TB7300 Base Station

Installation and Operation Manual

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This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).

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Contents

Preface

Scope of Manual

This manual provides information on installing and operating the TB7300 base station. It is intended for use by experienced technicians familiar with installing and operating base station equipment. It also includes configuration, maintenance and troubleshooting information.

Document Conventions

The TB7300 base station has a web interface with an accordion menu on the left side of the screen. "Configure > Base Station > Channels" means click Configure in the top-level menu, then in the expanded Configure menu click Base Station, and finally click on the Channels tab on that page.

Within this manual, four types of alerts may be given to the reader. The following paragraphs illustrate each type of alert and its associated symbol.

Warning   **This alert is used when there is a hazardous situation which, if not avoided, could result in death or serious injury.**

Caution   This alert is used when there is a hazardous situation which, if not avoided, could result in minor or moderate injury.

Notice   This alert is used to highlight information that is required to ensure procedures are performed correctly. Incorrectly performed procedures could result in equipment damage or malfunction.

This icon is used to draw your attention to information that may improve your understanding of the equipment or procedure.

Associated Documentation

The current set of TB7300 product documentation is available on the Tait support website. Printed copies of the documentation are available on request.

- TB7300 Specifications Manual (MBD-00002-xx).
- TN9300 DMR Radio Network System Manual (MNB-00003-xx).
- TN9300 DMR Radio Network Node Controller Installation Manual (MNB-00001-xx).
- Safety and Compliance Information (MBA-00012-xx).

The characters **xx** represent the issue number of the documentation.

Technical notes are published from time to time to describe applications for Tait products, to provide technical details not included in manuals, and to offer solutions for any problems that arise. Look for new or updated technical notes on the Tait support website.

Publication Record

Issue	Publication Date	Description
1	December 2015	First release
2	April 2016	Add H5 UHF band, 400-470Mhz

1   Description

The Tait TB7300 base station is a robust state-of-the-art digital fixed station that combines Tait's proven strengths in reliability and high performance with software-based configurability and operation, digital signal processing and voice-over-IP technology.

The base station is designed for operation in a Digital Mobile Radio (DMR) Tier 2 conventional or Tier 3 trunked radio network. The ability of the base station to link stations using standard Internet Protocol communications, and to add features through software options ensures that DMR systems designed with the TB7300 are scalable in both size and functionality.

The TB7300 can also operate as a simple, conventional analog repeater with CTCSS[1] subaudible signaling[2].

The base station combines industry-leading digital voice quality with rugged design specifications and intuitive user interfaces. These products have been designed to meet the demanding needs of professional radio users.

Its Ethernet interface provides built-in network connectivity. This network supports voice-over-IP in DMR networks, and remote management of all base stations via a web browser.

---

1. Private Line (PL).

2. Multi-site operation with voice-over-IP connection will be supported in a later release.

1.1   Features

The following are some of the features of the base station:

■ Fully compliant with the DMR Tier 2 and Tier 3 Standards. Can therefore interoperate with any similarly compliant radios.

■ Analog conventional repeater operation.

■ Can be completely managed remotely from a PC running a web browser: configuration, alarm monitoring, fault diagnosis, feature and firmware upgrades. Alarms can also be reported via SNMP traps, allowing integration with an SNMP-based network management system.

■ Rugged construction with generous heatsinks and fan-forced cooling for continuous operation from $-22°F$ to $+140°F$ ($-30°C$ to $+60°C$).

1.2 Frequency Bands and Sub-bands

Much of the circuitry in the base station is common to all frequency bands, and is therefore covered by a single description in this manual. In some cases the descriptions refer to specific bands or sub-bands, and these are identified with the letters listed in the following table.

Frequency Identification	Frequency Band and Sub-band	40 W	50 W
B band	B3 = 148 MHz to 174 MHz		✓
H band	H5 = 400 MHz to 470 MHz	✓	

1.3 Applications

The TB7300 is designed for operation in a Tait TN9300 DMR Tier 2 conventional radio network, a Tait TN9300 DMR Tier 3 trunked radio network, or as an analog conventional repeater.

In a DMR Tier 2 conventional network it can operate as a stand-alone repeater, or as a member of a multi-site system (under the supervision of a DMR conventional node). Since DMR provides two logical channels (timeslots) simultaneously for each radio frequency (physical channel), two users can alternately access the same frequency, one in each timeslot. Base stations on different sites can be linked together to form channel groups. A base station can support two channel groups, one in each timeslot.

In a DMR Tier 3 trunked network it can operate as a traffic channel or a control channel. With two logical channels for each radio frequency, a single TB7300 base station can provide two traffic channels, two control channels, or both a traffic channel and a control channel.

In analog operation it can operate as a conventional repeater with CTCSS[1] subaudible signaling[2].

For more information, refer to the DMR System Manual.

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1. Private Line (PL).
2. Multi-site operation with voice-over-IP connection will be supported in a later release.

1.4   Licenses

Some operational functions of the base station are controlled by licenses. These functions will not work unless you purchase the appropriate feature license and enable the feature set controlled by that license. The feature sets currently available are listed below.

The base stations in a Tait DMR Tier 3 Network are controlled by a node (DMR trunking controller). The TB7300 is compatible with two types of Tait node: Express and Access. Each type of node has different capabilities. Refer to TN-2134 for more information.

Analog Air Interface (TBAS301)

By default, all base stations have the TBAS301 license which allows operation as an analog conventional repeater.

DMR Trunking Express (TBAS302)

A base station with this license can accept connections from any Express node/standalone node or Access standalone node. In single-site trunking and fallback modes, this license entitles a standalone node to control a single site of up to 20 physical channels.

DMR Trunking Access (TBAS303)

A base station with this license can accept connections only from an Access standalone node. This license entitles a standalone node to control a single site of up to four physical channels.

DMR Conventional (TBAS304)

A base station with this license can operate in a Tait DMR Tier 2 conventional network. It can operate as a stand-alone repeater, or as a member of a multi-site system (under the supervision of a DMR conventional node).

A base station with both a DMR Conventional license and a valid DMR trunking license (such as Express or Access) can be configured to operate in either mode. This enables a DMR Tier 2 base station to be reconfigured and re-used in a DMR Tier 3 trunked network.

1.5   Theory of Operation

The RF input is fed directly to the receiver board, while the RF output is via the exciter and PA boards. The control board also receives signals from, and sends signals to, the system interface, the Ethernet interface, and the front interface (see Figure 1.1).

The Ethernet interface carries voice over IP and also allows maintainer access via a web browser.

Figure 1.1   Base station high-level diagram
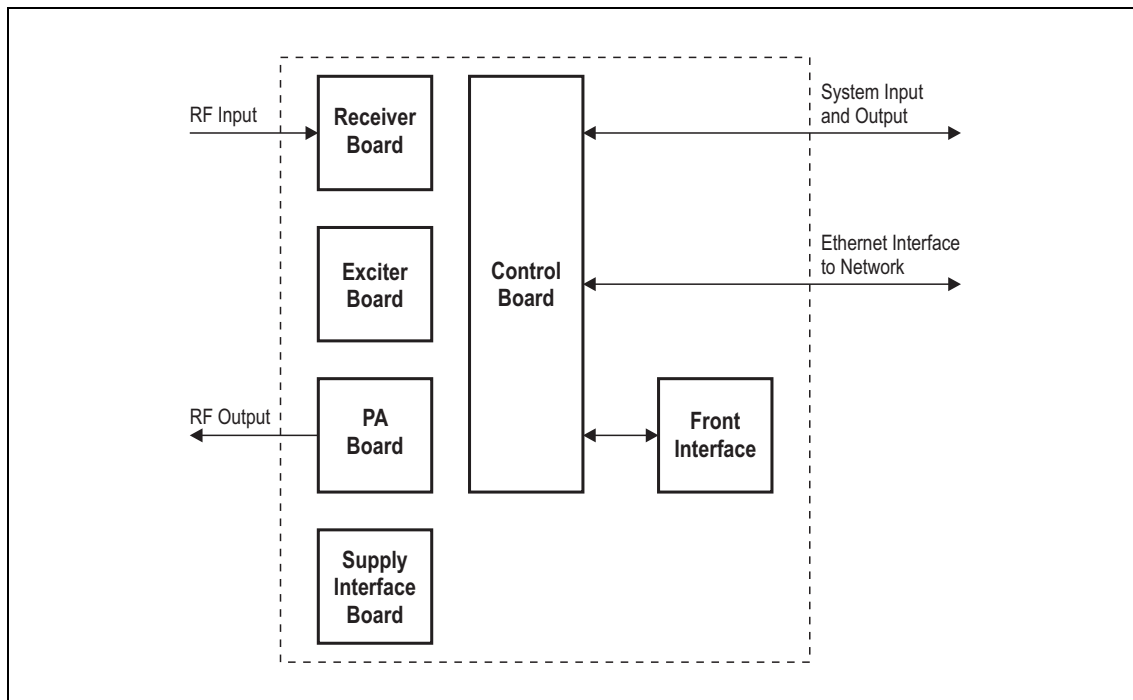
The control board carries out signal processing and has overall control of the base station.

The control board converts information between analog and digital and controls the maintainer's access via the Ethernet interface. It performs the air interface signal processing for digital DMR operation, gives the base station an identity as a network element, and provides the physical connections for the Ethernet and system interfaces.

1.5.1 Signal Paths

Figure 1.2 gives an overview of signal paths within the control board.

Figure 1.2   Control board signal paths
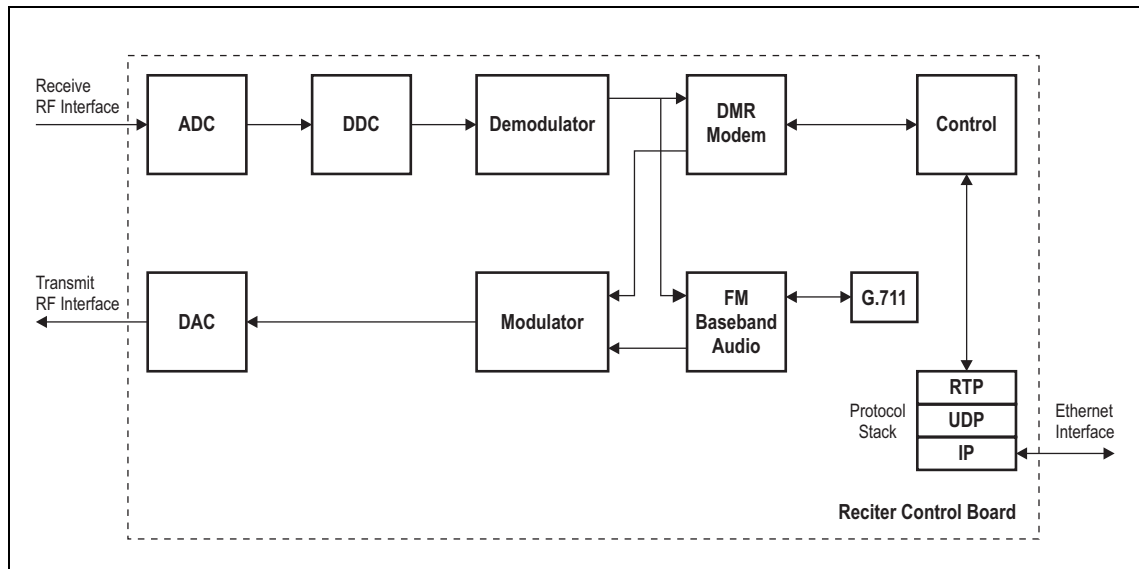
Digital DMR signals from the receive RF interface pass through the digital receiver and DMR modem to the control software in the RISC processor. The control software passes the signal through the Ethernet interface to the node controller.

Input to the Ethernet interface is from the node controller. This input is processed by the RISC and passed through the DMR modem to the transmitter.

Analog FM signals from the receive RF interface pass through the digital receiver and are converted to G.711 before being modulated and retransmitted.

1.5.2 Online and Offline Modes

The base station normally operates in Online mode, but you can put it into Offline mode via its web interface.

Online Mode   In Online mode, the base station performs its normal functions.

Offline Mode   Some procedures, such as activating firmware or running certain diagnostic tests, require the base station to be in Offline mode. This takes the base station out of service.

1.5.3 Power Supply

The supply interface board accepts a nominal 13.8 VDC input and distributes it to the PA board and front interface board. The front interface board then feeds the receiver, exciter and control boards. The supply interface is fused at 15 A.

1.5.4 Front Panel Fans

The base station is equipped with three fans. One fan is for the receiver, exciter and control boards, and the other two fans are for the PA. Front panel fans do not operate continuously, but are switched on and off as needed. The fans can also be temporarily enabled for test purposes via the web interface.

When the base station is powered up, the fans turn on until the main software fully boots.

2 General Safety and Regulatory Information

This chapter provides general information on safety precautions for operating the base station.

