Monogram Series
LTR Compatible
Trunking Portable

ERICSSON

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Electrical Characteristics

General

Communication Method:	LTR (trunked), simplex (talk-around) half duplex
Frequency Range:	
Tx:	806-825 MHz (trunked, half duplex) 851-870 MHz (simplex, talk around)
Rx:	851-870 MHz
Battery	1100 mAh standard
Duty Cycle	9 hours @ 90-5-5
Systems:	Up to 10
Groups:	Up to 10 per system

Channels:

Trunked:	Up to 20 per system (200 channels possible)
Conventional:	Up to 20 per system (200 channels possible)
Tx/Rx Separation	
Trunked:	45 MHz
Conventional:	45 MHz and 0 MHz
Channel Spacing:	25 kHz
Channel Increment:	12.5 kHz
Power Supply:	7.2 volt 1100 MA/H Ni-cad Battery

Receiver

Sensitivity	0.35 uV (12 dB SINAD)
Selectivity:	-70 dB
Spurious Rejection:	-70 dB (60 dB at half 1st IF)
Hum and Noise:	-40 dB
Intermodulation:	-70 dB
Audio output power:	0.4 Watt
Audio Distortion:	Less than 5% at rated output
Audio Response:	+2,-8 dB from standard De-emphasis curve
Channel Spread:	19 MHz (851-870 MHz)
Frequency Stability:	$\pm$ 2.5 ppm from -30 degrees C to 60 degrees C
Antenna Impedance:	50 ohms
Current Drain:	70 mA (Standby), 250 mA (at rated audio output)

Continued

Electrical Characteristics - Cont.

Transmitter

RF Power Output:	1.5 Watt
Adjacent channel power:	-70 dB
Spurious:	-60 dB
Harmonics:	-60 dB
FM Hum and Noise:	-40 dB
Audio Distortion:	5% maximum at rated modulation
Audio Response:	+1, -3 dB from standard pre-emphasis curve
Audio Modulation:	16koF1D, 16koF3D, 16koF3E
Tx Channel Spread:	19 MHz (806-825 MHz) 19 MHz (851-870 MHz)
Frequency Stability:	±2.5 ppm from -30 degrees C to +60 degrees C
Load Impedance:	50 ohms
Current Drain:	800 mA max.

GENERAL FEATURES

Trunking and Conventional modes are available in 800 MHz band.

Transmitter Bandwidth:	806.0125-823.9875 MHz
(Talk-Around)	851.0125-868.9875 MHz
Receiver Bandwidth:	851.0125-868.9875 MHz
Systems:	Up To 10
Groups:	10 Groups Per System
Channels:.	830 Channels

Trunked or Conventional operation on any system

Talk-around available on trunked and conventional modes.

LCD Display in all operation states.

LED Call indicator

Backlight on LCD Display

EEPROM Programming of frequencies and functions.

Current operating Parameters saved when transceiver is turned off.

Time-out-Timer when transmitting.

TX-Low battery indicator.

System scan

System Lock out function when system scans

Programmable Transmit Disable in conventional mode in order not to cause interference.

TRUNKING FEATURES AND OPERATIONS

10 Systems Selectable By System Switch.

10 ID Codes Per System (Selectable By Group Switch).

One ID Code Per System Programmable As Priority Id.

Priority ID Indication When Called From Priority Id.

Block Decode Of ID Codes (Up To All 250).

Transmit Inhibit ID Code (Block) Available.

Busy Alarm When No Available Channel.

Available System Alert.

Automatic Alert Of Service Area In Fass Mode
(FASS = First Available System Scan).

Out Of Range Alert

Connect Tone When Linking With Trunking Site. (Clear To Talk Tone).

Transpond

Free System Ringback In Interconnect Mode.

Memory And Automatic Dialing Functions Of 8 to 14 Digit Telephone Number.

System Scan

Programmable / Manual Group Scan

Programmable Adjustment Of System Scan Time (Revert System Scan Time).

Programmable Revert to Home Or Last Used System In Scan Code.

System Lock Out In Scan Mode.

Conventional Features and Operation

All 10 Systems Can Be Programmed For Conventional Usage (100 Channels In Total).

Up To 10 Channels Per System (Selectable By Group Switch).

Programmable Ctcss And DCS/IDCS Squelch.

Talk-around Available Via Talk-around Switch.

Monitor Switch To Monitor Channel Activity.

Programmable Receive Only Channels.

CONTROLS AND INDICATOR

On/Off Volume (VOL)

The top, right clockwise rotation applies power to the Monogram Series LTR with a mechanical click sound, and a full counter clockwise rotation, removes power with a click sound. A clockwise rotation makes the volume level increase and a counter clockwise rotation decreases the volume level.

Transmitter Switch (PTT)

The side, lowermost mounted momentary switch when pressed is put into transmit mode and the "TX" lamp is illuminated. When the switch is released, the unit is returned to the receiver mode.

Monitor Switch (M)

This is the side, center mounted momentary switch. When pressed for conventional operation mode, any squelch operation is defeated and the selected receive channel signal is heard. When there is no signal at the selected channel, noise will be heard. When this switch is in operation, the word "MONITOR" appears on the LCD display. When this switch is released, the unit goes back to it's previous state.

LCD Display Illumination Switch (L)

The side, uppermost mounted momentary switch when pressed illuminates the LCD.

System Select Switch (SYS)

The front keypad switch, when pressed, is stepped up from one system to the next, and the system number will be displayed on the LCD, under the "SYS" Icon. When this switch is pressed while in system scan, the system in the receive mode is skipped and the next system is scanned.This button does not function in TX mode.

Group Select Switch (GRP)

The front keypad switch when pressed is stepped up to the next group programmed, and the group number will be displayed on the LCD under the "GRP" Icon. This button does not function in TX mode.

Talk-Around Select Switch (T/A)

The front keypad switch is used to enable the Talk-Around function. When pressed, Talk-Around is selected from the normal state. Pressing the switch a second time returns the radio to Normal state. When Talk-Around is selected, "SIMPLEX" is displayed on the LCD. If "SYS" switch is pressed, the system selected is stepped up from one system to the system programmed and at the same time, the radio reverts to non-talk around mode. When the radio is in talk around mode and powered off and then on, the radio will be in non talk around mode. This button does not function in TX mode.

Mute Select Switch (MUTE)

When front keypad switch is pressed the musical note in lower right corner of LCD will disappear and the key beeps on each function key will be muted. When pressed again, or the power is turned off and back on, the musical note appears and the key beeps on each function key returns. This button does not function in TX mode.

Scan ON/OFF Select Switch (SCN)

When the scan button on the front keypad switch is pressed it puts the Monogram Series LTR in the mode to use system scan or group scan for 3 seconds. Group Scan is not available in the conventional mode. Pressing "SYS" key or "GRP" key within 3 seconds after pressing "SCN" key makes system scan or group scan respectively. While scanning the words "In Scan" and the"SCAN" Icon will be displayed. During system scan, the number of systems and groups which are being scanned will be displayed at the left hand side of LCD. If any systems are locked out, the "LOCK" Icon will be displayed. Pressing "SCN" again, disables scan mode. This button does not function in transmt mode.

System Scan Lockout Switch (LCK)/Keypad Lock Out

The front keypad pressing this key locks the currently selected system from the scan list and the "LOCK" icon will be displayed. Pressing the key again, allows the current system to be scanned. When scanning pauses while in system scan due to receiving a signal, or pressing this key during scan delay time for TX/RX, the selected system is locked and next system will be scanned. If any one system of 10 systems is locked out while in system scan, the "LOCK" icon is displayed on the LCD. This button does not function in scanning system mode.

Keypad Lock

LCK "Keypad Lock"- While you radio is on, this function prevents inadvertant setting changes due to accidential key presses.

A. To "Lock" Keypad - Press and hold the **LCK** key for 3 seconds and wait for 2 long beeps. The word "LOCK" will blink in the upper left hand corner of the LCD display to verify activation of the keypad lock.

B. To "Unlock" Keypad - Hold the **LCK** key down for 3 seconds and wait for 3 short beeps. The word "LOCK" will then disappear from the LCD display.

NOTE:
The **"LCK"** key will not work under two conditions:

1) Editing phone numbers (while in the "Phone" mode).
2) While in Manual System or Group Scan mode.

Phone Mode (PHONE)

When this key on the front keypad is pressed in trunked mode, group name on LCD display will disappear, and the "PHONE" icon on the LCD appears. It is now possible to dial phone numbers. Pressing numbers on the keypad will display on LCD up to 7 digits including "*", "#", but will hold up to 14 digits in memory. Automatic dialing, storing, searching and correcting the keyed phone number are available using "T/A(SND), "MUTE (STR)", "SCN(REC)", "LCK(CLR)" switches respectively.

Pressing this key again or turning power OFF/ON disables phone mode. The key will not function when transmitting, or using conventional, talk around, or receiving a signal from another trunked unit.

Automatic Dialing Function (T/A (SND))

This front keypad is used for dialing automatically in phone mode. Automatic dialing is operated as follows:

1. Automatic checking of each group is performed to see if there is telephone inter-connectable ID Code.

2. If inter-connectable ID code is found, it stops at the corresponding group and tries to handshake with the trunking site. If it cannot be found, it goes back to the original group and remains in standby.

3. If successful in handshaking with the trunking site, it transmits the phone number displayed on the LCD automatically and goes to stand by. At this time the dialing tone is heard on Monogram Series LTR. If no phone number is on LCD display, it dis-connects handshaking with the trunking site automatically after approximately 3 seconds and goes to the receive mode.

4. If the radio fails to handshake with a trunking site, the word "RANGE" appears on the LCD and an out of range alarm sounds from the speaker. To remove the "RANGE" alarm, you can press any one of the following buttons:

PTT Switch
System Select Switch (SYS)
Group Select Switch (GRP)
Talk Around Select Switch (T/A)
Mute Select Switch (MUTE)
Scan On/Off Select Switch (SCN)
System Scan Lock out Switch (LCK)

Phone Number Input/Output Mode Switch (PHONE)

This will disable the alarm and return the unit to phone mode.

Phone Number Store (Memory) function (MUTE (STR))

This front keypad switch is for storing desired telephone numbers in the phone mode. Eight telephone numbers can be stored in memory. After imputing a telephone number press the MUTE (STR) key and any key between 1-8 will enable the phone numbers to be stored at the corresponding number.

Phone Number Search (Recall) Function (SCN (REC)

This front keypad switch is for searching (recalling) stored phone numbers in phone mode. Pressing this key and any key between 1-8 will display the corresponding telephone number stored there.

Phone Number Correction Function (LCK (CLR))

This key on the front keypad is for correcting the phone number displayed on the LCD display. Pressing this key enables you to erase the phone number one digit at a time by the reverse order of entry. If you wish to remove the entire LCD, press (Recall) and "0" will clear the entire display. The location "0" is dedicated blank screen not used for storing.

Out Of Range Indication (RANGE)

When the word "RANGE" is displayed on the LCD, the Monogram Series LTR attempted to handshake with a trunking site, but was out of range.

TX Time Expiration Indicator (TX TIME)

When the words "TX TIME" appears on LCD, and an audio warning is heard, it indicates the expiration of transmitting time (30 seconds minimum - 5 minutes maximum. In 30 second increments) set up in advance when programming.

Channel not Available Indicator (BUSY)

The word "BUSY" appears on the LCD display, this indicates there is no available TX channel, and the speaker sounds a busy tone. If "TX disable when busy" is programmed, the speaker sounds a TX disable tone and the word "BUSY" will appear on the LCD display.

TX Inhibit Indication (TX INHB)

When the word "TX INHB" appears on the LCD display. It indicates that the transmitter is inhibited from transmitting while receiving communications. Tx inhibit remains in effect for 5 seconds after the received signal stops.

Low Battery Indication (BATTERY ICON)

When the battery Icon appears on the LCD display, it indicates a low battery condition while Monogram Series LTR is being used.

Operation State Confirmation Indicator (TEST)

When the word "TEST" appears on the LCD display, it indicates repair and testing mode.

Program Mode Indication (PROGRAM)

When the word "PROGRAM" appears on the LCD display, it indicates the Monogram Series LTR is in the program mode.
Audible and Supervisory Tones.

Busy Tone

Intermittent Tone (700Hz Tone switched on and off for 250 ms each).
Indicates that there is no available channel when trying to handshake with a trunking site in trunked mode. Sound stops when PTT switch is released.

Transmit Inhibit Tone

Indicates that transmitting is inhibited when TX is attempted by pressing PTT switch while the signal is being received from another unit in the Trunking mode. Sound stops when PTT switch is released.

This is programmed in advance according to user’s choice.

Intercept Tone

Mixed tone (Warning tone of two frequencies alternating every 250ms).

Out of Range Tone

Indicates the Trunking Portable attempted to handshake, but was out of Range.

Releasing PTT switch stops this tone and the unit returns to RX state.

TX Inhibit

Indicates that the specific ID code (Transmit Inhibit ID) selected is in communication or that the time is less than 5 seconds since completing last communication.
-Releasing PTT switch or press again after waiting 5 seconds since last transmission makes this tone stop.

TX Time Out Tone

Indicates that the programmed time of the time out timer has elapsed. (minimum 30 seconds - maximum 5 minutes, setting in 30 second increments).
-Releasing PTT switch stops this tone and the unit returns to RX state.

Receive Only Channel Tone

Tone will sound when TX is attempted on receive only programmed channel.
-Releasing PTT switch will stop this tone and the unit will return to RX state.

Low Battery Tone

Indicates a low battery condition while Monogram Series LTR is being used.
-Intercept tone sounds for 1 second . At this time the battery should be re-charged or replaced with new one.

Indicator Tone for Handling

Short burst tone (700Hz with a period of 50ms).

Clear To Talk tone

Indicates that handshaking with a trunking site is successful in trunked mode and starting voice transmission is possible. This is system operators choice and is programmed prior to use.

Key Press Tone

Indicates that one of the following keys has been pressed:

- ***System Select Switch (SYS)***
- ***Group Select Switch (GRP)***
- ***Talk Around Select Switch (T/A)***
- ***Mute Select Switch (MUTE)***
- ***Scan ON/OFF Select Switch (SCN)***
- ***System Scan Lock Out Switch (LCK)***
- ***Phone Number Input/Output Mode Switch (PHONE)***
- ***Automatic Dialing Switch (T/A (SND)***
- ***Phone Number Store (MEMORY) Switch (MUTE STR)***
- ***Phone Number Search (RECALL) Switch (SCN REC)***
- ***Phone Number Correction Switch (LCK CLR)***

Scan Tone For Availability of Dialing Phone Number

When automatic dialing is tried by the group, and is unable to dial, the Monogram Series LTR will scan the ID codes in the sequence they were programmed to be dialed and sound one scan tone whenever any group is scanned.

State Indicator Tone

Intermittent Tone with a duration of 2 seconds (700Hz tone switched on and off for 250ms each).

Available System Alert Tone

This tone sounds when a channel becomes available in the system when all channels were previously busy.

Telephone Ring Back

This tone indicates the Monogram Series LTR telephone dialing is available under the circumstances that a previous busy tone was received when a telephone call was attempted in the trunked mode.

Phone Ring Alert Tone

This tone indicates that a phone call is received in trunked mode. It sounds every other second continuously until answered.
Receiving the call by depressing PTT switch removes the tone.

FASS Alert Tone

This alert tone sounds when approaching the available area while scanning in FASS mode.

Dialing Tone/DTMF Tone

Manual Dialing Tone

DTMF Sounds when 1-0 "*", "#", key on keypad are pressed.

Automatic Dialing Tone

DTMF Tone is heard from speaker while phone number is being transmitted automatically.

Transmit Disable When Busy

This option is used to disable the ability to transmit when the channel is busy.
This option is used in conventional mode only.

Fundamental Explanation of Circuit Configuration

Monogram Series LTR is composed of an RF board and a digital board. In order to adjust and repair the radio, it is necessary to have a fixture to separate the RF board and the digital board during test and repair. Use the SK-480 to interconnect from the digital board to the RF board. When repairing the digital board, it will be necessary to separate the front panel from the digital board and connect a cable from the digital board to the keyboard.

All circuits in Monogram Series LTR are protected by a 2A fuse, which is connected in series with the battery terminal. The fuse is located at the bottom of the RF board.

The circuitry of the Monogram Series LTR consists of a Receiver, Transmitter, Synthesizer, Audio, and digital circuit. Audio and digital circuits are responsible for recovering and handling audio and data. DC-DC converter, VCO, and TCXO are attached to the radio in module type.

Receiver

The Monogram Series LTR consist of double conversion super-hetrodyne type receiver which uses a 1st IF frequency of 44.9625MHz and a 2nd IF frequency of 450kHz. The features of the receiver are as follows:

a. Non-tuneable pre-selector and post selector.

b. The 4 pole crystal filter in the first IF gives increased suppression of spurious received signals such as first and second IF Images.

c. A 6 pole ceramic filter in the 2nd IF.

Transmitter

The transmitter section of the Monogram Series LTR can be adjusted from 1.0 to 1.5 watts of output power. The output power is controlled automatically by the forward power detector which is located at the output of the power module.

Synthesizer

The frequencies of the Monogram Series LTR synthesizer consisting of the active components are generated by the VCO, which is controlled by the U201, U202, and Q203 through Q207. In the RX state, the generated frequency is used to convert the received signal to the first IF frequency. In the TX state, the generated frequency from the VCO is used for the FM exciter. In both the TX/RX state, the necessary frequency for each channel is made by programming the data into a counter which is located in the PLL IC. The data for producing necessary frequencies is contacted by the CPU on the digital board. The frequency stability of the TX/RX is maintained by the TCXO, which generates a stable frequency of 14.8375MHz. The TCXO used in the Monogram Series LTR has frequency stability of -/+ 2.5ppm from -30 degrees C to 60 degrees C.(-22 degrees F to 140 degrees F).

Audio

In the RX state, an 8th order 300Hz HPF suppresses noise from trunking data DCS, CTCSS tones. In the TX state, to prevent audio blocking a 300Hz HPF and a 3000Hz LPF are used. The 300Hz HPF is a 2nd order filter and 3000Hz LPF, is a 4th order filter for decreasing interference from adjacent channels.

Digital

The Digital circuit of the Monogram Series LTR is controlled by a microprocessor. The signals in the Trunking mode, DCS and CTCSS is processed by a 6th order switched capacitor filter. When receiving data signal, the LPF is used to decrease the loss of the data signal from unwanted voice signals and noise. The cut off frequency passing through the LPF 6th order switched capacitor filter is automatically controlled by the microprocessor. When transmitting data, the harmonics of the TX data and tone signals can be removed to minimize unnecessary noise by using a LPF. The 6th order switched capacitor LPF filter is controlled by the microprocessor.

