ASCENT Communication Technology

AT5100 External Modulation Optical Transmitter

Quick Reference Guide

Revision G

ACT AT5100 External Modulation Optical Transmitter

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ACT Document Number: ACT AT5100 External Modulation Optical Transmitter

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This document is produced to assist professional and properly trained personnel with installation and maintenance issues for the product. The capabilities, system requirements and/or compatibility with third-party products described herein are subject to change without notice.

For more information, contact ACT: support@ascentcomtec.com

Revision History

Revision	Date	Reason for Change
A	01/23/2018	Initial release
B	02/20/2018	Update Sections
C	02/22/2018	Minor updates
D	05/27/2018	Updated specifications
E	09/03/2019	Updated section 2.4
F	04/27/2020	Added section 9
G	09/10/2020	Updated pictures

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1 Precautions

Warning Exposure to class 1M laser radiation is possible. Access should be restricted to trained personnel only. Do not view exposed fiber or connector ends when handling optical equipment.

- Ensure adequate cooling and ventilation as specified.
- The installation and operation manual should be read and understood before units are put into use.
- Always replace protective caps on optical connectors when not in use.
- The typical connectors fitted are SC/APC 8°. **Note:** 8° angle polished connectors must be used.

Cleaning

Use only a damp cloth for cleaning the front panel. Use a soft dry cloth to clean the top of the unit.

Do not use spray cleaner of any kind.

Grounding

The XMOD2 Transmitter should have good grounding with grounding resistance $< 4\Omega$. According to the international standard, 220V plug in adopts tri-wire rule and the middle wire is the grounding wire.

Before connecting circuit, please use proper electric wire (#20AWG and more) to connect the grounding screw and the grounding frame. When use DC input power supply, the equipment chassis must be grounded.

Overloading

Overloading wall outlets and extension cords can result in a risk of fire or electric shock.

Use approved electrical cords.

Damage requiring service

Unplug unit and refer servicing only to Ascent Communication Technology qualified service personnel.

Servicing

Do not attempt to service this unit yourself. Refer all servicing only to Ascent Communication Technology qualified service personnel.

2 Introduction

2.1 Overview

AT5100 1RU Dual Output 1550nm Externally-Modulated (XMOD2) Laser Transmitter offers a flexible, medium and long distance and scalable optical transmission for high quality analog and digital video in CATV networks.

AT5100 XMOD2 1550nm series transmitters are designed with two optical output ports with power from 3 dBm, 6 dBm, 9 dBm, and 10 dBm. These transmitters are equipped with field adjustable Stimulated Brillouin Scattering (SBS) suppression from 13 dBm to 18 dBm. AT5100 XMOD2 series simplifies the application by offering chirp-free operation with confined optical line width and maintain excellent distortion performance CNR, CSO and CTB across the entire network.

AT5100 XMOD2 transmitter provides low dispersion transmission with intuitive front panel LCD display to make operator's life easier. The optical transmitter is packaged in a self-contained 19" sub-rack of 1 RU with dual main power supplies and SNMP management.

Together with ACT 1RU EDFA optical amplifiers, the AT5100 XMOD2 provides an ideal long-distance video and short, medium video overlay solution in high density FTTX networks to bring the CATV services to business and home premises.

2.2 Features

- High performance on CSO, CTB with RF pre-distortion circuit
- Dual optical output power up to 10dBm
- Suitable for long distance 1550 nm DWDM Video transmission applications
- Suitable for short, medium distance FTTH applications
- Low noise DFB continuous wave laser, reduce the dispersion effect
- Optimized models for 60 PAL or 89 PAL channels, 80 NTSC channels or 110 NTSC channels
- Dual redundant hot-swappable AC or DC power supplies
- Field-adjustable Stimulated Brillouin Scattering (SBS) suppression for optimized CSO
- Front-panel LCD for local monitoring of transmitter status
- Local or remote monitoring and configuration
- SNMP/HTTP monitoring, management and control

2.3 Specifications

AT5100 XMOD2 1550nm Externally-Modulated (XMOD2) Laser Transmitter - 19” 1RU

Items	Unit	Min.	Typ.	Max.	Notes
Optical					
Wavelength	nm	1540		1563	Compatible with ITU wavelength
Output Port No.		1	2		
Each Output	dBm	5		10	1 dBm/step
Laser linewidth	MHz	0.35			
SMSR	dB	45	50		
RIN	dB/Hz			-160	20 MHz to 1002 MHz
Optical Return Loss	dB	50			
Fiber Connector		SC/APC			FC/APC, LC/APC Optional
RF					
Bandwidth	MHz	47		1218	870 MHz / 1002 MHz optional
Input Level	dBµV	75	80	85	AGC
MGC ATT	dBµV	0		15	In MGC
Unflatness	dB	-0.75		+0.75	47 to 1002MHz
Return Loss	dB	16			47 to 1002MHz
Input Impedance	Ω		75		
RF Connector		F Metric/ Imperial			Optional
Link					
Test Channels		PAL-D/59CH	PAL-D/99CH		
CNR1	dB	≥53.0	52.0		TX to RX, 0 dBm input to node
CNR2	dB	≥51.0	50.0		65K fiber, 0 dBm input to node
CTB	dB	≥65			
CSO	dB	≥65			
SBS	dBm	13		19	Adjustable, Step 0.1dB
General					
Network Management		SNMP, WEB supported			
Power Supply	V	90		265	AC
		-72		-36	DC
Power Consumption	W			50	Dual power supply, 1+1back up
Working Temperature	°C	-5		+65	Auto case temp control
Storage Temperature	°C	-40		+85	
Working Relative Humidity	%	5		95	
Dimensions (W×L×H)	mm	450×483×44			
Weight	kg	7.4			

Note: Measured in a typical system configuration for the nominated channel numbers and nominated fibre lengths for each model at 25 °C ambient temperature.

2.4 Models and Options

AT 5000 Series 1RU Dual Output XMOD2 TX Ordering Information

AT-	5X-	XMOD2-	XX-	X-	XX-	XX	X

	Gain Type
50	870 MHz
51	1002 MHz
512	1218 MHz
52	2600 MHz

	Output Wavelength
00	1550 nm ± 5 nm
21	ITU CH 21
23	ITU CH 23
25	ITU CH 25
xx	ITU CH XX

	Optical Connector
SC	SC/APC
FC	FC/APC

	Output Power
6	6 dBm
8	8 dBm
9	9 dBm
10	10 dBm

	Power Supply
1	Single PS
2	Dual PS

	Power Supply
AC	90 to 265 VAC Australia Plug
DC	30 to 72 VDC
A3	90 to 265 VAC with Continental EU Plug
A4	90 to 265 VAC with North America Plug

Note

Contact ACT for additional product variations on output power, 1 GHz, specific ITU channels, optical connectors etc.

3 Installation

3.1 Equipment Inventory

On receiving your new AT5100-XMOD2, you should carefully unpack and examine the contents for loss or damage that may have occurred during shipping. Refer to warranty registration if loss or damage has occurred. The AT5100-XMOD2 should consist of the following:

Qty	Description
1	AT5100-XMOD2 Unit
1	Key for switching laser ON / OFF
1	Power supply cord
1	Optional Product User Manual (includes individual test sheet)

3.2 Packaging and Transportation

Keep all AT5100-XMOD2 packing boxes and packaging for future transport.

Use only the original AT5100-XMOD2 packaging when transporting. This packaging has been specifically designed to protect the equipment.

3.3 Power and Cooling Requirements

The AT5100-XMOD2 requires a mains input of 90 V_{AC} to 265 V_{AC} at 50 to 60 Hz. The unit will automatically adjust the power conversion for inputs within these ranges, with no switch setting or other user intervention. Power consumption of the unit is 50 watts maximum.

