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# Park Air T6TR Mk6 50 W VHF Transceiver
# User Documentation

## Foreword

This user documentation provides the information required by a user to install, use and maintain the Park Air T6TR transceiver. The Maintenance procedures included in this documentation are limited to rectification by replacing faulty modules, fuses, cables, or fans.

User documentation is supplied on disk as Adobe Acrobat files. A hard copy may be printed from any file; the hard copy printout will include any interactive commands included in the file.

## Copyright and Trademarks




| | |
|---|---|
| Handbook Title: | Park Air T6TR Mk6 50 W VHF Transceiver<br>User Documentation |
| Handbook Part Number: | 31-300B6550 |
| Handbook Version: | 3.1 |
| Date of Issue: | February 2016 |
| Published By: | Northrop Grumman<br>Park Air Systems Ltd<br>Northfields<br>Market Deeping<br>Peterborough PE6 8UE<br>England |
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www.northropgrumman.com/international

# Configuration Page

This user documentation is applicable only to transceivers that is configured as per the information given on this page.

## Transceivers

Configuration for the transceivers applicable to this user documentation is listed in Table 1.

**Table 1 Transceiver Configuration**

| Model | Part Number | Mark | Modification State |
|---|---|---|---|
| Park Air T6TR Mk6 50 W standard frequency coverage transceiver | B6550/IP/NB/50 | 6 | 19 |
| Park Air T6TR Mk6 50 W extended frequency coverage transceiver | B6550/IP/WB/50 | 6 | 19 |

## Software Configuration

The transceiver software configuration applicable to this user documentation is listed in Table 2. The software part numbers, when viewed at the transceiver's front panel display (see page 3-33)

**Table 2 Software Configuration**

| Software | Software Part Number |
|---|---|
| Boot software | 65-00000643 |
| EBoot software | 65-00000642 |
| Mode software | As selected by user |
| Ethernet software | 65-00000640 |
| Fill 1 software AM-voice (default) | 65-00000649 |
| Fill 2 software VDL-2 (optional) | 65-00000697 |

# Modifications

Modifications to the transceiver are listed below.

| Modification State | Date | Detail | Applicable Park Air Change Notice |
|---|---|---|---|
| 17 | May 2010 | Add thermistor to power regulator | - |
| 18 | May 2010 | Mk6 release | - |
| 19 | November 2010 | Addition of insulator plate to prevent metal whiskers | 5002b |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# Health and Safety

## Park Air T6TR 50 Watt VHF Transceiver

The Park Air T6TR 50 W VHF transceiver operates from a low voltage dc input supply, or a standard mains ac input supply. When using a mains supply, dangerous voltage is present on the rear panel ac connector and within the equipment. For this reason, only suitably qualified personnel should install and maintain the equipment.

In use, the transmit antenna is connected to the transceiver. During installation, consideration must be given regarding the resultant field strength in areas accessible to personnel. The equation to determine the safe working distance is given in the Annex.

The output transistors used in the power amplifier (PA) of this transceiver contain the toxic material beryllium. Although no procedures in this documentation instruct component removal, users should be aware that there could be a hazard should the output transistors become damaged.

### Disposal

This product is covered by the European Directive 2002/96/EC.

It must not be disposed of in domestic waste.

Disposal should be made using designated collection facilities appointed by the government or the local authorities in your area.

## Warnings and Cautions

The following warnings and cautions are used in Northrop Grumman documentation.

### Warnings

A warning is used to indicate possible danger to personnel. Throughout Northrop Grumman user documentation, warnings are indicated by the following symbols:

| | |
|---|---|
| **WARNING**  | **Indicates electrical danger to personnel.** |
| **WARNING**  | **Indicates a hazardous material.** |
| **WARNING**  | **Indicates a non-ionizing radiation hazard.** |
| **WARNING**  | **Indicates a specified danger to personnel.** |

### Cautions

A caution is used to indicate possible danger to the equipment. Throughout Northrop Grumman user documentation, cautions are indicated by the following symbols:

| | |
|---|---|
| **Caution**  | **Indicates the presence of electrostatic sensitive devices (ESDs).** |
| **Caution**  | **Indicates a specified danger to the equipment.** |

# Customer Support

**Contacting Northrop Grumman**
Customer support is available using email or telephone. If you require help in configuring, installing or maintaining equipment, use any of the contact methods listed below.

**Email**

| | |
|---|---|
| Address: | support@parkairsystems.com |

**Telephone**

| | | |
|---|---|---|
| 24 hours: | Within the UK, | 01778 381557 |
| | International, | 44 1778 381557 |

**Mail**

| | |
|---|---|
| Address: | Customer Services Department<br>Northrop Grumman<br>Park Air Systems Ltd<br>Northfields<br>Market Deeping<br>Peterborough PE6 8UE<br>England |

**Web Site**

| | |
|---|---|
| Web address: | www.northropgrummaninternational.com/capabilities/aviation-customer-support |

# Fault Reporting

To ensure the highest level of after sales service, it is necessary to gather as much information as possible about equipment faults. If any equipment supplied by us becomes unserviceable, please complete a copy of the fault report shown on the next page, and return it to the Customer Services department.

## Fault Report

NORTHROP GRUMMAN

Customer: . . . . . .

Address: . . . . . .

. . . . . .

. . . . . .

Telephone: . . . . . .

Email: . . . . . .

Fax: . . . . . .

**Equipment Details**

Works order number: . . . . . .

Equipment model: . . . . . .

Equipment serial number: . . . . . .

**Service Details**

Commissioning date: . . . . . .

Failure/repair date: . . . . . .

Software version (if known): . . . . . .

Supply voltage: . . . . . .

Equipment environment: Office area / dedicated equipment room / heated / air-conditioned (delete as applicable)

**Fault Detail**

Symptoms of fault: . . . . . .

. . . . . .

. . . . . .

. . . . . .

Results of any tests: . . . . . .

. . . . . .

Any repairs carried out: . . . . . .

. . . . . .

Comments/action requested: . . . . . .

. . . . . .

. . . . . .

. . . . . .

# Approvals and Regulations

The following approvals and regulations apply to the T6TR Mk6 50 W VHF transceiver.

**Approvals**
The equipment is designed to meet the essential requirements of Directives 1999/5/EC, 2004/108/EC.

**Standards**
The following standards are applied:

- EMC EN 301 489-1; EN 301 489-22
- This Class B digital apparatus complies with Canadian ICES-003
- Health & Safety, EN60950, CAN/CSA-C22.2 No. 60950, UL 60950
- Radio EN 300 676-1, IC RSS141, FCC part 15 and 87
- Telecom CS-03.

**Interoperability of the European Air Traffic Management Network**
Northrop Grumman declares that the T6TR 50 watt VHF transceiver conforms to the essential requirements set out in Regulation (EC) No 552/2004 amended by Regulation (EU) No.1079/2012 for 8.33 kHz channel spacing on the interoperability of the European Air Traffic Management network.

**FCC Statement-USA only**
This device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the supplier or an experienced radio/TV technician for help.

Changes or modifications to this equipment, not expressly approved by Northrop Grumman could void your authority to operate this radio under FCC regulations.

**This equipment is only licensed for operation on 25 kHz channel spacing.**

**EC Declaration of Conformity**
The declaration of conformity is shown on the next page.

CE 0336

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DOC-124-005V2.0

# Declaration of Conformity

We, the undersigned,

| | |
|---|---|
| **Company** | *Park Air Systems Limited* |
| **Address, City** | *Northfields, Market Deeping, Peterborough PE6 8UE* |
| **Country** | *England* |
| **Phone number** | *+44 1778 345434* |
| **Fax number** | *+44 1778 342877* |

certify and declare under our sole responsibility that the following equipment:

| | |
|---|---|
| **Product description / Intended use** | 50W VHF Ground to air communications transceiver |
| **EU / EFTA member states intended for use** | **EU**: All countries<br>**EFTA**: Switzerland, Iceland, Lichtenstein, Norway |
| **Member states with restrictive use** | *None* |
| **Manufacturer** | *Park Air Systems Limited* |
| **Brand** | PAE |
| **Type** | T6TR |

is tested to and conforms with the essential requirements for protection of health and the safety of the user and any other person and Electromagnetic Compatibility, as included in following standards:

| Standard | Issue date |
|---|---|
| *EN60950-1:2006* | *2006* |
| *EN 60215* | *1989+A1+A2* |
| *EN301 489-1, EN301 489-22* | *06/2005, 11/2003* |

and is tested to and conforms with the essential radio test suites so that it effectively uses the frequency spectrum allocated to terrestrial/space radio communication and orbital resources so to as to avoid harmful interference, as included in following standards:

| Standard | Issue date |
|---|---|
| *EN 300 676* | *V1.3.1 03/2003* |
| *EN 301 841-1* | *V1.2.1 08/2003* |

and therefore complies with the essential requirements and provisions of the Directive 1999/5/EC of the European Parliament and of the council of March 9, 1999 on Radio equipment and Telecommunications Terminal Equipment and the mutual recognition of their conformity and with the provisions of Annex IV (Conformity Assessment procedure referred to in article 10).

The following Notified Body has been consulted in the Conformity Assessment procedure:

| **Notified Body number** | Name and address |
|---|---|
| 0336 | TNO Certification B.V., PO Box 15, 9822 ZG Niekerk, The Netherlands |

The technical documentation as required by the Conformity Assessment procedure is kept at the following address:

| | |
|---|---|
| **Company** | *Park Air Systems Limited* |
| **Address, City** | *Northfields, Market Deeping, Peterborough PE6 8UE* |
| **Country** | *England* |
| **Phone number** | *+44 1778 345434* |
| **Fax number** | *+44 1778 342877* |

CE 0336

| | |
|---|---|
| TCF/TF reference nr. | *TCF-124-005* |
| Drawn up in | *Northfields, Market Deeping, Peterborough PE6 8UE* |
| Date | *1 September 2010* |
| |  |
| Name and position | *R W Allis. Technical Director* |



Park Air Systems Ltd, Northfields, Market Deeping, Peterborough, PE6 8UE, England. Tel: +44 1778 345434 Fax: +44 1778 342877
www.parkairsystems.com Registered in England 1951792 A subsidiary of Northrop Grumman Corporation

# Glossary of Terms

The following terms are used in Northrop Grumman user documentation.

**Automatic Gain Control (AGC)**
AGC is a circuit function that compensates for a wide range of input RF signal levels to give a more uniform audio output.

**E and M Signalling**
Refers to PTT and the squelch indication signalling between a radio site and the control equipment. E represents 'Ear' (what is heard, or received) and M represents 'Mouth' (what is sent). Therefore:

- A PTT signal sent from the control equipment is referred to as the M signal; the same signal at the transmitter is referred to as the E signal
- A squelch indication at the receiver is referred to as the M signal; the same signal at the control equipment is referred to as the E signal.

**Squelch**
Squelch (also referred to as Mute in older receivers) is a circuit function that:

- Mutes a receiver's audio output during periods of no reception
- Mutes a receiver's audio output when signals weaker than the squelch threshold are received.

The adjustable squelch threshold's default setting is -107 dBm. The squelch function may be switched off (Squelch Defeated).

**Squelch (Noise Compensated)**
Noise compensated squelch is a circuit function that:

- Mutes a receiver's audio output during periods of no reception
- Mutes a receiver's audio output when signals weaker than the squelch threshold are received
- Mutes a receiver's audio output when signals stronger than the squelch threshold are received but are excessively noisy.

**Squelch (Carrier Override)**
The carrier override squelch facility is used in conjunction with the noise compensated squelch facility. If too many noisy signals are being lost due to noise compensation, carrier override can be switched on to reduce the squelch threshold by 10 dB. The default threshold of -107 dBm effectively becomes -97 dBm with carrier override switched on. All signals stronger than -97 dBm, irrespective of the noise level, are then heard in the normal way.

**VCCS**
A Voice Control and Communications Switch (VCCS) is the control centre equipment that is used to operate the radios.

**VOGAD**
Voice-Operated Gain Adjusting Device (VOGAD) is an automatic gain control that is normally applied to microphone circuits to prevent a transmitter over modulating. VOGAD is also applied to a transmitter's line inputs.

A VOGAD circuit has a very fast attack time, so that an initial loud voice signal does not cause a sudden burst of excessive modulation. In practice the attack time will be a few milliseconds. A much longer decay time is employed so that the gain does not get boosted too quickly during the normal pauses in natural speech. VOGAD circuits are adjusted so that, at low levels of input, the signal is not fully boosted, but instead follows a linear boost curve.

**Phantom Keying**
Phantom keying is when the keying potential is superimposed on the audio lines.

**Phantom Squelch**
Phantom squelch is when the squelch signal is superimposed on the audio lines.

# Abbreviations

The following list details standard abbreviations.

| | |
|---|---|
| A | ampere |
| ac | alternating current |
| AGC | automatic gain control |
| ALC | automatic level control |
| AM | amplitude modulation |
| ATC | air traffic control |
| BER | bit error rate |
| BIT | built-in test |
| bps | bits per second |
| C | celsius |
| CAS | channel associated signalling |
| CCE | control centre equipment |
| CD | compact disk |
| CSMA | carrier sense multiple access |
| dB | decibel |
| dc | direct current |
| DSB | double sideband |
| D8PSK | differentially encoded 8-phase shift keying |
| E1-RIC | E1-radio interconnect |
| ESD | electrostatic sensitive device |
| E-BIT | external bit signal |
| FCC | Federal Communications Commission |
| Fig | figure |
| FM | frequency modulation |
| FP | frequency preset |
| g | gramme |
| HPA | high power amplifier |
| Hz | hertz |
| IF | intermediate frequency |
| IP | internet protocol |
| k | kilo |
| kbits/s | kilobits per second |
| kg | kilogramme |
| kHz | kilohertz |
| LCD | liquid crystal display |
| LED | light emitting diode |
| LRU | line replaceable unit |
| M | mega |
| m | metre |
| mA | milliamp |
| MARC | multi-access remote control |
| Mbits/s | megabits per second |
| MHz | megahertz |
| mm | millimetre |
| ms | millisecond |
| MSK | minimum shift keying |
| mW | milliwatt |
| NB | narrow-band |
| N/A | not applicable |
| n/c | normally closed |
| n/o | normally open |
| PA | power amplifier |
| PC | personal computer |
| PCB | printed circuit board |
| pk-pk | peak-to-peak |
| PM | phase modulation |
| ppm | parts per million |
| PSU | power supply unit |
| PTT | press to transmit |
| RCMS | remote control and monitoring system |
| Ref | reference |
| RF | radio frequency |
| RF PA | radio frequency power amplifier |
| TDMA | time division multiple access |

## Abbreviations (continued)

| | |
|---|---|
| RSSI | radio signal strength indication |
| THD | total harmonic distortion |
| TS | time slot |
| UHF | ultra high frequency |
| V | volt |
| VA | volt-ampere |
| VCCS | voice control and communication switch |
| VFP | virtual front panel |
| VHF | very high frequency |
| VOGAD | voice-operated gain adjusting device |
| VoIP | voice over internet protocol |
| VSWR | voltage standing wave ratio |
| W | watt |
| WB | wideband |
| WP | waveform profile |

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## Contents (continued)

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# Introduction

## Purpose

The Park Air T6TR Mk6 50 W VHF multimode transceiver (Fig 1-1) is intended for use in fixed ground environments such as airports and en-route centres. The transceiver operates in voice and ICAO defined data modes at frequencies between 118 and 136.975 MHz for the standard model, and between 112 and 155.975 MHz for the extended frequency model.

Dependent on the software loaded into the radio, the following operating modes can be selected:

- AM-voice (standard software fill)
  This software provides voice via 4-wire E & M, E1 or VoIP. It provides SNMP via Ethernet, and MARC via RS232, RS422, E1 and Ethernet. Note that the optional VoIP Configurator Application (VCA) software is required to input set-up parameters for VoIP operation
- VDL Mode 2 (optional).

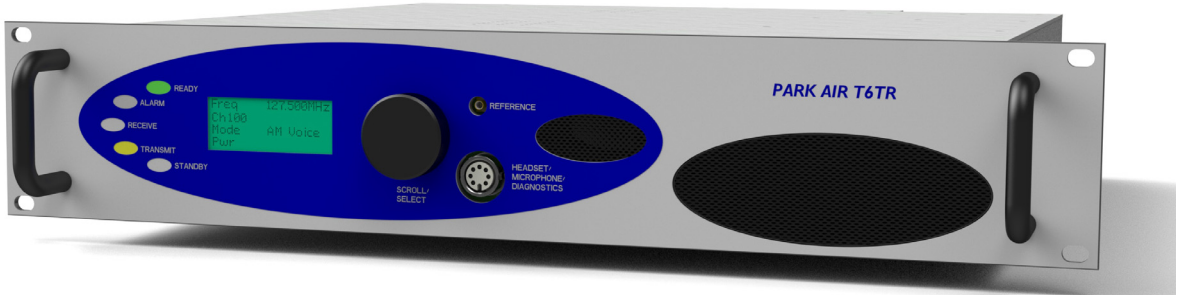


**Fig 1-1 T6TR 50 W VHF Multimode Transceiver**

## Models and Part Numbers

The following table identifies the T6TR Mk6 50 W VHF transceivers:

| Description | Part Number | Frequency Range | Channel Spacing (AM-Voice) | Special Applications (see Note) |
|---|---|---|---|---|
| T6TR Mk6 50 W standard frequency coverage transceiver | B6550/IP/NB/50 | 118 to 136.975 MHz | 25 kHz or 8.33 kHz | Both models support 2, 3, 4 and 5-offset carrier operation when using 25 kHz spaced channels.<br><br>Both models support 2-offset carrier operation when using 8.33 kHz spaced channels. |
| T6TR Mk6 50 W extended frequency coverage transceiver | B6550/IP/WB/50 | 112 to 155.975 MHz | 25 kHz or 8.33 kHz | |

Note:

Although both models are capable of selecting the offsets detailed above, care should be taken to use the radio in suitable operating environmental conditions; this is to ensure compliance with the stability requirements laid down by ICAO or ETSI.

## Options

The following options are available to purchase:

- VDL mode 2 waveform, Park Air part number T6M2 (see page 3-24)
- Offset carrier dynamic filter software, Park Air part number T6OCDF (see page 3-11).

## What's in the Box

The following items are supplied with each transceiver:

- A CD containing the radio's user documentation in interactive Adobe Acrobat™ format is supplied in the box.

## Accessories

A virtual front panel maintenance application and a VoIP configurator application are available to purchase and are detailed below.

Suitable microphones are listed in Table 1-1.

### Virtual Front Panel Maintenance Application

Part number 70-T6000VFP

The optional Virtual Front Panel (VFP) maintenance application software supplied on CD is compatible with any PC or laptop running Windows XP™, Windows Vista™ or Windows 7™. The VFP allows changes to a radio's settings and channel information, it displays the current BIT state, displays BIT history, allows security locks to be set, and provides maintenance facilities. Using the VFP has several advantages over setting a radio from the front panel; these are:

- A profile of the operational settings and channel information can be created, stored on disk, and then recalled to download into other radios
- A printout of the radio's profile can be made from the VFP
- The front panel controls can be locked. Front Panel Lock is available only when using the VFP.

The software is supplied with a 9-pin D-type to DIN interconnecting lead (part number 17E126000001) for RS232 connection to the radio's front panel.

### VoIP Configurator Application (VCA)

Part number 70-T6VCA

The optional VoIP Configurator Application (VCA) software supplied on CD is compatible with any PC or laptop running Windows XP™, Windows Vista™ or Windows 7™. The user interface for this application is similar to the VFP. It allows the user to retrieve, save and load VoIP settings. Once these attributes and values are visible it is possible to edit parameters and update the radio. The VCA is compliant with EUROCAE ED137/1A. The user documentation on the CD provides instructions for its use.

### T6 Series Connector Kit

Part number 70-T6VUCUST

The optional T6 series connector kit contains ac and dc power connectors, RF connectors and Facilities connector.

**Table 1-1 Microphones**

| Description | Part Number |
|---|---|
| Engineer's hand microphone for maintenance and general purpose use | 24-11030301 |
| T6 Desk microphone.Tubular aluminium bodied dynamic microphone with PTT switch. Can be hand-held or clipped to robust stand for desktop use. | 24-11201011 |
| Telephone handset with integral PTT switch | 24-13000501 |
| T6 Headset/Boom microphone. Robust dual earpiece medium weight headset with foam-filled cushions and pneumatically padded headband. Dynamic noise-cancelling boom microphone with ball-joint for continuous adjustment | 24-12000PH2 |

## Connecting to Control Equipment

The transceiver may be connected to suitable control equipment using a variety of analogue and digital methods. These include:

- 4-wire audio and signalling using analogue lines
- An E1 digital link
- Ethernet links.

## Mechanical Installation

The transceiver fits into an industrial standard 19 inch (483 mm) equipment cabinet and occupies 2U of space. Additionally, a transceiver can be mounted free-standing; for this purpose a desk mount kit is available as an accessory.

## Frequency Selection

The transceiver is a single frequency synthesised radio that can operate with 25 kHz and 8.33 kHz channel spacing. The radio recognizes frequencies entered in ICAO format and automatically adjusts to the correct channel spacing. For multichannel operation up to 100 preset frequency channels can be stored in the radio for immediate recall; any combination of 8.33 kHz and 25 kHz channel spacing can be stored. Valid operating frequencies can be selected from the radio's front panel or a compatible remote control equipment.

## Operating Parameters

The transceiver's operating parameters are set using the front panel multi-purpose Scroll/Select switch, remotely from suitable control equipment or by using the optional Park Air Virtual Front Panel (VFP) software in conjunction with a PC or laptop.

When implementing VoIP on T6 radios the optional VoIP Configurator Application (VCA) software is used in conjunction with a PC or laptop to configure settings and parameters required for VoIP operation.

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# Specification

# General Specification

The general specification applies to a transceiver irrespective of the selected operating mode. All radios operate in AM-voice mode. Additional software must be loaded to allow VDL Mode 2.

## Models

The Park AirT6TR Mk6 50 W VHF multimode transceiver is available in two models as listed in Table 2-1.

**Table 2-1 Transceiver Models**

| Description | Part Number | Frequency Range | Channel Spacing (AM-Voice) | Special Applications (see Note) |
|---|---|---|---|---|
| Park Air T6TR Mk6 50 W standard frequency coverage transceiver | B6550/IP/NB/50 | 118 to 136.975 MHz | 25 kHz or 8.33 kHz | Both models support 2, 3, 4 and 5-offset carrier operation when using 25 kHz spaced channels.<br><br>Both models support 2-offset carrier operation when using 8.33 kHz spaced channels. |
| Park Air T6TR Mk6 50 W extended frequency coverage transceiver | B6550/IP/WB/50 | 112 to 155.975 MHz | 25 kHz or 8.33 kHz | |

Note:

Although both models are capable of selecting the offsets detailed above, care should be taken to use the radio in suitable operating environmental conditions; this is to ensure compliance with the stability requirements laid down by ICAO or ETSI.

## Number of Channels

The transceiver can store a single frequency or up to 100 frequencies in its channel memory without the need for additional hardware.

## Frequency Accuracy

Better than 1 ppm.

## Power Requirements

The transceiver operates from an ac mains supply, or a dc input supply. When both supplies are connected, the dc input acts as an automatic backup for the ac mains.

ac input supply — The transceiver operates from a 47 to 63 Hz single phase ac supply and automatically adjusts to operate from any supply voltage ranging from 99 Vac to 264 Vac. The power consumption figures are given in Table 2-2.

dc input supply — The transceiver operates from a dc input supply between 21.6 and 32 V (measured at the radio's input). Current loading is given in Table 2-2.

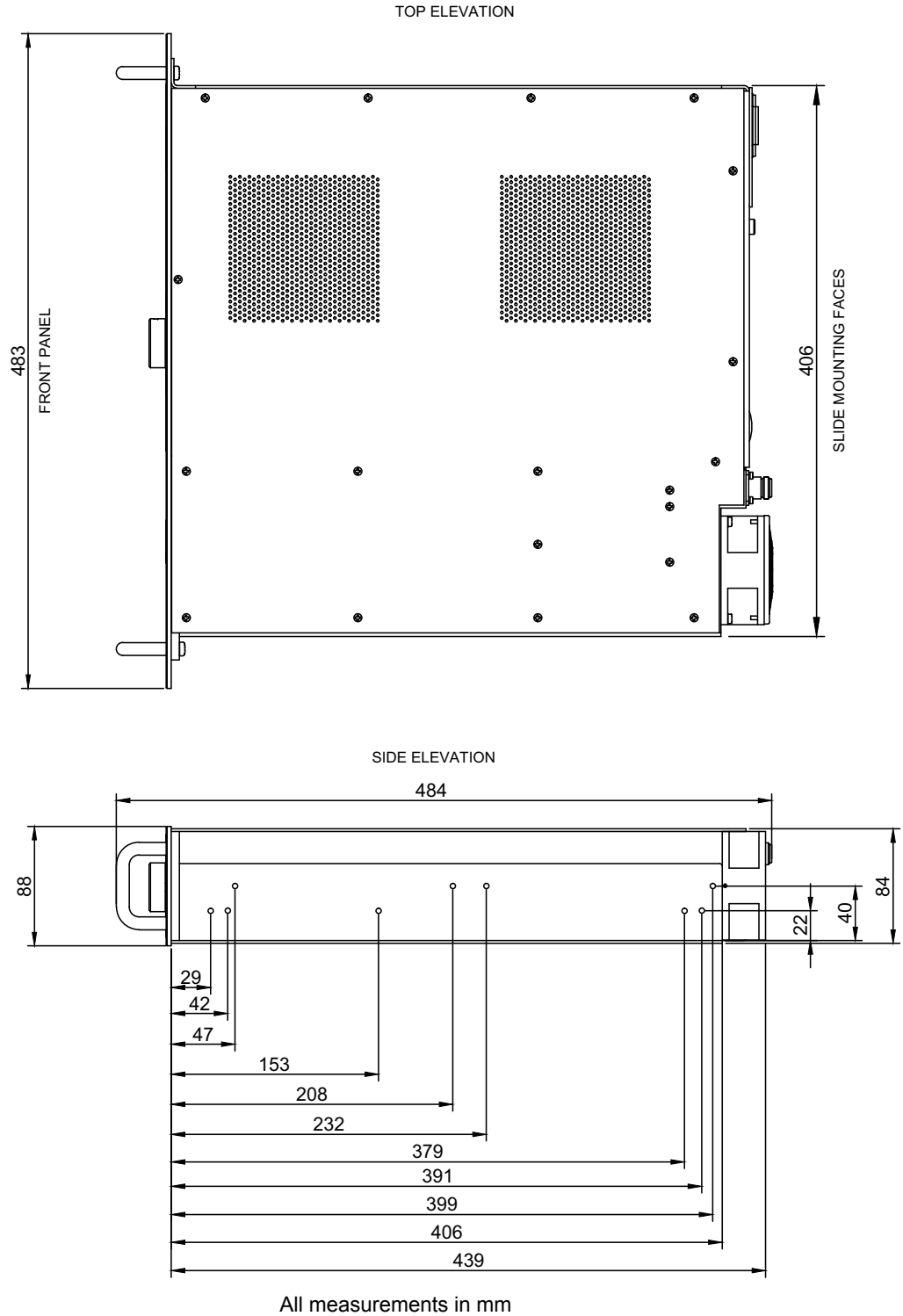
**Table 2-2 Power Consumption**

| Switched On | | Standby | | Switched Off | | Switch On Inrush |
|---|---|---|---|---|---|---|
| ac | dc | ac | dc | ac | dc | |
| Transmitting typically 300 VA<br><br>Transmitting 500 VA Maximum<br><br>Not transmitting typically 70 VA | Transmitting typically 8.5 A<br><br>Transmitting 12 A Maximum<br><br>Not transmitting typically 1.2 A | Typically 60 VA | Typically 700 mA | Typically 30 VA | Typically 30 mA | 85 A Maximum |

## Dimensions and Weight

The dimensions of the transceiver are detailed in Fig 2-1:

The transceiver weight is13.5 kg (29.76 pounds).




All measurements in mm

**Fig 2-1 T6TR Transceiver Dimensions**

## Environmental

| | |
|---|---|
| Temperature range | The transceiver operates to specification across the temperature range of -20 to +55°C.<br><br>The transceiver can be stored at temperatures ranging from -30 to +70°C without causing any damage. |
| Humidity | The transceiver operates to specification at a relative humidity between 5% and 90% non-condensing. |
| Altitude | The transceiver operates to specification up to 15,000 feet. Additionally the equipment is capable of storage at altitudes up to 50,000 feet without damage. |
| Shock and vibration | The transceiver complies with shock and vibration protection MIL-STD-810E, method 516.4, procedure VI - Bench Handling. |
| Ventilation | The transceiver is cooled by an integral fan, which normally runs at half speed. At an RF PA temperature of 45°C this is increased to full speed and at 40°C it reduces to half speed again.<br><br>The transceiver also includes an additional temperature controlled fan contained in the power supply. |
| Warm up time | All variants are fully operational to specification within 20 seconds after switch on. |

# AM-Voice Mode

The transceiver can operate in AM-voice mode (standard) and VDL Mode 2 (optional). The following specifications apply to both modes unless stated otherwise.

Note that ETSI test methods specified in EN 300 676 are used where applicable.

## Transmit RF Characteristics

### Output Impedance
50 ohms.

### RF Power Output
The RF carrier output power is adjustable in 1 W steps from 5 W to 50 W. As an option, the maximum selectable power can be limited. Output power is automatically controlled under the following conditions:

| | |
|---|---|
| Frequency range | Variations in power remain within 0 to +1 dB over the operational frequency range. |
| Low supply voltage | Loop error can reduce power progressively by up to ±1 dB for supply voltage between 24 Vdc and 32 Vdc. |
| High VSWR | Loop error can reduce power progressively by up to 3 dB. Variations in power remain within ±1 dB into a VSWR of up to 2.5:1. At VSWRs greater than this the output power may be reduced by 10 dB ±1 dB. |
| High RF PA temperature | If the RF PA temperature sensor exceeds 80°C the output power is reduced by 3 dB ±1 dB. If the RF PA temperature sensor exceeds 90°C the transceiver is de-keyed and automatically re-keyed at 70°C. |
| Rise time | The power rise time from a keying contact to 90% of full power is less than 15 ms without tone keying or offset carrier selected, or, less than 85 ms with both selected. |

### Duty Cycle
100% continuous operation.

### Channel Spacing (AM-Voice only)
25 kHz or 8.33 kHz.

### Offset Carrier (AM-Voice only)
The transceiver can operate with an offset carrier as detailed in Table 2-1 and with a frequency accuracy better than 1 ppm.

### Harmonic Outputs
Second harmonic outputs are less than -36 dBm, third harmonic outputs are less than -46 dBm and fourth harmonic outputs and above, up to 4 GHz, are less than -56 dBm.

### Spurious Outputs
The spurious outputs are less than -46 dBm for modulation depths up to 90%, measured at greater than 500 kHz from carrier in the frequency range 9 kHz to 4 GHz. There are no coherent spurious outputs above the spectral mask at less than 500 kHz.

**Intermodulation**
Intermodulation products, caused by an interfering signal with the same power as the transceiver isolated by 30 dB, are at least -40 dBc at ≥±150 kHz and -50 dBc at ≥±500 kHz.

## Transmit Modulation Characteristics

AM-voice mode uses Double Sideband (DSB) Amplitude Modulation (AM) full carrier, emission designator 6K80A3EJN for 25 kHz channels and 5K00A3EJN for 8.33 kHz channels.

**Modulation Depth**
The transceiver modulation can be set to a maximum of 95%. This eliminates any interference in adjacent channels at 25 kHz or 8.33 kHz channel spacing.

**Hum and Noise**
The hum and noise is more than 45 dB below the signal level for line input levels <-13 dBm, and more than 50 dB below the signal level for line input levels ≥–13 dBm, for a carrier modulated by a 1 kHz signal with a modulation depth of 90%.

**Frequency Response**

| | |
|---|---|
| 25 kHz channel spacing | The variation in frequency response with reference to a 1 kHz signal is within +0.5 dB and -1.5 dB across the frequency range 300 to 3400 Hz. The response is also less than -20 dB at 100 Hz and below, and less than -30 dB at 4 kHz and above. |
| 8.33 kHz channel spacing (AM-voice only) | The variation in frequency response with reference to a 1 kHz signal is within +0.5 dB and -1.5 dB across the frequency range 350 Hz to 2500 Hz. The response is also less than -10 dB at 100 Hz and below, and less than -30 dB at 3200 Hz and above. |

**Distortion**

| | |
|---|---|
| 25 kHz channel spacing | The total harmonic distortion is less than 5% due to signals with a modulation depth of 90%, within the frequency range 300 Hz to 3400 Hz.<br><br>Under extreme conditions, for example low supply or high VSWR, the distortion is maintained at less than 10%. |
| 8.33 kHz channel spacing (AM-voice only) | The total harmonic distortion is less than 5% due to signals with a modulation depth of 90%, within the frequency range 350 Hz to 2500 Hz.<br><br>Under extreme conditions, for example low supply or high VSWR, the distortion is maintained at less than 10%. |

**Residual FM**
For a test signal of 1 kHz set at 80% modulation depth applied to the line input of the transceiver, the unwanted peak frequency modulation does not exceed ±500 Hz.

**VOGAD (AM-Voice only)**
The VOGAD has an operational range of 30 dB with the threshold level set at 10 dB below the average speech line level setting. Within the VOGAD range the modulation depth remains at the set level ±10%. It has an attack time of less than 20 ms and a decay time of greater than 2 seconds, both measured with a 10 dB step to 15 dB into VOGAD. The VOGAD can be disabled.

**Mute (AM-Voice only)**
The mute level is set at 15 dB below the average speech line level setting. The mute can be disabled.

## Transmit Control

**Audio Inputs**
Voice can be connected to the transceiver via the front panel microphone/diagnostics connector. Voice can also be connected via the 600 ohm balanced line inputs. Line level setting from -30 to +10 dBm.

**PTT**
The transceiver can be keyed with a suitable microphone connected at the front panel. The transceiver can also be keyed via a direct PTT input, via phantom keying superimposed on the audio lines and through PTT tone signalling over the audio lines. Keying at any audio port selects that port as the source of the audio. Keying priority is on a first-come-first-served basis.

**PTT Time Out**
The time out period is adjustable from 2 to 510 seconds in 2 second steps or it can be disabled.

**PCM Voice**
Digitised voice can be connected to the transceiver via the E1 or IP interfaces. Line levels for these digital interfaces are not adjustable; they are fixed at a sine wave level of 0 dBm0 for IP and 3 dBm0 for E1.

- **E1** - 64 kbit/sec digitised 8-bit A-law encoded PCM voice can be connected to the transceiver via the T1/E1 connector. Audio uses TS1 and keying is achieved using the four associated CAS bits on TS16. This keying method is independent of any analogue keying configuration settings.
- **VoIP** - 64 kbit/sec digitised 8-bit A-law encoded PCM voice can be connected to the transceiver via the IP connector using VoIP Ethernet protocols. The mechanisms for call establishment, keying and signalling are compliant with ED-137. The standard AM-voice software fill provides VoIP functionality, however, the optional VoIP Configurator Application (VCA) software is required to input and edit operational parameters.

## Receive RF Characteristics

**Input Impedance**
50 ohms.

**Sensitivity**

| | |
|---|---|
| 118 to 136.975 MHz | 12 dB SINAD for -107 dBm (1 µV) 30% modulated. |
| 112 to 117.975 MHz | 12 dB SINAD for -105 dBm (1.25 µV) 30% modulated. |
| 137 to 155.975 MHz | 12 dB SINAD for -105 dBm (1.25 µV) 30% modulated. |

Note: All references to SINAD include ITU-T recommendation P.53 weighting.

When operating the transceiver in combined T/R antenna configuration, the sensitivity figures are degraded by 1 dB.

The transceiver has a nominal 6 dB reduced sensitivity feature to improve co-location performance when maximum sensitivity cannot be realised because of strong unwanted signals. This is in the form of a 6 dB RF pre-attenuator.

**Channel Spacing**
25 kHz or 8.33 kHz.

**IF Selectivity**

| | |
|---|---|
| 25 kHz channel spacing | At ±11 kHz from the centre frequency, the signal is attenuated by less than 6 dB.<br><br>At ±25 kHz from the centre frequency, the signal is attenuated by more than 80 dB. |
| 8.33 kHz channel spacing (AM-voice only) | At ±3.5 kHz from the centre frequency, the signal is attenuated by less than 6 dB.<br><br>At ±8.33 kHz from the centre frequency, the signal is attenuated by more than 70 dB (60 dB using the ETSI test method).<br><br>At ±25 kHz from the centre frequency, the signal is attenuated by more than 80 dB. |

**Unwanted Signal Suppression**

| | |
|---|---|
| Intermod signal suppression | The intermodulation signal suppression is 80 dB or greater (reference 12 dB SINAD) for two unwanted signals spaced 100 kHz (unmodulated) and 200 kHz (30% modulation) from the channel frequency. |
| Blocking ratio | 95 dB or greater (reference 12 dB SINAD and degraded by 6 dB) in the presence of an unmodulated unwanted signal spaced at 200 kHz from the channel frequency.<br><br>105 dB or greater (reference 12 dB SINAD and degraded by 6 dB) in the presence of an unmodulated unwanted signal spaced at 3 MHz from the channel frequency. |
| Cross modulation rejection | 95 dB or greater (reference 30 dB SINAD and degraded by 10 dB) in the presence of a 30% modulated unwanted signal spaced at 200 kHz from the channel frequency.<br><br>105 dB or greater (reference 30 dB SINAD and degraded by 10 dB) in the presence of a 30% modulated unwanted signal spaced at 3 MHz from the channel frequency. |

| | |
|---|---|
| Spurious signal suppression | The spurious signal suppression (reference 12 dB SINAD) is 80 dB, or greater (typically >100 dB) for a 30% modulated unwanted signal. This applies to unwanted signals up to 2 GHz and spaced by more than two channels from the tune frequency.<br><br>Above 2 GHz, spurious signal suppression is 70 dB or greater (typically >100 dB). |
| 1st image rejection | 100 dB or greater. |
| Interfering signals | At least 6 dB SINAD is achieved for a wanted -87 dBm signal modulated with a 1 kHz tone 30% in the presence of two -5 dBm interfering signals. The two signals are both FM modulated, one with a 19 kHz tone 7.5 kHz deviation at 107.9 MHz and varied by ±4 kHz; the other with a 19.1 kHz tone 7.5 kHz deviation with its frequency chosen such that one of the 3rd order products is located on the chosen receive frequency. |

**Antenna Radiation**
Radiation at the antenna socket is less than -81 dBm, typically less than -100 dBm, within the frequency range 9 kHz to 4 GHz.

**Maximum RF Input**
The transceiver can withstand an RF input of +36 dBm for 20 seconds, and a continuous +27 dBm input, without causing damage.

