



# LTE153-3000

1550 nm Externally Modulated  
Optical Transmitter

## Product User Manual



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# **LTE153-3000**

1550 nm Externally Modulated

Optical Transmitter

## **Product User Manual**

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# 1 Overview

## 1.1 Safety Precautions



Laser Radiation

**CAUTION!**

**This product may emit 1M class invisible laser radiation.**

**Don't view it directly with optical instruments.**

**Don't install the fiber connector when it is power on.**

### Precautions

To avoid equipment damage caused by improper use and personal injury, please observe the following precautions:

- Please read the LTE153-3000 product user manual and fully understand its content before the units are put into usage.
- Do not place the device near water or in damp places, in order to prevent water or moisture from entering the device.
- Do not open the equipment chassis without permission.

### Service and Repair

Do not attempt to service the unit yourself. Refer all servicing needs to Pacific Broadband Network's qualified service personnel only.

## 1.2 Technical Support

Please contact PBN's qualified service personnel for all your enquiries about LTE153-3000 transmitter.

### **PBN Offices**

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## 2 Introduction

LTE153-3000 1550 nm DFB laser externally modulated optical transmitter has been designed for the CATV signals in HFC networks, cable phone and cable data to be transmitted in long distance.

LTE153-3000 series transmitter is widely used in:

- High performance transmission in long distance;
- High power distribution networks;
- Redundancy loop architectures;
- FTTx networks;
- RFoG applications;
- DWDM networks.

Please read the LTE153-3000 datasheet for more specifications and order details by clicking on the following link to download it:

<http://www.pbnglobal.com/en/support/downloads/data-sheets>

### 2.1 Working Principle

LTE153-3000 series transmitter consists of 7 function modules: RF control, DFB laser, optical modulator, SBS control, CSO control, communication/display control and power supply.

Automatic gain control circuit (AGC) or manual gain control circuit (MGC) amplifies the RF signal. AGC or MGC control makes the optical modulator maintain a suitable input level. Use the detected RF root - mean square (RMS) - total power to calculate the optical modulation index (OMI).

In general we recommend using the AGC function, and special users can use the MGC function to adjust the CNR/CSO/CTB performance indexes.

The core of transmitter is the optical modulator. The 1550nm signal input the optical modulator, make the laser intensity changed follow the external RF signal voltage, and then generate the AM optical signal.

Stimulated Brillouin Scattering (SBS) occurs, when the optical input power is greater than a certain threshold value. SBS generate the lower frequency backscattered light which will attenuate the transmission light and return to the laser while destroying its performance. Causing optical power fluctuation, generates large noise, and seriously deteriorates the system carrier to noise ratio (CNR). To improve the SBS threshold, LTE153-3000 series optical transmitter adopts SBS control technology which is independent researched and developed by ourselves. The threshold value can be set up to 19dBm.

The optical modulator has a two-way optical signal output. Parts of that signal are routed to an InGaAs photodiode. This detection of the optical signal has two functions:

- Detect whether the laser is normal working. Once the output optical power is 2dB lower

than standard power, alarm will be set off.

- Detect CSO distortion to optimize the bias point of the optical modulator. For working normal the detector circuit needs at least two carrier signal inputs with an interval of 24MHz. There is a CSO initialization program in the boot process. If the CSO install failed, the RF indicator will flash red, please see more details on the chapter “5 Maintenance and Troubleshooting”.

