NOKIA

WPON

WPON AP-Pole Product Guide

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1 Preface

This preface provides general information about the documentation for the Access Point (AP) of the Nokia WPON solution.

1.1 Scope

The documentation for the AP provides information about safety, features and functionality, ordering, hardware installation and maintenance, and software installation procedures for the AP in the current release of the WPON solution.

1.2 Audience

The documentation for the AP is intended for planners, administrators, operators, and maintenance personnel involved in installing, upgrading, or maintaining the AP.

1.3 Required knowledge

The reader must be familiar with general telecommunications principles.

1.4 Acronyms and initialisms

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

1.5 Assistance and ordering phone numbers

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

For ordering information, contact your Nokia sales representative.

1.6   Nokia quality processes

Nokia's AP quality practices are in compliance with TL 9000 requirements.These requirements are documented in the Fixed Networks Quality Manual 3FQ-30146-6000-QRZZA. The quality 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

1.7   Safety information

For safety information, see the appropriate safety guidelines chapter.

1.8   Documents

Documents are available from Nokia using ALED or OLCS.

Procedure 1   To download a ZIP file package of the customer documentation

1   Navigate to http://support.alcatel-lucent.com and enter your user name and password. If you are a new user and require access to this service, please contact your Nokia 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 on-screen directions to download the file.

Procedure 2   To access individual documents

Individual PDFs of customer documents are also accessible through the Nokia Customer Support website.

1	Navigate to http://support.alcatel-lucent.com and enter your user name and password. If you are a new user and require access to this service, please contact your Nokia 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.

1.9   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.

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1.9.1   Steps with options or substeps

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

Procedure 3   Example of options in a step

At step 1, you must choose option a or b.

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 step

At step 1, you must perform a series of substeps within the step.

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.

1.10   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.
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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2 AP legal and data privacy information

2.1 Purpose

2.2 Data privacy

2.1 Purpose

This chapter describes legal and data privacy information for the AP.

The information shall not be interpreted as a specification, modification, or amendment to the specification, or additional or other warranty of any kind. In case of discrepancy between this document and product specification or terms and conditions of the valid supply agreement between Nokia and the customer, the supply agreement and product specification shall always prevail over this document.

2.2 Data privacy

2.2.1 Privacy rules

Nokia intends to serve our customers with innovative offerings while complying with privacy rules, and enable our customers to satisfy legal and social privacy requirements.

The development of products, systems, and solutions according to Nokia processes ensures the following:

- respect of end-user privacy
- compliance with privacy laws
- makes it simple and straightforward for Nokia customers to build privacy-respecting services
- offer enhanced protection against unintended use

Nokia strives to perform the following:

- provide products with design and features that enable its operator customers to comply with their privacy obligations
- use reliable and trustworthy methods, that is, no security breaches
- ensure that Nokia products respect the privacy of end-users

2.2.2   Privacy impact assessment

A privacy impact assessment analyzes what subscriber personal data the product supports and what is the effect of potential breaches.

Subscriber personal data is information relating to an identified or identifiable natural person.

Some applications support the export and backup of application data. If the application data contains subscriber personal data, then this subscriber personal data is also exported.

Table 1 describes the data that the AP collects and stores, and the safeguards that are in place to protect data privacy.

Note — The information in the table is applicable to the current (first) release of the AP.

<< the table is based on a template that TechComms is developing in consultation with Shawn Abigail; info in the table is taken from 3TG-00001-0007-DSZZA-01P05-Personal Data Inventory for WPON.xlsx; it should be noted that there are discrepancies between the template as used here and the spreadsheet that will need to be resolved, including a separate table for safeguards (the discrepancies are not indicated here, and will need to be approved by Shawn) >>

<< it is not clear to me why there is a row for Serial number >>

Table 1   **AP data privacy strategy and safeguards**

Data type	Collected by	Purpose of data collection	Stored by	Retention period	Processed	Access restricted by role	Anonymization support	Safeguards
HOU location (HOU GPS longitude, latitude and elevation information)	GPS	Needed to identify the location for HOU equipment	Stored in ConfD	Data is retained as long as the customer record is active. If there are system backups, data may be retained after a customer record is inactive.	No	Only the respective users and administrators have access	Not anonymized	Saved in ConfD in Binary

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Data type	Collected by	Purpose of data collection	Stored by	Retention period	Processed	Access restricted by role	Anonymization support	Safeguards
MAC address (subscriber's MAC address)	Operator	Used for black and white list in ACL	Stored in ConfD	Data is retained as long as the customer record is active. If there are system backups, data may be retained after a customer record is inactive.	Yes	Only the respective users and administrators have access	Not anonymized	Saved in ConfD in Binary
Serial number (equipment serial number)	Not collected	Hardware identification	Saved in flash memory	Data is retained as long as the customer record is active. If there are system backups, data may be retained after a customer record is inactive.	Not applicable	Not applicable	Not applicable	It is not collected, and not used by application

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3 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 Access Point (AP) equipment. This chapter also includes environmental operation parameters of general interest.

<<does this chapter need to include OLT info, or should it only cover the AP? >>

<< this chapter needs to be closely looked at to make sure that it only provides applicable info for the AP and that no relevant AP info is missing, as it was copied from a similar chapter in the G-241G-A Product Guide >>

3.1 Environmental labels

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

3.1.1 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.

3.1.2 Environmental related labels

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

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3.1.2.1   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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3.1.2.2   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, Nokia has determined it is appropriate to use an EFUP of 50 years for network infrastructure equipment and an 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.

3.2 Hazardous Substances Table (HST)

This section describes the compliance of the OLT and AP 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 AP 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 Nokia Hazardous Substance Table, in Chinese, from the following location:

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

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3.3   Other environmental requirements

Observe the following environmental requirements when handling the OLT or AP equipment.

3.3.1   AP environmental requirements

See chapter 7 in this guide for more information about temperature ranges.

3.3.2   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. << what about AP? >>

3.3.3   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.<< what about AP? >>

3.3.4   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. << what about AP? >>

3.3.5   Thermal limitations

When the OLT is installed in the CO or CEV, install air filters on the OLT. The thermal limitations for OLT operation in a CO or CEV are: << what about AP? >>

- 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)

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- operating relative humidity: 5% to 85%
- short-term relative humidity: 5% to 95%, but not to exceed 0.024 kg of water/kg

3.3.6   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. Nokia products shipped to the EU after 1 July 2006 comply with the EU RoHS Directive.

Nokia has implemented a material/substance content management process. The process is described in: Nokia process for ensuring RoHS Compliance (1AA002660031ASZZA). This ensures compliance with the European Union Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS2). With the process equipment is assessed in accordance with the Harmonised Standard EN50581:2012 (CENELEC) on Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

3.3.7   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.

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Figure 3   **Recycling/take back/disposal of product symbol**

At the end of their life, the OLT and AP are subject to the applicable local legislations that implement the European Directive 2012/19EU 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, Nokia will offer to provide for the collection and treatment of Nokia products bearing the logo shown in Figure 3 at the end of their useful life, or products displaced by Nokia equipment offers. For information regarding take-back of equipment by Nokia, or for more information regarding the requirements for recycling/disposal of product, contact your Nokia account manager or Nokia take back support at sustainability.global@nokia.com.

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4 ETSI safety guidelines

This chapter provides information about the mandatory regulations that govern the installation and operation of the Access Points (APs) of the Nokia WPON solution in the ETSI market.

<< this chapter needs to be closely looked at to make sure that it only provides applicable info for the AP and that no relevant AP info is missing, as it was copied from a similar chapter in the G-241G-A Product Guide >>

4.1   Safety instructions

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

4.1.1   Safety instruction boxes

The safety instruction boxes are provided in the AP 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 AP equipment. It does not provide safety-related instructions.

4.1.2   Safety-related labels

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

Table 2 provides sample safety labels on the AP equipment.

Table 2   **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 4 shows the PSE certification.

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Figure 4   **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

4.2   Safety standards compliance

This section describes the AP equipment compliance with the European safety standards.

4.2.1   EMC, EMI, and ESD compliance

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

- EN 300-386 V1.5.1: Electromagnetic Compatibility and Radio Spectrum Matters (ERM): Telecommunications Network Equipment; Electromagnetic Compatibility (EMC) requirements; Electrostatic Discharge (ESD) requirements
- EN 55022 (2006): Class B, Information Technology Equipment, Radio Disturbance Characteristics, limits and methods of measurement
- EN 55024 (2010): 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

4.2.2   Equipment safety standard compliance

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

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4.2.3   Environmental standard compliance

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

4.2.4   Laser product standard compliance

For most AP equipment, the AP complies with EN 60825-1 and IEC 60825-2 for laser products. If there is an exception to this compliance regulation, you can find this information in the standards compliance section of the unit data sheet in this Product Guide.

4.2.5   Resistibility requirements compliance

The AP equipment complies with the requirements of ITU Recommendation K.21 for resistibility of telecommunication equipment installed in customer premises to over voltage and overcurrents. << does this apply to the AP? >>

4.2.6   Acoustic noise emission standard compliance

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

4.3   Electrical safety guidelines

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

Note 1 — The AP equipment complies 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 AP equipment complies with BS EN 61140.

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4.3.1   Power supplies

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

4.3.2   Cabling

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

- All cables must be approved by the relevant national electrical code.
- The cables for outdoor connection to the AP equipment 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. << remove this bullet since it refers to POTS ? >>

4.3.3   Protective earth

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

4.4   ESD safety guidelines

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

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

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

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4.5 Laser safety guidelines

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

4.5.1 Laser classification

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

4.5.1.1 Laser warning labels

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

Figure 5 shows a laser product label.

Figure 5 **Laser product label**

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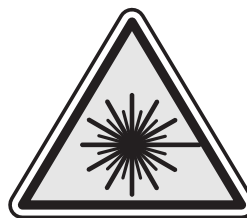
Figure 6 shows a laser classification label. Laser classification labels may be provided in other languages.

