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N E T W O R K S

ONT-2-E4xxxi Multi-service Residential Gateway Series Hardware Installation Guide

for ONT-2-E4000i, ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, ONT-2-E4021iWn, and ONT-2-E4001i

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Chapter 1   Introduction

This guide introduces hardware components and installation procedures for the Aurora Networks ONT-2-E4xxxi Multi-service Residential Gateway Series models and accessories. It provides information you will need to install and set up the ONT-2-E4000i, ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, ONT-2-E4021iWn, and ONT-2-E4001i models.

After you complete your installation, refer to the Aurora Networks *ONT-2-E4xxxi Multi-service Residential Gateway Series Operator Guide* for procedures for setting up your PC, logging in to the GUI interface, and managing Residential Gateway and wireless features of the EPON Multi-service Gateway ONT via the GUI.

1.1   Welcome

Thank you for taking the time to read the *ONT-2-E4xxxi Multi-service Residential Gateway Series Hardware Installation Guide*. This manual contains information and procedures that will assist network and field engineers with the installation and use of the ONT-2-E4000i, ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, ONT-2-E4021iWn, and ONT-2-E4001i models.

1.2   About This Manual

The following information describes the *ONT-2-E4xxxi Multi-service Residential Gateway Series Hardware Installation Guide*, the contents of its chapters, and the conventions it uses to present information.

1.2.1   Conventions Used in This Guide

The following symbols represent the conventions used in this guide.

Symbol	Description
⚠	**WARNING!** This symbol is used to identify conditions or actions that could seriously injure personnel; for example, an electrical shock hazard.
⚠	**CAUTION!** This symbol is used to identify situations that present minor hazards that can interfere with or threaten equipment or system performance.
Note:	This symbol identifies important points related to the text.
Tip	This symbol provides helpful suggestions.

1.2.2 Manual Contents

This manual contains the following chapters:

Chapter	Description
Chapter 1, Introduction	Provides general information about the manual, including conventions used, description of chapters, audience, related documents, product support, documentation feedback, standards and regulatory compliance.
Chapter 2, Overview	Introduces an overview of the ONT-2-E4xxxi Multi-service Residential Gateway Series, the supported features, and product specifications.
Chapter 3, Hardware Description	Describes the ONT enclosure, the LED diagnostics, the rear panel ports, the interfaces, the power connector, and backup power connector.
Chapter 4, Installing the	Describes the package contents, pre-installation check, system requirements, tools and materials needed. Presents step-by-step procedures for wall-mounting the ONT with and without the fiber tray, vertical-mounting the ONT, and detailed steps for connecting the optical fiber, voice ports, Ethernet wiring, and the power supply. Instructs you on how to connect to the GUI interface of the ONT to configure Residential Gateway and wireless features.
Index	This topical Index assists in locating information quickly.

1.2.3 Audience

This manual is intended for use by:

- Field technicians and engineers responsible for the installation of the ONT-2-E4000i, ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, ONT-2-E4021iWn, and ONT-2-E4001i.

- Service and administration personnel performing troubleshooting and physical configuration tasks on the ONT-2-E4000i, ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, ONT-2-E4021iWn, and ONT-2-E4001i.

1.2.4 Related Documents

Related information about the configuration of the ONT-2-E4xxxi Multi-service Residential Gateway Series may be found in the following documents:

- *ONT-2-E4xxxi Multi-service Residential Gateway Series Operator Guide*, TM 87-10878

- *ONT-2 E4020iWn Multi-service Residential Gateway* Data Sheet, 87-50074

- *Trident7 Element Management Suite User Guide*, TM 87-50067

1.2.5 Obtaining Documents

Refer to Aurora Networks' Web site at www.aurora.com for the latest product information and documentation updates. The Web site includes a special customer support area (password required) for Aurora customers.

1.2.6 Product Support

For technical support: phone +1 888.AURORA6 (888.287.6726) toll-free (U.S., Canada, P.R.), or Toll +1 408.850.8249, or e-mail tac@aurora.com.

1.2.7 Comments and Feedback

We have made every effort to ensure that this manual describes the product completely and correctly, and we encourage your feedback—your comments and corrections are welcome. You may submit comments by mail or by sending e-mail directly to techpubs@aurora.com.

1.3 Standards Compliance

Always work safely. Observe all CAUTIONs and laser radiation notices in this guide.

CAUTION! Laser Radiation – *This is a Class 1 laser product.*

CAUTION! Laser Radiation – *Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.*

WARNING: There must be a proper termination of all active fibers in the network.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

1.4 Regulatory Compliance

The EPON Multi-service Gateway ONTs meet the requirements of the applicable sections of the standards in the following sections.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1.4.1 ONT-2-E4000i, ONT-2-E4020i, ONT-2-E4021i, and ONT-2-E4001i Models

The models that do not have Wi-Fi or wireless functionality meet the following regulatory requirements:

EMC

- 47 CFR 15 - Sub Part B, Class B
- EN 55022 - Radiated and Conducted Emission for ITE
- EN 55024 - Immunity for ITE
- ETSI EN 300 386 - Electromagnetic compatibility and Radio spectrum Matters (ERM)
- ICES-003 - Spectrum Management and Telecommunications Interference
- VCCI – EMI Requirements
- KN 22 - Radio disturbance characteristics
- KN 24 - Immunity characteristics

Safety

- IEC 60950-1 - ITE - Safety - General requirements
- EN 60950-1 - ITE - Safety - General requirements
- UL 60950-1 - Information Technology Equipment Safety
- CAN/CSA-C22.2 No. 60950-1 - Safety of Information Technology Equipment

1.4.2 ONT-2-E4020iWn and ONT-2-E4021iWn Models

The models that have Wifi or wireless functionality meet the following regulatory requirements:

EMC

- 47 CFR 15 - Sub Part C, Class B
- ETSI EN 300 328 - Electromagnetic compatibility and Radio spectrum Matters (ERM)
- ETSI EN 301 489-17 - Electromagnetic compatibility and Radio spectrum Matters (ERM)

Safety

- IEC 60950-1 - Safety - General requirements
- EN 60950-1 - ITE - Safety - General requirements
- UL 60950-1 - Information Technology Equipment Safety
- CAN/CSA-C22.2 No. 60950-1 - Safety of Information Technology Equipment

It is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States relating to Electromagnetic Compatibility

(2004/108/EC), Low-voltage Directive (2006/95/EC) and R&TTE (1999/5/EC). The test was performed according to the following European standards:

ETSI EN 301 489-17

ETSI EN 301 489-1

ETSI EN 300 328

EN 62311: 2002

EN 60950-1

C€0700

FCC RF Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

To comply with CE and FCC RF exposure requirements, the device and the antenna for this device must be installed to ensure a minimum separation distance of 20cm or more from a person's body. Other operating configurations should be avoided.