The transmitter is designed to operate with an ambient temperature of 0 °C to 50 °C with humidity up to 95 %. Free ambient air should be maintained around all sides of the unit. Care should be taken to ensure that the air flow around the unit is unrestricted.

The AT5100-XMOD2 should have a minimum ventilation clearance of 1 RU above and below the transmitter.

Warning

DO NOT expose AT5100-XMOD2 to conditions which would permit condensation to form on the inside of the transmitter.
DO NOT operate AT5100-XMOD2 outdoors.

3.4 Installation and Adjustment

Warning

Exposure to class 1M laser radiation is possible. Access should be restricted to trained personnel only. Do not view exposed fiber or connector ends when handling optical equipment.

The following steps explain how the AT5100-XMOD2 is to be installed.

1. Unpack the transmitter and inspect the unit as stated in **Section 3.1**.
2. Locate the transmitter in a 19” cabinet ensuring adequate ventilation and space for accessing the rear ports and front-panel keypad.
3. Before connecting AC power to the unit, make sure that the LASER ON/OFF key is switched **OFF** (front panel).
4. Use the supplied power cord to apply mains power to the transmitter.
5. Switch the AC power ON (switch located on the rear panel).

   The ALARM LED will light red.

   The LCD will light and display “Model: AT5100-XMOD2” and “KEY OFF” on start up.
6. Switch on the laser using the key switch.

   Front panel shows "KEY ON…", Laser status LCD turns green from red, the unit enters self-checking, after checking it enters working status, display " Descriptor"

Warning

Allow **15 minutes** for the transmitter to reach its stable operating temperature. **Do not** connect the RF/optical ports to the network or start aligning the system until then.

7. Before connecting an RF signal, check that the power input level is within the acceptable range. Refer to **Section 2** for details.
8. Connect a matrix generator or head-end RF signal.

Note

The default control mode is AGC. The modulation control mode displayed in the main menu is RF Mode = AGC.

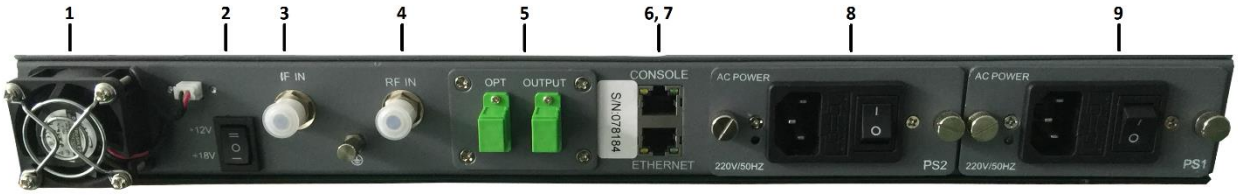
9. Connect a fiber patch-cord from optical port **OPT. OUT 1** to an optical power meter and verify the LCD reading matches your power meter reading.

   When the ALARM LED shows green, the transmitter is ready for full operation.

3.5 Front Panel Operation

Port	Item	Description
1	Mounting Points	Holes for securing unit to rack
2	LASER ON/OFF	Key switch for laser activation
3	LASER	Laser indicator GREEN – Output power is normal RED – Abnormal status
4	RF	RF indicator GREEN – Normal operation RED – RF input is too low or too high
5	TEMP	Temperature indicator GREEN – Temperature is normal RED – Operating temperature is too low or too high
6, 7	PWR1/PWR2	Power 1 / Power 2 indicators GREEN – Two-way switch power supply is working YELLOW – One-way power supply is working RED – Abnormal status
8	VFD/LED	VFD/LED display for optical transmitter parameters such as model number and operation status
9, 10	AGC/MGC	AGC/MGC indicator Displays AGC/MGC working status
11	OMI	OMI adjuster Adjust the OMI using a screwdriver. Clockwise rotation increases OMI, counterclockwise rotation decreases OMI
12	KEYPAD	Keypad used to scroll through menu items on transmitter display
13	ENT	Enter button
14	RF TEST	Input level test (-20 dBm)

3.6 Rear Panel Operation

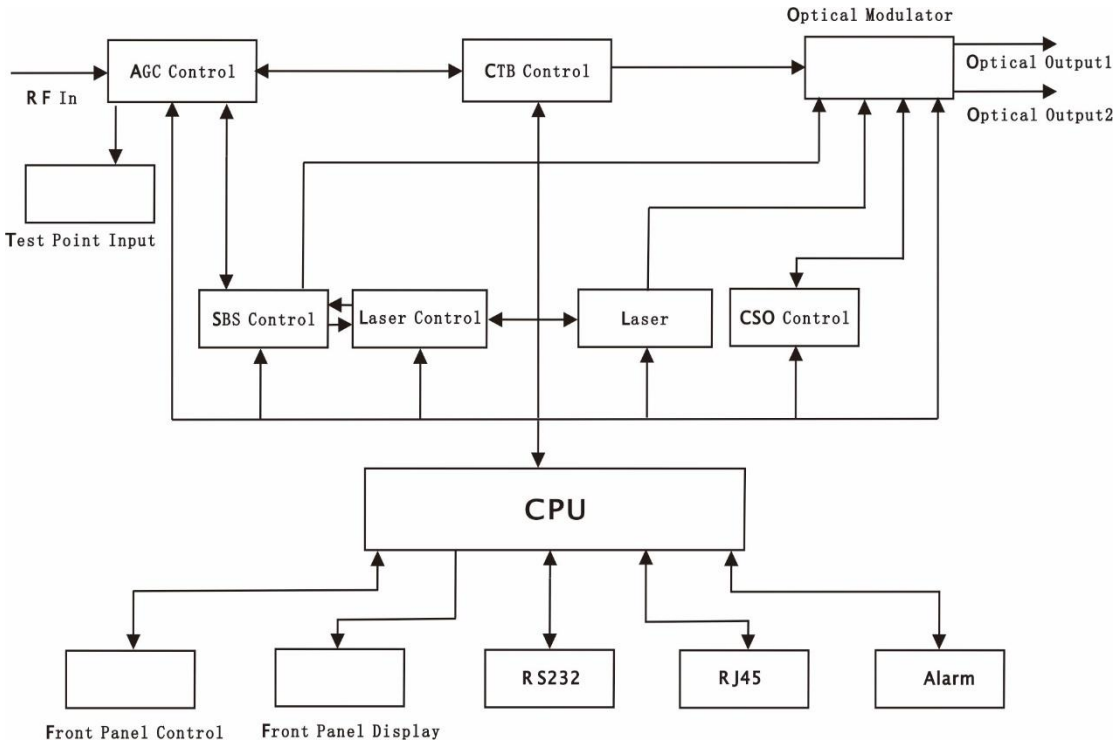


Port	Item	Description
1	FAN	Intelligent fan, begins to run when the chassis temperature reaches 32 °C to 35 °C (set by
2	Power Supply Switch	UP – 12 V DC MIDDLE – Off DOWN – 18 V DC
3	IF IN	IF signal input
4	RF IN	RF signal input
5	OPT OUTPUT	Optical signal output
6	CONSOLE	Console for computer network management
7	ETHERNET	Ethernet port, compliant with CNMP standard interface
8, 9	PS2/PS1	Power supply 2 outlet

Note Product appearance may vary with model options.

4 Technical Description

4.1 Overview



4.2 Physical Description

The unit is housed in a 19” rack, 1 RU height. Status indicators and control keys are located on the front panel along with an RF monitor port. The front panel provides an LCD display for comprehensive status information and user interface. The rear panel contains the optical interconnects, power, and data interface connectors.

The RF test port on the front panel is -20 dB from the modulating signal level. This is just after the internal AGC functional block. This signal is constant when the AGC circuit is functioning normally. Refer to the specification for typical levels. The output impedance of this port is 75 Ω, with an F-type connector.

The rear panel also contains the two optical ports, which are typically SC/APC bulkhead connectors.

