Technical Description

Mast Head Booster (PCS1900) and Ancillary Equipment

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Contents

GLOSSARY OF TERMS AND ABBREVIATIONS

BTS	Base Transceiver Station
HPA	High Power Amplifier
LNA	Low Noise Amplifier
MHA	Mast Head Amplifier
MHB	Mast Head Booster
PDU	Power Distribution Unit
RF	Radio Frequency
Rx	Receive
Tx	Transmit
VSWR	Voltage Standing Wave Ratio
SF/SA	Single Feeder / Single Antenna
DF/DA	Dual Feeder / Dual Antenna

1. GENERAL

1.1 System

The Masthead Booster System consists of the following:

- The Masthead Bi-directional Amplifier or Booster (MHB) including filters, LNA and HPA
- The Power Distribution Unit (PDU) to supply DC to MHB and provide system alarms

Technical Descriptions of the Mast Head Booster, Power Distribution Unit, Bias Tee and other ancillary equipment is given in this document.

The system enables dual duplex operation. The DC Power of the booster (MHB) is supplied via the BTS antenna coaxial feeder cable using Bias Tees.

The Mast Head Booster described in this documents is used at the tower top to provide increase in the coverage of the Cellular BTS. This is achieved by providing up to 12dB gain in the Transmitter Path (downlink) and up to 22dB gain in the Receiver Path (uplink).

Receive Path

The purpose of the low Noise Figure Amplifier in the receive path installed at the tower top close to the antenna is to compensate for all the losses between the antenna and the front end of the BTS receiver and thus improve the BTS sensitivity.

The gain of the LNA is remotely adjustable from the PDU via a serial communication interface injected on to the feeder cable through the Bias Tee.

Transmit Path

REMEC-Airtech's High Power Booster is installed at the tower top to provide a maximum of +43 dBm (20 W) output power at the antenna port thus overcoming any feeder cable losses. The REMEC-Airtech Booster provides up to 12 dB of gain thus allowing very low incoming signals (down to +31 dBm) to provide +43 dBm (20 W) at the antenna input. The gain of the HPA in the MHB is remotely adjustable from the PDU via serial communication interface injected on the feeder cable through the Bias Tee.

2. SYSTEM DESCRIPTION

2.1 GENERAL

The Booster System is used to compensate for cable loss between the BTS and the antenna and provide extra power on the Transmitter path. **The information frequency bandwidth of the Booster system is 15 MHz**.

The Masthead Booster system consists of the following modules:

i) The Masthead Bi-directional Amplifier or Booster (MHB) including filters, LNA and HPA (SF/SA Booster

ii) The Power Distribution Unit (PDU) to supply DC to the MHB and provide system alarms

iii) The Booster Bias Tee

iv) The interface cable kit

v) Mounting Kits (MHB, MHA and PDU)

A system configuration is shown in the following diagram. This uses a bi-directional Mast Head Booster (SF/SA) on the main Transmit/Receive antenna with a receive only Mast Head Amplifier (a separate REMEC-Airtech product) on the diversity antenna.

2.1.1 Booster System Configuration

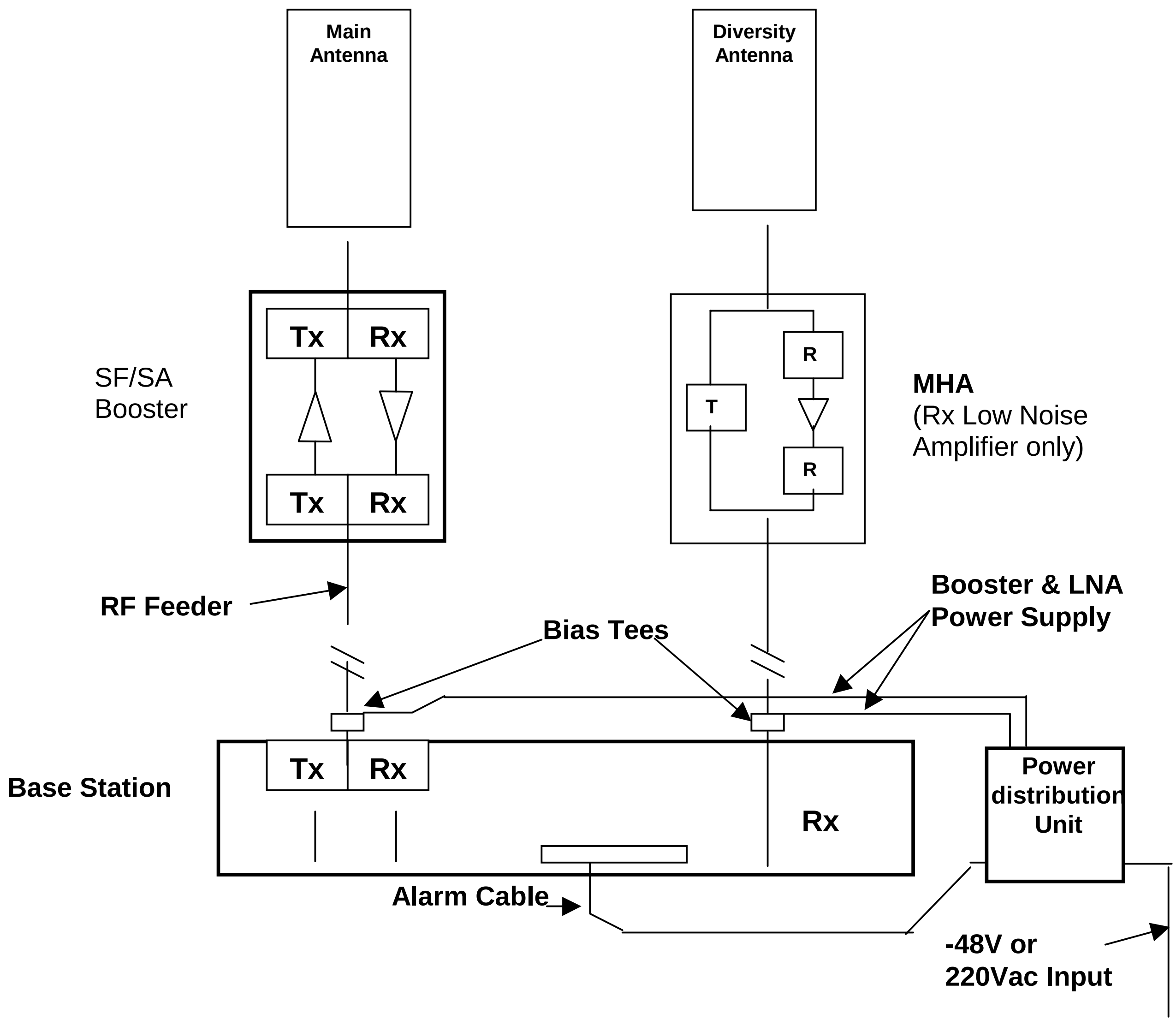

Figure 1: Booster System description

3. FUNCTIONAL SPECIFICATION

3.1 Mast Head Booster

3.1.1 Technical Description

This section describes the following PCS 1900 REMEC-Airtech Booster configuration and its performance characteristics.