## Receive Modulation Characteristics

**AM-Voice**

| | |
|---|---|
| Modulation | Double Sideband (DSB) amplitude modulation (AM) full carrier. |
| Emission designator | For 25 kHz channels: 6K80A3EJN.<br><br>For 8.33 kHz channels: 5K00A3EJN. |

**Frequency Response**

| | |
|---|---|
| 25 kHz channel spacing | The variation in frequency response with reference to a 1 kHz signal, is within +1 dB and -2 dB across the frequency range 300 to 3400 Hz.<br><br>The response is less than -20 dB for frequencies at or below 100 Hz, and less than -30 dB at 4 kHz and above. |
| 8.33 kHz channel spacing (AM-voice only) | The variation in frequency response with reference to a 1 kHz signal, is within +1 dB and -2 dB across the frequency range 350 to 2500 Hz.<br><br>The response is less than -10 dB for frequencies at or below 100 Hz, and less than -30 dB at 4 kHz and above. |

**Distortion**

| | |
|---|---|
| 25 kHz channel spacing | For RF input signals between -53 dBm and +10 dBm, the total harmonic distortion is less than 5% within the frequency range 300 Hz to 3.4 kHz when the modulation depth is between 30 and 90%. |
| 8.33 kHz channel spacing (AM-voice only) | For RF input signals between -53 dBm and +10 dBm, the total harmonic distortion is less than 5% within the frequency range 350 Hz to 2.5 kHz when the modulation depth is between 30 and 90%. |

**Wanted Signal Dynamic Range (RF AGC)**

For a 90% modulated on-channel signal, a change in signal level from -107 dBm to +10 dBm produces less than a 3 dB change in audio output. On-channel signals modulated at 90% up to a level of +17 dBm achieve at least 10 dB SINAD.

The RF AGC attack time is less than 40 ms and the decay time is less than 50 ms for a 40 dB step input.

**Audio AGC (AM-Voice only)**

The audio AGC compresses a 30% to 90% variation in input modulation depth to an audio output power change of 1 dB or less.

The audio output level is maintained at the equivalent of 90% modulation. Audio AGC can be disabled.

The audio AGC attack time is less than 20 ms; the decay time is greater than 1 s and less than 2 s for an input modulation depth change of 90% to 30%.

**Squelch**

The transceiver has a noise compensated carrier operated squelch. It has a carrier adjustment range of -114 to -60 dBm without the RF pre-attenuator selected (these levels are increased by the value of the RF pre-attenuator when it is selected) and provides greater than 60 dB of quieting.

- Attack time is <20 ms for a signal rising 10 dB above the squelch setting
- Release time is <20 ms for a signal falling 10 dB below the squelch setting
- Hysteresis is 2 to 4 dB.

The squelch has a noise compensation disable facility to provide carrier only operation.

The squelch has a carrier override enable facility, which is preset at 10 dB (±2 dB) above the current squelch setting.

The squelch can also be defeated.

The squelch is independent of the audio output control.

Squelch tone signalling can be enabled in AM-voice mode. Frequency and level are adjustable.

## Receive Control

### AM-Voice Audio Outputs

The transceiver's outputs are the remote 600 ohm balanced audio line, the headset output and the loudspeaker. Line level output is adjustable between -30 and +10 dBm (1 µW and 10 mW) 1 dB step size and a tolerance of ±2 dB.

An analogue Receiver Signal Strength Indication (RSSI) is available at the Facilities connector. This provides a 1 to 10 V output representing received signal strengths between -110 dBm and 10 dBm as detailed in Table 4-14 on page 4-27.

### PCM Voice

Digitised voice is available via the E1 or IP interfaces. Line levels for these digital interfaces are not adjustable; they are fixed at a sine wave level of 0 dBm0 for IP and -3 dBm0 for E1.

- **E1** - 64 kbit/sec digitised 8-bit A-law encoded PCM voice is available via the T1/E1 connector. Audio uses TS1 and squelch is signalled using the four associated CAS bits on TS16. The CAS bits are also used to give an indication of received signal quality. There are four signal quality levels based on the RSSI value and the signal-to-noise. The lower three have preset levels whereas the highest can be set by the user in conjunction with an associated transmitter. The VCCS can use this information to indicate the failure of a channel. These levels can also be used for voting at the VCCS.
- **VoIP** - 64 kbit/sec digitised 8-bit A-law encoded PCM voice is available via the IP connector using VoIP Ethernet protocols. The mechanisms for call establishment, keying and signalling are compliant with ED-137. The standard AM-voice software fill provides VoIP functionality, however, the optional VoIP Configurator Application (VCA) software is required to input and edit operational parameters.

# VDL Mode 2

VDL Mode 2 parameters are identical to AM-voice mode with the following exceptions.

## Transmit RF Characteristics

**RF Power Output**
The average RF power output (random data) is adjustable in 1 W steps from 5 W to 50 W.

**RF Power Rise Time**
The transceiver produces more than 90% of full power output within 2.5 symbol periods.

**RF Power Decay Time**
The output power decays by more than 20 dB within 2.5 symbol periods of the middle of the final symbol.

**Channel Spacing**
25 kHz channel spacing only.

**Harmonic Outputs**
Harmonic outputs are less than -36 dBm.

**Spurious Outputs**
The spurious outputs are less than -46 dBm, measured at greater than 1 MHz from carrier in the frequency range 9 kHz to 4 GHz.

## Transmit Modulation Characteristics

VDL Mode 2 uses Carrier Sense Multiple Access (CSMA) differentially encoded 8-phase shift keying (D8PSK), using a raised cosine filter with $\alpha$ =0.6 (nominal value), emission designator 14K0G1DE. Information is differentially encoded with 3 bits per symbol transmitted as changes in phase rather than absolute phase. The data stream is divided into groups of 3 consecutive data bits, least significant bit first. Zeros are padded to the end of transmissions if needed for the final channel symbol.

**Modulation Rate**
The symbol rate is 10,500 symbols/second (±0.005%), resulting in a nominal bit rate of 31,500 bits/s.

**RMS Phase Error**
The RMS phase error is less than 3°. The error vector magnitude is less than 6%.

## Receive RF Characteristics

**Sensitivity**
The transceiver has a sensitivity better than -100 dBm for $1x10^{-3}$ Bit Error Rate (BER) with Reed Solomon decoding off.

**Channel Spacing**
VDL Mode 2 channel spacing is 25 kHz.

## Receive Modulation Characteristics

VDL Mode 2 uses Carrier Sense Multiple Access (CSMA) differentially encoded 8-phase shift keying (D8PSK) using a raised cosine filter with $\alpha$ = 0.6 (nominal value), emission designator 14K0G1DE.

**Wanted Signal Dynamic Range (RF AGC)**
A BER better than $1x10^{-3}$ with Reed Solomon decoding off is achieved for received signals of -100 dBm to +10 dBm. The AGC attack time is less than 0.5 ms and the decay time is less than 1 ms for a 40 dB step input.

**Frequency Offsets**
The transceiver operates with frequency offsets up to 963 Hz.

## Transceiver Control

All control information and data is transferred to the attached network via the IP port.

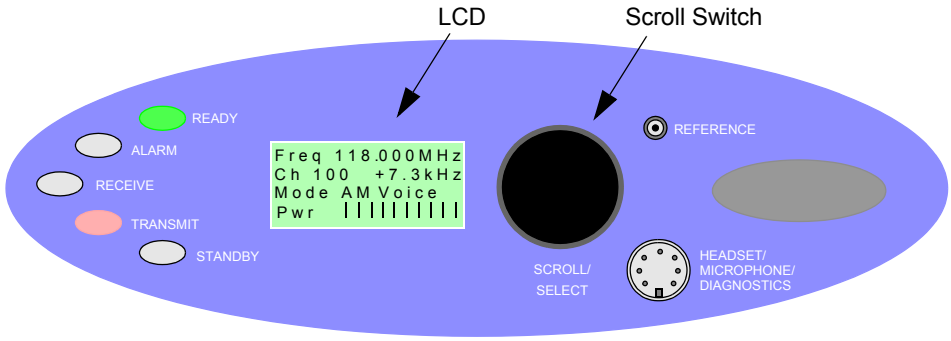
# Operation

# Controls, Indicators and Front Panel Connectors

This topic describes the transceiver's controls, indicators and front panel connectors.

## Front Panel

The transceiver's front panel is illustrated below.




### Scroll/Select Switch and LCD

The Scroll/Select switch is used in conjunction with the LCD to select most of the transceiver's operational settings. During normal operation, the LCD shows the operating frequency, the channel number (if the channel store facility is used), the offset carrier (if used), and displays a graphical representation of instantaneous peak power.

The example LCD screen above shows the transceiver operating on 118.000 MHz; the frequency has been preset as channel 100 and offset at +7.3 kHz.

### Ready Indicator

A green indicator that lights when the transceiver is ready for use and no BIT faults have been detected.

### Transmit Indicator

An amber indicator that lights when the transmit circuit is keyed and producing output power.

### Receive Indicator

An amber indicator that lights when a signal is received that is above the squelch threshold. Additionally, this indicator is lit when the transceiver's squelch facility is switched off (squelch defeated). This indicator also lights when the transceiver is keyed.

### Alarm Indicator

A red indicator that either flashes, or lights, when a BIT fault has been detected. BIT indications are classified as either Alarms or Alerts.

If an 'alert' condition is detected, the Alarm indicator flashes, the Ready indicator remains lit, and the transceiver remains operational. A BIT 'alert' is indicated if:

- The transceiver RF output power has reduced from its setting by more than 1 dB but not more than 3 dB
- The supply volts falls below a pre-defined level.

Any other BIT condition results in an alarm. When detected, the Alarm indicator lights and the Ready indicator becomes unlit; the transceiver cannot be used.

**Standby Indicator**
A red indicator that lights when the transceiver is in standby mode. When in standby mode, most of the radio's circuits are inactive, the front panel LCD is blanked, and the transceiver cannot be keyed.

Standby mode is selected and deselected using the front panel Scroll/Select switch and LCD, by initiating an instruction through a MARC system, through a T6 controller or through the VFP. For details of front panel selection and deselection see page 3-15.

**Reference Connector**
An SMB jack socket that allows a frequency counter to monitor the transceiver's reference frequency. This connector is used only for maintenance purposes. The instructions for checking and adjusting the reference frequency are given in the Maintenance topic.

**Headset/Microphone/Diagnostics Connector**
A dual purpose connector that allows either a headset/microphone, or a PC, to be connected to the transceiver. The connector is a 7-pin self-locking DIN socket; the pin-out is shown in Table 4-5 on page 4-17.

A microphone is fitted to this connector to enable the transceiver to be operated in AM local mode. A PC or laptop can also be connected to allow the optional VFP to be displayed. Using the VFP is detailed in the Maintenance topic.

## Rear Panel Supply Switch

**WARNING**  **Dangerous Voltage**

**When the Supply Switch is set to the Standby position, dangerous voltage is still present in the transceiver's internal power supply circuitry. To ensure safe working, the transceiver must be isolated from the ac and dc input supplies.**

The rear panel's Supply switch is a 2-way rocker switch used to select between power on and standby.

 = On

 = Standby

# Setting Up and Operation

Setting up the transceiver involves using the front panel Scroll/Select switch to specify the operating parameters.

Operating parameters can also be set using the Virtual Front Panel (VFP), through a Multi-Access Remote Control (MARC) system, or from an associated T6 controller. VFP operation is described in the Maintenance topic; MARC and T6 controller functionality is described in separate documentation.

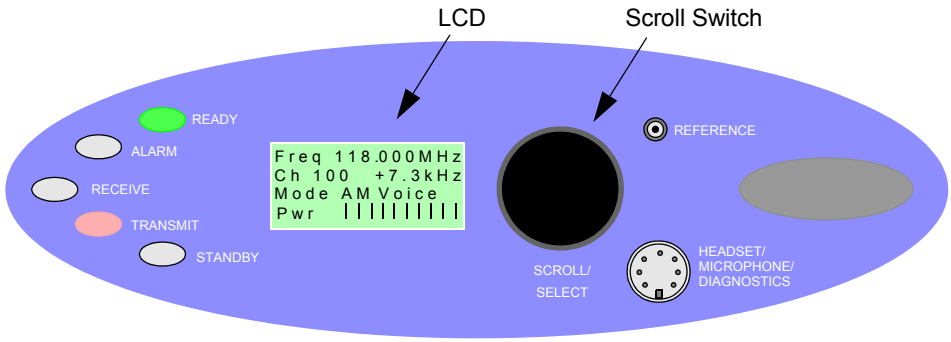
Table 3-11 on page 3-36 details the functions and parameters that can be set from all sources.

No attempt to set up the transceiver should be made until the installation procedures, given in the Installation topic, are completed.

Hearing loss can result when listening to audio at excessively high levels, or for prolonged periods of time. Always set the volume control to a safe (low) level before using headphones.

## Normal Operation

During normal operation, the LCD displays the Main screen. This screen shows the operating frequency, the channel number (if the channel store facility is used), the offset carrier (if used), and displays a graphical representation of output power when the transceiver is keyed. If the transceiver has been set to Standby mode, which is shown by the front panel Standby indicator being lit, the LCD is blanked.



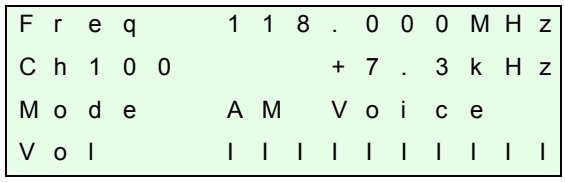

## Using the Scroll/Select Switch

The Scroll/Select switch (referred to throughout this topic as the 'switch') is used to leave the Main screen and display the Control screen (see page 3-7). Further use of the switch displays various selection menus and allows the required parameters to be set. The switch has three actions: it can be turned clockwise, anti-clockwise, or momentarily pushed in.

## Screen Protocol

The following protocol is applicable to all screens described in this document.

**Main screen** During normal transceiver operation, the Main screen, an example of which is shown below, is displayed.




**Switch** Refers to the front panel Scroll/Select switch. The switch is turned clockwise to scroll through fields from left to right, and from top to bottom. The switch is turned anti-clockwise to scroll through fields from right to left, and from bottom to top. The switch is pressed to make a selection.

**Time out** If during any setting up procedure the Scroll/Select switch is not operated for 30 seconds, the display returns to the Main screen. If editing any parameter has not been completed, the transceiver stays on the original setting.

**>>** Indicates more fields are available other than those currently displayed. To access those fields, turn the switch clockwise through the last displayed field.

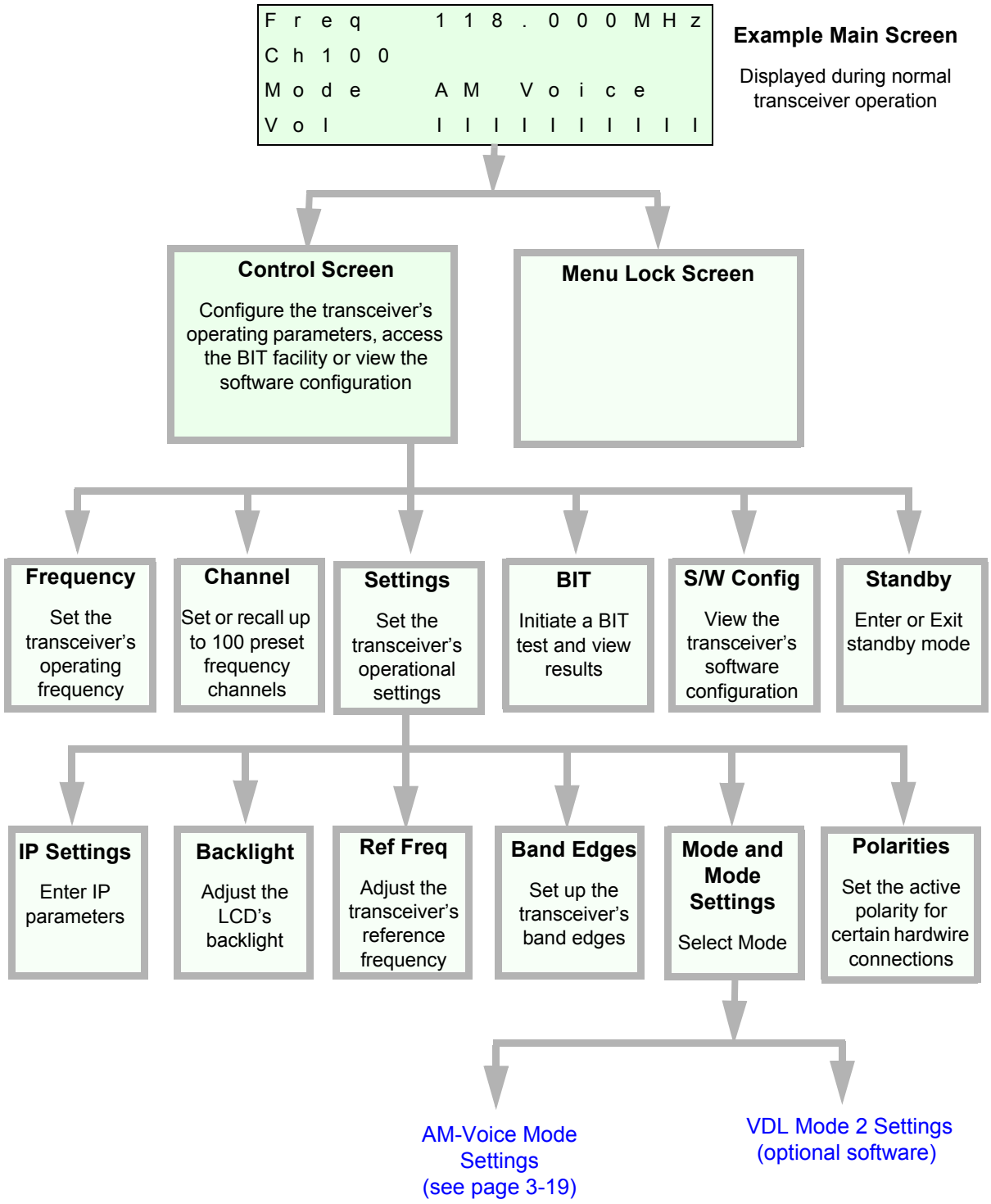
**<<** Indicates more fields are available other than those currently displayed. To access those fields, turn the switch anti-clockwise through the first displayed field.

**Back** When Back is selected, you are returned to the previous menu.

**Exit** When Exit is selected, you are returned to the Main screen.

## Menu System

The front panel control of the radio is implemented through a menu system illustrated below.

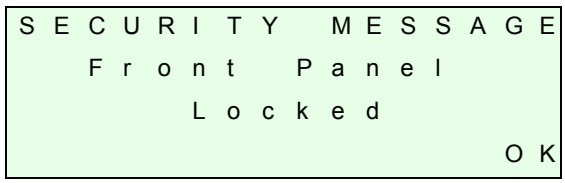



**Menu System**

## Menu Lock Screen

A security facility available only from the VFP allows the transceiver's front panel to be 'locked'. When this facility is active, no operational settings can be made from the front panel until an 'unlock' command is sent from the VFP.

The following screen is displayed when 'lock' is active, and the front panel switch is pressed.




To exit the system lock screen:

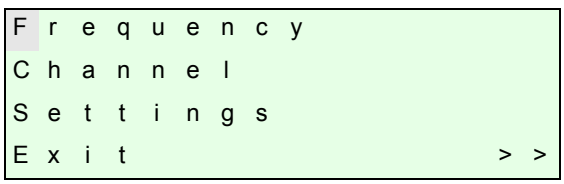
- Select OK, then press the switch. You are returned to the Main screen

  or,

- Wait for the 30 second time out to expire. You are returned to the Main screen.

## Control Screen

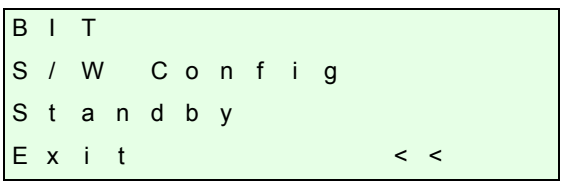
The Control screen is entered from the Main screen by pressing the switch. The following screen is displayed:




Change the transceiver's operating frequency.

Store or recall preset channel frequencies.

Select operating mode and mode settings.




Initiate a BIT test and view results.

View software configuration.

Enter or exit standby mode.

## Notes for Setting Up the Transceiver

The following notes should be read before setting up the transceiver. They advise on the special frequency display when using 8.33 kHz channel spacing, give guidance on the optimum line level settings, define offset carrier operation and detail the optional offset carrier filter settings.

Note that for operation in the United States of America, this equipment is certified only for operation using 25 kHz channel spacing.

### Front Panel Display for 25 kHz and 8.33 kHz Channel Spacing

When setting the operating frequency of the transceiver and 8.33 kHz channel spacing is selected, the displayed frequency differs from the actual channel frequency. Table 3-1 shows the pattern used for 25 kHz and 8.33 kHz spaced channel frequencies from 118.0000 MHz to 118.1416 MHz. The pattern is the same for any frequency within the transceiver's frequency range. The display conforms to ICAO convention for 8.33 kHz operation.

**Table 3-1 25 kHz and 8.33 kHz Channel Spacing Displays**

| Actual Frequency (to 4 decimal places) | Channel Spacing | Displayed Frequency at Transceiver's Front Panel |
|---|---|---|
| **118.0000 MHz** | **25 kHz** | **118.000 MHz** |
| 118.0000 MHz | 8.33 kHz | 118.005 MHz |
| 118.0083 MHz | 8.33 kHz | 118.010 MHz |
| 118.0166 MHz | 8.33 kHz | 118.015 MHz |
| **118.0250 MHz** | **25 kHz** | **118.025 MHz** |
| 118.0250 MHz | 8.33 kHz | 118.030 MHz |
| 118.0333 MHz | 8.33 kHz | 118.035 MHz |
| 118.0416 MHz | 8.33 kHz | 118.040 MHz |
| **118.0500 MHz** | **25 kHz** | **118.050 MHz** |
| 118.0500 MHz | 8.33 kHz | 118.055 MHz |
| 118.0583 MHz | 8.33 kHz | 118.060 MHz |
| 118.0666 MHz | 8.33 kHz | 118.065 MHz |
| **118.0750 MHz** | **25 kHz** | **118.075 MHz** |
| 118.0750 MHz | 8.33 kHz | 118.080 MHz |
| 118.0833 MHz | 8.33 kHz | 118.085 MHz |
| 118.0916 MHz | 8.33 kHz | 118.090 MHz |
| **118.1000 MHz** | **25 kHz** | **118.100 MHz** |
| 118.1000 MHz | 8.33 kHz | 118.105 MHz |
| 118.1083 MHz | 8.33 kHz | 118.110 MHz |
| 118.1166 MHz | 8.33 kHz | 118.115 MHz |
| **118.1250 MHz** | **25 kHz** | **118.125 MHz** |
| 118.1250 MHz | 8.33 kHz | 118.130 MHz |
| 118.1333 MHz | 8.33 kHz | 118.135 MHz |
| 118.1416 MHz | 8.33 kHz | 118.140 MHz |

### Input Line Level Setting

Transmitter Circuit

The input line level setting displayed on the front panel is calibrated for average speech level with a nominal peak-to-average ratio of 13 dB. This corresponds to the level specified for the lines.

When testing the transmitter using a sine wave, the line input level should be set to 10 dB above the front panel's line level setting. The VOGAD and mute thresholds are preset at 10 dB and 15 dB respectively below the front panel's line level setting (sine wave test level).

Table 3-2 shows the relationship between the input line level, VOGAD threshold and mute threshold.

**Table 3-2 Relationship Between Line Level, VOGAD Threshold and Mute Threshold**

| Line Level Setting (dBm) | Average Speech Level (dBm) | Sine Wave Test Level (dBm) | VOGAD Threshold with a Sine Wave Test Signal (dBm) | Mute Threshold with a Sine Wave Test Signal (dBm) |
|---|---|---|---|---|
| +10 | +10 | +20 | 0 | -5 |
| +5 | +5 | +15 | -5 | -10 |
| 0 | 0 | +10 | -10 | -15 |
| -5 | -5 | +5 | -15 | -20 |
| -10 | -10 | 0 | -20 | -25 |
| -15 | -15 | -5 | -25 | -30 |
| -20 | -20 | -10 | -30 | -35 |
| -25 | -25 | -15 | -35 | -40 |
| -30 | -30 | -20 | -40 | -45 |

Receiver Circuit

The output line level setting, displayed on the front panel, indicates the average line power for a speech signal (with a nominal 13 dB peak to average power ratio) when the receiver is demodulating an amplitude modulated signal and the peak amplitude of the speech corresponds to a modulation depth of 100%.

The receiver incorporates an audio AGC circuit that adjusts the peak line audio level to that which would be produced by a 100% modulated signal.

If the audio AGC is switched on:

- an AM sine wave test signal modulated between 30% and 100% produces an average line signal power 10 dB higher than the front panel line level setting.

If the audio AGC is switched off:

- an AM sine wave test signal modulated at 30% produces the same average line power as the front panel line setting
- an AM sine wave test signal modulated at 100% produces an average line signal power 10 dB higher than the front panel line setting.

Table 3-3 shows the relationship between line level, output levels with average speech and sine wave (assuming that the audio AGC is set to on, and the modulation depth is between 30% and 100%).

**Table 3-3 Relationship between Line Level, Output Levels with Average Speech and Sine Wave**

| Line Level Setting (dBm) | Output Level with Average Speech (dBm) | Output Level with Sine Wave and Audio AGC Switched On (dBm) |
|---|---|---|
| +10 | +10 | +20 |
| +5 | +5 | +15 |
| 0 | 0 | +10 |
| -5 | -5 | +5 |
| -10 | -10 | 0 |
| -15 | -15 | -5 |
| -20 | -20 | -10 |
| -25 | -25 | -15 |
| -30 | -30 | -20 |

**Output Line Level Setting**

The output line level setting displayed on the front panel is equivalent to the average speech level with a peak-to-average ratio of 13 dB. This corresponds to the level specified for the lines.

When testing the transceiver using a signal generator with sine wave modulation, the line output level will be 10 dB above the line level setting.

Table 3-4 shows the relationship between line level, output levels with average speech and sine wave (assuming that the audio AGC is set to on, and the modulation depth is between 30% and 100%).

**Table 3-4 Relationship between Line Level, Output Levels with Average Speech and Sine Wave**

| Line Level Setting (Front Panel Setting) (dBm) | Output Level with Average Speech (dBm) | Output Level with Sine Wave (dBm) |
|---|---|---|
| +10 | +10 | +20 |
| +5 | +5 | +15 |
| 0 | 0 | +10 |
| -5 | -5 | +5 |
| -10 | -10 | 0 |
| -15 | -15 | -5 |
| -20 | -20 | -10 |
| -25 | -25 | -15 |
| -30 | -30 | -20 |

**Offset Carrier Operation for 25 kHz Spaced Channels**
The transceiver can be set to operate using a 2, 3, 4 or 5-offset carrier system as follows:

- With 2-offset carrier working, the carriers are spaced at ±5 kHz
- With 3-offset carrier working, the carriers are spaced at zero and ±7.3 kHz
- With 4-offset carrier working, the carriers are spaced at ±2.5 kHz and ±7.5 kHz
- With 5-offset carrier working, the carriers are spaced at zero, ±4 kHz and ±8 kHz.

If using a 2, 3 or 4-offset carrier system, the appropriate offset is selected from the AM-voice mode settings screen. After selection, no further action is required.

If using a 5-offset carrier system, the appropriate offset (-4 kHz, +4 kHz, -8 kHz or +8 kHz) is selected from the AM-voice mode settings screen. After selection, step 9 of the procedure titled 'Setting the Transceiver's Internal Reference Frequency' must be completed; this procedure is found in the Maintenance topic.

**Offset Carrier Operation for 8.33 kHz Spaced Channels**
The transceiver can be set to operate using a 2-offset carrier system with the carriers spaced at ±2.5 kHz. No other offsets can be selected when 8.33 kHz channel spacing is selected.

**Offset Carrier Filter Setting**

The optional offset carrier filter facility is a proprietary software filter system for use with offset carrier working within a digital system. This facility can be used only when it has been software enabled by Northrop Grumman. If it is not enabled, the front screen (see page 3-20) displays OFF.

The transceiver can select different filters for use with offset carrier working. The software filters are designated A14, A16 and B16. Selection is made from the transceiver's front panel (see AM-Voice Mode Settings Screen on page 3-19).

Selection is made by highlighting Filter and pressing the Scroll/Select switch. One of four settings can then be made: OFF, A14, A16 and B16. Table 3-5 shows the filter configurations. Which leg (A, B, C or D) is allocated to which radio site is decided during system installation.

**Table 3-5 Offset Carrier Filter Configurations**

| Channel Configuration | A Leg | B Leg | C Leg | D Leg |
|---|---|---|---|---|
| 1-leg channel | Not applicable | Not applicable | Not applicable | Not applicable |
| 2-leg channel | B16 | A14 | Not applicable | Not applicable |
| 3-leg channel | B16 | A14 | A16 | Not applicable |
| 4-leg channel | B16 | A14 | A16 | A14 |

## Changing the Transceiver's Operating Frequency

The transceiver's frequency can be changed in two ways: either from the frequency screen, or by recalling a preset channel. This procedure details using the Frequency screen.

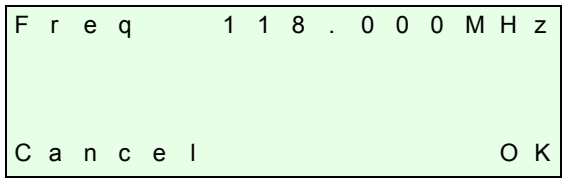
(1) From the Control screen, select frequency to display the Frequency screen.

(2) Turn the switch to highlight the digit to be changed, then press the switch.

(3) Turn the switch until the required digit is shown, then press the switch.

(4) Repeat until the required frequency is shown, then highlight OK and press the switch.

(5) Only frequencies that fall between the band edge settings can be selected.



## To Store and Recall Frequency Channels

Up to 100 frequency channels can be stored in the transceiver.

### To Store a Frequency Channel

(1) From the Control screen, select Channel to display the Channel screen. Highlight Channel, press the switch and then turn it until the required channel number is displayed; press the switch.

(2) Highlight the MHz frequency value (see Example 2), press the switch and then turn it until the required MHz value is shown. Press the switch.

(3) Highlight the kHz frequency value (see Example 3), press the switch and then turn it until the required kHz value is shown. Press the switch.

(4) Highlight Store and press the switch. The new frequency is now stored in the selected channel number.

### To Recall a Stored Frequency Channel

(1) From the Control screen, select Channel to display the Channel screen.

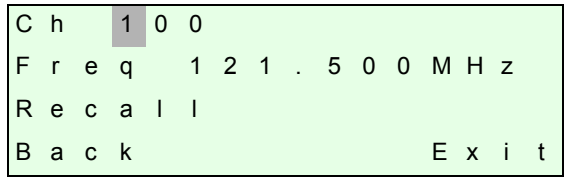
(2) To make the transceiver operate on any preset channel frequency, highlight Channel and press the switch. Turn the switch until the required channel number/frequency is displayed, then press the switch.

(3) Turn the switch to highlight Recall, then press the switch. Exit the screen. The transceiver now operates on the recalled frequency channel.

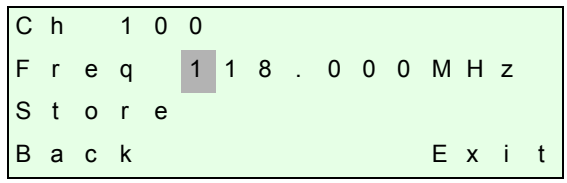
Notes:

(1) If a frequency outside the band edge limits is entered, a message (see Example 3) is displayed.

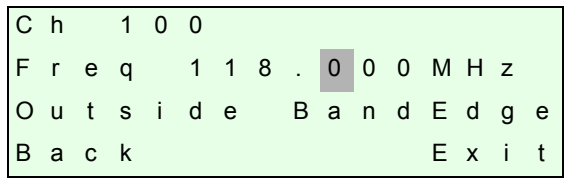
(2) If a frequency not valid for the mode of operation is entered, a message (see Example 4) is displayed.



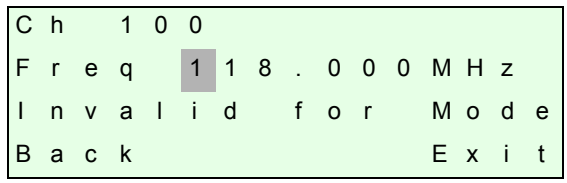

**Channel Screen - Example 1**




**Channel Screen - Example 2**




**Channel Screen - Example 3**



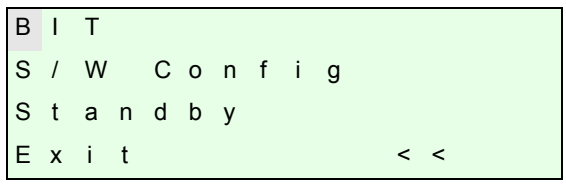

**Channel Screen - Example 4**

## To Initiate a BIT Test

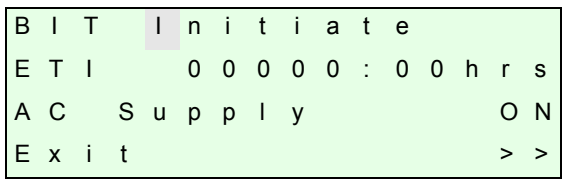
Use the following procedure to initiate an interruptive BIT test from the transceiver's front panel. A BIT test cannot be initiated while the transceiver is keyed. After a BIT test has been run, the BIT screen is displayed (see AM-Voice BIT Screen on page 3-30). An interruptive BIT test cannot be initiated in VDL Mode 2.

> During an interruptive BIT test, the transceiver radiates modulated carrier waves at the set power. Users should therefore obtain the necessary authority before initiating a test.
>
> If the test is to be carried out with the antenna disconnected, ensure a load is fitted to the transceiver's TX/RX Antenna (not RX Antenna) connector.
>
> In order to test the line input stages, an internally generated 1 kHz tone is injected into the line input circuit. Any other audio present on the line input will cause the test to be inaccurate. Therefore the transceiver MUST NOT be keyed during the test.

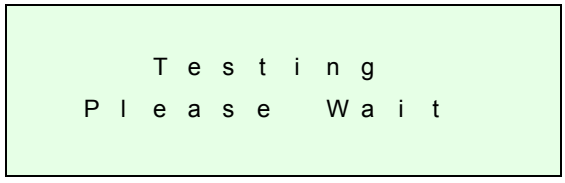
(1) From the Main screen, press the switch to display the Control screen. Turn the switch until BIT is highlighted. Press the switch.



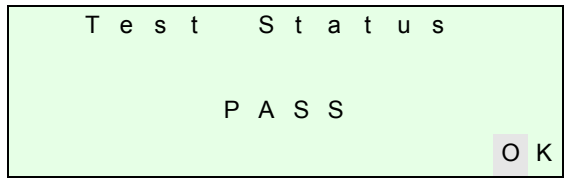

(2) Ensure the BIT menu is displayed. Turn the switch until BIT Initiate is highlighted. Press the switch.

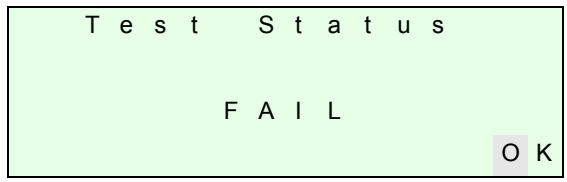



(3) During the test, which takes approximately two seconds, the Testing screen is displayed.



(4) On completion, and if the interruptive test was initiated from the front panel, one of the following screens will be shown.




(5) Selecting OK takes the user back to the BIT screen. If fail is displayed, scroll through the screen to check the cause of the failure.

## Standby Mode

Standby mode is a power saving feature that can be used for non-operational transceivers. When in standby mode, most of the transceiver's circuits are inactive, the LCD is blanked, and the transceiver cannot be keyed. To put the transceiver into standby mode, use the following procedure.

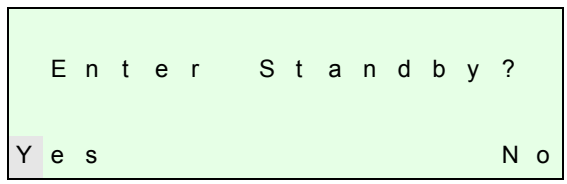
When the transceiver is in Standby mode, the red front panel Standby indicator is lit.

### To Enter Standby Mode

(1) From the Control screen select Standby.

(2) At the Standby screen, select Yes.

(3) Check that the display blanks and the front panel Standby indicator is lit.

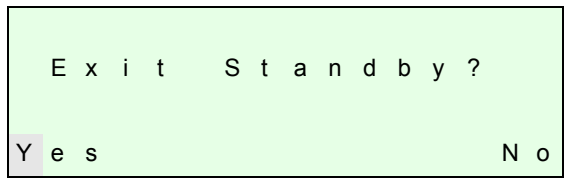



### To Exit Standby Mode

(1) Press the Switch.

(2) Select Yes.

(3) Check that the Main screen is displayed and that the front panel Standby indicator is unlit.



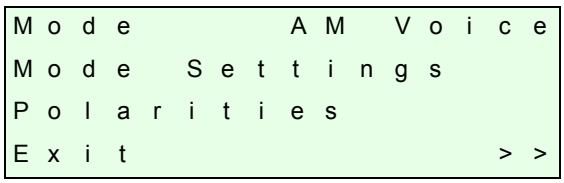
## Settings

Operational settings for the transceiver are configured at the front panel, through the VFP, or through an associated MARC system (or compatible control system). Some settings can also be made remotely via a T6 controller. The Settings screen is entered from the Control screen.

The settings that can be selected at the front panel Settings screen are:

- Mode - either AM-voice or VDL Mode 2 (optional)
- Mode settings - allows AM-voice mode parameters to be set (VDL Mode 2 parameters are set via the VFP application)
- Polarities
- Band edges
- Reference frequency
- Backlight
- IP settings.

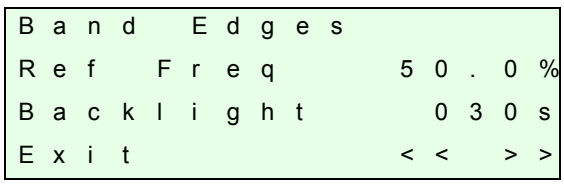
Note that the mode selection, reference frequency and backlight are set from this screen. When mode settings, polarities, band edges and IP settings are selected the user is taken to other screens. If Mode Settings is selected when in VDL Mode 2, a message is displayed informing the user that VDL Mode 2 parameters are set via the VFP application.




Select between AM-voice or VDL Mode 2 (optional).

Change AM-voice mode parameters.

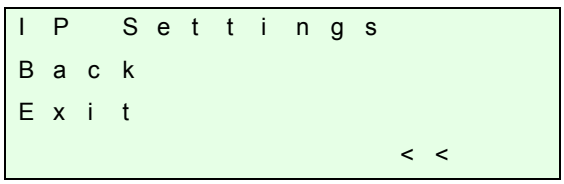
Set remote signal polarities.




Set the transceiver's frequency band edges.

Align the transceiver's reference frequency (Note 1).

Adjust the LCD's backlight time out (Note 2).




Set the transceiver's Ethernet parameters.

Notes:

(1) Setting the transceiver's reference frequency is a maintenance operation. The current value should not be reset unless the correct test equipment is connected. See Maintenance topic.

(2) The LCD's backlight can be set for permanently on, off, or timed to stay on for a period between 15 and 120 seconds.

General and mode specific settings, showing default values, are referenced in Table 3-6 on page 3-17. Click on any required parameter by page number for further references.