Receiver Circuit Description

RF Amplifier and 1st Mixer

The Received signal from the antenna, is passed through U206 antenna switching module, it is then supplied to FL101. When 0 volts is applied at pin #4 of U206, the signal from the antenna is supplied to the RX circuit. FL101 has a bandwidth of 20MHz. This filter prevents unwanted signals from passing through to the front end of the receiver. Signals that have passed through FL101 will be amplified by approx. 12dB by Q101 and then passes through FL102. This is to decrease 1st IF image and to prevent saturation of the mixer Q103 from signals other than the preferred frequency. Also, FL101 and FL102 minimize 1st LO leakage radiation through the antenna connector. Q102 is a current source and supplies Q101 with 4 MA of current. The signal that is passed through FL102 is supplied to the base of Q103. This signal is mixed with the 1st LO signal to generate the first IF signal frequency of 44.9625 MHz. The 1st LO signal is supplied to Q103's emitter, through C106. The Strip line that is connected to Q103's emitter maintains high impedance in order to supply a 1st Lo signal to Q103's emitter.

1st IF Filter and 1st IF Amplifier

The signal which is converted to the 1st IF frequency of 44.9625MHz by the mixer is impedance matched through T101. This signal is applied to the 3rd overtone MCF which has a center frequency of 44.9625MHz and a frequency bandwidth of +/-7.5kHz. In this the image of the 2nd IF and other un-wanted signals are decreased. The 1st IF signal is impedance matched by T102 and C109, and then it is supplied to the 1st IF amplifier, (Q104). In order for the RSSI output of U101, to operate correctly, the signal applied from Q104 is amplified approximately 20dB and then supplied to U101.

2nd Mixer, 2nd IF Detector (U101)

The received IF signal frequency of 44.9625MHz, which is supplied to U101 is mixed with the 2nd LO signal of 44.5125MHz, and is converted to the 2nd IF frequency of 450kHz. The 2nd IF frequency is passed through FL105 ceramic filter where it is limited and passed to the quad detector. The recovered audio signal is then outputed through pin 9 of U101.

The 2nd LO signal of 44.5125MHz is supplied to U101 which is derived from the TCXO frequency by the tripler Q202. The 2nd LO BPF which consist of C111-C113, L102-L103, selects only the 3rd order harmonic of 14.8375 MHz. The Squelch circuit is composed of using the RSSI output of U101. C117 in conjunction with surrounding resistors provide a time constant of approximately 5ms. to prevent falsing on impulse noise. The Squelch circuit has a squelch hysteresis of 3dB given by R117, R121, D102 for operation of a stable squelch in weak signal areas. When receiving signals, VR101 is used for adjusting the threshold of the squelch circuit. When receiving a signal of more then 11dB Sinad, 5 volts will appear at pin #14 of U101. Since the value of RSSI output is changing according to temperature, TH101 thermistor is used for temperature compensation.

Transmitter Circuit Description

Synthesizer Switching and Buffering (D202, Q210)

The Synthesizer output signal, by Q209 is switched to TX/RX paths by D202. When transmitting, TX voltage of 7.5 volts is applied at R210 and the synthesizer output signal is connected to the TX path. This signal is amplified by Q210, and then is supplied to U205 power module through C212. The input power level to U205 power module at 0dB.

Power Module and Antenna Switching Module (U205, U206)

When the Monogram Series LTR is in the TX mode, the TX voltage of 7.2 volts from the digital board is supplied to pin #2 of U205 power module. The signal supplied to U205 through C212 is amplified by approximately 33dB, and is supplied to U206 antenna switching module through forward power detector. The Tx voltage of 7.2 is also applied to pin #4 of U206 through R122 causing the path from the antenna connector to RX circuit to be dis-connected and the transmit output power from U205 power module will be connected to the antenna connector.

Forward Power Detector and APC (D204, Q211, Q212, Q213)

The Monogram Series LTR maintains stable output power of 1.5W by forward power detection and APC circuitry. The forward power is detected from R218, R227, and a strip line. This is rectified by D204, and then is filtered by C233. This filtered voltage will be directly related in respect to forward power, which will be applied at the base of Q213 by VR202. Q213 with Q212 is a differential circuit. When the voltage at base of Q213 is increased higher than the divided voltage between R219 and R220, collector voltage at Q213 is decreased. This decreased voltage is level-shifted and current amplified by Q211, and then applied to pin #1 of U205. When forward power is increasing higher than 1.5W gain control voltage is lowered and the gain of U205 is decreased. If the forward power is decreased lower than 1.5W gain control voltage is increased and the gain of U205 is increased. The output power is always maintained at a stable 1.5W. regardless of the efficiency changes of the power module in the wide TX bandwidth.

Synthesizer Circuit Description

VCO and Buffer Amplifier

The VCO of Monogram Series LTR generates the frequencies of 801-825MHz, in the normal RX and TX mode, and 851-870MHz in the talk-around TX mode. In the normal RX and TX mode, 5V is applied to Q301 through R201 and switches C303 to ground via D301. This increases the capacitance connected in parallel with CF301, ceramic resonator, and allows the generation of the frequencies of 806-825MHz. In the talk around TX mode 0V is applied to Q301, and C303 and is removed from the oscillator circuit. This can now generate the frequencies of 851-870MHz which is higher in frequency than those of the normal mode by 45MHz. The VCO is controlled by a PLL circuit to maintain a stable frequency. The generated frequency of the VCO is determined by programming data into U201 PLL IC from the microprocessor. The oscillator circuit consists of Q302, C308, C309, CF301, and other combined capacitors. This resonant circuit is made stable by using CF301 ceramic resonator. The generated frequency is varied by VC301 and C305 in parallel with CF301. When the control voltage is applied to VC301 through L302 in the PLL circuit, the frequency is varied according to the applied voltage. C306 and TC301 are used for compensating tolerance of CF301 and other components which affect the generated frequency. Audio and Data is supplied to VC302 for modulation. An attenuator circuit, which is composed by C304, R303, R304, R305 is used to attenuate the audio and data signals and supplies bias to VC302 for proper modulation levels. This generated signal by Q302 is buffered by Q303 and is applied to Q209 buffer amplifier on the RF board. The VCO output level through C208, and at the same time is supplied to U202 pre-scaler through C207 for PLL loop locking.

PLL IC and Pre-Scaler

The PLL synthesizer of the Monogram Series LTR consist of a single loop PLL circuit with a reference of 12.5kHz. The single loop PLL operates with U201 and U202 as follows:

U202 is a Dual-Modulus prescaler. This divides the frequency of the VCO to a lower frequency, so that the PLL (U201) can operate properly. The divide radio of the prescaler is 128 or 129, depending on the setting of MC (Pin 6) of U202. The PLL has 3 counter registers that are controlled by the microprocessor via Pin 9, 10 and 11 of U201. They are the R, N and A registers. The TCXO frequency of 14.8375 MHz is divided by 1187 which is value loaded by the microprocessor to the R register to obtain the reference frequency of 12.5kHz. The divide ratio of the prescaler is initially 129 and the A and N registers are set to a start value. The PLL will count the cycles given by the prescaler by decrementing the value in the A and N register by one for each cycle. When the A register equals zero, the prescalers divide ratio is changed to 128. The PLL will continue to count until the N register is zero, then the A and N registers are reloaded with the start values. This process is then repeated. The total divide ratio of the prescaler and the A and N register can be expressed by: K=[128 x (N-A)] + [129 x A]. This can be simplified to K=128 x N + A. After the VCO frequency is divided by the total divide ratio (K), it is compared with the reference frequency and a phase error voltage is generated.

To determine the VCO frequency, multiply the reference frequency by the divide ratio.
FVCO=FREF X K

Charge Pump and Loop Filter

The charge pump and loop filter are used for changing the PWM (pulse width modulation) phase error signal from 0-5 volts to 3.0 - 11 volts necessary for controlling VCO. The charge pump consist of Q204-Q207 which transforms 0V and 0R, the phase error output of U201, to a tri-state output of 0 -15 volts. The loop filter comprised of R234, R235, C231, C232 and C233 is used to convert the PWM signal to a control voltage to be applied to VC301.

DC-DC Converter

The DC-DC Converter converts the 5 volts to 15 volts in order to supply the necessary voltage to the charge pump. The period of the signal is about 0.6 micro seconds which is generated by Q503 and Q504 which is a Astable-multivibrator. Q501, Q502 and D505 is used as a buffer. The square wave is then applied to C505, C506 and C507. The steering diodes D502, D503 and D504 with capacitors are used as a voltage tripler. D501 protects the transformed voltage from rising above 15 volts.

Lock Detector

Q208 receives the PWM lock detect signal from Pin 7 of U201. When the PLL synthesizer is locked, the output of lock detector at U201 will be a PWM signal close to 5 VDC. This signal is filtered by R248, R246, C238, C237, Q208 and turns Q208 "ON", thus providing a logical low to the micro.

When the PLL synthesizer is out of lock, a PWM close to 0 volts appears at the lock detector. This output rapidly discharges the charge on C238 and C237 through D201 and R247.

After C238 and C237 are discharged, Q208 is turned "OFF", thus providing a logical high to the micro.

If the recovery of unlocking fails, all operations of TX/RX stop except for the PLL synthesizer circuit and "unlock" is shown on the LCD display.

Power Switching and Voltage Regulator

U203 and U204 provide a regulated +5VDC to the Monogram Series LTR.

U203 is used for supplying power to the PLL synthesizer. U204 is used for supplying power to the digital circuit and the use of two regulators provides protection from interference between analog and digital circuits.

Q214 connected through R260 to Pin 6 of U203 and U204 works as a power switching circuit with a delay. The delay time is dependent on a discharge time through C259 to the base of Q214. This circuit functions to maintain 5 Volts for about 0.5 seconds to the microprocessor when power is removed by turning VR203 off. Time is necessary for the microprocessor to back up automatically all operation states of the Monogram Series LTR to U614 EEPROM.

When the user turns the power on by turning VR203 clockwise, 7.2 volts is applied to D206 and C259 is charged. When the charged voltage at C259 is increased higher than about 2 volts, it turns on Q214 which in turn allows U203 and U204 to operate.

Receiver Audio Circuit Description

The audio circuit of Monogram Series LTR consist of a de-emphasis, 8th order 300 Hz HPF and a power amplifier.

Receiver Audio Circuit Description

De-Emphasis and 300Hz HPF (U603A, U601A, U601B, U601C, U601D)

The audio signal which is FM de-modulated at Pin 9 of U101, passes through U603A de-emphasis circuit which has corner frequency of about 150 Hz and -6dB/octive of audio characteristic. The signal is then applied to a 8th order 300 Hz HPF.

U601A-U601D consists of an 8th order HPF with a cut off frequency of 300 Hz where tones such as trunking data, CTCSS, DCS, etc. are suppressed.

RX audio signal is passed through the 8th order HPF and is applied to the analog switch U601D. When Pin 6 of U601D is in a logical high, this signal is connected to VR203 through C631 so that user can adjust the RX volume as desired.

Audio Power Amplifier (U606)

The RX audio signal is adjusted to the proper volume level by VR203 and is applied to Pin 3 of U606 and amplified by about 20 dB to produce a maximum of 0.4 watts of power to speaker.

When the audio mute pin #7 of U606 has 7.2 volts applied U606 will mute and no sound will be heard regardless of the signal applied at Pin #3 of U606.

Internal/External Speaker Switch (Q606)

When the external speaker is used, the internal speaker is turned off. When the internal/external select line is low, it turns off Q606, which will disconnect the internal speaker.

Transmitter Audio Circuit Description

Internal/External Microphone Switch (Q607)

When the external microphone is being used, the internal microphone is turned off.

When internal/external select line is low, Q607 is turned off via D604. This removes the bias on the microphone and the microphone will cease to operate.

300 Hz HPF (U602A)

The input audio signal from the internal/external microphone will pass through the 2nd order 300 Hz HPF which has about 12 dB of gain. The signals lower than 300 Hz will be attenuated at this stage in order to decrease talk off problems when using trunking data, DCS and CTCSS.

Pre-Emphasis and Amplitude Limiter (U602B)

The audio signal passes through the 300 Hz HPF and then through the analog switch U610A and then through the pre-emphasis and limiter which consists of C644, R638 and U602B. Here the audio signal has a pre-emphasis property of 6 dB/octive and audio signal larger than 4.5 Vp-p is clipped so that the occupied frequency band of the transmitter can not be exceeded. VR602 is adjusted not to exceed +/-3.8 kHz deviation.

3 kHz LPF (U602C, U602D)

The audio signal passes through VR602 and then through U602C and U602D which is 4th order LPF with a 3 kHz cut-off frequency. Audio harmonics above 3kHz produced by the amplitude limiter U602B will be attenuated and the occupied frequency bandwidth of the transmitter will not be exceeded. The audio signal then goes to Pin 1 of U607 data selector then is applied to the modulation terminals of the VCO and TCXO.

Data Signal Processing Description

The data signal processing circuit of the Monogram Series LTR is divided by TX data signal processing and RX data signal processing.

TX Data Signal Processing

The data generation for TX is accomplished by ports P20 (Pin 46) and P21 (Pin 47) of the microprocessor U616. TX data produced by P20 and P21 of the microprocessor is applied to R656 and R657 respectively and it acts as a D/A converter in order to minimize the content of high frequency noise which might affect voice bandwidth. The data produced here has an average voltage of about 1.38 volts by R655, and R658. This data passes through U607 Data Selector going in at Pin 3 and out at Pin 4. The signal is then applied to Pin 8 of U608 which is a 6th order switched capacitor filter.

When the Monogram Series LTR is in the TX mode, U607 mixes TX data from U608 (Pin 4) with the audio signal. Both signals are sent to the modulation ports of the VCO and TCXO located on the RF board.

VR601 is used for controlling deviation of transmitted data. The cutoff frequency of U608 6th order switched capacitor filter is adjusted by U616 microprocessor, U617, U612A, according to the property of transmitted data and is determined by the frequency applied to Pin 9 of U608 divided by 100.

The cutoff frequencies at each state are as follows:

Trunked Mode	174 Hz
DCS	150 Hz
CTCSS Tone	Same as tone frequency

RX Data Signal Processing

The received data signal is processed as follows:

The received data signal is applied to the input at Pin 8 of U608 switched capacitor filter through U607, (in Pin 5, out Pin 4) where the signal of the voice band affecting the processing of data is diminished sufficiently. The cutoff frequency of U608 is adjusted by U616 microprocessor, U617, U612A according to property of the data signal and is determined by the frequency applied to Pin 9 of U608 divided by 100.

The cutoff frequencies at each state are as follows:

Trunked Mode	174 Hz
DCS Mode	150 Hz
CTCSS Tone	Same as tone frequency

The signal passed through the switched capacitor filter is amplified 12 dB by the OP amp inside of U608.

The reference voltage necessary for processing received data signals at the comparator is obtained by the averaging detector which consists of U603B and D602.

The received data signal is sent to a comparator in U608, then it is applied to P11 (Pin 43) of U616 microprocessor through U612B and processed inside of microprocessor.

Low Battery Detector

The detection of low battery is performed by U603D. The switched voltage of 7.2 volts by VR203 is divided by the resistor divider, R659, R660, R661. This voltage is applied to the inverting input of U603D which is compared with the voltage on the non-inverting input of U603D. If the battery potential goes below 6.3 volts, the voltage at the inverting input of U603D becomes lower than the voltage at the non-inverting input, and Pin #14 of U603D will go "HIGH" which tells the microprocessor that the battery is low via Pin 40.

Also, since U603D has a hysterisis circuit of R663 and R664, low battery detection is designed not to operate by a small amount of voltage change for TX/RX conversion.

Power Off Detector

The Monogram Series LTR is designed to back up the current operating status to the EEPROM before the power is turned off. This is accomplished as follows:

The 7.2 volt supply switched by VR203 is divided by the resistor divider, R653 and R654 and is connected to P10 (Pin 42) power off detector of U616 microprocessor. When VR203 is switched off, the 7.2 volt is removed, thus providing a logical low to the microprocessor. This initiates the immediate back up of the operating parameters to the EEprom.

EEPROM

All states of operation in the Monogram Series LTR are defined by programming the U614 EEPROM. U614 consists of an EEPROM of 2 K bytes and stores parameters such as frequency, User ID, repeater number, etc. by using an external programmer. It can also be used for backing up telephone numbers entered when power is off.

Reset Circuit

The stable operation of the microprocessor can be attained by using a watch dog IC (U615) which will cause a reset when there is initial power on or when clock pulsing from U616 stops.

Port Expander

In order to control the following functions, U611 shift register is used as a port expander.

U611 Pin 4	RX Audio Signal ON/OFF
U611 Pin 5	TX Audio Signal ON/OFF
U611 Pin 6	TX/RX Data Signal ON/OFF
U611 Pin 7	DTMF Tone ON/OFF
U611 Pin 11	Talk Around ON/OFF
U611 Pin 12	Audio Amplifier ON/OFF
U611 Pin 13	Call LED ON/OFF
U611 Pin 14	Battery Low LED ON/OFF

The control of U611 output pin can be controlled by P70 (Pin 64), P71 (Pin 65), P73 (Pin 67) of U616 microprocessor.

DTMF Tone Generator

DTMF tone, warning sound, and instructing sounds are generated by U609. The generated tone is determined by P40, P41, P42, P43, P50, P51, P53, P54, P60 of U616 microprocessor. The clock frequency of the crystal X601, which is a 3.579545 MHz.

Key Scan

There are a total of 19 keys located on the front panel of the Monogram Series LTR. Column scan signals are generated by P50-P53, P60. When a key is pressed, the appropriate column scan signals are detected by the corresponding row scan port, P40-P43 of the microprocessor.

LCD Display

Three phase dynamic display techniques contained in U616 microprocessor are being used in the LCD display of the Monogram Series LTR. The necessary reference voltage for three phases is generated by R668, R669 and R670.

Data Programming

Data programming of the Monogram Series LTR can be accomplished by serial communication through program lines connected to the microphone connector and data IN/OUT as follows:

Data In (Programming)

When power is turned on and the system is reset U616 microprocessor checks P12 terminal. If P12 terminal is a logical low, it goes into program mode. P12 terminal is a logical low when the program line connected to the base of Q610 is a logical high, which is enabled by connecting external programmer to the microphone connector. When in the program mode, the synchronous Data are coming from the programmer which is inverted at Q610 and is supplied to P12 and programming begins.

