



T6M Service Manual Issue 1

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Federal Communications Commission (FCC) Regulations

- ◆ This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.
- ◆ You are required to obtain a station license before transmitting from your mobile equipment.
- ◆ **This equipment is only licensed for operation on 25 kHz channel spacing.** Operation on 8.33 kHz channel spacing is restricted to European customers.
- ◆ The mobile transmitter power output must not exceed the output necessary for satisfactory technical operation taking account of local conditions and the area to be covered.
- ◆ The mobile transmitter frequency and parameters should be checked by authorised service personnel before use, and at least yearly thereafter.

Safety Information

- ◆ DO NOT operate this equipment with the antenna close to or touching eyes, face, or exposed body parts.
- ◆ KEEP any mobile equipment containing a transmitter out of reach of children.
- ◆ AVOID holding the transmit (PTT) switch in the 'ON' position when not communicating.
- ◆ DO NOT operate equipment at filling stations.



- ◆ DO NOT operate equipment in vicinity of explosives or explosive atmospheres (e.g. in a blasting quarry).



- ◆ The Power Amplifier Module used in these mobile radios contains beryllium oxide, which is extremely toxic. In the unlikely event of coming into contact with beryllium oxide, wash the affected area thoroughly with soap and water. If the skin is broken obtain medical assistance. If there is eye contact, wash for 15 minutes with running water, including under the eyelids and seek medical attention. If ingested or inhaled, seek medical attention immediately.



Repairs, Modifications and Maintenance

- ◆ If any operational difficulties arise while using this product, report them to authorized service personnel as soon as possible.
- ◆ This system contains no user serviceable parts. Unauthorized adjustments or modifications will void the warranty and may lead to emissions outside FCC limits.
- ◆ DO NOT connect an external RF power amplifier to this equipment.

Patent Information

- ◆ The Linear Modulation techniques described in this publication are subject to Patents issued to the British Technology Group (BTG) and Linear Modulation Technology (LMT)

- ◆ Patent No's are: BTG – UK 2161661, 2163326; US 4691375, 4679243:
LMT - UK 2243058, 2274231, 2272589, 2293935: EU 0447237,
0725495, 0598585, 0648012, 0706259: US 5249202, 5381108,
5507017, 5623226.

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Amendment Schedule

Amendments to this manual will be issued to incorporate changes or detail additional information. Amended pages will be identified by the amendment date and number, which will be shown at the foot of the page. Record incorporation of amendments to this manual on this page.

If a new issue of this manual is made all amendments will be incorporated.

Date	Amdt. No.	Date Incorporated	Reason for Change

If you find any errors or omissions in this manual, or you have any suggestions for improvements please write to the address shown on the front page.

1 INTRODUCTION

The Park Air Electronics (PAE) mobile transceiver Type T6M is a multi-channel VHF AM equipment operating in the frequency range 118 to 137 MHz with a bandwidth of 8.33 or 25 kHz. The transceiver is designed for vehicle mounting via a bracket, usually around the dash board area. The equipment, which operates from a +13.2 volt, is supplied with mounting bracket and plug in microphone.

The transceiver provides a nominal 8 watt output.

The required frequencies, priority frequencies and scan facilities are normally programmed, to the user's requirements, during manufacture or by the equipment supplier. If a user wishes to programme the equipment, then disk based programming software and a programming lead can be supplied by PAE.

2. T6M Series Specifications

The following specifications are intended for testing and servicing the mobile radio. Specifications are subject to change without notice.

2.1 General

Air Interface	None
Operating Mode	Single Frequency Simplex
Frequency Range	
Receive	118 - 137 MHz
Transmit	118 - 137 MHz
Channel Bandwidth	25 kHz and 8.33 kHz.
Channel Increment	8.33 kHz
Input Voltage	13.2 VDC nominal (10.8 V to 18 V), negative ground
Max Receive Current	2A
Max Off Current	100mA
Audio Output	4W into 4ohm external speaker (<10%THD)
Temperature Range	
Normal	+15°C to +35°C
Operating	-20°C to +55°C
Storage	-40°C to +85°C
Dimensions	
Width	177 mm (6.95")
Depth	228 mm (8.98")
Height	50 mm (1.95")
Weight	1.75 kg (±0.1kg)
Approvals	CE, SERPS, MOPS EN300 279 Ed 2 EN 300 676

2.2 Receiver

Sensitivity	-100dBm
Selectivity	50dB @ 8.33kHz, 60dB @ 25kHz
Intermodulation	60dB
Spurious and Image Rejection	75dB
Audio Power Output	4 Watts.
Distortion	<10% THD
RF Input Impedance	50 ohms

2.3 Transmitter

RF Output Power, Nominal	8 Watts
Spurious	-46dBm
Harmonics	-36dBm
Audio Modulation	AM
RF Load Impedance	50 ohms
Frequency Stability	$\pm 1.0\text{ppm}$ (normal)

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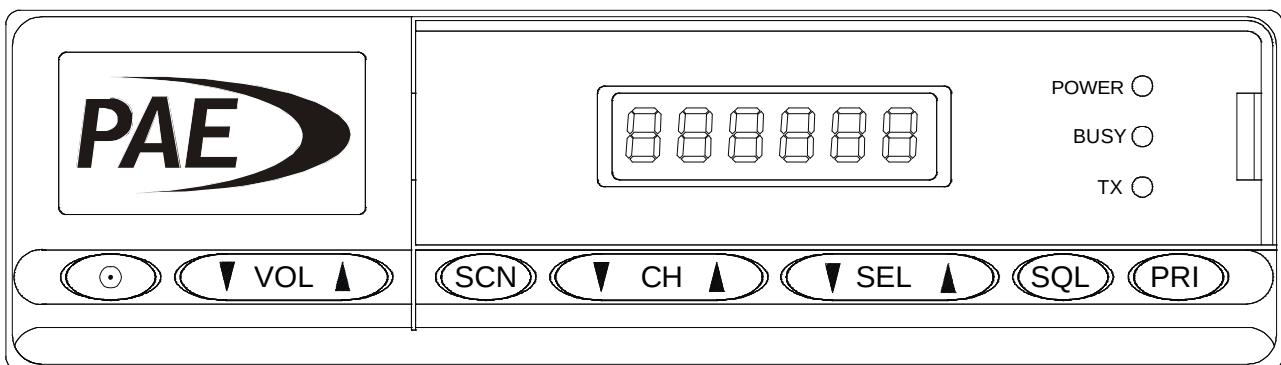
3.1 General

The T6M series mobile radio is designed to operate in single frequency simplex mode on the International Air Band allocation (118-137 MHz mobile transmit and receive).

The mobile radio is field programmable, allowing it to be customized both for the frequency allocation for which it is intended, and for the particular user. Refer to the built in help facilities of the Mobile Programming Software for more information.