2.1 Personal Safety

2.1.1 Explosive Environments

⚠ **Warning** **Do not operate the equipment near electrical blasting caps or in an explosive atmosphere. Operating the equipment in these environments is a definite safety hazard.**

2.1.2 High Temperatures

Take care when handling a base station which has been operating recently. Under extreme operating conditions ($+140°F$ [$+60°C$] ambient air temperature) or high duty cycles, the external surfaces of the base station can reach temperatures of up to $+176°F$ ($+80°C$).

2.1.3 LED Safety (EN60825-1)

This equipment contains Class 1 LED Products.

2.1.4   Proximity to RF Transmissions / A proximité des émissions RF

To comply with the RF Field Limits for Devices Used by the General Public for (Uncontrolled Environment)[a], a safe separation distance of at least 12 feet (3.6 metres) from the antenna system should be maintained.

This figure is calculated for a typical installation, employing one 50 W base station transmitter. Other configurations, including installations at multi-transmitter sites, must be installed so that they comply with the relevant RF exposure standards.

a. Reference Standards
Health Canada's Safety Code 6: *Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz*
USA Federal Communications Commission OET bulletin 65 (47CFR 1.1310)
IEEE C95.1 2005: *Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*

Pour respecter les limites imposées au champ RF au niveau des équipements utilisés par le grand public (environnement non contrôlé)[a], une distance de séparation de sécurité d'au moins 3.6 mètres du bloc d'antenne devrait être observée.

Ce nombre est calculé pour une installation typique, ayant un émetteur de station de base de 50 W. D'autres configurations, incluant les installations ayant des sites de plusieurs émetteurs, doivent être installées de façon à se conformer aux normes pertinentes des expositions RF.

a. Normes de référence
Code de sécurité 6 de Santé Canada: *Limites d'exposition humaine à l'énergie électromagnétique radioélectrique dans la gamme de fréquences de 3 kHz à 300 GHz*
Commission fédérale des communications (FCC) des Etats Unis d'Amérique bulletin OET numéro 65 (47CFR 1.1310)
IEEE C95.1 2005: *Norme pour les niveaux de sécurité compatibles avec l'exposition des personnes aux champs électromagnétiques de radiofréquence 3 kHz à 300 GHz*

2.2 Equipment Safety

2.2.1 Installation and Servicing Personnel

The equipment should be installed and serviced only by qualified personnel.

2.2.2 Preventing Damage to the PA

The base station has been designed to operate safely under a wide range of antenna loading conditions. Transmitting into a low VSWR will maximize the power delivered to the antenna.

Notice Do not remove the load from the TB7300 while it is transmitting.

Load transients (switching or removing the load) can damage the PA output stage. See "Connecting RF" on page 61 for recommendations.

2.2.3 ESD Precautions

Notice This equipment contains devices which are susceptible to damage from static charges. You must handle these devices carefully and according to the procedures described in the manufacturers' data books.

We recommend you purchase an antistatic bench kit from a reputable manufacturer and install and test it according to the manufacturer's instructions. Figure 2.1 shows a typical antistatic bench set-up.

You can obtain further information on antistatic precautions and the dangers of electrostatic discharge (ESD) from standards such as ANSI/ESD S20.20-1999 or BS EN 100015-4 1994.

Figure 2.1   Typical antistatic bench set-up
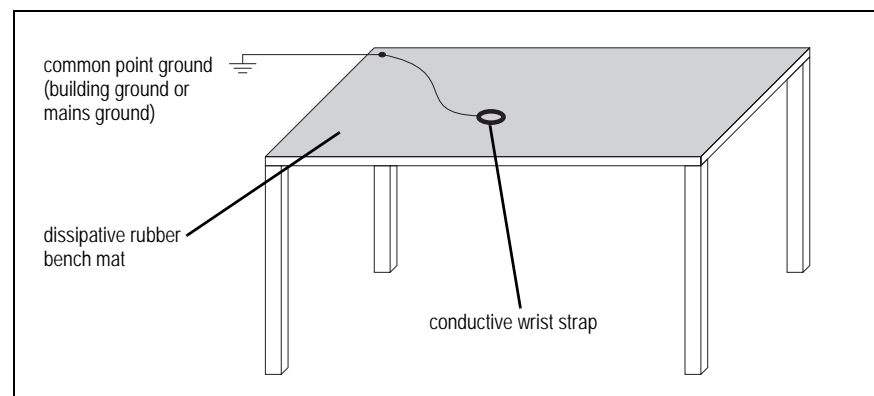
2.3 Environmental Conditions

2.3.1 Operating Temperature Range

The operating temperature range of the equipment is $-22°F$ to $+140°F$ ($-30°C$ to $+60°C$) ambient temperature. Ambient temperature is defined as the temperature of the air at the intake to the cooling fans.

2.3.2 Humidity

The humidity should not exceed 95% relative humidity through the specified operating temperature range.

2.3.3 Dust and Dirt

For uncontrolled environments, the level of airborne particulates must not exceed $100\,\mu g/m^3$.

2.4 Regulatory Information

2.4.1 Distress Frequencies

The 406 to 406.1 MHz frequency range is reserved worldwide for use by Distress Beacons. Do **not** program transmitters to operate in this frequency range.

2.4.2 Compliance Standards

This equipment has been tested and approved to various national and international standards. Refer to the latest issue of the Specifications Manual for a complete list of these standards.

2.4.3 Unauthorized Modifications

Any modifications you make to this equipment which are not authorized by Tait may invalidate your compliance authority's approval to operate the equipment.

The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

2.4.4 Health, Safety and Electromagnetic Compatibility in Europe

In the European Community, radio and telecommunications equipment is regulated by Directive 1999/5/EC, also known as Radio and Telecommunications Terminal Equipment (R&TTE) directive. The requirements of this directive include protection of health and safety of users, as well as electromagnetic compatibility.

Intended Purpose of Product

This product is a radio transceiver. It is intended for radio communications in the Private Mobile Radio (PMR) or Public Access Mobile Radio (PAMR) services, to be used in all member states of the European Union (EU) and states within the European Economic Area (EEA). This product can be programmed to transmit on frequencies that are not harmonized throughout the EU/EEA, and will require a licence to operate in each member state.

Declaration of Conformity

You can download the formal Declaration of Conformity from www.taitradio.com/eudoc.

2.5 Device and Network Security

If this radio network equipment is used for mission-critical applications, it is important to be able to ensure security and continuity of operation. For IP-network-connected equipment, it is also important to ensure that this equipment is not a means of compromising other equipment in the network.

All network elements should be physically secured, where possible. This includes the use of locked cabinets and locked rooms. Seals on connectors can also provide a visual indication of unauthorized tampering.

Tait recommends that all network and audio connectors should be sealed with the stick-on type of seal. The seal should reveal if any of the connectors have been unplugged, or if any unauthorized equipment has been plugged in.

The seals should be difficult to remove without breaking, and should bridge between the cable and equipment side (plug and socket) of the connection.

Seals should cover any unused network or audio sockets. This includes the Ethernet connector on any adaptor front panels, any spare switch ports, and the console port on the router and switch.

The seals should be difficult to reproduce. A sticker initialed or signed by the technician should satisfy this.

Seals must be replaced if they need to be disturbed during maintenance.

3 Operation

This section describes the indicator LEDs on the front panel.

The indicator LEDs on the front panel are shown in Figure 3.1. They allow monitoring of the base station's operational status.

Figure 3.1   LEDs on the front panel

① power LED   ③ receive LED
② alarm LED   ④ transmit LED
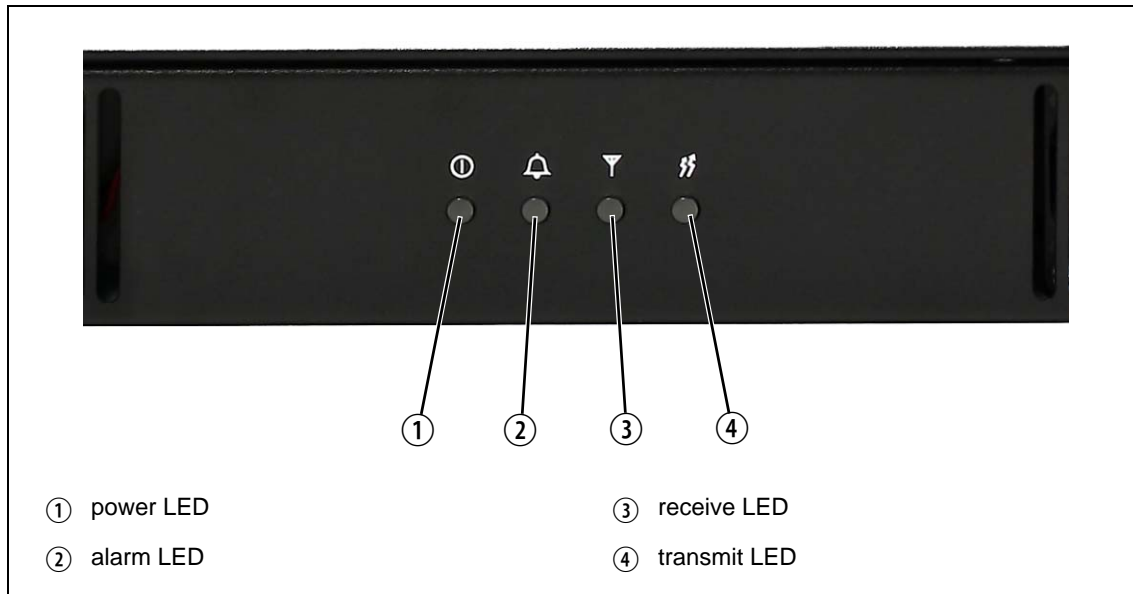
③ Power LED

The green power LED is lit when power is supplied to the base station.

④ Alarm LED

The red alarm LED flashes when an alarm has been generated by any of the base station modules. It will continue to flash until the alarm is canceled or the fault is fixed. Note that only those alarms which are enabled using the web interface will cause this LED to flash.

LED	Description
Flashing	One or more faults are present.
On (steady)	A base station is in Offline mode, and no faults are present.
Off	A base station is in Online mode, and no faults are present.

⑤ Receive LED

The amber receive LED indicates whether the base station is receiving a valid RF signal on one or both logical channels.

LED	Description
On (steady)	A base station is receiving a valid RF signal.
Off	A base station is not receiving a valid RF signal.

⑥ **Transmit LED** The amber transmit LED is lit while the transmitter is transmitting.

⚡

4 Working with Base Stations from Your PC

The normal web browser on your PC provides a window into the TB7300 base station. Use it to connect to the base station so that you can monitor, configure, diagnose, and calibrate it (if required).

This section describes the following:

■ Connecting to the base station, including initially setting things up.

■ Working with base station web pages.

■ Carrying out basic tasks.

This section provides an overview of some aspects of the web interface. Refer to the Help for detailed instructions.

4.1 PC Recommendations

We recommend the following PC hardware and software for connecting to a TB7300 base station:

- SVGA Monitor (1024 x 768 minimum).
- Network connection.
- The base station works with recent versions of most modern browsers.

    Notice   Refer to the Release Notes for more information on currently supported browsers.

4.2 Connecting Your PC to the Base Station

You connect to a base station using your web browser. Using multiple browser windows or tabs, you can view more than one base station and more than one page of any base station at once. Base stations have a web-based interface that provides the pages you view. Up to ten users may be logged in to a base station at once.

The base station has three different user access levels: Administrator, Maintainer, and Monitor. Passwords can be defined for each level. This is done using the base station's web interface (Tools > Settings > Local users). Refer to the Help for more information on setting user access levels.

Connections to the base station can be authenticated by a remote (i.e. centralized) service. Refer to the Help and "Setting Up Authentication" on page 34 for more information.

4.2.1 Logging In

1. Enter the base station's IP address into your browser using a secure connection (https://). The default factory IP address is 192.168.1.2. To find out the base station's IP address, refer to "Finding a Lost or Forgotten IP Address" on page 33.

2. A security warning appears when you connect for the first time. Proceed anyway (refer to "Security Certificates" on page 30).

3. The login screen appears.

4. Enter your user name and password. When connecting for the first time, enter the user name "admin" and password "tbc_admin".

5. Click **Login**.

   Notice After logging in we recommend that you change the password and username for your own security (refer to "Working with the Web Interface" on page 35). Make sure that you store your passwords and usernames securely and do not lose them. They may be needed by Tait support personnel if assistance is required. Tait cannot retrieve forgotten passwords.

4.2.2   Setting the IP Address

Before the base station is installed on site, you need to provide it with its proper IP address. Make sure that you do not lose this address.

1.   Select Identity > Identity > Network.

2.   Enter the required details in the **Change network identity** area and click **Save**.

4.2.3   Security Certificates

You can upload your own security certificates to the base station (Tools > Settings > Web certificate). If you have installed and configured the appropriate Certification Authority software, you can issue security certificates for all base stations. After uploading the certificates to the base stations, you can configure all maintainers' web browsers to accept security certificates from your own Certification Authority.

