

MAINTENANCE MANUAL

440-470 MHz 25-WATT WIDEBAND TRANSMIT/RECEIVE BOARD 19D901003G14

Page
1
1
6
7-13
0-14

DESCRIPTION

The 440-470 MHz wideband-synthesized transmit/receiver boards (Tx Rx) contain the receiver, exciter and power amplifier. The audio processor circuitry for the transmit (microphone) audio is included on the synthesizer/interconnect board. Transmit/receiver RF frequency injection (5-15 milliwatts) is provided by a common VCO on the synthesizer/ interconnect board. The output of the VCO is tripled by the exciter to generate the transmit frequency and by the receiver to generate the correct Rx injection frequency for the receiver first mixer. A block diagram of the TRS board is shown in Figure 1.

The transmit/receiver board assembly is located on the bottom side of the radio and is provided in one group. The characteristics of this group are identified in the table below.

CIRCUIT ANALYSIS

EXCITER

The exciter consists of an amplifier, a tripler and final amplifier. The transmit/receiver component board is 19D8901043G2 and operates in the 440-470 MHz range. The exciter receives the Tx injection frequency from the synthesizer VCO (5 milliwatts minimum) and amplifies multiplies and amplifies it again to provide 60 milliwatts minimum drive to the power amplifier circuitry. In addition to these functions, the exciter contains the filters that determine the bandwidth and spurious characteristics (exclusive of harmonics) of the transmitter.

RF injection from the synthesizer/interconnect board is applied to the base

of Class A Ampl Q101 through J151, a 2 dB resistive pad, and an impedance matching network consisting of C101, C102 and L101. This network matches the base of Q101 to 50 ohms. The 2 dB attenuator pad (R101-R103) provides a constant load for the VCO output to maintain frequency stability when switching to or from the transmit or receive mode. 8.5V TX is applied to Class A Amplifier Q101 through a collector feed network consisting of L102, R106, and R107. Capacitors C104 and C105 provide decoupling for the 8.5V Tx supply. 8.5V Tx is used to control the supply voltage to Ampl 1 to assure that the exciter is turned on only in the transmit mode. Base bias is set by R104 and R105. 8.5V Tx also provides the bias voltage for final amplifier Q103.

The output of Q101 is direct coupled to tripler Q102 through C106 and C107. 8.5V CONT is supplied to the tripler through a collector feed network consisting of R111, L104 and L103. Decoupling is provided by C108 and C109. For tuning purposes the collector voltage may be metered at TP101. A matching network consisting of L103, C110, and R112-R114 match the output of the tripler to a two-pole helical filter, L105 and L106. The output of this filter is then matched by L107 and C111-C113 to a single stage broadbanded Class B amplifier Q103. Bias voltage is supplied by the 8.5V Tx source and is set by R115 and R116. Collector voltage is taken from the 8.5V CONT supply and applied to Q103 collector through collector feed network R117, C115, and L108. Capacitors C118 and C119 provide decoupling for the 8.5V CONT supply. For tuning purposes the collector voltage is measured at TP102. An impedance matching network consisting of C116, L109 and C117 match the collector Q103 to 50 ohms. The exciter provides 60 milliwatts to the power amplifier.



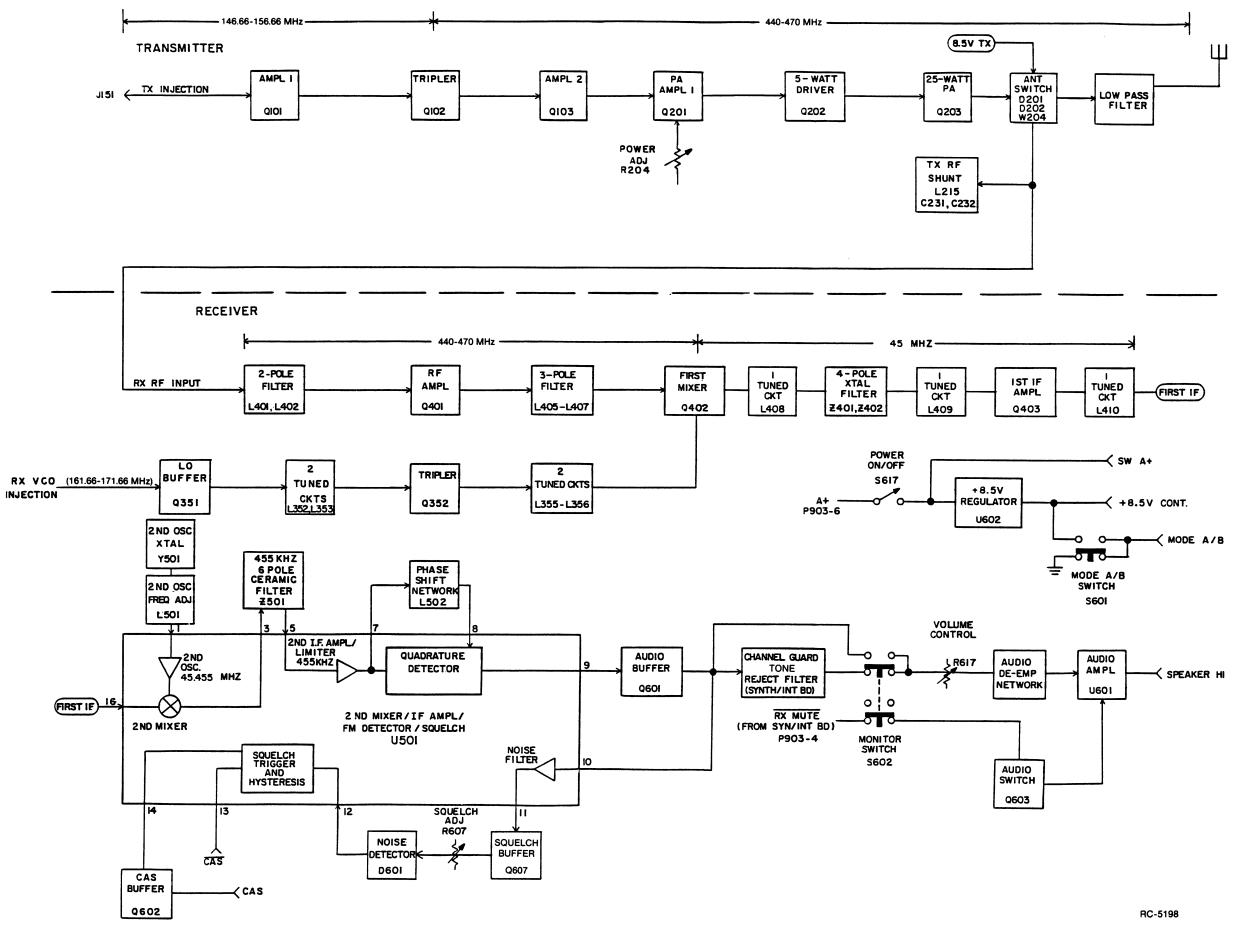


Figure 1 - TRS Board Block Diagram

--- NOTE ---

There are 5 points in the exciter with an impedance of approximately 50 ohms. They are W101, W102, W104, W105, and W106. These points can conveniently be used to monitor or inject signals for troubleshooting and testing using 50 ohm sources and terminations.

25-WATT POWER AMPLIFIER

The broadband three stage power amplifier consists of amplifier Q201, driver Q202 and power amplifier Q203, and associated circuitry. The 60 milliwatt output of the exciter is amplified to provide 25 watts RF output from the radio. No tuning is required.

The 50 ohm output of the exciter is applied to the base of AMPL Q201 through an impedance matching network consisting of L201, C201-C203, and 50 ohm microstrip W201. L203, L204, C206, and C207 match the collector of Q201 to 50 ohms. W202, L205, C208 and C209 match the 50 ohms at W202 to the base of driver Q202. Collector voltage for Q201 is supplied through collector feed network R203-R205, L202, and C205.

