MAINTENANCE MANUAL
RECEIVER BOARD
CMA-257
FOR
MLSH040
TWO-WAY MOBILE RADIO COMBINATIONS

TABLE OF CONTENTS

DESCRIPTION

The MLS FM dual conversion, superheterdoyne receiver board (CMA-257) is designed for operation in the 150.8 - 174 MHz frequency ranges and mounts in the front and bottom of the radio frame assembly as shown in Figure 1- Receiver Board Location.

A regulated 9.0 volts is provided to operate all receiver stages except the audio PA IC, which operates from the switched A+ (13.6 volts) supply.

The receiver has intermediated frequencies of 82.2 MHz and 455 KHz. Adjacent channel selectivity is obtained by using two band-pass filters: and 82.2 MHz crystal filter and a 455 KHz ceramic filter.

All of the receiver circuitry except the synthesizer, audio preamp, and audio PA are mounted on the receiver (RX) board (refer to Figure 2 - Block Diagram). The receiver consists of:

- a Front End and Mixer
- an 82.2 MHz First IF, a 455 MHz Second IF and a FM Detector
- Audio PA
- Squelch

CIRCUIT ANALYSIS

Receiver Front End

An RF signal from the antenna is coupled through the low-pass filter, antenna switch relay K1 and RF band-pass Filter FL401 to the input of RF amplifier HC401. The output of HC401 is coupled through RF band-pass filter FL402 and low-pass filter FL403 to the input of first mixer HC402. Front end selectivity is provided by the RF band-pass filters and low-pass filter.

Receiver Injection

The receiver board RF injection frequency (233.0 to 256.2 MHz) from the synthesizer VCO is applied to amplifier HC403 through RX injection connector J402. The input level at J402 will be between 0.5 and 1.0 milliwatts, 0.5 milliwatts minimum. The output of amplifier HC403 is filtered by an injection filter (FL403). This filter is tuned to pass frequencies in the 233.0 - 256.2 MHz band-pass range.

First Mixer

The first mixer (HC402) is a double-balanced diode mixer that converts a signal in the 150.8-174.0 MHz frequency range to the 82.2 Mhz first IF frequency.

