

# Multicell Deployment Guide

v1.0

## snom M700

# snom M700 multicell deployment guide

## (Capacity Planning/Deployment/Installation)

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### Document History

Revision	Author	Issue Date	Comments
0.1	Tim Koehler	27-Jun-2014	Initial Version
1.0	Benjamin Ziebarth	29-Aug-2014	Initial Release

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## Introduction

This document shall help to setup a multicell DECT system. Beside DECT and wireless aspects, it also addresses network requirements and capacity planning.

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## Intended Audience

The target audience for this document includes network administrators and anyone that will plan and design a multicell DECT solution.

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## Abbreviations

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

DHCP:	Dynamic Host Configuration Protocol
(T)FTP:	(Trivial) File Transfer Protocol
IOS:	Internetworking Operating System
NAT:	Network Address Translator
PCMA:	A-law Pulse Code Modulation
PCMU:	$\mu$ -law Pulse Code Modulation
RPN:	Radio Fixed Part Number
RSSI:	Received signal strength indication
RTP:	Real-time Transport Protocol
RPORT:	Response Port (Refer to RFC3581 for details)
SIP:	Session Initiation Protocol
SME:	Small and Medium scale Enterprise
SRTP:	Secure Real-time transport protocol
STUN:	Session Traversal Utilities for NAT
TLS:	Transport Layer Security (for SIP encryption)
VLAN:	Virtual Local Access Network
TOS:	Type of Service (policy based routing)
URL:	Uniform Resource Locator
UA:	User Agent
UTC:	Coordinated Universal Time (similar to GMT format)

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## DECT deployment assessment

DECT deployment assessment is essential to determine elements necessary to achieve the overall expectations of the user. Typical network requirements includes (but not limited to):

- The geographical area to be covered
- The type or architecture of building and/or topology, etc.  
This includes the material of walls, thickness of walls.
- The estimated traffic in each coverage area
- The blocking criteria in each coverage area.

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## Deployment Considerations

The following radiation related considerations must be examined before deploying a typical SNOM M700 System. These includes (but not limited to):

### Building Penetration:

When a signal strikes a building it is diffracted or absorbed; therefore to some extent the signal is reduced. The amount of absorption is dependent of the kind of building and its environment, the amount of solid structure. This is an important consideration in coverage planning.

Note: The structure of the building will have an impact of coverage range.

### Interference Sources:

Signals from receiving antennas are weakened by interference from other signals. These signals may be from the same network or other objects. A well planned DECT multicell installation should identify potential interference sources for optimal placement of Base stations and repeaters.

Note: Other DECT systems or devices transmitting in similar frequencies, weakens reception. Therefore it is recommended to set up base stations sufficiently close to each other.

### Radio/Cell Range:

The suggested distance between two base stations depends on the physical path between the base stations. If the path loss is lessened, e.g. by minimizing amount of walls/obstacles in the path, then signals from base stations will cover more distance. In a typical office building the suggested distance between two base stations is 20-40m.

Note: Less obstacles between two base stations increase the possible distance between two base stations.

### **Range**

· Office areas: Up to 40 meters

- Office areas with obstructions like elevator shafts, stairwells, metal walls: Up to 10 meters
- Shop floors: Up to 60 meters
- Exhibition halls or production areas without obstacles: Up to 100 meters
- Underground garages: Up to 20 meters
- Outdoors without obstructions: Up to 200-300 meters (for indoor use only)

## Capacity Planning

Each base station has a maximum limit of parallel calls.

	Narrow band	Wide band
<b>Base station</b>	8 calls	4 calls
<b>Repeater</b>	5 calls	2 calls

To avoid insufficient user experience through congested DECT network, the capacity for the DECT network should be planned in advance.

Due to different usage patterns, the number of base station required to fulfil the demand of voice channels may vary.

The total capacity in the coverage area of a base station is always limited to the capacity of a single base station.

