequency 1.75 mc; nom. primary inductance 4.5 uhy, ±.200 uhy; 4 terminals, wire lead type.	TZ126
T1602	TRANSFORMER, PULSE: 3 windings; winding no. one, 4.7 mh; turns ratio 5:5:1.	TF228K15
T1603	TRANSFORMER, AUDIO FREQUENCY: fixed; primary impedance 4,000 ohms, CT; DC resistance 370 ohms, ±20%; secondary impedance 600 ohms, CT; DC resistance 60 ohms, ±20%; operating frequency range 200-15,000 cps; frequency response ±3 db at 250 to 3,500 cps.	TF267-3
T1604	TRANSFORMER, AUDIO FREQUENCY: fixed; primary impedance 3,000 ohms, CT; DC resistance 260 ohms, ±20%; secondary impedance 1,000 ohms, CT; DC resistance 105 ohms, ±20%; operating frequency range 200-15,000 cps; frequency response ±3 db at 250 to 3,500 cps.	TF267-2
T1605	TRANSFORMER, AUDIO FREQUENCY: fixed; primary impedance 500 ohms, CT; DC resistance 26 ohms, ±20%; secondary impedance 3.2 ohms; DC resistance 0.3 ohms, ±20%; operating frequency range 150-45,000 cps, frequency response +0.2 db at 1,000 cps, ref; 150-45,000 cps.	TF267-5
XY1600	NOT USED	
XY1601	SOCKET, CRYSTAL: 2 beryllium copper silver plated contacts; for crystals having a .050 pin dia. and .486 spacing between pins.	TS104-2
XY1602	Same as XY1601.	
XY1603	Same as XY1601.	
Y1600	NOT USED	
Y1601	CRYSTAL UNIT, QUARTZ: 250 KC, ±.002%; operating temperature range 75°C, +5°C; parallel resonance; load capacitance 20 uuf, ±0.5 uuf; HC-6/U type holder.	CR47A/U 250. 000KC
Y1602	CRYSTAL UNIT, QUARTZ: 2 MC, ±.005%; operating temperature range -55°C to +30°C; max. capacitance 7.0 uuf; parallel resonance; load capacitance 32.0 uuf, ±0.5 uuf; HC-6/U type holder.	CR18A/U 2.00 0000MC

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Y1603	CRYSTAL UNIT, QUARTZ: 1.5 MC, +.005%; operating temperature range -55°C to +30°C; max. capacitance 7.0 uuf; parallel resonance; load capacitance 32.0 uuf, ±0.5 uuf; HC-6/U type holder.	CR18A/U 1.500 000MC

