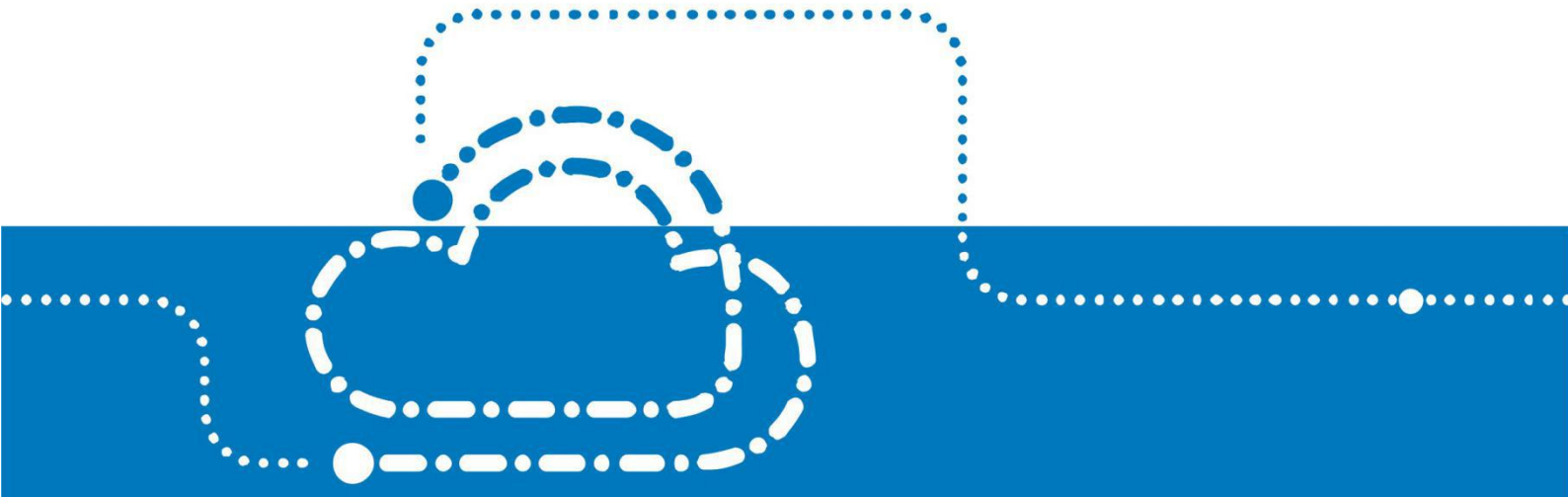
ZXHN F6600 Product Description



ZXHN F6600 Product Description

Version	Date	Author	Reviewer	Notes
V1.0	2020/07/29	ZTE		Process Version draft, not open to the third party

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1 Overview

1.1 Product Positioning

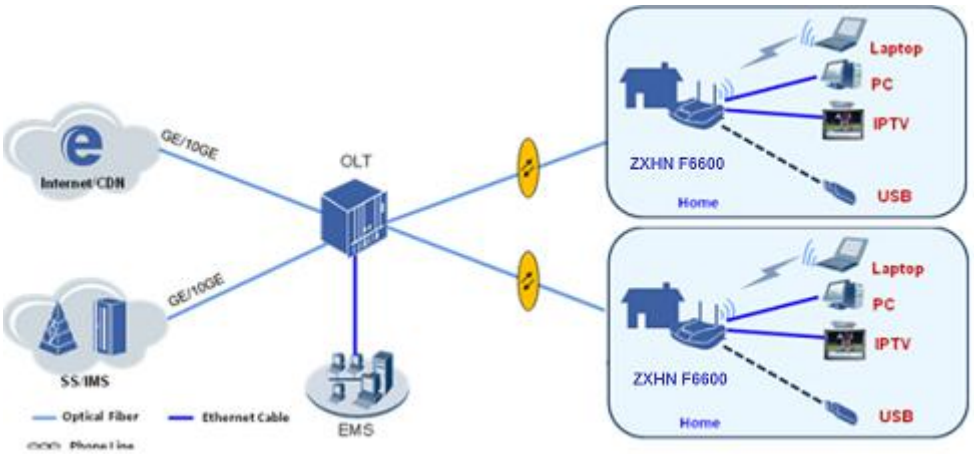
The ZXHN F6600 is an ITU-T G.984 and ITU-T G.988 compliant optical network terminal (ONT) that is designed for high-end home users. It is well suited to fiber to the home (FTTH) scenarios and supports desktop mounting. At the network side, it supports 2.488 Gbps downlink and 1.244 Gbps uplink. At the user side, it provides four GE ports, two FXS ports, one USB 2.0 port, and 2x2 802.11ax@2.4GHz & 2x2 802.11ax@5GHz concurrent. Figure 1-1 shows the housing design of the ZXHN F6600:

Figure 1-1 ZXHN F6600 Housing Design

1.2 Network Applications

The ZXHN F6600 is an ONT designed for FTTH application scenarios. By using the ZXHN F6600, the home users can access data, video and enjoy high-speed Internet access. Figure 1-2 illustrates the application scenarios of the ZXHN F6600:

Figure 1-2 Network Topology of the ZXHN F6600



2 Product Highlights

2.1 Dual Band Concurrent Wi-Fi

ZXHN F6600 supports dual band concurrent Wi-Fi 6, delivering superior performance with MIMO 2x2 on both 2.4GHz and 5GHz bands achieving up to 600Mbps PHY rate on 2.4GHz and 1.2Gbps PHY rate on 5GHz. With the advanced features of Wi-Fi 6 like MU-MIMO, OFDMA, TWT, the F6600 also provides high network efficiency and more users in dense scenarios, while saves power consumption of user clients.

2.2 Enriched User-Side Interfaces

- Provides four GE ports for HSI or HD VoD services.
- Provides one USB 2.0 port for file storage and sharing, print sharing and user configuration file fast recovery.
- Supports 802.11b/g/n/ax@2.4GHz & 802.11a/n/ac/ax@5GHz dual-band concurrent Wi-Fi with up to 1.8Gbps PHY rate and excellent coverage.
- Users can connect PCs, IPTV STBs, tablets, smartphones and other terminals to the ZXHN F6600 to enjoy all kinds of Internet services.

2.3 High Reliability

- The full-service access capability featuring high bandwidth, high performance, high reliability, and easy operation, administration and maintenance (OMCI/TR-069) meets the ever changing customer requirements, protects legacy investments, and enhances the value of operators' networks.
- The highly reliable heat dissipation design guarantees stable operation.

- The dual image ensures uninterrupted services during software downloads or upgrades, thereby enhancing software reliability.
- The highly reliable lightning protection design provides lightning and surge protection of 4 kV for the adapter and 1.5 kV for the Ethernet ports.

2.4 Convenient Installation and Management

- Remote batch upgrade, fault diagnosis, port loopback, and link detection via the OMCI/TR-069.
- Software upgrade and management via the EMS/ACS/OLT.
- Local Web management.
- Offline & batch configuration.

3 Hardware Features

3.1 Physical Interfaces and buttons

The ZXHN F6600 includes one GPON optical port, four 10/100/1000M Ethernet ports,two FXS ports, one USB 2.0 port, and Wi-Fi 802.11ax 2x2 @2.4GHz & 802.11ax 2x2 @5GHz concurrent.

The ZXHN F6600 provides one Wi-Fi/WPS button, one On/Off button and one Reset button.

