A MITEL
PRODUCT
GUIDE

Unify OpenScape Cordless IP V2

Unify OpenScape Cordless IP V2R1

Service Documentation
07/2024

A31003-C1020-S100-08-7620

Mitel

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Contents

1 Introduction and Important Notes

1.1 Safety Information and Warnings

Work on communication systems and devices may **only** be carried out by qualified persons.

For the purposes of safety information and warnings, qualified persons are persons who are authorized to place into operation, ground, and label systems, devices, and lines in accordance with applicable safety procedures and standards.

It is absolutely essential that you read and understand the following safety information and warnings before starting installation and implementation work on the communication system or device.

You should also carefully read and observe all safety information and warnings on the communication systems and devices themselves.

Familiarize yourself with emergency numbers.

Types of safety information and warnings

The following grades of safety information/warnings are used in this manual:

DANGER

Indicates an immediate danger that could result in death or serious injury.

WARNING

Indicates a general danger that could result in death or serious injury.

CAUTION

Indicates a danger that could result in injury.

NOTE: Indicates situations that could result in damage to property and/or loss of data.

Symbols for specifying the source of danger more exactly

The following symbols are not usually used in the manual. They explain symbols that may be depicted on the communication systems and equipment.

* electrostatically sensitive devices

1.2 Correct Use

The communications system may only be used for the purpose described in this document and only in connection with the additional devices and components as recommended and permitted by Unify GmbH & Co. KG. The proper use of the communications system assumes correct transport,storage, assembly and setup as well as careful operation and maintenance.

Cluster forming

A cluster comprises a number of base stations of a DECT manager that synchronise with each other to enable handovers, roaming and load balancing.

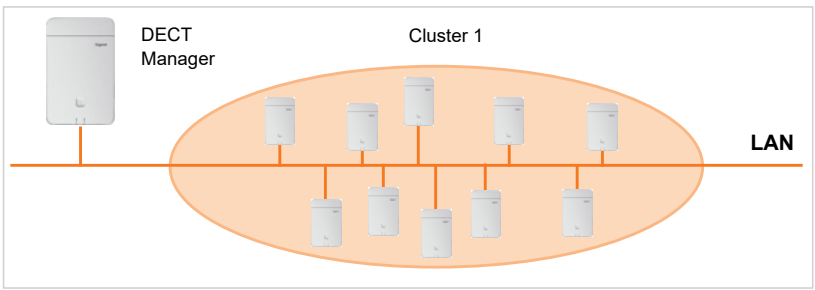
Handover: The DECT connection of a handset is passed to another base station during a call.

Roaming: A handset in idle mode is connected to the system via a new base station.

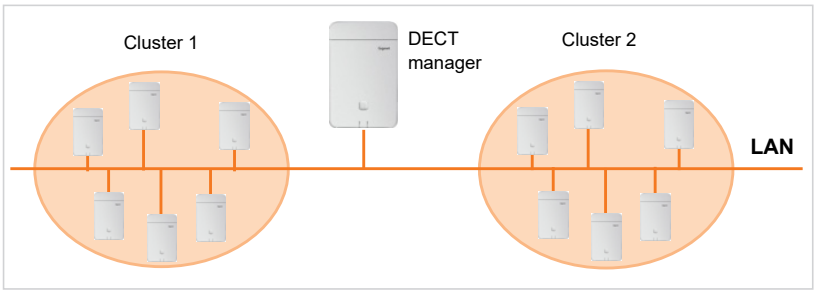
Load balancing: A DECT connection is not set up with the current base station for a call,
for administration or for other customer-specific purposes because it is overloaded with active DECT or media connections. It is instead set up with a neighbouring base station having free resources.

Handovers and load balancing can only be realised by base stations that are synchronised with each other.

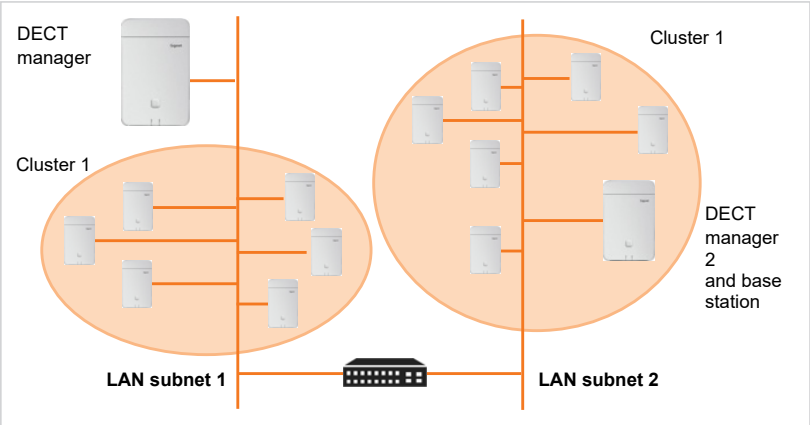
A DECT manager normally manages a cluster.



The DECT Manager is connected to the base stations and the PABX via the local network and is therefore not dependent on DECT ranges. Base stations that are far apart can be grouped into different clusters if synchronisation is barely, or not, possible, and is not required. All the base stations of a DECT manager must belong to the same LAN subnet of the DECT manager.



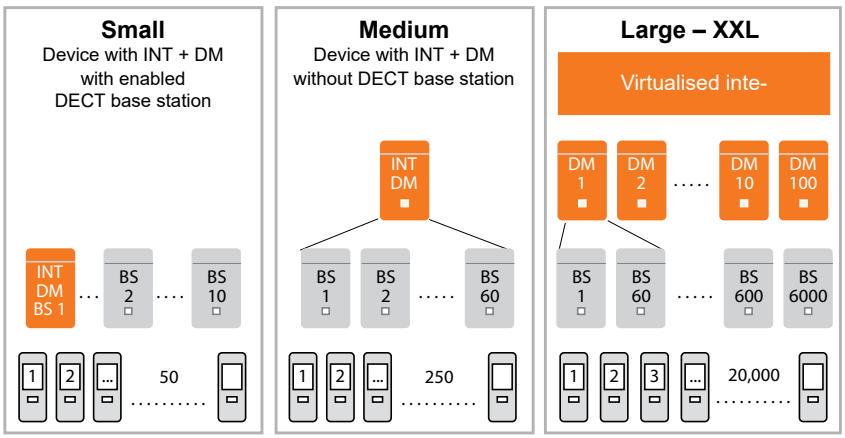
For installations in different LAN subnets, multiple DECT managers with one DECT manager per subnet are required. The DECT manager function can be installed in parallel on the same device (depending on the capacity of the local base station). Multiple DECT managers are also required when the requirement is to connect more than 250 handsets or provide more than 60 connection channels.



In installations with multiple DECT managers, handover and roaming between base stations of different DECT managers are possible when the clusters are synchronised. Load balancing is not possible.

Installations

Different build levels of the Unify OpenScape Cordless IP V2 can be installed.



INT = Integrator, DM = DECT manager, BS = Base station

Component	Small	Medium	Large
Base stations	Up to 10 BS functionality can be enabled on the INT/DM	Up to 60	Up to 6,000 Up to 60 per DM
Handsets	Up to 50	Up to 250 per DM	Up to 20,000
DECT manager	Integrator and DECT manager on the same device		Up to 100
Integrator			Virtual machine

NOTE: Gigaset offers the Gigaset N720 SPK PRO (Site Planning Kit) to help you with measuring the wireless coverage and quality of your DECT network.

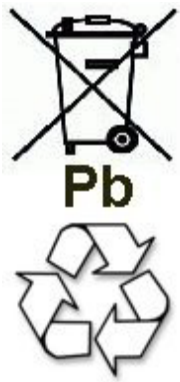
1.3 Proper disposal and recycling

All electrical and electronic products should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities.

The correct disposal and separate collection of your old appliance will help prevent potential negative consequences for the environment and human health. It is a precondition for reuse and recycling of used electrical and electronic equipment.

For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service, the shop where you purchased the product or your sales representative.

The statements quoted above are only fully valid for equipment which is installed and sold in the countries of the European Union and is covered by the directive 2002/96/EC. Countries outside the European Union may have other regulations regarding the disposal of electrical and electronic equipment.



Used accumulators and batteries with this sign are valuable economic goods and must be recycled. Used accumulators and batteries that are not recycled must be disposed of as hazardous waste with full observance of all regulations.

1.4 Standards and Guidelines on Installation

1.4.1 Labeling

The compliance of the equipment according to EU directives is confirmed by the CE mark. This Declaration of Conformity and, where applicable, other existing declarations of conformity as well as further information on regulations that restrict the usage of substances or affect the declaration of substances used in products can be found in the Unify Expert WIKI at http://wiki.unify.com under the section “Declarations of Conformity”.

This device has been manufactured in accordance with our certified environmental management system (ISO 14001). This process ensures that energy consumption and the use of primary raw materials are kept to a minimum, thus reducing waste production.

1.5 Data Protection and Data Security

This system processes and uses personal data for purposes such as call detail recording, displays, and customer data acquisition.

In Germany, the processing and use of such data is subject to various regulations, including those of the Federal Data Protection Law (Bundesdatenschutzgesetz, BDSG). For other countries, please follow the appropriate national laws.

The aim of data protection is to protect the rights of individuals from being adversely affected by use of their personal data.

In addition, the aim of data protection is to prevent the misuse of data when it is processed and to ensure that one's own interests and the interests of other parties which need to be protected are not affected.

The customer is responsible for ensuring that the system is installed, operated and maintained in accordance with all applicable labor laws and regulations and all laws and regulations relating to data protection, privacy and safe labor environment.

Employees of Unify GmbH & Co. KG are bound to safeguard trade secrets and personal data under the terms of the company's work rules.

In order to ensure that the statutory requirements are consistently met during service – whether on-site or remote – you should always observe the following rules. You will not only protect the interests of your and our customers, you will also avoid personal consequences.

A conscientious and responsible approach helps protect data and ensure privacy:

- Ensure that only authorized persons have access to customer data.
- Take full advantage of password assignment options; Never give passwords to an unauthorized person orally or in writing.
- Ensure that no unauthorized person is able to process (store, modify, transmit, disable, delete) or use customer data in any way.
- Prevent unauthorized persons from gaining access to storage media, such as backup CDs or log printouts. This applies to service calls as well as to storage and transport.
- Ensure that storage media which are no longer required are completely destroyed. Ensure that no sensitive documents are left unprotected.

Work closely with your customer contact; this promotes trust and reduces your workload.

1.6 Documentation Feedback

If you have questions that are not answered by this document:

- Internal employees should contact their National Support Center.
- Customers should contact their retailer or the Unify Customer Support Center.

When you call, please state the title and ID number of the document.

Example:

- **Title:** OpenScape Cordless IP V2, Service Documentation
- **ID number:** A31003-C1020-S100-01-7620

2 Planning a DECT multicell network

This document explains the preparations necessary to install a multi-cell DECT network and take measurements for the optimum positioning of the base stations. It also provides technical and practical background information.

2.1 Components of Unify OpenScape Cordless IP V2

Unify OpenScape Cordless IP V2 is a DECT multi-cell system for connecting DECT base stations to a VoIP PBX. It combines the options of IP telephony with the use of DECT telephones.

Section 2.1.1,	Central management
Section 2.1.2,	Management station for
Section 2.1.3,	DECT radio cells
Section 2.1.4,	Accepting or initiating

2.1.1 DECT integrator

Central management and configuration unit of the DECT multi-cell system.

The DECT integrator

- contains the central database for the DECT subscribers and base stations
- provides a web interface for configuring the entire cordless system
- enables access for configuration of all DECT managers and their base stations

2.1.2 DECT manager

Management station for a group of base stations. At least one DECT manager must be used in every installation.

The DECT manager

- manages synchronisation of the base stations within clusters
- acts as an application gateway between SIP and DECT signalising
- controls the media path from the phone system to the relevant base stations

2.1.3 DECT base stations

- form the wireless cells of the DECT phone network
- provide media processing from the handsets directly to the phone system
- make available connection channels for the handsets (the number is dependent on various factors, such as bandwidth approved) (refer to Section **Capacity** ¢ P. 22)

2.1.4 Handsets

- Many handsets are connected per DECT manager and many DECT calls can be held simultaneously (VoIP calls, and phone book or Info Centre accesses).
- Subscribers can accept or initiate calls in all DECT cells with their handset (**Roaming**), and can also switch between the DECT cells during a call (**Handover**). A handover is only possible when the cells are synchronised.

2.1.5 Phone system

Connect your DECT phone system to a VoIP phone system, e.g.:

- your own PABX (on-premise solution)
- a virtual phone system from an external provider (Cloud solution, hosted PBX)
- VoIP provider

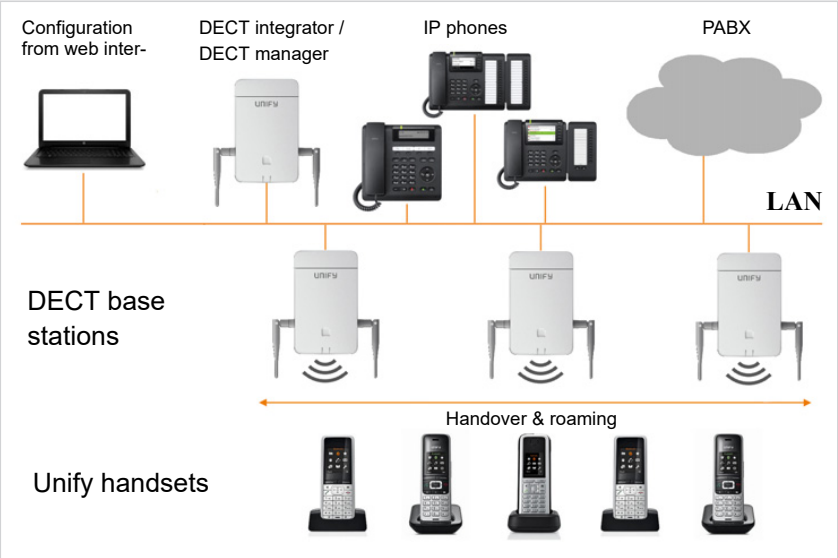
The phone system

- establishes the connection to a public phone network
- enables central management of phone connections, directories, network mailboxes.

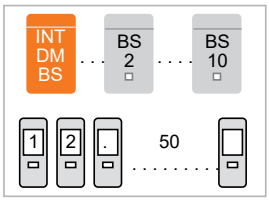
2.2 Unify OpenScape Cordless IP V2 installations

Different build levels of the Unify OpenScape Cordless IP V2 can be installed.

2.2.1 Small an medium installations

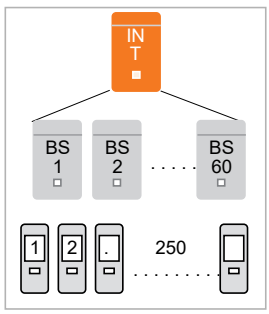


2.2.2 Small installations



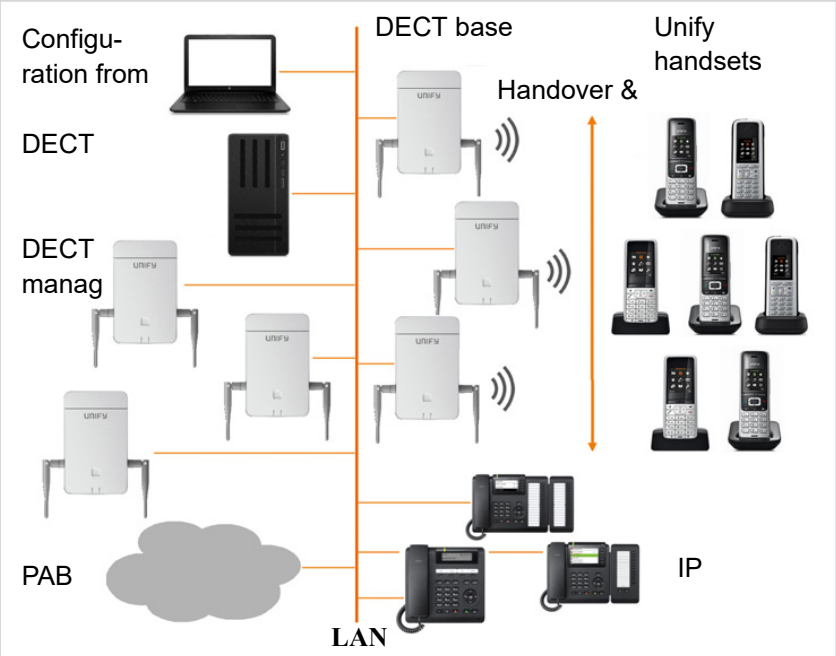
- Integrator, DECT manager and a base station are together at the same device.
- Up to 9 further base stations can be managed.
- Up to 50 handsets can be registered.

2.2.3 Medium installations



- Integrator and DECT manager are together at the same device. No base station is enabled at this device.
- Up to 60 base stations can be managed.
- Up to 250 handsets can be registered.

2.2.4 Large installations

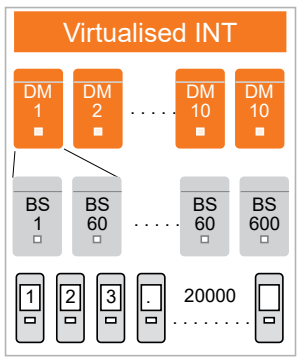


In a large installation the integrator is available as an own system component. An integrator is needed when:

- the system comprises more than 250 handsets
- you need more then 60 DECT base stations
- you want to manage more than one DECT manager via one web-interface
- you want to roam with the DECT handsets between multiple DECT managers/locations

2.2.5 Virtual integrator

- The integrator is available on a virtual machine.
- Up to 100 DECT managers can be used.
- Per DECT manager up to 60 base stations can be managed, 6000 in total.
- Up to 20000 handsets can be registered.



2.3 Cluster forming

A cluster comprises a number of base stations of a DECT manager that synchronise with each other to enable handovers, roaming and load balancing.

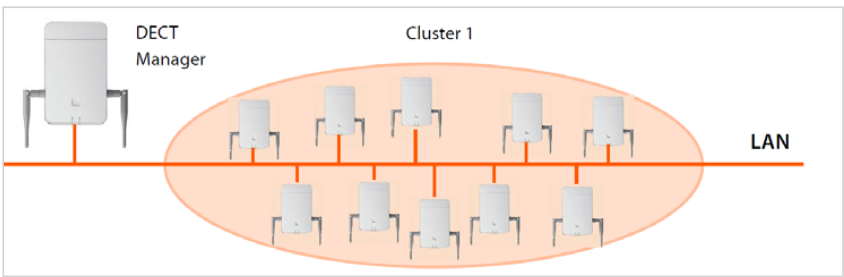
Handover: The DECT connection of a handset is passed to another base station during a call.

Roaming: A handset in idle mode is connected to the system via a new base station.

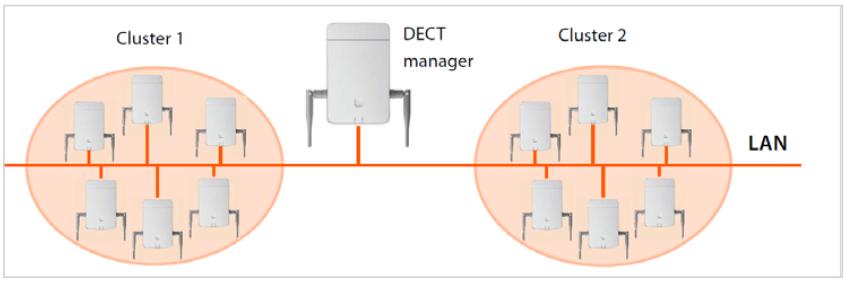
Overload balancing: Is the process to setup a DECT connection (for a call or other administrative or customer purpose) not at the current base station, which is fully loaded with active DECT or media connections, but via neighbour base station, which has free resources to setup/ accept the new DECT connection. While handover and roaming is possible between base stations of different DECT managers, overload balancing is only possible inside the area of one DECT manager.

Handovers and load balancing can only be realised by base stations that are synchronised with each other.

A DECT manager usually manages one cluster.