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Chapter 2   Overview

This chapter provides an overview of the supported features, product specifications, and system requirements for the ONT-2-E4xxxi Multi-service Residential Gateway Series, which comprise the ONT-2-E4000i, ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, ONT-2-E4021iWn, and ONT-2-E4001i models.

2.1   Overview of ONT-2-E4xxxi Multi-service Residential Gateway Series

The ONT-2-E4xxxi Multi-service Residential Gateway Series of Optical Network Terminals provide basic and optional features supporting current and future business and consumer connectivity needs for Data, IPTV including High-definition TV, Voice over IP (VoIP), and Triple-Play services. All ONTs in the family support the latest Residential Gateway features, including high-speed EPON and Turbo-EPON communication to the Cable Operator or ISP WAN network, firewall security, efficient provisioning, and up to 1 Gbps (1000BASE-T) connectivity to four independent LANs on the customer premise. Optional features for Wi-Fi, Voice over IP, and RF Video Overlay are also available.

The ONT-2-E4021iWn is the full-feature EPON ONT Residential Gateway, featuring a 4-port RJ-45 10/100/1000BASE-T Gigabit Ethernet switch, 2 POTS ports for VoIP, 1 RF Video Overlay port, and IEEE 802.11n wireless (Wi-Fi) access. The ONT-2-E4020iWn is the same basic unit as the E4021iWn without the RF Video; the ONT-2-E4021i provides RF Video without Wi-Fi; the ONT-2-E4020i has no Wi-Fi and RF Video; the ONT-2-E4000i only provides the four 1000BASE-T ports.

See Table 1 for a brief overview of interfaces, ports, VoIP, RF video, Wi-Fi, data, and IPTV services on each EPON Multi-service Gateway ONT. The various features are described in subsequent sections of this guide.

Table 1 EPON Multi-service Gateway ONT Supported Services and Features

Multi-service Gateway ONT	Gigabit Ethernet (GE) Interfaces	POTS Port VoIP Service	RF Overlay Port RF Video Service	Wi-Fi Service (Wireless)	Data and IPTV	Residential Gateway (RG) Features
ONT-2-E4000i	4	0	NA	NA	X	X
ONT-2-E4020i	4	2	NA	NA	X	X
ONT-2-E4021i	4	2	1	NA	X	X
ONT-2-E4001i	4	NA	1	NA	X	X
ONT-2-E4020iWn	4	2	NA	X	X	X
ONT-2-E4021iWn	4	2	1	X	X	X

2.2 EPON Multi-service Gateway Series Hardware Interface

This section describes the various hardware interfaces of the ONT.IEEE 802.3ah "First Mile" EPON Interface

All ONTs in the series feature an a high-speed PON interface to the outside world that is IEEE 802.3ah EFM (Ethernet First Mile) compliant, supporting bi-directional communications at 2 (2.488) Gbps downstream and 1 (1.244) Gbps upstream (Turbo-EPON) speeds.

2.2.1 Gigabit Ethernet Ports (1000BASE-T)

All ONTs feature a built-in 4-port 10/100/1000Mbps Ethernet switch that supports four independent LANs, and features automatic switching between MDI and MDI-X for 10BASE-T, 100BASE-TX and 1000BASE-TX ports. Auto-detection is supported for straight or crossover Ethernet cables.

2.2.2 IEEE 802.11n Wireless Access Point with Support for Secured Access

The ONT-2-E4020iWn and ONT-2-E4021iWn units feature an integrated 802.11n Wireless Access Point that provides flexible connectivity between wired, wireless, and broadband networks. The Wi-Fi Protected Access (WPA) and Wired Equivalent Privacy (WEP) features enhance the security level of data protection and access control via Wireless LAN. The unit is backward compatible with existing and installed 802.11g and 802.11b equipment. WPS (Wi-Fi Protected Setup) is used for easy establishment of secured wireless networks.

2.2.3 RF Video Service (RF Overlay)

The ONT-2-E4021i, ONT-2-E4021iWn, and ONT-2-E4001i units support both IP and RF video. The RF video overlay service on these units enables delivery of both IP and RF video over the same single fiber as all other services without additional wavelengths.

2.2.4 Voice over IP

ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, and ONT-2-E4021iWn units all provide 2 POTS voice ports with SIP protocol for interoperating with industry-standard VoIP switches. Telephony features such as silence suppression, voice activity detection (VAD), comfort noise generation (CNG), echo cancellation, call waiting, call transferring, and Caller ID (CID) are included. A broad range of codecs and standard telephones can be used with the ONT. T.38 Fax transmission and Fax pass-through modes of operation also are supported.

2.3 Supported Residential Gateway (RG) Features

All ONT-2-E4xxxi Multi-service Residential Gateway Series support the following Residential Gateway features.

2.3.1 Network Address Translation (NAT)/NAPT (Network Address Port Translations)

NAT and NAPT (Network Address Port Translation) simultaneously allow multiple users to access outside resources (such as the Internet) with one IP address/one Internet access account.

2.3.2   Dynamic Domain Name System (DDNS)

A DNS Relay provides an automatic way to associate a domain name (a user-friendly name such as www.yahoo.com) and IP address of a service or device. When a local machine sets its DNS server with this relay's IP address, every DNS conversion request packet from the PC to this gateway will be forwarded to the real DNS in the outside network.

The DDNS service allows you to alias a dynamic IP address to a static hostname. This dynamic IP address is the WAN IP address. For example, to use the service, you must first apply for an account from a DDNS service, such as http://www.dyndns.org/. More than five (5) DDNS servers are supported.

2.3.3   Dynamic Host Configuration Protocol (DHCP) Client and Server

As part of the Residential Gateway features, the ONT includes a DHCP server that can serve IP addresses to CPEs attached to the LAN ports. From the WAN side, the ONT's DHCP client can obtain a WAN IP address directly from the Internet Service Provider (ISP) automatically. For LAN-attached customer devices, the DHCP server in the ONT can allocate a range of client IP addresses and distribute them, including IP address and subnet mask, as well as DNS IP address to local computers. Layer 2 DHCP relay (with Option 82) is also supported.

2.3.4   Security Firewall and Rich Packet Filtering

A firewall with rich packet filtering process not only filters the packet based on an IP address, but also based on Port numbers. Packets will be filtered from and to the Internet, providing a higher level of security control.