ⓘ   Before you have uploaded a security certificate to the base station, it will raise a security warning when your browser connects to it for the first time. The base station creates a self-signed certificate when the firmware is installed. Your browser raises a security warning because the security certificate was not issued by a trusted Certification Authority. The browser has a way of letting you override or bypass the security warning.

4.2.4 Connecting a Networked PC to a Base Station

You may want to temporarily disconnect a networked PC from its LAN in order to be able to establish a direct connection with the base station. A physical connection is needed as well as an alternate (Windows 7, Windows Vista, Windows XP) or temporary (Windows 2000) IP address and subnet mask.

Windows 7 or Windows Vista

1. Remove the local area Ethernet connection and connect an Ethernet patch cable between the PC and the base station. You can use either a straight through or crossover Ethernet patch cable with the current base station firmware.

2. Navigate to Control Panel > Network and Internet > Network and Sharing Center.

3. Click **View status**.

4. In the Local Area Connection Status dialog box, click **Properties**.

5. In the Local Area Connection Properties dialog box, click **Internet Protocol Version 4 (TCP/IPv4)**, and then click **Properties**.

6. Click **Alternate Configuration**.

7. Select the User configured option, and then enter a number that is on the same subnet as the base station. For example, if the TB7300 has IP 192.168.1.2, enter 192.168.1.1 for the PC.

8. Enter a suitable subnet mask, for example 255.255.255.0.

   The web browser should now be able to connect to any physically connected base station that is on the same subnet.

9. Once the web browser session is finished, re-connect the local area network cable to the PC. The PC then uses its normal TCP/IP properties.

Windows XP Professional

1. Remove the local area Ethernet connection and connect an Ethernet patch cable between the PC and the base station. You can use either a straight through or crossover Ethernet patch cable with the current base station firmware.

2. Click Start > Settings > Control Panel.

3. Double-click **Network Connections**.

4. Double-click the Local Area Network icon.

5. Click **Properties**.

6. Click **Internet Protocol (TCP/IP)**, and then click **Properties**.

7. Click **Alternate Configuration**.

8.   Select the User configured option, and then enter a number that is on the same subnet as the base station. For example, if the TB7300 has IP 192.168.1.2, enter 192.168.1.1 for the PC.

9.   Enter a suitable subnet mask, for example 255.255.255.0.

The web browser should now be able to connect to any physically connected base station that is on the same subnet.

10. Once the web browser session is finished, re-connect the local area network cable to the PC. The PC then uses its normal TCP/IP properties.

Windows 2000

1.   Remove the local area Ethernet connection and connect an Ethernet patch cable between the PC and the base station. You can use either a straight through or crossover Ethernet patch cable with the current base station firmware.

2.   Select Start > Settings > Network and Dialup Connections.

3.   Double-click the Local Area Connection icon.

4.   Click **Properties**.

5.   Click I**nternet Protocol (TCP/IP)**, and then click **Properties**.

6.   Note the current settings so that you can restore them later.

7.   Select **Use the following IP address**, and then enter a number that is on the same subnet as the base station. For example, if the base station has IP 192.168.1.2, enter 192.168.1.1 for the PC.

8.   Enter a suitable subnet mask, for example 255.255.255.0.

The web browser should now be able to connect to the base station.

9.   When you have finished the web browser session, re-connect the local area network cable to the PC and then restore the original PC configuration. When you close the Network connection dialog box, the restored configuration is applied.

4.2.5 Troubleshooting Connection Problems

If the attempt to connect to a base station failed, consider these possible causes.

1. Your PC is part of your organization's LAN and does not belong to the same subnet as the base station. Give the PC a suitable IP address and subnet mask as described in "Connecting a Networked PC to a Base Station" on page 31.

2. You are attempting to connect to the wrong IP address. Check that the IP address is correct.

3. The link to the base station is down. Use ping to check.

4. You may have to bypass the proxy in your organization's LAN to access the radio communications network. Ask your system administrator to give you access.

5. JavaScript may be disabled in your browser. If JavaScript is disabled, your browser will be unable to connect to the base station. Note that modern browsers normally have JavaScript enabled by default.

4.2.6 Finding a Lost or Forgotten IP Address

Use the following procedure if an IP address has been lost or forgotten.

1. Connect your PC to the serial port on the back of the base station.

2. Run a program such as HyperTerminal, Teraterm or minicom.

3. Select the following port settings: 57600 baud, 8 data bits, no parity, 1 stop bit, no flow control.

4. Enter *root* as a login name, and enter the root password when requested (the default is *k1w1*).

5. Type *ifconfig* and press Enter. The IP address is displayed on the second line returned as "inet addr:xxx.xxx.xxx.xxx".

4.2.7   Setting Up Authentication

Connections to the base station can be authenticated by a remote
(i.e. centralized) service (Tools > Settings > Authentication). Two remote
authentication protocols are supported: LDAP and RADIUS.

> **Notice**   Only people experienced with the AAA architecture and
> authentication protocols should make changes on this page.

Moving logins to a centralized server can provide enhanced security for a
number of reasons, such as:

- less work is required to manage password-controlled access to all base
  stations in a network; you no longer need to change the password in
  each base station individually
- previously used passwords may be excluded from re-use
- access can be denied after a set number of incorrect passwords is
  entered
- passwords can be set to expire on a certain date
- remote access to base stations can be globally enabled and disabled as
  required for technical staff during the commissioning process.

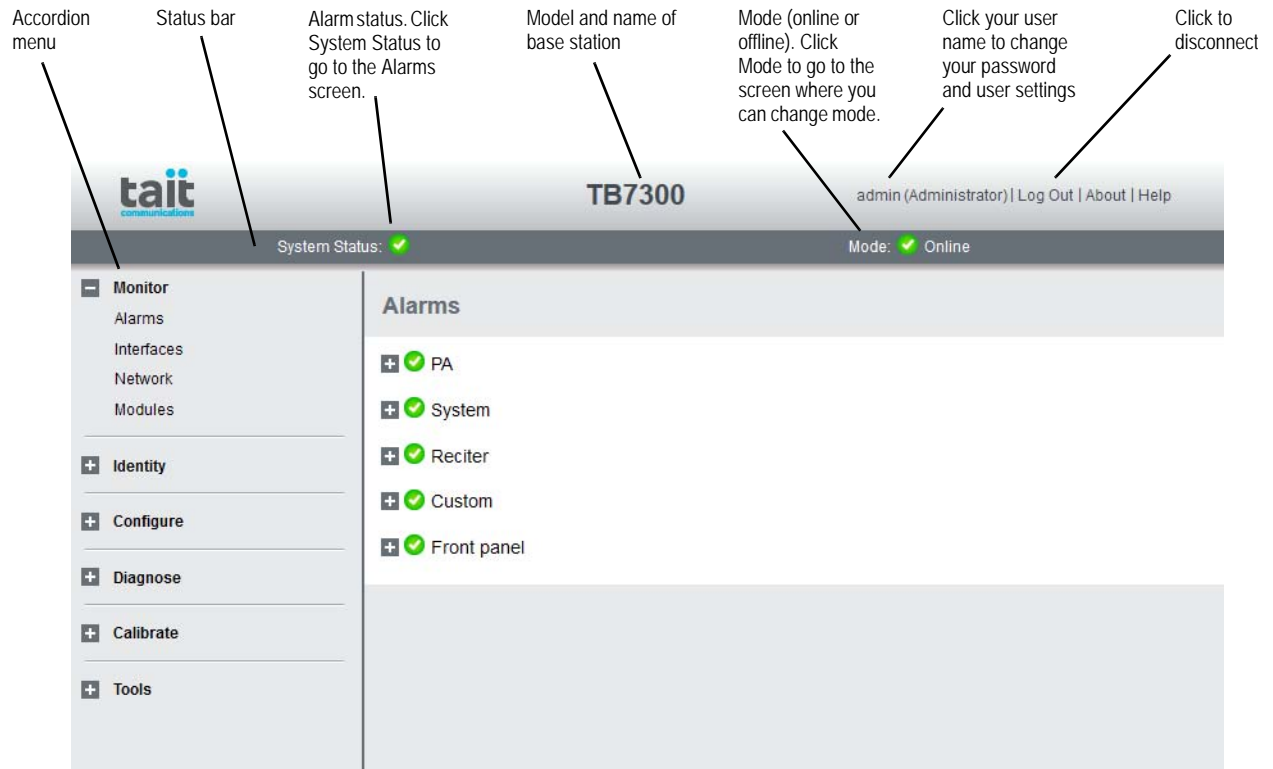Once the centralized server logins are set up, we recommend that only one
local administrator login is left on the base station for emergency use
(e.g. when the connection to the server is lost). The password for this
emergency login should be kept secret.

> **Notice**   Unless they are deleted, any local logins left on the base sta-
> tion will still work and have priority over remote logins.

4.3 Working with the Web Interface

This section provides an overview of the web interface. Refer to the Help for detailed instructions.

When you connect to a base station, the browser displays a page like the following.

Accordion menu | Status bar | Alarm status. Click System Status to go to the Alarms screen. | Model and name of base station | Mode (online or offline). Click Mode to go to the screen where you can change mode. | Click your user name to change your password and user settings | Click to disconnect

The accordion menu on the left gives you access to the various pages. Click a top level item (such as Configure) to open up its menu. Click on a menu item to display its page, then click on the appropriate tab on that page to display the required information. Click the + icon (⊞) on a menu item to expand the menu tree and the – icon (⊟) to collapse it again.

Press F11 for a full-screen display of the browser which does not show toolbars and other information. Press F11 again to return to the standard view.

ⓘ Using a browser window size smaller than 1024 x 768 may cause some pages to display incorrectly.

4.3.1 Monitoring Operation

Using the monitoring pages, you can see how the base station is currently operating.

For example, you can see the status of its network interface (Monitor > Interfaces > Network Connections).

4.3.2   Viewing Configuration Settings

The base station has many configuration settings that personalize it for its particular role in the network. Some settings, such as those for the trunking interface (Configure > Network Interfaces > Network), always apply.

Others are channel-based so that they can be dynamically changed. To view these, you first need to know the channel that the base station is operating on. Select Identity > Identity > Base Station to see its default channel number. Then you can view the base station's channel configuration settings. Select Configure > Base Station > Channels to view the list of channels.

Select a channel and click **Edit** to view details of the channel. Clicking directly on any text in a line will also open the edit screen.

4.3.3 Viewing the Base Station and Network Identity

Each base station in a network has a unique base station and network identity.

Select Identity > Identity and then Base Station or Network to view details such as name, default channel and network addresses. Note that the Host name field has a maximum of 63 characters, and may use the characters a−z, 0−9, dot and hyphen. You cannot use spaces.

4.4 Basic Tasks

4.4.1 User Settings

Click on your user name in the top right corner of the page to choose whether the temperature is displayed in Fahrenheit or Celsius[1], and to change your password. Note that this information is stored in the base station, not in your browser.

4.4.2 Taking the Base Station Offline

You may need to take the base station offline in order to carry out diagnostic tests or to take it out of service if a fault develops.

1. Click Mode on the status bar (or Select Tools > Tools > Base Station).

2. Under Control, select Offline. Click **Offline** to confirm the change. In the Status area, the Mode display changes first to "Changing", and then to "Offline" (⚠).

4.4.3 Troubleshooting Alarms

If the Alarm status on the status bar displays red, one or more alarms have been triggered, and the Alarms menu automatically expands to display the alarm(s). Click Help and navigate to the description of that alarm.

---
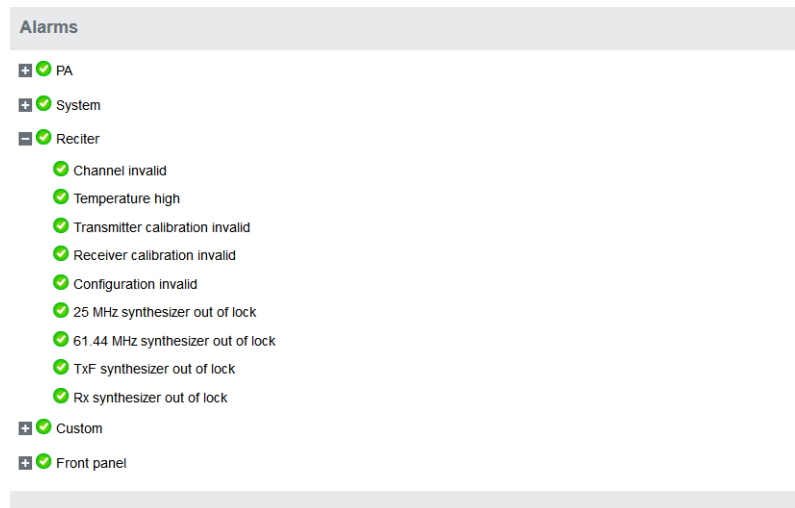
1. For this change to take effect, you must log out of the base station and then log back in again.

