



ZXA10 C320

Optical Access Convergence Equipment

Product Description

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ZTE CORPORATION
NO. 55, Hi-tech Road South, ShenZhen, P.R.China
Postcode: 518057
Tel: +86-755-26771900
Fax: +86-755-26770801
URL: <http://ensupport.zte.com.cn>
E-mail: support@zte.com.cn

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About This Manual

Purpose

The ZXA10 C320 Optical Access Convergence Equipment (ZXA10 C320 for short) is a 2U-height OLT device, which satisfies the market requirement for small-capacity OLTs. The ZXA10 C320 consists of the switching and control cards, and PON interface cards.

This manual provides the product description of the ZXA10 C320 Optical Access Convergence Equipment.

Intended Audience

This document is intended for:

- Network planning engineer
- Installation and debugging engineer
- On-site maintenance engineer
- Network monitoring engineer
- System maintenance engineer
- Data configuration engineer
- Application development engineer

What Is in This Manual

This manual contains the following chapters:

Chapter	Summary
1, System Overview	Describes the market background, product introduction, and product features.
2, System Architecture	Describes the hardware structure and software architecture.
3, Features and Performance	Describes the system features.
4, Technical Specifications	Describes the device parameters, interface specifications, performance specifications, reliability specifications, and environment requirements.
5, Networking Application	Describes the networking applications.
Appendix A, Protocols and Standards	Describes international standards and enterprise standards.

Chapter 1

System Overview

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1.1 Background

With the development of the society, people have more requirements on telecommunication services. Besides traditional the Internet access, voice, and Time Division Multiplexing (TDM) services, users require more new broadband services such as Internet Protocol Television (IPTV), Video on Demand (VOD), online game, remote education, remote medicine, video conference, and video phone. These new broadband services help carriers to attract more users and get generous profits.

Fiber to the Home (FTTH) is the target of the access layer network development. The network solution based on Passive Optical Network (PON) topology meets the network topology characteristics of the access network.

- As an optimum transmission medium, optical fiber can provide unlimited bandwidth to support various services access.
- The passive Optical Distribution Network (ODN) device is small and does not need any active apparatus. It has powerful lightning-proof and anti-interference capability.
- The long distance between Optical Line Terminal (OLT) and Optical Network Unit (ONU) meets the networking requirement of carriers.

The ZXAN xPON access network is a comprehensive optical solution to adapt to various networking scenarios. To meet the development tendency of telecommunication network from the IP network to the Next Generation Network (NGN), the ZXA10 xPON access network integrates xPON, Ethernet, and x-Digital Subscriber Line (DSL) technologies to support the access of various services.

The ZXA10 C320 Optical Access Convergence Equipment is an OLT system based on the xPON technology. It provides high-bandwidth data access service, Voice over IP (VoIP), IPTV, and CATV/HDTV services to meet different requirements and application scenarios.

1.2 Product Overview

The ZXA10 C320 is a multi-service optical access system, which supports Gigabit Passive Optical Network (GPON), Ethernet Passive Optical Network (EPON), and smooth

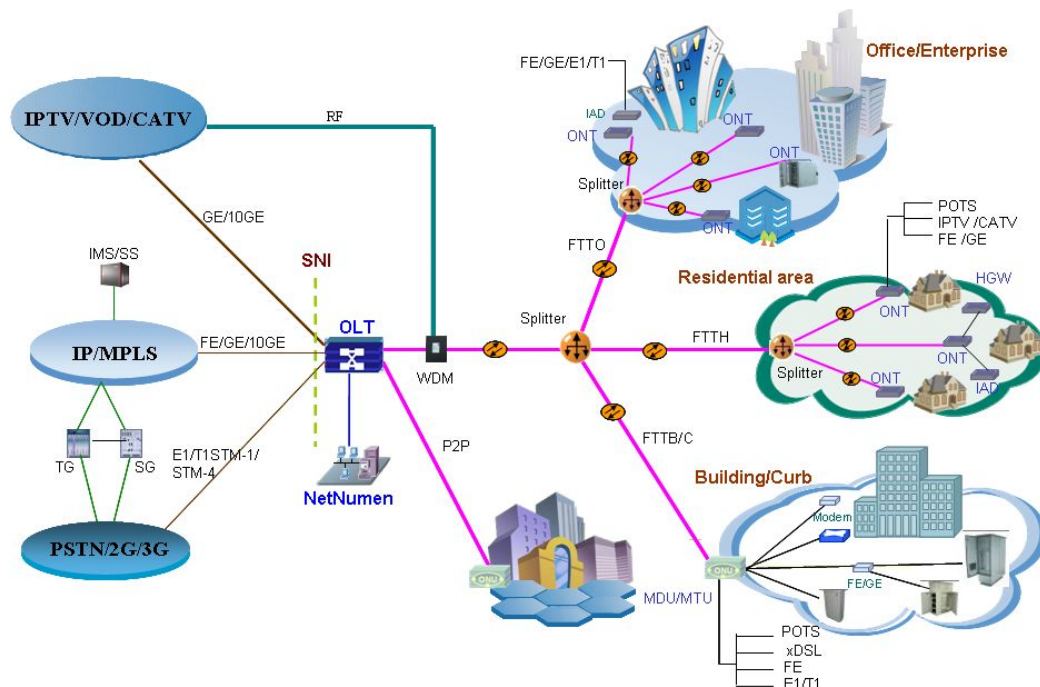
upgrading to Next Generation (NG) PON and Wavelength Division Multiplexing (WDM) PON.

The ZXA10 C320 provides the access of large-capacity, high-bandwidth, and high-density triple-play service.

- As an OLT device, the ZXA10 C320 is connected to ONUs/Optical Network Terminals (ONTs) via ODNs.
- Provides various networking solutions, including FTTH, Fiber to the Building (FTTB), Fiber to the Curb (FTTC), and Fiber to the Cabinet (FTTCab).

Figure 1-1 shows the ZXA10 C320 networking diagram. (The OLT represents the ZXA10 C320 in the diagram.)

Figure 1-1 ZXA10 C320 Networking Diagram



1.3 Product Features

The ZXA10 C320 system is composed of the ZXA10 C320 OLT, and Multiple Dwelling Units (MDUs)/Multi-Tenant Units (MTUs)/ONTs. The ZXA10 C320 can provide access for up to 1024 (splitting ratio 1:64) ONTs at maximum.

The ZXA10 C320 is a full-service and integrated optical access platform, catering to next generation optical access with large capacity and high density. It supports xPON and smooth evolution to XGPON, NG PON2 and WDM PON.

The ZXA10 C320 system provides abundant GPON terminals including Single Family Unit (SFU), Single Business Unit (SBU), MDU, MTU, and various types of outdoor equipment. For xPON terminal equipment, it provides various interfaces such as 10/100M,

10/100/1000M, xDSL, Wireless Local Area Network (WLAN), E1/T1, POTS, and Radio Frequency (RF), which can fulfill FTTx networking and service requirements.

1.3.1 Multi-Play Service Access

The ZXA10 C320 system provides a new generation of VoIP service access, High Speed Internet (HSI) service access, IPTV, and CATV service access to fulfill ordinary and commercial subscriber multi-play service access demands.

1.3.2 Excellent Performance and High Integration

The ZXA10 C320 system is designed with full consideration of optical access with broadband application and development. It enjoys excellent performance and high integration with following features:

- Supports N x 10 GE interface for uplink.
- Supports 420 G physical bandwidth on backplane data bus. This enables non-congestion switch in the whole system.
- Provides cards with 8 GPON/EPON high-density interfaces. It supports 16 GPON/EPON interfaces per shelf at maximum.
- Provides access for 1024 (splitting ratio 1:64) ONTs per shelf at maximum.

1.3.3 Powerful L2 and VLAN Functions

The ZXA10 C320 provides the following powerful L2 and Virtual Local Area Network (VLAN) functions:

- 32K Medium Access Control (MAC) addresses
- 802.1Q VLAN functions
- VLAN adding/removing
- VLAN transparent transmission
- VLAN translation/overwriting
- N:1 VLAN and 1:1 VLAN
- VLAN priority handling
- VLAN filter
- VLAN stacking as per IEEE 802.1 ad
- Enhanced VLAN functions

1.3.4 Perfect L3 Functions

The ZXA10 C320 supports L3 functions with following features:

- IPv4
- Static Routing
- Routing Information Protocol (RIP)/Open Shortest Path First (OSPF)/Intermediate System-to-Intermediate System (IS-IS) protocol

1.3.5 Powerful Multicast Capability

The ZXA10 C320 uses distributed multicasting management mechanism and supports Internet Group Management Protocol (IGMP) v1/v2/v3. The system also supports controllable multicast function and flexible Multicast Connection Admission Control.

1.3.6 Perfect QoS Control

The ZXA10 C320 supports various methods to fulfill the QoS requirement for an open access network. It has the following features.

- Dynamic Bandwidth Allocation (DBA)
- Traffic classification
- Priority handling
- Multi-queue scheduling
- Service Level Agreement (SLA)
- H-QoS control

1.3.7 Comprehensive Safety Protection

The ZXA10 C320 uses Advanced Encryption Standard (AES) 128 data encryption, and Triple churning encryption algorithms. The system supports subscriber/port isolation, broadcast and packet suppression, IP source guard, MAC Anti-Spoofing, Dynamic ARP Inspection (DAI), Internet Control Message Protocol (ICMP), Anti Deny of Service (DoS), and L2/L3 Access Control List (ACL).

1.3.8 Environment Protection

The ZXA10 C320 is designed with low power consumption. The system design complies with ITU-T G.Suppl.45 *GPON Power Conservation* and related regulations and standards of European energy saving and environment protection such as COC and Restriction of Hazardous Substances (RoHS).

1.3.9 Carrier-Class Reliability

Key components, such as control and switching cards and power cards, work in redundancy.

All cards are hot pluggable. The power supply is fully distributed. Each card has its own secondary DC/DC power converter thus ensuring power supply reliability.

The ZXA10 C320 supports Type B/C protection and dual-parented PON protection. The ZXA10 C320 supports uplink protection protocols such as Uplink Auto Protection Switching (UAPS) and Link Aggregation Control Protocol (LACP).

ODNs, which are passive devices, are maintenance-free in practical applications because they are free from interference of power supply, electromagnetic field, storm and lightning, and extreme weather.

1.3.10 GPON/EPON Integrated Platform

The ZXA10 C320 is a GPON/EPON integrated platform and fulfills the requirements of evolution to NGPON. Terminals like MDU/MTU support GPON/EPON flexible optional upstream configuration.

