MOBILE RADIO

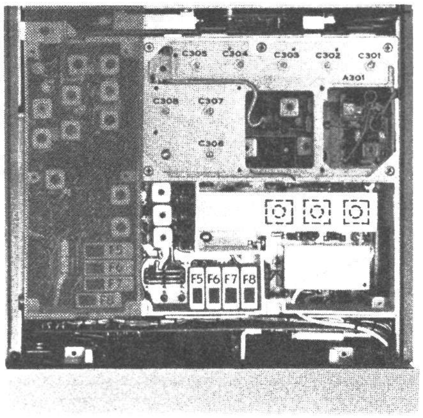
MASTR II
MAINTENANCE MANUAL

406-420 & 450-512 MHz DUAL FRONT END
OPTION 9201- MATCHING IF'S
OPTION 9202- NON-MATCHING IF'S

Maintenance Manual LBI-4694

DF-8411

406-512 MHz DUAL FRONT END



SPECIFICATIONS *

FREQUENCY RANGE	406-420 & 450-512 MHz	
SENSITIVITY	WITH PRE-AMPL	WITHOUT PRE-AMPL
DFE 12-dB SINAD	0.22 µV	0.385 µV
20-dB Quieting Method	0.275 µV	0.550 µV
Receiver	Sensitivity degraded not more than 1 dB from standard receiver specifications	
SELECTIVITY		
EIA Two-Signal Method	- 85 dB	- 90 dB
20 dB Quieting Method	-100 dB	-100 dB
SPURIOUS RESPONSE	- 90 dB	-100 dB
INTERMODULATION	- 75 dB	- 80 dB
CURRENT DRAIN (TYPICAL)	Non-Matching IF's - 90 mA Matching IF's - 65 mA	
FREQUENCY STABILITY		
5C-ICOM with EC-ICOM	±0.0005% (-40°C to +70°C)	
5C-ICOM or EC-ICOM	±0.0002% (0°C to +55°C)	
2C-ICOMS	±0.0002% (-40°C to +70°C)	
MODULATION ACCEPTANCE	±7 kHz (narrow-band)	
RF INPUT IMPEDANCE	50 ohms	

* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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COMBINATION NOMENCLATURE

1st Digit	2nd Digit	3rd Digit	4th Digit
Frequency Capability	Options	Frequency Range	Oscillator Stability
A 1-Freq.	**S** Standard	**88** 450-470 MHz	**A** ±5 PPM (±0.0005%)
C 2-Freq.	**P** UHS	**89** 470-494 MHz	**B** ±2 PPM (±0.0002%)
E 3-Freq.		**91** 494-512 MHz	
F 4-Freq.			
G 5-Freq.			
H 6-Freq.			
J 7-Freq.			

WARNING

Although the highest DC voltage in the radio is supplied by the vehicle battery, high current may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc. enough to cause burns. Be careful when working near energized circuits:

High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns. KEEP AWAY FROM THESE CIRCUITS WHEN THE TRANSMITTER IS ENERGIZED!

DESCRIPTION

Dual Front End

MASTR II, 406 to 512 MHz Dual Front Ends (DFEs) are used with MASTR II Receivers to allow wide channel spaced operation, and most cross-band or cross-split combinations. A total of eight frequencies can be accommodated between the DFE and the Receiver channel.

The DFE consists of the following modules:

- RF steering Switch
- RF Assembly (standard RF assembly)
- Ultra High Sensitivity (UHS) Pre-Amplifier (standard)
- Mixer Board (standard)
- IF Amplifier Board (standard)
- IF-Filter Board; modified standard IF-Filter Board
- Oscillator/Multiplier (OSC/MULT); modified standard OSC/MULT assembly
- Mixer/IF Switch (MIF Switch); used with matching IF frequencies
- Mixer IF Switch/2nd Converter (MIF Switch/2nd Converter); used with non-matching IF frequencies

The DFE utilizes the same Lexan® casting which is employed in a standard Receiver, and is mounted in the hinged lower assembly of "E" Model Combinations. The modules (board assemblies) utilized by the DFE occupy the same positions as those in a standard Receiver, except the MIF Switch/2nd Converter board is used in place of the standard IFAS board.

Centralized Metering Jack J2301, located on the MIF Switch or MIF Switch/2nd Converter board, is provided for use with GE Test Set 4EX3A11 or Test Kit 4EX8K12. The Test Set Meters the MULT 1, MULT 2 and MULT 3 test points of the OSC/Mult board.

An optional RF pre-amplifier stage (UHS) is available whenever an increase in sensitivity is required by the DFE.

A RF Steering Switch connects the antenna to either the Receiver or the DFE, depending upon the channel selected by the operator. The IF output of the DFE channel and the IF output of the Receiver channel are combined at the input of the Receiver IFAS board. Normally, the IF frequency of the DFE (11.2 MHz) matches that of the Receiver (11.2 MHz), therefore no IF frequency conversion is required (see Figure 1).

In certain instances of cross-band combinations the IF frequency of the DFE (11.2 MHz) does not match that of the Receiver (9.4 MHz), therefore a different MIF Switch is utilized (MIF Switch/2nd Converter) to convert the IF frequency of the DFE to the frequency required by the IFAS board (9.4 MHz) in the Receiver channel (See Figure 2).

Supply voltages, control functions and metering points are connected from the standard receiver (P903 of the System Board) to the DFE modules by cable harness 19B219980. RF signal connections to and from the RF steering Switch are made through 50-ohm RF cable assemblies equipped with phono plugs. IF signal connections (W2301 and W2302) are made from the MIF Switch board to the IFAS board of the Receiver channel using 72-ohm coaxial cable. Refer to DFE Interconnection and Cable Routing Diagram for details.

CIRCUIT ANALYSIS

RF STEERING SWITCH

The RF Steering Switch consists of PIN diodes CR1 and CR2, DC switches Q1 through Q3, and associated components (see Figure 3 and Figure 4). Pin diodes CR1 and CR2 are placed in series with the input/output RF paths through the RF Steering Switch. These diodes, when forward biased, establish a low resistance path between input and output of either selected channel (J1 to J2 or J3 to J2) but not both channels simultaneously.

RF from the antenna switch is applied to J2 (ANT) of the RF Steering Switch. When the select line from the DFE OSC/MULT board is in a high voltage state (approximately +10V), indicating selection of the Receiver channel (ICOM of selected channel in Receiver), transistors Q1 and Q2 are turned OFF, thus turning Q3 on. With Q3 turned ON, PIN diode CR2 is forward biased through the dc path from the collector of Q3, L2, PIN diode CR2. R6 and L3 to A-. A low resistance RF path is provided from J2 (ANT) through C6, CR2 and C5 to J1(RX). The antenna is now connected to the Receiver channel with the RF Steering switch offering a very low insertion loss (less than 0.75 dB).

Inductors L1, L2, L3 are RF chokes which provide RF isolation from the DC circuits. The DC Voltage developed across R6 reverse biases PIN diode CR1, increasing its resistance, thus providing a minimum of 17 dB of isolation (typical 20 dB of isolation) between the selected receiver channel and the unselected DFE channel.

When the DFE Channel is selected (ICOM of selected channel in DFE), the select line pulls to a low voltage state (+8.5 V maximum). As a result, Q2 turns ON, turning Q3 OFF. Also, Q1 turns ON, forward biasing

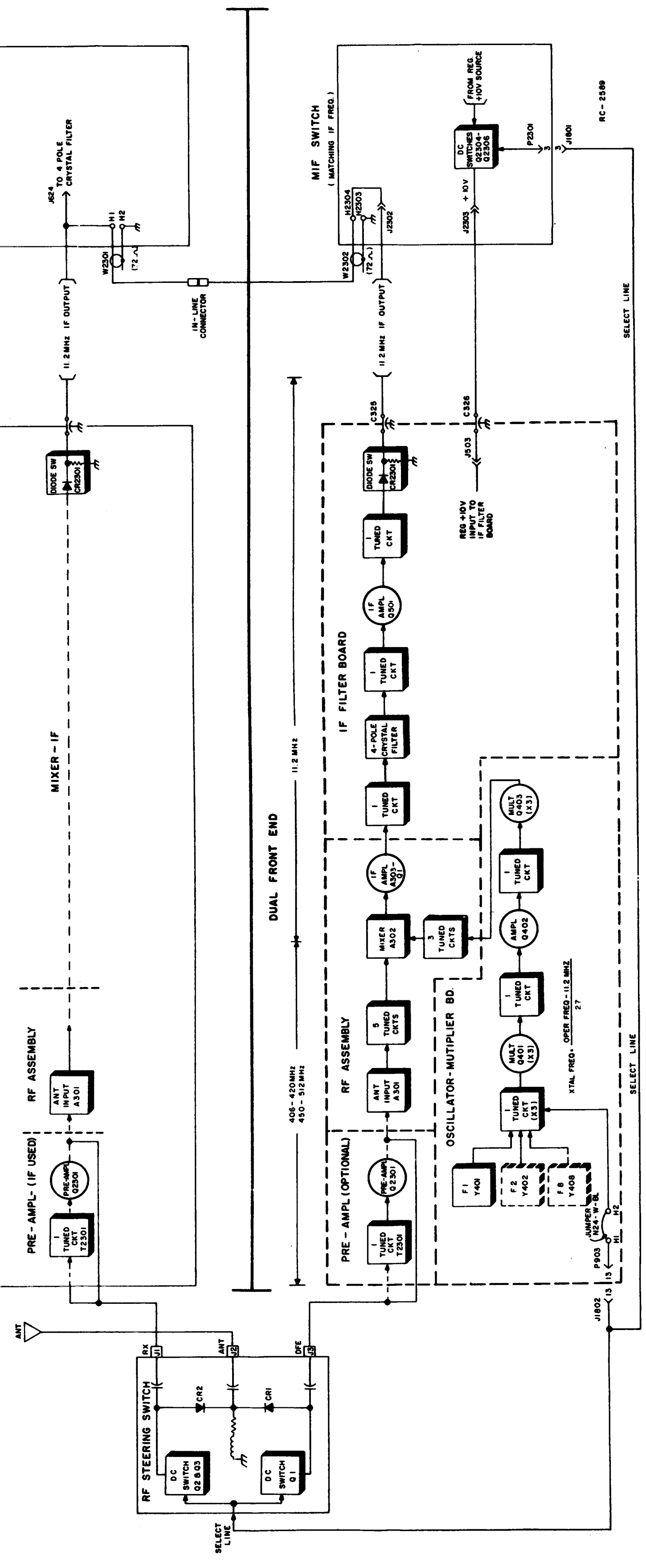


Figure 1 - DFE Block Diagram (Matching IF Frequency)

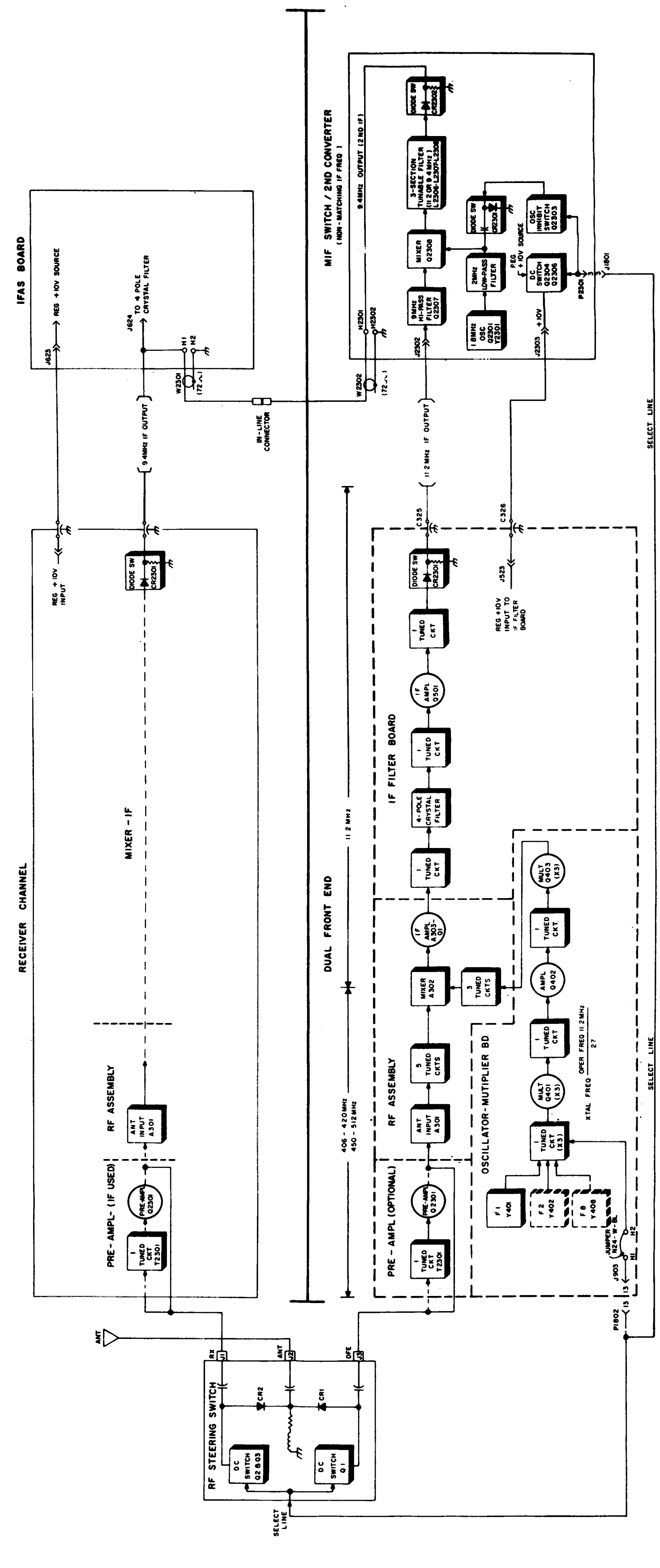


Figure 2 - DFE Block Diagram (Non-matching IF Frequency)

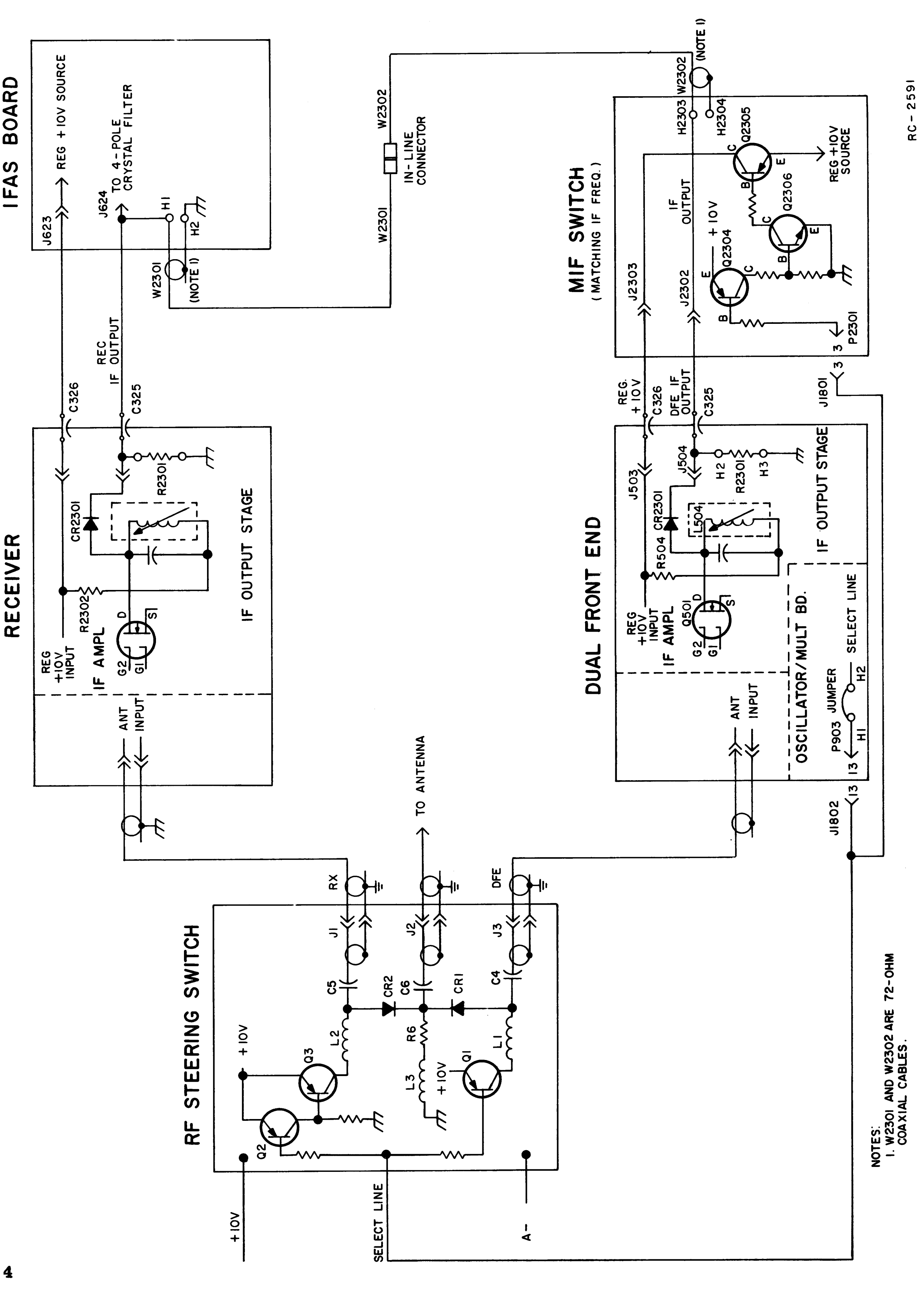


Figure 3 - Antenna and IF Switching (matching IF's)

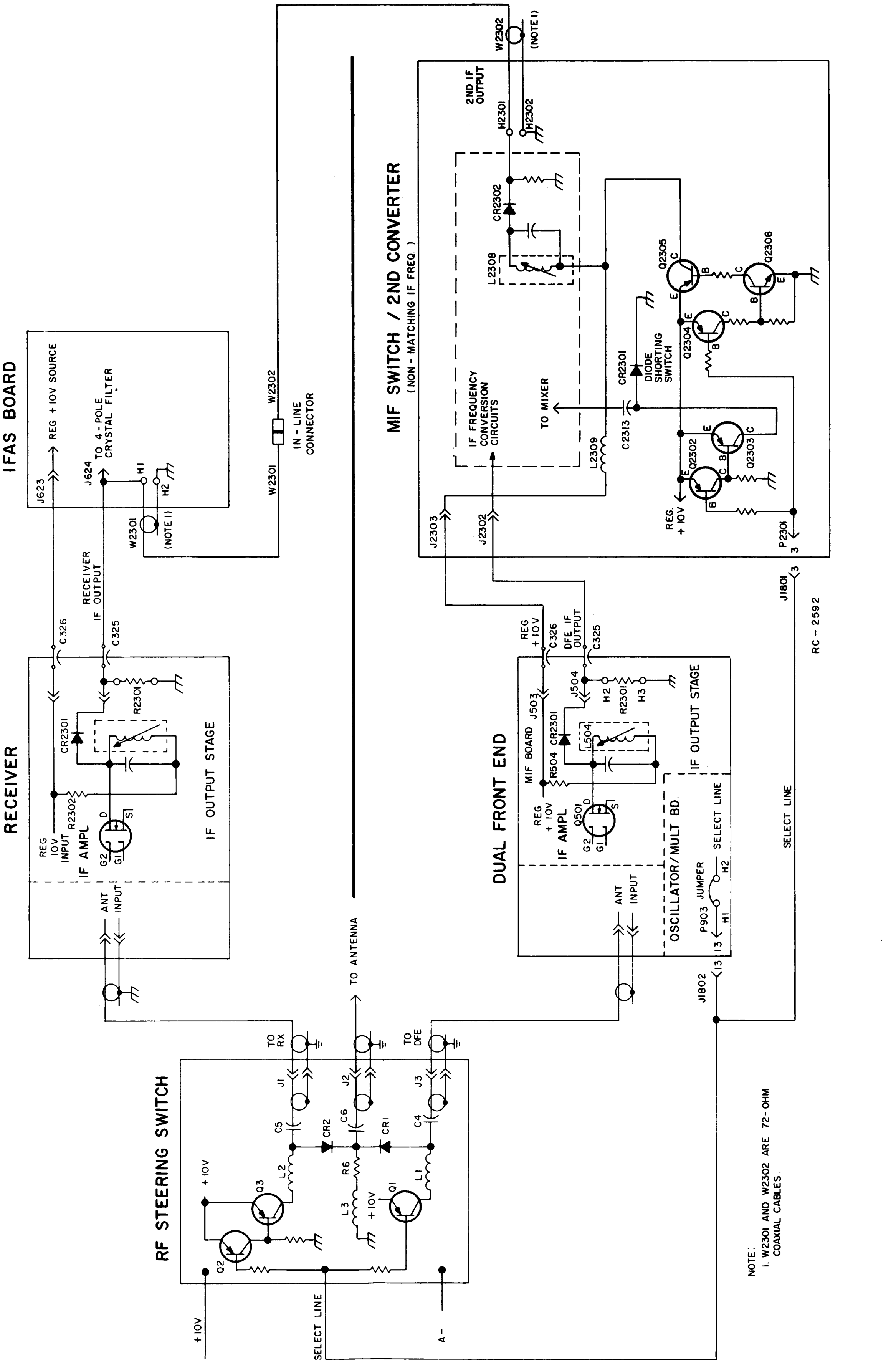


Figure 4 - Antenna and IF Switching (non-matching IF's)

PIN diode CR1. The antenna RF path is then established from J2 (ANT) through C6, CR1, and C4 to J3 (DFE). The DC path from the collector of Q1 is through L1, CR1, R6 and L3 to A-. The voltage developed across R6 reverse biases PIN diode CR2, thus increasing its resistance, and as a result provides RF isolation of the unselected Receiver Channel.

