LBI30618A
(DF3165)

MAINTENANCE MANUAL

66—88 MHz MASTR® II EXCITER BOARD 19D424762G1, G2

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CIRCUIT ANALYSIS

The exciter uses six transistors and two integrated circuits 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 11.0 to 14.67 megahertz, and is multiplied six times (divided by 2 and multiplied by 12 for a multiplication factor of six). Two exciter board groups are used. The Group 1 exciter board operates over a frequency range of 66-78 MHz (crystal frequencies are 11-13 MHz). Group 2 exciter boards operate over a frequency range of 77-88 MHz (crystal frequencies are 12.84-14.6 MHz).

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.

The exciter assembly is DC insulated from vehicle ground to permit operation in positive or negative ground vehicles.

Three different types of ICOMs are available for use in the exciter. Each ICOM 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 a dust-proof, 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 in the top of the can.

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. RF bypassing is provided for all unused keying leads on eight frequency radios. On two frequency radios, the six unused keying leads are shorted to ground.

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.

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.

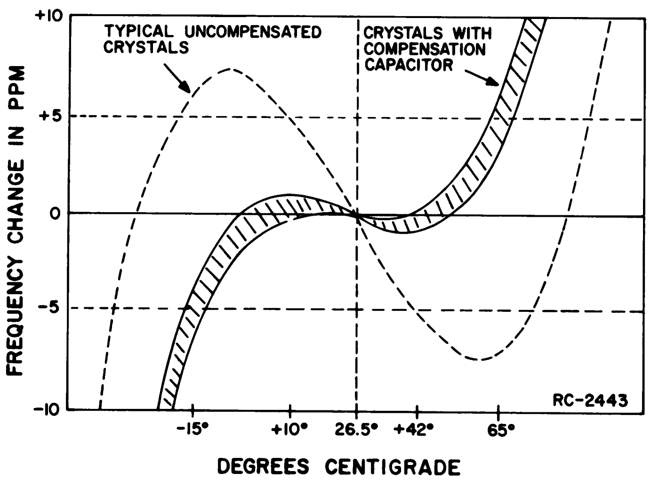

Figure 1 - Typical Crystal Characteristics

At temperatures above and below 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 by System Board Regulator IC U901) 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 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.

The increase in compensation voltage decreases the capacity 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 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 preamplifier 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 R126.

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 R106 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 R117 and R121. Instructions for setting R105 are contained in the Modulation Level

