

TB8100 base station

Specifications Manual



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Preface

Scope of Manual

Welcome to the TB8100 base station system Specifications Manual. This manual provides general, performance and physical specifications for the TB8100 5 W, 50 W and 100 W base station systems.

Enquiries and Comments

If you have any enquiries regarding this manual, or any comments, suggestions and notifications of errors, please contact Technical Support (refer to [“Tait Contact Information” on page 2](#)).

Updates of Manual and Equipment

In the interests of improving the performance, reliability or servicing of the equipment, Tait Electronics Ltd reserves the right to update the equipment or this manual or both without prior notice.

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Disclaimer

There are no warranties extended or granted by this manual. Tait Electronics Ltd accepts no responsibility for damage arising from use of the information contained in the manual 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.

Associated Documentation

TB8100 Installation and Operation Manual.

TB8100 Installation Guide (a subset of the Installation and Operation Manual).

TB8100 Service Manual.

TB8100 Service Kit and Alarm Center User's Manuals and online Help.

TB8100 Calibration Kit User's Manual and online Help.

Technical notes are 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.

All available TB8100 product documentation is provided on the CD supplied with the base station¹. Updates may also be published on the Tait support website.

1. Technical notes are only available in PDF format from the Tait support website. Consult your nearest Tait Dealer or Customer Service Organisation for more information.

1 System Specifications

This chapter provides specifications pertaining to the TB8100 base station system. You will find the specifications for individual modules in separate chapters in this manual.

The performance figures given in the power and current consumption specifications are typical figures based on using the equipment listed in the tables below.

AC and 12VDC Test Equipment

Module	Description
reciter	mid-band UHF (H2 band) reciter with isolated system interface PCB; the test frequency was 475MHz
PA	5W, 50W or 100W PA, as stated in the appropriate specifications
PMU	AC and DC PMU (12V DC module) fitted with a standby power supply card and an auxiliary power supply PCB
control panel	standard control panel, unless stated otherwise

24VDC and 48VDC Test Equipment

Module	Description
reciter	mid-band UHF (H2 band) reciter with standard system interface PCB; the test frequency was 460.5MHz
PA	5W, 50W or 100W PA, as stated in the appropriate specifications
PMU - 24VDC tests	AC and DC PMU (24V DC module) fitted with a standby power supply card and an auxiliary power supply PCB
PMU - 48VDC tests	AC and DC PMU (48V DC module) fitted with a standby power supply card and an auxiliary power supply PCB
control panel	standard control panel, unless stated otherwise

AC measurements were made using a Voltech PM100 power analyser. High power DC measurements were made using an HP 6032A DC power supply. All measurements for power save modes were made using a Tektronix TM502A current probe.



Note For AC power measurements the voltage, current drawn, volt.amp product, and true power are given. True power is equal to the volt.amp product multiplied by the power factor.

1.1 AC Input

Transmit Power and Current Consumption - 240VAC Input

	A	VA	W
5W BSS			
Minimum RF Output Power (1W)	480mA	115VA	30W
50% RF Output Power (2.5W)	490mA	118VA	37W
Maximum RF Output Power (5W)	490mA	118VA	41W
50W BSS			
Minimum RF Output Power (5W)	550mA	133VA	66W
50% RF Output Power (25W)	650mA	155VA	102W
Maximum RF Output Power (50W)	740mA	177VA	132W
100W BSS			
Minimum RF Output Power (10W)	640mA	154VA	100W
50% RF Output Power (50W)	870mA	209VA	171W
Maximum RF Output Power (100W)	1.1A	262VA	230W

Transmit Power and Current Consumption - 110VAC Input

	A	VA	W
5W BSS			
Minimum RF Output Power (1W)	350mA	39VA	30W
50% RF Output Power (2.5W)	400mA	44VA	36W
Maximum RF Output Power (5W)	430mA	47VA	39W
50W BSS			
Minimum RF Output Power (5W)	650mA	72VA	67W
50% RF Output Power (25W)	990mA	109VA	105W
Maximum RF Output Power (50W)	1.3A	138VA	136W
100W BSS			
Minimum RF Output Power (10W)	960mA	106VA	103W
50% RF Output Power (50W)	1.6A	178VA	176W
Maximum RF Output Power (100W)	2.2A	239VA	237W

Transmit Power and Current Consumption - AC Input Voltage Extremes

	A	VA	W
5W BSS*			
85VAC	530mA	45VA	42W
264VAC	540mA	142VA	40W
*at 5W RF output power			
50W BSS*			
85VAC	1.6A	139VA	138W
264VAC	730mA	194VA	131W
*at 50W RF output power			
100W BSS*			
85VAC	2.9A	243VA	242W
264VAC	1.0A	274VA	229W
*at 100W RF output power			

1.2 12.5VDC Input

Transmit Power and Current Consumption - 12.5VDC Input

	A	W
5W BSS		
Minimum RF Output Power (1W)	1.8A	23W
50% RF Output Power (2.5W)	2.2A	28W
Maximum RF Output Power (5W)	2.6A	32W
50W BSS		
Minimum RF Output Power (5W)	4.6A	58W
50% RF Output Power (25W)	7.6A	95W
Maximum RF Output Power (50W)	10A	125W
100W BSS		
Minimum RF Output Power (10W)	8.0A	100W
50% RF Output Power (50W)	14.0A	175W
Maximum RF Output Power (100W)	19.2A	240W

Transmit Power and Current Consumption - DC Input Voltage Extremes

	A	W
5W BSS*		
10.5VDC	2.9A	30W
15.5VDC	2.1A	33W
*at 5W RF output power		
50W BSS*		
10.5VDC	11.7A	123W
15.5VDC	8.3A	128W
*at 50W RF output power		
100W BSS*		
10.5VDC	21.7A	228W
15.5VDC	15.0A	232W
*at 100W RF output power		

Receive Power and Current Consumption

The specifications in this section refer to a BSS operating in receive mode with an input voltage of 12.5VDC.