In the mixer stage, RF from the front end RF filter is applied to an

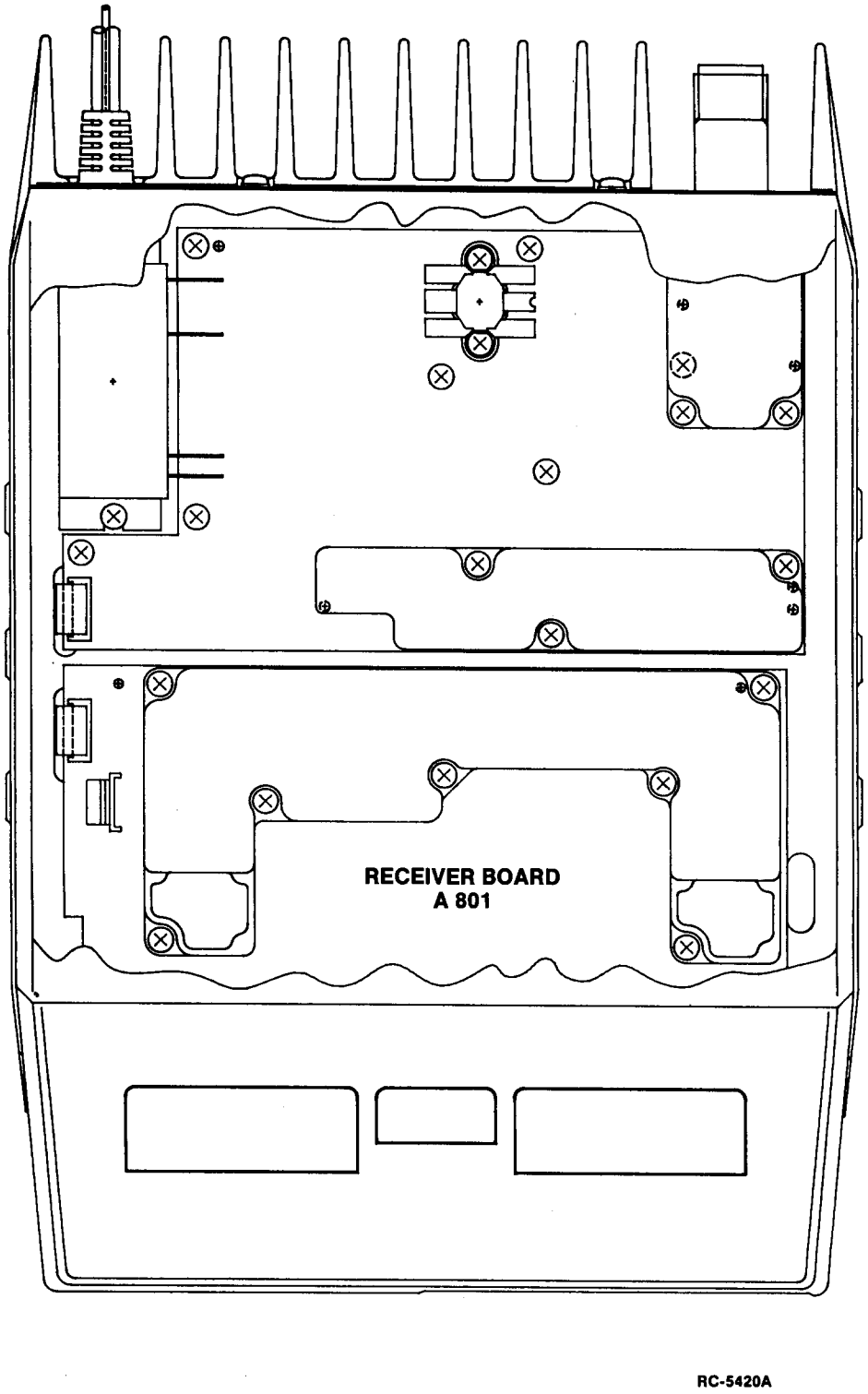
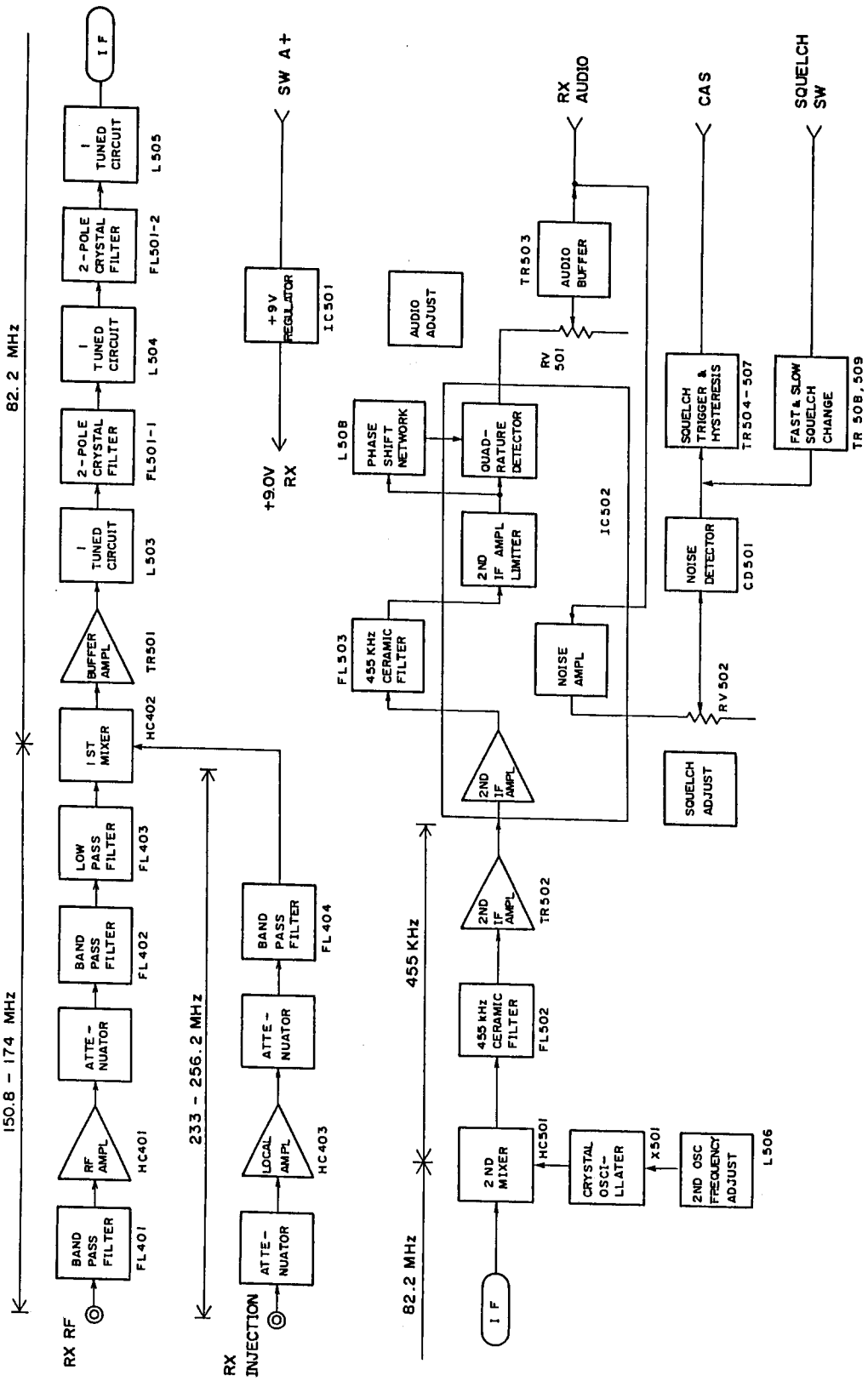