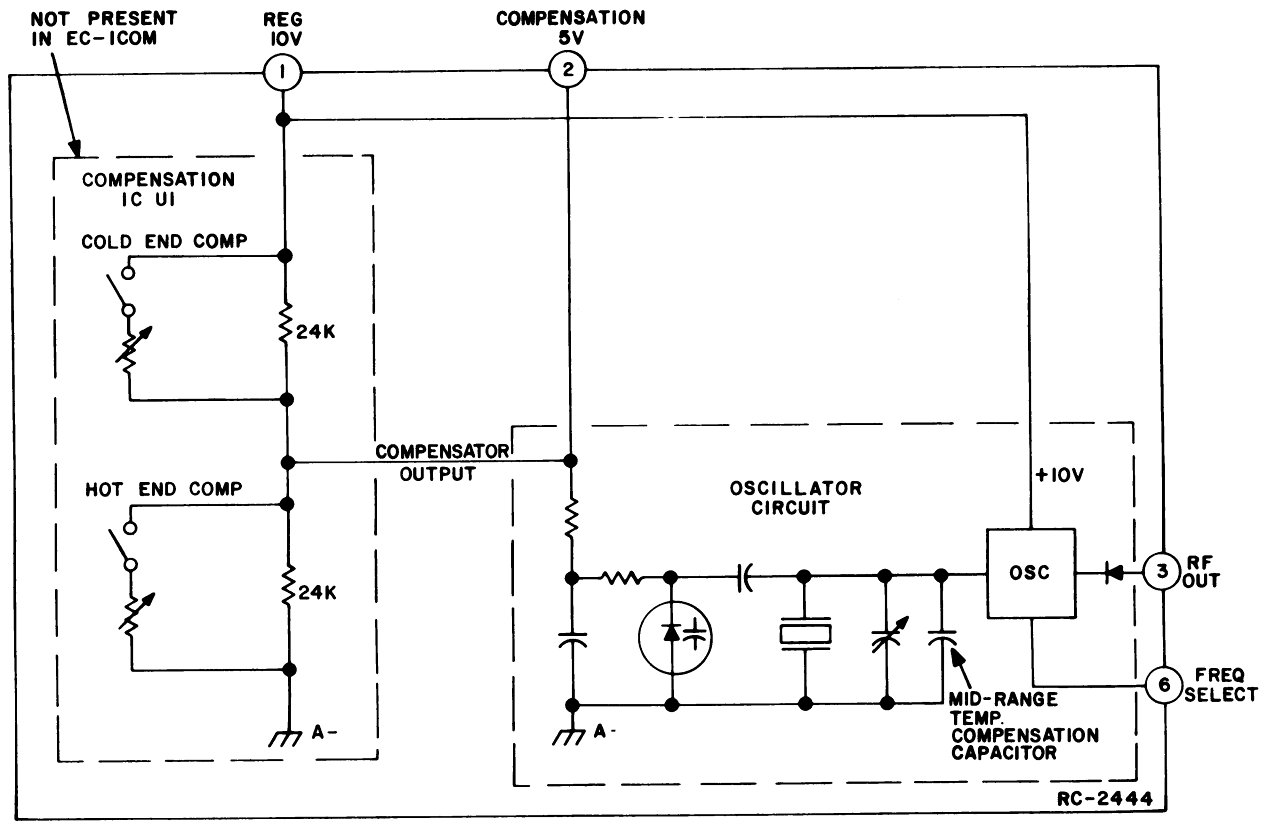

Figure 2 - Equivalent ICOM Circuit

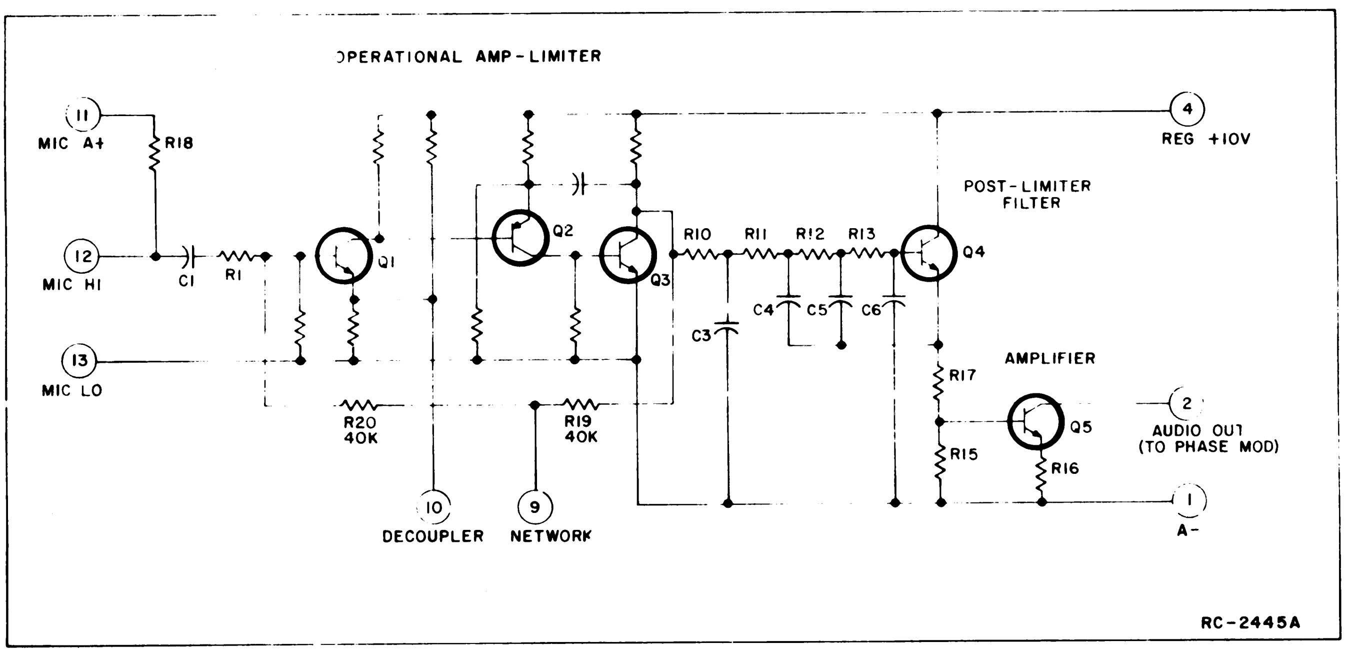

Figure 3 - Simplified Audio IC

Adjustment section of the Transmitter Alignment Procedure.

FREQUENCY DIVIDER IC

The output at pin 3 of the selected ICOM is coupled through buffer amplifier Q101 to frequency divider U102. U102 divides the oscillator frequency by 2.

When the transmitter is not keyed, Q101 is saturated (turned on) with its collector voltage near zero. Keying the transmitter turns on one of the ICOMs and its output turns Q101 off and on once each cycle. As Q101 turns on during each cycle, the drop in collector voltage causes the flip-flop to change state. Assume the flip-flop was in the "0" state (the output at "Q" near A-). The first cycle of the oscillator output causes it to switch to the "1" state (output at "Q" approximately 5 Volts). The second cycle will cause the flip-flop to switch back to the "0" state. Therefore, it requires two oscillator cycles to switch the flip-flop through one complete cycle from "0" to "1" and back to "0".

If U102 were operating into a pure resistive load, its output would be a square wave. However, the modulator circuit presents a tuned load to the IC, so that harmonics are filtered out and the waveform at the junction of C113 and C114 (modulator input) is essentially a sine wave at one-half the oscillator frequency. The output of the frequency divider is coupled through DC blocking capacitor C113 to the first modulator stage.

BUFFER & PHASE MODULATOR