SECTION 7

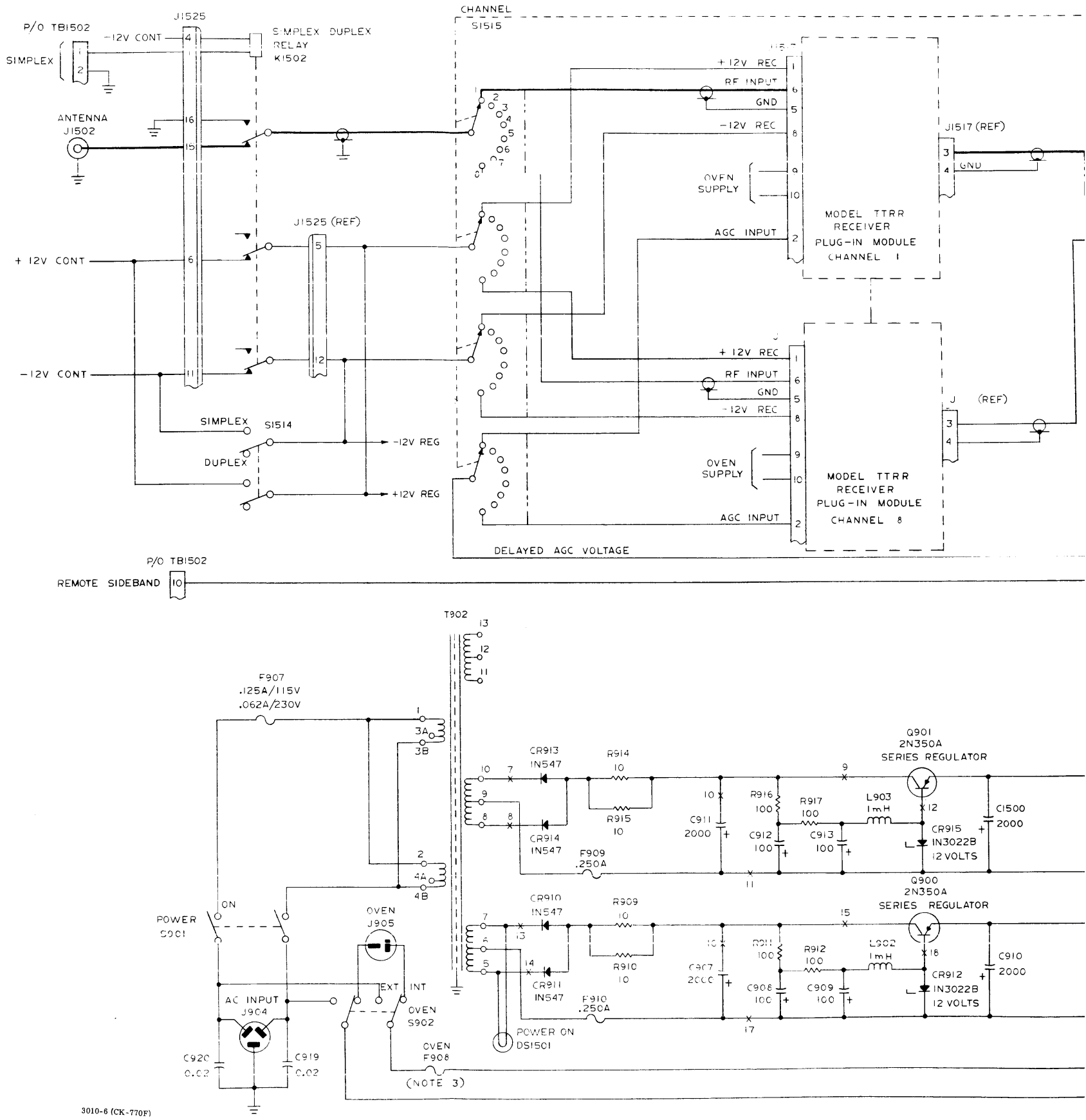
SCHEMATIC DIAGRAMS



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.
2. X DENOTES TERMINAL ON POWER SUPPLY BOARD.
3. THE VALUE OF R908 DEPENDS UPON THE TYPE OF CRYSTAL OVENS USED.
4. THE OVEN SUPPLY SHOWN IS FOR 115VAC OVENS.

Figure 7-1. Schematic Diagram, SMR-1 (Sheet 1 of 3)



3010-6 (CK-770F)

