Maintenance Manual

TRANSMITTER/RECEIVER BOARD

CMN-233 FOR MLSH041

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ComNet Ericsson
CRITICAL RADIO SYSTEMS

DESCRIPTION

The Transmitter/Receiver Board CMN-233A/B (A802) for the MLSH041 Mobile FM radio provides a Transmitter with 40W RF power and a dual conversion superheterodyne receiver for operation in the 150.8-174 MHz frequency ranges. The radio mounts in back of the radio frame assembly as shown in Figure 1 -Transmitter/Receiver location.

CIRCUIT ANALYSIS

TRANSMITTER

The transmitter consists of an exciter circuit, a power amplifier circuit, Automatic Power Control circuitry (APC), antenna relay, a low-pass filter, a voltage regulator and transmitter switch circuit (refer to Figure 2 – Block Diagram).

9-volt Regulator

The 9-volt regulator operates from the switched A+ (13.6 volts) line. The regulator circuit consists of 9-Volt regulator IC101 and TX 9V switching transistor TR103. Switches are controlled by the $\overline{\text{TX ENB}}$ lead from System Control & Synthesizer Board A801 (refer to Maintenance Manual LBI-38423).

When the $\overline{\text{TX ENB}}$ lead is activated ($\overline{\text{DPTT}}$ keyed), transistor switch TRl03 turns on and applies the regulated output of IC101 to exciter amplifier transistors TRl0l, TR102 and TR104.

Exciter

The exciter input from the synthesizer circuit is coupled through an attenuator circuit (resistors R119-R121) which provides approximately 2 dB attenuation. This attenuated input is coupled to the input of three RF amplifier stages; transistors TR101, TRl02 and TRl04 to provide 400 milliwatts drive to DRIVER POWER MODULE HC1.

40-Watt PA

The 40-Watt PA uses a 2 dB attenuator (resistors R1-R4), DRIVER POWER MODULE HC1 and PA transistor TR1 to provide the 40-Watts of RF power output.

DRIVER POWER MODULE HC1 contains two broadband amplifiers. The Automatic Power Control (APC) circuit supplies voltage to the first amplifier. Continuous 13.6 Volts is supplied to the second amplifier through filter transistor TR2. The output of the HC1 is coupled through a 50-ohm impedance matching network consisting of capacitors C7 through C11, inductors L1 and L2, resistor R5 and a stripline (printed wire pattern) to the base of Class C amplifier TR1.

The PA output is matched to Antenna connector J1 through antenna relay K1 and low-pass filter (inductors L7-L9, capacitors C38-C43). The continuous 13.6 voltage A+ source voltage is applied to transistor TR1 through inductor L3.

Antenna Relay

Antenna Relay K1 is controlled by the delayed PTT ($\overline{\text{DPTT}}$) output of the System Control/Synthesizer Board. When the $\overline{\text{DPTT}}$ output goes low, Antenna Relay K1 picks up and couples the PA output through the low-pass filter to Antenna Connector J1.

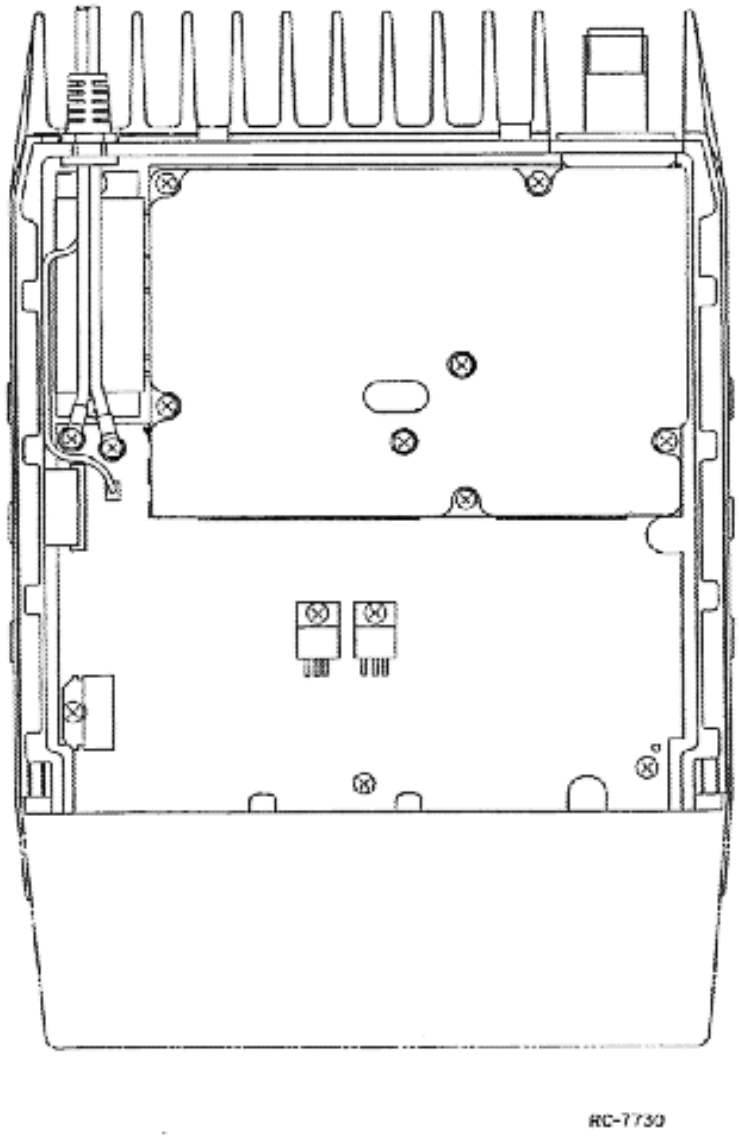


Figure 1 - Transmitter/Receiver Location (Bottom View)

APC Circuits

Automatic Power Control (APC) circuit protects the transmitter PA from damage due to excessive output power, reflected power or temperature. The output power control circuit allows the RF output power to be set at the rated output by power adjust control RV1. If the output power of the PA increases, the detected voltage and the input of OP AMP IC1-6 in the Thermal Detect circuit increases and the output. voltage decreases. This causes the DC Driver transistor TR4 to conduct less. Transistor TR4 conducting less increases the base voltage on PNP DC Pass transistor TR3, causing it to conduct less. This results in less voltage being applied to the first amplifier stage in the DRIVER MODULE HC1, reducing the power output of the exciter/PA in proportion to the increase in output power detected by the circuit.

To protect the PA against badly mismatched loads, a reverse power (VSWR) detector consisting of diode CD4, transistor TR4, OP AMP IC1 and DC Pass Transistor TR3

detect reverse (reflected) power. When sufficient power is detected by CD4 to cause IC1 to conduct, the voltage at the collector of TR3 decreases, causing the Driver/PA module to lower the output power, protecting the PA. The reverse power level is set by resistor R10.

The PA is protected against temperature increases by thermal detector circuit consisting of resistor R25 and transistors TR3, TR4, TR5 and OP AMP IC1. As the temperature increases, resistance to ground of thermal detector R25 increases. This causes TR3 to conduct less, causing a decrease in the PA output until the temperature is reduced. The temperature level is set by resistor R14 (located in the collector circuit of transistor TR5).

