# TB9400 Base Station/Repeater

# Specifications Manual

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# Contents

# Preface

## Scope of Manual

Welcome to the Specifications Manual for the TB9400 base station. This manual provides general, performance, and physical specifications for the TB9400 Rx only (when no PA is available), TB9400 50 W and 100 W base stations.

In the following, unless mentioned specifically, this manual will use the term “base station” to mean both base station and repeater.

## Document Conventions

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.taitradio.com).

- Tait Core Networks Installation and Configuration Manual (MNB-00012-xx)
- TB9400 Installation and Operation Manual (MBC-00001-xx)
- TN9400 P25 Trunked Network Maintenance Manual (MNC-00001-xx)
- TaitNet P25 Trunked Networks with TB9400 Base Stations System Manual (MBA-00064-xx)
- P25 and AS-IP Channel Group System Manual (MND-00002-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 |
|---|---|---|
| 25 | April 2022 | Updated for release 3.30 and later<br>■ "Requirements for Delay, Jitter, Loss and Duplication" on page 35 minimum bandwidth updated<br>■ "Channel Group Size" on page 36 updated |
| 24 | November 2021 | Updated for release 3.25 and later<br>■ B1 band replaces B2 and B3<br>■ "Antenna Relay Output" on page 40 updated<br>■ "Channel Details" on page 43 updated |
| 23 | April 2021 | Changes for 3.20 release and later<br>■ Receiver "Analog Audio - General" on page 27 updated<br>■ Receiver "Analog Audio - CTCSS" on page 27 updated<br>■ Transmitter "Analog Audio - Modulation Characteristics" on page 33 updated |
| 22 | February 2021 | Changes for 3.15 release<br>Minor updates throughout<br>Major updates to compliance table<br>"RX Gate Output" changed to "Antenna Relay Output" and content updated<br>H2, H3 and K4 band compliance content update<br>Updated "Channel Group Size" table<br>RSSI Output added |
| 21 | June 2020 | Changes for 3.10 release.<br>Minor updates throughout<br>Regulatory Information updated<br>Multiple updates to the Compliance Standards table |
| 20 | November 2019 | Changes for 3.05 release.<br>Minor updates throughout<br>Numerous updates for P25/AS-IP and DMR/MPT interoperability |
| 19 | July 2019 | Changes for 3.00 release.<br>Minor updates throughout<br>Wideband added to Analog RF table.<br>Simplex coaxial relay operating time updated<br>Input High Threshold updated |
| 18 | March 2019 | Changes for 2.60 release.<br>Analog Line content featured for both radio standards<br>B2 band added to Compliance Standards table<br>Simplex content added |
| 17 | December 2018 | Changes for 2.55 release.<br>Updated Limiting Deviation |

| Issue | Publication Date | Description |
|---|---|---|
| 16 | July 2018 | Changes for 2.50 release.<br>Added B2 band.<br>Added disclaimer (footer) that the 406 - 406.1 range is not legal to use - relates to HH band.<br>Updated “Limiting Deviation” specifications.<br>Updated “Channel Group Size” table.<br>Added product code T01-01121-XXXX.<br>Updated MTBF to 140,000 |
| 15 | March 2018 | Changes for version 2.45 release<br>“Publication Record” table has been switched so the most recent changes appear at the top<br>“Limiting Deviation” under “Analog Audio - General” changed to 73%<br>Updated Compliance standard tables<br>RF and EMC compliances table/s have been heavily updated |

# 1 Base Station Specifications

The performance figures given in these specifications are applicable only to equipment operating as an integral part of a TB9400 base station. These performance figures are minimum figures, unless otherwise indicated, for equipment operating at standard room temperature (+22 °C to +28 °C [+71.6 °F to +82.4 °F]) and standard test voltages as follows:

- AC power management unit (PMU) - 120 VAC and 230 VAC
- 12 V DC PMU - 12 VDC
- 24 V DC PMU - 24 VDC
- 48 V DC PMU - 48 VDC.

The TB9400 is available in the following configurations:

- 50 W single or dual base station with PMU
- 100 W single base station with PMU
- Rx only base station - up to four receivers (receive-only reciters) with PMU.
- Rx only base station (when no PA is available)

**Notice** The software release notes list known issues or limitations of the base station that may vary from the specifications published in this document. Please refer to the current software release notes for any variations to the specifications in this document.

# 1.1 Regulatory Information

**Test Methods**

Where applicable, the test methods used to obtain the specifications in this document are described in the following standards:

- TIA-102.CAAA-D
- TIA-102.CCAA-A
- EN 300 086 V2.1.2
- EN 300 113 (version 2.2.1)
- EN 300 219 V2.1.1
- EN 301 489-1 V1.9.2
- CFR Title 47 Part 15
- TIA/EIA-603/603-E
- AS/NZS 4295
- CFR Title 47 Part 20, 90

**Emission Designators**

This equipment is compatible with the emissions listed in the following table.

| Emission Designator | Common Name | Modulation Scheme | Operating Modes |
|---|---|---|---|
| 11K0F3E | FM | analog FM | analog voice |
| 16K0F3E | Wideband FM | analog FM | analog voice |
| 8K10F1E | P25 Phase 1 | C4FM | digital voice |
| 8K10F1D | P25 Phase 1 | C4FM | data/control channel |
| 8K10F7W | P25 Phase 1 | C4FM | digital voice/data/control channel |
| 8K70D1W | P25 Phase 1 linear simulcast modulation | CQPSK | digital voice |
| 8K70D7W | P25 Phase 1 linear simulcast modulation | CQPSK | digital voice/data/control channel |
| 9K80D7W | P25 Phase 2 linear simulcast and non-simulcast modulation | H-DQPSK | digital voice/data |
| 7K60F2D | MPT Control | FFSK | control channel/traffic channel data |
| 8K00FXD or 7K60FXD | 2-slot DMR | 4FSK | data/control channel |
| 8K00FXD or 7K60FXW | 2-slot DMR | 4FSK | digital voice/data/control channel |
| 11K0F3E | 2-slot DMR | 4FSK | FM analog/FM analog voice |

You can obtain further details on test methodology and conditions of compliance testing in all countries from Tait.

## 1.2 Frequency Bands and Sub-bands

Many of the performance figures in this manual are applicable to all frequency bands. In some cases the figures refer to specific bands or sub-bands, and these are identified with the letters listed in the following table.

This table also indicates which base station configurations are currently available in each frequency band.

Refer to "Compliance Standards" for details of which bands support which air interfaces.

| Frequency Identification | Frequency Band and Sub-band | 50W | 100W | Receive-only |
|---|---|---|---|---|
| B band | B1 = 136 MHz to 174 MHz | ✓ | ✗ | ✓ |
| H band | HH = 378 MHz to 420 MHz[a]<br>H1 = 400 MHz to 440 MHz[a]<br>H2 = 440 MHz to 480 MHz<br>H3 = 470 MHz to 520 MHz | ✓<br>✓<br>✓<br>✓ | ✓<br>✓<br>✓<br>✓ | ✓<br>✓<br>✓<br>✓ |
| K band | K4 = 762 MHz to 870 MHz[b] | ✓ | ✓ | ✓ |

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

b. The actual frequency coverage in this band is:

Transmit: 762 MHz to 776 MHz, and 850 MHz to 870 MHz
Receive: 792 MHz to 824 MHz

In Brazil, for K band, the TB9400 is considered to be configured as a base station with retransmission of receive frequencies.

## 1.3 Power Supply

The specifications in this section refer to the TB9400 base station fitted with a PMU.