The first phase modulator consists of varactor (voltage-variable capacitor) CR101 in series with tunable coil L101. 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 CR101 and CR102 resulting in a phase modulated output. A voltage divider network (R108 and R113) provides the proper bias for varactors CR101 and CR102.

The output of the modulator is coupled through blocking capacitor C116 to the base of buffer Q102.

MULTIPLIERS & AMPLIFIER

Buffer Q102 is saturated when no RF signal is present. Applying an RF signal to Q102 generates a sawtooth waveform at its collector to drive class C tripler, Q103. The tripler stage is metered through R124. The output of Q103 is coupled through tuned circuits T101 and T102 to the base of doubler Q104. T101 and T102 are tuned to one-fourth of the operating frequency. The doubler stage is metered through R127.

The output of Q104 is coupled through tuned circuits T103 and T104 to the base of second doubler Q105. T103 and T104 are tuned to one-half the operating frequency. Q105 is metered through R132.

The output of Q105 is coupled through two tuned circuits (T105 and T106) to the base of amplifier Q106. These circuits are tuned to the transmitter operating frequency.

Q106 is a class C amplifier and is metered through R135. The amplifier collector circuit consists of T107, T108, and C143 through C148 and matches the amplifier output to the input of the power amplifier assembly. The exciter provides a minimum of 300 milliwatts of RF power to the power amplifier through J101 and cable W216.

