

EXHIBIT 3

Section 2.1033 (c)(3) INSTALLATION AND OPERATING INSTRUCTIONS

A copy of the installation and operating instructions to be furnished to the user. A draft copy of the instructions may be submitted if the actual document is not available. The actual document shall be furnished to the FCC when it becomes available.

Response

A copy of Alcatel-Lucent **9763 MCI B25 PCS LTE 2x250mW, AC** Hardware Installation manual is attached to this exhibit.



Alcatel-Lucent 9763

Metro Cell Indoor B25 LTE 2x250mW

Operation and Installation

3MN-MCI-IMOP

Issue 1 | December 2013

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About this document

Purpose

The purpose of this document is to provide product operation information and hardware installation instructions for an Alcatel-Lucent 9763 Metro Cell Indoor V1.0 B25 LTE 2x250mW.

Reason for reissue

The reissue reasons are:

Issue number	Issue Date	Reason for reissue
1	December 2013	Standard

Supported systems

This document applies to the Alcatel-Lucent 9763 Metro Cell Indoor V1.0 B25 LTE 2x250mW.

How to use this document

Chapter 1 provides safety information.

Chapter 2 provides an overview of the 9763 MCI physical architecture and operations.

Chapter 3 provides 9763 MCI hardware installation steps.

Appendix A provides descriptions of the LED operational states for the 9763 MCI.

Appendix B provides 9763 MCI product conformances applicable within the United States.

Safety information

For your safety, this document contains safety statements. Safety statements are given at points where risks of damage to personnel, equipment, and operation may exist. Failure to follow the directions in a safety statement may result in serious consequences.

Prerequisites

None

Conventions used

Vocabulary conventions

In this document the Alcatel-Lucent 9763 Metro Cell Indoor V1.0 B25 LTE 2x250mW is also referred to as the 9763 MCI V1.0 B25 LTE 2x250mW, or simply the 9763 MCI.

Typographical conventions

The typographical conventions used in this document are described in the following table.

Appearance	Description
<i>emphasis</i>	Text that is emphasized
document titles	Titles of books or other documents
graphical user interface text	Text that is displayed in a graphical user interface
<i>variables</i>	A value or command-line parameter that the user provides

Technical conventions

Lengths and other measurements are given in metric units, with non-metric units given as equivalents for use in non-metric markets.

For manufactured parts, the following system of conventions is used:

- Metric sizes of nuts, bolts, flat washers, and lock washers are identified by an uppercase letter M followed immediately by a size in millimeters (example: M10)
- American fractional sizes of nuts, bolts, anchor bolts, and washers are identified by a number followed immediately by a double apostrophe (example: 3/8"). In the case of lengths measured in feet, "2 feet" is used rather than "2'" so that the single apostrophe is not overlooked.

The illustrations in this document do not contain all details and exceptions, but are rather intended to highlight main points. Dimensions are usually shown in millimeters, with inches in parenthesis. As an example, 680.0 (26.77) equals 680 millimeters or 26.77 inches.

Wire gauges are specified in metric units. Equivalent sizes in the American Wire Gauge (AWG) system are given in the following table.

Standard cross-sections and wire diameter of round copper conductors

The following table is from CEI/IEC 60947-1:2004, *Table 1, Standard cross-sections of round copper conductors and approximate relationship between mm² and AWG/kcmil sizes* for reference. Additional wire sizes are included in this information product as appropriate for the topic.

ISO rated cross-sectional area (mm ²)	AWG/kcmil size
0.2	24
0.34	22
0.5	20
0.75	18
1	-
1.5	16
2.5	14
4	12
6	10
10	8
16	6
25	4
35	2
-	1
50	0 (1/0)
70	00 (2/0)
95	000 (3/0)
-	0000 (4/0)
120	250 kcmil
150	300 kcmil
185	350 kcmil
-	400 kcmil
240	500 kcmil
300	600 kcmil
NOTE: The dash, when it appears, counts as a size when considering connecting capacity (see 7.1.7.2 in the standard).	

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Cellular or VoIP	1-888-582-3688	+1-630-224-2485
Landline – phones lacking the plus (+) character	1-888-582-3688	<i>origination country exit code</i> -1-630-224-2485 (replace the plus sign with your country's <i>exit code</i>) See a listing of exit codes .

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1 Safety statements

Overview

Purpose

This chapter provides general information on the structure of safety instructions and summarizes general safety requirements.

General safety and residual risk

The equipment has been developed in line with state-of-the-art technology and conforms with current national and international safety requirements.

The equipment is considered safe during normal operation when safe working practices are complied with. However, hazards may arise if procedures are not followed correctly or safe working practices are not complied with.

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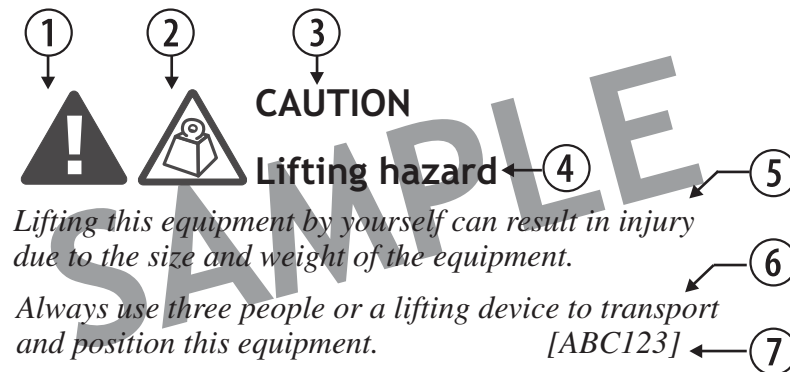
Structure of safety statements

Overview

This topic describes the components of safety statements that appear in this document.

General structure

Safety statements include the following structural elements:



Item	Structure element	Purpose
1	Safety alert symbol	Indicates the potential for personal injury (optional)
2	Safety symbol	Indicates hazard type (optional)
3	Signal word	Indicates the severity of the hazard
4	Hazard type	Describes the source of the risk of damage or injury
5	Safety message	Consequences if protective measures fail
6	Avoidance message	Protective measures to take to avoid the hazard
7	Identifier	The reference ID of the safety statement (optional)

Signal words

The signal words identify the hazard severity levels as follows:

Signal word	Meaning
DANGER	Indicates an extremely hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a hazardous situation not related to personal injury.

Safety

General precautions for installation procedures



WARNING

Failure to observe these safety precautions may result in personal injury or damage to equipment.

- *Read and understand all instructions.*
- *Follow all warnings and instructions marked on this product.*
- *Installation and maintenance procedures must be followed and performed by trained personnel only.*
- *The equipment must be provided with a readily accessible disconnect device as part of site preparation.*
- *Grounding and circuit continuity is vital for safe operation of the equipment. Never operate the equipment with grounding/bonding conductor disconnected.*
- *Install only equipment identified in the product's installation manual. Use of other equipment may result in an improper connection which could lead to fire or injury.*
- *Use caution when installing or modifying telecommunications equipment.*
- *Before servicing, disconnect power input to reduce the risk of energy hazards.*
- *For continued protection against risk of fire, all fuses used in this product must be replaced only with fuses of the same type and rating.*
- *Never install telecommunications equipment during a lightning storm or when conditions are wet.*
- *Never touch uninsulated wiring or terminals carrying direct current or ringing current, and never leave this wiring exposed. Protect and tape uninsulated wiring and terminals to avoid risk of fire, electrical shock, and injury to personnel.*
- *Never spill liquids of any kind on the product.*
- *To reduce the risk of an electrical shock, do not disassemble the product. Opening and removing covers and/or circuit boards may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electrical shock when the unit is subsequently used.*
- *for PERMANENTLY CONNECTED EQUIPMENT, a readily accessible disconnect device must be incorporated external to the equipment.*

Safety - specific hazards



Working in severe weather can result in personal injury or death and damage to the equipment.

Never install or perform maintenance during severe weather (high winds, lightning, blizzards, hurricane etc.).



Use of unspecified cleaning agents can result in personal injury.

Use only specified cleaning agents. Never use flammable solvents.

Always ensure there is adequate ventilation in the work area and wear the appropriate personal protective equipment.



RF exposure in excess of applicable limits can result in personal injury.