### AC Input

| | |
|---|---|
| **Input** | |
| Voltage | 88 VAC to 264 VAC |
| Frequency | 50 Hz to 60 Hz |
| Power factor | > 0.95 |
| Total harmonic distortion (THD) | < 8% |
| Inrush current | |
| 230VAC | < 30 A @ < 4 ms |
| 115VAC | < 15 A @ < 4 ms |
| Leakage current | < 3.5 mA / 240 VAC |
| **Protection** | |
| Fault current (input) | 10 A fuse |
| Transient suppression | 275 V MOV (line-to-line) |
| Overvoltage inhibit (self recovering) | 275 VAC ±10 V |
| Undervoltage signal | 83 VAC ±5 V |
| **General** | |
| Input-to-chassis isolation | 1500 VAC, 50 Hz, 1 minute |
| Output-to-chassis isolation | 500 VAC, 50 Hz, 1 minute |

## DC Input

| Input voltage | 12 V PMU | 24 V PMU | 48 V PMU |
|---|---|---|---|
| User-programmable alarms[a] | | | |
| Low battery voltage | 10 V to 14 V | 20 V to 28 V | 40 V to 56V |
| High battery voltage | 14 V to 17.5 V | 28 V to 35 V | 56V to 70V |
| User-programmable limits[b] | | | |
| Startup voltage (after shutdown) | 10.9 V to 15 ±0.3V | 21.8 V to 30 V ±0.5V | 43.6 V to 60V ±1V |
| Shutdown voltage | 10 V to 13.5 V ±0.3V | 20 V to 27 V ±0.5V | 40V to 54V ±1V |
| Battery protection (fail-safe) limits[c] | | | |
| Startup voltage | 10.8 V ±0.2 V | 21.6 V ±0.5 V | 43.2 V ±1 V |
| Undervoltage shutdown | 9.5 V ±0.3 V | 19 V ±0.5 V | 38 V ±1 V |
| Overvoltage shutdown | 18.1 V ±0.3 V | 36.2 V ±0.5 V | 72.4 V ±1 V |
| Overvoltage shutdown reset | 17.1 V ±0.3 V | 34.2 V ±0.5 V | 68.4 V ±1 V |

a. User-programmable alarms can be set for low or high battery voltage, using the web interface. 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” above.

b. The user-programmable startup and shutdown limits allow for adjustable startup and shutdown voltages. Using the web interface, these limits can be adjusted for different numbers of battery cells, or for the particular requirements of base station operation. Once the limits are reached, the PMU will shutdown. These limits are subject to the tolerances of the battery protection circuitry.

c. 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.

| Input current | 12 V | 24 V | 48 V |
|---|---|---|---|
| 0V to battery protection startup voltage[d] | 2 mA maximum | 2 mA maximum | 1.2 mA maximum |
| Battery protection startup voltage to user-programmed startup voltage[e] | 40 mA typical at 10.8 V | 30.1 mA typical at 21.6 V | 13.2 mA typical at 43.2 V |
| Operating current | refer to “Power and Current Consumption” on page 16 | | |

d. When the input voltage drops below the battery protection undervoltage shutdown limit, and until the voltage rises above the battery protection startup voltage.

e. At initial power-up; or, after battery protection has occurred, when the input voltage rises above the battery protection startup voltage (with the PMU now under control of its microcontroller), but is still below the user-programmed startup voltage

| Protection | |
|---|---|
| Fault current (input) | circuit breaker or fuse in external wiring[f] |
| Wrong input voltage | electronic lock-out |
| Wrong input voltage polarity | shunt diode |

f. Provided by user.

## Outputs

28 VDC output

| | |
|---|---|
| Voltage | 28 V |
| Current | 14 A maximum |
| Regulation | ±0.5% |
| Ripple and noise[a] | 50 mVpp |
| Ripple and noise rms | 10 mVrms |
| Transient response on 28 V loadstep[b] | 2% overshoot and recover within 0.6 ms |

a. 100 MHz bandwidth.

b. 10% to 100% loadstep.

Protection

| | |
|---|---|
| Overload | electronic current limit above 16 A |
| Short circuit | hiccup mode, self-resetting |
| Overvoltage | |
| AC module | electronic shutdown latch (33.5 V) |
| DC module | electronic hysteric control (33.5 V) |

## Auxiliary Power Supply

| DC input voltage | 28 V ±15% | | |
|---|---|---|---|
| **DC output** | **12 V** | **24 V** | **48 V** |
| Voltage | 13.65 V | 27.3 V | 54.6 V |
| Current | 3 A max | 1.5 A max | 750 mA max |
| Regulation | ±2% | ±2% | ±2% |
| Ripple and noise[a] | 50 mVpp | 50 mV pp | 50 mVpp |
| Ripple and noise rms | 10 mVrms | 10 mV rms | 10 mVrms |
| Zero load ripple | 100 mVpp | 100 mVpp | 100 mVpp |

a. 100 MHz bandwidth.

| Protection | **12 V** | **24 V** | **48 V** |
|---|---|---|---|
| Overload/short circuit | electronic current limit | electronic current limit | electronic current limit |
| Overvoltage | 16 V Zener diode | 32 V Zener diode | 62 V Zener diode |

General

| | |
|---|---|
| Input-to-output isolation | 1000 VAC, 50 Hz, 1 minute |
| Output-to-chassis isolation | 500 VAC, 50 Hz, 1 minute |

## 1.4 Power and Current Consumption

The specifications in this section refer to the TB9400 base station fitted with a PMU. Listed performance figures are typical.

The transmission measurements were taken when the base station was transmitting at the stated RF output power, with all the front panel fans running.

The standby measurements were taken when the base station was not receiving or transmitting, with no front panel fans running.

All measurements were carried out with no load on the auxiliary power supply.

### 1.4.1 120 VAC Input

#### Transmit

| | A | VA | W |
|---|---|---|---|
| Single 50 W base station | | | |
| Minimum RF output power (5 W) | 1 A | 120 VA | 117 W |
| Maximum RF output power (50 W) | 1.9 A | 238 VA | 235 W |
| Dual 50 W base station[a] | | | |
| Minimum RF output power (5 W) | 1.7 A | 207 VA | 204 W |
| Maximum RF output power (50 W) | 2 A | 450 VA | 440 W |
| 100 W base station | | | |
| Minimum RF output power (10 W) | 1.6 A | 192 VA | 189 W |
| 50% RF output power (50 W) | 2.4 A | 295 VA | 290 W |
| Maximum RF output power (100 W) | 3.3 A | 400 VA | 395 W |

a. Both channels transmitting.

#### Standby

| | A | VA | W |
|---|---|---|---|
| Single 50 W and 100 W base station | 370 mA | 44 VA | 30 W |
| Dual 50 W base station | 490 mA | 59 VA | 50 W |

## 1.4.2 230 VAC Input

### Transmit

| | A | VA | W |
|---|---|---|---|
| Single 50 W base station | | | |
| Minimum RF output power (5 W) | 700 mA | 159 VA | 108 W |
| Maximum RF output power (50 W) | 1.1 A | 250 VA | 220 W |
| Dual 50 W base station[a] | | | |
| Minimum RF output power (5 W) | 1 A | 230 VA | 196 W |
| Maximum RF output power (50 W) | 2 A | 460 VA | 440 W |
| 100 W base station | | | |
| Minimum RF output power (10 W) | 970 mA | 223 VA | 183 W |
| 50% RF output power (50 W) | 1.3 A | 310 VA | 285 W |
| Maximum RF output power (100 W) | 1.7 A | 395 VA | 375 W |

a. Both channels transmitting.

### Standby

| | A | VA | W |
|---|---|---|---|
| Single 50 W and 100 W base station | 510 mA | 117 VA | 31 W |
| Dual 50 W base station | 510 mA | 117 VA | 45 W |

## 1.4.3 12 VDC Input

### Transmit

| | A | W |
|---|---|---|
| Single 50 W base station | | |
| Minimum RF output power (5 W) | 8.8 A | 106 W |
| Maximum RF output power (50 W) | 18 A | 216 W |
| Dual 50 W base station[a] | | |
| Minimum RF output power (5 W) | 16 A | 192 W |
| Maximum RF output power (50 W) | 36 A | 432 W |
| 100 W base station | | |
| Minimum RF output power (10 W) | 14.6 A | 176 W |
| 50% RF output power (50 W) | 23.6 A | 285 W |
| Maximum RF output power (100 W) | 32 A | 385 W |

a. Both channels transmitting.