**Table 3-6 Operational Settings from the Front Panel**

| Parameter | Mode | Adjustment Range | Factory Default Setting | Further Reference |
|---|---|---|---|---|
| Menu lock screen | All | Locked or unlocked | Unlocked | page 3-7 |
| Enter standby mode | All | Yes or No | - | page 3-15 |
| Exit standby mode | All | Yes or No | - | page 3-15 |
| Set mode of operation | All | AM-voice or VDL Mode 2 (optional) | AM-voice | page 3-16 |
| Set polarities | AM-voice | STD or INV | STD | page 3-25 |
| Band edges | All | 118.000 to 136.975 MHz or 112.000 to 155.975 MHz | 118.000 and 136.975 MHz or 112.000 and 155.975 MHz | page 3-34 |
| LCD backlight | All | 15 to 120 s, On or Off | 30 s | page 3-16 |
| RF power | All | 5 to 50 W | 50 W | page 3-19 |
| Audio line in level | AM-voice | -30 to +10 dBm | -13 dBm | page 3-19 |
| Audio line out level | AM-voice | -30 to +10 dBm | -13 dBm | page 3-19 |
| Inhibit | AM-voice | On or Off | Off | page 3-19 |
| PTT (key) | AM-voice | On (key) or Off (de-key) | Off | page 3-19 |
| Tx time out | AM-voice | 2 to 510 s or Off | 180 s | page 3-19 |
| Modulation depth | AM-voice | 5 to 95% | 85% | page 3-19 |
| Mute | AM-voice | On or Off | On | page 3-19 |
| VOGAD | AM-voice | On or Off | On | page 3-19 |
| Antenna C/O delay | AM-voice | On or Off | On | page 3-20 |
| Offset | AM-voice | 0, ±2.5, ±4, ±5, ±7.3, ±7.5, ±8 kHz | 0 (No offset) | page 3-11 |
| Filter | AM-voice | Off, A14, A16 and B16 | Off | page 3-11 |
| Squelch | AM-voice | -114 to -60 dBm in 1 dB steps. With the RF pre-attenuator selected, the range is -108 to -54 dBm | -107 dBm | page 3-20 See also Squelch Setting Options on page 3-22 |
| RF pre-attenuation | AM-voice | On or Off | Off | page 3-20 |
| Squelch defeat | AM-voice | On or Off | Off | page 3-20 |
| Squelch noise compensation | AM-voice | On or Off | On | page 3-20 |
| Squelch carrier override | AM-voice | On or Off | Off | page 3-20 |
| Audio AGC | AM-voice | On or Off | On | page 3-20 |
| Loudspeaker | AM-voice | On or Off | On | page 3-20 |
| Step | AM-voice | 8.33, 25 kHz or both | 25 kHz | page 3-20 |
| Mic | AM-voice | Active or Passive | Passive | page 3-20 |
| Key priority | AM-voice | Local-Remote or Remote-Local | Local-Remote | page 3-20 |
| Local PTT | AM-voice | Enabled or Disabled | Enabled | page 3-20 |

**Table 3-6 Operational Settings from the Front Panel (continued)**

| Parameter | Mode | Adjustment Range | Factory Default Setting | Further Reference |
|---|---|---|---|---|
| Remote PTT | AM-voice | Enabled or Disabled | Enabled | page 3-20 |
| Remote phantom PTT | AM-voice | Enabled or Disabled | Enabled | page 3-20 |
| Self-receive | AM-voice | On or Off | Off | page 3-20 |
| High signal quality parameter (SQP) | AM-voice | -10 dBm to -80 dBm | -80 dBm | page 3-21 |
| Tone signalling | AM-voice | PTT tone signalling:<br>On or Off<br>1800 to 3000 Hz<br>-5 to -25 dB | <br>Off<br>2040 Hz<br>-10 dB | page 3-21 and page 3-23 |
| | | Squelch tone signalling:<br>On or Off<br>1800 to 3000 Hz<br>-2 to -25 dB | <br>Off<br>1930 Hz<br>-10 dB | page 3-21 and page 3-23 |
| PTT confirm | AM-voice | On or Off | On | page 3-21 and page 3-23 |
| RRC configuration | AM-voice | Enabled or Disabled | Disabled | page 3-21 and page 3-24 |
| **IP (Ethernet) Settings** | | | | |
| DHCP | All | On or Off | Off | page 3-29 |
| IP address | All | 000.000.000.000 to 255.255.255.255 | 000.000.000.000 | page 3-29 |
| IP subnet mask | All | 000.000.000.000 to 255.255.255.255 | 255.255.255.000 | page 3-29 |
| Default gateway | All | 000.000.000.000 to 255.255.255.255 | 000.000.000.000 | page 3-29 |
| Control application TCP port number | All | 05000 to 65535 | 05001 | page 3-29 |
| Maximum number of TCP connections | AM-voice | 00 to 07 | 01 | page 3-29 |

## AM-Voice Mode Settings Procedure

During this procedure, the following parameters can be set:

- RF power output
- Audio line input level
- Audio line output level
- Inhibit (on or off)
- PTT on (key) or off (de-key)
- Transmitter time out
- Modulation depth
- Mute (on or off)
- VOGAD (on or off)
- Antenna change-over delay (on or off)
- Offset carrier
- Offset carrier filter
- Squelch level (see Squelch Setting Options on page 3-22)
- RF pre-attenuation (on or off - see page 3-24)
- Squelch defeat (on or off)
- Squelch noise compensation (on or off)
- Squelch carrier override (on or off)
- Audio AGC (on or off)
- Speaker (on or off)
- Step
- Mic (active or passive)
- Key priority (local or remote)
- Enable or disable local PTT
- Enable or disable remote PTT
- Enable or disable remote phantom PTT
- Self-receive (on or off)
- High SQP (see page 3-21)
- Tone signalling (see page 3-21)
- PTT confirm (see page 3-24)
- RRC enable or disable (see page 3-24).

### AM-Voice Mode Settings Screen

The AM-voice mode settings screen is accessed from the Settings screen. Use the Scroll/Select switch to select the parameter, then enter the required setting(s). Notes regarding optimum line levels are given on page 3-9.

**Adjustments**

| | |
|---|---|
| Power 50 W | RF power between 5 W to 50 W. |
| Line In -13 dBm | Audio line in level between -30 to +10 dBm. |
| Line Out -13 dBm | Audio line out level between -30 to +10 dBm. |
| Exit >> | |

| | |
|---|---|
| Inhibit OFF | On or Off. |
| PTT OFF | On (key) or Off (de-key). |
| TX Timeout 180 s | 2 to 510 s or Off. |
| Exit << >> | |

| | |
|---|---|
| Mod Depth 85 % | 5 to 95%. |
| Mute ON | On or Off. |
| VOGAD ON | On or Off. |
| Exit << >> | |

## Adjustments

| | |
|---|---|
| Ant C/O Del ON | On or Off. |
| Offset 0.0kHz | See Offset Carrier Operation on page 3-11. |
| Filter OFF | See Offset Carrier Filter Setting on page 3-11. |
| Exit << >> | |

| | |
|---|---|
| Squelch -107dBm | -114 to -60 dBm in 1 dB steps. With the RF pre-attenuator selected, the range is -108 to -54 dBm. |
| RF Pre-Atten OFF | On or Off. |
| Sql Defeat OFF | On or Off. |
| Exit << >> | |

| | |
|---|---|
| Sql N/Comp ON | On or Off. |
| Sql Carr O/R OFF | On or Off. |
| Audio AGC ON | On or Off. |
| Exit << >> | |

| | |
|---|---|
| Speaker ON | On or Off. |
| Step 25kHz | 25 kHz, 8.33 kHz or both. |
| Mic PASSIVE | Active or Passive. |
| Exit << >> | |

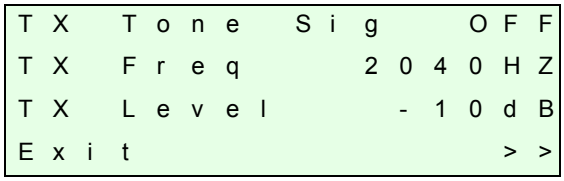
| | |
|---|---|
| Key Priority L-R | Local-remote or Remote-local. |
| Local PTT EN | Enabled or Disabled. |
| Remote PTT EN | Enabled or Disabled. |
| Exit << >> | |

| | |
|---|---|
| Rem Phan PTT EN | Enabled or Disabled. |
| Self-Receive OFF | On or Off. |
| High SQP -80dBm | See Signal Quality Parameter on page 3-21. |
| Exit << >> | |

| | |
|---|---|
| Tone Signalling | See sub-menus and Tone Signalling on page 3-21 |
| PTT Confirm ON | On or Off. See PTT Confirm see page 3-24. |
| RRC | See sub-menu and Radio Remote Control (RRC) on page 3-20. |
| Exit << >> | |

| |
|---|
| Back |
| Exit |
| << |

Tone Signalling sub-menu 1:

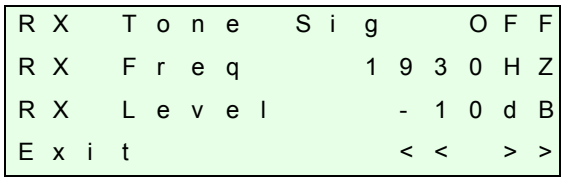



On or Off.

1800 to 3000 Hz in 1 Hz steps.

-5 to -25 dB with respect to the equivalent sine wave line level in 1 dB steps.

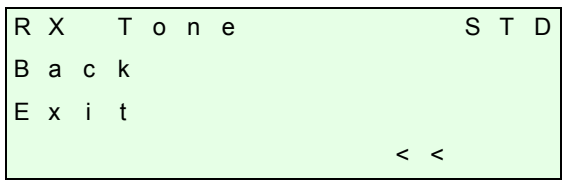
Tone Signalling sub-menu 2:




On or Off.

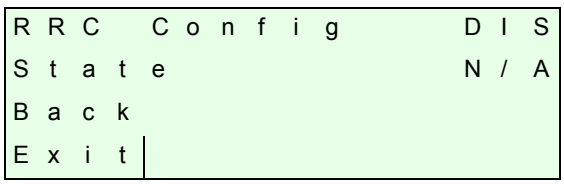
1800 to 3000 Hz in 1 Hz steps.

-2 to -25 dB with respect to the equivalent sine wave line level in 1 dB steps.



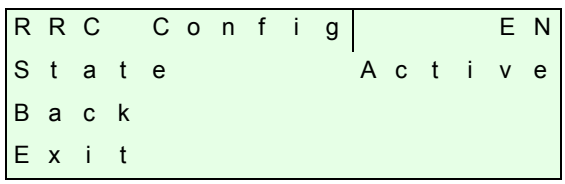

STD or INV (see page 3-24)

RRC Configuration sub-menu:



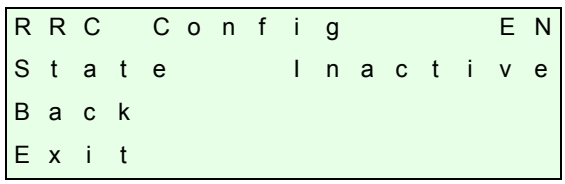

RRC Configuration disabled.

State not applicable.




RRC Configuration enabled.

State active.




RRC Configuration enabled.

State inactive.

**Signal Quality Parameter**

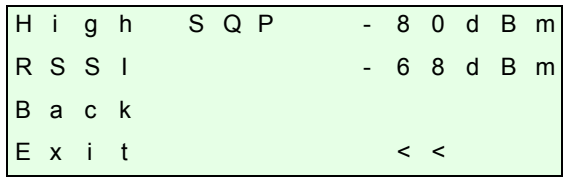
The signal quality parameter (SQP) is used to control receiver voting when the receiver connects to a digital voice switch via an E1 data link. The receiver activates one of four levels dependent on received signal strength.

As an additional facility, the highest of the four levels (High SQP) is adjustable. This can be used to provide an indication that an associated co-located transceiver/transmitter system is radiating power. When the associated radio is keyed, the receiver senses a strong signal and activates the High SQP level. The level is used by the digital voice switch to provide an appropriate indication.

A suggested method for setting the High SQP is given below:

(1) From the AM-voice mode settings screen (see below) highlight High SQP and press the switch.


(2) Ensure the High SQP Setting screen (see below) is displayed.




(3) Arrange for the associated transmitter (operating on the same frequency) to be keyed and note the RSSI reading.

(4) Using the switch, set the High SQP level to be 12 dB below the RSSI level. For example, if the RSSI is -68 dBm, the SQP should be set to -80 dBm (High SQP is adjustable between -10 dBm and -80 dBm).

## Squelch Setting Options

The transceiver's squelch facility is configured from the AM-voice mode settings screen. The following fields are applicable to squelch operation.

Sql Defeat — The squelch defeat facility can be set to on or off.

- When set to on, the squelch facility does not operate
- When set to off the transceiver's squelch facilities are available.

Squelch — The squelch field sets the threshold; the default setting is -107 dBm.

- During periods of no reception, or when signals weaker than the threshold are received, the receiver is muted
- When signals stronger than the squelch threshold are received, the squelch circuits are defeated and reception is heard in the normal way.

Sql N/Comp — This field allows noise compensated squelch to be selected on or off. When this facility is on, the squelch circuits mute all signals weaker than the threshold, and also mute signals stronger than the threshold that are excessively noisy.

Sql Carr O/R — The carrier override squelch facility is used in conjunction with the noise compensated squelch facility. If too many noisy signals are being lost due to noise compensation, carrier override can be switched on to reduce the squelch threshold by 10 dB. The default threshold of -107 dBm effectively becomes -97 dBm with carrier override switched on. All signals stronger than -97 dBm, irrespective of the noise level, are then heard in the normal way.

**Table 3-7 Squelch Facility Settings**

| Required Squelch Operation | Squelch Defeat Setting | Squelch Setting | Sql N/Comp Setting | Sql Carr O/R Setting |
|---|---|---|---|---|
| No squelch | On | Any | Off | Off |
| Squelch (without noise compensation) | Off | Required threshold | Off | Off |
| Noise compensated squelch | Off | Required threshold | On | Off |
| Noise compensated squelch with carrier override squelch | Off | Required threshold | On | On |

When the transceiver is used to monitor beacons such as Emergency Locator Transmitter frequencies it is suggested that the noise compensated squelch is set to off.

## Squelch Indications

Squelch indication can be obtained directly from relay contacts or via the receive audio lines as phantom squelch. These signals are available at the MARC, MARC Audio and Facilities connectors on the rear panel of the transceiver. These connectors are detailed in the Installation topic of this documentation. The transceiver can also be configured for squelch tone signalling on the audio lines.

### Squelch Tone Signalling

Squelch tone signalling can only be used in AM-voice mode and is enabled from the AM-voice mode settings screen. The tone frequency range can be set between 1800 and 3000 Hz in 1 Hz steps. The default tone frequency is 1930 Hz. The tone output level can be set between -2 and -25 dB (in 1 dB steps) with respect to the equivalent sine wave line level. The default setting is -10 dB. If, for example, a -23 dBm squelch tone is required with the line output level set at -13 dBm (-3 dBm equivalent sine wave level), set the squelch tone signalling level to -20 dB.

In STD (standard) mode the signalling injects a tone when the squelch has lifted. In INV (inverted) mode, the signalling injects a tone when the squelch is closed.

## Keying the Transceiver

The transceiver can be keyed using a suitable microphone connected to the headset/microphone/ diagnostics connector on the front panel. The transceiver can also be keyed via the rear panel MARC Audio connector as detailed on page 4-20 of the Installation topic. Direct PTT input (pin 8) or phantom PTT on the transmit audio lines (pins 4 and 5) can be utilised. The transceiver can also be configured for PTT tone signalling on the audio lines.

### PTT Tone Signalling

PTT tone signalling can only be used in AM-voice mode and is enabled from the AM-voice mode settings screen. The tone frequency range is settable between 1800 and 3000 Hz in 1 Hz steps. The default frequency is 2040 Hz. The tone level required for PTT detection is adjustable between -5 and -25 dB (in 1 dB steps) with respect to the equivalent sine wave line level. The default setting is -10 dB. If, for example, a -18 dBm tone is to be detected with the audio line input level set at -13 dBm (-3 dBm equivalent sine wave level), set the PTT tone signalling level to -15 dB.

## PTT Confirm

A transceiver can be configured to output a PTT confirm CAS (channel associated signalling) code on the E1 interface when it has been keyed and is producing power. This is the default condition. For some systems and to provide backward compatability, PTT confirm can be disabled from the AM-voice mode settings screen. This allows the High SQP code to be sent on the E1 interface instead of the PTT confirm code when self-receive is enabled.

## Radio Remote Control (RRC)

A VoIP radio system uses the RRC block of the RTP Header Extensions as defined in ED-137 to allow for main/standby switching at a radio site. The RRC block is used to both indicate and configure whether the radio is selected to be Active or Inactive. The use of this facility is controlled through the radio's RRC configuration setting.

The RRC configuration is enabled in VoIP radio systems to enable indication of active and inactive transceivers and, any switching requirements within a VoIP radio system.

When RRC configuration is enabled the RRC state can be set Active or Inactive. When RRC configuration is not enabled the RRC state is not applicable.

When the RRC State is Active, or when RRC configuration is not enabled, ED-137 PTT signalling will cause a transceiver to key.

When the RRC state is Inactive ED-137 PTT signalling does not key the transceiver (other keying sources are not affected).

Transceivers always provide received audio and squelch signalling irrespective of the RRC configuration and RRC state.

For non-IP based radio systems the RRC configuration should be disabled.

A radio with RRC configuration enabled always powers up Active. The RRC state can be set Active or Inactive via:

- The radio's front panel menu system (see page 3-21)
- MARC/RCMS
- In the RTP header (RRC block).

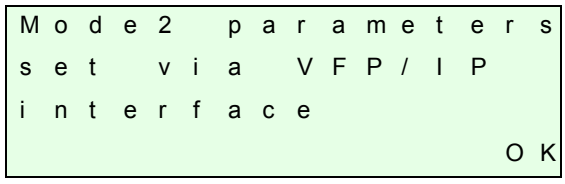
An RRC State output is provided on the Facilities connector, pin 15.

## Using the RF Pre-Attenuator

Selecting the RF pre-attenuator to On provides a 6 dB reduced sensitivity feature to improve co-location performance where maximum sensitivity cannot be realised due to large unwanted signals.

## VDL Mode 2 Settings Screen (Optional)

This is an advisory screen. Pressing OK returns the user to the previous screen.



## AM-Voice Polarities Screen

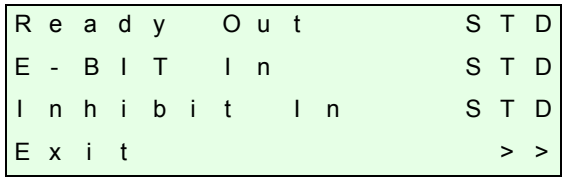
A number of remote indication and control signals can be hardwire connected to the transceiver. These signals include transceiver ready indication, E-BIT input, PTT control, phantom PTT control, PTT out indication, inhibit control, BIT initiation control, external VSWR fault indication, fast PTT out, squelch, phantom squelch and squelch defeat.

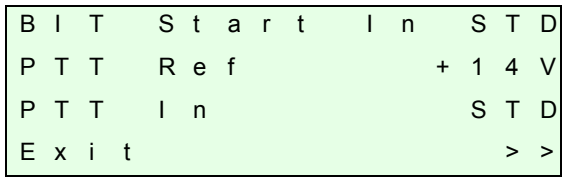
The Polarities screen is accessed from the Settings screen.

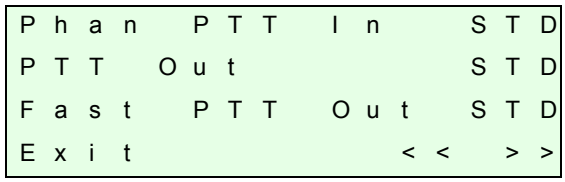
### Polarity Settings

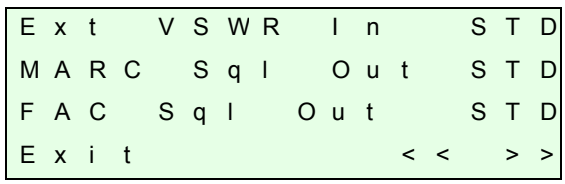
Each of thirteen polarity settings applicable to AM-voice can be set to the default STD (standard) or INV (inverted) setting.

The signal connections are shown in Table 3-8 along with the conditions when STD or INV is selected. The settings for the PTT Reference voltage are also shown in Table 3-8.



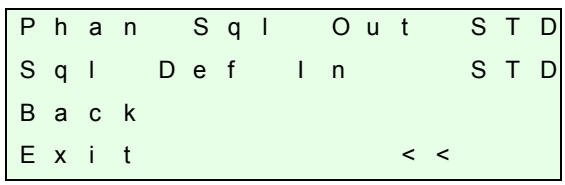



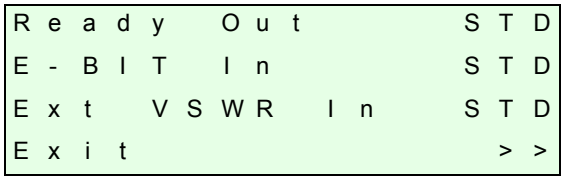
**Table 3-8 AM-Voice Polarity Settings**

| Signal | Connector | Polarity Set to STD | Polarity Set to INV |
|---|---|---|---|
| Ready Out | Facilities, pin 13 | An open collector grounded output when the radio is ready to transmit and no BIT faults are detected. | An open collector high impedance output when the radio is ready to transmit and no BIT faults are detected. |
| E-BIT In | Facilities, pin 2 | TTL input. 0 V indicates an external fault. | TTL input. 5 V indicates an external fault. |
| Inhibit In | Facilities, pin 10 | TTL input. 0 V inhibits transceiver operation. | TTL input. 5 V inhibits transceiver operation. |
| BIT Start In | Facilities, pin 11 | TTL input. 0 V initiates an interruptive BIT test. | TTL input. 5 V initiates an interruptive BIT test. |
| PTT In | MARC Audio, pin 8 | Active when input differs from reference by more than ±10 V. Inactive when input differs from reference by less than ±1 V. Maximum input level ±60 V with respect to reference. Input will draw no more than 6 mA, requires at least 1 mA to operate. | Active when input differs from reference by less than ±1 V. Inactive when input differs from reference by more than ±10 V. Maximum input level ±60 V with respect to reference. Input will draw no more than 6 mA, requires at least 1 mA to operate. |
| Phantom PTT In<br>(Phan PTT In) | MARC Audio, pin 4 | Active when input differs from reference by more than ±10 V. Inactive when input differs from reference by less than ±1 V. Maximum input level ±60 V with respect to reference. Input will draw no more than 6 mA, requires at least 1 mA to operate. | Active when input differs from reference by less than ±1 V. Inactive when input differs from reference by more than ±10 V. Maximum input level ±60 V with respect to reference. Input will draw no more than 6 mA, requires at least 1 mA to operate. |
| PTT Out | Facilities, pin 3 | Grounding solid state relay. +60 to -60 Vac or dc, 200 mA maximum, normally open. Activated 35 ms (±1 ms) before the start of the power ramp up to allow for the antenna relay to pull-in time. | Grounding solid state relay. +60 to -60 Vac or dc, 200 mA maximum, normally closed. Activated 35 ms (±1 ms) before the start of the power ramp up to allow for the antenna relay to pull-in time. |
| Fast PTT Output [antenna change-over]<br>(Fast PTT Out) | MARC Audio, pin 3 | Open collector NPN transistor grounding output, 200 mA maximum, normally open. | Open collector NPN transistor grounding output, 200 mA maximum, normally closed. |
| External VSWR Input<br>(Ext VSWR In) | Facilities, pin 4 | TTL input. 0 V active. | TTL input. 5 V active. |
| MARC Squelch Out<br>(MARC Sql Out) | MARC, pin 4<br>MARC Audio, pin 6 | Normally open relay contact that closes to give a 0 V output when the squelch circuits are defeated (aircraft calling). | Normally closed (0 V output) relay contact that opens when the squelch circuits are defeated (aircraft calling). |

**Table 3-8 AM-Voice Polarity Settings (continued)**

| Signal | Connector | Polarity Set to STD | Polarity Set to INV |
|---|---|---|---|
| FAC Squelch Out<br>(FAC Sql Out) | Facilities, pin 5 | Normally open relay contact that closes when the squelch circuits are defeated (aircraft calling). The relay contact can be configured to switch any potential between -60 V and +60 Vdc. | Normally closed relay contact that opens when the squelch circuits are defeated (aircraft calling). The relay contact can be configured to switch any potential between -60 V and +60 Vdc. |
| Phantom Squelch Out<br>(Phan Sql Out) | MARC, pin 2<br>MARC Audio, pin 1 | Phantom Squelch. Normally open relay contact that closes to connect a 0 V phantom potential to the audio lines when the squelch circuits are defeated (aircraft calling). | Phantom Squelch. Normally closed relay contact connecting a 0 V potential to the audio lines that opens when the squelch circuits are defeated (aircraft calling). |
| Squelch Defeat Input<br>(Sql Def In) | Facilities, pin 7 | TTL input. 0 V switches off the squelch circuits. | TTL input. 5 V switches off the squelch circuits. |
| PTT Ref | - | PTT Ref can be set to +14 V, 0 V or -14 V. Maximum input level ±60 V with respect to PTT reference. Input will draw no more than 6 mA, and requires at least 1 mA to operate.<br>When the input PTT signal and the PTT reference differ by more than 10 V the radio keys.<br>When the input PTT signal and the PTT reference are within 1 V, the radio dekeys.<br>Other conditions are indeterminable. | PTT Ref can be set to +14 V, 0 V or -14 V. Maximum input level ±60 V with respect to PTT reference. Input will draw no more than 6 mA, and requires at least 1 mA to operate.<br>When the input PTT signal and the PTT reference differ by more than 10 V the radio dekeys.<br>When the input PTT signal and the PTT reference are within 1 V, the radio keys.<br>Other conditions are indeterminable. |

## VDL Mode 2 Polarity Settings (Optional)




Each of the three polarity settings applicable to VDL Mode 2 can be set to the default STD (standard) or INV (inverted) setting.

The signal connections are shown in Table 3-9 along with the conditions when STD or INV is selected.

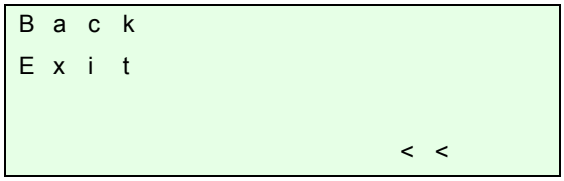
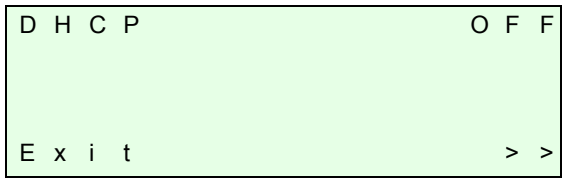



**Table 3-9 VDL Mode 2 Polarity Settings**

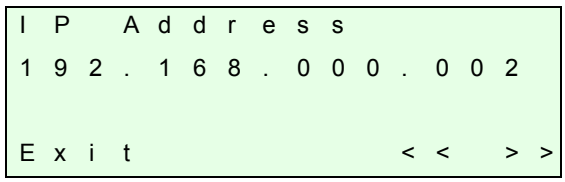
| Signal | Connector | Polarity Set to STD | Polarity Set to INV |
|---|---|---|---|
| Ready Out | Facilities, pin 13 | An open collector grounded output when the radio is ready to transmit and no BIT faults are detected. | An open collector high impedance output when the radio is ready to transmit and no BIT faults are detected. |
| E-BIT In | Facilities, pin 2 | TTL input. 0 V indicates an external fault. | TTL input. 5 V indicates an external fault. |
| External VSWR Input | Facilities, pin 4 | TTL input. 0 V active. | TTL input. 5 V active. |

## IP (Ethernet) Settings Screen

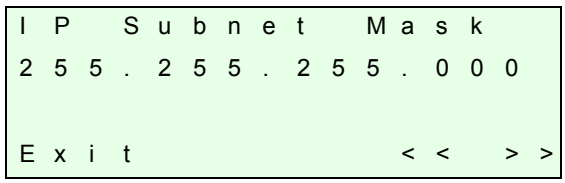
The IP (Ethernet) screen is accessed from the Settings screen.



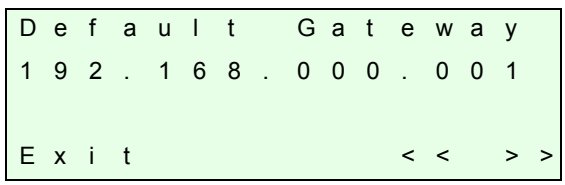

Dynamic host configuration protocol On or Off.



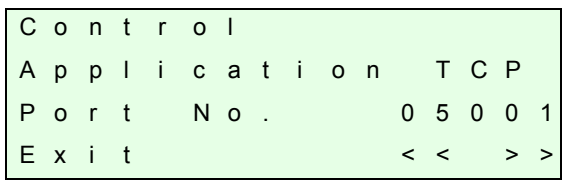

Range: 000.000.000.000 to 255.255.255.255



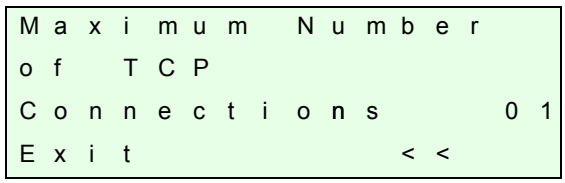

Range: 000.000.000.000 to 255.255.255.255



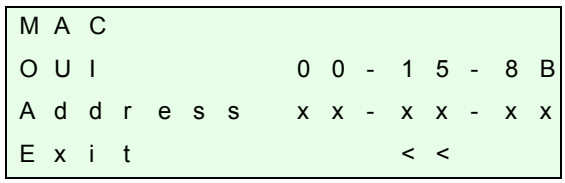

Range: 000.000.000.000 to 255.255.255.255




Range: 00000 to 65535



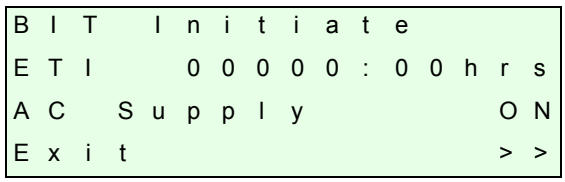

Range: 00 to 07



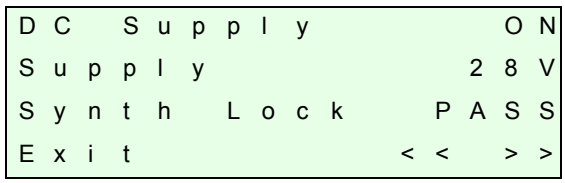

The MAC address is configured during manufacture, replacing xx-xx-xx.

## AM-Voice BIT Screen

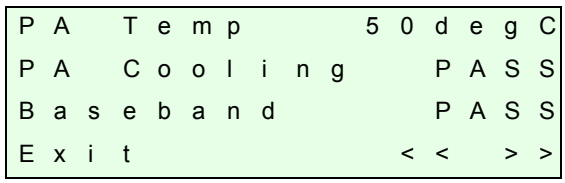
The AM-voice BIT screen is accessed from the Control screen.



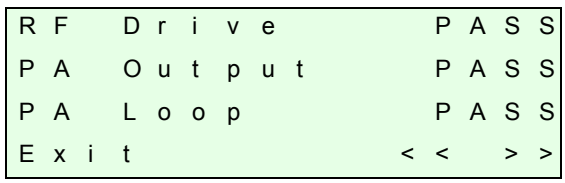

Select to initiate BIT test.
Shows elapsed time 0:00 to 99999:59 (Hrs:Min).
Shows state of ac supply (On or Off).



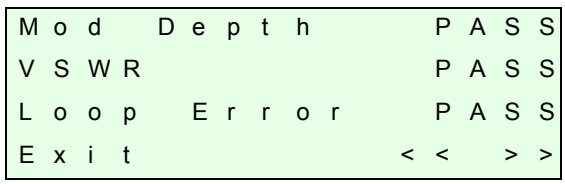

Shows state of dc supply (On or Off).
dc supply 0 to 40 V, <21.6 V Alert, <19 V Alarm.
Pass or Fail (Out-of-Lock).



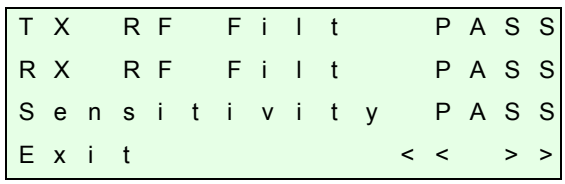

PA temperature -20°C to +150°C.
Pass or Fail.
Pass, Fail or ? (Not Tested).



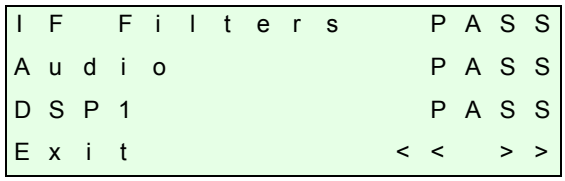

Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).



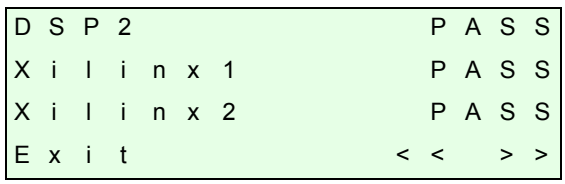

Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).
Pass or Fail.



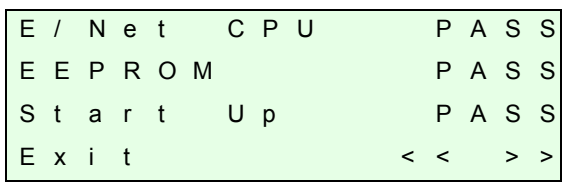

Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).



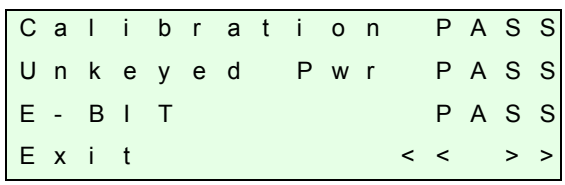

Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).



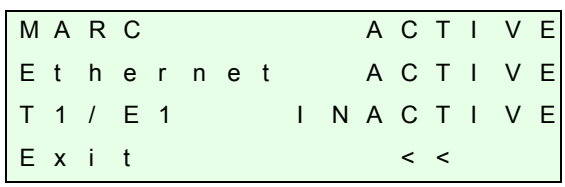

Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).



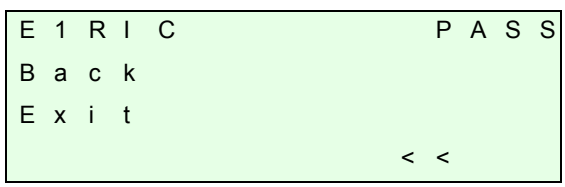

Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).




Pass or Fail.
Pass or Fail.
Pass or Fail.




Active or Inactive.
Active or Inactive.
Active or Inactive.




Pass or Fail.

Notes:

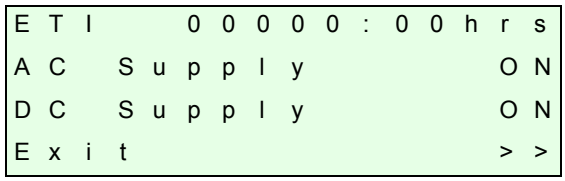
(1) When a transceiver has been powered up without an T1/E1 connection, T1/E1 displays Inactive and E1-RIC displays Pass, as shown above.

(2) When a transceiver is connected to an operational E1-RIC, T1/E1 displays Active and E1-RIC displays Pass.

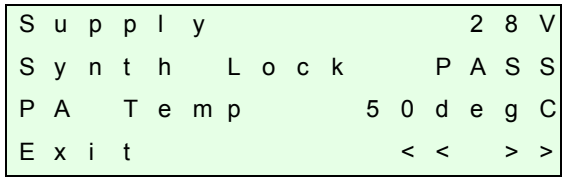
(3) If a connected E1-RIC fails or is disconnected, T1/E1 displays Inactive and E1-RIC displays Fail.

## VDL Mode 2 BIT Screen (Optional)

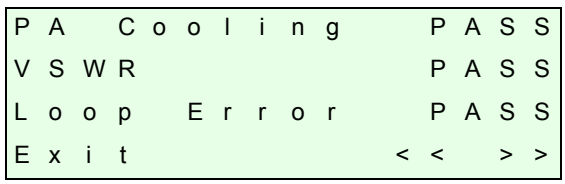
The VDL Mode 2 BIT screen is accessed from the Control screen.



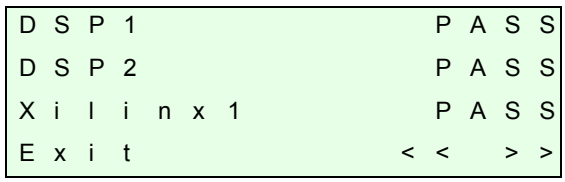

Shows elapsed time 0:00 to 99999:59 (Hrs:Min).
Shows state of ac supply (On or Off).
Shows state of dc supply (On or Off).



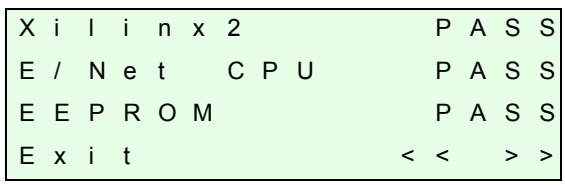

Shows value of dc supply.
Pass or Fail (Out-of-Lock).
Indicates the PA temperature.



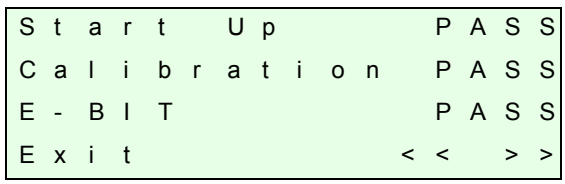

Pass or Fail.
Pass, Fail or ? (Not Tested).
Pass or Fail.



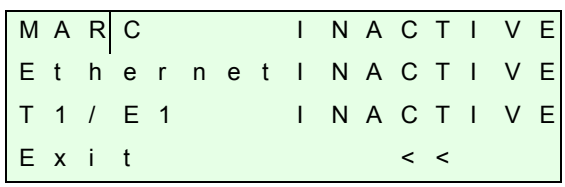

Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).




Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).
Pass, Fail or ? (Not Tested).



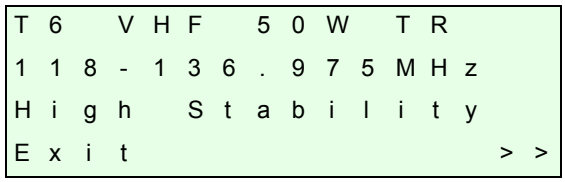

Pass, Fail or ? (Not Tested).
Pass or Fail.
Pass or Fail.



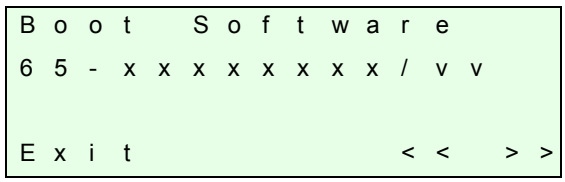

Active or Inactive.
Active or Inactive.
Active or Inactive.

