TB9300 Base Station/Repeater

Installation and Operation Manual

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Preface

Scope of Manual

This manual provides information on installing and operating the TB9300 base station. It is intended for use by experienced technicians familiar with installing and operating base station equipment. It also includes configuration, maintenance and troubleshooting information.

Unless mentioned specifically, this manual will use the term “base station” to refer to both base station, and repeater.

Document Conventions

The TB9300 base station has a web interface (WebUI) with an accordion menu on the left side of the screen. “Configure > Base Station > Channels” means click Configure in the top-level menu, then in the expanded Configure menu, click Base Station, and finally click on the Channels tab on that page.

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

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

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

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

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

Associated Documentation

The following associated documentation for this product is available on the Tait Partner Portal website (https://partnerinfo.taitcommunications.com).

- TB9300 Specifications Manual (MBC-00009-xx)
- DMR Channel Group System Manual (MNB-00010-xx)
- TN9300 DMR Tier 2 Conventional Radio Network System Manual (MNB-00005-xx)
- TN9300 DMR Tier 3 Trunked Radio Network System Manual (MNB-00003-xx)
- Tait Core Networks Installation and Configuration Manual (MNB-00012-xx)
- Safety and Compliance Information (MBA-00012-xx)

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

Technical notes are also published from time to time to describe applications for Tait products, to provide technical details not included in manuals, and to offer solutions for any problems that arise. For more information contact your regional Tait office.

Publication Record

Issue	Publication Date	Description
33	December 2023	Updated for release 3.55 and later ■ Section 2.2.4 Anti-tampering Devices updated ■ Section 4.1.5 Cabinet Ventilation updated ■ Section 4.6.9 Connecting General Purpose Inputs and Outputs updated ■ Section 5.2.3 Security Certificates updated ■ Appendix E Testing with the TBA0STU Calibration Test Unit table updated
32	August 2023	Updated for release 3.50 and later ■ H/W version 3 PMU added ■ “Power Management Unit” on page 18 updated ■ Section 2.2.4 Anti-tampering Devices updated ■ Section 4.4.2 Working with Configurations updated ■ “PMU Auxiliary DC Output” on page 123 updated
31	May 2023	Updated for release 3.45 and later ■ References to Mongoose removed ■ Section 1.1 Series 2 and Series 1 Reciters updated ■ Section 1.7.2 Feature Licenses updated

Issue	Publication Date	Description
30	December 2022	Updated for release 3.40 and later ■ Section 4.6.3 Connecting DC Power updated ■ Section 4.6.9 Connecting General Purpose Inputs and Outputs table updated
29	August 2022	Updated for release 3.35 and later ■ Section 1.1.3 Firmware Information updated ■ “Power Management Unit” on page 18 updated
28	April 2022	Updated for release 3.30 and later ■ Section 2.1.7 Proximity to RF Transmissions / A proximité des émissions RF updated ■ Section 3.2.1 Reciter, LED behaviors updated ■ Section 5.2.3 Security Certificates updated ■ Appendix C TB9300 Cable Kits updated ■ Appendix E Testing with the TBA0STU Calibration Test Unit added
27	November 2021	Updated for release 3.25 ■ Section 1.1 Series 2 and Series 1 Reciters added ■ BNC goal post adaptor (part number 240-06913-00) added to Section 4.6.6 Connecting an External Frequency Reference and Section 4.6.7 Connecting a 1PPS Source ■ Section 4.6.9 Connecting General Purpose Inputs and Outputs table updated
26	May 2021	Updated for release 3.20 ■ Simplex content added ■ “Power Management Unit” on page 18 updated ■ Section 3.2.1 Reciter updated ■ Section 5.4.11 Subaudible Signaling updated
25	November 2020	General updates for the 3.15 release Minor updates throughout RSSI Output included
24	June 2020	General updates for the 3.10 release Minor updates throughout Added Series 2 reciter information Updated ‘Updating Firmware’ section Updated ‘Activating New Firmware’ section Updated ‘PMU Alarm Thresholds’ section Updated ‘Identifying the Equipment’ section
23	November 2019	General updates for the 3.05 release Minor updates throughout RSSI notice added to tuning section Updated firmware upload section Updated feature licenses section
22	July 2019	General updates for the 3.00 release Minor updates throughout SNMP Network Management section added - provides information on MIBs

Issue	Publication Date	Description
21	March 2019	General updates for the 2.60 release Added “Connecting General Purpose Inputs and Outputs” section Instructions added for disabling Secure Shell Remote Access (SSH) Content added for working with configurations Content added for uploading, downloading and activating new firmware New chapter: Appendix C added, featuring cable kits
20	December 2018	General updates for the 2.55 release Updated root password information Added H4 band throughout
19	July 2018	General updates for the 2.50 release Updated to “Tait International Limited” Information added for H5 band Minor updates throughout Product Code “T01-01121-XXXX” included where required Under “Tuning the Reciter”, added a table to indicate which bands require manual tuning, and which bands are electronically tuned
18	March 2018	General updates for the 2.45 release “Publication Record” now shows most recent manual issue at top of table Added note about fill-in receiver to “8.4 Replacing a Power Amplifier” Added section: “5.4.11 Configuring Receive-Only Base Stations” Clarified “Bands and Sub-Bands” table” Added section 5.2.4 “Local Connection to a Base Station”

1 Description

The Tait TB9300 base station is a robust, state-of-the-art digital fixed station that combines Tait's proven strengths in reliability, high performance and modular design with firmware-based configurability and operation, digital signal processing, and Voice over IP (VoIP) technology.

The TB9300 combines industry-leading digital voice quality with rugged design specifications and intuitive user interfaces. These products are designed to meet the needs of professional radio users.

The ability of the base station to link stations using standard Internet Protocol communications, and to add features through firmware options, ensures that DMR systems designed with the TB9300re scalable in both size and functionality.

The base station's Ethernet interface provides built-in network connectivity, which allows it to join with other base stations to form a channel group. This network supports VoIP and remote management of all base stations via a web browser.

The TB9300 operates as the following:

- An IP connected transceiver in trunked DMR or MPT networks
- An IP connected transceiver in trunked simulcast radio networks
- An IP connected transceiver in non-simulcast multi-site networks
- An IP connected transceiver in digital conventional simulcast networks
- An IP connected repeater in DMR conventional networks
- An analog 600 Ohm connected repeater in an analog conventional network with CTCSS or DCS subaudible signaling[1]
-

1. (CTCSS) Continuous Tone Coded Squelch System, commonly referred to as PL, an acronym for Private Line

   (DCS) Digital Code Squelch, commonly referred to as Digital Private Line

- A data transceiver for custom digital modulations with the unbalanced line audio interface
-

1.1 Series 2 and Series 1 Reciters

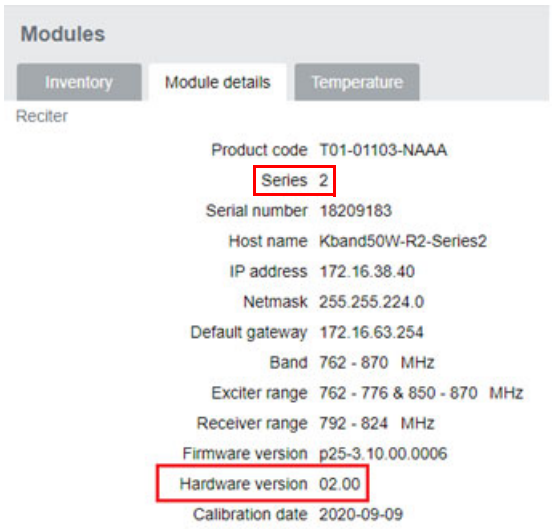
Series 2 reciters have been in production since 2020, and replace series 1 reciters, which are no longer in production.

Refer to the latest software release note for series 2 hardware and firmware compatibility information.

1.1.1 Identifying a Series 2 Reciter

Series 2 reciters can be identified by the label on the back of the reciter. Together with the type code and serial number is this graphic indicating that this is a series 2 reciter:

The WebUI Monitor > Modules > Module Details tab also lists the Series number and hardware version of the reciter:



1.1.2 New Reciters and Repairs

Tait only provides new and replacement series 2 reciters. There is no further production of series 1 reciters. Repairs needing a new control board will also use a series 2 control board.

Using Series 2 Reciters in an Existing Channel Group

If you are adding a new or replacement reciter, Tait strongly recommend that all the existing series 1 reciters be upgraded to version 3.10 or later, so that all the reciters in the channel group have the same firmware version.

Failure to do so may lead to problems with channel group operation.

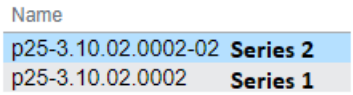
Reciter Repairs Needing a Replacement Control Board

Series 1 reciter repairs needing a new control board will be returned as series 2 reciters running version 3.10 or later firmware. Returned equipment will include a notification sticker that this reciter is now series 2 and warns of possible channel group compatibility issues with reciters in the network running older firmware.

1.1.3 Firmware Information

There are separate firmware packages for series 1 and series 2 reciters as they run different processors.

Upgrading version 3.05 or earlier from a feed server will display 2 versions for version 3.10 and later. The version ending in '-02' is series 2 reciter firmware:



Attempting to download -02 firmware to a series 1 reciter will fail, with a status of 'Error' within a few seconds.

Upgrading from a feed server with a reciter running version 3.10 or later will select the correct firmware package for the reciter automatically. The list of firmware presented in the lower section is filtered by the P25/AS-IP, DMR/MPT or All radio buttons at the top of the Tools > Firmware > Upload/Download tab WebUI page.

If you are using the direct firmware upload option, the series 1 firmware file has the suffix `.tbc` and series 2 has the suffix `.tbc02`. File selection has a filter for the correct file extension.

Uploading the incorrect firmware version for the series of reciter will fail with the message 'Information Failed Configuration' in the Direct upload section.

Refer to the latest software release note for series 2 hardware and firmware compatibility information.

1.2 Firmware Applications

The TB9300 operates in DMR/MPT networks.

1.2.1 Base Station Features

The following are lists of base station features available in both DMR/MPT firmware and non-specific applications:

DMR/MPT

- Fully compliant with the DMR conventional (Tier 2) and trunked (Tier 3) standards. They can therefore interoperate with any similarly compliant radios.
- Analog conventional repeater operation
- MPT operation as a control or traffic channel transceiver in an MPT-IP network, including standalone operation
- Digital simulcast operation
- Support for an analog, 600 Ohm connected repeater in an analog conventional network with CTCSS or DCS subaudible signaling
- Simplex operation with antenna delay

Simplex operation applies to analog conventional operation only. DMR operation does not support simplex.

Non-Application Specific

- Configuration, alarm monitoring, fault diagnosis, syslog capture, and feature and firmware upgrades can be managed remotely from a PC running a web browser. Alarms can be reported via SNMP traps, allowing integration with an SNMP-based network management system.
- An integrated wiring solution is provided for the system control bus and DC power connections to each module in the subrack
- Reciters (receiver/exciter modules) can be replaced without affecting the operation of other reciters in the same subrack
- Rugged construction with generous heatsinks and fan-forced cooling for continuous operation from – 30° C to + 60° C (– 22° F to + 140° F)

1.3 Firmware Application Details

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

channel groups. A base station can support two channel groups, one in each timeslot.

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

In an MPT network, the base station operates as a control channel or as a traffic channel. The base station operates with a trunking node or in fallback operation. MPT fallback provides trunking and conventional operation.

In analog operation, the base station operates as a conventional repeater with CTCSS or DCS subaudible signaling.

With DMR/MPT operation, channel groups can comprise a mixture of base station types. TB9400, TB7300 and TB9300 base stations are fully compatible and have identical timing in simulcast operation.

For more information, refer to the DMR System Manual (MNB-00010-xx).

1.4 Modules

The base station consists of a subrack with up to two physical transmit/receive channels.

The single PMU (power management unit) supplies and manages power to the whole subrack (refer to "Theory of Operation" on page 27). One reciter and one PA (power amplifier) are needed for each transmit/receive channel. There is also a front panel with user controls and fans. The modules are interconnected at the front of the subrack. External connections to the modules are located at the rear.

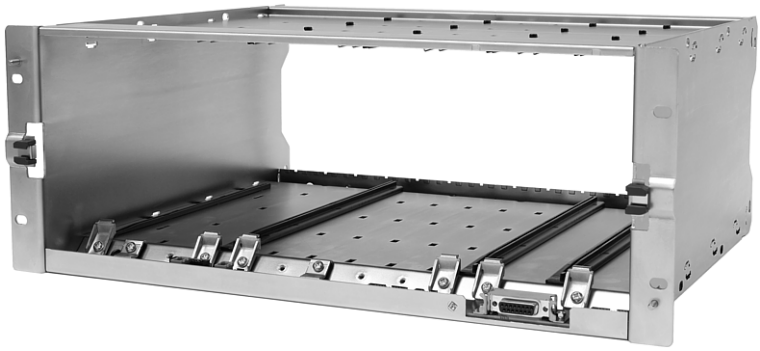
Modules come in variants depending, for example, on the RF band or the supply voltage.

Each module is inserted into the 4U subrack from the front, and is secured at the front with a metal clamp. Both clamp and module are easily removed for rapid module replacement. The modules are secured laterally with plastic guides that clip into the top and bottom of the subrack. These guides can be easily repositioned to change the configuration of a subrack. The heavier modules are also secured laterally by metal tabs at the rear of the subrack.

The following sections provide brief descriptions of the base station modules.

Subrack

The 4U subrack is made of passivated steel and is designed to fit into a standard 19 inch rack or cabinet. The subrack is fitted with an interconnect board that connects the system control bus and power to the modules and front panel. A module's position in the subrack is defined by the associated interconnect board socket, which connects the module to the system control bus.



Front Panel

The front panel is mounted onto the subrack with two quick-release fasteners. It incorporates the indicator LEDs, four-line LCD display, user controls, an ambient temperature sensor, and cooling fans.

The indicator LEDS allow some monitoring of the operational status of the base station. The user controls and display allow the technician to configure the IP address of each module. Refer to "Front Panel" on page 45 for more information.

The base stations have different front panel ducting arrangements depending on PA type and power. Front panels may not be interchangeable.

The microphone input and speaker are not currently used.

Reciter

The reciter module comprises the receiver, exciter and digital control circuitry. The reciter provides the Ethernet interface and system inputs and outputs.

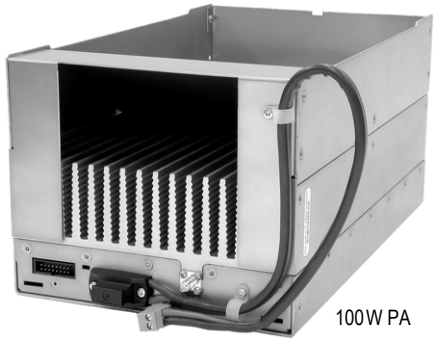
A TN9275 gateway module is physically similar to a reciter but does not have transmit or receive connectors.

Power Amplifier

The PA amplifies the RF output from the reciter and is available in 50 W and 100 W models.

The 50 W model mounts vertically in the subrack, while the 100 W model mounts horizontally, as it has a wider heatsink. The 100 W PA is also fitted with an airflow duct.

50 W PA



100 W PA

Both models are designed to operate on the 28 VDC output provided by the PMU.

Power Management Unit

The PMU provides the 28 VDC power supply for the modules in the subrack. It can operate on 120/230 VAC 50/60 Hz nominal, and 12, 24 or 48 VDC nominal. The input voltage can be AC, DC, or both AC and DC, depending on the model. The PMU also has an auxiliary DC output of 13.65 VDC, 27.3 VDC, or 54.6 VDC, depending on the model.

H/W version 1 AC and DC PMU shown

Notice From December 2020, new PMUs have different CPUs and firmware from previous versions. The new PMU design is functionally identical to the previous hardware version 1.00. The PMU reports version 3.16 when operating with older base station firmware, to remain compatible. PMU versioning is summarized in the table below:

PMU Hardware	Associated Base Station Firmware[a]	Requires PMU Firmware
0.xx	any	3.16
1.xx	3.25.01 or later	1.00.00 or later
2.xx	3.25.02 or later	1.03.01 or later

a. All hardware versions of PMU can operate in any base station if they have matching PMU firmware. Attempting to restore earlier version firmware will not proceed if that firmware is not compatible with PMU hardware. See the base station firmware release notes for detailed hardware compatibility information.

To identify the hardware version of the PMU, refer to the compliance label located at the rear of the module, which will contain the following text: `PMU HW x.xx` (modules sent in for repair needing a replacement control board will have an additional label applied to the rear containing the hardware ID).

The H/W version 3 PMU (available from August 2023 initially in the AC variant only) provides a new feature that allows a technician (via a simple mechanical link) to select the auxiliary voltage to be 12 V, 24 V, or 48 V (see rear view below). Note also the other hardware differences:

- The location of the AC IEC socket has moved slightly
- The power switch and auxiliary output socket have changed sides. The power switch is also a different design to allow an operator to tell immediately if the PMU is on or off.
- The orientation of the auxiliary output socket is flipped by 180^{o}

H/W version 3 PMU - front view

H/W version 3 PMU - rear view

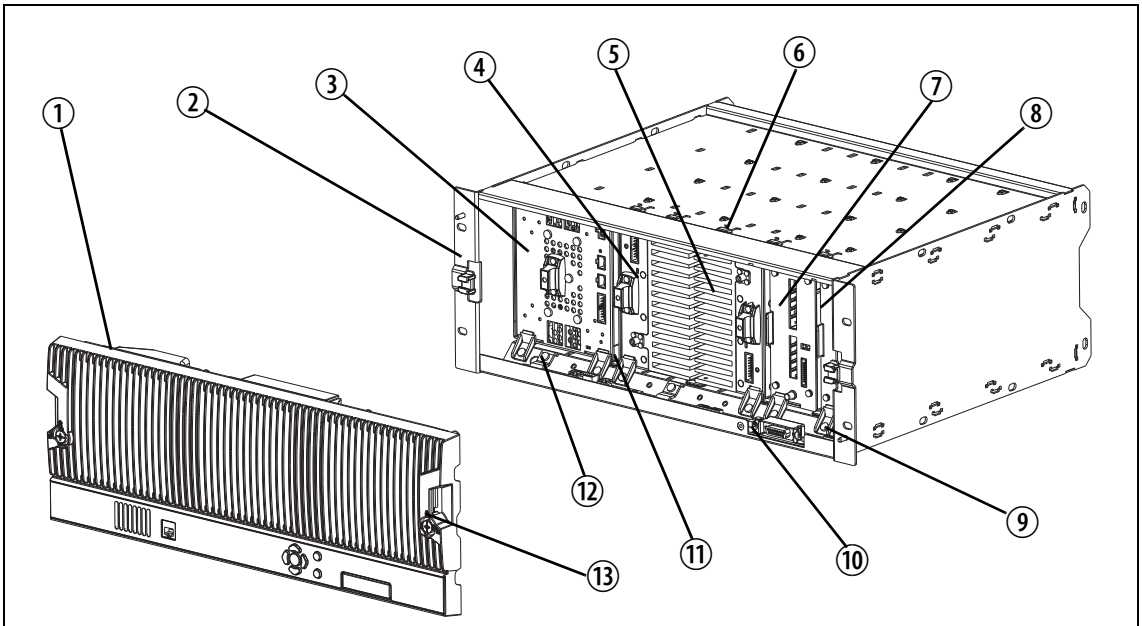
1.5 Mechanical Assembly

This section illustrates the main mechanical components of the base station.

Figure 1.1 below shows the configuration for a typical dual 50 W base station. The subrack has six slots, numbered from right to left as viewed from the front of the subrack. The PMU occupies slots 5 and 6, with the reciters in slots 1 and 2. The two PAs are mounted vertically in slots 3 and 4 with the heatsinks facing each other. The airflow separator between the PAs helps to direct the cooling airflow evenly through each heatsink. The PMU and each pair of reciters and PAs have their own cooling fans.

The front panel can be easily removed from the subrack by undoing two quick-release fasteners. Refer to "Replacing Modules" on page 112 for more details.

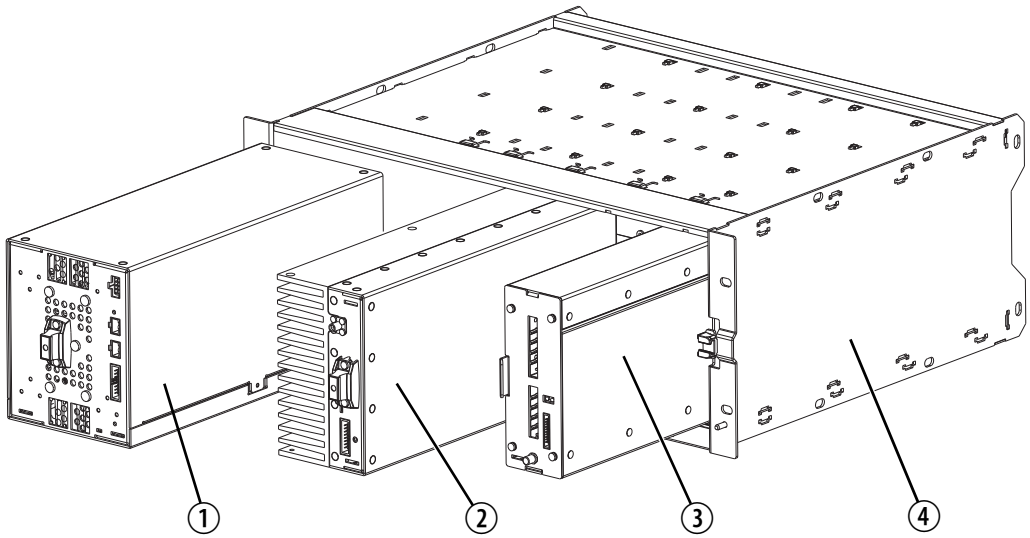
Figure 1.1 Mechanical assembly - dual 50 W base station with front panel



① front panel
② subrack
③ PMU
④ PA 2
⑤ PA 1
⑥ cable retaining clip
⑦ reciter 2
⑧ reciter 1
⑨ module retaining clamp
⑩ subrack interconnect board
⑪ plastic guide rail
⑫ subrack interconnect board retaining clamp
⑬ front panel fastener

Figure 1.2 below shows the configuration for a typical single 50 W base station. The PMU again occupies slots 5 and 6, with the reciter in slot 1 and the PA in slot 3. The single PA is mounted vertically with the heatsink facing the center of the subrack. This positions the cooling fins directly behind the fan.

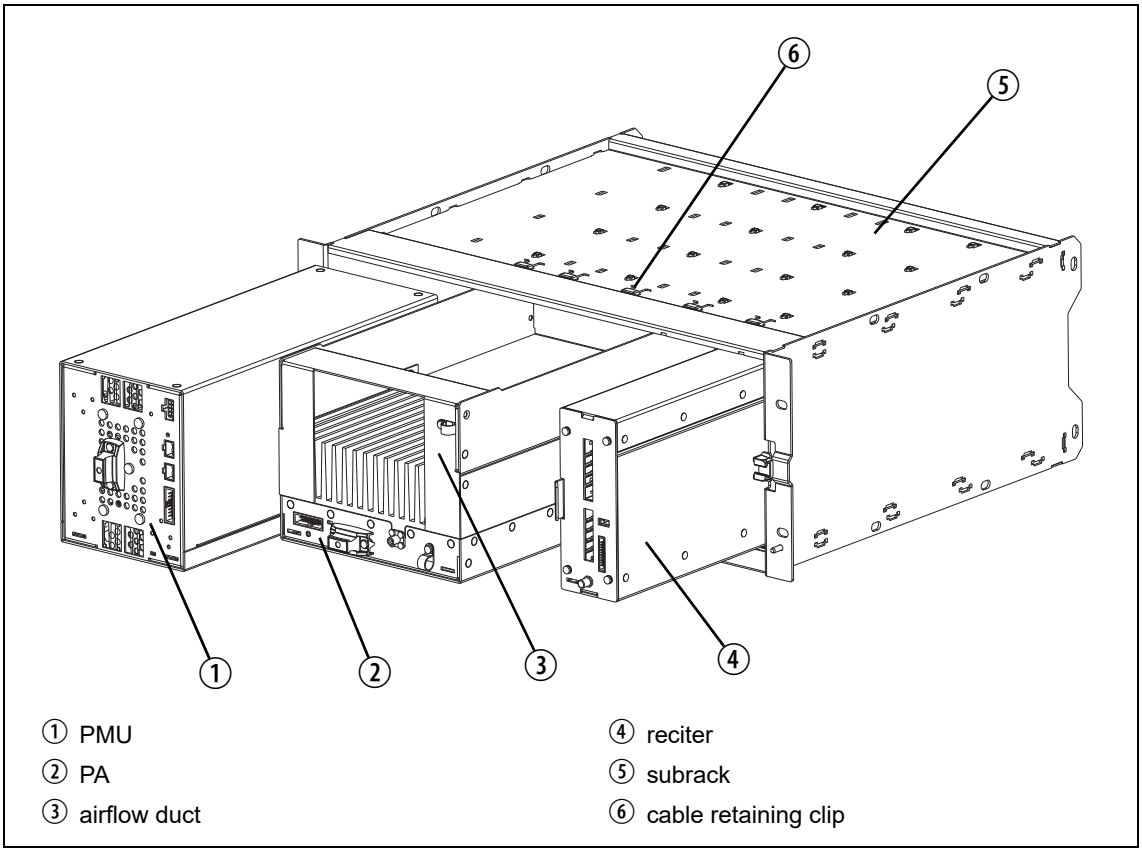
Figure 1.2 Mechanical assembly - single 50 W base station



① PMU
c 50 W PA
③ reciter
④ subrack

Figure 1.3 below shows the configuration for a typical 100 W base station. The PMU occupies slots 5 and 6, with the PA directly beside it in slots 3 and 4. The reciter occupies slot 1. Unlike the 50 W PAs, the 100 W PA is mounted horizontally with the heatsink facing upwards. It is also fitted with an airflow duct to channel the airflow from the cooling fan through the heatsink fins.

