BSS11
BSS11.5

Features Under Development
Version 2.2

NOKIA

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INTRODUCTION

This document describes features under development for the BSS system releases BSS11 and BSS11.5.

Note that content of BSS11.5 release is not frozen yet and features of it are still considered as candidates.

The BSS11 and BSS11.5 system features will be available in the following network element releases: S11, S11ED, S11.5, DF7, CXM4.0, CX4.0, CXM4.1, CX4.1.

The compatibilities for individual NE releases are as follows:

- BSS11 consists of the releases: S11, S11ED, DF7, CXM4.0, CX4.0,
- BSS11.5 consists of the releases S11.5, DF7, CXM4.1, CX4.1
- BSS11 is supported by following NE releases: OSS3.1ED3, M12, and SG3.
- BSS11.5 is supported by following NE releases: OSS4, M12, SG4

This document also includes the hardware requirements and planned system compatibility information of the features. The different BTS generations (Nokia 2nd generation, Talk-family, PrimeSite, MetroSite, UltraSite and InSite Base Stations) are mentioned so that any limitations are highlighted. If no exceptions are mentioned, the feature applies to all BTS generations.

BSS11/11ED/11.5 compatibility matrix

Release	S11	S11 ED	S11.5	S10.5	B13	DF7	CX3.0	CX3.3	CX4.0	CX4.1	CXM 3.0	CXM 3.3	CXM 4.0	CXM 4.1	SG3	SG4	OSS 4	OSS3.1 ED3	OSS 3.1	M12	M11
S11	-	-	-	-																	
S11ED	-	-	-	-																	
S11.5	-	-	-	-																	
DF7					-	-	-	-	-	-	-	-	-	-							
CXM4.0					-	-	-	-	-	-	-	-	-	-							
CXM4.1					-	-	-	-	-	-	-	-	-	-							
CX4.0					-	-	-	-	-	-	-	-	-	-							
CX4.1					-	-	-	-	-	-	-	-	-	-							
SG3															-	-					
SG4															-	-			-		
OSS3.1ED3																	-	-	-		
OSS4																	-	-	-		
M12																				-	-

The meaning of the colours in the compatibility matrix:

- Compatibility not applicable
- Compatibility not supported
- Secondary compatibility
- Primary compatibility

BSS11/11.5 does not include a software release for 2nd gen Base Station. The basic BSC S11/11.5 software release is compatible with 2nd gen Base Station B13 software release. Specific BSS11/11.5 feature support for 2nd gen Base Station can be found in the relevant feature specific dependency table.

Notations used in dependency tables

The table is used to relate the described BSS features to required system components:

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT

In the table we use the following notations:

SUPPORTED IN:

GSM 800	This feature is supported in the GSM EDGE 800 MHz system (Y= yes, N= no).
GSM 900	This feature is supported in the GSM EDGE 900 MHz system (Y= yes, N= no).
GSM 1800	This feature is supported in the GSM EDGE 1800 MHz system (Y= yes, N= no).
GSM 1900	This feature is supported in the GSM EDGE 1900 MHz system (Y= yes, N= no).
MSC	This feature is supported in the Nokia MSC (xxx = Nokia MSC release/feature nbr., N= no, - = not applicable).
Nokia NetAct	This feature is supported in the Nokia NetAct (Y= yes, xxx = Nokia NetAct release/feature nbr., - = not applicable).
BSC	This feature is supported by the BSC (Y= yes, N= no). (Y) in parentheses indicates that the BSC is not actually applicable with this feature.
SGSN	This feature is supported by the SGSN (Y= yes, N= no). (Y) in parentheses indicates that the SGSN is not actually applicable with this feature.
NetAct Planner	This feature is supported in Radio Network Tools, (Y= yes, xxx = Nokia NPS/X release/feature nbr., - = not applicable).
Nokia 2nd Gen.	This feature is supported by the 2nd gen. BTS (Y= yes, N= no). (Y) in parentheses indicates that the BTS is not actually applicable with this feature.
Nokia Talk-family	This feature is supported by Nokia Talk-family of base stations (Y= yes, N= no). (Y) in parentheses indicates that the BTS is not actually applicable with this feature.
Nokia PrimeSite	This feature is supported by Nokia PrimeSite (Y= yes, N= no). (Y) in parentheses indicates that the BTS is not actually applicable with this feature.
Nokia MetroSite	This feature is supported by Nokia MetroSite (Y= yes, N= no). (Y) in parentheses indicates that the BTS is not actually applicable with this feature.
Nokia InSite	This feature is supported by Nokia InSite (Y= yes, N= no). (Y) in parentheses indicates that the BTS is not actually applicable with this feature.
Nokia UltraSite	This feature is supported by Nokia UltraSite (Y= yes, N= no). (Y) in parentheses indicates that the BTS is not actually applicable with this feature.
BSC MMI	This feature has parameters that are managed with the BSC MMI (Y= yes, - = not applicable).
BTS MMI	This feature has parameters that are managed with the BTS MMI (Y= yes, - = not applicable).
MS	The feature sets special requirements to mobile stations (Y = yes, see the note; - = no requirements).

HW/FW DEPENDENCY:

BSC HW/FW	This feature requires additional or alternative BSC hardware or firmware (Y= additional, A= alternative, or - = not applicable).
BTS HW/FW	This feature requires additional or alternative BTS hardware or firmware (Y= additional, A= alternative, or - = not applicable).
TC HW/FW	This feature requires additional or alternative transcoder hardware or firmware (Y= additional, A= alternative, or - = not applicable).
SGSN HW/FW	This feature requires additional or alternative SGSN hardware or firmware (Y= additional, A= alternative, or - = not applicable).

BSS OPTIONALITY:

STD/ OPT	Indicates whether this feature is an optional or a standard BSS feature (S = standard, O = optional).

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1. BASE STATIONS

1.1 BSS11134 Antenna Hopping for UltraSite BTS

Antenna Hopping is targeted to optimise capacity and performance.

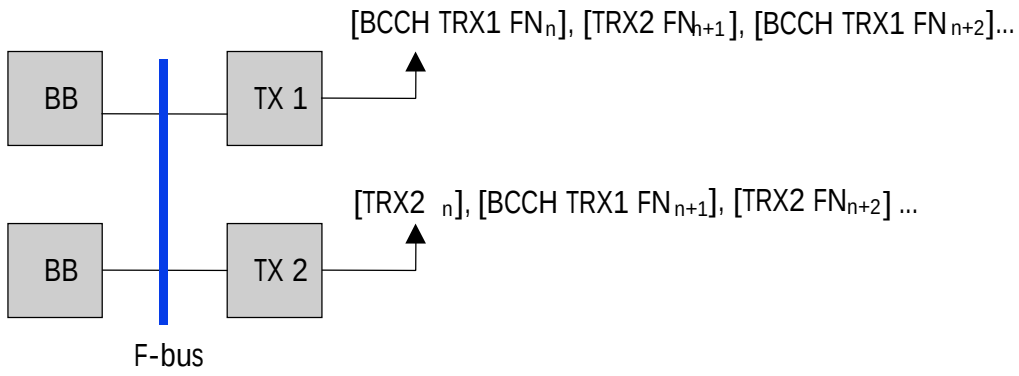
Antenna hopping for UltraSite BTS is an enhancement to RF hopping that, using existing BB-hopping functionality allows TRXs in an RF hopping BTS to transmit using all TX antenna in the BTS.

With Antenna Hopping it is possible to gain better spectral efficiency on BCCH layer in very narrow band environment (i.e. < 5 MHz, ideally =< 3.6 MHz). This is achieved with using Antenna Hopping application of transmit diversity where every other TDMA frame is transmitted via another antenna of hopping pair than the previous one.

Furthermore it is possible with Antenna Hopping to achive space diversity to regular RF-hopping configuration, which means that there is a distance that separates two or more transmitting antennas, providing uncorrelated signals. At the mobile unit a separation of half a wavelength is the minimum for obtaining uncorrelated signals. At the base station frequency, antenna height and antenna spacing affect the correlation coefficient.

At lower frequencies space diversity may be impractical, because the physical separation between the two antennas becomes larger.

Minimum configuration for this feature is 2 TRXs / cell where bothTRXs are used for antenna hopping.



Benefits of Nokia solution

With this feature extra gain with well-protected coding schemes (TCH/FR, TCH/EFR, MCS1-2 and MCS 5-7) can be achieved without extra TRX as required by Intelligent Downlink Diversity (IDD).

Better spectral efficiency can be obtained deploying the tighter BCCH re-use, which is allowed due to more robust non-hopping traffic timeslots on BCCH carrier, i.e. antenna hopping works against interference and frequency selective fading. By tighter BCCH re-use more frequencies can be used in hopping traffic layer thus providing better capacity for narrow band networks.

Interaction with other features

Following features can't be used simultaneously with Antenna Hopping:

- Baseband Hopping
- Dynamic Frequency and Channel Allocation, DFCA
- Received Signal Strength Indication, RSSI
- Intelligent Downlink Diversity, IDD
- Remote Tune Combiner, RTC

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	(OSS3.1 ED3)	S11	-	-	N	N	N	N	N	CX4.0

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	Y	-	-	Y 1)	-	-	O

Note(s): 1) EDGE capable TRX required

1.2 BSS11131 Rx Antenna Supervision by comparing RSSI Value for MetroSite (S11.5)

The purpose of this feature is to monitor the Rx antenna condition. Rx antennas can be monitored for major problems by taking a long-term average of the difference between Main Rx RSSI and Div Rx RSSI (Received Signal Strength Indication).

The monitoring is based on the principle that all received bursts where the Rx level of main or diversity branch is above the defined limit value (-95dBm) are accepted as samples and used in the averaging process. The difference is calculated per TRX between received levels on main and diversity antennas. If the difference is above the threshold (default value 10 dB), an alarm will be activated.

Benefits of Nokia solution

Rx antenna supervision by comparing RSSI value for MetroSite provides continuous antenna supervision for the BTSs, which have main and diversity in use. This will detect antennas with poor VSWR and inadequate feeders, for example.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	-	(S11.5)	-	-	-	(DF7)	-	CXM4.1	N	(CX4.1)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	Y	-	-	-	-	-	S

Note(s):

2. BASE STATION CONTROLLER

2.1 BSC Hardware Requirements in S11

The S11 hardware requirements for CPU performance and memory capacity are the same as in BSC S10.5 release. As in S10.5 release MCMUs and OMU computer units in BSC need at least 128MBytes memory. The memory extension to 128MBytes in MCMU and OMU is needed due to the new functionality and increased memory consumption. In BCSUs the minimum memory amount is 64 Mbytes.

From S9 and S10 releases computer units CP4HX, CP4HL and CP6LX used in OMU, BCSU and MCMUs need to be upgraded in old BSC variants (BSCE, BSCi, BSC2, and BSC2i) if memory amounts are not increased earlier. CP6MX introduced with S10 deliveries does not require any change no matter in which computer unit it is used since CP6MX has already equipped with 128Mbytes memories. Similarly CP710-A introduced with BSC3i in S10.5 does not require any changes.

Memory configuration can be flexibly extended to 128Mbytes in existing CPU types in all earlier BSC variants. However, concerning the HW requirements in forthcoming SW releases Nokia recommends upgrades to High Capacity HW level. As example existing BSC2E/A products utilising CP4HX or CP4HL processors can be upgraded with high capacity upgrade kits. Upgraded BSC2i with CP6MX CPUs corresponds the S10.5 new delivery of BSC2i product from memory capacity (128Mbytes) point of view.

There is also the minimum requirement for BSC S11 I/0 HW. New set of SW features and functionality within new BSC S11 SW release requires additional disk space preventing the use of old 1 Gbyte Winchester disks anymore. Therefore 4GB hard disk (WDW4) unit is the smallest acceptable hard disk product on S11 SW level. Upgrade to higher capacity hard disks can easily be done with dedicated hard disk upgrade kits, which include new disks as well as all necessary adapters and SCSI –terminator units.

Required minimum memory amount per computer unit:

Computer unit	**Required S11 Memory amount, Mbytes**
OMU	**128**
MCMU	**128**
BCSU	**64**

Allowed Central Processing Unit (CPU) types:

CPU type	**Micro-processor**	**Clock Frequency, MHz**
CP4HX	486	100
CP4HL	486	100
CP6LX	Pentium II	266
CP6MX	Pentium III	500
CP710-A	Pentium III	800

The S11 BSC hardware requirements are stated in Technical Change Note BSC HW TN124 and BSC HW TN126.

2.2 Tentative BSC Hardware Requirements in S11.5

Information available after release contents and implementation plan has been freezed.

3. RADIO NETWORK PERFORMANCE

3.1 BSS11052 Dynamic Frequency and Channel Allocation (S11.5)

Dynamic Frequency and Channel Allocation (DFCA) is a state of the art feature implemented in Nokia BSS11.5 release. DFCA is a new channel assignment scheme, which uses interference estimations derived from mobile DL measurement reports to dynamically assign a timeslot and frequency in the establishment of a new call or incoming handover. The criteria for this channel selection is to provide enough quality in terms of C/I, so each connection will meet its QoS requirements optimising also the interference caused to other connections, which leads to significant capacity gain as the usage of the valuable frequency resources is dynamically optimised. DFCA is completely automated functionality and removes the need to make a frequency plan for the TRXs configured for the functionality.

The effect of this feature on C/I distribution is similar as with other software capacity enhancement features such as power control, frequency hopping and IUO. The DFCA capacity effect, however, is significantly more powerful as the connection level C/I control ensures that very high proportion of the connections are within the desired C/I window as illustrated in figure below.

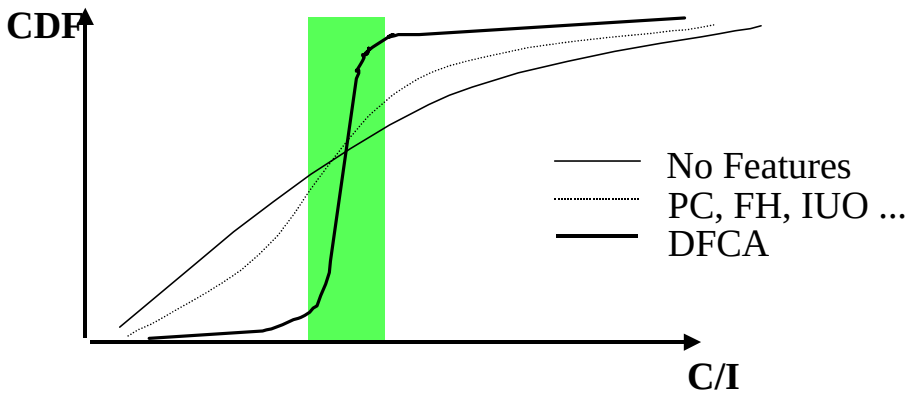


Figure: The effect of DFCA on network level C/I

In order to achieve this, TSL level of synchronisation is required. This is supported in BSS10 release with the synchronised BSS feature and enhanced in BSS11 release with the 'Recovery for BSS and Site Synchronisation' feature. The feature follows the synchronisation status of the BTSs so that synchronisation faults can be solved thus ensuring satisfactory operation of DFCA TRXs even when the BTS has lost the synchronisation. The effect of air interface synchronisation is presented in next figure.