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## Site Planning / Cell Coverage

The actual cell coverage and quality in an installation can be determined with a special handset feature, in which the handset establishes an audio loop.

Snom urgently recommends to

**Note:**        **This feature can be used with base stations in an infrastructure, but also with single base stations without Ethernet connection, so the feature allows to identify obstacles and difficulties in an installation.**

### 1. Using the Handset for reception measurement

Before starting the deployment measuring make sure the handset is properly charged. Identify the MAC address of the base station to which you want to measure. As well manually read the MAC address on the base station labels on the back side for the device to be used with the handset. The handset does not need to be (pre-)registered to a particular base.

1. Press "Menu" followed by the keys: \*47\* to get the handset into find bases menu.

Note: Stay close to the base station to start the search.

2. Use the cursor down/up to select the base MAC address for the base station.
3. Select the intended base.
4. The handset display will show the "RSSI" (Received signal strength indication) level of the base.
5. Optional: By pressing "hook off" key (green key) an audio loopback connection will be established with the base station.

Note: By plugging in a headset modified for a MP3 player connection audio from the handset/MP3 player will be looped back to the handset earpiece. This makes it possible to listen to audio at the same time as reading the RSSI levels of the display.

Snom recommends using a building plan and checking the base station coverage using the handset signal strength indication RSSI level from each base station.

## ***2. Placing 2<sup>nd</sup> and following base station***

In order to place the 2<sup>nd</sup> base station:

- Place the 1<sup>st</sup> SNOM M700 base station exact at the desired position, and power on the base
- Set up the handset as described in previous section.
- Use the building plan drawing and check the base station coverage using the handset RSSI levels. Mark up the acceptable spots and non-acceptable spots for placing the 2<sup>nd</sup> base station on the plan drawing. Acceptable spots are spots where the handset shows RSSI levels better than 075 dBm (meaning lower numeric number) and where you verified via audio loopback that the reception is clear.

**It is recommended to have a RSSI value better than/equal to -75dBm, and never below -90dBm.: Lower numeric number than 075 dBm on the handset screen. Please note that the minus is not shown on the screen.**

Typically, installations such as office buildings, warehouses and hospitality should be equipped with both base stations and repeaters on several floors to create uniform and complete radio coverage.

Do not link two or more multicell base station via a repeater. A repeater shall be only used to extend the coverage of a single base station. If Ethernet is available it is recommended to use a multicell station rather than a repeater.

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

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## IP configuration

The snom M700 can operate using a variety of the IP network settings, allowing it to be configured for different networks.

The base station can be configured for either dynamic IP-address retrieval using DHCP or setup for usage of a fixed IP-address. By default dynamic configuration is configured.

The base station can also be configured for usage of a virtual LAN (VLAN), which is the recommended configuration, as a dedicated VLAN for voice traffic in a corporate network can provide the most optimal Quality of Service (QoS). No VLAN tag is enabled as default. The VLAN can be configured during boot up via DHCP Option 132 (VLAN ID) and Option 133 (VLAN QoS).

Dedicated QoS settings in the IP packets for support of DiffServ, ToS and can be enabled using the base station configuration page or snom provisioning.

The communication between the base stations is either IP Multicast or Peer-To-Peer communication. IP Multicast is the preferred option as it generates the least traffic, but it requires either a single IP subnet or IP-Multicast pass-through in the network switches.

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## M700/M5 Repeater Placement Recommendations

The antennas in the base stations are close to omnidirectional; thereby there is no need to consider how the base stations face each other when deploying them. These are some recommendations for placement strategies:

### **Around Corridors:**

Base stations/repeater should be deployed vertically preferably at corridor intersections where propagation patterns follow the corridor patterns. In case there are high objects in the area, the base station/repeater should be installed above those objects.