### Standby

| | A | W |
|---|---|---|
| Single 50 W and 100 W base station | 2.0 A | 24 W |
| Dual 50 W base station | 3.3 A | 39 W |

### 1.4.4 24VDC Input

#### Transmit

| | A | W |
|---|---|---|
| Single 50 W base station | | |
| Minimum RF output power (5 W) | 4.4 A | 106 W |
| Maximum RF output power (50 W) | 9 A | 216 W |
| Dual 50 W base station[a] | | |
| Minimum RF output power (5 W) | 7.9 A | 190 W |
| Maximum RF output power (50 W) | 17 A | 408 W |
| 100 W base station | | |
| Minimum RF output power (10 W) | 7.1 A | 171 W |
| 50% RF output power (50 W) | 11.8 A | 285 W |
| Maximum RF output power (100 W) | 15.5 A | 370 W |

a. Both channels transmitting.

#### Standby

| | A | W |
|---|---|---|
| Single 50 W and 100 W base station | 975 mA | 23 W |
| Dual 50 W base station | 1.6 A | 39 W |

## 1.4.5 48 VDC Input

### Transmit

| | A | W |
|---|---|---|
| Single 50 W base station | | |
| Minimum RF output power (5 W) | 2.1 A | 101 W |
| Maximum RF output power (50 W) | 4.2 A | 202 W |
| Dual 50 W base station[a] | | |
| Minimum RF output power (5 W) | 3.7 A | 178 W |
| Maximum RF output power (50 W) | 7.8 A | 374 W |
| 100 W base station | | |
| Minimum RF output power (10 W) | 3.2 A | 155 W |
| 50% RF output power (50 W) | 5.5 A | 265 W |
| Maximum RF output power (100 W) | 7.4 A | 355 W |

a. Both channels transmitting.

### Standby

| | A | W |
|---|---|---|
| Single 50 W and 100 W base station | 480 mA | 23 W |
| Dual 50 W base station | 780 mA | 38 W |

# 1.5 Receiver

## General

| | |
|---|---|
| Frequency bands | |
| B1 band | 136 MHz to 174 MHz |
| HH band | 378 MHz to 420 MHz |
| H1 band | 400 MHz to 440 MHz |
| H2 band | 440 MHz to 480 MHz |
| H3 band | 470 MHz to 520 MHz |
| K4 band | 794 MHz to 824 MHz |
| Type | Triple conversion superheterodyne; first conversion is analog, second is hybrid, and third is digital |
| Frequency increments | |
| B band | 2.5 kHz and 3.125 kHz |
| H and K4 bands | 5 kHz and 6.25 kHz |
| Switching range[a] | |
| B band | ±2 MHz |
| H1, H2 & H3 bands | ±5 MHz |
| , HH & K4 bands | Full band |

a. The frequency range, measured from the tuned frequency, that can be used without needing to retune the front end or recalibrate the RSSI. Bands with full switching range do not require manual tuning.

| | |
|---|---|
| Input load impedance | 50 Ω nominal (VSWR < 2:1) |
| RF input protection | no degradation after 5 minutes exposure to on-channel signals at +20 dBm (2.2 V) |
| Frequency stability | |
| Internal reference | ±0.5 ppm –30 °C to +60 °C (–22 °F to +140 °F) |
| External reference | |
| B band | ±1 Hz ± multiplied accuracy of external reference |
| H band | ±1 Hz ± multiplied accuracy of external reference |
| K band | ±2 Hz ± multiplied accuracy of external reference |
| RSSI | ≤–125 dBm to –30 dBm |
| IF stages - B1 band | |
| Frequencies | |
| Analog | 21.4 MHz |
| Digital | 21.4 MHz and 0 Hz |
| IF stages - H and K4 bands | |
| Frequencies | |
| Analog | 70.1 MHz |
| Digital | 8.66 MHz and 0 Hz |

## General (Continued)

| | |
|---|---|
| Spurious Emissions | |
| Conducted | <–90 dBm 9 kHz to 2 GHz<br><–70 dBm 2 GHz to 12.75 GHz |
| Radiated | <–57 dBm 30 MHz to 1 GHz<br><–47 dBm 1 GHz to 4 GHz |

## Digital RF (DMR)

| | |
|---|---|
| Digital unfaded sensitivity[a] | <–120 dBm @ 5% BER (DAQ 2.0)<br><–118.5 dBm @ 2.6% BER (DAQ 3.0)<br><–118 dBm @ 2% BER (DAQ 3.4)<br><–117 dBm @ 1% BER (DAQ 4.0)<br><–122 dBm (0.18µV) @ 5% BER |

a. Center of switching range at 25°C.

| | |
|---|---|
| Digital selectivity | |
| B and H bands | ≥82 dB @ 1% BER |
| G band | ≥80 dB @ 1% BER |
| H5 band | ≥79 dB @ 1% BER |
| K and L2 bands | ≥77 dB @ 1% BER |
| Digital spurious response attenuation | ≥90 dB |
| Digital intermodulation response attenuation[b] | ≥78 dB @ 1% BER unfaded |

b. Up to 5 dB degradation at extremes of switching range and temperature.

| | |
|---|---|
| Digital blocking rejection | |
| >1 MHz | 100 dB @ 1% BER |
| Digital co-channel rejection | 12 dB |

## Digital RF (P25)

The test methods used to obtain these figures are those described in TIA-102.CAAA-D for P25 Phase 1, and TIA-102.CCAA-A for P25 Phase 2.

| | |
|---|---|
| Digital unfaded sensitivity[a] | <–120 dBm @ 5% BER |
| Digital faded sensitivity[a] | <–112 dBm @ 5% BER |

a. At 25 °C.

| | |
|---|---|
| Digital adjacent channel rejection | 60 dB |

## Digital RF (P25)

| | |
|---|---|
| Digital signal displacement bandwidth | 1 kHz |
| Digital spurious response attenuation | ≥100 dB |
| Digital intermodulation response attenuation | 85 dB |
| Digital blocking rejection | |
| 1 to 10 MHz | 100 dB |
| Digital co-channel rejection | 9 dB |

## Analog RF

| | Channel Spacing | Modulation 100% Deviation (Nominal) |
|---|---|---|
| Narrow Bandwidth (NB) | 12.5 kHz | +/-2.5 kHz |
| Wideband | 25 kHz | +/-5 kHz |

### FCC Narrow banding Regulations

The following regulations apply to all base stations, regardless of FCC jurisdiction.

From 1 January 2013 it is an FCC requirement that land mobile radio systems must not operate channels with a bandwidth greater than 12.5 kHz in the 150–174 MHz and 421–470 MHz frequency bands. From this date all base stations will be supplied with firmware that requires a software feature license to operate a wide bandwidth channel in these frequency bands.

The TBAS083 20/25 kHz Unrestricted Wideband feature license is available to any customer not subject to these FCC regulations, or with an FCC waiver. Note that this feature license is also required to operate a wide bandwidth channel on the spot frequencies which are exempt from the FCC requirement. To obtain the feature license, or for more information, contact your regional Tait office.

Unless otherwise noted, specifications in this section apply to narrowband and wideband operation.

Sensitivity[a,b]

| | |
|---|---|
| De-emphasized response | |
| Centre of switching range | <–119 dBm (0.25 µV) at 25 °C |
| Edge of switching range | <–117 dBm (0.32 µV) at 25 °C |

a. 12 dB SINAD.

b. Up to 2 dB degradation at extremes of temperature.

Maximum usable sensitivity[c,d]

| | |
|---|---|
| De-emphasized response | |
| Centre of switching range | <–116 dBm (0.35 µV) at 25 °C (narrowband)<br><–118 dBm (0.35 µV) at 25 °C (wideband) |
| Edge of switching range | <–114 dBm (0.45 µV) at 25 °C (narrowband)<br><–116 dBm (0.45 µV) at 25 °C (wideband) |

c. Sensitivity for 20 dB SINAD, psophometrically weighted, RF source modulated at 60% deviation with 1 kHz.

d. Up to 2 dB degradation at extremes of temperature.

FM quieting[e]

| | |
|---|---|
| Narrowband | –113 dBm |
| Wideband | –117 dBm |

e. 20 dB FM quieting, measured with de-emphasis on.

