MOBILE RADIO

MAINTENANCE MANUAL

138—174 MHz OSCILLATOR-MULTIPLIER BOARD 19C321740G1, G2

TABLE OF CONTENTS

DESCRIPTION

The oscillator-multiplier board (osc-mult) for MASTR®Executive II contains a Colpitts oscillator, two multiplier stages and an amplifier. The operating frequency of the Colpitts oscillator is maintained within ±5 PPM by an externally compensated crystal module. The crystal frequencies range from approximately 14 to 18 megahertz and are multiplied nine times and then amplified to provide a low side injection frequency to the mixer. An optional modification kit is available for high side injection.

Oscillator-multiplier board 19C321740G1 is used in radios with receive frequencies between 138 MHz and 155 MHz. Oscillator-multiplier board 19C321740G2 is used in radios with receive frequencies between 150.8 MHz and 174 MHz.

CIRCUIT ANALYSIS

F1 OSCILLATOR CIRCUIT

Transistor Q402, a plug-in crystal module, trimmer capacitor, varicap and associated components comprise a Colpitts oscillator operating at the assigned F1 receive frequency.

The crystal module, located in the base circuit of Q402, is temperature compensated to maintain frequency stability over a temperature range of -30°C to +60°C. Compensation voltage from the exciter is applied through P602-1 to pin four of the crystal modules.

The compensation voltage varies non-linearly with temperature to complement the temperature/frequency characteristics of the crystal. Listed below are typical minimum and maximum voltage readings to be expected at pin 4 of the crystal modules, as measured with a high impedance meter.

TEMPERATURE RANGE	OUTPUT VOLTAGE MINIMUM	MAXIMUM
-30°C	4.9 Volts	6.0 Volts
-10°C to +50°C	3.7 Volts	4.3 Volts
+75°C	3.3 Volts	3.8 Volts

Trimmer capacitor C3 is used to adjust the radio for the exact operating frequency. Refer to the Alignment Procedure for details.

Refer to the System Maintenance Manual for circuit details of the crystal modules.

SERVICE NOTE

Y1 and C2 are not field replaceable items. C2 is factory selected to compliment the temperature/frequency characteristics of each individual crystal. Should it become necessary to replace either Y1 or C2, the entire crystal module must be replaced.

In single frequency applications, the F1 keying lead is wired to A- by a DA jumper wire connected between H12-H31 on the SAS board. A voltage divider network consisting of R407 and R408 sets the bias for oscillator transistor Q402.

In multi-frequency radios this jumper (H12-H31) is removed to allow F1 frequency selection via the frequency selector switch on the control unit.

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

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CIRCUIT ANALYSIS

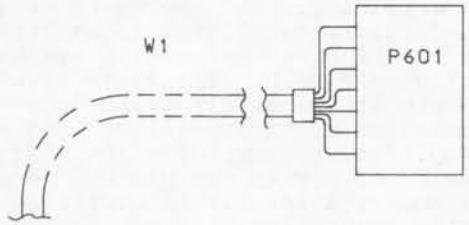
With the radio turned on and the PTT switch released, +10V is present on the Rx OSC control lead at P602-6 and the oscillator operates at the crystal frequency. Capacitor C402 provides the necessary in-phase feedback to sustain oscillations.

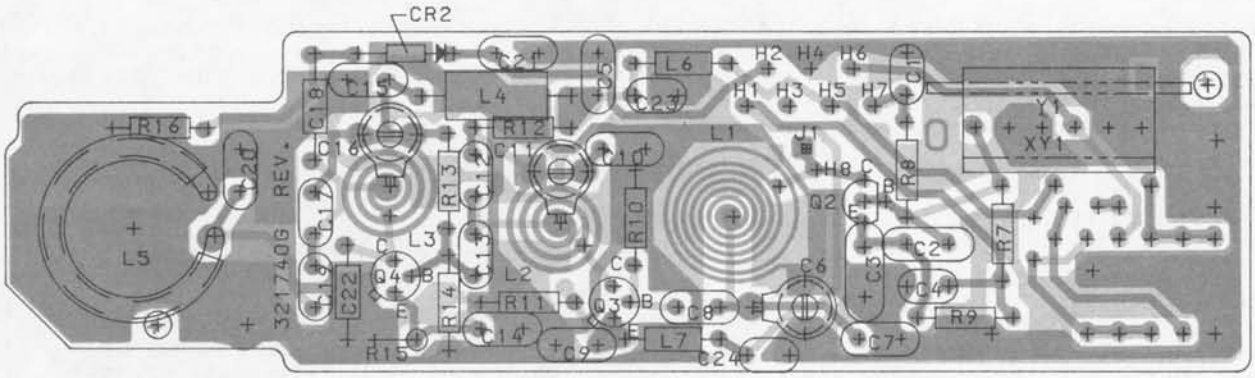
C406 is tuned to three times the crystal frequency. The output of the tuned circuit is applied to the base of Class C multiplier, Q403. The collector tank circuit of the multiplier (L402, C411, and C412) is tuned to nine times the crystal frequency. The output of the multiplier stage is metered across R411 and applied to receiver metering jack J601 through P602-3.