1.3.11 Perfect Optical Line Diagnosis Function

Perfect optical line diagnosis function, which involves the following functions, can reduce the Operating Expenditure (OPEX).

- Support perfect Optical Line Supervision (OLS) detection.
- Support PON-layer alarm detection.

1.3.12 User-Friendly Network Management

The NetNumen Network Management System (NMS), which provides user-friendly Graphic User Interfaces (GUIs), various management methods including Simple Network Management Protocol (SNMP), Command Line Interface (CLI), and Telnet, accomplishes unified management and maintenance for ZXA10 xPON Central Office (CO) equipment and Customer Premises Equipment (CPE).

The NetNumen NMS supports the following features:

- Provides diversified northbound interfaces.
- Supports fault isolation, alarm and performance monitoring, various loopback control functions, and PON connection views.
- Supports unified platform management together with other network equipment from the ZTE Corporation.

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Chapter 2

System Architecture

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2.1 Hardware Structure

The ZXA10 C320 hardware consists of cabinets, shelf, and cards.

2.1.1 Product Appearance

Figure 2-1 shows the appearance of the ZXA10 C320.

Figure 2-1 ZXA10 C320 Appearance



2.1.2 Cabinets

The ZXA10 C320 uses outdoor cabinet OUT50ET and various indoor cabinets.

Figure 2-2 shows the outlook of the OUT50ET cabinet.

Figure 2-2 OUT50ET Outlook



2.1.3 Shelf

Structure

Figure 2-3 shows the front view of the ZXA10 C320 shelf.

Figure 2-3 Shelf Front View



Configuration

Figure 2-4 shows the shelf configuration of the ZXA10 C320.

Figure 2-4 Shelf Configuration

Fan	PON interface card		1
	PON interface card		2
	Switching and control cad	Switching and control cad	3 4

Table 2-1 describes the shelf configuration.

Table 2-1 Shelf Configuration Description

Slot	Card Type
1-2	PON interface card

Slot	Card Type
3-4	Switching and control card

2.1.4 Cards

The ZXA10 C320 shelf is composed of cards and a fan module, as listed in [Table 2-2](#).

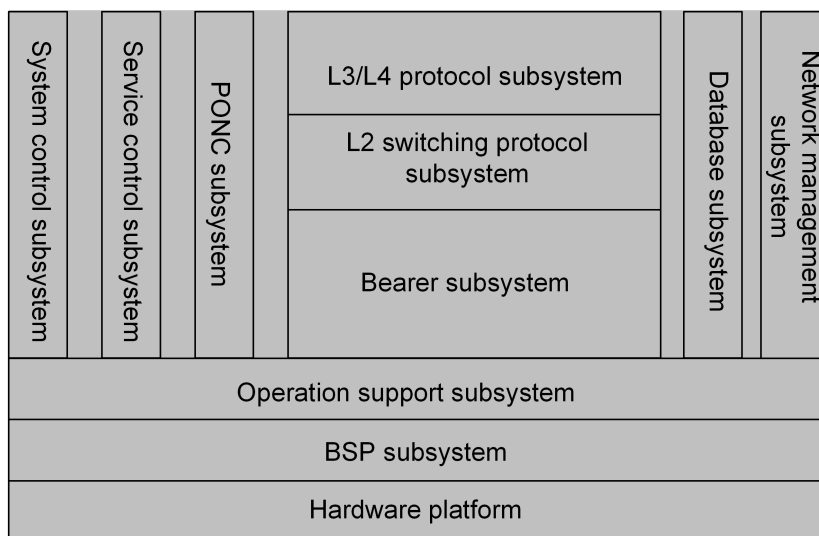
Table 2-2 Card List

Card Type	Name	Description	Interface
Switching and control card	SMXA	Switching and control card	1 out-of-band NM interface 1 debugging interface 1 10GE optical interface (GE available) 1 GE optical interface 1 GE electrical interface 1 environment monitoring interface
PON interface card	GTGO	8-port GPON interface card	8 GPON interfaces
	ETGO	8-port EPON interface card	8 EPON interfaces
Backplane	MWMT	Backplane	-
Fan module	FAN-C320	Fan module	-

2.2 Software Architecture

[Figure 2-5](#) shows the ZXA10 C320 software architecture.

Figure 2-5 ZXA10 C320 Software Architecture



The ZXA10 C320 software system consists of the following subsystems:

- System control subsystem
- Service control subsystem
- PONC subsystem
- L3/L4 protocol subsystem
- L2 switching protocol subsystem
- Bearer subsystem
- Database subsystem
- Network management subsystem
- Operation support subsystem
- Board Support Package (BSP) subsystem

2.2.1 Network Management Subsystem

The network management subsystem consists of the following modules:

- CLI module
This module implements Console and Telnet NM function.
- SNMP proxy module
This module provides interfaces for SNMP management and maintenance.
- Sub agent module
This module implements SNMP agent function.

2.2.2 L2 Switching Protocol Subsystem

The L2 switching protocol subsystem supports the following protocols and functions:

- Spanning Tree Protocol (STP)
- LACP
- IGMP snooping protocol (v1/v2/v3)
- MAC address management
- VLAN management
- Priority management
- IEEE 802.3x flow control

2.2.3 L3/L4 Protocol Subsystem

The L3/L4 protocol subsystem supports the following protocols:

- TCP
- UDP
- ARP
- IP
- ICMP
- Static route

- ACL

2.2.4 Database Subsystem

The database subsystem implements the access control over the system configuration data and network management data. The managed objects include the following:

- MAC address list
- VLAN data
- Remote Monitoring (RMON) Management Information Base (MIB) data

2.2.5 System Control Subsystem

The system control subsystem is in charge of the operation of the whole system. It consists of the following modules:

- System configuration module
- Main control module
- Fault management module
- Version management module

2.2.6 Service Control Subsystem

The service control subsystem is composed of the service control module and the test module. It controls system services. The service control subsystem implements the following functions:

- IP address binding
- MAC address binding
- Port mirroring
- Traffic flow control
- Broadcast suppression
- Port status management
- Port bandwidth limit
- Port priority control
- User log management
- MAC address aging management
- User port loop-back test
- Ping test

2.2.7 PONC Subsystem

The PONC subsystem implements EPON and GPON relevant functions, such as Multi-Point Control Protocol (MPCP), Operation, Administration and Maintenance (OAM), DBA algorithm, ONU/ONT registration and authorization, data encryption, and ONT Management Control Interface (OMCI) protocol stack.

2.2.8 Bearer Subsystem

The bearer subsystem consists of the MUX module, switching chip driver module, and PON MAC chip driver module.

The bearer subsystem is responsible for service chip driver. It isolates the upper-level software system from the hardware platform so that the specific hardware structure is unnecessary to be considered in service-layer design. The bearer subsystem communicates with the upper-layer module through the Multiplexer (MUX) interface.

2.2.9 Operation Support Subsystem

The operation support subsystem isolates the upper-level software system from the hardware platform. It manages the hardware system in the downlink direction and provides a unified operating platform for applications in the uplink direction.

2.2.10 BSP Subsystem

The BSP subsystem consists of the BSP module and built-in network interface driver module. The BSP subsystem is responsible for CPU initialization and lower-layer software drive.

Chapter 3

Features and Performance

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3.1 GPON Features

PON Interface Features

The ZXA10 C320 supports the following GPON interface features:

- Transmission rate: 2.488 Gbps downstream and 1.244 Gbps upstream
- Power budget: 28 dB (Class B+) or 32 dB (Class C+)
- Wavelength: 1490 nm downstream, 1310 nm upstream wavelength, and 1550 nm for CATV
- Supports Forward Error Correction (FEC) in both downstream and upstream
- Supports four types of protection.
 - Type A
 - Type B (ITU G.983 Type B)
 - Type C
 - Type D (ITU G.983 Type C)

ODN Features

The ZXA10 C320 supports the following ONU features:

- 128 ONUs per port
- Maximum physical reach: 60 km
- Maximum differential distance: 20 km

GTC Layer Features

The ZXA10 C320 supports the following GTC layer features:

- 4K GPON Encapsulation Method (GEM) port and 1K T-CONT (Transmission Container) per GPON port.
- Supports both Non-Status Reporting (NSR) DBA and Status-Reporting (SR) DBA.
- Supports downstream AES-128 encryption transmission for different ONUs.
- Supports SN auto detection or manual configuration based on ITU-T G.984.3.
- Supports OMCI based on G.984.4/G.988.
- Supports alarms and performance monitoring based on the G.984.3 and G.984.4.

Encryption Key Security

The ZXA10 C320 supports the following encryption key security features:

- Supports authentication mechanisms such as non-authentication, RFC 2617 basic authentication, and MD5 abstract authentication.
- Supports GPON encryption algorithm, password table, authentication result interaction. The creation and swap of GPON Transmission Convergence (GTC) layer key complies with G.984.4 (9.13.11 Enhanced Security Control).
- Supports the AES-CMAC-128 key algorithms.

3.2 EPON Features

The ZXA10 C320 supports the following EPON features:

- Complies with IEEE 802.3-2005.
- Satisfies technical requirements for EPON equipment from China CCSA, China Telecom, China Unicom, and China Mobile.
- Transmission rate: 1.25 Gbps (downstream and upstream)
- Power budget: 28 dB (PX20+).
- Wavelength
 - 1490 nm for downstream
 - 1310 nm for upstream
 - 1550 nm for CATV
- Split ratio: 1:64.
- Maximum logical reach: 60 km
- Maximum differential distance: 20 km
- Supports FEC function.
- Supports MPCP.
- Supports extended OAM functions.
- Supports the Single Copy Broadcast (SCB).
- Supports Triple Churning or AES-128 data encryption.
- Supports DBA.
- Supports ONU registration and authentication.
- Supports four types of protection.
 - Type A
 - Type B (ITU G.983 Type B)

- Type C
- Type D (ITU G.983 Type C)
- Supports measurement and diagnosis for optical link.

3.3 Ethernet Features

The ZXA10 C320 supports the following Ethernet features:

- **MAC** address management
 - Manages static addresses and detects dynamic address status.
 - Supports 32K MAC address table.
- **VLAN** management
 - Complies with TR156 and TR101.
 - Supports IEEE 802.1Q and 4K VLAN entries, and VLAN ID ranges from 1 to 4096.
 - Supports VLAN Stacking in compliance with IEEE 802.1ad .
 - Supports flexible selective QinQ.
- **STP**
Supports STP, RSTP and MSTP.
- **Link aggregation**
Supports static link aggregation and **LACP**.
- **L2 Multicast**
 - Supports **IGMP** v1/v2/v3.
 - Supports **IGMP** Snooping, Proxy, and Multicast VLAN Registration (**MVR**).
- **L2 ACL**
Supports classification based on destination or source MAC address, physical port, Ethernet types, Class of Service (**CoS**), and double tags.
- **Subscriber location**: supports Option82/18/37, Point to Point Protocol over Ethernet (**PPPoE**) Intermediate Agent (IA) protocol.