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3010-6

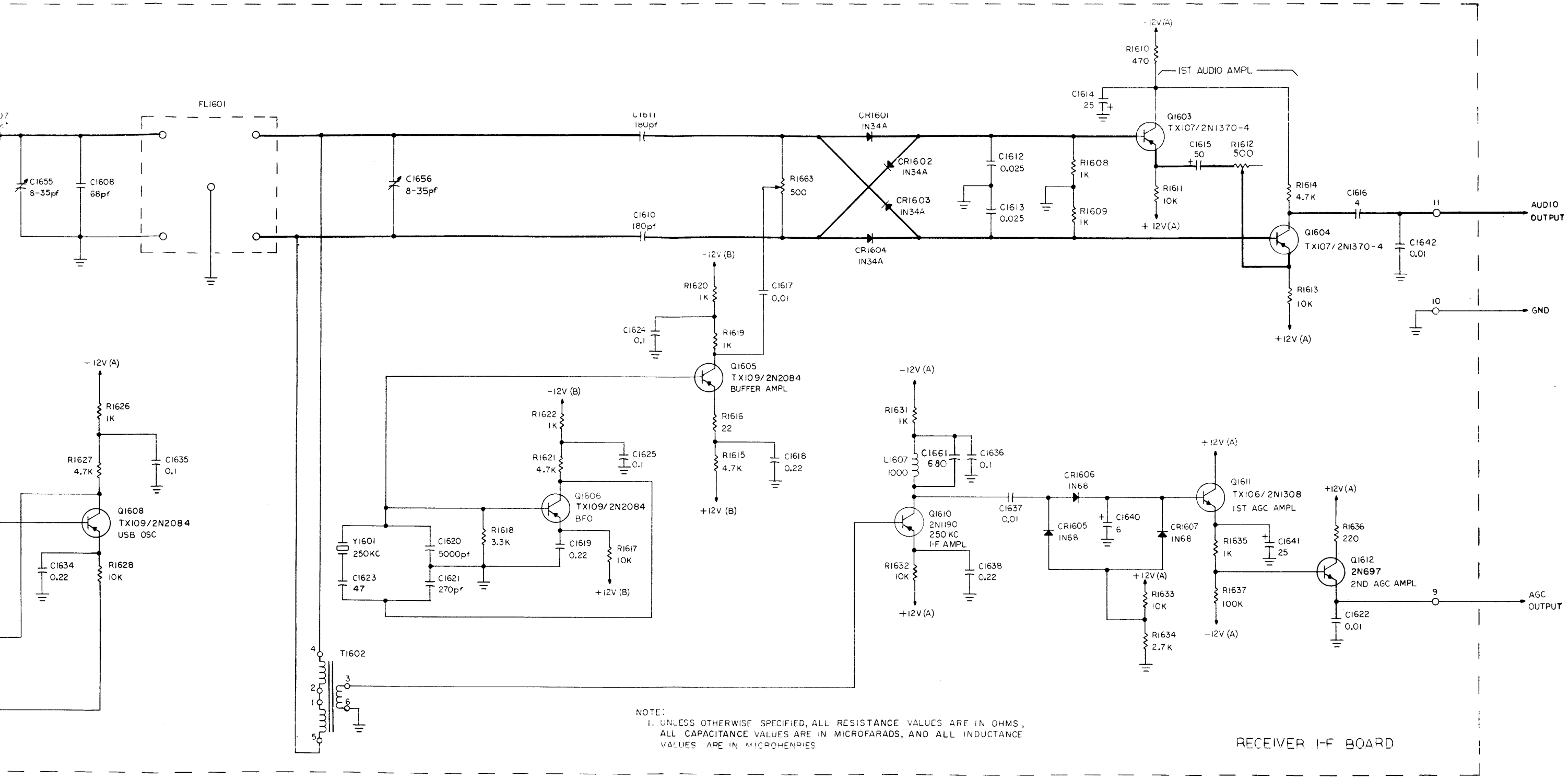
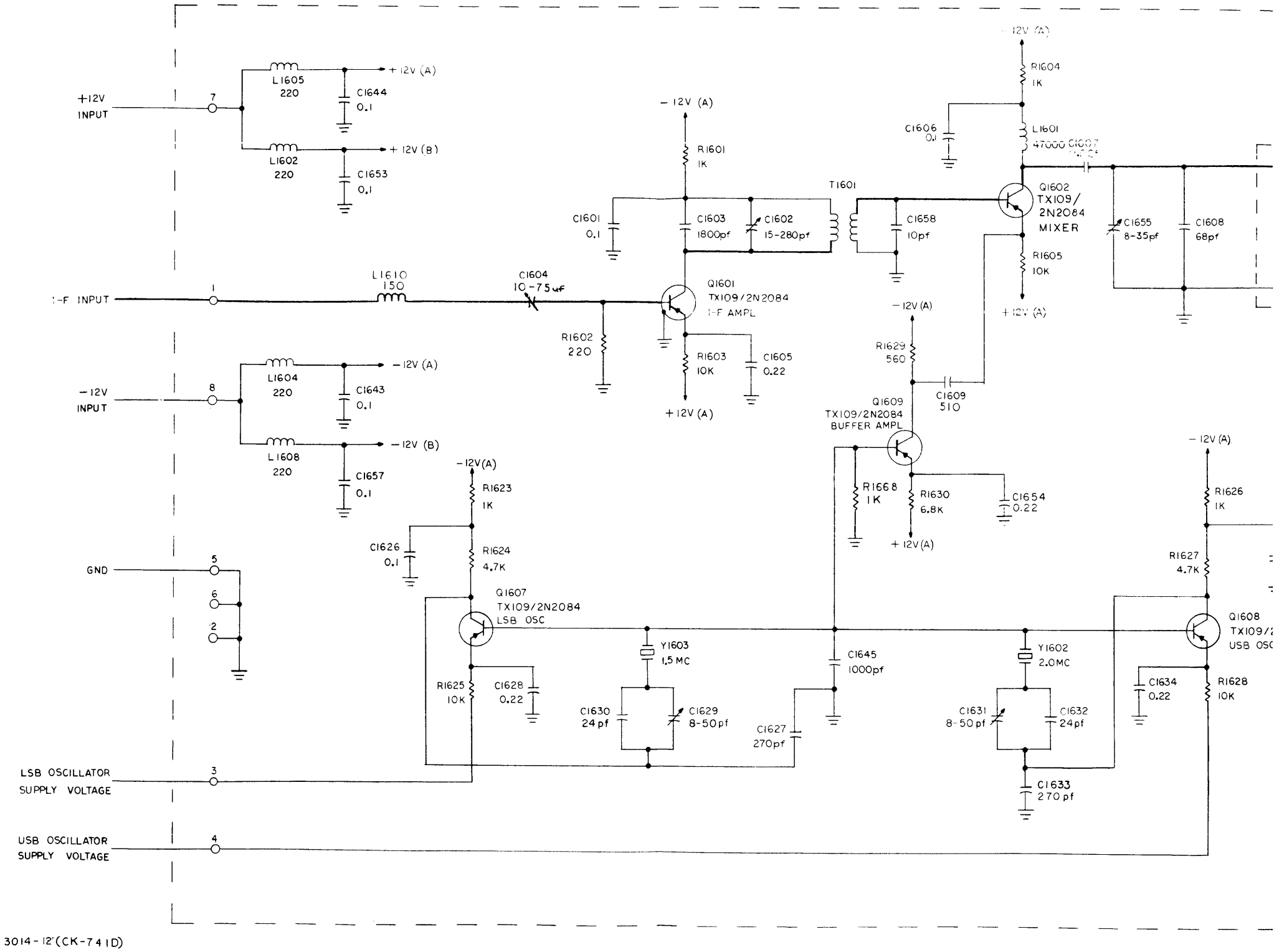