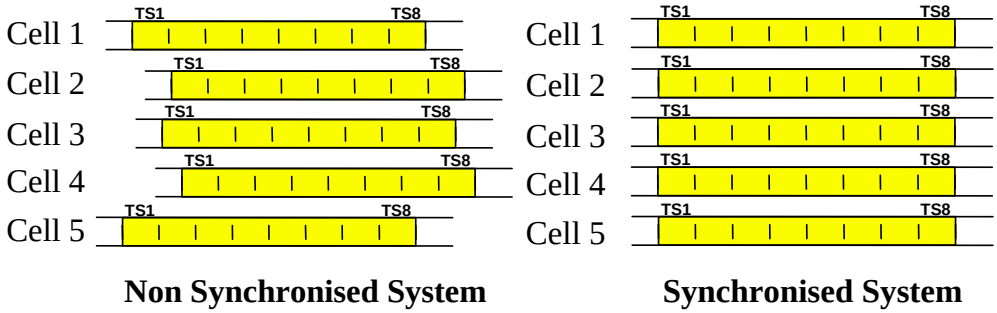


Figure: The effect of air interface synchronisation.

This TSL level of synchronisation for the BTSs allows the BSC to get the precise knowledge of the interference sources when a new channel assignment is to be performed. Combining this information with real time timeslot and frequency usage data makes it possible to choose the optimum radio channel for the connection. The information related to the potential interference situation expected for a certain connection comes mainly from mobile DL measurement reports (provided every 480 ms). However, due to the limited information contained in the actual measurements provided by the mobile stations (the number of reported neighbours is limited) some statistical estimation of the interference situation must be implemented to complement the C/I estimation. This is done by means of a Background Interference Matrix (BIM). Every cell using DFCA will have this new information structure in order to estimate the impact in terms of interference caused by other DFCA cells both in DL and UL directions.

Another enhancement needed in order to support DFCA efficiently is a BSC to BSC interconnection. If not provided, it would lead to a performance degradation of the DFCA, where DFCA cells placed in BSC border areas would not have all the required information from the neighbouring cells (i.e. potential interference sources) to operate.

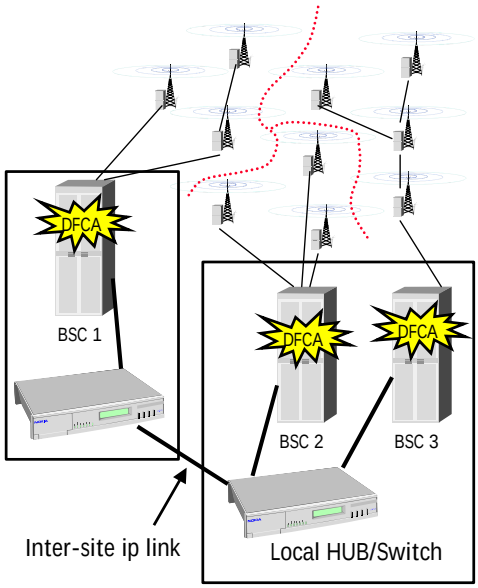


Figure: Inter BSC connection.

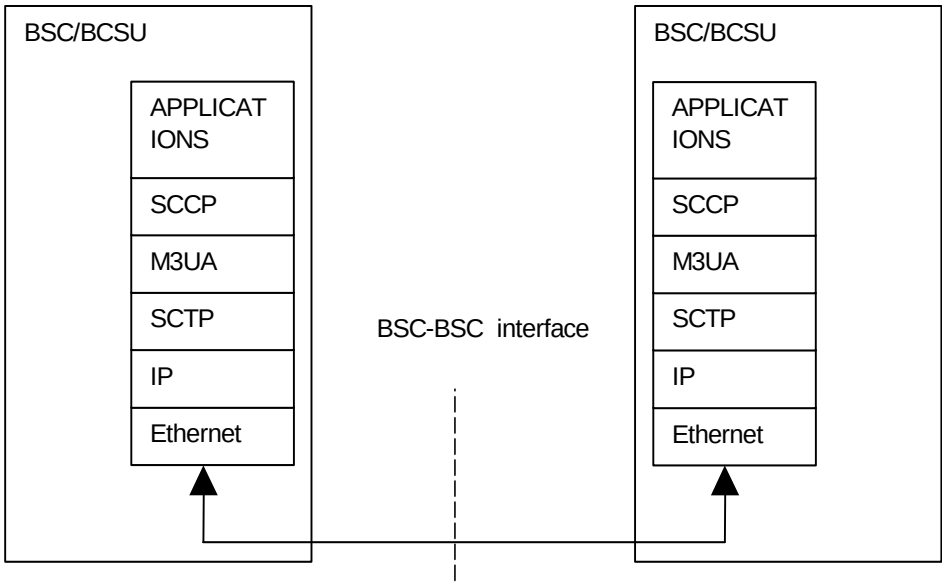


Figure: Inter BSC connection protocol stack.

In high-density networks that are the ones that will require the capacity benefits obtained from synchronisation, the BSC areas will be relatively small. If the BSC to BSC connection is not developed, this will effectively impose unacceptable limitations to the benefits achieved with DFCA, as the system will only have the required information from the cells located in the centre of the BSS area. The following figure illustrates this problem.

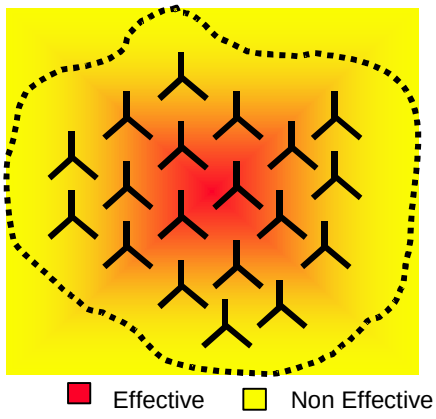


Figure: DFCA without inter BSC connection.

The application of DFCA is focused to circuit switched traffic (voice, CS data and HSCSD services), so (E)GPRS traffic is not configured for this feature. The packet switched territory will be placed on regular (non-DFCA) TRXs, which have been assigned on a separated frequency band and controlled by the conventional RRM. This TRX division concept is illustrated in next figure.

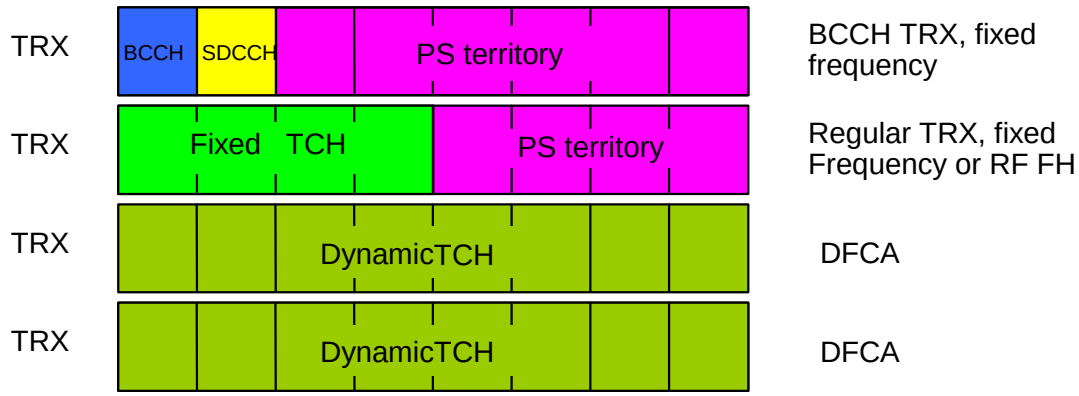


Figure: TRX split in a DFCA BTS

DFCA can be used with other existing features like Power Control, DTX and Frequency Hopping achieving most benefits coming from all of them. Because DFCA is based on the principle of controlling the interference, random frequency hopping is incompatible with DFCA. However, cyclic frequency hopping is supported for obtaining the frequency diversity gain. DFCA cannot interwork with IUO/IFH feature. One BTS can be configured either with IUO super layer TRXs or DFCA TRXs.

On the BTS side, DFCA introduces a new DFCA frequency hopping mode that allows full freedom for the dynamic radio channel selection in time slot level. This is required for the maximum performance and is supported in MetroSite and UltraSite base stations with wide band combiners. Talk family BTSs can use DFCA in conventional cyclic RF hopping with wide band combiner and BB hopping mode with narrow band combiner. UltraSite BTSs with narrow band combiners can use DFCA in conventional cyclic BB hopping mode. For optimum performance at least 50% of the BTSs should support the new DFCA frequency hopping mode.

The second generation BTSs cannot support DFCA, as they cannot be synchronised. Also, PrimeSite and InSite BTSs are not supported.

Requirements for memory and HW

DFCA will increase the amount of work needed during channel allocation in the MCMU processor unit of BSC. Some tasks that in traditional TCH allocation are done somewhere else are now assigned to the MCMU. There are also totally new tasks, such as the BSC-BSC interface, implemented in the BCSU processor. All these things lead to an increase in the processor load of the BSC processor units. Therefore DFCA will be available for BSC2i and BSC3i only. The BSC2i requires the use of CP6MX (500MHz) in all processor units.

Note: Cumulative load effect of DFCA and MS locationing features generating to BSC CPU is under further study.

Benefits of Nokia solution

QoS control enhancement: Different CS traffic classes (EFR, HR, HSCSD, AMR FR, AMR HR) can tolerate different interference conditions depending on the channel coding and interleaving properties. DFCA takes the C/I requirements of each user into account when selecting the radio channel thus providing means to differentiate between users. This is especially powerful when the full benefit of AMR connections is wanted without 100% AMR penetration.

Increasing capacity by decreasing the effective frequency reuse distance in the network. It is possible to accommodate more CS traffic by adding more TRXs to the existing BTSs without quality deterioration. Or alternatively, more frequencies can be used on the regular layer thus increasing the performance and capacity available for (E)GPRS.

Enhanced quality by maximising the C/I provided for each user the network performance in terms of RXQUAL, FER and dropped call rate can be significantly improved.

Operational costs can be reduced since DFCA removes the need of frequency planning for DFCA TRXs. Also no interfering cell definitions as with IUO/IFH are needed.

Interaction with other features

Following features cannot be used in a BTS using DFCA:

- IUO/IFH: DFCA will replace these features
- Dynamic Hotspots
- Extended cell radius
- ICE
- Antenna hopping
- IDD

Following features cannot be used in a TRX using DFCA:

- Dynamic SDCCH (not usable for the DFCA TRXs)
- FACCH call set up (not usable for the DFCA TRXs)
- Interference Band Recommendation: DFCA will replace this functionality
- Power optimisation in handover: DFCA will replace this functionality
- (E)GPRS: PS territory is not allowed in DFCA TRX but only in regular TRXs in DFCA BTS

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	OSS4 1)	S11.5	-	Y	N	DF7	N	CXM4.1	N	CX4.1

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	Y	-	Y 2)	Y 3)	-	-	O

Note(s): 1) Needed for parameter management 2)BSC – BSC connection, BSC2i, CP6MX in all processor units required, 3) LMU needed

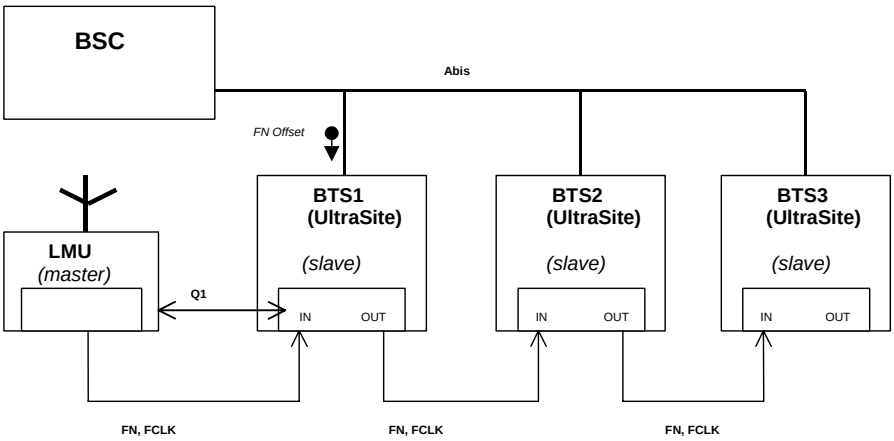
3.2 BSS11073 Recovery for BSS and Site Synchronisation

The purpose of this feature is to offer automatic recovery for the loss of LMU clock, meaning getting the chained cabinet to the unsynchronised mode and also to offer automatic recovery to the synchronised mode when the LMU clock is available again. This feature also offers synchronisation recovery for Multi BCF site.

In BSS10 if the BTSs in chain are synchronised and the clock signal is lost and then got back again there is no automatic recovery from this situation. User has to lock and unlock the sites in order to get the system synchronised again. In BSS11 this happens automatically when BTS chain is defined in BSS radio network database unless not then recovery happens like in BSS10.

This feature can be used together with DFCA when LMU is defined as clock source in BSS radio network database and BCF is in synchronized mode and with Multi BCF configuration providing that all unlocked BCFs are defined to same chain which is operating in synchronized mode.

For TalkFamily chain maximum is 6 BTS and for UltraSite a maximum of 9 BTS can be in the chain. Up to 3 MetroSite Edge BTS cabinets can be connected to 1 TalkFamily BTS. Expansion will be always made from TalkFamily to MetroSite BTS.



Benefits of Nokia solution

Automatic recovery for the loss of LMU clock when BTS chain is defined in BSS radio network database.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	(OSS3.1 ED3)	S11	-	-	N	DF7	N	CXM4.0	N	CX4.0

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	Y	-	-	Y 1)	-	-	S

Note(s): 1) LMU for BTS needed

3.3 BSS11136 Enhanced TRX priorisation in TCH allocation

With Enhanced TRX priorisation in TCH allocation feature BCCH TCHs are allocated with priority to non-AMR GSM mobiles.

The robustness of AMR codecs and frequency hopping allow AMR mobiles to maintain the quality of speech service under lower C/I radio conditions than non-AMR GSM mobiles can do. Therefore with AMR more traffic can be supported and tighter reuse schemes in non-BCCH TRXs can be applied.

However operators supporting the use of AMR still have to support also non-AMR users up to some extent till the AMR penetration has reached 100%. Even for those operators deploying full AMR from the beginning still the possibility to support non-AMR roamers has to be provided.

Enhanced TRX priorisation in TCH allocation feature enables operator to provide better signal quality for non-AMR mobiles in cells that are configured according to AMR network dimensioning guidelines by allocating them to TCHs in BCCH TRX which is providing higher signal strength than other TRXs.

Benefits of Nokia solution

Improved signal quality for non-AMR GSM mobiles in AMR network in low C/I radio conditions.

Interaction with other features

- Data calls are preferred over non-AMR calls to BCCH TRX
- In Intelligent Underlay-Overlay the TRX priority setting is not applied in super-reuse TCH allocation for underlay-overlay handovers.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	(OSS3.1 ED3)	S11	-	-	N	DF6	N	CXM3.0	N	CX3.0

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	-	-	-	-	S

Note(s):

3.4 BSS11107 GSM – WCDMA Interworking Enhancements

In the BSS11 the Inter-System Handover is improved with the following enhancements:

1. Support of service priorities in A-interface
2. Inter-System Direct Access from the GSM to the WCDMA RAN
3. Service area and cell based penalty timers

Support of service priorities in A-interface

MSC is able to inform the BSC about service priorities on the A-interface. That is, in the 'assignment request' and the 'handover request' messages the MSC is able to send indication whether the connection in question is prioritised to prefer WCDMA RAN or to prefer GSM or service is not allowed to be handed over from GSM.

