Voice over WLAN Design Guide R6.0 for OmniAccess® Stellar Access Points AP1101, AP1221/AP1222, AP1231/AP1232 and AP1251

OT81x8 and OT8128 SE WLAN Handsets

OTBE & OTMS R2.3

OmniPCX Enterprise R12.1

OmniPCX Office R2.2

edition 02

Presales Design Guide

Alcatel·Lucent Enterprise

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Note:
Text highlighted in blue refers to MLE offer H2 2017

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This documentation is provided for reference purposes only and does not fully describe the capabilities of each Product and related features. Therefore, ALE International declines any liability for inaccuracies contained herein. For an exhaustive view on features list and product limits for the current product release please see the required Feature List/Product Limits document available through the ALE eBusiness Portal web site.
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1. Introduction & Objectives

It is the intent of this guide to aid Sales Engineers in designing and selling telecommunications solutions Incorporating ALE OmniTouch (OT8118, OT8128 & OT8128 SE (SIP Edition)) Voice over Wireless LAN (VoWLAN) solution

This document has been created specifically in the context of an architectural and technical Pre-Sales Design Guide approach. It is clearly understood that a client's choice of solution components and design options will take into account many factors that will not be explored here (such as financial considerations, deployment constraints, and business process limitations).

ALE OT81x8 and OT8128 SE (SIP Edition) VoWLAN product offering is a multi-stage solution aimed at meeting customer demand for converged voice and data wireless environments based on 802.11 technologies. The OT81x8 and OT8128 SE (SIP Edition) suite is the result of leveraging existing OmniPCX Enterprise features with OEM products available in the ALE portfolio from Ascom and others.

Technically speaking, the VoWLAN solution can be built on several centralized WLAN topology schemes but must always adhere to the Voice over WLAN operational design restrictions *(For more information on design restrictions, see: section Voice over WLAN Design Rules of this document and the latest ALE OmniPCX Enterprise Standard Offer document).*

1.1. Product Releases

Below is the list of products composing OXE and OpenTouch Suite for MLE (Medium/Large Enterprises) that are covered in this document, with release number allowing readers to refer to corresponding presales presentations or technical documentations to get additional information on VoWLAN features:

- **OmniPCX Office release 2.2**
- **OmniPCX Enterprise release 12.1**
- **OpenTouch Business Edition (OTBE) release 2.3**
- **OpenTouch Multimedia Services (OTMS) release 2.3**

1.2. Validated Software versions for OT8118/OT8128/OT8128 SE solution

Warning the following versions are subject to change:

- **WLAN Stellar:** 3.0.2.38
- **OT81118/OT8128/OT8128 SE software version:** 6.0.8
- **WinPDM /IMS3:** 3.13.2 /4.3.1

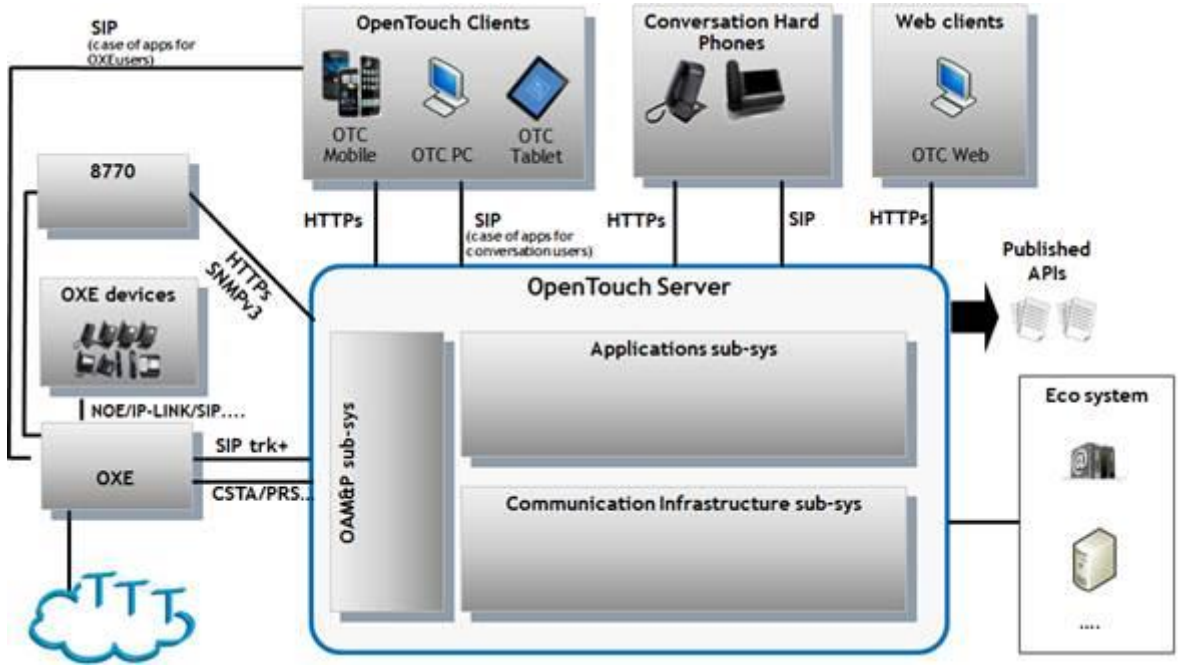
- For more details, check the latest validated software versions and related release notes available on ALE Business Portal.

2. OTBE, OTMS, OXE and OXO

ALE OT81x8 and OT8128 SE (SIP Edition) VoWLAN solution offer for OmniAccess® Stellar Access Points is comprised of many subcomponents. These components can be easily grouped into their categories defined by their functions and responsibilities.

Key to enabling the capabilities of ALE VoWLAN solution is NOE or SIP features.

2.1. OpenTouch Business Edition & Multimedia Services



ALE OT81x8 and OT8128 SE (SIP Edition) VoWLAN offer is available in the OpenTouch Suite that is declined in two different solutions:

- OpenTouch Business Edition (OTBE)

- OpenTouch Suite for MLE

ALU OT8118, OT8128 & OT8128 SE (SIP edition) WLAN handsets are not available for the "Conversation" users. These devices can be registered only with OXE, therefore as **Connection users** when OTMS applications are present.

2.2. OmniPCX Enterprise

ALE OmniPCX Enterprise can be :

- A internal component of OTBE
- An autonomous system with an optional OTMS add-on

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2.3. OmniPCX Office

ALE OmniPCX Office can be : - An autonomous OXO RCE system - An autonomous OXO Connect 1U, 2U or 3U Rack system - An autonomous OXO Connect Compact Edition system	

3. WLAN Components

3.1. OmniAccess® Stellar Access Points (Distributed Controller)

OmniAccess® Stellar Access Points are a family of high performance and distributed WLAN controllers which deliver speeds of latest IEEE 802.11ac standards.
AP11XX series are IEEE 802.11ac wave 1.
AP12XX series are IEEE 802.11ac wave 2.
For more details refer to the related datasheets.

OAW-AP1101 **Minimum software version 2.1.0.110 is equivalent to AP207** **Dual-Radio (Indoor)** **802.11a/b/g/n/ac wave1 (Dual Band concurrent)** 5GHz: 802.11ac very high throughput (VHT) support: VHT 20/40/80 2.4GHz: 802.11n high-throughput (HT) support: HT 20/40 1× 10/100/1000Mb/s full/half-duplex Ethernet (RJ-45) PoE-PD: 48 V DC (nominal) 802.3af or 802.3at PoE Built-in antenna 2×2: - 2, 3.4 dBi at 2.4 GHz - 3.96 dBi at 5 GHz AP1101 access point group is an autonomous system that consists of a group of **distributed OmniAccess® AP1101s controllers.** **AP1101 in Express mode** One AP-Group supports up to 32 OmniAccess® AP1101s (version 3.0) When mixed with Stellar AP12XX, one AP1101 AP-Group supports up to 64 OmniAccess® Access Points, 512 clients and 16 WLANs (SSID)	 **OAW-AP1101**

One AP1101 AP-Group supports up to 16 OmniAccess® AP1101s, 256 concurrent clients and 16 WLANs (SSID) in its version 2.1 **AP1101 in Enterprise mode** One AP1101 AP-Group supports up to 2000 OmniAccess® Access Points (any model any mix version 3.0)	
OAW-AP1221 /AP1222 **Minimum software version 3.0.2.38 is equivalent to AP305/304** **Dual-Radio Indoor)** **802.11a/b/g/n/ac wave2 (Dual Band concurrent)** Data rate up to 3 MU-MIMO capable devices simultaneously 5GHz: 802.11ac very high throughput (VHT) support: VHT 20/40/80 2.4GHz: 802.11n high-throughput (HT) support: HT 20/40 1× 10/100/1000Mb/s full/half-duplex Ethernet (RJ-45) PoE-PD: 48 V DC (nominal) 802.3af or 802.3at PoE **OAW-AP1221** Built-in antenna 2×2 @2.4GHz, 4x4 @5GHz: - 3.61 dBi at 2.4 GHz - 4.45 dBi at 5 GHz **OAW-AP1222** 4 RP-SMA connectors for external dual band antennas. Optional BLE radio through USB port Application monitoring & control /DPI AP1221/AP1222 access point group is an autonomous system that consists of a group of **distributed OmniAccess® AP1221/AP1222s controllers.** **AP12XX in Express mode** One AP12XX AP-Group (any model any mix) supports up to 64 OmniAccess® Access points, 512 concurrent clients and 16 WLANs (SSID) (version 3.0) **AP12XX in Enterprise mode** One AP12XX AP-Group supports up to 2000 OmniAccess® Access Points (any model any mix), 1024 concurrent clients and 16 WLANs (SSID)	 **OAW-AP1221**  **OAW-AP1222**

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OAW-AP1231 /AP1232

Minimum software version 3.0.2.38 is equivalent to AP325/AP324

Three-Radio (Indoor)

802.11a/b/g/n/ac wave2 (Dual Band concurrent)

Data rate up to 6 MU-MIMO capable devices simultaneously

Dual 5GHz: 802.11ac very high throughput (VHT) support: VHT 20/40/80

2.4GHz: 802.11n high-throughput (HT) support: HT 20/40

1× 10/100/1000Mb/s full/half-duplex Ethernet (RJ-45)

1× 10/100/1000/2500Mb/s full/half-duplex Ethernet (RJ-45)

PoE-PD: 48 V DC (nominal) 802.3at PoE

OAW-AP1231

Built-in antenna 4×4 @2.4GHz, dual 4x4 @5GHz:

- 3.9 dBi at 2.4 GHz
- 5.9 dBi at 5 GHz

OAW-AP1232

8 RP-SMA connectors for external dual band antennas.

Integrated BLE radio

Application monitoring & control /DPI

AP1231/AP1232 access point group is an autonomous system that consists of a group of **distributed OmniAccess® AP1231/AP1232s controllers.**

AP12XX in Express mode

One AP12XX AP-Group (any model any mix) supports up to 64 OmniAccess® Access points, 512 concurrent clients and 16 WLANs (SSID) (version 3.0)

AP12XX in Enterprise mode

One AP12XX AP-Group supports up to 2000 OmniAccess® Access Points (any model any mix), 1024 concurrent clients and 16 WLANs (SSID)

OAW-AP1231

OAW-AP1232

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OAW-AP1251

Minimum software version 3.0.2.38 is equivalent to AP365

Dual-Radio (Outdoor)

802.11a/b/g/n/ac wave2 (Dual Band concurrent)

Data rate up to 3 MU-MIMO capable devices simultaneously

5GHz: 802.11ac very high throughput (VHT) support: VHT 20/40/80

2.4GHz: 802.11n high-throughput (HT) support: HT 20/40

2× 10/100/1000Mb/s full/half-duplex Ethernet (RJ-45)

PoE-PD: 48 V DC (nominal) 802.3af or 802.3at PoE

OAW-AP1251

Built-in antenna 2×2 @2.4GHz, 2x2 @5GHz:

- 8.46 dBi at 2.4 GHz
- 6.62 dBi at 5 GHz

Application monitoring & control /DPI

AP1251 access point group is an autonomous system that consists of a group of **distributed OmniAccess® AP1251s controllers.**

AP12XX in Express mode

One AP12XX AP-Group (any model any mix) supports up to 64 OmniAccess® Access points, 512 concurrent clients and 16 WLANs (SSID) (version 3.0)

AP12XX in Enterprise mode

One AP12XX AP-Group supports up to 2000 OmniAccess® Access Points (any model any mix), 1024 concurrent clients and 16 WLANs (SSID)

OAW-AP1251

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3.2. Antennas for OmniAccess® Stellar Access Points

(For more details refer to the related datasheets)

3.2.1. General Remarks concerning Antennas

Any type of antenna (802.11a or b/g) can be connected to an Access Point operating in MIMO, provided the fact that the quantity of antennas match the MIMO value:

- 4 antennas of the same type for 4x4 MIMO AP

  or 8 antennas of the same type for dual 4x4 MIMO AP

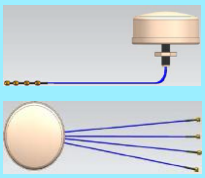
Note: Connector type RP-SMA or N-Type should be considered

For outdoor antennas a lightening arrestor is highly recommended

When a MIMO AP (all OmniAccess® Stellar Access Points are MIMO) operates in pure 802.11a or 802.11b/g:

- all the antennas must be connected (e.g. four antennas on AP1222 and eight antennas on AP1232)

3.2.2. INDOOR ONLY Antennas (RP-SMA)

Model	Picture	Band	Gain	Polarization	Beamwidth
ANT-O-6 **Indoor MIMO (4 or 8 Antennas needed for MIMO)** Omnidirectional Direct-mount on AP		2.4-2.5 GHz 4.9-5.9 GHz	4.0 dBi 6.0 dBi	**Vertical Linear** 1x RP-SMA/m	E-Plane 45° H-Plane 360° E-Plane 25° H-Plane 360°
ANT-O-M4-5 **Indoor 4x4 MIMO (for mesh link applications or client access)** Omnidirectio!nal Ceiling-mount kit 4 cables		2.4-2.5 GHz 4.9-5.9 GHz	3.3 dBi 5.5 dBi	**Linear Vertical & Horizontal** **4x RP-SMA/j+86/500 mm**	E-Plane 90° H-Plane 360° E-Plane 35° H-Plane 360°
ANT-S-M4-60 **Indoor 4x4 MIMO (for mesh link applications)** Sector antenna Wall-mount kit 4 cables		2.4-2.5 GHz 4.9-5.9 GHz	4.5 dBi 6 dBi	**Linear Vertical & Horizontal** **4x RP-SMA/j+86/762 mm**	E-Plane 70° H-Plane 70° E-Plane 70° H-Plane 70°

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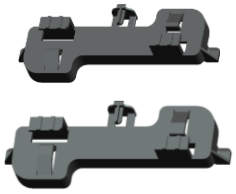
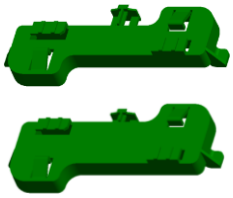
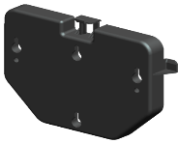
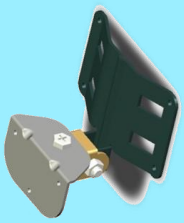
3.2.3. AP mouting kits

Model	Picture	Characteristics
OAW-AP-MNT-B **Ceiling-mount kit (for T-shaped standard rail mounting)** Included in box		
OAW-AP-MNT-C **Ceiling-mount kit (for other-form rail mounting)**		
OAW-AP-MNT-W **Wall/Ceiling-mount kit**		With screws
AP-MNT-OUT **External-mount kit for AP1251**		With expansion bolts and hose clamps

3.2.4. AP external power adapters

The OmniAccess® Stellar Access Points can be supported via a localized external power supply. This AC/DC transformer is the same type of device used to recharge batteries in PDAs, mobile phones, and some laptop computers. While an available option, the use of localized power is discouraged due to the likely location of Access Point placement and this proximity to AC outlets, fire-code safety concerns, and power autonomy costs.

Model	Picture	Characteristics
ADP-30HRBD **AC power adapter for AP1101, AP1221 and AP1222**		AC100-240V input, 48V DC output, 30W Compatible 802.3af/at

ADP-60GRBC **AC power adapter for AP1101, AP1221, AP1222, AP1231 and AP1232**		AC100-240V input, 48V DC output, 60W Compatible 802.3af/at

4. Server Elements (DHCP, TFTP, Management, RADIUS, IMS3)

4.1. DHCP Server

Customers have two IP address allocation schemes to choose for OT81x8 and OT8128 SE (SIP Edition) handsets, static mode and dynamic mode. Static mode operation is very simple and requires no expanded explanation. Terminals are simply programmed manually with IP addresses, subnet mask, default gateway, and TFTP server information. Optionally, OT81x8 WLAN handsets can be configured in a dynamic mode via standard DHCP server options.

Dynamic mode is recommended due to ease of use and speed of reconfiguration. An external or an internal DHCP server (OmniPCX Enterprise) can be used for all OT81x8 and OT8128 SE (SIP Edition) VoWLAN solutions. ALE does not currently offer the DHCP Server hardware platform and recommends the customers or business partners source this equipment from their usual PC Server supplier.

Dynamic mode is the default mode for OmniAccess® Stellar Access Points IP address allocations. It is recommended to configure OmniAccess® Stellar Access Points in a dynamic mode via standard DHCP server options specially to facilitate any AP Group deployment.

The automatic provision of APs configuration can be done from standard TFTP server options to specific Capwap option if Omnivista 2500 server is used.

Dynamic mode is also the recommended mode for any DHCP deployment of OT81x8 and OT8128 SE (SIP Edition) handsets with an IMS3 server. IMS3 deployment is configured via standard DHCP server options and specifically 43 option to facilitate any deployment of OT81x8 and OT8128 SE (SIP Edition) handsets.

ALE has validated the following DHCP Server software platforms for use with OT81x8 VoWLAN solutions.

Validated DHCP Server software platforms	
Windows 2003 (Server)	ALE VitalQIP
OXE embedded for OT81x8 WLAN handsets	

4.2. TFTP Server

A TFTP Server is mandatory for all OT81x8 VoWLAN solutions in NOE mode. The TFTP Server is responsible for supplying Binary to the OT81x8 WLAN handsets. TFTP Server can be also responsible for supplying the Configuration of the OmniAccess® Stellar AP1101 if necessary.

TFTP Server functions can be hosted from the OmniPCX Enterprise Communication Server or external.

There are no unique TFTP Server requirements beyond standard TFTP protocol specifications to support OT81x8 WLAN handsets. It is possible to combine TFTP Server and DHCP Server functions on a single external platform.

ALE has validated the following TFTP Server platforms for use with OT81x8 solutions.

Validated TFTP Server software platforms	
3Com TFTP Server (3CDaemon)	OXE embedded for OT81x8 WLAN handsets

4.3. Omnivista 2500 Server

A Omnivista 2500 management server is mandatory for the deployment of Stellar solutions in Enterprise mode.

Omnivista 2500 is responsible for registering Stellar Access Points, for supplying Binaries to the APs and managing full wireless/wired mobility with a unique network profiling to the devices networking on the supervised site. Omnivista 2500 is also responsible for advanced management of Stellar wireless protection (WIPS), for advanced management of guest/BYOD network accesses and for advanced networking strategies.

Omnivista 2500 server includes an internal RADIUS server within its embedded Unified Policy Authentication Manager (UPAM) that is associated with any authentication method which requires the use of a Network Authentication Server (NAS) in an 802.1x architecture.

Use of DHCP server is still required and declaration of the Omnivista 2500 management server to Stellar APs is done via the standard option 138 of the DHCP server.

ALE has validated the following 2500 Management Server platforms for use with OT81x8 and OT8128 SE (SIP Edition) solutions.

Validated Omnivista 2500 Server software platforms	
2500 NMS Enterprise version 4.2.2.R01	

4.4. RADIUS Server

A RADIUS server is always associated with any authentication method for devices that require the use of a Network Authentication Server (NAS) in a 802.1x architecture.

In Express mode application of a strong authentication method like WPA2 Enterprise for OT81x8 and OT8128 SE (SIP Edition) handsets requires the use of external RADIUS server. In this case OT81x8 WLAN handsets support both 802.1X EAP-TLS and PEAP methods and Stellar access points have the role of RADIUS client for all the vowlan handsets.

The use of the Omnivista 2500 internal RADIUS server in Enterprise mode is the preferred mode as it allows apply a single NAS server for both voice and data wireless/wired devices and apply coherent 802.1x network access policies for an entire Enterprise network supervised by the Omnivista 2500 server. Enterprise mode gives always the possibility for OT81x8 and OT8128 SE (SIP Edition) handsets to authenticate through their external RADIUS server if maintained for the Voice over WLAN.

ALE has validated the following Radius servers platforms for use with OT81x8 and OT8128 SE (SIP Edition) solutions.

Validated Radius servers on OT81x8 and OT8128 SE (SIP Edition)	
Microsoft Network Policy Server (NPS)	Microsoft IAS
Steel-Belted	FreeRadius
Clearpass	2500 NMS Enterprise version 4.2.2.R01

4.5. IMS3 Server

The use of IMS3 server for automatic provisioning of OT81x8 and 0T8128 SE (SIP Edition) handsets with a pre-defined SSID is recommended for large Voice over WLAN deployments. With the 6.0.8 version, a pre-defined "**AWS-INIT**" SSID is embedded in handset and broadcast by OmniAccess® Stellar Access Points on both 2.4Ghz & 5Ghz bands. A DHCP deployment with IMS3 server provides the easiest method to centralize the management and configure all OT81x8 and 0T8128 SE.

There is always the possibility to use a combination of IMS3 and WinPDM cradle for handsets administration.

ALE has validated the following IMS3 server platform for use with OT81x8 and OT8128 SE (SIP Edition) solutions.

Validated IMS3 server on OT81x8 and OT8128 SE (SIP Edition)	
Ascom IMS3/Elise3 administration tool version 4.3.0	

4.6. RF Director Management

The initial goal of RF Spectrum Management is to configure and calibrate radio settings for the wireless network. After the radio network is operational, the goal of RF Spectrum Management changes to that of tuning and adjusting radio parameters in order to maintain a high degree of performance. With ALE, RF Spectrum Management is largely automatic, requiring little configuration or intervention from the administrator. Key components of ALE RF Director solution are:

- Calibration: Used continuously throughout the life of a wireless network; Calibration functions allow network administrators to optimize power and sensitivity settings of the network on an antenna by antenna basis.

- Optimization:

- Auto Radio Resource Allocation: allows individual access points to monitor for RF changes and, in conjunction with Calibration information, make appropriate channel assignment changes.
- Self Healing: In the event that an AP fails, surrounding APs can automatically increase their transmit power level to fill in any gaps.
- Load Balancing: ensures optimum performance by automatically spreading client association in an equitable manner to avoid the premature saturation of a single AP.

- RF Monitoring:

- Coverage Hole Detection: Continuous monitoring of client data access and error rates provides for the identification of coverage holes or areas of diminished service.
- Interference Detection: notifies network administrators when localized interference becomes sufficient to cause performance degradation.

