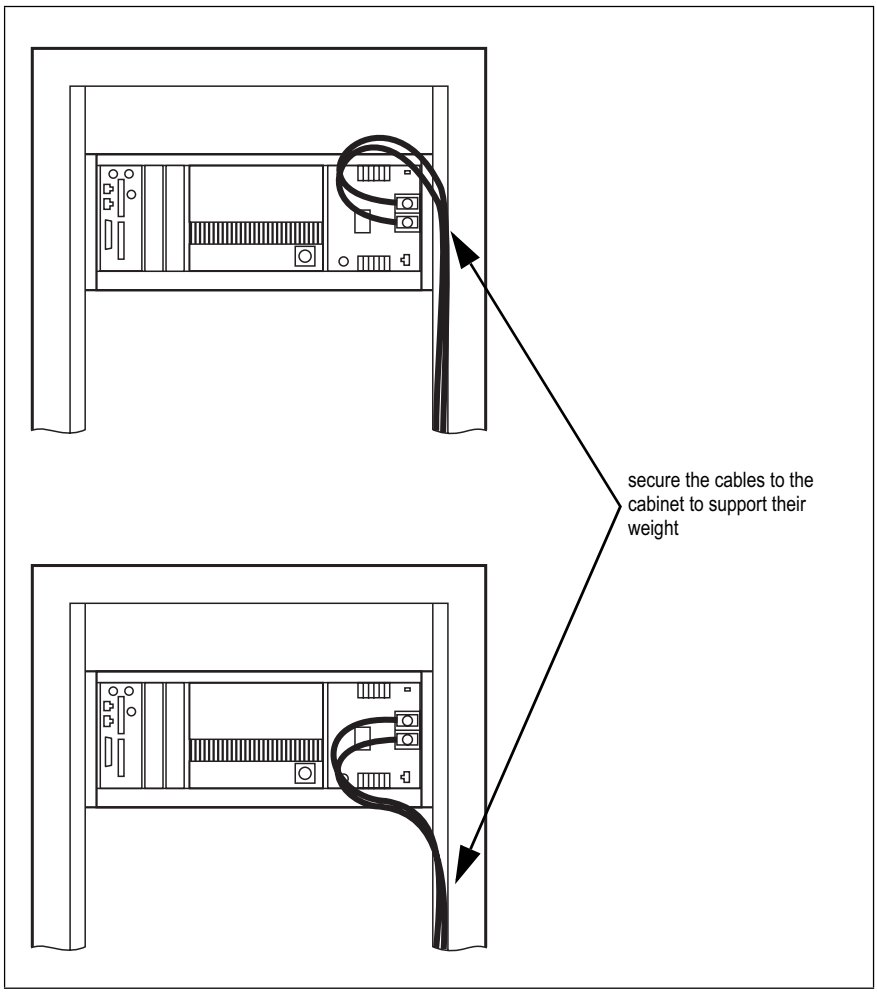
DC Power Cabling

DC power cables should be well supported so that the terminals on the PMU and on the ends of the cables do not have to support the full weight of the cables.

Figure 4.8 shows two recommended methods of securing these cables to prevent straining either set of terminals.

We recommend that you fit the supplied covers to the DC terminals to protect against accidental shorts.

Figure 4.8 DC power cabling



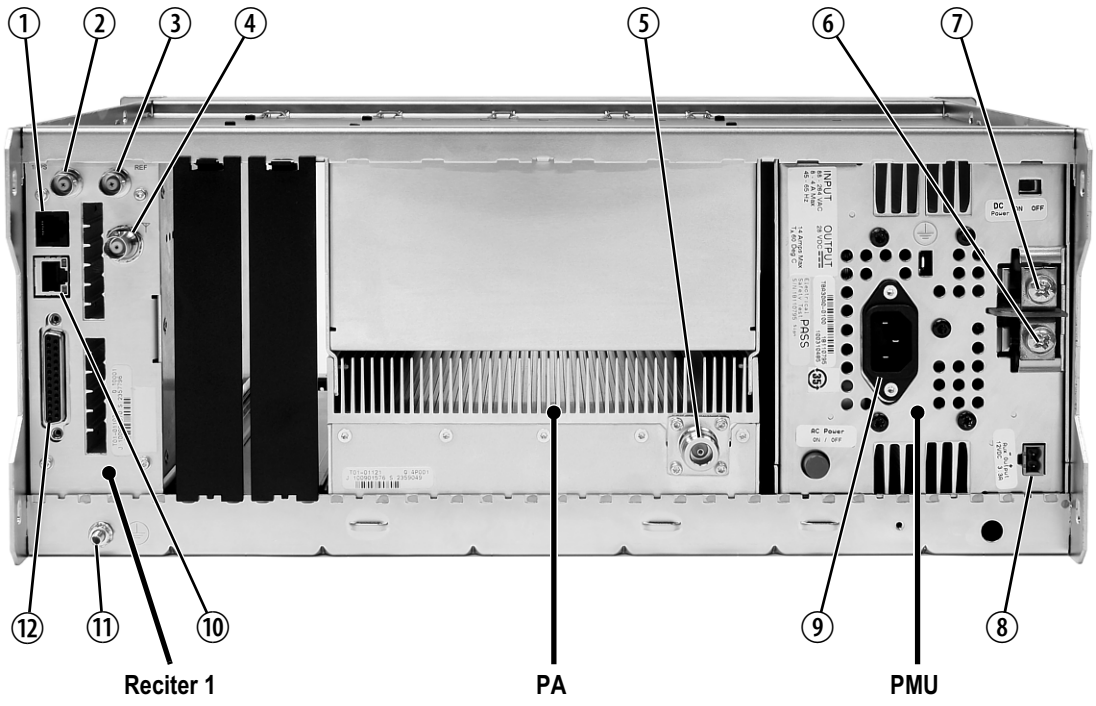
4.6 Connecting Up the Base Station

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

4.6.1 Connection Overview

The connections at the rear of a 100 W base station are identified in Figure 4.9. External connections are all located at the rear of the subrack.

Figure 4.9 100 W base station inputs and outputs



① serial RS-232 connector[a]
② 1 PPS input
③ external reference frequency input
④ RF input
⑤ RF output
⑥ –VDC input
⑦ +VDC input
⑧ auxiliary DC output
⑨ AC mains input
⑩ Ethernet interface connector
⑪ subrack ground connector
⑫ system interface connector

a. Factory use only.

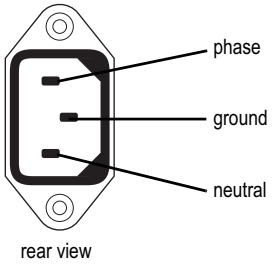
4.6.2 Connecting AC Power

The PMU is designed to accept a mains input of 88 to 264 VAC at 45 to 65 Hz. A standard 3-wire grounded socket outlet must be used to supply the AC power. The socket outlet must be installed near the equipment and must be easily accessible. This outlet should be connected to an AC power supply capable of providing at least 600 W. The requirements of two typical AC supplies are given in the following table.

Nominal Supply	Current Requirement[a]	Circuit Breaker/Fuse Rating[a]
115 VAC	8 A	10 A
230 VAC	4 A	6 A

a. The actual current consumption of the base station will be lower than these requirements (refer to the Specifications Manual for more information).

Your base station should come supplied with a power supply cord to connect the male IEC connector on the PMU to the local AC supply. The pins of the IEC connector on the PMU are identified at right.



4.6.3 Connecting DC Power

The PMU is designed to accept a nominal 12 VDC, 24 VDC or 48 VDC input (depending on the model) with negative or positive ground. There is a minimum DC startup threshold to prevent damaging a battery which has little capacity left.

You must connect the DC supply from the battery to the PMU via a fuse or DC-rated circuit breaker with the appropriate rating, as shown in the table below. The circuit breaker must have a contact separation of 3 mm, an interrupt capacity of 1000 A or more, and an inrush current capability of at least 500 A for a minimum of 3.5 ms.

Notice The inrush current is not affected by the state of the DC module on/off switch on the PMU. This switch does not disconnect power from the DC converter itself. It disables the converter by switching off its control circuitry. Even when the DC converter is off, the DC input is still connected to its power circuitry.

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.

Nominal Supply Voltage	Input Voltage Range	Circuit Breaker/ Fuse Rating[a]	Recommended Wire Gauge[b]
12 VDC	10 VDC to 16.8 VDC	60 A	2 AWG / 35 mm^2
24 VDC	20 VDC to 33.6 VDC	30 A	5 AWG / 16 mm^2
48 VDC	40 VDC to 60 VDC	15 A	8 AWG / 8 mm^2

a. The actual current consumption of the base station will be lower than these requirements (refer to the Specifications Manual for more information).

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

Terminate and insulate the DC input leads to protect them from accidentally shorting to the subrack if the PMU is removed before the leads are disconnected. Protective covers for the DC terminals are supplied with each PMU. We recommend a screw torque of 18 – 20 lbf · in (2 – 2.25 N · m).

4.6.4 Connecting the Auxiliary DC Power Output

The PMU can provide an auxiliary DC output from the auxiliary power supply board. This board is available with an output of 13.65 VDC, 27.3 VDC, or 54.6 VDC (depending on the model), and is current limited to 3 A, 1.5 A or 750 mA respectively. This power supply is permanently on as soon as the base station has finished powering up, and is available on the auxiliary output connector on the rear panel.

You can connect multiple auxiliary power supply boards in parallel for redundancy purposes, or to provide an output greater than 40 W. Although no active current sharing is used, auxiliary boards connected in parallel will current-share before reaching their power limit. The failure (or switching off) of one auxiliary board will not load any other paralleled auxiliary boards in the circuit.

The auxiliary power supply turns off briefly when the PMU restarts after a firmware upgrade. This interruption may also cause any ancillary equipment powered from the auxiliary supply to restart. If this is a problem for your system, we recommend connecting auxiliary power supply boards in parallel to ensure an uninterrupted power supply for the ancillary equipment.

Auxiliary DC Power Output Cabling

Network elements are supplied with a connector, as shown in Figure 4.10. You can use this to connect the PMU's auxiliary DC power output to another device (refer to "PMU Auxiliary DC Output" on page 118 for the pin allocations).

Contact your regional Tait office for details on the full range of wiring kits available.

Figure 4.10 Auxiliary DC power connector

Phoenix MVSTBR2.5HC/2-ST/5.08 female

4.6.5 Connecting RF

Notice Do not remove the load from the PA 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 of the reciter. The RF output is via the N-type connector on the rear panel of the PA (refer to Figure 4.9 on page 72).

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 PA

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 PA directly to the antenna. Fit an isolator or duplexer between the PA and the load. Fit the isolator as close as possible to the RF output connector on the PA. Do not connect any switching equipment between the isolator and the PA, 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.

4.6.6 Connecting an External Frequency Reference

For K4 band, the internal frequency reference accuracy is inadequate, and an external reference **must** be used. An external reference is also required for simulcast and P25 Phase 2. The external reference frequency can be 10 MHz or 12.8 MHz, with an input level of 300 mV_{pp} to 5 V_{pp}. The reciter automatically detects the frequency of the external reference and configures itself accordingly. The stability of this reference should be as shown below.

