MAINTENANCE MANUAL

TRANSMITTER/RECEIVER/SYNTHESIZER BOARD

FOR

TMX-8415

TABLE OF CONTENTS

DESCRIPTION

The transmitter/receiver synthesizer (TRS) board for the TMX-8415 trunked mobile radio consists of the following circuits:

- A frequency synthesizer for generating the transmitter output frequencies and the receiver 2ND IF injection frequencies
- The transmitter exciter, PA and power control stages
- The receiver front end, IF and audio stages
- Voltage regulators
- System interface connectors for power on-off and volume controls, battery, microphone, TQ2310 programmer, test handset, and an optional external speaker

Operation of the TRS board is controlled by the microcomputer circuitry located on the logic board.

The TRS board is mounted at the bottom of the "U" frame chassis, under the logic board. A block diagram of the complete radio is shown in Figure 1.

CIRCUIT ANALYSIS

POWER DISTRIBUTION

Power connections to the radio are made to system connector J23. Power from the battery (+13.6 Volts nominal) is connected to J23-11. The battery input is filtered by C201, C202, C203, L151, L152 and surge protector Z31, and is applied to relay contact K2-4. Reverse polarity protection is provided by diode CR31.

A continuous 13.6 Volt supply is taken from the junction of L51 and L52, and supplies the logic board reset/memory circuit and the final stage of PA module A11.

The 13.6 Volts from the ignition switch is applied to J23-1. This input is filtered by C208 and C209, and applied to the power on-off switch on the control panel. Reverse polarity protection is provided by CR32.

Pressing in the power-on switch energizes power relay K2. Energizing the relay applies the switched 13.6 Volts to the logic board, the transmitter power control circuit and PA module, the speaker audio amplifier, antenna relay, and all voltage regulators.

FREQUENCY SYNTHESIZER

The frequency synthesizer circuit consists of reference oscillator module Z1, phase-lock loop (PLL) module A5, dual modulus pre-scaler A6, charge pump Q2 and Q3, voltage-controlled oscillator (VCO) Z2, a loop filter and associated circuitry.

Reference Oscillator Module

Reference oscillator Z1 operates at a frequency of 12.8 MHz. The oscillator is temperature compensated to provide a frequency stability of 2.5 PPM. Voltage for the oscillator is supplied by 5-Volt regulator A2. The oscillator output is applied to PLL module A5 on pin 17.

PLL Module

PLL module A5 consists of a 1024-divider, a phase detector, and a ÷ N counter.

When the PTT switch is pressed (transmit) or released (receive), new frequency data is received on the clock, data, and enable lines and the synthesizer immediately begins generating the new RF frequency. This serial data determines the VCO frequency by setting the internal dividers. The reference oscillator frequency applied to the programmable divide-by-N counter is divided down to some lower frequency as indicated by the input data and applied to the internal phase detector.

The phase detector compares this signal with the output of the internal ÷N counter. The output of the ÷ N counter is a function of the RF frequency which is divided down by the dual modulus pre-scaler and the ÷ N counter. When operating on the correct frequency, the inputs to the phase detector are identical and the output voltage of the phase detector is constant. Under these conditions, the VCO is stabilized or locked on frequency.

If the compared frequencies (phases) differ, an error voltage is generated and applied to the VCO through the frequency acquisition circuit causing the phase-lock loop to acquire the new frequency. The SYNTH UNLOCK line provides the PLL lock status information to the microcomputer on the logic board. When the PLL is out of lock, the SYNTH UNLOCK lead goes low. When locked on frequency, the lead goes high.

VCO Module

The output of the PLL module at A5-12 and A5-13 are applied to a charge pump consisting of Q2 and Q3. The transistors "sum" the two outputs of A5 and apply the PLL output to a loop filter.

The loop filter consists of C26, C27, C28, R17 and R18. The filter reduces any spurious output from the phase detector, and controls the loop stability. The filter output is applied to the voltage control input of the VCO (Z2).

The charge pump output voltage changes with frequency, changing the VCO output frequency approximately 3.5 MHz per volt. The charge pump output is metered at TP1 with typical readings of 2.7 to 6.0 Volts.

Modulated audio from the CODEC on the logic board is applied to amplifier A7 through the DA Out lead. The gain of the amplifier stage is adjusted by switching resistors R64 through R67 in the feedback path of A7.

The AREA 0 and AREA 1 outputs from the logic board change with changes in frequency, switching one of resistors R64 through R67 in parallel with feedback resistor R50 to increase the gain as the frequency increases. This keeps the modulated signal applied to the VCO more constant over the frequency range. The output of the VCO is 806 to 825 MHz.

NOTE

The modulation is adjusted by MOD ADJDUST potentiometer R52 on the logic board.

The modulated output of the VCO is coupled through an attenuator network and an impedance-matching circuit to the base of RF buffer-amplifier Q4. The attenuator network consists of R32, R33 and R34. The matching circuit consists of C30, L3 and R19. Bias voltage for the buffer stage is metered at TP3.

The buffer amplifier output is applied to an RF "splitter" (L5, C36 and T1) to provide drive for transmitter exciter module A9 and to receiver injection amplifier Q9.

TRANSMITTER

The transmitter consists of exciter module A9, PA module A11, isolator Z15, a low-pass filter, and power control circuit. Supply voltage for the exciter is provided by a switched Tx 8-Volts.

8-Volt Regulator

The 8-Volt regulator operates from the 13.6 volt ignition switch voltage.

The regulator circuit consists of 8-Volt regulator A10 and Tx 8-Volt switches Q7 and Q8. Switches Q7 and Q8 are controlled by the RX MUTE lead from the logic board.

When the RX MUTE lead is activated, Q8 turns on. This turns on transistor switch Q7 and applies the regulator output at A10-3 to exciter module A9.

The Tx 8-Volts also powers the mobile microphone through J22-4 (MIC HI), and is applied to the test handset through J23-7. TP5 is used to meter the regulator output (typically 7.6 Volts).

Exciter

Applying the Tx 8-Volts to the exciter forward-biases diode CR5, allowing the VCO output from the RF splitter circuit to be applied to exciter input A9-1. The exciter input is coupled through an attenuator circuit (R24, R25 and R26) which provides approximately 3 dB attenuation. The RF input is amplified to provide 400 milliwatts drive to PA module A11.

The PA module A11 consists of three broadband, fixed-tuned transistor stages. Supply voltage for the PA consists of a switched 13.6 volts for the first two amplifiers (Vcc1 and Vcc2). A continuous 13.6 Volts is used for the final PA amplifier (Vcc3). The supply voltage is coupled through collector-feed networks consisting of L25, L26, L27 and associated circuitry. Supply voltage for the final amplifier is metered at TP12. The PA output is coupled through isolator Z15 and a low-pass filter to the antenna relay (K1).

PA Control Circuits

The power control circuit protects the PA module from damage due to excessive output power, reflected power and temperatures.

The output power adjust circuit allows the RF output power to be set at the rated output by R87.

If the output power of the PA increases, more RF power is rectified by CR11 and applied to A12-5. This cause the output at A12-1 to decrease, causing Q14 to conduct less. Q14 conducting less increases the base voltage on PNP pass transistor Q15, causing it to conduct less. This results in less voltage being applied to the first amplifier stage in PA module A11, reducing the power output of the PA module in proportion to the increase in output power detected by the circuit.

To protect the PA module against badly mismatched loads, a reverse power (VSWR) detector consisting of isolator Z15, diode CR12, transistor Q13, A12, Q14 and pass transistor Q15 detect reverse (reflected) power. When sufficient power is detected by CR12 to cause Q13 to conduct, this reduces the voltage at the collector of Q15, causing the PA module to produce less output power, protecting the PA. The reverse power level is set by R83.

The PA is protected against temperature increases by thermal detector Z13, A12, Q14 and Q15.

