NOKIA

BSC

FACCH call set-up and handovers with AMR

Technical Note
No. 774

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TN774: FACCH call set-up and handovers with AMR

Validity:

Software		ETSI environment		ANSI environment	
	S9	X	GSM 900	X	GSM 800
X	S10	X	GSM 1800	X	GSM 1900
X	S10.5				
X	S11				
X	S11.5				

Keywords:
AMR, FACCH, call set-up, HO

Summary:
This technical note is written to clarify the verification of interaction between AMR and FACCH call set-up and to clarify few aspects, which should be taken into account while optimising the performance of intra-BSC handovers, especially with the AMR codec. Using guidelines and BSC MML settings described in the following sections can shorten the length of speech audio break, due to an intra-BSC handover.

Description:

1. AMR and FACCH call set-up

FACCH call set-up is a GSM phase 2 feature. The interaction between FACCH call set-up and AMR is not specified in 3GPP standard.
Nokia does not support FACCH call set-up with AMR activated at this stage. The full support will be available with the System Release at the end of October 2002.
Meanwhile, it is recommended to disable the FACCH call set-up if the AMR is in use in the network and use the existing Dynamic SDCCH feature as an alternative solution for avoiding signalling congestion on Air-interface.

2. Intra-cell handovers

There are no special requirements for optimisation of intra-cell handovers. From the voice quality point of view intra-cell handovers guarantee the shortest possible audio break and minimal disturbances due to stolen speech frames because there are less FACCH signalling messages compared with inter-cell handovers.

3. Intra-BSC inter-cell handovers

3.1 Synchronized handovers (EAC)

It is recommendable to use synchronized handovers whenever possible, i.e. within the same BCF. This reduces the amount of bad speech frames in the downlink direction as no Physical Info message (FACCH) is sent by the BTS. (Note that each FACCH message stoles one speech frame on the FR channel and two frames on the HR channel.) Furthermore this potentially shortens the uplink audio break because less Handover Access bursts are sent to the target BTS by the MS. Therefore the MS can start to send speech frames earlier. In order to achieve benefit from this, the two-way speech has to be triggered from the Handover Detect message (see next section).

3.2 Two-way speech path connect trigger point (EGP:31)

This BSC level parameter defines when the two-way speech path connection is made during internal inter-cell handovers for speech calls. The default is after an Establish Indication message reception from a BTS.

If the channel mode or speech codec changes during internal handover, no unidirectional connection is applied to the target BTS, because 8 kbit/s and 16 kbit/s TRAU frames cannot be branched at the BSC. When unidirectional connection is not used, internal inter-cell handover causes an audio break of 300…400 ms in the downlink direction depending on the BTS HW and round-trip delay between the BTS and transcoder. This downlink audio break can be shortened by 100…200 ms for internal inter-cell channel mode handovers if the default value “Always after Establish Indication” is changed to “Always after Handover Detect” by using either value 1 or 2. The reason for the shortened break is that bi-directional speech path switching is triggered earlier, i.e. from the first possible BTS2-to-BSC message.

0 = Always after Establish Indication from a BTS (default).
1 = Always after Handover Detection from a BTS.
2 = Always after Handover Detection from a BTS when a channel mode change or speech codec change happens during internal HO. Otherwise after Establish Indication from a BTS.

The value “1” is recommendable as the uplink speech path is also switched earlier, and therefore potentially the uplink audio break is also shortened. This applies to all internal inter-cell handovers, including other GSM codecs. However, it has been noticed that especially some old FR MSs might send corrupted data in the first speech frames on the new channel after the handover. This might produce a click sound on the uplink. If this is found as a problem, the value “2” can be used instead.

Note! If the parameter EGP:31 is set to value “1” or “2”, another BSC level parameter “number of ignored transcoder failures” (EEQ:ITCF) must be set to the value “1” or higher. If the default value “0” is used, the call might be released after a handover failure. This is applicable to handovers in which the channel mode or speech codec changes, i.e. when unidirectional connection is not used.

The reason is that after a successful handover access, the bi-directional speech path is changed to the target channel. However if L2 establishment fails on the target channel (i.e. target BTS fails to receive 6 consecutive SABM messages from MS) and MS returns back to the source BTS, the source BTS might not receive TRAU frames for over one second in the downlink direction. Therefore BTS sends a connection failure message with cause remote transcoder failure to the BSC. The BSC releases the call.

In an extreme condition, the L2 establishment might be delayed during back to previous procedure due to corrupted SABM messages on the source channel side as well. In this case the source BTS might not receive TRAU frames for over two seconds before bi-directional speech path is changed back to the source channel. Therefore it might be reasonable to set ITCF parameter to value “2” or higher.

