MAINTENANCE MANUAL
806-825 MHz OSCILLATOR-MULTIPLIER BOARD 19D423194G1

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DESCRIPTION

The Oscillator-Multiplier board (OSC-Mult) for MASTR® II station contains an Integrated circuit Oscillator Module (ICOM) The ICOM crystal frequencies range from approximately l5.85 to 16.25 megahertz, and the crystal frequency is multiplied 48 times to provide a low side injection frequency is multiplied 48 times to provide a low side injection frequency to the mixer.

CIRCUIT ANALYSIS

1 PPM ICOM (Y401)

The quartz crystal used in the ICOM exhibits the traditional "S" curve characteristics of output frequency versus operating temperature. Rated stability (±1 PPM) of the ICOM is maintained over a temperature range of -30C° to +85°C.

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 l 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.

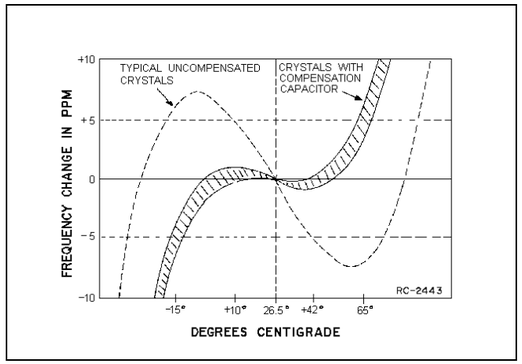

Figure 1 - Typical Crystal Characteristics

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.

Com-Net Ericsson Critical Radio Systems, Inc.
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Compensator Circuits

The ICOM is 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 below 55°C. The hot end compensation circuit consists of two branches; the first branch is activated at +55°C and the second branch is activated at +70°C so that both branches are now operating. At temperatures above these activation points, the equivalent resistance decreases thereby decreasing the compensation voltage. This increases the capacitance of the varicap thus reducing the output frequency of the ICOM.

SERVICE NOTE: Proper ICOM operation is dependent on the closely-controlled input voltages from the l0-Volt regulator. Should the ICOM shift off frequency, check the l0-Volt regulator module or check output of the ICOM.

CAUTION

The 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.

MULTIPLIERS & AMPLIFIERS

The output of the ICOM Y401 is coupled through a tuned circuit (L401) that is tuned to four times the crystal frequency. The output of the tuned circuit is applied to the base of the Class C doubler Q401. The tuned collector circuit (L403) of the doubler is tuned to two times the input to the base (8 X crystal).

Following the doubler is a Class A Amplifier stage, Q402. The amplified output of Q402 is applied to the base of trippler Q403. The output of Q403 is metered across the Emitter resistor R412 through a metering network consisting of R422, C415 and R421, and applied to receiver metering jack J601 through P903-14. The tuned collector circuit (Z401) of the trippler Q403 is tuned to three times the input to the base (24 X crystal).

Following the trippler Q403 is a class A Ampli-fier stage, Q404. The tuned collector circuit (Z402) is tuned to the same frequency as the input to the Base. The tuned circuits provide some selectivity in the Oscillator-Multiplier chain. The amplified output of Q404 is applied to the base of the second doubler Q405. The output of Q405 is metered through a metering network consisting of C428, C431, CR403 and R418 and applied to receiver metering jack J601 through P402. The output of the second doubler Q405 is tuned to two times the input to the base (48 X crystal), this output is applied through W401 to J302 on the RF Assembly.

