QUESTTEL

Broadcast Systems

CATV 32 mW RF Optical Transmitter 47-750/862/1003 MHz

User Manual

L-RF-32mW-TX

Foreword

This manual applies to 1310nm AM direct modulated optical transmitter with SNMP network management interface. It mainly describes the performance characteristics, technical parameters, installation and debugging, common troubleshooting, and other related content of the product. In order to ensure that the equipment can be successfully installed and safely operated, please read this manual carefully before installing and debugging the equipment. And the installation and debugging should be strictly according to the specified steps on the manual to avoid unnecessary damage to equipment or accident harm to the operator. Any questions, please contact with us in time.

Special Tips:

- Optical transmitter is professional equipment, and its installation and debugging must be operated by special technician. Read this manual carefully before operating to avoid damage to equipment caused by fault operation or accident harm to the operator.
- While the optical transmitter is working, there is an invisible laser beam from the optical output adapter on the front panel. Avoiding permanent harm to the body and eye, the optical output should not aim at the human body and human should not look directly at the optical output with the naked eye!
- Please make sure that the ground terminal of the case and power outlet has been reliably grounding before turning on the power (Grounding resistance should be less than 4Ω) to prevent the static damage the pump laser device and harm to human because of case charged.
- To ensure the equipment can work stable over a long time in voltage unsteady or poor voltage wave region, it´s recommend to the customer that he equips special AC regulated power supply, or even AC uninterrupted power supply (UPS) system for conditional regions. In the region with large temperature variation environment (The equipment's ideal work environment temperature is 25°C) or bad room environment it´s recommend to the customer that he equips special air-condition system to improve the work environment.

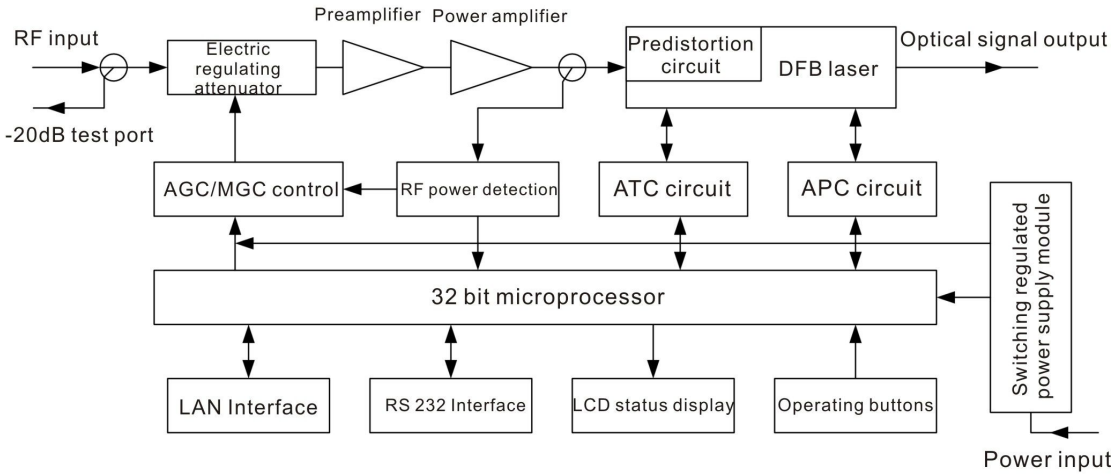
1. Product Summary

1310nm AM direct modulated optical transmitter is the most important equipment to construct the CATV HFC network. It mainly used for the long distance optical fiber transmission of TV image signal, digital television signal, telephone voice signal and data (or compressed data) signal. This product does use the high-performance DFB laser as the optical source. The RF drive part adopts RF power digital automatic processing technology and advanced RF pre-distortion circuit, and built-in microcomputer automatic monitoring system, to ensure the excellent performance indicators.