## Analog RF

| | |
|---|---|
| Hum and Noise (Ultimate signal-to-noise ratio) (at –47 dBm)[f] | |
| B and H bands | 45 dB (ANSI/TIA) (narrowband)<br>50 dB (CEPT - psophometric) (narrowband) |
| B band | 55 dB (ANSI/TIA) (wideband) |
| K4 band | 43 dB (ANSI/TIA) |

f. Up to 5 dB degradation at extremes of switching range and temperature.

| Selectivity[g] | EIA-603[h] | TIA/EIA-603-D[h] | ETSI |
|---|---|---|---|
| B and H bands, narrowband | 85 dB | 50 dB | 85 dB |
| B band, wideband | 90 dB | 87 dB | |
| K4 band | 79 dB | 45 dB | — |

g. Up to 5 dB degradation at extremes of switching range and temperature.

h. The EIA-603 is a single tone test method. The TIA/EIA-603-D is a two-tone test method.

| | |
|---|---|
| Signal displacement bandwidth | ≥1 kHz |
| Spurious response attenuation | ≥100 dB (ANSI/TIA)<br>≥90 dB (ETSI) |
| Intermodulation response attenuation[i] | |
| B and H bands | 80 dB (ETSI) (narrowband) |
| B band | 85 dB (ANSI/TIA) (wideband) |
| K4 band | 80 dB (ANSI/TIA) |

i. Up to 5 dB degradation at extremes of switching range and temperature.

| | |
|---|---|
| Blocking rejection | |
| B and H bands | |
| 1–10 MHz | 100 dB (ETSI) |
| >10 MHz | 110 dB (ETSI) |
| ±1, ±2, ±5 and ±10 MHz | 100 dB (ANSI/TIA) |
| K4 band | |
| 1–10 MHz | 100 dB (ANSI/TIA) |
| >10 MHz | 110 dB (ANSI/TIA) |
| ±1, ±2, ±5 and ±10 MHz | 100 dB (ANSI/TIA) |
| Co-channel rejection | |
| Narrowband | –8 dB |
| Wideband | –5 dB |
| Amplitude characteristic[j] | ≤3 dB (ETSI) |

j. RF Input Level –107 dBm to –13 dBm.

## Analog Audio - General

| | |
|---|---|
| Frequency response (FM demodulator to G.711) | |
| Bandwidth (subaudible signaling enabled) | 339 Hz - 3 kHz |
| Bandwidth (subaudible signaling disabled) | 185 Hz - 3 kHz |
| De-emphasis | within +1, -3 dB of a -6 dB/octave de-emphasis curve (ref 1 kHz). |
| Pre-emphasis | within +1, -3 dB of a +6 dB/octave pre-emphasis curve (ref 1 kHz) |
| Flat | within +1, -3 dB (ref 1 kHz) |
| | For more information, refer to "Appendix A Frequency Response Diagrams" on page 55. |

Extended bypass mode response for speech path set to flat (FM demodulator to G.711)

| Frequency range (Hz) | Response (dB compared with 1 kHz) |
|---|---|
| 0 - 3300 | +/- 1.0 |
| 3550 | -3 |
| 4000 | -30 |

## Analog Audio - CTCSS

| | |
|---|---|
| High pass (subaudible) filter | |
| Hum and noise[a] | 30 dB minimum at 250.3 Hz<br>35 dB typical (67 Hz to 240 Hz) |

a. 1 kHz at 60% system deviation, CTCSS at 10% system deviation.

| | |
|---|---|
| Tone detect | |
| Tone squelch opening | better than 6 dB SINAD |
| Tone detect bandwidth | |
| Accept | ±2 Hz typical |
| Reject | ±3.6 Hz typical |
| Response time (open) | ≤150 ms typical |

## Analog Audio - Gating Operation

SINAD gating

| | |
|---|---|
| Opening level | 6 dB to 20 dB SINAD |
| Accuracy | ±3 dB |
| RF hysteresis | 4 dB |
| Opening time | 60 ms typical |
| Closing time | 60 ms typical |

# 1.6 Transmitter

The specifications in this section pertain only to the combination of a TB9400 reciter with a 50 W or 100 W power amplifier.

**FCC Narrow banding Regulations**

The following regulations apply to all base stations, regardless of FCC jurisdiction.

From 1 January 2013 it is an FCC requirement that land mobile radio systems must not operate channels with a bandwidth greater than 12.5 kHz in the 150–174 MHz and 421–470 MHz frequency bands. From this date all base stations will be supplied with firmware that requires a software feature license to operate a wide bandwidth channel in these frequency bands.

The TBAS083 20/25 kHz Unrestricted Wideband feature license is available to any customer not subject to these FCC regulations, or with an FCC waiver. Note that this feature license is also required to operate a wide bandwidth channel on the spot frequencies which are exempt from the FCC requirement. To obtain the feature license, or for more information, contact your regional Tait office.

Unless otherwise noted, specifications in this section apply to narrow-band and wideband operation.

### General

| | |
|---|---|
| Frequency bands | |
| B1 band | 136 MHz to 174 MHz |
| HH band | 378 MHz to 420 MHz |
| H1 band | 400 MHz to 440 MHz |
| H2 band | 440 MHz to 480 MHz |
| H3 band | 470 MHz to 520 MHz |
| K4 band | 762 MHz to 776 MHz and 850 MHz to 870 MHz |
| Frequency increments | |
| B band | 2.5 kHz and 3.125 kHz |
| H and K4 bands | 5 kHz and 6.25 kHz |
| Frequency stability[a] | ±0.5 ppm –30 °C to +60 °C (–22 °F to +140 °F) |
| Output load impedance | 50 Ω nominal |

a. For K4 band (762 MHz to 776 MHz) the internal frequency reference accuracy is inadequate, and an external reference must be used. The stability of this reference should be better than 100 parts per billion. See "External Frequency Reference Input (BNC)" on page 36.

## General (Continued)

| | |
|---|---|
| Output power | |
| 50 W PA | |
| Rated Power | 50 W |
| Range of Adjustment | 5 W to 50 W in 1 W steps |
| 100 W PA | |
| Rated power | 100 W |
| Range of adjustment | 10 W to 100 W in 1 W steps |
| Output power accuracy[b] | |
| Within normal operating voltages and temperatures | +0.5 / –0.2 dB into a 50 Ω load |
| At extremes of temperature and altitude | +0.5 / –1.5 dB into a 50 Ω load |
| Peak-to-average power level[c] | peak power is +2.7 dB above average rated power |
| Duty cycle | |
| Up to 3600 m (11810 ft) altitude | 100% at maximum rated output power[d] at +60 °C (+140 °F) ambient temperature |
| Above 3600 m (11810 ft) altitude | 100% at maximum rated output power[d] at +50 °C (+122 °F) ambient temperature, or output power derated by 1.5 dB at +60 °C (+140 °F) |
| Mismatch capability | |
| Ruggedness | open and short circuit load at any phase angle for one hour[e] |
| Stability | 5:1 load VSWR at all phase angles[e] |
| Protection[f] | |
| Temperature | power foldback to 35 W if RF power devices exceed safe operating conditions |
| Current | power foldback and shutdown if RF power devices exceed safe operating currents for more than 5 seconds |
| Supply voltage | power foldback to 35 W when supply voltage is 24 V to 26 V and 30 V to 32 V; shutdown when supply voltage is <24 V and >32 V |
| VSWR | power foldback to 25 W to 35 W when VSWR >3:1 |
| Feedback loop instability | power reduces to maintain loop stability within safe margins |

b. Measured directly on PA output.

c. LSM and P25 Phase 2 only.

d. Measured directly on PA output.

e. Under power foldback.

f. Power foldback only occurs if the set power is higher than the foldback power level.

