AIMA-FT5S

1550 nm Optical Forward Transmitter - Standard

Product User Manual

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Product User Manual

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Contents

1 About This Manual

1.1 Related Documentation

The following documents may be used in conjunction with this manual:

- PBN.AIMA3000 - Product User Manual
- PBN.AIMA ASMM - Product User Manual
- AIMA3000 NMS Web Management System Product User Manual
  - PBN.NMS3-EPSM - Basic Inventory Management
  - PBN.NMS3-EPSM - Basic Alarm Management
  - PBN.NMS3-EPSM - Basic System Management
  - PBN.NMS3-EPSM - Basic Template Management

The document can be found at the download section of PBN's corporate website:

http://www.pbnglobal.com/en/support/downloads/manuals. A registered account is required.

1.2 Document Conventions

Before you use the manual, please familiarize yourself with the format used in this manual.

'*' Asterisk: Points marked with an asterisk means there is a corresponding note on the page

1.3 Technical Support

If you need help in the process of setting up and maintaining an FT5S, please contact PBN's technical support staff:

Australia:

Suite 15, Building 3, 195 Wellington Road

Clayton, VIC 3168, Australia

Phone: +61-3-8561-1400

Fax: +61-3-9562-2957

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Transistorstraat 46-II, 1322 CG Almere

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Americas:

Phone: +1-888-339-8805

Company Website: www.pbnglobal.com

Support Email: support@pbnglobal.com

2 Precautions

WARNING!

This equipment is intended for indoor applications. To prevent fire or electrical shock, or damage to the equipment, do not expose units to water or moisture.

- You should carefully read and thoroughly understand the contents of the manual before installing and using this equipment.
- A typical connector is the SC/APC 8°. **Note**: An 8 ° angle polished optical connectors must be used.
- At any time, there may be dangerous voltage inside the device.
- Do not power up before the cover and the panels of the equipment are installed and the enclosure is closed.

Cleaning

Only use a damp cloth for cleaning the front panel. Use a soft dry cloth to clean the top of the unit. Do not use any spray cleaners or chemicals of any kind.

Outage or overload requiring service and repairs

Unplug the unit and refer the servicing to Pacific Broadband Networks' qualified service personnel only.

Servicing and repairs

Do not attempt to service this unit yourself. Refer all servicing needs to Pacific Broadband Networks' qualified service personnel only.

WARNING!

Exposure to class 3A laser radiation is possible. Access should be restricted to trained personnel only. Do not view exposed fiber or connector ends when handling optical equipment.

3 Overview

3.1 Product Description

The 1550 nm Forward Transmitter Module - Standard series (FT5S) is designed to plug into PBN's latest Advanced Intelligent Multi-services Access platform - the AIMA3000.

PBN's AIMA3000 FT5S is available in single and dual laser configurations. It features advanced forward transmitters engineered for multi-service operators (MSOs) to increase network capacity to satisfy an ever-growing subscriber demands for more bandwidth. The module's operating wavelength conforms to ITU's standards and works with PBN's Erbium Doped Fiber Amplifier Module (EDFA). It allows for full-spectrum broadcast and narrowcast channels, providing the utmost flexibility for MSOs during the transition to all digital.

The FT5S series employs an advanced RF circuit design and laser with high-quality and low-chirp characteristics. The module offers a consistent optical modulation index (OMI) and ensures high-index optical power output. In addition, it is a cutting-edge optoelectronic design for the delivery of high-quality transmissions, in both analog and digital formats over passive fiber optical networks.

All FT5S models can also be conveniently monitored and controlled through a computer connected to one of the Ethernet ports or an Android mobile device via the ASMM module. All module settings are retained in non-volatile memory to ensure trouble-free operation. Bulk updating, automatic uploading and downloading of configuration files can be done when using PBN's NMSE web-based management system.

3.2 Product Key Features

- Plug-and-play with the AIMA3000 platform
- High quality 1550 nm, isolated low-chirp analog DFB laser
- RF amplifier gain blocks with advanced GaAs technology for better performance
- Conforms to the ITU DWDM standards
- Frequency response from 45 MHz to 1000 MHz fit for both broadcast and narrowcast applications
- Alarm monitoring via ASMM web interface and PBN NMSE
- Automatic gain control (AGC) for a consistent optical modulation index (OMI)
- Automatic thermo-cooler control (ATC) for a consistent laser temperature
- Automatic power control (APC) for a consistent optical output power
- Available in single or dual transmitter configurations
- Up to 32 transmitters per chassis
- Remote firmware upgrade and auto upload/download of configuration files through ASMM web interface or using PBN's NMSE
- Bulk firmware updates through PBN's NMSE
- FCC, CE and RCM [(1)] compliant

[(1)] See Declaration of Conformity for current status.

3.3 Specifications

Optical Performance

Optical wavelength	1550 ±5 nm or ITU wavelength
Optical outputs	Single port: 1 Double port: 2
Output power	8 dBm, 9 dBm, 10 dBm
Optical return loss	> 60 dB
Optical connector	SC/APC (1), LC/APC, FC/APC, E2000 / APC
Laser RIN	<- 155 dB/Hz

RF Performance

RF bandwidth	45 ~ 1000 MHz
RF flatness	± 0.75 dB
RF input return loss	> 16 dB
RF input level, NC nominal (2)	15 ~ 25 dBmV per channel
RF input level, BC nominal (2)	10 ~ 25 dBmV per channel
AGC range	±3 dB
RF impedance	75 Ω
RF test point relative to RF input port	-20 ±1 dB
Alarms and laser status	Front-panel LEDs, SNMP traps
RF input connectors	Single port: 2 x GSK-type female (1 for NC input, 1 for BC input) Double port: 4 x GSK-type female (2 for NC input, 2 for BC input)
RF test points	Single port: 3 x Mini-SMB (3) Double port: 4 x Mini-SMB (4)

Notes:

(1) Standard option. Contact a PBN Sales Representative for availability of other options.

(2) dBuV=60+dBmV.

(3) Three mini-SMBs on front panel: one each for BC and NC inputs and one for laser RF level.

(4) Four mini-SMB connectors on front panel: BC and NC inputs test ports (user switchable) and two for laser RF level.

Link Performance [(5)]

CNR *(4 MHz narrow bandwidth)*	> 53 dB
CSO	> 58 dB
CTB	> 67 dB
MER	> 38 dB
BER	< 1E-9

General

Power supply	Powered via AIMA3000 backplane
Power consumption	Single port: < 8 W Double port: < 15 W
Operating temperature	-5 ~ +55 ^{o}C
Operating humidity	90 % (Non-condensing)
Storage temperature	-25 ~ +70 ^{o}C
Storage humidity	90 % (Non-condensing)
Dimensions (W*D*H)	24.6 * 410 * 152.5 mm
Weight	0.88 kg
Supported network management options	PBN's NMSE or through ASMM's Web Interface

Notes:

(5) CNR, CSO, CTB and MER are loaded with 30 NTSC+124 QAM256 or 30 PAL D/K+85 QAM256. BER is loaded with 30 NTSC+124 QAM256, 30 PAL D/K+85 QAM256 or 153 QAM256. All are measured with PBN referenced optical receiver with 5 km single-mode optical fiber 0 dBm.

3.4 Block Diagram

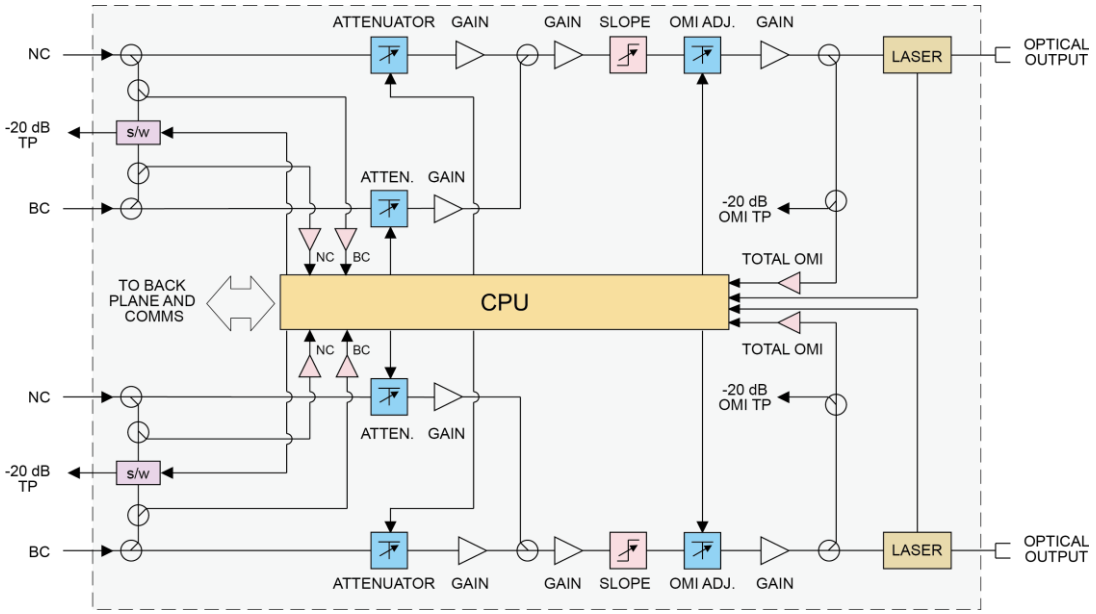


Figure 3-1 Block diagram FT5S

Table 3-3 FT5S Block Diagram Glossary

Parameters	Glossary
NC	Narrowcast Input
NC MGC	Narrowcast Input Gain
-20 dB TP	-20 dB Test Point
BC	Broadcast Input
BC MGC	Broadcast Input Gain
PRE AMPLIFIER	Pre-Amplifier Module
MID AMPLIFIER	Mid-Amplifier Module
OMI AGC	OMI Automatic Gain Control
OUTPUT STAGE	Output Stage Amplifier Module
LASER	Laser
OPTICAL OUTPUT	Optical Output
TO BACK PLANE AND COMMS	Data Bus
NC1	Narrowcast Input Internal Test Point
BC1	Broadcast Input Internal Test Point
TOTAL OMI	Total Modulation (OMI) at laser
CPU	Central Processing Unit

3.5 Order Details

A-FT5S-[V]-[W]-[X_1X_2]-[Y]-[Z] 1550 nm Forward Transmitter – Standard

Options:

V Number of Optical Ports

- **S** Single (1)
- **D** Dual (2)

W Optical Output Power

- **08** 8 dBm (6.3 mW) optical power
- **09** 9 dBm (8 mW) optical power
- **10** 10 dBm (10 mW) optical power

X_1X_2 [(1)(2)] First Channel Last Channel

- **21** 192.1 THz (1560.61 nm)
- **23** 192.3 THz (1558.98 nm)
- **25** 192.5 THz (1557.36 nm)
- **27** 192.7 THz (1555.75 nm)
- **29** 192.9 THz (1554.13 nm)
- **31** 193.1 THz (1552.52 nm)
- **33** 193.3 THz (1550.92 nm)
- **35** 193.5 THz (1549.32 nm)
- **…** …
- **51** 195.1 THz (1536.61 nm)

Y Optical Connector Type

- **S** SC/APC [(3)]
- **L** LC/APC
- **F** FC/APC
- **E** E2000/APC

Z Bandwidth

- **1G** 45 ~ 1000 Hz

Notes:

(1) Default spacing is 200 GHz. For other wavelength configurations not listed, please contact PBN.

(2) X2 used only in dual transmitter version

Dual version, X_1 is first channel and X_2 is second channel

Examples:

Single	*X_1*	*25*
Dual	*X_1X_2*	*2527*

(3) Contact PBN Representatives for detailed optical channel information.

