TB7300 Base Station/Repeater

Specifications Manual

MBD-00002-23 · Issue 23 · December 2023

Contact Information

Tait Communications Corporate Head Office

Tait International Limited
P.O. Box 1645
Christchurch
New Zealand

Imported into the EU by:

Tait Communications GmbH
Stipcakgasse 40
1230 Vienna
Austria

Imported into the UK by:

Tait Europe Limited
Unit A, Buckingham Business Park, Anderson Road Swavesey
Cambridge, CB24 4UQ
United Kingdom

For the address and telephone number of regional offices, refer to our website:
www.taitcommunications.com

Copyright and Trademarks

By using a Tait product you are agreeing to be bound by the terms of the Tait Software Licence Agreement.Please read the Tait Software Licence Agreement carefully before using this Tait product. If you do not agree to the terms of the Tait Software Licence Agreement, do not use the Tait Product. The full agreement is available at www.taitcommunications.com/our-resources/legal#Tait_Software_Licence_Agreement.

Disclaimer

There are no warranties extended or granted by this document. Tait International Limited accepts no responsibility for damage arising from use of the information contained in the document or of the equipment and software it describes. It is the responsibility of the user to ensure that use of such information, equipment and software complies with the laws, rules and regulations of the applicable jurisdictions.

Enquiries and Comments

If you have any enquiries regarding this document, or any comments, suggestions and notifications of errors, please contact your regional Tait office.

Updates of Manual and Equipment

In the interests of improving the performance, reliability or servicing of the equipment, Tait International Limited reserves the right to update the equipment or this document or both without prior notice.

Intellectual Property Rights

This product may be protected by one or more patents or designs of Tait International Limited together with their international equivalents, pending patent or design applications, and registered trade marks, for a complete list please check www.taitcommunications.com/our-resources/legal#Intellectual_Property

The AMBE+2™ voice coding Technology embodied in this product is protected by intellectual property rights including patent rights, copyrights and trade secrets of Digital Voice Systems, Inc. This voice coding Technology is licensed solely for use within this Communications Equipment. The user of this Technology is explicitly prohibited from attempting to decompile, reverse engineer, or disassemble the Object Code, or in any other way convert the Object Code into a human-readable form.

Environmental Responsibilities

Tait International Limited is an environmentally responsible company which supports waste minimization, material recovery and restrictions in the use of hazardous materials.

The European Union's Waste Electrical and Electronic Equipment (WEEE) Directive requires that this product be disposed of separately from the general waste stream when its service life is over. For more information about how to dispose of your unwanted Tait product, visit the Tait WEEE website at www.taitcommunications.com/our-resources/compliance#WEEE. Please be environmentally responsible and dispose through the original supplier, or contact Tait International Limited.

Tait will comply with environmental requirements in other markets as they are introduced.

Contents

Preface

Scope of Manual

Welcome to the Specifications Manual for the TB7300 base station. This manual provides general, performance and physical specifications for the TB7300 base station.

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 current set of TB7300 product documentation is available on the Tait Partner Portal website (https://partnerinfo.taitcommunications.com).

- TB7300 Installation and Operation Manual (MBD-00001-xx)
- TN9300 DMR Trunked System Manual (MNB-00003-xx)
- Tait Core Networks Installation and Configuration Manual (MNB-00012-xx)

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.

Publication Record

Issue	Publication Date	Description
23	December 2023	Updated for release 3.55 and later ■ “13.8VDC Input” on page 12 Standby table updated ■ “Audio Delay” on page 28 updated
22	July 2023	Updated for release 3.50 and later ■ “Analog Audio - Gating Operation” on page 20 updated ■ “External General Purpose Digital Outputs” on page 36 added
21	May 2023	Updated for release 3.45 and later ■ “Audio Delay” on page 28 updated
20	December 2022	Updated for release 3.40 and later ■ K4 frequency band added ■ “Unbalanced Interface” on page 28 added ■ “Appendix A – Frequency Response Diagrams” updated
19	August 2022	Updated for release 3.35 and later ■ “Audio Delay” on page 28 updated
18	April 2022	Updated for release 3.30 and later ■ “Requirements for Delay, Jitter, Loss and Duplication” on page 35 updated
17	November 2021	Updated for release 3.25 ■ “Standby” on page 13 table updated ■ “Antenna Relay Output” on page 31 updated ■ “Channel Details” on page 33 updated
16	April 2021	Updated for release 3.20 ■ B1 frequency band added ■ AC power variant added ■ Various minor updates ■ Receiver “Analog Audio - General” on page 19 updated ■ Receiver “Analog Audio - CTCSS” on page 19 updated ■ Transmitter “Analog Audio - Modulation Characteristics” on page 24 updated ■ “1PPS Timing Reference Input (BNC)” on page 31 updated ■ “Compliance Standards” updated
15	November 2020	General updates for version 3.15 release Various minor updates Updated compliance for H3 band Updated “Antenna Relay Output” Updated “Channel Group Size” table Added RSSI Output Table
14	August 2020	General updates for version sub-release 3.10.01 release Sub-release due to content request: Radiated spurious emissions and Conducted spurious emissions specifications updated