- Wireless Intrusion Protection: can identify and defeat a wide assortment of DoS attacks aimed at Wi-Fi networks.

5. OmniTouch WLAN Handsets

5.1. General Description

ALE makes now three models available, one each for office (OT8118) or industrial use (OT8128 and OT8128 SE (SIP Edition)). The performance of these three handsets families is very similar but their designs and options are focused for use in specific environments. The OT8128 SE (SIP Edition) is the latest and handset handling SIP protocol while both OT8118 and OT8128 are legacy NOE protocol.

All of these terminals are products of an OEM partnership between ALE and Ascom.

Main differencies between OT8118, OT8128 and OT8128 SE (SIP Edition) WLAN handsets:

OT8118 has a black&white screen

OT8128 and OT8128 SE (SIP Edition) have a color screen and in addition embed the following features:

- Hands-free
- Push-To-Talk
- Ekahau RTLS

Figure 1: OmniTouch 8118 WLAN handset, 8128 WLAN handset & 8128 SE (SIP Edition) WLAN handset

5.2. OT81x8 and OT8128 SE (SIP Edition) Look and Feel

Figure 2: OT8118, OT8128 & OT8128 SE (SIP Edition) look and feel

This picture describes the main functionalities and keys available on OT81118, OT8128 and OT8128 SE (SIP Edition) WLAN handsets

5.3. OT81x8 and OT8128 SE (SIP Edition) Physical Features

Mechanical characteristics	OT 8118	OT 8128	OT 8128 SE
Dimensions (hxwxd)	134x53x26 mm - 5,27x2,08x1,02 in.		
Weight	136g – 4,8oz		
Display type	B&W graphical	Color graphical	
Display size (pixels)	112x115	176x220	
Display Backlight	Yes		
Keypad Backlight	No	Yes	
Hands-free	No	Yes	
Vibrator	Yes		
Headset connector	2,5mm jack		

This table presents the physical features of the OmniTouch WLAN handsets (OT8118, OT8128 & OT8128 SE (SIP Edition)).

5.4. OT81x8 and OT8128 SE (SIP Edition) Technical characteristics

Technical characteristics	OT 8118	OT 8128	OT 8128 SE
Navigation keys	4		
OK key	Yes		
Soft keys	3		
Volume keys +-	Yes		
Loudspeaker key	No	Yes	
Mute key	Yes		
Dial by name key	Yes		
Keypad lock key	Yes		
Alarm Button/ Profile key	No Yes	Alarm /Profile key configurable	Yes No
Push to Talk key	No	Yes	
Color (front panel/ bezel/keys)	Black/Silver/Silver	Black/Black/Black	
IP class	IP44		
Belt clip (standard)	Yes		
Belt clip (swivel)	Accessory		
Security chain hole	Yes		
Operating Temp.	-5 +45°C, +23 +113°F		
Operating humidity	10 to 95% non condensing		
Talk time	Up to 15 hours		
Standby time	Up to 100 hours		
Charging time	2.5 hours		

This table presents Technical characteristics of OmniTouch WLAN handsets (OT8118, OT8128 & OT8128 SE (SIP Edition)).

5.5. 802.11n

5.6. 802.11n specifications

802.11n is supported on both 2.4 GHz and 5 GHz Radio Bands.

Some particularities with 802.11n:

- HT20 configuration (20 MHz channel)
- HT40 configuration (40 MHz channel aggregation)
  HT40 is currently used in the 5 GHz radio band (802.11an) as many channels are available.
  HT20 is mainly used in the 2.4 GHz radio band (802.11bgn). HT40 configuration in the 2.4GHz radio band remains possible for a hot spot (using few APs) but is not adapted to a large deployment due to the 3 channel limitation in 2.4 GHz (interferences between channels)
- Better modulation (64-QAM)
- Additional streams (up to 4 streams)
- Beam forming (explicit and implicit)
- Backwards compatibility with 11a/b/g

5.7. OT81x8 and OT8128 (SIP Edition) operation in 802.11n

In order to match WLAN network characteristics OT8118 and OT8128 WLAN handsets can be configured either:

- In 802.11a
- In 802.11b/g
- In 802.11 a/n
- In 802.11 b/g/n

The main benefit of configuring OT8118/8128 WLAN handsets in 802.11n is that they can work in an environment where n is implemented in the infrastructure and there is no need to configure a separate legacy network just for the handsets. The OT8118/8128 WLAN handset understands 802.11n PHY and MAC mechanisms/extensions.

The only “n” related setting that can be set right now is the 802.11 protocol to use.
If OT8118/8128 WLAN handsets are configured in a/n or b/g/n, they will work in **a 20MHz “n” network (HT20)** and legacy network.
The handsets can coexist with 40 MHz channels (channel bonding HT40).

OT8118, OT8128 and OT8128 SE (SIP Edition) WLAN handsets when configured in 802.11n operate in **1x1 MIMO mode**

Due to AP deployment constraints in b/g/n operation (limit of 3 channels in 802.11 b/g/n) and also the potential risk of interference in 2.4 GHz band (Bluetooth, Intrusion radar, microwave oven, etc.),
the recommended 802.11n mode for OT8118/8128 and OT8128 SE (SIP Edition) is 802.11a/n

5.8. 802.11ac

5.9. 802.11ac Specifications

Some particularities with 802.11ac:

- 802.11ac is only supported on the 5 GHz Radio Band
- Even wider channels (80 MHz and 160MHz for wave 2) HT80 and HT160
- Better modulation (256-QAM for wave 2)
- Additional streams (up to 8 for wave 2)
- Explicit Beam forming
- Backwards compatibility with 11a/b/g/n

  (Refer to http://www.802-11.ac.net for in-depth information)

OmniAccess® Stellar AP1101 is 802.11ac wave 1 and OmniAccess® Stellar AP12XX are 802.11ac wave 2 and are compatibles with OT8118/8128/8128 SE (SIP Edition) WLAN handsets under 802.11ac operations.

5.10. OT81x8 & OT8128 SE (SIP Edition) operation in 802.11n

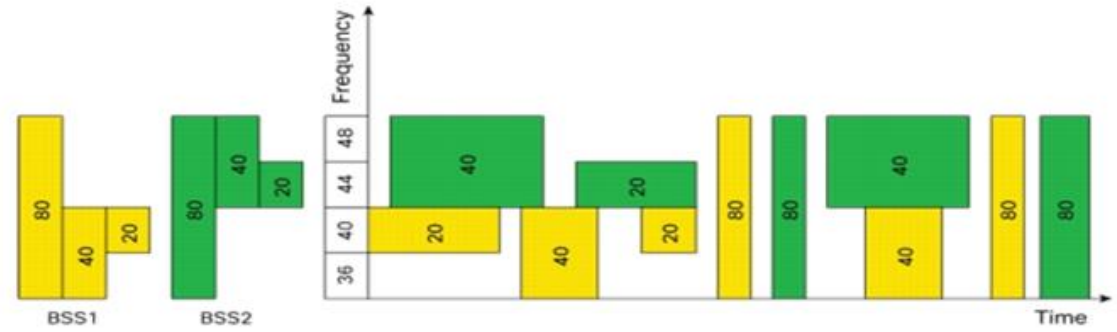


Figure 3: Dynamic bandwidth allocation. Channel usage with 2 APs (BSS1 & BSS2)

This above picture shows how different modes of operation are multiplexed on access points:

- 802.11an (HT20) –matching OT8118/OT8128 operation-mode
- 802.11an (HT40)
- 802.11ac (VHT80 wave 1 and wave 2)

OT8118/8128 and OT8128 SE (SIP Edition) WLAN handsets are 802.11n 1x1 MIMO devices (HT20 operation). Due to the backward compatibility of 802.11ac with 802.11n, OT8118/8128/8128 SE (SIP Edition) WLAN handsets are also compatible with 802.11ac operations.

5.11. Push-To Talk on OT8128 and OT8128 SE (SIP Edition)

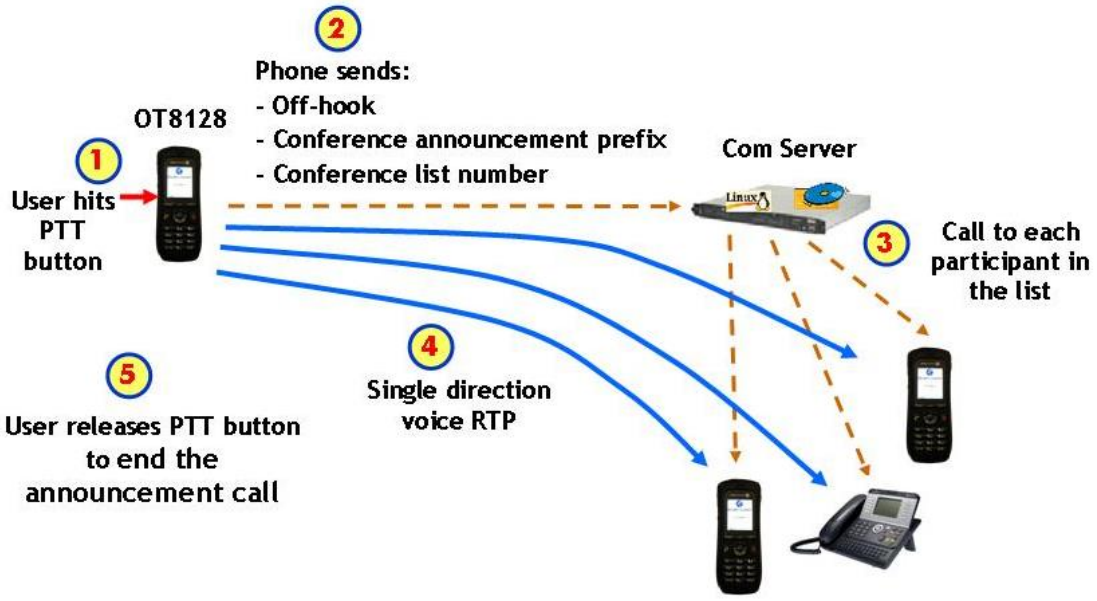


Figure 4: Push-To-Talk operation

PTT on OT8128 and OT8128 SE (SIP Edition) is based on OXE Mastered conference (announcement), using single direction voice RTP.

- Automatic off-hook and speak to participants in conference list
- Participants are MUTEd automatically and cannot be UN-MUTEd, the announcement is forced to loudspeaker.
- predefined Announcement lists (up to 12) can be created on each OT8128 set

There is a parameter in OT8128 PDM (configuration tool), indicating the list number in use for Push To Talk. On OT8128 local menu, there is also a field corresponding to “PTT list number”.

Participants to PTT can be wireless or wired phone sets.

A OT8128 SE (SIP Edition) cannot be the initiator of the OXE Mastered conference.

Warning: Push-To-Talk is Not supported on OTBE (OpenTouch Business Edition)

5.12. OT81x8 and OT8128 SE (SIP Edition) Features

Feature	OT 8118	OT 8128	OT 8128 SE
Radio support	802.11 a/b/g/n		
Wireless security	802.11i, WEP 64/128, WPA/WPA2 Personal & Enterprise		
Authentication	WEP, WPA 802.1x & EAP: PEAP-MSCHAPv2, EAP-TLS, EAP-FAST		
Certificates	Factory and up to 8 root & clients		
QoS	802.11e, WMM		
Power Save	U-APSD, WMM-PS		
Call admission control	TSPEC, TCLASS, WMM admission control		
Fast roaming	PMK caching & OKC (Opportunistic Key Caching)		

This table presents QoS and Security and QoS features of OmniTouch WLAN handsets (OT8118, OT8128 & OT8128 SE (SIP Edition)).

Feature	OT 8118	OT 8128	OT 8128 SE
Audio codec	ITU-T G711 (A,µ), G729AB		
Telephony protocol	ALE telephony protocol (NOE)		SIP
IP address assignment	Static, DHCP		
DSCP	Pbx settings or local settings		
TFTP	Yes, SUOTA (SW update over the air)		No
Location support	No	RTLS Ekahau	
Serviceability	Test, Diagnostic, Syslog, site survey modes		
Configuration tool	PDM (Portable device manager)		
System registration	Up to 4 systems		
WLAN infrastructure	ALE OmniAccess® Stellar, ALE OmniAccess®, HPE/Aruba, Cisco, Avaya, Meru, Juniper (Trapeze), Motorola, Aerohive, Extreme, Xirrus, Brocade		
Languages (Handset MMI)	English US, French, German, Spanish, Italian, Dutch, Swedish, Danish, Norwegian, Finnish, Portuguese, Polish, Flemish, Czech, Greek, Hungarian, Turkish, Russian		
Additional languages	1 downloadable additional language		
System languages	System dependant		
Screensaver	No	Yes, customizable	
User profiles	4 pre-defined	5 pre-defined among 10 user configurable	

This table presents additional features of OmniTouch WLAN handsets (OT8118, OT8128 & OT8128 SE (SIP Edition)).

5.13. Integrated Messaging and Wireless Services (IMS3) Tool for OT81x8 and OT8128 SE (SIP Edition)

The IMS3 (Integrated Messaging and Wireless Services) is a web-based tool used for OT81x8 devices management, messaging, and alarms control. The module is based on ELISE3 hardware and the Linux operating system, designed as an all in one central device management.

The device management is supported via the LAN of the installation.
IMS3 is able to manage the wlan radio settings of OT81x8 in both NOE and SIP modes.

This Ascom product is directly “bought and resold” by ALE.

5.14. WinPDM Administration Tool for OT81x8 and OT8128 SE (SIP Edition)

The WinPDM (Windows Portable Device Manager) Administration Tool is a software utility installed on a PC, the Configuration Cradle is connected to this PC via an USB cable.

OT81x8 and OT8128 SE (SIP Edition) configuration through a Configuration Cradle is always supported

Note: The configuration cradle does not intend to replace the Desktop Charger, as it just provides a light power feeding to keep the battery operational during the OT81x8 and OT8128 SE (SIP Edition) configuration.

5.15. Integrated Messaging and Wireless Services (IMS3) Specifications

_ Web-based application on ELISE3 hardware and Linux operating system
_ 1x 10baseT or 100baseT Ethernet LAN port
_ USB Host port 2.0 for device management via USB
_ Serial R232 ports used for external Ascom protocols
_ AUX inputs/outputs and error relay for alarm systems

5.16. WinPDM Specifications

_ Install on a PC running Windows XP SP2 or Windows 7 (Vista is not supported)
_ SUN Java Runtime Environment version 6.x or higher
_ Acrobat Reader 4.0 or higher
_ USB port 1.1 or higher
_ Administrator rights to the computer

5.17. Needed parameters on OT81x8 and OT8128 SE (SIP Edition) handsets

SIP and NOE Parameters cannot be set from inside the IMS3 or WinPDM. Assigning a phone number to the device is done by registering the handset to the PBX in the normal fashion. When OT81x8 and OT8128 SE (SIP Edition) are configured in static mode TFTP parameters must be configured via IMS3 or WinPDM.

WLAN and other Network parameters :
a few can be set using the Handsets Admin menu from the keypad, **advance parameters must be set using the IMS3 or WinPDM**. Some User settings cannot be performed from the keypad so **the IMS3 or WinPDM must be used.** Using IMS3 Templating or WinPDM Templates for all tasks will reduce the risk for errors and will make the deployment faster. Storing all handsets parameter files in the **IMS3 databases will create a status record of handsets belonging to an installation**

5.18. Integrated Messaging and Wireless Services (IMS3) Technical Overview

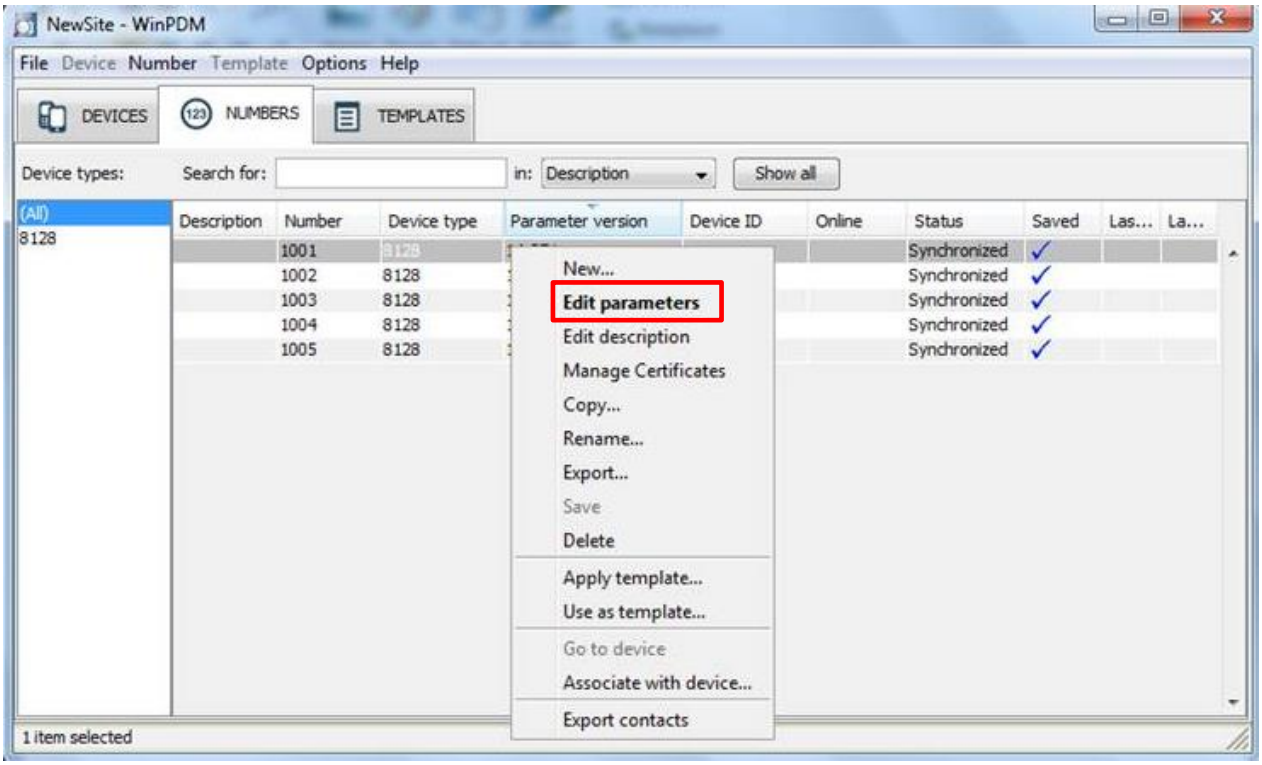


Figure 1: IMS3 Phones overview window

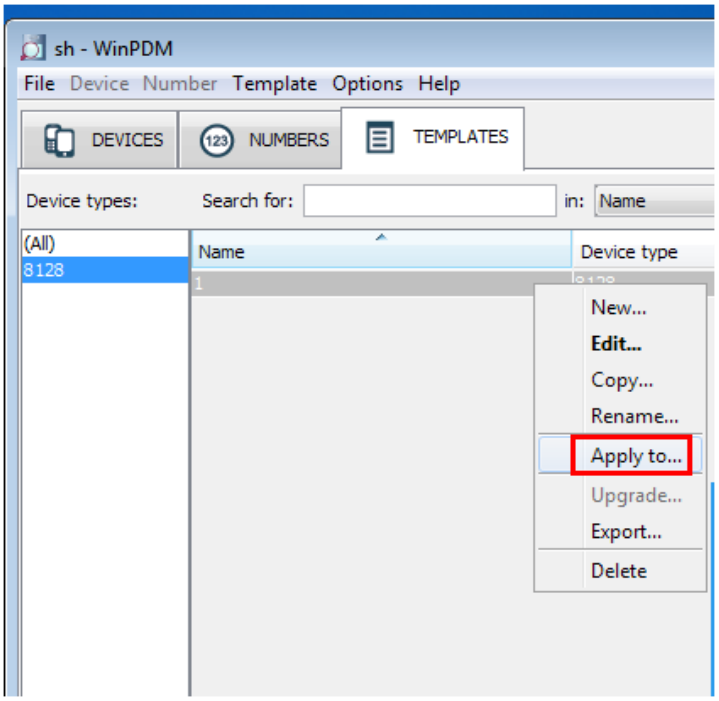


Figure 1: Template assignment with IMS3

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An embedded Linux server connected to the LAN of the installation to provide a centralized management for all OT81x8 and OT8128 SE (SIP Edition) phones and configuring each phones, management of templates for several common settings or all devices.
IMS3 is able to manage the wlan radio settings of OT81x8 and OT8128 SE (SIP Edition) in both NOE and SIP modes.

This web-based server can download the phonebook from a phone or a phone contact, then download specific language file to a phone (add a language) if needed.

A Backup of all individual settings phone, including contacts can be done and Software Upgrade can be scheduled for a specific date or time.

IMS3 server can control several phones at the same time.