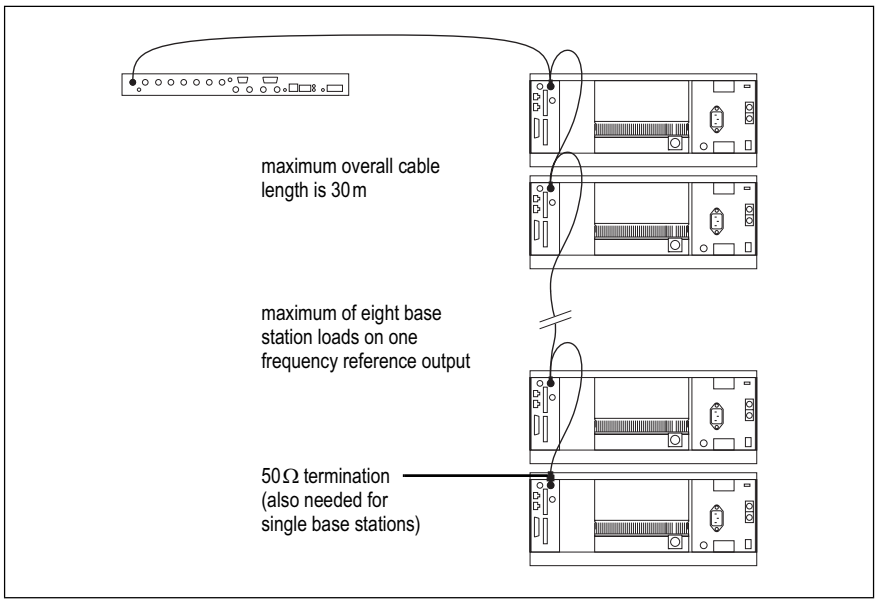
For more details, refer to 'TN2411A Providing Synchronisation to Tait Networks.'

Multicast	P25 Phase 1	B and H bands	not required
	P25 Phase 1	K4 band	100 parts per billion
	P25 Phase 2	All bands	100 parts per billion
Simulcast	P25 Phase 1 P25 Phase 2	All bands	10 parts per billion

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

Use a 50Ω 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 F-junctions. The maximum overall cable length is 30 m. Terminate the last connection (including single base stations) with a 50Ω load.

Figure 4.11 Daisy-chaining an external frequency reference input

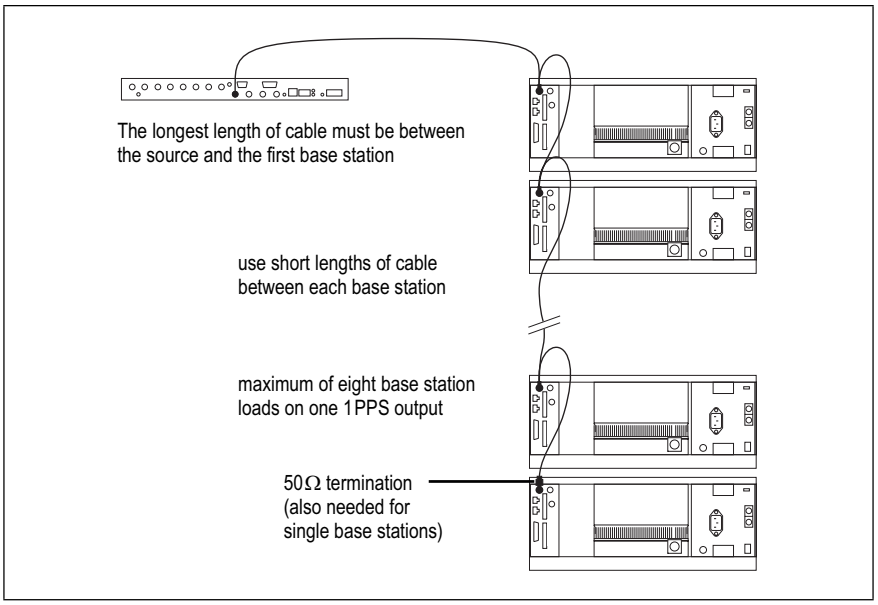


4.6.7 Connecting a 1PPS Source

A 1PPS signal is required for simulcast and P25 Phase 2 base stations. Use a 50Ω coaxial cable (RG58 or RG223) to connect the source to the base station's 1PPS input. You can daisy-chain up to eight base stations using F-junctions. We recommend that the cable length between the first and last load is kept to a minimum. This will reduce any propagation variation between base stations. The maximum overall cable length is 30m. Terminate the last connection (including single base stations) with a 50Ω resistor, otherwise reflections of the 1PPS pulse may occur.

Notice For P25 Phase 2 operation the NTP signal must be linked to the 1PPS signal. To ensure synchronization, both signals must come from a source that is GPS-disciplined.

Figure 4.12 Daisy-chaining a 1PPS input



4.6.8 Ethernet Connection

The RJ-45 socket on the reciter's rear panel provides the 1-BASE-T or 100BASE-T Ethernet connection to the other devices in the network. Use a Cat-5 cable to connect this socket to the Tait Network via a router or switch.

The Web UI allows you to set the Ethernet port speed auto-negotiation to 10/100 Mbit/s or to negotiate a maximum 10 Mbit/s. Tait recommends that you keep the port speed at the factory default setting of 10 Mbit/s. The reciter hardware and software are scaled to meet the performance requirements of processing multiple voice streams along with supervisory control and management communications. 10 Mbit/s is ample for those requirements. The 10/100 Mbit/s setting is provided for compatibility reasons, but it is possible under high traffic conditions at 100 Mbit/s for traffic arriving at the reciter at the full rate within a small timing window

to overflow internal buffers and therefore suffer packet loss. If you set the port speed to 100 Mbit/s and observe QoS lost packet alarms, then review your Ethernet port speed settings.

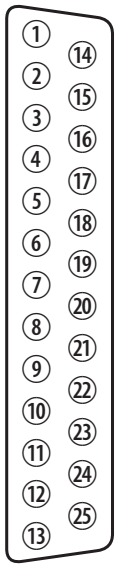
With the port speed at 10 Mbit/s it is particularly important to set the voice QoS on the reciter port of your site router or switch to a strict priority queue policy - which is the same policy that you should also be setting for your site link ports. The default QoS settings restrict the voice bandwidth to 1/25th of the port speed which is smaller than the required bandwidth for typical systems at 10 Mbit/s.

If necessary, refer to "Ethernet Connector" on page 118 for a list of Ethernet connection pin allocations.

4.6.9 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.



external view

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	

5 Working with Base Stations from Your PC

The normal web browser on your PC provides a window into the TB9400 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.

5.1 PC Recommendations

We recommend the following PC hardware and software for connecting to a TB9400 base station:

- SVGA Monitor (1024 x 768 minimum).
- Network connection.
- The base station works with recent versions of most modern browsers. Refer to the Release Notes for more information on currently supported browsers.

5.2 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 > Tools > User Administration). 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 89 for more information.

5.2.1 Logging In

1. Enter the base station's URL into your browser using a secure connection (https://). To find out the base station's IP address, on the front panel select Modules > Reciter 1 (or 2) > View Reciter 1 (or 2) Address. To set the IP address, refer to "Setting the IP Address" on page 84.

   Notice If access to this menu has been disabled, you cannot use the front panel to find out the IP address. Make sure that you store the IP address securely and do not lose it.

2. A security warning appears when you connect for the first time. Proceed anyway (refer to "Security Certificates" on page 85).

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 90). 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.

5.2.2 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. A quick way to set the base station's IP address is to use the front panel, as described below.

Notice If access to this menu on the front panel has been disabled, log in to the base station and set the IP address using the web interface (Identity > Identity > Network Identity).

1. Use the front panel display to enter the IP address, subnet mask and gateway specified for this base station by the IP addressing plan for the network. From the base station menu select Modules > Reciter 1 (or 2) > Edit Reciter 1 (or 2) Address. If the home screen is showing, press an arrow key, a scroll key or OK to clear it.

   Notice In this screen each octet in the address lines has provision for three characters. If an octet in the address has less than three characters, enter one or two leading zeroes so that each position is filled, even though the zeroes are not part of the address. For example, enter 172.25.163.47 as 172.025.163.047. Leading zeroes are removed when the address is programmed into the base station.

2. Set each address as described below. Use the left and right arrow keys to move the cursor across each line in the Addresses screen. Use the scroll keys to scroll through the available numbers for each position in a line.
   a. Set the IP address and press OK. This moves the cursor to the next line. To move the cursor back to the previous line, press the return key.
   b. Set the Mask address and press OK.
   c. Set the Gateway address and press OK.
   d. The display shows "Setting Reciter 1 (or 2) address Please wait..." while the base station confirms that the addresses are correct. When this process has finished, the display will show "SUCCEEDED" or "FAILED" as appropriate. Press OK to return to the previous menu.

3. If the process failed, try entering the address again. If it still fails, try the following:
   - enter the address through the web interface
   - check that the IP address you are trying to enter is not already in use by another device on the same subnet.

5.2.3 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 reciter's 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.

5.2.4 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 TB9400 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.

ⓘ For those using Windows XP, be aware that Microsoft no long updates this, therefore this may leave you open to security risks.

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 TB9400 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 Internet 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.

5.2.5 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 86.

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

   Notice You can quickly check the base station's IP address via the front panel, as long as access to this menu has not been disabled.

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 Tait 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.

5.2.6 Finding a Lost or Forgotten IP Address

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

1. Mount the reciter in a TB9400 subrack and fit the front panel. Power up the subrack.

2. On the front panel display select Modules > Reciter 1 (or 2) > View Reciter 1 (or 2) Address.

5.2.7 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.

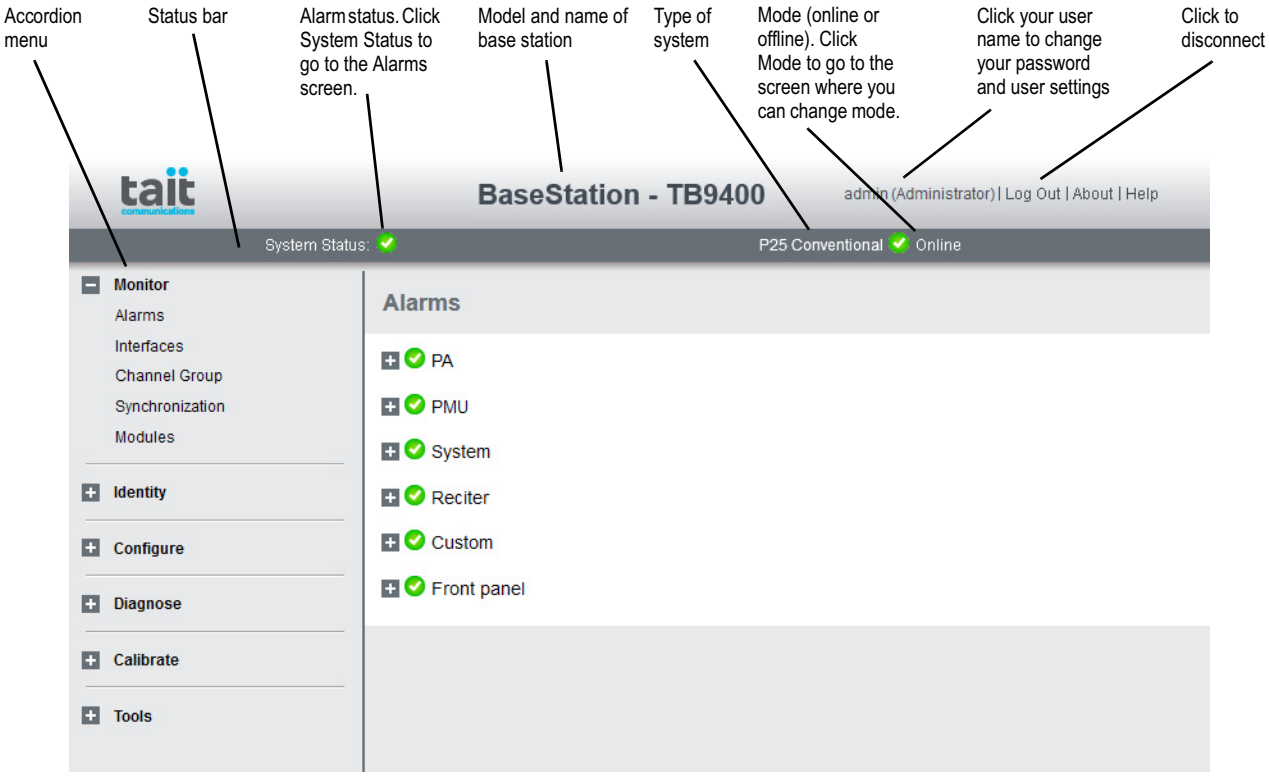
Once the centralized server logins are set up, we recommend that only one local administrator login is left on the base station for emergency use (e.g. when the connection to the server is lost). The password for this emergency login should be kept secret.