- Duplex MHB - Transmit Booster (MHB) designed to interface with duplexing feeds to common transmit/receive antenna and Base Station (Single Feeder / Single Antenna Booster).

The transmit section (downlink) consists of a high power amplifier and bandpass filter. The receive section (uplink) includes bandpass filters, Low Noise Amplifier and a Low pass filter.

The MHB system provides single carrier transmit gain of up to 12dB to deliver +43 dBm (20 W) maximum rated output power. Up to 22 dB gain is provided in the receive path. The variable uplink and downlink gain of the amplifiers can be configured remotely via a dedicated control interface. The unit is housed in a compact low volume, lightweight IP68 enclosure and is convection cooled.

By-pass in the receive path is a standard feature in the Low Noise Amplifier. By-pass is also provided in the HPA as an option. Bypass, which is automatically enabled by signals from the Digital / Control module, is implemented using mechanical relays in the HPA module and PIN diode circuits in the LNA module.

The MHB is designed to operate over the entire PCS band, but the filters are optimised to pass only a 15 MHz band. The unit is designed to mount on a mast and be integrated with a customer provided sector antenna. A Solar Shield included in the MHB provides protection against direct Sun Radiation.

An isolator, a VSWR monitoring circuit at the output and a variable attenuator at the input form an integral part of the High Power Amplifier (HPA) tile in the MHB. Couplers at the output of the HPA are used to monitor the forward and reflected signal levels at the output port. The Booster is designed to provide good thermal stability.

The MHB includes voltage regulators to provide the required voltage to the amplifiers and to account for any voltage drop across the feeder cables which transmit DC power from the Power Distribution Unit (PDU) at the BTS to the Booster unit. The DC power is transmitted via the RF feeder cable using Bias Tees to couple the DC power onto the RF cables. The Bias Tees also provide protection against a lightning strike.

A serial data interface is used to monitor the status of the amplifiers, and display on the PDU at the base. The data interface system is also used to transmit commands from the PDU to adjust the variable attenuators within the HPA and the LNA. The serial data signals are coupled onto the RF feeder cable via the Bias Tees used for coupling the DC power.

All the components of the MHB are assembled in a sand-casted body the base of which includes a finned heat sink to dissipate the heat from the HPA. A lid on the top weatherproofs the unit to IP68. 7/16 RF (IP68) connectors are provided for the antenna and the RF feeder cable connections. An earth stud is provided to connect earth strap between the unit and the mast.

The MHB is fitted with two mounting brackets, one at the top and one at the bottom. These brackets are designed such that the unit can either be mounted on a pole or a wall.

Functional block diagrams of a Single Feeder / Single Antenna (Dual Duplexed) MHB and Transmit only MHB (DF/DA Booster) are shown in figure 2

3.1.1.1 *MHB System Block Diagrams*

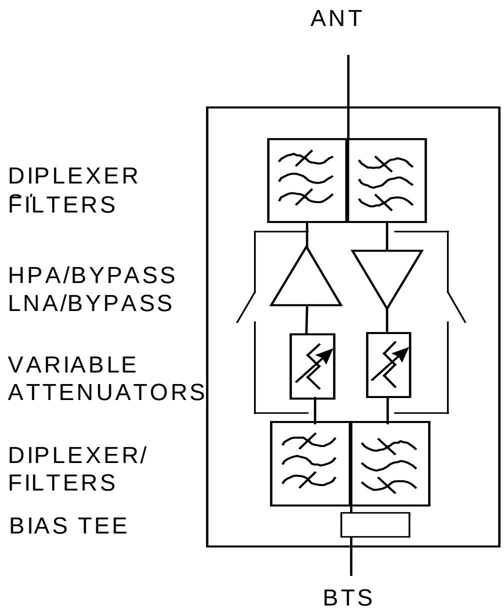

Figure 2 Duplexed MHB System Block Diagram

3.1.1.2 *High Power Amplifier Module*

A schematic block diagram of the High Power Amplifier module is shown in figure 3. The transmit HPA used in the REMEC-Airtech Booster is capable of providing a minimum of 32 W (+45 dBm) output at the 1dB compression point. The gain of the amplifier, variable in eleven 1dB steps, will be able to provide 20W (+43dBm) MHB output given +31dBm minimum input from the BTS and a variable feeder length. The HPA is designed to meet the overall downlink performance requirements. The control for the variable gain is provided via a digital interface to the PDU via a feeder cable. The HPA includes a VSWR detection circuit to provide the capability to monitor temperature and the condition of the antenna connection.

The HPA meets the systems gain stability requirements over the specified temperature range in accordance with GSM requirements under stable operating conditions and during the peak of the burst transmission, as stated in ETSI 11.21.

The HPA includes a built-in test circuit to detect a failure of the HPA and the loss of power and will activate the mechanical RF switches on either side of the HPA to enable the bypass of the HPA (optional). The current drawn by the amplifiers and the level of the forward and reflected power at the output can also be monitored. The fault condition will be displayed on the PDU.