Service Priority	Description and action
• Prefer WCDMA	WCDMA RAN is preferred i.e. the Handover Algorithm should initiate Inter-Systen Direct Access from the SDCCH or Inter-System handover from the TCH to the WCDMA RAN regardless of the serving GSM cell load.
• Prefer GSM	Inter-System Direct Access or Inter-System handover to the WCDMA RAN should not be performed i.e. the Handover Algorithm shall initiate Inter-System Direct Access from the SDCCH or Inter-System handover from the TCH to the WCDMA RAN only if the load of the serving cell is over the defined thresholds.
• GSM only	GSM is preferred i.e. the Handover Algorithm is not allowed to initiate Inter-System Direct Access or Inter-System handover from the GSM to the WCDMA RAN.

Inter-System Direct Access from the GSM to the WCDMA

The purpose of the Inter-System Direct Access is to enable the BSC to hand a mobile directly from the SDCCH to the WCDMA. The BSC performs the direct access when the following conditions are fulfilled:

- Inter-system handover is enabled and Direct Access is allowed
- Load of the serving GSM cell exceeds the Inter-System Direct Access threshold
- BSC receives an indication from the mobile about its WCDMA RAN capability in the 'classmark change' message. The mobile has to be FDD capable.
- Mobile has received information about the adjacent WCDMA RAN cells from the BSC via BCCH.
- BSC has received measurement reports of the WCDMA RAN adjacent cell(s) via SDCCH.
- Energy per chip to interference ratio (Ec/No) of the target WCDMA RAN cell(s) has to be over the Inter-System Direct Access threshold.

Service area and cell based penalty timers

Service area and cell based penalty timers are used to decrease number of unnecessary handover attempts from GSM network to WCDMA RAN network when traffic load conditions are not seen favourable for it.

- With service area based penalty timers unnecessary handover attempts from GSM network to WCDMA RAN can be avoided within pre-defined period of time with pre-defined attempt rate threshold after WCDMA RAN service area has handed over calls to GSM network and thus indicated its level of load being high.

- With cell based penalty timers unnecessary handover attempts from GSM network to WCDMA RAN can be avoided by preventing handover attempts if in pre-defined period of time pre-defined number of unsuccessful handover attempts have taken place. Unsuccessful handover attempts indicate that WCDMA RAN cell in question is so loaded that initiation of handovers to there is meaningless.

Benefit of Nokia Solution

With GSM-WCDMA interworking enhancements operator can optimize directing of CS traffic to most preferable radio networks.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	M11 1)	(OSS3.1 ED3)	S11	-	Y	(B13)	(DF6)	(DF6)	(CXM3.0)	(I3)N	(CX3.0)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 2)	-	-	-	-	O 3)

Note(s): 1) M11 feature 1260 2) Dual mode (GSM-WCDMA) MS, 3) Optionally related to BSS10.5 GSM – WCDMA Interworking

3.5 BSS11085 Automated Planning Enhancements

Currently, the BSC Statistics includes several measurements, which are developed to produce information for creating neighbour plans and frequency plans for GSM radio network. These tasks are being carried out in the OSS, whilst the BSC provides the required information to accomplish these tasks. In the last BSC releases, new measurements have been introduced to automate these tasks as well as to improve their accuracy.

S11 feature ‘Automated Planning Enhancement’ introduces two independent means to achieve these goals:

- New measurement for interference matrix, based on Total FEP
- Automated changing of active BA list

3.5.1 New Total FEP Measurement for interference matrix generation

Current methods for interference matrix generation are based on the usage of C/I ratio, calculated using the RX Level values of the serving cell and its neighbouring cells. In BSC, the Channel Finder Measurement and Defined Adjacent Cell Measurement are examples of tools created for this purpose. These measurements are providing counters for C/I ratios between the serving cell and its undefined (Channel Finder) or defined (Defined Adjacent Cell Measurement) neighbouring cell as well as other statistical information.

This new feature introduces a new approach for C/I matrix generation. In trials and simulations it has been noticed that it is possible to create a mapping between radio interference, i.e. the C/I ratio and the resulting speech quality measured using FER, frame erasure rate. Since S10, FER is used in BSC statistics for assessing the speech quality with the new FER Measurement as well as in handover and power control decisions.

FER gives the ratio between the number of erased speech frames and all speech frames. This is considered to be better way of measuring the speech quality than Bit Error Ratio (BER), which is traditionally used for this purpose, both in statistics as well as in handover and power control algorithms.

For uplink direction, the FER is available as the BFI value in the mobile measurement reports. For downlink direction the value is not currently available, because the MS does not measure FER, therefore the estimated FEP value is used in S10 FER Measurement for the downlink direction.

Frame Erasure Probability (FEP) is an estimated probability for a speech frame being erased. If a frame is erased upon receiving, the FER value for this frame is 1, if not, the FER value is 0. FEP gives the probability (0 … 1) of a certain frame being erased. FER values collected over some period of time are giving information of multiple frames. Because FEP is based on erasure probability of a single frame, average of FEPs gives a good approximation of the speech quality.

3.5.2 Automated Changing of activated BA list

Automated Radio Network Tuning (ARNT) feature is targeted for allowing neighbour and frequency planning by using mobile measurement data. The required measurements are obtained by sending all the BCCH frequencies to the active mobiles in a cell.

As the BCCH allocation frequency list (BA) that is sent to mobiles can hold only up to a maximum of 32 BCCH frequencies, the frequencies that a mobile can measure is limited to 32. In order to enhance ARNT to handle more than 32 BCCH frequencies, it is required to replace or cycle frequencies during the measurement periods. Thus for the duration of Total FEP Measurement it is required that the active BCCH Allocation frequency list (BA) is changed in order to collect the correct information.

Changes to the BA list are provided automatically by the BSC to reduce manual input work from the user of the BSC measurement.

Benefit of Nokia Solution

The emphasis is on setting and self-regulating radio network parameters and to improve the accuracy of the information required building a frequency plan.

Interaction with other features

- Network doesn't order a MS to use Enhanced Measurement Report (EMR) for reporting when Idle BCCH Allocation List or Measurement BCCH Allocation List is used in active state in the serving cell.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	OSS3.1ED 3 1)	S11	-	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	-	-	-	-	O 2)

Note(s): 1) NetAct Optimiser related functionality 2) Optional related to BSS10 feature Automated Network Planning

3.6 BSS11086 Support of Enhanced Measurement Reports

The enhanced measurement reporting (new downlink measurement report) provides the system with enhanced serving cell measurements, including information about erased frames in downlink direction (FER) and extended range for downlink RXLEV values. Moreover, with the enhanced measurement reporting, the mobiles are able to report significantly more neighbours than before. Finally the report of WCDMA neighbours using GSM Measurement Reports is included in this new Measurement Report format.

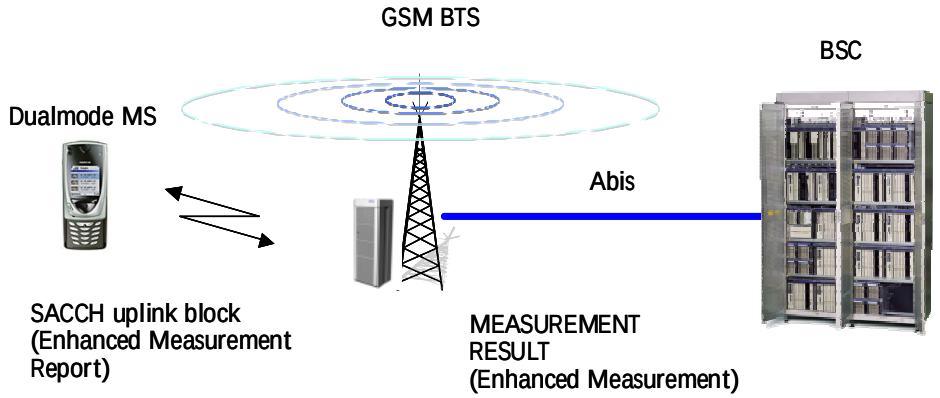
The generic performance of the system would be enhanced and the GSM/WCDMA inter-working enabled with the introduction of the Enhanced Measurement Report. Furthermore the new measurement information can also be used to enhance several Nokia specific features, such as:

- FER measurement
- IUO and IFH

The BSS requests MS to report the serving cell and neighbouring cell measurements with 'enhanced measurement report' message instead of the normal 'measurement report' message with the parameter 'report_type' of the 'measurement information' message. This is referred as Enhanced Measurement Reporting [3GPP TS 45.008].

When the Enhanced Measurement Report [3GPP TS 44.018] is supported by MS, the report can contain up to 15 reported neighbours in one report.

If the Enhanced Measurement Reporting is used, valid Base Transceiver Station Identity Codes BSICs of the neighbouring cells are sent to the MS in the 'measurement information' message.



Benefit of Nokia Solution

Enhanced network performance and improved GSM/EDGE/WCDMA interworking.

Interaction with other features

- Network doesn't order a MS to use Enhanced Measurement Report (EMR) for reporting when Idle BCCH Allocation List or Measurement BCCH Allocation List is used in active state in the serving cell.
- With common BCCH control when a call is on non-BCCH frequency band, serving cell BCCH frequency is added to the BCCH frequency list. In addition to this when Enhanced Measurement Report message is used for reporting, also serving cell BSIC is added to the BSIC list before sending it to an MS.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	(OSS3.1 ED3)	S11	-	-	N	DF7	N	CXM4.0	N	CX4.0

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 1)	-	-	-	-	S

Note(s): 1) rel'99 MS support required.

3.7 Wireless Priority Service

The deployment of WPS is intended to allow qualified and authorized National Security and Emergency Preparedness (NS/EP) users to obtain priority access to radio traffic channels during situations when Commercial Mobile Radio Service (CMRS) network congestion is blocking call attempts.

The complement of the Initial Operating Capability (IOC) of the Wireless Priority Service (WPS) and the implementation of Full Operating Capability (FOC) of the Wireless Priority Service (WPS) in BSC means improvements to traffic channel allocation and queuing algorithms.

Wireless Priority Services will be implemented in 3 phases. The first one in BSS10.5 as a S10.5 CD, the second phase in BSS11 and the third phase in S11.5.

Benefits of Nokia solution

Wireless Priority Service (WPS) allows the Service Provider to ensure that a reasonable amount of GSM radio capacity is made available for the use of public authorities.

3.7.1 BSS11149 Enhancement for Wireless Priority Service (IOC)

Wireless Priority Service (WPS) for the Initial Operating Capability (IOC) /1/ allows the Service Provider to ensure that a reasonable amount of GSM radio capacity is made available for the use of public authorities. WPS is based on a sub-set of enhanced Multi Level Precedence and Pre-emption (eMLPP) mechanism and is provided only upon call-by-call invocation. Nokia implementation makes use of Queuing and Priority feature in Nokia BSS. WPS is specified by US authorities and thus targeted to be used mainly in US markets as such. The main focus in enhancements is in Radio Resource Management (RRM) and in implementation of counters for improving performance management statistics.

In RRM enhancement is implemented for handling exceptional traffic conditions when radio resource congestion occurs and when therefore WPS calls are in queue due to having encountered radio resource blocking, a percentage or number, X, of a cell's radio resource capacity to serve call attempts shall be allocated with preference to queued WPS calls. The remaining radio traffic channel capacity (Y = 1-X) shall be allocated with preference to public user calls, in accordance with the normal dynamics of call arrivals and capacity availability.

WPS feature is enhanced with statistics including counters for different priority levels. Following occurrences are compiled on statistics:

- Average numbers of full rate and half rate traffic channels occupied by WPS users during measurement period

- Peak number of full rate and half rate traffic channels occupied by WPS users during measurement period
- Peak number of WPS users in queue during measurement period
- Average queuing time for WPS users who have got a traffic channel via queuing
- Indication of the numbers of priority level 1, 2, 3, 4 and 5 WPS users put to queue
- Indication of the number of traffic channel allocations for public users while there are WPS users in queue
- Indication of the number of priority level 1 WPS users that are not allowed into the queue when the maximum queue length has been reached.
- Indication of the numbers of priority level 2, 3, 4 and 5 WPS users that are either dropped from the queue because of the arrival of a higher priority WPS user or are not allowed into the queue when the maximum queue length has been reached.
- Indication of the numbers of priority level 1, 2, 3, 4 and 5 WPS users that are removed from queue because of queue timer expiration

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	M12	OSS3.1ED 3	S11	-	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	-	-	-	-	O

/1/ Wireless Priority Service (WPS) Industry Requirements for the Initial Operating Capability (IOC) for GSM-based Systems, Issue:1.0 February 22, 2002.

3.7.2 BSS11149 Wireless Priority Service (FOC) (BSS11.5)

Wireless Priority Service (WPS) for the Full Operating Capability (FOC) /1/ is enhancement for WPS (IOC) introduced in S11 release.

The WPS (FOC) implementation provides as new feature:

- Statistics on WPS users removed from queue due to loss of radio contact or user has abandoned the call.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	M12 TOP	OSS4	S11.5	-	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	Y	-	-	-	O

/1/ Wireless Priority Service (WPS) Industry Requirements for the Full Operating Capability (FOC) for GSM-based Systems; Issue:1.0 September, 2002.

3.8 BSS12158 IMSI based handover (BSS11.5)

When WCDMA network deployment has also taken its share in mobile networks GSM/EDGE cells can have several types of neighbour cells:

- Own operated GSM/EDGE cells
- Own operated WCDMA cells
- WCDMA cells of roaming partner or partners
- GSM cells of roaming partner or partners

In BSS 10.5 one list of WCDMA neighbour cells can be defined per cell. These neighbours are informed to the mobiles in the Measurement Info Message sent on the SACCH. This requires that mobiles have to measure all of the desired cells in all of the desired WCDMA networks.

IMSI based handover will benefit roaming based mobile services provisioning and network sharing concepts by enabling handover control to direct subscribers from the shared or roamed network to the subscribers Home PLMN.

With this feature, a Host GSM Operator is able to define that BSC performs handovers only to the cells, which are permitted for the subscriber. Using Network Alliance Lists and Subscriber Groups this can be done. Each of Subscriber Groups is attached to a Network Alliance List, which contains all network PLMN identifiers of the alliance.

The owner (an operator) of a Subscriber Group is not required to be one of the owners of a network alliance. A group of few domestic operators can be sole owner of a network alliance, which offers roaming services for subscribers of other domestic operators or of foreign operators.

A Client GSM Operator network or Client WCDMA Operator network may belong either one or several network alliances according to roaming agreements. However, a subscriber is allowed to use services of one network alliance only.