2.3.5   Advanced Quality of Service,

The ONT-2-E4xxxi Multi-service Residential Gateway Series supports advanced QoS features, including rate limiting on a per port basis, bandwidth management, and Traffic Prioritization based on Layer 2 Class of Service (802.1p) and Layer 3 DiffServ markings.

2.3.6   Virtual Server

Users can specify services to be visible from the WAN side of the EPON Multi-service Gateway. The gateway can detect incoming service requests and forward either a single port or a range of ports to the specific local computer for dispensation. For example, a user can assign a PC in the LAN acting as a WEB server inside and expose it to the outside network. Outside users can browse inside web servers directly while it is protected by NAT. A DMZ host setting is provided to a local computer exposed to the outside network.

2.3.7   Flexible Management Interfaces including Web GUI

The ONT supports Ethernet OAM per IEEE 802.3 specifications through flexible management interfaces with LAN and WAN ports. Users can use Telnet, Web GUI, and SNMP through the WAN and LAN ports to configure and manage the device. Support for Trident7 EMS is built in for service provisioning and management of data, IPTV video, and VoIP services. Provisioning of Wi-Fi and RG services are supported through a separate Web-based GUI interface. The device can be upgraded to the latest firmware remotely through the Web-based GUI and/or the Trident7 EMS.

2.4 Additional Features

- The aesthetically-pleasing enclosure features a streamlined compact design, with an optimized rear access for a physically-secure fiber PON port.

- All connectors are on the rear-side of the unit. Connections include four (4) 10/100/1000BASE-T data, two (2) POTS, a backup power, and an 12 V_{DC} input. A USB port is reserved for future use.

- A separately sold, thin, modular fiber slack management tray, when mounted underneath the unit, securely hides excess fiber and protects it from potential abuse or destruction.

- All ONTs support desk or wall mount or vertical (tower) mount installations.

- LED Indicators—Ample LED indicators are available and conveniently located on the top-front of the unit, easily in view by the user to monitor important status information. See the LED indicator action descriptions the Product Specification Section.

2.5 Product Specifications

Table 2 provides a summary of the features and product specifications for the ONT-2-E4xxxi Multi-service Residential Gateway Series.

Table 2 Product Specifications for ONT-2-E4xxxi Multi-service Residential Gateway Series

Function/Parameter	Unit	ONT-2-E4000i	ONT-2-E4020i	ONT-2-E4021i & ONT-2-E4001i	ONT-2-E4020iWn	ONT-2-E4021iWn
Network Interface						
Optical Interface		SC/APC				
Fiber Type		G.652 Single-mode				
Transmit Wavelength	nm	1310 ±20				
Transmit Launch Power (min-max)	dBm	+0.5 to 5.0	+0.5 to 5.0	+0 to 5.0	+0.5 to 5.0	+0 to 5.0
Transmit Spectrum Width	nm	1				
Receive Wavelength (Data)	nm	1490 ±10				
Receive Wavelength (RF Video)	nm	–	–	1555 ±10	–	1555 ±10
Receive Sensitivity @1490 (min-max) (measured with a PRBS 2^{23}-1 test pattern @2.488 Gbps and ER= 10dB = 10^{-10})	dBm	-8 to -28				
Receive Sensitivity @1550nm (min-max) (linear operating range)	dBm	–	–	-8 to +2	–	-8 to +2
1550 nm Optical Isolation (1400 - 1500 nm)(min)	dB	–	–	30	–	30
Receive Overload @ 1550nm (min)	dBm	–	–	+5	–	+5
Downstream/Upstream Rate	Gbps	2.488/1.244 Turbo Mode				
Telephony						

Function/Parameter	Unit	ONT-2-E4000i	ONT-2-E4020i	ONT-2-E4021i & ONT-2-E4001i	ONT-2-E4020iWn	ONT-2-E4021iWn
Analog POTS Ports/Connectors (none on ONT-2-E4001i)		–	2-RJ-11			
REN	REN	–	4			
Data						
Wi-Fi (2 Antennas)		–	–	–	IEEE 802.11b/g/n, Max antenna gain +5dBi	IEEE 802.11b/g/n, Max antenna gain +5dBi
Ethernet Ports/Connectors (10/100/1000BASE-T)		4-RJ45				
RF Overlay						
RF Video Ports/Connectors		–	–	1 F-Type	–	1 F-Type
RF Video Output Bandwidth	Mhz	–	–	47 - 870	–	47 - 870
RF Output Level	dBmV	–	–	+17	–	+17
RF Output Tilt (typ/max)	dB	–	–	2/5	v	2/5

2.6   Physical Characteristics

Table 3 provides a summary of the physical specifications of the ONT-2-E4xxxi Multi-service Residential Gateway Series.

Table 3 Physical Characteristics for ONT-2-E4xxxi Multi-service Residential Gateway Series

Function/Parameter	Unit	E4000i	E4020i	E4021i & E4001i	E4020iWn	E4021iWn
Physical, Temperature, and Humidity Characteristics						
Dimensions (W x H x D)	in.	10.24 x 6.22 x 1.7				
	mm	260 x 158 x 43				
Weight	lbs.	1.1				
	g	500				
Operating Temperature	F	+32 to +104				
	C	0 to +40				
Storage Temperature	F	-4 to +158				
	C	-20 to +70				

Function/Parameter	Unit	E4000i	E4020i	E4021i & E4001i	E4020iWn	E4021iWn
Humidity - Operating	%	+10 to +90				
Humidity – Storage	%	+5 to +95				
Power Characteristics						
Input Voltage (100 - 240 V_{AC} Adapter Supplied)	V_{DC}	12				
Power Consumption (Maximum)	W	8.5	18	18	18	18

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Chapter 3   Hardware Description

This chapter describes the package contents, accessories, the ONT enclosure, LED indicators used for diagnostics, power adapter, and types of interfaces on the EPON Multi-service Gateway ONT.

Note: *Figures in the description of the product are for reference only.*

3.1   Package Contents

The following product items are shipped as part of the package contents.

Table 4 Package Contents for ONT-2-E4xxxi Multi-service Residential Gateway Series

Item	Part Number	Description
ONT-2-E4xxxi-** or ONT-2-E4xxxiWn-**	Where ** is one of the following: -US United States -UK United Kingdom -EU Europe -AU Australia	EPON Multi-service Residential Gateway ONT.
Power adapter	The appropriate power adapter, compatible with the ONT part number selected, will be shipped as part of the package.	Four power adapter options, based on the ONT part number options.

Note: *The ONT-2-E4020iWn and ONT-2-E4021iWn have two attached antennas. Do not attempt to detach the antennas.*

⚠ CAUTION!

