IP DECT (100 Series & GDC-800)

Site Planning Guide

Please read this guide carefully before operating your set. Retain it for future reference.

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Document Information

Issue	Date	Description of Changes
1.0	2015-03-16	Initial release
1.1	2015-03-24	General Update
1.2	2019-03-08	Added 100 series

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Before Starting

About this Guide

This guide briefly describes the elements involved in planning and designing a typical IP DECT system.

Planning and design begin with the collection of requirements for capacity, coverage and quality.

Audience

This guide is intended for network administrators and others involved in planning and designing IP DECT systems.

It is expected that the reader has read and is thoroughly familiar with the contents of the various documents referenced below.

Abbreviations

For the purpose of this document, the following abbreviations hold.

- **DHCP:** Dynamic Host Configuration Protocol
- **PoE:** Power over Ethernet
- **RSSI:** Received signal strength indication
- **SME:** Small and Medium scale Enterprise
- **TOS:** Type of Service (policy based routing)
- **VLAN:** Virtual Local Access Network

Reference or Related Documentations

- User Guide
- Base Station Install and Administration Guide
- Service Mode Management Guide

Notices

The following notices and statements are used in this guide.

CAUTION

A caution statement alerts you to situations that may cause serious damage to hardware, software, or data.

NOTE

A note provides additional explanations, important information, or a reference to related information.

Capacity Planning/Deployment

IP DECT Network Requirements

Establishing the network requirements for an IP DECT system is essential to determining elements necessary to achieve the overall expectations of the customer. Typical network requirements include but are not limited to:

- The geographical area to be covered,
- The structure of the building, including the material and thickness of walls,
- The estimated traffic in the coverage area,
- The acceptable blocking criteria in the coverage area,
- The connections to an Ethernet switch PoE port.

Deployment Considerations

The following radio related considerations must be examined before deploying an IP DECT system. These include but are not limited to:

Building Penetration

When an RF signal strikes a surface, such as a wall, it is partially diffracted and absorbed as it passes through the wall. Therefore, to some extent the signal is reduced (attenuated). The amount of attenuation is dependent on the type of material, thickness and the radio frequency. This is an important consideration in coverage planning.

Interference Sources

The sensitivity of the base station and repeater RF receiver is diminished by other extraneous RF signals. These signals may be from the same network or other RF sources such as Fax machines, copiers, etc. A well-planned system installation should identify potential interference sources for optimal placement of base stations and repeaters.

Radio/Cell Range

The distance between two base stations depends on the physical path between the base stations. If the path loss is reduced, e.g. by reducing the path length or minimizing the number of walls and obstacles in the path, then signals from base stations will cover greater distances. In a typical office, a good first order estimate of the distance between two base stations is 30-40m.

Network Connectivity

Base stations require a connection to an Ethernet LAN port with support for Class 2 PoE. The base station is connected to the port with at least Cat 5 cabling and the standard LAN wiring distance (100 meters) applies.

Capacity Planning

Capacity planning attempts to estimate how many calls will be initiated in a typical period of time, and the length of the calls. Based upon the expected usage patterns and voice codec, the required cell capacity can be estimated using the table below. The maximum capacity in the coverage area of a base station and associated repeaters is always limited to the capacity of the base station.

	Narrowband codec		Wideband codec	
Traffic (Erlang)	Number of users		Number of users	
Grade of Service(GOS)	1%	2%	1%	2%
0.05	65	74	19	23
0.10	34	38	10	13
0.15	23	26	7	9
0.20	18	20	6	7

The maximum base station and repeater capacity is indicated in the table below:

	Narrowband codec	Wideband codec
Base station	8 calls	4 calls
Repeater	5 calls	2 calls

Base station/Repeater Placement Strategy

The antennas in the base stations are approximately omnidirectional. Thus, there is no need to consider how the base stations face each other when deploying them. While there is no one strategy for deploying base stations, the following are some of the considerations to determine the probable base station and repeater placement.

Corridors:

Base stations and repeaters should be deployed vertically preferably at corridor intersections where propagation patterns can follow the corridor patterns. Base stations and repeaters should be installed so that they are above any objects, such as filing cabinets, located in the corridor.

Multi-Story Buildings:

Base stations and repeaters can be installed on opposite sides of the floor to establish floor-to-floor coverage. The coverage design cannot rely entirely on floor-to-floor propagation; each case must be verified due to variations in local attenuation patterns.