4 Module Characteristics

4.1 Module Appearance and Port Layout

4.1.1 Overview

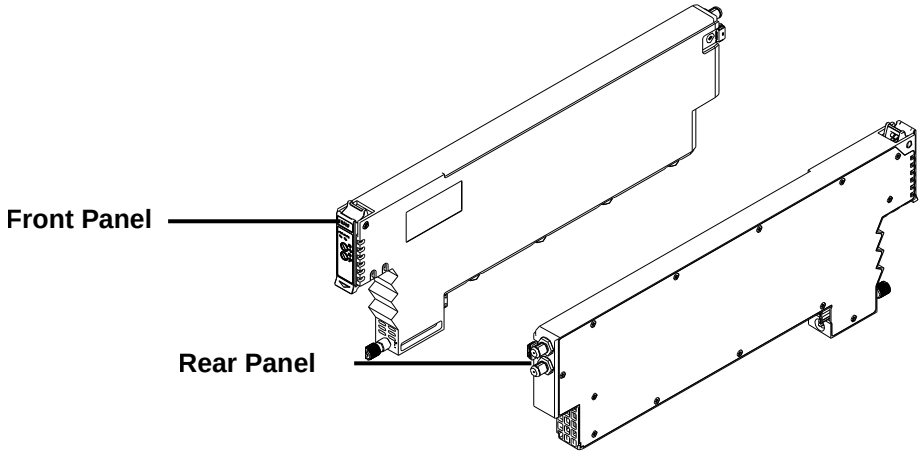


Figure 4-1 Module Appearance

4.1.2 Front Panel Layout

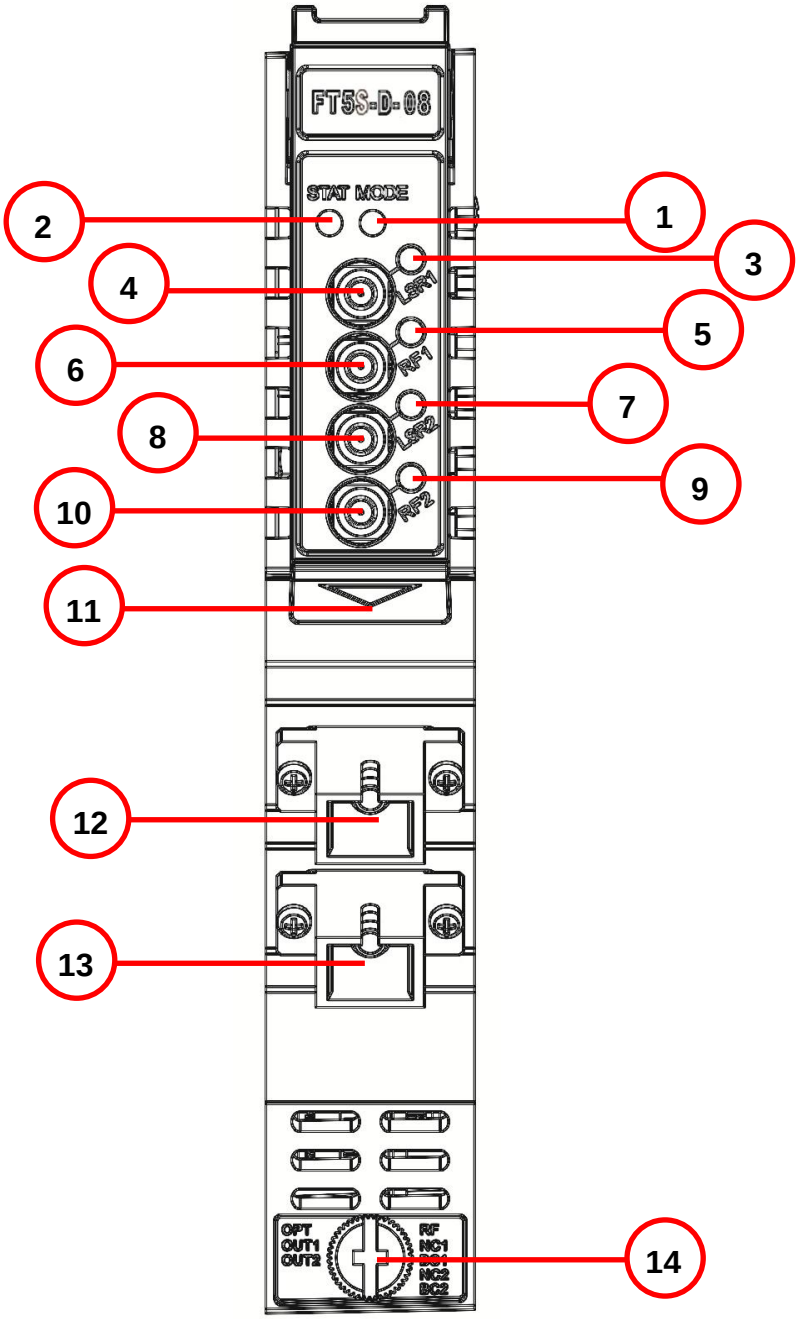


Figure 4-2 FT5S Front Panel Layout

Table 4-1 FT5S Front Panel Functions

Item Number	Item	Description
1	MODE LED	Module Gain Control Mode Indicator MGC: Green Light Blinking AGC: Green
2	STATUS LED	Module Alarm Indicator Normal: Green Minor Alarm: Orange Major Alarm: Red
3	LSR1 LED	Laser Status Indicator ON: Green OFF: Green Light Blinking Major Alarm: Red
4	LSR1-OUT	Laser 1 Input Test Point
5	RF1 LED	RF1 Status Indicator ON: Green Output RF level slightly high/Low: Orange Output RF level too high/low: Red
6	RF1-OUT	RF1 Test Point
7	LSR2 LED	Laser Status Indicator ON: Green OFF: Green Light Blinking Major Alarm: Red
8	LSR2-OUT	Laser 2 level input test point
9	RF2 LED	RF2 Status Indicator ON: Green Output RF level slightly high/Low: Orange Output RF level too high/low: Red
10	RF2-OUT	RF2 Test Point
11	Orange tab-retaining clip	Used to plug and anchor the module The tab-retaining clip will pop-up after pressing the release and plug module.
12	OPT OUT 1	Optical output 1
13	OPT OUT 2	Optical output 2
14	Mounting Screw	Module fastening screw

CAUTION!

"OPT OUT" emits a non-visible laser radiation when working.

4.1.3 Rear Panel Layout

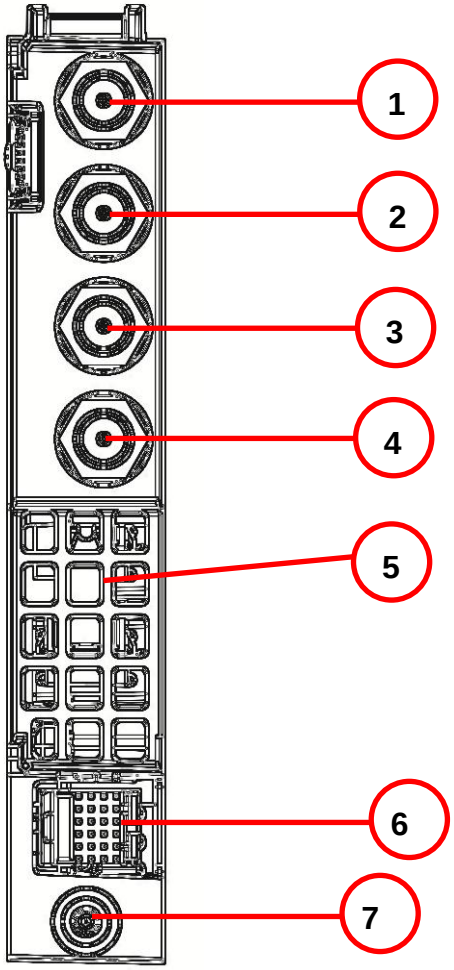


Figure 4-3 Rear Panel Layout

Table 4-2 FT5S Rear Panel Functions

Serial Number	Item	Description
1	NC1 IN	Narrowcast RF 1 Input
2	BC1 IN	Broadcast RF 1 Input
3	NC2 IN	Narrowcast RF 2 Input
4	BC2 IN	Broadcast RF 2 Input
5	Air Vent	Air vent allowing air to flow out of the module
6	Bus Connector	Power and communication port
7	Placement Pin	Used to position the module in the chassis

5 Installation

5.1 Preparatory Work for Installation

Before installing this device, you must ensure that the unit is intact and ready for installation.

Unpack and check the unit: Open the box to check for any damage that may have occurred during shipment.

If damage is found, please contact a PBN customer support representative.

Necessary equipment and tools for installation:

Table 5-1 Necessary equipment and tools for installation

Tools/Modules	Description
Phillips screwdriver PH1/PH2	For fastening the FT5S module in the AIMA3000 chassis
FT5S Module	The module to install into the AIMA3000 chassis

5.2 Unpacking

Unpack the module. Keep the packaging materials for future transport needs.

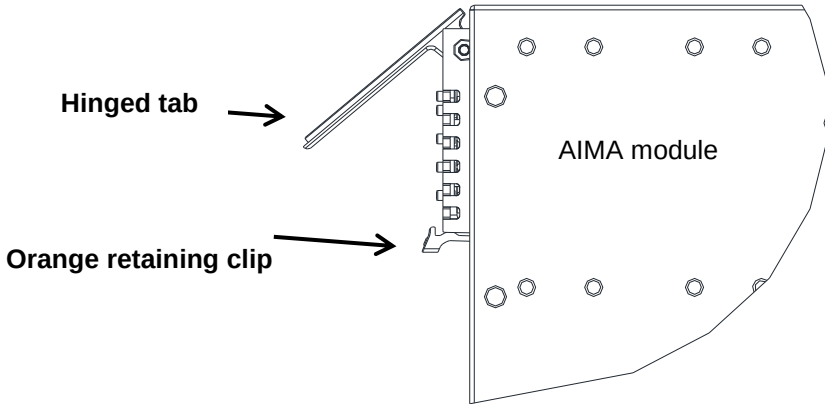
Check the package manifest, record the product module type, serial number, purchase date, and any other relevant information to facilitate later management and maintenance.

Table 5-2 Packing Manifest

No.	Description	Qty
1	FT5S module	1
2	Product User Manual (CD)	1
3	Individual test sheet (Certificate of Performance)	1

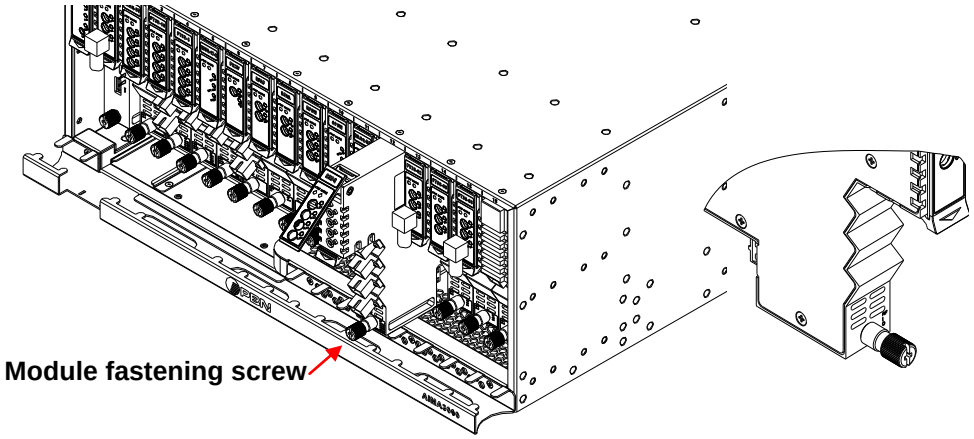
5.3 Module Installation

1. Gently depress the orange retaining clip and release the hinged tab



2. Hold the AIMA module casing upright, align it with the AIMA3000 slide rails for the correct slot, and insert the module until it reaches the multi-pin connector.

   DO NOT use excessive force when inserting the module, but ensure the RF connectors at the rear of the module are securely connected with the chassis's RF connectors.



CAUTION!

The module MUST be installed correctly to ensure a proper connection of the module's multi-pin connector and the backplane.

Tip:

When inserting the module into the guide rails, vertically tilt the module slightly to check that the guides are properly seated on the rails. The module is guided to the correct position using the large metal fastening screw on the lower part of the front panel.

3. After the module is inserted, gently push the hinged tab until it snaps into the orange retaining clip. While pushing down on the hinged tab, the AIMA module will mate with the power bus and will lock in into the chassis

CAUTION!

If force is required to insert a module, then it may not be correctly seated on the slide rails, or the mounting screw may be misaligned.

4. When the module is fully seated within the chassis, on the of the AIMA module, fasten the spring-loaded mounting screw. **Only use fingers to fasten the mounting screw. DO NOT use a screwdriver**

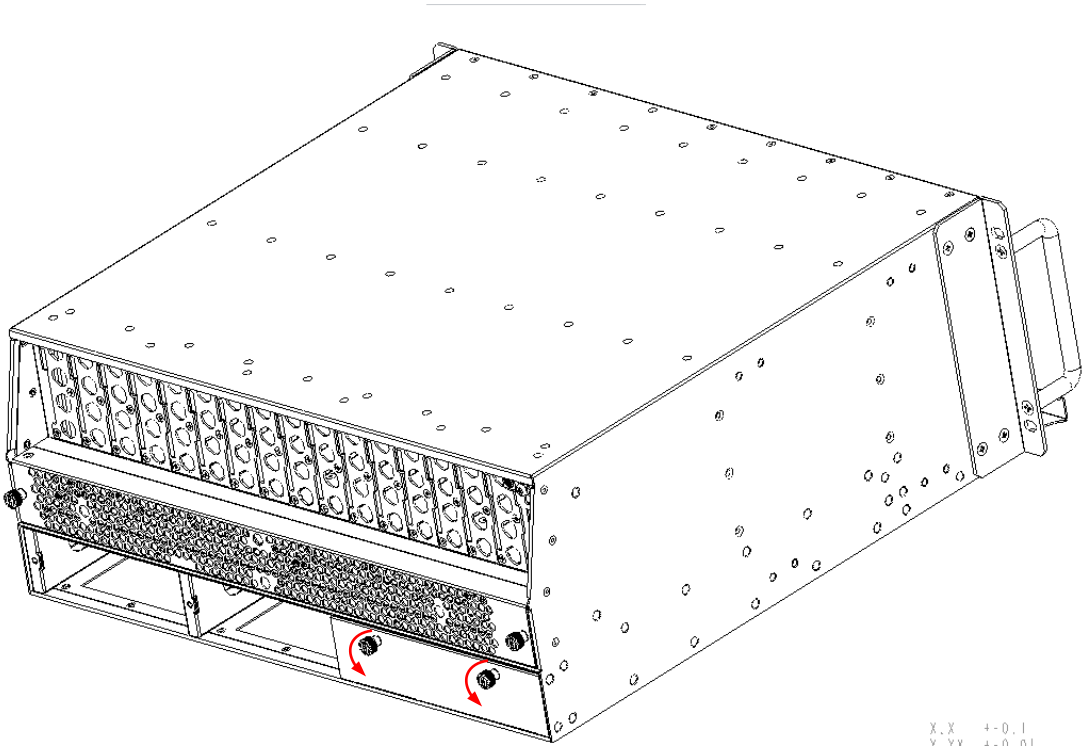
5.4 Connecting Optical Cables

For the convenience of the user, the AIMA3000 Chassis has a Sliding Fiber Guide to help the operator to arrange the cables. For the specific steps to connect the fiber, please refer to the instructions in section 5.4.1.

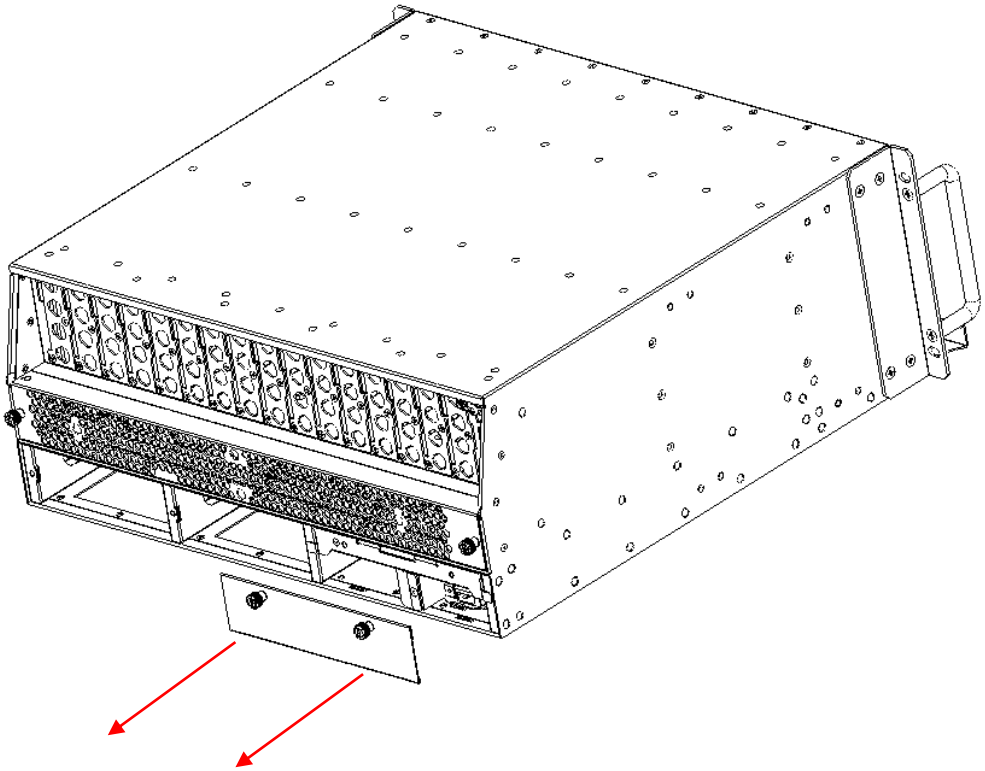
5.4.1 Using the Sliding Fiber Guide

The sliding fiber guide is located in the lower-left corner of the chassis if looking at the front of the chassis, and is designed to help installation of the optical fiber cabling. To access the sliding fiber guide you will need to first remove the rear panel located on the back of the chassis.