- *This ONT is for indoor use only.*

- *Only use the power adapter that comes with the product. Using a different voltage rating power adapter may damage the ONT.*

- *Do not open the case of the EPON Multi-service Gateway ONT. The exception is the protected PON compartment may be opened. There are no customer-serviceable parts inside the unit. If the ONT needs repair, contact the appropriate service provider for replacement instructions.*

3.2   Accessories

The following are accessories that compliment the EPON Multi-service Gateway ONT and may be ordered separately from Aurora Networks.

Table 5 Orderable Accessories for ONT-2-E4xxxi Multi-service Residential Gateway Series

Accessory Name	Part Number	Description	Image
Fiber storage tray with cover	To be added.	The tray is used to store the optical fiber cable. The tray can be wall-mounted with the cable inside; when the ONT has been provisioned, the ONT can be quickly snapped in the tray.	
Tower stand	To be added.	The tower stand is used for vertical or tower mounting.	

3.3 ONT-2-E4xxxi Multi-service Residential Gateway Series Enclosure

The EPON Multi-service Gateway ONTs are similar across the series. The ONT-2-E4xxxi Multi-service Residential Gateway Series is designed for inside building customer premises and/or inside plant environments. It can be placed on a desktop, or tower-mounted, or wall-mounted via keyhole slots that are built into the bottom of the unit. It has an optional fiber tray for slack management of the video fiber cable. Once the fiber tray is wall-mounted, the ONT can be easily and quickly snapped in any time. It also has an optional tower bracket for tower-mounting (vertical mounting).

The front of the EPON Multi-service Gateway houses the system LED status indicators for Power, Backup Power, EPON port, Alarm, WAN, four (4) LAN Gigabit Ethernet ports, two (2) telephone ports, Voice over IP (VoIP) service, Wi-Fi, WPS, USB, and RF connectivity. Refer to Figure 1 for the location of LED indicators on an example ONT-2-E4020iWn unit.

Note that the ONT-2-E4000i and ONT-2-E4001i do not have telephone ports. The ONT-2-E4020iWn and ONT-2-E4021iWn have wireless (Wi-Fi) access points that offer high speed wireless connectivity with built-in antennas. Only the ONT-2-E4021i and ONT-2-E4021iWn have RF Overlay capability.

3.4 LED Diagnostics on Front Panel

The LED status indicators are on the top of the front of the EPON Multi-service Gateway ONT. The LEDs can be used to diagnose the status of the ONT. See Figure 1 for a view of LED indicators on an ONT-2-E4xxxi Multi-service Residential Gateway Series.

Figure 1 LED Indicators on EPON Multi-service Gateway ONT

See Table 6 for a description of the LED indicators located on the front top of an EPON Multi-service Gateway ONT.

Table 6 LED Indicators and Descriptions

LED	Color	Status	Description
PWR (Power) or **SYS** (System)	Green-Blinking	Blinks	Booting up.
	Green-Solid	On	ONT is operating.
Backup Power	Dark	Off	No backup power is present.
	Green-Solid	On	Backup power is present.
	Green-Blinking	On	Slow blinking green when ONT is running on backup power. Fast blinking green when a problem exists with the backup power.
EPON	Dark	On	No fiber uplink to EPON interface or failed to connect over EPON network.
	Green-solid	On	PON uplink is OK, and EPON network connection is operational.
Alarm	Dark	Off	No alarm condition exists.
	Red-Blinking	Blinks	Alarm condition exists.
WAN (Internet)	Dark	Off	No fiber uplink to EPON interface or ONT model is configured by Service Provider so that it does not have a routed connection to the internet.
	Green-Blinking	Slow Blink	During DHCP, ONT failed to receive an IP address from the service provider.
	Green-solid	On	ONT is connected to the WAN.

LED	Color	Status	Description
LAN1, **LAN2**, **LAN3**, **LAN4** (Data Link/Activity)	Dark	Off	No link has been established at the LAN interface, or the interface is administratively disabled by the service provider.
	Green-Solid	On	LAN port is up.
	Green-Blinking	Blinks	Data is being transmitted or is received.
VoIP (all models except ONT-2-E4000i)	Dark	Off	The ONT has failed to register with the Call Agent (SIP server), or Voice services have not been provisioned.
	Green-Blinking	Blinks	To be determined.
	Green-Solid	On	To be determined.
Voice Diagnostics: ꥟ **Phone1** ꥟ **Phone2** (all models except ONT-2-E4000i)	Dark	Off	There is no phone is connected to the indicated line, or The phone port is disabled, or The phone port is enabled, but the attached phone is on-hook.
	Green-solid	On	To be determined.
WiFi (Wireless) (ONT-2-E4020iWn ONT-2-E4021iWn)	Green-Solid	On	A wireless connection is established via the web GUI.
	Green-Blinking	Blinks	Data is being transmitted or is received.
WPS	Dark	Off	WiFi Protected Setup (WPS) – status to be determined.
USB	Dark	Off	Reserved for future use.
RF (for RF-capable models: ONT-2-E4021i, ONT-2-E4021iWn)	Dark	Off	RF video is disabled.
	Green-solid	On	RF video is enabled with 1550 nm RF output.

3.5   Rear Panel and Interface Description

Ports on the ONT-2-E4xxxi Multi-service Residential Gateway Series are located on the rear panel. See Figure 2 for a picture of the ports on an ONT-2-E4020iWn.

Figure 2 Rear Panel Ports on the ONT-2-E4020iWn

The following table describes the ports and interfaces on the rear panel of the ONT-2-E4020iWn. For a description of the PON optical fiber connector, see Figure 3 SC/APC Optical Fiber Plugged into Optical Network Interface.

Table 7 Rear Panel Ports on the ONT-2-E4020iWn

Interface	Description
ON/OFF	Power ON/OFF switch. Depress button to turn on. Power off the device when it is not in use, for power saving. CAUTION: Beware of accidentally pressing this button—it will turn off the ONT.
Power	Connect to the supplied power adapter.
Backup Power	Connect to an external power supply.
Reset	Restore to factory defaults. If you power on the device and use a thin needle to press the Reset button for over 1 second, the ONT is automatically reset and is restored to the factory default settings. If you cannot log in to the ONT or forget your username/password, press this button for more than 6 seconds to restore to defaults.
WPS	Press to activate Wi-Fi Protected Setup (WPS) for a period of time. Activating WPS in this manner may override your disabling WPS via the GUI interface.
WiFi	Reserved for future use.
LAN1, LAN2, LAN3, LAN4	RJ-45 Ethernet interface with the self-adaptive rate of 10/100/1000 Mbps, for connecting to the local network.
Phone1 Phone2	Connect these two voice ports to an analog phone set with a RJ-11 cable.
USB	Reserved for future use. In the future, the standard USB connector will accommodate back up of local configuration data and firmware updates via mass storage media, such as a flash drive.