Large Halls

Open areas can be covered with a sparse network of base stations. In such applications, the base stations and repeaters cover an extended range due to the extended line-of-sight radio propagation.

Base stations and repeaters can be deployed in large halls that contain a central open space with windows to the other areas. This provides good coverage for the rooms in the inner circle on all floors (e.g. hotels).

In large halls, base stations and repeaters should be installed vertically in the middle of the space below the ceiling.

Mounting Positions

When base stations and repeaters are mounted vertically on a wall, the radio coverage in front of these devices is twice as large as the coverage at the rear. The base stations should always be mounted higher than any objects in the area. The minimum recommended height is 2 meters above the floor.

Metallic Structures/Objects

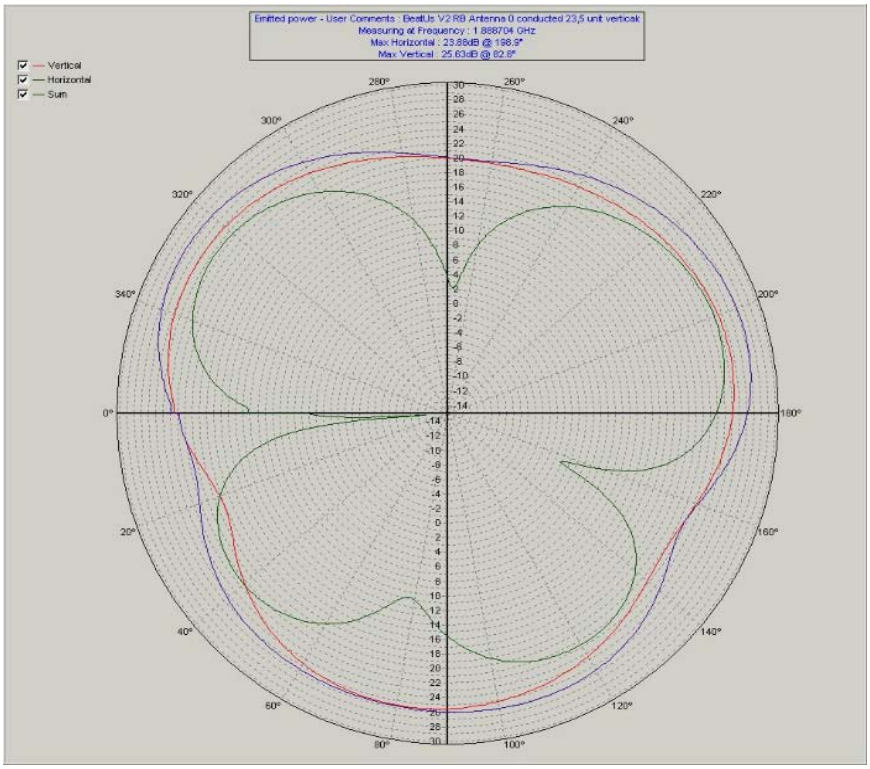
Base stations and repeaters should not be deployed near large metallic objects. Metallic objects such as filling cabinets significantly attenuate and thus reduce the signal strength.