4.4.4 Working with Configuration Files

At any time, you can save the current configuration settings as a file (Tools > Files > Configuration > Backup configuration). This is stored in the base station, but we recommend that you download it and store it on your computer as an off-site backup. The base station identity and network identity are not saved as part of the configuration file.

You may want to develop a master configuration and upload it to all base stations in the network. The master configuration can contain all the different channel configurations and can be common to all base stations. The base station identity selects the default channel.

(i) Base stations are delivered with a default configuration which provides a safe set of values. We recommend that you download it and store it on your computer as a backup before changing and saving any configuration settings.

You can also generate a report containing all the base station's configuration settings (Tools > Files > Configuration > Configuration report), which can be saved as a text file. We recommend that you do this when the base station is commissioned. This report can be useful later if there is a problem with the base station. Comparing the original report with the later one may highlight changes in configuration that are causing a problem.

4.4.5 Setting Up Custom Alarms

Each of the base station's 12 digital inputs can be used to raise a custom alarm when the input goes high or low. The Custom Alarms form (Configure > Alarms > Custom Alarms) allows you to assign a name to each custom alarm, and to configure whether the alarm is triggered when the digital input goes high or low. Custom alarms are reported via the web interface and SNMP traps.

Custom alarms are used to provide an alarm when an external event activates a digital input. You can rename any of the available alarms to provide a more meaningful name, such as "Door open".

(i) Take care when setting the severity of alarms, including custom alarms (Configure > Alarms > Severity). Setting an alarm's severity to Major will cause the node to take the base station out of service when the alarm is raised. Refer to the Help for more information.

4.4.6   Preparing to Download Firmware

New versions of base station firmware are remotely downloaded to base stations from a package server (a web server application). You can set up a single computer to be the central package server for all the base stations on your network, using a web server of your choice. Tait also provides the Mongoose[1] web server as part of the base station firmware package for use with a temporary package server, such as a laptop.

The base station firmware package can be downloaded as a zip file from the Tait support website.

This procedure describes using the Mongoose web server.

Installing the Firmware Package

The installation procedure copies files into a folder and adds items to the Windows Start menu (Start > Programs > Tait Applications > TB9300[2]). From the Start menu you can then access the Help, licenses, manuals and release notes for each firmware package, and also start Mongoose.

ⓘ   You do not have to install Mongoose to make it work, because it is a self-contained executable file. Once started, it will run in the background until stopped, or the computer is shut down. Mongoose must also run from the same folder as the firmware files.

1.   Save the zip file to a suitable location on the hard drive of the package server computer.

2.   Extract the zip file, then navigate to the root folder and double-click *TB9300.msi* to run the Windows installer.

Notice   Tait recommends that the maximum length of the path to the location of the extracted files is 100 characters. Using a longer path may cause the files to be extracted incorrectly.

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1. Mongoose runs on Windows only.
2. The TB7300 is designed to use the same firmware and download system as the TB9300.

Setting Up a Central Package Server

It is beyond the scope of this manual to describe the exact procedure for setting up a central package server for any particular network. Tait expects that each customer will configure their own package server according to the requirements for their network.

However, you do need to configure each base station with the IP address and port of the package server computer.

1. Log in to the base station and select Configure > Base Station > Miscellaneous.

2. Under Package server, enter the IP address and port number of the package server.

3. Download the firmware as described in the Help.

    Notice   The base station has enough space for two firmware packages. If the base station already has two packages, delete the unwanted package before downloading another.

Setting up a Temporary Package Server

If you want to use a laptop as a temporary package server, you can temporarily override the package server IP address and port in each base station.

1. Run Mongoose on the temporary package server (Start > Programs > Tait Applications > TB7300 > Mongoose).

2. Windows Firewall may raise a Security Alert about allowing Mongoose to access your network or the internet.
    a. In Windows 7 allow access to private networks.
    b. In Windows XP click Unblock.

3. Log in to the base station and select Tools > Firmware > Download.

4. Under Package server, enter the IP address of the laptop. The default port number is 8080.

5. Download the firmware as described in the Help.

6. If you have trouble with any of the above procedures, please consider the following points:
    - The firmware download process uses the HTTP protocol. If you are using a laptop from outside the radio communications network, make sure that HTTP traffic can get through the firewall.
    - If Mongoose fails to start, it may already be running, or another application may be using port 8080.
    - If the error message "Could not find index file" appears when listing packages, Windows security may be silently blocking access for Mongoose. Turn off the laptop's WiFi and temporarily disable its firewall, then try again.

■ The base station has enough space for two firmware packages. If the base station already has two packages, delete the unwanted package before downloading another.

4.4.7   Checking for Interference on a Receive Channel

You can use the Signal Level page (Diagnose > RF Interface > Signal Level) to look for sources of interference across a range of receive frequencies.

The chart on this page has two lines. One shows the current RSSI measurement for the selected frequency. The second shows a historical trace of peak RSSI readings on that frequency.

5   Installation

This chapter provides information on the site requirements for your TB7300 equipment and also describes how to install the base station in a standard 19 inch rack or cabinet.

If this is your first time installing a TB7300 base station, we recommend that you read the entire chapter before beginning the actual installation.

5.1 Before You Begin

5.1.1 Equipment Security

The security of your base station equipment is a high priority. If the site is not fully secure, the base station should at least be locked in a secure, ventilated cabinet to prevent unauthorized access.

5.1.2 Grounding and Lightning Protection

Electrical Ground   A threaded grounding connector is provided on the rear of the tray for permanent connection to the site protective ground point (refer to "Connecting Up the Base Station" on page 59 for more details). The minimum wire gauge for this connection is 1.35 mm²/16 AWG.

Lightning Ground   It is extremely important for the security of the site and its equipment that you take adequate precautions against lightning strike. Because it is outside the scope of this manual to provide comprehensive information on this subject, we recommend that you conform to your country's standards organization or regulatory body.

Norway and Sweden

Norsk
Utstyr som er koplet til beskyttelsesjord via nettplugg og/eller via annet jordtilkoplet utstyr - og er tilkoplet et kabel-TV nett, kan forårsake brannfare. For å unngå dette skal det ved tilkopling av utstyret til kabel-TV nettet installeres en galvanisk isolator mellom utstyret og kabel-TV nettet.

Svenska
Utrustning som är kopplad till skyddsjord via jordat vägguttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av utrustningen till kabel-TV nät galvanisk isolator finnas mellan utrustningen och kabel-TV nätet.

5.1.3   Equipment Ventilation

Always ensure there is adequate ventilation around the base station (refer to "Cabinet and Rack Ventilation" on page 48).

Notice   **Do not** operate it in a sealed cabinet. You **must** keep the ambient temperature within the specified range, and we **strongly** recommended that you ensure that the cooling airflow is not restricted.

Notice   The cooling fans are mounted behind the front panel. To ensure adequate airflow through the base station, do not operate it for more than a few minutes with the fans disconnected (e.g. for servicing purposes).

5.1.4   Ambient Temperature Sensor

The ambient temperature reading for the base station is provided by the temperature sensor located inside the chassis.

5.1.5 Cabinet and Rack Ventilation

Refer to Figure 5.1 on page 49.

Adequate cooling airflow is critical to the performance of the base station. The cooling airflow for the base station enters through the front panel and exits at the rear of the tray. For optimum thermal performance, the heated air that has passed through a base station must not be allowed to re-enter the air intakes on the front panel.

Each base station requires an unobstructed airflow of $18\,m^3/h$ (11 cfm).

To allow enough cooling airflow through a cabinet mounted base station we recommend the following:

■ A distance of 5 cm minimum clearance to any obstruction to the front of the tray.

■ An open area of at least $50\,cm^2$ (8 sq. in.) per tray of ventilation slots or louvres in front of the air intakes for the fans for each tray; for example ten 6×85 mm (0.25×3.3 in.) slots will allow the recommended airflow.

■ A distance of 10cm minimum clearance to any obstruction to the rear of the tray.

■ An open area of at least $50\,cm^2$ (8 sq. in.) per tray of ventilation slots or louvres in the top of the cabinet, or to the rear of each tray.

■ A distance of 7.5 cm minimum clearance to any obstruction to either side of the tray.

■ A 2U gap at the top of the cabinet.

(i) The ventilation opening must be unrestricted. If the slots or holes are covered with a filter, mesh or grille, the open area must be increased to allow the same airflow as an unrestricted opening.

The maximum ambient temperature entering the cabinet must not exceed the maximum temperature specified for the base station.

If the base station is installed in a rack or cabinet with other equipment with different ventilation requirements, we recommend that the base station be positioned below this equipment.

Auxiliary Extractor Fans

If multiple base stations are fitted in a cabinet, auxiliary extractor fans may be required to ensure adequate cooling. If fitted they should be capable of extracting $18\,m^3/h$ (11 cfm) per base station in the cabinet.

If you have any other configuration, the performance of your system will depend on how closely you comply with the base station airflow requirements described above.

Figure 5.1   Typical cabinet ventilation requirements

①	ventilation slots	③	airflow entry
②	blanking panels	④	airflow exit
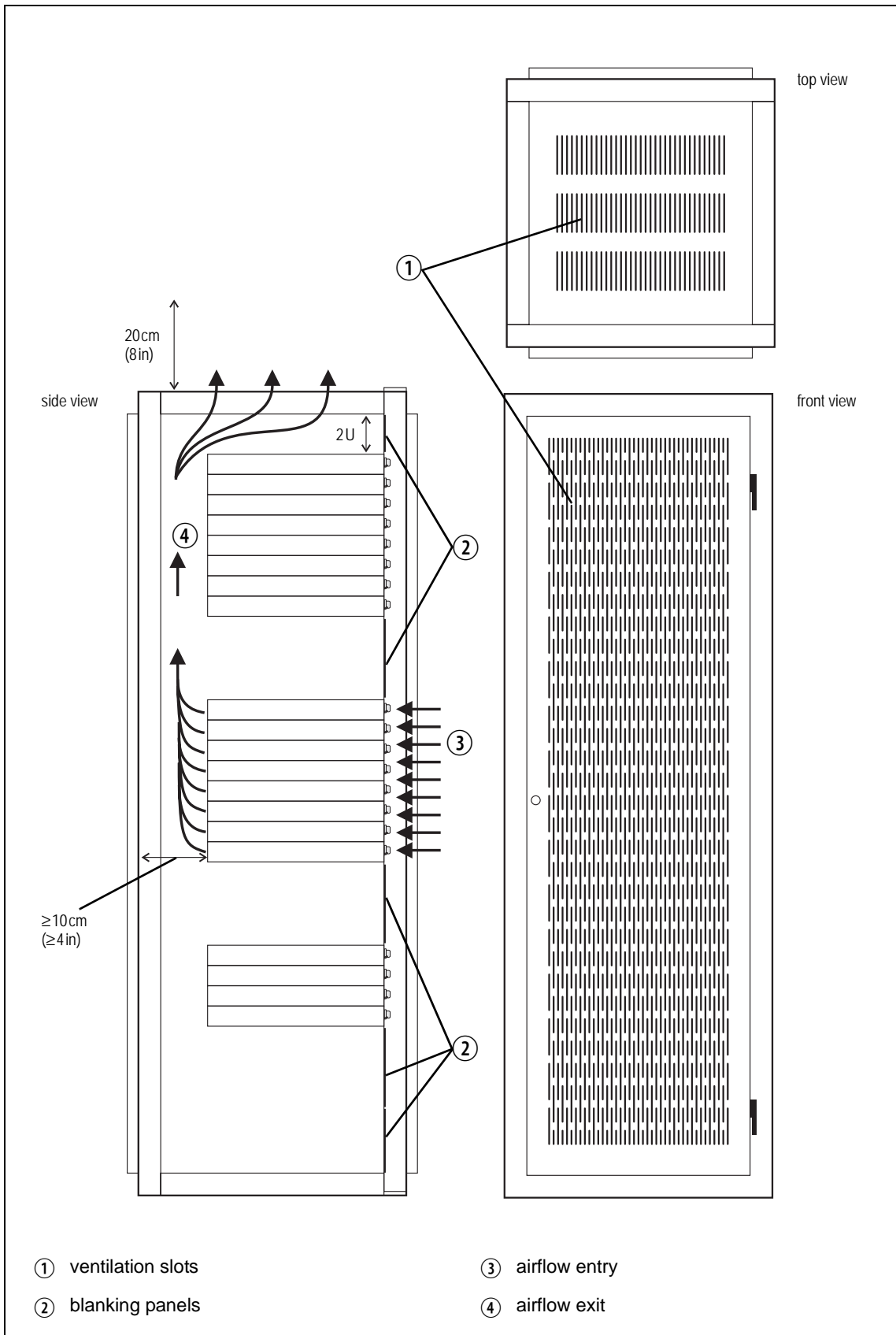
5.2   Unpacking the Equipment

**Unpacking the
Base Station**

The base station is packed in a strong corrugated cardboard carton with top
and bottom foam cushions.

