



Alcatel-Lucent 9962

Multi-standard Enterprise Cell v1

Technical Description and Troubleshooting Guide

3MN-02001-0003-DEZZA

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About this document

Purpose

The purpose of this document is to present a functional and technical description of the Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1 and its components, as well as basic trouble-shooting techniques. It is part of the Small Cells product group, and is designed for commercial use. The short name for the product is 9962 MSEC v1.0.

Intended audience

This document presents an integral overview of the 9962 MSEC v1.0 system, and is intended for all audiences.

Supported systems

This document applies to the Alcatel-Lucent system for use with W-CDMA and LTE carriers.

Conventions used

The full product name, Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1, is also referred to interchangeably as any of the following throughout this document:

- Alcatel-Lucent 9962 MSEC v1.0
- 9962 MSEC v1.0

Related information

For information on subjects related to the content of this document, refer to the documents listed in the following table:

Refer to this document	At this location	For information on
<i>Alcatel-Lucent Small Cell WiFi AP Technical Description,</i> 3MN-1840-0004-DEZZA	http://support.alcatel-lucent.com	Descriptions of the WiFi Access Point's functionality, physical attributes and architecture.

<i>Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1 - Site Preparation, 3MN-02001-0001-RJZZA</i>	http://support.alcatel-lucent.com	Site preparation before installation for the 9962 MSEC v1.0 system.
<i>Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1 - Hardware Installation, 3MN-02001-0002-RJZZA</i>	http://support.alcatel-lucent.com	Installation and commissioning processes according to the product configuration for the 9962 MSEC v1.0 system.
<i>Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1 - Troubleshooting, 3MN-02001-0004-REZZA</i>	http://support.alcatel-lucent.com	Trouble-shooting guide for the 9962 MSEC v1.0 system.
<i>Alcatel-Lucent W-CDMA Radio Access Network, Terminology Overview, 3MN-01111-0001- TQZZA0003-TQZZA</i>	http://support.alcatel-lucent.com	A glossary of terms and abbreviations used for W-CDMA networks.
<i>Alcatel-Lucent 9400 LTE Radio Access Network, Terminology Overview, 9YZ-04152-0003-TQZZA</i>	http://support.alcatel-lucent.com	A glossary of terms and abbreviations used for LTE networks.

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1 Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1 : Overview

Overview

Purpose

This chapter provides an overview of the Alcatel-Lucent Small Cells solution, and in particular the Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1 product.

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9962 MSEC v1.0 : Product Overview

Introduction

The Alcatel-Lucent 9962 Multi-Standard Enterprise Cell, or 9962 MSEC, is a wireless access point using licensed spectrum delivering improved network reach and increased capacity while off-loading traffic from the macro network.

It is part of Alcatel-Lucent's family of Small Cell Solutions.

Figure 1-1 9962 MSEC - Standard model, front view



Note: The stick antennas, as pictured, are used only for wall-mount (vertical) installation - not for ceiling mount (horizontal) installation - and are available separately from the standard product package.

The 9962 MSEC leverages the latest innovations to provide an indoor small cell that supports 3G W-CDMA and 4G LTE Radio Access Technology carriers, (using a single System on Chip, SoC) operating in multiple bands, coupled with an integrated Wi-Fi Access Point (Wi-Fi AP) functionality.

Its Software Defined Radio (SDR) capability provides the flexibility not only to evolve from 3G to 4G technology in a given band but also to assign any of the multiple supported bands to either technology. These software-only changes eliminate the need to visit the site, thus simplifying maintenance and reducing operating costs.

Integrated omni-directional antennas and optional external antennas are used to extend coverage, add capacity and improve end-user experience in small, medium and large indoor environments in a secure, cost effective and easily deployable manner.

Note: Operations in the 5.15-5.25GHz band are restricted to indoor usage only.

Product Capabilities

The 9962 MSEC has sophisticated capabilities developed by Bell Labs to ensure zero-touch configuration in the case of a single deployment.

The 9962 MSEC has several unique capabilities:

- Designed to blend into most business, office, or warehouse environments.
- It has 2 simultaneous carriers: one LTE and one W-CDMA, or 2 LTE carriers with Carrier Aggregation;
- It has a capacity up to 64 LTE and 32 W-CDMA active simultaneous users (128 users in LTE only mode);
- It has 2 x 2 MIMO configuration with transmit and receive diversity for LTE, and 1 x 2 receive diversity for W-CDMA;
- It uses a single cable for power with 4p PoE (Power over HD Base-T) and backhaul;
- It has a common backhaul across 3G/4G/Wi-Fi via one RJ45 and one SFP Port.

