Alcatel·Lucent

Alcatel-Lucent 7330

INTELLIGENT SERVICES ACCESS MANAGER FIBER TO THE NODE
ONT R04.02.41

Alcatel-Lucent 7302

INTELLIGENT SERVICES ACCESS MANAGER | ONT R04.02.41

ONT PRODUCT INFORMATION GUIDE
3FE 54017 AAAA TCZZA Edition 01

Disclaimers

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This document was originally written in English. If there is any conflict or inconsistency between the English version and any other version of a document, the English version shall prevail.

Preface

This preface provides general information about the documentation set for optical network terminals (ONTs).

Scope

This documentation set provides information about safety, features and functionality, ordering, hardware installation and maintenance, and software installation procedures for the current release.

Audience

This documentation set is intended for planners, administrators, operators, and maintenance personnel involved in installing, upgrading, or maintaining the ONTs.

Required knowledge

The reader must be familiar with general telecommunications principles.

Acronyms and initialisms

The expansions and optional descriptions of most acronyms and initialisms appear in the glossary.

Assistance and ordering phone numbers

Alcatel-Lucent provides global technical support through regional call centers. Phone numbers for the regional call centers are available at the following URL: http://www.alcatel-lucent.com/myaccess.

For ordering information, contact your Alcatel-Lucent sales representative.

Alcatel-Lucent quality processes

Alcatel-Lucent's ONT manufacturing, testing, and inspecting practices are in compliance with GR-1252-CORE and TL 9000 requirements. These requirements are documented in the Operations Quality Plan 8BD-00023-4204-QRZZA, the Alcatel North American Quality Manual 8BD-00001-0000-QRZZA, and the Wireline Network Quality Manual 8AB-83179-0001-QRAAA.

The quality plans and practices adequately ensure that technical requirements and customer end-point requirements are met. The customer or its representatives may be allowed to perform on-site quality surveillance audits, as agreed upon during contract negotiations.

Safety information

For safety information, see the appropriate safety guidelines chapter.

Documents

Documents are available using ALED or OLCS.

Procedure 1 To download an CD-ROM ISO image or ZIP file package of the customer documentation

1   Navigate to http://www.alcatel-lucent.com/myaccess and enter your user name and password. If you are a new user and require access to this service, please contact your Alcatel-Lucent sales representative.

2   From the Technical Content for drop-down menu, choose the product.

3   Click on Downloads: Electronic Delivery.

4   Choose Documentation from the drop-down menu and click Next.

5   Select the image from the drop-down menu and click Next.

6   Follow the onscreen directions to download the file.

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Procedure 2 To access individual documents

Individual PDFs of customer documents are also accessible through the Alcatel-Lucent Customer Support website.

1   Navigate to http://www.alcatel-lucent.com/myaccess and enter your user name and password. If you are a new user and require access to this service, please contact your Alcatel-Lucent sales representative.

2   From the Technical Content for drop-down menu, choose the product.

3   Click on Manuals and Guides to display a list of customer documents by title and part number. You can filter this list using the Release drop-down menu.

4   Click on the PDF to open or save the file.

Special information

The following are examples of how special information is presented in this document.

Danger — Danger indicates that the described activity or situation may result in serious personal injury or death; for example, high voltage or electric shock hazards.

Warning — Warning indicates that the described activity or situation may, or will, cause equipment damage or serious performance problems.

Caution — Caution indicates that the described activity or situation may, or will, cause service interruption.

Note — A note provides information that is, or may be, of special interest.

Procedures with options or substeps

When there are options in a procedure, they are identified by letters. When there are required substeps in a procedure, they are identified by roman numerals.

Procedure 3 Example of options in a procedure

At step 1, you can choose option a or b. At step 2, you must do what the step indicates.

1 This step offers two options. You must choose one of the following:

   a This is one option.

   b This is another option.

2 You must perform this step.

Procedure 4 Example of required substeps in a procedure

At step 1, you must perform a series of substeps within a step. At step 2, you must do what the step indicates.

1 This step has a series of substeps that you must perform to complete the step. You must perform the following substeps:

   i This is the first substep.

   ii This is the second substep.

   iii This is the third substep.

2 You must perform this step.

Multiple PDF document search

You can use Adobe Reader Release 6.0 and later to search multiple PDF files for a common term. Adobe Reader displays the results in a single display panel. The results are grouped by PDF file, and you can expand the entry for each file.

Note — The PDF files in which you search must be in the same folder.

Procedure 5 To search multiple PDF files for a common term

1 Open Adobe Acrobat Reader.

2 Choose Edit→Search from the Acrobat Reader main menu. The Search PDF panel appears.

3 Enter the search criteria.

4 Click on the All PDF Documents In radio button.

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5   Select the folder in which to search using the drop-down menu.

6   Click on the Search button.

Acrobat Reader displays the search results. You can expand the entries for each document by clicking on the + symbol.

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ETSI ONT safety guidelines

This chapter provides information about the mandatory regulations that govern the installation and operation of the optical network terminals (ONTs).

Safety instructions

This section describes the safety instructions that are provided in the ONT customer documentation and on the equipment.

Safety instruction boxes

The safety instruction boxes are provided in the ONT customer documentation. Observe the instructions to meet safety requirements.

The following is an example of the Danger box.

Danger — Possibility of personal injury.

The Danger box indicates that the described activity or situation may pose a threat to personal safety. It calls attention to a situation or procedure which, if not correctly performed or adhered to, may result in death or serious physical harm.

Do not proceed beyond a Danger box until the indicated conditions are fully understood and met.

The following is an example of the Warning box.

Warning 1 — Possibility of equipment damage.

Warning 2 — Possibility of data loss.

The Warning box indicates that the described activity or situation may, or will, cause equipment damage, loss of data, or serious performance problems. It identifies a possible equipment-damaging situation or provides essential information to avoid the degradation of system operations or data.

Do not proceed beyond a warning until the indicated conditions are fully understood and met.

The following is an example of the Caution box.

Caution 1 — Possibility of service interruption.

Caution 2 — Service interruption.

The Caution box indicates that the described activity or situation may, or will, cause service interruption.

Do not proceed beyond a caution until the indicated conditions are fully understood and met.

The following is an example of the Note box.

Note — Information of special interest.

The Note box provides information that assists the personnel working with ONTs. It does not provide safety-related instructions.

Safety-related labels

The ONT equipment is labeled with the specific safety instructions and compliance information that is related to a variant of the ONT. Observe the instructions on the safety labels.

Table 1 provides sample safety labels on the ONT equipment.

Table 1 Safety labels

Description	Label text
ESD warning	Caution: This assembly contains an electrostatic sensitive device.
Laser classification	Class 1 laser product
PSE marking	These power supplies are Japan PSE certified and compliant with Japan VCCI emissions standards.

Figure 1 shows the PSE certification.

Figure 1 PSE certification

⚠ Warning	This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.
警告	VCCI準拠クラスB機器（日本） この機器は、Information Technology EquipmentのVoluntary Control Council for Interference（VCCI）の規格に準拠したクラスB製品です。この機器をラジオやテレビ受信機の近くで使用した場合、混信を発生する恐れがあります。本機器の設置および使用に際しては、取扱い説明書に従ってください。

19841

Safety standards compliance

This section describes the ONT compliance with the European safety standards.

EMC, EMI, and ESD compliance

The ONT equipment complies with the following EMC, EMI, and ESD requirements:

- EN 300-386 V1.3.2 (2003-05): Electromagnetic Compatibility and Radio Spectrum Matters (ERM): Telecommunications Network Equipment; Electromagnetic Compatibility (EMC) requirements; Electrostatic Discharge (ESD) requirements
- EN 55022 (1998): Class B, Information Technology Equipment, Radio Disturbance Characteristics, limits and methods of measurement
- EN 55024 (1998): Information Technology Equipment, Immunity Characteristics, limits and methods of measurement
- European Council Directive 2004/108/EC
- EN 300-386 V1.4.1: 2008
- EN 55022:2006 Class B (ONTs)
- EN EN 61000-3-2:2006
- EN EN 61000-3-3:2008
- IEC 61000-4-2:2001
- IEC 61000-4-3:2006
- IEC 61000-4-4:2004
- IEC 61000-4-5:2005
- IEC 61000-4-6:2003/A1:2004/A2:2006
- IEC 61000-4-11:2004

Equipment safety standard compliance

The ONT equipment complies with the requirements of EN 60950-1, Safety of Information Technology Equipment for use in a restricted location (per R-269).

Environmental standard compliance

The ONT equipment complies with the EN 300 019 European environmental standards.

Laser product standard compliance

The ONT equipment complies with EN 60825-1 and IEC 60825-2 for laser products.

Resistibility requirements compliance

The ONT equipment complies with the requirements of ITU Recommendation K.21 for resistibility of telecommunication equipment installed in customer premises to over voltage and overcurrents.

Acoustic noise emission standard compliance

The ONT equipment complies with EN 300 753 acoustic noise emission limit and test methods.

Electrical safety guidelines

This section provides the electrical safety guidelines for the ONT equipment.

Note 1 — The ONTs comply with the U.S. National Electrical Code. However, local electrical authorities have jurisdiction when there are differences between the local and U.S. standards.

Note 2 — The ONTs comply with BS EN 61140.

Power supplies

The use of any non-Alcatel-Lucent approved power supplies or power adaptors is not supported or endorsed by Alcatel-Lucent. Such use will void any warranty or support contract with Alcatel-Lucent. Such use greatly increases the danger of damage to equipment or property.

Cabling

The following are the guidelines regarding cables used for the ONT equipment:

- All cables must be approved by the relevant national electrical code.
- The cables for outdoor installation of ONTs must be suitable for outdoor use.
- POTS wiring run outside the subscriber premises must comply with the requirements of local electrical codes. In some markets, the maximum allowed length of the outside run is 140 feet (43 m). If the outside run is longer, NEC requires primary protection at both the exit and entry points for the wire.

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Protective earth

Earthing and bonding of the ONTs must comply with the requirements of local electrical codes.

ESD safety guidelines

The ONT equipment is sensitive to ESD. Operations personnel must observe the following ESD instructions when they handle the ONT equipment.

Caution — This equipment is ESD sensitive. Proper ESD protections should be used when you enter the TELCO Access portion of the ONT.

During installation and maintenance, service personnel must wear wrist straps to prevent damage caused by ESD.

Laser safety guidelines

Observe the following instructions when you perform installation, operations, and maintenance tasks on the ONT equipment.

Only qualified service personnel who are extremely familiar with laser radiation hazards should install or remove the fiber optic cables and units in this system.

Danger — There may be invisible laser radiation at the fiber optic cable when the cable is removed from the connector. Avoid direct exposure to the laser beam.

Observe the following danger for laser hazard. Eyes can be damaged when they are exposed to a laser beam. Take necessary precautions before you plug in the optical modules.

Danger — Possibility of equipment damage. Risk of eye damage by laser radiation.
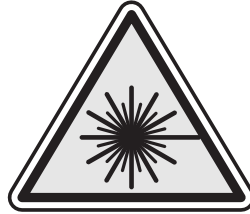
Laser classification

The ONT is classified as a Class 1 laser product based on its transmit optical output.

Laser warning labels

The following figures show the labels related to laser product, classification and warning.

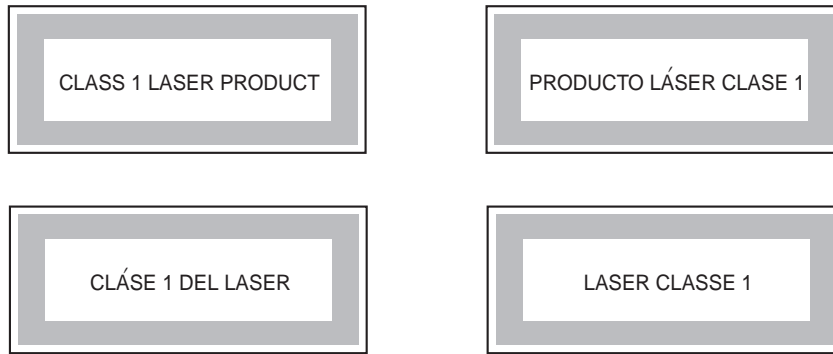Figure 2 shows a laser product label.

Figure 2 Laser product label

18455

Figure 3 shows a laser classification label. Laser classification labels may be provided in other languages.

Figure 3 Laser classification label

CLASS 1 LASER PRODUCT	PRODUCTO LÁSER CLASE 1
CLÁSE 1 DEL LASER	LASER CLASSE 1

18992

Figure 4 shows a laser warning label and an explanatory label for laser products. Labels and warning may be provided in other languages. The explanatory label provides the following information:

- a warning that calls attention to the invisible laser radiation
- an instruction against staring into the beam or viewing directly with optical instruments
- wavelength
- normal output power
- maximum output power

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Figure 4 Laser warning labels

```
INVISIBLE LASER RADIATION
DO NOT STARE INTO BEAM
OR VIEW DIRECTLY WITH
OPTICAL INSTRUMENTS
Wavelength(s): xxxx nm
Normal output power: xx m W
Max output power: yyy m W
```
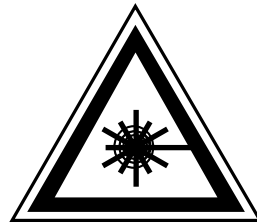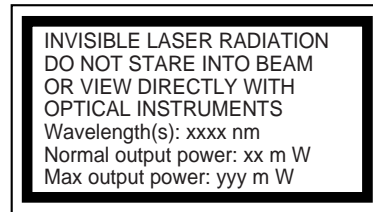
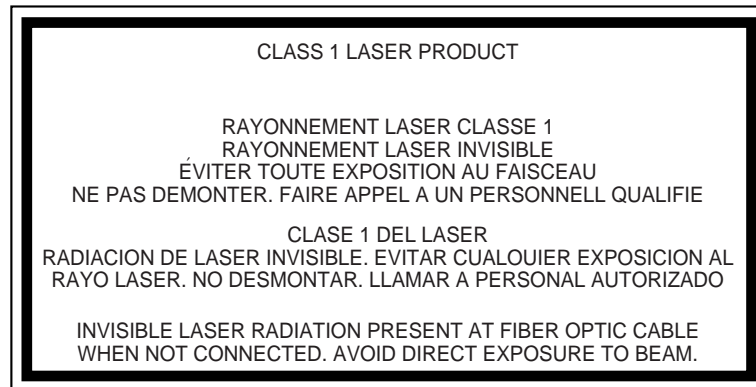Laser Warning Label   Laser Warning Label

```
CLASS 1 LASER PRODUCT


RAYONNEMENT LASER CLASSE 1
RAYONNEMENT LASER INVISIBLE
ÉVITER TOUTE EXPOSITION AU FAISCEAU
NE PAS DEMONTER. FAIRE APPEL A UN PERSONNELL QUALIFIE

CLASE 1 DEL LASER
RADIACION DE LASER INVISIBLE. EVITAR CUALOUIER EXPOSICION AL
RAYO LASER. NO DESMONTAR. LLAMAR A PERSONAL AUTORIZADO

INVISIBLE LASER RADIATION PRESENT AT FIBER OPTIC CABLE
WHEN NOT CONNECTED. AVOID DIRECT EXPOSURE TO BEAM.
```

Laser Warning Label

18993

Transmit optical output

The maximum transmit optical output of an ONT is +5 dBm.

Normal laser operation

In normal operation, fiber cable laser radiation is always off until it receives signal from the line terminal card.

Eyes can be damaged when they exposed to a laser beam. Operating personnel must observe the instructions on the laser explanatory label before plugging in the optical module.

Danger — Risk of eye damage by laser radiation.

Location class

Use cable supports and guides to protect the receptacles from strain.

Environmental requirements

See the ONT technical specification documentation for more information about temperature ranges.

During operation in the supported temperature range, condensation inside the ONT caused by humidity is not an issue. To avoid condensation caused by rapid changes in temperature and humidity, Alcatel-Lucent recommends:

- The door of the ONT not be opened until temperature inside and outside the enclosure has stabilized.
- If the door of the ONT must be opened after a rapid change in temperature or humidity, use a dry cloth to wipe down the metal interior to prevent the risk of condensation.
- When high humidity is present, installation of a cover or tent over the ONT helps prevent condensation when the door is opened.

ETSI environmental and CRoHS guidelines

This chapter provides information about the ETSI environmental China Restriction of Hazardous Substances (CRoHS) regulations that govern the installation and operation of the optical line termination (OLT) and optical network termination (ONT) systems. This chapter also includes environmental operation parameters of general interest.

Environmental labels

This section describes the environmental instructions that are provided with the customer documentation, equipment, and location where the equipment resides.

Overview

CRoHS is applicable to Electronic Information Products (EIP) manufactured or sold and imported in the territory of the mainland of the People's Republic of China. EIP refers to products and their accessories manufactured by using electronic information technology, including electronic communications products and such subcomponents as batteries and cables.

Environmental related labels

Environmental labels are located on appropriate equipment. The following are sample labels.

Products below Maximum Concentration Value (MCV) label

Figure 1 shows the label that indicates a product is below the maximum concentration value, as defined by standard SJ/T11363-2006 (Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products). Products with this label are recyclable. The label may be found in this documentation or on the product.

Figure 1 Products below MCV value label

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Products containing hazardous substances above Maximum Concentration Value (MCV) label

Figure 2 shows the label that indicates a product is above the maximum concentration value, as defined by standard SJ/T11363-2006 (Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products). The number contained inside the label indicates the Environment-Friendly User Period (EFUP) value. The label may be found in this documentation or on the product.

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Figure 2 Products above MCV value label

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Together with major international telecommunications equipment companies, Alcatel-Lucent has determined it is appropriate to use an EFUP of 50 years for network infrastructure equipment and and EFUP of 20 years for handsets and accessories. These values are based on manufacturers' extensive practical experience of the design, manufacturing, maintenance, usage conditions, operating environments, and physical condition of infrastructure and handsets after years of service. The values reflect minimum values and refer to products operated according to the intended use conditions. See "Hazardous Substances Table (HST)" for more information.

Hazardous Substances Table (HST)

This section describes the compliance of the OLT and ONT equipment to the CRoHS standard when the product and subassemblies contain hazardous substances beyond the MCV value. This information is found in this user documentation where part numbers for the product and subassemblies are listed. It may be referenced in other OLT and ONT documentation.

In accordance with the People's Republic of China Electronic Industry Standard Marking for the Control of Pollution Caused by Electronic Information Products (SJ/T11364-2006), customers may access the Alcatel-Lucent Hazardous Substance Table, in Chinese, from the following location:

- http://www.alcatel-sbell.com.cn/wwwroot/images/upload/private/1/media/ChinaRoHS.pdf

Other environmental requirements

Observe the following environmental requirements when handling the P-OLT or ONT equipment.

ONT environmental requirements

See the ONT technical specification documentation for more information about temperature ranges.

Storage

According to ETS 300-019-1-1 - Class 1.1, storage of OLT equipment must be in Class 1.1, weather-protected, temperature-controlled locations.

Transportation

According to EN 300-019-1-2 - Class 2.3, transportation of the OLT equipment must be in packed, public transportation with no rain on packing allowed.

Stationary use

According to EN 300-019-1-3 - Class 3.1/3.2/3.E, stationary use of OLT equipment must be in a temperature-controlled location, with no rain allowed, and with no condensation allowed.

Thermal limitations

When the OLT is installed in the CO or CEV, install air filters on the P-OLT. The thermal limitations for OLT operation in a CO or CEV are:

- operating temperature: 5°C to 40°C (41°F to 104°F)
- short-term temperature: –5°C to 50°C (23°F to 122°F)
- operating relative humidity: 5% to 85%
- short-term relative humidity: 5% to 95%, but not to exceed 0.024 kg of water/kg

Material content compliance

European Union (EU) Directive 2002/95/EC, "Restriction of the use of certain Hazardous Substances" (RoHS), restricts the use of lead, mercury, cadmium, hexavalent chromium, and certain flame retardants in electrical and electronic equipment. This Directive applies to electrical and electronic products placed on the EU market after 1 July 2006, with various exemptions, including an exemption for lead solder in network infrastructure equipment. Alcatel-Lucent products shipped to the EU after 1 July 2006 comply with the EU RoHS Directive.

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End-of-life collection and treatment

Electronic products bearing or referencing the symbol shown in Figure 3, when put on the market within the European Union (EU), shall be collected and treated at the end of their useful life, in compliance with applicable EU and local legislation. They shall not be disposed of as part of unsorted municipal waste. Due to materials that may be contained in the product, such as heavy metals or batteries, the environment and human health may be negatively impacted as a result of inappropriate disposal.

Note — In the European Union, a solid bar under the symbol for a crossed-out wheeled bin indicates that the product was put on the market after 13 August 2005.

Figure 3 Recycling/take back/disposal of product symbol

At the end of their life, the OLT products are subject to the applicable local legislations that implement the European Directive 2002/96EC on waste electrical and electronic equipment (WEEE).

There can be different requirements for collection and treatment in different member states of the European Union.

In compliance with legal requirements and contractual agreements, where applicable, Alcatel-Lucent will offer to provide for the collection and treatment of Alcatel-Lucent products bearing the logo shown in Figure 3 at the end of their useful life, or products displaced by Alcatel-Lucent equipment offers. For information regarding take-back of equipment by Alcatel-Lucent, or for more information regarding the requirements for recycling/disposal of product, contact your Alcatel-Lucent account manager or Alcatel-Lucent take back support at takeback@alcatel-lucent.com.

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ONT and MDU general system overview

1 — ONT and MDU overview

2 — Part numbers, ordering, and deployment configuration overview

3 — ONT and MDU general and interface technical specifications

4 — ONT and MDU statistics and performance monitoring

5 — ONT management using an ONT interface

1 — ONT and MDU overview

1.1 ONT and MDU general descriptions of features and functions

The ONT and MDU are part of a family of products that provide "last mile" broadband access solutions. The products work together to form a fiber access network capable of delivering high quality voice, video, and data services to both single-family and multi-dwelling residential subscribers.

The Alcatel-Lucent ONT and MDU products are edge devices that use GPON technology to extend a fiber optic cable from a P-OLT shelf at a CO to a subscriber residence, including single-family residences, multi-dwelling residences such as an apartment building, and small office applications.

The ONT product family consists of the following:

- Packet Optical Line Terminations (P-OLTs)
- ONTs that include:
  - business focused models
  - residential models (indoor, outdoor)
  - multi-dwelling unit models (MDU)
- Element Management System (EMS), including: a simple web-based management system and a sophisticated network management system

P-OLTs

The P-OLT resides in the central office (CO) or controlled environment vault (CEV) and provides interfaces between the network and the gigabit passive optical network (GPON).

Business ONTs

The business ONT terminates services at the subscriber's premises and is suitable for a mix of small to medium business as well as residential applications. The business ONT provides voice, data and IP video, and optional RF video services to subscribers and supports CES DS1 or E1 connections at the business premises.

Business ONTs also provide a single entry point for voice, data, and video services at the subscriber's premises and multiplexes E1 traffic with Ethernet data across the GPON.

Indoor ONTs

The indoor ONT terminates services at the subscriber's premises and is used for single-family residences. The indoor ONT is suitable for installation on a desktop or for attaching to an interior wall.

MDUs

The multi-dwelling unit ONT terminates services at the subscriber's premises and is suitable for apartment, condominium, and small office or home office (SOHO) applications. MDUs support VDSL2 interfaces and Ethernet interfaces.

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Outdoor ONTs

The outdoor ONT terminates services at the subscriber's premises and is used for single-family residences. The outdoor ONT is suitable for installation outside the building and has a tamper-resistant design and an environmentally-hardened enclosure.

EMS

The EMS software system use GUI interfaces to provide element management functions for the OLTs and ONTs.

ONTs and MDUs per package type

The ONT product family is categorized into package types based on the similar features and functions that are supported by the hardware on the 7302 ISAM / 7330 ISAM FTTN converged platform.

All ONTs and MDUs comply with the following standards:

- Dynamic Bandwidth Allocation (DBA) for sharing amongst multiple users while maintaining QoS
- Forward Error Correction (FEC) for longer reach upstream and downstream
- Advanced Encryption System (AES) for downstream and upstream data security
- ONT Management Control Interface (OMCI) for ONT management and provisioning

The common features and functions for ONTs and MDUs include the following:

- GEM mode support for efficient IP/Ethernet service traffic transport
- GPON interface capable of 1.244 Gb/s upstream and 2.488 Gb/S downstream line rates
- integrated triplexers or bidirectional transceivers for single fiber with 1490 nm wavelength downstream, 1310 nm wavelength upstream, and optional 1550 nm downstream for RF video overlay and/or MoCA service (on some models)
- class B+ 28 dB link loss budget with up to 20km (12.43 mi) reach
- CES encapsulation of DS1/E1 using the MEF-8 packetization format for transport across the layer 2 Ethernet PON
- interworking functions between the PON optical overlay and the RF video interface (on some models)
- voice interworking function from the analog POTS lines to the VoIP/Ethernet layers
- mux and demux functions to the PON
- interworking functions between the PON optical overlay and the RF video interface (on some models)
- voice interworking functions between the GEM and Ethernet layers
- support for up to 1:64 splits per PON
- single mode fiber (SC/APC) connector and optional Opti-Tap connector (on some models)
- optical-to-electrical conversion

- network demarcation for all services
- PON reach capacity: minimum 18.6 mi (30 km) and maximum 37.3 mi (60 km) depending on the optical budget supported by the LT card used, the PON reach specified based on network deployments, and the losses of optical fiber, connectors, and splitters, and so on.

Table 1-1 lists the ONTs and MDUs categorized into package types and describes the specific features, functions and limitations.

Warning — Existing ONTs that use 7342 ISAM FTTU releases older than R04.06.xx and R04.07.xx must be upgraded to use R04.00.10 software while assigned to a PON ID value smaller than 64. For this purpose, if split ratios larger than 1:64 are being deployed, you may choose to set aside the first PON ID as a staging point.

Table 1-1 ONTs and MDUs general descriptions per package type

Package type	ONT or MDU mnemonic	See UDS chapter	Features and functions	Considerations and limitations
A	I-010G-A I-020E-B I-020E-H I-020G-F I-220E-A I-241G-A O-421E-B	7 9 9 9 12 13 18	AES with operator enable/disable per port-ID level Single mode fiber and use 2x5 SFF SC/APC optical port Optical budget of 28 dB (without FEC) and an Rx optical sensitivity of -27 dB	See Package A ONT considerations and limitations FEC is not supported on the following ONTs: • I-020E-B • I-020E-H • I-020E-B • O-421E-B

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Package type	ONT or MDU mnemonic	See UDS chapter	Features and functions	Considerations and limitations
B	I-240G-B I-241G-B I-010G-B	14 14 8	Single mode fiber and use 2x5 SFF SC/APC optical port Optical budget of 28 dB (without FEC) and an Rx optical sensitivity of -27 dB ITU-IT G.984-compliant framing G.984.3-compliant multicast using a single GEM port-ID for all video traffic AES with operator enable/disable per port-ID level AES 128 decryption with key generation and switching Single T-CONT and multiple T-CONT mode Flexible mapping between GEM ports and T-CONTs Mapping of GEM ports into a T-CONT with priority queues-based scheduling Multicast GEM ports per device DBA reporting in status indications in the Physical Layer Overhead Upstream burst (PLOu), and by piggyback reports in the Dynamic BAndwidth Report Upstream (DBRu) for mode 0 G.984.3-compliant activation with automatic discovery of a serial number and a password 802.1p mapper service profile on the upstream	See Package B ONT considerations and limitations

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Package type	ONT or MDU mnemonic	See UDS chapter	Features and functions	Considerations and limitations
C	I-010G-P I-010G-Q I-011G-P I-020G-P I-040G-P I-110G-P I-240G-P I-241G-P I-240G-Q I-241W-P I-440G-P	10 – – 10 10 11 15 15 15 16 17	ITU-T G.984-compliant framing G 984.3-compliant multicast using a single GEM port-ID for all video traffic Single T-CONT and multiple T-CONT mode AES with operator enable/disable per port-ID level AES 128 decryption with key generation and switching 12 GEM ports per Ethernet UNI; see specific UDS Flexible mapping between GEM ports and T-CONTs Mapping of GEM ports into a T-CONT with priority queues-based scheduling Multicast GEM ports per device DBA reporting in status indications in the Physical Layer Overhead Upstream burst (PLOu), and by piggyback reports in the Dynamic BAndwidth Report Upstream (DBRu) for mode 0 G.984.3-compliant activation with automatic discovery of a serial number and a password 802.1p mapper service profile on the upstream	See Package C ONT considerations and limitations
D	—	—	Package D ONTs are not currently supported on the converged platform	—
E	All	—	Common Package E features and functions: • 100 Mb/s downstream and 100 Mb/s upstream VDSL2 line rate • configurable VDSL2 interfaces on a 24-pin AMP connector • fast Ethernet 10/100Base-T ports compliant with IEEE 802.3 • one MGMT port with RJ-45 connector for 100/1000Base-T Ethernet connection • deployment in an enclosure that wall mounts on a mounting bracket • FSAN GPON standards-compliant ONT for MDU	—

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Package type	ONT or MDU mnemonic	See UDS chapter	Features and functions	Considerations and limitations
	O-8881V-P	—	8 configurable VDSL2 interfaces on a 24-pin AMP connector One analog RF video over coaxial connection with a dedicated wavelength of 1550 nm VDSL2 system support for loop lengths of 300 m (984 ft) VDSL2 service compliant with ITU-T standard G.993.2	—
	O-00240V-P	21	24 VDSL2 (30MHz) ports Deployment scenario of horizontal 19 in rack mounting and cabinet mounting 802.1x service authentication support 1640 ft (500 m) target loop length VDSL service using up to 2 Alloc-IDs and 5 Port-IDs per VDSL port (assuming equal distribution across all 16 or 24 VDSL ports Save Data button on the front panel (but also accessible from a network manager) that activates a script for collecting relevant data and transferring it into a reserved area of flash memory Maximum of 8 CoS per VDSL2 port (per 802.1p mapping	—

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Package type	ONT or MDU mnemonic	See UDS chapter	Features and functions	Considerations and limitations
F	O-00160V-Q O-00240V-Q	20 21	16 or 24 VDSL2 (30MHz) ports FSAN GPON standards-compliant ONT for MDU Deployment scenario of horizontal 19 in rack mounting and cabinet mounting 802.1x service authentication support 1640 ft (500 m) target loop length VDSL service using up to 2 Alloc-IDs and 5 Port-IDs per VDSL port (assuming equal distribution across all 16 or 24 VDSL ports Save Data button on the front panel (but also accessible from a network manager) that activates a script for collecting relevant data and transferring it into a reserved area of flash memory Maximum of 8 CoS per VDSL2 port (per 802.1p mapping 100 Mb/s downstream and 100 Mb/s upstream VDSL2 line rate configurable VDSL2 interfaces on a 24-pin AMP connector fast Ethernet 10/100Base-T ports compliant with IEEE 802.3 one MGMT port with RJ-45 connector for 100/1000Base-T Ethernet connection deployment in an enclosure that wall mounts on a mounting bracket	—
G	O-0881V-A	19	AES with operator enable/disable per port-ID level 8 configurable VDSL2 interfaces on a 24-pin AMP connector 8 Fast Ethernet 10/100 Base-T ports compliant with IEEE 802.3 FSAN GPON standards-compliant ONT for MDU Deployment in an enclosure that wall mounts on a mounting bracket Save Data button on the front panel (but also accessible from a network manager) that activates a script for collecting relevant data and transferring it into a reserved area of flash memory One coaxial port with an operating wavelength range of 1550 nm to 1560 nm	See Package G ONT considerations and limitations

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Package type	ONT or MDU mnemonic	See UDS chapter	Features and functions	Considerations and limitations
H	B-0404-A	6	G.984.3 compliant AES with operator enable/disable on per port-ID level 802.3 compliant 10/100/1000BASE-T Ethernet interfaces using RJ-45 ports four E1/T1 interfaces using RJ-48C ports MEF-8 packetization for TDM transport over GPON subscriber location ID (SLID) IP video with multistage IGMPv3 or IGMPv2 snooping up to 64 video multicast streams shared by 4 GbE ports G.984.3-compliant multicast using a single GEM Port-ID for all video traffic	See Package H ONT considerations and limitations

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Package A ONT considerations and limitations

Table 1-2 lists the considerations and limitations for Package A ONTs.

Table 1-2 Package A ONT considerations and limitations

Considerations and limitations
No support for per VLAN protocol downstream tagging mode
In SVLAN cross-connect tunnel mode: • use non-overlapping pbits since the use of the same pbits on two or more VLAN ports results in a mismatch alarm • downstream frames sent with a single tag normally sent out on the user-side as untagged, will instead be sent as priority tagged
When using CVLAN translation, or when the same queue is used for multiple pbits, the highest pbit value in the queue in the downstream direction will be selected to stomp the pbit in the packet
Simultaneous configuration of a CVLAN port and an S-Tunnel on the same UNI will only be supported if these services are provisioned with non-overlapping pbits
The same VLAN port must be used when employing both protocol-based VLAN for PPPoE and IPoE-based VLANs
When the VLAN is translated, the pbit value must be modified and the highest pbit value is mapped to that GEM port
When more than one Ethernet port is in VLAN translation mode, or set to flexible mode with IGMP channels created, the USERSIDE VLAN IDs of those services are different. All downstream multicast packets will be tagged on the UNI port with VLAN ID of 4094
Maximum use of multicast on 1 Ethernet port at a time
For C forwarder and S+C CC forwarder, if the VLAN port uses regenerated profiles or regenerated pbits, then the downstream traffic can only flow with the derived pbits

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Considerations and limitations
When either tip or ring is grounded, DGNONTPOTS tip to ground and ring to ground restrictive measurements are simultaneously reported as 0 ohms

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Package B ONT considerations and limitations

Table 1-3 lists the considerations and limitations for Package B ONTs.

Table 1-3 Package B ONT considerations and limitations

Considerations and limitations
When using multicast on multiple Ethernet ports, all Ethernet ports must have the same VLAN ID. If the user-side VLAN IDs are all given the same VLAN ID, a common VLAN ID should result. If not, VLAN 4094 will be used
Package B ONTs are not able to sufficiently buffer enough traffic between grants to support an EIR rate of 1Gb/s over multiple GEM ports. There are only 1.256 Gb/s buffers available in the SoC chip. The buffers are divided among the number of configured GEM ports. Reducing the number of GEM ports configured results in increased upstream buffering and higher upstream traffic rates.
Packets of less than 64 bytes are increased to 100 bytes in size with padding under the following conditions: • in a downstream direction • in an upstream direction only if the ONT has more than 2 Ethernet ports
Package B ONTs that use pre R04.00.10 software may not range if the distance from the LT card is less than 1km

Package C ONT considerations and limitations

Table 1-4 lists the considerations and limitations for Package C ONTs.

Table 1-4 Package C ONT considerations and limitations

Considerations and limitations
Support for up to 32 GEM ports per Ethernet UNI
Support for 7 T-CONTs including the OMCI T-CONT
Ethernet OAM (802.1 ag) is not supported
TPID overwrite is not supported
Anti-spoofing is not supported
802.1x is not supported
IGMPv3 snooping with SSM is not supported
VLAN translation is supported prior to replication for downstream IPTV multicast. The same VLAN operation must be provisioned for all Ethernet UNIs participating in IPTV multicasting
The ONT will not support sending some untagged multicast frames through one Ethernet UNI while sending other tagged multicast frames through another Ethernet UNI

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Considerations and limitations
Double-tagged frames are not supported
Flow control is not supported. The ONT will not generate PAUSE frames for the client if there is traffic congestion
Configurable Ethernet for VLAN tag detection is not supported. Currently, only 0x8100 is supported
POTS pull-break-dial-tone (PBDT) is not supported for SIP, H.248, and G6
Call history data collection (ONTCALLHST) is not supported
G.729 and G.711 a/u are supported while G.726-32 codec is not supported
Only one global DSCP to pbit mapping table is supported
Default Ethernet flow and wildcard Ethernet flow coexisting on the same Ethernet port is not supported
Maximum of 16 service flows (VLANs) can be enabled with pbit translation
Non-supported call services: • Direct connect • Warm line • Call forward status indications • Home Intercom • Call park • Bridged line • Call pickup with barge-in • Suppressed ringing
Service classification by Ethertype is not supported
The first time an ONT is connected, the initial Ethernet UNI is enabled by default. This Ethernet UNI can be disabled by the OLT
When pbit translation is enabled, each GEM port can only translate into one pbit. Mapping downstream Pbits to different GEM ports is the only form of supported pbit translation
Static multicast is not supported
IPTV multicast over PPPoE (from the multicast port) is not supported
PM counter is partially supported
Pbit translation following DSCP to pbit mapping is not supported
Pbit translation when a UNI is set to pass through any VLAN ID (unisidevlan=4096 and networksidevlan=4096) is not supported
Packet loss occurs in 1G wirespeed. Due to the additional 4-byte routing tag, throughput is less than 1G for all packet lengths
Weighted round robin (WRR) is not accurate when configured with OMCI because the weight definition in BL device is the reverse of OMCI definition
For WRR scheduling, bandwidth is not used by a queue can not be claimed by any other queues
Up to eight extended VLAN rules per VLAN port is supported
AES key can not be changed locally on an ONT

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Package G ONT considerations and limitations

Table lists the considerations and limitations for Package G ONTs.

Table 1-5 Package G ONT considerations and limitations

Considerations and limitations
No support for per VLAN protocol downstream tagging mode
In SVLAN cross-connect tunnel mode: • use non-overlapping pbits since the use of the same pbits on two or more VLAN ports results in a mismatch alarm • downstream frames sent with a single tag normally sent out on the user-side as untagged, will instead be sent as priority tagged
When using CVLAN translation, or when the same queue is used for multiple pbits, the highest pbit value in the queue in the downstream direction will be selected to stomp the pbit in the packet
Simultaneous configuration of a CVLAN port and an S-Tunnel on the same UNI will only be supported if these services are provisioned with non-overlapping pbits
The same VLAN port must be used when employing both protocol-based VLAN for PPPoE and IPoE-based VLANs
When the VLAN is translated, the pbit value must be modified and the highest pbit value is mapped to that GEM port
When more than one Ethernet port is in VLAN translation mode, or set to flexible mode with IGMP channels created, the USERSIDE VLAN IDs of those services are different. All downstream multicast packets will be tagged on the UNI port with VLAN ID of 4094
Maximum use of multicast on 1 Ethernet port at a time
For C forwarder and S+C CC forwarder, if the VLAN port uses regenerated profiles or regenerated pbits, then the downstream traffic can only flow with the derived pbits
When either tip or ring is grounded, DGNONTPOTS tip to ground and ring to ground restrictive measurements are simultaneously reported as 0 ohms

Package H ONT considerations and limitations

Table 1-6 lists the considerations and limitations for Package H ONTs.

Table 1-6 Package H ONT considerations and limitations

Considerations and limitations
Do not submerge business ONTs. The ONT cannot withstand water submersion caused by flooding. Equipment damage will occur
The B-0404-A E1 interface supports standard 120 Ω termination via an RJ-48C. Customers that require a 75 Ω termination need an external adapter
Line loopbacks are not supported
The B-0404-A does not support VLAN translation and VLAN pass-through traffic that uses the same p-bit across the same UNI or downstream p-bit translation when services are configured in VLAN pass-through mode

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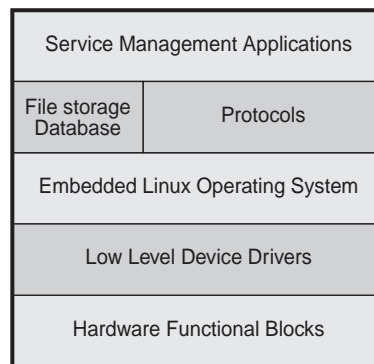
ONT ITU-T standards

All Alcatel-Lucent ONTs are developed using the following GPON ITU-T standards:

- G.984.1(GPON Service requirements)
- G.984.2 (GPON PDM layer)
- G.984.2 (GPON PDM layer) amendment 1
- G.984.3 (GPON TC Layer)
- G.984.3 (GPON TC Layer) amendment 1 and 2
- G.984.4 (GPON OMCI)
- G.984.4 (GPON OMCI) amendments 1 and 2

1.2   ONT and MDU software architecture and protocols

Figure 1-1 provides a depiction of each level of software used to support the ONT hardware.

Figure 1-1 Software architecture levels


```
┌──────────────────────────────────────────┐
│        Service Management Applications     │
├────────────────┬───────────────────────────┤
│ File storage   │                           │
│ Database       │        Protocols          │
├────────────────┴───────────────────────────┤
│       Embedded Linux Operating System      │
├────────────────────────────────────────────┤
│          Low Level Device Drivers          │
├────────────────────────────────────────────┤
│          Hardware Functional Blocks        │
└────────────────────────────────────────────┘
```

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The following list provides a description of the hardware and software functions supported for all ONTs.

1   The hardware functional blocks are described in the ONT unit data sheets.

2   Low level device drivers control elements of each functional block on an ONT.

3   The embedded Linux kernel provides the operating system for the ONT.

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4   Each ONT supports the following protocols:

- TCP/IP
- ICMP
- IGMP version 2 and 3
- FTP
- DHCP
- ARP
- VoIP (including SIP mode 1 and 2, H.248 (Megaco), etc.)
- PPPoE
- UDP

5   SOC-based ONTs rate-limit the number of control packets for protocols IGMP, DHCP, and ARP to 10 control packets per second by ONT UNI port. IGMP is not rate-limited for an ONT UNI port if an IGMP channel is provisioned for the port.

6   ONTs provide a file storage database (flash or SDRAM).

7   ONTs provide service management applications including the following:

- ONT management control interface (OMCI) manager
- VoIP manager
- VDSL2 manager
- 802.1x manager
- DS1/E1 manager
- MoCA manager
- Ethernet manager
- Craft manager
- Filter manager (DOS, rate limiting, OAM, MAC, DHCP, anti-spoofing etc...)
- DHCP client
- IGMP video manager
- GPON/Port-ID, QoS, and VLAN tagging manager
- GPON manager
- Equipment manager
- Software download manager
- MLT/Diagnostics manager

1.3   GPON transmission support

The GPON transmission layer supports GEM based packets as well as the following features also described in G.984.3 (GPON TC Layer) ITU specification.

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FEC

Forward Error Correction (FEC) is used by the GEM transport layer between the ONTs and an P-OLT, and is based on transmitting the data in an encoded format. The encoding introduces redundancy, which allows the decoder to detect and correct the transmission errors.

> **Note —** FEC is not supported on the following types of ONTs:
>
> • I-020E-B
> • I-020E-H
> • I-220E-A
> • O-421E-B

Fragmentation

Fragmentation occurs when a packet received at the ONT is larger than the maximum transmission grant size. The ONT segments the packet and sends the segments in multiple GEM frames over the GPON to the LT card at the P-OLT. The packets are then reassembled at the LT card. Fragmentation occurs between the ONT and the P-OLT in the upstream direction.

AES

The SSH transport layer provides authentication, encryption, and integrity. Encryption is provided by a public-private key exchange to negotiate a shared session secret between the ONT and the P-OLT: the symmetric key for AES. The connection layer provides multiplexing of different streams over the transport layer.

AES is enabled on a per-service level during service configuration at the P-OLT using TL1.

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1.4 ONT activation and behavior using SLID

For the P-OLT to communicate with an ONT, the ONT must be connected to the PON and the P-OLT must know either the serial number of the ONT, or the subscriber location ID (SLID) of the ONT.

- A serial number is hard coded into ONTs. The ONT serial number can be entered into the P-OLT using the ENT-ONT TL1 command before or after the ONT is installed at the customer site. The installer must install the ONT with the corresponding serial number at the customer site.
- The SLID is a decimal number, a hexadecimal number, or an alphanumeric string that uniquely identifies an ONT on a PON. For the P-OLT to know an ONT by a SLID, the SLID must be entered in two places:
  - at the P-OLT using the TL1 command ENT-ONT before or after the ONT is connected to the PON
  - at the ONT before the ONT is connected to the PON, using one of the SLID entry methods described in the following sections. The installer can use any ONT for a customer, but the same SLID must be used. When the ONT is polled, the P-OLT and the ONT SLIDs are compared. If the SLIDs match, the serial number is retrieved from the installed ONT and registered at the P-OLT.

The following sections describe SLID entry methods supported by some Alcatel-Lucent ONTs. The procedures for entering the SLID using these methods are described in the operations and maintenance documentation for the OLT.

SLID entry via craft terminal

The SLID can be entered with a laptop connected to the craft port on the ONT. This method is only supported on outdoor ONTs that have a craft port. A CLI interface supports this SLID entry method; see section 1.5 for more information about the CLI interface.

SLID entry via Ethernet port

The SLID can be entered with a laptop connected to an Ethernet port on the ONT through a Telnet session or an HTTP client. This method is only supported on indoor ONTs that have Ethernet connections. A CLI or HTTP interface supports this SLID entry method; see section 1.5 for more information about the CLI and HTTP interfaces.

SLID entry via first POTS port

The SLID can be entered with a butt set connected to the first POTS port on an indoor or outdoor ONT supporting this SLID entry method.

SLID and LED behavior

If a currently provisioned SLID contains non-numeric digits, the ONT exits the SLID output mode. If a currently provisioned SLID contains only numeric digits, the value is displayed back to the installer using the POTS or Voice LED on the ONT or MDU. Each SLID number is determined by counting the number of times that the LED flashes.

If a currently provisioned SLID contains non-numeric digits, the ONT exits the SLID output mode. If a currently provisioned SLID contains only numeric digits, the value is displayed back to the installer using the POTS LED on the ONT. Each SLID number is determined by counting the number of times that the POTS LED on the ONT flashes as follows:

- If the SLID is in decimal format:
  - For the numbers 1 to 9, the flash pattern is 0.5 second of green light followed by 1 second of no light, repeated the number of times necessary to correspond to the number.
  - For the number 0, the flash pattern is 0.5 second of green light followed by 1 second of no light repeated 10 times.
  - There is a three second interval between digits.
- If the SLID is in hexadecimal format:
  - For the numbers 1 to 9, the flash pattern is 0.5 second of green light followed by 0.5 second of no light, repeated the number of times necessary to correspond to the number.
  - For the number 0, the flash pattern is 0.5 second of green light followed by 0.5 second of no light repeated 10 times.
  - There is a three second interval between digits.

Note 1 — The SLID number displays more slowly in decimal format than in hexadecimal format.

Note 2 — The SLID number can be verified at any time by connecting a butt set to the first POTS port and dialing the "#" key.

1.5   ONT management at a local site

ONT interfaces support the management of an ONT at a local site, and include:

- HTTP interface
- CLI interface
- HTTP interface for Package C ONTs
- CLI interface for Package C ONTs
- butt set

The HTTP and CLI interfaces provide access to utilities that allow a field technician to:

- retrieve product information about an ONT, such as vendor name, firmware, type of ONT, and serial number
- retrieve operational information about an ONT, to monitor events such as the operational states, uptime, receive signal strength indication (RSSI), status of LEDs, and ranging state of the ONT
- monitor a software download to an ONT
- reboot or reset an ONT to recover from connection, power, software download, and other failures

- perform OMCI and protocol tracing for problem diagnosis and resolution
- enter the SLID at an ONT, to activate ONTs with their provisioning data and services using the SLID method, and to clear the SLID when an ONT is removed

Package C ONTs have a unique CLI that enable a field technician to retrieve and modify the SLID and HTTP interface for viewing the current and entering a new SLID.

The butt set allows a field technician to enter or clear the SLID at an ONT using a POTS port.

Table 1-7 identifies with a check mark the utilities that an ONT interface supports.