3.4 IP Features

The ZXA10 C320 supports the following L3 features:

- **RIP** v1/v2
- **OSPF** v2/v3
- **IS-IS**
- **Border Gateway Protocol (BGP)**
- **Protocol Independent Multicast-Sparse Mode/Dense Mode (PIM-SM/DM)**
- **IGMP** v1/v2/v3

- IGMP Snooping/Proxy/Router
- DHCP Relay/Server
- DHCP Relay in support for port location
- 8K IPv4 routing forward entries
- L3 ACL

3.5 Multicast Features

Multicast Features

The ZXA10 C320 supports the following multicast features:

- Supports distributed multicast processing architecture.
- Supports 8K multicasting entries.
- Supports IGMP v1/v2/v3 and ATM Switching Module (ASM), Source Specific Multicast (SSM).
- Supports multicast based on VPLS.
- Supports distributed protocol processing on service cards and control and switching cards.
- Supports IGMP Snooping/Proxy/SPR and 256 multicast VLANs.
- Each channel package supports 1024 channels. Each PON card can process 500 IGMP messages per second at maximum.
- ONUs support IGMP Snooping.

IPTV Features

The ZXA10 C320 supports the following IPTV features:

- Channel Access Control (CAC)
Controls subscribers' rights to access multicast channels.
Rights includes deny, preview, and permit (purchase).
- Preview (PRV)
Manages preview control lists, including the times and duration for each preview, and interval between previews.
- Call Detail Record (CDR)
Provides the basic access information of subscribers, such as access time, leaving time, access status (preview or not).
ZXA10 C320 also provides interfaces to transmit CDR information to the Service Management System (SMS) module.

3.6 QoS Features

The ZXA10 C320 supports the following QoS features:

- Supports marking service traffic and NM traffic with different Type of Service (ToS)/Differentiated Services Code Point (DSCP) and ToS/DSCP marking/re-marking, and supports service forwarding based on L3 priority.
- Supports marking service traffic and NM traffic with different 802.1p, and 802.1p marking/re-marking, and supports service forwarding based on L2 priority.
- Supports queue mapping based on 802.1p/GEM-Port. Supports multiple queue scheduler to fulfill different scheduling requirements and shaping requirements of different networks.
 - Strict Priority (SP)
 - SP + Deficit Weighted Round Robin (DWRR)/Weighted Fair Queuing (WFQ)
 - DWRR/WFQ
- Supports Weighted Random Early Detection (WRED) discarding policy to accomplish non-congestion.
- Supports powerful L2–L7 traffic classification mechanism, limiting ingress rate of the queue flexibly and accomplishes Two-rate Three Color Marker (TrTCM) and network overbooking.
- Provides flexible, effective and low-latency hardware DBA algorithm.
- Supports H-QoS mechanism and provides QoS based on each subscriber and each service.

3.7 Security Features

EPON Network Security Feature

The ZXA10 C320 supports the following features:

- Data encryption
 - Supports Triple Churning or AES-128 in downstream direction. Supports churning based on each Logical Link Identifier (LLID). Each LLID has independent key. When churning is enabled, all data frames and OAM frames are churned.
- Subscriber isolation
 - When the Point to Point (P2P) function is disabled, the upstream data of an ONU cannot be forwarded to other ONUs.
- Equipment access control
 - Unauthorized equipment cannot access the network.
- Subscriber access control
 - Unauthorized subscriber cannot access the network.
- Supports DHCP option82/18/37 and PPPoE IA to implement subscriber authentication.
- Supports authentication based on MAC address, Logical ONU ID (LOID) or password. The authentication method can be configured flexibly.

GPON Network Security Feature

The ZXA10 C320 supports the following features:

- Subscriber isolation
When the P2P function is disabled, the upstream data of an ONU cannot be forwarded to other ONUs.
- Equipment access control
Unauthorized equipment cannot access the network.
- Supports DHCP option82/18/37 and PPPoE Intermediate Agent (IA) to implement subscriber authentication.
- Supports authentication based on SN, SN + password or password. The authentication method can be configured flexibly.
- Supports Triple Churning and AES-128 data encryption.

Other Security Features

The ZXA10 C320 supports the following features:

- IP/MAC address and port binding
- IP anti-spoofing
- ACL based on L2 and L3
- Anti-Deny of Service (DoS) attack
 - Internet Control Message Protocol (ICMP)
 - Address Resolution Protocol (ARP)
 - Dynamic Host Configuration Protocol (DHCP)
 - PPPoE
 - Bridge Protocol Data Unit (BPDU)

3.8 Power-Saving Features

The ZXA10 C320 supports the following power-saving features:

- Power-saving cards
 - Unconfigured cards are power-off.
 - Power-off card properties can be checked by remote NM.
- Power-saving ports
 - Optical modules of unconfigured service port are power-off.
 - Supports Automatic Laser Shutdown (ALS) function of optical modules.

3.9 ONU Remote Management

The ZXA10 C320 supports standard ONU management channels.

- GPON ONU remote management is based on G.984/G.988 OMCI.
- EPON extended OAM.

The ZXA10 C320 supports the following ONU remote management features:

- ONU basic information and capability notification.
- DBA parameter query and configuration.
- Subscriber port configuration and management.
- VLAN configuration and management.
- Multicast related configuration.
- QoS related configurations including service traffic classification and identifying.
- Action functions such as reset ONU.
- ONU software download.
- ONU event notification.
- ONU voice service configuration and management.
- ONU version upgrade.

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Chapter 4

Technical Specifications

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4.1 Equipment Specifications

The ZXA10 C320 equipment specifications includes:

- Dimensions
- Weight
- Power consumption
- Operating voltage

4.1.1 Dimensions

Cabinet Dimensions

Table 4-1 lists cabinet dimensions of the ZXA10 C320.

Table 4-1 Cabinet Dimensions

Cabinet	Dimensions (Height × Width × Depth)
OUT50E	1035 mm × 770 mm × 460 mm

Shelf Dimensions

Table 4-2 lists shelf dimensions of the ZXA10 C320.

Table 4-2 Shelf Dimensions

Shelf Type	Dimensions (Height × Width × Depth)
C320 shelf	86.1 mm × 482.6 mm × 270 mm

Card Dimensions

Table 4-3 lists card dimensions of the ZXA10 C320.

Table 4-3 Card Dimensions

Card Type	Dimensions (Height × Width × Depth)
Switching and control card	200.25 mm × 37 mm × 225 mm
PON interface card	395.5 mm × 22.5 mm × 225 mm
Fan	84.3 mm × 35.8 mm × 247.9 mm
Backplane	81 mm × 411 mm × 4.7 mm

4.1.2 Weight

Equipment Weight

Table 4-4 lists equipment weight of the ZXA10 C320.

Table 4-4 Equipment Weight

Equipment	Weight (kg)
OUT50ET	100 (empty)
	130 (with 24 AH storage battery)
Shelf	2.5 (empty)
	6.9 (full configuration)
Power distribution box	4.8
Wiring box	1.5

Card Weight

Table 4-5 lists card weight of the ZXA10 C320.

Table 4-5 Card Weight

Card	Weight (kg)
SMXA	1.14
GTGO	0.925
ETGO	1.107
MWMT	0.395
FAN-C320	0.425

4.1.3 Power Consumption

Equipment Power Consumption

Table 4-6 lists equipment power consumption of the ZXA10 C320.

Table 4-6 Equipment Power Consumption

Item	Power Consumption (W)
GPON maximum power consumption	200
EPON maximum power consumption	130

Card Power Consumption

Table 4-7 lists card power consumption of the ZXA10 C320.

Table 4-7 Card Power Consumption

Card	Power Consumption (W)
SMXA	27.5
GTGO	72
ETGO	33.5
MWMT	-
FAN-C320	10

4.1.4 Operating Voltage

Table 4-8 lists the operating voltage of the ZXA10 C320.

Table 4-8 Operating Voltage

Item	Specification
Rate voltage	-48 V/-60 V DC
Range	$(-48 \pm 20\%) V / (-60 \pm 20\%) V, DC$

4.2 Interface Specifications

The ZXA10 C320 supports the following physical interfaces:

- Uplink: GE optical interface, GE optical interface, and 10GE optical interface
- Downlink: GPON/EPON interface

4.2.1 GPON Interface

Table 4-9 lists the GPON interface specifications.

Table 4-9 GPON Interface

Property	Specification
Connector	SC/PC

Property	Specification
Transmission rate	Downstream: 2.488 Gbps
	Upstream: 1.244 Gbps
Maximum logical reach	60 km
Maximum physical reach	60 km
Maximum differential distance	20 km
Ranging windows	0–60 km
Fiber type	G.652 or G.657 categ
Central Wavelength	Downstream: 1490 nm
	Upstream: 1310 nm
CATV wavelength	1550 nm

4.2.2 EPON Interface

Table 4-10 lists the EPON interface specifications.

Table 4-10 EPON Interface

Property	Specification
Connector	SC/PC
Transmission rate	Downstream: 1.25 Gbps
	Upstream : 1.25 Gbps
Maximum logical reach	40 km
Maximum differential distance	20 km
Cable type	Optical fiber
Central Wavelength	Downstream: 1490 nm
	Upstream: 1310 nm
Transmission optical power	+2.5~+7dBm (PX20+)
Maximum receiver sensitivity	-30 dBm (PX20+)
Average receiving power (maximum)	-6 dBm (PX20+)
Standard	IEEE 802.3, China Telecom EPON Equipment Technical Specifications V2.1

4.2.3 GE Interface

1000BASE-TX Interface

1 Table 4-11 lists the 1000BASE-TX interface specifications.

Table 4-11 1000 BASE-TX Interface

Property	Specification
Type	RJ-45 (TPI)
Rate	Full-duplex 10/100/1000 Mbps
Maximum transmission distance	100 m
Standard	IEEE 802.3u
Cable type	Cat 5 twisted cable

1000BASE-LX Interface

Table 4-12 lists the 1000BASE-LX interface specifications.

Table 4-12 1000BASE-LX Interface

Property	Specification
Type	LC
Rate	1000 Mbps
Cable type	9/125 μ m
Maximum transmission distance	10 km
Standard	IEEE 802.3
Central wavelength	1310 nm
Transmit power	-11 dBm to -3 dBm
Extinction ratio	9 dB
Receiver sensitivity	-19 dBm

1000BASE-LX40 Interface

Table 4-13 lists the 1000BASE-LX40 interface specifications.

