HG6145F

GPON Optical Network Terminal

Product Manual

Version: A

FiberHome Telecommunication Technologies Co., Ltd.

November 2020

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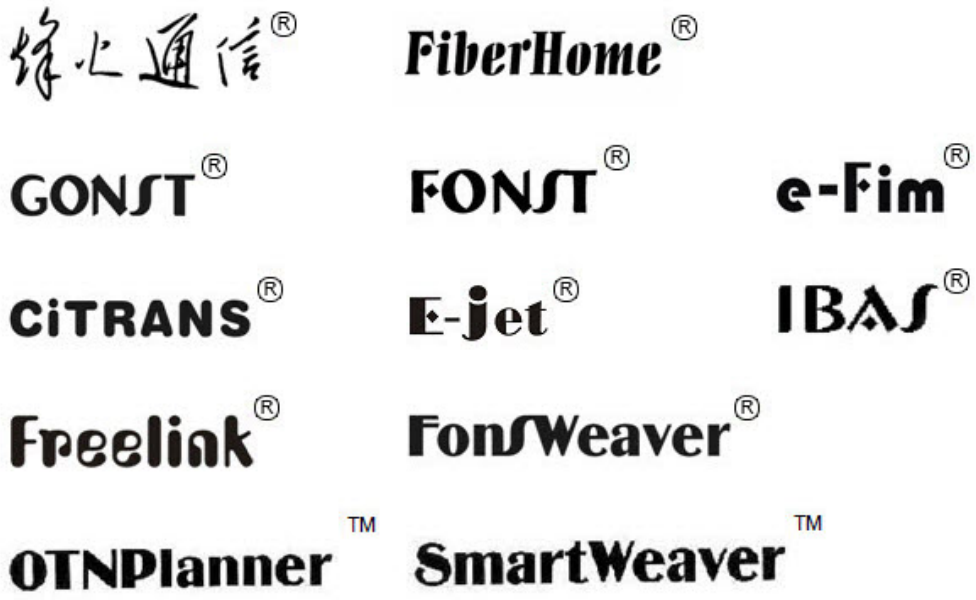

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Safety Precautions

For your correct and safe operations on the equipment, please carefully read and strictly observe the following safety instructions:

- High optical power can cause bodily harm, especially to eyes. Never look directly into the end of the optical transmitter fiber jumper or the end of its active connector.
- Exercise care if you must bend fibers. If bends are necessary, the fiber bending radius should never be less than 38 mm.
- Overloaded power sockets or damaged cables and connectors may cause electric shock or fire. Regularly check related electric cables. If any of them is damaged, replace it immediately.
- Use the power supply adapter provided in the package only. Using other adapters may cause equipment damage or operation failures.
- Install the equipment in a well ventilated environment without high temperature or direct sunlight to protect the equipment and its components from overheating, which can result in damage.
- Disconnect the power in lightning weather and disconnect all the wires and cables on the device (such as the power cable, network cable and phone cable), so as to prevent device from being damaged by lightning.
- Do not place this equipment in damp or near moisture environment. Water will lead to abnormal operation of device and even the danger caused by short circuit.
- Do not lay this equipment on an unsteady base.

Contents

1 Documentation Guide

Document Orientation

HG6145F Product Manual introduces the positioning, features, functions, technical specifications of the ONT (Optical Network Terminal) product HG6145F as well as handling of common problems, so that readers can have an overall knowledge about the HG6145F.

Intended Readers

- Marketing personnel
- Commissioning engineers
- Operation and maintenance engineers

Version Information

Version	Version Information
A	Initial version

Content

Chapter	Content
Product Introduction	◆ Product positioning ◆ Product specifications ◆ Interface specifications ◆ Introduction to the HG6145F
Handling Common Problems	Introduces how to handle common problems encountered during product operation and service test, including abnormal status of indicator LEDs, failing to access the Internet, failure of voice service test, etc.
Standards and Protocols	International standards and communications protocols

2 Product Introduction

- ☑ Product Positioning
- ☑ Product Specifications
- ☑ Interface Specifications
- ☑ Introduction to the HG6145F

2.1 Product Positioning

The HG6145F is an FTTH-type GPON ONT. It provides users with communication and entertainment services in the form of data, voice, video, and so on, to meet the integrated access demand of families and small-scaled enterprises.

See Figure 2-1 for the network positioning of the HG6145F.