The mobile radio is designed to be mounted in the driver's compartment of a road vehicle. It can withstand the vibration, shock and extremes of temperature typically encountered in this environment. The mobile radio's basic construction consists of a die-cast alloy chassis, and an injection molded ABS front panel.

3.2 T6M Series Mobile Front panel



3.3 Mobile Radio Programming

As well as the standard accessories supplied with the mobile radio (listed in the installation section of this manual), the following additional accessories can be used:

3.3.1 Programming Interface Lead

For programming purposes the microphone connector on the mobile radio is connected directly to the serial port of a PC using a special programming interface lead.

3.3.2 Programming Software

The personality of the mobile radio must be programmed before it can be put into service in a system. This is normally done at the time of manufacture or by the equipment supplier. Special programming software is

available for this purpose, which runs on a PC. The software is available on 3.5" floppy disks. The software contains built in help features.

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4.1 General

4.1.1 Scope of Instructions

The following installation instructions are a guide to installing the mobile radio. The use of the mounting hardware is described and the required electrical connections are shown. A serviceability check is described with fault-finding information.

4.1.2 Tools and Test Equipment Required.

Power drill	
Hole cutter	
Cross head screwdrivers	
Emery paper	
Connectors	
Crimp tools	
Wire cutters	
Earthing braid	
Torx screwdriver	M3 (No. 10)
Torx screwdriver	M2.5 (No. 8)
Hex nut spinner	M3 (5.5mm)
Hex nut spinner	M2.5 (5mm)
IC extraction tool	CEKA T2371 or equivalent
RF Power & VSWR Meter	Bird 4391 or equivalent
Programming interface lead	Special PC to mobile microphone socket lead (part number LM030400055)

4.1.3 Unpacking

Unpack the mobile radio install kit and check the contents against the packing list enclosed with the mobile.

4.1.4 Mobile Radio Programming

To operate on the system, the mobile radio requires certain “personality” information to be entered into memory

The mobile radio must therefore have been programmed before it can be placed in service. This is normally done at the time of manufacture or by the equipment supplier. To program the mobile radio, use the Mobile Programming Software.

4.1.5 Power Source

The mobile radio is designed to operate from a 13.2 VDC nominal, negative ground electrical system. This type of electrical system has the negative battery terminal connected directly to the vehicle chassis. For vehicles with a 24 V battery or where there must be isolation between the battery and the equipment, a suitable DC-DC converter should be used.

4.1.6 Selecting a Mounting Location

Choose a safe and sensible location for the mobile radio and mounting bracket, ensuring that the installation:

- ◆ Is easy to operate when seat belts are worn.
- ◆ Does not inconvenience driver or passengers when seated, or when entering or exiting the vehicle.
- ◆ Will not injure occupants if the vehicle suffers an impact.
- ◆ Does not interrupt the airflow from heater or air-conditioning vents.

Suitable mounting places include the dash, console or transmission hump.

Avoid mounting in small enclosed spaces (e.g. glove lockers). To prevent excessive self-heating, the mobile radio should have an unobstructed airflow space of at least 20 mm at the rear.

4.2 Mobile Radio Installation

4.2.1 Mounting Mobile Radio, Microphone and Speaker

Check that the mobile mounting bracket fixing screws will not damage any cables, brake or fuel lines when they are fitted. Then install the mounting bracket using the self-tapping screws provided. Mounting bracket dimensions and fixing hole centers are shown in Figure 4-1.

Install the mobile radio in the bracket using the rubber grips and fixing knobs included in the kit. The rubber grips can be fitted in two ways. One way locks the mobile radio rigidly in the bracket. The other provides a friction mount allowing the mobile radio to be tilted to the desired angle.

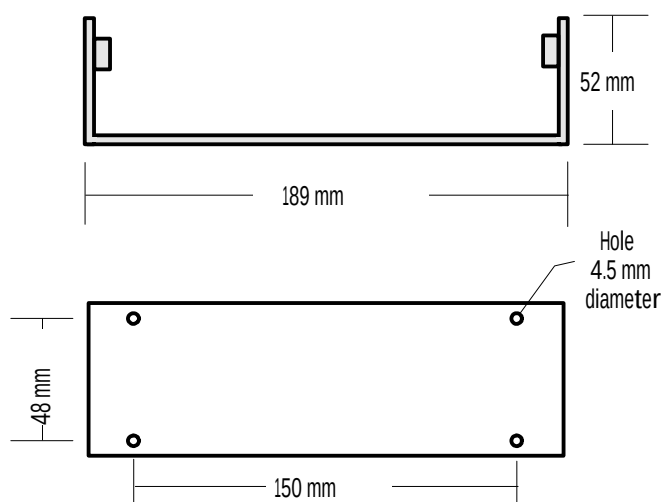


Figure 4-1 Mobile Radio Mounting Bracket - Dimensions

Install the microphone rest in a convenient location using the screws provided.

Plug the microphone lead into the socket located on the underside of the front panel of the mobile radio and fit the strain relief grommet into place.

Install the speaker in a location where it can be easily heard, using the mounting bracket and screws provided.