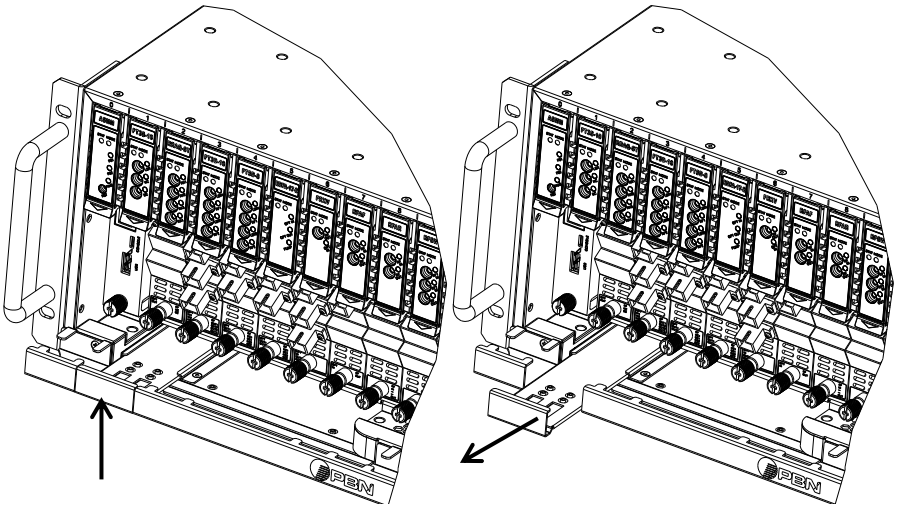
1. Unscrew the two thumbscrews on the rear panel.



2. Then, pull the panel the panel forward.

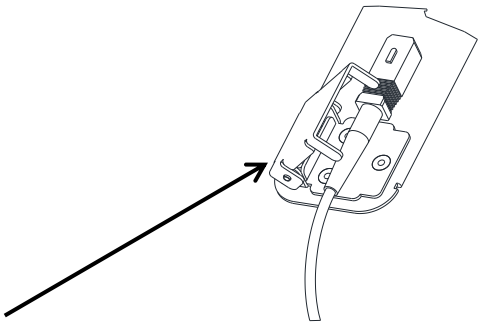


3. Then lift up the handle and slide the fiber guide out of the front of the chassis.



DO NOT remove the dust cap from the fiber connector until right before connecting it to the input port.

4. Raise the clip, insert the fiber connector, and then lower the clip over the connector.



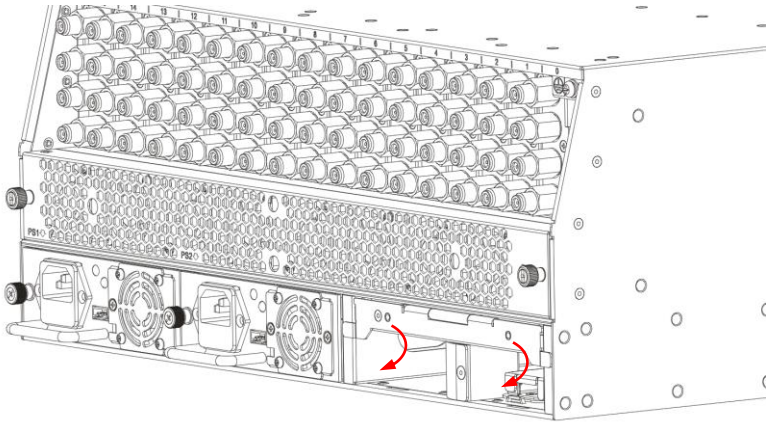
When using the sliding guide, put the fiber connector in the clip and slide it in from the rear to the front, through the chassis. Ensure that the optical fiber tail does not become trapped or pulled tightly.

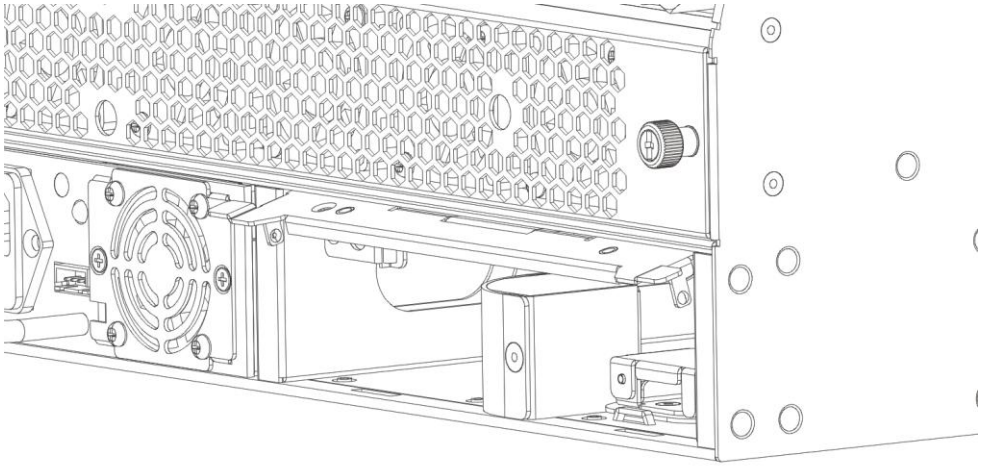
Fiber clip (at rear, for up to two connectors) **Handle (at front)**

5.4.2 Using the Fiber Tray

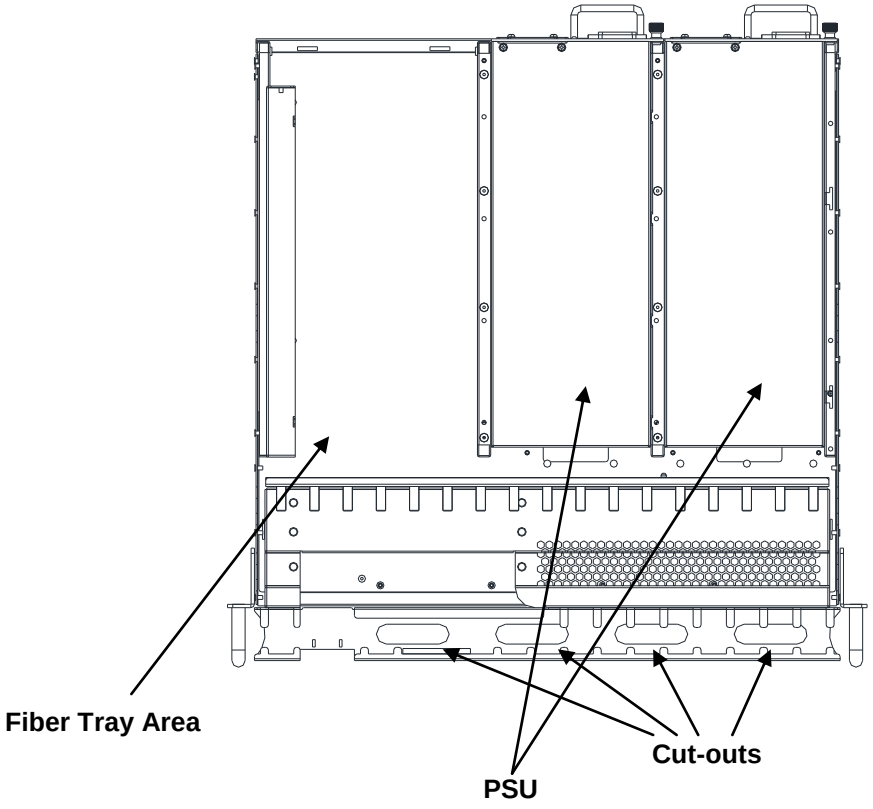
All optical fibers must be organized in a tidy manner in the chassis's fiber tray, which provides enough space for up to 64 optical fibers. This allows for easy positioning and future replacement of optical fibers. Along the front of the chassis, there are cut-outs for keeping the optical fibers in position.

1. When organizing the optical fibers, lift up the metal flap at the rear of the panel above the sliding guide. This will allow fiber cables to be moved away from the sliding guide rails.





2. Use the Fiber Guide Tool to organize the cables and wires in the fiber tray to prevent tangles and the blocking of the guide rails.



5.4.3 Cleaning the Fiber Connector Ends and Front-panel Optical Ports

To obtain a good quality optical input signal, optical fiber input ports and fiber connector ends must be carefully cleaned.

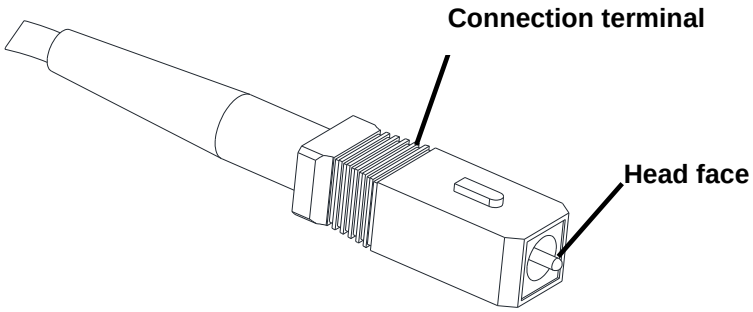


Figure 5-4

When cleaning the optical fiber-connector end, remove the dust cap and then use a lint-free cloth dampened with a static dissipative solvent to clean the angled surface. Dry the surface using a dry lint-free cloth.

To clean the front-panel optical port, use a special lint-free swab that is designed for this purpose. Dampen it with a static dissipative solvent. Apply slight pressure to the internal angled surface of the optical port, while rotating the swab 90 degrees back and forth. You may need to remove excess solvent using a dry lint-free swab. Alternatively, a cleaning pen such as the one click cleaner can be used.

SC one click cleaning pen

www.oneclickcleaner.com

5.4.4 Connecting the Optical Fibers

Carefully lift up the hinged cover of the optical input port, align the raised tab on the connector with the slot in the port. Insert the connector until the connector is securely held in place indicated by a clicking sound.

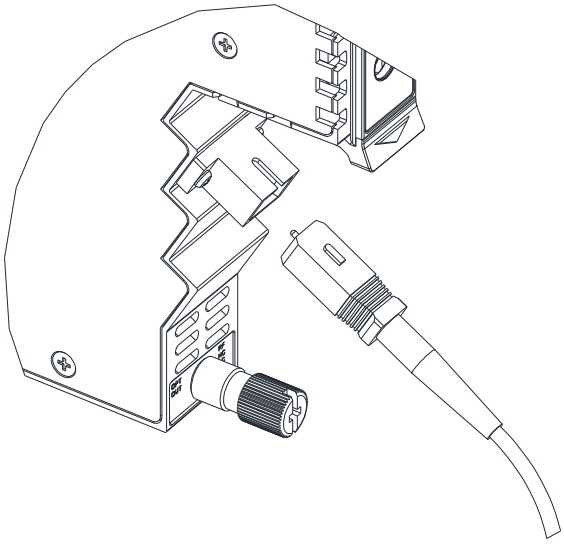


Figure 5-5

5.5 Check Module LEDs

When the module has been installed, and power is supplied from the chassis, the status LEDs will show a blinking green light indicating that module has started. The BC / NC status indicators show a green lightBC / NC.

5.6 Test the RF Input Signal

When setting up the transmitter for final deployment, the RF input levels must not exceed 20 dB.

5.7 Test the Optical Output Signal

After the input signal has been confirmed, the optical power of the associated optical output port should be tested. Use the optical power meter to test the output levels; the output values should be in accordance with the technical specifications.

Before testing, the optical power meter must be calibrated. Before measuring optical signals, verify the interfaces are clean and undamaged.

CAUTION!

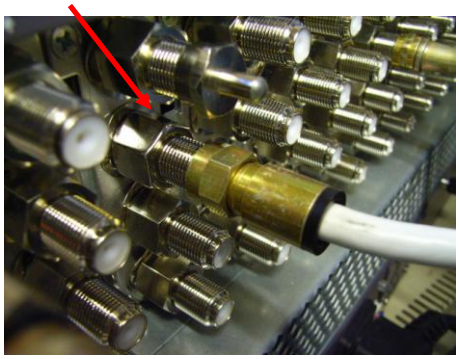
The device output optical power measurement procedure and regular maintenance must be performed by highly trained personnel. All procedures and maintenance must be comply with the necessary safety precautions indicated with using any optical transmitter module:

WARNING!

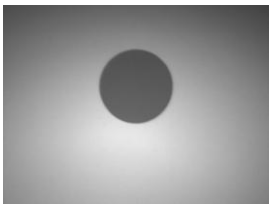
Module emits an invisible laser when working. Avoid direct contact with the laser connector. DO NOT look directly at the fiber connector.

5.8 Initial Setup

1. After calculating the correct RF drive level per channel for the channel plan to be used for BC only or BC and NC. See formula **in section 6.1.1.** Confirm RF channel level only on the BC RF input lead or BC and NC RF input leads and connect both to the chassis (pictured below). Note: if narrowcast is not in use install an “F” 75 Ω terminator to the NC RF input connection.

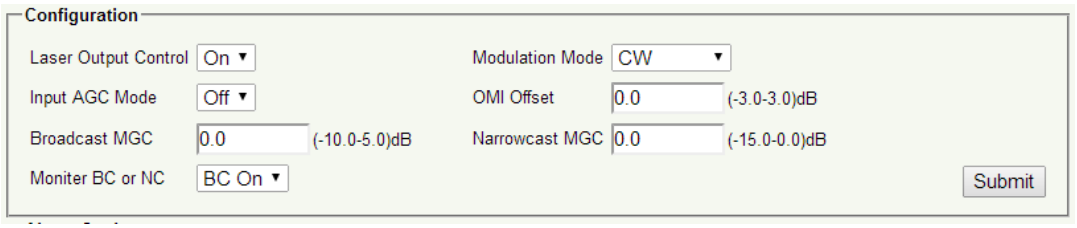


2. Before installing the FT5S, check the optical output ferrule tip with a fiberscope to ensure that the connector is clean (pictured below). The cap on the optical output connector does not prevent contamination from getting on to the optical connector, it prevents the laser from being emitted when laser is on and no optical patch cord is installed.