It has 7 integrated omni-directional antennas and 2 attached dipole antennas :

- 4 antennas are dedicated to RAN access, one is used for sniffing RAN frequency bands, 4 are dedicated to WiFi
- The Multi-Standard Enterprise Cell can support a set of external antennas.
- The internal or external antenna configuration is performed during hardware installation (and is reversible).
- The two configurations allow flexible installation and indoor coverage optimization.

For specific solutions, the customer may use their own antennas (directional, omni-directional) but must ensure that the necessary certifications are valid.

The 9962 Multi-Standard Enterprise Cell has also Wi-Fi capabilities:

- The Wi-Fi version module is Wi-Fi Certified™ ;
- IEEE 802.11n with dual-band dual-concurrent communication;
- Integrated antennas optimized for 2x2 MIMO, and up to 125/100 mW Tx power per path;
- 20/40 MHz bandwidth
- Maximum physical data throughput of 2x300Mbps;
- Supports up to 256 connected users;

- 32 SSIDs (16 per frequency band).
- The Wi-Fi internal antennas typical peak gain values are: 2.4GHz band: 5.4 dBi; 5GHz band 5.2 dBi.

Refer to the *Alcatel-Lucent Small Cell Wi-Fi AP Technical Description, 3MN-01840-0004-DEZZA*, for more information regarding the Wi-Fi Access Point functionality.

Technical Performance

Table 1-1 9962 MSEC Maximum Key Hardward Performances (based on Software used)

Maximal Performance	LTE	W-CDMA
Capacities:		
Maximum transmit power :	2 x 250 mW (2 x 24dBm)	250 mW (24 dBm)
Number of users:	Up to 32	Up to 32
Peak data rate:	DL: up to 75 Mbps UL: up to 37 Mbps	DL: up to 21 Mbps UL: up to 5.7 Mbps

Technical Specifications Summary

Wi-Fi Capability

- Carrier grade Wi-Fi
- Dual-Band: Simultaneous support of 2.4 / 5 GHz
- 802.11 n
- 2x2 MIMO
- Tx Power up to 19dBm in 2.4 GHz and 18dBm in 5GHz
- Integrated antenna in the module and external antenna option.

Interfaces

- GPS antenna
- External Antenna Connectors
- RJ45 and SFP
- 48 V DC Input

Power Supply

- Power over HD Base-T (4p POE)
- 48V DC
- Typical power consumption at ambient temperature: ~48W
- AC/DC convertor provided to power the unit via AC

Certifications and standards

- FCC Part 15 Subpart B Class B
- Safety: CSA-C22.2 No. 60950-1-07/UL 60950-1
- IPX2 certified

Environmental parameters

- Temperature range: 0°C to +50°C
- Relative humidity: Up to 93%
- Passive Cooling

Synchronization and Timing

- GPS
- NTP

Radio Characteristics

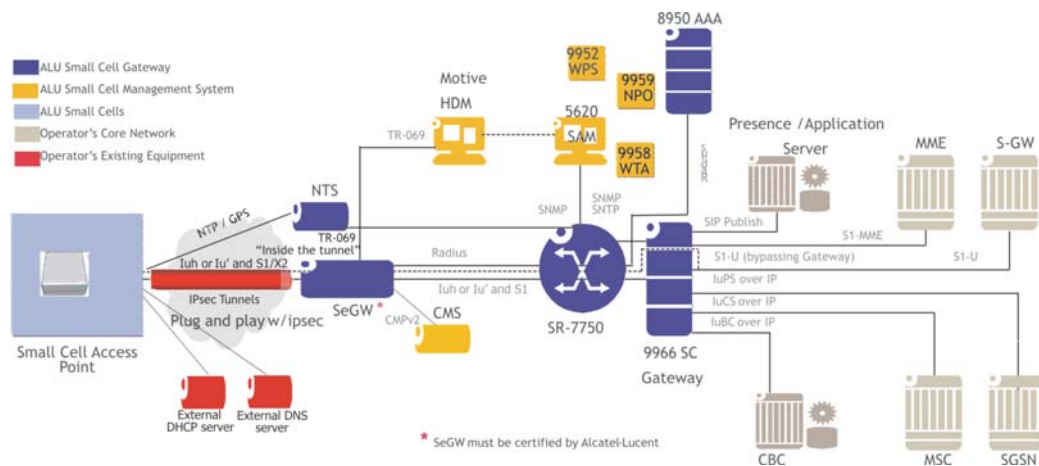
- Operating bands:
 - **W-CDMA (3G)**: B2 (PCS/1900MHz), B5 (850 MHz)
 - **LTE (4G)**: B2 (PCS/1900MHz) , B4 (AWS), B12 (700 MHz);
- 2x2 MIMO configuration with 2 transmit and 2 path receive diversity for LTE, and 1x2 W-CDMA
- Maximum transmission power: LTE 2x250 mW (24dBm) per path, W-CDMA 1x250 mW (24 dBm)
- Up to 64 LTE and 32 W-CDMA active simultaneous users (up to 128 users in LTE-only mode)
- LTE Peak rate support (75Mb/s down link and 37 Mb/s uplink at 10 MHz, 150Mb/s down link and 75 Mb/s uplink at 20 MHz)
- Network sniffing

Small Cells System Architecture

Overview

The Alcatel-Lucent Small Cell unit uses 3GPP interfaces to connect to neighboring eNodeBs and other existing mobile core network nodes, while offering a 3GPP-compliant air interface. The architecture integrates seamlessly into existing LTE and UMTS networks, including interfaces to other components, as well as to existing management systems, and therefore integrates with existing applications, portals, and services through standard interfaces.