The output power of the driver Q202 is coupled to the final power amplifier Q203 through impedance matching network consisting of W203, C212, C215, C220, and C221. The 25 watt output of Q203 is coupled to the antenna through and impedance matching network (C222-C225, C227, and L212), Tx/Rx switch (D201,D202) and the low pass filter to J601. The low pass filter consists of L214, C230, C229. W205 is a 50 ohm microstrip.

Collector voltage for Q202 and Q203 is provided by the A+ line through P251-3 and collector feed networks consisting of L207, L208, R207, and C210 for Q202 and L216, L211, C218 and C219 for Q203. Decoupling is provided by C211, C216, and C217.

Tx/Rx Antenna Switch

The antenna switch is controlled by 8.5V Tx (present when PTT is pressed) and connects either the PA output or receiver to the antenna. The antenna switch consists of diode D201 quarter wave stub W204, diode D202, C231, C232, and L215.

When the microphone is keyed, 8.5V Tx is applied to D201 through R210 and L213 forward biasing D201 and D202 and passing the PA output directly to the antenna through the low pass filter. At the same time the 1/4 wave stub W204 and

forward biased diode D202 presents an open circuit to the receiver preventing any possible damage to the receiver. C235 is a DC blocking capacitor.

In the receive mode D201 and D202 are turned off, the AC short is removed and the 1/4 wave stub now presents a 50 ohm impedance to the receiver, allowing the received RF to pass through the low pass filter to the receiver.

RF POWER ADJUST

RF output power is set by adjusting the collector voltage to Q201. Collector voltage for Ampl Q201 is supplied by the 8.5V CONT source and set by RF Power Adjust control R204. R204 is set for rated output power.

RECEIVER

The FM dual conversion, superheterodyne receiver is designed for operation in the 440-470 MHz frequency range. A regulated 8.5 volts is provided to all receiver stages except for the audio PA IC, which operates from the switched A+ supply.

The receiver has intermediate frequencies of 45 MHz and 455 kHz. Adjacent channel selectivity is obtained by using two band-pass filters: a 45 MHz crystal filter and a 455 kHz ceramic filter.

All of the receiver circuitry except the synthesizer is mounted on the Tx/Rx board. The receiver consists of:

- Front End and Mixer
- 45 MHz 1st IF o 455 kHz 2nd IF and FM Detector
- Audio PA
- Squelch

RECEIVER FRONT END

An RF signal from the antenna is coupled through the low pass filter, antenna switch, and two helical resonators (L401 and L402) to the base of RF amplifier Q401. The output of Q401 is coupled through three more helical resonators consisting of L405-L407 to the gate of 1st mixer Q402. Front end selectivity is provided by these five helical resonators.

RECEIVER INJECTION

' Receiver RF Injection (161.666 - 171.666 MHz) from the synthesizer VCO is applied to L.O. Buffer Q351 through J351. The input level at J351 will be between 5

and 15 milliwatts, 5 milliwatts minimum. R351-R353 and C351 match the source impedance of Q351 to the VCO output transmit/receive switching circuitry on the synthesizer/interconnect board.

The output of L.O. Buffer Q351 is coupled to the base of tripler Q352 through a two-pole LC filter L352, L353, and C352-C355. The LC filter will pass only those frequencies in the 149-185 MHz band, shunting all other frequencies to ground. Tripler Q352 multiplies the Rx injection frequency by 3 to provide a mixer injection frequency 45 MHz above the received RF frequency to First mixer Q402. The output of tripler Q352 is filtered by a two section helical filter consisting of L355 and L356. These filters are tuned to pass frequencies in the 447-555 MHz passband.

TP351 provides metering for the tripler Q352. The correct voltages with and without L.O. injection are shown on the Schematic Diagram.

1st MIXER

The 1st mixer uses a FET (Q402) as the active device. The FET mixer provides a high input impedance, high power gain and an output relatively free of intermodulation products.

In the mixer stage, RF from the front end helical filter is applied to the gate of the mixer. Injection voltage from the multiplier stages is applied to the source of the mixer. The 45 MHz mixer 1st IF output signal is coupled from the drain of Q402 through an impedance matching network (L408 and C410-C411) to a 4-pole crystal filter consisting of Z401 and Z402.

1st IF

The highly-selective crystal filters Z401 and Z402 provide the first portion of the receiver IF selectivity. The output of the filters is coupled through impedance matching network L409, C414, and R410 to the 1st IF amplifier Q403.

1st IF Amplifier Q403 is a dual-gate MOSFET transistor. The crystal filter output of Z402 is applied to Gate 1 of the amplifier, and the amplified signal is taken from the drain. The biasing on Gate 2 and the drain load determines the gain of the stage. The amplifier provides approximately 20 dB of IF gain. The output of Q403 is coupled through an impedance matching network, L410, C417, C418, and R415 that matches the amplifier output to the input of IC U501. Diodes D401 and D402 provide limiting for the 45 MHz IF signal (1.4 VPP) to prevent high level overload of U501.

2nd IF and DETECTOR

U501 and associated circuitry consists of the 2nd oscillator/mixer, IF amplifier, FM detector, and squelch circuit. The 45 MHz IF input is applied to pin 16 or U501 and mixed with a 45.455 MHz frequency supplied by crystal oscillator Y501. L501 sets the frequency of Y501. High side injection is used. output of the internal mixer is amplified and applied to a 6-pole ceramic filter, Z501, which provides the 455 kHz selectivity. The output of the 455 kHz filter is reapplied to U501-5. The 2nd IF signal is amplified and limited. L502 shifts the IF signal by 90° and reapplies it to the internal FM detector. The FM detector compares the shifted IF signal to the internal IF signal to recover the audio modulation.

AUDIO AND SQUELCH

The audio output of U501 is applied to the base of audio buffer Q601. The output of the audio buffer is applied to the Channel Guard Tone Reject filter on the synthesizer/interconnect board, the MONITOR switch, and to the squelch input U501-10.

Squelch Circuit

The squelch circuit senses the noise components contained in the FM detector audio output. The squelch input is applied to pin 10 of U501 from audio buffer Q601. Circuits internal to U501 provide filtering and apply received noise in the $6-8~\mathrm{kHz}$ frequency band to squelch buffer Q607 and potentiometer R607 (squelch adjust). The output of the squelch adjust potentiometer is connected to the noise detector. The noise detector consists of R608, C606, C607, C621 and diode D601. As the noise increases in magnitude in a negative direction, negative spikes cause D601 to conduct and charge C607 and C621 to a DC level proportional to the noise power. The output of the noise detector is applied to the input of squelch trigger (U501-12). The squelch trigger has approximately 3 dB of hysteresis to prevent sudden noise level changes from effecting the squelch threshold setting. R634 provides temperature compensation for the Squelch Circuit. The outputs of squelch trigger are CAS and CAS. The CAS output is applied to Q602 to provide sufficient drive to operate an optional channel busy light or external relay control.

Audio Circuits

Detected audio from audio buffer Q601 is applied to the Channel Guard Tone Reject filter on the synthesizer/interconnect board and returned as

filtered volume squelch high through P903-7. Filtered audio is then applied through MONITOR switch S602 and VOLUME control R617 to the deemphasis network (R618 and C615) and audio amplifier U601. Switched A+ is applied to U601 through S617. The RX MUTE line is high when a message is received and accompanied by a correct Channel Guard Tone, keeping audio switch Q603 turned off. This enables audio amplifier U601 which provides up to 3 watts of audio output power into a 4 ohm speaker. The feedback loop consisting of R615, R616, and C611 determine the amplifier closed loop gain. R614 and C612 provide the high audio frequency roll-off above 6 kHz.

The audio amplifier is muted (switched off) when RX MUTE is low. When this occurs (no messages being received) audio switch Q603 is turned on, applying additional bias current to the reference input pin 2 of audio amplifier U601. This turns U601 off causing its output to be grounded.