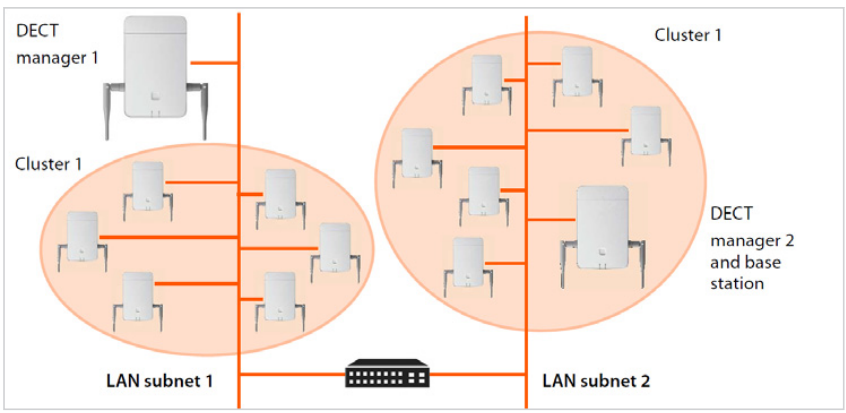


The DECT manager is connected to the base stations and the PABX via the local network and is therefore not dependent on DECT ranges. Base stations that are far apart can be grouped into different clusters if synchronisation is barely, or not, possible, and is not required. All the base stations of a DECT manager must belong to the same LAN subnet of the DECT manager.



2.3.1 Large installations

For installations in different LAN subnets, multiple DECT managers with one DECT manager per subnet are required. The DECT manager function can be installed in parallel on the same device (depending on the capacity of the local base station). Multiple DECT managers are also required when the requirement is to connect more than 250 handsets or provide more than 60 connection channels.



In installations with multiple DECT managers, handover and roaming between base stations of different DECT managers are possible when the clusters are synchronised.
Load balancing of attached handset from fully handset loaded DECT manager to alternative DECT manager is not possible.

For more information on this, refer to Section **Large installations: Using multiple DECT managers** ¢ P. 40.

2.4 Criteria for an optimum DECT wireless network

A carefully planned DECT wireless network with adequate coverage is the prerequisite for operating a telephone system that offers good call quality and sufficient call options for all subscribers in all buildings and areas belonging to the PABX.

It is difficult to assess the technical wireless conditions of a DECT installation in advance as they are influenced by many environmental factors. Therefore, the specific circumstances on-site must be determined by taking measurements. This leads to a reliable conclusion about the material required as well as the locations of the wireless units.

Various aspects need to be taken into consideration when planning a DECT wireless network. The following requirements must be considered when deciding how many base stations are required and where they should be placed:

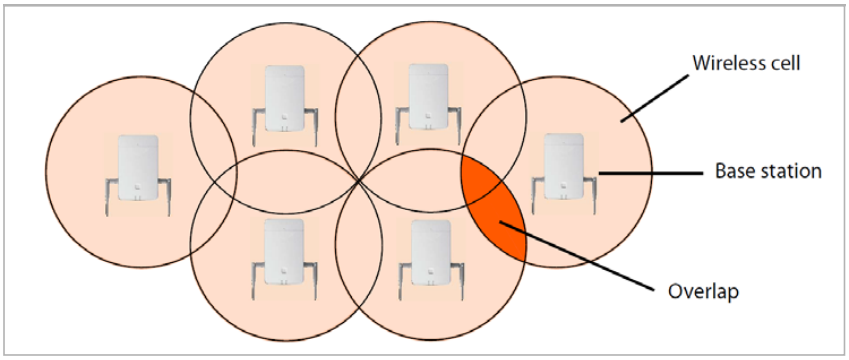
- Sufficient DECT wireless coverage of the entire site so that every subscriber can be reached.
- Sufficient wireless channels (DECT bandwidth), in particular in "hotspots", to avoid capacity bottlenecks.
- Sufficient overlap of cells to enable synchronisation of the base stations and to guarantee freedom of movement for subscribers when making calls.

2.4.1 Wireless coverage

The selection of locations where the base stations are to be installed should guarantee optimum wireless coverage and enable cost-effective wiring.

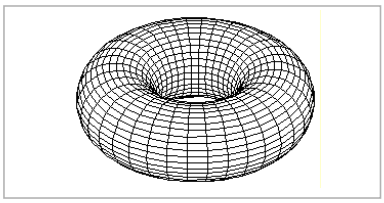
Optimum wireless coverage is achieved if the required reception quality is delivered at all points of the wireless network. If costs need to be considered, this should be done with a minimum number of DECT base stations.

To ensure an interference-free switch of call connections from one cell to another (handover), there must be an area where good reception is ensured for both base stations. To achieve this, a minimum quality for reception must be defined.

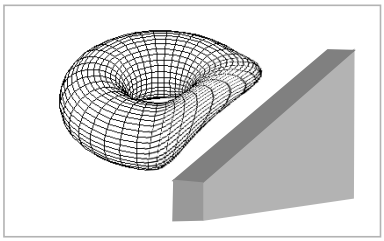


2.4.2 Signal transmission

The ideal signal transmission of a base station is shaped like a ring, i.e., so that the registered handsets can be the same distance away from the base station in all directions without the wireless signal being interrupted.



The range is actually influenced by a variety of environmental conditions. For example, obstacles such as walls or metal doors can impede the wireless signals or interfere with their uniform transmission.



You should investigate the actual conditions that the planned wireless network will be subjected to by measuring the signal transmission of the measuring base station at appropriate positions.

2.4.3 Capacity

The capacity of the cells must be high enough to guarantee that the subscribers can be reached in high-density traffic. A cell is at full capacity when the number of connections required for each base station is higher than the number of possible connections.

On the one hand, the number of parallel connections possible is dependent on the approved codecs that can be used for the connections. Which codecs are approved can be set from the web interface. The device function also has a bearing on capacity. An OpenScape Cordless IP V2 device can only be deployed as a base station, a DECT

manager with base station, or an integrator with DECT manager and base station. Also note that a DECT manager can manage a maximum of 60 connection channels in parallel.

The following table shows the maximum number of possible connections in relation to the device function and approved codecs.

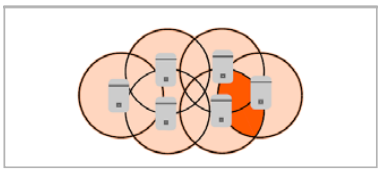
Approved codecs	Only BS	BS + DM	Base + DM + INT
G.711 only	10	8	5
G.729 and G.711	8	5	5
G.722 and G.729 and G.711	5	5	5

When the system is first delivered, all codecs are approved in the configuration. Broadband codec G.722 needs to be enabled explicitly however.

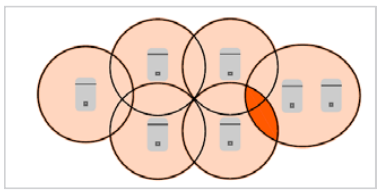
Narrowband mode ¢ P. 96; **Broadband mode** ¢ P. 92

There are two options for increasing capacity:

- Reducing the distance between the base stations.
  This means that the cells overlap more, giving the subscriber access to the base stations of the neighbouring cells. This results in more even wireless quality. However, this can result in considerable installation costs for an existing system.



- Installing parallel base stations.
  The cell size remains generally constant but the number of possible connections increases. Installing the base stations close to one another means that the additional assembly costs are low. A minimum distance between base stations must be observed however (£**Technical conditions**, p. 40).

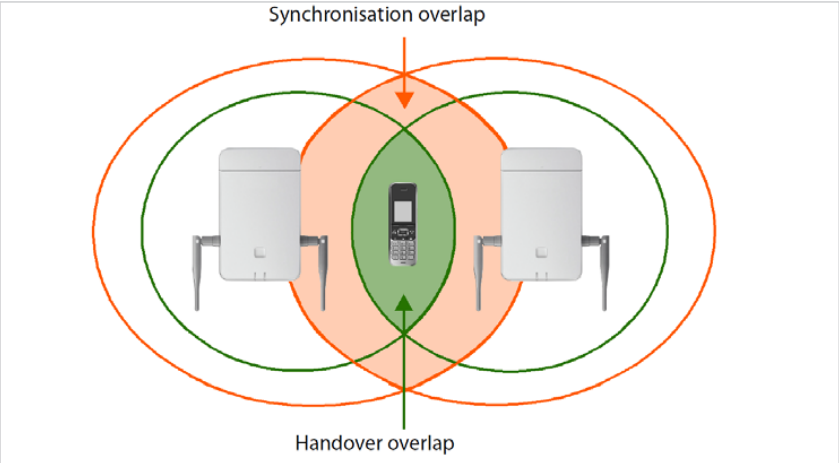


To keep the costs low for the devices, and for installation and maintenance, the typical requirement is to keep the number of base stations as low as possible. Despite this, as much as necessary needs to be planned to safeguard capacity and wireless coverage.

If entire call capacity at single base station is busy, handsets load balance to free capacity on neighboured base stations. Density of base stations must be planned to provide sufficient call capacity in any given area. In areas where high traffic volumes are expected, e.g. install a second base station.

2.5 Overlapping and synchronising

For interference-free cooperation in a multi-cell DECT network, the base stations must synchronise. In order to synchronise the base stations and ensure a smooth handover, the cells must overlap.



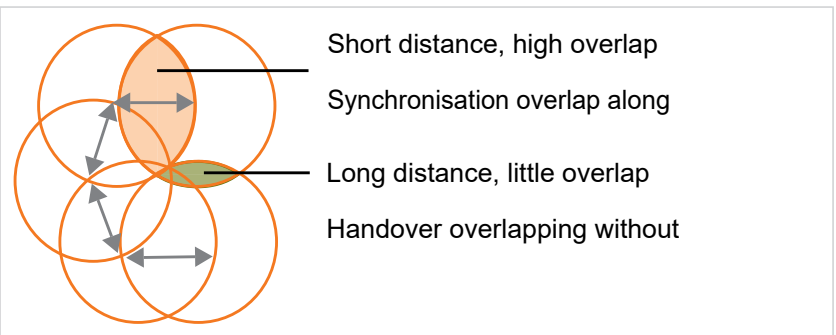
A sufficiently high number of overlapping zones between neighbouring cells must be ensured.

- For synchronisation, neighbouring cells must mutually receive DECT signals having continually good quality.
- For a handover, a handset must have a connection of sufficient quality to both base stations.

Information on the values required is in Section **Defining thresholds** (¢ p. 55).

The more densely the base stations are installed, the greater the overlap. Here, a compromise must be found between keeping the area relatively open and installing the lowest possible number of base stations.

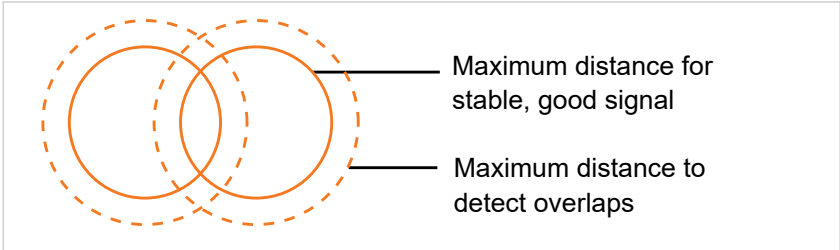
The conditions for synchronisation overlap require a shorter distance between the base stations than for a handover. However, the strict requirements are only relevant for base stations along the synchronisation path. Neighbouring base stations that do not synchronise directly with each other can be installed further away from each other.



To keep the synchronisation hierarchy flexible (e.g. when the requirement is to optimise synchronisation paths after installation, or to use redundant synchronisation paths), planning short distances for only one synchronisation path is not recommended. The recommendation from actual applications is the pragmatic solution of planning distances such that DECT synchronisation is possible between most neighbouring base stations. This is of course also dependent on the ambient conditions. Thick concrete ceilings or walls would not permit direct DECT synchronisation for example.

Necessary overlapping for LAN synchronisation

When the connection quality is not high enough in certain areas, base stations can also be synchronised over LAN. Between base stations synchronised over cable, the distances can be greater and the overlapping zones smaller. However, it is not possible either between these base stations to increase the distance to a minimum handover overlap. So that no signal overlaps of two base stations occur on the handsets, base stations must always detect the channels that neighbouring base stations are assigned in the process of dynamic channel assignment.



More information on LAN synchronisation is in operating instructions “Unify OpenScape Cordless IP V2 – Installation, Configuration and Operation”

2.6 Synchronisation planning

Base stations that combine to form a DECT wireless network must synchronise with one another to ensure a smooth transition of the handsets from cell to cell (handover). No handover and no (overload) balancing is possible between cells that are not synchronised. In the event of loss of synchronisation, the base station stops accepting calls once all ongoing calls that were being conducted on the asynchronous base station have ended and then it re-synchronises the asynchronous base station.

Base stations can be synchronised "over the air", meaning that they are synchronised via DECT. If the DECT connection between specific base stations seems to be not reliable enough, synchronisation can also take place via LAN. To carry out the synchronisation you will need the plan of the clusters with the synchronisation level for each base station.

The synchronisation within a cluster takes place in a master/slave procedure. This means that one base station (sync master) defines the synchronisation cycle for one or more additional base stations (sync slaves).

The synchronisation needs some kind of synchronisation hierarchy with the following criteria:

1 There must be one single and common root source for the synchronisation in the hierarchy (sync level 1).
2 With synchronisation over LAN there are just two levels needed (LAN-Master and LAN-Slave).DECT synchronisation usually needs more than two levels and just one hop, because most base stations won't be able to receive the DECT signal from the root source of the synchronisation (sync level 1). DECT signal providing reference timer synchronisation is relayed along a chain of multiple base stations, until it finally synchronises the last base station in a sync chain.
3 The number of hops along any branch of DECT synchronisation tree should be minimised, because any hop can introduce jitter in the synchronisation timer and could so lower the quality of the synchronisation.

2.6.1 DECT-based synchronisation

To relay DECT synchronisation signals from base station A to base station B, base station B must be able to receive signals from base station A with sufficient signal quality.

This means that the signal strength between neighbouring base stations must be sufficient for synchronisation. The guide value is a minimum of –65 dBm, but this can also be influenced by environmental conditions. For further information on this, refer to Section **Defining thresholds**, ¢ P. 55.

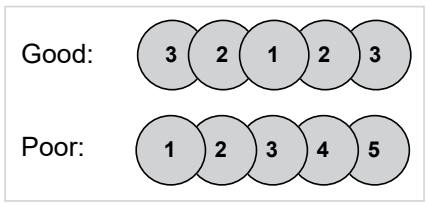
DECT manager and base stations must be connected to the same Ethernet or virtual LAN sharing a common broadcast domain.

A base station can synchronise with each base station on a higher sync level. The sync level concept allows base stations to automatically select the best suitable base station (having a lower sync level number) to receive synchronisation signal from. Simultaneously, it guarantees a strictly limited number of hops along any branch in the synchronisation tree and to prevent circles between automatically optimised synchronisation chains.

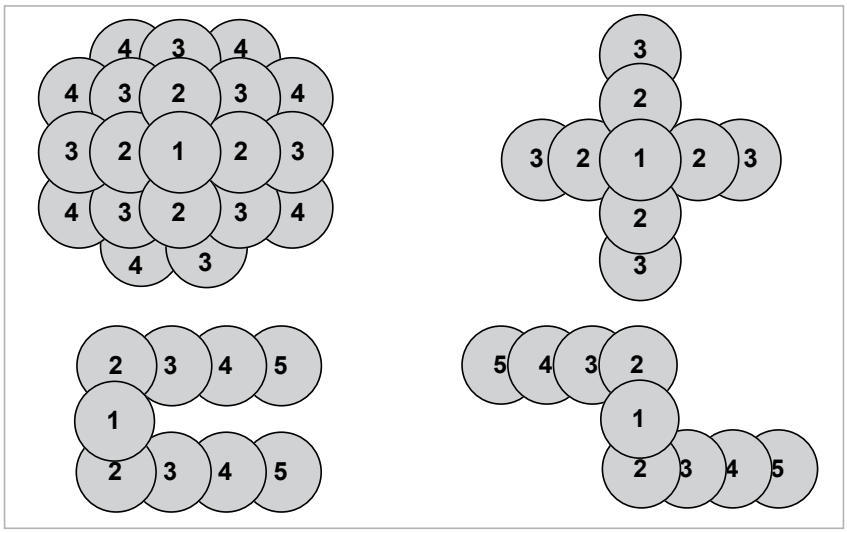
During configuration, assign one level in the synchronisation hierarchy (sync level) to each base station. Sync level 1 is the highest level; this is the level of the sync master and appears only once in each cluster. A base station always synchronises itself with a base station that has a better sync level. If it sees several base stations with a better sync

level, it synchronises itself with the base station that provides the best signal quality. If it does not see any base station with a higher sync level, it cannot synchronise.

During the synchronisation planning phase, make sure that the distance to the base station with sync level 1 is as short as possible from all sides, i.e., that there are as few levels as possible. It makes sense to select the station that is at the centre of your DECT network as the base station with sync level 1.



Depending on the topology of your DECT network, your synchronisation hierarchy could look like this, for example.



Summary: For DECT based synchronisation consider the following rules.

- There can be only one level 1 in a cluster.

- A base station can synchronise with each base station on a higher sync level.
- DECT manager and base stations must be connected to the same Ethernet or virtual LAN sharing a common broadcast domain.
- Minimise the DECT levels as much as possible.
- Sufficient signal quality between base stations is needed (-65dBm) along a synchronisation path.
- For redundancy reasons you may plan for multiple synchronisations paths.

2.6.2 LAN-based synchronisation along the synchronisation path

If the DECT connection between base stations seems to be not reliable enough to permanently guarantee a stable DECT over the air synchronization, e.g., because they are separated by iron doors or a firewall, you can determine that synchronisation should take place via LAN. In this case the base station with the higher sync level will act as LAN master, the base station with the lower sync level is a LAN slave. One base station must be explicitly be defined as LAN master.

Advantages of LAN synchronisation compared with DECT synchronisation:

- Higher flexibility in the arrangement of the base stations as no synchronisation chains need to be formed.
- Fewer base stations required as the overlapping area of the base stations is smaller. The overlapping area for handset handover can be smaller, because neighboured base stations do not need to receive each other in stable error free quality, but they must still be able to detect each other for the process of dynamic channel selection.
- Configuration of the system is simplified as all base stations can be synchronised on one synchronisation master.

2.6.3 Requirements

Network requirements:

- The Unify OpenScape Cordless IP V2 devices must be connected to a switch port of minimum
  100 Mbit/s with corresponding cabling.
- The DECT manager and all its base stations must be in the same layer 2 segment (common broadcast domain).

Requirements for LAN synchronisation:

- Minimum number of switch hops between master and all slave base stations.
- Enterprise class switches, internally and uplink switching for >= 1Gbit/s.

- VLAN based QoS could be fruitful to minimise packet delay and its jitter. Switch port based VLAN can isolate base stations from other devices' traffic.
- DSCP (Differentiated Services Codepoint) based QoS could be even more efficient.
  DSCP tagging:

Sync via LAN:	PTPv2, DLS (proprietary): DSCP=CS7=56
RTP:	DSCP=EF=46
SIP:	DSCP=AF31=26

- Synchronisation via LAN makes intensive use of IP multicasts which have to be supported by the switches.
  Multicast destination address and ports:

PTPv2:	224.0.1.129	UDP via ports 319/320
Proprietary DLS protocol:	239.0.0.37	UDP via ports 21045/21046

  Cascaded switches might need uplink switching of these multicast packets to allow inter-switch LAN synchronisation. Otherwise you need isolated LAN-sync clusters, inter-cluster-synchronized via DECT.
- IGMP snooping is supported and shall be supported by the switch, to configure and minimise multicast distribution only to the LAN synchronising base stations.

2.6.4 Packet delay jitter

Minimum packet delay jitter is crucial for successful synchronisation over LAN. As multiple LAN traffic parameters could have an impact on packet delay and its jitter, specific switches and maximum number of switch hops are required, to guarantee sufficient maximum packet delay jitter.

Consider the following:

- The less switch hops, the lower the transmission delay and its jitter will be.
- The higher the bandwidth or quality of used switches is regarding packet delay and its jitter, the lower the packet delay and the lower the packet delay jitter will be.
- Enhanced packet processing logics (like L3 switching or packet inspection) could have significant negative impact on the resulting packet delay jitter. If possible, they should be deactivated for HiPath HG 1500 base stations connected switch ports.
- Significantly increased traffic load on a switch, in the range of the maximum throughput, could have significant negative impact on the packet delay jitter.
- VLAN based prioritisation of LAN packets could be a fruitful measure to minimize packet delay and its jitter for OpenScape Cordless IP V2 base stations.