Figure 1-2 Small Cell Solution Architecture



The Small Cell unit interconnects with the core network elements with the addition of a Security Gateway (SeGW), a 3G Small Cell GW (HNB-GW) and optionally a HeNB-GW between the unit and the 3G/LTE core elements.

It supports S1-MME and S1-U interfaces based on 3GPP specifications as per macro eNodeB. The unit has connectivity to all MMEs/SGWs (located in the core network) in the pool/serving area. The S1-flex function and requirements for the unit differ from those for the macro eNodeB, as it is on the HeNB-GW, instead of on the unit itself.

The Serving Gateway (SGW) selection function selects an available SGW to serve a UE. The SGW selection function is performed by the MME and does not require any changes to support the unit.

9962 MSEC v1.0 : Physical characteristics

Overview

The following are the physical characteristics of the Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1.

The **physical dimensions** of the system are estimated as follows :

- Height : 355 mm
- Width : 326 mm
- Depth : 56 mm to 96 mm

Weight

- 5.8 kg

2 Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1 : Functional Description

Overview

Purpose

This chapter presents a functional description and use cases of the 9962 MSEC v1.0.

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Advantages and Functional Description

Use Cases

The Alcatel-Lucent 9962 Multi-Standard Enterprise Cell is designed for deployment in an indoor environment with its associated environmental and physical constraints. Therefore, it can be installed in many indoor private places such as business offices or warehouses, as well as in numerous indoor public places (supermarkets, shopping malls, airports...) The 9962 MSEC installation will depend on local or national laws in the country where the product is deployed.

Product Benefits

Since the 9962 MSEC can be installed in a wide variety of indoor places, it can offer many benefits to customers using those spaces.

If installed in **business offices**, new sources of revenue from corporate applications can be enabled by the enhanced indoor coverage and corporate networking possibilities. For instance, with the presence location API feature, the users can be connected to the Small Cell Access Points to take advantage of enterprise services. For example, workers can be connected to the company anytime, anywhere through a mobile application. They can make and receive their business calls as if they were in their office, thanks to a “One Number” capability.

Options such as call history, visual voice mails, corporate directory, and call routing are available on this kind of mobile application.

If installed in **indoor public places**, the 9962 MSEC can be deployed in areas formerly covered by microcells or picocells, but can also be used in many more cases, instead of macrocells, since they are very easy to install and are less subject to regulatory constraints with their low emission power.

With its high capacity, the Enterprise Cell is ideal for high user-density places where additional capacity is required or even in areas where cell phone coverage is needed on short notice. This deployment also allows new, innovative applications such as location, Quality of Service (QoS) and trusted security for application development.

Enterprise Cells also allow the operator to propose bundled offers and to include an entire group of employees into a single agreement. This leads to a reduction of customer churn, and allows higher revenue per user.

Auto-configuration and self-optimisation

The **Network Listening** feature is used for auto-configuration and self-optimisation of the radio. It allows the 9962 Multi-Standard Enterprise Cell to act as a UE and receive transmission from neighboring base stations. It is used to automatically identify, measure and record its neighbor cells, reducing the need for operator-provisioned neighbor cell lists.

The information is then used by the 9962 Multi-Standard Enterprise Cell to automatically select:

- its Physical Cell id (PCI) and to create and update a list of neighbor cells before UE measurements are received
- its primary scrambling code and power levels to transmit, and to create and update a list of UMTS neighbor cells

Those neighbor cell lists are used by the 9962 Multi-Standard Enterprise Cell for identification of the target cell for hand-over and for rebroadcasting of the system information messages, in support of re-selection by the UE.

The Wi-Fi part is a dual-band dual-concurrent module, supporting:

- Frequency bands: 2.4 and 5 GHz.
- Bandwidths: 20 and 40 MHz.

Security

The 9962 Multi-Standard Enterprise Cell security solution offers robust and mature security features to protect the Small Cell system against increasing security risks resulting from exposure to untrusted areas.