Notice Unless they are deleted, any local logins left on the base station will still work and have priority over remote logins.

5.3 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.



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.

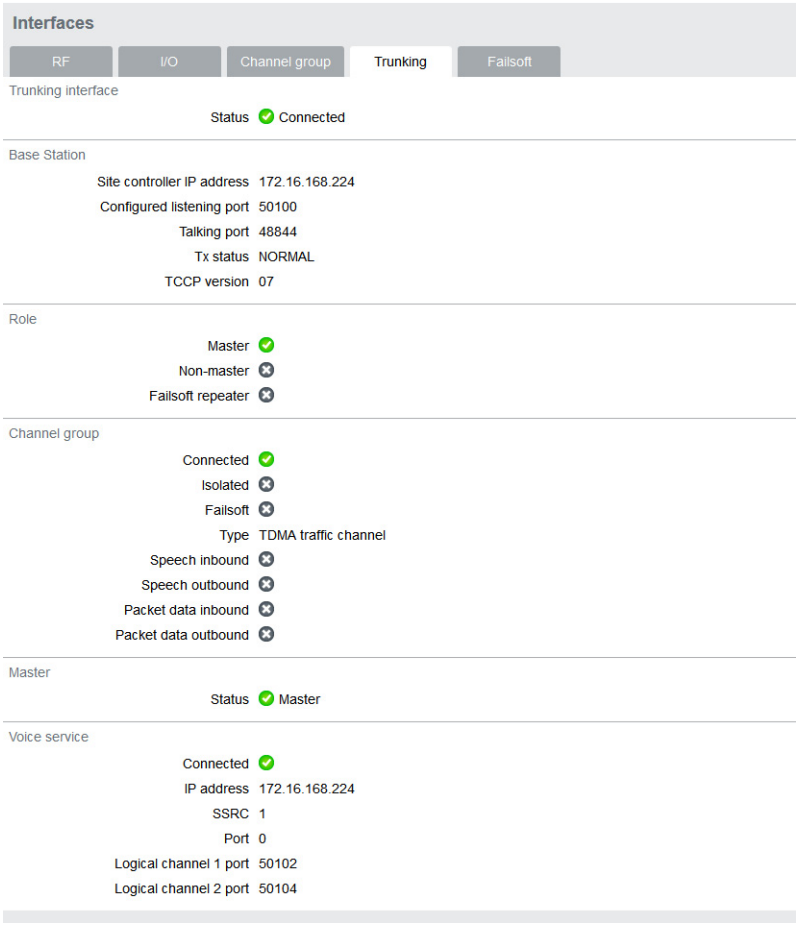
Press F11 for a full-screen display of the browser which does not show toolbars and other information. Press F11 again to return to the standard view.

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

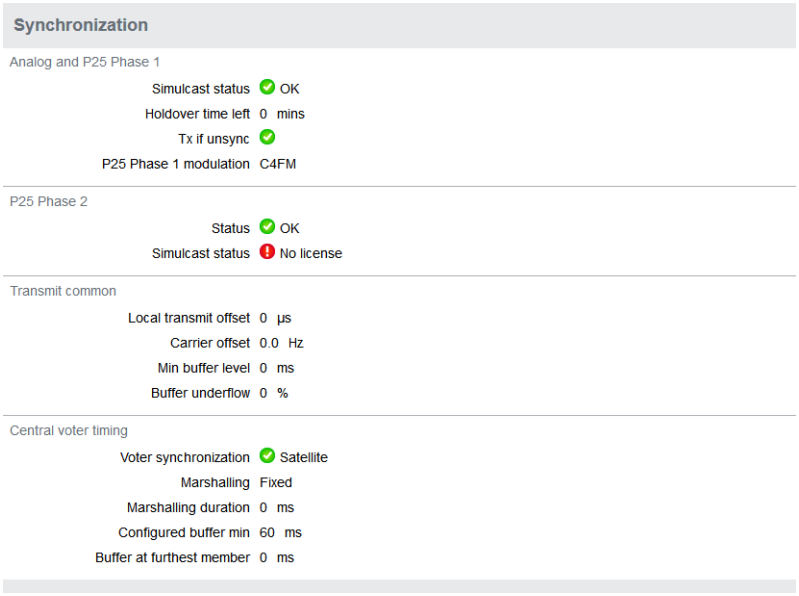
5.3.1 Monitoring Operation

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

For example, you can see the status of its RF interface (Monitor > Interfaces > P25 RF).

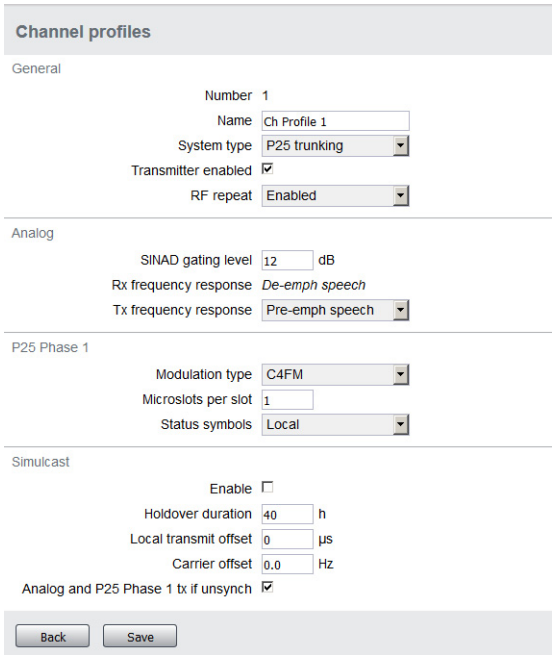


If the base station is part of a simulcast network, you can monitor the simulcast timing of the transmitter and the central voter (Monitor > Synchronization). When connected to the central voter, the browser can monitor its timing.

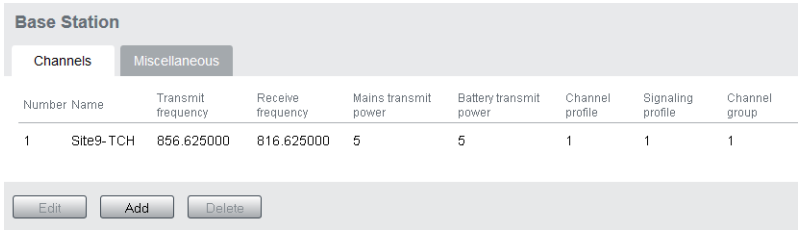


5.3.2 Viewing Configuration Settings

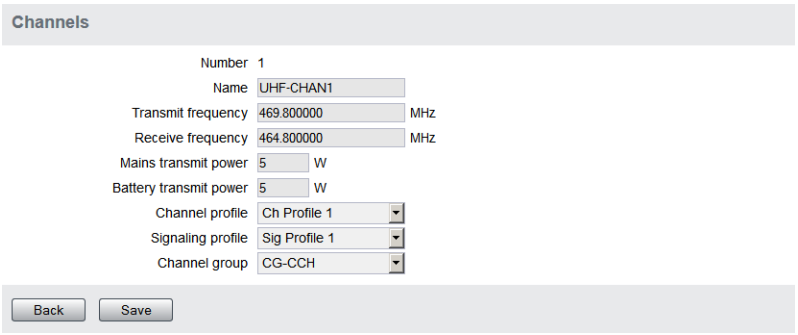
The base station has many configuration settings that personalize it for its particular role in the network. Some settings, such as those for the trunking interface (Configure > RF Interface > Channel profiles), always apply.



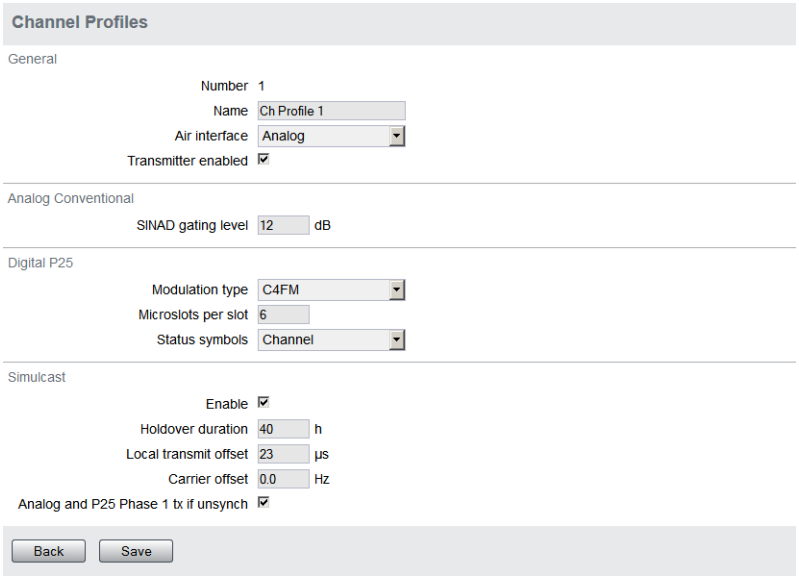
Others are channel-based so that they can be dynamically changed. To view these, you first need to know the channel that the base station is operating on. Select Identity > Identity > Base Station to see its default channel number. Then you can view the base station's channel configuration settings.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



Channel and signaling settings are grouped together in profiles. The channel configuration indicates the number of the currently active profile. To view the channel profile settings, select Configure > RF Interface > Channel Profiles and then click the relevant profile number.

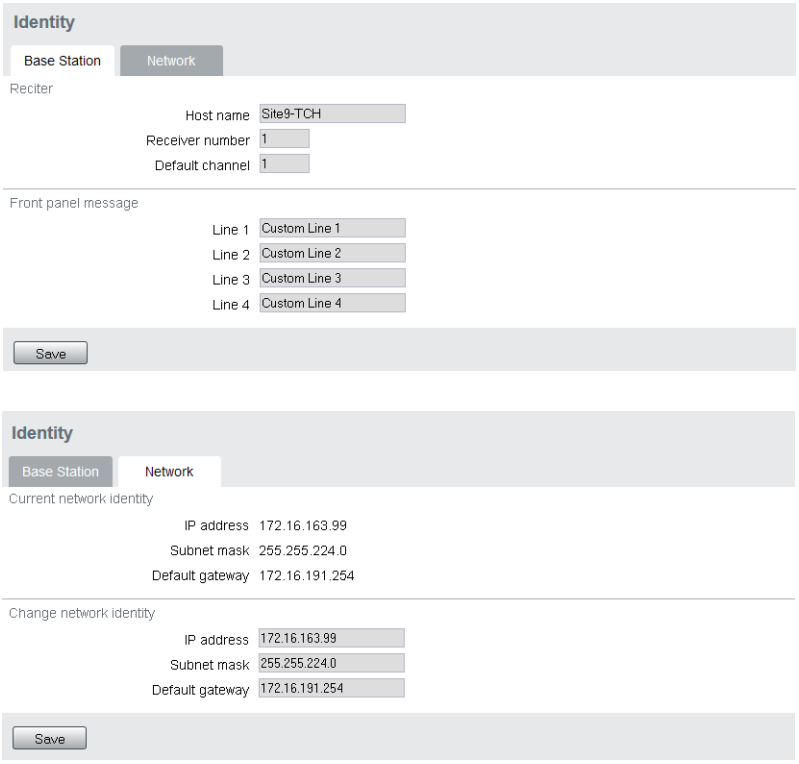


Proceed in a similar way to view signaling profile and channel group settings.

5.3.3 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, receiver number, 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.