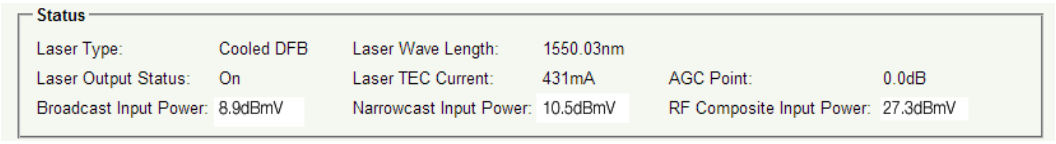


3. Next install the FT5S unit into a slot where RF BC / NC input leads are connected and check the optical output power with a cleaned optical patch cord and a calibrated optical power meter. Record the optical output level. Connect a cleaned patch cord to the fiber output and to the relevant optical distribution frame (ODF) panel.

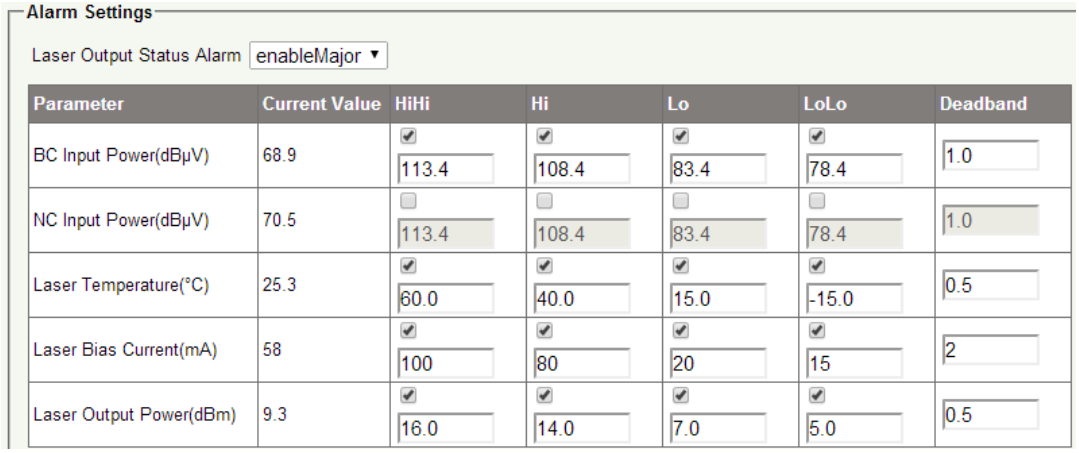
4. With a laptop connected to the ASMM module's network or an Android device connected to the front of the ASMM module's USB port in host mode. Select the port for the transmitter that needs to be adjusted, confirm that the "**Input AGC mode**" is set to "**OFF**", if not change it to "**OFF**" and then click on "**Submit**" button. In addition, confirm that the "**Broadcast MGC**" and "**Narrowcast MGC**" fields are set to 0.0, if not set to 0.0 and click on "**Submit**" button.



5. Confirm in the management "**Status**" section that the RF levels for BC or BC and NC inputs and the RF Composite Input Power are within the designated parameters.



6. Confirm that the "**Alarm Setting[s]**" are enabled if BC is only in use or that they are both enabled for BC and NC if both RF inputs are in use. Check the required selection and click on "**Submit**" to enable/disable alarms.

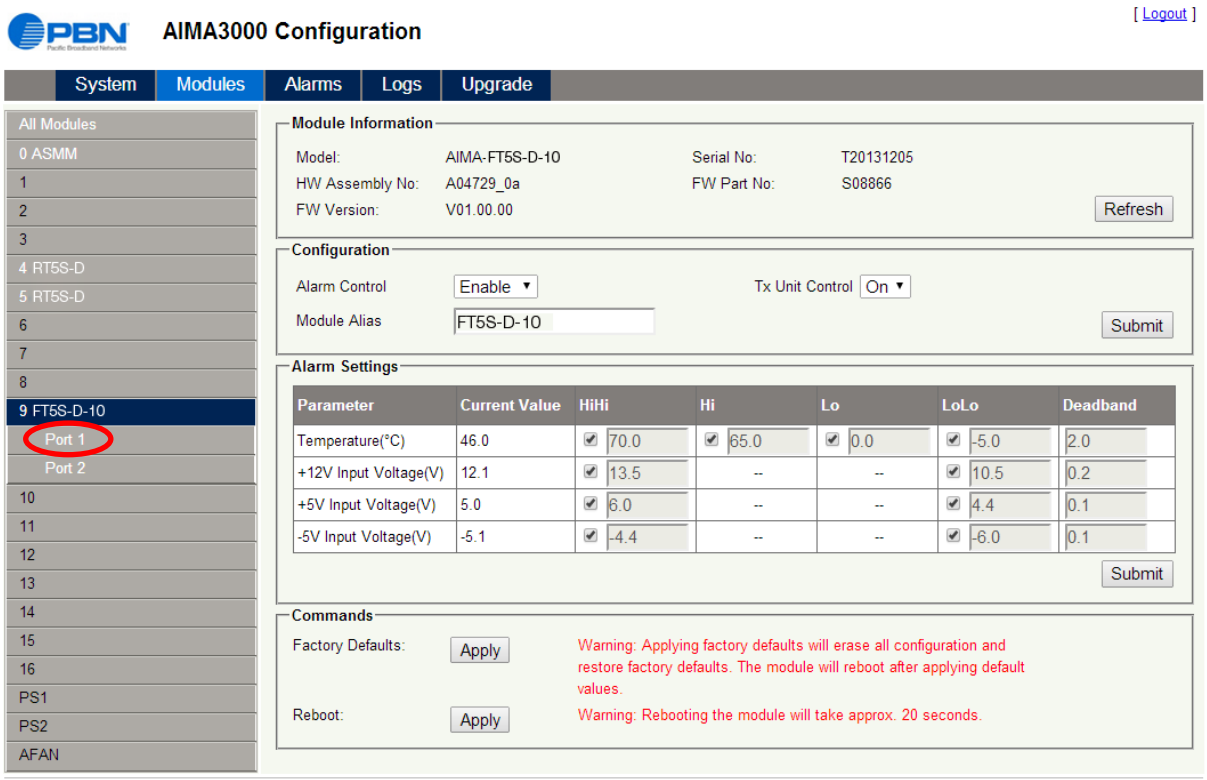


6 Module Configuration & Alarm setup

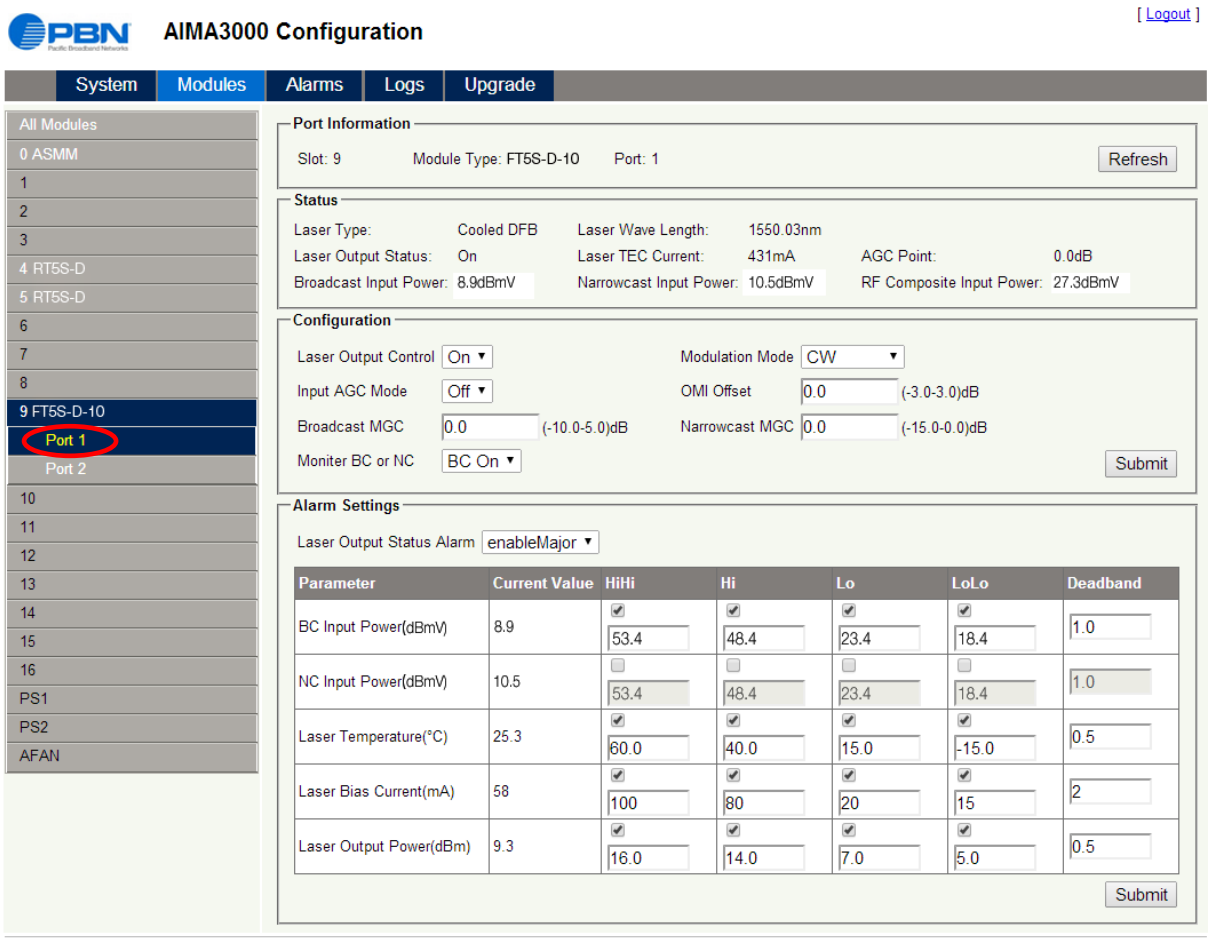
The module configuration settings can be configured using the web interface and PBN's NMSE (network management software). This manual only provides details on the web interface. For login details and network setup, please refer to the AIMA-ASMM user manual. If the same module is reinserted in the same slot, the ASMM will restore the previous settings if the module is set to "**Auto Download**" the configuration.

6.1 Port Configuration screen

After logging in to the AIMA ASMM controller, select the "**Modules**" tab and then the "**FT3D**" to configure one of the FT5S transmitters. After selecting "**FT5S**", the "**Port 1**" and "**Port 2**" options will appear.



After selecting “**Port 1**” or “**Port 2**”, the RF configuration screen will appear for the designated transmitter.



In the RF configuration screen “**Laser Output Control**”, “**Input AGC Mode**”, “**Modulation Mode**”, “**OMI Offset**”, “**Broadcast MGC**”, “**Narrowcast MGC**”, and ”**Alarm Settings**” become available. For proper RF settings with different RF channel loads, see the example calculations shown in 6.1.1. Both transmitters have independent settings and they need to be adjusted separately. The application of the values for setting RF transmitter are detailed in 6.2.

6.1.1 Determine the RF power to the RF input port.

In order to set up the port configuration for the FT5S transmitter, the proper RF level must to be determined and applied to the transmitter. The factory default RF load is listed below

- Number of analog RF channels = 80
- RF level for 80 channels = 15 dBmV
- This ensures an OMI of 2% per channel

The channel load listed above is the reference RF load for the FT5S transmitter. Any deviation from this RF load will require new RF levels to be calculated based on 80 analog channels for a designated RF input level of 15 dBmV.

To recalculate the RF input level following formula can be used:

PEAK analog RF input = 34 – 10 LOG (Na)

(Na) = number of channels to be used by the transmitter

Example

Example 1 is to verify the RF calculations. The standard channel load will be used to determine the correct RF input at the transmitter for 80 channels.

Channel load is 80 analog channels
Peak analog input = 34 – 10 LOG (80)
Peak analog input = 34 – 19
Peak analog input = **15 dBmV**

The calculated RF level is 15 dBmV as specified on the datasheet. .

Example

RF load consisting of a mix of analog and of QAM RF channels.
Analog channels = 50
QAM64 channels = 13 channels have -10 dB backoff
QAM256 channels = 15 channels have a -6 dB backoff
+

First, the total RF power of the suggested channel load must be determined. This will require the QAM RF channels to be converted to the equivalent analog RF power. QAM RF channels operate -6 dB and -10 dB below the analog RF channels, the RF power of QAM channels is significantly lower than the RF power compared with analog channels.

General Rule:

- 10 channels of QAM64 operating at -10 dB converted to analog channels equals the same RF power of a single analog RF channel

Formula for calculating the QAM RF to equivalent analog RF power.

$$\text{QAM RF equivalent power} = (Nd) \times 10^{-(\text{back off}/10)}$$

(Nd) = Number of QAM RF channels
Backoff = RF delta between Analog RF and QAM RF

Typically, QAM64 operates at 10 dB below analog RF levels; QAM256 operates 6 dB below analog RF levels.

Calculating the total RF power

13 QAM64 channels at -10 dB

QAM RF equivalent power = (Nd) x $10^{-(\text{backoff}/10)}$
QAM RF equivalent power = (13) x $10^{-(10/10)}$
QAM RF equivalent power = (13) x 0.1
QAM RF equivalent power = 1.3 x analog channel

15 QAM256 channels at -6 dB

QAM RF equivalent power = (Nd) x $10^{-(\text{backoff}/10)}$
QAM RF equivalent power = (15) x $10^{-(6/10)}$
QAM RF equivalent power = (15) x 0.25
QAM RF equivalent power = 3.8 x analog channel

Total RF power

50 analog channels = 50 analog equivalent

13 QAM64 channels @ -10 dB = 1.3 analog equivalent

15 QAM256 channels @ -6 dB = 3.8 analog equivalent

---------- +

Approximately 55.1 analog channels

RF level to be applied to the transmitter

Channel load = 55.1 analog channels

PEAK analog RF input = 34 – 10LOG (Na)

(Na) = number of channels to be applied to the transmitter

6.2 Applying RF settings to FT5S transmitter MGC mode

Go to the "**Port 1**" or "**Port 2**" section on the FT5S configuration page through the ASMM's web interface (see section 6.1 for details).

6.2.1 Sample RF load 80 channels analog RF load

Connect the RF cable to the BC input of the FT5S transmitter. If only the BC port is used, it is advised to terminate the NC port with a 75 Ω terminator.

Option 1

Connect the RF load to the transmitter at a level of 15 dBmV (80 analog channels) See sample calculation for a calculated RF input level (section 6.1.1: Example 1)

1. Set "**Input AGC Mode**" to "**OFF**" and click "**Submit**" to apply all settings
2. Set field the "**Broadcast MGC**" to 0 and click "**Submit**" to apply all settings

Option 2

Connect the RF load to the transmitter at a level of 10 dBµV.

1. Set the "**Input AGC Mode**" to "**OFF**" and click "**Submit**" to apply the setting
2. Set the "**Broadcast MGC**" field to **5** (15 dBµV – 10 dBµV) and click "**Submit**" to apply the settings

Both transmitters have independent settings and they need to be adjusted separately.