Table 1-7 Utilities supported by ONT interfaces

Utilities	HTTP interface	CLI interface	HTTP interface for Package C ONTs	CLI interface for Package C ONTs	Butt set
Retrieval of ONT product information	✓	✓	✓		
Retrieval of ONT states	✓	✓			
Retrieval of ONT uptime	✓	✓			
Retrieval of RSSI	✓	✓			
Retrieval of status of LEDs	✓	✓			
Retrieval of ranging state	✓	✓			
Retrieval of software download state	✓	✓			
ONT reset	✓	✓	✓		
OMCI and protocol tracing	✓	✓	✓		
Entry and clearing of SLID	✓	✓	✓	✓	✓

Access to ONT interfaces

An ONT interface is accessible through a port on the ONT.

- HTTP interfaces are accessible through an Ethernet connection on indoor ONTs with an HTTP server.
- The CLI interface is accessible through an Ethernet connection on indoor ONTs, and a serial RS-232 craft connection on outdoor ONTs.
- The CLI interface for Package C ONTs is accessible through an Ethernet connection and a serial RS-232 craft connection.
- The butt set is used through a POTS connection on an indoor or outdoor ONT.

Table 1-8 identifies the ONT interfaces, the ONTs that a specific ONT interface supports, the field equipment that the ONT interface requires, and the ONT port on which the field equipment must be connected.

Table 1-8 Local ONT interfaces

ONT interface	Supported ONTs	Field equipment required	Field equipment connected to
HTTP interface	Indoor ONT with Ethernet connection and HTTP server	Computer or laptop with HTTP client	First Ethernet port
CLI interface	Indoor ONT with Ethernet connection	Computer or laptop with Telnet software	First Ethernet port
	Outdoor ONT with craft connection	Computer or laptop	Craft port
HTTP interface for Package C ONTs	Indoor ONT with Ethernet connection and HTTP server	Computer or laptop with HTTP client	First Ethernet port
CLI interface for Package C ONTs	ONTs with Ethernet connection	Computer or laptop with Telnet software	Ethernet port
	ONT with craft connection	Computer or laptop	Craft port
Butt set interface	Indoor ONT with POTS connection	Butt set	First POTS port
	Outdoor ONT with POTS connection		

ONT interface security

The HTTP and CLI interfaces are password-protected to prevent unauthorized access to utilities. In addition, each ONT has a security setting that specifies the access level of a user to the HTTP and CLI interface utilities, after the ONT is ranged. User access levels are as follows:

- read-write access, which grants a user read and write access to all utilities
- read-only access, which grants a user read-only access to the SLID, ranging state, and RSSI of the ONT
- no access, which denies a user access to all utilities

1.6 ONT configuration using a web-based interface

Some Package C ONTs support additional limited configuration using web-based GUIs not included in section 1.5. By using the provided GUIs, the customer can perform the following configuration and reporting tasks:

- Network (including LAN, WAN, and Wi-Fi service configuration)
- Advanced (including SNTP, DDNS, Port forwarding, and Firewall configuration)
- Maintenance (including password change, revert to factory default, reboot device, and upgrade tasks)
- Status (including the display of device info, WAN status, and PON Statistics information)

The Package C ONT that supports limited configuration using web-based GUIs is the I-241W-P indoor ONT.

1.7 ONT physical security

Physical ONT security is provided to limit unauthorized access to remote or outdoor units. Tamper-resistant seals and bolts are used to secure the TELCO access cover to the ONT and to prevent easy access to the enclosure. Specialized security wrenches are required to open the pin-in Allen-type tamper-resistant screws. Certain models of indoor ONTs cannot be opened.

1.8 Rogue ONT defense

Fault or error conditions on a single ONT may disrupt the PON for other ONTs on the same PON. Figure 1-2 shows some possible failure conditions.

Figure 1-2 Rogue ONT failure conditions
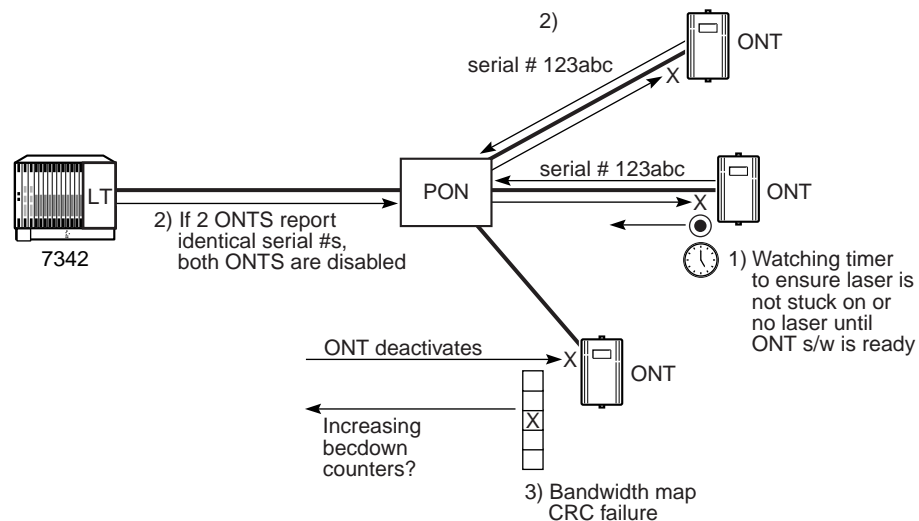
The following conditions on a single ONT may affect other ONTs using the same PON:

- an ONT continuously sends light up the fiber because a laser is stuck on, which may render the PON unusable
- two ONTs with the same serial number prevents correct ranging of both ONTs
- an ONT misinterprets the bandwidth map, causing the ONT to transmit for the wrong time slot allocation, disrupting the PON for another ONT that is trying to use its correctly allocated time slot
- an ONT signal is outside its timing window, affecting the start of another ONT time slot
- an ONT signal is too low or too high, causing bit rate errors or a ranging failure

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The system is designed to automatically identify these ONT fault or error conditions using alarms, statistics, or automatic action. This tells operators of a problem or disables the ONT so a single rogue ONT cannot affect the entire PON.

Laser stuck on

ONTs use watchdog timers to stop errors that cause light to be continuously sent up the fiber. These watchdog timers are maintained by the software. When a watchdog timer fails, the hardware triggers a reset. When a reset is triggered, the laser is disabled. Before the laser retransmits, the ONT software must pass power on and self tests.

Duplicate serial numbers

An ONT is automatically disabled when:

- A ranged ONT sends a broadcast PONID within a serial number PLOAM message. This indicates the ONT may not be aware of its ranged state or that a second ONT using the same serial number is on the PON.
- An ONT sends a serial number PLOAM message that does not match its assigned ID.
- An ONT sends a serial number PLOAM message but the ONT has not been assigned a PONID.
- A deactivate PLOAM message has been sent to the ONT three times and the ONT has not deactivated. The ONT is then sent a disable PLOAM message.

Receive and transmit errors

There are two ways to identify marginal receive problems:

1 Self correcting CRC check for the time slot; if the time slot allocation fails a CRC check, the ONU does not transmit in that time slot.

2 Increasing rate of becdown (Bit Error Rate Count Downstream) statistics.

There is one way to identify marginal transmission timing and level problems. If a marginally transmitting (due to timing or optical signal levels) ONT does range, upstream data from that ONT and possibly other ONTs on the PON will be corrupted. Increasing rates of becup (Bit Error Count Upstream) statistics are seen. The becup counters of the marginally transmitting ONT increase the fastest. Other ONTs may see smaller increases.

1.9 802.1x authentication

The P-OLT maintains the 802.1x authentication state by terminating the 802.1x protocol and authenticates end users using the RADIUS server. The ONT provides the filters for blocking and unblocking a local area network (LAN) port on the ONT. After the system authenticates a port using 802.1x, the user can use DHCP or PPP.

> **Note —** The 802.1x protocol is only applicable to iBridge mode. In iBridge mode, VLAN-tagged frames are not supported for 802.1x.

The 802.1x protocol can be enabled or disabled for each OLT system or for each ONT user-network interface (LAN port).

Port-based authentication

There are two MAC configuration scenarios for authentication:

- When MAXMAC is 1, the first MAC address to be authenticated is learned on the bridge port for the duration of session timeout (not the FDB aging timeout). The MAC address is learned on all VLANs configured on the bridge port. No other MAC addresses are learned.
- When MAXMAC is greater than 1, MAC learning occurs after authentication is successful. All MAC addresses are learned dynamically and age out using the FDB aging timer. The system responds with EAP-Success message if other users on the port try to authenticate after the port is authorized for traffic.

When the authenticated user logs out, the system performs the following actions:

- closes the port for traffic
- stops accounting for the port
- sends an identity request as multicast over the port to invite any potential users of the port for authentication
- opens the port for traffic again only after a successful authentication
- sends new identity requests only after the held period expires if the authentication fails
- sends periodic identity request messages until the port is authenticated
- does not require re-authentication
- flushes the FDB entries that correspond to the port

When the maximum MAC value on a bridge port is changed by the operator to a lower value, the system performs the following actions:

- flushes all the forward database (FDB) entries on the port
- closes the associated ONT UNI for data traffic
- sends identity request as multicast over the port in order to invite any potential users of the port for authentication
- opens the port for traffic after successful authentication

802.1x support assumptions

The system supports 802.1x authentication based on the following assumptions:

- Authentication is supported only on LAN ports at the ONT and not for the plain old telephone system (POTS) lines.
- Authentication is performed on an ONT UNI basis. The highest priority GPON encapsulation module (GEM) port ID that is configured on the user network interface (UNI) is used for authentication.
- There is no local authentication for 802.1x when the RADIUS server fails.

User session disconnection by system

The following three types of user disconnections are supported:

- When the RADIUS requests disconnection, the system does not send an accounting stop message. The system sends a failure message to the first authenticated user on the port and initiates the authentication of other users on the port.
- When the maximum session duration is expired. The system sends a failure message to the first authenticated user on the port and initiates other users on the port to start authentication.
- When there is a request to disable or delete a user port, the system gracefully terminates the user sessions on the port before the port is disabled or deleted. User session accounting data is sent to the RADIUS accounting servers when the session is terminated.

Re-authentication

To ensure that there is no service interruption during re-authentication, it is required re-authentication of the supplicant must occur before the session expires. The supplicant does not cause any service interruption during re-authentication. New accounting-stop or accounting-start messages are not sent due to re-authentication.

The P-OLT supports the re-authentication state. The configuration of the re-authentication function is made on a port basis and includes enabling or disabling re-authentication and setting the re-authentication period.

The RADIUS Termination Action attribute is supported. If a Termination Action is received, re-authentication is performed only at the request of the RADIUS server. The RADIUS server overrides local configuration of re-authentication in the P-OLT.

If re-authentication is enabled on a port, the Session Timeout value returned by RADIUS service is used as the re-authentication period. If the RADIUS server does not return a Session Timeout value, the re-authentication timer for the port that is configured by the management system is used.

If there is no response from an RADIUS server for re-authentication due to an NT card switchover, the P-OLT treats the re-authentication as a successful one for 30 min.

If re-authentication is disabled for a port, the Session Timeout value returned by RADIUS server is used to terminate the sessions. Re-authentication initiated by the management system is not required.

During re-authentication, traffic to and from the user is not interrupted. The port forwards bidirectional traffic until re-authentication is completed. If re-authentication fails, the port is changed to unauthorized state.

An EAP Request Identity message is sent to the port when the re-authentication timer expires.

1.10 Anti-spoofing mechanism

The system supports two features to protect against spoofing:

*   gratuitous ARP discard
*   source address anti-spoofing

Gratuitous ARP discard

A gratuitous ARP request is an ARP packet where the sender IP address and the target IP address are the same. Attackers can use gratuitous ARP requests to corrupt the ARP cache of a router by sending out a gratuitous ARP request that claims to be the default router.

The system supports a discard mechanism that filters incoming traffic for gratuitous ARP requests. When gratuitous ARP discard is enabled, incoming gratuitous ARP requests are discarded.

Gratuitous ARP discard is implemented on a per ONT UNI port basis using TL1. See the appropriate P-OLT TL1 documentation.
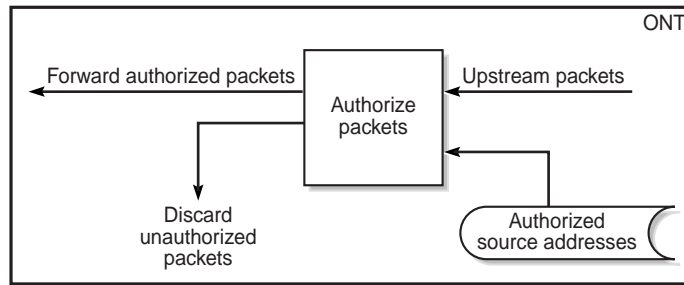
> **Note —** Gratuitous ARP discard only applies for residential bridge VLANs; in VLAN cross-connect mode, gratuitous ARP requests are always forwarded.

Source address anti-spoofing

Source address spoofing is an attempt to gain entry to a system by posing as a trusted source. Although the packet cannot be routed back to the initial source, source address spoofing can lead to unnecessary network congestion and to possible denial of service.

To block unauthorized traffic, the system supports an anti-spoofing mechanism that limits source address spoofing. Upstream traffic arriving at the ONT is validated for source address. Authorized packets are forwarded and non-validated packets are discarded, as shown in Figure 1-3.

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Figure 1-3 ONT packet authorization

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Source address anti-spoofing is implemented in either static or dynamic mode.

- Static mode enables the table of authorized source addresses to be provisioned statically by an operator for one of the following anti-spoofing control types:
  - MAC only
  - IP-only
  - MAC and IP
- Dynamic mode enables the table of authorized source addresses to be provisioned both statically by an operator and dynamically through DHCP, and supports the anti-spoofing control type IP-only.

Source address anti-spoofing filters are applied as follows:

- For IP-only anti-spoofing, packets that match a configured source address are forwarded, and non matching packets are dropped.
- For MAC and IP anti-spoofing, packets that match a configured pair of MAC source address and IP source address are forwarded, and non-matching packets are dropped.
- MAC-only anti-spoofing can be implemented in one of two modes:
  - Inclusive mode forwards packets that match a configured MAC source address, and drops non matching packets.
  - Exclusive mode forwards packets that do not match a configured MAC source address, and drops matching packets.

Not all anti-spoofing control types apply to all traffic. Table 1-9 identifies the anti-spoofing control types and any traffic exemptions by source address anti-spoofing mode.

Table 1-9 Anti-spoofing control types and traffic exemptions

Source address anti-spoofing mode	Anti-spoofing control type	Traffic exemptions
Static	MAC-only anti-spoofing	Is applied to all data traffic
	IP-only anti-spoofing	Is not applied to non-IP traffic, such as:
	MAC and IP anti-spoofing	• PPPoE
Dynamic	IP-only anti-spoofing	• ARP
		• EAPOL, EAP
		Is not applied to DHCP packets to allow a subscriber to obtain a DHCP lease.

The anti-spoofing control type limits the number of authorized source address entries.

When static or dynamic source address anti-spoofing is enabled, the LT card downloads the static entries provisioned for an ONT UNI port to the ONT by way of OMCI. When a static entry is removed or anti-spoofing is disabled, the LT card notifies the ONT to remove the corresponding anti-spoofing filter(s).

When dynamic anti-spoofing is enabled, the LT card forwards the currently leased IP addresses to the ONT by way of OMCI after an IP address is leased, or a DHCP lease expires or is released. When a UNI port has reached its maximum allowed number of IP source addresses, the LT card drops any subsequent DHCP ACKs with a leased IP address that is not in the lease table. IP source addresses that are added dynamically through DHCP survive ONT restarts, LT restarts, and NT switchovers.

See the appropriate P-OLT TL1 documentation for configuration information.

Per-service anti-spoofing

Per service dynamic or static IP anti-spoofing configuration using TL1 via the P-OLT is supported. The dynamic IP anti-spoofing allows up to eight IP addresses to be learned. The static IP anti-spoofing allows up to eight IP addresses to be specified by the operator.

When services dynamic IP-only anti-spoofing is configured for the ONT UNI, and per service anti-spoofing is enabled for a service, packets are allowed with a combination of leased IP address and the C-VLAN ID of the service. A packet sent upstream (user to network) over the service is permitted if the incoming packet's source IP address is that of the IP address leased for that service. In the case of static IP addresses (configured IP addresses), the C-VLAN check is not performed for the service in the ONT UNI and hence filtering is based on static IP address.

1.11 ONT reset

The ONT can be rebooted or reset using the HTTP, the CLI interface or the reset button on the ONT. A reboot/reset of the ONT can be used to recover from connection, power, software download, and other failure situations. The reboot process will interrupt service for a short period of time, approximately one minute. The reboot sequence consists of:

- hardware self check
- file system initialization
- PLOAM activation
- ranging of the ONT
- provisioning download from OLT
- activate POTS service
- activate VoIP service

1.12 ONT and MDU interface connection limitations

Table 1-10 shows the maximum connection capacity for ONTs and MDUs.

Table 1-10 ONT and MDU connection capacity

ONT type and model	Maximum capacity								
	POTS	10/ 100/ BASE-T	10/ 100/ 1000 BASE-T	RF video (CATV)	MoCA	VDSL2	DS1/E1	Local craft	GPON SC/APC
Business ONT									
B-0404-A	0	–	4	–	–	–	4	0	1
ONTs									
I-010G-A	0	–	1	–	–	–	–	–	–
I-010G-B	0	–	1	–	–	–	–	–	1
I-011G-P	0	–	1	1	–	–	–	–	1
I-020E-B	0	2	–	–	–	–	–	–	1
I-020E-H	0	2	–	–	–	–	–	–	1
I-020G-F	0	–	2	–	–	–	–	–	1
I-010G-P	0	–	1	–	–	–	–	–	1
I-020G-P	0	–	2	–	–	–	–	–	1
I-040G-P	0	–	4	–	–	–	–	–	1
I-240G-B	2	–	4	–	–	–	–	–	1
I-240G-P	2	–	4	–	–	–	–	–	1
I-240G-Q	2	–	4	–	–	–	–	–	1

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ONT type and model	Maximum capacity								
	POTS	10/ 100/ BASE-T	10/ 100/ 1000 BASE-T	RF video (CATV)	MoCA	VDSL2	DS1/E1	Local craft	GPON SC/APC
I-241G-P	2	–	4	1	–	–	–	–	1
I-241W-P	2	–	4	1	–	–	–	–	1
I-440G-P	4	–	4	0	–	–	–	–	1
MDUs									
O-00160V-Q	0	1	–	–	–	16	–	–	1
O-00240V-P	0	1	–	–	–	24	–	–	1
O-00240V-Q	0	1	–	–	–	24	–	–	1
O-0881V-A	0	8	–	1	–	8	–	1	1

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Table 1-11 shows the maximum number of ONTs or MDUs supported on a given PON when all ONTs or MDUs are of the same type.

Table 1-11 Maximum ONT or MDU connections per PON

ONT	Maximum ONTs per PON
Business ONT	64
Indoor ONT	64
MDU	64

1.13 Other ONT limitations

Table 1-12 show ONTs and MDUs limitations that need to be observed.

Table 1-12 PON and ONT limitations

Limitations	Maximum number	Comment
Data UNIs per PON	288	The total number of ENET, VDSL2, CES, and VOIP UNIs. Create a VOIP UNI for a planned ONT when VOIPALLOWED=YES.
CESUNI ports per PON	128	–
CESPW services per PON	128	–
POTS ports per PON	384	–
VIDEO ports per ONT	1	–

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Limitations	Maximum number	Comment
IGMP channels per PON	288	Create these channels on VLANports only on a GPON LT.
PM threshold (TCA) counters per ONT	128	A limitation that is not readily apparent to the user. PM threshold counter resources are allocated as ONTs and UNIs allow for the possibility of monitoring PM threshold crossings, even if these are not enabled by default. Depending on the line type, different numbers of TCA counter resources are allocated: • ONT — 1 • VOIP — 1 • ENET — 1 • VDSL2 — 3

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Some ONTs have limitations that are linked to their package type. Both Package A and B ONTs have specific limitations that apply only to them.

Upgrade considerations and limitations

Existing ONTs that use 7342 ISAM FTTU releases older than R04.06.xx and R04.07.xx must be upgraded to use R04.00.10 software while assigned to a PON ID value smaller than 64. For this purpose, if split ratios larger than 1:64 are being deployed, you may choose to set aside the first PON ID as a staging point.

Service creation considerations and limitations

Port-to-port mode must be enabled when using the four-port Ethernet ONT I-x4xx-x. When using port-to-port mode, you can only configure one Ethernet port.

OAM and statistics considerations and limitations

PM_ONTENET counters for SQE, IMTE, and CSE performance monitoring are not supported.

TC layer OAM performance monitoring is not supported on the OLT R04.00.10 therefore LOSTFRAGS and TXFRAG counters for PONONTTC are not supported on indoor ONTs.

The REPT-OPSTAT-ONTANI TL1 command which is used to determine the received optical power of the ONT will only work for RSSI-enabled ONTs.

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2 — Part numbers, ordering, and deployment configuration overview

2.1 Overview

This chapter provides information about planning and ordering equipment. The CRoHS column in the tables below indicate the CRoHS compliance status. CRoHS regulations only apply to products and subassemblies that are sold in the China market. See the ETSI environmental CRoHS guidelines for more information.

The information documented in the CRoHS column is explained as follows:

- No HS indicates that hazardous substances are not present.
- See HST indicates that the Hazardous Materials Table should be referenced, as indicated in the CRoHS guidelines mandatory regulations.
- Not for sale in PRC indicates that the equipment is not for sale in the People's Republic of China.

2.2 Part numbers for ordering

Table 2-1 lists the ordering information for the ONTs, MDUs, and power supplies.

Table 2-1 ONT, MDU, and power supply ordering information

Mnemonic	Unit data sheet	Part number	Additional information	CRoHS
B-0404-A business ONT				
B-0404-A	B-0404-A unit data sheet	3FE 61618 AA	Four RJ-45 GigE ports and RJ-48C E1/T1 ports for transmitting voice and data.	See HST
Cable storage and mounting	—	3EM 20293 AA	Provides storage space for 70 ft of excess fiber optic cable.	No HS
Storage adapter bracket	—	3EM 20425 AA	The bracket that interfaces between cable storage and the ONT.	Not for sale in PRC
Storage adapter bracket for Class 1 wiring	—	3EM 20425 AB	The bracket that interfaces between cable storage and the ONT. It allows separate routing of power cable per Class 1 wiring standards.	Not for sale in PRC
Cable entry fitting	—	3EM 20886 AA	An Alcatel-Lucent conduit for the cables used with the business ONT	No HS
Cable reels	—	07RZQLF0003 (Madison) 07RZQLF0003 (Tyco) 1AC006160004 (Asia Link) QA6819JRV (ISOTEC) CDC170 (BELDEN)	The cable reel used to build customized cables for power and alarm connections between the UPS and the ONT. RoHS-compliant reels are available from the listed companies.	See HST
Stand mount	—	3FE 60673 AA	The stand mount used to install the ONT vertically on a flat surface such as a desk.	—
Indoor ONTs				

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Mnemonic	Unit data sheet	Part number	Additional information	CRoHS
I-011G-P	I-011G-P unit data sheet	3FE 52959 AY	The I-011G-Q ONT does not have a fiber storage tray. An Alcatel-Lucent approved ac/dc power converter is required. Contact your Alcatel-Lucent technical support representative.	See HST
I-010G-A (28 dB)	I-010G-A unit data sheet	3FE 51912 AA (customer-specific logo)	The ONT shipped with a fiber storage tray. A separately orderable, Alcatel-Lucent approved ac/dc power converter is required.	See HST
I-010G-B	I-010G-B unit data sheet	3FE 51881 AC	A separately orderable, Alcatel-Lucent approved ac/dc power converter is required.	See HST
I-010G-P	I-010G-P, I-020G-P, or I-040G-P unit data sheet	3FE 52957 AA (AC/DC plug EU) 3FE 52957 AD (AC/DC plug AU) 3FE 52957 AE (AC/DC plug UK)	ONTs shipped with fiber storage trays. An Alcatel-Lucent approved ac/dc power converter is required. Contact your Alcatel-Lucent technical support representative for information about ordering.	See HST
I-020G-P		3FE 52957 AB (AC/DC plug EU) 3FE 52957 AF (AC/DC plug AU) 3FE 52957 AG (AC/DC plug UK) 3FE 52957 AL (AC/DC plug AU — customer-specific) 3FE 52957 AK (AC/DC plug US)		See HST
I-040G-P		3FE 52957 AC (AC/DC plug EU) 3FE 52957 AH (AC/DC plug AU) 3FE 52957 AH (AC/DC plug AU)		See HST
I-020E-B (28 dB)	I-020E-B, I-020E-H, and I-020G-F unit data sheet	3FE 28683 AB	—	See HST
I-020E-H (28 dB)		3FE 28683 AD 3AP 21017 DE	The I-020E-H part number 3FE 28683 AD has a maximum PON reach of 18.6 miles (30 km) [1] and uses SoC R2.1.	See HST
I-020G-F (28 dB)		3FE 29528 AA	A separately orderable, Alcatel-Lucent approved ac/dc power converter is required.	See HST
I-110G-P	I-110G-P unit data sheet	3FE 52959 AA (AC/DC plug EU) 3FE 52959 AJ (AC/DC plug AU) 3FE 52959 AK (AC/DC plug UK)	The ONT is shipped with a fiber storage tray. An Alcatel-Lucent approved ac/dc power converter is required. Contact your Alcatel-Lucent technical support representative for more information about ordering a separate power converter.	See HST
I-220E-A	I-220E-A unit data sheet	3FE 50754 AB 3FE 50754 AE 3FE 50754 AF (customer-specific logo)	A separately orderable, Alcatel-Lucent approved ac/dc power converter is required. An external 12 V dc UPS with battery backup is optional (kit number 3HG 00006 AU.	See HST
I-241G-A	I-241G-A unit data sheet	3FE 60344 AA	—	See HST

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Mnemonic	Unit data sheet	Part number	Additional information	CRoHS
I-240G-B	I-240G-B and I-241G-B unit data sheet	3FE 51880 AB	ONTs shipped with fiber storage trays. With some customer-specific ONT configurations, a different tray (3EM 23509 AA) can be ordered separately. Contact your Alcatel-Lucent technical support representative for more information. A separately orderable, Alcatel-Lucent approved ac/dc power converter is required.	See HST
I-241G-B		3FE 51880 AA		
I-240G-P	I-240G-P, I-240G-Q, and I-241G-P unit data sheet	3FE 52959 AC (AC/DC plug EU) 3FE 52959 AN (AC/DC plug AU) 3FE 52959 AP (AC/DC plug UK) 3FE 52959 AX (AC/DC plug UK — customer-specific)	The AC, AN, and AP variants do not provide an RF video interface. The AX variant is equipped with an RF video interface that is plugged and not used. The I-240G-P ONT does not have a fiber storage tray. An Alcatel-Lucent approved ac/dc power converter is required. Contact your Alcatel-Lucent technical support representative.	See HST
I-240G-Q		3FE 53821 AA (AC/DC plug EU) 3FE 53821 AB (AC/DC plug AU) 3FE 53821 AC (AC/DC plug UK)	The I-240G-Q ONT does not have a fiber storage tray. An Alcatel-Lucent approved ac/dc power converter is required. Contact your Alcatel-Lucent technical support representative.	See HST
I-241G-P		3FE 52959 AD (AC/DC plug EU) 3FE 52959 AS (AC/DC plug AU) 3FE 52959 AU (AC/DC plug UK)	The AD, AS, and AU variants provide an RF video interface. The I-241G-P ONT does have a fiber storage tray. An Alcatel-Lucent approved ac/dc power converter is required. Contact your Alcatel-Lucent technical support representative.	See HST
I-241W-P	I-241W-P unit data sheet	3FE 52958 AA (AC/DC plug EU) 3FE 52958 AG (AC/DC plug AU) 3FE 52958 AH (AC/DC plug UK)	Wi-Fi service, version P. ONTs shipped with fiber storage trays.	See HST
I-440G-P	I-440G-P unit data sheet	3FE 52959 AT (AC/DC plug UK — customer-specific) 3FE 52959 AG (AC/DC plug EU) 3FE 52959 AQ (AC/DC plug AU) 3FE 52959 AR (AC/DC plug UK)	ONTs shipped with fiber storage trays. An Alcatel-Lucent approved ac/dc power converter is required. Contact your Alcatel-Lucent technical support representative.	See HST

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Mnemonic	Unit data sheet	Part number	Additional information	CRoHS
Wall mount bracket	—	3FE 61224 AA	The wall mount bracket for wall mounting I-0X0-X and I-22x-x ONTs. Contact your Alcatel-Lucent technical support representative for more information.	—
	—	3FE 61677 AA	The wall mount bracket for wall mounting I-24x ONTs. Contact your Alcatel-Lucent technical support representative for more information.	—
MDUs				
O-0881V-A	O-0881V-A unit data sheet	3FE 51905 AA	—	See HST
VDSL2 cable	—	3FE 51973 AA	The cable equipped with a 24-pin AMP connector that provides a VDSL2 interconnection to the VDSL MDU ONT.	See HST
Plugs	—	1AD 05394 0002	Two plugs supplied with the ONT unit but additional plugs can be ordered separately.	See HST
Cable entry fitting	—	3EM 20886 AA	Three cable entry fittings are supplied with the ONT unit; additional fittings can be ordered separately.	See HST
O-00160V-Q	O-00160V-Q unit data sheet	3FE 53183 AK (AC/DC plug EU) 3FE 53183 AL (AC/DC plug AU) 3FE 53183 AM (AC/DC plug UK) 3FE 53183 AN (AC/DC plug UK)	MDU is either rack or desktop mounted.	See HST
O-00240V-P	O-00240V-P and O-00240V-Q unit data sheet	3FE 52975 AA (AC/DC plug EU) 3FE 52975 AB (AC/DC plug AU) 3FE 52975 AC (AC/DC plug UK) 3FE 52975 AH (AC/DC plug US)	MDU is either rack or desktop mounted.	See HST
O-00240V-Q	O-00240V-P and O-00240V-Q unit data sheet	3FE 52975 AD (AC/DC plug EU) 3FE 52975 AE (AC/DC plug AU) 3FE 52975 AF (AC/DC plug UK) 3FE 52975 AG (AC/DC plug US)	MDU is either rack or desktop mounted.	See HST
Phoenix Contact IDC connector, 5 or 8 position	—	1718025	Connector used when attaching wires to the battery alarm connector. Available only from Phoenix Contact at http://www.phoenixcon.com.	—
Outdoor ONTs				

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Mnemonic	Unit data sheet	Part number	Additional information	CRoHS
O-421E-B	O-421E-B unit data sheet	3FE 50683 AJ	The O-421E-B supports an RF return path when used with a Gemtek dongle (3EM 23162 AA). This device uses HPNA 3.1 technology over coaxial to establish the RF return path. A 12 V dc cable or optional Power Injector (3EM 23161 AA) can be used to power the dongle.	See HST
Power equipment				
Alpha outdoor UPS AX-12D-BBPS-7.2-LPS	—	(1) 12V/30W UPS part number: 1AF03892AF (2) 12V/24W Home Converter part number: 1AF03877AT (3) 7.2Ah AGM Battery, 3-year warranty: 1AF02175AF	ANSI municipality United States, Canada For ANSI Muni projects only. Battery needs to be purchased from Alpha for outdoor deployment compliance.	—
CyberShield CS 24 UPS 24 W, 12 V dc UPS, floating ground	CyberPower CyberShield CS 24 UPS unit data sheet	3EM 23134 AA	The UPS for indoor ONTs functions as a power supply equipped with a backup battery. The UPS is located at a subscriber location and converts ac input (85 V ac to 264 V ac, 47 Hz to 70 Hz) to a dc output (12 V dc). The backup battery provides up to 14 h of temporary power if power is lost. The CyberShield CS 24 provides alarm outputs to indicate the operational status of the unit.	See HST
	—	1AF 17581 AA	Battery for the 3EM 23134 AA	—
	—	1AB 38334 0010 1AB 38334 0008 1AB 38334 0007 1AB 38334 0009	AC power input cords for the 3EM 23134 AA are • North America (ANSI) (0010 variant) • Germany, Switzerland, Denmark (ETSI), Israel (0008 variant) • Australia, New Zealand (0007 variant) • United Kingdom, Italy, Pakistan, Kuwait (0009 variant)	Not for sale in PRC
Replacement information available from UPS provider installation manual	—	—	The UPS provides battery backup power may need to have the battery replaced. See the UPS manufacturer installation manual which is provided with the UPS, for more information about replacement battery types and when to replace batteries, and the steps to safely replace a battery.	—

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Mnemonic	Unit data sheet	Part number	Additional information	CRoHS
CyberPower 12 V 24 W UPS CS24U12V-JP2-SB-NC	CyberPower CyberShield CS 24 UPS unit data sheet	(1) 12 V/24 W UPS part number: 3EM23264AA (2) Japan 2-prong AC cord = 1AB383340006 (3) ONT to UPS cable = 3EM18276AD	Japan Battery not included with UPS. Compliant battery models: • BB Battery BP7.2-12 • GS Battery PE 12V7.2 (ANSI ALU part number 1AF17581AA)	—
CyberPower 12 V 24 W UPS CS24U12V-xx3	CyberPower CyberShield CS 24 UPS unit data sheet	(1) 12 V/24 W UPS w/battery w/AC-cord part number: 1AF03877XX where XX is the regional qualification code: • BR — ANSI • BZ — ETSI (Germany, Austria) • CB — Australia, New Zealand • CD — United Kingdom, Pakistan, Kuwait (2) ONT to UPS cable = 3EM18276AD	RBOC ANSI municipality United States, Canada Common European Union countries It is replaced by 3EM23134AAAA UPS above with an ALU battery part number of 1AF17581AA for a 7.2Ahr battery.	—
Delta 12 V 32 W UPS GES320W12V0081 (DUPS1232A)	Delta DUPS-1232A UPS unit data sheet	(1) 12 V/32 W UPS part number: 3EM23134AA (Once the order is placed, SCN can select this unit or the CS24U12V3-SB-NC for the shipping variant) (2) AC power cord, 1AB38334xxxx: • 0007 — Australia, New Zealand • 0008 — Europe • 0009 — United Kingdom, Ireland • 0010 — ANSI (3) ONT to UPS cable = 3EM18276AD	RBOC ANSI municipality United States, Canada Battery not included with UPS. Compliant battery models: • BB Battery BP7.2-12 • Vision CP1270A • CSB GP1272 • GS Battery PE12V7.2 (ANSI ALU part number 1AF17581AA) • Ritar RT1270 Ferrites are not required.	—
Delta DUPS-1215 15 W/12 V 4.5Ah UPS	Delta DUPS-1215 UPS unit data sheet	3FE52412AA (UPS to ONT cable included) 1AB 38334 0070 (AC/DC plug AU, NZ, China) 1AB 38334 0008 (AC/DC plug EU CEE 7/7 6 ft (1.83 m)] 1AB 38334 0009 (AC/DC plug UK, Ireland [BS1363 6 ft (1.83 m)] 1AB 38334 0010 (AC/DC plug ANSI [NEMA 5-15P, 8 ft (2.44 m)]	Power adaptor	See HST
Emerson 24 W ac/dc AD2412N3L-401	Emerson 24 W AC/DC switching power adapter unit data sheet	1AF 01226 AS	Power adapter with Molex connector	See HST

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Mnemonic	Unit data sheet	Part number	Additional information	CRoHS
Power cables for Emerson	—	DA12-120US-401 (1AF 17075 AA) DA12-120EU-401 (1AF 17075 AB) DA12-120UK-401 (1AF 17075 AC) DA12-120AU-401 (1AF 17075 AD)	Specialized output power cables with Molex connectors: • AA for USA • AB for Europe • AC for UK, Ireland • AD for Australia	Not for sale in PRC
Power input cords for Emerson	—	1AB 07676 0010 1AB 07676 0071 1AB 07676 0073	C13 IEC320 to plug ac power cords for the power adapter: • UK, Ireland, and Middle East • Europe • USA	Not for sale in PRC
Emerson 16 W ac/dc switching power adapter	Emerson 16 W AC/DC switching power adapter unit data sheet	3FE 61585 AA (AC/DC plug ANSI) 3FE 61585 AB (AC/DC plug UK, Ireland) 3FE 61585 AC (AC/DC plug EU)	Power adaptor	No HS
Emerson 24 W, 12 V ac/dc switching power adapter	—	3FE 62984 AA	Power brick, 3-pin IEC320 AC input receptacle, standard coax barrel DC connector	No HS
		1AB 07676 0010 (AC/DC plug UK) 1AB 07676 0071 (AC/DC plug EU)	Power adaptor	No HS
Emerson 24 W, 12 V ac/dc switching power supply	Emerson 24 W AC/DC switching power adapter unit data sheet	1AF 01226 AS	Power adapter and power supply with a Molex connector	No HS
		1AB 07676 0010 1AB 07676 0009 1AB 07676 0071 1AB 07676 0072 1AB 07676 0073	C13 IEC320 to plug ac power input cords for the switching power supply are: • United Kingdom, Ireland, Middle East (0010) • Australia, New Zealand, China (0009) • Europe (0071) • United Kingdom, South Africa, Middle East (0072) • United States, Canada (ANSI) (0073)	No HS
Emerson 12 W ac/dc switching power supply	Emerson 12 W AC/DC switching power supply unit data sheet	1AF 17075 AA 1AF 17075 AB 1AF 17075 AC 1AF 17075 AD	Power supply with a Molex connector for: • ANSI (AA variant) • Europe (AB variant) • United Kingdom (AC variant) • Australia, China, Korea (AD variant)	—
Leader Electronics 12 W ac/dc switching power adapter	Leader Electronics 12W and 18W ac/dc switching power supply unit data sheet	—	Leader Electronics 12 W, 12 V dc power adapter(MU12-2120100-C5). Contact your Alcatel-Lucent technical support representative for more information.	No HS

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Mnemonic	Unit data sheet	Part number	Additional information	CRoHS
Leader Electronics 18 W ac/dc switching power adapter	Leader Electronics 12W and 18W ac/dc switching power supply unit data sheet	—	Leader Electronics 18 W, 12 V dc power adapter(MU18-2120150-C5). Contact your Alcatel-Lucent technical support representative for more information.	No HS
Li Tone 12 V 24 W power adapter	Li Tone Electronics AC/DC switching power adapter unit data sheet	3EM 23308 AA	Japan Li Tone Electronics 24 W, 12 V dc power adapter (LTE24E-S2-320A). Contact your Alcatel-Lucent technical support representative for recommended plug type information. This product is available from the manufacturer. The Li Tone manufacturer part number is P00-1711-0024-052.	No HS

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Note
[1] The maximum reach capacity supported by the P-OLT system is typically either 18.6 miles (30 km) for GLT2-x cards or 37.3 miles (60 km) for GLT4-x cards.

2.3 ONT and MDU to UPS or power adapter compatibility support

Each ONT or MDU requires either a power adaptor, direct power feed, or UPS. See Table 2-1 for more information, including descriptions of the power adaptor and UPS models, the ONT and MDU part numbers, and the cabling part numbers.

Caution — Use only Alcatel-Lucent tested and approved ONT and UPS combinations. If you do not know whether a specific ONT model interoperates with a specific UPS or power adapter model, contact your Alcatel-Lucent technical support representative for more information.

Compliance and compatibility testing by compliance laboratories and by the vendors continues between software releases. The following information may not be the most up-to-date information. Contact your Alcatel-Lucent technical support representative for more information.

ONT and MDU to UPS or power adapter mapping table

Table 2-2 lists ONT and MDU to UPS or power adapter support mapping, including the specifications and standards tested to.

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Table 2-2 ONT and MDU to UPS or power adapter compatibility support

ONT type (orderable part number)			
Power/UPS model	**Power UPS and cabling part number information**	**Customer category or country compliance tested for** [1]	**Notes**
B-0404 (3FE61618AA) GPON indoor business ONT			
Emerson 24 W ac/dc switching power adaptor with Molex power DC cable	Part number: 1AF01226ASAA AC power cord, 1AB07676xxxx, where xxxx is: • 0010 — United Kingdom, Ireland, and Middle East • 0009 —Australia, New Zealand, China • 0071 — Europe • 0072 — United Kingdom, South Africa, and Middle East • 0073 — ANSI	ANSI municipality United States, Canada Common European Union countries Specialized output power connectors: • USA • Europe • United Kingdom or Ireland • Australia	Emerson 12 V/24 W ac/dc power brick (adaptor), 3-pin IEC320 AC input receptacle, Molex DC connector
Delta DUPS-1215 4.5 Ahr	UPS part number: 3FE52412AA (UPS to ONT cable included) AC power cord, 1AB38334xxxx, where xxxx is: • 0008 — Europe • 0009 — United Kingdom, Ireland • 0010 — ANSI	ANSI municipality United States, Canada Common European Union countries China/Australia/New Zealand.	12 V/15 W 4.5 Ah UPS without battery. Compliant battery models: • BB Battery BP4.5-12 • GS Battery PE12V4.5 (ANSI ALU part number 1AF17655AA) • Ritar RI1245 • Vision CP1245H
I-010G-A (3FE51912Ax), I-020G-F (3FE29528Ax), I-020E-B, I-020E-H (3FE28683Ax) GPON data-only ONTs			
Emerson 16 W 12V switching power adapter DA16-120xx-L (xx: US, UK or EU)	3FE61585AA: ANSI 3FE61585AB: United Kingdom 3FE61585AC: Europe	ANSI municipality United States, Canada Common European Union countries	Emerson 12 V/16 W ac/dc power adapter wall wart, 2-prong AC plug
I-241G-A (3FE60344AA) GPON Multifunction indoor ONTs			
Emerson 24 W ac/dc switching power adaptor with Molex power DC cable	Part number: 1AF01226ASAA AC power cord, 1AB07676xxxx, where xxxx is: • 0010 — United Kingdom, Ireland, and Middle East • 0009 —Australia, New Zealand, China • 0071 — Europe • 0072 — United Kingdom, South Africa, and Middle East • 0073 — ANSI	ANSI municipality United States, Canada Common European Union countries Specialized output power connectors: • USA • Europe • United Kingdom or Ireland • Australia	Emerson 12 V/24 W ac/dc power brick (adaptor), 3-pin IEC320 AC input receptacle, Molex DC connector
I-010G-B (3FE51881Ax) GPON data-only ONTs			
Emerson 12 W ac/dc switching power adapter with Molex DC cable	(1) Part number: • 1AF17075AA — ANSI • 1AF17075AB — Europe • 1AF17075AC — United Kingdom • 1AF17075AD — Australia, China, Korea	ANSI municipality United States, Canada Common European Union countries China, Australia, New Zealand	Emerson 12 V/12 W ac/dc power adapter with Molex connector

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ONT type (orderable part number)			
Power/UPS model	**Power UPS and cabling part number information**	**Customer category or country compliance tested for** [1]	**Notes**
Delta DUPS-1215 4.5 Ahr	UPS part number: 3FE52412AA (UPS to ONT cable included) AC power cord, 1AB38334xxxx, where xxxx is: • 0008 — Europe • 0009 — United Kingdom, Ireland • 0010 — ANSI	ANSI municipality United States, Canada Common European Union countries China/Australia/New Zealand.	12 V/15 W 4.5 Ah UPS without battery. Compliant battery models: • BB Battery BP4.5-12 • GS Battery PE12V4.5 (ANSI ALU part number 1AF17655AA) • Ritar RI1245 • Vision CP1245H
I-220E-A (3FE50754Ax) GPON GSFU-B indoor ONTs			
Emerson 24 W switching power adapter, AD2412N3L	1) Part number: 3FE62984AA (2) AC power cord, 1AB07676xxxx: • 0010 — United Kingdom • 0071 — Europe	Common European Union countries Brazil	Emerson 12 V/24 W ac/dc power brick, 3-pin IEC320 AC input receptacle, standard coax barrel DC connector
I-241G-B (3FE51880Ax) GPON multifunction indoor ONT			
Emerson 24 W ac/dc switching power adaptor with Molex power DC cable	Part number: 1AF01226ASAA AC power cord, 1AB07676xxxx, where xxxx is: • 0010 — United Kingdom, Ireland, and Middle East • 0009 —Australia, New Zealand, China • 0071 — Europe • 0072 — United Kingdom, South Africa, and Middle East • 0073 — ANSI	ANSI municipality United States, Canada Common European Union countries Specialized output power connectors: • USA • Europe • United Kingdom or Ireland • Australia	Emerson 12 V/24 W ac/dc power brick (adaptor), 3-pin IEC320 AC input receptacle, Molex DC connector
Delta DUPS-1215 4.5 Ahr	UPS part number: 3FE52412AA (UPS to ONT cable included) AC power cord, 1AB38334xxxx, where xxxx is: • 0008 — Europe • 0009 — United Kingdom, Ireland • 0010 — ANSI	ANSI municipality United States, Canada Common European Union countries China/Australia/New Zealand.	12 V/15 W 4.5 Ah UPS without battery. Compliant battery models: • BB Battery BP4.5-12 • GS Battery PE12V4.5 (ANSI ALU part number 1AF17655AA) • Ritar RI1245 • Vision CP1245H
O-00160V-Q and O-00240V-Q (3FE53183Ax, 3FE52975Ax) GPON MDUs			
Phoenix Contact IDC connector	Connector used when attaching wires to the battery alarm connector: • 5 position connector, 1718025 • 8 position connector, 1718025	United Kingdom Europe Australia	Connectors are only available from Phoenix Contact at: http://www.phoenixcon.com
O-0881V-A (3FE 51905 AA) GPON VDSL MDU ONT			
Direct AC power feed	AC power cord, part number 1AB07676xxxx: • 0071 — Europe • 0073 — ANSI	ANSI municipality United States, Canada Common European Union countries	—

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ONT type (orderable part number)			
Power/UPS model	**Power UPS and cabling part number information**	**Customer category or country compliance tested for** [(1)]	**Notes**
I-010G-P, I-020G-P, I-040G-P, I-011G-P, I-240G-P, I-241G-P, I-440G-P, I-240G-Q, and I-241W-P, (3FE52957Ax, 3FE52959Ax, 3FE53821Ax, 3FE52958Ax) GPON indoor ONTs			
Leader Electronics ac/dc switching power supply	(1) 12 W/12 V power supply part number —[(2)] (2) 18 W/12 V power supply part number —[(2)] Contact your Alcatel-Lucent technical support representative for information about ONT/power supply compatibility.	Contact your Alcatel-Lucent technical support representative for compliance information.	Leader Electronics: 12 W/12 V ac/dc power supply with power cord (Model number: MU12-2120100-C5) 18 W/12 V ac/dc power supply with power cord (Model number: MU18-2120150-C5)
O-421E-B (3FE50683AJ) GPON GSFU-B outdoor ONT			
CyberPower 12 V/24 W UPS CS24U12V3-SB-NC	(1) 12 V/24 W UPS part number: 3EM23134AA. (Once the order is placed, SCN can select this unit or the DUPS1232A for the shipping variant) (2) AC power cord, 1AB38334xxxx: • 0007 — Australia, New Zealand • 0008 — Europe • 0009 — United Kingdom, Ireland • 0010 — ANSI (3) ONT to UPS cable = 3EM18276AD	RBOC ANSI municipality United States, Canada Common European Union countries	Battery not included with UPS. Compliant battery models: • BB Battery BP7.2-12 • GS Battery PE 12V7.2 (ANSI ALU part number 1AF17581AA) When integrated with the outdoor HPNA 3.1 dongle in ANSI market - ferrites shipped with the HPNA 3.1 dongle are required on both Ethernet cables. Otherwise, ferrites are not required.
Delta 12 V 32 W UPS GES320W12V0081 (DUPS1232A)	(1) 12 V/32 W UPS part number: 3EM23134AA (Once the order is placed, SCN can select this unit or the CS24U12V3-SB-NC for the shipping variant) (2) AC power cord, 1AB38334xxxx: • 0007 — Australia, New Zealand • 0008 — Europe • 0009 — United Kingdom, Ireland • 0010 — ANSI (3) ONT to UPS cable = 3EM18276AD	RBOC ANSI municipality United States, Canada	Battery not included with UPS. Compliant battery models: • BB Battery BP7.2-12 • Vision CP1270A • CSB GP1272 • GS Battery PE12V7.2 (ANSI ALU part number 1AF17581AA) • Ritar RT1270 Ferrites are not required.
CyberPower 12 V 24 W UPS CS24U12V-JP2-SB-NC	(1) 12 V/24 W UPS part number: 3EM23264AA (2) Japan 2-prong AC cord = 1AB383340006 (3) ONT to UPS cable = 3EM18276AD	Japan	Battery not included with UPS. Compliant battery models: • BB Battery BP7.2-12 • GS Battery PE 12V7.2 (ANSI ALU part number 1AF17581AA)
Li Tone 12 V 24 W power adapter LTE24E-S2-3	(1) 24 W power adapter part number: 3EM23308AA (2) Japan 2-prong AC cord = 1AB383340006	Japan	Li Tone 12V/24W ac/dc power adapter. Order directly from supplier in Japan.