The power interface, is a standard 3-prong line cord, with hot, neutral, and chassis ground. The metal chassis of the transmitter is tied to ground.

4.3 AGC Operation

The AT5100-XMOD2 will be in AGC mode (Automatic Gain Control) when first powered on. To change it to MGC mode (Manual Gain Control), refer to **Section 5.3**.

4.4 SBS Suppression

The SBS suppression circuitry is based on industry techniques for line-width broadening the source. All of these schemes involve spreading out the optical power so that the optical power in any one region of the optical spectrum does not exceed the threshold at which SBS effects start to become evident.

The SBS suppression of the externally modulated laser transmitter needs to be optimized for the best possible CSO performance. The selected value needs to match the maximum optical drive level in the fiber lines. For short lines this level can be a bit higher than for very long lines. A reduced line drive level together with a reduced SBS suppression threshold in the transmitter increases the maximum achievable system range. The AT5100-XMOD2 incorporates field-selectable SBS thresholds. Ensure that the selected level will match the fiber line drive level as close as practical for best performance.

Follow the steps below to determine the correct SBS value for your optical network.

1. Look at the network design that the TX will be used in and determine the highest optical power launched into the actual transmission fiber. Keep in mind this is not necessarily the launch power out of the EDFA or the power into the passive devices that may be placed ahead of the fiber. If possible, measure the actual power that will be launched into the transmission fiber.
2. After determining the highest value of optical launch power in the network record this value.
3. Now, using the SBS adjust menu on the front panel, set the SBS threshold to this value you have recorded in step 2. Your system is now at its optimized operating point for both CNR (low frequencies) and CSO (high frequencies).
4. If this value is higher than +18 dBm then you will have to add loss to your optical network at this point, the transmitter does not support a SBS level higher than this.
5. If this value is lower than +14 dBm then set the TX to this minimum setting and your network will be at its optimized operating point.
6. To verify that you are not beyond the SBS threshold or that the TX SBS setting is correct, you can measure the CNR at the lowest frequency channel in your system. If the CNR is within specification then you do not have any SBS setting issues.

4.5 ITU Frequency Grid

The following table contains the ITU frequency plan with corresponding wavelengths available to the AT5100-XMOD2.

Channel Order Code	ITU Freq. (THz)	Avail. ITU Wavelengths (nm)	Channel Order Code	ITU Freq. (THz)	Avail. ITU Wavelengths (nm)
60	196.0	1529.55	40	194.0	1545.32
59	195.9	1530.33	39	193.9	1546.12
58	195.8	1531.12	38	193.8	1546.92
57	195.7	1531.90	37	193.7	1547.72
56	195.6	1532.68	36	193.6	1548.51
55	195.5	1533.47	35	193.5	1549.32
54	195.4	1534.25	34	193.4	1550.12
53	195.3	1535.04	33	193.3	1550.92
52	195.2	1535.82	32	193.2	1551.72
51	195.1	1536.61	31	193.1	1552.52
50	195.0	1537.40	30	193.0	1553.33
49	194.9	1538.19	29	192.9	1554.13
48	194.8	1538.98	28	192.8	1554.94
47	194.7	1539.77	27	192.7	1555.75
46	194.6	1540.56	26	192.6	1556.55
45	194.5	1541.35	25	192.5	1557.36
44	194.4	1542.14	24	192.4	1558.17
43	194.3	1542.94	23	192.3	1558.98
42	194.2	1543.73	22	192.2	1559.79
41	194.1	1544.53	21	192.1	1560.61

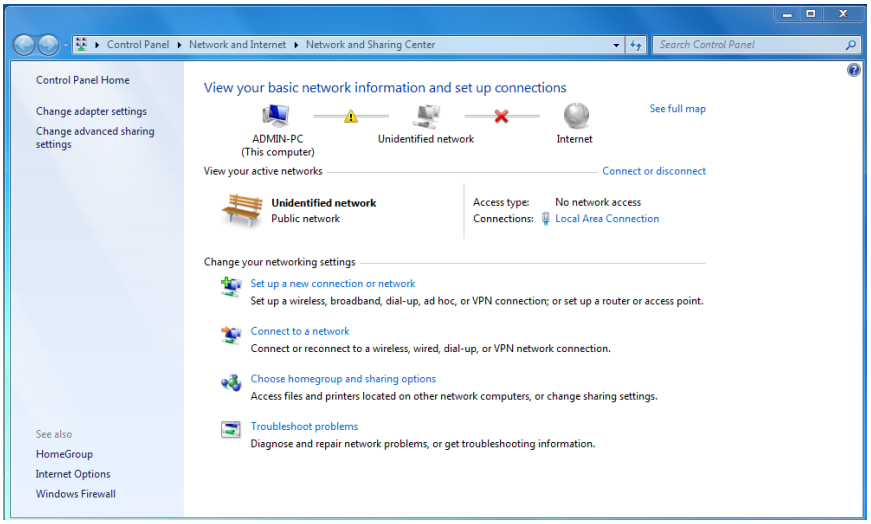
5 Software Description – Operation

5.1 Web Management

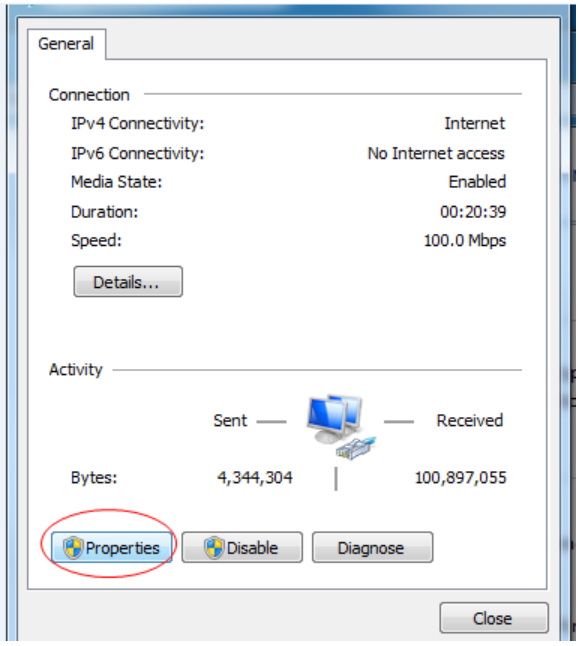
The user can use web browser to check the working condition and basic parameters of the amplifier, it supports IE, Chrome, Firefox, Opera and other main web browser. The following example are based on Opera browser.

1. Find the IP add in the machine, normally it is 192.168.1.XXX, set the IP add of the PC in the same range as following:

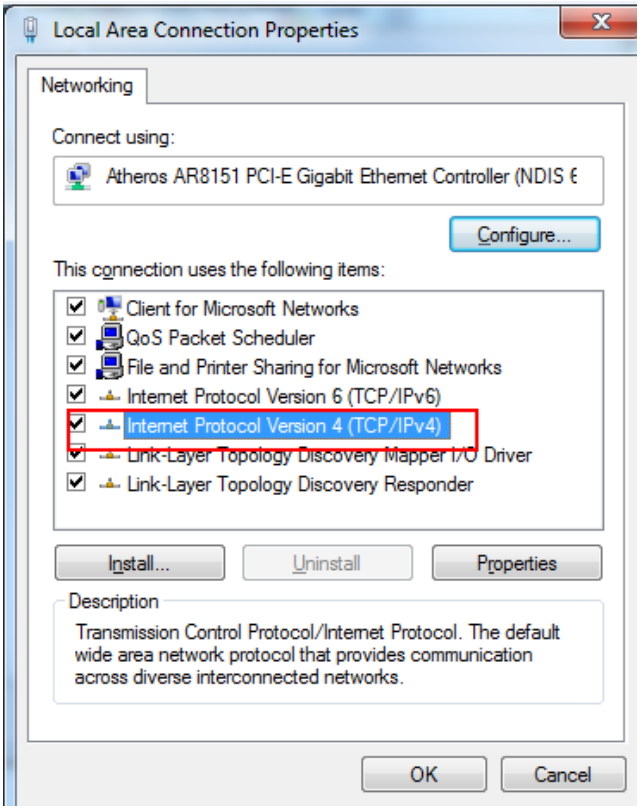
Step 1: Open local Area Connection setting:

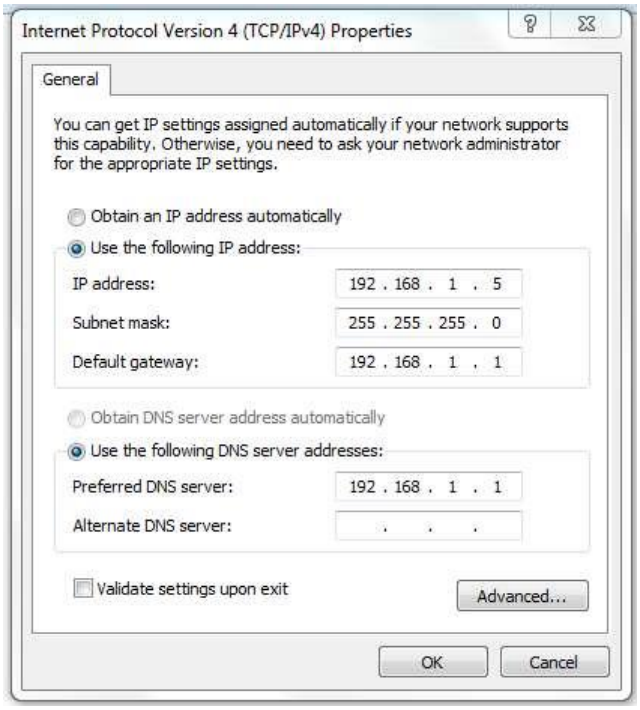


Step 2: Set Properties



Step 3: Set the PC IP address in the same range with device IP address. For example the device IP address is 192.168.1.122, pls set PC IP address to 192.168.1.X (X different to 122).

