5 Installation

This chapter provides information on the site requirements for your TB9300 equipment and also describes how to install the base station in a standard 19 inch rack or cabinet.

If this is your first time installing a TB9300 base station, we recommend that you read the entire chapter before beginning the actual installation.

5.1 Before You Begin

5.1.1 Equipment Security

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

5.1.2 Grounding and Lightning Protection

Electrical Ground

The base station modules are grounded by physical contact between the module case and the subrack. To ensure a good ground connection you must tighten each module retaining clamp securely (refer to "Final Reassembly" on page 111 for the correct torque).

A threaded grounding connector is provided on the rear of the subrack for connection to the site ground point (refer to "Connecting Up the Base Station" on page 89 for more details).

Lightning Ground

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

5.1.3 Equipment Ventilation

Always ensure there is adequate ventilation around the base station (refer to "Cabinet and Rack Ventilation" on page 69).

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

Notice The cooling fans are mounted 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).

5.1.4 Ambient Temperature Sensor

The ambient temperature reading for the base station is provided by the temperature sensor located on the front panel circuit board.

5.1.5 Cabinet and Rack Ventilation

The cooling airflow for the base station enters through the front panel and exits at the rear of the subrack. For optimum thermal performance, the heated air that has passed through a base station must not be allowed to re-enter the air intakes on the front panel. Any space at the front of the cabinet not occupied by equipment should be covered by a blanking panel. Refer to Figure 5.1 on page 70.

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

- an area of at least 23 in^2 (150 cm^2) of unrestricted ventilation slots or holes in front of the air intakes for the fans for each subrack; for example, thirty 0.25 x 3.3 in (6 x 85 mm) slots will allow the recommended airflow
- a vent in the top of the cabinet with an area of approximately 23 in^2 (150 cm^2) per subrack, or a similar area of ventilation per subrack at the rear of the cabinet behind each subrack
- a 2U gap at the top of the cabinet.

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

The maximum ambient temperature entering the cabinet must not exceed +140°F (+60°C).

If you are installing multiple subracks in a cabinet, ensure that there will be enough cooling airflow through the cabinet after the equipment has been installed. For example, the recommended maximum number of subracks in a 38U cabinet is five, as shown in Figure 5.1 on page 70.

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

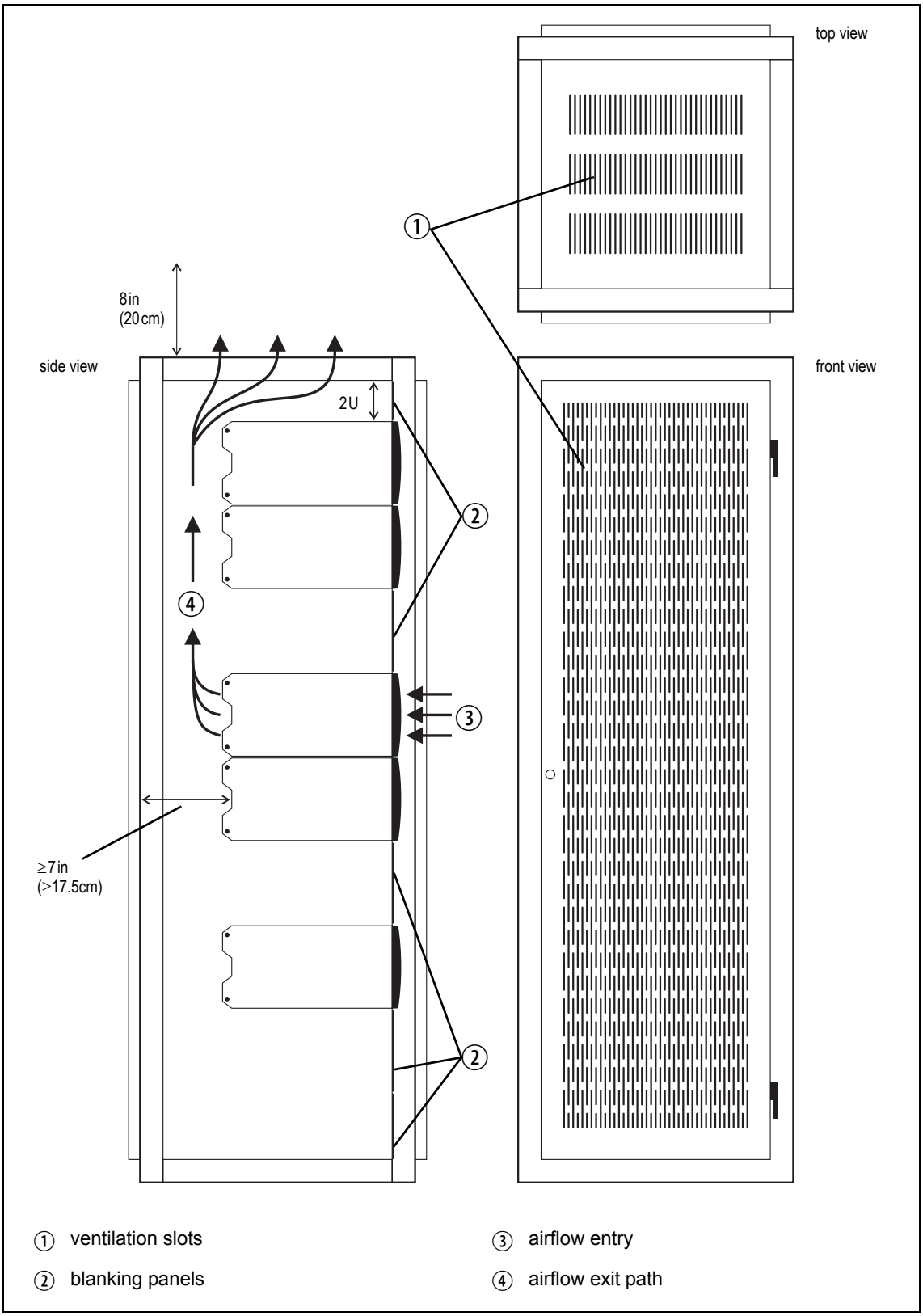
Auxiliary Extractor Fans

The base station does not require auxiliary extractor fans mounted in the top of the cabinet. If your cabinet is already fitted with fans, the following procedures apply:

- if there are six or more 4.75 in (12 cm) fans, each capable of extracting 94.2 ft^3 per minute (160 m^3 per hour), they must run continuously
- if there are fewer than six fans, you must remove them and ensure the vent in the top of the cabinet has an area of approximately 23 in^2 (150 cm^2) per subrack.

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

Figure 5.1 Typical cabinet ventilation requirements

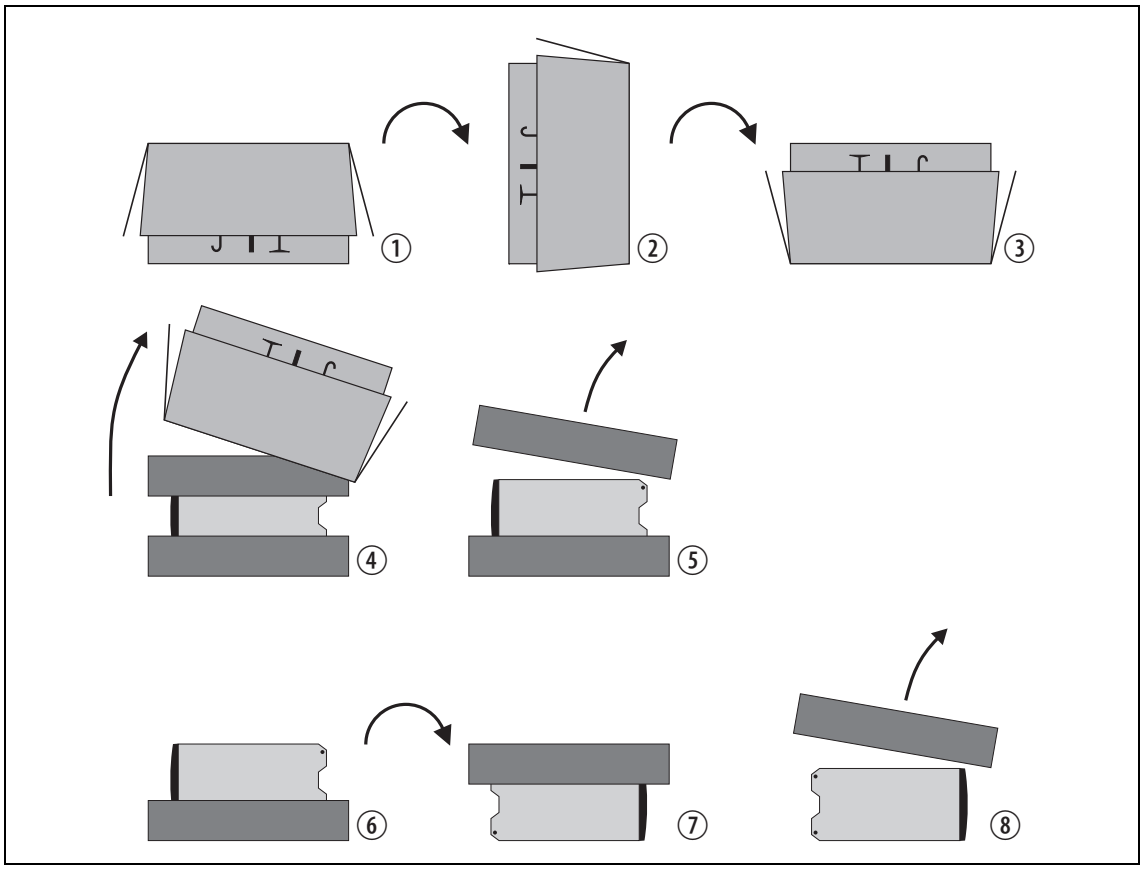


5.2 Unpacking and Moving the Subrack

The subrack is packed in a strong corrugated cardboard carton with top and bottom foam cushions. To prevent personal injury and damage to the equipment, we recommend that two people unpack and move the subrack. To remove the subrack from the carton, follow the procedure illustrated in Figure 5.2.