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| ONT type (orderable part number)			
Power/UPS model	**Power UPS and cabling part number information**	**Customer category or country compliance tested for** [1]	**Notes**
CyberPower 12 V 24 W UPS CS24U12V-xx3	(1) 12 V/24 W UPS w/battery w/AC-cord part number: 1AF03877XX where XX is the regional qualification code: • BR — ANSI • BZ — ETSI (Germany, Austria) • CB — Australia, New Zealand • CD — United Kingdom, Pakistan, Kuwait (2) ONT to UPS cable = 3EM18276AD	RBOC ANSI municipality United States, Canada Common European Union countries	It is replaced by 3EM23134AAAA UPS above with an ALU battery part number of 1AF17581AA for a 7.2Ahr battery.
Alpha outdoor UPS AX-12D-BBPS-7.2-LPS	(1) 12V/30W UPS part number: 1AF03892AF (2) 12V/24W Home Converter part number: 1AF03877AT (3) 7.2Ah AGM Battery, 3-year warranty: 1AF02175AF	ANSI municipality United States, Canada	For ANSI Muni projects only. Battery needs to be purchased from Alpha for outdoor deployment compliance.

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Notes
[1]   The list of detailed tests (for example, GR-1089i3 (ESD, EFT, RDE, CDE, RDI, and CDI), GR-1089i4 (LightningAC) and marks (for example, FCC Class B, UL, CE Mark Class B, and K.21) are available from your Alcatel-Lucent technical support representative.
[2]   The power supply is available only part of a kit that includes an ONT. Contact your Alcatel-Lucent technical support representative for ordering information.

2.4 Fiber distribution network

The GPON can carry multiple applications, including voice, data, and video over a single fiber. Figure 2-1 shows a fiber distribution network using a single GPON connection.

Figure 2-1 Fiber distribution network
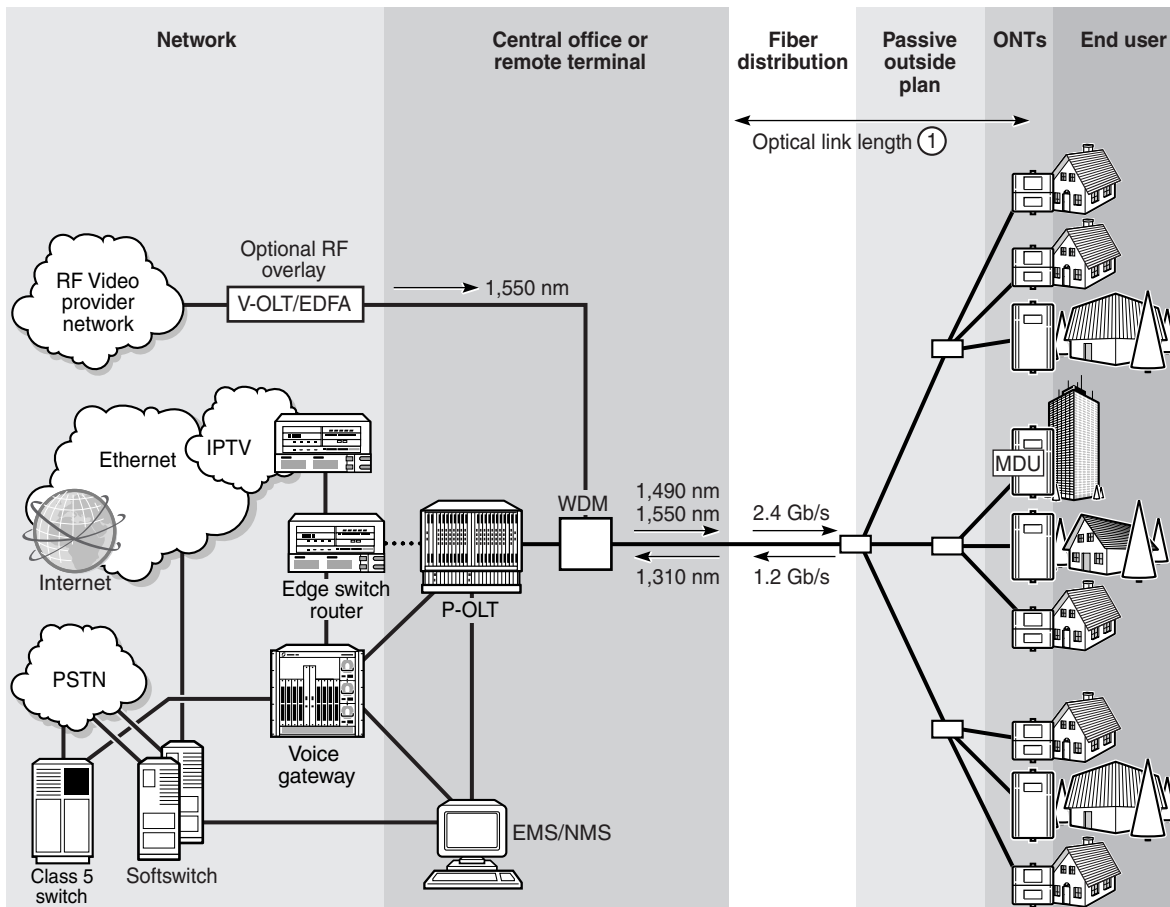
1 The maximum optical link length depends on the specific equipment and deployment conditions

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Line rate supported

Systems support standard-based GPON line rates of 2.488 Gb/s downstream and 1.244 Gb/s upstream between the packet optical line termination (P-OLT) units and optical network terminals (ONTs) based on the ITU-T G.984 protocol. The optical budget of the GPON connection is typically 28 dB.

Typical optical fiber outside plant architecture

The outside plant consists of optical fiber cables, splicing enclosures, fiber distribution cabinets or enclosures, and drop boxes. The outside plant can be implemented using different architectures. The specific architecture can greatly affect the cost of deployment.

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The key factors that significantly influence the cost of the architecture include:

• plant type, such as aerial or buried
• home density
• splitter location
• expected penetration rates

A typical system uses two levels of distribution and splitting. A primary flexibility point provides rough granularity for splitting the fiber, followed by a final drop or secondary flexibility point where the final split and drops to the ONTs at the premises are implemented. This basic architecture is cost-effective while also retaining flexibility for the future. Figure 2-2 shows a typical outside plant arrangement.

Figure 2-2 Typical outside plant arrangement
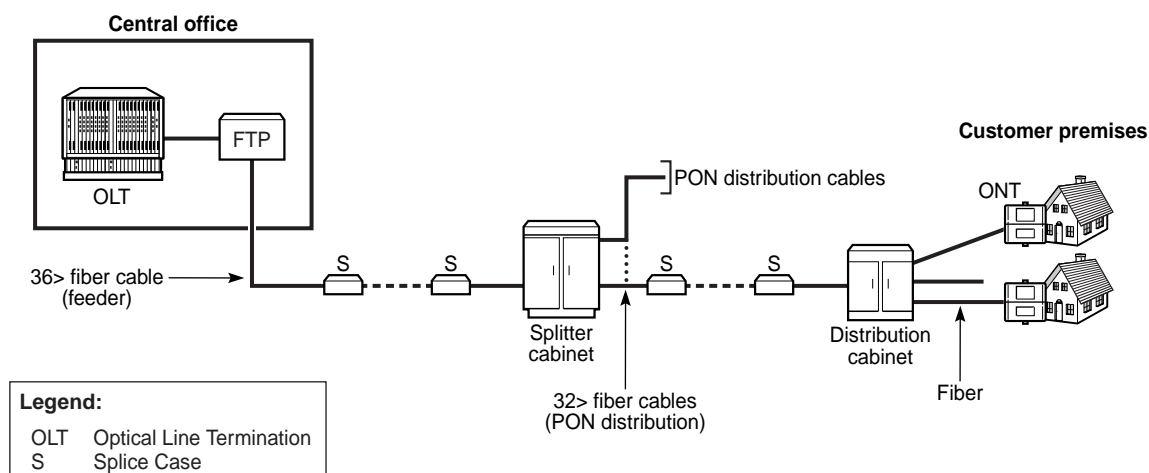
Distance and performance considerations

System performance varies in proportion to the amount of data that is transmitted to and from the subscriber location.

The system is designed to support a long reach from the CO to the subscriber location. The maximum reach capacity is typically 18.6 mi (30 km) for GPON LT cards. The optical link budget is defined by both loss and bandwidth characteristics. The loss characteristic is determined by the difference between the optical transmitter and optical receiver for each direction, and is typically 28 dB. The bandwidth characteristic is determined by the maximum link distance parameter of each OLT and ONT transmitter specification, and is limited by the lower of the upstream and downstream values.

Splitters and unused ports

It is an industry best practice for fiber distribution networks to use APC-based connections or spliced connections to avoid any potential network problems. Alcatel-Lucent recommends that the unused ports of splitters should be terminated on an APC-based connector.

2.5 ONT and customer premises environment

A large proportion of the physical layer connectivity problems are caused by poor installation practices and connectivity issues at the drop or inside the customer premises, because of internal wiring issues. Internal customer premises issues are outside of the scope of the ONT user documentation.

Space

Planners should determine the space requirement based on the footprint of the ONT and the UPS, and ensure that there is sufficient space at the installation site.

Alarms

Determine the alarm termination requirements. Find out the total number of alarms, and the number and types of connections required.

Power and ground cable

Examine the power and ground requirements. Collect information about the following:

- number of connections
- run lengths and required wire gauge
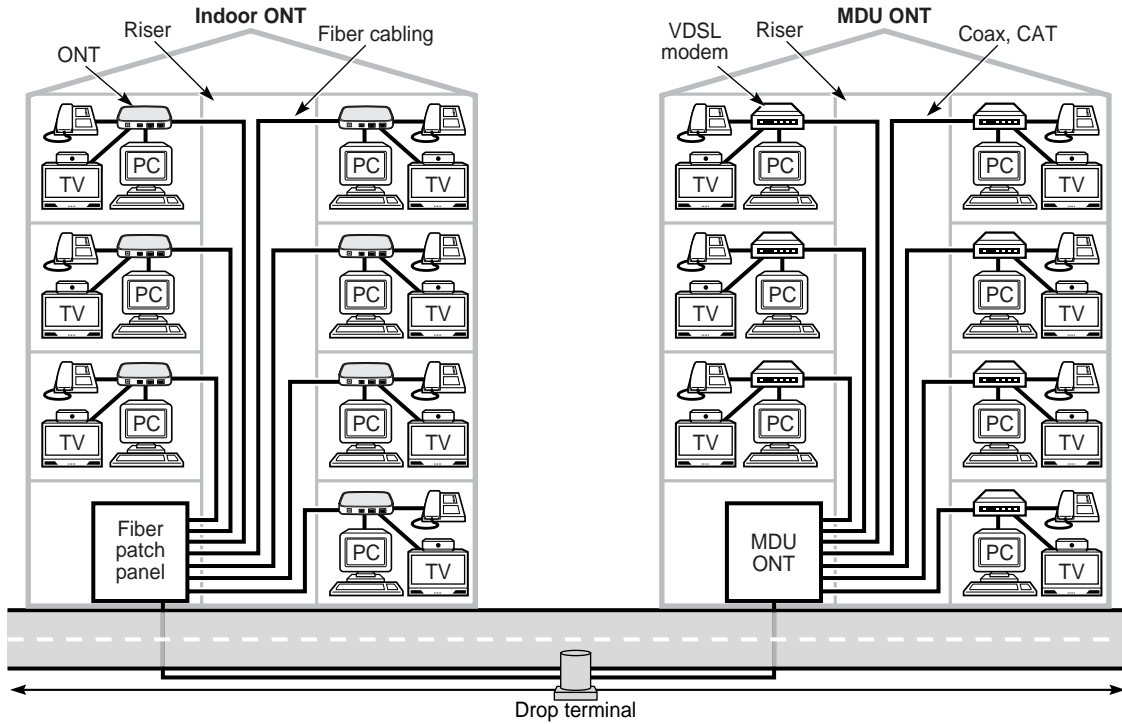- termination requirements, such as lugs
- safety guidelines

Fiber drop

A significant proportion of deployment costs is linked to the drop installation and service activation. A fiber drop involves the interconnection between the drop terminal and building to be served. In a PON, the drops can serve a MDU, BONT, or SFU.

Fiber drop cable termination is straightforward for outside installation at the customer premises. Most of the labor involves running power from inside the premises to the outside, and ensuring that the ONT is installed and grounded correctly. A large number of customer service issues are caused by incorrect installation, grounding, or cabling.

Fiber drops are more complicated for an MDU than BONTs and SFUs. MDUs may require multiple fibers in the drop cable to serve multiple ONTs or splitters in the building. Figure 2-3 shows MDU cabling considerations.

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Figure 2-3 MDU cabling

MDU installation planning considerations include:

- number of units served
- cable and conduit accessibility
- ownership of cable
- customer take-up rate

Other planning considerations:

- Running cable in older buildings can be more complicated.
- Running fiber to each unit in an MDU can be a better option when the existing cable is not owned by the service provider.
- When there is no access to the existing cable in an MDU, you can use existing coaxial or Cat5e, or better wiring.

> **Note 1** — Ensure that Cat5e or higher wiring is used.
>
> **Note 2** — Alcatel-Lucent recommends that in the fiber distribution network, APC-based or spliced connections, are used to avoid potential problems. In particular, splitters should be configured so that unused ports are terminated on APC-based connectors.

Customer premises

Successful customer installations increase customer satisfaction and reduce customer churn.

After the physical installation of the ONT and UPS, installers may be responsible for:

- running appropriately sized Cat5e or Cat3 (for voice) cabling from the ONT to outlets inside the premises
- connecting existing coaxial or Cat5e or Cat3 (for voice) cabling to support voice and RF cable services
- activating and testing voice, video, and data services

Figure 2-4 shows a cabling comparison for an SFU and an MDU.
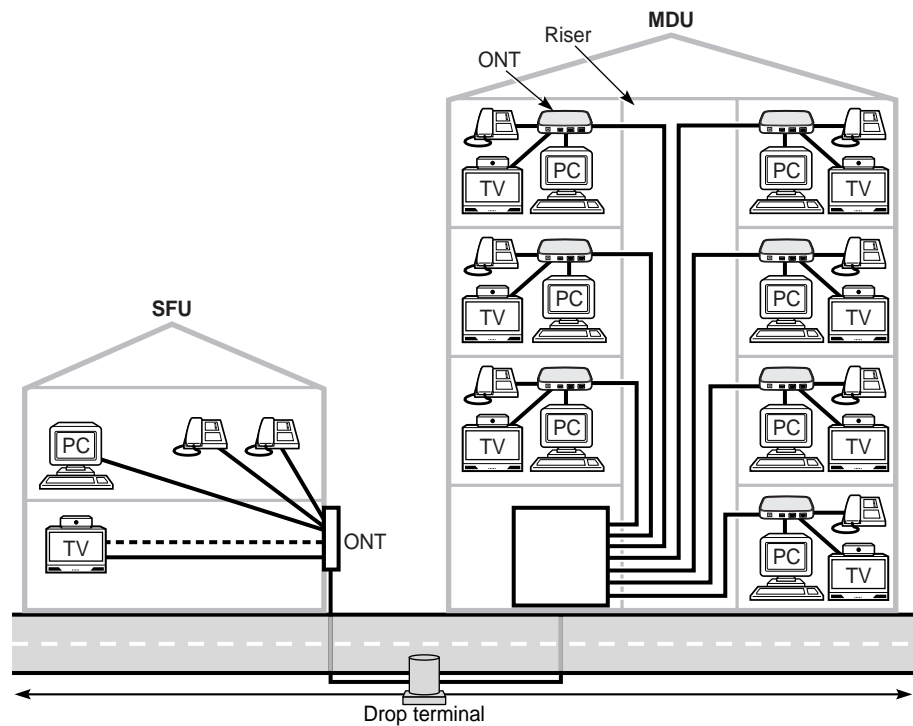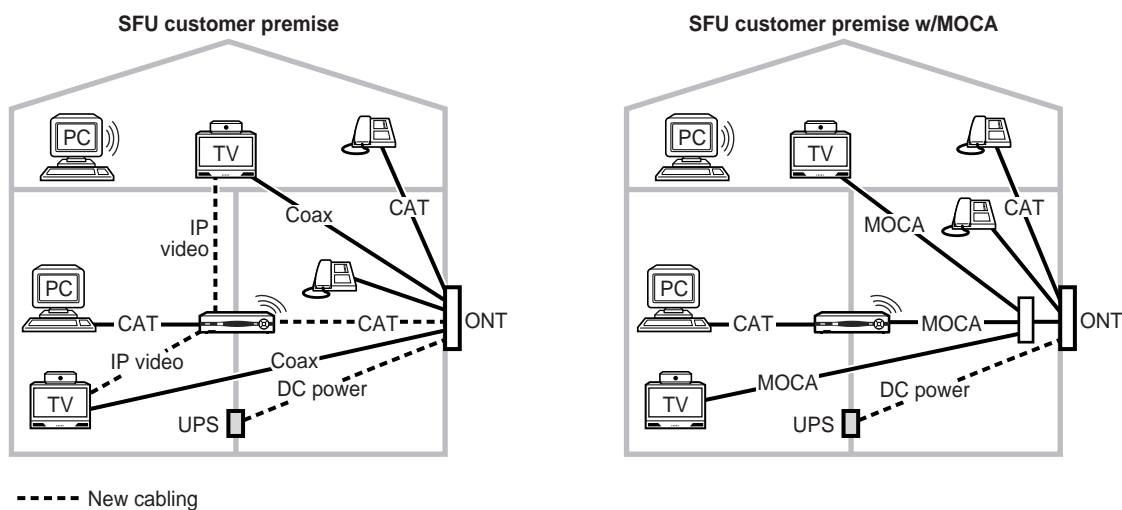
Figure 2-4 SFU and MDU cabling comparison

Figure 2-5 shows a cabling comparison for SFUs with and without MoCA interfaces.

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Figure 2-5 SFU cabling with and without MoCA

Switching existing services from a service provider can be a challenge. For example, an existing copper network interface device may be many feet away from the ONT, while the coaxial splitter may be at the opposite end of the premises. In this case, some of the options are:

- Install the ONT on top of the existing network interface device and use the ONT as the new network interface device.
- Run copper and coaxial jumpers from the ONT to the network interface device and the RF splitter.

New housing and MDU developments provide an opportunity to optimize the wiring design to support the offered services. The options include:

- specifying a central wiring and cabling closet or box
- installing the ONT indoors and running fiber directly to the ONT from the outside

2.6   Planning maintenance

This section provides information about planning ONT maintenance.

Monitoring

The system provides maintenance tools. The 5520 AMS can be used to monitor alarms and performance. In addition, TL1 and CLI commands can be used at the craft terminal at the OLT or the ONT/MDU (if supported) to perform monitoring tasks.

Monitoring alarms and performance provide some troubleshooting, but do not provide the granularity needed for fault isolation.

The system supports verification and query functions for each service provided from end to end. These functions include reporting of the required system or board status fields to help isolate problems and identify the source of the problems. The functions require sufficient monitor points in the system to partition the system to effectively troubleshoot system-level problems.

Requirement for spares

Spare ONTs should be ordered to support normal maintenance activities associated with the system. ONTs do not have field replaceable parts except battery supplies for UPSs. Replacement of the ONT is the recommended maintenance activity. ONTs removed should be reconditioned according to local practice, including all recommended actions by Alcatel-Lucent.

Training

Training is available at all levels for the operation, maintenance, and administration of the system. Contact your account representative to obtain the current version of the customer training catalog.

Documentation

Alcatel-Lucent provides a comprehensive set of documents to facilitate the installation, administration, operation, installation, and replacement of ONT equipment. See the appropriate *ONT Customer Release Notes* or *OLT Customer Release Notes* for the user documentation releases and part numbers.

2.7   ONT product identification

In a product series, each ONT or MDU is identified by a designation that defines its interface characteristics, such as the number of voice, data, and video ports. Table 2-3 describes the naming designation for ONTs.

Table 2-3 Naming designation for ONTs

Position in mnemonic	Description
Beginning character	The series that the product belongs to
First digit after the dash	The number of POTS interfaces
Second digit after the dash	The number of data interfaces
Third digit after the dash	The number of video interfaces
Character after the third digit	The type of data service supported. The codes for the supported types are: • E for 10/100BASE-T Ethernet • G for 10/100/1000Base-T Ethernet • H for HPNA (IP over coaxial cable) • M for MoCA and 10/100/1000Base-T Ethernet • V for VDSL • W for Wi-Fi service

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Position in mnemonic	Description
Ending character	The variant

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For example, I-241W-P identifies the following information:

- I – indoor ONT
- 2 –two POTS interfaces
- 4 –four data interfaces
- 1 –one RF video interface
- W –Wi-Fi service
- P –variant

Table 2-4 provides the designation for MDUs.

Table 2-4 Naming designation for MDUs

Position in mnemonic	Description
Beginning character	The series that the product belongs to
First digit after the dash	The number of POTS interfaces
Second digit after the dash	The number of data interfaces
Third and fourth digit after the dash	The number of VDSL interfaces
Fifth digit after the dash	The number of RF interfaces
Character after the last digit	The type of data service supported. The codes for the supported types are: • E for 10/100BASE-T Ethernet • G for 10/100/1000Base-T Ethernet • V for VDSL • M for MoCA and 10/100/1000Base-T Ethernet
Ending character	The variant

For example, O-0881V-A identifies the following information:

- O – MDU
- 0 –no POTS interfaces
- 8 –eight data interfaces
- 8 –eight VDSL interfaces
- 1 –one RF video interface
- V –VDSL
- A –variant

Table 2-5 provides the designation for the business ONTs.

Table 2-5 Naming designation for business ONTs

Position in mnemonic	Description
Beginning character	The series that the product belongs to
First digit after the dash	The number of POTS interfaces
Second digit after the dash	The number of data interfaces
Third digit after the dash	The number of video interfaces
Fourth digit after the dash	The number of DS1/E1 interfaces
Ending character	The variant

For example, B-0404-A identifies the following information:

- B –business ONT
- 0 –no POTS interface
- 4 –four data interfaces
- 0 –no RF video interface
- 4 –four DS1/E1 interfaces
- A –variant

3 — ONT and MDU general and interface technical specifications

3.1   Overview

This chapter provides information about ONT and MDU technical specifications.

3.2   System and service capacity specifications

This section provides the ONT system and service capacity specifications. Service descriptions, such as VoIP and flex services, are provided in the appropriate OLT *Product Information Manual*.

P-OLT performance and distance

The P-OLT provides performance and distance capacity of 2.488 Gb/s downstream and 1.244 Gb/s upstream, within a 18.6 mile (30 km) span with GLT2-x cards and within 37.3 miles (60 km) span with the GLT4-A and GLT4-D cards. The PON reach available depends on the optical budget supported by the LT card used, the PON reach specified based on network deployments, and the loss of optical fiber, connectors, and splitters, and so on. Extended PON deployment allows you to configure each PON to provide a 20 km, 34 km, and a 40 km differential window for ranging and ONT operation.

The optical link budget is defined by both loss and bandwidth characteristics. The loss characteristic is the difference between the optical transmitter and optical receiver for each direction, and is typically 28 dB. The bandwidth characteristic is the maximum link distance parameter of each OLT and ONT transmitter specification, and is limited by the smaller of the upstream and downstream values.

PON capacity

The number of ONTs on the PON affects the bandwidth available to each subscriber.

Table 3-1 lists the capacity of various components on the PON. Individual capacity per device is listed in the data sheet for the device.

Table 3-1 Capacity for PON system elements

Capacity	Maximum	Notes
PON		
Maximum number of IGMP channels per PON	288	Only created on VLAN ports.
Maximum number of data UNI ports per PON (total of all UNI types)	288	This is the total of all CES (CESUNUI and CESPW UNI), ENET, VoIP, and VDSL2 UNIs.
Maximum number of CESUNI UNI ports per PON	128	VoIP UNIs are created automatically when the ONT is planned with the VOIPALLOWED parameter set to enabled (YES in TL1).
Maximum number of CES PW UNI ports per PON	128	
Maximum number of POTS ports per PON	384	—

(1 of 2)

Capacity	Maximum	Notes
ONT		
Maximum number of video ports per ONT	1	—

(2 of 2)

GEM and T-CONT capacity

Table 3-2 lists the capacity of various system components for GEM ports and T-CONTs. Individual capacity per device is listed in the data sheet for the device.

Table 3-2 Capacity for GEM ports and T-CONTs per package and release

ONT or MDU	Release [1]	Maximum	Notes
Package A ONTs			
GEM ports per indoor or outdoor ONT	All	20	22 are present: 20 are available, 2 are reserved for OMCI and debugging
T-CONTs per indoor or outdoor ONT	All	21	22 are present: 21 are available, 1 is reserved for OMCI
Package B ONTs			
GEM ports per indoor or outdoor ONT	All	30	32 are present: 30 are available, 2 are reserved for multicast and debugging
T-CONTs per indoor or outdoor ONT	All	31	32 are present: 31 are available, 1 is reserved for OMCI
Package C ONTs			
GEM ports per indoor or outdoor ONT	R04.06.40 to R04.06.42	10	12 are present: 10 are available, 2 are reserved for multicast and debugging
	R04.06.3x, R04.06.43, R04.07.40, R04.07.45	30	32 are present: 30 are available, 2 are reserved for multicast and debugging
	R04.06.45x, R04.00.4x, R04.02.0x, R04.02.40x, R04.02.41x	30	
	R04.02.42x	30	
T-CONTs per indoor or outdoor ONT	R04.06.40 to R04.06.42	6	7 are present: 6 are available, 1 is reserved for OMCI
	R04.06.3x, R04.06.43, R04.07.40, R04.07.45	6	
	R04.06.45x, R04.00.4x, R04.02.0x, R04.02.40x, R04.02.41x	15	16 are present: 15 are available, 1 is reserved for OMCI
	R04.02.42x	31	32 are present: 31 are available, 1 is reserved for OMCI
Package D ONTs			
GEM ports per indoor or outdoor ONT	R04.02.42x	30	32 are present: 30 are available, 2 are reserved for multicast and debugging

(1 of 2)

ONT or MDU	Release [1]	Maximum	Notes
T-CONTs per indoor or outdoor ONT	R04.02.42x	31	32 are present: 31 are available, 1 is reserved for OMCI
Package E MDUs			
GEM ports per MDU	R04.02.3x	30	32 are present: 30 are available, 2 are reserved for multicast and debugging
T-CONTs per MDU	R04.02.3x	15	16 are present: 15 are available, 1 is reserved for OMCI
Package F MDUs			
GEM ports per MDU	R04.02.3x	252	254 are present: 252 are available, 2 are reserved for multicast and debugging
T-CONTs per MDU	R04.02.3x	31	32 are present: 31 are available, 1 is reserved for OMCI
Package G MDU			
GEM ports per O-0881V-A	All	126	128 are present: 126 are available, 2 are reserved for OMCI and debugging
T-CONTs per O-0881V-A	All	63	64 are present: 63 are available, 1 is reserved for OMCI
Package H ONTs			
GEM ports per B-0404-A	All	38	38 in SW, 38 in HW
T-CONTs per B-0404-A	All	39	39 in SW, 39 in HW

(2 of 2)

Note

[1]   The letter x following a release number denotes either a letter of the alphabet for maintenance releases or digit from 0 to 9 for minor releases.

3.3   Ethernet interface specifications

The Ethernet interface supports the following specifications:

- Ethernet ports are IEEE 802.3 and 802.3as compliant
- IEEE 802.1q, 802.1x port-based authentication, and 802.1p QoS classification per Ethernet port
- Layer 3 DSCP-to-802.1p mapping to allow layer 3 CoS over the layer 2 network
- RJ-45 connector(s)
- full or half duplex operations
- auto-negotiation or manual setting by operator
- 10/100 Base-T or 10/100/1000 Base-T (depending on the ONT type)

Voice subsystem

ONT SoC-based technology provides a maximum of four POTS lines for voice services and can support either H.248 (Megaco) or session initiation protocol (SIP) signaling protocols. All POTS ports on an ONT must be configured to use the same signaling protocol. Signaling protocols can not be mixed.

The following signaling protocols are supported:

- for ONTs with four POTS lines, two lines can have both 3-way and 2-way call support, but the remaining two lines can support only 2-way calls
- support for G.711, G.726, and G.729 CODEC; the support for G.729 requires reduced channel number with software upgrade
- fax per T.38 on POTS lines

ONTs are compatible with all existing subscriber voice equipment including analog phones with tone or rotary dial capabilities, cordless phones, modems, fax machines, and caller ID boxes (Type I, Type II, and Type III).

Data and IP video subsystems over Ethernet interface

Data and IP video services are delivered through the Ethernet cable interface. The Ethernet interface connects the subscriber premises equipment to the GPON.

A set-top box is required for the IP video service. The requirement for the television set associated with the set-top box is that it must be able to receive and display analog broadcasts on channel 3 or 4.

The Ethernet port can be set to the following:

- 10/100/1000BASE-T auto negotiation
- 10/100/1000BASE-T half duplex
- 10/100/1000BASE-T full duplex
- 10BASE-T auto-sensing
- 10BASE-T half duplex
- 10BASE-T full duplex
- 100BASE-T auto-sensing
- 100BASE-T half duplex
- 100BASE-T full duplex
- 1000BASE-T auto-sensing
- 1000BASE-T half duplex
- 1000BASE-T full duplex

ONTs support IP video service using the Internet Group Management Protocol (IGMP). The IGMP snooping function supports:

- the ability to enable and disable IGMP per Ethernet and MoCA port
- the ability to age out multicast MAC addresses in the IGMP table

- G.984.3 compliant multicast using a single GEM port-ID for all video traffic (as mandated by G.984.3)
- up to of 64 video multicast streams per ONT

Note — For ONTs that have SoC technology on-board in a two-Ethernet port device, only one Ethernet UNI port at a time can be configured for IPTV and multicast streams.

3.4 POTS interface specifications

Table 3-3 lists specifications for the ONT voice service.

Table 3-3 Voice service specifications

Service features	Specifications for the ONT
Voice quality	Toll quality voice with a mean opinion score (MOS) of 4 or better
DC supervisory range	Total dc supervisory range of 750 Ω, allowing for 1000 ft (305 m) of 26 AWG CAT3 cable, CPE equipment, and a margin allocation
G.168 echo cancellation	16 ms tail for near-end echo
CODEC [1]	G.711 (PCM 64 kb/s), G.729, and A-law and U-law encoding and decoding
Analog line impedance [1]	600 Ω
Ringing voltage [1]	minimum of 40 Vrms
Ringing capacity	5 REN (US) per POTS line [2]
Off-hook dc current [1]	25 mA
Maximum expected DTMF signal level	0.0 dBm
Receive (D/A) loss [1]	*4* dB
Transmit (A/D) loss [1]	2 dB
Loop start signaling	—
Loop length	Up to 984 ft (300 m)

Notes
[1] These items are determined by the country-specific VoIP configuration XML file. The values specified are for ANSI deployments.
[2] While the maximum ringing capacity for all ONTs is five REN per POTS line, some ONTs can support more than one POTS line at a time. For MDUs and business ONTs, the maximum ringing capacity is three POTS lines with a five REN load ringing simultaneously. For indoor ONTs, the maximum ringing capacity is two POTS lines with a five REN load ringing simultaneously.

SIP Overview

Voice-over-IP (VoIP) implementations enable users to carry voice traffic over an IP network. A VoIP system consists of a number of different components: softswitch, gatekeeper, user agent, signaling gateway and a call manager etc., depending on the type of signaling-control protocol that is being used. There are a variety of signaling protocols defined by the standard bodies Internet Engineering Task Force (IETF) and International Telecommunication Union (ITU), which specify how the user can setup signaling and bearer paths between the end devices. SIP signaling is based on a collection of IETF standards.

The ONT is based on an ASIC that provides L2 switching with filtering functions. In the upstream direction, the ONT assigns traffic to different GEM port IDs based on L2 fields. In the downstream direction, the ONT performs a cross-connect between the GEM port ID and the LAN ports. The POTS analog interfaces are part of the ONT. The VoIP signaling and bearer channels are terminated on the ONT. A VoIP client manages these terminations and POTS interfaces while performing SIP signaling with the soft switch.

SIP is a collection of IETF standards (i.e. RFCs). The main RFC for defining SIP is RFC 3261 which contains the primary "methods" or signaling messages used for SIP. Additional RFCs are defined that expand on this base to provided more complete functionality so that a complete set of call features that phone users are accustomed to can be supported. The connection model for the protocol consists of a series of signaling transactions with the soft switch which includes the media stream definitions using SDP (see RFC 2327). The intent of most signaling messages is to control and define the media stream used to convey the voice data between the endpoints of a phone call. The media stream or bearer channel has its own protocol, RTP, which is defined in RFCs 3550 and 3551. In the SIP model, as with all VoIP models, the bearer channel is connected directly through the IP network, between the two endpoints, and is not normally connected to the softswitch itself, except for special cases of application services in support of voice conferencing, voice mail, or other special softswitch services.

The ONT SIP client is expected to control the analog states of the POTS line, detect and process dialing, generate tones and Caller ID FSK transmissions, while signaling with the softswitch to control the phone call, and establish/teardown the RTP bearer channel associated with the voice path.

VoIP-supporting ONTs have the following general features:

- The ONT supports simultaneous calls on all ports at any point of time.
- The ONT supports up to:
    - two simultaneous 3-way Calls on a 2-port ONT
    - three simultaneous 3-way Calls on a 4-port ONT
    - six simultaneous 3-way Calls on an 8-port ONT
- The ONT supports a single VoIP client per ONT.
- The ONT has one MAC address associated the VoIP client.
- The ONT supports a configurable IP address for the VoIP client.

POTS voice support for SIP

To ensure high quality delivery of SIP-based VoIP services in SIP Mode 1 (thin client), Alcatel-Lucent recommends the following values for the bandwidth profile for each POTS line:

- Committed Information Rate (CIR) of 150 Kb/s
- Excess Information Rate (EIR) of 150 Kb/s
- Delay Tolerance (DT) of 8

For multiple POTS lines providing SIP-based VoIP service in SIP Mode 1, use a multiple of the recommended per-line EIR and CIR values. For example, with 4 POTS lines, use CIR of 600 Kb/s, EIR of 600 Kb/s, and DT of 8.

To ensure high quality delivery of SIP-based VoIP services in SIP Mode 2 (thick client), Alcatel-Lucent recommends the following values for the bandwidth profile for each POTS line:

- CIR of 250 Kb/s
- EIR of 250 Kb/s
- DT of 8

For multiple POTS lines providing SIP-based VoIP service in SIP Mode 2, use a multiple of the recommended per-line EIR and CIR values. For example, with 4 POTS lines, use CIR of 1000 Kb/s, EIR of 1000 Kb/s, and DT of 8.

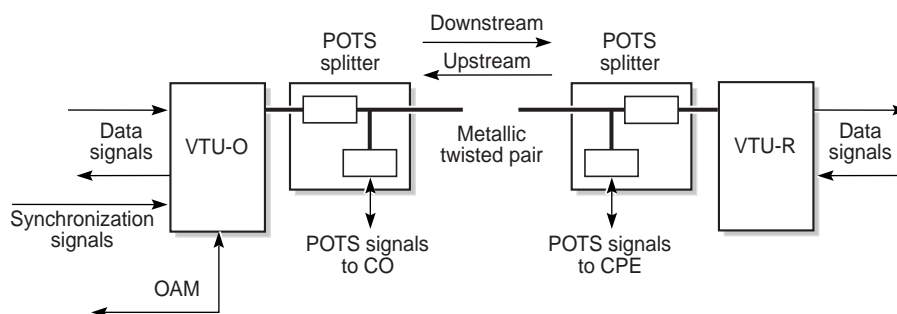## 3.5 VDSL2 interface specifications

Similar to ADSL, VDSL2 operates over the copper wires in a telephone line to provide both high-bandwidth service and POTS, and is asymmetric in its downstream and upstream speeds. However, VDSL2 provides subscribers with a higher bit rate than multi-ADSL and can achieve speeds over 57 Mb/s downstream and 25 Mb/s upstream, compared with 24 Mb/s downstream and 1.3 Mb/s upstream with multi-ADSL. The maximum bit rates supported depend on deployment, noise environment, and Ethernet system restrictions. The high bit rate asymmetrical mode can be used for high-bandwidth video service, while the symmetrical bit rate mode can be used for business users or residential users who need symmetrical bit rate access. The VDSL2 ports support loop lengths of 300 meters nominal.

VDSL allows very high speed data transmission on a metallic twisted pair between the operator network and the customer premise. This service is provisioned by using the existing unshielded copper twisted pairs, without requiring repeaters. By using a Frequency Division Multiplexing technique, the existing POTS or BR ISDN services can still be provided on the same wires. VDSL transceivers use Frequency Division Duplexing (FDD) to separate upstream and downstream transmission.

Each end of the VDSL line is terminated by a VDSL Termination Unit (VTU), as shown in . The unit at the (optical) network side is the VTU-O (MDU) and the Remote or Customer Premises (CP) unit is the VTU-R.

The High Pass Filter (HPF) blocks the POTS/ISDN signals towards the VTU, and the Low Pass Filter (LPF) blocks the VDSL signal towards the Local Exchange (VTU-O side) or telephone set (VTU-R side).

3-8

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Figure 3-1 VDSL Termination Points

A bandplan is a partitioning of the frequency spectrum into non-overlapping frequency bands, each of which is allocated for either upstream or downstream transmission. ANSI and ETSI define a set of predefined VDSL BandPlan modes of operation. The VDSL BandPlan shall be configurable on a per port basis. The following bandplans are supported:

- bandPlanAnnexA998 17A, 30A
- bandPlanAnnexB998ADE 17a, 30a
- bandPlanAnnexB998E 17a, 30a

Table 3-4 describes ITU-T standards and related VDSL2 modes supported on the MDUs.

Table 3-4 ITU-T standards supported

Standard	Description
G.993.2	VDSL2 over POTS operating above the POTS 25 kHz band with trellis
G.994.1	Handshake procedures for DSL transceivers

3.6   DS1/E1 interface specifications

The business ONT supports structured, unstructured, and fractional DS1 (100 Ω) or E1 (120 Ω/75 Ω) services. An external adapter is required for 75 Ω. You cannot mix DS1 and E1 services on the same ONT. You must configure both ports for either DS1 or E1 on the same ONT.

The CES subsystem encapsulates DS1 or E1 traffic received at the RJ-48C port using MEF-8 packetization as Ethernet layer 2 for transport across the GPON. The CES encapsulation is removed before DS1 or E1 traffic from the GPON is sent to the DS1 or E1 lines at the subscriber side.

Structured DS1 or E1 services emulate fractional services where the 1.544 Mb/s DS1, or 2.048 Mb/s E1, bandwidth is subdivided in to DS0 64 kb/s channels. Framing is used to group together multiple DS0s when the service is structured or fractional. Unstructured services treat the full bandwidth of a DS1 or E1 link as though it were one large channel, ignoring any framing.

CES encapsulation is a method of carrying TDM traffic in an Ethernet frame so that there is minimal loss of quality. The ISAM performs CES on the TDM traffic received at the ONT DS1 or E1 port using the MEF-8 payload structure for transport as Ethernet layer 2 packets over pseudo-wires (PW). The TDM payload within the MEF-8 packet, whether it is structured or unstructured, is treated as a bit stream. The MEF-8 packets are multiplexed along with other Ethernet layer 2 data packets at the ONT before being transported across the GPON.

In unstructured mode, the payload size is fixed at eight DS0 frames per MEF-8 packet. For DS1, the payload length is fixed at 192 bytes per frame. For E1, the payload length is fixed at 256 bytes per frame. In structured mode, the payload length is determined from the encapsulation delay setting.

Table 3-5 lists the specifications supported for the DS1/E1 interface.

Table 3-5 DS1/E1 interface specifications

Item		Specification
DS1/E1 WAN interfaces		Two RJ-48C ports configured for 100 Ω DS1, 120 Ω balanced E1, or 75 Ω unbalanced E1. An external adapter is required for 75 Ω.
DS1/E1 CES over Ethernet layer 2 GPON		MEF-8 packetization as IETF PWE3 pseudo-wires
DS1 standards		AT&T TR-6421; ITU-T Rec. G.703, G.704 Structured (fractional) and unstructured DS1
E1 standards		ITU-T Rec. G.703, G.704, G.706, G.732, G.823 Structured (fractional) and unstructured E1
Synchronization	CES DS1/E1	Upstream: A 16.384 MHz local oscillator or a derived clock [1] from the GPON that is provided by the P-OLT Downstream: Either a 16.384 MHz adaptive clock received from the PWE3 packet stream or a differential clock recovered from the PWE3 packet stream
	Gigabit Ethernet	A Gigabit Ethernet transmit reference clock of 125 MHz as per IEEE 802.3

Note

[1] The upstream derived clock that is provided by the P-OLT is tied to the BIT clock and must be traceable to a network timing reference. The derived clock is used for differential clock recovery and for timing the upstream PWE3 packet streams in the absence of a valid TDM recovery clock.

CES Overview

Circuit Emulation Services (CES) encapsulation is supported on DS1 and E1 TDM traffic for transport as Ethernet layer 2 over the GPON using the Metro Ethernet Forum standard MEF-8 payload structure and pseudo-wire (PW) technology. CES and the DS1 or E1 ports may be provisioned on the business ONT using a TL1 or an EMS management session with the P-OLT.

The business ONT supports DS1 and E1 service connections at the subscriber premises. The following TDM link types are supported:

- structured (fractional) DS1 or E1
- unstructured DS1 or E1

At the subscriber premises, the business ONT terminates DS1 or E1 links from the subscriber. The TDM traffic is adapted and packetized using MEF-8 pseudo-wire technology before being transported across the GPON. MEF-8 is the payload option that is used. The MEF-8 packets are multiplexed with the Ethernet layer 2 data traffic at the business ONT GPON port.

When the MEF-8 packets are received at the OLT, the packets are forwarded to the destination PSTN, typically via a voice gateway that is connected to the IP network. Figure 3-2 shows the traffic flow.

Figure 3-2 CES DS1 or E1 traffic between the ONT and PSTN over the GPON via the OLT
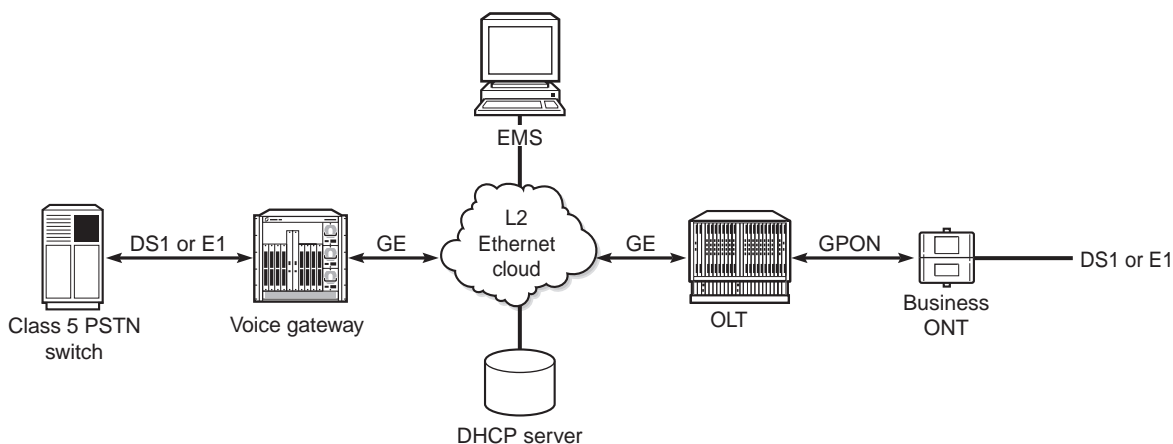
CES clocking and synchronization

The same clocking reference at both ends of the DS1 or E1 link is required to meet the wander requirements of TDM traffic.

The business ONT can use one of two clocking sources for CES:

*   a derived GPON clock at 16.384 MHz
*   a 6.384 MHz local oscillator.

When the system clock for CES is derived from the GPON, the upstream P-OLT locks to the BIT clock and supplies the ONT with an Ethernet clock that is traceable to a network timing reference. The supplied Ethernet clock is used for differential clock recovery and for timing the upstream pseudo-wire MEF-8 packet streams in the absence of a valid TDM recovery clock. The local oscillator is only used if adaptive mode is selected.

The downstream TDM streams may be timed from one of two clocking sources:

*   a 16.384 MHz adaptive clock received from the MEF-8 packet stream.
*   a differential clock recovered from the MEF-8 packet stream via the GPON.

When the clock is received from the GPON, the GPON must be configured to send RTP packets.

In adaptive timing, a local, free-running 25 MHz clock is used. The generated bit rate is determined by the long-term average data rate. The attached DS1/E1 equipment must be loop timed. In differential timing, a 16.384 MHz reference clock is synchronized to the PON. Both ends of the DS1/E1 CES PW must use the same reference clock frequency and be synchronized to a common source. RTP is used to transport the transmit bit rate information. The DS1 or E1 equipment that is attached to the terminating CES PW devices must be loop timed. In loop timing, the receive clock rate is used for the transmit clock rate. The DS1/E1 equipment that is attached must be source timed, not loop timed.

Timestamps within the MEF-8 packets are used for carrying timing information across the network. Timestamp values are generated in differential format when the interface is operating in differential timing reference mode. Otherwise, the timestamp values represent absolute time.

3.7 RF video interface specifications for video overlay

The following section provides design guidelines for coaxial connectivity, configuration recommendations, and information based on the RF video receiver types used by Alcatel-Lucent ONTs and MDUs.

> **Warning —** Operating equipment outside of its tested and documented performance characteristics and causing an optical overload may cause damage to equipment components, such as APD receivers. This can affect service delivery, and void any component or system warranties.

> **Note 1 —** V-OLT is an optional network equipment that is used to distribute Radio Frequency (RF) video signal from service providers to the ONTs. This equipment is not part of the OLT or ONT system. The following description of the V-OLT function is provided for informational purposes.
>
> **Note 2 —** Alcatel-Lucent only guarantees ONT RF video output levels. Coaxial cable and splitter information in the following sections are provided as guidelines. See the coaxial and splitter vendor documentation for more information.