As the temperature increases, the resistance to ground of thermal detector Z13 decreases. This causes Q15 to conduct less, causing a decrease in the PA output until the temperature is reduced. The temperature level is set by R97.

Instructions for setting R83, R87 and R97 are provided in the Transmitter Alignment Procedure.

RECEIVER

The receiver is a dual conversion, superheterodyne FM receiver for operation in the 851 to 870 MHz range. A regulated 9-Volt supply is used for all receiver stages except for audio PA module A26. The audio PA module operates off of the 13.6 Volt switched supply.

The receiver uses intermediate frequencies of 45.000 MHz and 455 kHz. Adjacent channel selectivity is obtained by using two bandpass filters: a 45.000 MHz crystal filter and a 455 kHz ceramic filter.

All receiver circuitry is mounted on the transmitter/receiver (Tx/Rx) board. The receiver consists of:

- Receiver Front End and First Mixer
- 45.000 MHz First IF Circuitry
- Second Oscillator
- 455 kHz Second IF Circuitry with FM Detector
- Audio PA Circuit

All squelch functions are performed by the logic board circuitry.

Receiver Front End

RF from the antenna is coupled through dielectric filter (FL2) to the base of RF amplifier Q21. Q21 is a Class A, common emitter amplifier that provides a gain of approximately 10 dB to 12 dB.

The amplified output is coupled through dielectric filter (FL3) to the first mixer. The two dielectric filters provide the front end selectivity.

First Mixer

The first mixer is a double-balanced diode mixer that converts a signal in the 851 MHz - 870 MHz range to the 45.000 MHz first IF frequency. The first oscillator operates at 44.455 MHz for low side injection (45.545 for high side injection).

RF from the front end dielectric filter is coupled to mixer directly. The low side injection input from the synthesizer is coupled through an attenuator (R44, R45 and R46) to 1st mixer Z21. The injection input port is isolated from the RF input and IF output by a balancing transformer in the mixer.

The first mixer output is coupled through a tuned circuit (L42 and C139) that matches the mixer output to gate of first IF amplifier Q22.

First IF Amplifier and Filter

IF Amplifier Q22 is a single gate FET that provides good intermodulation and desensitization characteristics. The amplifier also acts as a buffer between the variable balanced mixer output impedance and the crystal filter.

The IF output signal at the drain of Q22 is coupled through a tuned circuit (L43 and C143) that sets the impedance to crystal filter FL5.

FL5 is a 45.000 MHz, four-pole crystal filter that provides a minimum of 25 dB adjacent channel rejection. The filter output is coupled through a tuned circuit (L44 and C146) that matches the output impedance of FL5 to the second IF amplifier.

Second IF AMPL

The output of filter FL5 is applied to base of 2nd IF Amplifier Q23 and the output is taken from the collector. The amplifier provides approximately 20 dB of IF gain. The output of Q23 is coupled through C150 to the input of 2nd Mixer/Detector A21.

Second OSC/Mixer and Detector

The second oscillator, mixer and detector circuit consists of A21 and associated circuitry. The 2nd oscillator operates at 44.545 MHz. The oscillator crystal is Y1. The 45.000 MHz input frequency is mixed with the oscillator frequency to provide the second IF frequency of 455 kHz. L46 is used to set the 2nd oscillator frequency. The 2nd oscillator circuit can be metered at TP22.

The output of the 2nd mixer at A21-5 is coupled through ceramic filter FL6 which provides the 455 kHz selectivity. The filter output is then applied to A21-7.

Following filter FL6 is a 455 kHz limiter and a quadrature FM detector. L47 is used to tune the detector output. The circuit is metered at TP25. The detector output is applied to amplifier A23.

Audio Circuits

The output at A23-2 is coupled through C168 to the CODEC IC on the logic board. The CODEC converts the analog audio to a serial format and applied to a digital signal processor on the logic board. The signal processor provides the busy tone notching, tone detection and alert tone generation to alert the operator. The processor output is applied to the CODEC for processing, and then applied to the TRS board (RX AUDIO) and to active high pass filters A23 and A25. R165 and C170 in the feedback loop of A23 provide the receiver de-emphasis. The filter output is then coupled through the volume control on the control panel and then to audio PA stage A26. Audio amplifier IC A26 drives the speaker at the desired audio level. The feedback loop containing R190, R191 and C179 determines the amplifier closed loop gain.

Rx Mute Circuit

Receiver muting is controlled by the Rx Mute output from the logic board. A high output from the RX Mute lead turns on Q30, which turns on Q29. Turning on Q29 turns off audio PA A26, muting the receiver.

9-Volt Regulator

A 9-Volt regulator (A31) is supplied from the switched 13.6 Volt input to the TRS board. The regulator output is used to provide power for the test handset when servicing the TRS board.