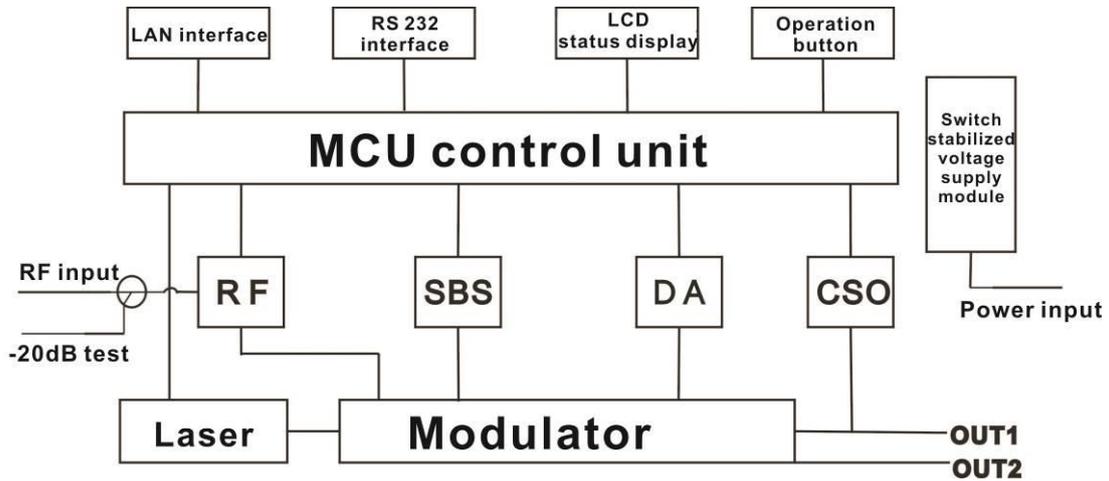


Figure 2-1 Working Principle

## 2.2 Panel Introduction

### 2.2.1 Front Panel Layout

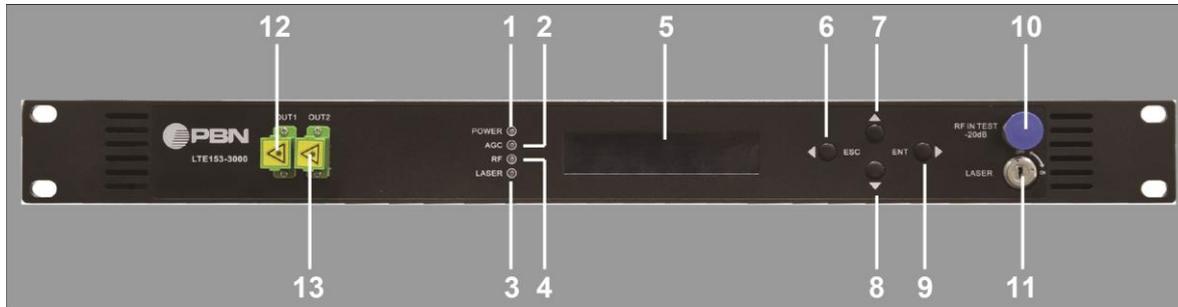


Figure 2-2 Front Panel Layout

Table 2-1 Front Panel Components

No.	Component Name	No.	Component Name
1	Power Indicator	8	Down Key
2	AGC Indicator	9	Enter Key
3	RF Modulation Degree Indicator	10	-20 dB RF Input Test point
4	Laser Indicator	11	Key Switch of Laser
5	LCD	12	Optical Output Interface A
6	ESC Key	13	Optical Output Interface B
7	Up Key		

Table 2-2 Indicator Instruction

Indicators	Working Status of Transmitter	Indicator Status
Power Indicator	With single power supply	The indicator illuminates yellow.
	With dual power supplies	The indicator illuminates green.
AGC Indicator	Working in AGC mode	The indicator illuminates green.
	Working in MGC mode	The indicator is off.
RF Modulation Degree Indicator	Working normally	The indicator illuminates green.
	Working abnormally	The indicator flashes red.
Laser Indicator	Bias current, cooling current and output power are normal.	The indicator illuminates green.
	Bias current, cooling current and output power, any of them is abnormal.	The indicator flashes red.

## 2.2.2 Rear Panel Layout

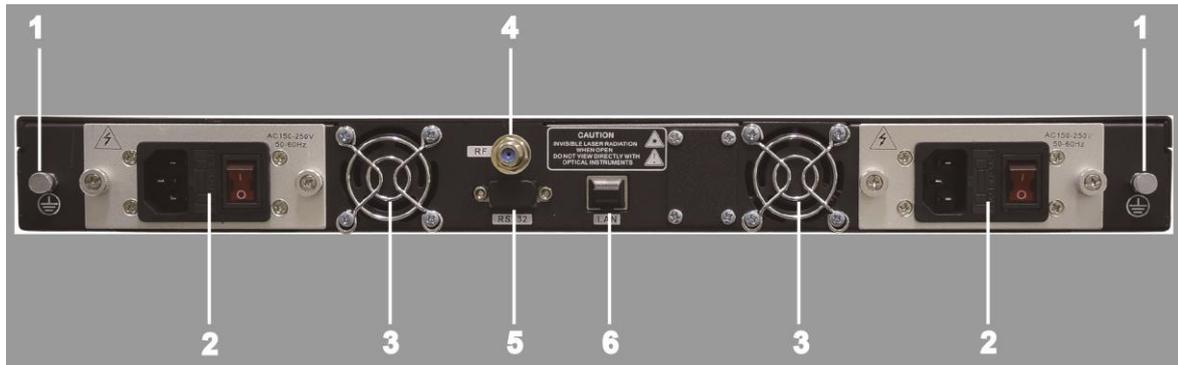


Figure 2-3 Rear Panel Layout

Table 2-3 Rear Panel Components

No.	Component Name	No.	Component Name
1	Ground Stud	4	RF Input Port
2	Power Module	5	COM Connector
3	Fan Module	6	LAN Interface

