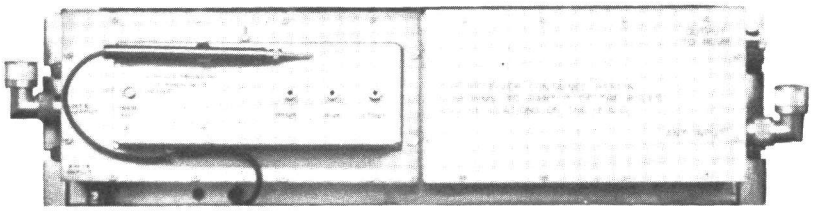
MOBILE RADIO

# MASTR Progress Line

## CONVERTER PANEL (19D413291-G1) & SIGNAL GENERATOR (19D413397-G1) FOR 960-MHz STATIONS

Maintenance Manual LBI-4082C

**********
DF-9023



CONVERTER PANEL & SIGNAL GENERATOR

## SPECIFICATIONS *

### Transmitter Converter

| | |
|---|---|
| Frequency Range | 952—960 Megahertz |
| Power Output | 10 watts (minimum) at 25 watts input |
| Temperature Range | -30°C to +60°C |

### Receiver Converter

| | |
|---|---|
| Frequency Range | 952—960 Megahertz |
| Frequency Stability | ±0.0002% |
| Temperature Range | -30°C to +60°C |

### Signal Generator

| | |
|---|---|
| Frequency Range | 952—960 Megahertz |
| Crystal Frequency | Output Frequency ÷ 72 |
| Output Levels | 1.25 μV, 10 μV, and 100 μV |
| Operating Temperature | 0°C to 40°C |
| Frequency Stability | ±0.0005% |
| Power Drain | 15 mA at 10 VDC |

*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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## DESCRIPTION

The Converter Panel with built-in Signal Generator provides both transmit and receive operation in the 952—960 megahertz range. MASTR Professional 476—480 megahertz transmitter is used as a driver, while the receiver section requires a MASTR Professional 450-megahertz receiver as an IF amplifier. Major functional sections of the converter are as follows:

1. 952—960 megahertz to 452—460 megahertz receiver converter stage.
2. 476—480 megahertz to 952—960 megahertz transmitter double stage.
3. 960 megahertz crystal controlled signal generator, for use in alignment of the receiver section of the converter.
4. For Local or Remote Control Station applications, an antenna switching relay is mounted on the rear of the converter panel.

A regulated +10 volts connects to TB2651-2 to provide power for the receiver converter and signal generator. The transmitter converter requires no external DC power source.

## CIRCUIT ANALYSIS

TRANSMITTER CONVERTER

A varactor doubler circuit converts the 480-MHz input (from the transmitter-driver) to the required 960-MHz output frequency.

The signal from the transmitter-driver is connected through W2151 to the converter. A low-pass consisting of C2151, C2152, L2151, L2152 and L2153 passes the 480-MHz signal to varactor doubler CR2151. Bias for the varactor is developed across R2151 and R2152. The doubler output is inductively coupled to a bandpass filter consisting of two tuneable 1/4 wavelength lines (C2157, L2155 and C2158, L2156) which reduce the spurious radiation. A low pass filter (C2159, L2157 and L2158), which accepts and passes 960-MHz signals, follows the bandpass filter.

For push-to-talk operation, the low pass filter output is connected through antenna relay K2651 to the antenna. Duplex operation requires separate antennas for transmit and receive or a duplexer for a signal antenna.

RECEIVER CONVERTER

A diode mixer converts the 960-megahertz input signal to the required frequency for the 450-megahertz receiver.

RF signals from the antenna connect to the receiver section of the converter at J2351. Two tuneable 1/4 wave lines (C36, L1 and C37, L2) provide RF selectivity. The output from the 1/4 wave lines is coupled through C1 to the diode mixer.

Integrated Circuit Oscillator Module (ICOM)

A General Electric ICOM module (Model

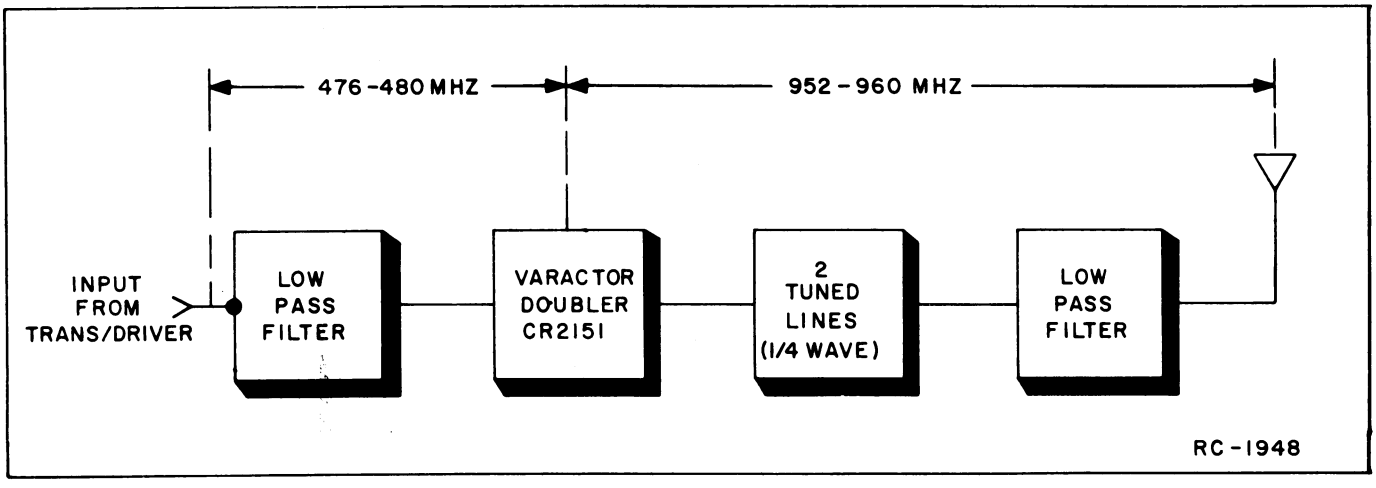


Figure 1 - Transmitter Converter Block Diagram

4EG25A13) is used as the oscillator. The ICOM module consists of a crystal-controlled Colpitts oscillator, a voltage regulator, and a buffer output stage. The entire module (including crystal) is enclosed in a dust-proof aluminum can, with the ICOM frequency and the oscillator injection frequency printed on the top. Access to the oscillator trimmer is obtained by prying off the plastic GE decal on the top of the can.

The oscillator frequency is temperature-compensated at both ends of the temperature range to provide instant frequency compensation with a frequency stability of ±0.0002% without crystal ovens or warmers.

**CAUTION**

All ICOM Modules are individually compensated at the factory and cannot be repaired in the field. Any attempt to remove the ICOM cover will void the warranty.

## Multipliers and Oscillator-Amplifier

The ICOM output is applied to the base of tripler Q2. This stage is metered at J1 on the oscillator printed wiring board. The output of Q2 is coupled through two tuned circuits (L10 and L11) to the base of Q3. Q3 also operates as a tripler and is metered at J2. The output of Q3 is coupled through L12 to the base of oscillator-amplifier Q4. L12 is tuned to nine times the ICOM frequency.

The oscillator-amplifier output is coupled through two tuned circuits (L13 and L14) to the cathode of multiplier diode CR10. The anode of CR10 connects to helical resonator L3, which is tuned by C38 to 27 times the ICOM frequency (500 MHz).

## Diode Mixer and IF Amplifier

RF from the 1/4-wave lines and the oscillator injection signal are applied to the anode of diode mixer CR1. The resulting 452- to 460-megahertz output is coupled through a helical resonator (C39 & L4) to the base of IF amplifier Q1. The output from Q1 is connected through C8 to J2352.

Potentiometer R1 adjusts the bias voltage for CR1. This control has been set at the factory for optimum performance of the diode mixer and should not be readjusted unless the diode mixer is changed.