5.19. WinPDM Technical Overview

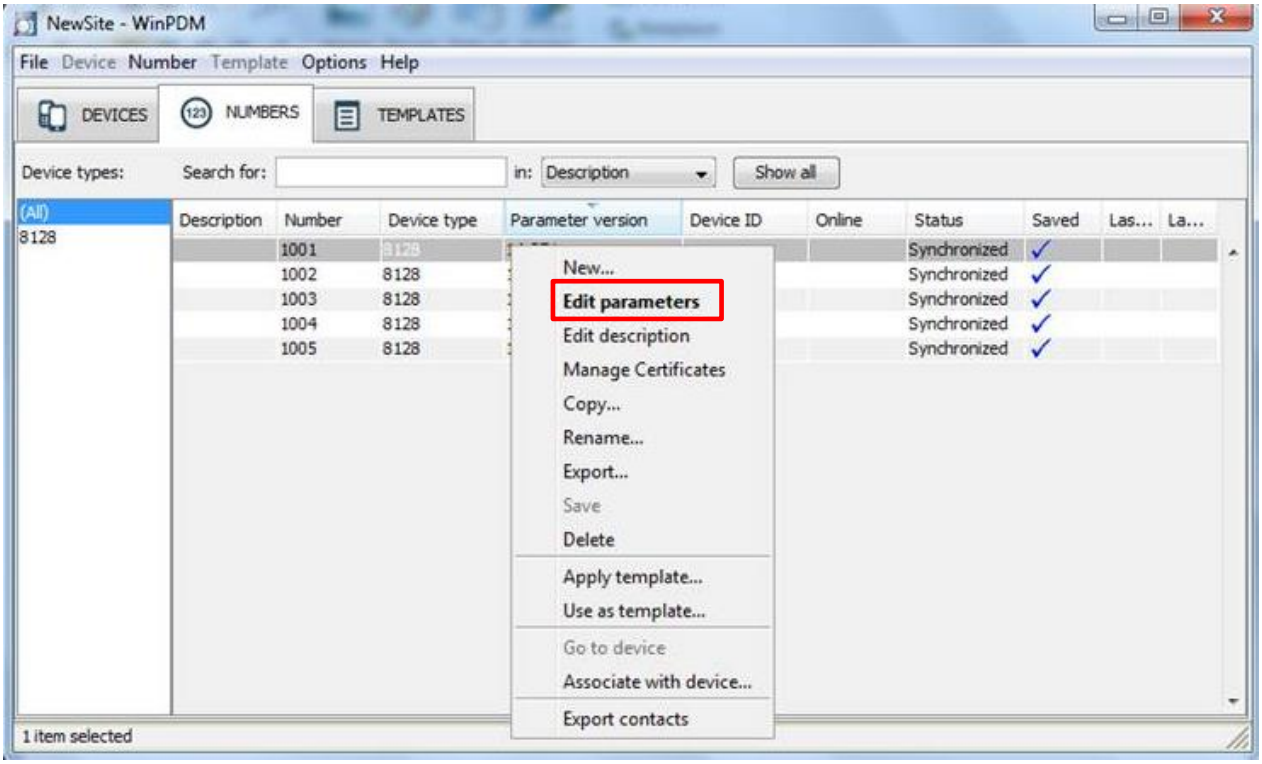
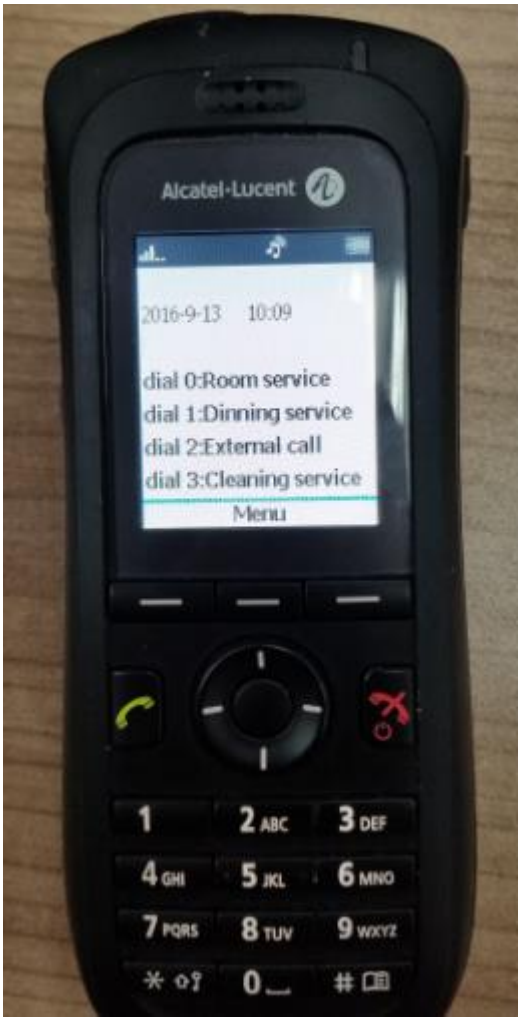


Figure 1: Handset administration tool window

A Java based software containing both a server and a client. Application will be installed in one folder and the databases in a second folder. The application can be updated with new versions without loosing the database. Handset data can be imported or exported to other PCs running WinPDM. The database is separated in Sites, a collection of handsets records. Several Installations corresponding to different customer sites can be supported on a single application.

5.20. Home Screen Customization for Hospitality

In order to answer customer needs in hospitality, it is now possible to configure the OT8128 or OT8128 SE (SIP Edition) screensaver with up to four lines. Following is an example:



5.21. Home Screen Prerequisites

Here are the prerequisites in order to set up home screen:

- Up to 4 lines
- For each line, max 32 characters input
- Only available on OT8128 or OT8128 SE (SIP Edition) (OT8118 is not supported)
- WinPDM 3.x.x
- Import of 8128 software pkg to WinPDM is required to allow the 4 line text message feature.

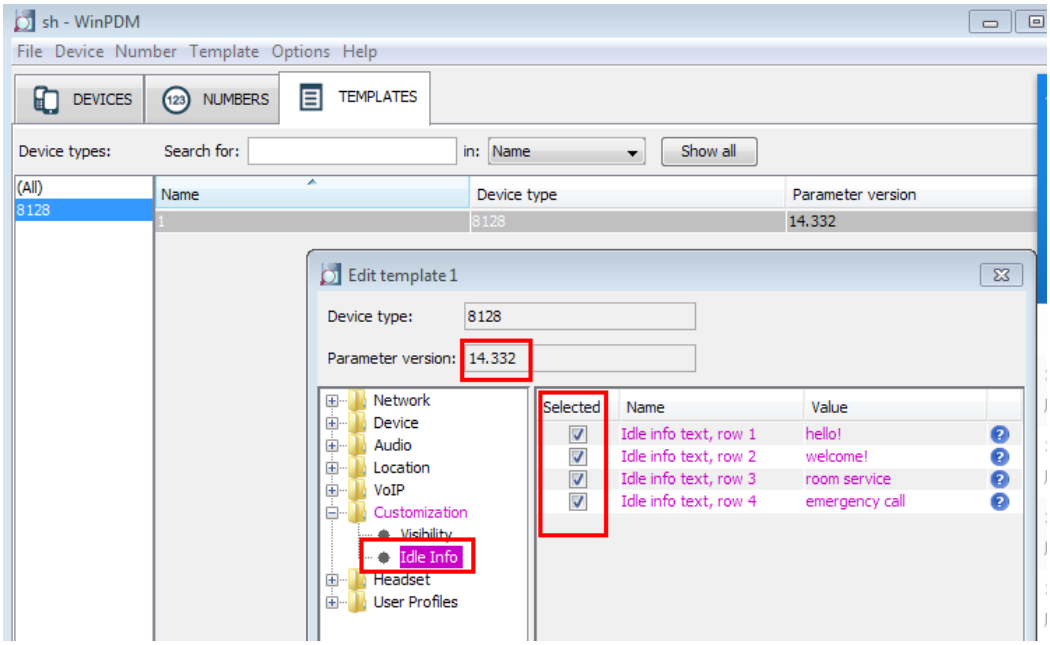


Figure 5: Four line creation with IMS3 or WinPDM

This template shows a configuration example of the four line display message. Question mark "?" provides additional information/help.

The 4 line display message can be specific to a user and can be created one by one.

The same 4 line display message can also be sent to multiple users.

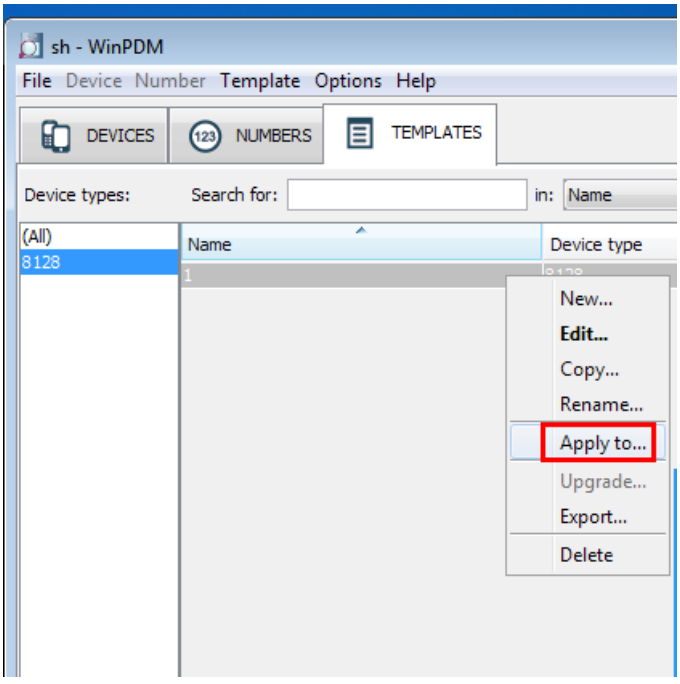


Figure 6: Template Assignment with IMS3 or WinPDM

Different templates can be created for different purposes. For instance a first template can be assigned to one or several users, while some other templates can be dedicated to one or some other users.

6. PBX services

6.1. PBX features

OT8118 and 8128 sets use integrated NOE features (dial by name, notification for messaging, multi-line, multiple calls, normal/casual conference, enquiry call, transfer, call parking, automatic call back, different forwards, voice mail access, send/read text message, etc…) and as a result can be globally considered as an IP Touch set, but limited by its ergonomics (a part of boss/assistant features , no MLA, no key programming, no interphony, etc…).

Warning: OT8128 SE (SIP Edition) supported with OmniAccess® Stellar WLAN Access Points uses integrated PBX SIP Extension features. For more details see Feature List and Product Limits.

6.2. Loudspeaker Announcement

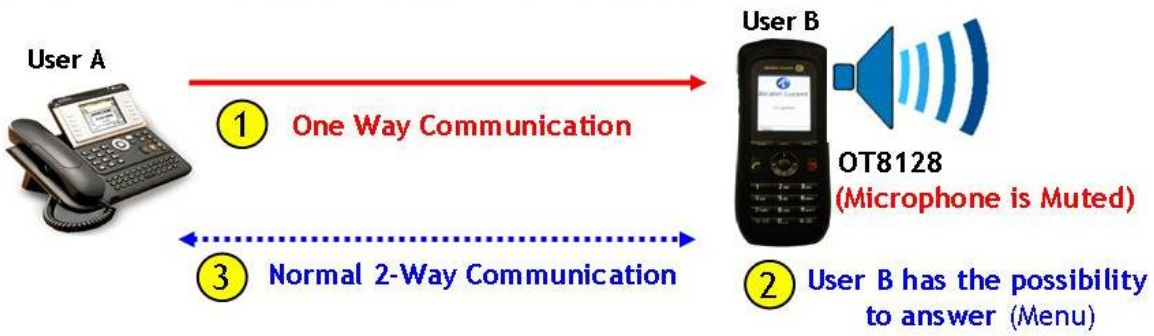


Figure 7: Loudspeaker Announcement

The OXE Loudspeaker Announcement feature is available on OT8128, but not on OT8118. because OT8118 has no loudspeaker. A one way communication takes place directly on OT8128 loudspeaker. The OT8128 user can answer the call (via the menu) if he wishes to do it.

6.3. Voice over WLAN offers: handset packs and options

OmniTouch 8118 WLAN handset This pack includes the OT8118 handset, the battery and the belt clip, without the desktop charger. (Ref 3BN78401AA) Note: The desktop charger must be ordered separately	 Battery OT8118 Belt Clip

OmniTouch 8128 WLAN handset This pack includes the OT8128, the battery and the belt clip, without the desktop charger. (Ref 3BN78402AA) Note: The desktop charger must be ordered separately	 **Battery OT8128 Belt Clip**
OmniTouch 8128 SE (SIP Edition) WLAN handset This pack includes the OT8128 SE (SIP Edition), the battery and the belt clip, without the desktop charger. (Ref 3BN78402AB) Note: The desktop charger must be ordered separately	 **Battery OT8128 SE Belt Clip**
Standard Battery for OT8118, OT8128 & OT8128 SE (SIP Edition) (Ref: 3BN78404AA)	 **Battery**
Belt Clip for OT8118, OT8128 & OT8128 SE (SIP Edition) (Ref: 3BN78409AA)	 **Belt Clip**
Swivel Clip for OT8118, OT8128 & OT8128 SE (SIP Edition) (Ref: 3BN78410AA)	 **Swivel Clip**
Leather Carrying Case for OT8118, OT8128 & OT8128 SE (SIP Edition) (Ref: 3BN78408AA)	 **Leather Carrying Case**

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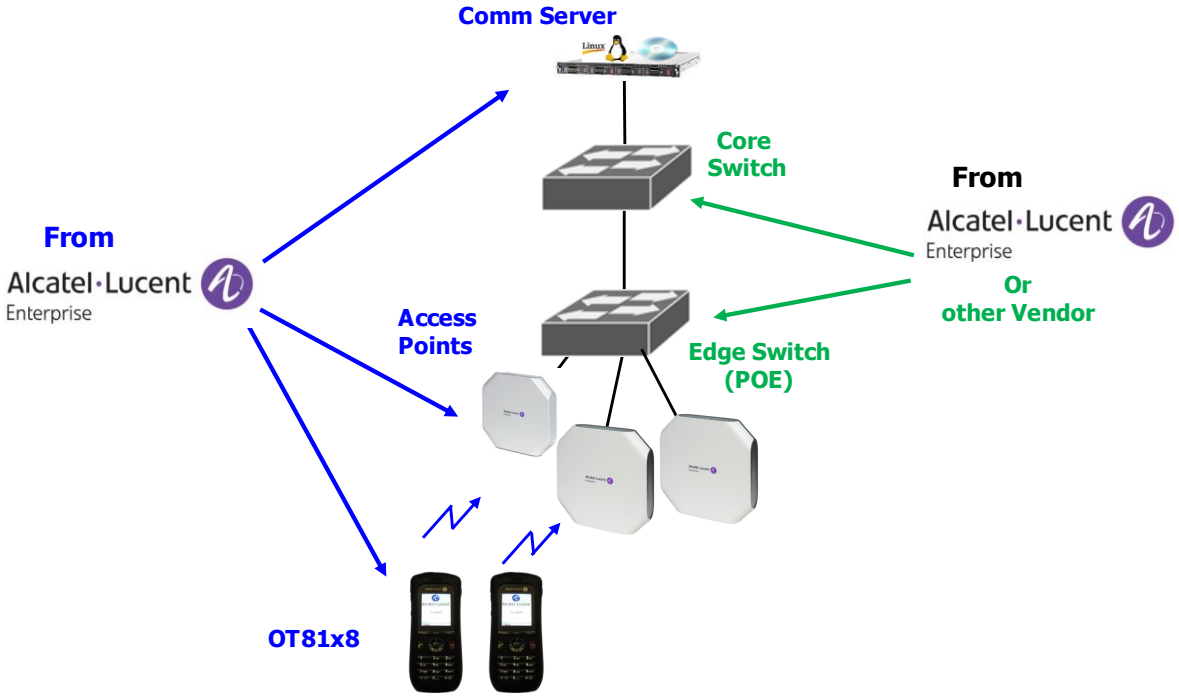
Desktop Charger for OT8118, OT8128 & OT8128 SE (SIP Edition) Europe (Ref 3BN78403AA) UK,US, AUS (Ref 3BN78403AB) For other countries but without Power supply/Mains plug (Ref 3BN78403AC)	 **Desktop Charger (with power supply)**
Rack Charger 6 slots to fit OT8118, OT8128 & OT8128 SE (SIP Edition) (Ref 3BN78406AA) A power cord (with an IEC13 Female connector) must be ordered separately : (e.g. Ref 3BA03215AA generic power cord) (e.g. Ref 3EH35004AA Power cord Europe for France)	 **Rack Charger**
Corded Monaural Headset for Mobile Jack Plug 2.5mm - Plantronics M175 - (Ref 3BN78158AA)	
Batteries Rack Charger 6 slots to fit batteries for OT8118, OT8128 & OT8128 SE (SIP Edition) (Ref 3BN78407AA) A power cord (with an IEC13 Female connector) must be ordered separately : (e.g. Ref 3BA03215AA generic power cord) (e.g. Ref 3EH35004AA Power cord Europe for France)	 **Batteries Rack Charger**

Configuration cradle for OT8118, OT8128 & OT8128 SE (SIP Edition) (Ref: 3BN78414AA) This device is similar to a desktop charger but has an USB port instead of a DC power connector. The configuration cradle only maintains power feeding during OT81x8 and OT8128 SE (SIP Edition) configuration but does not intend to replace a desktop charger for battery loading. WinPDM software runs on a PC connected to a configuration cradle and allows an easy configuration of OT81x8 & 8128 SE (SIP Edition) WLAN sets. Note: At least one cradle tool is required for OT81x8 & 8128 SE (SIP Edition) configuration.	 **Configuration Cradle**
IMS3 (Integrated Messaging and Wireless Services for OT8118, OT8128 & OT8128 SE (SIP Edition) Ascom IMS3 server is embedded Linux server which provides a centralized web-based tool used for OT81x8 & 8128 SE (SIP Edition) management, messaging and alarms control. It permits the overview and the configuring of all phones, the templates management for phones, Software Upgrades and phonebook management. IMS3 server runs as a standalone IP server and is connected to the LAN to allows easy configuration and maintenance of OT8118 & 8128 WLAN sets on the installations	 **IMS3**

WinPDM software is available from ALE Business Portal

7. OmniAccess® Stellar Access Points architectures



ALE OmniAccess® Stellar WLAN infrastructure provides a support for the ALE VoWLAN solution.

In this case the Com Server, WLAN switch(es) & Access Points, and also the OT8118/8128/8128 SE (SIP Edition) WLAN handsets are all provided by ALE. The edge switch and the core switch can be either provided by ALU or coming from other vendors. The edge switch must be POE compatible (AP power feeding).

8. OmniAccess® Stellar Access Points Mode of Operation

Being as no two customer network environments are exactly the same, it is critical for technology such as VoWLAN to possess a great degree of flexibility. ALE OT81x8 and 8128 SE (SIP Edition) solution is not exempt from this requirement. The following section highlights some OT81x8 and 8128 SE (SIP Edition) architectural adaptabilities.

8.1. Wifi-Express Mode

OmniAccess® Stellar Access Points in Wifi-Express Mode are configured to automatically connect each other using the Stellar protocol optimized for lightweight a centralized access points management and a distributed traffic transport.

In Wifi-Express Mode, a Primary Access Point Manager (PVM) is elected for the management of all the AP-Group. Configuration of the AP-Group is done directly on the Primary Manager GMIP through a Web-based configuration tool and applies for all Access Points within the AP-Group ID created.

It is possible to mix AP11XX wave 1 and AP12XX wave 2 models within a same AP-Group since OmniAccess® Stellar version 3.0. One AP12XX AP-Group (any model any mix) supports up to 64 OmniAccess® Access points, 512 concurrent clients and 16 WLANs (SSID) with the condition have minimum of 4x AP12XX (any model any mix) in the group.
One AP1101 only AP-Group supports up to 32 OmniAccess® Access points, 256 concurrent clients and 16 WLANs (SSID) in version 3.0.

Wifi-Express operational mode allows for a low-cost redundancy proposal for small configurations. Stellar Access Points can perform near-immediate transfer of management responsibilities to a Secondary Access Point Manager and in so doing maintain operation during periods of partial network outage and/or Primary Access Point Manager maintenance.

8.2. Wifi-Enterprise Mode

The Wifi-Enterprise mode is supported since OmniAccess® Stellar version 3.0, Stellar Access Points in Wifi-Enterprise Mode are configured to automatically connect at their first boot to their Omnivista® ov2500 server using Stellar secured protocol optimized for a centralized management of all OmniAccess® Stellar access Points.
The configuration of the AP-Group is done directly by the ov2500 management server through a Web-based configuration tool and applies for all Access Points within AP-Group created during registration of Stellar Access Points in the server.
Like in Wifi-Express mode, the Stellar control plan and traffic transport stay distributed on each AP.

The conversion of a Wifi-Express managed AP into Wifi-Enterprise mode, or reversely, is always possible through a factory reset. The consultation of the operation mode is done directly on the IP of the Access Point through a Web-based consultation page.

Wifi-Enterprise operational mode allows scalable configurations for large sites and can manage up to 2000 Access points with OmniAccess® Stellar version 3.0. The maintenance is done by the OmniVista® 2500 server whatever the operations/events on each access points and Stellar Access Points WLAN service stays in operation when ov2500 server is off or in maintenance.

9. OmniSwitch®/networking Mode of Operation

The following section highlights some networking architectural adaptabilities for ALE OT81x8 and 8128 SE (SIP Edition) solution and OmniSwitch access switches family are represented as fully interoperables with the solution.

The scenarios apply for both Stellar Wifi-Express and Wifi-Enterprise modes.

9.1. Overlay Mode Operation

In this scenario, Access Points are directly connected to an existing LAN infrastructure 10/100/1000 Ethernet data switch (from ALE or third-party supplier). The switches have the ability to provide Power over Ethernet (IEEE 802.3af) to Access Point (AP) on all Ethernet ports (Power Class 3 for all ports simultaneously).

This type of operational mode is desirable and advantageous in the following situations:

1. In small buildings or locations where cables lengths are less than 100m (in order neto effectively leverage integrated IEEE 802.3af capabilities).
2. Where there is no existing data network or existing data network is already operating at maximum capability.
3. For small WLAN environments requiring only a small number of Access Points.
4. To meet requirements for completely independent voice and data networks/backbones.

The Wifi-express mode fits particularly with this type of overlay mode of operation as it allows independent wifi management and does not need centralized Wifi /IT management.

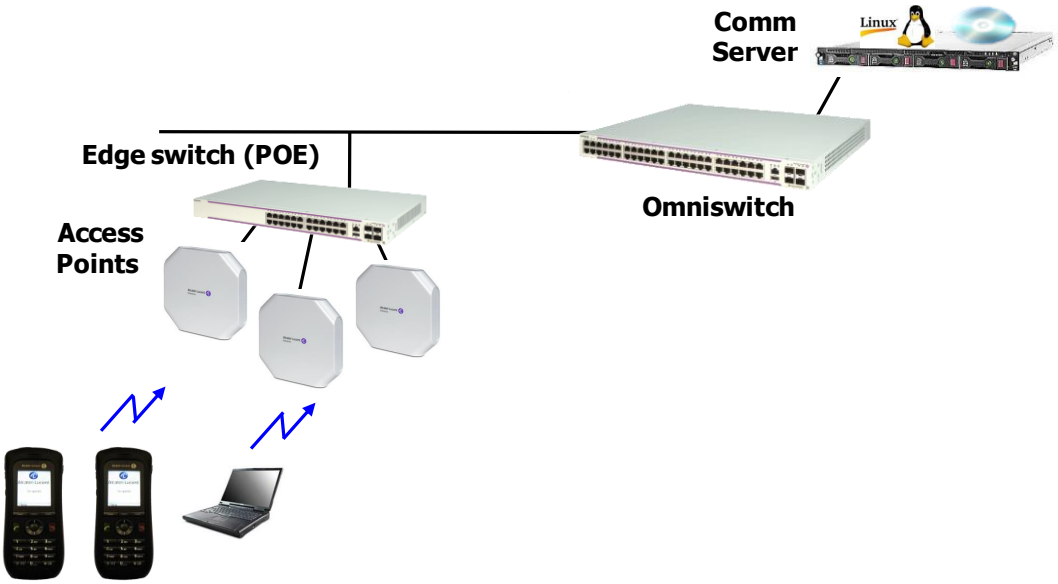


Figure 8: Overlay mode

9.2. Remote Stacking Mode Operation

In this scenario, Access Points are directly connected to Edge switches stacking remotely managed and seen as a single switch to manage.

This type of operation mode can be highly desirable and advantageous in the following situations:

1. When existing data network elements are present and capable to supporting WLAN Access Points and traffic.
2. In large and/or multi-floor buildings where cables lengths are commonly in excess of 100m from the data switching centers and wiring closets to Access Points, thus causing problems for Inline Power over Ethernet (IEEE 802.3af.)
   In cases such as this, localized power options can be proposed to meet or eliminate the distance limitation and power problems.
3. When system failover/redundancy of the WLAN Access Points elements is highly desired.