2.6.5 Cluster selective LAN synchronisation

For LAN synchronisation a cluster needs to be assigned to a PTP domain. This assignment takes place via the cluster number.

Cluster numbers from 1-c to 7-c (c = common PTP sync domain)

- Build up one **common** PTP sync domain

Clusters numbers 8-i to 15-i (i = isolated PTP sync domain)

- Build up an **isolated** PTP sync domain per each such cluster number
- Use a proprietary DLS (DECT over LAN Sync) which synchronizes the clusters isolated within one DECT manager.

For all clusters

- Multiple DLS domains are possible per DECT manager as DECT manager clusters.
- Maximum one LAN master per cluster.
- DLS sync master and slave do care for matching DECT manager and cluster numbers
- Multiple DLS domains possible per DECT manager as DECT manager clusters
- Inter-DM-LAN sync is only possible with matching cluster number (independent from PTP-domain)

A cluster forming an isolated PTP domain needs to have one LAN master of its own.

DECT managers forming one common LAN synchronisation domain need to use a cluster number from common domain (1..7) or an identical cluster number of isolated domain (8..15).

DECT managers using different PTP domains (cluster numbers 8..15) cannot be synchronised by inter-DECT manager LAN synchronisation rule (Reference=**LAN Master of DM x**), but only by inter-DM DECT synchronization rule.

The mentioned PTP domain in aspect of cluster numbers is only relevant for LAN master and LAN slave base stations. For DECT synchronisation, cluster numbers do not have any additional relevance beside just identifying different clusters.

2.6.6 Acceptable Network Jitter for LAN-synchronisation

LAN synchronisation is based on a two layer design:

- Native PTPv2 is used to synchronise a common reference timer along all base stations involved.
  Target quality benchmark to provide sufficient PTP synchronisation along the base stations, is to have a **PTP deviation lower than 500ns** (rms). For this PTP synchronisation a few single deviations >

500ns are accepted and might just generate first warnings. If the PTP sync packet deviation does continuously exceed this limit of 500ns, the PTP synchronisation is considered broken and will lead to new start synchronisation procedure.

- Based on the PTP synchronisation LAN master and LAN slave adjust their DECT reference timer to one common offset to the common PTP reference timer. This common offset will be permanently monitored by a proprietary communication.

  The target quality benchmark for this synchronisation level is to see reference timer deviation by this DECT reference timer sync packets: **DECT-LAN-Sync deviation lower than 1000ns**. A good mean value would be 500ns (rms).

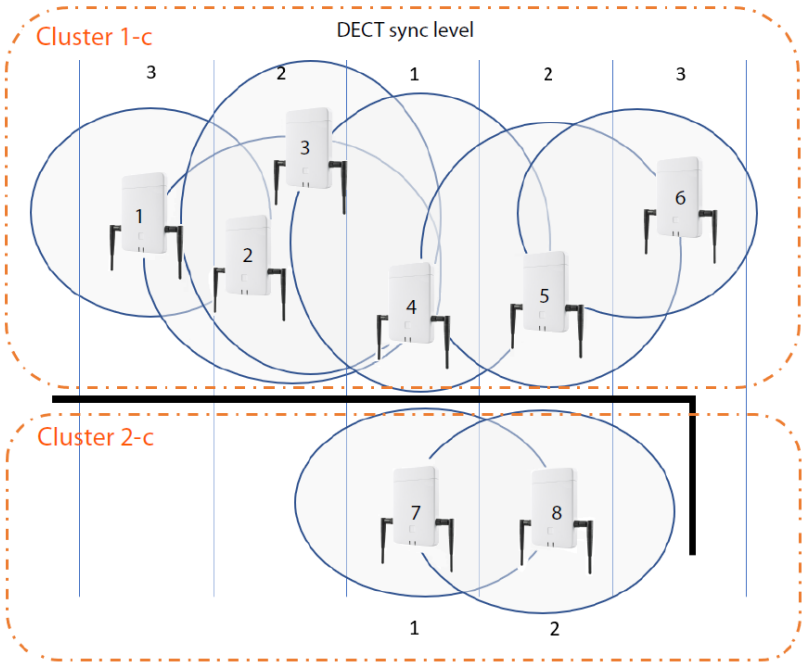
To meet this criteria the switches themselves do not necessarily need to be PTP aware. But the network should consider the above mentioned guidelines to meet this criteria.

2.6.7 Example scenarios for small/medium systems (single DECT manager clusters)

Synchronisation for handovers between base stations in clusters managed by one DECT manager are configured via the base station administration using the web configurator. Below are some example scenarios. Detailed information on configuration can be found in the Unify OpenScape Cordless IP V2 Administration Guide.

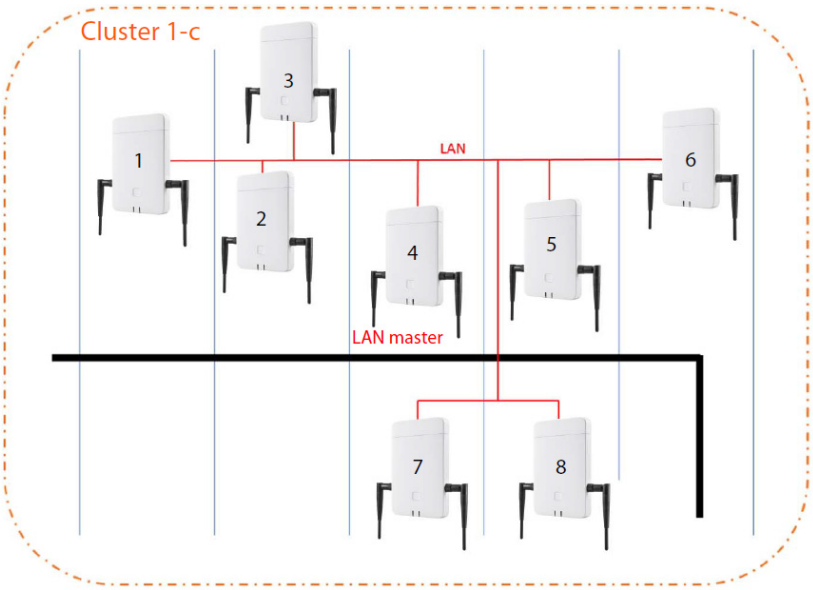
2.6.8 Scenario 1: Pure DECT

- Your environment ensures a stable DECT over the air synchronisation
- Cluster 1-c is created to insure handover, roaming and load balancing
- The base station in the centre is DECT level 1 to reduce the amount of sync levels
- Environment blocks DECT signal (e.g., a passage through a fire door)
- Second cluster 2-c is created to cover the area that can't be reached by cluster 1-c
- No handover (active calls are disconnected when switch over between clusters)
- Roaming between clusters is possible (handsets in idle mode can switch between clusters)



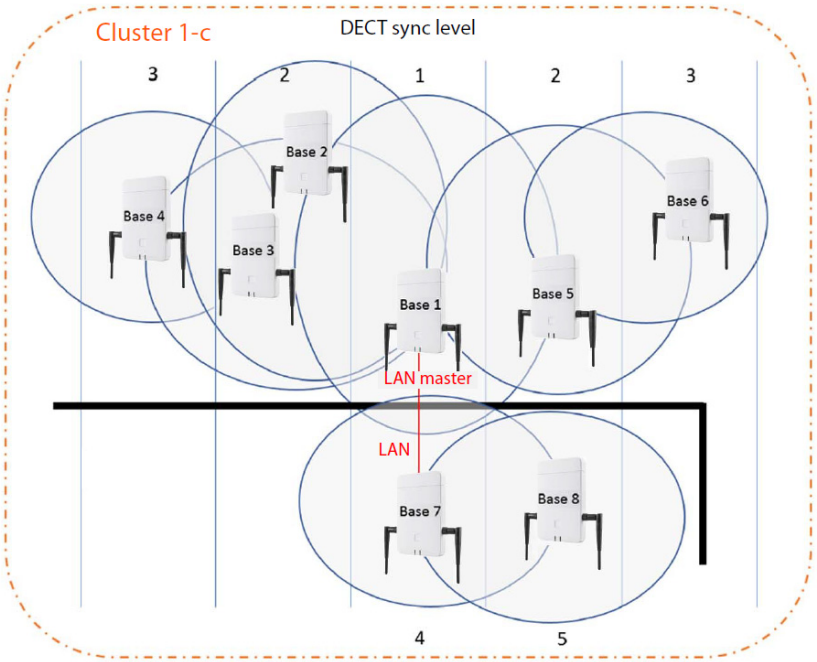
2.6.9 Scenario 2: Pure LAN

- Use such a configuration, if all requirements for LAN synchronisation are fulfilled
- Cluster 1-c is created to insure handover, roaming and load balancing
- Base 4 is configured as LAN master
- DECT level has no relevance for pure LAN synchronisation
- Handover and roaming is possible within the whole DECT environment
- That LAN sync is used, does not mean that DECT signal range is not important



2.6.10 Scenario 3: DECT-LAN mixed

- Use such a configuration, if your environment is mainly able to synchronise via DECT but there are particular circumstances which cannot always guarantee reliable DECT synchronisation, e.g., a passage through a fire door
- Cluster 1-c is created to insure handover, roaming and load balancing
- Base station 1 in the centre is DECT level 1 to reduce the amount of sync levels
- Base 1 with DECT level 1 is configured as LAN master
- For each base lower than the LAN master you can individually decide whether it should be synchronised via DECT or LAN
- Base 7 is synchronised via LAN and has DECT sync level 4
- Base 8 is synchronised via DECT and will synchronise with Base 7 via DECT, therefore the DECT sync level 5


Cluster 1-c
DECT sync level
3
2
1
2
3
Base 2
Base 4
Base 3
Base 6
Base 1
Base 5
LAN master
LAN
Base 7
Base 8
4
5

2.6.11 Example scenarios for large systems (multiple DECT manager clusters)

Synchronisation for handovers between base stations in clusters managed by different DECT managers are configured via the DECT manager administration using the web configurator. Below are some examples based on two DECT managers. Detailed information on configuration can be found in the Unify OpenScape Cordless IP V2 Administration Guide.

Scenario 1: DECT – DECT – DECT

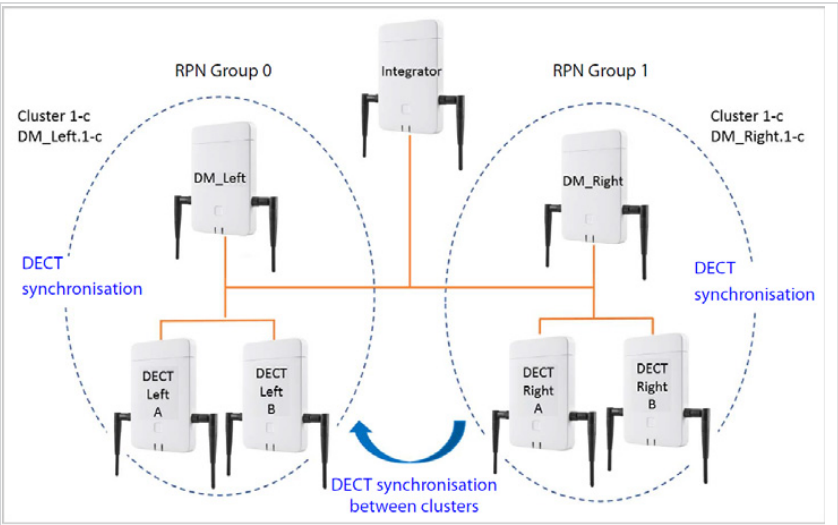
- Integrator (virtual or embedded)
- Two devices with role of DECT manager only
- Every DECT manager has two DECT base stations
- Cluster 1-c on the left side uses DECT synchronisation
- Cluster 1-c on the right side uses DECT synchronisation too (even if the name is the same, it is a different cluster as it is part of another DECT manager)
- Between the clusters also DECT synchronisation is used

Advantage:

- You can move within the system with handover and roaming.
- DECT synchronisation, no network requirements for LAN sync.

Attention:

- Enough DECT signal quality should be available within the complete system, also between the clusters.
- Every DECT manager must have a different RPN group.



Scenario 2: DECT – DECT – LAN

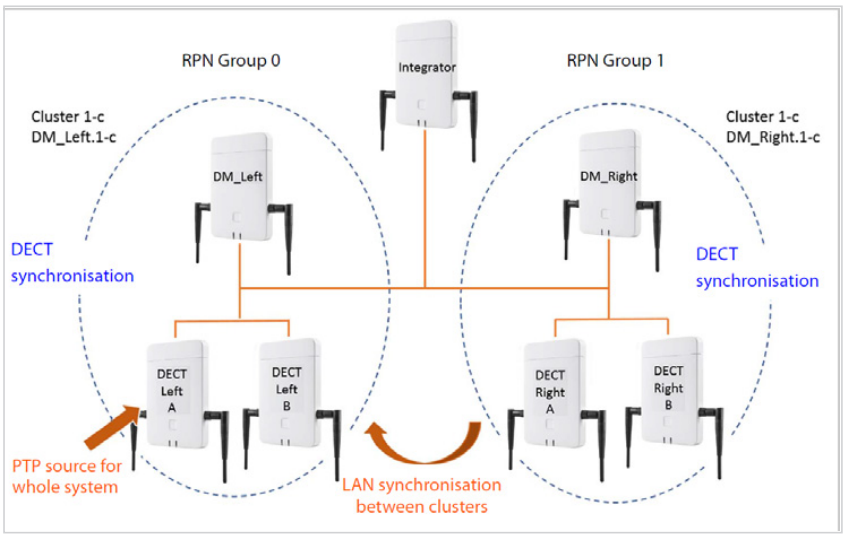
- Integrator (virtual or embedded)
- Two devices with role of DECT manager only
- Every DECT manager has two DECT base stations
- Cluster 1-c on the left side uses DECT synchronisation
- Cluster 1-c on the right side uses DECT synchronisation too (even if the name is the same, it is a different cluster as it is part of another DECT manager)
- Between the clusters LAN synchronisation is used
- Base station **DECT_Left_A** is the PTP source

Advantage:

- You can move within the system with handover and roaming.
- Synchronisation between the two clusters was not possible due to DECT signal range was not enough. LAN sync is the solution.

Attention:

- The customer network between the clusters must be capable to be used for LAN synchronisation. This needs more configuration in the customer network then using DECT synchronisation.



Scenario 3: LAN – LAN with isolated PTP domain – DECT

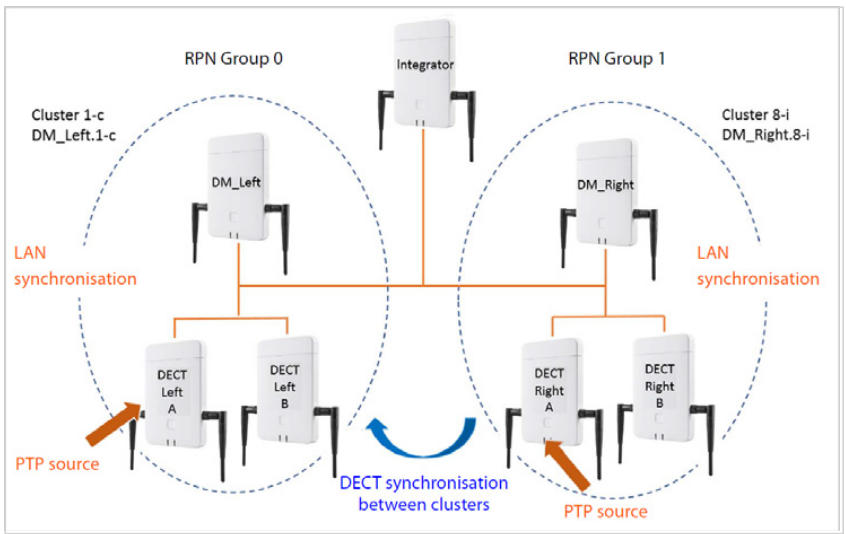
- Integrator (virtual or embedded)
- Two devices with role of DECT manager only
- Every DECT manager has two DECT base stations
- Cluster 1-c on the left side uses LAN synchronisation
- Cluster 8-i on the right side uses LAN synchronisation (cluster 8-i is the first isolated cluster)
- Between the clusters also DECT synchronisation is used
- DECT base **Left A** is the PTP source for cluster 1-c
- DECT base **Right A** is the PTP source for cluster 8-i

Advantage:

- You can move within the system with handover and roaming.

Attention:

- The customer network must be capable to be used for LAN synchronisation. This needs more configuration in the customer network then using DECT synchronisation.
- Every DECT manager must have a different RPN group.



3 Projecting the DECT network

There are a number of conditions to be considered when setting up a DECT network. They affect the subscribers' requirements for the telephone system as well as the technical requirements for the DECT wireless network. These conditions must therefore be recorded and evaluated
in a projection phase.

To project your DECT network, proceed as follows:

- First determine the requirements for the telephone network and establish the environmental conditions for the DECT wireless network.
- Define how many base stations are required and their probable optimum positioning. Create an installation plan for the base stations.
- **Large installations:** Specify how many DECT managers are required. You need an additional DECT manager when the base stations are not in the same LAN subnet, and when you use more than 60 base stations and/or more than 250 handsets. You can deploy a maximum of 100 DECT managers. In a multi-DECT manager system, you require an integrator as a virtual machine (¢ p. 31).
- Take measurements to check whether the positioning of the base stations at the assumed
positions meets the requirements and whether the reception and sound quality is sufficient
everywhere. If necessary, change the installation plan to optimise the DECT wireless network.

3.1 Determining the requirements for the telephone network

Clarify the following to determine the requirements for the telephone network:

3.1.1 Subscribers and subscriber behaviour

- How many employees should be able to make calls and how many subscribers should be able to make calls simultaneously?
  - How many handsets are required?
  - How many base stations are required?
- Where should telephone calls be possible?
  - In which buildings (floors, stairwell, basement, underground garage)?
  - Outdoors (on footpaths, on the car park)?
    For more information on this, refer to Section **Outside area** ¢ P. 49.
  - How are the handsets distributed from a location perspective?
- How many calls will be made?
  - What is the telephony behaviour of the subscribers? How long is the average call?
  - Where are the hotspots, i.e., where do a lot of subscribers gather simultaneously
    (open-plan office, canteen, cafeteria, etc.)?

- Where are telephone conferences held? How many telephone conferences are held and how long are these?

3.1.2 Environmental conditions

- Where is the site that is to be covered by the DECT wireless network?
  - Total area of the required wireless coverage
  - Position and dimensions of the rooms, building plan
  - Number of floors, basements
  - ¤ Request a building plan that shows positions and dimensions and that can be used to document the subsequent installation planning.
- What is the basic structure of the building?
  - What materials and construction types have been used for the buildings?
  - What type of windows does the building have (e.g., tinted glass)?
  - What construction changes are expected in the near future?
- What interference influences can be identified?
  - What are the walls made of (concrete, brick, etc.)?
  - Where are the lifts, fire doors, etc. located?
  - What furniture and devices are present or planned?
  - Are there other wireless sources in the vicinity?

For detailed information on material characteristics and interference factors, ¢ P. 45.

3.2 Conditions for the positioning of the base stations

3.2.1 Conditions of the OpenScape Cordless IP V2

In the planning stage, you must take into account which build level of the Unify OpenScape Cordless IP V2 multi-cell system you install, which codecs you use and which role a device used has.

Installation

- **Small installation:** requires an Unify OpenScape Cordless IP V2 device as integrator / DECT manager / base station and can manage up to 10 base stations and up to 50 handsets.
- **Medium-sized installation:** requires an Unify OpenScape Cordless IP V2 device as integrator / DECT manager and can manage up to 60 base stations and up to 250 handsets.
- **Large installation:** permits the use of up to 100 DECT managers and can manage up to 6,000 base stations and up to 20,000 handsets.

For more information on the installations, refer to ¢ P. 30

Codec and bandwidth

The number of parallel connections possible depends on the codecs permitted.

- If only codec G.711 is approved, a base station can realise up to 10 connections simultaneously.
- If codecs G.711 and G.729 are approved, a base station can realise up to 8 connections simultaneously.
- If broadband codec G.722 is approved (**HD voice**), a base station can realise up to 5
  connections simultaneously.

Device role

The number of parallel calls possible reduces when an Unify OpenScape Cordless IP V2 device houses a DECT manager, or integrator and DECT manager, at the same time as a base station (¢ p. 37).

