4 Installation

This chapter provides information on the site requirements for your TB9400 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 TB9400 base station, we recommend that you read the entire chapter before beginning the actual installation.

4.1 Before You Begin

4.1.1 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.

4.1.2 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 115 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 71 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.

4.1.3 Equipment Ventilation

Always ensure there is adequate ventilation around the base station (refer to "Cabinet and Rack Ventilation" on page 50).

> **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).

4.1.4 Ambient Temperature Sensor

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

4.1.5   Cabinet and Rack Ventilation

The cooling airflow for the subrack enters through the front panel and exits at the rear. For optimum thermal performance, the heated air that passes through a base station must never 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 4.1 on page 51.

Equipment installation should observe the following guidelines:

■ The recommended maximum number of subracks in a 38U cabinet is five as shown in Figure 4.1 on page 51.

■ Any space at the front of the cabinet not occupied by equipment should be covered by a blanking panel. Refer to Figure 4.1 on page 51.

■ Subrack placement in the cabinet should include a 2U gap at the top of the cabinet.

■ To allow enough cooling airflow through a cabinet-mounted base station, the cabinet should allow for 50 cu.ft/min for each subrack (0.024 cu.m/s).

■ To ensure adequate ventilation, the cabinet should have a vent at the top 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.

■ The maximum ambient temperature at the base station front panels must not exceed +140°F (+60°C).

Figure 4.1   Typical cabinet ventilation requirements

1 ventilation slots   3 airflow entry

2 blanking panels   4 airflow exit path
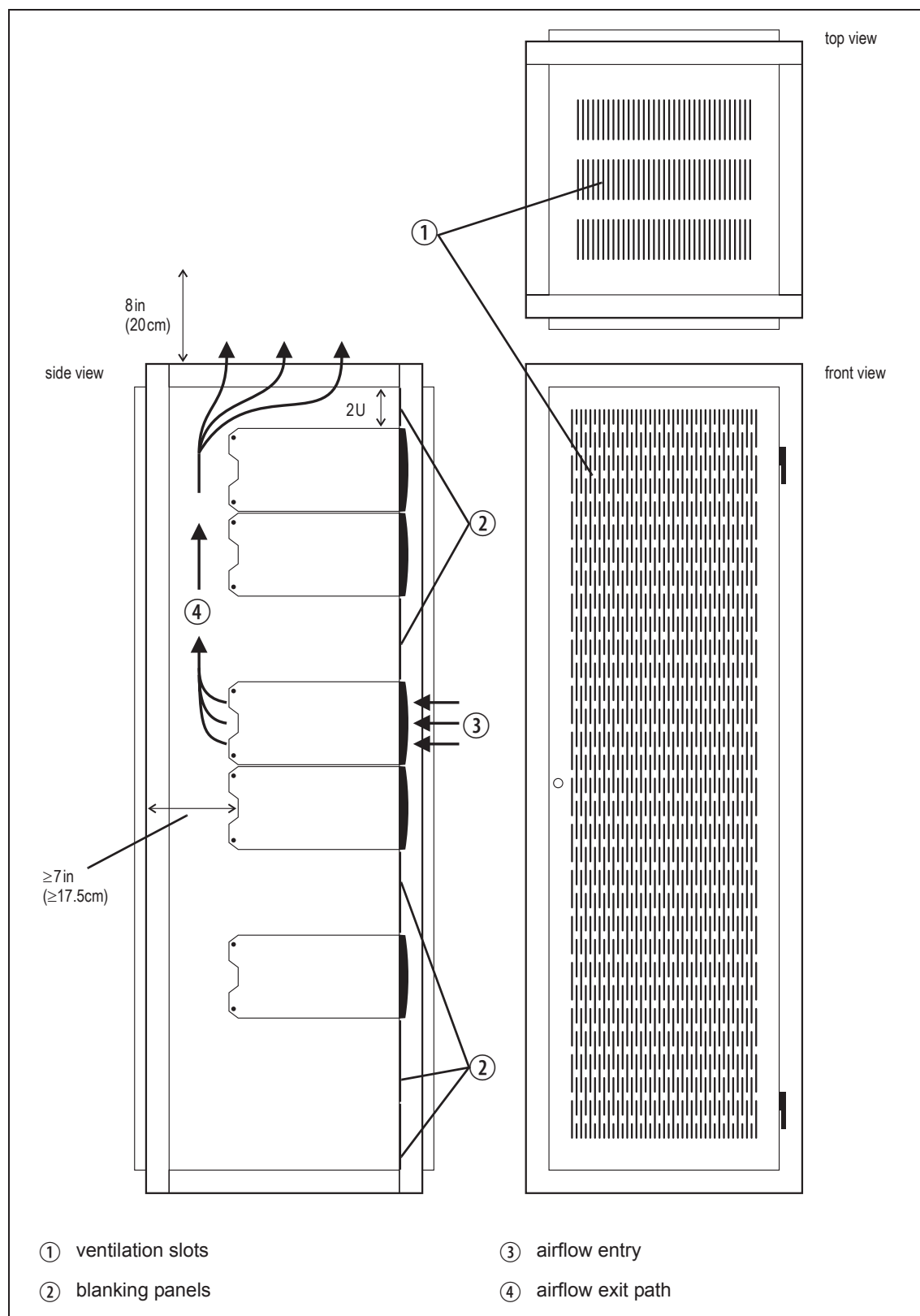
4.2   Unpacking and Moving the Subrack

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 4.2.