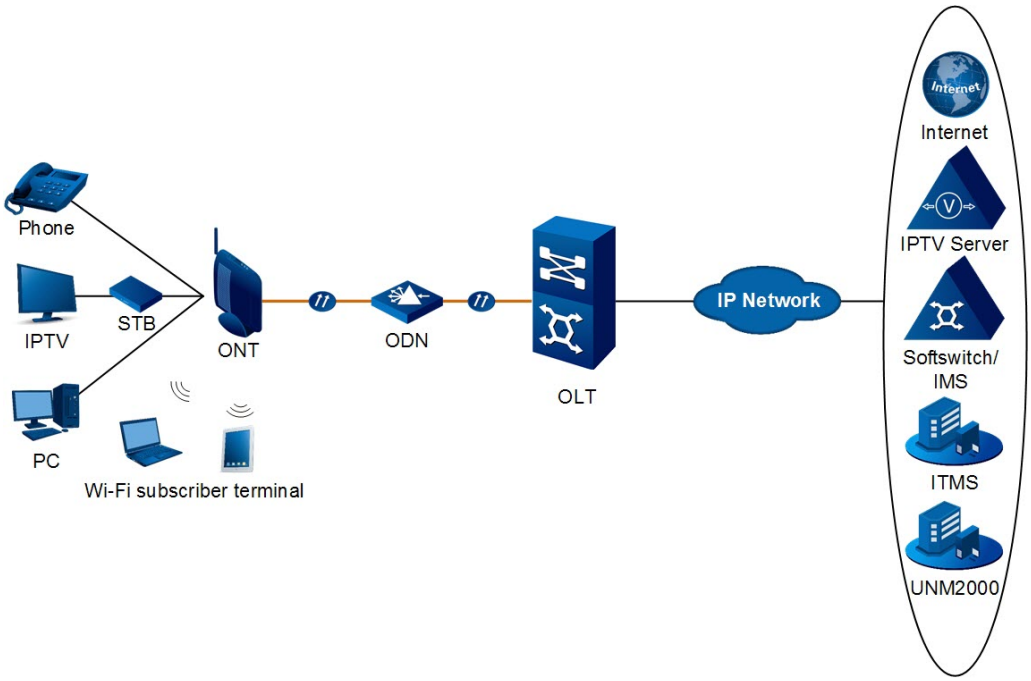

Figure 2-1 Network Application of the HG6145F

2.2 Product Specifications

The tables below list the interfaces on the HG6145F and the services supported by the ONT for users' reference on ONT configuration.

Table 2-1 Interfaces Supported by the HG6145F

ONT Type	Ethernet Interface Quantity	POTS Interface Quantity	Wi-Fi Interface	USB Interface Quantity	CATV Interface Quantity
HG6145F	4 (GE)	1	√ (2.4 GHz, 5 GHz)	2	-

Table 2-2 Service Types Supported by the HG6145F

ONT Type	Internet Service	Multicast Service	Voice Service	Wi-Fi Service
HG6145F	√	√	√	√
Note: “√”indicates “supported”; “×” indicates “not supported”.				

Service Reliability

The HG6145F supports MTBF up to 30 000 hours.

2.3 Interface Specifications

2.3.1 GPON Interface

Table 2-3 GPON Interface Specifications

Parameter	Specification
Standard compliance	ITU-T G.984, Class B+
Transmission rate	Rx: 2.5 Gbit/s; Tx: 1.25 Gbit/s
Interface mode	Single-mode
Interface type	SC/UPC
Maximum transmission distance	20 km
Central wavelength	Tx: 1310 nm; Rx: 1490 nm
Optical power	Tx optical power: 0.5 dBm to 5.0 dBm Rx optical power: -8 dBm to -29 dBm
Extinction ratio	More than 10 dB
Receiving sensitivity	-27 dBm to -29 dBm
Maximum overload optical power	-8 dBm

2.3.2 LAN Interface

Table 2-4 LAN Interface Specifications

Parameter	Specification
Standard compliance	IEEE 802.3ab
Interface type	RJ-45
Interface rate	10 Mbit/s, 100 Mbit/s or 1000 Mbit/s
Maximum transmission distance	100 m

Table 2-4 LAN Interface Specifications (Continued)

Parameter	Specification
Working mode	Supports full-duplex or half-duplex and 10/100/1000 M auto negotiation.
Specifications of the cable used	CAT-5 unshielded twisted pair

2.3.3 POTS Interface

Table 2-5 POTS Interface Specifications

Parameter	Specification
Interface type	RJ-11
Transmission rate	64 Kbit/s
Cable type	Twisted-pair cable
Line code	PCM