1. Cut the tape securing the flaps at the top of the carton and fold them
    flat against the sides.

2. Rotate the carton carefully onto its side and then onto its top,
    ensuring that none of the flaps is trapped underneath.

3. Slide the carton upwards over the foam cushions and lift it away.
    Remove the cushion from the bottom of the base station.

4. Lift the base station clear of the remaining cushion.

**Disposal of
Packaging**

If you do not need to keep the packaging, we recommend that you recycle
it according to your local recycling methods. The foam cushions are CFC-
and HCFC-free and may be burnt in a suitable waste-to-energy combustion
facility, or compacted in landfill.

5.3 Identifying the Equipment

You can identify the model and hardware configuration of the TB7300 by referring to the product code printed on a label at the rear of the base station. The meaning of each character in the product code is explained in the table below.

ⓘ This explanation of product codes is not intended to suggest that any combination of features is necessarily available in any one product. Consult your regional Tait office for more information regarding the availability of specific models and options.

Product Code	Description
TB73**XX**-XXXX-XXXX-XXXX-10	10 = single 40/50W base station/repeater
TB73XX-**XX**XX-XXXX-XXXX-10	**Frequency Band** B3 = 148MHz to 174MHz H5 = 400MHz to 470MHz
TB73XX-XX**X**X-XXXX-XXXX-10	B = 40/50W
TB73XX-XXX**X**-XXXX-XXXX-10	0 = default
TB73XX-XXXX-**XXXX**-XXXX-10	0 = default
TB73XX-XXXX-XXXX-**X**XXX-10	0 = 13.8VDC (nominal) input
TB73XX-XXXX-XXXX-X**X**XX-10	0 = default
TB73XX-XXXX-XXXX-XX**XX**-10	**Feature License** 00 = None [Default: DMR Analog (TBAS301)] AC = DMR Express SFE License with TDMA operation (TBAS302) AD = DMR Access SFE License with TDMA operation (TBAS303) AE = DMR conventional (TBAS304)
TB73XX-XXXX-XXXX-XXXX-**10**	10 = default

5.4 Initial Setting Up

Before putting the base station into service, you may want to carry out some basic functional testing, configuration, and tuning (if required). This section provides an overview of these procedures:

- checking that the base station powers up correctly
- checking the basic functionality of the base station by using the tests available in the web interface
- customizing the configuration for the intended installation and verifying that the configuration is correct
- changing the root password
- tuning the base station (if required).

5.4.1 Confirming Operation

Notice   Make sure that the RF output is connected to a suitable attenuator or dummy load. Do not remove the load while the PA is transmitting as this may damage the PA output stage.

Applying Power   1.   Apply power to the TB7300.

2.   Check that the base station powers up correctly:

All LEDs turn on initially, then the transmit and receive LEDs turn off, leaving the green power LED on, and the red alarm LED flashing. The alarm LED will turn off when the base station has finished its start-up sequence.

Functional Tests   The following table provides an overview of the tests available using the web interface. Refer to the Help for full details of these tests.

Test	Notes	Menu
receiver operation	requires a suitable RF source	Diagnose > RF Interface > Receiver
transmitter operation	requires connection to the network	Diagnose > RF Interface > Transmitter
ping	checks the IP connection to another device with an IP address	Diagnose > Connection > Network
NTP query	checks if the NTP-based time synchronization is working	

5.4.2　Customizing the Configuration

The following steps provide an overview of the process used to configure the base station with the settings it needs. Refer to the Help for detailed information.

1.   Log in to the base station (refer to "Connecting Your PC to the Base Station" on page 28 for more details).

2.   Select Configure. The base station has many different settings that can be configured before it is put into operation, such as:
     - channel configurations
     - alarm control and SNMP agent
     - network interfaces
     - quality of service
     - CWID
     - miscellaneous items such as NTP and package servers.

3.   Make the changes needed in each form and click **Save**.

We recommend that you save the configuration to your PC or network. First make a backup copy of the configuration (which is stored in the base station as a file), then save this file to a folder on your PC or network. This provides a backup which can be restored to the base station if the configuration information becomes lost or corrupted.

5.4.3 Restricted Port Numbers

Certain configuration settings in the base station's web interface require you to enter a port number (for example, the trunking interface).

Two ranges of port numbers are unavailable for use with the base station. The web interface will prevent you from entering a number from these ranges, as explained below.

Restricted Port Numbers	Details
0 – 1023	The "well-known ports", commonly used by other devices in a network. Using a port number in this range could cause compatibility problems with other devices.
12000 – 14999	Reserved for internal use in the base station. Using a port number in this range could cause the base station to malfunction.

5.4.4 Changing the Root Password

Notice　The following procedure can be carried out only if secure shell access (SSH) is enabled. Secure shell access to the base station is disabled by default from version 1.35 onwards. To enable SSH, select Tools > Settings > Secure shell and click **Start**.

The root password to the Linux operating system of the base station is a possible security risk. The equipment is delivered with a default password that is well known. Knowledge of the password could be used to render the equipment inoperable, for example by deleting files. If you are concerned about the security risk that this poses, change the password. If Tait provides support services, it may need to know the password.

Notice　If you change the password and then lose it, the equipment must be returned to Tait. Make sure that you store the password securely and do not lose it.

To change the root password, follow these steps.

1. Log in from your PC to the base station using SSH client software such as PuTTY. The username is "root" and the default password is "k1w1".

2. At the # prompt, enter the command "passwd".

3. Follow the on-screen instructions.

4. Record the password in a secure location.

5.4.5   Tuning the Receiver

Before the base station is installed on site, you may need to tune the receiver front end. The receiver front end requires tuning if the receive frequency is shifted more than 2 MHz away from the previously set frequency, or the RSSI level of the new frequency is more than 1 dB lower than the RSSI level of the previously set frequency. Manual tuning is not required for the H5 (400 MHz to 470 MHz) model.

The receiver in the B-band base station covers one of the following frequency bands, depending on the model:

■ B3 - 148 to 174 MHz

Each of these bands is split into 2 sub-bands:

■ B3 - 148 to 159 MHz and 159 to 174 MHz

Each sub-band has its own helical filter (shown in Figure 5.2 below) which is electronically switched in or out of circuit depending on the frequency programmed into the base station. The bandwidth of these helical filters is approximately ±1.5 MHz.

Figure 5.2   Identifying the B-band receiver front end helical filters
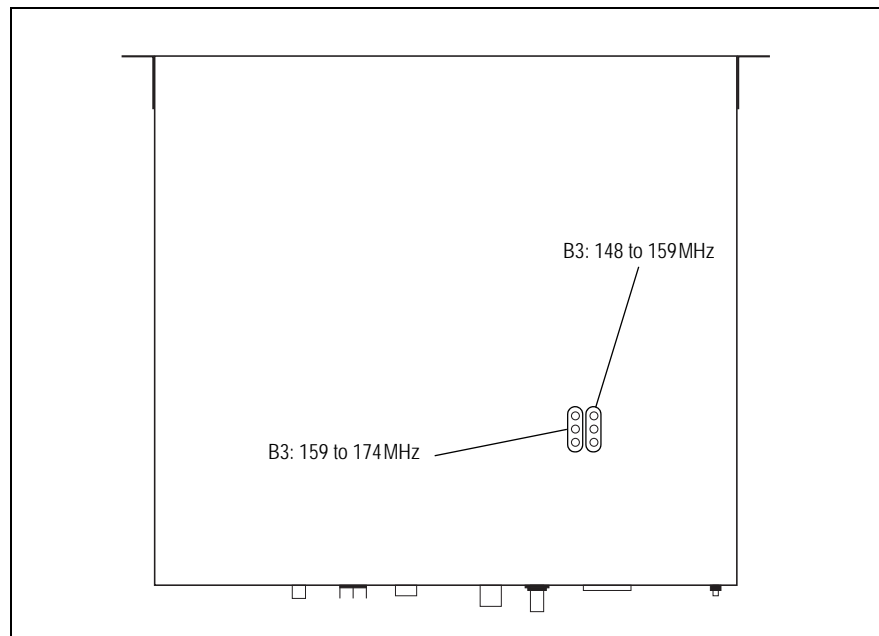
To check the RSSI level and tune the receiver front end (if required), follow these steps.

1.   Place the base station on its side or upside down to allow access to the holes on the base to tune the helical filters.

2.   Log in to the TB7300 and select Monitor > Interfaces > RF Interface. For information on connecting directly to the base station, refer to "Connecting a Networked PC to a Base Station" on page 31.

3. Feed a signal at the currently tuned receive frequency and at a level of $-80\,$dBm into the RF input. Check that the RSSI reading on the RF Interface page is $-80\,$dBm $\pm 1\,$dB. Note this reading.

4. Set the TB7300 to the new receive frequency.

5. Change the RF input signal to the new receive frequency at $-80\,$dBm. Check that the RSSI reading is $-80\,$dBm $\pm 1\,$dB. If it is, the receiver front end does not require tuning. If it is not, go to the next step.

6. Using the Johanson tuning tool[1], adjust the correct helical filter for the new frequency (as shown in Figure 5.2) to obtain a peak RSSI reading. This reading should be within $1\,$dB of the reading at the previous frequency.

    Adjust the center resonator of the filter first, followed by the two outer resonators (in any order). Each resonator should require approximately the same amount of adjustment when tuning.

(i) A change in frequency of $5\,$MHz requires approximately one turn of the tuning slug. If tuning to a lower frequency, adjust the slug in (clockwise); for a higher frequency, adjust the slug out (counterclockwise).

7. Change the RF input signal and the receive frequency to $0.5\,$MHz above and below the required frequency and check that the RSSI reading does not drop by more than $0.5\,$dB from the reading at the required frequency.

8. Recalibrate the RSSI at the new frequency (Calibrate > Calibrate > RSSI).

(i) If you wish to confirm the accuracy of the tuning procedure, carry out a sensitivity measurement at the new frequency.

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1. Included in the TBA0ST2 tool kit. Also available separately as part number 937-00013-00.

5.5 Installing the Base Station on Site

5.5.1 Base Stations for Trunked Systems

When installing base stations that are part of a trunked system, it is very important to observe good site engineering rules. This is especially true when the channels are combined into a single antenna.

If at all possible, the RF planner should avoid frequency plans in which the Rx to Tx spacing is an exact multiple of the trunked channel spacing, thus forcing Tx intermodulation products to fall outside the Rx channels.

Cables and antennas should be of high quality construction. Solid shield heliax type cables are best, but if braided shield cables must be used for short distances, their braids must be silver-plated. Isolators should be used at all transmitter outputs.

When the outputs of more than one transmitter are combined, their voltages add, and the resulting peak envelope power is not simply the sum of their powers, but is equal to the power of one of them multiplied by the square of the number of sources. Cables, components, and hardware must be rated to withstand the peak envelope power.

During the commissioning process, all transmitters should be activated together using a diagnostic test tone, while the receiver RSSI is monitored. There should be no perceptible increase in RSSI while the transmitters are active.

5.5.2 Equipment Required

It is beyond the scope of this manual to list every tool that an installation technician should carry. However, the following tools are specifically required for installing the base station:

■ Philips #2 tip screwdriver used to connect the DC power cables to the DC power terminals

■ Pozidriv PZ3 screwdriver for the M6 screws used to secure the tray to the cabinet in Tait factory-assembled systems

■ 8mm spanner for the M5 nut on the ground connector.

You can also obtain the TBA0ST2 tool kit from your regional Tait office. It contains the basic tools needed to install, tune, and service the base station.

5.5.3 Mounting the Base Station

1. Fit the base station into the cabinet or rack and secure it firmly with an M6 (or 0.25 in if you are using imperial fittings) screw, flat and spring washer in each of the four main mounting holes ①, as shown in Figure 5.3 on page 58.

2. The base station can be wall-mounted by rotating the front mounting brackets and fitting the optional rear brackets (TBBA03-01). When the base station is wall-mounted ensure the airflow is from bottom to top (front panel mounted down) or side to side.

3. For transport or in installations subject to vibration, the base station should be supported at the rear using a transit bracket (Tait recommends using the TBBA03-04 transit bracket).