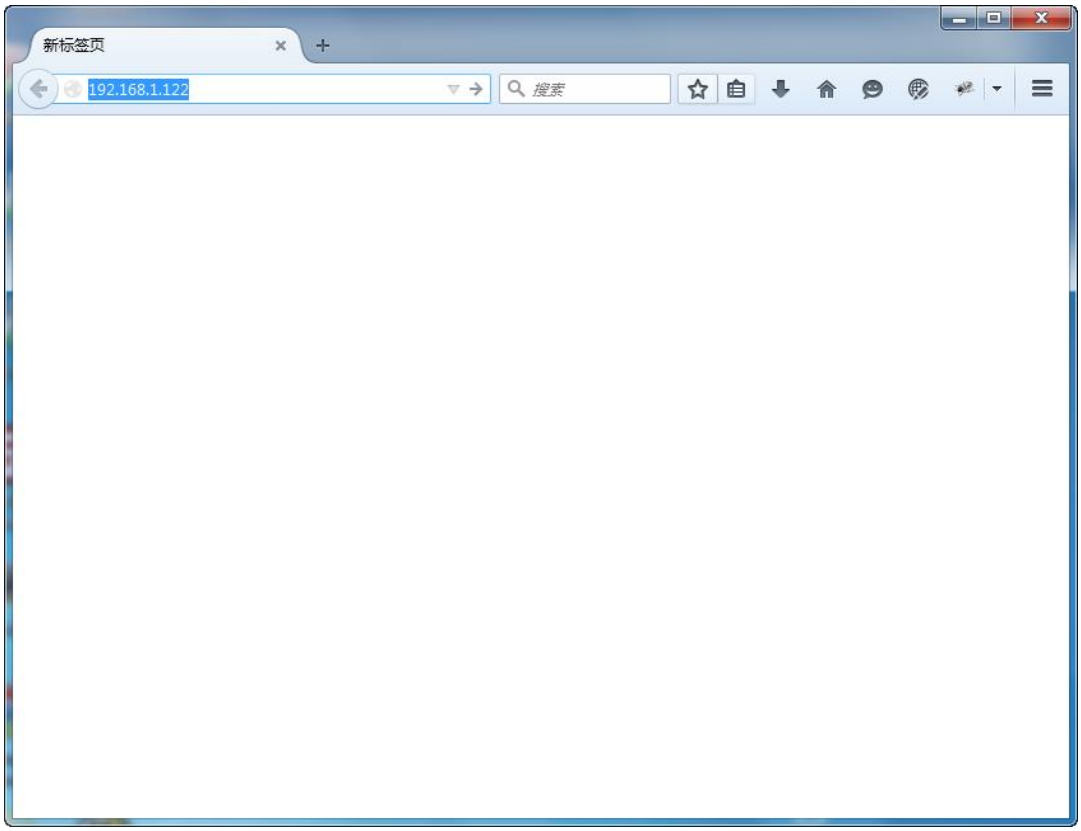


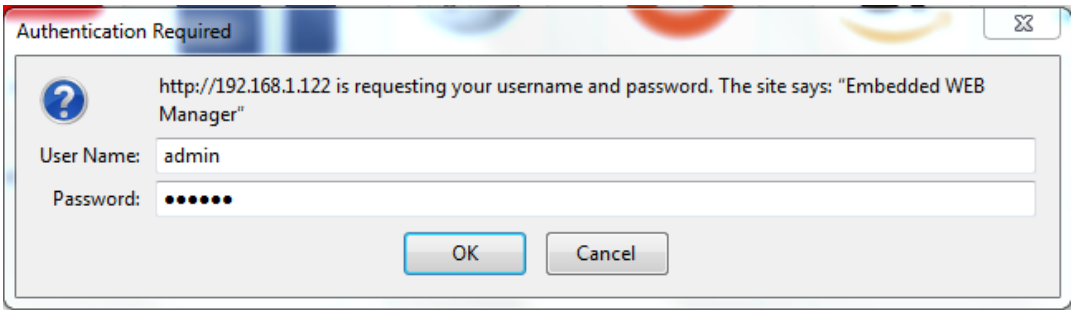


2. Open web browser, input the IP add and login in. The IP factory setting is 192.168.1.122.

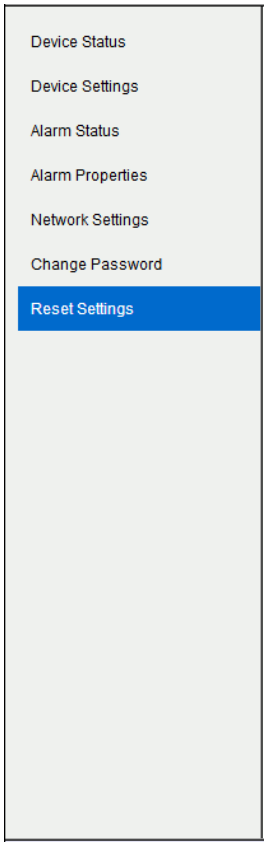
User Name: admin

Password: ascent

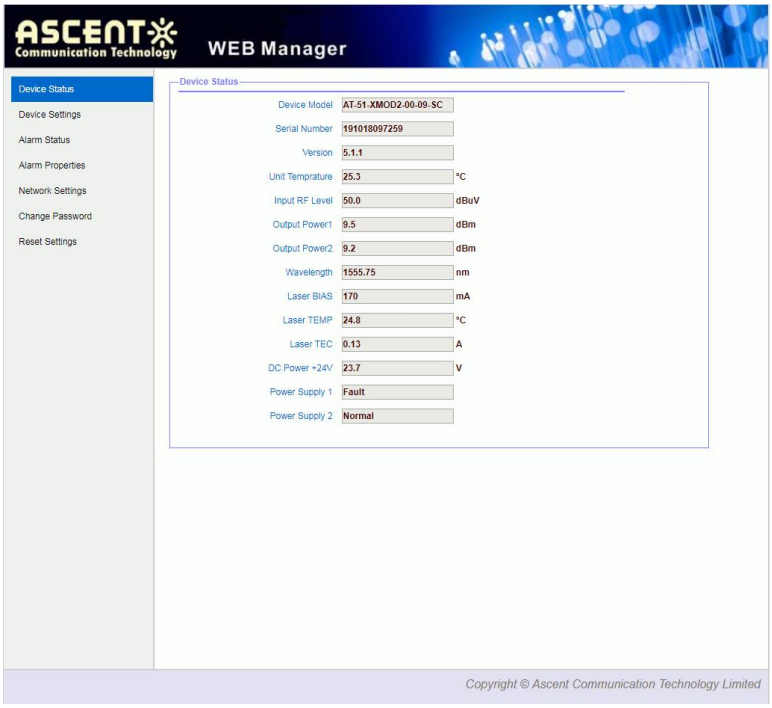




3. The web management consist of five submenus. Items guide on the left, click to enter.



5.2 Device Status Submenu

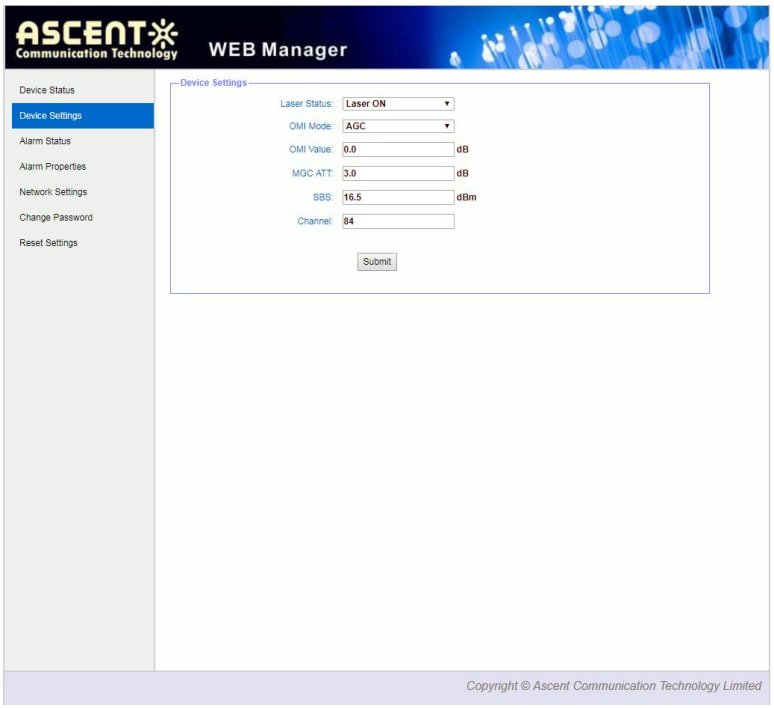


5.3 Device Settings Submenu

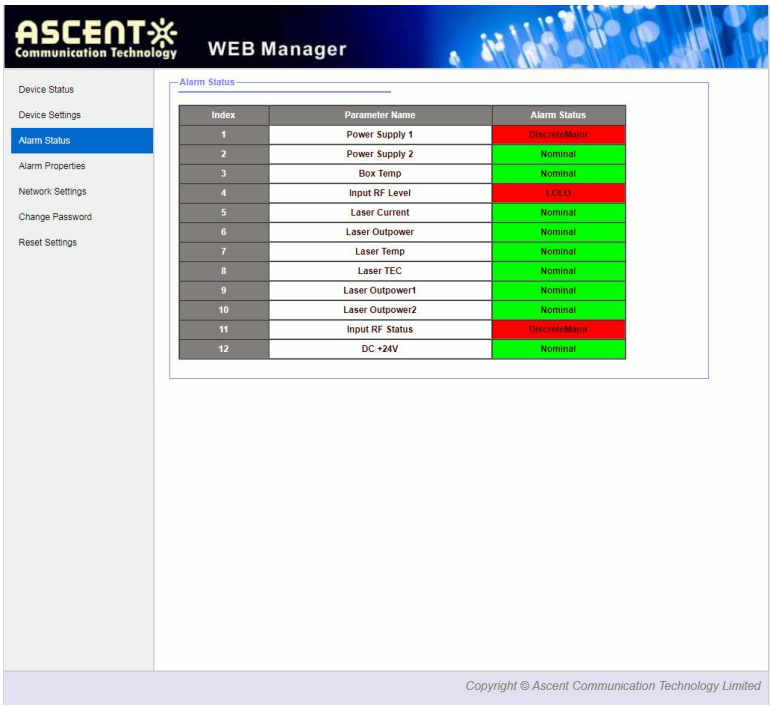
OMI mode: switch AGC/MGC statuses.

OMI Value: -3 dB to +3 dB adjustable, factory setting is 0 dB.

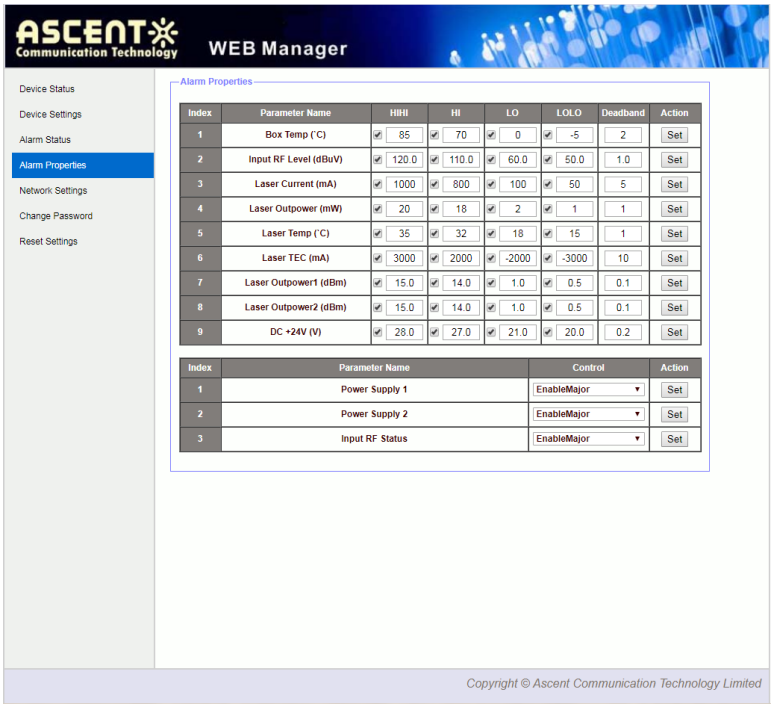
SBS: 13 dB to 19 dB continuously adjust, 0.1 dBm step 0.1 dB.



