3GPP TSG CN Plenary Meeting #16 **NP-020222**
5th - 7th June 2002. Marco Island, USA.

Source: **TSG CN WG 1**

Title: **CRs to R99 (with mirror CRs) on Work Item TEI towards 24.007 and 09.94 (29.994)**

Agenda item: **7.11**

Document for: **APPROVAL**

Introduction:

This document contains **10** CRs on **Phase2 and R99 including mirror CRs on** Work Item **"TEI"**, that have been agreed by **TSG CN WG1**, and are forwarded to TSG CN Plenary meeting #16 for approval.

Spec	CR	Rev	Phase	Subject	Cat	Version Current	Version-New	Meeting-2nd-Level	Doc-2nd-Level
09.94	A010	2	Ph. 2	QoS IE length	F	4.5.0	4.6.0	N1-24	N1-021491
09.94	A011	2	R96	QoS IE length	A	4.5.0	5.0.0	N1-24	N1-021493
09.94	A012	2	R97	QoS IE length	A	4.5.0	6.0.0	N1-24	N1-021494
09.94	A013	2	R98	QoS IE length	A	4.5.0	7.0.0	N1-24	N1-021495
29.994	A014	2	R99	QoS IE length	A	4.5.0	3.0.0	N1-24	N1-021496
29.994	A015	2	Rel-4	QoS IE length	A	4.5.0	4.0.0	N1-24	N1-021497
29.994	A016	1	Rel-5	QoS IE length	A	4.5.0	5.0.0	N1-24	N1-021374
24.007	048	1	R99	Clarification of the extension mechanism for type 4 IEs	F	3.8.0	3.9.0	N1-23	N1-020892
24.007	049	1	Rel-4	Clarification of the extension mechanism for type 4 IEs	A	4.1.0	4.2.0	N1-23	N1-020893
24.007	052	1	R99	Various clean-up of wrong references, eg towards 04.18 and 23.171	F	3.8.0	3.9.0	N1-24	N1-021366

3GPP TSG-CN1 Meeting #24
Budapest, Hungary, 13. – 17. May 2002

Tdoc N1-021491
Revision of Tdoc N1-021373

CR-Form-v5

CHANGE REQUEST

⌘ **09.94** **CR** **A010** ⌘ **rev** **2** ⌘ Current version: **4.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	QoS IE length
Source:	⌘	Nokia
Work item code:	⌘	TEI
Date:	⌘	6.5.2002
Category:	⌘	**F**
Release:	⌘	Ph. 2

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	One R97 ME implementation is known to handle QoS as fixed length IE and therefore it can not access R99 and later GPRS networks. It was not seen feasible in CN1 #23 to change the core specification due to this and therefore this specific mobile station problem needs to be described in the appropriate TR to document a workaround solution.
Summary of change:	⌘	SGSN can provide a workaround solution to overcome the problem by sending only the first 5 QoS octets to pre-R99 mobile stations. The workaround is defined in the latest version of the TR, the older versions only give a pointer to the currently latest version.
Consequences if not approved:	⌘	Lots of subscribers are not able to use GPRS services when 3G services are rolled out in GSM networks

Clauses affected:	⌘	2, 3, 4, 5, 6, and Annex A
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	Only one version of 09.94 did exist and this GSM phase 2 covered all releases. The intention is to keep just one version of the document but this should always be the latest one. The principle of creating corresponding RAN document and the scope of the document were agreed in RAN #14, tdoc RP-010928.

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

ETSI TR 101 646 V4.5.0 (1999-11)

Technical Report

Digital cellular telecommunications system (Phase 2 & Phase 2+); Recommended infrastructure measures to overcome specific Mobile Station (MS) faults (GSM 09.94 version 4.5.0)

Reference
RTR/SMG-000994PR4 (f8o021o4.PDF)

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Foreword

This Technical Report (TR) has been produced by the Special Mobile Group (SMG).

The present document supersedes ETR 200 version 4.4.0.

The contents of the present document is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will be re-released with an identifying change of release date and an increase in version number as follows:

Version 4.x.y

where:

- 4 indicates GSM Phase 2.
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document clarifies recommended measures which may be adopted by the GSM infrastructure to enable interworking to be obtained between the GSM infrastructure and various Mobile Station (MS) implementations of the GSM Phase 1 and Phase 2/2+ standard. The objective is to obtain compatibility without changing the consolidated set of Phase 1 and Phase 2/2+ specifications. The present document describes the recommended changes to the infrastructure to cater for specific faults within some MSs.

The lifetime of the herein described measures together with their potential impact on optimal network performance is out of the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] Void.~~GSM 01.04: "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".~~

[2] Void.~~GSM 04.08 Phase 1 (I-ETS 300 022-1): "Digital cellular telecommunications system (Phase 1); Mobile radio interface layer 3 specification Part 1: Generic".~~

[3] Void.~~GSM 04.08 (ETS 300 557): "European digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".~~

[4] Void. ~~GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~

[5] Void.~~GSM 05.05 (ETS 300 577): "Digital cellular telecommunication system (Phase 2); Radio Performance Aspects.~~

[6] Void.~~GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio Performance Aspects.~~

[7] 3GPP TR 29.994: Digital cellular telecommunications system; Recommended infrastructure measures to overcome specific Mobile Station (MS) faults.

3 Abbreviations

~~Abbreviations used in the present document are listed in GSM 01.04 [1]~~Void.

4 General

The recommendations of the present document are provided in the latest major version of 3GPP TR 29.994 [7].~~In the implementation of the standard it has been found that some aspects of the specifications have been mis-interpreted by~~

some MS manufacturers. These MSs require specific implementations of the Phase 1 standard in the infrastructure, to provide completely compatible interworking.

It has been assumed throughout this TR that Phase 2 and later infrastructure will interwork with Phase 1 MSs in the same way as Phase 1 infrastructure.

The remainder of this ETR describes how to overcome the possible impacts of the above factors. Descriptions given are limited to specific implementations which are permissible for the Phase of the infrastructure.

5 Specific implementation on the radio interfaceVoid

This clause deals with the choice of specific infrastructure implementation options of the protocols at the radio interface. The protocols concerned are defined in GSM 04.08 Phase 1 [2] Phase2 [3] and Phase 2+ [4].

5.1 Handovers and "Synchronisation Indication"

5.1.1 Justification

In the HANDOVER COMMAND message there is a mandatory part consisting of nine octets followed by several optional information elements. The first optional information element is Synchronisation Indication which is a type 1 Information Element (IE) and as such is coded, with IE Identifier (IEI), on one octet. Other optional IE follow the Synchronisation Indication IE and are used to:

- indicate the frequency hopping sequence to use on the new channel;
- indicate the channel mode for the new channel;
- indicate a start time.

Some types of MS do not correctly decode these following information elements if the Synchronisation Indication information element is omitted.

5.1.2 Solution

To ensure correct operation the infrastructure should always send the Synchronisation Indication IE to a Phase 1 MS.

NOTE: In a few cases this will force an extra layer 2 segment to be sent to the MS.

5.2 "Directed Retry" type Handovers

5.2.1 Justification

In the HANDOVER COMMAND message there is an optional Channel Mode Information Element. When this information element is included in the handover command the MS should go to the new channel mode when it hands over to the new channel. This information element may be used for "directed retry" type handovers where a cell has an MS on a control channel but has no available traffic channel for the MS to use. The network may then choose to handover the MS to a new cell with traffic channel (TCH) capacity and change the channel mode at the same time.

Some MSs appear to accept the handover command, from Stand-alone Dedicated Control Channel (SDCCH) to TCH with speech mode, and make the required channel and mode change but do not through connect the speech path.

5.2.2 Solution

To ensure correct operation, of these MSs, the infrastructure should always initiate a channel mode change procedure according to TS GSM 04.08 (Phase 1) (I-ETS 300 022-1) [2] clause 3.4.6 once the MS has arrived at the new channel following a handover of a Phase 1 MS involving a channel mode change to full rate speech.

The additional channel mode change procedure shall only be performed for a directed retry handover to a full rate speech channel, and not for a data channel. First this will save performance in these cases, and secondly some MS's will release the call with this additional and unnecessary channel mode change procedure in case of fax or data calls.

For internal intra-Base Station System (BSS) handovers, this decision to initiate channel mode modify is taken by the BSS concerned. For external intra-BSS and inter-BSS handovers, the new BSS must know that there has been a change of mode from the previous BSS and that therefore a channel mode change procedure must be executed. The communication of this information is achieved by using the "current channel" element in the HANDOVER REQUEST and HANDOVER REQUIRED message as described in the Annex A.

In the case of external handover, the following will ensure correct operation with mobiles suffering from fault 5.2.1:

i) The change described in Annex A shall be implemented by the MSC and BSS concerned.

ii) The new BSS, after receiving a HANDOVER REQUEST containing a current channel IE indicating "signalling only", and a channel type indicating full rate speech, shall behave as specified in TS GSM 08.08 and additionally, upon reception of the HANDOVER COMPLETE message, initiate a channel mode change procedure according to TS GSM 04.08 with the new mode indicating speech.

If the new BSS receives a HANDOVER REQUEST without the current channel IE but containing a cause value "directed retry", and a channel type indicating full rate speech, it shall also behave as ii) above.

NOTE: The performance of MSs not experiencing this problem has been checked for a sizeable subset of the MSs available in Phase 1, but it has not been possible to check all versions of all MSs.

5.3 Cell broadcast and frequency hopping

5.3.1 Justification

In the SYSTEM INFORMATION TYPE 4 message there is an optional Information Element "CBCH Channel Description" used when a cell broadcast channel is configured in the network.

Some Types of GSM 900 MSs may not obtain service whilst within reception range of a cell from any network having the CBCH configured with frequency hopping: i.e. the Hopping channel bit set to 1 in the "CBCH Channel description" information element.