Figure 3- 1 Rear Panel of the ZXHN F6600

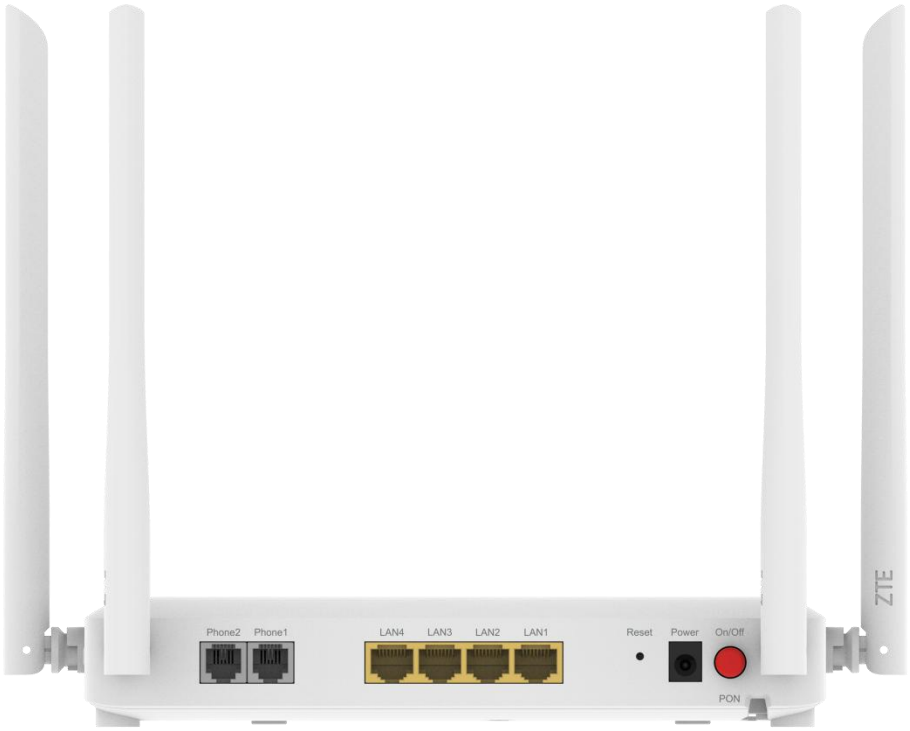


Table 3- 1 Specifications for the Interfaces and buttons on the rear panel

Interface	Description
PON	SC/APC GPON optical interface.
On/Off	Power switch.
Power	12 V Power Input Interface. +12 V DC (via external AC/DC adapter: 90 – 264 V, 50/60 Hz AC input, 12 V DC output).
Reset	When the ZXHN F6600 is powered on, press and hold the Reset button for one second to restart the ZXHN F6600. The user's settings information will not be lost. When the ZXHN F6600 is powered on, press and hold the Reset button for more than five seconds to restore the ZXHN F6600 to the factory settings.
LAN1-LAN4	Supports four 10/100/1000Base-T Ethernet ports with RJ-45 connector. Supports half/full duplex and flow control, auto negotiation or manual configuration. Supports MDI/MDIX auto-sensing.
Phone1/Phone2	Supports two FXS ports with RJ11 connector. Complies with USB 2.0 specifications.

Figure 3-2 Right Panel of the ZXHN F6600

Table 3-2 Specifications for the buttons on the right panel

Button	Introduction
USB	Supports one USB host interface. Complies with USB 2.0 specifications.
Wi-Fi/WPS	After pushing the Wi-Fi/WPS button for longer than 0.4s, the Wi-Fi function will be enabled. After pushing the WPS button for longer than 3s, the WPS function will be enabled.

3.2 LED Indicators

Figure 3-2 LED Indicators of the ZXHN F6600

Table 3-2 Specification for the LED Indicators of the ZXHN F6600

LED	Color	Status Description
Power	Off	The ONT is powered off
	Solid Green	The ONT is powered on
PON	Off	1. The ONT is powered off 2. The ONT has not started the registration process.
	Solid Green	The ONT registration is successfully.
	Blinking (2 Hz) Green	The ONT is registering.
	Flashing (1 Hz) Green	The ONT is upgrading.
LOS	Off	1. The ONT is powered off 2. The ONT received optical power is normal.
	Solid Red	The optical transmitter of the PON interface is powered off.
	Blinking Red	The received optical power is less than the optical receiver sensitivity.
Internet	Off	1. The ONT is powered off. 2. There is no WAN connection with Internet properties configured. 3. The session is disconnected on user request or remote peer request (PPP disconnected, DHCP address released or no static IP address available on