The Wifi-Enterprise mode fits particularly with this type of networking mode of operation since it is compatible with a centralized Wifi /IT management for an existing data network already supporting data traffic.

9.3. Network connectivity

Network connectivity and power options must be provided by an Ethernet switch or other source. It is important to ensure that the desired Ethernet switch is capable of supporting the QoS requirements of the VoIP traffic that it will be forced to carry. The uplink paths between ALE switches in stacking receive the high priority to ensure a sufficient level of voice quality.

Figure 9: OmniSwitch family with POE (IEEE 802.3af or IEEE 802.3at):
OS6450-P24/P48, OS6350-P24/P48 and OS6560-P24Z8/P24Z24

The Ethernet switch must be capable of supplying sufficient and standard format power (full 15W limit of IEEE 802.3af and 30W limit of IEEE 802.3at) In the event that this cannot be achieved, several power injectors options are available:

- Inline Power Injectors can be used to provide IEEE 802.3af power to individual Access Points. These low-cost, single port (one in, one out) injectors can be used in situations where only one or a few devices require power. These devices require a local AC outlet connection to produce IEEE 802.af power and then inject this power along with the Ethernet traffic that pass transparently through it.

Ref OAW-PD-3501G/AC : 1 Port 802.3af PoE Midspan 10/100/1000 15.4W

Ref OAW-PD-9001GR/AT/AC : 1 Port 802.3at PoE Midspan 10/100/1000 30W

Ref OAW-PD-9501GR/AC : 1 Port 802.3at PoE Midspan 10/100/1000 60W (no support of 2.5GE)

Ref OAW-PD9001GO/AC : 1 Port 802.3at PoE 10/100/1000 30W Outdoor with surge protection

Figure 10: Inline Power Injector

10. Quality of Service (QoS)

The first responsibility of the LAN infrastructure is to control the QoS, QoS management responsibilities are shared between the Stellar WLAN AP, the OT81x8 and 8128 SE (SIP Edition) WLAN handsets and the LAN switch infrastructure components.

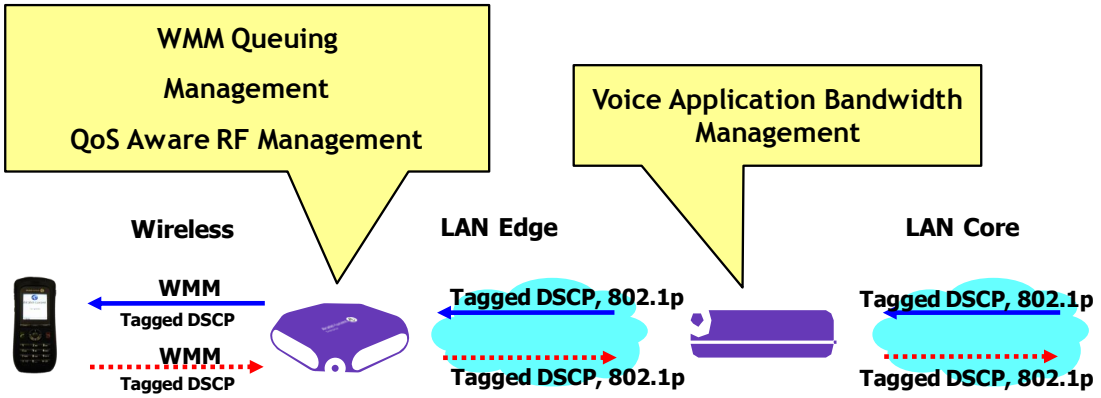


Figure 11: End-to-End QoS

An end-to-end QoS ensures a prioritization or Voice over Data from Wireless to LAN and vice versa. Ensure that network switches and routers do not change the DSCP, 802.1p value set for OT81x8 and 8128 SE (SIP Edition) or coming from LAN.

WMM	DSCP (downlink DSCP)	802.1p (downlink 802.1p)
Background	8 (2,8)	1 (1,2)
Best effort	0 (0,24)	0 (0,3)
Video	40 (26,32,40)	4 (4,5)
Voice	56 (48,56)	6 (6,7)

Both Wifi-Express and Wifi-Enterprise modes of OmniAccess® Stellar Access Points apply the above default WMM/802.1p-DSCP mapping for all critical QoS applications, can edit and adapt the mapping as necessary for the needs of a customized QoS on LAN.

- For packets from the wireless, the DSCP value, if existing, is kept without overwritten. 802.1p value is determined based on WMM/802.1p-DSCP mapping

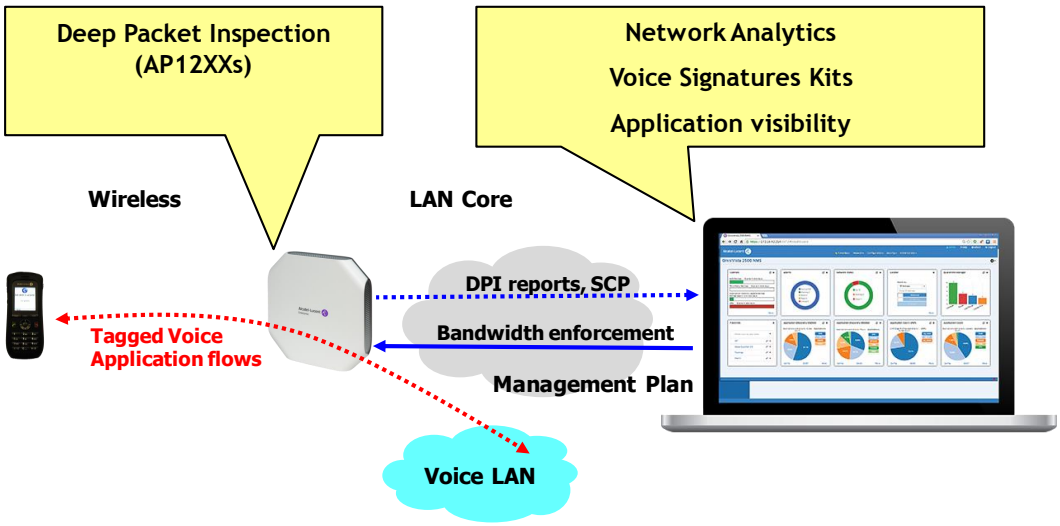
- For wired packets to the wireless, WMM is determined based on the WMM/802.1p-DSCP mapping. If conflict between DSCP and 802.1p exists, the one with higher priority of mapped WMM will take effect

11. Application Visibility & enforcement (Packet Inspection)

Another responsibility of the LAN is to control the Voice Application.

OmniAccess® Stellar AP12XX Access Points integrate a Stateful Packet Inspection technology (DPI), monitored by the **Application Visibility & enforcement** feature available on Omnivista® 2500 server in Wifi-Enterprise mode. **Application Visibility & enforcement /DPI** jointly provide IT a detailed visibility into the applications with the consumed bandwidth. That gives 2500 server the possibility to immediately enforce policies to control the bandwidth permitted for the Voice LAN, this at Access Point level or user level.

- Omnivista 2500 signature kits designed for NOE applications (OT8118 & OT8128) and for SIP applications (OT8128 SE (SIP Edition)).
- Visibility of NOE & SIP applications on Omnivista 2500 with calls in use and bandwidth consumption statistics



The voice application bandwidth control in Wifi-Express mode is managed directly by Stellar DPI, through the PVM, and is declined per user. There no Voice analytics and Voice application visibility in Wifi-Express mode.

The Voice Application Bandwidth on LAN must always be translated, assuming ideal conditions for the transport of Voice Application in the LAN, into a maximum limit of simultaneous voice conversations that can be reached per Access Point. The Bandwidth can be also declined per user or per location.

12. Security

Security is always a sensitive topic to discuss, and opinions on how best to provide for it vary greatly from one engineer to the next. With this in mind, ALE is constantly developing the list of security options available within the OT81x8 and 8128 SE (SIP Edition) VoWLAN solution offer to satisfy as many different opinions as possible.

As part of the Voice over WLAN solution offer, ALE makes the following security recommendations:

12.1. SSID Broadcast

When designing and managing a Wireless LAN, engineers must make calculated compromises between performance and ease of use. One such decision is that of whether or not to broadcast the SSID (Service Set Identifier) of a wireless network. Broadcasting the SSID allows clients to "scan" for available network and then attempt to join them. This eliminates the need for users to explicitly know the name of the network that must be defined in their 802.11 client configuration, since it can be learned from the over-the-air broadcasts (excluding OT81x8 and 8128 SE (SIP Edition) WLAN handsets that must be configured manually by design). Obviously, not broadcasting the SSID provides the opposite: users must know the SSID.

In the above mentioned way, it is commonly thought that we can offer a limited realm of security simply by not broadcasting the SSID of the Wi-Fi environment dedicated to VoWLAN activity. In truth, this practice is often far more troublesome to network administrators than it is to network attackers. The advantages of SSID broadcast usually far exceed the threat of visibility it offers.

Since all OT81x8 and 8128 SE (SIP Edition) terminals must be manually configured with an SSID, the decision to enable or disable SSID broadcast is of little consequence to ALE OT81x8 and 8128 SE (SIP Edition) WLAN handsets. There is no impact to ease of use or functionality presented by the state of SSID broadcast. ALE recommends that customers maintain their current or desired security policies governing this topic.

12.2. Authentication

12.2.1. 802.1X Authentication on OT81x8 and 8128 SE (SIP Edition)

OT81x8 and 8128 SE (SIP Edition) WLAN handsets support the following 802.1X authentication methods:

- PEAP-MSCHAPv2, EAP-FAST and EAP-TLS

PEAP- MSCHAPv2 ((Protected Extensible Authentication Protocol - Microsoft Challenge Handshake Authentication Protocol) uses TLS to create an encrypted Tunnel

- A certificate is required on server side (Radius Server)

- No certificate need on client side (OT81x8 and 8128 SE (SIP Edition))

- Only the Radius server is authenticated, but not the OT81x8 or 8128 SE (SIP Edition)

EAP-TLS (EAP-Transport Layer Security)

- is based on certificates (client and server sides)

- the both OT81x8 and 8128 SE (SIP Edition) WLAN handset and Radius server are authenticated

There are 2 modes of operation with EAP-TLS on OT81x8 and 8128 SE (SIP Edition) WLAN handsets:

- An ALE "Default certificate" that is embedded in OT81x8 and 8128 SE (SIP Edition) WLAN handsets
- A "certificate provided by the customer PKI" (Public Key Infrastructure). In this case the customer certificate overrides the default ALE certificate that remains present but inactive in the OT81x8 and 8128 SE (SIP Edition) WLAN handsets.

In order to minimize the re-authentication delay the following method is used:

- OKC (Opportunistic Key Caching) that is available on ALE WLAN infra (OT81x8 and 8128 SE (SIP Edition)) with WPA2 only

12.2.2. Radius Servers

Validated Radius servers on OT81x8 and 8128 SE (SIP Edition):

- Microsoft Network Policy Server (NPS)
- Microsoft IAS
- Steel-Belted
- FreeRadius
- Clearpass

12.3. Ekahau RTLS

Ekahau RTLS (Real-Time Location System) provides a geo-localization of OT8128 & OT8128 SE (SIP Edition) WLAN handsets within a building or an outdoor RF covered area, and is made of a server (Ekahau Positioning Engine) and an Ekahau client that is embedded on OT8128 WLAN handset.

The Ekahau RTLS solution provides an accurate localization of OT8128 WLAN handsets, that is based on information exchanged between the RTLS agent on OT8128 and the Ekahau server (via the APs and the WLAN controller):

RSSI information are extracted from AP Beacons and Probe Responses

Client triangulation is performed by the Ekahau Positioning Engine

Position is based on a stored site survey

Ekahau RTLS solution is **managed via AAPP (ALE Application Partner Program)** and is only supported on ALE/Aruba WLAN infrastructures.

Note: there is no AAPP IWR (Interworking Report) as OXE is not at all involved in RTLS operation.

Ekahau RTLS includes the following features:

Ekahau Tracker: End-user application for real-time tracking and analyzing the location of people

Ekahau Finder: End-user application for real-time grouping, locating and viewing the location of people

Ekahau Engine (dedicated Windows server): Systems and device management through a web-based interface

The EPE (Ekahau Positioning Engine) runs on Windows Server 2000, Windows Server 2003 or under VMWare. Hardware recommendations depend on the number of Tag clients to be serviced.

Ekahau Location Survey

For more details see: http://www.ekahau.com/products/real-time-location-system/overview.html

Deployment recommendations:

- Ekahau RTLS feature is supported on OT8128 ans OT8128 SE (SIP Edition) (not on OT8118)
- Ekahau RTLS and OV3600 cannot be installed on the same physical server
- Required Design rules for the Ekahau RTLS solution in order to get decent accuracy
  One AP at -65dBm (or better) and 2 APs at -75dBm or better.

12.4. Encryption

At present, for the WLAN R 6.0 offer, ALE provides encryption options based on WEP (Static Key), WPA-PSK and WPA2-PSK (based on pre-shared key) and preferably WPA2 enterprise mode based on EAP-PEAP or EAP-TLS 802.1X authentication.

12.5. MAC Address Filtering

MAC address filtering facilities are provided for within ALE OmniAccess product platforms. ALE strongly encourages the use of Local MAC address filter rules to help ensure that only authorized wireless clients are permitted to join the VoWLAN network.
For more information on MAC address filtering, please refer to the ALE VoWLAN Engineering Reference.

12.6. Rogue Activity Detection

Rogue Access Points and Rogue Ad-Hoc Wi-Fi activity can seriously degrade VoWLAN voice quality by wreaking havoc with carefully designed and implemented Radio Frequency coverage patterns. For this reason, ALE strongly recommends the use of the OmniAccess Wireless Intrusion Protection option to identify and eliminate these potential threats. The nominal cost of this technology option provides an immense amount of investment protection, and the value of Rogue Activity Detection cannot be stressed enough.

12.7. Isolation Practices

Network segmentation is seen as a critical core component of any network security design. Separating traffic by type and application scope allows for more sophisticated security methodologies to be later implemented. VPN, Packet Inspection/Filtering, Access Control Lists, and other security technologies generally rely on network segmentation in order to be most effective.

For the above reasons, ALE strongly suggests a Voice and non-Voice domain separation on VoWLAN equipment. Sharing the VoWLAN environment with non-voice related elements is a compromise in security that does not need to be made. For example at OmniAccess® Stellar WLAN Access Point level ALE recommends to implement first a single **Voice VLAN** dedicated to Voice and a **Data VLAN** dedicated to Wireless Data.

12.8. Non-voice applications Control & Visibility (Packet Inspection)

It is assumed that the VoWLAN environment will be hosted on a customer network which also supports data networking environments. To assure privacy and system security, security controls should be implemented at network routing points to restrict the ability of non-voice related elements from gaining access to VoWLAN and OmniPCX Enterprise components. These security controls can be delivered in the form of router or route-switch based Access Control Lists or via dedicated Packet Filtering and Packet Inspection platforms.

Application Visibility & control /DPI for Stellar AP12XX wireless Access Points in Wifi-Enterprise mode allows jointly strong access control policies, network protection and detailed visibility into the non-Voice applications usages.

12.9. Auxiliary Security Measures

In addition to the standard security mechanisms discussed above, some customers may desire to implement specialized security measures that apply specifically to their environment. Use of MAC address controls within the external TFTP server or DHCP server, as well as other application security methods can be very advantageous. ALE offers none of these server-based features, but encourages customers to explore the security capabilities present in third-party support hardware.

13. Design Process for VoWLAN

13.1. Pre Sale Data Collection

In order to prepare an ALE VoWLAN solution, several pieces of documentation must be sourced from the customer. The accuracy of a final system proposal is directly related, in most cases, to the amount and quality of information collected prior to initiating design formulation.

13.1.1. Physical Diagram (to include existing wireless technologies)

A clear understanding of the customer's physical network topology is essential in order to properly determine the possible future locations and integration points of VoWLAN support elements. This physical diagram should be as complete as possible and include information related to all existing customer infrastructure (Data Wi-Fi, LAN, MAN, closet switching platforms (to include power feeding abilities), core routing platforms, copper and fiber patching facilities (termination types).) Again, an accurate OT81x8 and 8128 SE (SIP Edition) VoWLAN solution cannot be developed without this information.

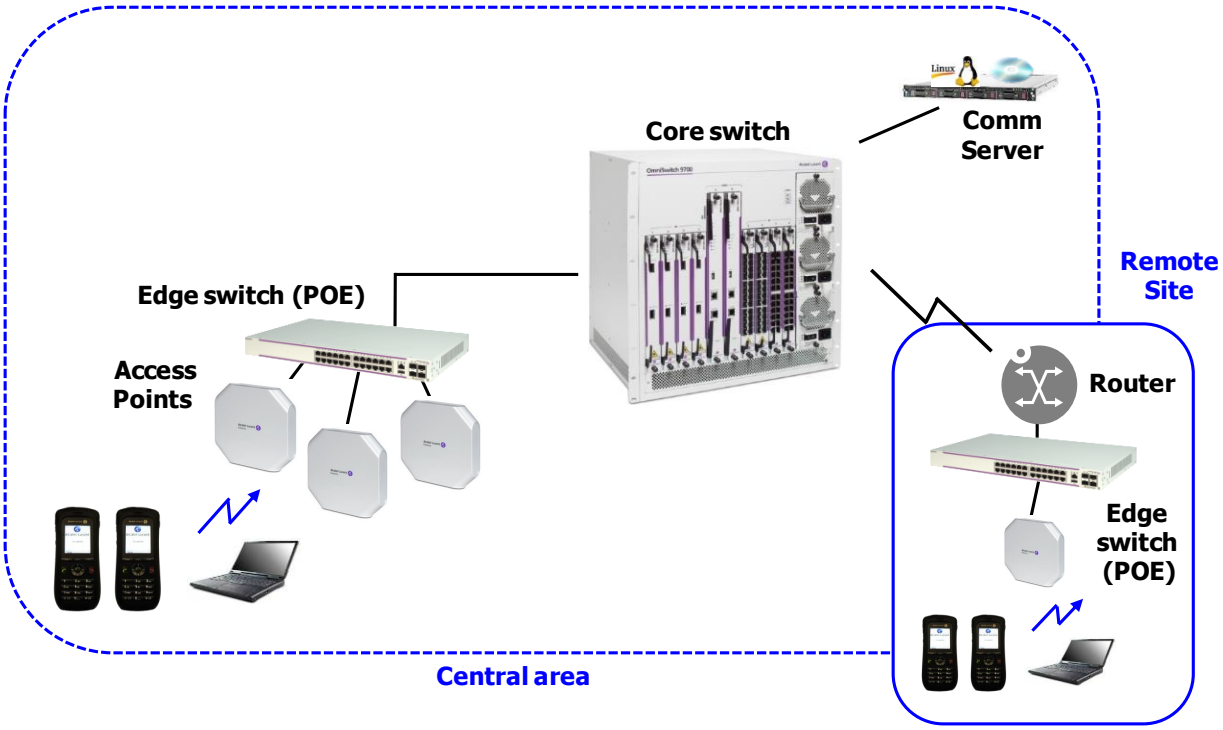


Figure 12: Physical Diagram

The physical diagram is responsible for helping the design engineer in gauging a number of placement and connectivity options from the number of locations where OmniAccess Stellar Access Points/Appliance platforms can be housed, to the type of physical connectors needed on the fiber patch cords to connect them to the network. To meet this requirement, the physical diagram must contain as much detail as possible.

This diagram should also detail cable-plant distances and the ability of existing data network switches to support IEEE 802.3af power in sufficient quantity for the proposed solution.

Of a much more complex nature is the presence and status of existing wireless technology. The Physical diagram should detail, in as much detail as possible, the presence of existing or proposed Bluetooth, Wi-Fi, microwave technology, high-gain or industrial radio transmitters, DECT/PWT technologies and other interference or radio spectrum competitors.

13.1.2. Logical Diagram

Logical Diagrams are also critical for complete and accurate solution construction. The logical diagram must include information related to the existing customer VLAN strategy, QoS policies, Security measures, redundancy and fault tolerance schemes, as well as future provisioning and traffic shaping.
Information gathered from the logical diagrams will determine IP addressing schemes, security measures, and VLAN mapping as well as influence certain physical design options (ideal TFTP & DHCP Server location, etc.)

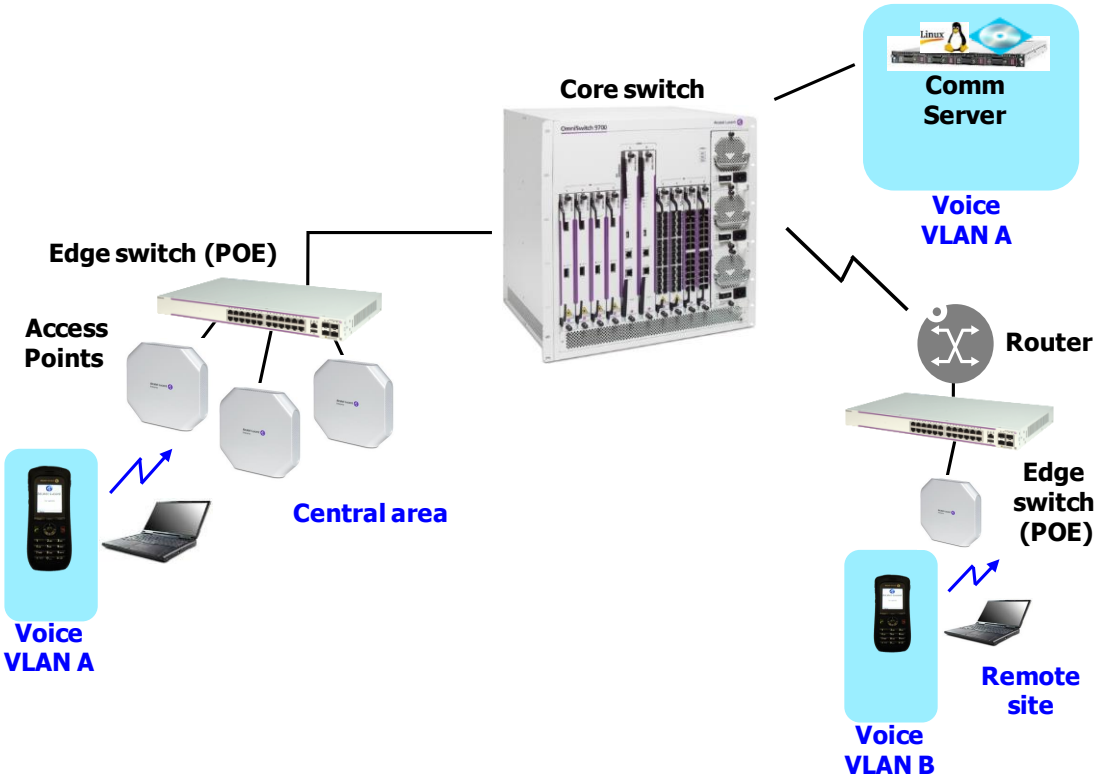


Figure 13: IP Logical Diagram

This diagram shows the different domains at layer 2 currently used in the customer network: VLANs, Broadcast domains, IP subnets and IP addressing Plan.