Monitor

When the MONITOR switch is pressed, detected audio from audio buffer Q601 is applied directly to the audio amplifier through S602-5 and R617, bypassing the Channel Guard Tone Reject Filter. S602 also opens the RX MUTE line to Q603, causing it to be turned off and allowing

audio amplifier U601 to operate. The detected audio is amplified and applied to the speaker. Channel Guard Tones may be audible when present.

MODE A/B

Mode A/B Switch S601 provides the channel selection capability of the radio by controlling the 8.5V CONT line applied to the Mode A/B input of the microcomputer. The microcomputer input (P912-2 is grounded in Mode A or has 8.5 VDC cont. applied for Mode B.

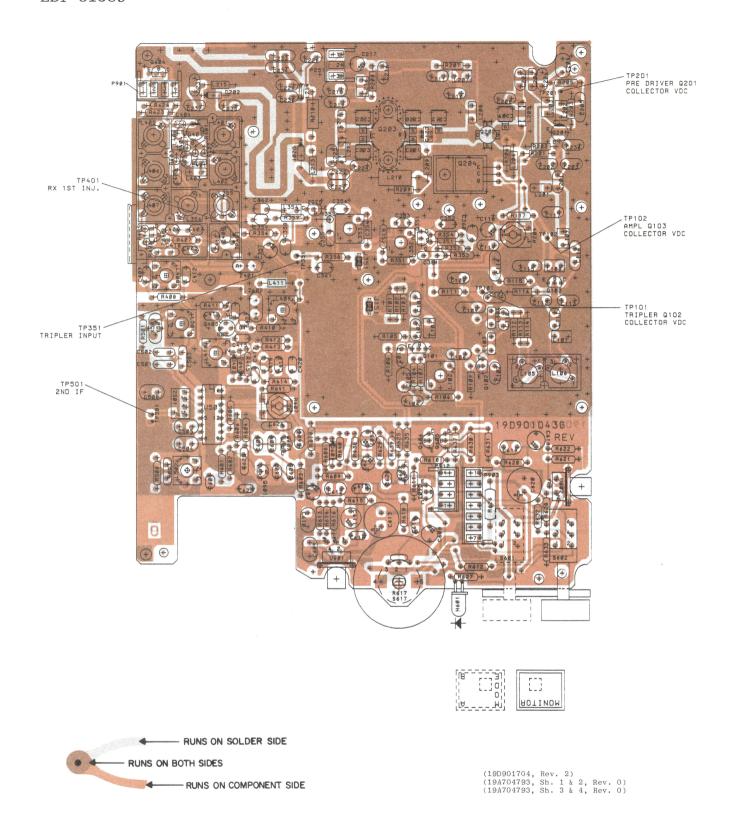
In two frequency radios, the MODE A/B switch is provided. Channel selection (MODE A/B) is controlled by the MODE switch which toggles the MODE A/B input to the microcomputer. When MODE A is selected the input to the microcomputer is held low by the ground connection between S601-2 and 4. In MODE B, pull-up resistor R628 applies +8.5 VDC to the MODE A/B input through S601-5 and 6, holding it high and causing MODE B (second channel) to be selected.

8.5 VOLT REGULATOR

8.5 Volt regulator U602 receives switched A+ from S617 and P903-6 and provides 8.5 Volts regulated to the radio. Switched A+ is available from S617.

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





OUTLINE DIAGRAM

440-470 MHz, 25 WATT WIDEBAND TRANSMIT/RECEIVE BOARD

TABLE OF CONTENTS

NOTES & CHARTS	SHEET
TRANSMITTER	2,2A
FUNCTION	CPNT <u>SERIES</u>
EXCITER TX PWR AMP TX 0.5V SWITCH	100 200 600
RECEIVER	3
FUNCTION	CPNT SERIES
1ST LO INJECTION RF/MIXER/1ST IF	350 400
RECEIVER/SYSTEM	4
FUNCTION	CPNT SERIES
2ND IF AUDIO/SQUELCH/SYSTEM	500 600

Δ COMPONENT IDENTIFICATION CHART									
043G2 043G5 043G6									
PART	440-470 MHZ	470-512 MHZ	403-440 MHZ						
C107	1 OP	8 P	15p						
C109	39 _P	36P	39p						
C110	ЗР	3p	4p						
C111	10P	7 P	7 p						
C116	56P	56P	1 n						
C117	6P	6P	5p						
C202	1 OP	1 OP	12p						
C208	1 OP	1 OP	15p						
C209	62p	51 _P	68P						
C212	10p	1 Op	12P						
C220	33 _P	30p	33p						
C222	43p	39P	47p						
C223	39p	39p	47p						
C224	5p	6P	7 p						
C225	5p	6P	7 p						
C226	7 p	7 p	8 P						
C227	7 P	7 P	8 P						
C229	4 p	4P	5p						
C230	6P	6P	8 P						
C231	10e	θP	12=						
C232	10p	8 P	12P						
C235	470p	20p	470P						
C236	5 _P	5p	7 P						
C352	12p	6.8P	10p						
C353	8.2p	6.8p	15p						
C354	0.56P	0.56P	0.82p						
C355	12p	8.2p	10P						
C356	1 OP	8.2P	12P						
C359	2.7p	5.6p	39P						
C401	18P	18P	39P						
C404	18p	3.9p	4.7P						
C406	4.7p	10p	4.7P						
C407	2.2p	2.2p	5.6P						

NOTES:

A PART OF PWB.

2 VALUE OF R621 DEPENDS ON COLOR CODE OF U602.

U602	COLOR CODE	R621 VALUE				
	BROWN	OMIT R621				
	RED	270				
	ORANGE	100				
	YELLOW	47				
	GREEN	22				
	BLUE	6.8				

★ SWITCH PRESENT ON 190901003G14,G16,G18 & G20 ONLY.

VOLTAGE READINGS:

ALL VOLTAGES ARE TYPICAL. VOLTAGES ARE MEASURED WITH A 20,000 OHM PER VOLT DC METER, REFERENCE TO A-, UNLESS OTHERWISE INDICATED.

SHEET 2,2A ALL VOLTAGES ARE DC ALL VOLTAGES ARE IN THE TRANSMIT CONDITION.