Video overlay overview

The system can provide RF video service through the video overlay function. The function operates downstream in the 1550 nm optical band. Signals sent over the overlay network are presented to the subscriber as RF signals from a video F-type connector in the ONT.

> **Caution —** Video subscribers can only be provisioned on the 7342 ISAM FTTU system platform.

The V-OLT supports the full cable television (CATV) spectrum from 47 MHz to 862 MHz.

Access to video services may require a Set-Top Box (STB) between the video output of the ONU equipment and other Customer Premises Equipment (CPE).

The V-OLT requires a separate Element Management System (EMS) to control video output signals from the V-OLT equipment.

The RF video service in the downstream 1550 nm optical band supports most available cable television (CATV) services, including standard analog broadcast channels, as well as standard and high definition digital broadcast channels. For access to these services, a set-top box may be required between the video output of the ONT equipment and the customer's television set.

Within the ONT functional blocks, the RF subsystem is an RF amplifier that produces the required RF output for the subscriber video equipment. The RF subsystem monitors the levels of optical and RF signals in support of the performance management functions. The RF video service is optional and independent of the SoC functions. Figure 3-3 shows the video overlay system.

Figure 3-3 Video overlay system

(A) Analog broadcast No STB needed
(B) Digital broadcast STB needed
(C) Broadcast and VoD STB needed
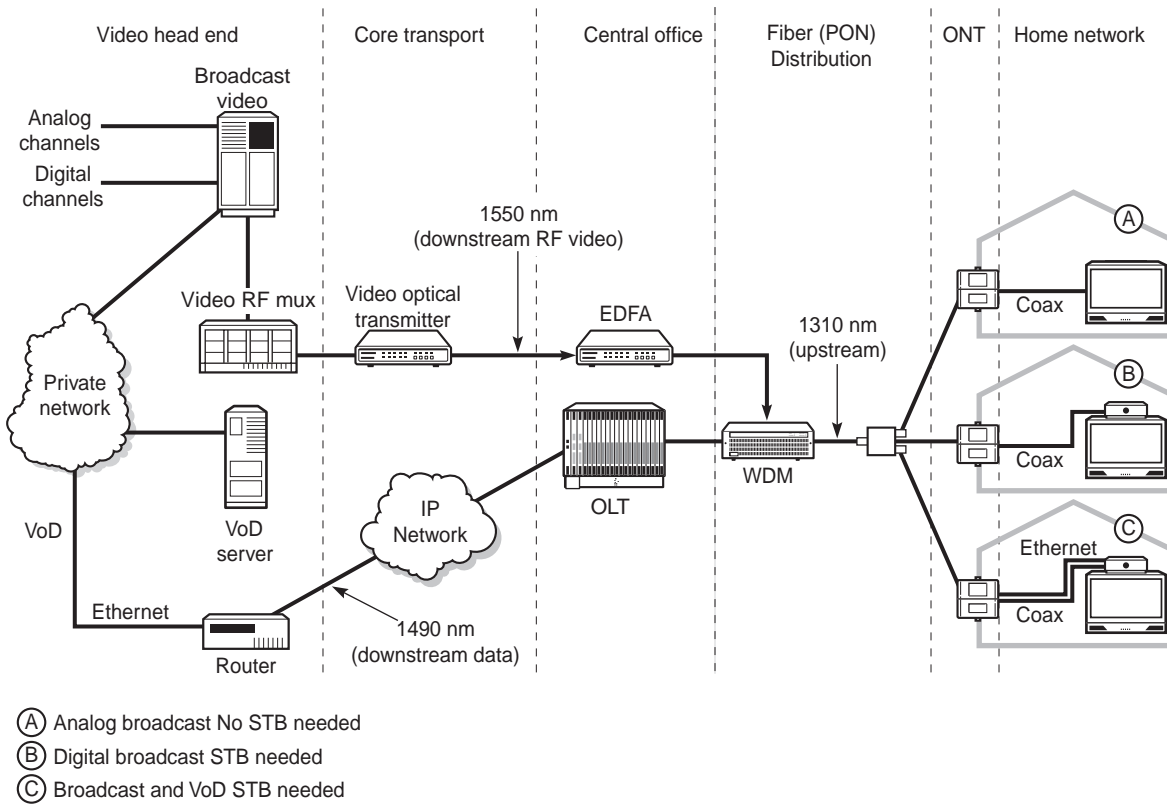
Radio Frequency Video Signal Distribution

The V-OLT uses Erbium Doped Fiber Amplifiers (EDFA). The distribution requires a Wavelength Division Multiplexer (WDM) to be overlaid into the fiber path.

The distribution of the optical video signal is described as follows:

- The V-OLT receives an incoming wavelength optical signal with embedded video channels through a fiber path from the cable TV head-end equipment.
- The V-OLT amplifies and splits the optical signal into multiple optical feeds to the video coupler.
- The video coupler merges the video signal over the fiber paths.
- The fiber paths carry the optical signals between the P-OLT and the ONTs.

## Coaxial connectivity in the home and design guidelines

Standard 75 Ω coaxial cable can be used, including RG-6 or RG-59 coaxial cable.

Consider the following limitations when planning video deployments:

- ONTs and MDUs supporting video overlays only support specific split ratios on the coaxial distribution, based on the ONT or MDU video receiver. For for +18 dBmV receivers, the maximum split is 1:8
- The maximum supported length of RG-6 or RG-59 coaxial cable used for +18 dBmV units is 100 ft (30.48 m).

There are numerous criteria that effect RF video overlay. Figure 3-4 shows an example of the factors affecting RF video overlay design and deployment.

Figure 3-4 RF video overlay design and deployment example with a +14 dBmV receiver
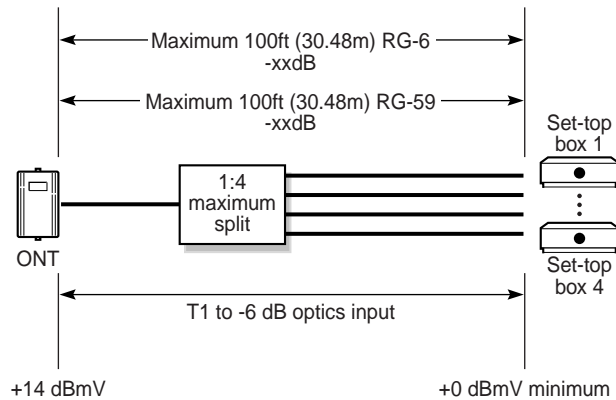
Conditions that need to be confirmed to ensure proper RF video overlay service, as shown in Figure 3-4, are based on:

- + 18 dBmV at the ONT
- 8 dB loss at the splitter in a 1:4 split; 6.6 dB loss in a 1:3 split, and 4.6 dB loss in a 1:2 split
- Cable attenuation loss based on frequency and cable type:

```
+ 18 dBmV (at the ONT at 450 MHz) - 8 dB (splitter) - XX dBmV (RG-59
cable loss at the highest frequency based on cable type, for example
400 MHz would be -7 dB) = Final dBmV (at set-top box or TV)
```

For example: +18 - 8 - 7 = +3 dBmV.

```
+ 18 dBmV (at the ONT at 870 MHz) - 8 dB (splitter) - XX dBmV (RG-59
cable loss at the highest frequency based on cable type, for example
870 MHz would be -11 dB) = Final dBmV (at set-top box or TV)
```

For example: +19 - 8 - 11 = -1 dBmV.

The cable attenuation loss is based on the frequency and the type of cable used, as listed in Table 3-6.

Table 3-6 Typical cable attenuation loss value based on frequency

Frequency (MHz)	RG-6 coaxial per 100 ft (30.48 m) (dB)	RG-59 coaxial per 100 ft (30.48 m) (dB)
50	1.9	2.4
100	2.7	3.4
200	4.1	4.9
400	5.9	7.0
700	8.1	9.7
900	9.4	11.1

Be sure to properly plan and design the RF video deployment at the customer site.

The following is an example of a properly planned and designed RF video deployment. Based on 900 MHz frequency and 100 ft (30.48 m) of cable length, 0.6 dBmV is reached at the set-top box using RG-6 coaxial cable:

```
+18 dBmV - 8 dB - 9.4 dB = + 0.6 dBmV
```

The following is an example of an improperly planned and designed RF video deployment. Based on 900 MHz frequency and 100 ft (30.48 m) of cable length, -1.1 dBmV is reached at the set-top box using RG-59 coaxial cable:

```
+18 dBmV - 8 dB - 11.1 dB = -1.1 dBmV therefore should not be used.
```

Note — It is the responsibility of the customer installation crew to ensure proper on-site layout of video distribution by verifying that the output power at the end devices, such as the TV, VCR, and STB, is between 0 to the limit of the ONT or MDU receiver's dBmV.

Configuration recommendations

You can control the quality of the output signal to the subscriber by specifying a number of parameters:

- If the ONT operates in AGC mode, you can specify the measurement offset to control the gain of the output signal, which ensures some measure of performance.
- You can set high and low optical power level thresholds for the downstream signal. An alarm is raised if either the high or the low optical power level threshold is crossed.

Consider the following before configuring RF video services:

- ONTs supporting RF video come with a 75 Ω (F-type) coaxial interface connector. You may have to install the 75 Ω coaxial F connector on the video cable.
- The F-type coaxial interface is typically connected to a four-way splitter in the home.
- You must use either RG-6 or RG-59 coaxial cable within the home.
- Ensure proper attenuation is inserted at the coaxial output to guarantee the following at the end of any coaxial drop:
    - video signal is below 15.5 dBmV
    - audio signal is below 2.55 dBmV per channel
- Tilt is a measure of the gain at the highest frequency relative to the lowest frequency. For example, if a receiver has a tilt of 5 dB, the RF level at 50 MHz may be 16 dBmV, the RF level at 450 MHz will be about 18 dBmV, and the RF level at 870 MHz will be (16 dBmV + 5 dB) = 21 dBmV. Tilt is an attempt to provide more gain at higher frequencies, to compensate for the higher loss at higher frequencies of typical RG-6 or RG-59 coaxial cable.

RF video service configuration requires the use of TL1 commands. These commands are issued at the P-OLT craft terminal.

14 dBmV RF video receivers

Table 3-7 lists RF video interface specifications for ONTs with a 14 dBmV receiver.

Table 3-7 RF video service specifications for ONTs with 14 dBmV receivers

RF video features	Specifications
RF output level	+14 dBmV @ 450 MHz using a per analog channel measurement at the ONT output [1]
RF slope correction (tilt)	5 to 8 dB from 50 to 870 MHz
Optical power range	+ 1.0 to -6.0 dB
CNR	45 dB
CSO/CTB	53 dB
MER	32 dB

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RF video features	Specifications
QAM signal-to-noise ratio	40 dB
Measurement assumptions	
Channel load	80 analog and 33 QAM
Digital backoff QAM-256	6 dB (QAM-256)
Digital backoff QAM-64	10 dB (QAM-64)
PON input CNR	52 dB

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Note
(1)   It is the responsibility of the customer installation crew to ensure proper on-site layout of video distribution by verifying that the output power at the end devices, such as the TV, VCR, and STB, is between 0 to 14 dBmV.

18 dBmV RF video receivers

Table 3-8 lists RF video interface specifications for ONTs with an 18 dBvM receiver. The following ONTs support +18 dBmV receivers:

- I-241G series ONTs
- I-241W-P ONTs

Table 3-8 RF video interface specifications for ONTs with 18 dBmV receivers

RF video features	Channel mix 80 analog/33 digital [1]	Channel mix 40 analog/63 digital	Channel mix 0 analog/135 digital
RF output level	+18 dBmV @ 450 MHz using a per analog channel measurement	+18 dBmV @ 450 MHz using a per analog channel measurement	+12 dBmV @ 450 MHz using a per digital channel measurement
RF slope correction (tilt)	2 dB from 50 to 870 MHz	2 dB from 50 to 870 MHz	2 dB from 88 to 870 MHz
Optical power range	+1 to -6 dB	+2 to -7 dB	+1 to -9 dB
CNR	45 dB	46 dB	—
CSO/CTB	53 dB	55 dB	—
MER	32 dB	32 dB	32 dB
QAM signal-to-noise ratio	40 dB	40 dB	40 dB
Measurement assumptions			
Channel load	80 analog and 33 digital	40 analog and 63 digital	0 analog and 135 digital
Digital backoff QAM-256	6 dB	6 dB	6 dB
Digital backoff QAM-64	10 dB	10 dB	10 dB
PON input CNR	52 dB	52 dB	52 dB

Note
(1)   It is the responsibility of the customer installation crew to ensure proper on-site layout of video distribution by verifying that the output power at the end devices, such as the TV, VCR, and STB, is between 0 to 18 dBmV.

3.8 SWRD interface specifications

The SWRD meets the following compliance and safety standards:

- UL safety (UL 60950-1)
- EU safety (IEC/EN 60950-1)
- IP rating NEMA 4 (IP 56)
- EMC emissions (U.S. and Canada) FCC part 15, class B
- EMC emissions (Europe) EN 55022 and 55024

The power specifications of the SWRD are as follows:

- input voltage range 12 +-2.0 V dc
- input current of 0.25 A

The power can be supplied by the ONT or MDU. In the ONT PoE case, jumpers must be configured on the EPC interface of the ONT to enable +12V power. In the MDU case, when the video return channel is configured for the SWRD Ethernet port, power is available.

Table 3-9 lists the electrical specifications for the SWRD when all ports and cabling use IEEE 802.3-compliant materials.

Table 3-9 SWRD electrical specifications

Electrical specifications	Value
Surge resistance on Ethernet ports	1.5 kV (1 positive, 1 negative)
Surge resistance on RF ports	1.5 kV (1 positive, 1 negative)
Forward pass band	46 to 870 MHz
Reverse operating frequency	18.5 MHz
Maximum length of power supply coaxial cable	50 ft (15.24 m)

The environmental specifications of the SWRD are as follows

- operating temperature range is –40°F to 140°F (-40°C to 60°C) and to the equivalent of 105.8°F (41°C) with solar loading
- operating relative humidity is 5% to 95%, non-condensing
- operating altitude range is 200 ft (61 m) below mean sea level to 13 000 ft (3962 m) above mean sea level
- operating temperature can vary by 3°F (16.6°C) per minute, to the maximum and minimum ranges

The physical specifications of the SWRD are as follows

- housing dimensions: 6.78 in. wide by 1.29 in. deep by 5.77 in. high (17.45 cm by 3.38 cm by 14.66 cm)
- weight: 1.5 lb (0.68 kg)

3.9 MoCA interface specifications

The following technical specifications apply to MoCA ONTs:

- RF interface connector: F-type with 75 Ω impedance
- MoCA 1.0 and 1.1 compliant
- Network center frequency: 1 000 MHz

> **Note —** MoCA ONTs only support MoCA v1.1 when connected to nodes that support MoCA v1.1. They revert to MoCA v1.0 if connected to nodes that only support MoCA v1.0.

MAC throughput (MAC rate) is the maximum rate at which Ethernet packets can be forwarded across the MoCA network while maintaining a PER of 10^{-5}. Table 3-10 lists minimum MAC rates for the specified maximum PHY rates, for MoCA v1.0 and v1.1. This applies for flat channels between two intermediate devices with 100 Mb/s or 1 Gb/s Ethernet PHY interface in a two-node MoCA network, with 1518-byte packets.

Table 3-10 MAC rate for PHY rates for 2-node network

PHY rate (Mb/s)	Minimum MAC rate (Mb/s) per PHY rate[1]	
	MoCA v1.0[2]	MoCA v1.1[3]
275[4]	not specified	176
250[4]	125	167.5

Notes

[1] MAC rates are aggregate (half traffic in one direction, and half in the opposite direction) and assume a 1518-byte maximum frame size.

[2] For MoCA v1.0 with less than 1518-byte frame size, the minimum aggregate MAC rate is 9500 packets/s.

[3] For MoCA v1.1, packet aggregation allows a minimum MAC rate of 20 000 packets/s for 800-byte frames.

[4] Maximum PHY rate is approximately 275 Mb/s when connected devices support optional QAM-256; otherwise the maximum PHY rate is approximately 250 Mb/s when using QAM-128.

The nominal transmit output power for MoCA ONTs is as follows:

- For Package B MoCA ONTs, the nominal transmit output power will be the values programmed via TL1 (range 0 to -30 dBm).
- For Package A MoCA ONTs, Table 3-11 lists the nominal transmit output power variance for the values programmed via TL1.

Table 3-11 MoCA ONT nominal transmit output power

TL1 value (dBm)	Nominal transmit output power (dBm)[1]
-26 and lower	-26
-23, -24, -25	-23
-20, -21, -22	-20
-17, -18, -19	-17
-14, -15, -16	-14
-11, -12, -13	-11
-8, -9, -10	-8
-5, -6, -7	-5
-2, -3, -4	-2
0, -1	0

Note

[1]   The transmit output power values shown apply to MoCA ONTs (as measured from the F-connector output using a power meter).

3.10   RSSI specifications

Received signal strength indication (RSSI) is a measurement of radio signal strength at the receiver. Use of the RSSI metric is governed by the IEEE 802.11 standard, which does not define any relationship between RSSI value and power level in mW or dBm. RSSI measurements are specified without units and range in value from 0 to 255 with the highest value being referred to as RSSI Max. Defining RSSI values or power levels is the responsibility of the vendor.

According to the Alcatel-Lucent implementation of RSSI for ONTs, the RSSI value is expressed in power levels of dBm and is the measurement of the received optical signal level at 1490 nm in dBM. The RSSI range is -65.536 to +65.534. The absolute accuracy of the optical signal reading is +/-3.0 dB. Take this possible variation in measured signals into account when reading the metric values.

A RSSI value of zero occurs when the ONT is not connected to the PON or there is a loss of connectivity with the PON. In the latter case, the problem may be either with the ONT or PON.

Table 3-12 describes the supported RSSI specifications.

Table 3-12 RSSI specifications

Standard	Description
IEEE 802.11	A set of standards carrying out wireless local area network (WLAN) computer communication in the 2.4, 3.6, and 5 GHz frequency bands

3.11 Wi-Fi specifications

Wi-Fi is a term used to categorize WLAN devices based on the IEEE 802.11 standard. Only products certified as meeting this standard are called Wi-Fi. Specifically, the certification process requires conformance to the IEEE 802.11 radio standards as well as the WPA and WPA2 security standards.

According to the Alcatel-Lucent implementation of Wi-Fi for ONTs, the following requirements must be met:

- Wi-Fi certified for IEEE 802.11a
- maximum transmit power (EIRP) equal to or greater than 200 mW (23.01 dBm) when operating in 802.11b mode
- Wi-Fi certified for Wi-Fi Multimedia (WMM) subset function of 802.11e
- Wi-Fi certified for Power Save, the U-APSD function of 802.11e
- maximum transmit power (EIRP) equal to or greater than 100 mW (20 dBm) when operating in 802.11g mode
- supports an 802.11h wireless access point
- supports WEP using a 104-bit key as identified in 802.11i
- Wi-Fi certified for WPA2-Personal that implements the mandatory elements of 802.11i
- Wi-Fi certified for WPA2-Enterprise
- 802.11g/n processing should not degrade the committed LAN-LAN and/or LAN-WAN throughput rate

Table 3-13 for descriptions of the supported Wi-Fi specifications mentioned above.

Table 3-13 Wi-Fi specifications

Standards and amendments	Description
IEEE 802.11	A set of standards carrying out WLAN computer communication in the 2.4, 3.6, and 5 GHz frequency bands. The amendments in this table are Wi-Fi specific.
IEEE 802.11a	An amendment to the 802.11 specification adding a higher data rate of up to 54 Mb/s using the 5 GHz band
IEEE 802.11b	An amendment to the 802.11 specification extending throughput to up to 11 Mb/s using the 2.4 GHz band
IEEE 802.11e	An amendment to the 802.11 specification defining a set of QoS enhancements for wireless LAN applications through modifications to the MAC layer
IEEE 802.11g	An amendment to the 802.11 specification extending throughput to up to 54 Mb/s using the same 2.4 GHz band as 802.11b
IEEE 802.11h	An amendment to the 802.11 specification for spectrum transit power management extensions that regulate interference with satellites and radar using the 5 GHz frequency band
IEEE 802.11i	An amendment to the 802.11 specification defining security mechanisms for wireless networks

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Standards and amendments	Description
IEEE 802.11n	An amendment to the 802.11 specification extending throughput significantly to up to 600 Mbit/s with the use of four spatial streams at a channel width of 400 MHz

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3.12   Ranging, discovery, and activation of ONTs

When the OLT system is ranging new ONTs, working ONTs must temporarily stop transmissions. This is done by opening a ranging window to discover new devices.

Two activation/ranging methods supported by the system:

- Configured-S/N:
  The serial number of the ONT is registered in advance at the OLT.
- Discovered-S/N:
  The serial number of the ONT is not registered at the OLT. It requires an automatic detection mechanism of the serial number of the ONT based on the operator-assigned SLID that is provisioned locally at the ONT and at the OLT for a match. In case a new ONT is detected, an ONT ID is assigned and the ONT is activated.

There are three triggers for initiating the activation of an ONT:

- The network operator enables the activation process to start when it is known that a new ONT has been connected.
- The OLT automatically initiates the activation process, when one or more of the previously working ONTs are 'missing', to see if those ONTs can return to service.
- The OLT periodically initiates the activation process, testing to see if any new ONTs have been connected.

ONU activation

The activation procedure is performed by the exchange of upstream and downstream flags and Physical Layer Operations Administration and Maintenance (PLOAM) standard messages defined for GPON, as follows:

1   The ONT receives the requested GPON operating parameters from the OLT.

2   The ONT adjusts it parameters accordingly.

3   The OLT system discovers the serial number of a new connected ONT.

4   The OLT system assigns an ID to the ONT.

5   The OLT system measures the round-trip delay of the ONT transmission.

6   The OLT system notifies the ONT of the equalization delay.

7   The ONT adjusts the transmission phase to the notified value.

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In the normal operating state, all the transmissions can be used for monitoring the phase of the arriving transmission. Based on the monitoring transmission phase information, the equalization delay can be updated.

3.13 ONT optical budget

This section provides the optical budget for all of the ONTs. Observe the safety requirements with ONTs, which are Class 1 laser products. Figure 3-5 shows the Class 1 laser product warning label attached to the ONT.

Figure 3-5 Class 1 laser product warning label

CLASS 1 LASER PRODUCT
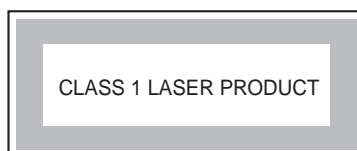
18256

Warning — Operating equipment outside of its tested and documented performance characteristics and causing an optical overload may cause damage to equipment components, such as APD receivers.

This can affect service delivery, and void any component or system warranties.

Table 3-14 lists ONT optical budget information.

Table 3-14 ONT optical budget

Item	Detail	Minimum	Typical	Maximum
Operating temperature	Ambient	See the data sheets for each device		
Transmitting budgets				
Tx nominal bit rate	—	—	1244 Mb/s	—
Tx/Rx line code	Scrambled NRZ	—	—	—
Tx central wavelength	Operating temperature	1290 nm	—	1330 nm
Tx reflection of equipment	At Tx wavelength	—	—	–6 dB
Mask of Tx eye diagram	G.984 burst mode	—	G.984	—
ORL of ODN at ONU Tx and Rx	More than	32 dB	—	—
Tx mean launched optical power for the ONT	At ONT optical port	+0.5 dBm	—	+5.0 dBm
Tx launched optical power w/o input	No input	—	Sensitivity –10 dB	—
Tx extinction ratio	G.984 burst mode	10 dB	—	—

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Item	Detail	Minimum	Typical	Maximum
Tolerance to Tx incident light	G.984 burst mode	–15 dB	—	—
Tx –20 dB spectral width	G.984 burst mode	—	—	1.0 nm [1]
Receiving budgets				
Rx nominal bit rate	—	—	2488 Mb/s	—
Rx wavelength	Operating temperature	1480 nm	—	1500 nm
Rx reflection of equipment into ODN	At Rx wavelength	—	—	–20 dB
Rx BER	PRBS 2E23-1	—	Less than $1E^{-10}$	—
Rx optical sensitivity for the ONT	At ONT optical port	–27.0 dBm	—	—
Rx optical overload	At ONT optical port	–8 dBm	—	—
Rx consecutive identical bits	CW	72 bits	—	—
Rx tolerance to reflected optical power	G.984 burst mode	—	—	10 dB

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Note
[1]   Maximum guaranteed length is 18.6 mi (30 km).

> **Note —** The following information is for ETSI customers only:
>
> - Power propagating in the fiber is 3.16 mW out of the ONT.
> - The maximum modulation frequency is 1244 MHz.
> - Operating wavelength is 1310 nm nominal in the ONT.
> - Operation time of the automatic power reduction of the ONT transmitted optical power is 1 s or less.

4 — ONT and MDU statistics and performance monitoring

4.1 Overview

This chapter provides a detailed description of ONT performance monitoring.

4.2 ONT performance monitoring

Performance monitoring is a tool that provides up-to-date information to measure how well the system is doing. Performance monitoring data at the ONT level include counters and alarms that enable service providers to do the following:

- set a baseline for performance
- get a high-level view of the activity at a given point in the network
- detect problems when they occur
- diagnose the cause of problems
- plan for development and growth

Performance monitoring limitations

Table 4-1 describes performance monitoring limitations that need to be observed.

Table 4-1 Performance monitoring limitations

Montype	Counters collected by	Limitation
ONTENET	ONT	No hard-coded limit enforced
ONTL2UNI		
ONTMOCA		
PONONTTC		
PONOLTTC	OLT	31 GEM port counters per each PON

4.3   ONT performance monitoring functions

The system provides the following functionality to simplify the usage of performance monitoring tools:

- Monitor at the edges per subscriber and per aggregate: The system provides counters at the edges where the subscriber originates and terminates. For example, these counters are performed on the ONTs and edge devices such as BRAS or Edge Router. This counting empowers the service providers to solve their own monitoring issues.
- Perform error counting: The system provides error counters and aggregate counters at places other than where per subscriber significance is necessitated. These counters are used to quickly identify and obtain a high level view of the activity at a given point in the network.
- Perform on-demand monitoring: This function allows the service provider to issue a count request on an ad hoc basis to isolate and monitor a situation further based on a criterion, such as per service, per VLAN, and per multicast stream.

Operators can use TL1, CLI, or an element management system (EMS) interface to:

- enable counters and set filters
- monitor performance
- view performance

4.4   ONT performance reporting

The system provides facilities that enable you to do the following:

- view statistics
- generate alarms
- report status
- capture diagnostic data

ONT statistical viewing

You can view statistics collected for the ONT using a TL1, CLI, or an EMS management session with the P-OLT.

Interval-based counters

For 15-min interval-based counters, you can use filters to define the scope of the statistics retrieved from the log file.

Depending upon the type of statistic you are retrieving, you can set filters to define any combination of the following:

- selected group of statistical parameters
- date range
- time range
- direction (Tx or Rx)

- location (near-end or far-end)
- count thresholds

If a command to retrieve performance statistics includes the current 15-min interval, a snapshot of the count at the time of the retrieval request is provided.

> **Note 1 —** During ONT initialization, the current count of the first 15-min interval may be forced to restart due to the synchronization procedure between the LT unit on the P-OLT and the ONT.
>
> **Note 2 —** Alcatel-Lucent recommends that users should wait for 30 seconds after the expiration of an interval before retrieving last interval counts. This will ensure reliable results as synchronization is then correct between the P-OLT and the ONTs.

Table 4-2 lists the 15-min ONT counters the system uses to collect performance monitoring statistics.

Table 4-2 15-min ONT counters

Counter description
CES DS1/E1
Layer 1 on Ethernet ports
Layer 2 on Ethernet ports
Multimedia over coaxial alliance (MoCA) ports
TC-layer of the gigabit passive optical network (GPON) connection
Very-high-bit-rate digital subscriber line (VDSL2) ports
IGMP on multicast GEM port

Rolling counters

When a rolling counter is enabled, you can retrieve the current count using a TL1 or an EMS management session with the P-OLT. A snapshot of the current value in the rolling counter is displayed as an integer.

Table 4-3 lists the rolling counters the system uses to collect performance monitoring statistics.

Table 4-3 Rolling counters

Counter description	ONT
GPON ports	✓

Some rolling counters can be set to automatically reset to zero after being retrieved. See the operations and maintenance documentation for the OLT for restrictions, maximum count ranges, and the resetting of rolling counters.

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TCA counters and alarms

The following performance monitoring counters can generate TCA alarms:

- errored or lost Tx and Rx fragments for upstream traffic across all GEM ports on the LT card on the modular and outdoor ONTs
- lost fragments (downstream) on aggregate GEM ports on the modular and outdoor ONTs
- dropped frames (upstream and downstream) and dropped bytes (upstream) for Ethernet traffic on all MoCA, VDSL2, and Ethernet ports on the outdoor ONT
- Rx errored frames for ports on the ONT configured for MoCA

TCA alarms

TCA thresholds are applied to 15-min interval-based counters. An alarm is raised if the number of events occurring within a 15-min period exceeds the specified threshold. The following alarms are raised:

- ONTL2UNI alarms
- ONTMOCA alarms
- PONOLTTC alarms
- PONOLTTCONT alarms
- PONONTTC alarms
- xDSL (VDSL2) alarms

TCA provisioning

Performance monitoring counters are provisioned using either a TL1 or an EMS management session with the P-OLT. TCA is disabled by default. The procedure required for provisioning TCAs varies, depending on the type of interface or service you are monitoring.

- To enable TCA for VDSL2, you must first create a VDSL2 TCA profile, which specifies the threshold values for ES. SES and USA counters. The name and ID of the profile must then be assigned to a particular VDSL2 interface. Finally, enable TCA using the TL1 ONTVDSL performance monitoring provisioning commands or set the appropriate fields in the EMS.
- To enable TCA for all other counters, you do not need to create a profile. You only need to set the threshold value using TL1 or an EMS. After the threshold is set, enable TCA using the appropriate TL1 performance monitoring provisioning commands or set the appropriate fields in the EMS.

PON quality can be monitored with the following:

- abnormal incrementation of absolute BER values in each direction
- BER-related alarms such as SD/SF in upstream or RDI in downstream
- optical power at OLT and ONT side (RSSI)

Performance monitoring TCAs can also be used to flag dropped frames which can occur due to either data corruption on the PON or queue overflows. TCA values should be set based on historic normal behaviors for the network.

Status reporting

Status reports are available for the following:

- 802.1 end-user authentication
- 802.1 operator authentication
- iBridges
- ONT Ethernet ports
- ONT MoCA ports
- ONT optical link status levels
- ONT VDSL2 channels and ports

Diagnostic data capturing

In addition to status reports, the operator can issue a request to the ONT to store diagnostic data in nonvolatile memory, which the ONT can make available to a diagnosis technician in a remote centre for repair purposes. In addition to issuing a request, the LP MDU ONTs support the sending of diagnostic data to nonvolatile memory by use of a Save Data push button on the faceplate of the ONT. Diagnostic data includes:

- OMCI service interface provisioning data
- UPS alarm status
- Content of relevant hardware registers
- Amount of allocated and free RAM at time of receipt of request
- Processor stack at time of receipt of request
- CPU utilization at time of receipt of request
- SLID information
- Quantity of traffic flowing through the ONT at time of receipt of request
- State of the software load images

4.5 ONT performance monitoring data

The system provides a number of statistical counters in both the downstream and upstream direction for the ONT. These statistical counts are available as "always-on" counters and "on-demand" counters, and include the following:

- DS1/E1 ports
- Ethernet layer 1
- Ethernet layer 2
- GPON TC-layer (near-end)
- MoCA ports
- optical link status level
- VDSL2 channels and ports
- VoIP ports
- multicast GEM port

You can enable or disable counters using TL1. Counters are disabled by default unless indicated otherwise. Some counters have restrictions for the total number that you can activate at the same time. See the *operations and maintenance documentation for the OLT* for information about any restrictions that apply to each performance statistic type.

Note — When the system date changes; for example, due to the move to daylight saving time, performance statistics collection is affected and an interval is either repeated or lost.

Monitoring thresholds and levels

For many performance management statistics retrieved using TL1, some or all of the following filter criteria apply. With a filter applied, only a matching subset of statistics counters are collected and displayed.

1   Monitoring level using the monlev parameter values [level, direction]. Only monitored values that meet the threshold specified are displayed. Where level is the threshold level and is an integer value (0...4294967295) and direction is a direction UP or DN. 1-UP is the default.

When the level is >=0, the value represents the threshold of statistics counter to show. When the direction is UP or DN, the value represents increase/decrease from threshold for counter to show.

For example, a configuration of [5,UP] would show only counters with values >=5, while a configuration of [10,DN] would show only counters with values <=10.

2   Facility location using the locn parameter values [NEND, FEND]. Where NEND if near end and FEND is far end.

3   Direction using the dirn parameter values (TX or RX) for the transmit or receive direction.

4   Monitoring period of either 15 minutes or 1 hour intervals.

Note — A performance monitoring limitation exists for threshold counters per ONT with a maximum of 128. This limitation is not apparent to the user. PM threshold counter resources are allocated as ONTs and UNIs allow for the possibility of monitoring PM threshold crossings, even if these are not enabled by default. Depending on the line type, different numbers of TCA counter resources are allocated:

- ONT - 1
- VOIP - 1
- ENET - 1
- VDSL2 - 3

Counters

Counters are either interval-based counters or rolling counters.

Interval-based counters are statistical counts that are accumulated over a predefined time interval, such as a 15-min interval, and logged as an integer entry in a table. A total of 32 15-min intervals occurring over an 8-hr period are logged. After the 8 hr period has elapsed, new 15-min intervals overwrite the oldest entry recorded in the log file.

Rolling counters start at zero and count up to a maximum value. When the maximum value is reached, the counter restarts at zero. Unlike interval-based counters, no logs are maintained for rolling counters.

Counters serve to:

- ensure availability of up-to-date information about how the system is working
- help to establish threshold settings that represent acceptable performance under normal operational conditions. After collecting counters over a range of network activities and loads, a range of measurements can be defined, which serve as a reference point to detect problems when they occur
- detect error conditions, so that an alarm is raised when the count violates the threshold setting
- isolate and monitor a situation
- diagnose problems as they occur when an alarm is raised

Supported ONT counters

This section describes the performance monitoring statistics that are supported by the system. Performance monitoring data is not available for all ONTs. Table 4-4 defines the supported alarm types and counters. Table 4-5 provides reference links to all supported ONT counters per ONT which are categorized into corresponding packages.

> **Note 1 —** VDSL2 line and VDSL2 channel related statistics are only available for the modular and LP MDU ONT. The indoor, outdoor, and business ONTs do not support VDSL2.
>
> **Note 2 —** CES DS1/E1 related statistics are only available for the business ONT. The indoor, outdoor, and modular ONTs do not support DS1 or E1.
>
> **Note 3 —** All performance monitoring statistics listed are maintained and available on the P-OLT.

Table 4-4 describes the following alarm types and their counters that support ONT performance monitoring statistics on the system:

- ONTENET
- ONTL2UNI
- ONTMOCA
- PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP, and PONONTTC (aggregate)
- X/VDSL2 line
- X/VDSL2 bearer/channel
- X/DSL2 line xTU-C (xDSL transceiver unit, central office)

- X/VDSL2 line xTU-R (xDSL transceiver unit, remote terminal
- CES PW
- CES UNI

Table 4-4 Supported ONT performance monitoring statistics

Alarm type	Interval	Montype	Counter description
ONTENET	15 min	FCSE	Count of frame check sequence errors
		EC	Count of excessive collisions
		LC	Count of late collision
		RBO	Count of received buffer overflows
		SCF	Count of successfully transmitted single collision frames
		MCF	Count of successfully transmitted multi-collision frames
		DT	Count of frames delayed due to deferred transmission
		IMTE	Count of unsuccessfully transmitted frames due to internal MAC transit errors
		CSE	Count of carrier sense errors
		AE	Count of frames with alignment errors
		IMRE	Count of unsuccessfully received frames due to internal MAC receive errors
		FTL	Frames too long
		TBO	Count of transmitted buffer overflows
		SQE	Sequence errors
ONTL2UNI	15 min	FRAMES	Count of frames upstream and downstream
		BYTES	Count of bytes upstream and downstream
		MCFRAMES	Count of multicast frames upstream and downstream
		DSDRPDFRMS	Count of dropped frames downstream
		USDRPDFRMS	Count of dropped frames upstream
		USFRAMES	Count of frames upstream
		DSFRAMES	Count of frames downstream
		USBYTES	Count of bytes upstream
		DSBYTES	Count of bytes downstream
		USMCFRAMES	Count of multicast frames upstream
		DSMCFRAMES	Count of multicast frames downstream
ONTMOCA	15 min	RXFRMS	Count of received frames upstream
		RXERRFRMS	Count of received errored frames upstream

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Alarm type	Interval	Montype	Counter description
PONONTTC PONONTMCTC PONONTTCHSI PONONTTCCES PONONTTCFLOW PONONTTCVOIP PONONTTC (aggregate)	15 min	TXBLOCKS	Transmitted GEM blocks upstream
		TXFRAGS	Transmitted GEM fragments upstream
		RXBLOCKS	Received GEM blocks downstream
		RXFRAGS	Received GEM fragments downstream
		LOSTFRAGS	Transmitted and received lost GEM fragments downstream and upstream
		BADGEMHDRS	Received bad GEM headers downstream
X/VDSL2 line	15 min	LOSS or LOS	Loss of signal seconds upstream
		LOFS or LOF	Loss of frame seconds upstream
		LOPS	Loss of power seconds upstream
		LOLS	Loss of link seconds upstream
		REINIT	Modem re-initialization events upstream
		FAILINIT	Modem failed initialization events upstream
		INITTIMEOUTS	Initialization time outs upstream
		ES	Errored seconds upstream
		SES	Severely errored seconds upstream
		UAS	Unavailable seconds upstream
X/VDSL2 bearer/channel	15 min	FCCB	Fast channel corrected blocks upstream
		FCBB	Fast channel bad blocks upstream
		SCCB	Slow channel corrected blocks upstream
		SCBB	Slow channel bad blocks upstream
		TXBLK	Count of transmitted blocks downstream (fast or slow)
		RXBLK	Count of received blocks upstream (fast or slow)
		CV	Code violations upstream
		FECC	Forward error corrections upstream
		CRC	Cyclic redundancy check

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Alarm type	Interval	Montype	Counter description
X/DSL2 line xTU-C (xDSL transceiver unit, central office)	15 min	LOF or LOFS	Loss of frame seconds near-end
		LOS or LOSS	Loss of signal seconds near-end
		ES	Loss of errored seconds near-end
		SES	Severely errored seconds near-end
		UAS	Unavailable seconds near-end
		LI	Count of the total number of full initializations attempted on the line (successful and failed) during the accumulation period.
		FLI	Count of the total number of failed full initializations during the accumulation period. A failed full initialization occurs when showtime is not reached at the end of the full initialization procedure.
		CV	Code violations near-end
		FEC	Count of forward error correction near-end.
X/VDSL2 line xTU-R (xDSL transceiver unit, remote terminal	15 min	LOF or LOFS	Loss of frame seconds far-end
		LOS or LOSS	Loss of signal seconds far-end
		ES	Loss of errored seconds far-end
		SES	Severely errored seconds far-end
		UAS	Unavailable seconds far-end
		CV	Code violations far-end
		FEC	Count of forward error correction far-end.
CES PW	15 min	TTLPKTS	Count of total number of received packets (signaling and payload) upstream
		MSGPKTS	Count of missing packets upstream
		MISORDRU	Count of misordered packets upstream that are usable
		OVERRUN	Count of buffer overruns and underruns upstream
		MALFRMPKTS	Count of malformed packets upstream
		PKTSLOST	Count of lost packets upstream (received packets with R -bit set)
		LBITPKTS	Count of packets received with L-bit set
CES UNI	15 min	ES	Count of errored seconds upstream
		SES	Count of severely errored seconds upstream
		BES	Count of bursty errored seconds upstream
		UAS	Count of unavailable seconds upstream
		CSS	Count of controlled slip seconds upstream

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Supported performance monitoring counters per package type of ONT

Table 4-5 provides reference links for each type of ONT to the various supported performance monitoring statistics per package type:

- Package A indoor ONTs
- Package A outdoor ONTs
- Package B indoor ONTs
- Package C indoor ONTs
- Package D ONTs
- Package E MDUs
- Package F MDUs
- Package G MDUs
- Package H business ONTs

Table 4-5 Supported performance monitoring counters per type of ONT

ONT	Performance monitoring counters by montype
Package A indoor ONTs	
I-010G-A	I-010G-A ONTENET statistics
	I-010G-A ONTL2UNI statistics
	I-010G-A ONTMOCA statistics
	I-010G-A PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-010G-A PONONTTC aggregate statistics
I-020E-B	I-020E-B ONTENET statistics
	I-020E-B ONTL2UNI statistics
	I-020E-B ONTMOCA statistics
	I-020E-B PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-020E-B PONONTTC aggregate statistics
I-020E-H	I-020E-H ONTENET statistics
	I-020E-H ONTL2UNI statistics
	I-020E-H ONTMOCA statistics
	I-020E-H PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-020E-H PONONTTC aggregate statistics
I-020G-F	I-020G-F ONTENET statistics
	I-020G-F ONTL2UNI statistics
	I-020G-F ONTMOCA statistics
	I-020G-F PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-020G-F PONONTTC aggregate statistics

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ONT	Performance monitoring counters by montype
I-220E-A	I-220E-A ONTENET statistics
	I-220E-A ONTL2UNI statistics
	I-220E-A ONTMOCA statistics
	I-220E-A PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-220E-A PONONTTC aggregate statistics
I-241G-A	I-241G-A ONTENET statistics
	I-241G-A ONTL2UNI statistics
	I-241G-A ONTMOCA statistics
	I-241G-A PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-241G-A PONONTTC aggregate statistics
Package A outdoor ONTs	
O-421E-B	O-421E-B ONTENET statistics
	O-421E-B ONTL2UNI statistics
	O-421E-B ONTMOCA statistics
	O-421E-B PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	O-421E-B PONONTTC aggregate statistics
Package B indoor ONTs	
I-010G-B	I-010G-B ONTENET statistics
	I-010G-B ONTL2UNI statistics
	I-010G-B PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-010G-B PONONTTC aggregate statistics
I-240G-B	I-240G-B ONTENET statistics
	I-240G-B ONTL2UNI statistics
	I-240G-B PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-240G-B PONONTTC aggregate statistics
I-241G-B	I-241G-B ONTENET statistics
	I-241G-B ONTL2UNI statistics
	I-241G-B PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-241G-B PONONTTC aggregate statistics
Package C indoor ONTs	

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ONT	Performance monitoring counters by montype
I-010G-P	I-010G-P ONTENET statistics
	I-010G-P ONTL2UNI statistics
	I-010G-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-010G-P PONONTTC aggregate statistics
I-010G-Q	I-010G-Q ONTENET statistics
	I-010G-Q ONTL2UNI statistics
	I-010G-Q PONONTTC, PONONTCMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-010G-Q PONONTTC aggregate statistics
I-020G-P	I-020G-P ONTENET statistics
	I-020G-P ONTL2UNI statistics
	I-020G-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-020G-P PONONTTC aggregate statistics
I-040G-P	I-040G-P ONTENET statistics
	I-040G-P ONTL2UNI statistics
	I-040G-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-040G-P PONONTTC aggregate statistics
I-110G-P	I-110G-P ONTENET statistics
	I-110G-P ONTL2UNI statistics
	I-110G-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-110G-P PONONTTC aggregate statistics
I-240G-P	I-240G-P ONTENET statistics
	I-240G-P ONTL2UNI statistics
	I-240G-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-240G-P PONONTTC aggregate statistics
I-240G-Q	I-240G-Q ONTENET statistics
	I-240G-Q ONTL2UNI statistics
	I-240G-Q PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-240G-Q PONONTTC aggregate statistics
I-241G-P	I-241G-P ONTENET statistics
	I-241G-P ONTL2UNI statistics
	I-241G-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-241G-P PONONTTC aggregate statistics

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ONT	Performance monitoring counters by montype
I-241W-P	I-241W-P ONTENET statistics
	I-241W-P ONTL2UNI statistics
	I-241W-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-241W-P PONONTTC aggregate statistics
I-440G-P	I-440G-P ONTENET statistics
	I-440G-P ONTL2UNI statistics
	I-440G-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	I-440G-P PONONTTC aggregate statistics
Package D ONTs	
Package D ONTs or MDUs are not currently supported on the converged platform	
Package E MDUs	
O-8881V-P	O-8881V-P ONTENET statistics
	O-8881V-P ONTL2UNI statistics
	O-8881V-P PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	O-8881V-P PONONTTC aggregate statistics
O-00240V-P	O-00240V-P ONTL2UNI statistics
	O-00240V-P X/VDSL2 line xTU-C statistics
	O-00240V-P X/VDSL2 line xTU-R statistics
Package F MDUs	
O-00160V-Q	O-00160V-Q ONTL2UNI statistics
	O-00160V-Q X/VDSL2 line xTU-C statistics
	O-00160V-Q X/VDSL2 line xTU-R statistics
O-00240V-Q	O-00240V-Q ONTL2UNI statistics
	O-00240V-Q X/VDSL2 line xTU-C statistics
	O-00240V-Q X/VDSL2 line xTU-R statistics
Package G MDUs	
O-0881V-A	O-0881V-A ONTL2UNI statistics
	O-0881V-A PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	O-0881V-A PONONTTC aggregate statistics
	O-0881V-A X/VDSL2 line statistics
	O-0881V-A X/VDSL2 bearer or channel statistics
Package H business ONTs	

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ONT	Performance monitoring counters by montype
B-0404-A	B-0404-A ONTENET statistics
	B-0404-A ONTL2UNI statistics
	B-0404-A PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics
	B-0404-A PONONTTC aggregate statistics

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Performance monitoring statistics for Package A ONTs

The following section identifies the supported performance monitoring statistics for Package A type ONTs. A check mark indicates the statistic is supported on that ONT. An empty cell indicates the statistic is not supported. A cell with n/a indicates the counter is not applicable to that type of ONT. The following tables are categorized by supported alarm types:

- Table 4-6 provides statistics for ONTENET type counters
- Table 4-7 provides statistics for ONTL2UNI type counters
- Table 4-8 provides statistics for ONTMOCA type counters
- Table 4-9 provides statistics for PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP, type counters
- Table 4-10 provides statistics for PONONTTC (aggregate) type counters

Table 4-6 Package A ONT ONTENET performance monitoring statistics

ONT	ONTENET statistics													
	FCSE	EC	LC	RBO	SCF	MCF	DT	IMTE	CSE	AE	IMRE	FTL	TBO	SQE
Indoor														
I-010G-A		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
I-020E-B		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
I-020E-H		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
I-020G-F		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
I-220E-A		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
I-241G-A		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
Outdoor														
O-421E-B [1]		✓	✓	✓	✓	✓	✓			✓		✓	✓	

Note
[1] ONT O-421E-B part numbers 3FE 50683 AA and 3FE 50683 AE.