This security solution is based on a long security hardening experience from W-CDMA Small Cell, LTE wireless security knowledge and customer feedback and lessons learned in this area, such as:

- IPsec tunnel for traffic integrity protection and encryption for OAM, control plane, user plane
- Certificate-based authentication and security with Secure boot, Trusted Environment to ensure the confidentiality and integrity of sensitive information on the Enterprise Cell, and Authentication of the Enterprise Cell to the SeGW by Certificate as per 3GPP TS33.320.
- Security hardening of the 9962 Multi-Standard Enterprise Cell
- Tamper Alarm
- Evolved Packet System

Forced opening of the casing causes permanent disablement of the unit. In this case, the repair process is not applicable, as irreversible damage is caused to the printed circuit board and a new one must be provided.

3 Alcatel-Lucent 9962 Multi-standard Enterprise Cell v1 : Hardware

Overview

Purpose

This chapter presents the hardware of the 9962 MSEC v1.0.

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9962 MSEC : Hardware Description

Product Characteristics

Deployment Scenario : The Alcatel-Lucent 9962 Multi-Standard Enterprise Cell is designed for use in an indoor environment, to be installed vertically, using the optional wall bracket, or horizontally.

Customization options

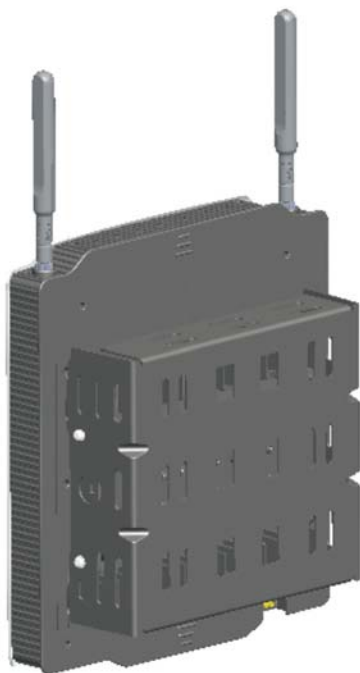
The 9962 MSEC case has a number of customization options. Below are pictures of the standard enclosure, front and back view:

Figure 3-1 9962 MSEC - Front and rear view



Note: The stick antennas, as pictured, are used only for wall-mount (vertical) installation - not for ceiling mount (horizontal) installation - and are available separately from the standard product package.

Figure 3-2 9962 MSEC - Rear view, with wall mount plate



Product delivery contents

The standard 9962 MSEC v1.0 is provided in a cardboard box with the following contents:

- The 9962 MSEC v1.0 access point,
- A mounting kit (wall or ceiling) including M5 steel screws to be used with N°2 driver,
- A quick start guide/user guide.

The standard package can be customized on demand.

The custom-tailoring process allows the option of adding the following items to the standard package :

- one GPS antenna with 10m cable length included,
- two RF stick antennas in case of wall-mounted installation.

The GPS antenna acquisition sensitivity is:

- -160dBm/Hz with AGPS server assistance and 2.5dB NF,
- -158dBm/Hz, unassisted.

Ancillary items

In addition to the standard delivered parts, the following ancillary items may be required. They may be purchased separately from Alcatel-Lucent, or purchased locally :

- two RF stick antennas for use in wall-mounted installation,
- SFP transceiver,
- Ethernet and/or fiber cable,
- 4p PoE compliant with PoH standard adapter,
- AC to DC power adapter,
- Lock,
- RF antenna jumper,
- GPS extension cable.

Connectors and Interfaces

The following connectors and interfaces are part of the 9962 MSEC solution :

- 1 Gigabit Ethernet connector (1000Base-T RJ-45) for backhauling or daisy-chaining. If 4p PoE is used to supply the power, this connector is to be connected to a 4p PoE capable router or a 4p PoE injector when the DC power connector is not used.
- 1 SFP interface for backhauling or daisy-chaining which supports a 1000base-X GbE optical transceiver or 100/1000Base-T electrical transceiver
- Jack connector for power supply. When the AC/DC power adaptor is used to supply the power, the PoE capable router is not used
- 1 SMA-type connector for the GPS antenna
- 9 SMA-type connectors for the external antenna version
- A lock slot
- 6 bi-color LEDs to provide the status of the unit
- A re-set button

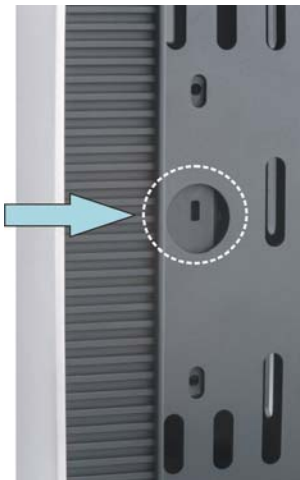
Figure 3-3 Power and Input/Output Ports



Figure 3-4 GPS Connector - detailed view



Figure 3-5 Lock slot - detailed view



Antennas

The 9962 Multi-Standard Enterprise Cell supports 4 polarized antennas configured for 2x2 MIMO with 2 transmit and 2 receive paths diversity for LTE, and 1x2 MIMO with 1 transmit and 2 receive paths diversity for W-CDMA.