2. Performance characteristics

- Adopt high-performance coaxial/butterfly DFB laser, narrow spectral lines, good linearity and high output power.
- The RF drive part adopts the RF power digital automatic processing technology. Automatic processing the drive level power according to the RF input signal level and the number of channels (15-84 channels), make the CSO, CTB and C/N index always at the optimal value to ensure the overall performance.
- Advanced multi-frequency RF pre-distortion technology, combined with the GaAs device, effectively improve the CATV system most important CTB and CSO index, C/N index also gets the maximum upgrade.
- Adopt advanced 32 bit processor; coordinate with perfect automatic monitoring system circuit. It can timely and accurately monitor working status of the laser to ensure a stable optical output power and effectively extend the working life of the laser.
- Built-in blue screen 160×32 dot matrix LCD monitor on the front panel, accurately showing all working status parameters.
- 19″1U standard rack mount, equipped standard IEEE802.3 10Base-T Ethernet interface and RS232 interface, can expediently realize network management monitoring.
- Fully support <GB/T 20030-2005 HFC Network device management system specification>.

3. Block Diagram



Note: Adopts butterfly DFB laser or coaxial DFB laser.

4. Technology Parameters

4.1 Link test conditions

Special instructions: The performance parameters of this manual according to the measuring method of GY/T 143-2000 <Specifications and methods of measurement on AM optical transmitter and receiver used in CATV systems>, and tested under the specified test conditions.

Test condition: With standard optical fiber and standard optical receiver composed the test link. Set 84 PAL-D analog TV channel signal at 750MHz frequency range under the specified link loss. When the optical input power of optical receiver is -1dBm, measure the C/CTB, C/CSO and C/N.

4.2 Technique Parameters Table

Item	Unit	Technique parameters											
Optical output power	mW	4	6	8	10	12	14	16	18	20	22	24	26
Optical link loss	dB	7	9	10	11	11.8	12.5	13	13.6	14	14.4	14.8	15.1
Optical wavelength	Nm	1310±20											
Laser type		DFB laser											
Optical modulation mode		Direct optical intensity modulation											
Optical connector type		FC/APC or SC/APC											
Frequency range	MHz	47-750/862/1003											
RF input level	dBμV	72-88											
Flatness in band	dB	±0.75											
RF input impedance	Ω	75											

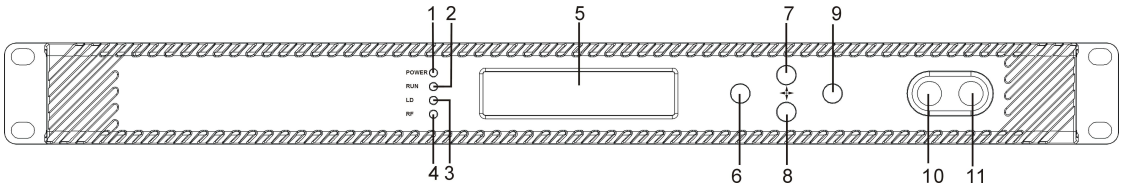
Input return loss	dB	≥ 16（47-550MHz）; ≥ 14（550-750/862/1003MHz）
C/CSO	dB	≥ 60
C/CTB	dB	≥ 65
C/N	dB	≥ 51
AGC control range	dB	±5
MGC control range	dB	0-10
Power supply voltage	V	AC 110V-250V（50Hz）
Consumption	W	30
Operating temperature	°C	0 -- 45
Storage temperature	°C	-20 -- +65
Relative humidity	%	Max 95% no condensation
Dimension	mm	483（L）×380（W）×44（H）