RF ASSEMBLY

UHS PRE-AMPLIFIER

The pre-amplifier which is present only in UHS receivers, uses a bi-polar transistor to provide approximately 10 dB gain.

RF from the antenna (RF Steering Switch) is link-coupled through helical resonator L2301 to the base of Class A pre-amplifier Q2301. L2301 matches the 50-ohm input to the base of Q2301. The amplified output is coupled through L2302, and connected through W2301 to J1 on Antenna Input Board A301. P2301 connects to J502 on the IF-Filter Board for regulated +10-Volt supply voltage.

ANTENNA INPUT A301

An RF signal from the antenna (RF Steering Switch) or UHS pre-amplifier is applied to A301 which provides an AC ground between vehicle ground and DFE A-. Resistor R1 prevents a static charge from building up on the vehicle antenna. The output of A301 is coupled through five high Q helical resonators that provide the front end RF selectivity. The helicals are tuned to the incoming frequency by C301 through C305.

MIXER A302

The mixer uses 4 hot-carrier diodes which are low noise diodes with non-linear resistance characteristics.

RF from the helical resonator is coupled to the mixer circuit through T1. Injection voltage from the oscillator-selectivity stages is coupled to the mixer circuit through T2. The mixer IF output is proportional to the level of the RF input and is independent of the injection voltage. The 11.2 MHz IF output is taken from H9 in the secondary of T1 and applied through P2/J2 to an IF amplifier stage.

IF AMPLIFIER A303

The IF amplifier uses a Field-Effect Transistor (FET) as the active device. The mixer output is applied to the Gate of the amplifier, and the output is taken from the drain and applied to the IF Filter Board. The amplifier provides approximately 15 dB of IF gain.

OSCILLATOR/MULTIPLIER

The DFE oscillator/multiplier and the Receiver oscillator-multiplier can accommodate a total of eight Integrated Circuit Oscillator Modules (ICOMs) between the two, rather than a total of 8 ICOMs for each unit. The ICOM crystal frequencies range from approximately 14.5 to 18.5 megahertz and the crystal frequency is multiplied 27 times to provide a low side injection frequency to the mixer.

ICOMS

Three different types of ICOMs are available for use in the OSC/MULT module. Each of the ICOMs contains a crystal controlled colpitts oscillator, and two of the ICOMs contain compensator ICs. The different ICOMs are:

- 5C-ICOM - contains an oscillator and a 5 part-per-million (±0.0005%) compensator IC. Provides compensation for EC-ICOMs.
- EC-ICOM - contains an oscillator only. Requires external compensation from a 5C-ICOM.
- 2C-ICOM - contains an oscillator and a 2 PPM (±0.0002%) compensation IC. Will not provide compensation for an EC-ICOM.

The ICOMs are enclosed in a RF shielded can with the type ICOM (5C-ICOM, EC-ICOM or 2C-ICOM) printed on the top of the can. Access to the oscillator trimmer is obtained by prying up the plastic tab on the top of the can. The tabs can also be used to pull the ICOMs out of the radio.

Frequency selection is accomplished by switching the ICOM keying lead (terminal 6) to A- by means of the frequency selector switch on the control unit. The keying leads for the Receiver and the DFE Osc/Mult ICOMS are operated in parallel, therefore ICOMs in the Receiver will not occupy the same positions as those in the DFE.

In the receive mode, +10 Volts is applied to the external ICOM load resistor (R401) by the RX Osc control line, keeping the selected ICOM turned on. Keying the transmitter removes the 10 Volts at R401, turning the ICOM off.

CAUTION

All ICOMs are individually compensated at the factory and cannot be repaired in the field. Any attempt to repair or change an ICOM frequency will void the warranty.

Normally, DFE's do not utilize the external compensation voltage (+5 Volts) supplied from the 10 Volt regulator IC in the standard radio, therefore, in DFE's requiring 5 PPM stability and utilizing EC-ICOMs, at least one 5C-ICOM must be used. The 5C-ICOM is normally used in the DFE's first frequency position. One 5C-ICOM can provide compensation for up to 15 EC-ICOMs. Should the 5C-ICOM's compensator (internal compensation voltage) fail in the open mode the EC-ICOMs will lose all compensation. If desired, all ICOMs used in the DFE may be 5C-ICOMs. The 2C-ICOMs are self-compensated to 2 PPM and cannot provide compensation for EC-ICOMs.

If a DFE option is utilized with a Wide Spaced Transmitter option in a "E" Model Combination, an external compensation voltage (+5 volts) will be supplied to the 5C-ICOM from the additional 10 volt regulator IC (part of Wide Spaced Transmitter Option). This compensation voltage will surfice as mid-temperature range compensation for the 5C-ICOM, as well as, backup compensation for the EC-ICOMs in case of failure of the 5C-ICOM's compensator circuit. Should failure occur in the 5C-ICOM, the EC-ICOMs will maintain 2 PPM frequency stability from 0°C to +55°C (+32°F to 131°F).

Oscillator Circuit

The quartz crystals used in ICOMs exhibit the traditional "S" curve characteristics of output frequency versus operating temperature.

At both the coldest and the hottest temperatures, the frequency increases with increasing temperature. In the middle temperature range (approximately 0°C to +55°C), frequency decreases with increasing temperature.

Since the rate of change is nearly linear over the mid-temperature range, the output frequency change can be compensated by choosing a parallel compensation capacitor with a temperature coefficient approximately equal and opposite that of the crystal.

Figure 5 shows the typical performance of an uncompensated crystal as well as the typical performance of a crystal which has been matched with a properly chosen compensation capacitor.

At temperatures above and below the midrange, additional compensation must be introduced. An externally generated compensation voltage is applied to a varactor (voltage-variable capacitor) which is in parallel with the crystal.

The compensation voltage applied to pin 2 of the ICOM establishes the varactor capacity at a constant value over the entire mid-temperature range. With no additional compensation, all of the oscillators will provide 2 PPM frequency stability from 0°C to 55°C (+32°F to 131°F).

Compensator Circuits

Both the 5C-ICOMs and 2C-ICOMs are temperature compensated at both ends of the temperature range to provide instant frequency compensation. An equivalent ICOM is shown in Figure 6.

The cold end compensation circuit does not operate at temperatures above 0°C. When the temperature drops below 0°C, the circuit is activated. As the temperature decreases, the equivalent resistance decreases and the compensation voltage increases.

The increase in compensation voltage decreases the capacitance of the varactor in the oscillator, increasing the output frequency of the ICOM.

The hot end compensation circuit does not operate at temperatures below +55°C. When the temperature rises above +55°C, the circuit is activated. As the temperature increases, the equivalent resistance decreases and the compensation voltage decreases. The decrease in compensation voltage increases the capacitance of the varactor, decreasing the output frequency of the ICOM.

Service Note: Proper ICOM operation is dependent on the closely-controlled input voltage from the 10-Volt regulator. Should all of the ICOMs shift off frequency, check the 10-Volt regulator module.

MULTIPLIER & AMPLIFIER

The output of the selected ICOM is coupled through a tuned circuit (L401 and C405) that is tuned to three times the crystal frequency. The output of the tuned

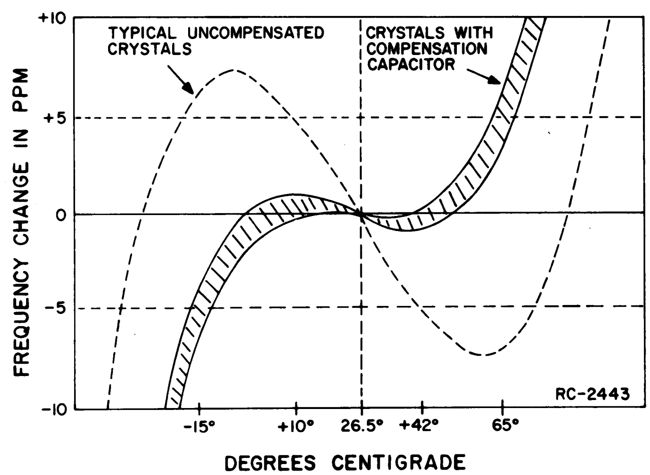


Figure 5 - Typical Crystal Characteristics

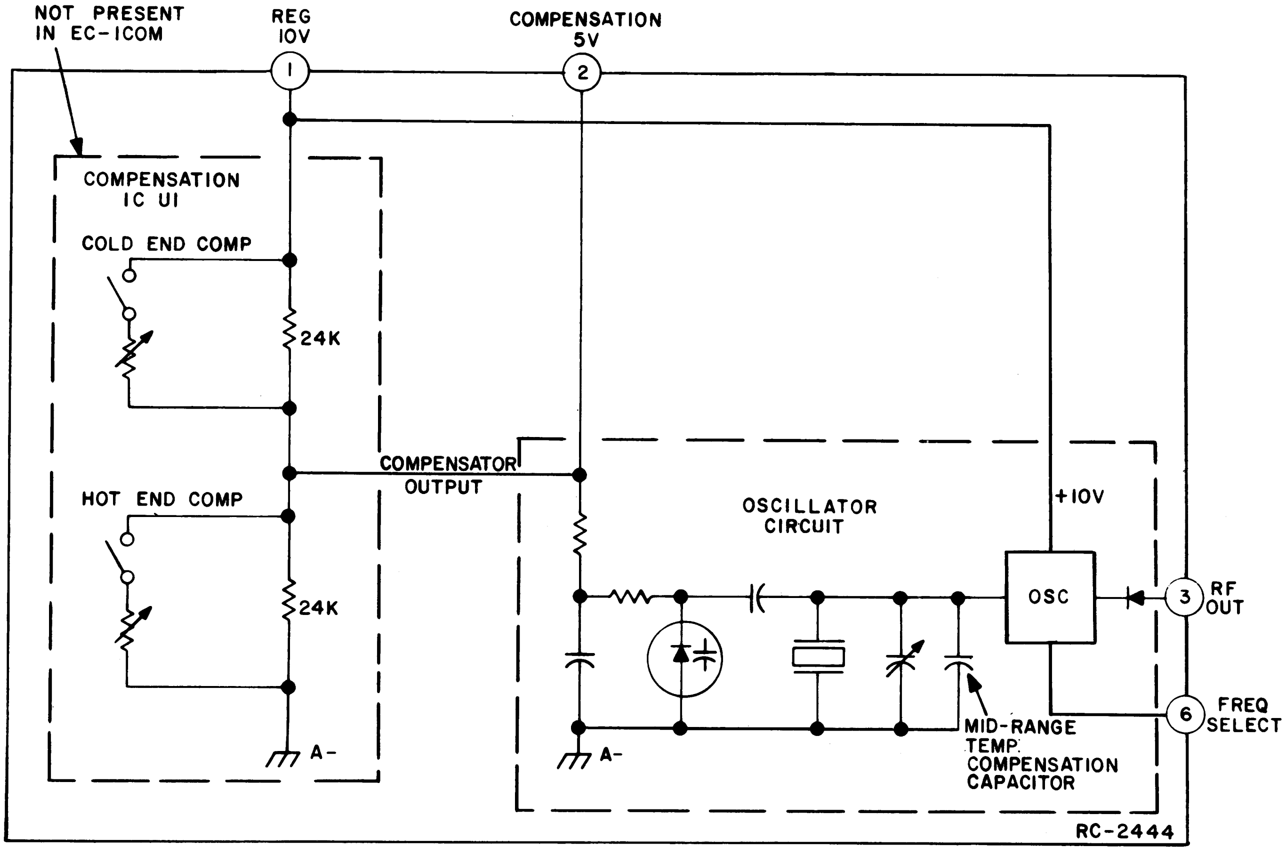


Figure 6 - Equivalent ICOM Circuit

circuit is applied to the base of Class C multiplier, Q401. The collector tank circuit of the multiplier (L402 and C409) is tuned to nine times the crystal frequency. The multiplier stage (MULT 1) is metered at metering jack J2301-3 on the MIF Switch or MIF Switch/2nd Converter board.

Following the multiplier is Class A amplifier stage Q402. Q402 is metered at J2301-4 (MULT 2) on the MIF Switch or MIF Switch/2nd converter board through a metering network consisting of C415, C416, CR401 and R408. The amplified output of Q402 is applied to a tuned circuit (L403 and C413) that is tuned to nine times the crystal frequency. The tuned circuit provides some selectivity in the oscillator-multiplier chain.

The output of L403-C413 is inductively coupled to the first helical resonator (L306/L316 and C306) through L405. The output of the second helical resonator (L307/L317 and C307) is inductively coupled through L501 to the source of the mixer. The two high-Q helical resonators provide most of the selectivity for the oscillator-multiplier chain.

The output of L403-C413 is inductively coupled to the first helical resonator (L306/L316 and C306) through L405. The output of the second helical resonator (L307/L317 and C307) is inductively coupled through L501 to the source of the mixer. The two high-Q helical resonators provide most of the selectivity for the oscillator-multiplier chain.

The select line, which connects from system plug P903-13 to the RF Steering Switch and the MIF Switch or MIF Switch/2nd Converter board, senses the selection of a DFE channel by the voltage change at the junction of L401-5 and R401. During operation of the Receiver channel (DFE not selected) the voltage at R401 will be in a high state (approximately +10V). When a DFE channel is selected, the voltage at R401 will drop to a low state (+8.5 V maximum).

The amplifier output (Q402) is applied to the base of Class C multiplier Q403 through a matching network (T401 and C424). The output of Q403 is inductively coupled to the first of three helical resonators through L407. The helicals are tuned to 27 times the crystal frequency by C306, C307 and C308.

Most of the selectivity for the oscillator-multiplier chain is provided by the three high-Q helicals. The output of the helicals is applied to the mixer circuit through T2 on the mixer board.

The multiplier output (Q403) is metered at J2301-7 (MULT 3) on the MIF Switch or MIF Switch/2nd Converter board through a metering network on the IF-Filter board. The metering network consists of L505, L506, C512, C513, C514, CR501 and R506. P501 connects the MULT 3 metering point to J2304 of the MIF Switch board via cable W501.

IF-FILTER

CRYSTAL FILTER

The output of A303-Q1 is coupled through a tuned circuit (L501 and C501) which matches the output to the input of the four-pole monolithic crystal filter. The highly-selective crystal filter (FL501 and FL502) provides the first portion of the receiver IF selectivity. The output of the filter is coupled through impedance-matching network L505 and C511 to the IF amplifier.

Service Note: Variable capacitor C504 does not require adjustment when performing normal DFE alignment. If the four-pole monolithic crystal filter is replaced, then adjustment of C504 is necessary for optimum IF response.

IF AMPLIFIER

IF Amplifier Q501 is a dual-gate FET. The filter output is applied to Gate 1 of the amplifier, and the output is taken from the drain. The biasing on Gate 2 and the drain load determines the gain of the stage. The amplifier provides approximately 20 dB of IF gain. The output of Q501 is coupled through a network (L504, C509 and CR2301) to J504. The output of the IF-Filter board is applied through feed-through capacitor C325 to the MIF Switch or MIF Switch/2nd Converter board.

Supply voltage for the RF amplifier and IF-Filter board is supplied from the MIF Switch or MIF Switch/2nd Converter board through feed-through capacitor C326.

MIXER-IF SWITCH (MATCHING IF FREQUENCY)

IF signal from the DFE IF-Filter board is applied to the Mixer-IF Switch board (MIF Switch) through J2302. The IF output of the MIF Switch is applied through W2302 and W2301 to the IFAS board of the Receiver Channel. W2302 and W2301 are 72-ohm coaxial cables.

Transistors Q2304, Q2305 and Q2306 comprise the DC switching circuit which controls the +10 V DC applied to the DFE IF Filter board. When the Select Line input at P2301-3 is in a high voltage state (Approximately +10 V), indicating selection of the Receiver channel, transistor Q2304 is turned OFF. Turning Q2304 OFF, turns Q2306 OFF, causing pass transistor Q2305 to turn OFF. This action removes regulated +10 V from J2303, thus removing the regulated +10 V applied to the DFE IF-Filter board.

Selection the DFE channel places the Select Line in a low voltage state (maximum of +8.5 V). Q2304 turns ON, causing Q2306 to turn ON. When Q2306 turns ON, pass transistor Q2305 turns ON, applying regulated +10 V to J2303, thereby applying regulated +10 V to the DFE IF-Filter board.

When the Receiver channel is selected, regulated +10 V is applied to the Receiver IF-Filter board from J623 of the IFAS board (see Figure 4). This +10 V is applied through R2302 and the IF output tuned circuit to PIN diode CR2301. The positive voltage applied to the anode of CR2301 forward biases CR2301, lowering its resistance. This allows the IF output to be coupled into the IFAS board (J624).

The DC voltage that is applied through CR2301 on the Receiver IF board, is passed along cable W2301 and W2302, through the MIF switch (J2302) to the IF output of the DFE IF-Filter board (J504). This voltage reverse biases PIN diode CR2301, increasing its resistance, thereby isolating the DFE from the Receiver IFAS board.

When the DFE channel is selected, regulated +10 V is applied to J503 of the DFE IF-Filter board from J2303 of the MIF Switch. +10 V is applied through R503 and L504 to the anode of PIN diode CR2301 on the DFE IF-Filter board. The positive voltage forward biases CR2301, lowering its resistance, allowing the IF output to be coupled into the MIF Switch (J2302).

The DC voltage applied through CR2301 on the DFE IF-Filter board is coupled through the MIF Switch (J2302) and is passed along cables W2302 and W2301, through the IFAS board (J624) to the IF output of the Receiver IF board. This positive voltage is then applied to the cathode of PIN diode CR2301 on the Receiver IF board. The positive voltage applied to the anode of CR2301 is slightly lower than that on its cathode (approximately 1 Volt lower), thus reverse biasing CR2301, increasing its resistance. This action provides isolation of the Receiver IF board from the IFAS board, allowing the DFE MIF Switch to operate into the IFAS board.

Metering jack J2301 provides MULT 1 (J2301-3), MULT 2 (J2301-4) and MULT 3 (J2301-7) metering points.