Metro Cells are designed and installed in order that they are compliant with the international exposure guidelines laid down by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

For all staff that are required to work in close proximity to the equipment, for example maintenance personnel, contact with the antenna should be avoided. No such persons shall stay in front of the product at a distance of less than 8 cm.

No other persons shall stay in front of the product at a distance of less than 22 cm.



Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure.

Do not view directly into the laser beam with optical instruments such as a fiber microscope because viewing of laser emission in excess of Class 1 limits significantly increases the risk of eye damage.

Never look into the end of an exposed fiber or an open connector as long as the optical source is switched on.

Ensure that the optical source is switched off before disconnecting optical fiber connectors.



Some parts of all electrical installations are energized. Failure to observe this fact and the safety warnings may lead to bodily injury and property damage.

For this reason, only trained and qualified personnel (electrical workers as defined in IEC 60215 + A1 or EN 60215) may install or service the installation.



The power supply lines to the equipment are energized. Contact with parts carrying current can cause serious injury, possibly including death, even hours after the event.

Turn off and lock out the system power at the disconnect device before working on or servicing the equipment.



DOUBLE POLE/NEUTRAL FUSING

A fuse is used in the neutral of single-phase equipment either permanently connected or provided with a non-reversible plug. After operation of the fuse, parts of the equipment that remain energized might represent a hazard during servicing.

Failure to observe this fact and the safety warnings may lead to bodily injury and property damage.



The surfaces of the MCI can become hot enough to cause burns on unprotected skin.

Before handling the unit, wait until its surfaces have cooled and, where the following conditions apply, ensure that it is mounted out of the public's reach.

For installations in ambient temperatures exceeding 25° C, the surface temperature of the aluminium housing may be considerably higher:

- 52° C at an ambient temperature of 25° C
- 64° C at an ambient temperature of 35° C
- 81° C at an ambient temperature of 50° C

In these situations, this equipment is intended for installation where access is restricted to only qualified service personnel.



Falls can occur when working at heights resulting in serious personal injury or death.

To prevent a fall when working at heights (ladder, scaffold, manlift, roof etc.) follow safe work practices and wear appropriate fall protection equipment.

**NOTICE****ESD hazard**

Semiconductor devices can be damaged by electrostatic discharges (ESD)

The following rules must be complied with when handling any module containing semiconductor components:

- *Wear conductive or antistatic working clothes (for example, coat made of 100% cotton).*
- *Wear a grounded wrist strap.*
- *Wear shoes with conductive soles on a conductive floor surface or conductive work mat.*
- *Leave the modules in their original packaging until ready for use.*
- *Make sure there is no difference in potential between yourself, the workplace, and the packaging before removing, unpacking, or packing a module.*
- *Whenever handling ESD-sensitive components, do not touch any connection pins or tracks.*
- *Place modules removed from the equipment on a conductive surface.*
- *Test or handle the module only with grounded tools on grounded equipment.*
- *Handle defective modules exactly like new ones to avoid causing further damage.*

NOTICE**Condensation**

Sudden changes in the weather may lead to the formation of condensation on components. Operating the unit when condensation moisture is present can destroy the unit.

Units which show signs of condensation must be dried before installation.

NOTICE**Tools**

Tools left in the working area can cause short circuits during operation which can lead to the destruction of units.

Make sure after finishing your work that no tools, testing equipment, flashlights, etc., have been left in or on the equipment.

Product safety

Equipment safety

Safety information for this equipment can be found on various Caution, Warning, Danger, information labels or instructions affixed to or included with the product or included within this document. Informational and cautionary labels may appear near the item they address or may be grouped in a single location on the equipment. Warnings are typically adjacent to the hazard that is noted on the label. The instructions, cautions and warnings found on these labels must be understood and observed by all personnel involved with the equipment installation and maintenance.

2 Hardware architecture and functionality

Overview

Purpose

This chapter provides an overview of the hardware architecture and product functionality of the Alcatel-Lucent 9763 Metro Cell Indoor.

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Functional description

General description

Alcatel-Lucent Metro Cells product family enables mobile service providers (MSPs) to deliver cost-effective capacity to high-density areas. They also enhance the quality of experience (QoE) for end users by enabling faster, more reliable data connections and higher data throughput on 4G networks. The product can be deployed by mobile operators to provide a transparent outdoor capacity layer to complement the macro cell “umbrella” coverage layer.

The Alcatel-Lucent 9763 Metro Cell Indoor product specified here is targeted for indoor, high user density locations where additional capacity is required within a small footprint, such as businesses and shopping malls.

Product features and capabilities

The product features and capabilities in this release are as follows:

- Supports LTE FDD.
- Single LTE carrier.
- PCS (1900 MHz - B25) frequency band.
- Supports up to 64 users simultaneously.
- High transmit power: 250mW at each antenna connector, and an Equivalent Isotropically Radiated Power (EIRP) of 28 dBm per path.
- Capable of supporting 30 Mbps downlink (1930 to 1995 MHz) and a 9 Mbps uplink (1850 to 1915 MHz) in the 5 MHz bandwidth.
- Supports two internal, quasi-omnidirectional, spatially-separated antennas (4 dBi gain).

Supports cabling to optional external antennas (used instead of the integrated antennas).

- Standard 2x2 MIMO configurations, 2 transmit and 2 receive diversity.
- Receiver sensitivity for LTE channel bandwidths 5 MHz optimized to permit near far simultaneous operation, with Rx sensitivity at -98 dBm.
- Supports Gigabit Ethernet backhaul and daisy chaining to one additional 9763 MCI.

Attention: The 9763 MCI product has feature parity with some but not all macro eNodeB features. See the *Alcatel-Lucent LTE RAN eNodeB Macro and Metro Products - LR13.3.L - FDD Release Notes, 9YZ-05817-0001-FMZZA*.

Physical description

Product overview

The Alcatel-Lucent 9763 Metro Cell Indoor is designed for indoor installations and is housed in an Alcatel-Lucent passively-cooled enclosure containing the following active components/modules:

Module	Functions
Power	AC/DC power conversion
MEMO board	Digital processing
Backhaul board	Backhaul interface
Radio	Radio, PA, Filter, Antennas

The 9763 MCI external views are reflected in the following figure.

Figure 2-1 9763 MCI hardware- front and back views



Front view



Back view

Weights and dimensions

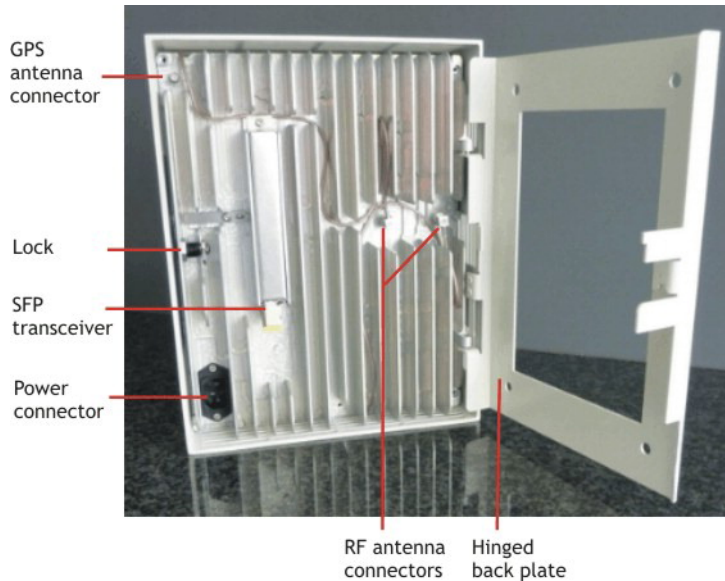
The physical dimensions of the 9763 MCI are:

Dimensions (Length x Width x Depth)	287 x 227 x107 (mm)
Volume	6.9 L
Weight	4.8 kg

Connection interfaces

The following figure shows the connection interfaces for the 9763 MCI.

Figure 2-2 9763 MCI connection interfaces



Connection location	Description
9763 MCI (back)	External GPS antenna connector (for external GPS antenna) RF antenna connectors (two) SFP connectors (two) - one for backhaul and one for daisy chaining AC power supply connector

Power supply

The 9763 MCI requires an uninterruptible AC power feed (single phase, three-wire voltage source).