RF VOLTAGES MEASURED WITH RF VOLTMETER W INJ - WITH L.O. INJECTION W/O INJ - WITHOUT L.O. INJECTION

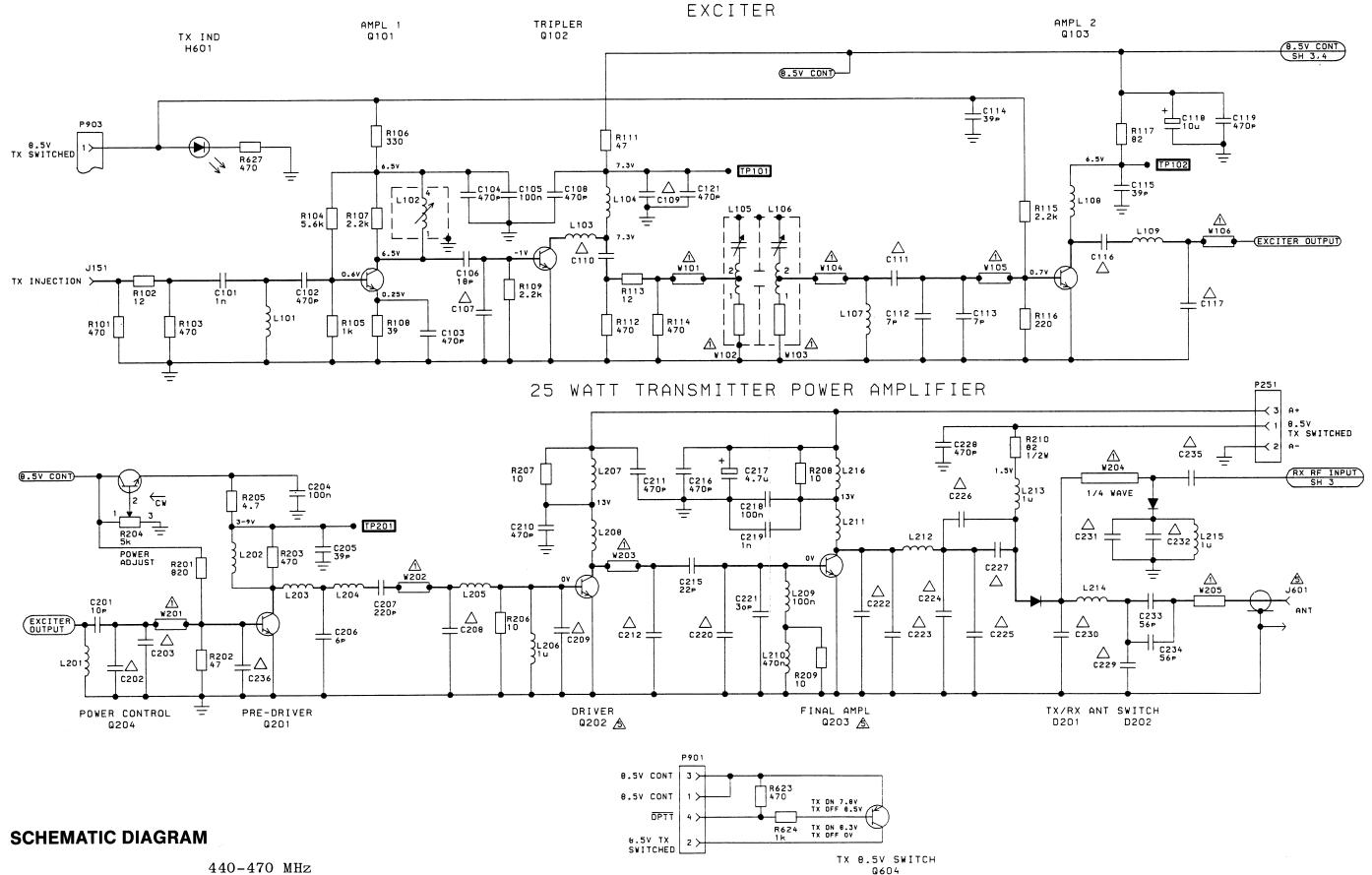
SHEET 4: VOLTAGES AT U501 AND U601 ARE MEASURED WITH 1 M OHM DC VOLTMETER AND NO SIGNAL INPUT. S - SQUELCHED RECEIVER US - UNSQUELCHED RECEIVER

△ CALLED FOR AT HIGHER ASM.

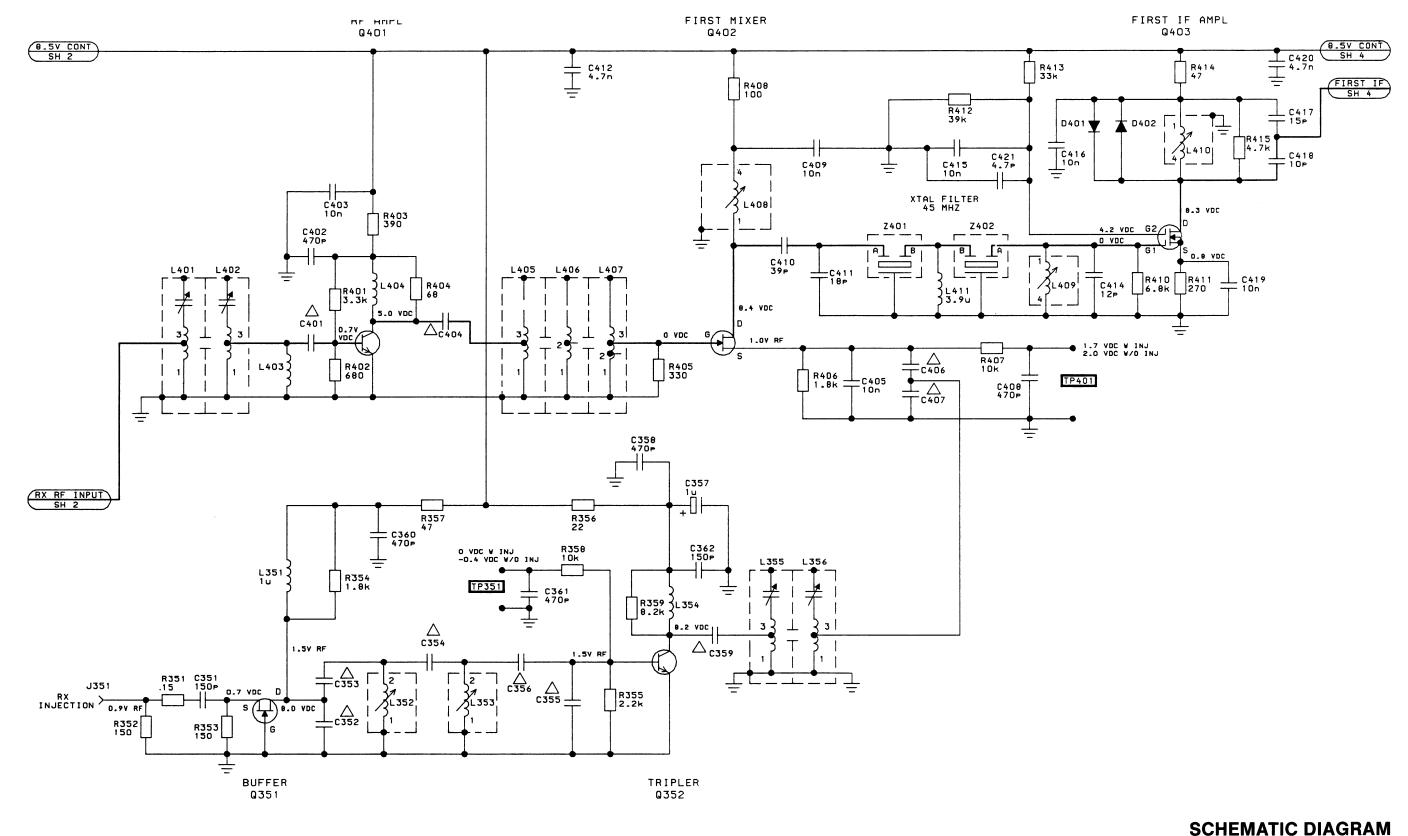
ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED. RESISTOR VALUES IN A UNLESS FOLLOWED BY MULTIPLIER K OR M. CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER UND OR P. INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR U.

MODEL NO.	REV. LTR	FREQ RANGE	TX POWER
PL19D901043G2	A		25W/5W
PL19D901003G13			25W
PL19D901003G14		440-470 MHZ	25W
PL19D901003G15			5W
PL19D901003G16			5 W
PL19D901043G5	А		22 W
PL19D901003G17		470-512 MHZ	22W
PL19D901003G18			22W
PL19D901043G6	A		25W
PL19D901003G19		403-440 MHZ	25W
PL19D901003G20			25W