3.6   Ethernet Connections

The ONT-2-E4xxxi Multi-service Residential Gateway Series provides four switched Ethernet 10/100/1000 Base-T RJ-45 copper wire twisted pair interfaces for direct connection to a PC or Ethernet set top box, or indirect connection to other Ethernet equipment via an attached switch, hub, or router.

All Ethernet ports are "switched" interfaces, meaning that each port can act as part of a separate independent network segment, hence video or data traffic can be restricted to the port for which it is intended.

The IEEE 802.3x-compliant gigabit Ethernet 10/100/1000Base-T interfaces auto-detect whether the connecting cable is a straight-through or cross-over type and configure themselves accordingly. In addition, the interfaces auto-negotiate (by default) to match the speed of the remote device.

The link length can be no greater than 100 m (≈328 ft), which is the Ethernet standard.

3.7 EPON SC/APC Fiber Optic Network Interface

The ONT-2-E4xxxi Multi-service Residential Gateway Series supports one EPON optical interface via an SC/APC connector located on the left-side rear panel for the Network Interface (NI) connection. This interface accepts a single mode fiber terminated with an SC/APC connector. The SC/APC PON connector is smartly enclosed by a small plastic removable cover that, when snapped into place, protects the connector from becoming dislocated or separated from the ONT. See Figure 3 for the optical fiber connector location, where the fiber is shown routed through the smaller aperture for wall mounting.

Figure 3 SC/APC Optical Fiber Plugged into Optical Network Interface

A small screw located in the unit holds the cover in place. The network connector and network EPON fiber must be wired to the premises by the service provider or contractor in an appropriate location before the EPON Multi-service Gateway ONT can be installed.

| Note | *The ONT-2-400i supports an UPC connector, not an APC connector. UPC connectors are blue in color.* |

3.8 Voice Telephony Interfaces (Standard Telephone)

The ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, and ONT-2-E4021iWn provide two independent standard analog voice ports. The voice ports are commonly known as Plain Old Telephone Service (POTS) ports. These connections provide toll quality voice through a Voice over IP (VoIP) connection. Refer to Figure 2 for the location of the telephone connectors, labeled "Phone1" and Phone2." The voice ports on the ONT use RJ-11 modular jacks, with one line per jack, wired in a standard two-wire configuration.

You can attach a standard household telephone to these ports to make voice calls. Call setup and signaling is provided via the Session Initiation Protocol (SIP) for interoperating with industry standard VoIP switches, and analog voice data is converted to IP packets for transmission over the service provider's network. The ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, and ONT-2-E4021iWn support a wide variety of te-

lephony features, such as silence suppression, voice activity detection, comfort noise generation, echo cancellation, call waiting, call transferring, and Caller ID.

A broad range of codecs is supported. FAX Transmission with T.38 fax relay and G.711 pass-through are also supported modes of operation.

Note	*The RJ-11 POTS (Standard Telephone) ports support a REN (Ringer Equivalency Number) load of four (4).*

3.9 RF Overlay

The ONT-2-E4021i and ONT-2-E4021iWn have RF Overlay capability. These two ONTs support an RF port for delivery of a full spectrum of broadcast RF video services over 75 Ohm RG-6 coaxial cable.

3.10 Power

The EPON Multi-service Gateway ONT is shipped with an AC/DC power adapter that accepts a rated input voltage of 100-240 volts AC and provides an output voltage of 12 VDC to the ONT. The EPON Multi-service Gateway ONT has a minimum input current rating of 1.5 AMPS. The power adapter (also referred to as power supply) shipped with the ONT is equipped with an AC plug that is suitable for the country or region of sale.

The EPON Multi-service Gateway ONT supports a backup power connector in the rear panel of the ONT that is marked as a "Backup Power" connector. The backup power connector is an 8-pin connector. It is intended for a backup power supply with alarm inputs. See Figure 4 for a closeup of the Backup Power connector in the rear panel of the ONT.

Figure 4 Rear Backup Power Connector

The EPON Multi-service Gateway ONT also supports an additional backup power connector on the side. This backup power connector is reserved for a future feature. See Figure 5 for a closeup of the side backup power connector.

Figure 5 Side Backup Power Connector

UNRELEASED DRAFT

Chapter 4   Installing the ONT-2-E4xxxi Multi-service Residential Gateway Series

Installation of the ONT-2-E4xxxi Multi-service Residential Gateway Series consists of the following procedures:

1. Unpacking the ONT

2. Installing and mounting the ONT.

    The EPON Multi-service Gateway ONT can be wall-mounted, tower-mounted (vertical mounting), or placed on a desk.

3. Connecting service provider cabling (the EPON network cable)

4. Connecting the premises wiring (POTs and Ethernet)

5. Connecting the power

6. Activating and powering up the ONT

We recommend you perform the steps in the order presented.

After you have completed the installation of the EPON Multi-service Gateway ONT, see the section "Connecting to the GUI Interface of the ONT" for information on using the ONT's GUI interface to configure, in particular, the Residential Gateway functions on all of the ONTs in the ONT-2-E4xxxi Multi-service Residential Gateway Series and Wi-Fi (wireless) capabilities on the ONTs that support Wi-Fi.

4.1   Cautions and Warnings

Follow all warnings, cautions, and required actions when working with the EPON Multi-service Gateway ONTs.

CAUTION: Telephone and telephony devices connected to the EPON Multi-service Gateway must comply with FCC Part 68 Class A and have appropriate approvals and labeling.

CAUTION! Class 1 Laser Radiation–*Avoid any exposure to laser beams.*

4.2   Pre-Installation Check

For successful installation of the ONT-2-E4xxxi Multi-service Residential Gateway Series, ensure that you have all the necessary equipment and account information set up for subscriber services.

Your Cable Operator or Service Provider must provide a fiber optic drop cable that is terminated with an SC/APC connector in order to utilize the EPON network services.

See Section 3.1 Package Contents and Section 3.2 Accessories for a list of products shipped in the package and types of accessories that can be ordered for the ONT-2-E4xxxi Multi-service Residential Gateway Series.

4.3 Tools and Materials Needed

The following tools and materials may be needed to install the EPON Multi-service Gateway ONT:

- Fiber optic splicing tools (if required to connect a pigtail fiber).

- Fiber optic connector cleaning tool.

- If wall mounting the unit, appropriate nails or screws to act as mounting posts and a hammer or screwdriver as needed.