Caution A subrack complete with modules can weigh up to 62 lb (28 kg), or up to 66 lb (30 kg) complete with packaging. We recommend that you have another person help you unpack and move the equipment. The TBAA03-16 carrying handles will make it easier to move the equipment once it has been unpacked. If necessary, remove the modules from the subrack before moving it (refer to "Replacing Modules" on page 100). In all cases follow safe lifting practices.

Figure 5.2 Unpacking the subrack



1. Cut the tape securing the flaps at the top of the carton and fold them flat against the sides ①.
2. Rotate the carton carefully onto its side ② and then onto its top ③, ensuring that none of the flaps is trapped underneath.

3. Slide the carton upwards over the foam cushions and lift it away ④. Remove the cushion from the bottom of the subrack ⑤.

4. Rotate the subrack and cushion carefully over the rear of the subrack ⑥ so that it is the right way up with the cushion on top ⑦. Remove the cushion from the top of the subrack ⑧.

Disposal of Packaging

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

5.3 Identifying the Equipment

You can identify the model and hardware configuration of the TB9300 modules by referring to the product code printed on labels at the rear of each module. The meaning of each character in the product code is explained in the tables below.

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

Reciter Product Codes

Product Code	Description	
T01-01105-**X**XXX	**Frequency Band**	**Tait Band Identifier**
	C = 136 MHz to 156 MHz	B2 band
	D = 148 MHz to 174 MHz	B3 band
	H = 330MHz to 380MHz	G4 band
	K = 400MHz to 440MHz	H1 band
	L = 440MHz to 480MHz	H2 band
	M = 470MHz to 520MHz	H3 band
	R = 400MHz to 440MHz (receive)	HC band
	R = 440MHz to 480MHz (transmit)	HC band
	N = 762 MHz to 870MHz[a]	K4 band
	Q = 896MHz to 902MHz (receive)	L2 band
	Q = 927MHz to 941MHz (transmit)	L2 band
T01-01105-X**X**XX	A = standard	
T01-01105-XX**X**X	A = default	
T01-01105-XXX**X**	A = default	

a. The actual frequency coverage in this band is:
Transmit: 762MHz to 776MHz and 850MHz to 870MHz
Receive: 792MHz to 824MHz

PA Product Codes

Product Code	Description	
T01-01136-**X**XXX	**Frequency Band**	**Tait Band Identifier**
	C = 136MHz to 174MHz	B1 band
	H = 330 MHz to 380 MHz	G4 band
	J = 380MHz to 520MHz	H0 band
	N = 762MHz to 870MHz[a]	K2 band
	Q = 850MHz to 941MHz	L0 band
T01-01136-X**X**XX	A = 50W B = 100W	
T01-01136-XX**X**X	A = default	
T01-01136-XXX**X**	A = default	

a. The actual frequency coverage in this band when used with a K-band TB9300 reciter is 762MHz to 776MHz and 850MHZ to 870MHz.

PMU Product Codes

Product Code	Description
TBA**X**XXX-XXXX	3 = PMU
TBA3**X**XX-XXXX	0 = default
TBA3X**X**X-XXXX	0 = AC module not fitted A = AC module fitted
TBA3XX**X**-XXXX	0 = DC module not fitted 1 = 12V DC module fitted 2 = 24V DC module fitted 4 = 48V DC module fitted
TBA3XXX-**X**XXX	0 = standby power supply card not fitted 1 = 12VDC standby power supply card fitted 2 = 24VDC standby power supply card fitted 4 = 48VDC standby power supply card fitted
TBA3XXX-X**X**XX	0 = auxiliary power supply board not fitted 1 = 12VDC auxiliary power supply board fitted 2 = 24VDC auxiliary power supply board fitted 4 = 48VDC auxiliary power supply board fitted
TBA3XXX-XX**X**X	0 = default
TBA3XXX-XXX**X**	0 = default

5.4 Initial Setting Up

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

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

5.4.1 Confirming Operation

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

Applying Power

1. Apply power by turning on the PMU.
2. Check that the base station powers up correctly:
   - The front panel display will show “Please wait...” while the base station starts up (this may take up to two minutes). When the startup process is complete, the display will show the home screen.
   - The cooling fans in the front panel will run at full speed for a few seconds, then run at low speed while the base station starts up, and then assume standard operation. One or more fans may operate, depending on the temperature of the modules.

Functional Tests

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

Test	Notes	Menu
receiver operation	requires a suitable RF source	Diagnose > RF Interface > Receiver
transmitter operation	requires connection to the network	Diagnose > RF Interface > Transmitter
ping	checks the IP connection to another device with an IP address	Diagnose > Connection > Network
NTP query	checks if the NTP-based time synchronization is working	
PMU mains failure	requires a DC backup supply	Diagnose > Subsystems > PMU Control Tests
fan operation	checks the operation of each fan individually	Diagnose > Subsystems > Fan Tests

5.4.2 Customizing the Configuration

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

1. Log in to the base station (refer to "Connecting Your PC to the Base Station" on page 50 for more details).

2. Select Configure. The base station has many different settings that can be configured before it is put into operation, such as:
   - Channel configurations
   - Alarm control and SNMP agent
   - Network interfaces
   - Quality of service
   - CWID
   - miscellaneous items such as minimum battery voltages, fan control, NTP and package servers.

3. Make the changes needed in each form and click **'Save**.' All changes made in the form will be applied when, and only when, the form is saved.

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

5.4.3 Recommended Configuration Settings

In a dual base station only reciter 1 communicates directly with the PMU and front panel. Therefore the following configuration settings are recommended for dual base station operation:

- Disable the "PMU not detected" alarm on base station 2 (Configure > Alarms > Control > PMU).
- Disable the "FP not detected" alarm on base station 2 (Configure > Alarms > Control > Front panel).

5.4.4 Restricted Port Numbers

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

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

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

5.4.5 Changing the Root Password

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

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

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

To change the root password, follow these steps.

1. Log in from your PC to the base station using SSH client software such as PuTTY. The username is "root" and the default password is "k1w1".
2. At the # prompt, enter the command "passwd".
3. Follow the on-screen instructions.
4. Record the password in a secure location.

5.4.6 Tuning the Reciter

B-Band

Before the base station is installed on site, you may need to tune the receiver front end. The receiver front end requires tuning if the receive frequency is shifted more than 2 MHz away from the previously set frequency, or the RSSI level of the new frequency is more than 1 dB lower than the RSSI level of the previously set frequency.

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

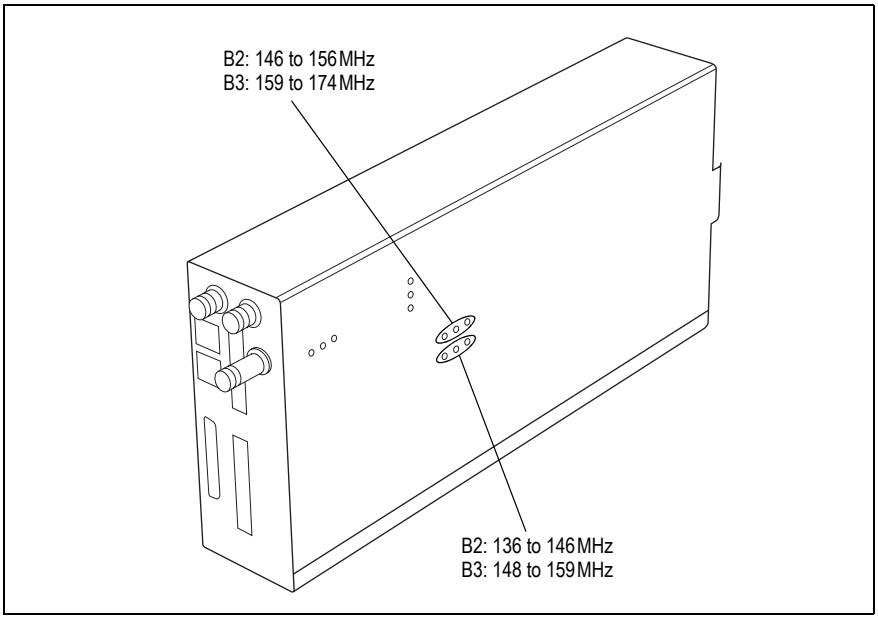
- B2 - 136 to 156 MHz
- B3 - 148 to 174 MHz

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

- B2 - 136 to 146 MHz and 146 to 156 MHz
- B3 - 148 to 159 MHz and 159 to 174 MHz

Each sub-band has its own helical filter (shown in Figure 5.3 below) which is electronically switched in or out of circuit depending on the frequency programmed into the reciter. The bandwidth of these helical filters is approximately ±1.5 MHz.

Figure 5.3 Identifying the B-band receiver front end helical filters



To check the RSSI level and tune the receiver front end (if required), follow these steps:

Remove the reciter from the subrack and reconnect the system control bus cable to power up the module.

Tait can provide extender cables (TBC Reciter Power Cables) to enable tuning with a subrack or from a bench power supply. To order these, the part number is T01-01150-0001.

1. Log in to the reciter and select Monitor > Interfaces > RF Interface. For information on connecting directly to the reciter, refer to "Connecting a Networked PC to a Base Station" on page 54.
2. Feed a signal at the currently tuned receive frequency and at a level of −80 dBm into the reciter's RF input. Check that the RSSI reading on the RF Interface page is −80 dBm ± 1 dB. Note this reading.
3. Set the reciter to the new receive frequency.
4. Change the RF input signal to the new receive frequency at −80 dBm. Check that the RSSI reading is −80 dBm ± 1 dB. If it is, the receiver front end does not require tuning. If it is not, go to the next step.
5. Using the Johanson tuning tool[1], adjust the correct helical filter for the new frequency (as shown in Figure 5.3) to obtain a peak RSSI reading. This reading should be within 1 dB of the reading at the previous frequency.

