Product Specification

R2100PB UltraSpan™ Power Booster up to 25.5 dBm Output Power, with OSC Booster

PN: FOA-R2100PB-EPB2C-AA010

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Customer: General

Product Features

- Fully controlled high power EDFA with up to 25.5 dBm output power
- Amplification of the optical supervisory channel (OSC), at 1510 nm
- Optional pre-tilt to compensate for SRS
- State of the art transient suppression
- Remote software maintenance and upgrade
- SNMP v2 or v3 and web-based GUI
- Class 1M* laser safety classification
- 1RU rack-mountable packaging

Applications

- Add-on to existing system boosters
- Long repeaterless links or spans, island hopping, desert ranges and oil rigs
- Storage area networks (SANs), remote locations, disaster recovery
- 100 Gb/s and 40 Gb/s transmission and/or increasing channel count to 80+ WDM channels

The UltraSpan™ Power Booster EDFA is a unique telecom grade, single-clad high output power EDFA that covers the full C-band. The Power Booster has the ability to boost output power of existing line EDFA to 25.5 dBm. Though output power of the Power Booster is in the range of Class 3B laser safety classification, it incorporates three independent automatic power reduction (APR) mechanisms that enable the unit to be classified as Class 1M* with respect to laser safety,

The main merit of the high power EDFA is to improve system optical signal to noise ratio (OSNR) and thus enable longer transmission spans, longer haul systems and larger channel count.

The Power Booster includes redundant user replaceable 48V DC power supplies and cooling fans, as well as a communication module supporting SNMP and a web based GUI through a standard Ethernet RJ45 connector.

Optical Specification

Parameter	Units	Min.	Typ	Max.	Notes
Bandwidth	nm	1529		1564	L-band available upon request
Saturation Output Power	dBm	25.5			At optimal gain with OSC filter at Output (filter IL=0.5dB)
Optimal Gain	dB	5.5	6	6.5	Can be tailored to any gain
Input Power Range	dBm	-5		21	
Output Power Range	dBm	5		26	
Output Power Stability	dB			±0.1	
Gain Flatness Versus WL	dB		±0.5	±0.75	At optimal gain
Gain Accuracy at Optimal Gain	dB		±0.3	±0.5	
Accuracy for all detectors	dB			±0.5	
Noise Figure	dB		8	9	
Transient Gain Excursion	dB			±1.5	For 16dB add/drop in 100 μs
Transient Gain Error	dB			0.5	
Transient Settling Time	μs			150	
Input and Output Return Loss	dB	40			
Pump Leakage	dBm			-30	
PDL+PDG	dB			<0.4	
PMD	ps			<0.2	
Pump Leakage	dBm			-30	

Add-on OSC Booster

The Power Booster is equipped with an OSC booster EDFA which is used to amplify the OSC at 1510nm for very long unrepeated span applications. The specification of this optional amplifier is shown in the table below.

Parameter	Units	Min.	Typ	Max.	Notes
Bandwidth	nm	1504.5		1517.5	
Saturation Output Power	dBm	11			Measured at output port of pizza box. Regardless of input power.
Input Power Range	dBm	-4	0	7	
PDG	dB			0.3	
Noise Figure	dB			11	At -3dBm input.

Optical Connections

The Power Booster is equipped with three optical ports, described in table below.