4.3 Optical link carrier to noise ratio degradation table

Optical power	**Optical link loss (dB)**														
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4mW	53.8	52.8	51.8	51	50.1	49.2	48.2								
6mW				53.0	52.0	51.0	50.1	49.1	48.1						
8mW					52.8	51.9	51.0	50.1	49.2	48.2					
10mW						52.9	51.9	51.0	50.1	49.1	48.2				
12mW							52.7	51.8	50.8	49.9	49.0	48.0			
14mW								52.4	51.5	50.5	49.5	48.6	47.8		
16mW									52.0	51.0	50.1	49.1	48.1		
18mW									52.5	51.6	50.6	49.7	48.7	47.9	
20mW										51.9	51.0	50.0	49.0	48.0	
22mW										52.2	51.4	50.4	49.4	48.6	47.8
24mW											51.5	50.3	49.2	48.5	47.7
26mW											51.5	50.2	49.2	48.5	47.6

5. External Function Description

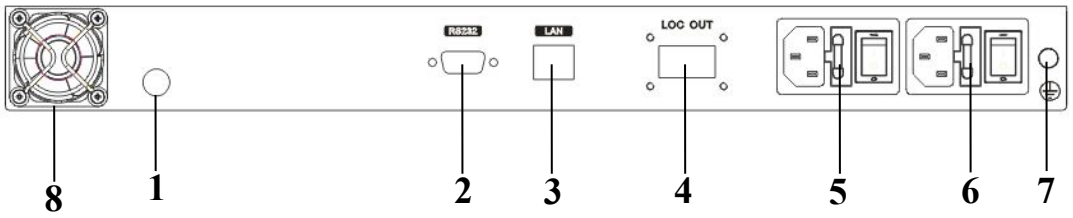
5.1 Front Panel Description



Schematic diagram of the front panel

1) Power indicator: The light is on while the switching power supply inside is working.
2) Device running indicator: This indicator will flash after the device start running.
3) Laser working status indicator: Red light means the laser is not working, but the machine parameters are normal; flashing red light means the machine has broken down, related fault reason see the alarm menu of the display menu; green light means the laser is working normal.
4) RF status indicator: Flashing red light means the RF input signal is warned; green light means RF input signal is normal.
5) 160×32 dot-matrix LCD screen: used to display all the parameters of the machine.
6) Display the exit or cancel key of the setup menu.
7) Display the up or increase key of the setup menu.
8) Display the down or decrease key of the setup menu.
9) Display the enter key of the setup menu.
10) Laser switching key: used to control the working status of laser. “ON” means the laser is open and “OFF” means the laser is closed. Ensure the key is on “OFF” position before power on. After passing self-test, rotate the key to “ON” position according to the displayed message.
11) RF input signal test port: -20dB test port of the rear panel RF input port.

5.2 Rear Panel Description



Schematic diagram of the rear panel

1) RF signal input.
2) RS232 interface (Console): Used for configuring the network management parameters.
3) LAN interface: correspond with IEEE802.3 10Base-T, used for network management.
4) Optical signal output: This interface is the optical signal output port of the device. The connector type is FC/APC. There is an invisible laser beam from this port while working normal. So the port should not be aligned to human body or naked eye to avoid accidental injury.
5) Power input 1(Reserved port, configured dual power or not is decided by the user).
6) Power input 2.
7) Ground stud of the chassis: used for the connection of the device and ground wire.
8) Fan outlet.

5.3 Displayed Parameter description

1) Power on, if the key is on the off position, shows:

Product's Logo and model

2) Turn the key to the on position, shows the turn on delay:

Delay countdown

3) After entering the system:

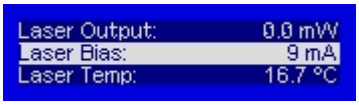
RF input signal level and optical output power at present

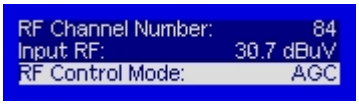
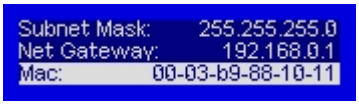
4) Press "Enter" key into the menu index