2.3.4 Wi-Fi Interface

Table 2-6 Wi-Fi Interface Specifications

Parameter	Specification
Standard compliance	IEEE 802.11 a/b/g/n/ac/ax
Operating band	2.4 GHz / 5 GHz
Specifications	Supports four SSIDs and 13 working channels for the 2.4 GHz band as well as four SSIDs and 24 working channels for the 5 GHz band. Supports automatic rate adjustment and launched power adjustment for both the 2.4 GHz band and the 5 GHz band.
Authentication mode	OPEN, SHARED, WPA-PSK, WPA2-PSK, WPA-PSK/WPA2-PSK, WPA3-SAE and WPA2-PSK/WPA3-SAE
Encryption mode	WEP, TKIP, AES and TKIP/AES

2.3.5 USB Interface

Table 2-7 USB Interface Specifications

Parameter	Specification
Standard compliance	USB2.0
Transmission rate	20 MB/s

2.4 Introduction to the HG6145F

2.4.1 Appearance

The following describes the appearance of the HG6145F, including the overall look, interfaces, buttons, and indicator LEDs.

Note:

The pictures here are only for reference.

Appearance

The overall appearance of the HG6145F is shown in Figure 2-2.

Figure 2-2 Overall Outlook of the HG6145F

Interface and Button

Table 2-8 Interfaces and Buttons of the HG6145F

Interface and Button	Description	Function
WPS	2.4G/5G WPS button	Enables or disables 2.4G/5G WPS.
WLAN	2.4G/5G WLAN button	Enables or disables 2.4G/5G WLAN.
Phone	Telephone interface	Connects to the user's telephone.
LAN1 to LAN4	Ethernet interface	Connects with the computer, IP router or IP set top box.
USB1, USB2	USB Host interface	Connects to the USB interface storage device.
Power	Power interface	Connects with the power adapter.
On/Off	Power switch	Turns on or off the power for the equipment.
Reset	Reset button	Pressing down the button for more than 5 seconds to restore the factory settings and reboot the equipment.
PON	Fiber interface	Connects with optical fiber for uplink access.

Indicator LED Description

Indicator LEDs of the HG6145F are located on the front panel of the equipment.

Table 2-9 Indicator LEDs on the HG6145F

Indicator LEDs	Meaning	Color	Status	Status Description
Power	Power status indicator LED	Green	ON	The equipment is powered on.
			OFF	The equipment is not powered on.
PON	Register status indicator LED	Green	ON	The ONT is activated.
			Blinking	The ONT is being activated.
			OFF	Activation of the ONT is not yet started.
LOS	Optical signal status indicator LED	Red	Blinking	The equipment has not received the optical signal.
			OFF	The equipment has received the optical signal.
Internet	Broadband network status indicator LED	Green	ON	Connection to the broadband network is normal.
			Blinking	Connection to the broadband network is normal with data transmission.
			OFF	Not connected to the broadband network.
WLAN	2.4G/5G wireless signal status indicator LED	Green	ON	The 2.4G/5G wireless interface is enabled.
			Blinking	The 2.4G/5G wireless interface is transmitting / receiving data.
			OFF	The 2.4G/5G wireless interface is disabled.
WPS	2.4G/5G WPS status indicator LED	Green	ON	The 2.4G/5G WPS is enabled, and the Wi-Fi terminal has been connected to the ONT.
			Blinking	The 2.4G/5G WPS is being used in negotiation.
			OFF	The 2.4G/5G WPS is not enabled, or the Wi-Fi terminal is not connected to the ONT.
USB1, USB2	USB indicator LED	Green	ON	The USB is connected.
			OFF	The USB is not connected.
LAN1 to LAN4	Ethernet interface status indicator LED	Green	ON	The interface is connected to the user terminal and no data is transmitted.
			Blinking	The interface is transmitting / receiving data.
			OFF	The interface is not connected to the user terminal.
Phone	Phone port status indicator LED	Green	ON	The port is registered in the softswitch system.
			Blinking	Service flow is found at the port.

Table 2-9 Indicator LEDs on the HG6145F (Continued)

Indicator LEDs	Meaning	Color	Status	Status Description
			OFF	The port is not registered in the softswitch system.

2.4.2 Product Characteristics

The HG6145F can be used together with the OLT equipment to make up a GPON system and access multiple services for users. The HG6145F has the following characteristics:

1. GPON access capability

- Conforms to ITU-T G.984 series of standards, with good interoperability.
- Provides large-capacity GPON transmission bandwidth: supports 2.5 Gbit/s for the downlink rate and 1.25 Gbit/s for the uplink rate.
- Supports the DBA (Dynamic Bandwidth Allocation) algorithm.
- Supports long-haul transmission. The maximum transmission distance can reach 20 km.