Figure 1.3 Mechanical assembly - single 100 W base station



1.6 Frequency Bands and Sub-bands

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

Frequency Identification	Frequency Band and Sub-band	50W	100W
B band	B2 = 136 to 156 MHz B3 = 148 to 174 MHz	✓ ✓	✓ ✓
C Band	C1 = 174 to 193 MHz C3 = 216 to 225 MHz	✓ ✗	✗ ✓
G band	G4 = 330 to 380 MHz	✓	✗
H band	H1 = 400 to 440 MHz H5 = 400 to 470 MHz H2 = 440 to 480 MHz H3 = 470 to 520 MHz H4 = 380 to 420 MHz	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓
K band	K4 Transmit: 762 to 776 & 850 to 870 MHz Receive: 792 to 824 MHz K8 Transmit: 757 to 758 MHz Receive: 787 to 788 MHz	✓ ✗	✓ ✓
L band	L2 = 896 to 902 MHz (receive) L2 = 927 to 941 MHz (transmit)	✗ ✗	✓ ✓

In Brazil, for K and L bands, the TB9300 is considered to be configured as a base station with retransmission of received signals.

1.7 Licenses

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

Having a license on the base station does not mean that the feature is enabled. To use the function associated with a license, you must first enable it in the base station configuration.

For more detailed information, see the appropriate base station help. Details for associated documents can be found in the "Associated Documentation" section of the manual.

1.7.1 Compatibility

The compatibility rules for operating as a trunking transceiver with a Tait trunking controller for DMR/MPT are defined in the following table:

The base stations in a Tait DMR trunked Network are controlled by a node (DMR trunking controller). Tait sells three types of node: Full, Express20, and Express6. Each type of node has different capabilities. Refer to **TN-2134** for more information.

		DMR - Controller			
		Full	**Express20**	**Express6**	**Standalone Access**
Base Station	**Full**	✓	✓	✓	✓
	Express20	✗	✓	✓	✓
	Express6	✗	✗	✓	✓
	Access	✗	✗	✗	✓

1.7.2 Feature Licenses

The following section lists the available feature licenses for DMR/MPT.

Licenses are not lost or changed under firmware upgrades, downgrades, or changes of system type. Older firmware may not display all licenses.

DMR/MPT Feature Licenses	
Feature License	**Description**
TaskBuilder (TBAS073)	Allows for the programming of TaskBuilder scripts
Analog Air Interface (TBAS301 - Default License)	A base station with this licence can operate as an MPT transceiver or an analog conventional repeater
DMR Conventional (TBAS304)	A base station with this licence can operate in a Tait DMR conventional network. It can also operate as a stand-alone repeater, or as a member of a multi-site system (under the supervision of a DMR channel controller).
DMR Trunking Access (TBAS303)	A base station with this licence can accept connections only from an Access controller. This licence entitles a base station to control a single site of up to four physical channels.
DMR Trunking Express6 (TBAS302)	A base station with this licence can accept connections from any Express node or Access controller. In single-site trunking and fallback modes, this licence entitles a base station to control a single site of up to 6 physical channels.
DMR Trunking Express20 (TBAS305)	A base station with this licence can accept connections from: ■ An Express20 node ■ An Express6 node ■ A base station site controller A base station with both a DMR conventional licence and a valid DMR trunking licence (such as Express or Access) can be configured to operate in either mode.
DMR Trunking Full (TBAS300)	A base station with this licence can accept connections from any node or base station site controller
DMR Central Voter (TBAS306)	This feature allows a base station to act as a DMR central voter
DMR IP Networking Satellite (TBAS307)	This feature allows a DMR base station to be part of a channel group

Figure 1.4 Licences and applicability

Licence	Name	Air Interface	System Type
TBAS301	Analog Air Interface	Analog/MPT	Conventional
TBAS304	DMR Conventional	DMR	Conventional
TBAS303	DMR Trunking Access	DMR	Trunked
TBAS302	DMR Trunking Express6	DMR	Trunked
TBAS305	DMR Trunking Express20	DMR	Trunked
TBAS300	DMR Trunking Full	DMR	Trunked
TBAS306	DMR Central Voter	DMR	Trunked/Conventional
TBAS307	DMR IP Networking Satellite	DMR	Trunked/Conventional

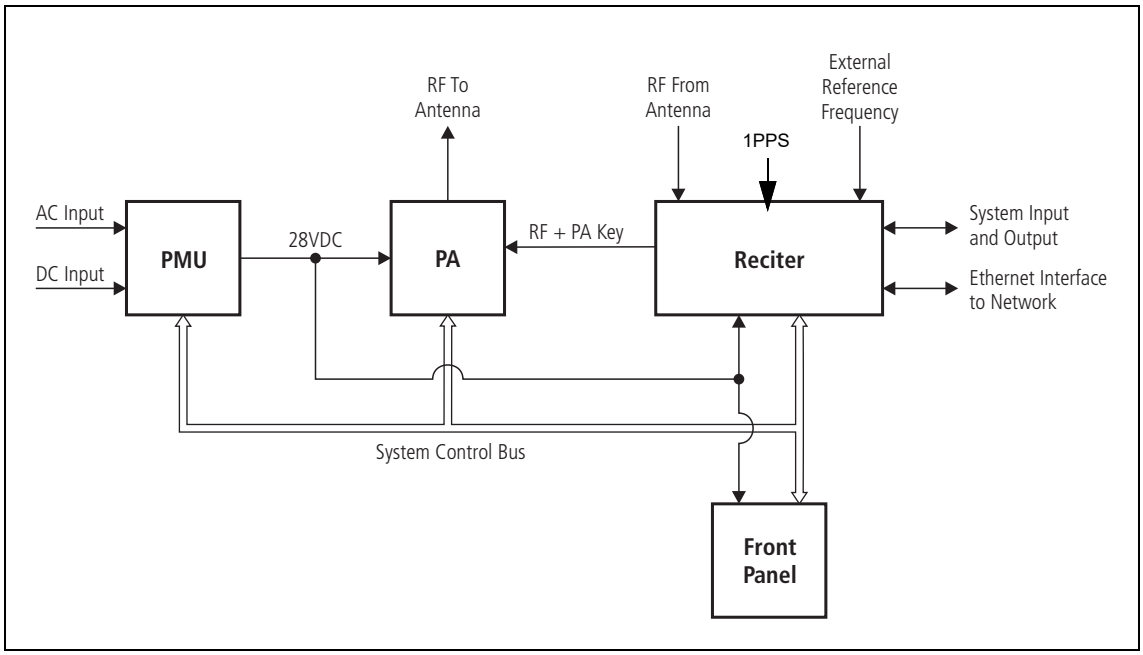
1.8 Theory of Operation

The reciter receives RF signals from its RF input (antenna), and outputs this to the PA, along with a PA key signal. The reciter also receives signals from, and sends signals to, the system interface, the Ethernet interface, and the front panel (see Figure 1.5).

A system control bus interconnects the modules and carries alarm and control signaling between the reciter and the other modules (refer to "Intermodule Communications" on page 30 for more details).

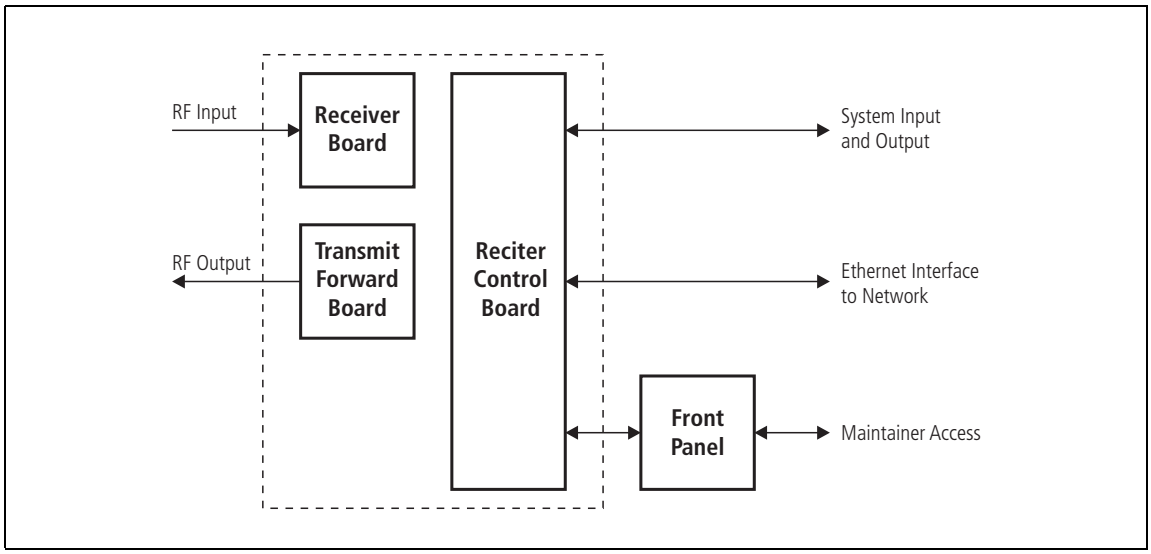
The Ethernet interface carries VoIP and also allows maintainer access via a web browser.

Figure 1.5 Base station high-level diagram



The reciter handles signal processing and has overall control of the base station. Its circuit boards are shown in Figure 1.6.

Figure 1.6 Reciter boards



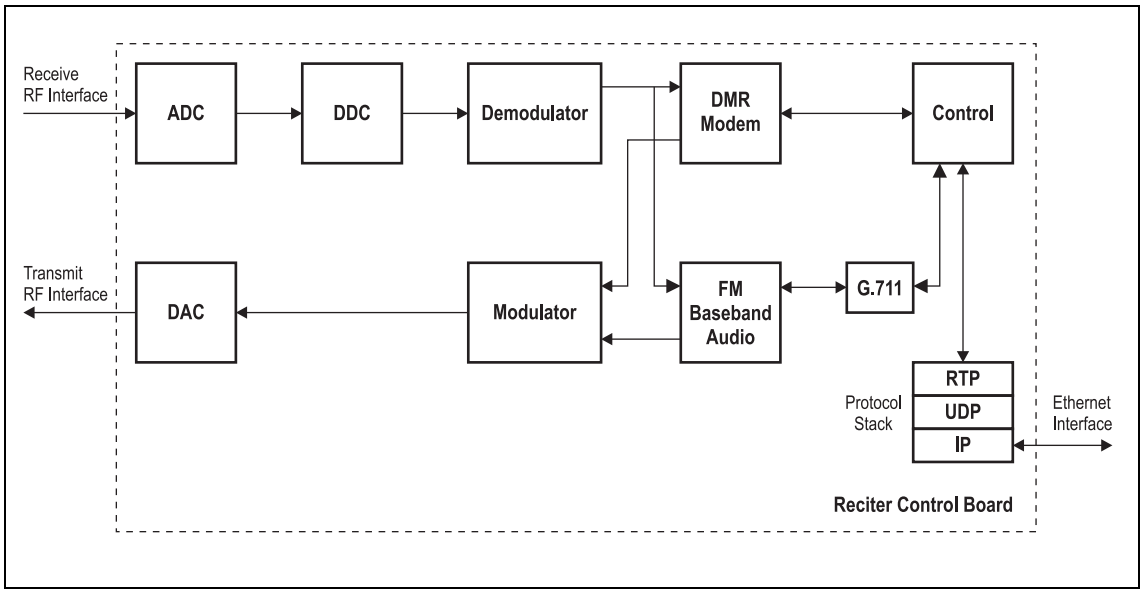
The receiver board contains all the receiver circuitry, while the exciter circuitry is located on the transmit forward board.

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

1.8.1 Signal Paths

Figure 1.7 gives an overview of signal paths within the reciter.

Figure 1.7 Reciter signal paths



Digital DMR signals from the receive RF interface pass through the digital receiver and DMR modem to the control firmware in the RISC processor. The control firmware passes the signal through the Ethernet interface to the node controller.

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

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

1.8.2 Online and Offline Modes

The base station normally operates in Online mode, but Offline mode can be selected via its WebUI.

Online Mode

In Online mode, the base station is in service and performs its normal functions of transmitting and receiving radio signals.

Offline Mode

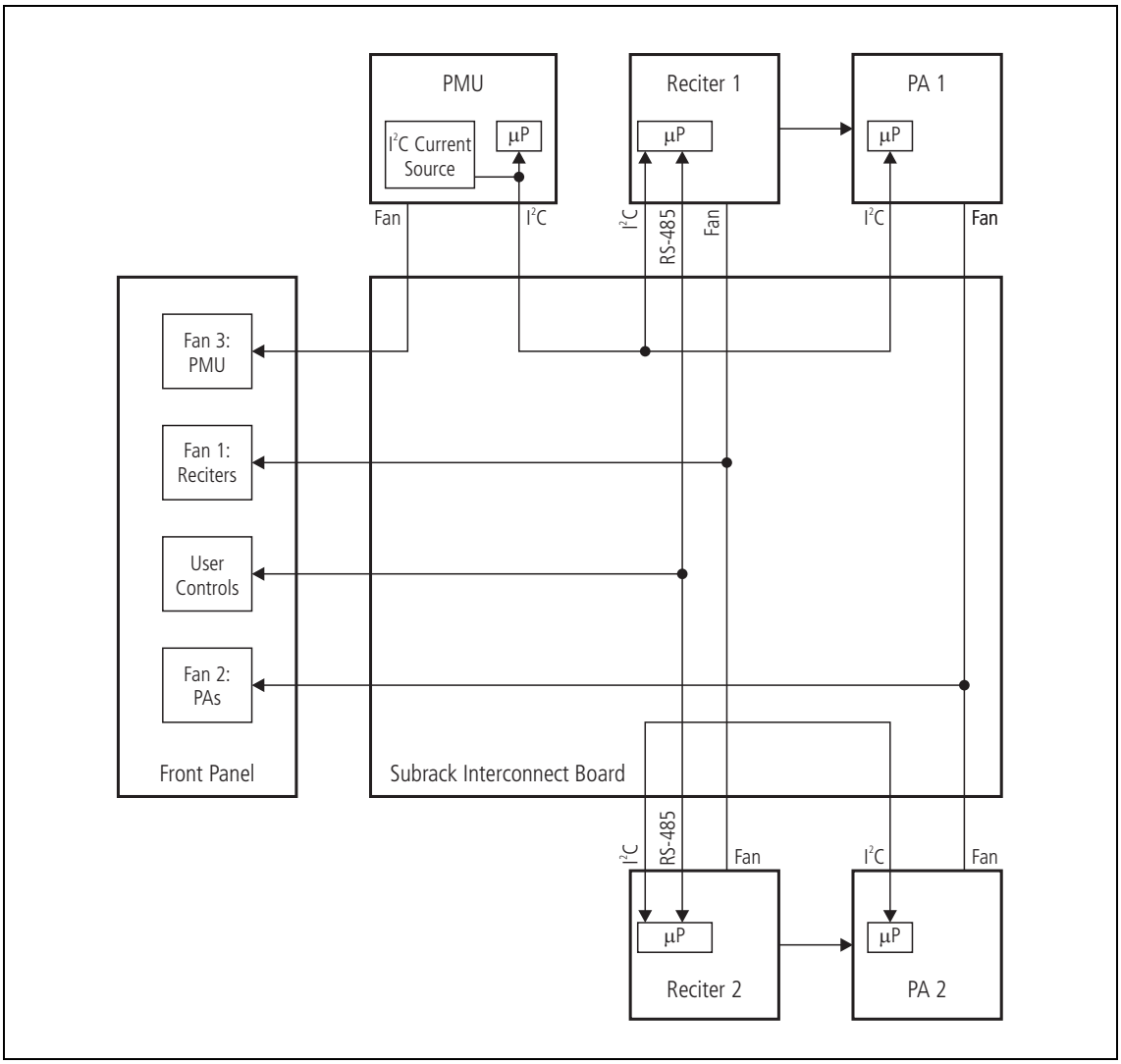
Offline mode allows a maintenance engineer to carry out tasks that can not be done while the base station is in service - such as activating firmware or running diagnostic tests.

1.8.3 Intermodule Communications

A system control bus and a subrack interconnect board link the modules in the subrack and carry alarm and control signaling between the reciter and the other modules, as shown in Figure 1.8.

Specific configuration settings for dual base stations are described in "Recommended Configuration Settings" on page 66.

Figure 1.8 Intermodule communication paths



1.8.4 Power Management and Distribution

The PMU manages the supply of power to ensure uninterrupted operation of the base station. A range of parameters is monitored and these can trigger alarms that are sent to the reciter. Alarms can be monitored via the WebUI and reported via SNMP traps; they are also recorded in the reciter's internal log file.

AC to DC Changeover

When the PMU has an AC and a DC module, the base station can be powered by either the AC (mains) or the DC (battery) supply. The base station will default to the AC supply if both supplies are provided. If the AC supply becomes unavailable, a seamless changeover from the AC to DC supply takes place, providing that the battery voltage is above the configured minimum startup voltage. Use a web browser to check whether the base station is running on battery or mains power.

DC Operation

When the base station is running off the DC supply and the battery voltage falls below the configured minimum, the base station will enter battery protection mode to protect the battery and base station equipment. When the battery voltage rises to the configured startup setting, power is resumed to the DC supply. Refer to "PMU Operation on DC Input" on page 33 for more detailed information.

Auxiliary Power Control

The output from the auxiliary power supply board can be used to power other site equipment. The maximum output is 40 W.

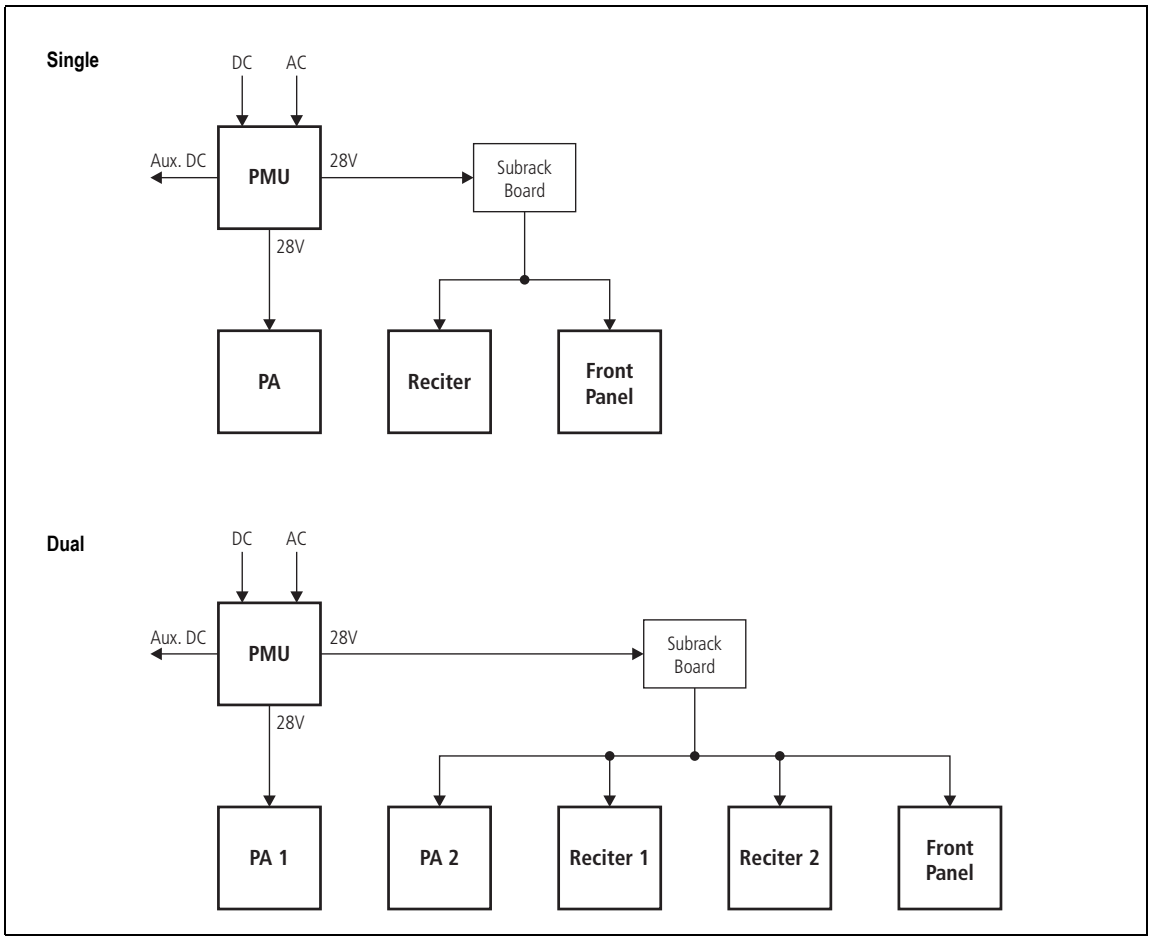
Distribution

Figure 1.9 shows how power is distributed to modules in the subrack. The 28 VDC output from the PMU is fed directly to the PA in a single base station, or directly to PA 1 in a dual base station, and to the other modules via the subrack interconnect board. Power to the reciters and front panel is current-limited by self-resetting fuses on the subrack board.

The AC converter has a series switch that breaks the phase input to the converter. In contrast, the DC input has much higher current ratings. Its switch does not disconnect power from the DC converter itself, but disables the converter by switching off its control circuitry.

The outputs from both the AC and DC high power converters are added together and fed to the modules via the high-current outputs. The auxiliary output is also tapped off this summed output.

Figure 1.9 Subrack power distribution



1.8.5 PMU Operation on DC Input

The operation of the PMU on DC input is controlled by three sets of parameters:

- User-programmable alarms
- User-programmable startup and shutdown limits
- Battery protection limits

The voltage range for each of these parameters is provided in Table 1.1 on page 34. Figure 1.10 on page 35 illustrates how these parameters interact, and how they control the operation of the PMU over a range of DC input voltages.

Alarms

User-programmable alarms can be set for low or high battery voltage (Configure > Alarms > Thresholds). The alarms will be triggered when the set voltage levels are reached. These limits are subject to the tolerances of the battery protection circuitry, as stated in "Battery Protection (Fail-safe) Limits" in Table 1.1.

Startup and Shutdown Limits

The user-programmable startup and shutdown limits allow for adjustable startup and shutdown voltages (Configure > Base Station > Miscellaneous). These limits can be adjusted for different numbers of battery cells, or for the particular requirements of the base station's operation. Once the limits are reached, the PMU will shut down. These limits are subject to the tolerances of the battery protection circuitry, as stated in "Battery Protection (Fail-safe) Limits" in Table 1.1.

> **Notice** It is possible to set the startup voltage of the base station below the nominal voltage of the battery. Continuing to use a battery for extended periods when it is below its nominal voltage will severely shorten its service life. For more information on battery management, we recommend that you consult the battery manufacturer.

Battery Protection Limits

The battery protection limits are set in hardware at the factory, and cannot be adjusted by the user. These limits will not be reached under normal operation conditions, but are provided as "fail-safe" measures to protect the battery from deep discharge. They also remove the need for low-voltage disconnect modules.