5.4 Alarm Status



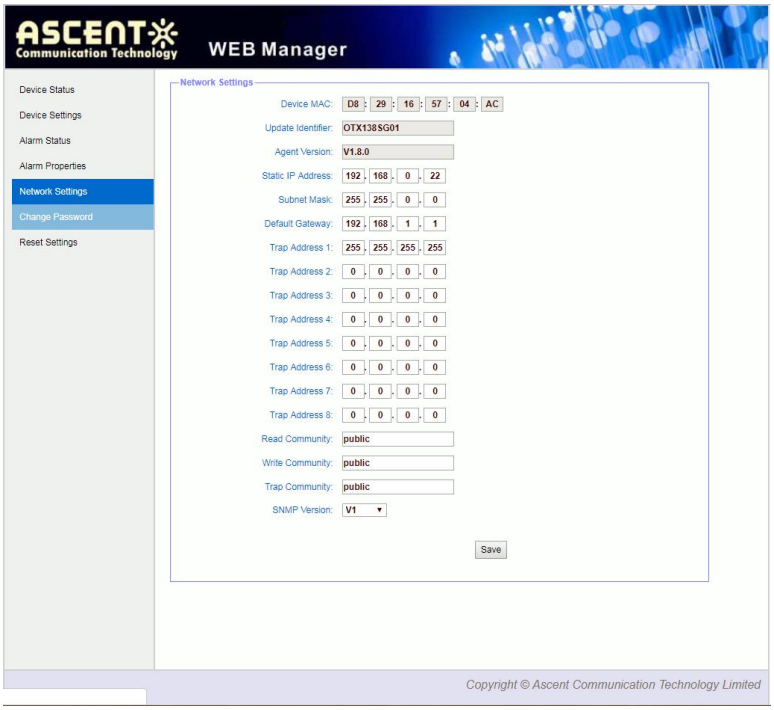
5.5 Alarm Properties



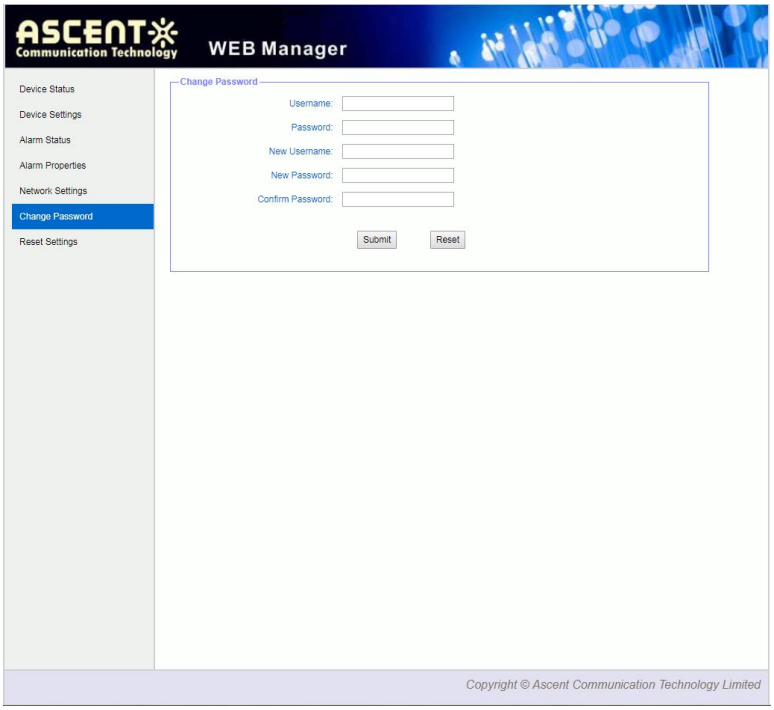
Index	Parameter Name	HIHI	HI	LO	LOLO	Deadband	Action
1	Box Temp (`C)	85	70	0	-5	2	Set
2	Input RF Level (dBuV)	120.0	110.0	60.0	50.0	1.0	Set
3	Laser Current (mA)	1000	800	100	50	5	Set
4	Laser Outpower (mW)	20	18	2	1	1	Set
5	Laser Temp (`C)	35	32	18	15	1	Set
6	Laser TEC (mA)	3000	2000	-2000	-3000	10	Set
7	Laser Outpower1 (dBm)	15.0	14.0	1.0	0.5	0.1	Set
8	Laser Outpower2 (dBm)	15.0	14.0	1.0	0.5	0.1	Set
9	DC +24V (V)	28.0	27.0	21.0	20.0	0.2	Set

Index	Parameter Name	Control	Action
1	Power Supply 1	EnableMajor	Set
2	Power Supply 2	EnableMajor	Set
3	Input RF Status	EnableMajor	Set

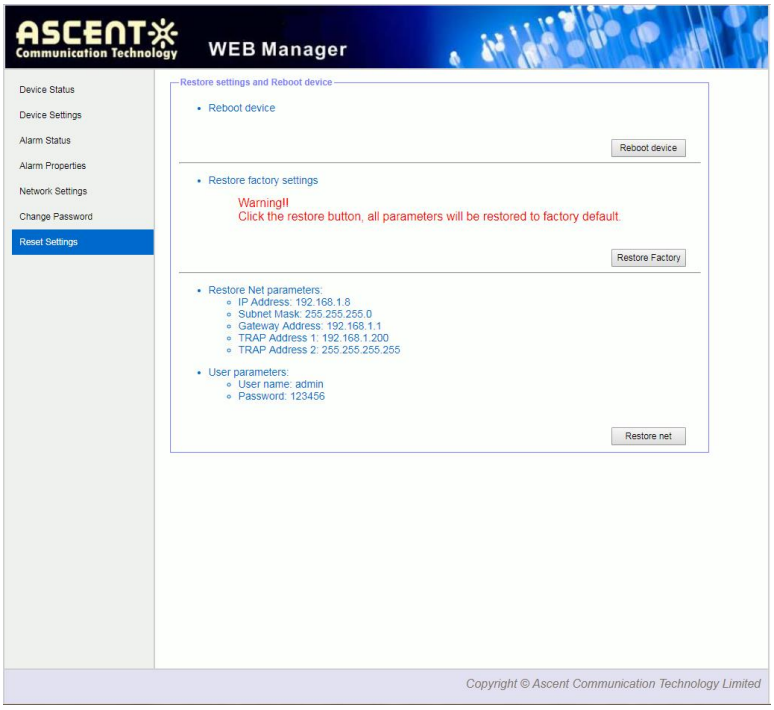
5.6 Network Settings:



5.7 Change Password

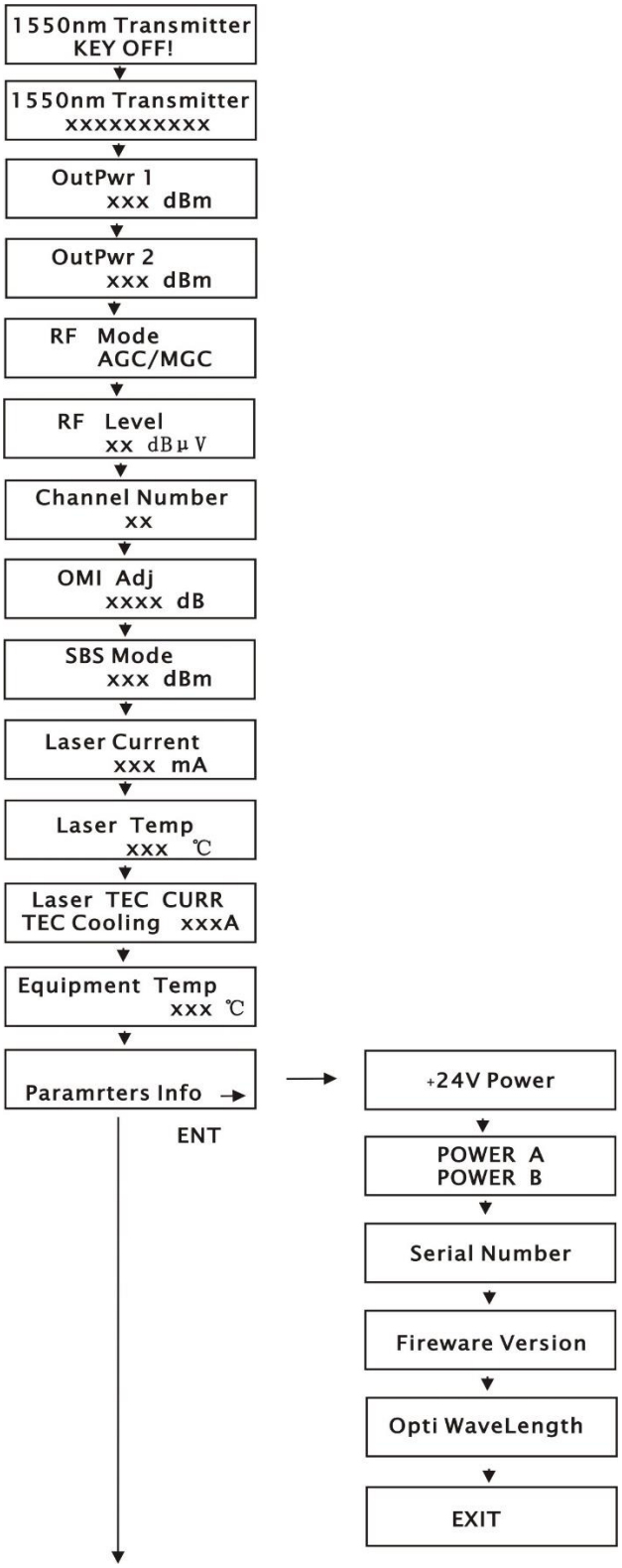


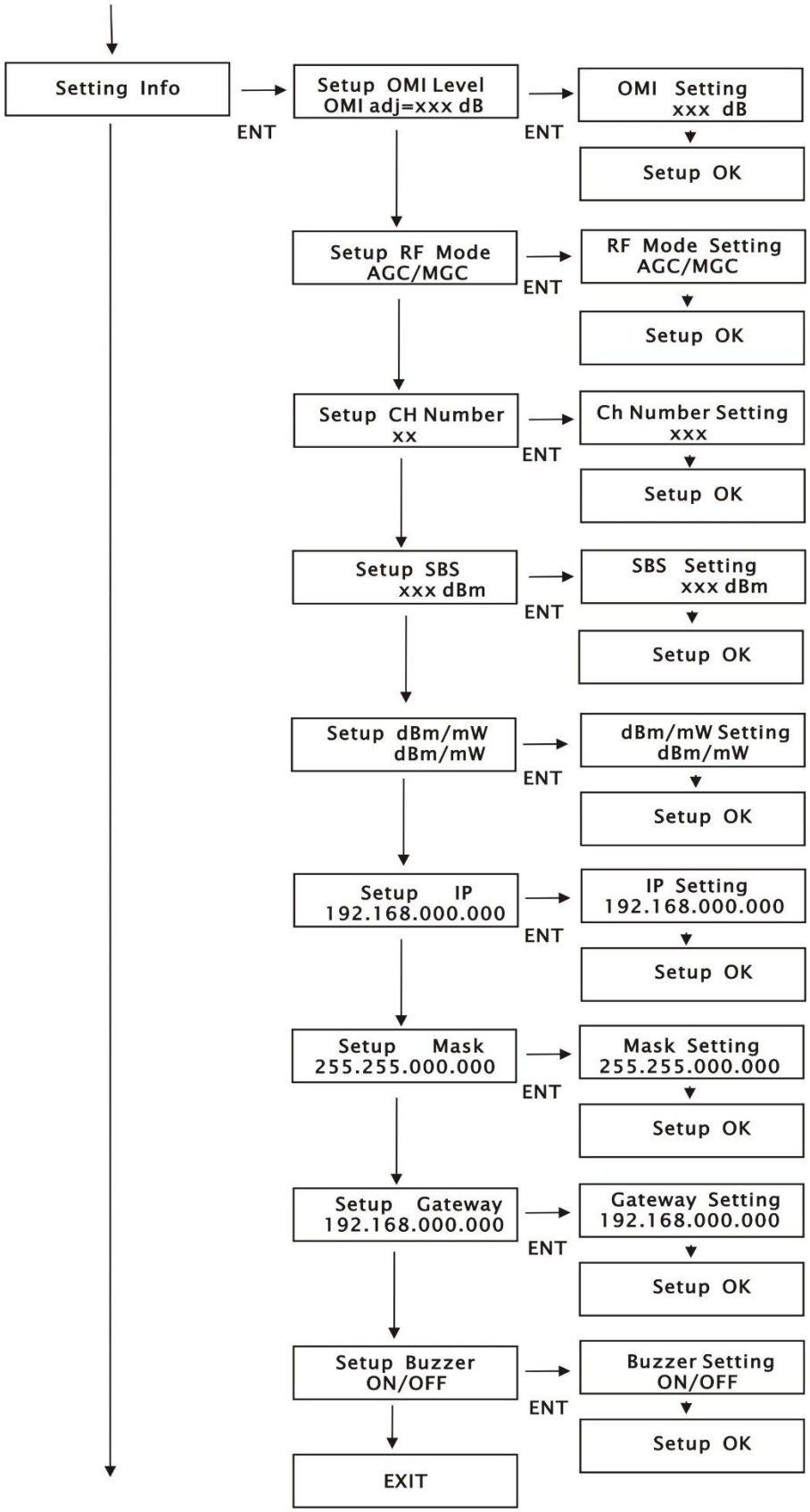
5.8 Reset Settings

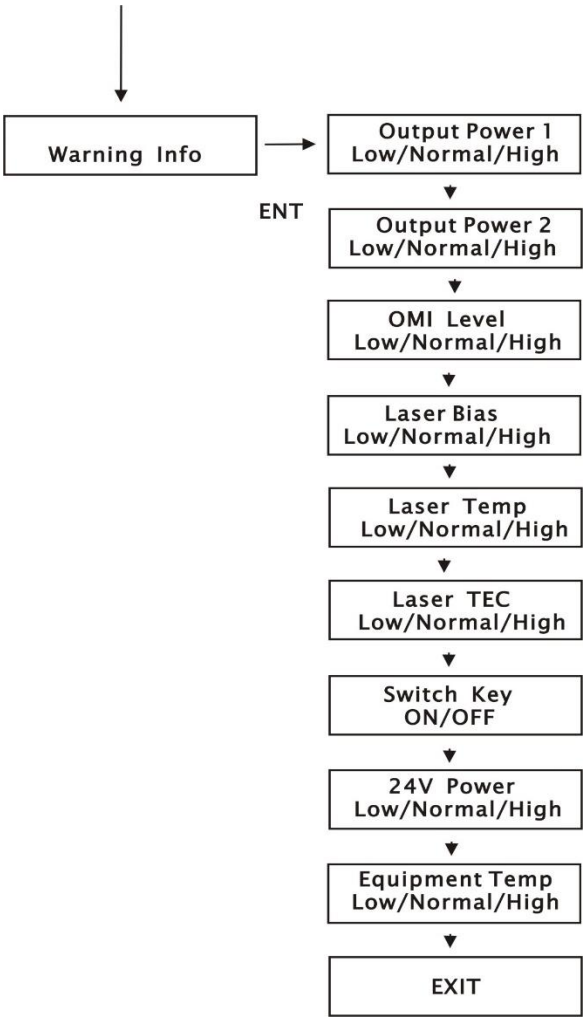


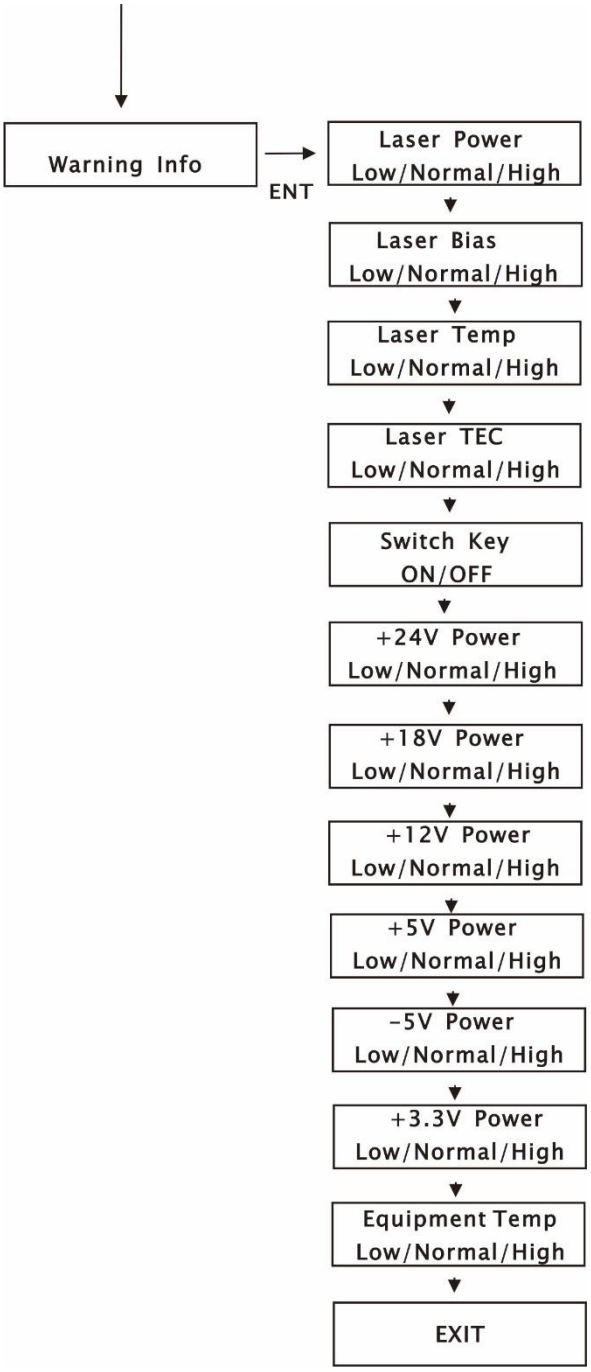
6 Setup Menu

The following menu shows all using the down arrow button; the up arrow button can be reversed.




Setting Info
ENT
Setup OMI Level
OMI adj=xxx dB
ENT
OMI Setting
xxx dB
Setup OK
Setup RF Mode
AGC/MGC
ENT
RF Mode Setting
AGC/MGC
Setup OK
Setup CH Number
xx
ENT
Ch Number Setting
xxx
Setup OK
Setup SBS
xxx dBm
ENT
SBS Setting
xxx dBm
Setup OK
Setup dBm/mW
dBm/mW
ENT
dBm/mW Setting
dBm/mW
Setup OK
Setup IP
192.168.000.000
ENT
IP Setting
192.168.000.000
Setup OK
Setup Mask
255.255.000.000
ENT
Mask Setting
255.255.000.000
Setup OK
Setup Gateway
192.168.000.000
ENT
Gateway Setting
192.168.000.000
Setup OK
Setup Buzzer
ON/OFF
ENT
Buzzer Setting
ON/OFF
Setup OK
EXIT


Warning Info
ENT
Output Power 1
Low/Normal/High
Output Power 2
Low/Normal/High
OMI Level
Low/Normal/High
Laser Bias
Low/Normal/High
Laser Temp
Low/Normal/High
Laser TEC
Low/Normal/High
Switch Key
ON/OFF
24V Power
Low/Normal/High
Equipment Temp
Low/Normal/High
EXIT

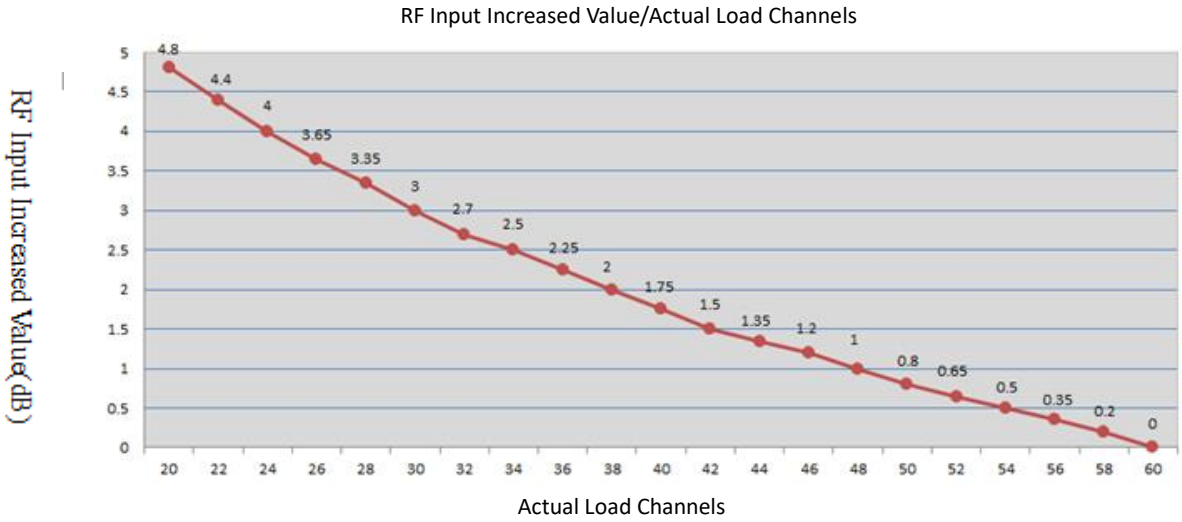

Warning Info
ENT
Laser Power
Low/Normal/High
Laser Bias
Low/Normal/High
Laser Temp
Low/Normal/High
Laser TEC
Low/Normal/High
Switch Key
ON/OFF
+24V Power
Low/Normal/High
+18V Power
Low/Normal/High
+12V Power
Low/Normal/High
+5V Power
Low/Normal/High
-5V Power
Low/Normal/High
+3.3V Power
Low/Normal/High
Equipment Temp
Low/Normal/High
EXIT

7 OMI Adjustment

7.1 The Request on RF Input Level

The standard RF input is 80±5dBμv in the condition of standard 59 channels, the advised RF steps between channels should controlled within 0.5dB to get the best parameters

The above advised RF input is based on 59 channels, in the actual application, the load number of channels may change, accordingly, the RF input of each channel will change, pls see the following picture. When the change of RF input changes within 5dB, the optical modulation index will be kept fixed.



When the device on AGC/MGC condition, input level range 75dBμV to 85dBμV