6.2.2 Sample RF load for 42 analog channels analog of RF load

Connect the RF load to the BC input of the FT5S transmitter. If the NC port is not used it is advised to terminate the NC port with a 75 Ω terminator.

Option 1

Connect the RF load to the transmitter at a level of 17.8 dBmV (42 analog channels). See the example calculation for a calculated RF input level (section 6.1.1: Example 2)

1. Set the "**Input AGC Mode**" to "**ON**" and click "**Submit**" to apply all settings
2. Set the "**Broadcast MGC**" field to 0 and click "**Submit**" to apply all settings

Option 2

Connect the RF load to the transmitter at a level of 20 dBµV.

1. Set the "**Input AGC Mode**" to "**OFF**" and click "**Submit**" to apply all settings
2. Set the "**Broadcast MGC**" field to **-2.2** (17.8 dBµV – 20 dBµV) and click "**Submit**" to apply all settings

6.2.3 Sample RF load of 50 analog channels + 13 QAM64 channels and 15 QAM256 channels

Connect RF to the BC input of the FT5S transmitter. If the BC port is not used it is advised to terminate the NC port with a 75 Ω terminator.

Option 1

Connect the RF load to the transmitter at a level of 16.6 dBmV (50 analog channels + 13 QAM64 channels + 15 QAM256 channels). See the sample calculation for a calculated RF input level (section 6.1.1: Example 3)

1. Set the "**Input AGC Mode**" to "**OFF**" and click "**Submit**" to apply all settings
2. Set the "**Broadcast MGC field**" to 0 and click "**Submit**" to apply all settings

Option 2

Connect the RF load to the transmitter at a level of 15 dBµV.

1. Set the "**Input AGC Mode**" to "**OFF**" and click "**Submit**" to apply all settings
2. Set the "**Broadcast MGC**" field to 16.6 dBmV – 15 dBmV = **1.6** and click "**Submit**" to apply all settings

6.3 Applying RF settings to FT5S transmitter AGC mode

Go to the "**Port 1**" or the "**Port 2**" section on the FT5S configuration page through the ASMM's web interface (see section 6.1 for details).

6.3.1 Sample RF load for 80 analog channels of RF load

Connect the RF load at a level of 15 dBmV ± 3 dB (80 analog channels) to the BC input of the FT5S transmitter. If the BC port is only being used it is advised to terminate the NC port with a 75 Ω terminator.

See the sample calculation for calculated RF input level (section 6.1.1. Example 1)

1. Set the "**Input AGC Mode**" to "**ON**" and click "**Submit**" to apply all settings

Both transmitters have independent settings and they need to be adjusted separately.

6.3.2 Sample RF load for 42 analog channels of RF load

Connect the RF load at a level of 17.8 dBmV ± 3 dB (42 analog channels) to the BC input of the FT5S transmitter. If the BC port is only being used it is advised to terminate the NC port with a 75 Ω terminator.

See the sample calculation for calculated RF input level (section 6.1.1. Example 2)

1. Set the "**Input AGC Mode**" to "**ON**" and click "**Submit**" to apply all settings

6.3.3 Sample RF load for 50 analog channels + 13 QAM64 channels and 15 QAM256 channels

Connect the RF load at a level of 16.6 dBmV ± 3 dB (50 analog channels + 13 QAM64 channels + 15 QAM256 channels) to the BC input of the FT5S transmitter. If the BC port is not used it is advised to terminate the NC port with a 75 Ω terminator.

See sample calculation for calculated RF input level (section 6.1.1. Example 3)

1. Set the "**Input AGC Mode**" to "**ON**" and click "**Submit**" to apply all settings

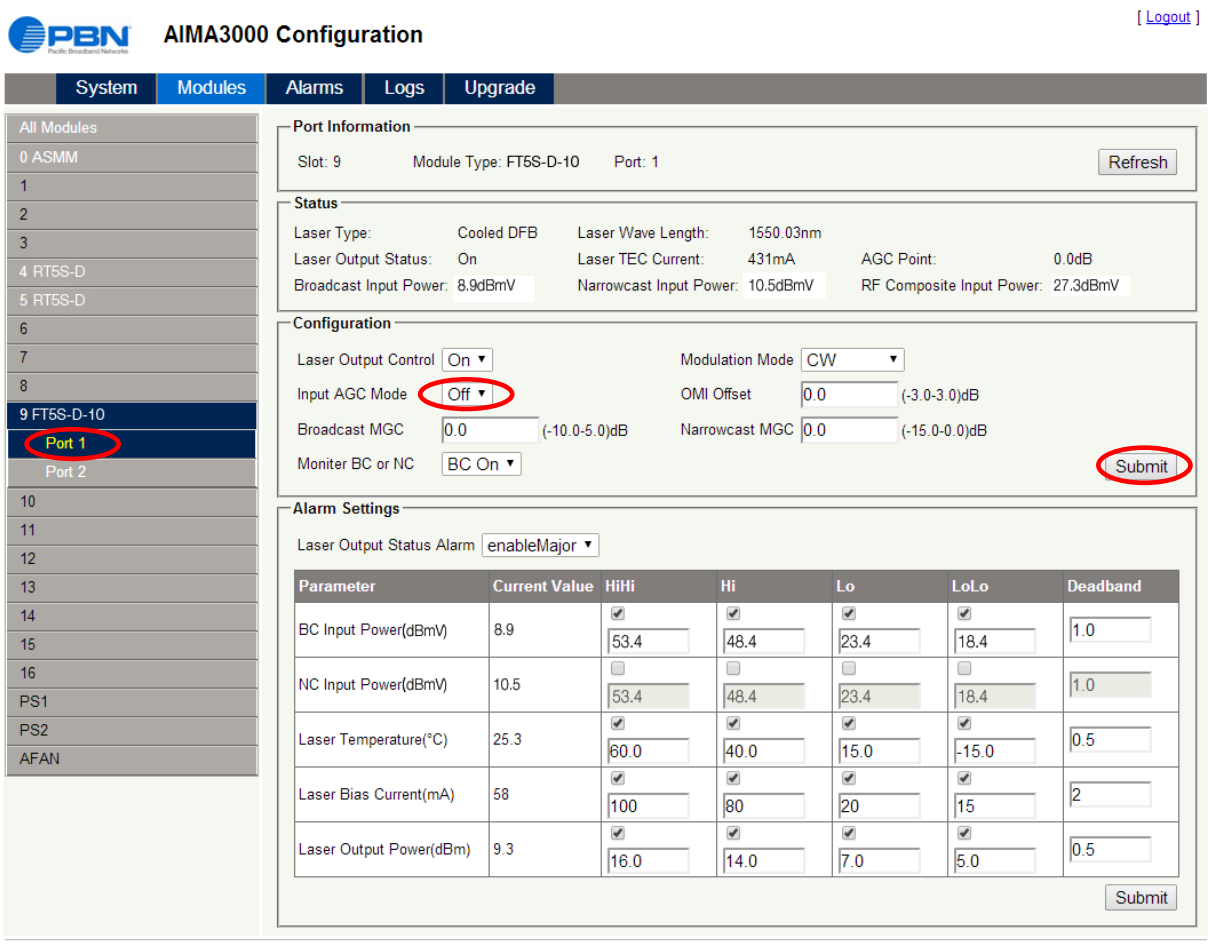


Figure 6-4

Table 6-5 Port Configuration Parameters Description

Items	Sub Items	Description	
		Effect and Configuration Method	Configuration
Module Information	Slot	-	-
	Module Type	-	-
	Port	-	-
Status	Laser Type	-	-
	Laser Wavelength	-	-
	Broadcast Input Power	-	Will display the RF total power
	Laser Output Status	-	ON / OFF
	Narrowcast Input Power	-	Will display the RF total power
	Laser TEC (thermoelectric) Current	-	-
	RF composite input power	-	-
Configuration	Laser Output Control	Control Laser ON or OFF	ON / OFF
	Input AGC Mode	Enable AGC	ON = Automatic Gain Control OFF = Manual Gain Control
	Broadcast MGC	Broadcast Gain Control	-10 ~ +5 dB
	OMI offset	Change Factory Default OMI Value based on individual needs	-3 ~ +3 dB
	Modulation Mode	Modulation mode: - **CW**: continuous wave, for Factory Configuration. - **Modulated**: modulating signal for customers. The default setting is modulated	Modulated
	Narrowcast MGC	Narrowcast Gain Control	-15 ~ 0 dB
Alarm Settings	Critical High	Alarm level threshold, alarm parameters are can be changed	
	Warning High		
	Warning Low		
	Critical Low		
	Dead Band		

6.3.4 Confirming Input Signal

Input Signal is shown as the red box in **Figure 6-6**:

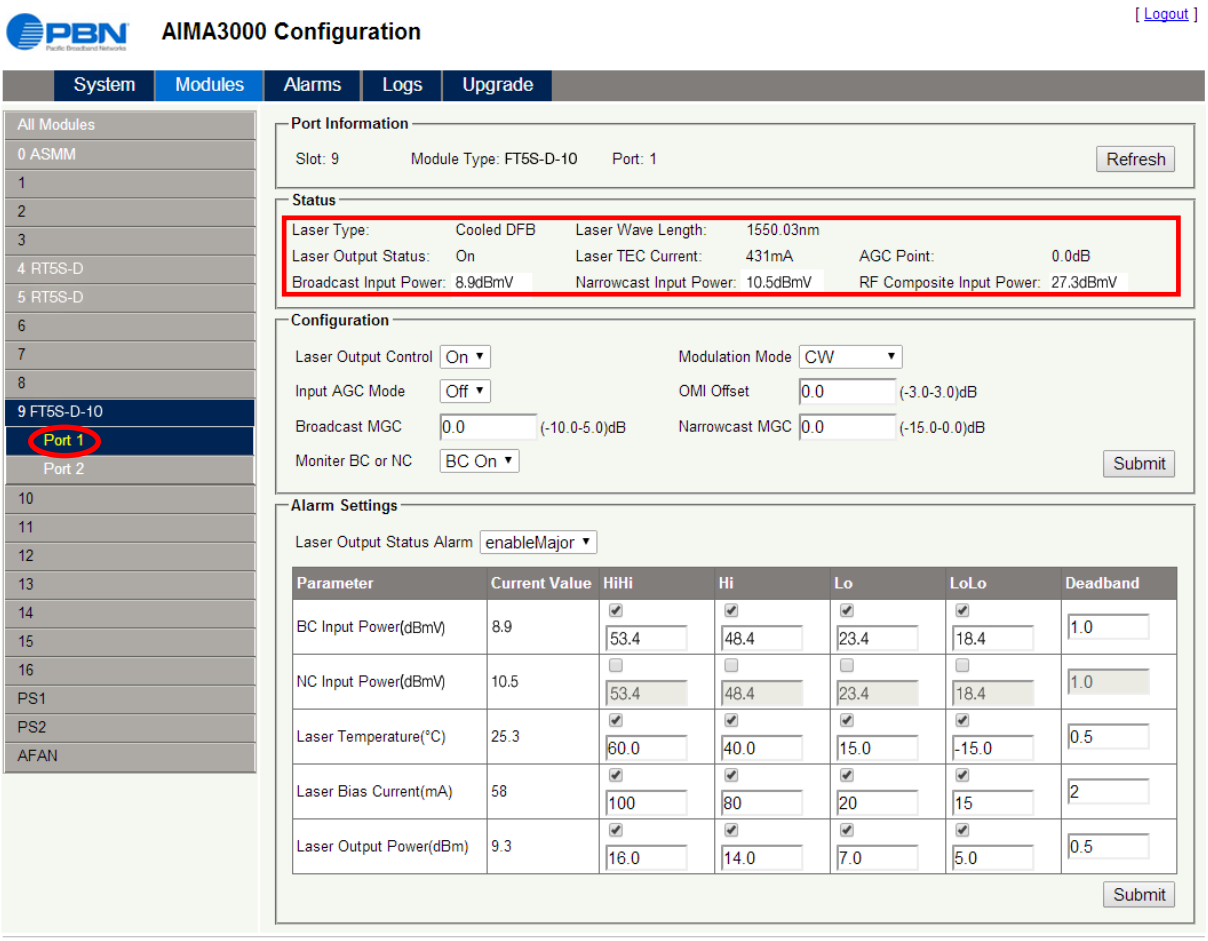


Figure 6-6

Input Power Calculations

The relationship between input power and the number of channels:

Per channel Power = Input Power -10LOG (number of channels)

On **Figure 6-6,** the interface displays the "**Broadcast Input Power**" as the total broadcast input power. The "**Narrowcast Input Power**" value displays the total narrowcast input power.

The operator can calculate the power per channel. When the different channels and levels are configured for the FT5S, the operator can also calculate the appropriate gain adjustment to ensure the total RF power for the laser.

6.3.5 Configuration of Module RF Signal

Default Configuration - AGC ON

The FT5S module's default signal setting is for 77 channels (NTSC) at 75 dBµV per channel.

If the operator sets, the module to AGC mode when the level changes within a range of ± 3 dB the FT5S can still work properly.

Typical environments:

- 77 channels (NTSC), Broadcast input: 75 dBµV per channel
- Narrowcast input: 75 dBµV per channel;

The factory default settings (**DO NOT** change the values when AGC is ON):

- Broadcast MGC Value: 0
- OMI offset: 0
- Narrowcast MGC: 0

Custom – AGC OFF

If the input signal is ± 3 dB beyond the range of 75 dBuV, set the AGC mode to off and configure the module with the following formula according to the input signal.

The narrowcast channel configuration method is the same as the broadcast method. Use the broadcast channel as an example; the derivation is as below:

1. If BC input signal level is 75 dBµV, the number of channels is N.
2. The adjustment level is: ΔP=75 + ΔS
3. Set the BC MGC value to ΔP, since the range of the MGC is -10 dB to +5 dB, if the value exceeds the range, the OMI offset should be changed (Range: ±3 dB).
4. Please refer to the table below for setting the corresponding values of ΔS=:

Channels	100	90	77	60	50	40	30
ΔS	-1.1	-0.6	0	1	1.8	2.8	4.0

Configuration Parameters Instruction

Items	Parameters	Description	Configuration
Broadcast MGC	Broadcast Gain Control	Broadcast Gain Control	-10 ~ +5 dB
OMI offset	OMI Offset	Change Factory Default OMI Value based on individual needs	
Narrowcast MGC	Narrowcast Gain Switch	Narrowcast Gain Control	-15 ~ 0 dB

6.4 Setup using separate BC and NC RF input in MGC mode

Since no QAM RF signals are used in sample calculation 1 or 2, this setup will use sample calculation 3. For the exact RF calculation, please refer to Chapter 6.1.1 sample calculation 3.