MIXER-IF SWITCH/2nd CONVERTER (NON-MATCHING IF FREQUENCY)

The Mixer-IF Switch/2nd Converter (MIF Switch/2nd converter) performs a second conversion of the IF output from the DFE IF-Filter board, and also applies a switched regulated +10 V to the DFE IF-Filter board when the DFE channel is selected. A 1.8 MHz local oscillator signal generated within the MIF Switch, is mixed with the incoming 11.2 MHz IF from the IF-Filter board (see Figure 4). The IF output (11.2 MHz-1.8 MHz = 9.4 MHz) from the MIF Switch will now match that of the IFAS board in the Receiver channel. The IF output signal is achieved by proper tuning of the circuits within the MIF Switch/2nd Converter. The MIF Switch/2nd Converter also provides unity gain of the converted output IF signal.

The MIF Switch/2nd Converter board contains a High Pass Filter, a Mixer circuit, a Bandpass Filter, a 1.8 MHz Local Oscillator and Low Pass Filter, a Diode-Shorting Switch, a DC Switch and a Regulated +10 V Switch Circuit.

IF AMPLIFIER AND HIGHPASS FILTER

The IF signal from the IF-Filter board enters the MIF Switch/2nd Converter board through J2302. The IF signal is then applied to IF amplifier Q2307. The output from the emitter of Q2307 is coupled to a 9 MHz highpass filter, which consists of C2318 through C2322, and L2304 and L2305. The output of the Highpass Filter is applied to Gate 1 of Mixer Q2308 (dual-gate FET).

1.8 MHz LOCAL OSCILLATOR AND 2 MHz LOWPASS FILTER

The Local Oscillator is comprised of crystal-controlled Colpitts oscillator Y2301 and Q2301. The oscillator operates at a fundamental frequency of 1.8 MHz, with feedback developed across C2304. The output at the collector of Q2301 is coupled to the input of a 2 MHz Lowpass Filter, which is utilized to reduce injection of local oscillator harmonics into the mixer circuit. The Lowpass Filter is comprised of L2301 and L2302, and capacitors C2306 through C2310. The output of the Lowpass Filter is coupled through C2311 to Gate 2 of Mixer Q2308 (Mixer injection).

MIXER

The Mixer (Q2308) uses a dual-gate FET as the active device. The mixer injection is applied to Gate 2 of Q2308, and is mixed with the IF signal applied to Gate 1, producing a different frequency of 9.4 MHz (11.2 MHz - 1.8 MHz = 9.4 MHz). This 2nd IF frequency is coupled from the drain of Q2308 to a tunable Bandpass Filter consisting of L2306, L2307 and L2308. The Bandpass Filter is tuned to 9.4 MHz.

The converted IF output or 2nd IF output, from the Bandpass Filter is coupled through PIN diode CR2302 to W2302. W2302 is a 72-ohm coaxial cable equipped with an in-line connector.

DIODE SHORTING SWITCH AND DC SWITCH CIRCUIT

Transistor switches Q2302 and Q2303, and diode CR2301 are utilized as an RF shorting switch, which provides a RF path to A- at the mixer injection point (GATE 2 of Q2308) when the DFE channel is not selected, thus providing additional protection against intermodulation interference in the Receiver channel.

When the DFE channel is not selected the select line goes to a high voltage state (approximately +10 V). Q2302 turns OFF and Q2303 turns ON. Diode CR2301 is forward biased by the collector voltage of Q2303. When this occurs an RF short is presented by C2313 and CR2301 to A-.

When the DFE channel is selected, the select line pulls to a low voltage state (+8.5 V maximum). As a result, Q2302 is turned ON and Q2303 is turned OFF, thus removing the RF short from the mixer injection point, allowing the mixer circuit to operate.

REGULATED +10 V SWITCH

The Regulated +10 V Switch is comprised of Q2304, Q2305 and Q2306. Selecting the DFE Channel places the select line in a low voltage state, turning Q2304 ON. When Q2304 turns ON, Q2306 is turned ON by the positive voltage applied to its base. As a result of Q2306 conducting, pass transistor Q2305 is turned ON, thus applying regulated +10 V to its collector. From the collector of Q2305, the regulated +10 V is applied through RF Choke L2309 to J2303, which is the DC connection point for powering the DFE IF-Filter board.

The switched +10 V on the collector of Q2305 is applied through L2308 to the anode of PIN diode CR2302, forward biasing CR2302 and lowering its resistance. This allows the converted or 2nd IF signal to be coupled to the Receiver IFAS board through cables W2302 and W2301. This same DC voltage is also applied to the IF output of the Receiver IF board, reverse biasing PIN diode CR2301. The positive voltage applied to the anode of CR2301 on the Receiver IF board is slightly lower than that on its cathode (approximately 1 Volt lower), thus reverse biasing CR2301, increasing its resistance. This action provides isolation of the Receiver channel from the IFAS board.

If the DFE channel is not selected, then the select line will be in a high voltage state, turning Q2304 OFF, which in turn allows the base of Q2306 to return to near A-, turning Q2306 OFF. When Q2306 is turned OFF, Q2305 is also turned OFF, removing Regulated +10 V from the DFE IF-Filter board.

Regulated +10 V is applied to the Receiver IF board from J623 of the IFAS board when the Receiver channel is selected. This +10 V is applied through R2302 and the IF tuned circuit to PIN diode CR2301. The positive voltage applied to the anode of CR2301 forward biases CR2301, lowering its resistance. The IF output from the Receiver IF board is coupled into the IFAS board through J624.

The DC voltage applied through CR2301 on the Receiver IF board is passed along cable W2301 and W2302 to the cathode of CR2302 on the MIF Switch/2nd Converter board. This voltage reverse biases PIN diode CR2302, increasing its resistance, thereby isolating the MIF Switch/2nd Converter Board from the IFAS board.

Metering jack J2301 provides MULT 1 (J2301-3), MULT 2 (J2301-4) and MULT 3 (J2301-7) metering points.

RECEIVER MODIFICATIONS

The following modification is required in the MASTR II (406 to 512 MHz) Receiver whenever the Receiver is used with a Dual Front End Option. The necessary parts required are supplied in Modification Kit 19A129750G1. Modified Units are identified by a RED dot located in the area of the unit assembly number.

MODIFICATION TO IF FILTER BOARD 19C320529, STANDARD RECEIVER

1. Replace R504 (47-ohm) with R2302 (680-ohm).
2. Replace C510 with CR2301 (PIN diode).
3. Add R2301 (22K-ohm) between holes H5 and H6.

MODIFICATION TO IFAS BOARD 19D416606, STANDARD RECEIVER

1. Connect 72-ohm coaxial cable (equipped with an in-line connector) to holes H1 (center conductor) and H2 (shield).

To adapt a standard UHF Receiver to operate as a Dual Front End, the following modification must be performed. All necessary parts required are supplied in Modification Kit 19A129750G2. Units should be identified as containing this modification by placing a RED dot near the unit assembly number after performing the modification.

MODIFICATION TO IF FILTER BOARD 19C320529, DUAL FRONT END

1. Replace C510 (0.001 µf) with CR2301 (PIN Diode).
2. Add R2301 (22 K-ohm) between holes H2 and H3.

MODIFICATION TO OSCILLATOR-MULTIPLIER BOARD 19D416610, DUAL FRONT END

1. Add jumper (N24-W-BL) between holes H1 and H2.

MAINTENANCE

DISASSEMBLY

To service the DFE:

1. Pull the locking handle down and pull the radio out of the mounting frame, and turn the radio over.
2. Loosen the two bottom cover retaining screws and remove the bottom cover. All major modules and tuning adjustments in the DFE are now accessible for servicing.
3. To service the bottom of the DFE, loosen the screw in the retaining latch and slide the latch open. The bottom section will now swing open.
4. Removal of modules or board assemblies from the DFE is essentially the same as for a standard Receiver. Refer to removal procedures in standard Receiver Maintenance Manuals for details.

FRONT END ALIGNMENT

EQUIPMENT

1. GE Test Set Models 4EX3A11, 4EX8K12, or 20,000 ohms-per-Volt Multimeter with a 1-Volt scale.
2. A 406-512 MHz signal source.

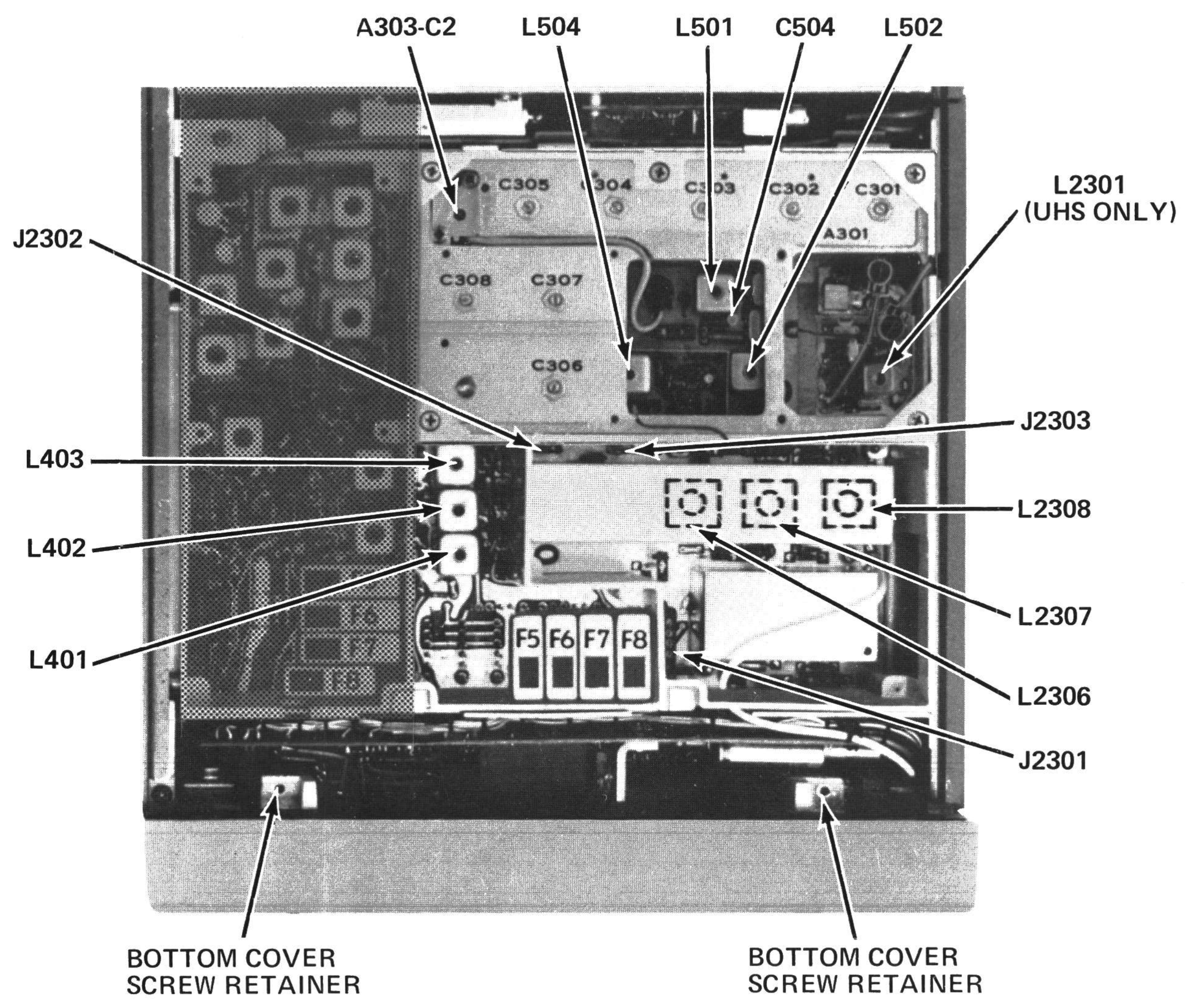
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect black plug from Test Set to Centralized Metering Jack J2301, and red plug to system board metering jack J905. Set meter sensitivity switch to the TEST 1 position (or 1-Volt position on 4EX8K12). Select the desired DFE channel for alignment.
2. In radios with three or more frequencies, align the DFE on the channel nearest the center frequency.
3. With Test Set in Position J, check for regulated +10 Volts. If using Multimeter, measure between J905-3 (+) and J905-9 (-).
4. If using Multimeter, connect the negative lead to J2301-9 (A-).
5. Disable Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE Test Set	METERING POSITION: Multimeter - at J2301-9	TUNING CONTROL	METER READING	PROCEDURE
			OSCILLATOR/MULTIPLIER		
1.	C (MULT-1)	Pin 3	L401	Maximum	Tune L401 for maximum meter reading.
2.	D (MULT-2)	Pin 4	L402, L403, C306	See Procedure	Tune L402 and L403 for maximum meter reading. Then carefully tune L401, L402 and L403 for maximum meter reading, and tune C306 for a change in meter reading.
3.	F (MULT-3)	Pin 1	C306, C307, C308	See Procedure	Tune C307 for maximum meter reading, then tune C308 for a dip. Next re-tune C306 and C307 for maximum meter reading. Then tune C308 for a dip in meter reading.

STEP	METERING POSITION: GE Test Set	METERING POSITION: Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			RF SELECTIVITY		
4.	A (DISC)	Pin 2		Zero	Connect Test Set to J601 on the IFAS board of Receiver. Apply an on-frequency signal to the DFE antenna jack. Adjust the signal generator for discriminator zero.
5.	B (IF AMP)	Pin 1	A303-C2, C301 thru C305 (and L2301 if present)	Maximum	Apply an on-frequency signal to the DFE antenna jack, keeping the signal below saturation. Then tune A303-C2 and C301 through C305 for maximum meter reading. In DFE's with the UHS pre-amplifier, also tune L-2301 for maximum meter reading.
6.	B (IF AMP)	Pin 1	A303-C2, C301 thru C305 (and L2301 if present)	Maximum	Apply an on-frequency signal to the DFE antenna jack and slightly tune A303-C2, C301 through C305 (and L2301 if present) for best quieting sensitivity.



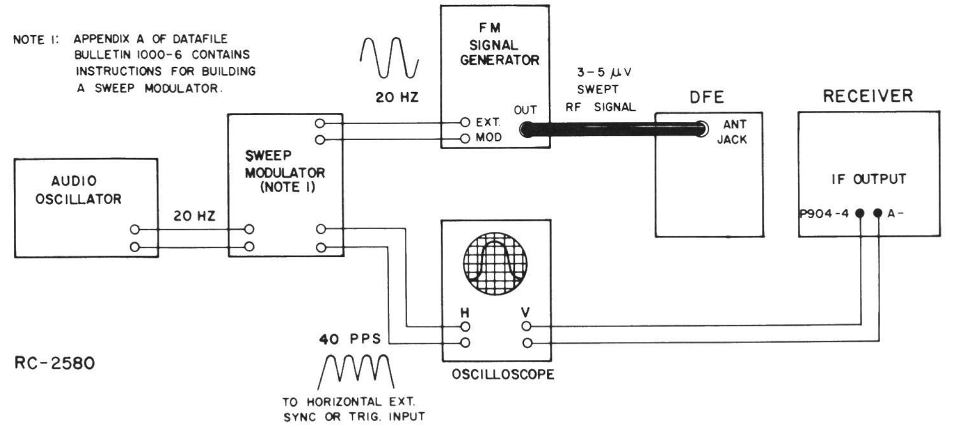


Figure 7 - Test Setup for 20-Hz Double-Trace Sweep Alignment

ICOM FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency measurement requires equipment with an absolute accuracy which is 5 to 10 times better than the tolerance to be maintained. When performing frequency measurement, the entire radio should be as near as possible to an ambient temperature of 26.5°C (79.8°F).

MASTR II ICOMs should be reset only when the measured frequency error exceeds the following limits.

A. ±0.5 PPM, when the radio is at 26.5°C (79.8°F).

B. ±2 PPM at any other temperature within the range -5°C to +55°C (+23°F to +131°F).

C. The specification limit (±2 PPM or ±5 PPM) at any temperature within the ranges -40°C to -5°C (-40°F to +23°F) or +55°C to +70°C (+131°F to +158°F).

If frequency adjustment is required, lift up the cover on the top of the ICOM to expose the adjustment trimmer. Depending upon the type of frequency measuring equipment that is available, any of the following procedures may be used:

A. DIRECT MEASUREMENT IN THE INJECTION CHAIN

1. WITH A FREQUENCY COUNTER. "Count" the frequency at the junction of C415 and C417 on the Oscillator/Multiplier Board. The frequency measured at this point is 9 times the ICOM frequency (one-third of mixer injection frequency). NOTE: The output from the ICOM itself is not sufficiently sinusoidal for reliable operation with most frequency counters.

2. WITH A COMMUNICATION MONITOR (for example: Cushman Model CE-3). "Monitor" frequency at the junction of C415 and C417 on the Oscillator/Multiplier Board. The frequency monitored at this point is 9 times the ICOM frequency (one-third of the mixer injection frequency). NOTE: This frequency will not always fall within an available measuring range of all monitors at all receiver operating frequencies.

B. STANDARD "ON FREQUENCY" SIGNAL AT THE RECEIVER INPUT (Generated from a COMMUNICATION MONITOR, for example: Cushman Model CE-3)

1. WITH A FREQUENCY COUNTER. "Count" the developed IF frequency at the junction of C612 and L603 on the IFAS board. The deviation from the nominal IF frequency (11.2 MHz) in Hz is compared to the receiver operating frequency (also in Hz) to calculate error in PPM.

2. WITH AN 11.2 MHZ IF FREQUENCY STANDARD (for example: General Electric Model 4EX9A10). Loosely couple the IF frequency standard to the IF signal path to create a heterodyne with the developed IF frequency. The resultant "beat frequency" can be monitored by either of the following methods:

NOTE

To set ICOM frequency using "beat frequency" method, the temperature should be at 26.5°C (79.8°F). If the temperature is not 26.5°C, then offset the "ON FREQUENCY" signal (at the receivers input), as a function of actual temperature, by the frequency error factor (in PPM) shown in Figure 8.

a. Audible "beat frequency" from the receiver speaker (this requires careful frequency adjustment of the frequency standard).

b. Observe "beat frequency" at P904-4 with an Oscilloscope.

c. With GE TEST SET (Meter Position B) connected to J601 on the IFAS Board, visually observe the "beat frequency" indicated by meter movement.

The frequency of the "beat" is the frequency error, related to the IF frequency. This deviation, in Hz, is compared to the receiver operating frequency, also in Hz, to calculate the error in PPM.

NOTE

The Discriminator DC output (Meter Position A of the Test Set) is provided for routine test and measurement only. The limited resolution available (0.025 V per kHz as measured with GE Test Set in Meter Position A, or 0.1 V per kHz as measured with a VTVM at P904-3 or J601-2 on the IFAS board) is inadequate for oscillator frequency setting.

If the radio is at an ambient temperature of 26.5°C (79.8°F), set the oscillator for the measured frequency (ICOM FREQ. X9).

If the radio is not at an ambient temperature of 26.5°C, setting errors can be minimized as follows:

A. To hold setting error to ±0.6 PPM (which is considered reasonable for 5 PPM ICOMS):

1. Maintain the radio at 26.5°C (±5°C) and set the oscillator to required frequency, or

2. Maintain the radio at 26.5°C (±10°C) and offset the oscillator, as a function of actual temperature, by the frequency error factor shown in Figure 8.

B. To hold setting error to ±0.35 PPM (which is considered reasonable to 2 PPM ICOMS): Maintain the unit at 26.5°C (±5°C) and offset the oscillator, as a function of actual temperature, by the frequency error factor shown in Figure 8.

For example: Assume the ambient temperature of the radio is 18.5°C (65.4°F). At that temperature, the curve shows a correction factor of 0.3 PPM. (At 138 MHz, 1 PPM is 138 Hz. At 174 MHz, 1 PPM is 174 Hz).