Figure 6   **Laser classification label**

```
┌──────────────────────────┐      ┌──────────────────────────┐
│  ┌────────────────────┐   │      │   ┌────────────────────┐  │
│  │ CLASS 1 LASER PRODUCT│  │      │   │ PRODUCTO LÁSER CLASE 1│ │
│  └────────────────────┘   │      │   └────────────────────┘  │
└──────────────────────────┘      └──────────────────────────┘

┌──────────────────────────┐      ┌──────────────────────────┐
│  ┌────────────────────┐   │      │   ┌────────────────────┐  │
│  │  CLÁSE 1 DEL LASER │   │      │   │   LASER CLASSE 1    │  │
│  └────────────────────┘   │      │   └────────────────────┘  │
└──────────────────────────┘      └──────────────────────────┘
```

18992
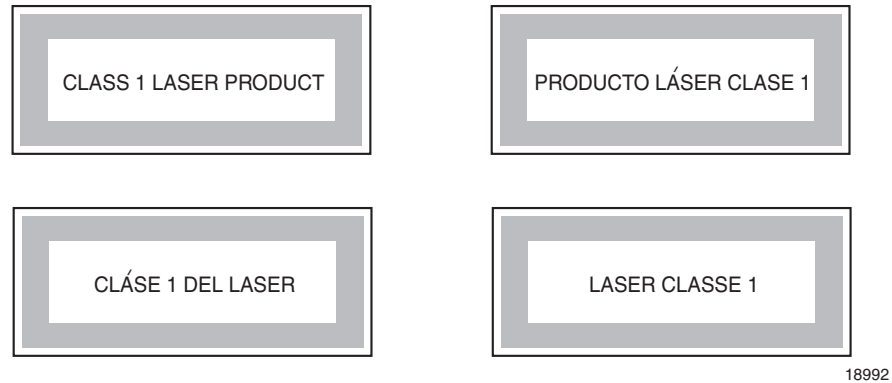
Figure 7 shows a laser warning label and an explanatory label for laser products. Labels and warning may be provided in other languages. The explanatory label provides the following information:

- 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 7 **Laser warning labels**

Laser Warning Label

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

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

4.5.2   Transmit optical output

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

4.5.3   Normal laser operation

In normal operation, fiber cable laser radiation is always off until it receives signal.

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.

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4.5.4   Location class

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

4.6   Environmental requirements

See section 7.6 in this guide for more information about temperature ranges.

During operation in the supported temperature range, condensation inside the AP equipment caused by humidity is not an issue. To avoid condensation caused by rapid changes in temperature and humidity, Nokia recommends:

• The door of the AP equipment not be opened until temperature inside and outside the equipment has stabilized. << does the AP have a "door"? >>
• If the door of the AP equipment 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 AP equipment helps prevent condensation when the door is opened.

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5 ANSI safety guidelines

This chapter provides information about the mandatory regulations that govern the installation and operation of the Access Points (APs) of the Nokia WPON solution in the North American or ANSI market.

<< this chapter needs to be closely looked at to make sure that it only provides applicable info for the AP and that no relevant AP info is missing, as it was copied from a similar chapter in the G-241G-A Product Guide >>

5.1 Safety instructions

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

5.1.1 Safety instruction boxes in customer documentation

The safety instruction boxes are provided in the AP 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.

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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 AP equipment. It does not provide safety-related instructions.

5.1.2   Safety-related labels

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

Table 3 provides examples of the text in the various AP equipment safety labels. << some of the examples have "ONT" >>

Table 3   **Safety labels**

Description	Label text
UL compliance	Communication service equipment US listed. Type 3R enclosure - Rainproof.
TUV compliance	Type 3R enclosure - Rainproof.
ESD warning	Caution: This assembly contains electrostatic sensitive device.

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Description	Label text
Laser classification	Class 1 laser product
Laser product compliance	This laser product conforms to all applicable standards of 21 CFR 1040.10 at date of manufacture.
FCC standards compliance	Tested to comply with FCC standards for home or office use.
CDRH compliance	Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007
Operation conditions	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.
Canadian standard compliance (modular ONT)	This Class A digital apparatus complies with Canadian ICES-003.
Canadian standard compliance (outdoor ONT)	This Class B digital apparatus complies with Canadian ICES-003.
CE marking	There are various CE symbols for CE compliance.

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Figure 8 shows a sample safety label on the AP equipment. << will need a new label, as the existing one shows "home or office use" >>

Figure 8   **Sample safety label on the AP equipment**

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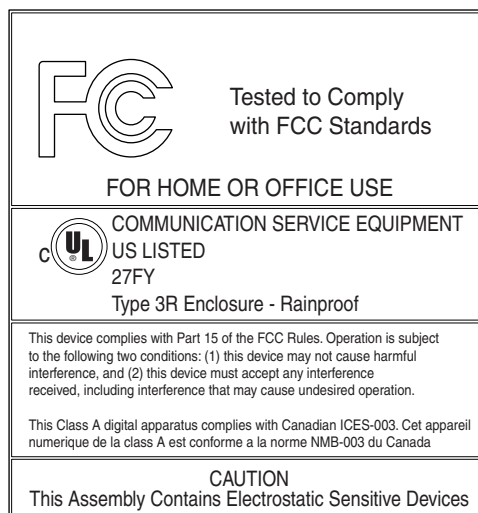
5.2   Safety standards compliance

This section describes the AP equipment compliance with North American safety standards.

Warning — Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

5.2.1   EMC, EMI, and ESD standards compliance

The AP equipment complies with the following requirements:

- Federal Communications Commission (FCC) CFR 47, Part 15, Subpart B, Class A requirements for << AP? >> equipment
- GR-1089-CORE requirements, including:
  - Section 3 Electromagnetic Interference, Emissions Radiated and Conducted
  - Section 3 Immunity, Radiated and Conducted
  - Section 2 ESD Discharge Immunity: System Level Electrostatic Discharge and EFT Immunity: Electrically Fast Transients
- ICES-003
- CAN/CSA C22.2 No. 60950-1

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 needed.
- Consult the dealer or an experienced radio/TV technician for help.

DRAFT

5.2.2   Equipment safety standard compliance

The AP equipment complies with the requirements of UL60950-1, Outdoor ONTs to "Communication Service Equipment" (CSE) and Indoor ONTs to Information Technology Equipment (ITE). << is "ONT" valid for both of these here? >>

5.2.3   Environmental standards compliance

The AP equipment complies with the following standards:

- GR-63-CORE (NEBS): requirements related to operating, storage, humidity, altitude, earthquake, office vibration, transportation and handling, fire resistance and spread, airborne contaminants, illumination, and acoustic noise
- GR-487-CORE: requirements related to rain, chemical, sand, and dust
- GR-487 R3-82: requirements related to condensation
- GR-3108: Requirements for Network Equipment in the Outside Plant (OSP)
- TP76200: Common Systems Equipment Interconnections Standards

5.2.4   Laser product standards compliance

The AP equipment complies with 21 CFR 1040.10 and CFR 1040.11, except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007" or to 21 CFR 1040.10 U.S. Center for Devices and Radiological Health (CDRH) of the Food and Drug Administration (FDA) Laser Notice 42 for ONTs containing Class 1 Laser modules certified by original manufactures. << is "ONT" okay here? >>

Per CDRH 21 CFR 10.40.10 (h) (1) (iv) distributors of Class 1 laser products, such as Nokia AP equipment shall leave the following Laser Safety cautions with the end user. << the AP is not installed at the end user's site, so is this needed? >>

a) "Class 1 Laser Product"

b) "Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure."

Figure 9 shows a laser product label.

DRAFT

Figure 9   **Sample laser product label showing CDRH 21 CFR compliance**
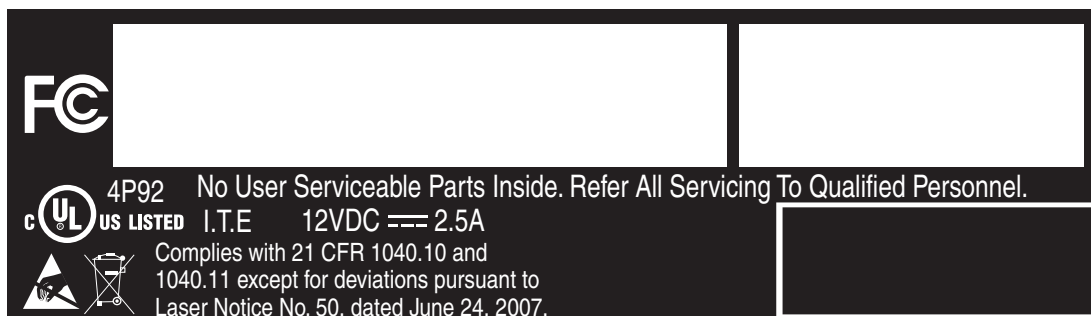
22813

5.2.5   Resistibility requirements compliance

The AP equipment complies with the requirements of ITU Recommendation K.21 for resistibility of telecommunication equipment installed in customer premises to overvoltage and overcurrents. << does this apply to the AP? >>

5.3   Laser safety guidelines

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.

Observe the following warnings when you perform installation, operations, and maintenance tasks on the AP equipment.

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

Observe the following danger for a 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.

Per CDRH 21 CFR 10.40.10 (h) (1) (iv) distributors of Class 1 laser products, such as Nokia AP equipment shall leave the following Laser Safety cautions with the end user. << the AP is not installed at the end user's site, so is this needed? >>

DRAFT

a) "Class 1 Laser Product"

b) "Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure."

5.3.1 Laser warning labels

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

Figure 10 shows a laser product label.

Figure 10 **Laser product label**
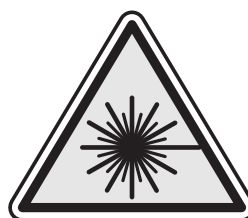
18455

Figure 11 shows a laser classification label. Laser classification labels may be provided in other languages.

Figure 11 **Laser classification label**

CLASS 1 LASER PRODUCT

PRODUCTO LÁSER CLASE 1

CLÁSE 1 DEL LASER

LASER CLASSE 1

18992

DRAFT
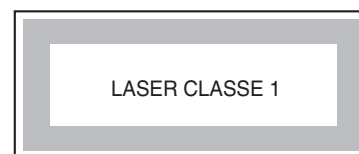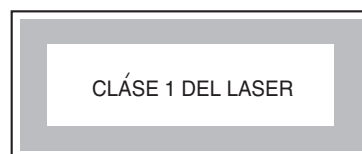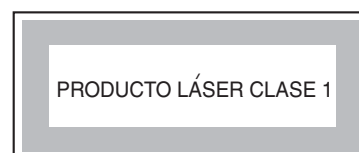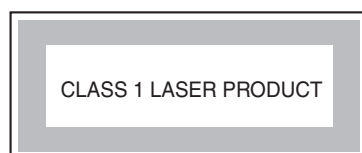
Figure 12 shows a laser warning label and an explanatory label for laser products. Explanatory labels may be provided in other languages. The explanatory label provides the following information:

- 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

Figure 12   **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

5.3.2   Laser classification

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

For Class 1 laser products, lasers are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Figure 13 shows a sample laser product safety label on the AP equipment.

DRAFT

Figure 13   Sample laser product safety label on the AP equipment
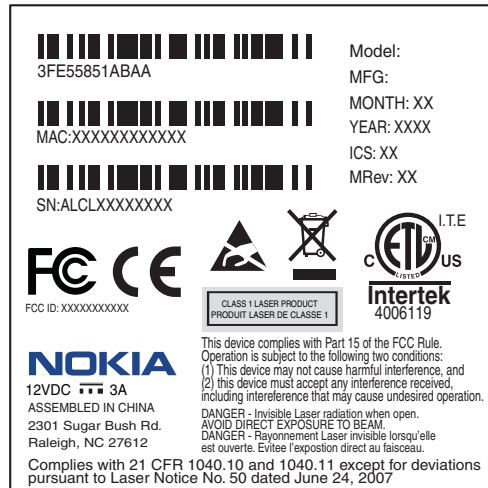
18532

5.3.3   Transmit optical output

The maximum transmit optical output of an AP is +15.89 dBm.