Caution   A subrack complete with modules can weigh up to 55 lb (25 kg), or up to 62 lb (28 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 104). In all cases follow safe lifting practices.

Figure 4.2   Unpacking the subrack
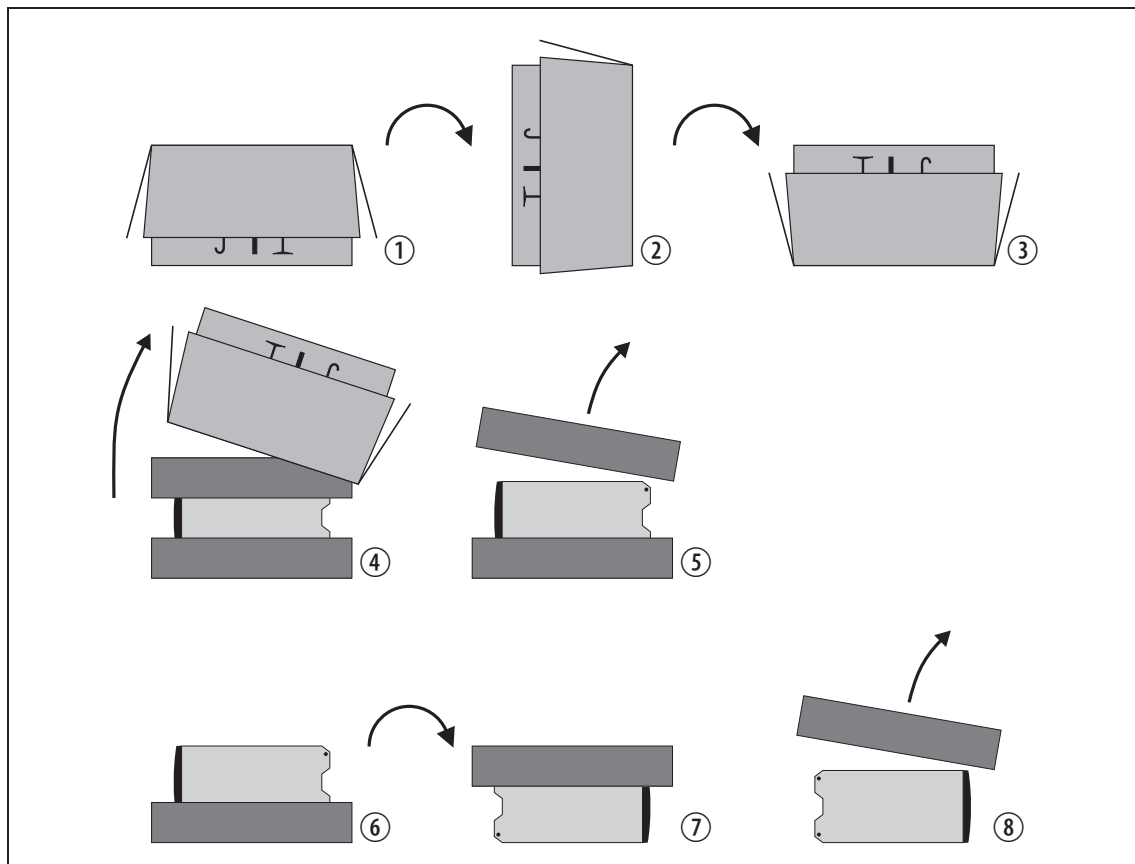
1.   Cut the tape securing the flaps at the top of the carton and fold them flat against the sides ①.

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.

4.3   Identifying the Equipment

You can identify the model and hardware configuration of the TB9400 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.

(i) 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 and Receiver Product Codes

Product Code	Description	
T01-0110**X**-XXXX	3 = reciter 4 = receiver[a]	
T01-0110X-**X**XXX	**Frequency Band** D = 148 MHz to 174 MHz K = 400 MHz to 440 MHz L = 440 MHz to 480 MHz M = 470 MHz to 520 MHz N = 762 MHz to 870 MHz[b]	**Tait Band Identifier** B3 band H1 band H2 band H3 band K4 band
T01-0110X-X**X**XX	A = standard	
T01-0110X-XX**X**X	A = default	
T01-0110X-XXX**X**	A = default	

a. Receive-only base stations are currently available for operation only on B3, H1, H2, H3 and K4 bands.

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

PA Product Codes

Product Code	Description	
T01-01121-**X**XXX	**Frequency Band** D = 148 MHz to 174 MHz K = 400 MHz to 440 MHz L = 440 MHz to 480 MHz M = 470 MHz to 520 MHz N = 762 MHz to 870 MHz[a]	**Tait Band Identifier** B3 band H1 band H2 band H3 band K4 band
T01-01121-X**X**XX	A = 50 W B = 100 W	
T01-01121-XX**X**X	A = default	
T01-01121-XXX**X**	A = default	

a. The actual frequency coverage in this band when used with a K-band TB9400 reciter is 762 MHz to 776 MHz and 850 MHZ to 870 MHz.