2. Abundant service types

The equipment provides abundant physical interfaces on the subscriber side to access multiple services such as Internet access, video, voice and home storage services.

3. Wi-Fi wireless access

- The equipment provides Wi-Fi wireless access based on IEEE 802.11 a/b/g/n/ac/ax to set up safe and reliable wireless network for users.
- Compatible with IEEE 802.11 a/b/g/n/ac/ax and passed Wi-Fi Alliance authentication, with good compatibility with other WLAN devices.
- Supports eight SSIDs (four SSIDs for the 2.4 GHz band and another four SSIDs for the 5 GHz band) so that users can set different wireless networks as needed.

- Supports multiple authentication and encryption modes to provide users with safe and reliable wireless access mode.

4. Network storage and file sharing

- Provides two USB interfaces for connection with the USB interface storage devices to provide convenient network storage and file sharing service.
- The USB interfaces support plug-and-play and hot insertion.
- Supports configuration of the USB function based on the Web page to facilitate file sharing in the family network.
- Supports the FTP-based network storage to provide FTP client end and FTP server end functions. Users can download the files on the public network FTP server to the USB interface storage devices or visit the USB interface storage devices on the ONT via the FTP client end on the PC.

5. Gateway function

- Serves as home gateway and provides abundant and reliable gateway functions.
- Functions as the DHCP Server to cater for application demands in different scenarios.
- Supports configuring protection against DoS attack, filtering of MAC addresses, IP addresses and URL addresses, firewall and ACL rules to guarantee safe operation of the equipment.

6. Remote automatic provisioning of services, maintenance and management

- The equipment adopts the management based on TR-069 and OMCI, and supports TR-069 over OMCI. It can manage terminal services without IP network, which facilitates automatic provisioning, maintenance and management of services remotely.
- Supports configuring the global profile and delivering the XML configuration file on the network management system. Only a few changes are required to deliver the ONT services in a batch manner and make network adjustment.
- Supports configuring the user-defined upgrade policies on the network management system so that the equipment can be upgraded automatically after being powered on.

- Supports collecting performance data of the ONT remotely via the network management system to enable real-time monitoring of the network performance.
- Supports remote fault isolation for the ONT via the network management system. Faults can be isolated remotely according to the alarms reported to reduce the maintenance cost.

2.4.3 Functions and Features

Table 2-10 Functions and Features of the HG6145F

Item		Description
GPON	GPON interface specifications	Compliant with standards ITU-T G.984.1, G.984.2, G.984.3 and G.984.4.
		Supports GEM encapsulation (Ethernet over GEM is supported, but ATM encapsulation is not supported).
		The GPON system adopts the single-fiber bidirectional transmission mechanism, using the TDMA mode with the wavelength 1310 nm in the uplink direction, and the broadcast mode with the wavelength 1490 nm in the downlink direction.
		Supports the embedded OAM message, PLOAM message and OMCI message.
		Supports the splicing of data packets and OMCI protocol packets in the uplink direction. Splicing with adaptive message length and that with fixed length are supported.
	GEM Port	Supports bearing the downlink broadcast packets and unknown multicast packets via the broadcast GEM port.
		Supports mapping from GEM ports to T-CONTs.
		Supports multiple flow mapping modes.
		Supports the GEM port loopback.
	T-CONT	Supports T-CONTs of Type 1 to Type 5.
		A T-CONT supports no less than 64 GEM ports.
		Supports eight T-CONTs.
	DBA	Supports DBA in the SR and NSR modes.
		Supports DBA Piggy-back DBRu Mode 0.
	FEC	Supports bi-directional FEC: downlink FEC decoding and uplink FEC encoding.
		Supports downlink FEC performance statistics.
	Encryption	Supports encryption of downlink unicast data channel.
		Supports the AES-128 encryption algorithm.
		Supports generation of the key and response to the OLT's request for key.

Table 2-10 Functions and Features of the HG6145F (Continued)