	A	W
Normal Mode, No Power Save*		
Full Speaker Audio	1.1A	13.9W
Gate Open, Speaker Off	1.0A	12.5W
*with standard control panel		
Normal Mode, 20ms Receiver Cycling, 20ms Transmit Key Time		
Gate Closed, Standard Control Panel	745mA	9.3W
Power Save Control Panel	720mA	9.0W
Sleep Mode, 200ms Receiver Cycling*	400mA	5.0W
*with power save control panel and standby power supply card		

Receive Power and Current Consumption (Continued)

	A	W
Deep Sleep Mode*		
200ms Receiver Cycling	160mA	2.0W
500ms Receiver Cycling	122mA	1.52W
1s Receiver Cycling	109mA	1.36W
5s Receiver Cycling	98mA	1.23W
*with power save control panel and standby power supply card		

1.3 24VDC Input

Transmit Power and Current Consumption - 24VDC Input

	A	W
5W BSS		
Minimum RF Output Power (1W)	1.0A	24W
50% RF Output Power (2.5W)	1.2A	29W
Maximum RF Output Power (5W)	1.3A	31W
50W BSS		
Minimum RF Output Power (5W)	2.5A	60W
50% RF Output Power (25W)	4.1A	98W
Maximum RF Output Power (50W)	5.4A	130W
100W BSS		
Minimum RF Output Power (10W)	4.0A	96W
50% RF Output Power (50W)	7.4A	178W
Maximum RF Output Power (100W)	10.3A	247W

Transmit Power and Current Consumption - DC Input Voltage Extremes

	A	W
5W BSS*		
21.0VDC	1.5A	32W
35.6VDC	1.1A	39W
*at 5W RF output power		
50W BSS*		
21.0VDC	6.1A	128W
35.6VDC	3.8A	135W
*at 50W RF output power		
100W BSS*		
21.0VDC	11.6A	244W
35.6VDC	7.1A	253W
*at 100W RF output power		

Receive Power and Current Consumption

The specifications in this section refer to a BSS operating in receive mode with an input voltage of 24VDC.

	A	W
Normal Mode, No Power Save*		
Full Speaker Audio	580mA	13.9W
Gate Open, Speaker Off	530mA	12.7W
*with standard control panel		
Normal Mode, 20ms Receiver Cycling, 20ms Transmit Key Time		
Gate Closed, Standard Control Panel	375mA	9.0W
Power Save Control Panel	360mA	8.6W
Sleep Mode, 200ms Receiver Cycling*	200mA	4.8W
*with power save control panel and standby power supply card		

Receive Power and Current Consumption (Continued)

	A	W
Deep Sleep Mode*		
200ms Receiver Cycling	88mA	2.11W
500ms Receiver Cycling	66mA	1.58W
1s Receiver Cycling	61mA	1.46W
5s Receiver Cycling	49mA	1.18W
*with power save control panel and standby power supply card		

1.4 48VDC Input

Transmit Power and Current Consumption - 48VDC Input

	A	W
5W BSS		
Minimum RF Output Power (1W)	435mA	21W
50% RF Output Power (2.5W)	540mA	26W
Maximum RF Output Power (5W)	610mA	29W
50W BSS		
Minimum RF Output Power (5W)	1.2A	58W
50% RF Output Power (25W)	2.0A	96W
Maximum RF Output Power (50W)	2.6A	125W
100W BSS		
Minimum RF Output Power (10W)	1.9A	91W
50% RF Output Power (50W)	3.6A	173W
Maximum RF Output Power (100W)	4.9A	235W

Transmit Power and Current Consumption - DC Input Voltage Extremes

	A	W
5W BSS*		
42.0VDC	680mA	29W
69.2VDC	450mA	31W
*at 5W RF output power		
50W BSS*		
42.0VDC	2.9A	122W
69.2VDC	1.8A	128W
*at 50W RF output power		
100W BSS*		
42.0VDC	5.6A	235W
69.2VDC	3.6A	247W
*at 100W RF output power		

Receive Power and Current Consumption

The specifications in this section refer to a BSS operating in receive mode with an input voltage of 48VDC.

	A	W
Normal Mode, No Power Save*		
Full Speaker Audio	265mA	12.7W
Gate Open, Speaker Off	245mA	11.8W
*with standard control panel		
Normal Mode, 20ms Receiver Cycling, 20ms Transmit Key Time		
Gate Closed, Standard Control Panel	180mA	8.6W
Power Save Control Panel	170mA	8.2W
Sleep Mode, 200ms Receiver Cycling*	98mA	4.7W
*with power save control panel and standby power supply card		

Receive Power and Current Consumption (Continued)

	A	W
Deep Sleep Mode*		
200ms Receiver Cycling	43 mA	2.06W
500ms Receiver Cycling	35 mA	1.68W
1 s Receiver Cycling	31 mA	1.49W
5s Receiver Cycling	24 mA	1.15W
*with power save control panel and standby power supply card		

1.5 Miscellaneous

Dimensions and Weight

Dimensions

Height	176.8mm (7in)
Width	482.6mm (19in)
Length	
Subrack Only	385mm (15.2in)
Including Front Panel	410mm (16.1in)

Weight*

Single 5/50W Base Station System	20.6kg (45.4lb)
Dual 5/50W Base Station System	27.6kg (60.8lb)
Single 100W Base Station System	21.5kg (47.4lb)

*with AC and DC PMU

Isolation

Coaxial Changeover Relay Isolation	when the base station is used in simplex mode using a single antenna with a coaxial changeover relay, the isolation of this relay must be ≥ 40 dB
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2 Reciter Specifications

This chapter provides specifications pertaining to the receiver and exciter circuitry within the reciter module. However, the transmitter RF specifications which pertain to the combination of exciter and power amplifier are given in [“Transmitter RF Section” on page 35](#).

The performance figures given in these specifications are applicable only to equipment operating as an integral part of a TB8100 base station. These performance figures are minimum figures, unless otherwise indicated (e.g. “typical”), for equipment tuned with the maximum switching range and operating at standard room temperature (+22°C to +28°C [+71.6°F to +82.4°F]) and standard test voltage (28VDC).