Reinforced Concrete Structures

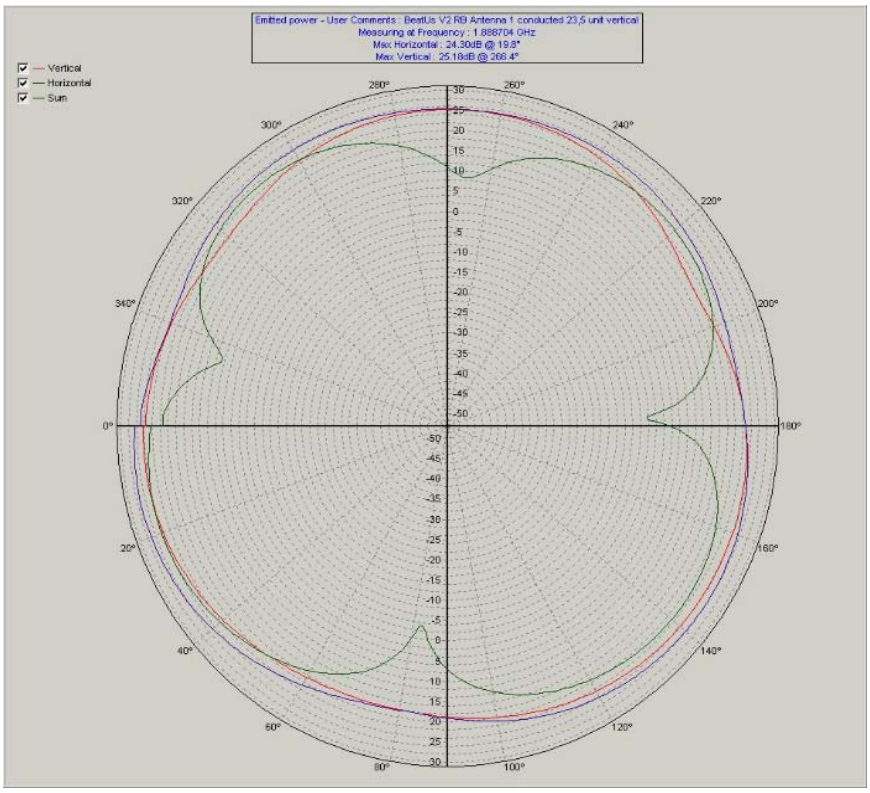
These structures have a high attenuation factor. They reduce the radio coverage range of the base stations and repeaters and therefore a higher number of base stations or repeaters are needed in the building. Lighter types of construction materials require fewer base stations since attenuation figures are considerably lower.

Base Station Position for Optimal Coverage

The base station radio frequency propagation pattern is similar to the illustrations below.



[Antenna 0]



[Antenna 1]

Antenna 0 is located on the right side of the unit as seen from the back of the base station.

From the radiation pattern, it can be seen that the position of the base for optimal coverage is upright. When a base station is deployed, this position should be employed as it provides optimal coverage between base stations in a chain and handset.

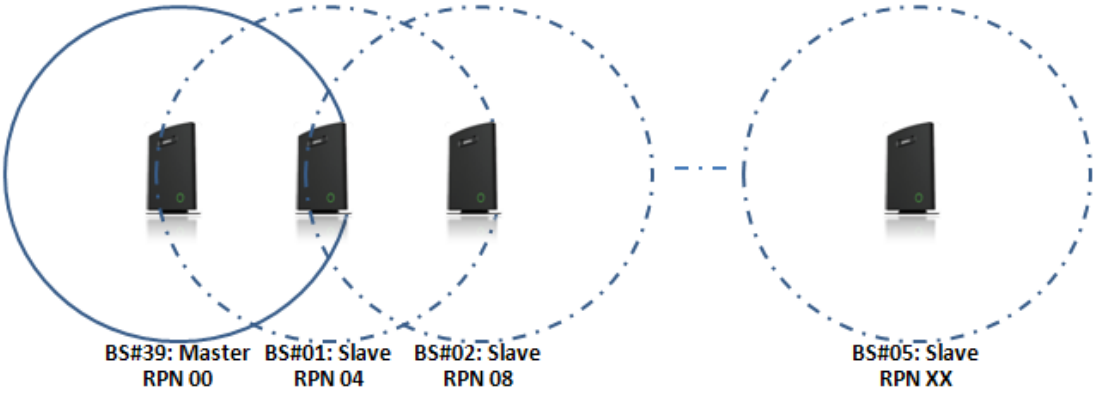
In case the upright position is not possible, it is important to study the radiation patterns again.

In case the base station is horizontally positioned, the optimal radiation pattern between base stations is when the base stations are placed side by side in the chain.

Deploying an IP DECT system

This chapter provides a brief description of practical deployments of an IP DECT system.

Case 1: Synchronization Chain with One Master Sync.



a) In a multi-cell deployment, bases stations must have a significant coverage overlap to allow for the air interface synchronization.