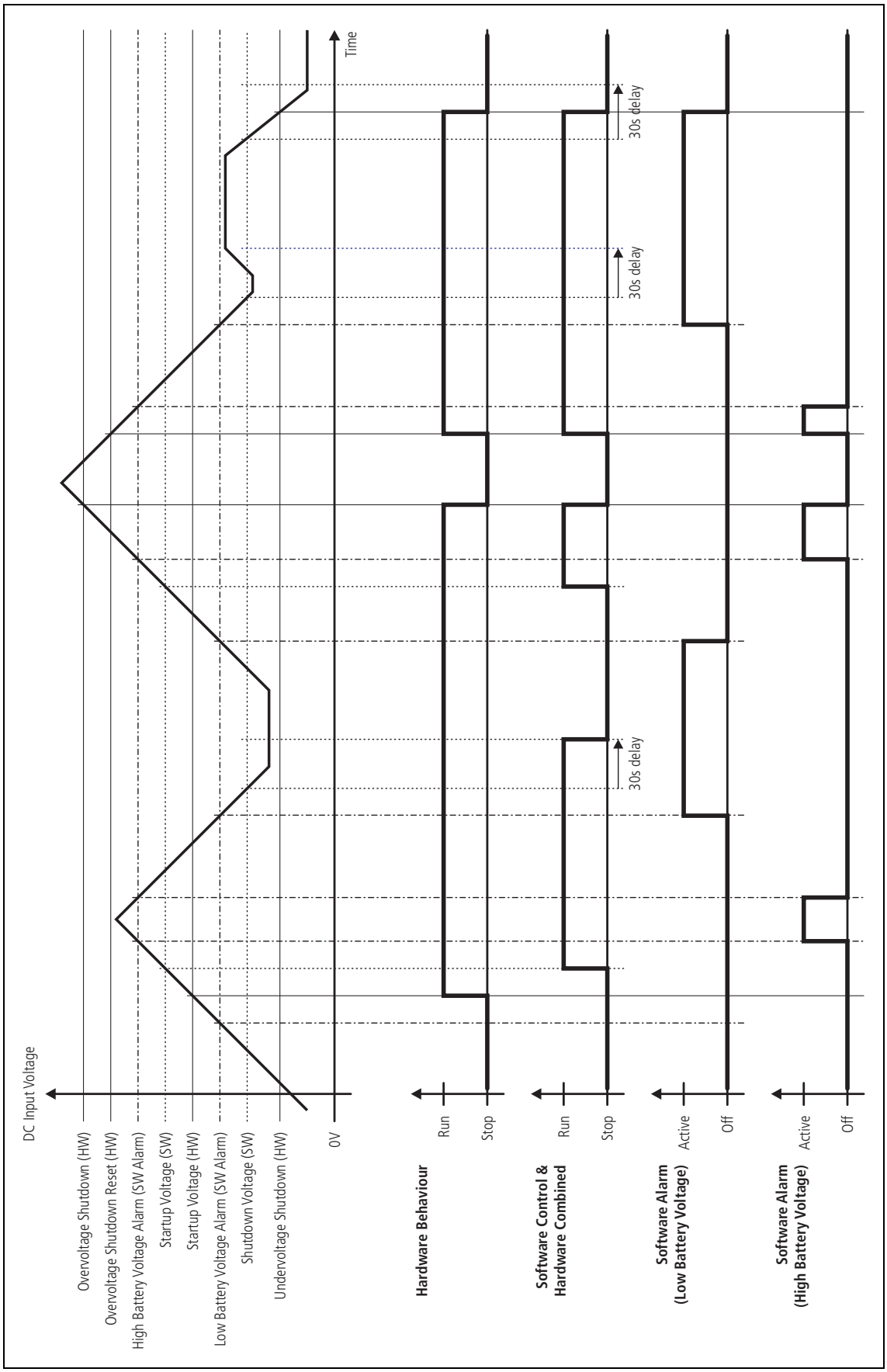
Table 1.1 PMU DC voltage limits[a]

Parameter	Voltage Range		
	12V PMU	**24V PMU**	**48V PMU**
User-programmable Alarms[b] Low Battery Voltage High Battery Voltage	 10V to 14V 14V to 17.5V	 20V to 28V 28V to 35V	 40V to 56V 56V to 70V
User-programmable Limits[b] Startup Voltage (after shutdown) Shutdown Voltage	 10.9V to 15V ±0.3V 10V to 13.5V ±0.3V	 21.8V to 30V ±0.5V 20V to 27V ±0.5V	 43.6V to 60V ±1V 40V to 54V ±1V
Battery Protection (Fail-safe) Limits Startup Voltage Undervoltage Shutdown Overvoltage Shutdown Overvoltage Shutdown Reset	 10.8V ±0.2V 9.5V ±0.3V 18.1V ±0.3V 17.1V ±0.3V	 21.6V ±0.5V 19V ±0.5V 36.2V ±0.5V 34.2V ±0.5V	 43.2V ±1V 38V ±1V 72.4V ±1V 68.4V ±1V

a. The information in this table is extracted from the Specifications Manual. Refer to the latest issue of this manual for the most up-to-date and complete PMU specifications.

b. Using the base station's WebUI.

Figure 1.10 PMU alarm thresholds and voltage limits when operating on DC



1.8.6 Front Panel Fans

The front panel is equipped with three fans. The first is for the reciters, the second is for the PAs, and the third is for the PMU. Front panel fans do not operate continuously, but are switched on and off as needed by their associated module. In a dual base station either PA or reciter can turn on its fan. The reciter in slot 1 can also carry out a fan test on all three fans.

Front panel fans are 3-wire fans (power, ground, and rotation detect). The reciter can monitor whether the fans are rotating and generate an alarm if any of the fans fail.

The fans turn on for the duration of time the base station takes to boot from power up. The fans also turn on for a few seconds after the front panel is refitted to a base station that is powered up.

Configuring Fan Control

The operation of the PA fan is configurable via the WebUI; you can specify the threshold temperature at which the fan will be turned on, and set the fan to operate only when the PA is transmitting.

Notice If a fan is not operational, the fan alarm will only be raised when the fan is turned on, not at system start-up. To avoid discovering a fan fault after leaving the site, Tait recommends running a diagnostics fan test.

The PMU fan has fixed on/off thresholds and a defined set of duty cycles based on the PMU temperature and load current, as described in the following table.

PMU Temperature	Current	Fan Duty Cycle
<149°F (65°C)	<4A 4A–6A 6A–8A 8A–12A 12A–14A ≥15A	always off 2 minutes on, 8 minutes off 2 minutes on, 5 minutes off 3 minutes on, 3 minutes off 4 minutes on, 1 minute off always on
>149°F (65°C)	—	always on

2 General Safety and Regulatory Information

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

2.1 Personal Safety

2.1.1 Unpacking and Moving the Equipment

To prevent personal injury and equipment damage, we recommend that two people unpack and move the equipment.

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 112). In all cases follow safe lifting practices.

2.1.2 Lethal Voltages

Warning **The PMU contains voltages that may be lethal. Refer to the ratings label on the rear of the module.**

The equipment must be installed so that the rear of the PMU is located in a service access area which is accessible only by qualified personnel. The PMU must be connected to the mains supply source by qualified personnel in accordance with local and national regulations.

Disconnect the mains IEC connector and wait for five minutes for the internal voltages to self-discharge before dismantling. The AC power on/off switch does not isolate the PMU from the mains. It breaks only the phase circuit, not the neutral.

The PMU should be serviced only by qualified technicians. There are no user-replaceable parts inside. If the PMU is damaged and does not function properly, stop the module safely and contact your regional Tait office immediately.

All servicing should be carried out only when the PMU is powered through a mains isolating transformer of sufficient rating.

2.1.3 AC Power Connection

English (en)	The PMU must be connected to a grounded mains socket-outlet.
Norsk (no)	Apparatet må tilkoples jordet stikkontakt.
Suomi (fi)	Laite on liitettävä suojamaadoitus-koskettimilla varustettuun pistorasiaan.
Svenska (sv)	Apparaten skall anslutas till jordat uttag.

2.1.4 Explosive Environments

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

2.1.5 High Temperatures

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

2.1.6 LED Safety (EN60825-1)

This equipment contains Class 1 LED Products.

2.1.7 Proximity to RF Transmissions / A proximité des émissions RF

To comply with the RF Field Limits for Devices Used by the General Public for (Uncontrolled Environment)[a], a safe separation distance of at least 22 feet (6.5 metres) from the antenna system should be maintained.

This figure is calculated for a typical installation, employing one 100 W base station transmitter. Other configurations, including installations at multi-transmitter sites, must be installed so that they comply with the relevant RF exposure standards.

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

Pour respecter les limites imposées au champ RF au niveau des équipements utilisés par le grand public (environnement non contrôlé)[a], une distance de séparation de sécurité d'au moins 6.5 mètres du bloc d'antenne devrait être observée.

Ce nombre est calculé pour une installation typique, ayant un émetteur de station de base de 100 W. D'autres configurations, incluant les installations ayant des sites de plusieurs émetteurs, doivent être installées de façon à se conformer aux normes pertinentes des expositions RF.

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

2.2 Equipment Safety

2.2.1 Installation and Servicing Personnel

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

2.2.2 Preventing Damage to the PA

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

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

Load transients (switching or removing the load) can damage the PA output stage. See "Connecting RF" on page 83 for recommendations.

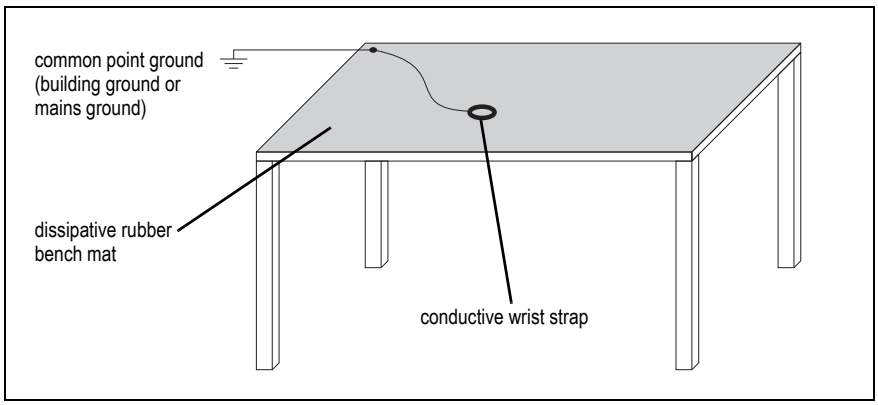
2.2.3 ESD Precautions

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

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

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

Figure 2.1 Typical antistatic bench set-up



2.2.4 Anti-tampering Devices

Hardware

Network elements should be kept secure to prevent damage from the elements as well as from unlawful tampering.

The following precautions are recommended:

- All network elements should be physically secured, where possible. This includes the use of locked cabinets and the use of seals on connectors.
- All network connectors should be sealed with the stick-on type of seal. The purpose of the seals is to detect unauthorized tampering. The seal should reveal if any of the connectors have been unplugged or if any unauthorized equipment has been plugged in.
    - The seals must be difficult to remove without breaking, and must bridge between the cable and equipment side (plug and socket) of the connection.
    - Seals must cover any unused network sockets. This includes the Ethernet connector on the rear panel, any spare switch ports, and the console port on the router and switch.
    - The seals must be difficult to reproduce. A sticker initialed or signed by the technician should satisfy this.
    - Seals must be replaced if they need to be disturbed during maintenance.

Software

Keeping the hardware secure is important because easy access to it could enable attempts to attack the hardware's IP network.

The following precautions are recommended to protect efforts to tamper with the software:

- Changing the default passwords to the WebUI (see Section 5.2.1 Logging In) and for SSH (see Section 4.4.6 Changing the Root Password)
- Taking regular backups. It is good practice to take regular backups, especially when making configuration changes, so that rollbacks are easy to perform in case of data loss or corruption. Refer to the WebUI for instructions.
- Creating a separate user account for each user (ideally using centralized AAA) so that the audit logs can indicate specifically who logged in and what they did (refer to the WebUI for instructions)
- Remote capture of audit information to a syslog collector (which should be checked periodically)
- Disabling the front panel keypad (done from the WebUI) when the base station has been installed and commissioned to prevent access to the base station via the front panel menus
- Periodic checks that the base station configuration still matches the latest backup

- Creating robust firewalls (particularly in situations where the base station uses an ephemeral source port)
- Setting up and using signed web certificates (refer to the WebUI for instructions)
- Setting up and using ‘Custom alarms’ to pass on indications from building or rack security if they do not have their own monitoring paths (smoke detectors, door alarms, etc.). See “Connecting General Purpose Inputs and Outputs” on page 87.

2.3 Environmental Conditions

2.3.1 Operating Temperature Range

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

2.3.2 Humidity

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

2.3.3 Dust and Dirt

For uncontrolled environments, the level of airborne particulates must not exceed 100 µg/m^3.

2.4 Regulatory Information

2.4.1 Distress Frequencies

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

2.4.2 Compliance Standards

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

2.4.3 FCC Compliance

This equipment complies with:

- CFR Title 47 Part 15 Class B (except PMU):

  Radiated and conducted emissions, and electromagnetic susceptibility specifications of the Federal Communications Commission (FCC) rules for the United States.

  Operation is subject to the following two conditions:

  a. This device may not cause harmful interference, and

  b. This device must accept any interference received, including interference that may cause undesired operation.

- CFR Title 47 Part 15 Class A (PMU only):

  Radiated and conducted emissions, and electromagnetic susceptibility specifications of the Federal Communications Commission (FCC) rules for the United States.

  Operation is subject to the following two conditions:

  a. This device may not cause harmful interference, and

  b. This device must accept any interference received, including interference that may cause undesired operation.

2.4.4 Unauthorized Modifications

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

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

2.4.5 Health, Safety and Electromagnetic Compatibility in Europe

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

Intended Purpose of Product

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

Declaration of Conformity

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

3 Operation

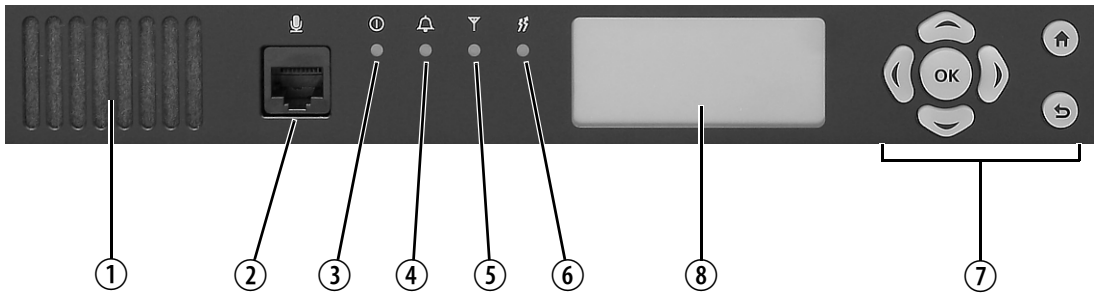
This section describes the user controls and indicator LEDs on the front panel and on the base station modules.

3.1 Front Panel

The user controls and indicator LEDs on the front panel are shown in Figure 3.1. They allow some manual control over the base station and monitoring of its operational status.

Notice If there is more than one reciter in a subrack, inputs from all reciters are summed to drive the front panel LEDs.

Figure 3.1 Operating controls on the control panel



① speaker
② microphone connector
③ power LED
④ alarm LED
⑤ receive LED
⑥ transmit LED
⑦ keypad
⑧ display

① ② **Speaker and Microphone Connector**

The speaker and microphone connector are not currently used.

③ **Power LED**

The green power LED is lit when power is supplied to the subrack.

④ **Alarm LED**

The red alarm LED will flash at a rate of 2 to 5 Hz when an alarm has been generated by any of the base station modules. It will continue to flash until the alarm is canceled or the fault is fixed. Note that only those alarms that are enabled using the WebUI will cause this LED to flash.

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

⑤ **Receive LED**

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

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

⑥ **Transmit LED**

The amber transmit LED is lit while the transmitter is transmitting.

⑦ **Keypad**

The keypad is used to navigate the base station's menus, enter text, and to adjust the contrast of the display. The complete list of menu items is provided in "Menu Map" on page 47.

If required, the keypad can be disabled in the WebUI to prevent access to the base station via the front panel menus.

Key	Name	Function
	left and right arrow keys	■ Move the cursor to the left or right when entering text. Moving the cursor beyond the end of a line will return it to the other end of the same line. ■ Decrease or increase the contrast in the Display Contrast screen
	scroll keys	■ Scroll up and down through a list of menu items ■ Scroll up and down through the list of available characters when entering text ■ Increase or decrease the contrast in the Display Contrast screen
	OK	■ Selects the highlighted menu item ■ Confirms any adjustments made and exits to the previous menu ■ When setting the IP address, moves the cursor down one line. When all the IP addresses are confirmed, exits to the previous menu.
	home	■ Returns to the home screen from any other menu
	return	■ Returns to the previous menu ■ Moves the cursor up one line in the IP address screen. When the top line is reached, pressing again returns to the previous menu.

⑧ Display

The display is used in conjunction with the keypad to access the base station's menus. It allows the technician to configure the IP address of each reciter (refer to "Setting the IP Address" on page 92), and to set the contrast of the display (see below).

After the base station is powered up, the display shows "Please wait…" while the base station is starting up, followed by the home screen when the start-up process is complete. The home screen shows four lines of user-defined text, which can be entered via the WebUI (Identity > Identity > Base Station > Front panel message).

From the home screen press an arrow key, a scroll key or OK to go to the base station menu. The display returns to the home screen from any other screen 30 seconds after the last key press. Press any key to turn on the backlight. The backlight turns off 30 seconds after the last key press.

ⓘ If the keypad has been disabled, pressing an arrow key, a scroll key or OK will cause the display to show "Keypad Disabled".

Set the display contrast as follows:

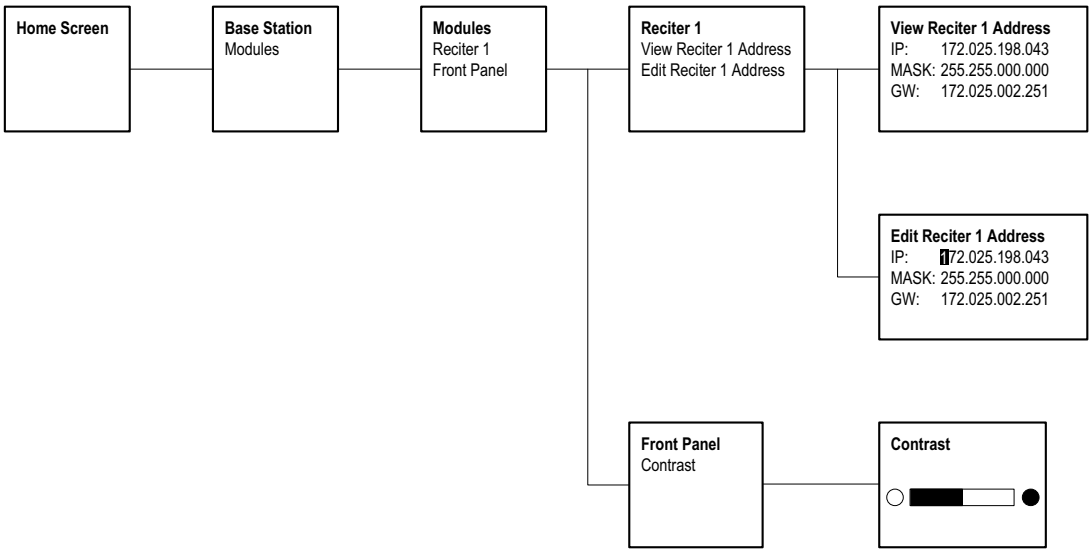
1. From the base station menu select Modules > Front Panel > Contrast.
2. To increase the contrast, press the right arrow or scroll up key. To decrease the contrast, press the left arrow or scroll down key.

When the contrast is set to the required level, press OK to save the changes and exit the menu.

Menu Map

The menu map below shows the menu items available in this release of the base station.

Notice The menu map shown is for a single base station. The menu items available in your base station will depend on which modules are present in the subrack, and whether the keypad has been disabled.



3.2 Module Indicator LEDs and Switches

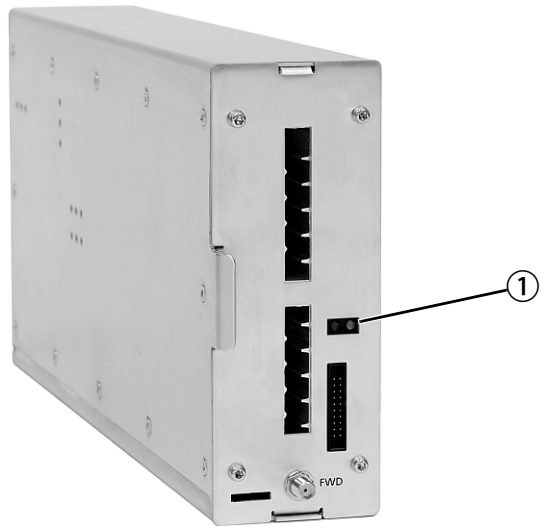
Additional status information is displayed by LEDs present in individual modules. The PMU also has switches that let you turn the AC and DC modules off.

3.2.1 Reciter

Front View

The indicator LEDs on the front of the reciter are visible through a slot in its front panel.

Figure 3.2 Indicator LEDs on the front of the reciter



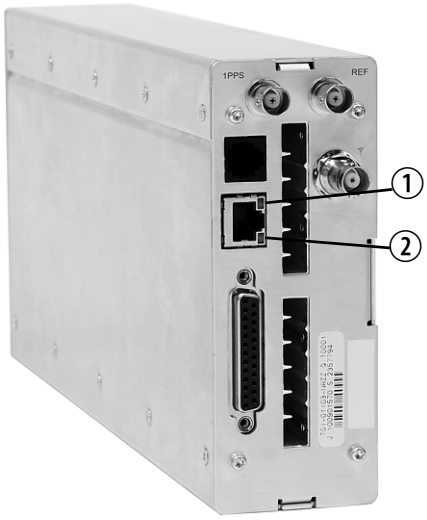
① indicator LEDs

These LEDs provide the following information about the state of the reciter:

- Steady green - the reciter is powered up
- Flashing red - one or more alarms are present in offline or online mode; refer to the WebUI for more details about the alarms
- Steady red - the reciter is offline

Rear View The indicator LEDs on the rear of the reciter are on the Ethernet connector.

Figure 3.3 Indicator LEDs on the rear of the reciter



① 10Base-T Ethernet Connector LED (green) ② 100Base-T Ethernet Connector LED (amber)

These LEDs provide the following information about the state of the reciter:

Series 2

10Base-T Ethernet The green Ethernet connector LED will flash and the amber LED will be off if the connection is running at 10 Mbits/s.

100Base-T Ethernet The green Ethernet connector LED will flash and the amber connector will be on if the connection is running at 100 Mbits/s.

Series 1

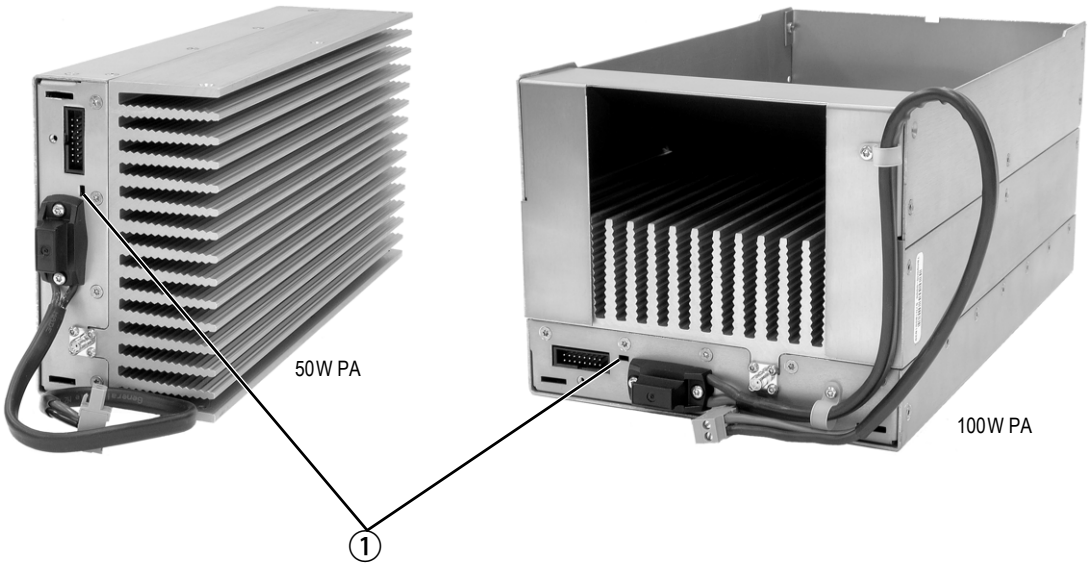
10Base-T Ethernet The green Ethernet connector LED will be on and the amber LED will be off if the connection is running at 10 Mbits/s.

100Base-T Ethernet The green Ethernet connector LED will be off and the amber connector will be on if the connection is running at 100 Mbits/s.

3.2.2 PA

The indicator LEDs on the PA are visible through a slot in its front panel.

Figure 3.4 Indicator LEDs on the PA



① indicator LEDs

Indicator LEDs

These LEDs provide the following information about the state of the PA:

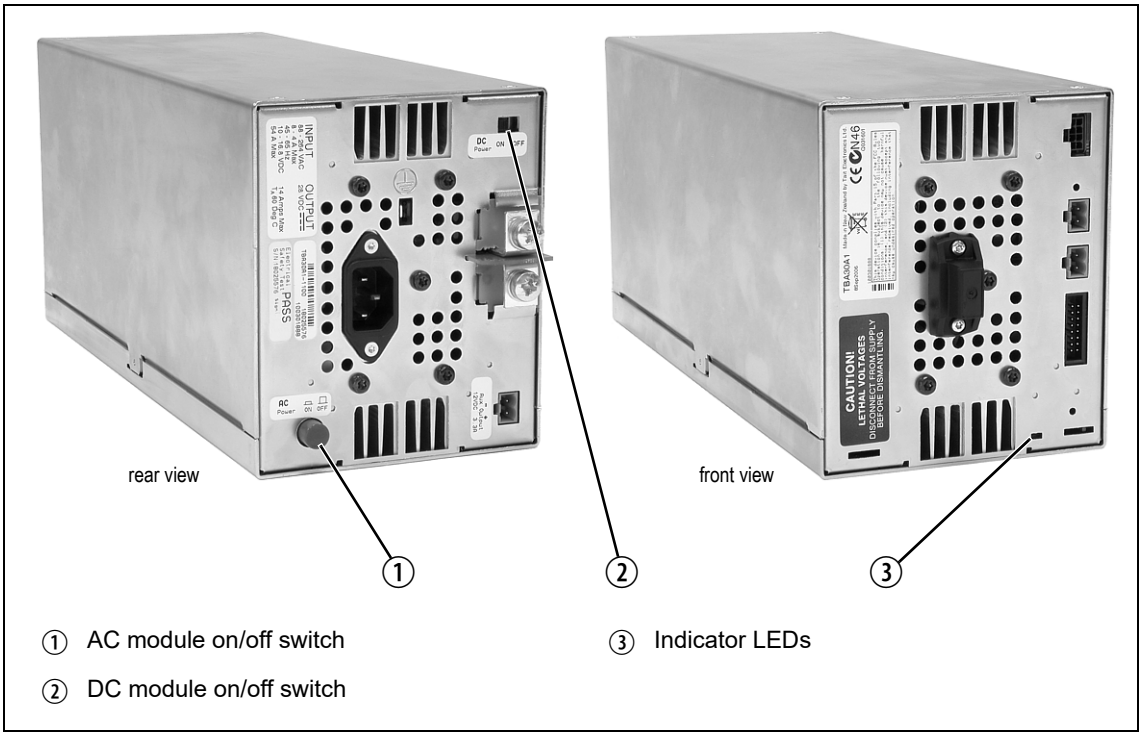
- Steady green - the PA is powered up
- Flashing green - the PA has no application firmware loaded or activated; use the WebUI to download or activate the firmware
- Flashing red - one or more alarms have been generated; refer to the WebUI for more details about the alarms

The alarm LED will flash whenever an alarm is generated, even if the alarm has been disabled via the WebUI.