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

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

6. Change the RF input signal and the reciter's receive frequency to 0.5 MHz above and below the required frequency and check that the RSSI reading does not drop by more than 0.5 dB from the reading at the required frequency.
7. Recalibrate the RSSI at the new frequency (Calibrate > Reciter > RSSI).

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

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

H-Band

Before the base station is installed on site, you may need to tune the receiver front end. The receiver front end requires tuning if the receive frequency is shifted more than 5 MHz away from the previously set frequency, or the RSSI level of the new frequency is more than 1 dB lower than the RSSI level of the previously set frequency.

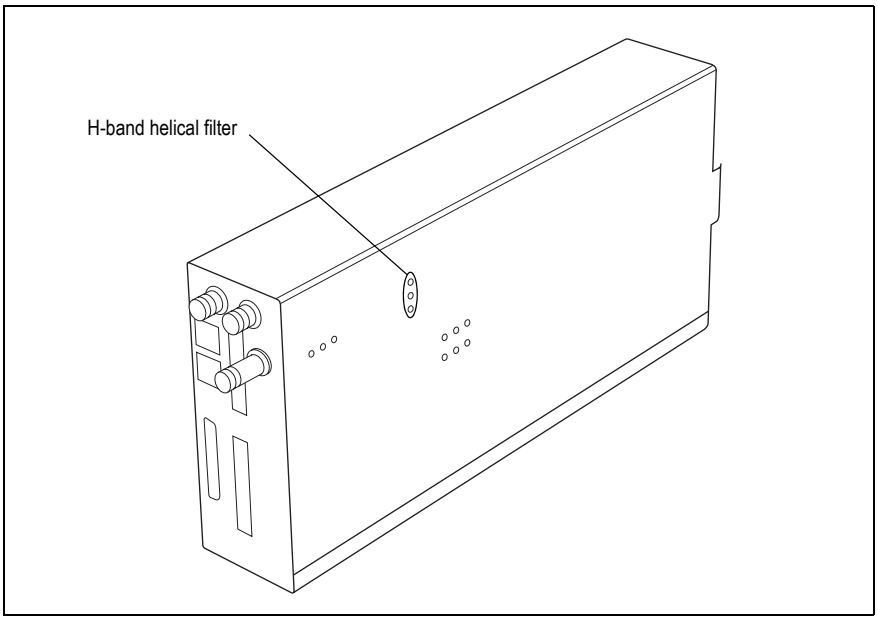
Tait can provide extender cables (TBC Reciter Power Cables) to enable tuning with a subrack or from a bench power supply. To order these, the part number is T01-01150-0001.

The receiver in the H-band reciter covers one of the following frequency sub-bands, depending on the model:

- H1 and HC - 400 to 440 MHz
- H2 - 440 to 480 MHz
- H3 - 470 to 520 MHz.

Each sub-band uses the same helical filter (shown in Figure 5.4 below). The bandwidth of the helical filter is approximately ±5 MHz.

Figure 5.4 Identifying the H-band receiver front end helical filter



To check the RSSI level and tune the receiver front end (if required), follow these steps.

1. Remove the reciter from the subrack and reconnect the system control bus cable to power up the reciter.

2. Log in to the reciter and select Monitor > Interfaces > RF Interface. For information on connecting directly to the reciter, refer to "Connecting a Networked PC to a Base Station" on page 54.

3. Feed a signal at the currently tuned receive frequency and at a level of −80 dBm into the reciter's RF input. Check that the RSSI reading on the RF Interface page is −80 dBm ± 1 dB. Note this reading.

4. Set the reciter to the new receive frequency.

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

6. Using the Johanson tuning tool[1], adjust the helical filter for the new frequency (as shown in Figure 5.4) to obtain a peak RSSI reading. This reading should be within 1 dB of the reading at the previous frequency.

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

If tuning to a lower frequency, adjust the slug in (clockwise); for a higher frequency, adjust the slug out (counterclockwise).

7. Change the RF input signal and the reciter's receive frequency to 2 MHz above and below the required frequency and check that the RSSI reading does not drop by more than 0.5 dB from the reading at the required frequency.

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

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

Electronically Tuned Reciters

The G-band, K-band and L-band reciters do not require tuning.

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

5.5 Installing the Base Station on Site

5.5.1 General Installation Advice

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

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

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

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

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

5.5.2 Equipment Required

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

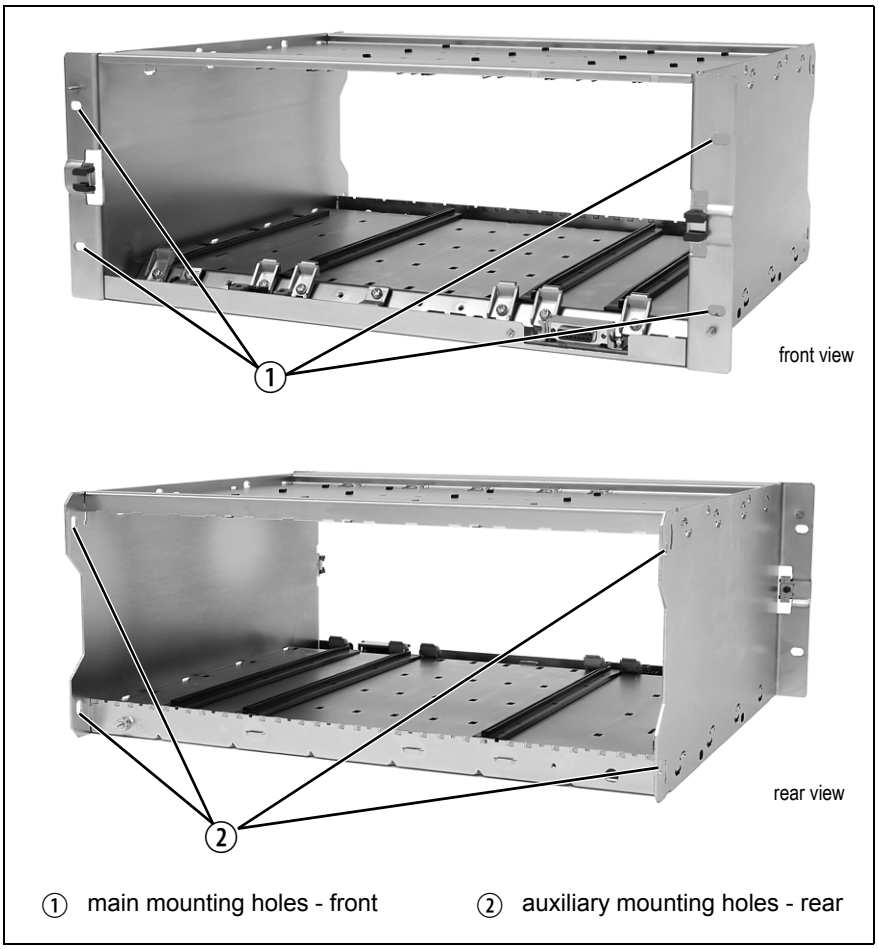
- Pozidriv PZ3 screwdriver for the M6 screws used in the DC input terminals on the PMU; M6 (0.25 in) screws are also used to secure the subrack to the cabinet in factory-assembled systems
- Pozidriv PZ2 screwdriver for the M4 screws used to secure the module retaining clamps, and for the fasteners used to secure the front panel to the subrack
- 8 mm AF spanner for the SMA connectors, and the subrack ground connector.

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

5.5.3 Mounting the Subrack

Caution A subrack complete with modules can weigh up to 62 lb (28 kg), or up to 66 lb (30 kg) complete with packaging. We recommend that you have another person help you unpack and move the equipment. The TBAA03-16 carrying handles will make it easier to move the equipment once it has been unpacked. If necessary, remove the modules from the subrack before moving it (refer to "Replacing Modules" on page 100). In all cases follow safe lifting practices.

Figure 5.5 Subrack mounting points

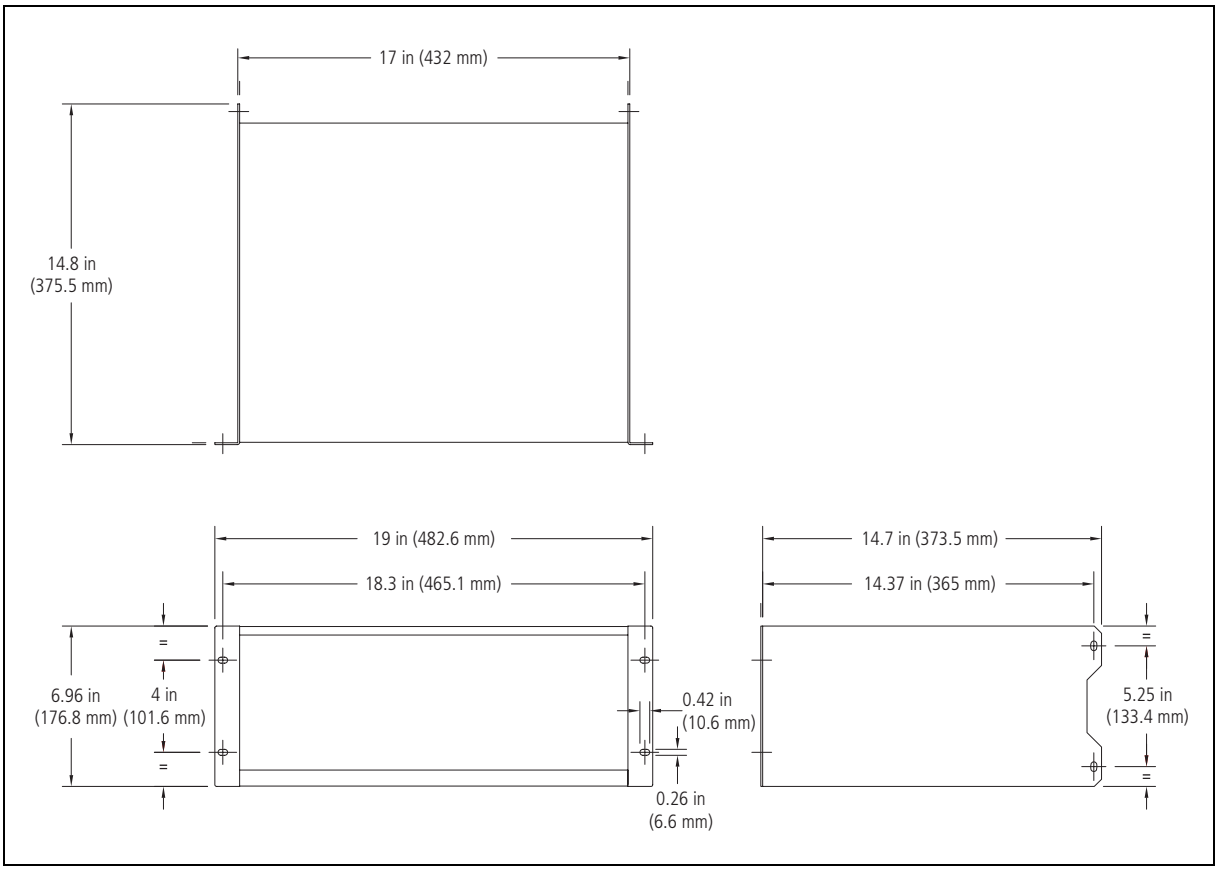


1. Remove the front panel, as described in "Preliminary Disassembly" on page 102.
2. Fit the subrack into the cabinet or rack and secure it firmly with an M6 (0.25 in) screw, flat and spring washer in each of the four main mounting holes ①, as shown in Figure 5.5.