You can also enter here the four lines of information you want to appear on the home screen on the front panel display. Each line has a maximum of 20 characters.

5.4 Basic Tasks

5.4.1 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 reciter, not in your browser.

5.4.2 Taking the Base Station Offline

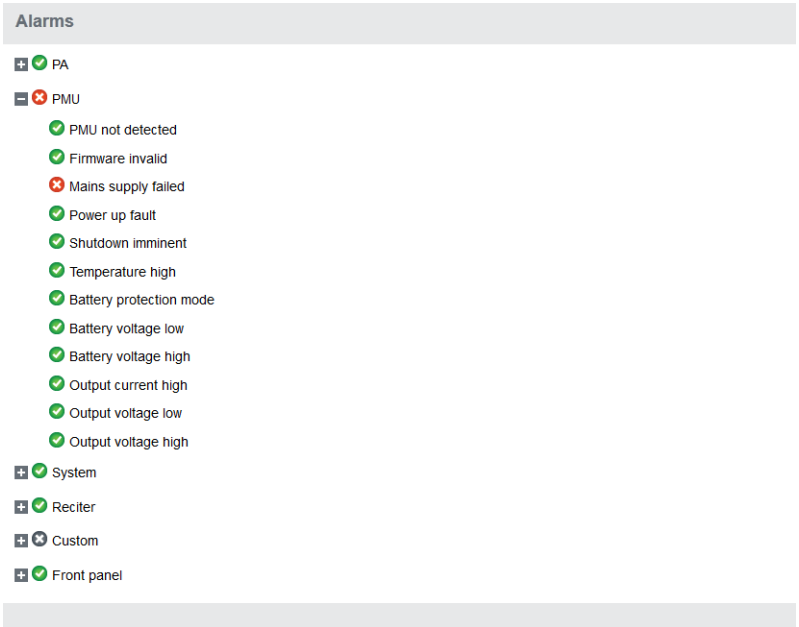
You may need to take the base station offline in order to carry out diagnostic tests or to take it out of service if a fault develops.

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" ( ).

5.4.3 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.

5.4.4 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.

ⓘ 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.

5.4.5 Configuring Single Base Stations

Most base stations in non-simulcast trunked networks are single. They interface to a site controller but not to other base stations. The following explains the special considerations when configuring single base stations.

Channel Group Membership

Although single base stations are not actually part of a channel group, their channel configurations (Configure > Base Station > Channels) must still select a channel group (Configure > Channel Group > Channel Groups). Once a channel group has been selected, the following parameters need to be configured.

Channel Group IP Address

The selected channel group must be configured for single base station operation. Specify 127.0.0.1 as the channel group IP address. This is the base station's localhost address and stops it from attempting to send voice packets to other base stations.

Preamble

Although the single base station's transmitter does not receive voice packets from other channel group members, it still receives them from other base stations via trunking controllers. So, while most channel group settings have no effect, the preamble setting still applies and determines how large the transmit buffer is.

The default setting of 40ms is intended for internal jitter only. If the base station is a traffic channel, you may have to increase the preamble. Voice arriving at the base station's trunking interface has travelled from another base station via the trunking site controller and could have significantly more jitter.

Marshalling Duration

Although marshalling duration applies only to control channels, and has no effect on traffic channels, we recommend that you configure the marshalling duration for each base station as described below. This will allow any base station to operate as a control channel when required.

Configure the channel group settings to specify fixed marshalling and allow a duration of 40 ms. This gives the control channel's transmitter an appropriate buffer (control channels do not use the preamble to regulate the transmit buffer).

Trunking Interface

Single base stations need a control connection to their site controller. A single base station interfaces to the site controller in the same way as the master base station in a trunked channel group. Select Configure > Network Interfaces > Trunking to configure this.

5.4.6 Configuring Receive-Only Base Stations

You can program a receiver with the same configuration as a reciter. This will keep the number of required configuration files to a minimum and, if possible, re-use existing configuration files.

Transmit information for the receiver will be displayed in the web interface, but this can be ignored. Also, some polled SNMP parameters, such as Tx NAC, will return the correct transmitter configuration data, but none of these parameters is used by the receiver.

5.4.7 Configuring Base Stations in a Channel Group

You can configure the way the base station behaves in its channel group. Also, qualified network engineers can change DSCP assignments, so that routers and switches provide a different quality of service to different types of IP packets. For more information on designing and configuring simulcast channel groups, refer to TN-1514 (P25 Phase 1) or TN-2341 (P25 Phase 2).

In trunked networks, many base stations are single and not actually part of a channel group. However, they still must be assigned to a channel group configuration and some of its parameters must be set correctly.

5.4.8 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".

5.4.9 Disabling the Front Panel Keypad

You can disable the front panel keypad to prevent access to the base station via the front panel menus. Select Configure > Base Station > Miscellaneous and in the Front Panel area clear the Keypad enabled check box.

Notice If you disable the front panel keypad, you cannot use it to find out the base station's IP address. Make sure that you store the IP address securely and do not lose it.

5.4.10 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). 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. Mongoose runs on Windows only.

1. If the CD does not autorun, navigate to the CD's root folder and double-click *TB9300.msi* to run the Windows installer.

If you are downloading a base station package zip file:

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.

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 package server (Start > Programs > Tait Applications > TB9300 > 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.

5.4.11 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.

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
- DC input voltage, especially on transmit
- any temperature alarms.

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

Reciter

We recommend that you calibrate the reciter after three months of operation, and then annually for H-band reciters, or every three years for B-band reciters. The calibration procedure is described in the Help (Calibrate > Reciter > Internal reference), and requires a calibrated frequency generator.

PA

There are no special maintenance requirements for the PA.

PMU

There are no special maintenance requirements for the PMU. However, we suggest that you periodically check that the screws on the DC input terminals are tightened to the recommended torque of 18–20 lbf·in (2–2.25 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 "Equipment Ventilation" on page 50 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 module heatsink fins, front panel air intakes, and fan ducts.

Cooling Fans

The cooling fans have a long service life and have no special maintenance requirements. You can use the web interface to configure the base station to generate an alarm if any of the front panel cooling fans fails. Refer to the Help for more details.

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.

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
Alarm LED flashing, display shows “Please wait...”, fans are running slowly	Front panel has lost communication with reciter 1	Check cable connections. Check front panel D-range connector. Use the web interface to check reciter 1.
Power LED on front panel is on, but keypad does not work	Keypad is disabled	Check that the keypad is enabled in the web interface (Configure > Base Station > Miscellaneous)
Power LED flashing, fans are running, but display is blank	The base station is downloading firmware	Use the web interface to monitor the progress of the firmware download
No power or LEDs on front panel	System control bus not connected to front panel	Check cable connections
	Pins bent on 15-pin D-range plug on front panel	Replace or repair D-range plug
Desired feature is not operating	Feature license missing	Check that you have the necessary feature licenses (refer to “Licenses” on page 20 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	Replace module and send faulty module for servicing

8 Replacing Modules

Caution The 100 W PA and PMU weigh between 9.3 lb (4.2 kg) and 15.4 lb (7 kg) each. Take care when handling these modules to avoid personal injury.

Notice The cooling fans are mounted on the front panel and will only operate when the panel is fitted correctly to the front of the subrack. To ensure adequate airflow through the base station, do not operate it for more than a few minutes with the front panel removed (e.g. for servicing purposes). Both the PMU and PA modules have built-in protection mechanisms to prevent damage from overheating.

8.1 Saving the Base Station's Configuration

Before replacing a module in the base station, you should decide whether you need to save its configuration data. If you are unsure whether you have a record of the configuration, backup and save the configuration file before removing any modules. Once you have replaced the module, you will be able to restore the original configuration to the base station.

If one or more of the modules is faulty, you may be unable to save the configuration. In this case, you will have to restore the configuration from a back-up file. Refer to the Help for more information.

8.2 Preliminary Disassembly

Hot-pluggable Modules

The reciter, PA and front panel are hot-pluggable and can be removed without powering down the whole base station. These modules can also be removed without disrupting the system control bus communications with the other modules in the subrack.

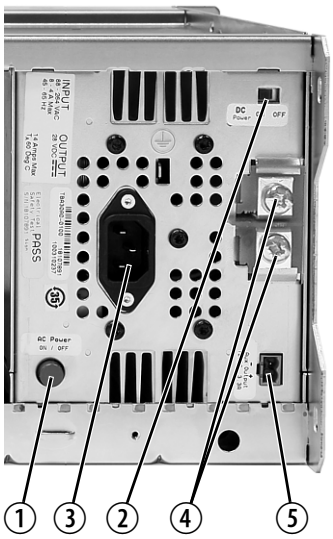
> **Notice** Before removing a PA, first disconnect the DC input, transmit forward input and transmit reverse output, followed by the RF output. After refitting the PA, reconnect the RF output first, followed by the transmit forward input, transmit reverse output, and then the DC input.

Disconnecting the Power

If you want to disconnect the power before working on the base station, follow these steps.

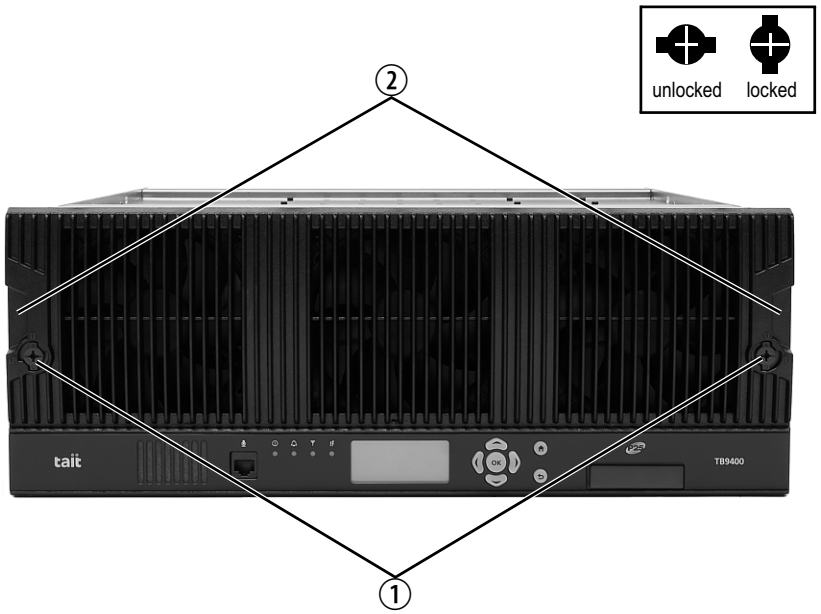
> **Caution** Before disconnecting the battery supply leads from the PMU, open the circuit breaker or disconnect the supply leads from the battery.

1. Turn off the AC ① and DC ② switches at the rear of the PMU.
2. Also at the rear of the PMU disconnect the mains ③ and battery ④ supply leads, and the auxiliary DC supply lead ⑤ (if fitted).



Remove the Front Panel

1. Using a Pozidriv PZ2 screwdriver, undo the fastener at each end of the front panel ① with a quarter turn counterclockwise.



2. Place a finger in the recess ② provided at each end of the front panel and pull the front panel away from the subrack.

