MOBILE RADIO

MAINTENANCE MANUAL

138—174 MHz EXCITER BOARD 19D416859G1-G4

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DESCRIPTION

This exciter for MASTR™ II uses nine transistors and one inegrated circuit to drive the PA assembly. The exciter can be equipped with up to eight Integrated Circuit Oscillator Modules (ICOMs). The ICOM crystal frequency ranges from approximately 11.5 to 14.5 megahertz, and the crystal frequency is multiplied 12 times.

Audio, supply voltages and control functions are connected from the system board to the exciter board through P902.

Centralized metering jack J103 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The test set meters the modulator, multiplier, and amplifier stages, and the regulated 10-Volts.

CIRCUIT ANALYSIS

ICOMS

Three different types of ICOMs are available for use in the exciter. 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%) compensator IC. Will not provide compensation for an EC-ICOM.

The ICOMs are enclosed in an 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 through a hole on the top of the can.

NOTE

For proper operation, be sure ICOM case makes contact with fingers on the RF shield on the exciter board. Also, the pins on the exciter bottom cover must make contact with the RF shield.

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. In single-frequency radios, a jumper from H9 to H10 in the control unit connects terminal 6 of the ICOM to A-. The oscillator is turned on by applying a keyed +10 Volts to the external oscillator load resistor.

CAUTION

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

In Standard 5 PPM radios using EC-ICOMs, at least one 5C-ICOM must be used. The 5C-ICOM is normally used in the receiver F1 position, but can be used in any

transmit or receive position. One 5C-ICOM can provide compensation for up to 15 EC-ICOMs in the transmit and receiver. Should the 5C-ICOM compensator fail in the open mode, the EC-ICOMs will still maintain 2 PPM frequency stability from 0°C to 55°C (+32°F to 131°F) due to the regulated compensation voltage (5 Volts) from the 10-Volt regulator IC. If desired, up to 16 5C-ICOMs may be used in the radio.

The 2C-ICOMs are self-compensated at 2 PPM and will not provide compensation for EC-ICOMs.

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 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 1 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.

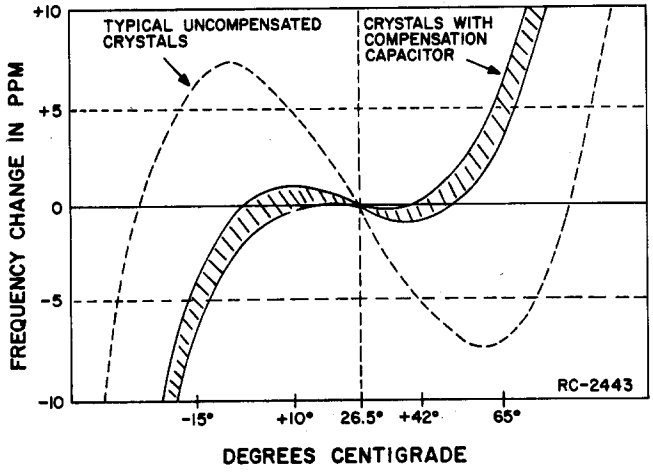

Figure 1 - Typical Crystal Characteristics

At temperatures above and below the mid-range, 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.

A constant bias of 5 Volts (provided from Regulator IC U901 in parallel with the compensator) established 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 circuit is shown in Figure 2.

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.

An increase in compensation voltage decreases the capacitance of the varactor in the oscillator, thereby 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 capacity of the varactor, decreasing the output frequency of the ICOM.

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

AUDIO IC

The transmitter audio circuitry is contained in audio IC U101. A simplified drawing of the audio IC is shown in Figure 3.

Audio from the microphone at pin 12 is coupled through pre-emphasis capacitor C1 to the base of Q1 in the operational amplifier-limiter circuit. Collector voltage for the transistorized microphone pre-amplifier is supplied from pin 11 through microphone collector load resistor R18 to pin 12.

The operational amplifier-limiter circuit consists of Q1, Q2, and Q3. Q3 provides limiting at high signal levels. The gain of the operational amplifier circuit is fixed by negative feedback through R19, R20 and the resistance in the network (Pin 9).