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

4.4 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).

4.4.1 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
synchronized transmit	checks the simulcast operation of a channel group or the transmitters in it	Diagnose > RF Interface > Synchronized Transmit
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

4.4.2 Working with Configurations

The Web UI page Tools > Files > Configuration allows you to manage your base station configuration.

You can:

■ Back up a configuration. This stores a snapshot of the base station's current configuration. It is advisable to back up the current configuration before making significant configuration changes.

■ Upload a configuration. This copies a configuration from your computer to the base station. You can develop a master configuration and upload it to all the base stations in the network.

■ Download a configuration. This sends a copy of the selected configuration to your computer so that you can store it.

■ Restore a configuration. This activates the selected configuration after rendering it compatible with the current software. You can restore configurations that have been backed up on the base station.

Users should be aware that the following parameters are **not** restored on a base station when a configuration is restored:

■ Keypad enabled

■ Receiver number

■ Host name

■ Default channel

■ Operating mode

■ Front panel test lines 1 through 4

■ IP address

■ Subnet mask

■ Gateway address

■ Link speed

4.4.3 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 81 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

   ■ channel groups and quality of service

   ■ channel and signaling profiles

   ■ 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.

   Notice   Before making changes, you should save the configuration to your PC or network. This provides a baseline which can be restored to the base station if the configuration information becomes lost or corrupted.
   You should also back up the configuration before downgrading to a different software release. Note that if you downgrade and then upgrade software, configuration values for new features may become default.

4.4.4 Recommended Configuration Settings

In a dual base station only base station 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).

4.4.5 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 and channel groups).

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.

4.4.6   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 1.40 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.

ⓘ   Tait networks are deployed with default weak passwords. For security, Tait strongly recommends changing the default password where applicable.

4.4.7 Tuning the Reciter and Receiver

(i) In this section "reciter" also applies to the receiver module (receive-only 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 B3-band reciter covers the 148 to 174 MHz frequency band. This is split into two sub-bands: 148 to 159 MHz and 159 to 174 MHz.

Each sub-band has its own helical filter (shown in Figure 4.3 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 4.3   Identifying the B-band receiver front end helical filters
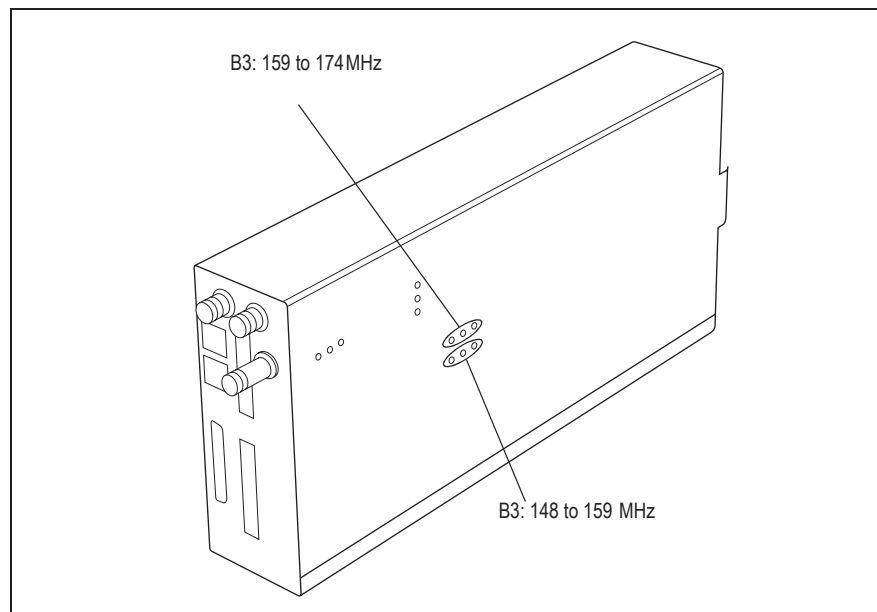
To check the RSSI level and tune the receiver front end (if required), follow these steps:

1. 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.

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 85.

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 $-80\,dBm \pm 1\,dB$. 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 $-80\,dBm \pm 1\,dB$. If it is, the receiver front end does not require tuning. If it is not, go to the next step.

6. Using the Johanson tuning tool[1], adjust the correct helical filter for the new frequency (as shown in Figure 4.3) 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).

7. 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.

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.

---

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.

(i) 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 - 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 4.4 below). The bandwidth of the helical filter is approximately ±5 MHz.