Cable Retaining Clips

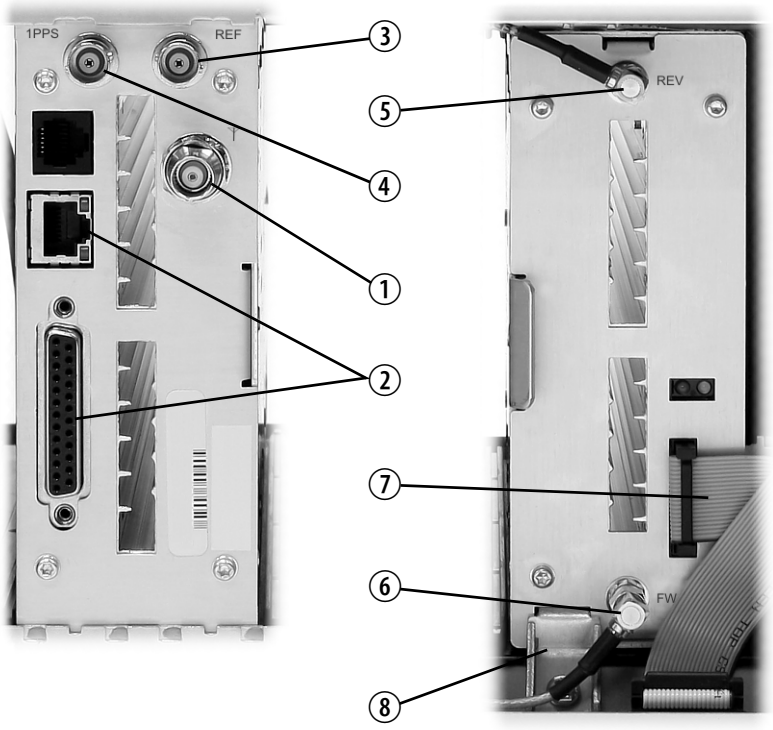
The cable retaining clips are used to hold cables in position at the top of the subrack so that they do not interfere with the mounting of the front panel, or interrupt the airflow through the base station.

If you need to remove any front panel cables, simply pull the front of the cable retaining clip down and then slide it out from the subrack until it reaches the end of its travel.

8.3 Replacing a Reciter

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 108.
2. At the rear of the reciter, unplug the RF input cable ①, any system cables ②, and the external reference ③ and 1 PPS ④ cables (if fitted).
3. At the front of the reciter, unplug the transmit reverse ⑤ and transmit forward ⑥ cables (if fitted), and move both cables to one side. Unplug both ends of the system control bus cable ⑦ and remove it.
4. Loosen the screw securing the retaining clamp ⑧ and rotate the clamp through 90° to clear the module.
5. Slide the reciter out of the subrack, taking care not to damage any of the cables.



Refitting

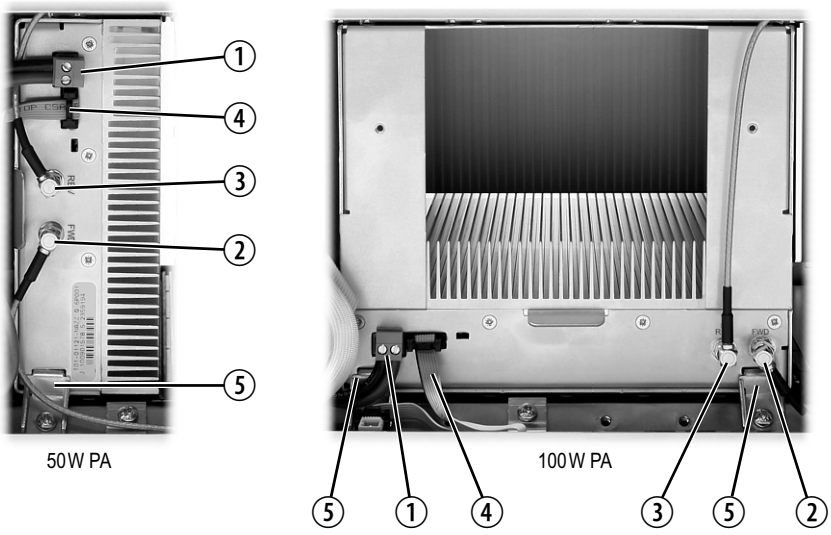
1. Slide the replacement reciter into the subrack and secure it with the retaining clamp.
2. Reconnect all the front and rear panel cables previously disconnected. Ensure the front panel cables are positioned correctly, and retained where required by the cable retaining clips in the top of the subrack (refer to “Appendix B – Inter-Module Connections” on page 119).
3. Tighten the nut on the SMA connector to a torque of 5 lbf·in (0.6 N·m).
4. Carry out the instructions in “Final Reassembly” on page 117.

8.4 Replacing a Power Amplifier

Notice Before removing a PA, first disconnect the DC input, transmit forward input and transmit reverse output, followed by the RF output. After refitting the PA, reconnect the RF output first, followed by the transmit forward input, transmit reverse output, and then the DC input.

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 108.
2. At the front of the PA, unplug the DC input ①, transmit forward ② and transmit reverse ③ cables, and move the cables to one side. Unplug both ends of the system control bus cable ④ and remove it.
3. At the rear of the PA, unplug the RF output cable.
4. Loosen the screw securing the retaining clamp(s) ⑤ and rotate the clamp(s) through 90° to clear the module.
5. Slide the PA out of the subrack, taking care not to damage any of the cables.



Refitting

1. Slide the replacement PA into the subrack and secure it with the retaining clamp(s).
2. At the rear of the PA, connect the RF output cable.
3. At the front of the PA, connect the transmit forward and transmit reverse cables, followed by the DC input cable.
4. Reconnect all the other front and rear panel cables previously disconnected. Ensure the front panel cables are positioned correctly, and retained where required by the cable retaining clips in the top of the subrack (refer to "Appendix B – Inter-Module Connections" on page 119).

5. Tighten the nut on the SMA connector to a torque of 5 lbf·in (0.6 N·m).

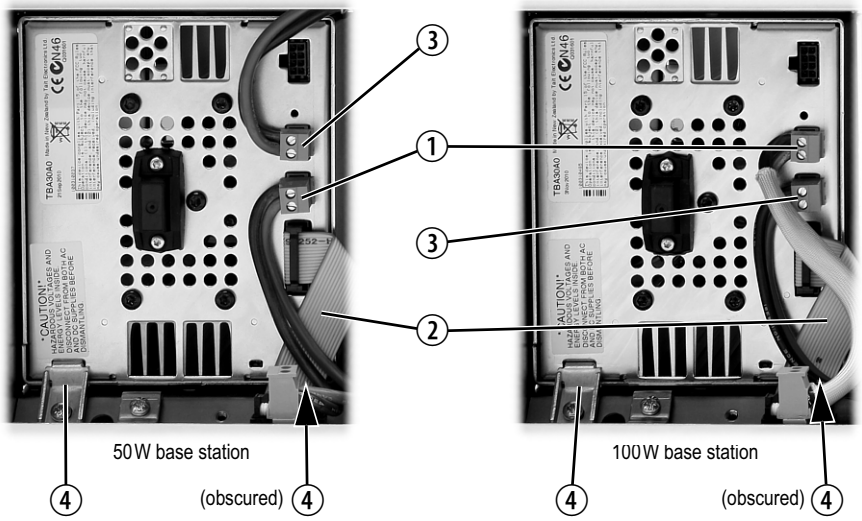
6. Carry out the instructions in “Final Reassembly” on page 117.

8.5 Replacing a Power Management Unit

Notice You must disconnect the AC and DC power cables before removing the PMU from the subrack.

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 108.
2. At the front of the PMU, unplug and remove the output power cable ① to the subrack interconnect board. Also unplug and remove the system control bus cable ②.
3. Unplug the output power cable to the PA ③ and move it to one side.
4. Loosen the screws securing the retaining clamps ④ and rotate the clamps through 90° to clear the module.
5. Slide the PMU out of the subrack, taking care not to damage any of the cables.



Refitting

1. Slide the replacement PMU into the subrack and secure it with the retaining clamps.
2. Reconnect all the front and rear panel cables previously disconnected. Connect the DC power cables on the rear panel as shown in Figure 4.8 on page 71. Tighten the screws to a torque of 18–20lbf·in (2–2.25N·m). Ensure the front panel cables are positioned correctly, and retained where required by the cable retaining clips in the top of the subrack (refer to "Appendix B – Inter-Module Connections" on page 119).
3. Carry out the instructions in "Final Reassembly" on page 117.

8.6 Replacing the Module Guide Rails

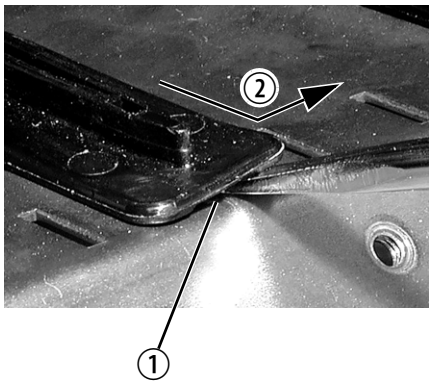
The module guide rails are held in place by four hooks that fit through the slots in the top and bottom of the subrack. There is also a locking tab which prevents the guide rails from working loose.

Notice Subracks produced from late 2008 onwards have wider slots than earlier subracks. Guide rails designed for these wider slots will not fit older subracks with narrow slots.

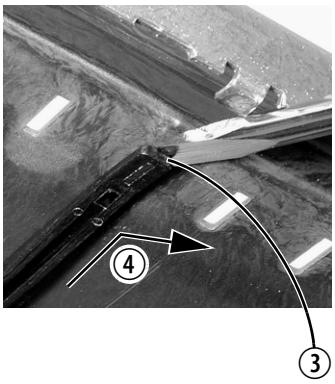
Removal

1. Bottom Guide Rails
   a. Insert a small flat-blade screwdriver under the front end of the guide rail and lift it slightly ①. This will ensure the small locking tab is clear of the slot in the subrack.
   b. While holding the front end of the guide rail up, pull the guide rail towards the front of the subrack ② and lift it clear of the slots.
2. Top Rails
   a. Insert a small flat-blade screwdriver under the rear end of the guide rail and lift it slightly ③. This will ensure the small locking tab is clear of the slot in the subrack.
   b. While holding the rear end of the guide rail up, pull the guide rail towards the rear of the subrack ④ and lift it clear of the slots.

bottom guide rail



top guide rail



Refitting

1. Bottom Guide Rails
   a. With the locating hooks pointing towards the rear of the subrack, insert the hooks into the slots in the subrack.
   b. Push the guide rail towards the rear of the subrack until you hear the locking tab “click” into place.
2. Top Guide Rails
   a. With the locating hooks pointing towards the front of the subrack, insert the hooks into the slots in the subrack.
   b. Push the guide rail towards the front of the subrack until you hear the locking tab “click” into place.

8.7 Replacing the Subrack Interconnect Board

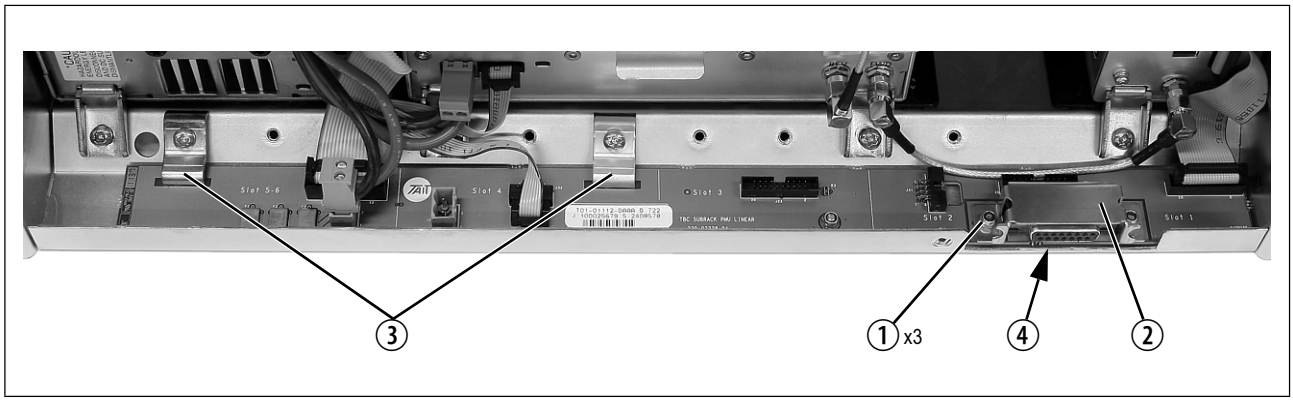
Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 108.
2. Disconnect any system control bus cables and DC power cables from the subrack board.
3. Remove the three M3 nuts and spring washers ① securing the right end of the board to the subrack.
4. Remove the D-range cover ②.
5. Remove the two retaining clamps ③ securing the left end and centre of the board.
6. Remove the board.