Table 4-13 1000BASE-LX40 Interface

Property	Specification
Type	LC
Rate	1000 Mbps
Cable type	9/125 μ m
Maximum Transmission distance	40 km
Standard	IEEE 802.3

Property	Specification
Central wavelength	1310 nm
Transmit power	-3 dBm to 0 dBm
Extinction ratio	9 dB
Receiver sensitivity	-19 dBm

1000BASE-ZX Interface

Table 4-14 lists the 1000BASE-ZX interface specifications.

Table 4-14 1000BASE-ZX Interface

Property	Specification
Type	LC
Rate	1000 Mbps
Cable type	9/125 μ m
Maximum Transmission distance	80 km
Standard	IEEE 802.3
Central wavelength	1550 nm
Transmit power	0–5 dBm
Extinction ratio	9 dB
Receiver sensitivity	-23 dBm

1000BASE-EZX Interface

Table 4-15 lists the 1000BASE-EZX interface specification.

Table 4-15 1000BASE-EZX Interface

Property	Specification
Type	LC
Rate	1000 Mbps
Cable type	9/125 μ m
Maximum Transmission distance	120 km
Standard	IEEE 802.3
Central wavelength	1550 nm
Transmit power	0–5 dBm
Extinction ratio	9 dB
Receiver sensitivity	-30 dBm

1000BASE-BX10 Interface

Table 4-16 lists the 1000BASE-BX10 interface specification.

Table 4-16 1000BASE-BX10 Interface

Property	Specification
Type	LC
Rate	1000 Mbps
Cable type	9/125 μ m
Maximum Transmission distance	10 km
Standard	IEEE 802.3
Central wavelength	Downstream: 1490 nm Upstream: 1310 nm
Transmit power	-9 dBm to -3 dBm
Extinction ratio	> 9 dB
Receiver sensitivity	-19.5 dBm

4.2.4 10GE Interface

10GBASE-LR/LW Interface

Table 4-17 lists the 10GBASE-LR/LW interface specification.

Table 4-17 10GBASE-LR/LW Interface

Property	Specification
Type	LC
Rate	10.3125 Gbps (LR) 9.953 Gbps (LW)
Cable type	9 / 125 μ m single-mode optical fiber
Max. transmission distance	10 km
Standard	IEEE 802.3
Central wavelength	1310 nm
Transmit power	-8.2 dBm to 0.5 dBm
Extinction ratio	6 dB
Receiver sensitivity	-12 dBm

10GBASE-SR/SW Interface

Table 4-18 lists the 10GBASE-SR/SW interface specification.

Table 4-18 10GBASE-SR/SW Interface

Property	Specification
Type	LC
Rate	10.3125 Gbps (SR) 9.953 Gbps (SW)
Cable type	50 μ m multi-mode optical fiber
Max. transmission distance	300 m
Standard	IEEE 802.3
Central wavelength	850 nm
Transmit power	-7.3 dBm
Extinction ratio	3 dB
Receiver sensitivity	-9.9 dBm

10GBASE-ER/EW Interface

Table 4-19 lists the 10GBASE-ER/EW interface specification.

Table 4-19 10GBASE-ER/EW Interface

Property	Specification
Type	LC
Rate	10.3125 Gbps (ER) 9.953 Gbps (EW)
Cable type	9/125 μ m single-mode optical fiber
Max. transmission distance	40 km
Standard	IEEE 802.3
Central wavelength	1550 nm
Transmit power	-4.7 dBm to -4 dBm
Extinction ratio	8.2 dB
Receiver sensitivity	-26 dBm

10GBASE-ZR/ZW Interface

Table 4-20 lists the 10GBASE-ZR/ZW interface specification.

Table 4-20 10GBASE-ZR/ZW Interface

Property	Specification
Type	SC/PC
Rate	10.3125 Gbps (ZR) 9.953 Gbps (ZW)

Property	Specification
Cable type	9/125 μm single-mode optical fiber
Max. transmission distance	80 km
Standard	IEEE 802.3
Central wavelength	1550 nm
Transmit power	-2 dBm to 2 dBm
Extinction ratio	8.2 dB
Receiver sensitivity	-27 dBm

4.3 Performance Specifications

System Performance

Table 4-21 lists the ZXA10 C320 system performance specifications.

Table 4-21 System Performance

Item	Specification
Backplane bandwidth	420 Gbps
Switching capacity	84 Gbps
Supported VLANs	4 K
MAC address table size	32 K
Supported multicast groups	4 K
Hot-swappable	Support
Redundancy backup	Support

System Configuration

Table 4-22 lists the ZXA10 C320 system configuration specifications.

Table 4-22 System Configuration

Item	Specification
Management ports	<ul style="list-style-type: none"> ● One out-of-band NM port ● One local maintenance serial port CLI ● One environment monitoring serial ports
Uplink ports	<ul style="list-style-type: none"> ● One 10GE Ethernet optical interfaces ● Oner GE Ethernet optical interfaces ● One GE Ethernet electrical interfaces
Maximum EPON ports (single shelf)	16

Item	Specification
Maximum GPON ports (single shelf)	16
Maximum EPON ONUs (single shelf)	1024
Maximum GPON ONUs (single shelf)	2048

Reliability

Table 4-23 lists the ZXA10 C320 reliability specifications.

Table 4-23 Reliability Specifications

Parameter	Specification
MTBF	≥ 127795 hours
MTTR	< 30 mins
System lifetime	≥ 20 years
CE, UL, FCC authentication requirements	Support

Service Functions

Table 4-24 lists the ZXA10 C320 service functions.

Table 4-24 Service Functions

Item	Function
Wire-speed Layer-2/Layer-3 switching	Wire-speed forwarding
Layer-2 protocols	Layer-2 Ethernet bridge forwarding
	MAC address learning and aging
	802.1Q VLAN based on port
	STP/MSTP/RSTP
	Port enabling/disabling
	Broadcast/multicast/flooding suppression
	Port mirroring
Layer-3 protocols	ARP, ARP Proxy
	Super VLAN
	Static route
	Equivalent route
	RIP/OSPF/IS-IS/BGP
	DHCP Relay
	DHCP Server

Item	Function
VLAN	4K VLANs based on 802.1q, ranging from 1 to 4093
	QinQ, VLAN Translation, VLAN Trunking, VLAN Stacking
	1:1 VLAN, N:1 VLAN
Multicast	PIM-SM, PIM-DM
	8K multicast groups
	256 multicast VLANs
	IGMP v1/v2/v3
	IGMP Proxy/Snooping/Route
	Controlled multicast
	Multicast VLAN
IPTV	2048 multicast packages
	Channel preview
	IPTV preview profile
	CDR
	CAC
	Pre-join
	Fast leave
Port convergence/port protection	Ethernet uplink ports support BFD
	UAPS/LACP and Trunking convergence
	TYPE A/B/C/D protection at PON layer
	The Ethernet uplink port supports BFD
Active/standby changeover	Active/standby changeover of the main control card
Ethernet OAM	802.1ag, 802.3ah at Ethernet side
Flow control	IEEE 802.3x flow control (full-duplex)
	Backpressure flow control (half-duplex)
QoS	PON line SBA/DBA
	Port traffic classification based on LLID, MAC DA, MAC SA, priority (IEEE 802.1D), or Ethernet type
	CoS, traffic priority Default: 802.1p
	802.1p/DSCP priority mark/remark
	CoS priority and schedule queue mapping, DSCP and schedule queue mapping

Item	Function
	PON port VLAN or VLAN + CoS priority and schedule queue mapping, PON port depth configuration
	Packet filtering, redirection, traffic mirroring, traffic statistics, traffic monitoring, traffic shaping, port schedule, priority policy, port rate limit, and VLAN translation based on traffic rule
Security	Class management on operation rights
	Layer-2 isolation and controlled interaction
	RADIUS
	Defense against DoS attack
	Defense against ICMP/IP packets
	Upstream/downstream ACL enabling/disabling
	IP/MAC anti-Spoofing
	ONU SN/Password/SN+Password authentication
	PPPoE+, DHCP Option82 port location
	MAC address limit based on traffic
	Static MAC address configuration based on traffic
	MAC/IP address binding
	Source MAC address filtering
	Protocol packets such as IGMP, DHCP rate limit
	Upstream/downstream FEC
	SSH configuration
Triple Churning or AES-128 encryption	
EPON port	512 LLID
	1:64 split ratio
	Maximum transmission distance: 30 km
	Maximum difference distance: 20 km
EPON terminal management	ONU authentication (MAC address, LOID + password, and hybrid)
	Offline ONU/ONT configuration and auto discovery
	ONU/ONT management extended OAM standard
	ONU/ONT diagnosis test and fault management

Item	Function
GPON port	4096 GEM Ports
	1024 T-CONTs
	1:128 split ratio
	Maximum transmission distance: 60 km
	Maximum difference distance: 20 km
GPON terminal management	ONU authentication (SN, Password, SN + password)
	Offline ONU/ONT configuration and auto discovery
	ONU/ONT management based on OMCI standard
	ONU/ONT diagnosis test and fault management

System Maintenance and Management

Table 4-25 lists the ZXA10 C320 system maintenance and management specifications.

Table 4-25 System Maintenance and Management

Item	Function
Management	Serial port (CLI) configuration
	SSH/Telnet remote configuration
	Command line configuration
	SNMP v1/v2/v3 management
	NetNumen U31 NMS
	System log
	Level alarm
Maintenance	Debugging information output
	Ping
	Trace Route
	SSH/Telnet remote maintenance
Upload and upgrade	FTP/TFTP upload and upgrade
	Online upload and upgrade
	Automatic download alarm, log, and data to FTP server

Item	Function
Performance statistics	Ethernet interface performance statistics, complied with RFC1213
	Terminal traffic performance statistics
	Pseudo wire connection performance statistics
	Port performance statistics at service access side
	IGMP packets performance statistics
	Multicast traffic statistics

4.4 Reliability Specifications

Table 4-26 lists the ZXA10 C320 reliability specifications.

Table 4-26 Reliability Specification

Item	Specification
MTBF	≥11 year
MTTR	30 minute
System lifetime	≥20 year
CE certification	CE, UL, FCC

4.5 Environment Requirements

4.5.1 Storage Environment

Climate Environment

Table 4-27 lists the ZXA10 C320 storage climate environment requirements.