Item		Description
		Supports OMCI channel encryption.
	Registration authentication	Supports the ONT registration process as specified in ITU-T. G.984.3.
		Supports four authentication modes: SN, Password, SN + Password and LOID.
		Supports performance statistics for the Ethernet interface.
		Supports performance statistics for the GEM interface.
Ethernet		Complies with the IEEE 802.3 standard.
		Supports configuring the Ethernet interface rate, working mode, and MDI/MDIX auto-negotiation mode.
		Supports manual configuration to the rate 10/100/1000 Mbit/s.
		Supports manual configuration of the half duplex or full duplex mode.
		Supports unlink / downlink rate control based on the Ethernet interface, with the control granularity of 64 kbit/s.
		Supports the PAUSE flow control.
		Supports the loopback detection at the subscriber side.
		Supports learning up to 1024 MAC addresses.
		Supports global configuration of enabling / disabling the MAC address learning function.
		Supports remote configuration of the MAC address aging time. The value ranges between 0s and 300s. The default value is 80s.
Multicast		Supports the IGMP Snooping protocol.
		Supports IGMP v1/v2/v3.
		Supports filtering and forwarding of multicast MAC addresses.
		Supports controllable multicast and uncontrollable multicast.
		Supports fast leave.
		Supports translation, transparent transmission and stripping of the multicast VLAN tags.
		Supports VLAN translation for the uplink multicast protocol packets.
		Supports filtering the downlink multicast packets.
		Supports bearing downlink multicast service flow and IGMP signaling packets via different GEM ports.
		Supports configuration of the multicast GEM ports.
		Supports authentication of the GEM ports.
		Supports no less than 256 multicast groups.
		Uses the IPoE/PPPoE mode for the multicast services.

Table 2-10 Functions and Features of the HG6145F (Continued)

Item	Description
	Supports the IPv6 Snooping multicast service, supports the MLDv1 information, MLDv2 query information and MLDv2 report information.
VLAN	Supports the IEEE 802.1Q VLAN standard.
	Supports joining the 802.1Q VLAN in the tag / untag mode.
	Supports up to 4K VLANs.
Wire-speed forwarding	Supports Layer 2 / Layer 3 wire-speed forwarding.
Layer 3 features	Supports the IPv4/v6 dual stack.
	Supports obtaining network parameters such as the user IP address, subnet mask and DNS in the DHCP mode. Supports reporting the physical location of the Ethernet interface based on DHCP Option82.
	Supports obtaining user IP addresses in the PPPoE mode, and supports the PPPoE+ function for precise identification of users.
	Supports static routing and default routing.
	Supports DDNS, NAT, port forwarding and DMZ.
	Supports ARP, UPnP, ALG, Portal and QoS.
Voice	Supports the protocols H.248 and SIP.
	Supports the speech encoding modes such as G.711, G.729, G.723.1 and G.722.
	Provides a phone number for each connected telephone set.
	Supports simultaneous call and conversation of two POTS subscribers.
	Supports static and dynamic jitter buffer.
	Supports DTMF detection.
	Supports RFC 2833 for transmitting / receiving DTMF.
	Supports RTP/RTCP (RFC 3550).
WLAN	Supports 802.11b, 802.11g, 802.11n, 802.11ax and hybrid mode for the 2.4 GHz frequency band; supports 802.11a, 802.11n, 802.11ac, 802.11ax and hybrid mode for the 5 GHz frequency band.
	Supports the MIMO program for the 2.4 GHz and 5 GHz frequency bands.
	Supports eight SSIDs (four SSIDs for the 2.4 GHz band and another four SSIDs for the 5 GHz band) to differentiate networks.
	Supports 13 working channels in the 2.4 GHz frequency band and 24 working channels in the 5 GHz frequency band.
	Supports automatic selection and manual configuration of channels.
	Supports OPEN, SHARED, WPA-PSK, WPA2-PSK, WPA-PSK/WPA2-PSK, WPA3-SAE and WPA2-PSK/WPA3-SAE authentication.
	Supports the WEP, TKIP, AES and TKIP/AES encryption.

Table 2-10 Functions and Features of the HG6145F (Continued)

Item	Description
	Supports the WPS negotiation encryption algorithm and key.
	Supports adjustment of the transmit power.
USB	Complaint with the USB 2.0 standard.
	Supports plug-and-play and hot insertion of the USB storage device.
	Supports storage devices such as the USB HUB and mass storage.
	Supports providing the FTP service on the USB.
Security	Supports the firewall.
	Supports packet filtering.
	Supports filtering MAC addresses.
	Supports filtering URL addresses.
	Supports protection against illegal message (DoS, ARP) attacks; supports suppression of broadcast storms.
	Supports configuring the HTTPS safe channel.
	Supports configuring ACL rules for the ONT.
	Supports remote control.
Management and maintenance	Supports local service configuration, query and software upgrade based on the Web page.
	Supports management of the OMCI configuration and queries.
	Supports delivering the XML configuration file via the OMCI, alarm reporting, alarm synchronization and performance statistics.
	Supports automatic provisioning of services, equipment management and software upgrade remotely based on OMCI/TR-069.
	Supports query of the ONT optical module information.
	Supports TYPE B protection.
QoS	Provides abundant QoS functions; supports global configuration of queue priorities and flexible mapping of 802.1p values in packets.
	Supports the ACL function to match traffic based on the ACL rules.
	Supports three queue scheduling modes (PQ, WRR and PQ+WRR); supports configuring the weight of the queues under scheduling, so as to guarantee the quality of high-QoS services such as voice and video in the multi-service scenario.