Refitting

1. If previously removed, replace the insulator ④.
2. Refit the board and D-range cover, and secure with the M3 nuts and spring washers. Replace the two retaining clamps.
3. Reconnect the system control bus cables and reciter DC cables as shown in "Appendix B – Inter-Module Connections" on page 119).

Figure 8.1 Replacing the subrack interconnect board

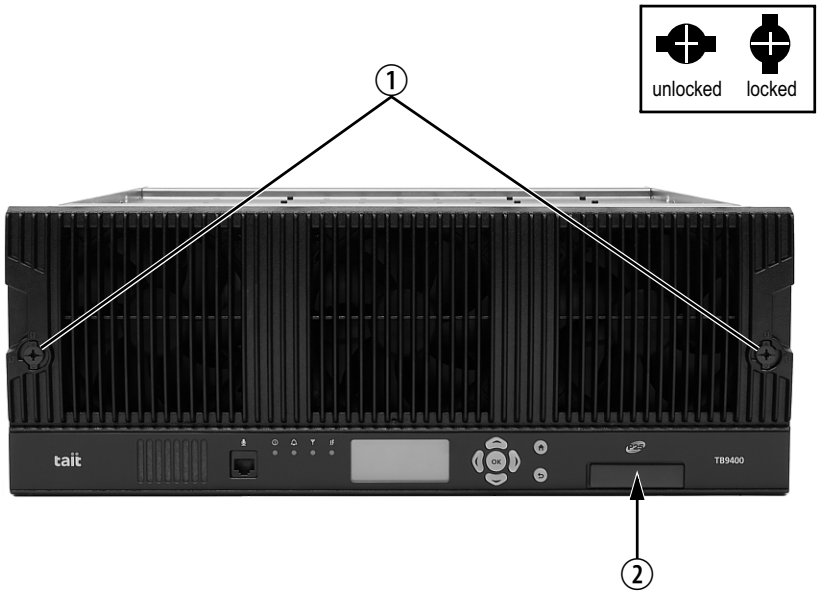


8.8 Final Reassembly

Notice You must fit the correct type of front panel to your base station. The different types of front panel and fan ducts are explained in "Appendix C – Identifying Front Panels" on page 123.

1. Before fitting the front panel, ensure that all cables are secured and positioned correctly so they are clear of the fan ducts (refer to "Appendix B – Inter-Module Connections" on page 119). Otherwise the panel may not fit properly, or you may damage the cables.

2. Refit the Front Panel
   a. Ensure that the fasteners ① are in the unlocked position.
   b. Fit the front panel onto the locating pegs on the subrack.
   c. Secure each fastener with a quarter turn clockwise.
   d. **Push the self-aligning D-range connector ② fully in.**



3. Before powering up the base station, check that all power, RF and system cables are connected correctly and securely at the rear of the base station.

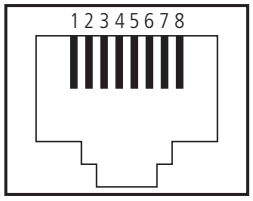
Notice When refitting modules, make sure they are fitted correctly into the subrack and all retaining clamps are securely tightened. The recommended torque for the retaining clamp screws is 17 lbf·in (1.9 N·m). As well as holding the modules in place, the retaining clamps push the modules hard against the rear rail of the subrack to ensure a good ground connection between the modules and the subrack.

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 80.

Ethernet Connector

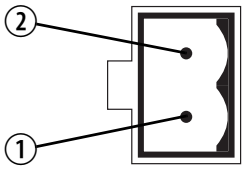


external view

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

PMU Auxiliary DC Output

The pin allocations for the auxiliary DC output on the PMU are given in the following table.



2-pin connector - external view

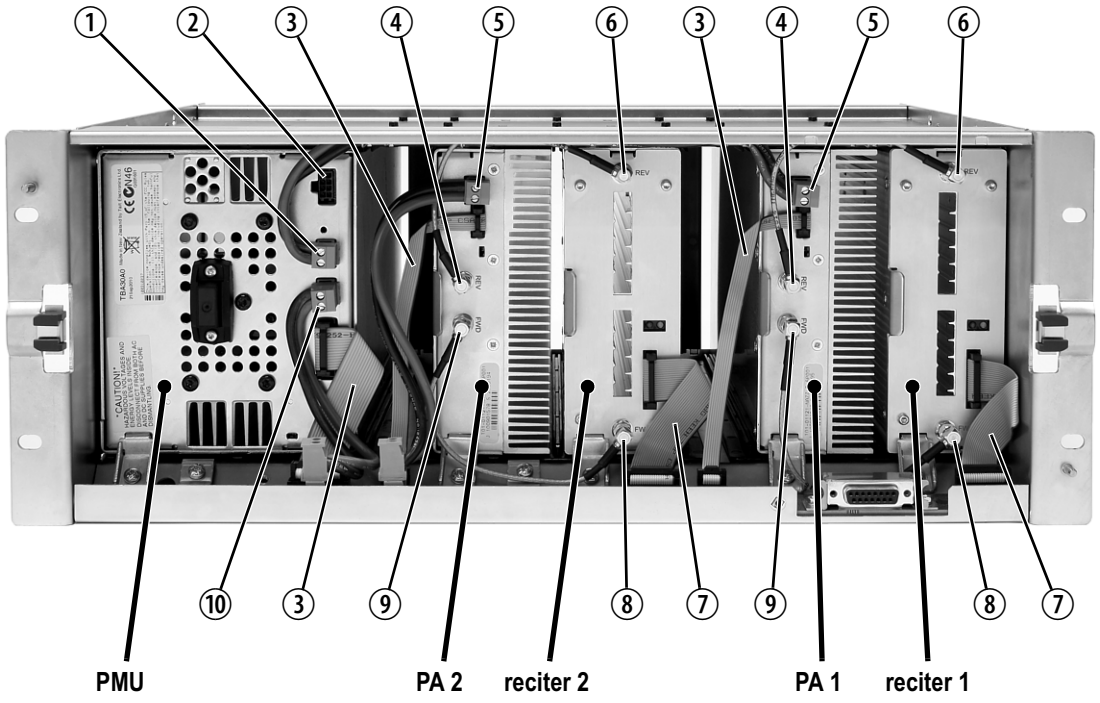
Pin	Description
1	+V output
2	–V output

Appendix B – Inter-Module Connections

Dual 50W Base Station

The connections between modules at the front of a dual 50W base station are shown below.

Dual 50W base station inter-module connections



① 28VDC output for PA 1
② not used
③ system control bus
④ transmit reverse output
⑤ 28VDC input
⑥ transmit reverse input
⑦ system control bus and 28VDC input
⑧ transmit forward output
⑨ transmit forward input
⑩ 28VDC output to subrack interconnect board

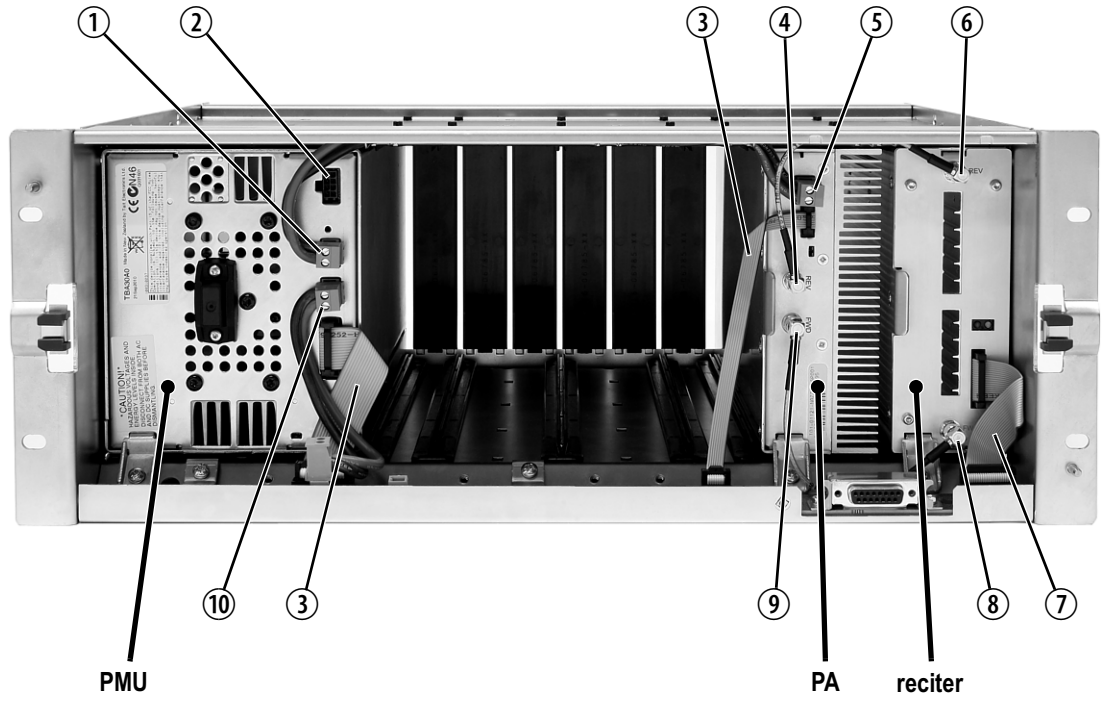
DC Supply

PA 1 is powered by a direct connection from the PMU. The other modules in the subrack are powered from the PMU via the subrack interconnect board. The DC supply to the reciters is via the system control bus ribbon cable.

Single 50W Base Station

The connections between modules at the front of a single 50W base station are shown below.

Single 50W base station inter-module connections



① 28VDC output for PA
② not used
③ system control bus
④ transmit reverse output
⑤ 28VDC input
⑥ transmit reverse input
⑦ system control bus and 28VDC input
⑧ transmit forward output
⑨ transmit forward input
⑩ 28VDC output to subrack interconnect board

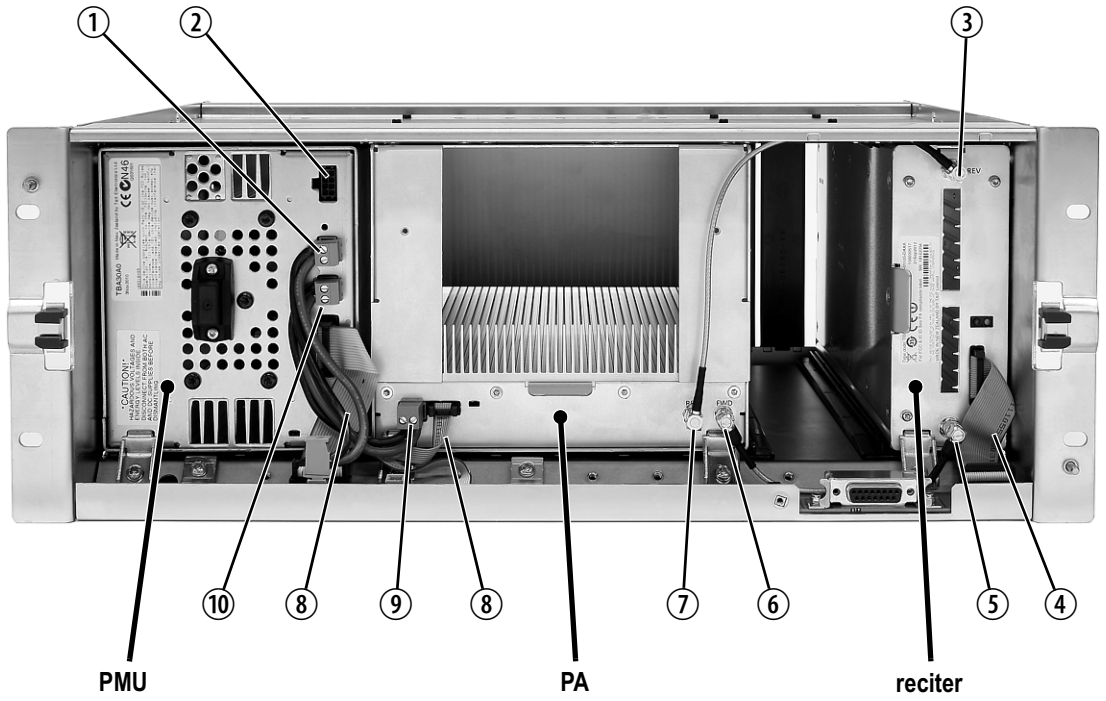
DC Supply

The PA is powered by a direct connection from the PMU. The reciter is powered from the PMU via the subrack interconnect board and system control bus ribbon cable.