With a measured frequency of 150 MHz, adjust the oscillator for a corrected frequency 45 Hz (0.3 x 150 Hz) higher. If a negative correction factor is obtained (at temperatures above 26.5°C), set the oscillator for the indicated PPM lower than the measured frequency.

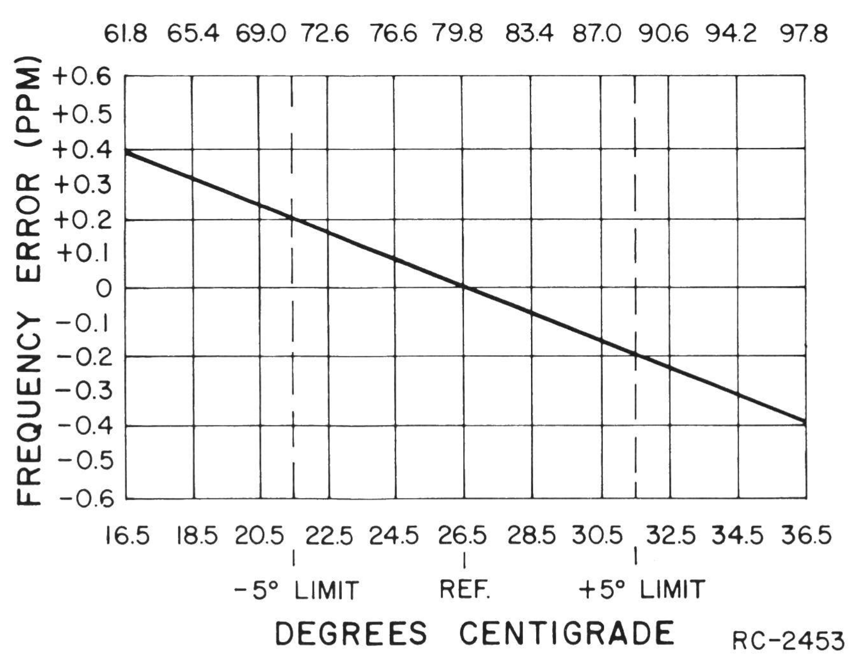


Figure 8 - Frequency Characteristics Vs. Temperature

COMPLETE DFE ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Models 4EX3A11, 4EX8K12 (or 20,000 ohms-per-Volt Multimeter with a 1-Volt scale.
2. A 9.4 or 11.2 MHz signal source (GE Test Set Model 4EX9A10). Also a 406-512 MHz signal source (Measurements 803) with a one-inch piece of insulated wire no larger than .065 inch diameter connected to generator probe.
3. A VTVM.

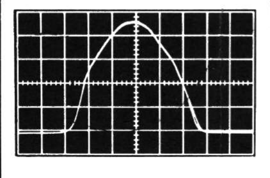
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect the black plug from the Test Set to DFE metering jack J2301 and the red plug to system board metering jack J905. Set the meter sensitivity switch to the Test 1 (or 1-Volt position on the 4EX8K12). Select desired DFE channel for operation.
2. In DFE's with three or more frequencies, align the DFE on the channel nearest the center frequency.
3. With the Test Set in Position J, check for regulated +10 Volts. With multimeter, measure from J905-3 to J905-9.
4. If using Multimeter, connect the negative lead to J2301-9 (A-).
5. Disable the Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE Test Set	METERING POSITION: Multimeter - at J2301-9	TUNING CONTROL	METER READING	PROCEDURE
			OSC/MULT		
1.	C (MULT-1)	Pin 3	L401	Maximum	Tune L401 for maximum meter reading.
2.	D (MULT-2)	Pin 4	L402, L403 and C306	See Procedure	Tune L402 and L403 for maxim meter reading. Then carefully tune L401, L402 and L403 for maximum meter reading, and tune C306 for a change in meter reading.
3.	F (MULT-3)	Pin 1	C306, C307 and C308	See Procedure	Tune C307 for maximum meter reading, then tune C308 for a dip. Next, retune C306 and C307 for maximum meter reading. Then tune C308 for a dip in meter reading.

STEP	METERING POSITION: GE Test Set	METERING POSITION: Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			RF SELECTIVITY		
4.	A (DISC)	Pin 2		Zero	Connect Test Set to Receiver Metering Jack J601 on IFAS board. Apply an on-frequency signal in the hole adjacent to C304. Adjust the signal generator for discriminator zero.
5.	B (IF AMP)	Pin 1	C305 and C304	Maximum	Apply an on-frequency signal in the hole adjacent to C304, keeping the signal below saturation. Then tune C305 and then C304 for maximum meter reading.
6.	B (IF AMP)	Pin 1	C304 and C303	Maximum	Apply an on-frequency signal in the hole adjacent to C303, keeping the signal below saturation. Then tune C304 and then C303 for maximum meter reading.
7.	B (IF AMP)	Pin 1	C303 and C302	Maximum	Apply an on-frequency signal in the hole adjacent to C302, keeping the signal below saturation. Then tune C303 and then C302 for maximum meter reading.
8.	B (IF AMP)	Pin 1	C302 and C301	Maximum	Apply an on-frequency signal to the DFE antenna jack, keeping the signal below saturation. Then tune C302 and C301 for maximum meter reading.
9.	B (IF AMP)	Pin 1	A303-C2, C301 thru C305 (and L2301 if present)	Maximum	Apply an on-frequency signal to the DFE antenna jack, keeping the signal below saturation. Then tune A303-C2 and C301 through C305 for maximum meter reading. In receivers with the UHS preamplifier, also tune L2301 for maximum meter reading.
10.	B (IF AMP)	Pin 1	A303-C2, C301 thru C305 (and L2301 if present)	Maximum	Apply an on-frequency signal to the DFE antenna jack and slightly tune A303-C2, C301 through C305 (and L2301 if present) for best quieting sensitivity.

STEP	METERING POSITION: GE Test Set	METERING POSITION: Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			MIXER & IF		
The mixer and IF circuits have been aligned at the factory and will normally require no further adjustment. If adjustment is necessary, use the procedure outlined in STEPS 11, 12 and 13. NOTE: Refer to DATAFILE BULLETIN 1000-6 (IF Alignment of Two-Way Radio FM Receivers) for helpful suggestions on how to determine when IF Alignment is required.					
11.	— 		L501, L503, L504, and C504	—	MATCHING IF FREQUENCY Connect scope, signal generator, and probe as shown in Figure 7. Set signal generator level for 3 to 5 µV and modulate with 10 kHz at 20 Hz. Select a DFE Channel and adjust signal Generator for on frequency signal. With probe between P904-4 (or J601-1) and A-, tune L501, L503, L504, and C504 for double trace as shown on scope pattern.
12.	—		L501, L503, L504 and C504	—	NON-MATCHING IF FREQUENCY Connect scope, signal generator and probe as shown in Figure 7. Select a DFE channel and adjust signal generator for on frequency signal. Set generator lined for 3 to 5 µV and modulate with 10 kHz at 20 Hz. With probe between P904-4 (or J601-1) and A-, tune L501, L503, L504 and C504 for best double trace as shown on scope pattern (Step 11).
13.	—		L504, L2306, L2307 and L2308	—	With tuning slugs of L2306, L2307 and L2308 pre-set to bottom of coils (nearest printed wire board), tune L2306, L2307 and L2308 for maximum noise as indicated on scope. Then Tune L2306 and L2307 for maximum IF response. NEXT, Tune L504 and L2308 for optimum IF response as indicated on scope pattern (Step 11).

TEST PROCEDURES

These Test Procedures are designed to help you to service a DFE that is operating---but not properly. A typical problem encountered could be poor sensitivity. Any problems relating to audio distortion, low audio, poor limiter operation or squelch trouble should be localized using the standard receiver channel since the IFAS board is common to both the Receiver and the DFE. Refer to appropriate Receiver Maintenance Manual for servicing procedures.

By following the sequence of test steps starting with Step 1, the defect can be quickly localized. After the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Test Procedures, be sure the DFE is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to:

  Heath IM-12

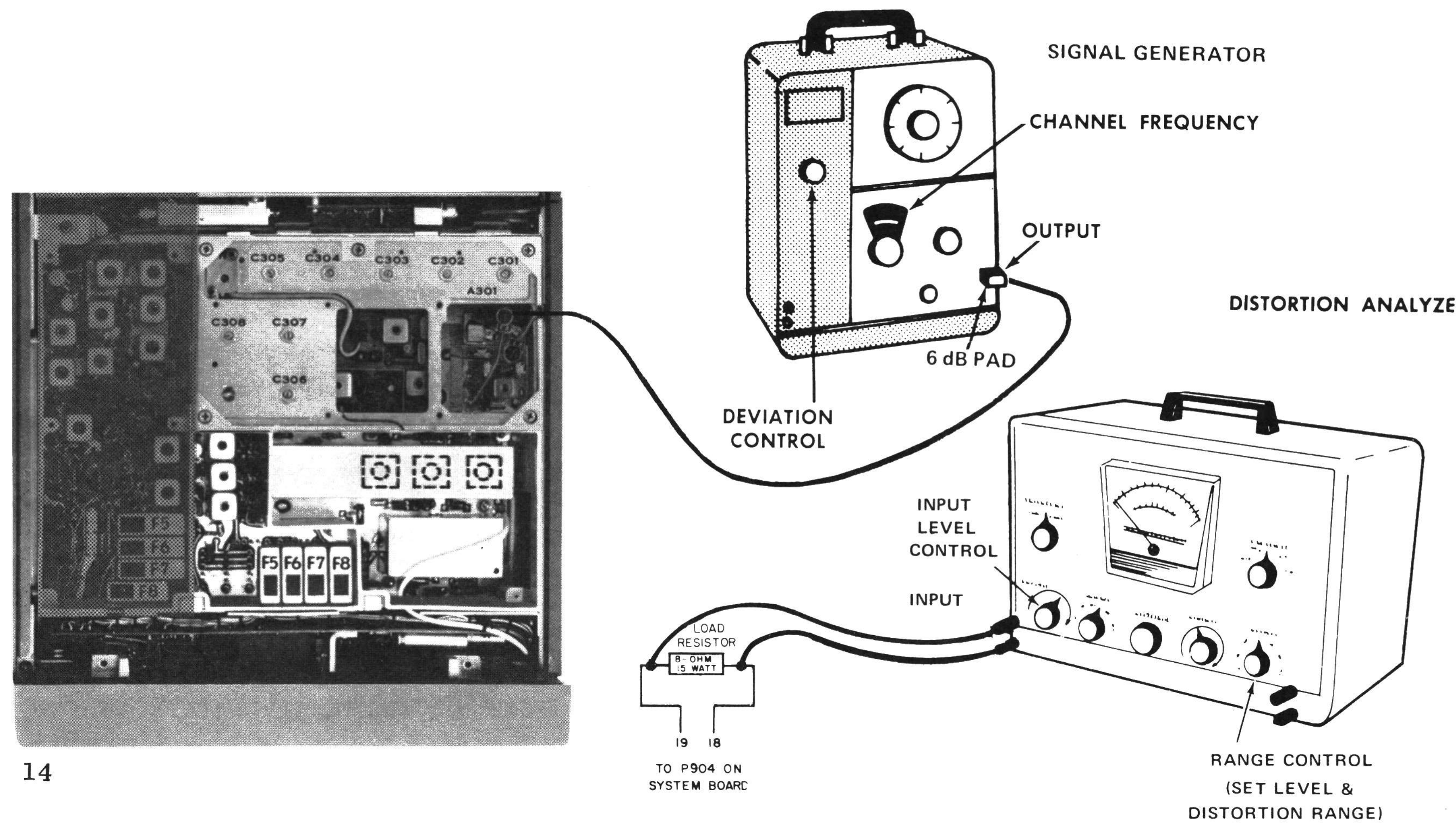
- Signal Generator similar to:

  Measurements 803

- 6-dB attenuation pad, and 8.0-ohm, 15-Watt resistor

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver and DFE as shown for all steps of the DFE Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.



STEP 1
USABLE SENSITIVITY (12-dB SINAD)

Measure DFE Sensitivity as follows:

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.0-kHz deviation to A301-J1.

B. With 15-Watt Speaker:

Disconnect speaker lead pin from Systems Plug P701-11 (on rear of Control Unit).

Connect an 8.0-ohm, 15-Watt load resistor from P904-19 to P904-18 or from P701-4 to P701-17 (SPEAKER Hi) on the System Plug. Connect the Distortion Analyzer input across the resistor.

OR

With Handset:

Lift the handset off of the hookswitch. Connect the Distortion Analyzer input from P904-19 to P904-18.

C. Adjust the VOLUME control for 12-Watt output (9.8 VRMS) using the Distortion Analyzer as a VTVM.

D. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

E. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

F. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

G. The 12-dB difference (Signal plus noise and distortion to noise plus distortion ratio) is the "usable" sensitivity level.

The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least 6.0 Watts (6.9 Volts RMS across the 8.0-ohm receiver load using the Distortion Analyzer as a VTVM).

H. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 2
MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

If STEP 1 checks out properly, measure the IF bandwidth as follows:

A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7 kHz.

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the DFE Troubleshooting Procedure.

STEP 1 - QUICK CHECKS

TEST SET CHECKS

These checks are typical voltage readings measured with GE Test Set Model 4EX3A11 in the Test 1 position, or Model 4EX8K12 in the 1-Volt position.

Metering Position	Reading With No Signal In
C (Mult-1)	0.2 VDC
D (Mult-2)	0.6 VDC
F (Mult-3)	0.3 VDC
J (Reg. +10 Volts at System Metering Jack)	+10 VDC

SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	• Check power connections and continuity of supply leads, and check fuse in power supply. If fuse is blown, check receiver for short circuits.
NO REGULATED 10-VOLTS	• Check the 12-Volt supply. Then check 10-Volt regulator circuit. (See Troubleshooting Procedure for 10-Volt Regulator).
LOW 1ST LIM READING ON IFAS BOARD WITH DFE SELECTED	• Check supply voltages and then check oscillator readings at P904-1 & -2 as shown in STEP 2. • Make SIMPLIFIED VTVM GAIN CHECKS from Mixer through Bandpass Filter stages as shown in STEP 2.
LOW DFE SENSITIVITY	• Check Front End Alignment. (Refer to DFE Alignment Procedure). • Check antenna connections, cable and antenna switch. • Check Oscillator injection voltages. • Check voltage readings of IF Amplifiers. • Make SIMPLIFIED GAIN CHECKS (STEP 2).

STEP 3 - VOLTAGE RATIO READINGS

EQUIPMENT REQUIRED

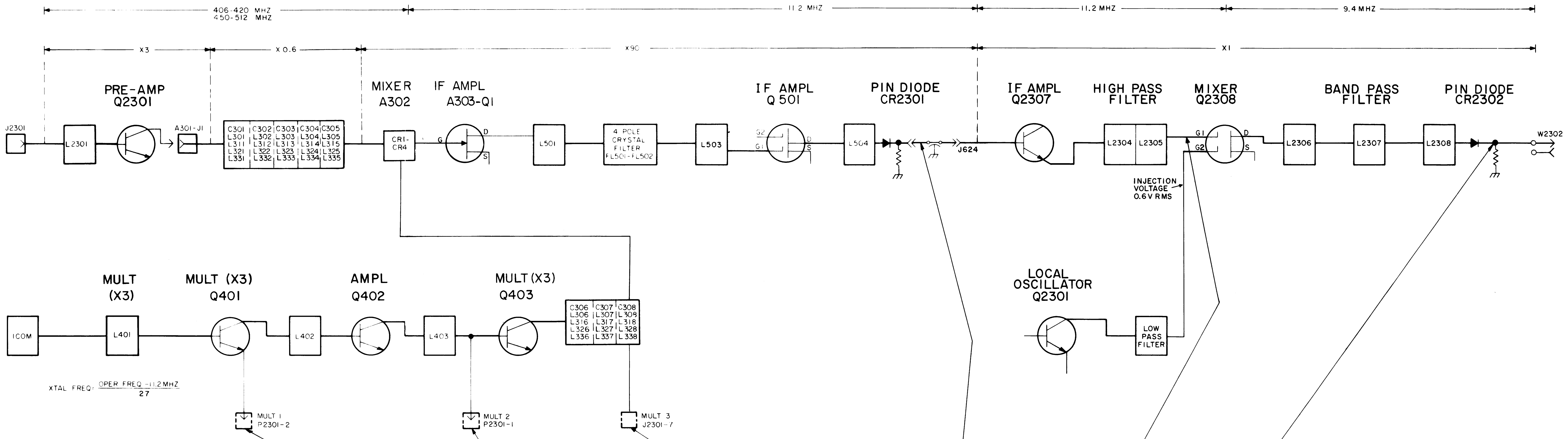
1. RF VOLTMETER (SIMILAR TO BOONTON MODEL 91-CA OR MILLIVAC TYPE MV-18 C.
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION). CORRECT FREQUENCY CAN BE DETERMINED BY ZEROING THE DISCRIMINATOR.

PROCEDURE

1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE, SOURCE OF RF AMP). PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (E1).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (MIXER). REPEAK FIRST RESONANT CIRCUIT THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (E2).
3. CONVERT READINGS BY MEANS OF THE FOLLOWING FORMULA.

$$\text{VOLTAGE RATIO} = \frac{E_2}{E_1}$$

4. CHECK RESULTS WITH TYPICAL VOLTAGE RATIOS SHOWN ON DIAGRAM.



STEP 2 - SIMPLIFIED GAIN CHECKS

EQUIPMENT REQUIRED

1. VTVM - AC & DC
2. SIGNAL GENERATOR (MEASUREMENTS 803 OR EQUIVALENT).
3. R F VOLTMETER

PRELIMINARY STEPS

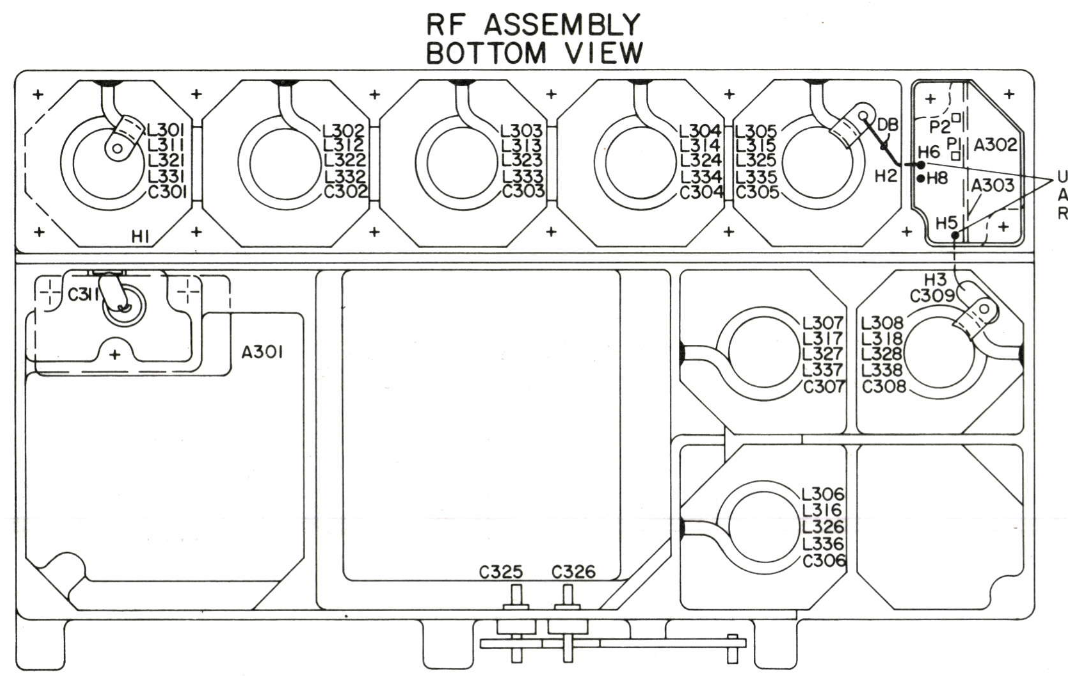
1. SET VOLUME CONTROL FOR 9.8 VOLTS ACROSS 8.0-OHM LOAD. IF THIS CANNOT BE OBTAINED, SET TO APPROX. 70% OF MAX ROTATION.
2. SET SQUELCH CONTROL FULLY COUNTERCLOCKWISE.
3. RECEIVER SHOULD BE PROPERLY ALIGNED.
4. CONNECT METER BETWEEN A- AND POINTS INDICATED BY ARROW.