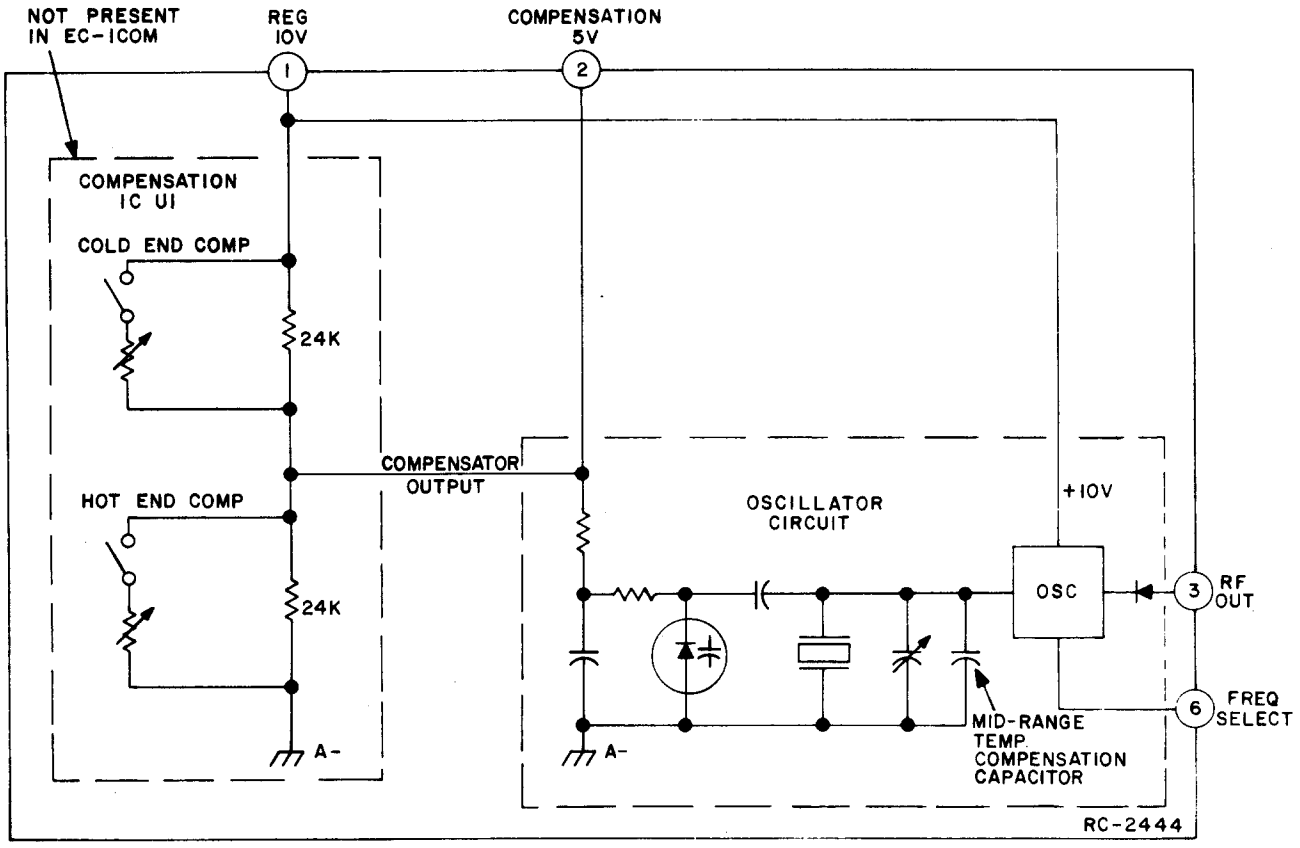

Figure 2 - Equivalent ICOM Circuit

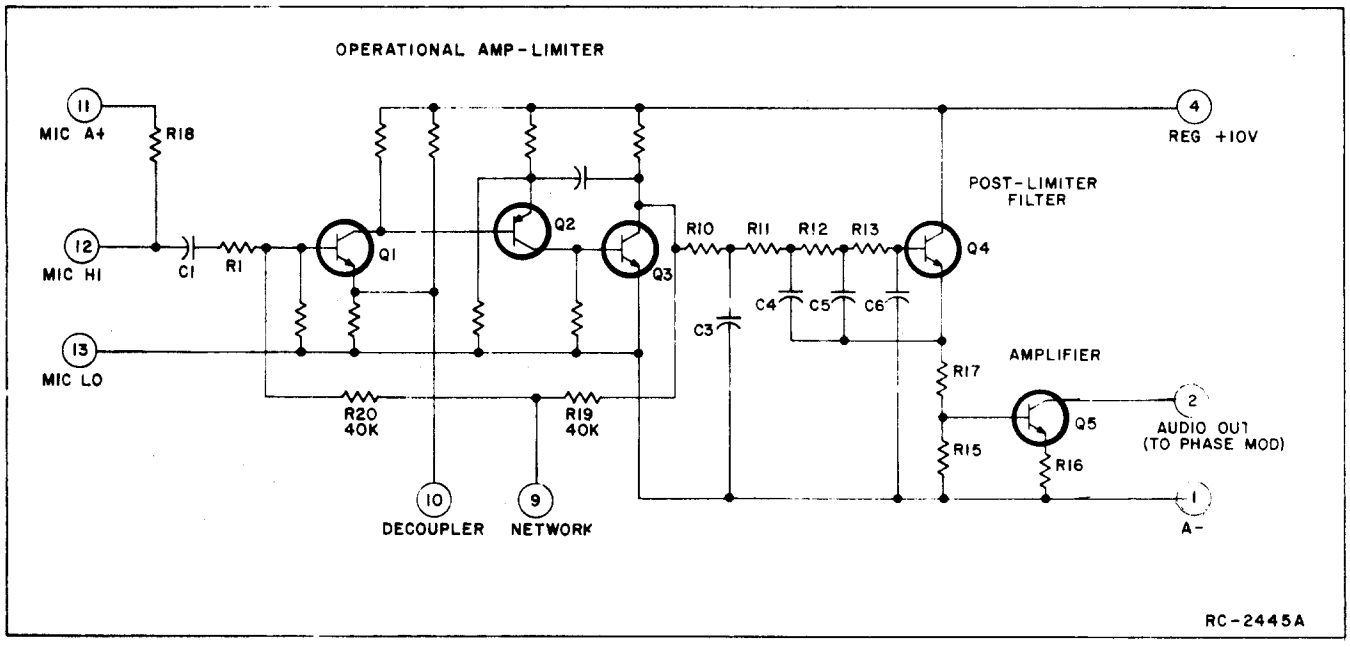

Figure 3 - Simplified Audio IC

The output of Q3 is coupled through a de-emphasis network (R10 and C3) to an active post-limiter filter consisting of C4, C5, C6, R11, R12, R13, R15, R17 and Q4.

Following the post-limiter filter is class A amplifier Q5. The output of Q5 is coupled through MOD ADJUST potentiometer R104 and resistors R108 and R125 to the phase modulators.

SERVICE NOTE: If the DC voltages to the Audio IC are correct and no audio output can be obtained, replace U101.

For radios equipped with Channel Guard, tone from the encoder is applied to the phase modulators through CHANNEL GUARD MOD ADJUST potentiometer R105, and resistors R112, R105 and R127. Instructions for setting R105 are contained in the modulation adjustment section of the Transmitter Alignment Procedure.

BUFFER, PHASE MODULATORS & AMPLIFIERS

The output at pin 3 of the selected ICOM is coupled through buffer-amplifier Q101 to the first modulator stage. The first phase modulator is varactor (voltage-variable capacitor) CV101 in series with tunable coil T101. This network appears as a series-resonant circuit to the RF output of the oscillator. An audio signal applied to the modulator circuit through blocking capacitor C107 varies the bias of CV101, resulting in a phase modulated output. A voltage divider network (R110 and R111) provides the proper bias for varactors CV101, CV102 and CV103.

The output of the first modulator is coupled through blocking capacitor C113 to the base of Class A amplifier Q102. The first modulator stage is metered through a metering network consisting of C115, R118, and CR101. Diodes CR102 and CR103 remove any amplitude modulation in the modulator output.

Following Q102 is another Class A amplifier, Q103. The output of Q103 is applied to the second modulator stage. The second modulator consists of two cascaded modulator circuits consisting of CV102, T102, T103 and CV103. Following the second modulator is a Class A amplifier, Q104. The output of the second modulator stage is metered through C123, R132, and CR104 and is applied to the base of buffer Q105. Diodes CR105 and CR106 remove any amplitude modulation in the second modulator output.

