MAINTENANCE MANUAL
RECEIVER BOARD
CMA-259
FOR
MLS8030
TWO-WAY MOBILE RADIO COMBINATIONS

TABLE OF CONTENTS

DESCRIPTION

The MLS FM dual conversion, superheterdoyne receiver board (CMA-259) is designed for operation in the 851 to 871 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 Intermediate Frequencies of 82.2 MHz and 455 KHz. Adjacent channel selectivity is obtained by using two band-pass filters: an 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

A 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 to the input of first mixer HC402. Front end selectivity is provided by the RF band-pass filters.

Receiver Injection

Receiver RF injection (384.40 to 394.4 MHz) from the synthesizer VCO is applied to doubler HC403 through RX INJECTION connector J402. The input level at J402 will be between 0.5 and 1.0 milliwatts. Doubler HC403 multiplies the Rx injection frequency by 2 to provide a mixer injection frequency 82.2 MHz below the received RF frequency to the first mixer HC402. The output of doubler HC403 is coupled to the input of amplifier HC404. The output of amplifier HC404 is filtered by a dielectric filter (FL403). This filter is tuned to pass frequencies in the 768.8-788.8 MHz band-pass range.

First Mixer

The 1st mixer uses a transistor (HC402) as the active device. This transistor mixer provides high power gain

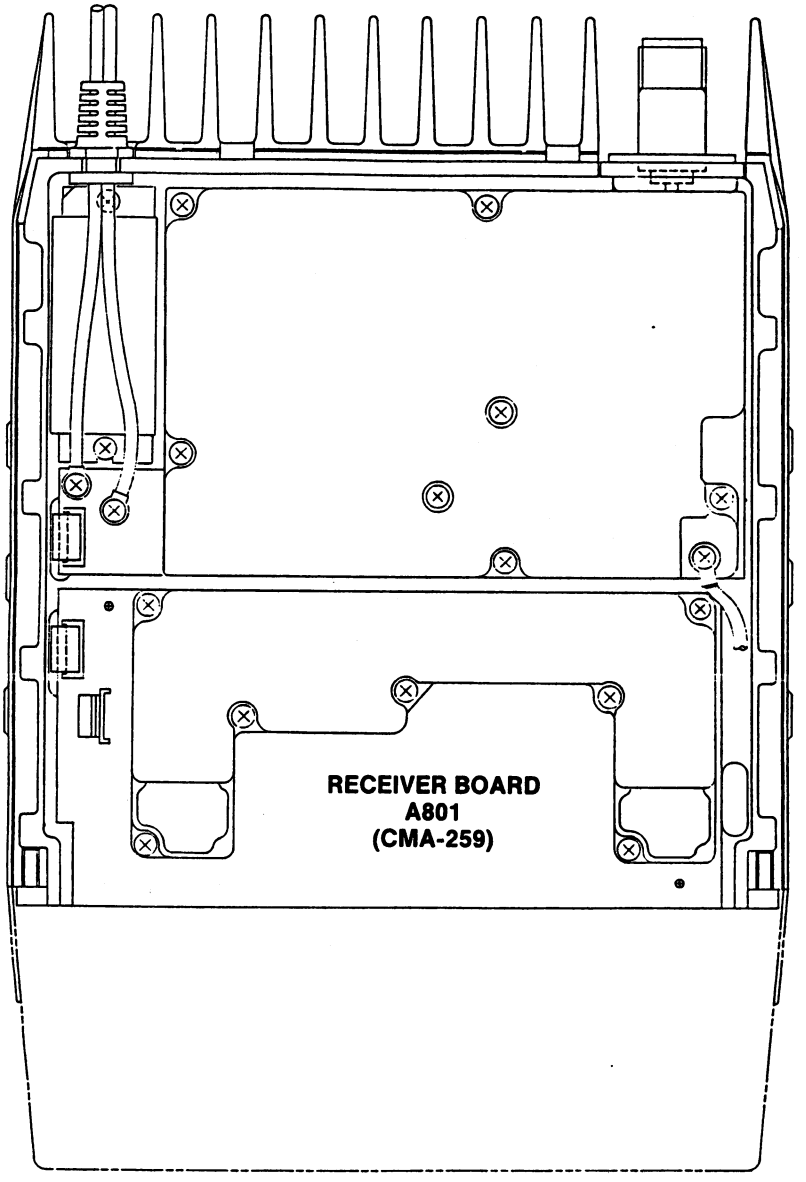


Figure 1 - Receiver Location (Bottom View)