Figure 5.3   Base station mounting points

①	main mounting holes	④	ground point
②	base station	⑤	rack frame
③	DC power connector		
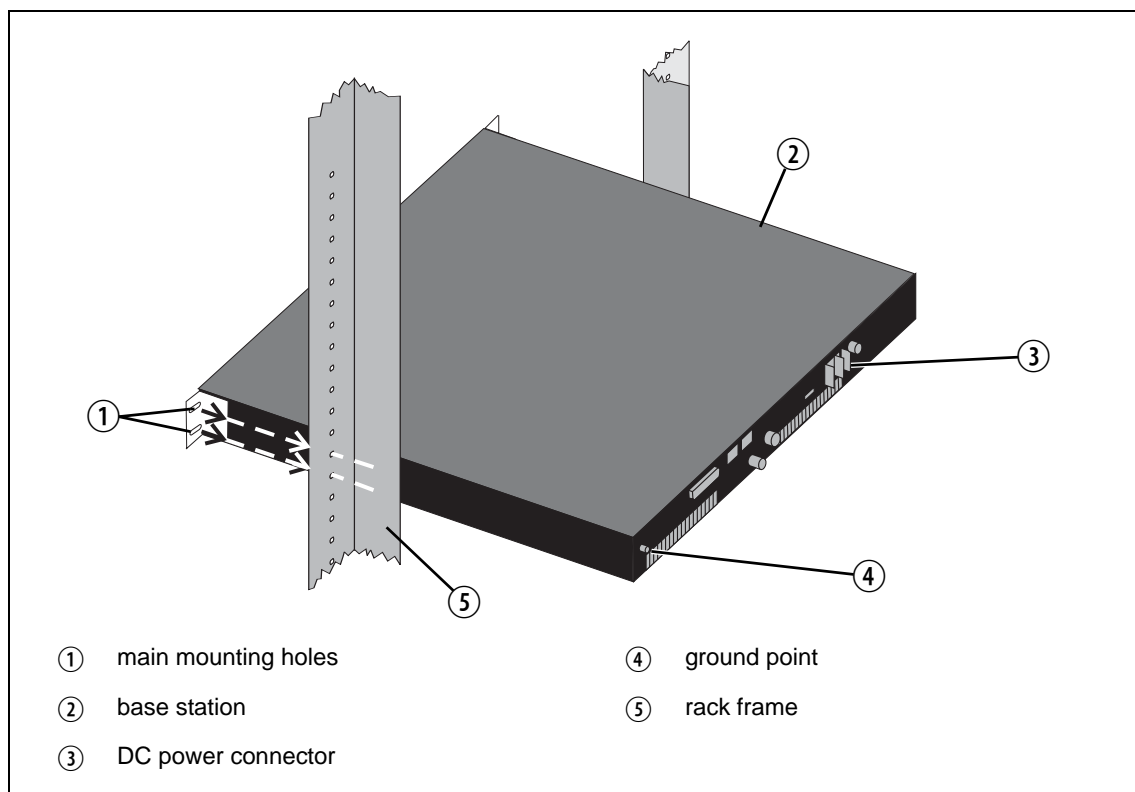
Cabling

We recommend that you route all cables to and from the base station along the side of the cabinet so the cooling airflow is not restricted.

Cables should be well supported so that the connectors or terminals on the base station and on the ends of the cables do not have to support the full weight of the cables.

Cables must be routed so that they do not restrict the air outlets at the rear of the base station.

5.6   Connecting Up the Base Station

This section provides information relevant to the task of connecting up the various inputs and outputs of the base station.

5.6.1   Connection Overview

External connections are all located at the rear of the base station. These are identified in Figure 5.4.

Figure 5.4   Base station inputs and outputs

①	ground connector	⑥	RF output
②	system interface connector	⑦	−VDC input
③	Ethernet interface connector	⑧	+VDC input
④	RF input	⑨	external reference frequency input
⑤	serial RS-232 connector		
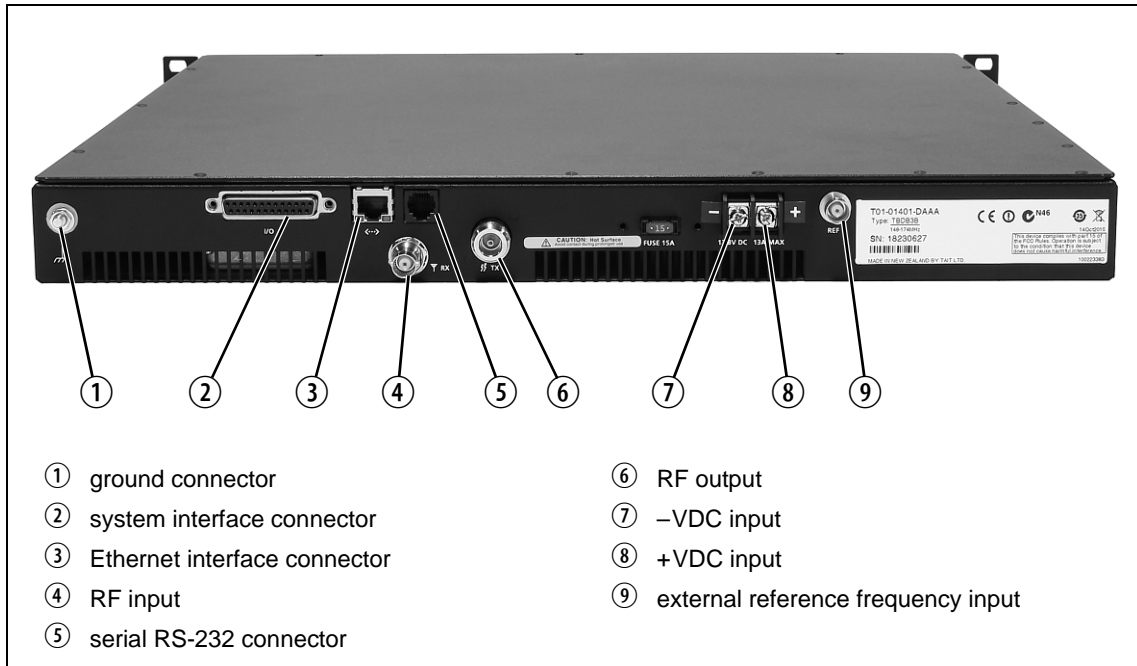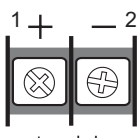
5.6.2   Connecting DC Power

The base station is designed to accept a nominal 13.8 V DC, with negative ground.

> **Notice**   Any mains power supply used to power the base station is required to meet the isolation separation for reinforced insulation of 3000 Vrms or 4242 VDC.

The DC power connector at the rear of the base station is a heavy-duty M4 screw terminal connector suitable for many forms of connection.

	Pin	Signal Name	Signal Type	Notes
	1	13.8VDC	input	
	2	ground	input	

external view

You must connect the DC supply from the battery to the base station via a readily accessible disconnect device such as a fuse or DC-rated circuit breaker with the appropriate rating, as shown in the table below.

The DC input leads should be of a suitable gauge to ensure less than 0.2 V drop at maximum load over the required length of lead. Use only flexible copper cables.

Nominal Supply Voltage	Input Voltage Range	Circuit Breaker/ Fuse Rating	Recommended Wire Gauge[a]
13.8VDC	11 VDC to 14.4 VDC	20A	12 AWG / 3.3mm^2

a. For a length of 1.5m to 2m (5ft to 6.5ft) (typical).

Terminate the DC input leads with a suitable crimp connector for attaching to the M4 screws of the DC power connector.

5.6.3 Connecting RF

Notice Do not remove the load from the base station while it is transmitting as this may damage the PA output stage. Before disconnecting any RF cables, put the base station into Offline mode to prevent any transmissions.

The RF input to the base station is via the marked BNC connector on the rear panel. The RF output is via the N-type connector on the rear panel (refer to Figure 5.4 on page 59).

Cables and antennas should be of high quality construction. Solid shield heliax type cables are best, but if braided shield cables must be used for short distances, their braids must be silver-plated.

Recommendations for Installing the Base Station

We recommend the following installation procedures, which should protect the PA from damage under all but the most extreme operating conditions.

1. Do not connect the base station directly to the antenna. Fit an isolator or duplexer between the base station and the load. Fit the isolator as close as possible to the RF output connector on the base station. Do not connect any switching equipment between the isolator and the base station, unless the switch **cannot** operate while there is RF present (i.e. the base station is transmitting).

2. Fit a surge suppressor to the antenna cabling where it enters the building.

3. Inspect all cables and equipment connected to the base station for defects.

Ice on the antenna, or a broken antenna, is unlikely to cause damage to the PA.

Explanation

The circuit design of the PA protects the circuitry from high VSWR. This makes it difficult to damage the RF power device by keying the PA into a mismatched load, or if the load deteriorates over even a short period of time (milliseconds).

However, it is possible to damage the device if **all** the following conditions happen **at the same time**:

■ there is a step change in the PA load (for example, the load is removed)

■ the PA is transmitting

■ the feed line loss between the PA and the mismatch is <1 dB.

The effect of such conditions is variable: some devices will not be destroyed, and some may fail after repeated load interruptions.

5.6.4 Connecting an External Frequency Reference

An external reference frequency is not normally required for B band. However, an external reference can be used when you need to maximize the range of the base station. The external reference frequency can be 10 MHz or 12.8 MHz, with an input level of $300\,\text{mV}_{pp}$ to $5\,\text{V}_{pp}$. The stability of this reference should be better than 100 parts per billion. The base station automatically detects the frequency of the external reference and configures itself accordingly.

If an external reference is required, enable the external reference "Absent" alarm (Configure > Alarms > Control).

Use a $50\,\Omega$ coaxial cable (RG58 or RG223) to connect the external reference to the base station's external reference frequency input. You can daisy-chain up to eight base stations using T-junctions. The maximum overall cable length is 30 m. Terminate the last connection (including single base stations) with a $50\,\Omega$ load.

Figure 5.5   Daisy-chaining an external frequency reference input
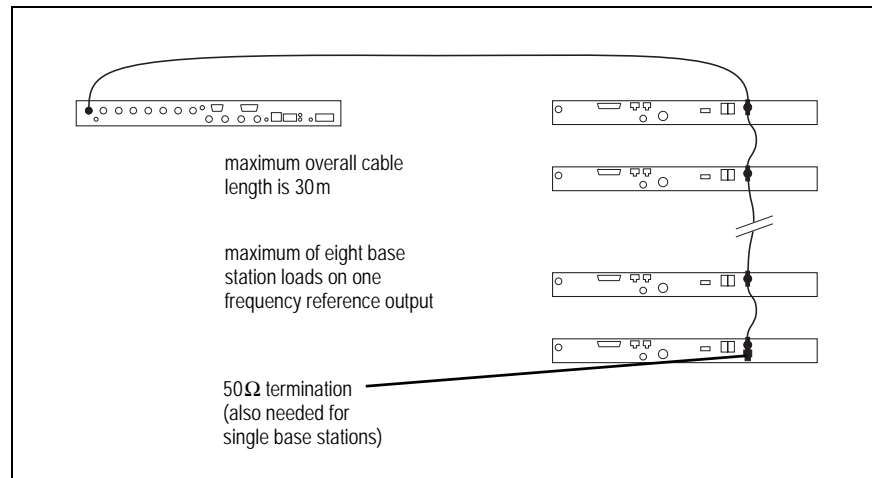
5.6.5 Ethernet Connection
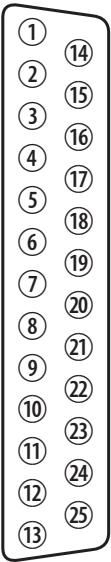
The RJ-45 socket on the rear panel provides the 10BASE-T or 100BASE-T Ethernet connection to the other devices in the network. Use Cat-5 cable to connect this socket to the radio communications network via a router or switch.

If necessary, refer to "Ethernet Connector" on page 69 for a list of Ethernet connection pin allocations.

5.6.6 Connecting General Purpose Inputs and Outputs

The base station has a number of general purpose inputs and outputs. These are connected via the 25-way D-range on the rear panel.

The pin allocations for the D-range connector are given in the following table. Not all pins are used in this release of the base station.

Pin	Signal Name	Signal Type	Notes
1	not used		reserved for future use
2			
3			
4			
5			
6			
7			
8			
9			
10			
11	digital in 1	input	5V TTL logic active low
12	digital in 2		
13	+5.2VDC output	power output	maximum current 200mA
14	digital in 3	input	5V TTL logic active low
15	digital in 4		
16	digital in 5		
17	digital in 6		
18	digital in 7		
19	digital in 8		
20	digital in 9		
21	digital in 10		
22	digital in 11		
23	digital in 12		
24	not used		reserved for future use
25	ground	ground	

external view

6   Maintenance

The base station is designed to be very reliable and should require little maintenance. However, performing regular checks will prolong the life of the equipment and prevent problems from happening.

It is beyond the scope of this manual to list every check that you should perform on your base station. The type and frequency of maintenance checks will depend on the location and type of your system. The checks and procedures listed below can be used as a starting point for your maintenance schedule.

Performance Checks

We suggest you monitor the following operational parameters using the web interface:

■ VSWR

■ any temperature alarms.

These basic checks will provide an overview of how well your base station is operating.

Calibration

We recommend that you calibrate the base station after three months of operation, and then every three years for B-band base stations. The calibration procedure is described in the Help (Calibrate > Calibrate > Internal reference), and requires a calibrated frequency generator - a GPS-derived frequency reference is recommended.