5.3.2 Solution

To enable operation from the affected MS, the infrastructure could configure the CBCH on a non hopping channel:

- In combined type of configuration: the CBCH would be distributed on the SDCCH/4 with BCCH
- In non-combined type of configuration, two types of solution are considered:
  - Type 1 CBCH distributed on a non hopping SDCCH broadcasted on TSx of C0 (x=1,2,3)
  - Type 2 CBCH distributed on a non hopping SDCCH broadcasted on TS0 of Cx ($x \neq 0$)

5.4 Handling of Phase 2 and Phase2+ BCCH Messages

5.4.1 Justification

Some types of Phase1 GSM 900 MSs could fail to offer full services whilst System Information messages other than those specified in GSM 900 Phase1 are broadcast with a L2 Pseudo Length value greater than 1.

5.4.2 Solution

In order to provide service to these existing GSM 900 MS and not disturb Phase2 MS, the following restrictions and changes should be implemented in the P-GSM 900 band of the network.

~~For System Information 2ter, the value 0 of the L2 Pseudo Length shall be used instead of 18.~~

~~The System Information 2bis shall not be used in the P-GSM 900 band of the network.~~

~~Therefore, the EXT-IND bit in System Information 2 in the P-GSM 900 Band of the network shall not be set to 1.~~

~~5.5 Handling of Phase 2 and Phase2+ SACCH Messages~~

~~5.5.1 Justification~~

~~Some types of Phase1 MSs may experience performance degradation if the network sends System Information Messages other than those specified in Phase1.~~

~~5.5.2 Solution~~

~~In order not to degrade the performance of these Phase1 mobile stations it is recommended:~~

- ~~any new messages that are not defined in Phase1 shall not be sent to a Phase1 MS, e.g System Information 5bis and 5ter to a Phase1 P-GSM 900 mobile station and System Information 5ter to a Phase1 DCS 1800 mobile station.~~

~~5.6 Handling of assignment message using Mobile Allocation IE including ARFCN=0~~

~~5.6.1 Justification~~

~~Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network sends an assigning message (Immediate Assignment, Assignment Command or Handover Command) that uses the Mobile Allocation IE to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.6.2 Solution~~

~~To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence. When assigning a channel at RR connection establishment (Immediate Assignment), this solution should be used.~~

~~When a channel resource is assigned, using either the Assignment Command or the Handover Command message, the infrastructure may use the Frequency List or the Frequency Short List IEs in the assigning message to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.7 Hopping sequence generation including ARFCN=0~~

~~5.7.1 Justification~~

~~Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network assigns an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.7.2 Solution~~

~~To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence.~~

6 VoidUse of VAD/DTX in conjunction with frequency hopping for a speech call

6.1 Scope

The chapter six of this Technical Report is to identify limitations in the specification for phase 1 reflected in performance degradation in phase 1 terminal equipment. This report identifies possible ways of improving the service offered to subscribers using phase 1 terminals whilst using the two features - downlink DTX and frequency hopping at the same time.

6.2 General

The specification of acoustic performance of the MS when downlink DTX is implemented is in GSM 05.05 which restricts the MS performance to 1 undetected bad frame in 10s when in the presence of random RF. In reality the MS does not experience random RF exclusively when downlink DTX is implemented.

There is a SIlence Descriptor (SID) frame sent on eight bursts every 104 bursts. Due to the interleaving scheme, half of the bits of the frame preceding the SID and half of the bits of the frame following the SID are sent and there is no specific requirement covering what is sent for these bits but in most cases it is every other bit of a correctly coded frame. The MS receives these bits

In addition, when the ARFCN used is C0, dummy bursts are sent when there is neither speech nor signalling to be transmitted.

Finally, when frequency hopping is used as well as downlink DTX, the MS may receive random RF on some TDMA frames and dummy bursts on others (C0).

It is possible for the MS to receive combinations of transmitted bits at high confidence and random RF at low confidence. In some cases the MS can then decode the frame as good when in fact it was never intended to have been transmitted and the resultant bad frame can give a very annoying acoustic effect known as banjo noise. The occurance of these noises, even if no more frequent than one in 10s, is worse than one would expect from a high quality cellular system.

The three following sections refer to ways of improving the system performance for MS approved according to the existing phase 1 specification. Section 6.3 identifies some "normal" operation configurations which would improve undetected bad frame performance for MS's with the above fault (banjo noise), section 6.4 describes aspects for possible changed network implementation, section 6.5 relates the results of tests performed using combinations of the implementations described in section 6.4 and whether that combination was effective or not.

6.3 Implementation options to reduce the occurance of undetected bad frames by utilising normal system features

This section deals with a variety of options to improve the system performance which are implementable by normal system operational choices. These options typically improve matters in specific configurations and are not universal solutions for all configurations. It may be possible that some networks do not permit such configuration.

6.3.1 Number of frequency hopping channels

The number of undetected bad frames is related to the probability of getting sufficient dummy bursts transmitted to make a false good frame decision. The number of dummy bursts received depends on the number of ARFCN in the hopping list. Hence frequency hopping on 3 ARFCN gives better audio performance than frequency hopping on 2, likewise hopping on 4 ARFCN gives better performance than hopping on 3.

In tests of the comparison between hopping on 2 ARFCN and hopping on 3, some MS have been found to improve to approximately one tenth of the occurance of bad frames, while others have improved from a slightly annoying level when hopping on 2 ARFCN, to give no audible disruption when hopping on 3. Not all MS have been tested and it is believed that the improvement for some MS may be less noticeable.

This solution is obviously not trivial to implement in a frequency plan, but could also be used to enable frequency hopping on cells which naturally have 3 or more ARFCN operational whilst selecting a solution for other parts of the network and operational scenarios.

6.3.2 Frequency hopping type

When utilising pseudo-random frequency hopping, it is possible to get more dummy bursts in a speech frame than when utilising cyclic frequency hopping. As an alternative to random frequency hopping, cyclic hopping may be used. It will minimise the banjo noise effect experienced by the faulty mobiles. This will however be done at the expense of a possible degradation of performance during speech activity period for all mobiles due to the absence of interferer diversity.

In tests of the comparison between pseudo-random frequency hopping and cyclic frequency hopping, some phones were found to improve with the use of cyclic hopping to approximately one third of the occurance of bad frames when using pseudo-random hopping, while others have improved from a slightly annoying level to give no audible disruption. Not all phones have been tested for this.

6.3.3 Continuous SID frames on C0

At some times, a network implementing downlink DTX may hold a call on C0. In this case it would be possible for the network to send dummy bursts when it has nothing else to send. This is likely to cause a high level of unwanted noises for some MS. An alternative would be to send continuous SID frames in which case there should be no undesired effects.

6.4 Implementation options to reduce the occurance of undetected bad frames by changing normal system operation

This section deals with implementation options which improve the audio quality of the faulty mobiles, suffering from banjo noise, by making changes to the network equipment. The solutions give varying performance improvements but not all solutions would be possible on all networks.

6.4.1 Changing the training sequence of the dummy burst to a new (ninth) training sequence

If a different training sequence code is used for all dummy bursts forming part of the TCH on C0, the MS will have difficulty training to the dummy burst frames and this would cause the bits to be received as low confidence. This would then give a performance rather more like that for random RF input and should then meet the 05.05 requirement.

6.4.2 Using an alternative training sequence out of the eight assigned

This option is similar in concept and performance to the one described in section 6.4.1. The advantage is that it may be usable in some networks where it is not easily possible to add a ninth training sequence. The following table gives a list of training sequence codes for the TCH and the preferred choice of training sequence code for the dummy burst.

Training sequence code for TCH	Training sequence code for dummy bursts on C0
0	2
1	5
2	0
3	4
4	5
5	2
6	3
7	5

6.4.3 Setting the stealing flag for the bits transmitted which are not intended to be part of the TCH

When bits are transmitted which are not intended for reception in the TCH path, such as dummy bursts and the half burst before and after a discrete, wanted frame, it would be possible to set the stealing flag for these bits and so bias the decision of the majority vote on stealing flags in favour of routing the frame as control information rather than speech information. The channel protection on the control channel is much greater and the chance of getting an undetected bad control channel frame is very low.

6.4.4 Sending partial SID frames on C0

It has been observed that improvements in the undetected bad frame rate are seen when the BTS sends partial SID frames on the otherwise unused TCH bursts on C0. This is because the high confidence bits are correctly coded for the relevant speech frame and the normal design of the MS receiver is expected to cope with such errors. This proposal works best for DCS 1800 because very early GSM models are not represented in DCS 1800.

6.5 Tested Combinations

This section identifies tests that have been performed and the results that have been obtained. The reporting of result is limited to acceptable or not acceptable and a brief additional comment is sometimes made. If the result is deemed to be acceptable, most products which suffer from the described problem have been improved to a point where extraneous noises are significantly reduced to virtually nothing and no product has got worse. No solution completely corrected all products but significant improvements have been achieved if the result is deemed acceptable.

6.5.1 "Normal" system

Test configuration:

Sent on C0:
Dummy bursts using training sequence from TCH.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Unacceptable; Several products exhibit frequent noises from undetected bad frames.

6.5.2 New training sequence

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.3 Alternative training sequence from the eight assigned

Test configuration:

Sent on C0:
Dummy bursts using alternative training sequence according to table in 6.4.2.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information not necessarily related to the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.4 Setting stealing flag for unintentionally transmitted bits

Test configuration:

Sent on C0:
Partial SID information from the two SID frames otherwise scheduled for transmission.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 1

Result:

Acceptable.

6.5.5 Setting stealing flag for unintentionally transmitted bits and modifying training sequence for Dummy Bursts

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Dummy burst mixed bits

Half burst stealing flags:
Set to 1

Result:

Acceptable; This configuration gave marginally the best performance of all tested.

6.5.6 Sending partial SID information on C0

Test configuration:

Sent on C0:
Part SID frames

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable for DCS 1800.

Annex A:
VoidAmendment Request 08.08 - 021 R4: Information on channel in use in HO REQUEST

NOTE: This Annex A reflects the Amendment Request 08.08 - 021 R4 which was approved by SMG#15 and is part of the TS GSM 08.08 version 4.9.0.

A.3.1.5.1.1 Generation of the HANDOVER REQUIRED message

Generation of the HANDOVER REQUIRED message can be for the following reasons:

- The BSS has detected that a radio reason exists for a handover to occur.
- The MSC has initiated a handover candidate enquiry procedure, and this MS is currently a candidate.
- A cell change is required at call setup due to congestion, e.g. directed retry.