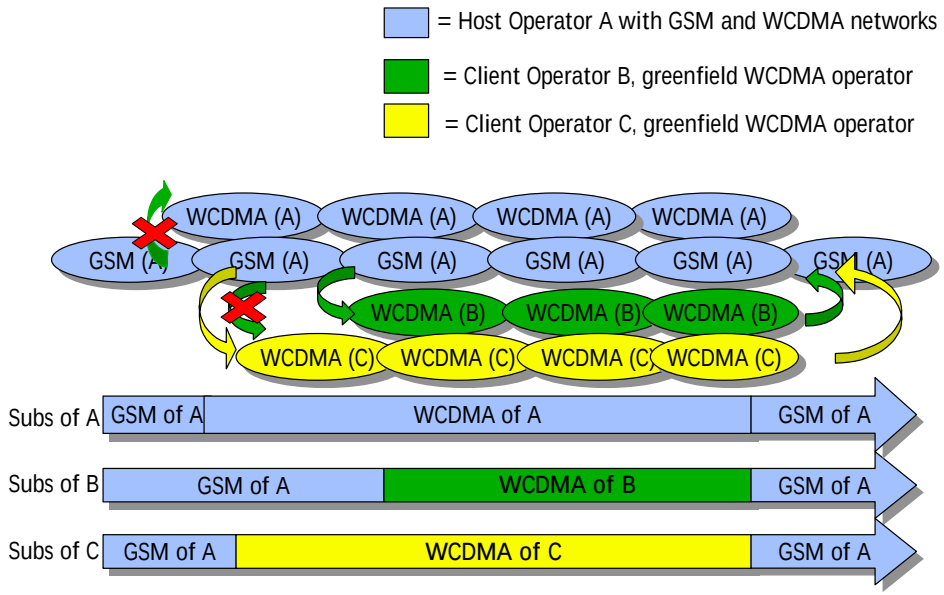


Figure: An example of IMSI based HO between a GSM operator and several WCDMA operator alliances

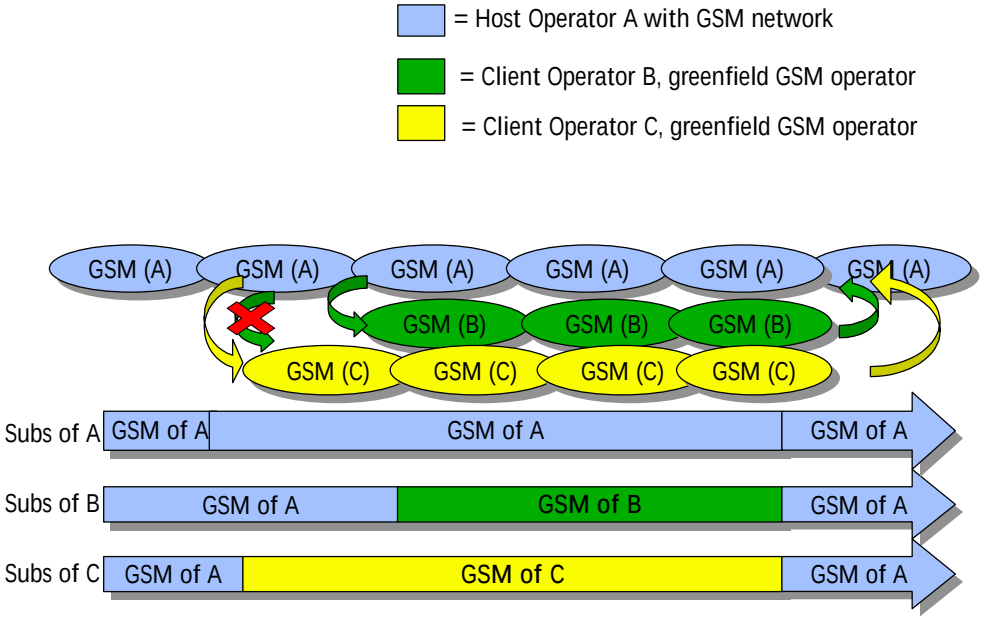


Figure: An example of IMSI based HO between a several GSM operators

Mandatory prerequisites for IMSI based handover feature are:

- connection to Nokia MSC because sending of the IMSI from MSC to BSC regardless of capability of the MS is not specified by 3GPP
- 64 kbit TRXSIG links in the cells for assuring necessary signalling capacity.

Benefits of Nokia solution

With the IMSI based handover feature it is enabled to control handovers between networks of different operators according to the identity of a subscriber. These networks can be GSM or other radio technology networks, for example WCDMA networks.

Interaction with other features

- Inter-system Handover (S10.5) feature must be enabled when IMSI based HO to WCDMA RAN cell is performed.
- Inter-system Direct Access (S11) and IMSI based HO to WCDMA RAN cell can't be enabled simultaneously in the same cell.
- Support of Cell Global Identity (S11): Own/alien PLMN parameters effects only in the case of IMSI based HO to a GSM cell.

Following features can't be used in the same cell where IMSI based HO to GSM cell is enabled:

- Undefined Adjacent Cell Measurement
- Channel Finder Measurement
- Statistical Support for Automated Planning

- Automated Planning Enhancement

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	M12 TOP 1)	OSS4	S11.5 2)	-	-	N	(Y)	N	(Y)	N	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 1)	-	-	-	-	O

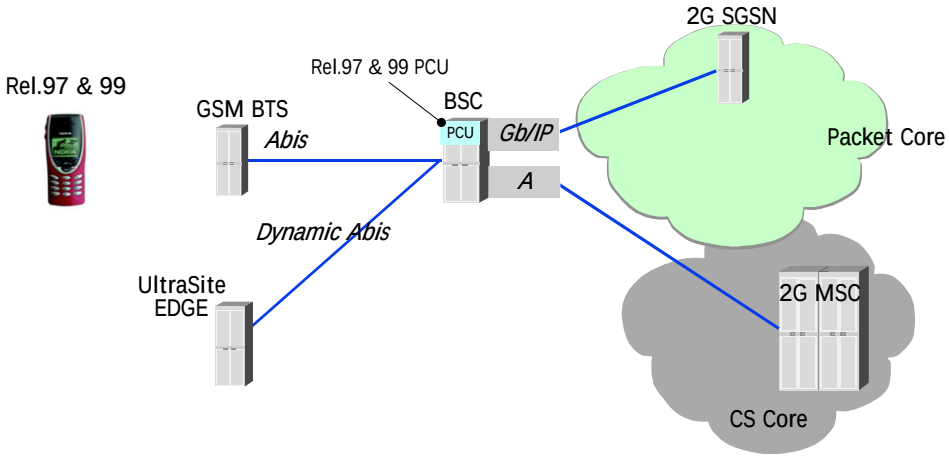
Note: 1) Nokia MSC required, 2) 64k TRXSIG signalling links required3) GSM – WCDMA MS

4. PACKET SWITCHED DATA: (E)GPRS EVOLUTION

4.1 BSS11110 (E)GPRS: Gb Over IP (BSS11.5)

Today we are witnessing rapid changes in the way we communicate, as the convergence of mobile communications and the Internet has begun. The amount of data usage in mobile networks is rapidly growing compared to traditional voice traffic. The increased demand for packet switched traffic transmission cost efficiency can be met by the deployment of IP in the transmission network.

The first BSC to SGSN transmission implementation uses FR (Frame Relay) on Gb interface. When IP is taken into use packet switched traffic does not go via a circuit switched network, but IP instead. The introduction of IP enables to build an efficient transport network for the future IP based multimedia services.



The IP transport can be used in parallel with FR under the same BSC and BCSU (Base Station Controller Signalling Unit). One Network Service Entity (NSE) and each PCU always uses either one, IP or FR. Inside one BCSU can separate PCUs use different transmission media. In the BSC there is always one local IP endpoint per PCU.

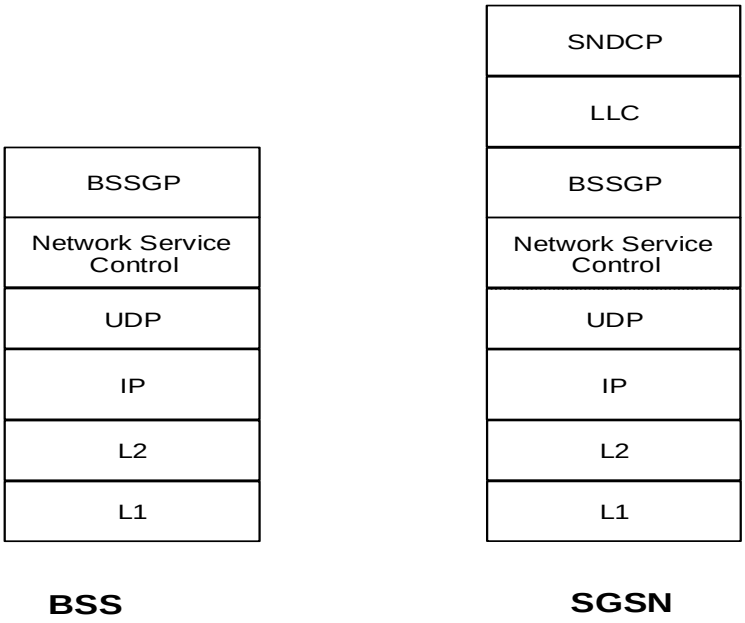


Figure: Gb interface protocol stack with Gb over IP

Note: (E)GPRS capacity on Gb interface is under further study with Gb over IP.

Gb over IP supports both dynamic and static configuration. In dynamic configuration only one IP address and UDP port pair of remote end SGSN is needed to establish NS-VC configuration on Gb. Static configuration can be used, if it is seen feasible to have fixed configuration between BSCs and SGSNs. This might be feasible when operator has direct cable connection between BSC and SGSN.

Benefits of Nokia solution

Gb over IP brings alternative to traditional Frame Relay based connectivity of Gb interface and thus enables operator to save in CAPEX by using possible unused IP capacity in site instead of building up new FR capacity.

Interaction with other features

Note that the use of Gb over IP is a system level feature requiring support from both BSC and SGSN.

PCU requirements for Gb over IP feature are under study.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	-	S11.5	SG3	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	Y 1)	-	-	-	S 1)

Note(s): 1) New cabling and LAN panel for the BSC2 required for connecting Gb i/f to external LAN switch and edge router at site. In BSC3i integrated LAN switch is part of standard set up. PCU requirements for Gb over IP feature are under study.

4.2 BSS11151 Extended Uplink TBF (S11 ED)

Typically releasing of Uplink TBF is done immediately if MS has no data to send providing that Downlink TBF from MS to BSC is existing or otherwise delay timer is started and after expiration of it Uplink TBF is released. If during that release procedure MS suddenly has new data to send a new Uplink TBF has to be established for that.

When MS is supporting Extended Uplink TBF and MS has received information from network in the system information messages (SI13 or PSI1) that also network is supporting it then releasing of Uplink TBF can be prolonged even MS has occasionally nothing to send to network along Uplink TBF and right after MS has new data to send the same Uplink TBF can be used for that purpose.

Extended Uplink TBF requires 3GPP Rel. 4 GERAN feature package 1 mobile stations.

Benefit of Nokia solution

Extended UL TBF Mode is applied instead of the “Delayed UL TBF release” of the current Nokia implementation for mobile stations supporting the GERAN feature package 1 (Rel4 mobile stations). As in the current implementation, with Extended UL TBF Mode the UL TBF release can be delayed in order to make it possible to establish the following downlink TBF on PACCH.

Additionally the Extended UL TBF Mode allows the mobile station to continue the data transfer if it gets more data to send when the countdown procedure has begun. Without this feature the release of the current TBF is required and establish a new one, causing more delay and signalling load.

Benefit of this is that occasional short breaks in data transmission are not causing delay of activation of new Uplink TBF which is seen as decrease in perceived service quality by end user e.g. in speech delivery in PoC.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	(OSS3.1 ED3)	S11ED	-	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 1)	-	-	-	-	S 2)

Note: 1) 3GPP Rel'4 GERAN feature package 1 MS required. 2) Requires Nokia GPRS functionality as a prerequisite.

4.3 BSS11156 EGPRS: Channel Request on CCCH (S11ED)

When the MS wants to send data or upper layer signalling messages to the network, it requires the establishment of an uplink TBF from the BSC.

With EGPRS terminal this has typically been done as two phase access on CCCH where the MS is first requesting RLC block from the BSC and after it has been assigned the MS provides information about its EGPRS capabilities. Based on that information Packet Data Channel, if available, is assigned for the TBF and the MS is instructed with attributes to be used in uplink transmission by BSC.

By using EGPRS Channel Request on CCCH feature uplink TBF establishment can be substantially speeded up since it is done in one phase. Already when the MS is requesting TBF establishment from the BSC it provides information about its EGPRS capabilities and BSC can assign right after this Packet Data Channel, if available, for the TBF based on that information.

Benefit of Nokia solution

Fast uplink TBF establisment for EGPRS terminals on CCCH.

Interaction with other features

Corresponding feature is available with PBCCH/PCCCH from the S10.5 ED release onwards.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	-	S11ED	-	-	-	-	-	CXM3.3	-	CX3.3

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 1)	-	Y 2)	-	-	S 3)

Note(s): 1) EDGE terminal support required. 2) EDGE TRX required, 3) Requires Nokia EGPRS functionality as a prerequisite.

4.4 BSS11111 (E)GPRS: Enhanced Quality of Service (BSS11.5)

The Enhanced Quality of Service (EQoS) feature consists of several improvements over the BSS10 QoS management. The QoS provisioning in previous BSS releases has only supported best effort services but due to the development in service types delivered over (E)GPRS inevitably better guarantees for service quality are required for delivering services like streaming video clips, packet over cellular (PoC) speech delivery, music and radio broadcasting with guaranteed throughput. With the EQoS minimum throughput can be guaranteed for service after its activation, if subscriber's quality parameters in (E)GPRS subscriber data in HLR allow the use of Streaming Traffic Class (STC). The EQoS with support of STC provides real means for differentiation between (E)GPRS users based on provided QoS level over the radio network down to MS.

The most significant change in EQoS is the support of BSS Packet Flow Context (BSS PFC), which gives BSS better visibility of the QoS parameters associated with the connections. Moreover, the support of services that require some guarantees is also included in the scope of this feature. This means that for the first time BSS can guarantee certain QoS in terms of throughput.

With the support of Streaming Traffic Class in BSS11.5, some QoS parameters like throughput need to be guaranteed. For efficient support of this traffic class the BSS PFC is required to communicate the QoS attributes from SGSN to PCU.

If some guarantees are needed, then radio resource reservation is required. Admission Control (AC) is used to calculate what network resources are required to provide the requested QoS, to determine if resources are available, and to reserve them. During the connection the usage of radio resources are monitored by Quality Control (QC), which makes sure that the usage of resources is in line with the negotiated ones.

The scheduling of data packets in BSS11.5 is based on Bucket Round Robin (BRR) scheduling, which can provide differentiated service for each Traffic Class. The handling of streaming traffic sets some new requirements for the scheduling algorithm as this traffic class should have the highest priority over the best effort, interactive and background traffic classes. In addition to this requirement, the scheduling is

further developed in order to harmonise it with radio resource management (RRM) and link adaptation (LA), which tries to maximise kbps/TSL. This harmonisation is needed for the AC and QC purposes.

The bottleneck of the throughput is in the Radio Access Network. Hence, providing streaming services is possible only, if the RAN guarantees a certain throughput.