## Software Configuration Screen

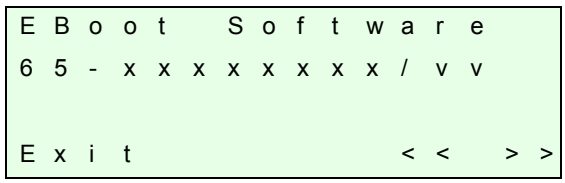
The Software Configuration screen is accessed from the Control screen.



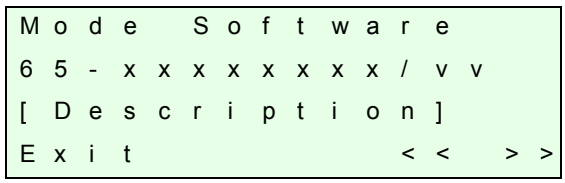

Second line variation for WB radios reads 112 to 155.975 MHz.
Third line can be blank.



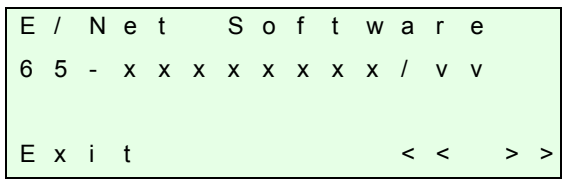

65-xxxxxxxx represents the software part number and /v v represents its version.



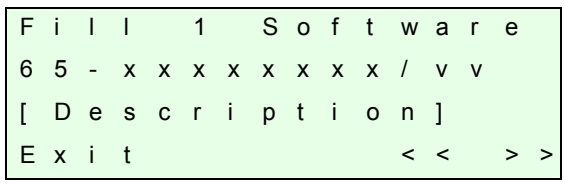

65-xxxxxxxx represents the software part number and /v v represents its version.




Current mode running. 65-xxxxxxxx represents the software part number and /v v represents its version.




65-xxxxxxxx represents the software part number and /v v represents its version.



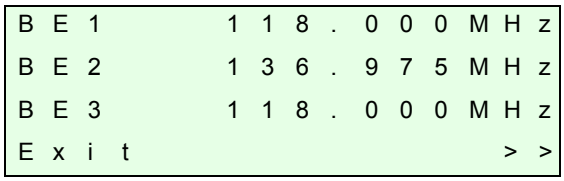

65-xxxxxxxx represents the software part number and /v v represents its version.

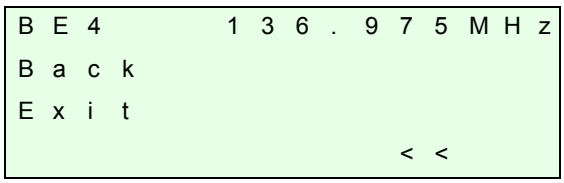
The transmitter has four software fills. Fills 2, 3 and 4 screens are the same format as this example shown for Fill 1.

## Band Edges

The frequency range of the transceiver is 118 to 136.975 MHz for the B6550/IP/NB/50 version, or 112 to 155.975 MHz for the B6550/IP/WB/50 version.

If required, operation can be limited to either one or two smaller parts of the frequency band by setting the band edges BE1 to BE4. Operation is possible between BE1 and BE2 frequencies, and frequencies between BE3 and BE4.




The Band Edge screen is accessed from the Control screen.

Band edge frequencies can be set only in increments of 25 kHz.

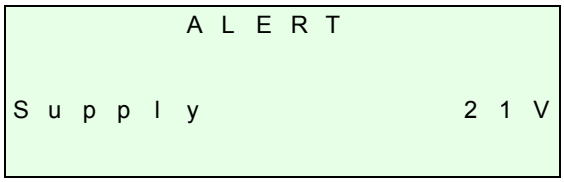
If the transceiver is required to operate over the full range, the band edge parameters must be set to the lowest and highest values in the range (see Table 3-10).

**Table 3-10 Band Edge Values**

| | BE1 | BE2 | BE3 | BE4 |
|---|---|---|---|---|
| B6550/IP/NB/50 set so that operation is over the full frequency range. | 118.000 | 136.975 | 118.000 | 136.975 |
| B6550/IP/WB/50 set so that operation is over the full frequency range. | 112.000 | 155.975 | 112.000 | 155.975 |
| *Example*: Transceiver set to transmit and receive only those frequencies in the range 120 to 130 MHz. | 120.000 | 130.000 | 120.000 | 130.000 |
| *Example*: Transceiver set to transmit and receive only those frequencies in the ranges 120 to 125 MHz and 130 to 135 MHz. | 120.000 | 125.000 | 130.000 | 135.000 |

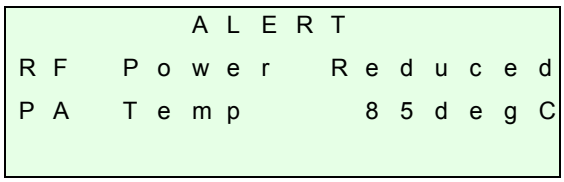
## BIT Status Warning Screen

The following shows some example BIT screens. These screens alternate with the Main screen when an alert or alarm condition is present. Only the parameters causing the alert or alarm are displayed, and if both an alert and alarm condition exists simultaneously only the alarm information is displayed. If multiple parameters are signalling an alert or alarm condition, multiple screens are used to display the status alternating with the Main screen.



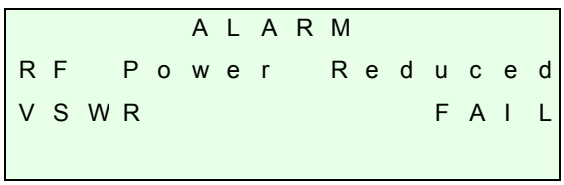

**Alert:**

There is no RF power reduction. The Alarm indicator is flashing.



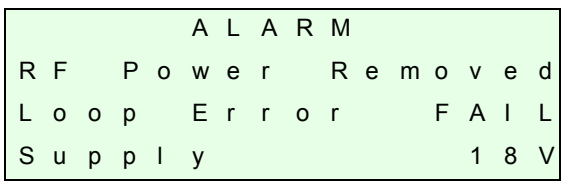

**Alert:**

The RF output power is reduced by 3 dB. The Alarm indicator is flashing.



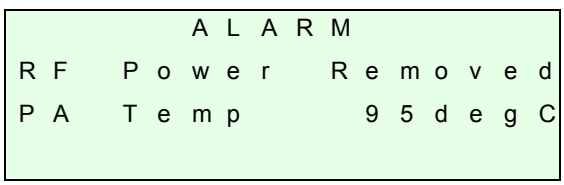

**Alarm:**

The RF output power is reduced by more than 3 dB. The Alarm indicator is lit.




**Alarm:**

The RF output power is shut down. The Alarm indicator is lit.




**Alarm:**

The RF output power is shut down. The Alarm indicator is lit.

**Table 3-11 Functions and Parameters**

| Function | Front Panel | VFP | MARC | T6 Controller | E1 | IP | Default Setting |
|---|---|---|---|---|---|---|---|
| **FREQUENCY** | | | | | | | |
| Change frequency | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | 118.000 MHz |
| **FREQUENCY CHANNELS** | | | | | | | |
| Store/Recall preset frequency channels | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | - |
| **SETTINGS** | | | | | | | |
| Set RF output power | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | 50 W |
| Set modulation mode | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | AM-voice |
| **Radio Settings (AM-Voice)** | | | | | | | |
| Set audio input line level | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | -13 dBm |
| Set audio output line level | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | -13 dBm |
| Set inhibit on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | Off |
| PTT test facility on (key) or off (de-key) | ✔ | ✔ | View state | ✗ | ✗ | View state | Off |
| Set Tx time out | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | 180 s |
| Set modulation depth | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | 85% |
| Set mute on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | On |
| Set VOGAD on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | On |
| Set antenna C/O delay on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | On |
| Set offset carrier | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | 0 (No offset) |
| Set offset carrier filter | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | Off |
| Squelch level | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | -107 dBm |
| RF pre-attenuator on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | Off |
| Set squelch defeat on or off | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Off |
| Set squelch noise compensation on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | On |
| Set squelch carrier override on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | Off |
| Audio AGC on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | On |

**Table 3-11 Functions and Parameters (continued)**

| Function | Front Panel | VFP | MARC | T6 Controller | E1 | IP | Default Setting |
|---|---|---|---|---|---|---|---|
| Loudspeaker on or off | ✔ | ✔ | View state | ✗ | View state | ✗ | On |
| Set frequency step size | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | 25 kHz |
| Set microphone type (active or passive) | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | Passive |
| Set keying priority (local or remote) | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | Local-Remote |
| Enable or disable local PTT | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | Enabled |
| Enable or disable remote PTT | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | Enabled |
| Enable or disable remote phantom PTT | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | Enabled |
| Self-receive (transmit audio on line output) | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | Off |
| Set high signal quality parameter (SQP) level | ✔ | ✗ | ✗ | ✗ | ✗ | ✗ | -80 dBm |
| Set tone signalling on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✗ | Off |
| Set PTT confirm on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✗ | On |
| **Radio Settings (Ethernet)** | | | | | | | |
| DHCP on or off | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | Off |
| IP address | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | 000.000.000.000 |
| IP subnet mask | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | 255.255.255.000 |
| IP default gateway | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | 000.000.000.000 |
| TCP port number | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | 05001 |
| Maximum number of TCP connections | ✔ | ✔ | ✔ | ✗ | ✔ | ✔ | 01 |
| **Radio Settings (VDL Mode 2)** | | | | | | | |
| MAC TM1 (inter access delay) | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | 4.5 ms |
| MAC TM2 (channel busy) | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | 60 s |
| MAC p (persistence) | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | 13/256 |
| MAC M1 (maximum number of access attempts) | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | 135 |
| Scramble vector | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | 4D4B (hex)<br>19787 (dec) |
| Tx enable | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | On |

**Table 3-11 Functions and Parameters (continued)**

| Function | Front Panel | VFP | MARC | T6 Controller | E1 | IP | Default Setting |
|---|---|---|---|---|---|---|---|
| Loop back | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | On |
| Set Reed Solomon decoding on or off | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | On |
| Set address filtering on or off | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | Off |
| **Polarities** | | | | | | | |
| Ready out | ✔ | ✔ | View state | ✗ | ✗ | View state | STD |
| Set PTT input polarity (AM-voice only) | ✔ | ✔ | View state | ✗ | ✗ | View state | STD |
| Set phantom PTT input polarity (AM-voice only) | ✔ | ✔ | View state | ✗ | ✗ | View state | STD |
| Set PTT reference voltage (AM-voice only) | ✔ | ✔ | View state | ✗ | ✗ | View state | +14 V |
| Set PTT output polarity (AM-voice only) | ✔ | ✔ | View state | ✗ | ✗ | View state | STD |
| Set fast PTT antenna change-over output polarity (AM-voice only) | ✔ | ✔ | View state | ✗ | ✗ | View state | STD |
| Set external VSWR input polarity | ✔ | ✔ | View state | ✗ | ✗ | View state | STD |
| Set inhibit input polarity (AM-voice only) | ✔ | ✔ | View state | ✗ | ✗ | View state | STD |
| BIT interruptive test input polarity (AM-voice only) | ✔ | ✔ | View state | ✗ | ✗ | View state | STD (active low) |
| E-bit input polarity | ✔ | ✔ | View state | ✗ | View state | ✗ | STD (active low) |
| Squelch output polarity at the MARC connector | ✔ | ✔ | View state | ✗ | ✗ | View state | STD (normally open) |
| Squelch output polarity at the Facilities connector | ✔ | ✔ | View state | ✗ | ✗ | View state | STD (normally open) |
| Phantom squelch output polarity | ✔ | ✔ | View state | ✗ | ✗ | View state | STD (normally open) |
| Squelch defeat input polarity | ✔ | ✔ | View state | ✗ | ✗ | View state | STD |

**Table 3-11 Functions and Parameters (continued)**

| Function | Front Panel | VFP | MARC | T6 Controller | E1 | IP | Default Setting |
|---|---|---|---|---|---|---|---|
| **Band Edges** | | | | | | | |
| Set band edges | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | 118.000 and 136.975 MHz or 112.000 and 155.975 MHz |
| **Reference Frequency** | | | | | | | |
| Adjust transceiver's reference frequency | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | - |
| **LCD Backlight** | | | | | | | |
| Adjust LCD backlight | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | 30 s |
| **BIT** | | | | | | | |
| Initiate BIT interruptive test | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | - |
| **STANDBY** | | | | | | | |
| Enter and exit standby facility | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | Not in Standby |
| **SOFTWARE CONFIGURATION** | | | | | | | |
| View the transceiver's software configuration | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | - |
| **LOCK FACILITIES** | | | | | | | |
| Front panel lock | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | Off |
| MARC lock | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | Off |
| E1 lock | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | Off |
| IP lock | ✗ | ✔ | ✗ | ✗ | ✗ | ✗ | Off |

## SNMP Interface

The T6 Ethernet interface provides management ports using Simple Network Management Protocol (SNMP) as per the requirements of ED-137B Part 5. The ports are:

- Port 161 for read/write operations
- Port 162 for trap monitoring.

For integration into an SNMP system, a MIB (Management Information Base) is provided on the user documentation CD that is supplied with each radio.

Authority to access the SNMP system is performed by a community string. The community strings are “public” for read and “private” for writes, the community string for traps is “public”.

## VoIP Configurator Application

The optional VoIP Configurator Application (VCA) software supplied on CD is compatible with any PC or laptop running Windows XP™, Windows Vista™ or Windows 7™. The user interface for this application is similar to the VFP. It allows the user to retrieve, save and load VoIP settings. Once these attributes and values are visible it is possible to edit parameters and update the radio. The user documentation on the CD provides instructions for its use.

Intentionally Blank

# Installation

# Warnings and Cautions

**WARNING**  **Dangerous Voltage**

**The instructions given in this topic involve connecting dangerous voltage to the transceiver and should be carried out only by suitably qualified personnel.**

**WARNING**  **Dangerous Voltage**

**The equipment is permanently connected to the mains supply when the mains connector is attached. Switching the rear panel Supply switch to Standby does not isolate all internal circuits from the mains supply. For this reason, a mains isolating switch should be fitted close to, and easily accessible from, the transceiver's position. The isolation switch should isolate both live and neutral supplies, be clearly labelled, and adequately rated to protect the equipment.**

**WARNING**  **Antenna Radiation**

**The transmit antenna must be installed such that the resultant radiated field strength is below national limits, see "Annex" for limits and examples. The safe distance will need to be calculated for each installation.**

**WARNING**  **ESDs**

**The T6TR transceiver's circuitry contains Electrostatic Sensitive Devices (ESDs). Personnel must be aware of the precautions necessary to prevent damage to such devices. During installation all precautions necessary to prevent ESD damage must be taken.**

**Caution**  **Unauthorized Modifications**

**Changes or modifications made to this equipment that are not expressly approved by Northrop Grumman, or parties authorized by Northrop Grumman, could void the user's authority to operate the equipment.**

# Introduction

The procedures necessary to install a transceiver are listed in Table 4-1.

**Table 4-1 Installation Procedures**

| Procedure | | Reference |
|---|---|---|
| 1 | Read and understand the warnings and cautions given on page 4-2. | |
| 2 | Perform an initial inspection of the transceiver and fit the correct ac input fuse. | page 4-12 |
| 3 | Setting the required antenna configuration. | page 4-13 |
| 4 | Fit the transceiver into an equipment cabinet (if required). | page 4-15 |
| 5 | Make external signal connections. See Fig 4-1 to Fig 4-5 to determine which external connections are required for the particular configuration. | page 4-16 |
| 6 | Connect the chassis stud to the cabinet or system earth. | page 4-28 |
| 7 | Connect the antenna(s). | page 4-28 |
| 8 | Connect the dc input supply (if required). | page 4-29 |
| 9 | Connect the ac input supply (if required). | page 4-30 |

## Fuses and Connectors

The following list details the radio's supply fuses and connectors. Some of the connectors (depending on your particular configuration) are required during installation.

**Table 4-2 Fuses and Connectors**

| Component | Type | Park Air Part Number |
|---|---|---|
| **Fuses:** | | |
| AC input fuse, F2, for 110 to 120 Vac input<br>AC input fuse, F2, for 220 to 230 Vac input | T4A, 125V, UL<br>T4A, 250V, IEC | 29C11120102S<br>29E01120108S |
| DC input fuse, F1 | 15A size 0 | 29-01350201 |
| **Connectors:** | | |
| AC supply connector | IEC | 20-02030102S |
| DC supply connector | XLR3 socket | 20-01030106 |
| Antenna connector | N-type plug | 19-01030301 |
| MARC connector | 9-way D-type plug | Plug: 20-01090100<br>Cover: 20-09090101 |
| MARC Audio connector | RJ45 plug | 20K01080100 |
| MARC Data connector | RJ45 plug | 20K01080100 |
| Facilities connector | 15-way D-type plug | Plug: 20-01150100<br>Cover: 20D09150101 |
| IP connector | RJ45 plug | 20K01080100 |
| T1/E1 connector | RJ45 plug | 20K01080100 |
| Reference connector | BNC to SMB 2 metre long lead | 17K11000004 |
| Headset/Microphone/Diagnostics connector | 7-pin DIN plug | 20-01070101 |

## Configuration

Connection of external equipment depends on the configuration required. Possible configurations are:

- T6TR transceiver configured for local operation (see Fig 4-1)
- T6TR transceiver configured for remote operation (see Fig 4-2)
- T6TR transceiver configured for use with an RSE2 (see Fig 4-3 and Fig 4-4)
- T6TR transceiver configured for use with an E1-RIC (see Fig 4-5)
- T6TR transceiver configured for Ethernet operation (see Fig 4-6).

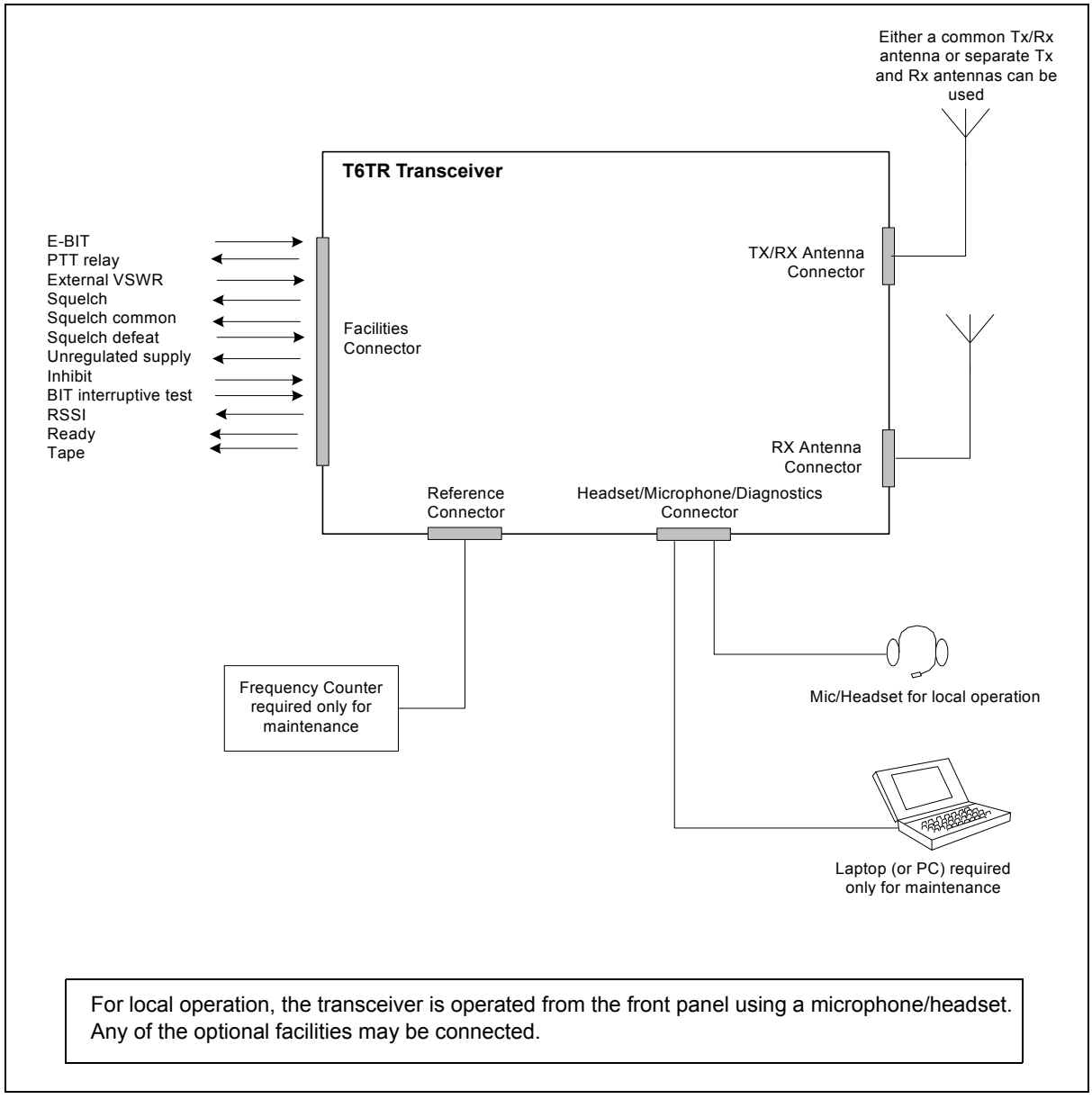
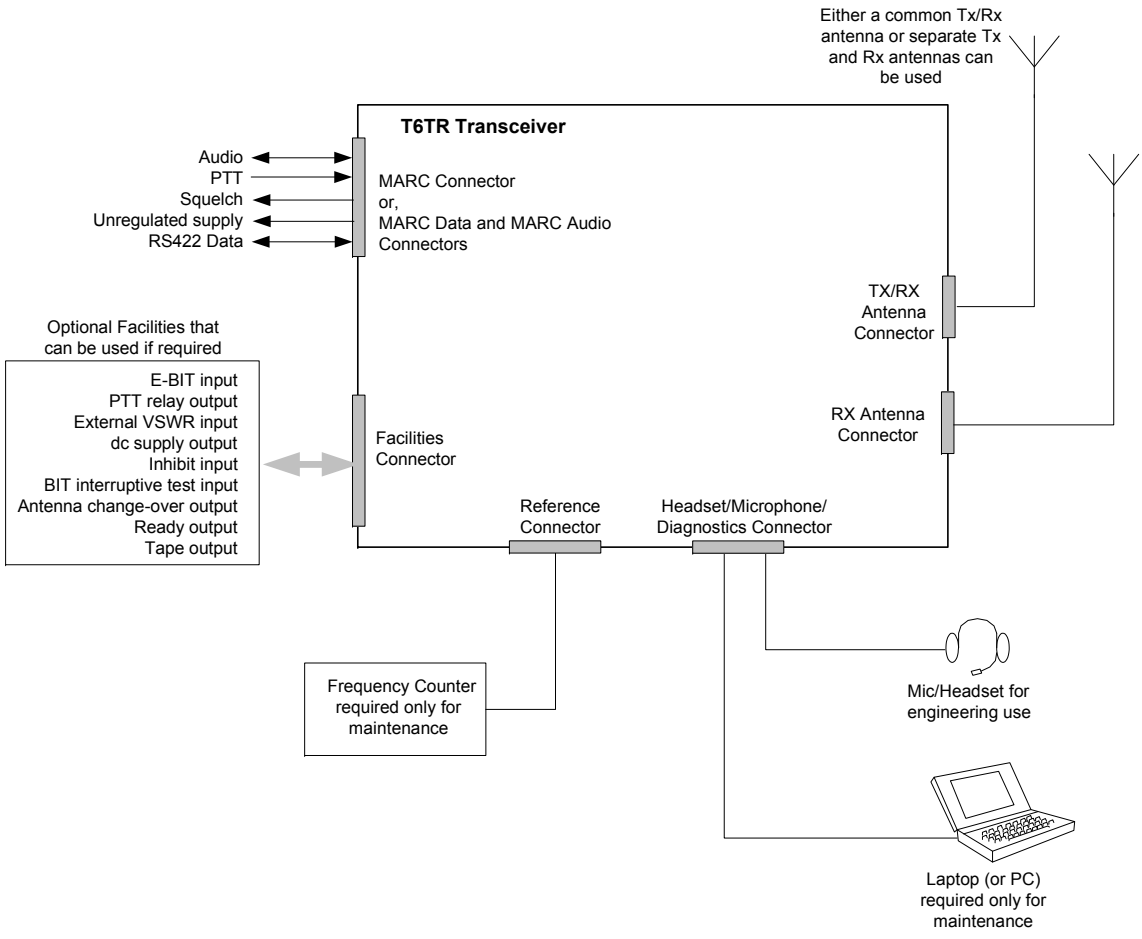



**Fig 4-1 T6TR Transceiver Configured for Local Operation**




For remote operation, audio, Squelch and PTT signals to and from the control equipment terminate on the MARC Audio connector. If data is required by a compatible data system, the RS422 data lines terminate on the MARC connector, or alternatively on the MARC Data connector. Any of the optional facilities may be used.

**Fig 4-2 T6TR Transceiver Configured for Remote Operation**

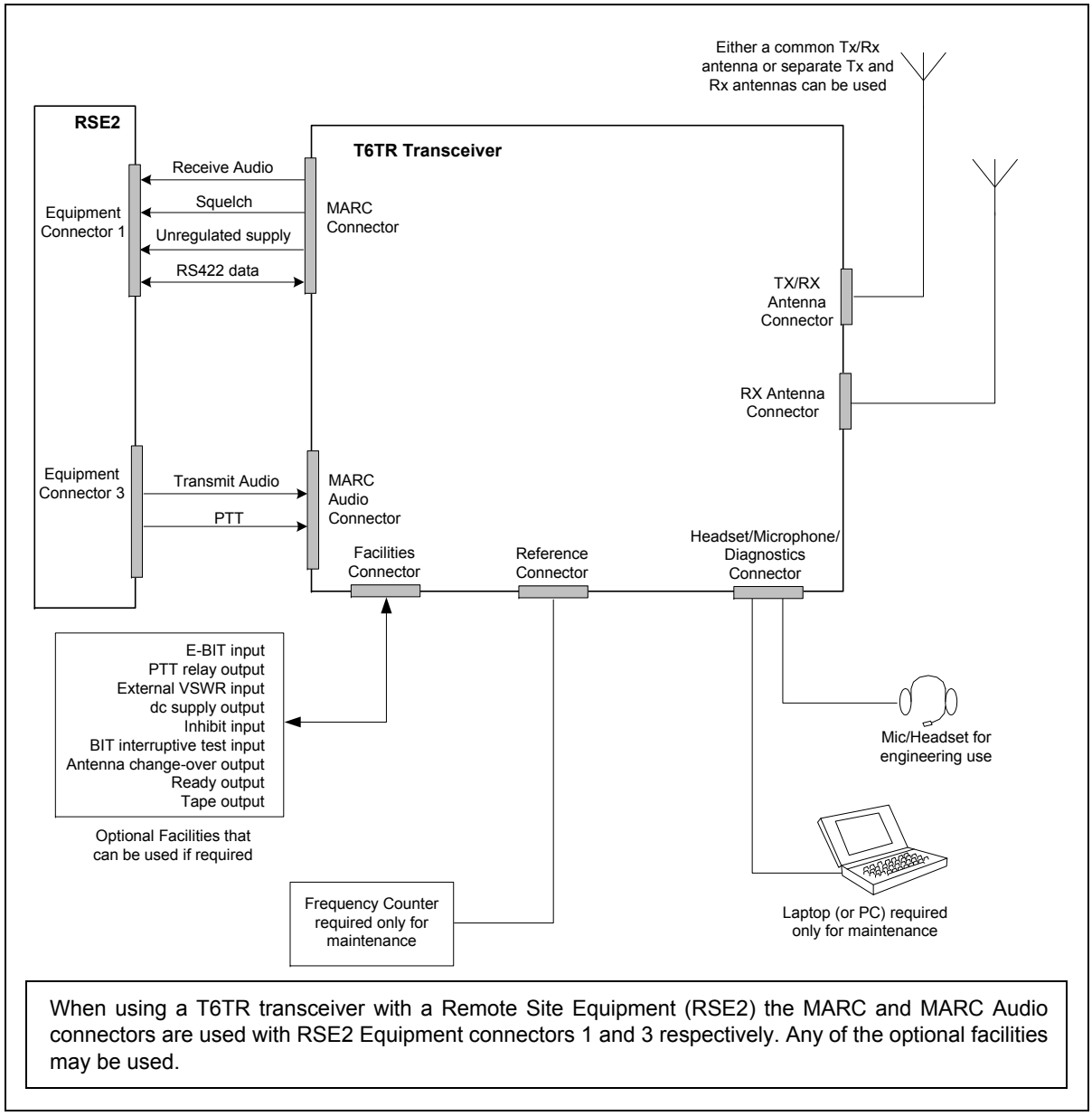
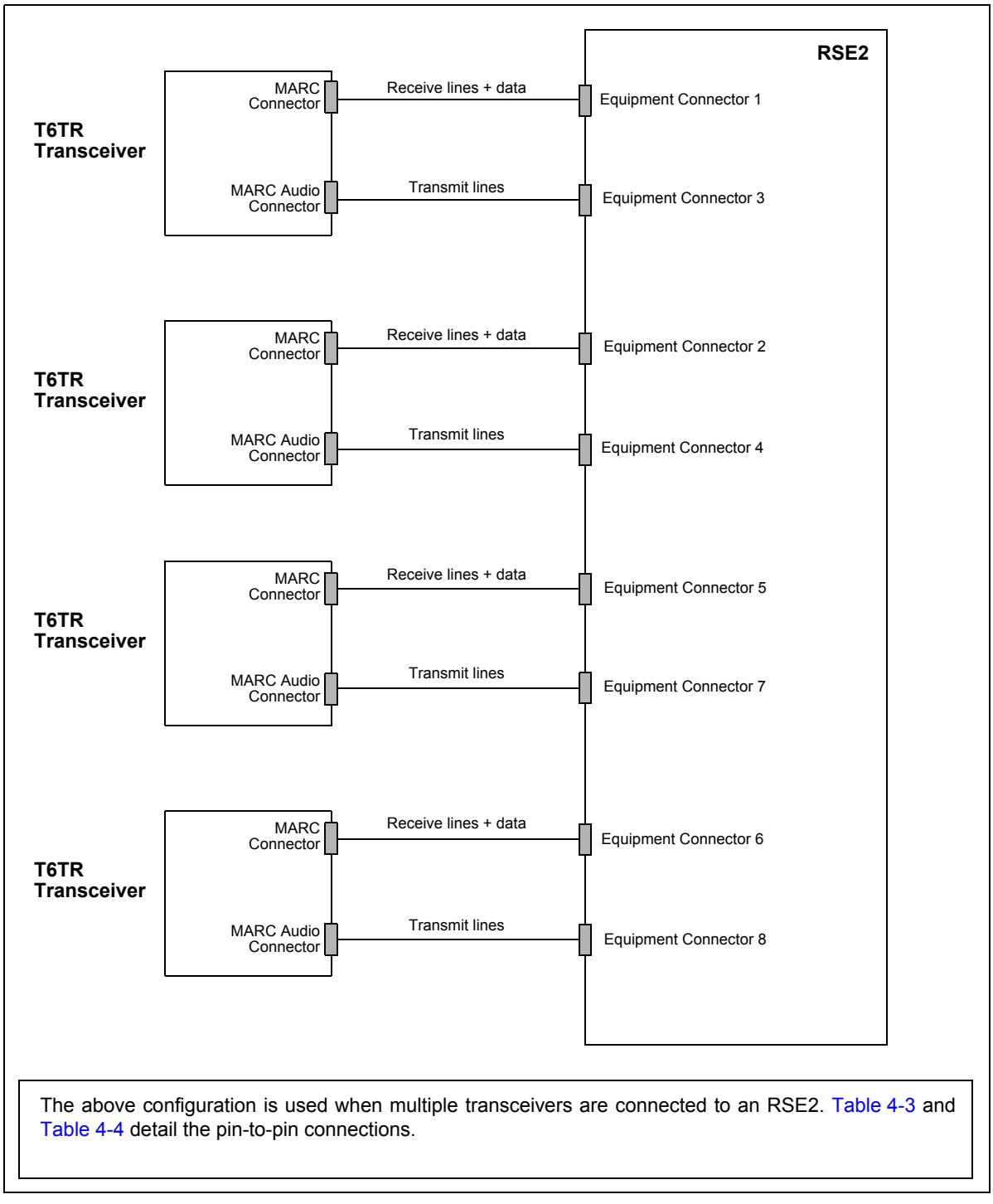



**Fig 4-3 T6TR Transceiver Configured for use with an RSE2**




The above configuration is used when multiple transceivers are connected to an RSE2. Table 4-3 and Table 4-4 detail the pin-to-pin connections.

**Fig 4-4 Multiple Transceivers Connected to an RSE2**

**Table 4-3 Transceiver to RSE2 Equipment Connector 1, 2, 5 or 6**

| Transceiver MARC Connector Pin Number | Signal at Transceiver | | Signal at RSE2 | RSE2 Equipment Connector Pin Number |
|---|---|---|---|---|
| 1 | Ground | | Ground | 1 |
| 2 | Audio line out (+) | | Audio line L1 | 2 |
| 3 | Audio line out (-) | | Audio line L2 | 3 |
| 4 | Squelch indication | | Mute indication | 4 |
| 5 | Unregulated supply output | | Unregulated supply input | 5 |
| 6 | Data in (+) | | Data out (+) | 6 |
| 7 | Data in (-) | | Data out (-) | 7 |
| 8 | Data out (+) | | Data in (+) | 8 |
| 9 | Data out (-) | | Data in (-) | 9 |

**Table 4-4 Transceiver to RSE2 Equipment Connector 3, 4, 7 or 8**

| Transceiver MARC Audio Connector Pin Number | Signal at Transceiver | | Signal at RSE2 | RSE2 Equipment Connector Pin Number |
|---|---|---|---|---|
| 7 | Ground | | Ground | 1 |
| 4 | Audio line in (+) | | Audio line L1 | 2 |
| 5 | Audio line in (-) | | Audio line L2 | 3 |
| 8 | PTT | | PTT | 4 |

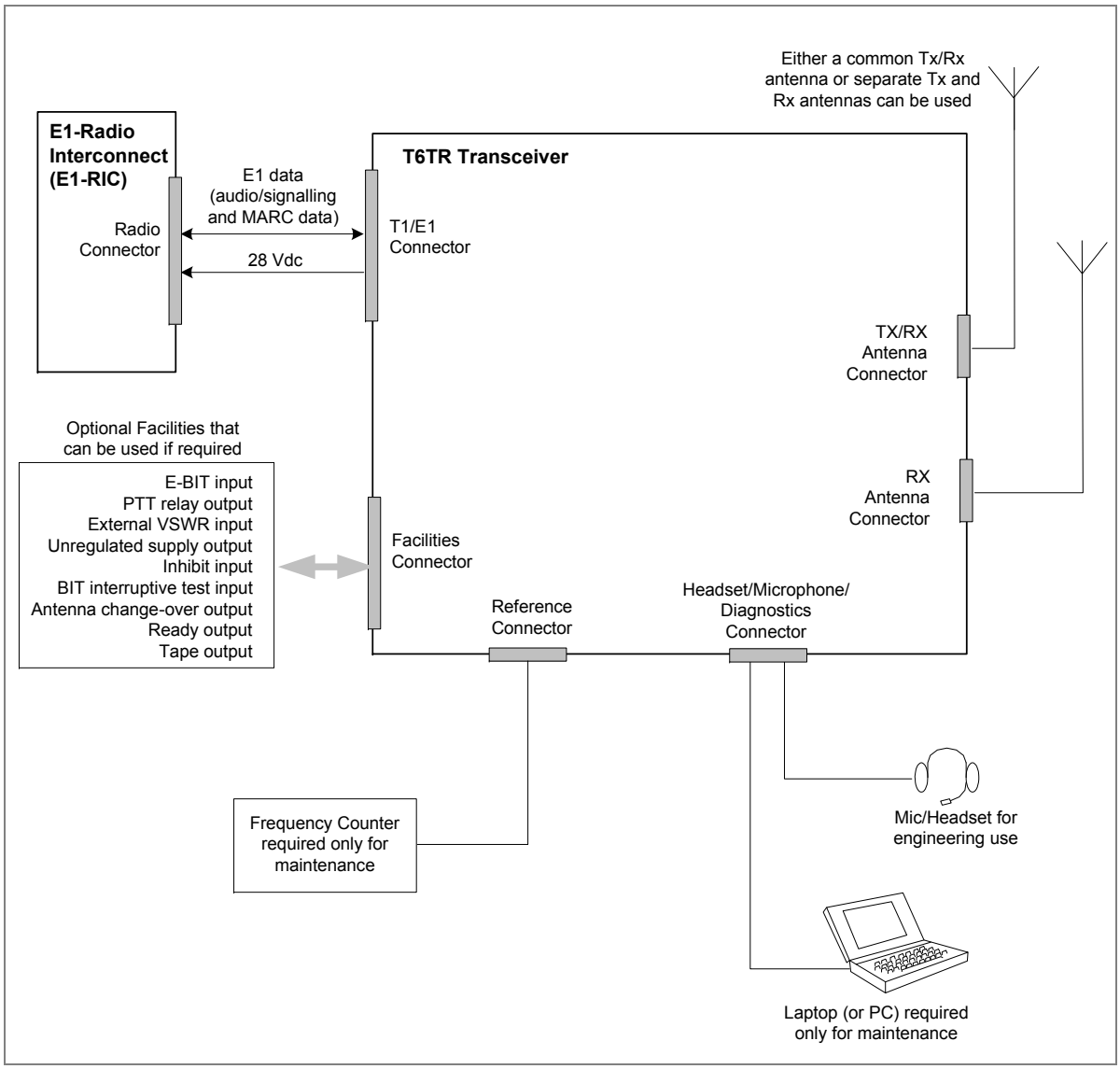



**Fig 4-5 T6TR Transceiver Configured for use with an E1-RIC**

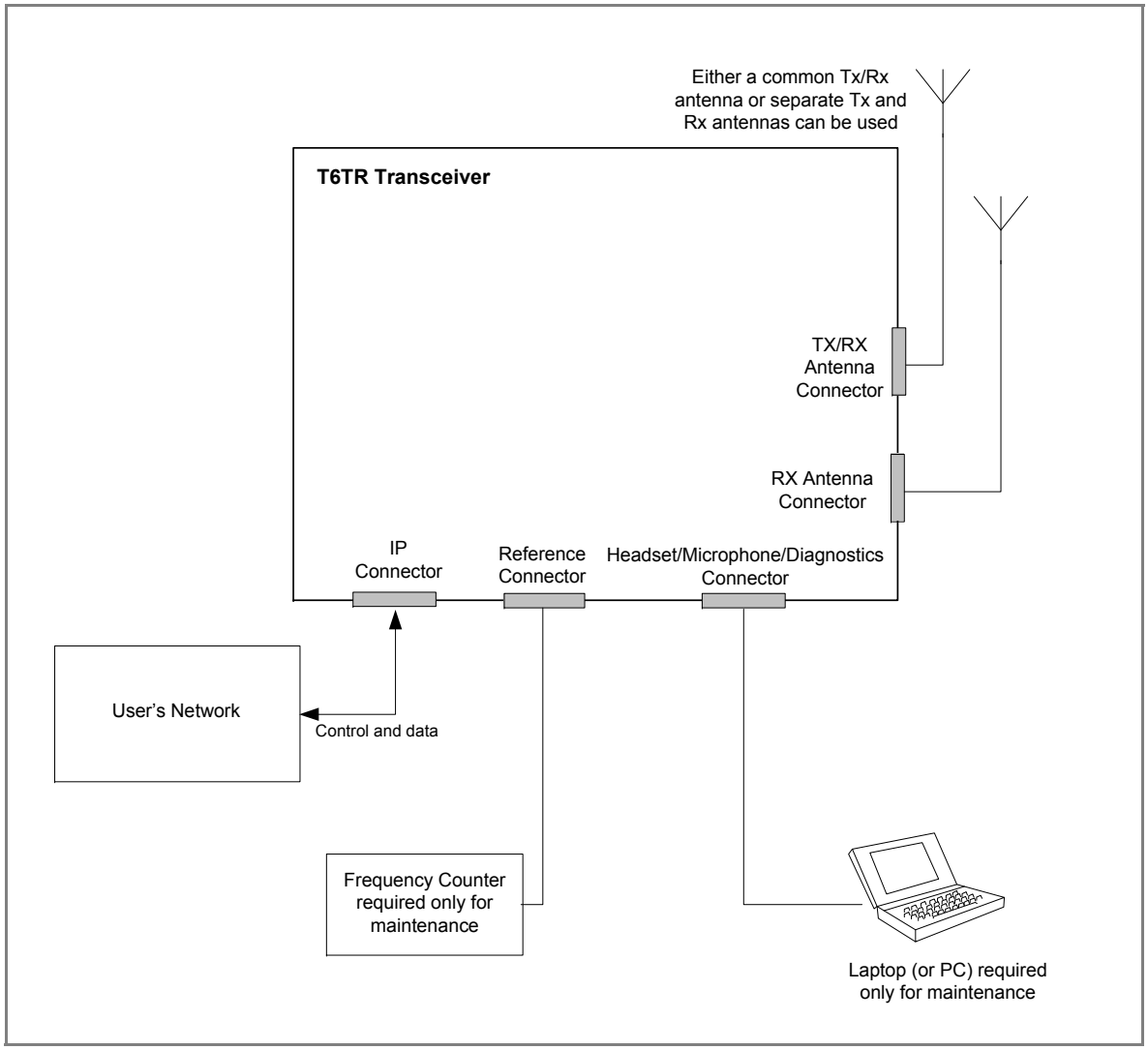



**Fig 4-6 T6TR Transceiver Configured for Ethernet Operation**

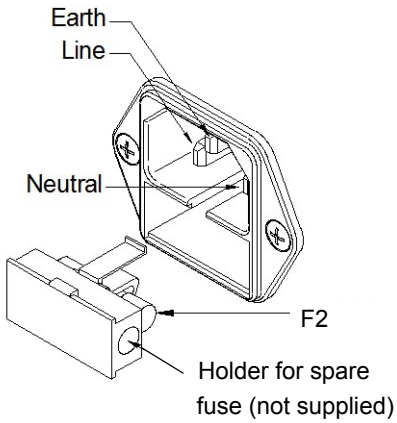
# Installation Procedures

## Initial Inspection of the Transceiver

On receipt of the transceiver, remove all transit packaging and check that there is no damage. If damage is evident, contact Northrop Grumman immediately and retain the original transit packaging. One copy of the T6 User Documentation CD is normally supplied with the transceiver.