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

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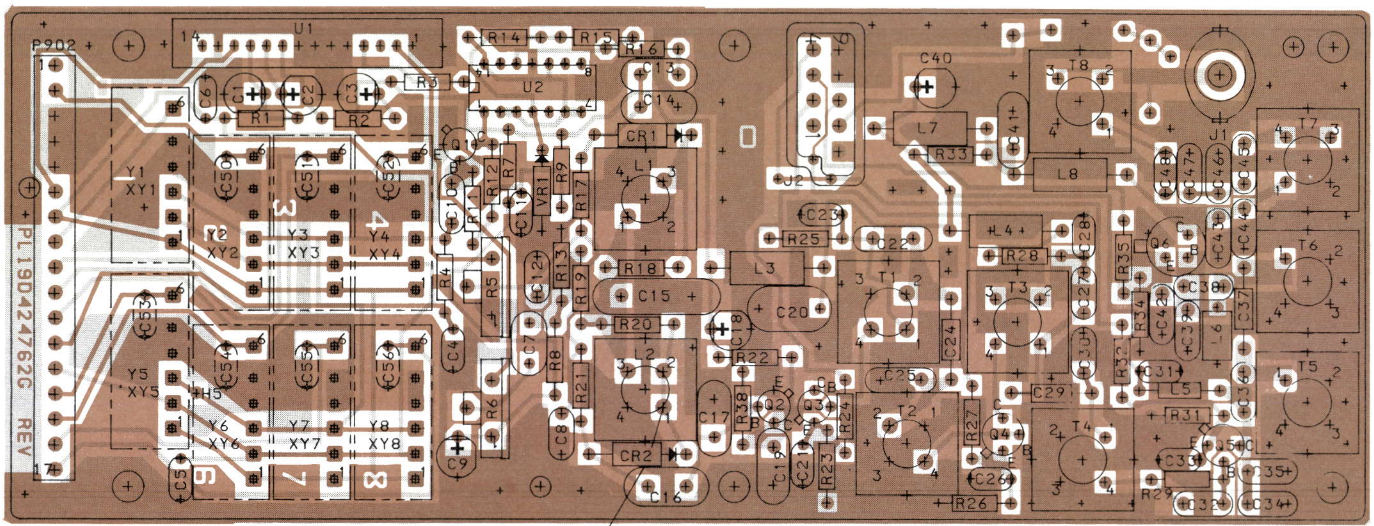
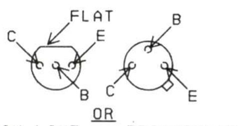


COLOR DOT ON BASE OF COIL IDENTIFIES PIN 1 ON L1, L2, T1 AND T2.

LEAD IDENTIFICATION FOR Q1 THRU Q5



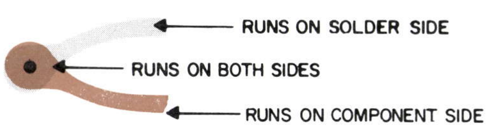
IN-LINE TRIANGULAR

TOP VIEW

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

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 100 SERIES. EXAMPLE: C1-C101, R1-R101, ETC. EXCEPT P902.

(19D424764, Rev. 1)
(19B227956, Sh. 1, Rev. 1)
(19B227956, Sh. 2, Rev. 0)



OUTLINE DIAGRAM

66—88 MHz EXCITER BOARD
19D424762G1, 2

NOTES
1. ■ IN EIGHT FREQUENCY EXCITERS, CAPACITORS C150-C156 ARE CLIPPED OUT AS REQUIRED TO MEET THE CUSTOMER REQUIREMENTS FOR FREQUENCIES. EXAMPLE: IF CUSTOMER WANTS ICOMS FOR F1,F2,F5 AND F7 THEN CAPACITOR C150,C153 AND C155 ARE CLIPPED OUT. C151,C152,C154, AND C156 ARE LEFT IN.
2. H5 IS FOR 12 FREQ. JUMPER CONNECTION.

* COMPONENT VALUES

SYMBOL	L	H
	66-78 MHZ	77-88 MHZ
C116	680	510
C117	330	270
C119	150	120
C122	33	20
C125	33	20
C127	33	24
C129	1.0	.82
C130	33	24
C134	43	18
C136	22	18
C138	20	15
C139	51	36
C143	43	20
C144	43	24
C145	33	20
C146	43	33
C147	47	15
C148	20	18

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.

(19R622292, Rev. 3)

MODEL NO	REV LETTER	FREQUENCY
PL19D424762G1	A	68-78 MHZ
PL19D424762G2	A	77-88 MHZ

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.