3.2.2 Large installations: Using multiple DECT managers

The following must be considered when multiple DECT managers are used:

- For roaming and handover beyond DECT manager boundaries, neighbouring base stations must be synchronised. Synchronisation normally only takes place inside a cluster, i.e. roaming and handover beyond DECT manager boundaries are not possible. Synchronisation beyond DECT manager boundaries can be set up from the web user interface.
- The roaming process between two DECT managers is not entirely without transition (a handset switches from a wireless cell to a cell of a base station being managed by another DECT manager). Delays of several seconds can result. This is why DECT manager transitions should not be in areas of the DECT network with high levels of traffic.
- If the requirement is for roaming to be possible between base stations of different DECT managers, certain capacity for visitor handsets of other DECT managers must be planned in. The maximum number of handsets (250) that can register with a DECT manager reduces depending on the number of visitors expected. To make roaming possible at all times,
  a maximum of 80% of the maximum possible number should be registered, so about 200.
- Neighbouring DECT managers must belong to different RPN groups. This is also set from the integrator web interface.

3.2.3 Technical conditions

The following values can be used as a guide for the planning. They are values that are influenced by environmental conditions and that should therefore be checked via measurements.

- The wireless range of a DECT base station for handsets is (guide values)
  - max. 50m in buildings
  - Up to 300m outdoors

  These guideline values do not apply to the maximum possible distance between two base stations. To ensure the handover of a handset from the cell of one base station to the cell of another, this distance is derived from the necessary overlap zone.

- Ensure adequately sized overlap zones between neighbouring cells are taken into consideration. For an interference-free handover, a spatial overlap of 5 to 10 metres with satisfactory signal strength should be sufficient, even for fast walking. Neighbouring base stations must be able to receive one another with sufficient signal strength to guarantee the synchronisation and handover (¢ p. 55).
- Maintain sufficient distance between the base stations as they can interfere with one another. The minimum distance depends on the circumstances. If no obstacles are present, the required distance can be 5 to 10 metres. If there is an absorbent wall or absorbent furniture between the base stations, 1 to 2 metres may be sufficient.

  You will also find information about possible interference in Section **Material characteristics and interference factors**, ¢ P. 45.
- In a horizontal direction, good connections can still be established behind 2–3 normal brick walls. In a vertical direction and on the ground floor or in basements, concrete ceilings are difficult to penetrate. This means that every floor may have to be supplied separately.
- Please note that in empty buildings, adding furniture and equipment (machines, movable walls, etc.) at a later stage will affect the wireless quality.
- Openings in obstacles improve the technical wireless conditions.
- Consider any possible interference factors (¢ p. 45).

3.2.4 Installation guidelines

The following points must be considered when installing DECT base stations:

- For wireless coverage within a building, always install the base stations on internal walls. Information on installation in an outside area, ¢ P. 49.
- The optimal installation height for a base station is between 1.8 and 3 m depending on the room height. If you position the base stations any lower, furniture and moving objects can cause interference. There should be a minimum clearance of 0.5 m to the ceiling.
- We recommend installing all base stations at the same height.
- BSIP2 base stations require an Ethernet connection to the PABX, i.e. it must be possible to connect to the LAN.
- BSIP2 base stations are powered by PoE (Power over Ethernet, IEEE 802.3af). Therefore, you do not normally require a power connection. However, if you use an Ethernet switch that does not support PoE, you can use a PoE injector as an alternative. If there is an option of connecting to the mains power supply in the vicinity of the base station, you can also use the power adapter to provide a power supply (to be ordered separately).
- Do not install the base station in suspended ceilings, cupboards or other closed furnishings. The wireless coverage can be significantly reduced, depending on the materials used.
- The base station should be installed vertically.
- The location and alignment of the base station installed should be identical to the position deemed optimum during the measurement stage.
- Avoid installation in the direct vicinity of cable channels, metal cupboards or other larger metal parts. These can reduce the radiation and couple into interfering signals. There should be a minimum distance of 10cm.
- Observe the safety distances and safety regulations. Observe the regulations specified in rooms where there is a danger of explosions.

- To best exclude interference by transmitter or other indoor radio techniques, a distance of minimum 0.3m recommended.

External antennas:

- The ideal signal transmission around provided antenna is shaped like a ring. But this ideal radiation is highly influenced by the environment (¢ p. 37). So orientation of the antenna angle can optimise coverage for certain areas. Because of the height environment influence, it is not possible to give an easy rule how to adjust the antenna angle. A measurement with multiple handsets at multiple handset locations could help to tune the best antenna orientation.
- Installation of antenna in parallel to a metal surface in direct neighbourhood should be prevented by tilting the antenna, e.g., by 45° - 90°.

3.2.5 Capacity measurement

The capacity of the DECT system must be high enough to guarantee that subscribers can be reached in high-density traffic. Both the capacity of the entire DECT system and the capacity of the individual cells must be taken into account.

The capacity of the DECT system is determined using the following criteria:

- Number of connection channels available
  The number of connection channels available defines how many connections can be managed simultaneously.

  NOTE: A connection channel is not only needed for phone calls. All actions for which a handset requires a connection to the phone system occupy a connection channel, such as accesses to the company phone book, querying the answering machine, group pickup, updating the time.

  The number of available connection channels on a BSIP2 depends on different factors ¢ P. 37.
- Grade of Service, GoS
  The grade of service determines the number of connections that may not be achieved due to the system being at full capacity, i.e., the line is engaged. A grade of service of 1% means that out of 100 calls, one cannot be connected for capacity reasons.

The capacity required can be determined using these two factors and the traffic volume expected.

Please note that the volume of traffic can vary during the course of the day.

The capacity must always be adjusted to the highest possible traffic volume if capacity bottlenecks are to be excluded.

3.2.6 Traffic volume

In order to calculate the traffic volume usually the Erlang B formula is used. This formula defines the probability of blocking, e.g., how many calls probably cannot be carried under given conditions. The Erlang B formula relates different values to each other:

- The load during the most active hour of the day (Busy Hour Traffic)
  This is given in Erlang (E). One Erlang corresponds to the continuous full capacity utilisation of one connection channel in a specific observation period, usually over an period of one hour. Accordingly, the occupation of a connection channel over one hour equals 1 E.
- Availability of channels
  Number of phone lines to be made available. The total bandwidth corresponds to the number of lines multiplied with the bandwidth of the used codec.
- Blocking rate (Quality of Service)
  Probability with which it will occur that a call cannot be accepted because all lines are busy.

Detailed information on the Erlang B formula can be found within technical literature for traffic theory. However, there are various Erlang B calculators provided in the Internet allowing you to calculate the necessary number of connection channels by giving the value of traffic load (E) and the desired blocking rate (QoS) without having further knowledge.

Example calculation:

- It is a multi-cell system with only one DECT manager. The DECT manager system includes no base station, i.e. it is provided as a separate BSIP2 device. All other devices only include one base station.
- Narrowband connections with codec G.711 or G.729 are permitted, i.e. the base stations each have a maximum of 8 connection channels.

Traffic load (Erlang)	Quality of Service	Connection channels	Base stations
1000 calls (of 3 minutes each)/per 1 hour 1000 x 3 min./60 min. = **50 E**	0.1%	71	9
	0.5%	66	8
	1%	64	8
	2%	60	8
	5%	57	7
2000 calls (of 5minutes each)/per 1 hour 2000 x 5 min./60 min. = **167 E**	0.1%	202	26
	0.5%	192	24
	1%	187	24
	2%	181	23
	5%	170	22

> Please consider that the effective availability of connection channels may be reduced by a lot of different influence factors. Therefore, to reach the required Quality of Service you should plan additional base stations as a buffer in any case.

3.2.7 Alternative calculation for small systems

For smaller systems, an approximate evaluation of the traffic volume can be sufficient.

Example:

Calculation details:

- It is a small-scale system. One BSIP2 contains the integrator, DECT manager and a base station.
- Narrowband connections with codec G.711 or G.729 are approved.
- The base station that is on a system together with the DECT manager and integrator makes available 5 connection channels. The other base stations each have 8 connection channels.
- The traffic volume is evaluated for every area as "low", "medium" or "high". The evaluation specifies the number of handsets (as a %) that require a connection simultaneously:

Number of handsets, that can be served with GoS <=1%:

Available codecs	Connection channels	Traffic load examples		
		Low (0.1 E/ user)	Medium (0.15 E/ user)	High (0.2 E/ user)
Wideband DECT: supporting G722	5	14	9	7
Narrowband DECT: G711 or G729	8	31	21	16
Narrowband DECT: G711 only	10	45	30	22

3.2.8 Hotspots

A hotspot is an area in which more calls than average are conducted simultaneously, e.g.,
open-plan offices or other areas where there are a lot of handsets in a small space.

You can cover such areas with several base stations since the DECT bandwidths in the coverage areas of neighbouring base stations add up. The DECT standard provides 120 radio channels that can be shared by several base stations. In practice, however, approximately only one quarter of these radio channels can be

used without special measures, since the neighbouring channels interfere with one another. This results in a practical value of a maximum of 30 simultaneous connections. With a maximum of eight handsets per base station, this means that four BSIP2 base stations would be required.

If we assume that a maximum of 50% of the available handsets are making a call simultaneously in a hotspot, 60 handsets can be used with four base stations.

If interference frequently occurs at a hotspot or more than 30 connections are required simultaneously, the following measures are possible:

- Distribute the base stations that cover the hotspot as widely as possible at the boundaries of the hotspot so that they are as far away from each other as possible and mutual interference is minimised.
- If this measure is not sufficient, use walls or other suitable means to diminish the strong signals.
- It might also be helpful, if the circumstances at the location allow, to arrange the base stations in the shape of a ball, i.e., cover the hotspot through floors and ceilings.

When optimising the coverage of the hotspot areas, make sure that handsets do not suddenly occupy the call channels of the hotspot base stations that were previously supplied by other base stations. When establishing a connection, handsets always occupy channels of the base station that provides the strongest signal. Therefore, moving the hotspot base stations may affect other base stations and you may have to relocate the base stations of the entire network.

3.2.9 Material characteristics and interference factors

There are a number of interference factors that influence the range and quality of the transmission in particular. The types of interference factors include:

- Interference as a result of obstacles that diminish the signal transmission, creating radio shadows
- Interference through reflection that restricts the call quality (e.g., crackling or background noise)
- Interference through other radio signals that can lead to errors in transmission

3.2.10 Interference due to obstacles

Possible obstacles are:

- Building constructions and installations such as reinforced concrete ceilings and walls,
  stairwells, long corridors with fire doors, uptakes and cable channels.
- Metal-clad rooms and objects such as cold stores, computer rooms, metallised glass areas (reflections), firewalls, tank systems, refrigerators, electrical boilers etc.
- Movable metal objects such as lifts, cranes, carts, escalators, shutters
- Room furnishings such as metal shelves, filing cabinets
- Electronic devices.

It is often difficult to locate the exact source of the interference; particularly if the received signal strength of the local DECT signals fluctuates strongly within a few centimeters. In these cases, the interference can be reduced or corrected by small changes to the position.

Wireless coverage in lifts is normally poor or not available at all (¢ p. 48).

3.2.11 Loss of range through building materials in comparison to a free wireless field:

Glass, wood, untreated	**Approx. 10%**
Wood, treated	**Approx. 25%**
Plasterboard	**Approx. 27 – 41%**
Brick wall, 10 to 12cm	**Approx. 44%**
Brick wall, 24cm	**Approx. 60%**
Aerated concrete wall	**Approx. 78%**
Wired glass wall	**Approx. 84%**
Reinforced concrete ceiling	**Approx. 75 – 87%**
Metal-coated glass	**Approx. 100%**

3.2.12 Interference from other wireless cells and networks

DECT is very robust against interference from other wireless networks. Co-existence with WLAN for example is not a problem. Most other asynchronous DECT single base stations do not present a problem either.

Problems may occur in special cases, such as an environment where there is a very high level of DECT usage. This applies when there are co-existing asynchronous DECT base stations but, even more so, when base stations have been installed too closely together to cover a hotspot, for example.

Despite sufficient signal strength, the following interference can occur:

- Unexpected termination of the connection
- Loss of synchronisation of handsets
- Poor voice quality

¤ When interference occurs because base stations are installed too closely together, try to resolve the problem with the measures described in Section **Hotspots** (increase the distances, use obstacles to absorb the interference, ¢ P. 44)

¤ If you have found other DECT sources, check whether you can switch them off, relocate them or integrate them in your DECT network.

3.2.13 Summary

Wireless traffic interference can have many causes that cannot all be determined in advance, that increase or decrease due to mutual influences and that can change during operation.

Therefore, the actual influence of interference factors on reception and voice quality can only be determined by taking measurements. However, the measurements also only provide an image of the wireless network at the time of measurement. We therefore recommend that when you plan the DECT network areas where interference can be expected, you err on the side of caution when you interpret the thresholds.

3.2.14 DECT installations in special environments

The **Projecting the DECT network** and **Taking measurements** sections describe all prerequisites and steps for planning a DECT network. In addition to the examples and applications described there, this section contains notes for special construction or topographical requirements.

3.2.15 DECT networks over several floors

If the DECT network is to cover several floors of a building, you must consider the following when planning the number and location of base stations:

- What material are the suspended ceilings made from?
  If they are reinforced concrete, only one ceiling can be positioned between the base station and telephone for a direct wireless path. Furnishings and partitions in rooms etc. can restrict the wireless transmission even further.
  Use measurements to check where further base stations are required.
- To what extent must a handover between the floors be guaranteed?
  In this case, the base stations must be positioned such that stairwells are also completely covered. Note also that any fire doors or walls can reduce the wireless transmission severely.
  Add the vertical levels of your planned coverage areas to your measurement plan and record the vertical transmission of the DECT network.
- No handover between floors required
  In this case you can work with clusters (more cost-effective). If you set up one cluster for each floor, the base stations of the cluster are synchronised with one another and a handover is possible. Handover is not possible between floors, but the IP PABX functions
  (VoIP configuration, directories, etc.) are available in all clusters.

3.2.16 Stairwells and lifts

Stairwells often have particularly absorbent walls (e.g., reinforced concrete); access to the
stairwell may be restricted by fire doors. Planning of the DECT network is therefore subject to special requirements here.

If you want calls via the DECT network to be possible in the stairwell, the most cost-effective variant is to install one (or even several) base station(s) as a separate cluster.

If a handover is required in the stairwell, you should check the position of the stairwell to the corridors (transitions, doors, fire doors), measure the wireless coverage and, if necessary, provide one or more base stations for wireless coverage of the stairwell.

Making calls in lifts is usually not possible due to the highly absorbent and/or reflective materials. However, if this is a requirement, you can check whether you can achieve sufficient signal strength and quality for making calls in a lift by installing a separate base station in the lift shaft.

3.2.17 Several buildings

Planning a DECT installation for several buildings or for separate parts of buildings requires
clarification of the following:

- Should calls only be possible within the internal rooms or across the whole site, even in the outside area?
- In which area should handover be guaranteed?

The cheapest way to connect separate parts of buildings with the DECT system is to use separate clusters (subnet). In this case, only the wiring of the different buildings or building parts via the LAN must be ensured. All phones registered with the DECT system can be used everywhere; handover is not always possible however.

3.2.18 Outside area

The outside area of a building can often be included in the DECT network through a base station close to a window. The prerequisite for this is that the glass in the window must not contain any metal (metal film, wire mesh).

If the outside area cannot be covered by base stations within the building, a base station can also be installed in the outside area. The base station should then be mounted in a suitable external housing to protect it against weather conditions (available from third-party manufacturers).
The thresholds for the operating temperature of the base stations (+5° to + 40°) must be taken into consideration.

The installation can be on a mast (not metal), on the roof or on a wall of the building. Please note that the LAN connection must be guaranteed, as this supplies the device with power and is also required for the connection to the DECT Manager.

The range on the site is up to 300m, but might be restricted by other buildings, walls or trees. A base station mounted in the outside area can also cover further indoor parts of buildings
if the walls of these areas do not reduce the radio signal too strongly.

For measurements outside, please note that weather conditions, e.g., rain or snow, can significantly influence the send and receive properties. If necessary, perform further measurements in different weather conditions; plan the radio coverage generously if you want to guarantee secured

reception. Changes in the vegetation (leaves on the trees, growth of bushes) can also affect the radio conditions.

3.2.19 Handover over the whole site

If handover is to be achieved over the whole site, including all buildings, the transition areas between internal rooms and the outside area must be planned and measured carefully.

Example: The building can only be accessed through a metal door with 100% absorption. In this case, when the door is open the handover between the nearest base station indoors and the base station for the outside area must be guaranteed. Both base stations must be synchronised and (with the door open) have the required overlap area.

3.3 Preliminary identification of the positions of the base stations

Now plan the positions of the base stations. Take the following into consideration:

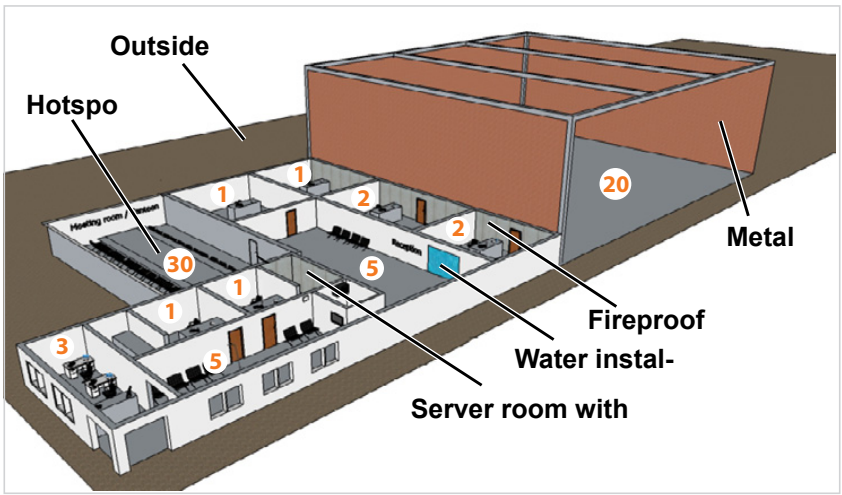
- The information you have collected regarding the requirements for the telephone network
- Your synchronisation planning
- The technical conditions for the wireless DECT.

First create a plan in which you then enter the locations of the base stations. You can use existing building and supply plans, if applicable. For very large buildings, you may be able to work with partial floor plans and then merge the results of the measurements into the evaluation.

3.3.1 Creating a planning drawing

Create a planning drawing from the information you have collected in the preliminary examination of the location. Enter building dimensions, hotspot areas and any sources of interference already identified.

Example:

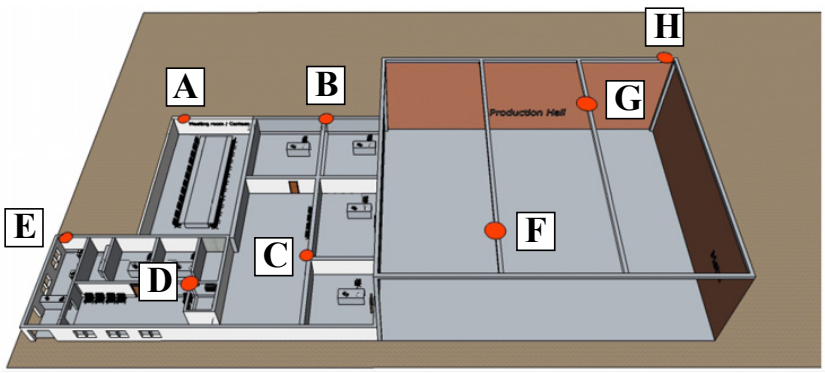


- The orange numbers in the rooms reflect the required number of DECT handsets (71 in total).
- Canteen is defined as a hotspot, where 30 calls should be possible simultaneously.
- Calls should be possible in the building and outside the building.
- Walls that are deemed to have a high absorption effect, or reflections, are indicated.

3.3.2 Positioning the base stations in the plan

Now define the positions of the base stations in the building plan taking into account the required capacity and the determined influences. As far as possible, you can take note of visual concerns as well as possibilities of technical connectivity.

Give the locations for the DECT bases unique labels.



Initially, the assumption is that eight base station (shown as red circles) should be adequate as measurement is not done at this point.