BUFFER, MULTIPLIERS & AMPLIFIER

Buffer Q105 is saturated when no RF signal is present. Applying an RF signal to Q105 provides a sawtooth waveform at its collector to drive the class C tripler, Q106. The tripler stage is metered through R138. The output of Q106 is coupled through tuned circuits T104 and T105 to the base of doubler Q107. T104 and T105 are tuned to one-fourth of the operating frequency. The doubler stage is metered through R141.

The output of Q107 is coupled through tuned circuits T106 and T107 to the base of second doubler Q108. T106 and T107 are tuned to one-half the operating frequency. Q108 is metered through R146.

The output of Q108 is coupled through three tuned circuits (T108, T109 and T110) to the base of amplifier Q109. The circuits are tuned to the transmitter operating frequency.

Q109 is a class C amplifier, and is metered through R148. The amplifier collector circuit consists of T111, C154, C155, T112, and C157, and matches the amplifier output to the input of the power amplifier assembly.

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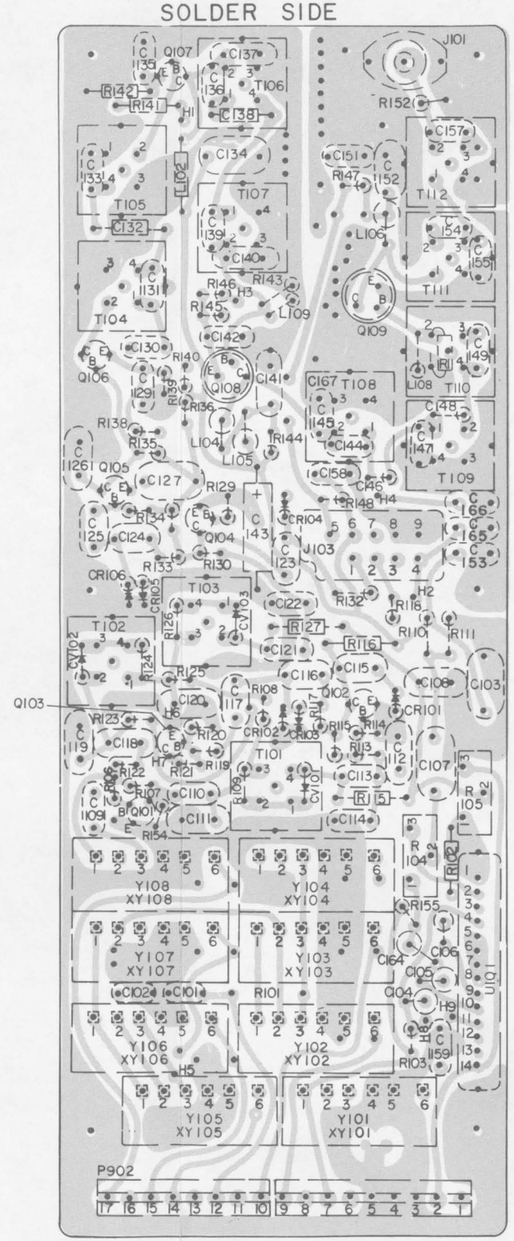
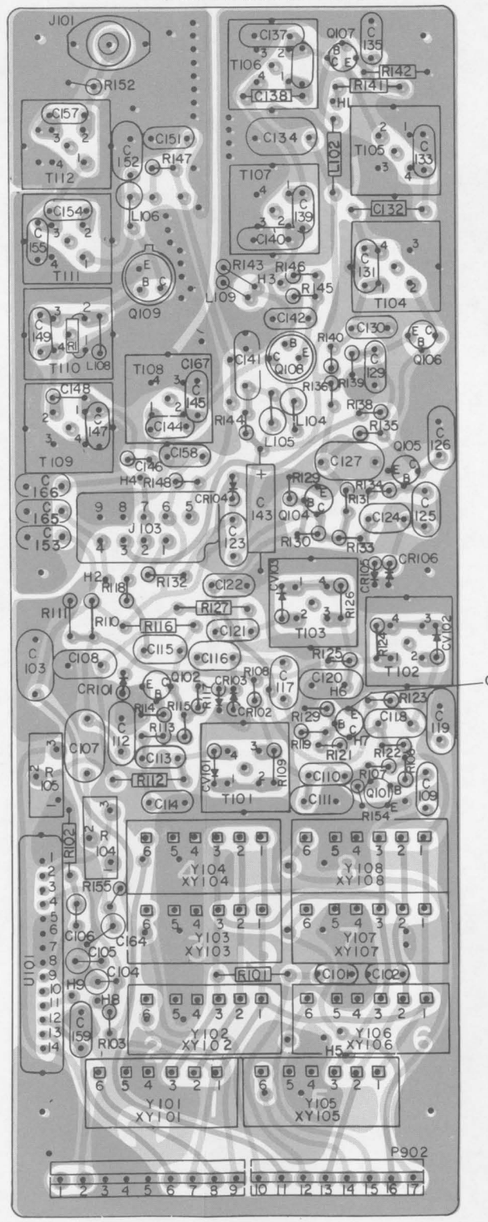
EXCITER BOARD