RECEIVER

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 and audio preamp are mounted on the Transmitter/Receiver board (see Figure 3 - Block Diagram). The receiver consists of:

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

Receiver Front End

An RF signal from the antenna is coupled through the low-pass filter, ANTENNA SWITCH relay K1 and the RF band-pass filter to the input of RF amplifier TR401. The output of TR401 is coupled through RF filter to the input of first mixer CD451. Front end selectivity is provided by the RF band-pass filters and low pass filter.

Receiver Injection

The receiver RF injection frequency (233.0 to 256.2 MHz) from the synthesizer VCO is applied to amplifier TR104 through RX/EX injection connector P101. The input level at J402 will be between +2 and +8 dBm.

First Mixer

The first mixer (CD451, T451 and T452) is a double balanced diode mixer that converts an RF signal in the 150.8 MHz to 174.0 MHz frequency range to the 82.2 MHz first IF frequency.

In the mixer stage, RF from the receiver front end RF filter is applied to an 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 the mixer through an impedance matching network (TR501 and L501) to a 4-pole crystal filter consisting of FL501-1and 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, capacitor C506 and resistor R504 to second mixer TR512.

Second Mixer and Oscillator

The 82.2 MHz IF input is applied to TR512 and mixed with an 81.745 MHz frequency supplied by crystal oscillator X501. Inductor L511 sets the frequency of X501.

Second IF and FM Detector

The output of the second mixer is coupled to the 4-pole ceramic filter FL511, which provides the 455 kHz selectivity. The output of the ceramic filter is coupled to the base of IF amplifier transistor TR513. This transistor provides limiting for the 455 kHz IF signal (1.4 Vpp) to prevent high level overloading of IC502 (Limiter/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 FL512, which provides the 455 kHz selectivity. The output of the 455 kHz filter is re-applied to IC502-8. The second IF signal is amplified and limited. Inductor L513 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 Frequency Synthesizer board (A801) through the base of audio buffer transistor TR531.

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 TR531. An internal circuit of IC502 provides filtering and applies received noise in the 6-8 kHz frequency band to the Squelch Adjust potentiometer RV531. The output of the squelch adjust potentiometer is connected to the noise detector. The noise detector consists of resistor R540, capacitor C538 and diode CD531. As the noise increases in magnitude in a negative direction, negative spikes cause CD531 to conduct and charge capacitors C537 and C538 to a DC level proportionate to the noise level. The output of the noise detector is applied to the input of a squelch trigger circuit consisting of transistors TR532 through TR535. The squelch trigger has approximately 3 dB of hysteresis to prevent sudden noise level changes from affecting the squelch threshold setting. Resistor R538 provides temperature compensation for the squelch circuit. The output of squelch trigger is the Carrier Activity Sensor (CAS). The CAS output is applied to the System Control/Frequency Synthesizer Board.

Audio Circuits

Received audio (VR IN) from the FM detector is applied to the input of audio pre-amplifier IC601-A on System Control/Frequency Synthesizer Board A801 (refer to Maintenance Manual LBI-38423). The audio is then applied through Tone Reject Filter HC601, audio gate IC603-C and pre-amplifier IC601-B to the Volume Control IC602. The audio output (VR OUT) from the Volume Control IC602 is applied through audio pre-amplifier IC601-D to the de-emphasis network, consisting of resistor R551 and R552 and capacitors C552 and C553 on the Transmitter/Receiver Board. This enables audio amplifier IC551 which provides up to 4 watts of audio output power to the 4-ohm speaker.