If you need extra mounting security, additional mounting holes ② are provided at the rear of the subrack for auxiliary support brackets.

Figure 5.6 below gives the dimensions of the subrack and its mounting holes.

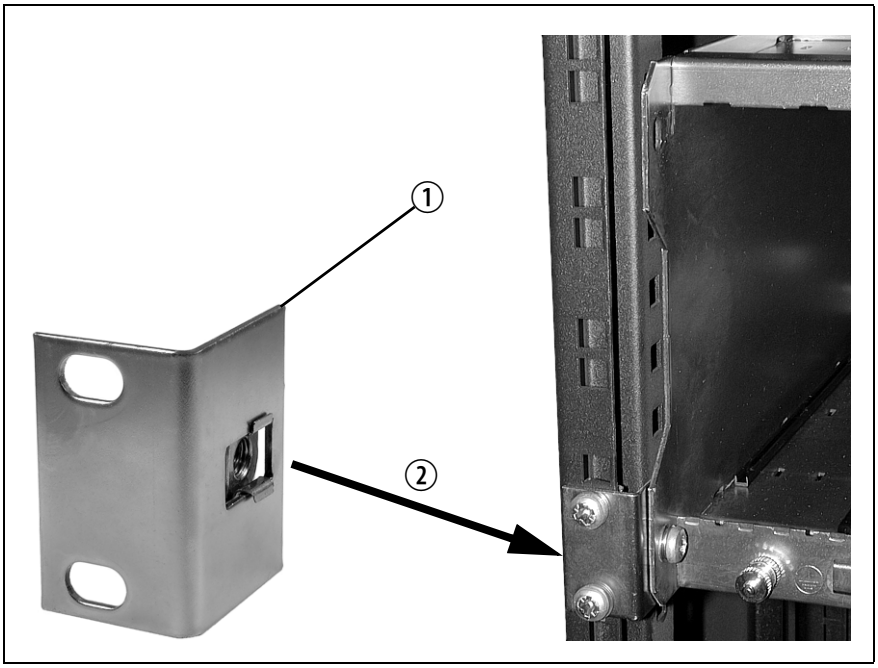
Figure 5.6 Subrack dimensions



Auxiliary Support Bracket

TBAA03-13 auxiliary support brackets can be fitted to the rear of the subrack to provide additional mounting security. Figure 5.7 shows a standard TBAA03-13 bracket ① fitted in a typical Tait cabinet ②. If you are not using the Tait cabinet, you may have to make your own brackets to suit your installation.

Figure 5.7 Auxiliary support bracket



Notice You **must** fit the auxiliary support brackets if you intend to transport a cabinet fitted with a fully built-up base station.

We also recommend that you fit the brackets under the following conditions:

- when the installation is in an area prone to earthquakes
- when third party equipment is installed hard up underneath the base station subrack.

General Cabling

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

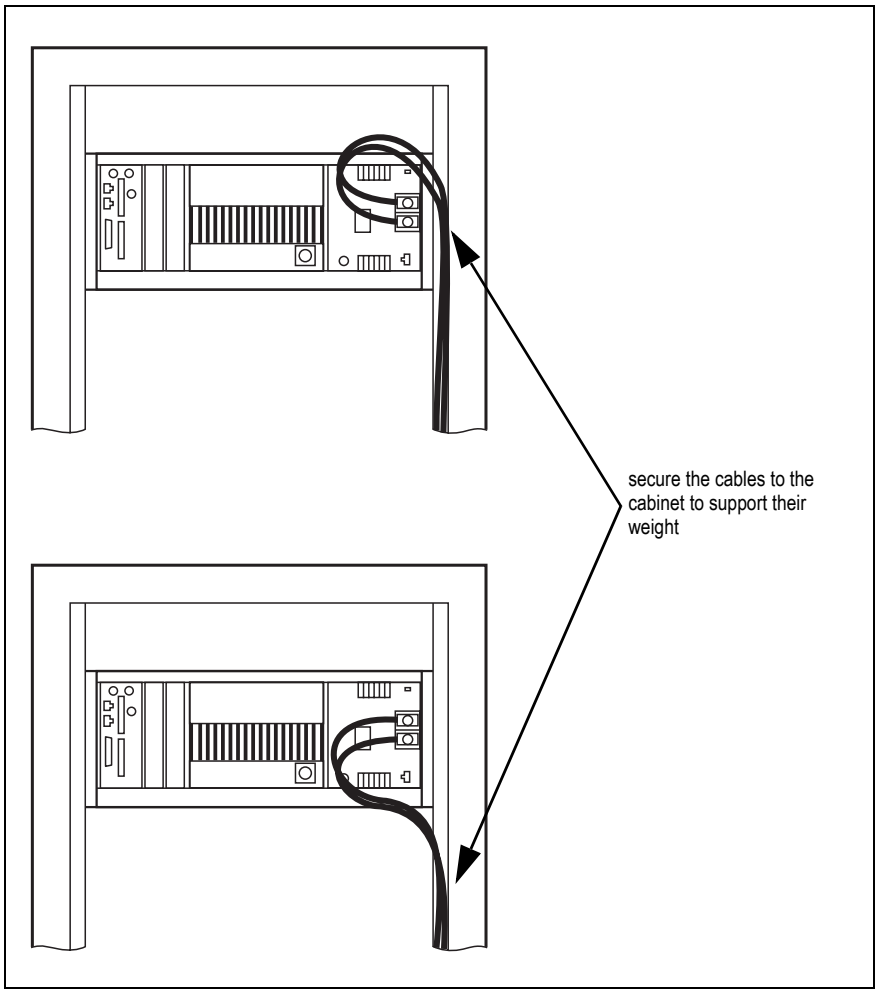
DC Power Cabling

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 5.8 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 5.8 DC power cabling



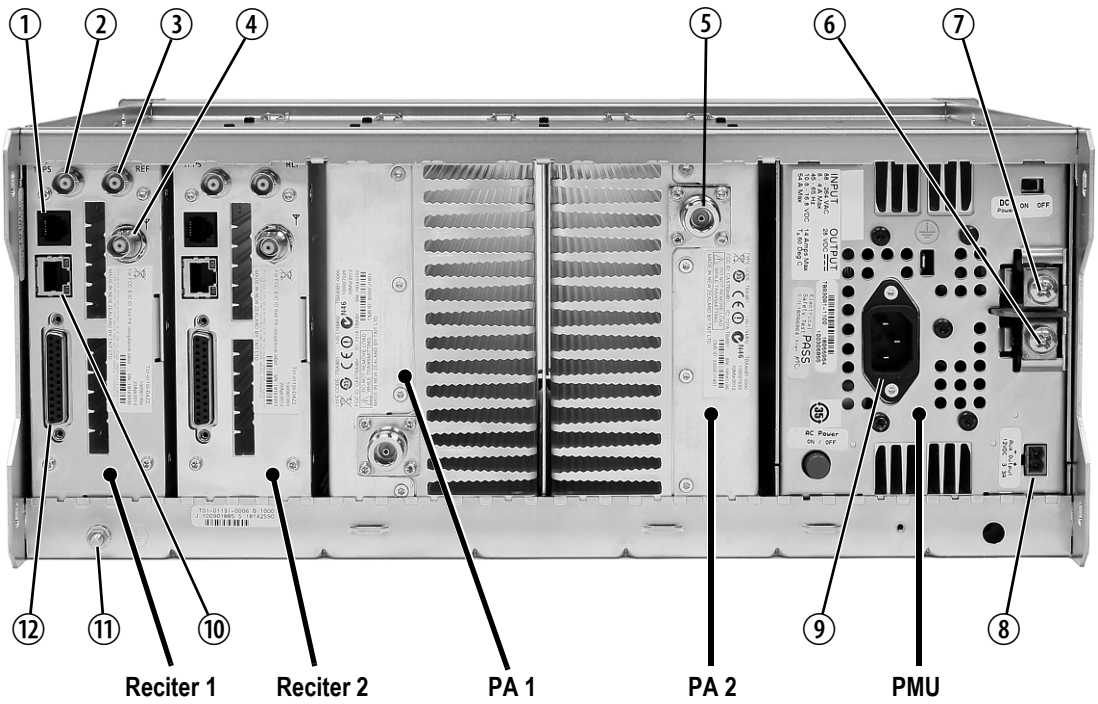
5.6 Connecting Up the Base Station

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

5.6.1 Connection Overview

The connections at the rear of a dual 50 W base station are identified in Figure 5.9. External connections are all located at the rear of the subrack.

Figure 5.9 50 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.