Figure 4.4   Identifying the H-band receiver front end helical filter
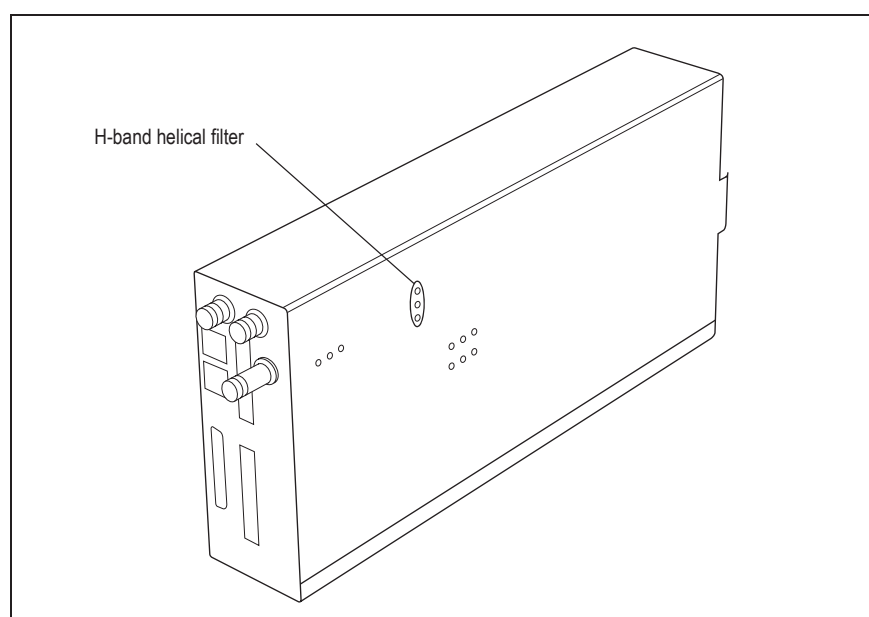
To check the RSSI level and tune the receiver front end (if required), follow these steps.

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 85.

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 $-80\,dBm \pm 1\,dB$. If it is, the
      receiver front end does not require tuning. If it is not, go to the next
      step.

6.   Using the Johanson tuning tool[1], adjust the helical filter for the new
      frequency (as shown in Figure 4.4) 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.   Re-calibrate 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.

K-Band   The K-band reciter does not require tuning.

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

4.5   Installing the Base Station on Site

4.5.1   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.

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.

Base stations may require an external frequency reference, a 1 PPS signal, and an NTP source, depending on the frequency band and type of radio system.

The following general rules apply:

■   Base stations operating at or above 700 MHz require an external frequency reference to meet the frequency accuracy requirements for transmitters and receivers.

■   Simulcast transmitters require an external frequency reference and a 1 PPS signal so that transmissions can be timed with the required accuracy. They also require an NTP source. Both the 1 PPS and NTP signals must be derived from a source that is GPS-disciplined. This will ensure a common timestamp in logs across all units in the system.

■   P25 Phase 2 base stations require an external frequency reference and a 1 PPS signal for site alignment of transmitters and receivers. They also require an NTP source to ensure correct, long-term Phase 2 alignment.

The requirements for P25 Phase 1 systems are described in more detail below. Also see "Connecting an External Frequency Reference" on page 76 and "Connecting a 1 PPS Source" on page 77.

P25 Phase 1   The requirements for an external frequency reference and a 1 PPS signal are set out in the following table.

		Transmit and Receive		Receive Only	
Band	System	External Reference	1 PPS	External Reference	1 PPS
B band H band	Non-simulcast	✘	✘	✘	✘
	Simulcast	✔	✔	✘	✘
K band	Non-simulcast	✔	✘	✔	✘
	Simulcast	✔	✔	✔	✘

ⓘ   An NTP source is also strongly recommended for P25 Phase 1 non-simulcast systems. This will ensure log timestamps are synchronized, which will assist the diagnosis of faults.

ⓘ   Synchronization requirements are more stringent with the introduction of simulcast and with TDMA in Phase 2. See Technical Note TN-2411a Providing Synchronization to Tait Networks.

4.5.2   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.

4.5.3 Mounting the Subrack

⚠ **Caution** A subrack complete with modules can weigh up to 55 lb (25 kg), or up to 62 lb (28 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 104). In all cases follow safe lifting practices.