Following the multiplier is a Class A Amplifier stage, Q404. The output of Q404 is metered through a metering network consisting of C418, C421, CR402, and R416 and applied to receiver metering jack J601 through P602-4. The amplifier output of Q404 is applied to a tuned circuit (L403 and C416) that is tuned to nine times the crystal frequency. The tuned circuit provides additional selectivity in the oscillator-multiplier chain.

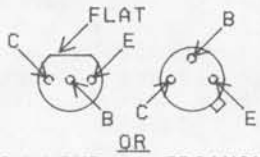
The output of the oscillator/multiplier board is inductively coupled through L405 and two helical resonators on the RF assembly to the input of the mixer stage.

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION, PREFIX WITH 400-SERIES.
EXAMPLE: C1 - C401, R1 - R401, ETC.





LEAD IDENTIFICATION FOR Q3 & Q4



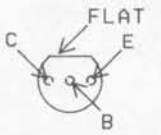
OR

IN-LINE TRIANGULAR

TOP VIEW

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

LEAD IDENTIFICATION FOR Q2



IN-LINE

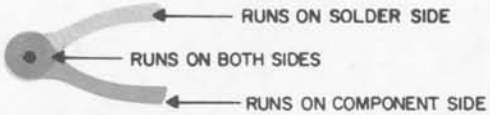
TOP VIEW

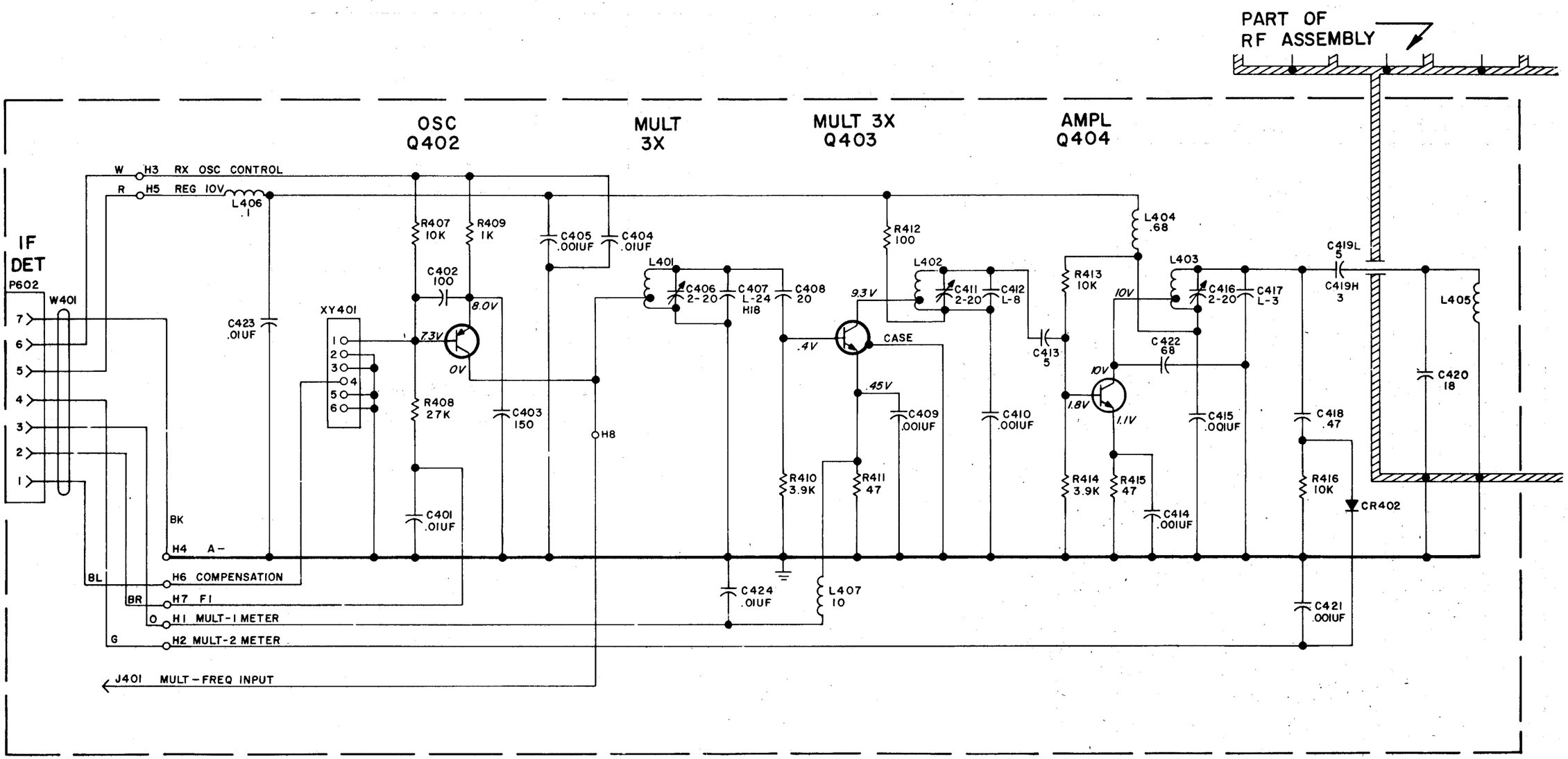
NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