Where applicable, the test methods used to obtain these figures are those described in the ANSI/TIA-603-B-2002 and ETSI-EN specifications. You can obtain further details of test methods and the conditions which apply for compliance testing in all countries from Tait Electronics Ltd.

Bandwidth

The terms “wide bandwidth”, “mid bandwidth” and “narrow bandwidth” used in this and following sections are defined in the following table.

	Channel Spacing	Modulation 100% Deviation	Receiver IF Bandwidth
Narrow Bandwidth (NB)	12.5kHz	±2.5kHz	7.5kHz
Mid Bandwidth ^a (MB)	20kHz	±4kHz	12 kHz
Wide Bandwidth (WB)	25kHz	±5.0kHz	15.0kHz

a. Mid bandwidth is available only in H band reciters (400MHz to 520MHz).

Sensitivity and distortion figures are stated for standard operating conditions which includes audio de-emphasis. Note that the sensitivity, distortion and signal-to-noise figures will be degraded when flat audio is selected.

Identifying the Reciter

You can identify the model and hardware configuration of a reciter 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.



Note This explanation of reciter product codes is not intended to suggest that any combination of features is necessarily available in any one reciter. Consult your nearest Tait Dealer or Customer Service Organisation for more information regarding the availability of specific models and options.

Product Code	Description
TBA <u>X</u> XXX-XXXX	4 = reciter
TBA4 <u>X</u> XX-XXXX	0 = default
TBA4XX <u>XX</u> -XXXX	Frequency Band and Sub-band B2 = 136MHz to 156MHz B3 = 148MHz to 174MHz C1 = 174MHz to 193MHz C2 = 193MHz to 225MHz H1 = 400MHz to 440MHz H2 = 440MHz to 480MHz H3 = 470MHz to 520MHz K4 = 762MHz to 870MHz ^a
TBA4XXX- <u>XXXX</u>	System Interface PCB 000 = no system interface PCB fitted 0A0 = standard 0B0 = isolated 0C0 = isolated E & M 0L1 = TaitNet RS-232 0T1 = TaitNet
TBA4XXX-XXX <u>X</u>	0 = default

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

General

Number of Channels	255
Supply Voltage	
Operating Voltage	12VDC to 29.5VDC
Standard Test Voltage	28VDC
Polarity	negative earth
Polarity Protection	Zener diode and thermal resistor
Supply Current	
Receiver and Exciter Operating	<330mA at 28VDC
Operating Temperature Range	–30°C to +60°C (–22°F to +140°F) ambient temperature*
	*ambient temperature is defined as the temperature of the air immediately in front of the control panel
Cooling	convection
Connectors	
RF Input	BNC female
RF Output	SMA female
Control and Alarm	16-way IDC male
External Reference Frequency Input	BNC female
28VDC Input	4-way Micro-Fit 3.0 (Molex) male
Auxiliary DC Input	4-way Micro-Fit 3.0 (Molex) male
System	depends on system interface PCB fitted*
	*refer to Installation and Operation Manual
Dimensions	
Height	143.6mm (5.7in)
Width	54.6mm (2.1in)
Length	333.3mm (13.1in)
Weight	2.1 kg (4.6lb)

Receiver RF Section

Frequency Bands

B Band	136MHz to 174MHz
C Band	174MHz to 225MHz
H Band	400MHz to 520MHz
K Band	792MHz to 824MHz

Frequency Sub-bands

B2	136MHz to 156MHz
B3	148MHz to 174MHz
C1	174MHz to 193MHz
C2	193MHz to 225MHz
H1	400MHz to 440MHz
H2	440MHz to 480MHz
H3	470MHz to 520MHz
K4	792MHz to 824MHz

Type	triple conversion superheterodyne; first conversion is analogue, second is hybrid, and third is digital
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Frequency Increments

B and C Bands	3.125kHz and 2.5kHz
H and K Bands	5kHz and 6.25kHz

Switching Range	>2% of the centre frequency* *e.g. ± 1.36 MHz from the centre frequency at 136MHz, ± 4 MHz from the centre frequency at 400MHz, or ± 5.2 MHz from the centre frequency at 520MHz
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Input Load Impedance	50 Ω nominal (VSWR <2:1)
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RF Input Protection	no degradation after 5 minutes exposure to on-channel signals at +20dBm (2.2V)
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Frequency Stability	± 1 ppm -30°C to $+60^{\circ}\text{C}$ (-22°F to $+140^{\circ}\text{F}$)
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RSSI	-120 dBm to -60 dBm (0.22 μV to 223.6 μV), 0.5V to 6V, programmable slope
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Receiver RF Section (Continued)

IF Stages - B and C Bands

Frequencies	
Analogue	16.9MHz
Digital	16.9MHz and 0Hz
Analogue IF Bandwidths	
Narrow Bandwidth	9kHz, –3dB
Wide Bandwidth	20kHz, –3dB
Digital IF Bandwidths	
Narrow Bandwidth	8.8kHz, –3dB
Wide Bandwidth	14.0kHz, –3dB

IF Stages - H and K Bands

Frequencies	
Analogue	70.1 MHz
Digital	9.9MHz and 0Hz
Analogue IF Bandwidth	20kHz, –4dB
Digital IF Bandwidths	
Narrow Bandwidth	8.8kHz, –3dB
Mid Bandwidth	12.0kHz, –3dB
Wide Bandwidth	14.0kHz, –3dB

Sensitivity*

De-emphasised Response	
Centre of Switching Range	<–119dBm (0.25μV) at 25°C**
Edge of Switching Range	<–117dBm (0.32μV) at 25°C**
Flat Response	
Centre of Switching Range	<–117.5dBm (0.30μV) at 25°C**
Edge of Switching Range	<–115.5dBm (0.38μV) at 25°C**

*12dB SINAD

**up to 2dB degradation at extremes of temperature

Maximum Usable Sensitivity*

De-emphasised Response	
Centre of Switching Range	<–116dBm (0.35μV) at 25°C (NB)** <–118dBm (0.28μV) at 25°C (WB)**
Edge of Switching Range	<–114dBm (0.45μV) at 25°C (NB)** <–116dBm (0.35μV) at 25°C (WB)**
Flat Response	
Centre of Switching Range	<–112dBm (0.56μV) at 25°C (NB)** <–116dBm (0.35μV) at 25°C (WB)**
Edge of Switching Range	<–110dBm (0.71μV) at 25°C (NB)** <–114dBm (0.45μV) at 25°C (WB)**