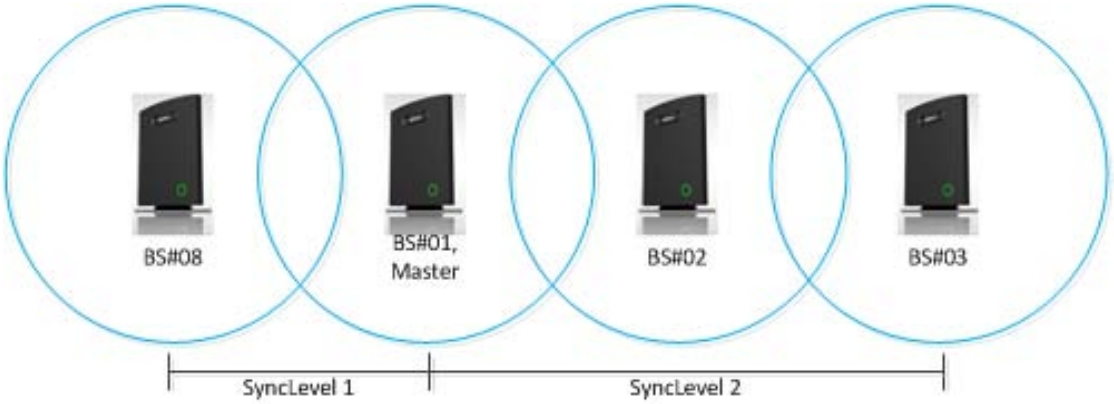
b) In the above illustration, base station #39 is the Master. All other Base stations in the chain synchronize with the master either directly or indirectly through another base station in the synchronization chain.

c) A maximum of 12 sync levels can be used in a deployment.

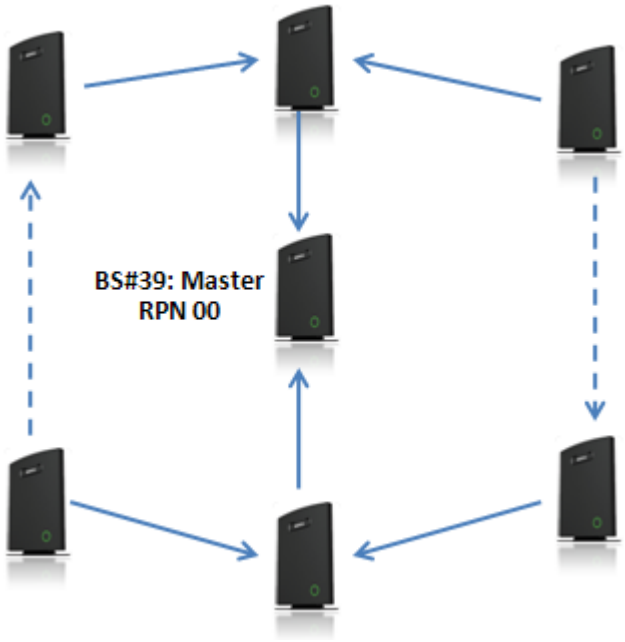
d) Other base stations or repeaters are connected to the Sync Master through the synchronization chain.

e) If a base station or repeater in the sync chain fails, Base stations and repeaters further down the chain will not be able to synchronize with the master. Since these units cannot synchronize, handovers between these units and others is not possible.

The sync level concept is illustrated below, where bases #08 and #02 are at sync level 1, and BS#03 is at level 2.



Case 2: Synchronization Chain without Alternative Sync Paths



a) In the above figure, the Master Sync source is base station #39. A maximum of 40 base stations can be deployed in an IP DECT system. Depending on the network requirements, not all base stations may require synchronization.

b) A maximum of 12 sync levels can be used in any deployment.

c) Depending on the system setup, it is recommended to place the Master in a central location in the building.