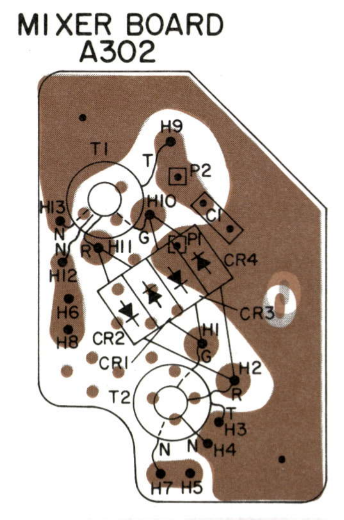
SIGNAL GENERATOR INPUT AT A301-J1 MAINTAIN SETTING AT DISCRIMINATOR ZERO				UNMODULATED	UNMODULATED	UNMODULATED
PROCEDURE				SET GENERATOR OUTPUT AT 1000 MICROVOLTS	SET GENERATOR OUTPUT AT 1000 MICROVOLTS	SET GENERATOR OUTPUT AT 1000 MICROVOLTS
READING	VTVM READING SHOULD BE APPROX 0.25 VDC	VTVM READING SHOULD BE APPROX 1.5 VDC	VTVM READING SHOULD BE APPROX 0.5 VDC	RF VOLTMETER READING SHOULD BE APPROX 150 MILLIVOLTS	RF VOLTMETER READING SHOULD BE 120 MILLIVOLTS	RF VOLTMETER READING SHOULD BE 150 MILLIVOLTS

RC-2585

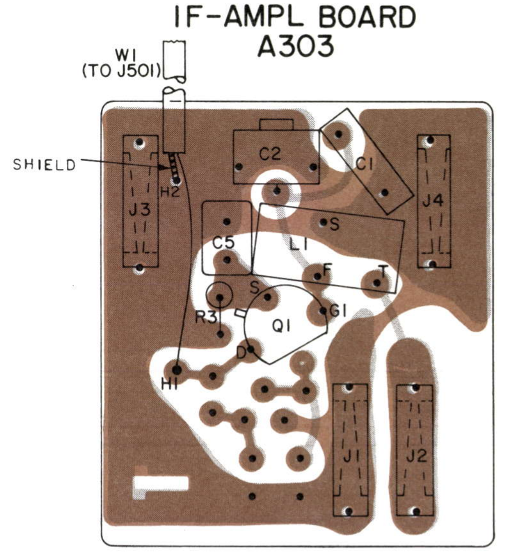
TROUBLESHOOTING PROCEDURE

406—512 MHz DUAL FRONT END





(19C320534, Sh. 2, Rev. 0)
(19C320534, Sh. 3, Rev. 0)



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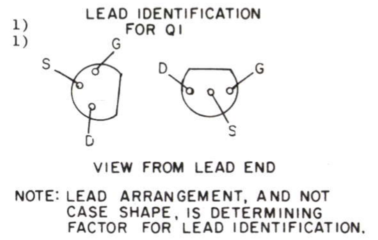
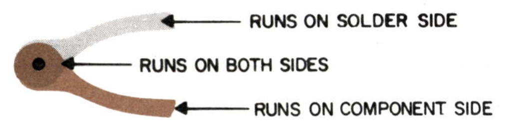
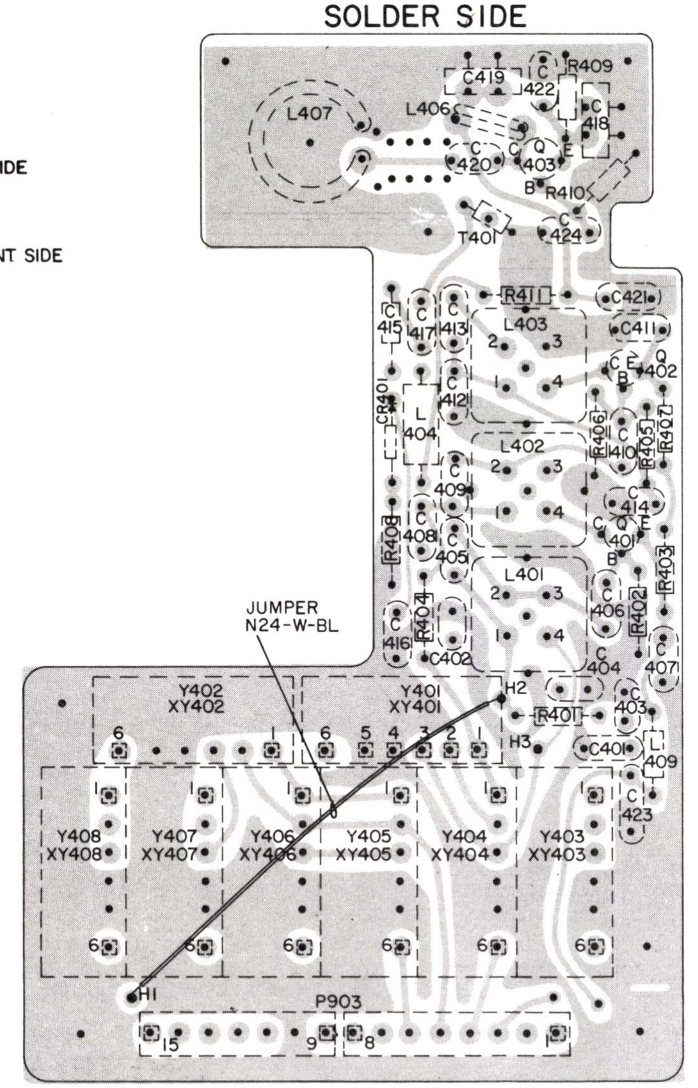
(19C320536, Sh. 3, Rev. 1)

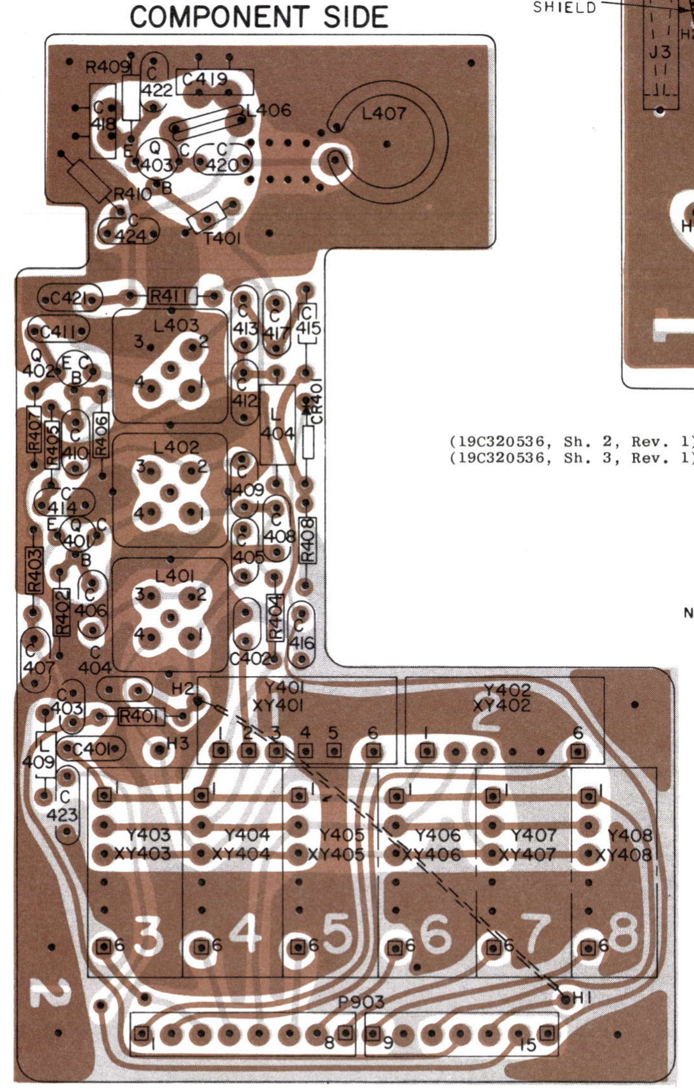




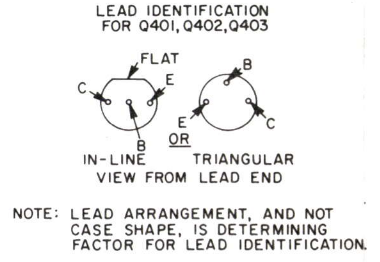
OSC/MULT BOARD

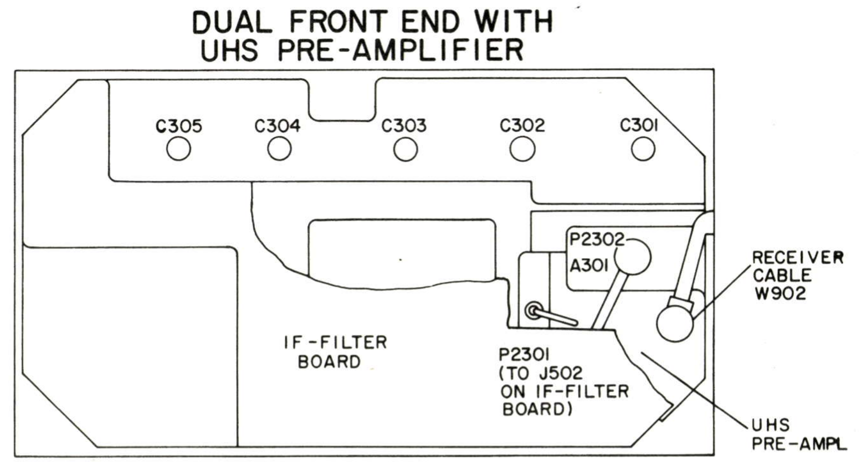


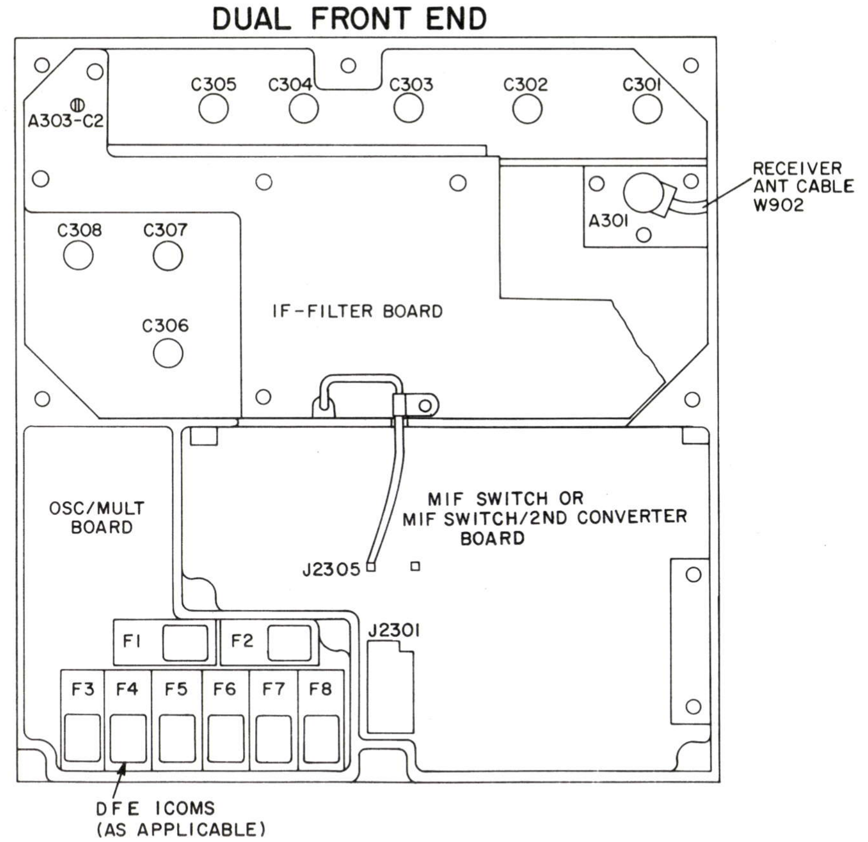
(19D417071, Sh. 2, Rev. 1)



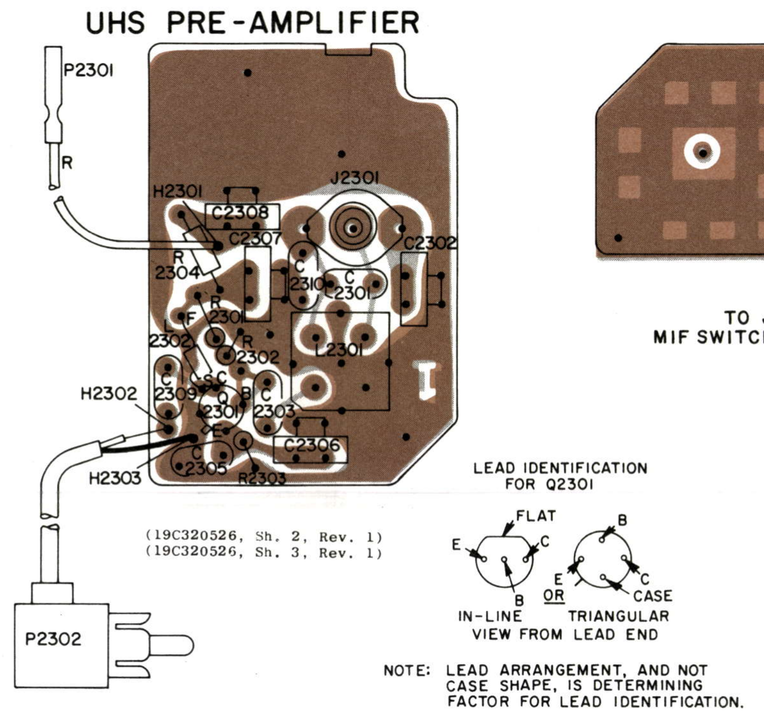
(19D417071, Sh. 2, Rev. 1)
(19D417071, Sh. 3, Rev. 2)



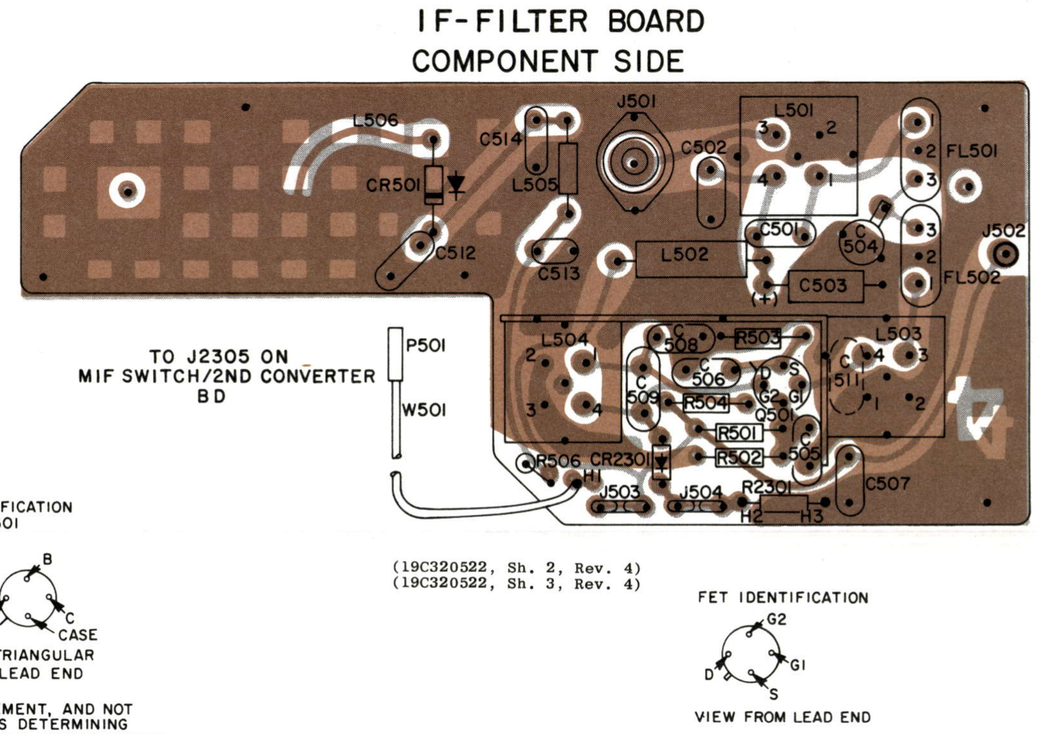




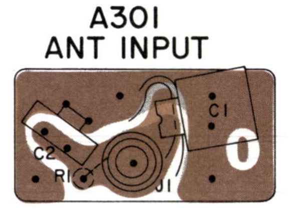
(19B622102, Rev. 1)



(19C320526, Sh. 2, Rev. 1)
(19C320526, Sh. 3, Rev. 1)

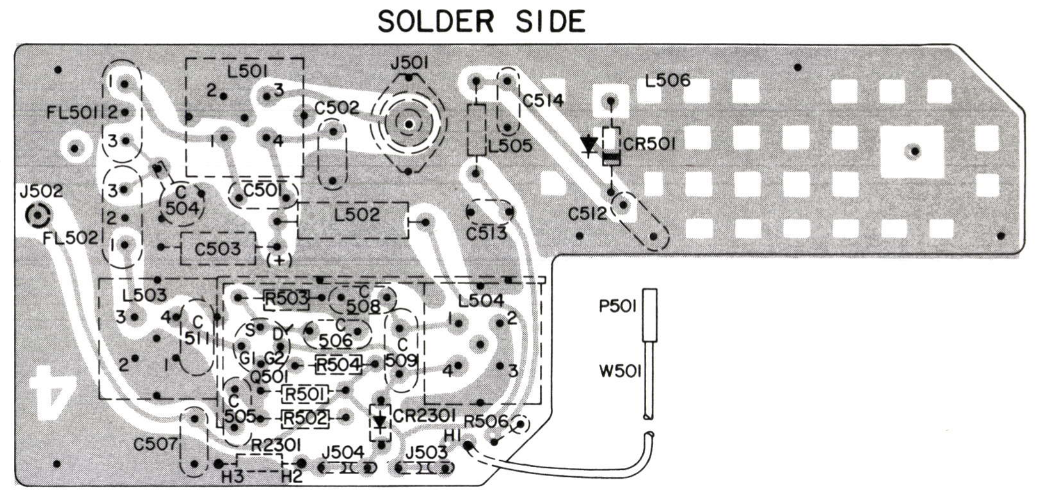


(19C320522, Sh. 2, Rev. 4)
(19C320522, Sh. 3, Rev. 4)



(19B219941, Sh. 2, Rev. 0)
(19B219941, Sh. 3, Rev. 0)

NOTES:
1. BOARDS IDENTIFIED BY A RED DOT HAVE BEEN MODIFIED FOR DFE OPERATION PER MOD KIT 19A129750G1 OR G2.