Table 4-27 Storage Climate Requirements

Name	Requirement
Temperature	-40°C to 70°C
Temperature change ratio	≤ 1 °C/min
Relative humidity	5%–95%
Air pressure	70 kPa–106 kPa
Sun radiation	≤ 700 W/m ²

Water Resistance Requirements

The equipment should be stored indoors. No accumulated water appears on the storage floor and no leakage from the ceiling. The equipment should be stored out of the possible leakage places, such as the auto fire control facilities and water-heating system.

Biological Environment

The ZX A10 C320 storage has the following requirements on the biological environment:

- Protection from biological generation, such as fungi and leaf mold.
- Protection from rodents, such as mouse.

Air Cleanness

The ZX A10 C320 storage has the following requirements on the air cleanness:

- No explosive, electronically conductive, magnetically conductive, or erosive dust exists.
- The mechanical active materials concentration meets the requirements, as listed in [Table 4-28](#).

Table 4-28 Storage Mechanical Active Materials Concentration

Mechanical Active Material	Unit	Value
Floating dust	mg/m ³	≤ 5.00
Sediment dust	mg/m ² ·h	≤ 20.00
Sands	mg/m ³	≤ 300.00

- Floating dust: diameter ≤ 75 μm
- Sediment dust: 75 μm ≤ diameter ≤ 150 μm
- Sands: 150 μm ≤ diameter ≤ 1000 μm

- The chemical active materials concentration meets the requirements, as listed in [Table 4-29](#).

Table 4-29 Storage Chemical Active Materials Concentration

Chemical Active Material	Unit	Value
SO ₂	mg/m ³	≤ 0.30
H ₂ S	mg/m ³	≤ 0.10
NO ₂	mg/m ³	≤ 0.50
NH ₃	mg/m ³	≤ 1.00
Cl ₂	mg/m ³	≤ 0.10
O ₃	mg/m ³	≤ 0.05

Mechanical Stress

[Table 4-30](#) lists the mechanical stress requirements of the ZX A10 C320 storage.

Table 4-30 Storage Mechanical Stress Requirements

Item	Sub-Item	Range	
Sinusoidal vibration	Location drift	≤ 1.50 mm	–
	Acceleration	–	≤ 5.00 m/s ²
	Frequency	2 Hz–9 Hz	9 Hz–200 Hz
Unsteady impact	Impact response spectrum II	≤ 40.00 m/s ²	
	Static load	≤ 5 kPa	

- Impact response spectrum: Maximum acceleration responding curve under regulated impact incentive
- Impact response spectrum II: Semi-sinusoidal impact response spectrum consistent time is 22 ms.
- Static load: Packed equipment top pressure endurance in regulated stacking way

4.5.2 Transportation Environment

Climate Environment

Table 4-31 lists the ZXA10 C320 transportation climate environment requirements.

Table 4-31 Transportation Climate Requirements

Name	Requirement
Temperature	-40°C to 70°C
Temperature change ratio	≤ 3 °C/min
Relative humidity	5%–95%
Air pressure	70 kPa–106 kPa
Sun radiation	≤ 1120 W/m ²
Heat radiation	≤ 600 W/m ²
Wind speed	≤ 30 m/sec

Water Resistance Requirements

The water resistance requirements during the transportation are as follows:

- The package should be in good condition.
- Transportation vehicles must have waterproof measures and are protected from rain.
- There should be no accumulated water in the transportation vehicles.

Biological Environment

The ZXA10 C320 transportation has the following requirements on the biological environment:

- Protection from biological generation, such as fungi and leaf mold.

- Protection from rodents, such as a mouse.

Air Cleanness

The ZXA10 C320 transportation has the following requirements on the air cleanness:

- No explosive, electronically conductive, magnetically conductive, or erosive dust exists.
- The mechanical active materials concentration meets the requirements, as listed in [Table 4-32](#).

Table 4-32 Transportation Mechanical Active Materials Concentration

Mechanical Active Material	Unit	Value
Floating dust	mg/m ³	–
Sediment dust	mg/m ² oh	≤ 3.00
Sands	mg/m ³	≤ 100

- The chemical active materials concentration meets the requirements, as listed in [Table 4-33](#).

Table 4-33 Transportation Chemical Active Materials Concentration

Chemical Active Material	Unit	Value
SO ₂	mg/m ³	≤ 0.30
H ₂ S	mg/m ³	≤ 0.10
NO ₂	mg/m ³	≤ 0.50
NH ₃	mg/m ³	≤ 1.00
Cl ₂	mg/m ³	≤ 0.10
HCl	mg/m ³	≤ 0.10
HF	mg/m ³	≤ 0.01
O ₃	mg/m ³	≤ 0.05

Mechanical Stress

[Table 4-34](#) lists the mechanical stress requirements of the ZXA10 C320 transportation.

Table 4-34 Transportation Mechanical Stress Requirements

Item	Sub-Item	Range		
Sinusoidal vibration	Location drift	≤ 3.50 mm	–	–
	Acceleration	–	≤ 10.00 m/s ²	≤ 15.00 m/s ²
	Frequency	2 Hz–9 Hz	9 Hz–200 Hz	200 Hz–500 Hz

Item	Sub-Item	Range		
Random vibration	Acceleration spectrum density	1 m ² /s ³	0.30 m ² /s ³	0.30 m ² /s ³
	Frequency	10 Hz–200 Hz	200 Hz–500 Hz	500 Hz–1000 Hz
Unsteady impact	Impact response spectrum II	≤ 300 m/s ²		
	Static load	≤ 5 kPa		

4.5.3 Operation Environment

Climate Environment

Table 4-35 lists the ZXA10 C320 operation climate requirements.

Table 4-35 Operation Climate Requirements

Name	Requirement
Temperature	<ul style="list-style-type: none"> ● -25°C to 55°C (long-term) ● -35°C to 65°C (short-term)
Temperature change ratio	≤ 3 °C/min
Relative humidity	<ul style="list-style-type: none"> ● 5%–95% (long-term) ● 10%–100% (short-term)
Altitude	≤ 4000 m
Air pressure	70 kPa–106 kPa
Sun radiation	≤ 700 W/m ²
Heat dissipation	≤ 600 W/m ²
Wind speed	≤ 5 m/sec

- The temperature and humidity values are measure from 1.5 m height above the floor to 0.6 m at the front of the cabinet without front and back protection panels.

Biological Environment

The ZXA10 C320 operation has the following requirements on the biological environment:

- Protection from biological generation, such as fungi and leaf mold.
- Protection from rodents, such as a mouse.

Air Cleanness

The ZXA10 C320 operation has the following requirements on the air cleanness:

- No explosive, electronically conductive, magnetically conductive, or erosive dust exists.

- The mechanical active materials concentration meets the requirements, as listed in [Table 4-36](#).

Table 4-36 Operation Mechanical Active Materials Concentration

Mechanical Active Material	Unit	Value
Floating dust	mg/m ³	≤ 0.40
Sediment dust	mg/m ² •h	≤ 15.00
Sands	mg/m ³	≤ 300.00

- The chemical active materials concentration meets the requirements, as listed in [Table 4-37](#).

Table 4-37 Operation Chemical Active Materials Concentration

Chemical Active Material	Unit	Value
SO ₂	mg/m ³	≤ 0.30
H ₂ S	mg/m ³	≤ 0.03
NH ₃	mg/m ³	≤ 1.00
Cl ₂	mg/m ³	≤ 0.10

Mechanical Stress

[Table 4-38](#) lists the mechanical stress requirements of the ZXA10 C320 operation.

Table 4-38 Operation Mechanical Stress Requirements

Item	Sub-Item	Range	
Sinusoidal vibration	Location drift	≤ 3.50 mm	–
	Acceleration	–	≤ 10.00 m/s ²
	Frequency	2 Hz - 9 Hz	9 Hz - 200 Hz
Unsteady impact	Impact response spectrum II	≤ 40 m/s ²	
	Static load	0	

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Chapter 5

Networking Application

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5.1 Overview

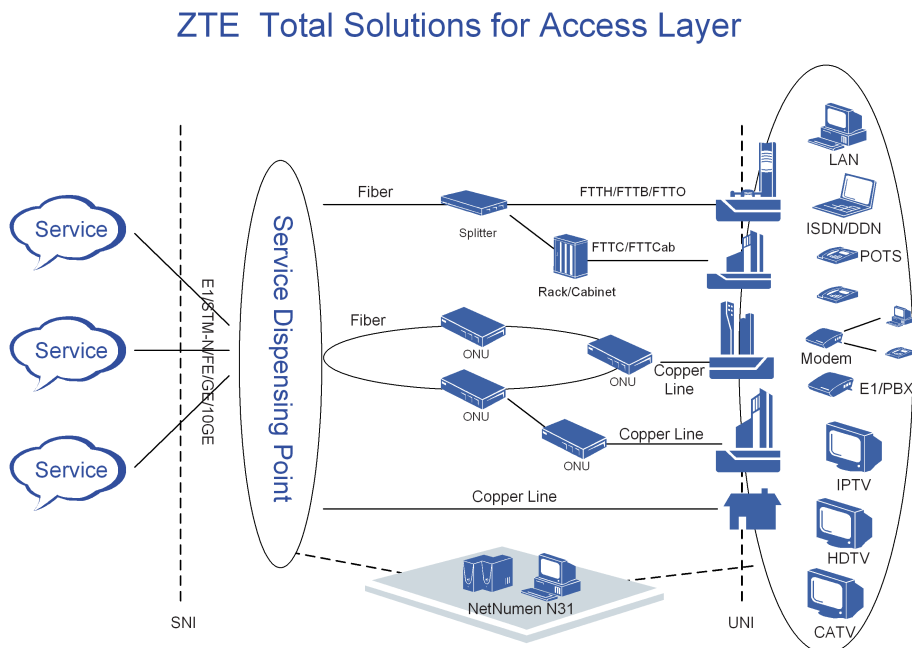
Various broadband and narrowband technologies are used to provide access to different subscribers. The PON technology is applicable for residential areas, houses, and buildings due to its high bandwidth and convenient maintenance.

It can also be used for the construction of old transmission systems, application of base stations, and construction of the existing access devices.

The ZXA10 system is one of the fixed network 3G (F3G) access solutions.

Figure 5-1 shows the ZTE F3G access solution.

Figure 5-1 ZTE F3G Access Solution



The Multi-Service access Node (MSAN)/Multi-Service access Gateway (MSAG), xDSL, and GPON can form a network independently or they can form a network together. For example, the PON terminal SFU/SBU forms a network together with other ZTE devices, such as Integrated Access Device (IAD), Home Gateway, and Ethernet switch.

The ZXA10 PON and the ZTE MSAG devices are used together to provide FTTx solutions.