5.3.4   Normal laser operation

In normal operation, fiber cable laser radiation is always off until it receives signal.

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.

5.3.5   Location class

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

DRAFT

5.4   Electrical safety guidelines

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

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

5.4.1   Power supplies

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

5.4.2   Cabling

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

• Use only cables approved by the relevant national electrical code.
• Use cables suitable for outdoor use for connection to AP equipment.
• The AP equipment has been evaluated for use with external POTS wiring without primary protection that may not exceed 140 ft (43 m) in reach. However, the power cable must not exceed 100 ft (31 m). << remove this bullet since it refers to POTS? >>

5.4.3   Protective earth

Earthing and bonding of the AP equipment must comply with the requirements of NEC article 250 or local electrical codes.

DRAFT

5.5   ESD safety guidelines

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

⚠️ **Caution —** This equipment is ESD sensitive. Proper ESD protections should be used when entering the TELCO Access portion of the AP equipment.

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

Nokia recommends that you prepare the site before you install the AP equipment. In addition, you must control relative humidity, use static dissipating material for furniture or flooring, and restrict the use of air conditioning.

5.6   Environmental requirements

See section 7.6 in this guide for temperature ranges for AP equipment.

During operation in the supported temperature range, condensation inside the AP equipment caused by humidity is not an issue. To avoid condensation caused by rapid changes in temperature and humidity, Nokia recommends:

- The door of the AP equipment not be opened until temperature inside and outside the enclosure has stabilized.
- If the door of the AP equipment 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 AP equipment helps prevent condensation when the door is opened.

DRAFT

6 WPON solution overview

6.1 << something to consider >>

<< This whole chapter (all 12+ pages of it) had been planned to also be in the HOU Product Guide pretty much identical to how it is in the AP Product Guide. However it has now been stripped down in the HOU Product Guide, as keeping two almost identical chapters in the two product guides is an invitation for them getting out of sync and as well the AP as an entity is more of a WPON big picture kind of item and the HOU as an entity is more of just a subscriber-type item that wirelessly connects to an AP, so it makes sense to have the more detailed chapter in the AP Product Guide and a less detailed chapter in the HOU Product Guide. When looking that this chapter, we need to consider if the whole chapter should also be in the HOU product guide, or if it is okay to have a stripped down version in the HOU product guide that refers to this chapter for more information about the WPON solution. >>

6.2   WPON solution

The Nokia Wireless PON solution provides a 60 GHz wireless drop for PON or P2P-based optic networks so that fiber optic cables are not used for connection to subscribers' homes. The WPON has an Access Point (AP) that physically connects to the PON or P2P-based optic network. The AP uses 802.11ad for wireless communication with up to six Home Outside Units (HOUs) that provide Gigabit Ethernet connectivity to CPE inside subscribers homes.

<< do we need to provide more info about PONs and/or or P2P-based optic networks? What exactly is a "P2P-based optic network" - does it refer to GE, 2,5G, 10G Optical Ethernet? >> << there is quite a difference between a PON, which is a "point to multipoint" network, and a point to point network >> << can the PON be GPON, EPON, or other types of PONs? >>

By using 802.11ad, the WPON solution offers limited interference between systems because of narrow beams and inherent propagation limitations.

Figure 14 shows a high-level representation of the WPON solution providing a wireless drop from a PON or P2P-based optic network to three subscriber homes.

Figure 14   **High-level representation of the WPON solution**

<< new figure to go here >>

The WPON solution can be used with a fiber distribution network that includes the Nokia 7342 ISAM FTTU P-OLT as shown in Figure 15.

Figure 15   **Example of three WPONs connected to a PON that uses a P-OLT**

<< new figure that has three WPONs instead of the nine ONTs that are in the "fiber distribution network" figure typically used in the OLT and ONT documentation >>

6.2.1   APs and AP pairs

The AP provides the optical-to-wireless conversion for the WPON solution. The AP can be installed on a utility pole or on the outside of a building and uses 802.11ad for wireless line-of-sight communication with up to six HOUs up to 300 m away << or is it 100m? >>. An AP contains a GPS and magnetometer, enabling it to report its location and orientation to the management system. See chapter 7 in this guide for detailed information about APs.

<< check distance in above paragraph >>

DRAFT

Two APs can be installed as a pair on a utility pole to provide wider wireless coverage, such as to HOUs on houses on both sides of a street, In this case the two APs are known as an AP pair and they are connected to each other through a 2.5 Gigabit electrical Ethernet cable that handles all the traffic between the two APs. An AP pair is considered to be a single AP, with one of APs of the pair serving as the Main AP and the other AP as the Extension AP.

Figure 16 shows an AP pair, with each AP of the AP pair using 802.11ad for wireless line-of-sight communication with three HOUs.

Figure 16 **Example of an AP pair**

<< new figure to go here >>

6.2.2   HOUs

An HOU provides the wireless-to-Gigabit Ethernet electrical conversion for the WPON solution at the subscriber premises. Based on 802.11ad, an HOU can be considered to be a wireless station (STA). An HOU is installed on the outside of a subscriber's home and uses a Gigabit Ethernet electrical cable for physical connectivity to CPE such as a residential gateway inside the home. The same cable is used to provide power over Ethernet to the HOU. An HOU contains a GPS and magnetometer, enabling it to report its location and orientation to the management system.

After physical installation and power up, an HOU automatically connects to the best AP available, reports its presence, gets configured, and initiates service per the customer subscribed service type. The HOU also detects any neighboring APs in its line of sight and reports these to the management system.

See the *HOU Product Guide* for detailed information about HOUs.

6.2.3   WPONs

A PON or a P2P-based optic network can have multiple WPONs; for example, the PON shown in Figure 15 has three WPONs.

At a minimum, a WPON consists of one AP and at least one HOU.

A WPON has a single NNI point at the optical connection point of the AP with the PON or P2P-based optic network.

A WPON can have multiple UNI points, one at each HOU that is part of the WPON.

An OLT in the PON sees each WPON as a NNI; the OLT does not see the UNIs. In this respect, a WPON is seen in a similar way as a subtending node, such as a DPU.

The number of APs and HOUs in a WPON depends on the topology used for the WPON. See section 6.3 for more information about WPON topologies.

DRAFT

6.2.4   Overhead cabling with composite cable

<< According to WPON product definition v12.pptx, there could be a number of APs on poles that have overhead cabling with composite cable. It is not exactly clear what is meant by "overhead cabling with composite cable", but assume that it is a cable that contains multiple fiber optic cables coming from an optical distribution frame, with each fiber optic cable to go to an AP that is not daisy chained (eg, if there are five cables in the composite cable, then there are five APs, but note that as per the PON model, each cable has traffic for all subscribers). If assumption is correct, then "overhead cabling with composite cable" is just a way for a fiber optic cable to get to an AP that is on a pole, and as such does not need to be described and this section is not needed >>

6.3   WPON topologies

The WPON solution can be set up in the following topologies:

- basic WPON topology
- wireless daisy chain topology
- wireless mesh topology

<< is mesh supported in this release? >>

6.3.1   Basic WPON topology

The basic WPON topology consists of a single AP or AP pair that connects to the PON or P2P-based optic network and provides wireless communications to HOUs for which it can use 802.11ad for wireless line-of-sight communication. The topology shown in Figure 14 is an example of the basic WPON topology. The network shown in Figure 15 has three basic WPONs,

<< does the single AP or AP pair have "Head AP" as the device type in the WPON manager GUI, or is "Head AP" only to be used for an AP that has the fiber optic connection for a daisy chain (see next section)? should we call a single AP or AP pair something like "standalone AP and standalone AP pair" to distinguish them from Head AP and Relay AP of daisy chains? >>

6.3.1.1   Resiliency of the basic WPON topology

<< should we use "redundancy" or "resiliency"? >>

DRAFT

Resiliency is possible between two basic WPONs by having the WPONs provide some resiliency for each other. HOUs have the ability to scan for the best AP and automatically self-align to it. An HOU will automatically try re-associate with any other AP in its reach if its active AP fails or the link with its active AP fails. From the WPON that experienced the failure, the HOUs would be using an AP in a different WPON if possible.

<< is this type of resiliency possible? >>

6.3.2   Wireless daisy chain topology

<< does WPON support linear and ring (looped) daisy chain topologies, or just non-branched linear? >> << this section is written on the assumption that only linear, non-branched non-looped daisy chains are supported >>

<< what is the max number of "hops"? >>

A WPON can be set up in a linear, non-branched, non-looped daisy chain configuration so that APs can use line-of-sight wireless communication with other APs. In this case, one of the APs is connected to the PON or P2P-based optic network and is known as the Head AP. The other APs in the daisy chain are known as Relay APs. The fiber optical connection at the Head AP supports all the subscribers that are served by all the APs in the daisy chain. Each AP in the daisy chain automatically uses self backhaul so that all upstream traffic is transmitted to the PON or P2P-based optic network through the Head AP.

The Head AP can use 802.11ad for wireless line-of-sight communication with one downstream Relay AP and up to six HOUs. A Relay AP can use 802.11ad for wireless line-of-sight communication with one upstream AP (which could be the Head AP or another Relay AP), one downstream Relay AP, and up to six HOUs.

Figure 17 shows a daisy chain that has two Relay APs. Each of the APs in the example has wireless communications with three HOUs.

Figure 17   **Example of a daisy chain configuration**

<< new figure to go here >>

Note — APs to be used in a daisy chain must be ordered from Nokia for use as a Head AP or as Relay APs in a daisy chain.

If an AP pair is used in a daisy chain, only one of the APs in the AP pair functions as an AP in the daisy chain, either as the Head AP or as a Relay AP. Figure 18 shows an example of an AP pair in a daisy chain where one of the APs in the AP pair is a Relay AP. The other AP in the AP pair is the Extension AP and it is not part of the daisy chain.

DRAFT

Figure 18   **Example of a daisy chain configuration that has an AP pair**

<< new figure to go here >>

6.3.2.1   Resiliency of the wireless daisy chain topology

Some resiliency within a linear, non-branched non-looped, daisy chain topology is possible due to the ability of HOUs to scan for the best AP and automatically self-align to it. An HOU will automatically try re-associate with another AP in its reach if its active AP fails or the link with its active AP fails. This can provide resiliency within the daisy chain for those HOUs that had been using a failed AP that can use an AP that is upstream from the failed AP in the daisy chain.

<< should we add a figure to show this? >>

It is also possible to have resiliency between WPONs by having the WPONs provide some resiliency for each other. HOUs have the ability to scan for the best AP and automatically self-align to it. An HOU will automatically try re-associate with another AP in its reach if its active AP fails or the link with its active AP fails. From the WPON that experienced the failure, the HOUs would be using an AP in a different WPON if possible.