### Fitting the Correct AC Input Fuse

The mains input fuse F2 is an integral part of the rear panel ac connector. The fuse type must be correct for the local mains supply as detailed below.




For a mains input in the range 110 to 120 Vac, fuse F2 should be rated T4A, 125V, UL.

For a mains input in the range 220 to 230 Vac, fuse F2 should be rated T4A, 250V, IEC.

### Setting the Required Antenna Configuration

The transceiver can be operated using a single antenna, or separate transmit and receive antennas (see Fig 4-7. For single antenna operation, the antenna's feeder cable is connected to the rear panel TX/RX antenna connector. For separate antenna operation, the receive feeder cable is connected to the RX antenna connector and the transmit feeder cable is connected to the TX/RX antenna connector.

Internal RF cables must be correctly positioned to suit the required configuration. This is normally carried out at Northrop Grumman prior to shipment but can be changed as required.

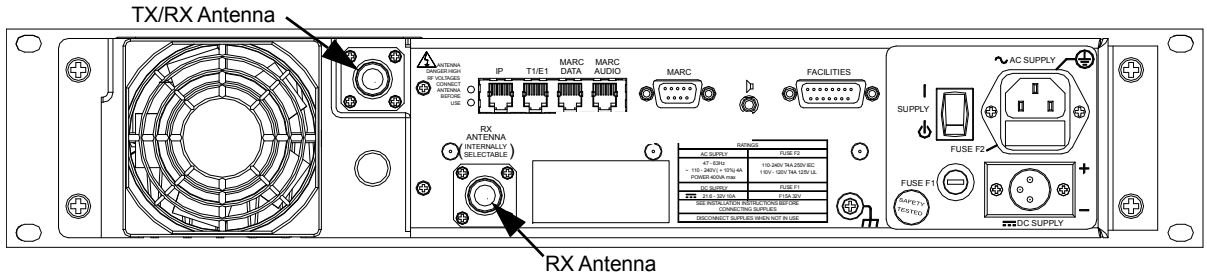



**Fig 4-7 Antenna Connectors**

### Changing the Antenna Configuration

**WARNING** **Dangerous Voltage**

**When the Supply switch is set to the Standby position, dangerous voltage is still present in the transceiver's internal power supply circuitry. To ensure safe working, the transceiver must be isolated from the ac and dc input supplies.**

(1) Ensure that no input supplies are connected to the transceiver.

(2) Remove the 15 screws securing the transceiver's bottom cover.

(3) With the cover removed locate the PA Control/Rx RF module.

(4) Locate CN7 and CN12 on the PA Control/Rx RF module (see Fig 4-8).

(5) For single antenna configuration, connect the Rx antenna RF cable to CN12 (Park). Connect the adjacent RF cable from the PA module to CN7.

(6) For two antenna configuration, connect the Rx antenna RF cable to CN7. Connect the adjacent RF cable from the PA module to CN12 (Park).

(7) Replace the transceiver's bottom cover.

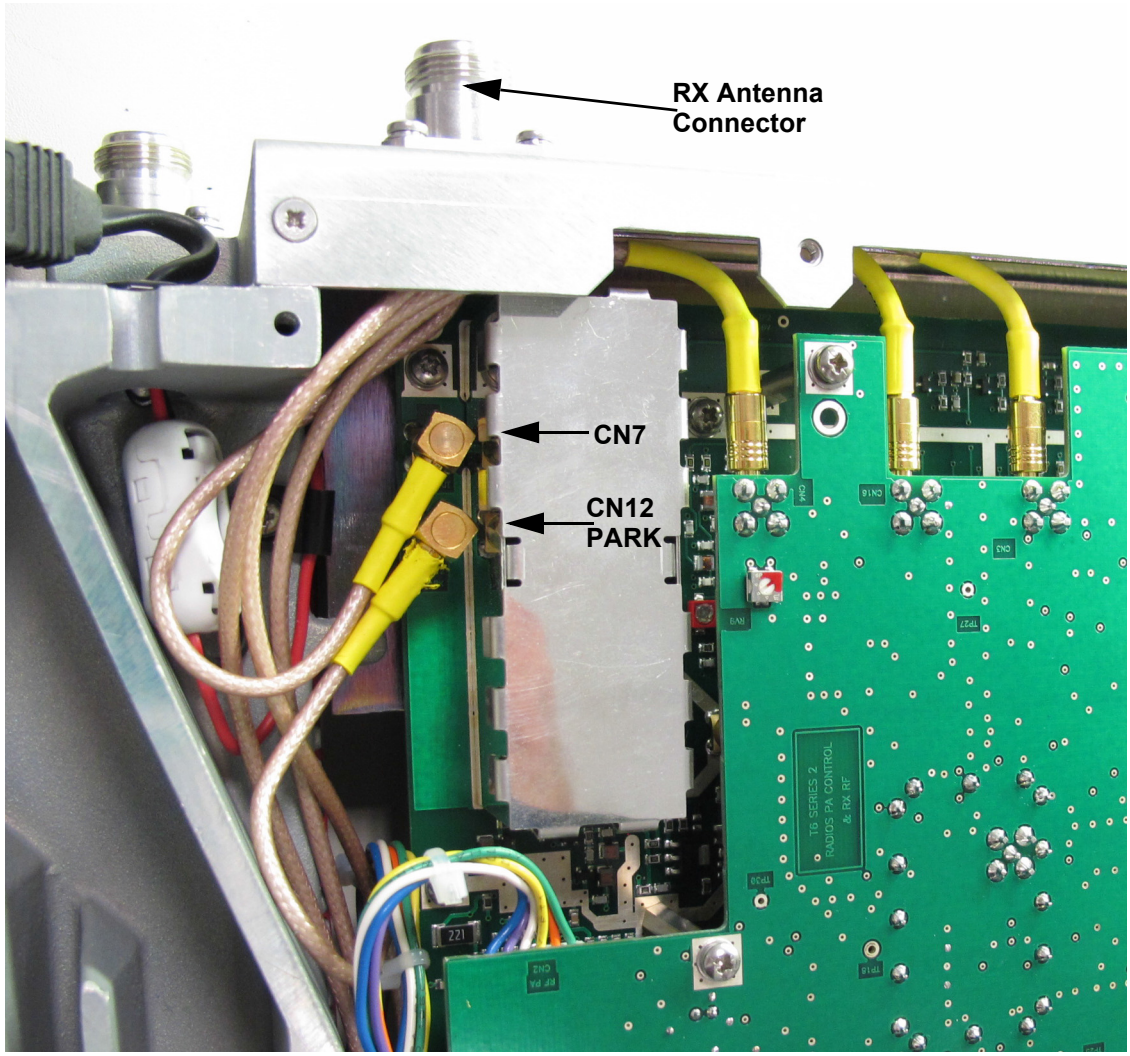



**Fig 4-8 Location of CN7 and CN12**

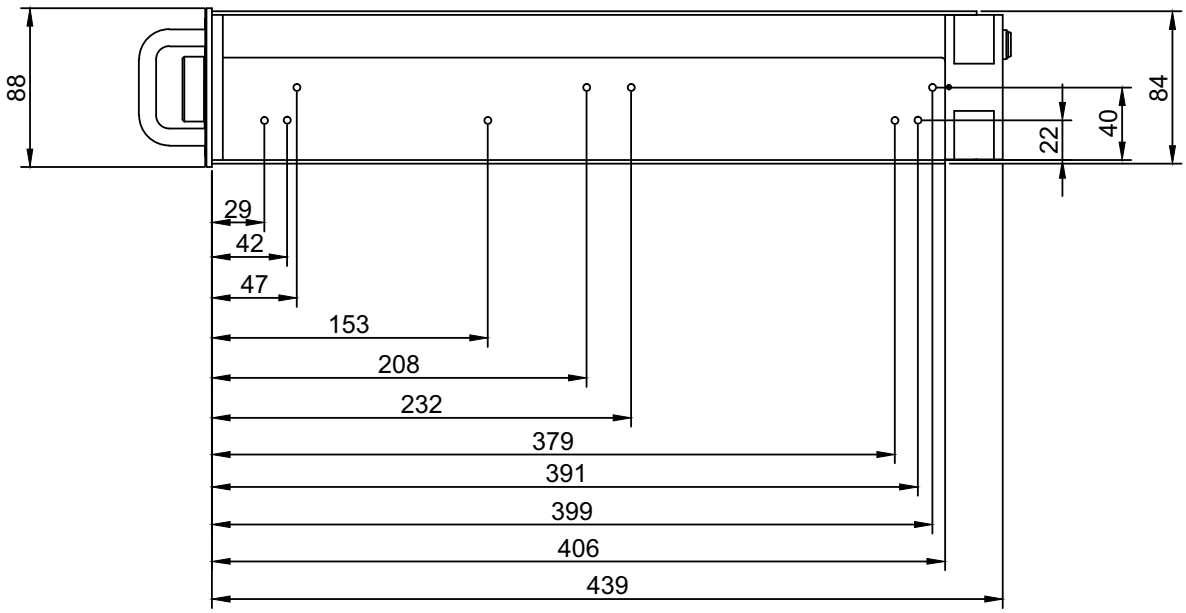
## Fitting a Radio into an Equipment Cabinet

**Caution** **Mechanical Support**

**It is essential that the chosen mechanical installation provides adequate support along the depth (front to rear) of the unit. The transceiver must not be supported by the front panel; doing so can cause damage.**

The transceiver can be installed on telescopic slides, or on fixed runners, within a standard 483 mm (19 inch) equipment cabinet. M4 tapped holes, each 10 mm deep (see Fig 4-9) are provided on each side of the equipment to accept the slides. Details of suitable telescopic slides and fixed runners are available from Northrop Grumman.

When fitted in the cabinet, the transceiver's front panel must be secured to the cabinet's chassis using four M6 x 16 mm screws and plastic washers.




All measurements in mm

**Fig 4-9 Slide Fittings**

## Make External Signal Connections

Making the external signal connections involves configuring the transceiver to suit its operational mode. Illustrations showing various configurations are shown in Fig 4-1 to Fig 4-5; these figures should be used only as a guide.

## Front Panel Connectors

The front panel has two connectors; Headset/Microphone/Diagnostics connector and Reference connector. These are illustrated in Fig 4-10.

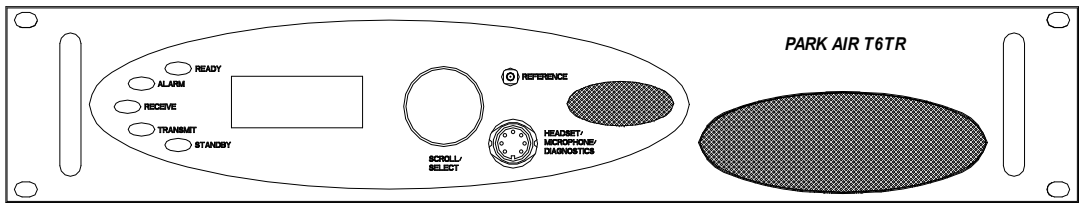
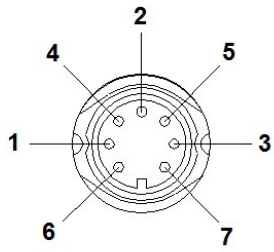



**Fig 4-10 Front Panel**

### Headset/Microphone/Diagnostics Connector

The Headset/Microphone/Diagnostics connector is a self-locking 7-way DIN socket used for connecting a microphone, microphone/headset, PC or laptop. The connector pin-out is shown below and detailed in Table 4-5.




Pin-out of the Headset/Microphone/Diagnostics connector looking into the mating face of the chassis mounted socket.

A suitable free plug is detailed in Table 4-2 on page 4-4.

**Table 4-5 Headset/Microphone/Diagnostics Connector**

| Pin Number | Signal | Characteristic | Usage |
|---|---|---|---|
| 1 | Microphone ground | 0 V. | Microphone/headset |
| 2 | Transmit data | RS232. 115200 baud, 8 data bits, 1 stop bit, no parity, no handshaking. | PC or laptop |
| 3 | Microphone PTT | 0 V to PTT. | Microphone/headset |
| 4 | Receive data | RS232. 115200 baud, 8 data bits, 1 stop bit, no parity, no handshaking. | PC or laptop |
| 5 | Sidetone/headset drive | The level is adjustable between 0 and 3 V peak-to-peak by using the volume control. | Microphone/headset |
| 6 | Microphone input | To ensure correct VOGAD operation, the following microphone input levels are required:<br>Passive setting: between 2 and 35 mV<br>Active setting: between 8 and 140 mV. | Microphone/headset |
| 7 | Ground | 0 V. | PC or laptop |

### Reference Connector

The Reference connector is an SMB plug used to monitor the radio's reference frequency. It monitors the frequency at a level of 100 mV (±50 mV) with less than -20 dBc harmonics.

## Rear Panel Connectors

The rear panel connectors are shown in Fig 4-11 and listed in Table 4-6. Select which connectors are going to be used and then make connections as required.

**Table 4-6 Rear Panel Connector Usage**

| Connector | Type | Usage |
|---|---|---|
| AC supply | IEC | Terminating the ac input supply. |
| DC supply | XLR 3-pin | Terminating the dc input supply. |
| Antenna | N-type | Terminating the antenna feeder coaxial cable. |
| External speaker | 3.5 mm stereo jack | Connects an external loudspeaker for monitoring sidetone. |
| MARC | 9-way D-type | Used to connect to a MARC remote site equipment.<br>Used to connect a T6 controller or hub.<br>Used to terminate remote receive audio and squelch signals when a remote site equipment or T6 controller is not used. |
| MARC Audio | RJ45 | Used to terminate remote transmit and receive audio, PTT and squelch signals. |
| MARC Data | RJ45 | Used as an alternative to the MARC connector for terminating data signals to and from a compatible data system. |
| Facilities | 15-way D-type | Provides a number of optional facilities that can be used as required. |
| T1/E1 | RJ45 | Used for connecting to a digital voice and data network. When AM is selected, the T1/E1 connector automatically functions as an E1 port. T1 is not supported by mode software. |
| IP | RJ45 | Used to connect to a 10/100 Base-T Ethernet network. |

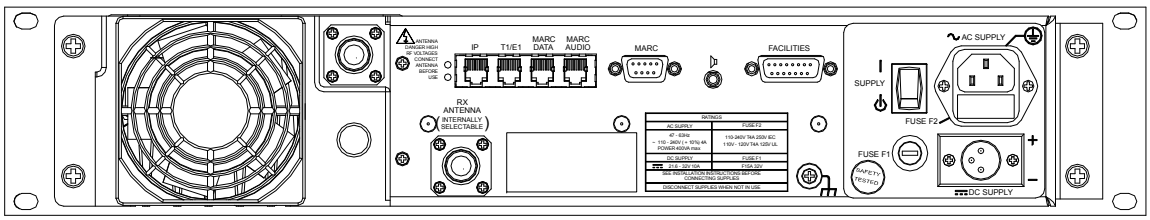


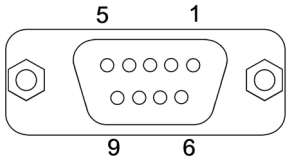

**Fig 4-11 Rear Panel Connectors**

### MARC Connector

The MARC connector is a 9-way D-type socket used to connect the transceiver to a MARC remote site equipment, or it can also be used for normal remote operation.

As an alternative to using this connector, the RJ45 style MARC Audio and MARC Data connectors can be used to provide the same functions.

The MARC connector pin-out is shown below and detailed in Table 4-7.




Pin-out of MARC connector looking into the mating face of the chassis mounted socket.

A suitable free plug is detailed in Table 4-2 on page 4-4.

**Table 4-7 MARC Connector**

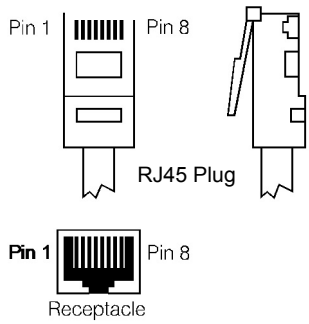
| Pin Number | Signal | Characteristic |
|---|---|---|
| 1 | Ground | 0 V. |
| 2 | Audio line out (+) | Balanced 600 ohm, -30 to +10 dBm.<br>Phantom squelch (see Fig 4-13) - solid state relay, +60 to -60 Vac or dc, 100 mA maximum, configurable normally open or normally closed. Contact closure time is less than 20 ms.<br>For squelch tone signalling see page 3-23 in the Operation topic. |
| 3 | Audio line out (-) | Pair to pin 2. |
| 4 | Squelch (output) | Solid state relay, +60 to -60 Vac or dc, 200 mA maximum, configurable normally open or normally closed. Contact closure time is less than 20 ms. |
| 5 | Unregulated supply (output) | This output is between 21.6 and 32 Vdc (nominally 28 V) fused at 500 mA. |
| 6<br>7 | Data in (+)<br>Data in (-) | RS422 differential asynchronous data at 9600 baud. 8 data bits, 1 stop bit, no parity, no handshaking. |
| 8<br>9 | Data out (+)<br>Data out (-) | RS422 differential asynchronous data at 9600 baud. 8 data bits, 1 stop bit, no parity, no handshaking. |

Note:

The line level figures shown for the MARC connector are the limits when testing the transceiver with sine wave modulation; the line level will be 10 dB above the line level setting. See the information supplied under the heading ‘Line Level Setting’ on page 3-9 in the Operation topic.

**MARC Audio Connector**

The MARC Audio connector is an 8-way RJ45 socket. It can be used as an alternative to the MARC connector for audio, PTT and squelch connections. The connector pin-out is shown below and detailed in Table 4-8.




Numbering is shown looking from the top of the connector.

The top is being viewed when the lever is on the bottom.

**Table 4-8 MARC Audio Connector**

| Pin Number | Signal | Characteristic |
|---|---|---|
| 1<br><br>2 | Audio line out (-)<br><br>Audio line out (+) | Balanced 600 ohm output, -30 to +10 dBm. Phantom squelch (see Fig 4-13) - solid state relay, +60 to -60 Vac or dc, 200 mA maximum, configurable normally open or normally closed. Contact closure time is less than 20 ms.<br>For squelch tone signalling see page 3-23 in the Operation topic. |
| 3 | Fast antenna change-over/PTT (output) | Open collector NPN transistor grounding output, 200 mA maximum, configurable normally open or normally closed. |
| 4<br><br>5 | Audio line in (+)<br><br>Audio line in (-) | Balanced 600 ohm input, -30 to +10 dBm. Phantom PTT (see Fig 4-12) - active when input differs from reference by more than ±10 V. Inactive when input differs from reference by less than ±1 V. Maximum input level ±60 V with respect to reference. Input will draw no more than 6 mA, requires at least 1 mA to operate. Configurable active high or low. Common reference to all inputs programmable to +14, 0 or -14 V (±1 V).<br>For PTT tone signalling see page 3-23 in the Operation topic. |
| 6 | Squelch (output) | Solid state relay, +60 to -60 Vac or dc, 200 mA maximum, configurable normally open or normally closed. Contact closure time is less than 20 ms. |
| 7 | Ground | 0 V. |
| 8 | PTT (input) | Active when input differs from reference by more than ±10 V. Inactive when input differs from reference by less than ±1 V. Maximum input level ±60 V with respect to reference. Input will draw no more than 6 mA, requires at least 1 mA to operate. Configurable active high or low. Common reference to all inputs programmable to +14, 0 or -14 V (±1 V). |

Note:

The line level figures shown for the MARC Audio connector are the limits when testing the transceiver with sine wave modulation; the line level will be 10 dB above the line level setting. See the information supplied under the heading ‘Line Level Setting’ on page 3-9 in the Operation topic.

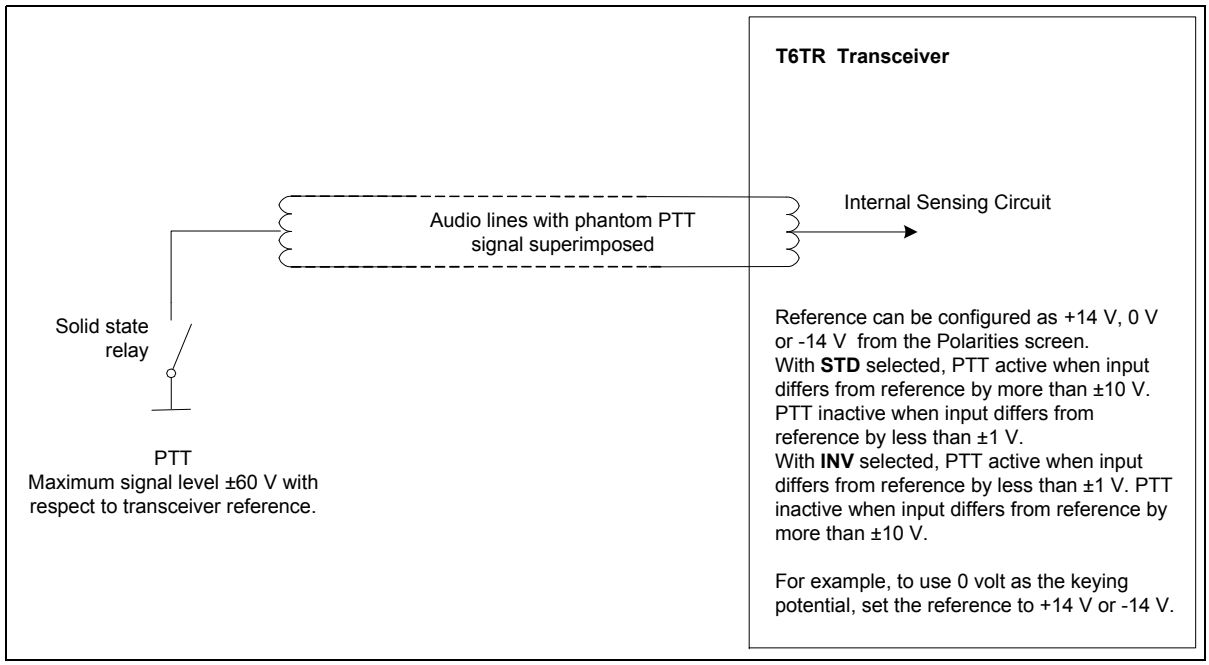



**Fig 4-12 Example Phantom PTT Keying Diagram**

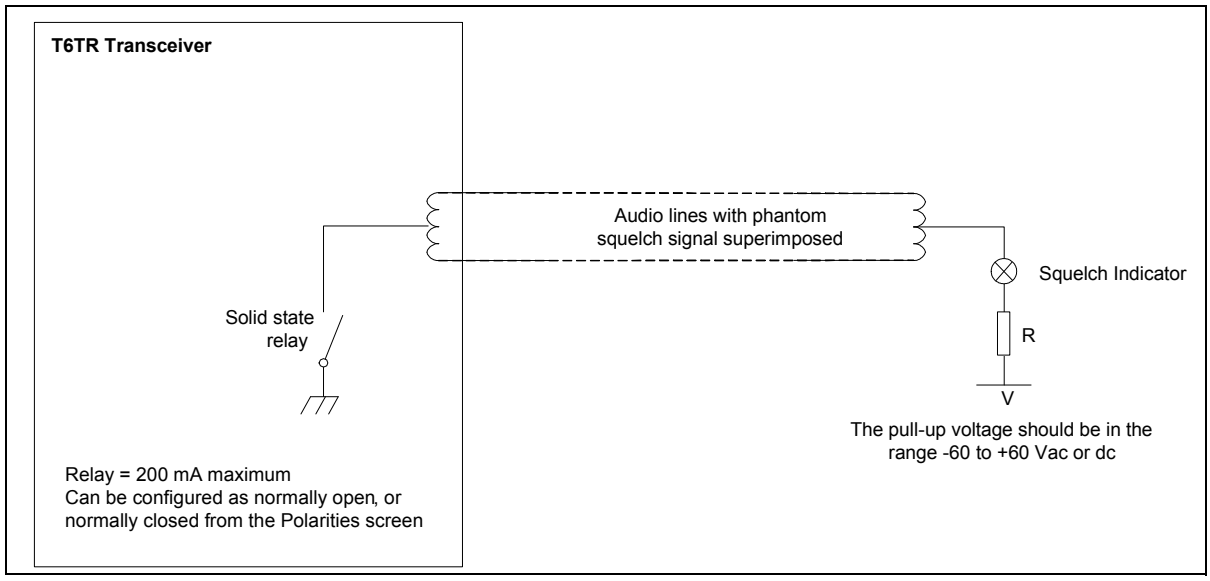
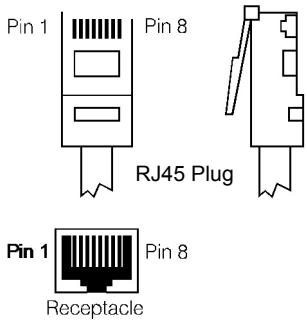



**Fig 4-13 Example Phantom Squelch Indication Diagram**

### MARC Data Connector

The MARC Data connector is an 8-way RJ45 socket. It can be used as an alternative to the MARC connector for data connections. The connector pin-out is shown below and detailed in Table 4-9.




Numbering is shown looking from the top of the connector.

The top is being viewed when the lever is on the bottom.

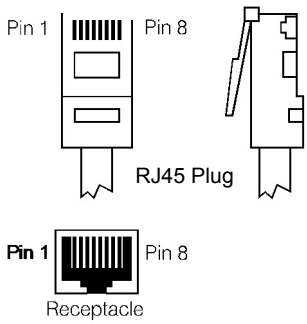
**Table 4-9 MARC Data Connector**

| Pin Number | Signal | Characteristic |
|---|---|---|
| 1<br>2 | Data in (-)<br>Data in (+) | RS422 differential asynchronous data, 9600 baud, 8 data bits, 1 stop bit, no parity, no handshaking. |
| 3 | Not connected | - |
| 4<br>5 | Data out (+)<br>Data out (-) | RS422 differential asynchronous data, 9600 baud, 8 data bits, 1 stop bit, no parity, no handshaking. |
| 6 | Remote Supply On/Off (input) | 0 V to switch off.<br>Note: Rear panel switch must be in On position for this function to operate. |
| 7 | Ground | 0 V. |
| 8 | Unregulated supply (output) | This output is between 21.6 and 32 Vdc (nominally 28 V) fused at 500 mA. |

### T1/E1 Connector

The T1/E1 8-way RJ45 socket is used to connect to a digital voice and data network. When AM-voice mode is selected, the T1/E1 connector automatically functions as an E1 port.

The connector pin-out is shown below and detailed in Table 4-10.




Numbering is shown looking from the top of the connector.

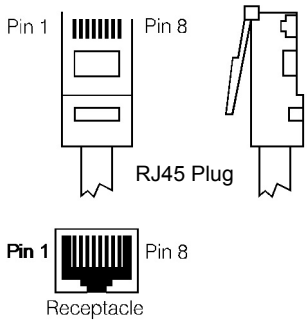
The top is being viewed when the lever is on the bottom.

**Table 4-10 T1/E1 Connector**

| Pin | Signal | Characteristic |
|---|---|---|
| 1 | RRing | E1 - Balanced 120 ohm (±10%), 2.048 Mbits per second (±50 ppm), AMI/HDB3 Coding.<br>Protected with 28 V differential and common mode clamp and 1.25 A fuse in each line. |
| 2 | RTip | |
| 3 | Not connected | - |
| 4 | TRing | E1 - Balanced 120 ohm (±10%), 2.048 Mbits per second (±50 ppm), AMI/HDB3 Coding.<br>Protected with 28 V differential and common mode clamp and 1.25 A fuse in each line. |
| 5 | TTip | |
| 6 | Remote On/Off | An input that is primarily used by a Park Air E1-RIC equipment to switch the radio on and off (0 V = off, 5 V = on). For this facility to work, the radio's rear panel Supply switch must be set to On and the E1-RIC must be powered from an external source. |
| 7 | Ground | 0 V. |
| 8 | 20 to 35 Vdc (nominally 28 V) | Output supply used to power an E1-RIC. |

### IP Connector

The Internet Protocol (IP) connector is an 8-way RJ45 socket used for connecting to a 10/100 Base-T Ethernet network. The connector pin-out is shown below and detailed in Table 4-11.




Numbering is shown looking from the top of the connector.

The top is being viewed when the lever is on the bottom.

**Table 4-11 IP Connector**

| Pin | Signal | Characteristic |
|---|---|---|
| 1 | TD + | Balanced 100 ohm, 10/100 Mbps. |
| 2 | TD – | |
| 3 | RD + | Balanced 100 ohm, 10/100 Mbps. |
| 4 | Not used | |
| 5 | | |
| 6 | RD – | Pair to pin 3. |
| 7 | Not used | |
| 8 | | |

**External Speaker**

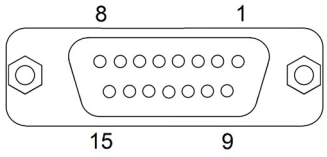
The External Speaker connector is a 3.5 mm stereo jack used for connecting an external speaker to the transceiver. This speaker should be a high impedance active type. The jack plug arrangement is shown in Table 4-12.

**Table 4-12 External Speaker**

| Pin | Signal | Characteristic |
|---|---|---|
| Tip | Speaker drive (output) | 0 to 3.5 V pk-pk. Connected directly to Ring. |
| Ring | Speaker drive (output) | 0 to 3.5 V pk-pk. Connected directly to Tip. |
| Sleeve | Ground | 0 V. |

### Facilities Connector

The Facilities connector is a 15-way D-type filtered socket used for connecting to associated parts of a system. The connector pin-out is shown below and detailed in Table 4-13.




Pin-out of Facilities connector looking into the mating face of the chassis mounted socket.

A suitable free plug is detailed in Table 4-2 on page 4-4.

**Table 4-13 Facilities Connector**

| Pin Number | Signal | Characteristic |
|---|---|---|
| 1 | Ground | 0 V. |
| 2 | E-BIT (input) | An external BIT input that connects from any ancillary equipment having a compatible BIT alarm output.<br>When this input is active, the transceiver's front panel Alarm indicator flashes and an E-BIT message is displayed on the LCD. The input is TTL having a 4.7 kohm pull-up resistor to 5 V. The input is configurable from the front panel to be active high or low. |
| 3 | PTT (output) | Grounding solid state relay. +60 to -60 Vac or dc, 200 mA maximum, configurable normally open or normally closed. Activated 35 ms (±1 ms) before the start of the power ramp up to allow for the antenna relay pull-in time. |
| 4 | External VSWR (input) | Used to indicate an external VSWR fault. TTL input with 4.7 kohm pull-up to 5 V. Configurable active high or low. |
| 5 | Squelch (output) | Solid state relay linked to pin 6. +60 to -60 Vac or dc, 200 mA maximum, configurable normally open or normally closed. Contact closure time is less than 20 ms. |
| 6 | Squelch common (output) | Solid state relay linked to pin 5. |
| 7 | Squelch defeat (input) | An input signal that, when active, disables the squelch circuit. This is a TTL input pulled-up to 5 V. The active polarity is set from the front panel. |
| 8 | Ground | 0 V. |
| 9 | Unregulated supply (output) | This output is between 21.6 and 32 Vdc (nominally 28 V) fused at 500 mA. |
| 10 | Inhibit (input) | Active signal prevents the transceiver keying. TTL with 4.7 kohm pull-up to 5 V. Configurable active high or low. |
| 11 | BIT interruptive test (input) | Active signal initiates a BIT test. TTL with 4.7 kohm pull-up to 5 V. Configurable active high or low. Must be asserted for >300 ms. |

**Table 4-13 Facilities Connector (continued)**

| Pin Number | Signal | Characteristic |
|---|---|---|
| 12 | RSSI (output) | An analogue Receiver Signal Strength Indication that varies between 0 V and 10 V. The output impedance is 10 ohms. RSSI can be used to provide relative indications when two transceivers are configured as a main and standby pair, when using voting, or when associated transmit field strength monitoring is required. The output levels are detailed in Table 4-14. |
| 13 | Ready (output) | An output that is active when the radio is ready to transmit and no faults are detected. Open collector NPN transistor grounding output, 200 mA maximum, configurable normally open or normally closed. |
| 14 | Tape (output) | An audio output for connection to a recording system. 0 dBm fixed output into 600 ohm for 90% modulation depth. |
| 15 | RRC state | Used only when RRC Configuration is enabled.<br>With RRC Configuration enabled and State active, pin 15 is low.<br>With RRC Configuration enabled and State inactive, pin 15 is high.<br>With RRC Configuration disabled, State is N/A and pin 15 is always high. |

**Table 4-14 RSSI Output**

| Received Signal Strength (dBm) | Voltage at the Facilities Connector Pin 12 (all voltages ±0.4 V) |
|---|---|
| -110 | 1.00 |
| -100 | 1.75 |
| -90 | 2.50 |
| -80 | 3.25 |
| -70 | 4.00 |
| -60 | 4.75 |
| -50 | 5.50 |
| -40 | 6.25 |
| -30 | 7.00 |
| -20 | 7.75 |
| -10 | 8.50 |
| 0 | 9.25 |
| 10 | 10.00 |

### Chassis Stud Connection

**WARNING** **Chassis Earth**

**A chassis stud is fitted to the transceiver's rear panel. This stud is used to connect the equipment to the equipment cabinet, or to the user's system earth point. The stud must not be used as the safety earth.**

In order not to compromise the transceiver's Electromagnetic Compatibility (EMC) the chassis stud, marked ⏚ and fitted to the rear panel (see Fig 4-11) must be connected to the equipment cabinet (if a cabinet is being used) or to the user's system earth point. The connection should be made using a single tri-rated, green-and-yellow cable having a cross-sectional area of 2.5 $mm^2$. The cable should have CSA and UL1015 approval, and be connected to the chassis stud through an M6 eyelet (for example, Park Air part number 20-08010103).

**Failure to comply with this instruction could result in non-compliance with the European Commission EMC Directive 2004/108/EC.**

## Connect the Antenna(s)

The antenna connectors are N-type sockets suitable for connecting a 50 ohm antenna. Make a connection to the TX/RX connector if using a single antenna, or the TX/RX and RX connectors if separate transmit and receive antennas are to be used. The antenna configuration must conform to the transceiver's internal coaxial link arrangement (see Setting the Required Antenna Configuration on page 4-13).

**WARNING** **Antenna Radiation**

**The transmit antenna must be installed such that the resultant radiated field strength is below national limits, see "Annex" for limits and examples. The safe distance will need to be calculated for each installation.**

## Connect the DC Input Supply

The transceiver operates from either an ac, or a dc input supply. When both ac and dc are connected, operation from the ac supply takes priority; automatic change-over to the dc supply occurs if the ac supply fails. On restoration of the ac supply, the equipment reverts to ac operation.

A dc input supply connector (see Fig 4-14) is fitted to the equipment's rear panel. The recommended minimum rating of the dc supply cable is: 2-core having a cross-sectional area of 1.5 $mm^2$ per core. The supply cable should be fitted with an XLR 3-pin socket (Park Air part number 20-01030106).