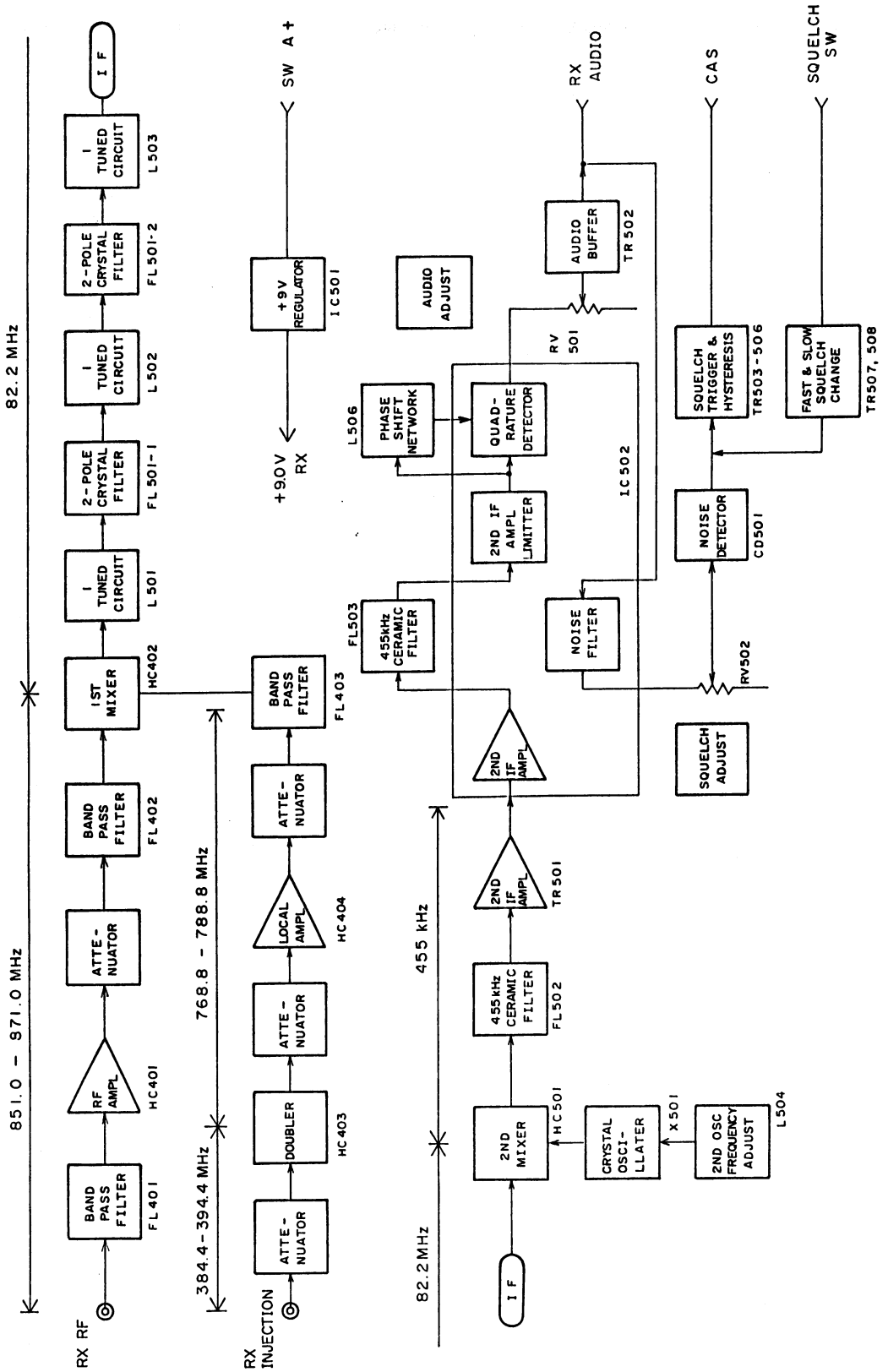


Figure 2 - Block Diagram

and an output relatively free of intermodulation products.