Issue	Publication Date	Description
13	June 2020	General updates for version 3.10 release Minor updates throughout Raised supply voltage threshold to 16.5V under “Power Supply” Compliance Standards tables updated
12	November 2019	General updates for version 3.05 release Minor updates added throughout Included narrowband and wideband specs Included ‘typical’ digital unfaded sensitivity DMR specs
11	July 2019	General updates for version 3.00 release
10	March 2019	General updates for version 2.60 release
9	December 2018	General updates for version 2.55 release
8	July 2018	General updates for version 2.50 release
7	March 2018	General updates for version 2.45 release
6	November 2017	General updates for version 2.40 release

1 Base Station Specifications

The performance figures given in these specifications are applicable only to equipment operating as an integral part of a TB7300 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 voltage.

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 these specifications are those described in the following standards:

- EN 300 086
- EN 300 113
- EN 300 219
- EN 301 489
- CFR Title 47 Part 15
- TIA/EIA-603/603-D
- AS/NZS 4295

Emission Designators

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

Emission Designator	Common Name	Modulation Scheme	Operating Modes
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
11K0F3E	FM	analog FM	analog voice
7K60F2D	MPT Control	FFSK	control channel / traffic channel data
7K60FXD	2-slot DMR	4FSK	data/control channel
7K60FXW	2-slot DMR	4FSK	digital voice/data/ control channel

You can obtain further details of test methods and the conditions which apply for 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.

Frequency Identification	Frequency Band and Sub-band	35W	40W	50W
B band	B1 = 136 MHz to 174 MHz B3 = 148 MHz to 174 MHz	✗ ✗	✗ ✗	✓ ✓
H band	H3 = 470 MHz to 520 MHz H5 = 400 MHz to 470 MHz[a]	✗ ✗	✓ ✓	✗ ✗
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 TB7300 is considered to be configured as a base station with retransmission of receive frequencies.

1.3 Identifying the Base Station

You can identify the model and hardware configuration of a TB7300 by referring to the product code printed on a label on the rear panel. The meaning of each character in the product code is explained in the table below.

Product Code	Description
TB73**XX**-XXXX-XXXX-XXXX-10	10 = DMR + analog base station/repeater 60 = P25 base station/repeater
TB73XX-**XX**XX-XXXX-XXXX-10	**Frequency Band** B1 = 136 MHz to 174 MHz B3 = 148 MHz to 174 MHz H3 = 470 MHz to 520 MHz H5 = 400 MHz to 470 MHz K4 = 762 MHz to 870 MHz
TB73XX-XX**X**X-XXXX-XXXX-10	B = 35/40/50 W
TB73XX-XXX**X**-XXXX-XXXX-10	0 = Default
TB73XX-XXXX-**XXXX**-XXXX-10	0 = Default
TB73XX-XXXX-XXXX-**X**XXX-10	0 = 13.8 VDC (nominal) input A = 120 V and 230 VAC input
TB73XX-XXXX-XXXX-X**X**XX-10	0 = Default (no mains cable) 1 - 5 = Mains cable type
TB73XX-XXXX-XXXX-XX**XX**-10	**Feature License** 00 = None [Default: Analog (TBAS301)] AC = DMR Express SFE License with TDMA operation (TBAS302) AD = DMR Access SFE License with TDMA operation (TBAS303) AE = DMR conventional (TBAS304)
TB73XX-XXXX-XXXX-XXXX-**10**	10 = default

1.4 Power Supply

DC Input

Input voltage	
Operating voltage	12 VDC to 16 VDC
Standard test voltage	13.8 VDC
Operating current	refer to “Power and Current Consumption” on page 12
Protection	
Fault current (input)	15 A fuse circuit breaker or fuse in external wiring[a]
Wrong input voltage	electronic lock-out
Wrong input voltage polarity	shunt diode

a. Provided by user.

AC Input

Input voltage	
Operating voltage	100 VAC to 253 VAC
Standard voltages	120 VAC and 230 VAC
Protection	
Fuse and MOV	

1.5 Power and Current Consumption

The specifications in this section are typical figures.

The transmit measurements were carried out with the base station transmitting at the stated RF output power with all front panel fans running. The standby measurements were carried out with the base station not receiving or transmitting and no front panel fans running.