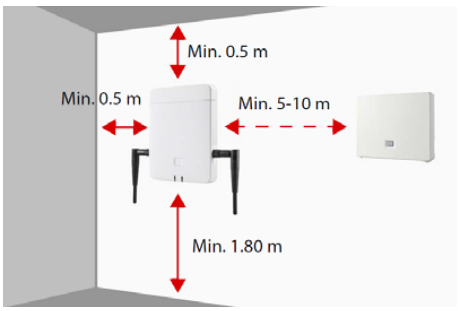
- Base A, B, C, D and E cover the office area and can handle up to 50 parallel calls.
- The hotspot meeting room / canteen is covert with multiple bases to assure 30 simultaneous calls.
- The production hall is covert with two base stations (F and G).
- The outside area is covert with base A, B, E and H.

You then check these initial assumptions later using the measurements (¢ p. 54).

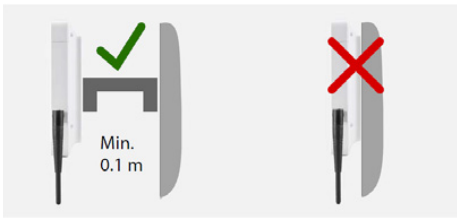
3.3.3 Hints for mounting base stations

Observe the following notes when mounting base stations:

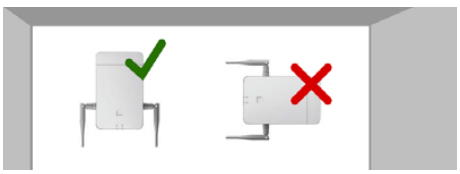
- Min. 1.8m distance from the ground.
- Min. 0.5m distance from the ceiling.
- Optimal height between 1.8 and 3m.
- Min. 0.3cm distance between two base stations.
- Min. 5 - 10m distance to not synchronised base stations.
- Install all base stations at the same height.
- Operating temperature between + 5 ° and + 45 °.



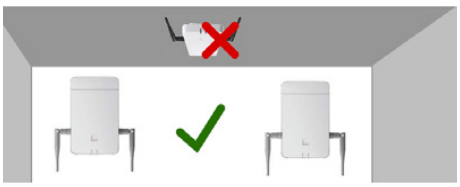
- Minimum 10 centimetres recommended distance from metal, supply lines and cable ducts.



- The base stations should be installed vertically.



- Do not install the base stations on ceilings, or suspended cup boards or other closed furnishings.



Important is that the location and alignment of the base stations installed should be identical to the position deemed optimum during the measurement stage.

4 Taking measurements

You have:

- Determined the requirements for the telephone network (¢ p. 38)
- Planned the number of base stations and their positions (¢ p. 51)
- Set up and operated the measurement equipment.

You can now start the measurements for your planned DECT network. The aim of the measurements is to determine the following:

- Is sufficient wireless coverage and a good voice quality guaranteed everywhere in the desired area?
- Is synchronisation of the bases stations ensured in their planned positions?
- Is a handover between the base stations possible where it is required?

The requirements from these three aspects must be taken into account in the measurements. For information on this, please also refer to Section **Conditions for the positioning of the base stations**, ¢ p. 39.

For measurement you can use any measuring equipment for DECT radio networks.

4.0.1 Notes for taking the measurements

- Take two different measurements:
  - Measure the connection quality in the wireless coverage area for the planned base stations.
  - Measure the signal quality between the base stations (synchronisation measurement).
- To measure the connection quality, establish a telephone connection. It is helpful if the measurements are performed by two people, since they can check the voice quality and interference on two measuring handsets directly in a call. If only one person performs the measurements, the connection quality can possibly be checked via a test tone.
- You can also test the connection quality by holding the handset to your ear as you measure, in the same way as you would in a real telephony situation. Turn around as you do so. Note how the acoustics quality of the test tone changes. If interference occurs at the limit of the range (e.g., crackling), power at the measuring site is critical. Your head can impair reception. For this reason, the test against your ear is an additional check for verifying the reception quality in limit areas.
- Use the measuring handset in idle status to measure the signal quality between the base stations. The main criteria for signal quality between base stations is the signal strength. Of course, if the frame quality is already showing lowered quality, this indicates that the quality is not good enough for over the air synchronisation along that path.
- Using the stand, position the measuring base station as precisely as possible in relation to the intended position for the base station.
- To measure the signal strength between base stations, position the measuring handset in the exact planned position of the base station. For example, if you

want to position the base
stations at a height of 3m, make sure the measuring handset is at this height.

- Installation closed to metal surface should be prevented best as possible. But if metal surface has to be accepted for the operation, it should **not** be removed for the measuring.
- Document the progress of the measurement by entering it in the layout plan (horizontally and, where applicable, vertically) and in a measurement log.
- In order to be able to recognise subsequent changes, it is helpful to document the planned assembly positions of the individual measurement series and their environment with
photographs.
- If the DECT system is to be used for several floors or very high rooms (e.g., with a gallery), you must also measure the vertical range and enter it in a plan of the building. For further information on this, please also refer to the DECT installations in special environments
chapter ¢ p. 48.

4.0.2 Fluctuations in the measurement result

When you are performing the measurements, the signal strength displayed on the handset can fluctuate strongly, particularly if you are moving around with the handset. The base stations have two aerials, so the handset displays the values for the aerial for which it receives the best signal. Since the measuring handset takes measurements at defined time intervals (2.5 seconds as standard), the values can change quickly.

For example, if you block the signal for the aerial that is in a better position for the handset with part of your body, the handset receives the signal from the weaker aerial. Turning your body slightly can significantly alter the measurement value, since the handset is suddenly able to receive the signal from the "better" aerial. By moving around, you determine an average value that you can use as the measurement value.

In case of marked fluctuations it makes sense to perform the measurement while a connection is established as you then have an additional check based on voice quality.

When the DECT system is being operated in real-life situations, these fluctuations are barely noticeable as the base stations automatically establish the connection with the best positioned aerial.

4.1 Defining thresholds

During the measurement process, the measuring handsets receive wireless signals from the
measuring base station and display various characteristics for the reception quality. The following are relevant for the reception quality:

- Received signal strength

- Connection quality

The values specified below are guidelines for determining thresholds for operating the DECT
telephone system under optimum conditions. Since the DECT network can be restricted by many factors that can also occur temporarily, we do not recommend positioning the base
stations at the thresholds. Instead, you should include a buffer according to the requirements for grade of service and voice quality. It may be acceptable for example, that voice quality
is restricted at times in the basement, and that calls cannot always be made there. In contrast, restrictions are unacceptable for meeting rooms where telephone conferences are held.

4.1.1 Received Signal Strength

The reception field strength is measured to assess the quality of transmission. The received signal strength (proportional to the field strength) is displayed on the measuring handset in **dBm**. A very good received signal strength is approximately –50 dBm. Systems that are measured at up to –60 dBm generally offer a good quality. For measurements up to –70 dBm, the measurement must be checked and evaluated with an audio connection to ensure sufficient quality. A handover
is no longer possible in this area.

Different thresholds can be used for the measurement, based on the quality or use of specific areas (e.g., office, corridor, basement). Different quality requirements can also be defined at the various base stations within a partial system.

Typical thresholds for normal, low-interference environments are:

1 Limit value for guaranteed call quality: -65 dBm
   This is the value at which a handset must receive the signal of a base station for a subscriber to be able to benefit from good quality telephony. For an interference-free handover, the handset must receive both base stations at this level of quality.
2 Limit value for synchronisation -70 dBm
   This is the value at which a base station must receive the signal of another base station to be able to synchronise.

When the received signal strength is not high enough in certain areas for synchronisation using DECT, base stations can also be synchronised over LAN. A minimum received signal strength must also be available here however (¢ p. 25).

The following table gives an initial guideline for the quality of the wireless connection.

Received signal strength	Quality evaluation

–50 dBm	Very good
-60 dBm	Good
–65 dBm	Satisfactory
-70 dBm	Adequate
-73 dBm	Weak, not suitable
-76 dBm	Poor, not suitable

4.1.2 Connection quality

In principle, the measurement of the field strength should always be supplemented by a check of the connection quality. Interference, e.g., through reflection or external systems that influence the voice quality, can also occur with good received signal strength.

The **Frame quality** is therefore also displayed on the measuring handset in addition to the received signal strength. This indicates the percentage rate of the packages received without errors in a measurement interval. The optimum value is 100%.

Frame quality	**Quality evaluation**
100%	Good
99%	Satisfactory
98%	Adequate
97%	Weak, not suitable
96%	Poor, not suitable

4.2 Measuring the wireless range of the planned base stations

Take two different measurements.

1 Measure the connection quality between the measuring handset and measuring base station in their wireless cells to ensure that sufficient voice quality is guaranteed at every position in the required coverage area. Taking the same measurement for the neighbouring station
produces the overlap zone required for a handover.
2 Measure the strength of the signal from the measuring base station that you receive at the planned position of the neighbouring base station to ensure sufficient synchronisation overlap.

4.2.1 Measurement sequence

The sequence in which you measure the wireless range of the planned base stations depends on the size of your DECT network and your assumptions with regard to the existing "problem areas". As a rule of thumb, first measure the base stations whose positions have the least leeway.

Take the following aspects into consideration:

- Assumed problem areas
  For base stations that are to cover specific problem areas, e.g., a stairwell or entrance area, there are often few alternative positioning options. In this case, measure these base stations first because the positioning of all other base stations depends on these initial positions.
- For large installations
  The more base stations you use, the higher the requirements of the synchronisation hierarchy (¢ p. 26). In this case, we recommend starting with the base station for which a subsequent change would mean the greatest effort. This is usually the base station with sync level 1. Start here and move outwards from sync level to sync level.
- For small installations
  Here it makes sense to start with the base station where the highest call traffic is to be expected, e.g., base stations in hotspots or other high-traffic areas. Once the coverage of these areas is ensured by measurement, check the positioning of the other base stations.

4.2.2 Measuring the cell of a base station

¤ Temporarily secure the measuring base station in the position in which the base station is to be installed.

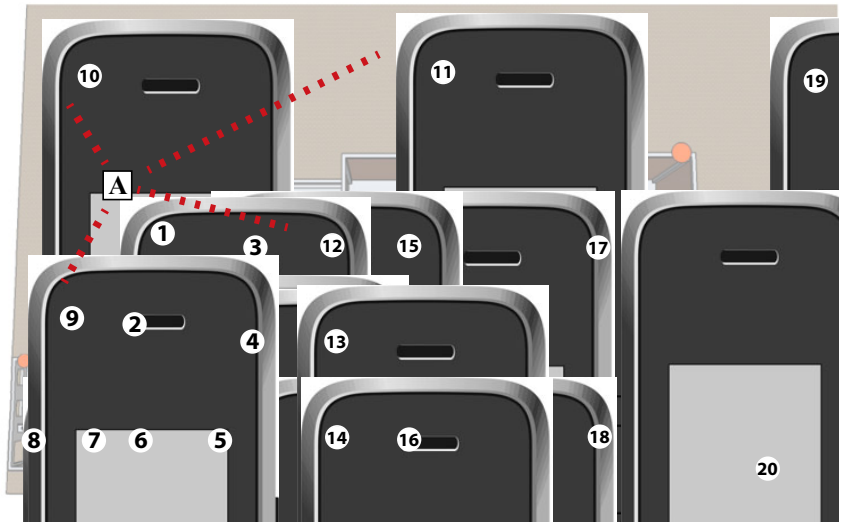
¤ Establish a telephone connection between the two measuring handsets or activate the continuous test tone of the measuring base station, if available.

¤ Move away from the base station with the handset, observing the display and the signal in the earpiece, until the limit value of –65 dBm is displayed or a wireless transmission boundary is reached (e.g., lift, exterior wall). Transfer this point to your plan and enter the value in the measurement log.

¤ Use this method to determine the border line around the base station. The theoretical ideal case of a ring-shaped transmission is considerably altered in reality by walls (depending on the construction material) and metal furnishings.

¤ Check the voice quality in the limit areas using the connection to the second measuring handset or the measuring tone of the base station.

¤ Enter deviations in the reception signal measurement of the voice quality in the layout plan or the measurement log.



4.2.3 Example of a measurement log for the cell of a base station

Measuring point	Base station A
1	–60 dBm/100%
2	-65 dBm/98%
. . .	. . .
14	-73 dBm/70%
. . .	. . .
20	---

If you have measured the cells of multiple base stations, the results may look like this, for example:

Meas-uring point	Base station A	Base station B	Base station C	Base station D	. . .
1	–60 dBm/100%				
2	-50 dBm/98%				
3	-65 dBm/100%				
4	-48 dBm/100%				
5	-55 dBm/98%				
6	-65 dBm/100%	-50 dBm/100%			
7	-68 dBm/96%	-59 dBm/100%			
8	-55 dBm/98%	-46 dBm/98%			
9		–60 dBm/96 %			
10		-52 dBm/98%	-65 dBm/100%		
11		-63 dBm/100%	-57 dBm/100%		
12		-48 dBm/98%	-42 dBm/100%		
13			-46 dBm/98%		
14			-40 dBm/100%		
15			–60 dBm/98%	-52 dBm/100%	

Meas-uring point	Base station A	Base station B	Base station C	Base station D	…
16			-43 dBm/100%	-42 dBm/100%	
17				-56 dBm/100%	
18				-50 dBm/98%	
19				-53 dBm/100%	
20				–60 dBm/98%	

Measuring points where two base stations are received with at least –65 dBm are located in an overlap zone of the two base stations in which a handover is possible (highlighted grey in the table).

4.2.4 Measuring the synchronisation overlap of neighbouring base stations

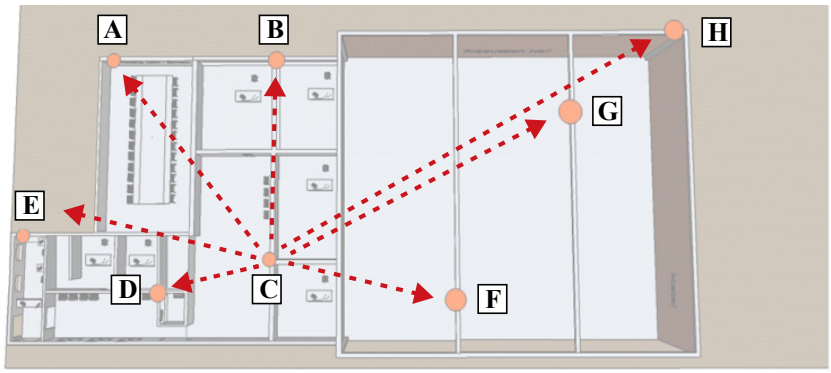
For the base stations to be able to synchronise via DECT, the signal strength between two neighbouring base stations must not be less than –70 dBm. This value applies in good environmental conditions, ¢ p. 55.

Proceed as follows for the measurements:

- ¤ Leave the measuring base station at the last measuring site and proceed with the handset to the planned position of a base station that is to synchronise with the first base station.

  In order to reliably assess the synchronisation, you must be located, with the handset, at the exact position of the planned base station (use a ladder to measure at the correct height, if necessary).
- ¤ Check whether the signal is within the limit of -70 dBm at 100% frame quality. If this is not the case, you should change the location of the base station until this minimum requirement is met.

  Alternatively, you can think about LAN synchronisation between
- ¤ Install the measuring base station at this location and take the measurements as for the first position.
- ¤ Enter the results in the plan and the measurement log.
- ¤ Now take this measurement for all planned assembly locations.



4.2.5 Example of a measurement log for measuring the synchronisation overlap

M.point	BS A	BS B	BS C	BS D	BS E	BS F	BS G	BS H
A		-52 dBm/ 100%	-40 dBm/ 100%	-58 dBm/ 100%	----	----	----	----
B	-50 dBm/ 100%		-48 dBm/ 100%	----	-70 dBm/ 92%	----	----	-60 dBm/ 93%
C	-42 dBm/ 100%	-46 dBm/ 100%		-50 dBm/ 100%	----	----	----	----

M.point	BS A	BS B	BS C	BS D	BS E	BS F	BS G	BS H
D	–60 dBm/ 100%	-----	-48 dBm/ 100%		-64 dBm/ 100%	----	----	----
E	----	-68 dBm/ 94%	----	-62 dBm/ 100%		----	----	----
F	----	----	----	----	----		-52 dBm/ 100%	-56 dBm/ 100%
G	----	----	----	----	----	-50 dBm/ 100%		-54 dBm/ 100%
H	----	-62 dBm/ 100%	----	----	----	-56 dBm/ 100%	-53 dBm/ 100%	

The result of the measurement is that the signal strength is sufficient for synchronisation
of base station A - E an H. Base station E only receives base station D with sufficient quality. Base station H only receives base station B, G and H with sufficient quality.

Here, a sensible synchronisation hierarchy would be:
Sync level 1 Base station C
Sync level 2 Base stations A, B and D
Sync level 3 Base station E and H
Sync level 4 Base station G and F

4.3 Evaluating measurements

A graphical display of your measurement results in the layout plan may show the overlap areas of the individually planned base stations. However, the measurement results of all stations must be used to check whether a further base station is required in the areas.

- ¤ Using the measurement results (where necessary), define new positions for the base stations and check them with further measurements.

  Note that moving one installation location also influences the other measurement results. Always consider how this affects the synchronisation of the base stations.
- ¤ Enter the determined optimum installation locations for the base stations in the plan (including the height and special construction circumstances, if necessary). We recommend you also
  document the assembly positions with photographs.
- ¤ In particular, check rooms or areas with very high wireless signal shielding (e.g., lifts, reinforced concrete ceilings, etc.) and add further base stations to your plan where necessary.

Once the measurements are complete and the positions of the base stations have been defined, the telephone system can be installed. This is described in the user guide for the OpenScape Cordless IP V2.

Recommendation

After installation and commissioning of the DECT network, the voice quality, roaming and handover should be checked again with the system telephones.

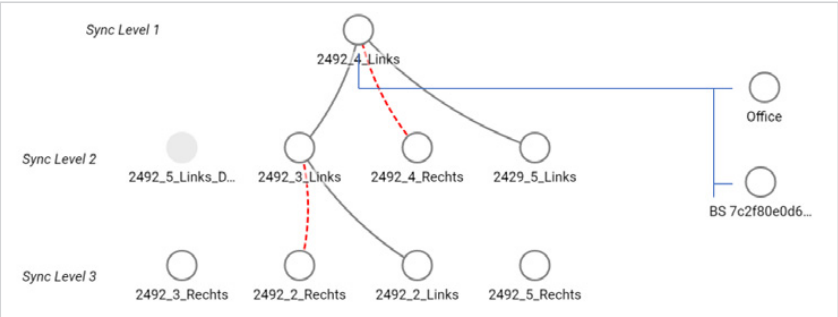
The web user interface for the Unify OpenScape Cordless IP V2 offers different tools for monitoring the operation and diagnosis in the event of problems occurring.

The page **Status ¢ Statistics¢ Base stations**

shows counters for various events occurring on base stations, such as active radio connections, incoming handover, outgoing handover and connections terminated unexpectedly.

On the page, you can also display graphics of the relationships between the base stations, the synchronisation level and information on the quality of the connections here.

Example:



Presentation:

Connections		RSSI range 43 -100, good - excellent
		RSSI range 0 - 42, poor
		No data available
Base Status		Active and synchronised
		Other status (click on the symbol for more information)
		Deactivated
Synchronisation Mode		DECT, internal synchronisation
		DECT, external synchronisation
		LAN, internal synchronisation
		LAN, external synchronisation
		RFPI, external synchronisation

5 Configuration Hints

In the following chapters you can find configuration notes for different PBXs which have to be released for usage with the OpenScape Cordless IP V2 system.

5.1 OpenScape Business (OSBiz)

Here you can find the configuration hints using an OpenScape Business using SIP users.