- Input voltage range: 85Vac - 270Vac
- Nominal voltages: 110Vac and 230Vac
- Frequency: 47Hz - 63Hz

A power module unit inside the 9763 MCI:

- Supports 90W power consumption.
- Provides AC/DC conversion (5.3V output) and distributes 5.3V to PCBs within the unit.

The AC input port satisfies the first and second level surge protection requirements specified for port type 7 in GR-1089, Issue 6. Voltage spikes with a duration of $\leq 10\mu\text{s}$ are ignored.

The internal power module is designed such that when an “under voltage”, “over voltage”, or “over temperature” condition occurs, the power module automatically shuts off, then automatically restarts when the conditions are within the acceptable limits.

Backhaul

The 9763 MCI supports two SFP interfaces for backhaul. as follows:

- 1000Base-X GigE optical transceiver
- 10/100/1000Base-T electrical transceiver

One SFP (BH1) may be cabled for backhaul to the network while the other SFP (BH2) may be cabled for daisy chaining to another 9763 MCI. Two 9763 MCIs may be daisy chained together.

RF Antennas

The 9763 MCI contains two internal quasi-omnidirectional, spatially-separated antennas configured for 2x2 MIMO.

The vertical plane half-power beamwidth (HPBW) is typically 90° for each of the antennas

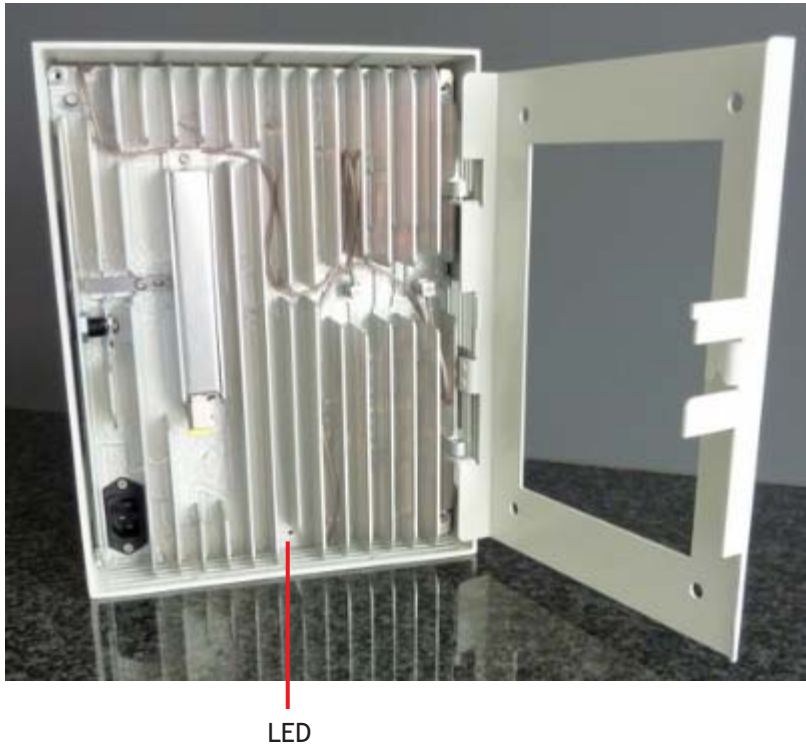
The RF antenna connectors are located externally on the rear of the unit, providing the service provider the option of connecting the internal RF antennas or connecting two externally cabled RF antennas.

GPS Antenna

The 9763 MCI has a connector for an external GPS antenna to provide frequency and phase synchronization.

Status indicator

The 9763 MCI supports a single bi-color LED (red/green) which is located on the rear lower portion of the 9763 MCI. The LED is not intended for use during normal operation of the equipment, however, it can provide a visual status of the equipment during initial installation and commissioning. Refer to the LED interpretation table in [Appendix A, “LED State Description”](#) for details.

Figure 2-3 LED position and orientation**Product labelling**

The 9763 MCI module has the following labelling:

1. A product label reflecting:
 - Vendor name/Icon
 - Model name
 - Part number
 - Serial number
 - Data matrix barcode for Part number and Serial number
2. A regulatory label reflecting:
 - Vendor name/Icon
 - Product name
 - Regulatory rules
 - Power input
 - Enclosure rating
 - Applicable regulatory and environmental certification logos
 - Manufacturer name

3. An FCC label reflecting:

- Vendor name/Icon
- FCC ID

Product base items and configuration

The 9763 MCI product is delivered with the following base items:

- Alcatel-Lucent 9763 Metro Cell Indoor

Ancillary orderable items

In addition to the 9763 MCI base items, the following ancillary and variable items can be ordered depending on the product configuration and deployment scenario:

- Mounting frame for wall installation
- AC power cable, 4.5 m (15 ft)
- SFP modules:
 - GBE 1000BaseSX (optical)
 - GBE 10/100/1000BaseT (electrical)
- Backhaul cables:
 - Multimode Dual Fiber LC-LC, various lengths (optical)
 - Ethernet cable, various lengths (electrical)
- External GPS antenna, installation kit and jumper cable

Supported installation options

Overview

The following section describes the supported installation options for the Alcatel-Lucent 9763 Metro Cell Indoor V1.0 B25 LTE 2x250mW product. These include:

- Standard wall mount installation.
- Standard wall mount installation with daisy chaining where two 9763 MCI modules are daisy chained together and share the same backhaul port.

Standard installation options

The 9763 MCI can be installed in any indoor place such as business environments or indoor public places (shopping malls, airports. etc.) and is designed to address mobile service providers' (MSPs) need to place coverage and capacity where it's needed fast (such as indoor high-use hotspots).

Figure 2-4 Wall mount Installation example



Front view
(9763 MCI locked to
mounting frame)

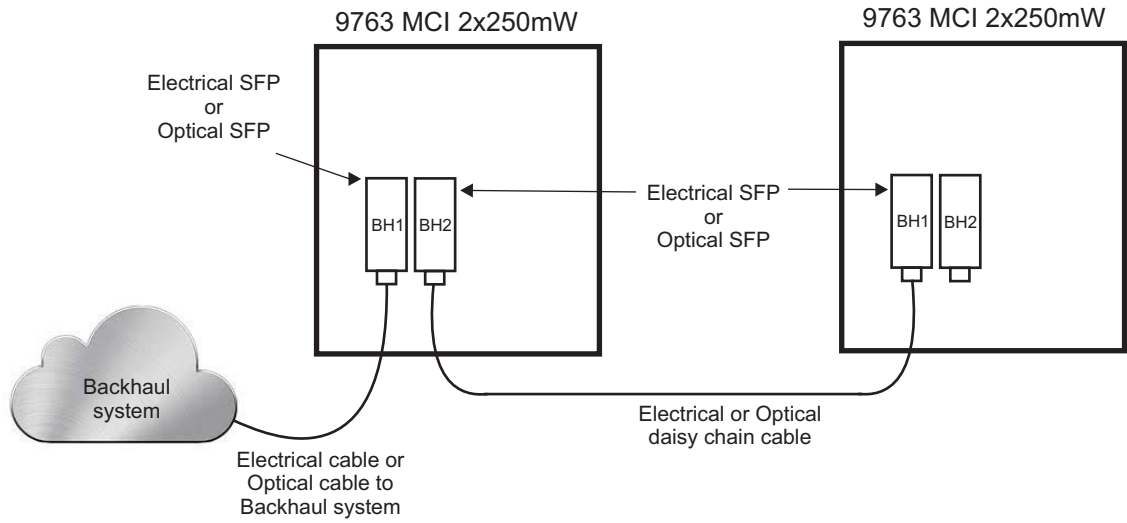


Back view
(9763 MCI unlocked
from mounting frame)

Daisy chain installation options

In a daisy chain installation configuration two 9763 MCIs can be daisy chained together, where they share the same backhaul port, thus reducing the investment cost needed to connect the 9763 MCIs to the backhaul network and aggregating the uplink traffic. Daisy chain connectivity scenarios support 9763 MCIs that are co-located or 9763 MCIs that are separated by some distance.

Figure 2-5 9763 MCI daisy chain installation example



Note: Daisy chain installation configurations will be available at LR13.3.L GA. The backhaul chain will be limited to two MCI in this initial release.