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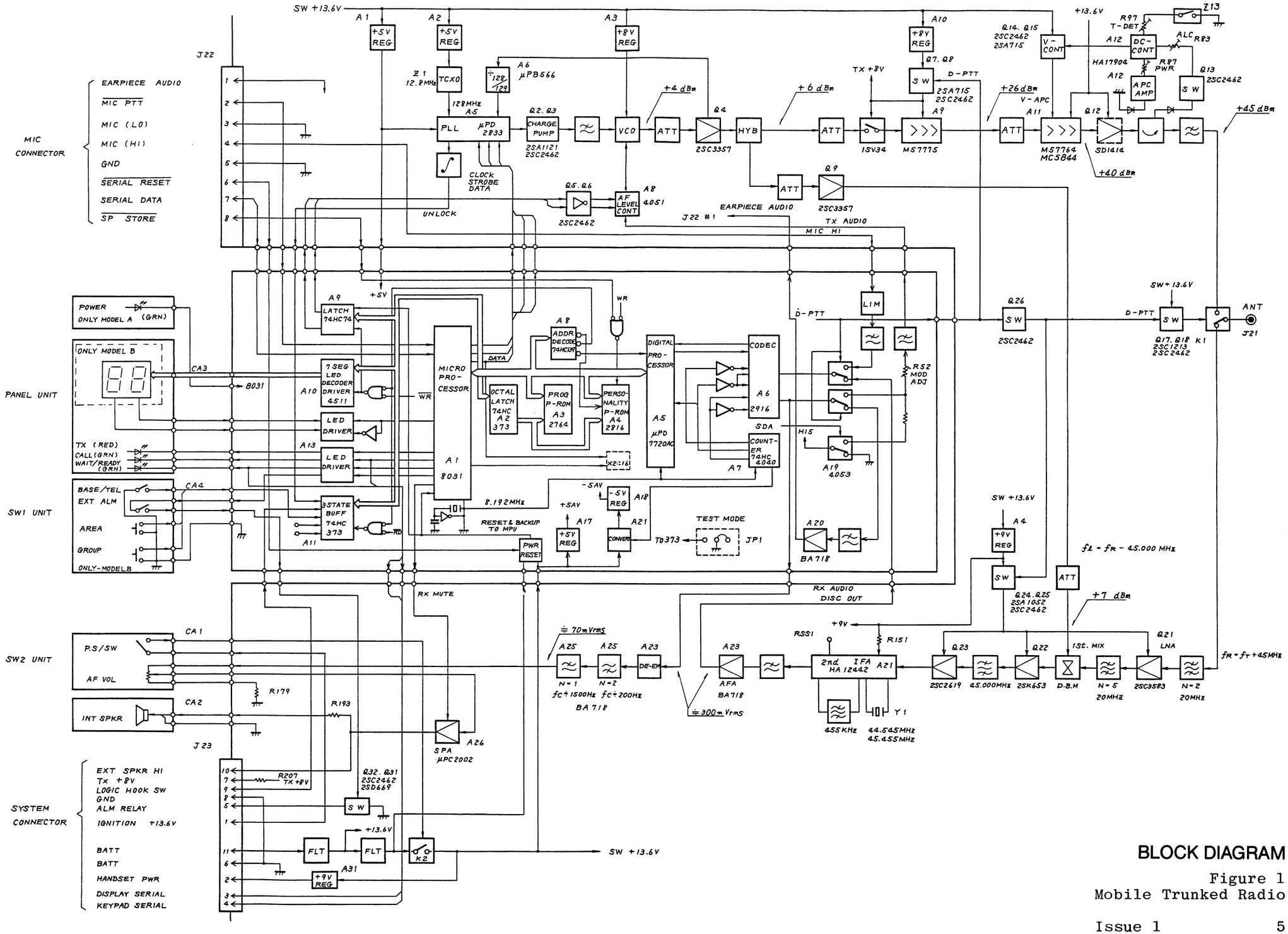
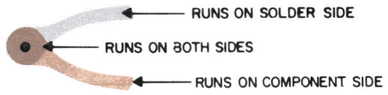
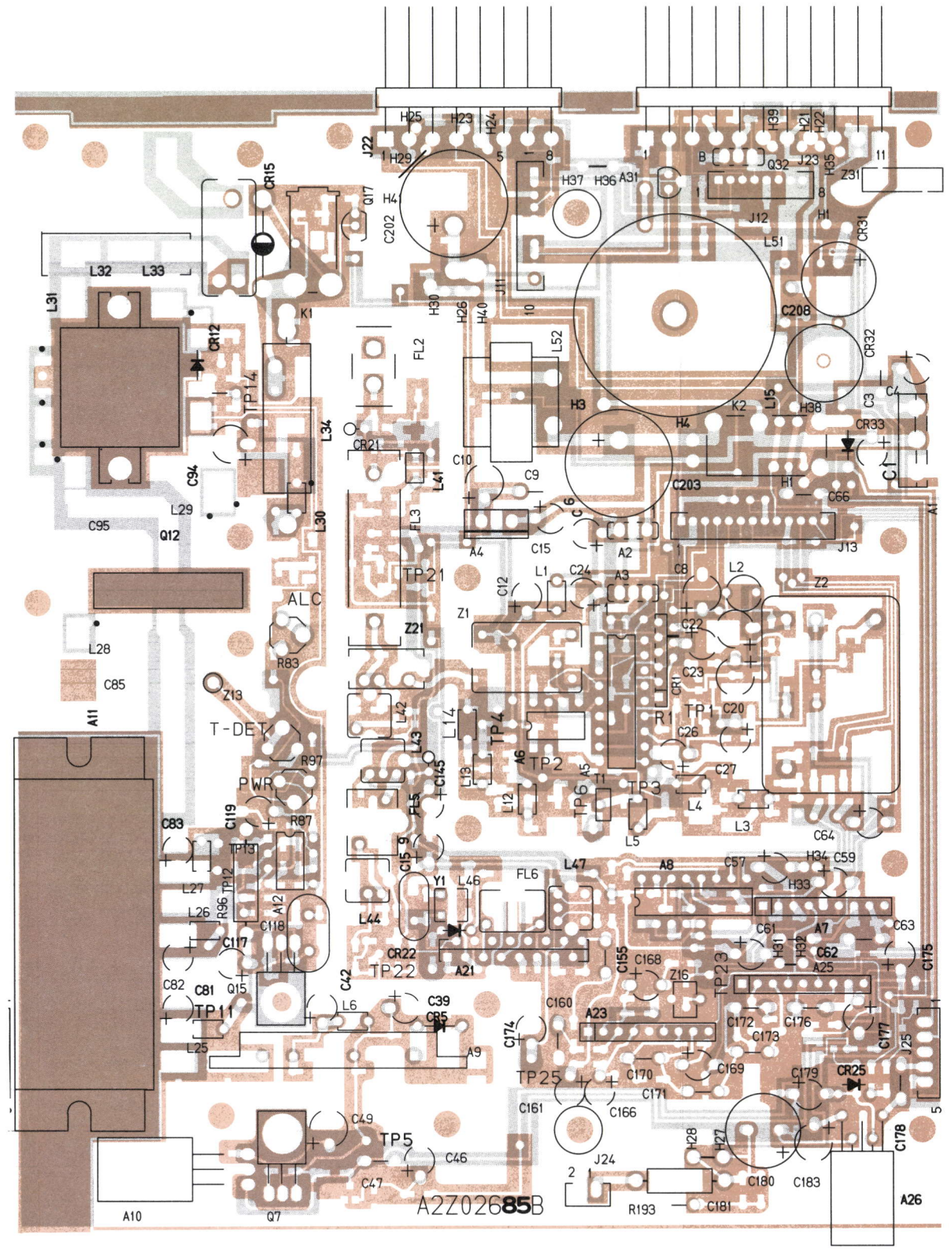


BLOCK DIAGRAM

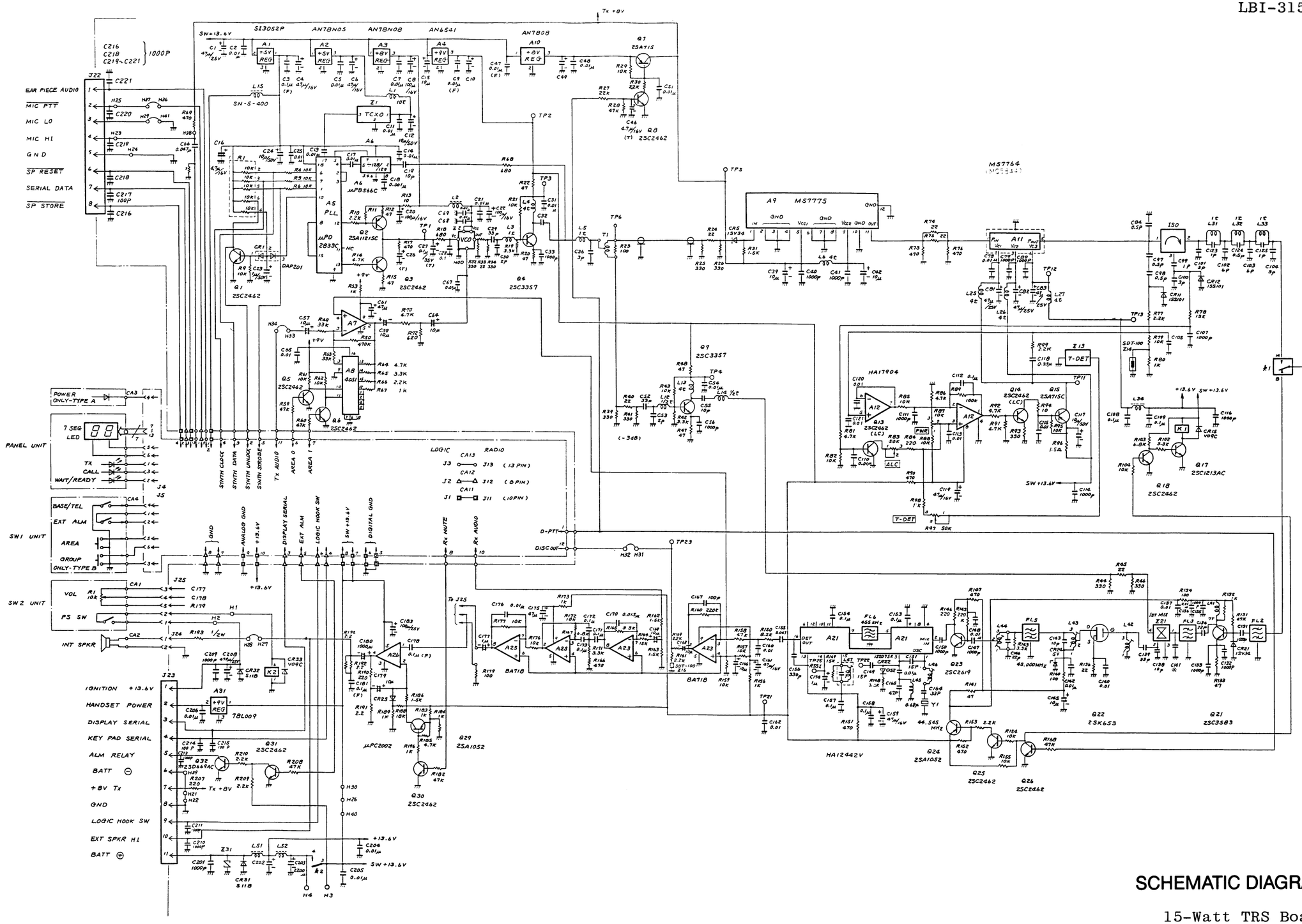
Figure 1
Mobile Trunked Radio





OUTLINE DIAGRAM

TRS Board
15-Watt TRS Board
(TMX-8415)



