Adding Multiple Base Stations to Network

(Multi-cell System)

Contents

Document History

Revision	Author	Issue Date	Comments
0.1	MYA	09-Jun-2010	Initial Version
0.2	MYA	10-Jun-2010	With inputs from LH, added Time Server requirements
0.3	MYA	07-Sep-2010	Update with new Base station features, new sections.
0.4	MYA	15-Sep-2010	With Inputs from IFJ, new section: Summary of Procedure

Introduction: Base station Installation

This document seeks to describe how to install, add and synchronize one or multiple base stations to the network. There are two main procedures involved:

1) Proper placement of the base stations (which is usually called network dimensioning). The present document does not address this issue.
2) Creating and adding base station profiles to the network via the SME Configuration Tool (to form a multi-cell system).

This document describes the second procedure.

NOTE This documentation is valid for Base station firmware version 00.36 and above.

Abbreviations

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

DHCP: Dynamic Host Configuration Protocol
DNS: Domain Name Server
HTTP: Hyper Text Transfer Protocol
IOS: Internetworking Operating System
NAT: Network Address Translator
PCMA: A-law Pulse Code Modulation
PCMU: mu-law Pulse Code Modulation
SME: Small and Medium scale Enterprise
STUN: Session Traversal Utilities for NAT

References
[1]:   Base station/Handset Firmware Update (Over-air) Version 0.2
[2]:   Bla Bla Bla

Multi-cell System

A multi-cell system has a coordinated installation of intra-system synchronized base stations, which enables seamless inter-cell handover for moving handsets.

It provides, besides the increased mobility, higher total capacity and higher quality than a corresponding number of standalone base stations. This is due to a combination of the inter-cell synchronization and the seamless handover features of a multi-cell system.

All handsets subscribed to a multi-cell system will benefit from high voice quality, full coverage and full mobility over the whole multi-cell system coverage area.

NOTE A multi-cell system always has intra-system synchronised cells and most multi-cell systems provide access to inter-system synchronisation means.

Multi-cell Configuration

A total of 40 Base stations can be hosted in a typical SME multi-cell system. At each time, a maximum of 6 levels can be formed in a multi-cell chain.

Level 1 is when Base unit 1 synchronizes to Master Base unit, and Level 2 is when Base unit 2 uses Base unit 1 as its synchronization source, in that order. We can illustrate the configuration with the figure below (Refer to STEP 13 to STEP 15 for details on how to actually set it up via SME HTTP web interface):
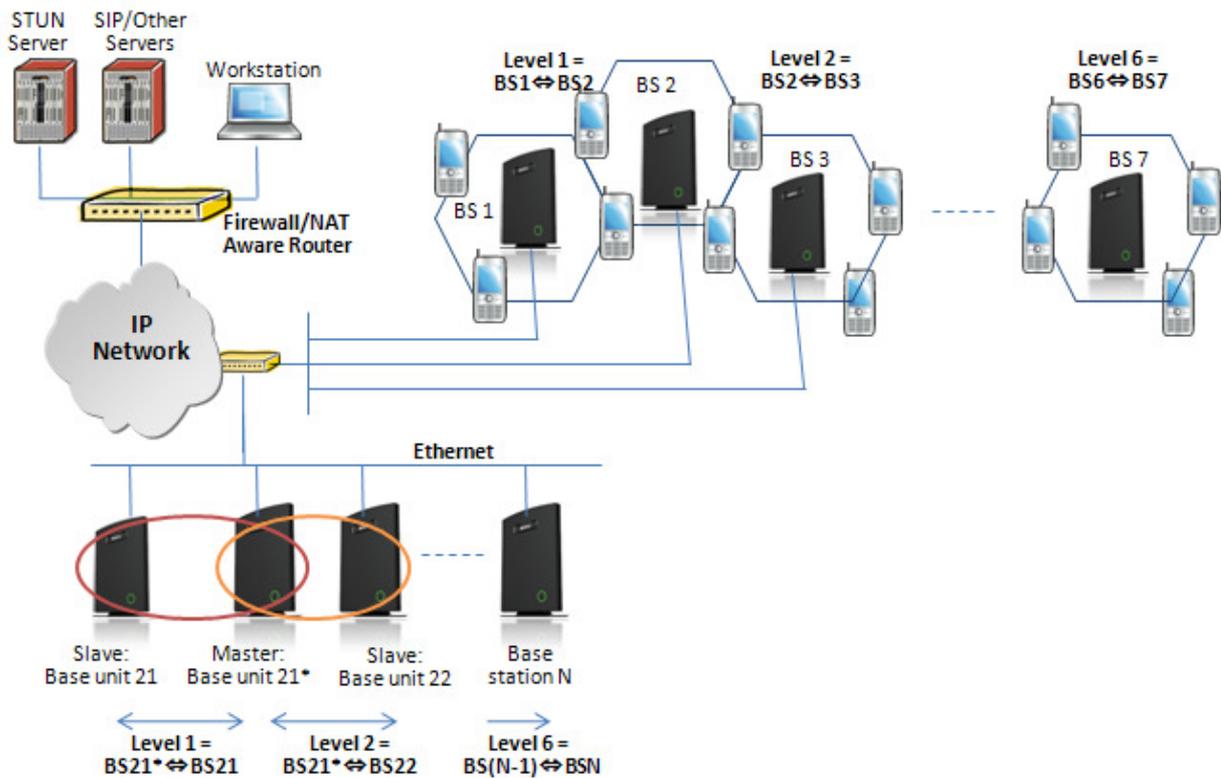
SME Configuration Interface