100W Base Station

The connections between modules at the front of a 100W base station are shown below.

100W base station inter-module connections



1. 28VDC output to subrack interconnect board
2. not used
3. transmit reverse input
4. system control bus and 28VDC input
5. transmit forward output
6. transmit forward input
7. transmit reverse output
8. system control bus
9. 28VDC input
10. 28VDC output for PA

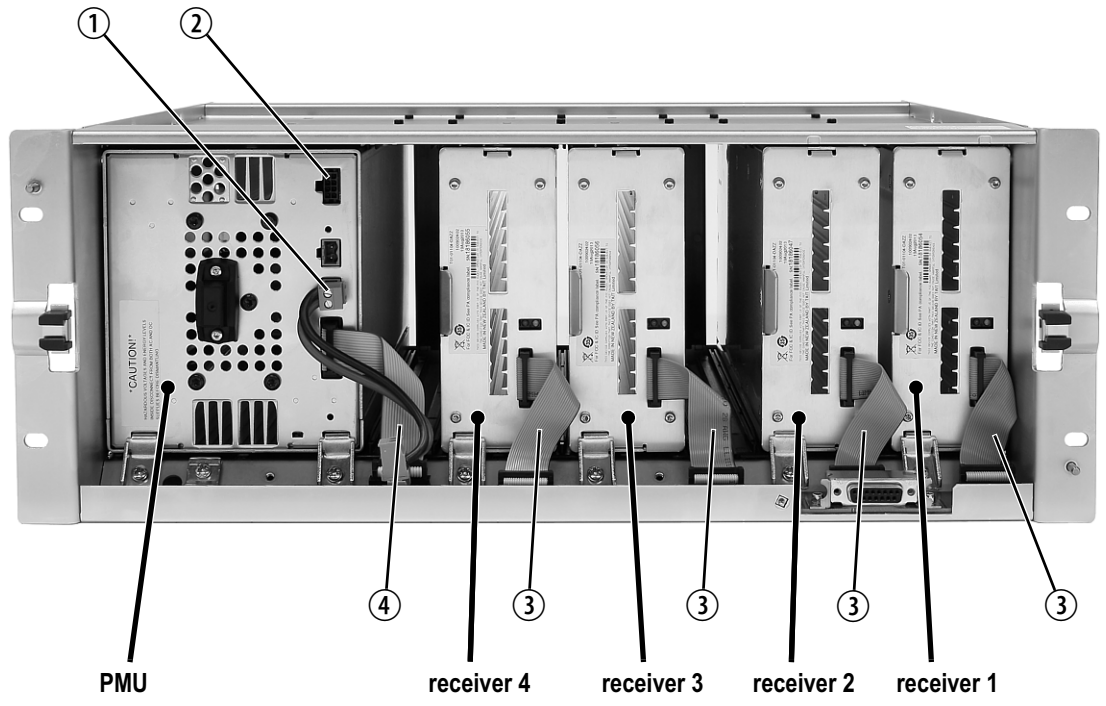
DC Supply

The PA is powered by a direct connection from the PMU. The reciter is powered from the PMU via the subrack interconnect board and system control bus ribbon cable.

Receive-only Base Station

The connections between modules at the front of a receive-only base station are shown below. A receive-only base station can have up to four receivers with a PMU.

Receive-only base station inter-module connections



① 28 VDC output to subrack interconnect board
② not used
③ system control bus and 28 VDC input
④ system control bus

DC Supply

The receivers are powered from the PMU via the subrack interconnect board and system control bus ribbon cables.

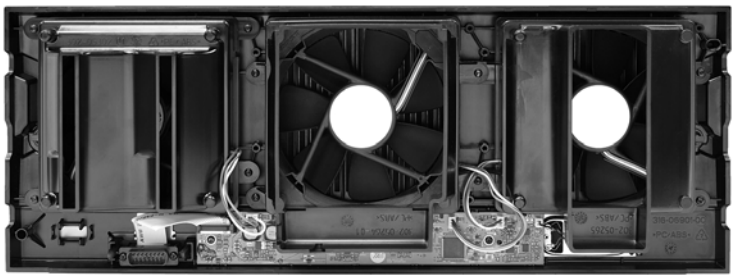
Appendix C – Identifying Front Panels

You must fit the correct type of front panel to your base station. Each type of base station has a different combination of modules, and must use a front panel fitted with fan ducts that match those modules. Each module, or pair of modules, requires a specific type of fan duct to ensure the cooling air flow passes directly through the modules' heatsinks. The illustration below shows the different front panels and identifies each fan duct by its part number (the xx in the part number indicates the version of the part).

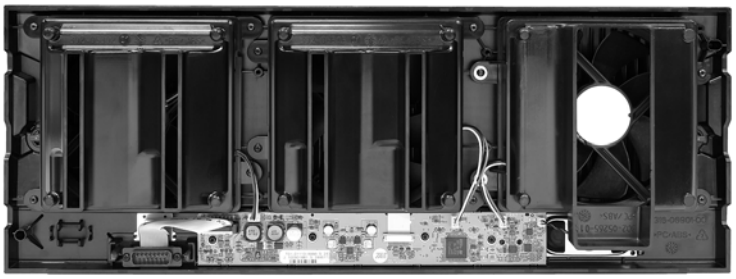
Identifying the different types of front panel

50 W base station (single and dual)	fan 1 reciter 1 and 50 W PA 1 duct: 304-10000-xx	fan 2 reciter 2 and 50 W PA 2 duct: 304-10001-xx	fan 3 PMU duct: 302-05265-xx

100 W base station	fan 1 reciter duct: 302-05302-xx	fan 2 100 W PA duct: 302-05264-xx	fan 3 PMU duct: 302-05265-xx



Receive-only base station	fan 1 receiver 1 and 2 duct: 302-05302-xx	fan 2 receiver 3 and 4 duct: 302-05303-xx	fan 3 PMU duct: 302-05265-xx



Glossary

This glossary contains an alphabetical list of terms and abbreviations related to the Tait network and the TB9400 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 P25 radios.

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

APCO The Association of Public Safety Communications Officials in the United States. The APCO Project 25 standards committee defined the P25 digital radio standard. The standard is often referred to as APCO or P25.

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. Specifically, Tait TB9400 equipment in a subrack.

battery protection mode A PMU enters battery protection mode when it has AC power but its DC power is below the configured power shutdown voltage. In battery protection mode, the PMU will shut down to protect the battery if it loses AC power.

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.

C4FM	Compatible Four-level Frequency Modulation. A modulation scheme defined in the P25 CAI standard for 12.5 kHz bandwidth.
CAI	Common Air Interface. The over-the-air data formats and protocols defined by the APCO P25 committee.
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.
Cartesian Loop	The reciter's RF output is fed to the PA through the transmit forward path. A coupled signal from the PA's RF output is fed back to the reciter through the transmit reverse path. The reciter uses this feedback through a Cartesian Loop to linearize the RF amplification system. Linearization is required to accurately transmit complex waveforms which vary in frequency and amplitude, such as those used in P25 Phase 2.
central voting	Voting that is centralized at one member of the channel group.
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). 3. One of the two timeslots that P25 Phase 2 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 group	A single logical channel consisting of a set of base stations. The members of a channel group operate on the same RF frequencies, are linked by an IP network and share a common multicast IP address.
channel profile	A named group of configuration settings that help to define the properties of a channel. Each channel in the channel table must have a channel profile assigned to it.
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).

community repeater	Repeater that is shared by several user groups.
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 SU 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 SUs.
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.
failsoft mode	An optional operational mode of Tait P25 trunked networks. It comes into effect when the channel group loses all connection to the trunking site controller. You can select the on-air signaling type to be compatible with previous TB9400 functionality, or to be interoperable with radio fleets from other manufacturers.
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.
fill-in receiver	An additional receiver placed within the coverage area of a base station to receive SU transmissions that are too weak to be received by that base station.
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.
front panel	The cover over the front of the base station containing the indicator LEDs, four-line LCD display, user controls and cooling fans.
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 SU 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.

holdover mode A simulcast base station can enter holdover mode when it loses its 1 PPS pulse. Holdover mode temporarily maintains synchronization by phase-locking the transmit clock to the external frequency reference.

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.

I^2C A bi-directional two-wire serial bus which is used to connect integrated circuits (ICs). I^2C is a multi-master bus, which means that multiple chips can be connected to the same bus, and each one can act as a master by initiating a data transfer. Used in the TB9400 for communications between reciter 1 and the PMU.

impairment A measure of signal quality used in channel group voting. Impairment is inversely related to signal quality. The lowest impairment (0) indicates the highest signal quality. The highest impairment (15) indicates the worst signal quality.

inbound Describes the direction of a signal: from an SU over the air interface to the fixed station.

inhibit A control command that can be sent across the CAI to inhibit an SU. An inhibited SU appears to the user as if it is powered off.

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 in 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.
LDU	Link Data Unit. Voice calls are sent over the CAI as a series of LDUs.
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 TB9400 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.
LSM	Linear Simulcast Modulation is a proprietary modulation scheme designed to give optimal performance in simulcast systems, compared to that obtainable using C4FM.
marshalling duration	The length of time that the voice stream needs to travel from the central voter to the furthest channel group member. The fixed marshalling duration parameter includes the time needed to fill the transmit buffer to the required level.
master	The channel group master is the member with the control connection to the trunking site controller.
multicast group	The group of hosts associated with a specific IP multicast address.
multicast IP address	An IP address that refers to a group of hosts rather than a single host. These hosts will all accept packets with this IP address.
mute	Prevents audio from being passed to the radio's speaker.
NAC	Network Access Code. The 12 most significant bits of the network identifier information that precedes every packet sent on the CAI. The

	NAC identifies which network the data belongs to, allowing base stations and mobiles to ignore packets belonging to interfering networks.
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 Tait digital network consists of a number of network elements. The TB9400 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 invasive 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 SU.
over	A single transmission, which begins when a user presses PTT and ends when the user stops pressing.
P25	Project 25. A suite of standards and requirements endorsed by the TIA and intended for digital public safety radio communications systems.
P25 Phase 2	P25 Phase 2 uses a two-slot TDMA modulation scheme to provide two logical channels (time slots) on one physical 12.5 kHz RF channel.
PA	The Power Amplifier is a base station module that boosts the exciter output to the required transmit level.
PCB	Printed Circuit Board.