Two internal omnidirectional W-CDMA and LTE antennas are included in the 9962 MSEC for B2/B5:

- Typical peak gain for internal antennas at B2 frequency: 3.2 dBi.
- Typical peak gain for internal antennas at B5 frequency: 1.8 dBi.

Two external omnidirectional “stick” antennas are available for B4/B12 frequencies :

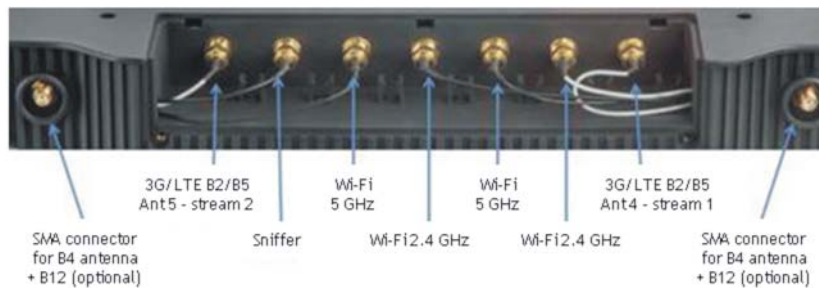
- Typical peak gain for RAN attached dipole antenna at B4 frequency: 1.8 dBi
- Typical peak gain for RAN attached dipole antenna at B12 frequency: 2.3 dBi

A version with external, omni-directional antennas is available. The average gain of the given antennas is the same as the internal ones, but offers a better coverage with a superior peak gain :

- Typical peak gain for external antenna at B4 or B12 frequency: up to 5 dBi (depending on the design)
- Typical peak gain for external antenna at B2 and B5 frequency: up to 5 dBi (depending on the design)

For specific solutions, the customer may use their own antennas (directional, omni-directional...) but must ensure that the necessary certifications are valid.

Figure 3-6 9962 MSEC Antenna Placement



The minimum value is 10 dBm (10mW).

Wi-Fi Parameters

The Wi-Fi module supports 4 integrated antennas optimized for 2x2 MIMO with up to 2 spatial streams. It uses advanced antenna design to support IEEE standard 802.11n, providing optimized MIMO performance and coverage.

The Wi-Fi internal antennas peak gain values are:

- 2.4GHz band: 5.4dBi
- 5GHz band 5.2 dBi

For a detailed description of the internal Wi-Fi Access Point antennas, refer to the Alcatel-Lucent Small Cell Wi-Fi AP Technical Description, 3MN-01840-0004-DEZZA, .

5620 Service Aware Manager (SAM)

The Alcatel-Lucent 5620 Service Aware Manager, or 5620 SAM, enables end-to-end network and service management of Alcatel-Lucent NEs, and limited management of third-party NEs. Third-party NEs are referred to as generic NEs, or GNEs.

The 5620 SAM performs the following tasks :

- It provisions a network with fast and easy configuration and multi-vendor scripting workflows that reduce the risk of error and shorten network deployment time.
- It accelerates set-up for integrated IP/optical performance and SLA monitoring with service-aware diagnostics that validate end-to-end services and IP/optical paths.
- It prevents service degradation through end-to-end power control, monitoring, tracing, and fault localization.
- It correlates faults to identify whether the problem resides in the IP or optical layer, and the root cause. This function simplifies troubleshooting and isolates problems before services are affected.

Technical Requirements

Power Supply

The power supply requirements and consumption are as follows :

- If a **Power supply over 4p PoE** is used to supply the power, a 4p PoE injector can be used while the AC/DC power connector is not used. Otherwise, a 4p PoE capable router can also be used. 4p PoE capable router and 4p PoE injector are not part of the standard product delivery.
- **Power supply with AC/DC power adaptor** : The Multi-standard Enterprise Cell v1 requires a 48V DC power feed. In this case, power injector is not used but a AC/DC power adaptor is needed.
- **Power consumption** : The maximum power consumption of the Enterprise Cell depends on the transmit power.

The power consumption on the 250 mW variant is approximately **48 W**.

Frequency Bands

The Alcatel-Lucent Enterprise Cell Multi-Standard supports 5, 10, 15 and 20 MHz carrier bandwidths for LTE and 5 MHz carrier bandwidth for W-CDMA applications.