### **Multi-Story Buildings:**

Base stations and repeaters can be installed on opposite sides of the floors to take advantage of the 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:**

Base stations and repeaters can be deployed in large halls that contain a central open space area with windows to the other areas. This provides a good coverage for the rooms in the inner circle on all floors. In large halls, base stations/repeater should be installed vertically in the middle of the space below the ceiling.

### **Mounting Positions:**

When Base stations and repeater 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 the obstructive objects in the area – e.g. minimum higher than 2m above floor. Repeaters should be installed in the middle of corridors and small rooms.

### **Metallic Structures/Objects:**

Base stations and repeaters should not be deployed near large metallic objects. This includes metallic in shelves in warehouses.

**Reinforced Concrete Structures:**

These structures reduce signal strength dramatically inside the building. They reduce the radio coverage range of the Base stations and repeaters and therefore require a higher number of base stations or repeaters in the building. Lighter types of construction materials require fewer base stations since attenuation figures are considerably lower.



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## M700 VoIP/DECT deployment limitations

The M700 system is a very powerful DECT system. Compared to most competitors it does not require special controllers or licenses for building your DECT network. An installation can be extended with additional M700 base stations.

Due to the highly integrated system and the “sharing” of resources there are some limitations and things to consider while planning or extending an existing installation:

- One base station will become the master base station, which will “organize” the installation and synchronize the other base stations (slave base stations) with the network topology.
- Outgoing from the “master base station”, a maximum of 6 additional base stations levels can be installed. This means a maximum of 7 levels of base stations in a line (row) including the master.
- The maximum amount of users/handsets/SIP-registrations is 200.  
Each base station can hold a maximum of 30 users, so you need at least 7 base stations to achieve the maximum amount of users (but more than 7 won't allow more than 200 users).
- Each base station allows to have 8 narrow band calls in parallel

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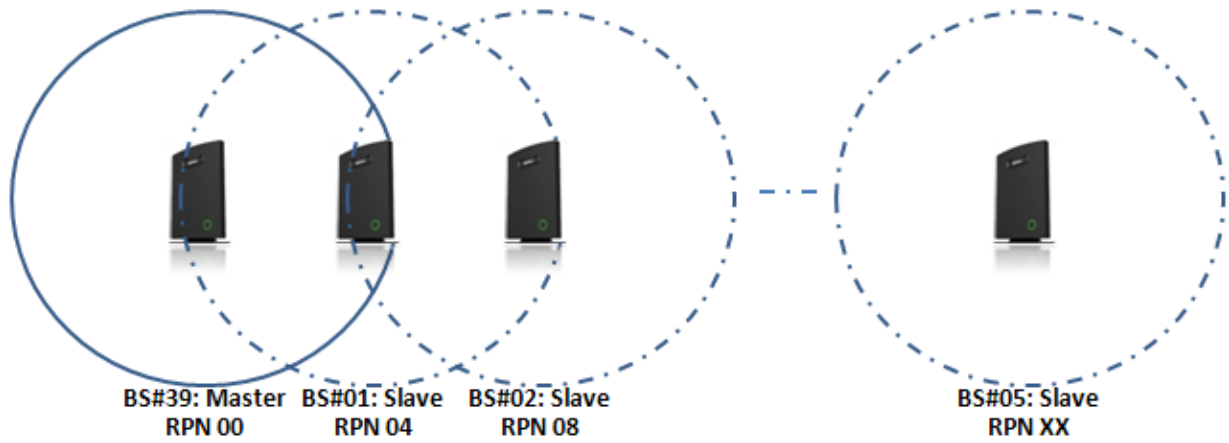
## M700 VoIP/DECT Network deployment considerations

To deploy a multicell DECT network, there are some requirements to follow and some limitations.

A multicell DECT network is based on a master/slave architecture. The master base station will ensure that all the slave receive the network layout. This means the slave cells are “synchronized” and are “aware” of each other to allow seamless handover for users handsets.