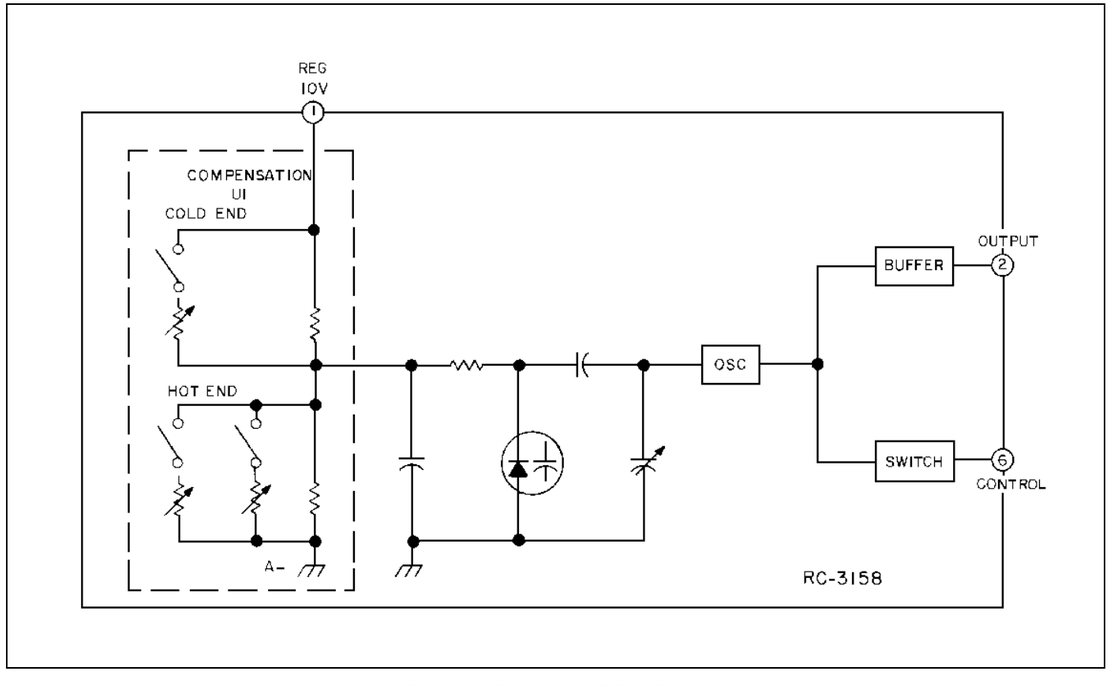
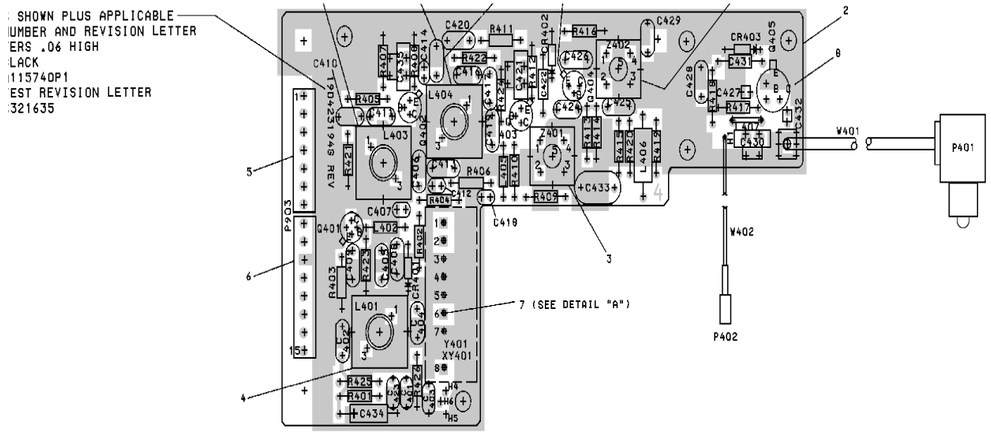