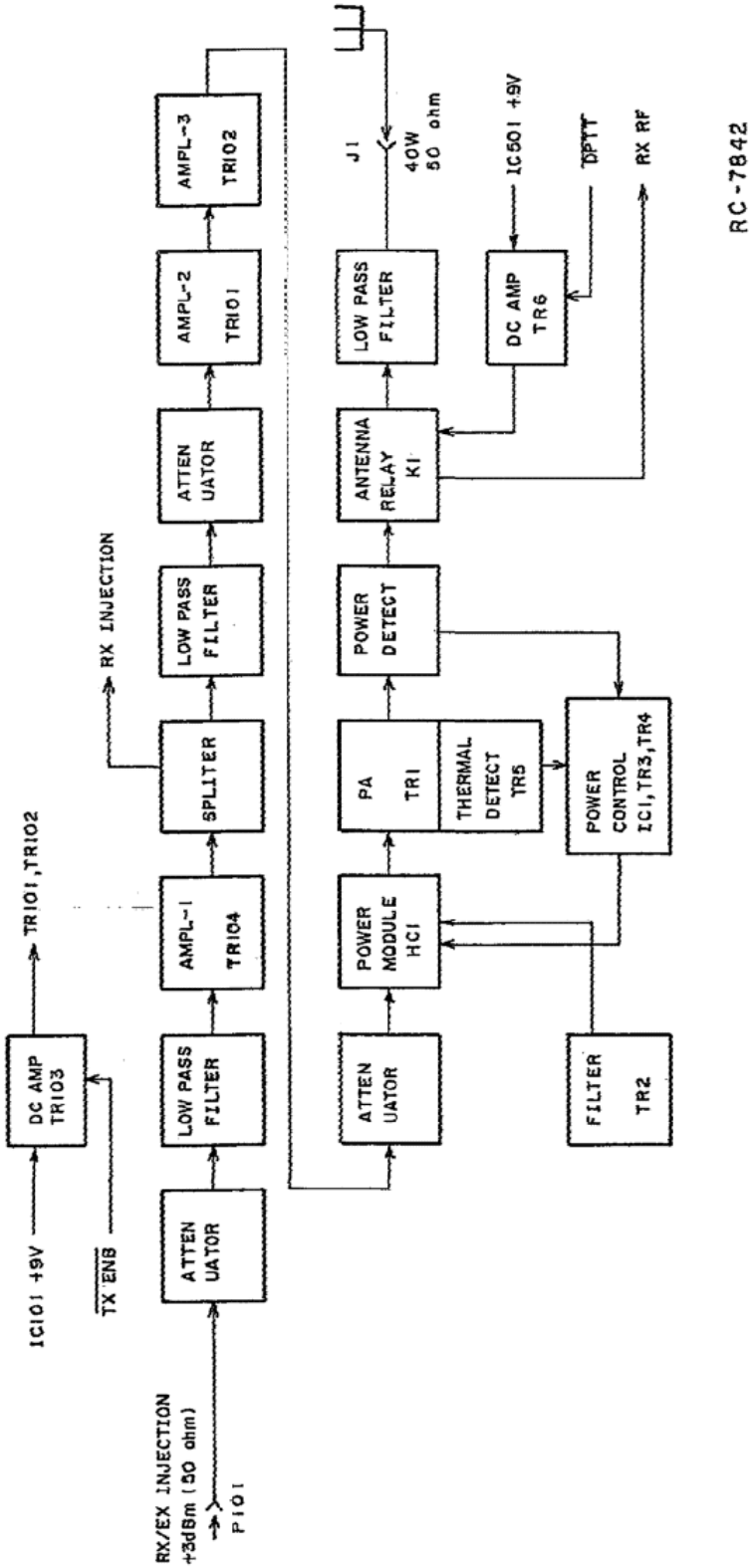


Figure 2 - Block Diagram

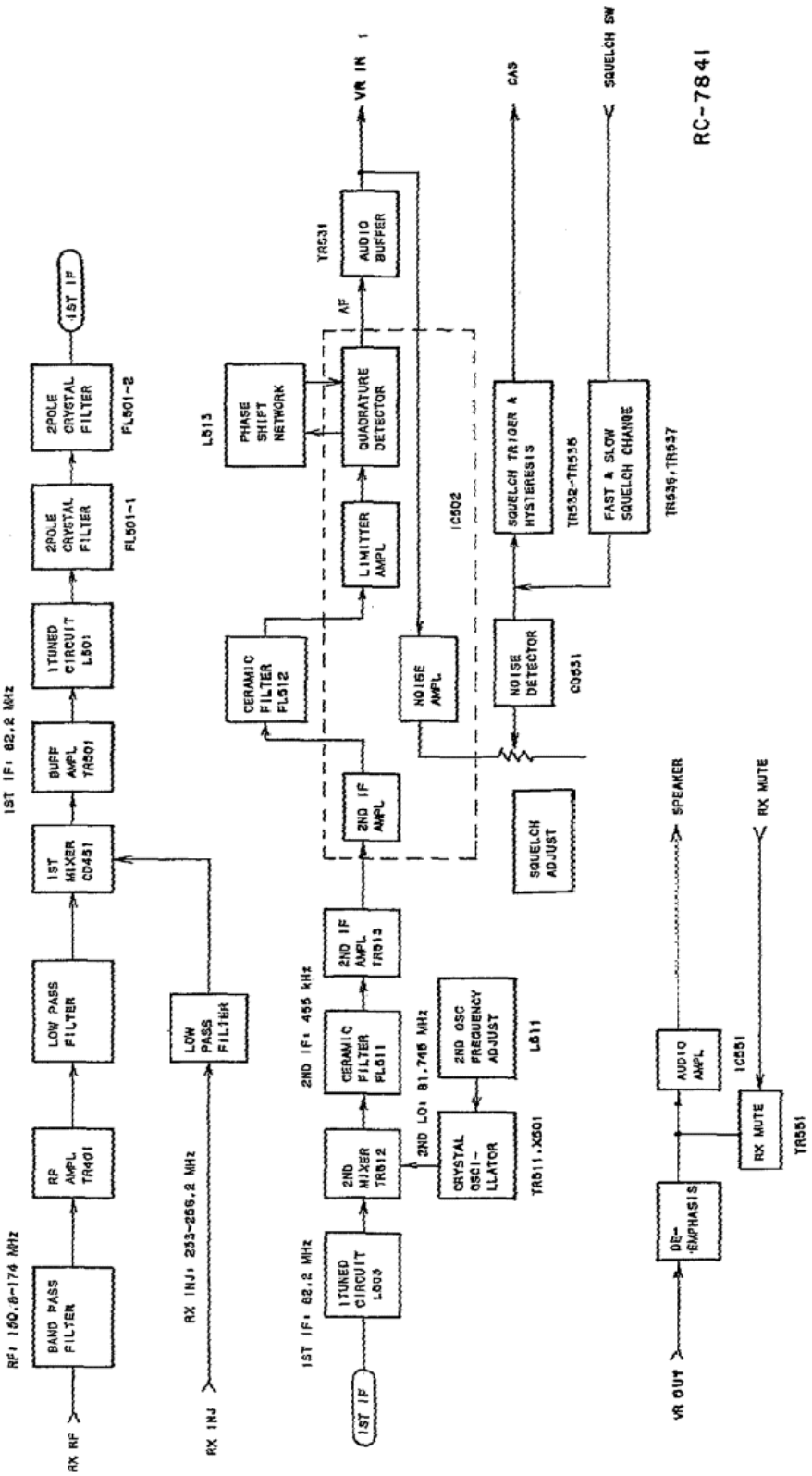
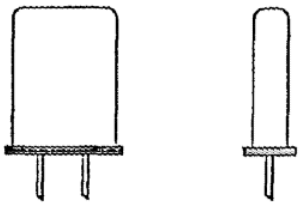


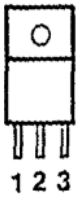
Figure 3 - Block Diagram - 150.8-174 MHz Receiver

IC DATA

QUARTZ CRYSTAL
X501



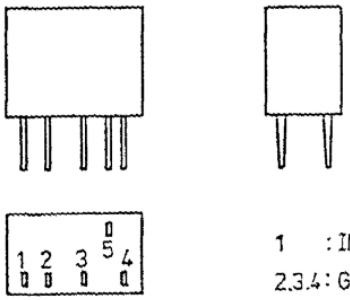
LEAD IDENTIFICATION
FOR IC101
(TOP VIEW)