1.5.1 13.8 VDC Input

Transmit

	A	W
B band		
Minimum RF output power (2W)	2.9A	40W
Maximum RF output power (50W)	9.6A	133W
H band		
Minimum RF output power (2W)	2.8A	38W
Maximum RF output power (40W)	8.1A	112W
K band		
Minimum RF output power (2W)	2.6A	36W
Maximum RF output power (35W)	8.5A	118W

Standby

Date	Band	Sleep A	No Sleep A	Sleep W	No Sleep W
December 2023	VHF	0.47	0.66	6.5	9.1
December 2023	UHF	0.46	0.63	6.3	8.7

1.5.2 AC Input

Transmit

	A	W	VA
B, H and K bands 120 VAC	1.67 A	200 W	200
B, H and K bands 230 VAC	0.87 A	200 W	200

Standby

	A	W	VA
B, H and K bands 120 VAC	0.20 A	20 W	24
B, H and K bands 230 VAC	0.20 A	20 W	46

1.6 Receiver

General

Frequency bands	
B1 band	136 MHz to 174 MHz
B3 band	148 MHz to 174 MHz
H3 band	470 MHz to 520 MHz
H5 band	400 MHz to 470 MHz
K4 band	792 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 K band	5 kHz and 6.25 kHz
Switching range	
B1 band	full range
B3 band[a]	±2MHz
H and K band	full range
Input load impedance	50Ω nominal (VSWR <2:1)
RF input protection	no degradation after 5 minutes exposure to on-channel signals at +20dBm (2.2V)
Frequency stability	
Internal reference	±0.5ppm –30°C to +60°C (–22°F to +140°F)
External reference	±1 Hz ± multiplied accuracy of external reference
RSSI	≤–125dBm to –30dBm

a. The frequency range, measured from the tuned frequency, that can be used without needing to retune the front end or recalibrate the RSSI.

General (Continued)

IF stages - B1 band	
Frequencies	
Analog	21.4 MHz
Digital	21.4 MHz and 0 Hz
Analog IF bandwidth	9 kHz, –3 dB
Digital IF bandwidth	8.06 kHz, –3 dB
IF stages - B3 band	
Frequencies	
Analog	16.9 MHz
Digital	16.9 MHz and 0 Hz
Analog IF bandwidth	9 kHz, –3 dB
Digital IF bandwidth	8.06 kHz, –3 dB
IF stages - H and K band	
Frequencies	
Analog	70.1 MHz
Digital	8.66 MHz and 0 Hz
Analog IF bandwidth	9 kHz, –3 dB
Digital IF bandwidth	8.06 kHz, –3 dB
Spurious Emissions	
Conducted	<–90 dBm 9 kHz to 2 GHz <–70 dBm 2 GHz to 12.75 GHz
Radiated	<–57 dBm 30 MHz to 1 GHz <–47 dBm 1 GHz to 4 GHz

Digital RF (P25)

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

Digital unfaded sensitivity[a]	<–120 dBm @ 5% BER
Digital faded sensitivity[a]	<–112 dBm @ 5% BER
Digital adjacent channel rejection	60 dB
Digital signal displacement bandwidth	1 kHz
Digital spurious response attenuation	≥100 dB
Digital intermodulation response attenuation	85 dB

a. At 25°C

Digital RF (P25) (Continued)

Digital blocking rejection	
1 to 10 MHz	100 dB
Digital co-channel rejection	9 dB

Digital RF (DMR)

Digital unfaded sensitivity[a]	
Guaranteed	<–120 dBm @ 5% BER (DAQ 2.0) <–118.5 dBm @ 2.6% BER (DAQ 3.0) <–118 dBm @ 2% BER (DAQ 3.4) <–117 dBm @ 1% BER (DAQ 4.0)
Typical	<–122 dBm (0.18 µV) @ 5% BER <-- 119 dBm @ 1% BER (ETS 300 113 test method)

a. Center of switching range at 25°C.

Digital selectivity	
B band	≥82 dB @ 1% BER
H band	≥79 dB @ 1% BER
K band	≥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

Analogue Bandwidth

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

FCC Narrowbanding Regulations

The following information applies to all base stations, not just to those sold in countries where FCC regulations apply.

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 who is not subject to the relevant FCC regulations, or who has 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-emphasised 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-emphasised response	
Centre of switching range	<–116 dBm (0.35 µV) at 25 °C (narrowband)
Edge of switching range	<–114 dBm (0.45 µV) at 25 °C (narrowband)

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 Wideband	–113dBm

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

Hum and Noise (Ultimate signal-to-noise ratio) (at –47dBm)[f]

B and H bands	45 dB (ANSI/TIA) (narrowband) 50 dB (CEPT - psophometric) (narrowband)
B band	55 dB (ANSI/TIA) (wideband)
K band	43 dB (ANSI/TIA)

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

Selectivity[g]

	EIA-603[h]	TIA/EIA-603-D	ETSI
B and H bands (narrowband)	85 dB	50 dB	85dB
B band (wideband)	90 dB	87 dB	-
K band	79 dB	45 dB	-

g. Up to 5dB 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	≥100dB (ANSI/TIA) ≥90dB (ETSI)

Intermodulation response attenuation[i]

B and H bands	79dB (ETSI) (narrowband)
B band	85dB (ANSI/TIA) (wideband)
K band	80 dB (ANSI/TIA)

i. Up to 5dB 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)
K 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	–8dB
Amplitude characteristic[j]	≤3dB (ETSI)

Analog RF (Continued)

Co-channel rejection

Narrowband	–8 dB
Wideband	–5 dB

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 38.