4.3 Radio Unit Connections

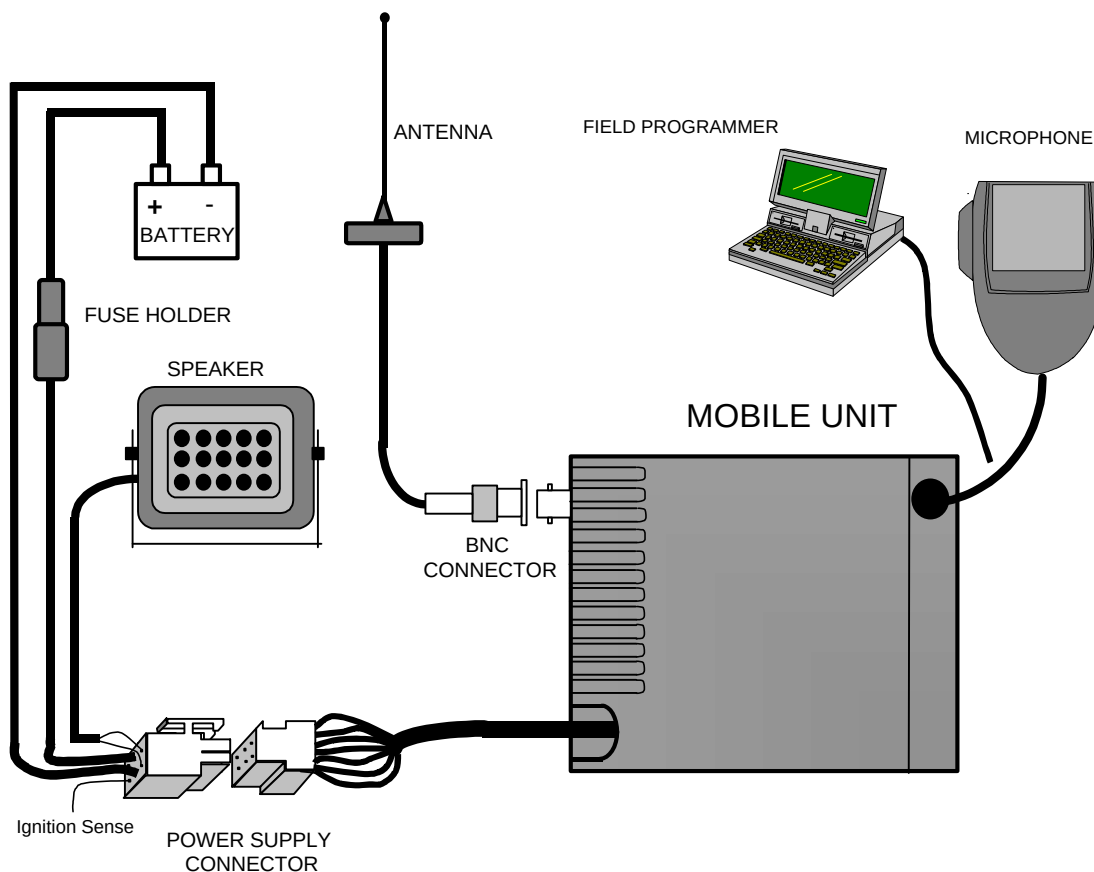


Figure 4-2 Mobile Connections

4.4 Power Cable Installation

Where possible disconnect the vehicles main positive DC supply cable from the battery to prevent damage from accidental short circuits during the installation.

In some cases this may cause problems with the loss of engine management information or radio key codes. Check with the customer to see if this is the case before disconnecting the battery. Power saver devices are available which plug into the cigar lighter or accessories socket and prevent loss of memory information on vehicle systems.

Route the power cable to the battery. If there is excess cable, cut it to the required length. If it is necessary to drill a hole in the firewall or bulkhead to route the cable through then fit a grommet and seal it when the installation is complete.

Fit the in-line fuse holder in the positive (Red) lead. The fuse protects against short circuits in the cable run, and so should be located near the battery.

Connect the black cable to the negative battery terminal connector and the red cable to the positive battery terminal connector.

Note: Both leads of the power cable should be connected directly to the vehicle battery terminals. Connection to other points may result in increased interference from the vehicle's electrical system and excessive voltage drop. If noise is still a problem, an DC noise filter should be fitted.

In some cases a master isolation switch is fitted to the vehicle (e.g. in the case of emergency vehicles) and it may be a legal requirement to wire to the switched side of the supply.

If required connect the ignition sense lead to the ignition switched supply on the vehicle.

Plug the power cable into the power supply in-line connector on the mobile radio, and reconnect the positive lead to the battery.

4.5 Antenna Connection

Install the antenna according to the manufacturer's instructions.

4.5.1 Location

For best all round performance of the mobile radio, the antenna should be mounted in the center of the roof. Alternative positions give degraded performance, the numbers on the diagram below giving the order of preference.

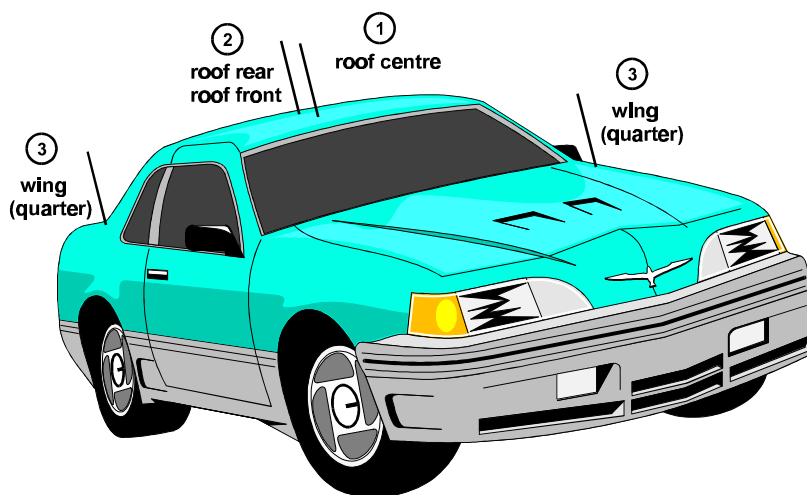
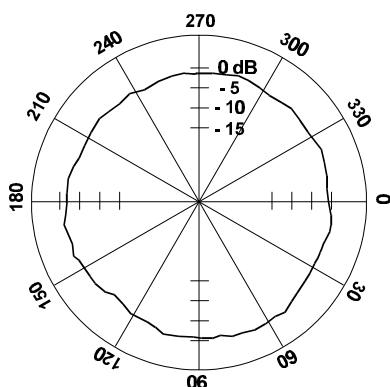
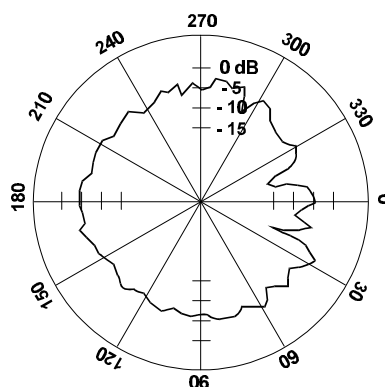


Figure 4-3 Antenna Locations

ANTENNA RADIATION PATTERNS



Centre roof monting



Quarter (wing) mounting

Figure 4-4 Antenna Radiation Patterns

Warning: Under no circumstances should the antenna be located near to a fuel filler cap (i.e. not closer than 300mm).

In practice the siting of the antenna is a compromise between performance and practicality. If a sunroof is fitted to the vehicle then site the antenna so that it will not be damaged when the sunroof is opened. Mounting at the front of a sunroof can cause annoyance due to wind noise from the antenna when the sunroof is opened.

Abrade the underside of the antenna hole with coarse emery cloth to remove paint and produce a clean, bright bare metal surface. This will provide a good contact for the antenna ground. Smear the surface lightly with silicone grease prior to tightening the antenna mount to prevent corrosion.

4.5.2 Fitting Antenna to Fiberglass Vehicles

A separate ground plane must be installed for fiberglass vehicles. This can take the form of a aluminum metal plate or close mesh. The ground plane must extend to at least a quarter of a wavelength in every direction. Alternatively two 'crossed' aluminum strips can be used. Again the distance from the antenna mounting point to the end of each strip must be at least a quarter of a wavelength.

It will normally be necessary to use an antenna with a longer shank for fiberglass vehicles due to the greater thickness of the material.

4.5.3 Antenna Feeder

Note: In the case of crimp connectors, use only the correct crimping tool.

Use a suitable, low-loss 50 Ω co-axial cable to provide a continuous run between the antenna and the mobile radio equipment. Excess coaxial cable should not be coiled up as this may cause interference and effect vehicle systems. Fit the correct antenna connector at the mobile radio end of the feeder using either crimp or soldered connections as appropriate.