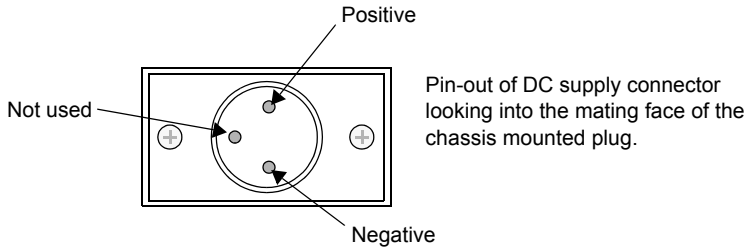



**Fig 4-14 DC Supply Connector**

## Connect the AC Input Supply

**WARNING** **Dangerous Voltage**

**The equipment is permanently connected to the mains supply when the mains connector is attached. Switching the rear panel Supply switch to Standby does not isolate all internal circuits from the mains supply. For this reason, a mains isolating switch should be fitted close to, and easily accessible from, the transceiver's position. The isolation switch should isolate both live and neutral supplies, be clearly labelled, and adequately rated to protect the equipment.**

**WARNING** **Earth Connection**

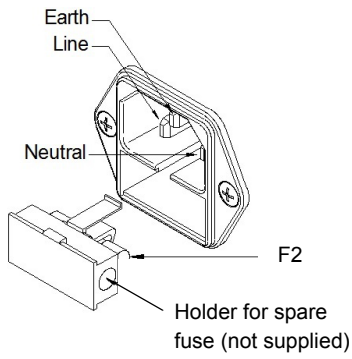
**This equipment must be earthed. The earth terminal of the ac connector should be used as the safety earth.**

An ac input connector is fitted to the equipment's rear panel. The cable used to connect between the equipment and the user's ac power source should be 3-core (to IEC 227) rated 250 Vac at 8 amps, and have a minimum cross-sectional area of 1.0 $mm^2$ per core. Northrop Grumman recommends the use of polyvinyl chloride (PVC) insulated cable. The cable must be fitted with the IEC approved equipment connector and conform to the following specification:

- If PVC insulated, be not lighter than ordinary polyvinyl chloride sheathed flexible cord according to IEC publication 227 (designation H05 VV-F, or H05 VVH2-F)
- If rubber insulated, be of synthetic rubber and not lighter than ordinary tough rubber-sheathed flexible cord according to IEC publication 245 titled 'Rubber Insulated Cables of Rated Voltage up to and Including 450/750 V (designation H05 RR-F)'.

The T6TR transceiver is a Class 1 equipment. The ac supply cable should have a green-and-yellow protective earthing conductor electrically connected to the protective earthing terminal of the equipment connector and the mains plug. Northrop Grumman recommends the ac supply cable is colour coded in accordance with the electrical appliance (colour code) regulations for the UK. That is:

- The core coloured green-and-yellow must be connected to the terminal in the plug that is marked with the letter E or by the earth symbol or coloured green-and-yellow
- The core coloured blue must be connected to the terminal that is marked with the letter N or coloured black
- The core coloured brown must be connected to the terminal that is marked with the letter L or coloured red.



## Switching On

**WARNING** **Dangerous Voltage**

**When the Supply switch is set to the Standby position, dangerous voltage is still present in the transceiver's internal power supply circuitry. To ensure safe working, the transceiver must be isolated from the ac and dc input supplies.**

When installation is complete, the transceiver should be switched on at the rear panel 2-way rocker Supply switch. The Supply switch is used to switch on, and switch off, power to the transceiver's circuitry but does not remove power from the radio.

| = On  = Standby

Under normal circumstances this screen is displayed for a few seconds when the radio is switched on.

```
T6 Digital Radio
(c)2010 Park Air
Initialising....
.............
```

The bottom row begins empty and dots are added as the initialisation progresses. When the initialisation is complete the Main screen is displayed.

## Setting Up

When installation has been successfully completed the transceiver must be set up using the front panel controls or the VFP.

Setting up is detailed in the Operation topic.

When setting up the transceiver, pay particular attention to the Polarities of any functions that have been hardwired during installation. For example, the polarity of the PTT input and the polarity and configuration of the Antenna change-over output. Failure to select the correct settings will result in incorrect operation.

Intentionally Blank

# Maintenance

# Introduction

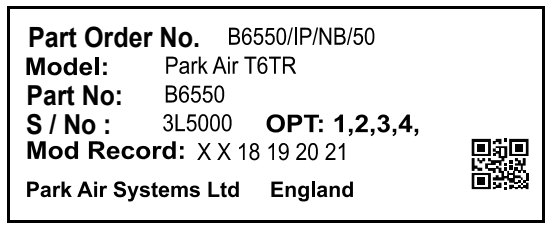
This topic gives the scheduled and unscheduled maintenance procedures for the T6TR transceiver and shows how to use the Virtual Front Panel (VFP).

| | |
|---|---|
| Scheduled Maintenance | A scheduled maintenance procedure is given on page 5-3. Northrop Grumman recommends that this task be completed every twelve months. |
| Unscheduled Maintenance | Normally, the T6TR transceiver is considered a Line Replaceable Unit (LRU) and should be replaced with a serviceable spare if a fault occurs. The faulty transceiver should then be returned to Northrop Grumman for repair.<br><br>In certain circumstances, Northrop Grumman Customer Support may suggest that the user change one of the transceiver modules. Dismantling and assembly instructions are therefore given under the heading Unscheduled Maintenance starting on page 5-7. |
| Using the VFP | Operating parameters can be set from the transceiver's front panel, or by using the VFP. Some additional functions are available from the VFP. See page 5-20. |

## Hardware Configuration

The radio's hardware configuration is identified by the modification level. A modification label is fitted to the radio's rear panel showing the radio's part order number, the radio's model and the radio's serial number.

The modification (Mod) record shows the configuration status. In the example shown, the radio is at Mod strike 18.




**Modification Label**

### Replacement Modules

To ensure compatibility when replacing a radio or a module, the configuration should be the same (see the previous heading: Hardware Configuration).

Spare modules received from Northrop Grumman are supplied with a Spares Instruction that details the configuration of the module and any special instructions. If in any doubt regarding the suitability of spare modules contact Northrop Grumman Customer Support.

# Scheduled Maintenance

Northrop Grumman recommends that scheduled maintenance is carried out at twelve-monthly intervals. Scheduled maintenance comprises the following checks:

| Number | Check | Tools/Test Equipment Required |
|---|---|---|
| 1 | Ensure the equipment is clean and that external connectors are securely fitted. | Camel hair brush/clean lint-free cloths. |
| 2 | Check and reset (if required) the transceiver's internal reference frequency. | VHF frequency counter. |
| 3 | Perform a BIT interruptive test. | |
| 4 | Perform an ac and dc change-over check (if both supplies are connected). | |

## Cleaning and Checking Security of Connectors

Remove all dust and dirt from the equipment's exterior using a lint-free cloth and camel hair brush. Check all external connections are secure and free from damage.

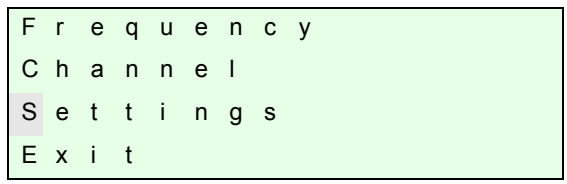
## Setting the Transceiver's Internal Reference Frequency

To set the transceiver's internal reference frequency, use the following procedure. Note that references to the switch in the procedure mean the Scroll/Select switch.

(1) Ensure the transceiver does not have an offset.

(2) Connect a frequency counter to the front panel Reference connector.

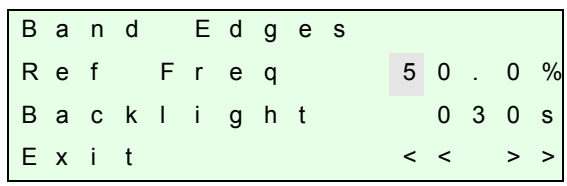
(3) From the Main screen, press the switch to display the Control screen. Turn the switch until Settings is highlighted. Press the switch.




**Control Screen**

(4) Ensure the Settings screen is displayed. Turn the switch until Ref Freq is highlighted, then press the switch.

(5) With Ref Freq selected turn the switch clockwise or anti-clockwise until the frequency counter reads 20.950000 MHz ±10 Hz, then press the switch.




**Settings Screen**

(6) Turn the switch clockwise until Exit is highlighted, then press the switch. You are returned to the Main screen.

(7) Disconnect the frequency counter.

(8) If not 5-offset carrier, refer to AM-Voice Mode Settings Screen on page 3-19 in the Operation topic of this document and set to the required offset.

(9) If 5-offset carrier is required, restore the offset using the following routine:

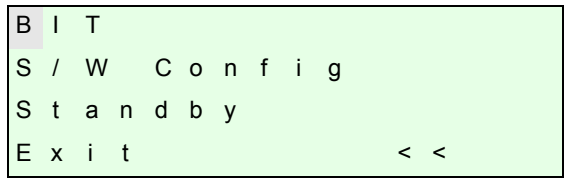
- Connect a 50 ohm frequency counter, through a 60 dB attenuator, to the transceiver's rear panel TX/RX Antenna connector
- Refer to AM-Voice Mode Settings Screen on page 3-19 in the Operation topic of this document and set the desired offset
- Refer to Changing the Transceiver's Operating Frequency on page 3-12 in the Operation topic of this document and set the transceiver to the nearest 25 kHz channel frequency. For example, if the required frequency is 124.504 (+4 kHz offset), set the transceiver to 124.500 MHz
- Key the transceiver and adjust the reference frequency, using the front panel Scroll/Select switch, until the frequency counter displays the required operating frequency. For example 124.504 MHz
- When the frequency counter displays the exact operating frequency, press the Scroll/Select switch and stop keying the transceiver
- Disconnect the test equipment and reconnect the antenna.

## To Initiate a BIT Test

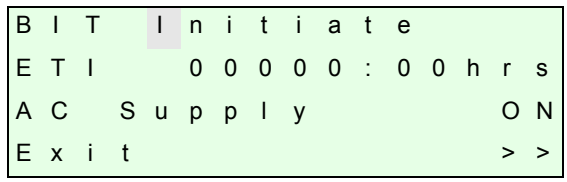
An interruptive BIT test cannot be initiated in VDL Mode 2.

> During an interruptive BIT test, the transceiver radiates modulated carrier waves at the set power. Users should therefore obtain the necessary authority before initiating a test.
>
> If the test is to be carried out with the antenna disconnected, ensure a load is fitted to the transceiver's TX/RX Antenna (not RX Antenna) connector.
>
> In order to test the line input stages, an internally generated 1 kHz tone is injected into the line input circuit. Any other audio present on the line input will cause the test to be inaccurate. Therefore the transceiver MUST NOT be keyed during the test.

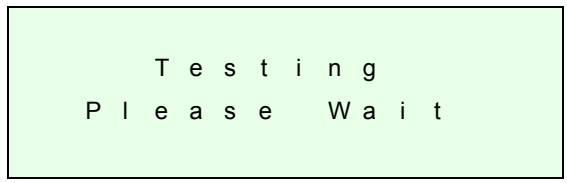
(1) From the Main screen, press the switch to display the Control screen. Turn the switch until BIT is highlighted. Press the switch.



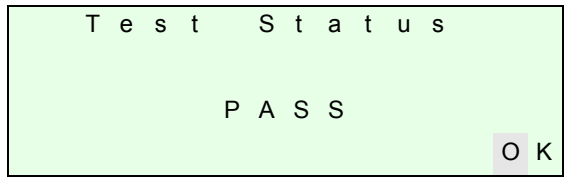

(2) Ensure the BIT menu is displayed. Turn the switch until BIT Initiate is highlighted. Press the switch.



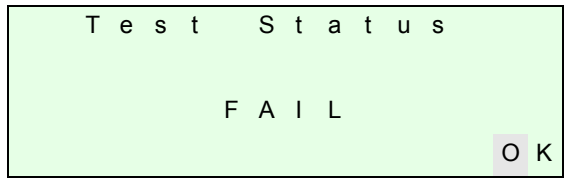

(3) During the test, which takes approximately two seconds, the Testing screen is displayed.




(4) After the test, either a Pass or Fail screen is displayed. Selecting OK takes the user back to the BIT screen.




(5) If fail is displayed, scroll through the screen to check the cause of the failure.



## AC and DC Change-Over Check

If both ac and dc input supplies are connected to the transceiver, carry out the following check:

(1) Confirm that both ac and dc supplies are connected to the transceiver. Ensure that the rear panel Supply switch is set to the I (on) position.

(2) Confirm that the front panel Ready indicator is lit, the LCD is illuminated, and the transceiver is operational.

(3) Switch off the ac supply from its source.

(4) Check that the transceiver continues to operate correctly from the dc supply. If accessed, the front panel BIT screen will show AC Supply as off and DC Supply as on. The value of the dc supply is also shown.

# Unscheduled Maintenance

**WARNING**  **Dangerous Voltage**

**The instructions given in this topic involve connecting dangerous voltage to the transceiver. Maintenance should be carried out only by suitably qualified personnel.**

**When an ac supply is connected, lethal voltage is present within the transceiver. Care must be taken by personnel to avoid accidental contact with exposed circuitry during maintenance or alignment procedures.**

**When the Supply switch is set to the Standby position, dangerous voltage is still present in the transceiver's internal power supply circuitry. To ensure safe working, the ac and dc input supplies must be disconnected from the transceiver.**

**WARNING**  **Beryllium Hazard**

**The output transistors used in the power amplifier (PA) contain the toxic material beryllium. Although no procedures in this documentation instruct component removal, users should be aware that there could be a hazard should the output transistors become damaged.**

**Caution**  **ESDs**

**The T6TR transceiver's circuitry contains Electrostatic Sensitive Devices (ESDs). Personnel must be aware of the precautions necessary to prevent damage to such devices.**

**Caution**  **Unauthorized Modifications**

**Changes or modifications made to this equipment that are not expressly approved by Northrop Grumman, or parties authorized by Northrop Grumman, could void the user's authority to operate the equipment.**

**Caution**  **Repairs**

**When carrying out repairs to the PA module, care must be taken not to damage the gasket. If the strips become damaged, they must be replaced. Failure to comply with this instruction may compromise the transceiver's Electromagnetic Compatibility (EMC) and breach European Commission regulations.**

**When screws are inserted into the transceiver PA casting care must be taken not to exceed a torque of 6 inch-lb (0.68 Nm) when tightening. This applies when replacing the top and bottom covers and during the refitting of the PA module.**

## Introduction

This topic provides the user with detailed instructions on the removal and replacement of modules and assemblies. When removing or refitting modules, observe antistatic handling precautions. Do not change any potentiometer (or link) settings unless detailed in these instructions. Potentiometers have been set using specialist equipment.

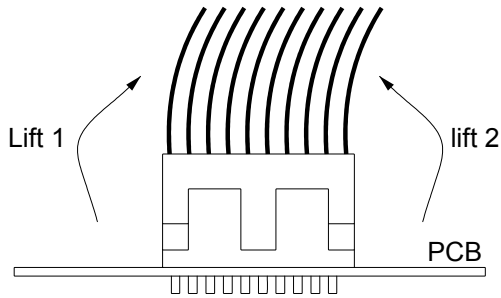
### Molex KK Connectors

The transceiver uses the following Molex KK connectors:

- CN2 on the PA Control/Rx RF module
- CN6 and CN7 on the PSU Regulator module
- CN3 on the Front Panel assembly PCB.

To remove KK type connectors:

- Free the locking mechanism on the connector by moving one side of the connector up, then move the other side up (see the following diagram). The upward motion should only be as far as needed to free the locking mechanism
- DO NOT pull the cable to free the connector
- Note that KK type connectors are designed to be removed in this manner to free the locking mechanism. Do not use this procedure with non-KK type connectors as damage to the connector may occur.




## Tools, Materials and Test Equipment Required

The following tools, materials and test equipment should be made available to complete the maintenance tasks described in this topic.

| | |
|---|---|
| ▫ Personal Computer (PC)<br>▫ General Purpose Tool Kit (including a 1.5 mm Allen key)<br>▫ 5 mm Nut Spinner<br>▫ Camel Hair Brush<br>▫ Clean Lint-Free Cloths | ▫ Frequency Counter<br>▫ Power Meter<br>▫ Dummy Load<br>▫ PC to Radio Interconnection Lead (Park Air part number 17E12600001)<br>▫ SMB to BNC Lead for Reference Frequency (Park Air part number 17K11000004) |

## Removing the Top and Bottom Covers

**WARNING**  **Dangerous Voltage**

**Dangerous voltage is present within the transceiver. Care must be taken by personnel to avoid accidental contact with exposed circuitry when the covers are removed and power is applied to the radio.**

One top and one bottom cover screw are covered with a warranty label that should not be tampered with unless Northrop Grumman Customer Support has advised otherwise. When authorisation has been given the following procedures should be followed. Ensure that the transceiver is isolated from the ac and dc input supplies.

To remove the top cover, locate and unscrew the 19 countersunk screws securing the top cover to the mainframe. Access can then be gained to the Processor module and PSU Regulator module.

To remove the bottom cover, locate and unscrew the 15 countersunk screws securing the bottom cover to the mainframe. Access can then be gained to the PA Control/Rx RF module.

The following modules require both top and bottom covers to be removed:

- Power Supply
- PA module
- Front Panel assembly PCB.

## Removing and Refitting the Processor Module

The Processor module is located as shown in Fig 5-8. A module removal diagram is shown in Fig 5-9.

**WARNING**  **Dangerous Voltage**

**Dangerous voltage is present within the transceiver. Care must be taken by personnel to avoid accidental contact with exposed circuitry when the covers are removed and power is applied to the radio.**

### Removal

Before attempting to remove the Processor module, and if possible, save the radio's settings. To achieve this connect a PC, with the VFP software loaded, to the radio using the PC to radio interconnection lead (Park Air part number 17E12600001). With the VFP software active, upload the radio settings to a specified file.

Ensure that the transceiver is isolated from the ac and dc input supplies. Then proceed as follows:

(1) Remove the transceiver's top cover as described previously.

(2) Locate the Processor module and disconnect the following connectors:

- CN1 50-way connector (50-way ribbon cable from PA Control/Rx RF module)
- CN3 14-way connector (14-way ribbon cable from PSU Regulator module)
- CN4 34-way connector (34-way ribbon cable from Front Panel module)
- CN2 SMB connector (to PA Control/Rx RF module).

(3) Gain access to the rear of the transceiver. Using a 5 mm nut spinner, remove the four 4-40 UNC 5 mm hex to 8 mm thread screws and wavy washers that secure the Processor module interface connectors CN5 and CN6 to the rear panel.

(4) Remove the seven M3 x 8 mm screws that secure the module to the transceiver's mainframe.

(5) Remove the module from the chassis.

**Refitting**

To refit the Processor module, proceed as follows:

(1) Place the module in position. Ensure no wires are trapped by the module. Ensure jumper JP2 on the module is set to 'R/TR' for transceiver (see Fig 5-1).

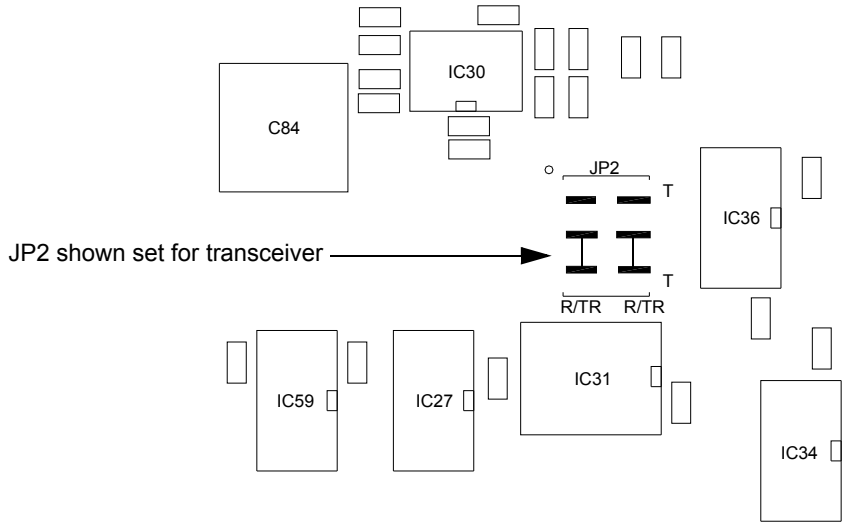



**Fig 5-1 Processor Module JP2 Location**

(2) Ensure the module's interface connectors CN5 and CN6 are located correctly and are aligned with the screw holes in the rear panel. Fit the four 4-40 UNC 5 mm hex to 8 mm thread screws and wavy washers, previously removed, but leave them loose.

(3) Fit the seven M3 x 8 mm screws, previously removed, that secure the module to the transceiver's mainframe, but leave them loose.

(4) Using a 5 mm nut spinner, tighten the four 4-40 UNC 5 mm hex to 8 mm thread screws and wavy washers that secure the connectors; then tighten the seven M3 x 8 mm screws that secure the module to the transceiver's mainframe.

(5) Refit the following connectors to the module:

- CN1 50-way connector (50-way ribbon cable from PA Control/Rx RF module)
- CN3 14-way connector (14-way ribbon cable from PSU Regulator module)
- CN4 34-way connector (34-way ribbon cable from Front Panel module)
- CN2 SMB connector (to PA Control/Rx RF module).

(6) Re-establish the ac and/or dc supplies.

(7) Switch power on at the radio using the rear panel Supply switch.

(8) Ensure the front panel Ready indicator is lit and the Alarm Indicator is unlit.

(9) If a new module has been fitted, connect the VFP PC to the radio using the PC to radio interconnection lead, Park Air part number 17E12600001 (if not already connected). Note that any module sent from Northrop Grumman as a spare for a particular radio will be programmed with compatible operating and Fill software. Northrop Grumman keeps records of module software in all radios supplied. Care must be taken when using a module removed from another radio as this module may not have compatible software.

(10) Download the saved radio settings from file using the VFP. Alternatively, the settings can be edited by hand as described in the Operation topic of this document. Once entered, ensure the required settings appear in the VFP screen.

(11) Carry out the Calibrate routine using the VFP, as detailed in the procedure To Calibrate the Transceiver on page 5-25.

(12) Carry out a BIT interruptive test as detailed in the procedure To Initiate a BIT Test on page 5-5.

(13) Set the transceiver's internal reference frequency by carrying out the procedure detailed on page 5-3.

(14) Set the rear panel Supply switch to Standby and remove the VFP connector. Isolate the transceiver from the ac and/or dc supplies.

(15) Refit the transceiver's top cover. The transceiver can now be returned to service.

## Removing and Refitting the PSU Regulator Module

The PSU Regulator module is located as shown in Fig 5-8. A module removal diagram is shown in Fig 5-10.

**WARNING**  **Dangerous Voltage**

**Dangerous voltage is present within the transceiver. Care must be taken by personnel to avoid accidental contact with exposed circuitry when the covers are removed and power is applied to the radio.**

### Removal

Before attempting to remove the PSU Regulator module, ensure that the transceiver is isolated from the ac and dc input supplies. Then proceed as follows:

(1) Remove the transceiver's top cover as described on page 5-9.

(2) Locate the PSU Regulator module and remove the three M3 x 8 mm captive washer screws that secure the module to the transceiver's mainframe.

(3) Carefully raise the module to gain access to the module connectors.

(4) Disconnect the following connectors:

- CN5 10-way connector (10-way ribbon cable to PA Control/Rx RF module)
- CN6 6-way connector (2-way loom to power supply)
- CN4 14-way connector (14-way ribbon cable to Processor module)
- CN3 3-way connector (3-wire loom to PA module)
- CN7 3-way connector (3-wire loom to rear panel On/Off switch)
- CN2 2-way connector (2-wire loom from dc input connector on rear panel)
- CN1 4-way connector (4-wire cable from power supply)

- CN9 2-way connector (2-wire cable ac input to power supply)
- CN8 3-way connector (2-wire loom to rear panel ac input connector plus chassis connection).

(5) Remove the module from the chassis.

**Refitting**

To refit the PSU Regulator module, proceed as follows:

(1) While holding the module in position, connect the following connectors:

- CN8 3-way connector (2-wire loom to rear panel ac input connector plus chassis connection)
- CN9 2-way connector (2-wire cable ac input to power supply)
- CN1 4-way connector (4-wire cable from power supply)
- CN2 2-way connector (2-wire loom from dc input connector on rear panel)
- CN7 3-way connector (3-wire loom to rear panel On/Off switch)
- CN3 3-way connector (3-wire loom to PA module)
- CN4 14-way connector (14-way ribbon cable to Processor module)
- CN6 6-way connector (2-way loom to power supply)
- CN5 10-way connector (10-way ribbon cable to PA Control/Rx RF module).

(2) Locate the module in position. Ensure no wires are trapped by the module.

(3) Secure the module to the transceiver's mainframe using the three M3 x 8 mm captive washer screws removed during the removal procedure.

(4) Re-establish the ac and/or dc supplies.

(5) Switch power on at the radio using the rear panel Supply switch.

(6) Ensure the front panel Ready indicator is lit and the Alarm indicator is unlit.

(7) Carry out a BIT interruptive test as detailed in the procedure To Initiate a BIT Test on page 5-5.

(8) Set the rear panel Supply switch to Standby. Isolate the transceiver from the ac and/or dc supplies.

(9) Refit the transceiver's top cover. The transceiver can now be returned to service.

## Removing and Refitting the PA Control/Rx RF Module

The PA Control/Rx RF module is located as shown in Fig 5-8. A module removal diagram is shown in Fig 5-11.

**WARNING**  **Dangerous Voltage**

**Dangerous voltage is present within the transceiver. Care must be taken by personnel to avoid accidental contact with exposed circuitry when the covers are removed and power is applied to the radio.**

### Removal

Before attempting to remove the PA Control/Rx RF module, ensure that the transceiver is isolated from the ac and dc input supplies. Then proceed as follows:

(1) Remove the transceiver's bottom cover as described on page 5-9.

(2) Locate the module and disconnect the following connectors (before removing CN7 and CN12, note the antenna configuration):

- CN1 50-way connector (50-way ribbon cable from Processor module)
- CN6 10-way connector (10-way ribbon cable from PSU Regulator module)
- CN5 SMB connector (reference frequency)
- CN3 SMB connector (RF drive)
- CN4 SMB connector (forward power sense)
- CN2 6-way connector (to PA module)
- CN8 SMB connector (to Processor module)
- CN7 SMB connector from the RX antenna connection or CN13 on the PA module (illustrated in Fig 5-2)
- CN12 SMB connector (connects to CN13 on the PA module) or RX antenna connection (illustrated in Fig 5-2).

(3) Remove the seven M3 x 8 mm captive washer screws that secure the module to the transceiver's mainframe and remove the module from the chassis.

### Refitting

To refit the PA Control/Rx RF module, proceed as follows:

(1) Place the module in position. Ensure no wires are trapped by the module.

(2) Fit the seven M3 x 8 mm captive washer screws, previously removed, that secure the module to the transceiver's mainframe.

(3) Refit the following connectors to the module:

- CN7 SMB connector to the RX antenna connection or to the connector from CN13 on the PA module (illustrated in Fig 5-2)
- CN12 SMB connector to CN13 on the PA module or the RX antenna connection (illustrated in Fig 5-2)
- CN8 SMB connector (to Processor module)
- CN2 6-way connector (to PA module)

- CN4 SMB connector (forward power sense)
- CN3 SMB connector (RF drive)
- CN5 SMB connector (reference frequency)
- CN6 10-way connector (10-way ribbon cable from PSU Regulator module)
- CN1 50-way connector (50-way ribbon cable from Processor module).

(4) Re-establish the ac and/or dc supplies.

(5) Switch power on at the radio using the rear panel Supply switch.

(6) Ensure the front panel Ready indicator is lit and the Alarm indicator is unlit.

(7) Carry out the Calibrate routine using the Virtual Front Panel (VFP), as detailed in the procedure To Calibrate the Transceiver on page 5-25.

(8) Carry out a BIT interruptive test as detailed in the procedure To Initiate a BIT Test on page 5-5.

(9) Set the transceiver's internal reference frequency by carrying out the procedure detailed on page 5-3.

(10) Set the rear panel Supply switch to Standby and remove the VFP connector. Isolate the transceiver from the ac and/or dc supplies.

(11) Refit the transceiver's bottom cover. The transceiver can now be returned to service.

| Antenna Configuration | Connector CN12 PARK | Connector CN7 |
|---|---|---|
| Single | RX Antenna | CN13 (from PA Module) |
| Dual | CN13 (from PA Module) | RX Antenna |

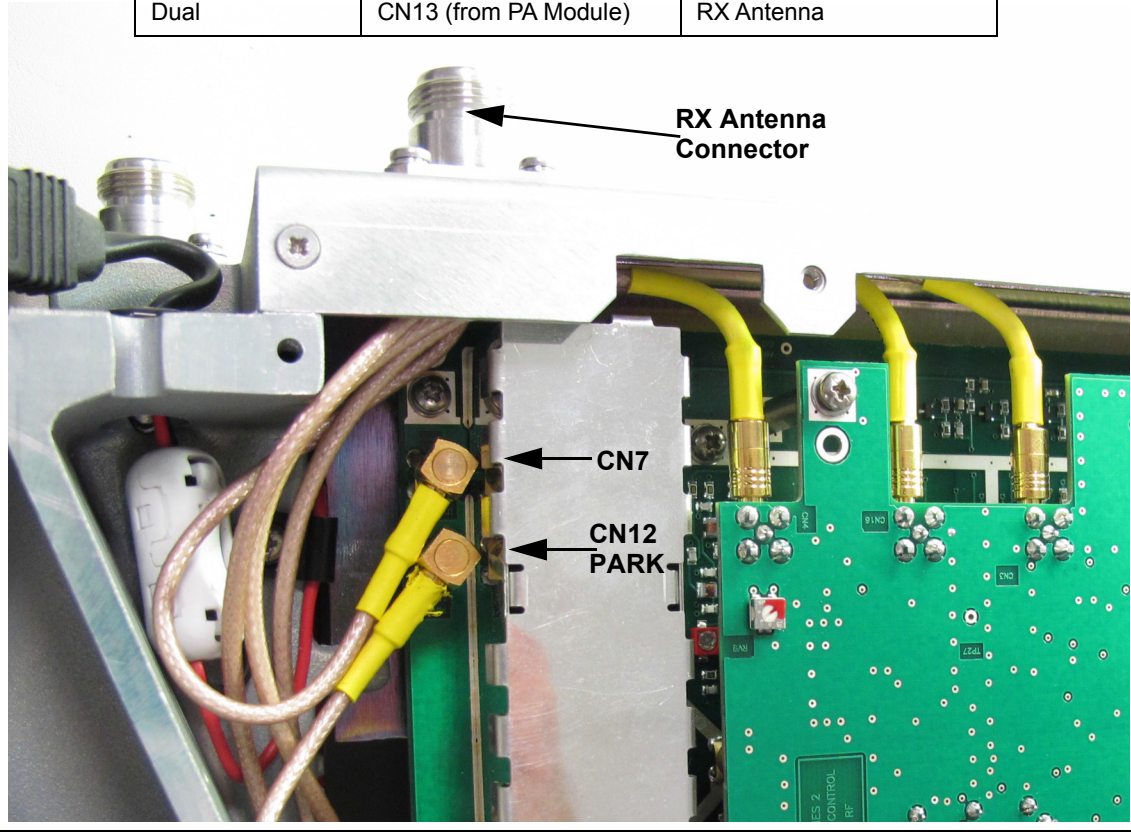



**Fig 5-2 Antenna Configuration**

## Removing and Refitting the Power Supply

The Power Supply is located as shown in Fig 5-8. A module removal diagram is shown in Fig 5-12.

**WARNING**  **Dangerous Voltage**

**Dangerous voltage is present within the transceiver. Care must be taken by personnel to avoid accidental contact with exposed circuitry when the covers are removed and power is applied to the radio.**

### Removal

Before attempting to remove the Power Supply, ensure that the transceiver is isolated from the ac and dc input supplies. Then proceed as follows:

(1) Remove the transceiver's top and bottom covers as described on page 5-9.

(2) Support the radio on its side.

(3) Locate the power supply. From the bottom half of the unit remove the four No. 6 x 32 UNC countersunk screws that secure the power supply to the transceiver's mainframe. During this operation support the power supply from the top half of the unit.

(4) Withdraw the power supply from the chassis sufficient to allow access to the power terminal blocks taking care not to damage the ac terminal plastic supply guard.

(5) Remove the connector CN4 (power supply to the power regulator).

(6) Disconnect the dc wires from the eight connector terminal block.

(7) Slide back the terminal block cover and disconnect the ac wires from the three connector terminal block (marked L N E).

(8) Carefully remove the power supply from the transceiver.

### Refitting

To refit the Power Supply, proceed as follows:

(1) With the transceiver on its side hold the power supply near to its securing position in the top half of the radio.

(2) Slide back the terminal block cover and connect the ac wires to the three connector terminal block (marked L N E); brown to terminal L, blue to terminal N and yellow/green to terminal E.

(3) Connect the dc wires to the eight connector terminal block; red to terminal 2 and terminal 3 and black to terminal 6 and terminal 7.

(4) Connect CN4 (power supply to the power regulator).

(5) Taking care not to damage the plastic supply guard, lower the power supply into position and secure from the bottom half of the unit using the four No. 6 x 32 UNC countersunk screws previously removed.

(6) Re-establish the ac and/or dc dc supplies.

(7) Switch power on at the radio using the rear panel Supply switch.

(8) Ensure the front panel Ready indicator is lit and the Alarm indicator is unlit.

(9) Carry out a BIT interruptive test as detailed in the procedure To Initiate a BIT Test on page 5-5.

(10) Set the rear panel Supply switch to Standby. Isolate the transceiver from the ac and/or dc supplies.

(11) Refit the transceiver's top and bottom covers. The transceiver can now be returned to service.

## Removing and Refitting the PA Module

The PA module is located as shown in Fig 5-8. A module removal diagram is shown in Fig 5-13.

**WARNING**  **Dangerous Voltage**

**Dangerous voltage is present within the transceiver. Care must be taken by personnel to avoid accidental contact with exposed circuitry when the covers are removed and power is applied to the radio.**

**WARNING**  **Beryllium Hazard**

**The output transistors used in the power amplifier (PA) contain the toxic material beryllium. Although no procedures in this documentation instruct component removal, users should be aware that there could be a hazard should the output transistors become damaged.**

**Caution**  **Repairs**

**When carrying out repairs to the PA module, care must be taken not to damage the gasket. If the strips become damaged, they must be replaced. Failure to comply with this instruction may compromise the transceiver's Electromagnetic Compatibility (EMC) and breach European Commission regulations.**

**When screws are inserted into the transceiver PA casting care must be taken not to exceed a torque of 6 inch-lb (0.68 Nm) when tightening. This applies when replacing the top and bottom covers and during the refitting of the PA module.**

### Removal

Before attempting to remove the PA module, ensure that the transceiver is isolated from the ac and dc input supplies. Then proceed as follows:

(1) Remove the transceiver's top and bottom covers as described on page 5-9.

(2) Remove CN3 from the PSU Regulator module.

(3) With the transceiver upside-down disconnect CN2 from the PA Control/Rx RF module.

(4) Disconnect the SMB connectors CN8 and CN10. Note that CN10 is located within the heatsink fins and should be disconnected using long nosed pliers. Do not attempt to remove the connector by pulling on the cable.

(5) Remove the black equipment handle from the PA side of the radio by unscrewing and removing the two M5 x 16 mm panhead screws that secure it to the transceiver.

(6) Remove the six M3 x 8 mm countersunk screws and two M3 x 8 mm captive screws that secure the PA from the bottom and top of the mainframe as shown in Fig 5-13. Ensure the PA module is well supported during this operation.

(7) Withdraw the PA module from the mainframe taking care not to snag the wiring looms.

**Refitting**
To refit the PA module, proceed as follows:

(1) Place the module in position and butt it up to the mainframe. Ensure no wires are trapped by the module.

(2) Fit the six M3 x 8 mm countersunk screws and two M3 x 8 mm captive screws, previously removed, that secure the module to the transceiver's mainframe.

(3) Fit the black equipment handle, previously removed, to the PA side of the radio using the two M5 x 16 mm panhead screws.

(4) Connect the SMB connectors CN8 and CN10. Note that CN10 is located within the heatsink fins and should be connected using long nosed pliers if unable to use fingers in the enclosed space.

(5) With the transceiver upside-down connect CN2 to the PA Control/Rx RF module.

(6) Fit CN3 to the PSU Regulator module.

(7) Re-establish the ac and/or dc supplies.

(8) Switch power on at the radio using the rear panel Supply switch.

(9) Ensure the front panel Ready indicator is lit and the Alarm indicator is unlit.

(10) Carry out the Calibrate routine using the Virtual Front Panel (VFP), as detailed in the procedure To Calibrate the Transceiver on page 5-25.

(11) Carry out a BIT interruptive test as detailed in the procedure To Initiate a BIT Test on page 5-5.

(12) Set the rear panel Supply switch to Standby and remove the VFP connector. Isolate the transceiver from the ac and/or dc supplies.

(13) Refit the transceiver's top and bottom covers. The transceiver can now be returned to service.

## Removing and Refitting the Front Panel Assembly PCB

The Front Panel assembly is located as shown in Fig 5-8. An assembly PCB removal diagram is shown in Fig 5-14.

**WARNING**  **Dangerous Voltage**

**Dangerous voltage is present within the transceiver. Care must be taken by personnel to avoid accidental contact with exposed circuitry when the covers are removed and power is applied to the radio.**

**Removal**
Before attempting to remove the Front Panel assembly PCB, ensure that the transceiver is isolated from the ac and dc input supplies. Then proceed as follows:

(1) Remove the transceiver's top and bottom covers as described on page 5-9.

(2) Disconnect CN4 at the Processor module. Carefully pull the cable through the aperture in the mainframe to free it.

(3) Disconnect SMB connector CN5 at the PA Control/Rx RF module.

(4) Remove the four M3 x 8 mm countersunk screws from the top and bottom of the mainframe box section (see Fig 5-14, Diagram A).

(5) Remove the two black equipment handles by unscrewing and removing the four M5 x 16 mm panhead screws that secure them to the transceiver. The front panel can now be moved forward and away from the mainframe.

(6) At the front panel, release the control knob by loosening the Allen head grub screw using a 1.5 mm Allen key. Withdraw the control knob from the spindle.

(7) Disconnect the speaker connector (CN3) from the Front Panel PCB.

(8) Remove the Front Panel PCB from the Front Panel assembly by removing the six M3 x 8 mm captive washer panhead screws (see Fig 5-14 Diagram B).

**Refitting**

To refit the Front Panel assembly PCB, proceed as follows:

(1) Place the PCB in position at the Front Panel assembly. Ensure the spindle of the control knob and headset/microphone/diagnostics connector are correctly located. Secure the PCB to the Front Panel assembly using the six M3 x 8 mm captive washer panhead screws previously removed (see Fig 5-14, Diagram B).

(2) Connect the speaker connector (CN3) to the Front Panel PCB.

(3) At the front panel, place the control knob, previously removed, onto the spindle and using a 1.5 mm Allen key, secure the Allen head grub screw.

(4) Secure the Front Panel assembly to the top and bottom of the mainframe box section using the four M3 x 8 mm countersunk screws previously removed. Fit the two black equipment handles, previously removed, using the four M5 x 16 mm panhead screws (see Fig 5-14, Diagram A).

(5) Route the ribbon cable to the Processor module connector CN4 (via the aperture in the mainframe assembly) and connect it.

(6) Route the SMB connector to CN5 on the PA Control/Rx RF module and connect it.

(7) Re-establish the ac and/or dc supplies.

(8) Switch power on at the radio using the rear panel Supply switch.

(9) Ensure the front panel Ready indicator is lit and the Alarm indicator is unlit.

(10) Carry out a BIT interruptive test as detailed in the procedure To Initiate a BIT Test on page 5-5.

(11) Set the rear panel Supply switch to Standby. Isolate the transceiver from the ac and/or dc supplies.

(12) Refit the transceiver's top and bottom covers. The transceiver can now be returned to service.