7.2 AGC Condition

The default condition is AGC (the best condition).

The OMI value can be adjusted according to the networks

After increasing the value of OMI, then CNR will be higher, but CTB and CSO will be lower. If reduce the value of OMI, the CNR will be lower, CTB and CSO higher

8 SBS Adjustment Steps

The default value of the SBS is 16.5dBm, It can be changed according to different request of networks.

9 Optimal Input Signal Level

The total RF analog input level depends on the number of analog channels in your system and is identical for the type of system (NTSC, PAL, CENELEC) used. Use the following equation to determine the optimum RF input level per channel when the rated channel loading is not being used:

Analog Input Level (dBmV) = A+10log(N/M)+10log(W1/W2)

A: Manufacturer's recommended nominal drive level for optical transmitter/module;

N: The number of channels corresponding to A;

M: Actual number of loaded channels

W1: The bandwidth corresponding to A;

W2: The actual bandwidth

For example, if the product datasheet give the following parameters:

75 dBµv @ 59 PAL channels

If the customer actually has: 40 NTSC channels, the drive level will be:

Actual drive level=75+10log(59/40)+10log(8/7)=75+10*1.69+10*0.06=75+1.7+0.6=77.3(dBµV)

For digital channels, if the digital signal level is 6 dB lower than the analog signal level, then 4 digital channels are equal to 1 analog channel; If the digital signal level is 10 dB lower than the analog signal level, then 10 digital channels are equal to 1 analog channel. In the actual calculation, first calculate the number of digital channels as the number of analog channels, and then use the above formula. For example, with 20 analog channels, 20 digital channels, and with the digital channel being 6 dB lower than the analog channel level, then the total number of channels is:

20 + 20/4 = 25 (channels)

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Specifications and product availability are subject to change without notice.

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