## General (Continued)

| | |
|---|---|
| Adjacent channel power (K4 bands) | |
| Steady State (All modulation types ETSI) | < –60dBc (EN 300 113 & EN 300 086) |
| Steady State (P25 - TIA) | < –67dBc (TIA-102.CAAA) |
| Steady State (DMR) | < –60dBc (EN 300 113) |
| Transient (P25 & DMR - ETSI) | < –50dBc (EN 300 113) |
| Adjacent Channel Power (B3 and H bands only) | |
| All modulation types | |
| Steady State | < –60 dBc (EN 300 113 & EN 300 086) |
| Transient | < –60 dBc (EN 300 113) |

g. 762-776 MHz band complies with FCC 47 CFR 27.53(e)(6) and 47 CFR 90.543(a).

| | |
|---|---|
| Modulation fidelity | |
| DMR | <2% (EN 300 113) |
| P25 | <2% TIA-102.CAAA and TIA-102.CCAA |
| Intermodulation | |
| P25/DMR | -40dBc with interfering signal at –30dBc at TB9400 base station RF output. For Europe, 70dB ratio is achieved using an external circulator/isolator with a minimum isolation of 30dB and less than 0.5dB insertion loss. |

Tait recommends that an external isolator should always be connected to the output of the VHF transmitter.

| | |
|---|---|
| Sideband noise[h] | |
| ±12.5 kHz | < –120 dBc/Hz |
| ±100 kHz | < –130 dBc/Hz |
| ≥±1.5 MHz | < –154 dBc/Hz at 50 W<br>< –157 dBc/Hz at 100 W |

h. No modulation, measured from center frequency.

| | |
|---|---|
| Radiated spurious emissions | |
| Transmit - B band | < –36 dBm 30 MHz to 1 GHz<br>< –30 dBm 1 GHz to 4 GHz |
| Transmit - H band | < –36 dBm 30 MHz to 1 GHz<br>< –30 dBm 1 GHz to 4 GHz[i]<br>< –30 dBm 1 GHz to 12.75 GHz[j] |
| Transmit - K4 band | <–20 dBm to 9 GHz |
| Standby | <–57 dBm to 1 GHz<br><–47 dBm 1 GHz to 4 GHz |

i. Transmit frequency below 470 MHz.

j. Transmit frequency above 470 MHz.

## General (Continued)

| | |
|---|---|
| Conducted spurious emissions | |
| Transmit - B band | < –36 dBm 9 kHz to 1 GHz |
| | < –30 dBm 1 GHz to 4 GHz |
| Transmit - H band | < –36 dBm 30 MHz to 1 GHz |
| | < –30 dBm 1 GHz to 4 GHz[k] |
| | < –30 dBm 1 GHz to 12.75 GHz[l] |
| Transmit - K4 band | <–20 dBm to 9 GHz |
| Standby | <–57 dBm to 1 GHz |
| | <–47 dBm 1 GHz to 12.75 GHz |

k. Transmit frequency below 470 MHz.

l. Transmit frequency above 470 MHz.

| | |
|---|---|
| Transient behavior - B and H bands | complies with EN 300 113 v2.2.1 |

## Simulcast

| | |
|---|---|
| Launch time accuracy[a] | ±1.5 µs |

a. Launch time offset, adjustable in 1 µs increments.

| | |
|---|---|
| Deviation accuracy | 0.2 dB |
| Frequency accuracy[b] | <1 Hz |

b. Carrier frequency offset, adjustable in 0.1 Hz increments.

| | |
|---|---|
| Supported simulcast modulation schemes | |
| P25 | C4FM |
| | LSM |
| | H-DQPSK |
| DMR | 4FSK |
| Analog | FM |
| Receive voter limitations[c] | |
| Maximum number of receivers | 10 (Conventional) 14 (Trunked) |
| Maximum marshaling duration: | |
| P25 | 300 ms (simulcast operation) |
| DMR | 300 ms (simulcast operation) |
| Analog | 150 ms (simulcast operation) |
| Maximum central voter speech packet arrival time skew | 100 ms |

c. For a discussion of the significance of these limitations, see the System Manual.

## Simplex

| | |
|---|---|
| Coaxial relay operating time | 30 ms (maximum)[a] |

### Simplex

| | |
|---|---|
| Isolation (off-state) | > 40 dB |

a. **Warning**: A coaxial relay that takes longer than 30 ms to operate risks damage to the PA.

### Analog Audio - General

| | |
|---|---|
| Peak deviation | |
| Narrowband | ≤2.5 kHz |
| Wideband | ≤5 kHz |
| Nominal deviation selection[a] | 55% to 65% of peak deviation |
| Limiting deviation[b] | 94% of maximum system deviation |
| CWID deviation | 40% of peak deviation |

a. For a level of –10 dBm0 applied to the line input.

b. With modulation input driven at a frequency of 1 kHz, and 20 dB above the nominal level of 60% deviation.

### Analog Audio - Modulation Characteristics

| | |
|---|---|
| Frequency Response (G.711 to FM modulator) | |
| Bandwidth (subaudible signaling enabled) | 307 Hz - 3 kHz |
| Bandwidth (subaudible signaling disabled) | 134 Hz - 3 kHz |
| Pre-emphasized response | within +1, –3 dB of a 6 dB/octave pre-emphasis curve (ref. 1 kHz) |
| Flat response | within +0.5, –1.5 dB of output level at 1 kHz |
| | For more information, refer to "Appendix A Frequency Response Diagrams" on page 55. |

Extended bypass mode response for speech path set to flat (G.711 to FM modulator)

| Frequency range (Hz) | Response (dB compared with 1 kHz) |
|---|---|
| 0 - 3600 | +/- 1.0 |
| 3600 - 3760 | +1.0 / -3 |
| 4000 | -10 |

| | |
|---|---|
| Distortion | <2% |

## Analog Audio - Modulation Characteristics (Continued)

| | |
|---|---|
| Hum and noise[d] | |
| Narrowband | –50 dB typical (ETSI) |
| Wideband | –55 dB typical (ANSI/TIA) |

d. Up to 5 dB degradation at extremes of switching range and temperature.

## Analog Audio - CTCSS

| | |
|---|---|
| Standard tones | all 37 ANSI/TIA group A, B and C tones plus 13 commonly used tones |
| Frequency error (from ANSI/TIA tones) | 0.08% maximum |
| Generated tone distortion | 1.2% maximum |
| Generated tone flatness | flat across 67 Hz to 250.3 Hz to within 1 dB |
| Modulation level | Adjustable |
| Modulated distortion | <5% |

# 1.7 Network

## 1.7.1 Requirements for Delay, Jitter, Loss and Duplication

| Standard Requirements | Recommended | Required |
|---|---|---|
| Out of order C plane and U plane packets[a] | Less than 0.01% | |
| Packet Loss | Less than 0.01% | |
| Latency | Less than 40 ms | < 150 ms |
| Jitter | Less than 20 ms | < 100 ms |
| Skew | Less than 80 ms | |
| Minimum bandwidth for user traffic (voice, control channel, packet data) | P25: 108 kbit/s per physical channel<br>Analog: 108 kbit/s per physical channel<br>DMR: 64 kbit/s per physical channel | |
| Minimum bandwidth to carry management traffic (web, logs, SNMP). | 100 kb/s per site | |
| Minimum bandwidth to meet jitter requirements on a non-fragmenting link | 600 kb/s per site up to 5 physical channels | |

a. ‘C plane’ and ‘U plane’ are telco terms for distinguishing between call setup and user traffic.

### 1.7.2 Channel Group Size

The table below defines vote contributors and channel group size for each channel type:

'Channel group size' is the number of receivers and transceivers in a channel group.

| | | Series 1 | Series 2 |
|---|---|---|---|
| **Channel Type** | **Vote Contributors** | **Channel Group Size** | **Channel Group Size** |
| P25 failsoft (trunking) | all base stations | 14 | 28 |
| P25 trunked control channel | all base stations | 14 | 28 |
| P25 trunked traffic channel Phase 1 and Phase 2 | all base stations | 14 | 28 |
| P25 conventional[a] | 10 | 20 | 28 |
| P25 dual mode[a] | 10 | 20 | 28 |
| AS-IP conventional[a] | 10 | 20 | 28 |
| All DMR (trunked and conventional) | all base stations | 10 | 28 |

a. P25/AS-IP conventional channel groups with more than 10 base station receivers automatically restrict the number of voting contributors to the best 10 receivers. This is to maintain responsiveness of management operations such as the web user interface.

## 1.8 System Connections

### 1.8.1 External Frequency Reference Input (BNC)

| | |
|---|---|
| Frequencies[a] | 10 MHz or 12.8 MHz |
| Lock range | ± 50 Hz |
| Input level | 500 mVpp to 5 Vpp |
| Input impedance | ≥ 1 kΩ |

a. Automatically detected by the reciter.