(19C327116, Rev. 6)
(19A144185, Sh. 1, Rev. 0)
(19A144185, Sh. 2, Rev. 0)

OUTLINE DIAGRAM

138—174 MHz OSCILLATOR-MULTIPLIER





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.

OSC / MULT	REV LETTER	FREQ RANGE (MHz)
19C321740G1	D	138-155
19C321740G2	E	150.8-174

VOLTAGE READINGS

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

SCHEMATIC DIAGRAM

138—174 MHz OSCILLATOR-MULTIPLIER

PARTS LIST

LBI30082H

OSCILLATOR - MULTIPLIER BOARD
19C321740G1 138-155 MHz
19C321740G2 150.8-174 MHz

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C401	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.
C401	19A701624P632	Ceramic, disc: 100 pF ±5%, 500 VDCW, temp coef N750 PPM ±120.
C403	19A700105P38	Mica: 150 pF ±5%, 500 VDCW.
C404	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.
C405	19A143481P19	Ceramic: 1000 pF ±20%, 1000 VDCW.
C406	19A700012P2	Variable, ceramic: 2.5 to 20 pF 200 VDCW, temp coef -250 -700 PPM; sim to Panasonic ECX1ZW20X32.
C407L	19A701624P117	Ceramic, disc: 24 pF ±5%, 500 VDCW, temp coef N80 PPM ±30.
C407H	19A701624P114	Ceramic, disc: 18 pF ±5%, 500 VDCW, temp coef N80 PPM ±30.
C408	19A701624P15	Ceramic, disc: 20 pF ±5%, 500 VDCW, temp coef 0 PPM ±30.
C409 and C410	19A701602P19	Ceramic: 1000 pF ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C411	19A700012P2	Variable, ceramic: 2.5 to 20 pF 200 VDCW, temp coef -250 -700 PPM; sim to Panasonic ECX1ZW20X32.
C412L	19A701624P6	Ceramic, disc: 8 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±60.
C412H*	19A116656P5J0	Ceramic dis: 5 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM. Deleted by REV C.
C413	19A701624P3	Ceramic, disc: 5 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±60.
C414 and C415	19A143481P19	Ceramic: 1000 pF ±20%, 1000 VDCW.
C416	19A700012P2	Variable, ceramic: 2.5 to 20 pF 200 VDCW, temp coef -250 -700 PPM; sim to Panasonic ECX1ZW20X32.
C417L	19A701624P1	Ceramic, disc: 3 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±120.
C418	5491601P13	Phenolic: 0.47 pF ±10%, 500 VDCW.
C419L	19A701624P3	Ceramic, disc: 5 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±60.
C419H*	19A701624P1	Ceramic, disc: 3 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±120.
		In REV B & earlier:
	19A116656P5J0	Ceramic dis: 5 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C420	19A701624P14	Ceramic disc: 18 pF ±5%, 500 VDCW, temp coef 0 PPM ±30.
C421	19A143481P19	Ceramic: 1000 pF ±20%, 1000 VDCW.
C422*	19A700013P11	Phenolic: 0.68 pF ±5%, 500 VDCW. Added by REV B.
C423* and C424*	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW. Added by REV B.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR402	19A116052P5	Silicon, hot carrier: Fwd. drop .500 v. max.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J401	19A701785P1	Contact, electrical; sim to Molex 08-50-0404.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L401 thru L403		(Part of Printed board 10D433181P1).
L404	19A700000P10	Coil, RF: 680 nH ±10%; sim to Jeffers 4411-6K.
L405	19A129280P1	Coil.
L406*	19B209420P101	Coil, RF: .10 uH ±10%, 0.8 ohms DC res max; sim to Jeffers 4416-1K. Added by REV B.