DC Input

We suggest that you periodically check that the screws on the DC input terminals are tightened to the recommended torque of $18-20\,\text{lbf·in}$ ($2-2.25\,\text{N·m}$). They may work loose with thermal cycling. Also, if you are using battery back-up, you should check the batteries regularly in accordance with the manufacturer's recommendations.

Ventilation

The base station has been designed to have a front-to-back cooling airflow. We strongly recommend that you periodically check and maintain the ventilation requirements described in to ensure a long life and trouble-free operation for your base station. Also check for a build-up of dust in and around the front panel air intakes and fan ducts.

Cooling Fans

The cooling fans have a long service life and have no special maintenance requirements.

7 Troubleshooting

Check that all front and rear connectors and cables are in place, and that power switches are on. If problems persist, contact your regional Tait office.

Notice   The TB7300 cannot be serviced in the field. It must be returned to the Global Repair Centre for repair.

Symptom	Possible Cause	Action
Alarm LED red and steady (not flashing)	The base station is in Offline mode	Use the web interface to put the base station in Online mode
Alarm LED flashing	One or more faults are present	Use the web interface to identify the faulty module
Power LED off	The rear panel fuse has blown.	Check the fuse.
	There is a problem with the supply voltage.	Check the supply input voltage.
Desired feature is not operating	Feature license missing	Check that you have the necessary feature licenses (refer to "Licenses" on page 13 and the Help)
	Feature license present but feature is not enabled	Use the web interface to enable the feature
Tx stuck on	Tx and Rx frequencies are the same	Reconfigure Tx and Rx with different frequencies
The base station appears to make random transmissions	CWID feature enabled	No action: CWID transmissions are made according to configuration settings
PA has low power	Channel is configured to low power	Use the web interface to check the power settings
	PA may have suffered partial damage	Return the base station to Tait for replacement.
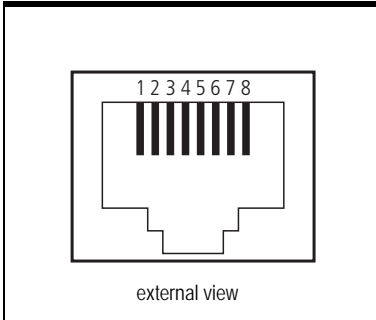
Appendix A – Interface Pin Allocations

System Interface Connector

For the pin allocations for the system interface D-range connector, see "Connecting General Purpose Inputs and Outputs" on page 63.

Ethernet Connector
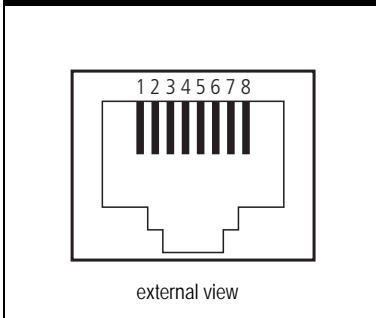
external view

Pin	Description
1	transmit data +
2	transmit data –
3	receive data +
4	not connected
5	not connected
6	receive data –
7	not connected
8	not connected

Serial Connector

external view

Pin	Description
1	not connected
2	not connected
3	not connected
4	ground
5	receive data input
6	transmit data input
7	clear to send output
8	request to send input

Glossary

This glossary contains an alphabetical list of terms and abbreviations related to the TaitNet network and the TB7300 base station.

AAA protocols   AAA commonly stands for Authentication, Authorization and Accounting. It refers to an IP-based security architecture that allows centralized, controlled access to devices in a network.

ADC   Analog-to-Digital Converter. A device for converting an analog signal to a digital signal that represents the same information.

AMBE+2™   Advanced Multiband Excitation. A voice compression technology patented by Digital Voice Systems, Inc and used in the vocoders of DMR radios.

ANI   Automatic Number Identification. A service that provides the receiver of a call with a numerical identifier or alphanumeric label of the caller.

ARP   Address Resolution Protocol is an IP protocol used to map IP network addresses to the hardware addresses used by a data link protocol.

base station   A radio receiver and transmitter that is located in a specific place (at a site) that enables a two-way radio to communicate with a dispatcher or over a larger range with other two-way radios.

bearer network   Telecom equipment that is used to carry user data.

BER   Bit Error Rate. A measure of the quality of digital transmission, expressed as a percentage. The BER indicates the proportion of errors to correctly received digits in a received signal.

BSP   Base Station Protocol. A proprietary protocol operating over IP for the exchange of channel control messages between a base station and a trunking node controller.

call   A complete exchange of information between two or more parties. A call requires a receive signal path and a transmit signal path. In conventional systems, a call is an over, but in trunked systems, a call may be a conversation, made up of a number of overs.

channel   1. A path through which signals can flow.
2. In the RF domain, a frequency pair (or just a single frequency in a

simplex system). Also called a physical channel in this manual.
3. One of the two timeslots that DMR provides for each radio frequency (physical channel). Refer to "logical channel".
4. A set of configuration information that defines the frequency pair and other related settings (a channel configuration). "Channel" has this meaning in the web interface.

channel spacing	The bandwidth that a channel nominally occupies. If a base station has a channel spacing of 12.5 kHz, there must be a separation of at least 12.5 kHz between its operating frequencies and those of any other equipment.
channel table	The base station's database of channel configurations.
CODEC	A device which combines analog-to-digital conversion (coding) and digital-to-analog conversion (decoding).
colour code	A marker determining which transmitted signals are gated. Inbound messages must carry this code to be listened to. The colour code is configured at the Node Controller. It can prevent interference from other networks and define private talkgroups.
configuration file	Consists of all the configuration settings needed for a base station, stored as a file.
conventional network	Systems that do not have centralized management of channel access. System operation is entirely controlled by system end users.
CTCSS	CTCSS (continuous tone controlled squelch system), also known as PL (private line), is a type of signaling that uses subaudible tones to segregate groups of users.
CWID	Continuous Wave Identification is a method of automatically identifying the base station using a Morse code. Continuous wave means transmission of a signal with a single frequency that is either on or off, as opposed to a modulated carrier.
DAC	Digital-to-Analog Converter. A device for converting a digital signal to an analog signal that represents the same information.
DDC	Digital Down Converter. A device which converts the digitized IF signal of the receiver down to a lower frequency (complex baseband) to suit the DSP.
dispatcher	A person who gives official instructions by radio to one or more mobile stations.

DMR   Digital Mobile Radio. A set of standards and requirements endorsed by ETSI and intended for professional mobile radio (PMR) users.

dotted quad   A method for writing IPv4 addresses. The form is DDD.DDD.DDD.DDD where DDD is an 8-bit decimal number.

downlink   The transmission path from fixed equipment to mobile stations.

DSP   Digital Signal Processor.

duplex   Providing transmission and reception in both directions simultaneously.

duty cycle   Used in relation to the PA, it is the proportion of time (expressed as a percentage) during which the PA is transmitting.

EIA   Electronic Industries Alliance. Accredited by the American National Standards Institute (ANSI) and responsible for developing telecommunications and electronics standards in the USA.

EMC   Electromagnetic Compatibility. The ability of equipment to operate in its electromagnetic environment without creating interference with other devices.

ETSI   European Telecommunications Standards Institute. The non-profit organization responsible for producing European telecommunications standards.

fallback mode An operational mode of Tait DMR trunked networks. It comes into effect when the base station loses communication with the trunking node controller. Fallback mode turns one of the base station's two logical channels into a control channel. In this mode the base station functions almost as an open channel, available to all calls without requiring authorization.

FCC   Federal Communications Commission. The FCC is an independent United States government agency that regulates interstate and international radio communications.

feature code   The alphanumeric code used to identify a feature set.

feature set   A function or mode of operation of the base station which can be enabled or disabled using the web interface. Each feature set requires a license to be purchased from Tait before it can be enabled.

feature license key	The unique set of digits belonging to a license which is programmed into the base station to enable a feature set.
FLASH	Electrically block-erasable and programmable read-only memory.
FM	Frequency Modulation. Often used as an adjective to denote analog radio transmission.
frequency band	The range of frequencies that the equipment is capable of operating on.
gating	The process of opening and closing the receiver gate. When a valid signal is received, the receiver gate opens, letting the signal through.
group call	A call that is sent to more than one MS simultaneously.
heartbeat message	A message whose purpose is to indicate to the receiver that the sender is operational.
hiccup mode	Many power supplies switch off in the event of a short-circuit and try to start again after a short time (usually after a few seconds). This "hiccup"-type of switching off and on is repeated until the problem is eliminated.
hostname	The unique name by which a network element is known on the network.
hub	A unit for connecting hosts together. It sends all incoming Ethernet packets to all the other hosts.
hysteresis	The difference between the upper and lower trigger points. For example, the receiver unmutes when the upper trigger point is reached, but will mute again until the level falls to the lower trigger point. An adequate hysteresis prevents the receiver gate from repeatedly muting and unmuting when the level varies around the trigger point.
inbound	Describes the direction of a signal: from an MS over the air interface to the fixed station.
IP	Internet Protocol is a protocol for sending data packets between hosts.
isolator	A passive two-port device which transmits power in one direction, and absorbs power in the other direction. It is used with a PA to prevent damage to the RF circuitry from high reverse power.
kernel	The core executable of an operating system.

LAN	Local Area Network. A computer network that interconnects computers in a limited area, such as a single building or group of buildings.
LED	Light Emitting Diode. Also the screen representation of a physical LED.
license	Some operational functions of the base station are controlled by licenses. Purchasing a license from Tait allows you to enable the feature set which includes the required functionality.
logical channel	One of the two timeslots provided in each TB7300 radio frequency. Each timeslot can function as a separate logical channel, independent of the other timeslot. One radio frequency can therefore carry two separate voice or data streams, one in each timeslot.
mobile station	The term used in the ETSI DMR standard documents for a two-way radio (generally a mobile or a portable radio) conforming to the DMR specifications.
MS	Mobile Station (see above).
NAT	Network Address Translation allows the use of a single IP address for a whole network of computers. A NAT sits between the public Internet and the network it serves, and works by rewriting IP addresses and port numbers in IP headers on the fly so the packets all appear to be coming from (or going to) the single public IP address of the NAT device instead of the actual source or destination.
network element	Any device that is network-connected. A TaitNet digital network consists of a number of network elements. The TB7300 base station is a network element designed and manufactured by Tait.
NTP	Network Time Protocol is a protocol and software implementation for synchronizing the clocks of computer systems across a network. An NTP server obtains the correct time from a time source and sets the local time in each connected computer.
octet	A set of 8 bits.
Offline mode	A mode of operation in which active service is suspended so that special operations can be carried out, such as programming in a new configuration or carrying out certain diagnostic tests.
Online mode	The normal operating mode of the base station.

outbound	Describes the direction of a signal: from a fixed station over the air interface to an MS.
over	A single transmission, which begins when a user presses PTT and ends when the user stops pressing.
PA	The Power Amplifier is a base station module that boosts the exciter output to the required transmit level.
PCB	Printed Circuit Board.
privileges	A set of access rights to the web interface functions. There are Administrator, Maintainer and Monitor privileges.
PSTN	Public Switched Telephone Network: the public telephone network.
PTT	Push To Talk. The button on an MS that keys the transmitter.
QoS	Quality Of Service. A router feature that gives real-time data such as voice calls priority over other data.
repeater talkaround	Allows the MS to bypass repeater operation and so communicate directly with other mobile stations. While repeater talkaround is active, all transmissions are made on the receive frequency programmed for the channel.
RISC	Reduced Instruction Set Computer. A type of microprocessor that recognizes a relatively limited number of instructions. The control board in the TB7300 has a RISC microprocessor.
router	A router is an internetwork packet switch that switches data packets from an input interface to an output interface. The interfaces can be of different types.
RS-232	A protocol for serial communications between a DTE (data terminal equipment) and a DCE (data communications equipment) device.
RS-485	An updated version of the RS-232 protocol for serial communications between multiple devices.
RSSI	Received Signal Strength Indicator is a level that indicates the strength of the received signal.

RTP	Real Time Protocol is an Internet protocol that supports the real-time transmission of voice and data.
Rx	Receiver.
SAW filter	Surface Acoustic Wave filter. A band pass filter that can be used to filter both RF and IF frequencies. A SAW filter uses the piezoelectric effect to turn the input signal into vibrations that are turned back into electrical signals in the desired frequency range.
selectivity	The ability of a radio receiver to select the wanted signal and reject unwanted signals on adjacent channels (expressed as a ratio).
sensitivity	The sensitivity of a radio receiver is the minimum input signal strength required to provide a usable signal.
simplex	Able to provide transmission and reception in only one direction at a time.
SINAD	Signal plus Noise and Distortion is a measure of signal quality. It is the ratio of (signal + noise + distortion) to (noise + distortion). A SINAD of 12 dB corresponds to a signal-to-noise ratio of 4:1.
site	1. The base station equipment at a particular location. This includes power supplies, transmitters, receivers, network interfaces and controllers. 2. The location of that equipment.
SNMP	Simple Network Management Protocol. A protocol used (for example) by the trunking site controller to monitor the base station's parameters and alarm status.
standalone node	The base station itself can act as a DMR trunking controller, but with limited functionality. The base station is then said to be a standalone node.
syslog collector	A program that can receive, display, and log syslog messages from many devices.
syslog protocol	A standard protocol used for the transmission of event notification messages across IP networks. TB7300 base stations can send messages such as alarms to an IP address on the Tait Network. The base station's logs store messages in the syslog format.
TaitNet	Brand name for any PMR network designed and manufactured by Tait Limited.