SOLDER SIDE



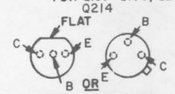
(19D423545, Sh. 2, Rev. 3)

COMPONENT SIDE



(19D423545, Sh. 2, Rev. 3)
(19D423545, Sh. 3, Rev. 2)

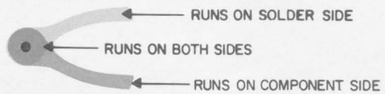
LEAD IDENTIFICATION
FOR Q101-Q109, Q208, Q213, Q214



IN-LINE TRIANGULAR

TOP VIEW

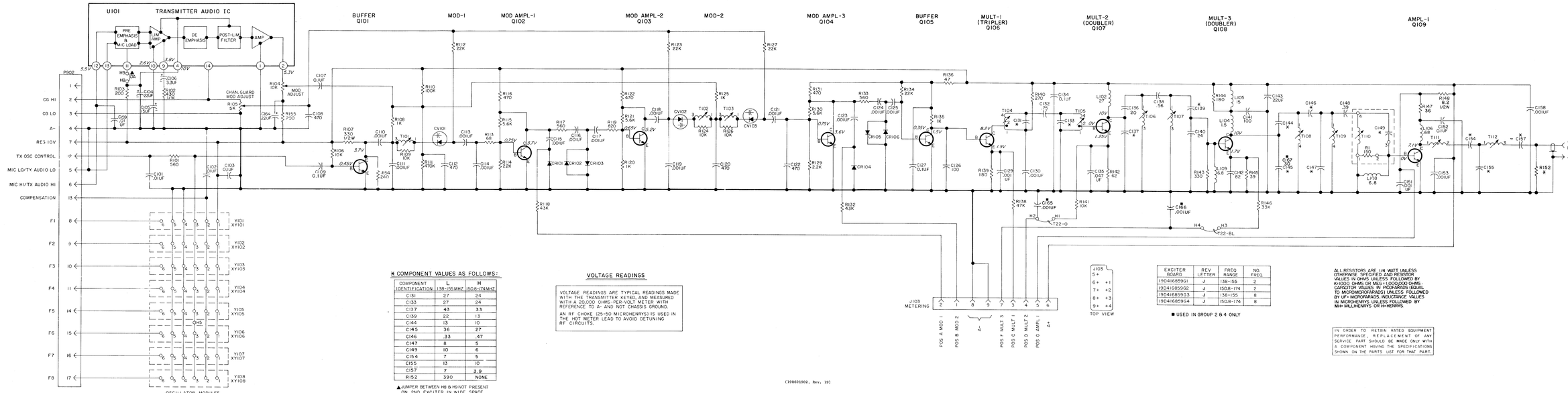
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



OUTLINE DIAGRAM

138—174 MHz, EXCITER BOARD
19D416859G1-G4

(19D424489, Rev. 1)



✱ COMPONENT VALUES AS FOLLOWS:

COMPONENT IDENTIFICATION	L	H
C131	27	24
C133	27	24
C137	43	33
C139	22	13
C144	13	10
C145	36	27
C146	33	47
C147	8	5
C149	10	6
C154	7	5
C155	13	10
C157	7	3.9
R152	390	NONE

▲JUMPER BETWEEN H8 & H9 NOT PRESENT ON 2ND. EXCITER IN WIDE SPACE XMTR COMBINATIONS.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND.

AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS.

(19B631902, Rev. 19)

EXCITER BOARD	REV LETTER	FREQ RANGE	NO. FREQ.
19D416859G1	J	138-155	2
19D416859G2	J	150.8-174	2
19D416859G3	J	138-155	8
19D416859G4	J	150.8-174	8

■ USED IN GROUP 2 & 4 ONLY

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 MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS, UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

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.

SCHEMATIC DIAGRAM

138—174 MHz, EXCITER BOARD
19D416859G1-G4

Issue 2

PARTS LIST

LBI-4554H

138-174 MHz EXCITER BOARD
19D416859G1-G4

SYMBOL	GE PART NO.	DESCRIPTION
		19D416859G1 2 FREQ 138-155 MHz (L) 19D416859G2 2 FREQ 150.8-174 MHz (H) 19D416859G3 8 FREQ 138-155 MHz (L) 19D416859G4 8 FREQ 150.8-174 MHz (H)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C101 and C102	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C103	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C104	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C105	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C106	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C107	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C108	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C109*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		In G1, G3 of REV C and earlier: In G2, G4 of REV B and earlier:
	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C110	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C111	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C112	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C113 thru C117	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C118 and C119	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C120	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C121	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C122	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C123 thru C125	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C126	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C127	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C129 and C130	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C131L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C131H	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C132*	5491601P118	Phenolic: 0.75 pf ±5%, 500 VDCW.
		Earlier than REV A:
	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C133L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C133H	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C134	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C135	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C136*	5496219P246	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C136L*	5496219P348	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -150 PPM. Deleted by REV B.
C136H*	5496219P246	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV B.
C137*	5496219P251	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV B.
		Earlier than REV A:
	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C137L*	5496219P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C137H*	5496219P251	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C138*	5491601P115	Phenolic: 0.56 pf ±5%, 500 VDCW.
		Earlier than REV A:
	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW.
C139L	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C139H	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C140	5496219P348	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -150 PPM.
C141*	5490008P127	Silver mica: 100 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
		Earlier than REV A:
	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C142	7489162P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C143	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C144L*	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
		In REV A and earlier:
	5496219P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C144H	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C145*	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV B.
		Earlier than REV A:
	5496219P246	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -80 PPM.
C145L*	5496219P252	Ceramic disc: 36 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C145H*	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B. Deleted by REV G.
C146*	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW. Deleted by REV B.
		Earlier than REV A:
	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C146L*	5491601P109	Phenolic: 0.33 pf ±5%, 500 VDCW. Added by REV B.
C146H*	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW. Added by REV B.
C147L	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C147H	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C148*	5491601P111	Phenolic: 0.39 pf ±5%, 500 VDCW.
		Earlier than REV A:
	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C149L	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C149H	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C151	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C152	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C153	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C154L	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C154H	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C155H	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C155L	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C157L	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C157H*	5491601P31	Phenolic: 3.9 pf ±10%, 500 VDCW.
		In REV F and earlier:
	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C158	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C159*	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
		In 19D416859G1, G3 of REV D and earlier: In 19D416859G2, G4 of REV C and earlier:
	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C164*	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D. Added to 19D416859G1, G3 by REV F. Added to 19D416859G2, G4 by REV E.
C165* and C166*	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV G.
C167*	5496219P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV G.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR101 thru CR106	19A115250P1	Silicon.
CV101* and CV102*	5495769P9	Silicon, capacitive: 33 pf ±10%, at 4 VDC.
		In 19D416859G1, G3 of REV D and earlier: In 19D416859G2, G4 of REV C and earlier:
	5495769P8	Silicon, capacitive: 33 pf ±20%, at 4 VDC.
CV103*	5495769P9	Silicon, capacitive: 33 pf ±10%, at 4 VDC. Added to G2, G4 by REV D; to G1, G3 by REV E.
	5495769P8	Silicon, capacitive: 33 pf ±20%, at 4 VDC. Deleted by REV B.
CV103L*	5495769P9	Silicon, capacitive: 33 pf ±10%, at 4 VDC. Added by REV B. Deleted by REV D.
CV103H*	5495769P8	Silicon, capacitive: 33 pf ±20%, at 4 VDC. Added by REV B. Deleted by REV D.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J101	19A130924G1	Receptacle, coaxial: sim to Cinch 14H11613.
J103	19B219374G1	Connector. Includes:
	19A116651P1	Contacts. (9).