The HANDOVER REQUIRED message contains the following information elements:

- Message Type;
- Cause;
- Cell Identifier List (preferred).

It should also contain the "Current channel" information element.

Sec. 3.2.1.9. gives coding details of the above message.

The "Cause" field indicates the reason for the HANDOVER REQUIRED message e.g. "uplink quality poor" or "response to MSC invocation" in the case of traffic reasons indicated by the MSC.

If present the "Response Request" Information Element indicates, that the BSS requires an indication if the HANDOVER REQUIRED message does not result in a HANDOVER COMMAND message.

If the BSS wants to change the CIC due to a channel change, the BSS sends a HANDOVER REQUIRED message with the cause "switch circuit pool" and the "circuit pool list" information element. The "circuit pool list" information element will allow the BSS to indicate to the MSC from which circuit pool or pools the new CIC should be chosen.

The "Cell Identifier List (preferred)" shall identify "n" preferred cells. The identified cells are given in order of preference. The algorithm by which the BSS produces this list is Operator dependent and is not addressed in this Technical Specification. The "n" number of preferred cells is a parameter set by O&M and shall range from 1 to 16. If "n" number of cells cannot be identified, then only as many as are available shall be encoded and sent (as specified in section 3.2.2.27).

It is mandatory for the BSS to be able to produce this "Cell Identifier List (preferred)". The sending of this list is controlled by the O&M parameter "n". It is mandatory for the MSC to be able to receive and interpret this Information Element.

The HANDOVER REQUIRED message shall be updated and repeated by the BSS with a periodicity of T7 until:

- A HANDOVER COMMAND message is received from the MSC, or;
- A RESET message is received, or;
- The reason for the original HANDOVER REQUIRED message disappears e.g. the MS transmission improves, or;
- All communication is lost with the MS as defined in Technical Specification GSM 04.08, and the transaction is abandoned, or;
- The transaction ends, e.g., call clearing.

A.3.1.5.2 Handover Resource allocation

This procedure has been defined to allow the MSC to request resources from a BSS in a manner similar to that used for the assignment case. However it does not result in the transmission of any messages over the radio interface, only in the reservation of the resource identified at the BSS, which awaits access of a MS on the reserved channel. These reserved resources are then indicated back to the MSC.

In order to support this procedure the MSC sets up a BSSAP SCCP connection to the BSS. This connection is then used to support all BSSAP messages related to this dedicated resource.

A.3.1.5.2.1 Operation of the procedure

The correct operation of the handover resource allocation procedure is as follows:

The MSC sends a HANDOVER REQUEST message to the new BSS (note 1) from which it requires radio resources. This message contains details of the resource that is required. If the requested resource is for speech or data it also indicates the terrestrial resource that shall be used between the MSC and the BSS. The type of channel required can be different from the type of channel in use, e.g. in the case of directed retry. The description of the resource can either specify it completely, or give the BSS some freedom in the selection. The message may also specify the channel in use.

On receipt of this message the new BSS shall choose a suitable idle radio resource.

The management of priority levels – relating to the Information Element "Priority" within the HANDOVER REQUEST message – is implementation dependent, under operator control.

If queueing is managed, new requests which cannot be served immediately are put in the queueing file according to the indicated priority levels.

(Refer to section 3.1.17 for Queuing Procedure)

As a further operator option, the preemption indicators may (alone or along with the priority levels) be used to manage the preemption process, which may lead to the forced release or forced handover of lower priority connections.

However, the preemption indicators (refer to section 3.2.2.18), if given in the HANDOVER REQUEST, shall be treated on a per connection basis as follows:

- the last received "Preemption Vulnerability" indicator and priority levels shall prevail.
- if the "Preemption Capability" bit is set to 1, then this allocation request can trigger the running of the preemption procedure.
- if the "Preemption Capability" bit is set to 0, then this allocation request cannot trigger the preemption procedure.
- if the "Preemption Vulnerability" bit is set to 1, then this connection is vulnerable and shall be included in the preemption process or procedure and as such may be subject to forced release or forced handover.
- if the "Preemption Vulnerability" bit is set to 0, then this connection is not vulnerable to preemption and shall not be included in the preemption process and as such may not be subject to forced release or forced handover.
- if no Priority Information Element has been received, both "Preemption Capability" and "Preemption Vulnerability" bits shall be regarded as set to 0.

If a radio resource is available then this will be reflected back to the MSC in a HANDOVER REQUEST ACKNOWLEDGE message. The HANDOVER REQUEST ACKNOWLEDGE message sent by the new BSS shall contain the radio interface message HANDOVER COMMAND within its "Layer 3 Information" Information Element. This "Layer 3 Information" (which is in fact the RR Layer 3 HANDOVER COMMAND) is transferred by the controlling MSC to the old BSS using the BSSMAP message HANDOVER COMMAND also within the Information Element "Layer 3 Information" of that BSSMAP message. The old BSS then sends to the MS over the radio interface the RR Layer 3 HANDOVER COMMAND message. Information about the appropriate new channels and a handover reference number chosen by the new BSS are contained in the HANDOVER COMMAND. Knowledge of the channel in use at the old BSS allows the new BSS to minimize the size of the HANDOVER COMMAND message (i.e. to decide whether the mode of the first channel IE need not be included in the HANDOVER COMMAND).

NOTE: The new BSS and the old BSS may be the same.

When several circuit pools are present on the BSS-MSC interface, the "circuit pool" information field shall be included in the HANDOVER REQUEST ACKNOWLEDGE. The "circuit pool" field will indicate to the MSC the circuit pool of the CIC given in the HANDOVER REQUEST message.

The sending of the HANDOVER REQUEST ACKNOWLEDGE by the new BSS to the MSC ends the Handover Resource Allocation procedure. The Handover Execution procedure can now proceed and this is given in section 3.1.5.3.

The new BSS shall then take all necessary action to allow the MS to access the radio resource that the new BSS has chosen, this is detailed in the GSM 05 series of Technical Specifications. If the radio resource is a traffic channel then the new BSS shall at this point switch it through to the terrestrial resource indicated in the HANDOVER REQUEST message, and the necessary transcoding/rate adaption/encryption equipment enabled as detailed in Technical Specification GSM 04.08.

The optimum procedure for switching through to the target cell at the MSC is not defined in these Technical Specifications.

A.3.2.1.8 HANDOVER REQUEST

This message is sent from the MSC to the BSS via the relevant SCCP connection to indicate that the MS is to be handed over to that BSS.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	MSC-BSS	M	1
Channel type	3.2.2.11	MSC-BSS	M	5
Encryption information	3.2.2.10	MSC-BSS	M	3-n
Classmark information 1 or	3.2.2.30	MSC-BSS	M#	2
Classmark information 2	3.2.2.19	MSC-BSS	M#	4-5
Cell identifier (serving)	3.2.2.17	MSC-BSS	M	5-10
Priority	3.2.2.18	MSC-BSS	O	3
Circuit identity code	3.2.2.2	MSC-BSS	O##	3
Downlink DTX flag	3.2.2.26	MSC-BSS	O*	2
Cell identifier (target)	3.2.2.17	MSC-BSS	M	3-10
Interference band to be used	3.2.2.21	MSC-BSS	O	2
Cause	3.2.2.5	MSC-BSS	O	3-4
Classmark information 3	3.2.2.20	MSC-BSS	O**	3-14
Current channel	3.2.2.49	MSC-BSS	O§	2

* This element may be included in the case of a speech TCH, and only in this case. If not included, this has no impact on the DTX function in the BSS.

** This element is included if the MSC has received such information.

One of these two elements is sent.

This element is included when the channel type Information Element indicates speech or data, and only in those cases.

§ This element is included at least when the message is sent as a reaction to reception of a HANDOVER REQUIRED message containing a "Current channel" information element. In this case it shall be equal to the received element.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength
- distance,
- better cell,
- response to MSC invocation
- O and M intervention,

- directed retry,
- switch circuit pool.

A.3.2.1.9 HANDOVER REQUIRED

This message is sent from the BSS to the MSC to indicate that for a given MS which already has a dedicated radio resource assigned, a handover is required for the reason given by the cause element.

The message is sent via the BSSAP-SCCP connection associated with the dedicated resource.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	BSS-MSC	M	1
Cause	3.2.2.5	BSS-MSC	M	3-4
Response request	3.2.2.28	BSS-MSC	O	1
Cell identifier list (preferred)	3.2.2.27	BSS-MSC	M	2n+3 to 7n+3
Circuit pool list	3.2.2.46	BSS-MSC	O*	V
Current channel	3.2.2.49	BSS-MSC	O**	2

* Shall be included when cause "switch circuit pool".

** This information element should always be included.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength,
- distance,
- better cell,
- response to MSC invocation,
- O&M intervention,
- directed retry,
- switch circuit pool.