Hardware and ancillary items

Overview

The following section lists the Alcatel-Lucent 9763 Metro Cell Indoor V1.0 B25 LTE 2x250mW base hardware equipment, the installation kits and ancillary items that can be ordered from Alcatel-Lucent.

9763 MCI base items

The 9763 MCI packaging contains the following base items:

- Alcatel-Lucent 9763 Metro Cell Indoor V1.0 B25 LTE 2x250mW module

Mounting bracket

The following table list the mounting bracket that is available for order from Alcatel-Lucent in support of the equipment installation options.

Item	Description	Use
Mounting bracket	Bracket for mounting 9763 MCI onto a wall or ceiling	Mandatory All installation scenarios (wall/ceiling)

Ancillary items

The following tables list the ancillary items that are available for order from Alcatel-Lucent in support of the defined equipment installation and configuration options.

Power

Item	Description	Use
Power cable	AC patch power cord compatible with a Standard IEC60320 C16 socket	Mandatory

SFP modules

Item	Description	Use
SFP module	10/100/1000Base-T electrical transceiver	Optional Used if backhaul interface is optical
SFP module	1000Base-SX GigE optical transceiver	Optional Used if backhaul interface is electrical

Ethernet cable - Electrical

Item	Description	Use
Electrical Ethernet cable	2m outdoor, 4 pairs, 2 RJ45	Optional Use with 10/100/1000Base-T electrical transceiver
Electrical Ethernet cable	25m outdoor, 4 pairs, 2 RJ45	Optional Use with 10/100/1000Base-T electrical transceiver
Electrical Ethernet cable	100m outdoor, 4 pairs, 2 RJ45	Optional Use with 10/100/1000Base-T electrical transceiver

Ethernet cable - Optical

Item	Description	Use
Fiber Optic cable	2.5m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	5m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	15m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	30m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	50m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	70m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	85m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	100m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	150m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	200m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	250m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver
Fiber Optic cable	300m Multimode Dual Fiber LC-LC	Optional 1000Base-SX GigE optical transceiver

3 9763 MCI installation

Overview

Purpose

This chapter provides information and procedures for mounting the Alcatel-Lucent 9763 Metro Cell Indoor onto a wall.

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9763 MCI pre-installation

Overview

Purpose

This section provides pre-installation information (including required tools and materials and installation clearances) as well as outlining the possible daisy chain deployment scenarios and requirements for the Alcatel-Lucent 9763 Metro Cell Indoor product.

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9763 MCI Pre-installation information

Verify site preparation

The following site preparation requirements should be checked and met before the installation of the equipment can begin. If some of the requirements are not met, the installer must do so now:

- Ensure equipment is planned to be installed as high as possible to avoid obstructions
- Consider nearby sources of interference. Also check possibility of future obstructions.
- Ensure adequate clearance is provided for service access
- Ground, power and backhaul cabling has been routed and is in place
- Ensure any site specific fixing materials (screws, washers, wall plugs) for pole/wall mounting the equipment are available.

Product delivery contents

Unpack and examine the product packaging contents. If you notice any damage, or missing items as listed in the Packing List, immediately notify the carrier that delivered the unit and contact your Alcatel-Lucent representative.

The product packaging contains the following items:

- The Alcatel-Lucent 9763 Metro Cell Indoor V1.0 B25 LTE 2x250mW.

Installation materials

In addition to the standard product deliverable ensure the appropriate mounting brackets, installation kits and ancillary items are available to support the product mounting options.

Figure 3-1 9763 MCI mounting bracket

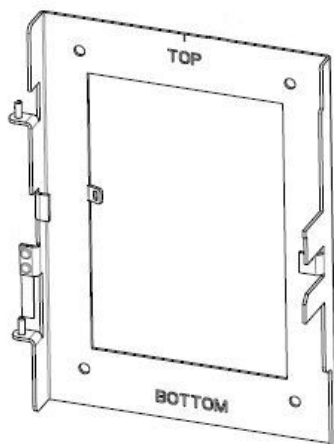


Table 3-1 Recommended wall anchor materials

Surface structure	Recommended anchor materials	Recommended screw torque
Wood	Screw Hex T M8x70 stainless steel (x4) Washer plain M8x16x1.6 stainless steel (x4)	7.0 N.m (62.0 lb.in).
Concrete	Screw CHC M6x80 stainless steel (x4) Washer plain M6x12x1.6mm stainless steel (x4) Washer spring M6x12x1.2mm stainless steel (x4) Plug expansion Rawlnut M6x50 (x4)	7.0 N.m (62.0 lb.in).

Tools required for installation

The following tools may be used during installation:

- Drill (pneumatic hammer) and assorted drill bits
- Pliers
- Adjustable spanners
- M17 socket wrench
- Screwdrivers (power and/or manual):
 - Phillips (flat blade)
 - Torx (T-25 and T-40)
- HRS (Hirose) HT206/TM21p-88p crimping tool (for RJ45 cable)
- Data cable tester for shielded RJ45 (optional)
- Measuring tape
- Digital compass (to aid establishing product orientation)
- Marker, to mark wall mounting holes
- Vacuum cleaner or equivalent (required for clearing debris from wall mounting holes)
- Spirit level
- Hammer
- PIB (self-amalgamating) tape and 3M Super 33+ vinyl tape
- Ear protectors and safety goggles/glasses
- Assorted cable ties (various lengths)
- Heavy duty tape
- Adjustable straps

9763 MCI installation clearances

Minimum installation clearances

The following provides the minimum wall mount clearances recommended around the Alcatel-Lucent 9763 Metro Cell Indoor V1.0 B25 LTE 2x250mW.

Figure 3-2 9763 Metro Cell Indoor installation clearances



Front view
(9763 MCI locked to
mounting frame)



Back view
(9763 MCI unlocked
from mounting frame)

9763 MCI	Minimum clearances mm (inches)	Comment
Side	250 mm (10 inches)	To swing the 9763 MCI away from the mounting frame to gain access to the back of the unit.
Top	400 mm (16 inches)	For free air flow and cable routing.
Bottom	400 mm (16 inches)	For free air flow and cable routing.
Front	250 mm (10 inches)	To swing the 9763 MCI away from the mounting frame to gain access to the back of the unit and the connection interfaces.
Rear	Not applicable	Rear clearance is defined by the supplied mounting frame.

9763 MCI daisy chain requirements

Overview

Two 9763 MCI can be daisy chained together to share the same backhaul port, reducing the investment cost needed to connect individual 9763 MCI to the backhaul network and aggregating the uplink traffic. The daisy chain link between two 9763 MCI can be the same as the backhaul link (either electrical or optical) or a mixed link configuration is possible as shown in the following deployment scenario's.

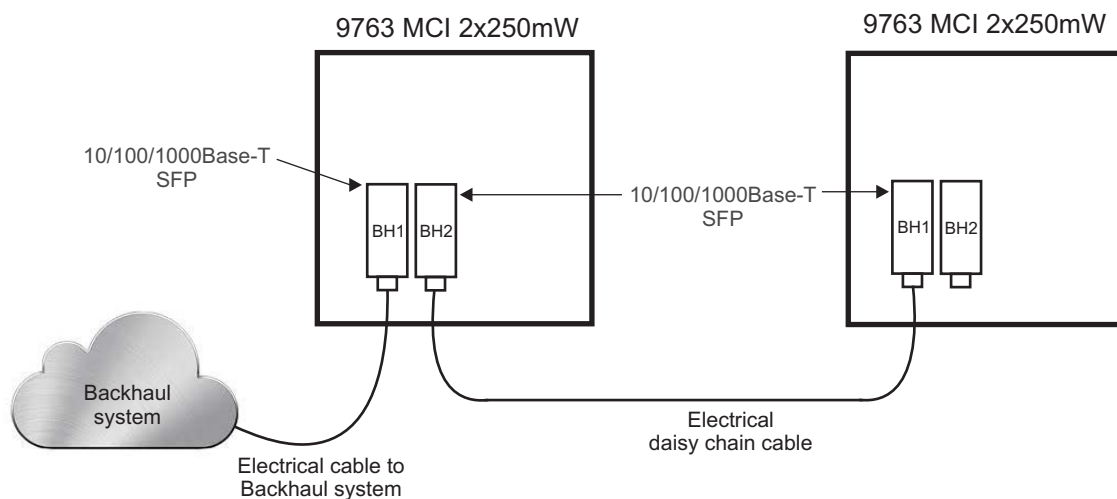
Note: Physically the backhaul SFP port BH1 is on top of daisy chain SFP port BH2.