Supported band and frequencies are provided in the table below:

Table 3-1 Frequency bands

Operating Band for LTE	Frequency Band	Common Name	UL Frequencies	DL Frequencies
II	1900	PCS	1850 – 1910 MHz	1930 – 1990 MHz
IV	1700	AWS	1710 – 1755 MHz	2110 – 2155 MHz
XII	700	LMSH A/B/C	699 – 716 MHz	729 – 746 MHz

Operating Band for UMTS Operation	Frequency Band	Common Name	UL Frequencies	DL Frequencies
II	1900	PCS	1850 – 1910 MHz	1930 – 1990 MHz
V	850	CLR	824 - 849 MHz	869 - 894 MHz

Operating Band for Network Listening	Frequency Band	Common Name	UL Frequencies	DL Frequencies
II	1900	PCS	-	1930 – 1990 MHz LTE and 3G Network Listening
IV	1700	AWS	-	2110 – 2155 MHz LTE Network Listening
V	850	CLR	-	869 - 894 MHz 3G Network Listening
XII	700	LMSH A/B/C	-	729 – 746 MHz LTE Network Listening

Transmission Power

The Multi-standard Enterprise Cell v1 is capable of output power up to 2x250 mW (250mW at each antenna connector). Due to its transmit power, the 9962 MSEC v1.0 is part of the 3GPP Local Area BS classification. It is configurable in 1 dB steps from minimum to maximum configuration.

The minimum value is 10 dBm (10mW).

The Wi-Fi transmit power has a minimum conducted TX power per chain of 21dBm/20dBm for 2,4/5GHz band and is configurable in 1 dB steps from minimum to maximum configuration.

Table 3-2 Transmit Power

Radio Access Technology	W-CDMA, LTE	W-CDMA, LTE	WiFi	
Frequency band:	1900 /1700 MHz	850/700 MHz	2.4 GHz	5 GHz

Table 3-2 Transmit Power (continued)

Radio Access Technology	W-CDMA, LTE	W-CDMA, LTE	WiFi	
Max conducted power per chain (dBm):	23	24	FCC : 19 ETSI : 11	FCC : 18 ETSI : 18
Typical Max EIRP (dBm) per band:	Depending on antenna gain		FCC : 28 ETSI : 20	FCC : 26 ETSI : 26

Radio Parameters

The Enterprise Cell Multi-Standard is designed according to the following parameters in 3GPP TS 25.104 and 3GPP TS 36.104 specifications.

Table 3-3 Radio Parameters

Parameter	W-CDMA Value	3GPP 25.104 requirement	LTE Value	3GPP 36.104 requirement
Sensitivity :	-116.5 dBm	- 107 dBm (or less)	-94.5	-93.5
QPSK EVM	17.5%	17.5% (or less)	17.5%	17.5%
16QAM EVM	12.5%	12.5% (or less)	12.5%	12.5%
64QAM EVM	7%	-	7%	8%
ACLR 5MHz	45 dB	45 dB (or greater)	45 dB	45 dB
ACLR 10MHz	50 dB	50 dB (or greater)	45 dB	45 dB

Reliability

The MTBF (Mean Time Between Failures) is calculated based on Telcordia SR-332 Issue 2, September 2006.

The MTBF of the Enterprise Cell Multi-Standard v1.0 at 25°C on a stand position is **356,000 hours**.

Status Indicators

Six bi-color LEDs provide indication for the system:

- Power
- LTE
- W-CDMA
- GPS status
- 2 rear LEDs indicate Wi-Fi status, labelled 2G and 5G

When the system is fully working for 15 minutes, the LEDs are extinguished.

Assuming the service functions normally, the system status LED color is green. In addition, it is possible to monitor different status elements following a LED sequence described later in this user guide, in the chapter on Troubleshooting.

4 Troubleshooting using the LED states

Overview

Purpose

This chapter details LED status and their meaning for the 9962 MSEC v1.0 product and troubleshooting.

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LED states for the 3G and 3G/4G 9962 MSEC v1.0	4-2
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LED states for the 3G and 3G/4G 9962 MSEC v1.0

Overview

This topic describes the states of the LEDs on the 9962 MSEC v1.0 device.

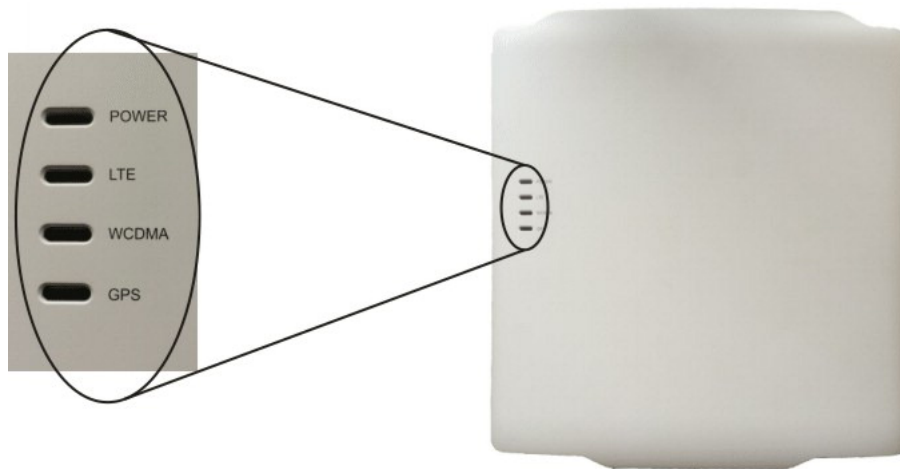
There are two variants of the 9962 MSEC v1.0:

- 3G only
- 3G and 4G (LTE)

There are six red/green bicolored LEDs that indicate the status:

- Power
- LTE cells: only on the 3G/4G variant
- W-CDMA cell
- GPS receiver
- 2 WiFi module status indicators on the rear of the unit, labelled 2G and 5G.

Figure 4-1 9962 MSEC v1.0 LEDs



The LEDs can take these states:

- Off
- flashing green
- solid green
- flashing red
- solid red
- toggling between red and green

LED interpretation

When the 9962 MSEC v1.0 is powered on, all LEDs are solid red: if the software fails to start, the LEDs remain in this condition. Otherwise the LEDs indicate the progress of the initialization of the unit.

After the four LEDs, excluding the WiFi LEDs, have been in a normal state for fifteen minutes, these four LEDs are all turned off to avoid bringing attention to the unit. If an event occurs that changes an LED state, then the four LEDs are turned on. After the LEDs have returned to normal state for fifteen minutes, all LEDs are turned off again.

The WiFi status LEDs act independently of this management.

Power LED

The system initialization and fault states are represented by a single bicolored red/green LED.

Table 4-1 Power LED initialization

System state	LED state	Description
Power off	OFF	Power is off
Boot	Red	Power is applied or the system is reset. During this phase the BLST is performed, DHCP access is made and the IP address is assigned. The system remains in this state if the boot fails or BLST fails.
Network attach	flashing red	The system attempts to establish contact with the DNS external server. The system negotiates with the Security Gateway and establishes an OAM IPsec tunnel.
EMS connect	Toggling red/green	Attempt to contact DNS Internal for HDM/SAM address resolution
Download and configuration	flashing green	The system is verifying the 9962 MSEC v1.0 software and database. It updates if necessary, followed by a reset.
System stable	Green	Software and database are current, and the system is ready to enable applications

In the case where a fault is detected, the LED turns red.

Table 4-2 Power LED fault indication

LED state	Description	Comment
Red	Hardware fault is detected such that no service can be provided or service is degraded	The LTE and WCDMA LEDs indicate whether service is still active. If either is not active, see Table 4-3, “Faults that set the Power LED hardware failure” (p. 4-4) for faults that set this LED. The LED fault state clears when the fault clears or the unit is reset
Red	9962 MSEC v1.0 temperature is outside of the supported range.	Service may be affected by extreme temperature conditions. The LED fault state clears when the fault clears or the unit is reset

Table 4-3 Faults that set the Power LED hardware failure

Hardware Fault	Comment
Ethernet switch	May prevent backhaul communication
RF transceiver	Blocks or degrades air interface operation
Oscillator module failure	Affects all clock and frequency generation
Network listen receiver	Affects network listen function

LTE LED

The LTE start-up sequence and fault state are indicated by a single bicolored red/green LED. This LED is only managed in the 3G/4G variant.

Table 4-4 LTE LED startup

State	LED state	Description
Power off	OFF	Power off
Booting and BLST	Red	Power on or restart

Table 4-4 LTE LED startup (continued)

State	LED state	Description
System initializing (timing, RF, cell) and begin location check	Toggling red/green	Establishing resources needed by the LTE cell. The 9962 MSEC v1.0 may leave this state before the location check completes if <i>passiveGPS</i> is True. Otherwise it remains in this state until the location check completes.
Location check failure	flashing red	The 9962 MSEC v1.0 remains in this state if the location check or movement check fails and <i>showLocationCheck</i> is True Unit reset is required to clear the state.
Boot complete	Off	LED comes on initially but is turned off once the software starts and <i>operatingMode</i> is WCDMA-only.
Cell unlocked and ready for service (LTE cell AST Unlocked and OST Enabled)	Green	Location check may be running in the background or no location check to be performed

In the case where a fault is detected, the LED indicates the fault.

Table 4-5 LTE LED fault conditions

LED state	Description	Comment
flashing green	Cell blocked. LTE cell AST set to Locked, or OST is Disabled due to ongoing Network Listen activity	Cell successfully configured but not transmitting The LED fault state clears when the cell is unlocked or Network Listen completes and OST is now Enabled.
Red	Cell failure LTE cell OST is Disabled for any reason other than ongoing Network Listen activity	cell configuration failure, cell operational failure reported by 3G application, WCDMA tunnel down, SCTP association failure or another fault. The LED fault state clears when the cell is reconfigured and unblocked.