Case 3: Synchronization Chain with Alternative Sync Paths

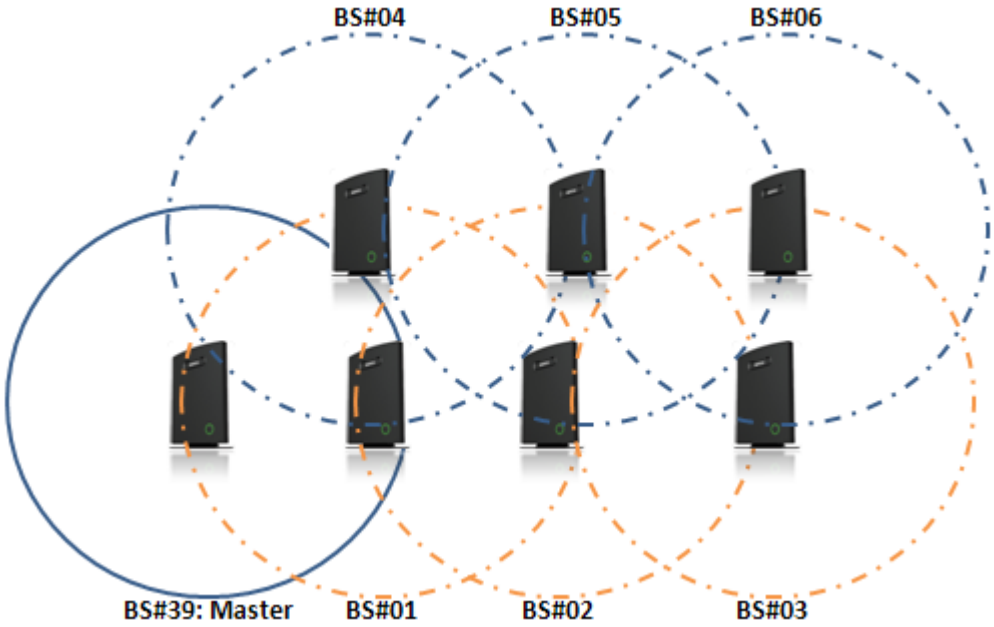
The illustration below shows a multi-cell network with alternative Synchronization paths. If a base station fails, other base stations can employ an alternative base station for synchronization. Thus, handovers between the active base stations still occur.

- **Solid line:** indicates the primary sync paths, with the base stations chained in a multi-cell network.
- **Dotted line:** indicates the alternative sync paths.

BS#39 is the SYNC Master, if BS#05 is down, most handovers can be performed via 3 alternative cells (i.e. BS#06, BS#02 and BS#04).

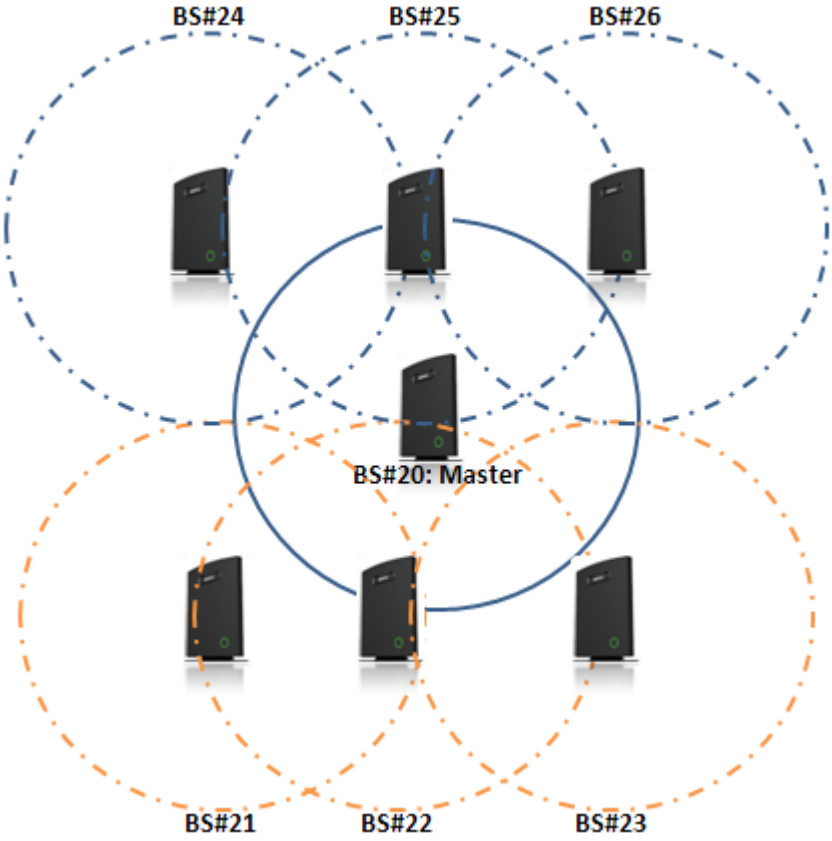
Furthermore, observe:

- BS#04 and BS#01 have “primary” sync to BS#39.
- BS#05 has “primary” sync to BS#04 while alternative sync is BS#01 or BS#02
- BS#03 has “primary” sync to BS#02 while alternative sync is BS#05 or BS#06, in that order



In the illustration below:

- BS#24 has “primary” sync to BS#25 while alternative sync is BS#20
- BS#22 has “primary” sync to BS#20 while alternative sync is BS#21 or BS#23, in that order



Measuring Cell Coverage

The actual cell coverage in an installation can be determined using a special handset feature, the Loop-back Survey Mode. In this mode, the handset displays the strength of the signal received from a base station (RSSI) and an audio loop back connection through the selected base station is established. Note the RF Site Survey mode described in the IP DECT installation manual may also be used to display the RSSI of nearby base stations.