Regulated DC power to the HPA is supplied from a regulator within the Booster System

HPA Module

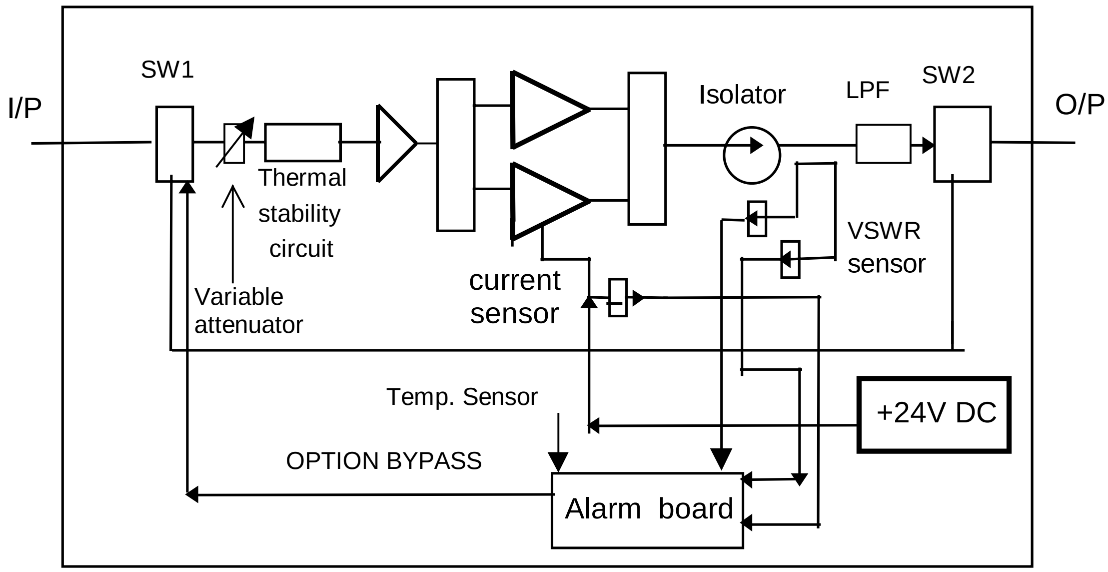

Figure 3 HPA Module

HPA Main Performance Characteristics

The main performance characteristics of the HPA tile are given in the following table 1 below:

Parameters	***Performance Specification***
Operating Frequency Band	1930 to 1990 MHz
Information Bandwidth	15 MHz
1 dB Compression Point	≥ 32 W (+45 dBm)
Nominal Output Power	20 W (+43 dBm)
Nominal Gain	5 to 15 dB Variable in 1 dB steps
Power Supply	+24 VDC
Operating base plate Temperature	-40 to +80 °C

Table 1.

3.1.1.3 Low Noise Amplifier Module

The LNA is a two stage design as shown in the schematic block diagram in figure 4 below. Super low noise MESFET devices are used in the design which includes a balanced amplifier first stage in order to achieve the required specification for gain and noise figure as well as the input and output match. This design provides a very high spurious free dynamic range by virtue of the low noise performance and high input 3rd order intercept point. The LNA includes a low pass filter at the output to reduce the out of band gain of the LNA. The module includes a digitally controlled variable attenuator to set the gain of the LNA within the 7 to 22 dB range.

The LNA incorporates a built-in test circuit to detect a failure within the LNA and the loss of power and will enable the bypass of the LNA. The fault condition are displayed on the PDU.

The BITE circuit is used to monitor the status of the FET and MMIC amplifier devices and report failure to the PDU utilising a serial communications interface modulated onto the RF feeder cable. The 4-bit word selecting the receive gain of the MHA is set using a rotary switch on the PDU and transmitted to the MHA using the serial interface.

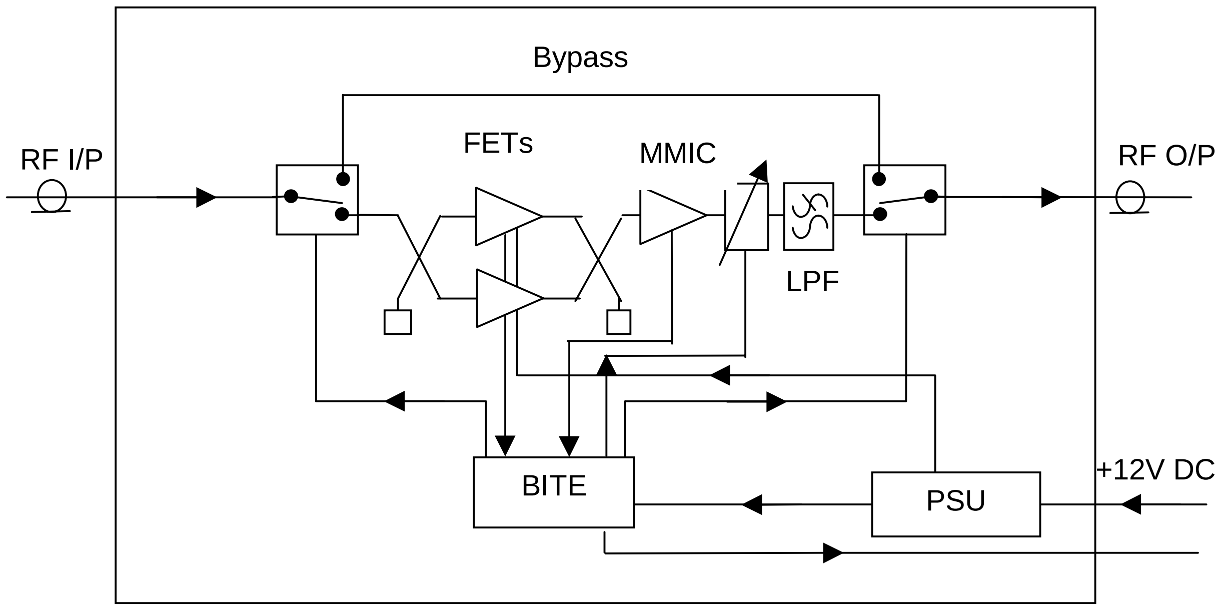

Figure 4 LNA Module

LNA Main Performance Characteristics

The main performance characteristics of the LNA tile are given in the following table 2:

Parameters	***Performance Specification***
Operating Frequency Band	1850 to 1910 MHz
Information Bandwidth	15 MHz
Output P1dB Point	≥ +13 dBm
Nominal Gain	7 to 22 dB Variable in 1 dB steps
Noise Figure (max gain)	< 1.2dB
Gain Tolerance	+/- 0.5 dB of nominal set gain
Power Supply	12 VDC
Operating air Temperature	-40 to +55 °C
Gain Flatness	+/- 0.5 dB over bandwidth

Table 2.

3.1.1.4 *Diplexers and Filters*

The MHB incorporates diplexers at the antenna and BTS ports, each containing one transmit bandpass filter diplexed to a receive bandpass filter. The Tx and Rx filters are of quarter wave cavity construction with iris coupling between adjacent resonators. The filter cavities are machined into the main silver plated aluminium filter body. The input and output to the filter is achieved by direct resonator tap point coupling wires. Each bandpass filter is tuned with resonator and iris screws located in the filter lid, which are all silver-plated.