## 2.3 Power Module Panel Layout

### 2.3.1 220V Power Supply

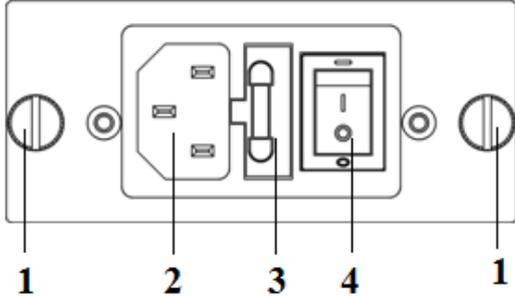


Figure 2-4 220V Power Supply

Table 2-4 220V Power Supply Components

No.	Component Name	No.	Component Name
1	Mounting Screws	3	Fuse
2	220V/110V Power Outlet	4	Power Switch

### 2.3.2 48V Power Supply

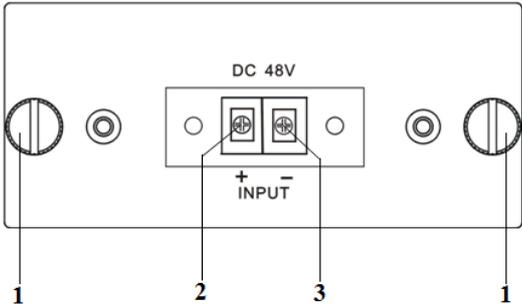


Figure 2-5 48V Power Supply

Table 2-5 48V Power Supply Components

No.	Component Name	No.	Component Name
1	Mounting Screws	3	Negative Terminal Block
2	Positive Terminal Block		