## SIGNAL GENERATOR

The built-in 960-megahertz signal generator enables the serviceman to properly align and check performance of the 960 to 450 megahertz receiver converter.

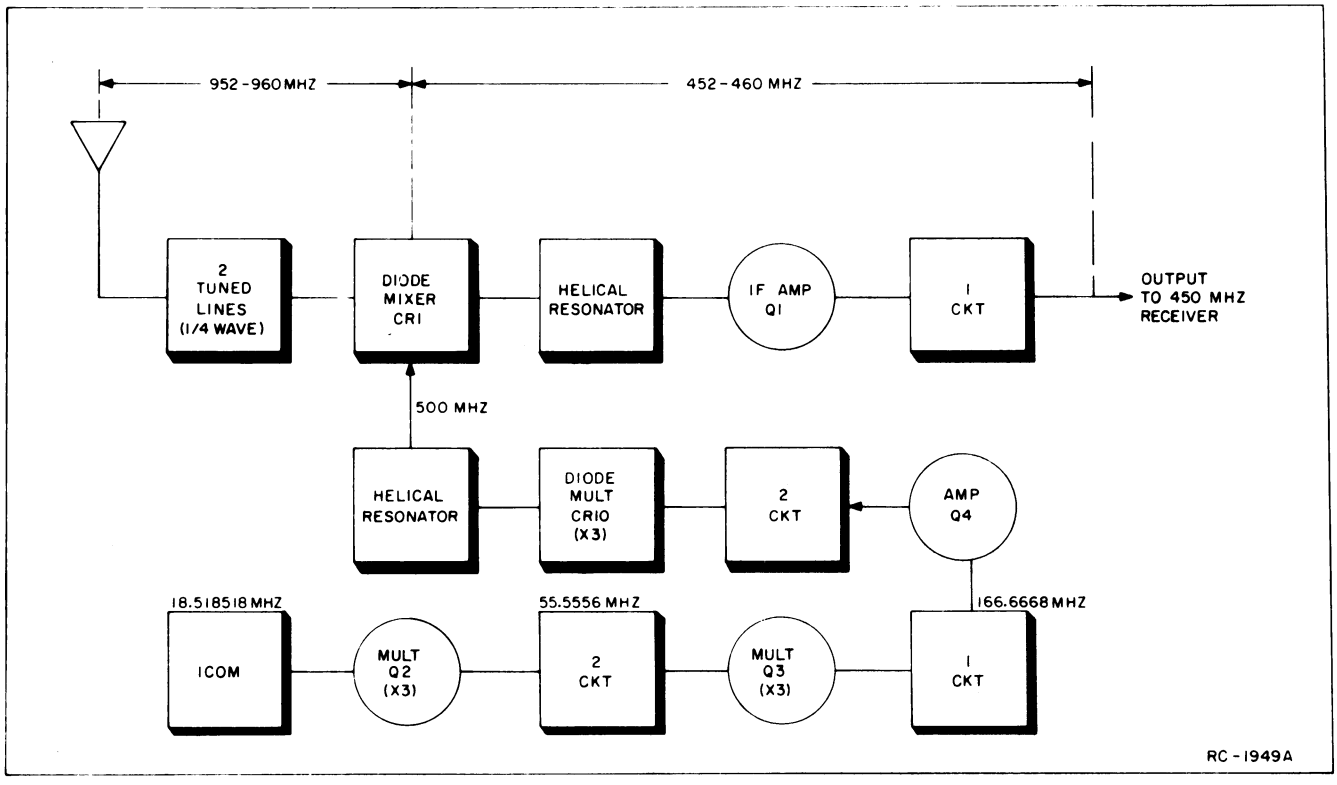


Figure 2 - Receiver Converter Block Diagram

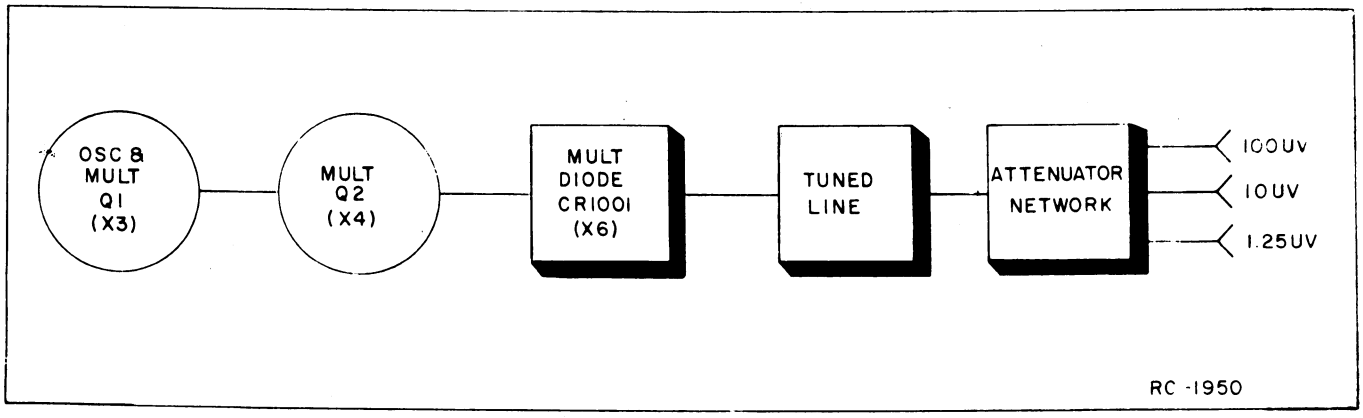


Figure 3 - Signal Generator Block Diagram

Q1 is a crystal-controlled Colpitts oscillator operating at approximately 13.33 megahertz. Trimmer capacitor C1 permits the oscillator frequency to be shifted slightly for setting the generator to the system operating frequency. Collector coil L1 is tuned to the third harmonic of the oscillator.

The signal from L1 is applied to the base of quardrupler Q2. Q2 provides an output at about 160-megahertz to drive multiplier diode CR1001 into rich harmonic output. The sixth multiple is selected by a tuned line (C1002, L1001) and the resultant 960-megahertz signal is link coupled to an attenuator network for use in servicing the receiver converter.

To operate the signal generator, connections must be made to +10 volts at J2651 and J2652 (GND) on the converter panel. Connect the red tip plug to J2651 and the black banana plug to J2652. When not in use, the red tip plug should be mounted in the clip provided on the signal generator. The black banana plug may be left connected to J2652 if desired. A test cable, with a type N connector on one end and a phone plug on the other, is provided for making connections between the signal generator output and the input of the receiver converter.

## MAINTENANCE

TROUBLESHOOTING PROCEDURE

Troubleshooting and servicing procedures for the converter panel are outlined in the following charts. Also refer to the Outline and Schematic Diagrams.