*sensitivity for 20dB SINAD, psophometrically weighted, RF source modulated at 60% deviation with 1 kHz

**up to 2dB degradation at extremes of temperature

Receiver RF Section (Continued)

Ultimate Signal-to-Noise Ratio*

B, C and H Bands	
Narrow Bandwidth	45 dB (ANSI/TIA)** 50 dB (CEPT - psophometric)**
Mid Bandwidth†	50 dB (ANSI/TIA)**
Wide Bandwidth	55 dB (ANSI/TIA)**
K Band	
Narrow Bandwidth	43 dB (ANSI/TIA)**
Wide Bandwidth	47 dB (ANSI/TIA)**
*at -47 dBm	**up to 5 dB degradation at extremes of switching range and temperature
†H band only	

Selectivity

B and C Bands	
Narrow Bandwidth	50 dB (ANSI/TIA-603-B)* 89 dB (ETSI)*
Wide Bandwidth	87 dB (ANSI/TIA-603-B)*
H Band	
Narrow Bandwidth	46 dB (ANSI/TIA-603-B)* 85 dB (ETSI)*
Mid Bandwidth	85 dB (ETSI)*
Wide Bandwidth	82 dB (ANSI/TIA-603-B)*
K Band	
Narrow Bandwidth	45 dB (ANSI/TIA-603-B)*
Wide Bandwidth	75 dB (ANSI/TIA-603-B)*
	*up to 5 dB degradation at extremes of switching range and temperature

Spurious Response Attenuation	≥100 dB (ANSI/TIA)* ≥90 dB (ETSI)
	*AGC switched off in H band reciter

Intermodulation Response Attenuation

B, C and H Bands	
Narrow Bandwidth	80 dB (ETSI)*
Mid Bandwidth**	80 dB (ETSI)*
Wide Bandwidth	85 dB (ANSI/TIA)*
K Band	
Narrow Bandwidth	80 dB (ANSI/TIA)*
Wide Bandwidth	85 dB (ANSI/TIA)*
**H band only	*up to 5 dB degradation at extremes of switching range and temperature

Receiver RF Section (Continued)

Blocking Rejection

B, C and H Bands	
1–10MHz	100dB (ETSI)
>10MHz	110dB (ETSI)
± 1 , ± 2 , ± 5 and ± 10 MHz	100dB (ANSI/TIA)*

K Band	
1–10MHz	100dB (ANSI/TIA)
>10MHz	110dB (ANSI/TIA)
± 1 , ± 2 , ± 5 and ± 10 MHz	100dB (ANSI/TIA)

*AGC switched off in H band reciter

Co-channel Rejection

Narrow Bandwidth	–8dB
Mid Bandwidth*	–8dB
Wide Bandwidth	–5dB

*H band only

Amplitude Characteristic*	≤ 3 dB (ETSI)
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*RF Input Level –107dBm to –13dBm

Spurious Emissions

Conducted	<–90dBm to 2GHz
	<–70dBm 2GHz to 4GHz
Radiated	<–57dBm EIRP to 1GHz
	<–47dBm EIRP 1GHz to 4GHz

Receiver Audio Section - General

Outputs Available	speaker output via control panel balanced and unbalanced line outputs via system interface PCB	
Frequency Response	flat or de-emphasised (750µs)	
De-emphasised Response		
Bandwidth	300Hz to 2.55 kHz (NB) 300Hz to 3.4kHz (MB)* 300Hz to 3.4kHz (WB)	
Response	within +1, –3dB of a –6dB/octave de-emphasis curve (ref. 1 kHz) *H band only	
Flat Response	Balanced Audio	Unbalanced Audio
Bandwidth	67Hz to 2.55kHz (NB) 67Hz to 3.4kHz (MB)* 67Hz to 3.4kHz (WB)	10Hz to 2.55kHz (NB) 10Hz to 3.4kHz (MB)* 10Hz to 3.4kHz (WB)
Response	within +1, –3dB of output level at 1 kHz *H band only	within +1, –1 dB of output level at 1 kHz
Balanced Line Output (via System Interface PCB)		
Output Level Range	–20dBm to +10dBm	
Output Impedance	600Ω	
Distortion*		
De-emphasised	≤2%	
Flat	≤4% (NB)	
*at –70dBm signal level	≤2% (WB)	
Unbalanced Line Output (via System Interface PCB)		
Output Level Range	0.3Vpp to 3Vpp into 10kΩ	
Speaker Output (via Control Panel)		
Power	0.5W maximum	
Speaker Impedance	16Ω nominal	
Distortion*	≤3% at 1 kHz, 0.35W, 16Ω	
*at –70dBm signal level, de-emphasis selected		

Receiver Audio Section - CTCSS

High Pass (Subaudible) Filter

Bandwidth	300Hz to 2.55kHz (NB) 300Hz to 3.4kHz (MB)* 300Hz to 3.4kHz (WB)
Response	within +1, –3 dB of level at 1 kHz
Hum and Noise**	30dB minimum at 250.3Hz 35dB typical (67Hz to 240Hz)
**1 kHz at 60% system deviation, CTCSS at 10% system deviation	*H band only

Tone Detect

Tone Squelch Opening	better than 6dB SINAD 3dB SINAD at 250.3Hz (typical) 4dB SINAD at 100Hz (typical)
Tone Detect Bandwidth	±2Hz accept (typical) ±3Hz reject (typical)
Response Time	150ms open and close (typical)

Receiver Audio Section - Gating Operation

Systems Available	SINAD gating (noise mute) RSSI gating (carrier mute)
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SINAD Gating

Opening Level	8dB to 20dB SINAD
Accuracy	±3dB
RF Hysteresis*	1.5dB to 6dB
Opening Time	≤20ms
Closing Time	50 ±10ms
*programmable	