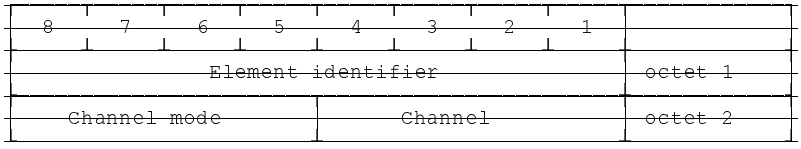
Element Identifier Coding	Element name	Reference
0000 0001	Circuit identity code	3.2.2.2.
0000 0010	Reserved	*
0000 0011	Resource available	3.2.2.4.
0000 0100	Cause	3.2.2.5.
0000 0101	Cell identifier	3.2.2.17.
0000 0110	Priority	3.2.2.18.
0000 0111	Layer 3 header information	3.2.2.9.
0000 1000	IMSI	3.2.2.6.
0000 1001	TMSI	3.2.2.7.
0000 1010	Encryption information	3.2.2.10.
0000 1011	Channel type	3.2.2.11.
0000 1100	Periodicity	3.2.2.12.
0000 1101	Extended resource indicator	3.2.2.13.
0000 1110	Number of MSs	3.2.2.8.
0000 1111	Reserved	*
0001 0000	Reserved	*
0001 0001	Reserved	*
0001 0010	Classmark information type 2	3.2.2.19.
0001 0011	Classmark information type 3	3.2.2.20.
0001 0100	Interference band to be used	3.2.2.21.
0001 0101	RR Cause	3.2.2.22.
0001 0110	Reserved	*
0001 0111	Layer 3 information	3.2.2.24.
0001 1000	DLCI	3.2.2.25.
0001 1001	Downlink DTX flag	3.2.2.26.
0001 1010	Cell identifier list	3.2.2.27.
0001 1011	Response request	3.2.2.28.
0001 1100	Resource indication method	3.2.2.29.
0001 1101	Classmark information type 1	3.2.2.30.
0001 1110	Circuit identity code list	3.2.2.31.
0001 1111	Diagnostic	3.2.2.32.
0010 0000	Layer 3 message contents	3.2.2.35.
0010 0001	Chosen channel	3.2.2.33.
0010 0010	Total resource accessible	3.2.2.14.
0010 0011	Cipher response mode	3.2.2.34.
0010 0100	Channel needed	3.2.2.36.
0010 0101	Trace type	3.2.2.37.
0010 0110	TriggerId	3.2.2.38.
0010 0111	Trace reference	3.2.2.39.
0010 1000	TransactionId	3.2.2.40.
0010 1001	Mobile identity	3.2.2.41.
0010 1010	OMCId	3.2.2.42.
0010 1011	Forward indicator	3.2.2.43.
0010 1100	Chosen encryption algorithm	3.2.2.44.
0010 1101	Circuit pool	3.2.2.45.
0010 1110	Circuit pool list	3.2.2.46.
0010 1111	Time indication	3.2.2.47.
0011 0000	Resource situation	3.2.2.48.
0011 0001	Current channel	3.2.2.49.

* Information Element codes marked as "reserved are reserved for use by previous versions of this interface specification.

A.3.2.2.49 CURRENT CHANNEL

This Information Element contains a description of the channel allocated to the MS.

It is coded as follows:



~~The channel mode field is coded as follows:~~

~~Bit 8765~~
~~— 0000 signalling only~~
~~— 0001 speech (full rate or half rate)~~
~~— 0011 data, 12.0 kbit/s radio interface rate~~
~~— 0100 data, 6.0 kbit/s radio interface rate~~
~~— 0101 data, 3.6 kbit/s radio interface rate~~

~~All other values are reserved.~~

~~The channel field is coded as follows:~~

~~Bit 4321~~
~~— 0001 SDCCH~~
~~— 1000 Full rate TCH~~
~~— 1001 Half rate TCH~~

~~All other values are reserved.~~

Annex B (informative): Change Request History

SPEC	SMG#	CR	PHS	VERS	NEW_V	SUBJECT
09.94	s30	A008	2	4.4.0	4.5.0	Change of Title, Scope and References Clauses 1 to 5)
09.94	s30	A009	2	4.4.0	4.5.0	Frequency Hopping using ARFCN=0

History

Document history		
Edition 1	August 1995	Publication as ETR 200
Edition 2	November 1995	Publication as ETR 200
Edition 3	September 1996	Publication as ETR 200
V4.5.0	November 1999	Publication

3GPP TSG-CN1 Meeting #24
Budapest, Hungary, 13. – 17. May 2002

Tdoc N1-021493
Revision of N1-021375

CR-Form-v5

CHANGE REQUEST

⌘ **09.94** **CR** **A011** ⌘ **rev** **2** ⌘ Current version: **4.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	QoS IE length
Source:	⌘	Nokia
Work item code:	⌘	TEI
Date:	⌘	6.5.2002
Category:	⌘	**A**
Release:	⌘	R96

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	One R97 ME implementation is known to handle QoS as fixed length IE and therefore it can not access R99 and later GPRS networks. It was not seen feasible in CN1 #23 to change the core specification due to this and therefore this specific mobile station problem needs to be described in the appropriate TR to document a workaround solution.
Summary of change:	⌘	SGSN can provide a workaround solution to overcome the problem by sending only the first 5 QoS octets to pre-R99 mobile stations. The workaround is defined in the latest version of the TR, the older versions only give a pointer to the currently latest version.
Consequences if not approved:	⌘	Lots of subscribers are not able to use GPRS services when 3G services are rolled out in GSM networks

Clauses affected:	⌘	2, 3, 4, 5, 6, and Annex A
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	Only one version of 09.94 did exist and this GSM phase 2 covered all releases. The intention is to keep just one version of the document but this should always be the latest one. The principle of creating corresponding RAN document and the scope of the document were agreed in RAN #14, tdoc RP-010928.

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

ETSI TR 101 646 V4.5.0 (1999-11)

Technical Report

Digital cellular telecommunications system (Phase 2 & Phase 2+); Recommended infrastructure measures to overcome specific Mobile Station (MS) faults (GSM 09.94 version 4.5.0)

Reference
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Foreword

This Technical Report (TR) has been produced by the Special Mobile Group (SMG).

The present document supersedes ETR 200 version 4.4.0.

The contents of the present document is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will be re-released with an identifying change of release date and an increase in version number as follows:

Version 4.x.y

where:

- 4 indicates GSM Phase 2.
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document clarifies recommended measures which may be adopted by the GSM infrastructure to enable interworking to be obtained between the GSM infrastructure and various Mobile Station (MS) implementations of the GSM Phase 1 and Phase 2/2+ standard. The objective is to obtain compatibility without changing the consolidated set of Phase 1 and Phase 2/2+ specifications. The present document describes the recommended changes to the infrastructure to cater for specific faults within some MSs.

The lifetime of the herein described measures together with their potential impact on optimal network performance is out of the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ~~GSM 01.04: "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".~~Void.

[2] ~~GSM 04.08 Phase 1 (I ETS 300 022-1): "Digital cellular telecommunications system (Phase 1); Mobile radio interface layer 3 specification Part 1: Generic".~~Void.

[3] ~~GSM 04.08 (ETS 300 557): "European digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".~~Void.

[4] ~~GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~Void.

[5] ~~GSM 05.05 (ETS 300 577): "Digital cellular telecommunication system (Phase 2); Radio Performance Aspects.~~Void.

[6] ~~GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio Performance Aspects.~~Void.

[7] 3GPP TR 29.994: Digital cellular telecommunications system; Recommended infrastructure measures to overcome specific Mobile Station (MS) faults.

3 Abbreviations

~~Abbreviations used in the present document are listed in GSM 01.04 [1]~~Void.

4 General

The recommendations of the present document are provided in the latest major version of 3GPP TR 29.994 [7].~~In the implementation of the standard it has been found that some aspects of the specifications have been mis-interpreted by~~

some MS manufacturers. These MSs require specific implementations of the Phase 1 standard in the infrastructure, to provide completely compatible interworking.

It has been assumed throughout this TR that Phase 2 and later infrastructure will interwork with Phase 1 MSs in the same way as Phase 1 infrastructure.

The remainder of this ETR describes how to overcome the possible impacts of the above factors. Descriptions given are limited to specific implementations which are permissible for the Phase of the infrastructure.

5 Specific implementation on the radio interfaceVoid

This clause deals with the choice of specific infrastructure implementation options of the protocols at the radio interface. The protocols concerned are defined in GSM 04.08 Phase 1 [2] Phase2 [3] and Phase 2+ [4].

5.1 Handovers and "Synchronisation Indication"

5.1.1 Justification

In the HANDOVER COMMAND message there is a mandatory part consisting of nine octets followed by several optional information elements. The first optional information element is Synchronisation Indication which is a type 1 Information Element (IE) and as such is coded, with IE Identifier (IEI), on one octet. Other optional IE follow the Synchronisation Indication IE and are used to:

- indicate the frequency hopping sequence to use on the new channel;
- indicate the channel mode for the new channel;
- indicate a start time.

Some types of MS do not correctly decode these following information elements if the Synchronisation Indication information element is omitted.

5.1.2 Solution

To ensure correct operation the infrastructure should always send the Synchronisation Indication IE to a Phase 1 MS.

NOTE: In a few cases this will force an extra layer 2 segment to be sent to the MS.

5.2 "Directed Retry" type Handovers

5.2.1 Justification

In the HANDOVER COMMAND message there is an optional Channel Mode Information Element. When this information element is included in the handover command the MS should go to the new channel mode when it hands over to the new channel. This information element may be used for "directed retry" type handovers where a cell has an MS on a control channel but has no available traffic channel for the MS to use. The network may then choose to handover the MS to a new cell with traffic channel (TCH) capacity and change the channel mode at the same time.

Some MSs appear to accept the handover command, from Stand-alone Dedicated Control Channel (SDCCH) to TCH with speech mode, and make the required channel and mode change but do not through connect the speech path.

5.2.2 Solution

To ensure correct operation, of these MSs, the infrastructure should always initiate a channel mode change procedure according to TS GSM 04.08 (Phase 1) (I-ETS 300 022-1) [2] clause 3.4.6 once the MS has arrived at the new channel following a handover of a Phase 1 MS involving a channel mode change to full rate speech.

The additional channel mode change procedure shall only be performed for a directed retry handover to a full rate speech channel, and not for a data channel. First this will save performance in these cases, and secondly some MS's will release the call with this additional and unnecessary channel mode change procedure in case of fax or data calls.

For internal intra-Base Station System (BSS) handovers, this decision to initiate channel mode modify is taken by the BSS concerned. For external intra-BSS and inter-BSS handovers, the new BSS must know that there has been a change of mode from the previous BSS and that therefore a channel mode change procedure must be executed. The communication of this information is achieved by using the "current channel" element in the HANDOVER REQUEST and HANDOVER REQUIRED message as described in the Annex A.

In the case of external handover, the following will ensure correct operation with mobiles suffering from fault 5.2.1:

i) The change described in Annex A shall be implemented by the MSC and BSS concerned.

ii) The new BSS, after receiving a HANDOVER REQUEST containing a current channel IE indicating "signalling only", and a channel type indicating full rate speech, shall behave as specified in TS GSM 08.08 and additionally, upon reception of the HANDOVER COMPLETE message, initiate a channel mode change procedure according to TS GSM 04.08 with the new mode indicating speech.

If the new BSS receives a HANDOVER REQUEST without the current channel IE but containing a cause value "directed retry", and a channel type indicating full rate speech, it shall also behave as ii) above.