RTX have offered HTTP interface in base station firmware that can be used as HTTP Web Server. The SME Configuration Interface can be retrieved from this HTTP Web Server in each Base station.

The HTTP Web Server is enabled in the base station by default.

NOTE This procedure is valid for Base station firmware version 00.34 and above. The system administrator must update the relevant Base station(s) to the latest firmware before proceeding to the next section. Refer to accompanied document **[1]**

Adding Base stations via SME Configuration Interface

Here are the recommended steps to add Base stations to network:

STEP 1   Connect the Base station to a private network via standard Ethernet cable (CAT-5).

STEP 2   Use the IP find menu in the handset (Menu * 4 7 *) to determine the IP-adr of the base station by matching the MAC address on the back of the base station with the MAC address list in the handset.

STEP 3   Type the IP-adress into a web brower, on a PC connected to the same subnet as the base station.

STEP 4   On the Login page, enter your authenticating credentials (i.e. username and password is default "admin"). Click **OK** button.
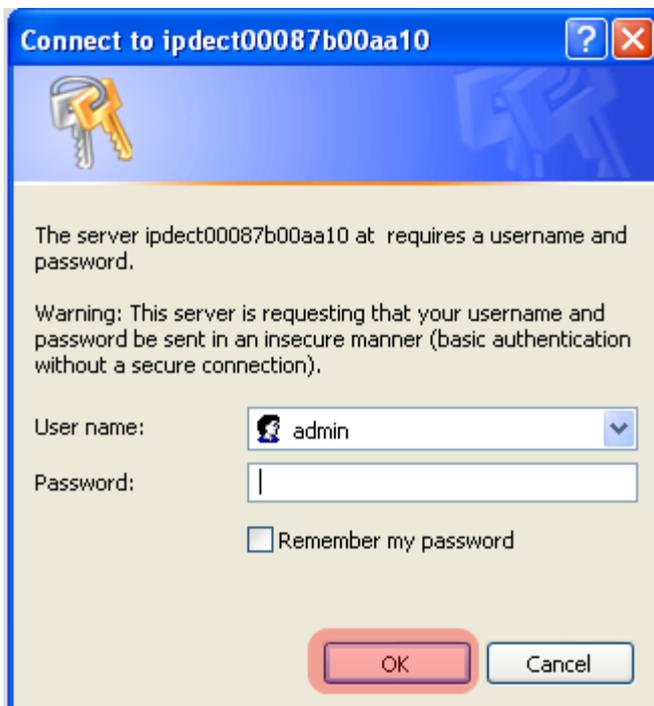
STEP 5 Once you have authenticated, the browser will display front end of the SME Configuration Interface. The front end will show relevant information of the base station (in this case MAC-Addr: **00087B00AA10** as highlighted in the snap-shot below).

STEP 6 Create the relevant SIP server information in the system. Each service provider/customer should refer SIP server vendor on how to setup SIP servers.