5.2 FTTx Application

Working with ONU/ONTs, the ZXA10 C320 supports multiple FTTx networking:

- FTTH provides fiber access to subscriber homes.
- FTTB provides fiber access to buildings.
- FTTC provides fiber access to distribution cabinet.

Service Description

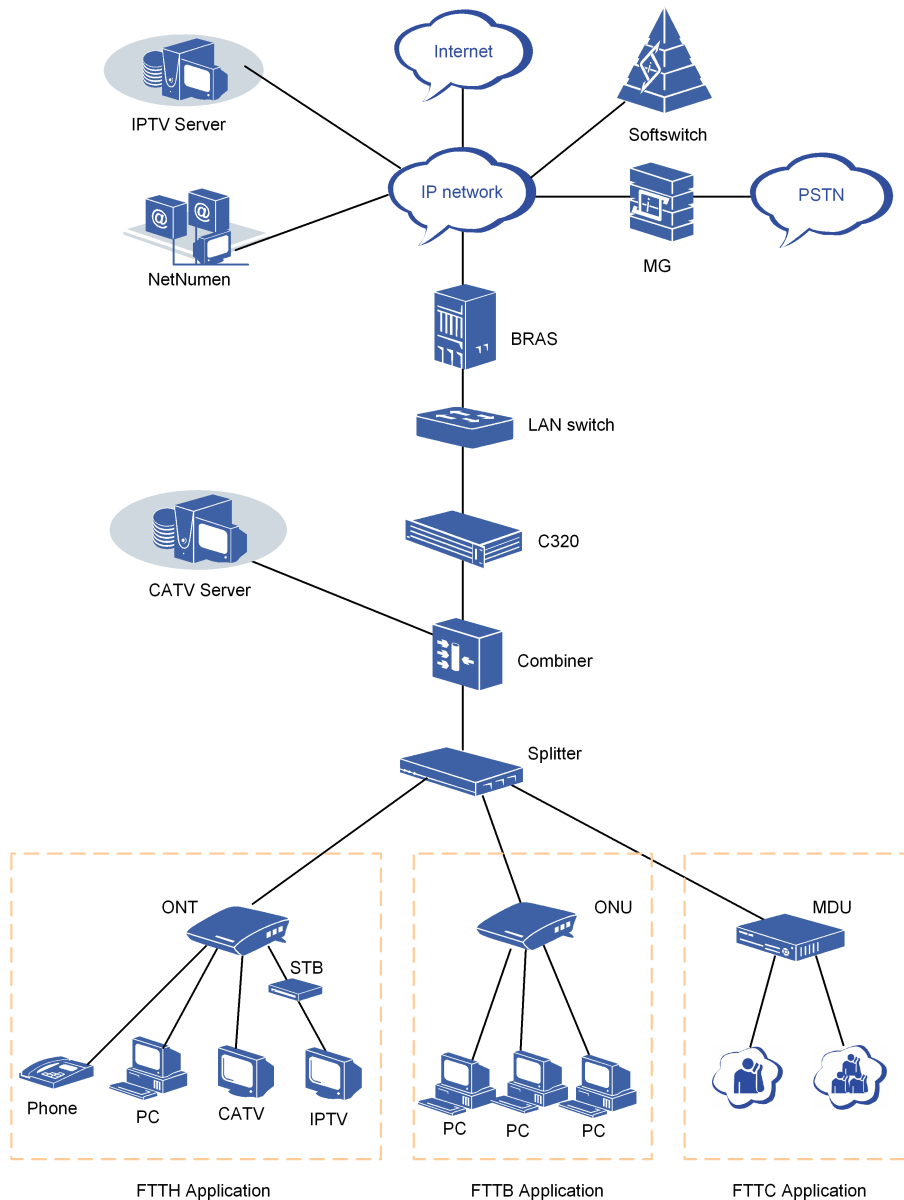
The ZXA10 C320 supports multiple FTTx applications:

- FTTH is applied in the distributed new apartments or houses. In the FTTH scenario, a single fiber that carries the data, voice, and video services reaches subscriber homes.
- FTTB is applied to existing buildings that have twisted pairs cabling. In the FTTB scenario, fibers are connected to ONT/ONUs in the buildings, and twisted pairs carry the data, voice, and video services to individual subscriber.
- FTTC is applied where street cabinet is close to the users' premises. In the FTTC scenario, fibers are connected to MDUs in street cabinets, and twisted pairs carry the data, voice, and video services to individual subscriber.

Networking Diagram

Figure 5-2 shows the networking diagram of FTTx applications.

Figure 5-2 Networking Diagram of FTTx Applications



Networking Description

- Voice service

VoIP terminals are connected to NGN through the ONTs and ZXA10 C320, or to the PSTN network through the MG.

- Data service

PCs are connected to the IP network through the ZXA10 C320 and BRAS equipment.

- Video service

Video service can be implemented by either IPTV or CATV.

→ IPTV

Video services are based on IP multicast traffic. Subscribers have choice on the video source.

The ZXA10 C320 manages multicast programs and subscribers rights through IGMP proxy and controllable multicast. When multicast subscribers pass the authentication, the ZXA10 C320 transmits the IGMP packets to the convergence layer equipment.

When the video traffic from the IPTV server arrives at the ZXA10 C320, the ZXA10 C320 forwards the traffic to multicast subscribers according to the authentication result.

On subscribers' terminals, video signals are terminated and converted on the STBs. switches programs on the STB. The programs can be switched on the STBs as well.

→ CATV

The video traffic is converted to optical signals, which are combined with the downstream optical signals from the ZXA10 C320 by WDM. When these signals arrive at ONTs, the video signals are separated and transmitted to the TV sets.

5.3 QinQ Application

The ZXA10 C320 supports the VLAN Tag in VLAN Tag (**Q-in-Q**, or QinQ) networking application, which saves the VLAN ID resource of the public network and achieves transparent transmission of the private network VLAN in the public network.

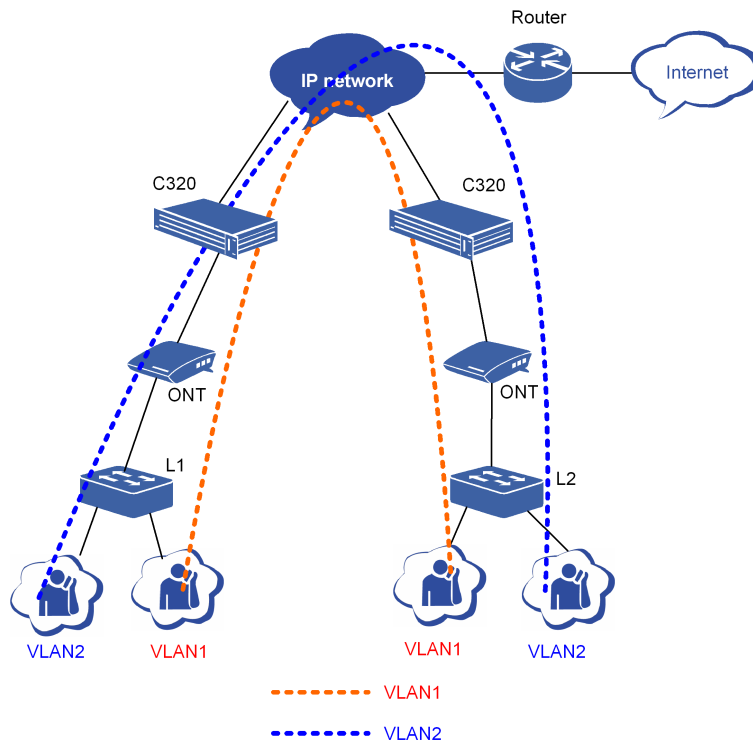
Service Description

The QinQ networking solution can assign the VLAN ID of the public network to the tagged user packets in a unified way and transmits packets in the backbone network by using the VLAN ID of the public network. This saves the VLAN ID resource of the public network and implements cross Metropolitan Area Network (**MAN**) connection of the point-to-point dedicated user lines.

Networking Diagram

Figure 5-3 shows the networking diagram of the QinQ application.

Figure 5-3 Networking Diagram of QinQ Application



Networking Description

The packets transmitted in the backbone network have two tags. One is the public network tag and the other is the private network tag.

- At the ZXA10 C320 user side

The enterprise users access the ZXA10 C320 through ONTs and use VLANs for bearing. When the VLAN 1 and VLAN 2 users access the ZXA10 C320, the ZXA10 C320 assigns the VLAN ID (VLAN 3, with QinQ properties) of the public network to the user packets and transmits the packets to the upper-layer network.

- At the ZXA10 C320 network side

The packets are transmitted in the backbone MAN according to the VLAN ID of the public network. When a packet arrives at the ZXA10 C320 device on the other end of the backbone network, its VLAN tag of the public network is removed and the packet is recovered to the user packet, and then is sent to the user-side device.

The QinQ networking solution saves the VLAN ID resource of the public network and achieves transparent transmission of the private network VLAN in the public network. It provides a simple layer-2 Virtual Private Network (VPN) channel for the users and expands the area for the private network.

5.4 VLAN Stacking Application

The ZXA10 C320 supports VLAN stacking networking to meet the requirements of user VLAN expansion and dedicated line wholesale services.

Service Description

- VLAN expansion

It is used for VLAN quantity expansion and user identification.

- Dedicated line wholesale services

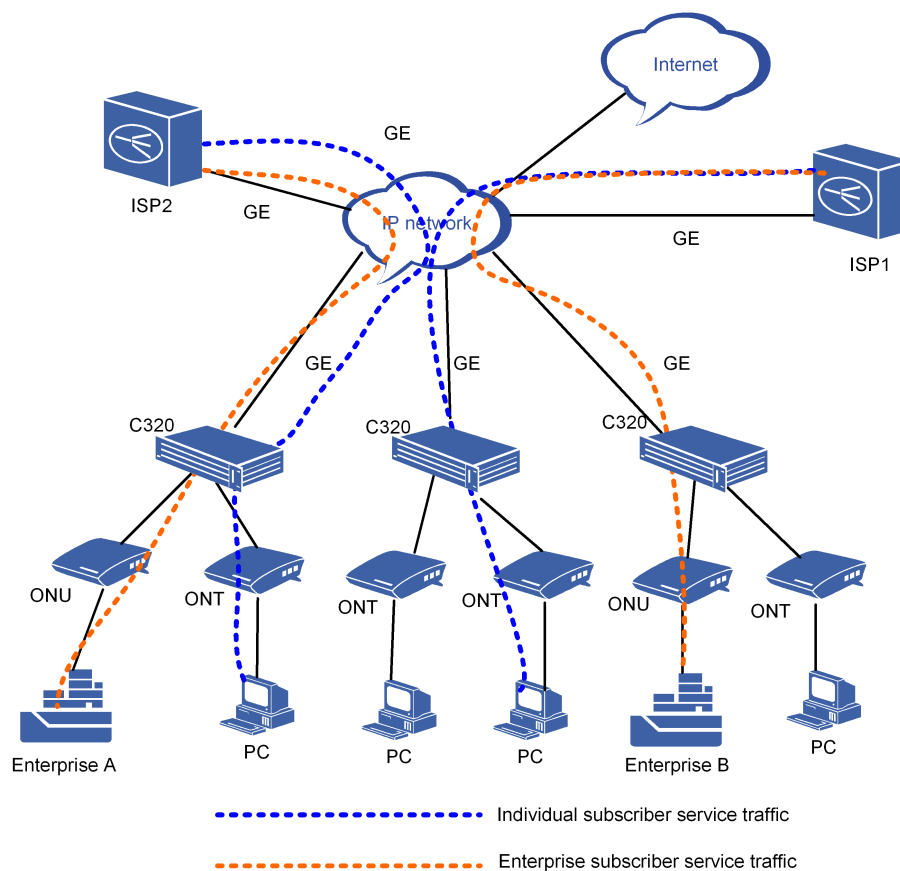
The upper-layer network works in layer-2 mode. It forwards packets according to the VLAN and MAC address.