NOTE: The performance of MSs not experiencing this problem has been checked for a sizeable subset of the MSs available in Phase 1, but it has not been possible to check all versions of all MSs.

5.3 Cell broadcast and frequency hopping

5.3.1 Justification

In the SYSTEM INFORMATION TYPE 4 message there is an optional Information Element "CBCH Channel Description" used when a cell broadcast channel is configured in the network.

Some Types of GSM 900 MSs may not obtain service whilst within reception range of a cell from any network having the CBCH configured with frequency hopping: i.e. the Hopping channel bit set to 1 in the "CBCH Channel description" information element.

5.3.2 Solution

To enable operation from the affected MS, the infrastructure could configure the CBCH on a non hopping channel:

- In combined type of configuration: the CBCH would be distributed on the SDCCH/4 with BCCH
- In non-combined type of configuration, two types of solution are considered:
  - Type 1 CBCH distributed on a non hopping SDCCH broadcasted on TSx of C0 (x=1,2,3)
  - Type 2 CBCH distributed on a non hopping SDCCH broadcasted on TS0 of Cx ($x \neq 0$)

5.4 Handling of Phase 2 and Phase2+ BCCH Messages

5.4.1 Justification

Some types of Phase1 GSM 900 MSs could fail to offer full services whilst System Information messages other than those specified in GSM 900 Phase1 are broadcast with a L2 Pseudo Length value greater than 1.

5.4.2 Solution

In order to provide service to these existing GSM 900 MS and not disturb Phase2 MS, the following restrictions and changes should be implemented in the P-GSM 900 band of the network.

~~For System Information 2ter, the value 0 of the L2 Pseudo Length shall be used instead of 18.~~

~~The System Information 2bis shall not be used in the P-GSM 900 band of the network.~~

~~Therefore, the EXT-IND bit in System Information 2 in the P-GSM 900 Band of the network shall not be set to 1.~~

~~5.5 Handling of Phase 2 and Phase2+ SACCH Messages~~

~~5.5.1 Justification~~

~~Some types of Phase1 MSs may experience performance degradation if the network sends System Information Messages other than those specified in Phase1.~~

~~5.5.2 Solution~~

~~In order not to degrade the performance of these Phase1 mobile stations it is recommended:~~

- ~~any new messages that are not defined in Phase1 shall not be sent to a Phase1 MS, e.g System Information 5bis and 5ter to a Phase1 P-GSM 900 mobile station and System Information 5ter to a Phase1 DCS 1800 mobile station.~~

~~5.6 Handling of assignment message using Mobile Allocation IE including ARFCN=0~~

~~5.6.1 Justification~~

~~Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network sends an assigning message (Immediate Assignment, Assignment Command or Handover Command) that uses the Mobile Allocation IE to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.6.2 Solution~~

~~To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence. When assigning a channel at RR connection establishment (Immediate Assignment), this solution should be used.~~

~~When a channel resource is assigned, using either the Assignment Command or the Handover Command message, the infrastructure may use the Frequency List or the Frequency Short List IEs in the assigning message to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.7 Hopping sequence generation including ARFCN=0~~

~~5.7.1 Justification~~

~~Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network assigns an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.7.2 Solution~~

~~To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence.~~

6 VoidUse of VAD/DTX in conjunction with frequency hopping for a speech call

6.1 Scope

The chapter six of this Technical Report is to identify limitations in the specification for phase 1 reflected in performance degradation in phase 1 terminal equipment. This report identifies possible ways of improving the service offered to subscribers using phase 1 terminals whilst using the two features - downlink DTX and frequency hopping at the same time.

6.2 General

The specification of acoustic performance of the MS when downlink DTX is implemented is in GSM 05.05 which restricts the MS performance to 1 undetected bad frame in 10s when in the presence of random RF. In reality the MS does not experience random RF exclusively when downlink DTX is implemented.

There is a SIlence Descriptor (SID) frame sent on eight bursts every 104 bursts. Due to the interleaving scheme, half of the bits of the frame preceding the SID and half of the bits of the frame following the SID are sent and there is no specific requirement covering what is sent for these bits but in most cases it is every other bit of a correctly coded frame. The MS receives these bits

In addition, when the ARFCN used is C0, dummy bursts are sent when there is neither speech nor signalling to be transmitted.

Finally, when frequency hopping is used as well as downlink DTX, the MS may receive random RF on some TDMA frames and dummy bursts on others (C0).

It is possible for the MS to receive combinations of transmitted bits at high confidence and random RF at low confidence. In some cases the MS can then decode the frame as good when in fact it was never intended to have been transmitted and the resultant bad frame can give a very annoying acoustic effect known as banjo noise. The occurance of these noises, even if no more frequent than one in 10s, is worse than one would expect from a high quality cellular system.

The three following sections refer to ways of improving the system performance for MS approved according to the existing phase 1 specification. Section 6.3 identifies some "normal" operation configurations which would improve undetected bad frame performance for MS's with the above fault (banjo noise), section 6.4 describes aspects for possible changed network implementation, section 6.5 relates the results of tests performed using combinations of the implementations described in section 6.4 and whether that combination was effective or not.

6.3 Implementation options to reduce the occurance of undetected bad frames by utilising normal system features

This section deals with a variety of options to improve the system performance which are implementable by normal system operational choices. These options typically improve matters in specific configurations and are not universal solutions for all configurations. It may be possible that some networks do not permit such configuration.

6.3.1 Number of frequency hopping channels

The number of undetected bad frames is related to the probability of getting sufficient dummy bursts transmitted to make a false good frame decision. The number of dummy bursts received depends on the number of ARFCN in the hopping list. Hence frequency hopping on 3 ARFCN gives better audio performance than frequency hopping on 2, likewise hopping on 4 ARFCN gives better performance than hopping on 3.

In tests of the comparison between hopping on 2 ARFCN and hopping on 3, some MS have been found to improve to approximately one tenth of the occurance of bad frames, while others have improved from a slightly annoying level when hopping on 2 ARFCN, to give no audible disruption when hopping on 3. Not all MS have been tested and it is believed that the improvement for some MS may be less noticeable.

This solution is obviously not trivial to implement in a frequency plan, but could also be used to enable frequency hopping on cells which naturally have 3 or more ARFCN operational whilst selecting a solution for other parts of the network and operational scenarios.

6.3.2 Frequency hopping type

When utilising pseudo-random frequency hopping, it is possible to get more dummy bursts in a speech frame than when utilising cyclic frequency hopping. As an alternative to random frequency hopping, cyclic hopping may be used. It will minimise the banjo noise effect experienced by the faulty mobiles. This will however be done at the expense of a possible degradation of performance during speech activity period for all mobiles due to the absence of interferer diversity.

In tests of the comparison between pseudo-random frequency hopping and cyclic frequency hopping, some phones were found to improve with the use of cyclic hopping to approximately one third of the occurance of bad frames when using pseudo-random hopping, while others have improved from a slightly annoying level to give no audible disruption. Not all phones have been tested for this.

6.3.3 Continuous SID frames on C0

At some times, a network implementing downlink DTX may hold a call on C0. In this case it would be possible for the network to send dummy bursts when it has nothing else to send. This is likely to cause a high level of unwanted noises for some MS. An alternative would be to send continuous SID frames in which case there should be no undesired effects.

6.4 Implementation options to reduce the occurance of undetected bad frames by changing normal system operation

This section deals with implementation options which improve the audio quality of the faulty mobiles, suffering from banjo noise, by making changes to the network equipment. The solutions give varying performance improvements but not all solutions would be possible on all networks.

6.4.1 Changing the training sequence of the dummy burst to a new (ninth) training sequence

If a different training sequence code is used for all dummy bursts forming part of the TCH on C0, the MS will have difficulty training to the dummy burst frames and this would cause the bits to be received as low confidence. This would then give a performance rather more like that for random RF input and should then meet the 05.05 requirement.

6.4.2 Using an alternative training sequence out of the eight assigned

This option is similar in concept and performance to the one described in section 6.4.1. The advantage is that it may be usable in some networks where it is not easily possible to add a ninth training sequence. The following table gives a list of training sequence codes for the TCH and the preferred choice of training sequence code for the dummy burst.

Training sequence code for TCH	Training sequence code for dummy bursts on C0
0	2
1	5
2	0
3	4
4	5
5	2
6	3
7	5

6.4.3 Setting the stealing flag for the bits transmitted which are not intended to be part of the TCH

When bits are transmitted which are not intended for reception in the TCH path, such as dummy bursts and the half burst before and after a discrete, wanted frame, it would be possible to set the stealing flag for these bits and so bias the decision of the majority vote on stealing flags in favour of routing the frame as control information rather than speech information. The channel protection on the control channel is much greater and the chance of getting an undetected bad control channel frame is very low.

6.4.4 Sending partial SID frames on C0

It has been observed that improvements in the undetected bad frame rate are seen when the BTS sends partial SID frames on the otherwise unused TCH bursts on C0. This is because the high confidence bits are correctly coded for the relevant speech frame and the normal design of the MS receiver is expected to cope with such errors. This proposal works best for DCS 1800 because very early GSM models are not represented in DCS 1800.

6.5 Tested Combinations

This section identifies tests that have been performed and the results that have been obtained. The reporting of result is limited to acceptable or not acceptable and a brief additional comment is sometimes made. If the result is deemed to be acceptable, most products which suffer from the described problem have been improved to a point where extraneous noises are significantly reduced to virtually nothing and no product has got worse. No solution completely corrected all products but significant improvements have been achieved if the result is deemed acceptable.

6.5.1 "Normal" system

Test configuration:

Sent on C0:
Dummy bursts using training sequence from TCH.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Unacceptable; Several products exhibit frequent noises from undetected bad frames.

6.5.2 New training sequence

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.3 Alternative training sequence from the eight assigned

Test configuration:

Sent on C0:
Dummy bursts using alternative training sequence according to table in 6.4.2.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information not necessarily related to the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.4 Setting stealing flag for unintentionally transmitted bits

Test configuration:

Sent on C0:
Partial SID information from the two SID frames otherwise scheduled for transmission.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 1

Result:

Acceptable.