Electrical link for backhaul and daisy chain

The following shows the deployment scenario for electrical backhaul and daisy chaining. For daisy chaining to another 9763 MCI and additional cable and SFP are required.

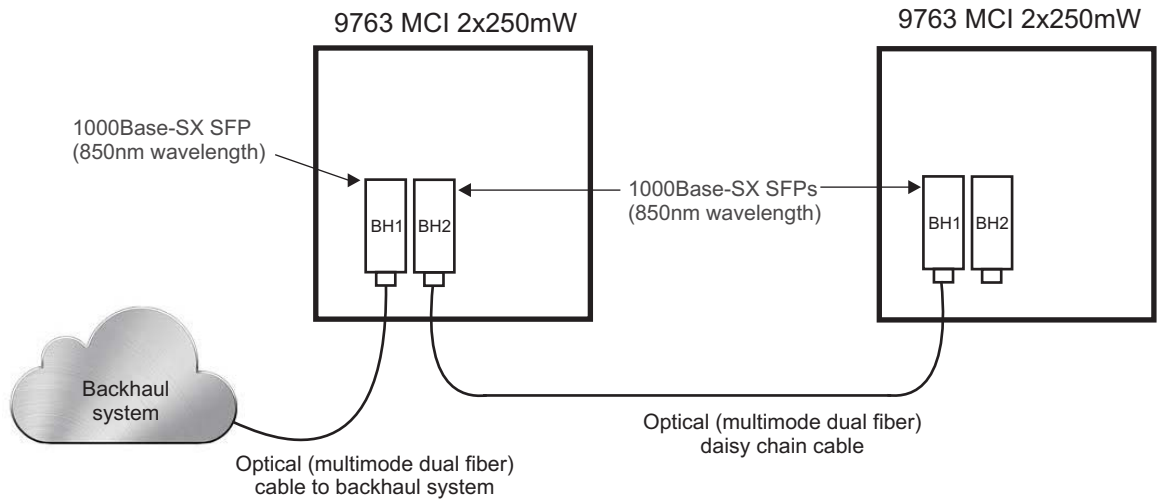
Figure 3-3 Electrical backhaul and daisy chain configuration



Optical link for backhaul and daisy chain

The following shows the deployment scenario for optical backhaul and daisy chaining. For daisy chaining to another 9763 MCI and additional cable and SFP are required.

Figure 3-4 Optical backhaul and daisy chain configuration



Mixed link for backhaul and daisy chain

The following shows the deployment scenario's for mixed optical/electrical backhaul and daisy chaining. For daisy chaining to another 9763 MCI and additional cable and SFP are required.

Figure 3-5 Mixed optical backhaul with electrical daisy chain configuration

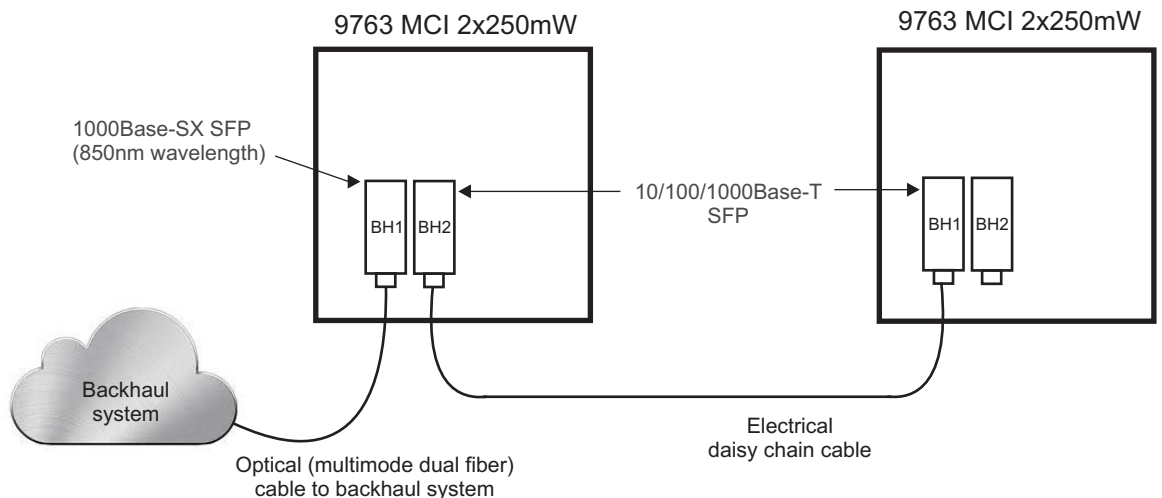
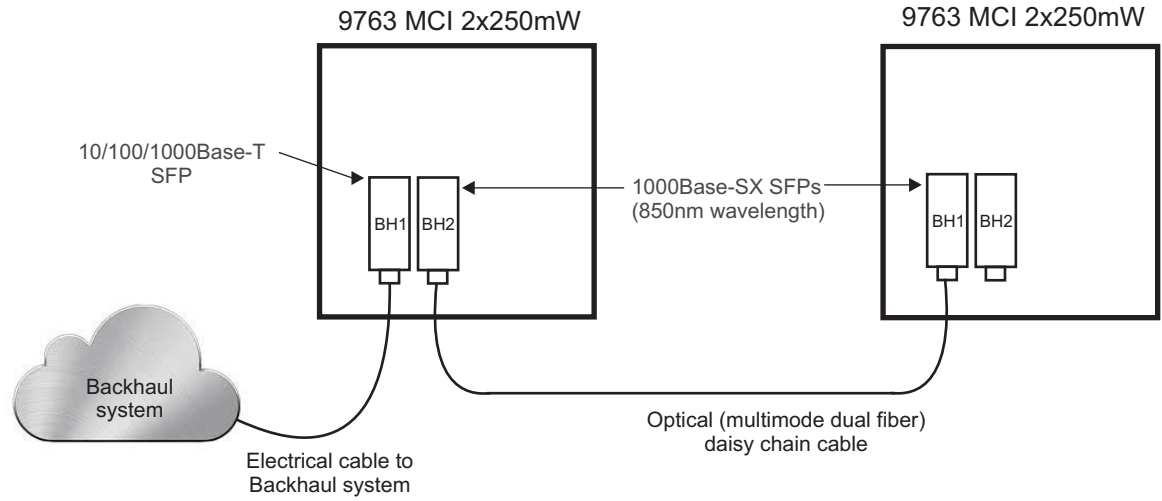


Figure 3-6 Mixed electrical backhaul with optical daisy chain configuration



9763 MCI installation

Overview

Purpose

This section provides the installation instructions for mounting the Alcatel-Lucent 9763 Metro Cell Indoor onto a wall.

Contents

Procedure 3-1: Mount the 9763 MCI onto a wall	3-10
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Procedure 3-1: Mount the 9763 MCI onto a wall

Purpose

This topic describes the procedures to be followed when installing the Alcatel-Lucent 9763 Metro Cell Indoor onto a wall or solid flat surface.

Prerequisites

A site survey has been conducted and a location for the device has been selected that is both central to the public space and elevated in order to maximize coverage. Before installation begins you should ensure the following are in place:

- Ensure adequate clearance is provided. See [“9763 MCI installation clearances” \(p. 3-5\)](#)
- Power cable has been routed and is in place
- Backhaul cable has been routed and is in place
- If required, daisy chain cable has been routed and is in place
- Any site specific fixing materials are available (for example, bolts, washers and wall plug materials).

Attention: The 9763 MCI must be mounted with the appropriate mounting hardware suitable for the various supporting structures, building materials and construction methods. Following a site survey, it is the responsibility of the customer to ensure that:

- the installation support structure is adequate and compliant with ICC IBC (2012): International Building Code, and all other national and local codes
- the appropriate mounting hardware and any necessary recommended supporting anchor fixings are used.