## 2.4 Menu Operation

### 2.4.1 Main Menu

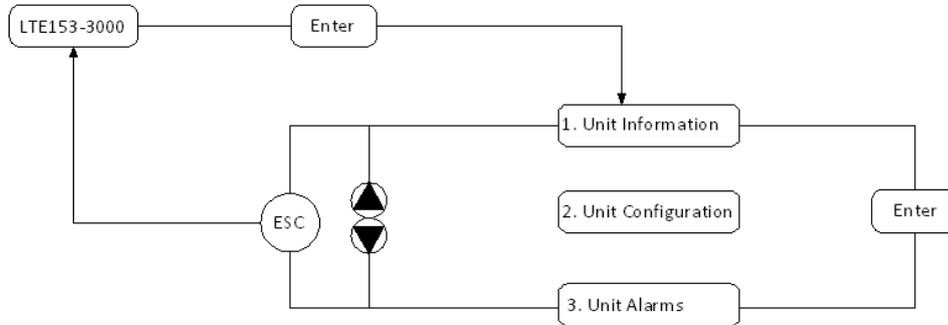


Figure 2-6 Main Menu

### 2.4.2 Display Menu

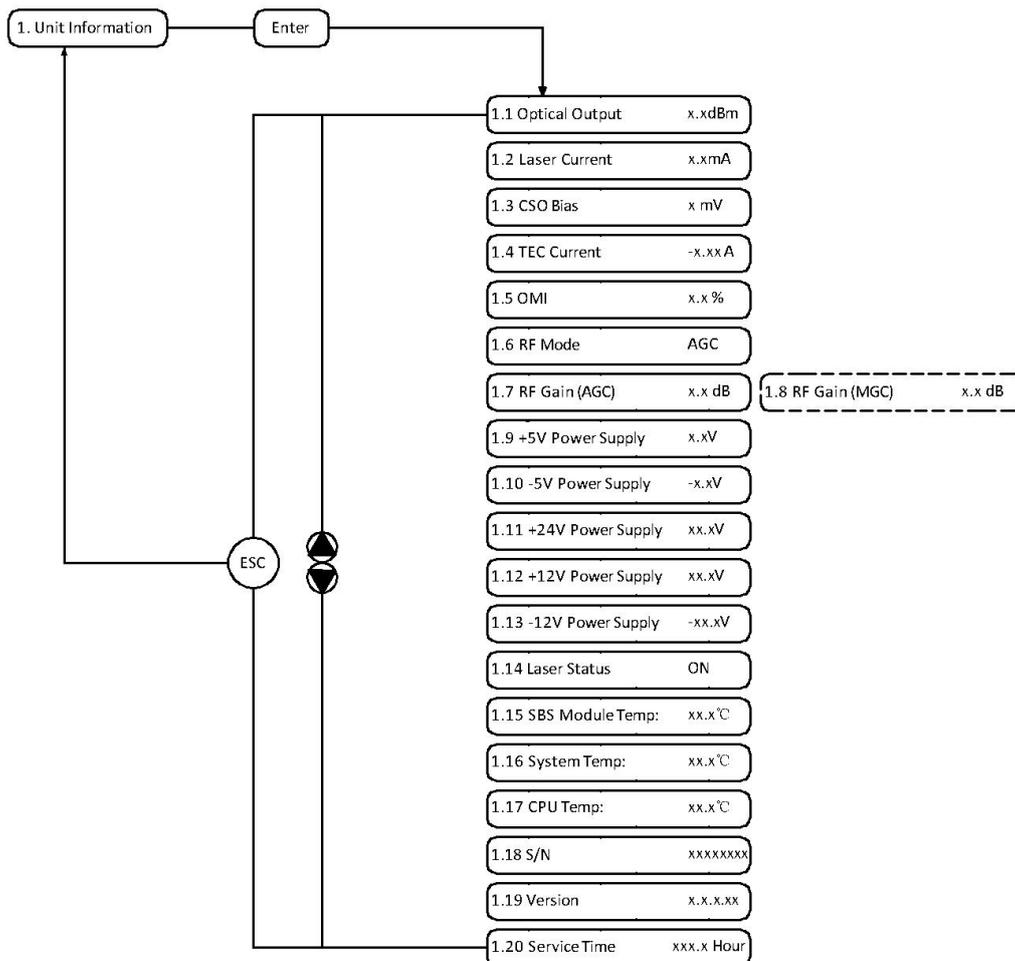


Figure 2-7 Display Menu

### 2.4.3 Configuration Menu

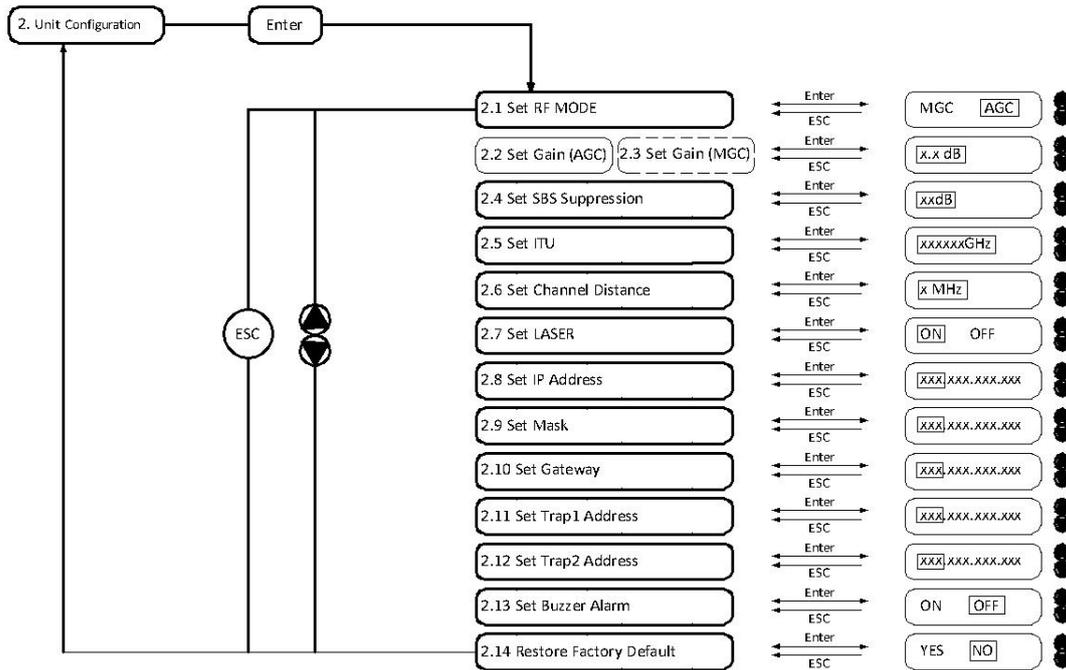


Figure 2-8 Configuration Menu

Table 2-6 Configuration Menu Instruction Table

Parameter	Description
2.1 Set RF MODE	Two modes selectable: MGC and AGC
2.2 Set Gain (AGC)    2.3 Set Gain (MGC)	MGC Range: 0 ~ 15 dB AGC Range: -3 ~ +3 dB
2.4 Set SBS Suppression	Rang, 13 ~ 19 dBm; 0.5 dB stepping
2.5 Set ITU	Range: ±50 GHz
2.6 Set Channel Distance	6 MHz, 7 MHz, 8 MHz (8MHz by default)
2.7 Set LASER	ON / OFF
2.8 Set IP Address	
2.9 Set Mask	
2.10 Set Gateway	
2.11 Set Trap1 Address	
2.12 Set Trap2 Address	
2.13 Set Buzzer Alarm	ON / OFF (OFF by default)

