23 MANUAL

Mobile Radio
SM-3000

SM-3000 Operation

Channel Monitoring

In accordance with the FCC Rules, while operating, the channel must be monitored prior to transmitting,. Your Maxon Dealer will be able to assist with particular operational parameters and procedures for the various functions.

Power On – Volume – Power Off

Turn the radio on by rotating the off/on – volume control clockwise. You will hear a click and the radio's alert tones. Increase the radio volume by continuing the clockwise rotation. To return the radio off, rotate the control counter-clockwise to detent.

Transmitting

1) It is necessary to monitor the channel for activity before a transmission. Monitor by pressing the monitor button or observing the TX/Call indicator for a solid yellow or green color. If solid yellow or green is observed, you must wait for the indication to leave before a transmission can be made.
2) Press and hold the P-T-T button on the front of the microphone unit. Hold the microphone unit 1 to 2 inches from your mouth, speak clearly and distinctly into the microphone area of the front.
3) Release the P-T-T nutton as soon as the message is complete. The P-T-T button must be pressed contimuously while speaking.

Receiving

1) When a message is received, the TX?Call indicator will glow solid yellow or green(depending if CTCSS or DCS tone has been programmed).
2) Respond to a message by pressing the P-T-T button on the front of the microphone unit. Press the P-T-T continuously while talking and release to listen. If scanning modes are enabled, be sure to respond before scanning resumes. If you do not, another call may be received and the selected channel may have to changed. Scanning is indicated by solid yellow Scan indicator. Refer to "Scan Modes" section for more information.

Monitor Button

1) Monitor : Pressing and holding the monitor button will open the squelch of the radio, defeating the CTCSS/DCS tone squelch and allowing you to listen for channel activity.
2) Nuisance Delete : This function will allow you to temporarily delete an unwanted channel from the scan list. Nuisance delete can be activated only when receiving the unwanted channel. Turning the unit off and on will return the unit to the original scan list.

Status Indicators and Audible Alert Tones

Your Radio has a sophsticated microprocessor control which provides a series of audible alert tones.

DESCRIPTION	LED MESSAGE or COLOR	AUDIBLE TONE
Power On - Ready	"88" and Red, All	Five Beeps
Correct Call	Green	N/A
Transmit	Red	N/A
Busy	Yellow	N/A
In Scan Mode	Scan	N/A
In Pscan Mode	Pscan	N/A
Busy Channel Lock Out	" bL "	Single Beep
Time-Out-Timer	" to"	Single Beep

Penalty	“ Pt ”	Three Beeps
Eeprom Error	“ Er ”	Single Beep
Key Accept	N/A	Single Beep
Out of Lock Error	“ UL ”	Two Beeps
Scan Delete	“ _d ”	Single Beep
Scan All Delete	“ Ad ”	Two Beeps
Transmit Inhibit In Scanning	“ _H ”	Two Beeps
Receive Only In Scanning	“ rO ”	Two Beeps

Editing Group Scan List

You can edit your pre-programmed Group Scan List by adding or deleting scan list from the Group Scan List. To activate scan list editing, press and hold the scan button on the front of the radio and turn volume on the radio. Upon entering the scan list edit function, the LED will indicate the “ SE ” message. To exit the scan list edit function, turn volume off the radio.

Select the Scan Group

The radio will display the Scan Group Number by “ Cx ”. You can change the Scan Group Number by up or down button. To activate scan list editing for selected group, press the scan button.

Adding or Deleting to Scan List

The radio will display the channel number by flash or static. To add or delete this channel from the scan list, press the monitor button. When added, the channel number will display by flash. When deleted, the channel number will display by static.

Editing Priority Channel

You can edit your pre-programmed Priority Channel. To activate priority channel editing, press and hold the pscan button on the front of the radio and turn volume on the radio. Upon entering the priority channel edit function, the LED will indicate the “ PE ” message.
The radio will display the priority channel number by flash. You can change the channel number by up or down button. To activate priority channel for selected channel, press the monitor button.