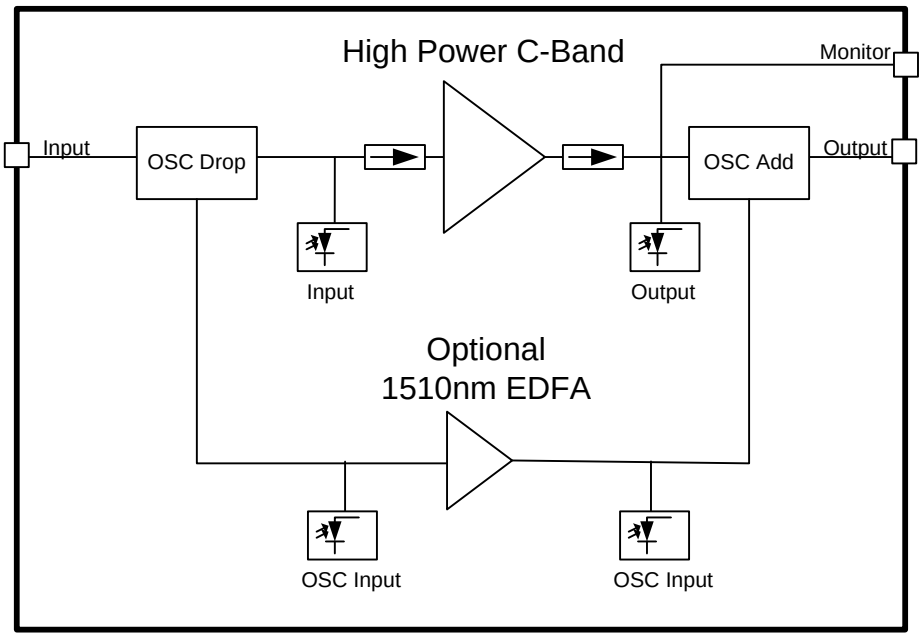
Port	Description
Input	LC/UPC - Amplifier input port
Output	E2000 - High power amplifier output port
Monitor	LC/UPC – Amplifier output monitor port

Electrical Specification

Parameter	Unit	Min.	Typ.	Max.
Supply Voltage	V	-76		-36
Power Consumption	W		38	55
Supply Current @48V Supply	A			1.5

Block Diagram

The following is a block diagram of the Power Booster with the 1510nm OSC EDFA. The “OSC drop” is optional, so that if needed the OSC input to the 1510nm EDFA can be done via a separate input optical connector.



APR Detection Mechanisms

There are three different APR detection criteria. These criteria are used either independently or collectively to detect various scenarios, which indicate a potential safety hazard and consequently result in APR activation. The criteria can also be used to detect and alert system management with regard to deterioration of the transmission line.

The three APR criteria are:

1. **Back-reflection in C-band**: Output power in C band of the Power Booster and the back reflected C Band is continuously monitored and compared to the output power. An increase in the back reflection ratio level indicates an open connector in the system and triggers an APR event. The threshold of the ratio between the output power and reflected power is settable from -28dB to -20dB. If back reflection ratio is higher than the threshold EDFA reduces its output power to 20dBm.
2. **Transient in back scattered Amplified Spontaneous Emission (ASE) in the L-band**: This mechanism continuously monitors the ASE in the L-band (1600-1650nm) caused by Raman process of the high-power C-band output entering the Power Booster from the output port. Changes in ASE indicate an open or degraded line (high loss points). If a change is detected which is greater than a preset threshold, the EDFA reduces its output power to 20dBm.
3. **Amplified Spontaneous Emission (ASE) in the L-band lower than Threshold**: This mechanism continuously monitors the ASE in the L-band (1600-1650nm) caused by Raman process of the high-power C-band output entering the Power Booster from the output port. Low ASE indicates an open or degraded line (high loss points). If low ASE is detected lower than the threshold, the EDFA reduces its output power to 20dBm.