SCHEMATIC DIAGRAM

15-Watt TRS Board
(TMX-8415)

PARTS LIST

TRANSMIT/RECEIVE/SYNTHESIZER BOARD

SYMBOL	PART NUMBER	DESCRIPTION
		- - - - - - INTEGRATED CIRCUITS - - -
A1	KE2AAE033243	VTG-REG
A2	KE2AAE049146	VTG-REG
A3	KE2AAE049153	VTG-REG
A4	KE2AAE049041	VTG-REG
A5	KE2AAH025048	upD2833C
A6	KE2AAH025055	upB566AC
A7	KE2AAB020011	BA718
A8	KE2ABC036022	TC4051
A9	KE2AAA013070	M57775
A10	KE2AAE049039	VTG-REG
A11	KE2AAA013088	M57764
A12	KE2AAB005145	HA17904GS
A21	KE2AAJ008089	HA12442V
A23	KE2AAB020011	BA718
A25	KE2AAB020011	BA718
A26	KE2AAJ009073	upC2002H
A31	KE2AAE049108	VTG-REG
		- - - - - - - - CAPACITORS - - - - -
C1	KE2CBB035021	Electrolytic, 47 uF.
C2	KE2CAK005391	Ceramic chip, 0.01 uF.
C3	KE2CDC001012	Film, 0.1 uF.
C4	KE2CBB034147	Electrolytic, 47 uF.
C5	KE2CAK005391	Ceramic chip, 0.01 uF.
C6	KE2CBJ001076	Electrolytic, 47 uF.
C7	KE2CAK005391	Ceramic chip, 0.01 uF.
C8	KE2CBJ001068	Electrolytic, 100 uF.
C9	KE2CDC001038	Film, 0.01 uF.
C10	KE2CBJ001068	Electrolytic, 100 uF.
C11	KE2CAK005391	Ceramic Chip, 0.01 uF.
C12	KE2CBJ001035	Electrolytic, 10 uF.
C13 and C14	KE2CAK005391	Ceramic chip, 0.01 uF.
C15	KE2CBJ001035	Electrolytic, 10 uF.
C17	KE2CAK005391	Ceramic chip, 0.01 UF.
C18	KE2CAK005383	Ceramic chip, 1000 pF.
C19	KE2CAK005110	Ceramic chip, 10 pF.
C20	KE2CBJ001068	Electrolytic, 100 uF.
C21	KE2CAK005391	Ceramic chip, 0.01 uF.
C22	KE2CBJ001068	Electrolytic, 100 uF.
C23	KE2CBJ001027	Electrolytic, 1 uF.
C24	KE2CBJ001035	Electrolytic, 10 uF.
C25	KE2CAK005391	Ceramic chip, 0.01 uF.
C26	KE2CCF001359	Tantalum, 105 uF.
C27	KE2CCF001375	Tantalum, 104 uF.
C28	KE2CAK005508	Ceramic chip, 0.1 uF.
C29	KE2CAK005169	Ceramic chip, 33 pF.
C30	KE2CAK005045	Ceramic chip, 2 pF.
C31	KE2CAK005391	Ceramic chip, 0.01 UF.
C32	KE2CAK005110	Ceramic chip, 10 pF.
C33	KE2CAK005383	Ceramic chip, 1000 pF.
C36	KE2CAK005052	Ceramic chip, 3 pF.
C39	KE2CBB042124	Electrolytic, 10 uF.
C40 and C41	KE2CAK005383	Ceramic chip, 1000 pF.
C42	KE2CBB042124	Electrolytic, 10 uF.
C46	KE2CCF001342	Tantalum, 10 uF.
C47	KE2CDC001038	Film, 0.01 uF.
C48	KE2CAK005391	Ceramic chip, 0.01 uF.
C49	KE2CBJ001068	Electrolytic, 100 uF.
C51	KE2CAK005391	Ceramic chip, 0.01 uF.
C52	KE2CAK005169	Ceramic chip, 33 pF.
C53	KE2CAK005045	Ceramic chip, 2 pF.
C54	KE2CAK005391	Ceramic chip, 0.01 uF.
C55	KE2CAK005185	Ceramic chip, 10 pF.
C56	KE2CAK005383	Ceramic chip, 1000 pF.
C57	KE2CBJ001035	Electrolytic, 10 uF.
C59	KE2CAJ001035	Electrolytic, 10 uF.
C61	KE2CBB034147	Electrolytic, 47 uF.
C65	KE2CAK005391	Ceramic chip, 0.01 uF.
C66	KE2CDC001129	Film, 0.047 uF.
C67 thru C69	KE2CAK005391	Ceramic chip, 0.01 uF.
C78	KE2CAK005391	Ceramic chip, 0.01 uF.
C79 and C80	KE2CAK005383	Ceramic chip, 1000 pF.
C81 thru C83	KE2CBJ001019	Electrolytic, 47 uF.
C85	KE2CFA098045	Mica chip, 1 pF.
C86	KE2CAK005110	Ceramic chip, 10 pF.
C87 thru C90	KE2CFA098102	Mica chip, 10 pF.
C91	KE2CAK005110	Ceramic chip, 10 pF.
C92	KE2CAK005136	Ceramic chip, 15 pF.
C93	KE2CAK005383	Ceramic chip, 1000 pF.
C94	KE2CBB043163	Electrolytic, 100 uF.
C95	KE2CFA098086	Mica chip, 5 pF.
C96	KE2CFA098110	Mica chip, 22 pF.
C97 thru C99	KE2CAK005011	Ceramic chip, 0.5 pF.
C100	KE2CAK005052	Ceramic chip, 3 pF.
C101	KE2CFA098060	Mica chip, 3 pF.
C102 and C103	KE2CFA098144	Mica chip, 6 pF.
C104	KE2CFA098060	Mica chip, 3 pF.
C105	KE2CAK005383	Ceramic chip, 1000 pF.
C107	KE2CAK005383	Ceramic chip, 1000 pF.
C108 and C109	KE2CAK005508	Ceramic chip, 0.1 uF.
C110	KE2CAK005391	Ceramic chip, 0.01 uF.
C111	KE2CAK005383	Ceraic chip, 1000 pF.
C112	KE2CAK005508	Ceramic chip, 0.1 uF.
C113	KE2CAK005391	Ceramic chip, 0.01 uF.