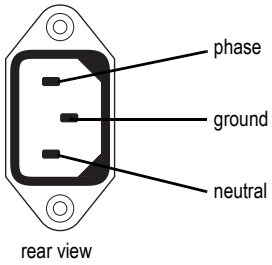
5.6.2 Connecting AC Power

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.



5.6.3 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).

5.6.4 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 5.10. You can use this to connect the PMU's auxiliary DC power output to another device (refer to "PMU Auxiliary DC Output" on page 113 for the pin allocations).

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

Figure 5.10 Auxiliary DC power connector

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

5.6.5 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 5.9 on page 89).

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.

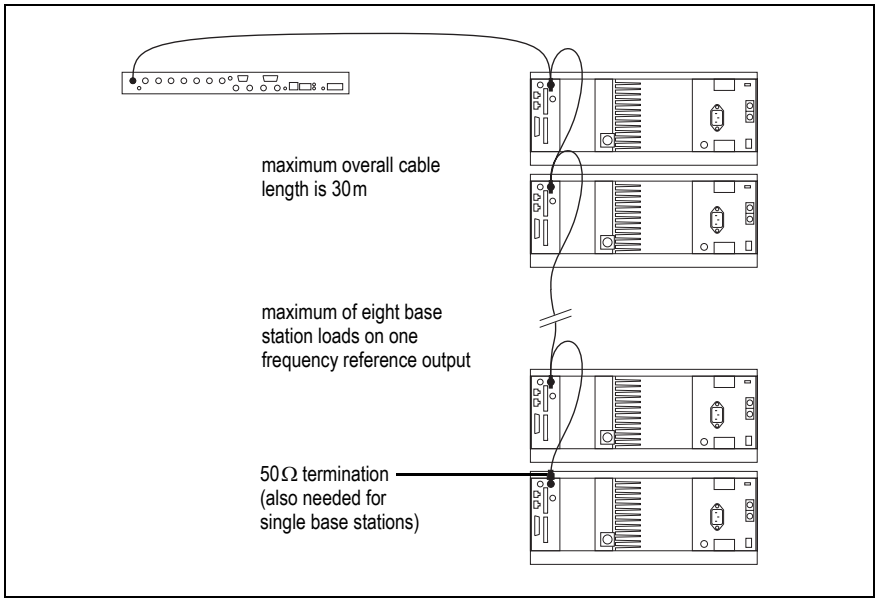
5.6.6 Connecting an External Frequency Reference

An external reference frequency is not normally required for B band. However, an external reference can be used when you need to maximize the range of the base station. For K4 band, the internal frequency reference accuracy is inadequate, and an external reference must be used. 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 stability of this reference should be better than 100 parts per billion. The reciter automatically detects the frequency of the external reference and configures itself accordingly.

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

Use a 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 5.11 Daisy-chaining an external frequency reference input



5.6.7 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.

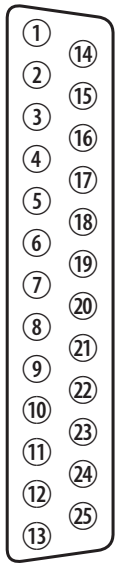
With the port speed at 10 Mbit/s it is particularly important to set the voice QoS on the reciter port of your site router or switch to a strict priority queue policy - which is the same policy that you should also be setting for your site link ports. The default QoS settings restrict the voice bandwidth 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 113 for a list of Ethernet connection pin allocations.

5.6.8 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	

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 68 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 PA and PMU weigh between 10.1 lb (4.6 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.

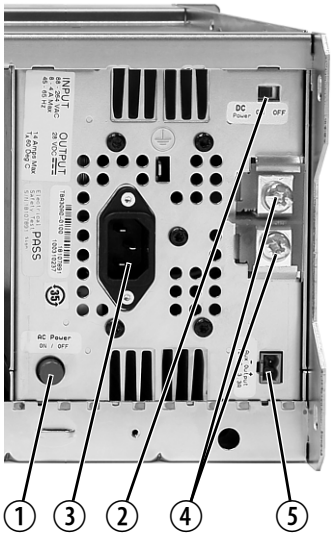
> **Notice** Before removing a PA, disconnect the DC input and RF input first, followed by the RF output. After refitting the PA, reconnect the RF output first, followed by the RF input, and then the DC input.

Disconnecting the Power

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

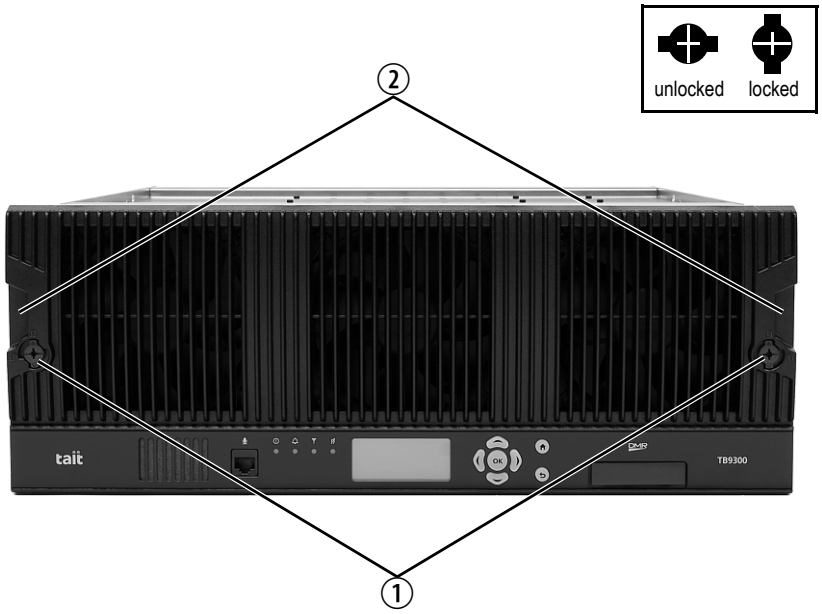
> **Caution** Before disconnecting the battery supply leads from the PMU, open the circuit breaker or disconnect the supply leads from the battery.

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

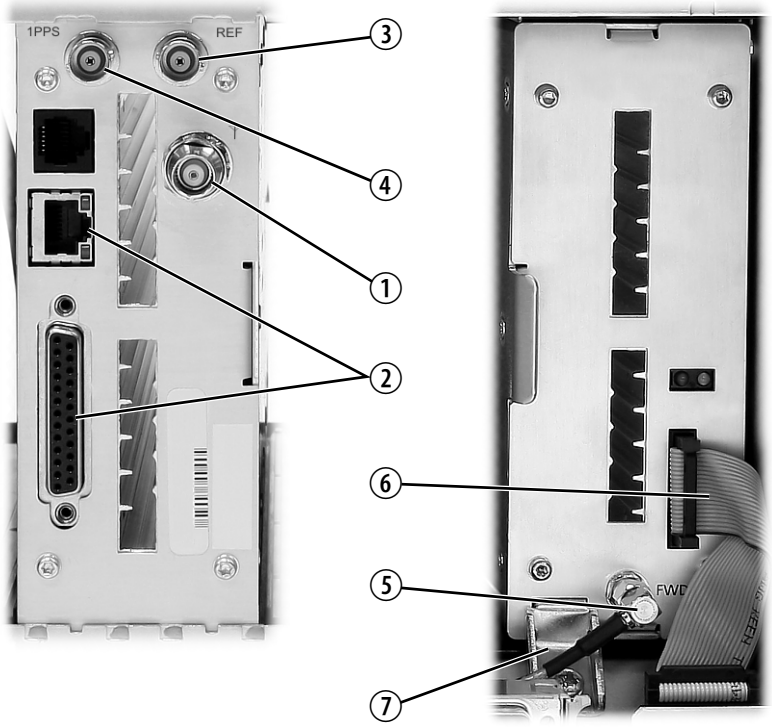
The cable retaining clips are used to hold cables in position at the top of the subrack so that they do not interfere with the mounting of the front panel, or interrupt the airflow through the base station.

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 102.
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 RF output cable ⑤, and move it to one side. Unplug both ends of the system control bus cable ⑥ and remove it.
4. Loosen the screw securing the retaining clamp ⑦ 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

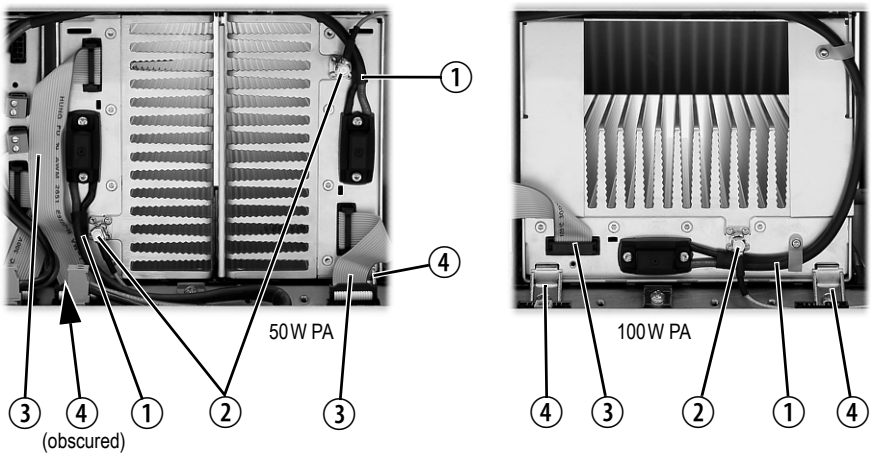
1. Slide the replacement reciter into the subrack and secure it with the retaining clamp.
2. Reconnect all the front and rear panel cables previously disconnected. Ensure the front panel cables are positioned correctly, and retained where required by the cable retaining clips in the top of the subrack (refer to “Appendix B – Inter-Module Connections” on page 114).
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 111.

8.4 Replacing a Power Amplifier

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

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 102.
2. At the front of the PA, unplug the DC input cable ① and the RF input cable ②, and move both cables to one side. Unplug both ends of the system control bus cable ③ and remove it.
3. At the rear of the PA, unplug the RF output cable.
4. Loosen the screw securing the retaining clamp(s) ④ 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 RF input cable, 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 114).
5. Tighten the nut on the SMA connector to a torque of 5 lbf·in (0.6 N·m).