BSS Packet Flow Context

BSS Packet Flow Context (BSS PFC) is a procedure defined for 3GPP R4 Gb, which enables transfer of QoS parameters between Core Network (SGSN) and BSS (PCU). Moreover, the QoS parameters transferred from SGSN are not related to one packet but to a flow of packets for a particular PDP Context. One MS may have several PDP contexts with different QoS parameters at a same time. This information is either given by SGSN, e.g. in PDP context activation or requested by BSS from SGSN when needed. BSS maintains this information as long as the packet flow is continuous (i.e. that the flow does not stop for more than some tens of seconds).

Traffic class	Conversational class	Streaming class	Interactive class	Background class
Maximum bitrate (kbps)	8,16,32,64,128,256, 512, 1024, 2048	8,16,32,64,128,256, 512, 1024, 2048	8,16,32,64,128,256, 512, 1024, 2048 overhead	8,16,32,64,128,256, 512, 1024, 2048 overhead
Delivery order	Yes/No	Yes/No	Yes/No	Yes/No
Maximum SDU size (octets)	<=1500 or 1502 (4)	<=1500 or 1502	<=1500 or 1502	<=1500 or 1502
SDU format information	-	-		
Delivery of erroneous SDUs	Yes/No/-	Yes/No/-	Yes/No/-	Yes/No/-
Residual BER	$5*10^{-2}$, 10^{-2}, $5*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-6}	$5*10^{-2}$, 10^{-2}, $5*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}	$4*10^{-3}$, 10^{-5}, $6*10^{-8}$	$4*10^{-3}$, 10^{-5}, $6*10^{-8}$
SDU error ratio	10^{-2}, $7*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}	10^{-1}, 10^{-2}, $7*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}	10^{-3}, 10^{-4}, 10^{-6}	10^{-3}, 10^{-4}, 10^{-6}
Transfer delay (ms)	100 – maximum value	250 – maximum value		
Guaranteed bit rate (kbps)	8,16,32,64,128,256, 516, 1024, 2048	8,16,32,64,128,256, 516, 1024, 2048		
Traffic handling priority			1,2,3	
Allocation/Retention priority	1,2,3	1,2,3	1,2,3	1,2,3

Table: Values set for GPRS Bearer Service Attributes as in 3G TS 23.107 V3.2.0

Admission Control

The role of AC is to estimate if the network elements have enough resources to accommodate a new BSS PFC. In that way, AC can ensure the QoS during a call set up. When resources available for reservation or monitored resources are low, new connections can be declined. For services that require a guaranteed throughput, AC needs some information in order to know whether there are available resources to guarantee QoS requirements:

- Throughput requirements: guaranteed and maximum bitrate requested
- Information about the quality of the radio channels

Radio channel quality information will be used to translate the throughput requirements from MS application into the radio resources at BSS side, i.e., into number of TSL needed to guarantee the '*guaranteed bitrate'*.

After the Admission Control has estimated that enough resources to accommodate a new BSS Packet Flow Context are available channel allocation for streaming services is done to GPRS or EPGRS territory. If channels in aforementioned territories are needed for handling of incoming CS traffic their size can be downgraded in order to free TSLs for CS use. However downgrading can be rejected if that would cause quality class degration for PFC for streaming service(s) with guaranteed bitrate in assigned to timeslots that are subject of proposed downgrading.

Quality Control

Admission Control together with guaranteed bitrate scheduling normally makes sure that all QoS requirements are fulfilled. However, information used in admission control is generally based on statistics over some period in time, but radio conditions in reality may vary considerably compared to past statistics. The purpose of QC is to detect degradation periods in service quality, and to perform corrective actions, which cannot be addressed during admission control or in scheduling. The possible actions include TBF reallocation, cell reselection, QoS parameter renegotiation, and finally dropping the PFC.

Characteristic of streaming traffic

The general characteristics of streaming traffic are basically its inherent jitter sensitivity (although it is compensated at application layer by an additional buffering), less stringent delay requirement (less than 10 seconds) and the need of a guaranteed sustainable bitrate, which requires reserved bandwidth. Each type of *streaming traffic* has its own QoS requirements profile.

Benefit of Nokia solution

With Enhanced Quality of Service feature services that require guaranteed data rates can be delivered over BSS. This makes possible to launch new type of services over (E)GPRS like speech delivery as Packet over Cellular service and other streaming services e.g. entertainment or streaming hotline news. Enhanced Quality of Service provides also possibility for operator real differentiation between subscribers based on subscribed quality of service classes.

Note that PCU requirements for EQoS are under study.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NMS	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	OSS4 1)	S11.5	SG4	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 2)	Y 3)	-	-	-	O

Note(s): 1) For visualising the QoS results. 2) Rel'99 MS support for QoS classes. 3) PCU requirements for EQoS are under study.

4.5 BSS11112 Network Controlled Cell Re-selection (BSS11.5)

The GPRS service introduces the benefits of packet switched data transmission in GSM cellular networks. In order to provide GPRS service in a certain geographical area, the MSs must be able to camp in one cell or another while moving so that they always get enough coverage to perform data transmissions. Cell re-selection is the operation that provides the means to perform the cell selection in GPRS, which is equivalent to handover in CS service.

The cell re-selection operation solves the same problem as handovers do in circuit switched (CS) services. In CS services, the MSs switch from one cell to another seamlessly, however, in packet switched (PS) mode, the cell selection is performed in such a way that the data transmission is interrupted for a moment in the old cell and then resumed again in the new selected cell.

4.5.1 Network Controlled Cell Re-selection procedure

The autonomous MS cell re-selection network control mode was introduced in BSS9. In BSS11.5 release, the cell re-selection feature is enhanced with the Network Controlled Cell Re-selection (NCCR).

When NCCR is activated network control is broadcast to all terminals. Then all MSs supporting NCCR send in Mobility Management (MM) Ready state measurement reports to BSS and cell re-selections are started only by network's order. However cell re-selection control may be based on MS capabilities then individual MSs are commanded under network control and such MSs that are not supporting network control will continue their operation in autonomous mode. Further the operator can select whether the intersystem cell re-selections are allowed.

An MS is in Ready state as long as it has to send or receive some PDUs. Whenever an MS is allocated radio resource providing a Temporary Block Flow (TBF) on one or more physical channels, it enters the Radio Resource (RR) packet transfer mode and MM Ready state. However, when the transfer of PDUs is concluded, the MS returns to RR packet idle mode, but it still remains in MM Ready state until the Ready timer expires. In that moment, it returns to MM Standby state. So, for a while, the MS may be in RR packet idle mode and in MM Ready state at the same time, and it has to follow network cell change orders.

Operator can set the measurement reporting periods separately for RR packet idle and RR packet transfer modes. In RR packet idle mode MS first makes packet access for single radio block and sends the measurement report on the allocated block. In RR packet transfer mode when MS has uplink TBF and the MS will send measurement reports on PACCH (i.e. replacing data blocks). In RR packet transfer mode with only downlink TBF, the MS will replace downlink acknowledgement messages with measurement reports.

BSS will trigger cell re-selection based on either order from SGSN or RX level and Quality indicators. Target cell selection is based on neighbour cell measurements.

When cell re-selection criterion triggers and appropriate target cell is found, the BSS will command the MS to start cell re-selection procedure. In RR packet idle mode the PACKET CELL CHANGE ORDER message is sent on (P)CCCH. In RR packet transfer mode the PACKET CELL CHANGE ORDER message is sent on PACCH.

Successful cell re-selection procedure continues similar to the autonomous MS cell re-selection procedure. However, BSS has to be prepared for cell re-selection failure e.g. due to no radio resources available in the target cell. MS may send PACKET CELL CHANGE FAILURE message in the original cell either on the existing TBF, new TBF or in a single radio block reserved specifically for the failure

message. In the failure case the operations are continued in the original cell and the target cell to which the cell re-selection failed is given a penalty time during which new cell re-selection attempt may not be started to it.

4.5.2 Network Controlled Cell Re-selection criteria

4.5.2.1 Power budget criterion

In order to efficiently allocate EDGE resources, the network can force EGPRS MSs to select EDGE capable cells as well as keeping GPRS MSs in non-EDGE capable cells according to a power budget criterion.

According to this criterion, the network can force the corresponding MSs to select a specific neighbouring cell that provides the minimum pathloss.

The inputs to this algorithm are received signal level (RXLEV) measurements of the BCCH frequency of adjacent cells and BCCH of serving cell which are performed by each MS and sent to the BSC on PACKET ENHANCED MEASUREMENT REPORT message or PACKET MEASUREMENT REPORT message (when no PBCCH is allocated and not all the BA (GPRS) frequencies have a BSIC assigned).

4.5.2.2 Data transmission quality criterion

According to this criterion, whenever the network realises that the quality of the data transmission is not good enough, it can force the corresponding MS to select the neighbouring cell, which is providing the best signal level. This criterion is meant to set the minimum data transmission quality that any user may experience. For services that require guaranteed throughput, other means for keeping the quality of the data transmission at a certain level have been developed e.g. Quality Control in EQoS.

4.5.2.3 Solution for GSM to WCDMA NC cell re-selection

Multi-Mode terminals, i.e., terminals that are both GSM and WCDMA capable, will be able to camp either on GSM cells or WCDMA cells. Although the terminals are already able to perform GSM to WCDMA cell re-selection autonomously, this operation will be enhanced by providing full control to the network over intersystem cell re-selection operation. Service based criterion has been developed to perform the intersystem cell re-selection such that best possible performance is offered to user.

Service based criterion

From the operator's point of view it is interesting to avoid big investments on the installation of new WCDMA networks, as well as to get revenue as fast as possible. From the very beginning, these networks have been designed keeping in mind the bursty nature of data traffic in order to efficiently allocate the available resources and provide data services to a large number of subscribers. On the other hand, GSM networks were originally designed to support CS speech services and nowadays they provide full coverage to the user.

If speech services could be kept in GSM system and data services in WCDMA, big investment in CS for WCDMA would be avoided and fast revenue would be achieved from the provisioning of data services in WCDMA.

The way to achieve this is by means of creating *service priority tables* that allow the operator to direct services to the most suitable system. An example of such table is shown in the next figure.

Service	Preferred system
Speech	Only GSM
Conversational	Prefer WCDMA
Streaming	Prefer WCDMA
Interactive	Prefer WCDMA
Background	Prefer WCDMA

Figure: Example of service priority table

This table is defined by the operator and it will be placed in the core network together with the subscriber information. This means that the priorities can be subscriber or group specific.

Once a service has been requested, the core network will inform the BSC about the priorities selected for the corresponding service. In the case that the requested packet data service is not available in GSM system, the SGSN will indicate to the BSC that a cell re-selection to WCDMA should be performed.

Network controlled cell re-selection to WCDMA network may take place also when MS is moving out from GSM coverage. The BSC will try to find a target WCDMA cell and will order the cell change as soon as possible.

Benefit of Nokia solution

- Efficient allocation of EDGE resources.

EDGE TRXs will be introduced in the network gradually. This means that EGPRS service will not be available in every cell and thus, EDGE resources will be limited at the beginning. Moreover, in the future, the operators may not want to activate EGPRS service in those areas where very tight reuse is used, because EDGE would not provide its whole potential performance. For this reason, it would be desirable that EGPRS MS would be pushed to those cells where EGPRS service is provided in such a way that EDGE resources can be efficiently utilised.

- Efficient inter-system cell re-selection.

Multi-Mode terminals will be able to camp either on GSM cells or WCDMA cells. Although this cell selection can be performed autonomously by the terminals, it is desirable that these terminals are selected the cell that will provide the most efficient bearer for the requested service.

- Packet Switched traffic controlled by the network.

It will make it possible that the network could control the all Packet Switched traffic, including GPRS traffic. This means that Circuit Switch like features such as traffic reason handovers could also be implemented for Packet Switched traffics. Also QoS can be better handled.

Note that PCU requirements for Network Controlled Cell Re-selection feature are under study.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	OSS4	S11.5	SG5 2)	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	1)	-	-	-	-	O

Note(s): 1) (E)GPRS capable MS. 2) Service priority table support.

4.6 BSS115006 (E)GPRS: Network Assisted Cell Change (NACC) (BSS11.5)

Network assisted cell change (NACC) is an enhancement for cell re-selection operation that it is standardised by 3GPP TSG GERAN. This enhancement is included in R4 release of 3GPP GERAN. This is mandatory for R4 terminals. This concerns intra BSC network assisted cell change. Inter BSC network assisted cell change is subject of R5 release of 3GPP GERAN.

NACC affects to network controlled cell re-selection operation by improving its performance.

When a pre-R4 MS is commanded to perform a cell change, it has to suspend the data transmission in the serving cell, acquire certain system information from the target cell, and then, resume the data transmission in the new cell. This leads to a certain delay that it is introduced by the fact that the MS has to synchronise with the SI broadcast cycle and collect a consistent set of SI messages. NACC aims at reducing this service outage time from a couple of seconds down to 300-700 ms for a MS that is in packet transfer mode by giving means to the network to assist MSs before and during the cell change. The assistance is given both by sending neighbour cell system information on PACCH to MS in packet transfer mode while it is camped on the serving cell and by the introduction of new procedures.

Benefit of Nokia solution

Minimized service outage in conjunction of cell re-selection by sending target cell system information data sets from serving cell to MS before cell change is ordered.

Interaction with other features

Network Controlled Cell Re-selection (NCCR) is required as prerequisite for NACC.

Note that PCU requirements for Network Assisted Cell Change feature are under study.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	-	S11.5	-	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 1)	-	-	-	-	O 2)

Note(s): 1) 3GPP Rel'4 (E)GPRS MS Required 2)Requires Network Controlled Cell Re-selection

4.7 BSS11088 GPRS: Coding Schemes CS-3 and CS-4 (BSS11.5)

GPRS provides four coding schemes, from CS-1 to CS-4, offering data rates from 9.05 to 21.4 kbit/s. The BSS9 supports 16 kbit/s Abis links and thus it is possible to support CS-1 and CS-2. Furthermore GPRS coding schemes CS-3 and CS-4 are supported in BSS11.5.

	Coding Scheme	NominalData per TSL
BSS9	CS1	9.05
	CS2	13.4
BSS11.5	CS3	15.6
	CS4	21.4

Figure: Nominal data rates per TSL in GPRS Coding Schemes CS-3 and CS-4

Benefit of Nokia Solution

The new GPRS coding schemes can boost the GPRS throughput bit rates by maximum of 60% compared to using only GPRS coding schemes CS-1 & CS-2. It is estimated that in practice with average real network conditions (average C/I value distribution) 0-30% throughput increase can be achieved depending on network's C/I values.