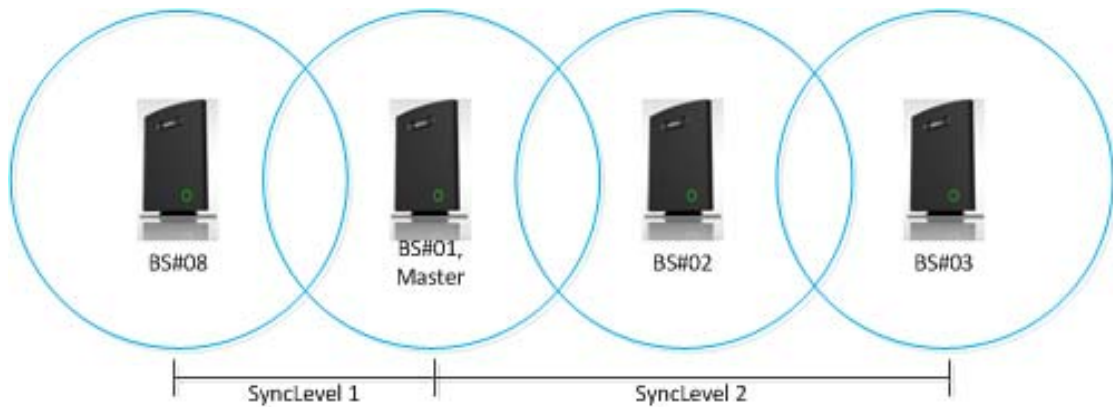
A maximum of 7 sync levels are supported, that means starting from the sync Master (Level 1), you can deploy and cascade up to 6 additional base stations (slaves) outgoing from the master. This means, if you want to cover a long corridor, you should set up the master base station in the middle, this allows the levels to be in both directions.

### **Case #1: Synchronisation Chain with One Master Sync.**

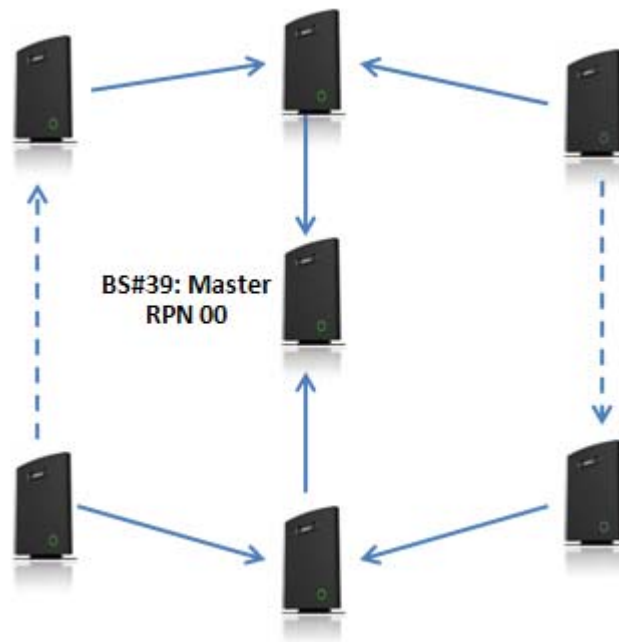


- The Synchronisation chain must always overlap with other Base stations in order to latch each other.
- In this illustration Base station #39 is the Sync Master, RPN 00 (Radio Fixed Part Number)
- A maximum of 7 sync levels (Including the master bases) can be used in a deployment.
- The other slave base stations or repeaters are connected to the Sync Master through the synchronisation chain.
- If one of the base or repeater units in the sync chain is broken or not working, then the units that follow the non-working device are cut off from the sync chain, and air-interface synchronization can be lost. When the air interface synchronization is lost handover between the two clusters 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: Synchronisation Chain without Alternative Sync Paths