Figure 1 - Receiver Location (Bottom View)



RC-5515

Figure 2 - Block Diagram

input of the mixer. Injection voltage from the amplifier stages is applied to an input of the mixer. The 82.2 MHz mixer first IF output signal is coupled from the output of HC402 through an impedance matching network (TR501 and L503) to a 4-pole crystal filter consisting of FL501-1 and FL501-2.

First IF

The highly-selective crystal filters FL501-1 and FL501-2 provide the first portion of the receiver IF selectivity. The output to the filters is coupled through an impedance matching network consisting of inductor L505, capacitor C506 and resistor R504 to second mixer HC501.

Second Mixer

Second mixer HC501 and associated circuitry provide the second oscillator and second mixer.

The 82.2 MHz IF input is applied to Pin 7 and mixed with an 81.745 MHz frequency supplied by crystal oscillator X501. Inductor L506 sets the frequency of X501.

Second IF and Detector

The output of the second mixer is coupled to the 4-pole ceramic filter FL502, which provides the 455 KHz selectivity. The output of the ceramic filter is coupled to the base of IF amplifier transistor TR502. This transistor provides limiting for the 455 KHz IF signal (1.4 Vp-p) to prevent high level overloading of IC502 (Limited/FM Detector, Noise Amplifier).

IC502 and associated circuitry provide an IF amplifier and FM detector. The 455 KHz IF input is applied to Pin 18.

The 455 KHz IF signal is amplified and applied to 4-pole ceramic filter FL503, which provides the 455 KHz selectivity. The output of the 455 KHz filter is re-applied to IC502-5. The second IF signal is amplified and limited. Inductor L508 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. The audio output of IC502 is applied to the System Control and Fre- quency Synthesizer board (A801) through the base of audio buffer transistor TR503.

Squelch Circuit

The squelch circuit senses the noise components contained in the FM detector audio output. The squelch input is applied to Pin 12 of IC502 from audio buffer transistor TR503. An internal circuit of IC502 provides filtering and applies received noise in the 6-8 KHz frequency band to potentiometer RV502 (Squelch Adjust). The output of the squelch adjust potentiometer is connected to the noise detector. The noise detector consists of resistor R528, capacitor C536 and diode CD501. As the noise increases in magnitude in a negative direction, negative spikes cause CD501 to conduct and charge C535 and C536 to a DC level proportional to the noise level. The output of the noise detector is applied to the input of a squelch trigger circuit consisting of transistors TR504 through TR507. The squelch trigger has approximately 3 dB of hysteresis to prevent sudden noise level changes from effecting the squelch threshold setting. Resistor R527 provides temperature compensation for the squelch circuit. The output of squelch trigger is the Carrier Activated Switch (CAS) signal. The CAS output is applied to the System Control and Frequency Synthesizer board.