TRANSMITTER CONVERTER

| SYMPTOM | PROCEDURE |
|---|---|
| No output from the transmitter converter at J2152. | 1. Check for proper drive (25 Watts) from Transmitter/Driver Model 4ET59C42 or 4ET59C43. |
| | 2. If drive is OK, check for approximately 0.56 VDC at J2153.<br>a. If voltage is low, check bias resistors R2151 & R2152 and varactor CR2151.<br>b. If voltage is high, check tuning (see tuning procedure). |

RECEIVER CONVERTER TROUBLESHOOTING

| SYMPTOM | PROCEDURE |
|---|---|
| No output from the receiver converter. | 1. Check the supply voltage (+10 VDC) at TB2651-2.<br>2. Check antenna connections, cable and relay.<br>3. Measure voltage at J3 of oscillator/ multiplier board (should be approx- imately 1.8 VDC measured with 20,000 ohms-per-volt meter).<br>4. Measure voltages on transistor terminals (see Schematic Diagram). |
| Low Receiver Sensitivity | 1. Be sure that the associated 450—470 MHz receiver is operating properly (refer to Unit Maintenance Manual).<br>2. Make the following voltage measurements at J1-J3 on the oscillator/multiplier board using 20,000 ohms-per-volt meter.<br>J1 0.5 VDC (approx)<br>J2 1.6 VDC (approx)<br>J3 1.8 VDC 9approx)<br>3. Measure voltages on transistor terminals (see Schematic Diagram).<br>4. Check Alignment (Refer to the Receiver Converter Alignment Procedures). |

EQUIPMENT REQUIRED

1. A properly aligned transmitter/driver Model 4ET59C42 or 4ET59C43 (tuned to 1/2 of the system operating frequency).
2. Wattmeter (similar to Bird Thruline Model 43 with 30-watt element) terminated with 50 ohm, 25-watt load.
3. 20,000 ohms-per-volt multimeter with a 3-volt scale.
4. An insulated tuning tool.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Remove the 12 hex nuts securing the transmitter converter cover. Lift off cover and signal generator assembly.
2. Insert the + lead of the multimeter into J2154 and the - lead into J2153.
3. Connect wattmeter to J2152.
4. For badly misaligned transmitter converter, adjust capacitors C2153, C2153, and C2156 to minimum capacitance (fully open).

TUNING PROCEDURE

1. With the transmitter/driver (Model 4ET59C42 or 43) delivering 25 watts into J2151, tune C2154 for a maximum indication on the multimeter.
2. Tune C2153 for maximum meter indication.
3. Tune C2156 for minimum meter indication.
4. Tune C2157 for maximum meter indication.
5. Tune C2158 for minimum meter indication. (At this point an indication should be visible on the output wattmeter).
6. Tune C2157, C2158, C2153, C2154 and C2156 (in that order) for maximum power output on the wattmeter.

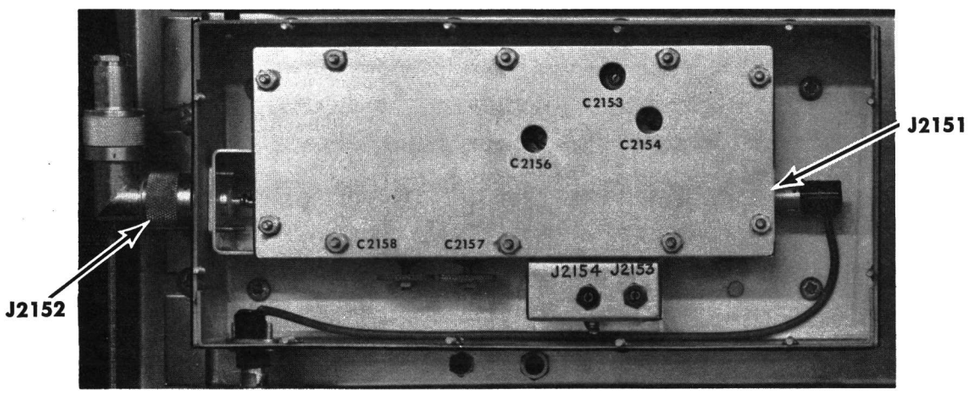


Figure 4 - Transmitter Converter (Cover Removed)

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## ICOM FREQUENCY ADJUSTMENT

Due to the high stability of the ICOM module, it is not recommended that zero discriminator be used as the indication for setting the oscillator frequency. Instead, measure the ICOM frequency as described in the following procedure.

EQUIPMENT REQUIRED:

1. Frequency Counter capable of measuring the 50—60 MHz frequency range. (The counter should have an accuracy of 0.4 part-per million.)
2. Coaxial cable with test loop as described in Figure 5.
3. Mercury thermometer.

PROCEDURE:

1. Check the ICOM temperature by taping the mercury thermometer to the side of the ICOM.
2. Connect the frequency counter to L11 (on the Osc/Mult) using the 4-turn test loop and cable shown in Figure 5.
3. If the ICOM temperature is 80°F (±4°F) or 26.5°C (±2°C), the frequency indication on the counter should be 3 times the frequency stenciled on the ICOM case. Adjust the ICOM trimmer (if necessary) to obtain this frequency.
4. If the temperature is not within the 80°F (±4°F) or 26.5°C (±2°C) range, use the correction curves of Figure 6 for setting the ICOM frequency as follows:
   a. Check the color dot beneath the GE emblem and select the matching curve to determine the correction factor in parts-per-million (PPM).
   b. Multiply the frequency stenciled on the ICOM by 3 and then multiply this figure by the correction factor (from Figure 6) observing the sign (±) given to the correction factor.
   c. The frequency measured at L11 should be 3 times the ICOM frequency ± the correction factor. Adjust the ICOM trimmer (if required) to obtain this frequency.

FOR EXAMPLE

ICOM Frequency - 18.518518
ICOM Color Dot - Green
Ambient Temperature - 35°C (95°F)
Correction Factor - -1.15 PPM
(From Figure 6)

Multiply ICOM Frequency by 3;
(18.518518 MHz x 3 = 55.555554 MHz)

Multiply preceding figure by correction factor;
(55.5555 MHz x -1.15 PPM = -63.88 hertz (or -64 hertz)

Set the frequency measured at L11 for 55.555490 MHz;

55.555554 MHz
- .000064 MHz
55.555490 MHz

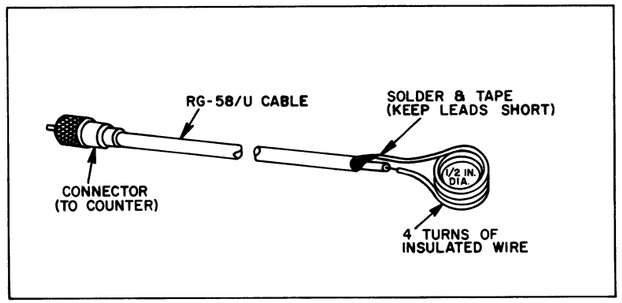



Figure 5 - Coaxial Cable and Test Loop

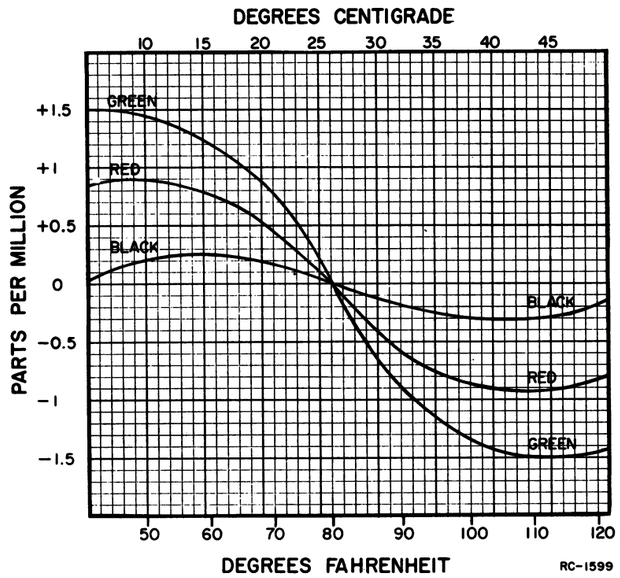



Figure 6 - ICOM Correction Curves

## RECEIVER CONVERTER ALIGNMENT

EQUIPMENT REQUIRED

1. A properly aligned 450—470 megahertz receiver (Model 4ER42H11 or 4ER42H17) tuned to the desired output frequency of the receiver converter.
2. GE Test Set Model 4EX3A10 or 4EX8K11, Station Test Meter Panel or a 20,000 ohms-per-volt multimeter.
3. AC VTVM
4. 3.5-ohm resistor (5-watts or larger).
5. Non-metallic alignment tool.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Remove the 12 hex nuts securing the receiver converter cover and lift off cover.
2. Connect the converter output (J2352) to the input of the pre-tuned receiver.
3. Insert the - lead of the test set meter (or multimeter) into J4 of the converter and the + lead into J1.
4. Connect the 3.5 ohm load resistor in place of the speaker.
5. Connect the AC VTVM in paralled with the 3.5 ohm load resistor.
6. For badly misaligned unit, perform the following steps:
   a. Adjust the plugs to the top of coils L10, L11, L12, L13 and L14.
   b. Set C36, C37, C38, and C39 to maximum counterclockwise position.