2.4.4 Technical Specifications

Table 2-11 Technical Specifications of the HG6145F

Classification	Item	Description
Mechanical parameters	Dimensions	204 mm × 41 mm × 149 mm
	Weight	About 350 g
Power supply parameter	DC	DC 12 V/1.5 A
Power consumption parameters	Static power consumption	12.5 W
	Maximum power consumption	17 W
Environment parameters	Operating temperature	-5℃ to 45℃
	Storage temperature	-20℃ to 70℃
	Environmental humidity	10% to 95% (no condensation)

3 Handling Common Problems

The following introduces how to handle common problems encountered in equipment operation and service test.

- ☑ Power Status Indicator LED Extinguished
- ☑ Register Status Indicator LED Extinguished
- ☑ Optical Signal Status Indicator LED Blinking
- ☑ Ethernet Interface Status Indicator LED Extinguished
- ☑ Failing to Detect ONT Using Wi-Fi
- ☑ Failing to Access Local Web Login GUI and Failing to Ping 192.168.1.1
- ☑ Failing to Access Internet Using the LAN Port
- ☑ Failing to Access Internet Using Wi-Fi
- ☑ Measured Internet Access Rate Lower or Higher Than the Standard Value
- ☑ Test of Voice Service Failed

3.1 Power Status Indicator LED Extinguished

Handle the problem according to the procedures below:

1. Check whether the mains supply is normal.
2. Check whether the power adapter matches the device.
3. Check whether the power button is pressed down.
4. Check whether the power cable connection is normal.

3.2 Register Status Indicator LED Extinguished

Handle the problem according to the procedures below:

1. Check whether the device power supply is normal.
2. Check whether the optical fiber connection is normal.
3. Check whether the ONT has obtained the ISP authorization.
4. Check whether the optical interface is normal; if not, replace the device.

3.3 Optical Signal Status Indicator LED Blinking

Handle the problem according to the procedures below:

1. Check whether the optical fiber is damaged.
2. Check whether the optical fiber is connected to the correct interface.
3. Check whether the Rx optical power of the ONT (measured with the optical power meter) is below specifications.
4. Check whether the ONT optical module is aged or damaged.
5. Check whether the local device is faulty.

3.4 Ethernet Interface Status Indicator LED Extinguished

Handle the problem according to the procedures below:

1. Check whether the network cable is damaged or connected incorrectly.
2. Check whether the color-coding scheme of the network cable is incorrect; if so, replace it with a standard CAT-5 twisted pair network cable.
3. Check whether the network cable length exceeds the allowed range (100 m).

3.5 Failing to Detect ONT Using Wi-Fi

Handle the problem according to the procedures below:

1. Check whether the wireless function is disabled for the ONT and whether the SSID is set to "Hidden" so that the network is unavailable.
2. Check whether the network card drive of the computer is installed normally and whether the WLAN function of the wireless terminal (such as computer and telephone) is enabled.
3. Adjust the position of the ONT to reduce the barriers on the wireless channel (such as walls) and make sure the distance between the ONT and the wireless terminal is within the required range.

3.6 Failing to Access Local Web Login GUI and Failing to Ping 192.168.1.1

Handle the problem according to the procedures below:

1. Check whether the LAN port indicator LED is ON; if not, replace the network cable.
2. Check whether the computer is set with a fixed IP address in the network segment of 192.168.1.x.

3.7 Failing to Access Internet Using the LAN Port

Handle the problem according to the procedures below:

1. Check whether the computer is set with a fixed IP address. If yes, modify the configuration so that the computer can obtain an IP address automatically. Then retry the connection.

2. If the computer is obtaining IP addresses automatically, check whether the computer has obtained an IP address in the network segment of 192.168.x.x.
3. Contact the personnel in the network management center to check whether the WAN is connected correctly and bound with the LAN port.

3.8 Failing to Access Internet Using Wi-Fi

Handle the problem according to the procedures below:

1. Check whether the computer is connected to the ONT's Wi-Fi signal correctly and can obtain an IP address automatically.
2. Contact the personnel in the network management center to check whether the WAN connection is bound with the Wi-Fi port correctly.

3.9 Measured Internet Access Rate Lower or Higher Than the Standard Value

Contact the personnel in the network management center to check whether the bandwidth profile is configured correctly and bound to the ONT.