RSSI Gating

Opening Level	–117dBm to –70dBm
Accuracy	±3dB
Hysteresis*	2dB to 10dB
Opening Time	≤5ms
Closing Time	50 ±10ms
*programmable	

Exciter RF Section

Frequency Bands

B Band	136MHz to 174MHz
C Band	174MHz to 225MHz
H Band	400MHz to 520MHz
K Band	762MHz to 776MHz and 850MHz to 870MHz

Frequency Sub-bands

B2	136MHz to 156MHz
B3	148MHz to 174MHz
C1	174MHz to 193MHz
C2	193MHz to 225MHz
H1	400MHz to 440MHz
H2	440MHz to 480MHz
H3	470MHz to 520MHz
K4	762MHz to 776MHz and 850MHz to 870MHz

Modulation Type	FM
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Frequency Increments

B and C Bands	3.125kHz and 2.5kHz
H and K Bands	5kHz and 6.25kHz

Switching Range - B and C Bands	>8MHz* *i.e. >±4MHz from the centre frequency
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Switching Range - H Band	>2% of the centre frequency* *i.e. ±4MHz from the centre frequency at 400MHz, and ±5.2MHz from the centre frequency at 520MHz
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Switching Range - K Band	762MHz to 776MHz and 850MHz to 870MHz
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Output Load Impedance	50Ω nominal (VSWR <2:1)
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Frequency Stability	±1 ppm –30°C to +60°C (–22°F to +140°F)
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Power Output	+11dBm ±2dB
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Exciter Audio Section - Inputs

Inputs Available	microphone input via control panel balanced and unbalanced line inputs via system interface PCB
Microphone Input	
Input Level Range*	80dB SPL to 115dB SPL
Impedance	600Ω
Compressor	
Attack Time	10ms
Decay Time	800ms
Dynamic Range	35 dB
Distortion	≤3%
*60% modulation at 1 kHz	
Balanced Line Input	
Input Level Range*	−20dBm to +10dBm
Impedance	600Ω balanced
*60% modulation at 1 kHz	
Unbalanced Line Input	
Input Level Range	0.3Vpp to 3Vpp
Impedance	>10kΩ

Exciter Audio Section - Modulation Characteristics

Frequency Response*	flat or pre-emphasised**	
*below limiting	**microphone input via control panel, balanced and unbalanced line inputs via system interface PCB	
Line and Microphone Inputs		
Pre-emphasised Response		
Bandwidth	300Hz to 2.55kHz (NB) 300Hz to 3kHz (MB)* 300Hz to 3kHz (WB)	
Below Limiting	within +1, -3dB of a 6dB/octave pre-emphasis curve (ref. 1 kHz)	
Flat Response	Balanced Audio	Unbalanced Audio
Bandwidth	67Hz to 2.55kHz (NB) 67Hz to 3kHz (MB)* 67Hz to 3kHz (WB)	10Hz to 2.55kHz (NB) 10Hz to 3kHz (MB)* 10Hz to 3kHz (WB)
Response	within +1, -3dB of output level at 1 kHz	within +1, -1dB of output level at 1 kHz
*H band only		

Exciter Audio Section - Modulation Characteristics (Continued)

Above Limiting Response	within +1, –2 dB of a flat response (ref. 1 kHz)
Distortion	<2%
Hum and Noise	
Narrow Bandwidth	–50 dB typical (ETSI)*
Mid Bandwidth**	–50 dB typical (ETSI)*
Wide Bandwidth	–55 dB typical, 300 Hz to 3 kHz (ANSI/TIA)*
**H band only	*up to 5 dB degradation at extremes of switching range and temperature

Exciter Audio Section - CTCSS

Standard Tones	all 37 ANSI/TIA group A, B and C tones plus 13 commonly used tones
Frequency Error*	0.08% maximum
*from ANSI/TIA tones	
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%

External Reference Input

Frequencies*	10 MHz or 12.8 MHz
*One frequency must be specified by the Service Kit.	
Lock Range	±50 Hz
Input Level	300 mV _{pp} to 5 V _{pp}
Input Impedance	≥1 kΩ

Compliance Standards

Where applicable, this equipment has been tested and approved to the following standards.

RF	EN 300 086-2:V1.2.1 EN 300 113-2 (03/2001) AS4295-1995 CFR 47 Parts 15, 22 and 90 RSS-119 Iss 6 HKTA 1002* TS 101* *H band only
EMC	ETSI EN 301 489 V1.4.1 (2002-08) CFR 47 Part 15 Level B1
Safety	BS EN 60950-1:2002 ANSI/UL Std. 60950 3rd edition CAN/CSA-C22.2 No. 60950-00 3rd edition AS/NZS 60950 and ACATS001
Environmental	
Low Pressure (Altitude)	MIL-STD-810F 500.4 Proc 2
Humidity	IEC60068-2-30
Vibration	MIL-STD-810F 514.5 Proc 1
Shock	MIL-STD-810F 516.5 Proc 1

3 Power Amplifier and Transmitter Specifications

This chapter provides specifications pertaining to the power amplifier as a separate module. It also includes a number of transmitter RF specifications which pertain to the combination of power amplifier and exciter.

The performance figures given in these specifications are applicable only to equipment operating as an integral part of a TB8100 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 (28VDC).

Where applicable, the test methods used to obtain these figures are those described in the ANSI/TIA-603-B-2002 and ETSI-EN specifications. You can obtain further details of test methods and the conditions which apply for compliance testing in all countries from Tait Electronics Ltd.

Bandwidth

The terms “narrow bandwidth”, “mid bandwidth” and “wide bandwidth” used in this chapter are defined in the following table.

	Channel Spacing	Modulation 100% Deviation	Receiver IF Bandwidth
Narrow Bandwidth	12.5kHz	±2.5kHz	7.5kHz
Mid Bandwidth ^a	20kHz	±4kHz	12kHz
Wide Bandwidth	25kHz	±5kHz	15kHz

a. Mid bandwidth is available only in H band transmitters (400MHz to 520MHz).

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 heatsink and rear of the cover. The meaning of each character in the product code is explained in the table below.