### 1.8.2 Ethernet Interface (RJ45)

| | |
|---|---|
| Transceiver | 10/100 Base-Tx/Rx (Auto-MDIX) |
| IEEE-spec | IEEE 802.3 and 802.3u |

### 1.8.3 System Interface (DB-25)

**External General Purpose Digital Inputs**

| | |
|---|---|
| Input low threshold | $V_{IL}$ < 0.6 V |
| Input high threshold | $V_{IH}$ > 2.3 V |
| Internal pull-up (5V) | ≥ 10 kΩ |
| Input source current | $I_{IL}$ < 1 mA ($V_{IL}$ = 0 V) |
| Continuous input voltage | $\|V_{IN}\|$ < 30 V |
| Transient input voltage | $\|V_{IN}\|$ < 35 V (t < 1 s) |

## 1.8.4 Balanced Interface

### Line Output - Balanced

| | |
|---|---|
| **Audio Headroom**<br><br>The largest sine-wave signal that meets distortion specifications | +10 dBm |
| **Input Level Range**<br><br>For an output signal of 60% deviation at 1 kHz<br>Adjustable over this range | -30 dBm to +0 dBm |
| Output impedance | 600 Ω balanced |
| Return loss | > 20 dB |
| Impedance balance about earth<br>(ITU-T G.117) | > 46 dB |
| Frequency response<br>('speech' setting) | 300 Hz to 3 kHz |
| Passband ripple<br>(compared with 1 kHz) | -3 dB to +1 dB |
| **Distortion (RF to line)**<br><br>Applicable over a level adjustment range up to the audio headroom limit<br><br>Applicable over the entire frequency response range | 3 % |

### Line Input - Balanced

| | |
|---|---|
| Audio headroom | +10 dBm |
| Input Level Range<br>For an output signal of 60% deviation at 1kHz<br>Adjustable over this range | -30 dBm to 0 dBm |
| Impedance | 600 Ω balanced |
| Return loss | >20 dB |
| Impedance balance about earth<br>ITU G.117 | >46 dB |
| Frequency response | 300 Hz to 3 kHz |
| Distortion (line to RF) | 3% |

### 1.8.5 Audio Delay

**Transmit direction:** 70 ms max (signal applied to a balanced input)

**Receive direction:** 70 ms max (signal sampled on a balanced output)

**Delay distortion:** ≤ 40 µspp 300 Hz to 3 kHz (relative to 1 kHz)

*Delay distortion is the pulse distortion that arises because different frequency components have different delays.*

### 1.8.6 Rx Gate Output

**Logic state:** Active low

**Logic type:** Open drain transistor connection

The Rx Gate output is not the same as an M-wire output:

Large negative voltages (traditionally associated with E&M signaling) can damage the reciter hardware when applied directly.

Tait offers an isolation adapter that provides E&M isolated signaling (order number TBC101A).

**Electrical Characteristics**

| Parameter | Specification | Comments |
|---|---|---|
| Low voltage level | <0.4 V | Rx gate activated |
| High voltage level | 0 to 30 V | Protection |
| Low level output current | <250 mA | |
| High level output current | <100 µA at 30 V | |

### 1.8.7 RSSI Output

| Parameter | Value | Unit |
|---|---|---|
| Configurable RF input range | -120 .. -60 | dBm |
| Configurable output range | 1 .. 4.5 | V |
| Maximum output range Series 1 | 0.8 .. 4.6 | V |
| Maximum output range Series 2 | 0.5 .. 4.9 | V |
| Accuracy | +/- 300 | mV |
| Response time | < 70 | ms |
| Output impedance | 100 | Ohm |

### 1.8.8 Antenna Relay Output

The antenna relay output will be active when the base station transmits, if the antenna relay is enabled in the WebUI.

**Logic state:** Active low

**Logic type:** Open drain transistor connection

Antenna relay operation applies to P25, and analog conventional mode when using DMR firmware.

**Electrical Characteristics**

| Parameter | Specification | Comments |
|---|---|---|
| Low voltage level | < 0.4 V | Antenna relay activated |
| High voltage level | 0 to 30 V | Protection |
| Low level output current | < 250 mA | |
| High level output current | < 100 µA at 30V | |

### 1.8.9 Tx Key Input

The Tx Key input is not the same as an E-wire input:

Large negative voltages (traditionally associated with E&M signaling) can damage the reciter hardware if applied directly.

Tait offers an isolation adapter that provides E&M isolated signaling (order number TBC101A).

**Logic state:** Active low.

**Electrical Characteristics**

| Parameter | Specification | Comments |
|---|---|---|
| Low voltage level | <= +0.8 V | Input active |
| High voltage level | >= +2 V | Input inactive |
| Input hysteresis | >= 0.4 V | |
| Input resistance | >= 10 kΩ | To +5 rail |
| Maximum external pull up voltage | <= 20 V | |

### 1.8.10 1PPS Timing Reference Input (BNC)

| | |
|---|---|
| Input low threshold | $V_{IL}$ < 0.6 V |
| Input high threshold | $V_{IH}$ > 2.3 V |
| Input termination | 470 Ω + 5% (AC terminated) |
| Transient input voltage | $\|V_{IN}\|$ < 15 V |
| Frequency | 1 PPS |
| Polarity | rising edge represents a timing reference |
| Maximum jitter | ±50 ns |

### 1.8.11 Channel Group Size

The table below defines vote contributors and channel group size for each channel type.

‘Channel group size’ is the number of members (transceivers or receivers) in a channel group.

‘Vote contributors’ are the number of active receivers that will contribute to a voted output.

| | | Series 1 | Series 2 |
|---|---|---|---|
| **Channel Type** | **Vote Contributors** | **Channel Group Size** | **Channel Group Size** |
| P25 failsoft (trunking) | all base stations | 14 | 28 |
| P25 trunked control channel | all base stations | 14 | 28 |
| P25 trunked traffic channel Phase 1 | all base stations | 14 | 28 |
| P25 conventional | 10 | 20 | 28 |
| P25 dual mode | 10 | 20 | 28 |
| AS-IP conventional | 10 | 20 | 28 |

In systems with a mixture of Series 1 and Series 2 base stations, the channel group sizes in the above table will depend on whether the channel group master is a Series 1 or Series 2 base station.

# 1.9 Miscellaneous

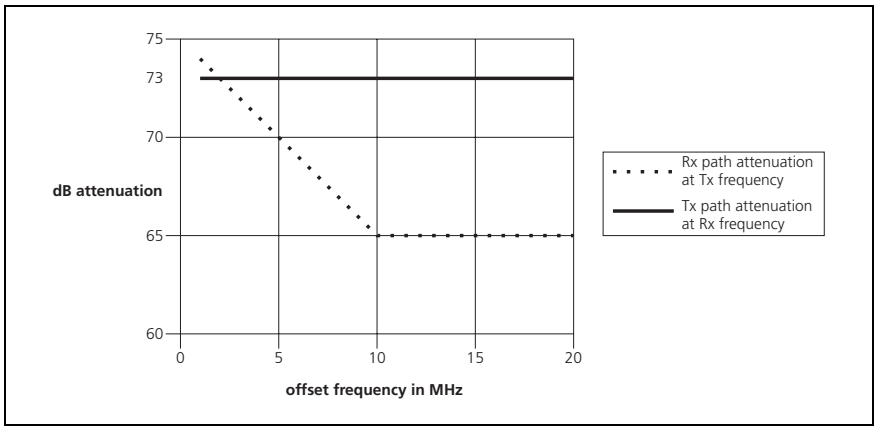
## 1.9.1 Channel Details

| | |
|---|---|
| Number of channels | 4000 |
| Channel change time | 300 ms |

## 1.9.2 Duplexer Attenuation Requirements

The following graph shows the attenuation requirements for duplexers used with the base station. The dotted plot represents the attenuation required in the Rx path at the Tx frequency, while the continuous plot shows the attenuation required in the Tx path at the Rx frequency.

A 100 W transmitter is assumed. The quoted attenuation will ensure no more than 1 dB of receiver desensitization (from the specified sensitivity), with a 5 dB margin built in.




## 1.9.3 Operating Temperature Range

| | |
|---|---|
| Operating temperature range | -30 °C to +60 °C (-22 °F to + 140 °F) ambient temperature[a] |

a. Ambient temperature is defined as the temperature of the air at the intake to the cooling fans.