1: INPUT
2: COMMON
3: OUTPUT

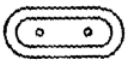
RC-5439

CERAMIC FILTER
FL 512

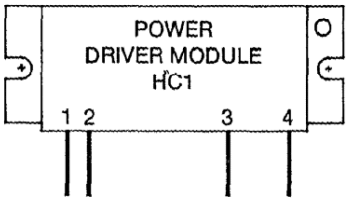


1 : INPUT
2.3.4 : GND
5 : OUTPUT

RC-7719

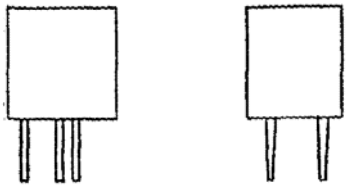


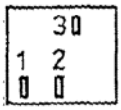
RC-7718



RC-5455A

CERAMIC FILTER
FL 502



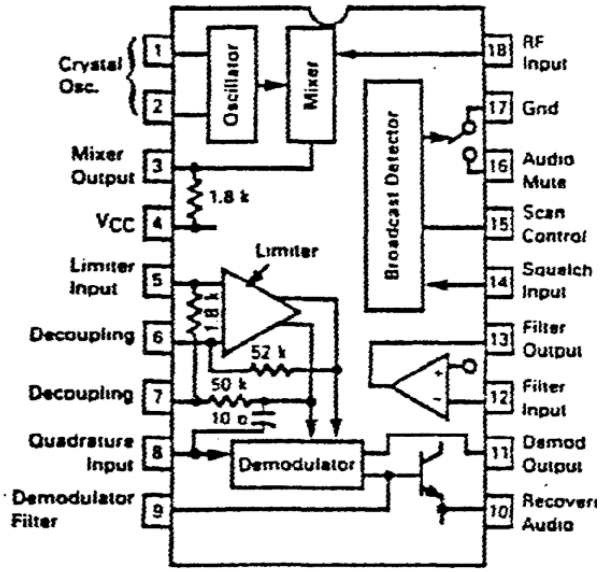


1: INPUT
2: GND
3: OUTPUT

RC-7720

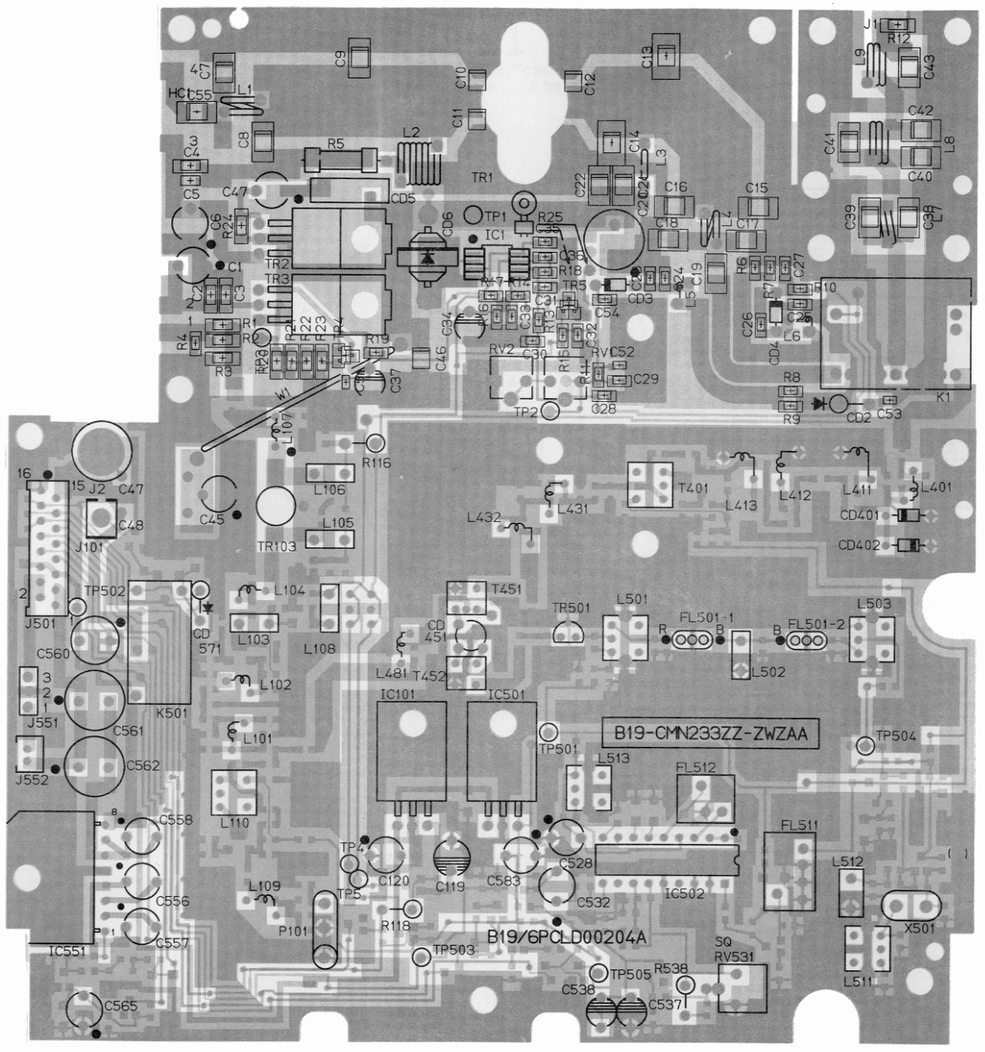
IC 502

Narrow Band FM, IF Amp Scan Control
Squelch Osc. Mixer, DET and AFC

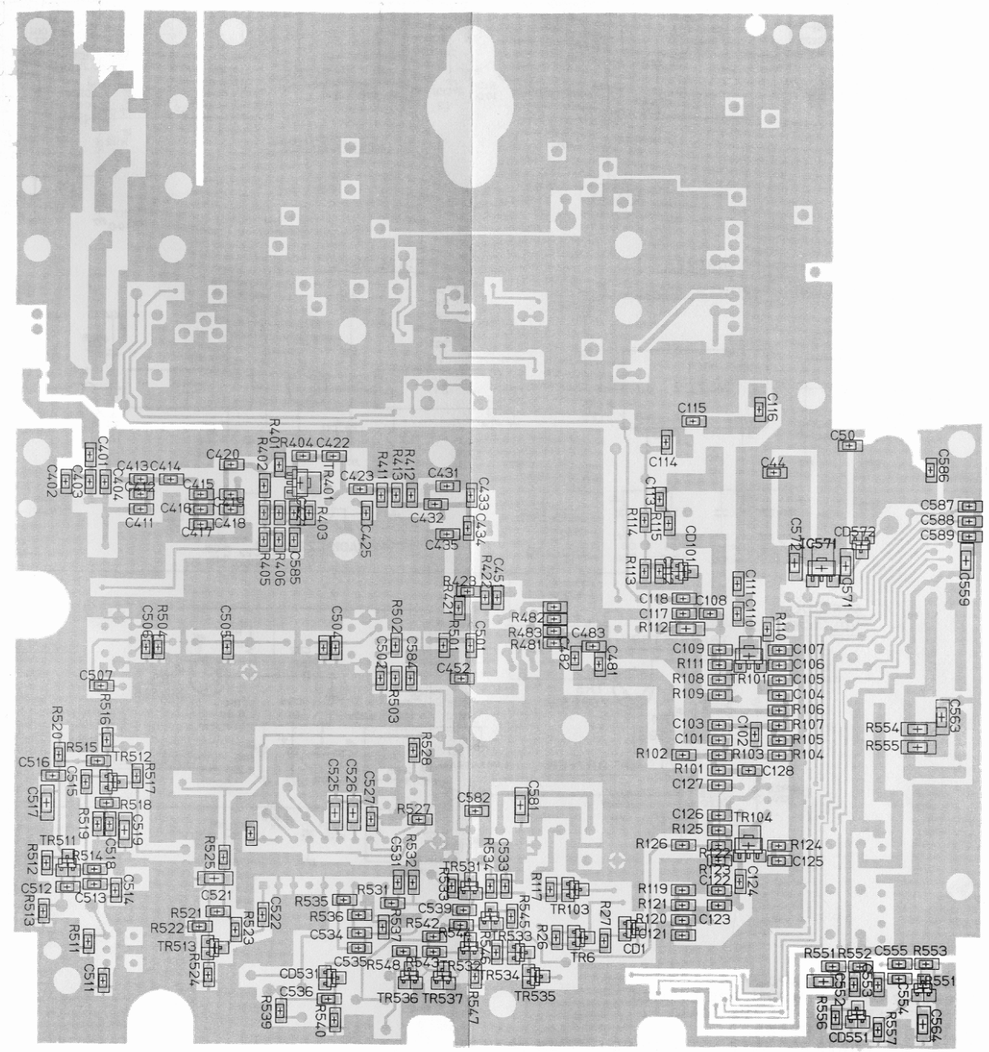


RC-7740

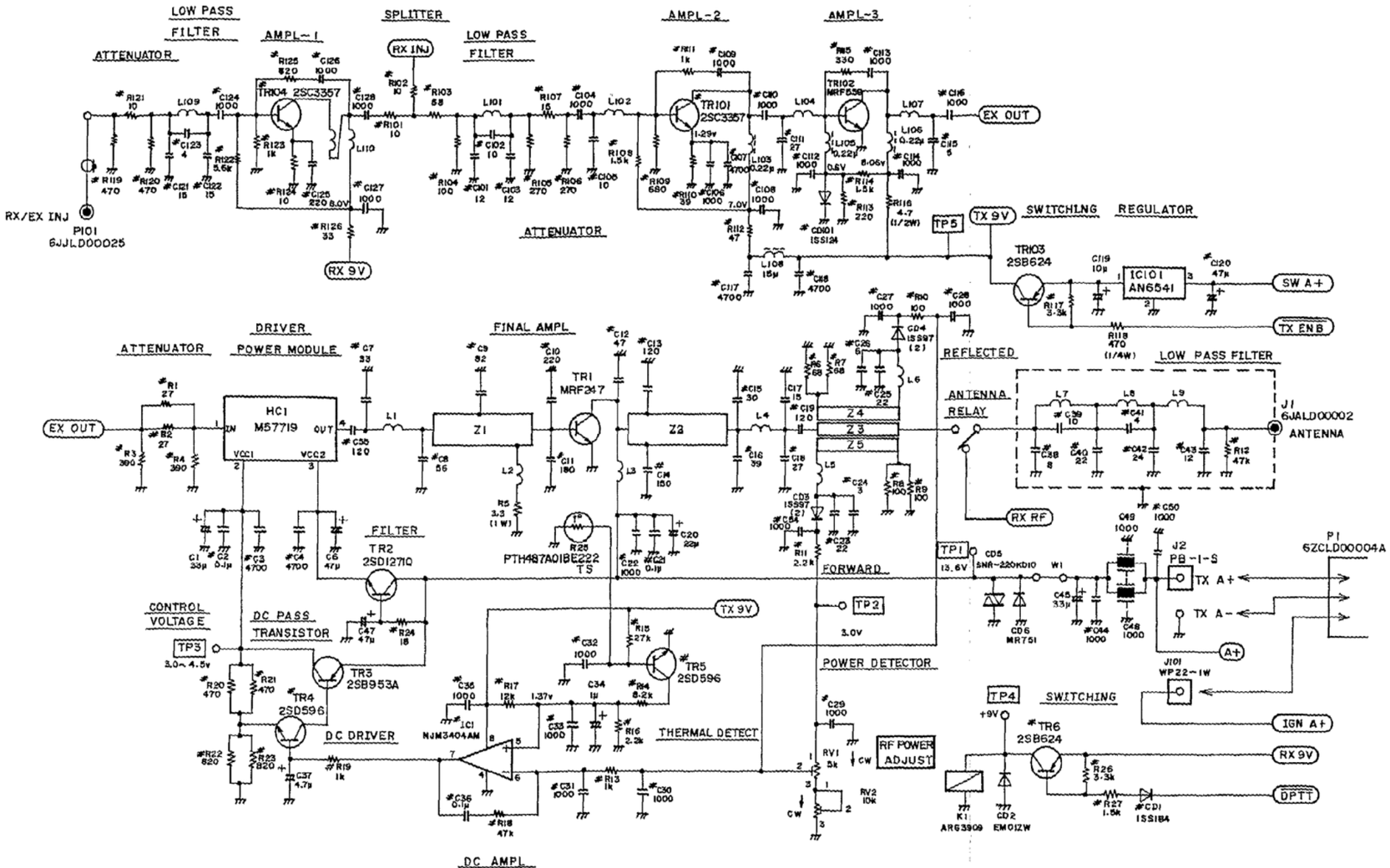
COMPONENT SIDE



SOLDER SIDE



TRANSMITTER/RECEIVER BOARD