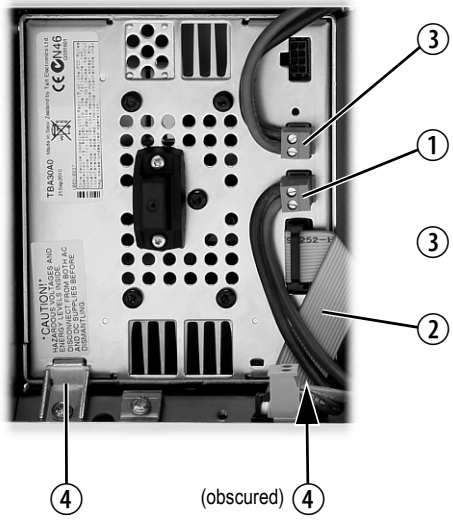
6. Carry out the instructions in "Final Reassembly" on page 111.

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 102.
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 5.8 on page 88. Tighten the screws to a torque of 18–20 lbf·in (2–2.25 N·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 114).
3. Carry out the instructions in "Final Reassembly" on page 111.

8.6 Replacing the Module Guide Rails

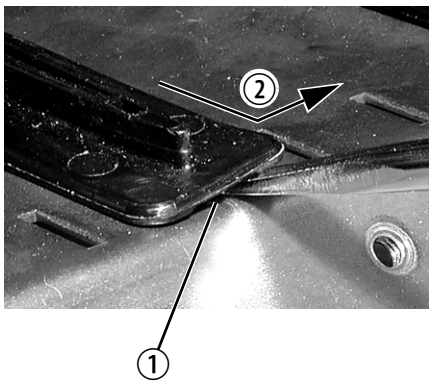
The module guide rails are held in place by four hooks that fit through the slots in the top and bottom of the subrack. There is also a locking tab which prevents the guide rails from working loose.

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.

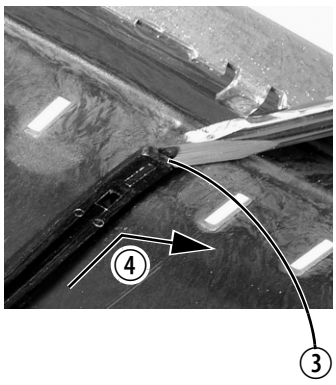
Removal

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

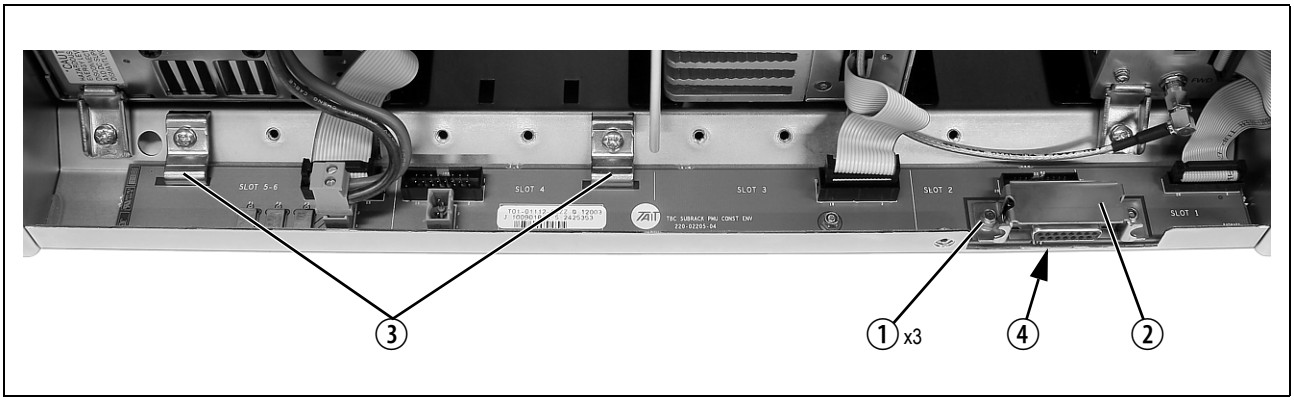
Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 102.
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 114.

Figure 8.1 Replacing the subrack interconnect board



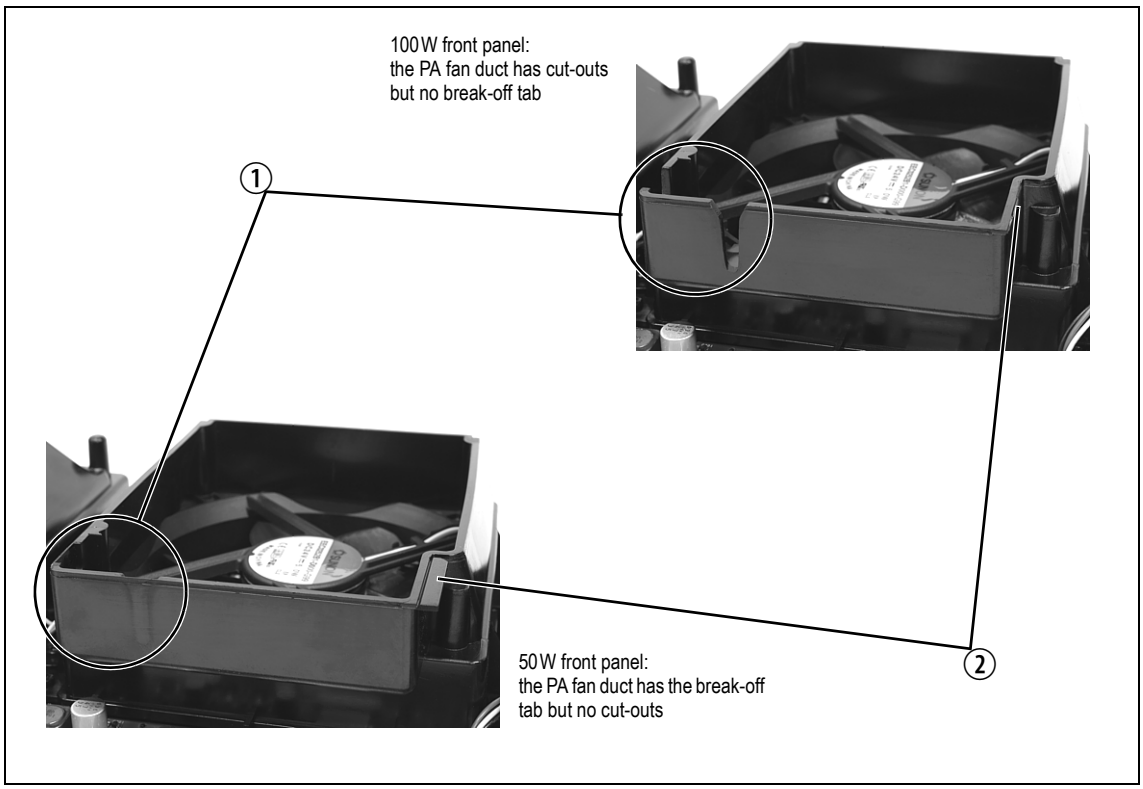
8.8 Final Reassembly

Notice You must refit the correct type of front panel to your base station. There are several small but important differences between the front panel for a 50 W base station and the front panel for a 100 W base station. These differences are in the duct for the PA fan and are described in the following paragraphs.

50 W Front Panel The PA fan duct does not have the cut-outs ① required for the 100 W PA RF and DC cables. The break-off tab ② will also still be present and will jam on the system control bus. Do not try to fit this front panel to a 100 W base station or you will damage these cables and possibly the front panel itself.

100 W Front Panel Do not fit this front panel to a 50 W base station. The presence of the cut-outs and absence of the break-off tab will allow air to escape and reduce the velocity of air directed through the heatsink.

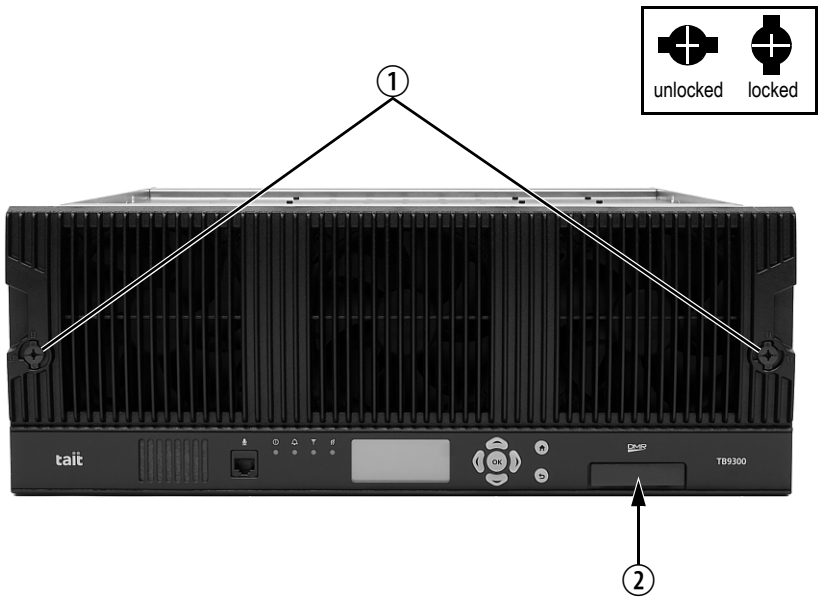
Figure 8.2 Identifying the correct front panel



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 114). Otherwise the panel may not fit properly, or you may damage the cables.

2. In 50 W base stations, check that the airflow separator is fitted correctly.

3. 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.**



4. 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.

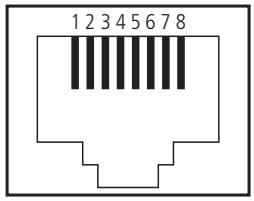
Notice When refitting modules, make sure they are fitted correctly into the subrack and all retaining clamps are securely tightened. The recommended torque for the retaining clamp screws is 17 lbf·in (1.9 N·m). As well as holding the modules in place, the retaining clamps push the modules hard against 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 96.