SYMBOL	PART NUMBER	DESCRIPTION
C114	KE2CAK005383	Ceramic chip, 1000 pF.
C115	KE2CAK005391	Ceramic chip, 0.01 uF.
C116	KE2CAK005383	Ceramic chip, 1000 pF.
C117	KE2CBJ001035	Electrolytic, 10 uF.
C118	KE2CDC001158	Film, 0.33 uF.
C119	KE2CBB034147	Electrolytic, 47 uF.
C120 and C121	KE2CAK005391	Ceramic chip, 0.01 uF.
C123	KE2CFA098045	Mica chip, 1 pF.
C124	KE2CFA098151	Mica chip, 0.5 pF.
C125	KE2CFA098045	Mica chip, 1 pF.
C131	KE2CAK005383	Ceramic chip, 1000 pF.
C132	KE2CAK005385	Ceramic chip, 1000 pF.
C133	KE2CAK005383	Ceramic chip, 1000 pF.
C134	KE2CAK005151	Ceramic chip, 22 pF.
C135	KE2CAK005383	Ceramic chip, 1000 pF.
C136 and C137	KE2CAK005391	Ceramic chip, 0.01 uF.
C138	KE2CAK005185	Ceramic chip, 10 pF.
C139	KE2CAK005227	Ceramic chip, 33 pF.
C140	KE2CAK005391	Ceramic chip, 0.01 uF.
C141	KE2CAK005029	Ceramic chip, 1 pF.
C142	KE2CAK005391	Ceramic chip, 0.01 uF.
C143	KE2CAK005185	Ceramic chip, 10 pF.
C145	KE2CBJ001035	Electrolytic, 10 uF.
C146	KE2CAK005201	Ceramic chip, 22 pF.
C147	KE2CAK005383	Ceramic chip, 1000 pF.
C148	KE2CAK005391	Ceramic chip, 0.01 uF.
C149	KE2CAK005193	Ceramic chip, 15 pF.
C150	KE2CAK005383	Ceramic chip, 1000 pF.
C151	KE2CAK005193	Ceramic chip, 15 pF.
C152	KE2CAK005391	Ceramic chip, 0.01 uF.
C153 and C154	KE2CAK005508	Ceramic chip, 0.01 uF.
[illegible]	KE2CDC001129	Film, 0.047 uF.
	KE2CAK005284	Ceramic chip, 330 pF.
C157 and C158	KE2CAK005508	Ceramic chip, 0.1 uF.
C159	KE2CBB034147	Electrolytic, 47 uF.
C160	KE2CDC001061	Film, 0.01 UF.
C161	KE2CBB034147	Electrolytic, 47 uF.
C162	KE2CAK005391	Ceramic chip, 0.01 uF.
C164	KE2CAK005227	Ceramic chip, 33 pF.
C165	KE2CAK005235	Ceramic chip, 47 pF.
C166	KE2CBJ001027	Electrolytic, 10 uF.
C167	KE2CAK005250	Ceramic chip, 100 pF.
C168 and C169	KE2CBJ001027	Electrolytic, 10 uF.
C170	KE2CDC001141	Film, 0.015 uF.
C171 thru C173	KE2CDC001012	Film, 0.1 uF.
C174	KE2CBJ001027	Electrolytic, 1 uF.
C175	KE2CBB034147	Electrolytic, 47 uF.
C176	KE2CDC001038	Film, 0.01 uF.
C177	KE2CBJ001027	Electrolytic, 1 uF.
C178	KE2CDC001012	Film, 0.1 uF.
C179	KE2CBJ001035	Electrolytic, 10 uF.
C180	KE2CBB034162	Electrolytic, 1000 uF.
C181	KE2CCD001012	Film, 0.1 uF.
C183	KE2CBB035219	Electrolytic, 100 uF.
C201	KE2CAK005383	Ceramic chip, 1000 pF.
C202 and C203	KE2CBB083015	Electrolytic, 2200 uF.
C204 thru C206	KE2CAK005391	Ceramic chip, 0.01 uF.
C208	KE2CBB035227	Electrolytic, 470 uF.
C209 thru C213	KE2CAK005383	Ceramic chip, 1000 pF.
C214 and C215	KE2CAK005250	Ceramic chip, 100 pF.
C216	KE2CAK005383	Ceramic chip, 1000 pF.
C217	KE2CAK005250	Ceramic chip, 100 pF.
C218 thru C221	KE2CAK005383	Ceramic chip, 1000 pF.
		- - - - - - - - - DIODE - - - - - -
CR1	KE2QBA015084	Silicon.
CR5	KE2QBA001188	Silicon.
CR11 and CR12	KE2QBA001105	Silison.
CR15	KE2QBC008371	Silicon.
CR21	KE2QBA001188	Silicon.
CR22	KE2QBA006161	Silicon.
CR24	KE2QBB001138	Zener.
CR25	KE2QBA006161	Silicon.
CR31 and CR32	KE2QBC008124	Silicon.
CR33	KE2QBC008371	Silicon.
		- - - - - - - - - FILTERS - - - - -
FL2	KE2EDB003021	861 MHz.
FL3	KE2EDB003039	861 MHz.
FL5	KE2FAA103033	Crystal, 45 MHz.
FL6	KE2FAD005136	Ceramic, SLF-D-15.
		- - - - - - - - - RELAYS - - - - - -
K1	KE2KCA001026	RF CX-1051.
K2	KE2KBA003800	G6B-1003H.
		- - - - - - - - - COILS - - - - - -
L1	KE2LAB013122	RF, 10T.
L2	KE2LAA01292	Choke, 101K.
L3	KE2LAB013031	RF, 1T.
L4	KE2LAB013064	RF, 4T.
L5	KE2LAB013031	RF, 1T.
L6	KE2LAB014064	RF, 4T.
L12	KE2LAB014856	RF, 1/2T.
L13	KE2LAB013064	RF, 4T.
L14	KE2LAB014856	RF, 1/2T.
L15	KE2LAA007260	SN-5-400
L25 thru L27	KE2LAB013064	RF, 4T.
L28	KE2LAB014229	RF, 2T.
L29	KE2LAB014229	RF, 5T.
L30	KE2LAB013064	RF, 4T.
L31 thru L33	KE2LAB014869	RF, 1T.
L34	KE2LAA021118	Choke, 11T.
L35	KE2LAB013122	RF, 10T.
L41	KE2LAB013098	RF, 7T.
L42	KE2LAB014885	A4WX00343
L43	KE2LAB014877	A4WX00342
L44	KE2LAB025183	A4WX00312
L45	KE2LAD001062	Chip, 0.68 uH.
L46	KE2LAB014901	A4WX01334
L47	KE2LAB030022	7MC-101000ZD
L51	KE2LAA007344	Choke.
L52	KE2LAA024088	Choke.
		- - - - - - - - - TRANSISTORS - - - - - -
Q1	KE2QAA012765	Silicon.
Q2	KE2QAA011390	Silicon.
Q3	KE2AAA012765	Silicon.
Q4	KE2QAA002436	Silicon.
Q5 and Q6	KE2QAA012765	Silicon.
Q7	KE2QAA011213	Silicon.
Q8	KE2QAA012765	Silicon.
Q9	KE2QAA002436	Silicon.
Q12	KE2QAB006274	Power TR, 30-Watt only.
Q13 and Q14	KE2QAA012765	Silicon.
Q15	KE2QAA011213	Silicon.
Q17	KE2QAA012443	Silicon.
Q18	KE2QAA012765	Silicon.
Q21	KE2QAA002506	Silicon.
Q22		FET
Q23	KE2QAA012836	Silicon.
Q24	KE2QAA011338	Silicon.
Q25 and Q26	KE2QAA012765	Silicon.
Q29	KE2QAA011338	Silicon.
Q30 and Q31	KE2QAA012765	Silicon.
Q32	KE2QAB013275	Silicon.
		- - - - - - - - RESISTORS - - - - - - - -
R1	KE2REA034047	10K ohm.
R3 and R4	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R6	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R9	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R10	KE2RGC001176	Square chip, 1/8W, 2.2K ohm.
R11	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R12	KE2RGC001069	Square chip, 1/8W, 47 ohm.
R13	KE2RGC001010	Square chip, 1/8W, 10 ohm.
R14	KE2RGC001192	Square chip, 1/8W, 4.7K ohm.
R15	KE2RGC001069	Square chip, 1/8W, 47 ohm.
R17	KE2RGC001135	Square chip, 1/8W, 470 ohm.
R18	KE2RGC001143	Square chip, 1/8W, 680 ohm.
R19	KE2RGC001184	Square chip, 1/8W, 3.3K ohm.
R20	KE2RGC001069	Square chip, 1/8W, 47 ohm.
R21	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R22	KE2RGC001069	Square chip, 1/8W, 47 ohm.
R23	KE2RGC001093	Square chip, 1/8W, 100 ohm.
R24	KE2RGC001044	Square chip, 1/8W, 22 ohm.
R25 and R26	KE2RGC001127	Square chip, 1/8W, 330 ohm.
R27	KE2RGC001242	Square chip, 1/8W, 22K ohm.
R28	KE2RGC001275	Square chip, 1/8W, 47K ohm.
R29	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R30	KE2RGC001176	Square chip, 1/8W, 2.2K ohm.