Audio Circuits

Received audio (RX AUDIO) from the FM detector is applied to the input of audio pre-amplifier IC601-A on Frequency Synthesizer Board A801 (refer to Maintenance Manual LBI-31767). The audio is then applied through Tone Reject Filter HC601, audio gate IC604-C and pre-amplifier IC601-C to the Volume Control IC602. The audio output from the Volume Control IC is applied through audio pre-amplifier IC601-C to the de-emphasis network R628, R618, capacitor C609 and C605. This enables audio amplifier IC603 which provides up to 4 watts of audio output power input to a 4-ohm speaker.

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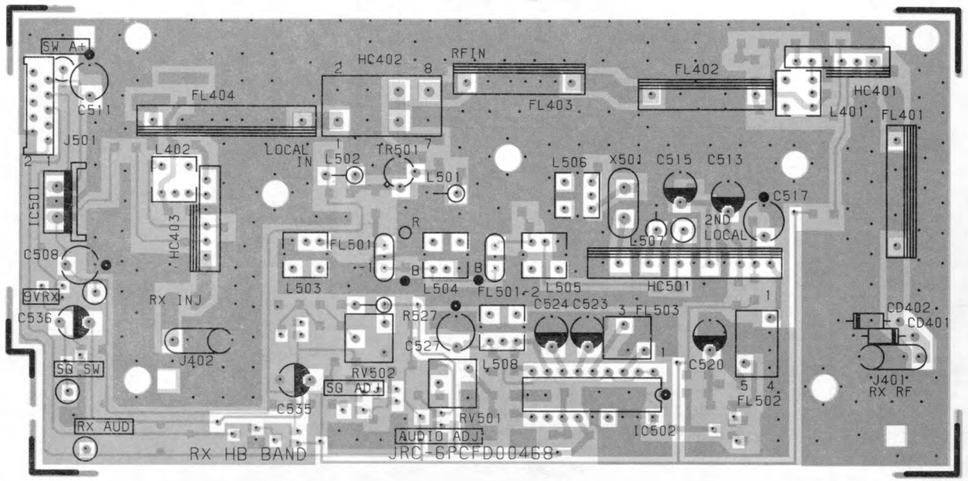
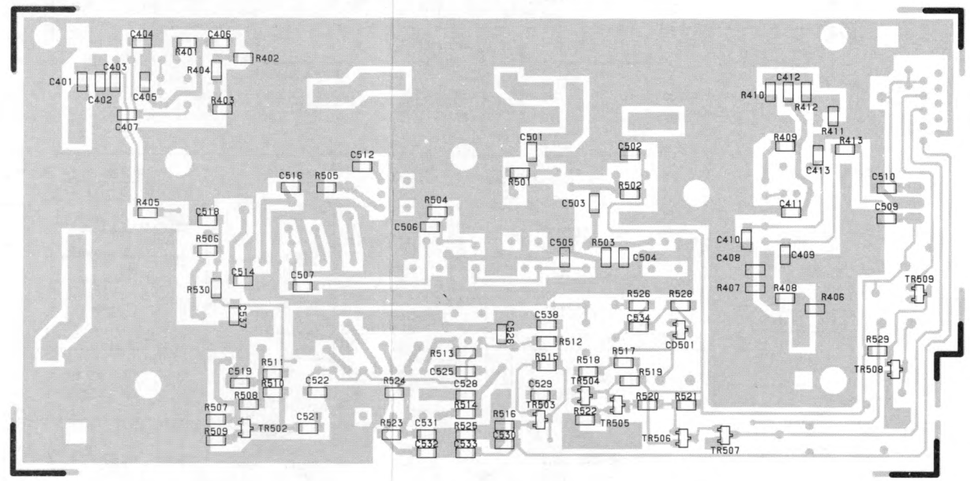
COMPONENT SIDE