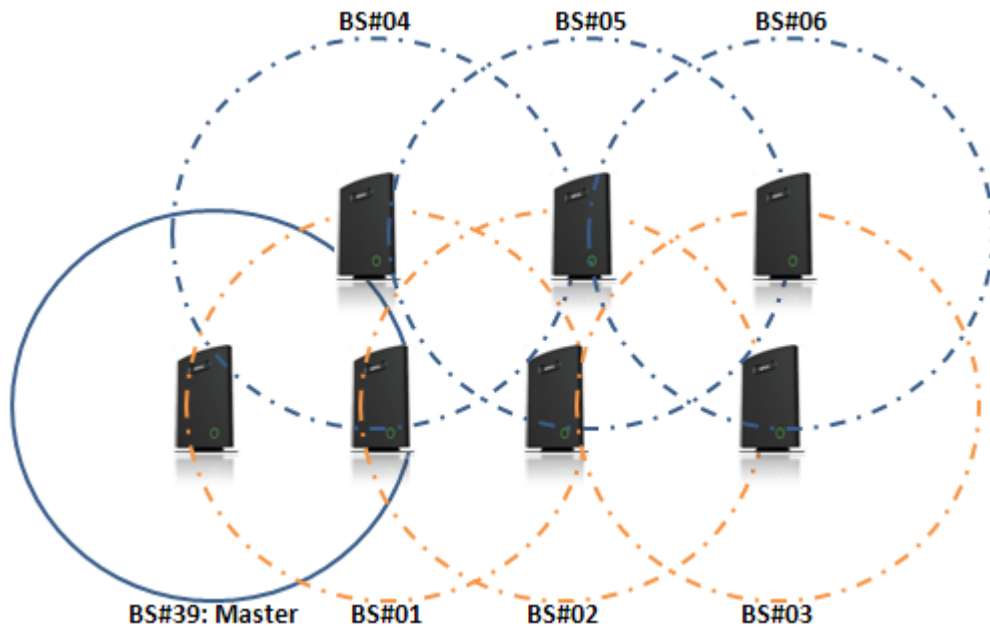


Depending on the system setup, it is recommended to place the Sync source Master in the middle of the building and to assign numbers/addresses, radio ID (RPN), etc. to each base station or repeater for easy identification.

- **Continuous line:** Shows the primary sync paths, with the relevant bases chained in the multi-cell network.
- **Dotted line:** Alternative sync paths.

## Case #3: Synchronisation Chain with Alternative Sync Paths

The illustration below shows a multi-cell network with alternative Synchronisation paths. A failure of one base unit does not mean handset or users cannot perform handovers to other active cells.