(19C320522, Sh. 2, Rev. 4)

OUTLINE DIAGRAM

406—512 MHz MASTR II DUAL FRONT END

PARTS LIST

LBI-4621B

406-420, 450-512 MHz RECEIVER RF ASSEMBLY, IF-FILTER BOARD ASSEMBLY, OSCILLATOR-MULTIPLIER AND UHS PRE-AMPLIFIER

SYMBOL	GE PART NO.	DESCRIPTION
		RF ASSEMBLY 19D417075G1-G4
A301		ANTENNA INPUT BOARD 19B219942G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	7484398P3	Silver mica: 250 pf ±10%, 500 VDCW; sim to Underwood Type J1HF.
C2	19A116679P220K	Mica: 220 pf ±10%, 250 VDCW.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1	7104941P16	Connector, phono: Jack; sim to National Tel.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P472K	Composition: 4700 ohms ±10%, 1/4 w.
A302		**MIXER BOARD** 19C320535G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116114P2038	Ceramic: 18 pf ±5%, 100 VDCW; temp coef -80 PPM.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 thru CR4	19A116052P3	Silicon.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2	19A116779P1	Contact, electrical: sim to Molex 08-54-0404.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1	19A129716G3	Coil.
T2	19A129716G2	Coil.
A303		**IF AMPLIFIER BOARD** 19C320537G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116114P2066	Ceramic: 110 pf ±5%, 100 VDCW; temp coef -80 PPM.
C2	19A116710P15	Variable: 6.2 to 22 pf, 50 VDCW; sim to Erie 511-002.
C3* and C4*	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121-050-W5R. Deleted by REV A.
C5	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1 thru J4	19A116428P3	Contact, electrical: sim to AMP 85487-3 (Strip Form).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B204403G3	Coil, toroidal.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1*	19A116154P1	N Channel, field effect.
		Earlier than REV A:
	19A116818P1	N Channel, field effect.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1*	3R151P103K	Composition: 10,000 ohms ±10%, 1/8 w. Deleted by REV A.
R2*	3R151P822J	Composition: 8200 ohms ±5%, 1/8 w. Deleted by REV A.
R3*	3R151P221J	Composition: 220 ohms ±5%, 1/8 w.
		Earlier than REV A:
	3R151P470K	Composition: 47 ohms ±10%, 1/8 w.
R4*	3R151P103K	Composition: 10,000 ohms ±10%, 1/8 w. Deleted by REV A.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	5491689P114	RF: approx 5-1/8 inches long.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C301 thru C305		Includes:
	4036765G11	Screw.
	7137968P8	Nut, stamped: thd size No. 6-32; sim to Palnut T0632005.
C306 thru C308		Includes:
	4036765G12	Screw.
	7137968P8	Nut, stamped: thd size No. 6-32; sim to Palnut T0632005.
C309	5496218P34	Ceramic disc: 3.0 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C311	5496218P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C325	19B209488P1	Ceramic, feed-thru: 6.8 pf ±20%, 500 VDCW; sim to Allen-Bradley Style FA5D.
C326	19B209488P2	Ceramic, feed-thru: 1000 pf +100%-10%, 500 VDCW; sim to Allen-Bradley Style FA5D.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L301	19B204938G37	Coil.
L302 thru L304	19B219944P1	Coil.
L305	19B204938G33	Coil.
L306 and L307	19B219944P5	Coil.
L308	19B204938G41	Coil.
L311	19B204938G38	Coil.
L312 thru L314	19B219944P2	Coil.
L315	19B204938G34	Coil.
L316 and L317	19B219944P6	Coil.
L318	19B204938G42	Coil.
L321	19B204938G39	Coil.
L322 thru L324	19B219944P3	Coil.
L325	19B204938G35	Coil.
L326 and L327	19B219944P7	Coil.
L328	19B204938G43	Coil.
L331	19B204938G40	Coil.
L332 thru L334	19B219944P4	Coil.
L335	19B204938G36	Coil.
L336 and L337	19B219944P8	Coil.
L338	19B204938G44	Coil.
		IF-FILTER BOARD 19C320523G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C501	5490008P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C502	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C503	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C504	19B209351P1	Variable: 1.7 to 10 pf, 200 VDCW, temp coef +500% -350 PPM; sim to Matsushita ECV-1ZW10P32.
C505 thru C508	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C509	5490008P139	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C510	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C511		(Part of L503).
C512	19A116656P20K0	Ceramic disc: 20 pf ±10%, 500 VDCW, temp coef 0 PPM.
C513	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C514	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR501	19A116052P1	Silicon.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL501	19B219573G3	Crystal, freq: Pad A: 11,200000 KHz, Pad B: 11,198024.
FL502		(Part of FL501).
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J501	19A116832P1	Receptacle, coaxial: sim to Cinch 14H11613.
J502	4033513P1	Contact, electrical: sim to Bead Chain L93-4.
J503 and J504	19A115675P1	Receptacle, wire spring.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L501*	19C320141G34	Coil.
		Earlier than REV A:
	19C320141G28	Coil. Includes:
	5493185P9	Tuning slug.
L502	7488079P48	Choke, RF: 27.0 µh ±10%, 1.40 ohms DC res max; sim to Jeffers 4422-9.
L503	19C320141G4	Coil. Includes:
	5493185P9	Tuning slug.
L504	19C320141G29	Coil. Includes:
	5493185P9	Tuning slug.
L505	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
L506		(Part of printed board 19C320522P1).
		- - - - - - - - - - PLUGS - - - - - - - - - -
P501		(Part of W501).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q501	19A116818P1	N Channel, field effect.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R501	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R502	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R503	3R152P221K	Composition: 220 ohms ±10%, 1/4 w.
R504	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R506	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W501	19A129947G1	Cable: orange, No. 22 stranded, approx 7 inches, includes (P501).
		OSCILLATOR-MULTIPLIER 19D417072G1 406-420 MHz 2 FREQ (LL) 19D417072G2 450-470 MHz 2 FREQ (L) 19D417072G3 470-494 MHz 2 FREQ (M) 19D417072G4 494-512 MHz 2 FREQ (H) 19D417072G5 406-420 MHz 8 FREQ (LL) 19D417072G6 450-470 MHz 8 FREQ (L) 19D417072G7 470-494 MHz 8 FREQ (M) 19D417072G8 494-512 MHz 8 FREQ (H)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C401 thru C404	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C405LL	19A116656P18K1	Ceramic disc: 18 pf ±10%, 500 VDCW, temp coef -150 PPM.
C405L	19A116656P15K1	Ceramic disc: 15 pf ±10%, 500 VDCW, temp coef -150 PPM.
C405M	19A116656P12K1	Ceramic disc: 12 pf ±10%, 500 VDCW, temp coef -150 PPM.
C405H	19A116656P10K1	Ceramic disc: 10 pf ±10%, 500 VDCW, temp coef -150 PPM.
C406	19A116656P20K0	Ceramic disc: 20 pf ±10%, 500 VDCW, temp coef 0 PPM.
C407 and C408	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C409LL	19A116656P8K1	Ceramic disc: 8 pf ±10%, 500 VDCW, temp coef -150 PPM.
C409L	19A116656P6K1	Ceramic disc: 6 pf ±10%, 500 VDCW, temp coef -150 PPM.
C409M	19A116656P4K1	Ceramic disc: 4 pf ±10%, 500 VDCW, temp coef -150 PPM.
C409H	19A116656P3K1	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef -150 PPM.
C410	19A116656P3K0	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef 0 PPM.
C411 and C412	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C413LL	19A116656P9K1	Ceramic disc: 9 pf ±10%, 500 VDCW, temp coef -150 PPM.
C413L	19A116656P6K1	Ceramic disc: 6 pf ±10%, 500 VDCW, temp coef -150 PPM.
C413M	19A116656P4K1	Ceramic disc: 4 pf ±10%, 500 VDCW, temp coef -150 PPM.
C413H	19A116656P3K1	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef -150 PPM.
C414	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C415	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C416	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C417LL	19A116656P7K0	Ceramic disc: 7 pf ±10%, 500 VDCW, temp coef 0 PPM.
C417L	19A116656P3K0	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef 0 PPM.
C417M	19A116656P5K0	Ceramic disc: 5 pf ±10%, 500 VDCW, temp coef 0 PPM.
C417H	19A116656P5K0	Ceramic disc: 5 pf ±10%, 500 VDCW, temp coef 0 PPM.
C418 and C419	19A116679P220K	Mica: 220 pf ±10%, 250 VDCW.
C420	19A116656P9K0	Ceramic disc: 9 pf ±10%, 500 VDCW, temp coef 0 PPM.
C421 and C422	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C423	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C424	19A116656P3K0	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef 0 PPM.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR401	19A115250P1	Silicon.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L401	19C320141G17	Coil. Includes:
	5493185P9	Tuning slug.
L402 and L403	19C320141G8	Coil. Includes:
	5493185P9	Tuning slug.
L404	7488079P1	Choke, RF: 0.15 µh ±20%, 0.03 ohms DC res max; sim to Jeffers 4411-1M.
L406	19A129711P1	Coil.
L407	19A129710P1	Coil.
L409	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P903		Includes:
	19B219594P1	Terminal strip: 7 pins.
	19B219594P2	Terminal strip: 8 pins.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q401	19A115991P1	Silicon, NPN.
Q402 and Q403	19A116201P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R401	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R402	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R403	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R404	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R405	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R406	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R407	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R408	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R409	3R152P220K	Composition: 22 ohms ±10%, 1/4 w.
R410	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R411	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T401	19A129920G1	Coil.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY401 thru XY408	19A116779P1	Contact, electrical: sim to Molex 08-54-0404. (Quantity 6 for each socket).
		- - - - - - - - OSCILLATOR MODULES - - - - - - - -
		NOTE: When reordering specify ICOM Frequency.
		ICOM Freq = Operating Freq - 11.2 / 27
Y401 thru Y408	19A129393G12	Compensated: ±5 PPM, 406-420 MHz, 450-512 MHz.
	19A129393G8	Externally Compensated: ±5 PPM, 406-420 MHz, 450-512 MHz.
	19A129393G4	Compensated: ±2 PPM, 406-420 MHz, 450-512 MHz.
		UHS RF PRE-AMPLIFIER 19C320527G1 (LL) 19C320527G2 (L) 19C320527G3 (M) 19C320527G4 (H)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2301	19A116656P3J8	Ceramic disc: 3 pf ±0.1 pf, 500 VDCW, temp coef -80 PPM.
C2302	19A116679P220K	Mica: 220 pf ±10%, 250 VDCW.
C2303	19A116656P18J8	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2305	19A116656P20K0	Ceramic disc: 20 pf ±10%, 500 VDCW, temp coef 0 PPM.
C2306	19A116679P100K	Mica: 100 pf ±10%, 250 VDCW.
C2307 and C2308	19A116679P220K	Mica: 220 pf ±10%, 250 VDCW.
C2309	19A116656P30J8	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2310	19A116656P20K0	Ceramic disc: 20 pf ±10%, 500 VDCW, temp coef 0 PPM.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J2301	19A116832P1	Receptacle, coaxial: sim to Cinch 14H11613.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2301LL	19D413078G3	Helical resonator.
L2301L	19D413078G5	Helical resonator.
L2301M	19D413078G6	Helical resonator.
L2301H	19D413078G7	Helical resonator.
L2302	19A129716G1	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P2301	4029840P2	Contact, electrical: sim to Amp 42827-2.
P2302		(Part of W2301).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q2301	19A116859P1	Silicon, NPN; sim to Type 2N5032 or 2N3570.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2301	3R152P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R2302	3R152P682K	Composition: 6800 ohms ±10%, 1/4 w.
R2303	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R2304	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2301	5491689P94	RF: approx 3 inches long. Includes P2302.
		- - - - - - - **MISCELLANEOUS** - - - - -
	19E501121P1	Casting, RF Circuit.
	19C320455P1	Cover, RF Circuit.
	19B219886P1	Cover. (Located over A303-C2).
	19B209209P304	Tap screw, Phillips Pozidriv: No. 6-32 x 1/4. (Secures RF Circuit Cover).
	4036765G11	Screw. (Part of C301-C305).
	4036765G12	Screw. (Part of C306-C308).
	7137968P8	Nut, stamped: thd size No. 6-32; sim to Palnut T0632005. (Part of C301-C308).
	19B219470P2	Shield. (Used with IF Filter Board).
	19A129424G1	Can. (Used with L401-L403, L501, L503, L504).
	19A127060P2	Can. (Used with L2301).
	4035306P59	Washer, fiber. (Used with FL501, FL502).
	19A129715G1	Adapter Board. (Carries IF from IF Filter Board to IFAS Board).
		RECEIVER MODIFICATION KIT 19A129750G1 (Used with DUAL FRONT END)
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR2301	19A116925P1	Silicon.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2301	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R2302	3R152P681K	Composition: 680 ohms ±10%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2301	19B219999G2	RF: approx 10-1/2 inches long.
		DUAL FRONT END MODIFICATION KIT 19A129750G2
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR2301	19A116925P1	Silicon.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2301	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R2303	3R152P911J	Composition: 910 ohms ±5%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - RF Assembly IF Amplifier Board A303 (19C320537G1)

To improve sensitivity of Receiver. Changed R3 and Q1, and deleted C3, C4, R1, R2 and R4.

REV. A - RF Assembly IF Filter Board (19C320523G1)

To improve sensitivity of Receiver. Changed L501.

▲ THESE COMPONENTS ARE USED TO ADAPT A STANDARD RECEIVER TO OPERATION AS AND WITH A DUAL FRONT END. THESE COMPONENTS SHOULD BE IGNORED IN THE STANDARD RECEIVER. BOARDS IDENTIFIED BY A RED DOT HAVE BEEN MODIFIED FOR DFE OPERATION PER MOD KIT 19A129750G1 OR G2	
RECEIVER CHANNEL ON PL19C320523 (IF FILTER BD)	D. F. E. CHANNEL ON PL19C320523 (IF FILTER BD)
1. R2302 USED INSTEAD OF R504 2. CR2301 USED INSTEAD OF C510 3. R2301 ADDED BETWEEN H2 & H3.	1. R504 USED 2. CR2301 USED INSTEAD OF C510 3. R2301 ADDED BETWEEN H2 & H3.
	ON PL19D417072 (OSC/MULT BD) 1. N24-W-BL JUMPER ADDED BETWEEN H1 & H2 ON OSC/MULT BD.
THESE ITEMS ARE SUPPLIED IN MOD. KIT PL19A129750G1.	THESE ITEMS ARE SUPPLIED IN MOD KIT PL19A129750G2.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-10) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

⏚ INDICATES A-

⏚ INDICATES VEHICLE GROUND

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

	REV LETTER	FREQ RANGE (MHZ)	NO OF FREQ
RF ASSEMBLY			
19D417075G1		406-420	
19D417075G2		450-470	
19D417075G3		470-494	
19D417075G4		494-512	
MIXER BD			
19C320535G1			
IF AMPL BD			
19C320537G1			
OSC/MULT BD			
19D417072G1		406-420	2
19D417072G2		450-470	2
19D417072G3		470-494	2
19D417072G4		494-512	2
19D417072G5		406-420	8
19D417072G6		450-470	8
19D417072G7		470-494	8
19D417072G8		494-512	8
IF FILTER BD			
19C320529G1			

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

✱ COMPONENT VALUE TABLE				
COMP DESIG	LL	L	M	H
RF FREQ(MHZ)	406-420	450-470	470-494	494-512
L301	X			
L302	X			
L303	X			
L304	X			
L305	X			
L306	X			
L307	X			
L308	X			
L311		X		
L312		X		
L313		X		
L314		X		
L315		X		
L316		X		
L317		X		
L318		X		
L321			X	
L322			X	
L323			X	
L324			X	
L325			X	
L326			X	
L327			X	
L328			X	
L331				X
L332				X
L333				X
L334				X
L335				X
L336				X
L337				X
L338				X
C405	18	15	12	10
C409	8	6	4	3
C413	8	6	4	3
C417	7	3	5	5

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER

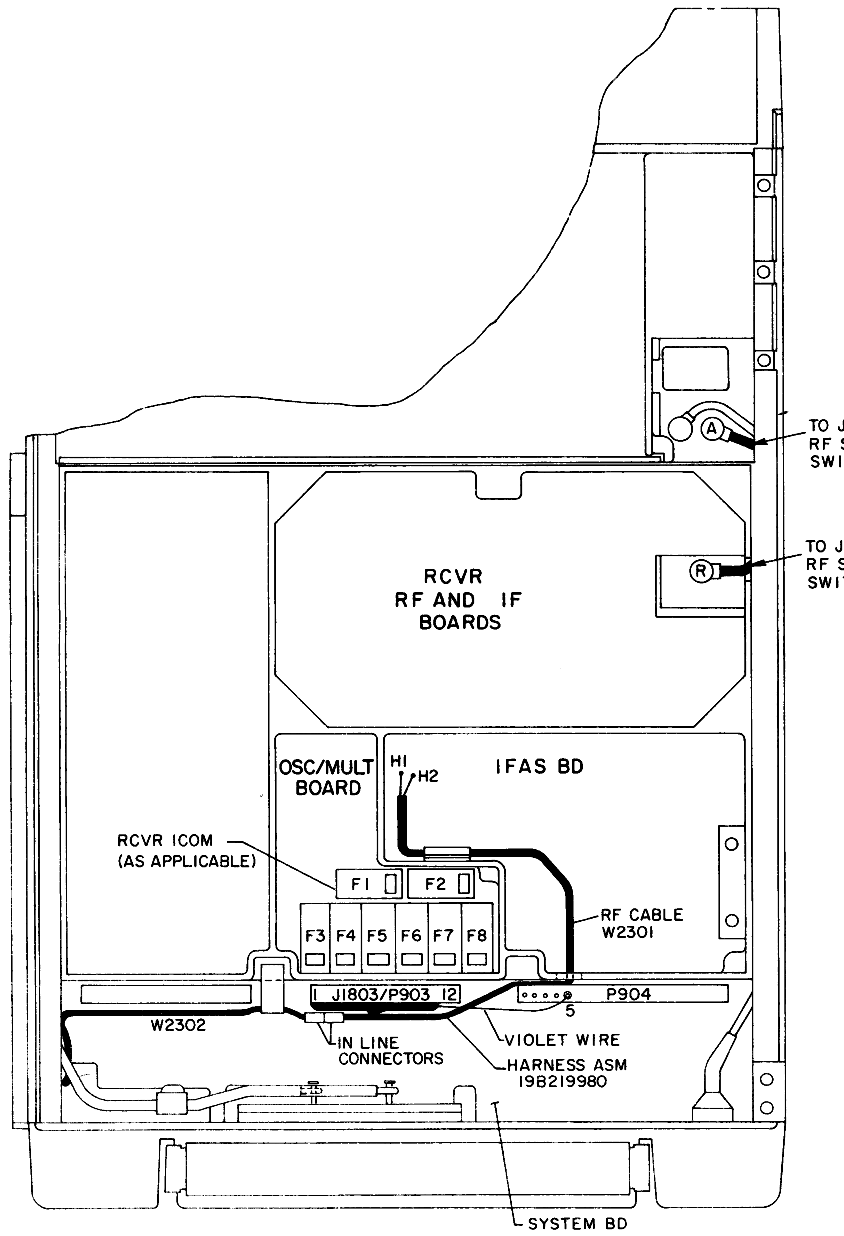
THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19D417075G1	A
PL19D417075G2	A
PL19D417075G3	A
PL19D417075G4	A
PL19C320523G1	A

SCHEMATIC DIAGRAM

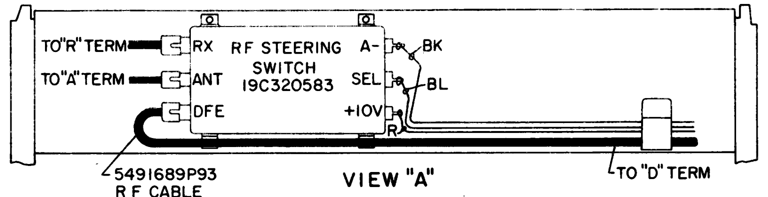
406—512 MHz MASTR II DUAL FRONT END
RF ASM., OSC/MULT, MIF BOARD,
AND OPTIONAL UHS PRE-AMPL.