<< is this type of resiliency possible? >> << should we add a figure that has at least one daisy-chained WPON with HOUs that can access APs in another WPON? >>

<< Branches in a daisy chain would make the topology more of a "meshed" topology and it could be covered in the next section >>

6.3.3   Wireless mesh topology

<< is mesh topology supported in this release? if yes, need info - how does it differ from branched daisy chain topologies? >>

6.4   WPON architecture

A WPON is made up:

- an underlay network
- one or more overlay networks

<< the AC - FNMS-20579 - NAC: WPON Manager App phase 1 wiki page has the above as two of four layers for "intents" for the WPON manager; the additional layers are the Equipment Deployment layer (responsible for provisioning the basis infrastructure like hardware components, device management configurations, targeted software version and uplink PON/P2P interfaces in-case of Head AP) as the top layer and the Service/VLAN Layer (responsible for provisioning the service related aspects like forwarders and sub vlan interfaces in Head AP and HOU) as the bottom layer; do we need to cover these other two layers, or are they already covered by the two layers that we have? >>

6.4.1   Underlay network

The underlay network serves as an IP-based network that provides connectivity between all the APs and HOUs in the WPON. The underlay network uses RIP for route distribution and routing for the APs and HOUs using IP addresses that are assigned by a DHCP server hosted in the Head AP.

<< what if the WPON does not have a Head AP (that is, what if it is a basic WPON topology that only has one AP?)? >>

A WPON has a single underlay network.

The underlay network is managed through the WPON manager. See section 6.6.1 for more information about the WPON manager.

6.4.2   Overlay network

The overlay network is a virtual network that provides L2 connectivity between an AP and its associated HOUs through the use of GRE tunnels. The overlay network provides logical P2P connectivity on top of the underlay network.

A WPON has an overlay network for each HOU in the WPON.

If an HOU is associated with an AP that is part of a basic WPON topology, the AP and the HOU function as a Layer 2 switch with the AP being the NNI point and a GRE tunnel endpoint and with the HOU being the UNI point and the other GRE tunnel endpoint.

If an HOU is associated with an AP that is part of a daisy chain topology, the Head AP and the HOU function as a Layer 2 switch with the Head AP being the NNI point and one GRE tunnel endpoint and with the HOU being the UNI point and the other GRE tunnel endpoint. The WPON solution behaves like a L2 network where Ethernet frames are cross connected on a tagged VLAN basis between the NNI and UNI.

A GRE tunnel serves as a VLAN that carries Ethernet frames both directions between the HOU and AP. Each HOU has a private IP address and an X.509 certificate. The AP has a DHCP server to assign internal IP addresses, with each wireless segment having its own subnet. In the AP, the remote IP address is unspecified and learned dynamically, and each GRE tunnel in the WPON is assigned a unique key. The DSCP field of the IP header of the GRE tunnel packets is used to preserve QoS inside the WPON. The DSCP values match the TC to which the flow carried inside is mapped. On the wireless interfaces, queue selection is done based on the DSCP values.

<< is "TC" the same as traffic control? >>

For multicast traffic, an IGMP/MLD proxy is used in the AP to dynamically build the multicast forwarding tree so that multicast traffic is passed to the GRE tunnels for delivery to the HOUs.

In the downstream direction, the AP transmits only subscriber-specific traffic (including multicast traffic) over the overlay network to each HOU (that is, it is the AP, not the HOU, that discards traffic that is not intended for the subscriber associated with each HOU).

In the upstream direction, APs use priority queues on a weighted fair queueing basis to ensure that each HOU gets a fair share of the upstream bandwidth in the overlay network.

Overlay networks, including GRE tunnels, are created and managed through the WPON manager. See section 6.6.1 for more information about the WPON manager.

6.5   WPON services

<< placeholder as per the outline to provide a section on "Services offered", but it is not clear what info should be provided here even after looking at some ONT documentation: the 7368 ISAM ONT Product Overview (3FE-47159-AAAA-TCZZA) indicates voice, IP video, RF video, and data as services; it has section 9.2 (System and service capacity specifications) that has the following: "Service descriptions, such as VoIP and flex services, are provided in the appropriate OLT Product Information Manual" (which is presumably the product guide); however the 7368 ISAM ONT O-210G-B O-211G-B Product Guide (3FE-53082-AAAA-TCZZA) has no description of services - do we need a section in the AP guide to describe these services, or perhaps this section would be better in the HOU product guide? >>

<< the WPON manager can be used to configure "services" but it is at the OLT, so perhaps we don't need a section on WPON services >>

<< does "services" mean things like high speed Internet, voice over IP, and broadcast TV? if yes, do they need to be included in this guide? >>

DRAFT

6.6   WPON management

The following are used for management of the WPON solution:

- WPON manager (section 6.6.1)
- Nokia Altiplano (section 6.6.2)
- Bluetooth (section 6.6.3)

<< is the above list complete? >> << section 4.1 (Software architecture Overview) of WPON TRS-20171228.docx (wPON Software Technical Requirement Specification 3TG-00001-0002-DSZZA) indicates OAM interface, NETCONF, SNMP, web, CLI, and Bluetooth and section 4.4 (Service Layer) has "6.Interface management External Interface (OMA-DM/Confd/WebUI/CLI) -North-bound interface to wPON Manager: Using Netconf/Yang for remote management -Local interface: CLI for local configuration/debug/test -WEB CGI/UI: Not mandatory for WPON >>

<< the WPON Feature Requirements doc indicates that until Altiplano market introduction has be accomplished, the management solution shall allow making use of the existing network management system, AMS, to a certain extent - do we need to include AMS in this doc? >>

<< should this section have some overview info about software and installation feature support, with a link to the section in the UDS that covers software and installation feature support? >>

<< what about system management, software management, performance management, fault management, hardware management, security management, and troubleshooting (including trace and debug)? >>

DRAFT

6.6.1   WPON management through the WPON manager

The WPON manager provides web server management for the WPON solution. The WPON manager allows you to configure the following:

- equipment deployment, specifically provisioning of the basic infrastructure such as hardware components of APs and HOUs in a WPON, including device management configurations, targeted software version, and the interface to the PON or P2P optical network
- the underlay network of a WPON, specifically provisioning of the wireless and/or Ethernet interfaces of APs and HOUs, including IP addresses and underlying network routing aspects
- the overlay networks of a WPON, specifically provisioning of loopback interfaces, provisioning GRE tunnels by creating GRE tunnel endpoints in the WPON, and creating services on the OLT

<< what services? are "services" something that we need to cover in this guide? >>

The WPON manager:

- provides abstractions for service provisioning across the various elements in a WPON
- is responsible for monitoring the health of the various elements in a WPON as well as monitoring the health of services provisioned on them
- is responsible for management of the GRE tunnels in a WPON
- is responsible for IP address assignment for the underlay network and configuration of DHCP services in the Head AP for dynamic IP assignment for all other elements in the WPON
- controls the entire QoS configuration

The WPON manager provides a GUI that provides the following:

- device list, with information such as name, type, connection status, alignment status, and health for each AP and HOU in the WPON
- topology maps that can show network view, redundancy view, overlay view, or street view of the WPON
- topology history that shows information such as topology version, timestamp, and user name and allows you to view a graphical comparison of topology versions of the WPON
- network list that provides the AP name, interface name, interface mode, IP address, and subnet for each WPON

<< how do you access/invoke the WPON manager? >> << can we indicate a document that the user can refer to for more info >>

DRAFT

<< would changes be needed in this section if it turns out that the APs and HOUs were "discovered" after they were installed rather than having been provisioned? >>

When you create and provision APs and HOUs and create GRE tunnels and services through the WPON manager, the information is passed to the Altiplano.

6.6.2   WPON management through the Nokia Altiplano

The Nokia Altiplano is a cloud-native access platform that consists of two products:

- the Nokia Altiplano Access Controller:
  - The Access Controller is the domain controller for unified management of both SDN and traditional access networks. It offers a wide range of APIs and tools, such as field force, service fulfilment, service assurance and task center applications that help to visualize, automate, optimize and enhance the network. It provides automation, easy integration with the OSS/BSS and flexible programming of end-to-end services in the access network.
  - The Access Controller automates the network
- the Nokia Altiplano Access Virtualizer:
  - The Access Virtualizer is the cloud component that creates a virtualized and centralized view of the network in the cloud. It offers the logic and primitives for efficiently programming and monitoring the underlying network elements, without having to deal with challenges such as node reachability and scalability when connecting to hundreds of thousands of nodes
  - The Access Virtualizer programs nodes

The Nokia Altiplano Access Controller serves as the Element Manager for the WPON solution by providing the following: << does the Altiplano Access Controller really serve as the Element Manager, because it looks like the WPON manager does a lot element management? >>

- PMA function for the APs and HOUs in each WPON, and acts as a PMA aggregator (PMAA) towards the WPON manager << what is PMA? >>
- software management, backup and restore, and alarm collection functions

The Altiplano << Controller or Virtualizer? >> provisions APs and HOUs in response to call-home messages sent by the APs and HOUs to it after they have been created and provisioned through the WPON manager.

<< do we need to include anything about Netconf Server/CLI/SNMP (Netconf server used in WPON is 3rd party commercial SW (confd coming from tail-f), which provides CLI interface, SNMP interface and netconf interface to NMS)? >>

DRAFT

<< section 5.1.2 (Relay AP Start-up) of WPON TRS-20171228.docx (wPON Software Technical Requirement Specification 3TG-00001-0002-DSZZA) indicates that the Operator manually installs the Relay AP (report serial number of AP hardware to PMA); however is it reported to the WPOM manager which then passes it to the Altiplano (which provides the PMA function)? >> << the TRS does not have this for the Head AP or HOU >>

<< do we need to say anything about installing or using the Altiplano? can we indicate a document that the user can refer to for more info? >>

6.6.3   WPON management through Bluetooth

Local craft terminal access for APs and HOUs is provided through a Bluetooth interface (classical Bluetooth, reach greater than 20 m) on the AP or HOU.

The Bluetooth interface provides access to a Bluetooth server that is used for local management of the AP or HOU by a Bluetooth-equipped mobile phone or tablet or other external device that can be used as a local terminal to access the AP or HOU for on-site configuration or maintenance.

See section 11.2 in this product guide for information about using the Bluetooth interface to configure an AP.

6.7   WPON Solution standards compliance

<< content needed; are there three (or more?) types of standards compliance based on the type of connection: PON/P2P connectivity, wireless connectivity, and CPE connectivity? >> << can we get info from "3TG-00014-000x-xxZZA" docs (there are approx. 20 docs that appear to have "spec/standards/safety guidelines-type" info or test results that could perhaps go in the two product guides)? >>

6.8   Planning considerations/Use Cases

<< content needed >>

6.9   Solution-level technical specifications

<< content needed >> << overlap with AP and HOU UDSs? >>

Supported channels: Center frequency: channel 2: 60.48 GHz, channel 3: 62.64 GHz

<< other specs as per 3TG-00011-AAAA-DDZZA-WPON Feature Requirements >>

6.10   Compatible CPE

<< Include a table here, or in the CRN, that lists CPE that can connect to the HOU? If here, should it be in the AP product guide as well as in the HOU product guide? >>

DRAFT

7 AP unit data sheet

7.1   AP part numbers and identification

Table 4 provides part numbers and identification information for the APs.