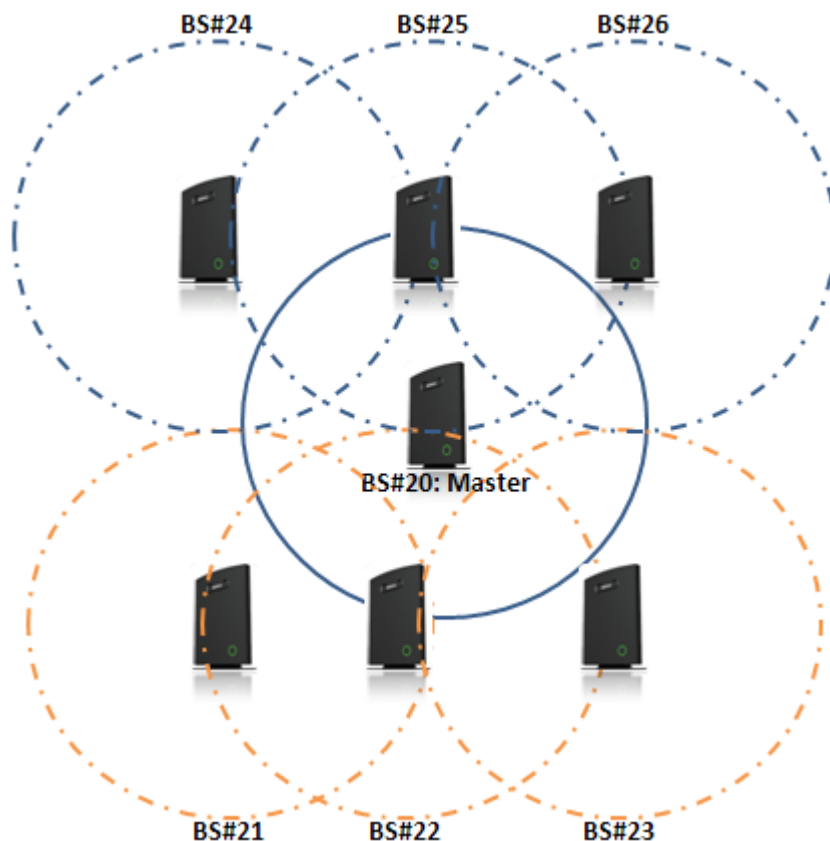


BS#39 is the SYNC Master, if BS#05 is down, most user handovers can be formed via 3 other alternative cells (i.e. BS#06, BS#02 and BS#04), but cannot operate in the coverage area of BS#05 where no other base station can reach the handset.

Furthermore observe the following:

- BS#04 and BS#01 are level 1 to BS#39.
- BS#05 is primary sync to BS#04 (level 2) while alternative sync is BS#02 in line with BS#01 (level 3)
- BS#03 is primary sync to BS#02 (level 3) while alternative sync is BS#06 in line with BS#05 and BS#04 (level 4)

Another illustration below shows a multi-cell network without alternative synchronisation paths. A failure of one base unit will affect the further levels of the topology.



- BS#24 or BS#26 cannot reach BS#20 (master) directly, but only through BS#25
- BS#21 or BS#23 cannot reach BS#20 (master) directly, but only through BS#22

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## Installation

Start with the intended master base station. It is recommended to update and reset all base stations prior to installing them in a multicell setup. **Secondary base stations must be reset to defaults!**

Important: Secondary base stations must not contain any (SIP) “Server” inputs. Disable the option “Plug&Play” in the menu “Network” to prevent an automated setup of a (SIP) server if you have related DHCP options running in your network.

- Only for the master base station:
  - Follow all steps from the “snom M300 and M700 administration and installation guide”:
    - Set up a SIP server
    - Create a user account
    - Register handsets
- Use the web browser menu and navigate to “Time” settings (left column). Enter the relevant parameters on this page and press the Save button. Make sure that the “Time server” is working, otherwise the Multi-cell feature will not work.

Base stations must be rebooted after the time server has been set.

- Navigate to “Multi cell” menu. By default a new base station has “Multi cell settings” feature disabled.

## Description of parameters

Multi cell system	Enable this option to allow the Base unit to be set in multi-cell mode (can be set as master or slave in the multi-cell chain system). Valid Inputs: Enable, Disable
System chain ID	This is an identifier (usually in string format for e.g. 2275) that is unique for a specific multi-cell system. Note: There can be several multi-cell systems in the network. Valid Input: 8 bit String
Synchronization time (s)	This specifies the period or window in seconds elements/nodes (for e.g. Base units) in a specific Multi-cell should synchronise to each other.
Multi cell debug	Enable this feature, if you want the system to catalogue low level multi-cell debug information or traces.

- Enable the Multi cell setting from the drop down menu.
- Enter the relevant values for “System chain ID” and “Synchronization time (s)” respectively. The “System chain ID” is a geographically unique DECT cell identity allocated to bridge several base stations together in a chain. An example is 2275. In one multi cell installation all base stations must have the same “System chain ID”.  
The Synchronization time (s) parameter is defined as window/period of time in seconds a specific base station synchronises to the master base station unit (by default 60).
- Click on “Save” button to keep modified changes of multi cell settings into the base station.
- On each configuration interface for the base station(s) navigate to the “Home/Status” page and Click the “Reboot” button.
- Repeat all steps as explained above for all the intended base stations in multi cell operation.