6.5.5 Setting stealing flag for unintentionally transmitted bits and modifying training sequence for Dummy Bursts

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Dummy burst mixed bits

Half burst stealing flags:
Set to 1

Result:

Acceptable; This configuration gave marginally the best performance of all tested.

6.5.6 Sending partial SID information on C0

Test configuration:

Sent on C0:
Part SID frames

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable for DCS 1800.

Annex A:
VoidAmendment Request 08.08 - 021 R4: Information on channel in use in HO REQUEST

NOTE: This Annex A reflects the Amendment Request 08.08 - 021 R4 which was approved by SMG#15 and is part of the TS GSM 08.08 version 4.9.0.

A.3.1.5.1.1 Generation of the HANDOVER REQUIRED message

Generation of the HANDOVER REQUIRED message can be for the following reasons:

- The BSS has detected that a radio reason exists for a handover to occur.
- The MSC has initiated a handover candidate enquiry procedure, and this MS is currently a candidate.
- A cell change is required at call setup due to congestion, e.g. directed retry.

The HANDOVER REQUIRED message contains the following information elements:

- Message Type;
- Cause;
- Cell Identifier List (preferred).

It should also contain the "Current channel" information element.

Sec. 3.2.1.9. gives coding details of the above message.

The "Cause" field indicates the reason for the HANDOVER REQUIRED message e.g. "uplink quality poor" or "response to MSC invocation" in the case of traffic reasons indicated by the MSC.

If present the "Response Request" Information Element indicates, that the BSS requires an indication if the HANDOVER REQUIRED message does not result in a HANDOVER COMMAND message.

If the BSS wants to change the CIC due to a channel change, the BSS sends a HANDOVER REQUIRED message with the cause "switch circuit pool" and the "circuit pool list" information element. The "circuit pool list" information element will allow the BSS to indicate to the MSC from which circuit pool or pools the new CIC should be chosen.

The "Cell Identifier List (preferred)" shall identify "n" preferred cells. The identified cells are given in order of preference. The algorithm by which the BSS produces this list is Operator dependent and is not addressed in this Technical Specification. The "n" number of preferred cells is a parameter set by O&M and shall range from 1 to 16. If "n" number of cells cannot be identified, then only as many as are available shall be encoded and sent (as specified in section 3.2.2.27).

It is mandatory for the BSS to be able to produce this "Cell Identifier List (preferred)". The sending of this list is controlled by the O&M parameter "n". It is mandatory for the MSC to be able to receive and interpret this Information Element.

The HANDOVER REQUIRED message shall be updated and repeated by the BSS with a periodicity of T7 until:

- A HANDOVER COMMAND message is received from the MSC, or;
- A RESET message is received, or;
- The reason for the original HANDOVER REQUIRED message disappears e.g. the MS transmission improves, or;
- All communication is lost with the MS as defined in Technical Specification GSM 04.08, and the transaction is abandoned, or;
- The transaction ends, e.g., call clearing.

A.3.1.5.2 Handover Resource allocation

This procedure has been defined to allow the MSC to request resources from a BSS in a manner similar to that used for the assignment case. However it does not result in the transmission of any messages over the radio interface, only in the reservation of the resource identified at the BSS, which awaits access of a MS on the reserved channel. These reserved resources are then indicated back to the MSC.

In order to support this procedure the MSC sets up a BSSAP SCCP connection to the BSS. This connection is then used to support all BSSAP messages related to this dedicated resource.

A.3.1.5.2.1 Operation of the procedure

The correct operation of the handover resource allocation procedure is as follows:

The MSC sends a HANDOVER REQUEST message to the new BSS (note 1) from which it requires radio resources. This message contains details of the resource that is required. If the requested resource is for speech or data it also indicates the terrestrial resource that shall be used between the MSC and the BSS. The type of channel required can be different from the type of channel in use, e.g. in the case of directed retry. The description of the resource can either specify it completely, or give the BSS some freedom in the selection. The message may also specify the channel in use.

On receipt of this message the new BSS shall choose a suitable idle radio resource.

The management of priority levels – relating to the Information Element "Priority" within the HANDOVER REQUEST message – is implementation dependent, under operator control.

If queueing is managed, new requests which cannot be served immediately are put in the queueing file according to the indicated priority levels.

(Refer to section 3.1.17 for Queuing Procedure)

As a further operator option, the preemption indicators may (alone or along with the priority levels) be used to manage the preemption process, which may lead to the forced release or forced handover of lower priority connections.

However, the preemption indicators (refer to section 3.2.2.18), if given in the HANDOVER REQUEST, shall be treated on a per connection basis as follows:

- the last received "Preemption Vulnerability" indicator and priority levels shall prevail.
- if the "Preemption Capability" bit is set to 1, then this allocation request can trigger the running of the preemption procedure.
- if the "Preemption Capability" bit is set to 0, then this allocation request cannot trigger the preemption procedure.
- if the "Preemption Vulnerability" bit is set to 1, then this connection is vulnerable and shall be included in the preemption process or procedure and as such may be subject to forced release or forced handover.
- if the "Preemption Vulnerability" bit is set to 0, then this connection is not vulnerable to preemption and shall not be included in the preemption process and as such may not be subject to forced release or forced handover.
- if no Priority Information Element has been received, both "Preemption Capability" and "Preemption Vulnerability" bits shall be regarded as set to 0.

If a radio resource is available then this will be reflected back to the MSC in a HANDOVER REQUEST ACKNOWLEDGE message. The HANDOVER REQUEST ACKNOWLEDGE message sent by the new BSS shall contain the radio interface message HANDOVER COMMAND within its "Layer 3 Information" Information Element. This "Layer 3 Information" (which is in fact the RR Layer 3 HANDOVER COMMAND) is transferred by the controlling MSC to the old BSS using the BSSMAP message HANDOVER COMMAND also within the Information Element "Layer 3 Information" of that BSSMAP message. The old BSS then sends to the MS over the radio interface the RR Layer 3 HANDOVER COMMAND message. Information about the appropriate new channels and a handover reference number chosen by the new BSS are contained in the HANDOVER COMMAND. Knowledge of the channel in use at the old BSS allows the new BSS to minimize the size of the HANDOVER COMMAND message (i.e. to decide whether the mode of the first channel IE need not be included in the HANDOVER COMMAND).

NOTE: The new BSS and the old BSS may be the same.

When several circuit pools are present on the BSS-MSC interface, the "circuit pool" information field shall be included in the HANDOVER REQUEST ACKNOWLEDGE. The "circuit pool" field will indicate to the MSC the circuit pool of the CIC given in the HANDOVER REQUEST message.

The sending of the HANDOVER REQUEST ACKNOWLEDGE by the new BSS to the MSC ends the Handover Resource Allocation procedure. The Handover Execution procedure can now proceed and this is given in section 3.1.5.3.

The new BSS shall then take all necessary action to allow the MS to access the radio resource that the new BSS has chosen, this is detailed in the GSM 05 series of Technical Specifications. If the radio resource is a traffic channel then the new BSS shall at this point switch it through to the terrestrial resource indicated in the HANDOVER REQUEST message, and the necessary transcoding/rate adaption/encryption equipment enabled as detailed in Technical Specification GSM 04.08.

The optimum procedure for switching through to the target cell at the MSC is not defined in these Technical Specifications.

A.3.2.1.8 HANDOVER REQUEST

This message is sent from the MSC to the BSS via the relevant SCCP connection to indicate that the MS is to be handed over to that BSS.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	MSC-BSS	M	1
Channel type	3.2.2.11	MSC-BSS	M	5
Encryption information	3.2.2.10	MSC-BSS	M	3-n
Classmark information 1 or	3.2.2.30	MSC-BSS	M#	2
Classmark information 2	3.2.2.19	MSC-BSS	M#	4-5
Cell identifier (serving)	3.2.2.17	MSC-BSS	M	5-10
Priority	3.2.2.18	MSC-BSS	O	3
Circuit identity code	3.2.2.2	MSC-BSS	O##	3
Downlink DTX flag	3.2.2.26	MSC-BSS	O*	2
Cell identifier (target)	3.2.2.17	MSC-BSS	M	3-10
Interference band to be used	3.2.2.21	MSC-BSS	O	2
Cause	3.2.2.5	MSC-BSS	O	3-4
Classmark information 3	3.2.2.20	MSC-BSS	O**	3-14
Current channel	3.2.2.49	MSC-BSS	O§	2

* This element may be included in the case of a speech TCH, and only in this case. If not included, this has no impact on the DTX function in the BSS.

** This element is included if the MSC has received such information.

One of these two elements is sent.

This element is included when the channel type Information Element indicates speech or data, and only in those cases.

§ This element is included at least when the message is sent as a reaction to reception of a HANDOVER REQUIRED message containing a "Current channel" information element. In this case it shall be equal to the received element.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength
- distance,
- better cell,
- response to MSC invocation
- O and M intervention,

- directed retry,
- switch circuit pool.

A.3.2.1.9 HANDOVER REQUIRED

This message is sent from the BSS to the MSC to indicate that for a given MS which already has a dedicated radio resource assigned, a handover is required for the reason given by the cause element.

The message is sent via the BSSAP-SCCP connection associated with the dedicated resource.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	BSS-MSC	M	1
Cause	3.2.2.5	BSS-MSC	M	3-4
Response request	3.2.2.28	BSS-MSC	O	1
Cell identifier list (preferred)	3.2.2.27	BSS-MSC	M	2n+3 to 7n+3
Circuit pool list	3.2.2.46	BSS-MSC	O*	V
Current channel	3.2.2.49	BSS-MSC	O**	2

* Shall be included when cause "switch circuit pool".

** This information element should always be included.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength,
- distance,
- better cell,
- response to MSC invocation,
- O&M intervention,
- directed retry,
- switch circuit pool.

