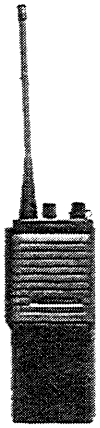
LBI-38860

ERICSSON

Mobile Communications



Monogram Series

MHz PORTABLE RADIO
MODEL MGP 148 - 148-162 MHz
MODEL MGP 160 - 160-174 MHz

Maintenance Manual

TABLE OF CONTENTS

SPECIFICATIONS

SYSTEM

Radio Identification:	FCC F3JSP2550	DOC 287 194 148F
Frequency range	148-174 MHz	
Number of Channels	10 Maximum	
Frequency Splits	148-162, 160 174 MHz	
Channel Spacing	30 kHz	
Batteries	Rechargeable Nickel-Cadmium Battery, 10.8 Vdc nominal 600 mAh MGPA5A or 1200 mAh MGPA5C	
Current Drain (maximum)		
Receive	210 mAh	
Standby	40 mAh (30 mAh battery save)	
Transmit	1.5 Amperes	
Environmental		
Temperature Range	-30°C to +60°C	
Relative Humidity9	0% at 40°C Non-condensing	
Speaker Impedance	8 Ohm	
Microphone Impedance	1.5k Ohm	
Dimensions (in mm)		
Radio	99(H) x 64(W) x 36(D)	
600 mAh Battery	59(H) x 64(W) x 36(D)	
1200 mAh Battery	94(H) x 64(W) x 36(D)	
Weight		
Radio	270 grams	
600 mAh Battery	230 grams	
1200 mAh Battery	300 grams	

TRANSMITTER

Output Power	1W or 5W nominal
Frequency Stability	Unconditional
RF Power Stability	+2 dB - 3 dB of nominal power
FM Hum and Noise	< 40 dB
Operational Bandwidth	8 MHz
Spurious Emissions	
Conducted	-60 dBc
Radiated	-60 dBc
Audio Distortion	< 5%

AF Response	+1, -4.5 dB 300-3000 Hz
Modulation Limiting	5 kHz 300-3000 Hz
Carrier Attack Time	< 100 ms
Microphone Sensitivity	> 90 dB S.P.L.
RECEIVER	
Sensitivity	
12 dB SINAD	< 0.25 μV (Typical)
20 dB	< 0.5 μV
Modulation Acceptance Bandwidth	7.0 kHz
Adjacent Channel Selectivity	-70 dB
Spurious Response Rejection	-70 dB
Squelch blocking	> 5 kHz
Intermodulation Rejection	-70 dB
Audio Power Output	0.5 Watts minimum
Audio Distortion	< 5%
Frequency Response	+2 to -8 dB 1000 Hz reference 6 dB/octave de-emphasized response 300 Hz - 3000 Hz.
Hum and Noise (Unsquelched)	45 dB
Conducted Spurious	-53 dB
Operational Bandwidth	7 MHz

* These specifications are intended primarily for use by the service technician during servicing. Refer to the appropriate Specification Sheet for complete specifications.

DESCRIPTION

The ERICSSON GE MONOGRAM Series Personal radio is small, lightweight, yet ruggedly constructed two way FM radio operating on the 148-174 MHz frequency band. This multichannel radio offers both simplex and semi-duplex operation with a wide range of options and accessories available.

Advanced state-of-the-art technology is used in the design and manufacture of this synthesized radio to provide the most in flexibility, capability, and adaptability to various system configurations. Up to 10 channels are offered with tone and digital Channel Guard programmable on a per channel basis.

OPTIONS AND ACCESSORIES

MGNC3N	Antenna, 148-174 MHz (19B802561P1)
MGAE1V	Speaker/Microphone (344A4209P30)
MGHC5L	Leather Case Assembly (use with 600 mAh battery)
MGHC5M	Leather Case Assembly (use with 1200 mAh battery)
MGPA5B	600 mAh Battery, Nickel-Cadmium battery (344A506P1)
MGPA5C	1200 mAh Battery, Nickel-Cadmium battery (344A506P3)
MGC3HJ	Standard Desk Charger (344A209P20)
MGC3HK	Rapid Multicharger (344A209P21)

PROGRAMMABLE FEATURES

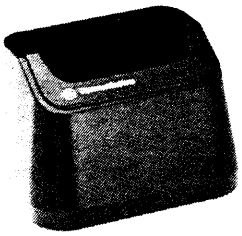
All programmable functions are controlled by the microcontroller. The microcontroller reads specific channel information from an Electronically Erasable Programmable Read Only Memory (EEPROM). Refer to the programming manual provided with the programming adaptor kit for programming instructions.

Except for the time-out-timer, the following features are programmable on a per channel basis:

- Time-out-timer
- Channel transmit frequencies
- Channel receive frequencies
- Channel Guard frequencies - tone or digital
- Transmit only channels
- Receive only channels

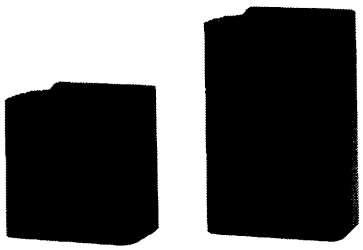
Other programmable features:

- Channel busy lockout
- TX Delay
- Battery Saver
- Marked Idle
- Monitor inhibit



Single Unit, Single
Rate Pedestal Charger

Dual Unit, Dual Rate
"Smart" 1 Hour Desktop Charger
MGCH3K



Slide-on 600 mAh Standard
Capacity Battery
MGPA5B

1200 mAh High Capacity
Battery
MGPA5C

Speaker/Microphone
Has rotating detent clip
for fastening to pocket
or lapel.
MGAE1V

Not Shown

Deluxe All Leather Case
with metal riveted
construction and slide
on metal swivel for use
with standard capacity
battery.
MGHC5L

Deluxe All Leather Case for
use with high capacity battery
MGHC5M

Antenna
MGNC3N-VHF

Antenna
MGNC3P-UHF

PC Programming
TQ 3375

PC Programming Cable
TQ 3376

Figure 1 - Options And Accessories

CTSS OR DCS

Allows users to hear only messages intended for them and blocks out all other communications (unless monitor button is pressed) using a sub-audible tone. DCS operates in a similar manner but uses digitally generated signals.

- CTCSS Non Standard Tone Hi/Low Settings: There are a maximum of two non-standard tone settings allowed with 49.0 Hz being the lowest and 260 Hz being the highest.

TX DELAY

This option is used to eliminate Squelch Tail Delay.

TRANSMIT TIME-OUT-TIMER

The transmit time-out-timer limits the time a user may continuously transmit. When the PTT switch is released another transmission may be initiated.

BUSY CHANNEL LOCKOUT

Busy Channel Lock-Out is used to prevent the radio from being keyed on a channel already in use. If the PTT switch is pressed while someone else is transmitting, as indicated by the Busy LED and/or Call LED being lit, the transmit function is disabled (unless the marked idle is enabled) and an audible alarm will sound. When the BUSY LED is off (no carrier is being received) the transmit function is enabled. This option can be disabled by enabling the Marked Idle feature.

MARKED IDLE

This is a Busy Channel Lock-Out override. With the proper tone present the Lock-Out will be disabled.

POWER SAVE MODE

The Power Save feature extends the useful life of the battery; three options available:

On Time - This is the time the battery save mode is enabled and the receiver is asleep. (Suggested setting - 400 msec)

Off Time - This is the time that the battery save mode is enabled and the receiver is awake. (Suggested setting - 5 seconds)

Delay Time - This is the time it takes to resume the Power Save Mode after the carrier drops out. (Suggested setting - 5 seconds).

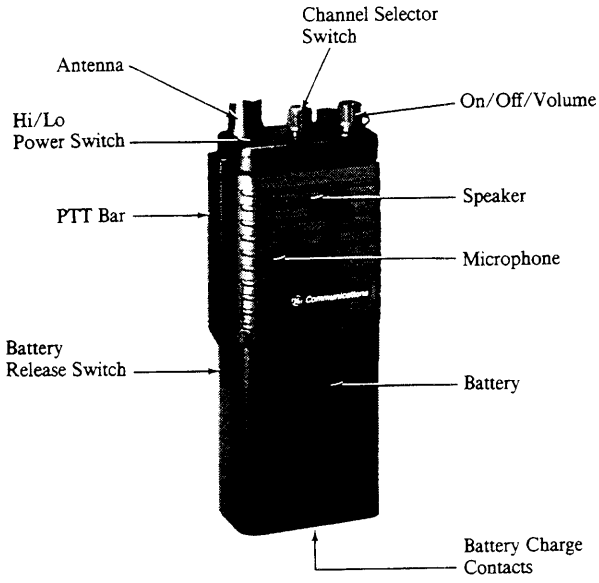
CONTROLS AND INDICATORS

Operating controls, indicators, accessories socket and antenna connections are all located on the top panel. The monitor and PTT buttons are located on the left hand side of the radio chassis. Figure 2 shows the location of the controls and indicators.

The radio battery pack securely latches in place at the bottom of the radio and is locked in position by the battery release switch.

CONTROLS

ANTENNA RECEPTACLE	Attaches the antenna to the radio, 1/4 inch in UNEF socket.
ACCESSORY JACK	Multipurpose jack, used with optional speaker microphone or VOX unit. May also be used for an external 8 ohm speaker or earphone.
ON/OFF/VOLUME	Located on the control panel, it is used to turn the radio on or off and to adjust the listening level.
CHANNEL SELECTOR SWITCH	Rotary switch, used to select one of up to 10 preprogrammed channels.
HI-LO POWER BUTTON	Selects either 1 or 5 watts RF power output.
MONITOR BUTTON	When pressed, it unsquelches the receiver to allow the user to monitor the selected channel.
PTT BAR	Pressing the PTT bar keys the transmitter and activates the radio Channel Guard encoder.



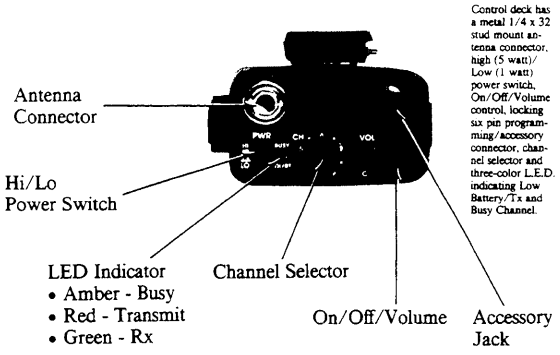


Figure 2 - Controls And Indicators

BATTERY	Slide on battery pack. A 600 mAh (standard) or a 1200 mAh (optional) battery is used to power the radio.
SPEAKER MICROPHONE	Located behind the grille.
BATTERY CHARGE	Charging contacts provided for pedestal slow CONTACTScharger or desktop quick charger.

INDICATORS

BUSY/TX/BTTX/BT:	Red LED- ON when the transmitter is keyed NOTE: The LED dims or goes out when the battery voltage is low.
BUSY:	Amber LED- ON when the selected channel is busy.
	Green LED- ON when a properly encoded signal is received on the selected channel.

ALERT TONES

A series of audible alert tones are sounded to indicate the operating status of the radio. Upon initial power-up, a quick four tone alert indicates the self test of the microprocessor functions has been successfully completed. Single tones are sounded when any of the following conditions exist:

- An attempt to transmit on a channel set for "receive only".
- An attempt to transmit on a channel that is already busy (if the "Busy Channel Lockout option has been programmed for operation).
- Transmitting time exceeds the preprogrammed time allowed by the "Time-Out-Timer (Dealer programmed).

NOTE

In some radios, a VCO out-of-lock indication is given while switching between channels. The out-of-lock indication is indicated by the top panel LED flashing and two short beeps sounded from the speaker. This in no way inhibits or restricts the operation of the radio and lasts for only a very short time.

A solution to this problem is to program all unused channels with a receive frequency. (Although the radio is only 10 channels, it is possible to program up to 16 channels into the radio. All 16 should be programmed. The programmer is capable of doing this.)

OPERATION

RADIO ON/OFF

Each time the radio is powered up, an automatic self-check is executed and, upon satisfactory completion, a quick four tone alert (melody) is sounded.

Turn the radio **ON** by rotating the VOLume control fully clockwise (to the right) until you hear a click and the "Self-Test" alert tone.

Turn the radio **OFF** by rotating the VOLume control fully counterclockwise until you hear a click and feel the switch enter the detente position.

TO RECEIVE MESSAGES

1. Turn the radio ON and set the channel selector switch to the desired channel.
2. Adjust the VOLume control to the desired listening level with the ON/OFF VOLume control. Unsquelch the radio by pressing the monitor switch on the side of the radio. When the radio is unsquelched, adjust the VOLume control to the desired level.

NOTE

When CTCSS is programmed, only calls coded with the radio's assigned code will be heard. In normal operation the speaker is muted until the correct CTCSS code is received. The status indicator will show green, the loudspeaker will open and the call will be heard.

TO TRANSMIT A MESSAGE

NOTES

- When making a call on channels programmed for Channel Guard, only calls with that channels specific tone or code will be heard. In normal operation the speaker will remain quiet until the correct tone or code is received. The status indicator will glow green, the loudspeaker will open and the call will be heard.
- A red transmit indicator (TX/BT BUSY) is on continuously while the PTT bar is pressed, indicating the transmitter is keyed.
- If the TX/BT/BUSY indicator is dimly lit or fades rapidly, it is an indication that the battery should be replaced or recharged.
- When the Busy Channel lock-out function is programmed and the system is busy, the transmitter is disabled. If the PTT button is pressed, an audible alert will sound and the yellow status indicator will blink off and then on.

WARNING

Operation of the transmitter without a proper antenna installed may result in permanent damage to the radio.

1. Before making a call always monitor the channel. The status indicator glows yellow when the channel is busy. If the status indicator glows yellow and you cannot hear who is transmitting because they are using a different DCS or CTCSS tone you may listen to the channel by pressing the Monitor Button.
2. If a message is being received, transmit only after the incoming message has been received.
3. Press and hold the PTT switch, the status indicator glows red to indicate the transmitter is operating.
4. Place the microphone 2.5 cm to 10 cm from the mouth and speak clearly in a normal tone of voice.
5. Release the PTT switch to listen.
6. Turn the radio off by rotating the on/off/VOLume control fully counterclockwise.

CIRCUIT ANALYSIS

The radio consists of two main printed circuit boards: an RF board and a control board. The RF board contains the transmitter and receiver circuits, the synthesizer, automatic power control, and microphone audio circuits. The control board contains the microcontroller and associated digital circuits.

TRANSMITTER

The transmitter consists of the microphone audio circuit, transmitter and harmonic filter, automatic power control, and frequency synthesizer.

Microphone Audio Circuit

The audio signals from the microphone (CON 6/CON 9, connection 3) or the external microphone (through CON 7, connection 1) are amplified, pre-emphasized, and limited by IC404 and associated components. The AF microphone signal is applied to IC404D-13 to produce an amplified and pre-emphasized audio signal. The signal is limited by IC404C and applied through VR402 (and the DCS AF signals from Q409 through VR401 when present) to a low-pass filter (IC404A and IC404B). The Low-pass filter rejects frequencies above 3 kHz (outside the voice spectrum). The filtered signal is applied to the VCO (within the frequency synthesizer circuit) through the analog switch IC402B, CON 1 (connection 15) and flexible printed circuit board PCB1, (connection 14). RV402 is used to adjust voice deviation.

Transmitter And Harmonic Filter

The power amplifier contains transistors Q1-Q4 inductors L3-L9 and capacitors C3 thru C6, C12, C13, and C17. When operating in the transmit mode diode D1 is forward biased, enabling the RF signal to pass to input buffer Q1. The buffered RF signal is further amplified by Q2 and power amplifier driver transistor Q3. C5 couples Q1 to Q2. L3, C6, and L4 are configured to provide filtering with signal matching. The output from Q3 is impedance matched to C12, C13, L6, and C4 and passed to the power amplifier Q4. Diode D3 is reversed biased preventing the TX signal from passing through the receiver stage. The amplified RF signal passes through the

stripline coupler and is fed to a harmonic lowpass filter comprised of L10 and L11, and then to the antenna connector (ANT).

The stripline coupler provides a sample of the RF signal to the automatic power control circuit.

Automatic Power Control

The automatic power control circuit contains the stripline coupler, diode D2 and variable resistor VR1, two comparators IC6A and IC6B and transistors Q6 and Q7. The RF signal present in the coupler is rectified by D2, to produce a DC voltage that is passed to VR1. The DC voltage is also applied to IC6A-3 via VR1. The voltage TX5 V is applied to pin IC6A-2 via a voltage divider. The voltage TX5 is also applied to IC6B-6 via a voltage divider. IC6B determines the RF power level by producing a difference signal The difference signal is passed to Q7 and Q6 to produce a constant power output to the antenna connector, ANT. VR2 is used to adjust the RF power level.

Frequency Synthesizer Circuit

With data received from EEPROM IC408, the frequency synthesizer circuit generates and controls the RF carrier frequency for the transmitter and the receive local oscillator frequency for the receiver. The frequency synthesizer circuit consists of:

- Voltage Controlled Oscillator Module
- Loop Filter
- PLL Frequency Synthesizer
- Prescaler.

Voltage Controlled Oscillator Module

The VCO module contains two VCO's, one for generating transmit carrier frequencies and one for generating receive local oscillator frequencies. The module also includes TX and RX power supply ripple filters. The ripple filters consist of transistors Q301 and Q303. Q301 provides TX5 V (pin-8 and Q303 provides RX5 V (pin 5).

The receiver VCO consists of JFET transistor Q304, L307, and varactor VD302 which are configured as a Colpits oscillator. VD302 produces a change in frequency with a change in DC voltage and is controlled by the phase detector signal (pin 2) present at the anode. The local oscillator signal at the drain of Q304 is applied to pin 7 of the module, when diode D1 is reversed biased and D7 is forward biased. L307 is used for PLL alignment.

The transmitter VCO consists of JFET Q302, L302 and varactor VD301 and is configured as a Colpits oscillator. The audio signal at flexible PCB-1 pin 14 is applied to the anode of VD301 via pin 3 of the module. The control voltage from the loop filter is applied to the cathode of VD302 through pin 2. The TX RF modulated signal produced at the drain of Q304 (module pin 7) is passed to the power amplifier and harmonic filter through buffer amplifier Q1, when diode D1 is forward biased and diode D7 is reversed biased. L302 is used for PLL alignment.

Loop Filter

Transistors Q101 and Q102, resistors R101-R106 and capacitors C101-C107 form the loop filter. The phase detector from of IC1-6 is filtered to remove any reference frequency harmonics and then applied to the VCO module pin 2.

PLL Frequency Synthesizer

PLL frequency synthesizer IC1 contains an oscillator for the reference crystal, a reference divider, a programmable divider, a phase/frequency comparator, an out-of-lock detector and a prescaler controller.

Reference oscillator IC1 along with a 10.25 or 12.8 MHz Crystal X1, varactor diode VD1, and thermistors TH1, TH2 and TH3 produce a temperature compensated 10.25 or 12.8 MHz reference signal at IC1-18 respectively.

Programmable divider IC1 contains two dividers, a data programmable divider and a hardwired programmable reference divider. Pins 1, 2 and 20 are connected to +ve to allow it to divide by 2048. Serial frequency data (DATA) is received by the data programmable divider at IC1-12 from IC409-20 (the microcontroller) through flexible printed circuit board PCB1-connection 10 and CON 1 connection 11. The prescaler divided output frequency at IC1-10 is further divided by the programmable divider. The 10.25 or 12.8 MHz frequency at pin 18 is the reference divider to produce a reference frequency of 5 or 6.25 kHz respectively. The programmable divided frequency (F_v) and the reference frequency (F_r) are fed to the phase detector.

The phase detector (pin 6) produces negative pulses when $F_v < F_r$ positive pulses when $F_v > F_r$. When $F_v = F_r$ and the phase is the same, the phase detector presents a high impedance at pin 6. The signal at pin 6 is applied to the VCO through the loop filter.

The out-of-lock detector produces a high logic level when F_r and F_v are in phase and frequency, or low logic level pulses when the loop is out-of-lock at IC1-9. The signals at IC1-9 are buffered by Q105 and then integrated by R116 and C124. The product of the integrating circuit is fed to flexible PCB 1, connection 8.

The prescaler controller through pin 8 sets the prescaler to divide by 64 or 65.

Dual Modulus Prescaler

Dual modulus prescaler IC2 divides the VCO frequency by 64 or 65 with signals received from the PLL frequency synthesizer. A low logic level received at IC2-1 will divide the VCO frequency at pin 5 by 64. A high logic level received at IC2-1 will divide the VCO frequency at pin 5 by 65. The divided VCO frequency is passed to the PLL frequency synthesizer through pins 2 and 3.

RECEIVER

The Receiver uses dual conversion superheterodyning techniques and consists of:

- RF Amplifier
- First Mixer and First IF Amplifier
- Second Mixer, Second IF Amplifier and FM Detector
- Receiver Audio Circuit
- Mute (Squelch) Circuit

RF Amplifier

The receiver RF amplifier contains coils T1-T4 and MOSFET transistor Q11. Coils T1-T4 are configured as 2-pole bandpass filters. The RF signal passes through tuned circuit T1, T2, RF amplifier Q11 and bandpass filter T3, T4, enabling the RF signal at the operating frequency to pass to the first mixer.

First Mixer And First IF Amplifier

FET Q9, transistors Q10, and Q106, crystal filter XF1, and coils T5-T7 form the First Mixer and First IF Amplifier. The VCO local oscillator signal is buffered by Q9 and filtered by T5 and T6. Q10 produces a difference frequency of 21.4 MHz at the drain connection, from the filtered RF signal at the gate connection and the filtered VCO local oscillator signal at the source connection. The 21.4 MHz difference frequency is filtered by 2-pole crystal filter XF1. Tuned circuit T7 and associated components provide matching of the crystal filter to insure good passband response and selectivity. The IF signal is amplified by Q106 and passed to the second mixer, second IF, and FM detector.

Second Mixer, Second IF, And FM Detector

A single conversion FM receiver integrated chip, IC3, contains the second mixer, second IF, and FM detector functions. The second local oscillator frequency is determined by the crystal X2 connected to IC3-1. The IF signal is received at IC3-16 through R117 and coupling capacitor C126. The second IF frequency of 455 kHz is produced when the 1st IF frequency is applied to the mixer through pin 6. The output of the second mixer through pin 3 is applied to a 455 kHz bandpass filter, CF1. The output of CF1 is passed to a high gain IF amplifier (limiter) in IC3-5. The amplified signal is coupled to the adjustable quadrature detector T8. Detected audio is present at IC3-9 and applied to the receiver audio circuit and the mute (squelch) circuit.

Receiver Audio Circuit

The receiver audio circuit consists of a low pass filter and an audio amplifier on the RX/TX printed circuit board, and a high pass filter and de-emphasis circuit on the control printed circuit board.