13.1.3. Floor Level Maps/Diagrams

To complete detailed planning, a floor level diagram is required. This floor level diagram can be used in the design process in two different ways, Prediction Planning and the Site Survey. This diagram does not necessarily need to include detail on how desks are situated within office and where toilets and potted plants are located within restroom, but walls, dividers, elevators, pillars, windows, doors, and other obstacles should be clearly marked and to scale.

Figure 14: Floor Map (with scale & legend)

14. Customer Specific Application & Design Considerations

14.1. Voice Network Topologies

When studying VoWLAN topologies it is needed to use some terminology in order to well define the various basic configurations

14.1.1. Campus definition

Network topology where all components (Com Servers, IPMG, Switch/Routers, etc.) are scattered over a large geographic area and are interconnected through High Speed links (such as Fiber Optic cabling), resulting in no delay or bandwidth concerns.

14.1.2. Multi-Node definition

Several OmniPCX Enterprise Nodes belonging to the same Homogenous ABC network.

14.1.3. Multi-Site definition

Topology comprised of a Single OmniPCX Enterprise Node with one or several remote site(s). For instance it can be a headquarter and one or more branch offices.

14.2. Single OXE Node in a Multi-Site Environment (Campus / Remote Site)

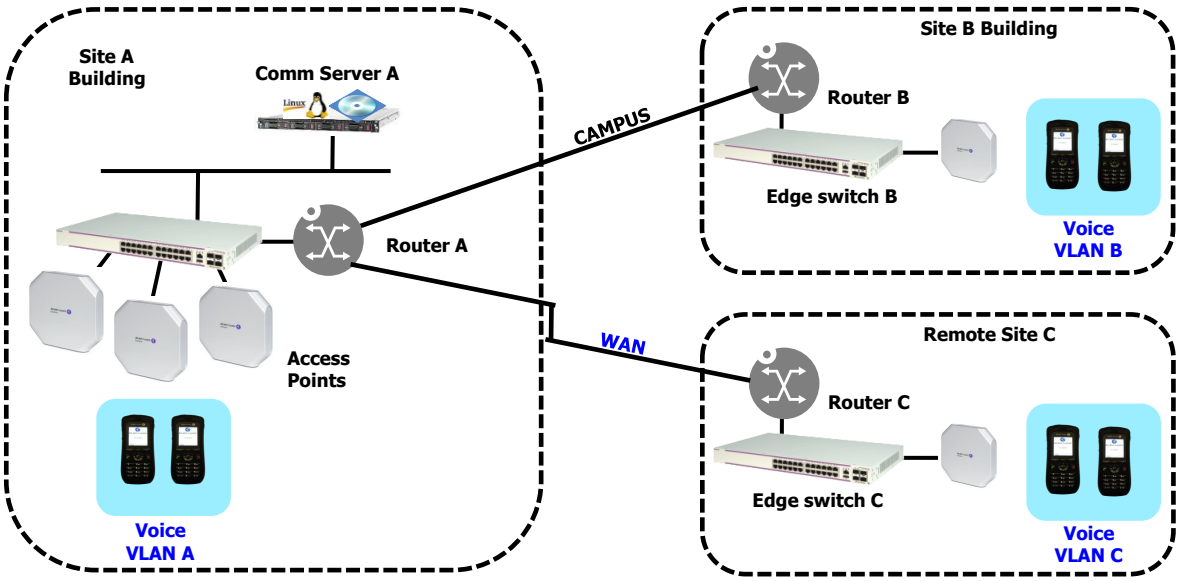


Figure 15: Single-OXE Node and Multi-Site

This topology based on a single OXE node allows a VoWLAN implementation on remote sites.
For Roaming and Handover restrictions in campus or remote site see the chapter dedicated to Roaming & Handover.

14.3. Multi OXE Node in a Multi-Site Environment (WAN)

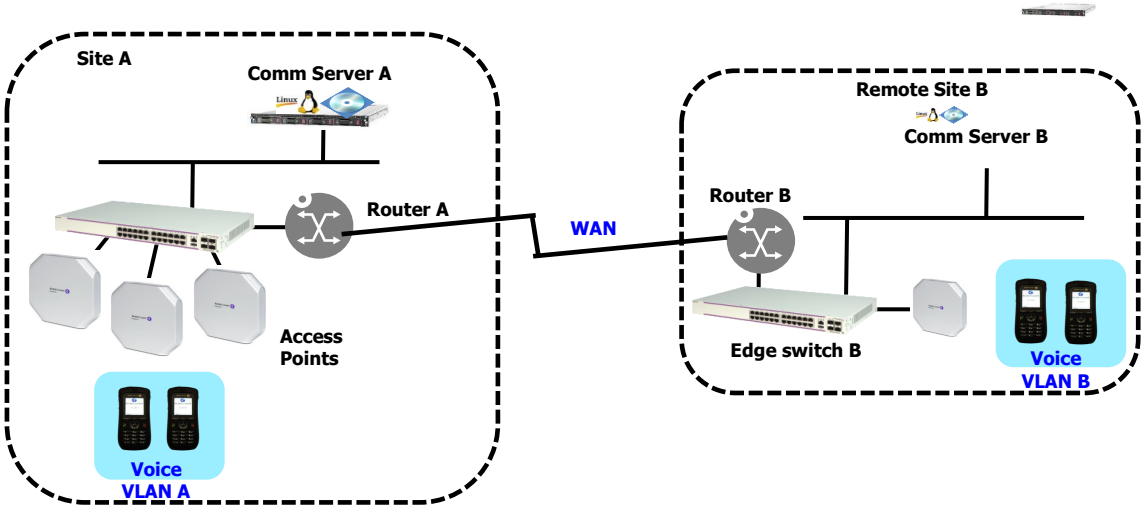


Figure 16: Multi-OXE Node and Multi-Site

Same configuration as previously, but now in an OXE Multi-node OmniPCX topology.
For Roaming and Handover restrictions see the chapter dedicated to Roaming & Handover.

14.4. Multi-WLAN Layer 2 Configuration

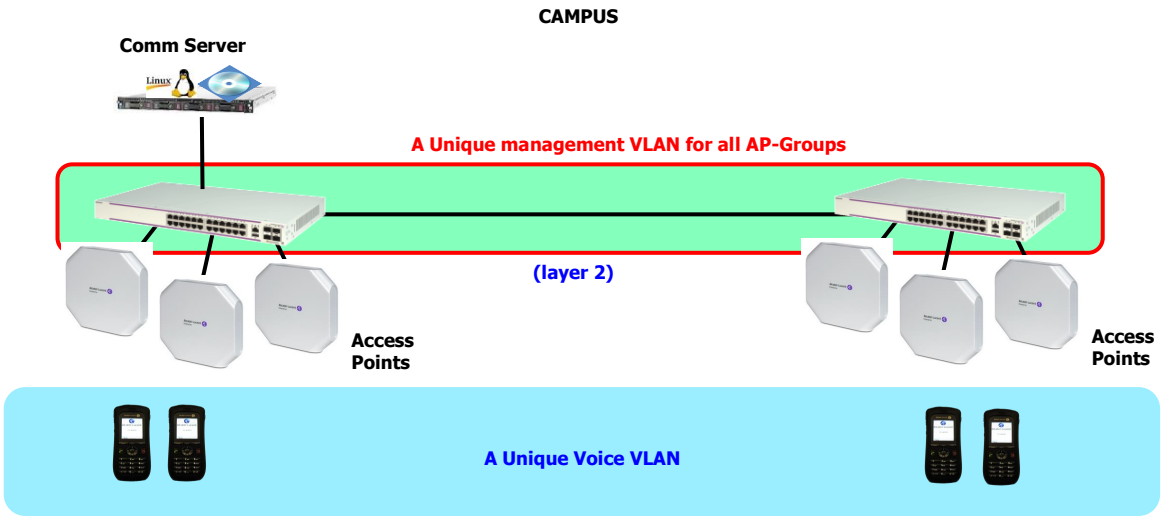


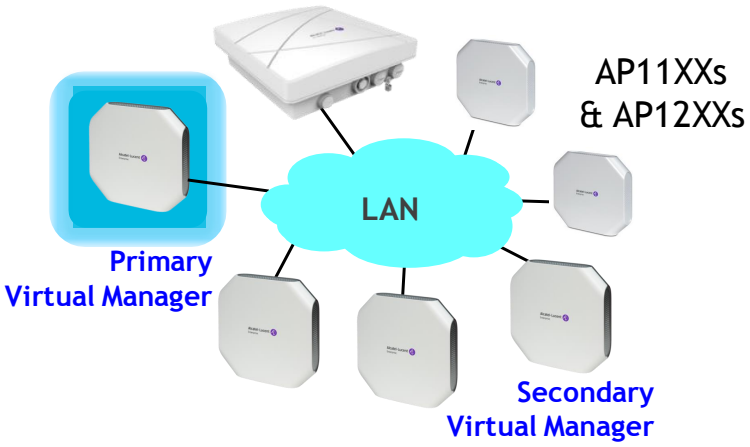
Figure 17: Layer 2 configuration (WLAN Stellar)

Layer 2 configuration means that all WLAN Stellar AP-Groups are in a unique VLAN/IP subnet and OT81x8 and 8128 SE (SIP Edition) sets are all in the same Voice VLAN/IP subnet. This topology allows quick handover.

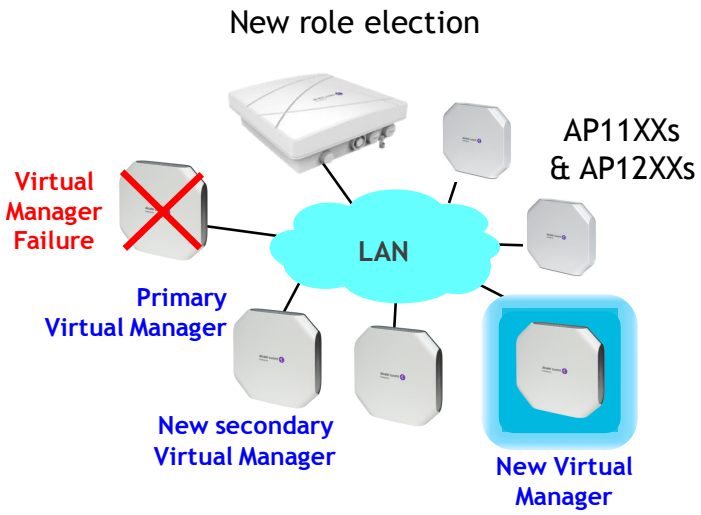
15. VoWLAN on OmniAccess® Stellar Access Points

15.1. OmniAccess® Stellar in Wifi-Express mode

OmniAccess® Stellar Wifi-Express Mode depicted here is a distributed WLAN controller solution based on a Virtual Manager (VM) and does not require any License. This mode permits Access Pointss automatically connect each other using Stellar protocol with the Configuration of Access Points group through a Web-based configuration tool without the handling of any OmniVista 2500.



15.1.1. Managers role election



- Each AP in AP-Group is eligible to become Primary Virtual Manager
- In case of Primary Virtual Manager failure a new Primary Virtual Manager election takes place
- Wireless devices can be associated to any AP or to the AP acting as Primary Virtual Manager

- Primary Virtual Manager Election process:
    - In case several AP started at the same time: AP with highest MAC is PVM
    - Once PVM is designated, its emits an SSID dedicated to the configuration of AP-Group

- Normal Operation
    - The Primary Virtual Manager centralizes the AP Group management
    - The Group is identified by a “Group ID” and all AP with same “ID” are put in the group
    - All other APs are member and are called Members
    - Any next AP which want to connect to AP-Group and exceeds limit of Members is rejected

- Primary Virtual Manager Election after a Virtual Manager AP failure
    - Another AP has the possibility to rescue the role of centralized management and is called Secondary Virtual Manager

- The AP eligible to become Secondary Virtual Manager in case of PVM failure is the AP with second highest MAC

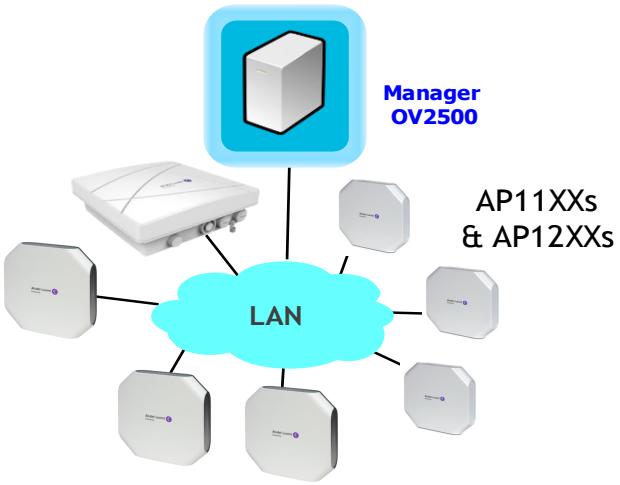
- Operation for mixed AP12XXs and AP11XXs
  - There is always the possibility to mix AP12XXs (any model any mix) within the AP-Group with the condition have a minimum of 4x AP12XXs in the group.
  - All rules detailed before for the virtual manager election apply on AP12XXs models only
  - Limits defined for the AP-Group are limits of highest AP12XXs models

15.1.2. Wifi-Express OmniAccess AP scope for OT81x8 and 8128 SE (SIP Edition) solution

Up to 32 Stellar AP1101 Access Points per AP-Group & 256 users, 16 SSIDs (release 3.0)
Up to 64 Stellar AP12XXs (any model any mix) & AP1101s Access Points per AP-Group & 512 users, 16 SSIDs (release 3.0)
Up to 16 Stellar AP1101 Access Points par AP-Group & 256 users, 8 SSIDs per in Stellar release R2.1

15.2. OmniAccess® Stellar in Wifi-Enterprise mode

OmniAccess® Stellar Wifi-Enterprise Mode depicted here is a distributed WLAN controller solution based on a centralized and licensed management mode with the handling of Omnivista® 2500 server. Wifi-Enterprise mode permits Access Points automatically connect at their first boot to their 2500 server using Stellar secured protocol optimized for a centralized management for all OmniAccess® Stellar access Points.
The configuration AP-Group is done directly on 2500 management server through a Web-based configuration tool.

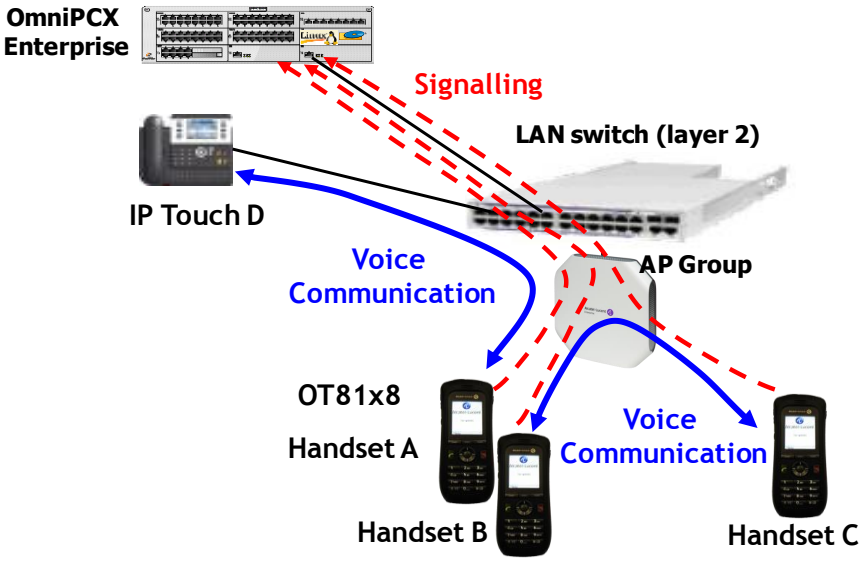


15.2.1. Wifi-Enterprise OmniAccess AP scope for OT81x8 and 8128 SE (SIP Edition) solution

Up to 2000 Stellar AP12XXs (any model any mix) & AP1101s Access Points per AP-Group, 1024 users and 16 SSIDs (release 3.0)

15.3. OmniAccess Stellar Topologies

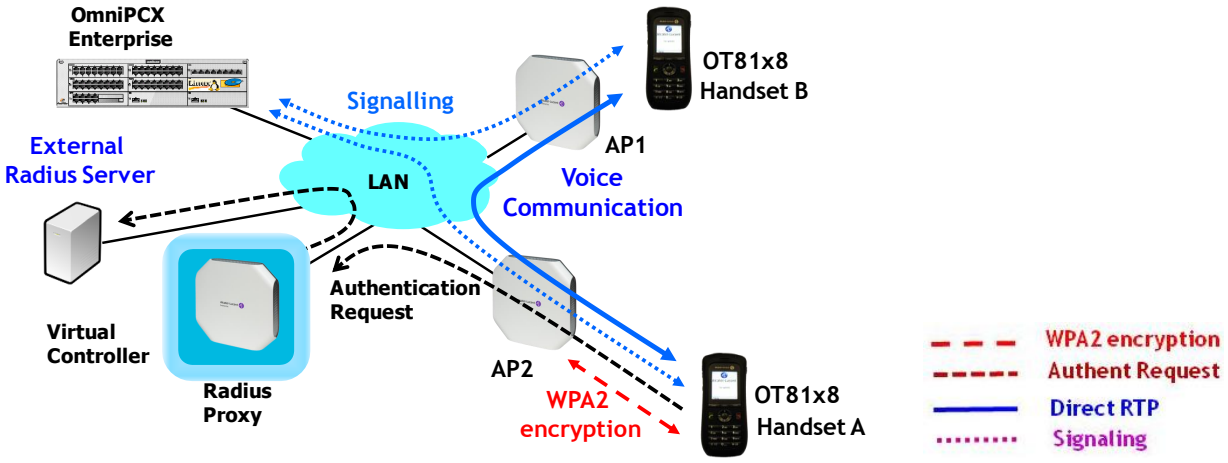
15.3.1. Voice Communication on a Single Stellar Access Point



OT81x8 and 8128 SE (SIP Edition) handsets are supported on single Access Point

- Direct RTP between handset A and IP Touch D, and between handsets B and C
- The single Access Point acts as a standalone AP-Group controller

15.3.2. Voice Communication through different Stellar APs



In this Wifi-Express scenario the voice communication (Direct RTP) does need to go through the Access Point where wireless device is associated to.

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Encryption when configured (e.g. WPA2 encryption) takes place from the wireless device and ends at the AP the wireless device is associated to.
802.1x authentication is managed by external Radius server. The Primary Virtual Manager acts as a Radius Proxy and Direct RTP flow does not pass through the Radius Proxy Access Point.

15.4. Voice Communication Bandwidth per Stellar AP

Radio	Maximum Voice Communication Bandwidth per AP (per user)	Max calls per AP * (Equivalent RTP stream per AP)	AP model
802.11bgn	3 Mbps (400 Kbps)	8 (up to 16 streams)	All Stellar
802.11an	5 Mbps (400 Kbps)	12 (up to 24 streams)	All Stellar
802.11ac	5 Mbps (400 Kbps)	12 (up to 24 streams)	All Stellar

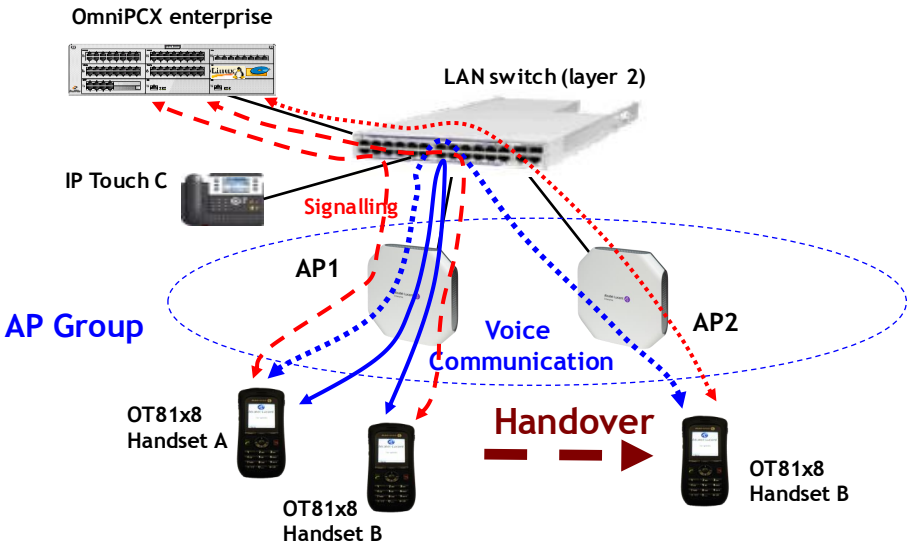
Some Figures for Maximum Voice communication Bandwidth consumption per Stellar AP:

- Estimation of Max Voice communications Bandwidth on LAN per Access Point
- Related Max Voice communications Bandwidth on LAN per user
- Maximum equivalent of simultaneous Voice communications per Access Point *

Note the limit of consumed Bandwidth is for 802.11a/n with up to 12 simultaneous voice calls per Access Point. Audio-codec considered here for the table is G.711.

802.11a/n operation is recommended for VoWLAN to avoid interferences existing in the 2.4 GHz radio band (Bluetooth, microwave oven, intruder detection systems, etc.), nevertheless 802.11b/g/n can also be used.

15.5. Layer 2 Handover on Stellar AP



- AP1 & AP 2 are in the same AP group (Layer 2)

- OT81x8 SE (SIP Edition) handset B performs a handover between AP1 and AP2 within the same AP group

OT81x8 SE (SIP Edition) WLAN handset starts for a Layer 2 handover (within the same AP group) as long as it can see another AP with a RSSI that is 6 dB better than the current one.

16. VoWLAN (OT81x8 and 8128 SE (SIP Edition)) Validation Tests on OmniAccess® Stellar AP

16.1. VoWLAN on AP1101

ALE VoWLAN solution (OT81x8 and 8128 SE (SIP Edition)) has been validated on AP1101 and as a result is supported.

16.2. VoWLAN on AP1221

ALE VoWLAN solution (OT81x8 and 8128 SE (SIP Edition)) has been validated on AP1221 and as a result is supported.

16.3. VoWLAN on AP1222

ALE VoWLAN solution (OT81x8 and 8128 SE (SIP Edition)) has been validated on AP1222 and as a result is supported.

16.4. VoWLAN on AP1231

ALE VoWLAN solution (OT81x8 and 8128 SE (SIP Edition)) has been validated on AP1231 and as a result is supported.

16.5. VoWLAN on AP1232

ALE VoWLAN solution (OT81x8 and 8128 SE (SIP Edition)) has been validated on AP1232 and as a result is supported.

16.6. VoWLAN on AP1251

ALE VoWLAN solution (OT81x8 and 8128 SE (SIP Edition)) has been validated on AP1251 and as a result is supported.

17. 802.11n

17.1. Overview

802.11n is a standard supplement to increase the throughput in 2.4 GHz & 5 GHz radio bands in order to reach very high data rate up to 300Mbps. 802.11n technology is based on MIMO (Multiple-Input-Multiple-Output) technology that takes advantage of multipath effects.