Figure 4.5 Subrack mounting points

① main mounting holes - front   ② auxiliary mounting holes - rear
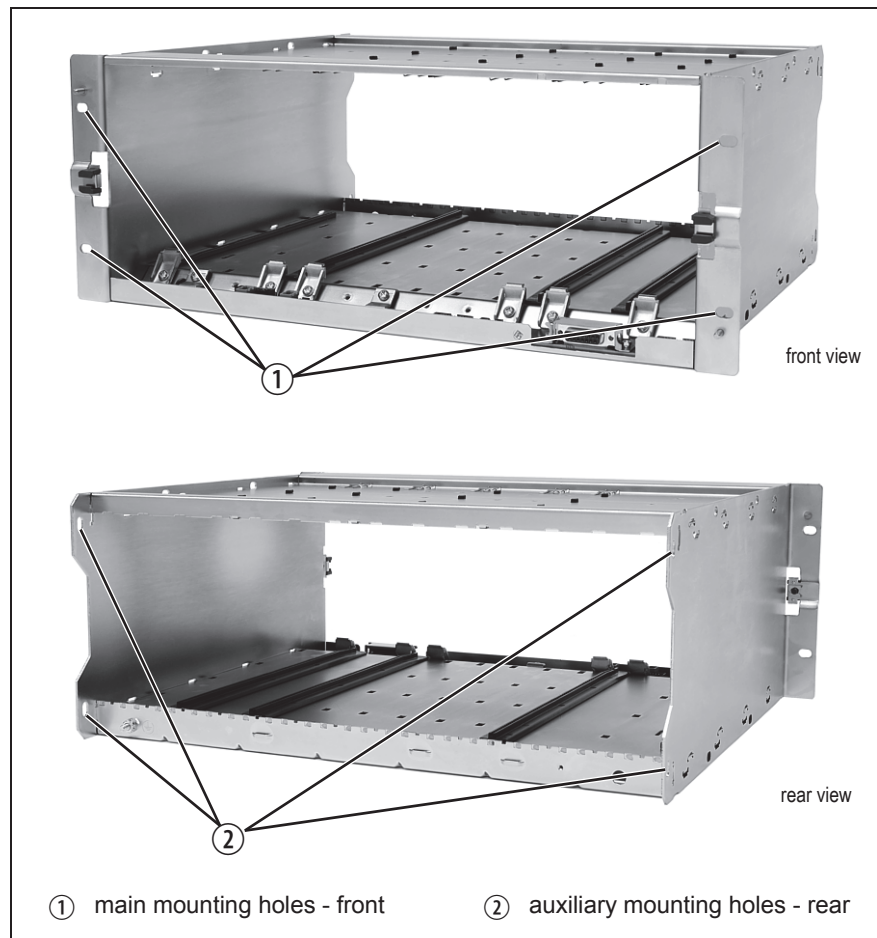
1. Remove the front panel, as described in "Preliminary Disassembly" on page 106.

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 4.5.

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

Figure 4.6 below gives the dimensions of the subrack and its mounting holes.

Figure 4.6   Subrack dimensions
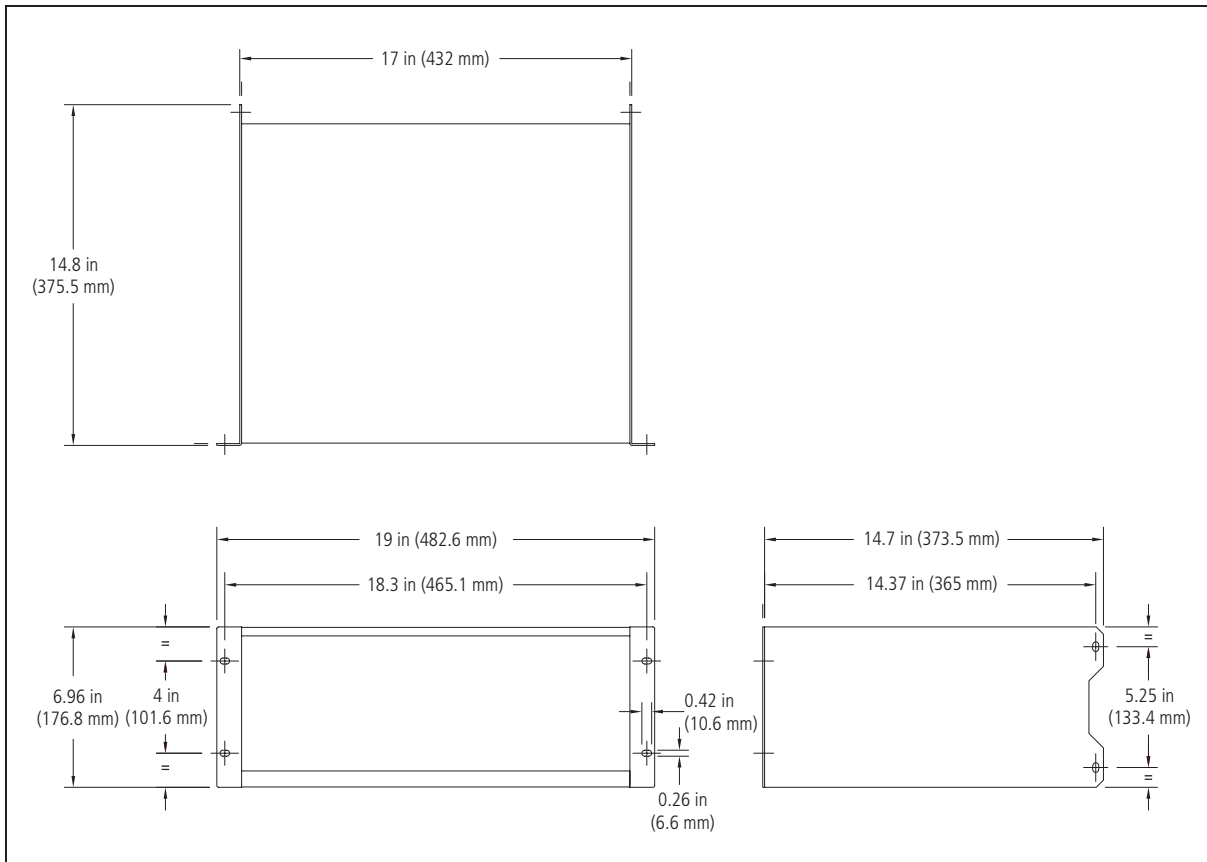
Auxiliary Support Bracket