Parameter	Description
2.14 Restore Factory Default	

## 2.4.4 Alarm Menu

**Table 2-7 Alarm Menu Instruction Table**

Parameters	Alarm Contents
3.1 RF IN Status	HIGH (LOW)
3.2 Laser Current	HIGH (LOW)
3.3 TEC Current	HIGH
3.4 Output Power Status	HIGH (LOW)
3.5 -5V Power Supply	HIGH (LOW)
3.6 +5V Power Supply	HIGH (LOW)
3.7 +12V Power Supply	HIGH (LOW)
3.8 -12V Power Supply	HIGH (LOW)
3.9 +24V Power Supply	HIGH (LOW)
3.10 Laser	OFF
3.11 CSO Initialization failed	
3.12 Power Supply Failure	LEFT (RIGHT)

## 2.4.5 AGC Mode (Recommended)

This mode is the recommended mode and also the standard operation.

The optical transmitter will automatically adjust to the optimal gain while the input level is in the working range (see the technical data sheet). And the specified OMI (rms) modulation index will be automatic gain control.

## 2.4.6 MGC Mode

Special users, who need to adjust system CNR/CSO/CTB performance indexes to satisfy the specified requirements, can use this mode. The amplification gain attenuation range 0-15dB.

## 2.4.7 Frequency Adjust ITU in DWDM

To help DWDM applications, LTE153-3000 transmitter can adjust optical wavelength. The adjustable range is  $\pm 100\text{GHz}$ , 50GHz stepping. The button on the front panel or the Ethernet interface will complete the adjustment.

$\lambda = c/f$ ,  $c$  is the speed of light. It is the constant value.

$c=299792458\text{m/s}$ ,  $f$  is the frequency, its unit is Hz; eg frequency 193400GHZ, the corresponding wavelength is 1550.12nm.

In the 1545-1560nm band, the frequency distance and the wavelength distance is very similar to linear relationship.

50GHz frequency distance reflects to wavelength is very approximate to 0.4nm width;

As the same, 100GHz frequency distance reflects to wavelength is very approximate to 0.8nm width.

### **2.4.8 SBS Suppression Adjustment**

SBS value is very important in 1550nm long-distance transmission system. Stable continuous coherent light source, add +6 dBm optical power in the standard single mode fiber may occur SBS phenomenon. Ultrahigh SBS threshold will reduce CNR and CSO low-frequency indicators.

High SBS threshold will also influence self phase modulation (SPM) and reduce high-frequency CSO indicator.

When meet the conditions, as far as possible to use a low threshold SBS.

## 3 Installation

### 3.1 Receiving and Inspecting

As you unpack your unit, inspect the shipping container and equipment for damage. Save the shipping material for future use. If the container or the equipment is damaged, notify both the freight carrier and us.



General Warning

#### **CAUTION!**

**To protect yourself from potential injury and to protect the equipment from further damage, do not perform any operational tests if the equipment appears to be damaged.**

### 3.2 Precautions

Heed the following precautions when working with the LTE153-3000 transmitter.



General Warning

#### **WARNING !**

**Read the installation instructions before connecting the system to the power source.**

**The plug-socket combination must be accessible at all times, because it serves as the main disconnecting device.**

### 3.3 Mounting

#### 3.3.1 Mounting in the Rack

Mounting the LTE153-3000 transmitter in the standard 19 inch equipment rack:

1. Place the equipment in the rack.
2. Use four screws fixed the mounting lug on the LTE153-3000 transmitter front panel to the rack.
3. Reliably ground the equipment. The ground terminal is on the rear panel.
4. Visually inspect each key (button) on the front panel to ensure that it is not trapped under the edge of its hole. If a key is trapped, tap the key to enable it to move freely.

#### 3.3.2 Connecting the RF Cables

Verify the RF input F connector type according to the ordering information, then screw on the matched RF cable.

#### 3.3.3 Connecting the Optical Fiber Cables

LTE153-3000 transmitter has two output optical connectors.