4.4 System Requirements

Before installing the device, check the following items:

1. Service subscription

   You need to apply for service to your Internet service provider (ISP), and access services provided by your ISP by using the PON access (broadband access) mode. Your ISP must provide at least one valid IP address for you (static or dynamic allocation).

2. Hardware configuration

   Ensure that a 10/100/1000 Mbps Ethernet card or an 802.11b/g/n wireless network card is installed in your computer or that you have a network device that provides a 10/100 Mbps Ethernet interface.

   Ensure that computers that need to access the network are equipped with the network card driver and the TCP/IP protocol. Correct network setting is also required.

3. Operating system

   Operating systems can be Windows 98SE, Windows ME, Windows 2000, Windows XP, or Windows 7. For system configuration in the web interface, the browser should be Internet Explorer V6.0 or later.

The following equipment and associated service account information must be available for the EPON Multi-service Gateway ONT to operate:

- For data services

  - Up to four (4) personal computers or Ethernet switches with 10/100/1000BASE-T network adapters and RJ-45 physical connectors installed.

  - Up to 100 meters of Cat5, Cat5E, or Cat6 copper Ethernet cable, with RJ-45 connectors at each end.

  - An Ethernet hub or wired/wireless router can be used to extend connectivity beyond the four direct connections coming from the ONT.

  - An account for data services must be established by the Cable Operator or Service Provider.

- For IPTV video services

  - At least four (4) Ethernet set top boxes can be connected directly to the ONT.

  - All subscriber video services must be pre-provisioned by the video service provider.

- For IP telephone services (except the ONT-2-E4000i has no voice ports)

  - Up to two (2) standard analog telephones can be connected to the ONT, using the standard RJ-11 telephone connector.

  All subscriber phone services including any available calling features must be pre-provisioned by the Cable Operator or Service Provider.

4.5   Situating the EPON Multi-service Gateway ONT

The ONT-2-E4xxxi Multi-service Residential Gateway Series is designed to accommodate desktop, wall, or tower mounting. If the unit is to be placed on a desktop or other flat surface, make sure that the surface is stable. You should also ensure that you select a location which allows easy access to the rear of the unit for wiring and testing purposes.

There must be an AC electrical outlet close by for the power adapter. This outlet should be dedicated for the EPON Multi-service Gateway ONT. It is recommended to not have multiple EPON Multi-service Gateway ONTs sharing the outlet by means of a power strip, because emergency voice services for multiple users can be affected in the event of a power strip failure. Be sure that you only use the power adapter included in the package.

The ONT-2-E4xxxi Multi-service Residential Gateway Series is designed for operation in a dry room temperature indoor environment. Do not use it outdoors, or in a location with excessive heat or humidity.

4.6   Wall-Mounting the ONT Using the Fiber Tray

The fiber storage tray is used for slack management of the optical fiber cable. The fiber tray can also be used as a mounting bracket for the EPON Multi-service Gateway ONT for interior installations. After the field technician mounts the fiber tray, the fiber tray cover is snapped in place. Then the EPON Multi-service Gateway ONT can be snapped into the fiber tray any time when the service for the ONT is ready to be turned on.

To wall-mount an EPON Multi-service Gateway ONT by installing the fiber tray, we recommend the following procedure:

1. Ensure that the location of the EPON Multi-service Gateway ONT is within reach of a suitable AC outlet. The power cord on the AC adapter is approximately 5 ft. (1.52 m) long.

2. Select a flat, rigid mounting surface to wall-mount the fiber tray.

3. Note the keyhole slots in the back of the fiber tray that are available for wall hanging. See Figure 6.

Figure 6 Schematic of the Back of the Fiber Tray
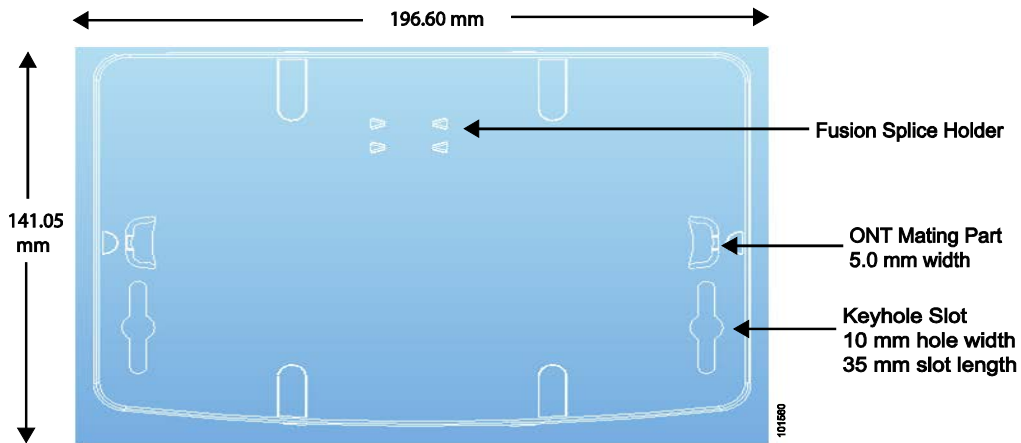
4. Select 2 screws or nails (with heads appropriately sized to snugly fit the keyhole slots), and insert them into the wall so that they align with the keyhole slots. Ensure that the screw/nails are horizontally level.

5. When the screws are in place and the fiber tray is ready to be mounted, hold the fiber tray so that its keyhole slots are positioned directly over the screw heads, push it back towards the wall, and then slide it downward until it is firmly seated in place.

    Snap the fiber tray cover over the fiber tray. You can wire the optical fiber cable any time. See Figure 7 for a picture of a fiber tray that has been mounted on a wall, in preparation for a provisioned EPON Multi-service Gateway. Remove the fiber tray cover and deftly snap the ONT onto the tray.

Figure 7 Fiber Tray with Cover Installed on Wall
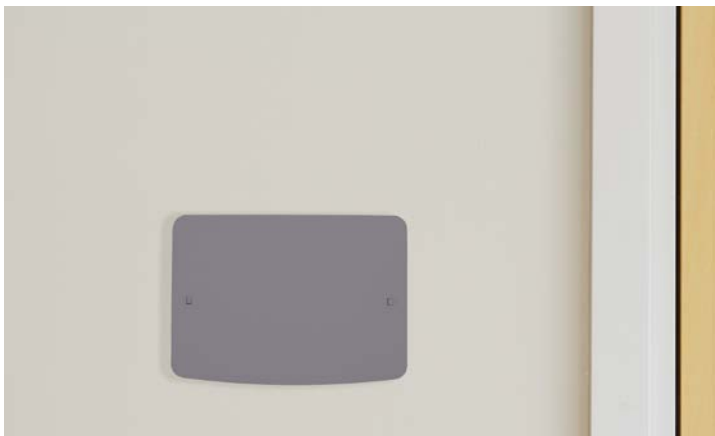
6. When the EPON Multi-service Gateway ONT has been provisioned for service, you can place the ONT onto the fiber tray by holding the ONT with the Aurora Networks logo on top and snapping the ONT onto the fiber tray.