Note 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 nearest Tait Dealer or Customer Service Organisation for more information regarding the availability of specific models and options.

Product Code	Description
TBA <u>X</u> XXX-XXXX	7 = 5W 8 = 50W 9 = 100W
TBA <u>X</u> XX-XXXX	0 = default
TBA <u>XX</u> -XXXX	Frequency Band and Sub-band B1 = 136MHz to 174MHz C0 = 174MHz to 225MHz H0 = 400MHz to 520MHz K2 = 760MHz to 870MHz ^a
TBAXXX <u>X</u> -XXXX	0 = default
TBAXXX-X <u>X</u> XX	0 = default
TBAXXX-XX <u>X</u> X	0 = default
TBAXXX-XXX <u>X</u>	0 = default

a. The actual frequency coverage in this band when used with a K band TB8100 reciter is 762MHz to 776MHz, and 850MHz to 870MHz.

General

Supply Voltage

Operating Voltage	26.5VDC to 29.5VDC
Standard Test Voltage	28VDC
Polarity	negative earth only
Polarity Protection	reverse polarity diode

Supply Current

	Maximum	Typical
Standby	50mA	42mA
Transmit*		
5W PA @ 5W	600mA	530mA
50W PA @ 50W	5A	4.2A
100W PA @ 100W	10A	8.3A

*into a 50Ω load

Operating Temperature Range

–30°C to +60°C (–22°F to +140°F) ambient temperature*

*ambient temperature is defined as the temperature of the air at the intake to the cooling fan

Cooling

forced air over heatsink via fan mounted in subrack

Connectors

28VDC Input	Phoenix Combicon MVSTBR2.5HC
RF Input	SMA female
RF Output	N-type female
Control and Alarm	16-way IDC male

Dimensions

Height	86mm (3.4in)
Length	350mm (13.8in)
Width	
5W and 50W PAs	144mm (5.7in)
100W PA	177mm (7in)

Weight

5 and 50W PAs	4.9kg (10.8lb)
100W PA	5.8kg (12.8lb)

Power Amplifier RF Section

Frequency Bands

B Band	136MHz to 174MHz
C Band	174MHz to 225MHz
H Band	400MHz to 520MHz
K Band	760MHz to 870MHz*

*the actual frequency coverage in this band when used with a K band TB8100 reciter is 762MHz to 776MHz, and 850MHz to 870MHz

Input Power	+11dBm \pm 2 dB
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Output Power

5W PA	
Rated Power	5W
Range of Adjustment	1W to 5W in 1W steps
50W PA	
Rated Power	50W
Range of Adjustment	5W to 50W in 1W steps
100W PA	
Rated Power	100W
Range of Adjustment	10W to 100W in 1W steps

Output Power Accuracy*	\pm 0.5dB into a 50 Ω load
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*within normal operating voltages and temperatures

Duty Cycle	100% at maximum rated output power* at +60°C (+140°F) ambient temperature
	*measured directly on PA output

Input Load Impedance	50 Ω nominal (VSWR \leq 1.8:1)
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Output Load Impedance	50 Ω nominal
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Mismatch Capability

Ruggedness	open and short circuit load at any phase angle for one hour*
Stability	5:1 load VSWR at all phase angles*
	*under power foldback

Power Amplifier RF Section (Continued)

Protection

Temperature	power foldback to 10% if RF power devices exceed safe operating conditions
Current	power foldback and shutdown if RF power devices exceed safe operating currents
Supply Voltage	power foldback to 10% when supply voltage is 24V to 26V and 30V to 32V; shutdown when supply voltage is <24V and >32V
VSWR	power foldback to 10% at VSWR extremes; continuous analogue power foldback to maintain 100% duty cycle into mismatched loads

Transmitter RF Section

The specifications in this section pertain only to the combination of a 5W, 50W or 100W power amplifier with a TB8100 reciter.

Adjacent Channel Power

Steady State (Full Deviation)	
Narrow Bandwidth	<-60dBc
Mid* and Wide Bandwidth	<-70dBc
Transient (Unmodulated)	
Narrow Bandwidth	<-50dBc
Mid* and Wide Bandwidth	<-60dBc

*H band only

Sideband Noise*

±25kHz	<-137dBc/Hz
±1 MHz	<-147dBc/Hz
±10MHz	<-147dBc/Hz at 5W <-157dBc/Hz at 50W <-160dBc/Hz at 100W

*no modulation, measured from centre frequency

Hum and Noise

Narrow Bandwidth	-50dB (300Hz to 3kHz [ANSI/TIA])
Mid Bandwidth*	-54dB (300Hz to 3kHz [ANSI/TIA])
Wide Bandwidth	-55dB (300Hz to 3kHz [ANSI/TIA])

*H band only

Intermodulation	-40dBc with interfering signal at -30dBc at PA output
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Transmitter RF Section (Continued)

Radiated Spurious Emissions

Transmit - B, C and H Bands	<-36dBm to 1 GHz <-30dBm 1 GHz to 4GHz
Transmit - K Band Standby	<-20dBm to 9GHz <-57dBm to 1 GHz <-47dBm 1 GHz to 4GHz

Conducted Spurious Emissions

Transmit - B, C and H Bands	<-36dBm to 1 GHz <-30dBm 1 GHz to 12.75GHz
Transmit - K Band Standby	<-20dBm to 9GHz <-57dBm to 1 GHz <-47dBm 1 GHz to 12.75GHz

Transmitter Switching - B, C and H Bands	complies with EN 300 113-1 v1.4.1 and EN 300 113-2 (03/2001)
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Transmit Key Time*

Key Up	
5W PA	≤2.5ms
50 and 100W PAs	≤2ms
Key Up Debounce Timer	20ms
Key Down	
5W PA	≤2.5ms
50 and 100W PAs	≤2ms
Key Down Debounce Timer	20ms

*with VCO in lock

Continuous Repetitive Key Rate	24Hz maximum
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Lock Time	≤20ms
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Control and Monitoring

Control Inputs and Outputs	I ² C data, clock and ground PA key line input fan control output
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Monitor Outputs*

Permanently Assigned	forward power reverse power ambient temperature
Selectable**	RF power control voltage

*analogue

**select one

Compliance Standards

Where applicable, this equipment has been tested and approved to the following standards.