Data Out (Restore)

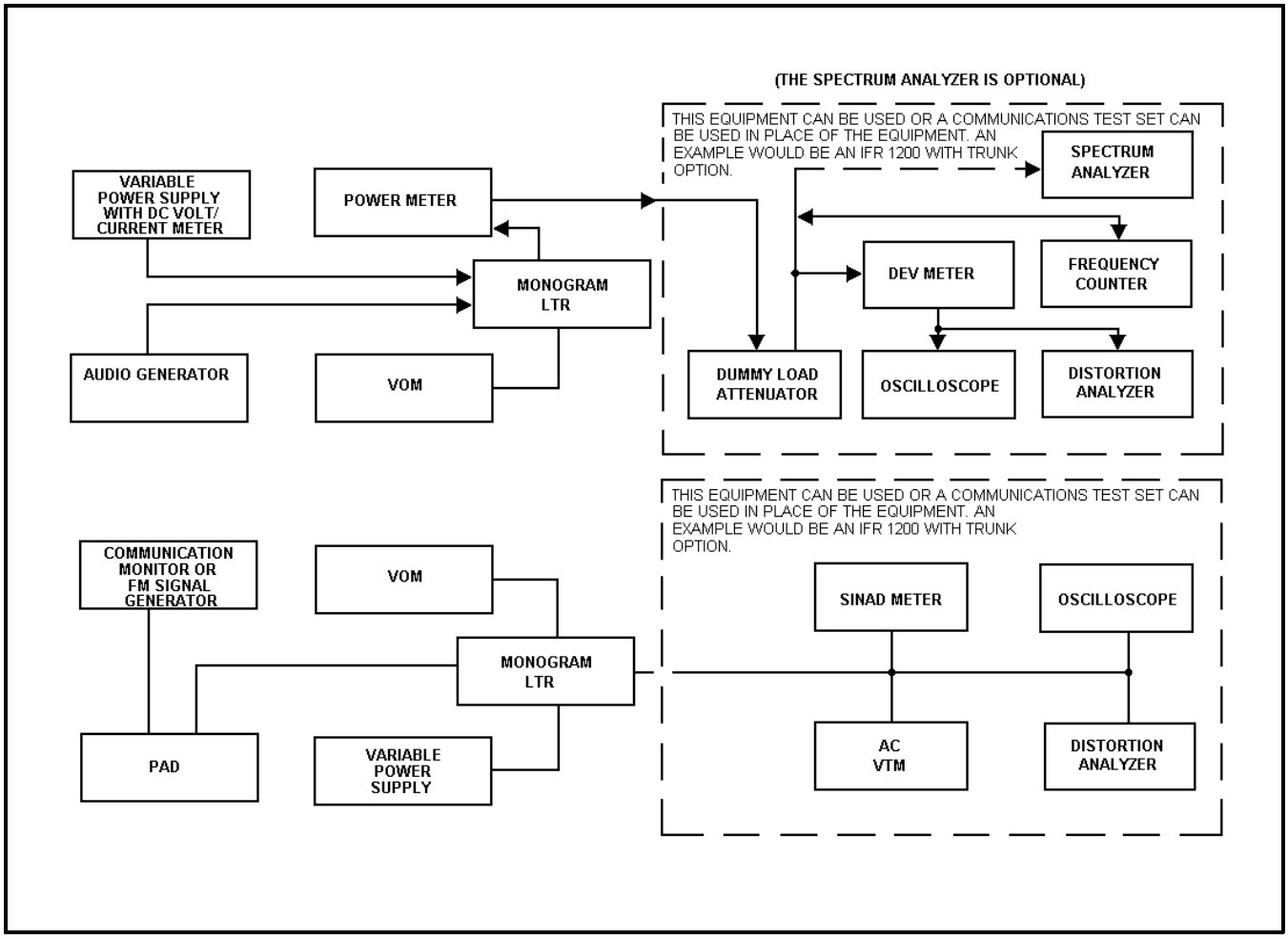
When power is turned on and the system is reset U616 microprocessor checks P12 terminal. If P12 terminal is a logical low, it goes into program mode. P12 terminal is a logical low. When the program line connected to the base of Q610 is a logical high, this is enabled by connecting external programmer with the microphone connector.

The programmer sends Data request to the microprocessor as described for Data in. The microprocessor responds by sending synchronous data from P23 and is then inverted by Q611 before it is sent to the programmer via the program line.

Microprocessor

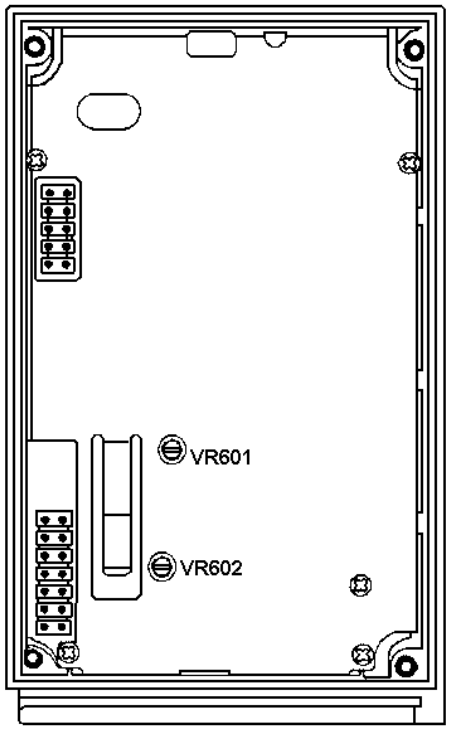
Most functions of the Monogram Series LTR are controlled by U616 microprocessor. The microprocessor has an internal ROM of 16 K byte, which contain the operating program for the Monogram Series LTR. When the power is turned on, U616 determines the operating mode by reading data from U614 EEPROM. Therefore, suitable data should always be programmed to U614 EEPROM for Monogram Series LTR's operations.

Test Equipment Diagram

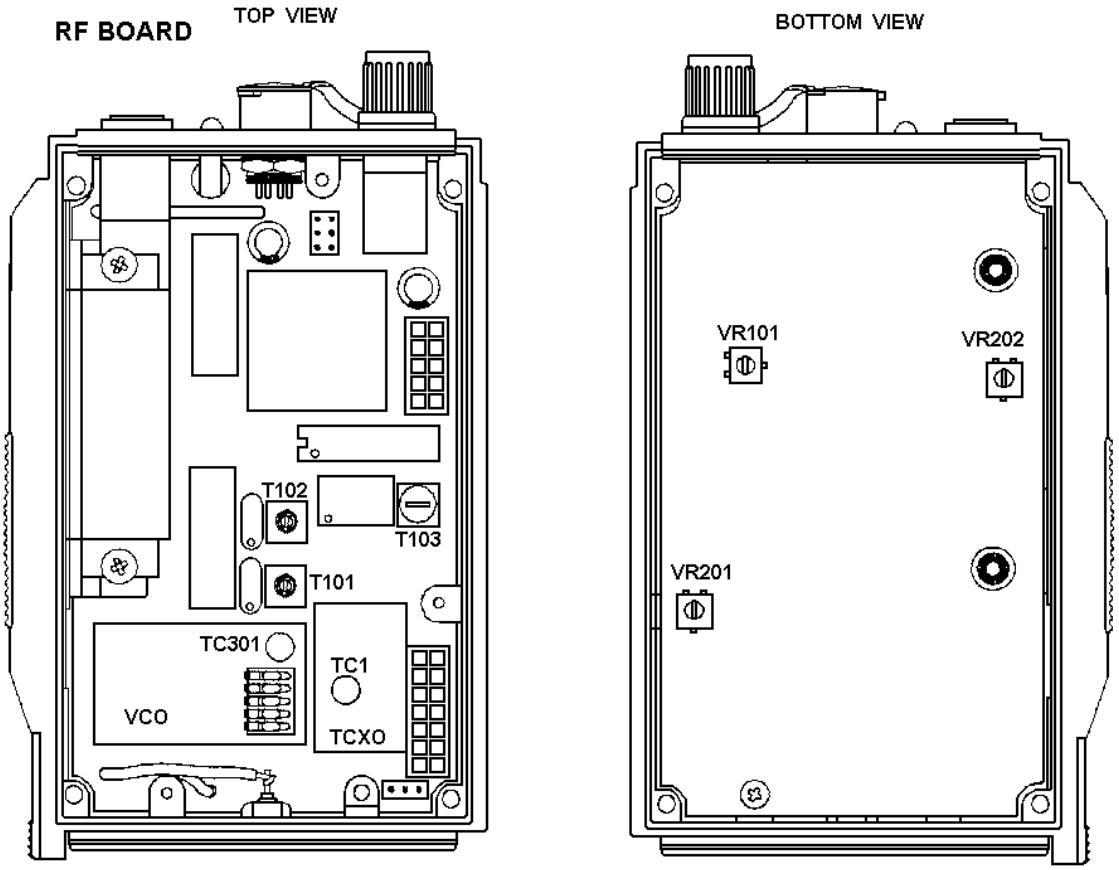


ALIGNMENT POINTS DIAGRAM

DIGITAL BOARD



RF BOARD



Alignment Procedure

The Monogram Series LTR is aligned correctly before it is shipped from the factory. However it may be necessary to readjust due to repair.

The general alignment procedure for the Monogram Series LTR will be described.

Necessary Accessories for Alignment

Because most alignment is done with the digital board separated from the RF board, the following connectors will be needed.

TBD:	This is plugged into the external mic jack of Monogram Series LTR to connect external speaker and external microphone, and operate PTT.
TBD:	Test extender cable for connecting the digital board with the RF board.
AE/LZY 213 722:	Programmer.
RPM 113 2471/01:	Programming Cable.

Setup of Text Mode

As a mode for adjusting Tx circuit of Monogram Series LTR, this is for adjusting modulation and deviation of data and audio of Tx circuit.

Connect Programming Cable to the external mic jack with Monogram Series LTR power off, and apply power by pressing the PTT switch. The radio will then be in the test mode and the word **"TEST"** will appear on LCD display.

Operation of each SYS. and GRP. at Test Mode

In test mode, the modulation of data and audio for Tx are adjusted. The alignments for Rx will be done in normal operation mode.

	Channel/Tx Frequency	Rx/Talk Around
SYS 1	FCC# 001/806.0125 MHz	851.0125 MHz
SYS 2	FCC# 100/808.4875 MHz	853.4875 MHz
SYS 3	FCC# 200/810.9875 MHz	855.9875 MHz
SYS 4	FCC# 300/813.4875 MHz	858.4875 MHz
SYS 5	FCC# 400/815.9875 MHz	860.9875 MHz
SYS 6	FXX# 500/818.4875 MHz	863.4875 MHz
SYS 7	FCC# 600/821.9875 MHz	865.9875 MHz
SYS 8	FCC# 700/822.3125 MHz	876.3125 MHz
SYS 9	FCC# 800/823.9875 MHz	868.9875 MHz

GRP1-GRP3 also are selected at each system, and each group will be used as described in the following.

GRP1	34 Hz square wave Tx (adjustment of modulation balance)
GRP2	134 Hz sine wave Tx (adjustment of data deviation)
GRP3	No data (adjustment of mic deviation)

Equipment Setup for Alignment

The equipments are connected as follows:

Untighten 4 screws at the rear of Monogram Series LTR and remove the bottom cover,then separate the digital board from RF board. Connect the digital board vertically to the RF board using test extender cable.

Tx Alignment

ALignment of Modulation Balance

After SYS4, GRP1 are selected, transmit by pressing PTT switch of SK-2000, then 34 Hz square wave mode of Monogram Series LTR will be transmitted. While this modulated signal is observed by modulation analyzer or communication monitor, adjust VR201 to transmit the square wave.

Tx frequency = 813.4875 MHz 5 kHz
Modulation frequency= 34 Hz square wave
Deviation= 0.5-1.5 kHz

Adjustment of Data Deviation

After SYS 4, GRP 2 is selected, transmit by pressing PTT switch. Adjust VR601 so the sinewave of 134 Hz is modulated to a deviation of 0.86 kHz.

Tx frequency= 813.4875 MHz 5kHz
Modulated frequency= 134 Hz sinewave
Deviation= 0.84-0.86 kHz

*** Audio deviation should be adjusted after adjusting data deviation. If data deviation is increased audio deviation will decrease. If data is decreased, audio deviation will increase.

Adjustment of Audio Deviation

After SYS4, GRP3 is selected, apply audio tone of 1 kHz, 200 m VRMS. While transmitting by pressing the PTT switch, adjust VR601 so that the sine wave of 1 kHz is modulated to a deviation of 3.34-3.45 kHz.

Tx frequency= 813.4875 MHz 5kHz
Modulated frequency= 1kHz sine wave
Deviation= 3.35-3.45 kHz

*** Since adjustment of audio deviation does not have any effect upon data deviation, it is not necessary to readjust data deviation after adjustment of audio deviation.

Adjusting of Tx Frequency

Select SYS 4, GRP 3 and remove audio tone of 1 kHz, 200 mV RMS applied at external mic terminal. While transmitting by pressing PTT switch, adjust TC1 located at TCXO in order that Tx frequency be 813.4875 MHz ± 100Hz.

Tx frequency= 813.4875 MHz ± 100Hz
Modulated frequency=None
Deviation= None

Tx Power Adjustment

Select SYS 4, GRP 3 and transmit by pressing PTT switch with bottom cover installed for adjustment at the back of Monogram Series LTR. While watching power meter, adjust VR 202 so that Tx power is between 1.45-1.55 watt.

Tx frequency= 813.4875 MHz 100 Hz
Tx power=1.45-1.55 watt

Receiver Alignment

Receiver alignment is done in normal mode, not in test mode. The data for the channel to be adjusted should be programmed already to align the receiver in normal mode. The data for Rx adjustment is a file named **LINETEST.DAT** and is programmed like the following:

File=Line, Est.Dat		Channel/Tx Frequency	Rx/Talk Around	Squelch/Tone
SYS 1	GRP 1	Fcc#001/806.0125 MHz	851.0125 MHz	Carrier/None
	GRP 2	Fcc#300/813.4875 MHz	858.4875 MHz	Carrier/None
	GRP 3	Fcc#600/820.9875 MHz	865.9875 MHz	Carrier None
SYS 2	GRP 1	Fcc#300/815.9875 MHz	860.9875 MHz	CTCSS#12 (100Hz)
SYS 3	GRP 1	Home=04		Trunking Data
	-GRP 10	Fcc#360/814.9875 MHz	959.9875 MHz	
	(Trunking Data)	Go To=06		
		Fcc#320/813.9875 MHz	958.9875 MHz	

The adjustment of the receive should be done on the center frequency among all usable Rx frequencies, which is FCC CHANNEL# 300.

SIGNAL GENERATOR (SG) Setting

Apply the following signal to the antenna connector of the Monogram Series LTR:

RF frequency= 858.4875 MHz (FCC CH# 300)
Modulated frequency= 1 kHz
Deviation= 4 kHz
Signal level= -47 dBm

Adjustment of Receiver Sensitivity

A.) AFTER SYS1, GRP2 is selected in normal mode, put on bottom cover for adjustment at the back of Monogram Series LTR. Then apply to the antenna connector of Monogram Series LTR the signal as follows:
RF frequency= 858.4875 MHz (FCC CH# 300)
Modulation frequency= 1 kHz
Deviation= 4 kHz
Signal level= -116 dBm max (at SINAD 11 dB)

B.) By adjusting VR101 at this condition, squelch should be open at SINAD 11 dB.

Performance Tests

Configuration and connection for measuring equipment.

Measurement for receiver

The measurement for receiver is done at FCC CH#001, CH#300, and CH#600.

A) Set SG to the frequency to be measured, and modulate 1 kHz tone to deviation of 4 kHz.

B) Set the volume of Monogram Series LTR at the center of adjustment range. Connect SG output to the antenna connector of Monogram Series LTR. Then measure 12 dB Sinad sensitivity.

C) At this time, the level of SG output to make Sinad 12 dB should be less than 0.35 mV.

D) Take the measurements of Rx sensitivity at CH#001, CH#300, and CH#600.

Measurement of Squelch Threshold

A) Set SG to the frequency to be measured, and modulate 1 kHz tone to deviation of 4 kHz.

B) Connect SG output to the antenna connector of Monogram Series LTR. Then by increasing or decreasing of SSG output, read SG level at ON/OFF squelching.

C) The ON/Off point of squelch should be in the range of the following:
Squelch on=less than 12 dB Sinad sensitivity
Squelch off=more than 0.08 uV

D) The measurement of squelch threshold should be done on CH#001, CH#300 and CH#600.

Measurements of Audio Output Power and Rx Audio Distortion

A) Set SG to the frequency to be measured, and modulate 1 kHz tone to deviation of 4 kHz.

B) Set output level of SG to 1000 mV, adjust audio distortion to 10% by tuning audio volume of Monogram Series LTR, and then read the indication of audio voltmeter. The value of audio voltmeter should be more than 1.55 volt RMS.

C) Adjust audio volume of Monogram Series LTR in order that the indicator volume of audio voltmeter is 1 volt RMS. Then read the audio distortion. Audio distortion should be less than 10%.

Measurement for Transmitter

The measurements for transmitter are done at FCC CH#001, CH#300, CH#600, and talk around (frequency range of 851-866 MHz).

Power Output

A) Connect the rated voltage of 7.2 volts, or fully charged battery pack to Monogram Series LTR, and transmit by pressing PTT. Then read the value of the power meter. It should be within 1.5 watt + 0.15/-0.3 watt.

Transmit Frequency

Connect the rated voltage of 7.2 volts or fully charged battery pack to Monogram Series LTR, and transmit by pressing PTT. Then read the Tx frequency, It should be the programmed frequency $\pm$ 500 Hz at 25 degrees C.

Transmit Modulation

A) Connect the rated voltage of 7.2 volts, or fully charged battery pack to Monogram Series LTR, and select SYS 4, GRP 2 in test mode.

B) Apply sine wave of 1 kHz, 200 mV to external mic connector of Monogram Series LTR. Transmit by pressing PTT and confirm that total deviation is not greater than 5 kHz.

C) Remove sinewave of 1 kHz, 200 mV applied to external mic connector, make sure that data deviation is 850 Hz $\pm$ 100 Hz.

DTMF Modulation

A) Connect the rated voltage of 7.2 volts, or fully charged battery pack to Monogram Series LTR, select SYS 4, GRP 3 in test mode.

B) Transmit by pressing PTT, transmit DTMF tone by pressing 1-0,*,# buttons of keypad. Be sure that the deviation is within 2-3 kHz.

Troubleshooting

Before troubleshooting, make sure operation of the PLL circuit, CPU, digital circuit, etc. is fully understood. Check following before preceding on.