TBAA03-13 auxiliary support brackets can be fitted to the rear of the subrack to provide additional mounting security. Figure 4.7 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 4.7   Auxiliary support bracket
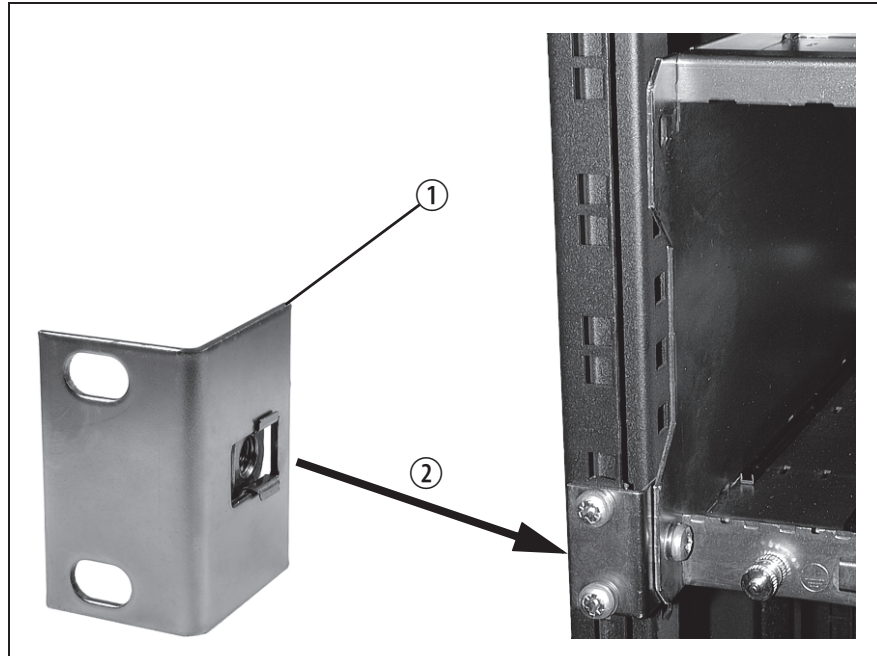
> **Notice**   You **must** fit the auxiliary support brackets if you intend to transport a cabinet fitted with a fully built-up base station.

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 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

secure the cables to the cabinet to support their weight
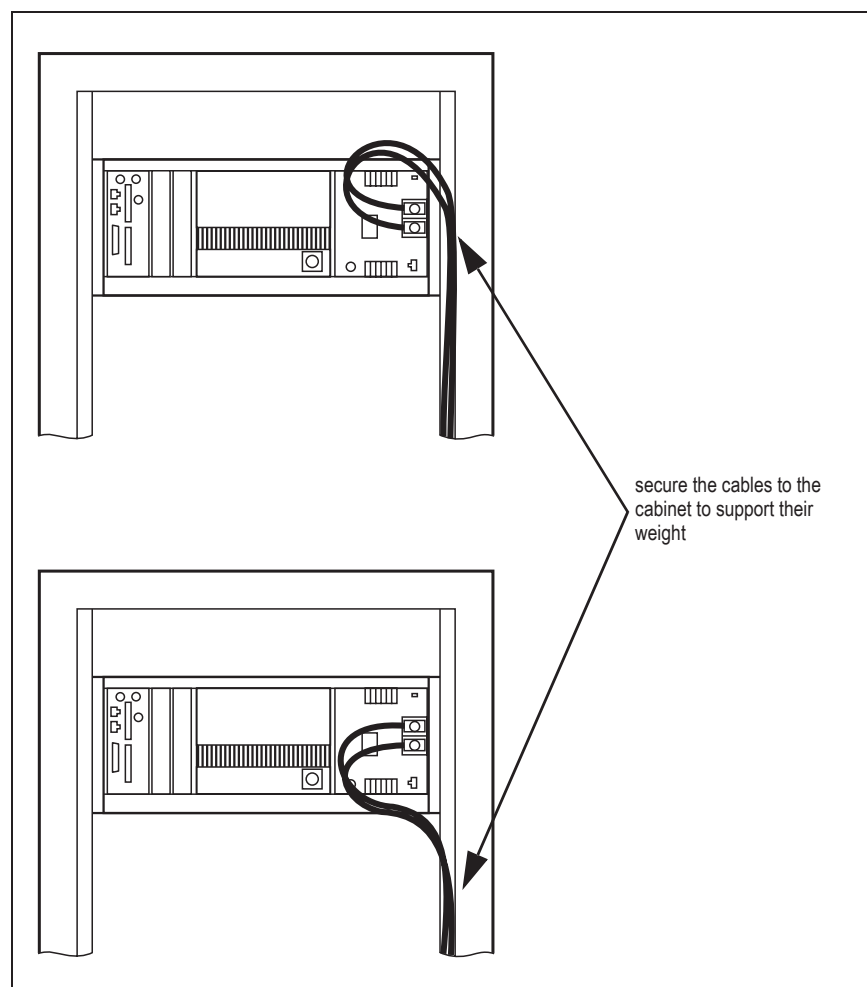
4.6 Connecting Up the Base Station