PCLD00204A

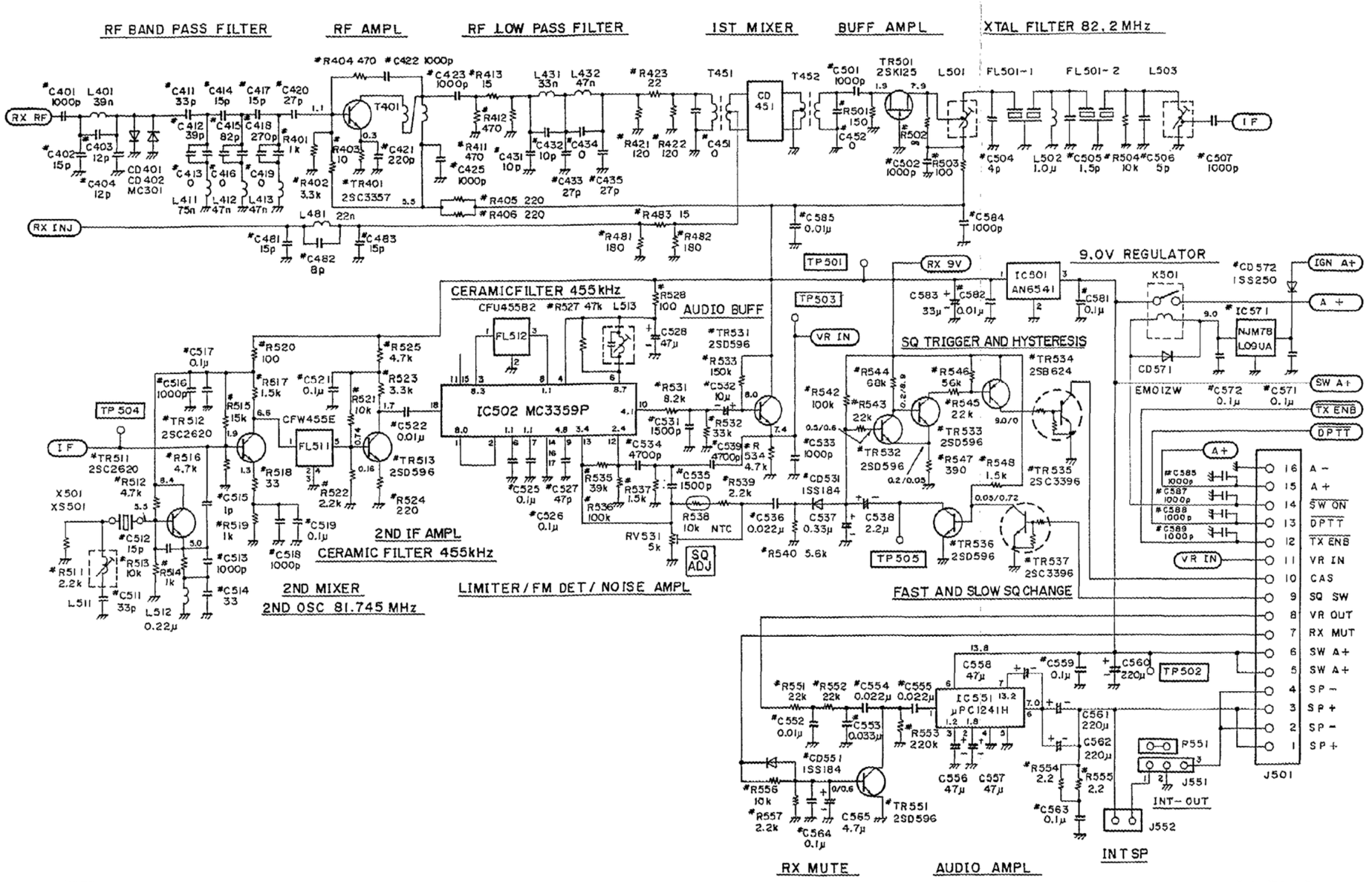


RC-7949

NOTES
1. "#" IDENTIFIES CHIP COMPONENTS (EXAMPLE #R12 OR R12#) WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD
2. Z_1~Z_5, STRIPLINE PART OF PWB.
3. RV2 IS FACTORY TURNED AND DOES NOT REQUIRE FURTHER ADJUSTMENT.

ALL RESISTORS ARE 1/10 OR 1/8 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN P UNLESS FOLLOWED BY MULTIPLIER μ.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR μ.

150-174 MHz Transmitter



NOTE
"#" IDENTIFIES CHIP COMPONENTS (EXAMPLE #C401) WHICH ARE LOCATED ON SOLDER SIDE OF PWB.

ALL RESISTERS ARE 1/10 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, µ OR n.