LED	Color	Status Description
		the Internet WAN connection).
	Solid Green	IP connected (the ONT has a Internet WAN IP address from IPCP, DHCP or statically configured).
	Blinking Green	IP traffic is passing through the Internet WAN connection (either direction)
LAN1-LAN 4	Off	1. The ONT is powered off. 2. The Ethernet port is not connected to any terminal device.
	Solid Green	The Ethernet port is connected but no data is transmitted via the Ethernet port.
	Blinking Green	Data is being transmitted or received via the Ethernet port.
Phone1/P hone2	Off	1、The ONT is powered off. 2、unable to register on the soft switch/IMS.
	Solid Green	The ONU has registered on the softswitch/IMS but no traffic is being transmitted
	Blinking Green	Data transmission
Wi-Fi	Off	1. The ONT is powered off. 2. The 2.4G and 5G wireless interface is disabled.
	Solid Green	The 2.4G and 5G wireless interface is enabled but no data is being transmitted or received.
	Blinking Green	Data is being transmitted or received on the 2.4G or 5G wireless interface.
WPS	Off	1. The ONT is powered off. 2. The WPS function is disabled.
	Solid Green	Some device has connected the ONT Wi-Fi using WPS.
	Blinking Green	Some device is trying to connect to the ONT Wi-Fi using WPS.
USB	Off	1. The ONT is powered off. 2. There is no USB device connect to the USB port.
	Solid Green	There is some USB device connect to the USB port and works in host mode, but no data is transmitted via the USB interface

LED	Color	Status Description
	Blinking Green	Data is being transmitted or received via the USB interface

4 System Features

4.1 GPON Features

- ITU-T G.984 and ITU-T G.988 compatible
- Flexible mapping between GEM port and T-CONT
- Priority queuing and scheduling for upstream traffic
- AES-128 encryption
- FEC
- Five types of T-CONT
- Upstream traffic classification based on VLAN ID and 802.1p
- Multicast GEM port
- SN, password, and SN+password authentication
- Auto-restart and recovery after power failure

4.1.1 Bandwidth Allocation

- Static bandwidth allocation
  - ITU-T G.983.1 compliant static bandwidth allocation
- Dynamic bandwidth allocation (DBA)
  - Adopts fair DBA policy for the same CoS services during traffic congestion
  - Dynamic bandwidth status report mode complies with ITU-T G.984.3

4.1.2 GEM Adaptation

- GEM mode
- GEM frame mapping to GTC payload
- Ethernet data frame mapping to GEM frame; Ethernet frame mapping into GEM ports based on VLAN, CoS, or VLAN+CoS

4.1.3 T-CONT

- Five types of T-CONT
- T-CONT as the basic unit of the upstream service
- T-CONT allocation based on the user and CoS; mapping to T-CONT queue based on the CoS value or GEM port
- WRR, SP, or WRR+SP T-CONT queue scheduling mode

4.1.4 Operation and Maintenance

- Physical layer operations and maintenance (PLOAM) defined in ITU-T G.984.3
- OMCI and OMCI extension defined in ITU-T G.984.4 and ITU-T G.988

4.1.5 Optical Link Analysis and Diagnosis

- The optical module diagnostic interface analyses the parameters including operating temperature of the optical module, supply voltage, bias current, transmission power, and receiving power.
- Detection and auto shutdown of rogue ONTs.

4.2 Ethernet Features

4.2.1 MAC Address Features

- MAC address learning
- MAC address aging
- MAC address learning enable/disable
- MAC address learning limit
- MAC address binding to a user port. Only controls the input side of the port.
- Anti-MAC transferring (spoofing)
  - Forbids the MAC addresses learned from a user port to be transferred to other user port before aging.
  - Forbids the MAC addresses learned from an uplink port to be transferred to the user port.
- MAC filtering
  - Both the source and destination MAC addresses support the blacklist and the white list function.

4.2.2 VLAN Features

- IEEE 802.1q VLAN with the VLAN ID from 1 to 4094
- VLAN tagging/untagging on the user port
- VLAN overwrite function on the user port
- 1:1 mapping between the user port (physical port or logical port) and VLAN
- VLAN-based data forwarding
- VLAN-based packet filtering

- VLAN untagged mode, tagged mode and double tagged mode
- VLAN tag
  - Adds S-Tag to the untagged or priority tagged frames from the user port as per the needs.
  - Adds C-Tag and S-Tag to the untagged or priority tagged frames from the user port as needed.

4.3 Wi-Fi Features

The Wi-Fi function provides an easy, convenient, flexible, and cost-efficient method for users to access the Internet via a wireless LAN network.