Scanning

The radio can be programmed for one of four diffent scan type, as determined by your dealer.

Once the radio has enabled the scan mode, it will traverse through the pre-programmed Scan List. The time spent on receiving on receiving a channel in the scan list is referred to as the Scan Speed. The radio will wait on the carrier detected channel for the Scan Speed Time in order to decode the signaling scheme. When an incoming call is detected and decoded, scanning stops and the radio enters the Un-Muted Rx Mode. After the call has ended, the radio enters the Scan Wait Mode for a pre-programmed period of time. This is referred to as the Scan Wait Time. This allows the user time to respond to the call (if the call is valid) before the Scan Wait Time expires. The radio then re-enters the Scan Wait Mode and Scan Wait Time is reset. Once the Scan Wait Time has expires, the radio will resume scanning.

1) Normal Scan TX

RX : The radio only receives calls from channels in the selected group scan list.
TX : The radio will transmit on the priority channel if a call is not received. If a scanned call is received, the radio will transmit on that scanned channel until scanning resumes. If transmission is attempted when the radio have not priority channel, an alert will sound.

2) RX Only/No TX

RX : The radio will only receive calls on the channels in the selected group scan list
TX : No transmissions are allowed. If transmission is attempted, an alert will sound.

3) Priority Scan TX

RX : The radio will receive calls from channels in the selected group scan list.
TX : All transmisions will be made on the programmed priority channel. Transmissions can also be made only on those scanned calls which have been received before scanning rewsumes.

4) Priority Only TX

RX : The radio will receive calls from channels in the selected group scan list.
TX : All transmissions will be made on the programmed priority channel. No transmissions will be allowd on scanned calls.

Nuisance Delete

If a channel contained in the scan list is constantly being scanned because of unwanted "chatter", you can temporarily delete the channel from your scan list by pressing the monitor button. Nuisance delete can only be initiated when scan is active and the radio has finished receving the call on the channel to be deleted. Nuisance delete can be activated for all channels by turning scan off.

Radio Option Parameters

1) Tx Time-Out Timer

(Default:10s Range:0-990s Increment:10s)
This timer prevents the user from transmitting for extended periods of time, which may damage the radio. An audible alert is emmited 5 seconds prior to transmission termination. If the user attempts longer than the Time-Out Timer, the radio provides a Time-Out Timer Alert and will cease transmission.

2) Tx Inhibit Time

(Default:5s Range:0-75s Increment:5s)
The Tx Inhibit features may be used in conjunction with the Time-Out Timer. The Tx Inhibit feature prevents the user from transmitting again for a period of time after the Time-Out Timer expires. If the user attempts to tansmit before the Tx Inhibit Time expires, a Transmit Not Available alert is given. Once the Tx Inhibit Time expires, an alert is given.

3) Scan Speed Time

(Default:300ms Range:0-2s Increment:10ms)
This is amount of time spent on receiving a channel in the Scan List. The radio will wait on a channel to check for valid tone.

4) Scan Wait Time

(Default:1s Range:0-15s Increment:1s)
The Scan Wait Time is the mount of time after a call has been completed or a transmission is enabled before radio resumes scanning.

5) Look Back Time

(Default:1s Range:0-7s Increment:1s)
The priority Look Back Time determines how open the priority channel is monitored.

6) ANI Before Tx

The radio supports an ANI option. Upon pressing the PTT, the radio transmits up to 16 DTMF tones at the beginning of the voice transmission. The radio ceases transmission after the pre-programmed ANI Delay. The ANI Digit Time allows the radio to be programmed so that each DTMF digit lasts for a duration of 55ms or 65ms, and there is a ANI Interdigit Time of 50ms.

7) Power Up Beep

Upon power up, the radio emits a 50ms long, 2000Hz, 1600Hz, 1400Hz, 1200Hz, 900Hz tones or 2,3,4,5,6 DTMFs.