1. Parameter menu; 2. Set parameters; 3.Alarm menu

5) Sub-menu of parameters

Press "Enter" key into the menu

Content	Meaning
	Optical output power of the laser at present
	Bias current of the laser at present
	Internal temperature of the laser
	Operating current of the laser thermoelectric cooler
	Transmission channel number of the system
	Laser RF signal level at present

	RF control mode at present
	The offset of control level in the AGC mode
	The attenuation of electrically controlled attenuator in the MGC mode
	Switching power supply output +5V supply voltage
	Switching power supply output -5V supply voltage
	Switching power supply output +24V supply voltage
	Serial number
	Internal temperature at present
	IP address
	Subnet Mask
	Gateway
	MAC address
	Software system version

6) Setting menu

Press “Enter” key into the menu

Content	Meaning
	Set the displayed optical power unit
	Turn on or off the buzzer alarm
	Set the control mode of the RF signal: AGC or MGC
	Set the attenuation of MGC
	Set the offset of AGC start control level
	Set system transmission channels number. This parameter is used to correct the accuracy of displayed laser RF signal level
	Set IP address
	Set subnet mask
	Set gateway

7) Warning menu

Press “ENTER” into the alarm menu

6. Installation debugging

6.1 Unpack and Check

1. Insure the package is not defaced. If it has any damage or water mark, please contact local agency or carrier.
2. After unpacking, check equipments and accessories according to package list. Any question, please contact local agency or our company.
3. If you think the equipment has been damaged, please don't electrify to avoid worse damage. Please contact local agency or our company in time.

6.2 Instruments and tools

1. An optical power meter;
2. A digital multimeter;
3. A standard optical fiber test jumper (FC/APC or SC/APC);
4. Some absolute alcohol and medical cotton wool;

6.3 Installation steps

1. Before installing the equipment, please read the <User's manual> carefully and install the equipment according to the <User's manual>. **Note:** For the man-made damage and other all consequence caused by error installation that not according to the <User's manual>, we will not be responsible and will not supply free warranty.
2. Take out the device from the box; fix it to the rack and reliably grounding. (The grounding resistance must be < 4Ω).
3. Use the digital multimeter to check the supply voltage, make sure the supply voltage comply with the requirements and the switch key is on the “OFF” position. Then connect the power supply.
4. Input the RF signal, turn the switch key to the “ON” position and observe the front panel LED status. After the LED working status indicator turn into green, the device is working normal. Then press the menu button on the front panel to check the working parameters.
5. Connect the optical power meter to the optical signal output end by the standard optical fiber test jumper, then measure the optical output power. Affirm the measured optical output power and the displayed power are the same and have reached the nominal value. (Affirm the optical power meter is on 1310nm wavelength test position; the optical fiber test jumper is the matched one and on the connector surface has no pollution). Remove the standard optical fiber test jumper and optical power meter; connect the device to the network. So far, the device has been completely installed and debugged.

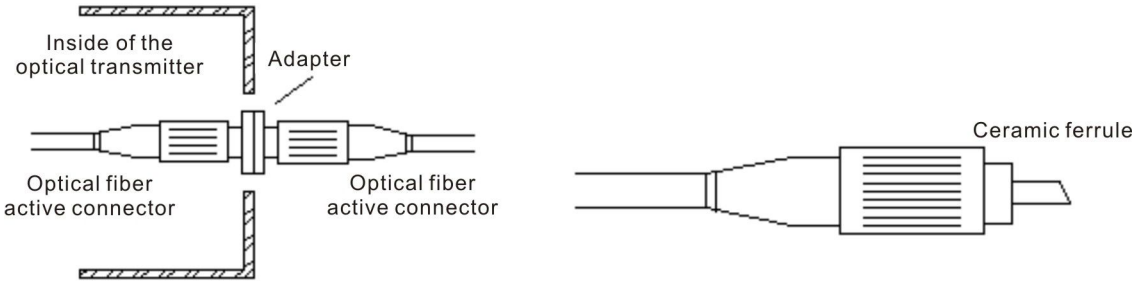
7. Common Failure Analysis and Troubleshooting