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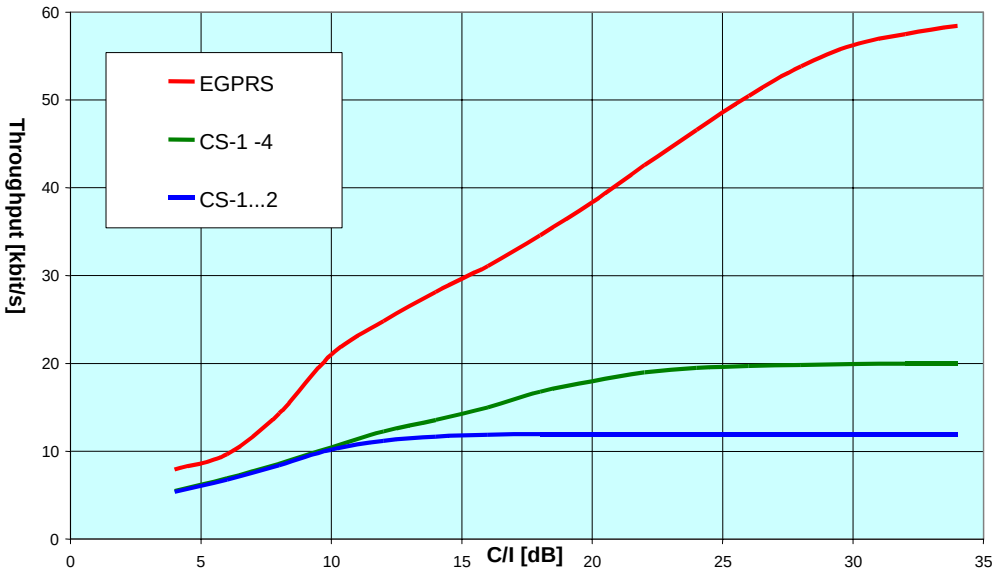

Figure: Data rates per TSL in GPRS Coding Schemes CS-3, CS-4 compared to CS-1, CS-2 and EGPRS

Interaction with other features

- CS-3 and CS-4 do not fit to one 16kbit/s Abis/PCU channel and require the use of Dynamic Abis Allocation feature and EDGE TRX. For more details see Dynamic Abis Feature description e.g. CS-2 takes two TSLs in Abis when CS-3 and CS-4 are used in network due to dynamic Abis and EDGE TRX.

- EDGE TRXs must be defined as separate BTS object in BSC when added to Segment. BSC has 248 BTS objects. Please see also description on BSS115001 BTS/BCF object amount increase in BSC feature.

Note that PCU requirements for GPRS coding schemes CS-3 & CS-4 feature are under study.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	(OSS4)	S11.5	-	-	N	N	N	CXM4.1	N	CX4.1

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 1)	-	Y 2)	-	-	O

Note(s): 1) GPRS CS-3 & CS-4 capable MS 2) EDGE capable TRX required

5. MACROCELLULAR

5.1 BSS11102 Extended Cell for UltraSite BTS (BSS11.5)

The extended cell implementation is based on one-BCCH and two TRX sollution. Different TRXs serve the normal area and the extended area. The TRX, which serves the normal area, is normally configured with the BCCH/SDCCH and TCHs. The timing of the receiver of the TRX which serves the extended area (E-TRX) has been delayed so that it can serve the area beyond 35 kilometres. The time slot 0 of E-TRX is tuned to the BCCH frequency in order to get RACH-bursts from the extended area. The timing of transmitters is same in both TRX and E-TRX. See following picture. If more capacity is needed either in normal area or extended area more TRXs can be added as required to serve those areas.

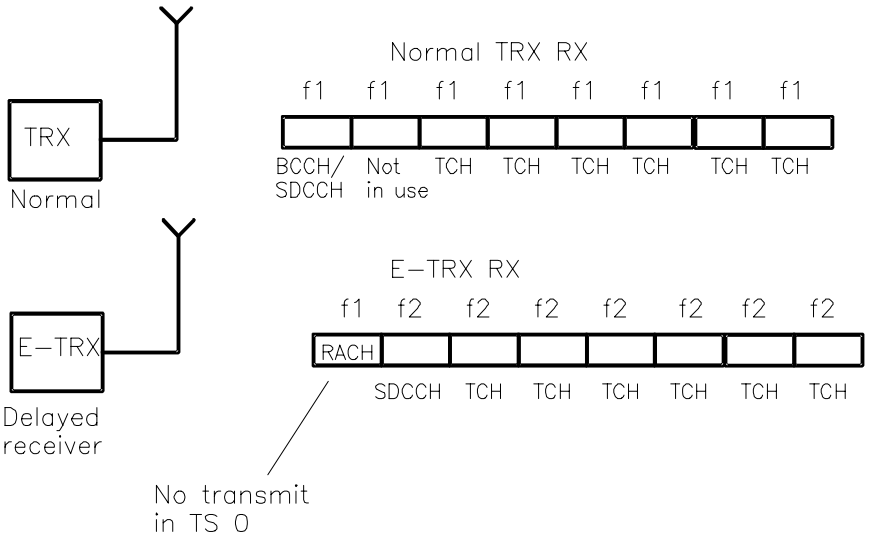

Figure: Implementation for supporting cell size up to 70km

Benefit of Nokia Solution

Extended cell feature is best suited for applications in coastal areas, rural areas and corresponding ones where coverage exceeds typical GSM maximum cell size of 35km.

Interaction with other features

Following features can't be used simultaneously with Extended cell for UltraSite:

- GPRS
- Baseband hopping
- RF hopping
- Antenna hopping
- IUO

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	Y	(OSS4)	(S11.5)	-	-	N	N	N	N	N	CX4.1

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	-	Y	-	-	O

Note(s):

5.2 BSS11070 Support of Cell Global Identity

The inter PLMN handover means the possibility to use seamless handover between GSM networks of different operators in different countries. This offers a flexible way to use multiple networks in the one country or in the border of countries.

In the current solution the Nokia BSC uses cell identification (CI) and location area code (LAC) for neighbouring cell identification. This feature brings in the support of Cell Global Identity (CGI) when also mobile network code (MNC) and mobile country code (MCC) are used for identification of the neighbour cell. This can be utilised in handover target planning. In addition of MCC and MNC for cell identification neighbour cells have to be defined with unique LAC and CI. Previously the BSC software has filled the values of serving cell MNC and MCC into handover related messages instead of the real neighbour cell MNC and MCC. This can lead to extra planning needs when HO targets are defined and neighbours are located in different PLMNs i.e. the cells have different MNC and MCC values.

Benefit of Nokia solution

When the feature is taken into use, a neighbour GSM cell can be identified by MCC+MNC+LAC+CI combination.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	M11	OSS3.1ED 3 (1	S11	-	-	(Y)	(Y)	(Y)	(Y)	(Y)	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	-	-	-	-	S

Note(s): 1) LAC+CI must not be same between neighbour cells.

5.3 BSS10087 GSM/EDGE800/1900 Band Specific Power Controlling Parameters for Common BCCH

The Common BCCH Control feature enables the utilisation of different frequency band resources within one cell configured on separate BTSs in the cell that is called a segment. Typically a segment has BCCH frequency on lower band and power is adjusted for non-BCCH band BTSs also according to that.

When GSM 800/GSM1900 segment has BCCH frequency on upper frequency band BTS, e.g. because of the fact that 1900MHz band has been taken into use earlier than lower band, then for adjusting maximum transmission power for both 800MHz and 1900MHz bands needs to be done separately in order to maintain connection to MS due to different radio propagation properties resulting as different radio coverages of 800MHz and 1900MHz. Matching radio coverage to same size on both bands can be done by adjusting them with Band Specific Power Controlling Parameters. See figure below.

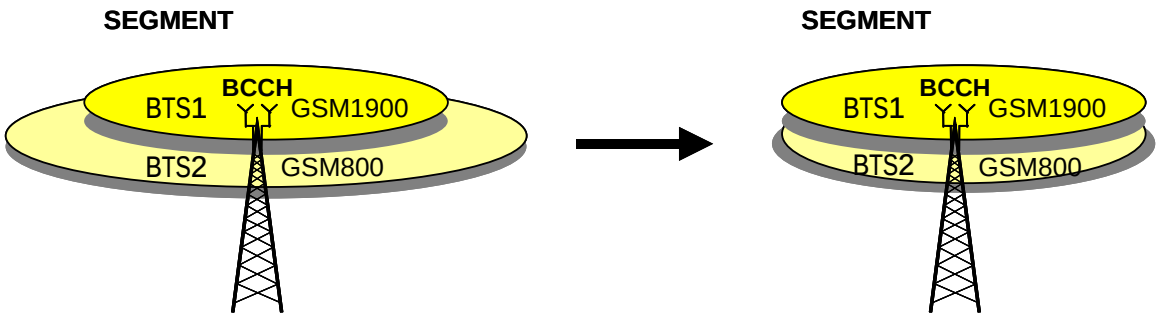

Figure: Band specific power controlling when BCCH is on GSM1900 band.

Benefit of Nokia solution

Adjusting of radio coverage between different bands in segment.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	N	N	Y	-	OSS3.1ED3 (1	S11	-	-	-	-	-	(Y)	-	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	-	-	-	-	O 1)

Note(s): 1) Part of GSM/EDGE 800/1900 Common BCCH feature.

5.4 BSS11118 Multi BCF for MetroSite BTS

Multi BCF Control feature allows the combination of several BTSs into one logical cell, allowing the operator to increase the capacity of a cell while maintaining the maximum spectral efficiency. Up to 3 MetroSite BTS cabinets can be connected to 1 TalkFamily BTS. Maximum number of TRXs with this combination can be 24 (12 TRXs Talk cabinet and 12 TRXs using 3 chained Metro cabinets). Multi BCF also provides a path for site expansion from Nokia Talk-family to Nokia Metro & UltraSite EDGE BTS and therefore an evolution path to EDGE services.

Operator can arrange base stations so that TRXs in different base stations (operating on the same frequency band) can serve the same cell with single BCCH. At the base station site operator makes some installations for example synchronisation is needed between the base stations. At the BSC operator uses a new SEGMENT (SEG) object where operator sets all BTS objects sharing the same BCCH.

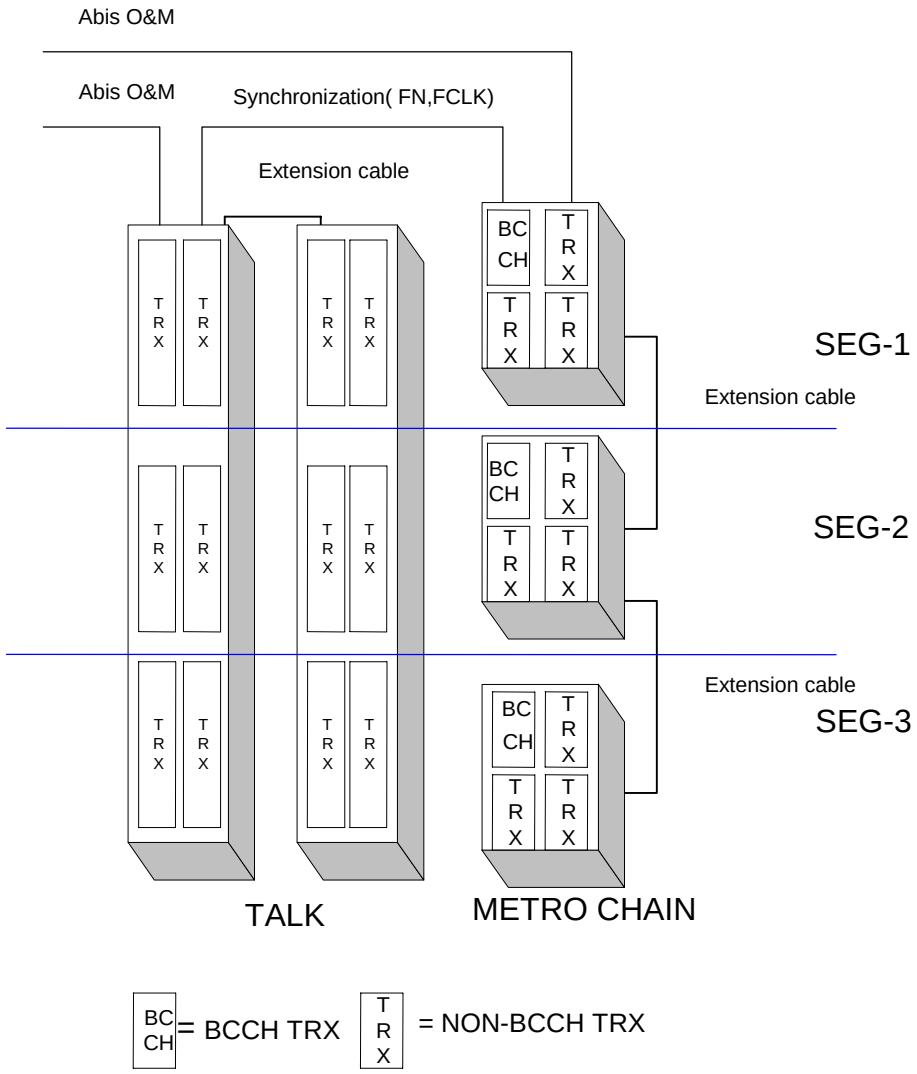

Figure: Multi BCF configuration example

Segment functionality

The Multi BCF feature introduces a new architecture and radio network object, called SEGMENT (SEG). The SEG is essentially the same as the "telecom cell". Currently, the BTS object has been the same as a "telecom cell", however this is not the case anymore since the "telecom cell" (SEG) may consist of several BTS objects.

A BTS is a group of similar TRXs. BTS must consist of TRXs of the same frequency band (Common BCCH) and TRXs of the same base station site type (Multi BCF).

The possibility to use the segment structure will not be restricted to the Common BCCH and Multi BCF features but will be an option of its own. An operator can for example create multiple hopping groups in a cell by gathering TRXs of one hopping group into one BTS and have several such BTSs in a segment.

In the common BCCH feature there are three possible frequency bands in a SEG: Primary GSM900, Extended GSM900, and GSM1800. Each band contains only TRXs of the same frequency in one or several BTSs.

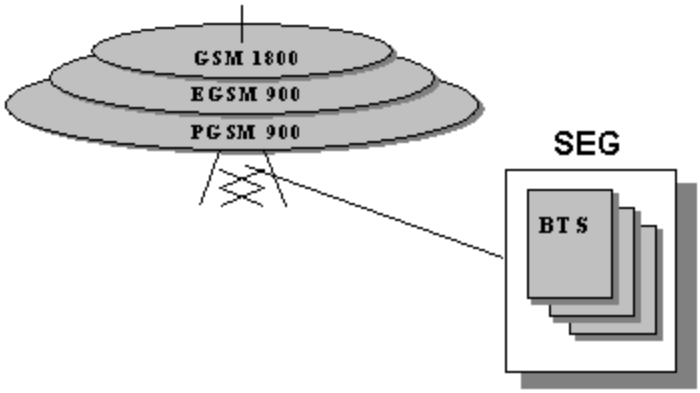

Figure: High level view of a SEG containing three frequency bands.

A SEG must contain a "serving layer", which is always the PGSM900 frequency band containing the TRX that has the BCCH channel, and any other combination of TRXs from other frequency bands.

When combined with the Multi BCF feature each band of a segment can have TRXs of different base station types. But as mentioned earlier, TRXs of different base station types must be in different BTSs of a band.

A SEG may also consist of only one BTS/TRX in its simplest form.

The need for dividing GSM900 resources in two different bands in the Common BCCH feature comes from the different capabilities of the terminals. Specifications state that the EGSM900 band includes both the Primary GSM900 frequencies and the extension band. This means that BTSs supporting EGSM900 support also the PGSM900 frequencies. In our segment solution, however, an EGSM900 BTS contains only the extended GSM900 frequencies that are outside the Primary GSM900 band. Using this division the BSC can make sure that only terminals supporting EGSM900 are directed to the EGSM900 BTSs.