3.10 Test of Voice Service Failed

Handle the problem according to the procedures below:

1. Check whether you can hear the current tone when you go off-hook; if no, check whether the phone cable is connected correctly.
2. Check whether you can hear the dial tone when you go off-hook; if no, contact the network management center to check whether the voice service work order has been delivered correctly and whether the uplink device has delivered the configuration data to the voice service port of the ONT.
3. Log into the ONT to check whether it has obtained an IP address for voice service .
4. Contact the softswitch platform to check whether the voice node data have been configured.

4 Standards and Protocols

Classification	Standard Number	Title
GPON	ITU-T G.984.1	Gigabit-capable passive optical networks (GPON): General characteristics
	ITU-T G.984.2	Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification
	ITU-T G.984.3	Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification
	ITU-T G.984.4	Gigabit-capable passive optical networks (G-PON): ONT management and control interface specification
Ethernet	IEEE 802-2001	IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture
	IEEE 802.1D-2004	IEEE Standard for Local and metropolitan area networks: Media Access Control (MAC) Bridges
	IEEE 802.1Q-2005	IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks - Amendment 4: Provider Bridges
	IEEE 802.1ad	IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks - Amendment 4: Provider Bridges
	IEEE 802.1x-2004	IEEE Standard for Local and Metropolitan Area Networks Port- Based Network Access Control
	IEEE 802.1ag-2007	IEEE Standard for Local and Metropolitan Area Networks Virtual Bridged Local Area Networks Amendment 5: Connectivity Fault Management
	IEEE 802.3-2005	IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
	IEEE 802.3z	Gigabit Ethernet Standard
	IEEE 802.1p	Traffic class expediting and dynamic multicast filtering. Describes important methods for providing QoS at MAC level
	TR-101	Migration to Ethernet-Based Broadband Aggregation
	TR-143	Enabling Network Throughput Performance Tests and Statistical Monitoring
VoIP	ITU-T G.711	Pulse code modulation (PCM) of voice frequencies
	ITU-T G.711.1	Wideband embedded extension for G.711 pulse code modulation
	ITU-T G.722	7 kHz audio-coding within 64 kbit/s

Classification	Standard Number	Title
	ITU-T G.723.1	Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s
	ITU-T G.729	Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)
	ITU-T G.729.1	G.729 based Embedded Variable bit-rate coder: An 8-32 kbit/s scalable wideband coder bitstream interoperable with G.729
	ITU-T G.165	Echo Cancellers
	ITU-T G.168	Digital network echo cancellers
Multicast	IETF RFC 2236	Internet Group Management Protocol, Version 2
	IETF RFC 3376	Internet Group Management Protocol, Version 3
	IETF RFC 4541	Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches
WLAN	IEEE 802.11-2016	IEEE Standard for Information technology - Telecommunications and information exchange between systems Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications
	IEEE 802.11a-1999	IEEE Standard for Telecommunications and Information Exchange Between Systems - LAN/MAN Specific Requirements - Part 11: Wireless Medium Access Control (MAC) and physical layer (PHY) specifications: High Speed Physical Layer in the 5 GHz band
	IEEE 802.11b-1999	IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and Metropolitan networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Higher Speed Physical Layer (PHY) Extension in the 2.4 GHz band
	IEEE 802.11g-2003	IEEE Standard for Information technology– Local and metropolitan area networks– Specific requirements– Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Further Higher Data Rate Extension in the 2.4 GHz Band
	IEEE 802.11n-2009	IEEE Standard for Information technology– Local and metropolitan area networks– Specific requirements– Part 11: Wireless LAN Medium Access Control (MAC)and Physical Layer (PHY) Specifications Amendment 5: Enhancements for Higher Throughput
	IEEE 802.11ac-2013	IEEE Standard for Information technology–Telecommunications and information exchange between systems - Local and metropolitan area networks–Specific requirements–Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications–Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz

Classification	Standard Number	Title
	P802.11ax	IEEE Draft Standard for Information Technology – Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks – Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment Enhancements for High Efficiency WLAN
Time	IETF RFC 1305	Network Time Protocol (Version 3) Specification, Implementation and Analysis
	IETF RFC 2030	Simple Network Time Protocol (SNTP) Version 4 for IPv4, IPv6 and OSI
EMC	EN 300 386	Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; Electromagnetic Compatibility (EMC) requirements
	CISPR 22 (EN55022)	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
	CISPR 24 (EN55024)	Information technology equipment - Immunity characteristics - Limits and methods of measurement
Other	TR-069	CPE WAN Management Protocol