The filters are designed with pseudo-elliptic transmission responses. Each transmission zero generated by internal resonator cross coupling. Lowpass filtering is included in the transmit and receive paths to provide further attenuation up to 13 GHz.

Main Performance Characteristics of Filters

The main performance characteristics of the filters are given in the following tables:

Transmit Filter (Antenna Port Diplexer)

Parameters	***Performance Specification***
Tuneable Transmit Frequency Band	1930 to 1990 MHz
Information Bandwidth	15 MHz
Passband Insertion Loss	<0.6dB over temperature
Rejection (receive band)	>85dB
Return Loss	>23dB
Temperature Range	-30 to +65 °C

Table 3.

Receive Filter (Antenna Port Diplexer)

Parameters	***Performance Specification***
Tuneable Receive Frequency Band	1850 to 1910 MHz
Information Bandwidth	15 MHz
Passband Insertion Loss	<0.6dB over temperature
Rejection (transmit band)	>85dB
Return Loss	>23dB
Temperature Range	-30 to +65 °C

Table 4.

Transmit Filter (BTS Port Diplexer)

Parameters	***Performance Specification***
Tunable Transmit Frequency Band	1930 to 1990 MHz
Information Bandwidth	15 MHz
Passband Insertion Loss (inc. Bias Tee)	<0.7dB over temperature
Rejection (receive band)	>45dB
Return Loss	>23dB
Temperature Range	-30 to +65 °C

Table 5.

Receive Filter (BTS Port Diplexer)

Parameters	***Performance Specification***
Tunable Receive Frequency Band	1850 to 1910 MHz
Information Bandwidth	15 MHz
Passband Insertion Loss (inc. Bias Tee)	<0.85dB over temperature
Rejection (transmit band)	>85dB
Return Loss	>23dB
Temperature Range	-30 to +65 °C

Table 6.

3.1.1.5 Alarm Monitoring / Reporting and Control

The MHB has an integrated microprocessor circuit to monitor and report the performance of the LNA, and HPA. The monitoring circuit includes an 8 bit micro controller. Included within the micro are reset/watchdog circuits and a universal asynchronous serial interface. The micro monitors digital signals from the LNA and HPA to provide a comprehensive status and monitoring system. The watchdog and reset circuit ensures correct operation during start-up and supply fluctuations. Figure 4 shows a block schematic of the Digital / Control Module.

The micro controller provides remote control and alarm interfaces on the PDU via the feeder cable

Bypass Operation

In the event of a failure, it will be reported to the BTS via the alarm interface as well as being displayed on the PDU. At the time of the alarm indication the appropriate bypass condition will take effect and the microprocessor will continue to monitor the alarm and automatically revert to active mode if the fault recovers. The loss of power will activate the RF switches on either side of the HPA and LNA to bypass each of these amplifier modules.

Integrated Serial Communications

The micro controller, due to the comprehensive monitoring and BITE within the MHB design, provides detailed diagnostic and failure information. This information can be used by an intelligent base station system to verify correct operation and predict system performance under various fault conditions and alert the network operator to the site status. With this detailed information the system will be able to provide fault isolation and corrective action information to ensure that site visits are only required when absolutely necessary and when these do occur the maintenance engineer is prepared with the correct resources to minimise the down time of the site.

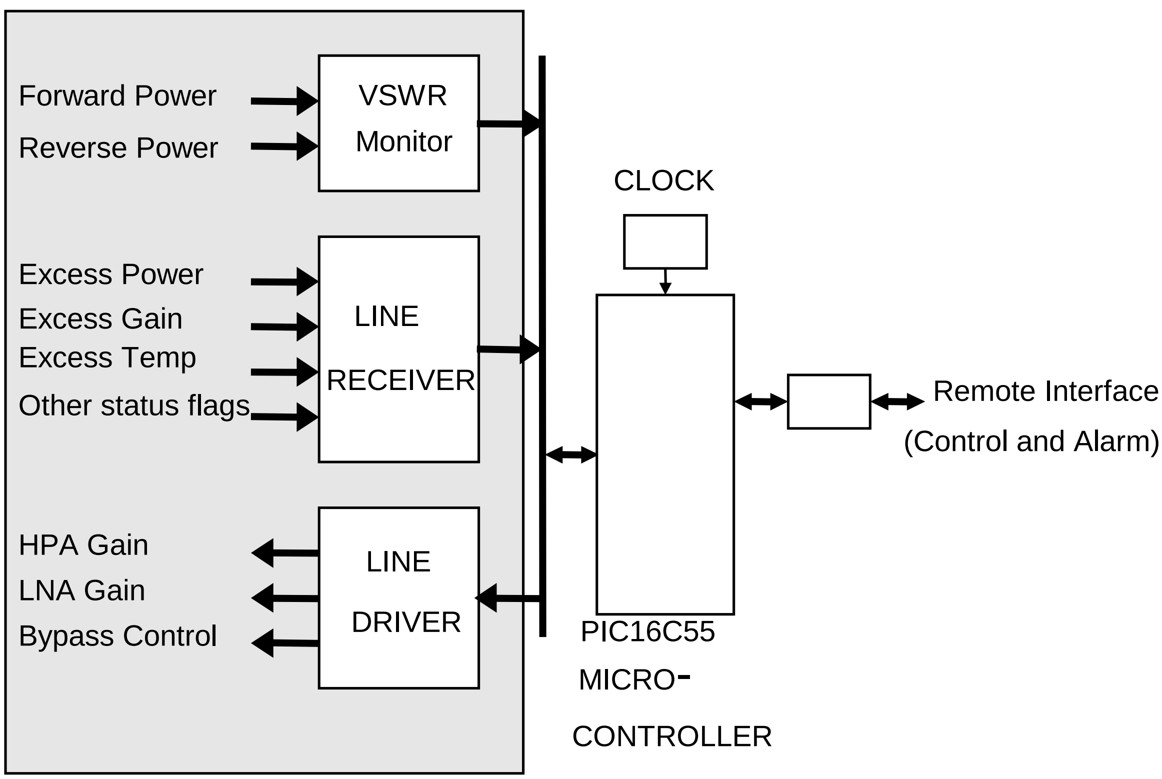

Figure 5. Block Diagram of Digital / Control Module

3.1.1.6 Bias Tee

The Booster bias tee, which is integrated within the Booster, performs four functions. A straight through path is provided for RF signals, the DC power for the Booster received from the PDU is coupled off the feeder and the serial communications to/from the PDU is taken from the feeder and supplied to the Booster. The bias tee also provides lightning protection for the Booster. Figure 6 shows a block schematic of the Bias Tee used in the Booster.