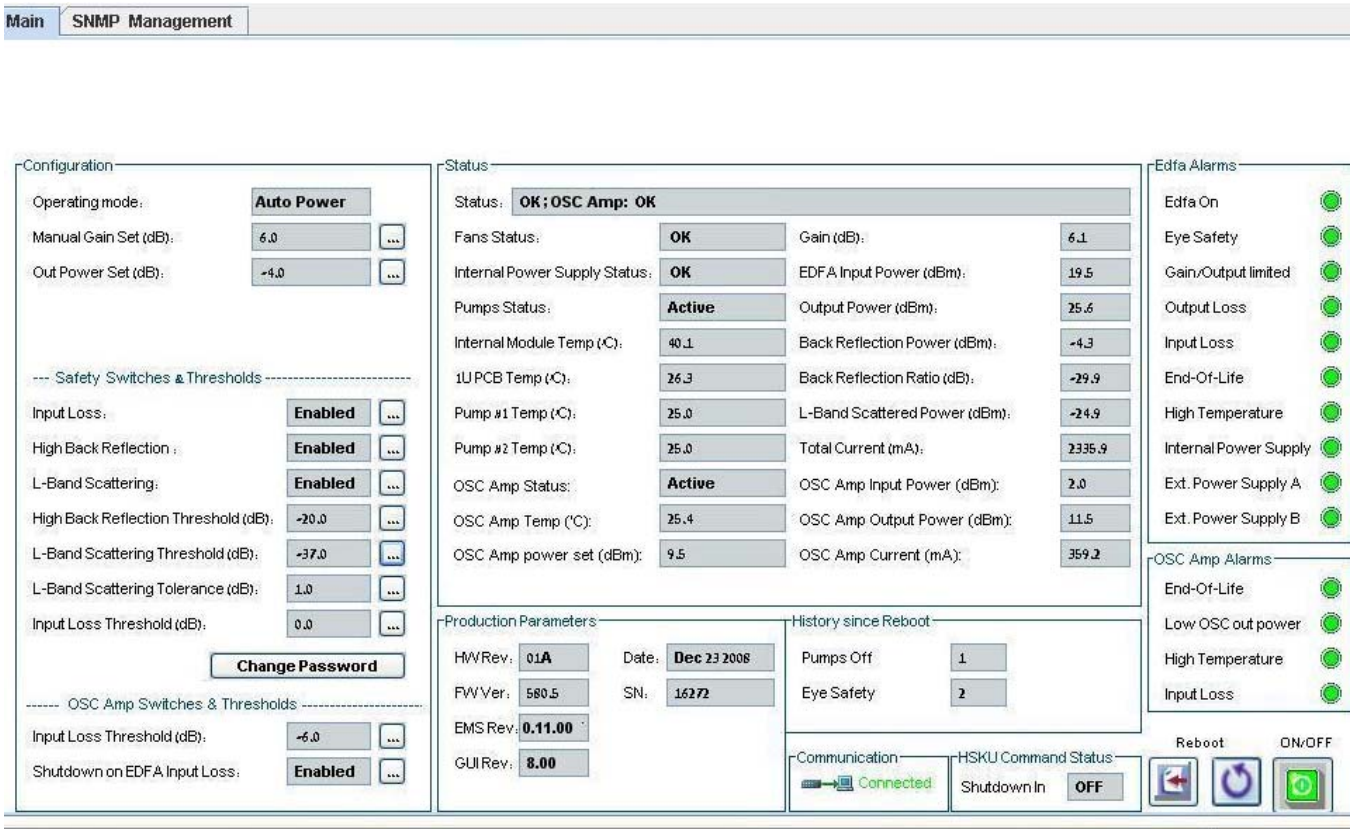
Restart and Automatic Return from APR

The Power Booster will restart based on the input power (>-3dBm). It will shut down if input power is below -5dBm. If the Power Booster is in automatic restart procedure (ARP) due to APR, it will restart according to following logic:

1. **APR due to High Back-reflection in C band**: After APR the power level will drop to 20dBm (Mode=APC). Back reflected power ratio will continue to be monitored. Once the back-reflected ratio is within normal range, the power level will be increased to normal operating level.
2. **APR due to L-band back scattering**: After APR (output is at 20dBm), if the ratio of the L-band power level to output power increases compared to the same ratio measured directly after the APR event, then the power level will be increased to normal operating level.