3.2.3 PMU

The only controls on the HW version 1 and 2 PMUs are the on/off switches on the rear panel for the AC and DC modules, and the indicator LEDs visible through a slot in its front panel. The H/W version 3 PMU has, in addition, jumper settings for user selectable voltage (see Figure 3.6 on page 53).

Figure 3.5 Operating controls on the PMU H/W versions 1 and 2



① AC module on/off switch

② DC module on/off switch

③ Indicator LEDs

Warning **The AC and DC module on/off switches do not totally isolate the internal circuitry of the PMU from the AC or DC power supplies. You must disconnect the AC and DC supplies from the PMU before dismantling or carrying out any maintenance.**

AC Module On/Off Switch

This switch turns the AC input to the PMU on and off. Note that this switch breaks only the phase circuit, not the neutral.

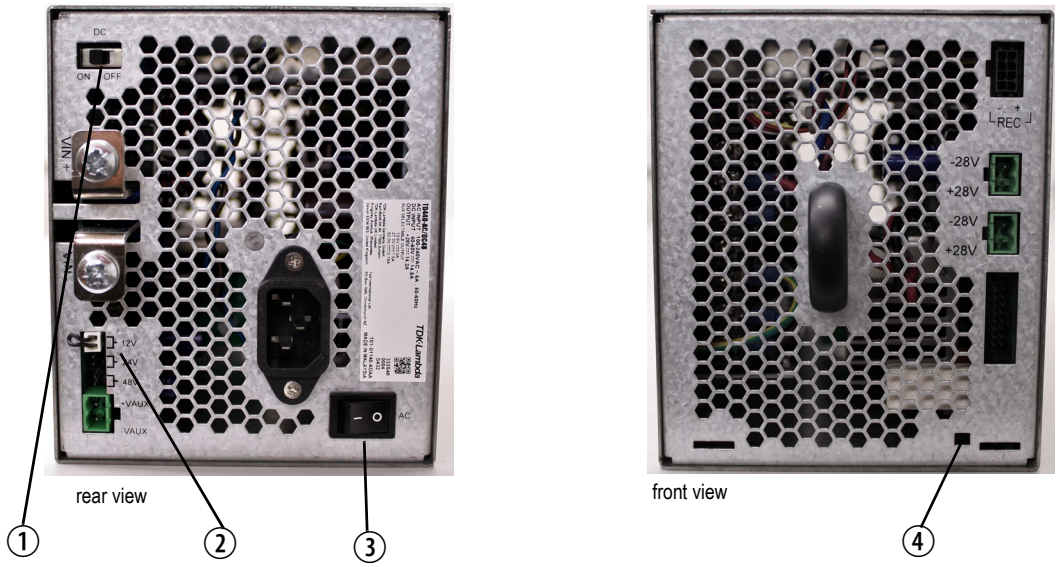
Note that in H/W version 1 and 2 PMUs, the The AC On/Off switch is a button that protrudes whether on or off.

DC Module On/Off Switch

This switch turns the DC output from the PMU on and off. Note that 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 switch is recessed to prevent the DC module being accidentally switched off.

Figure 3.6 Operating controls on the PMU H/W version3



① DC module on/off switch

② User selectable voltage

③ AC module on/off switch

④ Indicator LEDs

Indicator LEDs

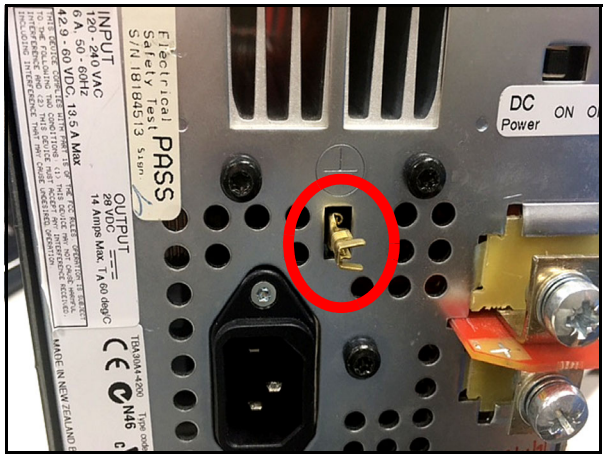
These LEDs provide the following information about the state of the PMU:

- Steady green - the PMU is powered up
- Flashing green - the PMU has no application firmware loaded or activated; use the WebUI to download or activate the firmware
- Flashing red - one or more alarms have been generated; use the WebUI to find more details about the alarms
- Flashing red and green - the PMU is in battery protection mode; check that the battery voltage is above the configured minimum startup voltage; also check that the minimum startup voltage is configured correctly

The alarm LED will flash whenever an alarm is generated, even if the alarm has been disabled via the WebUI.

H/W Version 1 and 2 PMUs Only - Rear Grounding Terminal

Notice To comply with EN 62368-1:2014, a spade connector must be fitted onto the PMU rear grounding terminal (circled in red in the image below). This is required to fill the opening and does not perform any other function.



4 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.

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 120 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 79 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 strikes. 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 Ventilation” on page 56).

Notice **Do not** operate the base station 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.

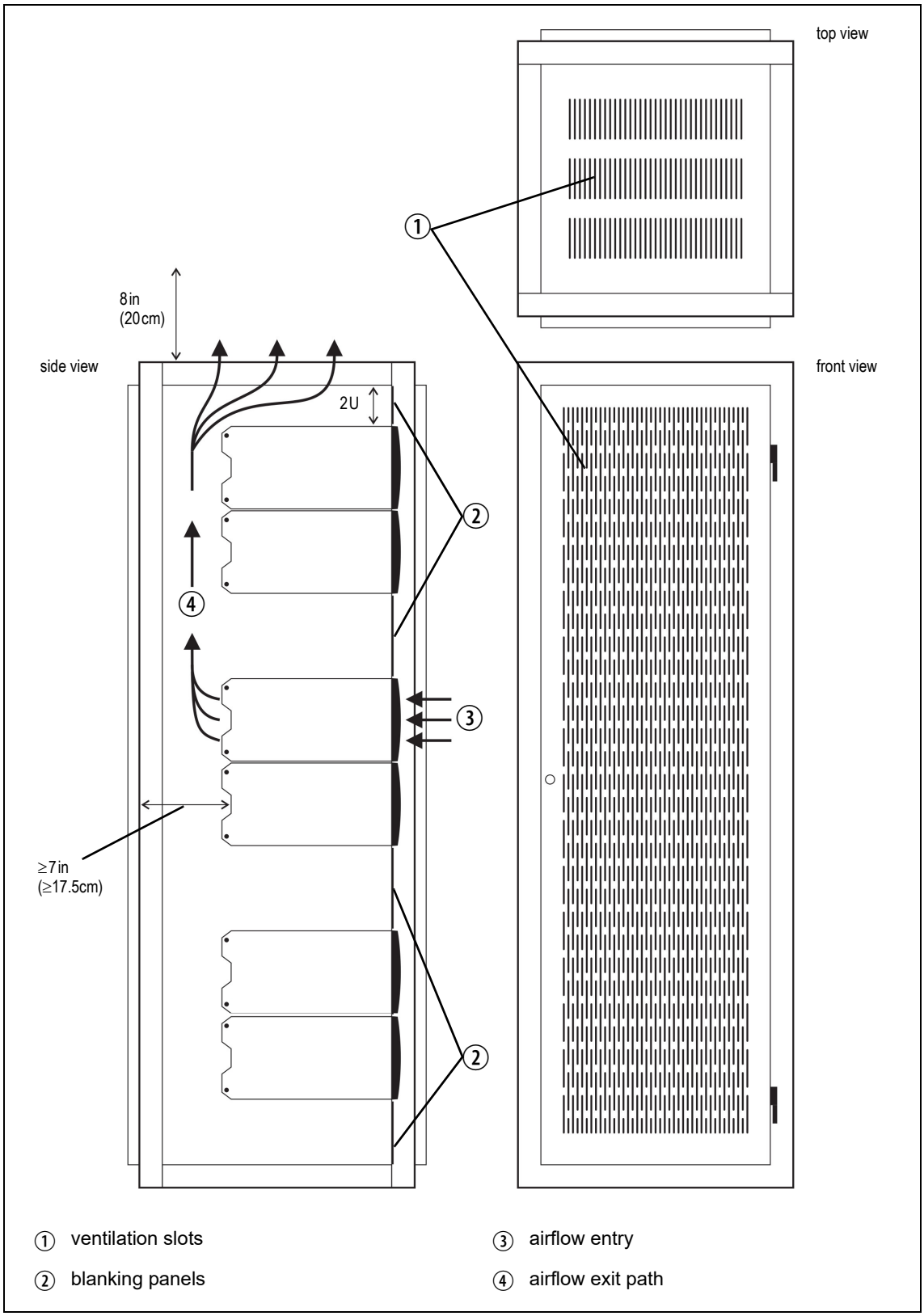
4.1.5 Cabinet Ventilation

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 57.

Equipment installation should observe the following guidelines:

- The recommended maximum number of subracks in a 38U cabinet is six as shown in Figure 4.1 on page 57. These can be single 100W or dual 50W subracks.
- 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 57
- Subrack placement in the cabinet should include a 2U gap at the top of the cabinet
- The maximum ambient temperature at the base station front panels must not exceed +140°F (+60°C). This is displayed on the WebUI in the Monitor > Modules > Temperature tab in the Air intake section, current.

Figure 4.1 Typical cabinet ventilation requirements



① ventilation slots

② blanking panels

③ airflow entry

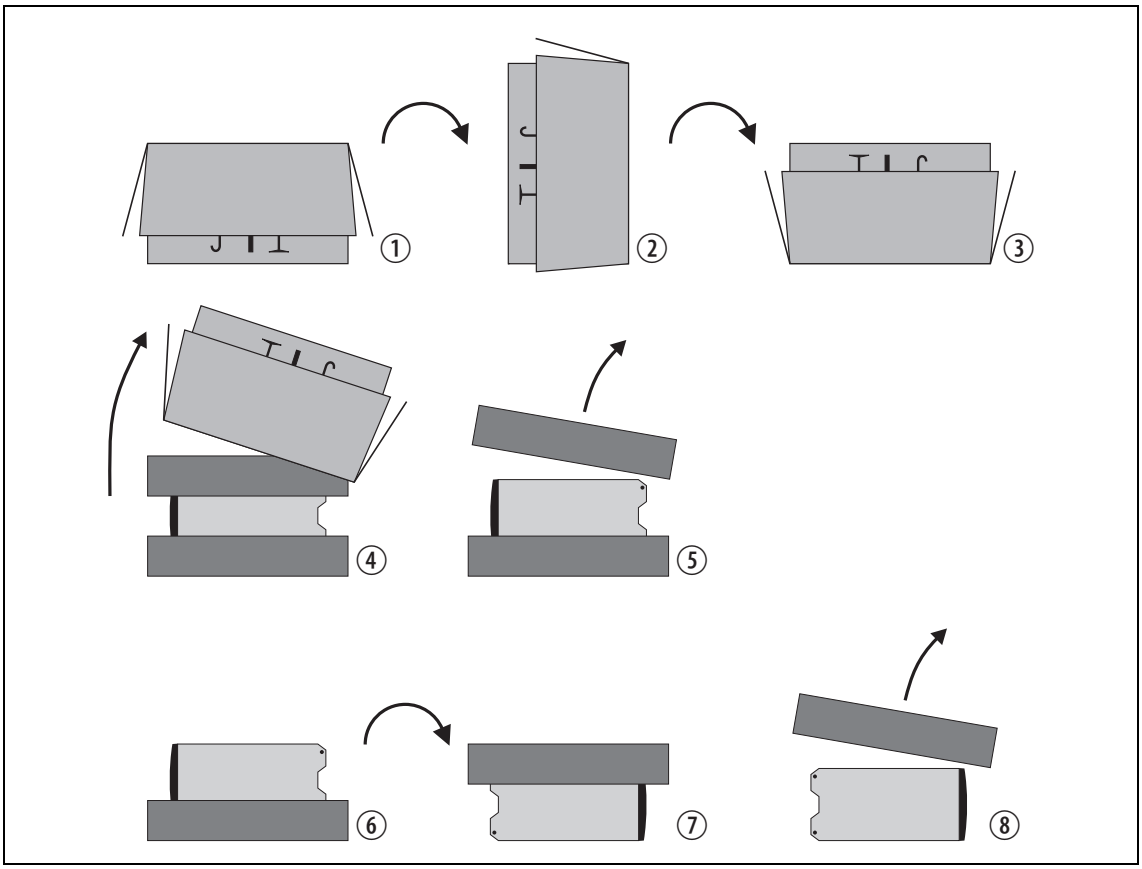
④ airflow exit path

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 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 112). 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 a landfill.

4.3 Identifying the Equipment

To identify the model and hardware configuration of the TB9300 modules, refer 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
	E = 174 MHz to 193 MHz	C1 band
	F = 216 MHz to 225 MHz	C3 band
	H = 330 MHz to 380 MHz	G4 band
	K = 400 MHz to 440 MHz	H1 band
	L = 440 MHz to 480 MHz	H2 band
	M = 470 MHz to 520 MHz	H3 band
	S = 400 MHz to 470 MHz	H5 band
	N = 762 MHz to 870 MHz[a]	K4 band
	T = 787 MHz to 788 MHz (receive)	K8 band
	T = 757 MHz to 758 MHz (transmit)	K8 band
	Q = 896 MHz to 902 MHz (receive)	L2 band
	Q = 927 MHz to 941 MHz (transmit)	L2 band
	U = 380 MHz to 420 MHz	H4 band
T01-01105-X**X**XX	A = standard	
T01-01105-XX**X**X	A = default	
T01-01105-XXX**X**	A = Series 1[b] B = Series 2	

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

b. The Series 2 reciter replaces the previous Series 1 and has a more capable CPU subsystem.

PA Product Codes

Product Code	Description	
T01-01136-**X**X**X**X	**Frequency Band** B = 136MHz to 174MHz E = 174MHz to 225MHz H = 330 MHz to 380 MHz J = 380MHz to 520MHz N = 757MHz to 870MHz[a] Q = 850MHz to 941MHz	**Tait Band Identifier** B1 band C0 band G4 band H0 band K2 band 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 K4 band TB9300 reciter is 762MHz to 776MHz and 850MHZ to 870MHz.
The actual frequency coverage in this band when used with a K8 band TB9300 reciter is 787MHz to 788MHz.

PMU Product Codes

H/W version 1 and 2 PMUs:

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

H/W version 3 PMU:

Product Code	Description
T01-01140-**X**XAA	A = AC module B = DC module
T01-01140-X**X**AA	A = AC only B = 12 V DC C = 24 V DC D = 48 V DC

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 WebUI
- 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 The RF output **must** be 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

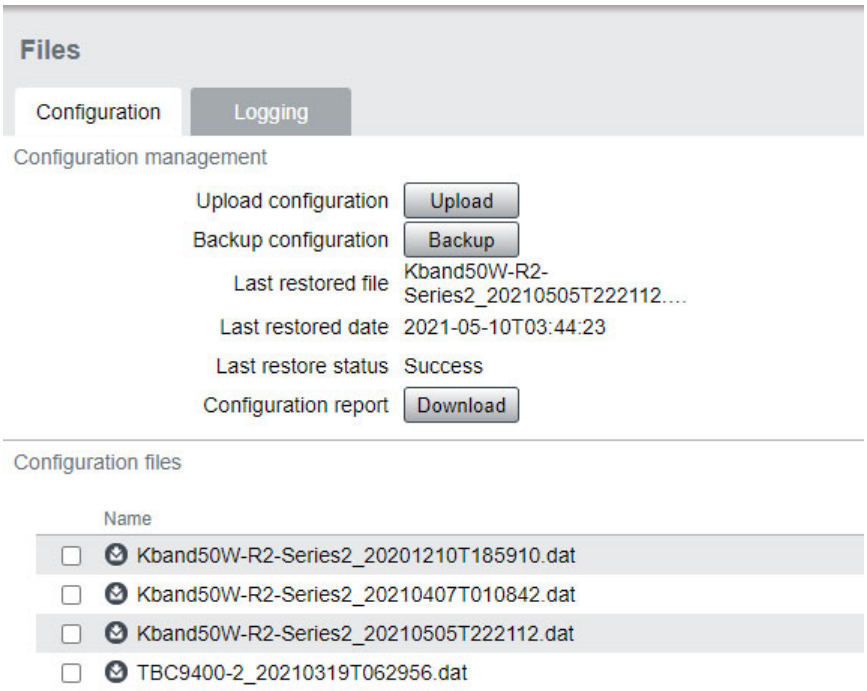
The following table provides an overview of the tests available using the WebUI. Refer to the Help for full details of these tests.

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

4.4.2 Working with Configurations

Configuration backup files contain sensitive information such as LDAP and RADIUS server settings, channel frequencies, and IP addresses. They must be kept confidential and protected from tampering.

The WebUI page under Tools > Files > Configuration allows you to manage your base station configuration. The base station can store up to 10 configurations internally.



New configurations are created on the base station and downloaded to your PC. They can also be transferred from one base station to another, and can be transferred from one firmware application to another.

When working with base station configurations, you can do the following:

- **Back up a configuration:** store a snapshot of the base station's current configuration
- **Upload a configuration:** copy 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. Uploading a configuration adds to the set of stored configurations but does not make that configuration active.
- **Restore a configuration:** make the selected configuration active
- **Download a configuration:** copy the selected configuration to your computer so that you can store it. To download a configuration file, click on the name of the saved configuration in the list of saved configurations.
- **Create a human readable configuration report:** download and save a text report of the base station's configuration settings. You can use it

to capture, view, review, and compare configurations.

Advice on Working with Configurations

Tait recommends creating a back-up of the current configuration before making significant configuration changes. A backed up configuration is added to the list of stored configurations on the base station.

When transferring configuration values between base stations, or from one firmware application to another, all configuration values are preserved.

To copy configurations between base stations, you can download the configuration file from the source base station, then upload and restore this to a new base station.

It is safe to restore configurations created under different base station firmware versions than the one currently operating. When restoring a configuration from an old version that does not contain values defined for all configuration parameters, any absent data values are set to their default.

The following parameters are not over-written when restoring a configuration from a different base station:

- Keypad enabled
- Secure shell (SSH) console access enabled
- Receiver number
- Host name
- Default channel
- Operating mode
- Front panel text 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 90 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.

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 firmware release. Note that if you downgrade and then upgrade firmware, configuration values for new features will generally disable the feature.

Default Configuration Parameters

The base station is delivered from the factory with a saved configuration containing factory defaults. The configuration is named something like `QBCS20CF_11.dat`.

The default configuration file is associated with DMR/MPT and serves as a starting point for when you need to create your own tailored configuration.

Base stations from the factory all have the same default configuration file. As a result, some settings will not be correct for your network. Frequency plan and alarm settings are examples.

For more information, please contact your local Tait dealer.

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 WebUI 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 WebUI 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 1.35 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 potential 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 will need to know the changed 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.

ⓘ The serial port uses the same password.

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 weak default passwords. For the sake of security, Tait **strongly** recommends changing the default password where applicable.

4.4.7 Tuning the Reciter

The following table indicates which bands are manually tuned and which are electronically tuned:

Band	Manual	Electronic
B2	✓	✗
B3	✓	✗
C1	✓	✗
C3	✓	✗
H1	✓	✗
H2	✓	✗
H3	✓	✗
H4	✗	✓
H5	✗	✓
K4	✗	✓
K8	✗	✓
L2	✗	✓
G4	✗	✓

B2 and B3 Bands
C 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 has shifted more than 2 MHz away from the previously set frequency, or if the RSSI level of the new frequency is more than 1 dB lower than the RSSI level of the previously set frequency.

The base station receiver signal level diagnostic (Diagnose > RF Interface > Signal Level) offers the ability to verify that the configured receiver frequency aligns with the receiver tuning.

When the frequency sweep is set to “Use calibrated noise source”, the resulting curve represents the receiver front end response, and provides a quick visual check of whether the receiver is optimally tuned. A well tuned receiver should have the maximum response at the operating frequency. See the online help for more details.

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

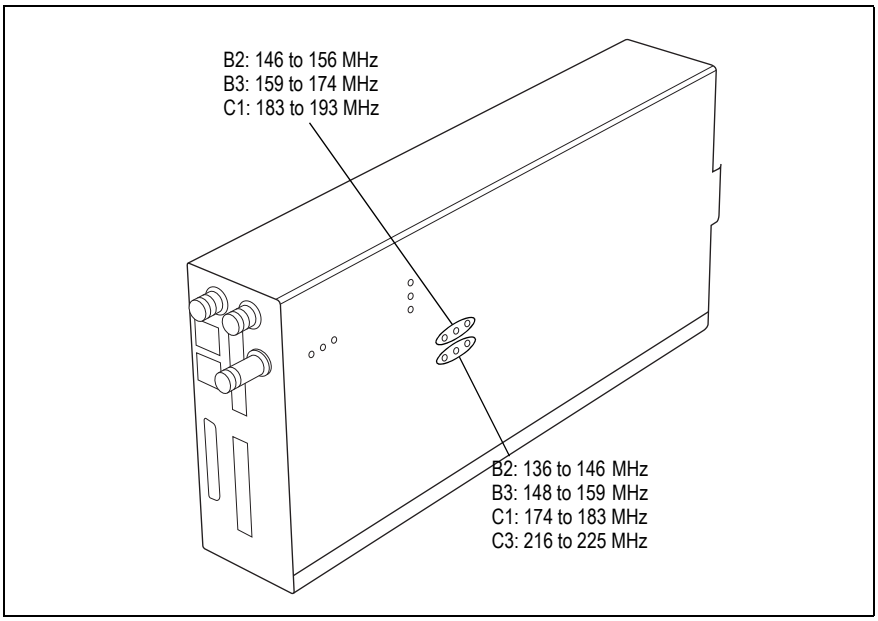
- B2 - 136 to 156 MHz
- B3 - 148 to 174 MHz
- C1 - 174 to 193 MHz
- C3 - 216 to 225 MHz

The B and C1 band frequencies are 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
- C1 - 174 to 183 MHz and 183 to 193 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 and C 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 "Local Connection to a Base Station" on page 93.

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.

Notice If you remove the reciter from the subrack, the RSSI reading, without having a PA connected, will be zero. To fix this, go to Configure > RF Interfaces > Channel Profiles, and disable 'Tx enable'.

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 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, turn the slug clockwise; for a higher frequency, turn the slug anti-clockwise.

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).

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.

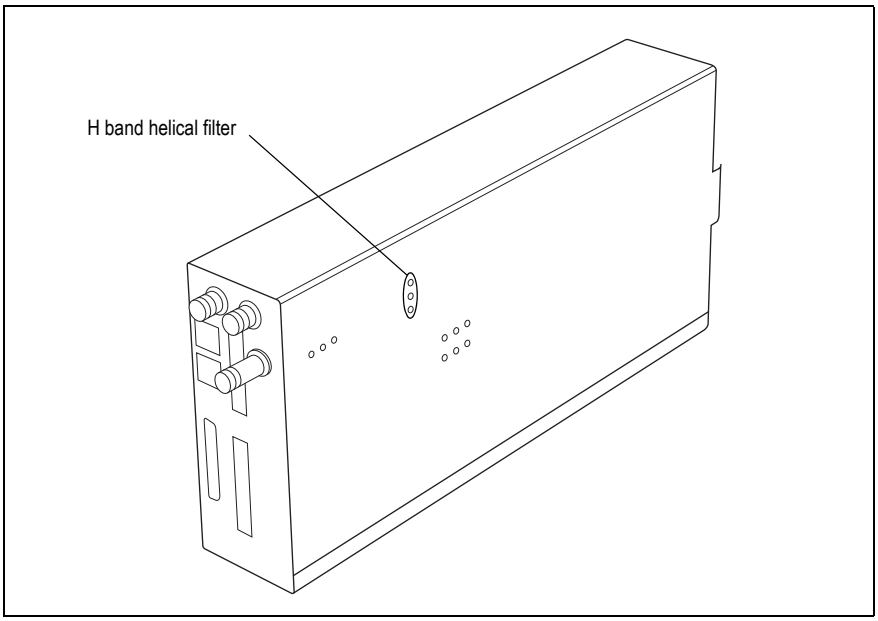
The receiver in the H band reciter covers one of the following frequency sub-bands, depending on the model:

- H1 - 400 to 440 MHz
- H2 - 440 to 480 MHz
- H3 - 470 to 520 MHz
- H4 - 380 to 420 MHz[2]

Each sub-band uses the same helical filter (shown in Figure 4.4 below). The bandwidth of the helical filter is approximately ±5 MHz.

1. Included in the TBA0ST2 tool kit. Also available separately as part number 937-00013-00.
2. The H4 band variant has no helical filter, so does not require tuning.

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 "Local Connection to a Base Station" on page 93.

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 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 either order). Each resonator should require approximately the same amount of adjustment when tuning.

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

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.

Electronically Tuned Reciters

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

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. 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.

4.5.2 Synchronization

For full Synchronization information, refer to the relevant Channel Group System Manual.

All Transceivers

All base station transceivers operating above 700 MHz require an external frequency reference for sufficient frequency accuracy.

Operating Frequency	Frequency Reference Input
VHF, UHF below 700 MHz	Not required
UHF above 700 MHz	Required

Channel Group Multicast

Channel group non-simulcast operation requires the following synchronization inputs:

Channel Type	Frequency Reference Input	1PPS	NTP
DMR conventional voted	Not required	Required	Required[a]

a. 1PPS and NTP must be GNSS sourced (coherent).

Channel Group Simulcast

Simulcast operation requires frequency reference input, 1PPS and NTP derived from GNSS.

Simulcast Channel Type	Frequency Reference Input	1PPS	NTP
DMR conventional / trunked	Required	Required	Required

4.5.3 Equipment Required

It is beyond the scope of this manual to list everything required. However, the following tools and equipment 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.

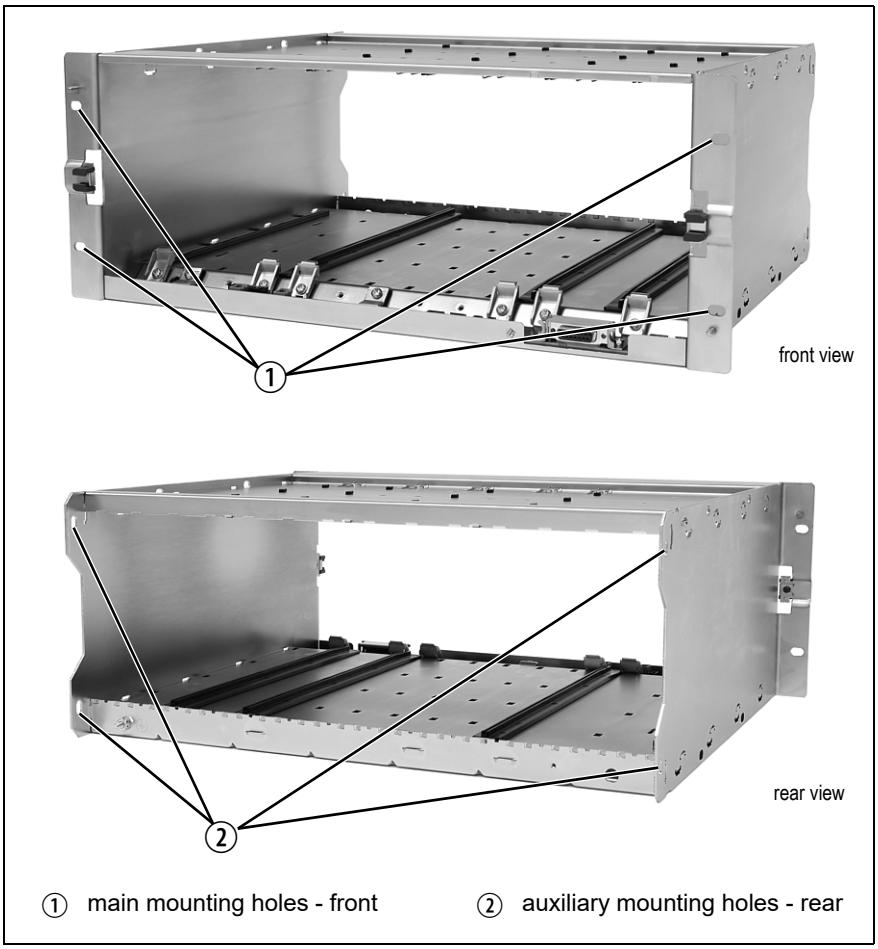
Base Station Calibration Test Unit & Cable

The Base Station Calibration Test Unit supports test and diagnosis. It is available for order under **TBA0STU**. It contains a breakout box, tone source and speaker.

4.5.4 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 112). In all cases follow safe lifting practices.

Figure 4.5 Subrack mounting points

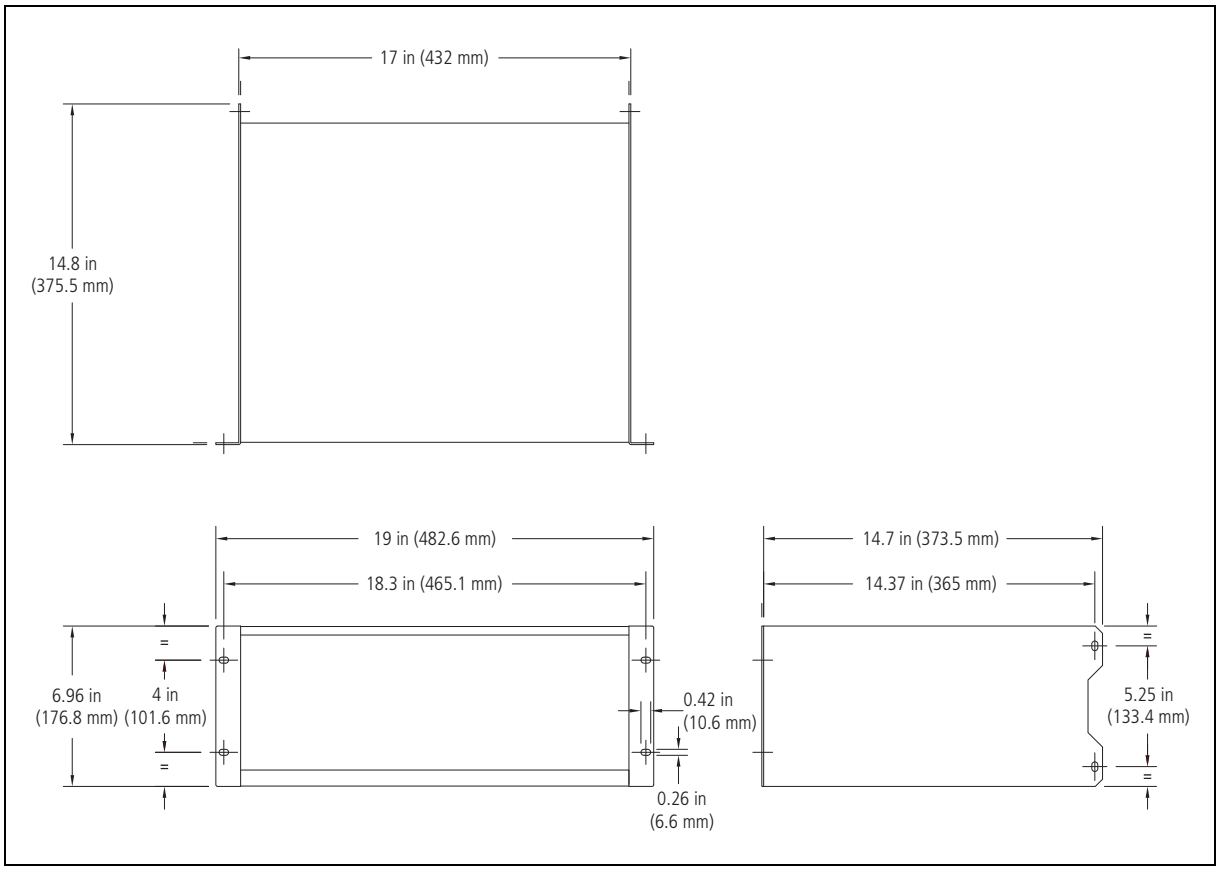


1. Remove the front panel, as described in "Preliminary Disassembly" on page 113.
2. Fit the subrack into the cabinet or rack and secure it firmly with an M6 (0.25 in) screw, flat and spring washer in each of the four main mounting holes ①, as shown in Figure 4.5.

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.

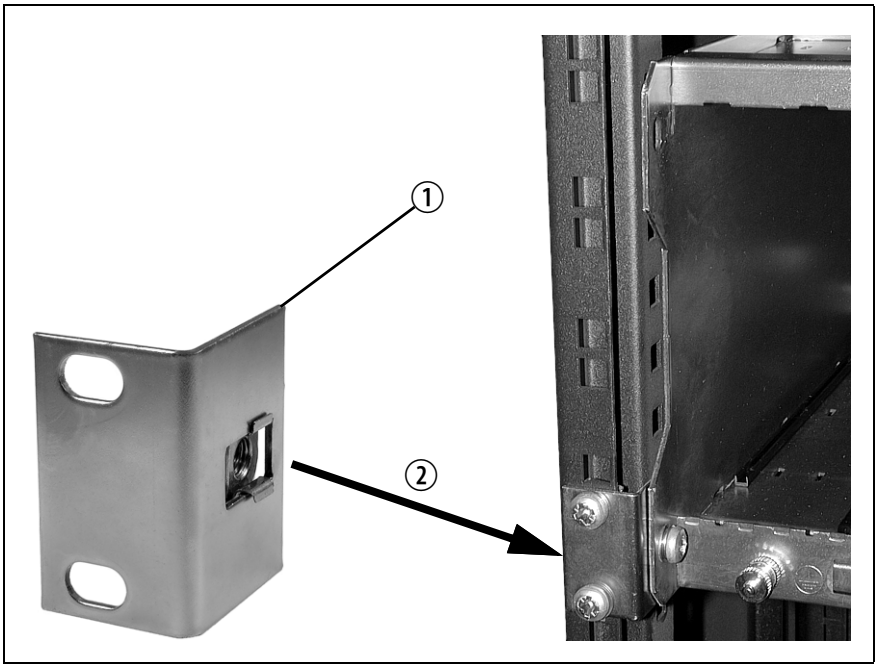
Figure 4.6 Subrack dimensions



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 directly 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.

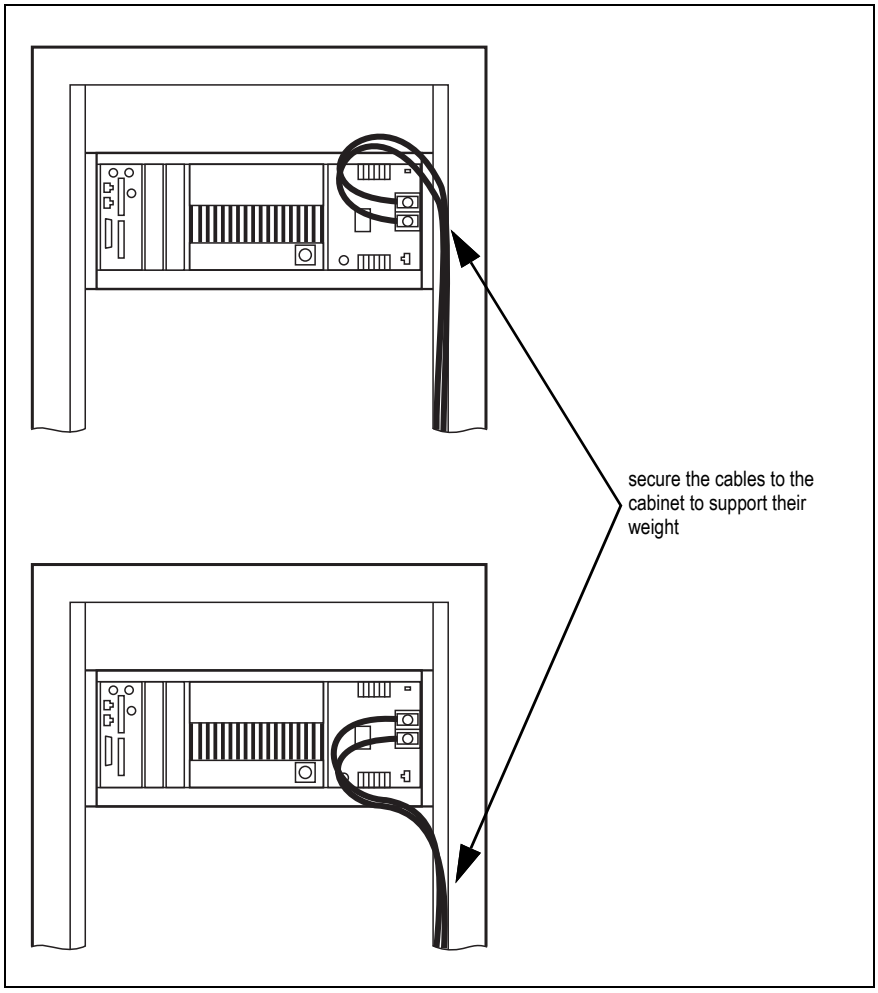
DC Power Cabling

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

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

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

Figure 4.8 DC power cabling



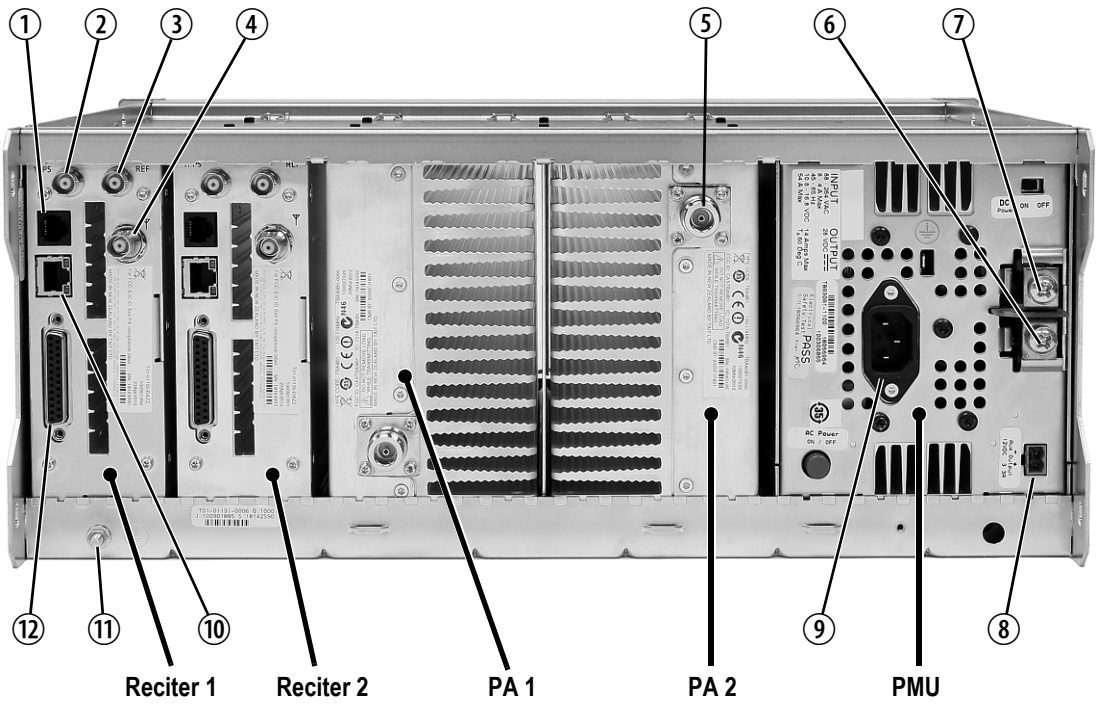
4.6 Connecting Up the Base Station

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

4.6.1 Connection Overview

The connections at the rear of a dual 50 W base station are identified in Figure 4.9. External connections are all located at the rear of the subrack.

Figure 4.9 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.

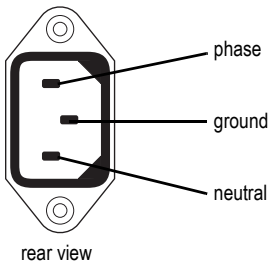
4.6.2 Connecting AC Power

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

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

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

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



4.6.3 Connecting DC Power

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

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

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	8 AWG / 10 mm^2
24 VDC	20 VDC to 33.6 VDC	30 A	10 AWG / 6 mm^2
48 VDC	40 VDC to 60 VDC	15 A	12 AWG / 4 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 3% voltage drop over 4.6m (15ft) at the expected maximum current.

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. The auxiliary power supply is permanently on as soon as the base station has finished powering up, and is available from the auxiliary output connector on the rear panel.

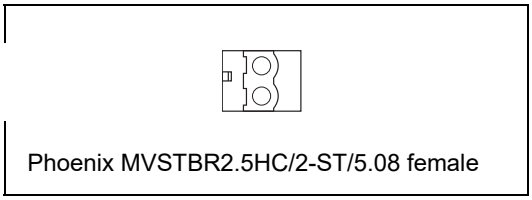
You can connect multiple auxiliary power supply boards in parallel for redundancy purposes, or to provide an output greater than 40 W. Although no active current sharing is used, auxiliary boards connected in parallel will current-share before reaching their power limit. The failure (or switching off) 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 123 for the pin allocations).

Figure 4.10 Auxiliary DC power connector



Note that on H/W version 3 PMUs, the auxiliary DC power connector has been rotated 180°.

H/W Version 3 PMUs - Auxiliary Voltage

On H/W version 3 PMUs, the auxiliary voltage is selected by moving a jumper next to the output connector at the rear. The user can set the voltage to 12 V, 24 V or 48 V.

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 79).

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

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.

Notice An external reference is required for simulcast operation.

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 BNC goal post adaptors (see Figure 4.12). The maximum overall cable length is 30 m. Terminate the last connection (including single base stations) with a 50Ω load.

Figure 4.11 Daisy-chaining an external frequency reference input

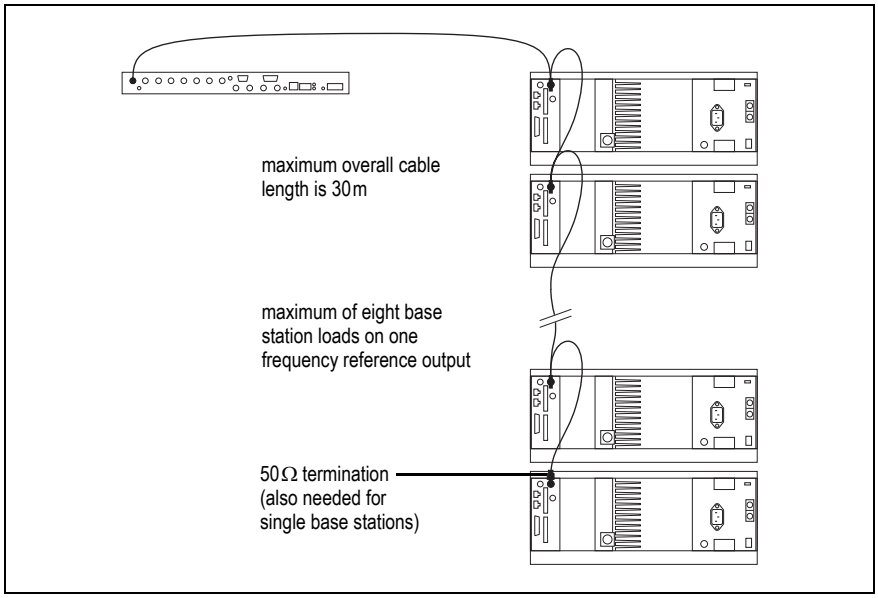


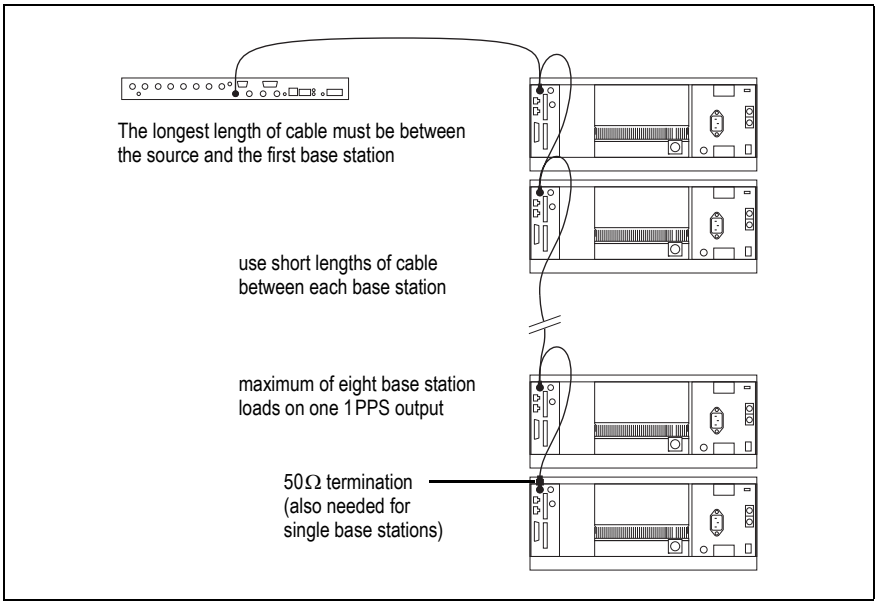
Figure 4.12 BNC goal post adaptor (part number 240-06913-00)

4.6.7 Connecting a 1 PPS Source

A 1 PPS signal is required for simulcast base stations. Use a 50 Ω 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 BNC goal post adaptors (see Figure 4.12). 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 with a 50 Ω resistor, otherwise reflections of the 1PPS pulse may occur.

Notice If 1PPS is used then 1PPS and NTP must both be derived from the same time base. Normally this will be a GPS disciplined source.

Figure 4.13 Daisy-chaining a 1 PPS input



4.6.8 Ethernet Connection

The RJ-45 socket on the reciter's rear panel provides the 10-BASE-T or 100-BASE-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 WebUI 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 firmware are scaled to meet the performance requirements for processing multiple voice streams along with supervisory control and management communications. 10 Mbit/s is ample for these requirements. The 10/100 Mbit/s setting is provided for compatibility reasons, but with a 100 Mbit/s rate and high traffic conditions at the reciter, small windows of internal buffer overflow may occur. These overflows cause 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 123 for a list of Ethernet connection pin allocations.

4.6.9 Connecting General Purpose Inputs and Outputs

General purpose inputs and outputs are connected via the DB-25 connector on the rear panel of the base station.

Analog line operation requires reciter hardware version 1.01 or later. Reciters with hardware version 1.0 can be upgraded to version 1.01 at a Tait service centre. Contact your Tait dealer for details.

The existing Tx key and Rx gate signals are sufficient for balanced audio interconnection with connecting equipment compatible with 5V TTL level signaling. Tait also offers an isolation adapter that provides E&M isolated signaling (order number TBC101A).

It is recommended that E&M isolated signaling be used in the following situations:

- Locally connected equipment that is not 5V TTL signaling compatible
- There is significant distance between connected equipment, and voltage transients could cause equipment damage

From V3.40.00, unbalanced audio in and out are supported.

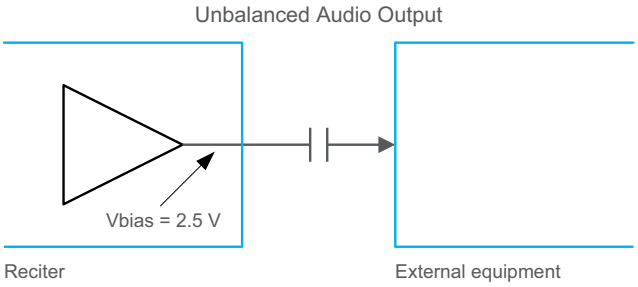
Unbalanced Audio In - pin 5

The unbalanced audio input is AC coupled via a 10uF capacitor. Any DC offset that may be present on an audio signal used to modulate the base station transmitter is blocked by this capacitor.

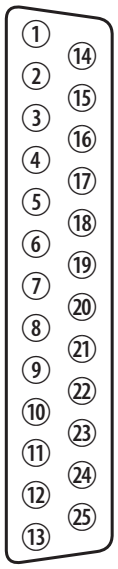
Selecting extended bypass mode will DC couple the unbalanced audio input path. **Note:** a license is required to enable selection of extended bypass mode.

Unbalanced Audio Out - pin 3

The unbalanced audio output is DC coupled and has a 2.5V DC offset. For most applications users should AC couple this output to the external equipment. For example, a 10 µF capacitor should be suitable.