Wall mount installation

The 9763 MCI weighs 4.8 kg (10.6 lbs) and can be easily mounted onto solid concrete or wooden flat surface using the following installation kits, anchor materials and tools.

- For installation and recommended anchor materials, see [“Installation materials” \(p. 3-3\)](#)
- For a list of installation tools, see [“Tools required for installation” \(p. 3-4\)](#)

Before you begin

Before you begin the following should be noted:

- Record the product 9763 MCI 18 digit serial number
- Equipment cabling should only be carried out by suitably trained or qualified personnel and must comply with local and national electrical codes.

- As a prerequisite, backhaul cable has been routed from the backhaul system to the 9763 MCI.
- SFP port “BH1” may be cabled for backhaul to the network while the other SFP port “BH2” may be cabled for daisy chaining to another 9763 MCI.

Perform standard wall mount installation



Falls can occur when working at heights resulting in serious personal injury or death.
To prevent a fall when working at heights (ladder, scaffold, manlift, roof etc.) follow safe work practices and wear appropriate fall protection equipment.

Perform the following procedure to mount the 9763 MCI directly onto a wall.

- 1 Mount the 9763 MCI wall bracket (mounting frame) to the wall.

- 2 Attach 9763 MCI to the mounting bracket.



Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure.

Do not view directly into the laser beam with optical instruments such as a fiber microscope because viewing of laser emission in excess of Class 1 limits significantly increases the risk of eye damage.

Never look into the end of an exposed fiber or an open connector as long as the optical source is switched on.

Ensure that the optical source is switched off before disconnecting optical fiber connectors.



Semiconductor devices can be damaged by electrostatic discharges (ESD)
Always observe the general ESD instructions for handling modules containing semiconductor components.

Install SFP module(s) into the SFP ports on the rear of the 9763 MCI.

- 4 Attach the Ethernet cable(s) to the SFP module(s) at the rear of the 9763 MCI.

- 5 Check attachment of RF antenna cables:

If you are using...	Then...
the internal RF antennas	antenna cables should already be attached to the RF antenna connectors on the rear of the 9763 MCI.
external RF antennas	detach the internal RF antenna 9763 MCI from the connectors and attach the external RF antenna cables.



The current to the unit must be limited by an external fuse or circuit breaker incorporated in the fixed wiring. The fuse or circuit breaker can be used as a disconnect device to turn off the power to the system.

Ensure that the system power is off and that power cables are safe to handle before you proceed with this procedure.



The power supply lines to the equipment are energized. Contact with parts carrying current can cause serious injury, possibly including death, even hours after the event.

Turn off and lock out the system power at the disconnect device before working on or servicing the equipment.

Ensure that the power that feeds the AC power cable to the 9763 MCI is OFF. Block access so that no one can restore power to that cable during this procedure.

Attention: Blocking access likely consists of not only putting a physical impediment in the way, but also broadly circulating or broadcasting a warning about the hazard and getting the cooperation of persons who have the authority to limit the access of others.

Attach the power cable to the power connector on the rear of the 9763 MCI.

-
- 7** Swing the 9763 MCI toward the wall bracket (mounting frame) to hide access to the rear of the unit, and lock the 9763 MCI in position using the key supplied with the 9763 MCI.

-
- 8** Ensure all cables are externally routed and secured.

END OF STEPS

Appendix A: LED State Description

Overview

Purpose

This chapter describes the LED status and descriptions for 9763 MCI.

Contents

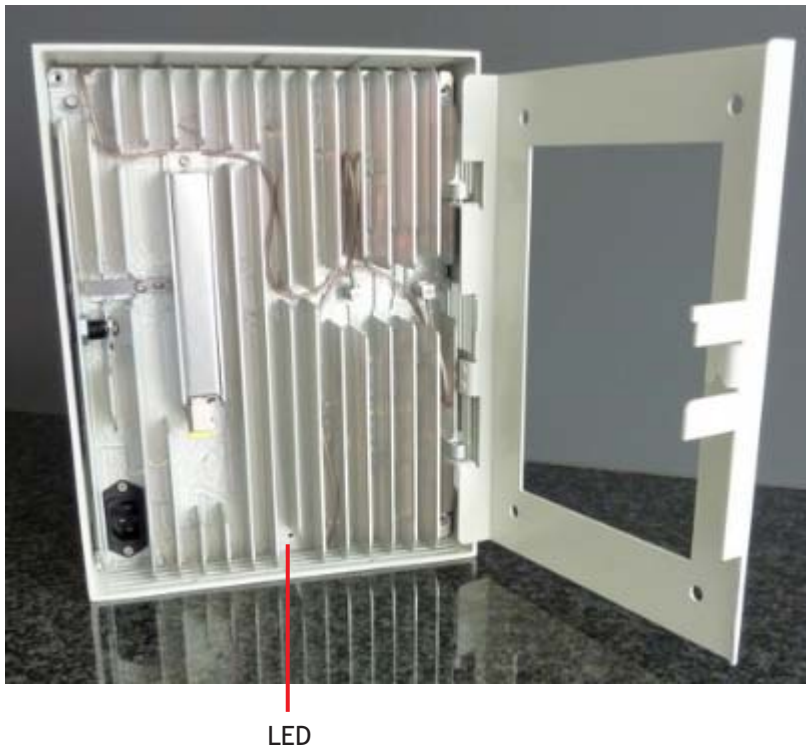
LED status for 9763 MCI	A-2
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LED status for 9763 MCI

Overview

This topic describes the LED status of the 9763 MCI device.

Figure A-1 LED position and orientation



Hardware LED interpretation table

The following table describes the possible states for the single bi-color LED:

State	Description	LED
Power off	Power off	OFF
Initial state	Power on or Restart	ON (Red)
System Initializing, registering, and performing auto-configuration	Software downloading	Blinking (Green)
Failure	Cell start-up or operational failure	ON (Red)
Cell becomes operational	Cell becoming operational	ON (Green) (Note: LED is switched OFF after 15 minutes of stable operation)

State	Description	LED
Cell is operational	Cell has been in stable operation for 15 minutes	OFF

Appendix B: Product conformance statements

Overview

Purpose

This section presents the product conformance statements that apply to the Alcatel-Lucent 9763 Metro Cell Indoor access point equipment.

The statements that are required are determined primarily by national or multi-national regulations. However, in some regions, contract terms determine which statements are required.

The presence of the statement indicates that the product does comply with that statement wherever it is required to do so.

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United States compliance

Introduction

Purpose

The statements that follow are the product conformance statements that apply to the Alcatel-Lucent 9763 Metro Cell Indoor when deployed in the United States.

Contents

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Federal Communications Commission

Federal Communications Commission

Important! Changes or modifications not expressly approved by Alcatel-Lucent, Inc. could void the user's authority to operate the equipment.

This device complies with Part 15 of the 47 CFR 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.

47 CFR FCC Part 15 Class B

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 47 CFR 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.

RF approval

This equipment complies with Part 2, Subpart J - Equipment Authorization Procedures, of the 47 CFR FCC Rules.

This equipment complies with Part 24 - Personal Communications Services, Subpart E - Broadband PCS.

Product safety conformance statements

Product safety conformance

This equipment is Safety Certified for the United States of America by a Nationally Recognized Test Laboratory (NRTL) accredited by the US Department of Labor, Occupational Safety and Health Administration (OSHA), such as UL, CSA, or others. The product bears this certification mark of this certification laboratory on its main nameplate label. Should the local authority having jurisdiction (AHJ) require prior or additional verification of this certification, a product certificate of compliance can be obtained from the specific certification laboratory by the business/product unit Applicant for the product or by contacting Alcatel-Lucent Technical Support. See the Alcatel-Lucent Support web site (<http://www.alcatel-lucent.com/support/>) for contact information.

Any modifications to this equipment are not permitted without review and official written authorization from the specific Certification Body. Unauthorized changes may violate the Product Safety Certification. Modifications or changes authorized by official CN/CNN are assumed to have received prior approval from this Lab.

Indoor applications

When external antennas are used, this equipment is intended for installation in restricted access locations where access is controlled or where access can only be gained by service personnel with a key or tool. Access to this equipment is restricted to qualified service personnel only.