A) Is power source normal, and is it connected to the equipment correctly?

B) Is there any damage or crack in case of equipment and internal PCB?

Confirmation and Disposal for Troubled Location

Symptoms	Causes	Disposal
Dead	1.Poor quality of power switch (VR 203)	1.Replace power switch
	2.Power supply fuse (Fuse 201) is defective.	2.Replace power supply fuse
	3.Bad 5V regulator (U 203,204)	3.Replace bad regulator
	4.Problem in voltage source	4.Check PCB pattern or circuit of voltage source like L202, D205, etc.
		5.Compare voltage at corresponding location with voltage chart
No letters on LCD display even if no problems on voltage source.	1.Circuit problem on CPU reset (U615)	1.Replace U615, or entire digital board.
	2.Oscillation problem on CPU (U616) clock.	2.Replace X602
	3.Problem of CPU (U616)	3.Replace U616, or entire digital board
	4.Problem on circuit supplying voltage source at CPU (U616).	4.Compare the voltage at corresponding location with voltage chart.
Dead, but only "____" or little "Lock" icon at upper LCD display appears.	1.Damage of memory stored in EEPROM (U614)	1.Try again to program frequency and ID code, and turn on/off the voltage source. If the same problem still remains, check Q214, C261, D206. When these are measured by oscilli scope, wait for more than 0.2 sec. to maintain 0-1 volts, and then increase voltage to 7.2 volts.
		2.If programming can not be done, U614 is bad. Replace it.
		3.Compare the corresponding voltage with voltage chart.
"UNLOCK" appears on LCD display at the Rx stand by state.	1.Problems on PLL network including U201, U202, U616, VCO and TCXO.	1.Make a short circuit between collector and emitter of Q208 (forced lock), and check if Monogram Series LTR LCD display is normal. If it is normal, the problem is in circuits from U201 pin#7 to Q208.
	2.Defective DC-DC converter	2.Program CH001 and CH600 and check if any one channel is working. If only either one of two channels is working the VCO frequency is drifted and readjust TC301 of VCO. If both channels do not work, do not adjust TC301.
		3.Confirm TCXO oscillation frequency
		4.Remove R236 and R237 and check output voltage of DC-DC converter. If that voltage is below 13 volt, DC-DC converter is defective.
		5.Make sure if there is VCO oscillator power at VCO output terminal.
		6.Check by oscilloscope if there is signal of 12.5 kHz at pin #12 of U201.
		7.Check the connection between digital board, and pin #9, #10, #11 of U201.
		8.Compare the corresponding voltage with voltage chart.

"UNLOCK" appears on LCD display at the Rx stand by state.	1.Problems on PLL network including U201, U202, U616, VCO and TCXO.	1.Make a short circuit between collector and emitter of Q208 (forced lock), and check if Monogram Series LTR LCD display is normal. If it is normal, the problem is in circuits from U201 pin#7 to Q208.
	2.Defective DC-DC converter	2.Program CH001 and CH600 and check if any one channel is working. If only either one of two channels is working the VCO frequency is drifted and readjust TC301 of VCO. If both channels do not work, do not adjust TC301.
		3.Confirm TCXO oscillation frequency
		4.Remove R236 and R237 and check output voltage of DC-DC converter. If that voltage is below 13 volt, DC-DC converter is defective.
		5.Make sure if there is VCO oscillator power at VCO output terminal.
		6.Check by oscilloscope if there is signal of 12.5 kHz at pin #12 of U201.
		7.Check the connection between digital board, and pin #9, #10, #11 of U201.
		8.Compare the corresponding voltage with voltage chart.
When transmitting by turn-around, "UNLOCK" appears on LCD display.	1.Circuit problem of Q201, U611 which controls voltage of VCO T/A terminal.	1.When transmitting by talk-around, compare the voltage of Q201, Q203, U611 with voltage chart.
	2.Defective Q203	
Even if battery voltage is normal, low battery appears.	1.Defective U603D low battery detector	1.Compare voltage of each terminal of U 603D with voltage chart.
	2.Problem of voltage divider by R626, 627	2.Compare pin #8 voltage of U603C with voltage chart
	3.Problem of voltage divider by R659, R661, R660.	3.Compare pin #13 voltage of U603D with voltage chart.
		4. Check fuse for resistance.
SYS GRP in use is changing when voltage source is on/off	1.Defective U614 EEPROM	1.Compare the corresponding voltage with voltage chart.
	2.Defective delay circuit by Q214, C259, D206	2.Replace the defective parts.
	3.Defective 5 volt regulator of U204	
No sound or very low sound from the speaker	1.Defective U101 FM IF/ detector IC or defective T103 quadrature coil.	1.If the sound from the speaker is a little low, readjust T103.
	2.Circuit problem of de-emphasis of U603D	2.By using oscilloscope, observed the received signal of pin #9 of U101, pin #1 of U603A, pin #14 of U601D, pin #9 of U610D, VR203, pin #5 of U606 in sequence. Then check the position where the received signal disappears or decreases abnormally.
	3.Defective 300 Hz HPF of U601	3.Compare the voltage at Q604, Q605, Q606, Q612, U611, etc. with the corresponding voltage chart.
	4.Defective analog switch of U610D	
	5.Defective VR203.	
	6.Defective audio amplifier of U606	
	7.Problem of audio mute control circuit including Q604, Q605, Q612, U611, etc.	
	8.Defective of internal/external speaker switch of Q606.	
	9.Defective internal speaker of SP201.	

No sound or very low sound from the speaker	1.Defective U101 FM IF/ detector IC or defective T103 quadrature coil.	1.If the sound from the speaker is a little low, readjust T103.
	2.Circuit problem of de-emphasis of U603D	2.By using oscilloscope, observed the received signal of pin #9 of U101, pin #1 of U603A, pin #14 of U601D, pin #9 of U610D, VR203, pin #5 of U606 in sequence. Then check the position where the received signal disappears or decreases abnormally.
	3.Defective 300 Hz HPF of U601	3.Compare the voltage at Q604, Q605, Q606, Q612, U611, etc. with the corresponding voltage chart.
	4.Defective analog switch of U610D	
	5.Defective VR203.	
	6.Defective audio amplifier of U606	
	7.Problem of audio mute control circuit including Q604, Q605, Q612, U611, etc.	
	8.Defective of internal/external speaker switch of Q606.	
	9.Defective internal speaker of SP201.	
Low Sensitivity	1.Defective antenna switch of U206	1.When receiving, check if pin #4 of U206 is 0 volt. If the voltage is more than 0.6v, check Q601, Q602, Q608, Q609.
	2.Mechanical damage of FL101, FL102	2.Check if FL101, Fl102 are damaged mechanically.
	3.Defective RF Amp of Q101, Q102.	3.Compare the voltage at corresponding position of Q101, Q102 with voltage chart.
	4.Defective mixer of Q103	4.Compare the voltage at each position of Q103 with voltage chart.
	5.Defective 1st IF filter made up of T101, T102, FL103, FL104.	5.Remove C109, apply signal of 44.9625 MHz modulated 1 kHz tone, I3 kHz dev to base of Q104, if receiver sensitivity is not still low, the problem is possibly around one of Q104, R202 or U101.
	6.Defective If Amp of Q104.	
	7.Defective 2nd Lo oscillator composed of Q202, L102, L103, L104.	
	8.Defective FM IF/detector IC of U201	
	9.Problem on 1st Lo circuit system such as Q209, D202.	
If PLL is normal and no receive or very low sensitivity.	1.Disconnection of T101, T102	1.Check if T101, T102 are disconnected.
	2.Breakage of FL103, FL104	2.Apply high frequency signal of -47 dBm through antenna terminal, and measure collector portion of Q103 and base portion of Q104 by spectrum analyzer. If there is severe attenuation, check for mechanical damage on FL103, F104.
	3.Defective U101.	3.Measure pin #1 of U101 by spectrum analyzer, and check the strength of 2nd Lo signal at 44.5125 MHz is more than -30 dBm.
	4.Defective 2nd Lo generator made up of Q202, L102, L103, L104.	4.If the 2nd Lo signal of 44.5125 MHz is normal and there is no receiving, one of U101, FL105, T103 will possibly be defective.

If PLL is normal and no receive or very low sensitivity.	1.Disconnection of T101, T102	1.Check if T101, T102 are disconnected.
	2.Breakage of FL103, FL104	2.Apply high frequency signal of -47 dBm through antenna terminal, and measure collector portion of Q103 and base portion of Q104 by spectrum analyzer. If there is severe attenuation, check for mechanical damage on FL103, F104.
	3.Defective U101.	3.Measure pin #1 of U101 by spectrum analyzer, and check the strength of 2nd Lo signal at 44.5125 MHz is more than -30 dBm.
	4.Defective 2nd Lo generator made up of Q202, L102, L103, L104.	4.If the 2nd Lo signal of 44.5125 MHz is normal and there is no receiving, one of U101, FL105, T103 will possibly be defective.
If receive is normal, but squelch does not work at all.	1.Defective U101	1.Apply high frequency signal to antenna connector. While measuring pin #13 of U101 by oscilloscope, decrease or increase the strength of applied signal to antenna connector. If the voltage at pin #13 does not change, U101 is defective.
	2.Defective C117	2.Without applying any signal to antenna connector, check the voltage at pin #14 of U101 if it changes to 0-5 Volt by adjusting VR101. If that voltage does not change, it is highly possible that U101 is defective.
	3.Defective TH101, R114, VR101, R118, R117, R116.	3.If #1 and #2 above are satisfactory, compare the voltage at pin #12 and #4 of U611 with voltage chart.
	4.Defective U611, Q612, Q694, Q605	4.Compare Tx frequency voltage of Q612, Q604, Q605 with voltage chart.
Low sensitivity and severe distortion.	1.TCXO frequency is off.	1.Check Tx frequency by transmitting.
	2.Misadjustment of T101, T102, T103.	2.Readjust the corresponding parts.
If Rx of normal signal is satisfactory, but receiving of data such as CTCSS, DCS trunking is not possible.	1.Defective SCF clock generator of U617, U612A	1.Observe pin #9 of U608 by oscilloscope at the channel programmed CTCSS, DCS and trunking. Check to see if 6.5-25 kHz clock is supplied according to the kind of received data, (regardless of duty ratio of clock).
	2.Defective U607 and U611.	2.Check to see if received data signal is applied to pin #4 of U607 and pin #8 of U608 through pin #5 of U607.
	3.Defective SLF data filter of U608.	3.Compare the voltages at pins #9,10 and 11 with voltage chart.
	4.Defective average voltage generator of U603B, D602, C605.	4.Measure received data signals at pin#3 of U608, pin #4 of U608, and pin #1 of U608, pin #2 of U608, and pin #9 of U612B in proper sequence, and find problem area. (The observed waveform at pin #2 of U608 and pin #9 of U612B are signals of digital level).
	5.Defective U612B.	5.If the received data signal from pin #2 of U608 is not observed, check to see if the voltage at pin #14 of U608 is the same as the average voltage at pin #1 of U608.
		6.Compare the corresponding voltage at other areas with voltage chart.
Even if CTCSS, DCS and trunking signals are received, no trunking handshake data are received.	1.Defective D602 and C605	1.Replace defective components.
	2.Defective C231, C232, C233, R234 and R235	
No transmitting even if pressing PTT switch.	1.Defective PTT switch.	1.Replace defective parts.
	2.Bad contact between PTT board and case frame.	2.Compare the voltage at corresponding place with the voltage chart.
	3.Bad contact on CON 205 and CON 208.	

No mic modulation at all	1.Defective Q607, Q602A, U602B, U601A and U611.	1.If external mic works, but internal mic does not, then check Q602, mic.
	2.Defective VR 602	2.Apply 1 kHz tone through external mic terminal, check U602A, U610A, U602B, VR602, U602C, U607D, and U607 pin #15 is sequence and find the problem area.
	3.Defective U602C and U602D	3.If there is no signal at pin #1 of U610A, check pin #13 of U610A. If voltage at pin #13 of U610A is not 5V, check U611.
	4.Defective U607	4.Compare the voltages at the corresponding parts with voltage chart.
	5.Defective CN602	
Weak mic modulation and severe distortion.	1.Defective VC302, C304, R303, R305 and R304.	1.Observe mic audio signal from Mod terminal of VCO, if normal audio signal is supplied to VCO, but modulation is very weak, and distortion is severe, then one of VC302, C304, R303, R305 and R304 inside VCO is bad. Replace VCO.
	2.Defective Q607, U602 and U610A	2.Apply 1 kHz tone at external mic terminal. Check U602A, U610A, U602B, VR602, U602C, U602D and U607 pin #15 in sequence and find the problem area.
No data modulation at all.	1.Defective U608	1.Use an oscilloscope, check pin #3 of U607, pin #8 of U608, pin #4 of U608, pin #14 of U607, VR601, and VR201, TCXO data modulation terminal in sequence and then confirm the trouble spot.
	2.Defective U607, U611	2.If Tx data is not observed from pin #8 of U608, check pins #9, #10, #11 of U607. If the voltage at pins #9, #10, #11 of U607 are not 5V, check U611.
	3.Defective VR601	3.If tx data is not observed from pin #3 of U608, confirm if 6.5-25 kHz of clock is supplied at pin #9 of U608. If clock is not supplied at pin #9 of U608, check U617, U612A.
	4.Defective VR201	4.If Tx data is not observed from pin #14 of U607, check the voltages at pins #9,10 and 11 of U607. If these voltages are not 5V, check U611.
		5.If correct data signal is applied to data modulation terminal of TCXO but the data is not modulated, replace TCXO.
	1.Defective VR601	1.Readjust the corresponding parts or replace the defective ones.
	2.Defective VR201 or mis-alignment.	
Weak transmitting power.	1.Defective antenna switch of U206.	1.If current consumption at Tx is normal and only Tx power is weak, it is possible that the antenna switch of U206 or LPF composed of C265, L203, C266 is bad. Compare the voltage at pin #4 of U206 with voltage chart.
	2.Defective power module of U205.	2.If current consumption at Tx is smaller notably than standard value, compare the strength of Tx signal input at pin #1 of U206 and voltage at each pin with voltage chart.
	3.Defective D202 and Q210.	3.Compare voltages at each portion of Q601 and Q603 with voltage chart.
	4.Defective APC circuit.	4.Check to see if Tx power changes by tuning VR 202, and if Tx power can not be adjusted, then check the APC circuit.
	5.Defective Q601 and Q603	5.Compare the voltage at corresponding part with voltage chart.

Impossible to program	1.Disconnection of flexible PCB connected with external microphone jack.	1.Check the connection of corresponding parts
	2.Defective Q611 and Q610.	2.If program error instead of "PROGRAM" appears on LCD display, check A) computer cable B) Q611.
	3.Defective computer I/O part for programming.	3.Replace bad parts.
	4.Defective cable connecting computer and radio	
	5.Defective EEPROM of U614	

VOLTAGE CHART

THE VOLTAGE CHART WAS MEASURED UNDER THE FOLLOWING CONDITIONS:
A). VOLTAGE: 7.2 VOLTS
B). FREQUENCY: FCC CH#300 CONVENTIONAL WITHOUT TONE SQUELCH OPTION
C). TX POWER: 1.5 WATTS
D). PLL CONDITION: LOCK
E). VOLTAGE DIMENSION: VOLT AND AVERAGE VOLTAGE

TRANSISTOR

	RECEIVE						TRANSMIT						EXT. MIC / (NORMAL TX)			PROGRAM MODE		
	SQ/ON			SQ/OFF			NORMAL			TALK AROUND								
	B	C	E	B	D	E	B	D	E	B	D	E	B	D	E	B	D	E
Q 1	2.0	3.5	1.4	2.0	3.5	1.4	2.0	3.5	1.4	2.0	3.5	1.4	2.0	3.5	1.4	2.0	3.5	1.4
Q101	0.8	4.6	0.0	0.8	4.6	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.8	4.6	0.0
Q102	4.1	1.5	4.6	4.1	1.5	4.6	0.5	0.0	0.6	0.5	0.0	0.6	0.5	0.0	0.6	4.1	1.5	4.6
Q103	0.8	5.0	0.2	0.8	5.0	0.2	0.2	0.6	0.0	0.2	0.6	0.0	0.2	0.6	0.0	0.8	5.0	0.2
Q104	0.8	1.8	0.0	0.8	1.8	0.0	0.5	0.6	0.0	0.5	0.6	0.0	0.5	0.6	0.0	0.8	1.8	0.0
Q201	0.3	4.9	5.0	0.3	4.9	5.0	0.3	4.9	5.0	5.0	0.0	5.0	0.3	4.9	5.0	0.3	4.9	5.0
Q202	0.3	1.2	0.0	0.3	1.2	0.0	0.3	1.2	0.0	0.3	1.2	0.0	0.3	1.2	0.0	0.3	1.2	0.0
Q203	0.2	1.8	0.0	0.2	1.8	0.0	0.2	1.5	0.0	5.0	0.0	0.0	0.2	1.5	0.0	0.2	1.8	0.0
Q204	14	6	14	14	6	14	14	6	14	14	5	14	14	6	14	-	-	-
Q205	0.0	6.0	0.0	0.0	6.0	0.0	0.0	6.0	0.0	0.0	5.0	0.0	0.0	6.0	0.0	-	-	-
Q206	4.9	0.0	4.9	4.9	0.0	4.9	4.9	0.0	4.9	4.9	0.0	4.9	4.9	0.0	4.9	-	-	-
Q207	4.9	14	4.9	4.9	14	4.9	4.9	14	4.9	4.9	14	4.9	4.9	14	4.9	-	-	-
Q208	0.8	0.1	0.0	0.8	0.1	0.0	0.8	0.1	0.0	0.8	0.1	0.0	0.8	0.1	0.0	-	-	-
Q209	2.5	4.2	2.0	2.5	4.2	2.0	2.5	4.2	2.0	2.5	4.2	2.0	2.5	4.2	2.0	2.5	4.2	2.0
Q210	0.0	0.0	0.0	0.0	0.0	0.0	1.4	5.8	0.7	1.4	5.8	0.7	1.4	5.8	0.7	0.0	0.0	0.0
Q211	0.0	0.0	0.0	0.0	0.0	0.0	3.6	4.4	3.0	3.9	4.4	3.1	3.6	4.4	3.0	0.0	0.0	0.0
Q212	0.0	0.0	0.0	0.0	0.0	0.0	0.9	4.6	0.3	0.9	4.5	0.3	0.9	4.6	0.3	0.0	0.0	0.0
Q213	0.0	0.0	0.0	0.0	0.0	0.0	0.9	3.6	0.3	0.9	3.9	0.3	0.9	3.6	0.3	0.0	0.0	0.0
Q214	7.2	0.0	0.0	7.2	0.0	0.0	7.2	0.0	0.0	7.2	0.0	0.0	7.2	0.0	0.0	7.2	0.0	0.0
Q215	4.1	4.7	4.9	4.9	0.0	4.9	4.9	0.0	4.8	4.9	0.0	4.8	4.9	0.0	4.8	4.1	0.0	4.9
Q216	4.8	0.0	4.8	4.8	0.0	4.8	4.8	1.7	4.8	4.8	1.7	4.8	4.8	1.7	4.8	4.8	0.0	4.8
Q301	4.9	0.1	0.0	4.9	0.1	0.0	4.9	0.1	0.0	0.0	4.2	0.0	4.9	0.1	0.0	4.9	0.1	0.0
Q302	2.3	4.0	1.7	2.3	4.0	1.7	2.3	4.0	1.7	2.3	4.0	1.7	2.3	4.0	1.7	2.3	4.0	1.7
Q303	0.7	1.9	0.0	0.7	1.9	0.0	0.7	1.9	0.0	0.7	1.9	0.0	0.7	1.9	0.0	0.7	1.9	0.0
Q304	4.9	5.0	4.2	4.9	5.0	4.2	4.9	5.0	4.2	4.9	5.0	4.2	4.9	5.0	4.2	4.9	5.0	4.2
Q501	2.5	4.9	2.5	2.5	4.9	2.5	2.5	4.9	2.5	2.5	4.9	2.5	2.5	4.9	2.5	2.5	4.9	2.5
Q502	0.4	2.5	0.0	0.4	2.5	0.0	0.4	2.5	0.0	0.4	2.5	0.0	0.4	2.5	0.0	0.4	2.5	0.0
Q503	0.5	0.8	0.0	0.5	0.8	0.0	0.5	0.8	0.0	0.5	0.8	0.0	0.5	0.8	0.0	0.5	0.8	0.0
Q504	0.6	1.1	0.0	0.6	1.1	0.0	0.6	1.1	0.0	0.6	1.1	0.0	0.6	1.1	0.0	0.6	1.1	0.0
Q601	7.2	0.0	7.2	7.2	0.0	7.2	6.0	6.6	7.2	6.0	6.6	7.2	6.0	6.6	7.2	7.2	0.0	7.2
Q602	4.3	4.9	5.0	4.3	4.9	5.0	4.9	0.6	5.0	4.9	0.6	5.0	4.9	0.6	5.0	4.3	4.9	5.0
Q603	0.0	7.2	0.0	0.0	7.2	0.0	5.0	0.1	0.0	5.0	0.1	0.0	5.0	0.1	0.0	0.0	7.2	0.0
Q604	0.0	7.2	0.0	2.7	0.1	0.0	2.7	0.1	0.0	2.7	0.1	0.0	2.7	0.1	0.0	2.7	0.1	0.0
Q605	7.2	3.6	7.2	0.1	7.2	7.2	0.1	7.2	7.2	0.1	7.2	7.2	0.1	7.2	7.2	0.1	7.2	7.2