- Supports 2.4GHz (2* 2 MIMO), IEEE802.11b/g/n/ax compliant
- Supports 5GHz (2* 2 MIMO), IEEE802.11a/n/ac/ax compliant
- Auto and manual channel selection
- Auto and manual rate control
- Supports 20MHz and 40MHz @2.4G
- Supports 20MHz, 40MHz and 80MHz @5G
- Transmission power control
- Four SSIDs per frequency band
- Maximum 32 users per frequency band
- SSID broadcast enabling/disabling
- Access control based on MAC address
- WPA2-PSK and WPA-PSK + WPA2-PSK security authentication

- WPS
- WMM
- Beamforming
- Uplink(UL) and Downlink(DL) MU-MIMO
- Uplink(UL) and Downlink(DL) OFDMA

4.4 VoIP Features

4.4.1 SIP Protocol

- RFC 2617: HTTP Authentication: Basic and Digest Access Authentication.
- RFC 2833: RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals
- RFC 3261: SIP: Session Initiation Protocol
- RFC 3262: Reliability of Provisional Responses in the Session Initiation Protocol (SIP)
- RFC 3263: Session Initiation Protocol (SIP): Locating SIP Servers
- RFC 3264: Offer/Answer Model with Session Description Protocol (SDP)
- RFC 3265: SIP Specific Event Notification
- RFC 3311: The Session Initiation Protocol UPDATE Method
- RFC 3323: A Privacy Mechanism for the Session Initiation Protocol SIP), For further information see the CLIP/CLIR/CNIP/CNIR document.
- RFC 3325: Private Extensions to the Session Initiation Protocol (SIP) for Asserted Identity within Trusted Networks
- RFC 3515: The Session Initiation Protocol (SIP) - Refer Method

- RFC 3581: An Extension to the Session Initiation Protocol (SIP) for Symmetric Response Routing.
- RFC 3842: A Message Summary and Message Waiting Indication Event Package for the Session Initiation Protocol (SIP)
- SDP: draft-ietf-mmusic-sdp-new-24.txt
- RFC 3891: The Session Initiation Protocol (SIP) "Replaces" Header
- RFC 3960: Early Media and Ringing Tone Generation in the Session Initiation Protocol(SIP)
- RFC 3966: The Tel URI for Telephone Numbers
- RFC 4028: Session Timers in the Session Initiation Protocol (SIP)

4.4.2 Voice Codec

- G.711a/u law
- G.729
- G.722

4.4.3 Supplementary Services

- Call Forwarding Unconditional (CFU)
- Call Forwarding No Answer/On no Reply (CFNA)
- Call Forwarding on Busy (CFB)
- Calling Line Identity Presentation (CLIP)
- Calling Line Identity Restriction (CLIR)
- Internal call between FXS

4.4.4 Advanced Features

- Digit Map and Call Routing Management
- Voice Activity Detection (VAD)/ Silence Suppression
- Comfort Noise Generation (CNG)
- DTMF tone detection and generation
- Fax / Modem detection and pass-through
- Support in-band DTMF tone sending/receiving and out-band DTMF signaling with RTP
- Packet Loss Concealment
- Echo Cancellation
- Fixed and adaptive jitter buffer
- Fax over IP
  - T.30 Fax Pass-through
  - T.38 Fax Relay

4.5 USB Features

- One USB 2.0 host port
- Supports file storage and sharing
- Supports print sharing

4.6 QoS Features

- Traffic rate limiting based on the user port, traffic, and GEM port

- Upstream traffic classification based on VLAN ID, VLAN priority level (IEEE802.1D), and Ethernet type (such as IP, PPPoE and ARP/RARP)
- Ethernet priority level tagging of the upstream services based on the DSCP value
- Ingress rate limiting
- Egress shaping

4.7 Multicast Features

- IGMP v1/v2/v3 and MLD Snooping
- IGMP PROXY
- 256 multicast groups per LAN port
- Fast leave time-the interval, from when a user sends an IGMP leaving message to when the ONU stops the multicast data packet, is less than 20ms.
- Supports MVLAN

4.8 L3 Features

- Data forwarding and routing
  - Bridging, routing, or hybrid mode (bridging and routing)
  - Static routing
- Address management
  - DHCP server/client, Option 60
  - DHCP client, options 6, 15, 42, 50, 60, and 120
- PPPoE client
- DNS client/relay

- SNTP client
- NAT
- ALG function: implements H.323, SIP, FTP, TFTP, PPTP, L2TP, IPSec, and RTSP private network traversal function; provides separate switches for each ALG function.