Antenna exposure statements

Antenna exposure

Equipment with integrated antennas

This equipment complies with FCC RF radiation exposure limits set forth in 47 CFR Part 1, Subpart I, Section 1.1310 for a general population/uncontrolled exposure environment. The antenna(s) used for this transmitter shall be installed to provide a separation distance of at least 20 cm from all persons when they are not co-located or operating in conjunction with any other antenna or transmitter.

This equipment is equipped with two integrated quasi-omnidirectional antennas. Any changes to the antenna or other equipment in the transmit path may require re-evaluation of the exposures to electromagnetic fields.

Equipment with external antennas

Antenna installations for this equipment shall be performed in accordance with all applicable manufacturer's recommendations, and national laws and regulations. To ensure correct antenna installation, the antenna installer shall perform all necessary calculations and/or field measurements to evaluate compliance with applicable national laws or regulations regarding exposure to electromagnetic fields. The supplier of radio equipment, the supplier of antenna equipment and the integrator and builder of the site must provide sufficient information so that the limits of the exclusion zones can be determined. Any changes to the antenna or other equipment in the transmit path may require re-evaluation of the exposures to electromagnetic fields.

Pursuant to 47 CFR Part 1, Subpart I, subject to the provisions of section 1.1307, all installations must be evaluated for requirements contained in Table 1, "Limits for maximum permissible exposure", in section 1.1310.

FDA/IEC optical transmitter product compliance statements

FDA/IEC optical transmitter product compliance

Alcatel-Lucent declares that this equipment complies with the Food and Drug Administration's Center for Devices and Radiological Health (FDA/CDRH) regulations 21 CFR 1040.10 and 1040.11. It is a Class I/1 laser optical fiber communication systems "product" under the FDA.

This Product is designed to ensure that personnel operating the product are not endangered by laser radiation during normal operation and fault conditions. This product does not present a risk of eye injury because it is fully enclosed and does not contain embedded lasers greater than Class I/1 unless otherwise noted.

Eco-environmental statements

Packaging collection and recovery requirements

Countries, states, localities, or other jurisdictions may require that systems be established for the return and/or collection of packaging waste from the consumer, or other end user, or from the waste stream. Additionally, reuse, recovery, and/or recycling targets for the return and/or collection of the packaging waste may be established.

For more information regarding collection and recovery of packaging and packaging waste within specific jurisdictions, contact the Alcatel-Lucent Environment, Health and Safety organization or Alcatel-Lucent Hazardous Waste Center technical support at (888) 539-2783.

Material content compliance

The following notification applies to Alcatel-Lucent products distributed for sale, resale, or use.

This product, part, or both may include a lithium-manganese dioxide battery, which contains very small amounts of a perchlorate substance. Special handling may apply.

For California:

Perchlorate Material - special handling may apply.

See (<http://www.dtsc.ca.gov/hazardouswaste/perchlorate/>).

Glossary

Numerics

3GPP

3rd Generation Partnership Project

A **A (Ampere)**

Base SI unit of electrical current.

A-GPS

Assisted Global Positioning System

AC (Alternating Current)

Continuously variable current, rising to a maximum in one direction, falling to zero, then reversing direction and repeating the cycle in the other direction.

AC convenience outlet

Sites must be equipped with at least two duplex outlets for installation and maintenance procedures. The outlets are required to power test equipment and installation tools.

ACF (AC Fail)

The AC Fail (ACF) alarm indicates that AC input to one or more rectifiers in the power plant is absent or outside of the operating range of the equipment

Ambient temperature

The temperature of air or other media in a designated area, particularly the area

ANSI (American National Standards Institute)

An organization chartered to accredit standards developed by a wide variety of industry groups, without influence from any one company or organization. Does not develop standards, but reviews and implements those developed by other organizations. ANSI is a member of the International Standards Organization (ISO).

Antenna

An elevated device for radiating or receiving radio waves. It changes electrical currents into electromagnetic waves, and vice versa.

AP (Application Processor)

Network element located at the MSC which provides the radio control logic for managing calls. The AP is a general purpose computer that can host a number of RCS virtual machines.

AWG (American Wire Gauge)

American standard for classifying wire diameter.

B Backup

Facility used to replace an element which has failed.

Base station

The equipment that provides the air interface that allows mobile terminals to communicate with the telecommunications network.

Bonding

Permanent connection of metallic parts to form an electrically conductive path that will assure electrical continuity and have the capability to safely conduct any current likely to be imposed.

Branch circuit

The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

Breaker, circuit

A cut-out device which breaks a circuit when preset limits of current are exceeded.

Buried cable

A communication cable manufactured or produced for the purpose of burial in direct contact with the earth.

Buried ring ground

A buried, bare, tinned, solid copper cable encircling the site building and/or tower foundation.

Bus bar

One or more conductors that serves as a common connection for a group of related devices.

Busy hour

The uninterrupted period of 60 minutes for which the average intensity of traffic is at maximum.

C Cable run

Referring to cable routing.

Cable sweep

(See Sweep)

Cell site

An installation located within a cell that houses the equipment needed to set up and complete calls on a cellular telephone.

CFR

Code of Federal Regulations

Circuit

1. The complete path between two terminals over which one-way or two-way communications may be provided. 2. An electronic path between two or more points, capable of providing a number of channels. 3. A number of conductors connected together for the purpose of carrying an electrical current. 4. An electronic closed-loop path among two or more points used for signal transfer. 5. A number of electrical components, such as resistors, inductances, capacitors, transistors, and power sources connected together in one or more closed loops.

Coaxial cable

A cable with one or more coaxial pairs under one outer sheath. The cable consists of a center conductor surrounded by an insulating material and a concentric outer conductor.

Configuration

An arrangement of functional units according to their nature, number, and chief characteristics.

Controlled environment

An indoor location in which temperature, humidity, and ventilation are maintained at specific levels.

CPRI

Common Public Radio Interface

CSA (Canadian Standards Association)

An independent, non-government, not-for-profit association for the development, by consensus, of Canadian standards and product certifications.

CSC (Cell Site Configuration)

Sheets provided in this document for documenting cell site configuration, conditions, and other pertinent information for reference during product deployment, and future additions.

D d2U

digital 2U-height box.

dBi

Decibels relative to an isotropic antenna gain

dBi (Decibel)

A unit which expresses the ratio of two voltages, currents, or powers. It is used to specify transmission loss, gain, or relative level. It is equal to 20 times the common logarithm of the ratio of two voltages or two currents, or 10 times the common logarithm of the ratio of two powers.

DC (Direct Current)

Current flow in one direction.

Diversity

A method of radio transmission and/or reception, which counteracts the effects of fading by combining several signals all bearing the same information.

Down conductor

A vertical conductor of low impedance that connects the cell site grounding electrode system to the grounding electrode system.

Driven ground rod

A copper-clad steel or stainless steel rod, a minimum of 2.4 meters (8 feet) long and 5/8 inch in diameter.

E E1

A four-wire voice and data trunking facility that carries 30 duplex channels in 64-kbps time slices. E1 facilities are commonly used in countries outside of North America.

Earthquake zone

Seismic ratings ranging from zone 1 (relatively low central office operational shock and vibration levels) to the most severe zone 4 levels. Equipment must be able to withstand earthquake zone requirements under both operational and non-operational conditions.

Electrolytic ground electrode (rods)

A low resistance grounding rod (pipe) using low resistivity materials.

ESD

Electrostatic Discharge

Exothermic weld

A method of making electrical connections of copper to copper or copper to steel using high temperature fusion. The molten copper flows over conductors in a mold, melting and welding them together.

F FA (Fuse Alarm)

The fuse alarm (FA) indicates that the power system battery and load protection fuse opens.

Facility

Any element of physical telephone equipment needed to provide service, such as cables, switching systems, and microwave radio transmission systems.

FCC (Federal Communications Commission)

A group founded in 1934 to regulate all types of communications in the United States.

Float

To operate a power load on a main-driven rectifier in parallel with a low impedance storage battery, which is kept fully charged by the rectifier and is itself only called upon to provide power

during temporary and short-duration peaks for which the rectifier output is insufficient.

Frequency

For a periodic wave, such as alternating current, the number of complete cycles per unit of time. The unit of frequency is cycles per second, or hertz.