Sample calculation 3 details:

Total RF power
50 channels analog = 50 analog equivalent
13 x QAM @ -10 dB = 1.3 analog equivalent
15 x QAM256 @ -6 dB = 3.8 analog equivalent
---------- +

Totals 55.1 analog equivalent channels

6.4.1 RF transmitter setup using both BC and NC RF input

Option 1

Connect Broadcast analog RF load to the BC port of the transmitter at a level of 16.6 dBmV (50 x Analog)) See sample calculation for calculated RF input level (chapter 6.1.1. Sample 3)

Broadcast port setup

1. Set “**Input AGC Mode**” to OFF and click "**Submit**" to apply the setting
2. Set field “**Broadcast MGC**” to 0 and click "**Submit**" to apply the setting
3. Apply the Channel load of the 50 channels analog RF load with a level of 16.6 dBmV to the transmitter.
4. Click "**Apply**" to store setting at the transmitter

Narrow cast port setup

1. Apply the QAM RF load to the NC input of the transmitter.
2. Apply The RF level of the QAM RF load to the NC port at 16.6 dBmV
3. With equal RF input at the transmitter at the BC and NC port, the transmitter will automatically introduce a backoff of 0 dB. Set the Narrowcast MGC to -6 dB to create the 6 dB RF backoff between BC RF lead and NC RF load.
4. Click the "**Apply**" button to store transmitter settings.

Option 2

Broadcast port setup

1. Set “**Input AGC Mode**” to OFF and click "**Submit**" to apply the setting
2. Apply the Channel load of the 50 channels analog RF load with a level of 15 dBmV to the transmitter.
3. Set the Broadcast MGC setting to 16.6 dBmV – 15 dBmV = **1.6 dB**. Click "**Apply**" to store setting at the transmitter

Narrow cast port setup

1. Apply the QAM RF load to the NC input of the transmitter at 15 dBmV.
2. Set NC MGC backoff to – 6 dB by subtracting 6 dB from the BC MGC setting (1.6 dB)
   1.6 – 6 = **-4.4 dB**
3. Set Narrowcast MGC to -4.4 dB
4. Click the "**Apply**" button to store setting into the transmitter.

6.5 Setup using separate BC and NC RF input in AGC mode

Since no QAM RF signals are used in sample calculation 1 or 2, this setup will use sample calculation 3. For the exact RF calculation, please refer to Chapter 6.1.1 sample calculation 3.

Sample calculation 3 details:

Total RF power
50 channels analog = 50 analog equivalent
13 x QAM @ -10 dB = 1.3 analog equivalent
15 x QAM256 @ -6 dB = 3.8 analog equivalent

Totals 55.1 analog equivalent channels

6.5.1 RF transmitter setup using both BC and NC RF input

Option 1

Connect Broadcast RF load to the BC port of the transmitter at a level of 16.6 dBmV ± 3 dB (50 x analog) See sample calculation for calculated RF input level (chapter 6.1.1. Sample 3)

Broadcast port setup

1. Set “**Input AGC Mode**” to OFF and click "**Submit**" to apply the setting
2. Set field “**Broadcast MGC**” to 0 and click "**Submit**" to apply the setting
3. Apply the Channel load of the 50 channels analog RF load with a level of 16.6 dBmV to the transmitter.
4. Click "**Apply**" to store setting at the transmitter

Narrow cast port setup

1. Connect the QAM RF load to the NC input of the transmitter.
2. Apply The RF level of the QAM RF load to the NC port at 16.6 dBmV
3. With equal RF input at the transmitter at the BC and NC port, the transmitter will automatically introduce a backoff of 0 dB. Set the Narrowcast MGC to -6 dB to create the 6 dB RF backoff between BC RF lead and NC RF load.
4. Click the "**Apply**" button to store transmitter settings.

Enabling AGC mode

1. Set “**Input AGC mode**” from OFF to ON
2. Click "**Apply**" to store the settings to the transmitter.

Note: When applying the Analog RF at 16.6 dBmV, at this RF level, the AGC circuit will operate exactly in the middle of the AGC dynamic range. This means that RF variations of 16.6 dBmV +3 dB or -3 dB will be compensated.

6.6 Alarms Monitoring

All alarm information is monitored by the ASMM module. If an alarm occurs, the operator can view the associated module page to find more detailed alarm information.

6.6.1 Alarm Status Pages

Click the **Alarms** tab on the menu bar to display an overview of the alarm status of all the installed modules as shown in **Figure 6-6** below.

The each module row has an alarm status indicator used to show:

- Normal operation: Green
- Minor Alarm: Orange
- Major Alarm: Red

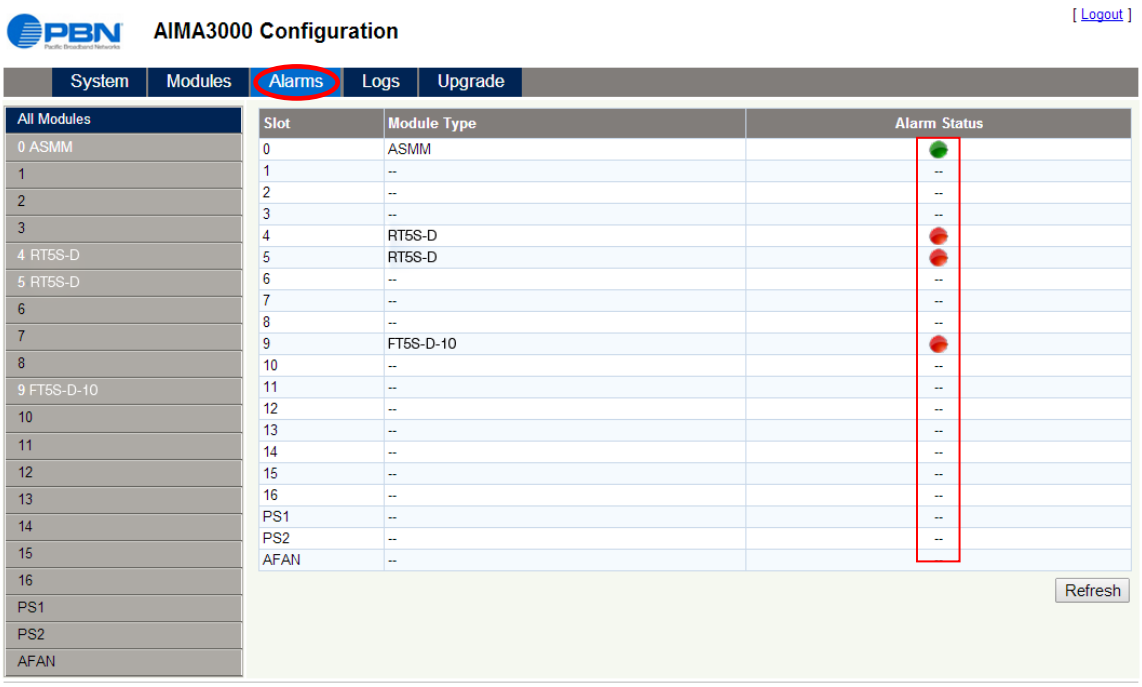


Figure 6-6

6.6.2 Module operating voltage and temperature alarm

Click on the corresponding module, as shown in the following figure, to view the module alarm information. By clicking on "**FT5S**", under "**Modules**" tab, the operator can view the module temperature and power supply voltage alarms. The operator can utilize the status indicators to judge whether the module is working properly.

The status has three conditions:

- Normal: Green Light
- Minor Alarm: Orange Light
- Major Alarm: Red Light

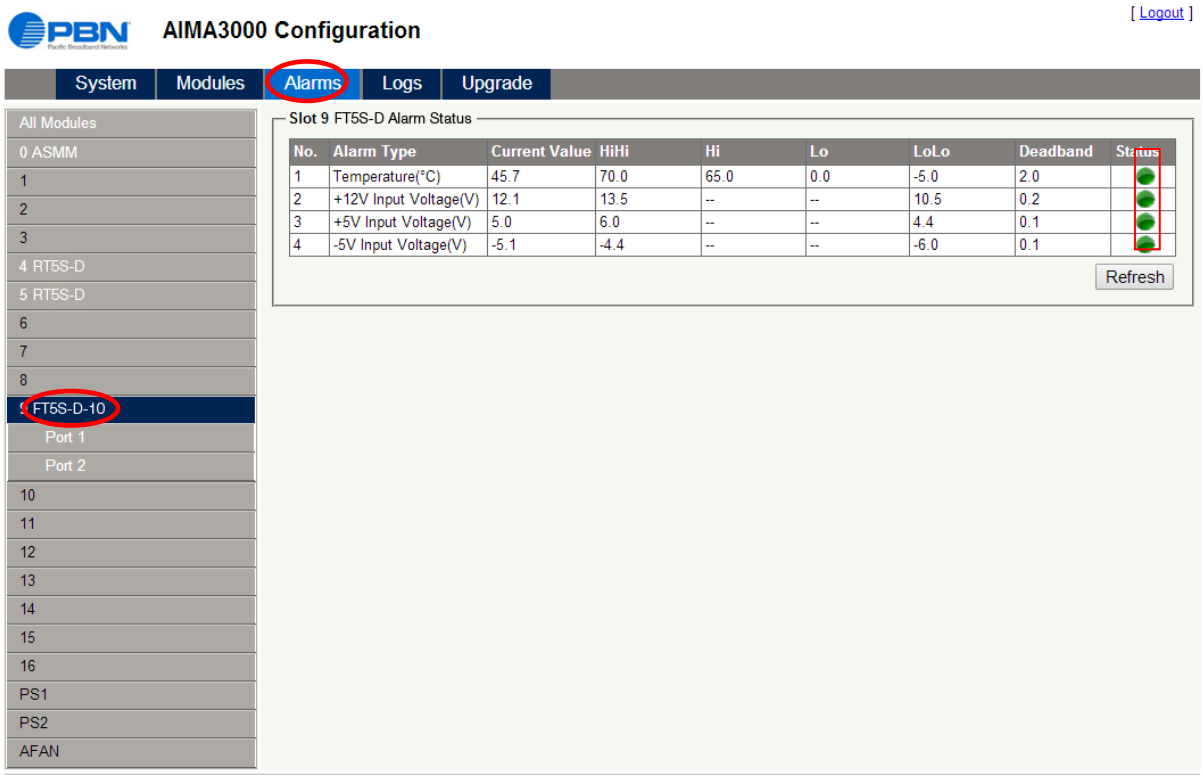


Figure 6-7

Use the status indicators to determine if the module is working properly. If the device is replaced or reset, click on "**Refresh**" to refresh the alarms information.

6.6.3 Module Port Alarms

Click on the "**Port 1**" or "**Port 2**" label under the module on the left column, as shown in **Figure 6-8**. On the module port page, the operator can view the Total Input Power, Laser Temperature, Laser Output Power and the Laser bias voltage alarms:

Status has three conditions:

- Normal: Green Light
- Minor Alarm: Orange Light
- Major Alarm: Red Light

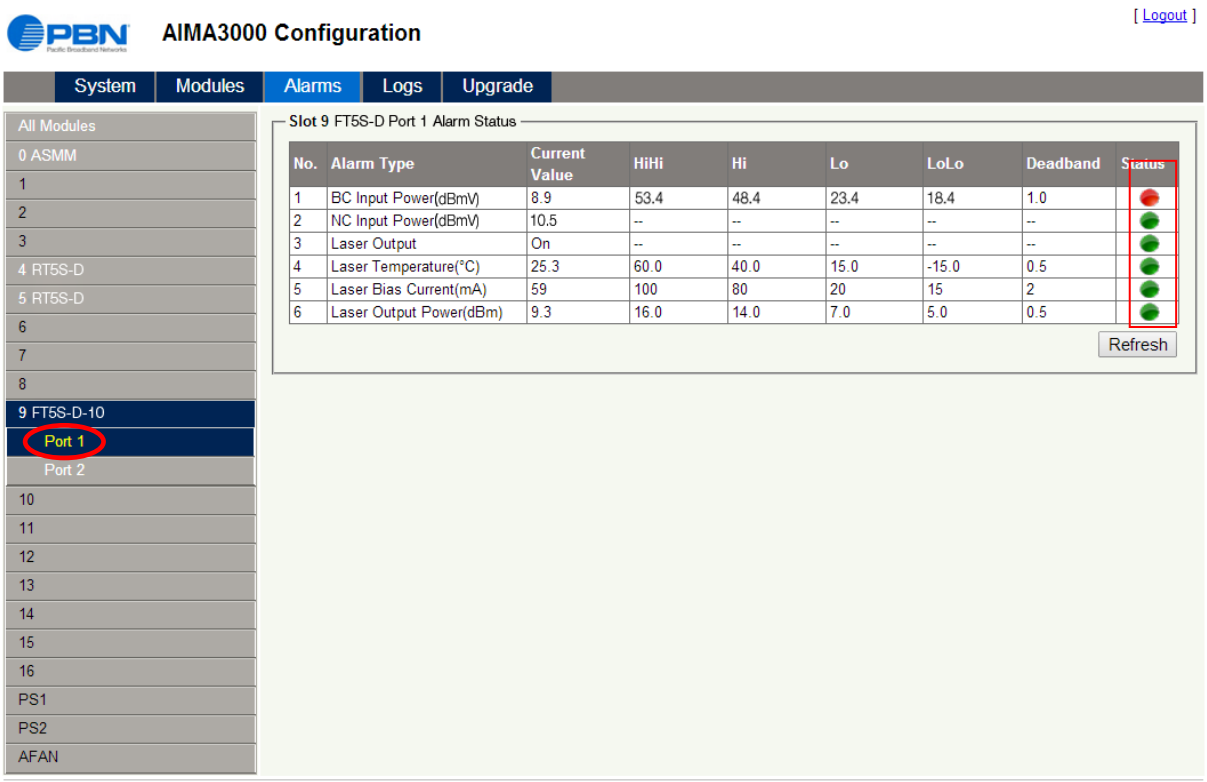


Figure 6-8

6.6.4 Alarm Monitoring Configuration

6.6.4.1 Monitoring Function ON / OFF

In Configuration section on Modules page, click Alarm Control to Enable/Disable Monitoring Function.

6.6.4.2 Temperature, +12V, +5V Voltage Alarm Levels Management

By default, temperature, +12 V, +5 V, - 5V voltage alarms are all set to ON. The check box ☑ as shown in **Figure 6-9** controls the detection is set to ON or OFF. When the check box is checked (detection ON), the text in the text box will be solid black. When the check box is NOT checked, (detection OFF), the text in the text box will be light grey and cannot be changed. The parameters instruction is shown in **Figure 6-9**, **Table 6-4** below.