## RECEIVER CONVERTER ALIGNMENT (CON'D)

TUNING PROCEDURE

Oscillator & Multipliers

1. Tune L10 for maximum meter reading (test set meter or multimeter).
2. Tune L11 for minimum meter reading.
3. Move the + meter lead to J2. Tune L12 for maximum meter reading. Then retune L10 and L11 for maximum meter reading.
4. Move the + meter lead to J3. Tune L13 and L14 for maximum meter reading. Retune L12 for maximum meter reading.
5. Tune C38 for a slight dip on the meter.
6. Remove the meter test leads from the converter. Plug the test set into the metering jack (J442) of the 450—470 MHz receiver and set on the 1-volt scale (position B). If using multimeter, connect + lead to J442-16 and the - lead to J442-2.
7. Adjust C39 for maximum meter reading.

RF Selectivity

1. Connect power leads of the 960-MHz Signal Generator to the converter panel. The black banana plug (P1002) connects to J2652, the red tip plug (P1001) connects to J2651.
2. Connect the signal generator output to the ANT. INPUT (J2351) of the receiver converter using the test cable provided. Use the lowest output that will provide an output indication on the AC VTVM.
3. While keeping the signal input level below saturation, adjust C37, C36, C39 and C38 for best quieting on the VTVM.
4. Using the 1.25 µV output of the signal generator, readjust C36, C37, C38, C39, L13, L14, and L12 for best quieting on VTVM. It may be necessary to repeat this step several times.

NOTE

Resistor R1 is preset at the factory for optimum performance of diode mixer CR1 and should not be readjusted. If the diode mixer is replaced, realign the RF circuits and adjust R1 for best quieting.

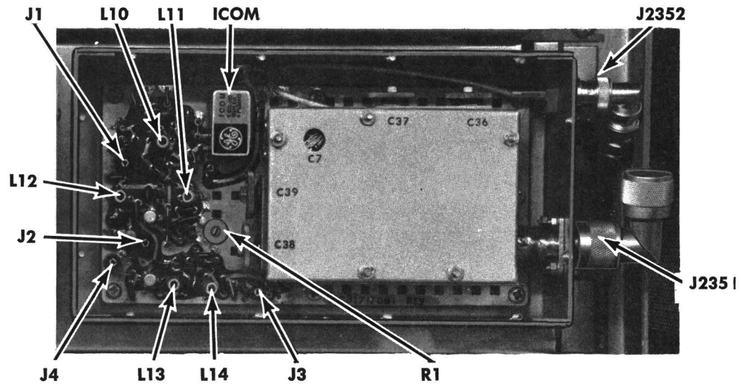



Figure 8 - Receiver Converter (Cover Removed)

## SIGNAL GENERATOR ADJUSTMENT

Check to see that the signal generator is set to the receiver frequency as follows:

1. Connect the signal generator output to the input (J2351) of the receiver converter.
2. While metering the discriminator output of the 450-MHz receiver, adjust crystal trimmer C1 for an "on frequency" discriminator indication.

Normally, the foregoing adjustment is all that is required. However, if the signal generator crystal frequency is changed it is necessary to remove the signal generator from the transmitter converter and perform the following steps.

1. Insert new crystal into XY1.
2. Set crystal trimmer C1 to mid position.
3. Turn R9 fully counterclockwise.
4. Connect a multimeter between J1 and ground, and tune L1 for maximum meter indications.
5. Move the meter lead to J2 and tune L2 for maximum meter indication.
6. Set R9 to provide the same meter reading as recorded on the case of the signal generator.
7. Connect the signal generator output to the input (J2351) of the receiver converter.
8. While metering the discriminator output of the 450-MHz receiver, adjust crystal trimmer for an "on frequency" discriminator indication.

NOTE

If multiplier diode CR1001 is changed, the signal generator should be returned to the factory for recalibration.

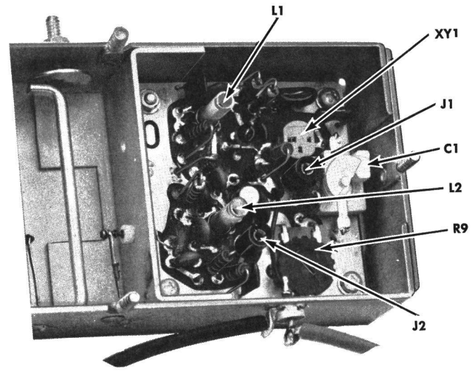
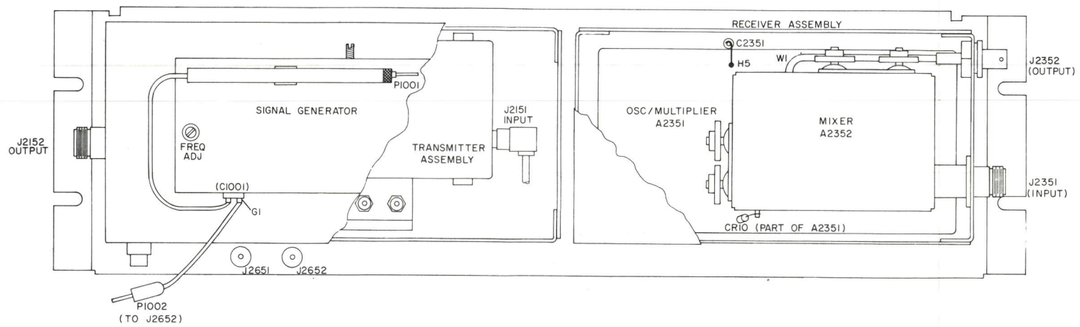
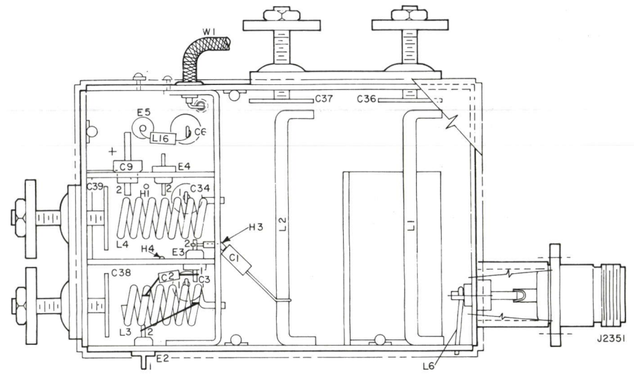



Figure 9 — Signal Generator (Component View)