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Table 4   **AP part numbers and identification**

Part number	Provisioning number	Description	CLEI	CPR	ECI/ Bar code
3FE 47281 AA << confirm >>	<< need >>	AP with one fiber optic connection and two 802.11ad baseband units. One of the 802.11ad baseband units is used for wireless connections to HOUs. This AP can mounted on a wall or utility pole. The AP can be used with an Extension AP if mounted on a utility pole. This is the only AP with a fiber optic connection and it is designed to be used as a standalone AP (does not use wireless connections to other APs) or as the Head AP in a daisy chain topology (uses a wireless connection to a downstream Relay AP). The fiber optic connection is used to connect the AP to a PON or P2P-based optic network that uses fiber optic cabling that has an SC/APC adapter << confirm adapter >>. The AP requires a protector module and/or an SFP optical module << confirm >>	<< need >>	<< need >>	<< need >>
3FE 47444 AA << confirm >>	<< need >>	AP with three 802.11ad baseband units. One of the 802.11ad baseband units is used for wireless connections to HOUs. This AP can mounted on a wall or utility pole. The AP can be used with an Extension AP if mounted on a utility pole. This AP is designed to be used as a Relay AP in a daisy chain topology (supports a wireless connection to one upstream AP, which could be the Head AP or another Relay AP, and one downstream Relay AP). This AP does not have any fiber optic connections and cannot connect to a PON or P2P-based optic network.	<< need >>	<< need >>	<< need >>
3FE 47289 AA << confirm >>	<< need >>	AP with one 802.11ad baseband unit. The 802.11ad baseband unit is used for wireless connections to HOUs. This AP does not support wireless connections to other APs. This AP is designed to be used as the Extension AP in an AP pair mounted on a utility pole. A 2.5G electrical Ethernet cable is used to connect the APs in an AP pair. This AP does not have any fiber optic connections and cannot connect to a PON or P2P-based optic network.	<< need >>	<< need >>	<< need >>

Table 5 provides power supply ordering information for APs. For more information on power supplies, see the *7368 ISAM ONT Power Supply and UPS Guide.* << are there any power supplies for the APs? If yes, are they in the *7368 ISAM ONT Power Supply and UPS Guide* and, if yes, would it be useful to keep the reference to the *7368 ISAM ONT Power Supply and UPS Guide*? >> << does the AP only use mains AC connection, 110-230 VAC for power? >>

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Table 5   **AP power adapter and UPS power supplies**

Power/UPS model	Power UPS and cabling part number information	Customer category or country compliance tested for [1]	Notes
<< need >>	<< need >>	<< need >>	<< need >>
<< need >>	<< need >>	<< need >>	<< need >>
<< need >>	<< need >>	<< need >>	<< need >>
<< need >>	<< need >>	<< need >>	<< need >>

Note
[1]   The list of detailed tests << need >>.

Table 6 provides accessory ordering information for APs. << are there any accessories for the APs? what about connection cable for an AP pair, pole-mounting hardware (strapping, fasteners, etc), wall-mounting hardware (brackets, etc)? >>

Table 6   **AP accessories**

Accessory	Orderable part number	Notes
<< need >>	<< need >>	<< need >>
<< need >>	<< need >>	<< need >>

7.2   AP general description

APs are designed to provide the optical-to-wireless conversion for the WPON solution by providing a fiber optic interface to the PON or P2P optical network along with providing wireless line-of-sight communication with up to six HOUs or up to two other APs. See section 6.2 for more information about the WPON solution.

On the optical side, the AP is compliant with ITU-T G.984 supporting 2.5Gbps downstream and 1.25Gbps upstream line-rates. << note that these values do not match the figure to be added in the WPON overview chapter >>

On the wireless side, the AP is compliant with 802.11ad supporting unlicensed 60 GHz mmWave wireless line-of-sight communication with 1 Gb/s peak speeds.

The AP is managed through the WPON manager and the Nokia Altiplano cloud-native access platform. A local craft terminal access point is provided on the AP through a Bluetooth interface (classical Bluetooth, reach greater than 20 m). See section 6.6 in this guide for more information about management of the WPON solution.

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The AP provides the following functions and features:

- optical to wireless conversion
- << in the downstream direction to the HOUs, does the AP simply multicast the signal received from the upstream AP or fiber optic connection to all its HOUs or does it only transmit subscriber-specific traffic to each HOU (that is, is it the AP or HOU that discards traffic that is not intended for the subscriber associated with the HOU?) >>
- can be installed on a utility pole (fits multiple pole dimensions and geometries) or on the outside of a building
- daisy chain with other APs using self backhaul
- up to 3 Gbps aggregate capacity per HOU, supporting 1 Gbps peak speeds to up to six HOUs up to 100 m << or is it 300 m >> away << confirm aggregate vs peak values >>
- beam-forming antennas for fast and reliable wireless connection
- different antenna configurations and applications
- wide field of view for antennas: 180 degrees horizontal and 60 degrees vertical
- GPON or P2P optic fiber feed (SFP)
- single mode fiber (SC/APC connector)
- local grid or DC loop powered << or is it mains AC connection, 110-230 VAC for wall-mount and remote powering with multiple pairs carrying high voltage/low current for pole mounted version only? >>
- sends dying gasp signal upstream if loss of power occurs
- has a built-in GPS and magnetometer
- fiber storage tray for wall mounting << confirm the AP has this >>
- robust design for harsh conditions (IP66)
- small size: 18 cm by 18 cm by 7 cm << or is it 25x16x7 cm? >>
- MDI/MDIX auto sensing << confirm the AP has this for its Ethernet connection to another AP >>
- network demarcation for all services << confirm the AP does this >>
- interworking functions between the GEM and Ethernet layers << confirm the AP does this >>
- mux and demux functions to the PON or P2P optical network<< confirm the AP does this >>
- optics that support received signal strength indication (RSSI) << confirm the AP has this >>
- G984.4 standard and revised compliant OMCI interface for management and provisioning << confirm the AP has this >>
- on/off button << confirm the AP has this >>
- support for AIS with DOWN MEP << confirm the AP has this >>

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7.3   AP software and installation feature support

Software for the AP is managed through the WPON manager and the Nokia Altiplano; see section 6.6.1 for information about the WPON manager and section 6.6.2 for information about the Nokia Altiplano.

For information about installing or replacing an AP, see the following chapters:

- chapter 8 (Pre-installation steps for an AP or AP pair)
- chapter 9 (Procedures to install an AP or AP pair)
- chapter 10 (Procedures to replace an AP)

7.4   Subscriber traffic interfaces on the AP

Table 7 describes the supported subscriber traffic interfaces for the APs.

Table 7   **AP subscriber traffic interfaces**

AP application	Head or Relay AP	Number of interfaces		
		PON/P2P optic fiber	**Ethernet** [1]	**Wireless** [2]
AP used in a basic WPON topology	-	One	One	One for drop to the HOUs [3]
AP used in a daisy chain topology	Head AP	One	One	Two: • one for drop to the HOUs • one for daisy chaining to the downstream AP
	Relay AP	-	One	Three: • one for drop to the HOUs • one for daisy chaining to the upstream AP [4] • one for daisy chaining to the downstream AP
Extension AP used in an AP pair (any topology)	-	-	One	One for drop to the HOUs

Notes

[1]   The Ethernet interface is only used for connecting two APs that make up an AP pair
[2]   The wireless components are described in more detail in section 7.4.2
[3]   There is a second wireless interface but it is not used in this application.
[4]   The upstream AP can be a Rely AP or the Head AP.

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7.4.1 AP physical connections and components

Figure 19 shows the AP physical connections and components and section 7.4.2 describes the wireless components.

Figure 19 **AP physical connections and components**

<< add figure that has AP connections and components (if no components, then change title of section and figure) >>

Table 8 describes the AP physical connections and components.

Table 8 **AP physical connections and components**

Connection or component	Description
PON/P2P fiber optic connection	This connection is provided through single mode fiber optic cable with an SC/APC connector. << does the AP require an SFP? >>
Ethernet connection	This connection is provided through an RJ 25 connector. It is used for connecting two APs in an AP pair to each other through a 2.5G electrical Ethernet cable.
Ground connection	<< is there a ground point? >>
On/off button	This button turns the AP on or off << is there an on/off button? >>
Reset button	This button turns resets the AP << is there a reset; if yes is it a button with a narrow hole? >>
Power connection	This connection is provided through a power cable with a << type? >>connector.

7.4.2 AP wireless components

Depending on the variant, the AP has wireless components for the following:

- drop to HOUs:
  - one 802.11ad baseband unit that has three single-tile 32-antenna/RF arrays that have a scan range of +/- 90° Azimuth, +30°+x /-30°+x elevation, antenna tiles tilted upwards, angle x << need values for "x" >>
  - the 32-antenna/RF arrays use vertical polarization and are located at the center line of the AP

DRAFT

- daisy chaining to an upstream or downstream AP:
  - two 802.11ad baseband units (one for upstream and the other for downstream)
  - each 802.11ad baseband unit has a 64-antenna/RF array that is made up of two 32-antenna tiles and has a scan range of +/- 30° Azimuth, +/- 30° elevation, antenna tiles are not tilted
  - the 64-antenna/RF arrays use horizontal polarization and are located towards the left and right sides of the AP
  - for a wall-mounted AP, the antenna/RF arrays are angled 15° away from the wall

7.5   AP LED information

The AP has a single multifunction LED that is software-defined to light under certain conditions.

Figure 20 shows the location of the LED.

Figure 20   **AP LED location**

<< add figure showing location of the LED>>

Table 9 describes the AP LED. << need info for AP LED >>

Table 9   **AP LED behavior description**

LED color and behavior	LED behavior description
Off	<< need >>
Solid green	<< need >>
Solid red	<< need >>
Flashing green (fast)	<< need >>
Flashing green (slow)	<< need >>
Flashing red (fast)	<< need >>
Flashing red (slow)	<< need >>
<< any other (eg alternating red and green)? >>	<< need >>

7.6   AP specifications

Table 10 lists the physical specifications for the AP. << are the specs the same for all APs? >>

DRAFT

Table 10   **AP physical specifications**

Dimensions	Specifications
Height	<< need >>
Width	<< need >>
Depth	<< need >>
Weight [within ± 0.5 lb (0.23 kg)]	<< need >>

Table 11 lists power consumption specifications for the AP.