The principle of VLAN stacking is similar with that of the QinQ dedicated line application. The difference is that VLAN stacking encapsulates two VLAN tags for user packets, while QinQ encapsulates only one VLAN tag for user packets.

Networking Diagram

Figure 5-4 shows the networking diagram of the VLAN stacking application.

Figure 5-4 Networking Diagram of VLAN Stacking Application



Networking Description

In VLAN stacking networking mode, the Broadband Remote Access Server (BRAS) device needs to authenticate the two VLAN tags. When a user packet is sent to the ZXA10 C320, it is capsulated with two VLAN tags, one outer VLAN tag and one inner VLAN tag. Then, the packet is forwarded to the corresponding Internet Service Provider (ISP) according to the outer VLAN tag of VLAN stacking and the user is identified according to the inner VLAN tag.

The VLAN stacking networking solution improves the VLAN reusability and achieves batch configuration of the dedicated line services.

5.5 Triple-Play Application

The ZXA10 C320 supports voice, data, and video service with QoS assurance.

Service Description

The ZXA10 C320 encapsulates data to different VLANs according to service types and then forwards data.

- EPON triple-play solution

An ONT uses different VLANs to discriminate different service traffics, and maps them to one LLID before sending service traffics to the ZXA10 C320.

The ZXA10 C320 forwards services in different VLANS according to service types.

- GPON: multiple GEM port triple-play solution

ONTs use different GEM Ports to discriminate service traffics.

ONTs map different service traffics to different GEM ports according to the VLAN ID, 802.1p, or physical port and then transmit traffics to the ZXA10 C320.

- GPON: single GEM port triple-play solution

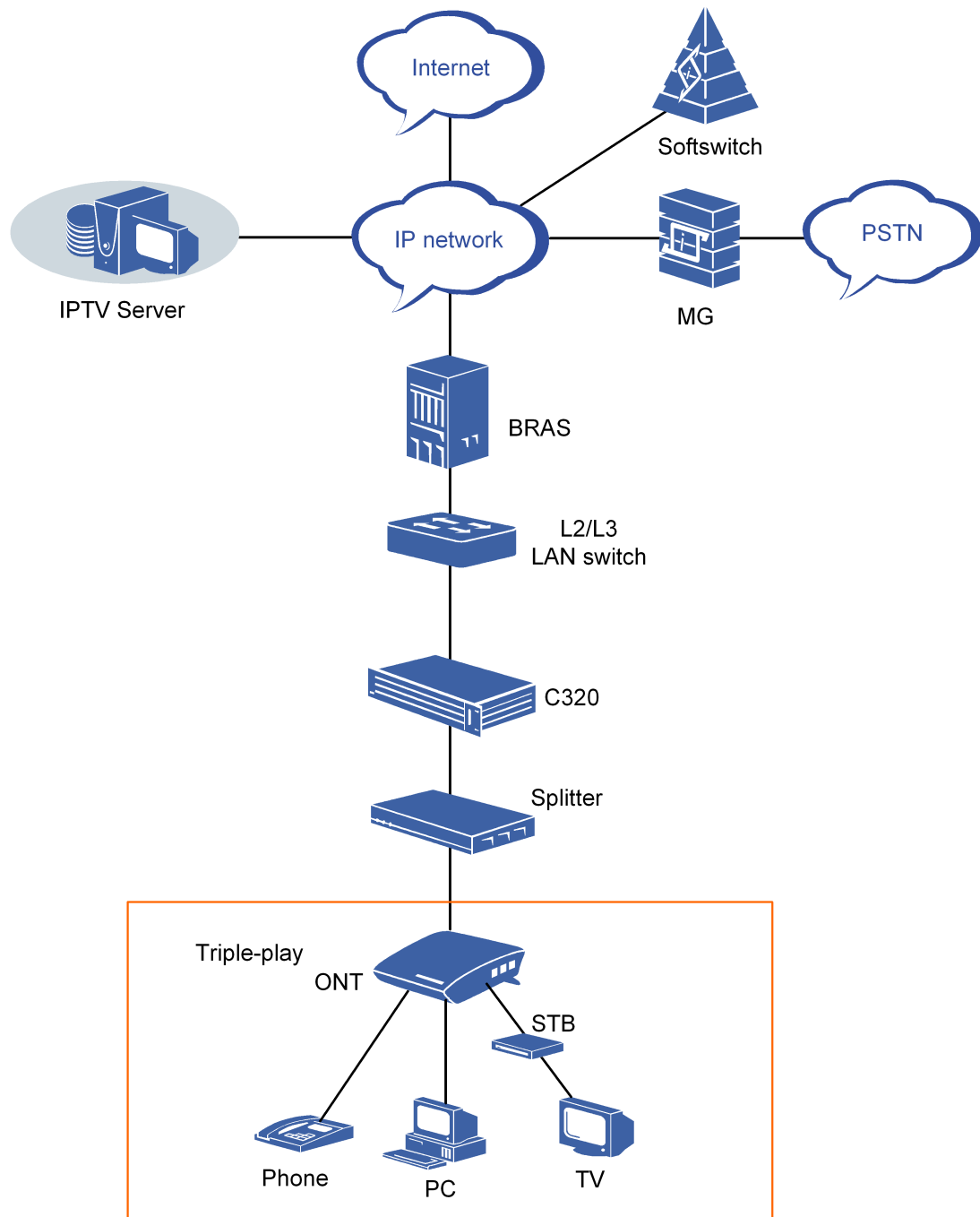
ONTs discriminate different service traffics according to the Ethernet type, VLAN ID, and 802.1p of the packets, or physical port and then transmit traffics to the ZXA10 C320.

This solution does not require the reconfiguration on existing ONTs and saves GEM Port resource.

Networking Diagram

Figure 5-5 shows the networking diagram of the triple-play application.

Figure 5-5 Networking Diagram of Triple-Play Application



Networking Description

- Voice service

VoIP terminals are connected to NGN through the ONTs and ZXA10 C320, or to the PSTN network through the MG.

- Data service

PCs are connected to the IP network through the ZXA10 C320 and BRAS equipment.

- Video service

Video services are based on IP multicast traffic. Subscribers have choice on the video source.

The ZXA10 C320 manages multicast programs and subscribers rights through [IGMP](#) proxy protocol packets and then transmits the packets to the [IPTV](#) server.

When the video traffic from the IPTV server arrives at the ZXA10 C320, the ZXA10 C320 transparently forwards the traffic to multicast subscribers.

Triple Play networking implements multiple services on a single user terminal.

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Appendix A

Protocols and Standards

Table of Contents

- International Standards..... A-1
- Enterprise Standards..... A-7

A.1 International Standards

Environment Standards

Standard No.	Standard Name
ETS 300 019	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment
IEC 60068	Basic Environmental Testing Procedures
NEBS GR-63-Core	NEBS Requirements: Physical Protection

Electromagnetic Compatibility Standards

Standard No.	Standard Name
2004/108/EC	Electromagnetic Compatibility (EMC)
EN 300386	Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements
IEC 61000	Electromagnetic compatibility (EMC)
EN 55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
EN 55024	Information technology equipment - Immunity characteristics - Limits and methods of measurement
NEBS GR-1089-Core	Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment

Security Standards

Standard No.	Standard Name
EN 60950	Information Technology Equipment - Safety - Part 1: General requirements
ITU-T K.27	Bonding configurations and earthing inside a telecommunication building
ETS 300 253	Equipment Engineering (EE) - Earthing and bonding of telecommunication equipment in telecommunication centres
ITU K.20	Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents
ITU K.44	Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation
73/23/EEC	Low Voltage Directive
93/68/EEC	CE Marking Directive

Power Supply Standards

Standard No.	Standard Name
ETS 300 132	Equipment Engineering (EE); Power Supply Interface at the Input to Telecommunications Equipment
ETSI TR 100 283	Environmental Engineering (EE); Transient voltages at Interface "A" on telecommunications direct current (dc) power distributions

Ethernet Protocol Standards

Standard No.	Standard Name
IEEE 802.2	IEEE standard for local and metropolitan area networks: Specific Requirements Part 2: Logical Link Control
IEEE 802.3	IEEE standard for local and metropolitan area networks: Specific Detection (CSMA/CD) Access Method and Physical Layer Specifications (includes 802.3ab, 802.3ac and 802.3ad)
IEEE 802.3u	Definition of Fast Ethernet (100BTX, 100BT4, 100BFX)

Standard No.	Standard Name
IEEE 802.3x	Definition of Full Duplex operation in a switched LAN
IEEE 802.3z	Definition of Gigabit Ethernet (over Fiber)
IEEE 802.3ad	Definition of Ethernet VLAN Trunking
IEEE 802.1d	MAC bridges
IEEE 802.1p	Traffic Class Expediting and Dynamic Multicast Filtering
IEEE 802.1q	IEEE standard for local and metropolitan area networks: Virtual Bridged Local Area Networks
IEEE 802.1w	Rapid Reconfiguration of Spanning Tree
IEEE 802.1x	Port Based Network Access Control