Figure 7-1. Schematic Diagram, SMR-1 (Sheet 2 of 3)



3014-12'(CK-741D)

~~3014-12~~

C1065-3010

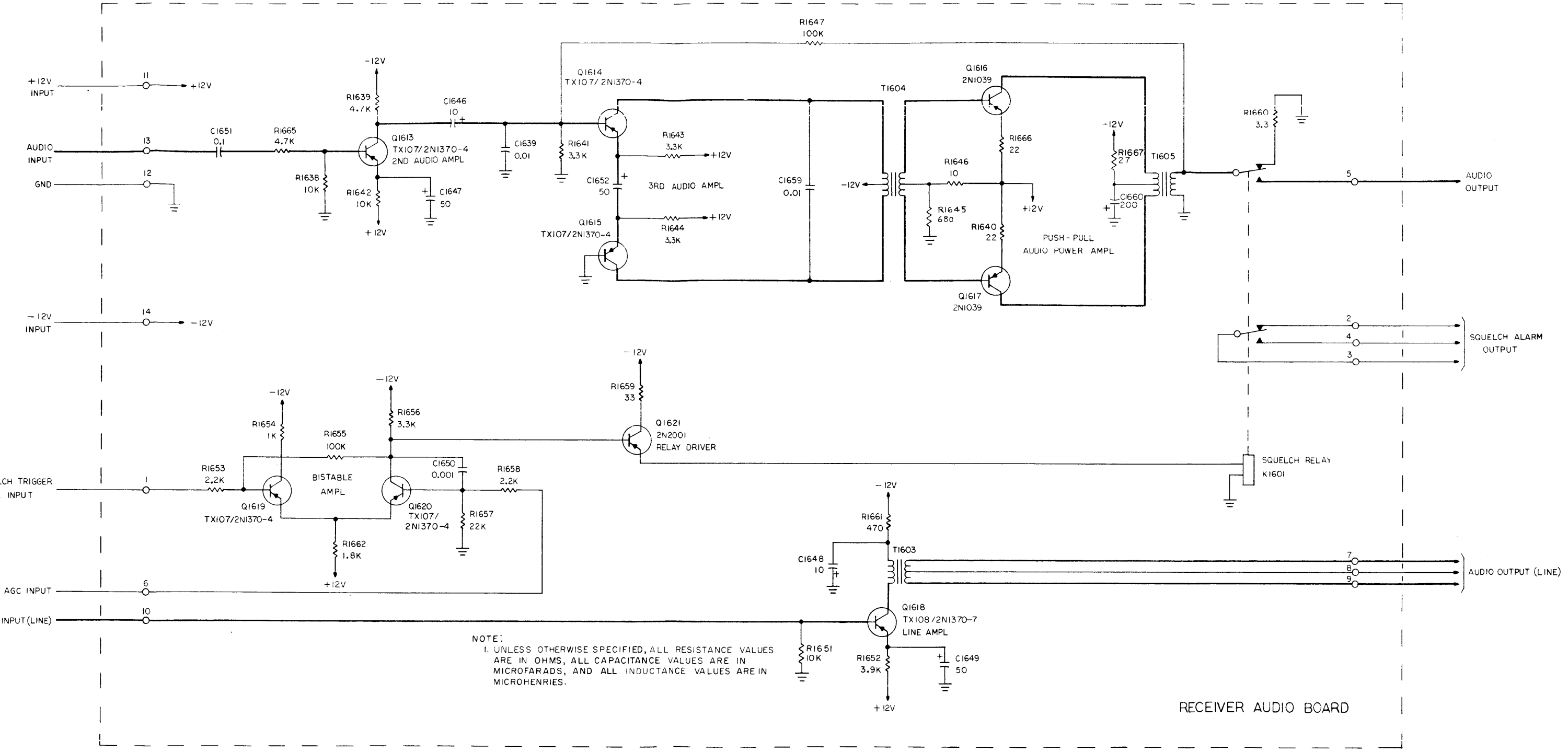
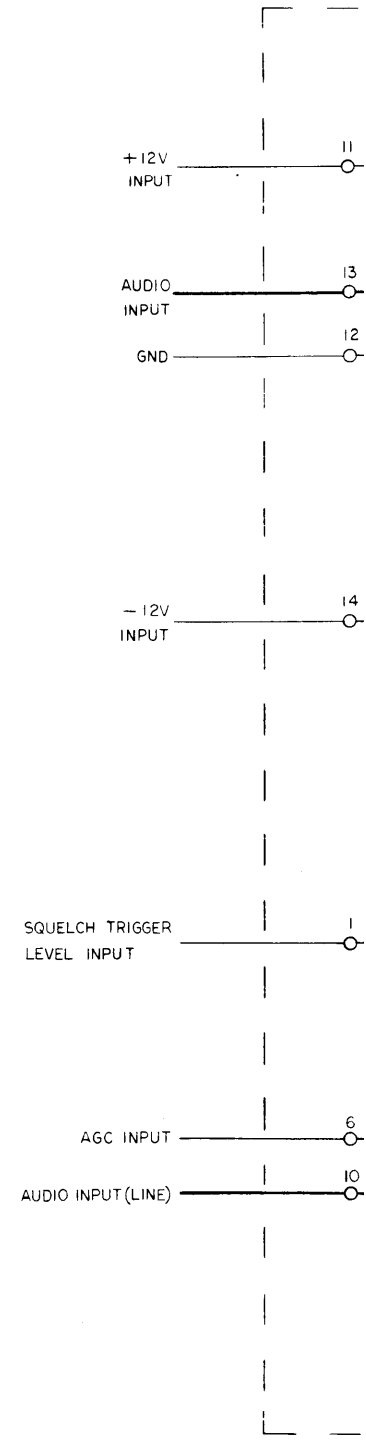


Figure 7-1. Schematic Diagram, SMR-1 (Sheet 3 of 3)



3014-13 (CK-741D)

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c/c 6530c