SCHEMATIC DIAGRAM

66—88 MHz EXCITER BOARD
19D424762G1, 2

Issue 2

PARTS LIST

LBI30620A

66-88 MHz EXCITER BOARD
19D424762G1 66-78 MHz (L)
19D424762G2 77-88 MHz (H)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - CAPACITORS - - - - - - - - - -
C101	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C102	19A134202P8	Tantalum: 15 µf ±20%, 20 VDCW.
C103	19A134202P5	Tantalum: 3.3 µf ±20%, 15 VDCW.
C104 thru C106	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C107	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C108	19A116655P12	Ceramic disc: 330 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C109	19A134202±	TNTALUM: 22 µf ±20%, 15 VDCW.
C110	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C111	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C112	19A116655P12	Ceramic disc: 330 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C113 and C114	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C115	7147203P14	Silver mica: 1800 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-20.
C116L	7489162P47	Silver mica: 680 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C116H	7489162P44	Silver mica: 510 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C117L	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C117H	7489162P7	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C118	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C119L	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C119H	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C120	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C121	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C122L	19A116656P33J1	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -150 PPM.
C122H	19A116656P20J0	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM.
C123	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C124	5491601P111	Phenolic: 0.39 pf ±5%, 500 VDCW.
C125L	19A116656P33J1	Ceramic disc: 33 pf±5%, 500 VDCW, temp coef -150 PPM.
C125H	19A116656P20J0	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM.
C126	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C127L	19A116656P33J1	Ceramic disc: 33 pf±5%, 500 VDCW, temp coef -150 PPM.
C127H	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C128	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C129L	5491601P120	Phenolic: 1.0 pf ±5%, 500 VDCW.
C129H	5491601P119	Phenolic: 0.82 pf ±5%, 500 VDCW.
C130L	19A116656P33J1	Ceramic disc: 33 pf±5%, 500 VDCW, temp coef -150 PPM.
C130H	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C131	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C132	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C133	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C134L	19A116656P43J2	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -220 PPM.
C134H	19A116656P18J0	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef 0 PPM.
C135	19A116656P39J2	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -220 PPM.
C136L	19A116656P22J0	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef 0 PPM.
C136H	19A116656P18J0	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef 0 PPM.
C137	5491601P115	Phenolic: 0.56 pf ±5%, 500 VDCW.
C138L	19A116656P20J0	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM.
C138H	19A116656P15J0	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef 0 PPM.
C139L	19A116656P51J2	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -220 PPM.
C139H	19A116656P36J2	Ceramic disc: 36 pf ±5%, 500 VDCW, temp coef -220 PPM.
C140	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C141	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C142	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C143L	19A116656P43J2	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -220 PPM.
C143H	19A116656P20J0	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM.
C144L	19A116656P43J2	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef 0 PPM.
C144H	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -150 PPM.
C145L	19A116656P33J1	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -150 PPM.
C145H	19A116656P20J0	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM.
C146L	19A116656P43J2	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -220 PPM.
C146H	19A116656P33J1	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -150 PPM.
C147L	19A116656P47J2	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -220 PPM.
C147H	19A116656P15J0	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef 0 PPM.
C148L	19A116656P20J0	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM.
C148H	19A116656P18J0	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef 0 PPM.