The pin allocations for the DB-25 connector are given in the following table:



external view

Pin	Signal Name	Signal Type	Notes
1	balanced audio out +	output	Transformer isolated line
2	balanced audio out -		
3	unbalanced audio out	output	DC coupled - see information on previous page
4	ground	ground	
5	unbalanced audio in	Input	AC coupled
6	balanced audio in +	input	Transformer isolated line
7	balanced audio in -		
8	RSSI indication	output	
9	Rx gate	output	
10	Tx key	input	
11	digital i/o 1 custom alarm 1	input/output	Configurable as a digital input for TaskBuilder or a custom alarm input. 5V TTL logic active state configurable (active high vs. active low).
12	digital i/o 2 custom alarm 2		
13	+5.2VDC output	power output	Maximum current 200mA
14	digital i/o 3 custom alarm 3	input/output	Configurable as a digital input for TaskBuilder or a custom alarm input. 5V TTL logic active state configurable (active high vs. active low).
15	digital i/o 4 custom alarm 4		
16	digital i/o 5 custom alarm 5		
17	digital i/o 6 custom alarm 6		
18	digital i/o 7 custom alarm 7		
19	digital i/o 8 custom alarm 8		
20	digital i/o 9 custom alarm 9		
21	digital i/o 10 custom alarm 10 / Rx disable		Configurable as a digital input for TaskBuilder, a custom alarm input or as the input for the Rx disable function. 5V TTL logic active state configurable (active high vs. active low).
22	digital i/o11 custom alarm 11		Configurable as a digital input for TaskBuilder or a custom alarm input. 5V TTL logic active state configurable (active high vs. active low).
23	digital i/o 12 custom alarm 12		
24	digital out 13 antenna relay	output	Configurable as a digital output for TaskBuilder or to drive the antenna relay with simplex operation. Cannot be configured for both at the same time.
25	ground	ground	

4.6.10 Setting Up Simplex Operation

Simplex operation allows the base station to use one antenna to either transmit or receive, so the base station cannot transmit and receive at the same time. A coaxial relay switches an antenna between base station receive and transmit automatically.

Simplex operation is supported by analog conventional mode using DMR firmware.

In single frequency simplex, only one physical radio frequency is used.

700 MHz operation requires separate receive and transmit frequencies. While simplex operation is possible, single-frequency simplex is not.

Simplex operation applies to analog, FM and P25 conventional mode with any conventional line interface: analog line, DFSI, console gateway.

Simplex operates in a single base station context, and simulcast and non-simulcast channel group operation.

When the base station is transmitting, the receiver is disabled.

Pin 24 in the 25-way D-range is configured as the relay driver. Refer to Connecting General Purpose Inputs and Outputs for pin-out information.

Warning **Switching the PA output while it is operating can damage the PA. It is essential to use a relay that meets the 30 ms operating time specification.**

Warning **When the base station is in simplex mode using a single antenna with a coaxial changeover relay, the isolation of this relay must be >40dB to avoid damage to the receiver.**

The relay operating time interacts with the base station transmit buffer. Once a transceiver begins receiving a transit stream, it will not begin transmitting that signal until the relay operating time has passed. To avoid any confusion, you must allow at least this much time in the transmit buffer setting (Tx delay for non-simulcast operation, and marshalling duration for simulcast operation).

Tait offers an Antenna Relay Kit TBCA03-10, which comes complete with installation instructions (402-00119-01).

Configuration

Configure > Base station > Programmable I/O “Antenna relay control” check box.

5 Working with Base Stations from Your PC

The web browser on your PC provides a window into the TB9300 base station. Use it to connect to the base station so that you can monitor, configure, diagnose, and calibrate it (if required).

This section describes the following:

- Connecting to the base station, including initial setup
- Working with base station web pages
- Carrying out basic tasks

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

5.1 PC Recommendations

We recommend the following PC hardware and software for connecting to a TB9300 base station:

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

5.2 Connecting your PC to the Base Station

You connect to a base station using your web browser. You can view multiple base stations at once by using multiple browser windows or tabs. Base stations have a web-based interface that provides the pages you view. Up to ten users may be logged in to a base station at once.

When loading the WebUI with Internet Explorer, the web page may go blank. To fix this, refresh the page with the ‘F5’ key.

The base station has three different user access levels:

- Administrator
- Maintainer
- Monitor

Passwords can be defined for each level. This is done using the base station's WebUI (Tools > Tools > User Administration). Refer to the base station Help for more information on setting user access levels.

Connections to the base station can be authenticated by a remote (i.e. centralized) service. Refer to "Setting Up Authentication" on page 95 and the base station Help for more information.

5.2.1 Logging In

1. Enter the base station's URL into your browser using a secure connection (https://). To find out the base station's IP address, on the front panel select Modules > Reciter 1 (or 2) > View Reciter 1 (or 2) Address. To set the IP address, refer to "Setting the IP Address" on page 92.

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

2. A security warning appears when you connect for the first time. Proceed anyway (refer to "Security Certificates" on page 93).

3. The login screen appears.

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

5. Click Login.

   Notice After logging in we recommend that you change the password and username for your own security (refer to "Working with the Web Interface" on page 96). Make sure that you store your passwords and usernames securely and do not lose them. They may be needed by Tait support personnel if assistance is required. **Tait cannot retrieve forgotten passwords.**

5.2.2 Setting the IP Address

Before the base station is installed on site, you need to provide it with its proper IP address. Make sure that you do not lose this address. A quick way to set the base station's IP address is to use the front panel, as described below.

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

Notice If the base station is online when changing the IP address, it is possible that the base station will restart. Tait recommends that all configuration changes are made after taking the base station offline.

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

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

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

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

5.2.3 Security Certificates

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

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

5.2.4 Local Connection to a Base Station

Using a computer on site normally requires the computer to have an IP address that is compatible with the sub-netting and routing used by the communications network. Additionally, you may need to connect to a reciter after removing it from service. In either case, you may have to change your computer IP address configuration.

To connect the base station to your computer, ensure that your computer is part of the same subnet as the base station, or has a route to it. Refer to your operating system provider's help for further information on how to do this.

Base stations leave the factory with default IP address: 192.168.1.2, Subnet mask: 255.255.255.0. If your base station will not connect to your PC, contact your local Tait dealer.

You may need to temporarily disconnect a networked PC from its LAN in order to establish a direct connection with the base station. A physical connection is needed as well as an alternate or temporary IP address and subnet mask.

5.2.5 Troubleshooting Connection Problems

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

1. Your PC is part of your organization's LAN and does not belong to the same subnet as the base station. Give the PC a suitable IP address and subnet mask as described in "Local Connection to a Base Station" on page 93.

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

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

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

4. A connection error may occur if your PC is using the organization's web proxy, but the base station doesn't have a valid gateway address allowing it to send responses back to that proxy. Users should ensure that all network parameters are correct (IP address, network mask and gateway address). You may have to bypass the proxy in your organization's LAN to access the Tait Network. Ask your system administrator to give you access.

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

5.2.6 Finding a Lost or Forgotten IP Address

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

1. Mount the reciter in a TB9300 subrack and fit the front panel. Power up the subrack.

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

5.2.7 Setting Up Authentication

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

> **Notice** Only people experienced with the AAA architecture and authentication protocols should make changes to the authentication settings.

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

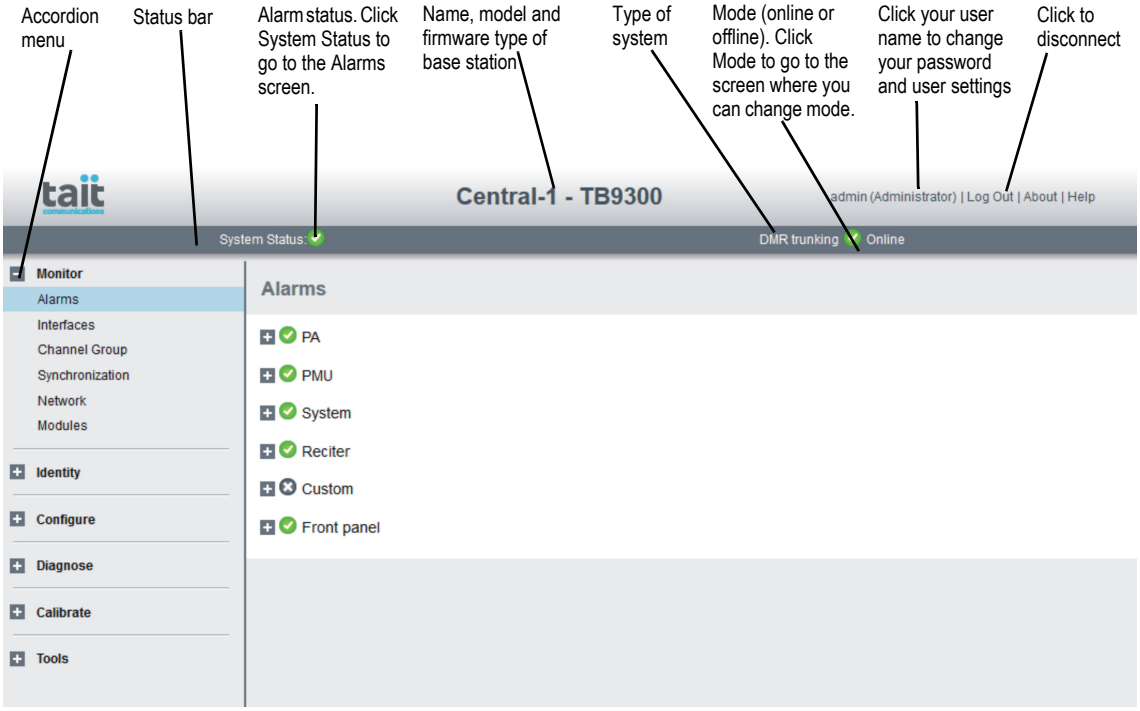
- Less work is required to manage password-controlled access to all base stations in a network; you no longer need to change the password in each base station individually
- Previously used passwords may be excluded from re-use
- Access can be denied after a set number of incorrect passwords is entered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

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

5.3 Working with the Web Interface

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

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



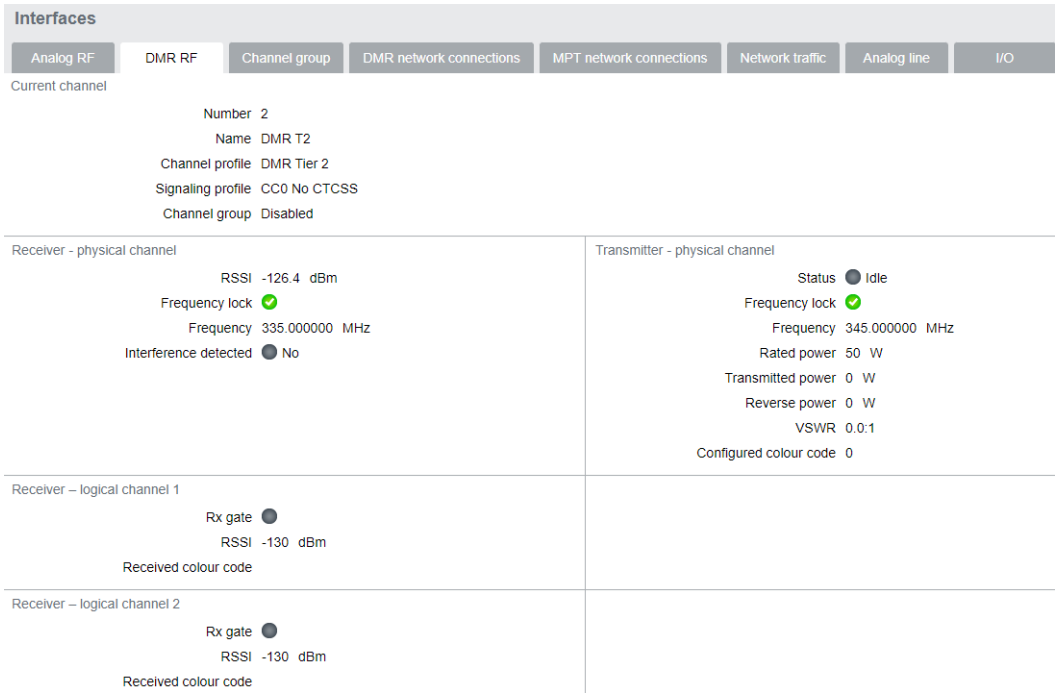
The accordion menu on the left gives you access to the various pages. Click a top level item (such as Configure) to open up its menu. Click on a menu item to display its page, then click on the appropriate tab on that page to display the required information. Click the + icon (⊞) on a menu item to expand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

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

■

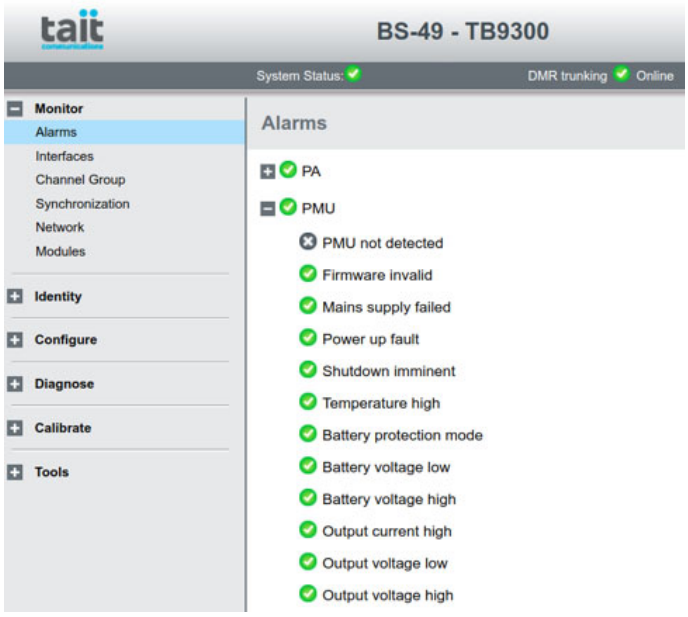
5.3.1 Monitoring Operation

Use the monitoring pages, to see how the base station is currently operating. For example, you can see the status of its RF interface if you navigate to Monitor > Interfaces > DMR RF.



5.3.2 Troubleshooting Alarms

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



5.3.3 Viewing Configuration Settings

The base station has many configuration settings that personalize it for its particular role in the network. Some settings, such as alarm thresholds (Configure > Alarms > Thresholds), always apply.

Others are channel-based, so they can be dynamically changed. To view these, you must first know which channel the base station is using.

To see the channel number and profiles the base station is using, navigate to Monitor > Interfaces > Analog RF or DMR RF.

Channels can be edited from Configure > Base Station > Channels. To edit a channel, select it from the table and then click the Edit button.

5.3.4 Viewing the Base Station and Network Identity

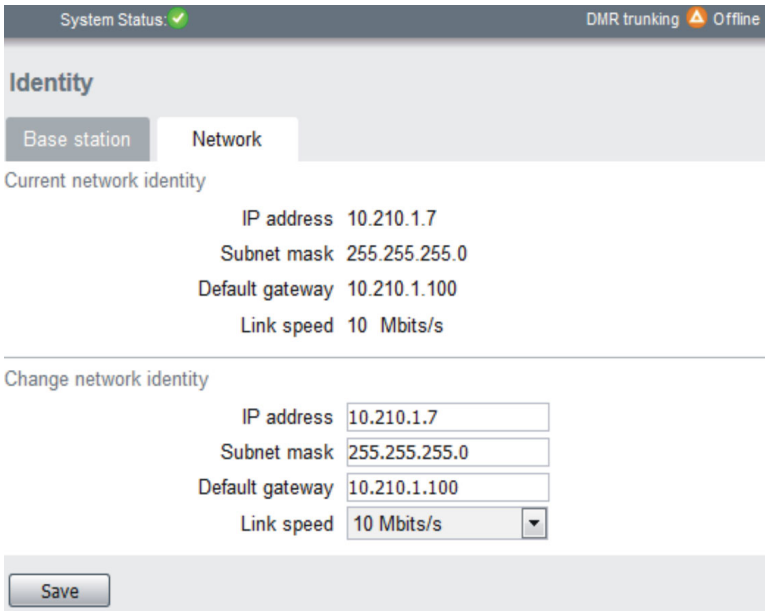
Base Station Channels

Channels can be edited from Configure > Base Station > Channels. Select a channel and click Edit to view details of the channel. Clicking directly on any text in a line will also open the edit screen.

Base Station Identity

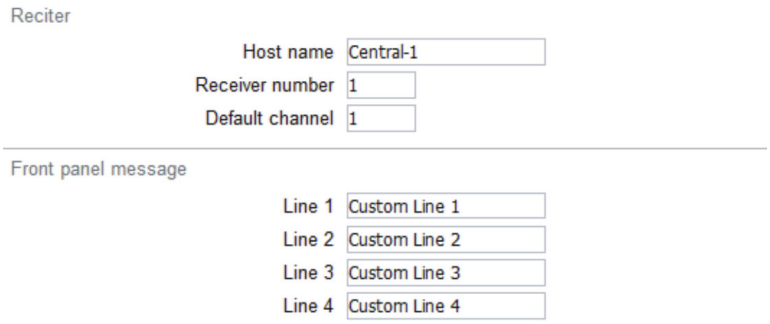
Each base station in a network has a unique base station and network identity.

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



The Link speed configuration option enables the Ethernet port speed to auto-negotiate either 10/100 MBits/s or a 10 Mbits/s maximum. Under high traffic conditions it is possible for traffic arriving at the reciter at the full rate (100 Mbits/s) within a small timing window to overflow internal buffers and therefore suffer packet loss. To minimize this packet loss, a setting of 10 Mbits/s is recommended.

Enter here the four lines of information you want to appear on the home screen on the front panel display.



5.4 Basic Tasks

5.4.1 User Settings

Click on your user name in the top right corner of the page to change your password. Note that this information is stored in the base station, not in your browser.

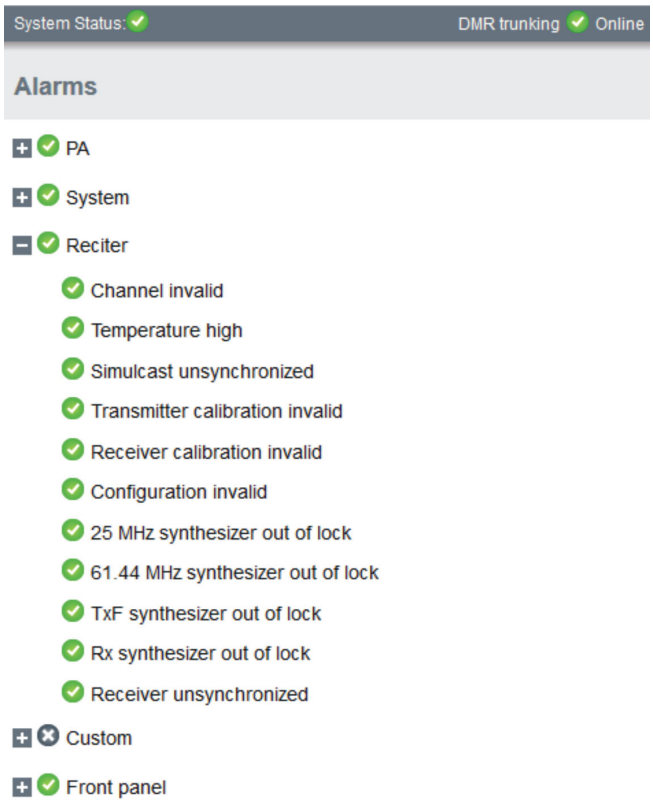
5.4.2 Taking the Base Station Offline

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

1. Click Mode on the status bar (or Select Tools > Settings > Base Station).
2. Under Mode, select Offline. Click Offline to confirm the change. In the Status area, the Mode display changes first to `Changing`, and then to `Offline` ( ).

5.4.3 Troubleshooting Alarms

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



5.4.4 Disabling the Front Panel Keypad

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

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

5.4.5 Updating Firmware

The base station supports two methods of updating base station firmware. The WebUI page Tools > Firmware > Upload/Download allows you to upload base station firmware directly from your PC to the base station, or download firmware files to the base station from a web server.

Uploading firmware is covered in 5.4.6 Firmware Upload

Downloading firmware is covered in 5.4.7 Downloading Firmware from a Package Server

Before Uploading or Downloading

- Back up your data off the base station. If the activate process fails, there could be a risk of the configuration database being corrupted. Give the backup file a user-friendly name (incorporating, for example, the site ID, date and time) so it can readily be identified.
- If the base station has two firmware packages displayed on the Tools > Firmware > Activate page, the update will replace the inactive package

Reciter Hardware

Beginning with firmware release 3.10, there are two different reciter series, which have different executable files. You can find out the reciter series, 1 or 2, on the WebUI Monitor > Modules > Module details page. Firmware files for Series 1 & 2 hardware have different file extensions. The differences are summarized in the tables below.

File Locations

The Windows installer by default places firmware files in the following location:

```
C:\Program Files (x86)\Tait Applications
```

For Linux computers, firmware is supplied in Zip files with the structure described here. Install in a directory of your choice.

Reciter Series 2 Files and Extensions

		Direct Upload		
Release	**Application**	**Folder**	**Files[a]**	**Choose Firmware from folder**
3.10 and later	DMR/MPT	BaseStation\feeds	dmr-bin-n.nn.nn.nnnn.**dmr.tbc02**	BaseStation

a. File extensions differ between Series 1 & 2 files. When you [Upload] a file, the base station chooses a file extension filter that reflects your hardware and the selected firmware type.

Reciter Series 1 Files and Extensions

		Direct Upload		
Release	**Application**	**Folder**	**Files[a],[b]**	**Choose Firmware from folder**
3.10 and later	DMR/MPT	BaseStation\feeds	dmr-bin-n.nn.nn.nnnn.**dmr.tbc**	BaseStation
3.05 to 3.09	DMR/MPT	BaseStation\feeds	dmr-bin-n.nn.nn.nnnn.**tbc**	BaseStation
3.00, 2.60	DMR/MPT	TB9300\feeds	dmr-bin-n.nn.nn.nnnn.**tbc**	TB9300
pre - 2.60	TB9300, TB7300	TB9300\feeds	dmr-bin-n.nn.nn.nnnn.**tbc**	TB9300

a. File extensions differ between Series 1 & 2 files. When you [Upload] a file, the base station chooses a file extension filter that reflects your hardware and the selected firmware type.

b. The file extension for Series 1 binaries changes in version 3.10. If upgrading from older releases, choose ‘All Files (*.*)’ in the [Upload] file picker dialog.

5.4.6 Firmware upload

The Upload button allows you to select a file to upload from your computer or network location.

5.4.7 Downloading Firmware from a Package Server

See 5.4.5 Updating Firmware for information about file locations and extensions.

While Tait recommends uploading firmware directly to the base station, the base station also supports downloading firmware files from a package server (web server).

5.4.8 Activating New Firmware

Activating firmware causes the base station to reboot, and then start back up in offline mode. The base station will then have to be manually put back online.

The WebUI page Tools > Firmware > Activate allows you to review the two firmware packages stored on the base station and activate the one that is presently inactive.

The base station can remain online while doing upload or download, minimizing any outage time for activation.

Two firmware package slots allow for the separation of the upload and download procedures from the activation itself. This minimizes outage time when upgrading the firmware.

After activation, the retained, but now inactive firmware allows the user to quickly revert versions, if necessary.

Upon activation, the base station will reboot and come up with the firmware that has been activated.

5.4.9 Working with Configuration Files

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

The following parameters are not restored on a base station when a configuration is restored:

- Keypad enabled
- Trunking capability
- Trunking control channel priority
- Host name
- Default channel
- Operating mode

- Front panel text lines 1 through 4
- IP address
- Subnet mask
- Gateway address
- Link speed
- SSH enabled

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

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

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

5.4.10 Setting Up Custom Alarms

Each of the base station's 12 digital inputs can be used to raise a custom alarm when the input goes high or low. The Custom Alarms page (Configure > Alarms > Custom Alarms) allows you to assign a name to each custom alarm.

The active state of the inputs (active high vs. active low) is configured on (Configure > Base Station > Programmable I/O)

Custom alarms are reported via the WebUI and SNMP traps.

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

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

Major

An alarm of this severity causes the node to take a base station out of service. This alarm **must** be cleared at the base station before the channel

will be used again. To avoid this, an alarm's severity **must** be set to 'Minor' or 'Notification'.

Minor An alarm of this severity means the base station has a fault that will need addressing, but it remains capable of operating as part of the radio network.

Notification An alarm of this severity is not reported to the node.

5.4.11 Subaudible Signaling

The purpose of CTCSS and DCS signaling is to reject transmissions from radios that do not belong on the network.

Use of 250.3 Hz and 254.1 Hz CTCSS tones

The receiver has a known issue where reverse tone burst signaling on CTCSS tones of 250.3 Hz and 254.1 Hz can briefly trigger the other detector. D**o not use both tones in the same network. I**f using either tone, be aware that there is a risk of falsing if co-channel transmissions are using the other tone.

5.4.12 Checking for Interference on a Receive Channel

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

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

5.4.13 Single or Channel Group Base Stations

Base stations can operate singly, or as part of a simulcast or voted channel group. Channel group operation is enabled in the channel group profile: (Configure > Channel Group > [*name*]), and the channel group that is in-use is selected in the channel table (Configure > Base Station > Channels > [*name*]). For more details, see the DMR Simulcast and Voted Channel system manual.

5.4.14 Marshaling or Transmit Delay

As an IP connected base station, transmitters must buffer the signal to be transmitted so that variations in delay in the IP network do not cause the transmitter to underrun.

Non-simulcast channels use a configurable transmit delay. The amount of transmit delay required varies with the QoS (specifically jitter) of the IP transmission network.

Transmitters in a simulcast channel must all begin transmitting simultaneously, therefore the configured value of the marshaling duration must allow for the worst case of network delay, including delay variation (jitter).

The table below provides a summary of where to configure transmit or marshaling delay:

See the base station help for more information on configuring transmit or marshaling delay (MBC-00006-xx).