### 1.9.4 Heat Load Values

These measurements were carried out with the base station transmitting at its rated output power with all front panel fans running. All measurements were carried out with no load on the auxiliary power supply.

| | W | Btu/h |
|---|---|---|
| Base station[a] | | |
| Single 50 W | 185 W | 631 Btu/h |
| Dual 50 W | 340 W | 1160 Btu/h |
| 100 W | 295 W | 1007 Btu/h |

a. Transmitting at rated output power.

### 1.9.5 Dimensions and Weight

| | |
|---|---|
| Dimensions | |
| Height | 176.8 mm (7 in) |
| Width | 482.6 mm (19 in) |
| Length | |
| Subrack only | 385 mm (15.2 in) |
| Including front panel | 400.5 mm (15.8 in) |
| Weight[a] | |
| Single 50W Base Station | 19.6 kg (43.2 lb) |
| Dual 50W Base Station | 24.8 kg (54.7 lb) |
| 100W base station | 21.1 kg (46.5 lb) |
| Receive-only | |
| 1 receiver | 16.9 kg (37.3 lb) |
| 2 receivers | 19.3 kg (42.5 lb) |
| 3 receivers | 21.7 kg (47.8 lb) |
| 4 receivers | 24.1 kg (53.1 lb) |

a. With AC and DC PMU.

### 1.9.6 Reliability

| | |
|---|---|
| MTBF | 140,000 hours minimum (based on field returns) |

# 2 Module Specifications

This chapter provides hardware specifications for the individual modules used in the TB9400 base station:

- Reciter and receiver
- PA
- PMU

**Notice** The software release notes list known issues or limitations of the base station that may vary from the specifications published in this document. Please refer to the current software release notes for any variations to the specifications in this document.

# 2.1 Reciter and Receiver

## 2.1.1 Identifying the Reciter and Receiver

You can identify the model and hardware configuration of a reciter and receiver by referring to the product code printed on labels on the front and rear panels. The meaning of each character in the product code is explained in the table below.

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

| Product Code | Description |
|---|---|
| T01-0110**X**-XXXX | 3 = reciter<br>4 = receiver |
| T01-0110X-**X**XXX | **Frequency Band and Sub-band**<br>B = 136 MHz to 174 MHz (B1 band)<br>J = 378 MHz to 420 MHz (HH band)<br>K = 400 MHz to 440 MHz (H1 band)<br>L = 440 MHz to 480 MHz (H2 band)<br>M = 470 MHz to 520 MHz (H3 band)<br>N = 762 MHz to 870 MHz (K4 band)[a] |
| T01-0110X-X**X**XX | A = standard |
| T01-0110X-XX**X**X | A = default |
| T01-0110X-XXX**X** | A = default |

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

### 2.1.2 Physical Details

| | |
|---|---|
| Cooling | forced air via front panel fan |
| Connectors | |
| RF input | BNC female |
| Transmit forward RF output | SMA female |
| Transmit reverse RF input | SMA female |
| Recommended SMA torque | 0.6 N·m (5 lbf·in) |
| Control, alarm and 28 VDC input | 20-way IDC male |
| External reference frequency input | BNC female |
| 1PPS input | BNC female |
| Ethernet | RJ45 |
| System inputs and outputs | DB-25 connector |
| Dimensions | |
| Height | 144 mm (5.7 in) |
| Width | 54.6 mm (2.1 in) |
| Length | 321.5 mm (12.7 in) |
| Weight | 2.4 kg (5.3 lb) |

## 2.2 PA

### 2.2.1 Identifying the PA

You can identify the model and hardware configuration of a PA by referring to the product code printed on labels on the front and rear panels. The meaning of each character in the product code is explained in the table below.

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

| Product Code | Description |
|---|---|
| T01-01121-**X**XXX | **Frequency Band and Sub-band**<br>B = 136 MHz to 174 MHz (B1 band)<br>J = 378 MHz to 420 MHz (HH band)<br>K = 400 MHz to 440 MHz (H1 band)<br>L = 440 MHz to 480 MHz (H2 band)<br>M = 470 MHz to 520 MHz (H3 band)<br>N = 762 MHz to 870 MHz (K4 band)[a] |
| T01-01121-X**X**XX | A = 50 W<br>B = 100 W |
| T01-01121-XX**X**X | A = default |
| T01-01121-XXX**X** | A = default |
| T01-01121-XXXX | A = default<br>B = no internal Isolator |

a. The actual frequency coverage in this band when used with a K4-band TB9400 reciter is 762 MHz to 776 MHz and 850 MHZ to 870 MHz.

## 2.2.2 Physical Details

| | |
|---|---|
| Cooling | forced air over heatsink via front panel fan |
| Connectors | |
| 28 VDC input | Phoenix MSTBA2.5HC/2-G-5.08 male |
| Transmit forward RF input | SMA female |
| Transmit reverse RF output | SMA female |
| Recommended SMA torque | 0.6 N·m (5 lbf·in) |
| RF output | N-type female |
| Control and alarm | 8-way IDC male |
| Dimensions - 50 W PA | |
| Height | 144 mm (5.7 in) |
| Width | 54.6 mm (2.1 in) |
| Length | 320.6 mm (12.6 in) |
| Dimensions - 100 W PA | |
| Height | |
| With duct | 144 mm (5.7 in) |
| Without duct | 60 mm (2.4 in) |
| Width | 177 mm (7.0 in) |
| Length | 321.8 mm (12.7 in) |
| Weight | |
| 50 W PA | 2.7 kg (6.0 lb) |
| 100 W PA | 4.2 kg (9.3 lb) |

# 2.3 PMU

## 2.3.1 Identifying the PMU

You can identify the model and hardware configuration of a PMU by referring to the product code printed on labels on the front and rear panels. The meaning of each character in the product code is explained in the table below.

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

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

## 2.3.2 Physical Details

| | |
|---|---|
| Cooling | forced air over heatsink via front panel fan |
| Dimensions | |
| Height | 143.5 mm (5.6 in) |
| Width | 121.4 mm (4.8 in) |
| Length | |
| AC PMU | 324 mm (12.8 in) |
| DC PMU | 337 mm (13.3 in) |
| AC and DC PMU | 337 mm (13.3 in) |
| Weight | |
| AC PMU | 4.8 kg (10.6 lb) |
| DC PMU | 5.1 kg (11.2 lb) |
| AC and DC PMU | 7.0 kg (15.4 lb) |

## 2.3.3 Connections

The following specifications refer to the external wiring and connectors that are connected to the PMU. They do not refer to the wiring and connectors built into the PMU itself.

| | |
|---|---|
| AC input | |
| Connector type | IEC female |
| Current rating | 6 A |

DC input[a]

| | | | |
|---|---|---|---|
| Connector type | M6 screw into threaded fitting on bus bar | | |
| Recommended screw torque | 2–2.5 N·m (18–20 lbf·in) | | |
| | 12 V | 24 V | 48 V |
| Connector current rating | 50 A | 25 A | 12 A |
| Flexible wire size[b] | 2 AWG | 5 AWG | 8 AWG |
| Flexible wire cross section[b] | 35 $mm^2$ | 16 $mm^2$ | 8 $mm^2$ |

a. Battery.

b. For a length of 1.5 m to 2 m (5 ft to 6.5 ft) (typical); the DC input leads should be of a suitable gauge to ensure no more than 3% drop at maximum load over the required length of lead.

| | |
|---|---|
| DC output - low current (from auxiliary power supply) | |
| Connector type | Phoenix MVSTBR2.5HC/2-ST/5.08 female |
| Flexible wire size | 20 AWG to 11 AWG |

# 3 Compliance Standards

The TB9400 base station has been tested and approved to appropriate national and international compliance standards. These standards are listed on the following page and only apply to equipment operating as an integral part of a TB9400 base station.

You can obtain further details of test methods and the conditions that apply for compliance testing in all countries from Tait.

**Notice** The software release notes list known issues or limitations of the base station that may vary from the specifications published in this document. Please refer to the current software release notes for any variations to the specifications in this document.

**RF and EMC Compliances**

The following tables show which variants of the TB9400 have been tested and approved to the listed standards.