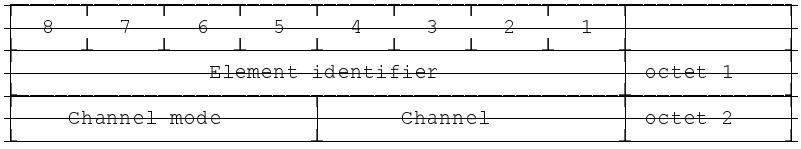
Element Identifier Coding	Element name	Reference
0000 0001	Circuit identity code	3.2.2.2.
0000 0010	Reserved	*
0000 0011	Resource available	3.2.2.4.
0000 0100	Cause	3.2.2.5.
0000 0101	Cell identifier	3.2.2.17.
0000 0110	Priority	3.2.2.18.
0000 0111	Layer 3 header information	3.2.2.9.
0000 1000	IMSI	3.2.2.6.
0000 1001	TMSI	3.2.2.7.
0000 1010	Encryption information	3.2.2.10.
0000 1011	Channel type	3.2.2.11.
0000 1100	Periodicity	3.2.2.12.
0000 1101	Extended resource indicator	3.2.2.13.
0000 1110	Number of MSs	3.2.2.8.
0000 1111	Reserved	*
0001 0000	Reserved	*
0001 0001	Reserved	*
0001 0010	Classmark information type 2	3.2.2.19.
0001 0011	Classmark information type 3	3.2.2.20.
0001 0100	Interference band to be used	3.2.2.21.
0001 0101	RR Cause	3.2.2.22.
0001 0110	Reserved	*
0001 0111	Layer 3 information	3.2.2.24.
0001 1000	DLCI	3.2.2.25.
0001 1001	Downlink DTX flag	3.2.2.26.
0001 1010	Cell identifier list	3.2.2.27.
0001 1011	Response request	3.2.2.28.
0001 1100	Resource indication method	3.2.2.29.
0001 1101	Classmark information type 1	3.2.2.30.
0001 1110	Circuit identity code list	3.2.2.31.
0001 1111	Diagnostic	3.2.2.32.
0010 0000	Layer 3 message contents	3.2.2.35.
0010 0001	Chosen channel	3.2.2.33.
0010 0010	Total resource accessible	3.2.2.14.
0010 0011	Cipher response mode	3.2.2.34.
0010 0100	Channel needed	3.2.2.36.
0010 0101	Trace type	3.2.2.37.
0010 0110	TriggerId	3.2.2.38.
0010 0111	Trace reference	3.2.2.39.
0010 1000	TransactionId	3.2.2.40.
0010 1001	Mobile identity	3.2.2.41.
0010 1010	OMCId	3.2.2.42.
0010 1011	Forward indicator	3.2.2.43.
0010 1100	Chosen encryption algorithm	3.2.2.44.
0010 1101	Circuit pool	3.2.2.45.
0010 1110	Circuit pool list	3.2.2.46.
0010 1111	Time indication	3.2.2.47.
0011 0000	Resource situation	3.2.2.48.
0011 0001	Current channel	3.2.2.49.

* Information Element codes marked as "reserved are reserved for use by previous versions of this interface specification.

A.3.2.2.49 CURRENT CHANNEL

This Information Element contains a description of the channel allocated to the MS.

It is coded as follows:



~~The channel mode field is coded as follows:~~

~~Bit 8765~~
~~— 0000 signalling only~~
~~— 0001 speech (full rate or half rate)~~
~~— 0011 data, 12.0 kbit/s radio interface rate~~
~~— 0100 data, 6.0 kbit/s radio interface rate~~
~~— 0101 data, 3.6 kbit/s radio interface rate~~

~~All other values are reserved.~~

~~The channel field is coded as follows:~~

~~Bit 4321~~
~~— 0001 SDCCH~~
~~— 1000 Full rate TCH~~
~~— 1001 Half rate TCH~~

~~All other values are reserved.~~

Annex B (informative): Change Request History

SPEC	SMG#	CR	PHS	VERS	NEW_V	SUBJECT
09.94	s30	A008	2	4.4.0	4.5.0	Change of Title, Scope and References Clauses 1 to 5)
09.94	s30	A009	2	4.4.0	4.5.0	Frequency Hopping using ARFCN=0

History

Document history		
Edition 1	August 1995	Publication as ETR 200
Edition 2	November 1995	Publication as ETR 200
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V4.5.0	November 1999	Publication

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Tdoc N1-021494
Revision of N1-021376

CR-Form-v5

CHANGE REQUEST

⌘ **09.94** **CR** **A012** ⌘ **rev** **2** ⌘ Current version: **4.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	QoS IE length
Source:	⌘	Nokia
Work item code:	⌘	TEI
Date:	⌘	6.5.2002
Category:	⌘	**A**
Release:	⌘	R97

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	One R97 ME implementation is known to handle QoS as fixed length IE and therefore it can not access R99 and later GPRS networks. It was not seen feasible in CN1 #23 to change the core specification due to this and therefore this specific mobile station problem needs to be described in the appropriate TR to document a workaround solution.
Summary of change:	⌘	SGSN can provide a workaround solution to overcome the problem by sending only the first 5 QoS octets to pre-R99 mobile stations. The workaround is defined in the latest version of the TR, the older versions only give a pointer to the currently latest version.
Consequences if not approved:	⌘	Lots of subscribers are not able to use GPRS services when 3G services are rolled out in GSM networks

Clauses affected:	⌘	2, 3, 4, 5, 6, and Annex A
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	Only one version of 09.94 did exist and this GSM phase 2 covered all releases. The intention is to keep just one version of the document but this should always be the latest one. The principle of creating corresponding RAN document and the scope of the document were agreed in RAN #14, tdoc RP-010928.

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

ETSI TR 101 646 V4.5.0 (1999-11)

Technical Report

Digital cellular telecommunications system (Phase 2 & Phase 2+); Recommended infrastructure measures to overcome specific Mobile Station (MS) faults (GSM 09.94 version 4.5.0)

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Foreword

This Technical Report (TR) has been produced by the Special Mobile Group (SMG).

The present document supersedes ETR 200 version 4.4.0.

The contents of the present document is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will be re-released with an identifying change of release date and an increase in version number as follows:

Version 4.x.y

where:

- 4 indicates GSM Phase 2.
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document clarifies recommended measures which may be adopted by the GSM infrastructure to enable interworking to be obtained between the GSM infrastructure and various Mobile Station (MS) implementations of the GSM Phase 1 and Phase 2/2+ standard. The objective is to obtain compatibility without changing the consolidated set of Phase 1 and Phase 2/2+ specifications. The present document describes the recommended changes to the infrastructure to cater for specific faults within some MSs.

The lifetime of the herein described measures together with their potential impact on optimal network performance is out of the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] Void.~~GSM 01.04: "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".~~

[2] Void.~~GSM 04.08 Phase 1 (I-ETS 300 022-1): "Digital cellular telecommunications system (Phase 1); Mobile radio interface layer 3 specification Part 1: Generic".~~

[3] Void.~~GSM 04.08 (ETS 300 557): "European digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".~~

[4] Void.~~GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~

[5] Void.~~GSM 05.05 (ETS 300 577): "Digital cellular telecommunication system (Phase 2); Radio Performance Aspects.~~

[6] Void.~~GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio Performance Aspects.~~

[7] 3GPP TR 29.994: Digital cellular telecommunications system; Recommended infrastructure measures to overcome specific Mobile Station (MS) faults.

3 Abbreviations

~~Abbreviations used in the present document are listed in GSM 01.04 [1]~~Void.

4 General

The recommendations of the present document are provided in the latest major version of 3GPP TR 29.994 [7].~~In the implementation of the standard it has been found that some aspects of the specifications have been mis-interpreted by~~

some MS manufacturers. These MSs require specific implementations of the Phase 1 standard in the infrastructure, to provide completely compatible interworking.

It has been assumed throughout this TR that Phase 2 and later infrastructure will interwork with Phase 1 MSs in the same way as Phase 1 infrastructure.

The remainder of this ETR describes how to overcome the possible impacts of the above factors. Descriptions given are limited to specific implementations which are permissible for the Phase of the infrastructure.

5 Specific implementation on the radio interfaceVoid

This clause deals with the choice of specific infrastructure implementation options of the protocols at the radio interface. The protocols concerned are defined in GSM 04.08 Phase 1 [2] Phase2 [3] and Phase 2+ [4].

5.1 Handovers and "Synchronisation Indication"

5.1.1 Justification

In the HANDOVER COMMAND message there is a mandatory part consisting of nine octets followed by several optional information elements. The first optional information element is Synchronisation Indication which is a type 1 Information Element (IE) and as such is coded, with IE Identifier (IEI), on one octet. Other optional IE follow the Synchronisation Indication IE and are used to:

- indicate the frequency hopping sequence to use on the new channel;
- indicate the channel mode for the new channel;
- indicate a start time.

Some types of MS do not correctly decode these following information elements if the Synchronisation Indication information element is omitted.

5.1.2 Solution

To ensure correct operation the infrastructure should always send the Synchronisation Indication IE to a Phase 1 MS.

NOTE: In a few cases this will force an extra layer 2 segment to be sent to the MS.

5.2 "Directed Retry" type Handovers

5.2.1 Justification

In the HANDOVER COMMAND message there is an optional Channel Mode Information Element. When this information element is included in the handover command the MS should go to the new channel mode when it hands over to the new channel. This information element may be used for "directed retry" type handovers where a cell has an MS on a control channel but has no available traffic channel for the MS to use. The network may then choose to handover the MS to a new cell with traffic channel (TCH) capacity and change the channel mode at the same time.

Some MSs appear to accept the handover command, from Stand-alone Dedicated Control Channel (SDCCH) to TCH with speech mode, and make the required channel and mode change but do not through connect the speech path.

5.2.2 Solution

To ensure correct operation, of these MSs, the infrastructure should always initiate a channel mode change procedure according to TS GSM 04.08 (Phase 1) (I-ETS 300 022-1) [2] clause 3.4.6 once the MS has arrived at the new channel following a handover of a Phase 1 MS involving a channel mode change to full rate speech.

The additional channel mode change procedure shall only be performed for a directed retry handover to a full rate speech channel, and not for a data channel. First this will save performance in these cases, and secondly some MS's will release the call with this additional and unnecessary channel mode change procedure in case of fax or data calls.

For internal intra-Base Station System (BSS) handovers, this decision to initiate channel mode modify is taken by the BSS concerned. For external intra-BSS and inter-BSS handovers, the new BSS must know that there has been a change of mode from the previous BSS and that therefore a channel mode change procedure must be executed. The communication of this information is achieved by using the "current channel" element in the HANDOVER REQUEST and HANDOVER REQUIRED message as described in the Annex A.