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

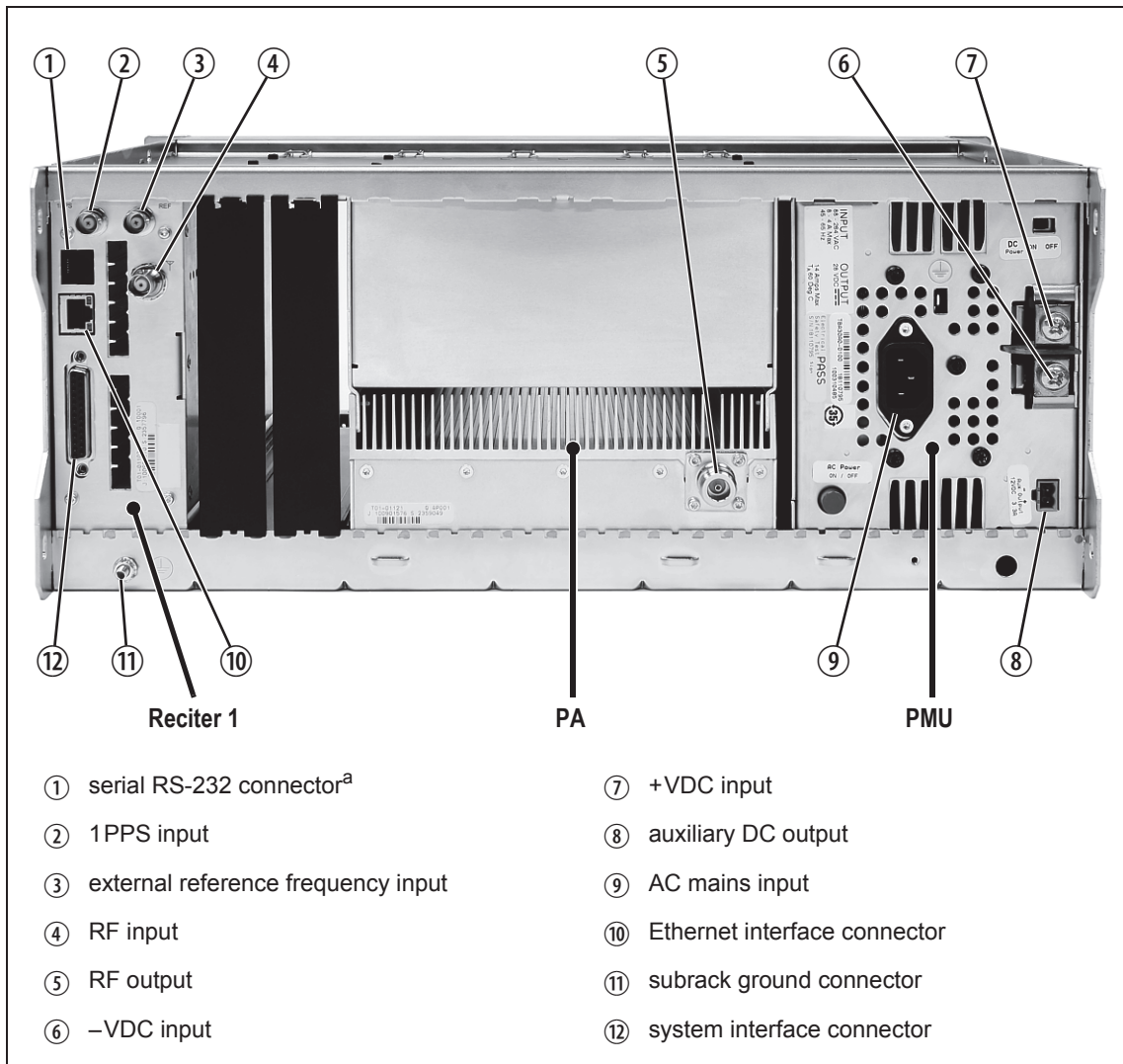## 4.6.1 Connection Overview

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

Reciter 1   PA   PMU

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

rear view
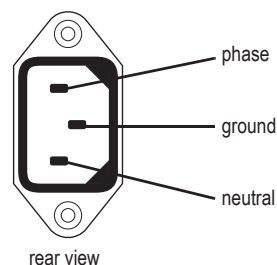
4.6.3   Connecting DC Power

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 3% voltage 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 116 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
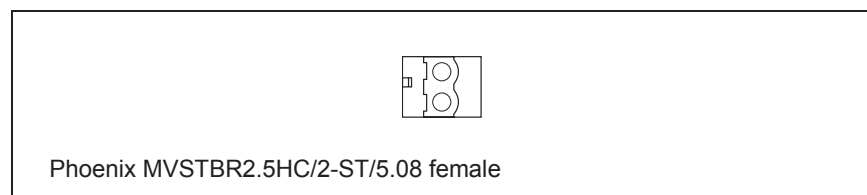
4.6.5   Connecting RF

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 71).