A tick indicates the compliance has been received, a date indicates when the compliance is expected to be received, and a blank cell indicates there are currently no plans to apply for this compliance.

| | | B1 Band | | | HH Band | | | H1 Band | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 50 W | 100W | Rx only | 50 W | 100W | Rx only | 50 W | 100W | Rx only |
| RF - P25 Phase 1 and Phase 2 | CFR Title 47 Parts 22 and 90 (FCC) | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| | P25 CAP (P25-CAB-CAI_TEST_REQ July 2017) | | | | | | | | | |
| | RSS-119 (IC) | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| | EN 300 113 (ETSI) | ✓ | ✓ | | | | | ✓ | ✓ | |
| | AS/NZS 4768 Appendix A | ✓ | ✓ | | | | | ✓ | ✓ | |
| | Anatel Act #944:2018 | | | | | | | | | |
| RF DMR/MPT | CFR Title 47 Parts 22 and 90 (FCC) | ✓ | ✓ | | | | | ✓ | ✓ | |
| | RSS-119 (IC) | ✓ | ✓ | | | | | ✓ | ✓ | |
| | EN 300 113 (ETSI) | ✓ | ✓ | | | | | ✓ | ✓ | |
| | AS/NZS 4768 Appendix A | ✓ | ✓ | | | | | ✓ | ✓ | |
| RF - Analog | CFR Title 47 Parts 22 and 90 (FCC) | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| | EN 300 086 (ETSI) | ✓[e] | ✓ | | | | | ✓ | ✓ | |
| | AS/NZS 4295 Appendix B | ✓ | ✓ | | | | | ✓ | ✓ | |
| RF - Analog WB | EN 301 929 (ETSI) (maritime) | | | | | | | | | |
| EMC | CFR Title 47 Part 15 (FCC) / RSS-Gen (ISED) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | EN 301 489-1, EN 301 489-5 (ETSI) | ✓ | ✓ | | | | | ✓ | ✓ | |
| | Anatel Act #952:2018 | | | | | | | | | |

| | | H2 Band | | | H3 Band | | | K4 Band | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 50 W | 100W | Rx only | 50 W | 100W | Rx only | 50 W | 100W | Rx only |
| RF - P25 Phase 1 and Phase 2 | CFR Title 47 Parts 22 and 90 (FCC) | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| | P25 CAP (P25-CAB-CAI_TEST_REQ July 2017) | | | | | | | | | |
| | RSS-119 (IC) | ✓ | ✓ | | | | | ✓ | ✓ | |
| | EN 300 113 (ETSI) | ✓ | ✓ | | ✓ | ✓ | | | | |
| | AS/NZS 4768 Appendix A | ✓ | ✓ | | ✓ | ✓ | | | | |
| | Act #944:2018 ANATEL | | | | | | | | ✓ | |
| RF DMR/MPT | CFR Title 47 Parts 22 and 90 (FCC) | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| | RSS-119 (IC) | ✓ | ✓ | | | | | ✓ | ✓ | |
| | EN 300 113 (ETSI) | ✓ | ✓ | | ✓ | ✓ | | | | |
| | AS/NZS 4768 Appendix A | ✓ | ✓ | | ✓ | ✓ | | | | |
| RF - Analog | CFR Title 47 Parts 22 and 90 (FCC) | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| | EN 300 086 (ETSI) | ✓[a] | ✓[a] | | ✓ | ✓ | | | | |
| | AS/NZS 4295 Appendix B | ✓ | ✓ | | ✓ | ✓ | | | | |
| RF - Wideband | CFR Title 47 Parts 22 and 90 (FCC) | | | | ✓ | ✓ | | | | |
| EMC | CFR Title 47 Part 15 (FCC) / RSS-Gen (ISED) | ✓ | ✓ | ✓ | ✓[b] | ✓[b] | ✓[b] | ✓ | ✓ | ✓ |
| | EN 301 489-1, EN 301 489-5 (ETSI) | ✓ | ✓ | | ✓ | ✓ | | | | |
| | Anatel Act #952:2018 | | | | | | | | ✓ | |

a. Wideband according to EN 300 086

b. FCC only

## Safety and Environmental Compliances

The TB9400 base station has been tested and approved to the following standards.

| | | |
|---|---|---|
| Safety | EN62368<br>UL 60950-1 (E223047)[a]<br>AS/NZS 60950-1, Q090114[a] | |
| Environmental | Low Pressure (Altitude)[b] | MIL-STD-810G Method 500.5 Procedure 2 |
| | Humidity | MIL-STD-810G Method 507.5 Procedure 2 |
| | Vibration | MIL-STD-810G Method 514.6 Procedure 1 |
| | Shock | MIL-STD-810G Method 516.6 Procedure 1 |

a. PMU only

b. 15000 ft (4572 m)

# Appendix A Frequency Response Diagrams

This appendix shows the transmitter and receiver frequency response diagrams.

**Figure A.1 Receiver frequency response**

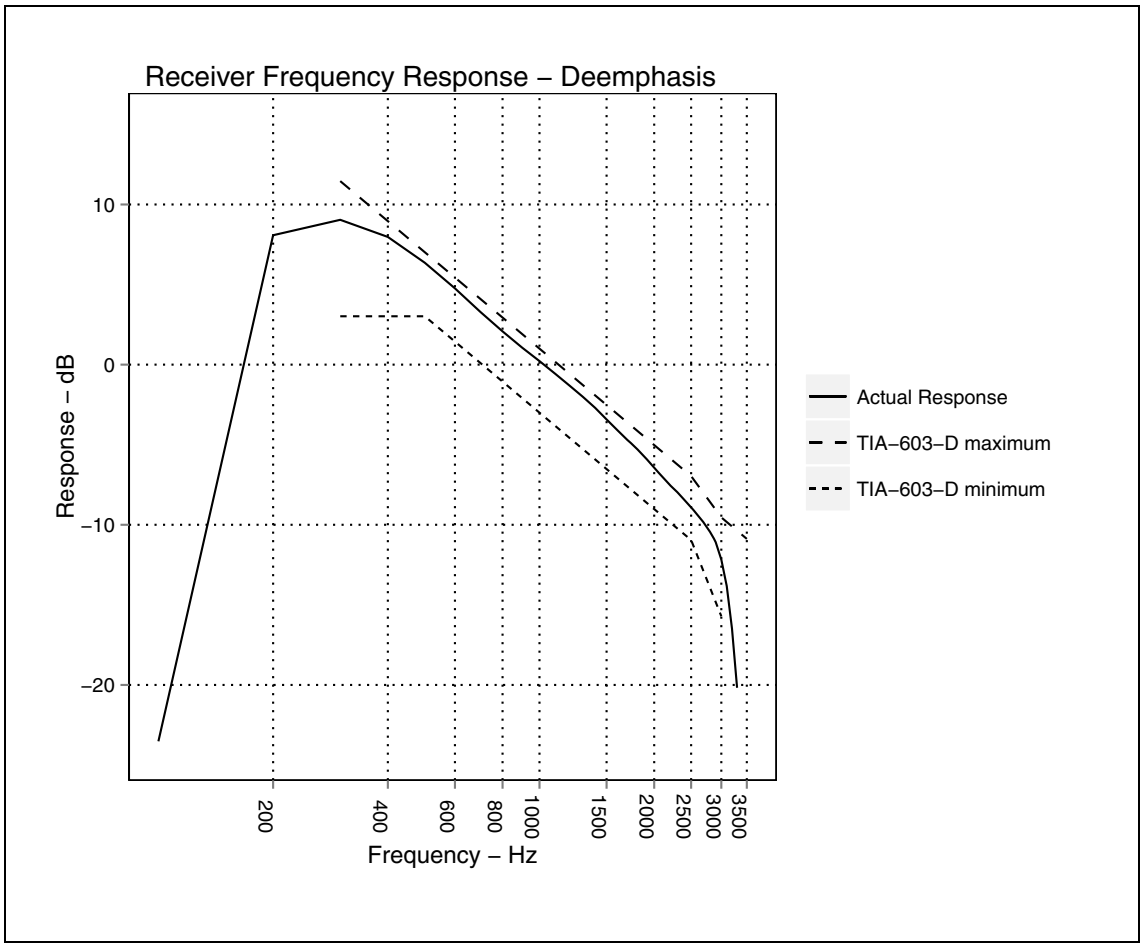


**Figure A.2 Transmitter frequency response**