Failure phenomenon	Failure cause	Solution
Power on, the front panel display screen and power indicator are both off.	Switching power supply couldn't start; equipment; internal DC power supply is not working.	Check if the power supply is normal (should be AC: 110V-250V). If the supply voltage is normal, it could be a failure of switching power supply module. Please contact the dealer or our company.
Power on; the display screen is off, only the power indicator is on.	The internal microprocessor is not working.	Please contact the dealer or our company.
Power on; the optical output power displayed on the front panel display screen and laser status indicator are both normal, but the actual measured optical output power is low.	1. The poor quality of the test jumper. 2. The active fiber connector or adapter may be contaminated. 3. The ceramic tube in the adapter may have been broken.	1. Replace with good quality test jumper. 2. Clean the contaminated active fiber connector or adapter. Specific operation methods see “The clean and maintenance method of optical fiber connector”. 3. Replace the damaged adapter.
After initial startup, the image of the optical contact point has obvious netlike curve or large particles highlights.	1. The received optical power of the optical contact point is too high; the output level of the optical receiver module is too high and intermodulation index of RF signal deteriorates. 2. The RF signal input of the optical transmitter is too high; beyond the device AGC control range, results in deterioration of the intermodulation index. 3. The intermodulation index of RF signal input of the optical transmitter itself is poor.	1. Check the received optical power of the optical contact point and make appropriate adjustments. 2. Check the input level of the optical transmitter RF signal, and adjust to the device required input range. (RF signal input level should be 72--88dBμV). 3. Check the intermodulation index of the RF signal input of the optical transmitter and make appropriate adjustments.
After initial startup, the image of the optical contact point has obvious noises.	1. The received optical power of the optical contact point is not high enough, results in decrease of C/N. 2. The RF signal level input of the optical transmitter is too low; make modulation degree	1. Recover received optical power of the optical contact point by cleaning the active fiber connector or. Specific operation methods see “Clean and maintenance methods of optical fiber connector”. 2. Check the RF signal level input of

	of the laser is not enough. 3. The C/N index of system link signal is too low.	the optical transmitter and adjust to the device required input range. (72--88dBμV). When the input channel number less than 15, set to the MGC control mode. 3. Use a spectrum analyzer to check the system link C/N and make appropriate adjustments. Make sure the system link signal C/N > 51dB.
After initial startup, the image of several optical contact points randomly appear obvious noises or bright trace.	The optical contact point has open circuit signal interference or strong interference signal intrusions.	1. Check if there is a strong interference signal source; change the optical contact point location if possible to avoid the influence of strong interference signal sources. 2. Check the cable lines before the optical contact point, the shielding net or the RF connector shielding effect is not good. 3. Close the equipment enclosure tightly to ensure the shielding effect; if possible add shielding cover to the optical contact point and reliable grounding.
After initial startup, at optical contact points, the image of several channels have obvious noises.	The C/N indexes of these channels are too low.	Check the C/N of these channels signal and make appropriate adjustments.
After initial startup, the image of several optical contact points appear one or two horizontal bright traces.	Power supply AC ripple interference because of the bad earth of equipment or power supply.	Check grounding situation of the equipment; make sure that every equipment in the line has been reliably grounding and the grounding resistance is < 4Ω.
After initial startup, the received optical power of the optical contact point is unstable and has large continuous change. The RF output signal is unstable too. But the detected optical output power of the optical transmitter is normal.	The fiber connector types do not match, maybe the APC type connect to PC type, make the optical signal cannot normal transmission. The active fiber connector or adapter may be contaminated seriously or the adapter has been broken.	1. Check the fiber connector type; adopt the APC type fiber connector to ensure the normal transmission of optical signal. 2. Clean the contaminated active fiber connector or adapter. Specific operation methods see “The clean and maintenance method of optical fiber connector”. 3. Replace the damaged adapter.