5.1.1 Base Configuration - OSBiz

The following value is used for the base configuration:

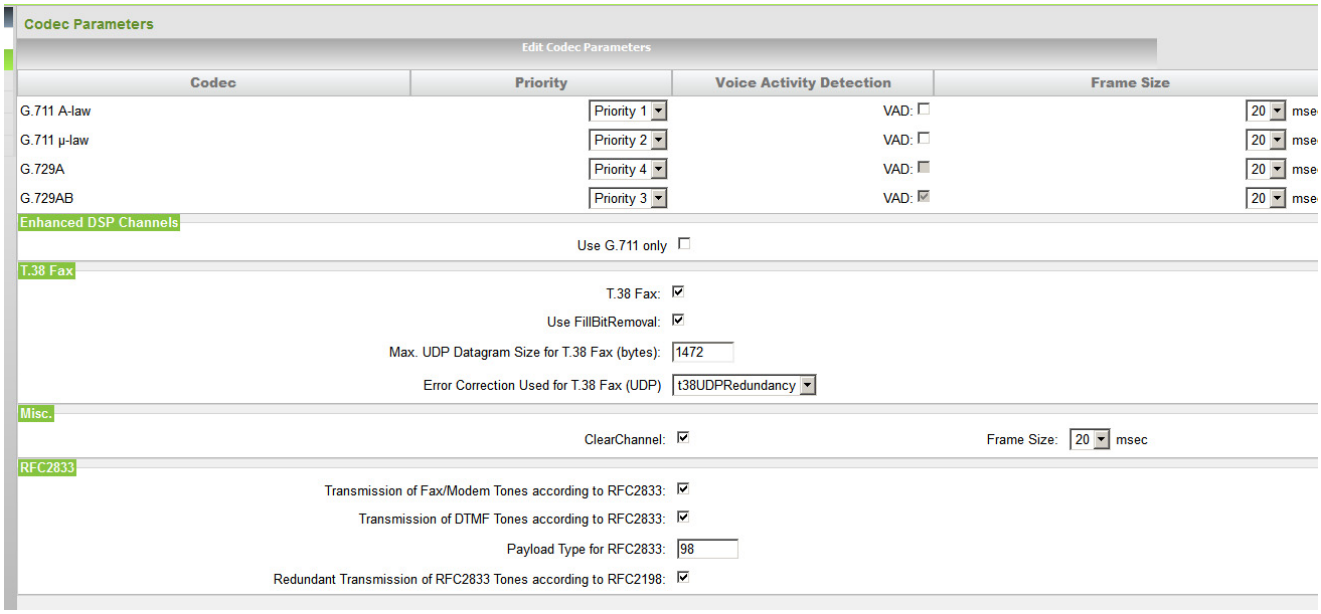
Parameter	Value
IP address of the OSBiz	192.168.0.93

Detailed configuration instruction for the OSBiz would go beyond the scope of this documentation. Therefore only the information regarding the configuration which is very important and relevant for the interworking is described here.

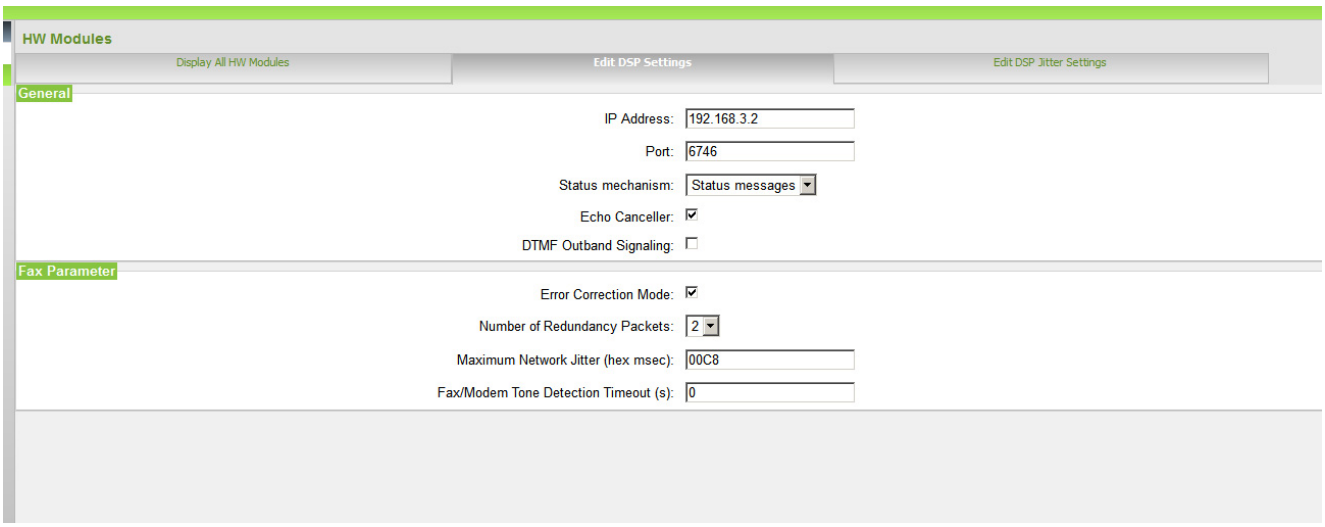
Detailed documentation for the OSBiz may be found in the OpenScape Business Administrator Documentation.

1. Please configure the OSBiz for the usage with SIP Users and configure the needed number of SIP Users in the Installation Assistant.
2. Configure the IP address of the OSBiz to 192.168.0.93 or change the according IP addresses.
3. Configure the following Codec Parameters via "WBM - Expert mode - Voice Gateway - Codec Parameters":

   Codec priority (G711a, G711u, G729a, G729b) and RTP framing (20msec) is recommended.



4. Configure the DSP Settings (primarily the Echo Cancellation) via “WBM - Expert mode - Payload - HW Modules - Edit DSP Settings”:



5.1.2 INT-DM Configuration

Please perform the following configuration settings at the INT-DM.

Under **Settings>Provider or PBX Profiles>** click on the **edit** button

Entry	Value (example)
Connection name or number	OSbiz
Domain	192.168.0.93
Proxy Server Address	192.168.0.93
Registration Server	192.168.0.93

Save all modifications with [**Set**].

5.1.3 Station Configuration - OSBiz

The following values are used as a sample for this configuration instruction:

Parameter	Value
Name	761 HcIP
Callnumber	761
Password	1234

The configuration of the OSBiz is done via Web browser (Web Based Management - WBM).

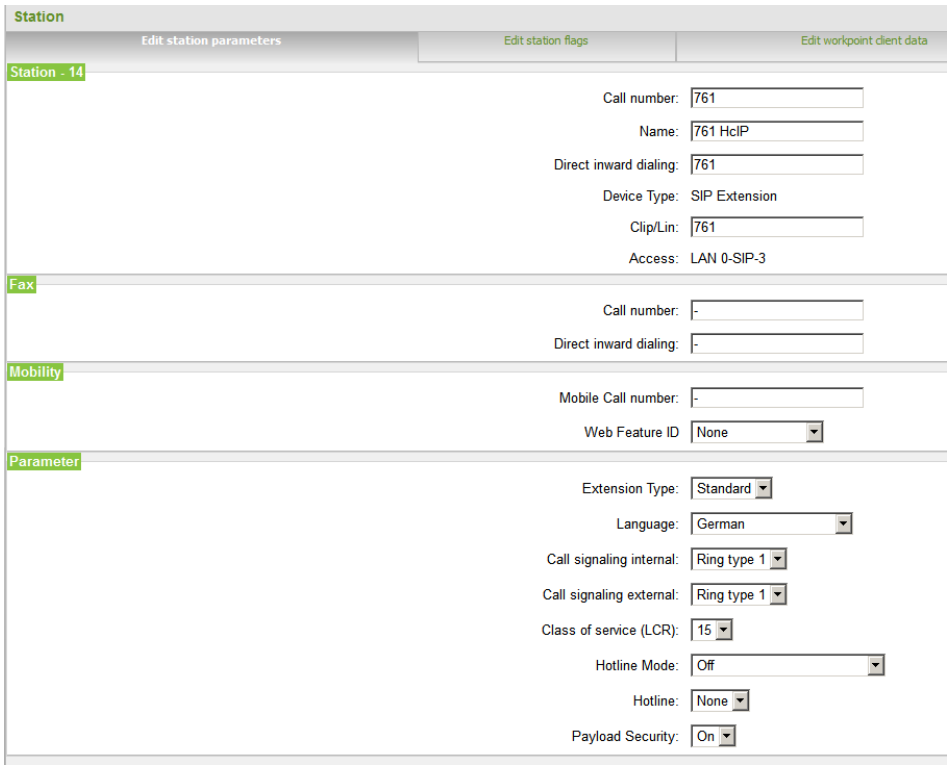
1. Please log in to the OSBiz, start the Web Based Management in Expert mode and navigate to the page "WBM - Expert mode - Station - IP Clients - SIP Clients".
2. Select a free entry (after the base configuration of the OSBiz with the Assistant free entries should be available).
3. If no free entries are available, use the page "WBM - Expert mode - Stations - Station - IP Clients - Edit subscriber", change the "Device Type" of a free entry to "SIP Client" and store the modifications with [Apply]. Now a free SIP User should be available on "WBM - Explorers - Stations - Station - IP Clients - SIP Clients".

5.1.3.1 Step 1 - User Parameters

Select the free entry and choose "Edit station parameter".
Enter the following values in the input mask:

Entry	Value
Callnumber:	761
Name:	761 HcIP
Direct inward dialing:	761

Please do not change the other values. After that the configuration page should look like this:

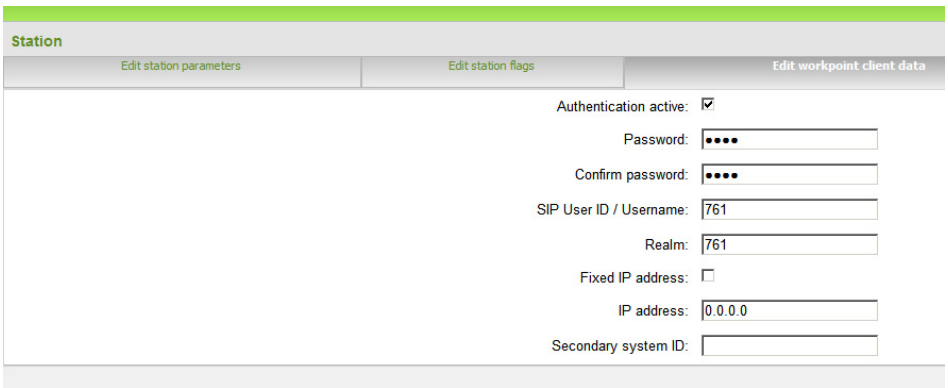


5.1.3.2 Step 2 - Workpointclient Data

Select the free entry and choose "Edit Workpointclient data".
Enter the following values in the input mask:

Entry	Value
Authentication active:	[V]
Password:	1234
Validate password:	1234
User ID:	761
Realm:	761

Please do not change the other values.



After that you should save the new configuration on the OpenScape with the [**Apply**] Button at the bottom of the WBM.

5.1.4 Station Configuration - INT-DM

Please make the following configurations at the INT-DM:

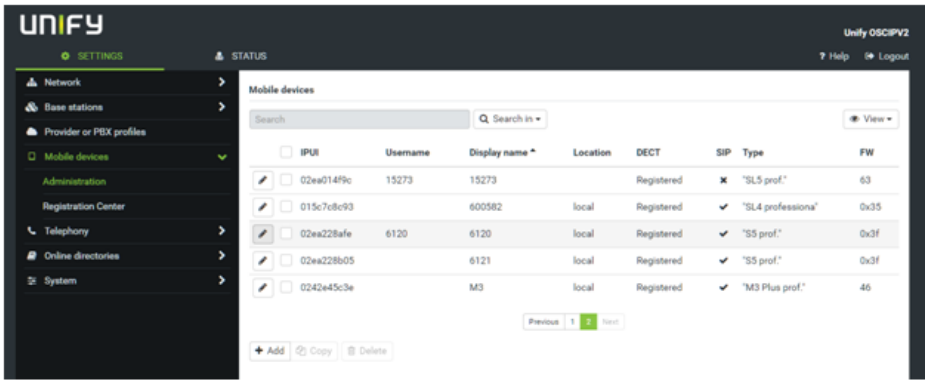
Under **Settings>Mobile Devices>Administration>** click the **add** button

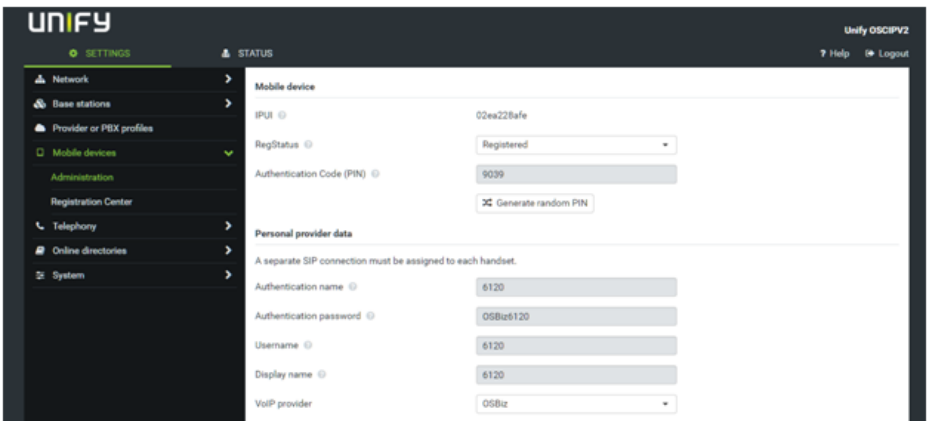
Add "**Generate a random PIN or enter one manually**"

Entry	Value(example)
Authentication name	6120
Authentication password	OSBiz6120
UserName:	6120
Display name:	6120

Select for VoIP Provider: **OSBiz**

Save the modifications by clicking [**Set**].





5.2 OpenScape 4000

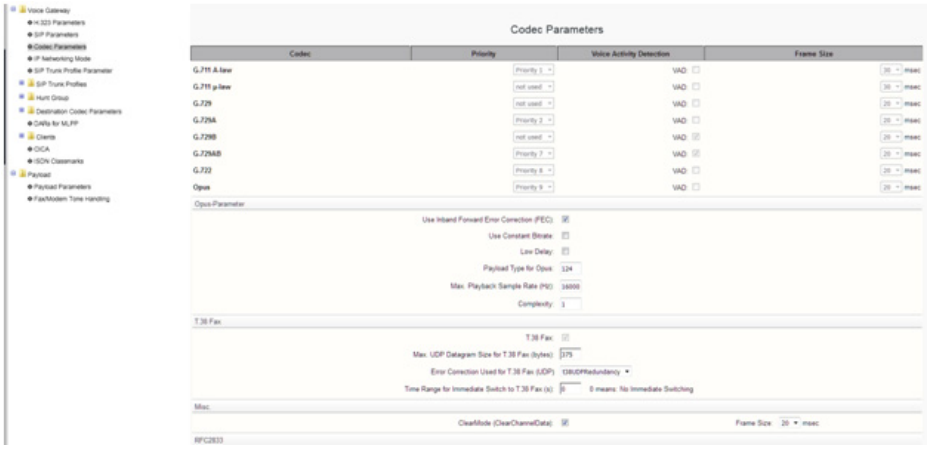
This chapter contains configuration hints to configure a OpenScape 4000 for usage with a OpenScape Cordless IP V2 system using SIP subscribers as UFIP device.

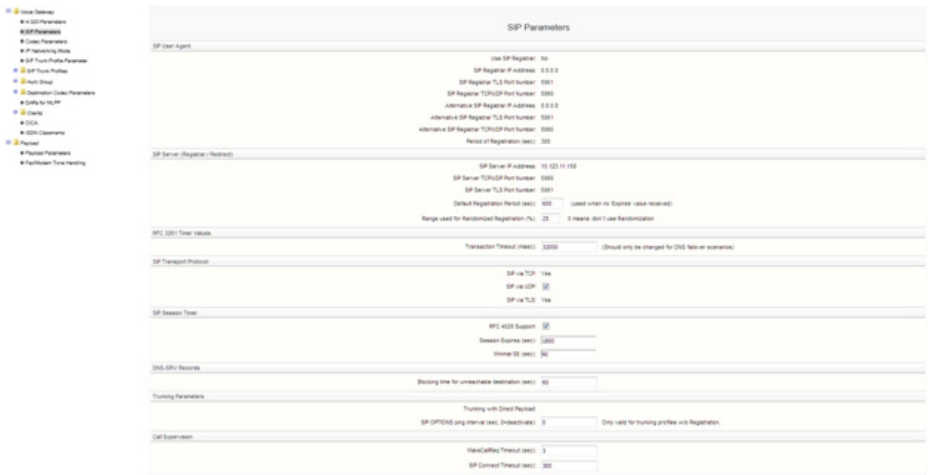
5.2.1 Base Configuration - OpenScape 4000

Please configure SIP devices on OpenScape 4000 SoftGate or STMIX in Assistant or ComWin.
For details check **OpenScape 4000 V8, Volume 4: IP Solutions, Service Documentation-SIP Connectivity Chapter 2.5.2 Configuring SIP Subscriber**.

e.g.

NOTE: Configure the following Codec Parameters via "WBM - Expert mode - Explorer - Voice Gateway - Edit Codec Parameters". Frame Sizes of 20msec are required (mandatory.)



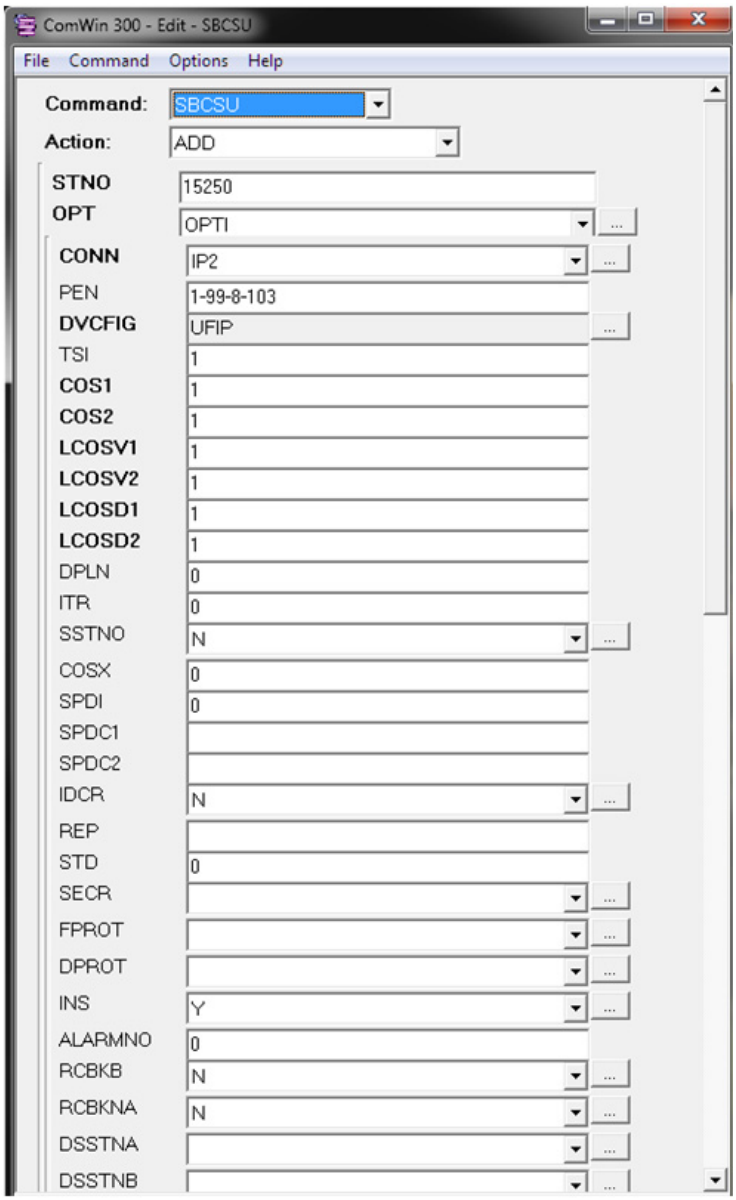


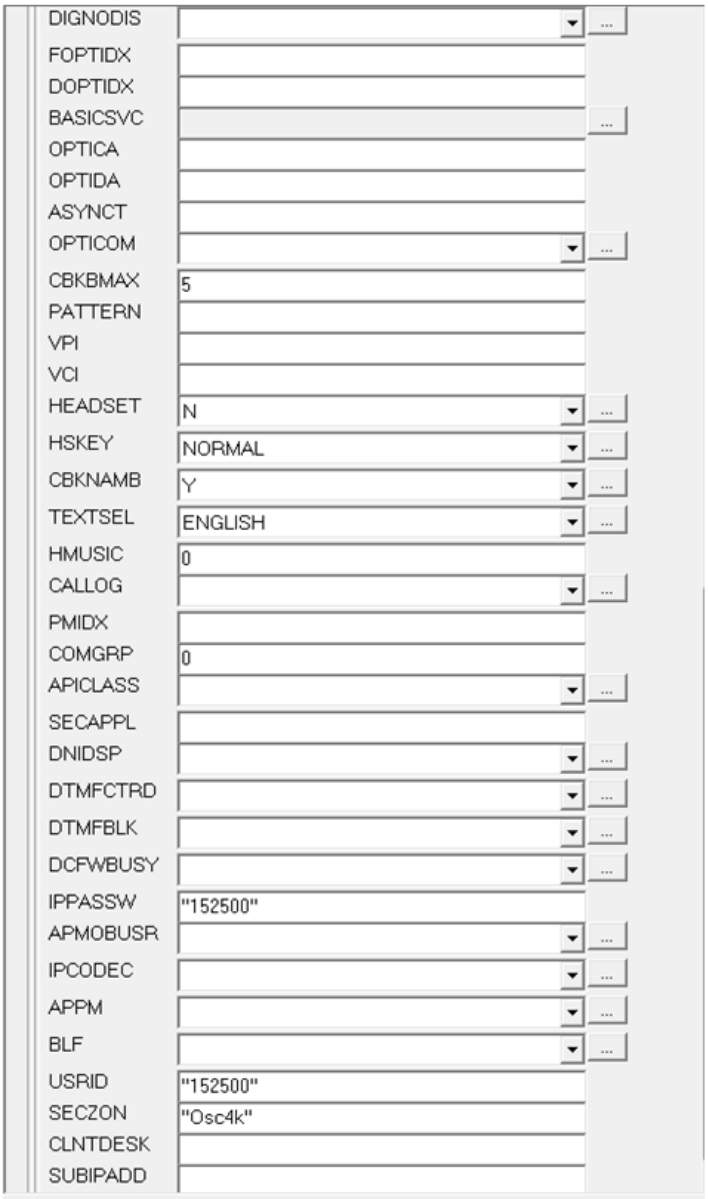
ADD-SBCSU:

ADD-SBCSU	
STNO	15250,
OPT	OPTI
CONN	IP2
PEN	1-99-8-103
DVCFIG	UFIP
TSI	1
COS1	1
COS2	1
LCOSV1	1
LCOSV2	1
LCOSD1	1
DPLN	0
ITR	0
SSTNO	N
COSX	0
SPDI	0
IDCR	N
STD	0
INS	Y
ALARMNO	0
RCBKB	N
RCBKNA	N
HEADSET	N
HSKEY	NORMAL
CBKNAMB	Y
TEXTSEL	ENGLISH
HMUSIC	0
COMGRP	0
IPPASSW	“152500”
USRID	“152500”
SECZON	“Osc4k”

Table 1

The table above only lists the variables that need to be changed or added. The rest of the variables should be left blank. Please refer to the image below for the exact configuration of command **ADD-SBCSU**.