4.5.4 Antenna DC Check

- ◆ Check for low resistance ($<0.1 \Omega$) between the center pin of the coaxial connector and the antenna radiator
- ◆ Check for high resistance between the center pin of the coaxial connector and the vehicle chassis
- ◆ Check for low resistance between the body of the connector and the vehicle chassis

Note: Some antennas are DC earthed. If this is the case consult the manufacturer's installation instructions.

4.6 Loudspeaker Connection

The loudspeaker is connected to the mobile radio via PL1 (the power supply and speaker connector shown in Figure 4-2), pins 3 and 7.

4.7 Serviceability Check - General Operation

Once the mobile radio, its accessories and antenna are installed, carry out a serviceability check as follows:

1. Place the directional power or VSWR meter in series with the antenna feed. A Peak Envelope Power meter should be used.
2. Start the vehicle and allow to idle for 1 minute to ensure that the battery voltage is at the correct level for testing.
3. Switch on the mobile radio using the on/off selector/switch, or switch on ignition if ignition sensing is utilized, and check that the LED's and display function and that the startup warble is heard.
4. Select a suitable channel that can be used for test purposes and press the PTT to cause the mobile to transmit. Measure the PEP and VSWR.
5. PEP should be between 7 and 30 Watts, dependent on modulation, and VSWR less than 1.5:1.
6. Carry out a functional check by setting up a voice call. Check that the received noise is acceptable. If not it will be necessary to carry out suppression of the vehicle electrical system
7. It is important to check that the mobile radio does not affect the operation of any vehicle systems such as lights, electronic ignition, engine management system and anti-lock brakes. Other electronic devices fitted to the vehicle, such as radio/cassette player or cellular telephone, should also be checked. Check that these systems still operate correctly when the mobile radio is transmitting.
8. If the mobile radio does not function correctly refer to the fault-finding section in this chapter or fit another unit.
9. A vehicle installation report should be completed. An example is provided at the end of this manual.

4.8 Troubleshooting Flow Chart - General Operation

If the mobile radio does not pass the serviceability check, the installation troubleshooting flow chart (see Figure 4-5)

For reference:

SPU : Signal Processing Unit (PCB)

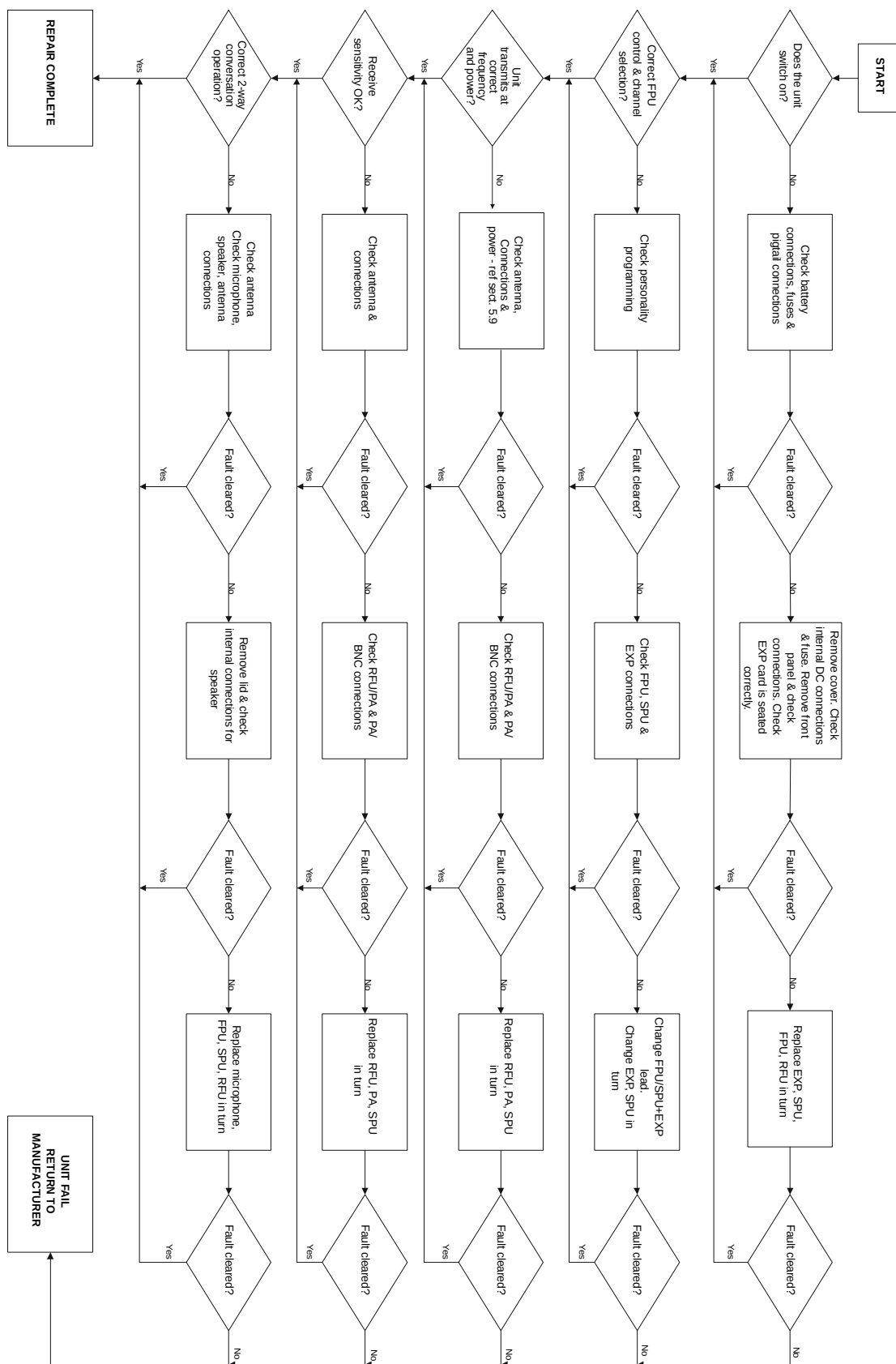
EXP : Expander card (PCB)

RFU : Radio Frequency Unit (PCB)

FPU : Front Panel Unit (PCB)

PA : Power Amplifier (PCB)

Figure 4-5 - T6M Series General Troubleshooting Flow Chart



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5.1 Operation

5.1.1 Switching on / off - manual

To switch on, press the PWR button until the display shows “On”, about 1 second, then release the button. The mobile makes a warble sound, then a few seconds later the display shows the initial operating frequency. If the mobile displays “c Err” (critical error) at start-up, then it has probably no personality programmed into it. See sections 5.8 for instructions on programming.

To switch off, press the PWR button until the display shows “Off”, then release the button.