## Removing and Refitting the Cooling Fan

The cooling fan is mounted at the rear of the PA module as shown in Fig 5-8. A removal diagram is shown in Fig 5-15.

### Removal

Before attempting to remove the fan, ensure that the transceiver is isolated from the ac and dc input supplies. Then proceed as follows:

(1) Disconnect the two-pin connector.

(2) Remove the fan's finger guard.

(3) Using an Allen key, inserted through the holes in the fan exposed with the finger guard removed, remove the three M4 x 12 mm caphead Allen screws that secure the fan to the PA module's heatsink.

(4) Remove the fan from the PA module.

### Refitting

To refit the cooling fan, proceed as follows:

(1) Locate the fan in position and using a suitable Allen key inserted through the holes for the fan's finger guard, secure using the three M4 x 12 mm caphead Allen screws previously removed.

(2) Secure the finger guard to the fan.

(3) Connect the two-pin fan connector to the fan. Ensure the + marked socket mates with the + marked plug on the fan.

(4) Re-establish the ac and/or dc supplies.

(5) Switch power on at the radio using the rear panel Supply switch.

(6) Ensure the front panel Ready indicator is lit and the Alarm indicator is unlit. The transceiver can now be returned to service.

# Virtual Front Panel (VFP)

The optional Virtual Front Panel (VFP) software supplied on CD (Park Air part number 70-T6000VFP) is compatible with any PC or laptop running Windows XP™, Windows Vista™ or Windows 7™. The VFP allows changes to a radio's settings and channel information, it displays the current BIT state, displays BIT history, allows security locks to be set, and provides maintenance facilities.

A radio can be set up using the front panel Scroll/Select switch and LCD, or by using the VFP. Using the VFP has several advantages over setting the transceiver from the front panel; these are:

- A profile of the transceiver's operation settings and channel information can be created, stored on disk, and then recalled to download into other transceivers
- A printout of the transceiver's profile can be made from the VFP
- Front Panel Lock is available only when using the VFP. As part of the transceiver's Settings (see typical screen display shown below) Front Panel Lock can be set to ON. When selected to on, no settings or frequency information can be changed from the front panel
- If the transceiver is part of a MARC system or operates in a digital mode, a MARC Lock and T1E1 Lock are available when using the VFP. When selected to on, no settings or frequency information can be changed from the MARC equipment screen, or the digital control equipment.

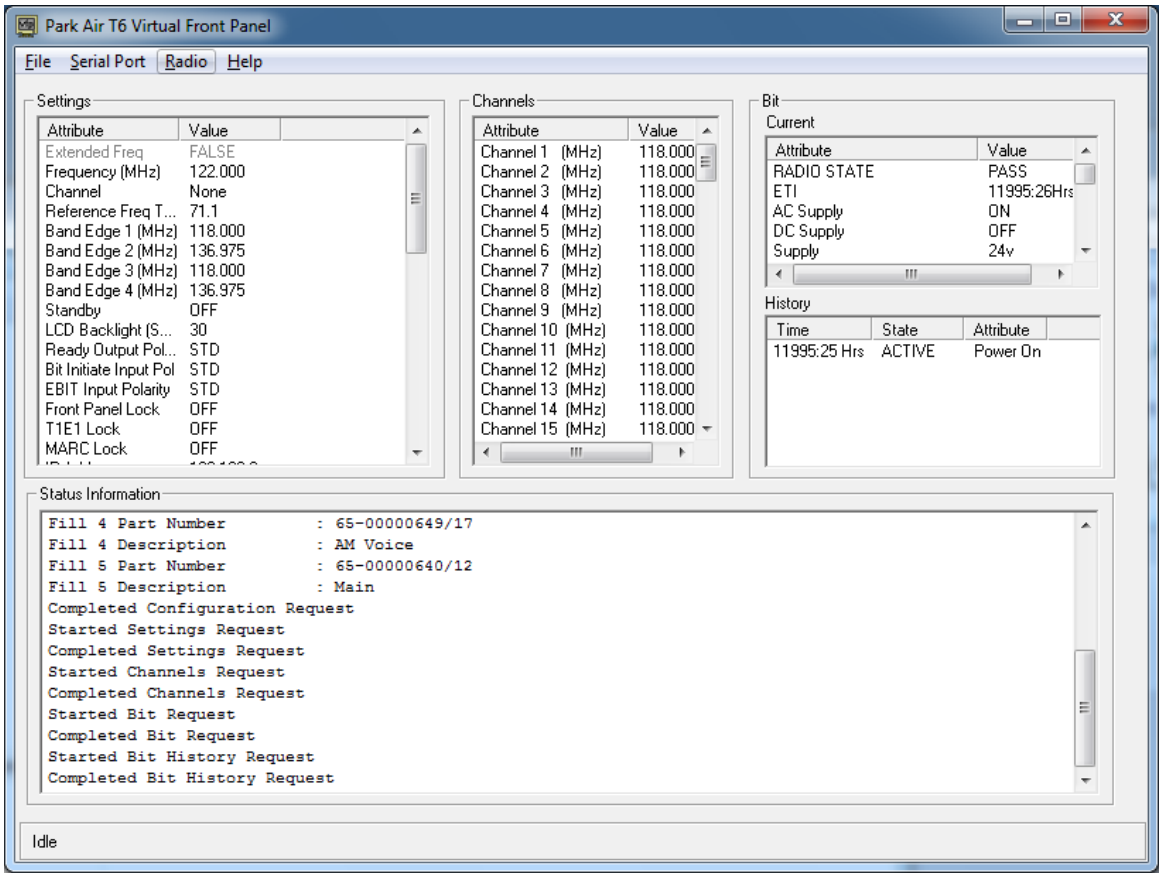



**Fig 5-3 Typical VFP Screen - AM-Voice Profile Shown**

## Installing the VFP Software

The VFP software is supplied by Northrop Grumman on CD (Park Air part number 70-T6000VFP). The software can be run from the Main page or installed on your PC via Explorer.

To install the software onto your PC:

(1) Using explorer, display the contents of the CD supplied by Northrop Grumman. Identify the file named S0473Vxx.EXE (where xx is the version number).

(2) Using the mouse, right click on the file and then select *Copy*.

(3) Display the Windows desktop. Right click anywhere on the desktop and select *Paste*.

(4) Check that the VFP icon is shown on the desktop. Reposition the icon as required. The VFP application is now installed on the PC's desktop.


**VFP Icon**

## VFP Features

The VFP screen is divided into four main windows: Settings, Channels, BIT and Status Information. Four colours are used to display text. The colours have the following meanings:

- Black indicates a valid parameter that has been accepted by the radio
- Red indicates an invalid parameter that has been rejected by the radio, or a BIT failure
- Green indicates text that has not yet been downloaded to the radio. Text loaded into the VFP from a previously stored file, or any text that is manually amended is green until it is downloaded into the radio; after being downloaded into the radio the text changes to black, or if it is invalid, to red
- Blue indicates Help text and is shown in the Status Information window.

### The Menu-Bar

The menu-bar has four categories: File, Serial Port, Radio and Help.

| | |
|---|---|
| File | Has the sub-categories: Open, Save and Print. These sub-categories allow the user to open previously saved profiles, save a new profile, or print a profile.<br><br>A special sub-category: File > Save > Diagnostics should only be used when advised by Northrop Grumman. |
| Serial Port | Opens the Serial Port Settings dialogue box. Before the VFP can be used, the appropriate Com Port (1 to 99) must be selected to correspond with the PC's Com Port used for the radio connection. |
| Radio | Has the sub-categories: Retrieve, Send, Calibrate and Test. These sub-categories allow a radio's profile to be loaded into the VFP, allow a profile to be downloaded from the VFP to a radio, calibrates a radio and initiates a BIT test. |
| Help | Provides detail about the VFP software. |

**Settings Window**
This window lists all attributes that can be adjusted by the user. If any individual attribute is clicked on using the mouse, help information is displayed in the Status Information window showing the range of adjustment for that attribute. Click on the value and use the keyboard to amend it; press Enter to confirm the new value noting that the amended text is green until it is downloaded into the radio.

Any invalid parameters are not indicated until the Settings are downloaded to the radio. It is the radio that rejects invalid parameters, not the VFP.

The transceiver's reference frequency setting is displayed in the window. Adjusting the reference frequency is a maintenance operation that requires external test equipment to be connected. The value shown in the Settings window should not be changed; instead, adjustment of the reference frequency should be performed using the radio's front panel controls as detailed on page 5-3.

**Channels Window**
Up to 100 preset channels can be stored in the radio. These are listed in the Channels window. Any channel frequency can be amended by clicking on the value to amend it and pressing Enter to confirm the new value. Note that the amended channel is green until it is downloaded into the radio.

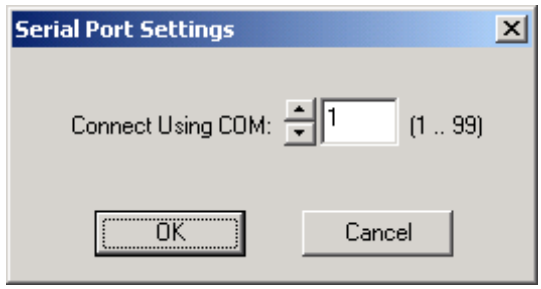
Any invalid frequencies are not indicated until the Channels are downloaded to the radio. It is the radio that rejects invalid frequencies, not the VFP.

**BIT Window**
Two lists of information are presented. The current BIT status and the BIT history. The BIT history shows the last 100 entries.

**Status Information Window**
The Status Information window gives information regarding the type of radio, the software fills, recent VFP actions and Help information.

**Serial Port Error Message**
When the VFP application is started it attempts to open Com 1 as a default selection. If this is not possible an error box is displayed.


A valid serial port can be selected from the Serial Port Settings box.



## To Change the Transceiver's Profile or Save a Profile

(1) Using a PC to radio interconnection lead, Park Air part number 17E12600001, connect the radio's front panel Headset/Microphone/Diagnostics connector to the PC's Com Port (note which Com Port is used).

(2) Run up the VFP software and check that a blank VFP screen (Fig 5-4) is displayed.

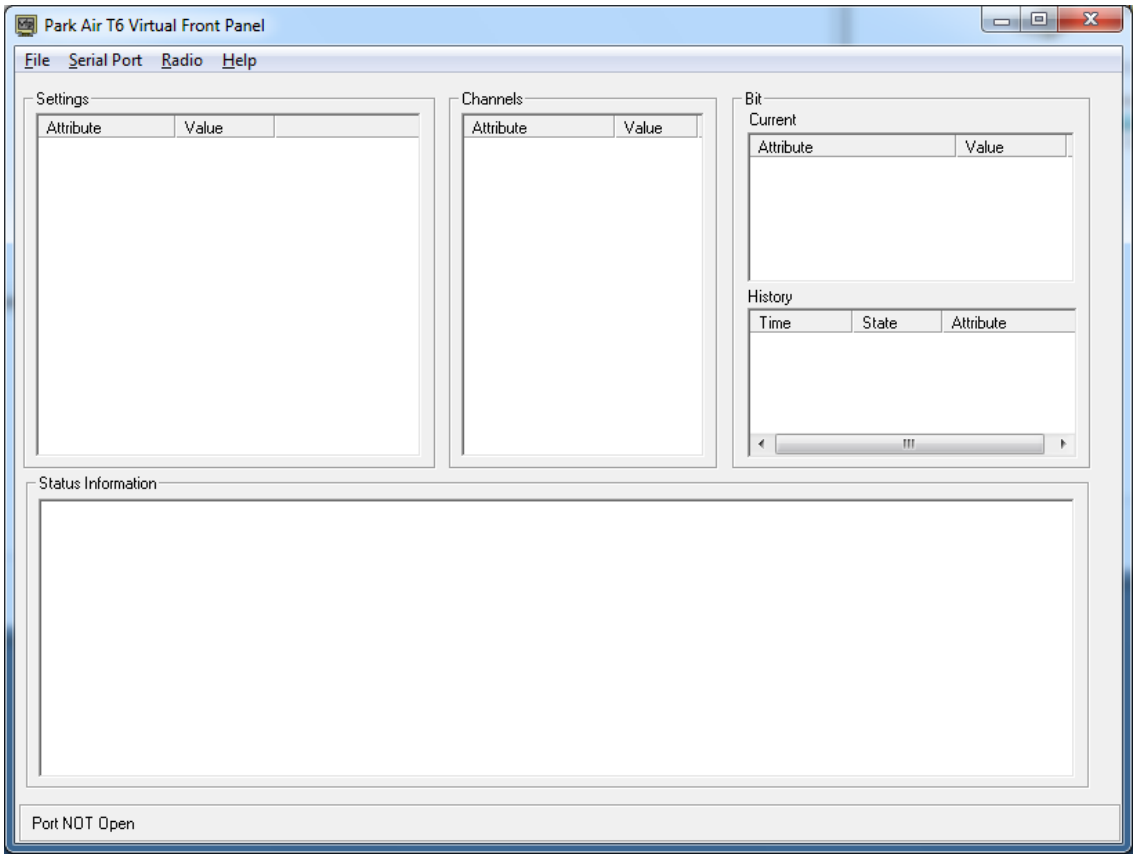



**Fig 5-4 Blank VFP Screen**

(3) At the menu-bar, click on *Serial Port* and select *Com 1* to *Com 99*. The selection must correspond to the port used to connect to the radio.

(4) Load the required information from the radio, or from a stored file. The required information can be radio settings, frequency channels, BIT information, or all of these.

To load a previously stored file, select *File* > *Open* > *All*
or, *File* > *Open* >*Settings*
or, *File* > *Open* > *Channel*
or, *File* > *Open* > *BIT*

To load information from the radio, select *Radio* > *Retrieve* > *All*
or, *Radio* > *Retrieve* > *Settings*
or, *Radio* > *Retrieve* > *Channel*
or, *Radio* > *Retrieve* > *BIT*

(5) If required, amend any radio Settings or Channel information.

(6) Download the radio's profile as shown on the VFP screen to either the radio, or to a file.

To download into the radio, select *Radio* > *Send* > *All*
or, *Radio* > *Send* > *Settings*
or, *Radio* > *Send* > *Channel*

To download to a file, select *File* > *Send* > *All*
or, *File* > *Send* > *Settings*
or, *File* > *Send* > *Channel*
or, *File* > *Send* > *BIT*

(7) Check that after downloading to a radio, no invalid parameters are returned (such parameters are displayed as red text). If there are invalid parameters, amend them and then repeat the download.

(8) When there is no further requirement for using the VFP, exit the VFP software and disconnect the radio from the PC.

## To Initiate a BIT Test

During an interruptive BIT test, the transceiver radiates modulated carrier waves at the set power. Users should therefore obtain the necessary authority before initiating a test.

If the test is to be carried out with the antenna disconnected, ensure a load is fitted to the transceiver's TX/RX Antenna (not RX Antenna) connector.

In order to test the line input stages, an internally generated 1 kHz tone is injected into the line input circuit. Any other audio present on the line input will cause the test to be inaccurate. Therefore the transceiver MUST NOT be keyed during the test.

(1) Using a PC to radio interconnection lead, Park Air part number 17E12600001, connect the radio's front panel Headset/Microphone/Diagnostics connector to the PC's Com Port (note which Com Port is used).

(2) Run up the VFP software and check that a blank VFP screen is displayed.

(3) At the menu-bar, click on *Serial Port* and select *Com 1* to *Com 99*. The selection must correspond to the port used to connect to the radio.

(4) At the menu-bar select *Radio* > *Test*.

(5) An interruptive BIT test now takes place. The results are displayed in the BIT window.

(6) When there is no further requirement for using the VFP, exit the VFP software and disconnect the radio from the PC.

## To Calibrate the Transceiver

(1) Connect a dummy load via a power meter to the transceiver's TX/RX Antenna connector (Fig 5-6).

(2) Remove the transceiver's bottom cover as described on page 5-9.

(3) Using a PC to radio interconnection lead, Park Air part number 17E12600001, connect the radio's front panel Headset/Microphone/Diagnostics connector to the PC's Com Port (note which Com Port is used).

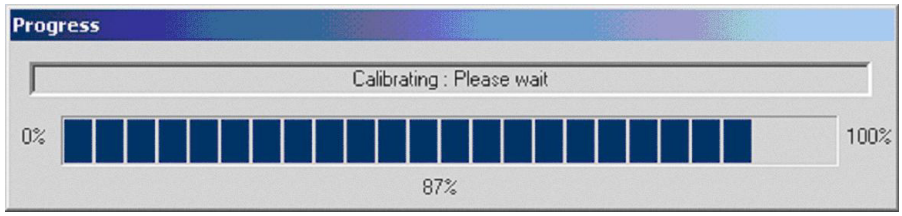
(4) Run up the VFP software and check that a blank VFP screen is displayed.

(5) At the menu-bar, click on *Serial Port* and select *Com 1* to *Com 99*. The selection must correspond to the port used to connect to the radio.

(6) At the menu-bar select *Radio* > *Retrieve* > *All*.

(7) At the menu-bar select *Radio* > *Calibrate*. The Confirm screen will then be displayed to remind you that a dummy load must be connected before proceeding.


(8) With the Confirm screen displayed and dummy load connected, select Yes to continue with the calibrate routine. The Progress screen will then be displayed.




(9) When the PA Control/PA loop has been calibrated the Progress screen disappears and the VFP screen reappears showing a calibration complete message in the Status Information window.

(10) Gain access to the PA Control/Rx RF module and identify RV9 (this control is on the solder side of the outer PCB as shown in Fig 5-5). From the transceiver's front panel AM-Voice mode settings screen, select PTT On.

(11) From the Settings window, note the RF power setting. Adjust RV9 until the power meter reads this value.

(12) From the transceiver's front panel AM-voice mode settings screen select PTT Off, then remove the power meter and dummy load. This completes the calibration routine.

(13) When there is no further requirement for using the VFP, exit the VFP software, disconnect the radio from the PC and refit the bottom cover.

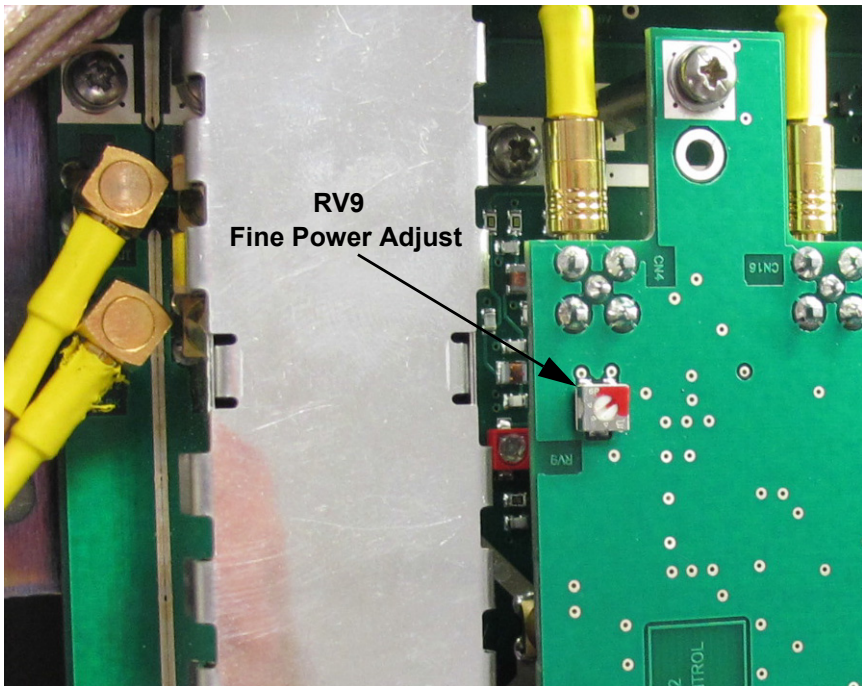
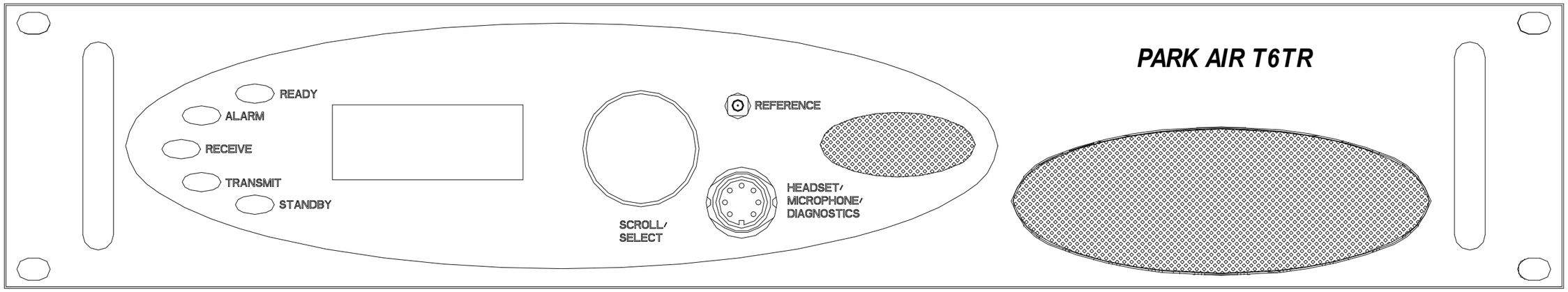
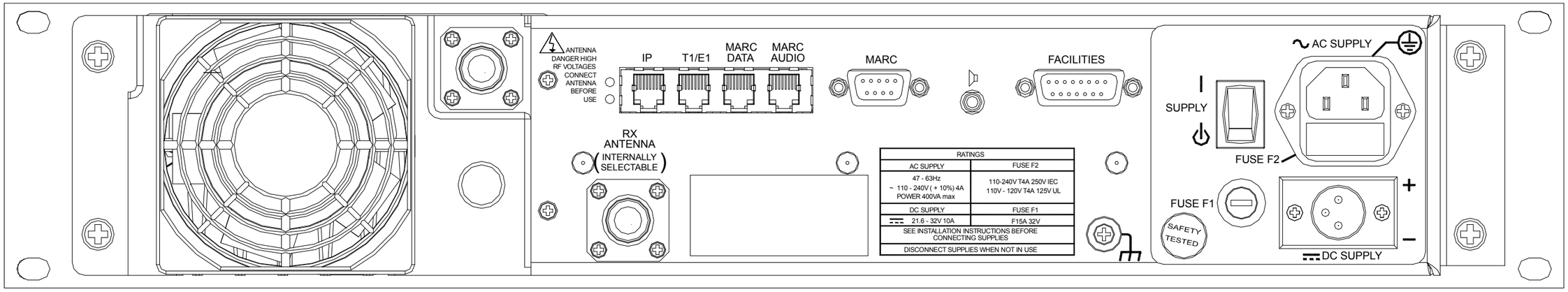



**Fig 5-5 Location of RV9**




Front View




Rear View

**Fig 5-6 T6TR Front and Rear Panels**

| Connections | | Name | Characteristic |
|---|---|---|---|
| Processor | Front Panel | | |
| CN4-1 | CN1-1 | LED Alarm | Open collector (5mA) |
| CN4-2 | CN1-2 | LED Ready | Open collector (5mA) |
| CN4-3 | CN1-3 | LED Standby | Open collector (5mA) |
| CN4-4 | CN1-4 | LED Tx | Open collector (5mA) |
| CN4-5 | CN1-5 | LCD RS | TTL |
| CN4-6 | CN1-6 | LCD R/W | TTL |
| CN4-7 | CN1-7 | LCD Enable | TTL |
| CN4-8 | CN1-8 | Data 0 | TTL |
| CN4-9 | CN1-9 | Data 1 | TTL |
| CN4-10 | CN1-10 | Data 2 | TTL |
| CN4-11 | CN1-11 | Data 3 | TTL |
| CN4-12 | CN1-12 | Data 4 | TTL |
| CN4-13 | CN1-13 | Data 5 | TTL |
| CN4-14 | CN1-14 | Data 6 | TTL |
| CN4-15 | CN1-15 | Data 7 | TTL |
| CN4-16 | CN1-16 | LCD Backlight | Open collector (200mA) |
| CN4-17 | CN1-17 | Transmit Data | RS232 |
| CN4-18 | CN1-18 | +5 V Supply | +5 V |
| CN4-19 | CN1-19 | Receive Data | RS232 |
| CN4-20 | CN1-20 | -5 V Supply | -5 V |
| CN4-21 | CN1-21 | Ground | 0 V |
| CN4-22 | CN1-22 | +15 V Supply | +15 V |
| CN4-23 | CN1-23 | Ground | 0 V |
| CN4-24 | CN1-24 | LED RX | Open collector (5mA) |
| CN4-25 | CN1-25 | Turn + | 5 V pull-up |
| CN4-26 | CN1-26 | Turn - | 5 V pull-up |
| CN4-27 | CN1-27 | Push | 5 V pull-up |
| CN4-28 | CN1-28 | Mic PTT | 0 V=PTT,5 V pull-up=PTT |
| CN4-29 | CN1-29 | Ground | 0 V |
| CN4-30 | CN1-30 | Sidetone (Headset Drive) | 3 Vac pk-pk |
| CN4-31 | CN1-31 | Loudspeaker Amp Drive | 2V p-p maximum |
| CN4-32 | CN1-32 | Ground | 0V |
| CN4-33 | CN1-33 | Mic Input | 1.6V p-p maximum |
| CN4-34 | CN1-34 | Ground | 0V |

| Connections | | Name | Characteristic |
|---|---|---|---|
| Front Panel | Microphone/ Diagnostics | | |
| CN2-1 | 1 | Ground - Microphone | 0 V |
| CN2-2 | 2 | Transmit Data | RS232 |
| CN2-3 | 3 | MIC PTT | 0 V = PTT, 5 V pull-up = not PTT |
| CN2-4 | 4 | Receive Data | RS232 |
| CN2-5 | 5 | Sidetone (Headset Drive) | 3 Vac pk-pk, 200R |
| CN2-6 | 6 | Microphone Input | 6k8 input impedance, 5mV sensitivity |
| CN2-7 | 7 | Ground | 0 V |

**

| Connections | | Name | Characteristic |
|---|---|---|---|
| Processor | MARC Port | | |
| CN5-1 | 1 | Ground | 0 V |
| CN5-2 | 2 | Line Out+ | +20 dBm to -20 dBm 600R |
| CN5-3 | 3 | Line Out- | +20 dBm to -20 dBm 600R |
| CN5-4 | 4 | Squelch Output | Grounding output +/- 60V, 200mA max. |
| CN5-5 | 5 | Unregulated Supply | Fused 500mA, 21.6 to 32 V |
| CN5-6 | 6 | Data RX B - Data In + | RS422 |
| CN5-7 | 7 | Data RX A - Data In - | RS422 |
| CN5-8 | 8 | Data TX B - Data Out + | RS422 |
| CN5-9 | 9 | Data TX A - Data Out - | RS422 |

* CN7A

| Pin Number | Name | Characteristic |
|---|---|---|
| 1 | TD+ | 100R 10/100Mbps |
| 2 | TD- | |
| 3 | RD+ | |
| 4 | Not Used | |
| 5 | Not Used | |
| 6 | RD- | 100R 10/100Mbps |
| 7 | Not Used | |
| 8 | Not Used | |

* CN7C

| Pin Number | Name | Characteristic |
|---|---|---|
| 1 | Data Rx A (Data In -) | RS-422 |
| 2 | Data Rx B (Data In +) | RS-422 |
| 3 | n/c | |
| 4 | Data Tx B (Data Out +) | RS-422 |
| 5 | Data Tx A (Data Out -) | RS-422 |
| 6 | Remote Supply On/Off | |
| 7 | Ground | 0V |
| 8 | Unregulated Supply | 21.6V to 32V |

* CN7B

| Pin Number | Name | Characteristic |
|---|---|---|
| 1 | RRING | ANSI T1.403-1995 (T1), ITU-T: G.703 (E1) |
| 2 | RTIP | |
| 3 | n/c | |
| 4 | TRING | ANSI T1.403-1995 (T1), ITU-T: G.703 (E1) |
| 5 | TTIP | |
| 6 | n/c | |
| 7 | n/c | |
| 8 | n/c | |

* CN7D

| Pin Number | Name | Characteristic |
|---|---|---|
| 1 | Line Out- | +20 dBm to -20 dBm 600R |
| 2 | Line Out+ | +20 dBm to -20 dBm 600R |
| 3 | Fast Antenna Change Over / PTT | NPN open collector grounding transistor |
| 4 | Line In + | +20 dBm to -20 dBm 600R |
| 5 | Line In - | +20 dBm to -20 dBm 600R |
| 6 | Squelch Output | Grounding output +/- 60V, 200mA max. |
| 7 | Ground | 0 V |
| 8 | PTT Input | 0 V or +10 V to +60 V or - 10 V to -60 V at 6mA |

| Connections | | Name | Characteristic |
|---|---|---|---|
| Front Panel | | | |
| CN3-1 | Loudspeaker | Loudspeaker output | 2V p-p maximum |
| CN3-2 | Loudspeaker | Ground Regulator | 0 V |
| CN3-3 | | n/c | n/c |

| Connections | | Name | Characteristic |
|---|---|---|---|
| DC Input | Regulation | | |
| Input-1 | CN2-2 | dc Input | Fused 21.6 to 32 V |
| Input-2 | CN2-1 | Ground Supply | 0 V |
| Input-3 | | n/c | n/c |

| Connections | | Name | Characteristic |
|---|---|---|---|
| Regulation | PSU | | |
| CN5-1 | | 0 V | 0V |
| CN5-2 | | PSU OK | 0 V OK |
| CN5-3 | | PSU OK | o/c OK |
| CN5-4 | | PSU off | 0 V = on |
| CN5-5 | CN4-3 | 0 V | 0 V |
| CN5-6 | CN4-1 | PSU off | PSU off 0V = Off |

| Connections | | Name | Characteristic |
|---|---|---|---|
| Regulation | Processor | | |
| CN4-1 | CN3-1 | +15 V Supply | +15 V |
| CN4-2 Regulator | CN3-2 | +15 V Supply | +15 V |
| CN4-3 | CN3-3 | +5 V Supply | +5 V |
| CN4-4 | CN3-4 | +5 V Supply | +5 V |
| CN4-5 | CN3-5 | Ground | 0V |
| CN4-6 | CN3-6 | Ground | 0V |
| CN4-7 | CN3-7 | -15 V Supply | -15 V |
| CN4-8 | CN3-8 | -15 V Supply | -15 V |
| CN4-9 | CN3-9 | ac Detect | 15V on, 0V off |
| CN4-10 | CN3-10 | dc Detect | Open collector |
| CN4-11 | CN3-11 | V Unreg | 21.6 to 32 V |
| CN4-12 | CN3-12 | V Unreg | 21.6 to 32 V |
| CN4-13 | CN3-13 | Remote on/off | 0V = off, open collector = on |
| CN4-14 | CN3-14 | n/c | n/c |

| Connections | | Name | Characteristic |
|---|---|---|---|
| Regulation | PA Control & RX RF | | |
| CN5-1 | CN6-1 | +15 V Supply | +15 V |
| CN5-2 | CN6-2 | +15 V Supply | +15 V |
| CN5-3 | CN6-3 | +5 V Supply | +5 V |
| CN5-4 | CN6-4 | +5 V Supply | +5 V |
| CN5-5 | CN6-5 | Ground | 0V |
| CN5-6 | CN6-6 | Ground | 0V |
| CN5-7 | CN6-7 | -15 V Supply | -15 V |
| CN5-8 | CN6-8 | -15 V Supply | -15 V |
| CN5-9 | CN6-9 | ac Detect | n/c |
| CN5-10 | CN6-10 | dc Detect | n/c |

| Connections | | Name | Characteristic |
|---|---|---|---|
| Processor | External Speaker | | |
| CN8 Tip | 1 | External Speaker Drive | 3.5 Vac pk-pk max |
| CN8 Ring | 2 | External Speaker Drive | 3.5 Vac pk-pk max |
| CN8 Sleeve | 3 | Ground | 0 V |

| Connections | | Name | Characteristic |
|---|---|---|---|
| Processor | Facilities | | |
| CN5-1 | 1 | Ground | 0 V |
| CN5-2 | 2 | E Bit | TTL pull-up active low |
| CN5-3 | 3 | PTT | Grounding output +/- 60V, 200mA max. |
| CN5-4 | 4 | External VSWR | TTL pull-up active low |
| CN5-5 | 5 | Squelch | Grounding output +/- 60V, 200mA max. |
| CN5-6 | 6 | Squelch | Grounding output +/- 60V, 200mA max. |
| CN5-7 | 7 | Squelch Defeat | TTL pull-up active low |
| CN5-8 | 8 | Ground | 0 V |

| Connections | | Name | Characteristic |
|---|---|---|---|
| Processor | Facilities | | |
| CN5-9 | 9 | Unregulated Supply | Fused 500mA 21.6 to 32 V |
| CN5-10 | 10 | Inhibit | TTL pull-up active low |
| CN5-11 | 11 | BIT Interruptive Test | TTL pull-up active low |
| CN5-12 | 12 | RSSI | Potential range 0 V to 10 V |
| CN5-13 | 13 | Ready Output | Open collector, 0 V = Ready |
| CN5-14 | 14 | Tape Output | -10 dBm, 100R |
| CN5-15 | 15 | Reserved | n/c |

| Connections | | Name | Characteristic |
|---|---|---|---|
| PSU | Regulator | | |
| CN1-1 | CN1-1 | Ground Supply | 0 V |
| CN1-2 | CN1-2 | Ground Supply | 0 V |
| CN1-3 | CN1-3 | V Unreg | 29 V |
| CN1-4 | CN1-4 | V Unreg | 29 V |

| Connections | | Name | Characteristic |
|---|---|---|---|
| RF PA | PA Control & RX RF | | |
| CN8-1 | CN4-1 | Forward Power Sense | 17 dBm ± 1 dB (-30.5 dBc ± 0.9 dB) |

| Connections | | Name | Characteristic |
|---|---|---|---|
| PA Control & RX RF | Front Panel | | |
| PC CN5-1 | CN4-1 | Reference Frequency | -20 dBm to 0 dBm |

| Connections | | Name | Characteristic |
|---|---|---|---|
| RF PA | PA Control & RX RF | | |
| CN13-1 | CN7-1 | Rx Input | Sensitivity: -107dBm Max. continuous: 5 V rms |

| Connections | | Name | Characteristic |
|---|---|---|---|
| PA Control & RX RF | RF PA | | |
| CN3-1 | CN10-1 | RF Drive | 1 dBm carrier |

| Connections | | Name | Characteristic |
|---|---|---|---|
| RF PA | | | |
| CN1-1 | Antenna Port | RF Output/Input | 5 to 50 W/-107dBm sensitivity |

| Connections | | Name | Characteristic |
|---|---|---|---|
| PA Control & RX RF | RF PA | | |
| CN2-1 | CN4 | PA Temperature | 10 mV/°C + 0.5V |
| CN2-2 | CN2 | Drive Detect | 0.5 V for +10 dBm |
| CN2-3 | CN7 | PA Bias Enable | TTL - High for bias on |
| CN2-4 | CN5 | Fan Enable | TTL - High for fan on |
| CN2-5 | CN9 | Reflected Power | 50 W = 670mV |
| CN2-6 | CN12 | PA Current Detect | 0.1V per Amp |

| Connections | | Name | Characteristic |
|---|---|---|---|
| RF PA | | | |
| CN6 | Fan | Fan Control | 10V approx. or 26.5V |
| PA Heatsink | Fan | Ground | 0V |

***

| Connections | | Name | Characteristic |
|---|---|---|---|
| Processor | PA Control & RX RF | | |
| CN1-1 | CN1-1 | Ground | 0 V |
| CN1-2 | CN1-2 | IF AGC | 0 to 2.5 V |
| CN1-3 | CN1-3 | Ground | 0 V |
| CN1-4 | CN1-4 | RF AGC | 0 to 2.5 V |
| CN1-5 | CN1-5 | Ground | 0 V |
| CN1-6 | CN1-6 | I | 0 to 2.5 V |
| CN1-7 | CN1-7 | Ground | 0 V |
| CN1-8 | CN1-8 | BIT I Monitor | ±2.5 V |
| CN1-9 | CN1-9 | Ground | 0 V |
| CN1-10 | CN1-10 | BIT Q Monitor | ±2.5 V |
| CN1-11 | CN1-11 | Ground | 0 V |
| CN1-12 | CN1-12 | Q | 0 to 2.5 V |
| CN1-13 | CN1-13 | Ground | 0 V |
| CN1-14 | CN1-14 | Frequency Trim | 0 to 4 V / 0 to 6V |
| CN1-15 | CN1-15 | Tx/Rx Detect | TTL |
| CN1-16 | CN1-16 | Power Down | TTL pull up active low |
| CN1-17 | CN1-17 | Ground | 0 V |
| CN1-18 | CN1-18 | Filter 0 | TTL |
| CN1-19 | CN1-19 | Filter 1 | TTL |
| CN1-20 | CN1-20 | Filter 2 | TTL |
| CN1-21 | CN1-21 | Filter 3 | TTL |
| CN1-22 | CN1-22 | Filter 4 | TTL |
| CN1-23 | CN1-23 | Ground | 0 V |
| CN1-24 | CN1-24 | Synth Load | TTL |
| CN1-25 | CN1-25 | Data | TTL |
| CN1-26 | CN1-26 | Clock | TTL |
| CN1-27 | CN1-27 | Phase Load | TTL |
| CN1-28 | CN1-28 | Reserved | TTL |
| CN1-29 | CN1-29 | Tx Key | TTL |
| CN1-30 | CN1-30 | Auto Level Control | 0 to 5 V (5 V 3dB back off) |
| CN1-31 | CN1-31 | PA Temperature | 10 mV / °C |
| CN1-32 | CN1-32 | Reflected Power | 0 to 2.5 V |
| CN1-33 | CN1-33 | PAC Temperature | 10 mV / °C |
| CN1-34 | CN1-34 | External VSWR | TTL |
| CN1-35 | CN1-35 | Narrow/Wide | TTL |
| CN1-36 | CN1-36 | BIT Control 0 | TTL |
| CN1-37 | CN1-37 | BIT Control 1 | TTL |
| CN1-38 | CN1-38 | BIT Open Loop | TTL |
| CN1-39 | CN1-39 | BIT Synth Lock | TTL |
| CN1-40 | CN1-40 | BIT Loop Correct | TTL |
| CN1-41 | CN1-41 | BIT VSWR OK | TTL |
| CN1-42 | CN1-42 | RF PA Bias Disable | TTL |
| CN1-43 | CN1-43 | Fan Enable | TTL - High fan on |
| CN1-44 | CN1-44 | OCXO Fitted | TTL - Low OCXO fitted |
| CN1-45 | CN1-45 | Reserved | TTL |
| CN1-46 | CN1-46 | Step Size | TTL |
| CN1-47 | CN1-47 | TR Detect | TTL |
| CN1-48 | CN1-48 | V/U Detect | TTL |
| CN1-49 | CN1-49 | BIT Control 2 | TTL |
| CN1-50 | CN1-50 | BIT Control 3 | TTL |