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 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

Analog Audio - CTCSS (Continued)

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

RSSI gating

Opening level	-117 dB to -70 dBm
Accuracy[a]	± 0.1 dB
RF hysteresis	6.5 dB
Opening time	20 ms maximum
Closing time	20 ms maximum

a. Assumes that RSSI has been calibrated (WebUI) at the receiver frequency

Receiver gate logical combinations:

SINAD gating only	Provides for robust operation
RSSI gating only	Provides for rapid operation
SINAD OR RSSI gating	Gate operates rapidly and provides robust operation while SINAD condition is met
SINAD AND RSSI gating	Can reject low level interfering signals

1.7 Transmitter

FCC Narrowbanding Regulations

The following information applies to all base stations, not just to those sold in countries where FCC regulations apply.

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 who is not subject to the relevant FCC regulations, or who has 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.

General

Frequency bands	
B1 band	136 MHz to 174 MHz
B3 band	148 MHz to 174 MHz
H3 band	470 MHz to 520 MHz
H5 band	400 MHz to 470 MHz
K4 band	762 MHz to 776 MHz and 850 MHz to 870 MHz
Modulation types	11K0F3E, 7K60FXD, 7K60FXW, 7K60F2D, 8K10F1E, 8K10F1D, 8K10F7W
Frequency increments	
B band	2.5 kHz and 3.125 kHz
H and K band	5 kHz and 6.25 kHz
Output load impedance	50 Ω nominal
Frequency stability[a]	±0.5 ppm –30°C to +60°C (–22°F to +140°F)

a. For K band (700 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 26.

General (Continued)

Output power	
B band	
Rated power	50W
Range of adjustment	2W to 50W in 1W steps
H band	
Rated power	40W
Range of adjustment	2W to 40W in 1W steps
K band	
Rated power	35W
Range of adjustment	2W to 35W in 1W steps
Output power accuracy[b]	±1dB into a 50Ω load

b. Within normal operating voltages and temperatures; measured directly on PA output.

Duty cycle	100% at maximum rated output power[c] at +60°C (+140°F) ambient temperature

c. Measured directly on PA output.

Mismatch capability	
Ruggedness	open and short circuit load at any phase angle for one hour[d]
Stability	5:1 load VSWR at all phase angles[d]

d. Under power foldback.

Protection	
Temperature	shutdown if PA sensor exceeds 100°C
Supply voltage	shutdown if supply is less than 11V
VSWR	gradual power foldback as VSWR increases above acceptable operating level

Adjacent channel power	
Steady State (All modulation types)	<–60dBc (EN 300 113 & EN 300 086)
Steady State (P25)	<–67dBc (TIA-102.CAAA)
Transient (DMR & P25)	<–50dBc (EN 300 113)

Modulation fidelity	
DMR	<2% (EN 300 113)
P25	<2% TIA-102.CAAA

General (Continued)

Intermodulation	
P25/DMR	–40 dBc with interfering signal at –30 dBc at TB7300 base station RF output. For Europe, 70 dB ratio is achieved using an external circulator/isolator with a minimum isolation of 30 dB and less than 0.5 dB insertion loss.
Sideband noise[e]	
B1 and B3	
±1.5 MHz	<–142 dBc/ Hz
≥±4 MHz	<–160 dBc/ Hz
H5 and H3	
±1.5 MHz	<–150 dBc/ Hz
≥±4 MHz	<–160 dBc/ Hz

e. No modulation, measured from center frequency at max power.

Radiated spurious emissions	
Standby	<–57 dBm to 1 GHz <–47 dBm 1 GHz to 4 GHz
Transmit - B band	<–36 dBm 30 MHz 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[a] <–30 dBm 1 GHz to 12.75 GHz[b]
Transmit - K band	<–20 dBm to 9 GHz
Conducted spurious emissions	
Standby	<–57 dBm to 1 GHz <–47 dBm 1 GHz to 12.75 GHz
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 4GHz[a] <–30 dBm 1 GHz to 12.75 GHz[b]
Transmit - K band	<–20 dBm to 9 GHz
Transient behavior - B, H and K bands	complies with EN 300 113 v2.2.1

a. Transmit frequency below 470 MHz.

b. Transmit frequency above 470 MHz.

Analog Audio - General

Peak deviation	
Narrowband Wideband	≤2.5 kHz ≤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 at a level 20dB 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 38.