8) Busy Channel Lockout

These features are not to be defeated when scan is enabled.

Enabled : Upon PTT being pressed, if carrier is present, the radio will not exit Muted Rx Mode to enter Tx Mode. The Transmit Not Available alert is given.

Disabled : Upon the PTT being pressed, the radio enters Tx Mode regardless of the presence of carrier.

9) Marked Idle

Enabled : If the Busy Channel Lockout is on, and carrier is detected, the radio is permitted to enter Tx Mode if the radio squelch option is valid.

Disabled : Eliminates Marked Idle.

Squelch Option

1) **No option (Carrier squelch**)

When tone option is not selected, the radio uses carrier squelch.

2) CTCSS (Continuous Tone Controlled Squelch System)

When this tone option is selected, the radio will use the CTCSS option. If Non-Standard option is selected, the PC programmer will allow Non Standard CTCSS tones to be programmed into the radio.

3) DCS (Digital Coded Squelch)

When this tone option is selected, the radio will use the DCS option. When Inverted tone option is selected, the radio inverts the DCS tones.

TABLE OF CONTENT

Introduction

The current SM2000 / SM4000 / PM100 mobile will be phased out due to component obsolescence and has almost reached the end of its life cycle. The "SM-250" is intended as a direct replacement for these mobiles and as such must retain the features of these radios in addition to new features to enhance marketability.

Maxon Europe have recently completed approval of the PM100 VHF to ETS 300 113 for data applications. This approval opens new markets for the PM100 and MEL, with possible additional sales of 200 - 500 units PER MONTH. To retain this market, any replacement MUST meet ETS 300 113 and support the same interface as the PM100

The SM-250 will be a wide-band, low cost conventional mobile with 99 channel or 10 Group operation.

Content

- Unit
- Microphone
- DC Power Cord
- Mobile Mounting Braket
- Assembly hardware
- Operating Guide

THEORY OF OPERATION

The VHF and UHF mobile radios include a unique main P.C.B. cosisting of RF, Digital .
The RF containts the transmitter, receiver circiuts and the Digital , control circuits respectively. The control circuits contain the micro controller, Asic(Audio sigmal precessor) and associated digital circuits.

DIGITAL CIRCUIT

ASIC is comprised of Analog signal path, SAT signal path, miscellaneous signals and controller as follows

Analog signal path

A1： is a BUFFER AMP to generate discriminator audio from Pin9 to ASW1.
And its gain 1

A2：amplifies analog signal which was received from IN2(Mic input terminal) by 10dB.
And then output signal goes ASW1.

ASW1 : is 2 way switch. It generates one of analog signals which was applied from A1 and A2. The control signal should be controlled by 1 bit signal. Default value is ＜0＞and A1 is selected

INTRIM : compensates the deviation for the input analog signal sensitivity. The control range of the signal is +3.5/-4dB and is controlled by 16 steps. And the control signal is handled by 4 bit signal. Default value is ＜1000＞ and gain is 0dB.

HPF : was composed of the 8th order or more and the cut-off frequency is 300Hz. As for the attenuation characteristic of filter, the signal diggerence must at least over 30dB at the cut-off frequency 300Hz and the first 250Hz of attenuation bandwith.

ASW2 : is 4 way switch. It receives analog signals from HPF and its output goes one of De-Emphasys, RXVOL or AMP(with 6dB/oct Pre-Emphasys), AMP(without Pre -Emphasys)by the control instruction.
The control signal must be controlled by 2 bit signal. Default value is ＜00＞ and De-Emphasys is selected.

DEMPHA : has a characteristic of +6dB/oct De-Emphasys. The gain for 1KHz Analog Signal which is appllied from ASW2 is 1.

PREMPHA : has a characteristic of +6dB/oct Pre-Emphasys. The gain for 1KHz Analog Signal which is appllied from ASW2 is 1.