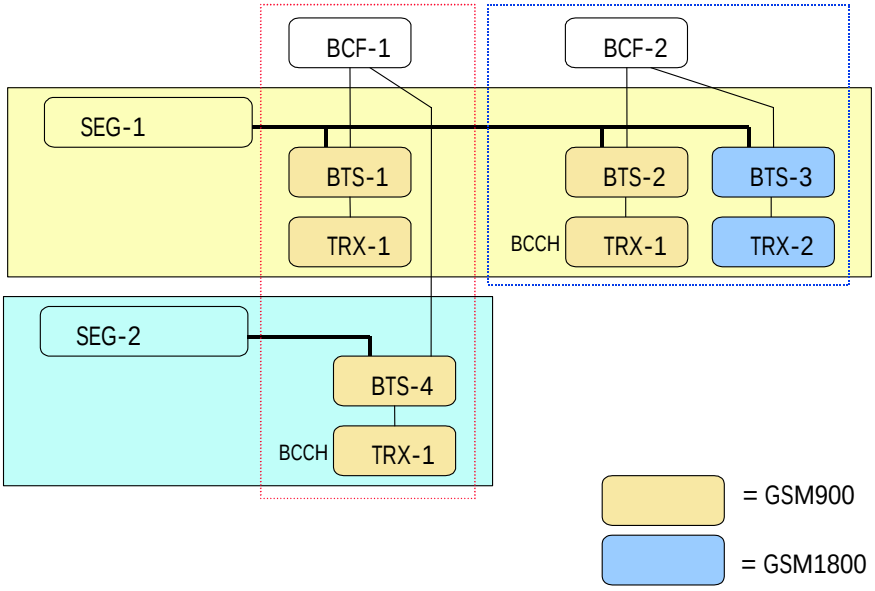

Figure: Example of a SEGMENT radio network object.

Benefit of Nokia solution

With Multi BCF for MetroSite BTS feature enhances MetroSite BTS as part of MultiBCF concept which allows combination of several BTSs into one segment. Evolution to EDGE services in TalkFamily BTS sites is enabled in addition of UltraSite BTS also with MetroSite BTS.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	OSS3.1 ED3	S11	-	-	N	(DF7)	N	CXM4.0	N	N

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	-	Y	-	-	S 1)

Note(s):1) Works within same frequency band. Common BCCH feature needed for multi band single cell solutions

5.5 BSS115001 BTS/BCF object amount increase in BSC (BSS11.5)

The maximum number of BTS objects is increased from former 248 BTS objects to same level with the amount of TRXs in BSC. That is a 512 and 660 BTS objects in BSC2i and BSC3i respectively.

Increase the number of BCF objects in BSC3i is targeted and under study.

Benefit of Nokia solution

Increasing the amount of BTS objects provides better use of BSC resources and higher efficiency to radio network configuring when different GSM frequency bands (850/900/1800/1900kHz), TRX types (GSM or EDGE) and BTS types (TalkFamily, UltraSite, MetroSite) are used in same logical cell i.e. SEGMENT.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	OSS4	S11.5	-	-	Y	Y	Y	CXM4.0	Y	CX4.0

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	Y	-	Y 1)	-	-	-	S

Note(s): 1) AS7-C unit needed for increase of BCFobjects. BCF ID increase is applicable only with BSC3i

5.6 BSS115002 IDD for MetroSite (BSS11.5)

The antenna diversity gain is applied in downlink enhancement, through a feature called Intelligent Downlink Diversity (IDD) for MetroSite. In IDD the cell coverage area is extended by sending simultaneously the same downlink signal through minimum of two transmitters, with slight delay. Two antennas (or X-polarised antenna) are needed for one cell.

Auxiliary transmission is delayed 1-1.5 symbol periods, which gives good performance for all modulation schemes. Random Phase hopping degreases correlation between the main and auxiliary transmitter. Correlation between the antennas has to be low.

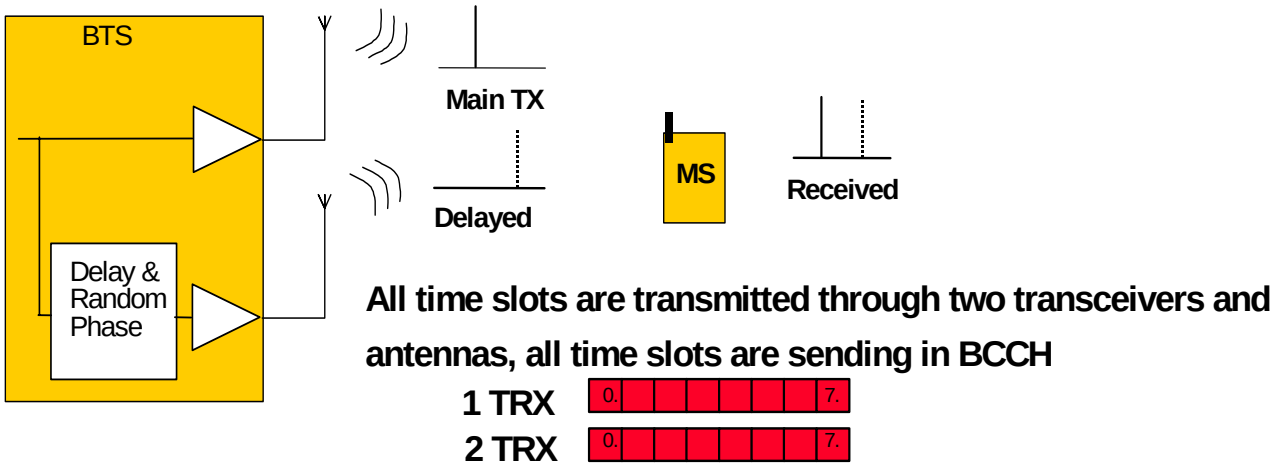

Figure: Intelligent Downlink Diversity for EDGE TRXs

The typical configurations in one MetroSIte EDGE base station cabinet are, for example following:

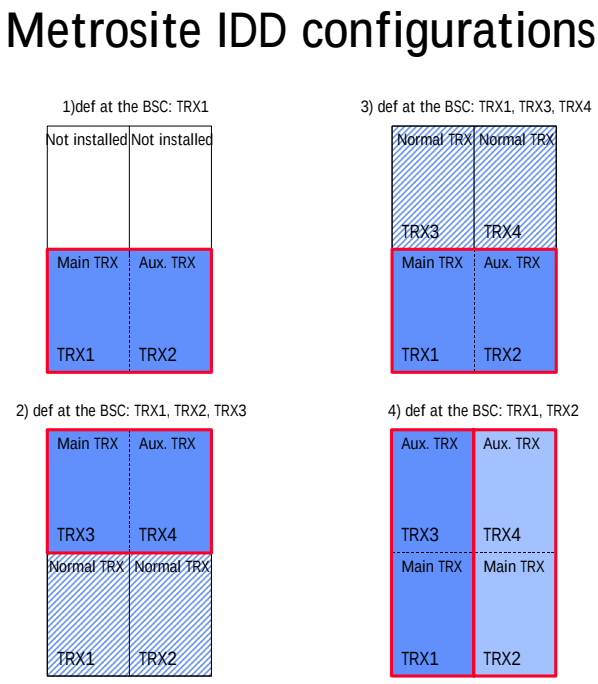

Figure: MetroSite IDD configurations

1. {IDD main TRX (TRX1) + Auxiliary TRX (TRX2)}, other TRXs not installed.
2. Two normal TRX (TRX1 and TRX2) + {IDD main TRX (TRX3) + auxiliary TRX (TRX4)}
3. {IDD main TRX (TRX1) + Auxiliary TRX (TRX2)} + two normal TRX (TRX3 and TRX4).
4. {IDD main TRX (TRX1) + Auxiliary TRX (TRX3)} + {IDD main TRX (TRX2) + Auxiliary TRX (TRX4).

In the chained configuration IDD main TRX and auxiliary TRX has to be in the same cabinet, because f-bus is not fed between cabinets.

Benefit of Nokia solution

The IDD boosts downlink performance by up to 5 dB (min. 3 dB), in all radio timeslots.

Interaction with other features

EDGE capable TRXs are required with IDD.

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	-	(S11.5)	-	-	N	N	N	CXM4.1	N	N

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
-	Y	-	-	Y 1)	-	-	S 1)

Note(s): 1) EDGE HW functionality required

5.7 BSS11121 IDD with BB Hopping (BSS11.5)

In Baseband hopping a transceiver transmits on a fixed frequency and a call is switched burst by burst through transceivers. Radio time slots in different transceivers may form a hopping group. A radio time slot is hopping inside the frequency hopping group from one transceiver to another according to the calculated hopping sequence. The number of frequencies in the hopping sequence is the number of unlocked transceivers in a hopping group. The BCCH time slot does not hop, but baseband hopping is possible on the BCCH transceiver for time slots 1 to 7.

In BSS11.5 IDD with baseband hopping support is added for UltraSite.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	-	(S11.5)	-	-	N	N	N	N	N	CX4.1

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
-	Y	-	-	Y 1)	-	-	S 1)

Note(s): 1) EDGE HW functionality required

6. OPERABILITY

6.1 BSS11047 Intelligent shutdown for UltraSite and MetroSite BTS

To provide protection against mains break a BTS site may be equipped with battery backup. The aim is to maintain service as long as possible. To achieve this it is reasonable to reduce capacity on certain sites in order to save battery, and maintain only the essential BTS functions.

This feature provides means to control the behaviour of the site equipped with battery backup in case of mains break. As the power consumption depends on the equipment supplied by the back-up batteries, shutting down a part of the site prolongs the remaining service time.

On a BTS site basis, the operator can define the service level of the site to be maintained while battery backup is in use. Also the operator can define two timers to allow executing the shutdown procedure in several phases. Three service level options are available:

1. Full service. Service is maintained on full level as long as batteries last.

2. BCCH back up. After expiry of first timer only BCCH TRX(s) are maintained to offer minimum service, RF power is switched off and no calls are allocated to other TRXs in UltraSite and in MetroSite TRXs are switched off completely. Timer two has no meaning in this case.

3. Transmission back up. Second timer starts after the first one has expired. After the expiry of the second timer all TRXs are switched off as described in BCCH back-up and BCCH transmission is stopped furthermore the BTS transmission equipment power is maintained. This secures the functionality of a transmission chain. When a mains break takes place, the BTS sends an alarm to the BSC, which performs, forced handovers for all the calls on the TRXs to be shut down. The calls are handed over to a TRX, which will remain powered, or to adjacent cells. If all the necessary handovers cannot be made during the defined maximum time the calls are released. Finally the BSC orders the BTS site to power down the TRXs.

When the main power restores the BSC takes the BTS automatically back in full service.

Third party BBU equipment can also be used together with intelligent shutdown. It is possible to designate an external alarm line that is used to indicate a mains break to the BTS. This alarm is then sent to the BSC as a mains break down alarm which then triggers the shutdown procedure.

Benefit of Nokia solution

Optimal operation during both short and long mains breaks. Timers allow executing the shutdown procedure in several phases. Each phase reduces the battery power consumption.

With Intelligent shutdown for UltraSite and MetroSite it is possible to optimize the trade-off between service level and battery lifetime. Short mains break will not reduce service unnecessarily, whereas during a longer break the essential functions, BCCH or transmission chain, can be maintained as long as possible.

SUPPORTED IN:

GSM 80	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	-	(Y)	-	-	(Y)	(Y)	N	CXM4.0	N	CX4.0

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	-	-		-	-	O

Note(s):

7. VALUE ADDED SERVICES

7.1 MS Location

Location Services LCS allows a GSM subscriber to be positioned with a certain Quality of Service. Positioning may be initiated by the subscriber, the network, or an external party utilising the Mobile Positioning Function.

Positioning is subject to various restrictions based on capability, security, service profiles, etc. LCS shall allow the location of a GSM mobile station (MS) to be determined at any time whilst the MS is within the radio coverage area of the GSM HPLMN or VPLMN. Important applications of Location Services are e.g.:

- Government Applications
- Operator Applications
- Commercial Services

Different MS Location methods have different benefits and drawbacks. No single method is suitable for all applications.

The purpose of the Network assisted, MS based GPS features are to increase location calculation capacity by sharing location calculation with network and MSs and to get more accurate location estimations fast enough. When MS requests GPS assistance data instead of a location and the MS is capable to calculate its own location, the network determines and transmits the needed assistance data to the MS. Using point-to-multipoint connection GPS assistance data can be provided to the MS in the most efficient way.

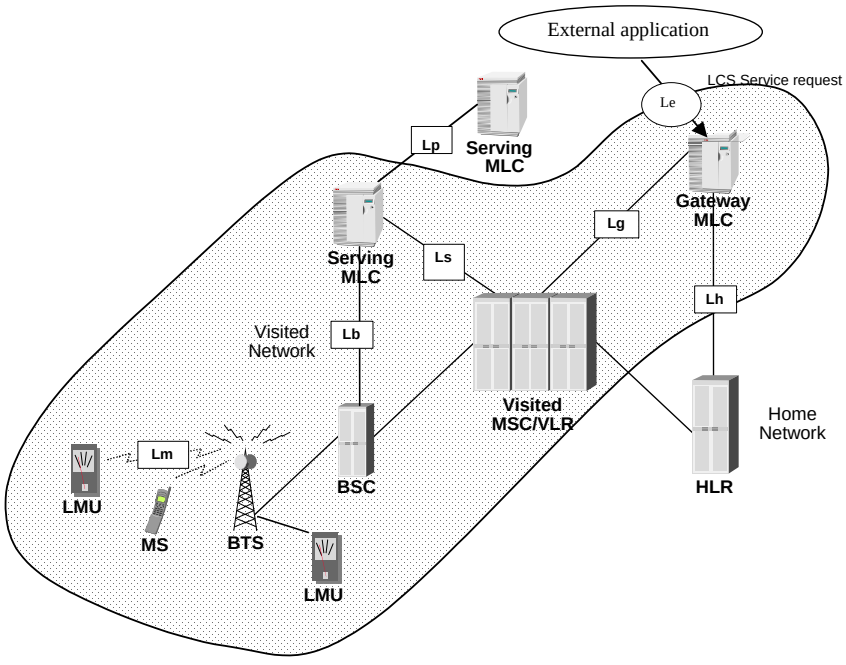

Figure: . General Architecture for the location service features.

7.2 BSS11114 Lb Interface

The Purpose of the Lb interface is to connect a Standalone SMLC (S/A SMLC) to a BSC. With S/A SMLC, the location calculation capacity in BSS can be boosted up to corresponding demand. The Lb interface in the GSM network is presented in next figure.