		- - - - - - - - - - - INDUCTORS - - - - - - - - -
L102	19B209420P130	Coil, RF: 27.0 µh ±10%, 3.60 ohms DC res max; sim to Jeffers 441316-5.
L104	7488079P7	Choke, RF: 1.50 µh ±10%, 0.50 ohms DC res max; sim to Jeffers 4411-10K.
L105	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-9K.
L106	7488079P5	Choke, RF: 0.68 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4411-5K.
L108*	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2. Added to low split by REV B.
L109*	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2. Added by REV A.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P902		Includes:
	19B219594P2	Contact strip: 8 pins.
	19B219594P3	Contact strip: 9 pins.
		- - - - - - - - - - - TRANSISTORS - - - - - - - - -
Q101*	19A115330P1	Silicon, NPN.
		In G1, G3 of REV B and earlier: In G2, G4 of REV A and earlier:
	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q102 thru Q106	19A115330P1	Silicon, NPN.
Q107	19A115328P1	Silicon, NPN.
Q108*	19A115329P2	Silicon, NPN.
		Earlier than REV A:
	19A115329P1	Silicon, NPN.
Q109*	19A116868P1	Silicon, NPN; sim to Type 2N4427.
		In REV A-H:
	19A115329P2	Silicon, NPN.
		Earlier than REV A:
	19A115329P1	Silicon, NPN.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R101	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R102*	3R152P431J	Composition: 430 ohms ±5%, 1/4 w.
		In 19D416859G1, G3 of REV F and earlier: In 19D416859G2, G4 of REV E and earlier:
	3R152P391K	Composition: 390 ohms ±10%, 1/4 w.
R103*	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
		In 19D416859G1, G3 of REV D and earlier: In 19D416859G2, G4 of REV C and earlier:
	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R104	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R105*	19B209358P105	Variable, carbon film: approx 200 to 5000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
		In 19D416859G1, G3 of REV D and earlier: In 19D416859G2, G4 of REV C and earlier:
	19B209358P108	Variable, carbon film: approx 2000 to 50,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R106*	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
		In G1, G3 of REV B and earlier: In G2, G4 of REV A and earlier:
	3R152P393K	Composition: 39,000 ohms ±10%, 1/4 w.
R107*	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
		In 19D416859G1, G3 of REV E and earlier: In 19D416859G2, G4 of REV D and earlier:
	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R108	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R109	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R110	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R111	3R152P474K	Composition: 0.47 megohm ±10%, 1/4 w.
R112	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R113	3R152P680K	Composition: 68 ohms ±10%, 1/4 w.
R114	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R115	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R116	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R117	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R118	3R152P433J	Composition: 43,000 ohms ±5%, 1/4 w.
R119	3R152P821K	Composition: 820 ohms ±10%, 1/4 w.
R120	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R121	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R122	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R123	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R124	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R125	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R126	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R127	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R129	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R130	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R131	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R132	3R152P433J	Composition: 43,000 ohms ±5%, 1/4 w.
R133	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R134*	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
		Earlier than REV A:
	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R135	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R136	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R138	3R152P473K	Composition: 47,000 ohms ±10%, 1/4 w.
R139*	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
		Earlier than REV A:
	3R152P301J	Composition: 300 ohms ±5%, 1/4 w.
R140	3R152P271K	Composition: 270 ohms ±10%, 1/4 w.
R141	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R142	3R152P620J	Composition: 62 ohms ±5%, 1/4 w.
R143	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R144*	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
		Earlier than REV A:
	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R145*	3R152P390K	Composition: 39 ohms ±10%, 1/4 w.
		Earlier than REV A:
	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R146	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R147*	3R152P360J	Composition: 36 ohms ±5%, 1/4 w.
		In REV H and earlier:
	3R152P200J	Composition: 20 ohms ±5%, 1/4 w.
R148*	7147161P42	Composition: 8.2 ohms ±5%, 1/2 w.
		In REV H and earlier:
	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R152*	3R152P391K	Composition: 390 ohms ±10%, 1/4 w. Added by REV B.
R154*	3R152P241J	Composition: 240 ohms ±5%, 1/4 w. Added to 19D416859G1, G3 by REV E. Added to 19D416859G2, G4 by REV D.
R155*	3R152P201J	Composition: 200 ohms ±5%, 1/4 w. Added to 19D416859G1, G3 by REV F. Added to 19D416859G2, G4 by REV E.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T101*	19D416843G10	Coil. Includes:
	5493185P12	Tuning slug.
		In REV G and earlier:
	19D416843G9	Coil. Includes:
	5493185P12	Tuning slug.
T102 and T103	19D416843G1	Coil. Includes:
	5493185P12	Tuning slug.
T104	19D416843G3	Coil. Includes:
	5493185P12	Tuning slug.
T105	19D416843G2	Coil. Includes:
	5493185P12	Tuning slug.
T106 and T107	19D416843G7	Coil. Includes:
	5493185P12	Tuning slug.
T108 and T109	19D416843G5	Coil. Includes:
	5493185P13	Tuning slug.
T110		COIL ASSEMBLY 19D416843G8
		- - - - - - - - - - - RESISTORS - - - - - - - -
R1	3R152P151K	Composition: 150 ohms ±10%, 1/4 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	5493185P13	Tuning slug.
T111	19D416843G4	Coil. Includes:
	5493185P12	Tuning slug.
T112	19D416843G6	Coil. Includes:
	5493185P12	Tuning slug.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U101	19D416542G2	Audio Transmitter.
		- - - - - - - - - - - SOCKETS - - - - - - - - - - -
XY101 thru XY108		Socket. Part of Mechanical Construction. Includes:
	19A116779P1	Contact, electrical: sim to Molex 08-54-0404. Quantity (6) with each.
		- - - - - - - - - - - OSCILLATORS - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency.
		ICOM Freq = Operating Frequency / 12
Y101 thru Y108	19A129393G17	Externally compensated, ±5 PPM, 138-174 MHz.
Y101 thru Y108	19A129393G14	Internally compensated, ±2 PPM, 138-174 MHz.
		MECHANICAL PARTS
	19A129424G2	Can. (Used with T101-T112).
	4036555P1	Insulator, washer: nylon. (Used with Q108, Q109).
	19B227611G1	Exciter PA Interconnecting Cable. (Used in G2, G4 only).