RXVOL : controls the magnitude of input analog signal to generate to the speaker. The analog signal must be able to be controlled as 16 stages within the range of maximum 0dB to minimum -37.5dB.

AMP : is amplifier which generates ana1log signal is applied by ASW2 to Limitter. And it also has to have the characteristicof +6dB/oct Pre-Emphasys before the amplifing stage. And the minimum gain of the amplifier is +20dB at the minimum level of the control signal. The control instruction should be controlled as 8 stages from minimum+20dB to +41dB by 3bit signal

LIMITER : has the function of limiting the signal at the definite magnitude for modulation Limiter input level must be limited at 0dB(2800mVp-p)and Liniter output signal must be controlled at 4 stages from 0dB to -5.4dB by 2 bit signal. Also output signal of Limiter go to the LMOUT termimal.

ASW3 : is 2 way switch. It selects signal from either Limiter or SATRIM and its output goes VSLP.

VSLP : is low pass filter of at least 6th order or more and its cut-off frequency must be selected either 2.55KHz or 3KHz by 1 bit signal. Filter attenuation characteristics must be at least over 21dB/oct.
But unlike VSCBPF, the cut-off frequency of VLPF should be changed by switching of device.
That is to prevent reducting of S/N ratio due to the harmonic by the internal clock.

TXTRIM1 : to compensate deviation for the magnitude of analog input signal, within the Gain range of +3.5dB
ti -4dB, TXTRIM1 controls as 16 stages by 4bit signal.

TXSUM : mixes the signal from TXTRIM1 with the other signal which is applied by TDIN 4 bit signal , or selects one of the signals. And it also must be able to mute two applied signal. When muting, attenuation factor must be at least ove 50dB.

ATTN : attenuates the signal applied from TXSUM by 6dB. This should be able to select the atteneation of 0dB
or 6dB by 1 bit contro signal.

TXTRIM2/3 : control the deviation of final output signal for modulation, Within the range of +3.75 to -4dB. It can be controlled as 32 stages by 5 bit signal, respectevely.

A3/A4/INV : is the final output Buffer AMP of TX Analog signal and Gain is 0dB, respectively. Output A3 and A4 is non-inveriting signal.INV inverts the phase of the TXTRIM3 output of TXTRIM3 is INV.

SAT Signal Path

SATRIM2 : is received DTMF or other tone signal and compensates the deviation of the input signal. The signal can be controlled by 4 bit control signal within the range of +2.5dB to -3dB and +13.5dB to +12dB.

ASW3 : Two way switch. selects one of the signals which is applied by RDIN and TDIN.
Both RDIN AND TDIN siganls is DCS or CTCSS , and all of the paths from TDIN to FLTOUT and COMPON to MODOUT1/2/3 must be DC couple.

VSCLPF : is the Variable Switched Capacitor Low Pass Filer , which is variable the applied signal from ASW4 by signal instruction, at cut-off frequency, from 50Hz to 300Hz. It is composed of the 7th order elliptic Low Pass Fiter or mor. To make the desition of cut-off frequency , the clock which is applied to VSCLPF oscillates at internal controller by controller instruction and it must be supplied to VSCLPF.

SATRIM : to compensate the deviation of input SAT signal, it controls the amplitude as 16 stages within the range of +3.5dB to -4dB by 4 bit signal.

COM : comparing external reference voltage(COMPP)with the applied SAT signal which is from FLTOUT to COMPIN and it goes to Logic High and Logic Low at this point. The reference voltage goes to Vref.

Miscellaneous signals and controller

ADC/ DAC : 8 bit Analog to Digital Converter/ 8 bit Digital to Analog Converter

CTRL : transfering its mutual data passing throug 3 pin to external controller by Serial Communication. And execute the relevant instructions

DATA : transferring all the instructions with exeternal controller. It operates as output terminal by READ instruction and it operates as input terminal by WRITE instruction.