4.9 IPv6 Features

- Transparent transmission of IPv6 protocol packets
- IPv4/IPv6 dual stack
- MLD v1 and MLD snooping
- IPv6 address management
  - SLAAC allocation mode on LAN side
  - DHCPv6 on LAN side
  - SLAAC on WAN side
  - DHCPv6 on WAN side
  - DHCPv6-PD on WAN side
  - PPPoE+DHCPv6 on WAN side
  - PPPoE+SLAAC on WAN side

4.10 Management Features

- OMCI management
- Web management
- TR-069 management

- Management via the OLT on the EMS
- Built-in capability for remote management with standards compliance, including the full range of FCAPS functions like supervision, analysis, and maintenance
- UNI loopback detection
- Remote software download, activation, and reboot via the OMCI
- Dual image, version download, update detection, and auto rollback

4.11 Security Features

- Traffic filtering based on UNI, VLAN ID, 802.1p, UNI + 802.1p, and VLAN + 802.1p
- Multicast , unicast and broadcast flow attack protection
- MAC address limiting based on each UNI or a single ONT
- Broadcast packet rate limiting
- Anti-DoS attack
- MAC filtering

4.11.1 Data Security of the GPON Interface

Because the GPON system works in broadcast mode in the downstream direction, malicious users can easily attack other users' messages. To enhance data security of the user, the GPON downstream provides AES-128 encryption.

4.11.2 Traffic Suppression

- Broadcast storm suppression
  - When the broadcast traffic including the unknown unicast and multicast traffic exceeds the threshold that the user sets, the broadcast traffic will be discarded

till the traffic is reduced to an allowable range, thereby avoiding network congestion and ensuring normal operation of the network services.

4.12 Alarm Features

- Dying gasp
- Receiving optical power too high
- Receiving optical power too low
- Transmission optical power too high
- Transmission optical power too low
- Port loopback alarm
- Loss of signal
- Loss of frame
- Signal degradation alarm
- Loss of GEM channel delineation

4.13 Performance Statistic Features

4.13.1 Ethernet Port Performance Parameters

- Frames transmitted
- Bytes transmitted
- Unicast frames
- Multicast frames
- Broadcast frames

- Frames received
- Bytes received
- Unicast frames received
- Multicast frames received
- Broadcast frames received

5 Technical Indices and Parameters

5.1 Physical Structure, Environmental and Electrical Indices

Table 5-1 Specifications and Environmental Indices of the ZXHN F6600

Parameter	Nominal Value
Net dimensions	210mm (W) x 130mm (D) x 35mm (H) (Not including antenna)
Typical power consumption	12.5W(Estimated power consumption)
Noise	Null
Heat dissipation mode	Natural heat dissipation
Power supply	Rated 12 V DC (through the external AC/DC adapter)
Mounting	Desktop or wall-mount
Operating environment	0°C – 40°C
Relative humidity	5% – 95%
Atmospheric pressure	70 – 106 kPa

5.2 GPON Interface Indices and Parameters

Table 5-2 GPON Interface Indices of the ZXHN F6600

Parameter	Nominal Value
Connector type	SC/APC
Number of PON	1
Fiber type	Single-mode fiber
Wavelength	Transmitting end: 1310 nm (PON interface) Receiving end: 1490 nm (PON interface)
Compliant standard of the PON interface	ITU-T 984.x

Parameter	Nominal Value
Receiving rate of the optical interface	2.488 Gbps
Transmitting rate of the optical interface	1.244 Gbps
Transmission wavelength range	1290 – 1330 nm
Root-mean-square spectral width of the transmitting end	< 1 nm (spectral width: 20 dB)
Output optical power	1 – 5 dBm
Optical power of the transmitter in output OFF status	< -45 dBm
Extinction ratio	> 10 dB
Receive range	1480 – 1500 nm
Receive sensitivity	-28 dBm
Saturation optical power of the receiver	-8 dBm
Optical link length	20 km