RC-7948

150-174 MHz Receiver Board

PARTS LIST

TRANSMITTER SECTION
MLS (HIGH BAND)
CMN-233-1
ISSUE 1

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	B19/5ECAA02283	Electrolytic: 33 uF ±20%, 25 VDCW.
C2	B19/5CAAD01268	Polypropylene: 0.1 uF ±5%, 50 VDCW.
C3 and C4	B19/5CAAD01138	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±10%.
C6	B19/5CEAA01816	Electrolytic: 47 uF ±5%, 25 VDCW.
C7	B19/5CAAA03140	Ceramic: 33 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C8	B19/5CAAA03095	Ceramic: 56 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C9	B19/5CAAA03096	Ceramic: 82 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C10	B19/5CAAA03097	Ceramic: 220 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C11	B19/5CAAA03098	Ceramic: 180 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C12	B19/5CAAA03080	Ceramic: 47 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C13	B19/5CMAB01439	Mica: 120 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C14	B19/5CMAB01471	Mica: 150 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C15	B19/5CAAA03081	Ceramic: 30 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C16	B19/5CAAA03100	Ceramic: 39 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C17	B19/5CAAA03101	Ceramic: 15 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C18	B19/5CAAA03079	Ceramic: 27 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C19	B19/5CAAA03078	Ceramic: 120 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C20	B19/5CEAA00451	Electrolytic: 22 uF ±10%, 40 VDCW.
C21	B19/5CAAA03083	Ceramic: 0.1 uF ±5%, 50 VDCW.
C22	B19/5CAAA03082	Ceramic: 1000 pF ±10%, 500 VDCW.
C23	B19/5CAAD00840	Ceramic: 22 pF ±5%, 500 VDCW, temp coef 0±30 PPM.
C24	B19/5CAAD00853	Ceramic: 3 pF ±0.25 pF 500 VDCW, temp coef 0±30 PPM.
C25	B19/5CAAD00840	Ceramic: 22 pF ±5%, 500 VDCW temp coef 0±30 PPM.
C26	B19/5CAAD00962	Ceramic: 6 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C27 thru C33	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C34	B19/5CSAC00982	Tantalum: 1 uF ±10%, 35 VDCW.
C35	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C36	B19/5CAAD01078	Ceramic: 0.1 uF ±5%, 25 VDCW, temp coef ±30%.
C37	B19/5CSAC01409	Tantalum: 4.7 uF ±10%, 16 VDCW.
C38	B19/5CAAA03103	Ceramic: 8 pF ±0.5 pF, 500 VDCW, temp coef 0±60 PPM.
C39	B19/5CAAA03094	Ceramic: 10 pF ±0.5 pF, 500 VDCW, temp coef 0±60 PPM.
C40	B19/5CAAA03086	Ceramic: 22 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C41	B19/5CAAA03128	Ceramic: 4 pF ±0.25 pF, 500 VDCW, temp coef 0±60 PPM.
C42	B19/5CAAA03088	Ceramic: 24 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C43	B19/5CAAA03089	Ceramic: 12 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C44	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C45	B19/5ECAA02283	Electrolytic: 33 uF ±20%, 25 VDCW.
C47	B19/5CEAA01816	Electrolytic: 47 uF ±5%, 25 VDCW.
C48 and C49	B19/5CBAB02093	Ceramic, feed thru type: 1000 pF ±20%, 50 VDCW.
C50	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C54	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C55	B19/5CAAA03078	Ceramic: 120 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C101	B19/5CAAD00968	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C102	B19/5CAAD00953	Ceramic: 10 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C103	B19/5CAAD00968	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C104	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C105	B19/5CAAD00953	Ceramic: 10 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C106	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C107	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±15%.
C108 thru C110	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C111	B19/5CAAD00952	Ceramic: 27 pF ±5%, 50 VDCW, temp coef ±15%.
C112 thru C114	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C115	B19/5CAAD00956	Ceramic: 5 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM.
C116	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C117 and C118	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±15%.
C119	B19/5CSAC00932	Tantalum: 10 uF ±20%, 16 VDCW.
C120	B19/5CEAA01816	Electrolytic: 47 uF ±20%, 25 VDCW.
C121 and C122	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C123	B19/5CAAD00961	Ceramic: 4 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM.
C124	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C125	B19/5CAAD00954	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C126 thru C128	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
		- - - - - - - - - - DIODES - - - - - - - - - -
CD1	B19/5TXAD00290	Silicon, Fast Recovery (2 diode in cathode common): sim to TOSHIBA 1SS184.
CD2	B19/5TXAN00068	Silicon: 2001A, sim to SANKEN EM01ZW.
CD3 and CD4	B19/5TXAA00313	Silicon, Schottky Barrier: sim to NEC 1SS97 (2).
CD5	B19/5TZAA00104	Ceramic Varistor: sim to SAKENSNR-220KD10.