1. Verify the matched fiber cable connector type according to the ordering information.
2. Verify that the fiber cable connector has been cleaned properly. If the fiber cable connector needs to be cleaned, follow the cleaning procedure outlined in “Cleaning Patch Cord or Pigtail Fiber Optical Connectors”.
3. Verify that the optical connector has not been exposed to any contamination. **Any contamination of optical connector can significantly degrade optical link performance. This degradation will most likely manifest itself as poor signal-to-noise (SNR) performance.**
4. Note to butt the nick of the connectors and align them accordingly.



Laser Radiation

### **DANGER !**

**The fiber carries invisible laser radiation. AVOID DIRECT EXPOSURE TO BEAM. Never operate the unit with a broken fiber or with a fiber connector disconnected.**

### **3.3.4 Connecting the Ethernet Cable**

You can connect the LTE153-3000 transmitter to your TCP/IP network in order to monitor and control the transmitter remotely. After you complete the installation procedures described in this chapter, you can use a network management system (NMS) to monitor and control the LTE153-3000 transmitter.

To connect the LTE153-3000 transmitter, you must use a shielded and grounded Category 5 Ethernet cable.

To connect the Ethernet cable:

1. Connect an Ethernet cable to the transmitter’s RJ-45 Ethernet port and to your TCP/IP network. The Ethernet port is on the built-in transponder of the transmitter.
2. Verify that the green Link LED is illuminated, indicating that there is a connection. The Link LED is above the Ethernet port on the rear panel.

### **3.3.5 Connecting Power**

The LTE153-3000 transmitter is available in an AC power model or DC power model. After mounting the LTE153-3000 TRANSMITTER in a rack, follow the power connection procedure below for the model that you are installing.

The AC-powered LTE153-3000 transmitter has two optional power supplies 110V and 220V:

- 110V power supply has two 110 VAC (50/60 Hz) input connector that requires input voltage from 90 to 130 VAC, at 50 to 60 Hz single phase. The AC power plug is located on the rear panel.

- 220V power supply has two 220 VAC (50/60 Hz) input connector that requires input voltage from 150 to 265 VAC, at 50 to 60 Hz single phase. The AC power plug is located on the rear panel.

The DC-powered LTE153-3000 transmitter has two -48 VDC input connectors that require input voltage from -36 to -72 VDC. The DC input connectors are located on the rear panel.

Turn on the power source. It takes about 60 seconds for all systems to operate. When connect one power supply, the power indicator is yellow; when connect two power supplies, the power indicator is green.

## 4 Communication Setting

### 4.1 Remote Monitoring: SNMP

#### 4.1.1 LAN Communication Interface

Adopt RJ45 standard connector, the pin definitions are shown in Table 4-1 below.

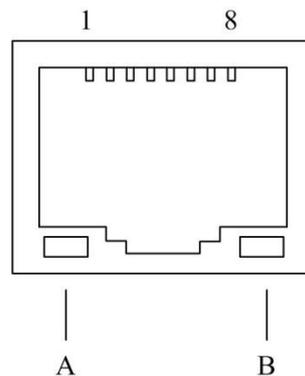


Figure 4-1 LAN Communication Interface

Table 4-1 Pin Definitions

Pin No.	Definition	Pin No.	Definition	Pin No.	Definition
1	TX+	4	-	7	-
2	TX-	5	-	8	-
3	RX+	6	RX-		
A	Green indicator flashing means that the LAN port is sending data.				
B	Yellow indicator means that the network connection is normal.				

#### 4.1.2 SNMP Basic Background

Simple Network Management Protocol (SNMP) is an application layer protocol. It makes the management information between network devices exchange easier. It is part of the TCP / IP protocol group. SNMP enables the end-users to manage network performance, find and solve network problems, and arrange for future network upgrades.

Management Information Base (MIB) is the organized hierarchical information set. Use SNMP to visit these MIB. They are composed of manageable information, and identified by the object identifier.

#### 4.1.3 SNMP

##### Transmitter configuration of network communication

When the transmitter initial work, the IP address and gateway are in the default state, you need to configure them. The configuration of initial state can be achieved through the RS-232 interface or the front panel keys.

## 4.2 Web Network Management

Open the IE browser, type the IP address (factory default: 192.168.25.168), enter the Log-in interface as shown in Figure 4-2.