(19R621959, Rev. 11)

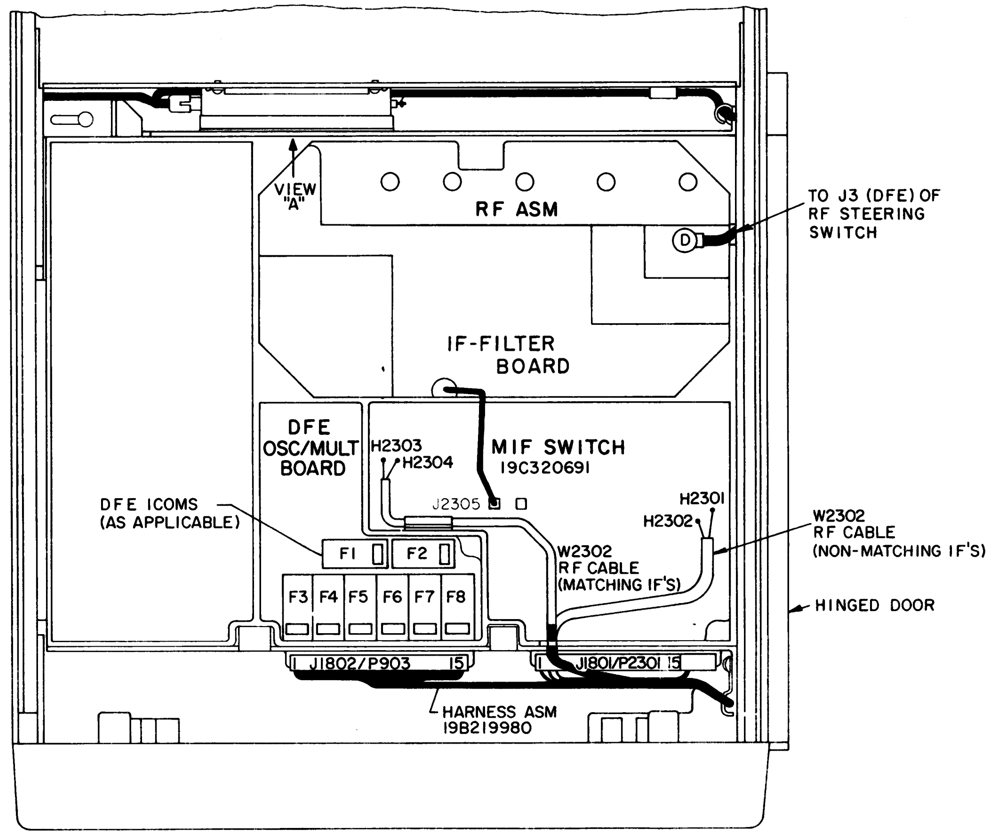
CABLE HARNESS ROUTING



TOP VIEW
RECEIVER



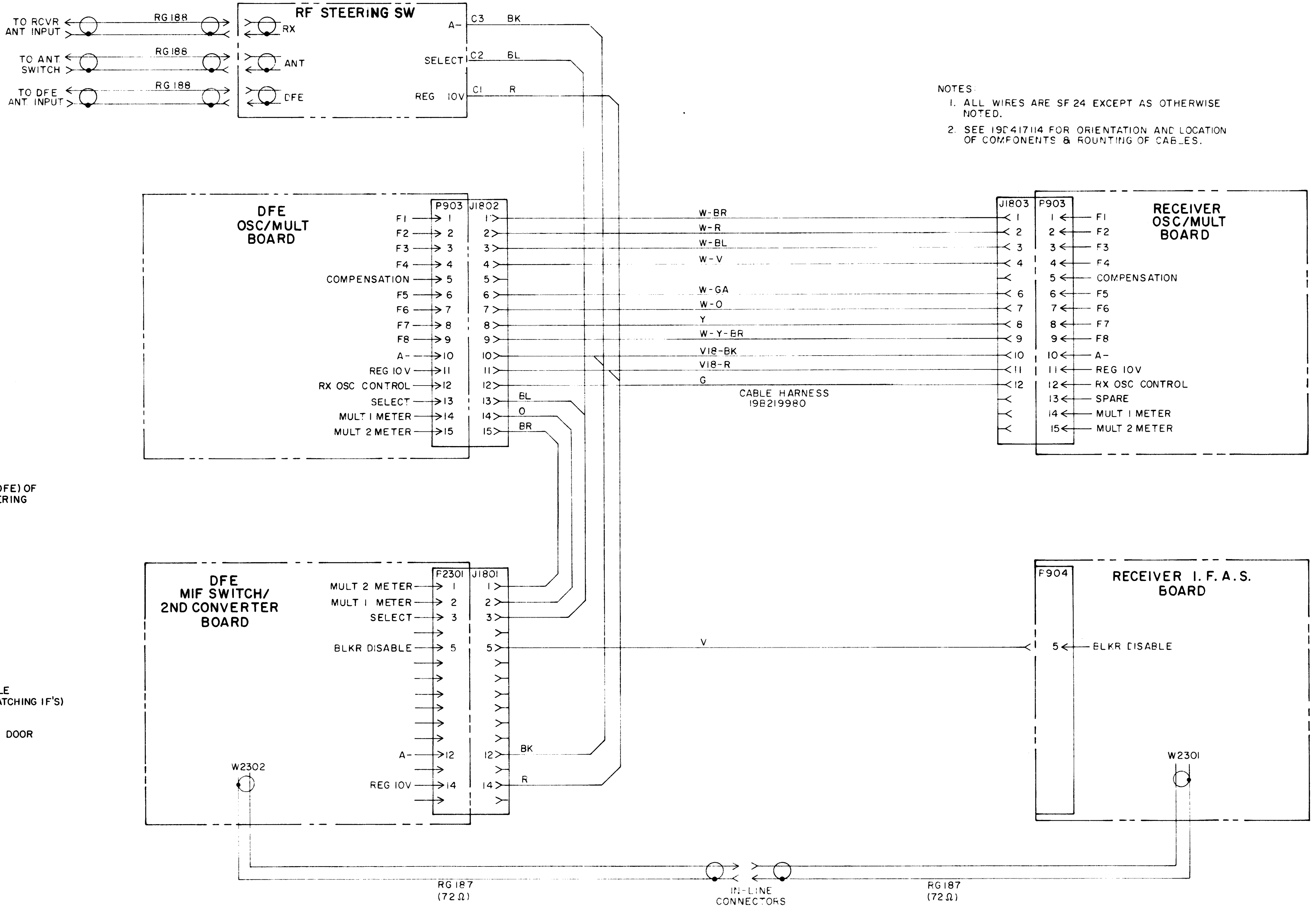
VIEW "A"
RF SWITCH & TERMINATIONS



BOTTOM VIEW OF HINGE ASM
DUAL FRONT END

RC-2593

DFE INTERCONNECTION DIAGRAM



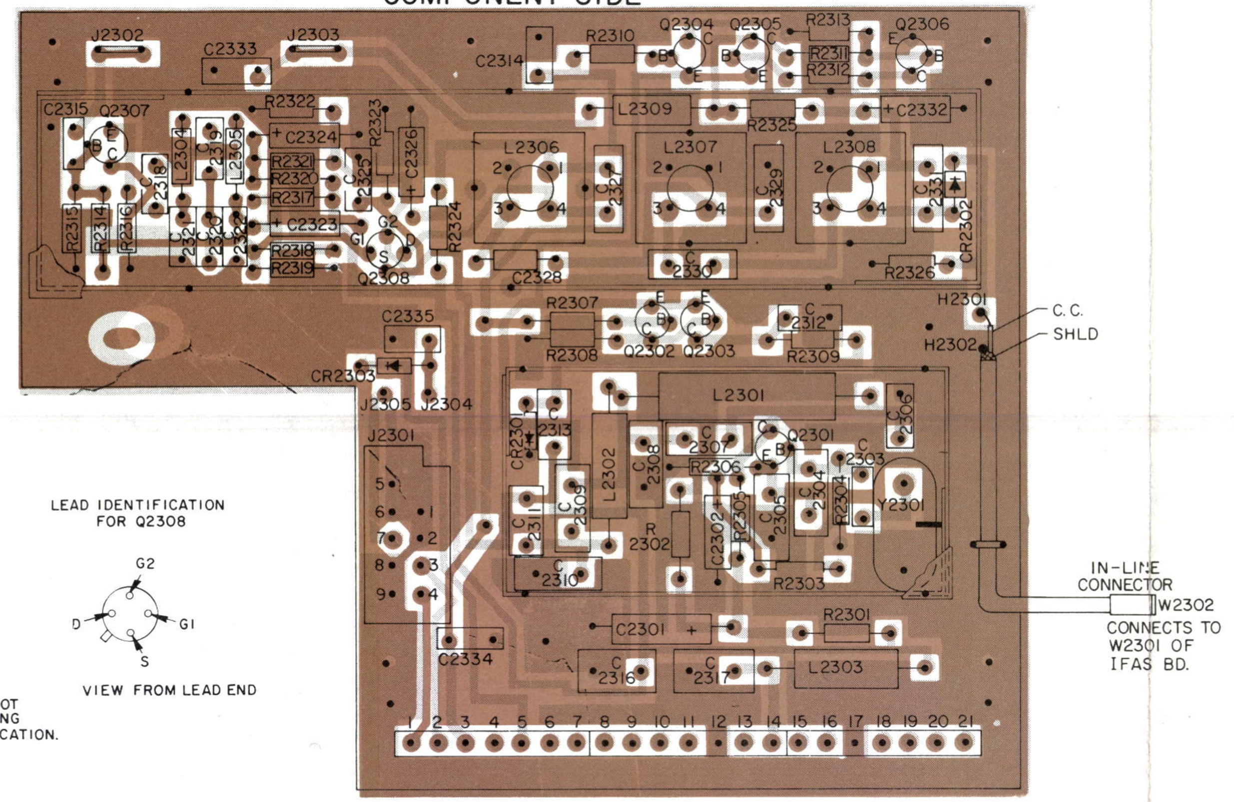
(19D417142, Rev. 1)

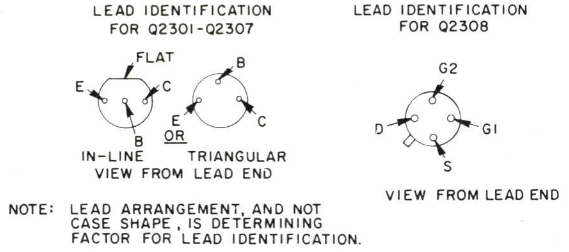
CABLE HARNESS ROUTING & INTERCONNECTION DIAGRAM

406—512 MHz DUAL FRONT END

MIF SWITCH/2ND CONVERTER BOARD
(NON-MATCHING IF FREQ)

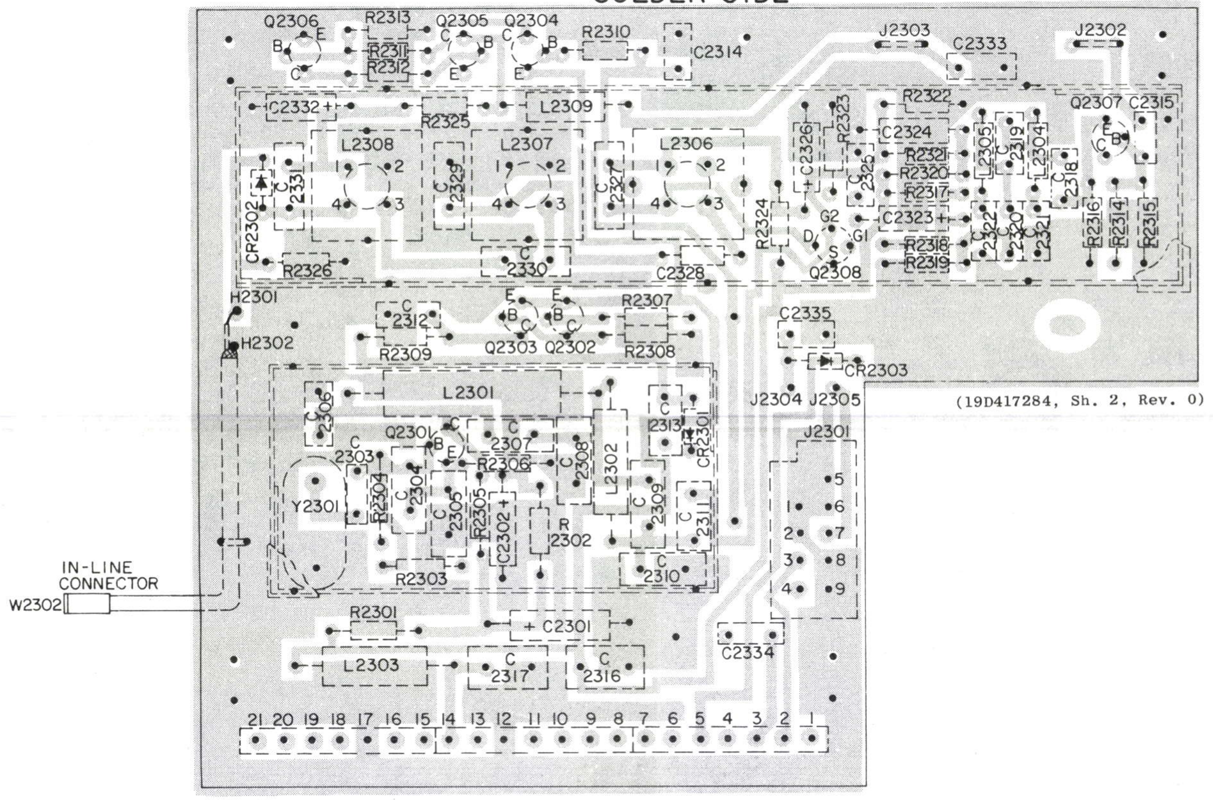
COMPONENT SIDE





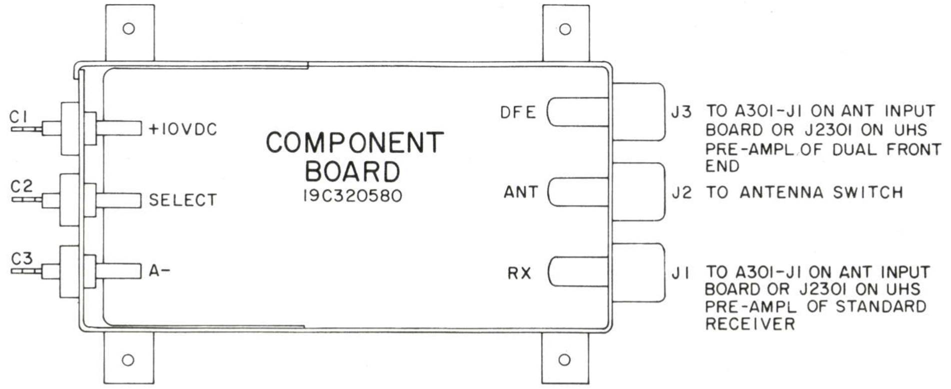
(19D417284, Sh. 2, Rev. 0)
(19D417284, Sh. 3, Rev. 0)

SOLDER SIDE



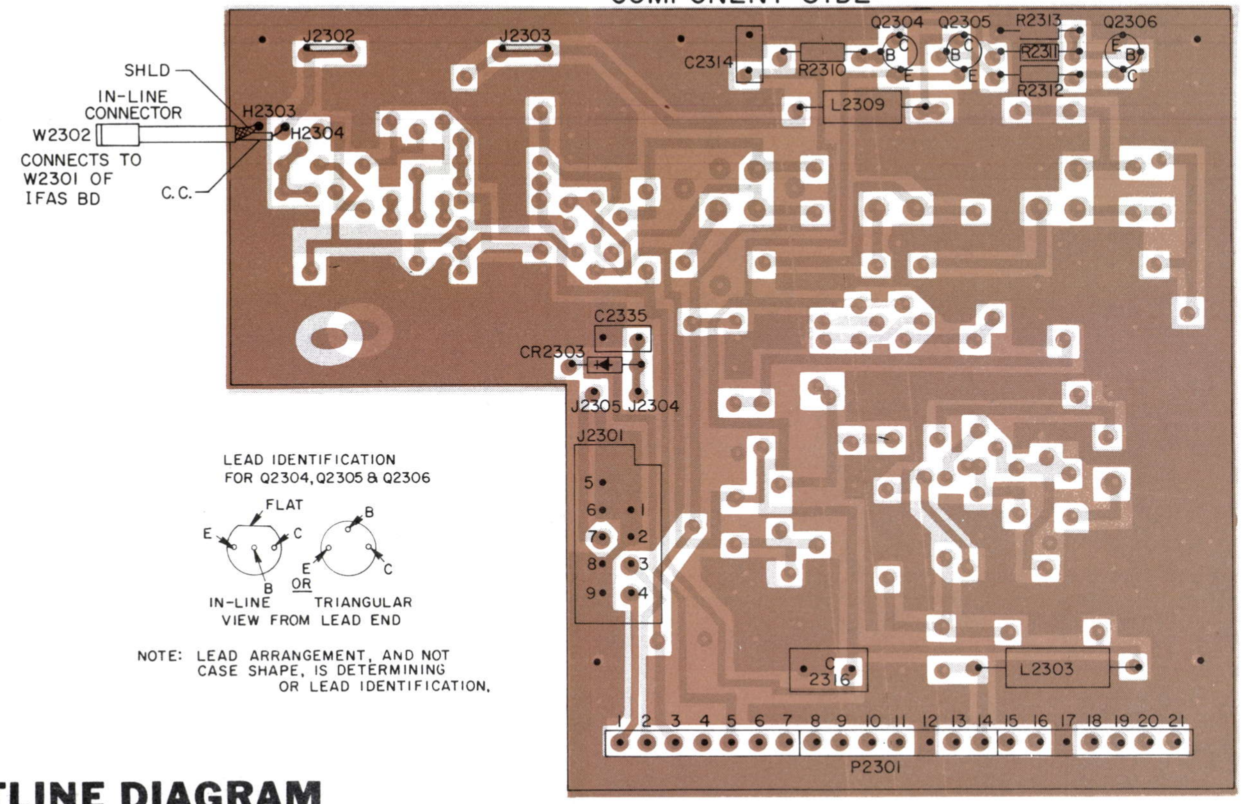
(19D417284, Sh. 2, Rev. 0)

RF STEERING SWITCH
19C320583



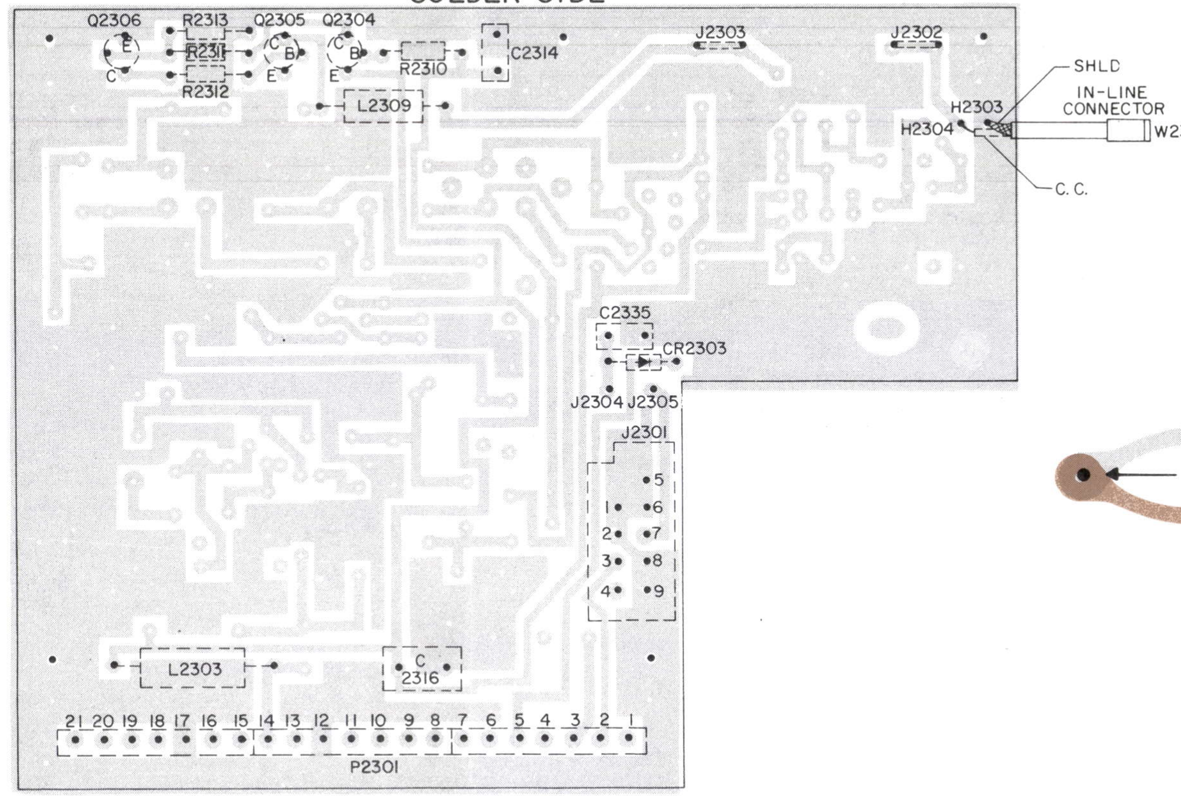
MIF SWITCH BOARD
(MATCHING IF FREQ)