RUNS ON SOLDER SIDE

RUNS ON BOTH SIDES

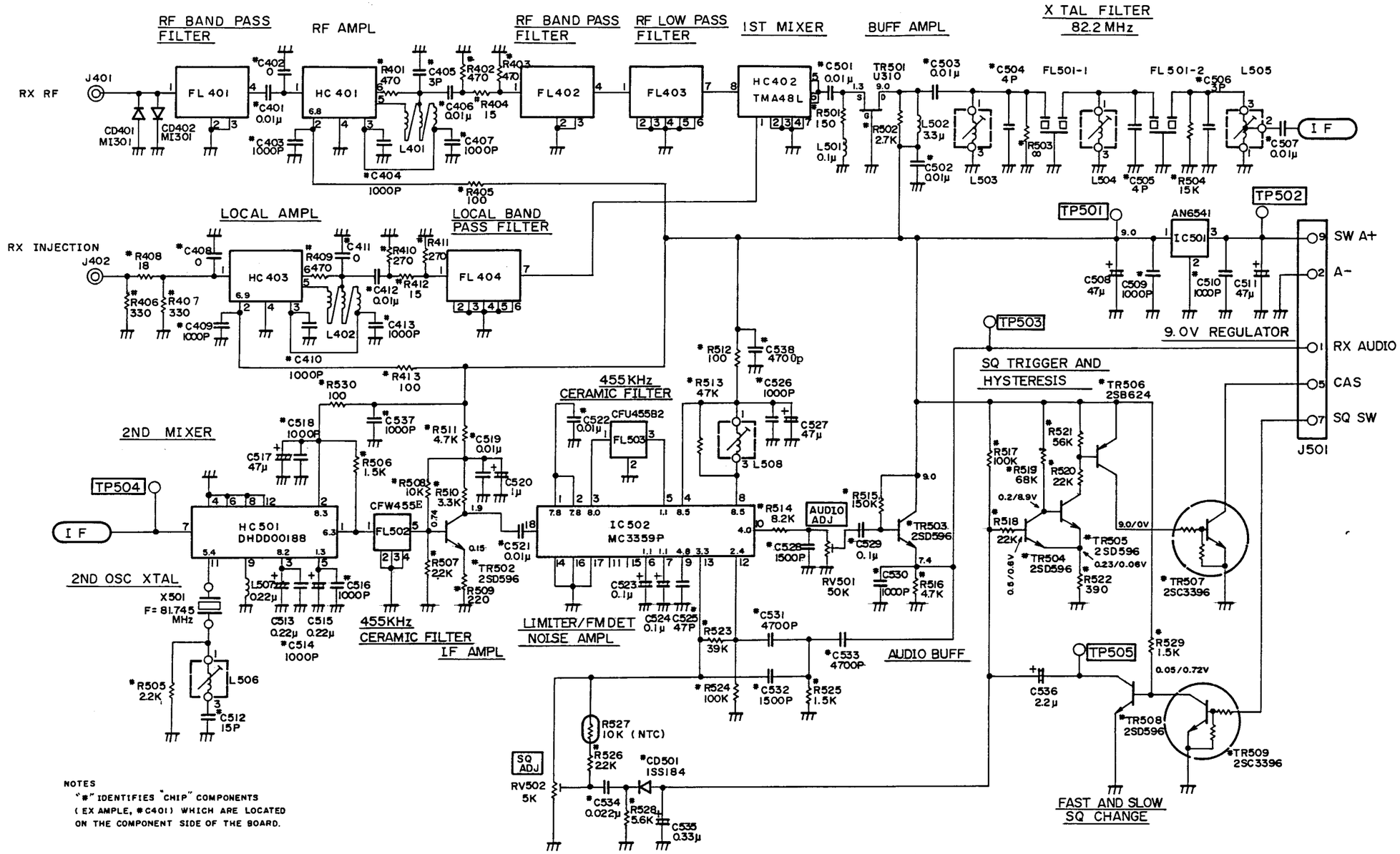
RUNS ON COMPONENT SIDE

LEAD IDENTIFICATION FOR RV501 (TOP VIEW)

RC-5442

OUTLINE DIAGRAM

Receiver Board (A801)
CMA-257



NOTES
"*" IDENTIFIES "CHIP" COMPONENTS
(EX AMPLE, *C401) WHICH ARE LOCATED
ON THE COMPONENT SIDE OF THE BOARD.

ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μ, n OR p.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR μ.

SCHEMATIC DIAGRAM

150.8-174 MHz Receiver
DD00-CMA-257

PARTS LIST

RECEIVER BOARD
JRC/CMA-257

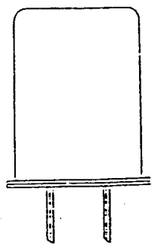
ISSUE 1

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C401	JRC/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C403 and C404	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C405	JRC/5CAAD00796	Ceramic: 3 pF ±0.25 pF, 50 VDCW, temp coef 0 ±60 PPM.
C406	JRC/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C407	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C409 and C410	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C412	JRC/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C413	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C501 thru C503	JRC/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C504 and C505	JRC/5CAAD00801	Ceramic: 4 pF ±0.25 pF, 50 VDCW, temp coef 0 ±60 PPM.
C506	JRC/5CAAD00796	Ceramic: 3 pF ±0.25 pF, 50 VDCW, temp coef 0 ±60 PPM.
C507	JRC/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C508	JRC/5CEAD00756	Electrolytic: 47 uF ±20%, 16 VDCW.
C509 and C510	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C511	JRC/5CEAA01816	Electrolytic: 47 uF ±20%, 25 VDCW.
C512	JRC/5CAAD00787	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±60 PPM.
C513	JRC/5CSAC00988	Tantalum: 0.22 uF ±20%, 35 VDCW.
C514	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C515	JRC/5CSAC00988	Tantalum: 0.22 uF ±20%, 35 VDCW.
C516	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C517	JRC/5CEAD00756	Electrolytic: 47 uF ±20%, 16 VDCW.
C518	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef ±10%.
C519	JRC/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C520	JRC/5CSAC00982	Tantalum: 1 uF ±20%, 35 VDCW.
C521	JRC/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C522	JRC/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C523 and C524	JRC/5CSAC01068	Tantalum: 0.1 uF ±20%, 35 VDCW.
C525	JRC/5CAAD00864	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±60 PPM.
C526	JRC/5CAAD00782	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±10%.
C527	JRC/5CEAD00756	Electrolytic: 47 uF ±20%, 16 VDCW.
C528	JRC/5CAAD00791	Ceramic: 1500 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C529	JRC/5CAAD01056	Ceramic: 0.1 uF +80% -20%, 50 VDCW, temp coef +30 -80%.
C530	JRC/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C531	JRC/5CAAD00783	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±10%.
C532	JRC/5CAAD00791	Ceramic: 1500 pF ±10%, 50 VDCW, temp coef ±10%.
C533	JRC/5CAAD00783	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±10%.
C534	JRC/5CAAD01109	Ceramic: 0.022 uF ±10%, 50 VDCW, temp coef ±10%.
C535	JRC/5CSAC01151	Tantalum: 0.33 uF ±20%, 35 VDCW.
C536	JRC/5CSAC01069	Tantalum: 2.2 uF ±20%, 35 VDCW.
C537	JRC/5CAAD00782	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±10%.
C538	JRC/5CAAD00783	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±10%.
		- - - - - - - - - - - DIODES - - - - - - - - - -
CD401 and CD402	JRC/5TXAR0004	Silicon, RF Switching; sim to Mitsubish.
CD501	JRC/5TXAD00290	Silicon, fast recovery (2 diodes in cathode common); sim to Toshiba 1SS184.
		- - - - - - - - - - - FILTERS - - - - - - - - - -
FL401	JRC/5NBAG00012	Band-pass filter: sim to Soshin BP150-174A1.
FL402	JRC/5NBAG00013	Band-pass filter: sim to Soshin BP150-174A2.
FL403	JRC/5NLAT00020	Low-pass filter: sim to Soshin LP174A1.
FL404	JRC/5NBAG00014	Band-pass filter: sim to Soshin BP232-257A1.
FL501	JRC/5XHAA00850	Crystal filter: sim to Nihon denpa XPJ15-2.
FL502	JRC/5NRAA00094	Ceramic filter: sim to Murata CFW455E.
FL503	JRC/5NRAA00041	Ceramic filter: sim to Murata CFU455B2.
HC401	JRC/5DHBE00005	Linear, RF Amplifier: sim to Soshin AMP-2.
HC402	JRC/5DHAV00004	Linear, DB-Mixer: sim to Toukou TMA48L.
HC403	JRC/5DHBE00005	Linear, RF Amplifier: sim to Soshin AMP-2.
HC501	JRC/6DHDD00188	Linear, Mixer: sim to JRC DHDD188.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