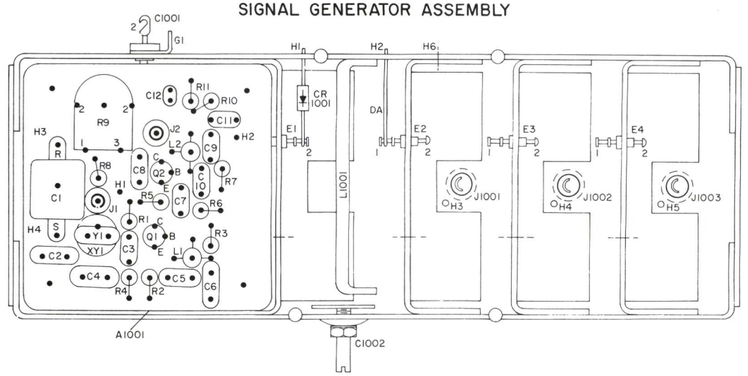
CONVERTER PANEL WITH SIGNAL GENERATOR



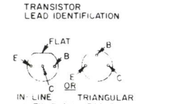

MIXER ASSEMBLY
A2352




SIGNAL GENERATOR ASSEMBLY

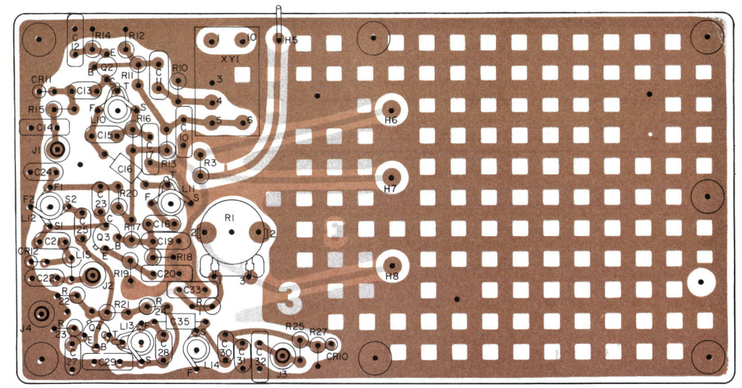



TRANSISTOR LEAD IDENTIFICATION

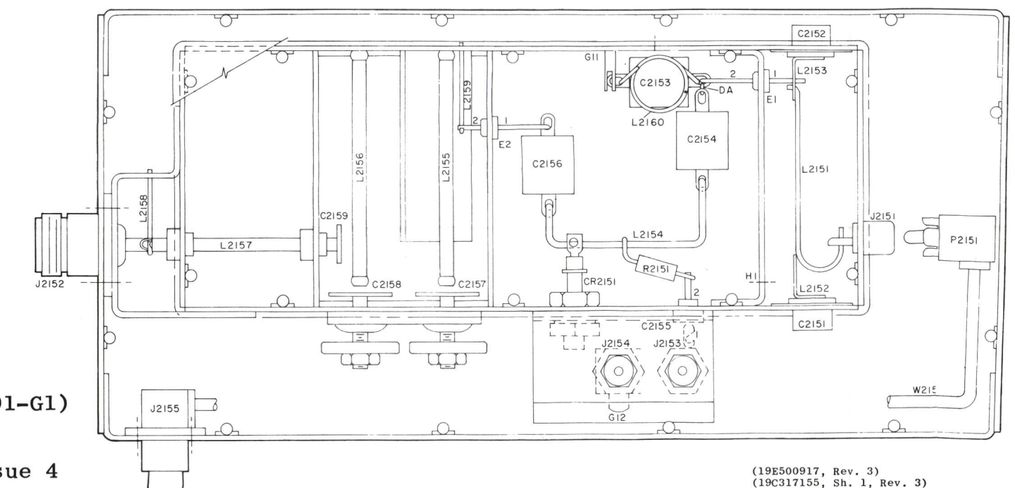



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

OSCILLATOR/MULTIPLIER ASSEMBLY
A2351

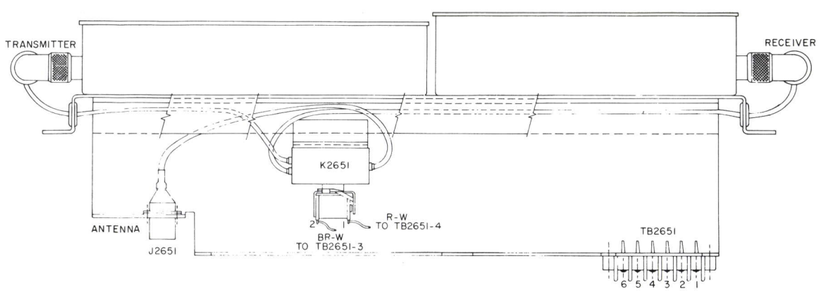



TRANSMITTER ASSEMBLY




(19E500917, Rev. 3)
(19C317155, Sh. 1, Rev. 3)
(19C317155, Sh. 2, Rev. 3)

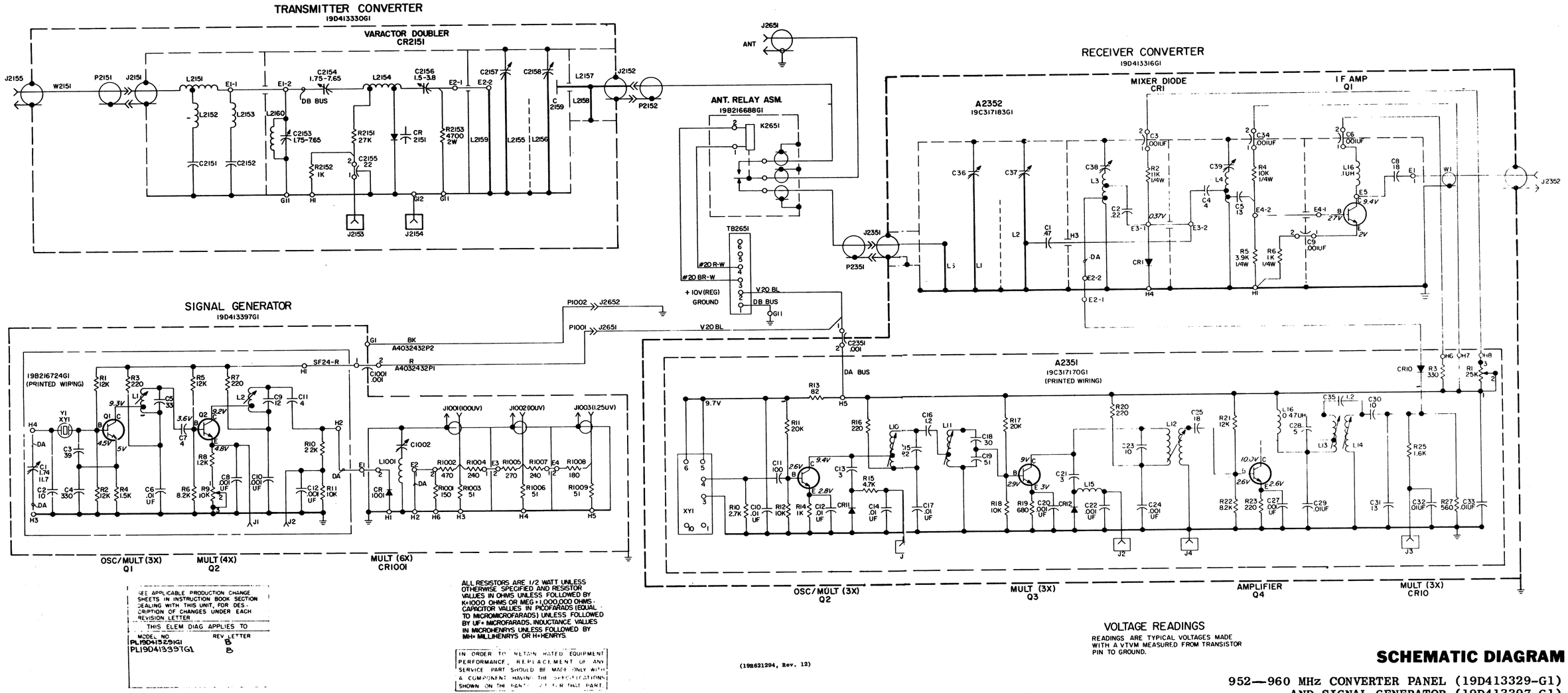
CONVERTER PANEL
(BOTTOM VIEW)




RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

## OUTLINE DIAGRAM

952—960 MHz CONVERTER PANEL (19D413291-G1) AND SIGNAL GENERATOR (19D413397-G1)




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 |
| PL19D413291G1 | B |
| PL19D413397G1 | B |

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

IN ORDER TO MAINTAIN 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.

(19B621294, Rev. 12)

VOLTAGE READINGS

READINGS ARE TYPICAL VOLTAGES MADE WITH A VTVM MEASURED FROM TRANSISTOR PIN TO GROUND.