STEP 7 Navigate to the Time settings and configure it. Scroll on the left column and click on **Time** url link to Open the **Time Settings** Page. Enter the relevant parameters on this page and press the **Save** button.
Make sure there is contact to the "Time server" otherwise the Multi-cell feature will not work.

**STEP 8** Scroll down and Click on **Multi Cell** url link in the **SME VoIP Configuration** to view the current **Multi cell settings** status of the current base station. Normally, most brand new base stations have **Multi cell system** feature disabled by default.

Description of Settings for Specific Base units is as follows:

Parameter	Description
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 SME 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.
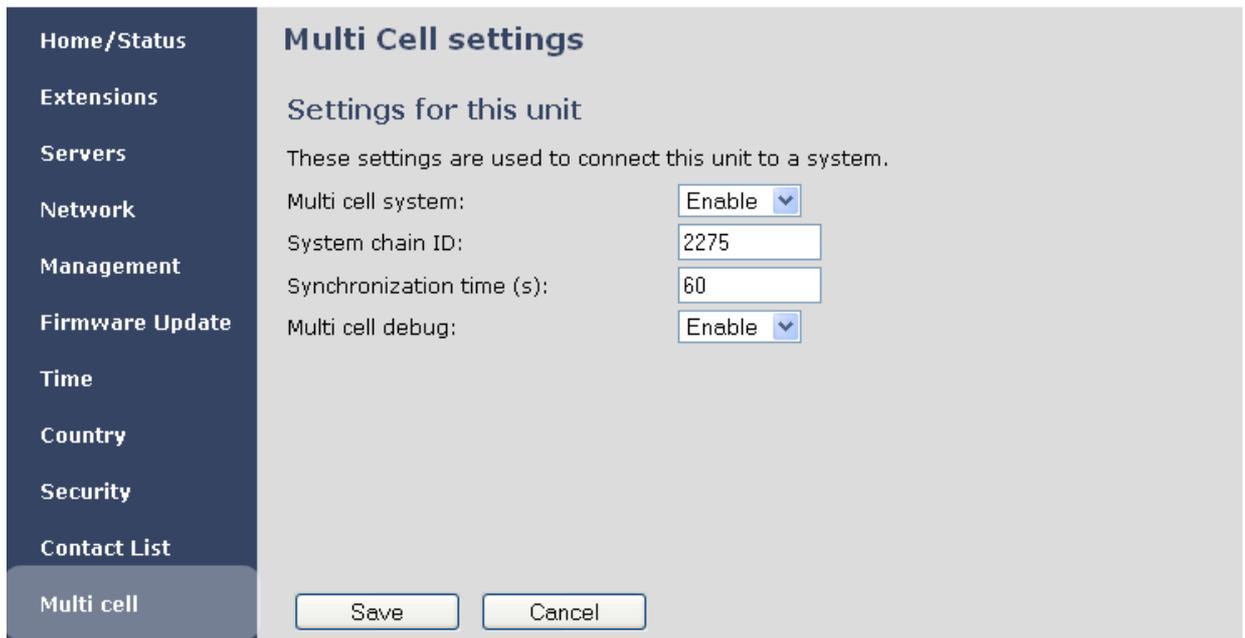
STEP 9   Next, the system administrator needs to create and Enable Multi Settings profile for the current base station. On the **Multi Cell settings** Page, choose **Enable** option from the drop down menu of the **Multi cell system** parameter. Enable the **Multi cell debug** option if the system administrator wants some Multi-cell related logs to be catalogued by the system.
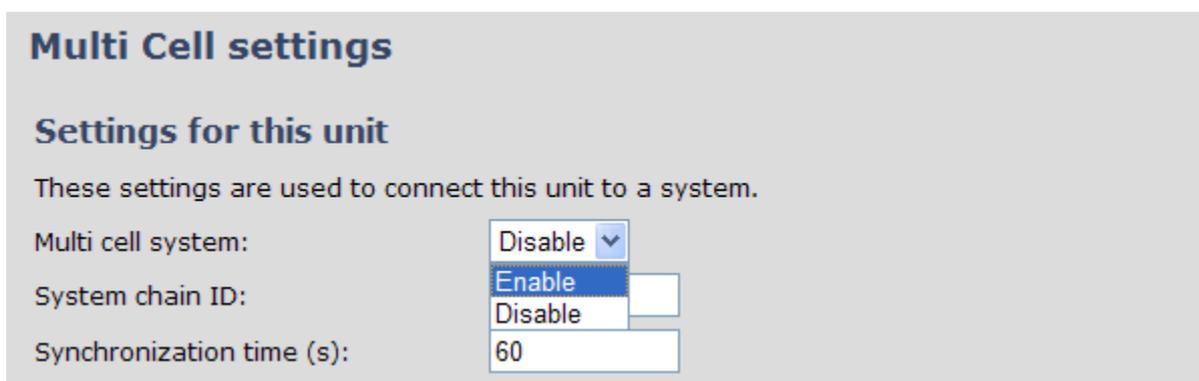
STEP 10   On the same **Multi Cell Settings** page > Enter the relevant values for **System chain ID** and **Synchronization time (s)** respectively. The **System chain ID** is a geographically unique DECT cell identity allocated to bridge several base stations together in a chain. An example is **2275**. 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.