WCDMA LED

The WCDMA start-up sequence and fault state are indicated by a single bicolored red/green LED.

Table 4-6 WCDMA LED startup

State	LED state	Description
Power off	OFF	Power off
Booting and BLST	Red	Power on or restart
System initializing (timing, RF, cell) and begin location check	Toggling red/green	Establishing resources needed by the LTE cell. The 9962 MSEC v1.0 may leave this state before location check completes if <i>passiveGPS</i> is True. Otherwise it remains in this state until the location check completes.
Location failure	flashing red	The 9962 MSEC v1.0 remains in this state if location check or movement check fails and <i>showLocationCheck</i> is True Unit reset is required to clear this state.
Cell unlocked and ready for service (LTE cell AST Unlocked and OST Enabled)	Green	Location check may be running in the background or no location check to be performed

In the case where a fault is detected, the LED indicates the fault.

Table 4-7 WCDMA LED fault condition

LED state	Description	Comment
flashing green	Cell blocked. LTE cell AST is set to Locked, or OST is Disabled due to ongoing Network Listen activity	Cell successfully configured but not transmitting The LED fault state clears when the cell is unlocked or Network Listen completes and OST is now Enabled.

Table 4-7 WCDMA LED fault condition (continued)

LED state	Description	Comment
Red	Cell failure	cell configuration failure, cell operational failure reported by 3G application, WCDMA tunnel down, SCTP association failure or another fault. The LED fault state clears when the LTE cell OST is Enabled, WCDMA tunnel is ready

GPS LED

The status and fault condition of the GPS are represented by a single bicolored red/green LED.

Table 4-8 GPS LED

State	LED state	Description
Power off	OFF	Power off
Boot and BLST in progress	Red	Unit will remain in this state if BLST fails or the software does not successfully boot
GPS off	Off	LED will come on at startup but turn off again once the database is validated and GPS is not required (<i>syncReferenceSource</i> does not include GPS and <i>enableGPSLocationCheck</i> is False)
Acquiring GPS	flashing red	Looking for a GPS signal If it stays in this condition, the antenna may be bad or mounted in a poor location
Lost GPS	flashing green	The GPS signal has been lost
GPS lock	Green	A GPS signal has been acquired

In the case where a fault is detected, the LED indicates the fault.

Table 4-9 GPS LED fault condition

LED state	Description	Comment
flashing green	Satellite lost	Satellite lock must have been previously attained. This may be a temporary outage due to marginal satellite visibility, or a long-term outage due to a failed antenna.
Red	Hardware Failure	GPS receiver has failed.

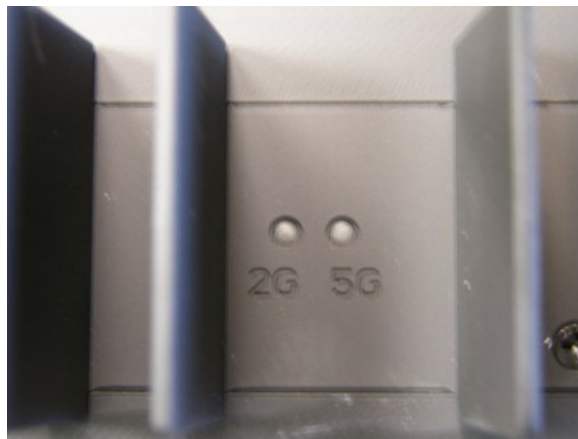
WiFi LEDs

These LEDs indicate the state of the WiFi module. They are driven directly from the WiFi module itself and not by the Multi-Standard Small Cell OAM software. Expected LED states are documented below.

The WiFi LEDs are extinguished during normal activity like the other LEDs.

The WiFi LEDs are located on the WiFi module on the rear of the 9962 MSEC v1.0 hardware. The 2G label corresponds with the 2.4 GHz segment while the 5G label corresponds with the 5 GHz segment.

Figure 4-2 WiFi LEDs



The table describes the initialization steps of the 2G and 5G WiFi LEDs.

Table 4-10 WiFi Status LED initialization states

Step	Description	State	5G LED	2G LED
1	Power-up or reload	BOOTING	Solid On	Solid On
2	AP tries to get adopted by controller	ADOPTING	Slow blinking	Off
3	(optional) controller pushes a software upgrade	UPGRADING	Off	Slow blinking
4	The controller pushes the AP configuration	CONFIGURING	Fast blinking	Fast blinking
5	WLAN are mapped to radios: normal service	OPERATIONAL	5GHz service: Slow blinking	2.4GHz service: Slow blinking
6	After 30 ¹ minutes in the same state	HIDING	Off	Off

Notes:

1. configurable from 15 to 1440 minutes.

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