Channel type	Configured value	Notes
Single base station, DMR (conventional, trunked)	Configure > Network Interfaces > DMR Network	Rounded up to 60 ms
Single base station, MPT	Configure > Network Interfaces > MPT Network	Rounded up to 60 ms
Simulcast channel, DMR (conventional, trunked)	Configure > Channel Group [name] > Synchronized – network > Fixed duration	Rounded up to 60 ms
Non simulcast voted channel, DMR (conventional, trunked)	Configure > Channel Group [name] > Unsynchronized local Tx delay	Rounded up to 60 ms

5.4.15 Uploading Firmware to the Base Station

To upload firmware directly from the base station, go to Tools > Firmware > Upload/Download.

5.4.16 Configuring Single Base Stations

It is possible to operate the base station as a single base station that is not part of a channel group (for example, trunked, non simulcast, or as a conventional single repeater). The following explains the special considerations when configuring single base stations.

Channel Group Membership

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

Channel Group IP Address

Set the channel group to 'disabled'. Specify 127.0.0.1 as the channel group IP address. This is the base station's localhost address and stops it from attempting to send voice packets to other base stations.

Marshaling Duration

Single base station operation should not require marshaling. Channel group and simulcast operation have no meaning for a single transceiver.

It is recommended to leave Tx Delay at the value of 40 ms for single base station operation.

Network Interface (DMR/MPT Software)

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

5.4.17 Configuring Receive-Only Base Stations

To configure the base station as receive-only, the transmitter used within the channel profiles needs to be off. To turn off the transmitter, navigate to Configure > RF Interface > Channel Profiles. With the transmitter off, the base station can even operate without a PA. If the PA is absent, it is good practice to turn off any PA related alarms. If your base station has been ordered as receive-only, it has been pre-configured with the transmitter disabled. Transmit information for the receiver will be displayed in the WebUI, but this can be ignored. Some polled SNMP parameters will return the correct transmitter configuration data, but none of these parameters are used by the receiver.

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 WebUI:

- VSWR and/or reflected power
- DC input voltage, especially on transmit
- Any temperature alarms
- Forward power

Simulcast

- External reference absent
- NTP unsynchronized
- 1PPS
- Simulcast Unsynchronized

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 - a GPS-derived frequency reference is recommended.

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. In addition, 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 55 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 WebUI 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 WebUI to put the base station in Online mode
Alarm LED flashing	One or more faults are present	Use the WebUI 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 DB-25 connector is pressed in fully. Use the WebUI to check reciter 1 (Monitor > Modules > Inventory).
Power LED on front panel is on, but keypad does not work	Keypad is disabled	Check that the keypad is enabled in the WebUI (Configure > Base Station > Miscellaneous)
Power LED flashing, fans are running, but display is blank	The base station is downloading firmware	Use the WebUI 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 DB-15 plug on front panel	Replace or repair DB-15 plug
Desired feature is not operating	Feature licence missing	Check that you have the necessary feature licenses (refer to “Licenses” on page 24 and the Help)
	Feature licence present but feature is not enabled	Use the WebUI 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 WebUI 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 6.6 lb (3.0 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 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. See Working with Configuration Files for more information.

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 other modules in the subrack.

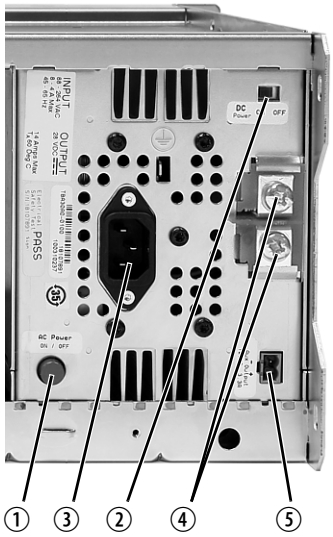
> **Notice** Before removing a PA, disconnect the DC input and RF input first, followed by the RF output. After refitting the PA, reconnect the RF output first, followed by the RF input, and then the DC input.

Disconnecting the Power

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

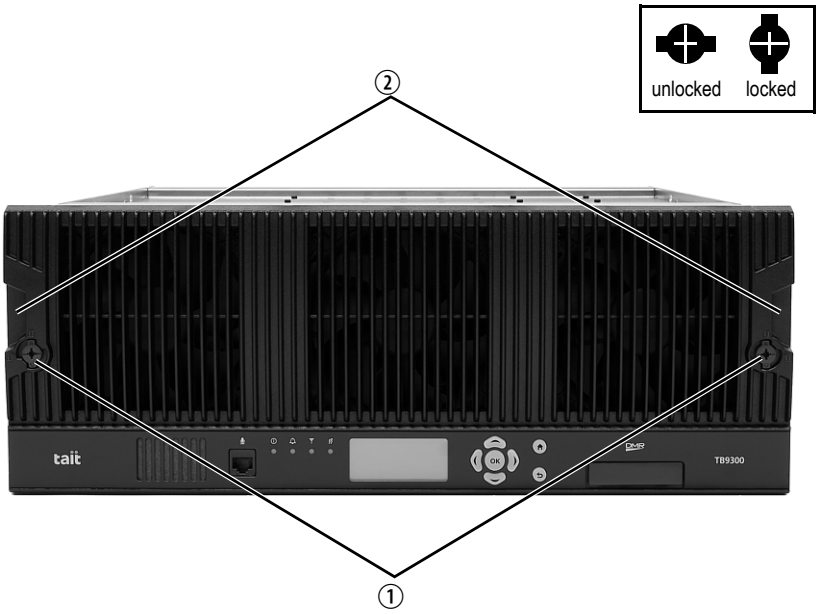
> **Caution** Before disconnecting the battery supply leads from the PMU, open the circuit breaker or disconnect the supply leads from the battery.

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.

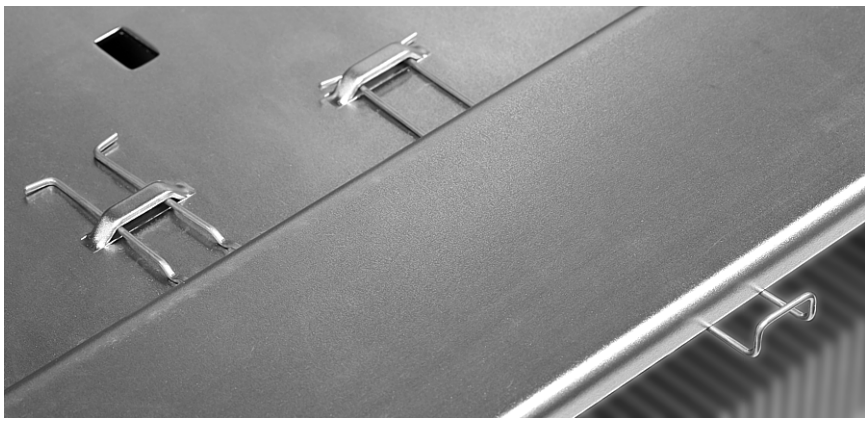


2. Place a finger in the recess ② provided at each end of the front panel and pull the front panel away from the subrack.

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.

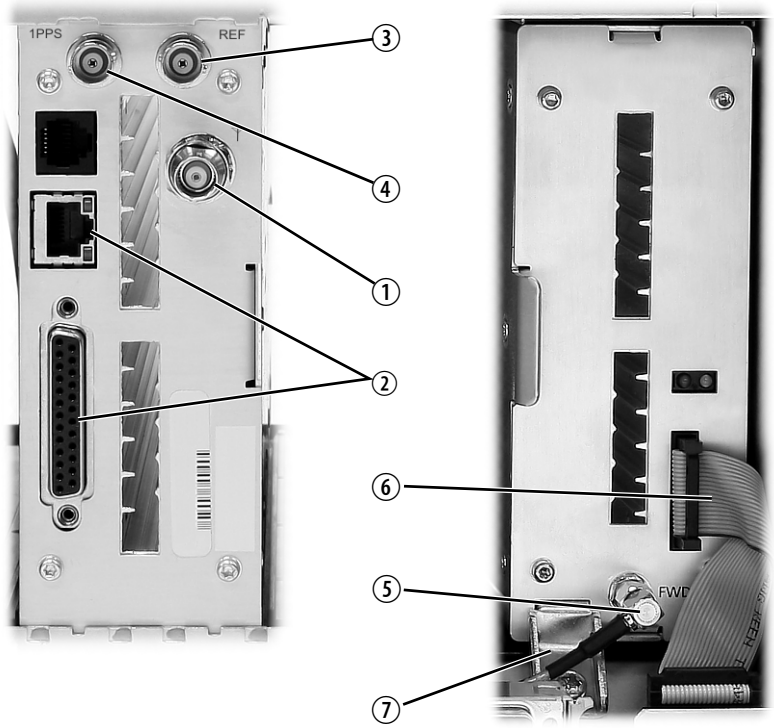
If you need to remove any front panel cables, simply pull the front of the cable retaining clip down and then slide it out from the subrack until it reaches the end of its travel.



8.3 Replacing a Reciter

Removal

1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 113.
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 124).

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 120.

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

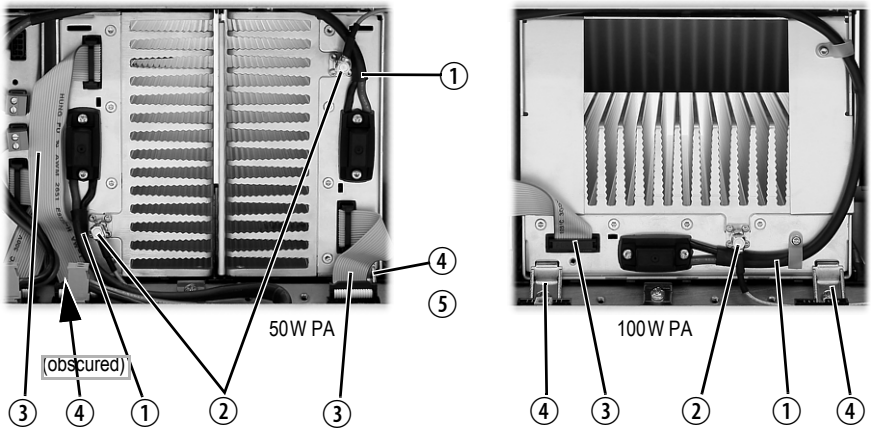
1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 113.

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 124).

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

6. Carry out the instructions in "Final Reassembly" on page 120.

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

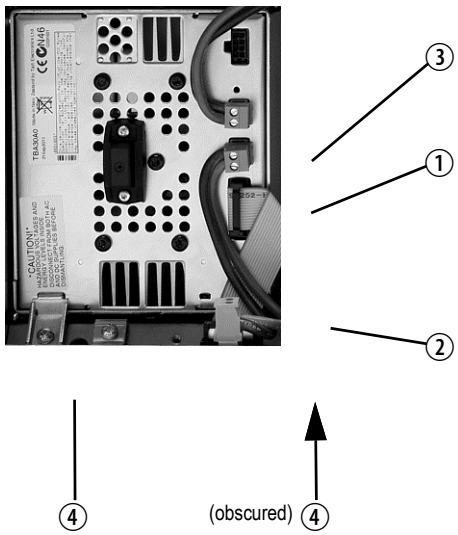
1. If you have not already done so, carry out the instructions in "Preliminary Disassembly" on page 113.

2. At the front of the PMU, unplug and remove the output power cable ① to the subrack interconnect board. Also unplug and remove the system control bus cable ②.

3. Unplug the output power cable to the PA ③ and move it to one side.

4. Loosen the screws securing the retaining clamps ④ and rotate the clamps through 90° to clear the module.

5. Slide the PMU out of the subrack, taking care not to damage any of the cables.



Refitting

1. Slide the replacement PMU into the subrack and secure it with the retaining clamps.

2. Reconnect all the front and rear panel cables previously disconnected. Connect the DC power cables on the rear panel as shown in Figure 4.8 on page 78. Tighten the screws to a torque of

18–20lbf·in (2–2.25N·m). Ensure the front panel cables are positioned correctly, and retained where required by the cable retaining clips in the top of the subrack (refer to "Appendix B Inter-Module Connections" on page 124).

3. Carry out the instructions in "Final Reassembly" on page 120.

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.

A subrack hardware spares kit (TBC-SP-002) is available, containing 5 top and 5 bottom guide rails, blanking panels, clamps and screws.

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.

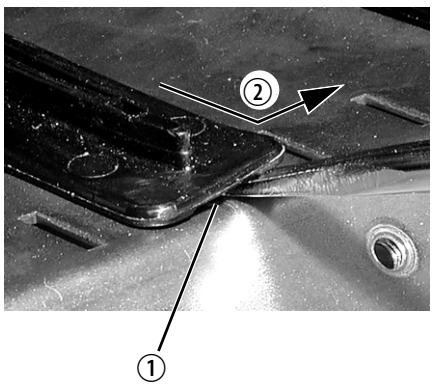
b. While holding the front end of the guide rail up, pull the guide rail towards the front of the subrack ② and lift it clear of the slots.

2. Top Rails

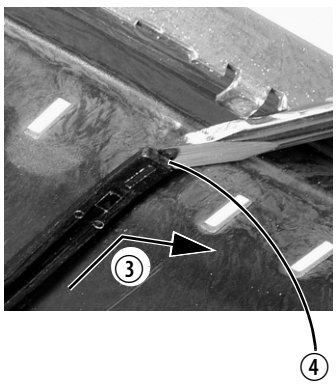
a. Insert a small flat-blade screwdriver under the rear end of the guide rail and lift it slightly ③. This will ensure the small locking tab is clear of the slot in the subrack.

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

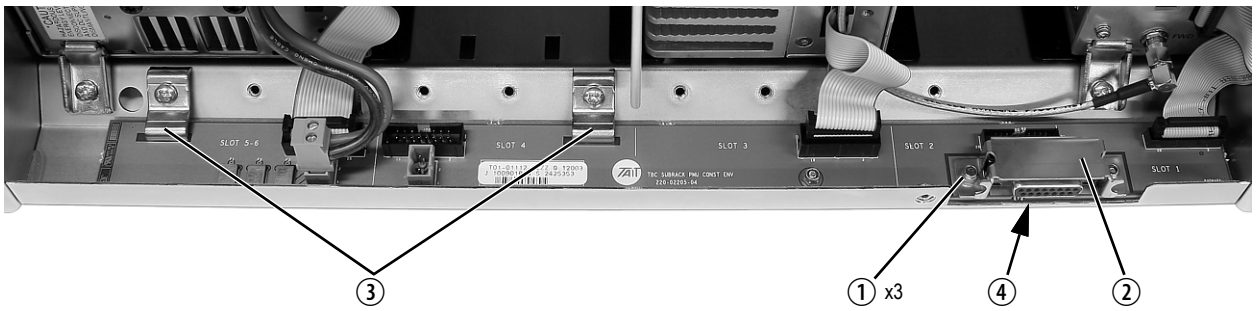
Removal

1. If you have not already done so, carry out the instructions in “Preliminary Disassembly” on page 113.
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 124.

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.

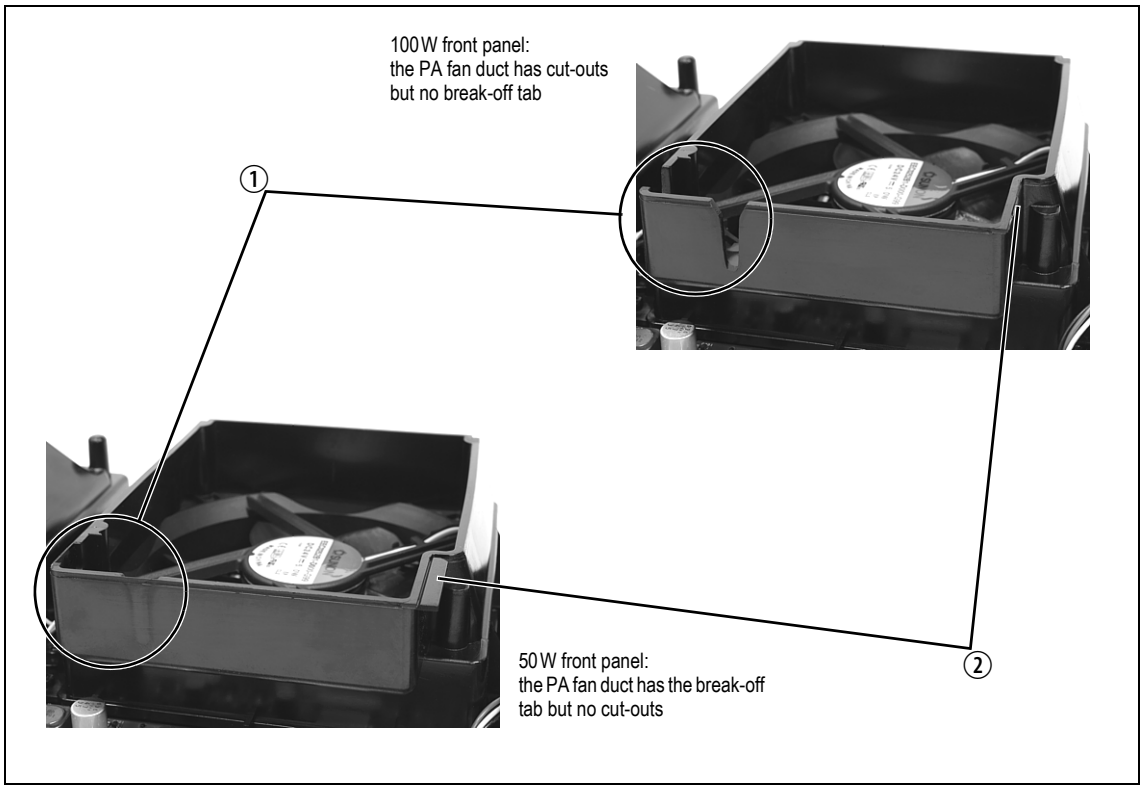
50W Front Panel

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.

100W 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

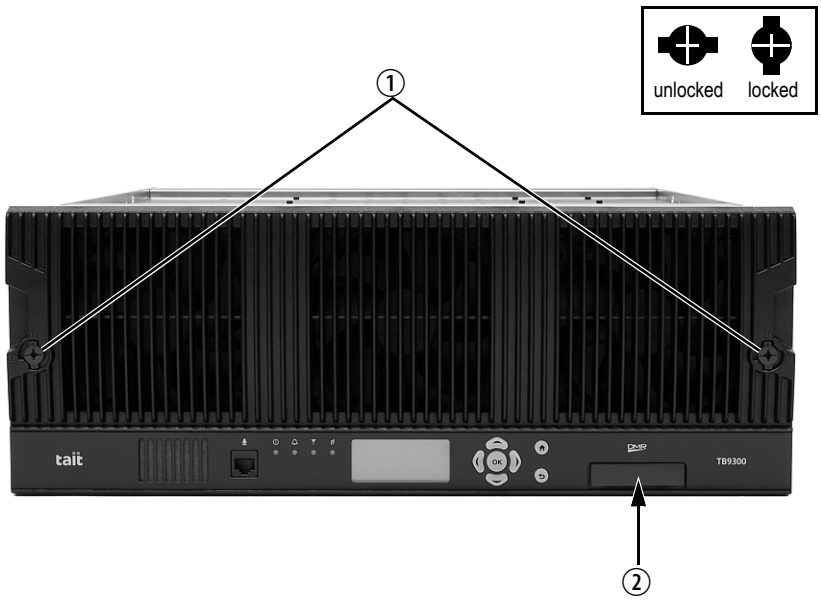


1. Before fitting the front panel, ensure that all cables are secured and positioned correctly so they are clear of the fan ducts (refer to "Appendix B Inter-Module Connections" on page 124). Otherwise the panel may not fit properly, or you may damage the cables.

Base stations manufactured after May 2015 no longer have an airflow separator.

2. In 50W 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.

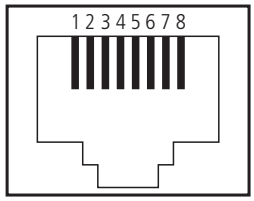
When refitting modules, make sure they are fitted correctly into the subrack and all retaining clamps are securely tightened. The recommended torque for the retaining clamp screws is 17 lbf·in (1.9 N·m). As well as holding the modules in place, the retaining clamps push the modules hard against the rear 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 DB-25 connector, see "Connecting General Purpose Inputs and Outputs" on page 87.

Ethernet Connector

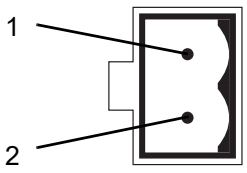


external view

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

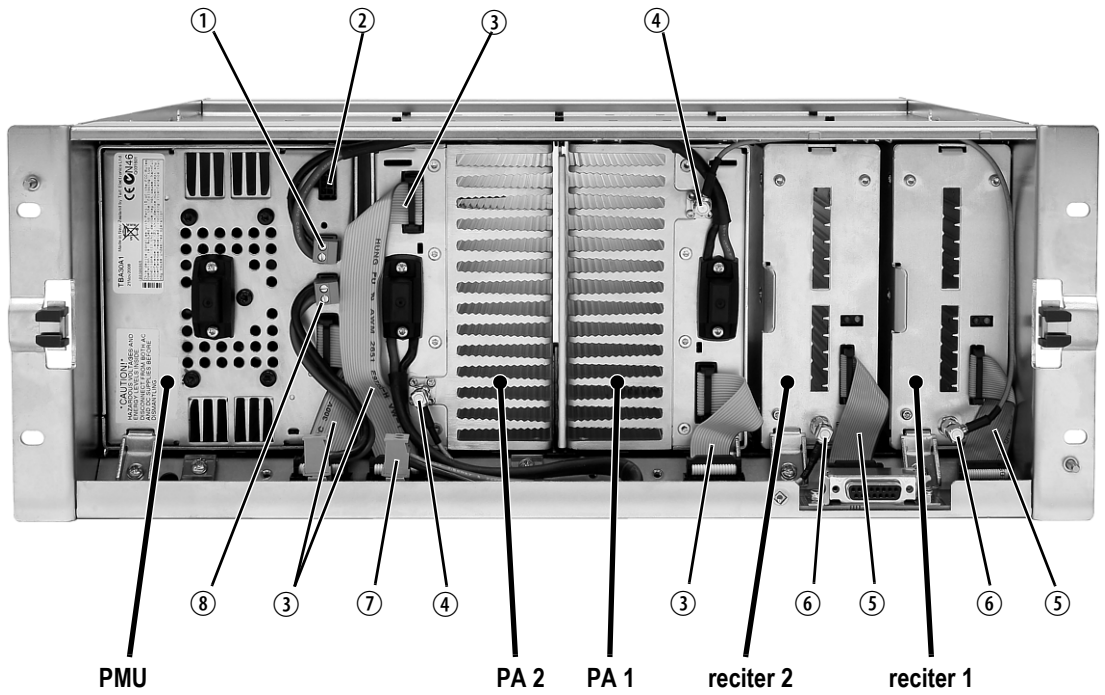
Note that on H/W version 3 PMUs, the auxiliary DC power connector has been rotated 180°.

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

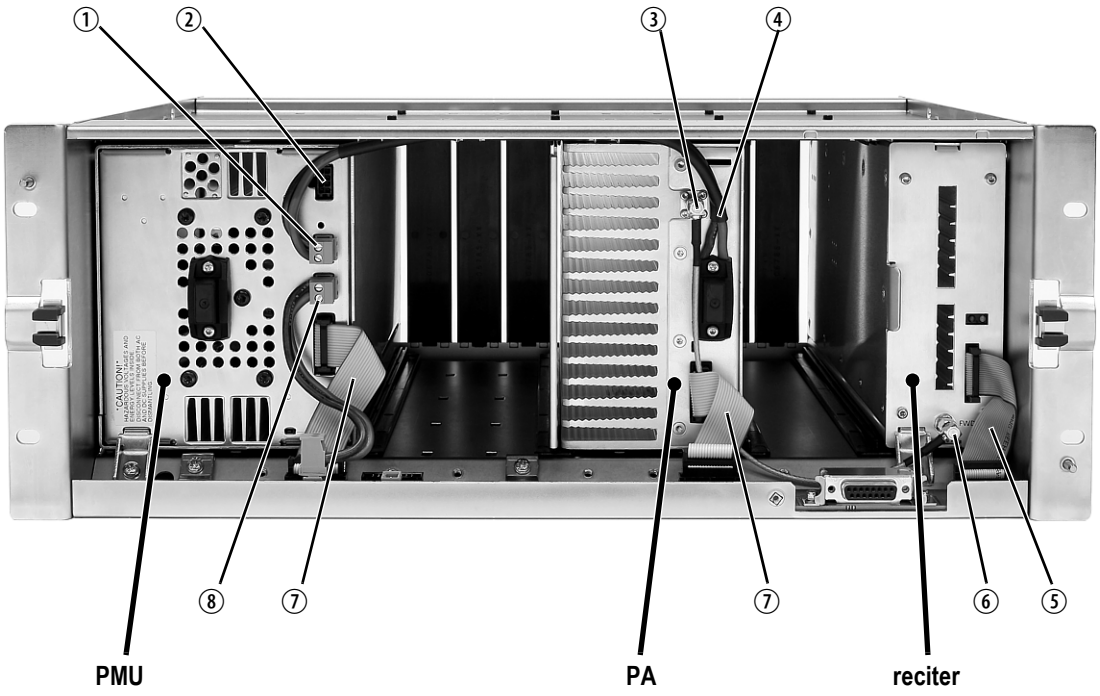
DC Supply

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

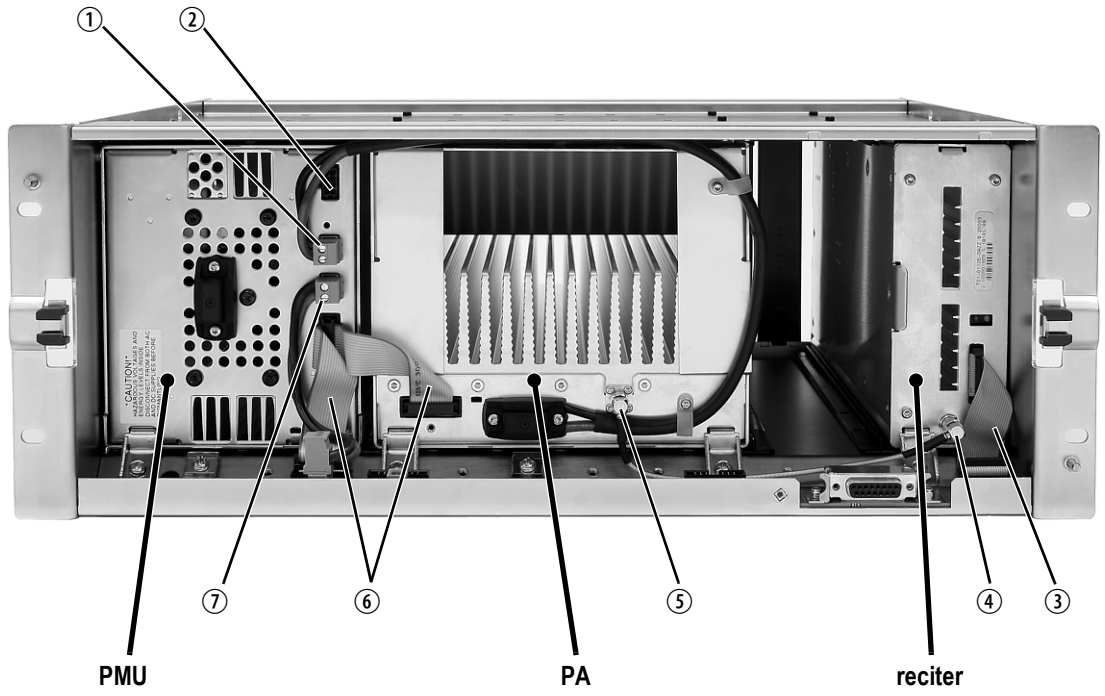
DC Supply

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.