TRANSISTOR - Cont.

	RECEIVE						TRANSMIT						EXT. MIC / (NORMAL TX)			PROGRAM MODE		
	SQ/ON			SQ/OFF			NORMAL			TALK AROUND								
Q606	4.2	0.0	0.0	4.2	0.0	0.0	4.2	0.0	0.0	4.2	0.0	0.0	0.0	4.5	0.0	4.2	0.0	0.0
Q607	2.4	1.8	1.8	2.4	1.8	1.8	2.4	1.8	1.8	2.4	1.8	1.8	0.6	0.6	4.6	2.4	1.8	1.8
Q608	3.0	0.1	0.0	3.0	0.1	0.0	0.0	4.8	0.0	0.0	4.8	0.0	0.0	4.8	0.0	3.0	0.1	0.0
Q609	0.0	3.0	0.0	0.0	3.0	0.0	5.0	0.1	0.0	5.0	0.1	0.0	5.0	0.1	0.0	0.0	3.0	0.0
Q610	0.0	5.0	0.0	0.0	5.0	0.0	0.0	5.0	0.0	0.0	5.0	0.0	0.0	5.0	0.0	5.0	0.0	0.0
Q611	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
Q612	5.0	0.0	0.0	0.0	2.7	0.0	0.0	2.7	0.0	0.0	2.7	0.0	0.0	2.7	0.0	0.0	2.7	0.0

DIODE

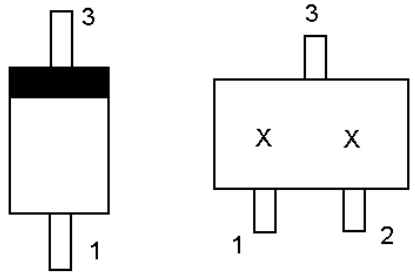


DIAGRAM TO THE RIGHT SHOWS TERMINAL NUMBERS.

	RECEIVE						TRANSMIT						EXT. MIC / (NORMAL TX)			PROGRAM MODE		
	SQ/ON			SQ/OFF			NORMAL			TALK AROUND								
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CR 1	-	-	4.9	-	-	4.9	-	-	4.9	-	-	4.9	-	-	4.9	-	-	4.9
D102	4.5	4.5	4.2	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.4
D201	0.6	0.6	4.8	0.6	0.6	4.8	0.6	0.6	4.8	0.6	0.6	4.8	0.6	0.6	4.8	-	-	-
D202	0.0	0.8	0.1	0.0	0.8	0.1	1.6	0.7	0.8	1.6	0.7	0.8	1.6	0.7	0.8	0.0	0.8	0.1
D203	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	1.3	0.0	0.0	1.3	0.0	0.0	0.0
D204	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	1.3	0.0	0.0	1.3	0.0	0.0	0.0
D205	0.0	-	7.2	0.0	-	7.2	0.0	-	7.2	0.0	-	7.2	0.0	-	7.2	0.0	-	7.2
D206	7.2	7.2	6.6	7.2	7.2	6.6	7.0	7.0	6.2	7.0	7.0	6.2	7.0	7.0	6.2	7.2	7.2	6.6
D207	0.0	0.0	0.0	0.0	0.0	0.0	2.4	2.4	1.7	2.4	2.4	1.7	2.4	2.4	1.7	0.0	0.0	0.0
VC301	0.0	0.0	6.0	0.0	0.0	6.0	0.0	0.0	6.0	0.0	0.0	5.0	0.0	0.0	6.0	0.0	0.0	-
VC302	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0
D501	0.0	0.0	14	0.0	0.0	14	0.0	0.0	14	0.0	0.0	14	0.0	0.0	14	0.0	0.0	14
D502	11	14	13	11	14	13	11	14	13	11	14	13	11	14	13	11	14	13
D503	8	11	10	8	11	10	8	11	10	8	11	10	8	11	10	8	11	10
D504	4.9	8.0	6.5	4.9	8.0	6.5	4.9	8.0	6.5	4.9	8.0	6.5	4.9	8.0	6.5	4.9	8.0	6.5
D505	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
D601	0.1	0.1	-	0.1	0.1	-	4.8	4.8	4.3	4.8	4.8	4.3	4.8	4.8	4.3	0.1	0.1	-
D602	-	-	-	-	-	-	1.1	1.1	0.5	1.1	1.1	0.5	1.1	1.1	0.5	-	-	-
D603	0.0	-	4.2	0.0	-	4.2	0.0	-	4.2	0.0	-	4.2	0.0	-	0.0	0.0	-	4.2
D604	3.3	3.3	4.2	3.3	3.3	4.2	3.3	3.3	4.2	3.3	3.3	4.2	0.6	0.6	0.0	3.3	3.3	4.2
D605	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.0	1.2

FREQUENCY:

FCC CH#300, TRUNKED OR CTCSS

	RECEIVE						TRANSMIT						EXT. MIC / (NORMAL TX)			PROGRAM MODE		
	SQ/ON			SQ/OFF			NORMAL			TALK AROUND								
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
D601	0.1	0.1	2.1	0.1	0.1	2.1	4.8	4.8	4.3	4.8	4.8	4.3	4.8	4.8	4.3	0.1	0.1	-
D602	2.1	2.1	2.1	2.1	2.1	2.1	1.1	1.1	0.5	1.1	1.1	0.5	1.1	1.1	0.5	2.1	2.1	2.1

IC

PIN NO	U101		U201		U202		U203		U204		U205		U206	
							POWER		POWER					
	RX	TX	LOCK	UN-LOCK	LOCK	UN-LOCK	ON	OFF	ON	OFF	RX	TX	RX	TX
1	4.3	4.3	2.0	2.0	2.5	2.5	0.0	7.2	0.0	7.2	0.0	3.4	0.0	0.0
2	3.9	3.9	2.1	2.1	4.7	4.7	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0
3	3.3	3.3	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	7.2	7.1	0.0	0.0
4	4.4	4.4	4.8	4.8	3.1	3.1	5.0	0.0	5.0	5.0	7.2	7.1	0.0	1.5
5	3.3	3.3	2.4	- -	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	3.3	3.3	0.0	0.0	1.5	- -	7.2	7.2	7.2	7.2			0.0	0.0
7	3.3	3.3	4.8	- -	0.0	0.0							0.0	0.0
8	4.4	4.4	1.9	- -	2.5	2.5								
9	2.0	2.0	0.0	0.0										
10	0.0	0.0	0.0	0.0										
11	4.3	4.3	0.0	0.0										
12	0.7	0.7	CLK-	- -										
13	0.7	0.7	0.0	0.0										
14	- -	0.0	2.4	2.4										
15	0.0	0.0	4.8	- -										
16	1.7	1.7	4.8	- -										

	PIN 14 OF U101	PIN 12 OF U611	PIN 13 OF U611	PIN 41 OF U616		PIN 11 OF U611
SQ ON (UNMUTE)	4.4	5.0	0.2	4.4	NORMAL TX	0.3
SQ OFF (MUTE)	0.0	0.2	5.0	0.0	T/A TX	5.0

PIN NO	U610		U611		U612		U613		U614		U615		U617	
	RX	TX	RX	TX	RX	TX	RX	TX	RX	TX	RX	TX	RX	TX
1	- -	1.9	0.0	0.0	5.0	5.0	CLK-	CLK-	0.0	0.0	1.2	1.2	CLK-	CLK-
2	1.9	1.9	0.0	0.0	- -	- -	- -	- -	0.0	0.0	0.0	0.0	CLK-	CLK-
3	0.0	0.0	0.0	0.0	- -	- -	5.0	5.0	0.0	0.0	CLK-	CLK-	CLK-	CLK-
4	- -	0.0	- -	0.0	5.0	5.0	CLK-	CLK-	0.0	0.0	0.0	0.0	5.0	5.0
5	- -	5.0	- -	5.0	CLK-	CLK-	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
6	- -	0.0	0.0	5.0	CLK-	CLK-	CLK-	CLK-	5.0	5.0	1.2	1.2	5.0	5.0
7	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	0.0	0.0	1.4	1.4	5.0	5.0
8	1.9	1.9	0.0	0.0	- -	5.0	5.0	5.0	5.0	5.0	5.0	5.0	0.0	0.0
9	- -	- -	0.0	0.0	- -	0.0	5.0	5.0					- -	- -
10	- -	- -	0.0	0.0	5.0	5.0	CLK-	CLK-					5.0	5.0
11	1.9	1.9	0.3	- -	CLK-	CLK-	CLK-	CLK-					- -	- -
12	- -	0.0	- -	0.0	- -	- -	5.0	5.0					0.0	0.0
13	- -	5.0	- -	5.0	5.0	5.0	0.0	0.0					- -	- -
14	5.0	5.0	- -	- -	5.0	5.0	5.0	5.0					CLK-	CLK-
15			5.0	5.0									CLK-	CLK-
16			5.0	5.0									5.0	5.0

	PIN 13 OF U603	PIN 14 OF U603	PIN 14 OF U611	PI N 40 OF U616	PIN 14 OF U611
GOOD BATTERY	2.0	0.0	5.0	0.0	5.0
LOW BATTERY	1.7	3.9	2.5	3.9	2.5

PIN NO	U616		PIN NO	U616		PIN NO	U616		PIN NO	U616	
	RX	TX		RX	TX		RX	TX		RX	TX
1	LCD DRIVE		21	LCD DRIVE		41	SQUELCH		61	0.0	0.0
2	LCD DRIVE		22	LCD DRIVE		42	5.2	5.2	62	- -	- -
3	LCD DRIVE		23	LCD DRIVE		43	- -	0.0	63	0.0	0.0
4	LCD DRIVE		24	LCD DRIVE		44	5.0	5.0	64	0.0	0.0
5	LCD DRIVE		25	5.0	5.0	45	CLK-	CLK-	65	0.0	0.0
6	LCD DRIVE		26	5.0	5.0	46	- -	- -	66	0.0	0.0
7	LCD DRIVE		27	3.2	3.2	47	- -	- -	67	0.0	0.0
8	LCD DRIVE		28	2.6	2.6	48	- -	- -	68	5.0	5.0
9	LCD DRIVE		29	CLK-	CLK-	49	0.0	0.0	69	LCD DRIVE	
10	LCD DRIVE		30	CLK-	CLK	50	0.0	0.0	70	LCD DRIVE	
11	LCD DRIVE		31	CLK-	CLK-	51	0.0	0.0	71	LCD DRIVE	
12	LCD DRIVE		32	CLK-	CLK-	52	0.0	5.0	72	LCD DRIVE	
13	LCD DRIVE		33	0.0	0.0	53	5.0	5.0	73	LCD DRIVE	
14	LCD DRIVE		34	CLK-	CLK-	54	5.0	5.0	74	LCD DRIVE	
15	LCD DRIVE		35	CLK-	CLK-	55	0.0	0.0	75	LCD DRIVE	
16	LCD DRIVE		36	CLK-	CLK-	56	5.0	5.0	76	LCD DRIVE	
17	LCD DRIVE		37	CLK-	CLK-	57	4.3	4.3	77	LCD DRIVE	
18	LCD DRIVE		38	PTT		58	2.5	2.5	78	LCD DRIVE	
19	LCD DRIVE		39	MONITER		59	2.5	2.5	79	LCD DRIVE	
20	LCD DRIVE		40	LOW BATT		60	CLK-	CLK-	80	LCD DRIVE	

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APPENDIX I

ELECTRICAL PARTS LIST

The following parts will be stocked and can be ordered from Ericsson Inc. After-Market Services.

ITEM	PART NO.	DESCRIPTION
	R29/566-35B-0	Rear Cover Assembly
F5	R29/665-018	"E" Ring
F9	R29/732-796	Holder
F10	R29/752-599	Slider
F11	R29/795-460	Overlay
F13	R29/825-942	Knob
F14	R29/830-745-A	Dust Cap
F15	R29/860-130-A	Pin Contact
F16	R29/881-504	Spring
F18	R29/421-666-7	Connector
F19	R29/421-648-1	Connector
	R29/566-35P-A	Belt Clip Assembly
	R29/566-35P-B	PTT Board Assembly
	LTRRFA	RF Board Assembly
R4	R29/416-918-B	Flex PCB
R5	R29/406-142-B	Receiver Board Assembly
R7	R29/233-439-7	IC MHW 830 - 2
	R29/566-35D-B	Digital Board Assembly
	LTRCA	Cover Assembly
U5	R29/772-024	Shield Plate
U6	R29/795-461	Front Overlay
U8	R29/894-600	Gasket
U9	R29/894-811	Keypad
U10	R29/906-408	Speaker Filter
U13	R29/420-206-0	Condenser Microphone
	R29/420-584-1	Battery, Nickel Cadium
D205	R29/245-013-1	Diode
D503	R29/251-168-1	LED
FL104	R29/280-089-7	Fuse
FLEX201	R29/416-918-B	Flex PCB
SP701	R29/420-112-4	Speaker

Monogram Series LTR PARTS LIST

IDENTIFIER	NAME & DESCRIPTION
BAT901	BATTERY NI-CA KR-1100AAE
C102	CER. AXIAL 0.01UF:EP050Y103MN
C103	CER. MONO. 0.0022UF:GRM40X7R222J50PT
C104	CER. MONO. GRM40COG221G50VM6305-500PT
C106	CER. MONO. 2PF:GRM40C0G020C50
C107	CER. MONO 2.2PF:GRM40C0G2R2C50V
C108	CER. MONO. 0.01UF:GRM40X7R103J50
C110	CER. MONO. 0.01UF:GRM40X7R103J50
C115	CER. MONO. 20PF:GRM40C0G200J50
C117	TAN. CHIP 0.33UF 35WV:TCM1VR33AS#R
C118	CER. MONO. 0.047UF:GRM40X7R473J25
C119	TAN. CHIP 3.3UF:293D335X0010A2T
C120	CER. MONO. 0.5PF:GRM40C0G0R5C50V
C121	CER. MONO. 0.0018UF:GRM40X7R182J50PT
C122	CER. MONO. 2.2PF:GRM40C0G2R2C50V
C202	CER. MONO. 0.015UF:GRM40X7R153J50PT
C203	CER. MONO. 0.0012UF:GRM40C0G122J50
C205	CER. MONO. 27PF:GRM40C0G270J50
C206	CER. 3PF 50WV: D "NPO"
C208	CER. MONO. 1.5PF:GRM40C0G1R5D50
C210	CER. CHIP 3PF:GRM40C0G030C50
C211	CER. MONO. 4PF:GRM40C0G040C50
C212	CER. MONO. 18PF:GRM40C0G180J50
C213	CER. MONO. 47PF:GRM40C0G470J50
C214	CER. MONO. 470PF:GRM40C0G471J50
C215	CER. MONO. GRM40C0G4R7C50VM6305-500PT
C216	CER. MONO. 5PF:GRM40C0G050C50
C217	CER. MONO. GRM40C0G101J50V:M6305-500PT
C219	TANTAL CHIP 1UF:293D105X0016A2T
C220	CER. MONO. 5PF:GRM40C0G050C50
C221	CER. MONO. 56PF:GRM40C0G560J50
C222	CER. MONO. 1PF:GRM40C0G010C50
C223	CER. MONO. 5.6PF:GRM40C0G5R6C50-500PT
C224	TAN. CHIP 4.7UF:293D475X0010A2T
C227	CER. MONO. 0.001UF:GRM40X7R102J50
C229	TAN. CHIP 4.7UF:293D475X0010A2T
C232	CER. MONO. 0.01UF:GRM40X7R103J50
C237	CER. MONO. 0.01UF:GRM40X7R104J50
C238	CER. MONO. 0.01UF:GRM40X7R104J50
C240	CER. MONO. 0.01UF:GRM40X7R104J50
C242	CER. MONO. 0.001UF:GRM40X7R102J50
C243	CER. MONO. 5.6PF:GRM40C0G5R6C50-500PT
C244	CER. MONO. 120PF:GRM40C0G121J50V
C245	CER. MONO. GRM40C0G1R2C50VM6305-500PT
C246	CER MONO. 150PF:GRM40C0G151J50V
C247	CER. MONO. 1.5PF:GRM40C0G1R5D50
C248	CER. MONO. 0.001UF:GRM40X7R102J50
C249	CER. MONO. 680PF:GRM40C0G681J50
C250	CER. MONO. 7PF:GRM40C0G070D50
C251	CER. MONO. GRM40C0G750J50 M6301-500PT
C252	CER. MONO. 82PF:GRM40C0G820J50
C253	TAN. CHIP 0.1UF35WV:293D104X0035A2T
C254	TAN.CHIP 0.1UF35WV:293D104X0035A2T

Monogram Series LTR PARTS LIST - Cont.