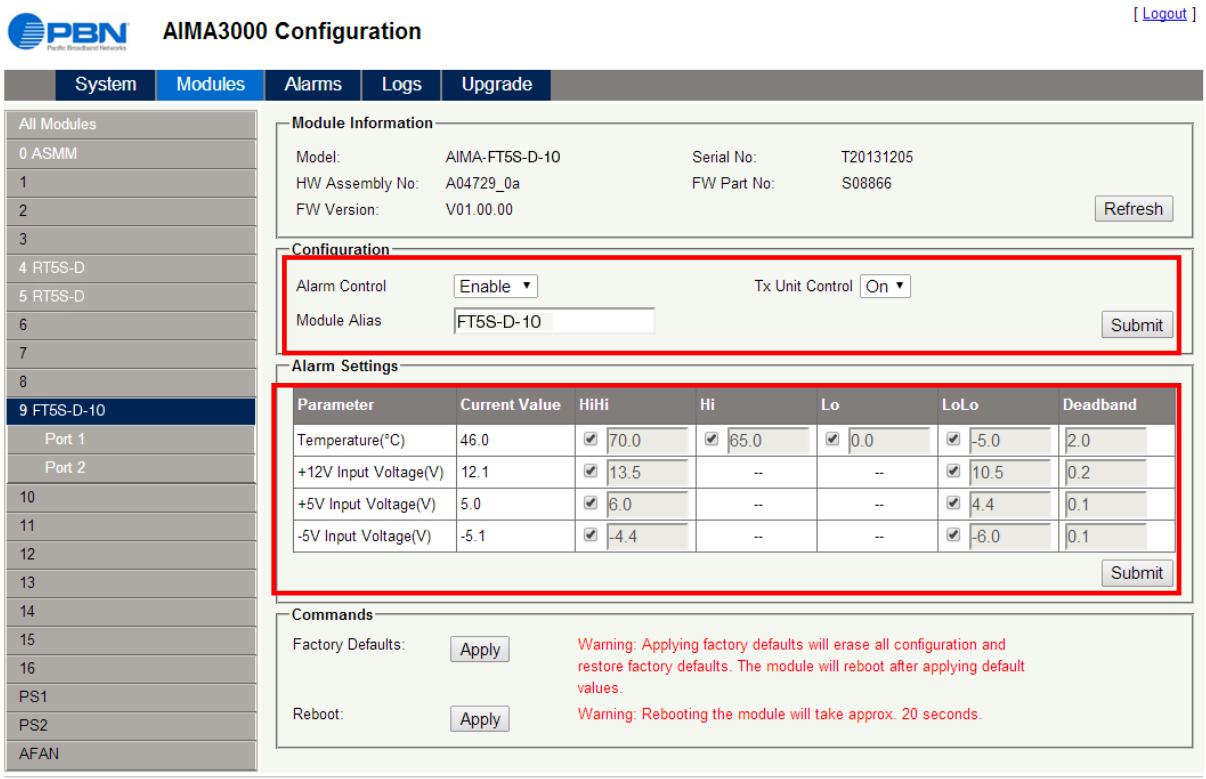


Figure 6-9

Table 6-4 Modules Page Alarms Threshold Parameters Instruction

Parameters	Critical High	Warning High	Normal	Warning Low	Critical Low	Dead Band	Factory Default	Detection Range
Temperature (^{o}C)	70.0	65.0	28.0	0.0	-5.0	2.0	ON	-40 ~ 120
+12V Input Voltage (V)	13.5		12.0		10.5	0.2	ON	0 ~ 15.5
+5V Input Voltage (V)	6.0		5.0		4.4	0.1	ON	0 ~ 6.6
-5V Input Voltage (V)	-4.4		-5.0		-6.0	0.1	ON	-6.6 ~ 0

6.6.5 Input / Output Status Monitoring

To setup Input / Output status monitoring, select the either "**Port 1**" or "**Port 2**" from the left menu, and then the monitoring parameters will be listed for the designated transmitter under the "**Alarm Settings**" section, click on ☑ to turn the toggle the alarms. The customer can change the monitoring parameters. Both transmitters have independent settings and they need to be adjusted separately. See **Figure 6-10**.

ON / OFF

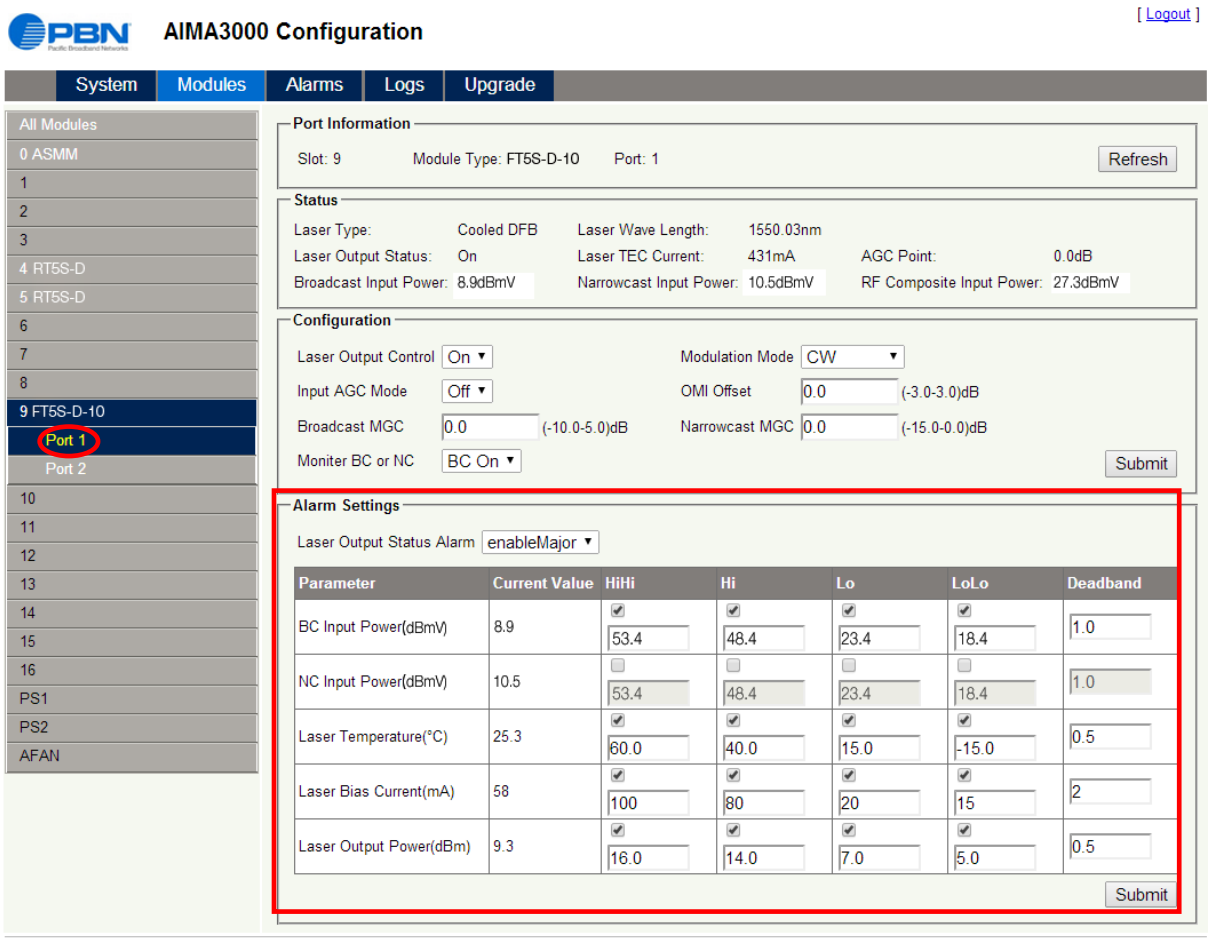


Figure 6-10

Module Alarm Indicator Definitions

Table 6-6 Module Alarm Indicator Definitions

Parameters (Common)	Description	Definitions	Related Indicators	Lighting Conditions
Power OFF	Power OFF	Power OFF	All	All OFF
Initiating AM	Power ON	During Module Power ON	All	Green (2 times / sec)
No Alarm	Normal operation	Normal	All	Green
Upgrading AM Firmware	AM Upgrading	Module upgrade	MODE	
AM-Critical-ALM	Critical Alarm		STAT	Red
AM-Minor-ALM	Warning Alarm		STAT	Orange
BC Critical High (BC-Major-ALM)	BC Level High		STAT BC	Red
BC Warning High (BC-Minor-ALM)	BC Level Low		STAT BC	Orange
NC Critical High (NC-Critical-ALM)	NC Level High (NC set Enable)		STAT NC	Red
NC Warning High (NC-Minor-ALM)	NC Level Low (NC set Enable)		STAT NC	Orange
AGC / MGC	AGC / MGC Mode Control	AGC / MGC Mode Control	MODE	MGC Blinking (1 times / sec), AGC Green always
Laser-Critical-ALM	Laser preceding stage Gain High	Laser Current High	STAT LSR	Red
Laser-Warning-ALM	Laser preceding stage Gain Low	Laser Current Low	STAT LSR	Orange
Laser-Shutdown	Laser-Shutdown	Laser-Shutdown	LSR	Red

6.7 Logs Management

The operator can view all the alarms of the modules in the chassis on the Logs Management page. Click "**Logs**" to enter the Logs Management page. Refer to **Figure 6-11** below:

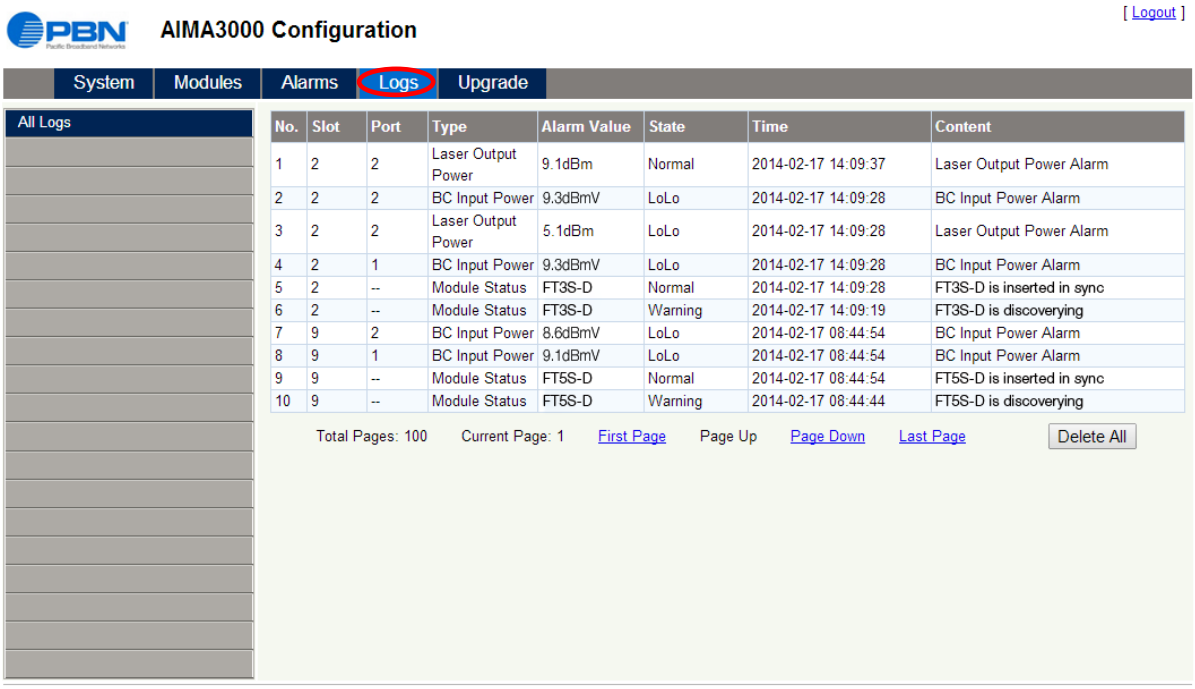


Figure 6-11

6.8 Device Upgrade

The Module supports firmware upgrade function.

To upgrade the firmware first upload the local upgrade file, and then click "**Start Upgrade**" to begin with the upgrade process. At the same time, you will be automatically redirected to the Network Management page. The upgrade operation is then complete.