(DF-9023)

# SCHEMATIC DIAGRAM

952—960 MHz CONVERTER PANEL (19D413329-G1)
AND SIGNAL GENERATOR (19D413397-G1)

## PARTS LIST

LBI-4083B

CONVERTER PANEL 19D413291G1
SIGNAL GENERATOR 19D413397G1
AND
ASSOCIATED ASSEMBLIES

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | CONVERTER PANEL 19D413291G1 |
| | | - - - - - - - JACKS AND RECEPTACLES - - - - - - |
| J2651 | 5490384P2 | Jack, tip: red nylon; sim to EF Johnson 105-252-1. |
| J2652 | 7868736P1 | Jack, tip: sim to EF Johnson 108-740. |
| | | - - - - - - - - TERMINAL BOARDS - - - - - - - - |
| TB2651 | 19C301086P4 | Feed-thru, phen: 6 terminals; sim to GE CR151D. |
| | | TRANSMITTER CONVERTER 19D413330G1 |
| | | - - - - - - - - - CAPACITORS - - - - - - - - - |
| C2151 and C2152 | | See Mechanical Parts (RC-1999), items 5, 6, and 7. |
| C2153 and C2154 | 19B209418P1 | Variable, air: 1.75 to 7.65 pf; sim to EF Johnson Type V. |
| C2155 | 5493392P3 | Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type S55A. |
| C2156 | 19B209418P3 | Variable, air: 1.56 to 3.8 pf; sim to EF Johnson Type V. |
| C2157 and C2158 | | See Mechanical Parts (RC-1999), items 1-4. |
| C2159 | N402P35C13 | Flatwasher: No. 4. |
| | | - - - - - - - DIODES AND RECTIFIERS - - - - - - |
| CR2151 | 19A116273P1 | Silicon. |
| | | - - - - - - - - - - TERMINALS - - - - - - - - - - |
| E1 and E2 | 4029309P1 | Terminal, feed-thru: sim to Sealectro FT-SM-27. |
| | | - - - - - - - JACKS AND RECEPTACLES - - - - - - |
| J2151 | 7104941P16 | Jack, phono type: coaxial. |
| J2152 | 7777145P5 | Receptacle: 1 female contact; sim to Amphenol 82-97 or Military UG-58A/U. |
| J2153 | 5490384P4 | Jack, tip: green nylon; sim to EF Johnson 105-254-1. |
| J2154 | 5490384P3 | Jack, tip: black nylon; sim to EF Johnson 105-253-1. |
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - - |
| L2151 | 19A127574P1 | Coil. |
| L2152 and L2153 | 7878455P2 | Terminal, lug. |
| L2154 | 19A127573P1 | Coil. |
| L2155 and L2156 | 19A127551P1 | Line coil. |
| L2157 | 19A127548P2 | Rod. |
| L2158 and L2159 | 19A115060P22 | DB bus wire: approx .0403 dia, wire size 18. |
| L2160 | 19B216954P1 | Coil. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R2151 | 3R77P273K | Composition: 27,000 ohms ±10%, 1/2 w. |
| R2152 | 3R77P102K | Composition: 1000 ohms ±10%, 1/2 w. |
| R2153 | 3R79P472K | Composition: 4700 ohms ±10%, 2 w. |
| | | - - - - - - - - - - - CABLES - - - - - - - - - - |
| W2151 | 5491689P75 | Cable, RF: approx 12 inches long. Includes J2153 and P2151. |
| | | **RECEIVER CONVERTER** 19D413316G1 |
| A2351 | | COMPONENT BOARD 19C317170G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - - |
| C10 | 19A116080P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| C11 | 5490008P27 | Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15. |
| C12 | 19A116080P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| C13 | 5496219P34 | Ceramic disc: 3.0 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. |
| C14 | 19A116080P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| C15 | 5496219P247 | Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM. |
| C16 | 7130348P5 | Molded, phen: 1.20 pf ±0.060, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32. |
| C17 | 19A116080P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| C18 | 5496219P250 | Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM. |
| C19 | 5496219P256 | Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -80 PPM. |
| C20* | 5494481P111 | Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. |
| | | Earlier than REV A: |
| | 19B209243P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| C21 | 5496219P34 | Ceramic disc: 3.0 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. |
| C22 | 5494481P111 | Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. |
| C23 | 5496219P241 | Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM. |
| C24 | 5494481P111 | Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. |
| C25 | 5496219P245 | Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM. |
| C27 | 5494481P111 | Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. |
| C28 | 5496219P236 | Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM. |
| C29 | 19A116080P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| C30 | 5496219P241 | Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM. |
| C31 | 5496219P243 | Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM. |
| C32 and C33 | 19A116080P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| C35 | 7130348P5 | Molded, phen: 1.20 pf ±0.060, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32. |
| | | - - - - - - - DIODES AND RECTIFIERS - - - - - - |
| CR10 | 19A116052P1 | Silicon. |
| CR11 | 7777146P3 | Germanium; sim to Type Hughes 1N90. |
| CR12 | 19A115250P1 | Silicon. |
| | | - - - - - - - JACKS AND RECEPTACLES - - - - - - |
| J1 thru J4 | 4037265P1 | Jack, tip: black plastic body; sim to Component Mfg Service A-1128. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - - |
| L10 and L11 | 19C303960G3 | Coil. Includes tuning slug 19B200497P2. |
| L12 | 19B205236G1 | Coil. Includes: |
| | 19B200497P2 | Tuning slug. |
| L13 | 19B205239G1 | Coil. Includes: |
| | 19B200497P2 | Tuning slug. |
| L14 | 19B205240G2 | Coil. Includes: |
| | 19B200497P2 | Tuning slug. |
| L15 | 7488079P6 | Choke, RF: 1.00 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4411-8K. |
| L16 | 7488079P4 | Choke, RF: 0.47 µh ±20%, 0.09 ohms DC res max; sim to Jeffers 4411-4M. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q2 | 19A115330P1 | Silicon, NPN. |
| Q3* and Q4* | 19A115991P1 | Silicon, NPN. |
| | | Earlier than REV A: |
| | 19A115666P1 | Silicon, NPN. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R1 | 19B209358P7 | Variable, carbon film: approx 75 to 25,000 ohms ±20%, 0.25 w; sim to CTS Type U-201. |
| R3 | 3R77P331K | Composition: 330 ohms ±10%, 1/2 w. |
| R10 | 3R77P272J | Composition: 2700 ohms ±5%, 1/2 w. |
| R11 | 3R77P203J | Composition: 20,000 ohms ±5%, 1/2 w. |
| R12 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R13 | 3R77P820K | Composition: 82 ohms ±10%, 1/2 w. |
| R14 | 3R77P102J | Composition: 1000 ohms ±5%, 1/2 w. |
| R15 | 3R77P472K | Composition: 4700 ohms ±10%, 1/2 w. |
| R16 | 3R77P221K | Composition: 220 ohms ±10%, 1/2 w. |
| R17 | 3R77P203J | Composition: 20,000 ohms ±5%, 1/2 w. |
| R18 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R19 | 3R77P681J | Composition: 680 ohms ±5%, 1/2 w. |
| R20 | 3R77P221K | Composition: 220 ohms ±10%, 1/2 w. |
| R21 | 3R77P123J | Composition: 12,000 ohms ±5%, 1/2 w. |
| R22 | 3R77P822J | Composition: 8200 ohms ±5%, 1/2 w. |
| R23 | 3R77P221J | Composition: 220 ohms ±5%, 1/2 w. |
| R24 | 3R77P221K | Composition: 220 ohms ±10%, 1/2 w. |
| R25 | 3R77P162J | Composition: 1600 ohms ±5%, 1/2 w. |
| R27 | 3R77P561J | Composition: 560 ohms ±5%, 1/2 w. |
| | | - - - - - - - - - - SOCKETS - - - - - - - - - - |
| XY1 | 19B216043G1 | Socket: 6 contacts. |
| | | OSCILLATORS |
| Y1 | 4EG25A13 | Integrated Circuit Oscillator Module (ICOM). 18.518518 MHz. |
| A2352 | | **MIXER** 19C317183G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | 7130348P1 | Molded, phen: 0.47 pf ±0.047 pf, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32. |
| C2 | 7130348P9 | Molded, phen: 0.22 pf ±0.022, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32. |
| C3 | 5493392P7 | Ceramic, stand-off: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type S55D. |
| C4 | 5496218P35 | Ceramic disc: 4.0 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| C5 | 5496218P43 | Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM. |
| C6 | 5493392P7 | Ceramic, stand-off: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type S55D. |
| C7* | 7484389P1 | Variable: 1.5-7 pf, temp coef 0 PPM; sim to Erie Style 503. Deleted by REV B. |
| C8 | 5496218P245 | Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM. |
| C9 | 5493392P7 | Ceramic, stand-off: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type S55D. |
| C34 | 5493392P7 | Ceramic, stand-off: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type S55D. |
| C36 thru C39 | | See Mechanical Parts (RC-1999), items 1-4. |
| | | - - - - - - - DIODES AND RECTIFIERS - - - - - - |
| CR1 | 19A116052P1 | Silicon. |
| | | - - - - - - - - - - TERMINALS - - - - - - - - - - |
| E1 | 4034512P3 | Terminal, feed-thru: sim to Sealectro RSF-MM-10-TUR. |
| E2 thru E4 | 4029309P1 | Terminal, feed-thru: sim to Sealectro FT-SM-27. |
| | | - - - - - - - JACKS AND RECEPTACLES - - - - - - |
| J2351 | 7777145P5 | Receptacle: 1 female contact; sim to Amphenol 82-97 or Military UG-58A/U. |
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - - |
| L1 and L2 | 19A127551P1 | Line. |
| L3 | 19A127545P1 | Coil. |
| L4 | 19A127544P1 | Coil. |
| L5* | 19A127547P1 | Strap. Deleted by REV B. |
| L6 | 19A127548P3 | Rod. |
| L16* | 19B209420P1 | Coil, RF: 0.10 µh ±5%, 0.08 ohms DC res max; sim to Jeffers 4416-1. Added by REV B. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 | 19A115991P1 | Silicon, NPN. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R2 | 3R152P113J | Composition: 11,000 ohms ±5%, 1/4 w. |
| R4 | 3R152P103J | Composition: 10,000 ohms ±5%, 1/4 w. |
| R5 | 3R152P392J | Composition: 3900 ohms ±5%, 1/4 w. |
| R6 | 3R152P102K | Composition: 1000 ohms ±10%, 1/4 w. |
| | | - - - - - - - - - - - CABLES - - - - - - - - - - |
| W1 | 19B216611G1 | Cable: approx 6 inches long. Includes receptacle (J2352). |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C2351 | 5493392P7 | Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C. |
| | | **SIGNAL GENERATOR** 19D413397G1 |
| A1001 | | COMPONENT BOARD 19B216724G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | 19B209328P4 | Variable: 1.74 to 11-7 pf, 650 v peak; sim to EF Johnson Type V 193. |
| C2 | 5490008P6 | Silver mica: 10 pf ±0.5 pf, 500 VDCW; sim to Electro Motive Type DM-15. |
| C3 | 5496219P853 | Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -1500 PPM. |
| C4 | 5490008P39 | Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| C5 | 5496219P251 | Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM. |
| C6 | 19A116080P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| C7 | 5496219P35 | Ceramic disc: 4.0 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. |
| C8 | 5494481P111 | Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. |
| C9 | 5496219P42 | Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM. |
| C10 | 5494481P111 | Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. |
| C11 | 5496219P35 | Ceramic disc: 4.0 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. |
| C12* | 19A116192P13 | Ceramic: 1000 pf ±10%, 50 VDCW; sim to Erie 8121-A050-W5R-102K. |
| | | In REV A: |
| | 5494481P111 | Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. |
| | | Earlier than REV A: |
| | 19A116080P1 | Polyester: 0.01 µf ±20%, 50 VDCW. |
| | | - - - - - - - JACKS AND RECEPTACLES - - - - - - |
| J1 and J2 | 4037265P1 | Jack, tip: black plastic body; sim to Component Mfg Service A-1128. |
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - - |
| L1 | 19C303960G3 | Coil. Includes: |
| | 19B200497P2 | Tuning slug. |
| L2 | 19B205239G1 | Coil. Includes: |
| | 19B200497P2 | Tuning slug. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 | 19A115330P1 | Silicon, NPN. |
| Q2 | 19A115925P1 | Silicon, NPN. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R1 and R2 | 3R77P123K | Composition: 12,000 ohms ±10%, 1/2 w. |
| R3 | 3R77P221K | Composition: 220 ohms ±10%, 1/2 w. |
| R4 | 3R77P152K | Composition: 1500 ohms ±10%, 1/2 w. |
| R5 | 3R77P123K | Composition: 12,000 ohms ±10%, 1/2 w. |
| R6 | 3R77P822K | Composition: 8200 ohms ±10%, 1/2 w. |
| R7 | 3R77P221K | Composition: 220 ohms ±10%, 1/2 w. |
| R8 | 3R77P122K | Composition: 1200 ohms ±10%, 1/2 w. |
| R9 | 19B209358P6 | Variable, carbon film: approx 300 to 10,000 ohms ±20%, 0.25 w; sim to CTS Type U-201. |
| R10 | 3R77P222K | Composition: 2200 ohms ±10%, 1/2 w. |
| R11 | 3R77P103K | Composition: 10,000 ohms ±10%, 1/2 w. |
| | | - - - - - - - - - - SOCKETS - - - - - - - - - - |
| XY1 | 5490277P1 | Transistor, phen: 4 contacts; sim to Elco 3303. |
| | | - - - - - - - - - - CRYSTALS - - - - - - - - - - |
| Y1 | 19B206357P1 | Quartz: 12 to 20 KHz, -30°C to 85°C. |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - - |
| C1001 | 5493392P7 | Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C. |
| C1002 | | See Mechanical Parts (RC-1999), items 2, 4, and 8 |
| | | - - - - - - - DIODES AND RECTIFIERS - - - - - - |
| CR1001* | 19A116052P1 | Silicon. |
| | | Earlier than REV A: |
| | 19A115250P1 | Silicon. |