Ethernet Connector

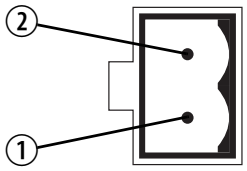


external view

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

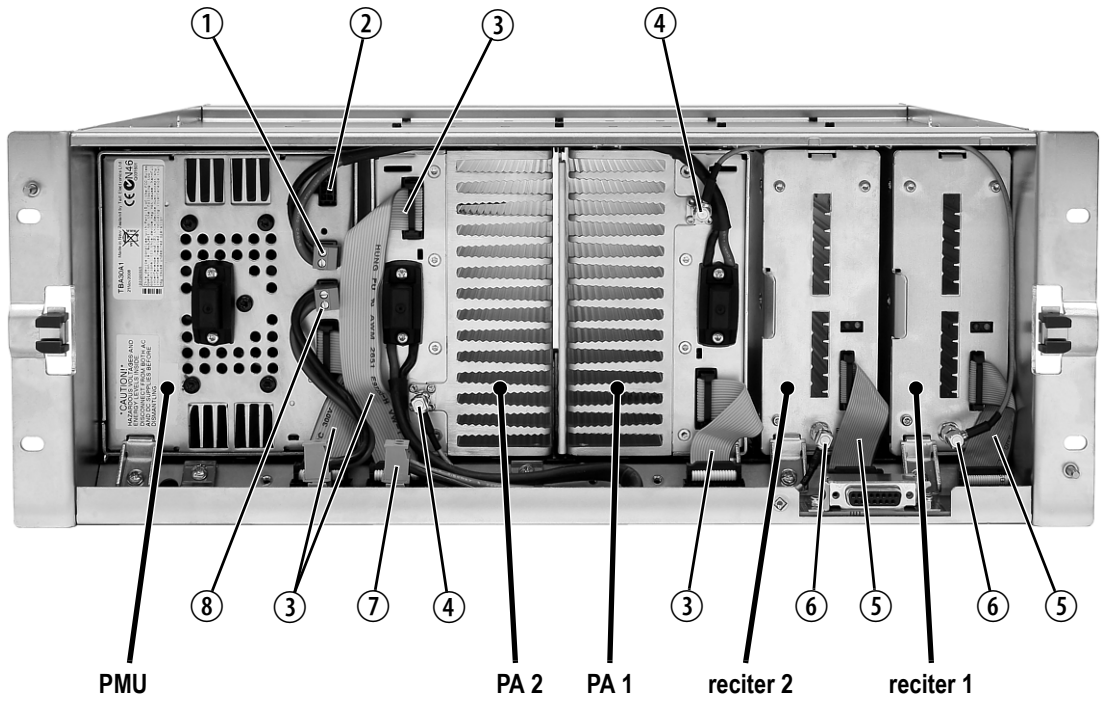
Pin	Description
1	+V output
2	–V output

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 to PA 1
② not used
③ system control bus
④ RF input from reciter
⑤ system control bus and 28VDC input
⑥ RF output to PA
⑦ 28VDC input to PA2
⑧ 28VDC output to subrack interconnect board

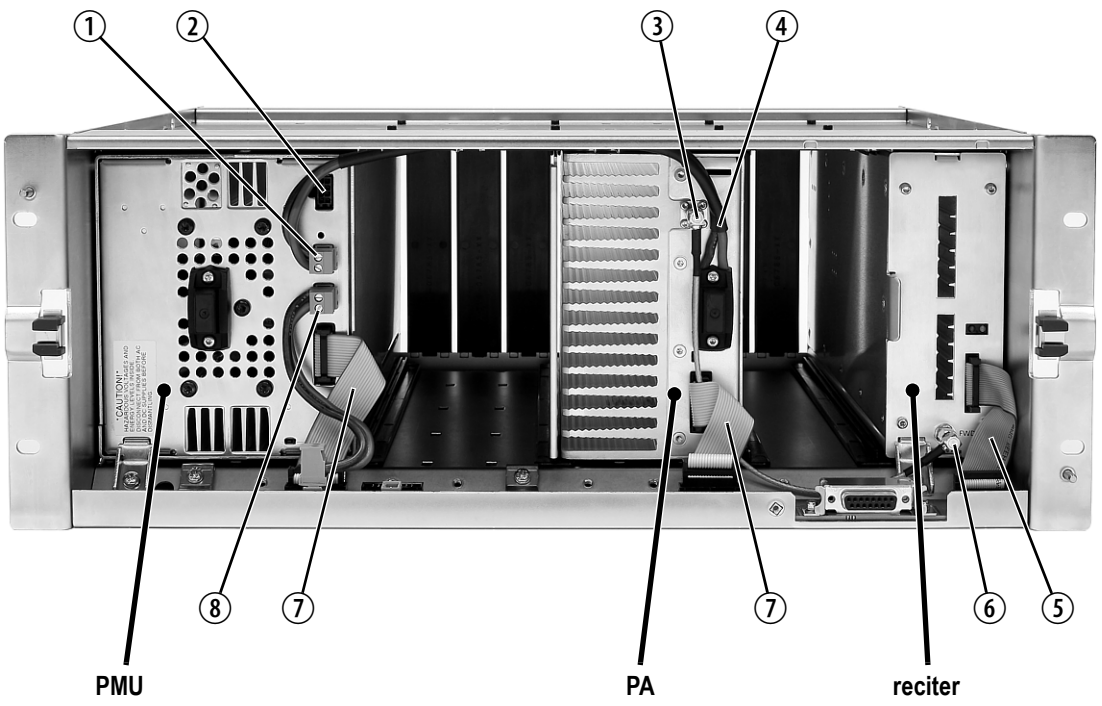
DC Supply

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 RF input from reciter
④ 28VDC input cable from PMU
⑤ system control bus and 28VDC input
⑥ RF output to PA
⑦ system control bus
⑧ 28VDC output to subrack interconnect board

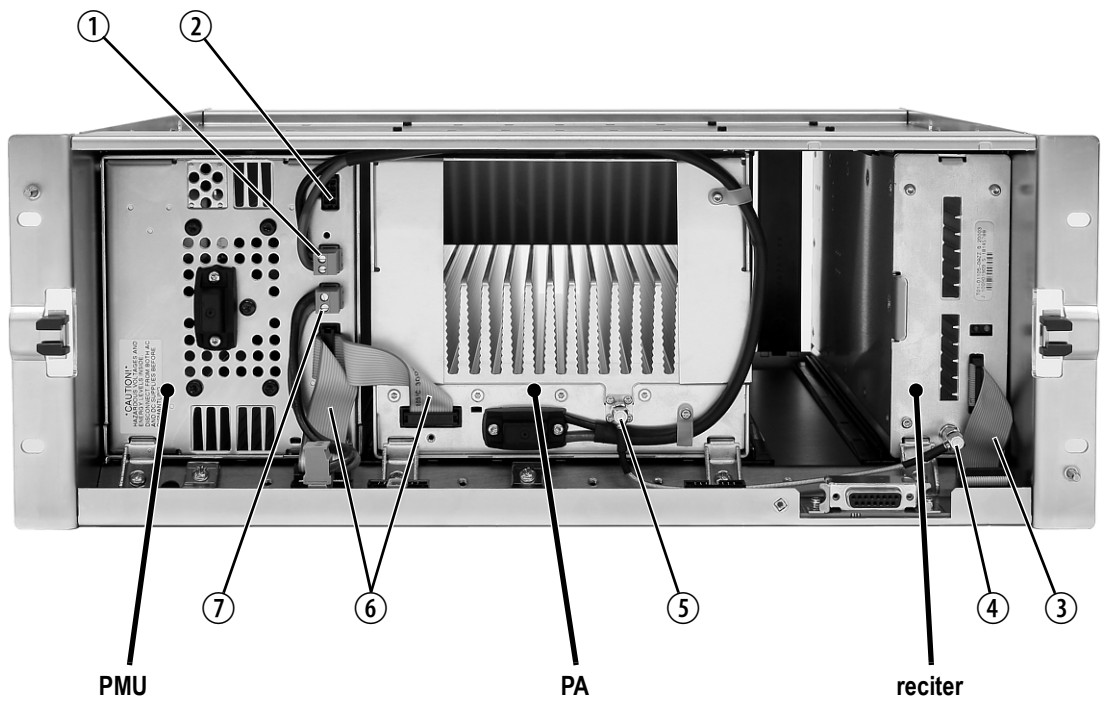
DC Supply

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 for PA

② not used

③ system control bus and 28VDC input

④ RF output to PA

⑤ RF input from reciter

⑥ system control bus

⑦ 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.

Glossary

This glossary contains an alphabetical list of terms and abbreviations related to the TaitNet network and the TB9300 base station.

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

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

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

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

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

base station A radio receiver and transmitter that is located in a specific place (at a site) that enables a two-way radio to communicate with a dispatcher or over a larger range with other two-way radios. Specifically, Tait TB9300 equipment in a subrack.

battery protection mode A PMU enters battery protection mode when its DC input drops below the user-configured power shutdown voltage. In battery protection mode, the PMU will shut down the base station to protect the battery. The base station will restart when the DC input reaches the user-configured startup voltage.