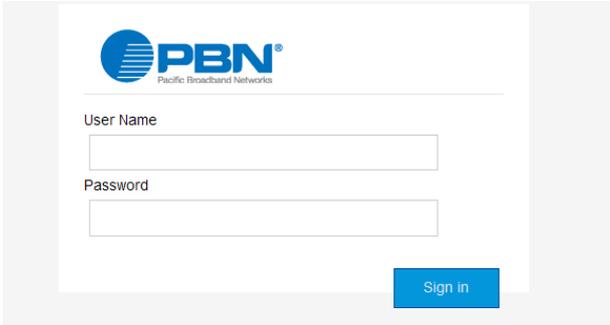


Figure 4-2 Log-in Interface

Type the user name (“admin” by default) and the password (“123456” by default), enter the following interface.

The image shows the PBN web management interface. On the left is a navigation menu with three items: 'Information and status' (highlighted in blue), 'Configuration', and 'User Management'. The main content area is titled '1550nm Externally Modulated Optical Transmitter'. It is divided into two sections: 'Module Information' and 'Module Status'.  
**Module Information**

Device Model:	LTE153-3000	Device Name:	Optical Transmitter
Serial Number:	14031544	MAC Address:	00.0b.05.63.3d.89

  
**Module Status**

Optical Power:	9.4dBm	Laser Bias:	172.8mA
Laser TEC:	-180mA	OMI(rms):	0.4%
Laser Control:	ON	+5V:	5.0V
-5V:	-5.0V	+24V:	23.5V
+12V:	11.9V	-12V:	-11.4V
MCU Temp:	54.6°C	SBS Temp:	36.2°C
Device Temp:	34.7°C		

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Figure 4-3 Information and Status Interface

There are 3 sub-interfaces:

1. Information and status interface (see Figure 4-3): Mainly described the basic information of the equipment.
2. Configuration interface (see Figure 4-4): the equipment’s parameters and IP address can be

configured here.

**1550nm Externally Modulated Optical Transmitter**

Unit Information

Item	Current	Config	Submit
Channel Spacing:	8MHz	8 MHz	Submit
Gain Control Type:	AGC	MGC	Submit
AGC Gain:	0.0dB	-3 dB	Submit
MGC Gain:	11.0dB	0 dB	Submit
Laser Power:	ON	OFF	Submit
Wavelength Offset:	193400GHz	-50 GHz	Submit
SBS Set:	16.0 dBm	13	Submit

IP Address Set

Item	Current	Config	Submit
Static IP Address:	192.168.25.188	[ ][ ][ ][ ]	Submit
Subnet Mask:	255.255.255.0	[ ][ ][ ][ ]	Submit
Default Gateway:	192.168.25.1	[ ][ ][ ][ ]	Submit
SNMP Trap Address 1:	192.168.25.24	[ ][ ][ ][ ]	Submit
SNMP Trap Address 2:	192.168.25.25	[ ][ ][ ][ ]	Submit
Enable the new address			Reboot

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**Figure 4-4 Configuration Interface**

Item columns list the parameters that can be changed, the Current column lists the present parameter values, the Config column can select or type the new parameter values, and the Submit column can update the parameters.

The steps to change the parameters: find the item in the Item column, select the new parameter values in the Config column, and click the corresponding Submit button to update the parameters.

The change steps in the IP Address Set are the same, but finally need to click the Reboot button to take effect.

Clicking the Reboot button will auto reboot the device.