IC501	JRC/5DAAR00021	Linear, Positive Voltage Regulator: sim to Matsushita AN6541.
IC502	JRC/5DDAS00074	Linear, IF Amplifier 8 Detector: sim to Motorola MC3359P.
		- - - - - - - - - - - JACKS - - - - - - - - - - -
J401	JRC/5JWCL00045	Connector, RF: sim to Talko TMP-J01X-A2.
J501	JRC/5JWBS00178	Connector, 10 pins: sim to Hirose PH3-10S-1.25DAS(G).
		- - - - - - - - - - - COILS - - - - - - - - - - -
L401 and L402	JRC/6LAFD01136	Coil, RF.
L501	JRC/5LCAC00391	Choke coil: 0.1 uH ±10%.
L502	JRC/5LCAC00160	Choke coil: 3.3 uH ±10%.
L503 thru L505	JRC/6LADD00553	Coil, RF.
L506	JRC/6LADD00554	Coil, RF.
L507	JRC/5LCAC00165	Choke coil: 0.22 uH ±20%.
L508	JRC/6LAFD00877	Coil, RF.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R401 thru R403	JRC/5RDAC02153	Metal film: 470 ohms ±5%, 200 VDCW, 1/8 W.
R404	JRC/5RDAC02161	Metal film: 15 ohms ±5%, 200 VDCW, 1/8 W.
R405	JRC/5RDAC02137	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 W.
R406 and R407	JRC/5RDAC02140	Metal film: 330 ohms ±5%, 200 VDCW, 1/8 W.
R408	JRC/5RDAC02146	Metal film: 18 ohms ±5%, 200 VDCW, 1/8 W.
R409	JRC/5RDAC02153	Metal film: 470 ohms ±5%, 200 VDCW, 1/8 W.
R410 and R411	JRC/5RDAC02163	Metal film: 270 ohms ±5%, 200 VDCW, 1/8 W.
R412	JRC/5RDAC02161	Metal film: 15 ohms ±5%, 200 VDCW, 1/8 W.
R413	JRC/5RDAC02137	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 W.
R501	JRC/5RDAC02135	Metal film: 150 ohms ±5%, 200 VDCW, 1/8 W.
R502	JRC/5RDAC02128	Metal film: 2.7K ohms ±5%, 200 VDCW, 1/8 W.
R504	JRC/5RDAC02160	Metal film: 15K ohms ±5%, 200 VDCW, 1/8 W.
R505	JRC/5RDAC02124	Metal film: 2.2K ohms ±5%, 200 VDCW, 1/8 W.
R506	JRC/5RDAC02133	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 W.
R507	JRC/5RDAC02124	Metal film: 2.2K ohms ±5%, 200 VDCW, 1/8 W.
R508	JRC/5RDAC02125	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 W.
R509	JRC/5RDAC02159	Metal film: 220 ohms ±5%, 200 VDCW, 1/8 W.
R510	JRC/5RDAC02147	Metal film: 3.3K ohms ±5%, 200 VDCW, 1/8 W.
R511	JRC/5RDAC02152	Metal film: 4.7K ohms ±5%, 200 VDCW, 1/8 W.
R512	JRC/5RDAC02137	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 W.
R513	JRC/5RDAC02134	Metal film: 47K ohms ±5%, 200 VDCW, 1/8 W.
R514	JRC/5RDAC02158	Metal film: 8.2K ohms ±5%, 200 VDCW, 1/8 W.
R515	JRC/5RDAC02129	Metal film: 150K ohms ±5%, 200 VDCW, 1/8 W.
R516	JRC/5RDAC02152	Metal film: 4.7K ohms ±5%, 200 VDCW, 1/8 W.
R517	JRC/5RDAC02138	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 W.
R518	JRC/5RDAC02148	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 W.
R519	JRC/5RDAC02176	Metal film: 68K ohms ±5%, 200 VDCW, 1/8 W.
R520	JRC/5RDAC02148	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 W.
R521	JRC/5RDAC02231	Metal film: 56K ohms ±5%, 200 VDCW, 1/8 W.
R522	JRC/5RDAC02443	Metal film: 390 ohms ±5%, 200 VDCW, 1/8 W.
R523	JRC/5RDAC02374	Metal film: 39K ohms ±5%, 200 VDCW, 1/8 W.
R524	JRC/5RDAC02138	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 W.
R525	JRC/5RDAC02133	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 W.
R526	JRC/5RDAC02124	Metal film: 2.2K ohms ±5%, 200 VDCW, 1/8 W.
R527	JRC/5RZBX00002	Thermistor: 10K ohms ±3%, sim to TDK NTCDS40203HG 103JC.
R528	JRC/5RDAC02154	Metal film: 5.6K ohms ±5%, 200 VDCW, 1/8 W.
R529	JRC/5RDAC02133	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 W.
R530	JRC/5RDAC02137	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 W.
RV501	JRC/5RVAB00317	Variable: 50K ohms ±30%, 0.1 W.
RV502	JRC/5RVAB00277	Variable: 5K ohms ±30%, 0.1 W.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
TR501	JRC/5TKAG00007	Field effect (Single Gate): sim to Siliconix U310.
TR502 thru TR505	JRC/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR506	JRC/5TBAB00055	Silicon, PNP: sim to NEC 2SB624 (DV3).
TR507	JRC/5TCAZ00007	Silicon, NPN: sim to Sanyo 2SC3396.
TR508	JRC/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR509	JRC/5TCAZ00007	Silicon, NPN: sim to Sanyo 2SC3396.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
X501	JRC/5XHAA00849	Quartz crystal: 82.655 MHz, XPJ15-3.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XS501-A and XS501-B	JRC/5ZJDF00001	Crystal Socket: sim to Hakuto 75315-001.