MIMO is defined as MxN: e.g. 2x2, 3x3 and up to 4x4

M = number of transmit antennas N = number of antennas at the receiver.

802.11n improves RF coverage of 30% when using 802.11n clients only and can run in 2.4 GHz and 5 GHz in 2 modes (40 MHz channel and 20 MHz channel. 802.11n is backward compatible with 802.11a/b/g (OT81x8 and OT8128 SE (SIP Edition)) but not at “n” speed).

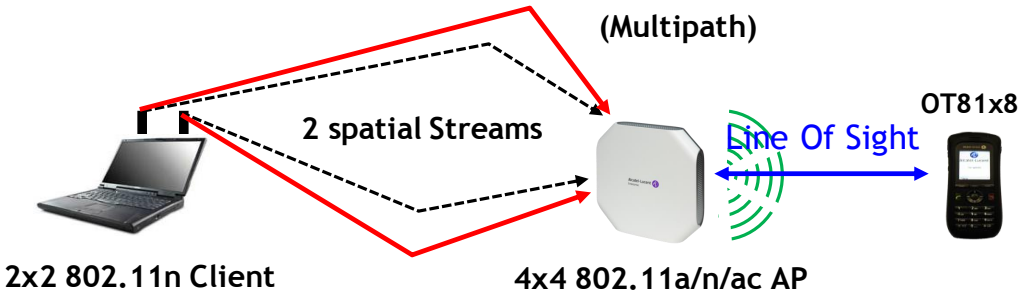


Figure 18: MIMO principle

This picture shows a 802.11n client that is associated to a 802.11n AP using a 4x4 MIMO mode and taking advantage of multipath reflections while the OT81x8 and OT8128 SE (SIP Edition), configured in 802.11a or b/g, use line of sight to reach the AP and uses diversity provided by this 802.11a/n/ac AP.

17.2. 2.4 GHz channel aggregation for 802.11n

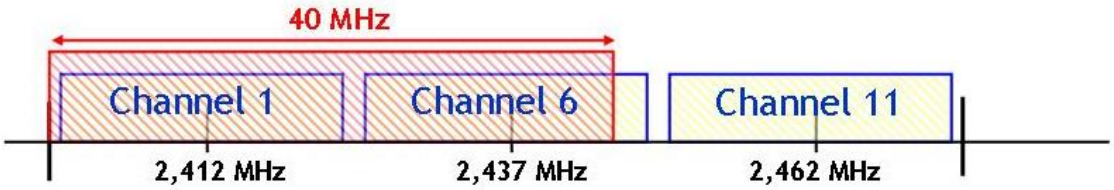


Figure 19: Channel aggregation in 2.4GHz

802.11n can operate either in 20 MHz or 40 MHz. Channel aggregation made of 2 channels is possible in 2.4 GHz (802.11 b/g /n) but makes the AP implementation difficult to avoid interferences between APs. As a reminder channels 1, 6 and 11 must not interfere. If channels 1 and 6 are aggregated in the same AP, the only remaining channel is 11, and it becomes difficult to ensure at the same time a correct coverage and avoid interferences between APs using the same channel number (i.e. channels 1 & 1, 6 &6 and channels 11 & 11).

17.3. 5 GHz channel aggregation for 802.11n

Figure 20: Channel aggregation in 5 GHz

5 GHz radio (802.11a/n) offers many more channels making possible a 802.11n operation in 40 MHz (aggregation of 2 channels on the same AP). In this example 20 MHz channels 36 and 40 have been aggregated in order to create a 40 MHz channel.

17.4. General Recommendations for a 802.11n Deployment

802.11n implementation should be a green field allowing fewer APs as long as all clients are native 802.11n.

Gigabit support is mandatory for AP Ethernet connection due to the larger bandwidth involved by MIMO operation and channel aggregation:

- GB Ethernet ports, GB Ethernet cabling, GB controller throughput

New power sources for 40MHz support (Dual-channel): PoE+ followed by 802.3at

New drivers may be involved: Driver maturity must be considered (Wireless clients)

New channel planning approach related to Channel Bandwidth: 40MHz instead of 20MHz (channel distribution).

17.5. OT81x8 and OT8128 SE (SIP Edition) Recommendations for a 802.11n Deployment

- OT81x8 and OT8128 SE (SIP Edition) WLAN handsets are managed with 802.11a with a LAN Voice application bandwidth limiting the quantity of simultaneous calls per AP (equivalent of about 8 calls per AP -to be tuned-)
- Wireless PCs operate in 802.11 a/n
- Non-802.11n legacy wireless PCs if any, can be configured in 802.11g

Advantages:

- Due to the fact that 802.11a requires a slightly higher AP density for Voice coverage, it is not necessary to reach the full capacity of 8 simultaneous OT81x8 /OT8128 SE (SIP Edition) calls per AP. This keeps room for 802.11 a/n wireless PCs that can optimize AP throughput by using 40 MHz channel aggregation.
- Using 802.11a for OT81x8 and OT8128 SE (SIP Edition) avoids Bluetooth interference, and potential interferences created by intrusion protection radars operating in the 2.4 GHz band and without the need to cope with 802.11g protection mode issue (involving a global bandwidth reduction).
- Gigabit Ethernet ports with POE are required to feed the Access Points
- A Voice Site survey must be performed in 802.11a with a minimum available Received Signal Strength (RSSI)of **- 60 dBm**

17.5.1. Remarks concerning Non-DFS channels in 5 GHz Radio Band

As part of the 5 GHz Radio Band used by 802.11a or 802.11a/n, most of the available channels are prone to interfere with Radars except the four first channels (36, 40, 44, and 48) that are Non-DFS channels (Dynamic Frequency Selection). The radar interference may happen but is unlikely to occur (airport proximity, military area, etc.).

ALE Recommendation: For a VoWLAN (OT81x8 and OT8128 SE (SIP Edition)) deployment it is preferable to configure all 802.11a available channels without restriction and check in a second step if the area of deployment is prone to radar interferences. In case of radar interference 802.11a channels should be limited to NON-DFS channels.

17.6. VoWLAN Use Case in 802.11n

Purpose of this section is to describe an implementation scenario mixing WiFi customer needs in 802.11a, 802.11b/g and 802.11n.

In a recent past (before 802.11n) the recommendation was having Voice over WLAN (OT81x8 and OT8128 SE (SIP Edition)) in 802.11a and wireless data in 802.11b/g, provided the fact that dual-radio access points were deployed. Today 802.11n implementation modifies a little bit the rules.

Following is a scenario example:

17.6.1. Customer requirements (use case)

- Voice should be preferably in 802.11a (802.11b/g being currently used by legacy PCs)
- Legacy PCs in 802.11 b/g (about 30% of the total quantity of wireless PCs)
- 802.11an need for new PCs (about 70 % of the total quantity of wireless PCs)
- Customer R&D labs also uses 802.11a

17.6.2. Radio band allocation (use case)

- 802.11n cannot be based on 802.11b/g (i.e. 802.11 b/g/n mode) in a deployment made of many adjacent APs, because only two channels remain available (the aggregated channel for 802.11n and the third available channel), resulting in interference occurrence between adjacent APs.
  The only possible choice is 802.11n based on 802.11a (i.e. 802.11a/n mode).

  Due to customer requirements, **Voice and Data clients must share the same 802.11a radio band.**
  As a result **the dedicated bandwidth on LAN for voice application has to be revised** (tuning about 6 or 7 calls par AP), in order to keep enough bandwidth for 802.11n data users.
  Voice & Data sharing on the same radio has a direct impact on the allowed density of voice/data users per AP.

  Note: *The alternative solution with Voice alone in 802.11b/g is not possible due to the legacy wireless PCs also working in 802.11b/g. This alternative solution (sharing Voice & data in 802.11 b/g) has not been retained by the customer.*

- **Voice over WLAN (OT81x8 and OT8128 SE (SIP Edition) WLAN handsets) must be configured in 802.11a**
- **802.11n Data Wireless PCs must be configured in 802.11a/n**
- **Legacy Data Wireless PCs must be configured in 802.11g/n**

Due the late adoption today of 802.11ac radio, the number of 802.11a/n customers still predominate and recommendations in this use case remain valid.
- **New 802.11ac Data Wireless PCs must be configured in 802.11a/n/ac**

- All 802.11a Access Points handling Voice over WLAN must use exclusively the four NON-DFS channels (Dynamic Frequency Selection) **channels 36, 40 ,44 and 48** to avoid Radar interference.
- In order to minimize interference risks between the existing customer R&D labs working in 802.11a and the new VoWLAN network also operating in 802.11a, customer R&D must use 802.11a channels that are out of these four first channels, **starting from channel 56 and upper** (in order to maintain a gap with VoWLAN channels).

17.6.3. Voice site survey (use case)

- A Voice site survey must be performed in 802.11a with a minimum RSSI level of **-60 dBm**.
- Floor maps for involved buildings must be provided and also the areas to be covered in WiFi
- Quantity of voice/data users per zone/area or room are also required.

17.6.4. Recommendations for the deployment (use case)

- Access Points must be visible (not hidden behind false ceiling)
- Staircases must be covered with access points
- Even if all users are expected to arrive in one shot, it is preferable starting the OT81x8 and OT8128 SE (SIP Edition) deployment in a first step with just a few targeted users to check the good operation with final tuning, and in a second
  step extend to all VoWLAN users.

18. Roaming and Handover

18.1. Roaming definition

Refers to the ability to be reached (ie: making and receiving calls) in a different Site or Network. Inside a site or a network, provides a wireless device the capability to associate to an AP after a power-on or a reset of this device.

18.2. Handover definition

Refers to the ability to move from one AP coverage area to another AP without service disruption or loss in connectivity.

18.3. Handover and Roaming restrictions

This table is a summary of roaming and handover capabilities according to the different VoWLAN topologies.

Roaming and handover capabilities are linked directly to the Stellar WLAN Access Points configurations:
- Single Stellar AP-Group, or different Stellar RF domains in layer 2 or 3 with OXE topologies.

VoWLAN Topologies	Roaming	Handover
OXE Single-Node (Campus) **Stellar Access Points in layer 2**	**OK**	**OK** (within a same AP Group)
OXE Single-Node (Campus) **Stellar Access Points in layer 3**	**OK**	**OK *** (within a same AP Group)
OXE Single-Node (WAN) **Stellar Access Points in layer 3**	**OK**	Not Applicable because no handover between Headquarter and Remote Site
OXE Multi-Node (WAN) **Stellar Access points in layer 3**	Not Supported (except if there is No bandwidth restriction on WAN)	Not Applicable because no handover between Headquarter and Remote Site

OT81x8 and OT8128 SE (SIP Edition) Roaming between headquarter and a Remote Site is possible only if:
- There is enough bandwidth on WAN to ensure additional bandwidth involved by OT81x8 and OT8128 SE (SIP Edition) roamers
- The SSID is the same on Headquarter and Remote Site.
- In Personal Mode (WEP,WPA,WPA2) the Pre-shared keys are identical on Headquarter & Remote Site

19. G711 and G729A

Used in Multi-Site configuration (One Com Server)
- G711 in Intra-domain and G729A in Inter-Domain (WAN)

Used in Multi-Node Configuration
- G711 in Intra-domain and G729A in Extra-Domain (WAN)

For more details about OT81x8 and OT8128 SE (SIP Edition) restrictions see Feature List and Product Limit for OmniPCX Enterprise

19.1. G711 considerations

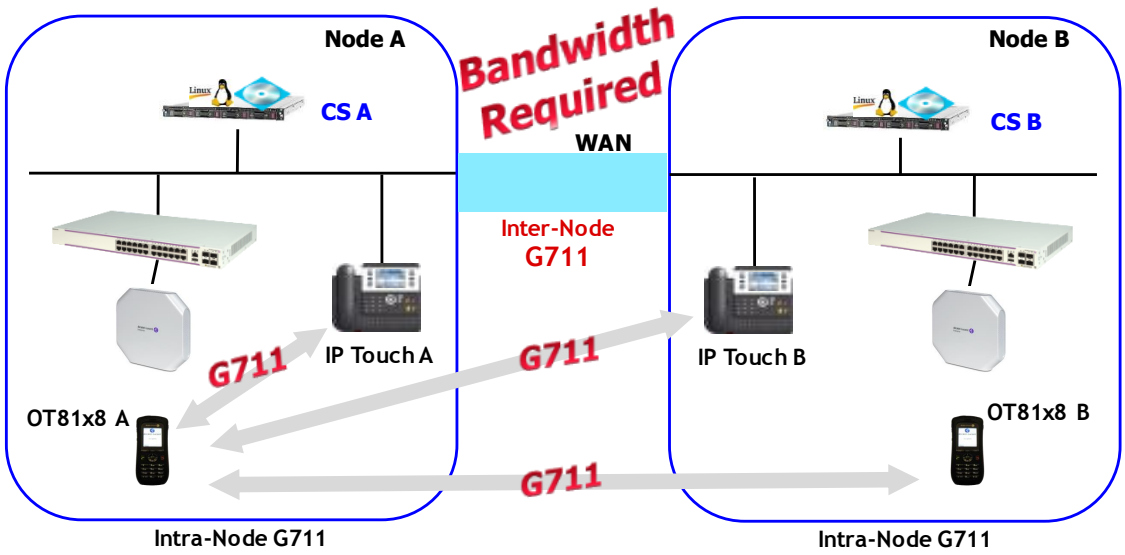


Figure 21: G711

This topology fully based on G711 does not contain any compression.
This configuration is supported but requires a minimum of bandwidth on WAN (no Voice compression).
In this example G711 is permanently used whatever the call destination is (intra-node or extra-node).

19.2. G729 considerations

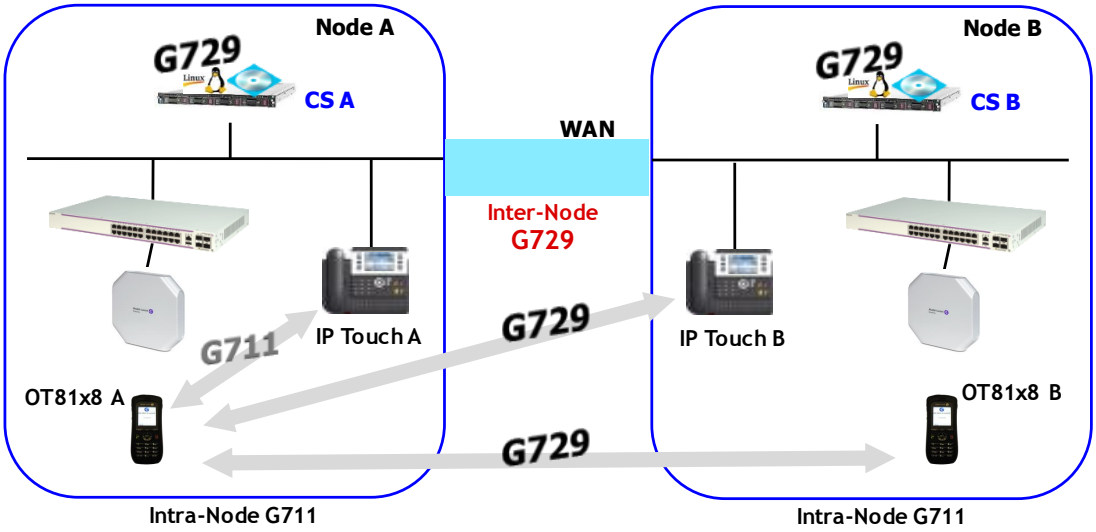


Figure 22: G729

This topology based on G729 allows compression on WAN for OT81x8 and OT8128 SE (SIP Edition) WLAN handsets.
(OT81x8 and OT8128 SE (SIP Edition) handsets support G711 and G729 only, but not G723). Generic rules:

- The OXE Network must be homogeneous in G729
- G729 must be set on all OXE nodes
- When compression is required (i.e. on WAN), G729 must be used by all OT81x8, OT8128 SE (SIP Edition) & IP Touch sets.

20. Voice over WLAN Design Rules (ALE WLAN infra)

ALE OT8118, OT8128 and 8128 SE (SIP Edition) WLAN handsets support the following radios:

- 802.11a/n
- 802.11b/g/n

20.1. Security on OT81x8 and OT8128 SE (SIP Edition) solution

20.1.1. Encryption

WEP (128 bits)
WPA (PSK with TKIP) Personal and Enterprise modes
WPA2 (PSK with AES) Personal and Enterprise modes

20.1.2. Authentication

802.1X authentication

- PEAP-MSCHAPv2
- EAP-TLS

20.2. WLAN Licensing

20.2.1. License Overview in Wifi-Express Mode

There is no licenses for OmniAccess® Stellar WLAN Access Points in Wifi-Express Mode.

20.2.2. License Overview in Wifi-Enterprise Mode

The Omnivista 2500 Server software platform serves as License Server in Wifi-Enterprise mode (NMS Enterprise version 4.2.2.R01 minimum is required).
- **OV4-START-NEW** starter pack version 4 include 10 ALE devices, 10 APs, 10 GAs and 10 BYOD licenses for small WLAN infrastructures
- **OV-AP-NM-XX-N** required for Stellar Access Points and includes RF management, WIPS and spectrum floorplan/heatmap

(For instance a configuration made of 16 Stellar APs requires **OV-AP-NM-20-N** license)
- **OV-AP-XX-K12** required for Stellar Access Points and includes 1YR 24x7 remote support

21. Converged Wireless Environments (Voice & Data Combinations)

One of the most significant reasons that businesses look to use wireless LAN technology to support voice is the desire to have a single infrastructure for both voice and data services. While this may at first sound like a very simple thing to implement, it often is far more complex to design than most customers originally anticipate. Alone, a VoWLAN environment has some challenges that must be overcome. Combined with a need to coexist with data client service, VoWLAN environments can face a tremendous amount of competition that requires special planning to minimize.

One of the major complexity factors faced during the design stage is the varied nature of the standards that can be used to support a data WLAN, and the affects each method has on voice quality and performance.

21.1. Voice on 802.11g, Data on 802.11a

This implementation is possible but not recommended as 2.4GHz radio band is prone to interferences from Bluetooth, microwave oven and intrusion radar.

21.2. Voice on 802.11a, Data on 802.11g

This implementation stays possible on installations with data devices using 802.11 b/g/n radio. Radio 802.11b/g/n PCs is still a most common device than PCs 802.11a onsites. It is also strongly advisable with the use of PCs still working with radio 802.11b.

This is an ideal situation for voice subscribers to take benefit greatly from the density and coverage capabilities of the 10-13 non-overlapping channels (depending on local market restrictions) the 802.11a radio makes available.

There is no direct radio competition to Data Wireless solutions that require use of the 2.4 GHz IEEE 802.11g realm. As a result of the lack of frequency competition, Data wireless elements are free to utilize the full theoretical 54 Mbps of the IEEE 802.11g network. Congestion and competition is eliminated, resulting in the highest possible levels of service and voice quality.

21.3. Voice on 802.11a, Data on 802.11a

Because IEEE 802.11a utilizes the 5 GHz wireless spectrum that fits VoWLAN needs, it offers no direct radio competition to Data Wireless solutions that require use of the 2.4 GHz IEEE 802.11g realm. This is an ideal situation that offers the greatest benefit for both voice and data subscribers. As a result of the lack of frequency competition, Data wireless elements are free to utilize the full theoretical 54 Mbps of the IEEE 802.11g network.

Utilization of the 5 GHz wireless spectrum is also great advantage to Voice subscribers to take benefit greatly from the density and coverage capabilities of the 10-13 non-overlapping channels (depending on local market restrictions) it makes available.

Customers seeking this type of solution can unify the infrastructure elements by using ALE OmniAccess product suite for both Wi-Fi formats. ALE OmniAccess Stellar Access Point can be effectively leveraged to construct networks for both 2.4 GHz (802.11b/g) and 5 GHz (802.11a) networks simultaneously.

Another advantage is the fact that there is no environmental interference from Bluetooth and microwave oven in 802.11a.

In some specific cases 802.11a radio may be prone to RADAR interferences at 5 GHz (DFS, 802.11h) or sometimes not allowed by local regulations.

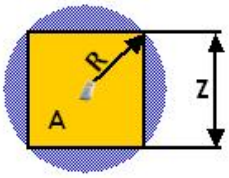
This implementation based on 802.11a for Voice and 802.11g for data remains, (when 802.11a is allowed), the most optimized VoWLAN solution in terms of bandwidth for Voice and Data users.

22. Predictive Environment Solution Options (Responding to RFx)

When answering an RFP or RFI, normally, there is little possibility of scheduling a Site Survey for various reasons: Building under construction or not yet built, short delay to answer the RFP, fair competition clause, etc. In these cases we can make a compromise between absolute accuracy of design and ease of offer presentation by trying to evaluate the user environment and theorize the required quantity of Access Points. It is essential to never forget to clearly indicate on the RFP, or unsolicited bid, that a compulsory Site Survey is required to verify the correct quantity of AP and their related locations.

22.1. Manual Calculation of Predictive Coverage

The following predictive method can be used to produce a budgetary design. Many environment variables like wave propagation, type of building, wall structure, interferences, etc. may, unexpectedly- affect the size quality, and complexity of the RF (Radio Frequency) coverage plan.



Buiding type		Average User Throughput			
		1 Mbps	5 Mbps	12 Mbps	18 Mbps
Typical Office	A (m^2) R (m) Z (m)	650 18 25	550 16,5 23,5	450 15 21	350 13,5 19
	dBm	**-85dBm**	**-75dBm**	**-70dBm**	**-65dBm**
Drywall Office	A (m^2) R (m) Z (m)	450 15 21	350 13,5 19	300 12,5 18	250 11,5 16,5
	dBm	**-85dBm**	**-75dBm**	**-70dBm**	**-65dBm**
Brickwall Office Space	A (m^2) R (m) Z (m)	350 13,5 19	300 12,5 18	250 11,5 16,5	N/A N/A N/A
	dBm	**-85dBm**	**-75dBm**	**-70dBm**	**-65dBm**

Figure 23: User Throughput (type of Wall) for 802.11b/g

In the above chart:

R="The coverage radius provided by an AP and is used to define a perimeter or radial-footprint."
Z="The coverage square contained within the perimeter(R)."
A="The area of (Z^2) covered in square meters."

For the following example (Drywall construction office building), use of the above defined calculation table results in an estimated bandwidth average of roughly 18 Mbps for data 802.11 b/g Wi-Fi traffic. We can apply the same calculation strategy to VoWLAN simply by focusing on the performance of 802.11b at an estimated signal strength of -65dBm (target limit for voice coverage.)