SYMBOL	PART NUMBER	DESCRIPTION
R31	KE2RGC001168	Square chip, 1/8W, 1.5K ohm.
R32	KE2RGC001127	Square chip, 1/8W, 330 ohm.
R33	KE2RGC001044	Square chip, 1/8W, 22 ohm.
R34	KE2RGC001127	Square chip, 1/8W, 330 ohm.
R39	KE2RGC001127	Square chip, 1/8W, 330 ohm.
R40	KE2RGC001044	Square chip, 1/8W, 22 ohm.
R41	KE2RGC001127	Square chip, 1/8W, 330 ohm.
R42	KE2RGC001184	Square chip, 1/8W, 3.3K ohm.
R43	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R44	KE2RGC001127	Square chip, 1/8W, 330 ohm.
R45	KE2RGC001044	Square chip, 1/8W, 22 ohm.
R46	KE2RGC001127	Square chip, 1/8W, 330 ohm.
R47 and R48	KE2RGC001069	Square chip, 1/8W, 47 ohm.
R49	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R50	KE2RGC001341	Square chip, 1/8W, 470K ohm.
R53	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R59 and R60	KE2RGC001275	Square chip, 1/8W, 47K ohm.
R61 and R62	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R63	KE2RGC001259	Square chip, 1/8W, 33K ohm.
R64	KE2RGC001192	Square chip, 1/8W, 4.7K ohm.
R65	KE2RGC001184	Square chip, 1/8W, 3.3K ohm.
R66	KE2RGC001176	Square chip, 1/8W, 2.2K ohm.
R67	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R68	KE2RGC001143	Square chip, 1/8W. 680 ohm.
R69	KE2RGC001135	Square chip, 1/8W, 470 ohm.
R70	KE2RGC001275	Square chip, 1/8W, 47K ohm.
R71	KE2RGC001168	Square chip, 1/8W, 1.5K ohm.
R73	KE2RGC001135	Square chip, 1/8W, 470 ohm.
R74 and R75	KE2RGC001044	Square chip, 1/8W, 22 ohm.
R76	KE2RGC001135	Square chip, 1/8W, 470 ohm.
R77	KE2RGC001242	Square chip, 1/8W, 2.2K ohm.
R78	KE2RGC001226	Square chip, 1/8W, 15K ohm.
R79	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R80	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R81	KE2RGC001192	Square chip, 1/8W, 4.7K ohm.
R82	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R83	KE2RFB017076	Variable, 50K ohm.
R84	KE2RGC001119	Square chip, 1/8W, 220 ohm.
R85	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R86	KE2RGC001192	Square chip, 1/8W, 4.7K ohm.
R87	KE2RFB017068	Variable, 10K ohm.
R88	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R89	KE2RGC001309	Square chip, 1/8W, 100K ohm.
R90	KE2RGC001135	Square chip, 1/8W, 470 ohm.
R92	KE2RGC001192	Square chip, 1/8W, 4.7K ohm.
R93	KE2RGC001127	Square chip, 1/8W, 330 ohm.
R94	KE2RGC001028	Square chip, 1/8W, 10 ohm.
R95	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R96A	KE2RBA013138	RNM2FB 4.7 ohm.
R96B	KE2RDA001027	W1/2P 0.1 ohm.
R97	KE2RFB017076	Variable, 50K ohm.
R98	KE2RGC001259	Square chip, 1/8W, 33K ohm.
R99	KE2RGC001242	Square chip, 1/8W, 2.2K ohm.
R102	KE2RGC001184	Square chip, 1/8W, 3.3K ohm.
R103	KE2RGC001200	Square chip, 1/8W, 6.8K ohm.
R104	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R131	KE2RGC001275	Square chip, 1/8W, 47K ohm.
R132	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R133	KE2RGC001069	Square chip, 1/8W, 47 ohm.
R134	KE2RGC001093	Square chip, 1/8W, 100 ohm.
R136	KE2RGC001192	Square chip, 1/8W, 22 ohm.
R140	KE2RGC001184	Square chip, 1/8W, 100 ohm.
R141	KE2RGC001069	Square chip, 1/8W, 47 ohm.
R143	KE2RGC001184	Ceramic chip, 1/8W, 3.3K ohm.
R145	KE2RAA002518	Carbon, 1/8W, 330K ohm.
R146	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R147	KE2RGC001135	Square chip, 1/8W, 470 ohm.
R148	KE2RGC001184	Square chip, 1/8W, 3.3K ohm.
R149	KE2RGC001226	Square chip, 1/8W, 15K ohm.
R151 and R152	KE2RGC001135	Square chip, 1/8W, 470 ohm.
R153	KE2RGC001176	Square chip, 1/8W, 2.2K ohm.
R154 and R155	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R156	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R157	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R158	KE2RGC001275	Square chip, 1/8W, 47K ohm.
R159	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R160	KE2RGC001325	Square chip, 1/8W, 220K ohm.
R161	KE2RGC001176	Square chip, 1/8W, 22K ohm.
R162 thru R164	KE2RGC001168	Square chip, 1/8W, 1.5K ohm.
R165	KE2RGC001259	Square chip, 1/8W, 33K ohm.
R166	KE2RGC001135	Square chip, 1/8W, 470 ohm.
R167	KE2RGC001200	Square chip, 1/8W, 6.8K ohm.
R168	KE2RGC001275	Square chip, 1/8W, 47K ohm.
R169	KE2RGC001176	Square chip, 1/8W, 2.2K ohm.
R171	KE2RGC001184	Square chip, 1/8W, 3.3K ohm.
R172	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R173	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R176 and R177	KE2RGC001218	Square chip, 1/8W, 10K ohm.
R179	KE2RGC001093	Square chip, 1/8W, 100 ohm.
R182	KE2RGC001275	Square chip, 1/8W, 47K ohm.
R183 and R184	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R185	KE2RGC001192	Square chip, 1/8W, 4.7K ohm.
R186	KE2RGC001168	Square chip, 1/8W, 1.5K ohm.
R188	KE2RGC001234	Square chip, 1/8W, 18K ohm.
R189	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R190	KE2RGC001119	Square chip, 1/8W, 220 ohm.
R191 and R192	KE2RGC001684	Square chip, 1/8W, 2.2 ohmm.
R193	KE2RBA013120	RNM2FB 1 ohm.
R194	KE2RGC001684	Square chip, 1/8W, 2.2 ohm.
R196	KE2RGC001150	Square chip, 1/8W, 1K ohm.
R207	KE2RGC001119	Square chip, 1/8W, 220 ohm.
R208	KE2RGC001275	Square chip, 1/8W, 47K ohm.
R209 and R210	KE2RGC001176	Square chip, 1/8W, 2.2K ohm.
		- - - - - - - - TEST POINTS - - - - - - - -
TP1 thru TP5	KE2PYD006016	75404-041
TP11 and TP12	KE2PYD006016	75404-041
TP14	KE2PYD006016	75404-041
TP21 thru TP23	KE2PYD006016	75404-041
TP25	KE2PYD006016	75404-041
		- - - - - - - - CONNECTORS - - - - - - - -
J11	KE2PDA012026	IL-S-10P-S2T2-EF
J12	KE2PDA012018	IL-S-8P-S2T2-EF
J13	KE2PDA012034	IL-S-13P-S2T2-EF
J21	KE2PCB007279	RF N-R
J22A & B	KE2PDA020107	5274-04A
J23A	KE2PDA020123	5274-06A
J23B	KE2PDA020115	5274-05A
J24	KE2PDA010738	TSL-P05P-B1
J25	KE2PDA010720	TSL-P02P-B1
		- - - - - - - - - CRYSTAL - - - - - - - - -
Y1	KE2YAA181640	44.545 MHz.
		- - - - - - - - - OTHERS - - - - - - - - -
Z1	KE2YBA103246	TCXO, 12.8 MHz.
Z2		VCO, 800 MHz.
Z11 and Z12	KE2LDA014018	Core, 5.8 x 6.4 x 2.0
Z13	KE2KPD002134	Thermal detector.
Z14	KE2QBD005038	Thermistor.
Z15	KE2EEA004028	Isolator.
Z16	KE2QBD005038	Thermistor.
Z21	KE5UAY001054	Double balance mixer.
Z22	KE2YYZ001064	Silicon damper.
Z31	KE2QBD011275	Surge Absorber.
		- - - - - - - CONNECTOR ASSY - - - - - - -
CA11	KE2WHE002880	10 Pin.
CA12	KE2WHE002898	8 Pin.
CA13	KE2WHE002906	13 Pin.