In the mixer stage, RF from the front-end dielectric filter is applied to one input of the mixer. Injection voltage from the multiplier stages is applied to the other 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 (L501 and C502) 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 L503, capacitors C504 and C505 and resistor R503 to the 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 82.655 MHz frequency supplied by crystal oscillator X501. Inductor L504 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 TR501. 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 L506 shifts the IF signal by 90° and applies 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 Frequency Synthesizer board (A801) through the base of audio buffer transistor TR502.

Squelch Circuit

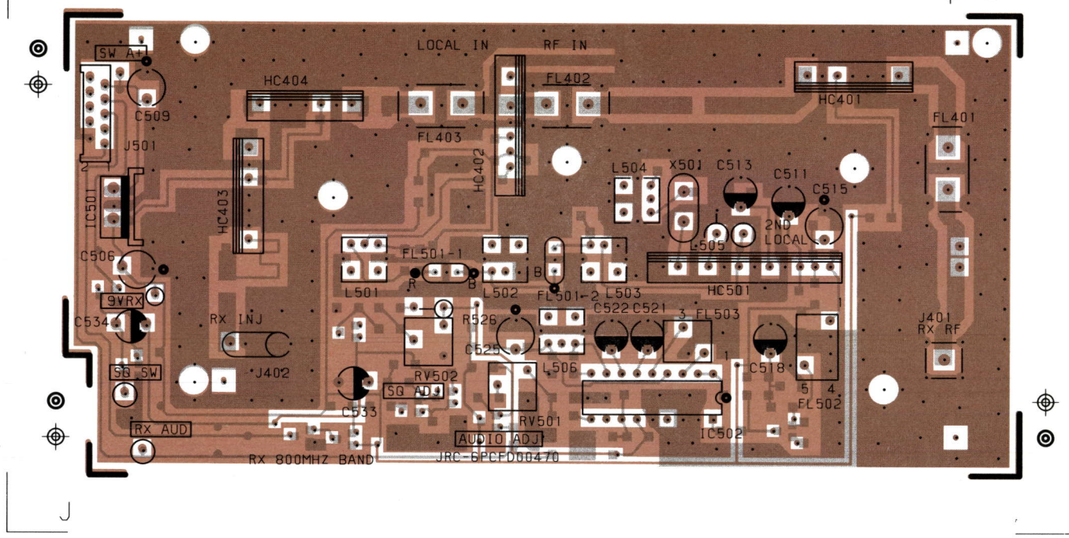
The squelch circuit senses the noise components contained in the FM detector audio output. The squelch input is applied to Pin 12 of IC502 from audio buffer transistor TR502. An internal circuit of IC502 provides filtering and applies received noise in the 6-8 KHz frequency band to potentiometer RV502 (Squelch Adjust). The output of the squelch adjust potentiometer is connected to the noise detector. The noise detector consists of resistor R527, capacitor C533 and diode CD501. As the noise increases in magnitude in a negative direction, negative spikes cause CD501 to conduct and charge C533 and C534 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 TR503 through TR506. The squelch trigger has approximately 3 dB of hysteresis to prevent sudden noise level changes from effecting the squelch threshold setting. Resistor R526 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-31849). 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.