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - - |
| L1001 | 19A127551P1 | Line. |
| | | - - - - - - - - - - - PLUGS - - - - - - - - - - |
| P1001 | 4038147P1 | Plug, tip: sim to HH Smith 382. |
| P1002 | 4032795P3 | Plug, tip: black nylon; sim to EP Johnson 108-303. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R1001 | 3R77P151J | Composition: 150 ohms ±5%, 1/2 w. |
| R1002 | 3R77P471J | Composition: 470 ohms ±5%, 1/2 w. |
| R1003 | 3R77P510J | Composition: 51 ohms ±5%, 1/2 w. |
| R1004 | 3R77P241J | Composition: 240 ohms ±5%, 1/2 w. |
| R1005 | 3R77P271J | Composition: 270 ohms ±5%, 1/2 w. |
| R1006 | 3R77P510J | Composition: 51 ohms ±5%, 1/2 w. |
| R1007 | 3R77P241J | Composition: 240 ohms ±5%, 1/2 w. |
| R1008 | 3R77P181J | Composition: 180 ohms ±5%, 1/2 w. |
| R1009 | 3R77P510J | Composition: 51 ohms ±5%, 1/2 w. |
| | | ASSOCIATED PARTS |
| K2651 | 19A127605G1 | Antenna Relay. Includes J2651, P2152 and P2351. |
| | 19B216678G1 | Antenna Cable. |
| | 19B216679G1 | Receiver Duplexer Cable. |
| | 19B216679G2 | Transmitter Duplexer Cable. |
| | 19A127597G1 | Receiver Converter Cable. |
| | 19A127595G1 | Transmitter Converter Cable. |
| | 19B216786G1 | Test Cable. (Internal Signal Generator). |
| | 19C317178G1 | Receiver Converter Cover. |
| | 19B216641G1 | Transmitter Converter Cover. |
| | 19B216640P1 | Transmitter Converter Board Cover. |
| | 19B216596P1 | Mixer Cover. |
| | 19B216641P2 | Signal Generator Cover. |
| | | MECHANICAL PARTS (SEE RC-1999) |
| 1 | 4036765G8 | Screw. |
| 2 | 7141225P3 | Nut. No. 6-32. |
| 3 | 19A127552P1 | Nut. |
| 4 | 7137968P8 | Nut, stamped: sim to Palnut T0632005. |
| 5 | 19A127163P1 | Washer. |
| 6 | 19A121006P11 | Washer, aluminum: .450 dia. |
| 7 | 19A127064P1 | Insulator. |
| 8 | 4036765G3 | Screw. |