Table 4-7 Package A ONT ONTL2UNI performance monitoring statistics

ONT	ONTL2UNI statistics				
	FRAMES	BYTES	MCFRAMES	DSDRPDFRMS	USDRPDFRMS
Indoor					
I-010G-A	✓	✓	✓	✓	✓
I-020E-B	✓	✓	✓	✓	✓
I-020E-H	✓	✓	✓	✓	✓
I-020G-F	✓	✓	✓	✓	✓
I-220E-A	✓	✓	✓	✓	✓
I-241G-A	✓	✓	✓	✓	✓
Outdoor					
O-421E-B	✓	✓	✓	✓	✓

Table 4-8 Package A ONTs ONTMOCA performance monitoring statistics

ONT	ONTMOCA statistics	
	RXFRMS	RXERRFRMS
Indoor		
I-010G-A	n/a	n/a
I-020E-B	n/a	n/a
I-020E-H	n/a	n/a
I-020G-F	n/a	n/a
I-220E-A	n/a	n/a
I-241G-A	n/a	n/a
Outdoor		
O-421E-B	n/a	n/a

Table 4-9 Package A ONT PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP performance monitoring statistics

ONT	PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
Indoor [1]						
I-010G-A		✓		✓		
I-020E-B		✓		✓		
I-020E-H		✓		✓		
I-020G-F		✓		✓		
I-220E-A		✓		✓		
I-241G-A		✓		✓		
Outdoor						
O-421E-B		✓		✓		

Note

[1]   TC layer OAM performance monitoring is not supported on the OLT R04.00.10 therefore LOSTFRAGS and TXFRAG counters are not supported on indoor ONTs.

Table 4-10 Package A ONT PONONTTC aggregate performance monitoring statistics

ONT	PONONTTC aggregate statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
Indoor						
I-010G-A		✓		✓		✓
I-020E-B		✓		✓		✓
I-020E-H		✓		✓		✓
I-020G-F		✓		✓		✓
I-220E-A		✓		✓		✓
I-241G-A		✓		✓		✓
Outdoor						
O-421E-B		✓		✓		✓

Performance monitoring statistics for Package B ONTs

The following section identifies the supported performance monitoring statistics for Package B type ONTs. A check mark indicates the statistic is supported on that ONT. An empty cell indicates the statistic is not supported. A cell with n/a indicates that the counter is not applicable to that type of ONT. The following tables are categorized by supported alarm types:

- Table 4-11 provides statistics for ONTENET type counters
- Table 4-12 provides statistics for ONTL2UNI type counters
- Table 4-13 provides statistics for PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP type counters
- Table 4-14 provides statistics for PONONTTC (aggregate) type counters

Table 4-11 Package B ONT ONTENET performance monitoring statistics

ONT	ONTENET statistics													
	FCSE	EC	LC	RBO	SCF	MCF	DT	IMTE	CSE	AE	IMRE	FTL	TBO	SQE
Indoor														
I-010G-B		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
I-240G-B		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
I-241G-B		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	

Table 4-12 Package B ONTs ONTL2UNI performance monitoring statistics

ONT	ONTL2UNI statistics				
	FRAMES	BYTES	MCFRAMES	DSDRPDFRMS	USDRPDFRMS
Indoor					
I-010G-B	✓	✓	✓	✓	✓
I-240G-B	✓	✓	✓	✓	✓
I-241G-B	✓	✓	✓	✓	✓

Table 4-13 Package B ONT PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP performance monitoring statistics

ONT	PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
Indoor [1]						
I-010G-B		✓		✓		
I-240G-B		✓		✓		
I-241G-B		✓		✓		

Note
[1] TC layer OAM performance monitoring is not supported on the OLT R04.00.10 therefore LOSTFRAGS and TXFRAG counters are not supported on indoor ONTs.

Table 4-14 Package B ONT PONONTTC (aggregate) performance monitoring statistics

ONT	PONONTTC (aggregate) statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
Indoor						
I-010G-B		✓		✓		✓
I-240G-B		✓		✓		✓
I-241G-B		✓		✓		✓

Performance monitoring statistics for Package C ONTs

The following section identifies the supported performance monitoring statistics for Package C type ONTs. A check mark indicates the statistic is supported on that ONT. An empty cell indicates the statistic is not supported. A cell with n/a indicates that the counter is not applicable to that type of ONT. The following tables are categorized by supported alarm types:

- Table 4-15 provides statistics for ONTENET type counters
- Table 4-16 provides statistics for ONTL2UNI type counters

- Table 4-17 provides statistics for PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP type counters
- Table 4-18 provides statistics for PONONTTC aggregate type counters

Note — If you have trouble accessing Package C ONTs performance monitoring statistics using TL1, please contact your Alcatel-Lucent support representative for more information about how to access and retrieve performance monitoring type counters.

Table 4-15 Package C ONT ONTENET performance monitoring statistics

ONT	ONTENET statistics													
	FCSE	EC	LC	RBO	SCF	MCF	DT	IMTE	CSE	AE	IMRE	FTL	TBO	SQE
Indoor														
I-010G-P (1)	✓		✓	✓	✓	✓	✓			✓				
I-010G-Q	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
I-020G-P (1)	✓		✓	✓	✓	✓	✓			✓				
I-040G-P (1)	✓		✓	✓	✓	✓	✓			✓				
I-110G-P (1)	✓		✓		✓	✓	✓		✓	✓				
I-240G-P (1)	✓		✓	✓	✓	✓	✓			✓				
I-240G-Q (1)	✓		✓	✓	✓	✓	✓			✓				
I-241G-P (1)	✓		✓	✓	✓	✓	✓			✓				
I-241W-P (1)	✓		✓	✓	✓	✓	✓			✓				
I-440G-P (1)	✓		✓	✓	✓	✓	✓			✓				

Note
(1)   A 5 second polling window limitation exists on the ONT, therefore the margin of error for each 15-min window is 5 seconds

Table 4-16 Package C ONT ONTL2UNI performance monitoring statistics

ONT	ONTL2UNI statistics										
	FRAMES	BYTES	MCFRAMES	DSDRPDFRMS	USDRPDFRMS	USFRAMES	DSFRAMES	USBYTES	DSBYTES	USMCFRAMES	DSMCFRAMES
Indoor											
I-010G-P (1)				✓	✓	✓	✓	✓	✓	✓	✓
I-010G-Q				✓	✓	✓	✓	✓	✓	✓	✓
I-020G-P (1)				✓	✓	✓	✓	✓	✓	✓	✓
I-040G-P (1)				✓	✓	✓	✓	✓	✓	✓	✓
I-110G-P (1)				✓		✓	✓	✓	✓	✓	✓
I-240G-P (1)				✓	✓	✓	✓	✓	✓	✓	✓
I-240G-Q (1)				✓	✓	✓	✓	✓	✓	✓	✓
I-241G-P (1)				✓	✓	✓	✓	✓	✓	✓	✓
I-241W-P (1)				✓	✓	✓	✓	✓	✓	✓	✓
I-440G-P (1)				✓	✓	✓	✓	✓	✓	✓	✓

Note
(1)   A 5 second polling window limitation exists on the ONT, therefore the margin of error for each 15-min window is 5 seconds

Table 4-17 Package C ONT PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP performance monitoring statistics

ONT	PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
Indoor (2)						

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| ONT | PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP statistics | | | | | |
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
I-010G-P (1)	✓	✓	✓	✓		
I-010G-Q	✓	✓	✓	✓	✓	
I-020G-P (1)	✓	✓	✓	✓		
I-040G-P (1)	✓	✓	✓	✓		
I-110G-P (1)	✓	✓	✓	✓	✓(3)	
I-240G-P (1)	✓	✓	✓	✓		
I-240G-Q (1)	✓	✓	✓	✓		
I-241G-P (1)	✓	✓	✓	✓		
I-241W-P (1)	✓	✓	✓	✓		
I-440G-P (1)	✓	✓	✓	✓		

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Notes
(1)   A 5 second polling window limitation exists on the ONT, therefore the margin of error for each 15-min window is 5 seconds
(2)   TC layer OAM performance monitoring is not supported on the OLT R04.00.10 therefore LOSTRFRAGS and TXFRAG counters are not supported on indoor ONTs.
(3)   The lost GEM fragment counter supports downstream direction only. Upstream direction is not supported.

Table 4-18 Package C ONT PONONTTC aggregate performance monitoring statistics

| ONT | PONONTTC (aggregate) statistics | | | | | |
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
Indoor						

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ONT	PONONTTC (aggregate) statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
I-010G-P (2)	✓	✓	✓	✓	✓(1)	
I-010G-Q	✓	✓	✓	✓	✓	✓
I-020G-P (2)	✓	✓	✓	✓	✓(1)	
I-040G-P (2)	✓	✓	✓	✓	✓(1)	
I-110G-P (2)	✓	✓	✓	✓	✓(1)	
I-240G-P (2)	✓	✓	✓	✓	✓(1)	
I-240G-Q (2)	✓	✓	✓	✓	✓(1)	
I-241G-P (2)	✓	✓	✓	✓	✓(1)	
I-241W-P (2)	✓	✓	✓	✓	✓(1)	
I-440G-P (2)	✓	✓	✓	✓	✓(1)	

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Notes
(1)   The lost GEM fragment counter supports downstream direction only. Upstream direction is not supported.
(2)   A 5 second polling window limitation exists on the ONT, therefore the margin of error for each 15-min window is 5 seconds

Performance monitoring statistics for Package E ONTs

The following section identifies the supported performance monitoring statistics for Package E type ONTs. A check mark indicates the statistic is supported on that ONT. An empty cell indicates the statistic is not supported. A cell with n/a indicates that the counter is not applicable to that type of ONT. The following tables are categorized by supported alarm types:

- Table 4-19 provides statistics for ONTENET type counters
- Table 4-20 provides statistics for ONTL2UNI type counters
- Table 4-21 provides statistics for PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP type counters
- Table 4-22 provides PONONTTC aggregate type counters

- Table 4-23 provides X/VDSL2 line xTU-C type counters
- Table 4-24 provides X/VDSL2 line xTU-R type counters

Note — If you have trouble accessing Package E type ONTs or MDUs performance monitoring statistics using TL1, please contact your Alcatel-Lucent support representative for more information about how to access and retrieve performance monitoring type counters.

Table 4-19 Package E MDU ONTENET performance monitoring statistics

ONT	ONTENET statistics													
	FCSE	EC	LC	RBO	SCF	MCF	DT	IMTE	CSE	AE	IMRE	FTL	TBO	SQE
O-8881V-P (1)	✓		✓	✓	✓	✓	✓			✓				
O-00240V-P														

Note
(1) A 5 second polling window limitation exists on the ONT, therefore the margin of error for each 15-min window is 5 seconds

Table 4-20 Package E MDU ONTL2UNI performance monitoring statistics

ONT	ONTL2UNI statistics										
	FRAMES	BYTES	MCFRAMES	DSDRPDFRMS	USDRPDFRMS	USFRAMES	DSFRAMES	USBYTES	DSBYTES	USMCFRAMES	DSMCFRAMES
O-8881V-P (1)				✓	✓	✓	✓	✓	✓	✓	✓
O-00240V-P				✓	✓	✓	✓	✓	✓	✓	✓

Note
(1) A 5 second polling window limitation exists on the ONT, therefore the margin of error for each 15-min window is 5 seconds

Table 4-21 Package E MDU PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP performance monitoring statistics

| ONT | PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP statistics | | | | | |
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
O-8881V-P (1)	✓	✓	✓	✓		
O-00240V-P						

Note

(1) A 5 second polling window limitation exists on the ONT, therefore the margin of error for each 15-min window is 5 seconds

Table 4-22 Package E MDU PONONTTC aggregate performance monitoring statistics

| ONT | PONONTTC (aggregate) statistics | | | | | |
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
O-8881V-P (1)	✓	✓	✓	✓	✓(2)	
O-00240V-P						

Notes

(1) A 5 second polling window limitation exists on the ONT, therefore the margin of error for each 15-min window is 5 seconds

(2) The lost GEM fragment counter supports downstream direction only. Upstream direction is not supported.

Table 4-23 Package E MDU X/VDSL2 line xTU-C performance monitoring statistics

| ONT | X / VDSL2 line xTU-C statistics | | | | | | | | |
	LOSS	LOFS	LI	FLI	ES	SES	UAS	CV	FEC
O-8881V-P	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
O-00240V-P	✓	✓	✓	✓	✓	✓	✓	✓	✓

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Table 4-24 Package E MDU X/VDSL2 line xTU-R performance monitoring statistics

ONT	X / VDSL2 line xTU-R statistics						
	LOSS	LOFS	ES	SES	UAS	CV	FEC
O-8881V-P	n/a	n/a	n/a	n/a	n/a	n/a	n/a
O-00240V-P	✓	✓	✓	✓	✓	✓	✓

Performance monitoring statistics for Package F ONTs

The following section identifies the supported performance monitoring statistics for Package F type ONTs. A check mark indicates the statistic is supported on that ONT. An empty cell indicates the statistic is not supported. A cell with n/a indicates that the counter is not applicable to that type of ONT. The following tables are categorized by supported alarm types:

- Table 4-25 provides statistics for ONTL2UNI type counters
- Table 4-26 provides statistics for X/VDSL2 line xTU-C type counters
- Table 4-27 provides statistics for X/VDSL2 line xTU-R type counters

Table 4-25 Package F MDU ONTL2UNI performance monitoring statistics

ONT	ONTL2UNI statistics				
	FRAMES	BYTES	MCFRAMES	DSDRPDFRMS	USDRPDFRMS
O-00160V-Q				✓	✓
O-00240V-Q				✓	✓

Table 4-26 Package F MDU X/VDSL2 line xTU-C performance monitoring statistics

ONT	X / VDSL2 line xTU-C statistics								
	LOSS	LOFS	LI	FLI	ES	SES	UAS	CV	FEC
O-00160V-Q	✓	✓	✓	✓	✓	✓	✓	✓	✓
O-00240V-Q	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 4-27 Package F MDU X/VDSL2 line xTU-R performance monitoring statistics

ONT	X / VDSL2 line xTU-R statistics						
	LOSS	LOFS	ES	SES	UAS	CV	FEC
O-00160V-Q	✓	✓	✓	✓	✓	✓	✓
O-00240V-Q	✓	✓	✓	✓	✓	✓	✓

Performance monitoring statistics for Package G ONTs

The following section identifies the supported performance monitoring statistics for Package G type ONTs. A check mark indicates the statistic is supported on that ONT. An empty cell indicates the statistic is not supported. A cell with n/a indicates that the counter is not applicable to that type of ONT. The following tables are categorized by supported alarm types:

- Table 4-28 provides statistics for ONTL2UNI type counters
- Table 4-29 provides statistics for PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCLFOW, and PONONTTCVOIP type counters
- Table 4-30 provides statistics for PONONTTC aggregate type counters
- Table 4-31 provides statistics for X / VDSL2 line type counters
- Table 4-32 provides statistics for X / VDSL2 bearer or channel type counters

Table 4-28 Package G MDU ONTL2UNI performance monitoring statistics

ONT	ONTL2UNI statistics				
	FRAMES	BYTES	MCFRAMES	DSDRPDFRMS	USDRPDFRMS
O-0881V-A	✓	✓	✓	✓	✓

Table 4-29 Package G MDU PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP performance monitoring statistics

ONT	PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics					
	TXBLOCKS	TXFRAGS[1]	RXBLOCKS	RXFRAGS	LOSTFRAGS[1]	BADGEMHDRS
O-0881V-A	✓	✓	✓	✓	✓	

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Note

(1) TC layer OAM performance monitoring is not supported on the OLT R04.00.10 therefore LOSTFRAGS and TXFRAG counters are not supported on indoor ONTs.

Table 4-30 Package G MDU PONONTTC aggregate performance monitoring statistics

ONT	PONONTTC aggregate statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
O-0881V-A		✓				✓

Table 4-31 Package G MDU ONT X / VDSL2 line performance monitoring statistics

ONT	X / VDSL2 line statistics									
	LOSS	LOFS	LOPS	LOLS	REINIT (1)	FAILINIT	INITTIMEOUTS	ES	SES	UAS
O-0881V-A	✓	✓			✓	✓	✓	✓	✓	✓

Note

(1) The performance monitoring parameter PM_VLINE_REINIT includes these counters: modem reinitializations, initialization failures, and initialization time-outs.

Table 4-32 Package G MDU X / VDSL2 bearer or channel performance monitoring statistics

ONT	X / VDSL2 bearer or channel statistics								
	FCCB	FCBB	SCCB	SCBB	TXBLK	RXBLK	CV	FECC	CRC
O-0881V-A								✓	✓

Performance monitoring statistics for Package H ONTs

The following section identifies the supported performance monitoring statistics for Package H type ONTs. A check mark indicates the statistic is supported on that ONT. An empty cell indicates the statistic is not supported. A cell with n/a indicates that the counter is not applicable to that type of ONT. The following tables are categorized by supported alarm types:

Table 4-33 Package H ONT ONTENET performance monitoring statistics

ONT	ONTENET statistics													
	FCSE	EC	LC	RBO	SCF	MCF	DT	IMTE	CSE	AE	IMRE	FTL	TBO	SQE
Business														
B-0404-A	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	

Table 4-34 Package H ONT ONTL2UNI performance monitoring statistics

ONT	ONTL2UNI statistics				
	FRAMES	BYTES	MCFRAMES	DSDRPDFRMS	USDRPDFRMS
Business					
B-0404-A	✓	✓	✓	✓	✓

Table 4-35 Package H ONT PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP performance monitoring statistics

ONT	PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
Business						
B-0404-A		✓		✓		

Table 4-36 Package H ONT PONONTTC aggregate performance monitoring statistics

ONT	PONONTTC aggregate statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
Business						

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ONT	PONONTTC aggregate statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
B-0404-A				✓		✓

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5 — ONT management using an ONT interface

5.1 About this document

This document provides the information necessary to manage an ONT at a local site using an HTTP interface, CLI interface, CLI interface for Package C ONTs, or butt set.

Intended audience

This document is intended for field technicians who are responsible for installing or troubleshooting ONTs at a local site.

Conventions used

This document uses the typographical conventions described in Table 5-1.

Table 5-1 Typographical conventions

Appearance	Description
graphical user interface	Text that is displayed in a graphical user interface
↵	Press the **Return** or **Enter** key on the keyboard

5.2 About the interfaces

The HTTP and CLI interfaces provide access to utilities that enable a field technician to:

- retrieve product information about an ONT, such as vendor name, firmware, type of ONT, and serial number
- retrieve operational information about an ONT, to monitor events such as the operational states, uptime, receive signal strength indication (RSSI), status of LEDs, and ranging state of the ONT
- monitor a software download to an ONT
- reboot or reset an ONT to recover from connection, power, software download, and other failures
- perform OMCI and protocol tracing for problem diagnosis and resolution
- enter the SLID at an ONT, to activate ONTs with their provisioning data and services using the SLID method, and to clear the SLID when an ONT is removed

Package C ONTs have a unique CLI that enable a field technician to retrieve and modify the SLID and HTTP interface for viewing the current and entering a new SLID. For a list of Package C ONTs, see Performance monitoring statistics for Package C ONTs.

The butt set allows a field technician to enter or clear the SLID at an ONT using a POTS port.

Supported utilities and ONTs

An ONT interface is accessible through a port on the ONT.

- HTTP interfaces are accessible through an Ethernet connection on indoor ONTs.
- The CLI interface is accessible through an Ethernet connection on indoor ONTs, and a craft connection on outdoor ONTs.
- The CLI interface for Package C ONTs is accessible through an Ethernet connection or craft connection on indoor and outdoor ONTs and MDUs.
- The butt set is used through a POTS connection on an indoor or outdoor ONT.

Table 5-2 identifies the utilities and the ONTs that these interfaces support.

Table 5-2 Supported utilities and ONTs

Utilities	Supported ONTs using HTTP interface	Supported ONTs using CLI interface	Supported ONTs using Package C ONT HTTP interface	Supported ONTs using Package C ONT CLI interface	Supported ONTs using a butt set
Retrieval of ONT product information	Indoor ONTs with Ethernet connection	Indoor ONTs with Ethernet connection Outdoor ONTs with serial RS-232 craft interface	Indoor ONTs with Ethernet connection		
Retrieval of ONT states					
Retrieval of ONT uptime					
Retrieval of RSSI					
Retrieval of status of LEDs					
Retrieval of ranging state					
Retrieval of software download state					
ONT reset			Indoor ONTs with Ethernet connection		
OMCI and protocol tracing			Indoor ONTs with Ethernet connection		
Entry and clearing of SLID			Indoor ONTs with Ethernet connection	Indoor and outdoor ONTs and MDUs with Ethernet or craft connections	Indoor and outdoor ONTS with POTS connection

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Security

The HTTP and CLI interfaces are password-protected to prevent unauthorized access to utilities. In addition, each ONT has a security setting that specifies the access level of a user to the HTTP and CLI interface utilities, after the ONT is ranged. User access levels are as follows:

- read-write access, which grants a user read and write access to all utilities
- read-only access, which grants a user read-only access to the SLID, ranging state, and RSSI of the ONT
- no access, which denies a user access to all utilities

Note 1 — Contact the CO for the level of access that has been set for a specific ONT.

Note 2 — The HTTP and CLI interfaces require a specific username and password. Contact your Alcatel-Lucent technical support representative for username and password information.

Note 3 — The following exceptions apply to security.

- If the PON is out of service, you have read-only access to the SLID, ranging state, and RSSI of the ONT, regardless of the access level of the ONT.
- If the ONT or the Ethernet port on the ONT is out of service, you cannot log in to the ONT using the HTTP or CLI interface.

HTTP interface

The HTTP interface is GUI-based. Figure 5-1 shows a sample HTTP interface, with the main parts of the interface labeled. The following sections describe these parts.

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Figure 5-1 HTTP interface
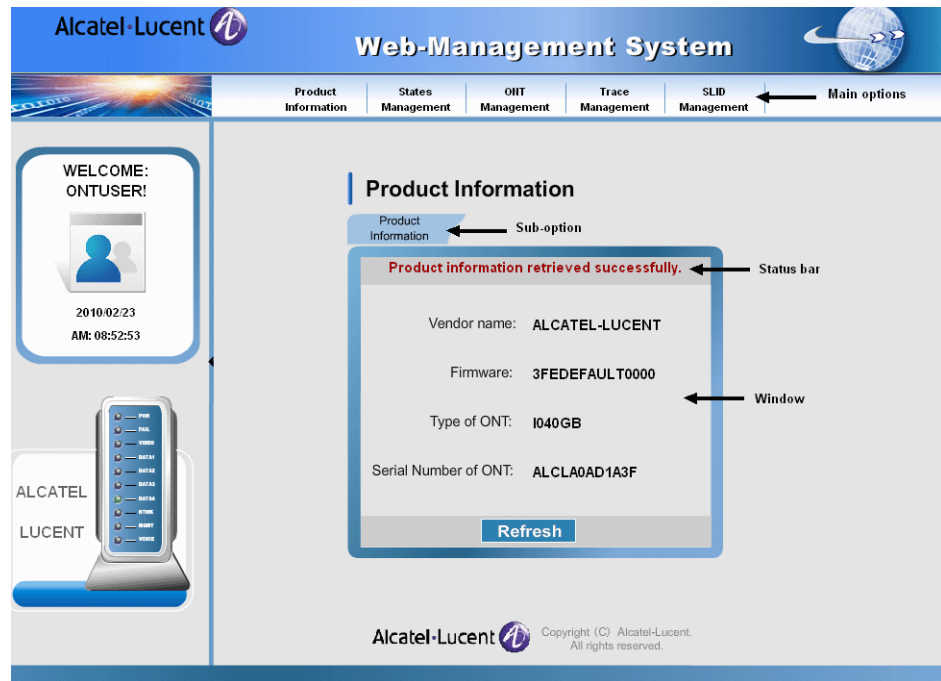
Main options and sub-options

The HTTP interface has five main options, which are referred to as tabs in this document. Each option has one or more sub-options. Table 5-3 identifies the options and their related sub-options.

Table 5-3 Options and sub-options

Main option	Sub-option
Product information	—
States management	ONT status
	Uptime
	RSSI
	LED
	Ranging
ONT management	Download state
	Reset ONT
Trace management	—
SLID management	SLID

Window and status bar

Each main option opens a window with one or more sub-options as tabs. The window always opens with the first sub-option preselected. For example, Figure 5-2 shows the **States Management** window with the **ONT status** sub-option preselected.

Figure 5-2 States Management window with ONT status sub-option shown
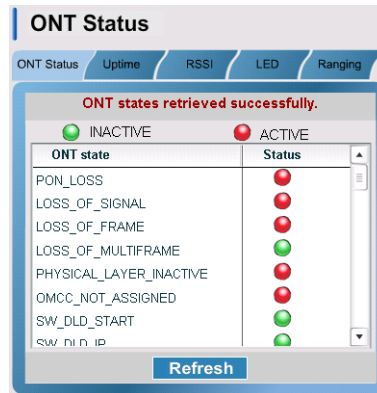
To select another sub-option you must click on the applicable tab. The content of the window changes to reflect your new selection. A status bar at the top of the window displays information about the current state of the window. A **Refresh** button at the bottom of the window refreshes the contents of the window with the current settings for the ONT.

CLI interface

The CLI interface is menu-driven, and consists of two menus: the main menu and a secondary menu. Each menu contains a number of options from which you can choose. To navigate to the secondary menu, you must choose option **8. More options** from the main menu. Figures 5-3 and 5-4 show the main and secondary menus.

Figure 5-3 Main menu

```
Main menu
===============
     1.   Enter SLID in volatile mode
     2.   Enter SLID in permanent mode
     3.   Enter SLID in registration mode
     4.   Retrieve SLID
     5.   Clear SLID
     6.   Retrieve ranging state
     7.   Retrieve optical level
     8.   More options
     9.   Log out


     Enter choice :
```

Figure 5-4 Secondary menu

```
Secondary menu
===============
     1.   Retrieve firmware version
     2.   Retrieve ONT status
     3.   Retrieve uptime
     4.   Retrieve ONT type
     5.   Retrieve ONT serial number
     6.   Retrieve ONT LED status
     7.   Retrieve download progress
     8.   Reboot ONT
     9.   Enable tracing
     10.  Upload traces
     11.  Return to main menu

     Enter choice :
```

Option selection

To choose an option from the main or secondary menu, type the number of the option in the menu prompt **Enter choice:** and press ↵. If you enter an invalid option number, the system responds with the message **Unknown option** and displays the menu again.

CLI interface for Package C ONTs

The CLI interface for Package C ONTs is menu-driven, and consists of two menus: the login menu and SLID menu. Each menu contains a number of options from which you can choose. To navigate to the SLID menu, you must successfully login. Following are the login and SLID menus.

login menu

```
<L>ogin
E<x>it
```

SLID menu

```
Retrieve<S>lid
<M>odify Slid
<R>eboot
E<x>it
```

Option selection

To choose an option from the login or SLID menu, type the letter (in either uppercase or lowercase) in the option that appears between angle brackets (<>). For example, to modify the SLID type either **M** or **m** in response to the **<M>odify Slid** menu option.

Butt set

A butt set is a portable telephone used by technicians for installing and testing local loop telephone lines.

A typical butt set integrates an ear piece, a mouthpiece, a dialing interface, and a set of test leads for connecting to the telephone circuit. Most butt sets use a variant of the standard 12-button DTMF keypad. Butt sets are designed to be used with analog POTS lines.

5.3   Quick reference

Table 5-4 provides quick access to the HTTP interface, CLI interface, and butt set procedures in this document.

Table 5-4 Tasks and procedures

Task	Procedure using HTTP interface	Procedure using CLI interface	Procedure using Package C ONT HTTP interface	Procedure using Package C ONT CLI interface	Procedure using butt set
Accessing or disconnecting from the HTTP or a CLI interface	—	To access the CLI interface using a craft port	—	To access the CLI interface using a craft port	—
	To access the HTTP interface using the first Ethernet port	To access the CLI interface using the first Ethernet port	—	To access the CLI interface using an Ethernet port	
	To disconnect from the HTTP interface	To disconnect from the CLI interface	—	To disconnect from the CLI interface	
Retrieving product information for an ONT	To retrieve product information for an ONT	To retrieve product information for an ONT	To retrieve product information for an ONT	—	
Checking ONT status	To check ONT status	To check ONT status	—		
Retrieving uptime of an ONT	To view the uptime of an ONT	To view the uptime of an ONT	—		
Retrieving RSSI	To view RSSI	To view RSSI	—		
Checking status of LEDs	To check the status of LEDs	To check the status of LEDs	—		
Checking ranging state of an ONT	To check the ranging state of an ONT	To check the ranging state of an ONT	—		
Monitoring software download to an ONT	To check status of software download	To check the status of software download	—		
Rebooting an ONT	To reboot an ONT	To reboot an ONT	To reboot a Package C ONT	To reboot a Package C ONT	
Tracing OMCI and protocol traffic	To enable tracing	To trace in real time or logging mode	To perform an OMCI trace for a Package C ONT	—	
	To disable tracing	To specify logging option	To perform a Protocol trace for a Package C ONT		
	To retrieve a trace log	To disable tracing in logging mode	—		
	—	To copy a trace log to a TFTP server	—		

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Task	Procedure using HTTP interface	Procedure using CLI interface	Procedure using Package C ONT HTTP interface	Procedure using Package C ONT CLI interface	Procedure using butt set
Activating an ONT using an SLID	To view current SLID settings	To view current SLID settings	To view current SLID settings	To retrieve the current SLID settings	—
	To clear the SLID	To clear the SLID	—	—	To clear the SLID using a butt set
	To enter the SLID	To enter the SLID	To enter the SLID	To modify the SLID	To enter the SLID using a butt set

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5.4 Accessing or disconnecting from the HTTP or a CLI interface

This section shows you how to:

- access the HTTP or a CLI interface
- disconnect from the HTTP or a CLI interface

Prerequisites

The prerequisites are:

- The ONT is installed.
- The ONT is in service.
- For an indoor ONT, the first Ethernet port, which is typically labeled 1 on the ONT, is in service.
- For an outdoor ONT, the ONT has a serial RS-232 craft interface.
- For an indoor Package C ONT, the ONT has an Ethernet port in service.

Procedures using HTTP interface

The HTTP interface is accessible through the first Ethernet port on an indoor ONT using a computer or laptop with an HTTP client. The ONT must support an HTTP server, and the computer must have a supported HTTP client (Web browser).

Note — Contact your Alcatel-Lucent technical support representative for a list of supported Web browsers.

The following procedures provide the steps to access and to disconnect from the HTTP interface using the first Ethernet port.

Procedure 5-1 To access the HTTP interface using the first Ethernet port

1   Connect a computer or laptop with an HTTP client to the first Ethernet port on the ONT using an Ethernet cable.

2   Open a Web browser and enter the IP address of the ONT in the **Address** bar:

`http://192.168.4.254↵`

The login screen appears, as shown in Figure 5-5.

Figure 5-5 Login screen
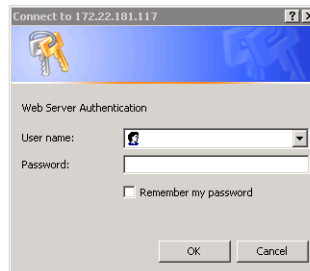
3   Type a **User name** and **Password** in the login screen, and click on **OK**.

> **Note —** The HTTP interface requires a specific username and password. Contact your Alcatel-Lucent technical support representative for username and password information.

The **Web-Management System** window opens; see Figure 5-1.

4   STOP. This procedure is complete.

Procedure 5-2 To disconnect from the HTTP interface

1   Close any open window.

2   Disconnect the computer or laptop from the first Ethernet port.

3   STOP. This procedure is complete.

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Procedures using CLI interface

The CLI interface is accessible in two ways:

- craft port—The CLI interface is accessible through a craft port, which is provided by some outdoor ONT models. You connect to the craft port with an RS-232 DB-9 connector, using a VT100 terminal or PC terminal emulation software set at 9600 Baud, 8 bits, no parity.
- Ethernet over LAN—The CLI interface is accessible through the first Ethernet port on an indoor ONT using a computer or laptop with Telnet software.

The following procedures provide the steps to access and to disconnect from the CLI interface using a craft port, or the first Ethernet port.

Procedure 5-3 To access the CLI interface using a craft port

1   Connect a laptop via serial cable to the RS-232 connector on the ONT.

2   Configure the communications software to the following settings:

- bits/second = 9600
- data bits = 8
- parity = None (N)
- stop bits = 1
- terminal emulation = VT100

3   Log in to a craft session:

login:*login*

password:*password*

where
login is the username for the ONT
password is the password for the ONT

> **Note —** The CLI interface requires a specific username and password. Contact your Alcatel-Lucent technical representative for login and password information.

The Main menu appears.

4   STOP. This procedure is complete.

Procedure 5-4 To access the CLI interface using the first Ethernet port

1   Connect a computer or laptop to the first Ethernet port on the ONT using an Ethernet cable.

2   Configure the IP address on the laptop Ethernet port to 192.168.4.1.

3   Perform one of the following:

    a   If the ONT is not ranged, start a Telnet session and Telnet to 192.168.4.254.

        `telnet 192.168.4.254↵`

> **Note —** The 192.168.4.254 IP address remains open until the ONT has been ranged. After the ONT has been ranged, the ONT no longer accesses this IP address.

    b   If the ONT is ranged, start a Telnet session using the IP address of the ONT. For example:

        `telnet 192.168.3.10↵`

4   Log in to a Telnet session:

    `login:`*login*

    `password:`*password*

where
login is the username for the ONT
password is the password for the ONT

> **Note —** The CLI interface requires a specific username and password. Contact your Alcatel-Lucent technical support representative for login and password information.

The Main menu appears.

5   STOP. This procedure is complete.

Procedure 5-5 To disconnect from the CLI interface

1   Choose option 9, **Logout**, from the main menu.

2   Perform one of the following:

    a   If you are connected to the CLI interface through a craft port, disconnect the serial cable from the RS-232 connector.

    b   If you are connected to the CLI interface through the first Ethernet port, disconnect the Ethernet cable from the first Ethernet port.

3   STOP. This procedure is complete.

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Procedure using HTTP interface for Package C ONTs

Package C ONTs support limited configuration using a web-based GUI. The ONT must support an HTTP server, and the computer must have a supported HTTP client (Web browser).

> **Note —** Contact your Alcatel-Lucent technical support representative for a list of supported Web browsers.

The following procedures provide the steps to access the HTTP interface.

Procedure 5-6 Login to web-based GUI

1 Open a web browser and enter the IP address of the ONT in the address bar.

The login window appears.

The default gateway IP address is http://192.168.50.101. You can also obtain the IP address using DHCP after connecting your PC to the layer 3 UNI.

2 Enter your username and password in the Login window.

The default username is root while the default password is admin.

> **Note —** If you forget the current username and password, press the reset button for 5 s and the default values for the username and password will be recovered upon start up.

3 Click OK.

4 STOP. This procedure is complete.

Procedures using CLI interface for Package C ONTs

The CLI interface for Package C ONTs is accessible in two ways:

- craft port—The CLI interface is accessible through a craft port, which is provided by some ONT models. You connect to the craft port with an RS-232 DB-9 connector, using a VT100 terminal or PC terminal emulation software set at 9600 Baud, 8 bits, no parity.
- Ethernet over LAN—The CLI interface is accessible through an Ethernet port on an ONT using a computer or laptop with Telnet software.

The following procedures provide the steps to access and to disconnect from the CLI interface using a craft port, or an Ethernet port.

Procedure 5-7 To access the CLI interface using a craft port

1   Connect a laptop via serial cable to the RS-232 connector on the ONT.

2   Configure the communications software to the following settings:

- bits/second = 9600
- data bits = 8
- parity = None (N)
- stop bits = 1
- terminal emulation = VT100

3   Log in to a craft session:

<L>ogin

User Name:*CRAFTSPERSON*

Password:*ALC#FGU*

where
User Name is the username for the ONT
Password is the password for the ONT

The SLID menu appears.

4   STOP. This procedure is complete.

Procedure 5-8 To access the CLI interface using an Ethernet port

1   Connect a computer or laptop to an Ethernet port on the ONT using an Ethernet cable.

2   Press the Reset button on the ONT. The ONT reboots with an enabled Telnet server.

3   Start a Telnet session and Telnet to the ONT at 192.168.1.251.

4   Configure the IP address on the laptop Ethernet port to 192.168.1.x. For example, 192.168.1.100.

5   Perform one of the following:

   a   To connect the ONT using an Ethernet port and cable to a computer or laptop, start a Telnet session by typing

   telnet 192.168.1.x⏎

> **Note —** Any three digits can supply the last segment of the 192.168.1.x IP address. For example, 192.168.1.100 is a valid IP address.

   b   To connect the computer or laptop to the ONT using a Telnet client, start a Telnet session by typing

   telnet 192.168.1.251⏎

> **Note —** NetTerm is the recommended Telnet client.

6   Log in to a Telnet session:

   <L>ogin

   User Name:*CRAFTSPERSON*

   Password:*ALC#FGU*

   where
   User Name is the username for the ONT
   Password is the password for the ONT

   The SLID menu appears.

7   STOP. This procedure is complete.

Procedure 5-9 To disconnect from the CLI interface

1   Type **X** or **x** for **Exit** from the SLID menu at any time during the session.

2   Perform one of the following:

   a   If you are connected to the CLI interface through a craft port, disconnect the serial cable from the RS-232 connector.

   b   If you are connected to the CLI interface through an Ethernet port, disconnect the Ethernet cable from the Ethernet port.

3   STOP. This procedure is complete.

5.5   Retrieving product information for an ONT

Product information about an ONT includes the vendor name, firmware, type of ONT (mnemonic only), and serial number.

This section shows you how to retrieve product information for an ONT.

Prerequisites

The prerequisites are:

- The user access level of the ONT is read-write.
- The steps to access the interface are completed.
    - See Procedure 5-1 for HTTP interface using the first Ethernet port.
    - See Procedure 5-4 for CLI interface using the first Ethernet port.
    - See Procedure 5-6 for HTTP interface for Package C ONTs

Procedures using HTTP interface

The following procedure provides the steps to retrieve product information using the HTTP interface.

Procedure 5-10 To retrieve product information for an ONT

1   From the **Web-Management System** window, click on the **Product Information** tab, as shown in Figure 5-6.

Figure 5-6 Main options in the Web-Management System window

The **Product Information** window opens with the product information for the ONT, as shown in Figure 5-7.

Figure 5-7 Product Information window

where

Vendor name is the name of the vendor who built the ONT

Firmware is the software version that is active on the ONT

Type of ONT is the ONT mnemonic

Serial Number of ONT is the serial number that is hard-coded in the ONT

> **Note 1 —** The software load number (FExxxxx) is available from the appropriate ONT Customer Release Notes.
>
> **Note 2 —** See the appropriate ONT Customer Release Notes for additional information about the ONT.

2   Click on the **Refresh** button to refresh the contents of the window.

3   STOP. This procedure is complete.

Procedures using CLI interface

The following procedure provides the steps to retrieve the product information for an ONT using the CLI interface, including firmware version, ONT type, and serial number. The vendor name of the ONT is not available using the CLI interface.

Procedure 5-11 To retrieve product information for an ONT

1   Choose option 8, **More options**, from the Main menu. The Secondary menu appears.

2   To retrieve firmware version:

    i   Choose 1, **Retrieve firmware version**, from the secondary menu.

       The active and passive software versions appear. For example:

```
Active software: 3FEDEFAULT000z
```

```
Passive software: 3FEDEFAULT000x
```

where
Active software is the software that is running on the ONT
Passive software is the software that is in passive mode on the ONT

    ii   Press ↵ to continue.

3   To retrieve the ONT type:

    i   Choose option 4, **Retrieve ONT type**, from the secondary menu.

        The ONT mnemonic appears. For example:

```
ONT type: I040GM
Type enter key to continue...
```

    ii   Press ↵ to continue.

4   To retrieve the serial number of ONT:

    i   Choose option 5, **Retrieve serial number**, from the secondary menu.

        The serial number of the ONT appears. For example:

```
ONT serial number: ALCLA0AD1A3F
Type enter key to continue...
```

    ii   Press ↵ to continue.

5   Choose option 11, **Return to main menu**, to return to the main menu.

6   STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONT

The following procedure provides the steps to retrieve the product information for an ONT using the HTTP interface, including ONT type, software version and serial number. The vendor name of the ONT is not available using the HTTP interface.

Procedure 5-12 To retrieve product information for an ONT

1   Select the Device Info option from the ONT Admin section of the navigation tree in the GPON ONT window.

    The Device info window appears; see Figure 5-8.

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Figure 5-8 Device info window
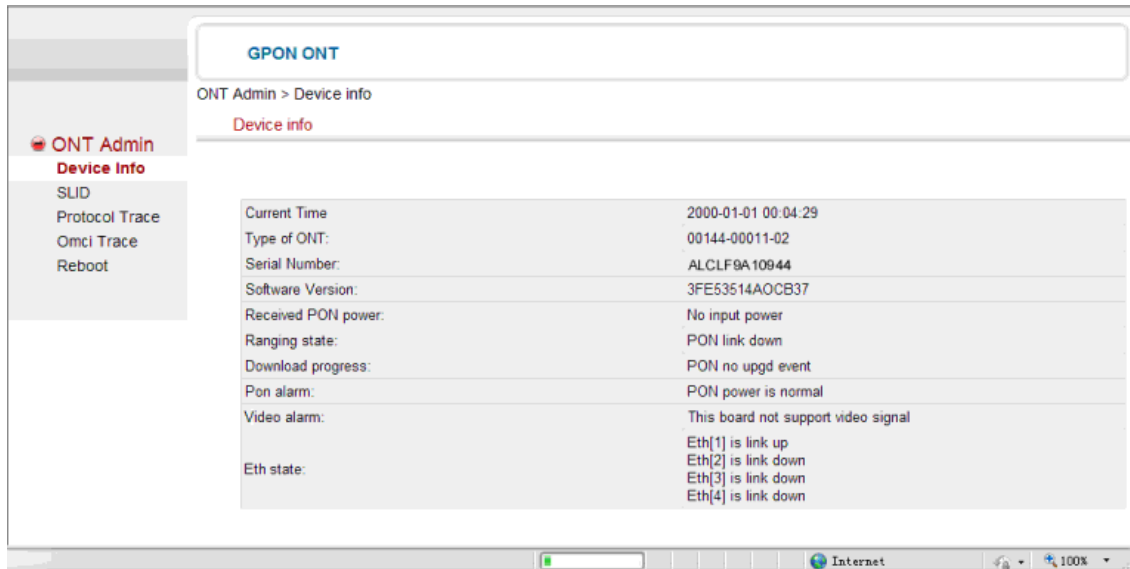
Table 5-5 describes the fields in the Device info window.

Table 5-5 Device info parameters

Field	Description
Current Time	Time when the information was collected
Type of ONT	Sequence of characters identifying the ONT type
Serial Number	Serial number unique to the ONT
Software Version	Current version of the software
Received PON power	Indicates whether ONT is receiving power from PON
Ranging state	Indicates the operational mode of the ONT
Download progress	Status of any current upgrade download events
PON alarm	Status of any current PON alarms
Video alarm	Status of any current video alarms
Eth state	Current status, either up or down, for each Ethernet link

2   STOP. This procedure is complete.

Procedures using CLI interface for Package C ONTs

Not applicable.

Procedures using butt set

Not applicable.

5.6   Checking ONT status

ONT states indicate the status of an ONT. An ONT state is an operational condition that exists on the ONT, such as the ONT is ranged. Some ONT states, such as loss of signal, generate an alarm that reports the event at the P-OLT. More than one ONT state can be active at the same time.

Table 5-6 describes the ONT states in alphabetical order. For alarm-generating states, Table 5-6 also identifies the alarm that is raised. See the OLT operations and maintenance documentation for information about the alarm, and isolating or resolving the fault condition indicated by the alarm.

Table 5-6 ONT states

ONT state	Description	Alarm
BATTERY_NOT_PROV	The battery on the ONT is not provisioned to be used on the ONT.	—
DATAACTIVITY	Ethernet packets are being received on the ONT.	—
EQUIPMENT_POWERED	The ONT has power.	—
EQPT_FAILURE	The ONT hardware failed.	—
IPTV_JOINED	An IP multicast stream is joined.	—
IPTV_NOT_PROVISIONED	The in-band IGMP multicast video is not provisioned.	—
LANLOS	There is a loss of signal on an Ethernet port interface (no carrier). The LANLOS alarm is raised, and is the OMCI LAN-LOS alarm on the PPTP Ethernet UNI Managed Entity. The alarm is directly related to the LAN Link LED on the ONT.	LANLOS
LINK_MISMATCH	Not supported	MIS
LOSS_OF_FRAME	The signal between the P-OLT and ONT loses framing. The data signal between the P-OLT and ONT consists of packets of information that is put in frames to encapsulate the data and make it distinguishable. A loss of frame might be caused by timing error or data corruption.	LOF
LOSS_OF_GEM	There is loss of GEM/ATM channel delineation of the ONT.	LCD
LOSS_OF_MULTIFRAME	Contact your Alcatel-Lucent technical support representative for information.	—
LOSS_OF_SIGNAL	The signal to the ONT is lost.	LOS
LOW_BATTERY	The UPS battery charge is low.	BATTLOW
MISSING_BATTERY	The UPS battery is provisioned, but is missing.	BATTMISS
MOCA_ACTIVITY	Packets are received over the MoCA link.	—

(1 of 3)

ONT state	Description	Alarm
MOCA_LOSS_OF_LINK	There is a loss of link on the MoCA physical interface between the ONT and the broadband home router.	MOCALOL
MOCA_NOT_REG	There is a loss of link on the MoCA physical interface between the ONT and the broadband home router	MOCALOL
MSG_ERROR_MSG	There is a physical layer error message from the ONT.	MEM
OMCC_NOT_ASSIGNED	The ONT fails to respond to OMCI message requests, or loss of communication	OMCICOMM
OMCI_ENV1	State corresponds to a customer installed device. The source of the ENV1 alarm, which is the customer device, is at fault and must be addressed by the customer.	ENV1
OMCI_ENV2	State corresponds to a customer installed device. The source of the alarm, which is the customer device, is at fault and must be addressed by the customer.	ENV2
ON_BATTERY	There is loss of external power to ONT, or the ONT is on battery backup, or the power supply failed.	ACFAIL (was PWR)
ONT_DEACTIVATE	There is a deactivate failure of the ONT.	DF
ONT_DISABLE	The ONT has been autonomously disabled because of misbehaving transmissions. The ONTDISABLED alarm is a defense alarm so that the ONT does not affect the entire PON.	ONTDISABLED
ONT_RANGED	The ONT is ranged.	—
PHY_EQPT_ERROR_IN	There is physical equipment error on ONT.	PEE
PHYSICALEQUIPMENTERROR	There is physical equipment error on ONT.	PEE
PHYSICAL_LAYER_DISABLED	Contact your Alcatel-Lucent technical support representative for information.	—
PHYSICAL_LAYER_INACTIVE	Contact your Alcatel-Lucent technical support representative for information.	—
PON_HIGH	The 1490 nm optical signal level is too high. The ONT polls this signal level once a second, and indicates if the alarm condition is present.	LEVELHI
PON_LOSS	The P-OLT is not receiving transmissions from the PON. The state normally results from a fiber pulled from the PON interface, or the feed into a splitter.	PONLOS
PON-LOW	State indicating if the 1490 nm optical signal level is too low The ONT polls this signal level once a second, and indicates whether the alarm condition is present.	LEVELLO

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ONT state	Description	Alarm
RDI	There is a remote defect indication from the ONT. The OLT transmission was received with errors at the ONT. Check the receive signal at the ONT.	RDI
REPLACE_BATTERY	The UPS battery is provisioned and present, but cannot recharge.	BATTFAIL
SIGNAL_DEGRADED	The signal degraded for the ONT (BER threshold exceeded).	SD
SIGNAL_FAILED	The signal failed from the ONT (BER threshold exceeded). You can check the signal quality of the line from the ONT.	SF
STARTUP_FAILURE	There is a startup failure in the ranging of the ONT.	SUF
SW_DLD_DONE	The software download to the ONT is completed [1].	—
SW_DLD_FAIL	The software download to the ONT failed [1]. The SWDLFAIL alarm is raised if the download fails.	SWDLFAIL
SW_DLD_IDLE	A software download to the ONT is idle [1].	—
SW_DLD_IP	A software download is in progress from the OLT to the ONT [1].	—
SW_DLD_START	A software download to the ONT is initiated [1]. The SWDLIP alarm is raised when the download is initiated, and clears when there is no pending file-transfer activity or when the download has completed, successfully or not.	SWDLIP
TRANSMITTER_FAILURE	There is a transmitter failure on an OLT port.	TXFAIL
VIDEO_HIGH	The RF video signal being generated out of the ONT has a high power level.	RFOUTHIGH
VIDEO_LOSS	There is loss of signal on the RF video overlay port interface. The VIDEOLOS alarm is raised and is the OMCI video loss of signal alarm on the PPTP Video ANI Managed Entity. This indicates that the 1550 nm video overlay optical signal level has dropped. The ONT polls this once signal level once a second and indicates if the alarm condition is present or if the alarm condition is cleared.	VIDEOLOS
VIDEO_LOW	The RF video signal being generated out of the ONT has a low power level.	RFOUTLOW
VIDEO_PROVISIONED	The 1550 nm video overlay is provisioned.	—

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Note
[1]   See Procedure 5-23 to monitor a software download from the P-OLT to the ONT.