Calculating Access Point Quantity

- **Drywall building with a theoretical bandwidth of 18 Mbps for 802.11b/g (-65dBm)**
- **Determine Radius & Z factors: R=~11.5m Z=~16.5m Z^2=~250m^2 (approximated with margin of error)**
- **Divide the building floor in rectangles and calculate the number of AP by dividing the area of each rectangle by Z^2:**

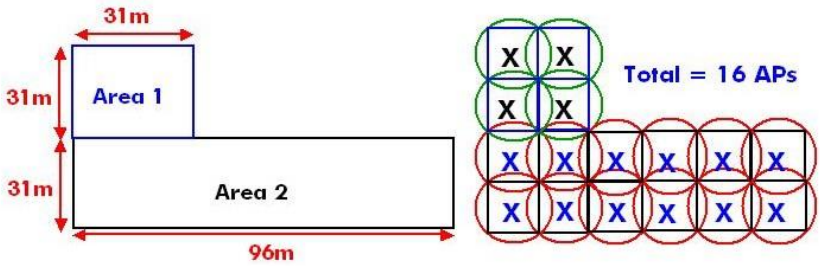


Figure 24: Predictive Method: AP Calculation

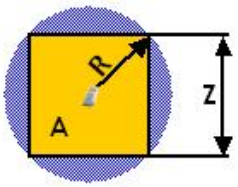
Example Results:
Area 1 => Quantity of AP = (31 x 31)/250 = 3.84 => 4 AP (rounded up to next highest whole number)
Area 2 => Quantity of AP = (31 x 96)/250 = 11.9 => 12 AP

Note 1: This calculation remains an approximation.

Note 2: The area covered by an Access Point in 802.11a is smaller than in 802.11b/g

Only a Voice over WLAN site survey can determine the exact quantity of APs to be installed in order to ensure the both, a seamless RF coverage and a correct handover.

22.2. Predictive Data Coverage chart example for 802.11 b/g and 802.11a



Buiding type		Average User Throughput			
		802.11bgn: 12 Mbps	802.11an: 15 Mbps	802.11an: 18Mbps	802.11ac: 30 Mbps
Typical Office	A (m^2) R (m) Z (m)	450 15 21	450 15 21	324 13 18	290 12 17
	dBm	**-70dBm**	**-65dBm**	**-65dBm**	**-65dBm**
Drywall Office	A (m^2) R (m) Z (m)	324 13 18	324 13 18	290 12 17	225 10 15
	dBm	**-70dBm**	**-65dBm**	**-70dBm**	**-65dBm**
Brickwall Office Space	A (m^2) R (m) Z (m)	290 12 17	290 12 17	N/A N/A N/A	N/A N/A N/A
	dBm	**-70dBm**	**-65dBm**	**-65dBm**	**-65dBm**
Hospital	A (m^2) R (m) Z (m)	324 13 18	324 13 18	290 12 17	225 10 15
	dBm	**-70dBm**	**-65dBm**	**-65dBm**	**-65dBm**
Warehouse /Manufacturing with no obstacles, metallic separations	A (m^2) R (m) Z (m)	450 15 21	450 15 21	324 13 18	290 12 17
	dBm	**-70dBm**	**-65dBm**	**-65dBm**	**-65dBm**

Figure 25: User Throughput for 802.11b/g/n and 802.11a/n/ac

This chart provides additional indications about building coverage for 802.11b/g and 802.11a for data, but on the other hand it is important to keep in mind the RSSI levels required for Voice over WLAN

For more details see the chapter:

Required RSSI levels for a Voice Site Survey (VoWLAN) 23.4

22.3. Predictive Tool Coverage Planning

In the interest of easing predictive planning for large sites, or sites not yet fully constructed, several predictive coverage planning tools are available. These tools focus almost exclusively on the service requirements of 802.11 data clients with typical power and sensitivity specifications. It is for this reason that the use of predictive planning tools is not currently recommended by ALE. Even in the case of ALE predictive planning tool, the unique operational characteristics of OT81x8 and OT8128 SE (SIP Edition) handsets cannot be taken into full consideration, resulting in often flawed and under-engineered proposals. When the use of such tools is absolutely mandatory, it is recommended that a coverage plan of 160% or better be used in order to ensure proper plan overlap at the desired -65 dB level (802.11b). It is assumed that future versions of predictive coverage planning tools will be more accurate, and capable of calculating plans based on VoWLAN characteristics.

23. Environment Verification & Validation

After collecting information on the customer data networking environment from both a logical and physical perspective, and evaluating the customer voice communications needs; it becomes important to verify and validate the collected information. These operations are not meant to be insulting to a customer or business partner, nor are these practices meant to be “revenue generation” tactics. The processes outlined below are incredibly important steps required to ensure customer satisfaction and to provide for baseline references for support contracts and service level agreements.

23.1. Pre Install VoWLAN Radio Coverage Audit (Site Survey)

It s recognized that in many situations, a customer may be unwilling or unable to perform a wireless audit before the establishment of budgetary costs (RFP/RFQ.) Regardless of whether or not predictive tools were used to define a “budgetary” topology design, a Radio Coverage Audit (also known as a Site Survey) is mandatory for all OT81x8 and OT8128 SE (SIP Edition) VoWLAN solutions prior to installation. Voice quality and coverage continuity cannot be guaranteed without this compulsory environmental evaluation.

In ideal situations, this audit would be performed as the first step towards building a VoWLAN solution. The results of the audit could be used to strategically identify ideal locations for Access Points to maximize coverage and minimize radio spectrum conflict. By working backwards from the Access Points, we could easily see where best to place and how best to size Wireless Switches and/or Wireless Appliances.

VoWLAN Radio Coverage Audits are very specific in that they focus on the requirements of 802.11b, g or a based wireless clients. Being small, handheld, battery operated devices; Omni Touch wireless handsets possess unique radio sensitivities. Where a typical Wi-Fi enabled PC could find the ability to maintain a useful connection with a signal as weak as -80dBm, OT81x8 and OT8128 SE (SIP Edition) terminals lose reliable communications capabilities beyond -70 dBm in 802.11a/b/g while a level of -60dBm is required to ensure a correct handover. It is for this reason that typical Wi-Fi surveys, as well surveys for other digital wireless technologies, cannot be used for VoWLAN solutions. Again: A VoWLAN Radio Coverage Audit is mandatory for all solutions prior to installation.

ALE OmniAccess platform family can be used to support data as well as voice. For solutions that propose both voice and data coverage, it is important to distinguish between the needs of the voice and data elements. If voice and data are to share 802.11b/g Access Points, bandwidth consumption and client saturation need to be incorporated into the overall audit results. If the data will utilize 802.11a Access Points, a completely different wireless audit may be required.

The specificity of VoWLAN audits requires a certain level of solution specific training and knowledge. For the benefit of ALE customers and Business Partners, ALE Professional Services organization can provide VoWLAN and WLAN Radio Coverage Audits at a competitive price. For more details on this service, please contact ALE Professional Services.

23.2. Post Install Survey

Wireless networks are often changing to meet new application demands, business processes, or in response to external influences (neighboring networks and other spectrum disturbing sources.) For this reason, ALE recommends regular radio coverage surveys in order to continuously revalidate system operation. This is not a mandatory process, but a recommended one as proactive network modification is often less costly and disruptive than reactionary engineering to sudden holes or degradations in the RF coverage plan.

The regularity by which a customer should consider RF coverage re-evaluation depends greatly on network size, radio spectrum competition, sensitivity to degraded voice quality, rate of user population growth, and other factors. As a general rule, ALE recommends re-evaluation whenever new technology demand is generated or roughly every 18 months. Some customers may be able to happily use VoWLAN technology in a static environment for many years without a renewed survey, others may find that continuous evolution of network demands require a validation every six months. It is recommended to set proper customer expectations before they decide to implement VoWLAN technology.

23.3. Required RSSI levels for OT81x8 and OT8128 SE (SIP Edition) WLAN Handsets

The wireless cell planning is done using an AP placement tool which estimates the placement of AP based on the building/campus characteristics. It is recommended that a site survey is done using the built-in tools in the OT81x8 and OT8128 SE (SIP Edition) WLAN handset. The tool provides a true measurement of the RF environment based upon the radio of the handset. Other wireless analysers can be used to provide additional assistance during a site survey.
The basic approach to cell planning is to have sufficient overlap between adjacent cells in order to ensure that sufficient radio signal strength is present during a handover between the cells, see the figure below

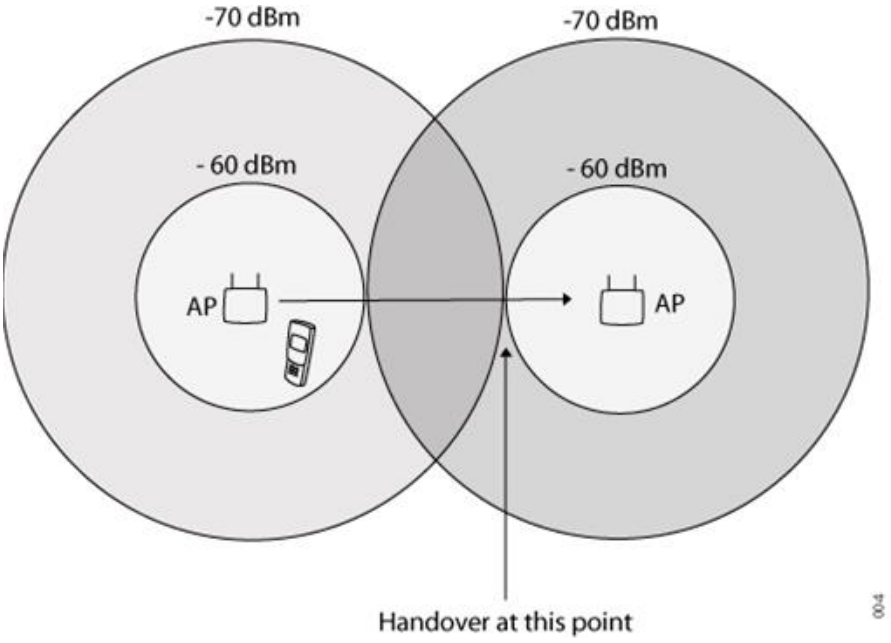


Figure 26: Cell overlap between adjacent cells

The distance between the APs is often a trade-off between the amount of APs and coverage.
To make up for fading effects in an indoor office environment it is recommended that the radio signal strength at the cell coverage boundary does not drop below -70 dBm. The APs should be placed to overlap their boundaries by approximately 6–10 dB.
This means that when the STA reaches a point where the RSSI is -70 dBm, the STA is also inside the adjacent cell and the RSSI from that AP is between -60 to -64 dBm.
The recommendations above ensure a fading margin of approximately 20dB which should be appropriate for “normal” environments.

Note: The illustration above is valid when AP transmission power are configured to 100mW (20dBm). Since the OT81x8 and OT8128 SE (SIP Edition) WLAN handsets transmission power is pre-configured to approximately 100 mW, this ensures a symmetric wireless link.
Note that the illustration also is valid for other transmission power settings, but the same power setting must be set in both the handset and AP.

23.4. Required RSSI levels for a Voice Site Survey (VoWLAN)

Following are the Required RSSI levels for a Voice Site Survey with OT81x8 and OT8128 SE (SIP Edition) WLAN handsets configured in 802.11an or 802.11bgn.

-70 dBm (or better) to maintain a voice communication

-60 dBm to -64 dBm (or better) to ensure a correct handover

23.5. Recommended SNR and Noise levels for a Voice Site Survey (VoWLAN)

Following are the Recommended SNR and Noise levels for a Voice Site Survey with OT81x8 and OT8128 SE (SIP Edition) WLAN handsets configured in 802.11an or 802.11bgn.

a 25 dB SNR (or better)

Noise level < -92 dBm

RSSI > 67 dBm

23.6. ALE Professional Services Offer

Specific service offer is available from ALU Professional Services to provide a **Voice Site Survey** with on-site deployment of Access Points (accurate positions resulting from the Site survey) and also WLAN switch configuration.
Send your request to: Professional.Services@al-enterprise.com

24. Design Examples

24.1. Configuration for up to 8 AP (Demo & small area coverage)

This configuration example depicts a model well adapted to a Demo context in Wifi-Express Mode for up to 8 AP.

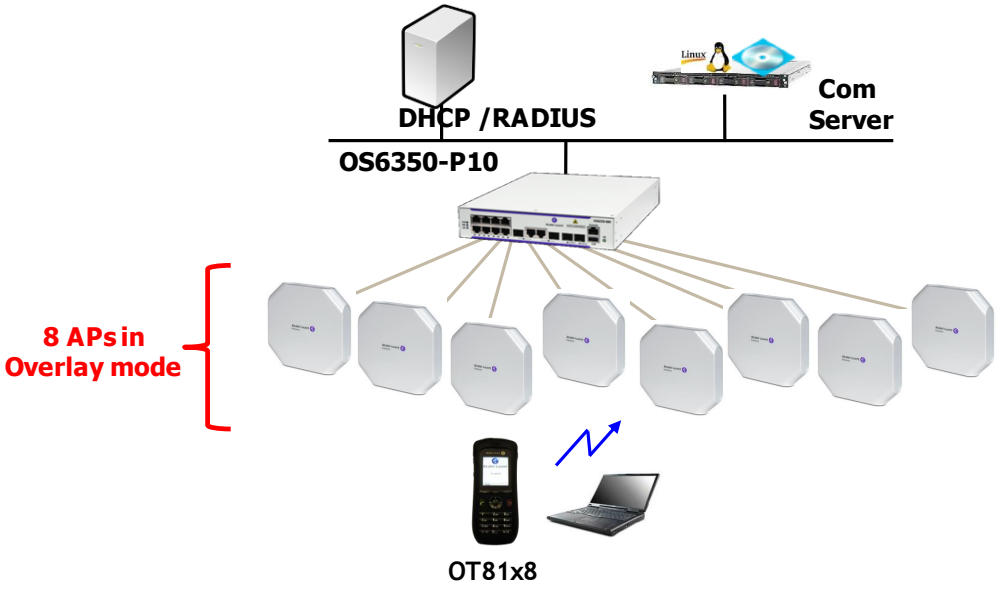


Figure 27: Configuration for 8 AP

This entry topology takes advantage of the OAW-6350 that proposes 8 POE+ ports to connect and feed up to 8 Access Points (POE+)

24.2. Configuration for up to 16 AP (with redundancy)

This example depicts a model for up to 16 AP in Wifi-Express Mode.

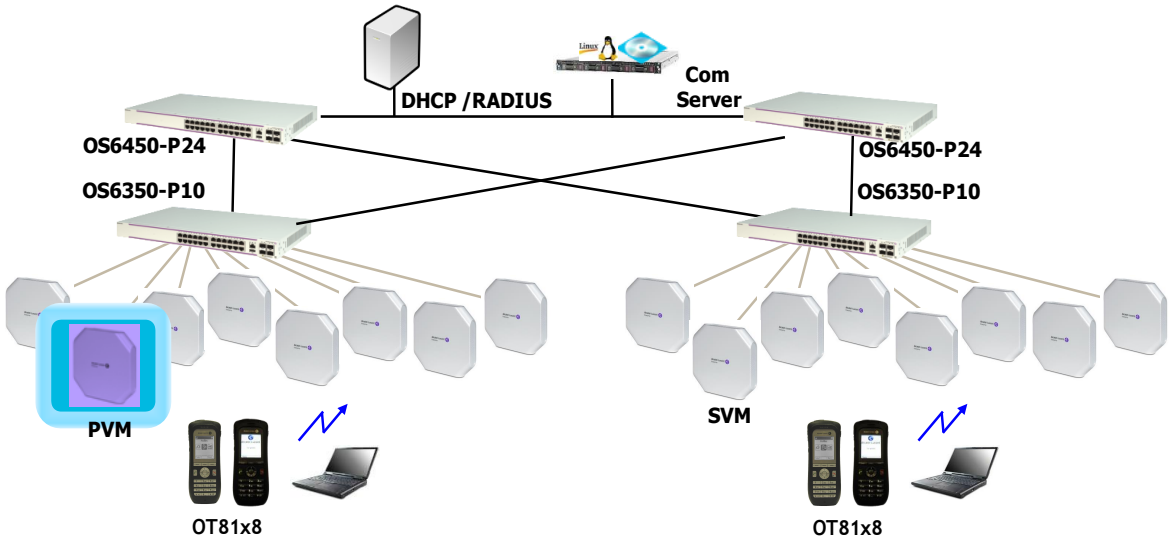


Figure 28: Configuration for up to 16 AP (with redundancy)

In this scenario, the backup process takes place between the 2 WLAN Access Points of the same model. In order to insure a full backup, the total quantity of AP must not exceed the maximum number of AP supported by the AP-Group. Depending on the global Bandwidth a Gigabit port can be used on both OS6450.

24.3. WLAN in different RF domains

This example depicts a model for up to 3 groups of Access Points in Wifi-Express Mode, forming 3 distincts RF domains.

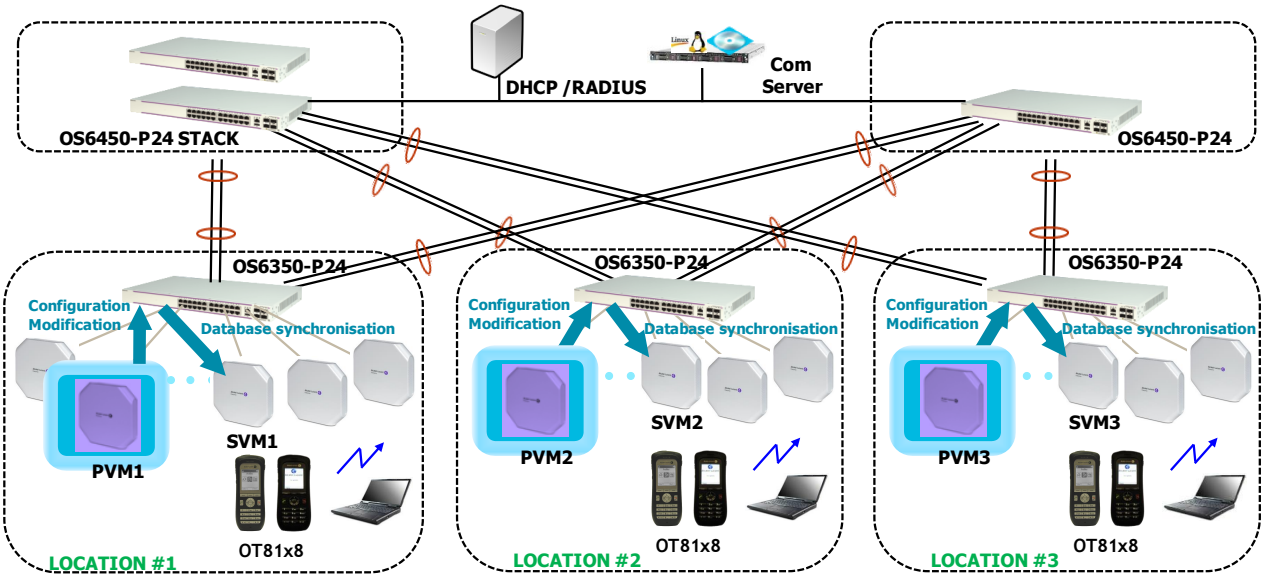


Figure 29: WLAN in different RF domains

Alcatel·Lucent Enterprise

24.3.1. PVM - SVM Redundancy scenario

Each Stellar Access Point is located in different AP-Group and managed in Wifi-Express Mode. They are configured to automatically connect each other using the Stellar protocol optimized for lightweight a centralized access points management.
Configuration of each AP-Group is done directly on the Primary Manager through the GMIP of the group created (differents AP-Group ID) and through Web-based configuration tool and applies for all Access Points within the AP-Group. On any configuration modification, a Database synchronization is done on Secondary Virtual Manager.

24.4. WLAN RF domains in Wifi-Enterprise

This example depicts a model for up to 3 groups of Access Points in Wifi-Enterprise Mode, forming 3 distincts RF domains with varied scales.

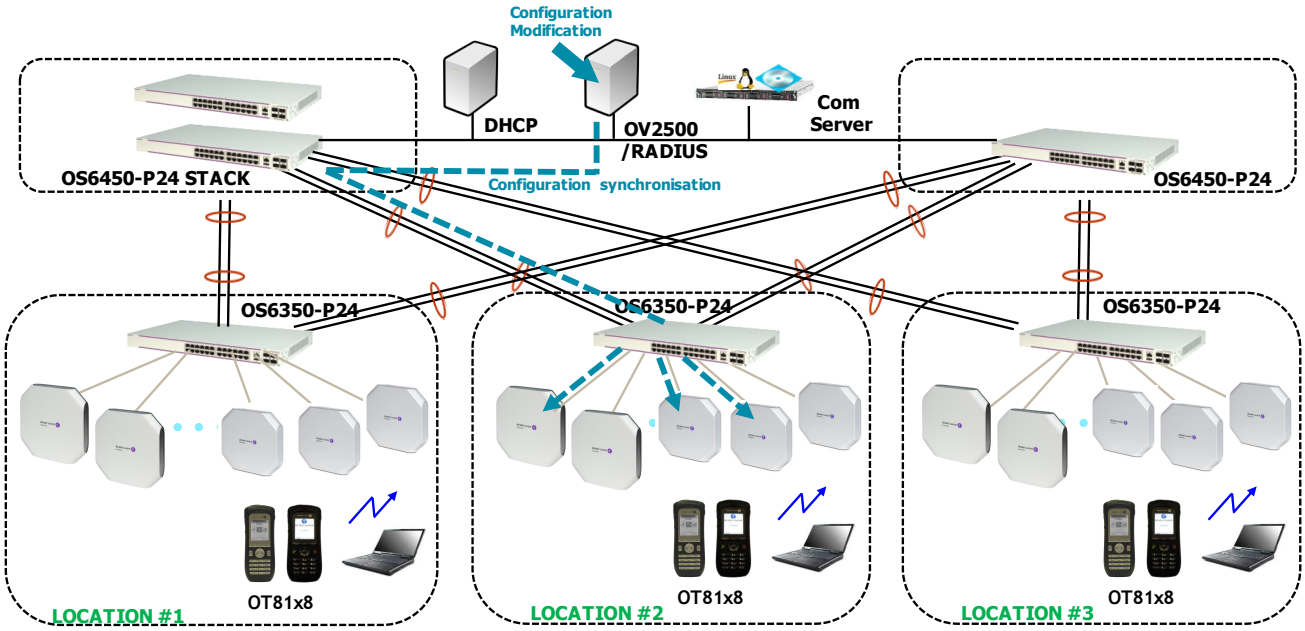


Figure 30: WLAN in Wifi-Enterprise mode

24.4.1. Wifi-Enterprise management scenario

Each access point is located in a different group and managed in Wifi-Enterprise mode. The Access Points are configured to automatically register on the Omnivista 2500 Server Software Platform.
The configuration of each AP group is done directly on the Omnivista 2500 platform through Web-based configuration tool of 2500 Server and applies to all access points within the AP group.
For all configuration, security, accounting and fault tasks, Access Points and Omnivista Server communicate using Message Queue Telemetry Transport (MQTT) protocol. The MQTT session is performed on Stellar management plan and remains active as long as Omnivista Server is reachable.

There is no specific manager role for access points in Wifi-Enterprise groups.