Figure 8 EPON Multi-service Gateway Wall-mounted onto Fiber Tray


4.7 Wall-Mounting the ONT without the Fiber Tray

To wall-mount an EPON Multi-service Gateway ONT without installing the fiber tray, we recommend the following procedure:

1. Ensure that the location of the EPON Multi-service Gateway ONT is within reach of a suitable AC outlet. The power cord on the AC adapter is approximately 5 ft. (1.52 m) long.

2. Select a flat, rigid mounting surface to wall-mount the EPON Multi-service Gateway ONT.

3. Turn the ONT unit upside down and note the keyhole slots which are available for wall hanging.

Figure 9 Schematic of the Bottom of EPON Multi-service Gateway
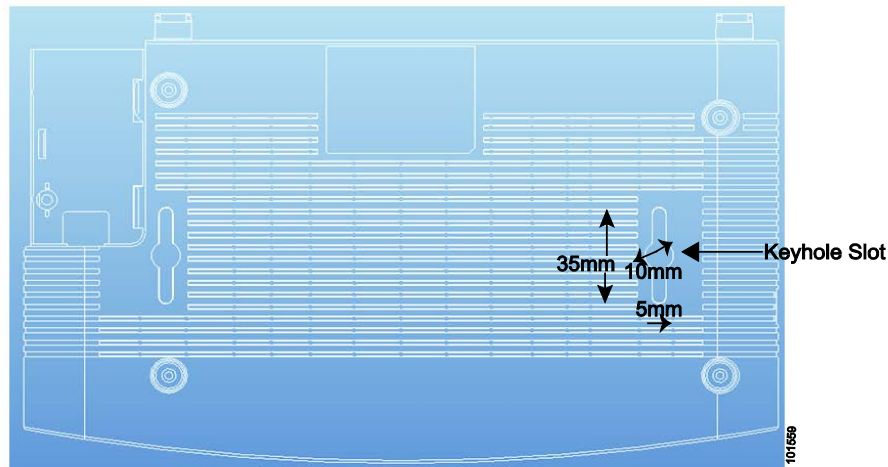
4. Select 2 screws or nails (with heads appropriately sized to snugly fit the keyhole slots), and insert them into the wall so that they align with the keyhole slots. Ensure that the screw/nails are horizontally level.

5. When the screws are in place and the unit is ready to be mounted, hold the ONT (with the Aurora Networks logo on top) so that its keyhole slots are positioned directly over the screw heads, push it back towards the wall, and then slide it downward until it is firmly seated in place.

Figure 10 EPON Multi-service Gateway Wall-mounted

4.8 Vertical or Tower Mounting the ONT

You might want to vertically mount your EPON Multi-service Gateway ONT, instead of installing it on your desk, to save space. To vertically mount or tower mount an ONT, we recommend the following procedure:

1. Ensure that the location of the EPON Multi-service Gateway ONT is within reach of a suitable AC outlet. The power cord on the AC adapter is approximately 5 ft. (1.52 m) long.

2. Select a flat, stable surface. Ensure that you select a location which allows easy access to the rear of the unit for wiring and testing purposes.

3. Place the tower stand on the flat surface and carefully drop the EPON Multi-service Gateway ONT into the tower stand. See Figure 11 for a picture of a vertically-mounted (or tower-mounted) ONT.

Figure 11 EPON Multi-service Residential Gateway ONT Vertically-Mounted

4.9   Connecting the EPON Optical Fiber to the ONT

The following procedure should be performed by the service provider or the cable installation contractor.

The EPON Multi-service Gateway ONT has a single SC/APC connector for connecting optical fiber to the unit. Prior to installation, the service provider or cable installation contractor must have routed and secured the optical fiber run from the utility pole or conduit, pulled and routed the individual fiber optic cable inside the premises, installed any wall plate outlets for fiber distribution, and supplied any fiber optic jumper/patch cable to connect to the EPON Multi-service Gateway ONT. The fiber optic cable (or patch cable) that connects to the Multi-service Gateway must be terminated with an SC/APC connector for a proper connection.

If you obtained the fiber tray, you can wrap the optical fiber cable inside the tray and install the tray on a wall, in preparation for snapping an EPON Multi-service Gateway onto it. A fiber tray example showing a view of the optical fiber wrapped in the tray and the ONT poised to be snapped onto the tray is shown in Figure 12.

Figure 12 Snapping the ONT onto the Fiber Tray


A typical wall plate example is shown in Figure 13.

Figure 13 Typical Wall Plate Example

The fiber optic cable should never be bent so that it exceeds its minimum bend radius during installation or use. Exceeding the bend radius can damage the fiber inside the cable, or reduce performance due to distortion of light along the fiber path. The fiber's minimum bend radius is 1 ¼ inch (3.175 cm) as shown in Figure 14.

Figure 14   Fiber Optic Cable Minimum Bend
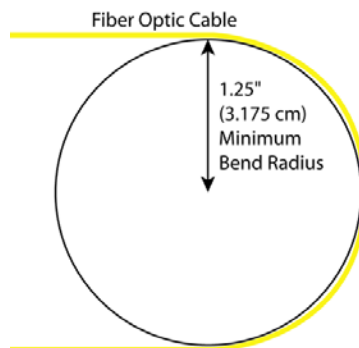
CAUTION: Ensure that you inspect and clean every fiber optic connector prior to mating the fiber ends. Failure to do so may compromise performance of the equipment, or cause component failure.

Take the following appropriate precautions when inspecting and cleaning fiber optics:

1. Turn off all laser sources

2. Ensure that the cable is disconnected from equipment at both ends of the cable

3. Wear appropriate safety glasses if required

4. Keep unplugged fiber connectors clean by using a protective cap, which is to be stored in a re-sealable container when not in use.

    Refer to document TN-08-001 "Cleaning Fiber Optic Connectors" for more information.

4.9.1   Steps to Connect the Optical Fiber to the ONT

Follow these steps for making connections to the ONT:

1. Remove the protective covers from the tips of the SC optical connector at the end of the jumper or terminated fiber cable.