This section shows you how to retrieve ONT states to check the status of an ONT.

Prerequisites

The prerequisites are:

- The user access level of the ONT is read-write.
- The ONT is connected to the PON, and is ranged.
- The steps to access the interface are completed.
  - See Procedure 5-1 for HTTP interface using the first Ethernet port.
  - See Procedure 5-4 for CLI interface using the first Ethernet port.

Procedures using HTTP interface

The following procedure provides the steps to check ONT status using the HTTP interface.

Procedure 5-13 To check ONT status

1 From the **Web-Management System** window, click on the **States Management** tab, as shown in Figure 5-9.

Figure 5-9 Main options in the Web-Management System window

The **ONT status** window opens with the ONT states and their current status, as shown in Figure 5-10.

Figure 5-10 ONT status window
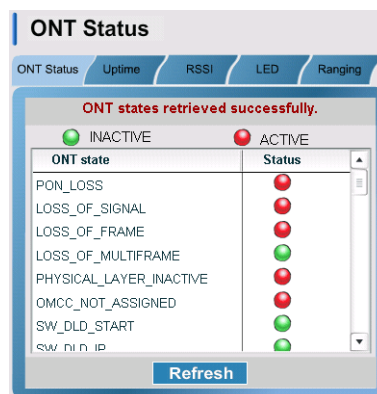
where

ONT state is a mnemonic that represents a possible condition on the ONT; see Table 5-6 for an alphabetical listing and description of the ONT states

Status is the operational state of the condition, where a red button means that the condition is present, that is active, on the ONT, and a green button means that the condition is not present, that is inactive, on the ONT

2 Use the scroll bar in the **ONT status** window to scroll up and down the list of ONT states.

3 Click on the **Refresh** button to refresh the contents of the window.

4 STOP. This procedure is complete.

Procedures using CLI interface

The following procedure provides the steps to check ONT status using the CLI interface.

Procedure 5-14 To check ONT status

1 Choose option 8, **More options**, from the Main menu. The Secondary menu appears.

2 Choose option 2, **Retrieve ONT states**, from the secondary menu.

The list of ONT states appear with their current status shown as either active or inactive. For example:

```
ONT_SW_FAULT              -- INACTIVE
OMCI_ENV1                 -- INACTIVE
OMCI_ENV2                 -- INACTIVE
NO_ALARM                  -- INACTIVE
press enter key to continue...
```

where

the ONT state is shown as a mnemonic that represents a possible condition on the ONT; see Table 5-6 for an alphabetical listing and description of the ONT states

the operational state of the condition is either active, which means that the condition is present on the ONT, or inactive, which means that the condition is not present on the ONT

3 Press ↵ to continue.

4 Choose option 11, **Return to main menu**, to return to main menu.

5 STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONTs

Not applicable.

Procedures using CLI interface for Package C ONTs

Not applicable.

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Procedures using butt set

Not applicable.

5.7 Retrieving uptime of an ONT

The uptime of an ONT is the length of time that the ONT has run without resetting. The uptime time can be used to detect a power failure.

This section shows you how to retrieve the uptime of an ONT.

Prerequisites

The prerequisites are:

- The user access level of the ONT is read-write.
- The steps to access the interface are completed.
  - See Procedure 5-1 for HTTP interface using the first Ethernet port.
  - See Procedure 5-4 for CLI interface using the first Ethernet port.

Procedures using HTTP interface

The following procedure provides the steps to view the uptime of an ONT using the HTTP interface.

Procedure 5-15 To view the uptime of an ONT

1   From the **Web-Management System** window, click on the **States Management** tab, as shown in Figure 5-11.

Figure 5-11 Main options in the Web-Management System window

The **ONT status** window opens with the ONT states and their current status, as shown in Figure 5-10.

2   Click on the **Uptime** tab in the window. The **Uptime of ONT** windows opens with the current uptime, as shown in Figure 5-12.

Figure 5-12 Uptime of ONT window
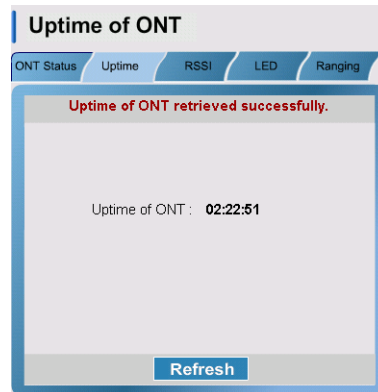
where **Uptime of ONT** represents the length of time since the ONT was last powered on or reset, in the format hh:mm:ss

3   Click on the **Refresh** button to refresh the contents of the window.

4   STOP. This procedure is complete.

Procedures using CLI interface

The following procedure provides the steps to view the uptime of an ONT using the CLI interface.

Procedure 5-16 To view the uptime of an ONT

1   Choose option 8, **More options**, from the Main menu. The Secondary menu appears.

2   Choose option 3, **Retrieve uptime**, from the secondary menu.

The uptime of the ONT appears. For example:

```
ONT uptime is: 01:22:44 up  1:23
press enter key to continue...
```

where **ONT uptime** represents the length of time since the ONT was last powered on or reset, in the format hh:mm:ss and hh:mm, where hh:mm is rounded to the nearest minute

3   Press ↵ to continue.

4   Choose option 11, **Return to main menu**, to return to main menu.

5   STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONTs

Not applicable.

Procedures using CLI interface for Package C ONTs

Not applicable.

Procedures using butt set

Not applicable.

5.8   Retrieving RSSI

The RSSI is the recorded measurement of the ONT receive optical signal at 1490 nm in dBm. This feature is available for RSSI-capable ONTs only.

This section shows you how to retrieve the RSSI measurement for an ONT.

Prerequisites

The prerequisites are:

- The user access level of the ONT is read only or read-write.
- The ONT is RSSI capable.
- The steps to access the interface are completed.
  - See Procedure 5-1 for HTTP interface using the first Ethernet port.
  - See Procedure 5-4 for CLI interface using the first Ethernet port.

Procedures using HTTP interface

The following procedure provides the steps to view the RSSI measurement for an ONT using the HTTP interface.

Procedure 5-17 To view RSSI

1   From the **Web-Management System** window, click on the **States Management** tab, as shown in Figure 5-13.

Figure 5-13 Main options in the Web-Management System window

The **ONT status** window opens with the ONT states and their current status, as shown in Figure 5-10.

2   Click on the **RSSI** tab. The **RSSI** window opens with the current RSSI measurement, as shown in Figure 5-14.

Figure 5-14 RSSI window

where **receive RSSI** is the recorded measurement of the ONT receive optical signal level at 1490 nm in dBm. The RSSI range is −65.536 dBm to +65.538 dBm where −65.536 means unknown and +65.538 means unsupported. The receive RSSI is zero when the ONT is not connected to the GPON, or there is loss of connection with the GPON.

> **Note —** The absolute accuracy of the optical signal reading is + or − 3.0 dB. This should be taken into account when reading values.

3   Click on the **Refresh** button to refresh the contents of the window.

4   STOP. This procedure is complete.

Procedures using CLI interface

The following procedure provides the steps to view the RSSI measurement for an ONT using the CLI interface.

Procedure 5-18 To view RSSI

1   Choose option 7, **Retrieve optical level**, from the Main menu. The current RSSI measurement appears. For example:

```
ponOpticalSignalLevel = -40.727268 dBm
```

where **ponOpticalSignalLevel** (receive RSSI) is the recorded measurement of the ONT receive optical signal level at 1490 nm in dBm. The range is −65.536 dBm to +65.538 dBm, where −65.536 means unknown and +65.538 means unsupported. The receive RSSI is zero when the ONT is not connected to the GPON, or there is loss of connection with the GPON.

> **Note —** The absolute accuracy of the optical signal reading is + or − 3.0 dB. This should be taken into account when reading values.

2   STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONTs

Not applicable.

Procedures using CLI interface for Package C ONTs

Not applicable.

Procedures using butt set

Not applicable.

5.9   Checking status of LEDs

The ONT LEDs provide information related to the connectivity between the ONT and the LT card. The LEDs can indicate a variety of issues, such as:

- ONT not powered
- equipment failed or not ranged
- higher-level problem in management software

Table 5-7 describes the ONT LEDs.

Table 5-7 ONT LEDs

LED	Description
EQPT	Battery power is available.
PON	The PON is communicating with the ONT.
IPTV	The IPTV service is provisioned.
RFTV	The RF video is provisioned.
POTS	A phone is off-hook.
MGMT	Communication is established between the P-OLT and ONT through OMCI.
NTWK	The 1490 nm data path is available.
DATA	The data (Ethernet or MoCA) link is active, or if the data link is not active or not provisioned.
VID	The video signal is above or below acceptable level or not provisioned.
FAIL	The equipment is 100% operational, or the equipment has failure, or is not ranged or synchronized.
BTRY	The status of the battery
MOCA	The activity on the MoCA link
PWR_LED	There is power to the ONT
ALM_LED	The operational state of the ONT
WAN_LED	The ONT is connected properly to the PON.

Note — Table 5-7 lists all possible LEDs on an ONT. For a list of LEDs specific to a particular ONT, see the unit data sheet for that ONT.

This section shows you how to check the current and persistent state of LEDs.

Prerequisites

The prerequisites are:

- The user access level of the ONT is read-write.
- The steps to access the interface are completed.
    - See Procedure 5-1 for HTTP interface using the first Ethernet port.
    - See Procedure 5-4 for CLI interface using the first Ethernet port.

Procedures using HTTP interface

The following procedure provides the steps to check the status of the ONT LEDs using the HTTP interface.

Procedure 5-19 To check the status of LEDs

1   From the **Web-Management System** window, click on the **States Management** tab, as shown in Figure 5-15.

Figure 5-15 Main options in Web-Management system window

The **ONT status** window opens with the ONT states and their current status, as shown in Figure 5-10.

2   Click on the **LED** tab. The **ONT LEDs** window appears with the LEDS, their color, current LED state, and persistent LED state shown.

Figure 5-16 ONT LEDs

where

LED is the mnemonic for an LED on the ONT. Each LED represents a condition or activity on the ONT, such as the condition of the battery or the activity of a data link; see Table 5-7 for an explanation of each LED.

COLOR is the color of the LED. The color of the LED represents the status of a condition or activity on the ONT, such as red for failing battery or green for activity on the data link; see the ONT-specific unit data sheet for the meaning of a color for a specific LED and ONT type.

CURSTATE represents the current LED state, where **OFF** means the LED is not lit, **ON** means that the LED is lit and the color is solid.

PERSTATE represents the persistent state of the LED, where **OFF** means that the LED was not lit, and **ON** means that the LED was lit and the color was solid.

3   Use the scroll bar in the **ONT LEDs** window to scroll up and down the list of LEDs.

4   Click on the **Refresh** button to refresh the contents of the window.

5   STOP. This procedure is complete.

Procedures using CLI interface

The following procedure provides the steps to check the status of the ONT LEDs using the CLI interface.

Procedure 5-20 To check the status of LEDs

1   Choose option 8, **More options**, from the Main menu. The Secondary menu appears.

2   Choose option 6, **Retrieve ONT LED status**, from the secondary menu.

The ONT LEDs appear with their color, current LED state, and previous LED state shown. For example:

```
In print_led_states
LED         COLOR        CURSTATE       PRESTATE
==================================
EQPT        GREEN        OFF            OFF
PON         GREEN        OFF            OFF
IPTV        GREEN        OFF            OFF
RFTV        GREEN        OFF            OFF
POTS        GREEN        OFF            OFF
MGMT        GREEN        OFF            OFF
NTWK        GREEN        OFF            OFF
DATA        GREEN        OFF            OFF
VID         GREEN        OFF            OFF
FAIL        GREEN        OFF            OFF
BTRY        GREEN        OFF            OFF
MOCA        GREEN        OFF            OFF
PWR_LED     GREEN        ON             ON
ALM_LED     GREEN        OFF            OFF
WAN_LED     RED          ON             ON
press enter key to continue...
```

where

LED is the mnemonic for an LED on the ONT. Each LED represents a condition or activity on the ONT, such as the condition of the battery or the activity of a data link; see Table 5-7 for an explanation of each LED.

COLOR is the color of the LED. The color of the LED represents the status of a condition or activity on the ONT, such as red for failing battery or green for activity on the data link; see ONT-specific unit data sheet for the meaning of a color for a specific LED and ONT type.

CURSTATE represents the current LED state, where **OFF** means the LED is not lit, **ON** means that the LED is lit and the color is solid.

PRESTATE represents the previous state of the LED, where **OFF** means that the LED was not lit, and **ON** means that the LED was lit and the color was solid.

3   Press ↵ to continue.

4   Choose option 11, **Return to main menu**, to return to main menu.

5   STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONTs

Not applicable.

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Procedures using CLI interface for Package C ONTs

Not applicable.

Procedures using butt set

Not applicable.

5.10 Checking ranging state of an ONT

The ranging state indicates the operational mode of the ONT as per ITU 984.3. Table 5-8 describes the possible ranging states for an ONT.

Table 5-8 Ranging states of an ONT

Ranging state	Description
Initial state	The ONT is on, but is not connected to the GPON.
Standby state	The ONT is waiting for network parameters, such as a preassigned equalization delay, or the number of preamble bytes to use in the upstream direction.
Serial number state	The ONT is waiting for a serial number request. When the request is received, the ONT registers.
Ranging state	The ONT is waiting for a ranging request. Based on the round-trip delay (RTD) time, the P-OLT calculates the ONT's equalization delay.
Operation state	The ONT is ranged. In the operation state, the upstream frames will be synchronized together between the ONTs on the PON. Also, the upstream transmissions will arrive separately, each one in its correct location within the frame. In this state, the ONT can be halted by the P-OLT, to implement serial number or ranging processes with other ONTs.
Popup state	The ONT enters the popup state from the operation state after detecting an alarm, such as loss of signal (LOS) or loss of frame (LOF). In the pop-up state, the ONT stops transmitting in the upstream direction.
Emergency stop state	The ONT is in an emergency stop state, and does not receive and transmit data until the P-OLT enables it.

This section shows you how to retrieve the ranging state of an ONT.

Prerequisites

The prerequisites are:

- The user access level of the ONT is read only or read-write.
- The steps to access the interface are completed.
    - See Procedure 5-1 for HTTP interface using the first Ethernet port.
    - See Procedure 5-4 for CLI interface using the first Ethernet port.

Procedures using HTTP interface

The following procedure provides the steps to check the ranging state of an ONT using the HTTP interface.

Procedure 5-21 To check the ranging state of an ONT

1   Ensure that the ONT is connected to the GPON.

2   From the **Web-Management System** window, click on the **States Management** tab, as shown in Figure 5-17.

Figure 5-17 Main options in the Web-Management System window

The **ONT status** window opens with the ONT states and their current status, as shown in Figure 5-10.

3   Click on the **Ranging** tab. The **Ranging State** window opens with the current ranging state, as shown in Figure 5-18.

Figure 5-18 Ranging State window

where the ranging states are described in Table 5-8

4   Click on the **Refresh** button to refresh the contents of the window.

5   STOP. This procedure is complete.

Procedures using CLI interface

The following procedure provides the steps to check the ranging state of an ONT using the CLI interface.

Procedure 5-22 To check the ranging state of an ONT

1   Ensure that the ONT is connected to the GPON.

2   Choose option 6, **Retrieve ranging state**, from the Main menu.

The current ranging state of the ONT appears. For example:

```
Ranging State = Initial State (Auto-Disable State = Normal State)
```

where the ranging states are described in Table 5-8

3   Press ↵ to continue.

4   STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONTs

Not applicable.

Procedures using CLI interface for Package C ONTs

Not applicable.

Procedures using butt set

Not applicable.

5.11   Monitoring software download to an ONT

Software downloads are updates or upgrades to software features of an ONT. Software updates and upgrades are performed at the CO, and downloaded from the P-OLT to the ONT.

Table 5-9 identifies the software download states.

Table 5-9 Software download states

Download state	Description
Idle	There is no download activity.
Downloading	Software is being downloaded from the P-OLT to the ONT.
Writing to flash	Software updates are being written to memory.
Complete	Software download is complete.

Note — The ONT changes from one operational state to another as the software download progresses, as follows:

- SW_DLD_IDLE, when there is no software download activity
- SW_DLD_START, when the software download is initiated
- SW_DLD_IP, when the software download is in progress
- SW_DLD_DONE, when the software download is complete
- SW_DLD_FAIL, when the software download failed

See section 5.6 for more information about checking the operational state of an ONT.

This section shows you how to check the status of a software download.

Prerequisites

The prerequisites are:

- The user access level of the ONT is read-write.
- The ONT is connected to the GPON.
- The steps to access the interface are completed.
    - See Procedure 5-1 for HTTP interface using the first Ethernet port.
    - See Procedure 5-4 for CLI interface using the first Ethernet port.

Procedures using HTTP interface

The following procedure provides the steps to check the status of the software download from the P-OLT to the ONT using the HTTP interface.

Procedure 5-23 To check status of software download

1 From the **Web-Management System** window, click on the **ONT management** tab, as shown in Figure 5-19.

Figure 5-19 Main options in the Web-Management System window

The **ONT management** window opens with the current download state, as shown in Figure 5-20.

Figure 5-20 Download state window

where the download states are described in Table 5-9

2 Click on the **Refresh** button to refresh the contents of the window.

3 STOP. This procedure is complete.

Procedures using CLI interface

The following procedure provides the steps to check the status of the software download from the P-OLT to the ONT using the CLI interface.

Procedure 5-24 To check the status of software download

1 Choose 8, **More options**, from the Main menu. The Secondary menu appears.

2 Choose 7, **Retrieve download progress**, from the secondary menu.

The current state of the download appears. for example:

```
Software Download: State = Complete
press enter key to continue...
```

where the download states are described in Table 5-9

3   Press ↵ to continue.

4   Choose option 11, **Return to main menu**, to return to main menu.

5   STOP. This procedure is complete.
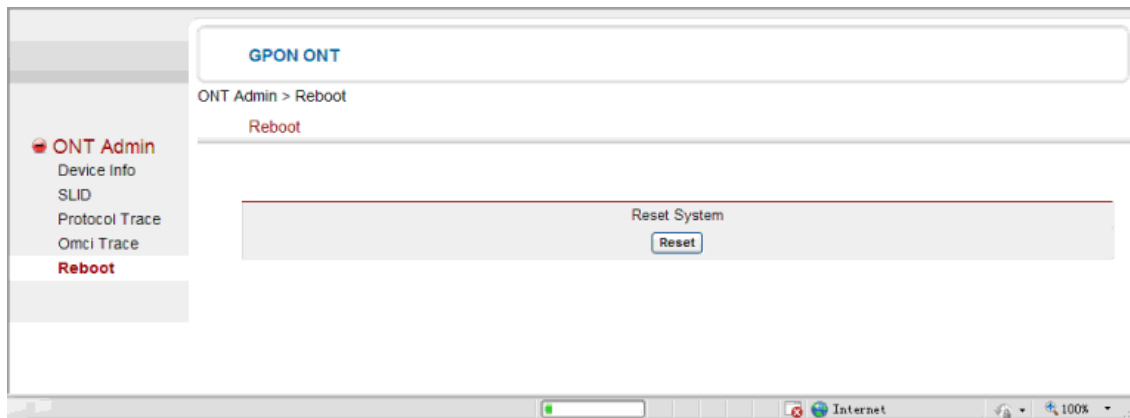

Procedures using HTTP interface for Package C ONTs

Not applicable.

Procedures using CLI interface for Package C ONTs

Not applicable.

Procedures using butt set

Not applicable.

5.12   Rebooting an ONT

The ONT may require rebooting from time to time to recover from certain events. Two forms of reboot are available:

- **Force reset**, to reboot immediately regardless of the download state of the ONT
- **Graceful reset**, to reboot after a software download is complete

This section shows you how to reboot an ONT.

Prerequisites

The prerequisites are:

- The user access level of the ONT is read-write.
- The steps to access the interface are completed.
  - See Procedure 5-1 for HTTP interface using the first the Ethernet port.
  - See Procedure 5-4 for CLI interface using the first Ethernet port.
  - See Procedure 5-6 for HTTP interface for Package C ONTs
  - See Procedure 5-8 for Package C ONT CLI interface using an Ethernet port.

Procedures using HTTP interface

The following procedure provides the steps to reboot an ONT using the HTTP interface.

Procedure 5-25 To reboot an ONT

1   From the **Web-Management System** window, click on the **ONT Management** tab, as shown in Figure 5-21.

Figure 5-21 Main options in the Web-Management System window

The **Download state** window opens with the current download state, as shown in Figure 5-22.

Figure 5-22 Download state window

where the download states are described in Table 5-9

2   Check if a software download is in progress. Click on the **Refresh** button to refresh the **Download state**, as required.

3   Click on the **Reset** tab. The **Reset** window opens, as shown in Figure 5-23.

Figure 5-23 Reset window
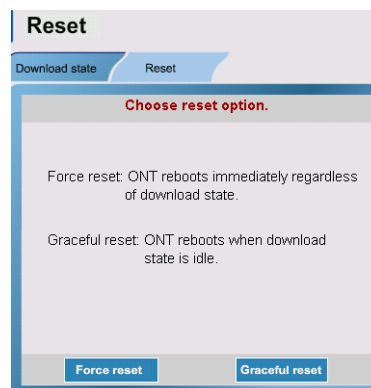
4 Click on one of the following buttons to reboot the ONT:

- **Force reset**—to reboot the ONT immediately regardless of the download state of the ONT
- **Graceful reset**—to reboot after an ongoing software download is complete

The reset ONT dialog box opens, as shown in Figure 5-24.

Figure 5-24 Reset ONT dialog box
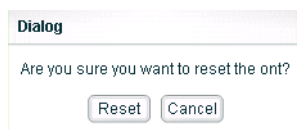
5 Click on the **Reset** button to reboot the ONT.

The status bar appears a message after the ONT is rebooted successfully.

6 STOP. This procedure is complete.

Procedures using CLI interface

The following procedure provides the steps to reboot an ONT using the CLI interface.

Procedure 5-26 To reboot an ONT

1 Choose option 8, **More options**, from the Main menu. The Secondary menu appears.

2 Choose option 7, **Reboot an ONT**, from the secondary menu.

The current state of the download appears. For example:

```
Software Download: State = Complete
press enter key to continue...
```

where the download states are described in Table 5-9

3 Press ↵ to continue.

4 Choose option 11, **Return to main menu**, to return to main menu.

5 STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONT

The following procedure provides the steps to reboot an ONT using the HTTP interface for Package C ONTs.

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Procedure 5-27 To reboot a Package C ONT

1   Select the Reboot option from the ONT Admin section of the navigation tree in the GPON ONT window.

The Reboot window appears; see Figure 5-25.

Figure 5-25 Reboot window

2   Click Reset to reboot the system.

3   STOP. This procedure is complete.

Procedures using CLI interface for Package C ONTs

The following procedure provides the steps to reboot an ONT using the CLI interface provided with Package C ONTs.

Procedure 5-28 To reboot a Package C ONT

1   Type **R** or **r** for **Reboot** from the SLID menu at any time during the session.

2   STOP. This procedure is complete.

Procedures using butt set

Not applicable.

5.13   Tracing OMCI and protocol traffic

Tracing is a logging of traffic to detect or resolve networking problems. Trace logs are normally provided to support staff for troubleshooting. You can trace OMCI, ARP, DHCP, or IGMP protocol traffic.

From the HTTP interface, you can collect trace statements in a log file that you can view on-line as follows:

1 Specify the traffic to log, and enable tracing.

2 Specify the action for the system to take when the trace log is full.

3 Disable tracing.

4 Specify the trace log to view.

From the CLI interface, you can view trace statements in real time, or collect trace statements in a log file that you can copy to a TFTP server. To view trace statements in real time from the CLI interface:

1 Specify the traffic that you want to view in real time.

2 Enable real-time tracing.

3 Press ↵ when you are finished.

To trace in logging mode from the CLI interface:

1 Specify the traffic that you want to log.

2 Enable tracing.

3 Specify the action to take by the system when the trace log is full.

4 Disable tracing.

5 Copy the trace log to a TFTP server.

Note — As tracing affects the performance of an ONT, ensure that you disable tracing when you are finished.

This section shows you how to:

- enable tracing
- disable tracing
- retrieve the trace log

Prerequisites

The prerequisites are:

- The user access level of the ONT is read-write.
- The ONT is connected to the GPON.
- The ONT is activated with its services.
- The steps to access the interface are completed.
  - See Procedure 5-1 for HTTP interface using the first Ethernet port.
  - See Procedure 5-4 for CLI interface using the first Ethernet port.
  - See Procedure 5-6 for HTTP interface for Package C ONTs

Procedures using HTTP interface

The following procedures provide the steps to enable tracing, and to retrieve trace logs for an ONT using the HTTP interface.

Procedure 5-29 To enable tracing

1 From the **Web-Management System** window, click on the **Trace Management** tab, as shown in Figure 5-26.

Figure 5-26 Main options in Web-Management system window

The **Trace Management** window opens with the current trace management settings, as shown in Figure 5-27.

Figure 5-27 Trace Management window

2   Enable or disable one or more of the following radio buttons, and click on the **Apply** button to enable or disable tracing:

- **OMCI**—Tracing OMCI traffic allows you to review the transfer of data between the P-OLT and the ONT, such as service provisioning data, anti-spoofing filters, and leased IP addresses, and to test the physical layer of the GPON from the P-OLT to the ONT. The OMCI trace can help to pinpoint faults in the fiber link during or after installation.
- **ARP**—Tracing ARP protocol traffic allows you to review ARP dialog between the ONT and host devices including ARP requests and responses for MAC addresses, and to test the media access level of the network. Traces are displayed in hexadecimal format (see Figure 5-29).
  You can use a product, such as Wireshark, to decode traces.
- **DHCP**—Tracing DHCP protocol traffic allows you to review DHCP dialog between the ONT and the CPE devices, and between the ONT and the P-OLT to ensure CPE devices are able to request and obtain IP addresses for host devices.
- **IGMP**—Tracing IGMP traffic allows you to monitor IGMP messages between host devices and the ONT, and between the ONT and the LT to ensure proper IPTV or IP video service to subscribers.

3   Enable one of the following radio buttons to specify the action for the system to take when a log file is full, and click on the **Apply** button to apply setting:

- **Stop logging**—create only one log file.
- **Append**—create a second log file when the first log file is full. The content of this second log file will be appended to the content of the first log file when you view the log files, using Procedure 5-31.

4   STOP. This procedure is complete.

Procedure 5-30 To disable tracing

1   From the **Trace Management** window, as shown in Figure 5-27, disable one or more of the following radio buttons, and click on the **Apply** button to disable tracing:

- **OMCI**
- **ARP**
- **DHCP**
- **IGMP**

2   STOP. This procedure is complete.

Procedure 5-31 To retrieve a trace log

1 Ensure that tracing has been disabled; see Procedure 5-30.

2 From the **Trace Management** window shown in Figure 5-28, choose a log file from the list of log files to view, and click on the **Show** button.

Figure 5-28 Trace Management window

Note — The list of log files includes only the traffic that was enabled for tracing in Procedure 5-29.

A screen displays the trace information in the log file. Figure 5-29 shows a sample ARP log file.

Figure 5-29 Sample ARP log file

Note — The log file is not permanently stored on the ONT, and can be lost after an ONT power cycle or reboot.

3   Click on **Exit** to return to the **Trace Management** window.

4   STOP. This procedure is complete.

Procedures using CLI interface

The following procedures provide the steps to enable tracing in real time or in logging mode using the CLI interface.

Procedure 5-32 To trace in real time or logging mode

This procedure allows you to enable tracing in real time or in logging mode. In real time, trace statements display automatically on the console; in logging mode, trace statements are collected in a trace log that you can copy to a TFTP server for retrieval.

1   Choose option 8, **More options**, from the Main menu. The Secondary menu appears.

2   Choose option 9, **Enable protocol traces**, from the Secondary menu. The following menu of options appears:

```
 Please select protocol
===============
1.  OMCI
2.  DHCP
3.  ARP
4.  IGMP
5. Logging options
Enter choice :
```

3   Choose one of the following protocols to trace:

    a   Choose option 1 for OMCI.

        Tracing OMCI traffic allows you to review the transfer of data between the P-OLT and the ONT, such as service provisioning data, anti-spoofing filters, and leased IP addresses, and to test the physical layer of the GPON from the P-OLT to the ONT. The OMCI trace can help to pinpoint faults in the fiber link during or after installation.

    b   Choose option 2 for DHCP.

        Tracing DHCP protocol traffic allows you to review DHCP dialog between the ONT and the CPE devices, and between the ONT and the P-OLT to ensure CPE devices are able to request and obtain IP addresses for host devices.

    c   Choose option 3 for ARP.

        Tracing ARP protocol traffic allows you to review ARP dialog between the ONT and host devices including ARP requests and responses for MAC addresses, and to test the media access level of the network. Traces are displayed in hexadecimal format. For example:

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```
-- ARP --
ff ff ff ff ff ff 00 e0 b1 7a 00 c0 08 06 00 01
08 00 06 04 00 01 00 e0 b1 7a 00 c0 ac 16 b5 41
00 00 00 00 00 00 ac 16 b5 4e b1 7a 00 c0 77 19
00 00 00 00 00 00 00 00 00 00 00 00
```

You can use a product, such as Wireshark, to decode traces.

d　Choose option 4 for IGMP.

Tracing IGMP traffic allows you to monitor IGMP messages between host devices and the ONT, and between the ONT and the LT to ensure proper IPTV or IP video service to subscribers.

After you choose a protocol, the following trace options appear:

```
 Trace options
===============
  1.  Real-time traces
  2.  Enable logging
  3.  Disable logging
  Enter choice :
```

4　Perform one of the following:

a　To view trace statements in real time:

i　Choose option 1, **Real-time traces.** The system responds by displaying trace statements.

```
Press enter key to disable real-time tracing at any
time...
```

ii　To stop the display of trace statements, press ↵. The system responds by displaying the Secondary menu with the message:

```
dbg_logger: disabling this console
```

b　To enable logging of trace statements:

i　Choose option 2, **Enable logging**. The following message appears:

```
xxxx traces logging enabled
Press enter key to continue...
```

where xxxx is the selected protocol

ii　Press ↵ to continue. The Secondary menu appears.

iii　Specify the action for the system to take when log file is full using Procedure 5-33.

iv　Disable tracing, using Procedure 5-34.

v　Copy the trace log to a TFTP server, using Procedure 5-35.

5　STOP. This procedure is complete.

Procedure 5-33 To specify logging option

1   Choose option 9, **Enable protocol traces**, from the Secondary menu. The following menu of options appears:

```
 Please select protocol
===============
1. OMCI
2. DHCP
3. ARP
4. IGMP
5. Logging options
Enter choice :
```

2   Choose option 5, **Logging options**. The following menu of options appears:

```
 When log file size limit is reached, what do you want to do:
===============
 1.  Append
 2.  Stop logging
 Enter choice :
```

3   Choose one of the following actions for the system to take when the log file is full:

a   Choose option 1, **Append**, to create a second log file when the first log file is full. The content of this second log file will be appended to the content of the first log file when you view the log files, using Procedure 5-31.

b   Choose option 2, **Stop logging**, to create only one log file.

The following message appears:

```
Press enter key to continue...
```

> **Note —** The log file is not permanently stored on the ONT, and can be lost after an ONT is powered off and on, or is reset.

4   Press ↵ to continue. The Secondary menu appears.

5   STOP. This procedure is complete.

Procedure 5-34 To disable tracing in logging mode

Use this procedure to disable tracing in logging mode. You must disable tracing before copying the trace log to a TFTP server.

1   Choose option 9, **Enable protocol traces**, from the Secondary menu. The following menu of options appears:

```
 Please select protocol
===============
1. OMCI
2. DHCP
3. ARP
4. IGMP
5. Logging options
Enter choice :
```

2   Choose one of the following protocols to disable tracing:

    a   Choose option 1 for OMCI.

    b   Choose option 2 for DHCP.

    c   Choose option 3 for ARP.

    d   Choose option 4 for IGMP.

After you choose a protocol, the following trace options appear:

```
 Trace options
===============
  1.  Real-time traces
  2.  Enable logging
  3.  Disable logging
  Enter choice :
```

3   Choose option 3, **Disable logging**. The following message appears:

```
Press enter key to continue...
```

4   Press ↵ to continue. The Secondary menu appears.

5   STOP. This procedure is complete.

Procedure 5-35 To copy a trace log to a TFTP server

Use this procedure to copy a trace log to a specified file on a TFTP server. You must specify the trace log, the IP address of the TFTP server, and the file name of the log file on the TFTP server.

1   Ensure tracing has been disabled, using Procedure 5-34.

2   Choose option 10, **Upload traces** from the Secondary menu. The following menu of options appears:

```
 Please select trace file
===============
  1.  OMCI
  2.  DHCP
  3.  ARP
  4.  IGMP
Enter choice :
```

3   Choose the trace log to copy over to the server:

    a   Choose option 1 for OMCI.

    b   Choose option 2 for DHCP.

    c   Choose option 3 for ARP.

    d   Choose option 4 for IGMP.

    The following appears:

```
Enter server IP address:
```

4   Type the IP address of the TFTP server.

    The following appears:

```
Enter file name on the server:
```

5   Type the name of the file on the server where the content of trace log is to be copied.

    The system copies the trace log into the specified file on the TFTP server.

- If a trace log is not found, the following message appears:
  No logs to retrieve
  Press enter key to continue...
- If a trace log is found, the following message appears after the copying is complete:
  Done
  Press enter key to continue...

6   Press ↵ to continue. The Secondary menu appears.

7   To return to Main menu, choose option 11, **Return to main menu**.

8   STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONTs

The following procedures provide the steps to enable OMCI and Protocol tracing using the HTTP interface for Package C ONTs.

Procedure 5-36 To perform an OMCI trace for a Package C ONT

1   Select the Omci Trace option from the ONT Admin section of the navigation tree in the GPON ONT window.

The Omci Trace window appears; see Figure 5-30.

Figure 5-30 Omci trace window
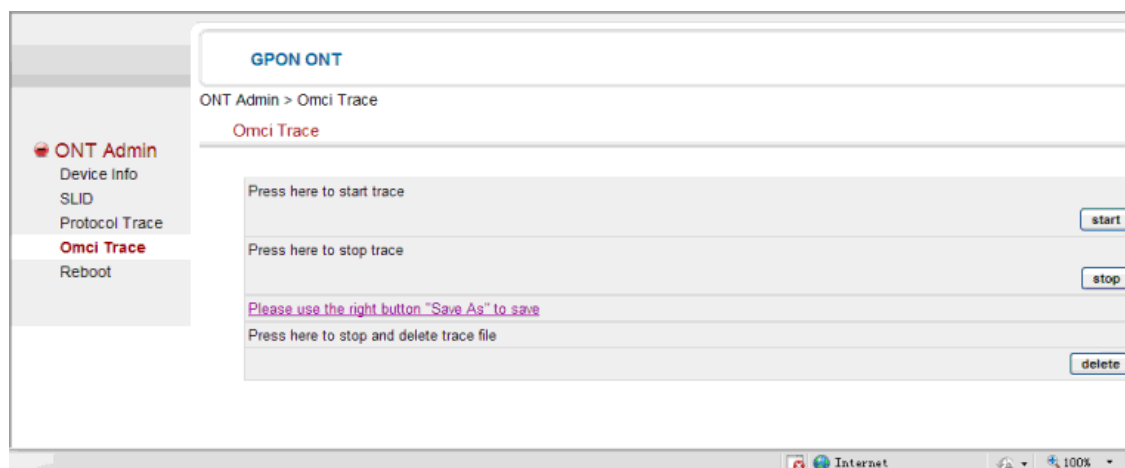
2   Click Start to initiate an OMCI trace.

3   Perform one of the following tasks to stop an OMCI trace.

    i   Click Stop to end the OMCI trace.

    ii   Click Delete to end the OMCI trace and delete the trace file.

4   STOP. This procedure is complete.

Procedure 5-37 To perform a Protocol trace for a Package C ONT

1   Select the Protocol Trace option from the ONT Admin section of the navigation tree in the GPON ONT window.

The Protocol Trace window appears; see Figure 5-31.

Figure 5-31 Protocol Trace window
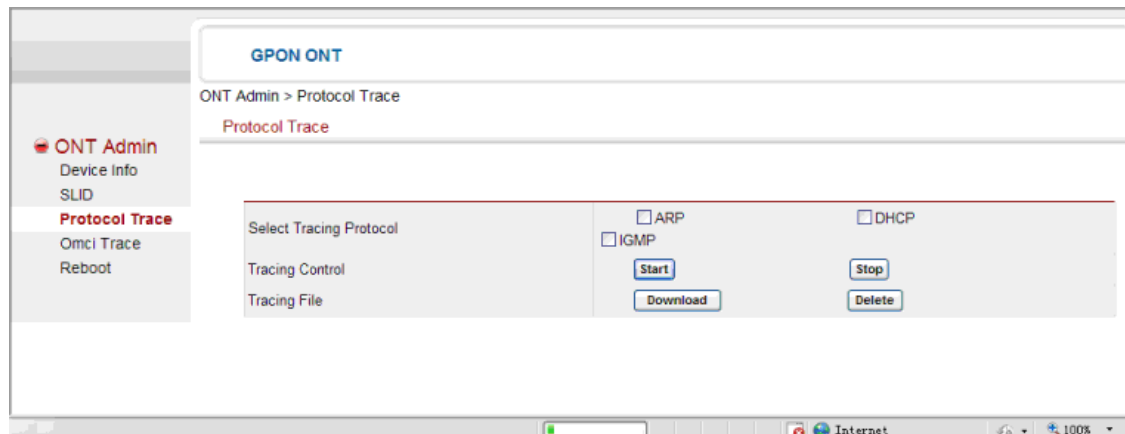
2   Select a tracing protocol by choosing either ARP, DHCP, or IGMP.

3   Click Start to initiate a protocol trace.

4   If necessary, click Stop to end a protocol trace.

5   Perform one of the following tasks with the tracing file produced by the protocol trace.

  i   Click Download to save the tracing file.

  ii   Click Delete to delete the tracing file.

6   STOP. This procedure is complete.

Procedures using CLI interface for Package C ONTs

Not applicable.

Procedures using butt set

Not applicable.

5.14   Activating an ONT using an SLID

The P-OLT is programmed to use the serial number or a SLID to activate a newly polled ONT on the PON with its provisioning data and services. The serial number is hard-coded into the ONT; the SLID is a hexadecimal or alphanumeric string that you enter locally into the ONT to uniquely identify the ONT on the PON.

After the P-OLT polls the PON for new ONTs, the ONT sends its SLID, range, and registration information to the P-OLT. The P-OLT matches the ONT with its provisioning data and services in the P-OLT database, using the serial number or the SLID. When a database match is found, the P-OLT downloads the provisioning data and services to the ONT, and the ONT and its services are activated.

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To activate an ONT using the serial number, the following is required:

- The ONT must be provisioned at the P-OLT with its serial number, a dummy SLID, provisioning data, and services.
- The ONT with the corresponding serial number must be installed at the customer site.
- The ONT must be connected to the GPON.

To activate an ONT using the SLID, the following is required:

- The ONT must be provisioned at the P-OLT with a dummy serial number, its SLID, provisioning data, and services.
- The ONT with any serial number must be installed at the customer site.
- The SLID in the ONT must be cleared locally, if the ONT has a non-default SLID.
- The SLID must be entered locally into the ONT.
- The ONT must be connected to the GPON.

Activation of an ONT can also be initiated by the P-OLT automatically at regular intervals or when one or more formerly registered and active ONTs become inactive. In both cases, the frequency of the P-OLT polling is programmed by the user.

Note — The ONT and its services can be preprovisioned at the P-OLT before or after the ONT is installed.

The SLID at the ONT can be stored in volatile or non-volatile mode. In volatile mode, the SLID is delivered to the P-OLT in proprietary mode; in non-volatile mode, the SLID can be delivered to the P-OLT in registration ID or proprietary mode. The SLID can be entered in hexadecimal or alphanumeric string format. See Table 5-10 for more information about SLID settings

Note — If you are reusing an ONT that was previously configured with a non-volatile SLID, the SLID must be reset to its default value. If you are reusing an ONT that was previously configured with a volatile SLID, the SLID will automatically return to its default value when the ONT is powered off and on.

Table 5-10 SLID settings

Parameter	Value	Description
Mode	Volatile	In volatile mode: • The SLID at the ONT returns to its default value after the ONT is powered off and on. • The SLID is delivered to the P-OLT in the proprietary mode, which uses the proprietary PLOAM message.
	Permanent	In permanent mode: • The SLID at the ONT retains its configured value after the ONT is powered off and on. • The SLID is delivered to the P-OLT in the proprietary mode, which uses the proprietary PLOAM message.
	Registration	In registration mode: • The SLID at the ONT retains its configured value after the ONT is powered off and on. • The SLID is delivered to the P-OLT in registration ID mode, which uses the password PLOAM message defined in G.984.3.
String format	Hexadecimal	Hexadecimal string of 0 to 9 and usually a to f or A to F, with zeroes appended to a length of 20 characters
	Alphanumeric	String of up to 10 characters (default)
SLID value	DEFAULT	The ONT is set to a default value.
	Non-default value	—

This section shows you how to:

• view or retrieve the current SLID setting
• clear (reset) the SLID
• enter or modify a SLID

Prerequisites

The prerequisites are:

• To enter a SLID, the user access level of the ONT is read-write.
• To view current SLID settings, the user access level of the ONT is read only, or read-write.
• The ONT must have a SLID value of null or default before you can enter a new SLID. To reset a SLID to its default value, you must clear it.
• The steps to access the interface are completed.
    • See Procedure 5-1 for HTTP interface using the first Ethernet port.
    • See Procedure 5-3 for CLI interface using the craft port.
    • See Procedure 5-6 for HTTP interface for Package C ONTs.
    • See Procedure 5-7 for Package C ONT CLI interface using the craft port.
    • See Procedure 5-8 for Package C ONT CLI interface using an Ethernet port.

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Procedures using HTTP interface

The following procedures provide the steps to view the current SLID settings, to clear the SLID, and to enter the SLID at the ONT using the HTTP interface.

Note 1 — To enter or clear a SLID using an Ethernet connection, the ONT must be disconnected from the PON optical cable.

Note 2 — You cannot change the SLID settings when the ONT is connected, ranged, and provisioned.

Procedure 5-38 To view the current SLID settings

1 From the Web-Management System window, click on the **SLID Management** tab, as shown in Figure 5-32.

Figure 5-32 Main options in the Web-Management System window

The **SLID** window opens with the current SLID settings, as shown in Figure 5-33.

Figure 5-33 SLID window
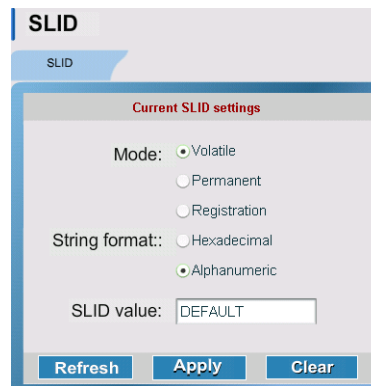
where the SLID settings are described in Table 5-10

2 Click on the **Refresh** button to refresh the contents of the window.

3 STOP. This procedure is complete.

Procedure 5-39 To clear the SLID

1 Ensure that the ONT is disconnected from the PON optical cable.

2 From the **SLID** window, click on the **Clear** button to reset the SLID to its default settings.

The SLID clear dialog box opens, as shown in Figure 5-34.

Figure 5-34 SLID clear dialog box
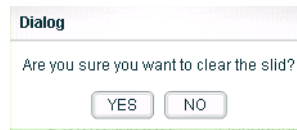
3 Click on **YES** to reset the SLID. The SLID window is refreshed with the default SLID settings for the ONT.

Note — After a SLID is reset, the SLID value is DEFAULT.

4 STOP. This procedure is complete.

Procedure 5-40 To enter the SLID

1 Ensure that the ONT is disconnected from the PON optical cable.

2 From the **SLID** window, ensure that the **SLID value** is null or DEFAULT, as shown in Figure 5-35.

Figure 5-35 SLID window
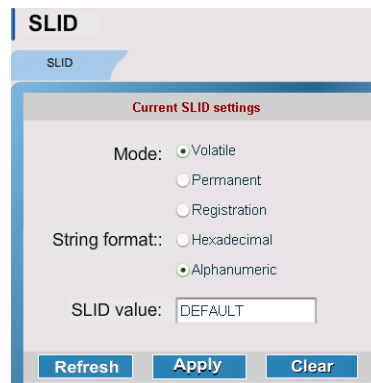
3 Enable one of the following radio buttons to set the **Mode** of the SLID:

- **Volatile**—In volatile mode, the SLID at the ONT returns to its default value after the ONT is powered off and on. A volatile SLID is always delivered to the P-OLT in the proprietary mode, which uses the proprietary PLOAM message.
- **Permanent**—In permanent mode, the SLID at the ONT is stored in non-volatile mode, and is delivered to the P-OLT in proprietary mode, which uses the proprietary PLOAM message. A non-volatile SLID retains its configured value after the ONT is powered off and on.
- **Registration**—In registration mode, the SLID at the ONT is stored in non-volatile mode, and is delivered to the P-OLT in registration ID mode, which uses the password PLOAM message defined in G.984.3. A non-volatile SLID retains its configured value after the ONT is powered off and on.

4 Enable one of the following radio buttons to set the **String format**:

- **Hexadecimal**—20 characters of 0 to 9 and usually a to f or, A to F, with zeroes appended to a length of 20 characters
- **Alphanumeric**—up to 10 ASCII characters

Note — The default value is alphanumeric.

5 Type the SLID in the **SLID Value** box.

6 Click on the **Apply** button to apply the SLID to the ONT. The **Set SLID** dialog box opens, as shown in Figure 5-36.

Figure 5-36 Set SLID dialog box
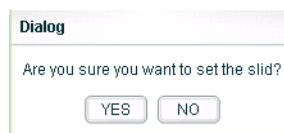
7 Click on **Yes** to set the SLID to its new value.

The status bar displays the message "The slid setting has been applied!".

8 Connect the PON optical cable to the ONT.

9 Perform one of the following to provision ONT and services:

a If the ONT and services were preprovisioned at the P-OLT, the P-OLT will automatically range and provision the ONT, after the ONT is connected to the PON optical cable.

b If the ONT and services were not pre-provisioned at the P-OLT, notify the TL1 or network manager GUI operator to provision the ONT and services at the P-OLT using SLID.

10 STOP. This procedure is complete.

Procedures using CLI interface

The following procedures provide the steps to view the current SLID settings, to clear the SLID, and to enter the SLID using the CLI interface.

Note — To enter or clear a slid:

- If you are using an Ethernet connection, the ONT must be disconnected from the PON optical cable.
- If you are using a craft connection, the ONT can be connected or disconnected from the PON optical cable. However, if you configure the SLID with the ONT connected to the PON optical cable, the data at the ONT is not changed; the data at the ONT is only changed after the ONT reranges. Rerange the ONT by disconnecting and reconnecting the PON optical cable, which generates a NEWONT alarm.

Procedure 5-41 To view current SLID settings

1 Choose option 4, **Retrieve SLID**, from the Main menu.

The system displays the string format, the mode, and the value of the SLID.

Example:

```
The SLID in ALPHANUMERIC MODE (Volatile) : DEFAULT
```

where the SLID settings are described in Table 5-10

2 STOP. This procedure is complete.

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Procedure 5-42 To clear the SLID

1   Perform one of the following:

    a   If you are using an Ethernet port, ensure that the ONT is disconnected from the PON optical cable.

    b   If you are using a craft port, you can clear the SLID with the ONT connected to or disconnected from the PON optical cable.

2   Choose option 5, **Clear SLID**, from the Main menu to clear the SLID.

The ONT sets the SLID to the default value, and the following message appears:

```
SLID cleared successfully!
```

3   Choose option 4, **Retrieve SLID** from the main menu to verify that the SLID is reset to its default value.

4   STOP. This procedure is complete.

Procedure 5-43 To enter the SLID

1   Perform one of the following:

    a   If you are using an Ethernet port, ensure that the ONT is disconnected from the PON optical cable.

    b   If you are using a craft port, you can enter the SLID with the ONT connected or disconnected from the PON optical cable.

2   Choose option 4, **Retrieve SLID**, from the Main menu to ensure that the SLID is set to DEFAULT or null.

3   Perform one of the following from the main menu

    a   Choose option 1, **Enter SLID in volatile mode**, to enter a volatile SLID.

    b   Choose option 2, **Enter SLID in permanent mode**, to enter a non-volatile SLID delivered in proprietary mode.

    c   Choose option 3, **Enter SLID in registration mode**, to enter a non-volatile SLID delivered in registration ID mode.

The following appears:

```
Enter Subscriber Location Id

> ALPHANUMERIC MODE (Length(1..10)):

> HEX MODE (Length(1..20))