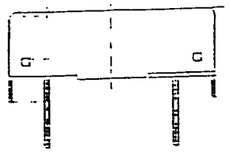
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

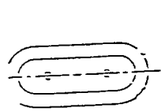
OSCILLATORS

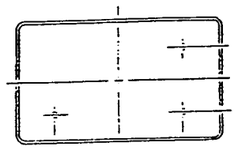
X501



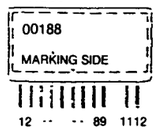
XU201



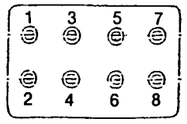




HC501

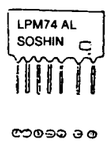


HC402

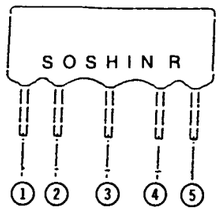


FILTERS

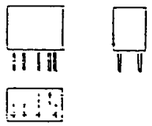
FL403



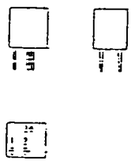
FL401-FL403



FL502



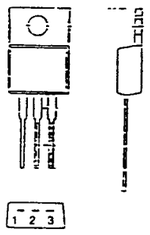
FL503



Input
Gnd
Output

9-VOLT REGULATOR

IC501



1 = Input
2 = Common
2 = Output

IC DATA

RC-5421

ADDENDUM NO. 1 TO LBI-31766A
(PCML)

PARTS LIST CHANGES

The prefix of Service Parts replacement part numbers listed in the various Parts Lists included in this maintenance manual has been changed from "JRC/" to "B19/". All other characters remain as shown. When this manual is next reprinted, all replacement parts lists will show only the "B19/" prefix.

When ordering replacement parts listed in this manual from the GE Mobile Communications Service Parts Operation, please use only the "B19/" prefix. The "B19/" prefix will be the only one shown in any future SERVICE PARTS PRICE LIST.

ADDENDUM NO. 2 TO LBI-31766A
(PCML)

This addendum identifies revision letter changes not previously incorporated in this publication.

REV. A - RECEIVER BOARD B19/CMA-257
Original issue

REV. B - RECEIVER BOARD B19/CMA-257
Improve receiver sensitivity:

Changed capacitors C508, C517 and C527 to 33 uF (B19/5CEAA02283).

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