The low pass filter consists of L21, C138 and R127. Audio signals from IC3-9 are filtered by the low-pass filter to remove any components of the 455 kHz IF signal. The filtered signal at flexible PCB 1, connection 14 is passed to the high pass filter on the control printed circuit board through flexible PCB 1 connection 15.

The high pass filter is an 8-pole active filter consisting of IC410 and associated components. It removes the Digital and Tone Channel Guard signals from the recovered audio signal. De-emphasis is provided by R451 and C471. The de-emphasized audio signal at CON 2, connection 15 is fed to the audio amplifier on the RX/TX printed circuit board through PCB 2, connection 13.

The audio amplifier consists of IC4. The audio signal at flexible printed circuit board PCB 2, connection 12 is passed to IC4-3 through variable resistor VR3 (located on the front panel). The gain of the amplifier is set by R124 and C145. The amplified audio signal at IC4-5 is applied to the internal speaker by flexible printed circuit board PCB 2, connection 9, CON 9 (connection 1) and CON 2 (connection 10). The external speaker connection is through the 6-way connector CON 7 (socket 3).

Mute (Squelch) Circuit

The squelch circuit switches off the audio power amplifier in the absence of audio signals. It is comprised of a 50 kHz pass band filter, squelch control VR2 and a noise detector circuit.

The 50 kHz Band Pass Filter is formed by L22, L23, C135, C136 and C137. The audio signal from IC3-9 is filtered by the 50 kHz bandpass filter. The noise in the IF pass band is accepted; frequencies in the voice frequency band are rejected. Any noise present at the output of the filter is applied to the noise detect circuit through VR2. VR2 is used to adjust the squelch sensitivity.

The noise detect circuit (on squelch board) in conjunction with IC3 consists of transistors Q201 and Q202, thermistor TH201 and diode D201. Any noise signal present is applied to pin 2 of the SQ board from IC3-11. The signal is amplified by Q202, rectified by D201 then buffered by Q201. The buffered signal at pin 1 of the SQ board is applied to the squelch trigger of IC3-12 through resistor R201. The squelch trigger output (IC3-13) is applied to the microcontroller on the control board through connection 1 on the flexible PCB 1. When the noise present at IC3-12 exceeds 0.7 V, the squelch trigger output is 0 V (logic 0), muting the receiver audio circuit. When no noise is present, the voltage at IC3-12 is less than 0.7 V and IC3-13 is at 5V (logic 1), unmuting the receiver audio circuit. Resistor R119 is used to provide hysteresis of 3 to 6 dB.

MICROCONTROLLER

Microcontroller, IC409, is a Zilog based Z86C10 with 4k-byte ROM and 128k-byte RAM. It has a clock frequency of 11.1552 MHz derived from crystal X401, connected between pins 2 and 3. The microcontroller, in conjunction with control signals from the control switches on the top panel, controls the frequency synthesizer circuit from data stored in the EEPROM, the control and indicator circuit, the DCS/CTCSS Channel Guard circuit, and the power save circuit. Table 1 identifies the microcontroller interface signals.

Table 1 - Microcontroller Signal Descriptions

SIGNAL NAME	ENABLE STATE	DESCRIPTION/FUNCTION
BATT	L	BATTERY LOW DETECTOR
MON	L	MONITOR SWITCH DETECTOR
PTT	L	PTT SWITCH DETECTOR
CALL	H	CALL DETECTOR
SQ	L	SQUELCH DETECTOR
L/D	H	LOCK DETECTOR
TXLED	H	RED LED CONTROLLER
BUSY LED	H	GREEN LED CONTROLLER
386 EN	H	386 MUTE CONTROLLER
TXEN	L	TX ENABLE CONTROLLER
P/S	H	POWER SAVING CONTROLLER
PLL ENH	H	PLL SELECTOR (MC 145156)
93C46	H	EEPROM SELECTOR (93C46)
X-SWEN	H	X-SWEN SELECTOR (MC 142100)
A	DATA	EEPROM CLK/X-SW A/TONE A/CH SW A(1)
B	DATA	X-SWB/TONE B/CHANNEL SW B(2)

Table 1 - Microcontroller Signal Descriptions (Cont.)

SIGNAL NAME	ENABLE STATE	DESCRIPTION/FUNCTION
D1	DATA	EEPROM D1/X-SW D/CH SW C(4)/PLL CLOCK
C	DATA	X-SWC/TONE C/CH SW D(8)
DO	DATA	EEPROM DO/X-SW DATA/PLL DATA
CALLDET	INTERUPT	CALL DETECTOR INTERRUPT
I/O EN	L	I/O CONTROL SELECTOR (74HC368)
MF6CLK	CLK	FILTERING CLOCK GENERATOR (MF 6-100)

Receive And Transmit Switching Circuit

The receive and transmit switching circuit in conjunction with microcontroller IC409 consists of transistors Q12, Q104, Q401, diode D5 and IC402. They are configured so that when a switch in the receiver circuit is closed the transmitter circuit is off.

When the PTT switch is on flexible PCB 3 is pressed, the PTT input at IC409-16 is held low, causing transmit enable pin (TX EN) of IC409 to go low (0 V) and power save pin (P/S) to go high (+5V). TX EN is connected to Q401, IC402 on the control printed circuit board, and TX switching transistor Q12 and D5 on the RF printed circuit board.

Analog switch IC402A is disabled and Q401 is forward biased, applying +5V to IC404 and analog switch IC402B. This enables the microphone audio circuit. The transmit enable signal is passed to Q12 through CON 1, connection 7 and flexible PCB 1, connection 6.

The transmit enable signal forward biases Q12, switching the +5V output of IC5-3 to the transmitter driver stage and harmonic filter at the junction of C25 (+) and R4.

CTCSS/DCS Tone Encode And Decode Circuits

The CTCSS/DCS encode and decode circuits, in conjunction with IC409, comprise an addressable 4 x 4 cross point switch (IC406) and a 6th order switched capacitor lowpass filter IC407). IC407 has two internal general purpose op-amps. When programmed the circuit is used to control the audio muting function of the radio. Table 2 details the 4 x 4 cross point switch input/output descriptions. The cross point switching is detailed in Table 3.

CTCSS/DCS Decoding Circuit. When CTCSS/DCS (Channel Guard) decoding circuit, IC406, is enabled, CTCSS/DCS signals present at CON 2, connection 15 are passed to IC407-8 (FIL IN) through R4 (pin 11), C3 (IC406-12) and C436. The clock frequency is used to set the cut-off frequency to filter out the Channel Guard tones and codes. During the digital decoding operation the filtered tone frequency at IC407-3 is passed to the input of an internal amplifier through pin 13. During the tone decoding operation the filtered tone frequency present at IC407-3 is passed to the CTCSS filter through coupling capcitor C505 to IC407-13. The output of the internal amplifier (pin 2) is fed to inverter input pin 12 of IC411. The inverted output of IC411-11 is applied to the CALL and the CALL DETECT pin (pin 26) of the microcontroller. The signal is filtered and matched with a preprogrammed frequency and if successful the TX LED and BUSY LED output lines are set at +V. The green LED is then lit on the front panel. The receiver audio circuit is also enabled. For Digital Channel Guard (DCS) R2 of IC406 and C4 are added for low pass filtering improvement.

CTCSS/DCS Tone Encoding Circuit - When operating in the TX mode, the tone squelch digital signal is generated and produced as a 3-bit parallel word at pins 18 (A), 19 (B) and 21 (C) of the microcontroller. The 3-bit digital signal is converted to an analog signal by resistors R421-423. RV403 is used to adjust signal deviation. The analog signal is passed to digital filter IC407-8 through 4 x 4 cross switch IC406-10 and 14. The filtered output at IC407-3 is connected to IC406-14 and fed to pin 1 (CTCSS) and pin 15 (DCS). The CTCSS signal at IC406-1 is passed to the VCO module through R46 and Flexi PCB 1, connection 16. The DCS signal at IC406-15 is passed to Q409, RV401 and IC404 A and B. RV401 is used to adjust DCS distortion. IC404 A and B form a low pass filter. The output is passed to the VCO module through Flexi PCB 1, connector 15.

Table 2 - Switch Input And Output Description

NAME	PIN NO	Input/Output	DESCRIPTIONS
R1	15	Output	To Modulation Circuits
R2	14	Input	From Filter Output
C3	10	Input	From Tone Generator
C4	11	Input	From Signal Receive Circuits
C1	9	Output	To Warning Tone Indication Circuits
C2	1	Output	To TCXO
C3	12	Output	To Filter Input
C4	13	Output	To DCS (or CTCSS Tone Coupling)

Table 3 - 4 X 4 Cross Point Switching

FUNCTION	MODE	I/O
CTCSS	Receive Transmit	R4.C3 R1.C2 R3.C3 R2.C2
DCS	Receive Transmit	R4.C3 R2.C4 R1.C2 R2.C2 R3.C3
WARNING		R3.C1
SELF CHECK		R3.C3

Control And Indicator Circuits

External PTT Control Circuit - When the external microphone is connected at the adaptor socket (pin 4) on the RF printed circuit board, the CONT control line on the control printed circuit board is at logic 0, switching IC401A off to disable the internal microphone. The CONT control line is also connected to the junction of R416 and C449 at IC405. IC405A in conjunction with R416 form a voltage comparator. When PTT is pressed, IC405A-2 falls below 2V and IC405A-1 goes high (+5V), turning on Q402. The PTT control line is pulled low, enabling the radio transmitter through D401.

Channel Select - One of 10 channels may be selected using the CHannel switch (CH) on the top panel. The channel switch encodes the channel number selected into a 4-bit binary word. Periodically the microcontroller enables IC411-1. The 4-bit binary word from the RF printed circuit board is passed through the 4-bit inverting buffer to the microcontroller data I/O lines A, B, C, and D through the control printed circuit board, the flexible PCB2 and then to IC411 for inversion. The inverted binary word is then decoded by the microcontroller, enabling the appropriate RX or TX frequency and associated data to be selected from the EEPROM.

Data present at the I/O lines is compared with previously sampled data. If a difference in data is detected, the microcontroller enables EEPROM IC408 and selects the RX or TX frequency data for the channel selected.

Battery Low Indicator - Should the battery voltage drop below 8.86 Vdc, IC405 B (voltage comparator) turns on Q403. The microcontroller then enables the red LED indicator and at the same time disables the transmitter. The battery must be replaced or recharged before continuing operation.

I/O Control Circuit - IC403 and IC411 are input/output buffers to isolate noise and are enabled by the microcontroller. IC411 is a tri-state 2-bit and 4-bit inverting buffer. The 4-bit buffer is enabled when pin 1 is at logic 0 (0 V). The 2-bit output is enabled when pin 15 is at logic 0 (0 V).

IC403 is a non-inverting TTL to CMOS level shifter and output buffer supplying data to the RX/TX printed circuit board.

EEPROM

RX/TX channels, Channel Guard, Tone and Digital, (CTCSS, DCS) as well as other data from the programmer are stored in the EEPROM. The data stored is retained during power outages and when the power is off. This is a non-volatile memory. The EEPROM may have information re-programmed or erased. IC408 is an EEPROM with 1024 bit (8 x 128) capacity. Data are written and read serially.

SERVICE SECTION

The Service Section contains information designed to assist you in rapidly identifying any problem areas and in tuning and adjusting the radio for optimum performance. A diagnostic section is included to help you, through the use of indicators and tones, to learn the current operating status of the radio.

CARE OF EQUIPMENT

1. Keep the exterior of the radio clean. Use a soft damp cloth.
2. To ensure efficient power transfer from battery to radio, wipe the contacts of the battery and radio to remove dirt or grease. Use a soft dry cloth.
3. When the accessories connector is not in use, cover the connector with the protective dust cap to prevent the build up of dust or water particles.

CAUTION

Do not carry or hold the radio by the antenna.

Do not use chemical cleaners, aerosol sprays or petroleum based products. They may damage the radio housing.

RADIO IDENTIFICATION

The portable radio operates in one of two frequency splits over the frequency range of 148-174 MHz. Radios operating in either split are identified below.

FREQ. SPLIT	MODEL
148-162	344A4209P2
160-174	344A4209P3

DIAGNOSTIC ANALYSIS

An analysis of the status indicators and audible tones are provided in Table 4.

Table 4 - Status Indicators And Audible Tones

STATUS	DESCRIPTION	LED COLOR	AUDIBLE TONE
NORMAL	Power on ready		Melody
	Busy	Yellow	N/A
	Correct Call	Green	N/A
	Transmit	Red	N/A
	Busy Lock	Yellow, Flashing	Single Tone
WARNING		Time Out Timer	Single Tone
	Battery Low	Red, Flashing	N/A
ERROR	EEPROM Error	Red, Flashing	Single Tone Continuous
	PLL Error	Red, Flashing	Double Tone Continuous
	Filtering Error	Red, Flashing	Triple Tone Continuous

NOTE

In some radios, a VCO out-of-lock indication is given while switching between channels. The out-of-lock indication is indicated by the top panel LED flashing and two short beeps sounded from the speaker. This in no way inhibits or restricts the operation of the radio and lasts for only a very short time.

A solution to this problem is to program all unused channels with a receive frequency. (Although the radio is only 10 channels, it is possible to program up to 16 channels into the radio. All 16 should be programmed. The programmer is capable of doing this.)

ELECTROSTATIC DEVICES

CAUTION

CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, the service person should discharge himself by touching the case of a bench test instrument that is equipped with a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering iron being used should also have a 3-prong power cord connected to an outlet with a known good earth ground. A battery operated soldering iron may be used in place of a standard soldering iron.

REMOVAL AND REPLACEMENT

A high quality molded antenna is supplied to match the operating frequency band of each radio. Should an antenna of the wrong frequency band be installed, the performance of the radio will be severely limited.

ANTENNA REMOVAL AND RE-INSTALLATION (See Figure 3)

1. To remove the antenna, turn the antenna counterclockwise until removed.

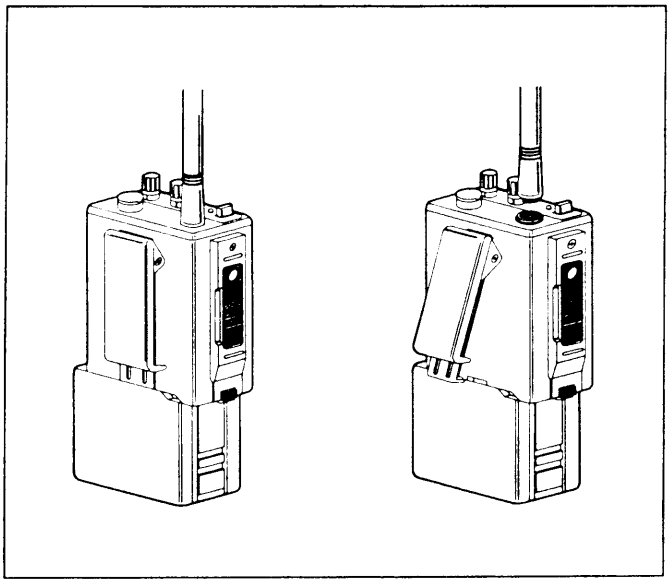


Figure 3 - Antenna, Battery, and Belt Clip Installation

2. To install the antenna, turn the antenna clockwise until the antenna is firmly seated. Do not overtighten.

BATTERY REMOVAL AND INSTALLATION Figure 3)

To remove the battery:

1. Holding the radio chassis in one hand, press and hold the battery release catch.
2. Using the other hand, slide the battery away from the battery release catch and off the battery guide rail.

To replace the battery:

1. With the slides of the battery positioned in line with the radio battery rail guides, slide the battery into position until a click is heard.

BELT CLIP REMOVAL AND INSTALLATION (See Figure 3)

1. With the battery removed, install the top of the belt clip bracket into the top recess on the back of the radio.
2. Push the bottom of the belt clip bracket into the bottom recess.
3. Install the Battery.

4. To remove the belt clip reverse the above procedure.

BEZEL REMOVAL AND REPLACEMENT

To remove the bezel:

1. Remove the battery.
2. Using the Phillips head screw driver (No. O) remove the two screws located on the battery rail guide.
3. Holding the bezel firmly with thumb and forefinger, gently apply pressure towards the top panel and lift the bezel from the radio chassis.
4. Unplug the speaker and microphone lead from the connector on the control printed circuit board.

To replace the bezel:

1. Ensure all gasket rubbers are in position and not broken.
2. Position the lip at the top end of the bezel into the gasket recess of the top panel and press the bezel firmly into position.
3. Using a phillips head screw driver (No. 0) replace the two screws located on the battery rail guide.

MICROPHONE AND SPEAKER REMOVAL AND REPLACEMENT

To remove the microphone and speaker:

1. Remove the bezel.
2. Unscrew the two speaker mounting screws.
3. Gently pry the rubber microphone holder from the microphone slot on the bezel.
4. Remove the speaker and microphone.

To replace the speaker and microphone, reverse the procedures given in steps 2 to 4.

CONTROL PRINTED CIRCUIT BOARD REMOVAL AND REPLACEMENT

To remove the printed circuit board:

1. Remove the bezel.
2. Disconnect the three flexible PCB's from the appropriate connectors.
3. Remove the three PCB mounting screws.
4. Gently lift the control board from the radio chassis.

To replace the PCB, reverse the procedures given in steps 2 to 4.

PCB SHIELD PLATE REMOVAL AND REPLACEMENT

1. Remove the bezel and the control PCB.
2. Using a small Phillips head screw driver remove the screw located on the square black insulating pad and the screw fixing the PCB shield to the top panel PCB.
3. Gently lift the PCB shield from the radio chassis.
4. To replace and fit a PCB shield plate, reverse the procedures given in steps 2 and 3 above.

RF BOARD REMOVAL AND REPLACEMENT

1. Remove the bezel, control board, and PCB shield plate.
2. Remove the four hexagonal mounting pillars.
3. Unsolder the lead of the fuse connected to the positive terminal of the battery connector.
4. Locate and remove the three TX transistor heatsink securing screws inside the radio chassis.
5. On the outside of the radio chassis remove the securing screw by the monitor and PTT switches and the securing screw on the opposite side.
6. Holding the top panel gently pull the radio chassis away from the top panel.

To replace the RF board, reverse the procedures given in steps 2 to 6.

DAUGHTER BOARD REMOVAL AND REPLACEMENT

The daughter boards are small printed circuit boards that are soldered onto the main printed circuit boards. To remove the control or TX/RX daughter boards proceed as follows:

1. Remove the control or RF board as required.
2. Unsolder the daughter board on the solder side of the appropriate printed circuit board.

To replace a daughter board:

1. Ensure that the control or RF printed circuit board is mechanically clean.
2. Insert the daughter board in the required position on the control or RF board and be sure that it is properly seated.
3. Solder the daughter board into position.

CAUTION

To avoid damage to the main PCB soldering must be accomplished quickly.

SMD COMPONENT REMOVAL AND REPLACEMENT

When removing and replacing the SMD components follow the procedure given below using a soldering iron and a solder sucker.

Removing SMD Components

1. Unsolder the component by heating one pad and using a solder sucker to remove the solder. Then apply heat to the other pad and lift the component from the board.

Replacing SMD Components

With the PCB appropriately held in the best position for repair:

1. Ensure that all excess solder and old glue is removed from the board and the pads on the printed circuit board and component solder pads are mechanically clean.
2. Centrally locate the component between the printed circuit board pads.
3. Using the soldering iron apply sufficient heat to the SMD component pads and the corresponding printed circuit board pads to set the component in position.

CAUTION

Do not allow the soldering iron tip to come in contact with the body of the replacement SMD component.

Avoid prolonged application of heat to the pads of the replacement SMD component. Damage to the component may result.

Do not use SMD components that do not accept solder properly. They may not function as required or the working life of the component may be reduced due to chemical contamination.

PERFORMANCE TEST AND ALIGNMENT

TEST EQUIPMENT REQUIRED

Either of the following test equipment lists may be used for test and alignment.

DISCRETE TEST EQUIPMENT

1. Volt, Ohm and Amp Meter, AVO 8
2. Power Meter, Bird 43
3. Power Supply, Farnell LS30-10
4. Oscilloscope, 20 MHz dual beam (HAMEG HM203_5)
5. Frequency Counter, Farnell 600 MHz
6. AF Signal Generator
7. RF Signal Generator, Marconi 2018A
8. Sinadder
9. Modulation Meter

10. Power Meter
11. Spectrum Analyzer (optional)
12. Coupler
13. 1/4 UNEF to BNC Adaptor, Part No. 4207999

TEST SET

1. Test Set, Marconi TF 2955
2. Volt Ohm and Amp Meter, AVO 8
3. Power Supply, Farnell LS30-10

TEST EQUIPMENT SETUP

Refer to Figure 4, Discrete List or Figure 5, Test Set.

Prerequisites

1. Connect Power supply as shown with the positive lead of the power supply connected to the 10.8 V terminal and the negative lead to the radio chassis.
2. Connect the audio and PTT connections to the 6-pin accessory socket on the top panel as indicated below.

Pin 1 -Transmitter audio microphone load, 600 ohm impedance

2 -Not used

3 -Receiver audio speaker load, 8 ohm impedance

4,6 -Ground

5 -PTT

3. Set the modulation level of the signal generator for 3.0 kHz deviation.

EEPROM Program Verification

Be sure the EEPROM has been programmed to customer specifications, otherwise use a test EEPROM programmed with the low, center and high RX/TX frequencies for the split being used prior to aligning the radio.

When Channel Guard checks are required use the CG frequencies listed below for test operation.

Lowest RX/TX frequency channel 67.0 Hz CTCSS

Middle RX/TX frequency channel DCS Code 072

Highest RX/TX frequency channel 250.3 Hz CTCSS

Channel Guard tones and codes are listed in Tables 5 and 6.

Table 5 - Standard CTCSS Tones

No.	Freq. (Hz)	No.	Freq. (Hz)	No.	Freq. (Hz)	No.	Freq. (Hz)
01	67.0	11	97.4	21	136.5	31	192.8
02	71.9	12	100.0	22	141.3	32	203.5
03	74.4	13	103.5	23	146.2	33	210.7
04	77.0	14	107.2	24	151.4	34	218.1
05	79.7	15	110.9	25	156.7	35	225.7
06	82.5	16	114.8	26	162.2	36	233.6
07	85.4	17	118.8	27	167.9	37	241.8
08	88.5	18	123.0	28	173.8	38	250.3
09	91.5	19	127.3	29	179.9		
10	94.8	20	131.8	30	186.2		

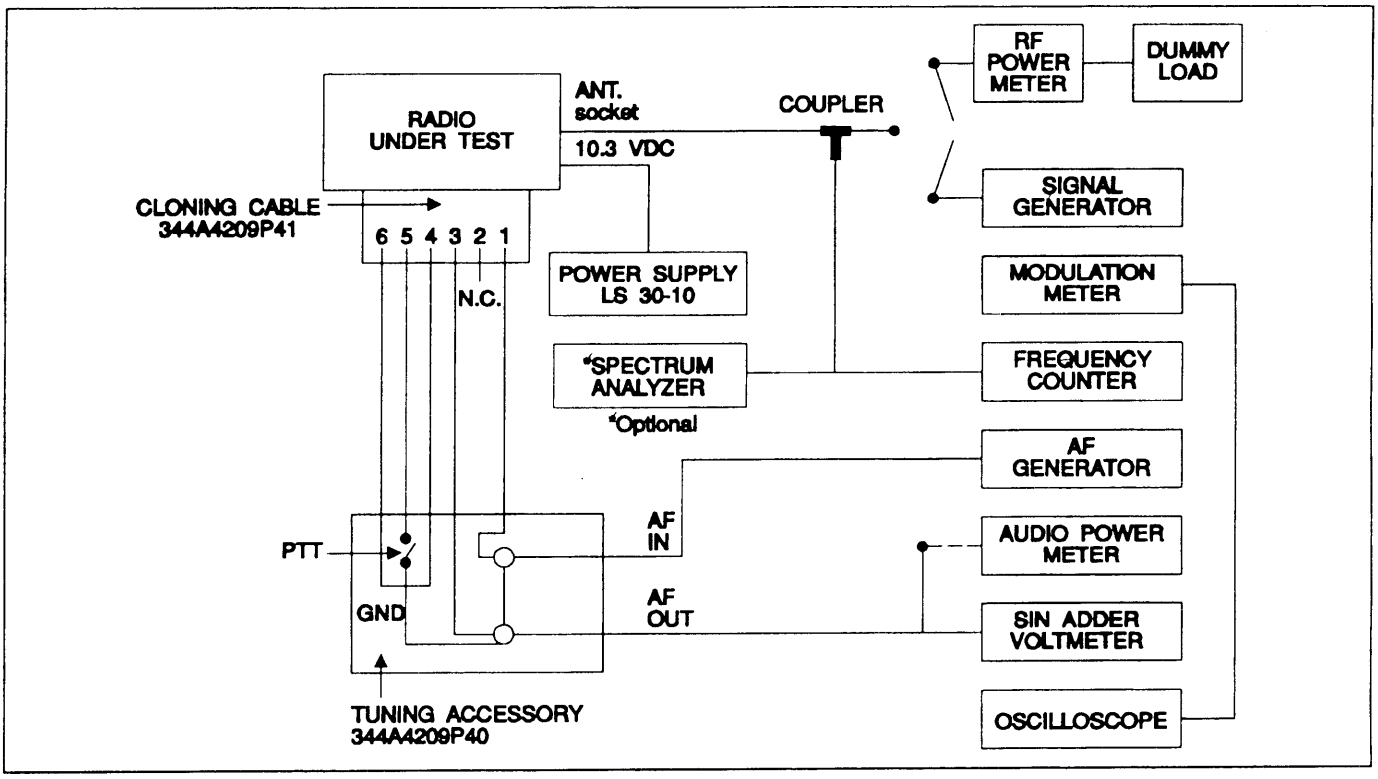


Figure 4 - Discrete List Test Equipment Setup

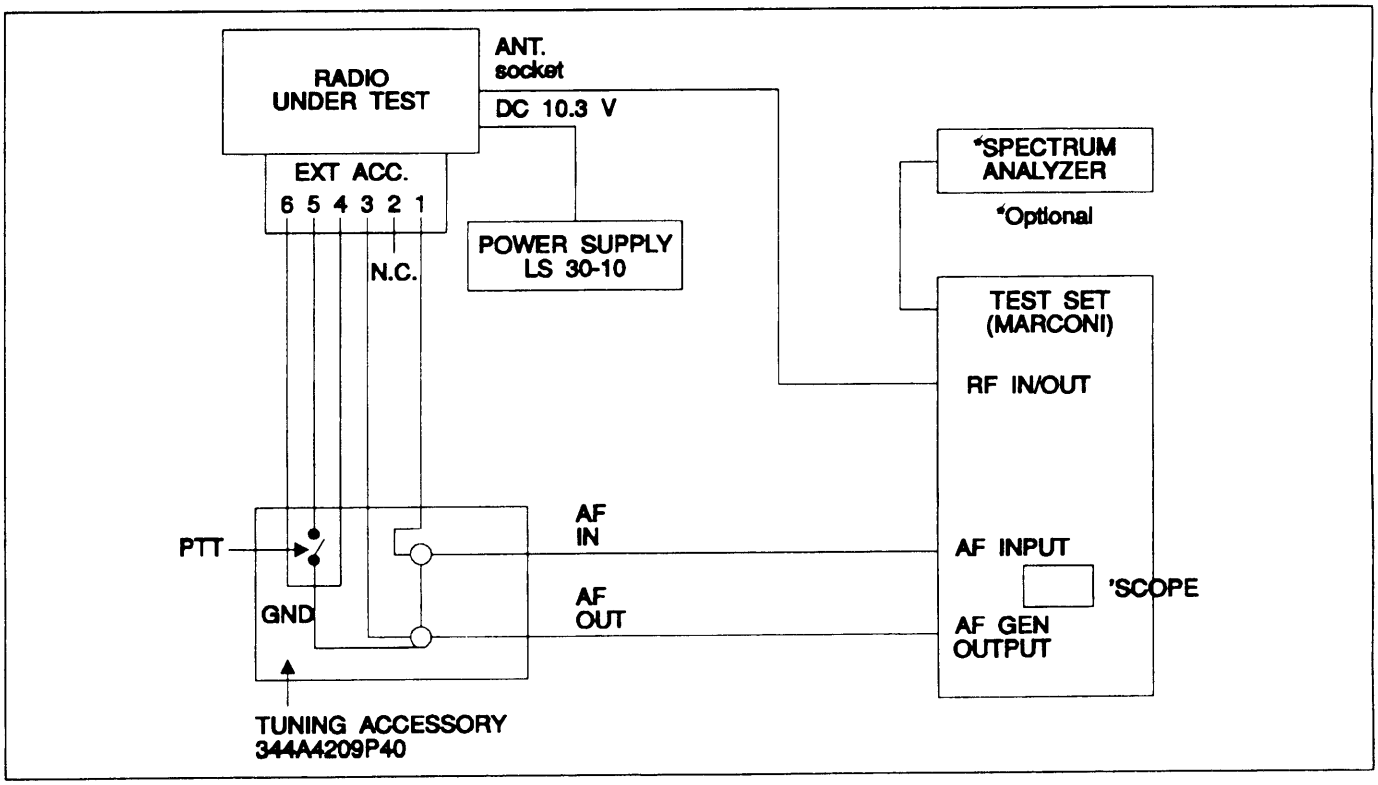


Figure 5 - Test Set Setup

Table 6 - Standard DCS Codes

No.	Code	No.	Code	No.	Code	No.	Code
01	023	21	134	41	306	61	503
02	025	22	143	42	311	62	506
03	026	23	152	43	315	63	516
04	031	24	155	44	321	64	532
05	032	25	156	45	343	65	546
06	043	26	162	46	346	66	567
07	047	27	165	27	251	67	607
08	051	28	172	28	364	68	612
09	054	29	174	49	365	69	624
10	065	30	205	50	371	70	627
11	071	31	223	51	411	71	631
12	072	32	226	52	412	72	632
13	073	33	243	53	413	73	654
14	174	34	244	54	423	74	662
15	114	35	245	55	431	75	664
16	115	36	251	56	432	76	703
17	116	37	261	57	445	77	713
18	125	38	263	58	464	78	723
19	131	39	265	59	465	79	731
20	132	40	271	60	466	80	732
						81	734
						82	743
						83	754

TRANSMITTER PERFORMANCE TESTS

POWER OUTPUT

1. Set the power supply voltage to 10.8 Vdc. Monitor the power supply voltage during transmit.
2. Press the PTT switch and record the output power. The nominal outputs are 1 or 5 Watts.
3. Reduce the power supply voltage to 7.9 Vdc and verify that the power output is above 65% of the recorded output power.
4. Release the PTT switch.

PEAK DEVIATION

1. Using the channel switch on the radio select the channel with lowest frequency.
2. Connect the oscilloscope to the deviation meter, refer to Figure 4.
3. Set the audio signal generator to 1 kHz at 3 kHz deviation.
4. Press the PTT switch and observe the oscilloscope display for a noise free 1 kHz audio tone.
5. Set the audio signal generator output level to 3 kHz deviation and sweep from 300 Hz to 3 kHz. Record the peak deviation.
6. Check for peak deviation not greater than 5 kHz.
7. Release the PTT switch.
8. Using the channel switch select the channel with the highest TX frequency and repeat steps 3 to 7.

SPECTRUM TEST

NOTE

It may be necessary to notch the fundamental signal during this test.

1. Connect a spectrum analyzer and RF power meter to the antenna (ANT) socket, refer to Figure 5.
2. Press the PTT switch. Observe the output on the spectrum analyzer.
3. All spurious signals and harmonics should be below -36 dBm.
4. Release the PTT switch.

RECEIVER PERFORMANCE TESTS

SENSITIVITY

The SINAD or noise quieting sensitivity performance test may be used to test the sensitivity of the receiver.

SINAD Sensitivity

1. Connect the RF signal generator to the coupler as shown in Figure 4.
2. Set the RF signal generator to the receive frequency of the selected channel.
3. Connect the leads of the SINAD meter to the speaker through the adaptor socket on the top panel.
4. Press the monitor socket and set the volume control to mid-range.
5. Set the deviation to 3 kHz.
6. Set the audio generator to 1 kHz.
7. Adjust the RF signal generator level until the SINAD meter reads 12 dB.
8. Check that the signal generator RF level is less than 0.25 μV.

Noise Quieting Sensitivity

1. Disconnect the signal generator from the radio.
2. Set the radio power meter to volts and connect the audio power meter to the speaker terminals.
3. Press and hold the monitor button.
4. Connect the signal generator to the radio
5. Adjust the VOLUME control to obtain a noise reading of 1 Vrms.
6. Set the deviation to 3 kHz.
7. Set the audio generator to 1 kHz.
8. Adjust the RF level of the signal generator RF level for a noise reading on the meter of 0.1 Vrms. This is the 20 dB noise quieting point. Check that the RF level is less than 0.5 μV.

Squelch Sensitivity

1. Set the RF signal generator to the receive frequency for the selected channel.
2. Set the deviation to for 3 kHz.
3. Set the AF generator to 1 kHz.

4. Set the RF signal generator to 20 dB or 2.0 μV and verify that a tone is heard.

5. Switch the RF signal generator off and verify that no audio is heard (received).

AUDIO OUTPUT

1. Set the RF signal generator to 1 mV and the deviation to 3 kHz .

2. Set the audio generator to 1 kHz.

3. Set the sin adder/power voltmeter to AC volts and connect it to the accessories socket.

4. Adjust the volume control of the radio under test fully clockwise.

5. The meter should indicate 2.0 V or greater, the power meter should read 500 mW or greater.

ALIGNMENT PROCEDURES

PLL ALIGNMENT

NOTE

If the PLL is out of lock, an audible warning will be heard and red LED on the top panel will flash.

1. Connect an RF power meter to the ANT socket.

2. Using the channel switch, select the channel having the lowest receive frequency.

NOTE

If the power save option is programmed and the squelch is closed (muted), there will be a periodic voltage change at TP1 unless step 3 below is performed. If the power save mode has not been selected in programming, it is not necessary to perform step 3.

3. Adjust VR2 to unmute the squelch.

4. Connect a DC voltmeter to test point 1 (TP1), accessed through the hole in the VCO cover.

5. Adjust L307 for 1.2 volts at TP1.

6. Using the channel switch, select channel with the highest receive frequency channel.

NOTE

The receiver operational bandwidth is typically 7 MHz. There may be some degradation in actual receiver performance if a bandwidth of more than 7 MHz is used. A receiver frequency more than 7 MHz up from the lowest receiver frequency may be programmed and used, if the voltage specification in step 7 is met.

7. Measure the voltage at TP1. It should be less than 3.5 volts. If the voltage is above 3.5 volts, the receive frequency programmed is too high for the operating bandwidth of the radio.

8. Using the channel switch, select the lowest transmit frequency channel.

9. Press the PTT switch to transmit.

10. Adjust L302 for 2.1 volts at TP-1.

11. Release the PTT switch.

12. Using the channel select switch, select the highest frequency transmit channel.

13. Press the PTT switch.

NOTE

The transmitter operational bandwidth is typically 8 MHz. There may be some degradation in actual performance if a bandwidth greater than 8 MHz is used. However, a transmitter frequency greater than 8 MHz may be programmed and used, if the voltage specification in step 14 is met.

14. Check the voltage at TP-1. It should be 3.5 volts or less. If the voltage is above 3.5 volts, the transmitter frequency programmed is too high for the operating bandwidth of the radio.

15. Release the PTT switch.

16. If step 3 was performed, readjust the squelch setting.

AUTOMATIC POWER ADJUSTMENT

NOTE

Transmit periods longer than five minutes are to be avoided.

1. Using the channel switch, select the center transmit frequency channel.
2. Press the PTT switch.
3. Adjust VR2 to provide rated transmit power and record for future reference.
4. Release the PTT switch.

DIGITAL CHANNEL GUARD (DCS) MODULATION ADJUSTMENT

1. Connect the test equipment to the radio as shown in Figure 4.
2. Using the channel switch select the DCS coded frequency channel.
3. Press the PTT switch and observe the demodulated waveform on the oscilloscope. Compare with Figure 6.
4. If necessary adjust RV401 to show the waveform.

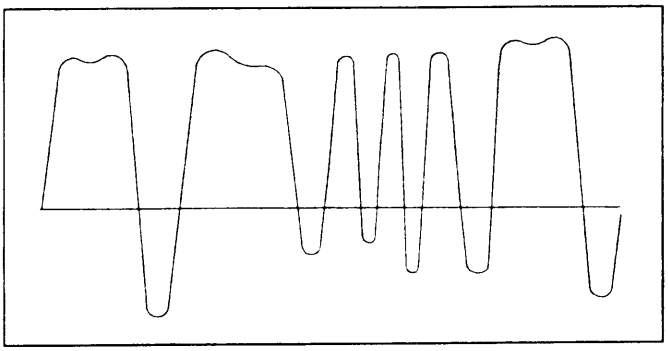


Figure 6 - Demodulated DCS Waveform

MODULATION DEVIATION ADJUSTMENT

1. Connect a power meter and a coupler to the radio as shown in Figure 4.
2. Connect an audio generator as shown in Figure 4.
3. Set the audio output level to 60 mV and the audio frequency to 1 kHz.
4. Using the channel switch, select the highest transmit channel without Channel Guard.
5. Press and hold the PTT switch.
6. Adjust RV402 for maximum system deviation.
7. Using the channel switch, select the lowest transmit channel without Channel Guard.
8. Press and hold the PTT switch.
9. Measure the deviation and verify that it is below peak system deviation. If the deviation is greater than the peak system deviation adjust RV402 to peak system deviation.
10. With channel showing the highest deviation selected, sweep the audio frequency between 300 kHz and 3 kHz. Adjust RV402 to ensure deviation is below peak system deviation at all frequencies.
11. Disconnect the audio generator and set the PTT switch to the off position.

CTCSS/DCS DEVIATION ADJUSTMENT

1. Connect a power meter and modulation meter to the radio as shown in Figure 4.
2. Using the channel switch select a transmit channel with Channel Guard.
3. Press the PTT switch.
4. Adjust RV403 for 10% of maximum system deviation.
5. Using the oscilloscope check that the positive and negative peak deviations are equal.
6. If necessary adjust RV401 to obtain equal and opposite peak deviations.
7. Release the PTT switch and disconnect the deviation meter.

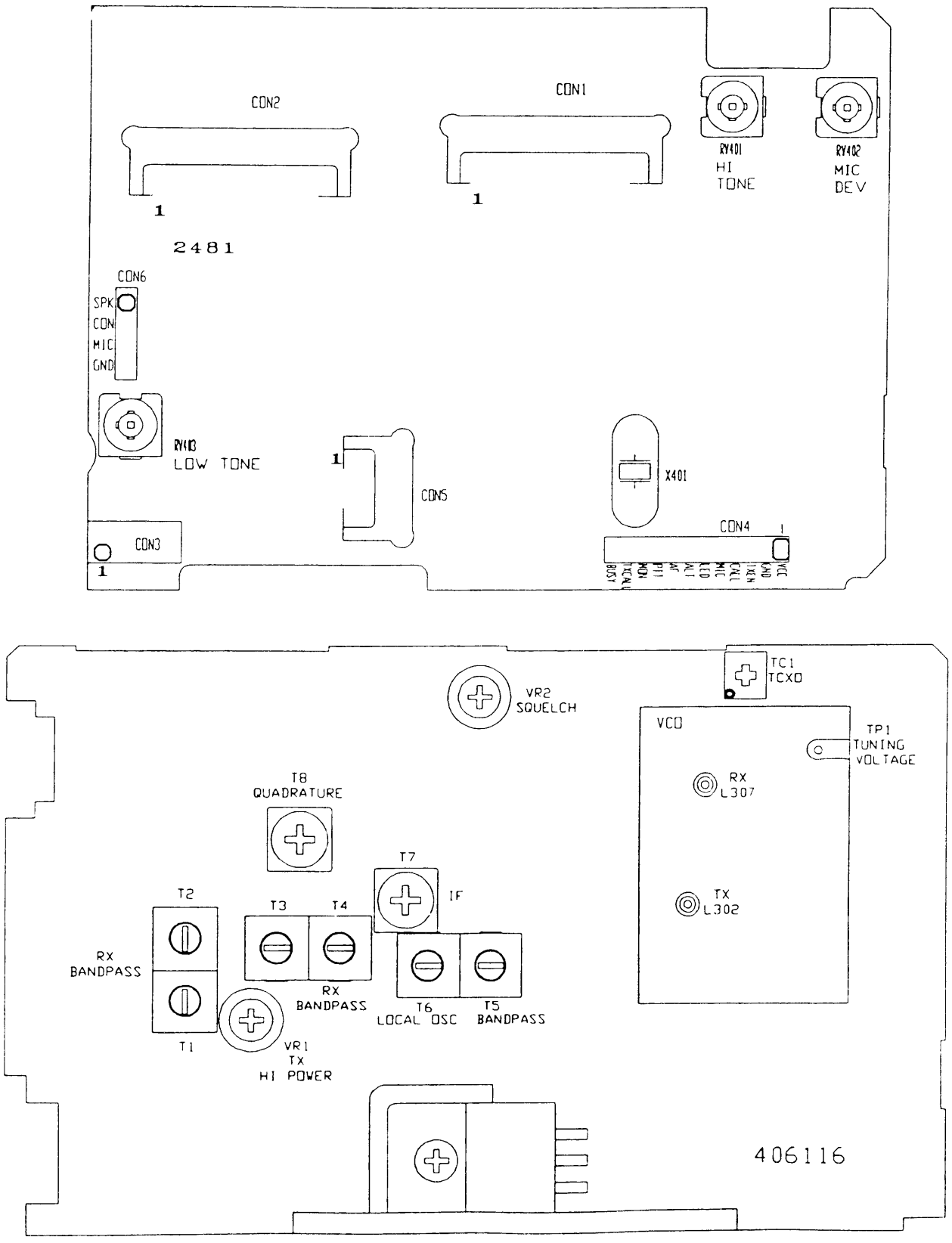


Figure 7 - Test and Alignment Test Points

RECEIVER ALIGNMENT

RF TUNING

1. Connect to the radio an RF signal generator to the ANT socket through an adaptor and a SINAD meter to the accessories socket as shown in Figure 4.
2. On the TX/RX printed circuit board set VR2 fully counter clockwise.
3. Adjust the VOLUME control to the center position.
4. Using the channel switch select the center frequency channel.
5. Set the RF signal generator to the receive channel frequency and set deviation to 60%.
6. Set the audio frequency to 1 kHz.
7. Adjust the RF output voltage level of the RF signal generator until the 1 kHz signal is audible. Note the RF output voltage level and the SINAD reading.
8. Adjust FL3 for an improvement in SINAD.
9. Adjust the RF output voltage level of the RF signal generator while keeping the SINAD meter readings between 12 and 20 dB.
10. Adjust FL2 for an improvement in SINAD.
11. Adjust the RF output voltage level of the RF signal generator while keeping the SINAD meter readings between 12 and 20 dB.
12. Adjust FL1 and check for an RF voltage signal level of 0.5 μV pd and a SINAD meter reading between 12 and 20 dB.
13. If the readings in step 11 are not as stated, adjust the RF output voltage level of the RF signal generator to a achieve SINAD meter reading between 12 and 20 dB.
14. Adjust T4 and check for an RF voltage signal level of 0.25 μV pd and a SINAD meter reading between 12 and 20 dB. Check the upper and lower sensitivities.
15. If the readings in step 12 are not as stated, adjust the RF output voltage level of the RF signal generator to achieve a SINAD meter reading between 12 and 20 dB.
16. If the SINAD meter reading is below 12 dB, repeat steps 7 to 16. Otherwise, reset VR201 to the required operating position (see squelch adjustment).

DISCRIMINATOR TUNING

1. Set the RF level to 10 mV pd.
2. Adjust T5 for maximum audio output and observe the oscilloscope for sinewave distortion.
3. Adjust T4 for minimum distortion, normally less than 3%.
4. Disconnect the test equipment.

SQUELCH ADJUSTMENT

1. Set the RF signal generator to the receiver frequency and deviation to 60%. Set the audio signal to 1 kHz.
2. Adjust the RF output level of the RF signal generator until the 1 kHz tone is audible.
3. Adjust the RF signal to the level desired for squelch sensitivity. Monitor SINAD, usually 12 dB.
4. On the TX/RX board, adjust VR201 until the squelch is just unmuted (open).
5. Turn the RF generator off.
6. Press and release the monitor button and check that the audio output may be muted/unmuted.
7. Disconnect the test equipment.

PROGRAMMING THE RADIO

Refer to programming manual TQ3375 when programming the radio. Programming cable TQ3376 is required to interconnect the radio and PC programmer.

SERVICING THE BATTERY

BATTERY CHARGING AND CARE

To insure peak performance from your radio, the b attery pack must be fully charged. Proper care and charging will allow maximum performance and life of your battery pack.

New batteries or batteries that have been stored for a long period of time, should be fully charged befre placing into service. The battery should be replaced if the charge state is in doubt.

If the rechargeable battery is only sparingly or seldom used and is left on continuous charge for one or two months at a time, it could experience reduced capacity. This would severely reduce the life of the battery between charges.

The rechargeable nickel-cadmium battery packs may be recharged using the MONOGRAM Dual Desk Charger 344A420P21, separately or while attached to the radio. The battery should be recharged whenever the charge state is in doubt. To recharge a battery insert the battery pack (with or without radio attached) into the charger.

BATTERY CHARGING USING THE RAPID BATTERY CHARGER

The charger operates from a 110/120V AC power source and should be installed with a suitable 3 ampere fused plug. The unit is capable of continuous operation. However the unit should be disconnected from the power source when not in use. To operate the Dual Desk Charger, plug the charger into the power source and check that the POWER indicator (red) lights.

Fast Charging

For fast charging insert the battery or radio into the rear section of the charger (Figure 6). The FAST charge indicator (green) will flash. At the end of the charge period a trickle charge will be applied to the battery to maintain the fully-charged condition indefinitely. This is indicated by the SLOW charge indicator (red).

Trickle Charging

For trickle charging insert the battery or radio into the first section of the charger (Figure 6). The SLOW charge indicator (green) will light continuously.

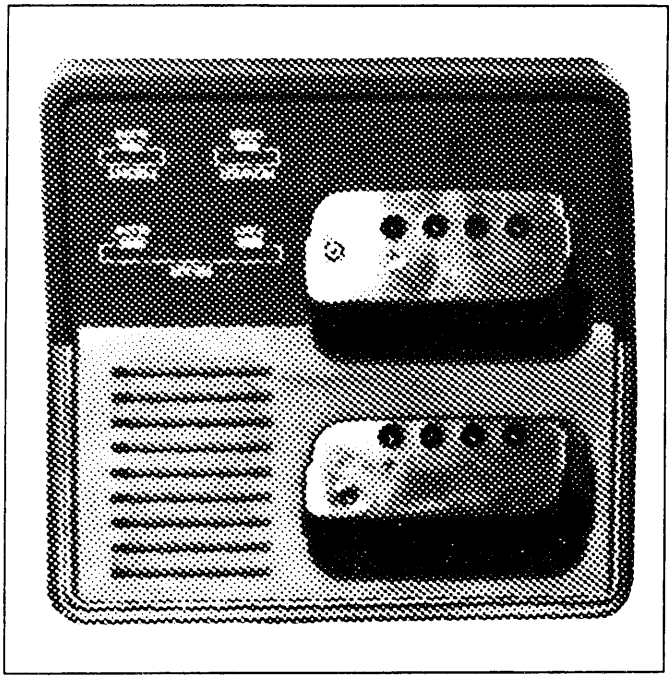


Figure 8 - Battery Charger

Table 7-Battery charging Times

BATTERY CAPACITY	CHARGE TIME(hours)	
	FAST	SLOW
600 mAh	1	10-14
1200 mAh	2	20-24

CAUTION

If the charge indicator does not light, check to see that the battery has been inserted properly.

Do not charge the battery when battery temperature is below 10°C or above 40°C. Usable life of the battery may be reduced.

Do not use the charger if it is wet or damaged in any way.

Do not toss batteries in a fire; they may explode.

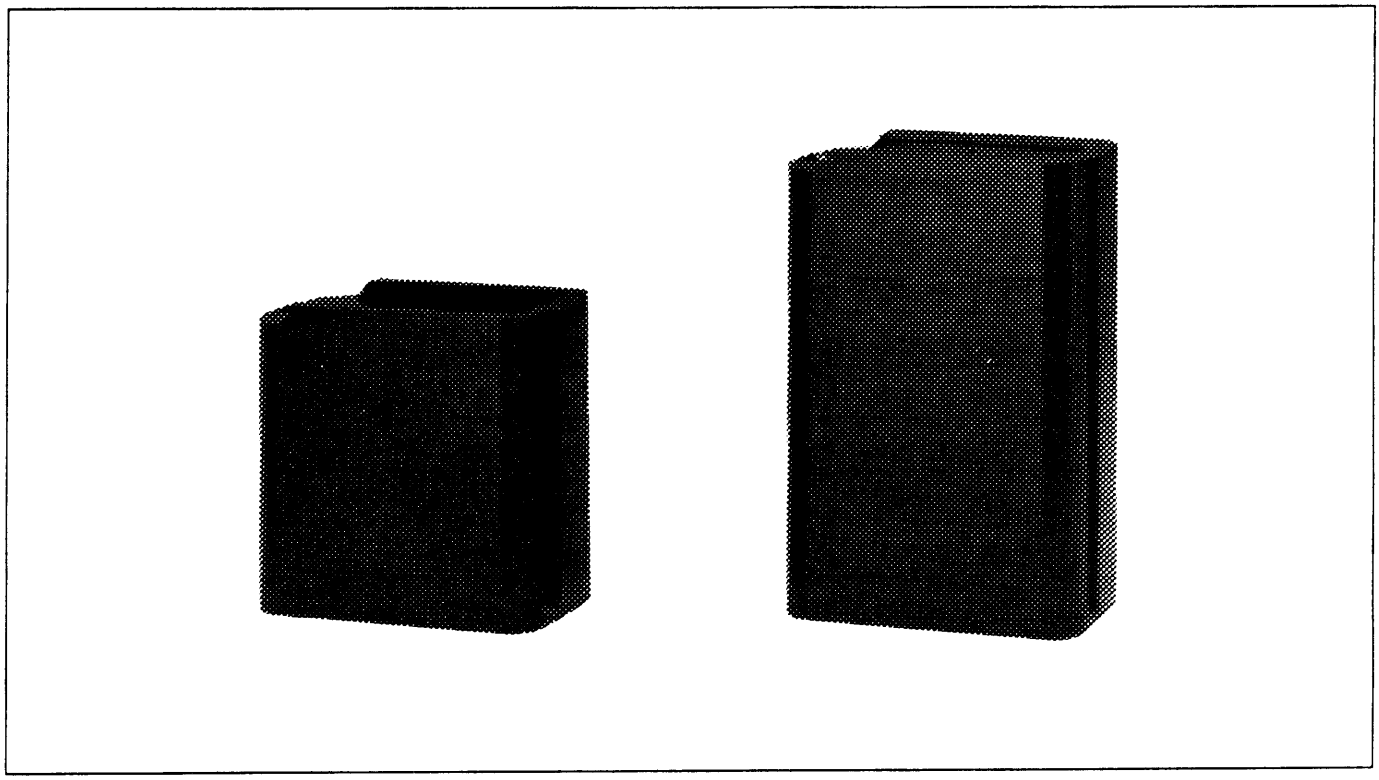


Figure 9 - 600 And 1200 mAh Batteries

ERICSSON

Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

Printed in U.S.A.

NOTE: When ordering parts for your Monogram radio, precede all part numbers with the prefix R29/.

131-027-0	CER MONO GRM40COG101J50V:M6305-500PT	C1
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C2
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C3
131-511-0	CER MONO 15PF:GRM40COG150J50	C4
131-027-0	CER MONO GRM40COG101J50V:M6305-500PT	C5
132-012-1	CER MONO 20PF:GRM40COG200J50	C6
132-220-2	CER MONO 220PF:GRM40COG221J50	C8
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C9
132-220-2	CER MONO 220PF:GRM40COG221J50	C10
101-043-5	CAPACITOR ELECT 10UF 16V SRA(M):4X7	C11
132-012-1	CER MONO 20PF:GRM40COG200J50	C12
134-722-1	CER MONO 47PF:GRM40COG470J50	C13
101-043-5	CAPACITOR ELECT 10UF 16V SRA(M):4X7	C14
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C15
132-220-2	CER MONO 220PF:GRM40COG221J50	C16
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C17
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C18
134-722-1	CER MONO 47PF:GRM40COG470J50	C19
133-314-9	CER MONO 33PF:GRM40COG330J50	C20
132-407-5	CER MONO 24PF:GRM40COG240J50	C21
133-314-9	CER MONO 33PF:GRM40COG330J50	C21
135-010-4	CER MONO 5PF:GRM40COG050C50	C22
135-613-9	CER MONO 56PF:GRM40COG560J50	C23
136-816-5	CER MONO 68PF:GRM40COG680J50	C23
136-816-5	CER MONO 68PF:GRM40COG680J50	C23
132-714-2	CER MONO 27PF:GRM40COG270J50	C24
101-043-5	CAPACITOR ELECT 10UF 16V SRA(M):4X7	C25
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C26

130-A60-4	CER MONO 0.1UF:GRM40X7R104K25	C27
132-220-2	CER MONO 220PF:GRM40COG221J50	C28
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C29
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C30
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C31
132-012-1	CER MONO 20PF:GRM40COG200J50	C32
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C33
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C34
131-511-0	CER MONO 15PF:GRM40COG150J50	C35
131-559-4	CER MONO 1.5PF:GRM40COG1R5C50V	C36
131-030-2	CER MONO 1PF:GRM40COG010C50	C36
132-714-2	CER MONO 27PF:GRM40COG270J50	C37
133-314-9	CER MONO 33PF:GRM40COG330J50	C37
133-314-9	CER MONO 33PF:GRM40COG330J50	C38
131-304-0	CER MONO 13PF:GRM40C0G130J50V	C39
131-511-0	CER MONO 15PF:GRM40COG150J50	C39
131-030-2	CER MONO 1PF:GRM40COG010C50	C40
130-702-1	CER MONO 0.75PF:GRM40COGR75C50V	C40
131-304-0	CER MONO 13PF:GRM40C0G130J50V	C41
131-511-0	CER MONO 15PF:GRM40COG150J50	C41
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C42
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C43
131-511-0	CER MONO 15PF:GRM40COG150J50	C44
131-304-0	CER MONO 13PF:GRM40C0G130J50V	C44
131-030-2	CER MONO 1PF:GRM40COG010C50	C45
131-559-4	CER MONO 1.5PF:GRM40COG1R5C50V	C45
132-012-1	CER MONO 20PF:GRM40COG200J50	C46
131-813-3	CER MONO 18PF:GRM40COG180J50	C46
137-504-4	CER MONO GRM40COG750J50 M6301-500PT	C47

135-010-4	CER MONO 5PF:GRM40COG050C50	C48
131-208-7	CER MONO 12PF:GRM40COG120J50	C48
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C49
101-043-5	CAPACITOR ELECT 10UF 16V SRA(M):4X7	C50
131-511-0	CER MONO 15PF:GRM40COG150J50	C51
104-739-6	CAPACITOR ELECT 47UF 16V SRA:(M) 6.3X7	C52
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C53
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C54
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C55
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C56
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C57
134-007-7	CER MONO 4PF:GRM40COG040C50	C58
143-301-0	TANTALUM 3.3UF 16WV	C59
131-039-1	CER MONO 10PF:GRM40COG100C50	C98
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C99
130-A60-4	CER MONO 0.1UF:GRM40X7R104K25	C101
130-A60-4	CER MONO 0.1UF:GRM40X7R104K25	C102
143-312-0	TANTALUM CHIP 3.3UF:293D335X0010A2T	C103
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C104
132-011-0	CER MONO 2PF:GRM40COG020C50	C105
130-A17-6	CER MONO 0.001UF:GRM40COG102J50-500PT	C107
144-722-2	TANTALUM CHIP 4.7UF:293D475X0010A2T	C112
131-027-0	CER MONO GRM40COG101J50V:M6305-500PT	C115
130-A17-6	CER MONO 0.001UF:GRM40COG102J50-500PT	C116
132-714-2	CER MONO 27PF:GRM40COG270J50	C117
135-103-5	CER MONO 51PF:GRM40COG510J50	C118
134-722-1	CER MONO 47PF:GRM40COG470J50	C118
101-043-5	CAPACITOR ELECT 10UF 16V SRA(M):4X7	C119
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C122

141-014-1	TANTALUM CHIP 1UF 16WV:TCM1C010AS#R	C123
101-043-5	CAPACITOR ELECT 10UF 16V SRA(M):4X7	C125
134-722-1	CER MONO 47PF:GRM40COG470J50	C127
137-504-4	CER MONO GRM40COG750J50 M6301-500PT	C129
101-043-5	CAPACITOR ELECT 10UF 16V SRA(M):4X7	C130
130-305-6	CER MONO 0.033UF:GRM40X7R333K50	C133
130-A10-9	CER MONO 0.015UF:GRM40X7R153K50V	C133
130-315-6	CER MONO GRM40X7R332K50:M6305-500PT	C134
130-305-6	CER MONO 0.033UF:GRM40X7R333K50	C135
130-A10-9	CER MONO 0.015UF:GRM40X7R153K50V	C135
130-305-6	CER MONO 0.033UF:GRM40X7R333K50	C136
130-604-6	CER MONO 0.068UF:GRM40X7R683K25	C136
130-305-6	CER MONO 0.033UF:GRM40X7R333K50	C137
130-604-6	CER MONO 0.068UF:GRM40X7R683K25	C137
132-220-2	CER MONO 220PF:GRM40COG221J50	C138
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C139
104-739-6	CAPACITOR ELECT 47UF 16V SRA:(M) 6.3X7	C141
141-014-1	TANTALUM CHIP 1UF 16WV:TCM1C010AS#R	C143
102-275-3	CAPACITOR ELECT 220UF 10WV:6.3X7.5	C144
101-043-5	CAPACITOR ELECT 10UF 16V SRA(M):4X7	C145
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C153
144-717-8	CAP.TANTALUM RADIAL 47UF:TAP47M10SCS	C154
144-722-2	TANTALUM CHIP 4.7UF:293D475X0010A2T	C155
141-036-1	TANTAL CHIP 1UF:293D105X0016A2T	C156
141-036-1	TANTAL CHIP 1UF:293D105X0016A2T	C157
134-722-1	CER MONO 47PF:GRM40COG470J50	C158
134-722-1	CER MONO 47PF:GRM40COG470J50	C159
134-722-1	CER MONO 47PF:GRM40COG470J50	C160
134-722-1	CER MONO 47PF:GRM40COG470J50	C161

134-722-1	CER MONO 47PF:GRM40COG470J50	C162
102-275-3	CAPACITOR ELECT 220UF 10WV:6.3X7.5	C163
134-722-1	CER MONO 47PF:GRM40COG470J50	C164
134-722-1	CER MONO 47PF:GRM40COG470J50	C165
134-722-1	CER MONO 47PF:GRM40COG470J50	C167
134-722-1	CER MONO 47PF:GRM40COG470J50	C168
134-722-1	CER MONO 47PF:GRM40COG470J50	C169
134-722-1	CER MONO 47PF:GRM40COG470J50	C170
134-722-1	CER MONO 47PF:GRM40COG470J50	C171
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C172
132-220-2	CER MONO 220PF:GRM40COG221J50	C173
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C201
130-176-6	CER MONO 0.1UF:GRM40X7R104J50	C202
134-722-1	CER MONO 47PF:GRM40COG470J50	C203
130-428-4	CER MONO 0.0047UF:GRM40X7R472J50	C204
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C204
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C301
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C302
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C303
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C304
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C305
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C306
133-314-9	CER MONO 33PF:GRM40COG330J50	C307
132-011-0	CER MONO 2PF:GRM40COG020C50	C308
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C309
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C310
133-911-8	CER MONO 39PF:GRM40COG390J50	C311
133-314-9	CER MONO 33PF:GRM40COG330J50	C311
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C312

130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C313
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C314
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C315
132-223-5	CER MONO 22PF:GRM40COG220J50	C316
132-223-5	CER MONO 22PF:GRM40COG220J50	C317
132-011-0	CER MONO 2PF:GRM40COG020C50	C318
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C401
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C402
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C403
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C405
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C406
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C407
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C408
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C409
134-722-1	CER MONO 47PF:GRM40COG470J50	C410
134-722-1	CER MONO 47PF:GRM40COG470J50	C411
134-722-1	CER MONO 47PF:GRM40COG470J50	C412
134-722-1	CER MONO 47PF:GRM40COG470J50	C413
134-722-1	CER MONO 47PF:GRM40COG470J50	C414
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C415
134-722-1	CER MONO 47PF:GRM40COG470J50	C416
134-722-1	CER MONO 47PF:GRM40COG470J50	C417
134-722-1	CER MONO 47PF:GRM40COG470J50	C418
134-722-1	CER MONO 47PF:GRM40COG470J50	C419
134-722-1	CER MONO 47PF:GRM40COG470J50	C420
134-722-1	CER MONO 47PF:GRM40COG470J50	C421
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C422
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C423
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C424

134-726-3	CER MONO 470PF:GRM40COG471J50	C425
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C426
132-220-2	CER MONO 220PF:GRM40COG221J50	C428
141-046-0	TANTALUM CHIP 10UF:293D106X0010B2T	C430
141-046-0	TANTALUM CHIP 10UF:293D106X0010B2T	C431
130-330-8	CER MONO 0.033UF:GRM40X7R333J50	C432
130-330-8	CER MONO 0.033UF:GRM40X7R333J50	C432
130-234-5	CER MONO GRM40X7R223J50V M6305-500PT	C432
141-046-0	TANTALUM CHIP 10UF:293D106X0010B2T	C433
141-046-0	TANTALUM CHIP 10UF:293D106X0010B2T	C434
143-312-0	TANTALUM CHIP 3.3UF:293D335X0010A2T	C435
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C436
141-046-0	TANTALUM CHIP 10UF:293D106X0010B2T	C437
141-046-0	TANTALUM CHIP 10UF:293D106X0010B2T	C438
141-046-0	TANTALUM CHIP 10UF:293D106X0010B2T	C440
130-A22-0	CER MONO 0.0018UF:GRM40X7R182K50	C441
130-234-5	CER MONO GRM40X7R223J50V M6305-500PT	C442
130-428-4	CER MONO 0.0047UF:GRM40X7R472J50	C443
130-513-7	CER MONO 0.0056UF:GRM40X7R562K50	C444
130-A60-4	CER MONO 0.1UF:GRM40X7R104K25	C445
135-613-9	CER MONO 56PF:GRM40COG560J50	C446
130-234-5	CER MONO GRM40X7R223J50V M6305-500PT	C447
135-613-9	CER MONO 56PF:GRM40COG560J50	C448
130-330-8	CER MONO 0.033UF:GRM40X7R333J50	C449
141-036-1	TANTAL CHIP 1UF:293D105X0016A2T	C450
132-220-2	CER MONO 220PF:GRM40COG221J50	C451
134-726-3	CER MONO 470PF:GRM40COG471J50	C456
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C457
130-A60-4	CER MONO 0.1UF:GRM40X7R104K25	C458

131-511-0	CER MONO 15PF:GRM40COG150J50	C460
131-511-0	CER MONO 15PF:GRM40COG150J50	C461
130-425-1	CER MONO 0.047UF:GRM40X7R473J25	C462
130-425-1	CER MONO 0.047UF:GRM40X7R473J25	C463
130-425-1	CER MONO 0.047UF:GRM40X7R473J25	C464
130-425-1	CER MONO 0.047UF:GRM40X7R473J25	C465
130-425-1	CER MONO 0.047UF:GRM40X7R473J25	C466
130-425-1	CER MONO 0.047UF:GRM40X7R473J25	C467
130-425-1	CER MONO 0.047UF:GRM40X7R473J25	C468
130-425-1	CER MONO 0.047UF:GRM40X7R473J25	C469
141-036-1	TANTAL CHIP 1UF:293D105X0016A2T	C470
130-A60-4	CER MONO 0.1UF:GRM40X7R104K25	C471
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C472
130-185-5	CER MONO 0.1UF:GRM40Y5V104Z25	C473
130-330-8	CER MONO 0.033UF:GRM40X7R333J50	C474
130-330-8	CER MONO 0.033UF:GRM40X7R333J50	C475
130-330-8	CER MONO 0.033UF:GRM40X7R333J50	C476
130-330-8	CER MONO 0.033UF:GRM40X7R333J50	C477
134-761-4	CER MONO 470PF:GRM40X7R471K50	C500
134-710-8	CER 470PF 50WV:K "B"	C501
142-227-2	TANTALUM CHIP 2.2UF:293D225X0016A2T	C502
141-036-1	TANTAL CHIP 1UF:293D105X0016A2T	C503
141-036-1	TANTAL CHIP 1UF:293D105X0016A2T	C504
140-204-1	TANTAL CHIP 0.22UF 35WV 293D224X0035A2T	C505
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C601
134-722-1	CER MONO 47PF:GRM40COG470J50	C602
132-220-2	CER MONO 220PF:GRM40COG221J50	C603
130-184-4	CER MONO 0.001UF:GRM40X7R102K50	C604
130-172-2	CER MONO GRM40X7R103K50VM6305-500PT	C605

270-027-8	FILTER CER CFW 455F	CF1
270-007-0	FILTER CER CFW455HT	CF1
421-619-5	CONNECTOR 00-6200-167-012-800:ZIF	CON1
421-619-5	CONNECTOR 00-6200-167-012-800:ZIF	CON2
422-689-3	TDH CONNECTOR TDH2-8SG	CON3
421-618-4	CONNECTOR 00-6200-057-012-800:ZIF	CON5
422-319-9	HEADER PIN CONNECTORGDH2-4SAC	CON6
421-648-1	CONNECTOR HR10A-7R-6SB	CON7
422-383-6	HEADER PIN CONNECTORGDH2-6DBC(1.2)	CON8
504-869	4P HOUSING ASS'Y	CON9
422-709-8	TDH CONNECTOR TDH2-6SG	CONEXT
243-054-8	DIODE SI TUNING BB619A	VD1
243-054-8	DIODE SI TUNING BB619A	VD301
243-054-8	DIODE SI TUNING BB619A	VD302
243-012-0	DIODE MMBV3401	D1
251-016-7	LED LAMP SLB26UR3HL RED	D1
243-026-3	DIODE SILICON SCHOTT1SS97	D2
243-012-0	DIODE MMBV3401	D3
245-013-1	DIODE 1N 4001 (1A50V)	D4
243-063-6	DIODE SWITCHING KDS181S A3	D5
243-012-0	DIODE MMBV3401	D7
243-052-6	DIODE SI KDS193	D8
251-148-1	LED LAMP SEF33G2TT	D99
243-067-0	DIODE SCHOTTKY BAR43	D150
241-179-8	DIODE ZENER Z02W5.6V-Y 56Y	D151
241-101-7	DIODE ZENER BZX84-C15V SOT23	D152
243-052-6	DIODE SI KDS193	D201
243-052-6	DIODE SI KDS193	D403
320-253-1	COIL FC 3X2 CORE BEAD	FB1

320-253-1	COIL FC 3X2 CORE BEAD	FB2
320-253-1	COIL FC 3X2 CORE BEAD	FB3
320-253-1	COIL FC 3X2 CORE BEAD	FB4
320-253-1	COIL FC 3X2 CORE BEAD	FB5
280-089-7	FUSE MICRO MS2(125V 2A SLOW)	FUSE
223-319-2	I.C MC145156DW2	IC1
223-368-6	I.C MC12017D	IC2
223-090-4	I.C MC3361D	IC3
231-008-4	I.C LM386(803-N-3)	IC4
223-119-8	I.C 78L05	IC5
222-022-8	I.C KIA393F	IC6
223-224-9	I.C MC14066BD:SO14	IC401
223-224-9	I.C MC14066BD:SO14	IC402
223-320-2	I.C MC14504BD	IC403
231-082-0	I.C LM2902M	IC404
231-082-0	I.C LM2902M	IC405
223-378-5	I.C MC142100DW	IC406
231-073-3	I.C MF6CWM-100	IC407
229-401-2	I.C CAT93C46J	IC408
229-451-7	I.C Z86C101ZFEC R562	IC409
231-082-0	I.C LM2902M	IC410
229-357-6	I.C GD74HC368DT	IC411
229-456-2	I.C LTC1059CS	IC501
420-718-6	JACK CONNECTOR HCY2505	J1
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L1
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L2
310-092-9	COIL CHOKE MK-4	L3
310-378-7	COIL AXIAL 2.2UH:LAL02TB2R2M	L4
310-218-7	COIL CHOKE 0.3DIAX7T 1KOHM RESISTOR TYPE	L5

310-224-2	COIL SPRING 3DIAX0.65DIAX1(1/2)T LEFT	L6
310-243-9	COIL INDUCTOR SPRING7NH 1/2 TURN LOOP	L6
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L7
310-218-7	COIL CHOKE 0.3DIAX7T 1KOHM RESISTOR TYPE	L8
310-224-2	COIL SPRING 3DIAX0.65DIAX1(1/2)T LEFT	L9
310-243-9	COIL INDUCTOR SPRING7NH 1/2 TURN LOOP	L9
310-573-7	COIL SPRING 2DIAX0.4DIAX4.5T L	L10
310-611-8	COIL SPRING 2DIAX0.4DIAX3.5T (L)	L10
310-574-8	COIL SPRING 2DIAX0.4DIAX5.5T L	L11
310-573-7	COIL SPRING 2DIAX0.4DIAX4.5T L	L11
310-092-9	COIL CHOKE MK-4	L13
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L14
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L16
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L17
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L18
310-576-0	COIL AXIAL 100UH:LAL02TB101K	L19
310-576-0	COIL AXIAL 100UH:LAL02TB101K	L20
310-381-0	COIL AXIAL 1MH:LAL03TB102K	L21
310-381-0	COIL AXIAL 1MH:LAL03TB102K	L22
310-381-0	COIL AXIAL 1MH:LAL03TB102K	L23
310-381-0	COIL AXIAL 1MH:LAL03TB102K	L24
310-380-9	COIL AXIAL 100UH:LAL03TB101K	L25
310-221-9	COIL AXIAL 100UH:LAL04TB101K	L150
310-221-9	COIL AXIAL 100UH:LAL04TB101K	L151
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L301
320-839-1	COIL CHIP VCOOSC5.5T E588CN-100024	L302
320-859-9	COIL CHIP VCOOSC4.5T(E558CN-100023)	L302
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L303
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L304

310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L305
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L306
320-839-1	COIL CHIP VCOOSC5.5T E588CN-100024	L307
320-859-9	COIL CHIP VCOOSC4.5T(E558CN-100023)	L307
310-293-4	CIOL AXIAL 1UH:LAL02TB1R0M	L308
203-096-4	TRANSISTOR MMBC1321Q4	Q1
203-096-4	TRANSISTOR MMBC1321Q4	Q2
203-055-7	TRANSISTOR MRF581	Q3
203-043-6	TRANSISTOR SRFH1900	Q4
202-095-8	BRT KRC104S ND	Q5
203-111-4	TRANSISTOR BCX-18	Q6
203-111-4	TRANSISTOR BCX-18	Q7
213-001-1	FET BF999LB	Q9
200-024-4	FET BF513S9	Q10
213-001-1	FET BF999LB	Q11
203-111-4	TRANSISTOR BCX-18	Q12
202-092-5	BRT KRA110S PK	Q13
202-110-8	TRANSISTOR 2N3906S ZA	Q101
202-109-8	TRANSISTOR 2N3904S ZC	Q102
203-096-4	TRANSISTOR MMBC1321Q4	Q103
202-092-5	BRT KRA110S PK	Q104
202-091-4	BRT KRA104S PD	Q105
203-096-4	TRANSISTOR MMBC1321Q4	Q106
202-095-8	BRT KRC104S ND	Q107
202-082-6	TRANSISTOR KTA1504ST1(G)	Q108
203-054-6	TRANSISTOR LSP966	Q150
202-097-0	TRANSISTOR KTN2369S	Q151
202-097-0	TRANSISTOR KTN2369S	Q152
202-113-1	TRANSISTOR KTC3875S(BL)	Q201

202-113-1	TRANSISTOR KTC3875S(BL)	Q202
202-181-2	TRANSISTOR SI KTC3295S TB	Q301
203-116-9	TRANSISTOR MMBFJ310 SOT-23	Q302
202-181-2	TRANSISTOR SI KTC3295S TB	Q303
200-024-4	FET BF513S9	Q304
202-092-5	BRT KRA110S PK	Q401
202-095-8	BRT KRC104S ND	Q402
202-095-8	BRT KRC104S ND	Q403
202-095-8	BRT KRC104S ND	Q404
202-095-8	BRT KRC104S ND	Q405
202-090-3	BRT KRA103S PC	Q406
202-090-3	BRT KRA103S PC	Q407
202-096-9	BRT KRC110S NK	Q408
202-113-1	TRANSISTOR KTC3875S(BL)	Q409
202-095-8	BRT KRC104S ND	Q410
202-095-8	BRT KRC104S ND	Q411
209-029-4	TRANSISTOR IRFD120	Q500
009-150-7	RESISTOR METALFILM 15 OHM 1/4W +-5% "S"	R1
060-332-8	RESISTOR CHIP 3.3K OHM 1/10W +-5%	R1
002-220-2	RESISTOR METALFILM 22 OHM 1/8W +-5% "S"	R2
060-153-3	RESISTOR CHIP 15K OHM 1/10W +-5%	R2
060-471-0	RESISTOR CHIP 470 OHM 1/10W +-5%	R3
060-100-5	RESISTOR CHIP 10 OHM 1/10W +-5%	R4
060-332-8	RESISTOR CHIP 3.3K OHM 1/10W +-5%	R5
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R6
060-100-5	RESISTOR CHIP 10 OHM 1/10W +-5%	R7
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R8
060-229-9	RESISTOR CHIP 2.2 OHM 1/10W +-5%	R9
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R10

060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R11
060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R12
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R13
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R14
060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R15
060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R16
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R17
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R18
060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R19
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R20
060-181-8	RESISTOR CHIP 180 OHM 1/10W +-5%	R21
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R22
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R23
060-471-0	RESISTOR CHIP 470 OHM 1/10W +-5%	R24
060-100-5	RESISTOR CHIP 10 OHM 1/10W +-5%	R26
060-122-5	RESISTOR CHIP 1.2K OHM 1/10W +-5%	R27
060-100-5	RESISTOR CHIP 10 OHM 1/10W +-5%	R28
060-332-8	RESISTOR CHIP 3.3K OHM 1/10W +-5%	R29
060-331-7	RESISTOR CHIP 330 OHM 1/10W +-5%	R30
060-471-0	RESISTOR CHIP 470 OHM 1/10W +-5%	R31
060-100-5	RESISTOR CHIP 10 OHM 1/10W +-5%	R32
060-821-3	RESISTOR CHIP 820 OHM 1/10W +-5%	R33
060-331-7	RESISTOR CHIP 330 OHM 1/10W +-5%	R33
060-821-3	RESISTOR CHIP 820 OHM 1/10W +-5%	R33
060-332-8	RESISTOR CHIP 3.3K OHM 1/10W +-5%	R34
060-152-2	RESISTOR CHIP 1.5K OHM 1/10W +-5%	R34
060-222-2	RESISTOR CHIP 2.2K OHM 1/10W +-5%	R35
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R36
060-100-5	RESISTOR CHIP 10 OHM 1/10W +-5%	R37

060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R98
060-392-2	RESISTOR CHIP 3.9K OHM 1/10W +-5%	R99
060-682-4	RESISTOR CHIP 6.8K OHM 1/10W +-5%	R99
060-222-2	RESISTOR CHIP 2.2K OHM 1/10W +-5%	R101
060-222-2	RESISTOR CHIP 2.2K OHM 1/10W +-5%	R102
060-151-1	RESISTOR CHIP 150 OHM 1/10W +-5%	R103
060-821-3	RESISTOR CHIP 820 OHM 1/10W +-5%	R104
060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R104
060-153-3	RESISTOR CHIP 15K OHM 1/10W +-5%	R105
060-333-9	RESISTOR CHIP 33K OHM 1/10W +-5%	R105
060-681-3	RESISTOR CHIP 680 OHM 1/10W +-5%	R106
060-471-0	RESISTOR CHIP 470 OHM 1/10W +-5%	R106
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R107
060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R108
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R109
060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R110
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R111
060-223-3	RESISTOR CHIP 22K OHM 1/10W +-5%	R112
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R113
060-152-2	RESISTOR CHIP 1.5K OHM 1/10W +-5%	R114
060-332-8	RESISTOR CHIP 3.3K OHM 1/10W +-5%	R115
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R116
060-332-8	RESISTOR CHIP 3.3K OHM 1/10W +-5%	R117
060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R118
060-104-9	RESISTOR CHIP 100K OHM 1/10W +-5%	R118
060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R118
060-513-5	RESISTOR CHIP 51K OHM 1/10W +-5%	R119
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R119
060-393-3	RESISTOR CHIP 39K OHM 1/10W +-5%	R119

060-683-5	RESISTOR CHIP 68K OHM 1/10W +-5%	R120
060-393-3	RESISTOR CHIP 39K OHM 1/10W +-5%	R120
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R120
060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R121
060-224-4	RESISTOR CHIP 220K OHM 1/10W +-5%	R121
060-104-9	RESISTOR CHIP 100K OHM 1/10W +-5%	R121
060-104-9	RESISTOR CHIP 100K OHM 1/10W +-5%	R122
060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R123
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R124
060-100-5	RESISTOR CHIP 10 OHM 1/10W +-5%	R124
060-224-4	RESISTOR CHIP 220K OHM 1/10W +-5%	R125
060-332-8	RESISTOR CHIP 3.3K OHM 1/10W +-5%	R127
060-104-9	RESISTOR CHIP 100K OHM 1/10W +-5%	R128
060-154-4	RESISTOR CHIP 150K OHM 1/10W +-5%	R150
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R151
060-822-4	RESISTOR CHIP 8.2K OHM 1/10W +-5%	R152
060-472-1	RESISTOR CHIP 4.7K OHM 1/10W +-5%	R155
060-223-3	RESISTOR CHIP 22K OHM 1/10W +-5%	R156
060-151-1	RESISTOR CHIP 150 OHM 1/10W +-5%	R157
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R158
060-000-8	RESISTOR CHIP 0 OHM 1/10W +-5%	R158
060-223-3	RESISTOR CHIP 22K OHM 1/10W +-5%	R201
060-223-3	RESISTOR CHIP 22K OHM 1/10W +-5%	R202
060-223-3	RESISTOR CHIP 22K OHM 1/10W +-5%	R203
060-272-7	RESISTOR CHIP 2.7K OHM 1/10W +-5%	R204
060-272-7	RESISTOR CHIP 2.7K OHM 1/10W +-5%	R205
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R206
060-183-0	RESISTOR CHIP 18K OHM 1/10W +-5%	R207
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R207

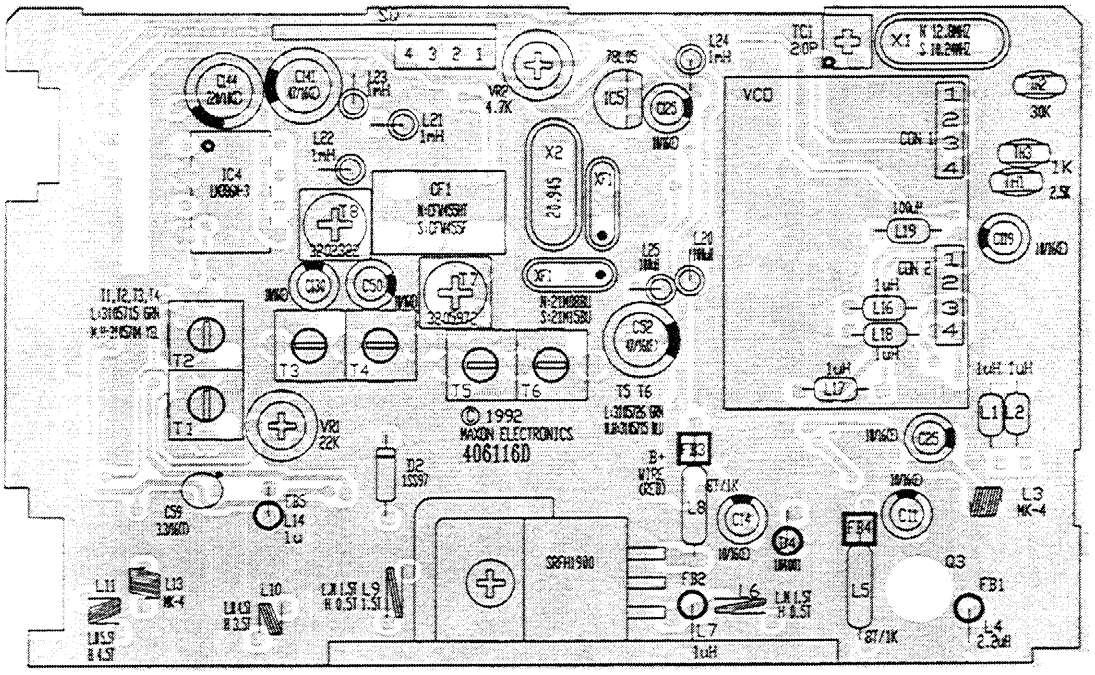
060-221-1	RESISTOR CHIP 220 OHM 1/10W +-5%	R208
060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R208
060-393-3	RESISTOR CHIP 39K OHM 1/10W +-5%	R209
060-184-1	RESISTOR CHIP 180K OHM 1/10W +-5%	R209
060-562-9	RESISTOR CHIP 5.6K OHM 1/10W +-5%	R210
060-000-8	RESISTOR CHIP 0 OHM 1/10W +-5%	R210
060-100-5	RESISTOR CHIP 10 OHM 1/10W +-5%	R301
060-472-1	RESISTOR CHIP 4.7K OHM 1/10W +-5%	R302
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R303
060-272-7	RESISTOR CHIP 2.7K OHM 1/10W +-5%	R304
060-220-0	RESISTOR CHIP 22 OHM 1/10W +-5%	R305
060-151-1	RESISTOR CHIP 150 OHM 1/10W +-5%	R306
060-151-1	RESISTOR CHIP 150 OHM 1/10W +-5%	R306
060-221-1	RESISTOR CHIP 220 OHM 1/10W +-5%	R306
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R307
060-101-6	RESISTOR CHIP 100 OHM 1/10W +-5%	R309
060-331-7	RESISTOR CHIP 330 OHM 1/10W +-5%	R310
060-221-1	RESISTOR CHIP 220 OHM 1/10W +-5%	R310
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R401
060-822-4	RESISTOR CHIP 8.2K OHM 1/10W +-5%	R402
060-682-4	RESISTOR CHIP 6.8K OHM 1/10W +-5%	R403
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R403
060-153-3	RESISTOR CHIP 15K OHM 1/10W +-5%	R404
060-104-9	RESISTOR CHIP 100K OHM 1/10W +-5%	R405
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R406
060-333-9	RESISTOR CHIP 33K OHM 1/10W +-5%	R407
060-223-3	RESISTOR CHIP 22K OHM 1/10W +-5%	R408
060-184-1	RESISTOR CHIP 180K OHM 1/10W +-5%	R409
060-182-9	RESISTOR CHIP 1.8K OHM 1/10W +-5%	R410

060-272-7	RESISTOR CHIP 2.7K OHM 1/10W +-5%	R410
060-182-9	RESISTOR CHIP 1.8K OHM 1/10W +-5%	R410
060-124-6	RESISTOR CHIP 120K OHM 1/10W +-5%	R411
060-153-3	RESISTOR CHIP 15K OHM 1/10W +-5%	R412
060-123-6	RESISTOR CHIP 12K OHM 1/10W +-5%	R412
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R413
060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R414
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R415
060-474-3	RESISTOR CHIP 470K OHM 1/10W +-5%	R415
060-222-2	RESISTOR CHIP 2.2K OHM 1/10W +-5%	R416
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R417
060-124-6	RESISTOR CHIP 120K OHM 1/10W +-5%	R419
060-334-0	RESISTOR CHIP 330K OHM 1/10W +-5%	R420
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R421
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R421
060-393-3	RESISTOR CHIP 39K OHM 1/10W +-5%	R422
060-203-5	RESISTOR CHIP 20K OHM 1/10W +-5%	R423
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R424
060-104-9	RESISTOR CHIP 100K OHM 1/10W +-5%	R425
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R426
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R427
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R428
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R429
060-472-1	RESISTOR CHIP 4.7K OHM 1/10W +-5%	R430
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R431
060-224-4	RESISTOR CHIP 220K OHM 1/10W +-5%	R432
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R433
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R434
060-153-3	RESISTOR CHIP 15K OHM 1/10W +-5%	R435

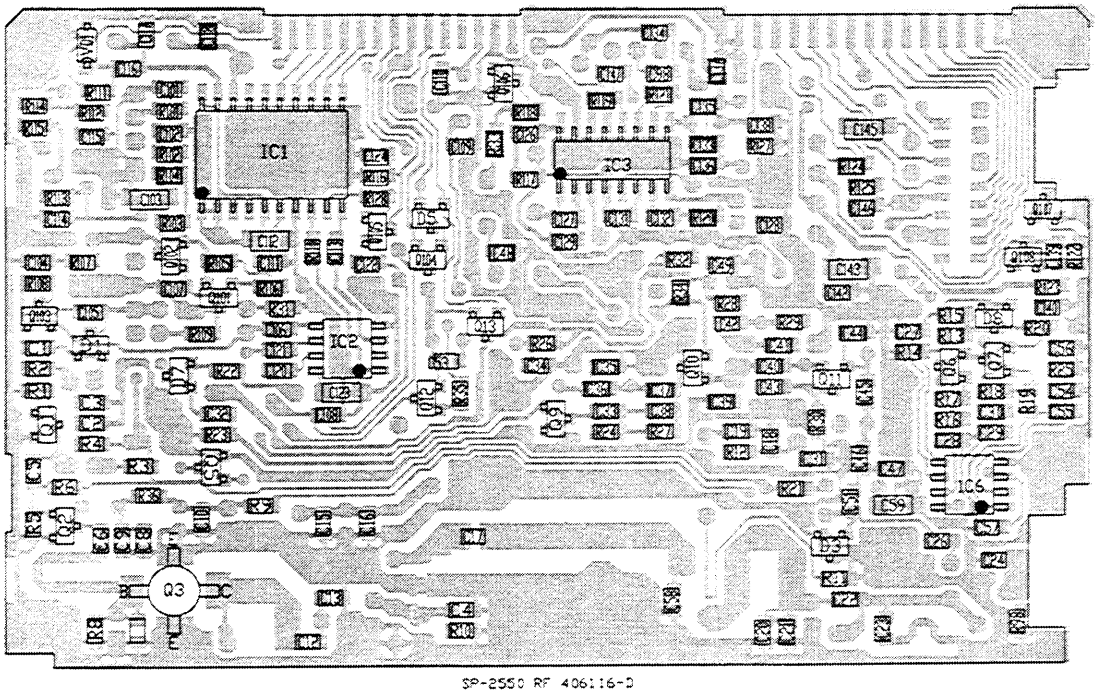
060-473-2	RESISTOR CHIP 47K OHM 1/10W +-5%	R435
060-222-2	RESISTOR CHIP 2.2K OHM 1/10W +-5%	R436
060-272-7	RESISTOR CHIP 2.7K OHM 1/10W +-5%	R439
060-472-1	RESISTOR CHIP 4.7K OHM 1/10W +-5%	R440
060-222-2	RESISTOR CHIP 2.2K OHM 1/10W +-5%	R441
060-223-3	RESISTOR CHIP 22K OHM 1/10W +-5%	R442
060-152-2	RESISTOR CHIP 1.5K OHM 1/10W +-5%	R443
060-563-0	RESISTOR CHIP 56K OHM 1/10W +-5%	R444
060-123-6	RESISTOR CHIP 12K OHM 1/10W +-5%	R445
060-681-3	RESISTOR CHIP 680 OHM 1/10W +-5%	R446
060-184-1	RESISTOR CHIP 180K OHM 1/10W +-5%	R447
060-153-3	RESISTOR CHIP 15K OHM 1/10W +-5%	R448
060-153-3	RESISTOR CHIP 15K OHM 1/10W +-5%	R450
060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R452
060-102-7	RESISTOR CHIP 1K OHM 1/10W +-5%	R453
060-333-9	RESISTOR CHIP 33K OHM 1/10W +-5%	R460
060-105-0	RESISTOR CHIP 1M OHM 1/10W +-5%	R461
060-184-1	RESISTOR CHIP 180K OHM 1/10W +-5%	R465
060-184-1	RESISTOR CHIP 180K OHM 1/10W +-5%	R466
060-472-1	RESISTOR CHIP 4.7K OHM 1/10W +-5%	R467
060-472-1	RESISTOR CHIP 4.7K OHM 1/10W +-5%	R470
060-223-3	RESISTOR CHIP 22K OHM 1/10W +-5%	R472
060-105-0	RESISTOR CHIP 1M OHM 1/10W +-5%	R473
060-104-9	RESISTOR CHIP 100K OHM 1/10W +-5%	R474
060-272-7	RESISTOR CHIP 2.7K OHM 1/10W +-5%	R475
060-123-6	RESISTOR CHIP 12K OHM 1/10W +-5%	R476
060-682-4	RESISTOR CHIP 6.8K OHM 1/10W +-5%	R477
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R501
060-202-4	RESISTOR CHIP 2K OHM 1/10W +-5%	R502

060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R503
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R504
060-103-8	RESISTOR CHIP 10K OHM 1/10W +-5%	R505
060-202-4	RESISTOR CHIP 2K OHM 1/10W +-5%	R506
480-044-8	TRIMMER POT.METER NRV630HF01 B100K	RV401
480-045-9	TRIMMER POT.METER NRV630HF01 B20K	RV402
480-051-4	POTENTIOMETER NRV630HF01 B50KOHM	RV403
432-063-7	SW PUSH SPPH221BP011	SW1
430-048-7	SW DIP ROTAR.DIGITALKDR-10	SW2
430-047-6	SW DIP ROTAR/DIGITALKDR-16	SW2
436-030-0	SW TACT SKHUPF	SW401
436-030-0	SW TACT SKHUPF	SW402
320-858-8	COIL D/D CONVERTER 5PSL-1006X0	T150
310-571-5	COIL MOLDED 140MHZ 5.5T RX	T1
310-571-5	COIL MOLDED 140MHZ 5.5T RX	T2
310-571-5	COIL MOLDED 140MHZ 5.5T RX	T3
310-571-5	COIL MOLDED 140MHZ 5.5T RX	T4
310-570-4	COIL MOLDED 150MHZ 4.5T RX	T1
310-570-4	COIL MOLDED 150MHZ 4.5T RX	T2
310-570-4	COIL MOLDED 150MHZ 4.5T RX	T3
310-570-4	COIL MOLDED 150MHZ 4.5T RX	T4
310-571-5	COIL MOLDED 140MHZ 5.5T RX	T5
310-571-5	COIL MOLDED 140MHZ 5.5T RX	T6
310-572-6	COIL MOLDED 130MHZ 6.5T RX	T5
310-572-6	COIL MOLDED 130MHZ 6.5T RX	T6
320-597-2	COIL 21.4MHZ RX MIXER	T7
320-232-2	COIL 455KHZ DETECTOR	T8
172-013-4	CAPACITOR TRIMMER 20PF:ECR-LA020A12	TC1
098-252-8	THERMISTOR 2.5K OHM +-15%:KTD5-225	TH1

099-303-6	THERMISTOR 30K OHM +-15%:KTD5-330	TH2
098-333-8	THERMISTOR CHIP 33K OHM:NTCCS32163SH333KC	TH201
097-102-1	THERMISTOR 1K OHM +-15%:KTD5-210	TH3
071-223-1	RESISTOR SEMIFIXED 22KB:RH0651C100223	VR1
071-472-9	RESISTOR SEMIFIXED 4.7KB:RH0651C100472	VR2
450-514-7	VR 20KAV12M4-1(6X5)PVBS(SJ)12R-15	VR3
260-861-1	CRYSTAL(S1-1060-0 NC-18C 10.240MHZ	X1
261-394-2	CRYSTAL NC-18C 12.800MHZ(S1-1060-0510)	X1
261-923-9	CRYSTAL HC-49/T 20.945MHZ:30PPM	X2
262-006-6	CRYSTAL HC49/S 11.155200MHZ	X401
271-002-0	FILTER CRYSTAL 21M 15BU	XF1
271-006-4	FILTER CRYSTAL 21M08BU	XF1



TOP SIDE PATTERN



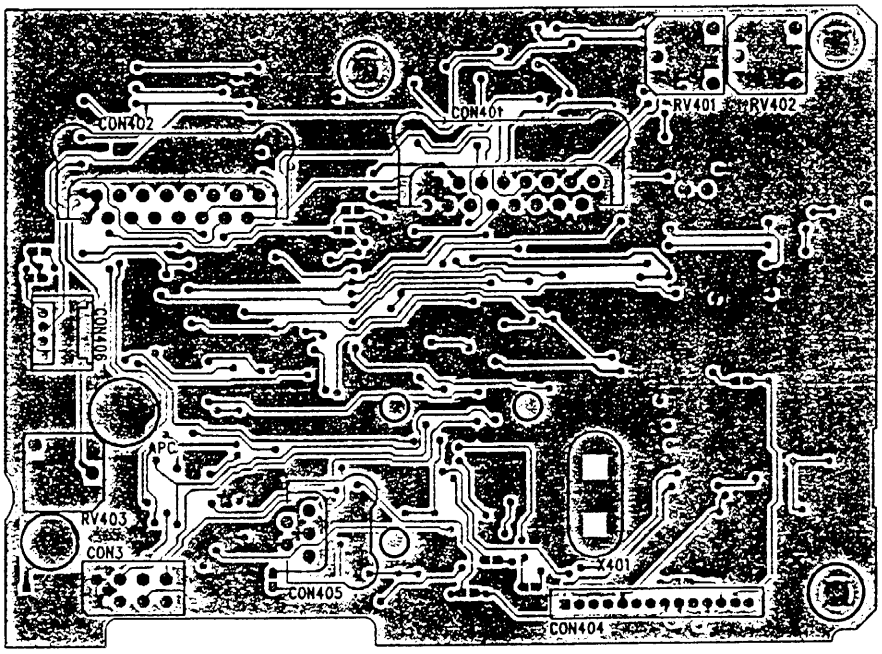
BOTTOM SIDE PATTERN

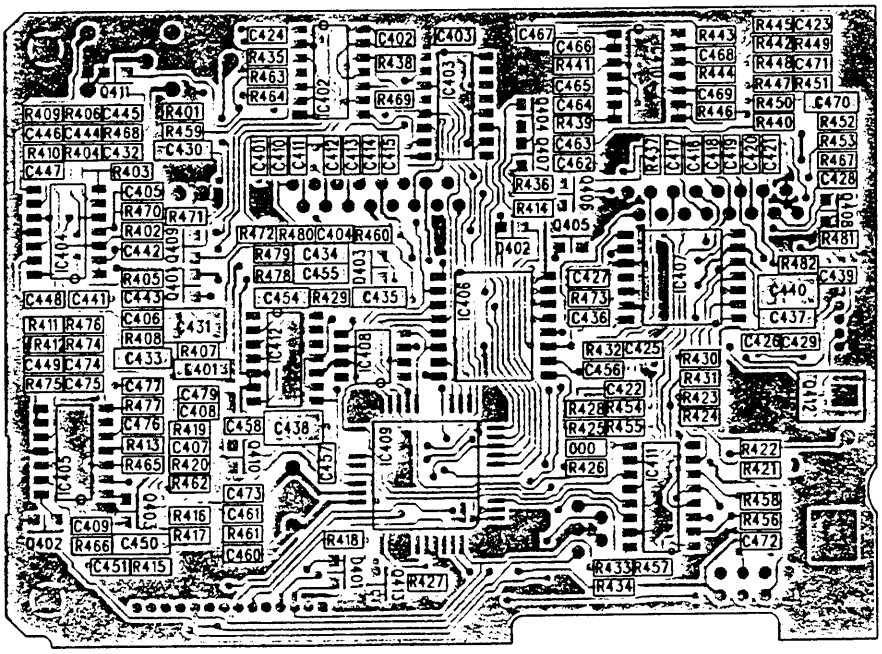
CAUTION

OBSERVE PRECAUTIONS FOR HANDLING

ELECTROSTATIC SENSITIVE DEVICES

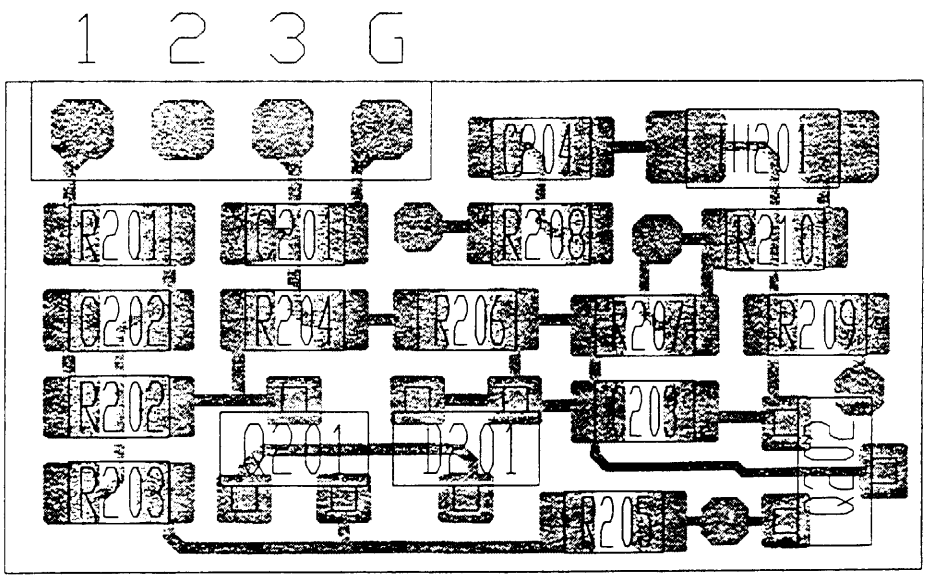
MONOGRAM PORTABLE
RF BOARD 406116-D

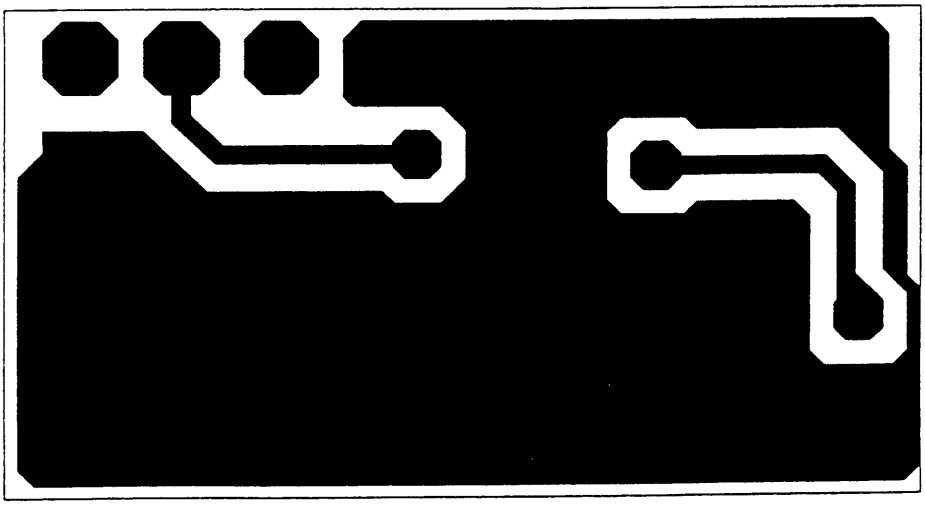




MONOGRAM PORTABLE
CONTROL BOARD 406115-H

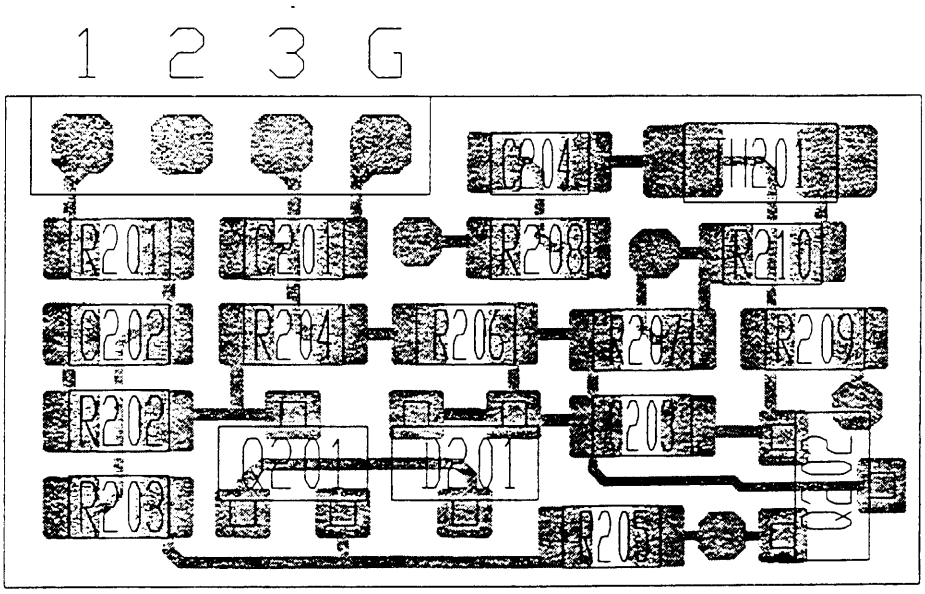
CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

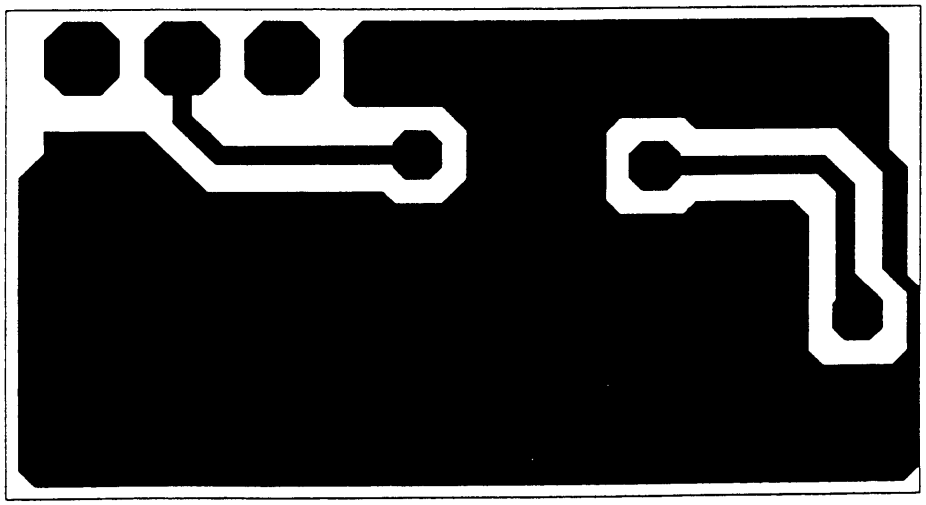




CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

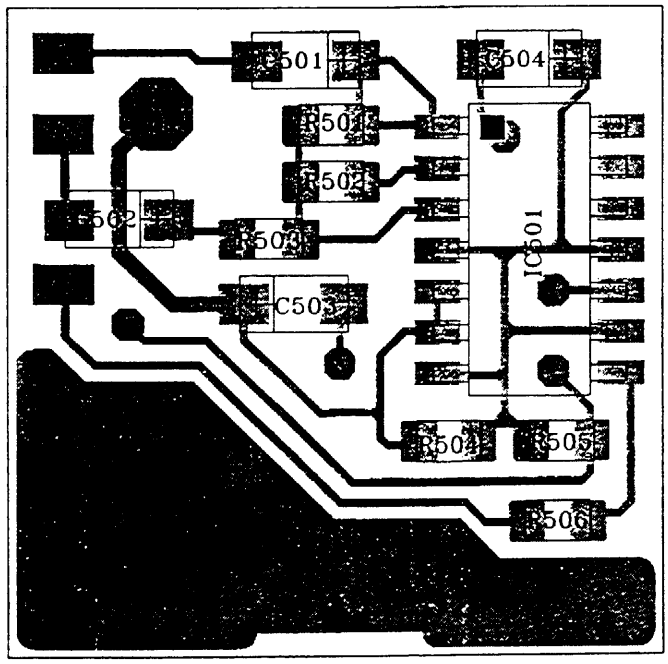
MONOGRAM PORTABLE
SQUELCH BOARD 416903-B

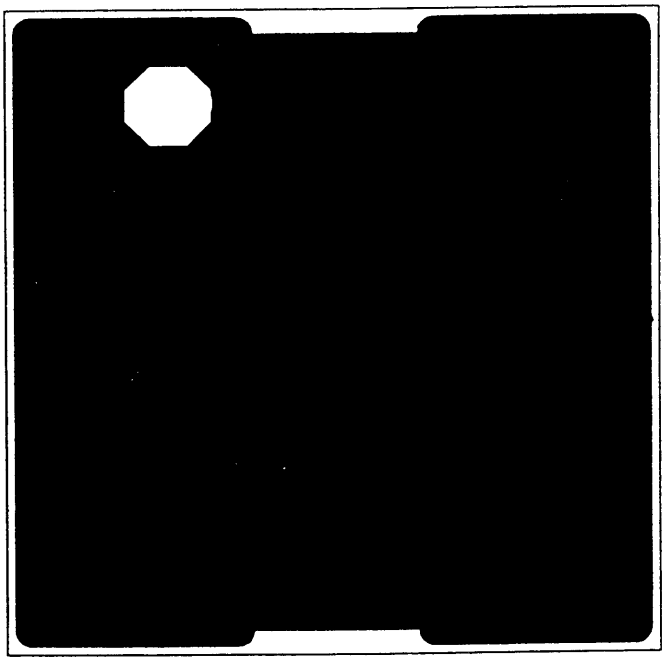




CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

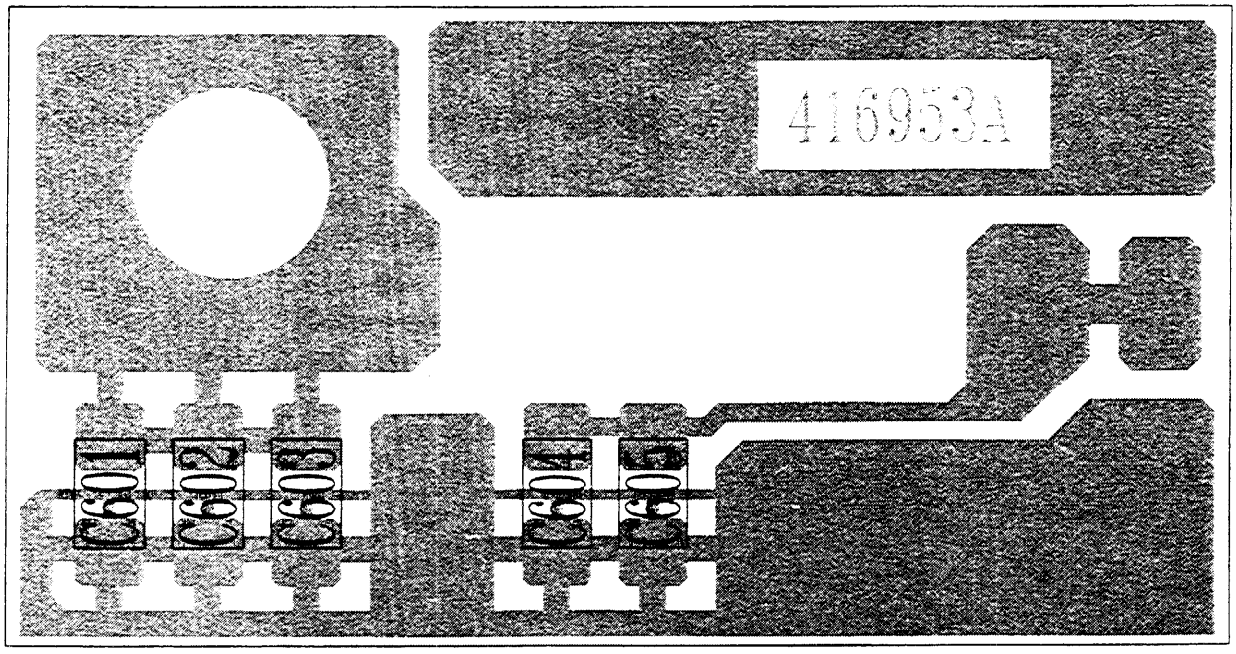
MONOGRAM PORTABLE
SQUELCH BOARD 416903-B

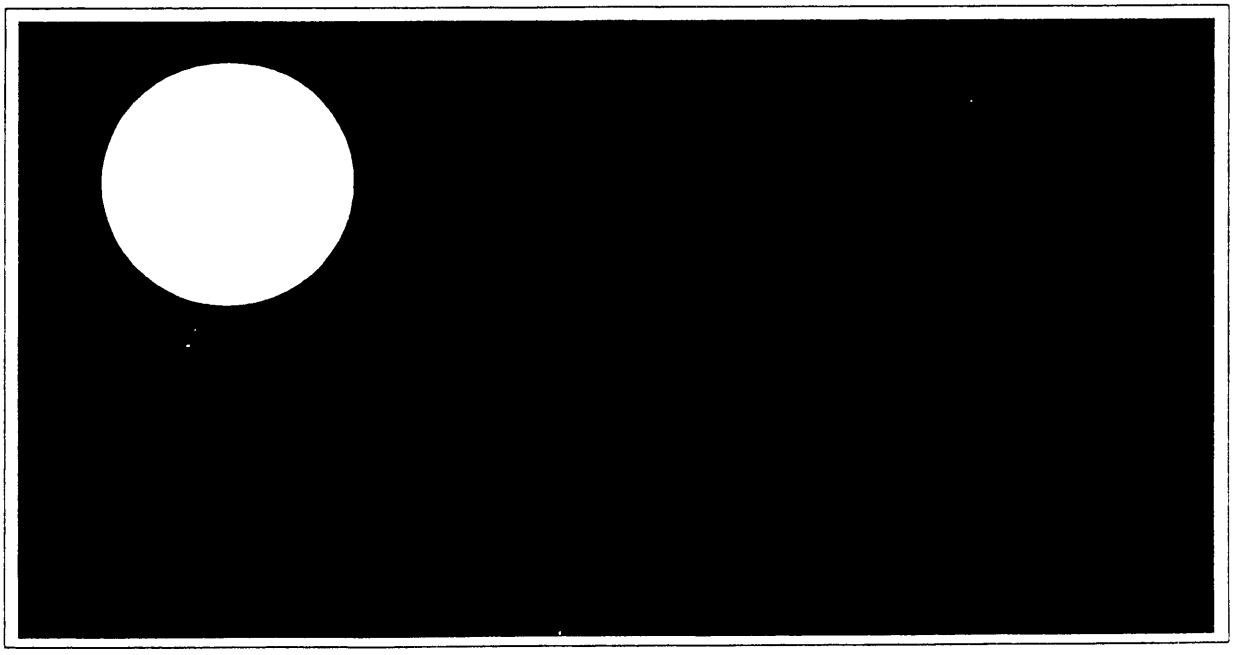




CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

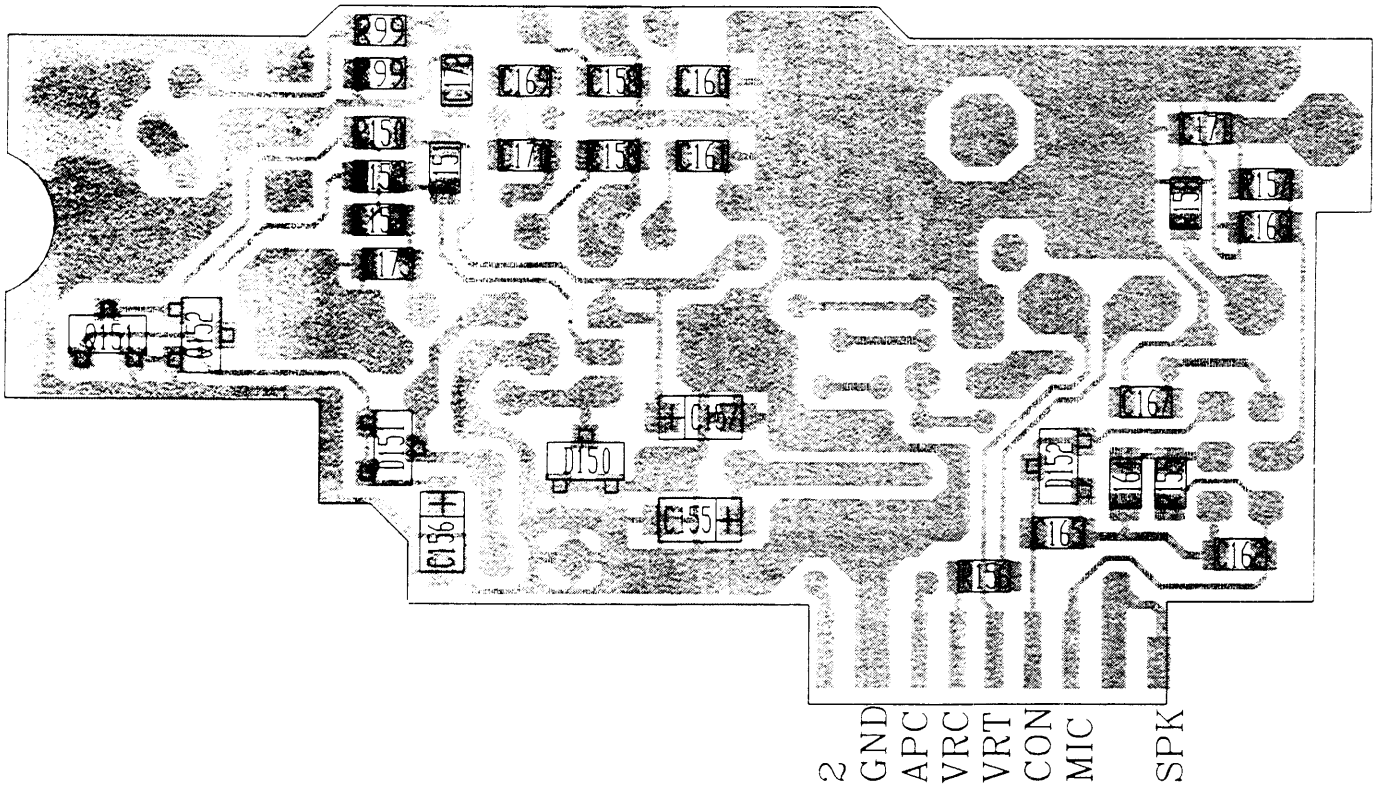
MONOGRAM PORTABLE
BANDPASS FILTER BOARD 416921-A

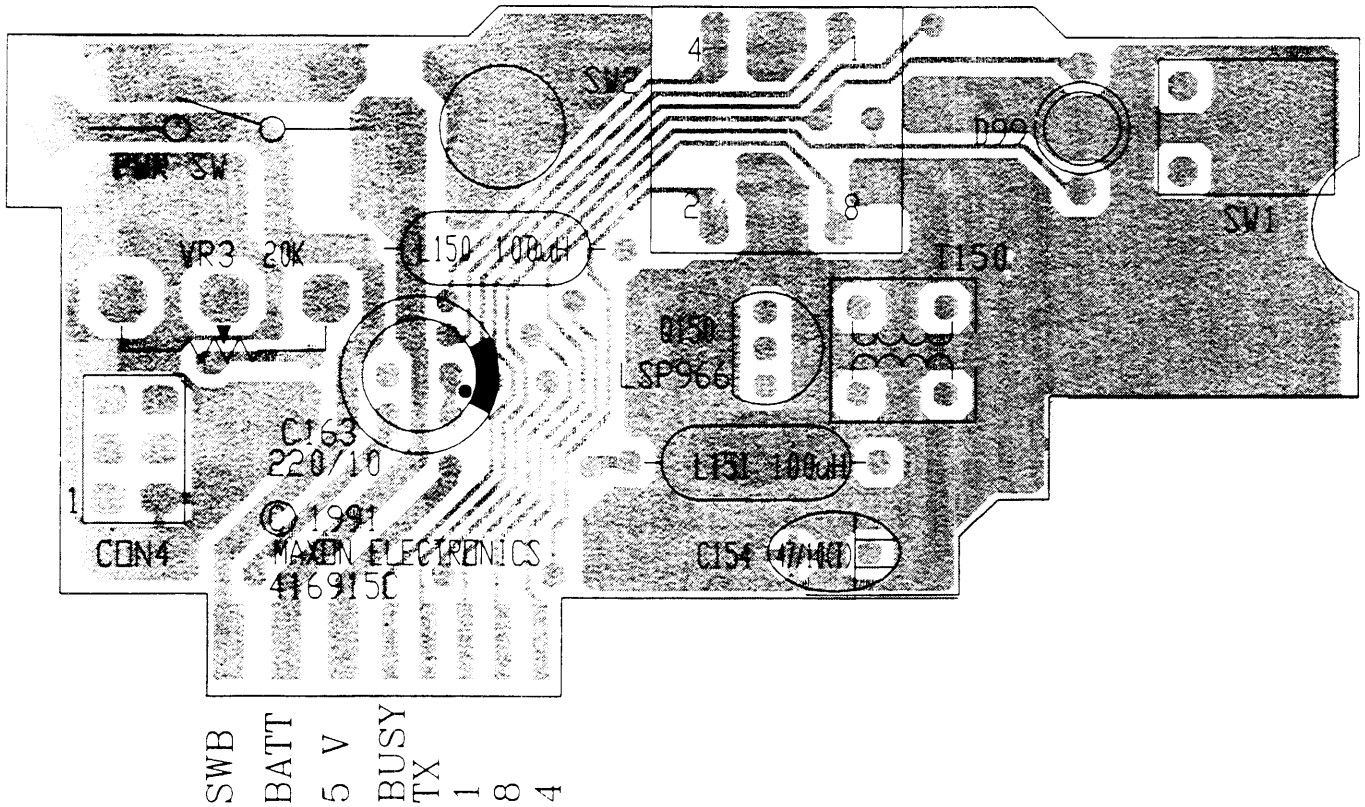




MONOGRAM PORTABLE
BATTERY TERMINAL 416953-A

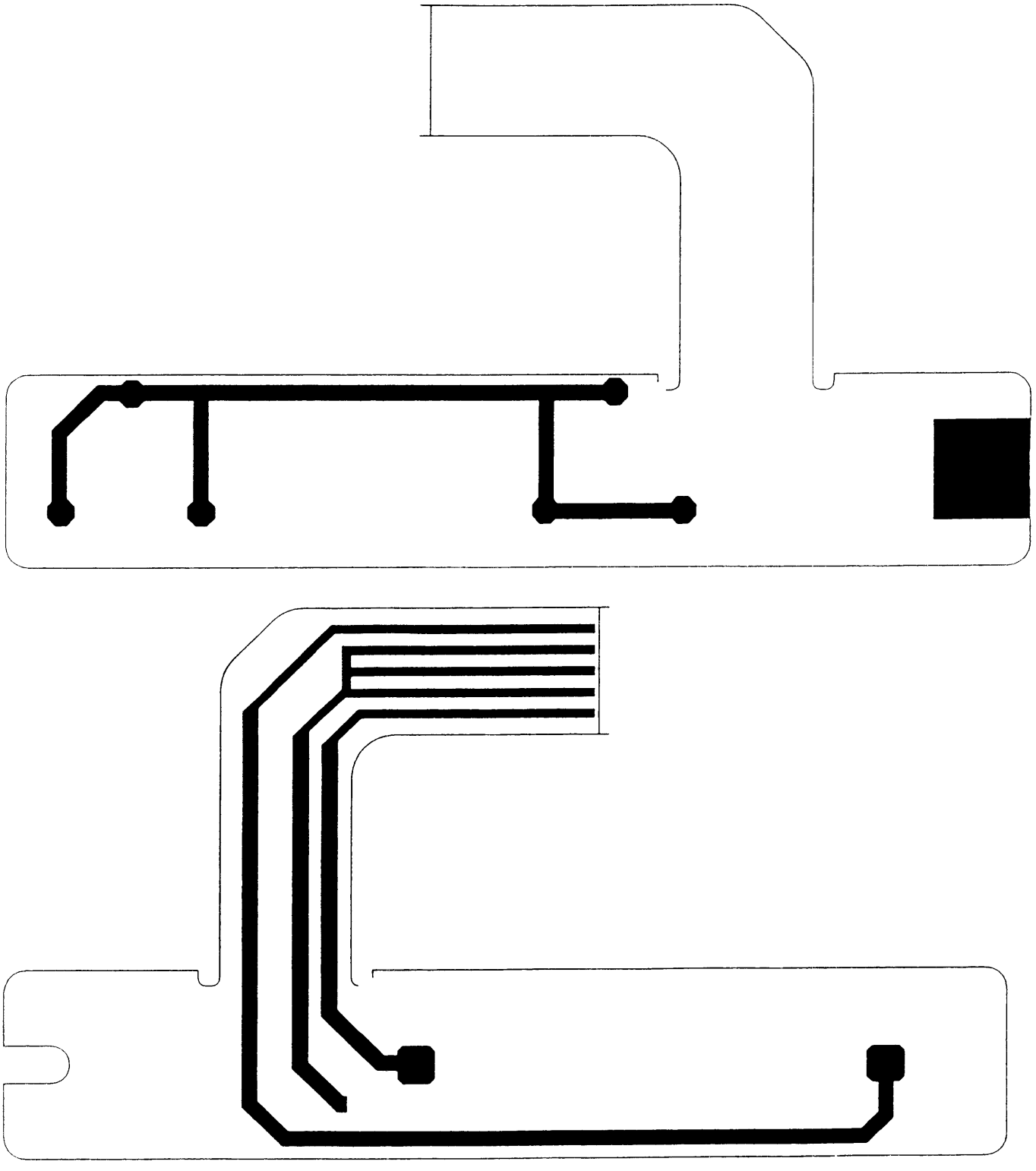
CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES





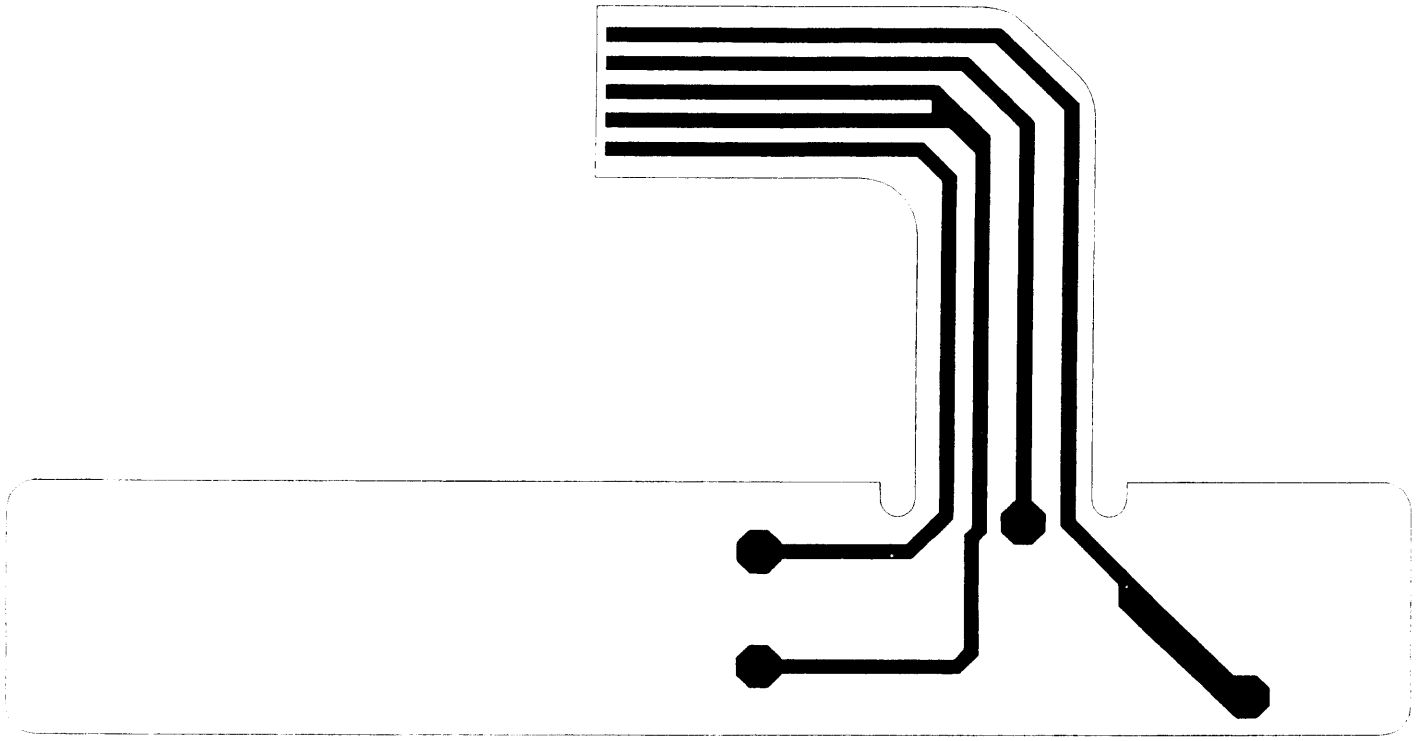
CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

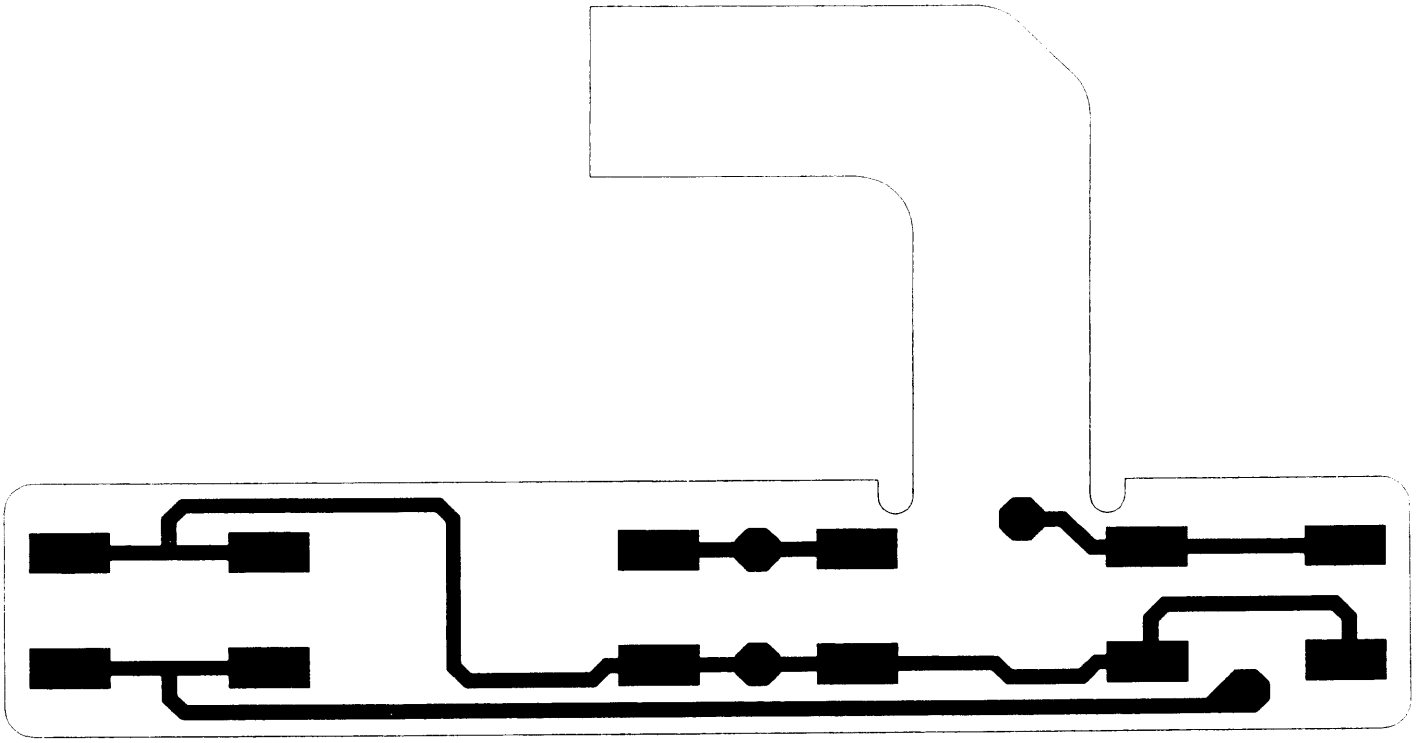
MONOGRAM PORTABLE
TOP PANEL 416915-C



MONOGRAM PORTABLE
PTT DOM 416911-A

CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES





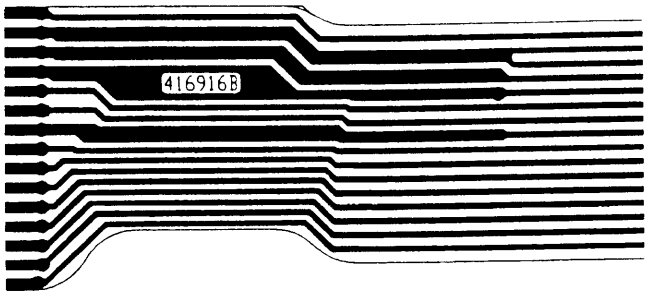
CAUTION

OBSERVE PRECAUTIONS FOR HANDLING

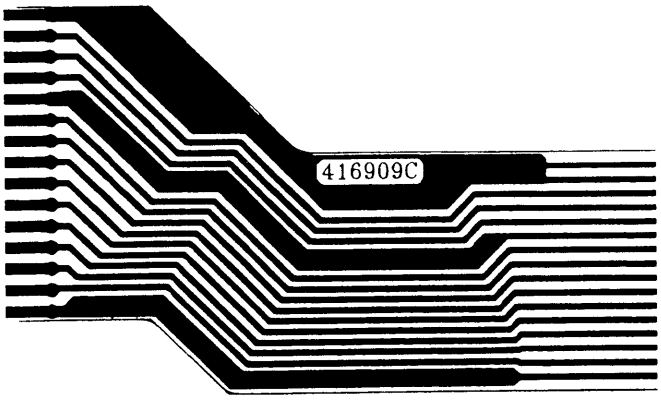
ELECTROSTATIC SENSITIVE DEVICES

MONOGRAM PORTABLE
PTT TACK 416954-A

FLEX PCB 416916-C



FLEX PCB 416909-C



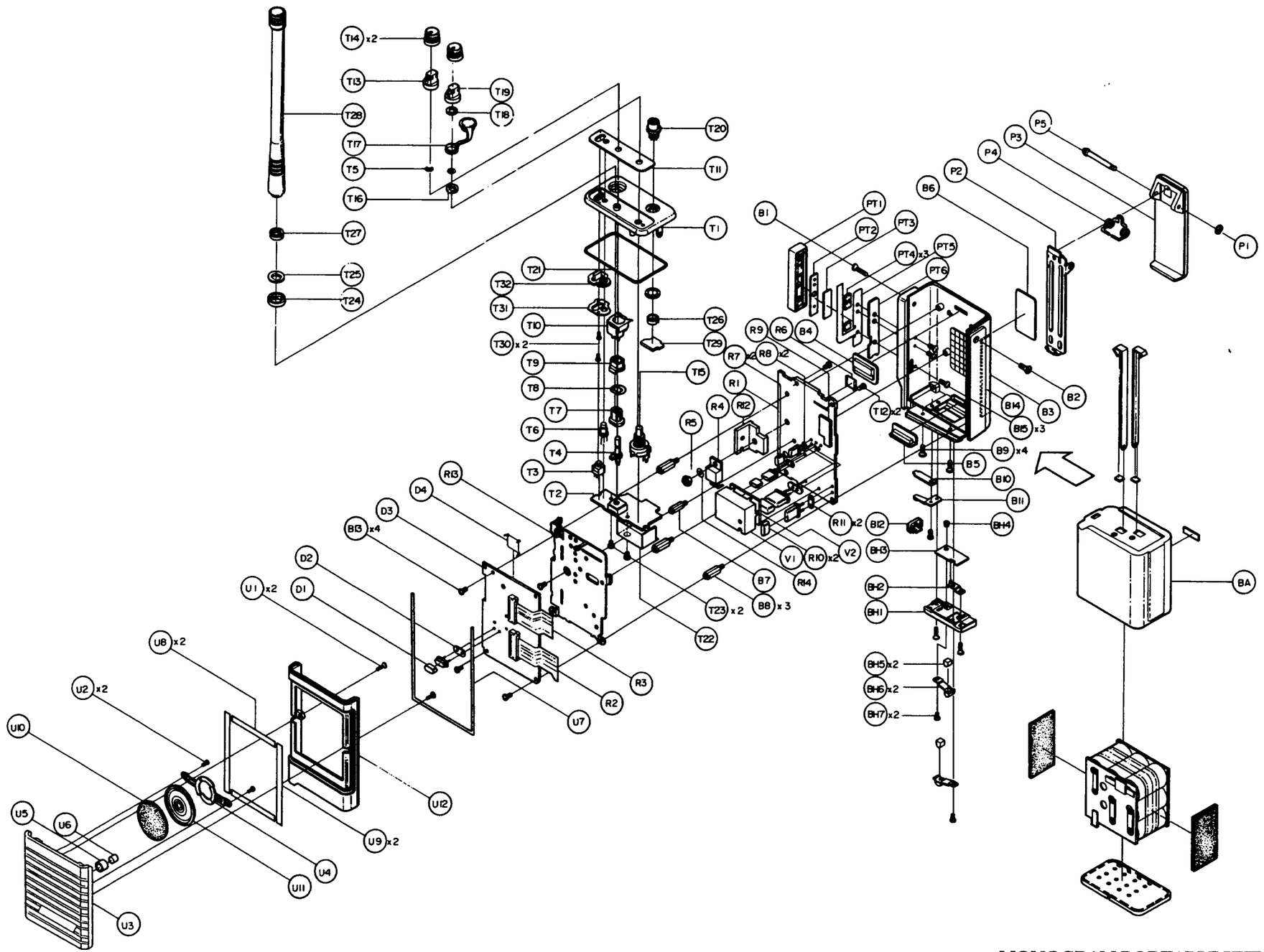
MONOGRAM PORTABLE
FLEX PCB

CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

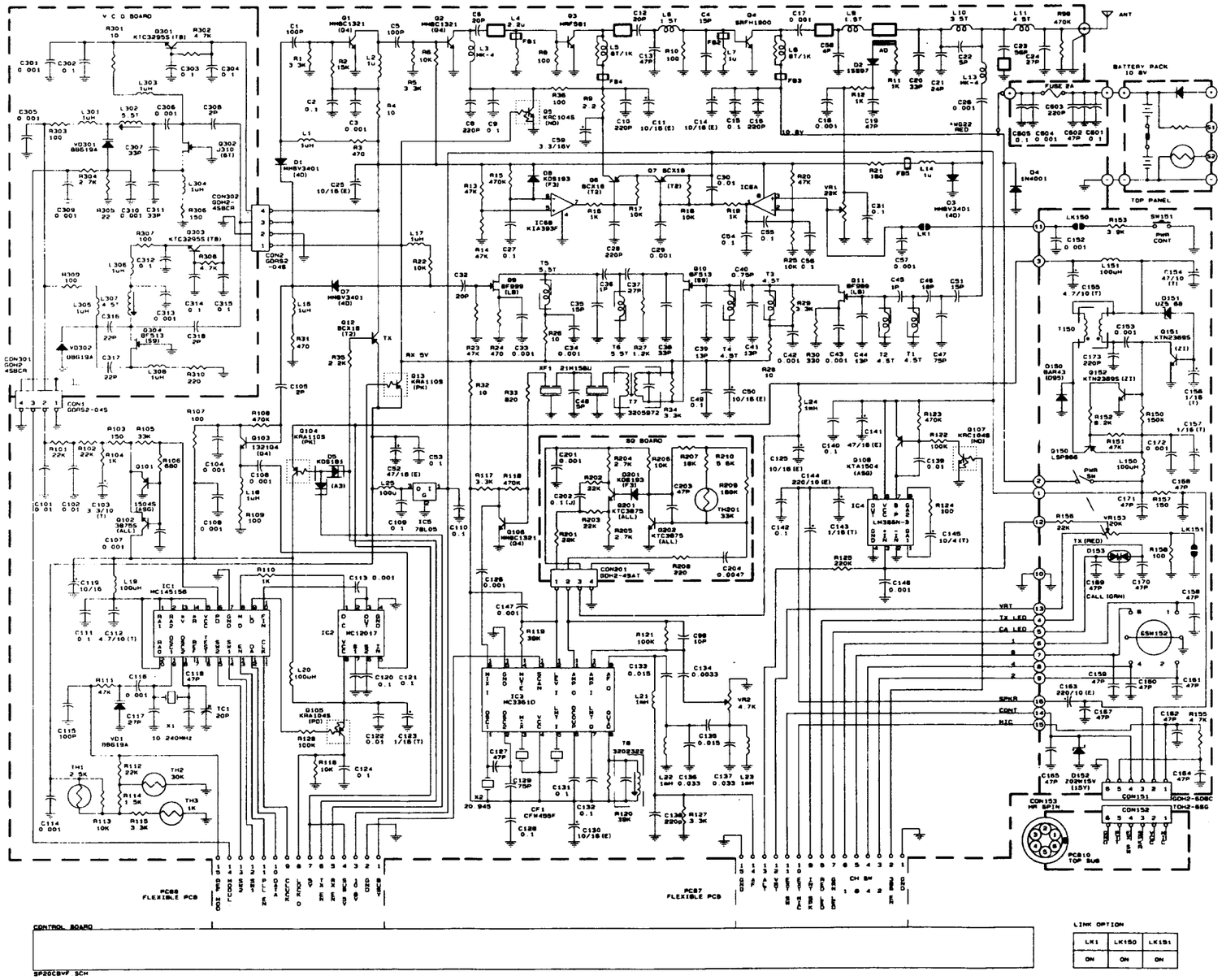
NOTE: When ordering parts for your Monogram radio, precede all part numbers with the prefix R29./