Appendix C TB9300 Cable Kits

Cable kits exist to provide replacement cables for the TB9300 subracks. This means customers do not have to order individual cables.

Cable Kits

T01-01150-0002 - TB9300 Kit Cable Single 50W Channel Upgrade

This kit supports adding a second reciter and 50W PA to a TB9300 subrack. It contains the following cables:

- 1 X 225mm SMA RF Cable reciter to PA
- 1 X 170mm 16-way cable PA to subrack board
- 1 X 85mm 20-way cable reciter to subrack board
- Also included are a clamp and screw to secure the PA, and a cable clamp to secure the PA power cable

T01-01150-0004 - TB9300 Kit Cable Single 100W Channel Upgrade

This kit supports adding a second reciter and 100W PA to a TB9300 subrack. It contains the following cables:

- 1 X 225mm SMA RF Cable reciter to PA
- 1 X 200mm 16-way cable PMU and PA to subrack board
- 1 X 85mm 20-way cable reciter to subrack board
- 1 X 130mm Power cable from PMU to subrack board
- Also included are a clamp and screw to secure the PA, and a cable clamp to secure the PA power cable

T01-01150-0006 - TB9300 Single 50W Replacement Cable Set

This kit contains a set of replacement cables for a single 50W TB9300 subrack. It contains the following cables:

- 1 X 225mm SMA RF Cable reciter to PA
- 1 X 100mm 16-way cable PMU to subrack board
- 1 X 85mm 16-way cable PMU to subrack board
- 1 X 90mm 20-way cable reciter to subrack board
- 1 X 130mm Power cable from PMU to subrack board
- Also included are 2 clamps and 2 screws

T01-01150-0006 - TB9300 Dual 50W Replacement Cable Set

This kit contains a set of replacement cables for a dual 50W TB9300 subrack. It contains the following cables:

- 2 X 225mm SMA RF Cable reciter to PA
- 1 X 100mm 16-way cable PMU to subrack board
- 1 X 85mm 16-way cable PA to subrack board
- 1 X 170mm 16-way cable PA to subrack board
- 2 X 90mm 20-way cable reciter to subrack board
- 1 X 130mm Power cable from PMU to subrack board
- Also included are 2 clamps and 2 screws

Appendix D Installing the Firmware Package

Setting Up a Central Package Server

It is beyond the scope of this manual to describe the exact procedure for setting up a central package server for any particular network. Tait expects that each customer will configure their own package server according to the requirements for their network. However, you do need to configure each base station with the IP address and port of the package server computer:

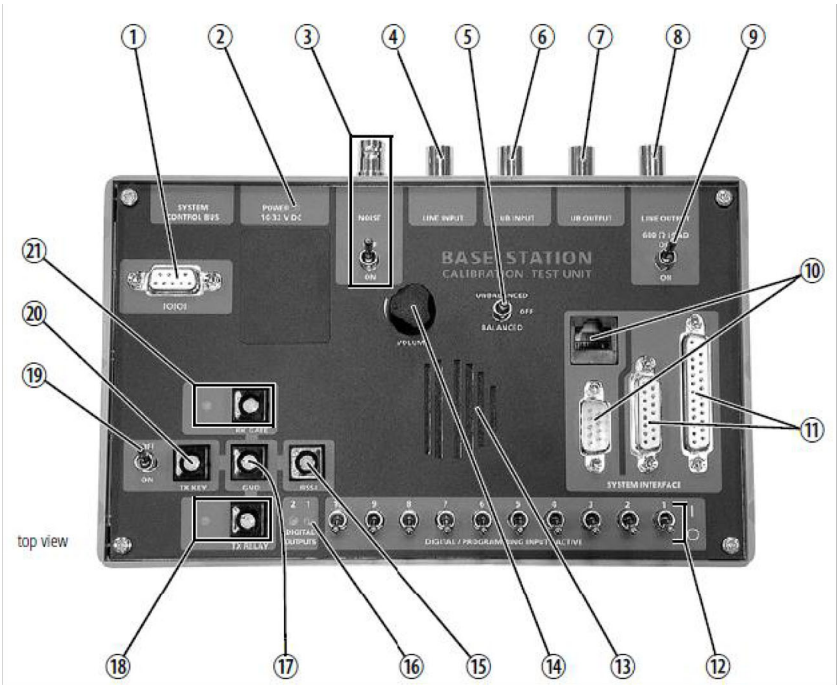
1. Log in to the base station and select Configure > Base Station > Miscellaneous.
2. Under Package server, enter the IP address and port number of the package server.
3. Download the firmware as described in the Help.

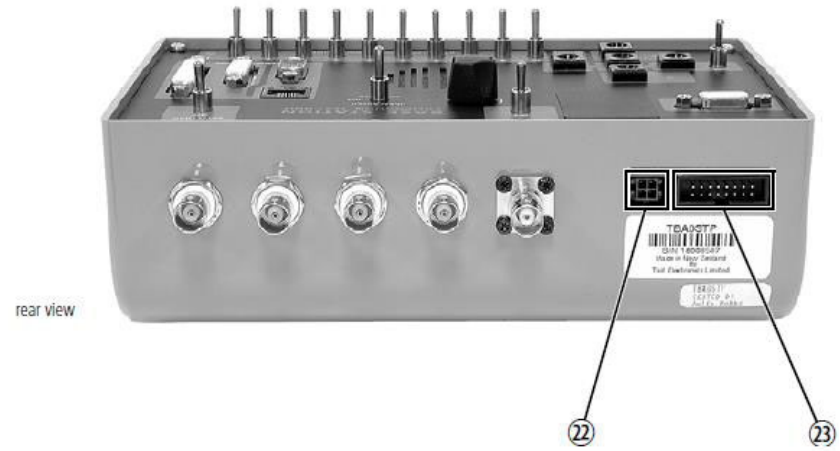
ⓘ If you click ‘Cancel’ while downloading a firmware package, it takes approximately 20 seconds for the cancellation to take effect and for the base station to respond.

Appendix E Testing with the TBA0STU Calibration Test Unit

The TBA0STU Calibration Test Unit (CTU) can be used with TB9300 base stations with hardware version 1.01 (or later) and firmware version 2.60 (or later). Testing can be done for the balanced audio line, RSSI, TX Key, and RX gate.

CTU Connections and Controls





	Function	Supported by TB9300	Information
①	Serial port	Not used	
②	Power LED	Supported (see Note 1)	The power LED is lit when the CTU is powered up. This supply powers the speaker and LEDs. You do not need to provide power to the CTU to make audio level measurements or to use the digital input switches.
③	Noise source output and on/off switch	Not used (see Note 2)	Use the noise source in the reciter controlled from the WebUI to test the receiver
④	Balanced line input	Supported	Connects the LINE INPUT connector to the balanced line input on the system interface
⑤	Speaker audio selection switch	Supported	This switch directs either the balanced or unbalanced receiver output audio to the CTU speaker. When set to “OFF”, no audio is present on the speaker.
⑥	Unbalanced line input	Supported	This input is connected to the unbalanced audio input on the system interface connector
⑦	Unbalanced line output	Supported	Connects the UB OUTPUT to the unbalanced audio output on the system interface. The audio can be monitored on the CTU speaker switched to Unbalanced. **Note:** This output is DC coupled. See Section 4.6.9 for more information.
⑧	Balanced line output	Supported	Connects the LINE OUTPUT to the balanced line output on the system interface. The audio can be monitored on the CTU speaker switched to Balanced.
⑨	600 Ohm load on/off switch	Supported	This switch connects or disconnects the 600Ω load across the balanced LINE OUTPUT. This allows the output to be terminated correctly for calibration procedures. Turn the switch on if the LINE OUTPUT is not otherwise terminated.
⑩	System interface connectors	The RJ45 connector can be used if the TBC101A E&M Isolation Adapter is fitted	Only the RJ45 connector on the CTU is supported

	Function	Supported by TB9300	Information
⑪	System interface connectors	The DB25 connector is supported	
⑫	Digital input switches	Supported for digital inputs 3 to 12 on the TB9300	These switches let you set the digital inputs high or low. The standard switch settings are: ■ 1 = high, 5V (10kΩ pull-up to 5V) ■ 0= low, active, 0V
⑬	Speaker	Supported for monitoring the balanced line output	The CTU is fitted with a 0.5W 16Ω speaker. Audio from balanced LINE OUTPUT can be heard on the speaker.
⑭	Speaker volume control	Supported for monitoring the LINE INPUT and UB INPUT	
⑮	RSSI output	Supported	This output is used to monitor the RSSI output voltage
⑯	Digital output LEDs	Supported for digital outputs 1 and 2	These LEDs indicate the status of the DIO1 and DIO2 on the system interface connector. They are lit when these digital outputs are active low.
⑰	Ground connector	Supported	This banana socket can be used as ground with RX GATE, TX KEY and RSSI. It is connected to the CTU and system interface connector ground.
⑱	Antenna (simplex) relay output and LED	Supported (see Note 3)	This output is connected to the antenna relay output system interface connector. The LED is lit when the output is activated.
⑲	Keying switch for transmitter	Supported to key the transmitter	Set this switch to ON to key the transmitter. When the switch is in the OFF position, applying a signal to the TX KEY banana socket will control the state of the transmitter.
⑳	TX key activation	Supported to key the transmitter	Ground this input to key the transmitter. Alternatively, turn on the TX KEY switch ⑲.
㉑	RX gate output and LED	Supported to indicate the RX gate is active	This output is connected to the Rx Gate output on the system interface connectors. The adjacent LED is lit when the receiver gate is open.

	Function	Supported by TB9300	Information
㉒	DC input	Supported (see Note 1)	Connect a 10 to 32VDC power supply to this input. This supply powers the speaker and LEDs.
㉓	System control bus connector	Not supported	

Note 1

The TB9300 reciter provides +5.2V on pin 13 of the system interface. This is insufficient for correct operation of the CTU's audio amplifier. The supplied power cable should be connected to the PMU auxiliary 12V or 24V power supply.

Do not power the CTU from a PMU fitted with a 48V auxiliary power supply board.

If you are not using the LED indicators or built-in audio amplifier, it is not necessary to connect a power supply.

Note 2

The noise source in the reciter itself should be used for receiver tuning and sensitivity measurements. See Receiver test at the bottom of the Diagnose > RF interface > Receiver tab WebUI page.

A signal level graph that can be used to tune the receiver with the reciter built-in noise source can be accessed from the Diagnose > RF interface > Signal level tab, check the calibrated noise source check box.

Note 3

The antenna relay is supported by P25 version 2.60 (and later) and DMR version 3.20.01 (and later) base station firmware.

TaskBuilder can operate this output as Digital output 13 in version 3.25 (and later) base station firmware.

Connecting the CTU to the Reciter DB25 System Interface

Use the DB25 ribbon cable to connect the DB25 system interface connector, ⑪ on the CTU, to the system interface connector on the back of the reciter.

Connect the power input to the PMU auxiliary output if required.

Connecting the CTU to the RJ45 from a TBC101A E&M Isolation Adaptor

Connect the power input of the CTU to the PMU auxiliary output.

Connect the RJ45 patch cable to the E&M isolation adaptor and the RJ45 connector on the CTU ⑩.

The CTU is compatible with the TB9100 and TN9110 network gateway configuration on page 14 of the Base Station E&M Isolation Adapter document (TD-0052-xx).

The CTU needs to be powered externally from a 12V to 32V supply for the E&M key switch ⑲ to work.

The RX gate output and LED ㉑ will light when the RX gate is open.

Available Tests

Checking the Balanced Line Input and Output Levels

For analog mode only.

On the WebUI, go to Diagnose > Analog Line.

The headings refer to the sections on the WebUI page.

Checking Audio Input

1. Put the base station online.
2. Connect an audio generator set to -10dBm @ 1kHz (this is the factory default line level) to the Line Input BNC connector of the CTU.
3. The audio input measured by the reciter is displayed as the “Measured RMS level” at the top right of the page. The configured level is also displayed.
4. The configured line input level is the audio level for 60% system deviation and can be set in the Configure > Analog line Audio input section on the WebUI. Connecting a service monitor to the PA and switching the TX Key switch to On should measure 60% system deviation at the configured audio level.

Checking Audio Output

1. Put the base station online.
2. Connect a load to the transmitter and put the base station in online mode.
3. Connect an on-channel RF signal of -80dBm with a 1kHz tone set to 60% of system deviation.
4. Switch the speaker audio selection to Balanced and, advancing the volume control, you should hear the 1kHz tone.
5. The configured and measured output levels are indicated on the WebUI in the Audio output section. Audio output is available from the Line Output BNC connector. If the load connected to this output is high impedance, the CTU 600 Ohm load can be switched to On to terminate the balanced line for accurate level measurement.

Checking Audio Out

1. Put the base station offline.
2. The reciter can generate a tone to the analog line output in the Audio out section.
3. Set the frequency and level required and click Start to generate the tone. This should be heard in the CTU speaker with the switch ⑤ set to Balanced.

Loopback Test

1. Put the base station offline.
2. Connect the audio generator set to -10dBm @ 1kHz (this is the factory default line level) to the Line Input BNC connector of the CTU ④.
3. Connect an audio level meter to the Line Output BNC connector of the CTU ⑧.
4. Start the Loopback test. Audio will be looped within the reciter from the audio generator to the audio level meter.

Checking Digital IO

On the WebUI, monitor the operation of digital IO at Monitor > Interfaces > IO tab.

Checking Digital Programming Input Switches

There are 10 switches connected to digital I/Os (DIO) 3 to 12.

DIO3 is connected to switch 1 and DIO12 to switch 10.

By default, the base station digital inputs are active low, so moving the switches to the down (0) position will activate the digital input. Setting the digital input for active high will activate the digital input with the switch in the up (1) position.

LEDs on the WebUI indicate the input and output states.

Checking Digital Output LEDS 1 and 2

These LEDS are connected to DIO1 and DIO2 and will light if the outputs are active low.

There are no switches connected to DIO1 and DIO2, so alarms and task builder applications using these inputs cannot be tested with the CTU.

Notice There is a central ground banana socket that is 19.6mm (0.75”) spacing from the RX gate, TX relay, TX Key and RSSI connectors to enable a dual banana plug to be used for signal output and ground. The banana sockets on each system IO can be used for timing and other tests of the base station.

Monitoring RX Gate Output

An LED will indicate when the RX gate output has activated, the RX gate output is active low.

RX Gate only works in analog mode.

Checking RSSI Levels

A voltage proportional to the received RF signal level is available on this output.

RSSI is the only output that is functional in analog, P25 and DMR modes.

Checking TX Relay

An LED will indicate when the antenna (simplex) relay is active. From version 3.25 firmware (and later) this output can be accessed as digital output 13 on TaskBuilder.

ⓘ This is only an output and has no input circuitry associated with it.

TX Relay works in analog and P25 modes.

Using TX Key

A switch is available to key the transmitter on. A banana socket is also available for keying from an external input.

TX Key only works in analog mode.

Glossary

This glossary contains an alphabetical list of terms and abbreviations found within this document, related to the TaitNet network and the TB9300 base station.

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

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.

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. 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 WebUI.

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.

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.
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.
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.
ETSI	European Telecommunications Standards Institute. The non-profit organization responsible for producing European telecommunications standards.
fallback mode	An operational mode of Tait DMR and MPT trunked networks. It comes into effect when the base station loses communication with the trunking node controller. In fallback, one base station operates a control channel and allocates calls to the other traffic channels at the site. The base station in fallback mode will accept all registrations without requiring authorisation.
FCC	Federal Communications Commission. The FCC is an independent United States government agency that regulates interstate and international radio communications.
feature set	A function or mode of operation of the base station which can be enabled or disabled using the WebUI. Each feature set requires a license to be purchased from Tait before it can be enabled.
feature license key	The unique set of digits belonging to a license which is programmed into the base station to enable a feature set.

Flash	Electrically block-erasable and programmable read-only memory.
FM	Frequency Modulation. Often used as an adjective to denote analog radio transmission.
frequency band	The range of frequencies that the equipment is capable of operating on.
front panel	The cover over the front of the base station containing the indicator LEDs, four-line LCD display, user controls and cooling fans.
group call	A call that is sent to more than one mobile station simultaneously.
host name	The unique name by which a network element is known on the network.
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.
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.
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.
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.
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.
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.
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.

RSSI	Received Signal Strength Indicator is a level that indicates the strength of the received signal.
Rx	Receiver.
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.
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.
SSH	Secure Shell Access (SSH) is a command interface and protocol for securely getting access to a remote computer.
syslog	Syslog is a way for network devices to send event messages to a logging server, usually known as a Syslog server
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 International 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.
tone	A sound wave of a particular frequency.
Tx	Transmitter.
uplink	The transmission path from mobile stations to fixed equipment.
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.
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.

Simplified EU Declaration of Conformity

EN Hereby, Tait International Limited declares that the radio equipment type TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E is in compliance with Directive 2014/53/EU.
The full text of the EU declaration of conformity is available at the following internet address: www.taitcommunications.com/eudoc

BG С настоящото Tait International Limited декларира, че този тип радиосъоръжение TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E е в съответствие с Директива 2014/53/ЕС.
Цялостният текст на ЕС декларацията за съответствие може да се намери на следния интернет адрес: www.taitcommunications.com/eudoc

ES Por la presente, Tait International Limited declara que el tipo de equipo radioeléctrico TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E es conforme con la Directiva 2014/53/UE.
El texto completo de la declaración UE de conformidad está disponible en la dirección Internet siguiente: www.taitcommunications.com/eudoc

CS Tímto Tait International Limited prohlašuje, že typ rádiového zařízení TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E je v souladu se směrnicí 2014/53/EU.
Úplné znění EU prohlášení o shodě je k dispozici na této internetové adrese: www.taitcommunications.com/eudoc

DA Hermed erklærer Tait International Limited, at radioudstyrstypen TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E er i overensstemmelse med direktiv 2014/53/EU.
EU-overensstemmelseserklæringens fulde tekst kan findes på følgende internetadresse: www.taitcommunications.com/eudoc

DE Hiermit erklärt Tait International Limited, dass der Funkanlagentyp TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E der Richtlinie 2014/53/EU entspricht.
Der vollständige Text der EU-Konformitätserklärung ist unter der folgenden Internetadresse verfügbar: www.taitcommunications.com/eudoc

ET Käesolevaga deklareerib Tait International Limited, et käesolev raadioseadme tüüp TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E vastab direktiivi 2014/53/EL nõuetele.
ELi vastavusdeklaratsiooni täielik tekst on kättesaadav järgmisel internetiaadressil: www.taitcommunications.com/eudoc

EL Με την παρούσα ο/η Tait International Limited, δηλώνει ότι ο ραδιοεξοπλισμός TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E πληροί την οδηγία 2014/53/ΕΕ.
Το πλήρες κείμενο της δήλωσης συμμόρφωσης ΕΕ διατίθεται στην ακόλουθη ιστοσελίδα στο διαδίκτυο: www.taitcommunications.com/eudoc

FR Le soussigné Tait International Limited, déclare que l'équipement radioélectrique du type TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E est conforme à la directive 2014/53/UE.
Le texte complet de la déclaration UE de conformité est disponible à l'adresse internet suivante: www.taitcommunications.com/eudoc

HR Tait International Limited ovime izjavljuje da je radijska oprema tipa TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E u skladu s Direktivom 2014/53/EU.
Cjeloviti tekst EU izjave o sukladnosti dostupan je na sljedećoj internetskoj adresi: www.taitcommunications.com/eudoc

IT Il fabbricante, Tait International Limited, dichiara che il tipo di apparecchiatura radio TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E è conforme alla direttiva 2014/53/UE.
Il testo completo della dichiarazione di conformità UE è disponibile al seguente indirizzo Internet: www.taitcommunications.com/eudoc

LV Ar šo Tait International Limited deklarē, ka radioiekārta TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E atbilst Direktīvai 2014/53/ES.
Pilns ES atbilstības deklarācijas teksts ir pieejams šādā interneta vietnē: www.taitcommunications.com/eudoc

LT Aš, Tait International Limited, patvirtinu, kad radijo įrenginių tipas TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E atitinka Direktyvą 2014/53/ES.
Visas ES atitikties deklaracijos tekstas prieinamas šiuo interneto adresu: www.taitcommunications.com/eudoc

HU Tait International Limited igazolja, hogy a TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E típusú rádióberendezés megfelel a 2014/53/EU irányelvnek.
Az EU-megfelelőségi nyilatkozat teljes szövege elérhető a következő internetes címen: www.taitcommunications.com/eudoc

MT B'dan, Tait International Limited, niddikjara li dan it-tip ta' tagħmir tar-radju TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E huwa konformi mad-Direttiva 2014/53/UE.
It-test kollu tad-dikjarazzjoni ta' konformità tal-UE huwa disponibbli f'dan l-indirizz tal-Internet li ġej: www.taitcommunications.com/eudoc

NL Hierbij verklaar ik, Tait International Limited, dat het type radioapparatuur TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E conform is met Richtlijn 2014/53/EU.
De volledige tekst van de EU-conformiteitsverklaring kan worden geraadpleegd op het volgende internetadres: www.taitcommunications.com/eudoc

PL Tait International Limited niniejszym oświadcza, że typ urządzenia radiowego TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E jest zgodny z dyrektywą 2014/53/UE. Pełny tekst deklaracji zgodności UE jest dostępny pod następującym adresem internetowym: www.taitcommunications.com/eudoc

PT O(a) abaixo assinado(a) Tait International Limited declara que o presente tipo de equipamento de rádio TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E está em conformidade com a Diretiva 2014/53/UE.
O texto integral da declaração de conformidade está disponível no seguinte endereço de Internet: www.taitcommunications.com/eudoc

RO Prin prezenta, Tait International Limited declară că tipul de echipamente radio TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E este în conformitate cu Directiva 2014/53/UE.
Textul integral al declarației UE de conformitate este disponibil la următoarea adresă internet: www.taitcommunications.com/eudoc

SK Tait International Limited týmto vyhlasuje, že rádiové zariadenie typu TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E je v súlade so smernicou 2014/53/EÚ.
Úplné EÚ vyhlásenie o zhode je k dispozícii na tejto internetovej adrese:

SL Tait International Limited potrjuje, da je tip radijske opreme TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E skladen z Direktivo 2014/53/EU.
Celotno besedilo izjave EU o skladnosti je na voljo na naslednjem spletnem naslovu: www.taitcommunications.com/eudoc

FI Tait International Limited vakuuttaa, että radiolaitetyyppi TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E on direktiivin 2014/53/EU mukainen.
EU-vaatimustenmukaisuusvakuutuksen täysimittainen teksti on saatavilla seuraavassa internetosoitteessa: www.taitcommunications.com/eudoc

SV Härmed försäkrar Tait International Limited att denna typ av radioutrustning TBCB1D, TBCB1E, TBCC0D, TBCG4D, TBCH0D and TBCH0E överensstämmer med direktiv 2014/53/EU.
Den fullständiga texten till EU-försäkran om överensstämmelse finns på följande webbadress: www.taitcommunications.com/eudoc