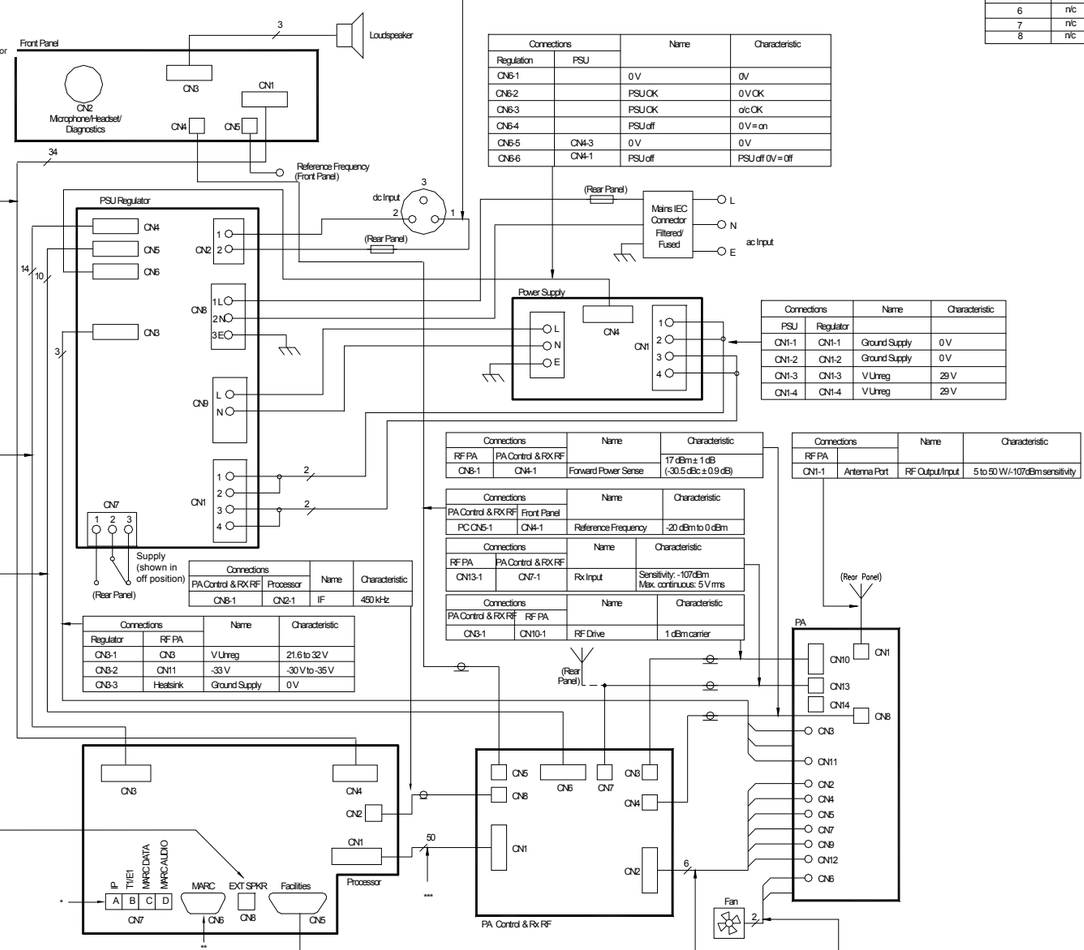



**Fig 5-7 Wiring and Interconnection Diagram**

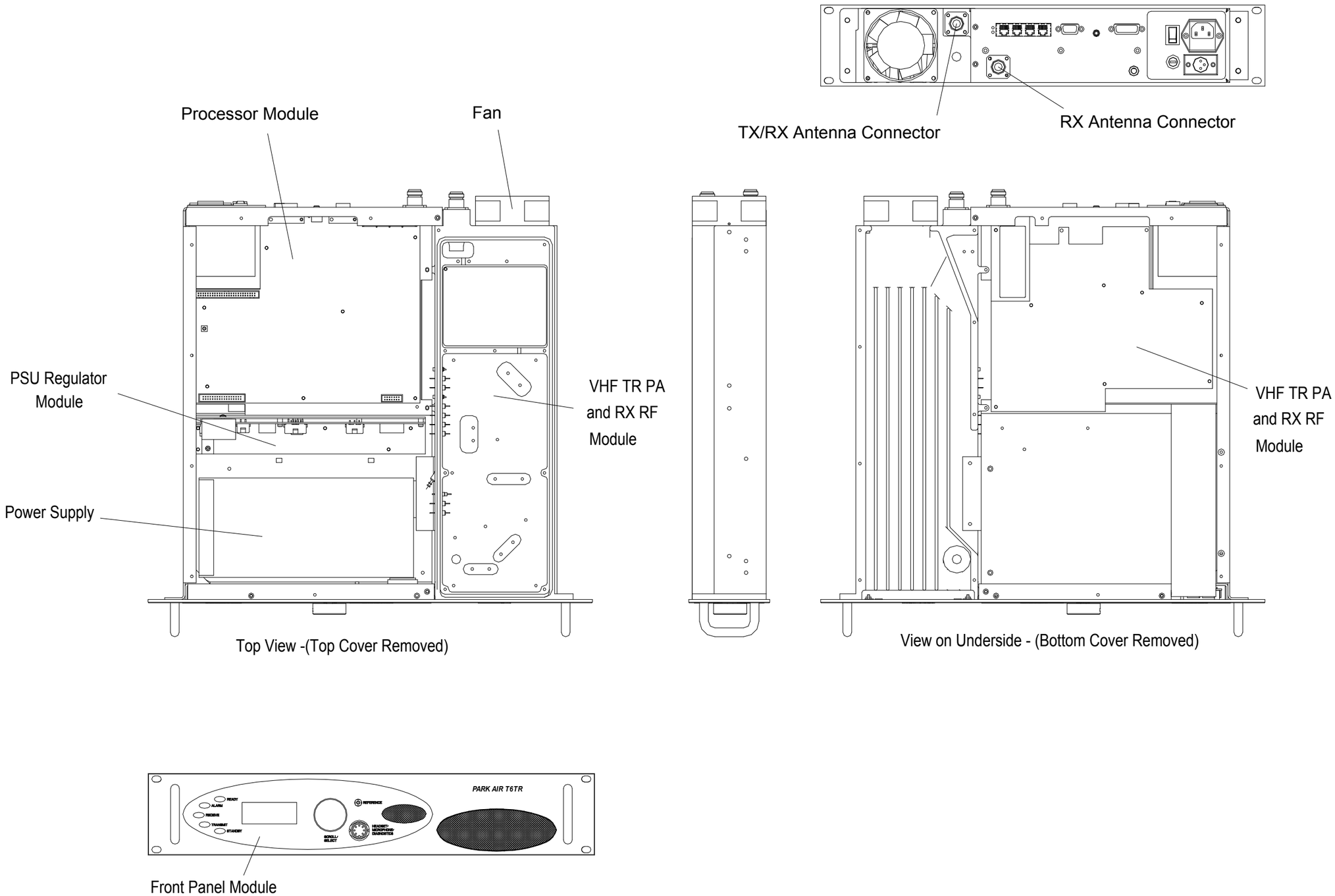



**Fig 5-8 Module Location Diagram**

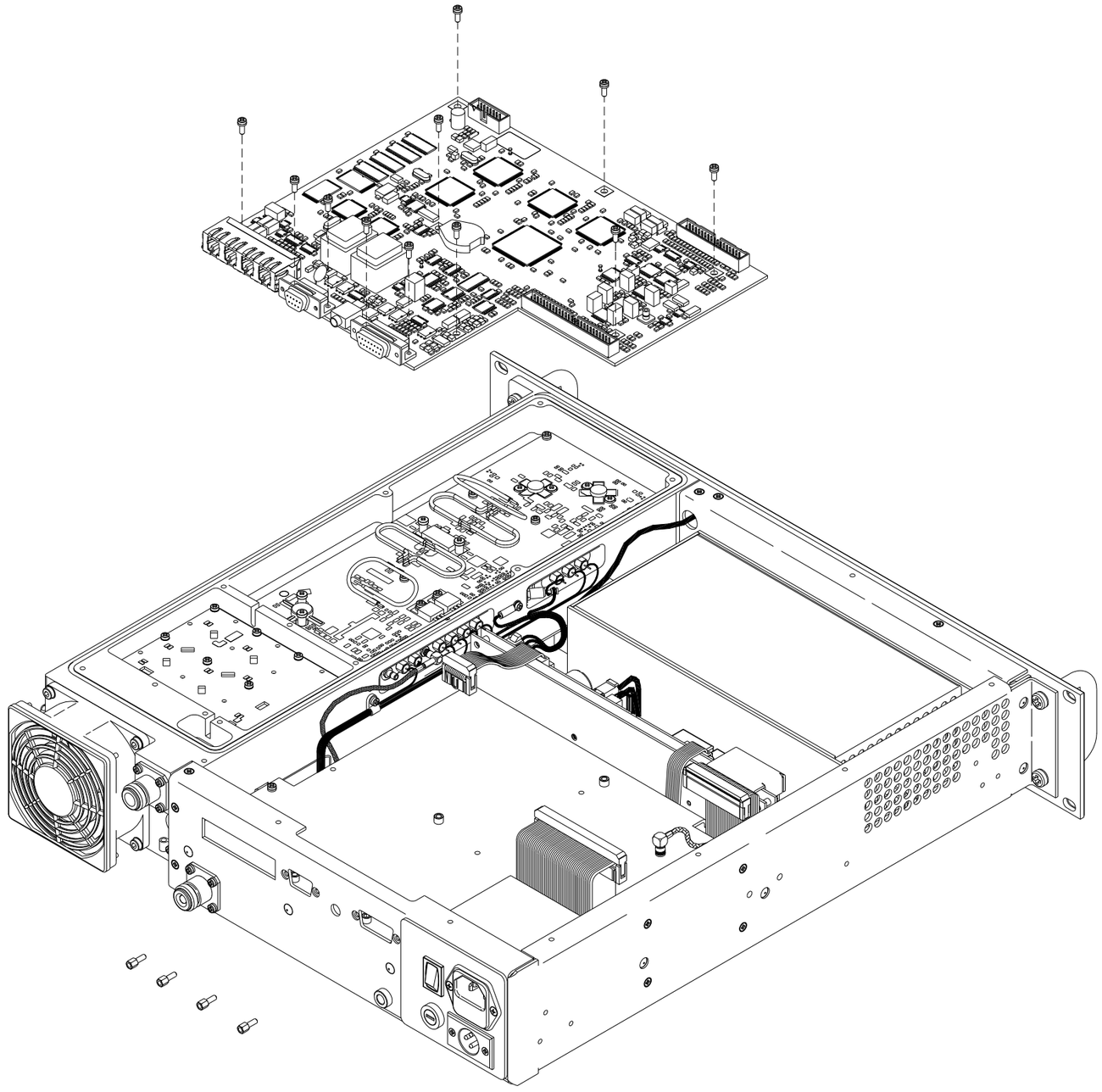


**Fig 5-9 Processor Module - Removal and Refitting Detail**

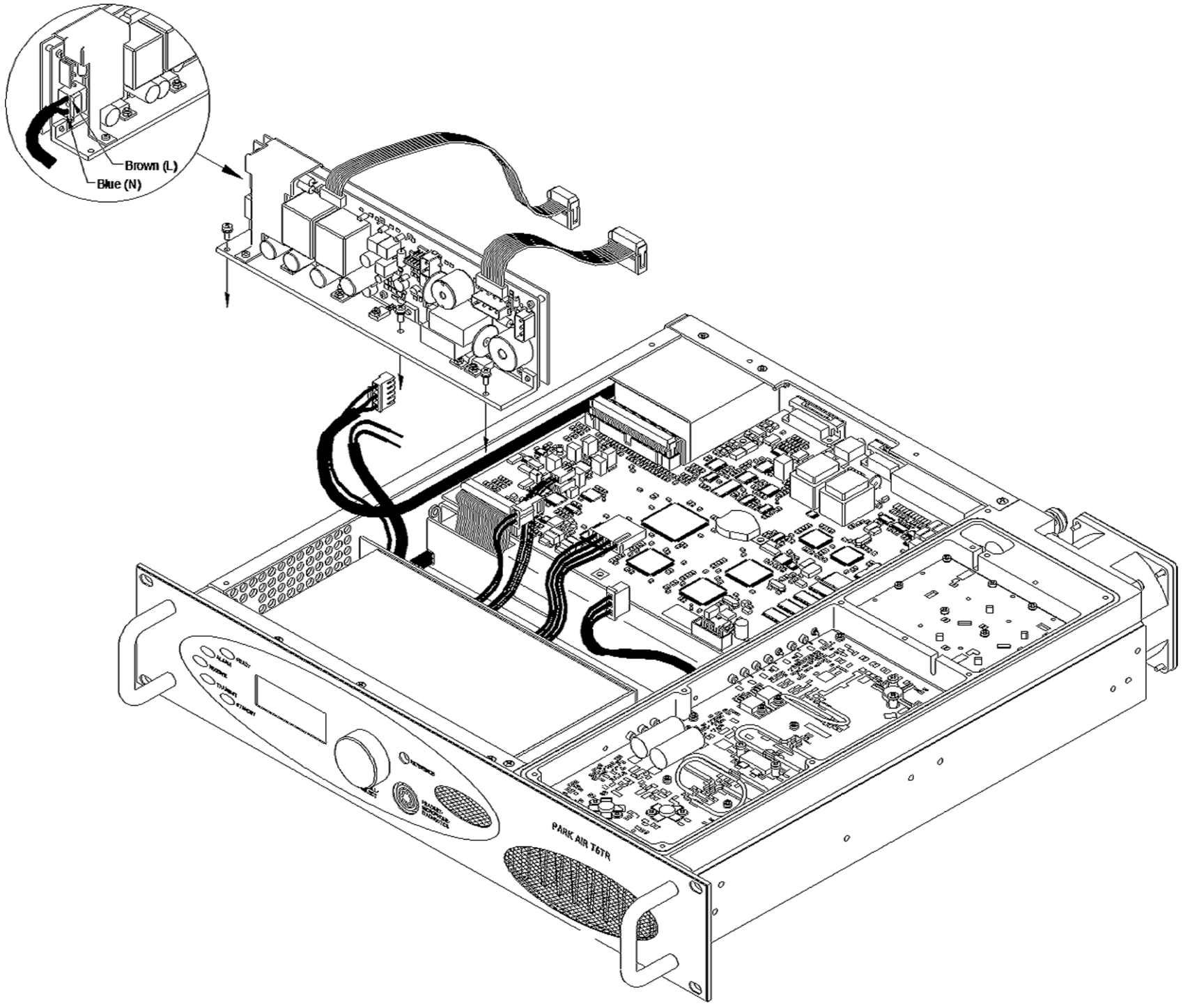



**Fig 5-10 PSU Regulator Module - Removal and Refitting Detail**

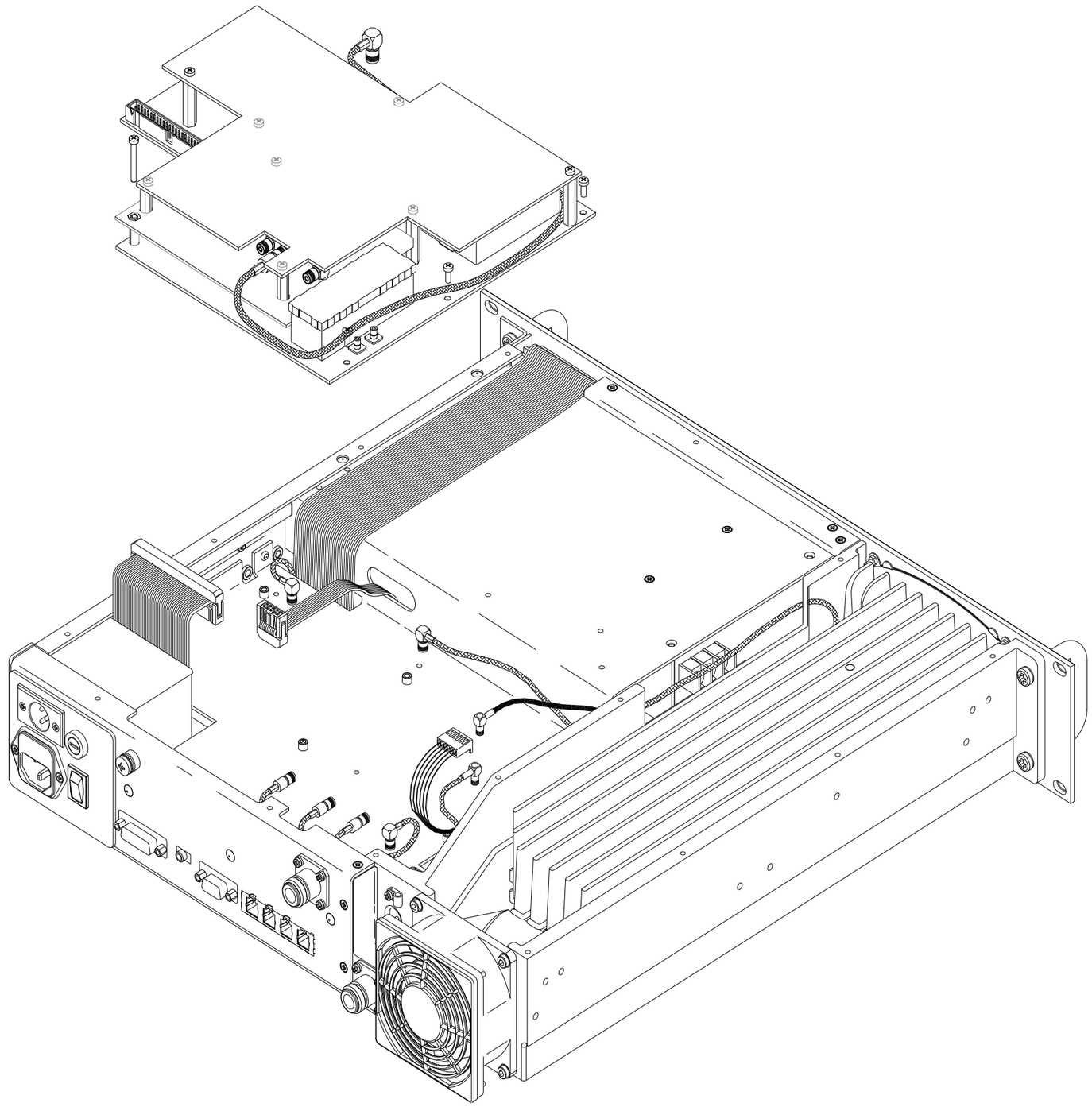


**Fig 5-11 PA Control/Rx RF Module - Removal and Refitting Detail**

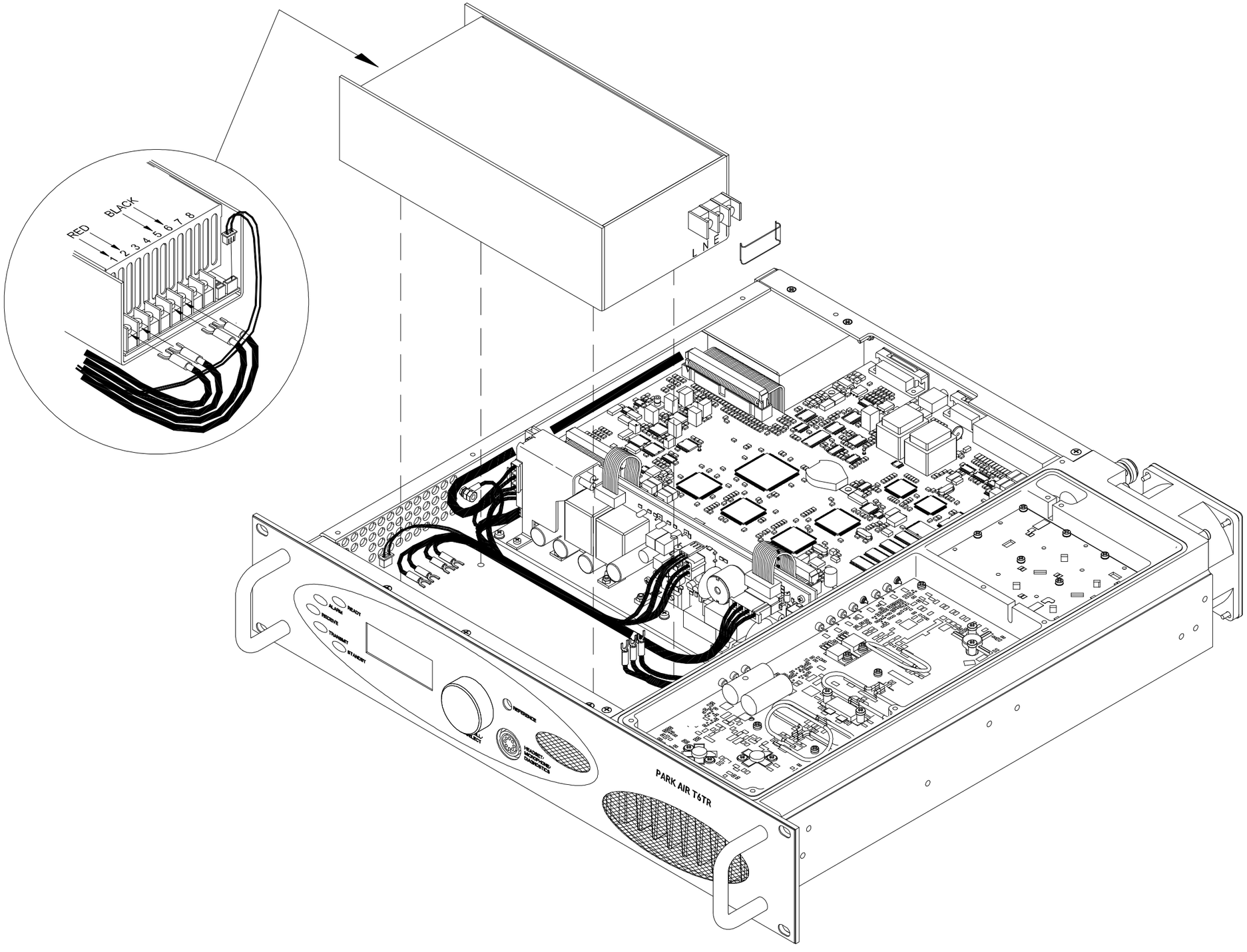



**Fig 5-12 Power Supply - Removal and Refitting Detail**

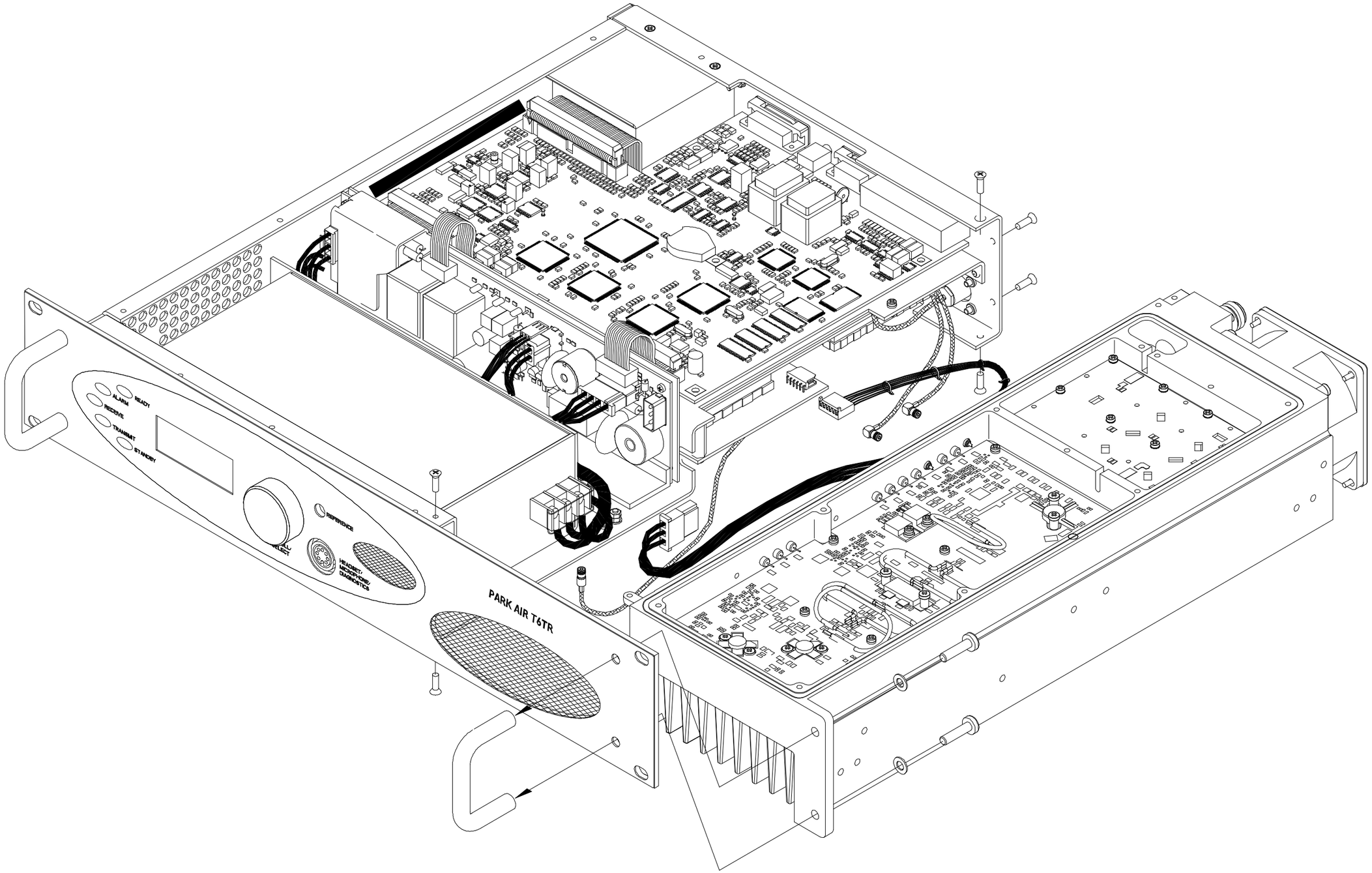



**Fig 5-13 PA Module -**
**Removal and Refitting Detail**

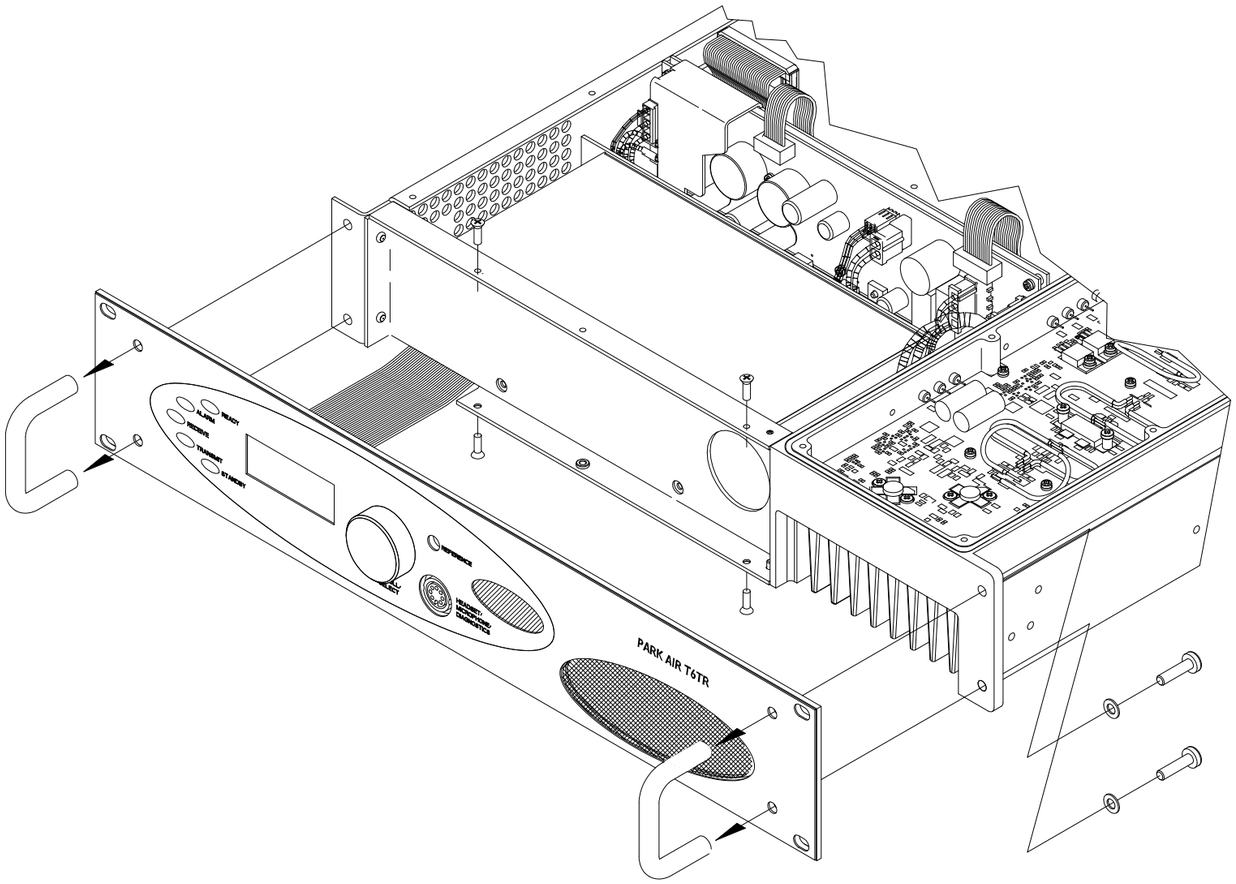



**Diagram A**

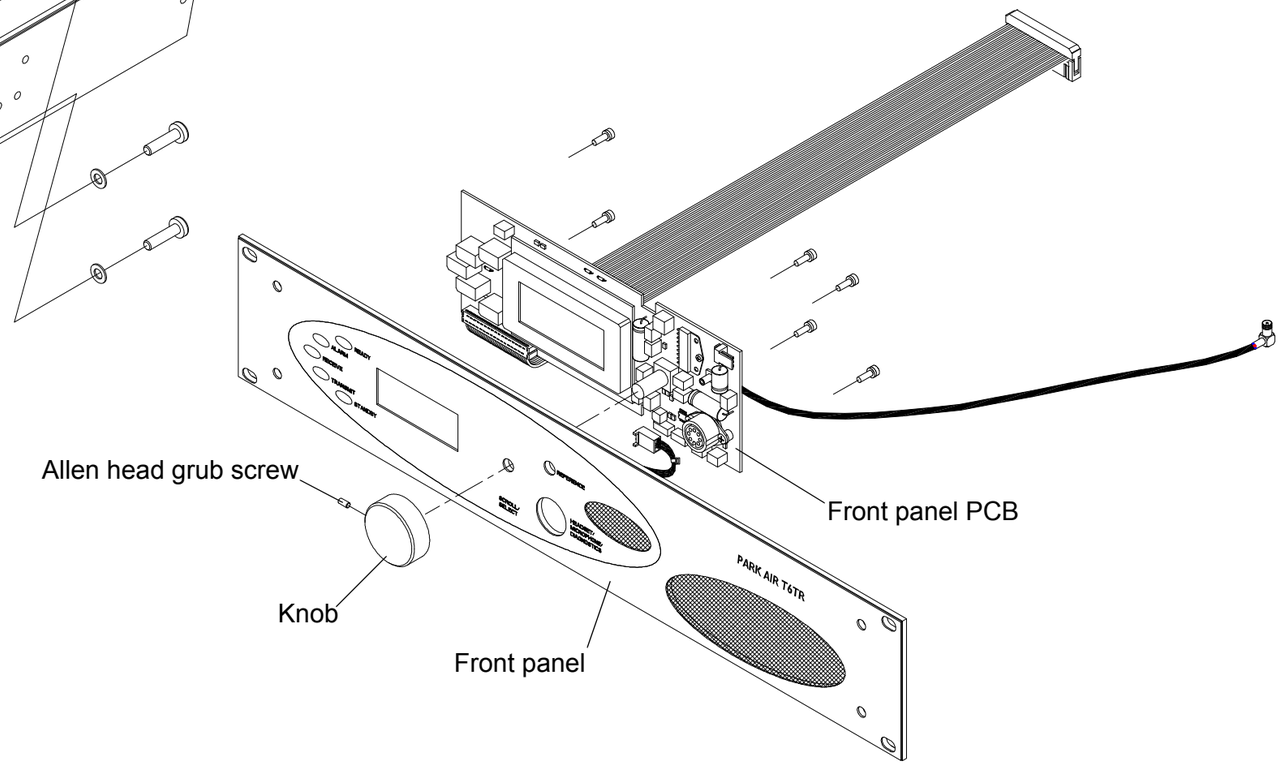



**Diagram B**

**Fig 5-14 Front Panel Assembly PCB - Removal and Refitting Detail**

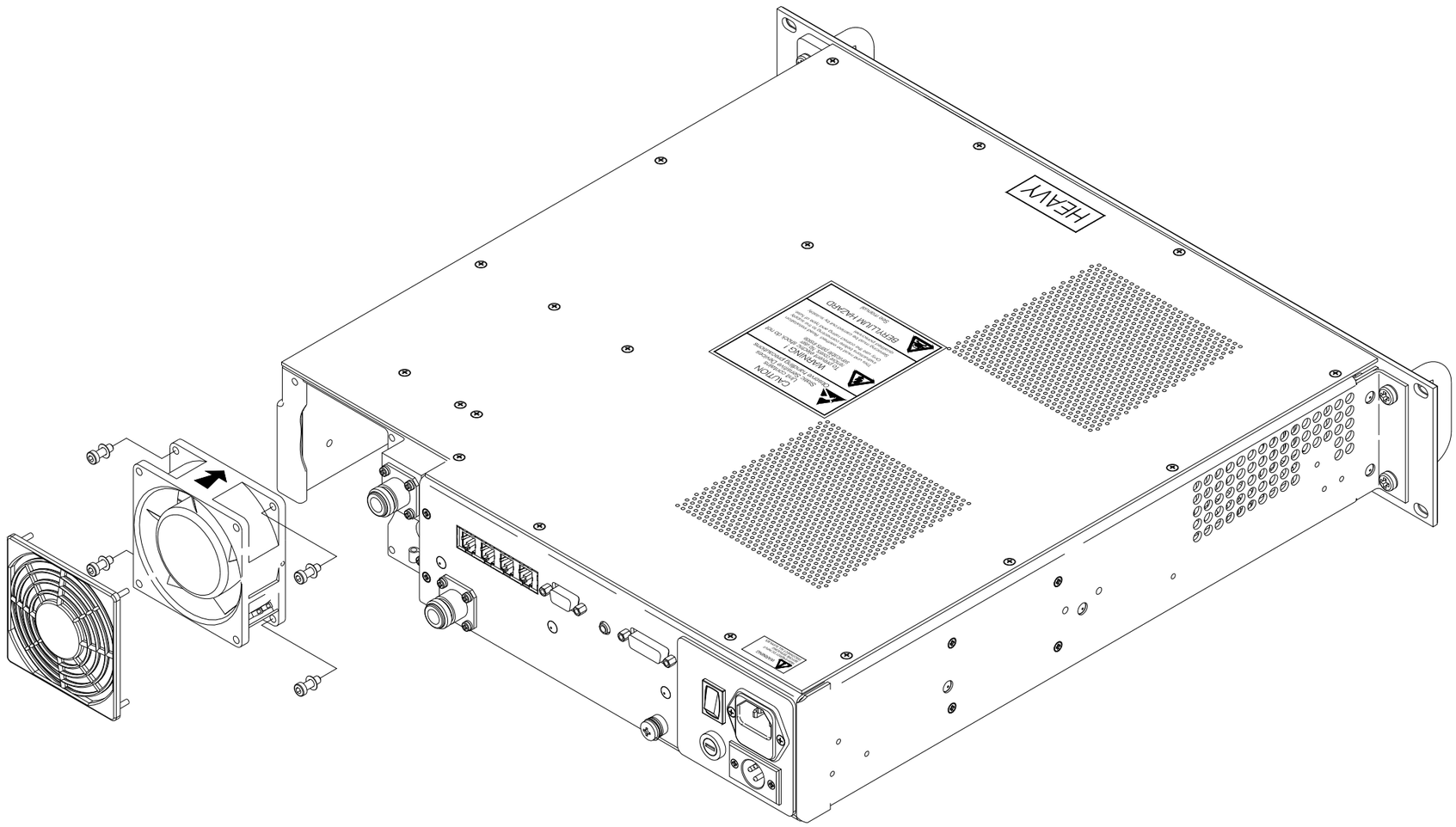



**Fig 5-15 Cooling Fan - Removal and Refitting Detail**

# Annex

## Health and safety

**Antenna radiation**

**Countries within the European Union**
The RF field strength limits according to EN 62311:2008 Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz), are shown in the table below:

| Frequency | Occupational level | General population level |
|---|---|---|
| 100 - 400 MHz | 10 W/m$^2$ | 2 W/m$^2$ |

***Example***
The safe distance from the antenna can be predicted using the equation:

$$R = \sqrt{\frac{1.45\ PG}{4\pi S}}$$

where,

R = distance to centre of radiation in metres

1.45 = multiplication factor for average power based on a modulation index of 0.95

P = power input to antenna in Watts (example, 50 Watts)

G = antenna gain as a ratio (example, 2 dB = $10^{2/10}$ = 1.585)

S = power density in W/m$^2$.

Based on this formula and using a 2 dBi antenna,

For RF and microwave workers:

The predicted safe distance from the centre of the radiation would be approximately 0.96 metres for a field strength of 10 W/m$^2$ (1 mW/cm$^2$).

For persons not classed as RF and microwave workers, and including the general public:

The minimum safe distance would be 2.14 metres for a field strength of 2 W/m$^2$ (0.2 mW/cm$^2$).

*Correct at 20th January 2016*.

For Canada, please see overleaf.

**Canada**
The RF field strength limits according to Health Canada Safety Code 6, are shown in the table below:

| Frequency MHz | Occupational level $W/m^2$ | General population level $W/m^2$ |
|---|---|---|
| 112.000 | 6.83 | 1.29 |
| 118.000 | 7.01 | 1.29 |
| 127.500 | 7.28 | 1.29 |
| 136.975 | 7.55 | 1.29 |
| 155.975 | 8.06 | 1.29 |
| 225.000 | 9.68 | 1.29 |
| 300.000 | 11.18 | 0.13 |
| 399.975 | 12.90 | 0.15 |

The general equation for Occupational level:

$W/m^2 = 0.6455\ f^{0.5}$

where, f = frequency in MHz.

The general equations for General Population level:

For 100 to 300 MHz = 1.291 $W/m^2$ and,

for 300 to 400 MHz, $W/m^2 = 0.02619\ f^{0.6834}$

where, f = frequency in MHz.

***Example***
The safe distance from the antenna can be predicted using the equation:

$$R = \sqrt{\frac{1.45\ PG}{4\pi S}}$$

where,

R = distance to centre of radiation in metres

1.45 = multiplication factor for average power based on a modulation index of 0.95

P = power input to antenna in Watts

G = antenna gain as a ratio (example, 2 dB = $10^{2/10}$ = 1.585)

S = power density in $W/m^2$.

Based on this formula and using a 2 dBi antenna, frequency of 118.000 MHz and a measured carrier power of 50 W, for RF and microwave workers:

The predicted safe distance from the centre of the radiation would be approximately 1.2 metres.

For persons not classed as RF and microwave workers, and including the general public:

The minimum safe distance would be 2.7 metres.

*Correct at 20th January 2016*.