It takes up to maximum 5 minutes (synchronization time) to add a new base station to a Multi Cell System.

- Navigate back to the Multi cell settings page by clicking “Multi-cell”. The revised Multi cell settings page shows the relevant base stations synchronized together. By default, the system uses the first registered base station as the master base unit.
- On the Multi-cell settings page, scroll to the DECT system settings and Enable or Disable the “Auto configure DECT sync option source tree” (See description in the table below). Usually the DECT system RFPI parameter is recorded by the system (It’s often greyed in a multi-cell system configuration).

Note: Enable this to allow the network to automatically synchronise the multi-cell chain/tree.

# DECT Chain

After a Multi cell installation you can manually configure the synchronisation source tree. On the settings page, scroll to the “Multi cell” settings and Enable or Disable the “Auto configure DECT sync option source tree”.

## Base Station Group

ID	RPN	Version	MAC Address	IP Address	IP Status	DECT sync source	DECT property	Base Station Name	
<input type="checkbox"/>	0	00	318.9	00041361000C	<a href="#">10.110.10.239</a>	This Unit	Select as primary	Primary	snomM700-01
<input type="checkbox"/>	1	04	318.9	00087B09FF70	<a href="#">10.110.10.238</a>	Connected	Primary:RPN00 (-79dBm)	Locked	snomM700-02
<input type="checkbox"/>	2	08	318.9	00087B0BBFCB	<a href="#">10.110.10.237</a>	Connected	Level 1:RPN04 (-69dBm)	Locked	snomM700-03
<input type="checkbox"/>	3	0C	318.9	00087B0BBFC6	<a href="#">10.110.10.236</a>	Connected	Primary:RPN00 (-52dBm)	Locked	snomM700-04
<input type="checkbox"/>	4	10	318.9	00087B0BB558	<a href="#">10.110.10.235</a>	Connected	Level 1:RPN0C (-81dBm)	Locked	snomM700-05

[Check All /Uncheck All](#)

With selected: [Remove from chain](#)

## DECT Chain

Primary: RPN00: [snomM700-01](#)  
 Level 1: RPN04: [snomM700-02](#)  
   Level 2: RPN08: [snomM700-03](#)  
 Level 1: RPN0C: [snomM700-04](#)  
   Level 2: RPN10: [snomM700-05](#)

- ID Base unit identity in the chained network.
- RPN The Radio Fixed Part Number is an 8-bit DECT cell identity allocated by the installer. The allocated RPN within the installation must be geographically unique. Base stations’ and repeater’s RPN must only differ on least significant bits that are masked out by the handover mask.
- MAD Address Contains the hardware Ethernet MAC address. Please refer to the product labels.
- Version Base station current firmware version.
- Status Current Base station behaviour in the SME network.  
Possible Outputs:  
-Connected: The relevant Base station(s) is online in the network  
-Connection Loss: Base station unexpectedly lost connection to network  
-This Unit: Current Base station whose http Web Interface is currently being accessed
- DECT Sync **The administrator can choose the relevant “multi cell chain” level. Maximum number of “multi-cell chain” levels is 6.**

**In the drop down menu you can see the signal strength indication to all other possible base stations.**

#### DECT Property

Base station characteristics in connection to the current multi cell network. Possible Output(s)

-Primary: Master base station unto which all other nodes in the chain synchronises to.

-Locked: The Base unit is currently synchronized and locked to the master Base unit.

-Searching: Base unit in the process of locating to a Master/slave as specified in DECT sync source .

-Free Running: A locked Base unit that suddenly lost synchronisation to the Master.

-Unknown: No current connection information from specific Base unit.

It is recommended to have a RSSI value better than/equal to -75dBm, and never below -90dBm.

Next step involves adding extensions to the system. Follow all steps from the “snom M300 and M700 administration and installation guide”.