24.5. Quotes & Orders

Quotation process for the Voice over WLAN solution is not fully automated within ACTIS as many of ALE other voice technologies. For this reason, engineers are strongly encouraged to complete the framework of the target VoWLAN design prior to beginning the ACTIS process. All hardware components must be manually selected from the "Onsite WLAN Mobililty equipment" menus.

Design engineers should pay special attention during the quotation process to insure that necessary items are not accidentally omitted. For instance, an OT81x8 or OT8128 SE (SIP Edition) subscriber is not complete with a terminal, battery, charging stand, charging stand power plug, and some form of clothing attachment. Each of these items must be selected separately within ACTIS (or in bundle package combination.) Infrastructure items are no less attention demanding. Design engineers should pay special attention to power cords, uplinks options, and mounting hardware.

OmniAccess® Stellar Access Points are not supported by ACTIS tool.

OmniAccess® Stellar WLAN Access Points bring an optimized cost with a minimum options to quote and can reduce the impact of possible expenses that could be possible by unforeseen future needs. Despite insure that necessary items are not accidentally omitted during the quotation process. For instance, External power supply or PoE inline block.

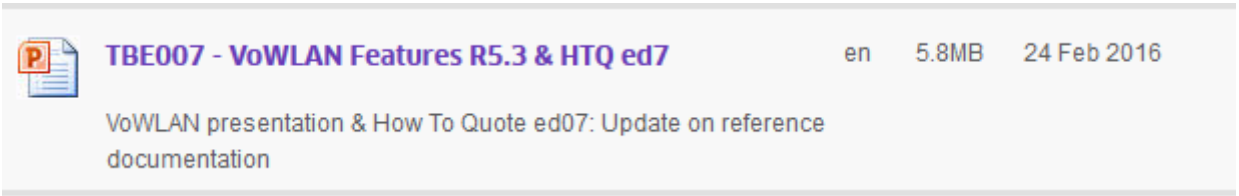
For more detailed information on the QUOTING process for VoWLAN solutions, refer to VoWLAN section of the PreSales Presentations.

24.6. Reference Documents

The documents related to the VoWLAN solution with OmniAccess® Stellar WLAN Access Points can all be found on the ALE Business Portal. Here are the related links:

24.6.1. VoWLAN section of the PreSales Presentations

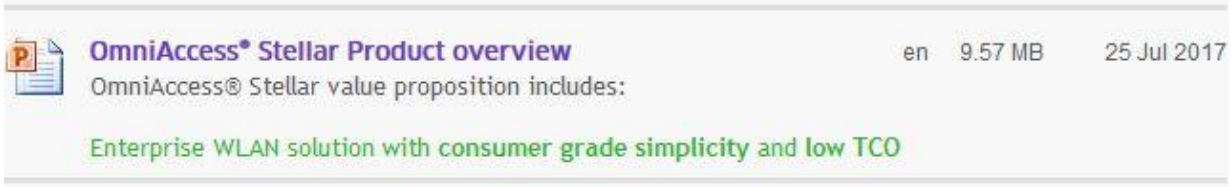
Business Portal:



https://businessportal2.alcatel-lucent.com/tbe007-vowlan-features-r53-htq-ed7

24.6.2. VoWLAN R6.0 documents

Technical Documentation Library:



https://businessportal2.alcatel-lucent.com/8AL90080ENAB

24.6.3. OT81x8, OT8128 SE (SIP Edition) & Stellar Technical Communications

Technical Documentation Library:

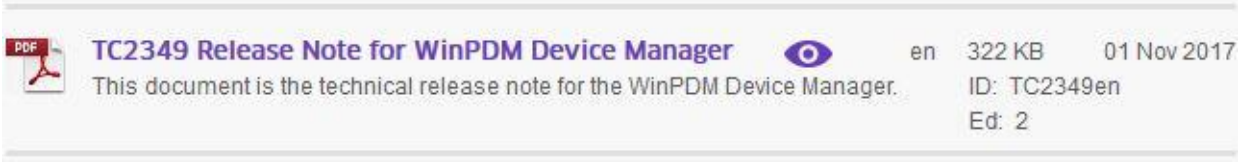
https://businessportal2.alcatel-lucent.com/TC1918en

https://businessportal2.alcatel-lucent.com/TC2323en

https://businessportal2.alcatel-lucent.com/awos-30057-30063-intermediate-release-notes

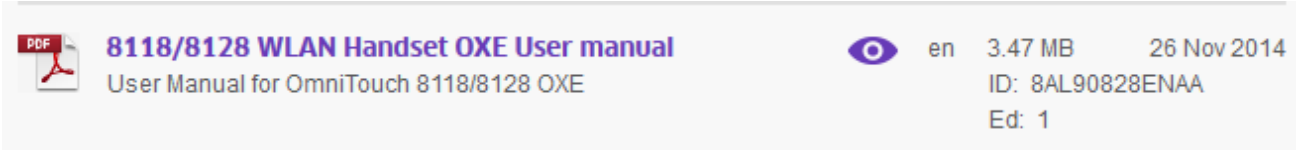
https://businessportal2.alcatel-lucent.com/omnivista-2500-nms-enterprise-422r01-release-notes

https://businessportal2.alcatel-lucent.com/TC2322en



https://businessportal2.alcatel-lucent.com/TC2349en

24.6.4. OT81x8, OT8128 SE (SIP Edition) & Stellar Manuals



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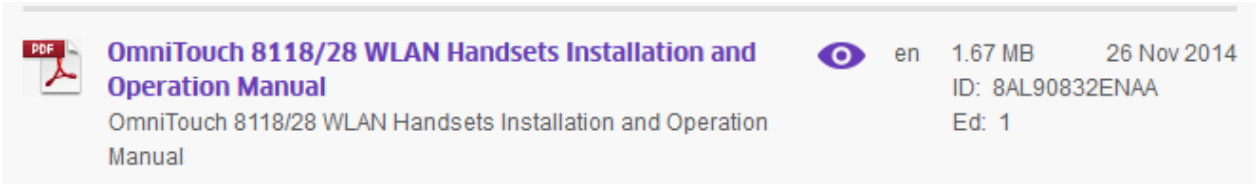

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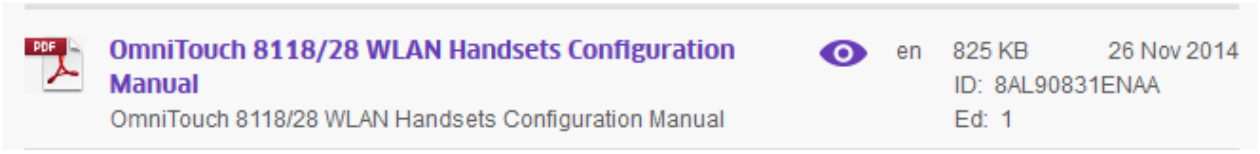
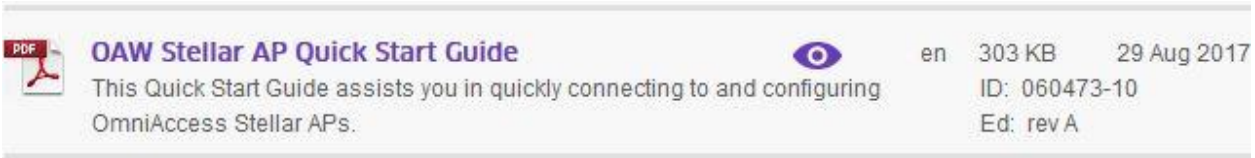


https://businessportal2.alcatel-lucent.com/060455-10



https://businessportal2.alcatel-lucent.com/060473-10

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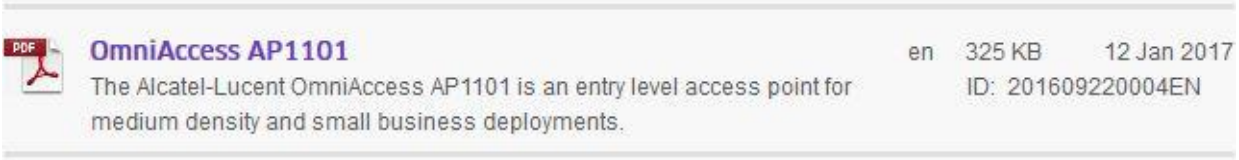
https://businessportal2.alcatel-lucent.com/TDD000359

24.6.5. OT81x8, OT8128 SE (SIP Edition) & Stellar Datasheets

Business Portal:

https://businessportal2.alcatel-lucent.com/node/225143



https://businessportal2.alcatel-lucent.com/omniaccess-ap1101

https://businessportal2.alcatel-lucent.com/omniaccess-stellar-ap1220-series

https://businessportal2.alcatel-lucent.com/alcatel-lucent-omniaccess-stellar-ap1230-series

https://businessportal2.alcatel-lucent.com/omniaccess-stellar-ap1251-datasheet

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25. Annex

25.1. Site Survey Tool

The Site Survey Tool is a portable engineering tool for measuring and monitoring the air interface of Wireless Local Area Networks (IEEE 802.11). This Tool helps to determine:
- The quantity of needed Access points
- The correct placement for these Access Points

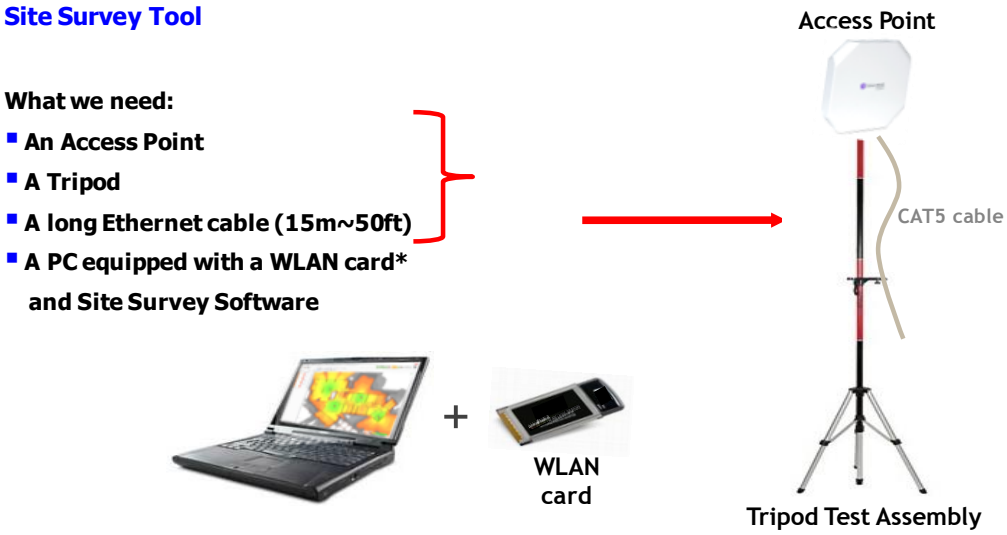


Figure 31: Site Survey components

The Site Survey tool is mainly used by ALE Professional Services and Business Partners. A site Survey is required every time it is needed to perform a quotation for VoWLAN implementation. A VoIP audit is also necessary. 3 OmniAccess Stellar APs can feed Chan 1, 6 and 11 being configured in manual mode. The WLAN adapter must be compliant with the Survey Soft.

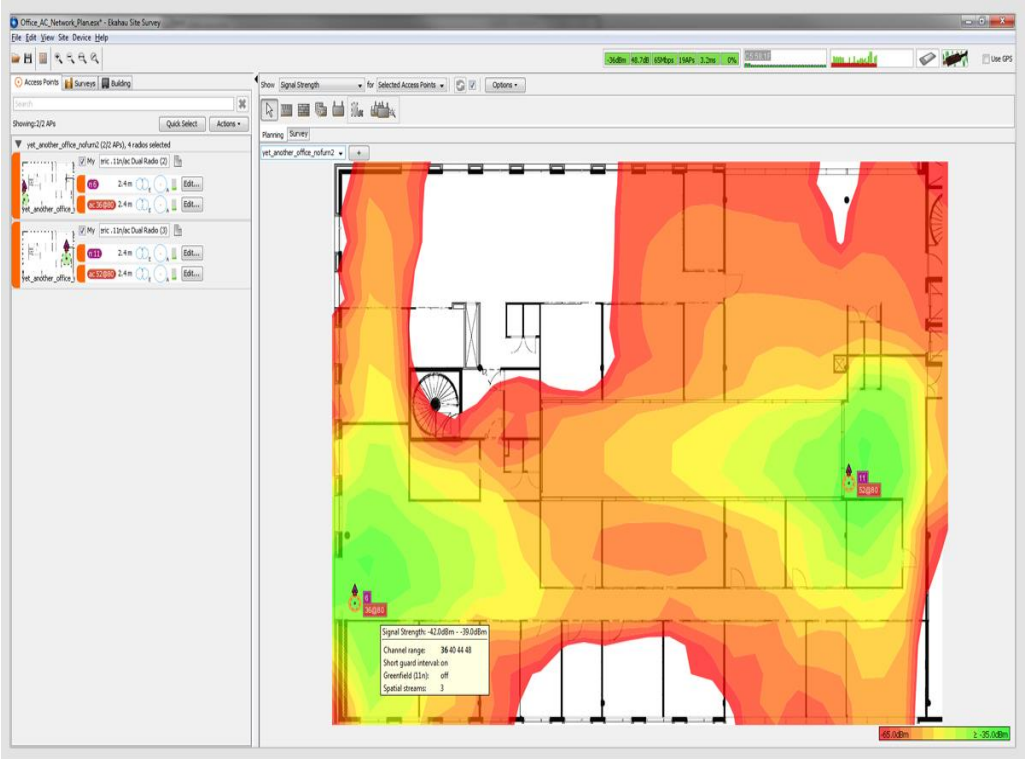
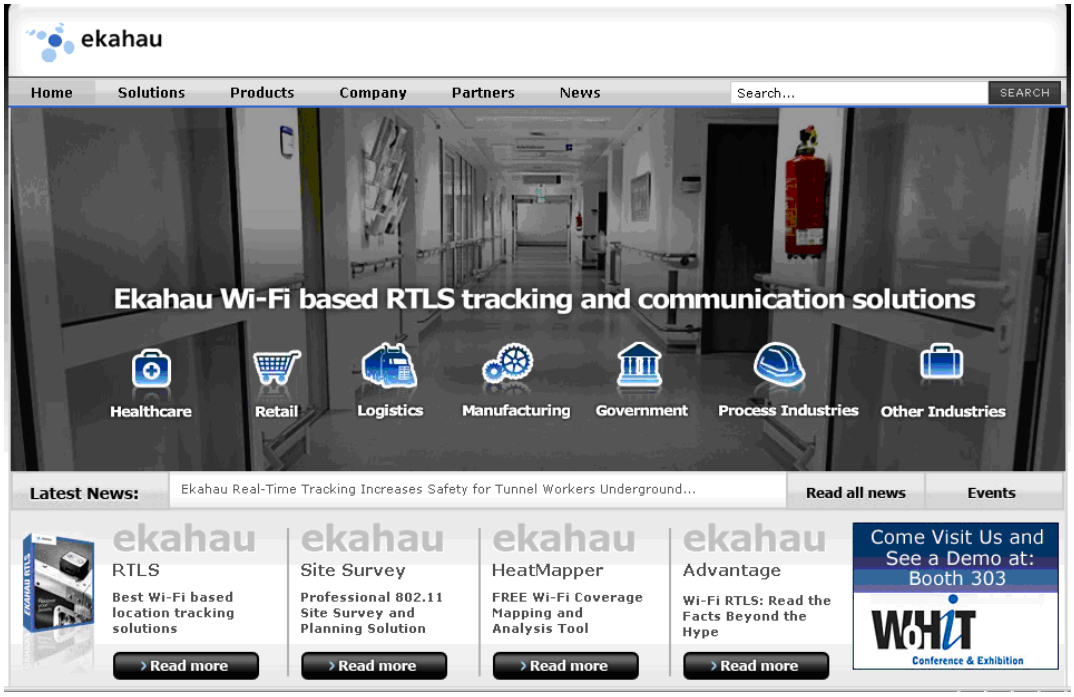


Figure 32: Survey Result

The above picture shows a site survey result done in 802.11a. Just compare the color to the scale. The target is to obtain a signal strength of **-60 dBm** or better required for OT81x8 and OT8128 SE (SIP Edition) WLAN handsets operation.

25.2. Site Survey Tool Example



Note: This Site Survey software is not orderable from ALE

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25.3. Embedded Site Survey on OT8118/8128

25.3.1. Show RSSI mode

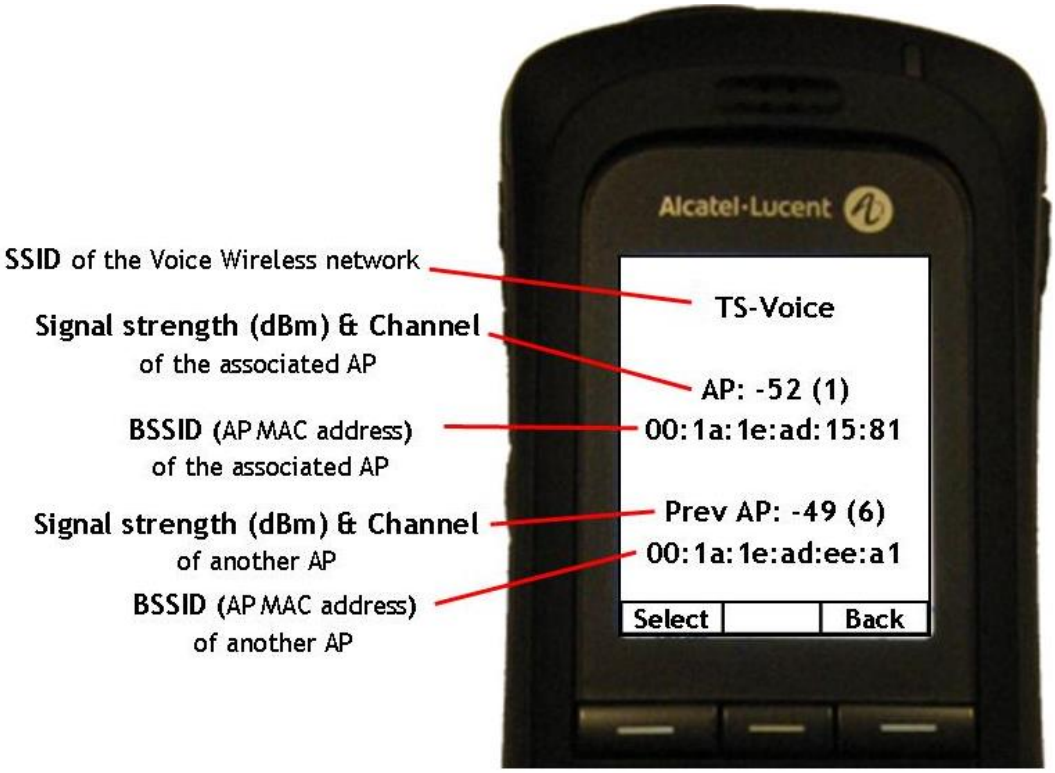

Figure 33: Show RSSI on OT81x8

An embedded Site Survey is present on OT8118, OT8128 and OT8128 SE (SIP Edition). This mode requires to reboot the OT81x8 and OT8128 SE (SIP Edition) WLAN handsets (offline mode). The OT81x8 and OT8128 SE (SIP Edition) "Show RSSI" provides the signal strength (in dBm), the channel and the BSSID (Basic Service Set Identifier) MAC address of the associated AP and also the signal strength (in dBm), the channel and the BSSID (Basic Service Set Identifier) MAC address of the another AP. It can be used at any time to evaluate coverage by testing signal strength, to gain information about an AP, and to scan an area to look for all APs regardless of SSID.

Note: This OT81x8 /OT8128 SE (SIP Edition) embedded site survey is not intended to replace the VoWLAN Site Survey tool, but provides additional diagnostics (handover capability).

25.3.2. Scan all Channels

Signal strength (dBm) & Channel for each discovered SSID

Figure 34: Scan all Channels

This mode displays the different SSIDs discovered by the OT81x8 & OT8128 SE (SIP Edition) and provides channel numbers and Signal Strength

26. Glossary

ACL Advanced Control List

AES Advanced Encryption Standard

AP Access Point

ARM Adaptative RF Management

BSSID Base Set Service ID

CAC Call Admission Control

CCKM Cisco Centralized Key Management

DECT/PWT Digital Enhanced Cordless Telephone /Personal Wireless Telephone

DFS Dynamic Frequency Selection

DHCP Dynamic Host Configuration Protocol

DoS deny of Service

DSCP Differentiated Services Code Point

EAP Enhanced Authentication Protocol

EIRP Equivalent Isotropically Radiated Power

FT Fast Fast Transition roaming 802.11r supported with WPA/WPA2

GMIP General Management IP

HT High Throughput

IEEE 802.1X is an IEE standard for port-based Network Access Control

IEEE Institute of Electrical and Electronics Engineers

IETF Internet engineering Task Force

IMS3 Integrated Messaging and Wireless Services

IPMG IP Media Gateway

L2 Layer 2 (MAC level)

L3 Layer 3 (IP level)

LAN Local Area Network

MAC Medium Access Control

MAN Metro Area Network

MIMO Multi Input Multi Output

MLE Medium/Large Enterprises

MU-MIMO Multi-User MIMO

NOE New Office Environment

NPS Network Policy Server

OFDM Orthogonal Frequency Division Multiplexing

OKC Opportunistic Key Caching

r OmniTouch 8118/8128 WLAN handset

OT8128 SE OmniTouch 8128 SIP Edition WLAN handset

OTBE OpenTouch Business Edition

OTC Cv OpenTouch Conversation for Conversation users

OTMS OpenTouch Multimedia Services

OXE OmniPCX Enterprise

OXO OmniPCX Office

PBX Private Branch eXchange

PEAP Protected Extensible Authentication Protocol

PMK (Pairwise Master Key) caching

PoE Power over Ethernet

PSK Pre shared key

PTT Push To Talk

PVM Primary Virtual Manager

QAM Quadratic Amplitude Modulation

QoS Quality of Service

RF Radio Frequency

RADIUS Remote Authentication Dial-In User Service

RFP Request For Proposal

RFQ Request For Quotes

RSSI Received Signal Strength Indicator

RTLS Real Time Location System

RTP Real Time Protocol

SIP Session Initiation Protocol

SNR Signal Noise Ratio

SSID Service Set Identifier

SVM Secondary Virtual Manager

TKIP Temporal Layer Security

TFTP Trivial File Transfert Protocol

TCLASS Traffic Classifications

TSPEC Traffic Specifications

U-APSD Unscheduled Automatic Power Save Delivery

UP User Priority

USB Universal Serial Bus

VHT Very High Throughput

VLAN Virtual Local Area Network

VoWLAN Voice over WLAN

VPN Virtual Private Network

WAN Wide Area Network

WinPDM Windows Portable Device Manager

WIP Wireless Intrusion Protection (WLAN license)

WEP Wired equivalent Privacy

WLAN Wireless Local Area Network

WMM Wi-Fi Multi Media

WMM-PS Wi-Fi Multi Media Power Safe

WPA Wi-Fi protected Access

WPA2 Wi-Fi protected Access

END OF DOCUMENT

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