IDENTIFIER	NAME & DESCRIPTION
C255	TAN.CHIP 100UF6.3WV:293D107X0006E2T
C256	TAN.CHIP 47UF:293D476X0006C2T
C259	CAPACITOR ELECT 100UF 16V SR (M) :8X9
C263	CER. MONO. 22PF:GRM40C0G220J50
C501	TAN. CHIP 10UF16WV:293D106X0016C2T
C601	TANTAL CHIP 1UF:293D105X0016A2T
C604	CER. MONO. 22PF:GRM40C0G220J50
C605	TAN. CHIP 2.2UF:293D225X0016A2T
C619	CER. MONO. GRM40C0G101G50VM6305-500PT
C620	CER. MONO. GRM40C0G101G50VM6305-500PT
C622	TAN. CHIP 10UF:293D106X001B2T
C635	TAN. CHIP 100UF6.3WV:293D107X0006E2T
C636	TANTAL CHIP 68UF 10WV:293D686X0010E2T
C639	TAN. CHIP 10UF:293D106X0010B2T
C649	TAN. CHIP 10UF:293D106X0010B2T
C651	CER. MONO. GRM40C0G22150VM6305-500PT
C652	CER. MONO. GRM40C0G221G50VM6305-500PT
CN601	HEADER PIN GDH-10DBCR (M1.2)
CN602	HEADER PIN CONNECTORGDH-14DBC (6)
CN603	HEADER PIN CONNECTORGDH-10DBC (6)
CN604	HEADER PIN GDH-4SBCR (M1.2)
CN701	HEADER PIN GDRS-04S (M2.5)
CN702	HEADER PIN GDRS-10D (M2.5)
CON203	TDH CONNECTOR TDH2-6SG
CON204	HEADER PIN CONNECTORGDH2-6DBC
CON205	HEADER PIN CONNECTORGDH2-3SBC (1.2)
CON206	3P HOUSING ASS'Y 3P 80MM
CON207	HEADER PIN CONNECTORTDH-10SG
CON208	HEADER PIN CONNECTORTDH-14SG
D202	DIODE PIN MC804
D204	DIODE SCHOTTKY MMBD101-LT1
D205	DIODE 1N 4001 (1A50V)
D502	DIODE SCHOTTKY MMBD352-LT1
D503	LED LAMP SPR-39MVW3 (RED. GRN)
D504	LED BACK LIGHT KLS-0021MS
D505	LCD DISPLAY DLC-4960P
DVC301	DIODE SILICON MMBV809L
DVC302	DIODE SILICON IN5404
FL101	FILTER BANDPASS DFC3R860P020BTD
FL102	RESONATOR CER. DRR040UE/10MM
FL103	FILTER CRYSTAL 44.9625MHz UM-1-3L
FL104	FUSE MICRO MS2 (125V 2A SLOW)
FL105	FILTER CER. CFW450E
FLEX201	P.C.B. FLEX (D) 23.7X10.5X1MILL FR4 1/0
L103	COIL CHIP 2.7UH:380LB-2R7M
L203	COIL SPRING 1.2DIAXO.5DIAX3T (R)
L301	COIL CHIP 0.22UH:380NB-R22M
L302	COIL CHIP 0.22UH:380NB-R22M
L303	COIL AXIAL 2.2UH:LALO2TB2R2K
L601	COIL CHIP 22UH:380KB-220K
L602	COIL 455kHz DETECTOR
MC701	MIC CONDENSER WM-063T 6DIA
Q103	TRANSISTOR MMBR941LT1

Monogram Series LTR PARTS LIST - Cont.

IDENTIFIER	NAME & DESCRIPTION
Q205	TRANSISTOR BC848C SOT-23
Q207	TRANSISTOR BC848C SOT-23
Q208	TRANSISTOR BC848C SOT-23
Q209	TRANSISTOR MMBR951:SOT23
Q210	TRANSISTOR MRF9411 (LT1)
Q211	TRANSISTOR BC858B SOT-23
Q212	TRANSISTOR KRA101S
Q213	TRANSISTOR KRA101S
Q303	TRANSISTOR MMBR951:SOT23
Q304	TRANSISTOR BC848C SOT-23
Q603	BRT KRC104S ND
Q604	BRT KRC104S ND
Q606	FET 2SK 1579-TMOS
Q608	BRT KRC104S ND
Q609	TRANSISTOR MRF5711LT1
Q610	TRANSISTOR LMMBT9426CLT1
Q611	TRANSISTOR BCX-18LT1
Q612	TRANSISTOR MMBR5179LT1
R2 (*)	RESISTOR CHIP 1K OHM 1/10W +-1%
R3 (*)	RESISTOR CHIP 10K OHM 1/10W +-1%
R4 (*)	RESISTOR CHIP 100K OHM 1/10W +-1%
R9	RESISTOR CHIP 39K OHM 1/10W +-5%
R10	RESISTOR CHIP 2.2K OHM 1/10W +-5%
R11	RESISTOR CHIP 2.2K OHM 1/10W +-5%
R101	RESISTOR CHIP 15K OHM 1/10W +-5%
R102	RESISTOR CHIP 33OK OHM 1/10W +-5%
R103	RESISTOR CHIP 82K OHM 1/10W +-5%
R106	RESISTOR CHIP 4.7K OHM 1/10W +-5%
R107	RESISTOR CHIP 27K OHM 1/10W +-5%
R113	RESISTOR CHIP 220 OHM 1/10W +-5%
R120	RESISTOR CHIP 33K OHM 1/10W +-5%
R122	RESISTOR CHIP 180 OHM 1/10W +-5%
R201	RESISTOR CHIP 1K OHM 1/10W +-5%
R203	RESISTOR CHIP 22 OHM 1/10W +-5%
R204	RESISTOR CHIP 4.7K OHM 1/10W +-5%
R205	RESISTOR CHIP 8.2K OHM 1/10W +-5%
R207	RESISTOR CHIP 47K OHM 1/10W +-5%
R208	RESISTOR CHIP 47 OHM 1/10W +-5%
R211	RESISTOR CHIP 470 OHM 1/10W +-5%
R212	RESISTOR CHIP 6.8K OHM 1/10W +-5%
R213	RESISTOR CHIP 470 OHM 1/10W +-5%
R215	RESISTOR CHIP 3.9K OHM 1/10W +-5%
R218	RESISTOR CHIP 330 OHM 1/10W +-5%
R223	RESISTOR CHIP 1K OHM 1/10W +-5%
R224	RESISTOR CHIP 10K OHM 1/10W +-5%
R225	RESISTOR CHIP 100K OHM 1.10W +-5%
R226	RESISTOR CHIP 47K OHM 1/10W +-5%
R227	RESISTOR CHIP 3.3K OHM 1/10W +-5%
R228	RESISTOR CHIP 4.7K OHM 1/10W +-5%
R233	RESISTOR CHIP 36K OHM 1/10W +-5%
R235	RESISTOR CHIP 12K OHM 1/10W +-5%
R243	RESISTOR CHIP 100K OHM 1/10W +-5%
R244	RESISTOR CHIP 1M OHM 1/10W +-5%

Monogram Series LTR PARTS LIST - Cont.

IDENTIFIER	NAME & DESCRIPTION
R245	RESISTOR CHIP 10M OHM 1/10W +-5%
R246	RESISTOR CHIP 27K OHM 1/10W +-5%
R250	RESISTOR CHIP 1.8K OHM 1/10W +-5%
R252	RESISTOR CHIP 68K OHM 1/10W +-5%
R257	RESISTOR CHIP 5.6K OHM 1/10W +-5%
R258	RESISTOR CHIP 56K OHM 1/10W +-5%
R261	RESISTOR CHIP 180K OHM 1/10W +-5%
R302	RESISTOR CHIP 1.5K OHM 1/10W +-5%
R303	RESISTOR CHIP 10K OHM 1/10W +-5%
R307	RESISTOR CHIP 10K OHM 1/10W +-5%
R308	RESISTOR CHIP 22 OHM 1/10W +-5%
R309	RESISTOR CHIP 180 OHM 1/10W +-5%
R505	RESISTOR CHIP 7.5K OHM 1/10W +-5%
R506	RESISTOR CHIP 7.5K OHM 1/10W +-5%
R508	RESISTOR CHIP 47 OHM 1/10W +-5%
R602	RESISTOR CHIP 820 OHM 1/10W +-5%
R603	RESISTOR CHIP 3.3K OHM 1/10W +-5%
R604	RESISTOR CHIP 1.5K OHM 1/10W +-5%
R605	RESISTOR CHIP 0 OHM 1/10W +-5%
R609	RESISTOR CHIP 120K OHM 1/10W +-5%
R610	RESISTOR CHIP 120K OHM 1/10W +-5%
R612	RESISTOR CHIP 15K OHM 1/10W +-5%
R614	RESISTOR CHIP 22K OHM 1/10W +-5%
R616	RESISTOR CHIP 3K OHM 1/10W +-5%
R618	RESISTOR CHIP 82K OHM 1/10W +-5%
R620	RESISTOR CHIP 1.2M OHM 1/10W +-5%
R621	RESISTOR CHIP 27K OHM 1/10W +-5%
R623	RESISTOR CHIP 22K OHM 1/10W +-5%
R624	RESISTOR CHIP 2K OHM 1/10W +-5%
R627	RESISTOR CHIP 3K OHM 1/10W +-5%
R629	RESISTOR CHIP 680 OHM 1/10W +-5%
R630	RESISTOR CHIP 200K OHM 1/10W +-5%
R632	RESISTOR CHIP 3.3K OHM 1/10W +-5%
R633	RESISTOR CHIP 220 OHM 1/10W +-5%
R634	RESISTOR CHIP 220K OHM 1/10W +-5%
R637	RESISTOR CHIP 390K OHM 1/10W +-5%
R638	RESISTOR CHIP 150K OHM 1/10W +-5%
R639	RESISTOR CHIP 150 OHM 1/10W +-5%
R642	RESISTOR CHIP 270 OHM 1/10W +-5%
R644	RESISTOR CHIP 2.7K OHM 1/10W +-5%
R645	RESISTOR CHIP 2.7K OHM 1/10W +-5%
R647	RESISTOR CHIP 150K OHM 1/10W +-5%
R652	RESISTOR CHIP 470K OHM 1/10W +-5%
R653	RESISTOR CHIP 330K OHM 1/10W +-5%
R657	RESISTOR CHIP 5.1K OHM 1/10W +-5%
R658	RESISTOR CHIP 12K OHM 1/10W +-5%
R660	RESISTOR CHIP 8.2K OHM 1/10W +-5%
R662	RESISTOR CHIP 51K OHM 1/10W +-5%
R666	RESISTOR CHIP 2.2K OHM 1/10W +-5%
R671	RESISTOR CHIP 5.6K OHM 1/10W +-5%
R672	RESISTOR CHIP 8.2K OHM 1/10W +-5%
R673	RESISTOR CHIP 33K OHM 1/10W +-5%
R701	RESISTOR ARRAY R104J5R3

Monogram Series LTR PARTS LIST - Cont.

IDENTIFIER	NAME & DESCRIPTION
R702	RESISTOR CHIP 100 OHM 1/10W +-1%
R901	RESISTOR METALFILM 15K OHM 1/4W +-2%
SP701	SPEAKER LOUD T036S25A-000
SW201	SW TACT SKHUPF
SW202	SW POLY SRP200
SW203	SW ANT MD003 (G471710)
T101	COIL IFT 45MHz:369SC-K5133Y
T102	COIL IFT 45MHz:369SC-K5132Y
TC1	CAPACITOR TRIMMER 5-20PF:TSW-S3-180
TC301	CAPACITOR TRIMMER TSW-3-P-180
TH1	THERMISTOR CHIP 10K OHM:NTCCS32163NH103KC
TH2	THERMISTOR CHIP 33K OHM:NTCCS32163SH333KC
TH3	THERMISTOR CHIP 150K OHM:NTCCS32164CH154KC
TH901	TERMISTOR 30K OHM +-10%:FTD5-330
U101	I.C MC3371P
U201	I.C MC145158DW2:SOG16
U202	I.C MC12022BD (S008)
U203	I.C REGULATOR TK11450MTR
U204	I.C EE PROM AT24C16N-10SI-2.7
U205	I.C MHW803-2
U601A	I.C LM2902M
U601B	DIODE ZENER MMBZ5230BLT1 (4.7V)
U601C	DIODE ZENER MMBZ5245BT1
U601D	DIODE ZENER MMBZ5245BT1
U602A	DIODE VARICAP MMBV109
U602B	DIODE SI KDS226
U602C	DIODE KDS196S
U602D	DIODE KDS196S
U603	DIODE PIN MC804
U606	I.C LM386 M1/SO-8
U607	I.C MC14053BD
U608	I.C MF6CWM-100
U609	I.C KS58015D (14SOP)
U610	I.C MC14066BDR2:S014
U611	I.C MC14094BDR2
U612	I.C 74HC74 F-FLOP DUAL SO14
U613	I.C MC74HC76D
U615	I.C MB3773 FPT-08P-M01
U616	I.C UPD75P316GF
U617	I.C TC74HC592AF
UR601	RES. SEMIFIXED CHIP 20K OHM5DIA:ST-4D "V"
VR101	RES. DEMIFIXED CHIP 200K OHM5DIA:ST-4A
VR201	THERMISTOR CHIP 2.2K OHM +-10%:B57621-C222-K62
VR202	RES. SEMIFIXED CHIP 10K OHM5DIA:ST-4A
VR203	VR 20KA:RK0971111
VR602	RES. SEMIFIXED CHIP 10K OHM5DIA:ST-4D
X1	CRYSTAL UM-1 14.837500MHz:10PPM
X601	CRYSTAL 3.57945MHz TC-38A
X602	CRYSTAL 4.194304MHz TC-38A

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APPENDIX II

EXPLODED VIEW PARTS LIST

Monogram Series LTR EXPLODED VIEW PARTS LIST

EXPLODED VIEW	PARTS NAME & DESCRIPTION
	Bottom Cover Ass'y
B1	(+) Machine Screw (Bh), 2 x 3 Blk.
B2	Cover Bottom, ALDC12, Spray
B3	Protector "A", Neoprene Rubber
B4	Gasket, Silicon Rubber d:1, Blk.
B5	Label Name, Polyester 34.7 x 17.8
	Body Assembly Ass'y
F1	(+) Machine Screw (Bh) 2.6 x 6, Ni-P
F2	(+) Machine Screw (Bh) 2 x 4, Zn-P
F3	(+) Machine Screw (Fh) 2 x 5, Ni-P
F4	Nut Ring, BsBm
F5	"E" Ring, d:1.5, Blk.
F6	Frame, ZnDC, Spray
F7	Holder (Ant), Spte t:0.3
F8	Holder (Stopper), ABS Blk.
F9	Holder, ABS Blk.
F10	Slider (Main), SUS27 t:0.8
F11	Overlay (Main), PVC t:0.4, Sticker
F12	Lens (Led), acryl Clear
F13	Knob (Vol.), ABS Blk., Spray
F14	Cap (Dust), Nylon66 Blk.
F15	Pin Contact, BsBm, Ni-P
F16	Spring (Coil), SUS304-WPA d:0.35
F17	Spring (Plate), SUS27 t:0.6
F18	Connector, SMA-R-PCB SW-1817
F19	Connector, HR10A-7R-6SB
F20	Shield Plate, CNP3 t:0.2
	Packing Ass'y
P1	"E" Ring, d:1.5, Blk.
P2	Bracket, SUS304, Spray
P3	Belt Clip, PC
P4	Pin, BsBm, Ni-P
P5	Spring (Belt Clip)
P6	Antenna
	PTT Board Ass'y
PT1	(+) Machine Screw (Ph) 2.6 x 5, Blk.
PT2	Holder (PTT), AL12DC, Spray
PT3	PTT. Pad Ass'y
PT4	S/W Tact, Skhupf
PT5	P.C.B. PTT., 74.5 x 12 x t:0.8
	R.F. Board Ass'y
R1	Shield Plate, CNP3 t:0.2
R2	Bushing, BsBm, Sn-P
R3	Finger Strip
R4	Flexible PCB
R5	P.C.B. Receiver
R6	LED PCB
R7	I.C MHW830-2
	VCO Board Ass'y
V1	VCO Can, Spte t:0.5
V2	PCB VCO, 31 x 18 x t:1.2
	TCXO Board Ass'y

Monogram Series LTR EXPLODED VIEW PARTS LIST - Cont.