Table 11   **AP power consumption specifications**

AP	Maximum power (not to exceed)	Condition	Minimum power	Condition
<< need >>	<< need >>	<< need >>	<< need >>	<< need >>
<< need >>	<< need >>	<< need >>	<< need >>	<< need >>
<< need >>	<< need >>	<< need >>	<< need >>	<< need >>

Table 12 lists the environmental requirements for the AP.<< need to verify >>

Table 12   **AP environmental requirements**

Mounting method	Temperature range and humidity	Altitude
Utility pole or on an outside wall	Operating: 23°F to 122°F (-5°C to 50°C) ambient temperature 5% to 85% relative humidity, non-condensing	Maximum operating altitude is 10 000 ft (3048 m) above mean sea level
	Storage: −40°F to 140°F (−40° to 60°C) 5% to 93% relative humidity, non-condensing	Maximum non-operating altitude is 40 000 ft (12 192 m) above mean sea level

7.7   GEM ports and T-CONTs

<< this section is as per the G-241G-A ONT product guide - does any of it apply to the APs? >>

Table 13 lists the maximum number of supported T-CONTs and GEM ports for G-241G-A ONT. 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   **G-241G-A ONT capacity for GEM ports and T-CONTs**

ONT or MDU	Maximum	Notes
Package P ONTs		
GEM ports per ONT	124	124 are present; 122 are available, and 2 are reserved for multicast and debugging
T-CONTs per ONT	32	32 are present; 31 are available, and 1 is reserved for OMCI

7.8   Performance monitoring statistics

<< this section is as per the G-241G-A ONT product guide - does any of it apply to the APs? >>

The following section identifies the supported performance monitoring statistics for G-241G-A ONT. A check mark indicates the statistic is supported on that ONT. An empty cell indicates the statistic is not supported. The following tables are categorized by supported alarm types:

- Table 14 provides statistics for ONTENET type counters
- Table 15 provides statistics for ONTL2UNI type counters
- Table 16 provides statistics for PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, and PONONTTCVOIP type counters
- Table 17 provides statistics for PONONTTC aggregate type counters

Note — If you have trouble accessing G-241G-A ONT performance monitoring statistics using TL1, please contact your Nokia support representative for more information about how to access and retrieve performance monitoring type counters.

Table 14   **G-241G-A ONT ONTENET performance monitoring statistics**

ONT	ONTENET statistics												
	FCSE	EC	LC	RBO	SCF	MCF	DT	IMTE	CSE	AE	IMRE	FTL	TBO	SQE
GPON													
G-241G-A [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

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Table 15 G-241G-A ONT ONTL2UNI performance monitoring statistics

ONT	ONTL2UNI statistics										
	FRAMES	BYTES	MCFRAMES	DSDRPDFRMS	USDRPDFRMS	USFRAMES	DSFRAMES	USBYTES	DSBYTES	USMCFRAMES	DSMCFRAMES
GPON											
G-241G-A [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 16 G-241G-A ONT PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP performance monitoring statistics

ONT	PONONTTC, PONONTMCTC, PONONTTCHSI, PONONTTCCES, PONONTTCFLOW, PONONTTCVOIP statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
GPON						
G-241G-A [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 17   **G-241G-A ONT PONONTTC aggregate performance monitoring statistics**

ONT	PONONTTC (aggregate) statistics					
	TXBLOCKS	TXFRAGS	RXBLOCKS	RXFRAGS	LOSTFRAGS	BADGEMHDRS
GPON						
G-241G-A [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

7.9   Functional blocks

Figure 21 shows the functional blocks for an AP. Note that not all functional blocks are used in all APs:

- the AP used in a basic WPON topology does not use upstream and downstream antenna/RF blocks
- a Head AP does not use the upstream antenna/RF block
- a Relay AP does not connect to a fiber optic cable
- an Expansion AP does not:
  - use upstream and downstream antenna/RF blocks
  - connect to a fiber optic cable
- the 2.5 G Ethernet block is only used if the AP is part of an AP pair

Figure 21   **Functional blocks of an AP**

<< add figure showing the functional blocks of an AP >>

Figure 22 shows the SoC functional block in more detail.

Figure 22   **SOC functional block**

<< add figure showing the SoC functional block >>

DRAFT

The SoC for the AP consists of the following key elements:

- GPON MAC:
  The Gigabit Passive Optical Network Media Access Control (GPON MAC) element on the SoC terminates the GPON interface using an optical diplexer. This interface supports GPON as described in G.984.3 (GPON TC Layer) ITU specification.
- Ethernet MAC:
  The SoC provides up to four GE MACs. << confirm >>
- Control Processor:
  The Control Processor features an integral memory management unit that supports a dedicated 64 kbyte instruction cache and shares a single 32 kbyte data cache with the DSP. The Control Processor and DSP also include a single channel Data Management Application (DMA) controller with a 4 kbyte read ahead low-latency Dynamic Random Access Memory (DRAM) access port. The processors typically run at 400 MHz.
- Switch matrix:
  The Switch matrix provides an integrated data channel between the four GE MACs, the GPON MAC, the control processor, and the other integrated elements such as flash memory, DRAM, and the local bus controller.

7.10 AP standards compliance

The APs are compliant with the following standards: << the following list is from the G-241G-A ONT product guide - it needs to be reviewed carefully to make sure that it is complete and accurate with respect to the APs >>

- EN-300019-2-1 (Class T1.2)
- EN-300019-2-2 (Class T2.3)
- EN-300019-2-3 (Class T3.2))
- ETL
- FCC (Class B)/CAN ICES-003
- IEEE 802.1p (QoS)
- IEEE 802.1q (VLANs)
- IEEE 802.3ab, 3i 3u (GE)
- IEEE 802.3 (2012) (auto-negotiation)
- IEEE 802.3x (flow control)
- MEF 2.0
- ITU-T G.984 (GPON interface framing)
- ITU-T G.984.2 (1.25 Gb/s, 2.5 Gb/s)
- ITU-T G.984.3 (activation with automatic discovery of a serial number and a password)
- ITU-T G.984.4 (standard and revised) (OMCI interface for ONT management and provisioning)

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7.10.1   Energy-related products standby and off modes compliance

<< this section needs to be confirmed >>

Hereby, Nokia declares that the APs are in compliance with the essential requirements and other relevant provisions of Directive 2009/125/EC together with Commission Regulation (EC) No 1275/2008 and Commission Regulation (EC) No 801/2013.

The APs qualify as equipment with high network availability (HiNA) functionality. Since the main purpose of the APs is to provide network functionality with HiNA 7 days /24 hours, the modes Off/Standby, Power Management, and Networked Standby are inappropriate.

For information about the type and number of network ports, see "Subscriber traffic interfaces on the AP" in this chapter.

For information about power consumption, see "AP specifications" in this chapter.

7.10.2   Laser product standards compliance

<< this section needs to be confirmed and a new figure needs to be provided that has the AP instead of the G-241G-A ONT >>

Figure 23 shows an AP laser product label. For information on laser product maintenance, see chapter 13.

Figure 23   **AP laser product label showing safety standard compliance**
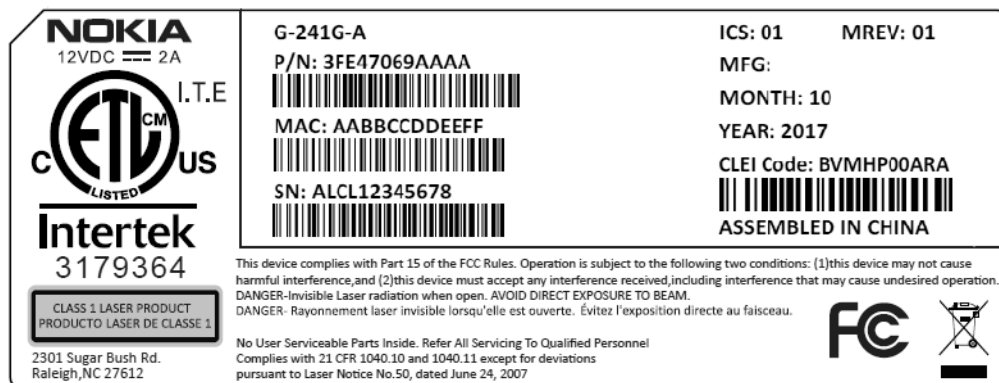
7.10.3   AP compliance statement

<< this section needs to be confirmed >>

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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.

2   This device must accept any interference received, including interference that may cause undesired operation.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: 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 needed.
• Consult the dealer or an experienced radio/TV technician for help.

7.10.4   Responsible party

<< this section needs to be confirmed >>

<< if it is Raleigh, is the phone number and other info correct? >>

Table 18 lists the party in the US responsible for this AP.

Table 18   **Responsible party contact information**

Legal Company name	Nokia USA Inc.
Address	2301 SUGAR BUSH RD. STE 300, RALEIGH,NC 27612
Phone, Fax	+1 919 850 6127

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7.11   AP special considerations

<< are there any special considerations and limitations for the APs? >>
<< the following table is for reference, as it is from the G-241G-A ONT product guide >>

Table 19   **G-241G-A ONT considerations and limitations**

Considerations and limitations
Call History Data collection (ONTCALLHST) is supported, except for the following parameters: RTP packets (discarded), far-end RTCP and RTCP-XR participation, RTCP average and peak round trip delay, MOS, average jitter, number of jitter-buffer over-runs and under runs.
Some voice features are configurable on a per ONT basis, including Call Waiting, Call Hold, 3-Way Calling, and Call Transfer.
The following voice features / GSIP parameters are configurable on a per-Client/ per-ONT basis (not per-Subscriber): • Enable Caller ID and Enable Caller Name ID • Digitmap and the associated Interdigit and Critical timers and Enter key parameters • Warmline timer is enabled per subscriber, but the warmline timer value is configured per ONT and must have a lower value than the Permanent time • Miscellaneous timers: Permanent, Timed-release, Reanswer, Error-tone, and CW-alert timers • Features / functions: Message waiting mode, WMWI refresh interval, DTMF volume level • Service Codes for the following features: CCW, Call Hold and Warmline

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8 Pre-installation steps for an AP or AP pair

8.1 General

8.2 Scan the AP identifier

8.3 Create and provision the AP

8.4 HOU installation information

8.5 << placeholder in case needed >>

8.1 General

<< the purpose of this chapter is to cover installation-related items that should be addressed at the CO or before the installer goes out to the installation site; Assume that the PON and power for the AP are already set up and are available >>

<< briefly describe the various installation scenarios (such as installing first AP (or a pair of APs) and one or more HOUs, adding an HOU to an existing WPON provided by an AP, adding a Relay AP (and one or more HOUs) to an existing WPON provided by an AP), and adding a second AP (and one or more HOUs) to create an AP pair? Is it likely that an AP would be installed by itself without at least one HOU being installed at the same time? It certainly seems possible that just a single HOU could be installed by itself for a "late uptake" customer. This could perhaps be covered at a general level in the WPON Overview chapter, with any specific info about the AP here, with a reference to the WPON Overview chapter. >>

8.2 Scan the AP identifier

<< Scan the AP identifier, as the WPON (Wireless PON) wiki of Feb 06/18 indicates to do this before installing the AP or HOU (this reports the serial number of the <<xx>> to the WPON manager) >> << need details on how to do this >>

8.3 Create and provision the AP

<< Create and provision the AP, through the WPON manager, as the WPON (Wireless PON) wiki of Feb 06/18 indicates to do this before installing the AP or HOU >> << need details on how to do this >>

DRAFT

8.4   HOU installation information

If you will be installing any HOUs while you are installing the AP or AP pair, refer to the HOU Product Guide for information about HOUs, including pre-installation steps and procedures on installing HOUs.