3.3 AMR set grades enabled (EEM:ASG)

It is not recommendable to use BSC level parameter “AMR set grades enabled” (default is disabled). If this parameter is enabled and if AMR codec sets of the source and target BTSs are different, the active codec set of either target or source BTS is aligned by the Channel Mode Modify procedure in such a way that sets are identical for both BTSs during the handover. Thus, the unidirectional connection can be applied during the handover although codec sets are originally different. Depending on the parameter setting “AMR configuration in handovers (EEM:ACH)”, the Channel Mode Modify is done either before or after the handover. (Note that ACH parameter has no effect if ASG parameter is disabled.)

The Channel Mode Modify procedure may cause an additional audio break due to an unsynchronised out-band L3 signalling and in-band AMR signalling. During the Channel Mode Modify procedure before the MS has acknowledged Channel Mode Modify message, the BTS cannot utilize the new

codec set in the in-band AMR channel. Therefore bad speech frames may be seen in both directions during the Channel Mode Modify procedure.

As a summary, it is recommended that equal AMR codec sets be used for all BTSs within a BSC area (AMR FR and AMR HR sets can be different). Therefore, there is no need to downgrade or upgrade codec sets and the unidirectional connection can effectively be used and thereby downlink audio breaks are minimized.

4. Inter-BSC handovers

There are no special requirements for inter-BSC handovers as the unidirectional connection is always utilized in the MSC (might be MSC vendor dependent). It does not matter whether AMR codec sets are equal or different on the source and target side as two transcoders are allocated during inter-BSC handovers. The transcoder on target side always starts to encode with the ICM on the downlink. Moreover, the unidirectional connection functions also with handovers in which the channel mode or speech codec changes.

Instructions:

Note

The following figures clarify the usage of unidirectional connection during handovers in the Nokia BSS.

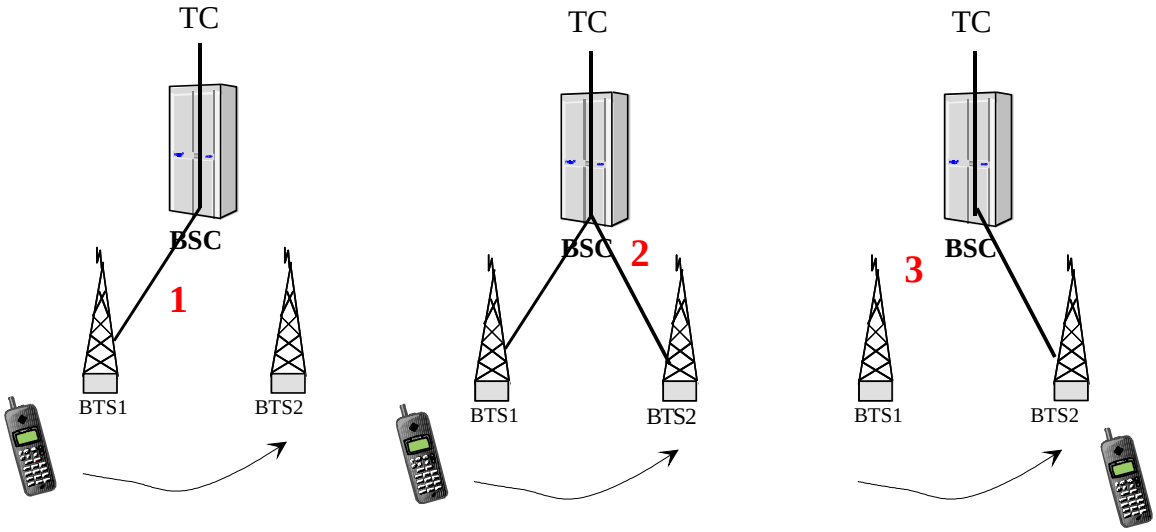

Fig. 1 Intra-BSC handover with unidirectional connection (speech codec and channel mode remains the same)

1.1. The mobile has a call active via BTS1, the physical channel is connected both in UL and in DL direction between BTS1 and the TC.
1.2 Based on measurement reports, BSC determines a HO is necessary from BTS1 to BTS 2

2.1 BSC activates a channel to BTS 2
2.2 A new unidirectional connection is made to BTS 2, now DL speech frames are transmitted from the TC to the BSC, and from the BSC to both the BTS 1 and BTS 2. UL is still from BTS1 to BSC to TC.