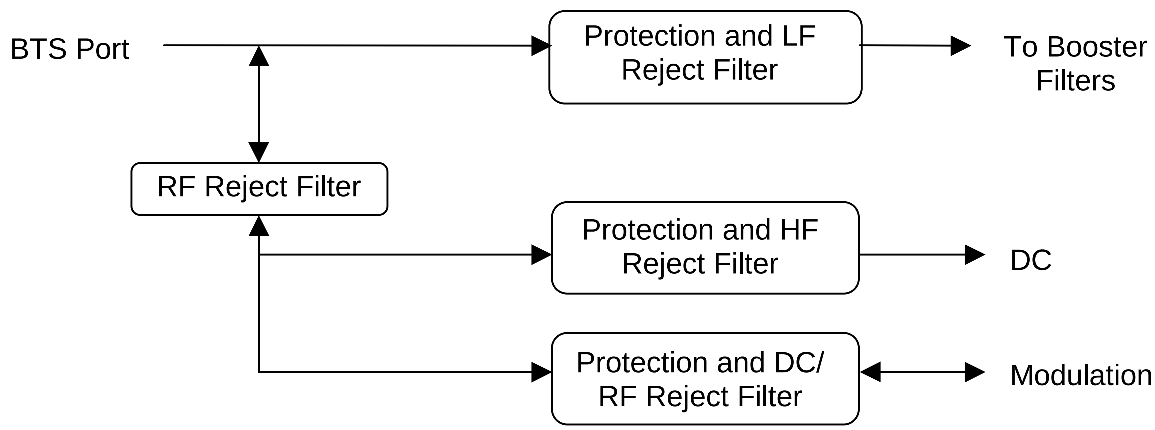

Figure 6. Block Diagram of the Bias Tee used in the Booster

3.2 Power distribution unit

A technical description of the Power Distribution Unit used to provide DC power to MHB (and MHA if used) is given in this section**.**

3.2.1 Technical Description

The Power Distribution Unit (PDU) converts the input supply to +30V DC for the boosters (and +12V DC for the MHAs if used). The PDU also generates an internal +5V DC supply used to drive the control and status panel integrated into the PDU. The PDU can supply, control and display the status of three boosters (and six Variable Gain G3 MHAs if used). The PDU reports the status of the three boosters and six masthead amplifiers and can also set the Tx and Rx gain for each sector independently.

The main features of REMEC-Airtech's PDU are:

- Can be mounted in an outdoor environment at the base of the antenna mast or on a building roof.
- The PDU can provide power to the masthead units comprising of 3 Boosters and 3 High Gain Masthead Amplifiers (MHA).
- The input can be –48VDC (nominal) or 88 to 264V AC
- The outputs for the Boosters are +30V. The outputs to the MHAs are at a nominal voltage of +12V.
- The PDU contains a Control Circuit which interfaces to the rest of the PDU providing output power enable and status monitoring facilities. The controls and indicators associated with this circuit are pcb mounted and accessed through appropriate apertures in the display panel.
- All connectors are weatherproofed and are mounted on the bottom surface of the PDU enclosure.
- A circuit breaker with switch is provided on the input for each Sector. This ensures that each sector may be isolated manually during installation or automatically if a fault develops.
- All outputs are stable into any load and are protected against any load.
- The Booster and the MHA DC/DC converter modules have a disable feature removing the supply to each individual sector.

Power Supply Requirements	***AC Option***	***DC Option***
Per Booster	300W	180W
Per Masthead Amplifier	5W	5W