CHANGE-SDAT:

- 15250
- ATTRIBUT
- MBCHL

5.2.2 Station Configuration - INT-DM

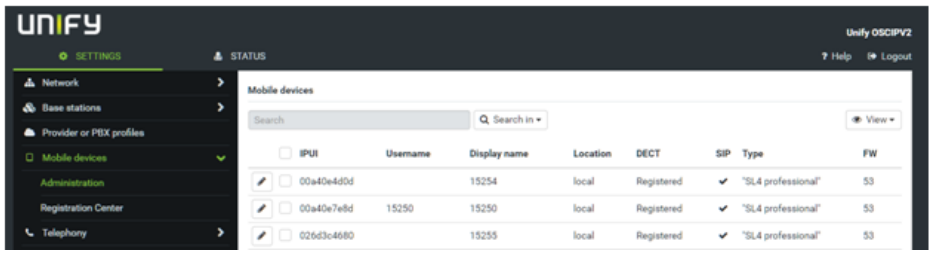
Please consider below values as configuration example at INT-DM:

Settings > Mobile Devices > Administration

Select the first entry and enter the following values:

Entry	Value(example)
Authentication name	152500
Authentication password	152500
Username:	15250
Display name:	15250
VoIP Provider:	ST15

Save the modifications by clicking [**Set**].



5.3 OpenScape Voice (OSV) V9

This chapter contains configuration hints to configure an OpenScape Voice for usage with an OpenScape Cordless IP V2 system using SIP subscribers.

5.3.1 General - OSV

There are 2 different setups for usage of OpenScape Cordless IP V2 connected to OpenScape Voice (OSV).

OpenScape Cordless IP V2 is connected to OpenScape Voice directly:

OpenScape Cordless IP V2 is able to communicate with one OpenScapeVoice-SIP-address only. In case of geographically separated OSV-cluster the nodes have different Signaling-IP-addresses in different IP-subnets. Therefore OpenScape Cordless IP V2 Users can only be connected to OSV-Node1 or to

OSV-Node2. If this node will fail no communication via OpenScape Cordless IP V2 would be possible anymore.

This problem does not exist if OpenScape Cordless IP V2 is connected to a co-located OSV-cluster until 2nd OSV will take over the Signaling-address of the 1st node in case of node-failure.

If the OpenScape Cordless IP V2 system has to be connected to a geo-separated OSV it is recommended to include OpenBranch, which is described below.

OpenScape Cordless IP V2 is connected to OpenScape Voice via OpenBranch:

In this setup scenario, OpenScape Cordless IP V2 is communicating with OpenBranch-SIP-address only and OpenBranch-proxy is forwarding all SIP-messages to OpenScape Voice. To avoid a single-point-of-failure at OpenBranch-side it is strongly recommended to set up OpenBranch redundantly (using VRRP).

In case of node-failure in a clustered-OSV OpenBranch will address OpenScape Cordless IP V2-messages to the remaining OSV-node (doesn't matter if co-located or geo-separated OSV is used).

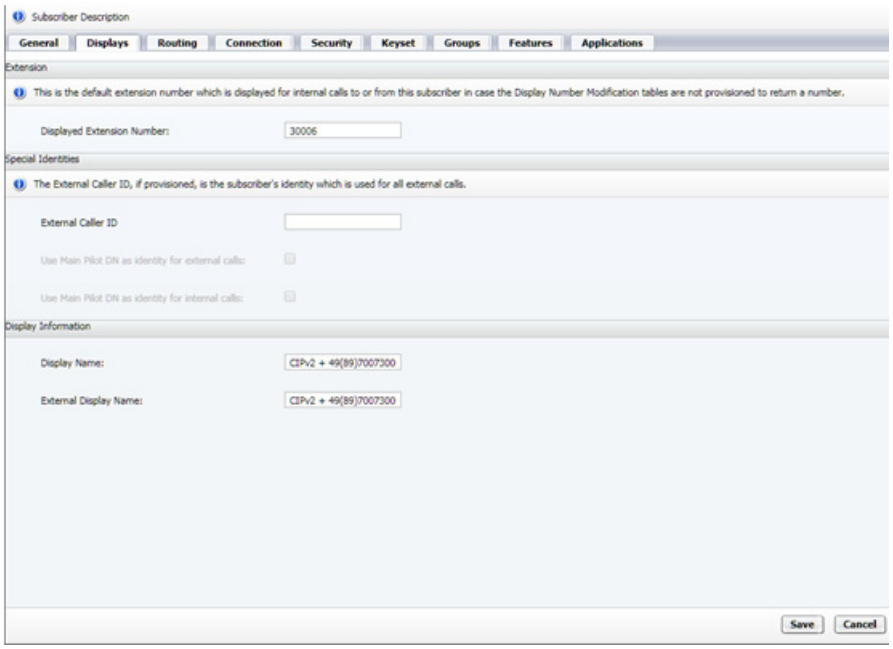
5.3.2 Base Configuration - OSV

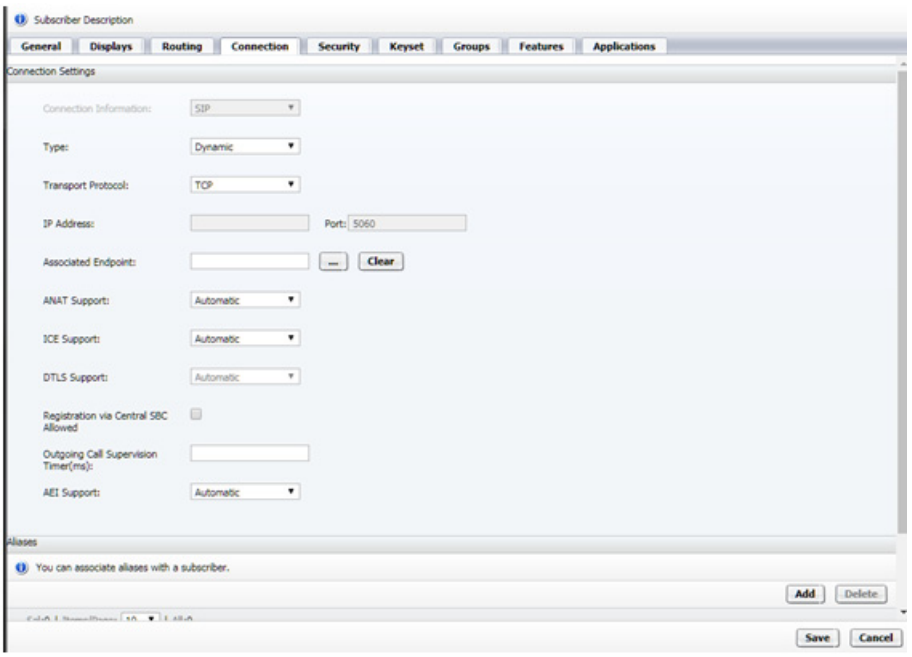
OpenScape Cordless IP V2 endpoints have to be configured in the same way in OSV-configuration as other SIP-users do. OSV does not know anything about the OpenScape Cordless IP V2 DECT system. All OpenScape Cordless IP V2 users will register at OSV with the same INT-DM address.

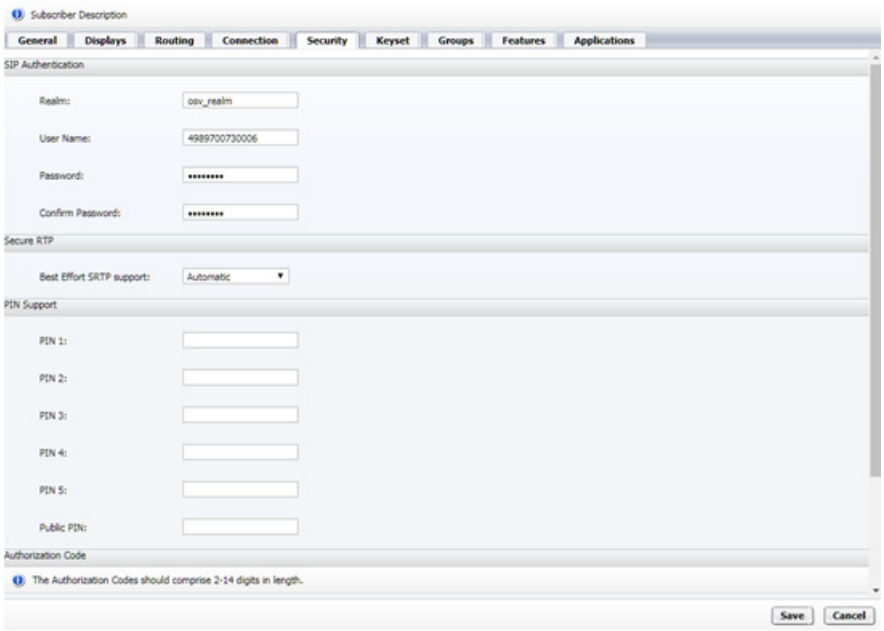
Usage with OpenScape Web client:

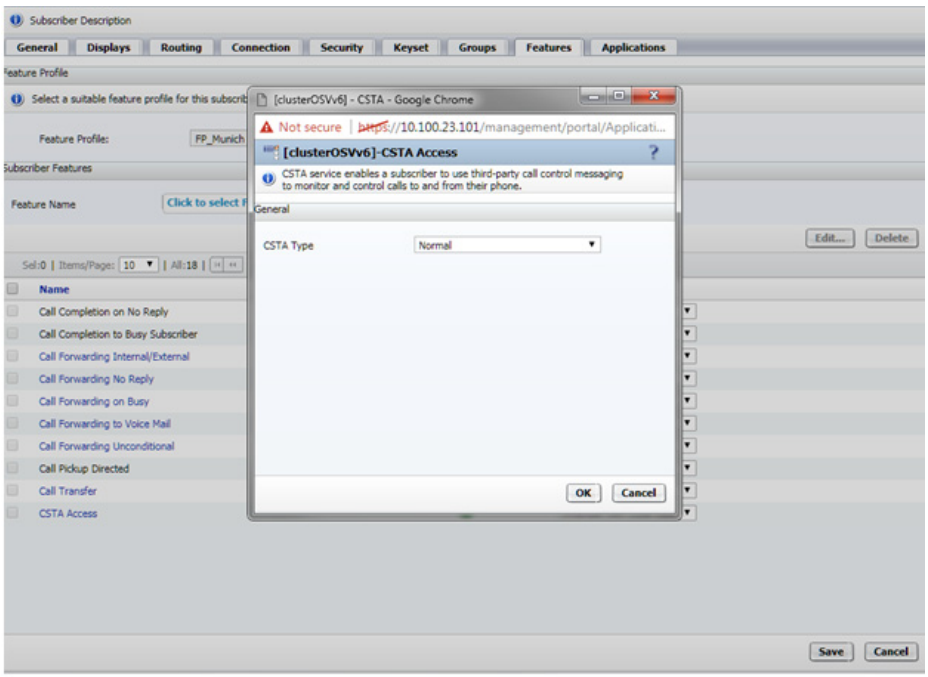
If OpenScape Cordless IP V2 users are used with OpenScape web client, the OpenScape Cordless IP V2 users feature-profile should be set to CSTA = Normal.

Only Limited feature-set using web client is supported.


Subscriber Description
General
Displays
Routing
Connection
Security
Keyset
Groups
Features
Applications
Extension
This is the default extension number which is displayed for internal calls to or from this subscriber in case the Display Number Modification tables are not provisioned to return a number.
Displayed Extension Number:
30006
Special Identities
The External Caller ID, if provisioned, is the subscriber's identity which is used for all external calls.
External Caller ID
Use Main Pilot DN as identity for external calls:
Use Main Pilot DN as identity for internal calls:
Display Information
Display Name:
CIPv2 + 49(89)7007300
External Display Name:
CIPv2 + 49(89)7007300
Save
Cancel


Subscriber Description
General
Displays
Routing
Connection
Security
Keyset
Groups
Features
Applications
Connection Settings
Connection Information:
SIP
Type:
Dynamic
Transport Protocol:
TCP
IP Address:
Port:
5060
Associated Endpoint:
...
Clear
ANAT Support:
Automatic
ICE Support:
Automatic
DTLS Support:
Automatic
Registration via Central SBC Allowed
Outgoing Call Supervision Timer(ms):
AEI Support:
Automatic
Aliases
You can associate aliases with a subscriber.
Add
Delete
Save
Cancel





Configuration of Gateways (Page SIP)

Each SIP-server (OpenBranch and/or OpenScapeVoice-signaling-IP-addresses has to be specified here).

Different OpenScape Cordless IP V2 users from one system may register on both Geo-separated OSV-nodes or on OpenBranch. In standard customer-scenarios only one gateway will be used.

For Geo-separated OpenScape Voice:

If the OpenScape Cordless IP V2 INT-DM is directly connected to a Geographically-node-separated OSV-cluster (Main-Office, no OpenBranch-Proxy involved) it is necessary to enable Flag "Direct Signaling". Otherwise calls from phones located on the 2nd node will not be accepted by OpenScape Cordless IP V2. If this flag is disabled the INT-DM allows only calls from the IP-address where the OpenScape Cordless IP V2 user is registered to. If this flag is enabled OpenScape Cordless IP V2 allows calls from any IP-addresses.

So for security-reasons this flag should only be enabled if OpenScape Cordless IP V2 is used in Geo-separated OSV.

Codec priority (G711a, G711u, G729a, G729b) and RTP framing (20msec) is recommended.

5.3.3 Station Configuration - INT-DM

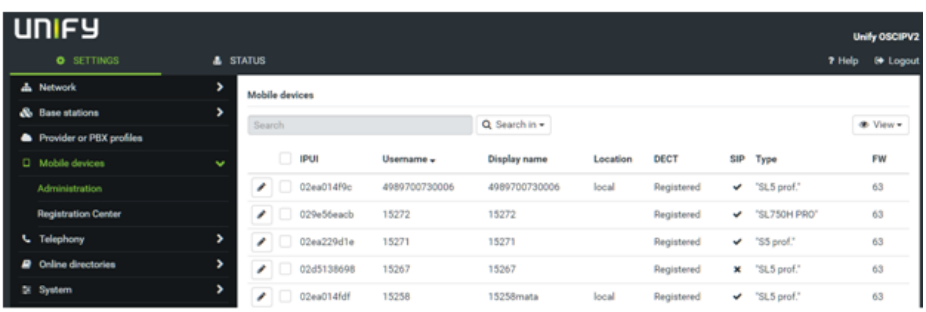
Please make the following configurations at the OpenScape Cordless IP V2-INT-DM:

Settings>Mobile Devices>Administration

Select the first entry and enter the following values:

Entry	Value(example)
Authentication name	4989700730006
Authentication password	123456
Username:	4989700730006
Display name:	4989700730006
VoIP Provider:	OSV

Save the modifications by clicking [**Set**].



5.4 Software License Management

OpenScape License Management (HLM) is used in the DECT Manager & Integrator. The Unify licensing process consists of 4 different steps, see for a general overview Figure 1:

1. The license key is centrally created and contains one "Base" with the SIELID, the number of "DECT Manager" (in case of small and medium this will be one) and one "Integrator Software" (in case of large deployment) for a Cordless IP system. The license file is signed by Unify CA.

   With V2R1 it is possible to license OSCIP2 systems (only small and medium) as part of the OSBiz license, i.e. the OSBiz license will contain a number of "OS Biz Cordless IP V2 DECT Manager" in its license file. Every OSCIP2 small/medium installation will contact the OSBiz CLA and request 1 DECT Manager license. Since this license type does not contain a OSCIP2 Base license the SIELID of the OSBiz license is displayed in WebUI of OSCIP2.

2. The license file is being download from a License Server (CLS, Central License Server). In general, the Customer Site Components (CSC) are part of the license SW of the product that interpret the license file and distribute it in a customer's network. In detail, the Customer License Agent (CLA) - usually on the Unify communication server - connects to the License Server and downloads the license file. Via CLA the customer can monitor the usage of licenses.

   If the CLA is located on the Unify communication server, the license file is downloaded onto the Unify communication server. A Customer License Client (CLC) which is always on DECT Manager & Integrator, is told, under which link on the Unify communication server it can contact the CLA.

3. Verification of the license key: the license file is read in and the signature is checked. If the check is successful, the license data will be retrieved from the license file. This is done by CLA.

4. License Enforcement: the license conditions are checked and supervised in the running system, e.g., as soon as a DECT IP Base station is installed and added to the system, the CLC contacts the CLA and a license counter in the license file is decremented. This step is performed by the Customer License Client (CLC) that is always running on DECT Manager & Integrator.

Figure 1 shows the OpenScape Cordless IP license management as part of the OpenScape License Management. CLS is the Central License Server. CLA is usually installed on the same Server as the Unify communication server. In DECT Manager & Integrator, the CLC module is integrated, which is the interface to the CLA.

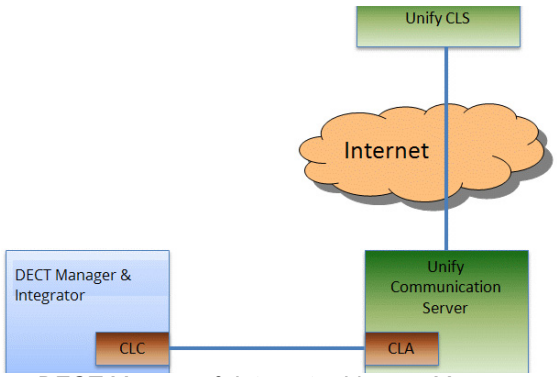


Figure 1 DECT Manager & Integrator License Management

When the OpenScape Cordless IP System is setup at a customer, a special Grace Period starts, i.e. the product can be used for 30 days without a license. Within this period of time, the one who is installing the system has to get a valid product license. After installation of the license software on the system, this license has no more time restrictions.