Appendix A Abbreviations

ONT	Optical Network Terminal
FTTH	Fiber To The Home
GPON	Gigabit-capable Passive Optical Network
ODN	Optical Distribution Network
OLT	Optical Line Termination
DBA	Dynamic Bandwidth Allocation
XML	Extensible Markup Language
GEM	GPON Encapsulation Mode
ATM	Asynchronous Transfer Mode
OAM	Operation, Administration And Maintenance
FEC	Forward Error Correction
TDMA	Time Division Multiple Access
PLOAM	Physical Layer Operations, Administration and Maintenance
OMCI	ONU Management and Control Interface
T-CONT	Transmission Container
NSR	Network Security Recorder
AES	Advanced Encryption Standard
MAC	Medium Access Control
IGMP	Internet Group Management Protocol
VLAN	Virtual Local Area Network
QoS	Quality of Service
ACL	Access Control List
WRR	Weighted Round Robin
DHCP	Dynamic Host Configuration Protocol
PPPoE	Point to Point Protocol over Ethernet
NAT	Network Address Translation
DMZ	Demilitarized Zone
ARP	Address Resolution Protocol
UPnP	Universal Plug and Play
DoS	Denial of Service
DDoS	Distributed Denial of Service
URL	Uniform Resource Locator

HTTPS	Hyper Text Transfer Protocol over Secure Socket Layer
CATV	Cable Antenna Television
CoS	Class of Service
SIP	Session Initiation Protocol
VoIP	Voice over Internet Protocol
RTP	Real-time Transport Protocol
IGD_WLAN_SSID	Service Set Identifier
WAN	Wide Area Network
LAN	Local Area Network
WLAN	Wireless Local Area Networks
MTU	Maximum Transmission Unit
PPPoE	Point to Point Protocol over Ethernet
DTMF	Dual Tone Multi Frequency
VPN	Virtual Private Network
DDNS	Dynamic Domain Name Server
FTP	File Transfer Protocol
ADSL	Asymmetric Digital Subscriber Line
BRAS	Broadband Remote Access Server
BSC	Base Station Controller
CDR	Call Detail Record
CPE	Customer Premise Equipment
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
EFM	Ethernet in the First Mile
EMC	Electro Magnetic Compatibility
EPON	Ethernet Passive Optical Network
EPRS	Ethernet Ring Protection Switching
FDB	Forwarding Database
FoIP	Fax over IP
FTTA	Fiber To The Antenna
FTTB	Fiber To The Building
FTTC	Fiber To The Curb
FTTDp	Fiber To The Distribution Point
FTTM	Fiber To The Mobile
FTTO	Fiber To The Office
GUI	Graphical User Interface
HG	Home Gateway

ISDN	Integrated Services Digital Network
ICMP	Internet Control Message Protocol
IMS	IP Multimedia Subsystem
IP	Internet Protocol
LACP	Link Aggregation Control Protocol
LAN	Local Area Network
MDU	Multi-Dwelling Unit
MGC	Media Gateway Controller
MGCP	Media Gateway Control Protocol
MLD	Multicast Listener Discover
MoIP	Modem over IP
MTBF	Mean Time Between Failure
MSAN	Multi-Service Access Network
MSTP	Multiple Spanning Tree Protocol
NGN	Next Generation Network
OLT	Optical Line Termination
OSPF	Open Shortest Path First
OTDR	Optical Time Domain Reflectometer
PON	Passive Optical Network
POTS	Plain Old Telephone Service
ppm	parts per million
PRI	Primary Rate Interface
PSTN	Public Switched Telephone Network
QinQ	802.1Q-in-802.1Q
RIP	Routing Information Protocol
RNC	Radio Network Controller
RSTP	Rapid Spanning Tree Protocol
RSSI	Received Signal Strength Indication
SBA	Static Bandwidth Allocation
SBU	Single Business Unit
SCB	Single Copy Broadcast
SDH	Synchronous Digital Hierarchy
SFU	Single Family Unit
SHDSL	Single-pair High bit rate Digital Subscriber Line
SNI	Service Node Interface
SNMP	Simple Network Management Protocol

SP	Strict Priority
STB	Set Top Box
STM	Synchronous Transport Module
STP	Straight-Through Processing
SSH	Secure Shell
TCP	Transmission Control Protocol
TDM	Time Division Multiplex
TG	Trunk Gateway
TOD	Time of Day
ToS	Type of Service
UDP	User Datagram Protocol
UNI	User-Network Interface
VDN	Video Distribution Network
VDSL	Very High Speed Digital Subscriber Line
WDM	Wavelength Division Multiplexing

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