CLOCK : is synchronous input terminal for communication with external controller. Clock is supplied from external controller and data transfer is moded at CLK down edge.

ENBL : In data communication , it determines effective timing. At Active Low, Data Read and Write can be effective.

AGND,DGND : Reference voltage of internal Analog paths. Classifed Digtal's Analog's GND.

CTCSS/ DCS Decoding Processing

Discriminator audio from pin 9 IC3 is applied to IC 408 and associated part, which are the 3rd order 500Hz Bessel low pass filter. The signal is then fed to Pin3 (IC 402) which is a the 7th order elliptic Low Pass Filter. Where the signal of the voice band affecting the processing of CTCSS or DCS decodig is diminished sufficiently. The deviation of the signal passed through the 7th order LPF is controlled by SATRIM2 and the applied signal which is from FLTOUT to COMPIN is compared with external reference voltage (COMPP) and then it goes to Logic High and Logic Low. The signal is output from Pin 21(IC402) and fed into IC401(micro) wher it is matched with a programmed frequency. If successful, a Decode occurs, which is shown by a green L.E.D on the top side of the VHF and UHF handheld and audio is heared. If valid Decode was not seen , the busy L.E.D.(Yellow) would be shown.

CTCSS Encoding Processing

During TX encode the tone squelch digital signal is produced at pins 55 of the micro controller (IC403)which is PWM port. The analog signal is fed into IC402 pin4 and filtered by 7th order elliptic LPF. The filtered signal is output on pin 23 (IC406) and fed into pin22 of IC402 . The filtered encode signal is mixed with the audio signal from TXTRIM1 by TXSUM. Via ATTN , the mixed signals applied to TXTRIM2/TXTRIM3, which control for modulation.

EEPROM

RX/TX channels, and CTCCS/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. IC409 is an EEPROM with 32768(8× 4096) capacity and data is written and read serially

Mute (squelch) Circuit

The mute circuit which is controlled by the output of IC402(micro) pin84(TDA1519A) is connected to Q33,R101, which mutes the TDA1519A on the Digital circuits.

RF CIRCUITS

Transmitter

The transmitter is comprised of:

1. Buffer
2 Power AMP
3. Low Pass Filter
4. Antenna Switch
5. A.P.C Circuits

Buffer

VCO output level is 0dBm and amplified to +26dBm (UHF)/(VHF). The buffer consists of Q16, Q19 and Q20 for isolation and gain.

Power AMP

The P.A Module consists of 3-stage amplifier and amplies the TX signal from +26dBm to +46dBm. The input and the output terminal of the P.A Module are matcued 50 OHM.

Low Pass Filter

The amplified RF output passes through the stripline coupler and is fed to the harmonic low pass filter, consisting of sring coils L24, L25, L26 and L27 and capacitors C179, C130, C131, C132 and C133, and then to the antenna connector.

Antenna Switch

When transmitting, the diodes D10, D12 and D14 are forward biased enabling the RF signal passage to the antenna. D12 and D14 is shorted to ground inhibiting the RF signal to front-end. In receive the diodes D10,D12 and D14 are reversed biased passing the signal from the antenna through L28 to the front-end without signal loss.

Automatic Power Control Circuit

The APC contains the stripline coupler, diode D11, and variable rasistor RV5, opamp IC8, and two TR : Q27 and Q28. IC8 acts as a differential amplifier. The RF signal is rectified by D13 to produce a DC voltage, proportional to RF power, that is applied to IC8 pin 3. Voltage divider R96, RV5 and R95 monitors TX 8.5V dc to develop a reference for IC8 pin 2. The difference at the output of (IC8 pin1) is passed to Q28 and drives the collector of Q27. This feedback controls the gain of IC1 to maintain a constant RF power output. RV5 is used to adjust the RF high power level. RV4 is used to the low power setting.