IP Protocol Standards

Standard No.	Standard Name
RFC768	User Datagram Protocol
RFC783	The TFTP Protocol (Revision 2)
RFC791	Internet Protocol
RFC792	Internet Control Message Protocol
RFC793	Transmission Control Protocol
RFC826	Ethernet Address Resolution Protocol
RFC854	Telnet Protocol Specification
RFC894	Standard for transmitting IP packet on Ethernet
RFC2131	Dynamic Host Configuration Protocol
RFC 3046	DHCP Relay Agent Information Option
RFC 2328	OSPF Version 2
RFC 1058	Routing Information Protocol (RIP)
RFC 1771	A Border Gateway Protocol 4 (BGP-4)
RFC 4251	The Secure Shell (SSH) Protocol Architecture

Multicast Protocol Standards

Standard No.	Standard Name
RFC 2236	Internet Group Management Protocol, Version 2
RFC 3376	Internet Group Management Protocol, Version 3

Standard No.	Standard Name
RFC 2362	Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification
RFC 3569	An Overview of Source-Specific Multicast (SSM)
RFC 4601	Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)
RFC 4602	Protocol Independent Multicast - Sparse Mode (PIM-SM) IETF Proposed Standard Requirements Analysis
RFC3590	Source Address Selection for the Multicast Listener Discovery (MLD) Protocol
RFC3815	Definitions of Managed Objects for the Multiprotocol Label Switching (MPLS),Label Distribution Protocol (LDP)
RFC4221	Multiprotocol Label Switching (MPLS) Management Overview
RFC4541	Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches
RFC3810	Multicast Listener Discovery Version 2 (MLDv2) for IPv6
RFC4604	Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast
RFC4605	Internet Group Management Protocol (IGMP) / Multicast ListenerDiscovery (MLD)-Based Multicast Forwarding ("IGMP/MLD Proxying")

OAM Protocol Standards

Standard No.	Standard Name
RFC 1157	Simple Network Management Protocol (SNMP)
RFC 1213	Management Information Base for Network Management of TCP/IP-based internets: MIB-II
RFC 1215	A Convention for Defining Traps for use with the SNMP
RFC 1493	Definitions of Managed Objects for Bridges

Standard No.	Standard Name
RFC 1643	Definitions of Managed Objects for the Ethernet-like Interface Types
RFC 1757	Remote Network Monitoring Management Information Base
RFC 1901	Introduction to Community-based SNMPv2
RFC 2274	User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
RFC 3195	Reliable Delivery for syslog
RFC 4133	The network element structure (rack/shelf/sub-shelf/slot/module)
RFC 4878	The DOT3-OAM-MIB
RFC 3635	The EtherLike-MIB
RFC 4188	BRIDGE-MIB
RFC 4363	P-BRIDGE-MIB Q-BRIDGE-MIB
RFC 2933	IGMP-STD-MIB
RFC 3414	User Based Security Model
RFC 3415	SNMP-VIEW-BASED-SECURITY-ACM-MIB
RFC 3413	SNMP-TARGET-MIB SNMP-NOTIFICATION-MIB
RFC 2819	RMON-MIB
RFC 2613	SMON-MIB
RFC 4221	Multiprotocol Label Switching (MPLS) Management Overview
draft-ietf-magma-mgmd-mib	Multicast Group membership Discovery MIB

GPON Protocol Standards

Standard No.	Standard Name
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 (GPON): Transmission Convergence Layer Specification

Standard No.	Standard Name
ITU-T G.984.4	Gigabit-capable Passive Optical Networks (GPON): ONU Management and Control Interface Specification
ITU-T G.984.5	Gigabit-capable Passive Optical Networks (G-PON): Enhancement band
ITU-T G.984.6	Gigabit-capable passive optical networks (GPON): Reach extension
ITU-T G.988	ONU management and control interface (OMCI) specification
ITU-T G.sup45	GPON power conservation

Other International Standards

Standard No.	Standard Name
ITU-T G.652	Characteristics of a single-mode optical fibre and cable
ITU-T G.692	Optical interfaces for multi-channel systems with optical amplifiers
ITU-T G.872	Architecture of optical transport network
ITU-T G.873	Optical transport networks requirements
ITU-T G.911	Parameters and calculation methodologies for reliability and availability of fiber optic systems
ITU-T M.3010	Principles for a Telecommunications management network
ITU-T -G.704	Synchronous Frame Structures Used at Primary Hierarchical Levels, July 1995.
ITU-T G.703	Physical/electrical characteristics of hierarchical digital interfaces
ITU-T G.823	The control of jitter and wander within digital networks which are based on the 2048 kbps hierarchy
ITU-T G.957	Optical interfaces for equipments and systems relating to the synchronous digital hierarchy
ITU-T G.825	The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH)

A.2 Enterprise Standards

Table A-1 lists the enterprise standards.

Table A-1 Enterprise Standard

Standard No.	Name
Q/ZX 00099.02-2010	PCB design specification – design technique
Q/ZX 04.100.3-2009	PCB design specification – production and test requirements
Q/ZX 00296.02-2010	Structure design specification - color requirements
Q/ZX 04.101.4-2007	Structure design specification - coating methods
Q/ZX 04.101.5-2000	Structure design specification - cabinet dimensions
Q/ZX 04.101.8-2007	Structure design specification - silk print requirements
Q/ZX 04.103-2001	Product name plate design requirements
Q/ZX 04.122-2009	Telecommunication equipment general application environment conditions
Q/ZX 04.402-2002	Processing characteristics in its structure design valuation items
Q/ZX 07.101-2005	Cable identification tag requirements
Q/ZX 07.102-2002	Cable identification tag design and application requirements
Q/ZX 07.200-2008	PCB parts 3 – anti general techniques
Q/ZX 07.212-2008	Integrated equipment cabling design and technology requirements
Q/ZX 12.203.11-2001	Metal products inspection specification – cabinet package inspection
Q/ZX 14.001-2008	Product package technology requirements and inspection method
Q/ZX 14.002-2000	Product package general technique specification
Q/ZX 14.003-2005	Product package inspection regulations
Q/ZX 14.004-2005A	Incoming material package general technique requirements
Q/ZX 23.011.1-2008	Telecommunication equipment Electromagnetic Compatibility (EMC) test requirements – overview
Q/ZX 23.018.1-2009	Reliability test requirements – overview
Q/ZX 23.019-2002	Product security design guide (trial version)

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Glossary

ACL

- Access Control List

AES

- Advanced Encryption Standard

ARP

- Address Resolution Protocol

ASM

- Asynchronous Transfer Mode (ATM) Switching Module

ASM is a board rather than a subsystem , which performs communication between BSCs, and achieves inter-BSC soft handoff.

BGP

- Border Gateway Protocol

BPDU

- Bridge Protocol Data Unit

BRAS

- Broadband Remote Access Server

BSP

- Board Support Package

CAC

- Channel Access Control

CAC

- Call Admission Control

CATV

- CAble TeleVision

CDR

- Call Detail Record

CLI

- Command Line Interface

CO

- Central Office

CPE

- Customer Premises Equipment

CPU

- Central Processing Unit

CoS

- Class of Service

DBA

- Dynamic Bandwidth Allocation

DHCP

- Dynamic Host Configuration Protocol

DSCP

- Differentiated Services Code Point

DSL

- Digital Subscriber Line

DWRR

- Deficit Weighted Round Robin

DoS

- Denial of Service

EPON

- Ethernet Passive Optical Network

FEC

- Forward Error Correction

FTP

- File Transfer Protocol

FTTB

- Fiber to the Building

FTTC

- Fiber to the Curb

FTTCab

- Fiber to the Cabinet

FTTH

- Fiber to the Home

GE

- Gigabit Ethernet

GEM

- GPON Encapsulation Method

GPON

- Gigabit Passive Optical Network

GTC

- GPON Transmission Convergence

GUI

- Graphical User Interface

HDTV

- High Definition Television

IAD

- Integrated Access Device

ICMP

- Internet Control Message Protocol

IGMP

- Internet Group Management Protocol

IP

- Internet Protocol

IPTV

- Internet Protocol Television

IS-IS

- Intermediate System-to-Intermediate System

ISP

- Internet Service Provider

ITU-T

- International Telecommunication Union - Telecommunication Standardization Sector

LACP

- Link Aggregation Control Protocol

LLID

- Logical Link Identifier

MAC

- Medium Access Control

MAN

- Metropolitan Area Network

MDU

- Multiple Dwelling Unit

MIB

- Management Information Base

MPCP

- Multi-Point Control Protocol

MSAG

- Multi-Service Access Gateway

MSAN

- Multi-Service Access Network

MSTP

- Multiple Spanning Tree Protocol

MTBF

- Mean Time Between Failures

MTTR

- Mean Time To Recovery

MTU

- Multi-Tenant Unit

MUX

- Multiplexer

MVR

- Multicast VLAN Registration

NGN

- Next Generation Network

NM

- Network Management

NMS

- Network Management System

OAM

- Operation, Administration and Maintenance

ODN

- Optical Distribution Network

OLT

- Optical Line Terminal

OMCI

- ONT Management Control Interface

ONT

- Optical Network Terminal

ONU

- Optical Network Unit

OPEX

- Operating Expenditure

OSPF

- Open Shortest Path First

P2P

- Peer-to-Peer

PIM-SM

- Protocol Independent Multicast - Sparse Mode

PON

- Passive Optical Network

POTS

- Plain Old Telephone Service

PPPoE

- Point to Point Protocol over Ethernet

PSTN

- Public Switched Telephone Network

Q-in-Q

- VLAN Tag in VLAN Tag

QoS

- Quality of Service

RADIUS

- Remote Authentication Dial In User Service

RF

- Radio Frequency

RIP

- Routing Information Protocol

RMON

- Remote Monitoring

RSTP

- Rapid Spanning Tree Protocol

RoHS

- Restriction of Hazardous Substances

SBU

- Single Business Unit

SCB

- Single Copy Broadcast

SFU

- Single Family Unit

SLA

- Service Level Agreement

SMS

- Service Management System

SNMP

- Simple Network Management Protocol

SP

- Strict Priority

SPR

- Subscription Profile Repository

SSH

- Secure Shell

SSM

- Source Specific Multicast

STP

- Signaling Trace Part

STP

- Spanning Tree Protocol

TCP

- Transfer Control Protocol

TDM

- Time Division Multiplexing

TFTP

- Trivial File Transfer Protocol

ToS

- Type of Service

TrTCM

- Two-rate Three Color Marker

UAPS

- Uplink Auto Protection Switching

UDP

- User Datagram Protocol

VLAN

- Virtual Local Area Network

VOD

- Video On Demand

VPN

- Virtual Private Network

VoIP

- Voice over Internet Protocol

WDM

- Wavelength Division Multiplexing

WFQ

- Weighted Fair Queuing

WLAN

- Wireless Local Area Network

WRED

- Weighted Random Early Detection