COMPONENT SIDE

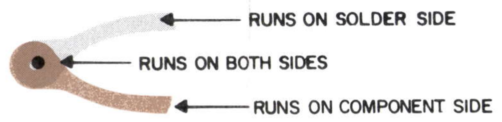


(19D417284, Sh. 2, Rev. 0)
(19D417284, Sh. 3, Rev. 0)

SOLDER SIDE



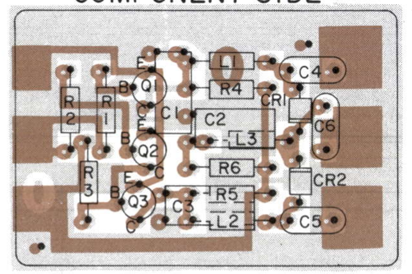
(19D417284, Sh. 2, Rev. 0)



(19R622099, Rev. 1)

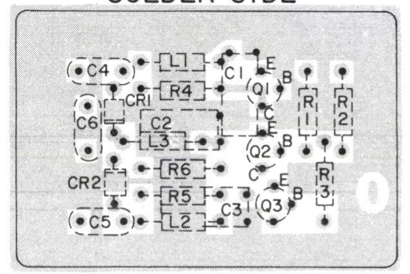
RF STEERING SWITCH BOARD

COMPONENT SIDE

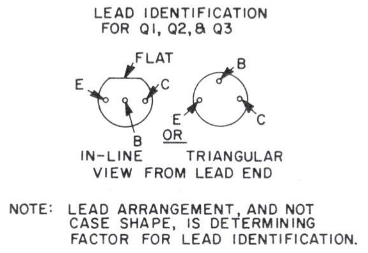


(19C320581, Sh. 2, Rev. 0)
(19C320581, Sh. 3, Rev. 0)

SOLDER SIDE



(19C320581, Sh. 2, Rev. 0)



OUTLINE DIAGRAM
MIF SWITCH (MATCHING IF'S)
MIF SWITCH/2nd CONVERTER (NON-MATCHING IF'S)
RF STEERING SWITCH

MIXER-IF-SWITCH (MATCHING IF'S)

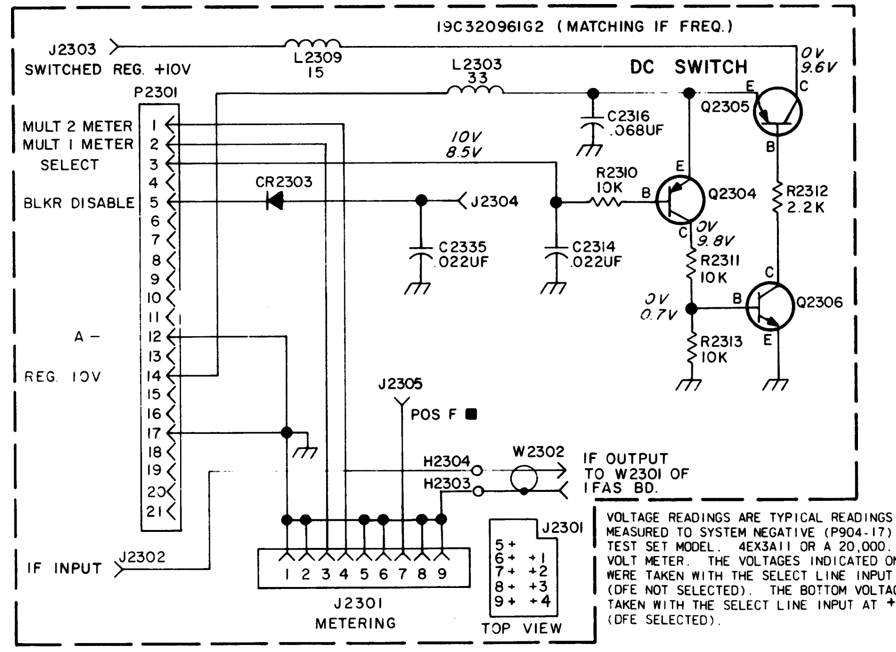
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
19C320961G2	

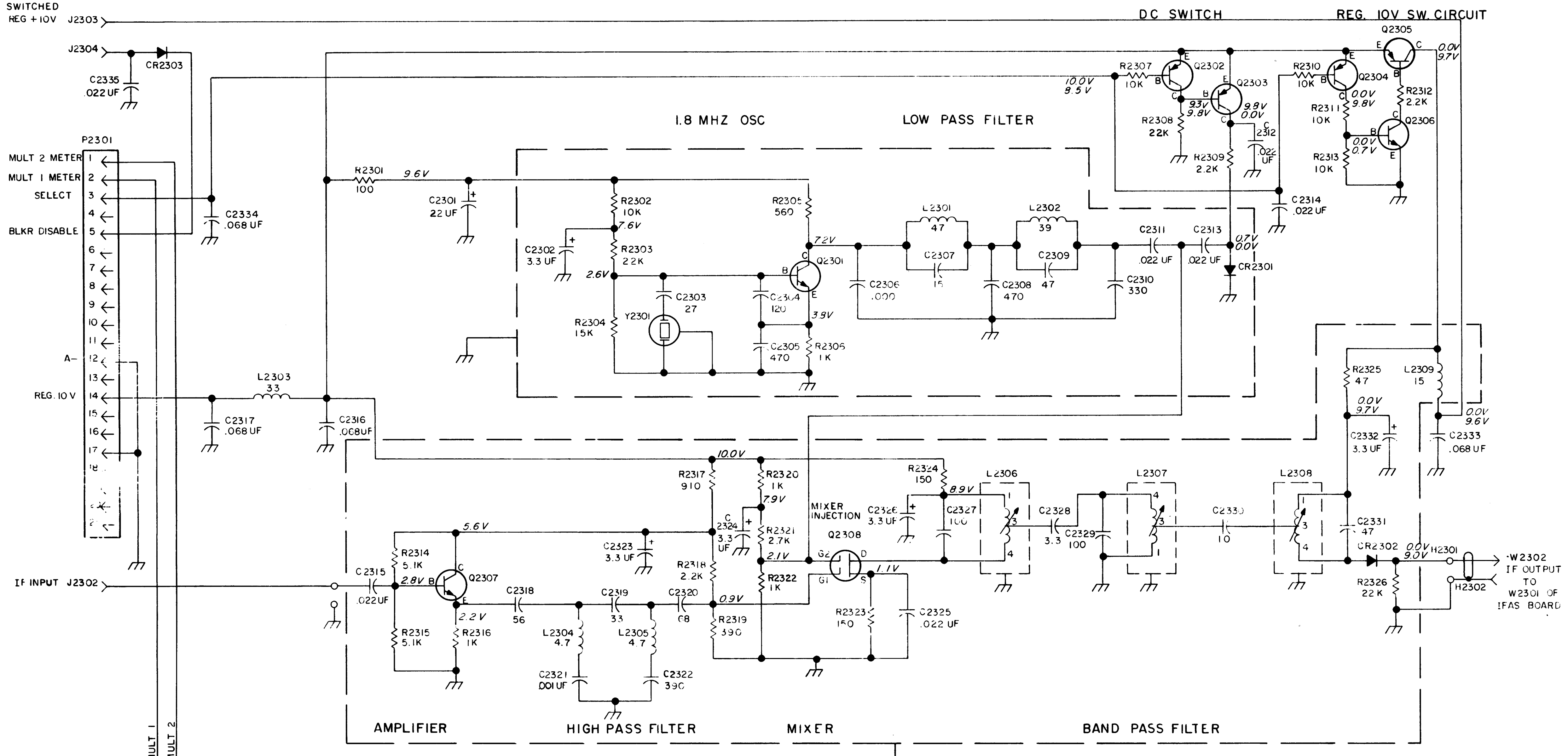
■ 25-50 MHz AND 138-174 MHz DFE NOISE BLANKER TEST POINT. 406-420 MHz AND 450-512 MHz MULT 3 TEST POINT.

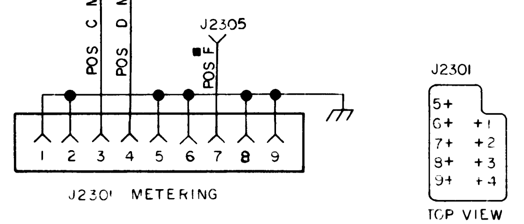


VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P904-17) WITH TEST SET MODEL. 4EX3A11 OR A 20,000. OHM PER VOLT METER. THE VOLTAGES INDICATED ON TOP WERE TAKEN WITH THE SELECT LINE INPUT AT +10V. (DFE NOT SELECTED). THE BOTTOM VOLTAGES WERE TAKEN WITH THE SELECT LINE INPUT AT +8.5 V (DFE SELECTED).

(19B226053, Rev. 2)

MIXER-IF SWITCH/2nd CONVERTER (NON-MATCHING IF'S)





SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
19C320961G1	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS

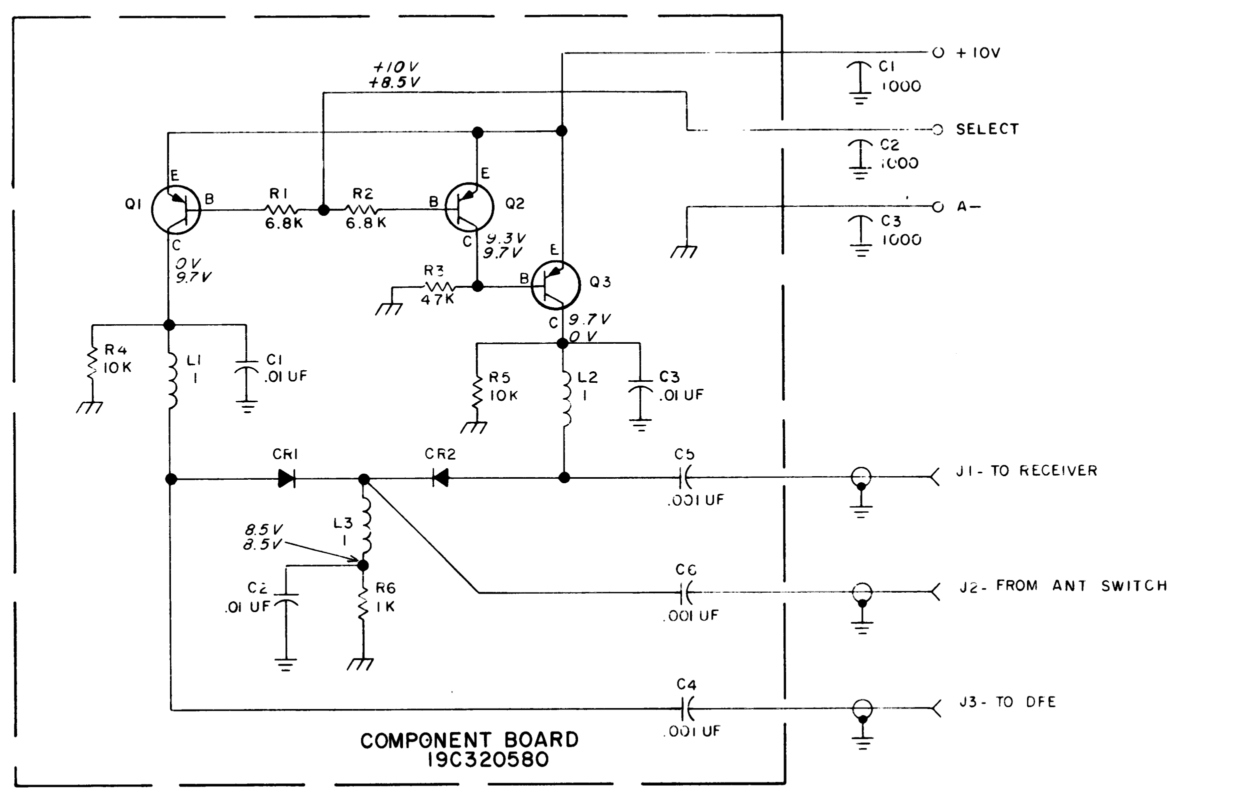
■ 25-50 MHZ AND 138-174 MHZ DFE NOISE BLANKER TEST POINT. 406-420 MHZ AND 450-512 MH7 MULT 3 TEST POINT

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P904-17) WITH TEST SET MODEL 4EX3A11, OR A 20,000 OHM PER VOLT METER. THE VOLTAGES INDICATED ON TOP WERE TAKEN WITH THE SELECT LINE INPUT AT +10V (DFE NOT SELECTED) THE BOTTOM VOLTAGES WERE TAKEN WITH THE SELECT LINE INPUT AT +8.5V (DFE SELECTED)

(19D417300, Rev. 2)

RF STEERING SWITCH



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
19C320583G1	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (A-) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER. VOLTAGES LISTED AT THE TOP ARE TAKEN WITH THE SELECT LINE IN A "HIGH STATE". THE BOTTOM VOLTAGES WERE TAKEN WITH THE SELECT LINE IN A "LOW STATE."

(19C320585, Rev. 1)

SCHEMATIC DIAGRAM

MIF SWITCH (MATCHING IF'S)
MIF SWITCH/2ND CONVERTER (NON-MATCHING IF'S)
RF STEERING SWITCH

PARTS LIST

LBI-4673

MIF SWITCH/2ND CONVERTER
(NON-MATCHING IF FREQ)
MIF SWITCH (MATCHING IF FREQ)
RF STEERING SWITCH

SYMBOL	GE PART NO.	DESCRIPTION
		MIF SWITCH/2ND CONVERTER (NON-MATCHING IF FREQ) 19C320691G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2301	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2302	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2303	7489162P13	Silver mica: 27 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2304	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2305	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C2306	5494481P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C2307	7489162P8	Silver mica: 15 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2308	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C2309	7489162P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2310	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2311 thru C2315	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C2316 and C2317	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C2318	7489162P21	Silver mica: 56 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2319	7489162P15	Silver mica: 33 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2320	7489162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2321	5494481P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C2322	7489162P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2323 and C2324	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2325	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C2326	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2327	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2328	5491601P130	Phenolic: 3.3 pf ±5%, 500 VDCW.
C2329	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2330	7489162P6	Silver mica: 10 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2331	7489162P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2332	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2333 and C2334	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C2335	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR2301	4037822P1	Silicon.
CR2302	19A116925P1	Silicon.
CR2303	19A115250P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J2301	19B219374G1	Connector: 9 contacts.
J2302 and J2303	19A116975P1	Receptacle, wire spring.
J2304 and J2305	19A116779P1	Contact, electrical: sim to Molex 08-54-0404.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L2301	7488079P69	Choke, RF: 47.0 µh ±10%, 1.10 ohms DC res max; sim to Jeffers 4424-5.
L2302	7488079P50	Choke, RF: 39.0 µh ±10%, 2.00 ohms DC res max; sim to Jeffers 4422-11.
L2303	7488079P49	Choke, RF: 33.0 µh ±10%, 1.90 ohms DC res max; sim to Jeffers 4422-10.
L2304 and L2305	19B209420P121	Coil, RF: 4.70 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4436-8.
L2306 thru L2308	19C320141G3	Coil.
L2309	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-9.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P2301	19B219594P1	Contact, electrical: 7 pins. (Quantity 3).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q2301	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q2302 thru Q2305	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q2306 and Q2307	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q2308	19A115818P1	Silicon, NPN; sim to Type 2N3772.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R2301	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R2302	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R2303	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R2304	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R2305	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R2306	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R2307	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R2308	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R2309	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R2310 and R2311	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R2312	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R2313	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R2314 and R2315	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R2316	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R2317	3R152P911J	Composition: 910 ohms ±5%, 1/4 w.
R2318	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R2319	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R2320	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R2321	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
R2322	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R2323 and R2324	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R2325	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R2326	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W2302	19B219999G1	RF: approx 18-1/4 inches long.
		- - - - - - - - - - - CRYSTALS - - - - - - - - - -
Y2301	19B226002G1	Crystal, freq: 1800 KHz.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B226048G1	Can. (Located around L2306-L2308).
	19B219554G1	Can. (Located around Y2301).
	19B219555G1	Cover. (Located over Y2301).
	19B226046P1	Cover. (Located over L2306-L2308).
	19A129424G1	Can. (Used with L2306-L2308).
	4035306P59	Washer, fiber. (Used with Y2301).
		MIF SWITCH (MATCHING IF FREQ) 19C320691G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2314	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C2316	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C2335	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR2303	19A115250P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J2301	19B219374G1	Connector: 9 contacts.
J2302 and J2303	19A116975P1	Receptacle, wire spring.
J2304 and J2305	19A116779P1	Contact, electrical: sim to Molex 08-54-0404.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L2303	7488079P49	Choke, RF: 33.0 µh ±10%, 1.90 ohms DC res max; sim to Jeffers 4422-10.
L2309	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-9.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P2301	19B219594P1	Contact, electrical: 7 pins. (Quantity 3).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q2304 and Q2305	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q2306	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R2310 and R2311	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R2312	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R2313	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W2302	19B219999G1	RF: approx 18-1/4 inches long.
		RF STEERING SWITCH 19C320583G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C3	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J3	7104941P16	Jack, phono type: coaxial.
		COMPONENT BOARD 19C320580G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C3	19A116080P101	Polyester: 0.01 µf ±20%, 50 VDCW.
C4 thru C6	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A116925P1	Silicon.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1 thru L3	19B209420P113	Coil, RF: 1.00 µh ±10%, 0.74 ohms DC res max; sim to Jeffers 4426-6.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 thru Q3	19A115852P1	Silicon, PNP; sim to Type 2N3906.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1 and R2	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R3	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R4 and R5	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R6	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B219965P1	Cover.
		ASSOCIATED ASSEMBLIES
		DUAL FRONT END INTERCONNECTION CABLE 19B219980G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1801 thru J1803		Includes:
	19A116659P22	Shell: sim to Molex 09-50-3151.
	19A116781P3	Contact, electrical. (J1801-3, 12, 14, J1802-10, 11, J1803-10, 11).
	19A116781P4	Contact electrical. (J1801-1, 2, 5, J1802-1, 2, 3, 4, 6, 7, 8, 9, 12, 13, 14, 15, J1803-1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12).
	4036634P1	Contact, electrical; sim to AMP 42428-2. (Quantity 1).
	5491689P93	RF Cable. (Located between DFE terminal of RF Steering Switch and antenna input of DFE).
	19A129694G1	RF Cable. (Located between antenna switch and antenna terminal of RF steering switch).
	19A129694G2	RF Cable. (Located between receiver terminal of RF steering switch and receiver antenna input).

 *COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ORDERING SERVICE PARTS

Each component appearing on the schematic daigram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

MAINTENANCE MANUAL

LBI-4694

DF-8411

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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