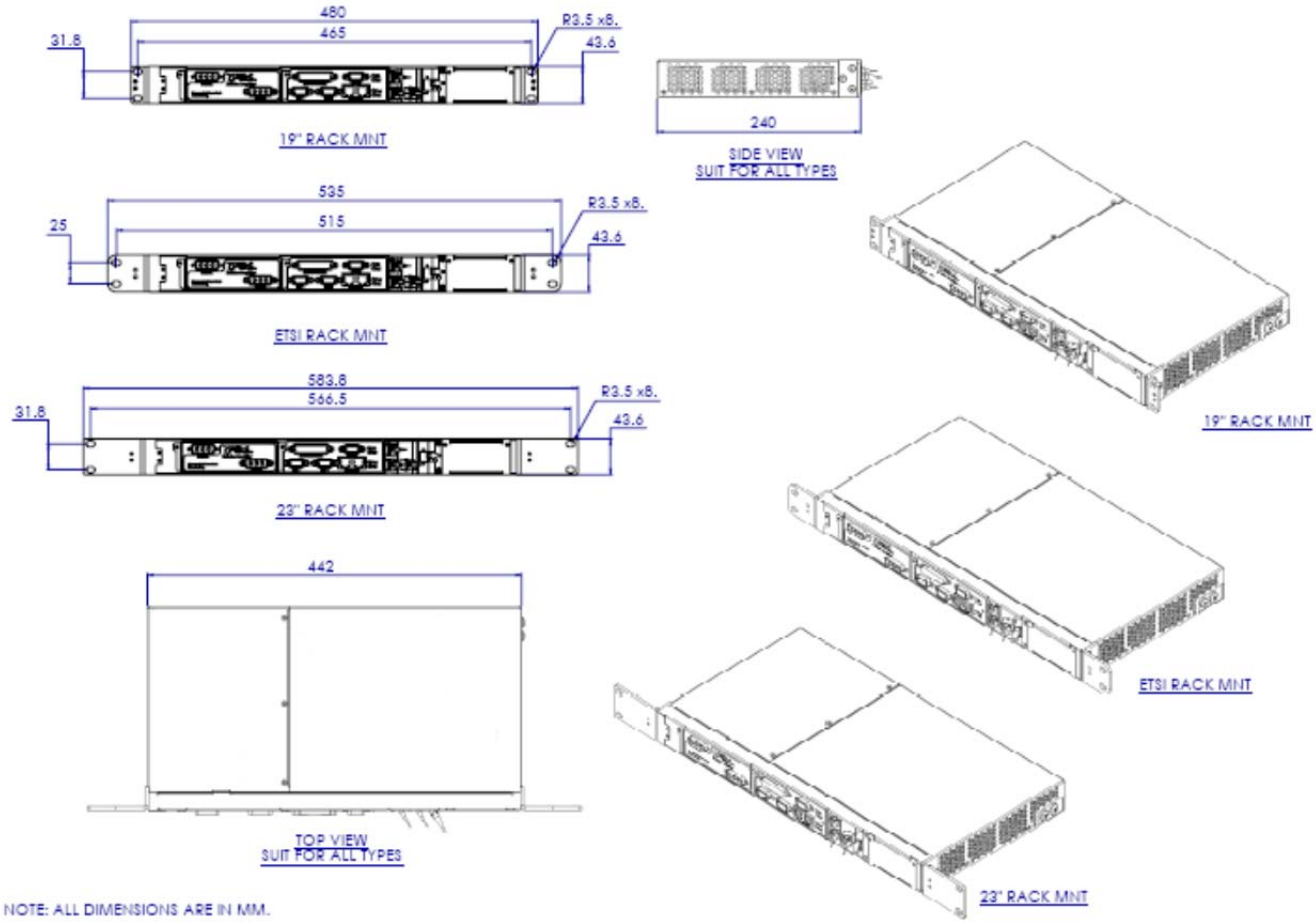
Example GUI

A typical GUI snapshot can be seen in the figure below. The easy to use GUI is web-based and can be accessed using internet explorer by simply entering the IP address of the unit.



Mechanical Specifications

The following drawing shows the Power Booster's width, height and length dimensions.



Front panel connectors are shown in the drawing below:

Environmental and Qualification

Parameter	Value/Range
Operating Temperature	-5°C to +55 °C
Operating Humidity	5 to 85%
Storage Temperature	-40°C to +85°C
Storage Humidity	5 to 95%
Qualification	ETSI, NEBS Level 3
Laser Safety	Class 1M*

* Class 1M products are not hazardous under normal circumstances, but may pose an eye hazard when the laser output is viewed with certain optical instruments (for example eye loupes, magnifiers and microscopes) within a distance of 100 mm