8.5   << placeholder in case needed >>

<< if needed, for any other pre-installation activities >>

DRAFT

9 Procedures to install an AP or AP pair

9.1 Purpose

This chapter provides the procedures to install an AP or AP pair.

9.2 General

<< need to determine what should go here or if this section is even needed >>

9.3 Prerequisites

You need the following items before beginning the installation:

- appropriate AP or APs
- a 2.5G electrical Ethernet cable if installing an AP pair
- a protector module and/or an SFP optical module if the AP is going to connect to a PON or P2P-based optic network << confirm >>
- pole-mounting hardware (strapping, fasteners, etc) or wall-mounting brackets
- power supply and/or other "accessories"

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- mobile phone or tablet for local management of the AP via Bluetooth
- << anything else? >>

9.4   Recommended tools

You need the following tools for the installation:

- scanner for reading bar code on the AP
- something << what? >> for measuring distance << others?>> << note that the rest of the items in the list are from the G-241G-A ONT Product Guide and might not apply to an AP 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
- drill and drill bits
- pin-in-hex screwdriver

9.5   Safety information

Read the following safety information before beginning the installation

<< need to confirm that the info in this section applies to the AP, as it is from the G-241G-A Product Guide >>

<< - include fiber optic safety info for AP

- include height/fall safety info

DRAFT

- include reference to chapter 11 for grounding safety >>

Danger 1 — Hazardous electrical voltages and currents can cause serious physical harm or death. Always use insulated tools and follow proper safety precautions when connecting or disconnecting power circuits.

Danger 2 — Make sure all sources of power are turned off and have no live voltages present on feed lines or terminals. Use a voltmeter to measure for voltage before proceeding.

Danger 3 — Always contact the local utility company before connecting the enclosure to the utilities.

Warning 1 — This equipment is ESD sensitive. Proper ESD protections should be used when removing the fiber access cover of the AP.

<< does the AP have an access cover? >>

Warning 2 — The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Note 1 — Observe the local and national laws and regulations that may be applicable to this installation.

Note 2 — The AP 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.

Note 3 — The AP must be installed by qualified service personnel.

Note 4 — See AP specifications in the AP unit data sheet for the temperature ranges for the AP.

DRAFT

9.6   Identify the mounting site

<<intro needed >>

1   Identify exact location on pole or wall for AP (or for AP pair on a pole); confirming that there is line of sight and there is less than 100 m (or is it 300 m?) between the prospective AP location and planned or installed HOU(s), and if the AP is to be part of a daisy chain, with the planned or installed upstream or downstream AP (lines of sight will depend on the installation scenario, covered in section 7.1) << need details >>

2   STOP. This procedure is complete.

9.7   Make preparations at the mounting site

<< intro needed >>

1   Make sure that you have the correct type of AP or APs:

- If you are installing an AP pair, one of the APs must be an Extension AP and you will need to have a 2.5G electrical Ethernet cable to connect the two APs. The other AP must be a Relay AP or an AP that can connect to a PON or P2P-based optic network.
- If you will be connecting the AP to a PON or P2P-based optic network, the AP must have a fiber optic connection point
- If you are installing an AP in a daisy chain, and the AP is not connecting to the PON or P2P-based optic network, the AP must be a Relay AP
- << is it possible that they could be adding an Extension AP to an AP already mounted on a pole? >>

2   Scan the AP or AP pair if it was not done in section 7.2 (assuming that it is not too late if it was not already scanned)? << need details >>

3   Confirm power is available for the AP or AP pair << need details >>

4   Prepare near-end of cables - does the AP require that the fiber optic cable have an SC/APC adapter? If yes, then this step needs to cover that >> << use info from chapter 5 in the 7368 ISAM ONT Hardware and Cabling guide (far-end equipment and connections already done as per section 7.1) << need details >>

5   Verify optical signal levels at the near end of the PON or P2P-based optic networks – use info from chapter 11 in the 7368 ISAM ONT Hardware and Cabling guide << need details >>

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6   Do any pre-work on the AP/AP pair and/or pole/wall before mounting the AP/AP pair on the pole/wall, esp since that actually mounting of the AP/AP pair could be high up and so it would be good to do what can be done while on the ground (such as attaching a mounting plate to an AP) or before mounting the AP/AP pair (such as attaching a bracket to the wall) in order to minimize how many times the installer needs to go up the pole or on a ladder. << need details >>

7   STOP. This procedure is complete.

9.8   Mount the AP or AP pair and make connections

<< need intro >> << Perhaps chapters 18 and 19 of the 7368 ISAM ONT Hardware and Cabling guide might have useful info >>

1   Mount the AP/AP pair << Will need to cover mounting AP or AP pair on a pole and mounting an AP on an outside wall. If AP pair, note which AP is going to be the Head/Relay AP and which AP is the Extension AP >> << need details >>

2   Route and connect ground to the AP/AP pair << need details >> << perhaps use info from chapter 6 in the 7368 ISAM ONT Hardware and Cabling guide >>

3   If an AP pair, connect 2.5G electrical Ethernet cable between the two APs << need details >>

4   Route and connect power to the AP/AP pair << need details >> << perhaps use info from chapter 6 in the 7368 ISAM ONT Hardware and Cabling guide >>

5   If the AP is going to connect to the PON or P2P-based optic networks, route the fiber cable to the AP and make the fiber optic connection << Place the fiber optic cable inside the wall-mounted outdoor enclosure. Tie wrap the cable at the fiber optic strain relief if necessary. >> << need details, but see below >> << is a protector module and/or an SFP optical module needed? >> << include fiber optic warnings etc for the fiber optic connection >>

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<< the following is based on the G-241G-A ONT product guide >>

⚠ **Danger —** Fiber cables transmit invisible laser light. To avoid eye damage or blindness, never look directly into fibers, connectors, or adapters.

⚠ **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.

i Route the fiber optic cable to the AP.

ii Loosen the lock screw on the connection clip of the fiber optic cable.

iii Lift up the connection clip.

iv Plug the SC/APC adapter of the fiber optic cable into the fiber optic connector located on the AP, as shown in Figure << fig reference >>.

v Lower the connection clip of fiber optic cable so that it secures the fiber optic cable.

vi Tighten the lock screw on the connection clip of the fiber optic cable.

6 STOP. This procedure is complete.

9.9 **Complete the installation**

<< need intro >>

1 Power up the AP by using the ON/OFF power switch. << add a figure showing location of switch? >> If an AP pair, power up both APs << does it matter which one first? >>

2 Verify the AP LED, voltage status, and optical signal levels << need details >> << are there applicable details in the *7368 Hardware and Cabling Installation Guide* that could be added here? >>

3 Verify system functionality of the AP << assume that this can be done via Bluetooth (used with external app of mobile phone or tablet for local device management) >> << need details >> << single AP vs AP pair >> << configure anything on the AP via Bluetooth >>

4 If the HOU or HOUs for the AP have been installed, check that the AP has wireless connectivity with the HOU or HOUs << need details >>

<< doc part number is tbd >>

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5   If the AP is to be part of a daisy chain and the upstream or downstream AP has been installed, check that the AP has wireless connectivity with the upstream or downstream AP << need details >>

6   If necessary, reset the AP. << can the AP be reset as described here? >>

    i   Locate the Reset button.

    ii   Insert the end of a straightened paper clip or other narrow object into the hole in the Reset button to reset the AP.

7   STOP. This procedure is complete.

DRAFT

10   Procedures to replace an AP

10.1   Purpose

This chapter provides the procedures to replace an AP. << work on this chapter after working on the installation chapter >>

<< will need to cover "replacing" a single AP on a pole with an AP pair - or is it "installing? >>

10.2   General

<< is this section needed? >>

10.3   Prerequisites

<< work on this section after working on the installation chapter >>

10.4   Recommended tools

<< work on this chapter after working on the installation chapter >>

10.5   Safety information

<< work on this chapter after working on the installation chapter >>

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10.6   AP replacement procedure

<< work on AP replacement procedures after working on the AP installation chapter >> << this procedure is currently the one for replacing the G-241G-A ONT and is left here for use as a model for the AP >>

1   Deactivate the ONT services at the P-OLT.

If you are using the SLID feature, this step is not required. The ONT and the services can remain in service (IS).

i   Use the RTRV-ONT command to verify the ONT status and the associated services. Record the serial number or the SLID of the ONT displayed in the command output.

Example:

```
RTRV-ONT::ONT-1-1-1-1-1;
```

ii   If the ONT is in service, place the ONT in OOS state.

Example:

```
ED-ONT::ONT-1-1-1-1-1;
```

2   Power down the ONT unit by using the ON/OFF power switch.

3   Disconnect the video, POTS, Ethernet, power, and ground cables from the ONT; see Figure 24.

Figure 24   **G-241G-A ONT connections**

Ground lug   RF Video   POTS ports (RJ-14)   Gigabit Ethernet ports (RJ-45)   On/off button   Power connector   SC/APC connector
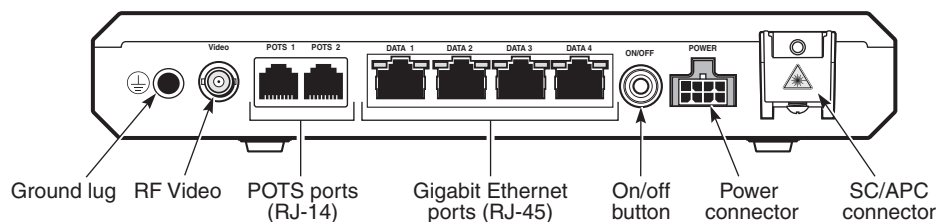
28061

4   Unplug the SC/APC fiber optic cable from the ONT.

i   Loosen the lock screw on the fiber optic connection clip.

ii   Lift the connection clip up.

iii   Unplug the fiber optic cable with SC/APC adapter from the fiber optic connector; see Figure 24.

iv   Lower the clip and tighten the lock screw.

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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 8.

    b   On a wall. The G-241G-A can be wall-mounted with or without a fiber storage tray.

> **Note —** If the Emerson 24W AC/DC Power Adapter or the Delta DUPS-1232GA will be used, the ONT must be mounted a minimum of 31.5 in (0.8 m) above the floor.
>
> If the Delta DUPS-1232A will be used, the ONT must be mounted a minimum of 59 in (1.5 m) above the floor.