5.5 Mass Provisioning of handsets

5.5.1 Mass deployment of handsets

DECT devices can be imported via provisioning file for large numbers of devices.

Provisioning use cases:

- IPUI defined for each handset before registration
- IPUI not defined before registration process with status “NotReg”
- IPUI not defined before registration process with status “ToReg”

5.5.2 IPUI defined for each handset before registration

Using a list of all handset with it’s corresponding IPUIs (and RegStatus = “ToReg”) and SIP accounts assigned in advance. After data import every handset can be registered manually and sent to the user.

Procedure of mass import and registration of handsets with IPUI defined for each handset before registration:

- Prepare xml provisioning
- Upload xml auto configuration file via GUI e.g. Settings - Sytem - Provisioning and Configuration - Auto Configuration file - Browse -> upload the provisioning file
- Set Registration duration and start registration Centre e.g. Mobile devices - Registration Centre - Start now
- Register the handsets, introducing the PIN (e.g. 0111) and wait until the message “Handset registered” appears on the handsets. Up to 10 DECT phones can register in parallel.

5.5.3 IPUI not defined before registration process with status “NotReg”

Using a list of SIP accounts without predefined handsets (with wildcard IPUI set to 0_xxxxx and RegStatus “NotReg”), when the handset should be registered for a specific user the administrator executes the registration procedure for this user.

Procedure of mass import and registration of handsets without IPUI defined and status “NotReg”

- Prepare xml provisioning. (Recommendation same DECT_AC should be used for all DECT devices)
- Upload xml auto configuration file via GUI e.g. Settings - System - Provisioning and Configuration - Auto Configuration file - Browse -> upload the provisioning file
- Select handset from WebUI and press “Register Now” button
- Register the handset, introducing the PIN (e.g. 0111) and wait until the message “Handset registered” appears on the handsets.

5.5.4 IPUI not defined before registration process with status “ToReg”

Using a list of SIP accounts without predefined handsets (with wildcard IPUI set to 0_xxxxx and RegStatus “ToReg”), when several handsets of the same type should be registered as a bulk.

Procedure of mass import and registration of handsets without IPUI defined and status “ToReg”

- Prepare xml provisioning with same DECT_AC for all DECT devices (same DECT_AC must be used for all DECT devices)
- Upload xml auto configuration file via GUI e.g. Settings - System - Provisioning and Configuration - Auto Configuration file - Browse -> upload the provisioning file
- Set Registration duration and start registration Centre e.g. Mobile devices - Registration Centre - Start now
- Register the handset one by one, introducing the PIN (e.g. 0111) and wait until the message “Handset registered” appears on the handsets. Parallel registration is not supported.

5.5.5 Correlation between GUI and XML parameter name

Mobile Device

OSCIP GUI name	Keys in XML provisioning file	possible values/ Note
IPUI	<oper name=”add_hs”value=””>	e.g. value=”0242e45c3e”> for predifined IPUI e.g. value=”0_xxxxx”> for wildcard IPUI
Regstatus	<param name=”hs.RegStatus”value=””/>	e.g.value=”ToReg”> e.g.value=”NotReg”>
Authentication code (PIN)	<param name=”hs.DECT_AC”value=””/>	e.g.value=”0106”

Personal provider data

Authentication name	<param name=”SipAccount.AuthName”value=””/>	e.g. value=”82202”
Authentication password	<param name=”SipAccount.AuthPassword” value=””/>	e.g. value=”822020”
Username	<param name=”SipAccount.UserName”value=””/>	e.g. value=”82202”
Display name	<param name=”SipAccount.DisplayName” value=””/>	e.g. value=”82202”
VoIP Provider	<param name=”SipAccount.ProviderId”value=””/>	e.g. value=”0” for first provider in the list IP1

Online Directories

Directory for direct access	<param name=”hs.DirectAccessDir”value=””/>	e.g. value=”3” online directories e.g. value=”1” local directory

LDAP authentication

Corporate directory for INT key	<param name=hs.IntKeyDir”value=””/>	e.g. value=”0” deactivated e.g. value=”10” LDAP 1
Automatic look-up	<param name=”hs.AutoLookupDir”value=””/>	e.g. value=”0” deactivated e.g. value=”10” LDAP 1

LDAP authentication

Selected LDAP book	<param name=hs.LDAPId”value=””/>	e.g. value=”0” LDAP 1 e.g. value=”255” none
Show other LDAP servers	<param name=hs.LDAPShowProviders” value=””/>	e.g. value=”0” Yes e.g. value=”1” No
LDAP Authorisation type*	<param name=”hs.LDAPAuthType”value=””/>	e.g. value=”0” Global e.g. value=”1” User e.g. value=”2” SIP
	<param name=”hs.LDAPUseSIPCredentials” value=”1”/>	e.g. value=”1” enable user
	<param name=”hs.LDAPUsername” value=””/>	e.g. value=”” Username
	<param name=”hs.LDAPPassword” value=””/>	e.g. value=”” Password

Network mailbox configuration

Call number or SIP name	<param name=”SipAccount.VoiceMailMailbox” value=””/>	e.g. value=”*g”
Show other LDAP servers	<param name=”SipAccount.VoiceMailActive”valu e=””/>	Activate network mailbox

Group pick-up

Call number or SIP name	<param name= ”SipAccount.OpenScapeGroupPickupAddr ess” value=””/>	e.g. value=”*7”

Call manager

Show other LDAP servers	<param name= ”SipAccount.OpenScapeGroupPickupActive” value=””/>	Activate group pick-up

Call manager

Accept calls directly via Call Manager	<param name=”hs.CallManagerCallsVia” value=””/>	e.g.value=”via Headseat” e.g. value=”via Handsfree” e.g. value=”No”

Missed calls and alarms

Missed calls count	<param name=”hs.SaveMissedCalls”value=””/>	e.g. value=”1” Yes e.g. value=”0” No
Accepted calls count	<param name=”hs.SaveAcceptedCalls” value=””/>	e.g. value=”1” Yes e.g. value=”0” No
Flashing LED (MWI) for missed calls	<param name=”hs.ShowMissedCalls” value=””/>	e.g. value=”1” Yes e.g. value=”0” No
Flashing LED (MWI) for missed alarms	<param name=”hs.ShowMissedAlarms” value=””/>	e.g. value=”1” Yes e.g. value=”0” No
Flashing LED (MWI) for network mailbox	<param name=”hs.ShowMissedNetAM” value=””/>	e.g. value=”1” Yes e.g. value=”0” No

Example an xml “Auto configuration file” without predefined IPUI (wildcard IPUI)

```
<?xml version=”1.0.” encoding=”UTF-8”?>
<provisioning version=”1.1” productID=”e2”>
<nvm>
<oper name=”add_hs” value=”0_00001”>
<param name=”hs.RegStatus” value=”NotReg”/>
<param name=”hs.DECT_AC” value=”0111”/>
<param name=”SipAccount.AuthName” value=”82202”/>
<param name=”SipAccount.AuthPassword” value=”822020”/>
<param name=”SipAccount.UserName” value=”82202”/>
<param name=”SipAccount.DisplayName” value=”82202”/>
```

```
<param name="SipAccount.ProviderId" value="0"/>
</oper>
<oper name="add_hs" value="0_00002">
<param name="hs.RegStatus" value="NotReg"/>
<param name="hs.DECT_AC" value="0111"/>
<param name="SipAccount.AuthName" value="82204"/>
<param name="SipAccount.AuthPassword" value=""/>
<param name="SipAccount.UserName" value="82204"/>
<param name="SipAccount.DisplayName" value="82204"/>
<param name="SipAccount.ProviderId" value="0"/>
</oper>
</nvm>
</provisioning>
```

6 Technical Data

6.1 OSCIP V2 specific data

• Number of channels	120 duplex channels, freely administered (10 carriers, each with 12 time-division multiplex channels)
• Frequency range	– 1.88 to 1.9 GHz (send and receive range) – 1.91 to 1.93 GHz in case of LAM
• Channel spacing	1.728 MHz
• Bit rate	1.152 Mbps
• Speech encoding	32 kilobit/s ADPCM
• GAP standard	Specified in DECT specification ETS 300 444
• PN CAP	Unify-specific protocol enhancement
• DECT Access	EN 301 406 V.1.5.1

6.2 Base Stations

General

• Software	Can be loaded via the communication system.
• Antennas	Two external antennas are mounted on the top of the housing of the base station. The base station works as option with antenna diversity (this means that the radio receiver is connected to whichever antenna delivers the greater field strength).
• Average output power	10 mW to 125 mW
• Radio range	Basically dependant on the radio transmission characteristics of the environment/premises.
– Outdoors	Up to 300 m
– Indoors	Up to 50 m
• Power supply	PoE is used to supply power to the DECT IP base station
• Accessories	Outdoor housing

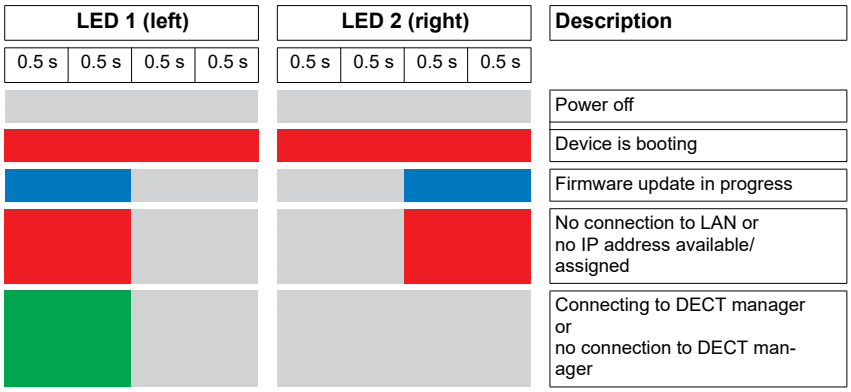
DECT IP Basisstation BSIP2

• Dimensions	202 x 172 x 43 (W x H x D in mm)
• Weight	500 g
• Power supply	PoE, according IEEE 802.3af Class 2
• Power consumption	< 4 W
• Operating temperature indoors Outdoors (in outdoor housing)	+ 5°C to + 45°C - 25°C to + 40°C
• Cabling	10/100Mbps Ethernet cable, Cat. 5 and higher, 8-pin shielded RJ45 connector

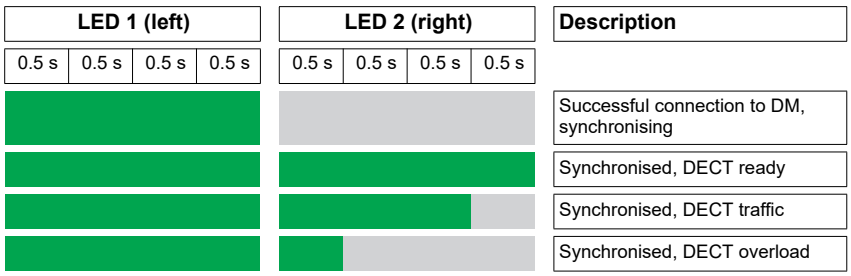
Light Emitting Diode (LED) status displays on the base station

Depending on the device role the LEDs on the front side show different operational states. The LEDs can have three different colours (red, blue, green) or can be off.

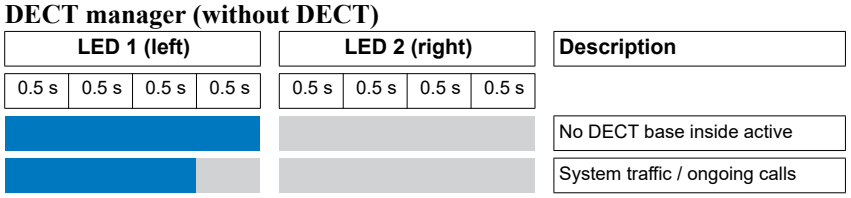
DECT manager and base stations



Base station operational states



DECT manager (without DECT)



DECT manager (with DECT)

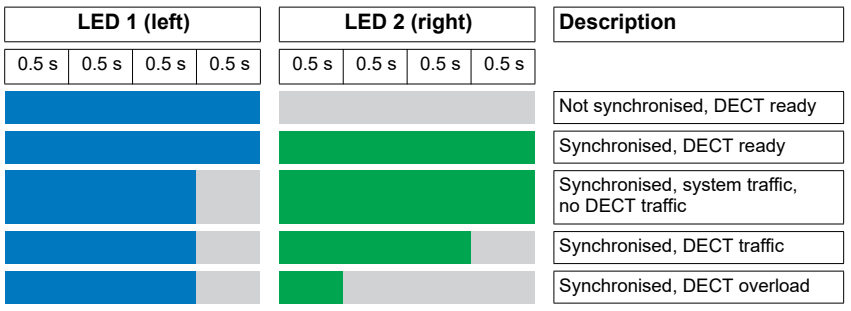


Table 8

Blinking frequency = 500msec. ON, 500msec. OFF

Figure 1 LED position on the base station

6.2.1 PoE Injector

- An injector is needed when operating the DECT IP base station on the mains,
- Single-port PoE injector in compliance with IEEE 802.3af Class 2
- Injector is included in the scope of features
- The PoE injector ships with startup information and notes on LED status displays.

6.3 Measuring Equipment

Site Planning Kit BFA227

L30280-F600-A227

7 Glossary

7.0.0.1 Bandwidth

The bandwidth defines the size or transmission capacity of a transmission channel or, more precisely, the difference between the lowest and highest possible frequency on a transmission channel. The bandwidth is specified in Hz. For digital data transmission, the bandwidth determines the data volume that can pass through a transmission channel in a specified period, i.e., the transmission speed (specified in bit/s).

The bandwidth used to transmit analogue voice data via a digital transmission medium, e.g., the Internet for VoIP, determines the number of channels that can be used simultaneously and the quality of the voice transmission. How the available bandwidth is used to transmit voice data is determined by the selection of a £**Codec**. Codecs are available for broadband transmission up to 64 Kbit/s (£**Broadband mode**) or narrowband transmission up to 32 Kbit/s (£**Narrowband mode**).

7.0.0.2 Broadband mode

For VoIP (digital transmission medium), voice data is transmitted in broadband mode or in £**Narrowband mode**. In broadband mode, a transmission rate or £**Bandwidth** of 64 Kbit/s is available.

The bandwidth used for the transmission is determined by the selection of a £**Codec**.

7.0.0.3 Cluster

Subdivision of a DECT network into groups (subnets) by a central management station
(DECT Manager). All telephones in the network use the central functions of the PABX
(VoIP configuration, directories, etc.). However, the base stations only synchronise within a cluster, meaning that a handover of a handset from one cluster to a neighbouring cluster is not possible.

7.0.0.4 Codec

Codec is a procedure that digitalises and compresses analogue voice before it is sent via the Internet, and decodes – i.e. translates into analogue voice – digital data when voice packets are received. There are different codecs that vary, for instance, in the level of compression.

Both parties involved in the telephone connection (caller/sender and recipient) must use the same codec. This is negotiated between the sender and the recipient when establishing a connection.

The choice of codec is a compromise between voice quality, transmission speed and the
necessary £**Bandwidth**. A high level of compression, for example, means that the bandwidth required for each voice connection is low. However, it also means that the time needed to
compress/decompress the data is greater, which increases execution time for data in the
network and thus impairs voice quality. The time required increases the delay between the sender speaking and the recipient hearing what has been said.

The selection of the codec for the telephone connection therefore influences the voice
quality and, via the available bandwidth, the possible number of usable channels per base station.

Codecs in £**Broadband mode**

G.722

Excellent voice quality. The G.722 codec works at the same bit rate as G.711 (64 Kbit/s per speech connection) but with a higher sampling rate. This allows higher frequencies to be played back. The speech tone is therefore clearer and better than with the other codecs and enables a speech tone in High Definition Sound Performance (£**HD voice**).

G.711 a law/G.711 µ law

Excellent voice quality (comparable with ISDN). The necessary bandwidth is 64 Kbit/s per voice connection.

Codecs in £**Narrowband mode**

G.726

Good voice quality (inferior to that with G.711 but better than with G.729). The necessary bandwidth is 32 Kbit/s per voice connection.

G.729

Average voice quality. The necessary bandwidth is less than or equal to 8 Kbit/s per voice connection.

7.0.0.5 dBm

Decibel (dB) related to milliwatt (mW)

Unit of measure for the send power.

0 dBm corresponds to a power of 1 mW, larger power values have positive dBm values, smaller power values have negative dBm values. The ratio of dBm to mW is logarithmic. An increase of 30 dB corresponds to a thousand fold increase.

Consequently, the power of one microwatt (µW) corresponds to -30 dBm, one nanowatt (nW) to -60 dBm and one picowatt (pW) to -90 dBm.

7.0.0.6 DCS

Dynamic Channel Selection

A process for DECT radio networks that base stations can use to flexibly determine and select the channels with the best availability.

7.0.0.7 DECT

Digital Enhanced Cordless Telecommunications

Global standard for wireless connection of mobile end devices (handsets) to telephone base stations.

7.0.0.8 DECT Manager

Exchange in a DECT multi-cell system. The DECT Manager groups several DECT base stations together as a DECT network.

7.0.0.9 Erlang

Unit which measures the traffic volume in a communications system. One erlang corresponds to the continuous full capacity utilisation of one connection channel in a specific period.

7.0.0.10 Frame

For radio transmission, DECT uses a time multiplex procedure with a frame structure for separating the uplink and downlink for each radio channel (£**Frequency**). This time frame is ten ms long and is subdivided into 24 time slots (slot 0 – 23). The first 12 time slots are for the downlink and the second 12 time slots for the uplink. For one connection, the base station and handset each occupy one £**Slot pair**.

7.0.0.11 Frame quality

The radio quality in the DECT network is measured at defined time intervals. The frame
quality indicates the percentage rate of the packages received without errors in a measurement interval.

7.0.0.12 Frequency

The frequency range 1880 –1900 MHz is assigned exclusively for DECT in Europe. This frequency band is divided into ten carrier frequencies (channels) with a channel interval of 1728 kHz, where 0 represents the highest frequency and 9 the lowest.

7.0.0.13 Handover

Possibility for a subscriber with a DECT handset to change from one cell to another during a call or a data connection without interrupting this connection.

7.0.0.14 HD voice

Gigaset technology for extraordinary sound quality in which the sound in calls is transmitted via the Internet in double £**Bandwidth** (8 KHz).

7.0.0.15 Multi-cell system

DECT wireless network that consists of the cells of several base stations. A DECT multi-cell system must have a £**DECT Manager** as the central station.

7.0.0.16 RFP

Radio Fixed Part
Base stations in a multi-cell DECT network.

7.0.0.17 RFPI

Radio Fixed Part Identity

ID for a base station in a multi-cell DECT network. It includes the number (RPN) and an ID for the DECT Manager. A handset uses it to recognise the base stations it is connected to and the DECT network to which it belongs.

7.0.0.18 Roaming

Possibility for a subscriber with a DECT handset to accept or make calls in all cells of a DECT network.

7.0.0.19 RPN

Radio Fixed Part Number

Number for the base station in a multi-cell DECT network.

7.0.0.20 RPP

Radio Portable Part

Handset in a multi-cell DECT network.

7.0.0.21 RSSI

Received Signal Strength Indication

Indicator for the reception field strength of radio signals.

On the measuring handsets of the Gigaset N720 SPK PRO, RSSI is specified as a percentage value. In this case, the maximum assumed signal strength is defined as 100%. The percentage value represents the signal strength of the package received as a ratio of the maximum
possible RSSI (100%).

7.0.0.22 Narrowband mode

For VoIP (digital transmission medium), voice data is transmitted in narrowband mode or £**Broadband mode**. In narrowband mode, a transmission rate or £**Bandwidth** of up
to 32 Kbit/s is available.

The bandwidth used for the transmission is determined by the selection of a £**Codec**.

7.0.0.23 Slot pair

A slot pair (0–11) identifies the time slots within a time frame (£**Frame**) that the base station and handset use for their connection. Of the 24 time slots (slot 0–23) of a frame, the first 12 are for the downlink and the second 12 for the uplink. The time slot from the first half (0–11) and the second half (12–23) form a slot pair.

Slot pair four means, for example: the base station sends in time slot four, the handset in time slot 16 (four + 12).

7.0.0.24 Cell

Wireless coverage area of a base station in a multi-cell DECT network.