CD6	B19/5TXAM00019	Silicon, Fwd current 3A, 200 PIV: sim to MOTOROLA MR751.
CD101	B19/5TXAD00290	Silicon, Fast Recovery (2 diode in cathode common): sim to TOSHIBA 1SS184.
		- - - - - - - - - - HIC - - - - - - - - - -
HC1	B19/5DDAB00269	RF power module: sim to MITSUBISHI M57719.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
IC1	B19/5DAAN00368	Linear, Dual OP AMP: sim to NJRC NJM3403AM.
IC101	B19/5DAAR00021	Linear, Positive Regulator: sim to MATSUSHITA AN6541.
		- - - - - - - - - - CONNECTORS - - - - - - - - - -
J1	B19/6JALD00002	Connector.
J2	B19/5JTDW00060	Connector.
J101	B19/5JDAS00001	Connector.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	B19/5KLAD00657	Relay: DC9V. drive current 39 mA.
		- - - - - - - - - - COILS - - - - - - - - - -
L1	B19/5LZAV00018	Coil, RF.
L2	B19/5LZAV00019	Coil, RF.
L3	B19/5LZAV00020	Coil, RF.
L4	B19/6LALD00021	Coil, RF.
L5 and L6	B19/5LZAV00022	Coil, RF.
L7	B19/5LZAV00014	Coil, RF.
L8 and L9	B19/5LZAV00023	Coil, RF.
L101	B19/5LZAV00024	Coil, RF.
L102	B19/5LZAV00016	Coil, RF.
L103	B19/5LCAA00560	Coil, RF, 0.22 uH ±10%.
L104	B19/5LZAV00044	Coil, RF.
L105 and L106	B19/5LCAA00560	Coil, RF, 0.22 uH ±10%.
L107	B19/5LZAV00026	Coil, RF.
L108	B19/5LCAA00576	Coil, RF.
L109	B19/6LALD11022	Coil, RF.
L110	B19/6LAFD01136	Coil, RF.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	B19/6ZCLD00004	Power cable.
P101	B19/6JJLD15115	Connector, RF.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	B19/5RDAC02744	Metal film: 27 ohms ±5%, 200 VDCW, 1/8W.
R3	B19/5RDAC02443	Metal film: 390 ohms ±5%, 200 VDCW, 1/8W.
R4	B19/5RDAC02491	Metal film: 390 ohms ±5%, 100 VDCW, 1/10W.
R5	B19/5REAG00485	Metal film: 3.3 ohms ±5%, 100 VDCW, 1W.
R6 and R7	B19/5RDAC02467	Metal film: 68 ohms ±5%, 100 VDCW< 1/10W.
R8 thru R10	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R11	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R12	B19/5RDAC02134	Metal film: 47K ohms ±5%, 200 VDCW, 1/8W.
R13	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R14	B19/5RDAC02479	Metal film: 8.2K ohms ±5%, 100 VDCW, 1/10W.
R15	B19/5RDAC02457	Metal film: 27K ohms ±5%, 100 VDCW, 1/10W.
R16	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R17	B19/5RDAC02480	Metal film: 12K ohms ±5%, 100 VDCW, 1/10W.
R18	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W.
R19	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R20 and R21	B19/5RDAC02257	Metal film: 470 ohms ±5%, 200 VDCW, 1/8W.
R22 and R23	B19/5RDAC02142	Metal film: 820 ohms ±5%, 200 VDCW, 1/8W.
R24	B19/5RDAC02146	Metal film: 18 ohms ±5%, 200 VDCW, 1/8W.
R25	B19/5RXAE00028	POSISTOR.
R26	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R27	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R101 and R102	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R103	B19/5RDAC02467	Metal film: 68 ohms ±5%, 100 VDCW, 1/10W.
R104	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R105 and R106	B19/5RDAC02555	Metal film: 270 ohms ±5%, 100 VDCW, 1/10W.
R107	B19/5RDAC02464	Metal film: 15 ohms ±5%, 100 VDCW, 1/10W.
R108	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R109	B19/5RDAC02472	Metal film: 680 ohms ±5%. 100 VDCW, 1/10W.
R110	B19/5RDAC02624	Metal film: 39 ohms ±5%, 100 VDCW, 1/10W.
R111	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R112	B19/5RDAC02149	Metal film: 47 ohms ±5%, 200 VDCW, 1/8W.
R113	B19/5RDAC02469	Metal film: 220 ohms ±5%, 100 VDCW, 1/10W.
R114	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R115	B19/5RDAC02470	Metal film: 330 ohms ±5%. 100 VDCW, 1/10W.
R116	B19/5RDAA01660	Metal film: 4.7 ohms ±5%. 350 VDCW, 1/2W.
R117	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R118	B19/5RDAA01541	Metal film: 470 ohms ±5%, 300 VDCW, 1/4W.
R119 and R120	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R121	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R122	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R123	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R124	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R125	B19/5RDAC02542	Metal film: 820 ohms ±5%, 100 VDCW, 1/10W.
R126	B19/5RDAC02466	Metal film: 33 ohms ±5%, 100 VDCW, 1/10W.
RV1	B19/5RVAB00421	Variable: 5K ohms ±30%, 0.1W.
RV2	B19/5RVAB00411	Variable: 10K ohms ±30%, 0.1W.
		- - - - - - - - - TRANSISTORS - - - - - - - - - -
TR1	B19/5TZAR00024	Silicon, NPN: sim to MOTOROLA MRF247.
TR2	B19/5TDAR00012	Silicon, NPN: sim to MATSUSHITA 2SD127-Q.
TR3	B19/5TBAR00001	Silicon, NPN: sim to MATSUSHITA 2SB953A.
TR4 and TR5	B19/5TDAB00054	Silicon, NPN: sim to NEC 2CD596-T1B DV3.
TR6	B19/5TBAB00055	Silicon, NPN: sim to NEC 2SB624-T1B DV3.
TR101	B19/5TCAB00287	Silicon, NPN: sim to NEC 2SC3357-T1.
TR102	B19/5TZAR00019	Silicon, NPN: sim to MOTOROLA MRF559.
TR103	B19/5TBAB00055	Silicon, NPN: sim to NEC 2SB624-T1B DV3.
TR104	B19/5TCAB00287	Silicon, NPN: sim to NEC 2SC3357-T1.
W1	B19/6LALD00115	Jumper wire.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