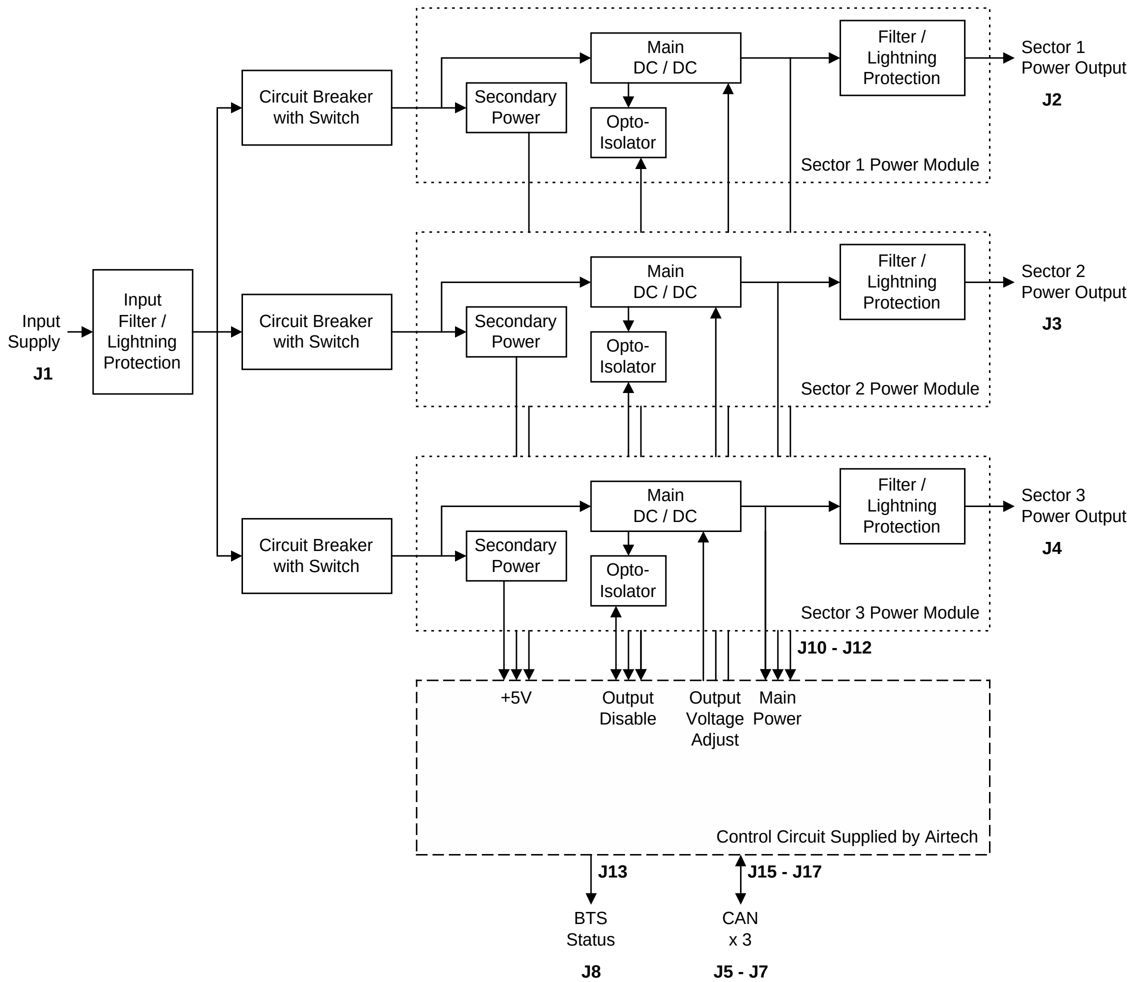

Figure 7. Block Diagram of the Power Distribution Unit

3.3 Booster Bias Tee

The booster Bias Tee is installed between the BTS RF Jumper Cable and the main RF feeder carrying the Tx/Rx signals. Each Bias Tee has a separate DC cable coming from the booster interface of the PDU

The high current Booster Bias Tee is designed to inject DC current on to co-axial (RF) feeder cables to power the remote Booster devices which use the feeder.

The Bias Tee design also allows a modulated signal to be injected on to the co-axial (RF) feeder cable, required to control and monitor the remote Booster devices which use the feeder.

It is designed to operate over the DCS1800 and PCS1900 frequency bands, with excellent return loss and very low insertion loss performance.

The bias tee includes circuitry to suppress lightning transients induced on the RF line.

Figure 8 shows a block schematic of the high current bias tee.

The Bias Tee is housed in a metal enclosure with four connectors. Two 7/16 RF connectors for the base transceiver station (BTS) and Mast Head Equipment (MHE) ports, a single MIL-C-5015 type connector for the DC input and a single SMA type connector for the communication serial data modulation.

It is designed to operate both indoors and outdoors.

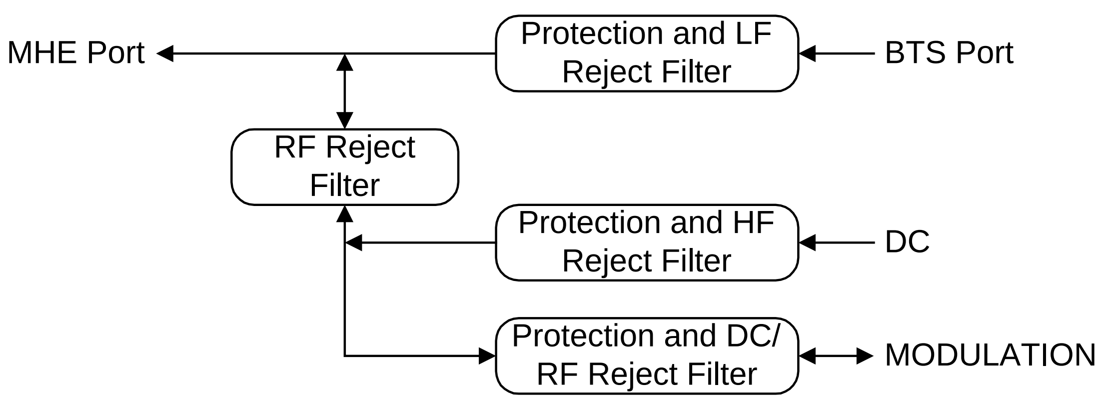

Figure 8: Block Diagram of the High Current / Serial Bus Booster Bias Tee

3.4 Cable Set.

A set of three cables is required to provide DC power and communication to the Mast Head Booster and Mast Head Amplifier (two for Booster and one for MHA if used). These three cables are shown in figure 9. The Bias Tee power harness provides a DC power between the PDU and the Booster Bias Tee. The Bias tee Communications harness provides a serial data bus link between the PDU and the Booster Bias Tee. The MHA Bias Tee harness provides a combined DC and a serial data bus link between the MHA Bias Tee and the PDU. The electrical interface of the alarm cable between the PDU and the BTS can be a customer specific requirement.