L407*	19A700024P25	Coil, RF: 10.0 uH ±10%, 3.70 ohms DC res max. Added by REV B.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P602		(Part of W401).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q402	19A700022P1	Silicon, PNP; sim to Type 2N3906.
Q403*	19A134670P1	Silicon, NPN.
		In G1 of REV B & earlier: In G2 of REV C & earlier:
	19A115440P1	Silicon, NPN.
Q404*	19A116899P1	Silicon, NPN.
		In G1 of REV C & earlier: In G2 of REV D & earlier:
	19A115329P2	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R407	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R408	19A700106P97	Composition: 27K ohms ±5%, 1/4 w.
R409	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R410	19A700106P77	Composition: 3.9K ohms ±5%, 1/4 w.
R411	19A700106P31	Composition: 47 ohms ±5%, 1/4 w.
R412	19A700106P39	Composition: 100 ohms ±5%, 1/4 w.
R413	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R414	19A700106P77	Composition: 3.9K ohms ±5%, 1/4 w.
R415	19A700106P31	Composition: 47 ohms ±5%, 1/4 w.
R416	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W401	19B226965G1	Cable,includes (P602) 19A116659P82.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY401	19A116659P50	Connector, printed wiring: 6 contacts; sim to Molex 09-65-1061.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	4031594P1	Insulator. (Used with C406, C411, C416).
		ASSOCIATED PARTS
		HIGH SIDE INJECTION MODIFICATION KIT 19A130045G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2311	19A116656P12K0	Ceramic disc: 12 pF ±10%, 500 VDCW; temp. coef 0 PPM.
C2312	19A116656P3J0	Ceramic disc: 3 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C2313	19A116656P5J0	Ceramic dis: 5 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C2314	19A116656P4J0	Ceramic disc: 4 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM.
C2318	19A116656P10J8	Ceramic disc: 10 pF ±5%, 500 VDCW; temp. coef -80 PPM.
C2324	19A116080P101	Polyester: 0.01 uF ±10%, 50 VDCW.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2301	19A700005P7	Polyester: 0.01 uF ±10%, 50 VDCW.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A130028P1	Spacer.
	19A130028P2	Spacer.
	19A130029P1	Washer, brass.
		ASSOCIATED PARTS
		- - - - - - - - - - CRYSTAL MODULE - - - - - - - - -
		NOTE: When reordering, give GE Part Number and specify exact operating frequency needed.
		For Standard Low Side Injection Frequency.
Y401	19B226962G13	Rx. 5 PPM. (138-155 MHz).
	19B226962G14	Rx. 5 PPM. (150.8-174 MHz).
		NOTE: For High Side Injection Frequency Using High Side Modification Kit 19A130045G1.
	19B226962G19	Rx. 5 PPM. (138-155 MHz).
	19B226962G20	Rx. 5 PPM. (150.8-174 MHz).

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 - Oscillator/Multiplier Board 19C321740G1, G2
To prevent suprious 600 MHz oscillation of amplifier Q404. Added C422.

REV. B - To improve operation. Added C422, C423, C424, L406 and L407.

REV. C - Oscillator/Multiplier Board 19C321740G2
Improve tuning at high end of frequency board. Deleted C412H. Add C419H.

REV. C - Oscillator/Multiplier Board 19C321740G1
To improve operation. Changed Q403.

REV. D - Oscillator/Multiplier Board 19C321740G2
To improve operation. Changed Q403.

REV. D - Oscillator/Multiplier Board 19C321740G1

REV. E - Oscillator/Multiplier Board 19C321740G2
To incorporate new transistor. Changed Q404.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES