SM-PM200/250-01

PM200/250

Service Manual

maxon cic EUROPE

AMENDMENT RECORD SHEET

All amendments to this manual should be incorporated as soon as they are received and recorded below:

Issue No.	Effective Date	Reason for Change	Date	Signature

All Engineering Bulletins relevant to this product should be placed at the rear of this binder. Please ensure that this manual is updated with any replacement pages, which may accompany these Engineering Bulletins.

Always read all Engineering Bulletins before carrying out work on a radio.

Please read the WARNINGS on the next page before referring to subsequent sections.

WARNINGS

1. WARNING! NEVER connect the transceiver to an AC outlet. This may pose a fire hazard or result in an electric shock.

2. NEVER operate the radio transmitter without a suitable artificial load or antenna connected.

3. NEVER connect the transceiver to a power source of more than 16V DC such as a 24V battery.

4. NEVER cut the DC power cable between the DC Plug and fuse holder. If an incorrect connection is made after cutting, the transceiver may be damaged.

5. NEVER place the transceiver where normal operation of the vehicle may be hindered or where it could cause bodily injury.

6. NEVER expose the transceiver to rain, snow or any liquids.

7. NEVER modify a radio or accessory except as instructed in the service manual, engineering bulletins or formal communication as this may invalidate any warranty, guarantee or type approval.

8. USE the supplied microphone only. Other microphones have different pin assignments and may damage the transceiver. (ACC-700, optional DTMF MIC. ACC-703)

9. DO NOT use or place the transceiver in areas with temperatures below -30°C or above +60°C, In areas subject to direct sunlight, such as the dashboard.

10. AVOID operating the transceiver without running the vehicle's engine. The vehicle's battery will quickly run out if the transceiver transmits while the vehicle's engine is OFF.

11. AVOID placing the transceiver in excessively dusty environments.

12. AVOID the use of chemical agents such as benzene or alcohol when cleaning, as they damage the transceiver surfaces.

13. BE CAREFUL! The transceiver will become hot when operating continuously for long periods.

14. DO NOT operate this equipment in environments containing explosive materials or vapours.

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Note:

Although this manual is a generic manual for PM200 and PM250 there are a number of differences between PM200 and PM250. A separate appendix has been written which includes the drawings and part list for the PM250. Please be aware that all drawings and parts are only relevant to the PM200. All features and functions are relevant to both models. The PM250 appendix can be downloaded from the MaxonCIC website http://www.maxoncic.co.uk/

Introduction

This Maxon Service Manual is a comprehensive guide for the maintenance and field repair of this equipment. It covers all versions of the PM-200/250 radio. Before using this manual please read the whole of this introductory chapter, this will help you to make the best use of it. If you have not done so already, please also read the warnings immediately in front of this chapter before proceeding any further.

Using this Manual

The organization of this manual has been made to access the location and referencing of information, as quickly as possible.

Section 3 - Installation, Commissioning & Alignment. This describes connections to the radio, how to commission it and how to align the radio should this become necessary.

Section 4 - Detailed Functional Description.

Section 5 - Troubleshooting..

Amendments to this Manual

From time to time during its lifetime, this product will be changed and improved. To cover such changes, amendments to this manual will be issued in the form of replacement and/or additional pages. It is important that anyone working on a product has all the relevant information. Therefore you should incorporate amendments to this manual on receipt. Please follow the instructions accompanying the amendment (in the form of an Engineering Bulletin) and be sure to complete the amendment record at the front of this manual.

On occasion it may be necessary to issue product information more quickly than can be achieved with an amendment. In this case the information will be distributed as a Maxon Engineering Bulletin. Engineering Bulletin numbers are prefixed with a category letter – A, B or C.

E.g. CATEGORY C – ENGINEERING BULLETIN 120

Category C describes how Maxon recommends an improvement and/or a modification to make an improvement to a product

Engineering Bulletin 120 index number allocated to this bulletin.

'A' Category A Engineering Bulletins will only be released if, by using the equipment manufactured by Maxon or its subcontractors, a risk to operator safety or an infringement of Type Approval is probable.

All units affected should be returned for modification to Maxon CIC Europe Works Department on receipt of such a Bulletin.

'B' Category B Engineering Bulletins are for equipment manufactured by Maxon CIC that may have component batch problems.

All equipment affected that is in service is to be returned to the Distributor or Dealer workshop for modification. Maxon CIC will supply replacement components free of charge.

'C' Category C Engineering Bulletins are for improvement or modification to equipment manufactured by Maxon.

Dealer/Distributor to modify affected units in the field on the next service call. Maxon will supply components free of charge.

Please place these at the back of this manual and refer to them before carrying out any work. This Service Manual should be updated with any accompanying replacement pages. You may wish to retain the previous issue pages for future reference.

Specification

General

Performance Specifications	R&TTE Directive 1999/5/EC ETSI EN 300 086-1/-2; ETSI EN 300113-2 EMC Directive 89/336/EEC ETSI EN 301 489-1/-5 LV Directive 73/23/EEC EN 60950-1 72/245 EC as assembled by 2004/104/EC
Frequency coverage	(UHF) 440.000 – 480.000MHz (VHF) 146.000 – 174.000MHz
Channel Spacing	12.5 kHz, / 25 kHz (12.5 / 25 kHz switchable by CPU control)
RF Output Power PM200	2W - 25W nominal (+/-20%)
RF Output Power PM250	5W - 45W nominal (+/-20%)
Modulation Type	F3E/G3E
Audio Power	4W (Internal 16 Ω speaker)
Intermediate Frequencies	45.1MHz First I.F. 455 kHz Second I.F.
Number of Channels	208 Channels
Frequency Source	PLL Synthesiser
Frequency Stability	+/- 2.5ppm

Power Supply	13.8Vdc nominal
	10.8Vdc minimum (extreme)
	15.6Vdc maximum (extreme)
Current Consumption	OFF <10µA
	Standby (muted)<140mA
	Unmuted with 25% AF power <350mA
	Unmuted with 50% AF power <450mA
	Unmuted with 100% AF power <1000mA
	Transmit @ 2W RF output <2.0A
	Transmit @ 25W RF output <7.0A

Environmental

Temperature Range	
Operating	-15 to +35°C (nominal)
	-20 to +55°C (extreme),
Humidity	EIA/TIA 603 (95%)
ESD	20kV (C-MIC = 15kV)
EMC	EMC Directive 89/336/EEC May 89
	ETS 301 489-1/-5
Physical Dimensions	161.8(W) mm x 168.8(D) mm x 44(H) mm
Weight	1.46kgs
Programmer	PM200 PC Programmer

Transmitter

Test Method is ETS 300.086 2001 unless stated. Performance without Sub-Audio Modulation.

PM200 Power Output

High Power	25W nominal adjusted
Low Power	2W nominal adjusted

PM250 Power Output

High Power	45W nominal adjusted
Low Power	5W nominal adjusted

Audio Freq. Deviation

	Nominal	Peak
12.5 kHz	+/-1.5 kHz	+/-2.5 kHz
25 kHz	+/-3.0 kHz	+/-5.0 kHz

With or without audio sub-modulation (10% peak deviation)

Audio Characteristic

(Method as FTZ17 TR 2049 July 1988)

Modulation Type F3

Within +1/-3dB of limit wrt 1 kHz:

300Hz to 2.55 kHz for 12.5kHz channel spacing

300Hz to 3.0 kHz for 20 / 25kHz channel spacing

TX Spurious Emission (conducted and radiated)

Below 1GHz	Better than –36dBm
1 – 4GHz	Better than –30dBm

MIC Sensitivity

At Accessory/Mic connector	12mV +/- 3.5mV

Values for 60% peak dev.

Transmitter Audio Distortion (Without CTCSS)

1 kHz < 5% (nominal)

Transmitter Audio Distortion (With CTCSS)

1 kHz < 8% (nominal)

Audio frequency = 1 kHz, with any CTCSS freq. combined.

Hum and Noise (Residual Modulation)

Method as FTZ 17 TR 2049 July 1988

Better than 40dB (with PSOPH)

Sub Audio Tones - CTCSS

Tone Range 67 to 250.3Hz @ 0.3% accuracy

Tone Standard RS-220A EIA

Nominal Tone 10% (8-15%) Pk Sys Dev.

Sub Audio Tones - DCS

Tone Standard Normal and Inverted

Tone Deviation 10% (3%) Pk System Dev. (UK)

Receiver

Test Method is ETS 300.086 2001 unless stated. Performance without Sub-Audio Modulation

Sensitivity

12dB SINAD (nominal)	UHF: Better than –117dBm

Amplitude Characteristic Within +/- 3dB

Co-channel Rejection

12.5 kHz	From 0dB to –12dB
25 kHz	From 0dB to –8dB

Adjacent Channel Selectivity

	Nominal
12.5 kHz	Better than 60dB
25 kHz	Better than 70dB

Spurious Response Rejection

Better than 70dB (100 kHz – 4GHz)

Intermediation Response Rejection

+/- 25 / 50 kHz	Better than 65dB
+/- 50 / 100 kHz	Better than 65dB

Blocking >85dB

(+/-1MHz, +/-5MHz, +/-10MHz)

Rx Spurious Emissions (radiated) - nominal

9 kHz – 1GHz	Better than –57dBm
1GHz – 4GHz	Better than –47dBm

AF Power	4W max. (Internal 16Ω speaker)

AF Distortion – Method as FTZ 17 TR 2049

1 kHz	< 5% (nominal)

RX Hum and Noise

Method as TIA / EIA-603

12.5 kHz	<40dB No PSOPH
25 kHz	<40dB No PSOPH

Sub Audio Tones - CTCSS

Tone Range	67 to 250.3Hz @ 0.3% accuracy
Tone Standard	ETSI 300.219

Decode Sensitivity

Method (Decrease Signal Level, @ 10% peak dev. with no audio tone)

All Tones	<=9dB SINAD

Maintenance and repair

Introduction

This section covers the tests which should be undertaken prior to customer handover. All of the following tests can be carried out without having to gain access to the interior of the radio.

Recommended Test Equipment

The alignment and performance test procedures assume the use of the following equipment. The functions of most of the equipment may be found in a “Communications Test Set”. This type of equipment is available from a number of test equipment manufacturers.

Throughout this book, reference will be made to the use of the Communications Test Set. Where applicable, the equivalent discrete item of test equipment may be used. For example, if measuring power, a stand-alone power meter and a dummy load could be used instead of the Test Set

Discrete Test Equipment

RF Signal Generator

RF Power Meter

RF Frequency Counter

Spectrum Analyser and notch filter (optional)

Audio Signal Generator

Audio Power Meter

SINAD Meter

Modulation Meter

Oscilloscope

Voltmeter

DC Power Supply, 0 - 15V 10A min.

Combined Equipment

Communications Test Set (e.g. HP 8920B, Stabilock 4040 or similar).

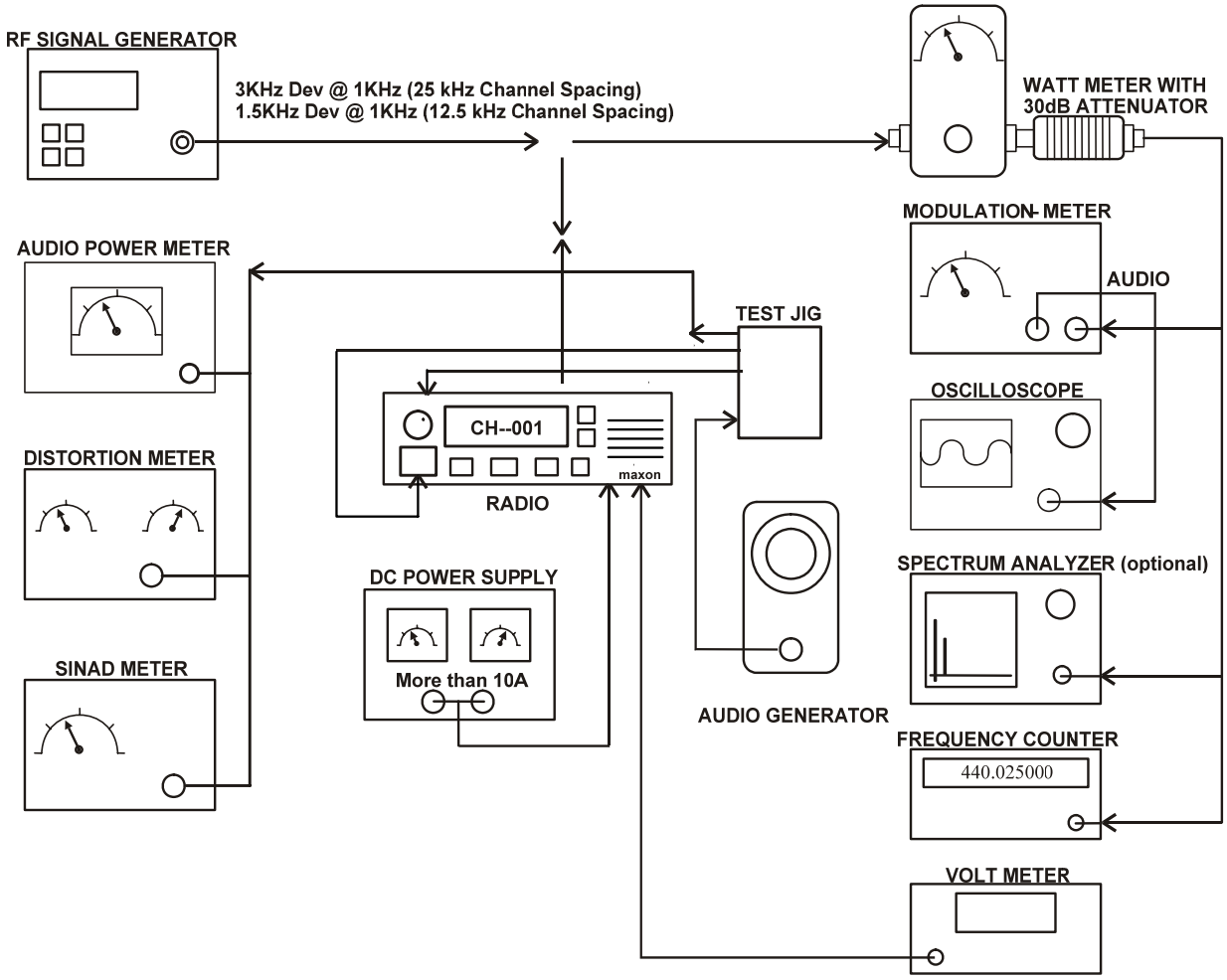
Accessories

PM200 Microphone.

ACC - 2006

Note: Use fig.1 as a suggested connection diagram to connect up the recommended discrete test equipment.

Test Equipment Configuration



(Fig. 1)

Prerequisites

For the following tests, signal generator modulation level should be set to Average System Deviation, i.e. 60% of maximum system deviation.

The level should therefore be set to:

1.5 kHz for 12.5 kHz channel spacing

3.0 kHz for 25 kHz channel spacing

EEPROM programming

Ensure that the EEPROM has the required customer parameters programmed, otherwise ensure that a test EEPROM is programmed with at least the lowest, middle and highest RX/TX frequencies prior to aligning the UHF scanning mobile radio.

Test Equipment Connection

Test equipment connections for performance and Alignment tests are shown in figure 1.

Connect the power supply leads as follows:

1. Ensure the power supply is switched off.

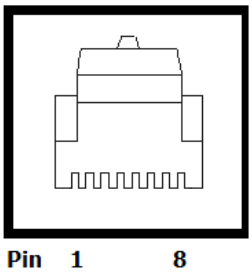
2. Positive lead of the power supply to the red wire terminal tag of the 13.8V D.C. connector.

3. Negative lead of the power supply to the black wire terminal tag of the 13.8V D.C. connector.

Microphone and PTT connections.

The microphone and PTT connections are via the 6 pin socket on the front panel. The specification for the connector is shown in figure 2. RX audio can be monitored at the 3.5mm jack on the rear panel.

Connect pin outs	Function
1	Data In/out
2	GND
3	N/F
4	HOOK IN
5	MIC_HI_INPUT
6	PTT_INPUT
7	+8V
8	BUSY_I/O



(Fig. 2)

Transmitter Performance Tests

Power Output

a) Connect the transmitter to the Communications Test Set (CTS) with the power meter set to read 25W for the PM200.

b) Set the power supply to 13.8Vdc and connect a dc voltmeter across the power supply to monitor the supply voltage.

c) Set the CTS to the same frequency as the radio and then set the PTT to start transmitting. Check and record the power output. The nominal power output is 2W for low power and 25W for high power.

d) Reduce the power supply voltage to 11Vdc and then set the PTT to start transmitting. The output power should be greater than 65% of the level measured above.

Frequency Error

a) Using the frequency counter check that the transmit frequency is within +/- 750Hz of the frequency which is programmed into the radio.

Distortion and Deviation Measurements

a) Set the radio to the middle TX frequency. Connect the oscilloscope to the AF output of the modulation meter.

b) Set the audio signal generator to 1 kHz tone, low output impedance and adjusts its level for 60% system deviation:

12.5 kHz channel spacing 1.5kHz dev.

25 kHz channel spacing 3kHz dev.

c) Press and hold the PTT button.

d) Measure the audio distortion. This should be less than 5%.

e) Increase the audio signal generator level by 20dB (10x voltage). The peak deviation should be:

12.5 kHz channel spacing <= 2.2 kHz dev.

25 kHz channel spacing <= 4.3 kHz dev.

f) Release PTT.

When CTCSS and DCS performance checks are also required, ensure that the lowest, middle and highest RX/TX frequencies include: (see below for suggested test channel set-up).

Lowest RX/TX freq. ch.	67.0 Hz CTCSS
Middle RX/TX freq. ch	DCS Code 072
Highest RX/TX freq. ch	250.3 Hz CTCSS

The middle RX/TX frequencies should be halfway between the lowest and the highest frequencies.

Receiver Performance Tests

Sensitivity

Set the radio to the correct channel.

SINAD performance test is used to test the sensitivity of the radio receiver.

Select the required frequency to be measured (without CTCSS enabled)

a) Connect the RF signal generator, modulated with a 1 kHz tone, to the radio.

b) Set the frequency of the RF signal generator, to correspond with to the RX frequency of selected channel

c) Connect the SINAD voltmeter to the external speaker socket on the radio. Ensure that the radio has been programmed to path the audio to the external accessory socket.

d) If signal is not present press the monitor button. Set the volume control to mid-range.

e) Set the RF signal generator deviation to:

12.5 kHz channel spacing	1.5 kHz dev.
25 kHz channel spacing	3 kHz dev.

f) Adjust the RF signal generator level until the SINAD meter reads 12dB.

g) Check that the signal generator

RF level is < -117dBm (0.31μVpd).

Squelch

a) Ensure that both the radio and the signal generator are set to the appropriate channel spacing.

b) With the above setting, reduce the RF level to –130dBm (speaker should be muted).

Adjust the RF output level until the radio unmutes. Sinad reading should be in the range of 8db to 12db.

Audio Output

a) Set the RF signal generator to 1mV Pd (-47.0dBm) and the tone and deviation as above.

b) Connect the audio power meter set to16Ω to the external speaker socket on the radio. Program audio to external socket i.e. Audio test enable.

Note: The audio power meter should be set to 16Ω.

c) Adjust the volume control on the radio under test to maximum (Volume Level 8).

The voltmeter should indicate >= 5V.

The audio power meter should read >= 6.25W.

This concludes the Performance Tests.

If the Radio should fail any of these tests it will be necessary to turn to the next section on Alignment.

Alignment

WARNINGS

Any repairs or adjustments should only be made by, or under the supervision of a qualified radio-telephone service technician.

CAUTION

This radio contains static sensitive devices. Static safe precautions should be observed; in particular we would recommend the use of a suitable floor mat, table mat, bonding cords and a wrist strap. The soldering iron should have an earthed tip.

Care should be exercised in the handling of static sensitive components and they should always be transported in the correct containers.

Never remove, or insert, static sensitive devices with the power applied.

Alignment Section Frequency Table

CH	Rx Freq	Rx Squelch	TX Freq	Tx Squelch	Scan CH	Bandwidth	Power	Priority CH	PowON CH
1	440.0250	OFF	440.0750	OFF		S	High		
2	460.0250	OFF	460.0750	OFF		S	High		
3	479.9250	OFF	479.9750	OFF		S	High		
4	440.0250	OFF	440.0750	OFF		N	Low		
5	460.0250	OFF	460.0750	OFF		N	Low		
6	479.9250	OFF	479.9750	OFF		N	Low		
7	460.0250	CTCSS : 67.0	460.0750	CTCSS : 67.0		N	Low		
8	460.0250	CTCSS : 151.4	460.0750	CTCSS : 151.4		N	Low		
9	460.0250	CTCSS : 250.3	460.0750	CTCSS : 250.3		N	Low		
10	460.0250	DCS : 023	460.0750	DCS : 023		N	Low		
11	460.0250	DCS : 245	460.0750	DCS : 245		N	Low		
12	460.0250	DCS : 754	460.0750	DCS : 754		N	Low		
13	460.0250	CTCSS : 67.0	460.0750	CTCSS : 67.0		S	Low		
14	460.0250	CTCSS : 151.4	460.0750	CTCSS : 151.4		S	Low		
15	460.0250	CTCSS : 250.3	460.0750	CTCSS : 250.3		S	Low		
16	460.0250	DCS : 023	460.0750	DCS : 023		S	Low		
17	460.0250	DCS : 245	460.0750	DCS : 245		S	Low		
18	460.0250	DCS : 754	460.0750	DCS : 754		S	Low		

Note: The Above frequency Table should be used whenever the alignment section refers to a channel Number.

Disassembly and Re-assembly of the Radio

In order to carry out the following Test and Alignment procedures it will be necessary to gain access to the inside of the radio.

Care should be exercised when opening up the radio for maintenance or repair.

Removing and replacing the main cover

a) Turn the radio over, so that the radio is upside down.

b) Remove the four holding screws.

c) Lift the cover off.

d) Replace the main cover by reversing the above procedure.

Removing and replacing the front panel

a) Firstly, remove the main cover, as described above.

b) Remove the two black screws on the sides, which hold the front panel to the base of the radio.

c) Turn the radio the normal way up and remove the front panel.

d) Replace the front panel by reversing the procedure.

PLL Alignment

RX VCO

a) Select Channel 1.

b) Check that the VCO tuning voltage at TP1 (Please see fig.3) is >1.3V

c) Select Channel 3

d) Check that the voltage at TP1 is <9V

e) If the voltage is >9V it will be necessary to adjust RX coil, (see drawing below), reducing the voltage set in b nearer to 1.3V.

TX VCO

a) Select Channel 1.

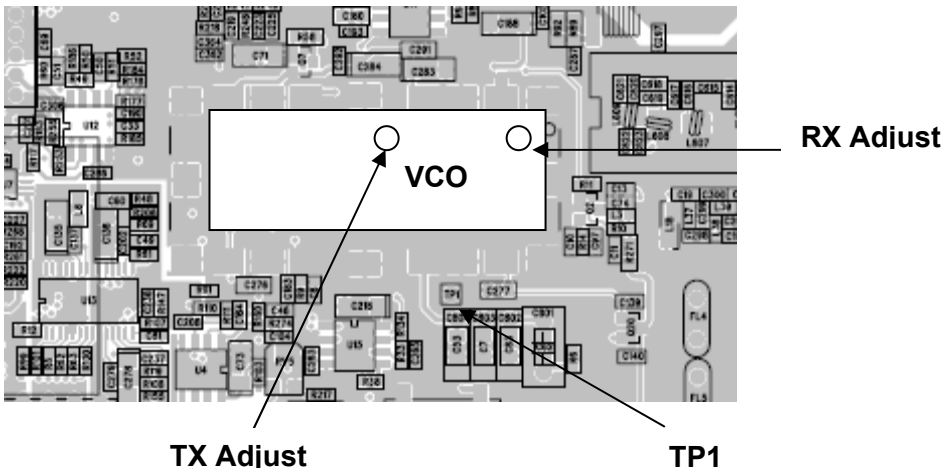
b) Set the PTT switch to on. Check that the VCO tuning voltage at TP1 is >1.5V.

c) Set the PTT switch to off. Select Channel 3.

d) Set the PTT switch to on and check that the voltage at TP1 is <10V.

e) If the voltage is >10V it will be necessary to adjust TX coil, (see Fig.3 below) reducing the voltage set previously in b) nearer to 1.5V.

f) Set the PTT switch to off.



(Fig.3)

Transmitter TCXO Alignment

TCXO

a) Select Channel 2.

b) Set the PTT switch to on.

c) Using the frequency counter, adjust the TCXO, so that the transmit frequency is within +/- 300Hz of the required frequency.

d) Set the PTT switch to off.

If no further alignment is to be carried out, it may be necessary to reset the squelch.

Receiver Alignment

The receiver is, by design, a broadband device. It should require no special alignment unless repairs are performed on the receiver.

The following alignment may be performed:

a) Select Channel 2 on the radio.

b) Set the RF generator to the receiver frequency and the RF level to 1mV Pd (-47dBm).

c) Set the AF signal to 1 kHz.

d) Set the deviation to:

12.5 kHz channel spacing	1.5 kHz deviation
25 kHz channel spacing	3 kHz deviation

e) Monitor the audio output level and the distortion, setting the volume control to mid-range. (Volume level 5)

Squelch

a) Connect the RF signal generator to the radio.

b) Set the RF signal generator to the receive frequency of the current channel two.

c) Connect the SINAD meter to the speaker socket on the rear panel.

d) Set the volume control to mid-range.

e) Set the deviation to:

12.5 kHz channel spacing	1.5 kHz
25 kHz channel spacing	3 kHz

f) Set the AF generator to 1 kHz.

g) With the above setting, reduce the RF level to –130dBm. The radio should be mute.

h) Adjust the RF level until the radio ummutes. SINAD meter reads 8dB to 12dB. The radio should unmute. If radio does not unmute adjust RV2 for 12.5 kHz channel spacing and RV3 for 25 kHz channel spacing.

This completes the receiver alignment process.

Receiver Performance Tests

SINAD or noise quieting sensitivity performance tests may be used to test the sensitivity of the receiver. Both tests are given below.

12dB SINAD Sensitivity

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

a) Connect the RF signal generator, modulated with a 1 kHz tone, to the radio.

b) Set the frequency to correspond to the Rx frequency of the radio.

c) Using the Audio breakout Box, connect to the SINAD voltmeter to the external speaker socket on the radio.

d) Press the monitor if radio is muted button and set the volume control to mid-range.

e) Set the RF signal generator deviation to:

12.5 kHz channel spacing	1.5kHz dev.
25 kHz channel spacing	3kHz dev.

f) Adjust the RF signal generator level until the SINAD meter reads 12dB.

g) Check that the signal generator RF level is < -117dBm (UHF).

Squelch sensitivity

The RF input level to open the squelch is usually set in the range -123.5 dBm to -117dBm (0.15 to 0.3mV). The squelch should open with SINAD set between 8dB and 14dB (no CCITT).

The squelch should close between 2dB and 4dB below the value at which it opens.

Note: Please refer to frequency table (page 20) whenever a channel number is referred to.

Detailed functional description

UHF Transmit

The transmitter is comprised of:

- Microphone audio
- Frequency synthesiser
- Power amplifier and harmonic filter
- Automatic power control

Microphone Audio Circuit

Microphone audio is fed through the front panel PCB onto the main PCB, where it is amplified, limited the inside parts of the CMX881 and pre-emphasised before being applied to the VCO and TCXO (via pin 2 on TCXO module).

Frequency synthesiser circuit

With data received from the EEPROM (U6) the frequency synthesiser circuit controls and produces the RF carrier frequency for the transmitter during transmit and the local oscillator frequency for the receiver. The frequency synthesiser circuit is comprised of:

- RX/TX Voltage Controlled Oscillator (VCO)
- Charge Pump and Loop Filter
- Dual Modulus Prescaler

Voltage Controlled Oscillator

Contains two VCOs. One for producing carrier frequencies during transmit and one for producing the local oscillator frequency during receive. The module also has RX and TX power line filters.

RX/TX VCO

The VCO consist of an RX VCO and a TX VCO. It is switched RX/TX by the power source.It is connected to the buffer as a cascade bias in order to save power. The varicap diode D201, D202, D301 are low-resistance elements and produce a change in frequency With a change in reverse bias voltage(1.2~10v) .L203,L303 are resonant coils, which change the control voltage by the tuning core. D201modulation diode modulates the audio signal.

Charge Pump and Loop Filter

Transistors Q903 to Q904 and associated resistors and capacitors form the charge pump and loop filter. The phase detector output from U1 pins 7 and 8 are combined by the charge pump to produce a 0 – 15 tuning volt signal. The signal is filtered by the loop filter to remove any residual reference frequency harmonics from the signal. After filtering, the signal is applied to the voltage controlled oscillator module.

Dual Modulus Prescaler

The prescaler divides the VCO frequency by 64 or 65.

Power Amplifier and Harmonic Filter

The power amplifier contains transistors Q12, Q13, Q34, Q39, Q41, Q28 and associated inductors, capacitors and resistors. When the radio is in transmit mode the diode D1 is forward biased enabling the modulated RF signal from the VCO (amplified by the first stage amplifier / buffer Q12 and Q13) to pass to the pre-driver Q34 via Q41. The output signal is passed from Q39 to Q28 where it is then amplified for transmission. The amplified RF signal is passed through strip-line coupler and is fed to the harmonic low pass filter, comprising L21, L22, L25, C96, C98, C99, C100, C109, C110 and then to the antenna connector (ANT). The strip-line coupler provides a sample of the RF signal for the automatic power control. During transmit D1 is forward biased which connects the power amp to the antenna. D2, D3 are forward biased inhibiting transmit signal power from being fed to the receiver circuitry.

Automatic Power Control

The automatic power control contains the strip-line coupler, diodes D30, D13, resistors and U11. In transmit mode a reference level is supplied to the differential amplifier U11, and compared with the DC voltage fed back from the coupler, the output of U2 then drives the PA module through Q34 and Q41, which determines the final output power. The U7 D-A converter sets high or low power depending on the APC Program.

UHF Receive

The receiver is comprised of:

- Front End Filter / RF amplifier
- First mixer and first IF amplifier
- Second mixer, second IF amplifier and FM detector
- Receiver audio circuit(CMX881)
- Mute (Squelch) circuit

RF amplifier

The receiver Front End module contains two stages of filtering and an amplifier, Q601. The module filters out the unwanted frequencies and provides a gain of typically 12dB for the wanted frequencies. The wanted RF signal at the operating frequency is passed to the first mixer.

The signal received from the antenna is routed through the 7th order Chebyshev low-pass filters contained C601, C603, C604, CL603, C605, C608 and L601, L602, L604 and passed through Front End Module (RF amplifier) via pin 1. The front-end module contains D602 to Q601, the front end module is configured to enable the RF signal at the operating frequency to pass to the first mixer.

First Mixer and First IF Amplifier

The VCO local oscillator signal routed through buffer transistors Q2 is filtered by C14, C15, C16, L2, L4 and D4 produces a difference frequency IF of 45.1MHz from output of front end module and the filtered VCO local oscillator signal at pin 2. The 45.1MHz difference frequency is filtered by the 2-pole crystal filter FL4,5. The tuned circuit T1 and T2 and associated components provide matching of the crystal filter to ensure good pass-band response and selectivity. The IF signal is amplified by Q3 and passed to the second mixer, second IF and FM detector U2.

Second Mixer, Second IF, FM Detector

U2 is a single conversion FM receiver integrated chip and contains the second mixer, second IF amplifier and FM detector. The second local oscillator frequency is determined by the crystal Y6 connected to pin 1 of U2. The first IF signal is received at

pin 16 of U2 and applied to the mixer. The output of the second mixer, a frequency of 455kHz, is the difference between the IF signal and the second local oscillator. The 455kHz passes via pin 5 and is applied to a 455kHz bandpass filter, FL2, (20/25kHz channel spacing) or FL3 (12.5kHz channel spacing). The selection of the filters is accomplished by diodes D11 (input) and D12 (output) whose bias is controlled by software and applied to the diodes from pin 100 of the microprocessor (U18). The output of FL2/FL3 is passed via pin 11 to a high gain amplifier coupled to the adjustable quadrature detector Y1 (pin 10). Any detected signal is produced at pin 91 of U18 and applied to the Receiver Audio Circuit and the Mute (Squelch) circuit.

Receiver Audio and Sub-audio Circuit

The receiver audio circuit has been fully controlled by Baseband Process, CMX881 supported by CML using internal firmware program.

Frequency and CTCSS/DCS data storage

Control Details

EEPROM

RX/TX channels, CTCSS/DCS as well as other data from the programmer are stored in the EEPROM. The data stored is retained without power supplied. This is a non-volatile memory. The EEPROM may have information re-programmed or erased. U6 is an EEPROM with 32Kbite capacity and data is written and read serially.

Troubleshooting

Obvious checks, such as battery performance on load, should be made before pulling the radio apart. The use of a power supply isolates this cause.

The alignment procedures, given in Section 5, list how standard tests such as SINAD measurements can be made. These can be used to check the performance of the receiver.

Diagnostic Function

The diagnostic function is designed to inform the user about the operational status of the radio.

The possible audible and visual warnings are:

Status	Description	LED Colour	Audible Tone
Normal	Power On Ready	N/A	Melody
	Busy	Amber	N/A
	Correct S.A. Tone	Green	N/A
	Transmit	Red	N/A
	Scan	Flashing Green	N/A
	Busy Lock	Flashing Yellow	Single Tone
PC Program	Write		
	Reading		
Warning	Time-Out Timer	N/A	Single Tone
Error	EEprom	Flashing Red	Repeating Single Tone
	PLL Error	Flashing Red	Repeating Dual Tone
	Filtering Circuit Error	Flashing Red	Repeating Triple Tone

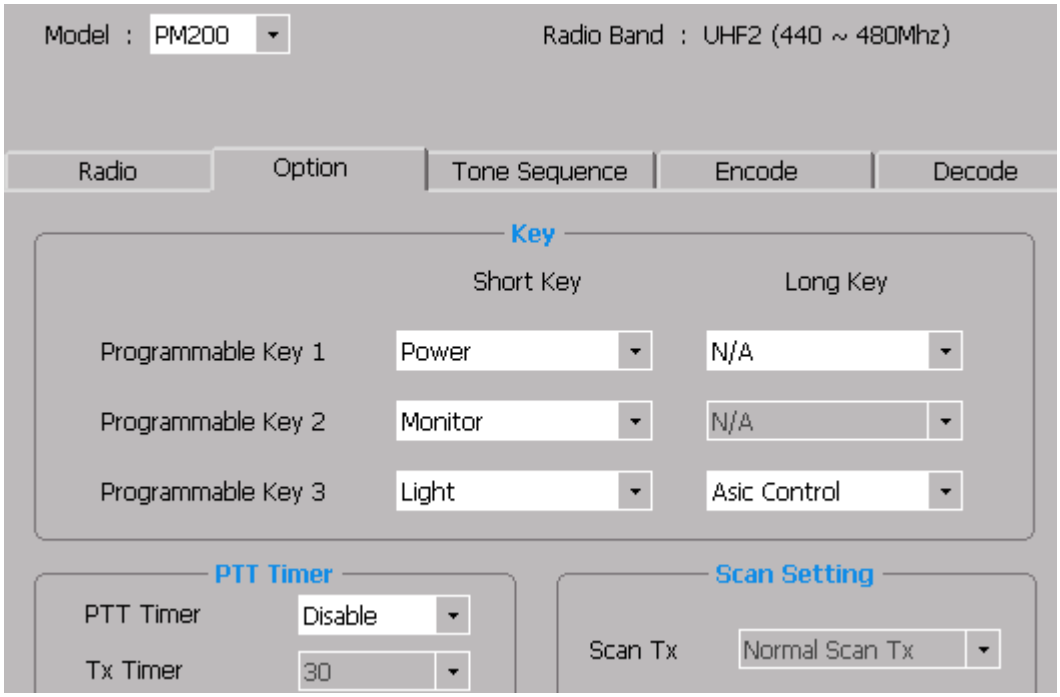
(Fig.4)

ASIC

ASIC Control

Key Assign:

Programmable Key P3 (long Press) assigned to the ASIC Control using the PC Programmer. When the PM200 has finished programming remove lead, switch off and on again. Long press of the P3 key will access the ASIC mode.



(Fig.5)

The Asic is used the make adjustments to the following parameters:

Balance Deviation CTCSS Balance Mic gain Peak Deviation CTCSS Deviation

Key	Display	Parameter
P1	Mod-1	Balance Deviation
P2	Mod-2	CTCSS Balance
P3	Gain-	Mic Gain
Down ▼	TX ------	Peak Deviation
Emergency	rGain-	CTCSS Deviation

(Fig.6)

TRANSMITTER Control

Mod1 Control

Press P1 Key for tuning Mod1.

This is used for TX audio tone gain by attenuator.

Default value is 1. (N/S band)

Mod2 Control

Press P2 Key for tuning Mod2.

This is the same as tuning TX audio deviation gain by attenuator.

Default value is 1. (N/S band)

INPUT Gain Control

Press P3 Key for tuning TX Input Gain.

This is used for TX modulation gain.

Default value is 2 (S band) or 0 (N band).

TX LIMIT Control

TX LIMIT: Press Down key for tuning TX limit.

This is used for TX audio deviation.

It is possible tune PEAK FM Deviation at Mic deviation 20dB up.

Default value is 3100 (S band) or 1600 (N band).

TONE Deviation

It is possible tune PEAK FM Tone Deviation by pressing Emergency key at the channel set.

CTCSS:

The higher the numeric value the more the deviation will increase.

Default value is 58200 (S band) or 57800 (N band).

DCS:

It is possible to tune PEAK FM Tone Deviation by pressing

Emergency key at the channel set DCS.

The higher the numeric value the more the deviation will increase.

Default value is 58045 (S band) or 57645 (N band).

Note: Please refer to frequency table (page 20) whenever a channel number is referred to.

Receiver Audio Adjustment

Note: this option can only be used on a channel without CTCSS or DCS.

It is possible to tune the RX Audio output gain by pressing emergency key on a channel that is without signaling. The higher the numeric value the more the external and internal audio will increase.

Default value is 58200 (S band) 57745 (N band)

Set the unit to the mid-frequency range of S Band. Activate PTT and adjust RV5 for desired 3 KHz deviation at MIC sensitivity around 11.5mV.

Increase the signal level to 20dB from standard level

Adjust RV4 the TX data with 400Hz standard audio level.

Select Channel 11, and increase the signal level to 20dB from standard level

Activate PTT and confirm less than 5 KHz deviation.

Set the unit without Modulation and adjust ASIC control as below.

If the modulation is >**1 KHz**

It will be necessary to adjust DCS ASIC control lower than **58045**

If the modulation is <1 KHz of 0.5 and more than 5 KHz deviation.

It will be necessary to adjust TX LIMIT control lower than **3100.**

Select Channel 17, and increase the signal level to 20dB form standard level

it will be necessary to repeat parameter n to o,

Activate PTT and confirm less than 2.5 KHz deviation

If the modulation is >**0.5 KHz**

It will be necessary to adjust DCS ASIC control lower than **57645**

If the modulation is <1 KHz of 0.5 and more than 5 KHz deviation.

It will be necessary to adjust TX LIMIT control lower than **1600.**

Measure the audio distortion. This should be less than 5%

Release PTT.

Increase the audio signal generator level by 20dB (10 x voltage). The peak deviation should be:

12.5 kHz channel spacing <= 2.0 kHz dev.

25 kHz channel spacing <= 4.2 kHz dev.

If the modulation is >4.21 KHz it will be necessary to repeat parameters as above.

Measure the audio distortion. This should be less than 5%.

Normal setting *(Fig.7)*

	P1	P2	P3	EMG	Down	Up
Without tone CH	Mod1	Mod2	Gain	RX Gain	Limiter	Save
CTCSS CH	Mod1	Mod2	Gain	Tone align	Limiter	Save
DCS CH	Mod1	Mod2	Gain	Tone align	Limiter	Save

S Band setting default value *(Fig.8)*

	P1	P2	P3	EMG	Down	Up
Without tone CH	1	1	2	6	3100	Save
CTCSS CH	1	1	2	58200	3100	Save
DCS CH	1	1	2	58045	3100	Save

N Band setting default value *(Fig.9)*

	P1	P2	P3	EMG	Down	Up
Without tone CH	1	1	2	6	1600	Save
CTCSS CH	1	1	2	57800	1600	Save
DCS CH	1	1	2	57645	1600	Save

Asic control sequence *(Fig.10)*

tone(CTCSS)	Tone(DCS)	Gain	Limiter	
57645	57545	0	1200	3100
57745	57645	1	1400	3200
57800	57745	2	1600	3300
57945	57800	3	1800	3500
58045	57945	4	1900	3800
58145	58045	5	2200	4000
58200	58145	6	2500	
58300	58200	7	2800	
58400	58300		3000	

If you want to raise deviation, amend to the higher number.

If you want deviation to be lower, amend to lower number.

DCS S Band 58200 (58045)

N Band 57745 (57645)

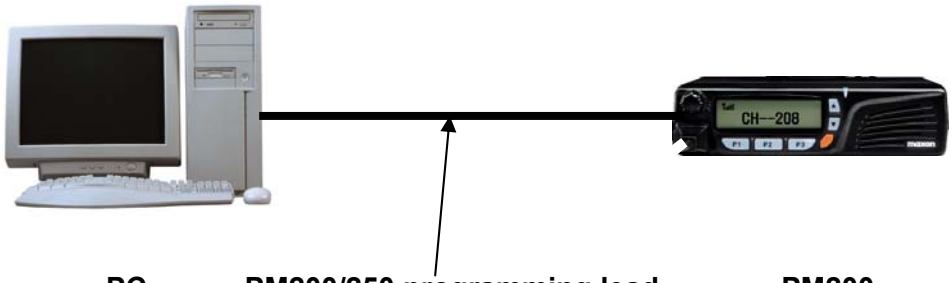
APC (Automatic Power Control)

Installation of APC software

The APC (Automatic Gain Control) is used to adjust the RF power output via a PC.

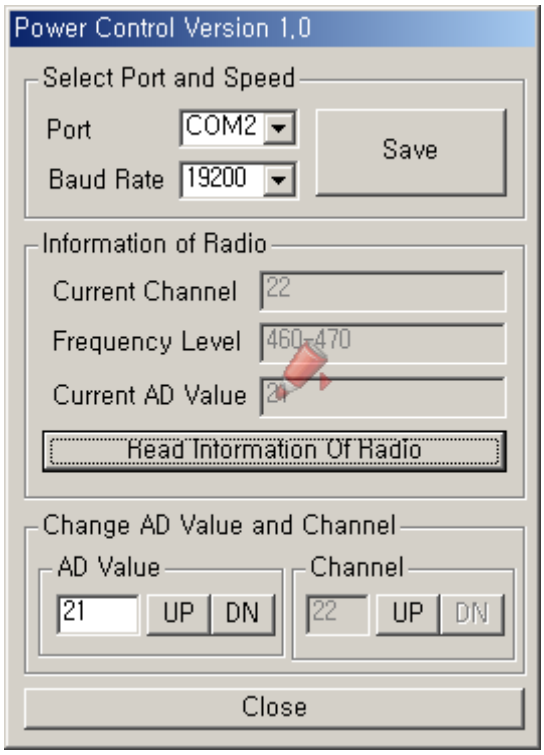
Click on the setup.exe file and follow on screen instructions 

APC Set-up



(Fig.11)

APC Test Program



(Fig.12)

1.) Open APC programmer 

2.) Select the Port and the Baud Rate (Baud Rate default 19200bps)

Press save button, to save port and baud rate Settings.

3.) Connect programming lead to PC and radio, switch radio on.

4.) Press the “Read information Of Radio” button, the radio will download the AD value.

5.) The AD value is split into four frequency bands; any changes to the AD value will affect all power values for that frequency band

Frequency Bands
440 – 450
450 – 460
460 – 470
470 – 480

(Fig.13)

6) The AD value range is in hexadecimal, therefore the higher the value the higher the power out-put. The highest value is ff, the lowest value is 100.

7.) Select the required channel using the UP channel button on the APC AD value change section.

8.) To change the AD value the radio must be in TX mode i.e. actually transmitting, using the ▼ button until the required value is set. To do this correctly it is advised to transmit into either a power meter with a 50Ω load or a communications test-set.

9.) Once the value is set stop TX and press the ▲ button to exit and value is automatically saved.

Schematics and PCB layout Index

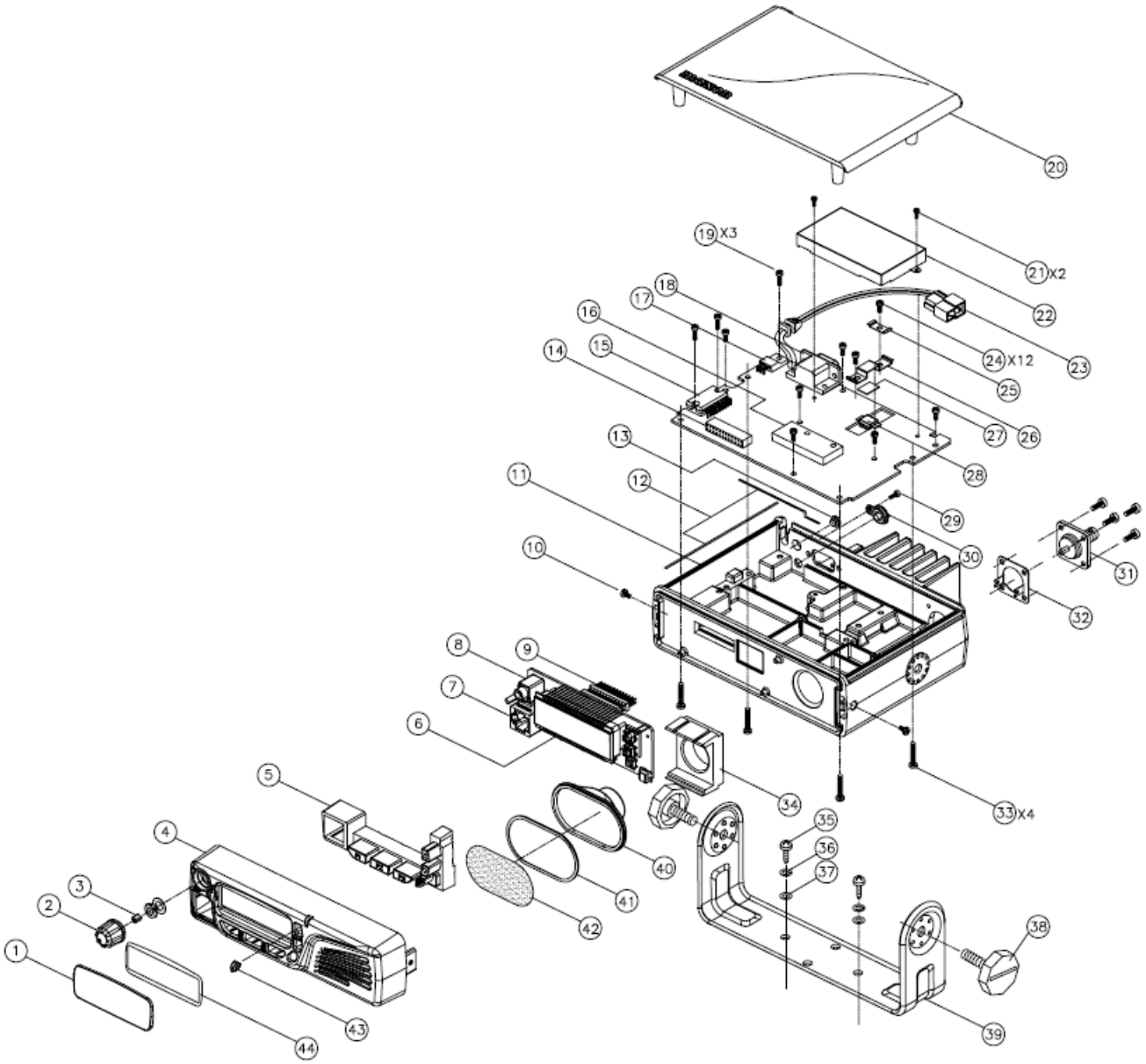
This section contains PCB layouts pertaining to the PM200 Radio. Associated Main Schematics may be found in the wallet at the rear of this binder.

Order of drawings	Drawing description	Size of drawing
Schematics		
1	Digital Schematic	A4 + A1
2	RF TX Schematic UHF and VHF	A4 + A1
3	RF RX Schematic UHF and VHF	A4 + A1
4	VCO Schematic UHF and VHF	A4
5	Control Header Schematic UHF and VHF	A4
Layouts		
6	Main Board Layout Top UHF and VHF	A4
7	Main Board Layout Bottom UHF and VHF	A4
8	Front Panel Layout top UHF and VHF	A4
9	Front Panel Layout Bottom UHF and VHF	A4
Silk Screen Layouts		
10	Main Board Top Silk Screen UHF and VHF	A4
11	Main Board Bottom Silk Screen UHF and VHF	A4
12	Front Panel top Silk Screen UHF and VHF	A4
13	Front Panel Bottom Silk Screen UHF and VHF	A4
Block Diagram		
14	RF RX Block Diagram UHF and VHF	A3

Parts List

The following pages detail the mechanical and electronic parts for the Maxon PM200 Mobile Radio. Refer to Exploded diagram for the PM200.

Mechanical Exploded View



NO.	PART NO.	PART NAME	DESCRIPTION
1	814-562	LENS LCD	PC CLEAR
2	826-638	KNOB VOL	PC BLACK
3	881-764	SPRING VOL	SK5 0.2t
4	801-823	FRONT COVER	PC BLACK
5	896-448	KEYPAD	SILICONE RUBBER
6	2523292	LCD	ISO9238P
7	4208017	MODULAR JACK	8PIN TOP ENTRY TYPE
8	4300951	POWER ON/OFF SWITCH	RK0971111ZOP
9	4217334	MALE CONNECTOR	ZW-12-10-G-D-400-100
10	613-059	SCREW	(+) M3X6 BLK (PH)
11	71A-367	BOTTOM COVER	ALDC12
12	895-816	GASKET CONDUCTIVE	2140-04-D50-ORA-NPS
13	896-007	CAP RUBBER	NBR
14	4217323	FEMALE CONNECTOR	BCS-112-L-D-HE
15	2214771	AUDIO DUAL I.C	LM1877M-9
16	772-526	SHIELD VCO	SPTE 0.3T
17	2220130A	8V REGUL IC	KIA7808PI
18	4226563Z	DATA CONNECTOR	DRAHD-15S
19	613-323	SCREW	(+)M3X8 NI-PLAT (BH)
20	71A-356	UPPER COVER	ALDC12
21	612-027	SCREW	(+)M2X5 ZN-PLAT (PH)
22	772-745	SHIELD CAN	NSP 0.3T
23	504367C	2P PLUG ASS'Y	SHD-60410
24	613-580	SCREW	(+)M3X6 NI-PLAT (PH)
25	752-973	POWER TERMINAL	PBS 0.3T
26	752-977	POWER PLATE	PBS 0.3T
27	896-493	RUBBER PLATE	SILICONE RUBBER 1T
28	2003225	RF POWER TR	PD55035S
29	612-289	SCREW	(+)M2X5 BLK (BH)
30	895-247	CAP (EXT SPK)	NEOPRENE RUBBER
31	4216557	CONNECTOR	SW-1090(BNC-R)
32	752-972	ANT TERMINAL	PBS 0.3T
33	613-670	33	(+)M3X22 NI-PLAT (BH)
34	895-627	SPEAKER HOLDER	SILICONE RUBBER
35	625-007	SCREW	(+)T5X12-1S ZN-PLAT
36	662-606	WASHER(SPRING)	M6 ZN-PLAT
37	661-605	WASHER(PLAT)	M6 ZN-PLAT
38	600-051	SECURING SCREW	M6X9(P:1)BLK
39	723-963	BRACKET MOUNTING	SPC 2T
40	4201280	SPEAKER	16 OHM 6W PB-06410
41	895-779	GASKET SPK	EVA SPONGE T1
42	907-013	FELT SPK	FELT T0.3(BLK)
43	896-321	LENS LED	SILICONE RUBBER
44	907-596	TAPE LENS	3M 9448HK 0.16T

Parts List

PART NO.	NAME & DESCRIPTION	Q'ty	REFERENCE-NO
	CHASSIS ASS'Y		
	M2X5 (+)PH ZN	2	
612289	2X5 BLK (+)MACHIN	1	
613323	3X8 NI-PLAT	3	
613580	3X6 NI-PLAT	12	
613670	M3X22 (+)BH NI	4	
71A356	ALDC 12 UPPER COV	1	
71A367	ALDC 12 BOTTOM CO	1	
752972	PBS 0.3T ANT TERMI	1	
752973	PBS 0.3T POWER TER	1	
752977	PBS 0.3T POWER PLA	1	
772745	NSP 0.3T SHIELD CA	1	
895247	NEOPRENE RUBBER	1	
896007	NBR CAP RUBBE	1	
896493	SILICON RUBBER T1.0	1	
	FRONT PANEL ASSEMBLY		
2512864Z	L-115 VEGWLAMP LED	1	DS4
2523203	KLS-020MSYLED DISPL	1	DS3
2523292	ISO9238P LCD DISPL	1	DS5
4201280	16 OHM 6 W PB-06401	1	SP1
4208017	8PIN TOP ENTRY TYPE	1	J1
4217334	ZW-12-10-G-D-400-10	1	J6
4222675	8283-0211:2MM PITCH	1	J2
4300951	RK0971111ZOP	1	S7

504671	2P 85MM 2P HOUSIN SPK wire	1	
4360685	SKHWALA010TACK SWIT	1	S6
4360696	1194 YELLOW	5	S1.2.3.4.5
05B0005Z	0 1/16W 5% T 16	3	R5.7.44
05B1046Z	100K 1/16W 5% T 16	4	R8.17.38.43
05B4739Z	47K 1/16W 5% T 16	5	R10.11.12.13.14
06E1511	150 1/ 4W 5% T 32	3	R23.24.25
0601016Z	100 1/10W 5% T 20	5	R18.19.20.21.22
0602013Z	200 1/10W 5% T 20	7	R1.2.3.4.6.40.41
0603911Z	390 1/10W 5% T 20	3	R26.28.30
130A736Y	0.01UF GRM39 X7R1	7	C9.10.11.12.13.14.15
1410460	10UF 293D106X00	1	C2
2000749	KRC244S TRANSISTO	2	Q2.3
2020925	KRA110SPK BRT	2	Q5.6
2203780	KIA78L05F I.C REGUL	1	U4
2218835	HT1622 I.C	1	U3
2431040	KDS160 DIODE	10	D1.2.3.4.5.6.7.8.9.10
2513180	KPT-1608SGC	1	DS1
3111426Y	10UH:NL322522T-100J	1	L1
406735A	PCB	1	A1
814-562	LENS LCD	1	1
826-638	VOL KNOB	1	2
881-764	SPRING VOL	1	3
801-823	FRONT COVER ESCUTCHEON	1	4
907-596	TAPE LENS 3M 9448HK 0.16T	1	44
896-321	LENS LED SILICONE RUBBER	1	43
896-448	KEYPAD SILICONE RUBBER	1	5
907-013	FELT SPEAKER T0.3(BLK)	1	42
895-779	GASKET SPK	1	41

895-627	SPEAKER HOLDER	1	34
416180A	FRONT PANEL PCB	1	
FRONT-END ASS'Y			
05B0005Z	0 1/16W 5% T 16	1	R(C607)
05B2230Z	22K 1/16W 5% T 16	1	R601
05B4706Z	47 1/16W 5% T 16	1	R602
1310928Y	10PF GRM39 COG1	3	C603.613.618
1311057Y	11PF GRM39 COG1	1	C620
1312405Y	12PF GRM39 COG1	2	C616.623
1313062Y	13PF GRM39 COG1	1	C608
1314058Y	14PF GRM39 COG1	1	C619
1320121Y	20PF GRM40 COG2	1	C(L603)
1320253Y	20PF GRM39 COG2	1	C617
1327340Y	27PF GRM39 COG2	1	C605
1339407Y	3.9PF GRM39 COG3R	1	C622
1347571Y	47PF GRM39 COG4	1	C609
1347724W	470PF C1608 C0G1	1	C611
1356315Y	5.6PF GRM39 COG5	1	C614
1360143Y	6PF GRM39 COG0	2	C615.621
1380110Y	8PF GRM39 COG0	3	C601.604.624
2003070	AT-41532 TRANSISTE	1	Q601
2430494Z	KDS226 DIODE CHI	2	D601.602
3119433	14NH 03095TL	3	L604.607.608
3119828	0.30X0.90$X4T(R)	5	L601.602.605.606.609

MAIN B'D MANUAL ASS'Y			
101A028Y	1000UF 25V 20% 10	1	C27
1048195	470UF 25V 20%	1	C156
1801266Z	0.01UF 63V	1	C803
1804751	0.47UF 4	1	C801

1804762	0.047UF 4	1	C802
2003225	PD55035S RF POWER	1	Q28
2216786	TDA1519C I.C AUDIO	1	U14
2220130A	KIA7808PI I.C REGUL	1	U20
2431765	XB15A407A2GB	2	D1.2
2450087X	1N5404 DIODE REC	1	D21
2622280Z	3.579545MHZ	1	Y7
2634180	44.645M -30 15PM 3	1	Y6
2703169Y	LTWM455HT(2.832.689	1	FL3
2703510Z	LTM455FW(2.832.685)	1	FL2
2712255	45N15B4 45.1MHZ	2	FL4.5
3000081Z	EI-19(CHOKE)	1	L28
3106273	5.0X0.8X7.5T:R	1	L46
3109131	1.0X0.45X4T:R(SMD)	2	L31.33
3111789	2.5X0.5X10T:R	1	L23
3111790	2.5X0.7X3T:R	1	L24
3112027	1.2X0.3X2T SMD (R)	1	L18
3120655	2.95X1.3X2T:L	1	L21
3120666	3.45X1.3X2T:L	1	L25
3120688	3.98X1.3X2T:L	1	L22
3204238	FB-64-5111 FERRITE	1	
4208358Z	3.5& SKJS-3501G	1	J1
4210021	6PIN SINGLE LINE	2	CON1.2
4217323	BCS-112-L-D-HE	1	J4
4227461	52231-1417CONNECTOR	1	J2
907600	CU PLATE STIC 85 X	1	

MAIN B'D SMD ASS'Y

05B0005Z	0 1/16W 5% T 16	58	R(LK1.2.4.5.6.7.8.9.
			10.11.12. 13.14.15.17
			18.19.21.24.30.31

			39.40.101,03.22,5,67
			32) R7.9.12.15.55.
			76.85.91.107.114,18,
			33,46,72,87,97.203.209
			249,254,256,284.304,
			5,6.505.C112
05B1002Z	10 1/16W 5% T 16	2	R506.714
05B1013Z	100 1/16W 5% T 16	9	R5.14.23.62.103.217.
			426.901. 910
05B1024Z	1K 1/16W 5% T 16	12	R8.63.100.101.123.171
			191.192.216.308.902
			909
05B1035Z	10K 1/16W 5% T 16	26	R4.18.20.21.26.30.31
			53.82.83.86.95.97.1
			35.158.225.243.255.
			283.295.298.500.501.
			502.503.903
05B1046Z	100K 1/16W 5% T 16	12	R3.35.38.50.61.119.1
			25.159.196.220.307.712
05B1057Z	1M 1/16W 5% T 16	3	R47.145.302
05B1134Z	11K 1/16W 5% T 1608	1	R32
05B1222Z	1.2K 1/16W 5% T 16	1	RV1
05B1233Z	12K 1/16W 5% T 16	2	R81.270
05B1529Z	1.5K 1/16W 5% T 16	1	R36
05B1530Z	15K 1/16W 5% T 16	1	R904
05B1541Z	150K 1/16W 5% T 16	1	R57
05B1804Z	18 1/16W 5% T 16	1	R121
05B1815Z	180 1/16W 5% T 16	2	R78.80,238
05B1826Z	1.8K 1/16W 5% T 16	1	R37
05B1837Z	18K 1/16W 5% T 16	2	R33.111

05B1848Z	180K 1/16W 5% T 16	1	R51
05B2032Z	20K 1/16W 5% T 16	4	R98.275.278.281
05B2207Z	22 1/16W 5% T 16	2	R1.17
05B2218Z	220 1/16W 5% T 16	8	R45.70.200.207.221.
			223.231.244
05B2229Z	2.2K 1/16W 5% T 16	5	R69.122.179.239.907
05B2230Z	22K 1/16W 5% T 16	12	R19.22.25.27.137
			226,229.230.246,294
05B2241Z	220K 1/16W 5% T 16	4	R49.56.109.131
05B2296Z	2.2 1/16W 5% T 16	2	R296.297
05B2427	2.4K 1/16W 5% T 16	1	R6
05B2438Z	24K 1/16W 5% T 16	2	R213.253
05B2713Z	270 1/16W 5& T 16	1	R241
05B2724Z	2.7K 1/16W 5% T 16	1	R274
05B2735Z	27K 1/16W 5% T 16	3	R16.235.288
05B2746Z	270K 1/16W 5% T 16	2	R199.299
05B3040Z	300K 1/16W 5% T 16	1	R713
05B3303Z	33 1/16W 5% T 16	2	R77.132
05B3314Z	330 1/16W 5% T 16	4	R54.198.205.214
05B3325Z	3.3K 1/16W 5% T 16	1	R157
05B3336Z	33K 1/16W 5% T 16	2	R208.315
05B3622	3.6K 1/16W 5% T 160	1	R154
05B3907Z	39 1/16W 5% T 16	1	R79
05B3929Z	3.9K 1/16W 5% T 16	4	R2.227.260.908
05B3930Z	39K 1/16W 5% T 16	2	R228.236
05B4333Z	43K 1/16W 5% T 16	3	R102.110.152
05B4706Z	47 1/16W 5% T 16	1	R292
05B4717Z	470 1/16W 5% T 16	1	R293
05B4728Z	4.7K 1/16W 5% T 16	15	R11.48.60.117.130.150
			160.166..167.175.240

			257.258.259.291
05B4739Z	47K 1/16W 5% T 16	17	R28.52.68.99.138.144
			173.182. 184.222.224
			234.245.251.269. +
			301.309
05B4740Z	470K 1/16W 5% T 16	3	R94.120.185
05B5109Z	51 1/16W 5% T 1608	3	R66.905.906
05B5604Z	56 1/16W 5% T 16	2	R13.59
05B5615Z	560 1/16W 5% T 16	2	R141.242
05B5626Z	5.6K 1/16W 5% T 16	7	R10.74.194.218.247.30
			303
05B5637Z	56K 1/16W 5% T 16	4	R24.108.156.711
05B6832Z	68K 1/16W 5% T 16	1	R34
05B7521Z	7.5K 1/16W 5% T 16	3	R96.287.289
05B8232Z	82K 1/16W 5% T 16	1	R237
05B9129Z	9.1K 1/16W 5% T 16	1	R183
0592718Z	270 1/ 8W 5% T 32	1	R129
06C1016Z	100 1/ 2W 5% T 50	2	R90.126
0600008Z	0 1/10W 5% T 20	2	R(C132.180)
0601027Z	1K 1/10W 5% T 20	1	R67
0601050Z	1M 1/10W 5% T 20	1	R267
0601225Z	1.2K 1/10W 5% T 20	1	R58
0602035Z	20K 1/10W 5% T 20	2	R29.310
0605618Z	560 1/10W 5% T 20	2	R89.92
751036	10K RH03E1C14X	2	RV2.3
752231	22K RH03E1CJ4X	1	RV4
130A604Y	0.1UF GRM40 X7R1	4	C59.155.159.162
130A736Y	0.01UF GRM39 X7R1	37	C31.36.60.129.133.137
			147.176 .177.182.
			198.201.202.210.212.

			226.229.243.245.267.
			275.276. 286.309.310
			313.314.316.195.
			317.321.904.905.908.
			909.910. 911
130A747Y	0.1UF GRM39 Y5V1	36	C2.6.35.37.38.40.41.
			42.43.44. 45.47.65.69
			70.72.75.88.90.91,108
			172.191.205, 214.257.
			271.274.278, 279.323.
			331.423. 424.902
130A758Y	0.001UF GRM39 X7R1	18	C32.33.101.102.127.
			138.171.174.189.190.
			287.288.291.292.307.+
			308.329.330
130B307	UMK107CG 102JZ 5% 0	3	C32.54.506
1301755	0.01UF GRM40 X7R1	3	C277.311.312
1301986	0.01UF GRM40 X7R1	1	C3
130A990	0.012UF GRM39 X7R1	1	C170
1302509	0.0027UF GRM39 X7R2	1	C263
1303407	0.0033UF GRM39 X7R3	1	C262
1304327Y	0.0047UF GRM39 X7R4	3	C50.51.164
1305313Y	0.5PF GRH111COG0	1	C96
1306068Y	0.068UF GRM40 X7R6	1	C232
1306244	0.68UF GRM40 Y5V6	1	C163
1307098Y	0.75PF GRH111COG0	1	C109
1308062	0.0082UF GRM39 X7R8	1	C104
1310897Y	1UF GRM40 Y5V1	3	C26.242.901
1310928Y	10PF GRM39 COG1	3	C12.16.266
1310939Y	100PF GRM39 COG1	2	C237.280