2. Insert the SC connector on one end of the cable into the ONT's SC/APC EPON port, which is located on the left side of the unit as viewed from the rear. The plastic cover of the SC/APC connector compartment must first be removed. See Figure 15 for a picture of the optical EPON port with the cover removed.

### Figure 15 SC/APC Optical EPON Port

3. See Figure 16 for the location of the SC/APC connector compartment with the optical fiber plugged into the connector.

Figure 16 SC/APC EPON Connector Compartment

4. Remove the dust cap from the connector and connect the EPON fiber cable to the ONT. The connector is keyed to prevent mis-insertion into the port. The dust cap should always be left on the connector when the fiber is not connected to the equipment.
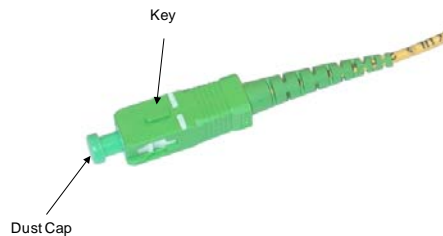
5. Connect the opposite end of the EPON fiber to the wall service connector, which may be similar to that shown in Figure 13 Typical Wall Plate Example.

6. You can also instead connect the EPON fiber that was wrapped in a fiber tray to the ONT. See an example in Figure 12 Snapping the ONT onto the Fiber Tray.

4.10   Connecting Telephones to the EPON Multi-service Gateway ONT

The ONT-2-E4020i, ONT-2-E4021i, ONT-2-E4020iWn, and ONT-2-E4021iWn provide two 6-pin modular RJ-11 jacks for connecting standard premises telephones. These voice ports each support a REN (Ringer Equivalency Number) of 4, and a maximum line length of up to 152.4 meters or 500 feet. The Ringer Equivalency Number is the allowable load for all analog telephony devices (telephones, fax machines, modems, etc.) on the same incoming line.

Note	*The REN value controls the ringer (ringing) of telephones. A ringer equivalency number of 1 represents the loading effect of a single "traditional" telephone ringing circuit, such as that within the Western Electric Model 500 telephone. Note that the REN of modern telephone equipment may be significantly lower than 1: as a rough guide, externally-powered digital-ring phones may have a REN as low as 0.1, while modern analog-ring phones (where the ringer is powered from the phone line) typically have a REN around 0.8.*

Note	*The REN is indicated on an FCC-Compliance label affixed to the telephony device, and, in the case of internal modems, generally is indicated in the user documentation.*

Follow these steps to connect the telephones or telephony equipment to the EPON Multi-service Gateway ONT:

1. Telephony equipment is generally supplied with a cable that includes an RJ-11 type plastic connector on the opposite or both ends. Insert the RJ-11 connector for the first telephone (or other equipment) into the #1 telephone port (Phone1) located on the rear panel of the EPON Multi-service Gateway ONT.

2. If a second telephony device is to be connected, plug its RJ-11 connector into the #2 telephone port (Phone2) located on the rear panel of the EPON Multi-service Gateway ONT.

Refer to Figure 2 Rear Panel Ports for the location of the telephone port connectors.

4.11   Connecting Premises LAN Ethernet Wiring

The ONT-E-4020i provides four Ethernet network interfaces.

Each Ethernet Port (LAN1 - LAN4) can be individually mapped to a VLAN as necessary for service deployment.

All Ethernet interfaces auto-detect whether the connectivity cable is straight-through or cross-over and configure themselves accordingly. In addition, all Ethernet interfaces auto-negotiate by default to operate at the speed and duplex mode of attached devices.

The Ethernet link length can be no greater than 100 m (≈ 328 ft) as defined by the IEEE 802.3 Ethernet Standard for 10/100/1000BASE-T.

The following steps are an example of how you can directly connect a network interface card, Ethernet set top box (STB), or an Ethernet switch, hub, or router on the customer premises Local Area Network (LAN). The service provider or cable operator may provide any site-specific instructions.

1. Use port 1 to connect the household's primary computer (or switch/router that supports the primary data services).

2. Ethernet compatible CPEs (computers, switches, routers, etc) utilize standard Ethernet wiring, which includes an RJ-45 connector on each end of the wire. Plug one end of the Ethernet cable into the target CPE, and plug the other end of the wire into the Gigabit Ethernet Port #1 on the rear panel of the EPON Multi-service Gateway ONT. Refer to Figure 2 Rear Panel Ports for the location of the Ethernet ports.

3. Use ports 2, 3, and 4 to connect any remaining Ethernet equipment, such as additional computers, Ethernet Set Top Boxes, or game controllers with Ethernet ports.

4. To organize the connected cables and reduce stress on the physical connections, it is recommended to tie-off and strain relieve the cable bundle connected to the rear on the ONT.

5. It is also advisable to label the individual cables noting the CPE and location to which it is connected.

Note	*The actual equipment that is connected to ports 1, 2, 3, and 4 may depend on how the Service Provider has provisioned each port, such as for data or IPTV services.*

4.12 Connecting Power and Powering Up the ONT

The EPON Multi-service Gateway ONT has a DC power input for connecting to an external 12 volt DC power supply. Once the power input is connected, the EPON Multi-service Gateway ONT can be powered on by using the power switch.

Note *Only use the 12 Volt DC power supply and integrated cord that was shipped with the EPON Gateway ONT. The plug for the power supply is specific to the geographic region in which the EPON Gateway ONT is distributed.*

Follow these steps to connect power and power on the EPON Multi-service Gateway ONT.

1. Make sure the ON/OFF switch is in the OFF position.

2. Ensure that the operational location of the ONT is within reach of a suitable AC outlet. The power cord is approximately 5 feet (1.52 meters) in length.

3. Connect the power cord to the DC power input connector on the rear of the unit.

4. Plug the power supply into a suitable AC wall outlet.

5. Tie down and strain-relieve the power supply cable to avoid accidental power loss to the unit.

6. Press the ON/OFF switch to ON to apply power to the ONT, and check that the Power LED on the front of the ONT is green.

See Figure 17 for a closeup of the Backup Power connector in the rear panel of the ONT.

Figure 17 Rear Backup Power Connector

Powering by the Backup Power connector is only effective when the power ON/OFF switch is at the OFF position.

4.13 Connecting to the GUI Interface of the ONT

1. Open your web browser and type http://192.168.1.1 in the browser's address box. This number is the default IP address for this ONT. Press **Enter.**

2. A username and password window will appear. The default username and password are "admin" and "admin" respectively. Press **OK** to proceed.

3. If the authentication succeeds, the ONT's GUI homepage "Device Info Summary" screen displays.

Figure 18 Device Info Summary Screen

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