Issue 1



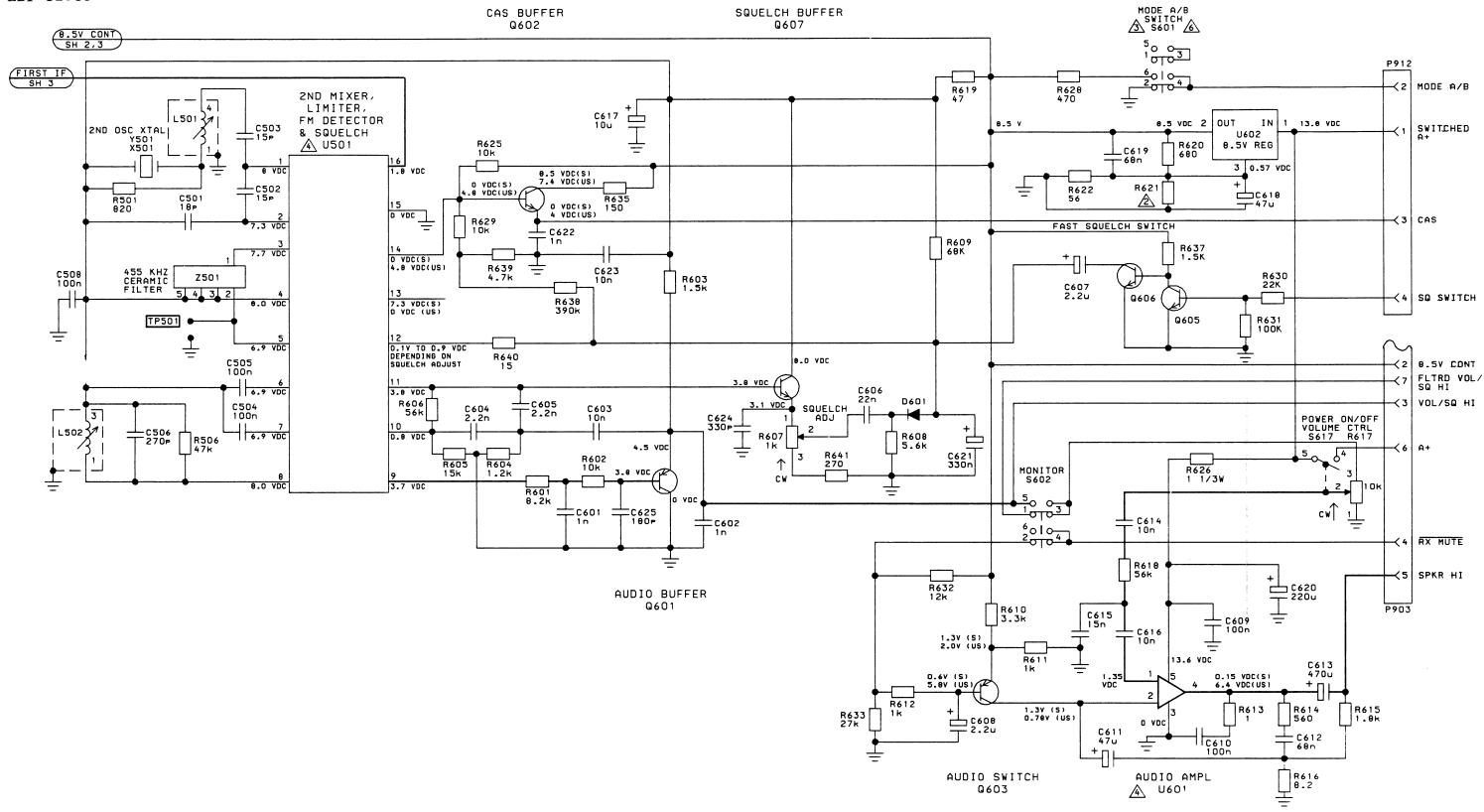
440-470 MHz WIDEBAND EXCITER/POWER AMPLIFIER



440-470 MHz WIDEBAND RECFIVER, FRONT END & FIRST MIXER/IF

(19D901701, Sh. 3, Rev. 1)

Issue 1



SCHEMATIC DIAGRAM

440-470 Mhz WIDEBAND RECEIVER, SECOND IF & AUDIO

(19D901701, Sh. 4, Rev. 1)

LBI-31589

403-512 MHz

PARTS LIST

SYMBOL GE PART NO.