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[f]	
B and H bands:	
Narrowband	–50 dB typical (ETSI)
Wideband	–55 dB typical (ANSI/TIA)
K band	–43 dB typical (ANSI/TIA)

f. Up to 5 dB degradation at extremes of 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%

1.8 Connections

1.8.1 External Frequency Reference Input (BNC)

Frequencies[a] a. Automatically detected by the reciter.	10 MHz or 12.8 MHz
Lock range	±50 Hz
Input level	500 mV pp to 5 V pp
Input impedance	≥1 kΩ

1.8.2 Ethernet Interface (RJ45)

Transceiver	10/100 Base-Tx/Rx (Auto-MDIX)
IEEE-spec	IEEE802.3 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} > 2.2 V
Internal pull-up (5 V)	≥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)

External General Purpose Digital Outputs

Low level	< 0.4 V
High level	< 30 V
Low level sink current	< 5.0 mA
High level current	< 100 μA

1.8.4 Balanced Interface

Line Output - Balanced

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

Line Input - Balanced

Audio headroom	+10 dBm
Input Level Range For output signal of 60% deviation at 1kHz Adjustable over this range	-30 dBm to 0 dBm
Impedance	600Ω balanced
Return loss	>20 dB
Impedance balance about earth ITU G.117	>46 dB
Frequency response	300 Hz to 2.55 kHz
Distortion (line to RF)	3%

1.8.5 Unbalanced Interface

Line Output - Unbalanced

Linear range of operation	1 to 3 V

Line Input - Unbalanced

Linear range of operation	1 to 3 V

1.8.6 Audio Delay

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

Transmit direction (analog audio to P25 RF): 130 ms max

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

Receive direction (P25 RF to analog audio): 90 ms max

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.

Allow an additional 100 ms for the transmitter to wake when using transmitter sleep power save.

1.8.7 Rx Gate Output

The Rx gate output indicates a valid analog received signal.

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, if applied directly, can damage the reciter hardware.

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	RXGATE activated
High voltage level	0 to 30 V	Protection
Low level output current	<250 mA	
High level output current	<100 µA at 30 V	

1.8.8 RSSI Output

Parameter	Value	Unit
Configurable RF input range	-130 .. -60	dBm
Configurable Output range	0 .. 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

1.8.9 Tx Key Input

The Tx Key input is a 5 V logic level input that causes the base station to transmit the audio signal presented to the balanced input.

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

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

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 V rail
Maximum external pull up voltage	<= 20 V	

1.8.10 Antenna Relay Output

The antenna relay output will be active when the base station transmits, and the antenna relay is enabled in the web user interface.

Logic state: Active low

Logic type: Open drain transistor connection

Antenna relay operation applies to P25/AS-IP, and analog conventional operation 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	

1.8.11 1PPS Timing Reference Input (BNC)

Input low threshold	Vil <0.6V
Input high threshold	Vih >2.3V
Input termination	470Ω + 5% (AC terminated)
Transient input voltage	|Vin| <15V
Frequency	1PPS (required for simulcast and voted DMR channel)
Polarity	rising edge represents timing reference
Maximum jitter	±50ns

1.8.12 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 the 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
DMR (trunked and conventional)	all base stations	10	28

1.8.13 Digital Air Interface

Vocoder	AMBE+2
Digital Protocol	DMR ETSI-TS102 361 -1,-2,-3,-4

1.9 Miscellaneous

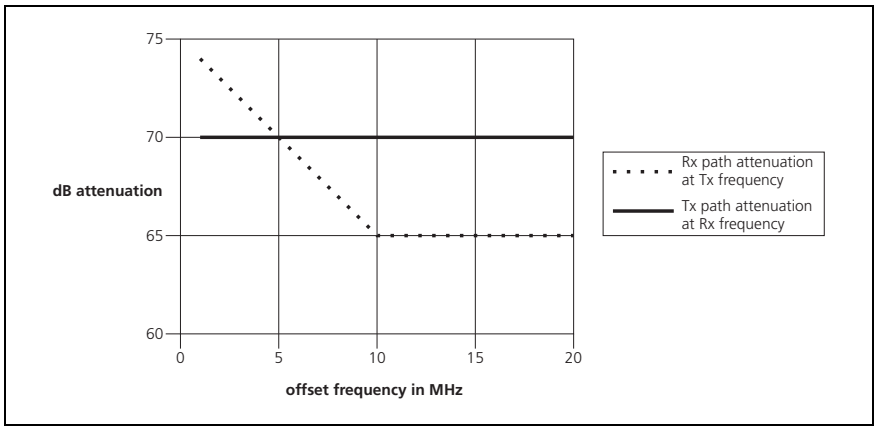
1.9.1 Channel Details

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.

The quoted attenuation will ensure not more than 1 dB receiver desensitization (from the specified sensitivity), and has 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.