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 10MHz or 12.8MHz, with an input level of $300\,\mathrm{mV_{pp}}$ to $5\,\mathrm{V_{pp}}$. The reciter automatically detects the frequency of the external reference and configures itself accordingly. The stability of this reference should be as shown below.
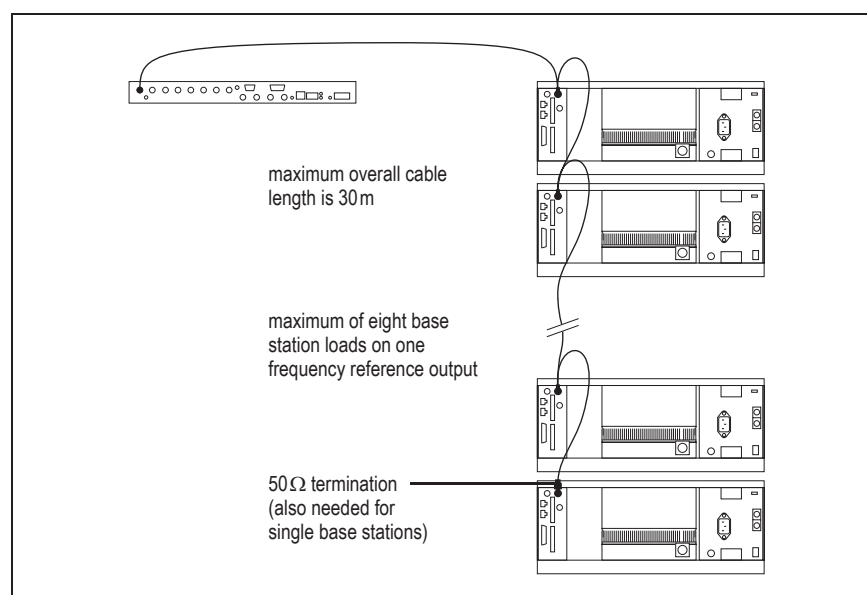
For more details, see Technical Note TN-2411a Providing Synchronization to Tait Networks.

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	All bands	10 parts per billion
	P25 Phase 2		

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

Use a $50\,\Omega$ coaxial cable (RG58 or RG223) to connect the external reference to the base station's external reference frequency input. You can daisy-chain up to eight base stations using F-junctions. The maximum overall cable length is 30m. Terminate the last connection (including single base stations) with a $50\,\Omega$ load.

Figure 4.11   Daisy-chaining an external frequency reference input

maximum overall cable length is 30m

maximum of eight base station loads on one frequency reference output

$50\,\Omega$ termination (also needed for single base stations)

4.6.7 Connecting a 1 PPS Source

A 1 PPS 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 1 PPS 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 30 m. Terminate the last connection (including single base stations) with a 50Ω resistor, otherwise reflections of the 1 PPS 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 1 PPS input
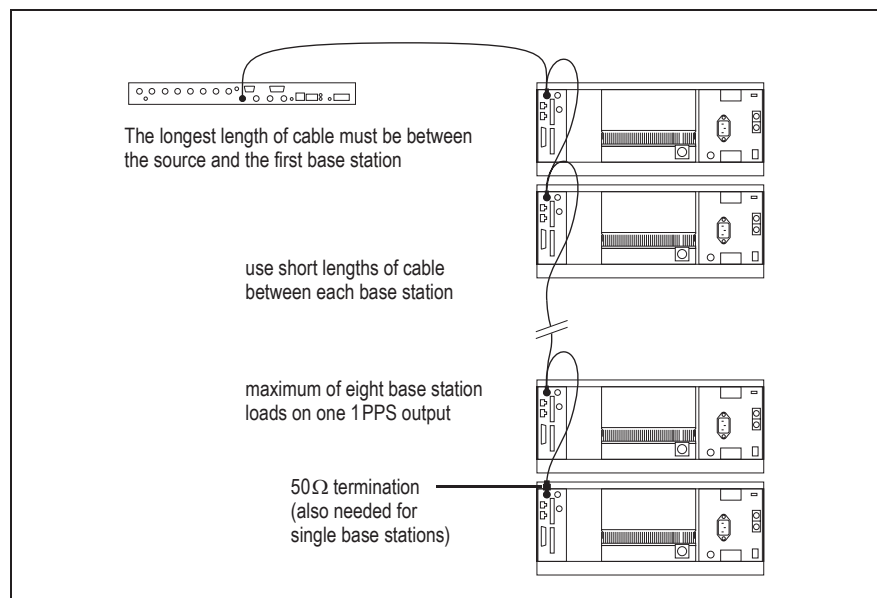
4.6.8 Ethernet Connection

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.
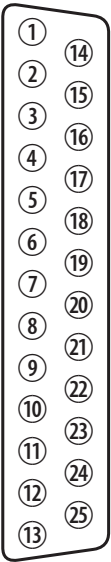
With the port speed at 10 Mbit/s it is particularly important to set the voice QoS on the reciter port of your site router or switch to a strict priority queue policy - which is the same policy that you should also be setting for your site link ports. The default QoS settings restrict the voice bandwidth 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 116 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.

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

external view