Identifier	Parts Name & Description	Parts No.
B1	Screw Machine (FH) M2. 6x10	611379
B2	Screw Machine (FH) M2. 5x6	611380
B3	Bottom Cover	718153A
B4	Protecter "A" NBR	894566
B5	Protecter "B" NBR	894567
B6	Label Name AL Foil 34.7x17.8	958845A
B7	Post 4.5x8.6 NI-PLT	852991A
B8	Post 4.5x13.1 NI-PLT	852950
B9	Screw Machine (PH) #2-56x5	600727
B10	Latch Plate	771885
B11	Spring (Latch)	881476
B12	Latch (Batt. Lock)	825642
B13	Screw Machine (PH) #2-56x5	600747
B14	Felt 80x20x0.2t PVC	906406
B15	Screw Machine (PH) #2-56-7	600726
BH1	Holder Conductive Spray	732779
	Holder None. Spray	732729
BH2	Terminal(-) 0.6t NI-PLT	752651
BH3	Batt.PCB	416953B
BH4	Bushing SN-PLT	853042
BH5	Cushion Hs50	894550A
BH6	Contact (Batt.) NI-PLT	881477
BH7	Screw Machine (PH) #2-56x5	894550A
D1	Rubber Cap Sili.Hs50	894785
D2	Rubber Holder Sili.Hs50	894787
D3	Digital PCB	416115G
D4	Shield Plate STPEO.3t	772013
P1	"E" Ring & 1.5 BLK	665018
P2	Bracket SUS304 Spray	3670A
P3	Belt Crip Lexan 141-2032	752483A
P4	Spring SUS304-WPA	881496
P5	Pin BSBM & 3.5x30 NI-PLT	860110
PT1	PTT Pad SILL.Hs45 BLK (3 BUTT.)	894883
PT2	In-Plate SUS304 0.2t (3 BUTT.)	772051
PT3	Te-Plate PVC 0.2t 22x6.5 (3 BUTT.)	795541
	PTT Pad SILL. Hs45 BLK (2BUTT)	894848
	In-Plate SUS304 0.2t (2BUTT.)	772061
	Te-Plate PVC 0.2t 26x6.5 (2 BUTT.)	795540
PT4	Tact Switch	4360300
PT5	Felx PCB	406954A
PT6	Plate PTT SPC 1t NI-PLT	772050
R1	RF PCB	406116D
R2	Bushing BSBM SN-PLT	852994
R3	Heat Sink CUP 1.5t SN-PLT	761728A
R4	Transistor SRFH1900	2030436
R5	Washer DUP 9.8x6x1.5t	660730
R6	Screw Machine (PH) M2.6x8 Ni-PLT	611077
R7	Rubber Cap Hs50 Gray	894785
R8	Rubber Holder Sili.	894787
R9	SQ PCB	416903B
R10	Rubber Cap Hs50 Gray	894786
R11	Rubber Holder Sili.	894788
R12	Flex PCB "A"	416916C

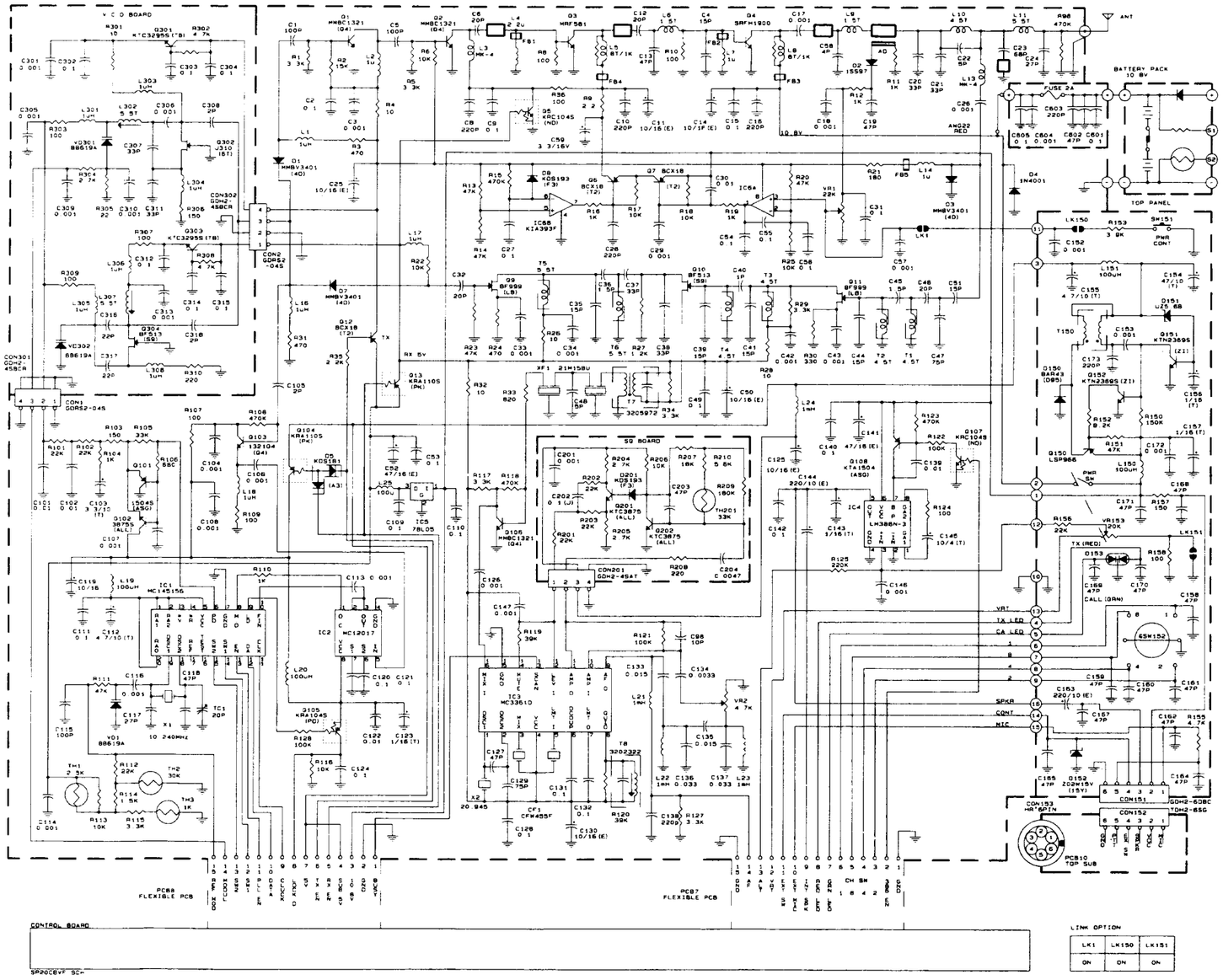
R13	Shield Plate SPTE 0.3t	771955B
R14	Flex PCB "B"	416909C
T1	Top Panel ALDC 12 Spray	702359A
T2	Interface PCB	416915D
T3	Push SW SPPH221BP011	4320637
T4	Stopper Ass"y (10CH)	508159A
	Stopper Ass"y (16CH)	508130A
T5	"E" Ring & 2.5 Ni-PLT	665060
T6	LED Lamp SEF33G2TT	2511481
T7	Holder (ANT) BSBM (1/4'-32)	723535
T8	Washer (ANT) SPTE 0.3t	650985
T9	Bushing (ANT) P.C Clear	852761
T10	Washer (GRD.) SPTE 0.3t	660986
T11	Overlay (10CH.) ALP 0.5t	795359
	Overlay (16CH.) Lexan 0.5t	795385
	Overlay (16CH.) Lexan 0.5t	795380
T12	Screw Machine (PH) M1.7x4	617120
T13	Knob (CH.) AL A5056E BLK	825646
T14	Cap Ne.Rubb.Hs70	830872
T15	Volume 20kav 12m4-1	4505247
T16	Nut BSBM M6xP 0.5 & 8.3	650345
T17	Dust Cap Nylon66 BLK	830992A
T18	'O' Ring Sili. & 6.6x & 4.8	894547
T19	Knob (Cont.) AL A5056E BLK	825647
T20	Connector HR10A-7R-65B	4216481
T21	Gasket Sili.Rubb. BLK Hs40	894549
T22	Insulator PVC 0.3t BLK	906381A
T23	Screw Machine (PH) #2-56x5	600747
T24	Ring (ANT MTG) BSBM & 13.8	852765
T25	Washer (ANT) & 8x & 11.5x1t	905481
T26	Nur BSBM M8 x P0.5 & 10	650344
T27	Nut (ANT) BSBM & 10.6 Ni-PLT	650295
T28	Top Sub PCB	416961A
T29	Screw Machine (PH) M2x3 Zn-PLT	612287
T30	Bracket SPTE 0.5t	723688
T31	Key Pad SILL. RUBB. BLK. Hs40	894544
U1	Screw Tapping (FH) 2.6x6-2S	621104
U2	Screw Tapping (PH) M2.6x5-2S	621460
U3	Bezel Noryl Cone.Spray BLK	831117
	Bezel Noryl None.Spray BLK	831117A
U4	Bracket (SPK.) SPC 0.8t	723776
U5	Bushing Mic & 7.5x5.5 NBR	850924
U6	Mic Condenser WM063T	4202060
U7	Gasket Sili.Rubb. & 1 BLK	894600
U8	Double Tape 3M930 3x52	906214A
U9	Double Tape 3M4930 3x59	906215
U10	Spk. Filter & 33.5x0.15t	906369
U11	Speaker T036S25A-000	4201124
U12	Upp[er Cover AL DC12 Spray	718850
V1	Shield Can BSP 0.4t	771950
V2	Felt 0.5t BLK. Sticker	906316
V3	VCO PCB	416902A
V4	VCO Date Code 25x6	958903A



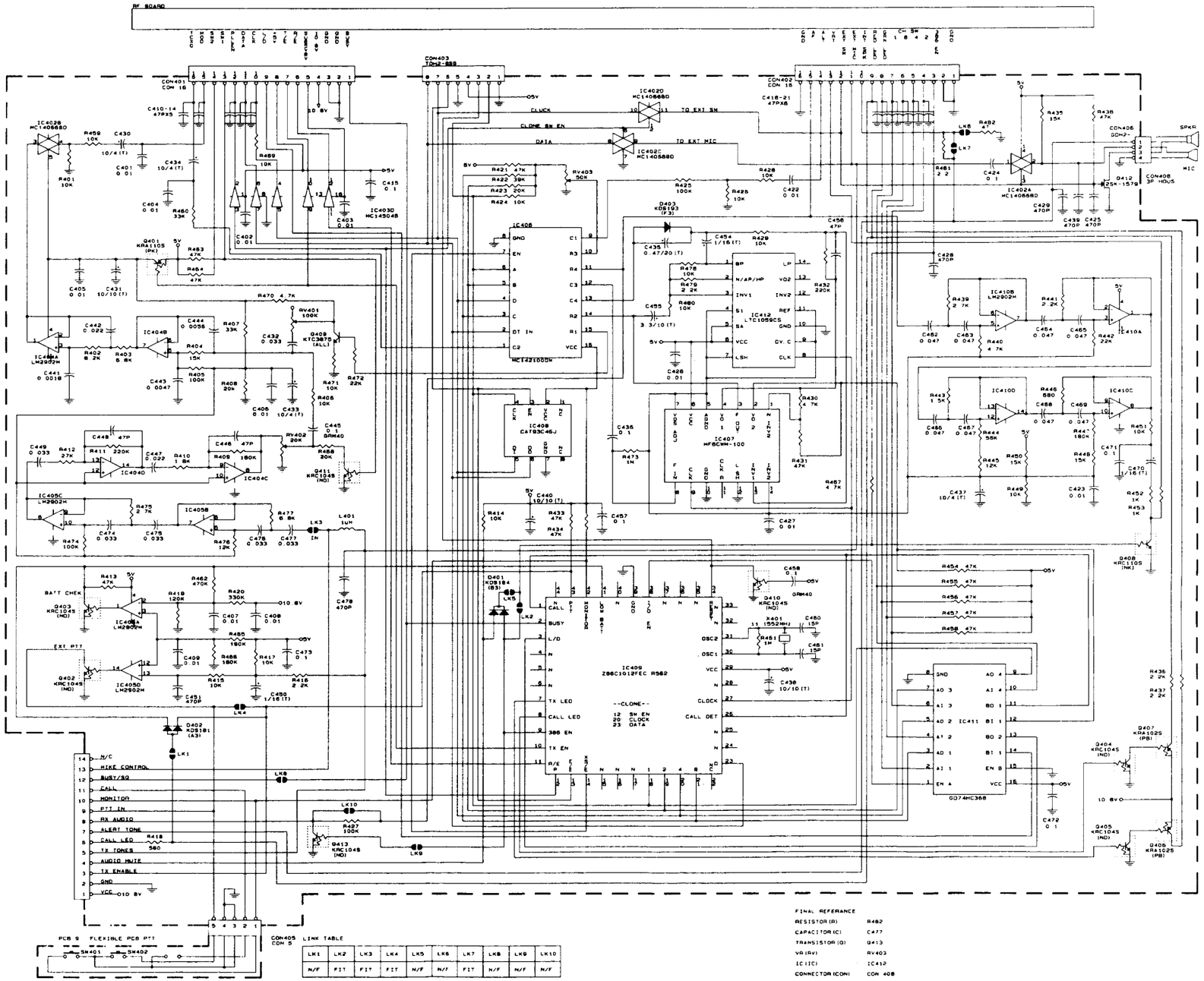
MONOGRAM PORTABLE VHF



MONOGRAM PORTABLE (344A4209P3)
RF BOARD 406116-D
148-162 MHz



MONOGRAM PORTABLE (344A4209P2)
RF BOARD 406116-D
160-174 MHz

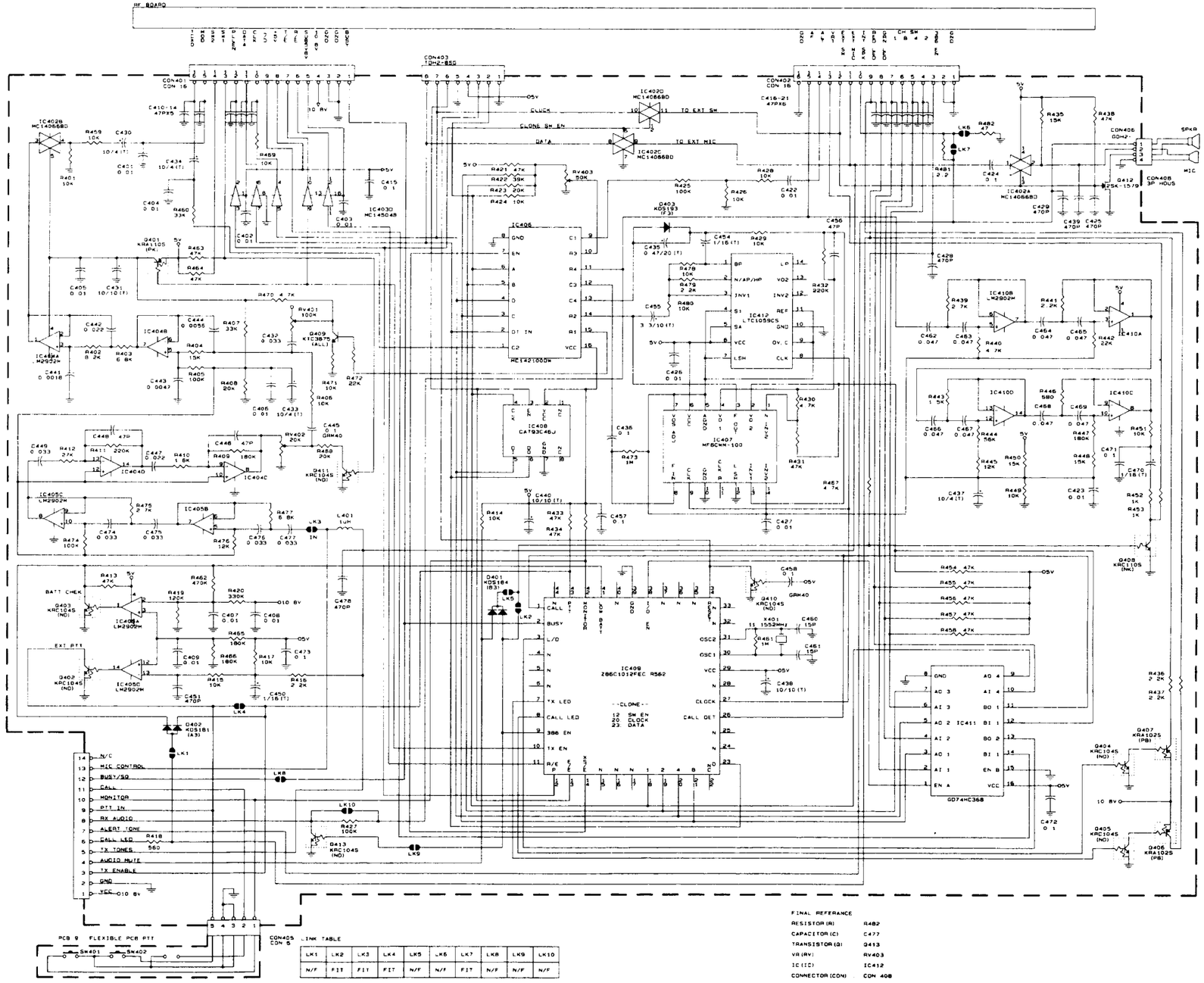


CON405 LINK TABLE									
LK1	LK2	LK3	LK4	LK5	LK6	LK7	LK8	LK9	LK10
N/F	FIT	FIT	FIT	N/F	N/F	FIT	N/F	N/F	N/F

FINAL REFERANCE

RESISTOR (R)	R482
CAPACITOR (C)	C477
TRANSISTOR (Q)	Q413
VR (RV)	RV403
IC (IC)	IC412
CONNECTOR (CON)	CON 408

MONOGRAM PORTABLE 344A4209P2
CONTROL BOARD 406115-H



LINK TABLE									
LK1	LK2	LK3	LK4	LK5	LK6	LK7	LK8	LK9	LK10
N/F	FIT	FIT	FIT	N/F	N/F	FIT	N/F	N/F	N/F

FINAL REFERANCE

RESISTOR (R)	R482
CAPACITOR (C)	C477
TRANSISTOR (Q)	Q413
VR (RV)	RV403
IC (IC)	IC412
CONNECTOR (CON)	CON 408

MONOGRAM PORTABLE 344A4209P3
CONTROL BOARD 406115-H

ADDENDUM NO. 1 TO LBI-38860 (PCMG)

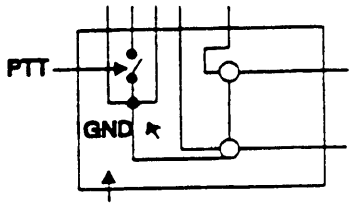
This addendum corrects errors in the manual. These changes will be incorporated in the next printing of the manual.

Page 11, "PLL Frequency Synthesizer": Any reference to 10.25 MHz in this paragraph should be changed to 10.24 MHz.
Delete any reference to 12.8 MHz.
Third paragraph, Line 6: Change IC409-20 to IC409-23.

Page 13, "Mute (Squelch) Circuit": Any referency to 50 kHz in this paragraph should be changed to 25 kHz.

Page 14, "Receive And Transmit Switching Circuit", second paragraph, second line: Change IC409-16 to IC409-43.

Page 21, Figures 4 & 5: Add connection as shown to Tuning Accessory Box



Page 23, "Noise Quieting Sensitivity", Step 2:Change "Set the radio power meter..." to "Set the audio power meter...".

Page 25, "Automatic Power Adjustment, Step 3: Change VR2 to VR1.
"Modulation Deviation Adjustment, Step 10: Change 300 kHz to 300 Hz.
"CTCSS/DCS Deviation Adjustment, Step 4: Add (500-750 Hz) after the word deviation.

Page 27, "RF Tuning", Step 8: Change FL3 to T1 and T2.
"RF Tuning", Step 10: Change FL2 to T3 and T4.
"RF Tuning", Step 14: Change T4 to T5 and T6.
"RF Tuning", Step 16: Change VR201 to VR2.
"Discriminator Tuning", Step 2: Change T5 to T8.
"Discriminator Tuning", Step 3: Change T4 to T7.
"Squelch Adjustment", Step 4: Change VR201 to VR2.

ERICSSON
Ericsson GE Mobile Communications Inc
Mountain View Road • Lynchburg, Virginia 24502

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