	W	Btu/h
B band	110W	375Btu/h
H band	95W	324Btu/h
K band	95W	324Btu/h

1.9.5 Physical Details

Cooling	forced air via front panel fan
Connectors	
RF input	BNC female
RF output	N-type female
External reference frequency input	BNC female
1PPS input	BNC female
Ethernet	RJ45
Serial	RJ12
System inputs and outputs	DB-25
DC input	screw terminal
Dimensions	
Height	44mm (1.73in)
Width	436mm (17.17in)
Width with 19” rack mounting bracket	483mm (19in)
Length	400mm (15.7in)
Weight	
DC variant	6.7kg (14.8lb)
AC variant	7.8kg (17.2lb)

1.9.6 Reliability

MTBF at ≥ 50,000 hours (estimated)

1.9.7 Requirements for Delay, Jitter, Loss and Duplication

Standard Requirements	Recommended	Required
Out of order C plane and U plane packets[a]	< 0.01%	
Packet Loss	< 0.01%	
Latency	< 40 ms	< 150 ms
Jitter	< 20 ms	< 100 ms
Skew	< 40 ms recommended	< 270 ms
Minimum bandwidth for user traffic (voice, control channel, packet data)	P25: 108 kbit/s per physical channel Analog: 108 kbit/s per physical channel DMR: 64 kbit/s per physical channel	
Minimum bandwidth to carry management traffic (web, logs, SNMP).	100kb/s per site	
Minimum bandwidth to meet jitter requirements on non-fragmenting link	600kb/s per site up to 5 physical channels	

a. C plane and U plane are references to telco terminology distinguishing call setup and user traffic.

2 Compliance Standards

The TB7300 base station has been tested and approved to appropriate national and international compliance standards. These standards are listed on the following page.

You can obtain further details of test methods and the conditions which 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 table shows which variants of the TB7300 have been tested and approved to the listed standards.

A check 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	B3 Band	H5 Band	H3 Band	K4 Band
		50W	50W	40W	40W	35W
P25	CFR Title 47 Parts 22 and 90 (FCC)	✓	✓	✓	✓	✓
	RSS-119 (IC)	✓	✓	✓	✗	✓
	EN 300 113 (ETSI)	✓	✓	✓	✓	✗
	AS/NZS 4768 Appendix A	✓	✓	✓	✓	✗
DMR/MPT	CFR Title 47 Parts 22 and 90 (FCC)	✓	✓	✓	✓	✓
	RSS-119 (IC)	✓	✓	✓	✗	✓
	EN 300 113 (ETSI)	✓	✓	✓	✓	✗
	AS/NZS 4768 Appendix A	✓	✓	✓	✓	✗
RF - Analog Narrowband	CFR Title 47 Parts 22 and 90 (FCC)	✓	✓	✓	✓	✓
	RSS-119 (IC)	✓	✓	✓	✗	✓
	EN 300 086 (ETSI)	✓	✓	✓	✓	✗
	AS/NZS 4295 Appendix B	✓	✓	✓	✓	✗
RF - Analog Wideband	EN 300 086 (ETSI)	✓	✓	✓	✓	✗
	CFR Title 47 Part 80 (FCC)	✓	✓	✗	✗	✓
	CFR Title 47 Parts 22 and 90 (FCC)	✗	✗	✓	✗	✓
EMC	CFR Title 47 Part 15 (FCC)	✓	✓	✓	✓	✓
	RSS-Gen (ISED)	✓	✓	✓	✓	✓
	EN 301 489-1, EN 301 489-5 (ETSI)	✓	✓	✓	✓	✗

Safety and Environmental Compliances

The TB7300 base station has been tested and approved to the following standard: IEC 62368

	Testing Method	Testing Standard
Environmental	Shock	MIL-STD-810G:2008

Appendix A – Frequency Response Diagrams

This appendix shows the transmitter and receiver frequency response diagrams.