PMU	The Power Management Unit is a module in the base station that provides power to the subrack and monitors power conditions.
preamble	A well-defined signal that is transmitted at the beginning of digital P25 calls to facilitate downlink voting and to allow the transmit buffer to fill.
privileges	A set of access rights to the web interface functions. There are Guest, Maintainer, and Administrator privileges.
Project 25	A project set up by APCO (the Association of Public Safety Communications Officials), together with other US governmental organizations, to develop standards for interoperable digital radios to meet the needs of public safety users.
PSTN	Public Switched Telephone Network: the public telephone network.
PTT	Push To Talk. The button on an SU that keys the transmitter.
QoS	Quality Of Service. A router feature that gives real-time data such as voice calls priority over other data.
receiver number	A unique number assigned to the members of a channel group.
reciter	A module of a base station that provides both receiver and exciter functionality.
repeater talkaround	Allows the SU user to bypass repeater operation and so communicate directly with other SUs. 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 reciter's control board 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.
satellite voter	A channel group member that has delegated voting activity to a central voter.
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.
signaling profile	A named set of configuration items related to signaling that can be applied to any channel.
simplex	Able to provide transmission and reception in only one direction at a time.
simulcast	The simultaneous broadcast by more than one transmitter of the same signal on the same frequency.
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.
skew	A measure used in centrally voted channel groups. If a voice stream arrives at the central voter 20 ms later than the first voice stream from the same SU, it is said to have a skew of 20 ms.
SMR	Specialized Mobile Radio. A communications system used by police, ambulances, taxis, trucks and other delivery vehicles.

SNMP	Simple Network Management Protocol. A protocol used (for example) by the trunking site controller to monitor the status of the channel group and its members.
SSRC	Synchronization source. The SSRC is a large number specified by the trunking controller in its connection message. It uniquely identifies voice streams sent from the master base station.
SU	Subscriber Unit. The term used in the APCO P25 standard documents for a two-way radio (generally a mobile or a portable radio) conforming to the CAI specifications.
supplementary service	A term used in the P25 standards. It refers to a group of services that is additional to the basic service that a telecommunications network provides. Examples include encryption and SU monitoring.
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. TB9400 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.
system control bus	Provides the following physical paths in a TB9400 base station: ■ I^2C and RS-485 communications between the modules in the subrack ■ fan power from the PMU ■ power connections for the reciter and front panel.
TaitNet	Brand name for a PMR network designed and manufactured by Tait Limited.
Tait P25 network	A set of Tait base stations interconnected by an IP network that can carry voice and data traffic.
TB9400 Base Station	A base station consisting of the equipment necessary to receive and transmit on one channel in a P25 Phase 1, P25 Phase 2, or analog network. Generally, this means a reciter, a PA, and a PMU. Often abbreviated to TB9400 or base station.
TCCP	Trunking Channel Control Protocol. A proprietary protocol operating over IP for the exchange of channel control messages between a base station and a trunking site controller.

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. TDMA divides a single RF channel into multiple time slots (logical channels), with each time slot being transmitted in rapid succession, one after the other. A time slot can be occupied by a single voice or data stream.
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.
TSBK	A Trunking Signaling Block is an over-the-air message format used in digital P25 mode for setting up trunked calls and for supplementary services such as messaging and status updates.
Tx	Transmitter.
UDP	User Datagram Protocol. A simple protocol on top of IP for sending streams of data.
uninhibit	A control command that can be sent across the CAI to restore an inhibited SU to normal functioning.
uplink	The transmission path from SUs 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.
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.

voting	The systematic sampling of a group of channels for the channel with the greatest signal strength. Voting provides wide-area coverage and ensures that as the user moves throughout the coverage area the strongest channel is always available for a call.
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.

Tait Software License Agreement

This Software License Agreement ("Agreement") is between you (“Licensee”) and Tait Limited (“Tait").
By using any of the Software items embedded and pre-loaded in the related Tait Designated Product, included on CD, downloaded from the Tait website, or provided in any other form, you agree to be bound by the terms of this Agreement. If you do not agree to the terms of this Agreement, do not install or use any of the Software. If you install or use any of the Software, that will be deemed to be acceptance of the terms of this Agreement.
For good and valuable consideration, the parties agree as follows:

Section 1 DEFINITIONS

“Confidential Information” means all or any information supplied to or received by Licensee from Tait, whether before or after installation or use and whether directly or indirectly pertaining to the Software and Documentation supplied by Tait, including without limitation all information relating to the Designated Products, hardware, software; copyright, design registrations, trademarks; operations, processes, and related business affairs of Tait; and including any other goods or property supplied by Tait to Licensee pursuant to the terms of this Agreement.
“Designated Products” means products provided by Tait to Licensee with which or for which the Software and Documentation is licensed for use.
“Documentation” means product and software documentation that specifies technical and performance features and capabilities; user, operation, and training manuals for the Software; and all physical or electronic media upon which such information is provided.
“Executable Code” means Software in a form that can be run in a computer and typically refers to machine language, which is comprised of native instructions the computer carries out in hardware. Executable code may also refer to programs written in interpreted languages that require additional software to actually execute.
“Intellectual Property Rights” and **“Intellectual Property”** mean the following or their substantial equivalents or counterparts, recognized by or through action before any governmental authority in any jurisdiction throughout the world and including, but not limited to all rights in patents, patent applications, inventions, copyrights, trademarks, trade secrets, trade names, and other proprietary rights in or relating to the Software and Documentation; including any adaptations, corrections, de-compilations, disassemblies, emulations, enhancements fixes, modifications, translations and updates to or derivative works from, the Software or Documentation, whether made by Tait or another party, or any improvements that result from Tait processes or, provision of information services.
“Licensee” means any individual or entity that has accepted the terms of this License.
“Open Source Software” means software with freely obtainable source code and license for modification, or permission for free distribution.
“Open Source Software License” means the terms or conditions under which the Open Source Software is licensed.
“Person” means any individual, partnership, corporation, association, joint stock company, trust, joint venture, limited liability company, governmental authority, sole proprietorship, or other form of legal entity recognized by a governmental authority.
“Security Vulnerability” means any flaw or weakness in system security procedures, design, implementation, or internal controls that if exercised (accidentally triggered or intentionally exploited) could result in a security breach such that data is compromised, manipulated, or stolen, or a system is damaged.
“Software” (i) means proprietary software in executable code format, and adaptations, translations, de-compilations, disassemblies, emulations, or derivative works of such software; (ii) means any modifications, enhancements, new versions and new releases of the software provided by Tait; and (iii) may contain one or more items of software owned by a third-party supplier. The term "Software" does not include any third-party software provided under separate license or not licensable under the terms of this Agreement.
“Source Code” means software expressed in human readable language necessary for understanding, maintaining, modifying, correcting, and enhancing any software referred to in this Agreement and includes all states of that software prior to its compilation into an executable programme.
“Tait” means Tait Limited and includes its Affiliates.

Section 2 SCOPE

This Agreement contains the terms and conditions of the license Tait is providing to Licensee, and of Licensee’s use of the Software and Documentation. Tait and Licensee enter into this Agreement in connection with Tait delivery of certain proprietary Software and/or products containing embedded or pre-loaded proprietary Software.

Section 3 GRANT OF LICENSE

3.1. Subject to the provisions of this Agreement and the payment of applicable license fees, Tait grants to Licensee a personal, limited, non-transferable (except as permitted in Section 7), and non-exclusive license to use the Software in executable code form, and the Documentation,

solely in connection with Licensee's use of the Designated Products for the useful life of the Designated Products. This Agreement does not grant any rights to source code.

3.2. If the Software licensed under this Agreement contains or is derived from Open Source Software, the terms and conditions governing the use of such Open Source Software are in the Open Source Software Licenses of the copyright owner and not in this Agreement. If there is a conflict between the terms and conditions of this Agreement and the terms and conditions of the any applicable Open Source Software Licenses, the terms and conditions of the Open Source Software Licenses will take precedence. For information about Open Source Components contained in Tait products and the related Open Source licenses, see:

http://support.taitradio.com/go/opensource

Section 4 LIMITATIONS ON USE

4.1. Licensee may use the Software only for Licensee's internal business purposes and only in accordance with the Documentation. Any other use of the Software is strictly prohibited. Without limiting the general nature of these restrictions, Licensee will not make the Software available for use by third parties on a "time sharing," "application service provider," "service bureau" basis, or for any other similar commercial rental or sharing arrangement.

4.2. Licensee will not, and will not directly or indirectly allow or enable any third party to: (i) reverse engineer, disassemble, extract components, decompile, reprogram, or otherwise reduce the Software or any portion thereof to a human perceptible form or otherwise attempt to recreate the source code; (ii) modify, adapt, create derivative works of, or merge the Software; (iii) copy, reproduce, distribute, lend, or lease the Software or Documentation to any third party; (iv) grant any sublicense or other rights in the Software or Documentation to any third party; (v) take any action that would cause the Software or Documentation to be placed in the public domain; (vi) remove, or in any way alter or obscure any copyright notice or other notice of Tait or third-party licensor’s proprietary rights; (vii) provide, copy, transmit, disclose, divulge or make the Software or Documentation available to, or permit the use of the Software by, any third party or on any machine except as expressly authorized by this Agreement; or (viii) use, or permit the use of, the Software in a manner that would result in the production of a copy of the Software by any means whatsoever other than what is permitted in this Agreement. Licensee may make one copy of the Software to be used solely for archival, back-up, or disaster recovery purposes; provided that Licensee may not operate that copy of the Software at the same time as the original Software is being operated. Licensee may make as many copies of the Documentation as it may reasonably require for the internal use of the Software.

4.3. Unless otherwise authorized by Tait in writing, Licensee will not, and will not enable or allow any third party to: (i) install a copy of the Software on more than one unit of a Designated Product; or (ii) copy or transfer Software installed on one unit of a Designated Product to any other device. Licensee may temporarily transfer Software installed on a Designated Product to another device if the Designated Product is inoperable or malfunctioning. Temporary transfer of the Software to another device must be discontinued when the original Designated Product is returned to operation and the Software must be removed from the other device.

4.4. Licensee will maintain, during the term of this Agreement and for a period of two years thereafter, accurate records relating to this license grant to verify compliance with this Agreement. Tait, or a third party nominated by Tait, may inspect Licensee’s premises, books and records, upon reasonable prior notice to Licensee, during Licensee’s normal business hours and subject to Licensee's facility and security regulations. Tait is responsible for the payment of all expenses and costs of the inspection, provided that Licensee shall indemnify Tait for all costs (including audit costs and legal costs on a solicitor client basis) if Licensee has breached the terms of this Agreement. Any information obtained by Tait during the course of the inspection will be kept in strict confidence by Tait and used solely for the purpose of verifying Licensee's compliance with the terms of this Agreement.

Section 5 OWNERSHIP AND TITLE

Tait, its licensors, and its suppliers retain all of their Intellectual Property Rights in and to the Software and Documentation, in any form. No rights are granted to Licensee under this Agreement by implication, estoppel or otherwise, except for those rights which are expressly granted to Licensee in this Agreement. All Intellectual Property developed, originated, or prepared by Tait in connection with providing the Software, Designated Products, Documentation, or related services, remains vested exclusively in Tait, and Licensee will not have any shared development or other Intellectual Property Rights.

Section 6 LIMITED WARRANTY; DISCLAIMER OF WARRANTY

6.1. The commencement date and the term of the Software warranty will be a period of one (1) year from Tait shipment of the Software. If Licensee is not in breach of any obligations under this Agreement, Tait warrants that the unmodified Software, when used properly and in accordance with the Documentation and this Agreement, will be free from a reproducible defect that eliminates the functionality or successful operation of a feature critical to the primary functionality or successful operation of the Software. Whether a defect has occurred will be determined solely by Tait. Tait does not warrant that Licensee’s use of the Software or the Designated Products will be uninterrupted, error-free, completely free of Security Vulnerabilities, or that the Software or the Designated Products will meet Licensee’s particular requirements. Tait makes

no representations or warranties with respect to any third-party software included in the Software.
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.

CE ⓘ Directive 1999/5/EC Declaration of Conformity

da Dansk

Undertegnede Tait Limited erklærer herved, at følgende udstyr TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B 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 TBCB1A, TBCB1B, TBCB1X, TBCH1A, TBCH1B, TBCH2A & TBCH2B står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
Se även: www.taitradio.com/eudoc