*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 - Exciter Board 19D416859G1, G4

To improve operation. Changed C132, C137, C138, C141, C145, C148, R134, R139. R144, R145, Q108, Q109, and added L109.

REV. B - Exciter Board 19D416859G1, G3

To improve operation. Deleted C136L. Changed C136H, C137, C144L, C145, C146, CV103 and added C137L, C145L, C146L, C103L, L108 and R152.

REV. C - Exciter Board 19D416859G1, G3

To improve drive to modulator stage. Changed Q101 and R106.

REV. D - To Exciter Board 19D416859G1, G3

To reduce transmitter noise. Changed C109.

REV. B - Exciter Board 19D416859G2, G4

To improve drive to modulator stage. Changed Q101 and R106.

REV. C - Exciter Board 19D416859G2, G4

To reduce transmitter noise. Changed C109.

REV. D - Exciter Board 19D416859G2,4
REV. E - Exciter Board 19D416859G13

To improve operation. Changed CV101, CV102, CV103, C159, and R105. Added R154.

REV. E - Exciter Board 19D416859G2,4
REV. F - Exciter Board 19D416859G1,3

To reduce attenuation noise and improve operation. Changed R107. Added C164 and R155.

REV. F - Exciter Board 19D416859G2, 4
REV. G - Exciter Board 19D416859G1, 3

To increase audio sensitivity. Changed R102.

REV. G - Exciter Board 19D416859G2, 4

To reduce conducted spurious in transmitter output. Delete C145H. Added C165, C166 and C167.

REV. H - Exciter Board 19D416859G1-4

To improve band-end tuning. Changed T101 from 19D416843G9 to 19D416843G10

REV. J - Exciter Board 19D416859G1-4

To increase RF power output. Changed Q109, R147 and R148.