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

COMPONENT SIDE

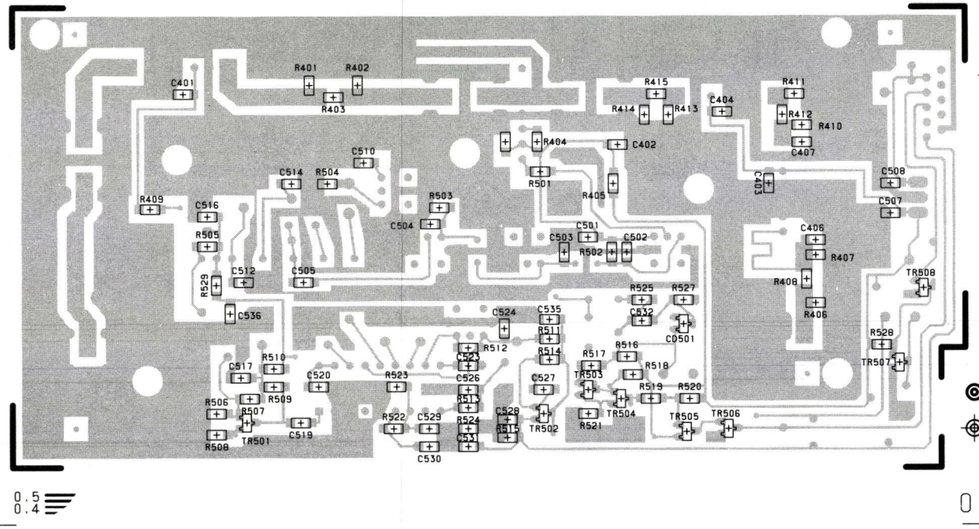


RUNS ON SOLDER SIDE

RUNS ON BOTH SIDES

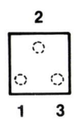
RUNS ON COMPONENT SIDE

SOLDER SIDE



0.5
0.4

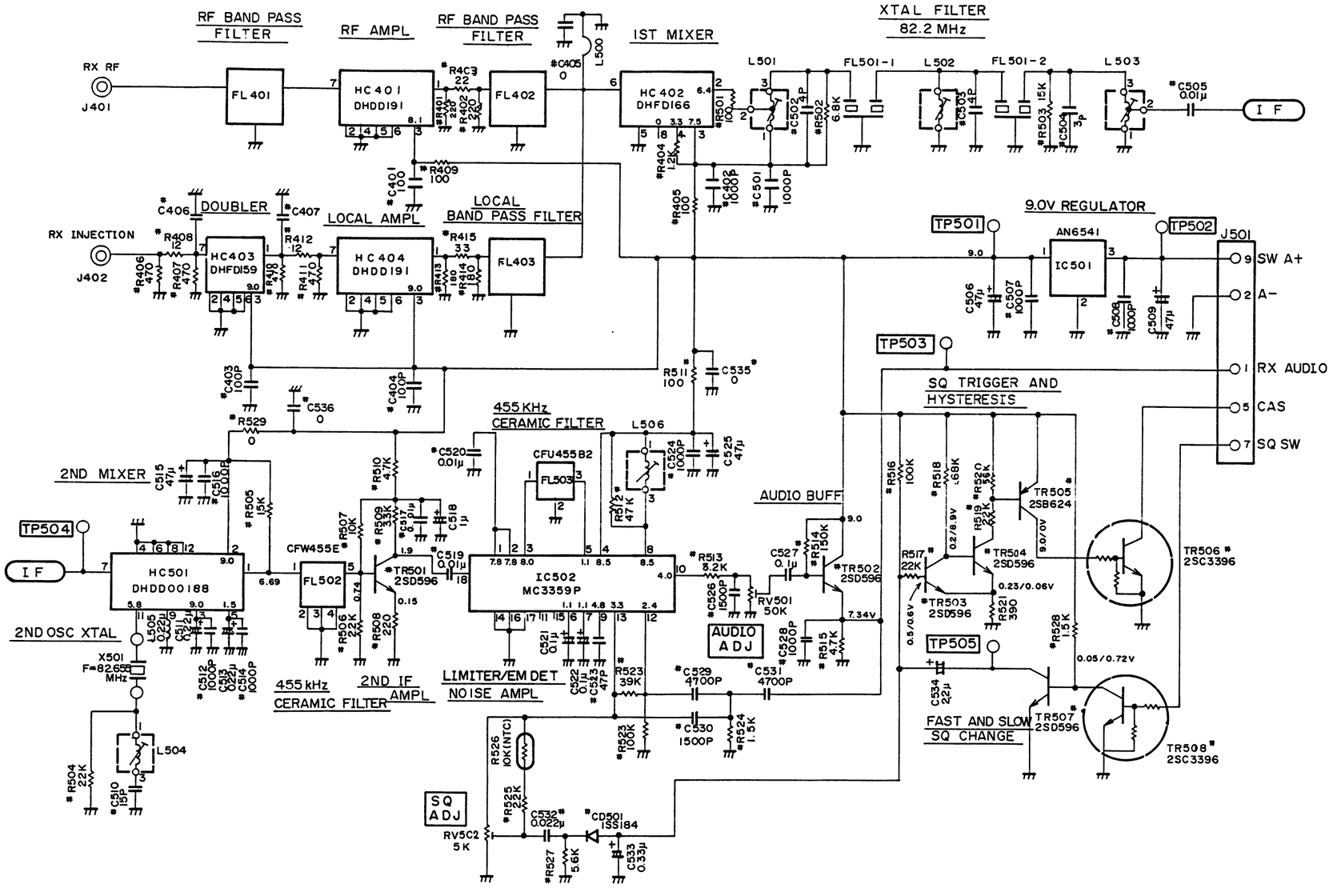
LEAD IDENTIFICATION FOR RV501 (TOP VIEW)