EXPLODED VIEW	PARTS NAME & DESCRIPTION
T1	Cover Shield, BsP t:0.25, Ni-P
T2	Rubber Holder
T3	Crystal Um-1, 14, 837500MHz:10PPM
T4	PCB Tcxob Ass'y
	Digital Board Ass'y
D1	Holder, Silicon Rubber
D2	PCB Digital, 92 x 55 x t:1.2
D3	LED Backlight, KLS-0021MS
D4	LCD Display, DLC-4960P
	Upper Cover Ass'y
U1	(+) Machine Screw (Bh), 2 x 4-2S, Zn-P
U2	(+) Machine Screw (Ph), 2 x 5-2S, Zn-P
U3	Upper Cover
U4	Bracket (Spk.)
U5	Shield Plate, Cnp3t:0.2
U6	Overlay (Front)
U7	Bushing (Mic), NBR, Blk.
U8	Gasket, Silicon Rubber, Blk.
U9	Key Pad, Silicon Rubber
U10	Speaker Filter
U11	Insulator, Fiber
U12	Speaker
U13	Condensor Mic
U14	Key Board PCB

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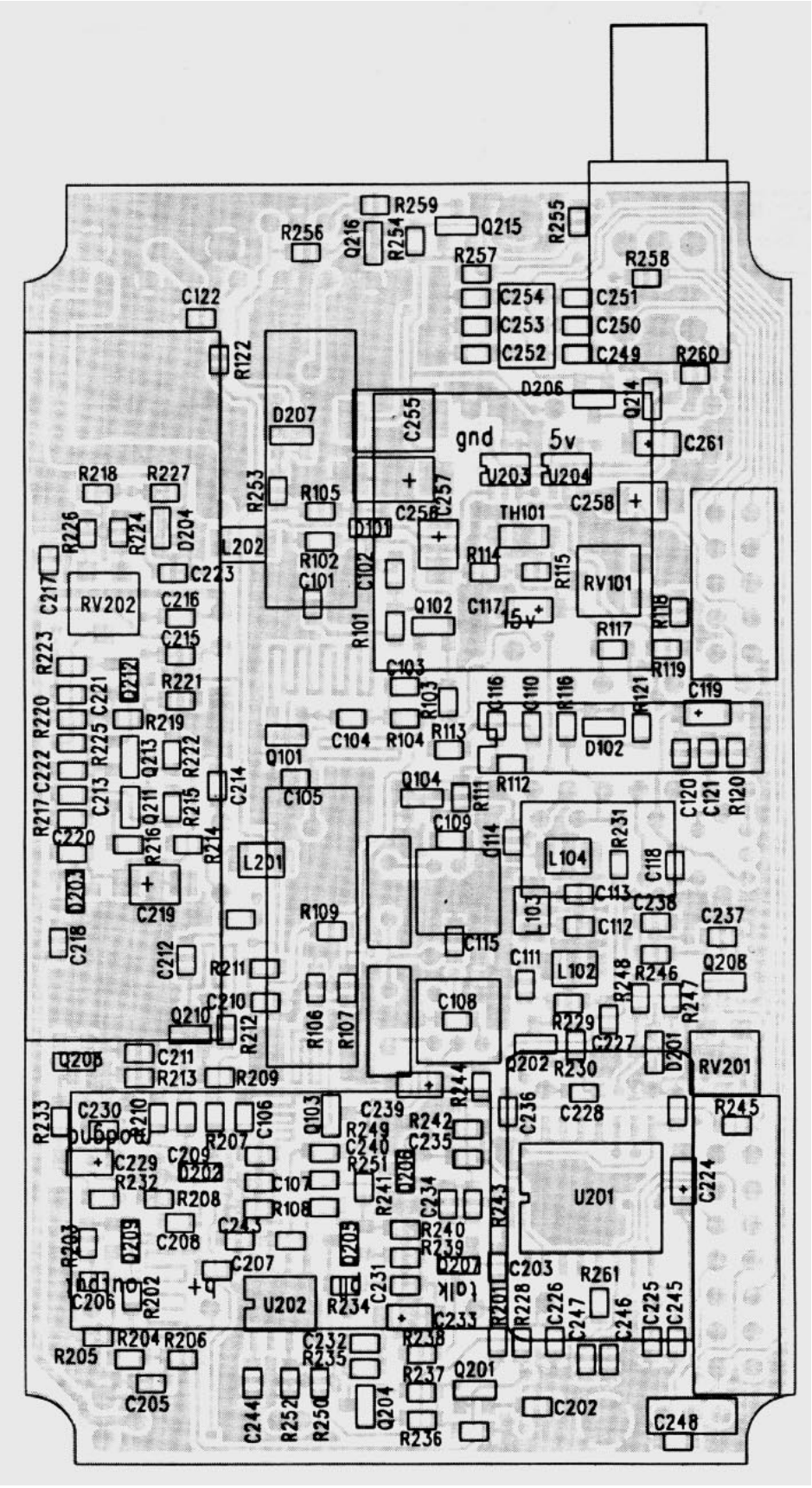
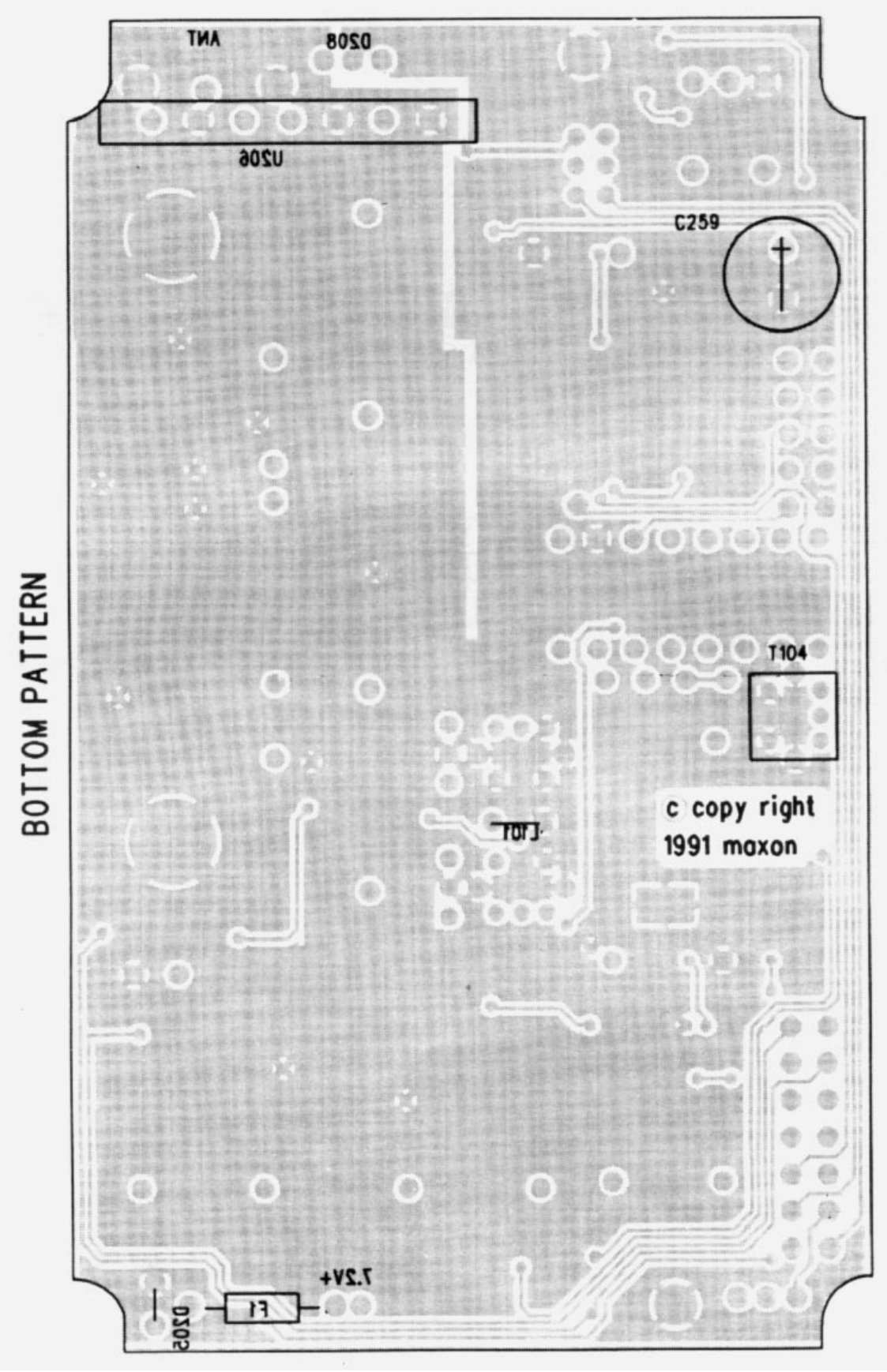
APPENDIX III

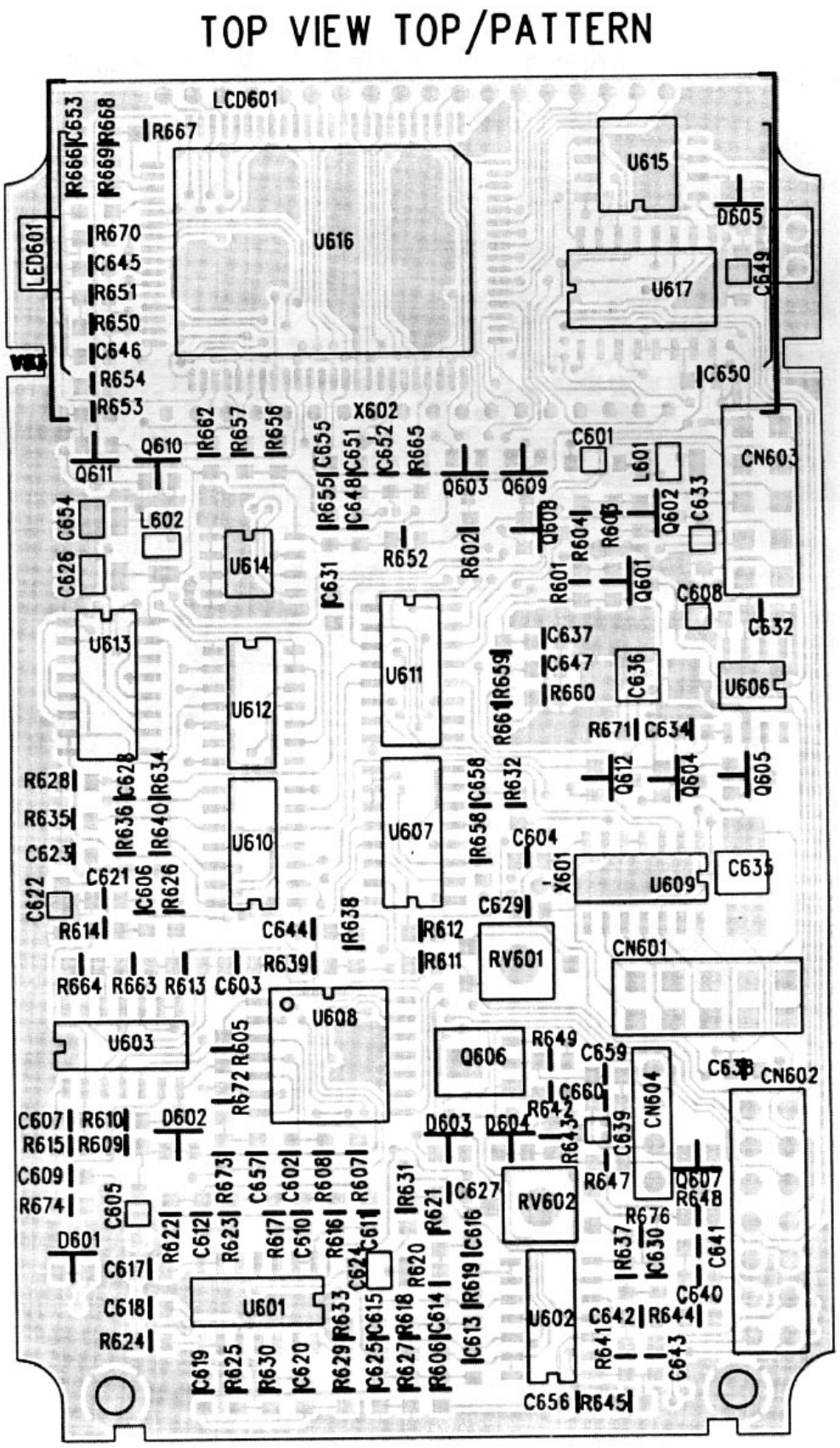
PRINTED CIRCUIT BOARDS



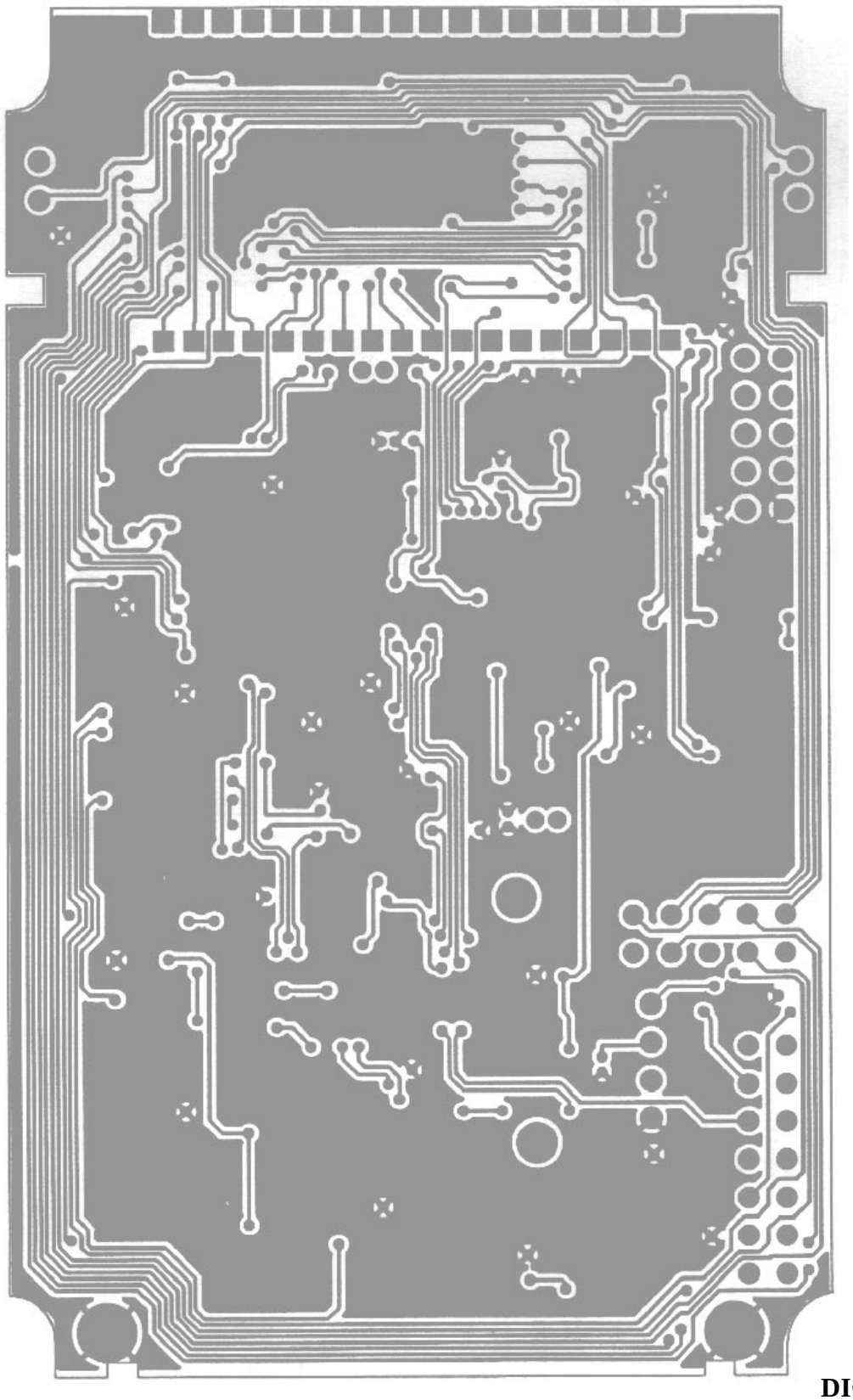
RF BOARD
406141-B
(TOP PATTERN)



RF BOARD
406141-B
(BOTTOM PATTERN)



DIGITAL BOARD
406141-B
(TOP PATTERN)



DIGITAL BOARD
406141-B
(BOTTOM PATTERN)

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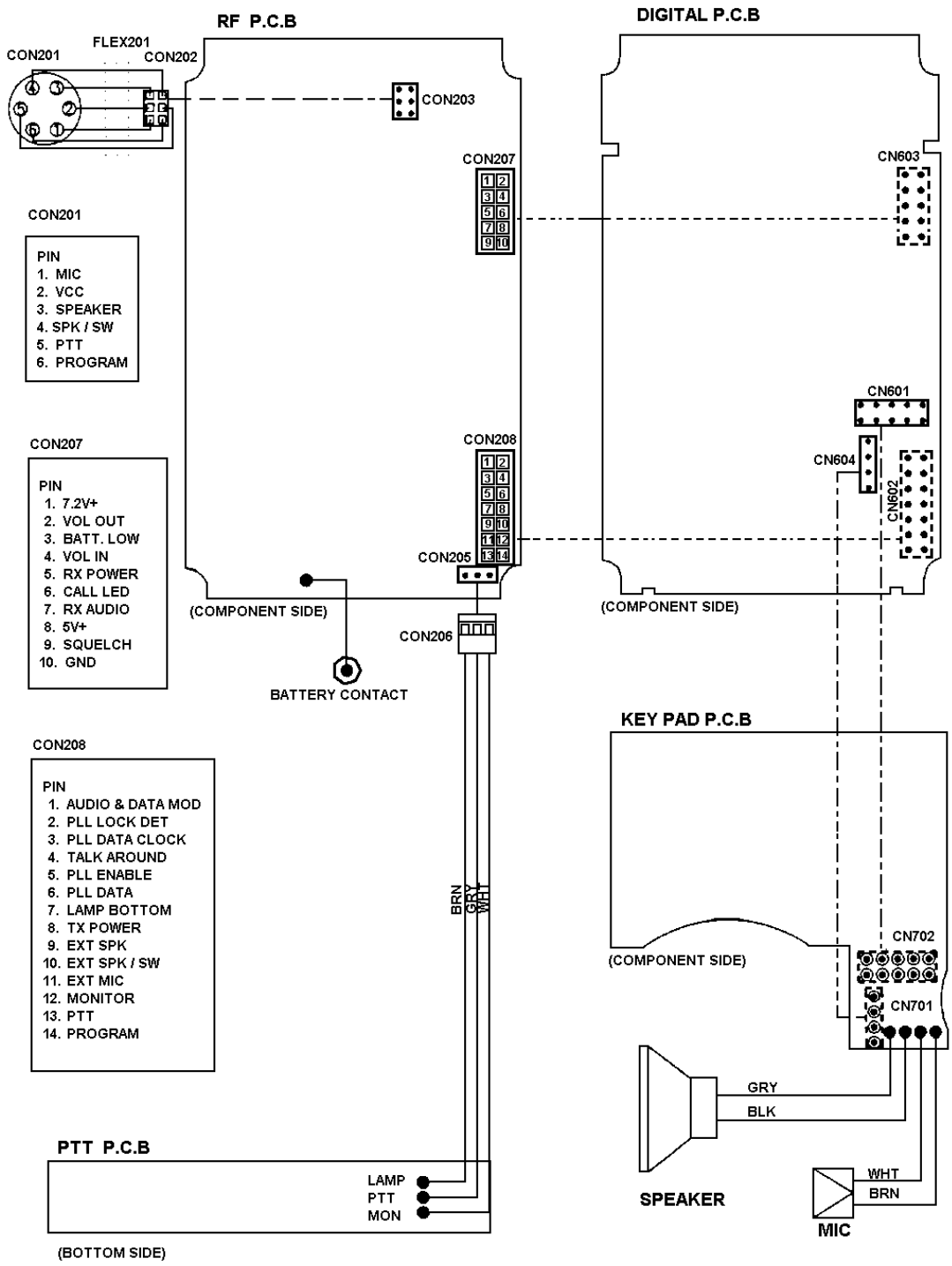
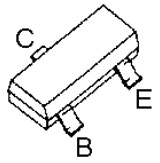
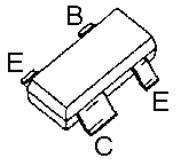
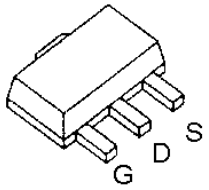
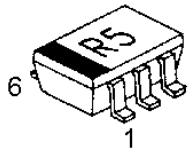
APPENDIX IV