1311057Y	11PF GRM39 COG1	2	C14.301
1311354Y	1UF GRM39 Y5V1	3	C46.175.421
1311529Y	10PF GRM111COG1	1	C258
1312405Y	12PF GRM39 COG1	2	C130.165
1312416Y	120PF GRM39 COG1	6	C1.22.58.67.183.230
1313040Y	13PF GRM40 COG1	1	C203
1313062Y	13PF GRM39 COG1	2	C181.234
1314058Y	14PF GRM39 COG1	1	C29
1315648Y	15PF GRM39 COG1	4	C122.303.332.334
1315758Y	150PF GRM39 COG1	2	C103.119
1315912Y	1.5PF GRM111COG1	2	C98.197
1316041Y	16PF GRM39 COG1	2	C28.83
1318342Y	18PF GRM39 COG1	4	C9.57.259.260
132A022Y	2.2UF JMK107F225	1	C52
1320253Y	20PF GRM39 COG2	2	C15.19
1322257Y	22PF:GR111COG220J50	1	C255
1322598Y	22PF GRM39 COG2	3	C77.145.146
1322608Y	220PF GRM39 COG2	26	C5.10.49.78.79.81.84,85
			86.105.113.134.167,173
			187. 208.221.223. 225.
			244. 248.249. 325.360
1322983Y	2.2PF GRH111COG2	2	C110.169
1327339Y	2.7PF GRM39 COG2	1	C272
1327340Y	27PF GRM39 COG2	3	C17.121.219
1331024Y	3PF GRM39 COG0	1	C235
1331035Y	30PF GRM39 COG3	1	C30
1333314	3.3PF GRH111COG3	1	C256
1333491Y	33PF GRM39 COG3	2	C18.123
1333600	330PF GRH111COG3	2	C107.118
1336140Y	36PF:GR111COG360D50	1	C186

1339130	3.9PF GRH111COG3	1	C296
1339361Y	390PF GRH111COG3	1	C124,125
1340077Y	4PF GRM40 COG0	1	C206
1347560Y	4.7PF GRM39 COG4	1	C299
1347571Y	47PF GRM39 COG4	4	C25.120.268.300
1347670Y	4.7PF GRM40 COG4	1	C204
1347724W	470PF C1608 C0G1	22	C11.89.115.126.139.
			140.141.143.144.149.
			150.151.152.160.184.+
			220.239.250.252.281.
			282.306
1356315Y	5.6PF GRM39 COG5	1	C298
1356579Y	5.6PF GRH111COG5	1	C99
1360143Y	6PF GRM39 COG0	2	C4.82
1368381Y	6.8PF GRM39 COG6	1	C13
1370071Y	7PF GRM40 COG0	1	C111
1370193Y	7PF GRH111COG0	1	C100
1380110Y	8PF GRM39 COG0	1	C196
1380176Y	8PF GRM111COG0	1	C200
1382323Y	82PF GRM39 COG8	3	C55.68.154
1382423Y	8.2PF GRM39 COG8R2	1	C264
1390061	9PF GRM426COG0	1	C222
1410361	1UF 293D105X00	8	C71.73.185.218.253.
			284.294.318
1410460	10UF 293D106X00	1	C320
1410514	10UF 293D106X00	3	C20.188.251
1410592	10UF 293D106X06	6	C135.136.246.270.273
			0.319
1410723Y	10UF TSM1A106AS	5	C34.39.161.216.283
1422326Z	22UF 293D226X00	1	C158

1447200Z	4.7UF 293D475X00	4	C153.233.333.335
1447419Z	4.7UF 293D475X00	8	C24.66.76.142.148.194
			236.241
2000035	BFR92A REEL	3	Q2.3.13
2001164	BLT50 (SOT223)	1	Q41
2003069	2SK3075 FET RF PO	1	Q39
2003289	BFP193 TRANSISTO	1	Q34
2003339	KTC4075V-Y-RTK	4	Q18.32.35.37
2003340	KTA2014V-Y-RTK	1	Q905
2003431	NTD20N06LT4G (CASE	1	Q25
2020925	KRA110SPK BRT	4	Q20.21.24.701
2020958Z	KRC104SND TRANSISTO	14	Q5.6.8.10.11.16.19.22
			26.27.30.38.42.48
2021065	KTA1504SY TRANSISTO	2	Q902.903
2021131	KTC3875S(BL)	4	Q7.15.901.904
2021164	KTA1663 TRANSISTO	3	Q14.23.47
2031817Z	PBR951 TRANSISTO	1	Q12
2180577Z	KRA104S TRANSISTO	8	Q1.4.9.29.31.33.36.40
2201104	KIA358F I.C OP AM	6	U4.5.9.11.12.15
2205201	TA31136FN I.C IF DE	1	U2
2208169	MAX232ACSE (SO16)	1	U3
2211967Y	CAT25C32V1-TE13	1	U6
2212953Z	TK71733SCLI.C VOLT.	1	U22
2213446Z	TK71750SCLI.C VOLT.	1	IC1
2214771	LM1877M-9 I.C DUAL	1	U19
2217936	MB15E03SL I.C PLL	1	U1
2218809	CMX881E1 I.C	1	U13
2218813	MT8870DN1 I.C	1	U34
2218824	AD5300 8BIT BIGITA	1	U7
2218909	M30624FGPGP(LQFP,10	1	U18

2232249	MC14066BDR2G	1	IC406
2310777Z	LP2951CMX I.C VOLT.	1	U10
2411798	Z02W5.6Y 5.6V 0.2	3	D5.22.23
2430494Z	KDS226 DIODE CHI	2	D901.902
2430515	KDS184S DIODE SI	2	D8.16
2430526	KDS193 DIODE SI	1	D20
2430636	KDS181S A3DIODE SWI	4	D11.12.17.19
2430878	UPP9401(T&R)50V 2.	1	D3
2431040	KDS160 DIODE	1	D10
2431226	HSMS-2817 #L31	1	D4
2490142	BAT74 DIODE DUA	2	D13.30
2690423Y	VX-F7M-2.0FX	1	Y2
2703587	CDBCB455KCAY24-R0	1	Y1
3002238	617PT-1667=P3	2	T1.2
3108596	18NH:LL2012-F18NM	2	L3.29
3112445	12NH HK160812NJ	1	L37
3114009	2.7UH LK16082R7K	6	L5.6.11.13.15.35
3117626	18NH LL1608-FH1	4	L1.2.4.16
3120435	22NH LL1608-FH2	2	L38.39
3121300	0.68UH SWI0805FTR	1	L27
3121322	1UH SWI0805FT1	1	L12
3121333	1.2UH SWI0805FT1	1	L47
3121652	100NH SWI0805CTR	2	L7.8
3121674	150NH SWI0805CTR	1	L14
3121849	10NH SWI0603CT1	1	L17
3212152	BCM201209A600	45	R39.40.41.42.43.44.46
			65.87.112.116.139
			140.143.149.161.
			162.165.168.169.170.
			174.178. 181.188.189

			193.211.212.233.
			250.252.262.263.264.
			265.266. 271.272.273
			276.277.280.282,85
4A6148A	136.4 X 184.7 X 1.6	1	
406753A	18.2 X 10.9 X 1.6T	1	
416172A	145 X 98 X 1.6T F	1	
416180A	102.5 X 37.8 X 1.6T	1	
PACKING ASS'Y			
91D412	DW1"E" 310(W)X 392	0.2	
91D423	SW 1S"E" 200(W)X 9	2	
91D434	SW 1S "E" 302(W)X 2	1	
921015E	P.E 100X150XT0.05	1	
922535E	P.E 250X350XT0.05	1	
VCO ASSEMBLY No. 57790VA			
05B1013Z	100 1/16W 5% T 16	2	R206.306
05B1046Z	100K 1/16W 5% T 16	1	R202
05B1815Z	180 1/16W 5% T 16	1	R307
05B2218Z	220 1/16W 5% T 16	1	R207
05B2229Z	2.2K 1/16W 5% T 16	4	R204.205.304.305
05B4728Z	4.7K 1/16W 5% T 16	2	R203.303
130A758Y	0.001UF GRM39 X7R1	1	C215
1305159Y	0.5PF GRM39 COG0	1	C205
1310917Y	1PF GRM39 COG0	1	C203
1310928Y	10PF GRM39 COG1	1	C311
1311057Y	11PF GRM39 COG1	1	C202
1313062Y	13PF GRM39 COG1	1	C302
1315637Y	1.5PF GRM39 COG1	1	C204
1322608Y	220PF GRM39 COG2	5	C212.216.301.312.316
1331024Y	3PF GRM39 COG0	2	C213.313

1340121Y	4PF GRM39 COG0	4	C208.217.308.317
1347702Y	470PF GRM39 X7R4	1	C201
1356315Y	5.6PF GRM39 COG5	2	C206.211
1370137Y	7PF GRM39 COG0	2	C214.314
1380110Y	8PF GRM39 COG0	1	C306
2000673	2SC5084-O TRANSISTO	4	Q202.203.302.303
2020925	KRA110SPK BRT	2	Q204.304
2420224	1SV229 DIODE VAR	3	D201.202.301
3110517	0.033UH:NL252018T-0	2	L205.305
3110672	0.1UH:NL252018T-R10	2	L201.301
3110759	0.47UH:NL252018T-R4	1	L202
3110782	0.82UH:NL252018T-R8	2	L204.L(R309)
3112182	VCOOSC1.2T E558AN-1	2	L203.303
406833A	17 X36 X0.8 FR4	1	

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