RC-5442

OUTLINE DIAGRAM

800 MHz Receiver
DD-CMA-259



NOTES
"#" IDENTIFIES "CHIP" COMPONENTS
(EXAMPLE, #C401) WHICH ARE LOCATED
ON SOLDER SIDE PWB

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

800 MHz Receiver
DD-CMA-259

PARTS LIST

MLS 800 MHz RECEIVER BOARD
CMA-259

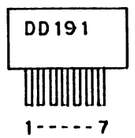
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C401	B19/5CAAD00780	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±60 PPM.
C402	B19/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C403 and C404	B19/5CAAD00780	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±60 PPM.
C406	B19/5CAAD00868	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0 ±60 PPM.
C407	B19/5CAAD00977	Ceramic: 7 pF ±0.5 pF, 50 VDCW, temp coef 0 ±60 PPM.
C501	B19/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C502 and C503	B19/5CAAD00801	Ceramic: 4 pF ±0.25 pF, 50 VDCW, temp coef 0 ±60 PPM.
C504	B19/5CAAD00796	Ceramic: 3 pF ±0.25 pF, 50 VDCW, temp coef 0 ±60 PPM.
C505	B19/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C506	B19/5CEAD00756	Electrolytic: 47 uF ±20%, 16 VDCW.
C507 and C508	B19/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C509	B19/5CEAA01816	Electrolytic: 47 uF ±20%, 25 VDCW.
C510	B19/5CAAD00787	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0 ±60 PPM.
C511	B19/5CSAC00988	Tantalum: 0.22 uF ±20%, 35 VDCW.
C512	B19/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C513	B19/5CSAC00988	Tantalum: 0.22 uF ±20%, 35 VDCW.
C514	B19/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C515	B19/5CEAD00756	Electrolytic: 47 uF ±20%, 16 VDCW.
C516	B19/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C517	B19/5CAAD00789	Ceramic: 0.01 uF±10%, 50 VDCW, temp coef ±10%.
C518	B19/5CSAC00982	Tantalum: 1 uF ±20%, 35 VDCW.
C519 and C520	B19/5CAAD00789	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±10%.
C521 and C522	B19/5CSAC01068	Tantalum: 0.1 uF ±20%, 35 VDCW.
C523	B19/5CAAD00864	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0 ±60 PPM.
C524	B19/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C525	B19/5CEAD00756	Electrolytic: 47 uF ±20%, 16 VDCW.
C526	B19/5CAAD00791	Ceramic: 1500 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C527	B19/5CAAD01056	Ceramic: 0.1 uF +80 -20%, 50 VDCW.
C528	B19/5CAAD00782	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef +350 -1000 PPM.
C529	B19/5CAAD00783	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±10%.
C530	B19/5CAAD00791	Ceramic: 1500 pF ±5%, 50 VDCW, temp coeef +350 -1000 PPM.
C531	B19/5CAAD00783	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±10%.
C532	B19/5CAAD01109	Ceramic: 0.022 uF ±10%, 50 VDCW, temp coef ±10%.
C533	B19/5CSAC01151	Tantalum: 0.33 uF ±20%, 35 VDCW.