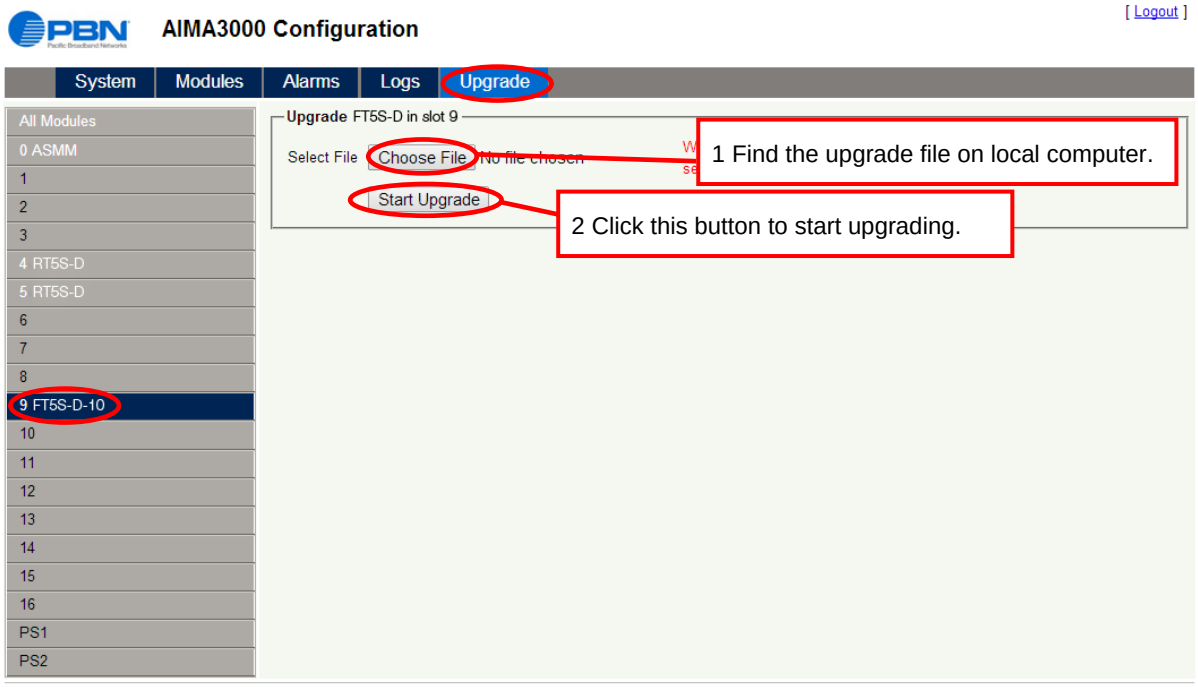


Figure 6-12

** The upgrade file needs to be located in the PC that is connecting to ASMM*

** The Web GUI above only supports the manual operation from a local PC.*

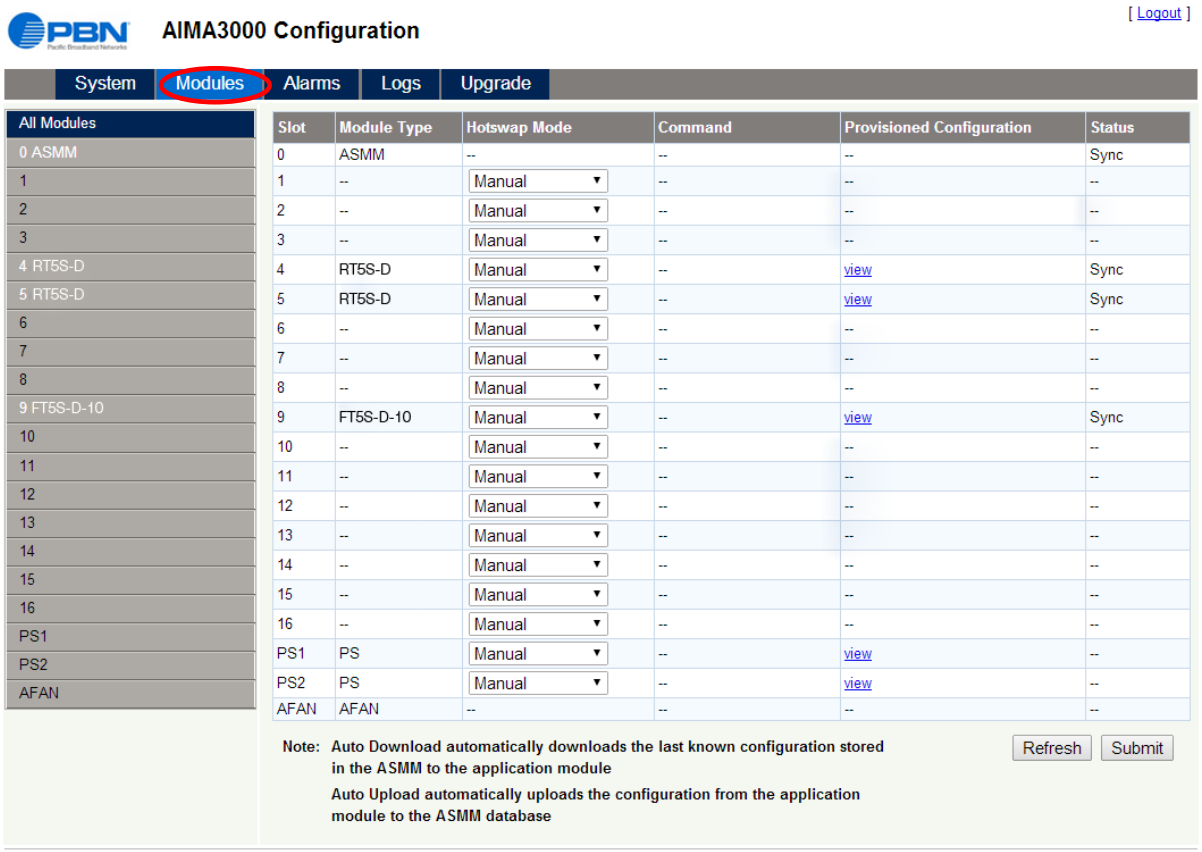
** The FT5S supports automated firmware updates and automatic backup & restore features via TFTP when managed via PBN NMSE management software. Please refer to the NMSE Product User Manual for more information.*

6.9 Restoring Factory Defaults

Loading factory default can restore the device to the factory default setting.

Detailed operations:

Click Modules tab and click the module to be configured as the page shown in **Figure 6-1**. Click "**Apply**" button in Factory Default section. When finished, the device configuration will be reset. For more detailed factory reset information, please refer to the factory restore and upgrade configuration parameters table as in **Table 6-1**.



Note:

All the powers displayed on the webpage are total power.

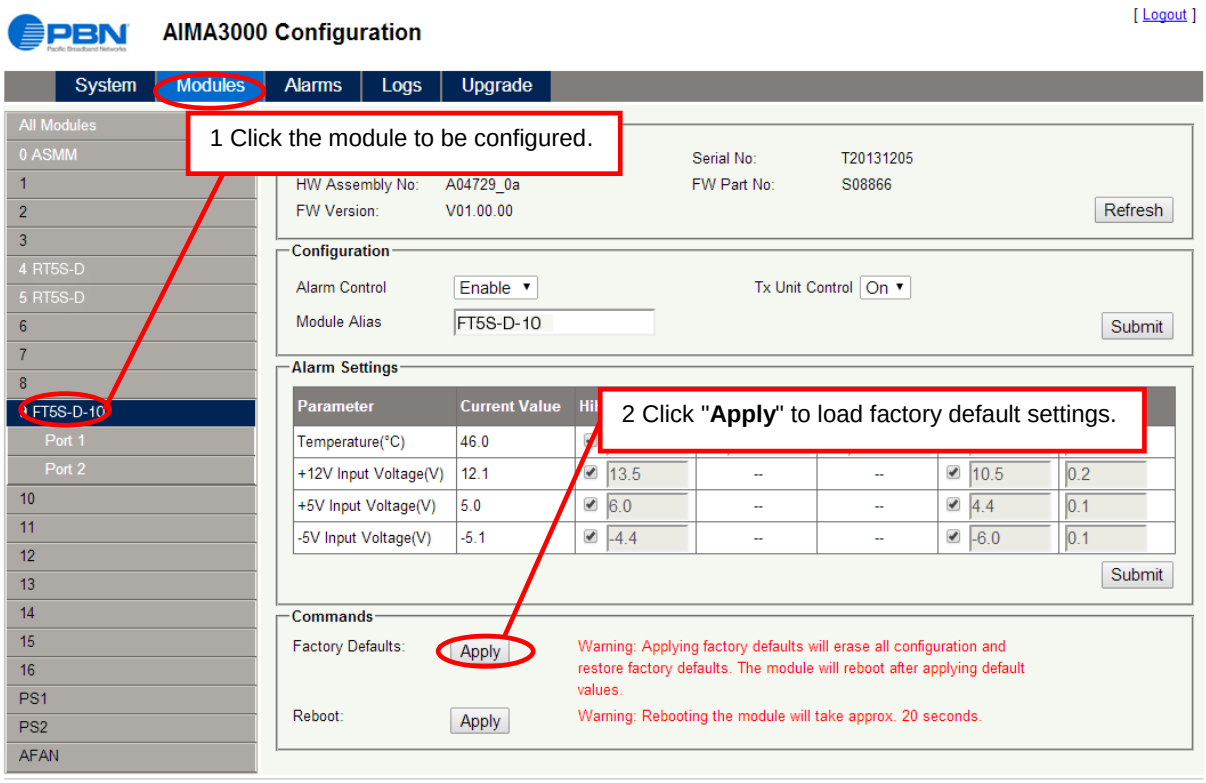


Figure 6-1

Table 6-1 Factory default and upgrade configuration parameters table

Parameters	Configuration	Factory default value	After software upgrade
Alarm Control	ON / OFF	ON	ON
TxUnitControl	ON / OFF	ON	OFF
AGC Mode	ON / OFF	OFF	OFF
Broadcast MGC (dB)	-10 ~ +5	0	Retention
Narrowcast MGC (dB)	-15 ~ 0	0	Retention
Laser Output Control	ON / OFF	ON	OFF

6.10 Reboot

The module can be made to reboot remotely, shown in **Figure 6-2** below.

Detailed operations:

Click Modules tab, click the corresponding FT5S module, and click the "**Apply**" button in Reboot section. Next, click on "**Submit**" to confirm, and then the module will automatically restart. The configuration of the module will not be lost after rebooting.

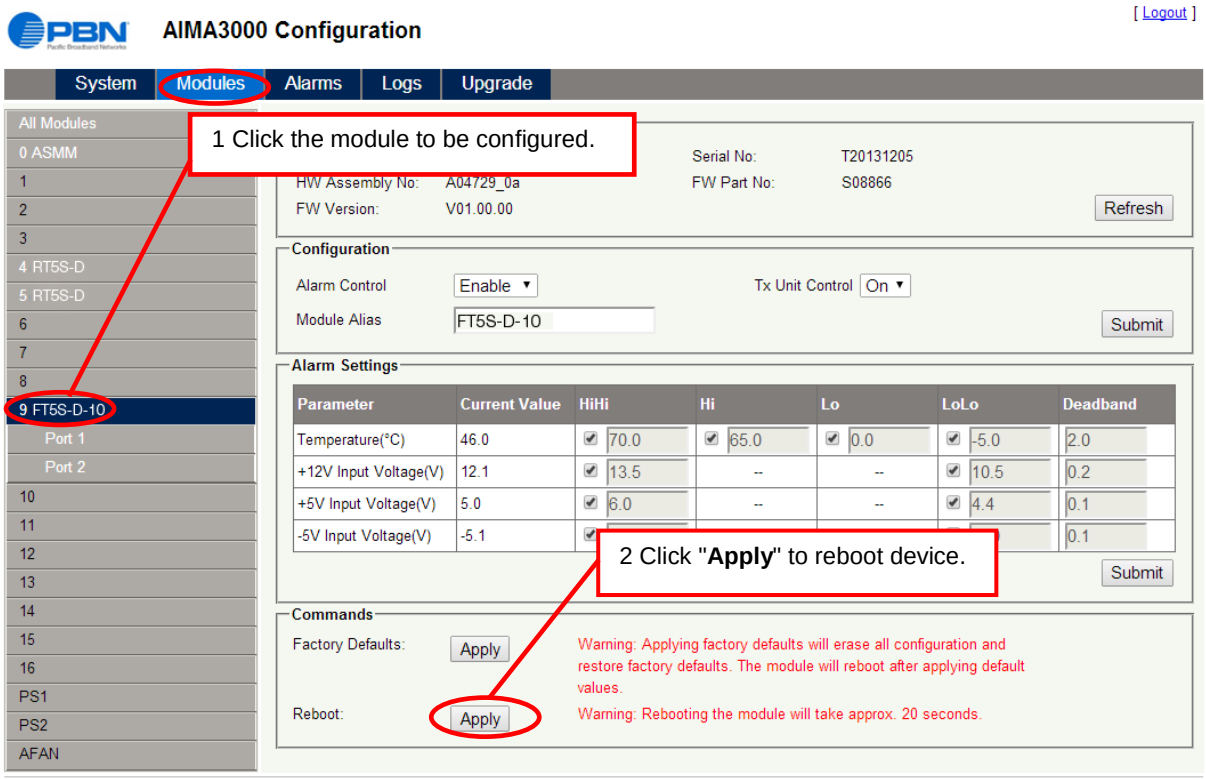


Figure 6-2

7 Troubleshooting

Indicator for determining faults

If there is a fault, the operator can use the status LEDs to determine the location and condition of the fault. Please see **Table 7-1** below:

Table 7-1 Fault Judgment Table

Alarm Indicator status	Common Faults	Trouble Shooting
BC status is orange	BC input signal is lower or higher.	Adjust input signal or adjust MGC to an appropriate value.
BC status is red	BC input signal is too high or no input.	Adjust input signal
STAT red	The output optical power is abnormal or bias current is abnormal.	Please contact PBN's technical support.
	Power failure	Please contact PBN's technical support.
	Operating environment temperature is too high.	Lower the room temperature. If the temperature is normal, please contact PBN's technical support.

8 Product Warranty

Pacific Broadband Networks warrants its equipment to be free of manufacturing defects in material and workmanship for a period of one year from the date of shipment, provided it is installed and operated in accordance with the factory recommendations.

The liability of Pacific Broadband Networks under this warranty is solely limited to repairing, replacing or issuing credit provided that:

5. The warranty registration has been completed and received by Pacific Broadband Networks.
6. Pacific Broadband Networks' helpdesk is promptly notified in writing or by telephone that a failure or defect has occurred.
7. A return authorization number is obtained from Pacific Broadband Networks' helpdesk and clearly marked on the outside of the shipping container and all the documents.
8. The customer is responsible for all the shipping and handling charges. C.O.D. and freight collection will not be accepted without prior approval from Pacific Broadband Networks' helpdesk.
9. The equipment (at PBN's sole discretion) has not been abused, misused, or operated under conditions outside the manufacturer's specifications.

The warranty does not cover the following:

1. Products purchased from someone other than an authorized Pacific Broadband Networks dealer.
2. Damage caused by accident, negligence, misuse, abuse, improper operation, or failure to operate the equipment according to the manufacturer's specifications.
3. Damage caused by fluctuation in electrical current, lightning, power surges, etc.
4. Damage resulting from overhaul, repair or attempt to repair caused by someone other than Pacific Broadband Networks' qualified service personnel.
5. Any product where the serial number has been defaced modified or removed.
6. Any product that has been opened or modified without prior written permission from PBN.
7. Replacement of parts necessitated by normal wear and tear.
8. Any consequential or implied damage.
9. Pacific Broadband Networks will not be liable for DFB Laser failure after 90 days from receipt of item. Any claim for DFB Lasers will be presented to the laser vendor for replacement. Pacific Broadband Networks will make every effort to replace faulty lasers although the ultimate decision is at the laser vendor's discretion. Pacific Broadband Networks will cover all the labor costs associated with the replacement of the laser within the one-year warranty period.

9 Declaration of Conformity

According to ISO/IEC Guide 22 and EN45014

Manufacturer's Name:	Pacific Broadband Networks
Manufacturer's Address:	Suite 15, 1st Floor, Building 3, 195 Wellington Road, Clayton, Victoria 3168, Australia
Product Name:	FT5S – 1550 nm Optical Forward Transmitter Module

Conforms to the following standards:

FCC:	FCC Part 15 Subpart B: 2012
CE:	EN 50083-2: 2012; EN 5504: 2010; EN 61000-3-2: 2006+A1: 2009+A2: 2009; EN 55022:2010; EN 61000-3-3: 2008
RCM:	AS/NZS CISPR22: 2009+A1: 2010 (Pending)

Federal Communications Commission

For Compliance Information ONLY, contact:

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Appendix A: Default Alarm Limit Settings

Parameters	Critical High	Warning High	Normal	Warning Low	Critical Low	Dead Band	Factory Default	Detection Range
Temperature (°C)	70.0	65.0	28.0	0.0	-5.0	2.0	ON	-20 ~ 125
+5V Input Voltage (V)	5.7		5.0		4.6	0.1	ON	0 ~ 6.5
+12V Input Voltage (V)	13.2		12.0		10.8	0.1	ON	0 ~ 16

Appendix B: Factory Default Settings

Parameters	Conditions	Factory Default Value	After Software Upgrade
Alarm Detection Control	ON / OFF	ON	ON
Output Control	ON / OFF	ON	ON
Output Gain Type	MGC / AGC	MGC	MGC
Output RF Pad Level (dB)	0 ~ 20	10	10
Remote Node Control	ON / OFF	OFF	OFF

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