5.1.2 Switching on / off - Ignition sense

If ignition sense is required then connect the ignition sense lead (Accessory Lead Pin 1 – L033ACC4000) to the vehicle ignition sense. If ignition sense is not required then leave the ignition sense unconnected.

When ignition sense is connected, the mobile switches on when the vehicles ignition is switched on. When the vehicle ignition is switched off, the mobile remains on for a period of two hours before switching itself off. The mobile may be switched off manually during that period by using the PWR button, described above.

5.2 Modes of operation

The mobile has three main modes of operation:

- Normal mode
- Priority mode
- Scan mode

5.2.1 Normal mode

- Channels are selected using the CH ↑ and CH ↓ buttons. These buttons step through the programmed channels one at a time.
- The SEL ↑ and SEL ↓ buttons may also be used for channel selection. These buttons step 10 channels at a time.
- Both the CH and SEL buttons auto-repeat when held down.

If the highest programmed frequency is reached when stepping up through the channels, the mobile wraps round to the lowest programmed frequency. If the lowest programmed

frequency is reached when stepping down through the channels, the mobile wraps round to the highest programmed frequency.

Channel frequencies are displayed in ICAO format, e.g.

Actual operating frequency	Channel bandwidth	Display
118.000 MHz	25kHz	118.000
118.000 MHz	8.33kHz	118.005
118.008 MHz	8.33kHz	118.010
118.017 MHz	8.33kHz	118.015
118.025 MHz	25kHz	118.025
118.025 MHz	8.33kHz	118.030
118.033 MHz	8.33kHz	118.035
118.042 MHz	8.33kHz	118.040

Whilst the mobile is receiving, the loudspeaker volume may be altered using the VOL **↑** and VOL **↓** keys. The volume keys only affect the volume level of the received audio; the volume of the confidence tones is unaffected.

Squelch may be enabled / disabled, or the squelch level altered using the SQL button.

To enable squelch, or to see the squelch level, press the SQL button. The display will show an “S” and the current squelch level. If you do nothing else, then the display returns to the current frequency after a few seconds.

To disable squelch, press SQL again whilst the squelch level is being displayed. The display will show “S OFF” for a few seconds before returning to the current frequency.

To alter the squelch threshold use the volume keys whilst the squelch level is being displayed. If you are hearing unwanted noise, press the VOL **↑** button to increase the squelch threshold. If you are not hearing a wanted signal then press VOL **↓** to lower the squelch threshold. After you have adjusted the threshold the mobile will automatically return to the normal frequency display after a few seconds.

The yellow LED (busy) lights to indicate that the receiver is unmuted by a received signal, i.e., a signal that exceeds the squelch threshold.

Display blanking may operate whilst the mobile is receiving in normal mode. When display blanking is active in normal receive mode, a flashing horizontal bar replaces the frequency display. If the display blanks then it may be reinstated by pressing either volume button, or by pressing the PTT button.

To transmit, press the PTT button and talk. Whilst you are transmitting the red Tx LED will light.

It may be that the mobile does not transmit when you press the PTT button. This may happen if there is a mobile fault or if transmitting is inhibited. In either case, the red Tx LED will not light. If the mobile is programmed to produce warning sounds then you will hear a warning sound. If there is a fault, a Fault Code is displayed whilst the PTT button is held down. Fault Codes are described in Section 5.7. Transmit inhibit options are described in sections 5.3 & 5.7.

A mobile may be programmed to transmit indefinitely, or to limit the duration of a transmission. If transmission time is limited then mobile produces warning beeps 10 seconds before the end of the transmission. When the allowed transmission time is reached the mobile stops transmitting, the red Tx LED goes out, and a warning sound is produced if warning sounds are enabled.

5.2.2 Priority mode

Priority mode gives you quick access to your most frequently used channels. Up to 15 channels may be programmed into the mobile's priority channel list. Select priority mode by pressing the PRI button.

Priority mode operates like normal mode with the following exceptions.

- Every few seconds the display shows "P" to remind you that you are in priority mode.
- Channels are selected using the SEL  and SEL  keys.
- Display blanking in priority mode causes the display to show a blinking "P" rather than a bar.

You may leave priority mode in one of three ways.

- Press PRI to return the previous mode (normal or scan).
- Press CH  or CH  to go to normal mode.
- Press SCN to go to scan mode.

5.2.3 Scan mode

In scan mode the mobile scans a range of predefined channels looking for a busy one. A busy channel is defined as a channel with a received signal strength greater than the squelch threshold. A mobile may be programmed with up to 15 scan groups, with up to 15 channels in each group.

When the mobile finds a busy channel you will be able to listen to that channel. What happens next depends on the way the mobile is programmed. It has two possible seek modes, "Hold" and "Pause".

If Hold mode is programmed then the mobile remains on the channel until you press the CH  button to resume scanning.

the number of the current scan group.

Scan mode is cancelled by:

- Pressing the SCN button to go to normal mode.
- Pressing the PRI button to go to priority mode.

If the mobile is holding or paused on a channel then pressing the PTT allows you to transmit, unless there is a transmit fault or transmission is inhibited. See sections 5.3 & 5.7 for more information on transmit inhibit and transmit faults.

Display blanking is not operative in scan mode.

Channels may be locked out of the current scan group by pressing the CH ↓ button whilst the mobile is paused or holding on the channel to be locked out. This lock out is temporary; all locked out channels are reinstated when scan mode is cancelled.

Squelch is automatically enabled when scan mode is selected.

Channels may be programmed into more than one scan group.

Scan and priority modes are mutually exclusive.

5.3 Programmable options

The following general options are programmable via the mobile unit's serial programming port. An external, PC based, programming software package and associated interconnection leads can be supplied to provide access to these features.

	Range	Default	Notes
Display blanking	On or off	Off	See description below.
Display blanking time	10 – 300 seconds	60	See description below.
Maximum transmit time	30 – 300 seconds, or unlimited	60	Use this option to limit the maximum continuous time transmit duration.
Hold on scan mode	On or off	On	Described in scan mode section.
Key beeps	On or off	On	See description below.
Warning beeps	On or off	On	See description below.
Warning beep volume	1 – 7	3	See description below.
Personality description	46 character alphanumeric string	An empty string	A free format text string that you may use to identify the mobile.
Use channel strings	Yes or no	Yes	Indicates if channel programming data is to include descriptive strings. Selecting this option reduces the maximum number of channels from 760 to 400.
Busy on time	0.1 – 5 seconds	0.5 seconds	Squelch must be open for this time before an inactive channel is considered busy.
Offset channels	On or off	Off	When on, the mobile scans for the strongest frequency within a 25kHz channel.

These options are programmable for each of the channels programmed into the mobile.