> Note: FOR HEX MODE -- APPEND THE VALUE WITH 0x
```

4 Perform one of the following to enter the SLID value in alphanumeric or hexadecimal format:

a In alphanumeric format, enter the SLID up to 10 ASCII characters of 0 to 9, a to z, or A to Z.

b In hexadecimal format, enter the SLID up to 20 characters of 0 to 9, a to f, or A to F, with zeroes appended to a length of 20 characters.

5 Choose option 4, **Retrieve SLID**, to verify that the SLID was entered correctly.

6 Perform one of the following to connect the ONT to the PON:

a If the ONT is disconnected from the PON, connect the PON optical cable to the ONT.

b If the ONT is connected to the PON, disconnect, and then reconnect the PON optical cable.

7 Perform one of the following to provision the ONT and services:

a If the ONT and services were preprovisioned at the P-OLT, the P-OLT will automatically range and provision the ONT, after the ONT is connected to the PON optical cable.

b If the ONT and services were not preprovisioned at the P-OLT, notify the TL1 or network manager GUI operator to provision the ONT and services at the P-OLT using SLID.

8 STOP. This procedure is complete.

Procedures using HTTP interface for Package C ONTs

The following procedures provide the steps to view the current SLID settings and to enter a new SLID at the ONT using the HTTP interface for Package C ONTs.

> **Note —** To enter or clear a SLID using an Ethernet connection, the ONT must be disconnected from the PON optical cable.

Procedure 5-44 To view current SLID settings

1 Select the SLID option from the ONT Admin section of the navigation tree in the GPON ONT window.

The SLID window appears; see Figure 5-37.

Figure 5-37 SLID window

The current SLID settings are displayed in the Configured SLID and Current SLID fields.

2   If required, press Refresh to update the display of the configured and current SLID.

3   STOP. This procedure is complete.

Procedure 5-45 To enter the SLID

1   Select the SLID option from the ONT Admin section of the navigation tree in the GPON ONT window.

The SLID window appears; see Figure 5-38.

Figure 5-38 SLID window

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2 Perform one of the following to enter the new SLID value in alphanumeric or hexadecimal format in the Input New SLID field:

    a In alphanumeric format, enter a numeric string of up to 10 characters.

    b In hexadecimal format, enter a numeric string of up to 20 characters. The string must be prefixed with a zero.

3 Press Apply.

4 STOP. This procedure is complete.

Procedures using CLI interface for Package C ONTs

The following procedures provide the steps to retrieve the current SLID and to modify the SLID using the CLI interface provided with Package C ONTs.

> **Note —** To enter or clear a slid:
>
> - If you are using an Ethernet connection, the ONT must be disconnected from the PON optical cable.
> - If you are using a craft connection, the ONT can be connected or disconnected from the PON optical cable. However, if you modify the SLID with the ONT connected to the PON optical cable, the data at the ONT is not changed; the data at the ONT is only changed after the ONT reranges. Rerange the ONT by disconnecting and reconnecting the PON optical cable, which generates a NEWONT alarm.

Procedure 5-46 To retrieve the current SLID settings

1 Type **S** or **s** for **Retrieve SLID** from the SLID menu.

The system displays the current SLID in string format. The SLID settings are described in Table 5-10.

2 STOP. This procedure is complete.

Procedure 5-47 To modify the SLID

1 Type **M** or **m** for **Modify SLID** from the SLID menu.

2 Perform one of the following to enter the new SLID value in alphanumeric or hexadecimal format:

    a In alphanumeric format, enter a numeric string of up to 10 characters.

    b In hexadecimal format, enter a numeric string of up to 20 characters. The string must be prefixed with a zero.

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3 Press Enter.

4 If necessary, reboot the ONT (Procedure 5-28) in order for the new SLID to take effect immediately.

5 STOP. This procedure is complete.

Procedures using butt set

The following procedures provide the steps to clear the SLID and to enter a SLID at the ONT using a butt set.

Note — To use a butt set:

- The ONT must be disconnected from the PON optical cable.
- The butt set must be connected to the first POTS port on the ONT.
- The SLID must be in decimal or hexadecimal format.

Procedure 5-48 To clear the SLID using a butt set

1 Ensure that the ONT is disconnected from the PON optical cable.

2 Reboot the ONT.

3 Connect the butt set to the first POTS port on the ONT.

4 Wait for the green POTS LED on the ONT to start flashing (one second on, and two seconds off).

5 Take the butt set off-hook.

6 Dial "*1#" to convert the permanent SLID to a volatile SLID.

When the ONT is powered off and on, the SLID is reset to its default value.

7 Power the ONT off and on to reset SLID to its default value.

8 Take the butt set on-hook to exit.

9 STOP. This procedure is complete.

Procedure 5-49 To enter the SLID using a butt set

1 Ensure that the ONT is disconnected from the PON optical cable.

2 Connect the butt set to the first POTS port on the ONT.

3 Wait for the green POTS LED on the ONT to start flashing (one second on, and two seconds off).

4 Take the butt set off-hook.

5 Perform one of the following to activate the dial tone:

    a For a volatile decimal SLID, dial "*":

    b For a volatile hexadecimal SLID, dial "0*".

    c For a permanent decimal SLID:

- Dial "9* to deliver the SLID to the P-OLT using the proprietary PLOAM message.
- Dial "8*" to deliver the SLID to the P-OLT using the password PLOAM message defined in G.984.3

    d For a permanent hexadecimal SLID:

- Dial "90* to deliver the SLID to the P-OLT using the proprietary PLOAM message.
- Dial "80*" to deliver the SLID to the P-OLT using the password PLOAM message defined in G.984.3

The dial tone is activated.

6 After the dial tone is activated, perform one of the following to dial the SLID value:

    a For a decimal SLID, dial the SLID value up to 10 digits long.

    b For a hexadecimal SLID, dial the SLID value up to 20 digits long. Only digits in the range 0 to 9 are accepted.

7 Dial "#" to send the SLID number to the ONT.

The ONT exits the SLID input mode and enters the SLID output mode, and sends confirmation tone and SLID number. If a hexadecimal SLID is less than 20 digits, the ONT automatically appends zeroes to the end of the SLID.

8 Verify that the SLID was entered correctly.

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If a currently provisioned SLID contains nonnumeric digits, the ONT exits the SLID output mode. If a currently provisioned SLID contains only numeric digits, the value is displayed back to the installer using the POTS LED on the ONT. Each SLID number is determined by counting the number of times that the POTS LED on the ONT flashes, as follows:

- If the SLID is in decimal format:
    - For the numbers 1 to 9, the flash pattern is 0.5 s of green light followed by 1 s of no light, repeated the number of times necessary to correspond to the number.
    - For the number 0, the flash pattern is 0.5 s of green light followed by 1 s of no light repeated 10 times.
    - There is a 3s interval between digits.
- If the SLID is in hexadecimal format:
    - For the numbers 1 to 9, the flash pattern is 0.5 s of green light followed by 0.5 s of no light, repeated the number of times necessary to correspond to the number.
    - For the number 0, the flash pattern is 0.5 s of green light followed by 0.5 s of no light repeated 10 times.
    - There is a 3s interval between digits.

Note 1 — The SLID number displays more slowly in decimal format than in hexadecimal format.

Note 2 — The SLID number can be verified at any time by connecting a butt set to the first POTS port and dialing the "#" key.

9 Take the butt set on-hook to exit the SLID output mode.

10 Connect the PON optical cable to the ONT.

The ONT exits all SLID management modes.

11 Perform one of the following to provision ONT and services:

a If the ONT and services were preprovisioned at the P-OLT, the P-OLT will automatically range and provision the ONT, after the ONT is connected to the PON optical cable.

b If the ONT and services were not preprovisioned at the P-OLT, notify the TL1 or network manager GUI operator to provision the ONT and services at the P-OLT using SLID.

12 STOP. This procedure is complete.

5.15 XML file configuration data for package C ONTs

For ONTs that are shipped with an XML file already configured, the data that defines L3 interface and WiFi behavior is pre-configured with default values. Use an XML file editor to update the file to meet WiFi requirements. See the appropriate unit data sheet for more information. Table lists the XML file configuration options, sample XML, and parameter ranges.

Table 5-11 XML file configuration data for package C ONTs

XML parameter	Parameter values	Sample XML	Information
WAN interface configuration			
instanceID	Specifies the instance ID. Set to 1 and cannot be changed	`<Layer3>` `<WANInterface NumberOfInstance="1" MaxNumber="1">` `<WANInterfaceConfig InstanceID="1" WANName="wan1" IpGetMode="static" IpAddress="222.10.60.88" SubMask="255.255.255.0" PPPoEUserName="" PPPoEUserPasswd="" Gateway="222.10.60.254" DNSDomainName="tele.com" DNSServer1="210.11.123.13" DNSServer2="210.11.123.13" WANID="1"/>` `</WANInterface>`	—
WANName	Specifies the WAN name, an alphanumeric string of 1 to 256 characters		—
IpGetMode	Specifies the method used by the device to retrieve its IPv4 address. The options are: • static • dhcp • pppoe		Use standard IPv4 addressing for static.
IpAddress	Specifies the IPv4 address in dotted decimal notation format. Can be configured when IpGetMode is set to static.		—
PPPoEUserName	Specifies the user name for the PPPoE connection. Can be configured when IpGetMode is set to pppoe.		—
PPPoEUserPasswd	Specifies the user password for the PPPoE connection. Can be configured when IpGetMode is set to pppoe.		—
Gateway	Specifies the IPv4 address of the network device when the default IP address does not match any routing table routes. Can be configured when IpGetMode is set to dhcp		—
dnsdomainname	Specifies the DNS domain name of the DHCP gateway device. Can be configured when IpGetMode is set to dhcp		—
DNSServer1	Specifies the DNS primary server IP address for the DHCP gateway device. Can be configured when IpGetMode is set to dhcp		—
DNSServer2	Specifies the DNS secondary server IP address for the DHCP gateway device. Can be configured when IpGetMode is set to dhcp		—
LAN type			

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XML parameter	Parameter values	Sample XML	Information
L3Port	Specifies the Layer 3 LAN port in unsigned long bit definition format. Bit31~16 : 0 Bit15~8: wireless LAN port ~~~~~~ | bit15:~bit12:reserved | bit11:WLAN_4 | bit10:WLAN_3 | bit9:WLAN_2 | bit8:WLAN_1 | ~~~~~~ Bit7~0: LAN port ~~~~~~ | bit7:~bit4:reserved | bit3:LAN_4 | bit2:LAN_3 | bit1:LAN_2 | bit0:LAN_1 | ~~~~~~ default: 0; 1: enable;	`<LANType L3Port="0"/>`	—
LAN interface configuration			
instanceID	Specifies the instance ID. Set to 1 and cannot be changed	`<LANInterface NumberOfInstance="1" MaxNumber="2">`	—
LANName	Specifies the LAN name, an alphanumeric string of 1 to 256 characters	`<LANInterfaceInstance InstanceID="1"`	—
IpAddress	Specifies the IPv4 address of the LAN interface in dotted decimal notation format.	`LANName="Primary" IpAddr="192.168.100.1" SubnetMask="255.255.255.0"`	—
SubnetMask	Specifies the IP address subnet mask of the LAN interface in dotted decimal format. The default is 255.255.255.0.	`DHCPServerEnable="enable" StartIP="192.168.100.100" EndIP="192.168.100.200" Leasetime="259200" Option60="dhcpOp"/>`	—
DHCPSState	Specifies whether DHCP is enabled or disabled. The options are: • enable (default) • disable	`</LANInterface>`	When enabled, the device assigns IP addresses, an IP default gateway, and DNS servers.
StartIP	Specifies the start and end range of the DHCP IP address pool.		—
EndIP			
Leasetime	Specifies the client IP pool lease time, in seconds. The range is 0 to 6048000. The default is 259200 (72 hours). The maximum is 70 days		—
Option60	Specifies the IP address for the device that transits the DHCP discovery packets with the matched option 60 functionality.		—
uPnP configuration			

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XML parameter	Parameter values	Sample XML	Information
UPnPEnable	Specifies whether LAN uPnP is enabled or disabled. The options are: • enable (default) • disable	<LANUPnPConfig UPnPEnable="enable"/>	—
Security configuration			
FTP	Specifies whether FTP service is enabled or disabled from the WAN. The options are: • enable • disable (default)	<Security> <WANServiceACL FTP="disable" HTTP="disable" TELNET="disable" SSH="disable"/>	Not currently supported
HTTP	Specifies whether HTTP service is enabled or disabled from the WAN. The options are: • enable • disable (default)		—
TELNET	Specifies whether TELNET service is enabled or disabled from the WAN. The options are: • enable • disable (default)		Not currently supported
SSH	Specifies whether SSH service is enabled or disabled from the WAN. The options are: • enable • disable (default)		—
LAN service ACL configuration			
FTP	Specifies whether FTP service is enabled or disabled from the LAN. The options are: • enable • disable (default)	<LANServiceACL FTP="disable" HTTP="enable" />	Not currently supported
HTTP	Specifies whether HTTP service is enabled or disabled from the LAN. The options are: • enable (default) • disable		—
Wireless WiFi configuration			
wifiNetMode	Specifies the WiFi mode for the device. The options are: • mixed for 802.11b/g/n • disable for no WiFi (default)	<Wireless> <WifiNetwork wifiNetMode="mixed" WiFiChBW="auto" wifiNetChannel="auto" wifiWideNetCh="auto" />	—
WiFiChBW	Specifies the WiFi channel bandwidth. The options are: • auto (default) • 20 • 40		—
wifiNetChannel	Specifies the net channel. When WiFiChBW is set to auto, the option is auto. When WiFiChBW is set to 20, the options are 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, or 13. When WiFiChBW is set to 40, the options are auto or the wifiWideNetCh value plus or minus 2.		—
wifiWideNetCh	Specifies the wide net channel. You can specify the parameter when the wifiNetChannel is set to 40. The options are auto, 3, 4, 5, 6, 7, 8, 9, 10, 11		—

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XML parameter	Parameter values	Sample XML	Information
Wireless WiFi SSID configuration			
wifiSsidAdmin	Specifies the SSID administration status. The options are: • enable • disable	<WifiSsid1> <Wifi1SsidCfg wifiSsidAdmin="enable" wifiNetSsid="cigrg" wifiNetSsidBc="enable" wifiWps="enable" wifiLegacy="disable" secMode="wep" />	Value cannot be changed from default.
wifiNetSsid	Specifies the SSID name; which is a 1 to 32 alphanumeric character string.		—
wifiNetSsidBc	Specifies whether to enable or disable WiFi SSID broadcast ID. The options are: • enable • disable		—
wifiWps	Specifies whether to enable or disable WPS status. This parameter can be set when the WiFiChBW parameter is set to 40. The options are: • enable • disable		—
wifiLegacy	Specifies whether to enable or disable legacy mode, supporting 802.1g 54 Mb/s speeds. The options are: • enable • disable		—
secMode	Specifies the security mode. The options are: • open • wep • wpa-per • wpa-ent		—
WPA personal security configuration			
You can configure the parameters when the secMode is set to wpa-per (personal)			
wpaVer	Specifies the WPA version. The value is an integer from 1 to 2.	<Wifi1SecuWpaPersonal wpaVer="1" encryptionAlgo="tkip" personalKey="" groupKeyRenewal="3600" />	—
encryptionAlgo	Specifies the encryption algorithm used. The options are: • aes • tkip		—
personalKey	Specifies the encryption key. The key is an alphanumeric string of 0 to 32 characters		—
groupKeyRenewal	Specifies the encryption key renewal period. The value, in seconds, ranges from 1 to 65535 seconds. The default is 3600 s (1 hour)		—
WPA enterprise security configuration			
You can configure the parameters when the secMode is set to wpa-ent (enterprise)			

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XML parameter	Parameter values	Sample XML	Information
wpaVer	Specifies the WPA version. The value is an integer from 1 to 2.	<Wifi1SecuWpaEnterprise wpaVer="1" encryptionAlgo="tkip" radiusServerIp="" radiusPort="1812" enterpriseKey="" keyRenwal="900" />	—
encryptionAlgo	Specifies the encryption algorithm used. The options are: • aes • tkip		—
personalKey	Specifies the encryption key. The key is an alphanumeric string of 0 to 32 characters		—
groupKeyRenewal	Specifies the encryption key renewal period. The value, in seconds, ranges from 1 to 65535 seconds. The default is 900 s (15 minutes)		—
radiusServerIp	Specifies the IPv4 address of the authenticating RADIUS server. The value is an IP address in v4 format.		—
radiusPort	Specifies the port of the authenticating RADIUS server. The value is a port number (integer) from 1 to 65535. The default is 1812.		—
Hardware configuration -- layer 3 profile extension			
layer3PortMapping	Specifies the Layer 3 port mapping bitmap setting. Bit 31 to Bit 4 are reserved. Bit 3: LAN port 4; Bit 2: LAN port 3; Bit 1: LAN port 2; Bit 0: LAN port 1. The options are: • 0: disabled Layer 3 functions at this port • 1: enable Layer 3 functions at this port	<Layer3Profile> <Layer3PortMapping>0x00000007</Layer3PortMapping> </Layer3Profile> </HW_Configuration>	For example: 0x00000007 will enable L3 function in port 1/2/3; 0x8 will enable L3 function in port 4
WEP personal security configuration			
You can configure the parameters when the secMode is set to wep			
wepKeydefault	Specifies the default WEP key value. The value is an integer from 1 to 4.	<Wifi1SecuWep wepKeydefault="1" wepPassphrase="" wepKey1="" wepKey2="" wepKey3="" wepKey4="" /> </WifiSsid1>	—
wepPassphrase	Specifies the WEP passphrase. algorithm used. The value is a string from 1 to 8 hexidecimal characters.		—
wepKeyLen	Specifies the WEP key length. The value is 40 or 104.		—
wepKey1~4	Specifies the first to fourth WEP keys. Each key is a string of 1 to 40 characters.		—
radiusServerIp	Specifies the IPv4 address of the authenticating RADIUS server. The value is an IP address in v4 format.		—
radiusPort	Specifies the port of the authenticating RADIUS server. The value is a port number (integer) from 1 to 65535. The default is 1812.		—
SSID 2 security configuration			
You can configure two sets of SSID parameters. repeat the above parameters substituting Wifi2 for Wifi1			

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13 — I-241G-A unit data sheet

13.1   I-241G-A part numbers and identification

Table 13-1 provides identification information about I-241G-A indoor ONTs.

Table 13-1 I-241G-A part numbers and identification

Part number	Mnemonic [1]	Description	CLEI	CPR	ECI/Bar code
3FE 60344 AA	I-241G-A	I-241G-A GPON I-series ONT, version A, asymmetric, 2 POTS, 4 Ethernet 10/100/1000Base-T, and 1 RF video	—	—	—

Note
[1]   See Chapter 2 Part numbers, ordering, and deployment configuration overview for product identification information.

13.2   I-241G-A general description

The I-241G-A indoor ONT provides the subscriber interface for the network. The ONT terminates the PON interface and converts it to user interfaces that directly connect to subscriber devices. The ONT is compatible with all existing subscriber equipment, including analog phones with both tone and rotary dial capabilities, cordless phones, modems, fax machines, and caller ID boxes (Type I, Type II, and Type III).

The I-241G-A indoor ONT provides the following functions:

- FSAN GPON standards compliant
- Network management support
- IP video with multistage IGMPv3 or IGMPv2 for channel change
- network demarcation for all services in an open business model
- voice interworking function from the analog POTS lines to the VoIP/Ethernet layers
- interworking functions between the GEM and Ethernet layers
- interworking functions between the PON optical overlay and the RF video interface
- mux and demux functions to the PON
- optical to electrical conversion
- G984.4 standard and revised compliant OMCI interface for ONT management and provisioning

13.3   I-241G-A software and installation feature support

Table 13-2 provides a list of software-based features and installation information supported by I-241G-A indoor ONTs.

13-2

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Table 13-2 I-241G-A ONT software feature support

Features	Chapter	Cross reference for more information
General ONT and MDU overview	ONT and MDU overview	ONT and MDU general descriptions of features and functions
Service interface specifications	ONT and MDU general and interface technical specifications	Ethernet interface specifications POTS interface specifications RF video interface specifications for video overlay • Coaxial connectivity in the home and design guidelines • Configuration recommendations • 14 dBmV RF video receivers
Services supported	—	See the appropriate P-OLT user documentation for service creation procedures and descriptions.
RSSI specifications	—	—
Wi-Fi specifications	—	—
Optical budget	ONT and MDU general and interface technical specifications	ONT optical budget
Location and installation options	How to install and replace an I-241G-A indoor ONT	Install an I-241G-A indoor ONT Replace an I-241G-A indoor ONT
HTTP management	Information necessary to manage an ONT at a local site using an HTTP interface, CLI interface, CLI interface or butt set.	ONT management using an ONT interface
Statistics and performance monitoring	ONT and MDU statistics and performance monitoring	Performance monitoring statistics for Package A ONTs
Supported UPS configurations	Part numbers, ordering, and deployment configuration overview	ONT and MDU to UPS or power adapter compatibility support

13.4 I-241G-A interfaces and interface capacity

Table 13-3 describes the supported interfaces and interface capacity for I-241G-A ONTs.

Table 13-3 I-241G-A ONT interface connection capacity

ONT type and model	Maximum capacity								
	POTS	10/ 100/ BASE-T	10/ 100/ 1000 BASE-T	RF video (CATV)	MoCA	VDSL2	DS1/E1	Local craft	GPON SC/APC
I-241G-A	2	—	4	1	—	—	—	—	1

I-241G-A connections and components

The I-241G-A ONTs are for indoor deployment and can be installed vertically or horizontally. Connections to the SC/APC, RJ-45, RJ-11, and coaxial connectors are on the outside of the ONT.

Figure 13-1 shows the physical connections for I-241G-A indoor ONTs.
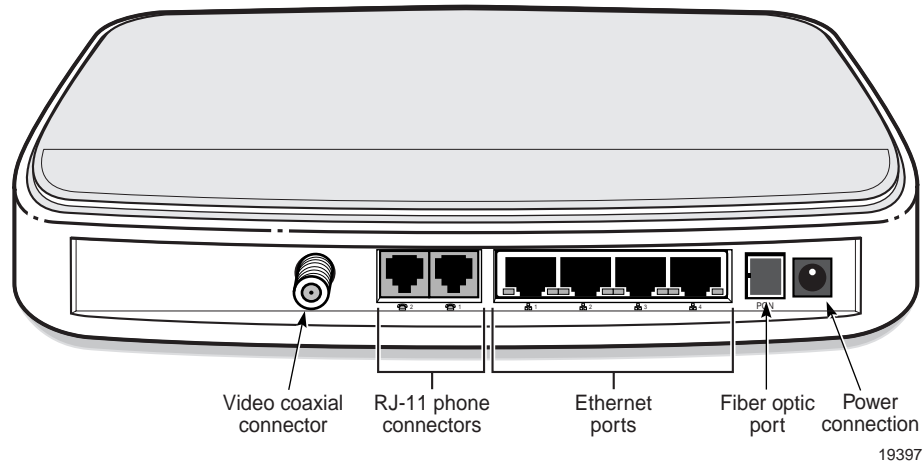
Figure 13-1 I-241G-A indoor ONT connections

Video coaxial connector   RJ-11 phone connectors   Ethernet ports   Fiber optic port   Power connection

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Table 13-4 describes the I-241G-A indoor ONT physical connections.

Table 13-4 I-241G-A indoor ONT connections

Connection	Description
POTS connections	This connection is provided through an RJ-11 phone connector.
RF video coaxial connector (Type F)	This connection is provided through a coaxial cable.
Fiber optic port	This connection is provided through a fiber optic cable.
Ethernet ports	This connection is provided through an Ethernet RJ-45 cable. Up to four Ethernet connections are supported.The Ethernet port can support both data and in-band video services on all four interfaces.
Power	This connection is provided through a cable to the ac/dc power converter.

13.5   I-241G-A ONT LEDs

Figure 13-2 shows the I-241G-A indoor ONT LEDs.

13-4

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Figure 13-2 I-241G-A indoor ONT LEDs

19398
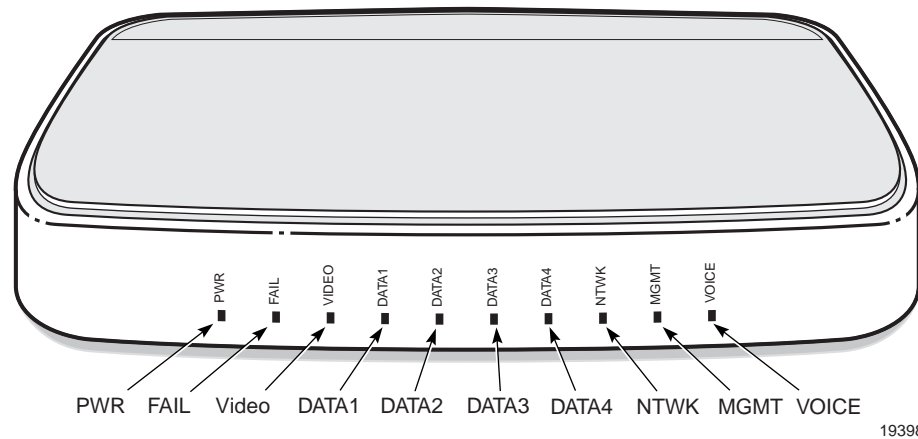
Table 13-5 lists I-241G-A indoor ONT LEDs

Table 13-5 I-241G-A indoor ONT LEDs

Indicator	LED color and behavior	LED behavior description
PWR	Off Green solid	Not powered 3.3 V dc power is available
FAIL	Off Red solid	Equipment is 100% operational Equipment failure or ONT not ranged/synchronized
RF TV[1]	Off Red solid	Video signal is not provisioned, or is above the acceptable level Video signal is provisioned and below acceptable level
DATA1	Off Green solid Green flashing	Ethernet 0 link failure Ethernet 0 link is good Ethernet 0 link is in Tx/Rx activity
DATA2	Off Green solid Green flashing	Ethernet 1 link failure Ethernet 1 link is good Ethernet 1 link is in Tx/Rx activity
DATA3	Off Green solid Green flashing	Ethernet 2 link failure Ethernet 2 link is good Ethernet 2 link is in Tx/Rx activity
DATA4	Off Green solid Green flashing	Ethernet 3 link failure Ethernet 3 link is good Ethernet 3 link is in Tx/Rx activity
NTWK	Off Green solid	1490 nm data path is unavailable 1490 nm data path is available
MGMT	Off Green solid Green flashing	No communication between P-OLT and the ONT Full communication between P-OLT and the ONT ONT is disabled
When device is not connected to the PON		

(1 of 2)

Indicator	LED color and behavior	LED behavior description
VOICE [2]	Off	No SLID activity and all phones on-hook
	Green flashing periodic	SLID input mode
	Green flashing patterned	Provisioned SLID in SLID output mode
When device is connected to the PON		
VOICE	Off	All phones are on-hook, POTS is not provisioned, or no phones connected
	Green solid	Any customer is off-hook

(2 of 2)

Notes
[1]   The RF TV LED is only functional for RF video-equipped ONTs.
[2]   See SLID and LED behavior for a description of SLID output mode LEDs.

Table 13-6 lists the RJ-45 LEDs on I-241G-A indoor ONTs.

Table 13-6 I-241G-A indoor ONT RJ-45 LEDs

Indicator [1]	LED color and behavior	LED behavior description
LINK	Off	Link not detected
	Green solid	Link active
	Green flashing	Link detected and activity present
MODE	Off	10 Mb/s operation
	Green solid	100 Mb/s operation
	Green flashing	1000 Mb/s operation

Note
[1]   LINK and MODE LEDs are reversed on the I-240G-A and I-241G-A

13.6   I-241G-A detailed specifications

Table 13-7 lists the physical specifications for I-241G-A indoor ONTs.

Table 13-7 I-241G-A indoor ONT physical specifications

Dimensions	Specifications
Length	8.2 in. (20.8 cm)
Width	5.6 in. (14.3 cm)
Height without cable tray	1.3 in. (3.3 cm)
Height with cable tray	1.9 in. (4.8 cm)
Weight without cable tray [within $\pm$ 0.5 lb (0.23 kg)]	1.25 lb (0.57 kg)
Weight with cable tray [within $\pm$ 0.5 lb (0.23 kg)]	1.41 lb (0.64 kg)

Table 13-8 lists the power consumption specifications for I-241G-A indoor ONTs.

Table 13-8 I-241G-A indoor ONT power consumption specifications

Mnemonic	Maximum power (Not to exceed)	Condition	Minimum power	Condition
I-241G-A	13 W	2 POTS off-hook, 4 Gig-E, Video operational	6.5 W	2 POTS on-hook, other interfaces/services not provisioned

Table 13-9 lists the environmental specifications for I-241G-A indoor ONTs.

Table 13-9 I-241G-A indoor ONT environmental specifications

Mounting method	Temperature range and humidity	Altitude
Indoor 10/100/1000Base-T Gigabit Ethernet ONTs (I-241G-A)		
Desk or wall mounted	Operating: 32°F to 104°F (0°C to 40°C) ambient temperature 5% to 85% relative humidity, non-condensing Maximum rate of temperature change is 32.9°F (0.5°C) per hour	Maximum operating altitude is 10 000 ft (3048 m) above mean sea level
	Storage: -13°F to 133°F (-25°C to 55°C) 5% to 93% relative humidity, non-condensing	Maximum non-operating altitude is 40 000 ft (12 192 m) above mean sea level

Table 13-10 lists RF video interface specifications for I-241G-A indoor ONTs.

Table 13-10 I-241G-A ONT RF video interface specifications

RF video features	Channel mix 80 analog/33 digital [1]	Channel mix 40 analog/63 digital	Channel mix 0 analog/135 digital
RF output level	+18 dBmV @ 450 MHz using a per analog channel measurement	+18 dBmV @ 450 MHz using a per analog channel measurement	+12 dBmV @ 450 MHz using a per digital channel measurement
RF slope correction (tilt)	2 dB from 50 to 870 MHz	2 dB from 50 to 870 MHz	2 dB from 88 to 870 MHz
Optical power range	+1 to -6 dB	+2 to -7 dB	+1 to -9 dB
CNR	45 dB	46 dB	—
CSO/CTB	53 dB	55 dB	—
MER	32 dB	32 dB	32 dB
QAM signal-to-noise ratio	40 dB	40 dB	40 dB
Measurement assumptions			
Channel load	80 analog and 33 digital	40 analog and 63 digital	0 analog and 135 digital

(1 of 2)

RF video features	Channel mix 80 analog/33 digital [1]	Channel mix 40 analog/63 digital	Channel mix 0 analog/135 digital
Digital backoff QAM-256	6 dB	6 dB	6 dB
Digital backoff QAM-64	10 dB	10 dB	10 dB
PON input CNR	52 dB	52 dB	52 dB

(2 of 2)

Note

[1] It is the responsibility of the customer installation crew to ensure proper on-site layout of video distribution by verifying that the output power at the end devices, such as the TV, VCR, and STB, is between 0 to 18 dBmV.

13.7 I-241G-A GEM ports and T-CONTs

Table 13-11 lists the maximum number of supported T-CONTs and GEM ports. Not all ONTs will be supported in all of the releases indicated the table. See the appropriate release Customer Release Notes for the most accurate list of supported devices.

Table 13-11 I-241G-A indoor ONTs capacity for GEM ports and T-CONTs per package and release

ONT or MDU	Release	Maximum	Notes
Package A ONTs			
GEM ports per indoor or outdoor ONT	All	20	22 are present: 20 are available, 2 are reserved for OMCI and debugging
T-CONTs per indoor or outdoor ONT	All	21	22 are present: 21 are available, 1 is reserved for OMCI

13.8 I-241G-A power support

The following power supply supports the I-241G-A indoor ONT. Click on the link for more information.

- Emerson 24 W AC/DC switching power adapter unit data sheet

13.9 I-241G-A functional blocks

Table 13-12 describes the supported interfaces for I-241G-A indoor ONTs.

13-8

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Table 13-12 I-241G-A indoor ONT interfaces

ONT category description	Interface capacity				
	POTS ports	Ethernet ports	RF video connectors	POTS/ VDSL2 / 10/100/1000 BASE-T Ethernet connectors	DS1/E1
Single-residence indoor ONTs (I-241G-A)	2	4	1	0	0

ONT SoC technology is an integrated system that provides the GPON, voice, and data (including IP video) subsystems. It provides two key connection functions: connecting the ONT to the GPON and the connecting the ONT to subscriber equipment. The voice subsystem supports RJ-11 ports, and the data and IP video subsystems support RJ-45 ports. The ONT connects to the GPON using a optical connector.

The GPON connection performs a GPON transmission convergence (TC) layer function. The GPON signal from the P-OLT terminates at a diplexer. The diplexer is an optical module that performs optical and electrical conversion. The diplexer interfaces with the GPON MAC on the SoC. Figure 13-3 shows an ONT with a diplexer, four POTS, and two Ethernet ports.

Figure 13-3 ONT with a diplexer
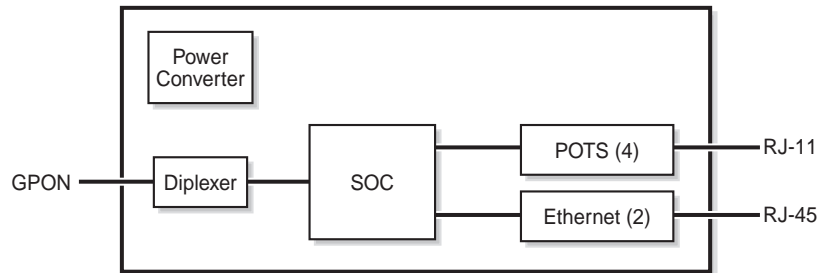
18783

ONT SoC technology serves as the main hardware block for the I-241G-A indoor ONTs; see Figure 13-4.

Figure 13-4 I-241G-A ONT hardware block
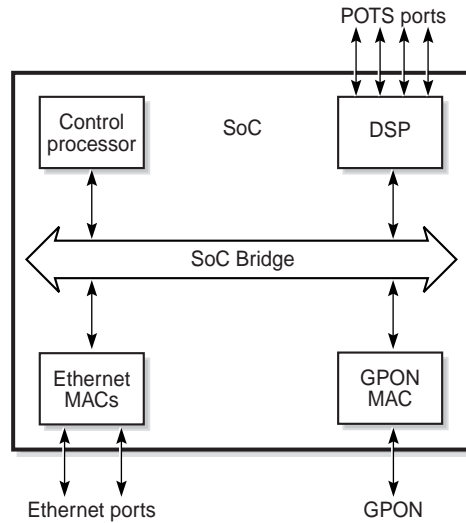
ONT SoC technology consists of five key elements:

* GPON MAC

  The GPON MAC element on the SoC provides the GPON interface to the TC layer via the optical diplexer or triplexer (if using RF video). This interface supports the FSAN standards compliant GEM mode transport and provides AES, FEC, and data fragmentation functionality over the GPON as described in G.984.3 (GPON TC Layer) ITU specification.

* Ethernet MAC

  The SoC provides an Ethernet PHY device (either 10/100BaseT or 10/100/1000BaseT) between the GMII interface and the RJ-45 port.

* Digital Signal Processor (DSP) interface

  The DSP provides voice processing and has a TDM interface to the CODEC/SLIC devices.

* control processor

  The control processor manages functions related to OMCI, IGMP, VoIP, and Ethernet services.

* SoC bridge

  The SoC bridge provides an integrated data channel between the Ethernet MAC, the GPON MAC, the DSP, the control processor, and the other integrated elements such as flash memory, SDRAM, the local bus controller, and the DUART interface to the craft port if used.

These ONTs can also interact with additional hardware components to support functionality not provided by SoC technology. For example, MoCA and CES functionality require additional hardware support.

13.10 I-241G-A standards compliance

The I-241G-A indoor ONT is compliant with the following standards:

- G.983.2 (revised) support for OMCI interface for ONT management and provisioning
- G.984.3 support for Dynamic Bandwidth Allocation (DBA)
- G.984.3 support for Advanced Encryption System (AES) with operator enable/disable per port-ID level
- G.984.3 support for Forward Error Correction (FEC) in both upstream and downstream directions
- G984.4 (standard and revised) support for OMCI interface for ONT management and provisioning

13.11 I-241G-A special considerations

Upgrade considerations and limitations

Existing ONTs that use 7342 ISAM FTTU releases older than R04.06.xx and R04.07.xx must be upgraded to use R04.00.10 software while assigned to a PON ID value smaller than 64. For this purpose, if split ratios larger than 1:64 are being deployed, you may choose to set aside the first PON ID as a staging point.

I-241G-A ONT considerations and limitations

Table 13-13 lists the considerations and limitations for I-241G-A indoor ONTs.

Table 13-13 I-241G-A ONT considerations and limitations

| Considerations and limitations |
| --- |
| No support for per VLAN protocol downstream tagging mode |
| In SVLAN cross-connect tunnel mode:
• use non-overlapping pbits since the use of the same pbits on two or more VLAN ports results in a mismatch alarm
• downstream frames sent with a single tag normally sent out on the user-side as untagged, will instead be sent as priority tagged |
| When using CVLAN translation, or when the same queue is used for multiple pbits, the highest pbit value in the queue in the downstream direction will be selected to stomp the pbit in the packet |
| Simultaneous configuration of a CVLAN port and an S-Tunnel on the same UNI will only be supported if these services are provisioned with non-overlapping pbits |
| The same VLAN port must be used when employing both protocol-based VLAN for PPPoE and IPoE-based VLANs |
| When the VLAN is translated, the pbit value must be modified and the highest pbit value is mapped to that GEM port |
| When more than one Ethernet port is in VLAN translation mode, or set to flexible mode with IGMP channels created, the USERSIDE VLAN IDs of those services are different. All downstream multicast packets will be tagged on the UNI port with VLAN ID of 4094 |
| Maximum use of multicast on 1 Ethernet port at a time |

(1 of 2)

Considerations and limitations
For C forwarder and S+C CC forwarder, if the VLAN port uses regenerated profiles or regenerated pbits, then the downstream traffic can only flow with the derived pbits
When either tip or ring is grounded, DGNONTPOTS tip to ground and ring to ground restrictive measurements are simultaneously reported as 0 ohms

(2 of 2)

In order to provide four GE ports on the I-241G-A indoor ONT, an Ethernet switch has been added between the SoC and the Ethernet ports; See Figure 13-5. The Ethernet switch provides the following features:

- IGMP packet replication for multicast channels
- internal VLAN tagging to direct traffic to appropriate ports and priority queues

Figure 13-5 Ethernet switch
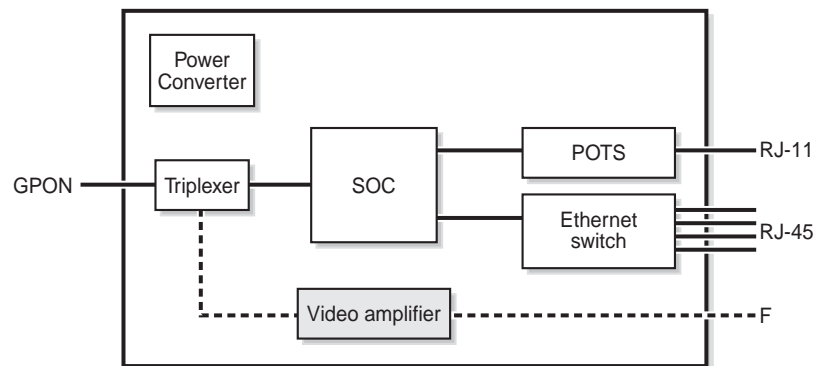
19394

Note — The RF video amplifier is integrated with the triplexer. It is shown split-out in Figure 13-5 to illustrate the functionality.

IGMP packet replication allows the I-241G-A to support IPTV on all four Ethernet channels at the same time. Internal VLAN tagging allows traffic to be routed and prioritized between the two Ethernet MACs on the SoC and the Ethernet switch and the appropriate subscriber RJ-45 ports.

Downstream multicast traffic received on a user side C-VLAN tagged port will use VLAN ID 4094 and have a P-bit value of 6.

The I-241G-A ONTs do not support downstream priority-tagged traffic on their ONT UNIs. Priority-tagged frames are dropped. When an unstacked VLAN is provisioned on the ONT UNI, downstream traffic that is single tagged is dropped.

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The new Ethernet switch functional block and the additional Ethernet switch features have modified certain VLAN tagging and priority queuing behaviors. The following sections describe these modifications.

> **Note 1** — Due to certain Ethernet switch restrictions, the I-241G-A provides up to 4 IP, 4 MAC, or 2 pairs of MAC/IP based anti-spoofing (static only). MAC, IP, and MAC/IP anti-spoofing only works on both IPoE packets.
>
> **Note 2** — Congestion may occur if Ethernet ports 1 and 2 or ports 3 and 4 are each set to 1000Base-T and are being used simultaneously. See the *ONT Customer Release Notes* for this product for throughput details.

VLAN tagging behavior

Before traffic can be routed to and from the I-241G-A ONT the following conditions must be met:

- The CVLAN ID of any HSI service cannot be 0.
- Default P-bits must be configured on each Ethernet port.

  This can be configured using the ENT-QOS-MARKPROF command. See the appropriate P-OLT Operations and Maintenance Procedure Guide for more information.

- When port-to-port communication is disabled, a default C-VLAN must be created for each Ethernet port. The VLAN must be unique for Ethernet port 1 and 2 or 3 and 4 on the ONT. The C-VLAN packet received at the ONT must be the same as the default C-VLAN or the packet is dropped. When port-to-port communication is enabled, each of the four Ethernet ports must have an unique C-VLAN. The default VLAN can be configured using the CVLANDEF parameter.
- DSCP to 1P mapping rules are reduced from 64 to 8 with only the highest 3 bits of the DSCP area used to determine P-bit value; see Table 13-14.

  This can be configured using the ENT-PROFILE-DSCPBITMAP command. See the appropriate P-OLT Operations and Maintenance Procedure Guide for more information.

Table 13-14 Default DSCP to P-bit mapping

DSCP	P-bit [1]
0 to 7	x
8 to 15	x
16 to 23	x
24 to 32	x
33 to 40	x
41 to 47	x
48 to 55	x
56 to 63	x

Note
(1) Where x is a number from 0 to 7.

All VLAN tagging behavior operates as described in the appropriate P-OLT system documentation except as indicated in the following sections.

Upstream traffic handling (trusted and untrusted)

Table 13-15 describes upstream VLAN tagging and P-bit allocation from trusted and untrusted traffic.

Table 13-15 Upstream untrusted and trusted tagging behavior

Traffic source	Traffic type	Ethernet switch behavior
Untrusted	Untagged packets	Default C-VLAN and P-bits are added to the packets.
	P-bit tagged packets	Default C-VLAN is added to the packets. P-bits are overwritten.
	P-bit and C-VLAN tagged packets	Received C-VLAN and P-bits are overwritten.
Trusted	Untagged packets	Default C-VLAN and P-bits are added to the packets.If the packets are IP, the DSCP to P-bits mapping is used. If the packets are PPPoE, the default P-bits are used.
	P-bit tagged packets	Received P-bits are overwritten with default C-VLAN. P-bits are unchanged.
	P-bit and C-VLAN tagged packets	Received C-VLAN must match default VLAN or the packet is dropped. P-bits are unchanged.

Downstream traffic handling (strip tag and tag through)

Table 13-16 describes downstream VLAN tagging behavior for strip tag and tag through modes.

Table 13-16 Downstream untrusted and trusted tagging behavior

Traffic mode	Traffic type	Transmitted to ONT port as
Strip tag	Untagged packets	Untagged packet.
	P-bit tagged packets	Untagged packet.
	C-VLAN tagged packets	Untagged packet.
Tag through	Untagged packets	Untagged packet.
	P-bit tagged packets	Default C-VLAN is added and the maximum number of P-bits will be accepted.
	C-VLAN tagged packets	Default C-VLAN overwrites the received C-VLAN and the maximum number of P-bits will be accepted.

VLAN translation traffic handling

VLAN translation is a feature that allows that ONT to translate a C-VLAN into another C-VLAN. A network (NW) C-VLAN is used when data is sent over the GPON network, and a user network interface (UNI) side C-VLAN is used when data is sent to customer equipment.

When using VLAN translation, the use the following configuration rules:

- Only a single UNI/NW C-VLAN pair is allowed per service.
- Overlapping P-bits can be used for difference services on UNI. However, in VLAN pass-tru mode, the same P-bits as other services cannot be used on the UNI. Overlapping P-bits are allowed only for non-default services.

Table 13-17 describes upstream VLAN tagging and P-bit allocation in VLAN translation mode.

Table 13-17 Upstream VLAN translation mode

Traffic mode	Traffic type	Ethernet switch behavior
VLAN translation	Untagged packets	Default C-VLAN and P-bits are added to the packets.If the packets are IP, the DSCP to P-bits mapping is used. If the packets are PPPoE, the default P-bits are used. The C-VLAN and derived P-bits are now considered the UNI side C-VLAN. Received UNI C-VLAN and P-bits must match NW C-VLAN configure P-bits or the packet is dropped.
	P-bit and C-VLAN tagged packets	Received UNI C-VLAN and P-bits must match NW C-VLAN configure P-bits or the packet is dropped.

Table 13-18 describes downstream VLAN tagging behavior for VLAN translation.

Table 13-18 Downstream VLAN translation behavior

Traffic mode	Traffic type	GPON behavior	Ethernet switch behavior
VLAN translation	Tagged packets	Only accepts VLAN tagged traffic that matches the network VLAN ID configured using the ENT-SERVICE-HSI TL1 command. All non matching VLAN IDs are dropped. Only one service is allowed per VLAN.	The Ethernet switch converts the network VLAN ID to the user side VLAN ID and forwards the packet to the appropriate port.

Ethertype classification and Ethertype with VLAN translation

Ethertype classification is used to classify traffic in the upstream direction based on the Ethernet type (IPoE or PPPoE). Ethertype classification operates as normal except that the received C-VLAN must match the default C-VLAN configured at the ONT or the packet is dropped.

Ethertype classification may also be used in conjunction with VLAN translation. All the considerations described in the VLAN translation section apply with the additional that the received C-VLAN and Ethertype must match the default NW C-VLAN an Ethertype or the packet is dropped.

See the appropriate P-OLT system Product Information Manual for more information on Ethertype classification.

NTP 121 — Install an I-241G-A indoor ONT

Purpose

This NTP provides the steps to install an I-241G-A indoor ONT.

General

The DLPs listed in this NTP describe the steps to install an I-241G-A indoor ONT.

Prerequisites

See the listed DLPs for prerequisites.

Recommended tools

You need the following tools for the installation:

- #2 Phillips screwdriver
- 1/4 in. (6 mm) flat blade screwdriver
- wire strippers
- fiber optic splicing tools
- RJ-45 cable plug crimp tool
- voltmeter or multimeter
- optical power meter
- wall mounting template
- drill and drill bits

Safety information

Read the following safety information before installing the unit.

Danger 1 — Always contact the local utility company before you connect the enclosure to the utilities.

Danger 2 — Observe the local and national laws and regulations that may be applicable to this installation.

Warning — This equipment is ESD sensitive. Proper ESD protections should be used when removing the fiber access cover of the indoor ONT.

Caution — Keep indoor ONTs out of direct sunlight. Prolonged exposure to direct sunlight can damage the unit.

Note — Observe the following:

- The indoor ONT should be installed in accordance with the applicable requirements of the NEC or CEC. Local authorities and practices take precedence when there is conflict between the local standard and the NEC or CEC.
- The indoor ONT must be installed by qualified service personnel only.
- Indoor ONTs must be installed with cables that are suitably rated and listed for indoor use.

Procedure

Use this procedure to install an I-241G-A indoor ONT.

1 Prepare the cables at the site where the ONT will be installed (DLP 100).

2 Review the connection locations shown in Figure NTP 121-1.

Figure NTP 121-1: I-241G-A indoor ONT connections

Video coaxial   RJ-11 phone   Ethernet   Fiber optic   Power
connector   connectors   ports   port   connection

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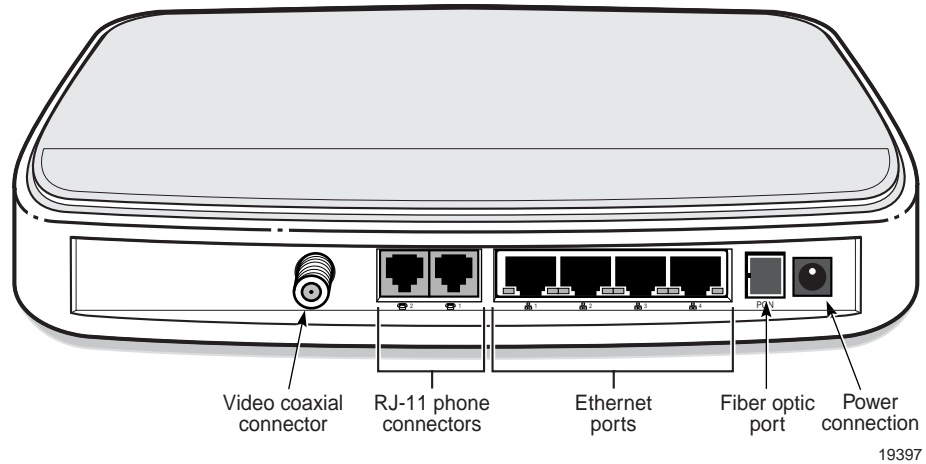
3   Place the indoor ONT unit:

    a   On the flat surface, such as a desk, horizontally resting on its four plastic feet; go to step 4.

    b   In the stand mount (3FE 60673 AA).

        i   Place the stand mount on the flat surface.

        ii   Slide the ONT into the opening on the stand mount, ensuring it is securely held. Figure NTP 121-2 shows the stand mount.

Figure NTP 121-2: ONT in a stand mount

EQPT
PON
MGMT
Data 2
Data 1
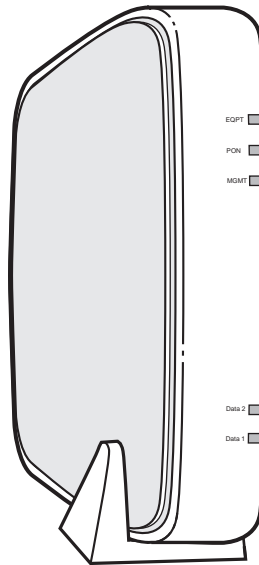
19660

      iii   Go to step 4.

  c   In the wall mount bracket.

      i   Measure and drill two holes in the wall where the ONT will be mounted. The holes should be the same distance apart as the holes on the wall mounting bracket (83.3 mm apart, or 3.28 in).

      ii   Place mounting screws or bolts in the wall.

      iii   Lay the mounting bracket flat on a table.

      iv   Slide the ONT down over the mounting bracket until the fiber optic port is directly in front of the fiber optic port cable lead, as shown in Figure NTP 121-3.

Figure NTP 121-3: I-24x ONT with wall mounting bracket
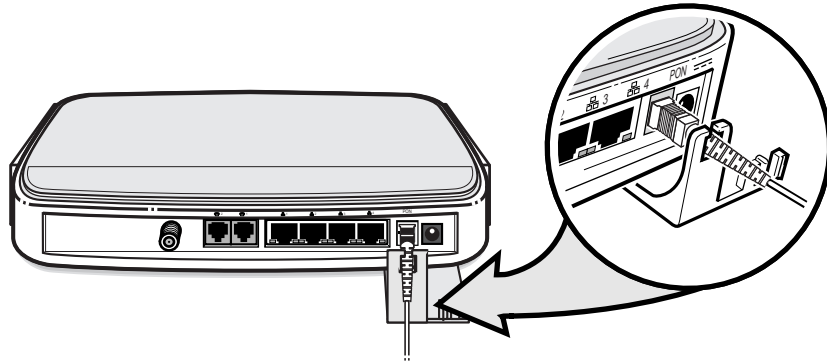
19814

v   Mount the ONT on the pre-installed screws or bolts in the bracket mounting holes. Ensure the ONT is firmly held in place by the bracket and is firmly secured to the wall.

4   Install the AC power converter and connect the power cable to the ONT (DLP 105).

5   Connect the Ethernet, POTS, and coaxial cables (DLP 101, DLP 115, and DLP 111).

6   If used, configure the SLID (DLP 121).

7   Connect the fiber optic cable (DLP 117).

8   Verify the ONT LEDs (DLP 119).

9   Activate and test the services (DLP 120).

10   STOP. This procedure is complete.

NTP 122 — Replace an I-241G-A indoor ONT

Purpose

This NTP provides the steps to replace an I-241G-A indoor ONT.

General

The DLPs listed in this NTP describe mounting and cabling for the I-241G-A indoor ONT.

Prerequisites

See the listed DLPs for prerequisites.

Recommended tools

You need the following tools for replacing the ONT:

* #2 Phillips screwdriver
* 1/4 in. (6 mm) flat blade screwdriver
* wire strippers
* fiber optic splicing tools
* RJ-45 cable plug crimp tool
* voltmeter or multimeter
* optical power meter
* wall mounting template
* drill and drill bits

Safety information

Read the following safety information before installing the unit.

Danger 1 — Always contact the local utility company before you connect the enclosure to the utilities.

Danger 2 — Observe the local and national laws and regulations that may be applicable to this installation.

Warning — This equipment is ESD sensitive. Proper ESD protections should be used when removing the fiber access cover of the indoor ONT.

Caution — Keep indoor ONTs out of direct sunlight. Prolonged exposure to direct sunlight can damage the unit.

Note — Observe the following:

- The indoor ONT should be installed in accordance with the applicable requirements of the NEC or CEC. Local authorities and practices take precedent when there is conflict between the local standard and the NEC or CEC.
- The indoor ONT must be installed by qualified service personnel.
- Indoor ONTs must be installed with cables that are suitably rated and listed for indoor use.

Procedure

Use this procedure to replace an I-241G-A indoor ONT.

1   Deactivate the ONT services (DLP 123). If you are using the SLID feature, this step is not required. The ONT and the services can remain in service (IS).

2   At the subscriber site, locate the indoor ONT and disconnect the power, RF video, phone, Ethernet and fiber optic cables; see Figure NTP 122-1.

NTP 122-2

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Figure NTP 122-1: Indoor ONT connections

Video coaxial connector RJ-11 phone connectors Ethernet ports Fiber optic port Power connection

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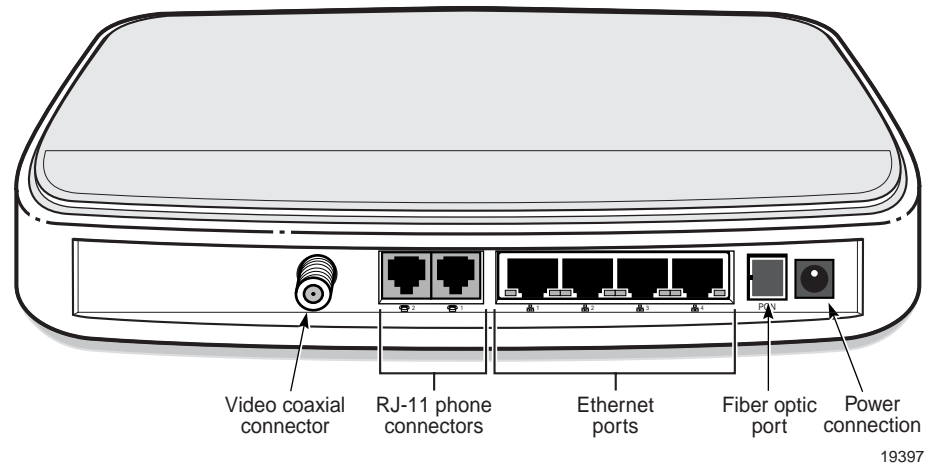
3 Replace the indoor ONT with a new unit.

4 Connect the power, RF video, phone, and Ethernet connections to the ONT (DLP 101, DLP 105, DLP 111, and DLP 115).

5 Connect the power cable to the ac outlet.

6 If used, configure the SLID (DLP 121).

Note — A new SLID or the old SLID may be used with the replacement ONT. If a new SLID is used, the new SLID must also be programmed at the P-OLT using TL1 or a network manager. If the old SLID is used, no changes need to be made at the P-OLT; see the appropriate P-OLT Operations and Maintenance Procedures Guide for more details.

7 If required, have approved service personnel who are trained to work with optic fiber clean the fiber optic connection. See DLP 126 for more information about fiber optic handling, inspection, and cleaning.

Danger — Fiber optic cables transmit invisible laser light. To avoid eye damage or blindness, never look directly into fibers, connectors, or adapters.

8 Make the fiber optic connection using the fiber optic port shown in Figure NTP 122-1.

Warning — Be careful to maintain a bend radius of no less than 1.5 inches (3.8 cm) when connecting the fiber optic cable. Too small of a bend radius in the cable can result in damage to the optic fiber.

9 Verify the ONT LEDs, voltage status, and optical signal levels (DLP 119).

10 Activate and test the services (DLP 120).

11 STOP. This procedure is complete.

NTP 123 — Configure an I-241G-A indoor ONT

General

Please refer to the OLT *Operations and Maintenance using TL1 and CLI* guide for the software configuration procedure for I-241G-A indoor ONTs.

For HTTP configuration procedures, please refer to chapter 5, ONT management using an ONT interface.

I-240G-B, I-241G-B

14 — I-240G-B and I-241G-B unit data sheet

NTP 124 — Install an I-240G-B or I-241G-B indoor ONT

NTP 125 — Replace an I-240G-B or I-241G-B indoor ONT

NTP 126 — Configure an I-240G-B or I-241G-B indoor ONT

14 — I-240G-B and I-241G-B unit data sheet

14.1   I-240G-B and I-241G-B part numbers and identification

Table 14-1 provides identification information about I-240G-B and I-241G-B indoor ONTs.

Table 14-1 I-240G-B and I-241G-B part numbers and identification

Part number	Mnemonic [1]	Description	CLEI	CPR	ECI/Bar code
3FE 51880 AB	I-240G-B	GPON I-series ONT unit, version B, 2 POTS and 4 Ethernet interfaces.	–	–	–
3FE 51880 AA	I-241G-B	GPON I-series ONT unit, version B, 2 POTS, 4 Ethernet, and 1 RF video interfaces.	–	–	–

Note
[1]   See Chapter 2 Part numbers, ordering, and deployment configuration overview for ordering information.

14.2   I-240G-B and I-241G-B general description

I-240G-B and I-241G-B indoor ONTs provide a subscriber interface for the system. The ONT terminates the PON interface and converts it to user interfaces that directly connect to subscriber devices. The ONT is compatible with all existing subscriber equipment, including analog phones with both tone and rotary dial capabilities, cordless phones, modems, fax machines, and caller ID boxes (Type I, Type II, and Type III).

The I-240G-B and I-241G-B indoor ONTs are not temperature hardened. These ONTs are intended for indoor deployment only and can be installed vertically or horizontally on a flat surface as well as attached to a wall.

These ONTs provide the following functions:

- network demarcation for all services
- voice interworking function from the analog POTS lines to the VoIP/Ethernet layers
- interworking functions between the GEM and Ethernet layers
- mux and demux functions to the PON
- optical to electrical conversion
- optics that support received signal strength indication (RSSI)
- G984.4 standard and revised compliant OMCI interface for ONT management and provisioning

Other features of I-240G-B and I-241G-B indoor ONTs include:

- a removable fiber access tray for storing excess cable
- an ON/OFF power switch for manual shut down when needed
- a reset button located on the base of the ONT

Note — The maximum supported capacity for downstream data traffic for the I-240G-B indoor ONT is 1 Gb/s. This supported capacity is constant whether one or more Ethernet ports are used. If you use one Ethernet port, the entire 1 Gb/s throughput travels on that port, while, if you use two or more Ethernet ports, the 1 Gb/s capacity is divided among the ports.

14.3 I-240G-B and I-241G-B software and installation feature support

Table 14-2 provides a list of software-based features for I-240G-B and I-241G-B indoor ONTs.

Table 14-2 I-240G-B and I-241G-B indoor ONT software feature support

Features	Chapter	Cross reference for more information
General ONT and MDU overview	ONT and MDU overview	ONT and MDU general descriptions of features and functions
Service interface specifications	ONT and MDU general and interface technical specifications	Ethernet interface specifications POTS interface specifications • Coaxial connectivity in the home and design guidelines • Configuration recommendations
Services supported	—	See the appropriate P-OLT user documentation for service creation procedures and descriptions.
RSSI specifications	ONT and MDU general and interface technical specifications	RSSI specifications
Wi-Fi specifications	—	—
Optical budget	ONT and MDU general and interface technical specifications	ONT optical budget
Location and installation options	How to install, replace, and configure an I-240G-B or I-241G-B ONT	Install an I-240G-B or I-241G-B indoor ONT Replace an I-240G-B or I-241G-B indoor ONT
HTTP management	—	ONT management using an ONT interface
Statistics and performance monitoring	ONT and MDU statistics and performance monitoring	Supported performance monitoring counters per package type of ONT
Supported UPS configurations	Part numbers, ordering, and deployment configuration overview	ONT and MDU to UPS or power adapter compatibility support

14.4 I-240G-B and I-241G-B interfaces and interface capacity

Table 14-3 describes the supported interfaces for I-240G-B and I-241G-B indoor ONTs.

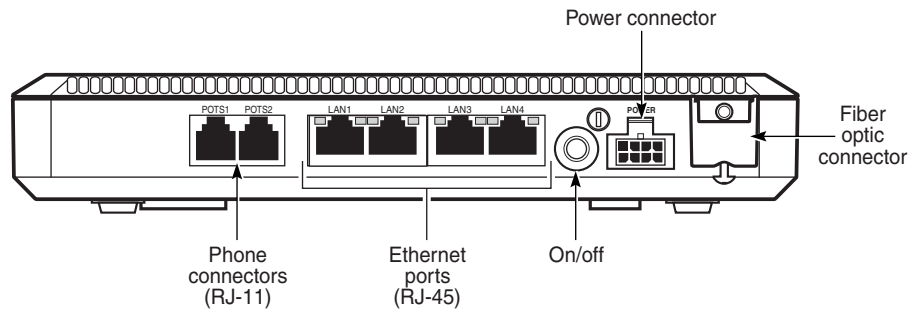### Table 14-3 I-240G-B and I-241G-B indoor ONT interfaces

ONT category description	Interface capacity				
	POTS ports	Ethernet ports	VDSL2 interfaces	MoCA interface	RF Video interface
Single-residence Gigabit Ethernet ONTs with or without POTS and RF video (I-240G-B and I-241G-B indoor ONTs)	2	4	0	0	0/1

I-240G-B and I-241G-B connections and components

Figures 14-1 and 14-2 show the I-240G-B and I-241G-B indoor ONT physical connections.

Figure 14-1 I-240G-B indoor ONT connections

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Figure 14-2 I-241G-B indoor ONT connections
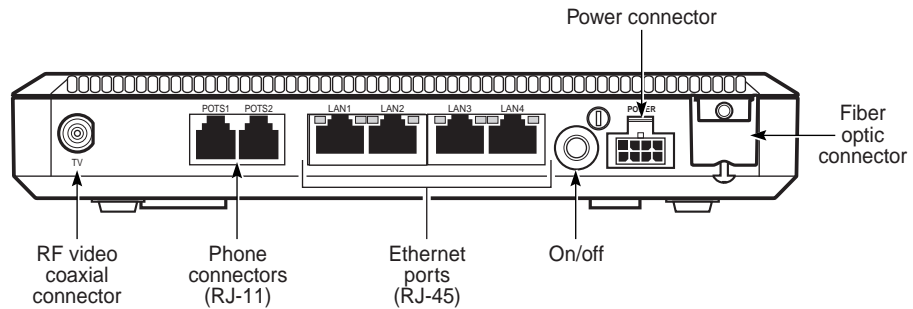
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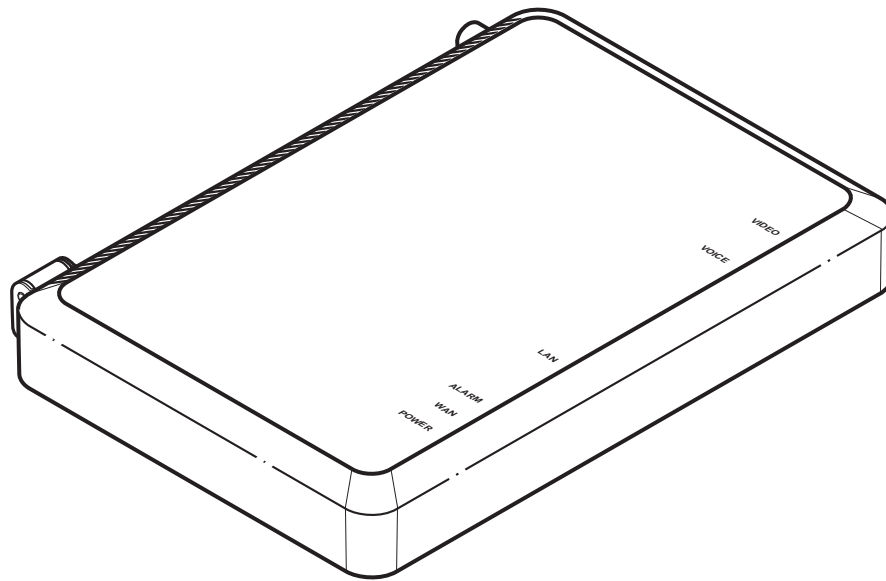Table 14-4 describes the I-240G-B indoor ONT physical connections.

Table 14-4 I-240G-B, and I-241G-B indoor ONT physical connections

Connection	Description
POTS	This connection is provided through RJ-11 ports.
Ethernet ports	This connection is provided through Ethernet RJ-45 cables. Four Ethernet connections are supported.The Ethernet ports can support both data and in-band video services on all four interfaces.
Power	This connection is provided through a power cable with a Molex connector to the power connector.
Fiber optic	This connection is provided through a SC/APC fiber optic cable and connector.
I-241G-B indoor ONT only	
RF video coaxial	This connection is provided through a Type F coaxial connector.

14.5   I-240G-B and I-241G-B LEDs

Figure 14-3 shows the I-240G-B and I-241G-B indoor ONT LEDs.

Figure 14-3 I-240G-B and I-241G-B indoor ONT LEDs

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Table 14-5 lists and describes the I-240G-B and I-241G-B indoor ONT LEDs.

Table 14-5 I-240G-B and I-241G-B indoor ONT LEDs descriptions

Indicator	LED color and behavior	LED behavior description
POWER	Off Green Green flashing Red	No power Operating on ac power ONT is starting up Operating on battery backup power
WAN	Green Green flashing Red Orange Orange flashing	PON is connected and operating properly Software downloading PON not connected but ONT has power ONT ranged but OMCI not established ONT is ranging
ALARM	Off Red Red flashing	ONT is operating without failure ONT operation failure (not ranged) ONT software failure
LAN 1 to 4	Off Green Green flashing Orange/Red flashing Orange	Not provisioned or no Ethernet connection 10/100 link detected 10/100 link has data activity 1000 link has data activity 1000 link detected
VOICE	Off Green solid	No POTS provisioned (all phones are on-hook or no phones connected) One or more phones is off-hook
I-241G-B indoor ONT only		
VIDEO	Off Red	Normal operation Service provisioned and optical power too low

Table 14-6 lists and describes the I-240G-B and I-241G-B indoor ONT RJ-45 LEDs.

Table 14-6 I-240G-B and I-241G-B Indoor ONT RJ-45 LEDs

Indicator	LED color and behavior	LED behavior description
LINK	Off Green solid Green flashing	Link not detected Link active Link detected and activity present
MODE	Off Green solid	10 and 100 Mb/s operation 1000 Mb/s operation

14.6   I-240G-B and I-241G-B detailed specifications

Table 14-7 lists the physical specifications for I-240G-B and I-241G-B indoor ONTs.

Table 14-7 I-240G-B and I-241G-B indoor ONT physical specifications

Dimensions	Specifications
Height	5.4 in. (13.7 cm)
Width	4 in. (10.2 cm)
Depth (excluding fiber storage tray)	1.3 in. (3.3 cm)
Weight [within ± 0.5 lb (0.23 kg)]	1.25 lb (0.57 kg)

Table 14-8 lists power consumption specifications for I-240G-B and I-241G-B indoor ONTs.

Table 14-8 I-240G-B and I-241G-B indoor ONT power consumption specifications

Mnemonic	Maximum power (not to exceed)	Condition	Minimum power	Condition
I-240G-B	7.75 W	2 POTS off-hook, 4 Gig-E operational	4.75 W	2 POTS on-hook, other interfaces/services not provisioned
I-241G-B	10 W	2 POTS off-hook, 4 Gig-E, Video operational	4.75 W	2 POTS on-hook, other interfaces/services not provisioned

Table 14-9 lists the environmental requirements for I-240G-B and I-241G-B indoor ONTs.

Table 14-9 I-240G-B and I-241G-B indoor ONT environmental requirements

ONT type		
Mounting method	**Temperature range and humidity**	**Altitude**
Desk or wall mounted	Operating: 32°F to 104°F (0°C to 40°C) ambient temperature 5% to 85% relative humidity, non-condensing Maximum rate of temperature change is 32.9°F (0.5°C) per hour	Maximum operating altitude is 10 000 ft (3048 m) above mean sea level
	Storage: -13°F to 133°F (-25°C to 55°C) 5% to 93% relative humidity, non-condensing	Maximum non-operating altitude is 40 000 ft (12 192 m) above mean sea level

14.7 I-240G-B and I-241G-B GEM ports and T-CONTs

Table 14-10 lists the maximum number of supported T-CONTs and GEM ports for I-240G-B and I-241G-B indoor ONTs. Not all ONTs will be supported in all of the releases indicated the table. See the appropriate release Customer Release Notes for the most accurate list of supported devices.

Table 14-10 I-240G-P and I-241G-B indoor ONT capacity for GEM ports and T-CONTs per package and release

ONT or MDU	Release	Maximum	Notes
Package B ONTs			
GEM ports per indoor or outdoor ONT	All	30	32 are present: 30 are available, 2 are reserved for multicast and debugging
T-CONTs per indoor or outdoor ONT	All	31	32 are present: 31 are available, 1 is reserved for OMCI

14.8 I-240G-B and I-241G-B power support

The following power supplies support the I-240G-B and I-241G-B indoor ONTs. Click on the link for more information.

- Delta DUPS-1215 UPS unit data sheet
- Emerson 24 W AC/DC switching power adapter unit data sheet

14.9 I-240G-B and I-241G-B functional blocks

POTS and RF video ports may or may not be available in addition to Ethernet ports. These ONTs transmit Ethernet packets to four RJ-45 Ethernet ports, and voice traffic to two RJ-11 POTS ports and RF video traffic to one F-type coaxial connector. These ONTs also feature fiber optic and power connectors.

Figure 14-4 shows the functional blocks for an indoor ONT with Gigabit Ethernet, POTS, and coaxial ports. For those ONTs with less than the maximum number of Gigabit Ethernet or POTS ports, the excess ports are blocked by a plastic cover.

Figure 14-4 Single-residence Gigabit Ethernet ONT with POTS and RF video
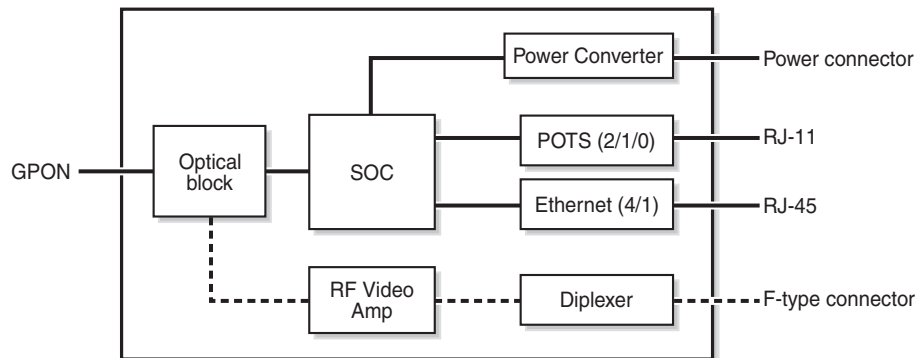
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14.10   I-240G-B and I-241G-B standards compliance

I-240G-B and I-241G-B indoor ONTs are compliant with the following standards:

- 802.1p mapper service profile on the upstream
- G.984 support for GPON interface (framing)
- G.984.3 support for activation with automatic discovery of a serial number and a password
- G984.4 (standard and revised) support for OMCI interface for ONT management and provisioning

14.11   I-240G-B and I-241G-B special considerations

IGMP packet replication allows the I-240G-B and I-241G-B indoor ONTs to support IPTV on all four Ethernet channels at the same time.

On a user-side port in flexible mode, downstream multicast traffic will have the UNI-side p-bit of the parameter DATAPRI configured for the IGMP signaling channel, unless the DATAPRI value differs between ONT UNIs. In the latter case, the downstream multicast traffic will retain the p-bit from the PON. On a user-side port in non-flexible mode, such as translation mode, downstream multicast traffic will retain the p-bit from the PON. The multicast VLAN ID may differ; see Table 14-11 for tagging behavior.

Table 14-11 Multicast downstream VLAN tagging for I-240G-B and I-241G-B indoor ONTs

Port configuration [1]	VLAN tagging of downstream multicast traffic
One port configured in flexible mode or VLAN translation mode with a configured IGMP signaling channel	Multicast traffic is tagged with UNI-side VLAN ID of IGMP-related service.
More than one port configured in flexible mode or VLAN translation mode each with a configured IGMP signaling channel	If the IGMP-related services are configured with the same UNI-side VLAN ID, then all multicast traffic is tagged with the UNI-side VLAN ID of their service.
	If the IGMP-related services are configured with different UNI-side VLAN IDs, then all multicast traffic is tagged with VLAN ID 4094.
More than one port configured in VLAN pass-through mode, untrusted mode, EtherType/VLAN translation mode, or EtherType classification mode with some ports in transmit with tag and other ports in transmit without a tag, and each port with a configured IGMP signaling channel	The multicast traffic is tagged with VLAN ID 4094.
All other cases	The multicast traffic retains the VLAN ID from the PON.

Note
[1]   You can only have one IGMP signaling channel on a port.

Service creation considerations and limitations

Port-to-port mode must be enabled when using four-port Ethernet ONTs I-240G-B and I-241G-B. When using port-to-port mode, you can only configure one Ethernet port.

Upgrade considerations and limitations

Existing ONTs that use 7342 ISAM FTTU releases older than R04.06.xx and R04.07.xx must be upgraded to use R04.00.10 software while assigned to a PON ID value smaller than 64. For this purpose, if split ratios larger than 1:64 are being deployed, you may choose to set aside the first PON ID as a staging point.

I-240G-B and I-241G-B ONT considerations and limitations

Table 14-12 lists the considerations and limitations for these ONTs.

Table 14-12 I-240G-B and I-241G-B ONT considerations and limitations

Considerations and limitations
When using multicast on multiple Ethernet ports, all Ethernet ports must have the same VLAN ID. If the user-side VLAN IDs are all given the same VLAN ID, a common VLAN ID should result. If not, VLAN 4094 will be used
ONTs are not able to sufficiently buffer enough traffic between grants to support an EIR rate of 1Gb/s over multiple GEM ports. There are only 1.256 Gb/s buffers available in the SoC chip. The buffers are divided among the number of configured GEM ports. Reducing the number of GEM ports configured results in increased upstream buffering and higher upstream traffic rates.
Packets of less than 64 bytes are increased to 100 bytes in size with padding under the following conditions: • in a downstream direction • in an upstream direction only if the ONT has more than 2 Ethernet ports
ONTs that use pre R04.00.10 software may not range if the distance from the LT card is less than 1km

NTP 124 — Install an I-240G-B or I-241G-B indoor ONT

Purpose

This NTP provides the steps to install an I-240G-B or I-241G-B indoor ONT.

General

The DLPs listed in this NTP describe mounting and cabling for the I-240G-B and I-241G-B indoor ONT.

Prerequisites

See the listed DLPs for prerequisites.

Recommended tools

You need the following tools for the installation:

- #2 Phillips screwdriver
- 1/4 in. (6 mm) flat blade screwdriver
- wire strippers
- fiber optic splicing tools
- RJ-45 cable plug crimp tool
- voltmeter or multimeter
- optical power meter
- wall mounting template
- Fair-Rite 0431164281 (1AB 09397 0031) ferrite core shipped with the ONT
- drill and drill bits

Safety information

Read the following safety information before installing the unit.

Danger 1 — Contact the local utility company before you connect the enclosure to the utilities.

Danger 2 — Observe the local and national laws and regulations that may be applicable to this installation.

Danger 3 — If the coaxial output of the ONT is connected to the dwelling infrastructure coaxial distribution system, ensure that the coaxial distribution system is separately grounded. Grounding of the dwelling coaxial infrastructure shall use Listed grounding devices and must be installed in accordance with local Codes and Article 800 of the National Electric Code, ANSI/NFPA 70, following the manufacturers instructions.

Warning 1 — This equipment is ESD sensitive. Proper ESD protections should be used when removing the fiber access cover of the indoor ONT.

Warning 2 — Installation of the supplied ferrite on the Ethernet cable is required for EMC compliance. Failure to install the supplied ferrite core may cause interference with TV or radio reception. Alcatel-Lucent is not responsible for any radio or television interference caused by using other than the supplied ferrite core or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate this equipment.

Caution — Keep indoor ONTs out of direct sunlight. Prolonged exposure to direct sunlight can damage the unit.

Note — Observe the following:

- The indoor ONT should be installed in accordance with the applicable requirements of the NEC or CEC. Local authorities and practices take precedent when there is conflict between the local standard and the NEC or CEC.
- The indoor ONT must be installed by qualified service personnel.
- Indoor ONTs must be installed with cables that are suitably rated and listed for indoor use.
- See I-240G-B and I-241G-B detailed specifications in the I-240G-B and I-241G-B unit data sheet for the temperature ranges for ONTs.

NTP 124-2

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Procedure

Use this procedure to install an I-240G-B or I-241G-B indoor ONT.

1 Prepare the cables at the site where the ONT will be installed (DLP 100).

2 Are any of the cables missing?

   a If yes, go to step 3.

   b If no, go to step 4.

3 Locate each missing cable and route them to the ONT as per local practices.

4 Place the indoor ONT unit:

   a On the flat surface, such as a desk, horizontally resting on its four feet as shown in Figure NTP 124-1; go to step 5.
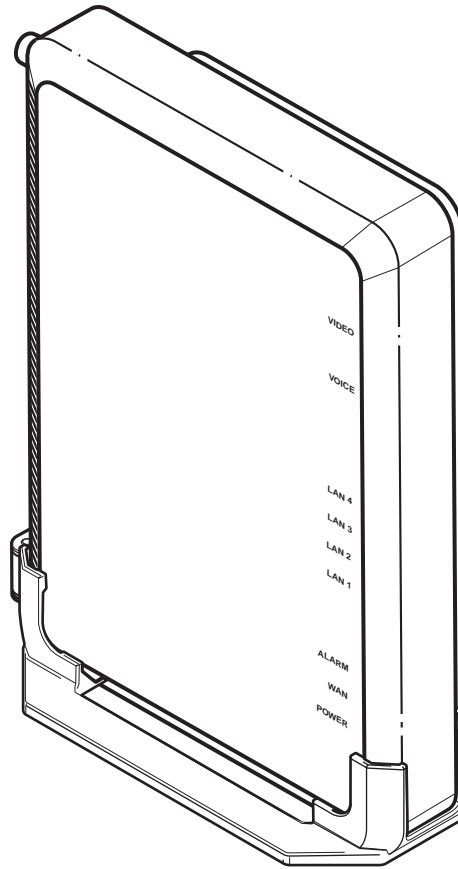
Figure NTP 124-1: I-240G-B or I-241G-B indoor ONT on a desk
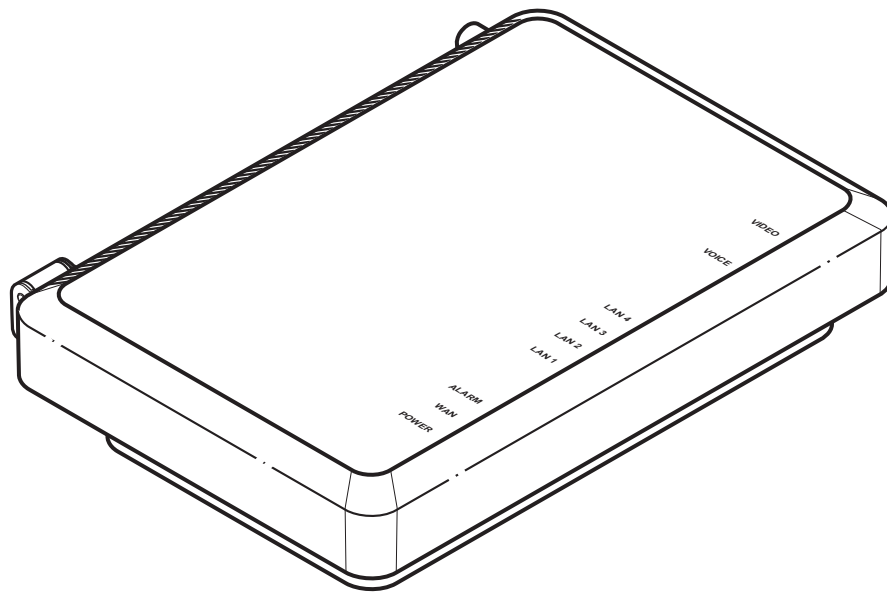
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   b In the stand mount.

      i Place the stand mount on the flat surface.

      ii Place the ONT into the opening on the stand mount, ensuring it is securely held. Figure NTP 124-2 shows the stand mount.
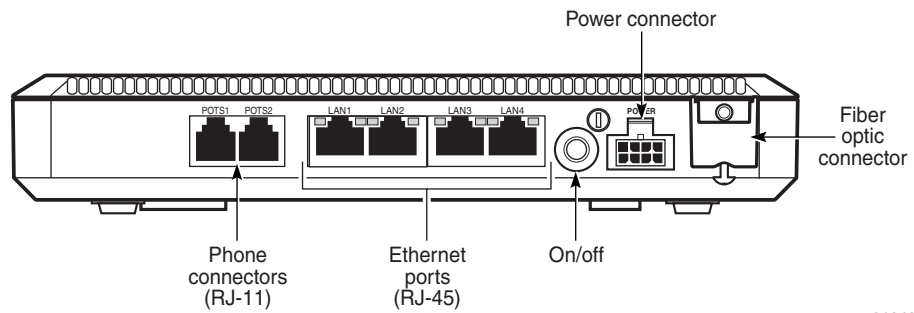
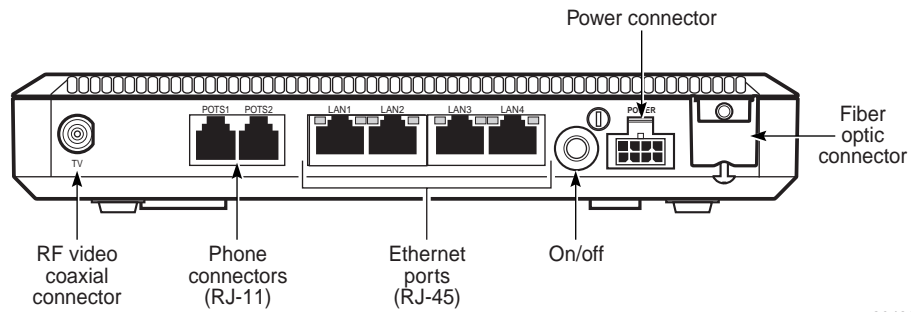**Figure NTP 124-2: I-240G-B or I-241G-B indoor ONT in a stand mount**

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    iii   Go to step 5.

    c   On a wall (DLP 114).

5   Review the connection locations shown in Figures NTP 124-3 and NTP 124-4.

Figure NTP 124-3: I-240G-B indoor ONT connections

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Figure NTP 124-4: I-241G-B indoor ONT connections

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6   Connect the Ethernet cables to the RJ-45 ports (DLP 101).

7   Connect the POTS cables (DLP 115).

8   Connect the SC/APC fiber optic cable (DLP 117).

> **Warning —** Be careful to maintain a bend radius of no less than 1.5 inches (3.8 cm) when connecting the fiber optic cable. Too small of a bend radius in the cable can result in damage to the optic fiber.

9   Install the power supply according to manufacturer specifications.

> **Note —** Observe the following:
>
> • Units must be powered by a Listed or CE approved and marked limited power source power supply with a minimum output rate of 12 V dc, 1.25 A.

10   Connect the power cable with an 8-pin Molex connector to the ONT unit.

11   Power up the ONT unit by using the ON/OFF power switch.

12   If necessary, reset the ONT (DLP 118).

13   Verify the ONT LEDs, voltage status, and optical signal levels (DLP 119).

14   Activate and test the services (DLP 120).

15   If used, configure the SLID (DLP 121).

16   STOP. This procedure is complete.

NTP 124-6

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NTP 125 — Replace an I-240G-B or I-241G-B indoor ONT

Purpose

This NTP provides the steps to replace an I-240G-B or I-241G-B indoor ONT.

General

The DLPs listed in this NTP describe mounting and cabling for the I-240G-B or I-241G-B indoor ONT.

Prerequisites

See the listed DLPs for prerequisites.

Recommended tools

You need the following tools for replacing the ONT:

- #2 Phillips screwdriver
- 1/4 in. (6 mm) flat blade screwdriver
- wire strippers
- fiber optic splicing tools
- RJ-45 cable plug crimp tool
- voltmeter or multimeter
- optical power meter
- wall mounting template
- Fair-Rite 0431164281 (1AB 09397 0031) ferrite core shipped with the ONT
- drill and drill bits

Safety information

Read the following safety information before replacing the unit.

Danger 1 — Contact the local utility company before you connect the enclosure to the utilities.

Danger 2 — Observe the local and national laws and regulations that may be applicable to this installation.

Danger 3 — If the coaxial output of the ONT is connected to the dwelling infrastructure coaxial distribution system, ensure that the coaxial distribution system is separately grounded. Grounding of the dwelling coaxial infrastructure shall use Listed grounding devices and must be installed in accordance with local Codes and Article 800 of the National Electric Code, ANSI/NFPA 70, following the manufacturers instructions.

Warning 1 — This equipment is ESD sensitive. Proper ESD protections should be used when removing the fiber access cover of the indoor ONT.

Warning 2 — Installation of the supplied ferrite on the Ethernet cable is required for EMC compliance. Failure to install the supplied ferrite core may cause interference with TV or radio reception. Alcatel-Lucent is not responsible for any radio or television interference caused by using other than the supplied ferrite core or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate this equipment.

Caution — Keep indoor ONTs out of direct sunlight. Prolonged exposure to direct sunlight can damage the unit.

Note — Observe the following:

- The indoor ONT should be installed in accordance with the applicable requirements of the NEC or CEC. Local authorities and practices take precedent when there is conflict between the local standard and the NEC or CEC.
- The indoor ONT must be installed by qualified service personnel.
- Indoor ONTs must be installed with cables that are suitably rated and listed for indoor use.
- See I-240G-B and I-241G-B detailed specifications in the I-240G-B and I-241G-B unit data sheet for the temperature ranges for ONTs.
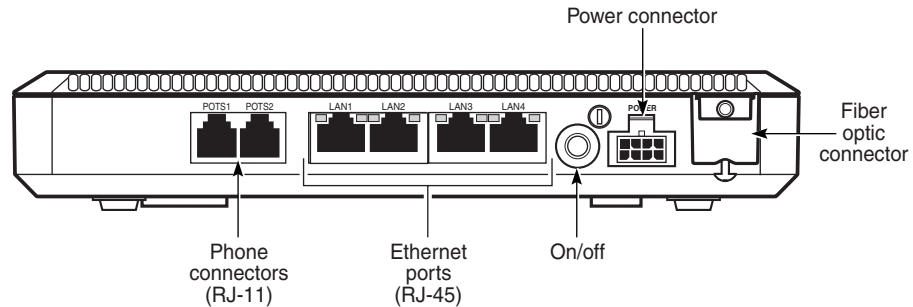
Procedure

Use this procedure to replace an I-240G-B or I-241G-B indoor ONT.

1 Deactivate the ONT services (DLP 123). If you are using the SLID feature, this step is not required. The ONT and the services can remain in service (IS).

2 Power down the ONT unit by using the ON/OFF power switch.

NTP 125-2

December 2010   Alcatel-Lucent 7330/7302 ISAM FTTN R04.02.41
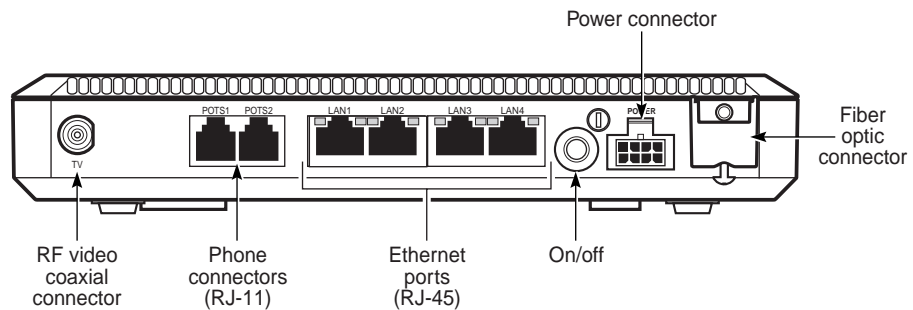*ONT Product Information Guide Edition 01   3FE 54017 AAAA TCZZA*

3 Disconnect the POTS, Ethernet, coaxial, and power cables from the ONT (DLP 124); see Figures NTP 125-1 and NTP 125-2.

Figure NTP 125-1: I-240G-B indoor ONT connections

Power connector

Fiber optic connector

Phone connectors (RJ-11)

Ethernet ports (RJ-45)

On/off

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Figure NTP 125-2: I-241G-B indoor ONT connections

Power connector

Fiber optic connector

RF video coaxial connector

Phone connectors (RJ-11)

Ethernet ports (RJ-45)

On/off

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4 Disconnect the SC/APC adaptor from the fiber optic connector on the ONT (DLP 125); see Figures NTP 125-1 and NTP 125-2.

5 Replace the ONT with a new unit:

  a On a flat surface, such as a desk, substitute a replacement ONT for the old ONT; go to step 6.

  b In a stand.

    i Unsnap the old ONT from the channels built into the stand. Snap the new ONT into channels built into the stand, ensuring it is securely held.

    ii Place the replacement ONT with stand vertically on a flat surface; go to step 6.

  c On a wall.

    i Slide the old ONT upward and then away from the two mounting screws until the ONT is free of the wall.

    ii Slide the wall mount keyholes on the ONT enclosure or fiber storage tray of the replacement ONT down over the mounting screws until it is securely seated.

6 Connect the Ethernet cables (DLP 101).

7 Connect the POTS cables (DLP 115).

8 If required, have approved service personnel who are trained to work with optic fiber clean the fiber optic connection. See DLP 126 for more information about fiber optic handling, inspection, and cleaning.

> **Danger —** Fiber optic cables transmit invisible laser light. To avoid eye damage or blindness, never look directly into fibers, connectors, or adapters.

9 Connect the SC/APC fiber optic cable (DLP 117).

> **Warning —** Be careful to maintain a bend radius of no less than 1.5 inches (3.8 cm) when connecting the fiber optic cable. Too small of a bend radius in the cable can result in damage to the optic fiber.

10 Install the power supply according to manufacturer specifications.

> **Note —** Observe the following:
>
> • Units must be powered by a Listed or CE approved and marked limited power source power supply with a minimum output rate of 12 V dc, 1.25 A.

11 Connect the power cable with an 8-pin Molex connector to the ONT unit.

12 Power up the ONT unit by using the ON/OFF power switch.

13 If necessary, reset the ONT (DLP 118).

14 If used, configure the SLID (DLP 121).

> **Note —** A new SLID or the old SLID may be used with the replacement ONT. If a new SLID is used, the new SLID must also be programmed at the P-OLT using TL1 or a network manager. If the old SLID is used, no changes need to be made at the P-OLT; see the operations and maintenance documentation for the OLT for more details.

15 Verify the ONT LEDs, voltage status, and optical signal levels (DLP 119).

16 Activate and test the services (DLP 120).

17 STOP. This procedure is complete.

NTP 126 — Configure an I-240G-B or I-241G-B indoor ONT

General

Please refer to the OLT *Operations and Maintenance using TL1 and CLI* guide for the software configuration procedure for an I-240G-B or I-241G-B indoor ONT.

For HTTP configuration procedures, please refer to chapter 5, "ONT management using an ONT interface".