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

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

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

call	A complete exchange of information between two or more parties. A call requires a receive signal path and a transmit signal path. In conventional systems, a call is an over, but in trunked systems, a call may be a conversation, made up of a number of overs.
channel	1. A path through which signals can flow. 2. In the RF domain, a frequency pair (or just a single frequency in a simplex system). Also called a physical channel in this manual. 3. One of the two timeslots that DMR provides for each radio frequency (physical channel). Refer to “logical channel”. 4. A set of configuration information that defines the frequency pair and other related settings (a channel configuration). “Channel” has this meaning in the web interface.
channel spacing	The bandwidth that a channel nominally occupies. If a base station has a channel spacing of 12.5 kHz, there must be a separation of at least 12.5 kHz between its operating frequencies and those of any other equipment.
channel table	The base station’s database of channel configurations.
CODEC	A device which combines analog-to-digital conversion (coding) and digital-to-analog conversion (decoding).
colour code	A marker determining which transmitted signals are gated. Inbound messages must carry this code to be listened to. The colour code is configured at the Node Controller. It can prevent interference from other networks and define private talkgroups.
configuration file	Consists of all the configuration settings needed for a base station, stored as a file.
conventional network	Systems that do not have centralized management of channel access. System operation is entirely controlled by system end users.
CTCSS	CTCSS (continuous tone controlled squelch system), also known as PL (private line), is a type of signaling that uses subaudible tones to segregate groups of users.
CWID	Continuous Wave Identification is a method of automatically identifying the base station using a Morse code. Continuous wave means transmission of a signal with a single frequency that is either on or off, as opposed to a modulated carrier.
DAC	Digital-to-Analog Converter. A device for converting a digital signal to an analog signal that represents the same information.

DDC	Digital Down Converter. A device which converts the digitized IF signal of the receiver down to a lower frequency (complex baseband) to suit the DSP.
dispatcher	A person who gives official instructions by radio to one or more mobile stations.
DMR	Digital Mobile Radio. A set of standards and requirements endorsed by ETSI and intended for professional mobile radio (PMR) users.
dotted quad	A method for writing IPv4 addresses. The form is DDD.DDD.DDD.DDD where DDD is an 8-bit decimal number.
downlink	The transmission path from fixed equipment to mobile stations.
DSP	Digital Signal Processor.
duplex	Providing transmission and reception in both directions simultaneously.
duty cycle	Used in relation to the PA, it is the proportion of time (expressed as a percentage) during which the PA is transmitting.
EIA	Electronic Industries Alliance. Accredited by the American National Standards Institute (ANSI) and responsible for developing telecommunications and electronics standards in the USA.
EMC	Electromagnetic Compatibility. The ability of equipment to operate in its electromagnetic environment without creating interference with other devices.
ETSI	European Telecommunications Standards Institute. The non-profit organization responsible for producing European telecommunications standards.
fallback mode	An operational mode of Tait DMR trunked networks. It comes into effect when the base station loses communication with the trunking node controller. Fallback mode turns one of the base station's two logical channels into a control channel. In this mode the base station functions almost as an open channel, available to all calls without requiring authorization.
FCC	Federal Communications Commission. The FCC is an independent United States government agency that regulates interstate and international radio communications.

feature code	The alphanumeric code used to identify a feature set.
feature set	A function or mode of operation of the base station which can be enabled or disabled using the web interface. Each feature set requires a license to be purchased from Tait before it can be enabled.
feature license key	The unique set of digits belonging to a license which is programmed into the base station to enable a feature set.
fill-in receiver	An additional receiver placed within the coverage area of a base station to receive MS 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 MS simultaneously.
heartbeat message	A message whose purpose is to indicate to the receiver that the sender is operational.
hiccup mode	Many power supplies switch off in the event of a short-circuit and try to start again after a short time (usually after a few seconds). This “hiccup”-type of switching off and on is repeated until the problem is eliminated.
hostname	The unique name by which a network element is known on the network.
hub	A unit for connecting hosts together. It sends all incoming Ethernet packets to all the other hosts.
hysteresis	The difference between the upper and lower trigger points. For example, the receiver unmutes when the upper trigger point is reached, but will mute again until the level falls to the lower trigger point. An adequate hysteresis

	prevents the receiver gate from repeatedly muting and unmuting when the level varies around the trigger point.
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 TB9300 for communications between each reciter and its associated PA, and between reciter 1 and the PMU.
inbound	Describes the direction of a signal: from an MS over the air interface to the fixed station.
IP	Internet Protocol is a protocol for sending data packets between hosts.
isolator	A passive two-port device which transmits power in one direction, and absorbs power in the other direction. It is used with a PA to prevent damage to the RF circuitry from high reverse power.
kernel	The core executable of an operating system.
LAN	Local Area Network. A computer network that interconnects computers in a limited area, such as a single building or group of buildings.
LED	Light Emitting Diode. Also the screen representation of a physical LED.
license	Some operational functions of the base station are controlled by licenses. Purchasing a license from Tait allows you to enable the feature set which includes the required functionality.
logical channel	One of the two timeslots provided in each TB9300 radio frequency. Each timeslot can function as a separate logical channel, independent of the other timeslot. One radio frequency can therefore carry two separate voice or data streams, one in each timeslot.
mobile station	The term used in the ETSI DMR standard documents for a two-way radio (generally a mobile or a portable radio) conforming to the DMR specifications.
mute	Prevents audio from being passed to the radio's speaker.
MS	Mobile Station (see above).
NAT	Network Address Translation allows the use of a single IP address for a whole network of computers. A NAT sits between the public Internet and

	the network it serves, and works by rewriting IP addresses and port numbers in IP headers on the fly so the packets all appear to be coming from (or going to) the single public IP address of the NAT device instead of the actual source or destination.
network element	Any device that is network-connected. A TaitNet digital network consists of a number of network elements. The TB9300 base station is a network element designed and manufactured by Tait.
NTP	Network Time Protocol is a protocol and software implementation for synchronizing the clocks of computer systems across a network. An NTP server obtains the correct time from a time source and sets the local time in each connected computer.
octet	A set of 8 bits.
Offline mode	A mode of operation in which active service is suspended so that special operations can be carried out, such as programming in a new configuration or carrying out certain diagnostic tests.
Online mode	The normal operating mode of the base station.
outbound	Describes the direction of a signal: from a fixed station over the air interface to an MS.
over	A single transmission, which begins when a user presses PTT and ends when the user stops pressing.
PA	The Power Amplifier is a base station module that boosts the exciter output to the required transmit level.
PCB	Printed Circuit Board.
PMU	The Power Management Unit is a module in the base station that provides power to the subrack and monitors power conditions.
privileges	A set of access rights to the web interface functions. There are Administrator, Maintainer and Monitor privileges.
PSTN	Public Switched Telephone Network: the public telephone network.
PTT	Push To Talk. The button on an MS that keys the transmitter.

QoS	Quality Of Service. A router feature that gives real-time data such as voice calls priority over other data.
reciter	A module of a base station that provides both receiver and exciter functionality as well as the interface to the network.
repeater talkaround	Allows the MS to bypass repeater operation and so communicate directly with other mobile stations. While repeater talkaround is active, all transmissions are made on the receive frequency programmed for the channel.
RISC	Reduced Instruction Set Computer. A type of microprocessor that recognizes a relatively limited number of instructions. The 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.
SAW filter	Surface Acoustic Wave filter. A band pass filter that can be used to filter both RF and IF frequencies. A SAW filter uses the piezoelectric effect to turn the input signal into vibrations that are turned back into electrical signals in the desired frequency range.
selectivity	The ability of a radio receiver to select the wanted signal and reject unwanted signals on adjacent channels (expressed as a ratio).
sensitivity	The sensitivity of a radio receiver is the minimum input signal strength required to provide a usable signal.

simplex	Able to provide transmission and reception in only one direction at a time.
SINAD	Signal plus Noise and Distortion is a measure of signal quality. It is the ratio of (signal + noise + distortion) to (noise + distortion). A SINAD of 12 dB corresponds to a signal-to-noise ratio of 4:1.
site	1. The base station equipment at a particular location. This includes power supplies, transmitters, receivers, network interfaces and controllers. 2. The location of that equipment.
SNMP	Simple Network Management Protocol. A protocol used (for example) by the trunking site controller to monitor the base station's parameters and alarm status.
standalone node	The base station itself can act as a DMR trunking controller, but with limited functionality. The base station is then said to be a standalone node.
syslog collector	A program that can receive, display, and log syslog messages from many devices.
syslog protocol	A standard protocol used for the transmission of event notification messages across IP networks. TB9300 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 TB9300 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 any PMR network designed and manufactured by Tait Limited.
TaitNet DMR network	A set of Tait base stations and controllers interconnected by an IP network that can carry voice and data traffic.
TB9300 Base Station	A base station consisting of the equipment necessary to receive and transmit on one physical channel in a DMR or analog network. Generally, this means a reciter, a PA, and a PMU. Often abbreviated to TB9300 or base station.
TCP	Transmission Control Protocol. A complex protocol on top of IP for sending reliable streams of data with flow control.

TDMA	Time Division Multiple Access. In the TB9300 each radio frequency provides two timeslots, with each timeslot representing one logical channel.
TELCO	Telephone company.
TIA	Telecommunications Industry Association
toggle	Describes the switching between two states. If something is on, toggling it turns it off. If it is off, toggling it turns it on.
tone	A sound wave of a particular frequency.
Tx	Transmitter.
UDP	User Datagram Protocol. A simple protocol on top of IP for sending streams of data.
uplink	The transmission path from mobile stations to fixed equipment.
UTC	Coordinated Universal Time (word order from French). An international time standard that has replaced Greenwich Mean Time.
valid signal	A signal that the receiver unmutes to. A signal is valid, for example, when it is strong enough to be decoded and when it has the specified NAC.
VDP	Voice Data Protocol. A proprietary protocol operating over IP for the exchange of voice and data between a base station and a trunking node controller.
voice stream	A digitized voice signal that passes through the main switch.
VoIP	Voice over IP. The name for the technology that puts speech signals in packets and then routes them over an IP backbone network.
VPN	Virtual Private Network. A private communications network used to communicate confidentially over a non-private network.
VSWR	Voltage Standing Wave Ratio is the ratio of the maximum peak voltage anywhere on the transmission line to the minimum value anywhere on the transmission line. A perfectly matched line has a VSWR of 1:1. A high ratio indicates that the antenna subsystem is poorly matched.

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

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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 ① Directive 1999/5/EC Declaration of Conformity

da Dansk

Undertegnede Tait Limited erklærer herved, at følgende udstyr TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E 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 TBCB1D, TBCB1E, TBCH0D & TBCH0E står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
Se även: www.taitradio.com/eudoc