Fuse

An overcurrent protective device that has as its critical component a metal wire or strip that will melt when heated by a prescribed (design) amperage, creating an open in the circuit of which it is a part, thereby protecting the circuit from an overcurrent condition.

G Gain

The ratio of output current, voltage, or power to input current, voltage, or power, respectively. Gain is usually expressed in dB. If the ratio is less than unity, the gain, expressed in dB, will be negative, in which case there is a loss between input and output.

Garmin 45XLS

A handheld GPS receiver that can be used to verify GPS reception at a cell site. It has a removable antenna and provides +5 VDC on the center pin of the RF connection to power external active antennas. If poor GPS reception is suspected, the Garmin 45XLS can be used to verify that the GPS antenna and cable system is working acceptably. It will also verify that the GPS antenna location is acceptable.

GFCI (Ground Fault Circuit Interrupter)

A device intended for protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

GPS (Global Positioning System)

A system of 24 satellites that provides, among other things, extremely accurate timing information to the cell sites.

Ground

A conducting connection between equipment or an electrical circuit and earth, or conductive body that is used in place of earth.

Grounding conductor

A conductor used to connect equipment or a grounded electrical circuit to the grounding electrode system.

Grounding electrode system

The conductive objects that are intentionally bonded to furnish connection to earth (i.e., buried ring ground with ground rods, electrically continuous buried metallic water pipe, electrolytic ground electrode, etc.).

Guy

Steel wire or rope used to hold a pole upright.

H Handoff

A automatic transfer of a cellular telephone call from one cell to another, maintaining call quality as the mobile user moves through the coverage area.

Heat dissipation

The heat generated by cabinets during operation.

HVAC (Heating, Ventilation, Air Conditioning)

Hz (hertz)

A unit of frequency of a periodic process equal to one cycle per second.

I Indoor site

Installation site in a controlled environment, allowing the use of indoor cabinets.

INTR (Intrusion Alarm)

The Intrusion (INTR) alarm indicates a door or access panel to the power system is open.

L Load

The power consumed by a device or circuit in performing its function.

Loss

The diminution, usually expressed in dB, of signal level in a communications medium. The power, usually expressed in watts, consumed by a circuit or component. The energy dissipated without accomplishing useful work or purpose.

LTE

Long Term Evolution

M MCI

Metro Cell Indoor

MGB (Main Ground Bus)

A copper bus bar used to provide the electrical interfaces for connection of the isolated ground plane to the integrated ground system.

MHz (Megahertz)

Reference of radio frequency spectrum of one-million cycles.

MOP (Method of Procedure)

Cell site walk-through where site preparation activities are verified prior to installing the 9412 eNodeB Compact equipment.

MSC (Mobile Switching Center)

In an automatic cellular mobile system, the interface between the radio system and the public switched telephone network. The MSC performs all signaling functions that are necessary to establish calls to and from mobile stations.

N NEC (National Electric Code)

Standard that governs the use of electric wire, cable, and fixtures, and electrical and optical communication cable installed in buildings.

Network

A set of terminals, the communications link that joins them, and the protocols that allow them to function together and communicate with each other.

NFPA (National Fire Protection Association)

Standards and code writing organization made up of volunteer industrial and institutional subject-matter-expert committees.

NIU (Network Interface Unit)

A device that performs interface functions, such as code conversion, protocol conversion, and buffering, required for communications to and from a network. The device is used primarily within a local area network to allow a number of independent devices, with varying protocols, to communicate with each other. An NIU converts each device protocol into a common transmission protocol. The transmission protocol may be chosen to accommodate directly a number of the devices used within the network without the need for protocol conversion for those devices by the NIU.

Nominal

Specified value or intended value independent to any uncertainty in its realization. In a device that realizes a physical quantity, it is the value of such a quantity specified by the manufacturer.

Non-Alcatel-Lucent power

3rd party power systems, or power systems other than Alcatel-Lucent.

P Pair cable

Cable made up of one or more separately insulated wire pairs, none of which is arranged with another quads.

PDU

Power Distribution Unit

Phase

The number of separate voltage waves in commercial alternating current, designated as "single phase", "three phase", etc.

Pigtail

A short length of electrical conductor permanently affixed to a component, used to connect the component to another.

PMJ

Conditions that impacts service of the power system and/or requires immediate attention are classified as major alarms and designated as Power Major (PMJ) alarms.

PMN

Conditions requiring service, but having no immediate impact on the power system output are classified as minor alarms and designated as Power Minor (PMN) alarms.

PVC (Polyvinyl Chloride)

A thermoplastic made of polymers, which is tough, nonflammable, and water resistant and is used as an insulation.

Q QaM

Quadrature Amplitude Modulation

QoE

Quality Of Experience

R Receive-only

Pertaining to a device or a mode of operation capable of receiving messages, but not transmitting messages.

RF (Radio Frequency)

Electromagnetic wave used for, among other things, cellular voice and data communications.

RMS (Root Mean Square)

Effective value of an alternative wave. For AC, this is numerically equal to DC value of the current with the same heating effect.

RoHS

Restriction of Hazardous Substances

Rx (Receive)

S Sector

The coverage area within the degree of directionality of the antennas.

Service provider

Customer who purchases switching and Site equipment from system vendors, which, in turn, is provided to end-user subscribers through resellers and distribution channels.

SFP (Small Form-Factor Pluggable)

A compact, hot-pluggable transceiver that interfaces a network device motherboard to a fiber-optic or copper networking cable to support telecommunication and data communications.

Shield

A housing, screen, sheath, or cover that substantially reduces the coupling of electric, magnetic, or electromagnetic fields into or out of circuits or transmission lines.

Short-term

No more than 96 consecutive hours or 15 days per year.

Single-phase

A circuit in which there is only one sinusoidal voltage variation.

Site

An installation that houses the equipment needed to set up and complete calls on a cellular telephone.

Site preparation

To perform the requirements necessary at the site before installation can begin.

Stranded

Wires twisted together to form a strong flexible cable.

Surge protector

Protective device used to limit surge voltages by discharging or bypassing any unwanted surge current that may enter a building or equipment.

Sweep

To vary the frequency of a signal over a whole band as a means of checking the response of equipment under test.

T

T1

A four-wire voice and data trunking facility that carries 24 duplex channels over 56-kbps time slots.

THHN (Thermoplastic high-heat resistant nylon-coated)

Three-phase

An alternating current supply with three sinusoidal voltages differing in phase by 120°.

THWN (Thermoplastic heat and water resistant nylon-coated)

TRDU (Transmit Receive Duplex Unit)

Twisted pair cable

Cable made up of one or more separately insulated twisted-wire pairs, none of which is arranged with another to form quads.

Tx (Transmit)

TYP (Typical)

U UBC

Uniform Building Code

UL (Underwriters Laboratories)

Laboratories that test and approve materials and equipment against pre-determined performance standards.

UV (Ultraviolet)

The portion of the electromagnetic spectrum in which the longest wavelength is just below the visible spectrum, extending from approximately 4 nm to approximately 400 nm. Some authorities place the lower limit of uv at values between 1 and 40 nm, 1 nm being the upper wavelength limit of x-rays. The 400-nm limit is the lowest visible wavelength, i.e., the highest visible frequency, violet.

V V (Volt)

The derived SI unit of electrical potential difference. It is the difference in potential between two points of a conducting wire carrying a constant current of 1 ampere when the power dissipated between these two points is equal to 1 watt.

Vac (Volts Alternating Current)

VDC (Volts Direct Current)

Vrms (Volts Root Mean Square)

VSWR (Voltage Standing Wave Ratio)

In a transmission line, the ratio of maximum to minimum voltage in a standing wave pattern. The VSWR is a measure of impedance mismatch between the transmission line and its load. The higher the VSWR, the greater the mismatch. The minimum VSWR, i.e., that which corresponds to a perfect impedance match, is unity.

W W (watts)

The derived SI unit of power. It is equivalent to 1 joule per second, or 1 volt-ampere.

Walk-through

A critical examination of a design or product undertaken to ensure that it is of adequate quality.

Waveform

The characteristic shape of a periodic wave, determined by the frequencies present and their amplitudes and relative phases.

WEEE

Waste Electrical and Electronic Equipment

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