	Range	Default	Notes
Frequency	Any frequency supported by the mobile		Enter this in ICAO format, which defines both the frequency and the bandwidth.
Priority channel	Yes or No	No	Up to 15 channels may be defined as priority channels.
Scan group	1 – 15 or not assigned	Not assigned to a scan group.	Up to 15 channels may be assigned to each of the 15 scan groups. A channel may be in more than one group.
Transmit inhibited	No inhibit, always inhibit or inhibit if busy	No inhibit	This option can be used to prevent the mobile transmitting on a particular channel.
Identification string	16 character alphanumeric string	An empty string	A free format text string describing the channel.

5.4 Warning sounds.

Warning sounds may be enabled / disabled when the mobile is programmed.

The volume of key beeps and warning beeps is not affected by the volume controls. The volume of these sounds is set when the mobile is programmed.

When warning beeps are enabled, the following conditions cause error beeps when the user attempts to transmit

- A mobile fault is preventing transmission.
- Attempting to transmit on a channel with the “transmit inhibit” option set to always inhibit.
- Attempting to transmit on a busy channel with the “inhibit if busy” option selected.
- Imminent transmitter timeout.

5.5 Key beeps.

The mobile may produce a single beep whenever a button is pressed. This option is selected during programming. The volume is the same as warning sounds and is set when the mobile is programmed.

5.6 Display Blanking

Display blanking is an option that can be enabled when the mobile is programmed. The display blanking time is programmable.

When display blanking is enabled, the normal frequency display is replaced by a flashing bar, if the mobile is not used for the display blanking time.

A blanked display is reinstated by pressing any button, including the on / off button, or by pressing the microphone PTT button. It is recommended that the volume buttons be used as this reinstates the display without altering any settings.

Display blanking only operates when the mobile is receiving in normal mode or in priority mode.

5.7 Fault Codes

F1	Synthesiser failed.
F2	Unstable output.
F4	Over temperature. This may occur during long or repeated transmissions. The fault clears itself as the mobile cools down.
F8	Reflected power problems. May occur if no antenna is connected or if the antenna, antenna cable, or connectors are faulty.
F16	Low supply voltage. May be caused by low power supply voltage or high resistance connections.
F32	High voltage. Probably caused by a power supply fault.

5.8 Using the programmer

5.8.1 Installing the mobile programming software

The programming software works with Windows 95 and 98 **only**. A mouse, or other pointing device, is strongly recommended.

To install, run “Setup.exe” from the disk provided. This creates a program group and icons for the programmer. An uninstall option is created automatically.

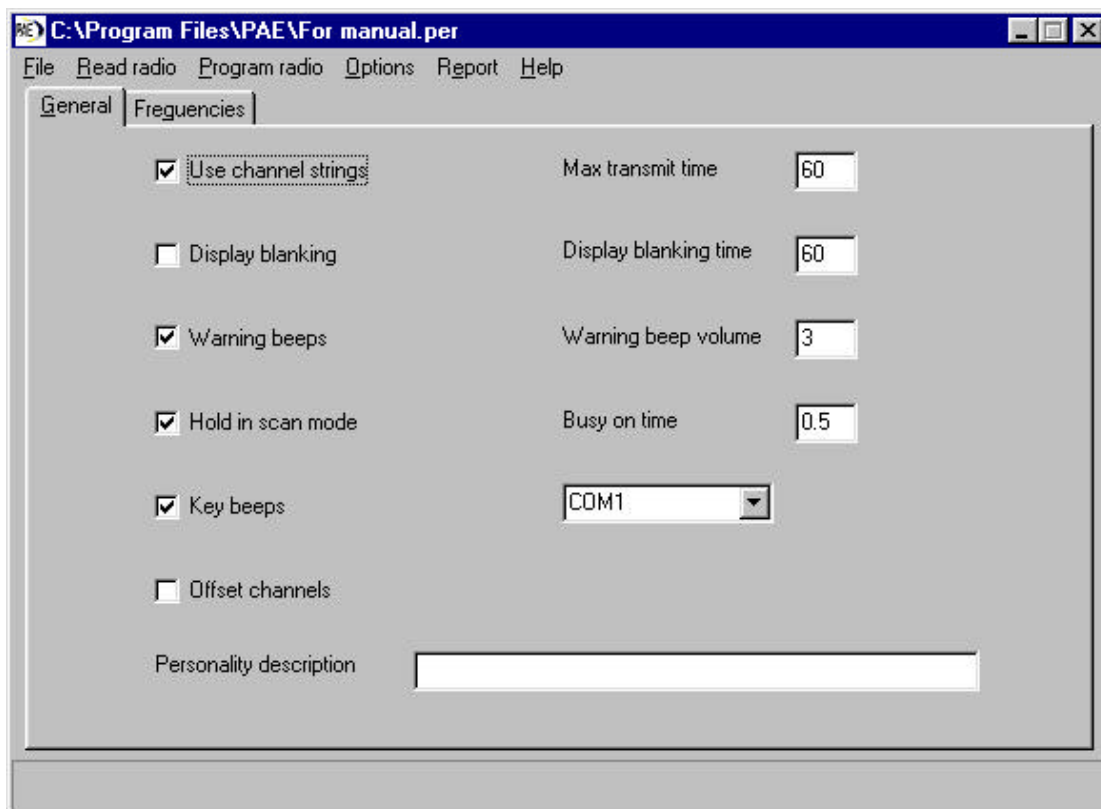
5.8.2 Operating hints

To help you use the programmer, hints are displayed on the status line at the bottom of the programmer’s window. This happens whenever you position your mouse pointer over a programmable option. For options that require you to enter numbers or text, the hints will tell you what the allowed options are.

The status line also shows the progress of programming operations.

5.8.3 Creating a new mobile personality

Select the **File | New** option from the menu. This resets all options to default values and clears all the entries in the frequency table except one. Select the “General” page.



Next, decide if you want to store a descriptive text for any of the frequencies you wish to use. If you do, make sure the **Use channel strings** option, on the **General** page is checked. If you do not need descriptive text, or you want to program more than 400 frequencies, then uncheck this option. With the option checked you may program up to 400 frequencies; when unchecked you may program up to 760 frequencies. You should always set the **Use channel strings** options before you start to enter frequencies onto the **Frequencies** page.

You may enter new values for the other options on the **General** page now, or after you have entered details of the frequencies you wish to use.

Your mobile has an optional power saving feature, **Display blanking**. This works by hiding the frequency display when you are not using the mobile. To enable this option, check **Display blanking**. You should also enter a **Display blanking time**. Any number between 10 and 300 seconds is allowed. If you do not use your mobile for this period of time then the display will blank. Note that the display is never blanked whilst your mobile is scanning.

You may program your mobile to produce warning sounds by checking the **Warning beeps** option. You will then hear warning sounds if a mobile fault occurs or if you attempt to transmit on an inhibited frequency. Transmit inhibit options are described in more detail later.

The **Hold in scan mode** option alters the way in which your mobile scans for busy frequencies. If **Hold in scan mode** is not checked then your mobile will pause on busy frequencies for six seconds, then start scanning again. If **Hold in scan mode** is checked then your mobile will stay on a busy frequency until the **CH ↑** button is pressed to restart scanning.