To complete the survey a plane view drawing of the office is required and is used to mark the signal strength and thus coverage area for each base station.

Prepare the Base Station

The base station requires no special preparation for the coverage measurements.

1. Starting with the intended master base station, note the MAC address of the base station on the plane view drawing where the base station will be located. The MAC address is printed on the label located on the rear of the unit.
2. Place the base station in the probable location then connect the base station LAN port to a PoE port of the LAN switch.
3. Assure the unit is initialized to default by pressing the Reset switch located on the right side of the unit.

Prepare the handset

Before starting the coverage measurements, make sure the handset is fully charged. The handset does not need to be registered to a base station to complete these measurements.

1. Press the “Menu” key and dial *47*. The handset will display the MAC address of nearby base stations. It may take a few moments for the handset to detect and display the MAC addresses.
2. Use the Navigation up/down key to highlight the MAC address for the desired base station.
3. Press the “OK” softkey to select the base station. To terminate the operation, press the “Cancel” softkey.
4. The handset will display the “RSSI” level of the base.
5. By pressing the “Off-hook” key (key with the green handset), an audio loopback connection is established with the base station. This will make it possible to listen to audio, and determine the audio quality as well as the RSSI.

6. At the handset, press the “Tone” softkey. The handset will send a continuous tone to the base station, which will return the tone to the handset. Use the “Tone off” softkey to terminate the tone.
   Alternatively, an audio source such as an MP3 player can be connected to the headset jack. In this case, the “Tone” softkey is not used.

Determine the Base Station Coverage Area

The purpose of this section is to describe how to determine the base station position and coverage area.

1. Walk toward the edge of the expected coverage area, monitoring the received audio and the RSSI.
2. When the signal strength drops to -72dBm or the audio is no longer of acceptable quality, mark your position on the plane view drawing.
3. Repeat steps 1 and 2 above at a number of locations around the base station and draw the coverage area on the site drawing.
4. Repeat the process for each base station in the IP DECT system. During the survey, modify the probable locations as needed to provide improved service.

Verify Deployment

The actual synchronization RSSI may be seen on the base station group web admin page. It is recommended to have a RSSI value of -72dBm or higher, and never lower than -90dBm. Below is an example of the base station web page.

Base Station Group

	ID	RPN	Version	MAC address	IP address	IP Status	DECT sync source	DECT Property	Base Name
☐	0	00	110	00:08:7B:07:7C:C8	192.168.10.126	Connected	RPN: 68 (-47dBm)	Locked	SME VoIP (RTX Chain S104-1)
☐	1	04	110	00:08:7B:07:91:CB	192.168.10.145	Connected	RPN: 68 (-52dBm)	Locked	SME VoIP (RTX Chain S104-2 Xtra)
☐	2	08	110	00:08:7B:D7:91:3F	192.168.10.137	Connected	RPN: 48 (-73dBm)	Locked	SME VoIP (RTX Chain A110)
☐	3	0C	110	00:08:7B:07:92:33	192.168.10.139	Connected	RPN: 14 (-43dBm)	Locked	SME VoIP (RTX Chain A115)
☐	4	10	110	00:08:7B:07:92:50	192.168.10.129	Connected	RPN: 08 (-45dBm)	Locked	SME VoIP (RTX Chain A207)
☐	5	14	110	00:08:7B:07:7C:FF	192.168.10.107	Connected	RPN: 08 (-62dBm)	Locked	SME VoIP (RTX Chain A211)
☐	6	18	110	00:08:7B:D7:91:6E	192.168.10.105	Connected	RPN: 44 (-77dBm)	Locked	SME VoIP (RTX Chain A214)

Figure 1: Example of DECT Synchronization chain

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