C534	B19/5CSAC01069	Tantalum: 2.2 uF ±20%, 35 VDCW.
		- - - - - - - - - - DIODES - - - - - - - - - -
CD501	B19/5TXAD00290	Silicon: Fast recovery (2 diode in cathode common): sim to TOSHIBA 1SS184.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL401 and FL402	B19/5NBAH00023	Dielectric RF filter.
FL403	B19/5NBAH00024	Dielectric RF filter.
FL501	B19/5XHAA00847	Crystal filter: f=82.2 MHz: XPJ12-2.
FL502	B19/5NRAA00094	Ceramic filter: 455 kHz; sim to MURATA CFW455E.
FL503	B19/5NRAA00041	Ceramic filter: 455 kHz; sim to MURATA CFU455B2.
		- - - - - - - - - HYBRID CIRCUITS - - - - - - -
HC401	B19/6DHDD00191	Linear, RF Amplifier: sim to JRC DHDD191.
HC402	B19/6DHFD00166	Linear, Mixer: sim to JRC DHFD166.
HC403	B19/6DHFD00159	Linear, RF Amplifier: sim to JRC DHFD159.
HC404	B19/6DHDD00191	Linear, RF Amplifier: sim to JRC DHDD191.
HC501	B19/6DHDD00188	Linear, 2nd Mixer: sim to JRC DHDD188.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
IC501	B19/5DAAR00021	Linear, Positive Voltage Regulator: sim to MATSUSHITA AN6541.
IC502	B19/5DDAS00074	Linear, IF Amplifier & Detector: sim to MOTOROLA MC3359P.
		- - - - - - - - - - JACKS - - - - - - - - - -
J401	B19/5JJBL00025	Connector, RF: sim to WAKA 01K0361.
J402	B19/5JWCL00045	Connector, RF: sim to TAIKO TMP-J01X-A2.
J501	B19/5JWBS00178	Connector, 10 pins: sim to HIROSE FH3-10S-1.25DSA(G).
		- - - - - - - - - - COILS - - - - - - - - - -
L501 thru L503	B19/6LADD00553	Coil, RF: sim to MIDORI 6LADD00553.
L504	B19/6LADD00554	Coil, RF: sim to MIDORI 6LADD00554.
L505	B19/5LCAC00165	Coil, RF: sim to TDK SP0408-R22M.
L506	B19/6LAFD00877	Coil, RF: sim to TOKO 6LAFD00877.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R401 and R402	B19/5RDAC02159	Metal film: 220 ohms ±5%, 200 VDCW, 1/8 W.
R403	B19/5RDAC02210	Metal film: 22 ohms ±5%, 200 VDCW, 1/8 W.
R404	B19/5RDAC02441	Metal film: 1.2K ohms ±5%, 200 VDCW, 1/8 W.
R405	B19/5RDAC02137	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 W.
R406 and R407	B19/5RDAC02257	Metal film: 470 ohms ±5%, 200 VDCW, 1/8 W.
R408	B19/5RDAC02442	Metal film: 12 ohms ±5%, 200 VDCW, 1/8 W.
R409	B19/5RDAC02137	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 W.
R410 and R411	B19/5RDAC02257	Metal film: 470 ohms ±5%, 200 VDCW, 1/8 W.
R412	B19/5RDAC02442	Metal film: 12 ohms ±5%, 200 VDCW, 1/8 W.
R413 and R414	B19/5RDAC02145	Metal film: 180 ohms ±5%, 200 VDCW, 1/8 W.
R415	B19/5RDAC02383	Metal film: 33 ohms ±5%, 200 VDCW, 1/8 W.
R501	B19/5RDAC02137	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 W.
R502	B19/5RDAC02157	Metal film: 6.8K ohms ±5%, 200 VDCW, 1/8 W.
R503	B19/5RDAC02160	Metal film: 15K ohms ±5%, 200 VDCW, 1/8 W.
R504	B19/5RDAC02124	Metal film: 2.2K ohms ±5%, 200 VDCW, 1/8 W.