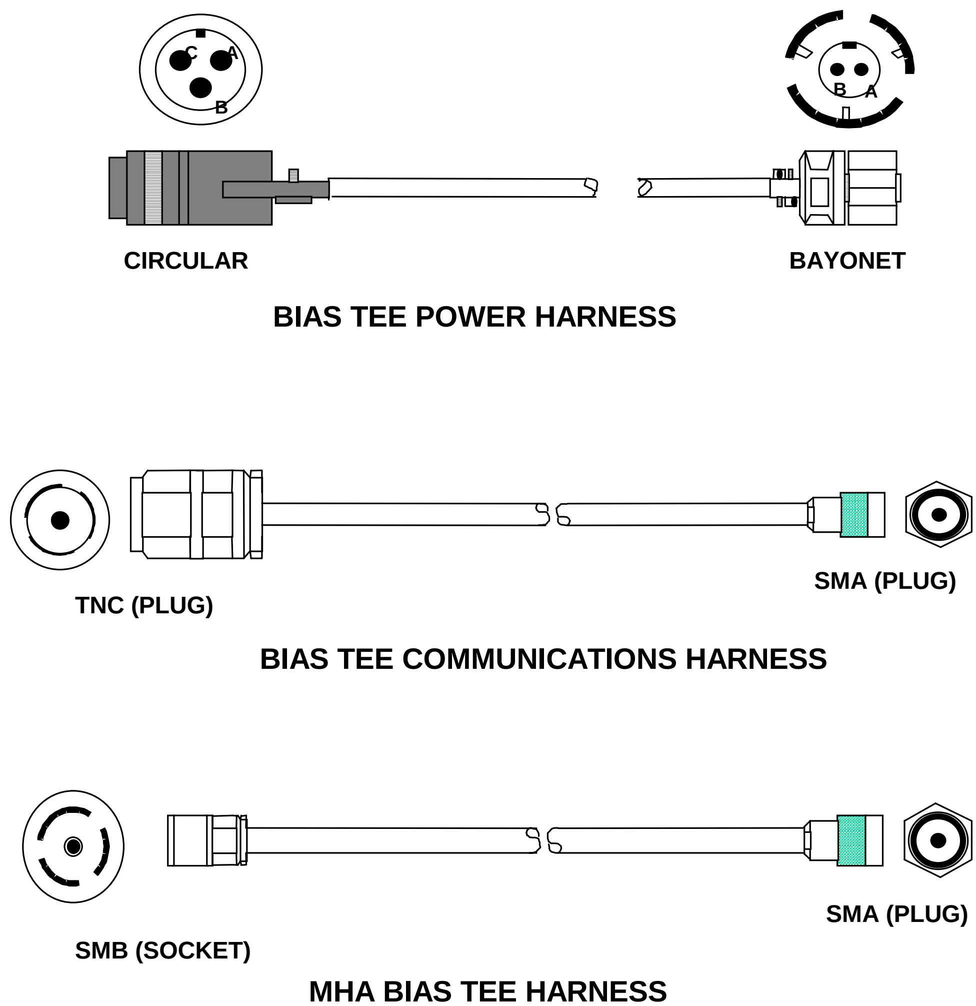

Figure 9 Cable Set

4 ELECTRICAL SPECIFICATION

This section provides the REMEC-Airtech's electrical specification. Nominal Impedance of all RF interfaces is 50 Ohm

4.1 Mast Head Booster

REMEC-Airtech's specification Booster is given in section 4.1.1 and 4.1.2.

4.1.1 Booster Receive Path

Parameters	***REMEC-Airtech Specification***
Frequency range	1850 – 1910MHz
Operating Bandwidth	15MHz
Gain range adjustment	7 – 22dB in 1dB steps
Noise figure	
Rx band over temperature range –30 to +55°C	<2.0dB
Typical value at +25°C	1.8dB
Receive path gain	
Nominal gain	22dB
Variation with temperature –40 to +55°C	±1.5dB
Return loss (LNA on)	> 18dB
Return Loss (LNA in bypass)	>15dB
Bypass Loss	< 2.4dB

4.1.2 Booster Transmit Path

Parameters	***REMEC-Airtech Specification***
Frequency range	1930 – 1910 MHz
Operating Bandwidth	15MHz
Gain range adjustment	2 – 12dB in 1dB steps
Maximum Tx Power output	+43 dBm (with max gain of 12 dB) Note: P1dB > +45dBm
Maximum Tx Power input	+40dBm
Spurious output from HPA measured at ANT port (See Product Specification for details)	
Frequency band	Level (dBm)
100 kHz – 1850 MHz	-50
1850 MHz – 1910 MHz	-120
1930 MHz – 1990 MHz	-36
Broadband noise	-36 dBm (or -70 dBc)
Bypass condition insertion loss	2.3dB Max

Transmit path gain	
BTS to ANT port, any 15MHz in range 1930 – 1990 MHz	
Nominal gain	12 ± 1dB
Variation with temperature –40 to +55°C	±2.0dB
Return loss	
ANT and BTS ports:	w. reference to 50Ω
Tx operating band	> 18dB
VSWR	1.3 :1

Note: The Booster is designed to meet spurious output requirements of ETSI 11.21

4.1.3 Filter Isolation

Parameters	REMEC-Airtech Specification
Filter isolation	
Measured at ANT port:	
Provided by Tx filter to Rx frequency band	>85dB
Provided by Rx filter to Tx frequency band	>80dB
Measured at BTS port:	
Provided by Tx filter to Rx frequency band	>45dB
Provided by Rx filter to Tx frequency band	>80dB

4.1.4 DC and Alarm Interfaces.

Parameters	REMEC-Airtech Specification
Power Requirements	
Booster input supply power	30VDC ± 10%
Power consumption	180 W made up of 6A @ 30V
Power supply interface	Coupled via Bias Tee
The equipment shall indicate minimum alarm as stated below once it is detected.	
Low Noise Amplifier (LNA) current out of range / failure	
HPA current out of range / failure	
Voltage Standing Wave Ratio (VSWR)	

4.1.5 Lightning Protection

Parameters	REMEC-Airtech Specification
Lightning protection	20kA, pulse shape 8/20 µsec based on IEC801-5

4.2 Power Distribution Unit

4.2.1 DC Input PDU

4.2.1.1 DC Interface.

Parameters	***REMEC-Airtech Specification***
Output Voltage	Adjustable +26VDC to +30VDC
Line Regulation	<0.5%
Load Regulation	<2%
Voltage Temperature Stability	0.02% / °C
Output Voltage Adjustment Accuracy	Adjustment must track the trim resistor to ±10%
Operational Output Current Max	10A each output
Total Output Current Max	30A
Output current limit maximum	13A each output
Protection	Outputs are protected against any load and over voltages of up to 50V (duration less than 1ms)
Disable feature	Standard TTL Levels Logic Low - Supply on Logic High - Supply off Switch off time must be less than 250ms

4.2.1.2 Auxiliary DC/DC Converter

One Sector Power Module will contain an auxiliary 1 Watt +5V DC/DC converter module as stated below.

Parameters	***REMEC-Airtech Specification***
Output Voltage	+5V ± 5%
Operational Output Current Max	600mA each output
Protection	Outputs are protected against any load
Output current limit maximum	1A each output maximum

4.2.1.3 Lightning Protection

The power supply input J1 and the sector power outputs J2, J3 and J4 shall each be protected by an appropriate voltage transorb rated at 5kW (at ambient temperature of +25°C).

4.2.1.4 *Power Supply Requirements*

The DC Input is at J1. The positive supply input shall be connected to the chassis.