RF CIRCUITS PLL SYNTHESIZER

12.8 MHz TCXO

The TCXO contains the 2-stage thermistor network compensation and crystal oscillator and modulation ports. Compensation is +/-2.5 PPM or less from -30c to +60c.

PLL IC Dual Modules Prescaler

Input frequency of 12.8 MHz to IC2 MC145191F pin 20 is divided to 6.25 KHz or 5 KHz by the reference counter, and then supplied to comparator. RF signal input from VCO is divided to 1/64 at prescaler in IC2, Divided by A and N counter in IC2 to determine frequency steps, and then supplied to the comparator. PLL comparison frequencccy is 6.25/5KHz so that minimum programmable frequency step is 5/6.25 KHz. A and N counter is programmed to obtain the desired frequency by serial data in CPU. In comparator, the phase difference between reference and VCO signal is compared. When the phase of reference frequency is leading , Fv is output, but when VCO frequency is leading, Fr is the output. When Fv=Fr, phase detector out is very small 0v pulse. 64/65 modulus prescaler is comprised in IC2, and has two output ports:

Port A pin 16: tx enable 2

Port B pin 15: prescaler power save control in pll IC Pin 13 labeled test2 allows the technician to see the output of the dual nodules pre-scaler for trouble shooting purposes, no connection should be made to this pin.

Level Shifter & Charge Pump

The charge pump is used for changing output signals Fr, Fv at PLL IC from 0-5v to 0-12v necessary for controlling vco.

Reference Frequency LPF

The Loop Filter contains R17, C21 and C20. LPF settling time is 12mS with 1 KHz frequency. This also reduces the residual side-band noise for the best signal-to-noise ratio.

DC to DC Converter

The DC to DC converter converts the 5v to 14-16v to supply the necessary voltage for wide range frequency in vco.

VCO

The VCO consist of one VCO. Is switched TX/RX by TX_EN(VHF) and RX_EN(UHF). It is configured as colpits oscillator and connected to buffer as cascade bias in order to save power. The varicap diodes D201 and D202 are low-resistance elements and produce a change in frequency with a change in reverse bias voltage (2-11v). L203 and C220 are resonant coil and capacitor, which change the control voltage by the turning core and capacitor. D202 modulation diode, modulates the audio signal. C204 compensate for the non-linearity of the vco due to modulation diode, and maintain a constant modulation regardless of frequency .

RECEIVER

Front End

The receive signal is routed backward through the low pass filter, then onward to Pin 1 of the FRONT END modual. The filter band pass filter consisting of C601 - C610 and L601 - L603 is coupled to the base of Q601 which serves as an RF amplifier. Diode D601 serves as protection from static RF overload from near by transmitters. The output of Q601 is coupled to a second band pass filter consisting of C604 - C623 and L604 - L607).The output of Pin 6 is then couples to the double balanced mixer D5. The receiver Front End module is factory pre-turned and requires no adjustment. Repair is effected by replacement of the entire module of the proper banded module. These are VHF 138MHz to 162 MHz and UHF 440 MHz to 470 MHz. The receiver Front End module signal pins are as follows:

1. RF Input
2. Input Ground
3. N/A
4. Receive +5V
5. Ground
6. Output

First Mixer

D5, T1 and T2 are double balanced mixers which provide the 45.1 MHz intermediate frequency output. The filtered frequency from the Front End module is coupled to T1 . The 45.1 MHz IF output is matched to the input of the 4-pole monolithic filter by L5 and C39. The crystal filter provides a bandwidth of +/-7.2 KHz from the operating frequency providing a high degree of spurious and intermodulation protection. Additionally, a 90 MHz trap (XF1) is also placed at the filter output to provide additional attenuation of the second order IMD. The output of the filter is impedance matched by C45 to the base of the post of filter IF amplifier Q18.