DESCRIPTION

		PARTS LIST					ļ		011111012					<u> </u>
						C223	19A700006P23	Mica: 39 pF ±5%, 100 VDCW; sim to Underwood	R205	H212CRP947C	Deposited carbon: 4.7 ohms ±5%, 1/4 w.	,		DEGRANDS BROWN IND
		403-512 MHz TRANSMIT/RECEIVE BOARD			RESISTORS	i		3HS0020.	R206	19A700106P15	Composition: 10 ohms ±5%, 1/4 w.			RECEIVER - FRONT END
	19D901003G14	(WIDEBAND) 440-470 MHz 25 WATT W MODE SWITCH	R101	19A700106P55	Composition: 470 ohms ±5%, 1/4 w.	C224 and	19A701624P3	Ceramic, disc: 5 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±60.	thru R209		- '			
	135501000011	ISSUE 1		19A700106P17		C225		-	R210	19A700113P37	Composition: 82 ohms ±5%, 1/2 w.	C401	19A700219P50	Ceramic: 39 pF +5%, 100 VDCW, temp coef 0 PPM.
		10002 1	R102	į.	Composition: 12 ohms ±5%, 1/4 w.	C226 and	19A701624P5	Ceramic, disc: 7 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM +60.	RZIO	194700113F37	Composition. 32 onms tox, 1/2 w.			Ceramic: 470 pF ±20%, 50 VDCW.
Γ			R103	19A700106P55	Composition: 470 ohms ±5%, 1/4 w.	C227		0 PPM <u>1</u> 00.				C402	19A700001P5	
SYMBOL	GE PART NO.	DESCRIPTION	R104	H212CRP256C	Deposited carbon: 5.6K ohms ±5%, 1/4 w.	C228	19A701602P14	Ceramic: 470 pF ±10%, 1000 VDCW.	TP201	19A703248P1	Contact, electrical.	C403	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.
OTHER DE	GE I ART NO.	DECOMI TION	R105	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.	C229	19A701624P2	Ceramic, disc: 4 pF ±0.5 pF, 500 VDCW, temp coef				C404	19A700219P38	Ceramic: 18 pF ±10%, 100 VDCW, temp coef 0 PPM.
			R106	H212CRP133C	Deposited carbon: 330 ohms ±5%, 1/4 w.			0 PPM ±60.				C405	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.
A1		COMPONENT BOARD 19D901043G2 440-470 MHZ 25 WATTS	R107	19A700106P71	Composition: 2.2K ohms $\pm 5\%$, 1/4 w.	C230	19A701624P4	Ceramic, disc: 6 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM +60.	W201 thru		Part of Printed Board 19D901044P1.	C406	19A700235P9	Ceramic: 4.7 pF ±0.25 pF, 50 VDCW, temp coef N150 PPM.
1		19090104302 440 410 min 20 wallo	R108	H212CRP039C	Deposited carbon: 39 ohms ±5%, 1/4 w.		10170100100	l - 1	W205			2405	1015000555	
İ		EXCITER	R109	19A700106P71	Composition: 2.2K ohms ±5%, 1/4 w.	C231 and	19A701624P8	Ceramic, disc: 10 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±30.				C407	19A700235P5	Ceramic: 2.2 pF ±0.25 pF, 50 VDCW, temp coef -150 PPM.
1			R111	H212CRP047C	Deposited carbon: 47 ohms ±5%, 1/4 w.	C232					RECEIVER-INJECTION	C408	19A700235P5	Ceramic: 2.2 pF ±0.25 pF, 50 VDCW, temp coef
i			R112	19A700106P55	Composition: 470 ohms ±5%, 1/4 w.	C233 and	19A701624P326	Ceramic, disc: 56 pF ±5%, 500 VDCW, temp coef N220 PPM +30.						-150 PPM.
C101	19A701602P20	Ceramic: 1000 pF ±10%, 1000 VDCW.	R113	19A700106P17	Composition: 12 ohms ±5%, 1/4 w.	C234		_				C409	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.
C102	19A701602P14	Ceramic: 470 pF ±10%, 1000 VDCW.		1		C235	19A701602P14	Ceramic: 470 pF ±10%, 1000 VDCW.	C351	19A700235P27	Ceramic: 150 pF <u>+</u> 5%, 50 VDCW.	C410	19A700235P20	Ceramic: 39 pF ±5%, 50 VDCW.
thru C104		1	R114	19A700106P55	Composition: 470 ohms ±5%, 1/4 w.	C236	19A701624P3	Ceramic, disc: 5 pF ±0.5 pF, 500 VDCW, temp coef	C352	19A700235P14	Ceramic, disc: 12 pF ±5%, 50 VDCW.	C411	19A700235P16	Ceramic: 18 pF ±5%, 50 VDCW.
C105	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.	R115	H212CRP222C	Deposited carbon: 2.2K ohms ±5%, 1/4 w.	İ		0 PPM <u>+</u> 60.	C353	19A700235P12	Ceramic: 8.2 pF ±0.25 pF, 50 VDCW.	C412	T644ACP247K	Polyester: .0047 uF <u>+</u> 10%, 50 VDCW.
C106	19A701624P14	Ceramic disc: 18 pF ±5%, 500 VDCW, temp coef 0	R116	19A700106P47	Composition: 220 ohms ±5%, 1/4 w.	ļ		DIODES	C354	19A700013P10	Phenolic: 0.56 pF ±5%, 500 VDCW.	C414	19A700235P14	Ceramic, disc: 12 pF ±5%, 50 VDCW.
		PPM ±30.	R117	H212CRP082C	Deposited carbon: 82 ohms ±5%, 1/4 w.	D201	19J706892P2	Silicon, pin; sim to Unitrode UM9401.	C355	19A700235P14	Ceramic, disc: 12 pF ±5%, 50 VDCW.	C415	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.
C107	19A701624P8	Ceramic, disc: 10 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±30.	1			and D202		· · · ·	C356	19A700235P13	Ceramic: 10 pF ±5%, 50 VDCW.	and C416		
	104701200014	1	, mn.a.	10470204071		1 202				1	.		19A700235P15	Ceramic: 15 pF ±5%, 50 VDCW.
C108	19A701602P14	Ceramic: 470 pF ±10%, 1000 VDCW.	TP101 and	19A703248P1	Contact, electrical.				C357	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.	C417		
C109	19A701624P122	Ceramic, disc: 39 pF ±5%, 500 VDCW, temp coef N80 PPM ±30.	TP102			L201	19B800890P8	Coil, RF: sim to Paul Smith SK-891-1.	C358	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.	C418	19A700235P13	Ceramic: 10 pF ±5%, 50 VDCW.
C110	19A701624P1	Ceramic, disc: 3 pF ±0.5 pF, 500 VDCW, temp coef				L202	19B800891P6	Coil, RF: .084 uH; sim to Paul Smith SK-890-1.	C359	19A700235P6	Ceramic: 2.7 pF ±0.25 pF, 50 VDCW, temp coef	C419	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.
		0 PPM ±120.	W101		Part of Printed Board 19D901044P1.	L203	19B800891P1	Coil, RF Choke: sim to Paul Smith SK-890-1.			N150 PPM.	C420	T644ACP247K	Polyester: .0047 uF ±10%, 50 VDCW.
C111	19A701624P8	Ceramic, disc: 10 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±30.	thru W106		Tart of Transa Board Tobotto Trans	L204	19B800890P7	Coil, RF: 15.8 nH ±5%; sim to Paul Smith	C360 and	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.			
	10150100405	<u> </u>	*100			1204	13800003011	SK-891-1.	C361			D401	10470000001	
C112 and	19A701624P5	Ceramic, disc: 7 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±60.			POWER AMPLIFIER	L205	19A701006P5	Strap.	C362	19A700233P2	Ceramic, disc: 100 pF ±20%, 50 VDCW.	D401 and	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
C113				1		L206	H343CLP10922	Coil, RF: 1.0 uH ±10%.				D402		