Parameters	***REMEC-Airtech Specification***
Nominal Input Voltage:	-48VDC
Minimum Input Voltage:	-36VDC
Maximum Input Voltage:	-76VDC

4.2.2 *AC Input PDU*

4.2.2.1 *Booster Converter*

Parameters	***REMEC-Airtech Specification***
Output Voltage	Fixed +30 V
Line Regulation	<0.5%
Load Regulation	<2%
Voltage Temperature Stability	0.02% / °C
Operational Output Current Max	10A each output
Output Current Min	0A
Total Output Current Max	30A
Output current limit maximum	13A each output
Protection	Outputs are protected against any load and over voltages of up to 60V (duration less than 1ms). If the over voltage protection circuit disables the output this must not require the manual resetting (toggling the Supply Disable may be used).
Disable feature	Standard TTL Levels Logic Low - Supply off Logic High - Supply on Switch off time must be less than 250ms

4.2.2.2 *MHA Converter*

Parameters	***REMEC-Airtech Specification***
Output Voltage	+12V
Line Regulation	<0.5%
Load Regulation	<2%
Voltage 5.3.2.2e.Temperature Stability	0.02% / °C
Output Voltage Adjustment Accuracy	Not required
Operational Output Current Max	800mA each output
Output Current Min	0A

Output current limit maximum	2A each output
Protection	Outputs are protected against any load and over voltages of up to 25V (duration less than 1ms). If the over voltage protection circuit disables the output this must not require the manual resetting (toggling the Supply Disable may be used).
Disable feature	Standard TTL Levels Logic Low - Switch off Logic High - Supply on time must be less than 250ms Supply off

4.2.2.3 *Auxiliary Supply*

The Auxiliary Supply consists of two AC/DC converter providing redundancy for increased reliability. The output from each converter shall be +5V at 5 Watts.

Parameters	***REMEC-Airtech Specification***
Output Voltage	+5V $\pm$ 5%
Operational Output Current Max	1.0A each output
Protection	Outputs are protected against any load
Output current limit maximum	2A each output maximum

4.2.2.4 *Lightning Protection*

The sector power outputs J2, J3 and J4 are protected by an propriety voltage transorb rated at 5kW (at ambient temperature of +25°C) from the General Instruments or the Semitron 5KP** series. The transorbs may be mounted on the Sector Power Module circuit board. (The mains input J1 shall be protected against input surges to the levels in the relavent specification in section 6).

4.2.2.5 *Grounding*

There is an 8mm earthing stud close to the mains input connector to which all the earth points are connected in a star configuration.

4.2.2.6 *Power Supply Requirements*

The AC Input is J1. This is a clearly labelled terminal block with a cable gland on the bottom of the enclosure.

Parameters	***TMTOUCH Requirements***
Input Voltage Range:	$85V_{rms}$ to $264V_{rms}$

Input Frequency Range:	47Hz to 63Hz

4.3 Booster Bias Tee

4.3.1 Electrical Specifications.

Parameters	***TMTOUCH Requirements***
Transmit Band	1930 – 1990 MHz
Receive Band	1850 - 1910 MHz
Insertion Loss	≤ 0.3 dB
RETURN LOSS - BTS AND MHE PORTS	
Rx Operating Band	> 18dB
Tx Operating Band	> 18dB
RF Power Handling	+49dBm
RF Intermodulation Level Two signals in the Tx band at power level of +40dBm into MHE port:-	
Rx band	-120dBm
Tx band	-50dBm
Modulation Operating Frequency	1MHz ± 0.5MHz
Modulation Insertion loss	≤ 3 dB
Power Handling	+30V @ ≤ 13A

4.3.2 Lightning Protection

The bias tee is designed to withstand the following lightning current waveforms between the inner and outer conductor of the MHB port:

Rise Time *	Fall Time #	Peak Current
10µs	350µs	2.5KA
8µs	20µs	20KA

During a lightning pulse the bias tee must clamp the voltage on the BTS port and the input to less than $60V_{peak}$.

During a lightning pulse the bias tee must clamp the voltage on the serial data input to less than $12V_{peak}$.

* The rise time is defined as the time from the start of the current waveform to point where the current is 90% of maximum value.

\# The fall time is defined as the time from the start of the pulse to the point where the current has decayed to 50% of is maximum value.

5 MECHANICAL SPECIFICATION

The following table gives the dimensions (including fixings, brackets, handles etc) of both the SF/SA (MHB), Booster Bias Tee and the PDU

Unit	Length (mm)	Width (mm)	Height (mm)	Weight (kG)
Booster	387.4	253	247	<15.0
Booster Bias Tee	120	94	41	<1.35
PDU	400	330	245.5	<21

6 ENVIORNMENTAL AND QUALIFICATION SPECIFICATIONS

6.1 EMC

The equipment is designed to be fully compliant with the following European Community requirements.

European EMC directives 89/336/EEC and 92/31/EEC for both spurious emissions and immunity.

European Telecommunications Standard ETS 300 342-3

6.2 ENVIRONMENT

6.2.1 Environmental Conditions for the Booster - MHB

Parameters	REMEC-Airtech Specification
OPERATING Environmental Condition	
Operating Air Temperature	-40 °C to +60 °C
Relative Humidity	5 to 95 %
Absolute Humidity	1 to 29 g/m³
Rate of Change of temperature	0.5°C / min.
Air Pressure	70 to 106 Kpa
Solar Radiation	1120 W/m²
Operational Conditions	Class 4.1, ETS 300 019-1-4
STORAGE Transportation Environmental Condition	
Air Temperature	-40 °C to +70 °C
Relative Humidity	8 to 100 %
Absolute Humidity	0.03 to 60 g/m³
Rate of Change of temperature	0.5°C / min.
Air Pressure	70 to 106 KPa
Solar Radiation	1120 W/m²
Transportation Conditions	Class 2.3, ETS 300 019-1-2
Storage Conditions	Class 1.2, ETS 300 019-1-1

Enclosure Weatherproofing	
The unit weatherproofing ratio (including connectors)	IP68 (European Standard IEC 529)

6.2.2 Environmental Conditions for the Booster Bias Tee

Parameters	***REMEC-Airtech Specification***
OPERATING Environmental Condition	**Value**
Operating Air Temperature	-40 °C to +60 °C
Relative Humidity	5 to 95 %
Absolute Humidity	1 to 29 g/m³
Rate of Change of temperature	0.5°C / min.
Air Pressure	70 to 106 Kpa
Solar Radiation	1120 W/m²
Operational Conditions	Class 4.1, ETS 300 019-1-4
STORAGE Transportation Environmental Condition	
Air Temperature	-40 °C to +70 °C
Relative Humidity	8 to 100 %
Absolute Humidity	0.03 to 60 g/m³
Rate of Change of temperature	0.5°C / min.
Air Pressure	70 to 106 Kpa
Solar Radiation	1120 W/m²
Transportation Conditions	Class 2.3, ETS 300 019-1-2
Storage Conditions	Class 1.2, ETS 300 019-1-1
Enclosure Weatherproofing	
The unit weatherproofing ratio (including connectors)	IP 68 (European Standard IEC 529)