Second Oscillator Mixer Limiter And FM Detector

The output of the post filter amplifier, Q18, is coupled, via C46 to the input of IC3 (MC3372). IC3 is a monolithic single conversion FM transceiver, containing a mixer, the second local oscillator, limiter and quadrature detector. Crystal X1 44.645 MHz is used to provide resultant 455KHz signal from the output of the second mixer. The mixer output is then routed to CF1 or CF2. These ceramic filters provide the adjacent channel selectivity of
25KHz or 12.5 KHz bandwidth .

Mute (squelch) Circuit

The mute circuit switches off the power amplifier when no audio signal is present. The squelch circuit consists of IC3 and RV801 and thier associated components. The noise signal foom pin 9 of IC3 is amplified by internal amp of IC3 and then fed into RV801 via L9, L8. RV801 is used to adjust the squelch circuit sensitivity .

Speaker Audio Amplifier

After signal detection and audio filtering , Via RV801 on the ESC board, the low level audio is returned to pin 1 and pin 9 of IC6, the audio PA. IC6 is enable by a logic low applied to Q33. Q33 mutes the audio amplifier by grounding R101 when the transistor tunes on.

MAINTENANCE AND REPAIR

GENERAL

The radio have been factory aligned for operation within frequency band.
Any repair or adjustment should only be made by or under the supervision of a qualified radio service technician.

When removing or fitting, use the Exploded View and Parts List in conjunction with the following procedures:

ALIGNMENT PROCEDURE

The SM3000 Receiver is designed for broad band covering VHF(138-162MHz) and should require no special alignment, unless repairs are performed on the receiver portion.

Should repairs be required, the following procedures should be applied:

VCO

1. Set the unit to the lowest transmitter frequency, 440MHz(UHF), 138MHz(VHF) and adjust the VCO L203 to 2.5V and 1.0V respectively.
2. Set the unit to the highest transmitter frequency, 470MHz(UHF), 162MHz(VHF) and check that the VCO voltage is below 11 volts.
3. Set the unit to the lowest receiver frequency, 440MHz(UHF), and adjust the VCO C208 to 1.5V.
4. Set the unit to the highest receiver frequency 470MHz(UHF), 162(VHF) and check that the VCO voltage is below 11 volts.

* Note : use TP1 to measure the voltage.

Transmitter

Connect the unit to a Service Monitor with the power meter setting to the 40 W scale (or autorange)

TCXO

Set the channel selector to the mid-range frequency 455 MHz, adjust CT1, for a reading of 445 MHz +/- 200Hz. For the VHF data radio, adjust the CT1 and set the frequency within the required range.

APC

1. Adjust RV5 for fixing up High Power(40W)
2. Adjust RV4 for fixing up Low Power(10W)

COMPOMENT REPLACEMENT

Surface Mount Components

Surface mount components should always be replaced using a temperature controlled soldering system. The soldering tools may be ether a temperature controlled soldering iron or a temperature controlled hot-air soldering station. A hot-air system is recommended for the removal of components on these boards. With either soldering system, a temperature of 700 F(371 C) should be maintained.

The following procedures outline the removal and replacement of surface mount components. If a hot-air soldering system is employed. See the manufacture's operating instructions for detailed information on the use of your system.

* CAUSION : Avoid applying heat to the body of any surface mount component using standard soldering methods. Heat should be applied only to the metailzed terminals of the components. Hot-air systems do not damage the components since the heat is quickly and evenly distributed to the external surface of the component.

* CAUSION : The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, service technicians should discharge themselves by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a know good earth ground. When soldering or desoldering a CMOS device, the soldering equipment should have a known good earth ground.

Surface Mount Removal

1. Grip the component with tweezers or small needle nose plies.
2. Alternately heat the metalized terminal ends of the surface mount component with the soldering iron. If a hot-air system is used, direct the heat to the terminals of the component. Use extreme care with the soldering equipment to prevent damage to the printed circuit board (PCB) and the surrounding components.
3. When the soldering on all terminals is liquefied, gently remove the component. Excessive force may cause the PCB pads to separate from the board if all solder is not completely liquefied.
4. It may be necessary to remove excess silder using a vacuum de-soldering tool or Solder wick. Again, us great care when de-soldering or soldering on the printed circuit board. It may also be necessary to remove the epoxy adhesive that was under the surface mount component and any flux on the printed circuit board.