NOTE The Multi Cell data synchronization ONLY works when the relevant **Time Server** is set in the system before Server/Subscriber profile is added or created. Refer to **STEP 6**.

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

STEP 11 Repeat **STEP 1-8** as explained above for N number of base stations.

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

Synchronizing the Base stations

STEP 12   On each **SME VoIP Configuration** interface for the base station(s) navigate to the Home/Status page and Click the Reboot button.

This will trigger **Are you sure you want to reboot gateway?** window. Click **OK** button on this window. A successful restart of the base stations will lead to a display of the page: **Gateway has been reset**.

STEP 13   Navigate back to the **Multi cell settings** page by clicking **Multi-cell** url link at the left column. 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.

STEP 14 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 computed by the system (Its often greyed in a multi-cell system configuration).

Parameter	Description
DECT system RFPI	This is a radio network identity accessed by all Base units in a specific multi-cell system. It composed of 5 octets. It is actually 5 different variables combined together. **RFPI Format:** XX XX XX XX XX (where XX are HEX values) <u>**Access Rights Class (ARC):**</u> Defines network identity structure used by terminals especially in multi-cell environment. **Fixed/default Value**=1 (Private multi-cell system). **RFPI:** 1X XX XX XX XX <u>**Equipment Installer's code (EIC):**</u> Code that allows terminals to distinguish between separate DECT networks. **Min:** 0x0000, **Max:** 0xFFFF; **RTX_EIC:** 0x16E6 (May change) **RFPI:** 11 6E 6X XX XX <u>**Fixed Part Number(FPN):**</u> Is a geographically unique identity transmitted to DECT networks to help PP distinguish between base station communications in different cells/multi-cell systems. **Min:** 0x001, **Max:** 0xFFF; **E.g. FPN:** 0x049 **RFPI:** 11 6E 60 49 XX <u>**Location Area Length (Lal):**</u> A unique code sent to the terminal during location registration to determine the size of the location or cell area. **Type:** 8-bit value (from 0x00 to 0xFF). **E.g Lal**=0x04 **RFPI:** 11 6E 60 49 04
Auto configure DECT sync source tree	Enable this to allow the network to automatically synchronise the multi-cell chain/tree **Permitted Inputs:** Enable, Disable

DECT system settings

These settings are DECT settings for the system.

DECT system RFPI: 0x11,0x6E,0x60,0x49,0x04

Auto configure DECT sync source tree Disable ▼

STEP 15   Scroll to the **SIP system settings** section, configure and save the parameter based on the description below:

Parameter	Description
Max ## of SIP Register per Base station	The maximum number of handsets or SIP end nodes that are permitted to perform location registration on a specific Base unit. **Note:** A maximum of 8 simultaneous can be routed through each Base units. **Permitted Input:** Positive Integers (for e.g. 30)

SIP system settings

These settings are SIP settings for the system.