C114 and	19A701624P122	Ceramic, disc: 39 pF ±5%, 500 VDCW, temp coef N80 PPM +30.			CAPACITORS	L207	19B800891P6	Coil, RF: .084 uH; sim to Paul Smith SK-890-1.					·	
C115		_	C201 and	19A701624P8	Ceramic, disc: 10 pF \pm 0.5 pF, 500 VDCW, temp coef 0 PPM \pm 30.	L208	19B800890P6	Coil, RF: 14.7 nH ±5%, sim to Paul Smith	J351	19A701883P4	Contact, electrical; sim to AMP 86444-1.	L401	19B209728P8	Coil, RF: sim to Paul Smith SK801-1.
C116	19A701624P326	Ceramic, disc: 56 pF ±5%, 500 VDCW, temp coef N220 PPM ±30.	C202		5552 5 77 4 <u>5</u> 555			SK-891-1.				and L402		, i
0,1,7	10470169404	·	C203	19A701624P10	Ceramic, disc: 12 pF ±5%, 500 VDCW, temp coef 0	L209	19A700024P1	Coil, RF: 100 nH ±10%, 0.08 ohms DC res max, 100 v.				1	19B800890P5	Coil, RF: sim to Paul Smith SK-891-1.
C117	19A701624P4	Ceramic, disc: 6 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±60.			PPM ±30.			[L351	H343CLP10922	Coil, RF: 1.0 uH ±10%.	L403		
C118	19A703314P10	Electrolytic: 10 uF -10+50% tol, 50 VDCW; sim to	C204	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.	L210	19A700000P8	Coil, RF: 470 nH ±12%; sim to Jeffers 4411-4K.	L352 and	19B800965P323	Coil, RF: variable; sim to Paul Smith SK767-2.	L404	19B800891P3	Coil, RF Choke; sim to Paul Smith SK890-1.
		Panasonic LS Series.	C205	19A701624P122	Ceramic, disc: 39 pF ±5%, 500 VDCW, temp coef N80 PPM ±30.	L211	19B800890P6	Coil, RF: 14.7 nH \pm 5%, sim to Paul Smith SK-891-1.	L353			L405	19B209728P8	Coil, RF: sim to Paul Smith SK801-1.
C119	19A701602P14	Ceramic: 470 pF ±10%, 1000 VDCW.	C206	19A701624P4	Ceramic, disc: 6 pF ±0.5 pF, 500 VDCW, temp coef	L212	19A701006P5	Strap.	L354	19B800891P2	Coil, RF Choke: sim to Paul Smith SK-890-1.	L406	19J706154P2	RF Coil: sim to Paul Smith SK802-1.
C121	19A701602P14	Ceramic: 470 pF ±10%, 1000 VDCW.			0 PPM ±60.	L213	19A700024P13	Coil, RF: 1.0 uH ±10%.	L355	19B209728P9	Coil, RF: sim to Paul Smith SK801-1.	L407	19B209728P5	Coil.
			C207	19A701602P9	Ceramic: 220 pF ±20%, 1000 VDCW; sim to Radio	L214	19A701237P3	Coil.	L356	19B209728P6	Coil, RF: sim to Paul Smith SK-801-1.	L408 thru	19A703311P1	Coil, RF: sim to TOKO American KON-K6572BA.
1	104701000004				Materials Type JF DISCAPS.						ma aya zamana	L410		
J151	19A701883P4	Contact, electrical; sim to AMP 86444-1.	C208	19A701624P8	Ceramic, disc: 10 pF ±0.5 pF, 500 VDCW, temp coef 0 PPM ±30.	L215	H343CLP10922	Coil, RF: 1.0 uH ±10%.				L411	19B209420P20	Coil, RF: 3.9 uH ±5%, 1.00 ohms DC res max; sim
	1		C209	19A700006P29	Mica: 62 pF ±5%, 100 VDCW; sim to Underwood	L216	19B800891P6	Coil, RF: .084 uH; sim to Paul Smith SK-890-1.	Q351	19A700060P3	N-Type, field effect; sim to J310.			to Jeffers 4436-7J.
L101	19B800891P5	Coil, RF: .064 uH; sim to Paul Smith SK-890-1.		1	3НS0020.				Q352	19A701808P2	Silicon, NPN; sim to MPS 6595.			
L102	19B800965P223	Coil, RF: variable; sim to Paul Smith SK767-2.	C210 and	19A701602P14	Ceramic: 470 pF ±10%, 1000 VDCW.	P251	19A700102P10	Printed wire: 3 contacts; sim to Molex			RESISTORS	Q401	19A702062P1	Silicon, NPN.
L102	19B800890P5	Coil, RF: sim to Paul Smith SK-891-1.	C211	1		1 201		09-52-3032.	, nos.	ug190pp0150			19J706038P2	N Type, field effect.
	1		C212	19A700006P8	Mica: 12 pF ±5%, 100 VDCW; sim. to Underwood				R351	H212CRP015C	Deposited carbon: 15 ohms ±5%, 1/4 w.	Q402		
L104	19B800890P6	Coil, RF: 14.7 nH ±5%, sim to Paul Smith SK-891-1.		1	3HS0020.		1		and	H212CRP115C	Deposited carbon: 150 ohms ±5%, 1/4 w.	Q403	19A116818P3	N-Channel, field effect; sim to Type 3N1877.
L105	19J706154P8	RF Coil: sim to Paul Smith SK802-1.	C215	19A701413P17	Mica: 22 pF ±5%, 100 VDCW.	Q201	19A701940P1	Silicon, NPN; sim to MRF-559.	R353					RESISTORS
and L106			C216	19A701602P14	Ceramic: 470 pF ±10%, 1000 VDCW.	Q202	19A134164P2	Silicon, NPN; sim to Type 2N5945.	R354	H212CRP218C	Deposited carbon: 1.8K ohms ±5%, 1/4 w.	R401	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
L107	19B800891P2	Coil, RF Choke: sim to Paul Smith SK-890-1.	C217	19A703314P9	Electrolytic: 4.7 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.	Q203	19A134239P2	Silicon, NPN.	R355	19A700019F41	Deposited carbon: 2.2K ohms ±5%, 1/4 w.	R402	19A700019P35	Deposited carbon: 680 ohms ±5%, 1/4 w.
L107	198800891P6	Coil, RF: .084 uH; sim to Paul Smith SK-890-1.	C210	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.	Q204	19A700054P1	Silicon, NPN, 60 w; sim to BD-201.	R356	H212CRP022C	Deposited carbon: 22 ohms ±5%, 1/4 w.	R402	19A700019P32	Deposited carbon: 390 ohms ±5%, 1/4 w.
i	1	Coil, RF Choke: sim to Paul Smith SK-890-1.	C218	1			1		R357	H212CRP047C	Deposited carbon: 47 ohms ±5%, 1/4 w.		I	1
L109	19B800891P2	COII, AT CHOME. SIM to Faul DMIth DR-000-1.	C219	19A701602P20	Ceramic: 1000 pF ±10%, 1000 VDCW.				R358	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.	R404	19A700019P23	Deposited carbon: 68 ohms ±5%, 1/4 w.
			C220	19A700006P21	Mica: 33 pF \pm 5%, 100 VDCW; sim to Underwood 3HS0020.	R201	19A700106P61	Composition: 820 ohms ±5%, 1/4 w.	R359	H212CRP282C	Deposited carbon: 8.2K ohms ±5%, 1/4 w.	R405	19A700019P31	Deposited carbon: 330 ohms ±5%, 1/4 w.
Q101	19A702084P2	Silicon, NPN: sim to MPS 2369.	C221	19A700006P20	Mica: 30 pF ±5%, 100 VDCW; sim to Underwood	R202	19A700106P31	Composition: 47 ohms ±5%, 1/4 w.		,	-	R406	19A700019P40	Deposited carbon: 1.8K ohms ±5%, 1/4 w.
Q102	19A703027P2	Silicon, NPN: sim to MPS 3866.			3HS0020.	R203	19A700106P55	Composition: 470 ohms $\pm 5\%$, 1/4 w.				R407	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
and	10		C222	19A700006P24	Mica: 43 pF ±5%, 100 VDCW; sim to Underwood	R204	19B800784P106	Variable: 5K ohms ±20%, 1/2 w.	TP351	19A703248P1	Contact, electrical.	R408	H212CRP110C	Deposited carbon: 100 ohms ±5%, 1/4 w.
Q103					3HS0020.							1		
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DESCRIPTION