Surface Mount Component Replacement

1. "Tin" one terminal end of the new component and the corresponding pad of one the PCB.
   Use as little solder as possible.
2. Please the component on the PCB pads, observing proper polarity for capacitors, diodes, transistors, etc.
3. Simultaneously touch the " tinned" terminal end and the " tinned" pad with the soldering Iron. Slightly press the components down on the board as the solder liquefies. Solder all terminals, allowing the component time too cool between each application of heat. Do not apply heat for an excessive length of time and do not use excessive solder.

With a hot-air system, apply hot air until all "tinned" areas are melted and the component is seated in place. It may be necessary to slightly press the component down on the board. Touch-up the soldered connections with a standard soldering iron if needed. Do not use excessive solder.

* CAUSION: Some chemicals may damage the internal and external plastic parts of the radio.
4. Allow the component and the board to cool and then remove all flux from the area using alcohol or another

approved flux remover.

Surface Mounted Integrated Circuit Replacement

Soldering and de-soldering techniques of the surface mounted IC's are similar to the above outlined procedures for the surface mounted chip components. Use extreme care and observe static precautions when removing or replacing the defective (or suspect) IC's. This will prevent any damage to the printed circuit board or the surrounding circuitry

The hot-air soldering system is the best method of replacing surface mount IC's. The IC's can easily be removed and installed using the hot-air system. See the manufacturer's instructions for complete details on tip selection and other operating instructions unique to your system.

If a hot-air system is not available, the service technician may wish to clip the pins near the body of the defective IC and remove it. The pins can then be removed from the PCB with standard soldering iron and tweezers, and the new IC installed following the Surface Mount Component Replacement procedures. It may not be necessary to "tin" all (or any) of the IC pins before the installation process.

TROUBLESHOOTING GUIDE

SYMPTOMS	CAUSES	COUNTERMEASURES
Unit does not Work	1. Broken DC cable (13.8+/-10%) 2. Open DC fuse in Power cable 3. Defective regulatore IC4, IC404, IC5 4. Defective volumn switch	1. Replace Power cable. 2. Replace fuse 3. IC4, 5 (5v+/-0.2v)
Worning tone& No Work	1. Pll error 2. Filtering Error 3. EEPROM Fail 4. Program error	1. Check TCXO/VCO/PLL IC 2. Check LPF 3. Re-programming 4. Replace or charge battery
Bad RX Sensitivity (-10 to -60dB)	1. Defective ANT sw 2. defective front-end 3. Defective DBM 4. IF IC 5. VCO level drop 6. Change of 1'st local frequency	1. check D10,D12 2. Check Q601 3. Check D5,T1,T2 4. Replace IC3 5. RX VCO level >2dBm 6. Retune TCXO
Defective RX	1. VCO frequency change or level drop 2. Defective voltage Source	1. Repair VCO Defective IF IC (IC1) 2. IC4, Q7,Q8
PLL Error	1. Defective 12.8 MHz TCXO 2. Voltage source for RX VCO/ TX VCO 3. Defective PLL IC	1. Replace TCXO. 2. Check RX VCO/TX VCO 3. Replace IC2
NO TX Power	1. Tx buffer APC 2. Power module 3. APC control	1. Check Q16,19,20 2. Replace Power module 3. Check Q27,28, IC8
Low TX power output	1. APC	1. Re-adjust RV4, RV5
No modulation	1. SW IC & mic amp IC	1. Check IC416, IC402
No programming	1. short protector VCC	1. Defective programming lead
NO S.A.T	1. IC402	1. Check IC402