TaitNet DMR network	A set of Tait base stations and controllers interconnected by an IP network that can carry voice and data traffic.
TB7300 Base Station	A base station consisting of the equipment necessary to receive and transmit on one physical channel in a DMR or analog network. Often abbreviated to TB7300 or base station.
TCP	Transmission Control Protocol. A complex protocol on top of IP for sending reliable streams of data with flow control.
TDMA	Time Division Multiple Access. In the TB7300 each radio frequency provides two timeslots, with each timeslot representing one logical channel.
TELCO	Telephone company.
TIA	Telecommunications Industry Association
toggle	Describes the switching between two states. If something is on, toggling it turns it off. If it is off, toggling it turns it on.
tone	A sound wave of a particular frequency.
Tx	Transmitter.
UDP	User Datagram Protocol. A simple protocol on top of IP for sending streams of data.
uplink	The transmission path from mobile stations to fixed equipment.
UTC	Coordinated Universal Time (word order from French). An international time standard that has replaced Greenwich Mean Time.
valid signal	A signal that the receiver unmutes to. A signal is valid, for example, when it is strong enough to be decoded and when it has the specified NAC.
VDP	Voice Data Protocol. A proprietary protocol operating over IP for the exchange of voice and data between a base station and a trunking node controller.
voice stream	A digitized voice signal that passes through the main switch.

VoIP   Voice over IP. The name for the technology that puts speech signals in packets and then routes them over an IP backbone network.

VPN   Virtual Private Network. A private communications network used to communicate confidentially over a non-private network.

VSWR   Voltage Standing Wave Ratio is the ratio of the maximum peak voltage anywhere on the transmission line to the minimum value anywhere on the transmission line. A perfectly matched line has a VSWR of 1:1. A high ratio indicates that the antenna subsystem is poorly matched.

watchdog   A circuit that checks that the system is still responding. If the system does not respond (because the firmware has locked up), the circuit generally resets the system.

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6.2 Tait sole obligation to Licensee, and Licensee's exclusive remedy under this warranty, is to use reasonable efforts to remedy any material Software defect covered by this warranty. These efforts will involve either replacing the media or attempting to correct significant, demonstrable program or documentation errors or Security Vulnerabilities. If Tait cannot correct the defect within a reasonable time, then at Tait option, Tait will replace the defective Software with functionally equivalent Software, license to Licensee substitute Software which will accomplish the same objective, or terminate the license and refund Licensee's paid license fee. If Tait investigation of the perceived defect reveals that no such defect in fact exists, Tait may recover its costs in respect of such investigation from Licensee.

6.3. Tait disclaims any and all other warranties relating to the Software or Documentation other than the express warranties set forth in this Section 6. Warranties in Section 6 are in lieu of all other warranties whether express or implied, oral or written, and including without limitation any and all implied warranties of condition, title, non-infringement, merchantability, or fitness for a particular purpose or use by Licensee (whether Tait knows, has reason to know, has been advised of, or is otherwise aware of any such purpose or use), whether arising by law, by reason of custom or usage of trade, or by course of dealing. In addition, Tait disclaims any warranty to any person other than Licensee with respect to the Software or Documentation.

Section 7 TRANSFERS

7.1. Licensee will not transfer the Software or Documentation to any third party without specific prior written consent from Tait. Tait may withhold such consent or at its own discretion make the consent conditional upon the transferee paying applicable license fees and agreeing to be bound by this Agreement.

7.2. In the case of a value-added reseller or distributor of Tait Designated Products, the consent referred to in Section 7.1 may be contained in a Tait Reseller or Tait Distributor Agreement.

7.3. If the Designated Products are Tait vehicle-mounted mobile products or hand-carried portable radio products and Licensee transfers ownership of the Tait mobile or portable radio products to a third party, Licensee may assign its right to use the Software which is embedded in or furnished for use with the radio products and the related Documentation; provided that Licensee transfers all copies of the Software and Documentation to the transferee.

7.4. For the avoidance of any doubt, Section 7.3 excludes TaitNet Infrastructure, or the products listed at any time under network products at: http://www.taitradio.com.

7.5. If Licensee, as a contractor or subcontractor (integrator), is purchasing Tait Designated Products and licensing Software not for its own internal use but for end use only by a Customer, the Licensee may transfer such Software, but only if a) Licensee transfers all copies of such Software and the related Documentation to the transferee and b) Licensee has first obtained from its Customer (and, if Licensee is acting as a subcontractor, from the interim transferee(s) and from the ultimate end user sub license) an enforceable sublicense agreement that prohibits any other transfer and that contains restrictions substantially identical to the terms set forth in this Software License Agreement. Except as stated in the foregoing, Licensee and any transferee(s) authorised by this Section may not otherwise transfer or make available any Tait Software to any third party nor permit any party to do so. Licensee will, on request, make available evidence reasonably satisfactory to Tait demonstrating compliance with all the foregoing.

Section 8 TERM AND TERMINATION

8.1. Licensee's right to use the Software and Documentation will commence when the Designated Products are supplied by Tait to Licensee and will continue for the life of the Designated Products with which or for which the Software and Documentation are supplied, unless Licensee breaches this Agreement, in which case this Agreement and Licensee's right to use the Software and Documentation may be terminated immediately upon notice by Tait.

8.2. Within thirty (30) days after termination of this Agreement, Licensee must certify in writing to Tait that all copies of the Software have been removed or deleted from the Designated Products and that all copies of the Software and Documentation have been returned to Tait or destroyed by Licensee and are no longer in use by Licensee.

8.3. Licensee acknowledges that Tait made a considerable investment of resources in the development, marketing, and distribution of the Software and Documentation and that Licensee's breach of this Agreement will result in irreparable harm to Tait for which monetary damages would be inadequate. If Licensee breaches this Agreement, Tait may terminate this Agreement and be entitled to all available remedies at law or in equity including immediate injunctive relief and repossession of all non-embedded Software and associated Documentation. Licensee shall pay all Tait costs (on an indemnity basis) for the enforcement of the terms of this Agreement.

Section 9 CONFIDENTIALITY

Licensee acknowledges that the Software and Documentation contain proprietary and Confidential Information valuable to Tait and are Tait trade secrets, and Licensee agrees to respect the confidentiality of the information contained in the Software and Documentation.

Section 10 LIMITATION OF LIABILITY

10.1. In no circumstances shall Tait be under any liability to Licensee, or any other person whatsoever, whether in Tort (including negligence), Contract (except as expressly provided in this Agreement), Equity, under any Statute, or otherwise at law for any losses or damages whether general, special, exemplary, punitive, direct,

indirect, or consequential arising out of or in connection with any use or inability of using the Software.

10.2. Licensee's sole remedy against Tait will be limited to breach of contract and Tait sole and total liability for any such claim shall be limited at the option of Tait to the repair or replacement of the Software or the refund of the purchase price of the Software.

Section 11 GENERAL

11.1. COPYRIGHT NOTICES. The existence of a copyright notice on the Software will not be construed as an admission or presumption of publication of the Software or public disclosure of any trade secrets associated with the Software.

11.2. COMPLIANCE WITH LAWS. Licensee acknowledges that the Software may be subject to the laws and regulations of the jurisdiction covering the supply of the Designated Products and will comply with all applicable laws and regulations, including export laws and regulations, of that country.

11.3. ASSIGNMENTS AND SUBCONTRACTING. Tait may assign its rights or subcontract its obligations under this Agreement, or encumber or sell its rights in any Software, without prior notice to, or consent of, Licensee.

11.4. GOVERNING LAW. This Agreement shall be subject to and construed in accordance with New Zealand law and disputes between the parties concerning the provisions hereof shall be determined by the New Zealand Courts of Law. Provided however Tait may at its election bring proceedings for breach of the terms hereof or for the enforcement of any judgment in relation to a breach of the terms hereof in any jurisdiction Tait considers fit for the purpose of ensuring compliance with the terms hereof or obtaining relief for breach of the terms hereof.

11.5. THIRD-PARTY BENEFICIARIES. This Agreement is entered into solely for the benefit of Tait and Licensee. No third party has the right to make any claim or assert any right under this Agreement, and no third party is deemed a beneficiary of this Agreement. Notwithstanding the foregoing, any licensor or supplier of third-party software included in the Software will be a direct and intended third-party beneficiary of this Agreement.

11.6. SURVIVAL. Sections 4, 5, 6.3, 7, 8, 9, 10, and 11 survive the termination of this Agreement.

11.7. ORDER OF PRECEDENCE. In the event of inconsistencies between this Agreement and any other Agreement between the parties, the parties agree that, with respect to the specific subject matter of this Agreement, this Agreement prevails.

11.8. SECURITY. Tait uses reasonable means in the design and writing of its own Software and the acquisition of third-party Software in order to limit Security Vulnerabilities. While no software can be guaranteed to be free from Security Vulnerabilities, if a Security Vulnerability is discovered, Tait will take the steps specified in Section 6 of this Agreement.

11.9. EXPORT. Licensee will not transfer, directly or indirectly, any Designated Product, Documentation or Software furnished hereunder or the direct product of such Documentation or Software to any country for which New Zealand or any other applicable country requires an export license or other governmental approval without first obtaining such license or approval.

11.10. SEVERABILITY. In the event that any part or parts of this Agreement shall be held illegal or null and void by any court or administrative body of competent jurisdiction, such determination shall not affect the remaining terms which shall remain in full force and effect as if such part or parts held to be illegal or void had not been included in this Agreement. Tait may replace the invalid or unenforceable provision with a valid and enforceable provision that achieves the original intent and economic effect of this Agreement.

11.11. CONSUMER GUARANTEES. Licensee acknowledges that the licenses supplied in terms of this agreement are supplied to Licensee in business, and that the guarantees and other provisions of prevailing consumer protection legislation shall not apply.

11.12. WHOLE AGREEMENT. Licensee acknowledges that it has read this Agreement, understands it and agrees to be bound by its terms and conditions. Licensee also agrees that, subject only to the express terms of any other agreement between Tait and Licensee to the contrary, this is the complete and exclusive statement of the Agreement between it and Tait in relation to the Software. This Agreement supersedes any proposal or prior agreement, oral or written, and any other communications between Licensee and Tait relating to the Software and the Designated Products.

C E ① Directive 1999/5/EC Declaration of Conformity

da   **Dansk**

Undertegnede Tait Limited erklærer herved, at følgende udstyr TBDB3G overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
Se endvidere: www.taitradio.com/eudoc

de   **Deutsch**

Hiermit erklärt Tait Limited die Übereinstimmung des Gerätes TBDB3G mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG.
Siehe auch: www.taitradio.com/eudoc

el   **Ελληνικά**

Η Tait Limited δηλώνει ότι το TBDB3G συμμορφώνεται προς τις ουσιώδεις απαιτήσεις και τις λοιπές σχετικές διατάξεις της Οδηγίας 1999/5/ΕΚ.
Βλέπε επίσης: www.taitradio.com/eudoc

en   **English**

Tait Limited declares that this TBDB3G complies with the essential requirements and other relevant provisions of Directive 1999/5/EC.
See also: www.taitradio.com/eudoc

es   **Español**

Por medio de la presente Tait Limited declara que el TBDB3G cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
Vea también: www.taitradio.com/eudoc

fi   **Suomi**

Tait Limited vakuuttaa täten että TBDB3G tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Katso: www.taitradio.com/eudoc

fr   **Français**

Par la présente, Tait Limited déclare que les appareils TBDB3G sont conformes aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.
Voir aussi: www.taitradio.com/eudoc

it   **Italiano**

Con la presente Tait Limited dichiara che questo TBDB3G è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Vedi anche: www.taitradio.com/eudoc

nl   **Nederlands**

Hierbij verklaart Tait Limited dat het toestel TBDB3G in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/ EG.
Zie ook: www.taitradio.com/eudoc

pt   **Português**

Tait Limited declara que este TBDB3G está conforme com os requisitos essenciais e outras provisões da Directiva 1999/5/CE.
Veja também: www.taitradio.com/eudoc

sv   **Svensk**

Härmed intygar Tait Limited att denna TBDB3G står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
Se även: www.taitradio.com/eudoc