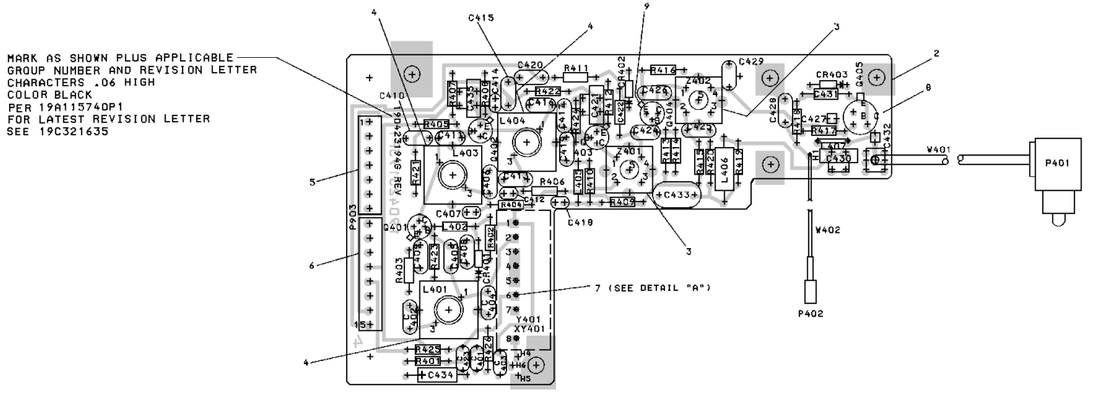
Figure 2 - Equivalent ICOM Circuit

COMPONENT SIDE



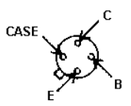
(19D432194, Sh. 1, Rev. 3)
(19C321504, Sh. 1, Rev. 4)

SOLDER SIDE



(19D432194, Sh. 1, Rev. 3)
(19C321504, Sh. 2, Rev. 4)

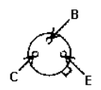
LEAD IDENTIFICATION
FOR Q401



TOP VIEW

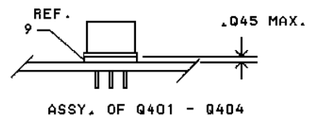
NOTE : LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION

LEAD IDENTIFICATION
FOR Q402 THRU Q405

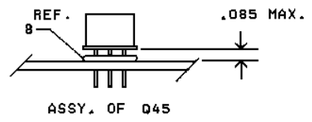


TOP VIEW

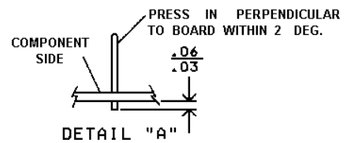
NOTE : LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION



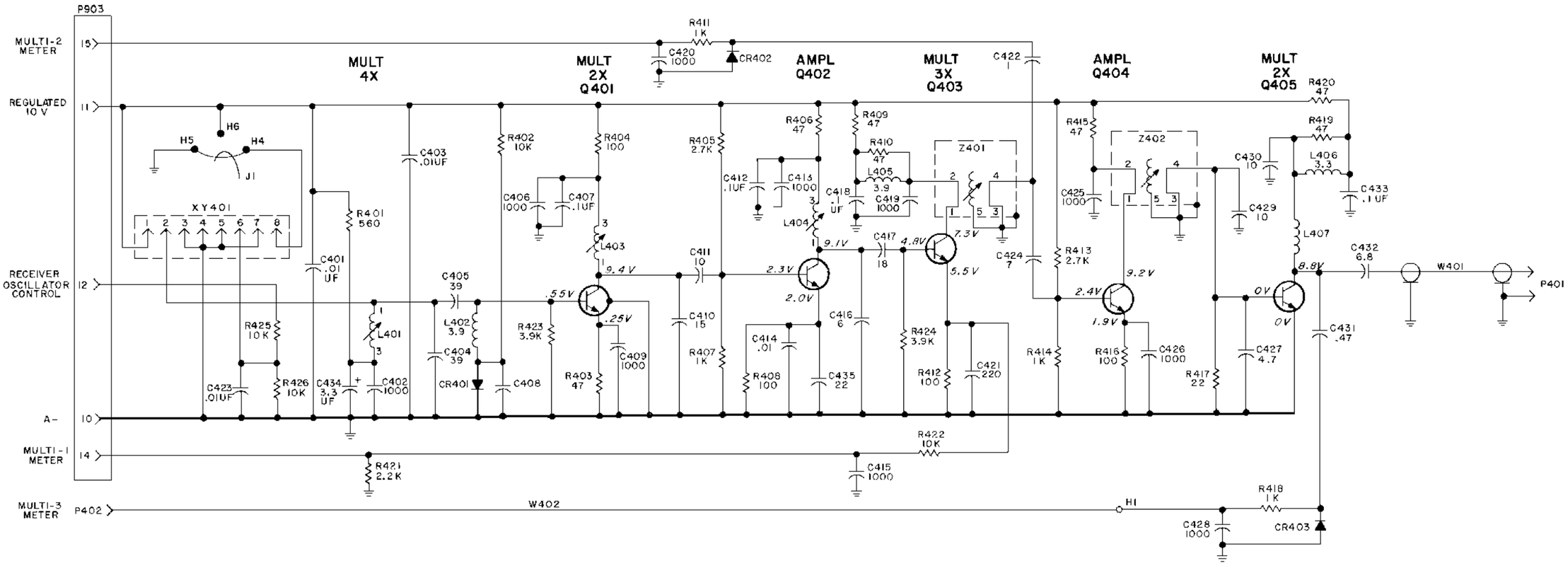
ASSY. OF Q401 - Q404



ASSY. OF Q45



DETAIL "A"



THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19D423194G1	B

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.

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.

VOLTAGE READINGS

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

806-825 MHz OSCILLATOR-MULTIPLIER BOARD
19D423194G1

(19D423679. Rev. 5)