C149 thru C156	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR101 and CR102	5495769P12	Diode, silicon.
CR103	19A115250P1	Silicon.
		- - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J101	19A130924G1	Connector, receptacle: coaxial, jack type; sim to Cinch 14H11613.
J102	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - - INDUCTORS - - - - - - - - - -
L101L	19C321810G2	Coil.
L101H	19C321810G3	Coil.
L102L	19C321810G2	Coil.
L102H	19C321810G3	Coil.
L103	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L104	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-9K.
L105	19B209420P114	Coil, RF: 1.20 µh ±10%, 0.18 ohms DC res max; sim to Jeffers 4436-1K.
L106	19A129773G1	Coil.
L107	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; im to Jeffers 4421-7K.
L108	7488079P6	Choke, RF: 1.00 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4411-8K.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P902	19A116659P8	Connector, printed wiring: 17 contacts; sim to Molex 09-64-1172.
		- - - - - - - - - - - TRANSISTORS - - - - - - - - -
Q101 thru Q103	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q104 and Q105	19A115328P1	Silicon, NPN.
Q106	19A116868P1	Silicon, NPN; sim to Type 2N4427.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R101	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R102	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R103	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R104	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R105	19B209358P108	Variable, carbon film: approx 2K to 50K ohms ±10%, 0.25 w; sim to CTS Type X-201.
R106	19B209358P106	Variable, carbon film: approx 300 to 10K ohms ±10%, 0.25 w; sim to CTS Type X-201.
R107	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R108	3R152P104J	Composition: 100K ohms ±5%, 1/4 w.
R109	3R152P680J	Composition: 68 ohms ±5%, 1/4 w.
R111	3R152P393J	Composition: 39K ohms ±5%, 1/4 w.
R112	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R113	3R152P474J	Composition: 470K ohms ±5%, 1/4 w.
R114 and R115	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R116	3R152P221J	Composition: 220 ohms ±5%, 1/4 w.
R117	3R152P223J	Composition: 22K ohms ±5%, 1/4 w.
R118	3R152P153J	Composition: 15K ohms ±5%, 1/4 w.
R119	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R120	3R152P683J	Composition: 68K ohms ±5%, 1/4 w.
R121	3R152P223J	Composition: 22K ohms ±5%, 1/4 w.
R122	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R123	3R152P181J	Composiifel 180 ohms ±5%, 1/4 w.
R124	3R152P683J	Composition: 68K ohms ±5%, 1/4 w.
R125	3R152P330J	Composition: 33 ohms ±5%, 1/4 w.
R126	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R127	3R152P333J	Composition: 33K ohms ±5%, 1/4 w.
R128	3R152P220J	Composition: 22 ohms ±5%, 1/4 w.
R129	3R152P100J	Composition: 10 ohms ±5%, 1/4 w.
R131	3R152P121J	Composition: 120 ohms ±5%, 1/4 w.
R132	3R152P683J	Composition: 68K ohms ±5%, 1/4 w.
R133	3R152P560J	Composition: 56 ohms ±5%, 1/4 w.
R134	3R152P150J	Composition: 15 ohms ±5%, 1/4 w.
R135	3R152P333J	Composition: 33K ohms ±5%, 1/4 w.
R136	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R137	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R138	3R152P152J	Composition: 1.5K ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T101 and T102	19D416635G5	Coil. Includes:
	5493185P13	Tuning slug.
T103	19C307170P301	Coil, RF: variable, wire size No. 20 AWG; sim to Paul Smith Co. Sample No. 082874-WS-2.
T104	19C307170P302	Coil, RF: variable, wire size No. 20 AWG; sim to Paul Smith Co. Sample No. 082874-WS-6.
T105 thru T108	19C307170P303	Coil, RF: variable, wire size No. 20 AWG; sim to Paul Smith Co. Sample No. 071774-OG-6.
		- - - - - - - - - - - - TUBES - - - - - - - - - - -
U101	19D416542G2	Transmitter, audio.
U102	19A116842P1	Digital, High Speed TTL: Dual J-K Master-Slave Flip Flop; sim to 54H73.
		- - - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR101	4036887P56	Zener: 500 mW, 5.0 v. nominal.
		- - - - - - - - - - - SOCKETS - - - - - - - - - - - -
XY101 thru XY108	19A116779P1	Contact, electrical: sim to Molex 08-50-0404. (Quantity 6 each).
		- - - - - - - - - - - OSCILLATORS - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency.
		ICOM Freq = $\frac{\text{Operating Frequency}}{6}$
Y101 thru Y108	19A129393G39	Externally compensated: ±5 PPM, 66-88 MHz.
Y101 thru Y108	19A129393G38	Internally compensated: ±2 PPM, 66-88 MHz.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A129424G2	Can. (Used with L101, L102, T101-T108).
	4036555P1	Insulator, washer: nylon. (Used with Q106).

*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 19D424762G1, G2
Delete Test Point "G". Deleted C149, CR103, R134 and R137.