Maximum number of SIP register per base station: 30

[Save]   [Cancel]

STEP 16   Next, on the **MAC-units in chains** section, you can manually configure the synchronisation source tree of the multi-cell system. 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 computed by the system (Its often grayed in a multi-cell system)

Parameters	Description
ID	Base unit identity in the chained network. **Permitted Output:** Positive Integers
RPN	The Radio Fixed Part Number, is an 8-bit DECT cell identity allocated by the installer. The allocated RPN within the SME 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. **Permitted Output:** 0 to 255 (DEC) **OR** 0x00 to 0xFF (HEX)
MAC Address	Contains the hardware Ethernet MAC address on the base station. It varies from Base station to Base stations. **Min. Value:** 0 (i.e. last 4 HEX digits of 0x00087B07**0000**, may change in the future) **Max. value:** 65535 (i.e. last 4 HEX digits of 0x00087B07**FFFF**, may change in the future)
Version	Base station current firmware version. **Permitted Output:** positive Integers (for e.g. 34)
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 source	The administrator should choose the relevant "multi cell chain" level its wants a specific Base unit be placed. Maximum number of "multi-cell chain" levels is 6.
Dect Property	Base station characteristics in connection to the current multi cell network.

	Possible Output(s) **Master:** Main 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

STEP 17 Now a quick overview what needs to be configured. The SME VoIP Configuration tool gives administrators the option to choose or customize a specific base station as the master, where all other bases synchronise to it in cascades of cell chains.

Parameter	Description
Settings for specific Unit(s)	Refer to STEP 7 above for detail description
DECT system settings	Refer to STEP 13 above for detail description
SIP System Settings	Refer to STEP 14 above for detail description
MAC-units in chain	Refer to STEP 15 above for detail description

Settings for this unit

These settings are used to connect this unit to a system.

Multi cell system:	Enable
System chain ID:	2275
Synchronization time (s):	60
Multi cell debug:	Enable

DECT system settings

These settings are DECT settings for the system.

DECT system RFPI: 0x11,0x6E,0x60,0x49,0x04

Auto configure DECT sync source tree: Disable

SIP system settings

These settings are SIP settings for the system.

Maximum number of SIP register per base station: 30

[Save]   [Cancel]

MAC-units in chain

	ID	RPN	MAC address	IP address	Version	Status	DECT sync source	Dect Property
☐	0	00	00:08:7B:07:7C:BC	192.168.50.71	34	Connected	0 - RPN: 00	Master
☐	1	04	00:08:7B:07:7C:F7	192.168.50.114	34	Connected	0 - RPN: 00	Unknown!

Check All / Uncheck All
With selected: Remove from chain

[Save]

Summary of Procedure – Creating a Chain

We enumerate the short version of how to add 3 base stations units in a multi-cell setup. This can be applied for up to N number of base units. The procedure below is valid ONLY for base station firmware version 00.36 and above.

This procedure is divided into four (4) main stages. Apply this procedure if all base unit are straight from production.

Stage 1

Skip this stage if relevant base stations are already in the network.

   a) Add 3 base stations i.e. RFP1, RFP2, RFP3 > Disable the "Multi cell system" option and "Save"
   b) RFP1, RFP2, RFP3: Reboot from the HTTP SME Configuration Main Page
   c) RFP1, RFP2, RFP3: Default by pressing reset button 12-sec.

Stage 2

Choosing 1st base unit i.e. RFP1 as Master
   a) RFP1: Define Time server and "Save" from the **Time** page
   b) RFP1: Reboot
   c) RFP1: Press "Add server" and define SIP server IP and "Save" from the **Servers** page
   d) RFP1: Multi cell system = enable and "Save" from the **Multi-cell** page
   e) RFP1: Reboot (Verify from Debug log "**SYNCMGR: This base is ready to be master in a Chain**")

Stage 3

Choose another base unit,RFP2 as Slave1
   a) RFP2: Multi cell system = enable and "Save"
   b) RFP2: Reboot (Verify from Debug log "**SYNCMGR: This base is ready to join into another Chain**")
   c) RFP1, RFP2: Wait 2min for stable Master-Slave chain (check for the message: **SYNCMGR: Socket#10 creation success**)

Stage 4

Choose the 3rd base unit, RFP3 as Slave2
   d) RFP3: Multi cell system = enable and "Save"
   e) RFP3: Reboot (Verify Debug log "SYNCMGR: This base is ready to join into another Chain")
   f) RFP1, RFP3: Wait 2min for stable Master-Slave chain (SYNCMGR: Socket#10 creation success)
   g) RFP3: Check mark ID2/RPN08 and select dropdown "1 – RPN: 04" and "Save"
   h) RFP3: Reboot (**SYNCMGR: Socket#8 creation success**)

Multi-cell chain of 3 base stations have been created successfully. Next step involves adding extensions to the system.