3. Set Parameters interface (see Figure 4-5): reset the username and password in this interface.

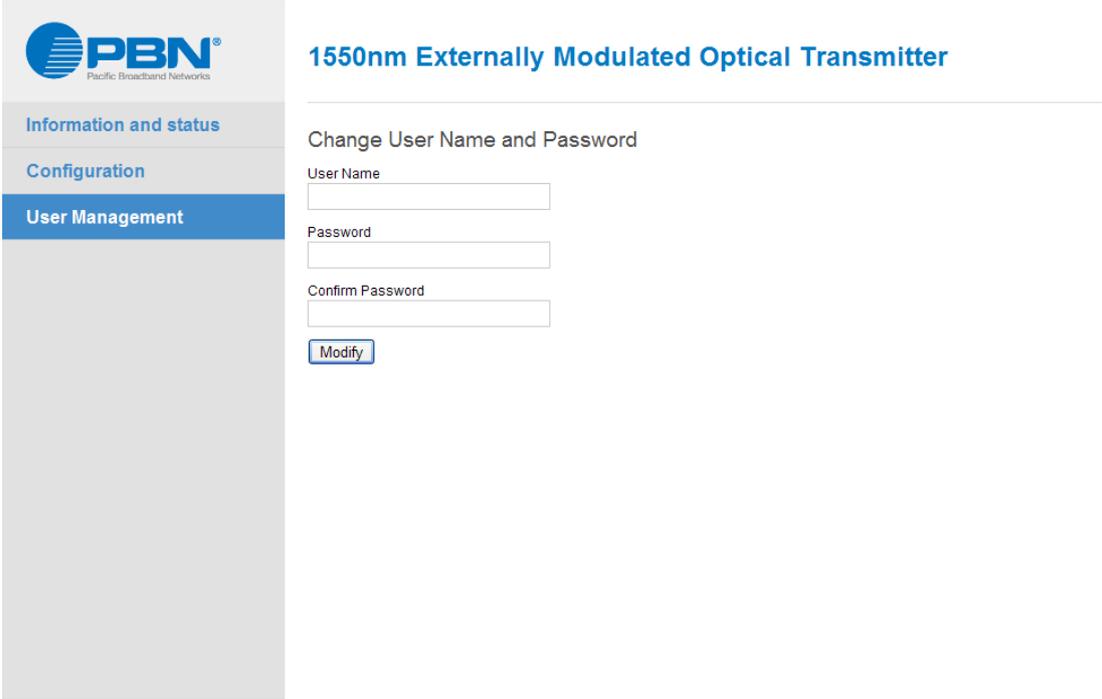


Figure 4-5 User Management Interface

## 5 Maintenance and Troubleshooting

**Table 5-1 Maintenance and Troubleshooting**

Indicator Status	Alarm Menu Content	Fault Phenomenon	Solution
Power indicator is yellow	Power Invailed LEFT (RIGHT)	The left (right) power is break down or the power cord is not plugged in	Plug in the left (right) power cord. If that does not correct the problem, contact Customer Service. Replace the power supply.
Power indicator is flash yellow	-5V Status HIGH (LOW) +5V Status HIGH (LOW) +12V Status HIGH (LOW) -12V Status HIGH (LOW) +24V Status HIGH (LOW)	Power alarm menu shows one of the contents. The laser is off.	Contact Customer Service.
RF indicator is flash red	RF IN Status LOW (HIGH)  CSO Initialization failed	RF input is low (high)  CSO nonlinearity indexes are poor	Verify the optical transmitter is operating within the proper input level threshold range (78-96dBμV).  If that does not solve the problem, contact Customer Service.  Disconnect the RF connection, wait 10 seconds before reconnecting the RF signal.
Laser indicator is flash red	Laser Bais HIGH  Laser TEC HIGH	The laser is off  The laser is off	Contact Customer Service.  Verify that the unit is operating within the proper temperature range (-5 ~ +45°C).  Verify that nothing is obstructing airflow through the openings in the front and back of the unit.  Recall factory settings by pressing the key on the front panel (see the chapter "2 Introduction").  If that does not correct the problem,

Indicator Status	Alarm Menu Content	Fault Phenomenon	Solution
			contact Customer Service.
	OutPutPower Status HIGH (LOW )	The laser is off	Reboot the equipment. If that does not correct the problem, contact Customer Service.
None	None	The optical output power is lower than the nominal value	Check the fiber connector. If that does not correct the problem, contact Customer Service.

## 6 Product Warranty

Pacific Broadband Networks warrants the ODN2000 and LE2000 for a period of one year from the date of shipment. The liability of Pacific Broadband Networks under this warranty is solely limited to repair and replacement.

Pacific Broadband Networks is not 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 judgment is at the laser vendor's discretion.

Repairs referred to Pacific Broadband Networks' qualified service personnel must meet the following conditions:

1. The warranty registration has been completed and received by Pacific Broadband Networks.
2. PBN's helpdesk is promptly notified in writing or by telephone that a failure has occurred or a defect was found.
3. PBN has determined that the equipment was not abused, misused, or operated under conditions outside manufacturer's specifications.
4. When returning a product, the return authorization number obtained from PBN must be clearly marked on the product or the outside of the shipping container and the package must include all relevant documents.
5. The customer is responsible for all shipping and handling charges. C.O.D. and freight collect will not be accepted without prior approval from PBN.

The warranty does not cover the following:

1. Products purchased from someone other than PBN or an authorized PBN dealer.
2. Damage caused by accident, negligence, misuse, abuse, improper operation, or failure to operate the equipment within the manufacturer's specifications.
3. Damage caused by fluctuation in electrical current, lightning, power surges, etc.
4. Damage resulting from an overhaul, repair, or attempt to repair caused by someone other than PBN's qualified service personnel.
5. Any product for which 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 damages.



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