3.1 BSC sends HO COMMAND to the MS via BTS1, the MS tunes to the new frequency.
3.2 MS sends HO ACCESS bursts to BTS 2, BTS2 receives this and sends HO detection to BSC, and Physical Information to the MS.
3.3. MS sends SABM to BTS2, BTS2 receives this and sends Establish Indication to the BSC, and UA to the MS.
3.3. BSC receives Establish Indication, and changes the UL physical connection from BTS1 to BTS2 (if EGP:31=0), now UL speech frames are transmitted from the MS to BTS2 to TC. DL connection is still to both BTS1 and BTS2
3.4. MS sends HO COMPLETE, at the reception of HO COMPLETE the BSC clears the old DL connection from BTS1, now we only have the bi-directional connection between BTS 2 and the TC.

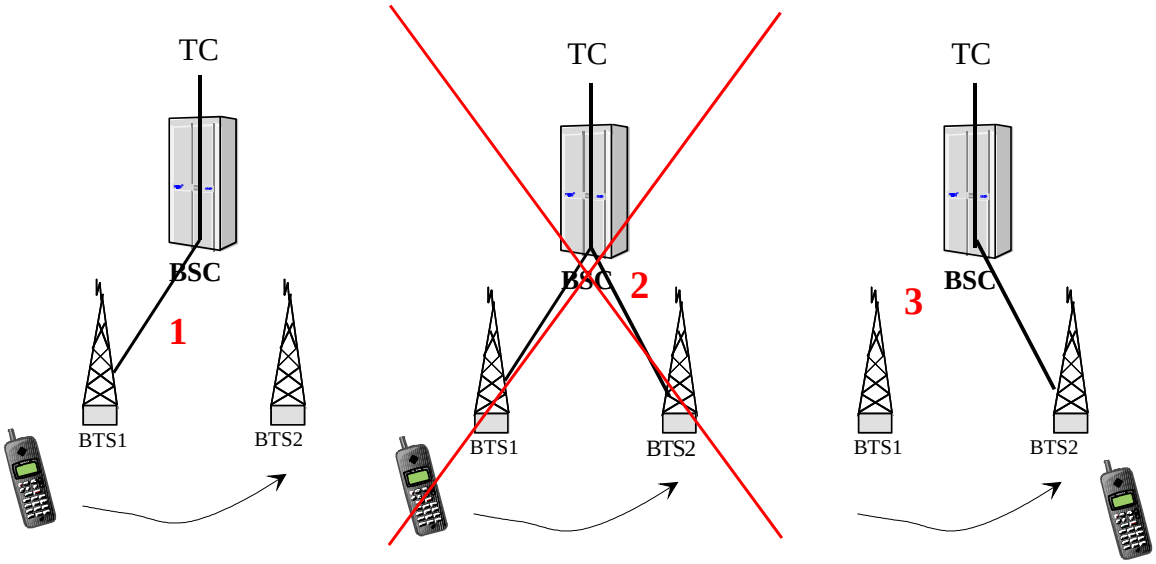

Fig. 2 Intra-BSC handover without unidirectional connection (speech codec or channel mode changes)

1.1. The mobile has a call active via BTS1, the physical channel is connected both in UL and in DL direction between BTS1 and the TC.
1.2 Based on measurement reports, BSC determines a HO is necessary from BTS1 to BTS 2
1.3 BSC activates a channel to BTS 2. Physical Channel connection stays from BTS1 to BSC to TC.

3.1 BSC sends HO COMMAND to the MS via BTS1, the MS tunes to the new frequency.
3.2 MS sends HO ACCESS bursts to BTS 2, BTS2 receives this and sends HO detection to BSC, and Physical Information to the MS.
3.3. MS sends SABM to BTS2, BTS2 receives this and sends Establish Indication to the BSC, and UA to the MS.
3.3. BSC receives Establish Indication. This triggers the change of the bi-directional physical channel connection from BTS1 to BTS2 (if EGP:31=0). Both UL and DL speech frames now go between BTS2 and the TC**.**
3.4. MS sends HO COMPLETE

Reference:

Technical Note Revision History

Date	Version	Editor	Summary of changes
12.09.02	1.0	O.Rissanen, O.Kirla	The first version
01.10.02	1.1	O.Kirla	A note added to the section 3.2, a description of unidirectional connection included
29.04.05	1.2	M.Mielonen	Updated the TN to S11 and S11.5 level. Removed chapter 3.4. and one paragraph from chapter 2. because of outdated information.