# PRODUCTION CHANGES

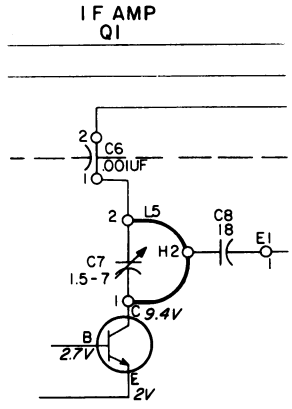
Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

RECEIVER CONVERTER 19D413316-G1

REV. A - To incorporate new transistors, and to increase oscillator injection. Changed C20, Q3 and Q4.

REV. B - To stabilize IF Amp. Deleted C7 and L5. Added L16.

SCHEMATIC DIAGRAM WAS:




RECEIVER CONVERTER ALIGNMENT WAS:

PRELIMINARY CHECKS AND ADJUSTMENTS

6-c. Set C7 so that the solder spot on the rotor is approximately 45° from the top edge of the ICOM as shown in Figure 7.

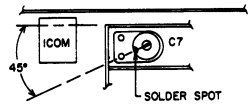



Figure 7 - Initial Setting For C7

TUNING PROCEDURE

Oscillator & Multipliers

7. Adjust C7 and C39 for maximum meter reading.

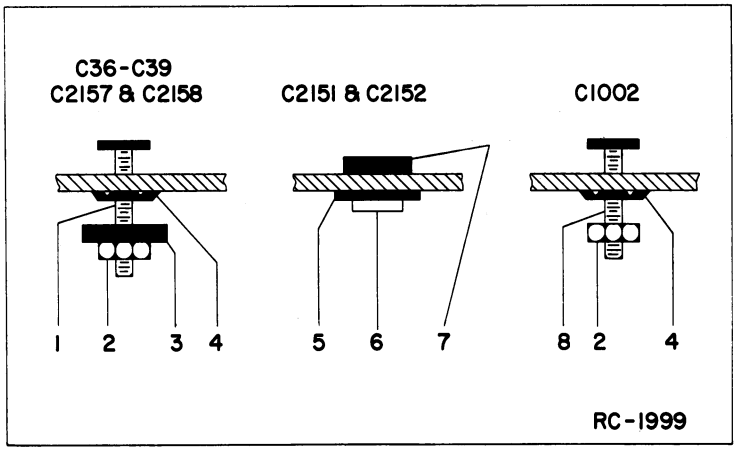
RF Selectivity

4. While applying a signal as above, adjust C7 for maximum reading on the station test meter (or multimeter).

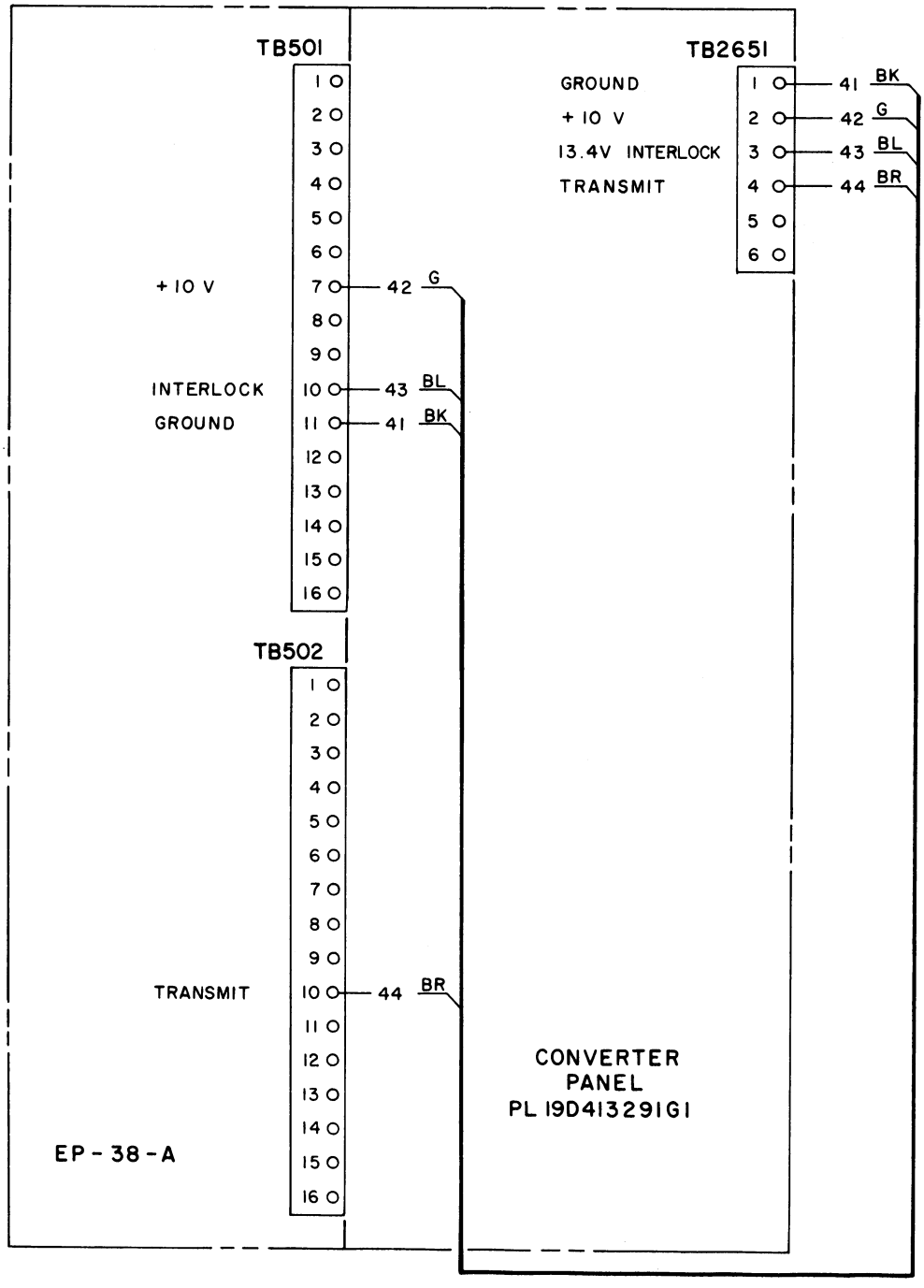
SIGNAL GENERATOR 19D413397G1

REV. A - To increase generator output. Changed CR101 and C12.

REV. B - To increase generator output. Changed C12.




960 CONVERTER UNIT




(19C317242, Rev. 1)

INSTRUCTIONS:

1. CABLES SHOULD BE CONSTRUCTED IN ACCORDANCE WITH WIRING INSTRUCTIONS 19A121850.
2. ALL WIRES ARE #16 AWG.
3. MARK WIRES IN CABLE ON BOTH ENDS WITH CORRESPONDING WIRE NUMBER USING MARKER STRIP 19B209090.
4. TERMINATE ALL WIRES WITH TERMINAL 19B209260P102.

# INTERCONNECTION DIAGRAM

OVERLAY HARNESS FOR
952—960 MHz CONVERTER PANEL

# ORDERING SERVICE PARTS

Each component appearing on the schematic diagram 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 componet
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

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These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the neareat Radio Communication Equipment Sales Office of the General Electric Company.

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**MAINTENANCE MANUAL**

LBI-4082

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

DF-9023