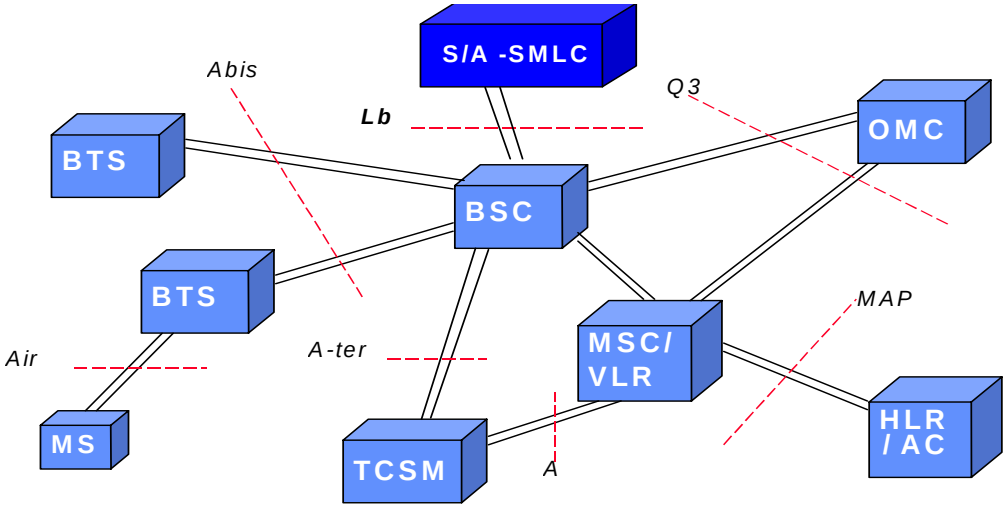

Figure: Interface and external SMLC in traditional GSM network

Furthermore the Lb interface feature contains controlling functionality for location requests allocation between Position Based Services in BSC and external S/A SMLC, communication with LMU units in BSS and support for assistance data point-to-multipoint broadcasting for E-OTD and GPS data. Lb interface supports ciphering key handling for ciphered broadcasting data from S/A SMLC.

The Nokia's Lb interface is based on 3GPP Rel.4 Specifications. However, the solution will be IP based as described in figure below.

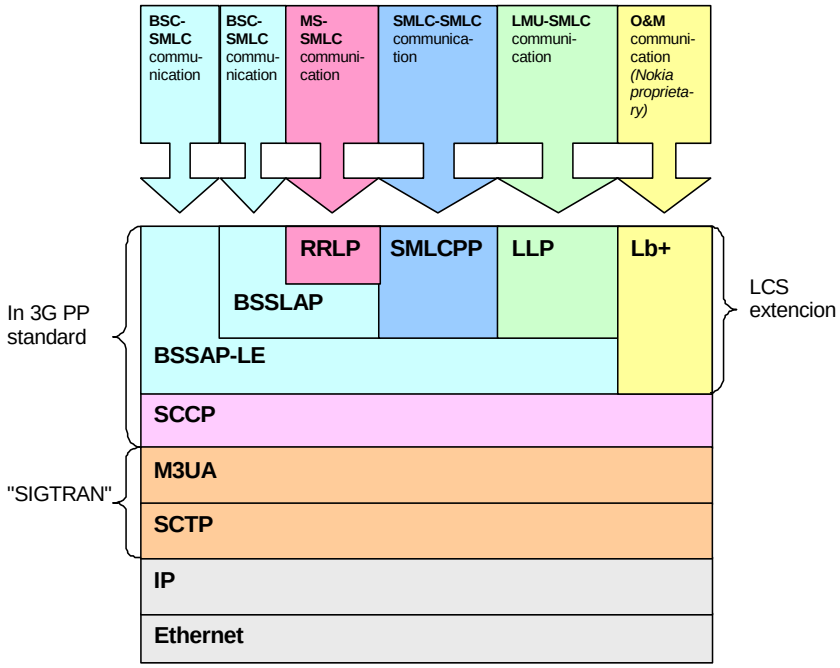

Figure: Lb Interface protocol stack

The Nokia Lb interface is extended with Nokia Lb+ protocol because O&M functions are not fully standardised in 3GPP. Lb+ part provides signalling such as modification of LCS parameters and definitions. Main purpose of the Lb+ interface is to have a remote access from the standalone SMLC to radio network database in the BSC so locationing related information from the BSC can be copied to the standalone SMLC database. The Lb interface can also be utilised without the Lb+ part.

The LCS implementation with the physical Lb interface is centralised to MCMU computer unit in the BSC.

Location requests allocation and scheduling

Controlling function in BSC can allocate position location requests (PLR) to be performed either by:

- internal BSC Position Based Services (PBS)
- S/A SMLC
- both internal BSC Position Based Services and S/A SMLC depending on location request type and chosen scheduling logic defined with LCS control parameter.

BSC do not have any queue for PLR but all PLRs are forwarded immediately to PBS or S/A SMLC.

BSC controlling function has internal counter, which keeps up amount of PLRs in PBS and maximum limit how many is allowed at the same time in PBS.

The scheduling logic, when LCS CONTROL is 3, 4:

If received PLR is possible to meet with CI+TA method, it is sent to PBS (PLRs in PBS counter incremented by 1). All other PLRs are shared between PBS and S/A SMLC: e.g. every fourth PLR are sent to PBS (counter incremented by 4) and others are sent to S/A SMLC. This ratio is adjustable. If mobile is able to calculate its own position (MS based E-OTD or GPS), the probability to send the PLR to internal SMLC is higher than for the other types of MSs.

In case of emergency calls the internal PLR counter is allowed to be exceeded 20% if S/A SMLC is not able to handle all incoming emergency PLRs. Thus emergency PLRs can be handled in PBS if limit (20%) is not exceeded.

The scheduling logic, when LCS CONTROL is 5:

In this mode PBS uses only CI+TA method. When received PLR is possible to meet with CI+TA method it's sent to PBS and PLRs in PBS counter are incremented. Other PLRs are sent to S/A SMLC.

When all PLRs are directed to PBS or to S/A SMLC LCS control parameter is set to 1 or 2 respectively.

Benefit of Nokia solution

Nokia Lb interface implementation provides location request control between BSC's internal locationing resources and external S/A SMLC. Furthemore existence of Lb interface guarantees future proof evolution of mobile location services by providing connection to S/A SMLC to where new locationing algorithms can be implemented.

7.2.1 Network assisted MS based GPS

The mobile requests assistance data from the network or in a case of mobile terminated location request (MT/LR) Stand-alone SMLC (S/A SMLC) notices that the MS is NW assisted GPS capable and decides to use this method.

GPS assistance data is determined from a raw GPS satellites information received from LMU type B with a capability to send GPS assistance data. BSS11 supports collection of raw data from LMU type B units and its forwarding to S/A SMLC which calculates GPS assistance data. BSC communicates with S/A SMLC via Lb interface, which directs PLRs demanding Network assisted MS based GPS method to S/A SMLC. The GPS assistance data is calculated in a geographical basis.

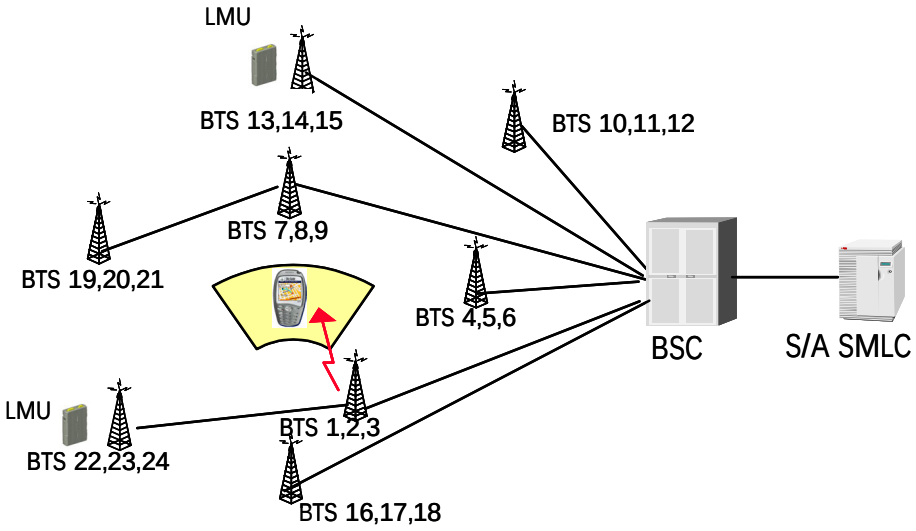

Figure: Assistance data determination using LMU type B with GPS assistance data determination and transmission capability.

GPS capable LMU type B collects the needed data received from the GPS satellites. GPS LMU does not calculate RIT information but it can be used for BSS synchronisation. Satellites ephemeris information is essential for GPS capable MS. It will improve the Time to First Fix (TTFF) and coverage.

Optionally ephemeris and clock correction assistance data can be broadcasted to cells using broadcasting functionality in a 60 seconds periodical rate supported by Lb interface feature. The channel to broadcast the GPS assistance Data message is CBCH over which the SMSCB DRX service is used. One SMCB message has fixed information data length of 82 octets and the maximum length of GPS Assistance Data is 82 octets.

Mandatory prerequisites for network assisted MS based GPS are Lb-interface and S/A SMLC.

Benefit of Nokia solution

Efficient sharing of location calculation resources between MS and the network when MS calculates its location based on assistance data provided by network.

SUPPORTED IN:

GSM 800	GSM 900	GSM 1800	GSM 1900	MSC	Nokia NetAct	BSC	SGSN	NetAct Planner	Nokia 2nd Gen.	Nokia Talk-family	Nokia PrimeSite	Nokia MetroSite	Nokia InSite	Nokia UltraSite
Y	Y	Y	Y	-	OSS3.1 ED3	S11	-	-	(Y)	(Y)	N	(Y)	N	(Y)

HW/FW DEPENDENCY: BSS OPT.:

BSC MMI	BTS MMI	MS	BSC HW/FW	BTS HW/FW	TC HW/FW	SGSN HW/FW	STD/ OPT
Y	-	Y 1)	Y 2)	Y 3)	-	-	O

Note(s):. 1) E-OTD and/or GPS mobile support 2) LAN connection in BSC MCMU (CP6MX processor unit) and mandatory SMLC upgrade for field BSCs as in BSS10 and Lb interface 3) LMU needed.

8. COMMITMENT TABLE

BTS	
BSS11134 Antenna Hopping for UltraSite BTS	4
BSS11131 Rx Antenna Supervision by comparing	2
Radio Network Performance	
BSS11052 Dynamic Frequency and Channel Allocation	2
BSS11073 Recovery for BSS and Site Synchronisation	4
BSS11136 Enhanced TRX priorisation in TCH allocation	4
BSS11107 GSM-WCDMA Interworking Enhancements	3
BSS11085 Automated Planning Enhancements	2
BSS11086 Support of Enhanced Measurement Report	3
BSS11149 Enhancement for Wireless Priority Service (IOC)	4
BSS11149 Enhancement for Wireless Priority Service (FOC)	4
BSS12158 IMSI based handover	2
Packet Switched Data Solutions	
BSS11110 (E)GPRS: Gb over IP	2
BSS11151 Extended Uplink TBF	3
BSS11156 EGPRS Channel Request on CCCH	4
BSS11111 (E)GPRS: Enhanced Quality of Service	2
BSS11112 (E)GPRS: Network Controlled Cell Re-selection	3
BSS115006 (E)GPRS: Network Assisted Cell Change	3
BSS11088 GPRS: Coding Schemes CS-3 and CS-4	2
Macrocellular	
BSS11102 Extended Cell for UltraSite BTS	2
BSS11070 Support of Cell Global Identity	4
BSS10087 GSM/EDGE800/1900 Band Specific Power Controlling Parameters for Common BCCH	4
BSS11118 Multi BCF for MetroSite BTS	4
BSS115001 BTS/BCF object amount increase in BSC	2
BSS115002 IDD for MetroSite	2
BSS11121 IDD with BB hopping	2
Operability	
BSS11047 Intelligent Shutdown for UltraSite and MetroSite	4
Value Added Services	
BSS11114 Lb Interface	3

Commitment to features:

2 = Intended (internal risk, e.g. workload/resources/open items/problems)

3 = Anticipated (external dependency, e.g. specification, MS availability)

4 = Commitment

NOKIA

Document Revision History

DATE	ISSUE	EDITED	SUMMARY OF MAIN CHANGES

March 18 2003	2.2	A.Filppula	About FUD structure: • Informative paragraphs 'Benefit of Nokia Solution' and 'Interaction with other features' paragraphs are added to most of the feature descriptions. • Dependency tables updated. Chapter 'Introduction' updated: • S11ED, CX4.1, CXM4.1 and OSS3.1ED3 added and OSS4ED removed. • Compatibility matrix updated. Following features removed from the scope of BSS11/11ED/11.5: • Network assisted MS based E-OTD from Lb interface feature. • UltraSIte 666-900 & 222-1800 in two cabinets using WBC. • 3rd PCU per BCSU in BSC2i. Following features added to the scope of BSS11: • Enhanced TRX priorisation in TCH allocation • GSM/EDGE800/1900 Band specific power controlling parameters for common BCCH Following features added to the scope of BSS11ED: • Extended Uplink TBF • EGPRS: Channel Request on CCCH Following features added to the scope of BSS11.5: • DFCA • Rx Antenna supervision by comparing RSSI value for MetroSite • Wireless Priority Service (FOC) • GPRS coding schemes CS-3 and CS-4 • IDD for MetroSite • IDD with BB hopping Following features described in previous FUD version 2.1 have been subjects of changes. • BSC Hardware Requirements in S11: New 4GB hard disk requirement and editorial changes. • Antenna Hopping: Technical implementation changed. • DFCA: Applicable hoping modes per BTS type clarified. *Continue in next page:*

March 18 2003	2.2	A.Filppula	*Continuation from previous page:* • GSM-WCDMA Interworking enhancements: Timers names changed. Editorial changes. • Automated planning enhancements: EMR restriction added. • Support of Enhanced Measurement Reports: Description modified and restriction about use with Automated planning added. • WPS description renewed. • IMSI based handover: Description renewed. • Gb over IP: Editorial changes, some implementation clarifications. • Enhanced Quality of Service: TDT removed and replaced with alternative method. Description on quality Control functionality added. Editorial changes. • NCCR: Network Controlled Cell Re-Selection procedure description renewed. • NACC: Editorial changes. • Support of Cell Global Identity: Prerequisite of unique LAC+CI between neighbour cells added. • Multi BCF for MetroSIte: Editorial changes • BTS/BCF object amount increase in BSC: Increasing of BCF added to the scope of the feature as study item. • MS location: Editorial changes.

September 05 2002	2.1	A.Filppula	Compatibility matrix updated. CX(M)4.1 releases removed. Following features removed from the scope of BSS11/11.5: • Rx Antenna supervision by comparing RSSI value for MetroSite • Downlink Power Control • CS-3 and CS-4 • load balancing criterion in NCCR • IDD for MetroSite • IDD with BB hopping EQoS moved to BSS11.5. EQoS and WPS contents updated. Following features added to the scope of BSS11/11.5: • IMSI based handover • BTS amount increase in BSC
June 20 2002	2.0	A Filppula/ J Virtanen	Split to BSS11 and BSS11.5 done. DualBand 800/1800, Remote BTS-MMI for MetroSite and UltraSite removed Network assisted MS based E-OTD and GPS as BSS features removed. Wireless Priority Service enhancement, UltraSite 666-900 & 222-1800 in 2 cabinets using WBC, IDD for MetroSite added. S11.5 & CX(M)4.1 releases added. Contents updates to various features.
Dec 3 2001	1.0.1	J Virtanen	Editorial Changes
Nov 30 2001	1.0	J Virtanen	First Approved Version