5.3 Key Technical Indices

Table 5- 3 Key Technical Indices of the ZXHN F6600

Parameter	Nominal Value
Configurable VLAN ID range	1 – 4094
Capacity of the MAC address table	1K
Capacity of the multicast table	1K
IGMP join delay	< 10 ms (single channel)
IGMP leave delay	< 10 ms (single channel)
Startup time	80s (default)
T-CONTs	8
GEM ports	256

6 Standards Compliance

Table 6- 1 Standards Compliance

Standard	Description
ITU-T G.984.1	General characteristics for Gigabit-capable Passive Optical Networks (GPON)
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
ITU-T G.984.5	Gigabit-capable Passive Optical Networks (G-PON): Enhancement band
Broadband Forum TR-101	Migration to Ethernet-Based DSL Aggregation, April 2006
Broadband Forum TR-156	Using GPON Access in the context of TR-101, December 2008
IEEE Std 802.1D-2004	Media Access Control (MAC) Bridges
IEEE Std 802.1Q-2005	Virtual Bridged Local Area Networks
IEEE Std 802.1ad-2005	IEEE Standards for Local and Metropolitan Area Networks —Virtual Bridged Local Area Networks—Revision—Amendment 4: Provider Bridges
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 (Includes: IEEE Std 802.3ae-2002, IEEE Std 802.3af-2003, IEEE Std 802.3ah-2004, IEEE Std 802.3aj-2003, IEEE Std 802.3ak-2004)(Revision of IEEE 802.3-2002)

Standard	Description
IEEE 802.1X-2004	IEEE Standards for Local and Metropolitan Area Networks: Port-Based Network Access Control
ITU-T Y.1291	An architectural framework for support of Quality of Service in packet networks
ITU-T H.248.1 V2	Gateway control protocol: Version 2
ITU-T H.248.1 v3	Gateway control protocol: Version 3
IETF RFC1112	Host extensions for IP multicasting
IETF RFC2236	Internet Group Management Protocol, Version 2
IETF RFC 3376	Internet Group Management Protocol, Version 3
ITU_T K.21	Resistibility of Telecommunication Equipment Installed in Customer Premises to Overvoltages and Overcurrents
EN60950	Information technology equipment. Safety, General requirements

7 Glossary

Table 7-1 Glossary

Acronym	Full Term
OMCI	ONU Management and Control Interface
AES	Advanced Encryption Standard
HSI	High Speed Internet
ARP	Address Resolution Protocol
MIMO	Multiple-Input Multiple-Output
FAT	File Allocation Table
NTFS	New Technology File System
PPP	Point to Point Protocol
IPCP	IP Control Protocol
PPPoE	Point to Point Protocol over Ethernet
DHCP	Dynamic Host Configuration Protocol
CoS	Class of Service
GEM	G-PON Encapsulation Mode
DBA	Dynamic Bandwidth Allocation
EMS	Element Management System
ACS	Auto-Configuration Server
LED	Light Emitting Diode
FEC	Forward Error Correction
FTP	File Transfer Protocol
TFTP	Trivial File Transfer Protocol
WMM	Wi-Fi Multi-Media
IGMP	Internet Group Management Protocol
MLD	Multicast Listener Discover
DNS	Domain Name System
FTTH	Fiber to the Home
GE	Gigabits Ethernet
GFP	Generic Framing Procedure

Acronym	Full Term
GPON	Gigabit-capable Passive Optical Networks
IP	Internet Protocol
IPTV	Internet Protocol Television
ITU	International Telecommunication Union
L3	Layer 3
WAN	Wide Area Network
LAN	Local Area Network
MAC	Media Access Control
SNTP	Simple Network Time Protocol
NAT	Network Address Translation
L2TP	Layer Two Tunneling Protocol
PPTP	Point to Point Tunneling Protocol
RTSP	Real Time Streaming Protocol
ALG	Application Layer Gateway
OLT	Optical Line Termination
ONT	Optical Network Terminal
ONU	Optical Network Unit
PON	Passive Optical Network
SN	Serial Number
QoS	Quality of Service
RARP	Reverse Address Resolution Protocol
SP	Service Priority
SP	Strict Priority
STB	Set Top Box
UNI	User Network Interface
VLAN	Virtual Local Area Network
VoD	Video on Demand
WPS	Wi-Fi Protected Setup
WRR	Weight Round Robin