The Clean and Maintenance Method of Optical Fiber Connector

In many times, we consider the decline of the optical power as the equipment faults, but actually it may be caused by that the optical fiber connector was polluted by dust or dirt. Inspect the fiber connector, component, or bulkhead with a fiberscope. If the connector is dirty, clean it with a cleaning technique following these steps:



1. Turn off the device power supply and carefully pull off the optical fiber connector from the adapter.
2. Wash carefully with good quality lens wiping paper and medical absorbent alcohol cotton. If use the medical absorbent alcohol cotton, still need to wait 1~2 minutes after wash, let the connector surface dry in the air.
3. Cleaned optical connector should be connected to optical power meter to measure optical output power to affirm whether it has been cleaned up.
4. When the cleaned optical connector screwed back to adapter, should notice to make force appropriate to avoid ceramic tube in the adapter crack.
5. The optical fiber connector should be cleaned in pairs. If optical power is on the low side after clean, the adapter may be polluted, clean it. (Note: Adapter should be carefully operated, so as to avoid hurting inside fiber.
6. Use compressed air or degrease alcohol cotton to wash the adapter carefully. When use compressed air, the muzzle aims at china tube of the adapter, clean the china tube with compressed air. When use degrease alcohol cotton, insert directions need be consistent, otherwise can't reach a good clean effect.

Special notice:

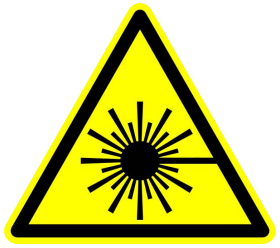
a. **In the process of clean the active optical fiber connector, you should avoid direct shining at eye, which will cause permanence burn!!!!**
b. **Use proper energy to install the active optical connector, or the ceramic tape in the adaptor will lead to break. Once the ceramic tape is broken, the optical output power will decrease rapidly. And turn the active optical fiber connector slightly, the optical output power changes obviously.**
c. **Please operate the optical fiber under the condition of shut off the pump laser. Or the high output power will lead to burn the joint of the optical output fiber, which will cause the output power decrease.**

Changes of the equipment lead to some disagree with this manual, without notice.

Safety Instructions

Read before operating equipment.

1. Cleaning - Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
2. Power Sources - Use supplied or equivalent UL/CSA approved low voltage DC plug-in transformer.
3. Outdoor Antenna Grounding - If you connect an outside antenna or cable system to the product, be sure the antenna or cable system is grounded so as to provide some protection against voltage surges and built-up static charges. Section 810 of the National Electrical Code, ANSI/NFPA No. 70, provides information with respect to proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding conductors, location of antenna discharge unit, connection to grounding electrodes, and requirements for the grounding electrode.
4. Lightning - Avoid installation or reconfiguration of wiring during lightning activity.
5. Power Lines - Do not locate an outside antenna system near overhead power lines or other electric light or power circuits or where it can fall into such power lines or circuits. When installing an outside antenna system, refrain from touching such power lines or circuits, as contact with them might be fatal.
6. Overloading - Do not overload wall outlets and extension cords as this can result in a risk of fire or electric shock.
7. Object and Liquid Entry - Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short out parts, resulting in a fire or electric shock. Never spill liquid of any kind on the product.
8. Servicing - Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.
9. Damage Requiring Service - Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
    - When the power supply cord or plug is damaged.
    - If liquid spills or objects fall into the product.
    - If the product is exposed to rain or water.
    - If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions. An improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
    - If the video product is dropped or the cabinet is damaged.
    - When the video product exhibits a distinct change in performance, this indicates a need for service.



WARNING !

This unit outputs continuous invisible light, which may beharmful to the eyes; use with caution. For additional safety, plug the attached dust caps into the optical transceivers when the fiber optic cable is unplugged. Direct viewing into optical connectors should be avoided at all times!