The **Busy on time** option also alters the way in which your mobile scans for busy frequencies. In scan mode, your mobile will pause or hold on a frequency only if it appears to be busy for at least the **Busy on time**. Set **Busy on time** to lower values for faster scanning. Set it to higher values to make scanning less sensitive to unwanted noise. You may find that your mobile tends to scan to noisy channels that are not really busy. If this problem cannot be cured by increasing the squelch threshold then increase the **Busy on time**.

Check the **Key beeps** option if you want your mobile to beep whenever a key is pressed.

Warning beep volume controls the volume of warning sounds and key beeps. It does not affect the volume of received signals. If warning sounds and key beeps are disabled then this option has no effect.

If you check the **Offset channels** option then your mobile will automatically lock to the strongest signal if it detects two or more transmitters operating on the same frequency.

Use the **Max transmit time** option to limit the maximum continuous transmit time. If you set this option to 0 then you may transmit indefinitely. If you set it to any other value then your mobile will stop transmitting after the specified time. If you limit transmit time and enable warning beeps then you will hear warning sounds 10 seconds before the mobile stops transmitting and again when transmitting stops.

You may want to store a short **Personality description** in the mobile. For example, if you save your mobile's personality as a file, then it might be useful to put the file name here.

On the **Frequencies** page, you will see a single default entry. If you want your mobile to be able to operate on the default frequency shown, then leave the frequency value as it is, otherwise alter it to a frequency that you do require.

Index	Frequency	Width	Priority	Scan group	Tx inhibit	Identity
	MMM.KKK	8/25kHz	Y or N	1 .. 15	A, B or N	Max 16 chars
1	118.000	25,000	No		Never	
2	121.500	25,000	Yes		Busy	Emergency
3	126.025	25,000	No		Always	ATIS

Enter frequencies in ICAO format, which specifies both the operating frequency and bandwidth. There is no need to enter a bandwidth as the programmer determines the bandwidth from the entered frequency.

If you want the frequency to be included in the list of priority frequencies then enter **Yes** in the **Priority** column. You need only press **Y** or **N**. Up to 15 frequencies may be marked as priority frequencies.

If you want the frequency to be a member of a scan group then enter the scan group number in the scan group column. If you want the frequency to be in more than one scan group then separate the scan group numbers with commas.

There are 15 scan groups, numbered 1 to 15. You may put up to 15 frequencies in each group.

The **Tx Inhibit** column determines when a mobile may transmit. If inhibit is set to **Never**, by entering **N** in this column, then transmit is always allowed. This allows you to transmit on this frequency even if it is busy.

If **Tx Inhibit** is set to **Always**, by entering **A**, then you will never be able to transmit on this frequency.

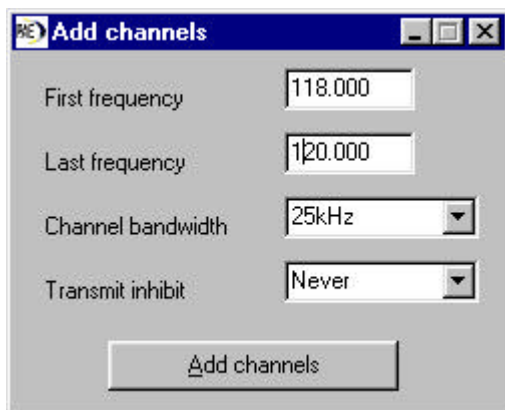
If **Tx Inhibit** is set to **Busy**, by entering **B**, then you will not be able to transmit on this frequency whilst it is busy, but you will be able to transmit when it is not.

If you have checked the channel string option then you may enter a short description of the frequency in the **Identity** column. This is optional.

To add another frequency to the list, use the **Add channel** button.

To remove a frequency from the list, first select the frequency to be removed, then use the **Delete channel** button.

To help you enter a large number of frequencies quickly you may use the **Fill table** button. This opens a new window that allows you to add a range of frequencies to the frequency table.



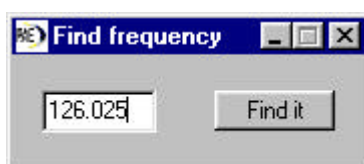
Enter the lowest required frequency in the **First frequency** box and the highest required frequency in the **Last frequency** box.

Use the **Channel bandwidth** selector to determine the bandwidth of the frequencies to be added. If **25kHz** is selected then all the frequencies between the first and last frequency will be added using 25kHz channel spacing. When **8.3kHz** is selected then only 8.3kHz frequencies will be added. The **Both** option allows all frequencies of both bandwidths to be added.

Use the **Transmit Inhibit** selector to specify the default Tx inhibit option for the new frequencies. Click the **Add channels** button to add the frequencies to the table.

You may edit the options for a frequency at any time.

If you have programmed a large number of frequencies then use the **Find channel** button to find quickly a frequency in the frequency table. Enter the frequency you are looking for, then click **Find it**.



When you have finished entering frequencies, click the **Verify and sort the table** button. This checks that everything you have entered is allowed, and sorts the frequencies into ascending order. You may omit this step as it is done automatically whenever you try to program a mobile, save a personality or generate a personality report file.

5.8.4 Saving a personality

To save a new personality select **File | Save as** from the menu. The programmer automatically verifies that everything you are trying to save is valid. If it is not then you will see an error message. If you see an error message, correct the error before selecting **File | Save as** again.

When the **Save as** window appears, enter a name for the personality, or select an existing name. The programmer requires that personality files have a **.per** extension, and will not allow you to save a personality with any other extension. When you have selected or entered a name, click **Save** to save the personality.

If the save is successful the file name appears at the top of the programmer window. If you now edit the personality you can save it under the same name by selecting the **File | Save** option.

5.8.5 Recovering a saved personality

Select **File | Open** from the main menu. Select one of the files displayed, then click **Open**.

5.8.6 Programming a personality into a mobile

Connect the programming lead to one of your PC's serial ports. You may use COM1 or COM2.

On the programmer's **General** page select the COM port that you want to use.

Unplug the microphone lead from the mobile. Connect the other end of the programming lead into the mobile's microphone socket, then switch on the mobile. The mobile shows that it is in programming mode by displaying **Pr**.

N.B. If the mobile does not contain valid firmware then the display may show odd symbols, rather than **Pr**. If this happens refer to the "Programming new firmware into a mobile" section.

Select **Program mobile | Personality** from the main menu.

The programmer automatically verifies that everything you are trying to program is valid. If it is not then you will see an error message. If you see an error message, correct the error before selecting **Program mobile | Personality** again.

The progress of the programming operation is displayed on the status line at the bottom of the programmer window. When programming is complete, switch off the mobile and disconnect the programming lead.

5.8.7 Reading the personality from a mobile

First connect the programming lead to one of your PC's serial ports. You may use COM1 or COM2.