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SYMBOL GE PART NO.

DESCRIPTION

SYMBOL GE PART NO.

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*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

11

LBI-31589

SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION
R410	H212CRP268C	Deposited carbon: 6.8K ohms ±5%, 1/4 w.	C604	T644ACP222J	Polyester: .0022 uF ±5%, 50 VDCW.	R618	H212CRP356C	Deposited carbon: 56K ohms ±5%, 1/4 w.		19C328587P1	Pushbutton. (S601 & S602).
R411	H212CRP127C	Deposited carbon: 270 ohms ±5%, 1/4 w.	and C605			R619	H212CRP047C	Deposited carbon: 47 ohms ±5%, 1/4 w.		NP280878P15	Nameplate. (MODE A, B - Used with S601).
R412	H212CRP339C	Deposited carbon: 39K ohms ±5%, 1/4 w.	C606	T644ACP322K	Polyester: .022 uF <u>+</u> 10%, 50 VDCW.	R620	H212CRP168C	Deposited carbon: 680 ohms ±5%, 1/4 w.		NP280878P17	Nameplate. (MONITOR - Used with S602).
R413	H212CRP333C	Deposited carbon: 33K ohms ±5%, 1/4 w.	C607 and	315A6047P225U	Tantalum: 2.2 uF <u>+</u> 20%, 35 VDCW.	R621A	H212CRP127C	Deposited carbon: 270 ohms ±5%, 1/4 w.		19A702381P508	Screw, thd. form: No. 3.5-0.6 x 8. (Secures A1).
R414	H212CRP047C	Deposited carbon: 47 ohms ±5%, 1/4 w.	: C608			R621B	H212CRP110C	Deposited carbon: 100 ohms ±5%, 1/4 w.		19A701886P1	Spring. (Used with L105, L106, L355, L356, L401,
R415	H212CRP247C	Deposited carbon: 4.7K ohms ±5%, 1/4 w.	C609 and	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.	R621C	H212CRP047C	Deposited carbon: 47 ohms ±5%, 1/4 w.		19B232901P1	L402, L405-L407). Support. (Used with U601 & U602).
			C610 C611	215 4 CO 4 7 D 4 7 C W	Mandalum, 47 nR 100% 6 2 UDOW	R621D	H212CRP022C	Deposited carbon: 22 ohms ±5%, 1/4 w.		19A700068P1	Insulator, bushing. (Used with U601 & U602).
TP401	19A703248P1	Contact, electrical.	C611	315A6047P476M 19A702250P112	Tantalum: 47 uF ±20%, 6.3 VDCW. Polyester: .068 uF ±10%, 50 VDCW; sim to NISSEI	R621E	H212CRP968C H212CRP056C	Deposited carbon: 6.8 ohms ±5%, 1/4 w. Deposited carbon: 56 ohms ±5%, 1/4 w.		19A700115P3	Insulator, plate. (Used with U601 & U602).
		NETWORKS	6012	1341022307112	TYPE AMZ.	R622 R623	H212CRP147C	Deposited carbon: 470 ohms ±5%, 1/4 w.		19A701516P2	Insulator, plate. (Used with Z401 & Z402).
Z401	19A702166G2	Crystal pair, quartz: 45 MHz reference frequency	C613	19A701225P8	Electrolytic: 470 uF -10+75%, 16 VDCW; sim to Sprague 5002D477-G016DGIC.	R624	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.		19B233285P1	Ground tab. (Located at L401-L407 casting).
Z402		Part of Z401.	C614	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.	R625	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.		19A701905P3	Tuning screw. (Used with L105, L106, L355, L356,
			C615	T644ACP315K	Polyester: .015 uF <u>+</u> 10%, 50 VDCW.	R626	19A700018P1	Deposited carbon: 1 ohm ±5%, 1/3 w.		19C851075P1	L401, L402, L405-L407). Knob. (R617).
		RECEIVER - IF/DETECTOR	C616	T644ACP310K	Polyester: .010 uF <u>+</u> 10%, 50 VDCW.	R627	H212CRP147C	Deposited carbon: 470 ohms $\pm 5\%$, 1/4 w.		19A701743P1	Pad. (Located behind S602 knob).
İ			C617	19A703314P10	Electrolytic: 10 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.	and R628		1		19D429946P4	Casting. (Located at L401 & L407).
C501	19A700235P16	Ceramic: 18 pF ±5%, 50 VDCW.	C618	19A703314P4	Electrolytic: 47 uF -10+50% tol, 16 VDCW; sim to	R629	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.	1	19C850619G6	Casting. (Located at L105 & L106).
C502	19A700235P15	Ceramic: 15 pF ±5%, 50 VDCW.			Panasonic LS Series.	R630	H212CRP322C	Deposited carbon: 22K ohms $\pm 5\%$, 1/4 w.		19A121175P46	Insulator, plate. (Located at L404).
and C503			C619	19A702250P112	Polyester: .068 uF \pm 10%, 50 VDCW; sim to NISSEI TYPE AMZ.	R631	H212CRP410C	Deposited carbon: 0.1M ohms ±5%, 1/4 w.		19B801338P1	. Shield, dust.
C504	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.	C620	19A701225P3	Electrolytic: 220 uF, -10+50%, 25 VDCW.	R632	H212CRP312C	Deposited carbon: 12K ohms ±5%, 1/4 w.			
and C505			C621	315A6047P334U	Tantalum: 0.33 uF <u>+</u> 20%, 35 VDCW.	R633	H212CRP327C	Deposited carbon: 27K ohms ±5%, 1/4 w.			
C508	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.	C622	T644ACP210K	Polyester: .0010 uF <u>+</u> 10%, 50 VDCW.	R635 R637	H212CRP115C H212CRP215C	Deposited carbon: 150 ohms $\pm 5\%$, $1/4$ w. Deposited carbon: 1.5K ohms $\pm 5\%$, $1/4$ w.			
			C623	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.	R638	H212CRP439C	Deposited carbon: 0.39M ±5%, 1/4 w.			
L501	19A703311P2	Coil, RF: sim to TOKO AMERICA KON-K6672BA.				R639	H212CRP247C	Deposited carbon: 4.7K ohms ±5%, 1/4 w.		4.	
L502	19B801023P1	Coil, RF: 450 uH ±6%, sim to TOKO AMERICAN	D601	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75	R640	H212CRP015C	Deposited carbon: 15 ohms ±5%, 1/4 w.			
		124LN-A064HM.			PIV; sim to Type 1N4148.	R641	H212CRP127C	Deposited carbon: 270 ohms ±5%, 1/4 w.			
		RESISTORS		. A							
R501	H212CRP182C	Deposited carbon: 820 ohms ±5%, 1/4 w.	Н601	19A134354P1	Diode, optoelectronic: red; sim to Hew. Packard 5082-4655.	S602	19B800563P8	Push: DPDT, contacts rated 15 mA at 130 VDC; sim			
R502	H212CRP318C	Deposited carbon: 18K ohms ±5%, 1/4 w.				5002	1020000010	to IEEE/SCHADOW F2UOA.			
R503 and	H212CRP218C	Deposited carbon: 1.8K ohms ±5%, 1/4 w.				8617		Part of R617.			
R504		777 shma 459 1/A m	Q601	19A700022P2	Silicon, PNP: sim to 2N3906.			INTEGRATED CIRCUITS			
R505	H212CRP347C H212CRP310C	Deposited carbon: 47K ohms ±5%, 1/4 w. Deposited carbon: 10K ohms ±5%, 1/4 w.	Q602 Q603	19A700023P2 19A700022P2	Silicon, NPN: sim to 2N3904. Silicon, PNP: sim to 2N3906.	U601	19A701830P1	Linear, Audio AMPLIFIER; sim to TDA 2003.			
R506	HZ12CRF310C	Deposited carbon. For same 100, 171 a.	Q604	19A702504P2	Silicon, PNP; sim to 2N4403.	U602	19A138414G1	Regulator: 8.5 V.			
			Q605	19A700023P2	Silicon, NPN: sim to 2N3904.						
TP501	19A703248P1	Contact, electrical.	and Q606				۶.	SYSTEM INTERCONNECT			
		INTEGRATED CIRCUITS			RESISTORS						
U501	19A704619P1	Linear: IF AMPLIFIER AND DETECTOR.	R601	H212CRP282C	Deposited carbon: 8.2K ohms ±5%, 1/4 w.	P901	19A116659P15	Connector, printed wiring: 4 contacts rated at 5 amps; sim to Molex 09-52-3042.			
			1 1	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.	P903	19A116659P83	Connector, printed wiring: 7 contacts rated at 5		F-5.	4 7
X501	19A702742P1	Crystal socket. (Quantity 2).	R603	H212CRP215C	Deposited carbon: 1.5K ohms ±5%, 1/4 w.			amps; sim to Molex 09-52-3072 SPECIAL.			
		CRYSTALS	R604	H212CRP212C	Deposited carbon: 1.2K ohms ±5%, 1/4 w.	P912	19A116659P15	Connector, printed wiring: 4 contacts rated at 5 amps; sim to Molex 09-52-3042.			
Y501	19B233066G8	Crystal: freq range 45.455 MHz.	R605	H212CRP315C	Deposited carbon: 15K ohms ±5%, 1/4 w.						
1501	1252555555		R606	H212CRP356C	Deposited carbon: 56K ohms ±5%, 1/4 w.	Q202	19A134164P2	Silicon, NPN; sim to Type 2N5945.			
			R607	19B800784P105	Variable: 1K ohms ±20%, 350 VDCW, .5 w.	Q203	19A134239P2	Silicon, NPN.			
Z501	19B801021P2	Bandpass filter: 455 kHz ± 1.5 ; sim to Murata CFW-455E.	R609	H212CRP368C	Deposited carbon: 68K ohms ±5%, 1/4 w.						
			R610 R611	H212CRP233C H212CRP210C	Deposited carbon: 3.3K ohms ±5%, 1/4 w. Deposited carbon: 1K ohms ±5%, 1/4 w.	2001	10000056301	SWITCHES Push: DPDT, 1 station, alternate action; sim to			
		RECEIVER - AUDIO	and R612	HZ1ZCRPZ10C	Deposited Carbon: Ik onms +5%, 1/4 w.	8601	19B800563P1	IEEE/SCHADOW 51281 (F2UEE).			es.
:			R613	H212CRP910C	Deposited carbon: 1 ohm ±5%, 1/4 w.			MISCELLANEOUS			
C601	T644ACP210K	Polyester: .0010 uF ±10%, 50 VDCW.	R614	H212CRP156C	Deposited carbon: 560 ohms ±5%, 1/4 w.		19A130465P1	Spacer, inner. (Used with Q202).			
and C602		÷	R615	H212CRP218C	Deposited carbon: 1.8K ohms ±5%, 1/4 w.		7142162P137	Nut, spacer: No. 8-32. (Used with Q202).			
C603	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.	R616	H212CRP982C	Deposited carbon: 8.2 ohms ±5%, 1/4 w.		5492178P2	Washer, spring tension: sim to Wallace Barnes			
			R617	19A703313P3	Variable: 10K ohms ±20%, .1 watt.			375-20. (Used with Q202).			<u> </u>
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ADDENDUM NO 1 TO LBI-31589A (PCN5)

This addendum provides neccessary information pertaining to a change in this publication.

To improve operation P901, P903, and P912 have been changed to gold plated contacts. New part numbers are:

P901 and P912: 19All6659P187 P903: 19All6659P188

When changing boards, care should be taken to assure boards with gold contacts are not interchanged with boards having tin contacts.