List of Active Technical Notes

Set	Nbr	Title	TN Vers	S9	S10	S10.5	S10.5 ED	S11	S11.5	S12
	816	EUTM and BS_VC_MAX Parameter Value Recommendation for EGPRS	1.0					x	x	
	815	New Time Limit Parameters for AMR DADL/B	1.0			x	x	x	x	
	814	PCU Overload Protection	1.0						x	
	813	PCU/PCU-S Connectivity Limit	1.0						x	
	812	Incorrect FIFILEGX version number in the MAFILEGX	1.0					x		
	811	Activating BSS11114: Lb interface towards True Position's SMLC	1.0					x		
	810	FRT parameter change	1.0	x	x	x	x	x		
	808	Detecting (E)GPRS Inactivity	1.0					x		
	807	A-Interface Parameters (MTP/SCCP)	1.0	x	x	x	x	x		
	806	EGPRS UL Throughput after correction for counter 079008 RETRANSMITTED RLC DATA BLOCKS UL	1.0					x		
	806	EGPRS UL Throughput after S11 CD3.0	1.0					x		
	804	Cell Global Identity usage in S11	1.0					x		
	803	BCSU reset required after modifying EXT_UTBF_USAGE parameter	1.0					x		
	802	Plug-in unit addresses with 256 MB RAM memory in OMU	1.0			x	x	x	x	
	801	Incorrect Transmission Unit indicated in MML for Ultrasite	1.0			x	x			
	800	Availability of Nokia S9 and S10 Releases	1.0	x	x					
	799	GSM800/GSM1900 Common BCCH and MULTI BCF	1.0				x	x	x	x
	798	AMR usage in SEGMENT	1.0			x	x	x		
	797	Usage of G40 segment with CP4x CPUs equipped	1.0					x	x	
	796	SW Support for Nokia BSCE, TCSME, BSC2E and BSC2A Products	1.0						x	x
	795	System Level Trace Reporting	1.0				x			
	794	Transmission delay impact to LapD throughput	1.0	x	x	x	x	X		
	793	Installing S11 compatible ET2 plug-in unit SW	1.0			x	x	x		
	792	Activating data filtering for FER measurement in UL and DL direction and changing filtering threshold	1.0				x			
	791	Removing semipermanent Trunk- to-Trunk circuits after S9	1.0			x	x			
	790	Guidelines for (E)GPRS radionetwork planning to get full benefit of improved intra PCU cell re-selection in S10.5(ED)	1.0			X	x			
	789	Dynamic Abis configuration	1.0				x			
	788	Instructions to use child cells when segment usage is activated	1.0				x			
	787	GSM900/GSM1800 Common BCCH (ETSI)	1.0				x			
	786	GSM800/GSM1900 Common BCCH (ANSI)	1.0				x			
	785	Load based TCH handover in Common BCCH	1.0				x			
	784	Using frequency hopping in segment with several BTS	2.0			x	x			
	783	Defining a maximum transmission power of GSM 800 frequency band BTS in segment environment	1.0			x	x			
	781	New traffic measurement counter for calculating network accessibility	1.0	x	x	x	x			
	780	Change Delivery requirement for S9-S10.5 upgrade	1.0	x		x	x			
	779	New traffic measurement counter for dropped calls	1.0	x		x	x			
	778	Message Bus fault investigation after SUPPROGX 7.12-4 correction	1.0	x	x	x	x			
	777	1GB Winchester disks with S10.5 software	1.0			x	x			
	776	Accessing PCU service terminal	1.0	x	x	x	x			
	775	Logical file connections of GALARM in MCMU	1.0	x	x	x	x			
	774	FACCH call set-up and handovers with AMR	1.2		x	x	x	x	x	
	773	Delaying call set-up to ensure MS measurement report availability in a segment environment	1.0			x	x			
	772	Clarifications to GPRS territory handling and allocation	1.0	x	x					
	769	AMR Codec mode settings	1.0		x					