PARTS LIST

LBI-30467A

806-825 MHz
OSCILLATOR/MULTIPLIER BOARD
19D423194G1

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C401	19A700005P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C402	19A116655P20	Ceramic disc: 1000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C403	19A700005P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C404 and C405	19A116656P39J4	Ceramic disc: 39 pF ±5%, 500 VDCW, temp coef -470 PPM.
C406	19A116655P20	Ceramic disc: 1000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C407	19A116244P4	Ceramic: 0.15 uF ±20%, 50 VDCW.
C408 and C409	19A116655P20	Ceramic disc: 1000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C410	19A116656P15J0	Ceramic disc: 15 pF ±5%, 500 VDCW, temp coef 0 PPM.
C411	19A116656P10J0	Ceramic disc: 10 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C412	19A116244P4	Ceramic: 0.15 uF ±20%, 50 VDCW.
C413	19A116655P20	Ceramic disc: 1000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C414	19A116192P1	Ceramic: 0.01 uF ±20%, 50 VDCW; sim to Erie 8121 Special.
C415	19A116655P20	Ceramic disc: 1000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C416	19A116656P6J0	Ceramic disc: 6 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C417	19A116656P18J0	Ceramic disc: 18 pF ±5%, 500 VDCW, temp coef 0 PPM.
C418	19A116244P4	Ceramic: 0.15 uF ±20%, 50 VDCW.
C419 and C420	19A116655P20	Ceramic disc: 1000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C421	19A700015P37	Teflon/Mica: 220 pF ±5%, 250 VDCW.
C422	19A700013P13	Phenolic: 1.00 pF ±5%, 500 VDCW.
C423	19A700005P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C424	19A116658P7J0	Ceramic disc: 7 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C425 and C426	19A116655P20	Ceramic disc: 1000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C427	19A700219P18	Ceramic: 4.7 pF ±5%, 100 VDCW, temp coef 0 PPM.
C428	19A116655P20	Ceramic disc: 1000 pF ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C429	19A116656P10J0	Ceramic disc: 10 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C430	19A116679P10D	Metallized teflon: 10 pF ±0.5 pF, 250 VDCW.
C431	19A700013P9	Phenolic: 0.47 pF ±5%, 500 VDCW.
C432	19A116114P22	Ceramic: 6.8 pF ±5%, 100 VDCW, temp coef 0 PPM.
C433	19A116080P107	Polyester: 0.1 uF ±10%, 50 VDCW.
C434	5496267P9	Tantalum: 3.3 uF ±20%, 15 VDCW; sim to Sprague Type 150D.
C435	19A700015P12	Teflon/Mica: 22 pF ±5%, 250 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR401	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR402 and CR403	19A116052P1	Silicon, hot carrier: Fwd drop .350 volts max.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L401	19C307169P201	Coil, RF: variable, wire size No. 20 AWG; sim. to Paul Smith Co. Sample No. C91774-WS-1.
L402	19A700024P20	Coil, RF: 3.9 uH ±10%.
L403 and L404	19C307169P204	Coil, RF: variable, wire size No. 20 AWG; sim. to Paul Smith Co. Sample No. 100374-DS-8.
L405	19A700024P20	Coil, RF: 3.9 uH ±10%.
L406	19A700000P17	Coil, RF: 3.3 uH ±10%; sim to Jeffers 4421-1K.
L407	19A130650P1	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P401		(Part of W401).
P402		(Part of W402).
P903		Connector. Includes:
	19B219594P1	Contact, electrical: 7 pins.
	19B219594P2	Contact, electrical: 8 pins.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q401	19A115440P1	Silicon, NPN.
Q402 thru Q404	19A116201P1	Silicon, NPN.
Q405	19A134237P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R401	19A700106P57	Composition: 560 ohms ±5%, 1/4 w.
R402	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R403	19A700106P31	Composition: 47 ohms ±5%, 1/4 w.
R404	19A700106P39	Composition: 100 ohms ±5%, 1/4 w.
R405	19A700106P73	Composition: 2.7K ohms ±5%, 1/4 w.
R406	19A700106P31	Composition: 47 ohms ±5%, 1/4 w.
R407	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R408	19A700106P39	Composition: 100 ohms ±5%, 1/4 w.
R409 and R410	19A700106P31	Composition: 47 ohms ±5%, 1/4 w.
R411	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R412	19A700106P39	Composition: 100 ohms ±5%, 1/4 w.
R413	19A700106P73	Composition: 2.7K ohms ±5%, 1/4 w.
R414	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R415	19A700106P31	Composition: 47 ohms ±5%, 1/4 w.
R416	19A700106P39	Composition: 100 ohms ±5%, 1/4 w.
R417	19A700106P23	Composition: 22 ohms ±5%, 1/4 w.
R418	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R419 and R420	19A700106P31	Composition: 47 ohms ±5%, 1/4 w.
R421	19A700106P71	Composition: 2.2K ohms ±5%, 1/4 w.
R422	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R423 and R424	19A700106P77	Composition: 3.9K ohms ±5%, 1/4 w.
R425 and R426	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W401	19A134357P2	Cable assembly, RF.
W402	19A129947G6	Cable: approx 8-1/2 inches long.

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY401	19A116779P6	Contact, electrical: sim to Molex 08-50-0410. (Quantity 8).
		- - - - - - - - - - OSCILLATORS - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency.
		ICOM FREQ. = Operating Frequency -45 / 48
Y401	19A136999G2	Internally Compensated: ±1 PPM, 806-825 MHz.
		- - - - - - - - - - NETWORKS - - - - - - - - -
Z401 and Z402	19D413078G8	Helical Resonator.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4035306P11	Washer, fiber: 1/8 dia. (Used with Q401-Q405).
	19A127060P2	Can. (Used with Z401, Z402).
	19A701544P7	Can. (Used with L504-L403).
	19A701332P4	Insulator, washer: nylon. (Used with Q405).

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 the descriptions of parts affected by these revisions.

REV. A - OSCILLATOR/MULTIPLIER BOARD 19D423194G1
To allow use of new oscillator design. Added H4, H5, and H6.

REV. B - OSCILLATOR/MULTIPLIER BOARD 19D423194G1
To reduce possible receiver spurs. Added connection from XY401-3 to XY401-4.

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