RECEIVER SECTION
MLS (HIGH BAND)
CMN-233-2
ISSUE 1

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C401	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C402	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C403 and C404	B19/5CAAD00968	Ceramic: 12 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C411	B19/5CAAD00948	Ceramic: 33 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C412	B19/5CAAD00955	Ceramic: 39 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C414	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C415	B19/5CAAD00960	Ceramic: 82 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C417	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C418	B19/5CAAD00972	Ceramic: 270 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C420	B19/5CAAD00952	Ceramic: 27 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C421	B19/5CAAD00954	Ceramic: 220 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C422 and C423	B19/5CAAD00838	Ceramic: 1000 pF ±5%, 50 VDCW, Temp coef ±15%.
C425	B19/5CAAD00838	Ceramic: 1000 pF ±5%, 50 VDCW, Temp coef ±15%.
C431 and C432	B19/5CAAD00953	Ceramic: 10 pF ±.5pF, 50 VDCW, Temp coef 0±30 PPM.
C433	B19/5CAAD00952	Ceramic: 27 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C435	B19/5CAAD00952	Ceramic: 27 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C481	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C482	B19/5CAAD00964	Ceramic: 8 pF ±0.5 pF, 50 VDCW, Temp coef 0±30 PPM.
C483	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C501 and C502	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C504	B19/5CAAD00961	Ceramic: 4 pF ±0.25 pF, 50 VDCW, Temp coef 0±30 PPM.
C505	B19/5CAAD1054	Ceramic: 1.5 pF ±0.25 pF, 50 VDCW, Temp coef 0±30 PPM.
C506	B19/5CAAD00956	Ceramic: 5 pF ±0.25 pF, 50 VDCW, Temp coef 0±30 PPM.
C507	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C511	B19/5CAAD00948	Ceramic: 33 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C512	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C513	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C514	B19/5CAAD00948	Ceramic: 33 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C515	B19/5CAAD00852	Ceramic: 1 pF ±0.25 pF, 50 VDCW, Temp coef 0±30 PPM.
C516	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C517	B19/5CAAD1237	Ceramic: 0.1 uF ±10%, 25 VDCW, Temp coef ±15%.
C518	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C519	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, Temp coef ±15%.
C521	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, Temp coef ±15%.
C522	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, Temp coef ±15%.
C525 and C526	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, Temp coef ±15%.
C527	B19/5CEAA01675	Ceramic: 47 pF ±5%, 50 VDCW, Temp coef 0±30 PPM.
C528	B19/5CEAA01982	Electrolytic: 47 uF ±20%, 16 VDCW.
C531	B19/5CAAD01478	Ceramic: 1500 pF ±5%, 50 VDCW, Temp coef +350, -1000 PPM.
C532	B19/5CEAA01864	Electrolytic: 10 uF ±20%, 25 VDCW.
C533	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C534	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, Temp coef ±15%.
C535	B19/5CAAD01478	Ceramic: 1500 pF ±5%, 50 VDCW, Temp coef +350, -1000 PPM.
C536	B19/5CAAD01366	Ceramic: 0.022 uF ±10%, 50 VDCW, Temp coef ±15%.
C537	B19/5CSAC01151	Tantalum: 0.33 uF ±20%, 35 VDCW.
C538	B19/5CSAC01069	Tantalum: 2.2 uF ±20%, 35 VDCW.
C539	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, Temp coef ±15%.
C552	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, Temp coef ±15%.
C553	B19/5CAAD01595	Ceramic: 0.033 uF ±10%, 50 VDCW, Temp coef ±15%.
C554 and C555	B19/5CAAD01366	Ceramic: 0.022 uF ±10%, 50 VDCW, Temp coef ±15%.
C556 thru C558	B19/5CAAD01982	Electrolytic: 47 uF ±20%, 16 VDCW.
C559	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, Temp coef ±15%.
C560	B19/5CEAA01786	Electrolytic: 220 uF ±20%, 25 VDCW.
C561 and C562	B19/5CEAA01657	Electrolytic: 220 uF ±20%, 16 VDCW.
C563 and C564	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, Temp coef ±15%.
C565	B19/5CEAA02084	Electrolytic: 4.7 uF ±20%, 35 VDCW.
C571 and C572	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, Temp coef ±15%.
C581	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, Temp coef ±15%.
C582	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, Temp coef ±15%.
C583	B19/5CEAA02283	Electrolytic: 33 uF ±20%. 25 VDCW.
C584	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C585	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, Temp coef ±15%.
C586 thru C589	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
		- - - - - - - - - - DIODES - - - - - - - - - -
CD401 and CD402	B19/5TXAR00023	Silicon: fast recovery; sim to MITSUBISHI MC301.
CD451	B19/5TXAA00334	Silicon: Schottky Barrier Diode Quad, sim to NEC ND487C1-3R.
CD531	B19/5TXAD00290	Silicon: fast recovery (2 diodes in cathode common); sim to TOSHIBA 1SS184.
CD551	B19/5TXAD00290	Silicon: fast recovery (2 diodes in cathode common); sim to TOSHIBA 1SS184.
CD571	B19/5TXAN00068	Silicon: 200V 1A, sim to SANKEN EM01ZW.
CD572	B19/5TXAN00065	Silicon diode, 200V 1A; sim to SANKEN EM1.
CD573	B19/5TXAE00323	Zener diode 20V; sim to Hitachi HZ20-1.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL501	B19/5XHAA00780	Crystal F=82.2 MHz.
FL511	B19/5NRAA00094	Filter 455 KHz.
FL512	B19/5NRAA00041	Filter 455 KHz.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
IC501	B19/5DAAR00021	Linear, Positive Voltage Regulator: sim to MATSUSHITA AN6541.
IC502	B19/5DDAS00074	Linear, Low Power Narrowband FM IF: sim to MOTOROLA MC3359P.
IC551	B19/5DAAA00245	Linear, Audio Amplifier: sim to NEC UPC1241H.
IC571	B19/5DAAN00483	Linear, Positive Voltage Regulator: sim to NJRC NJM78L09UA.
		- - - - - - - - - - CONNECTORS - - - - - - - - - -
J501	B19/5JWBS00240	Connector, 16 pins: sim to HIROSE PH3-16S-1.25DSA(G).
J551	B19/5JTCA00137	Connector, 3 pins.
J552	B19/5JWAD00121	Connector, 2 pins.
P551	B19/5JDAN00012	Receptacle: 2 position.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K501	B19/5KLAC00112	Relay: 9VDC, 3A; sim to TAKAMIZAWA JY9H-K.
		- - - - - - - - - - COILS - - - - - - - - - -
L401	B19/6LALD11039	Coil, RF.
L411	B19/6LALD11075	Coil, RF.
L412 and L413	B19/6LALD11047	Coil, RF.
L431	B19/6LALD11033	Coil, RF.
L432	B19/6LALD11047	Coil, RF.
L481	B19/6LALD11022	Coil, RF.
L501	B19/5LAAL00003	Coil, RF.
L502	B19/5LCAA00557	Coil, RF.
L503	B19/5LAAL00003	Coil, RF.
L511	B19/5LAAL00003	Coil, RF.
L512	B19/5LCAA00560	Coil, RF.
L513	B19/5LAAL00004	Coil, RF.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R401	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R402	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R403	B19/5RDAC02450	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R404	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R405 and R406	B19/5RDAC02469	Metal film: 220 ohms ±5%, 100 VDCW, 1/10W.
R411 and R412	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R413	B19/5RDAC02464	Metal film: 15 ohms ±5%, 100 VDCW, 1/10W.
R421 and R422	B19/5RDAC02554	Metal film: 120 ohms ±5%, 100 VDCW, 1/10W.
R423	B19/5RDAC02465	Metal film: 22 ohms ±5%, 100 VDCW, 1/10W.
R481 and R482	B19/5RDAC02578	Metal film: 180 ohms ±5%, 100 VDCW, 1/10W.
R483	B19/5RDAC02464	Metal film: 15 ohms ±5%, 100 VDCW, 1/10W.
R501	B19/5RDAC02468	Metal film: 150 ohms ±5%, 100 VDCW, 1/10W.
R503	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R504	B19/5RDAC02455	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R511	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R512	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R513	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R514	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R515	B19/5RDAC02481	Metal film: 15K ohms ±5%, 100 VDCW, 1/10W.
R516	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R517	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R518	B19/5RDAC02466	Metal film: 33 ohms ±5%, 100 VDCW, 1/10W.
R519	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R520	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R521	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R522	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R523	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R524	B19/5RDAC02469	Metal film: 220 ohms ±5%, 100 VDCW, 1/10W.
R525	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R527	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W.
R528	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R531	B19/5RDAC02479	Metal film: 8.2K ohms ±5%, 100 VDCW, 1/10W.
R532	B19/5RDAC02483	Metal film: 33K ohms ±5%, 100 VDCW, 1/10W.
R533	B19/5RDAC02455	Metal film: 150K ohms ±5%, 100 VDCW, 1/10W.
R534	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R535	B19/5RDAC02484	Metal film: 39K ohms ±5%, 100 VDCW, 1/10W.
R536	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R537	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R538	B19/5RZBX00002	Metal film: Thermal: 10K ohms; sim to TDK NTCDS40203HG 103JC.
R539	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R540	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R542	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R543	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R544	B19/5RDAC02485	Metal film: 68K ohms ±5%, 100 VDCW, 1/10W.
R545	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R546	B19/5RDAC02444	Metal film: 56K ohms ±5%, 100 VDCW, 1/10W.
R547	B19/5RDAC02491	Metal film: 390 ohms ±5%, 100 VDCW, 1/10W.
R548	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R551 and R552	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R553	B19/5RDAC02453	Metal film: 220K ohms ±5%, 100 VDCW, 1/10W.
R554 and R555	B19/5RDAC02223	Metal film: 2.2 ohms ±5%, 200 VDCW, 1/8W.
R556	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R557	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
RV531	B19/5RVAB00421	Variable: 5K ohms ±30%, 0.1W.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T401	B19/6LAFD01136	RF Transformer.
T451 and T452	B19/6LHLD00005A	RF Transformer.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
TR401	B19/5TCAB00287	Silicon, NPN: sim to NEC 2SC3357.
TR501	B19/5TKAH00006	N-Channel, field effect. (Junction Single Gate): sim to SONY 2SK125.
TR511 and TR512	B19/5TCAA00274	Silicon, NPN: sim to HITACHI 2SC2620.
TR513	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR531 thru TR533	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR534	B19/5TBAB00055	Silicon, PNP: sim to NEC 2SB624 (BV3).
TR535	B19/5TCAZ00007	Silicon, NPN: sim to SANYO 2SC3396.
TR536	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR537	B19/5TCAZ00007	Silicon, NPN: sim to SANYO 2SC3396.
TR551	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
X501	B19/5XHAA00835	Crystal.
XS501A and XS501B	B19/5ZJDP00001	Crystal Socket: sim to HAKUTO 75315-001.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

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