Figure A.1 Receiver frequency response de-emphasized

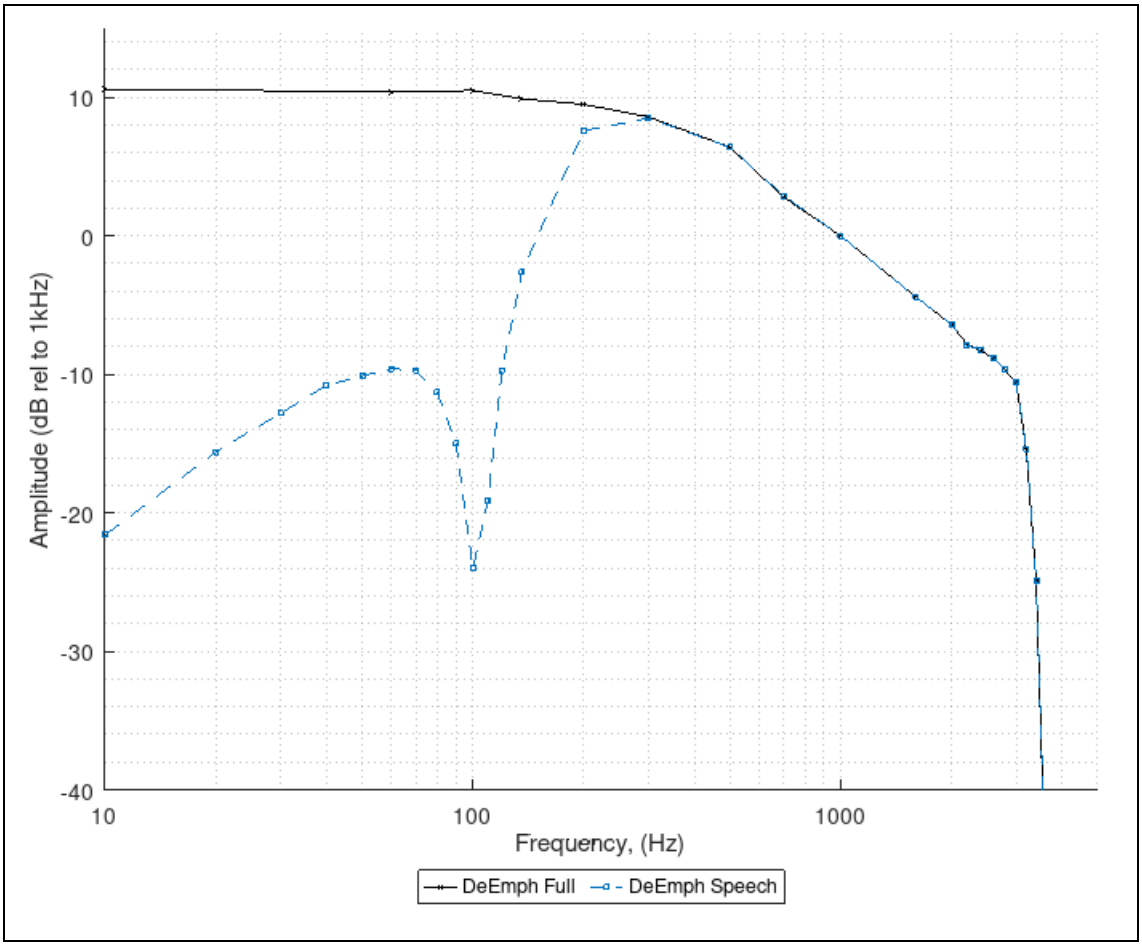


Figure A.2 Receiver frequency response flat

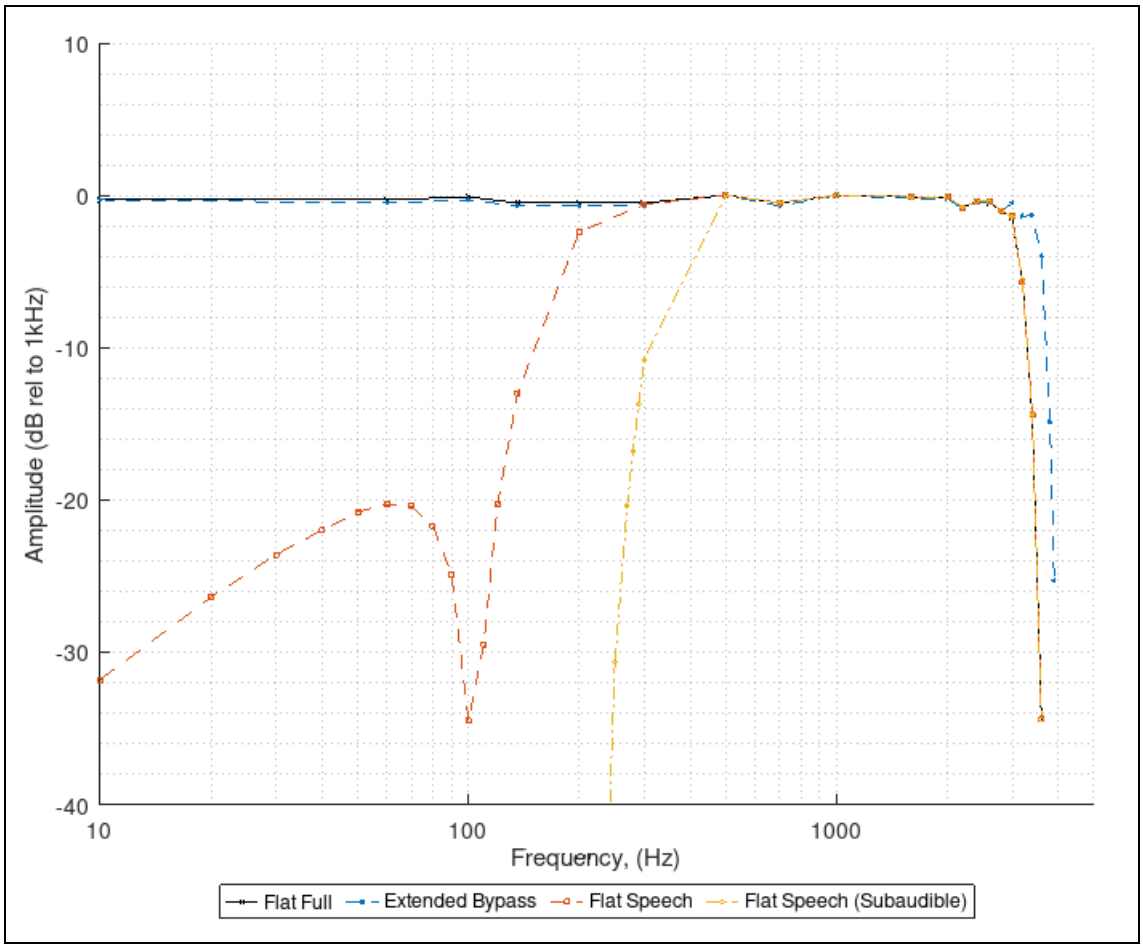