R505	B19/5RDAC02133	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 W.
R506	B19/5RDAC02124	Metal film: 2.2K ohms ±5%, 200 VDCW, 1/8 W.
R507	B19/5RDAC02125	Metal film: 10K ohms ±5%, 200 VDCW, 1/8 W.
R508	B19/5RDAC02159	Metal film: 220 ohms ±5%, 200 VDCW, 1/8 W.
R509	B19/5RDAC02236	Metal film: 3.3K ohms ±5%, 200 VDCW, 1/8 W.
R510	B19/5RDAC02152	Metal film: 4.7K ohms ±5%, 200 VDCW, 1/8 W.
R511	B19/5RDAC02137	Metal film: 100 ohms ±5%, 200 VDCW, 1/8 W.
R512	B19/5RDAC02134	Metal film: 47K ohms ±5%, 200 VDCW, 1/8 W.
R513	B19/5RDAC02158	Metal film: 8.2K ohms ±5%, 200 VDCW, 1/8 W.
R514	B19/5RDAC02129	Metal film: 150K ohms ±5%, 200 VDCW, 1/8 W.
R515	B19/5RDAC02152	Metal film: 4.7K ohms ±5%, 200 VDCW, 1/8 W.
R516	B19/5RDAC02138	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 W.
R517	B19/5RDAC02148	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 W.
R518	B19/5RDAC02176	Metal film: 68K ohms ±5%, 200 VDCW, 1/8 W.
R519	B19/5RDAC02148	Metal film: 22K ohms ±5%, 200 VDCW, 1/8 W.
R520	B19/5RDAC02231	Metal film: 56K ohms ±5%, 200 VDCW, 1/8 W.
R521	B19/5RDAC02443	Metal film: 390 ohms ±5%, 200 VDCW, 1/8 W.
R522	B19/5RDAC02374	Metal film: 39K ohms ±5%, 200 VDCW, 1/8 W.
R523	B19/5RDAC02138	Metal film: 100K ohms ±5%, 200 VDCW, 1/8 W.
R524	B19/5RDAC02133	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 W.
R525	B19/5RDAC02124	Metal film: 2.2K ohms ±5%, 200 VDCW, 1/8W.
R526	B19/5RZBX00002	Thermal: 10K ohms ±3%, sim to TDK NTCDS40203HG 103JC.
R527	B19/5RDAC02154	Metal film: 5.6K ohms ±5%, 200 VDCW, 1/8 W.
R528	B19/5RDAC02133	Metal film: 1.5K ohms ±5%, 200 VDCW, 1/8 W.
R529	B19/5RDAC02380	Metal film: 0 ohm 1/8 W.
RV501	B19/5RVAB00317	Variable: 50K ohms ±30%, 0.1 W.
RV502	B19/5RVAB00277	Variable: 5K ohms ±30%, 0.1 W.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
TR501 thru TR504	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596.
TR505	B19/5TBAB00055	Silicon, PNP: sim to NEC 2SB624.
TR506	B19/5TCAZ00007	Silicon, NPN: sim to SANYO 2SC3396.
TR507	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596.
TR508	B19/5TCAZ00007	Silicon, NPN: sim to SANYO 2SC3396.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
X501	B19/5XHAA00848	Quartz crystal: 82.655 MHz: XPJ12-3
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XS501-A and XS501-B	B19/5ZJDF00001	Crystal Socket: sim to HAKUTO 75315-001.

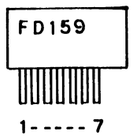
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

IC DATA

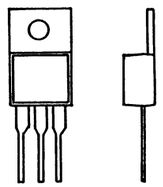
HC401, HC404



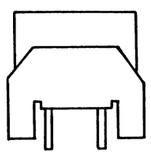
HC403



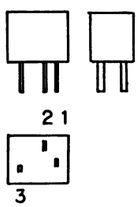
IC501



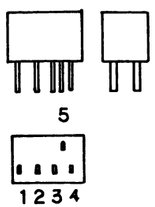
FL401-FL403



FL503



FL502



HC501