        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.

    c   In a wall-mounted outdoor enclosure.

        i   Unfasten the G-241G-A ONT by turning the brackets to the open position and remove the unit; see Figure 25.

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Figure 25   **G-241G-A ONT mounted in an outdoor enclosure**
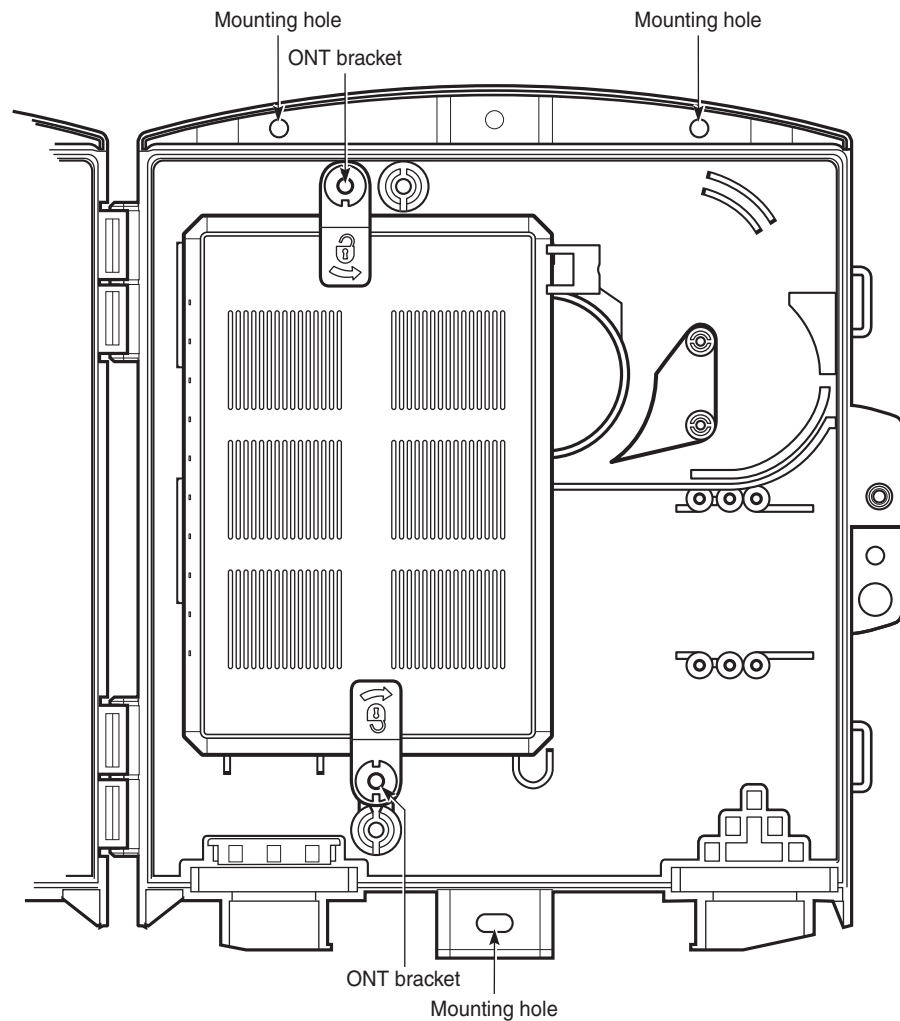
ii   Position the replacement G-241G-A ONT within the outdoor enclosure and between the ONT brackets, as shown in Figure 25.

iii   Secure the G-241G-A ONT by turning the brackets to the closed position.

Warning — Do not overtighten the ONT bracket when securing the G-241G-A ONT to the outdoor enclosure. The unit can become skewed and compromise the environmental seal of the ONT mounted in the outdoor enclosure.

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6 To ground a G-241G-A ONT:

⚠ **Danger 1 —** Hazardous electrical voltages and currents can cause serious physical harm or death. Always use insulated tools and follow proper safety precautions when connecting or disconnecting power circuits. For more information on grounding safety, see chapter 12.

Danger 2 — Make sure all sources of power are turned off and have no live voltages present on feed lines or terminals. Use a voltmeter to measure for voltage before proceeding.

Danger 3 — Always contact the local utility company before connecting the enclosure to the utilities.

a An indoor desktop or wall-mounted G-241G-A ONT is grounded by the 3-pin power adapter or a grounded UPS.

⚠ **Warning —** Do not connect the ground lug of the G-241G-A ONT for indoor installations; the ONT is grounded by the power adapter or UPS.

b A G-241G-A ONT mounted in an outdoor enclosure must be grounded with a permanent ground wire.

Connect a single #6 to #14 AWG ground wire to the recessed ground lug on the G-241G-A ONT. The ground wire exits from the back of the ONT unit in the same way as the cables.

7 Connect the RF video coaxial cable; see Figure 24.

8 Route up to four Ethernet cables to the RJ-45 ports, as shown in Figure 24. Connect the Ethernet cables.

9 Route up to two POTS cables to the RJ-14 ports, as shown in Figure 24. Connect the POTS cables.

10 If required, have approved service personnel who are trained to work with optic fiber clean the fiber optic connection. See the *7368 ISAM ONT Configuration, Management, and Troubleshooting Guide* 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.

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11 Connect the fiber optic cable to a G-241G-A ONT.

> **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.

    i Route the fiber optic cable to the ONT.

    ii Loosen the lock screw on the fiber optic connection clip.

    iii Lift the connection clip up.

    iv Plug the fiber optic cable with SC/APC adapter into the fiber optic connector; see Figure 24.

    v Lower the clip so that it secures the fiber optic cable.

    vi Tighten the lock screw.

12 Install the power supply according to manufacturer specifications.

> **Warning —** 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.

13 Connect the power cable with an 8-pin Molex connector or 3-pin power adapter to the ONT unit.

14 For a G-241G-A ONT installed in an outdoor enclosure with an FSST, coil the excess cable in a clockwise direction allowing it to exit the lower right cable exit port.

> **Note —** Observe the following:
>
> - There must be approximately 18 in. (45.72 cm) of cable stub exiting the FSST at the right cable exit point.
> - The FSST stores a maximum of 75 ft (22.86 m) of cable.

15 Power up the ONT unit by using the ON/OFF power switch.

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16   If used, configure the SLID; see the *7368 ISAM ONT Configuration, Management, and Troubleshooting Guide*.

> ℹ️   **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.

17   If necessary, reset the ONT.

    i   Locate the Reset button.

    ii   Insert the end of a straightened paper clip or other narrow object into the hole in the Reset button to reset the ONT.

18   Verify the ONT LEDs, voltage status, and optical signal level; see the *7368 Hardware and Cabling Installation Guide*.

19   Activate and test the services; see the *7368 Hardware and Cabling Installation Guide*.

20   For a G-241G-A ONT installed in an outdoor enclosure, close the access cover of the outdoor enclosure and secure using the pin-in-hex screw.

21   STOP. This procedure is complete.

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11 Configure an AP

11.1 Remote configuration

11.2 Local configuration

11.1   Remote configuration

The following can be used to configure an AP remotely:

- WPON manager (section 6.6.1)
- Nokia Altiplano (section 6.6.2)

11.2   Local configuration

Local craft terminal access for an AP is provided through a Bluetooth interface (classical Bluetooth, reach greater than 20 m) on the AP.

The Bluetooth interface provides access to a Bluetooth server that can be used for local management of the AP by a Bluetooth-equipped mobile phone or tablet or other external device.

You can configure the following through the Bluetooth interface of an AP:

<< need info on how to configure APs through the Bluetooth interface >>

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12 Grounding safety

12.1 Ground safety information

12.1   Ground safety information

<< this section is based on the equivalent section in the G-241-G-A ONT product guide, with "ONT" changed to "AP" - the section needs to be reviewed carefully to make sure that it is complete and accurate with respect to the AP >>

Improper grounding can result in personal injury or equipment damage. See below for specific dangers and considerations when handling grounding equipment.

Danger — Hazardous electrical voltages and currents can cause serious physical harm or death. Always use insulated tools and follow proper safety precautions when connecting or disconnecting power circuits.

Danger — Make sure all sources of power are turned off and have no live voltages present on feed lines or terminals. Use a voltmeter to measure for voltage before proceeding.

Danger — Always contact the local utility company before connecting the enclosure to the utilities.

Danger — You must connect the AP to earth ground before connecting the power supply to the AP.

<< change "the power supply" to "power"? >>

Danger — The earth bonding terminal shall be connected to an approved earth connection before the ac power is applied.

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Danger — Earthing and bonding of the AP must comply with the ANSI-specific requirements found in NEC Article 250.

- Insulation - The grounding conductor must be insulated and listed as suitable for the purpose.
- Material - The grounding conductor shall be copper or other corrosion-resistant conductive material stranded or solid.
- Size - The grounding conductor must be a minimum of 14 AWG per UL investigation. If local code or regulations require more, follow per local codes or regulation.
- Length - The primary protector grounding conductor must be as short as practicable. In one- and two-family dwellings, the primary protector grounding conductor must be as short as practicable, not to exceed 20 ft (6.0 m) in length.
- If the building or structure served has no grounding means, as described in 800.100 (B)(1) or (B)(2)(1) of NEC Article 250, the communications grounding conductor must be connected to either of the following:

  a) to any one of the individual electrodes described in 250.52 (A)(1), (A)(2), (A)(3), or (A)(4).

  b) to an effectively grounded metal structure or to a ground rod or pipe not less than 5 ft (1.5 m) in length and 1/ 2 in. (12.7 mm) in diameter, driven, where practical, into permanently damp earth, and the communications ground rod shall be bonded to the power grounding electrode system in accordance with 800.100 (D).

Warning — This equipment is ESD sensitive. Proper ESD protection must be used when entering the TELCO Access portion of the AP.

Warning — ANSI-specific: If using cable other than the recommended brands, select only UL-listed cable, rated for the specific installation.

Warning — ANSI-specific: If using cable other than the recommended brands, select only UL-listed cable, rated for the specific installation.

Note — Earthing and bonding of the AP must comply with the ETSI-specific requirements found in local electrical wiring codes.

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Note — Observe all local and national laws and regulations that may be applicable to this installation.

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13 Fiber optic maintenance

13.1 Purpose

13.1 Purpose

<< create a chapter for the AP product guide based on chapter 13 of the 7368 ISAM ONT Hardware and Cabling guide (3FE-47158-AAAA-TCZZA) >>

<< note that the HOU product guide does not need this chapter >>

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Customer document and product support

Customer documentation

Customer Documentation Welcome Page

Technical Support

Customer Documentation Technical Support

Documentation feedback

Customer Documentation Feedback

FCC Statement

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the 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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 25cm between the radiator& your body.

Note: 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.

it is not permitted to use the product on aircraft or satellites.