PARTS LIST

EXTERNAL ALARM RELAY
19B226025G4
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1701	19A704142P2	General Purpose Silicon; sim to 1N4005.
		- - - - - - - - - - - RELAYS - - - - - - - - - -
K1701	7486515P2	Armature, enclosed: 12 VDC nominal, 85 to 90 ohms coil res, 1 form A contact rated at 15 amps.
		FUSED LEAD 19B226454G1
	1R16P3	Quick blowing: 1 amp at 250 v; sim to Littelfuse 312001 or Bussmann AGC-1.
	19A115776P6	Fuseholder: sim to Bussmann 9835.
	19A115776P5	Knob assembly: sim to Bussmann 9953 1/2.
	19A115776P7	Spring: sim to Bussmann 1A1853.
	19A115776P3	Contact: sim to Littelfuse 904-88. (Crimped on wires inside holder).
		WIRE ASSEMBLY 19A129937G2
	19B209260P12	Terminal, solderless: wire range No. 22-16; sim to AMP41310.
	19A116781P5	Contact, electrical: wire range No. 18-24 AWG; sim to Molex 08-50-0106.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	N80P13005C6	Machine screw: No. 6-32 x 5/16. (Secures relay to support).
	N404P13C6	Lockwasher, internal tooth: No. 6. (Secures relay to support).
	N402P37C13	Flatwasher: No. 6. (Secures relay to support).
	N80P15005C6	Machine screw, phillips head: No. 8-32 x 5/16. (Secures wire to relay terminals).
	19A129833P1	Support. (K1701).
	N130P1608C6	Tap screw: No. 10-16 x 1/2. (Secures relay support).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

800 MHz ANTENNA
19B209568P4

ISSUE 2

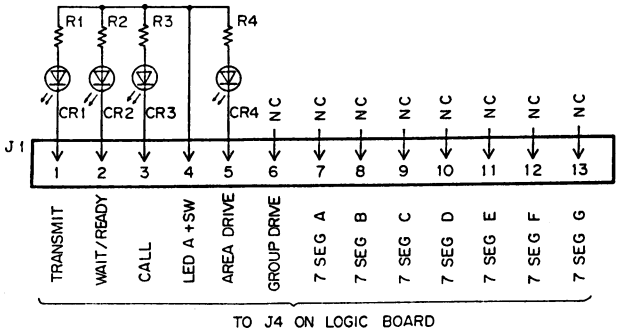
SYMBOL	GE PART NO.	DESCRIPTION
		Whip assembly. 068110-001.
		Whip nut assembly. 068047-001.
		Base nut assembly. 068048-001.
		"O" Ring (LARGE). 007059-122.
		Stud assembly. 068046-001.
	19B209018P5	Plug, Type N; sim to UG536A/U.
		Cable. (Included as part of complete antenna assembly only).

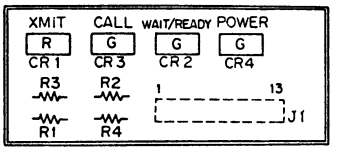
PARTS LIST

TMX-8415
CONTROL PANEL

SYMBOL	PART NUMBER	DESCRIPTION
		- - - - - - - - - - LEDS - - - - - - - -
CR1	KE2HAA014055	Diode, Light Emitting, Red.
CR2 thru CR4	KE2HAA014063	Diode, Light Emitting, Green.
		- - - - - - - - - CONNECTOR - - - - - - - - -
J1	KE2PDA012034	Jack, 13-Pin.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1 thru R4	KE2RAA002013	Fixed, carbon, 620 ohm.
		- - - - - - - - CABLE ASSEMBLY - - - - - - -
CA1	KE2WHE002914	Power, Volume.
CA2	KE2WHE002922	Speaker.
CA3	KE2WHE002864	Power-On.
		- - - - - - - - - - SPEAKER - - - - - - - - -
SP1	KE2SDA005121	3 Watts/4 ohm.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	KE2REA045016	Variable, Volume.
		- - - - - - - - - - SWITCH - - - - - - - - -
S1	KE2KJB004052	Power-On.

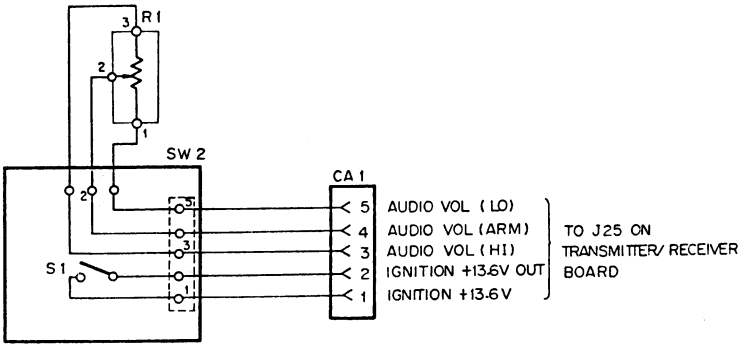
DISPLAY PANEL

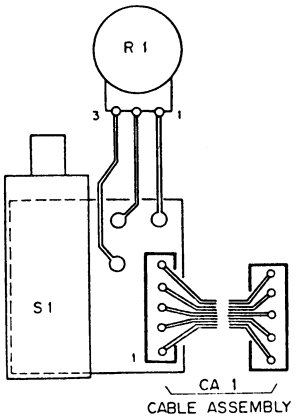




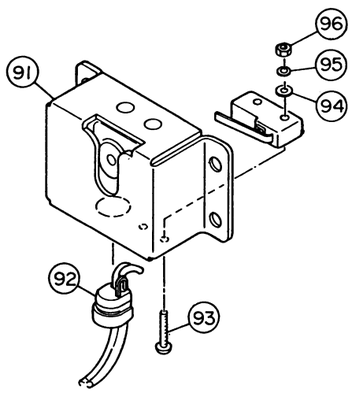
PARTS LOCATION (FRONT VIEW)
LED BOARD (PANEL 2)