On the programmer's **General** page select the COM port that you want to use.

Connect the other end of the programming lead into the mobile's microphone socket, then switch on the mobile. The mobile shows that it is in programming mode by displaying **Pr**.

Select **Read mobile | Personality** from the main menu.

The progress of the read operation is displayed on the status line at the bottom of the programmer window.

If the read is successful then the mobile's personality is displayed.

5.8.8 Printing a personality report

Select **Report | Generate** from the main menu. The programmer automatically verifies that the current personality is valid. If it is not then you will see an error message. If you see an error message, correct the error before selecting **Report | Generate** again.

A textual representation of the personality will be displayed using Windows' Notepad program. You may use Notepad to print, or to save the personality report as a text file. Before printing you might like to alter the displayed information, perhaps adding information about the mobile or the date of the report.

When you close Notepad after generating a new report you will be asked if you wish to keep the report. Select **Yes** to keep the report as a file or **No** to discard it.

You can open existing report files by selecting the **Report | Open** menu option.

5.8.9 Getting a mobile's serial number and firmware version

First connect the programming lead to one of your PC's serial ports. You may use COM1 or COM2.

On the programmer's **General** page select the COM port that you want to use.

Connect the other end of the programming lead into the mobile's microphone socket, then switch on the mobile. The mobile shows that it is in programming mode by displaying **Pr**.

Select **Read mobile | ESN** from the main menu. After a few seconds a pop-up window displays the mobile's ESN.

"ESN" is short for Electronic Serial Number. The first part of the number describes the mobile's type and firmware version. The second part is a serial number unique to your mobile.

5.8.10 Programming new firmware into a mobile

WARNING!

Use this option with care as programming a mobile with incorrect firmware may leave it in an unusable or unusable state.

First connect the programming lead to one of your PC's serial ports. You may use COM1 or COM2.

On the programmer's **General** page select the COM port that you want to use.

Connect the other end of the programming lead into the mobile's microphone socket, then switch on the mobile. The mobile shows that it is in programming mode by displaying **Pr**.

N.B. If the mobile does not already contain valid firmware then the display may show odd symbols, rather than **Pr**. This will not prevent you from programming new firmware; just continue as if **Pr** was displayed.

Select **Program mobile | Firmware** from the main menu.

A file "Open" window appears. Firmware files are in Intel hex format, and will have a **.i00** extension. Select the required file then click **Open**.

The progress of the programming operation is displayed on the status line at the bottom of the programmer window. When programming is complete, switch off the mobile and disconnect the programming lead.

5.9 Test Mode

Test mode is used to adjust the mobile's transmitted power output. The range of adjustment is typically from six to twelve watts, although this may vary from mobile to mobile.

To enter test mode switch on the mobile by pressing the power button. Without releasing the power key, press first the SQL button, then the SCN button, and finally the PRI. Then release the power button. The mobile displays "tEst" to indicate that it is in test mode. After a few seconds the display changes to show the current power level setting.

In test mode the mobile may operate on one of three predefined frequencies, i.e. 118MHz, 127.5Mhz or 136.975MHz. Use the SQL button to select one of these frequencies for operation at 25kHz bandwidth. Use the PRI button to select one of these frequencies for operation at 8.33kHz bandwidth. The select frequency is displayed in ICAO format. It is recommended that the output power is adjusted at 127.5Mhz, selected with the SQL button.

Transmit and receive operation in test mode is similar to normal operation, except that squelch is always off in test mode. The volume keys may be used to adjust the volume of received signals. The SCN key has no purpose in test mode.

Adjust the transmitted power level with the CH and SEL keys. The CH keys alter the setting one step at a time, whilst the SEL keys change it in steps of ten. The range of adjustment is from 1 to 240 inclusive.

Alter the power level setting whilst the mobile is receiving, then press the microphone PTT button to observe the result. The mobile should be adjusted to achieve 8 watts

transmitting.

The transmit LED lights whilst the mobile is transmitting. If there is a transmitter problem then the mobile stops transmitting and the red LED is extinguished. Note that transmit fault codes are not displayed in test mode.

To switch off without saving the new setting, press and release the power key. The display then shows "nS" and the speaker sounds a single, long tone.

To save the new setting, press and hold the power button. With the power button depressed, press PRI, then SCN, then SQL. When the new setting is saved, the display shows "S" and the speaker sounds two short pips. If the key sequence is incorrect then the display shows "nS" and the speaker sounds a single, longer tone to indicate that the new setting has not been saved.

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6.1 Introduction

The following sections detail basic field testing requirements of the mobile to confirm correct RF operation. These tests should be performed on a low, a middle and a high channel to ensure that the RF performance is consistent across the mobile's entire range. Whilst these tests do serve to indicate the nominal RF performance, there are relatively few adjustments available to field personnel, so mobile's failing to meet these basic tests should be returned to the supplier for correct repair or retuning.

6.2 Test Equipment

The tests require the following equipment:

- ◆ Bench Power Supply
- ◆ Digital Multimeter
- ◆ RF Power Meter
- ◆ Oscilloscope
- ◆ RF Signal Generator

Ensure that the range measurement capabilities of each item is appropriate for the mobile under test. Suitable alternatives, such as a comprehensive RF test set, may be substituted where available.

6.3 Power Supply

For this test and all others, ensure that the mobile is connected to a nominal 13.2V DC supply.

1. With the mobile configured to operate normally, check that the mobile draws <100mA when it is switched off.
2. Turn the mobile on and check that the mobile draws <2A when in normal standby mode (receive mode, muted).

6.4 Transmitter

1. Place the mobile into test mode (for details of test mode operation, please refer to Section 5.9).
2. Key up the mobile and, with no modulation applied, check the following:
 - I. Current draw is <6.2A
 - II. Transmit power is >7W and <10W
 - III. Transmitter frequency is within 1.0ppm

3. Apply an audio signal tone of 1 KHz at 35mV peak to pin 3 of the mobile's mic connector (ground on pin 5) and key up the transmitter. Check the following:
 - IV. Current draw is <6.2A
 - V. Transmit power is >7W and <10 W average
 - VI. Carrier modulated to >85%
4. Increase the 1KHz tone level by 20dB. Check that:
 - VII. Carrier is now modulated to <95%

6.5 Receiver

1. Take the mobile out of test mode and apply an RF signal to the mobile on an appropriate frequency, modulate it with a 1 KHz tone to 30% and set the Mobile's squelch threshold to 2. Adjust the RF level so that the squelch is muted.
2. Increase the RF level until the squelch just unmutes and check that the SINAD figure is >12dB.
3. Increase the mobile's volume to produce an audio output level of 4W. Check that the distortion figure is <5% for 30% modulation and is <10% for 90% modulation.
4. Check that the current drawn is 2A

6.6 TX Power Adjust

To adjust the TX Power, please refer to Section 5.9.