TRANSISTER AND I.C. PINOUT & WIRING DIAGRAM


RF P.C.B
DIGITAL P.C.B
FLEX201
CON201
CON202
CON203
CON207
CN603
CON201
PIN
1. MIC
2. VCC
3. SPEAKER
4. SPK / SW
5. PTT
6. PROGRAM
CN601
CON208
CN604
CN602
CON207
PIN
1. 7.2V+
2. VOL OUT
3. BATT. LOW
4. VOL IN
5. RX POWER
6. CALL LED
7. RX AUDIO
8. 5V+
9. SQUELCH
10. GND
CON205
(COMPONENT SIDE)
(COMPONENT SIDE)
CON206
BATTERY CONTACT
KEY PAD P.C.B
CON208
PIN
1. AUDIO & DATA MOD
2. PLL LOCK DET
3. PLL DATA CLOCK
4. TALK AROUND
5. PLL ENABLE
6. PLL DATA
7. LAMP BOTTOM
8. TX POWER
9. EXT SPK
10. EXT SPK / SW
11. EXT MIC
12. MONITOR
13. PTT
14. PROGRAM
BRN
GRY
WHT
(COMPONENT SIDE)
CN702
CN701
GRY
BLK
WHT
BRN
SPEAKER
MIC
PTT P.C.B
LAMP
PTT
MON
(BOTTOM SIDE)

Transistor & IC Pinout Information

SCHEMATIC REFERENCE NO.	MANUFACTURER'S PART NUMBER	BASE DIAGRAM
Q1	MMBR5719LT1	
Q103	MMBR941LT1	
Q104, Q202	LMMBT9426CLT1	
Q209, Q210, Q303	MMBR951	
Q102, Q204, Q206, Q215, Q216	BC858B	
Q205, Q207, Q208, Q211, Q212, Q213 Q304, Q501, Q502, Q503, Q504, Q607	BC858C	
Q201, Q605	KRA101S	
Q203, Q214, Q301, Q603, Q604 Q608, Q609, Q610, Q611, Q612	KRC104S (ND)	
Q601, Q602	BCX - 18LT1	
Q101	MRF9411LT1	
Q302	MRF5711LT1	
Q606	2SK1579 - TMOS	
U203, U204	TK11450MTR	

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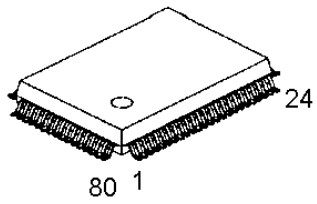
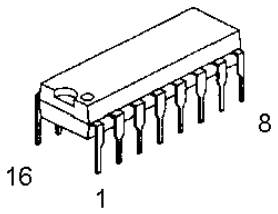
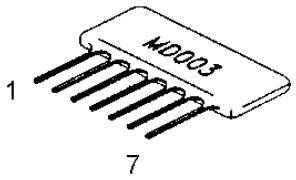
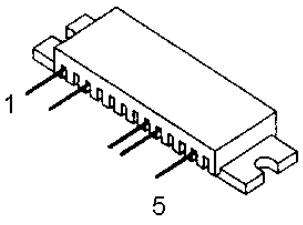
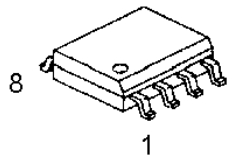
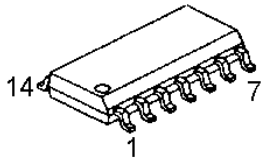
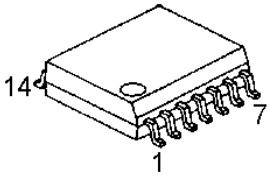
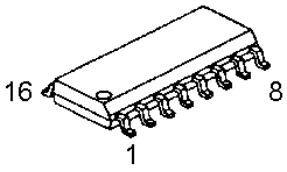
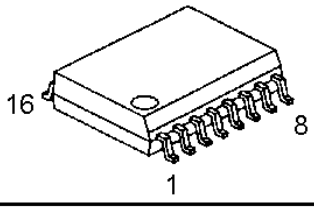
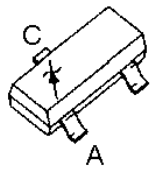
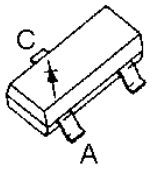
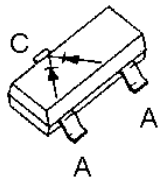
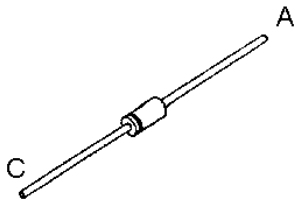
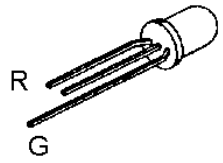
U616	UPD75P316GF	
U101	MC3371P	
U206	MD003(G471710)	
U205	MHW803 - 2	

SCHEMATIC REFERENCE NO.	MANUFACTURER'S PART NUMBER	BASE DIAGRAM
U202	MC12022BD	
U606	LM386M1	
U614	AT24C16N-10SI-2.7	
U615	MB3773FPT	
U601A-D, U602A-D, U603	LM2902M	
U609	KS58015D	
U610	MC140966BDR2	
U612	74HC74F-FLOP DUAL	
U608	MF6CWM-100	
U607	MC14053BD	
U611	MC14094BDR2	
U613	MC74HC76D	
U617	TC74HC592AF	
U201	MC145158DW2	

SCHEMATIC REFERENCE NO.	MANUFACTURER'S PART NUMBER	BASE DIAGRAM
D203	MMBZ5230BLT1	
D501, D603	MMBZ5245BT1	
CR1	MMBV109	
DV301, DV302	MMBV809L	
D204	MMBD101LT1	
D502, D503, D504, D505	MMBD352LT1	
D602	KDS226	
D102, D201, D206, D207, D601, D604, D605	KDS196S	
D202, D301	MC804	
D205	1N4001(1A50V)	
D208	SPR - 39MVW	

APPENDIX V

EXPLODED VIEW & SCHEMATICS

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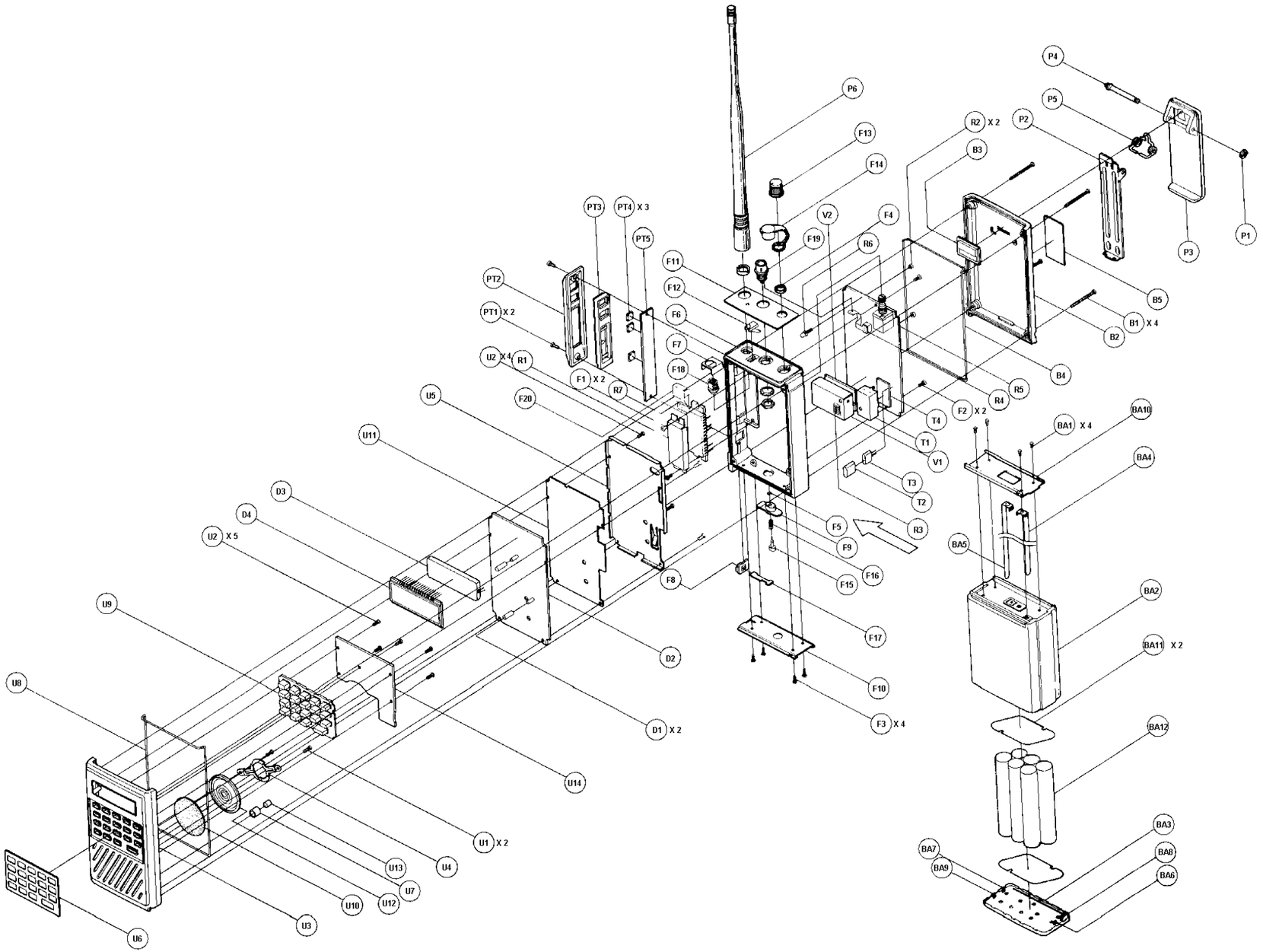
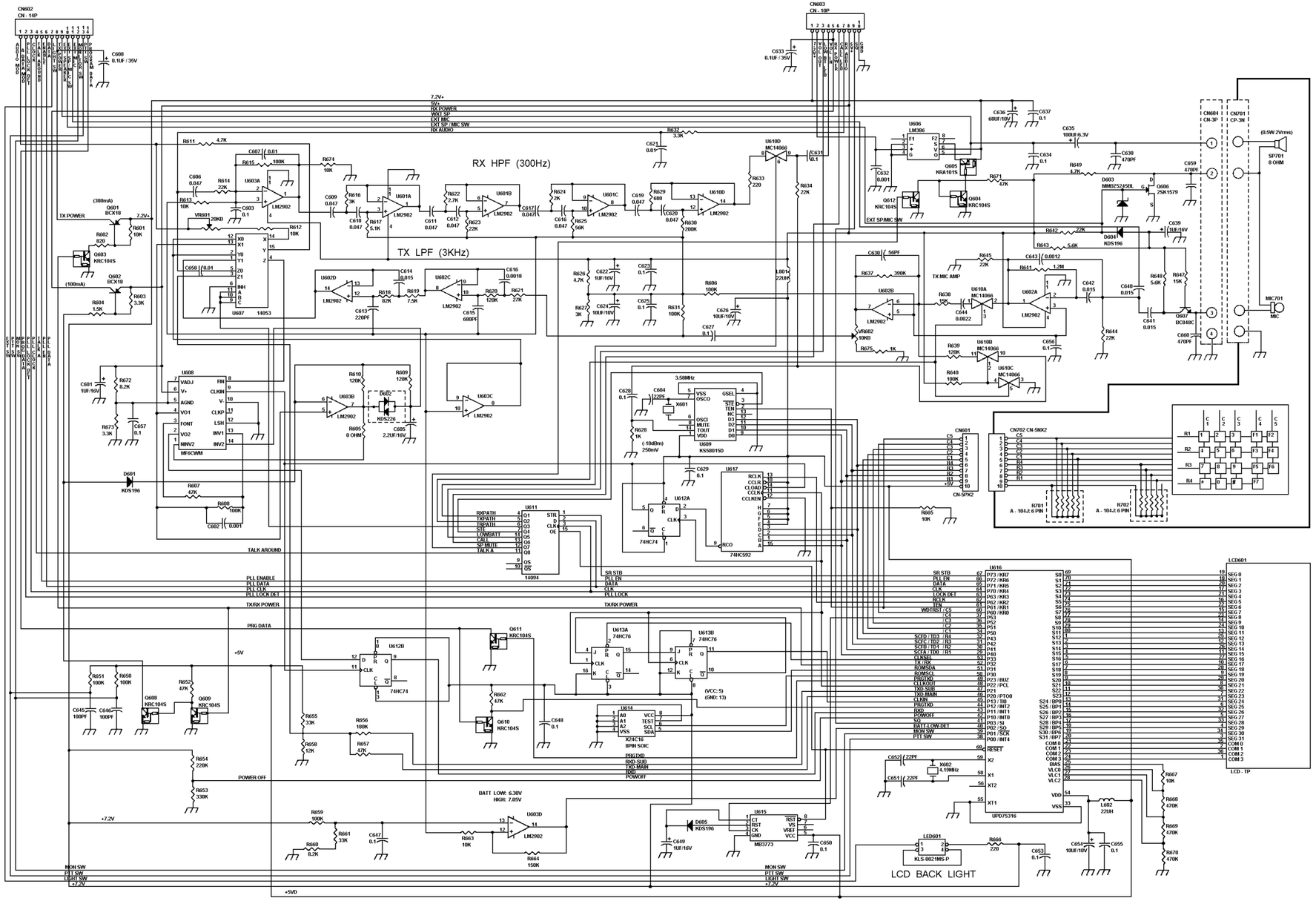
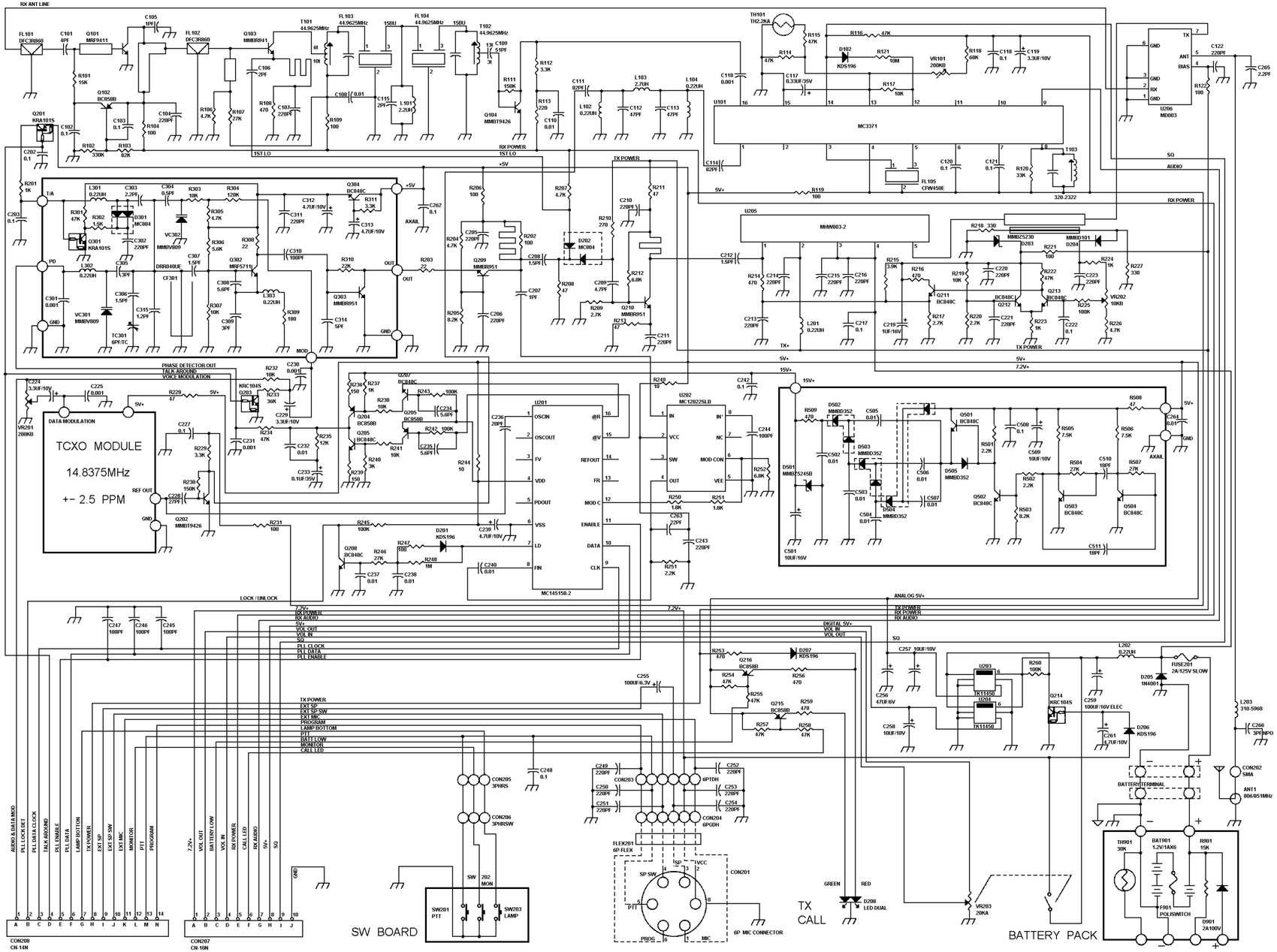


EXPLODED VIEW



DIGITAL BOARD
406141-B



RF BOARD
406142-B

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