Figure A.3 Transmitter frequency response pre-emphasized

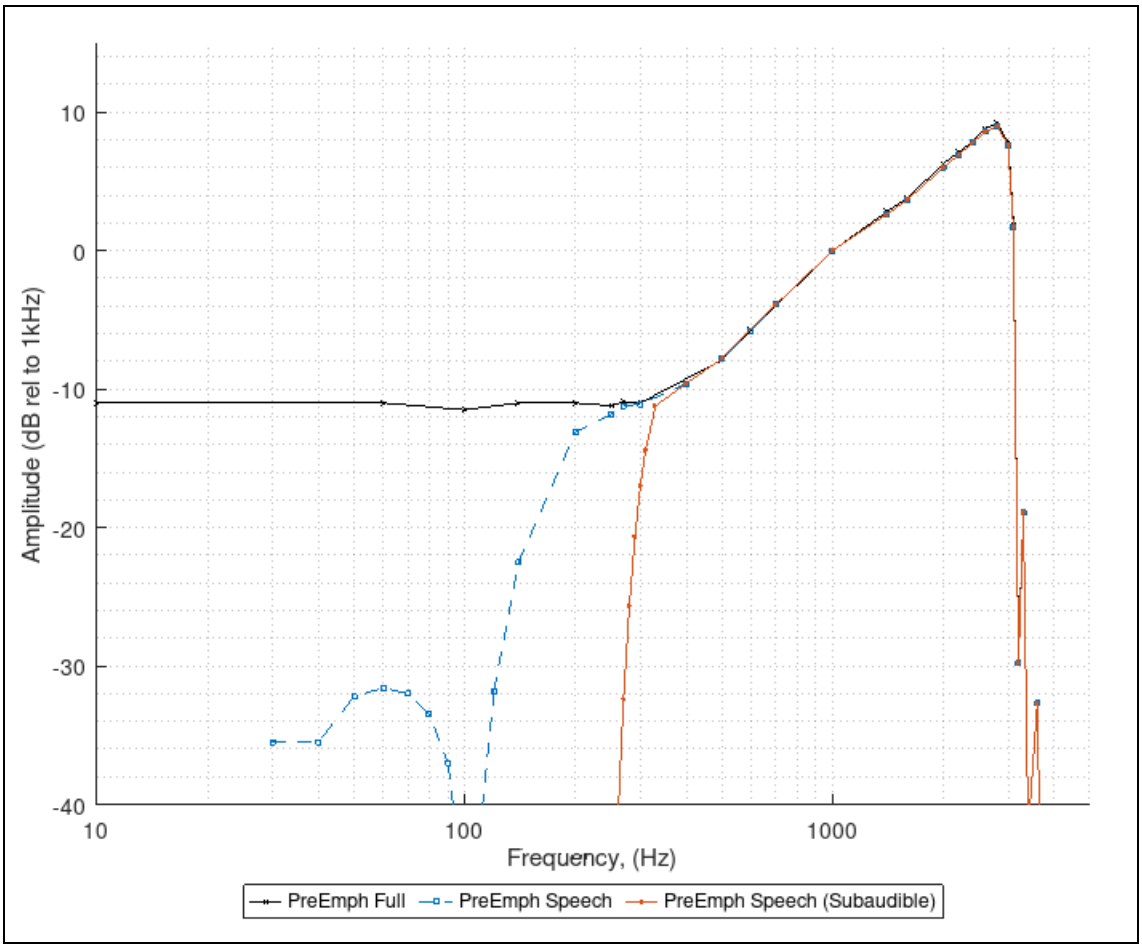


Figure A.4 Transmitter frequency response flat