	768	Pool Switch Indicator for AMR circuit pool	1.0		x	X	X			
	767	TCSM2 SW in S10 package	1.0		x					
	766	Illegal initialisation value for DRX_TIMER_MAX	1.0		x	X	X			
	765	BTS synchronisation	1.0		x					
	764	BSC IP- Address in High Capacity upgrade	1.0	x						
	763	Adding a TRX to a GPRS enabled cell	1.3	x	x	X	X			
	762	SPLIT_PG_CYCLE support deactivation / activation	1.1	x	x	X	X			
	761	CS TCH allocation with GPRS, Half Rate and BB-hopping	2.0			X	X			
	761	CS TCH allocation with GPRS, Half Rate and BB-hopping	1.0	x	x	X	X			
	760	Interaction between HSCSD and GPRS after BSC S9 SW CD 4.0 GEN	1.0	x	x	X	X			
	759	Defining directory sizes when extracting files from a ZIP archive	1.1	x	x	X	X			
	757	Supervision of Transmission Equipment in Q1 Bus	1.1	x	x	X	X			
	756	TCSM2E/A recovery problem after a power break with TRCO eprom version 5.7-0	1.1	x						
	755	SCCP Broadcast status settings in BSC	1.0	x						
	754	Gb interface loss due to MCMU switchover	1.0	x						
	753	Instructions to replace ET2E/ET2E-C with ET2E-S/ET2E-SC	1.1	x	x	X	X			
	752	Modifying Parameter "Bad Quality Experience Guard Time"	1.0	x	x	x	x			
	751	PCU Improvements	1.0	x						
	750	Corrupted S9 TCSM2 software on floppy	1.0	x						
	749	New software modules add on fallback	1.0	x						
	748	PCU Configuration Instructions	1.4	x						
	747	Patching BTS LOAD INFO TIMER with BSC feature AMH	1.0	x	x	x	x			
	746	BSC Remote SW Upgrade	1.1	x	x	X	X			
	745	BCSU Recovery and Alarms 690, 691 and 1001	1.1	x	x	X	X			
	744	TCSM2 SW floppy disk is corrupted	1.0	x						
	743	PCU boot SW updating and BSC Change Deliveries 0.2 and 0.3 installation recommendations	1.1	x						
	742	PCU boot SW compatibility	1.1	x						
	740	Installing BSC SW without conversions	1.3	x	x	X	X			
	739	MMI Password Encryption Based on Public Algorithms and S9 Release Upgrade	1.0	x						
	738	GPRS enabling and BTS SW support	1.1	x	x	X	X			
	737	BSC Q3 interface compatibility with different NMS SW releases	1.1	x	x	X	X			
0002	734	Parameters in MML command groups E0 and EM	1.2	x	x	X	X			
0001	732	BTS identifier 0 in BSDATA		x						
9921	729	Correction for GEN 637: File size of BSC measurements		x						
9920	728	Handover Adjacent Cell Measurement Counters		x	x	x	x			
9911	712	TCSM2 Routine Testing Notes	1.1	x	x	X	X			
9911	711	HSCSD Power Control parameters after S7 upgrade Validity		x						
9907	703	DSP Software Update of TR Plug-In Unit		x						
9907	702	Optimised Abis and not_in_use channels / Improvement for GEN 579	1.2	x	x	X	X			
9901	683	Unreliable activation of TCSM SMHW 02E correction		x						
9901	680	Unequal MNC values cause failures in location update	1.2	x	x	X	X			
9824	671	BTS alarms blocked after the SW upgrade	1.2	x	X	x	x			
9821	657	Functionality of the online call tracing observation	1.2	x	x	X	X			
9818	648	Implementation of BSS7210, Dual band MS access to IUO-lay	1.1	x	x	X	X			
9816	641	Information about Fallback usage	1.1	x	x	X	X			
9816	640	Actions before a system restart	1.2	x	x	X	X			
9813	635	Effects of BCSU working state change from WO to TE	1.3	x	x	X	X			
9813	632	Correction for GEN 547:BSC parameter DISABLE INTERNAL HO is highly recommended to have value NO	1.3	x	x	X	X			
9813	631	Correction for GEN 546: CCS7 30 Minutes freezing done	1.3	x	x	X	X			
9803	605	Dimensioning capacity of SS#7 links	1.2	x	X	x	x			
9719	595	Super-reuse TRX in BL-US state increases handover failure counter values in statistics	1.1	x	x	X	X			
9718	590	PCM failure alarm missing in PCM break in ISDN Abis		x						
9712	574	Using Satellite Abis and Landline Abis in the same BSC	1.2	x	x	X	X			
9709	565	Command Calendar output destination	1.1	x	x	x	x			
9707	558	Problems with synchronized handovers in PrimeSite	1.1	x	x	x	x			

9618	531	Availability of Nokia BSCE and TCSME Equipment	1.2	x	x	x	x			
9613	514	Removing TRCO PIU from the TC1C cartridge	1.1	x	x	x	x			
9613	509	SCCP broadcast status settings in BSC		x						
9519	34	Remove proms from the plug-in unit when sending them to repairing	1.2	x	x	x	x			
9512	15	Potential overload problem, Transcoder/MSC interaction	1.1	x	x	x	x			
9510	13	Different interpretation of DL DTX setting in MSCs	1.2	x	x	x	x			