RF	EN 300 086-2:V1.2.1 EN 300 113-2 (03/2001) AS4295-1995 CFR 47 Parts 15, 22 and 90 RSS-119 Iss 6 HKTA 1002* TS 101* *H band only
EMC	ETSI EN 301 489 V1.4.1 (2002-08) CFR 47 Part 15 Level B1
Safety	BS EN 60950-1:2002 ANSI/UL Std. 60950 3rd edition CAN/CSA-C22.2 No. 60950-00 3rd edition AS/NZS 60950 and ACATS001
Environmental	
Low Pressure (Altitude)	MIL-STD-810F 500.4 Proc 2
Humidity	IEC60068-2-30
Vibration	MIL-STD-810F 514.5 Proc 1
Shock	MIL-STD-810F 516.5 Proc 1

4 Power Management Unit Specifications

This chapter provides specifications pertaining to the power management unit (PMU) as a separate module.

The performance figures given in these specifications are applicable only to equipment operating as an integral part of a TB8100 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 module - 230VAC
- 12V DC module - 12VDC
- 24V DC module - 24VDC
- 48V DC module - 48VDC.

Where applicable, the test methods used to obtain these figures are those described in the ETSI-EN specifications. You can obtain further details of test methods and the conditions which apply for compliance testing in all countries from Tait Electronics Ltd.

Identifying the PMU

You can identify the model and hardware configuration of a PMU 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.



Note 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 nearest Tait Dealer or Customer Service Organisation for more information regarding the availability of specific models and options.

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

General

Operating Temperature Range	–30°C to +60°C (–22°F to +140°F) ambient temperature* *ambient temperature is defined as the temperature of the air at the intake to the cooling fan												
Cooling	forced air over heatsink via fan mounted in subrack												
Front Panel LED Indicators	<table><tr><td>Green - Steady</td><td>PMU operating correctly</td></tr><tr><td>Green - Flashing</td><td>PMU not operating, bootloader in progress</td></tr><tr><td>Red - Flashing</td><td>one or more alarm conditions present</td></tr></table>	Green - Steady	PMU operating correctly	Green - Flashing	PMU not operating, bootloader in progress	Red - Flashing	one or more alarm conditions present						
Green - Steady	PMU operating correctly												
Green - Flashing	PMU not operating, bootloader in progress												
Red - Flashing	one or more alarm conditions present												
Parameters Monitored by PMU Microprocessor	mains input good signal DC input voltage PA output current and voltage heatsink temperatures of AC and DC modules												
Dimensions	<table><tr><td>Height</td><td>143.5mm (5.6in)</td></tr><tr><td>Width</td><td>121.4mm (4.8in)</td></tr><tr><td>Length</td><td></td></tr><tr><td> AC PMU</td><td>324mm (12.8in)</td></tr><tr><td> DC PMU</td><td>337mm (13.3in)</td></tr><tr><td> AC and DC PMU</td><td>337mm (13.3in)</td></tr></table>	Height	143.5mm (5.6in)	Width	121.4mm (4.8in)	Length		AC PMU	324mm (12.8in)	DC PMU	337mm (13.3in)	AC and DC PMU	337mm (13.3in)
Height	143.5mm (5.6in)												
Width	121.4mm (4.8in)												
Length													
AC PMU	324mm (12.8in)												
DC PMU	337mm (13.3in)												
AC and DC PMU	337mm (13.3in)												
Weight	<table><tr><td>AC PMU</td><td>4.60kg (10.1lb)</td></tr><tr><td>DC PMU</td><td>4.86kg (10.7lb)</td></tr><tr><td>AC and DC PMU</td><td>6.40kg (14.1lb)</td></tr></table>	AC PMU	4.60kg (10.1lb)	DC PMU	4.86kg (10.7lb)	AC and DC PMU	6.40kg (14.1lb)						
AC PMU	4.60kg (10.1lb)												
DC PMU	4.86kg (10.7lb)												
AC and DC PMU	6.40kg (14.1lb)												

Input - AC Module

Input	<table><tr><td>Voltage</td><td>88VAC to 264VAC</td></tr><tr><td>Frequency</td><td>45Hz to 65Hz</td></tr><tr><td>Power Factor</td><td>>0.95</td></tr><tr><td>Total Harmonic Distortion (THD)</td><td><8%</td></tr><tr><td>Inrush Current</td><td><30A</td></tr><tr><td>Leakage Current</td><td><3.5mA/240VAC</td></tr></table>	Voltage	88VAC to 264VAC	Frequency	45Hz to 65Hz	Power Factor	>0.95	Total Harmonic Distortion (THD)	<8%	Inrush Current	<30A	Leakage Current	<3.5mA/240VAC
Voltage	88VAC to 264VAC												
Frequency	45Hz to 65Hz												
Power Factor	>0.95												
Total Harmonic Distortion (THD)	<8%												
Inrush Current	<30A												
Leakage Current	<3.5mA/240VAC												
Protection	<table><tr><td>Fault Current (Input)</td><td>10A fuse</td></tr><tr><td>Transient Suppression</td><td>275V MOV (line-to-line)</td></tr><tr><td>Overvoltage Inhibit (Self Recovering)</td><td>275VAC ±10V</td></tr><tr><td>Undervoltage Signal</td><td>83VAC ±5V</td></tr></table>	Fault Current (Input)	10A fuse	Transient Suppression	275V MOV (line-to-line)	Overvoltage Inhibit (Self Recovering)	275VAC ±10V	Undervoltage Signal	83VAC ±5V				
Fault Current (Input)	10A fuse												
Transient Suppression	275V MOV (line-to-line)												
Overvoltage Inhibit (Self Recovering)	275VAC ±10V												
Undervoltage Signal	83VAC ±5V												

Input - AC Module (Continued)