VOLUME/POWER
SWITCH



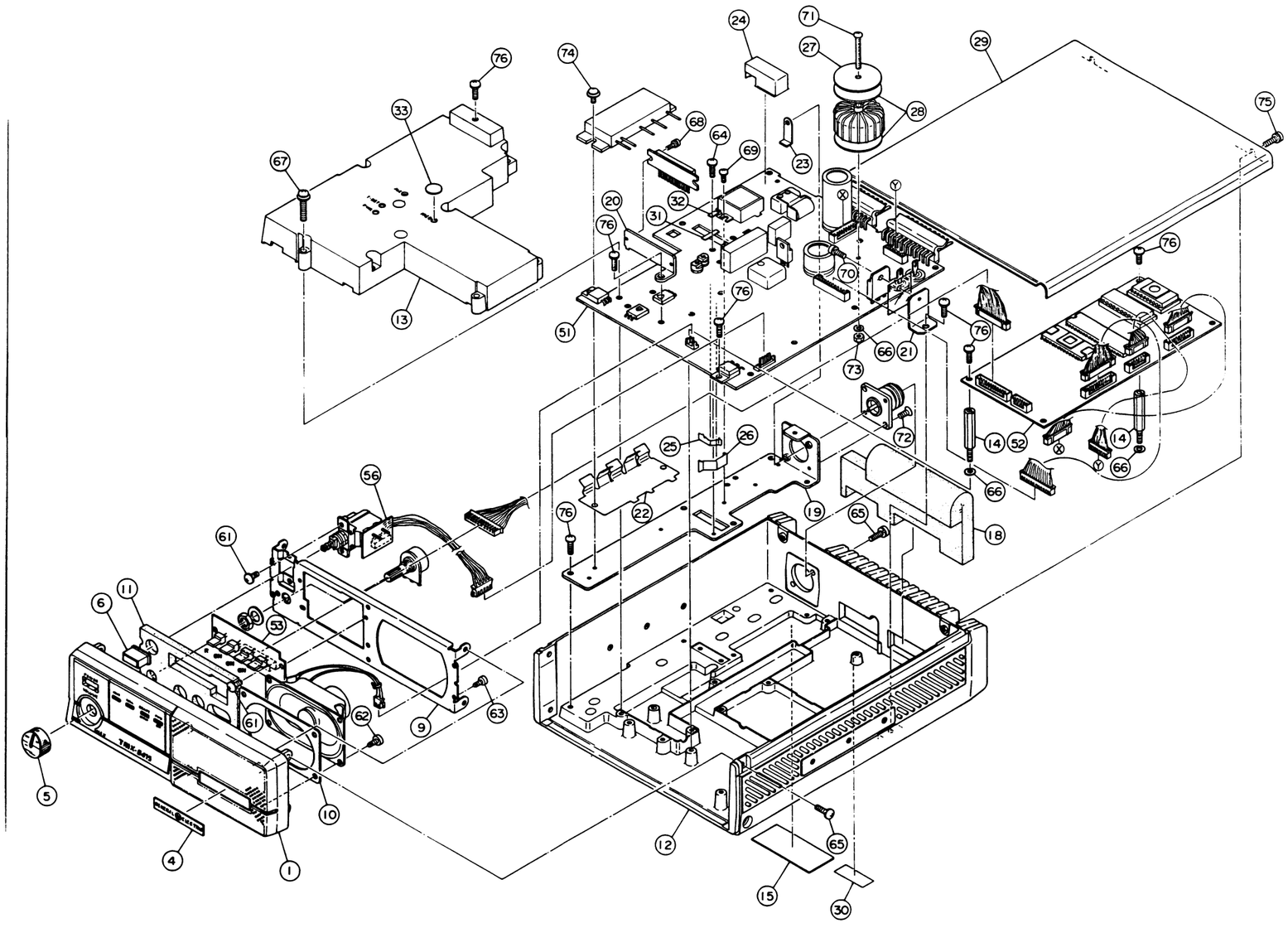


PARTS LOCATION (REAR VIEW)



PART NO.	DESCRIPTION	DRAWING NO.	QTY
91	HOOK SWITCH HOUSING ASSY	A4WL07531	1
92	BUSHING STRAN RELIEF CABLE	KD-31	1
93	CPS (PAN HEAD SCREW)	M2x12 Nip,BS	2
94	W	M2 Nip,BS	2
95	SW	M2 Nip,PB	2
96	CN (NUT)	M2 Nip,BS	2

HOOK SWITCH EXPLODED VIEW



PART NO.	DESCRIPTION	DRAWING NO.	QTY
1	FRONT CAP A SUB ASSY	A3WL07338	1
2	———	———	—
3	———	———	—
4	NAME PLATE	A4WL07406	1
5	VOLUME KNOB	A4WL07243	1
6	BUTTON A	A4WL07244	1
7	———	———	—
8	———	———	—
9	SWITCH PANEL	A2WL07247	1
10	SPACER	A4WL07248	1
11	SPONGE A	A4WL07367	1
12	FRAME	A1WL07249	1
13	SHIELD COVER	A1WL07281	1
14	POST	A4WL07317	2
15	FCC NAME PLATE	A4WL07345	1
16	———	———	—
17	———	———	—
18	SPONGE B	A4WL07368	1
19	HEAT SINK PLATE	A3WL07313	1
20	HEAT SINK A	A4WL07314	1
21	HEAT SINK B	A4WL07315	1
22	PLATE FOR PA PACK IC	A4WL07316	1
23	ANTENNA LEAD	A4WL07405	1
24	FILTER COVER	A4WL07596	1
25	SHIELD A	A4WL07597	1
26	SHIELD B	A4WL07598	1
27	CORE PLATE	A4WL05645	1
28	SPACER	A4WL04937	2
29	COVER	A3WL07250	1
30	DATE CODE LABEL	A3WL07648	1
31	STRIP	A4WL07602	1
32	SHORT BAR	A4WL07726	1
33	SHEET	A4WL07723	1
51	RADIO P.W.B.	A2Z02685	1
52	LOGIC P.W.B.	A3Z02677	1
53	LED A P.W.B.	A4Z02679	1
54	———	———	—
55	———	———	—
56	POWER SW P.W.B.	A4Z02681	1
61	CPS WITH SW (PAN HEAD SCREW)	M3x6 Nip, BS	4
62	CPS TAPPING (TAPPING SCREW)	M3x6 Znp, S	4
63	CPS TAPPING (TAPPING SCREW)	M2.6x6 Znp, S	6
64	CPS WITH SW (PAN HEAD SCREW)	M3x8 Nip, BS	3
65	CPS WITH SW (BLACK) (PAN HEAD SCREW)	M3x10 Znp, S	6
66	SW	M3 Nip, PB	3
67	CPS WITH SW, W(S) (PAN HEAD SCREW)	M3x20 Nip, BS	10
68	CPS WITH SW (PAN HEAD SCREW)	M2x6 Nip, BS	2
69	CPS WITH SW (PAN HEAD SCREW)	M2.6x6 Nip, BS	2
70	CPS WITH SW (PAN HEAD SCREW)	M2.6x8 Nip, BS	1
71	CPS (PAN HEAD SCREW)	M3x25 Nip, BS	1
72	CPS (FLUSH HEAD SCREW)	M3x6 Nip, BS	2
73	CN(NUT)	M3 Nip, BS	1
74	CPS WITH SW, W(L) (PAN HEAD SCREW)	M3x8 Nip, BS	2
75	CPS WITH SW, W(S) (PAN HEAD SCREW) (BLACK)	M3x10 Znp, S	2
76	CPS WITH SW (PAN HEAD SCREW)	M3x10 Nip, BS	15

TMX – 8415 EXPLODED VIEW

MECHANICAL PARTS BREAKDOWN