General

Efficiency at Rated Output*	86%
Input-to-chassis Isolation	1500VAC, 50Hz, 1 minute
Input-to-output Isolation	3000VAC, 50Hz, 1 minute
Output-to-chassis Isolation	500VAC, 50Hz, 1 minute

*at 220VAC

Input - DC Module

Input	12V	24V	48V
Factory-set Limits			
Minimum Run Voltage	9.5V \pm 0.3V	19V \pm 0.5V	38V \pm 1V
Minimum Turn-on Voltage	11.7V \pm 0.3V	23.4V \pm 0.5V	46.8V \pm 1V
Maximum Run Voltage	18.1V \pm 0.3V	36.2V \pm 0.5V	72.4V \pm 1V
Maximum Turn-on Voltage	17.1V \pm 0.3V	34.2V \pm 0.5V	68.4V \pm 1V
User-programmable Limits**			
Low Battery Shutdown Voltage	10V to 13.5V	20V to 27V	40V to 54V
Low Battery Restart Voltage (after shutdown)	11.5V to 15.0V	23V to 30V	46V to 60V
User-programmable Alarms*			
Low Battery Voltage	10V to 14V	20V to 28V	40V to 56V
High Battery Voltage	14V to 17.5V	28V to 35V	56V to 70V

*using the Service Kit software

**only available if the standby power supply card is fitted

Protection

Fault Current (Input)	circuit breaker or fuse in external wiring*
Wrong Input Voltage	electronic lock-out
Wrong Input Voltage Polarity	shunt diode
	*provided by user

General

Efficiency at Rated Output	
12VDC	82%
24VDC	85%
48VDC	90%
Input-to-output Isolation	1000VAC, 50Hz, 1 minute

Output - AC and DC Modules

High Current Output for PA

Voltage	28V
Current	14A maximum
Regulation	±0.5%
Ripple and Noise*	50mV pp
Ripple and Noise rms	10mV rms
Transient Response on 28V Loadstep**	2% overshoot and recover within 0.6ms

*100MHz bandwidth

**10% to 100% loadstep

Low Current Output for Reciter

Voltage	28.6V 26.5V in hysteresis mode
Current	1.2A maximum
Regulation	±3.5%
Ripple and Noise*	50mV pp
Ripple and Noise rms	10mV rms

*100MHz bandwidth

Protection - PA Output

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

Protection - Reciter Output

Short Circuit	2.5A self-resetting fuse
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Optional Standby Output - DC Module

Low Current Output for Reciter

Voltage	28.9V
Current	0.3A maximum
Regulation	±2.5%
Ripple and Noise*	50mV pp
Ripple and Noise rms	10mV rms

*100MHz bandwidth

Protection

Overload/Short Circuit	electronic current limit
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Optional Standby Output - DC Module (Continued)

General

Efficiency at Rated Output	86%
Input-to-output Isolation	1000VAC, 50Hz, 1 minute
Control	shutdown signal (isolated)

Optional Auxiliary Power Supply

The output from this optional power supply PCB may also be used to trickle-charge a 12V, 24V or 48V battery.

DC Input Voltage	28V \pm 15%
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DC Output*	12V	24V	48V
Voltage	13.65V	27.3V	54.6V
Current	3A maximum	1.5A maximum	750mA maximum
Regulation	\pm 2%	\pm 2%	\pm 2%
Ripple and Noise**	50mV pp	50mV pp	50mV pp
Ripple and Noise rms	10mV rms	10mV rms	10mV rms
Zero Load Ripple	100mVpp	100mVpp	100mVpp

*also for trickle-charging 12V, 24V or 48V battery

**100MHz bandwidth

Protection	12V	24V	48V
Overload/Short Circuit	electronic current limit	electronic current limit	electronic current limit
Overvoltage	16V Zener diode	32V Zener diode	62V Zener diode

General

Efficiency at Rated Output	88%
Input-to-output Isolation	1000VAC, 50Hz, 1 minute
Output-to-chassis Isolation	500VAC, 50Hz, 1 minute

Connections

The following specifications refer to the external wiring and connectors which 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	8A

Connections (Continued)

DC Input - 12VDC*

Connector Type	M6 screw into threaded fitting on bus bar
Connector Current Rating	50A
Flexible Wire Size	2AWG**
Flexible Wire Cross Section	35mm ² **

DC Input - 24VDC*

Connector Type	M6 screw into threaded fitting on bus bar
Connector Current Rating	25A
Flexible Wire Size	5AWG**
Flexible Wire Cross Section	16mm ² **

DC Input - 48VDC*

Connector Type	M6 screw into threaded fitting on bus bar
Connector Current Rating	12A
Flexible Wire Size	8AWG**
Flexible Wire Cross Section	8mm ² **

*battery

** for a length of 1.5m to 2m (5ft to 6.5ft) (typical); the DC input leads should be of a suitable gauge to ensure less than 0.2V drop at maximum load over the required length of lead

DC Output - 28V High Current for PA

Connector Type	Phoenix MVSTBR2.5HC/2-ST/5.08 female
Connector Current Rating	16A
Flexible Wire Size	11AWG

DC Output - 28V Low Current for Reciter

Connector Type	2x4-way Molex 43025-0800/crimp socket 43030-0001 female
Connector Current Rating	3A
Flexible Wire Size	20AWG

DC Output - Low Current/Battery Charger (from optional auxiliary power supply)

Connector Type	Phoenix MVSTBR2.5HC/2-ST/5.08 female
Connector Current Rating	3A to 16A
Flexible Wire Size	20AWG to 11AWG

Compliance Standards

Where applicable, this equipment has been tested and approved to the following standards.

Safety	BS EN 60950-1:2002 ANSI/UL Std. 60950 3rd edition CAN/CSA-C22.2 No. 60950-00 3rd edition AS/NZS 60950 and ACATS001
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EMC	ETSI EN 301 489 V1.4.1 (2002-08) CFR 47 Part 15 Level B1
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Environmental

Low Pressure (Altitude)	MIL-STD-810F 500.4 Proc 2
Humidity	IEC60068-2-30
Vibration	MIL-STD-810F 514.5 Proc 1
Shock	MIL-STD-810F 516.5 Proc 1