In the case of external handover, the following will ensure correct operation with mobiles suffering from fault 5.2.1:

i) The change described in Annex A shall be implemented by the MSC and BSS concerned.

ii) The new BSS, after receiving a HANDOVER REQUEST containing a current channel IE indicating "signalling only", and a channel type indicating full rate speech, shall behave as specified in TS GSM 08.08 and additionally, upon reception of the HANDOVER COMPLETE message, initiate a channel mode change procedure according to TS GSM 04.08 with the new mode indicating speech.

If the new BSS receives a HANDOVER REQUEST without the current channel IE but containing a cause value "directed retry", and a channel type indicating full rate speech, it shall also behave as ii) above.

NOTE: The performance of MSs not experiencing this problem has been checked for a sizeable subset of the MSs available in Phase 1, but it has not been possible to check all versions of all MSs.

5.3 Cell broadcast and frequency hopping

5.3.1 Justification

In the SYSTEM INFORMATION TYPE 4 message there is an optional Information Element "CBCH Channel Description" used when a cell broadcast channel is configured in the network.

Some Types of GSM 900 MSs may not obtain service whilst within reception range of a cell from any network having the CBCH configured with frequency hopping: i.e. the Hopping channel bit set to 1 in the "CBCH Channel description" information element.

5.3.2 Solution

To enable operation from the affected MS, the infrastructure could configure the CBCH on a non hopping channel:

- In combined type of configuration: the CBCH would be distributed on the SDCCH/4 with BCCH
- In non-combined type of configuration, two types of solution are considered:
  - Type 1 CBCH distributed on a non hopping SDCCH broadcasted on TSx of C0 (x=1,2,3)
  - Type 2 CBCH distributed on a non hopping SDCCH broadcasted on TS0 of Cx (x≠0)

5.4 Handling of Phase 2 and Phase2+ BCCH Messages

5.4.1 Justification

Some types of Phase1 GSM 900 MSs could fail to offer full services whilst System Information messages other than those specified in GSM 900 Phase1 are broadcast with a L2 Pseudo Length value greater than 1.

5.4.2 Solution

In order to provide service to these existing GSM 900 MS and not disturb Phase2 MS, the following restrictions and changes should be implemented in the P-GSM 900 band of the network.

For System Information 2ter, the value 0 of the L2 Pseudo Length shall be used instead of 18.

The System Information 2bis shall not be used in the P-GSM 900 band of the network.

Therefore, the EXT-IND bit in System Information 2 in the P-GSM 900 Band of the network shall not be set to 1.

5.5 Handling of Phase 2 and Phase2+ SACCH Messages

5.5.1 Justification

Some types of Phase1 MSs may experience performance degradation if the network sends System Information Messages other than those specified in Phase1.

5.5.2 Solution

In order not to degrade the performance of these Phase1 mobile stations it is recommended:

- any new messages that are not defined in Phase1 shall not be sent to a Phase1 MS, e.g System Information 5bis and 5ter to a Phase1 P-GSM 900 mobile station and System Information 5ter to a Phase1 DCS 1800 mobile station.

5.6 Handling of assignment message using Mobile Allocation IE including ARFCN=0

5.6.1 Justification

Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network sends an assigning message (Immediate Assignment, Assignment Command or Handover Command) that uses the Mobile Allocation IE to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.6.2 Solution

To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence. When assigning a channel at RR connection establishment (Immediate Assignment), this solution should be used.

When a channel resource is assigned, using either the Assignment Command or the Handover Command message, the infrastructure may use the Frequency List or the Frequency Short List IEs in the assigning message to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.7 Hopping sequence generation including ARFCN=0

5.7.1 Justification

Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network assigns an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.7.2 Solution

To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence.

6 VoidUse of VAD/DTX in conjunction with frequency hopping for a speech call

6.1 Scope

The chapter six of this Technical Report is to identify limitations in the specification for phase 1 reflected in performance degradation in phase 1 terminal equipment. This report identifies possible ways of improving the service offered to subscribers using phase 1 terminals whilst using the two features - downlink DTX and frequency hopping at the same time.

6.2 General

The specification of acoustic performance of the MS when downlink DTX is implemented is in GSM 05.05 which restricts the MS performance to 1 undetected bad frame in 10s when in the presence of random RF. In reality the MS does not experience random RF exclusively when downlink DTX is implemented.

There is a SIlence Descriptor (SID) frame sent on eight bursts every 104 bursts. Due to the interleaving scheme, half of the bits of the frame preceding the SID and half of the bits of the frame following the SID are sent and there is no specific requirement covering what is sent for these bits but in most cases it is every other bit of a correctly coded frame. The MS receives these bits

In addition, when the ARFCN used is C0, dummy bursts are sent when there is neither speech nor signalling to be transmitted.

Finally, when frequency hopping is used as well as downlink DTX, the MS may receive random RF on some TDMA frames and dummy bursts on others (C0).

It is possible for the MS to receive combinations of transmitted bits at high confidence and random RF at low confidence. In some cases the MS can then decode the frame as good when in fact it was never intended to have been transmitted and the resultant bad frame can give a very annoying acoustic effect known as banjo noise. The occurance of these noises, even if no more frequent than one in 10s, is worse than one would expect from a high quality cellular system.

The three following sections refer to ways of improving the system performance for MS approved according to the existing phase 1 specification. Section 6.3 identifies some "normal" operation configurations which would improve undetected bad frame performance for MS's with the above fault (banjo noise), section 6.4 describes aspects for possible changed network implementation, section 6.5 relates the results of tests performed using combinations of the implementations described in section 6.4 and whether that combination was effective or not.

6.3 Implementation options to reduce the occurance of undetected bad frames by utilising normal system features

This section deals with a variety of options to improve the system performance which are implementable by normal system operational choices. These options typically improve matters in specific configurations and are not universal solutions for all configurations. It may be possible that some networks do not permit such configuration.

6.3.1 Number of frequency hopping channels

The number of undetected bad frames is related to the probability of getting sufficient dummy bursts transmitted to make a false good frame decision. The number of dummy bursts received depends on the number of ARFCN in the hopping list. Hence frequency hopping on 3 ARFCN gives better audio performance than frequency hopping on 2, likewise hopping on 4 ARFCN gives better performance than hopping on 3.

In tests of the comparison between hopping on 2 ARFCN and hopping on 3, some MS have been found to improve to approximately one tenth of the occurance of bad frames, while others have improved from a slightly annoying level when hopping on 2 ARFCN, to give no audible disruption when hopping on 3. Not all MS have been tested and it is believed that the improvement for some MS may be less noticeable.

This solution is obviously not trivial to implement in a frequency plan, but could also be used to enable frequency hopping on cells which naturally have 3 or more ARFCN operational whilst selecting a solution for other parts of the network and operational scenarios.

6.3.2 Frequency hopping type

When utilising pseudo-random frequency hopping, it is possible to get more dummy bursts in a speech frame than when utilising cyclic frequency hopping. As an alternative to random frequency hopping, cyclic hopping may be used. It will minimise the banjo noise effect experienced by the faulty mobiles. This will however be done at the expense of a possible degradation of performance during speech activity period for all mobiles due to the absence of interferer diversity.

In tests of the comparison between pseudo-random frequency hopping and cyclic frequency hopping, some phones were found to improve with the use of cyclic hopping to approximately one third of the occurance of bad frames when using pseudo-random hopping, while others have improved from a slightly annoying level to give no audible disruption. Not all phones have been tested for this.

6.3.3 Continuous SID frames on C0

At some times, a network implementing downlink DTX may hold a call on C0. In this case it would be possible for the network to send dummy bursts when it has nothing else to send. This is likely to cause a high level of unwanted noises for some MS. An alternative would be to send continuous SID frames in which case there should be no undesired effects.

6.4 Implementation options to reduce the occurance of undetected bad frames by changing normal system operation

This section deals with implementation options which improve the audio quality of the faulty mobiles, suffering from banjo noise, by making changes to the network equipment. The solutions give varying performance improvements but not all solutions would be possible on all networks.

6.4.1 Changing the training sequence of the dummy burst to a new (ninth) training sequence

If a different training sequence code is used for all dummy bursts forming part of the TCH on C0, the MS will have difficulty training to the dummy burst frames and this would cause the bits to be received as low confidence. This would then give a performance rather more like that for random RF input and should then meet the 05.05 requirement.

6.4.2 Using an alternative training sequence out of the eight assigned

This option is similar in concept and performance to the one described in section 6.4.1. The advantage is that it may be usable in some networks where it is not easily possible to add a ninth training sequence. The following table gives a list of training sequence codes for the TCH and the preferred choice of training sequence code for the dummy burst.

Training sequence code for TCH	Training sequence code for dummy bursts on C0
0	2
1	5
2	0
3	4
4	5
5	2
6	3
7	5

6.4.3 Setting the stealing flag for the bits transmitted which are not intended to be part of the TCH

When bits are transmitted which are not intended for reception in the TCH path, such as dummy bursts and the half burst before and after a discrete, wanted frame, it would be possible to set the stealing flag for these bits and so bias the decision of the majority vote on stealing flags in favour of routing the frame as control information rather than speech information. The channel protection on the control channel is much greater and the chance of getting an undetected bad control channel frame is very low.

6.4.4 Sending partial SID frames on C0

It has been observed that improvements in the undetected bad frame rate are seen when the BTS sends partial SID frames on the otherwise unused TCH bursts on C0. This is because the high confidence bits are correctly coded for the relevant speech frame and the normal design of the MS receiver is expected to cope with such errors. This proposal works best for DCS 1800 because very early GSM models are not represented in DCS 1800.

6.5 Tested Combinations

This section identifies tests that have been performed and the results that have been obtained. The reporting of result is limited to acceptable or not acceptable and a brief additional comment is sometimes made. If the result is deemed to be acceptable, most products which suffer from the described problem have been improved to a point where extraneous noises are significantly reduced to virtually nothing and no product has got worse. No solution completely corrected all products but significant improvements have been achieved if the result is deemed acceptable.

6.5.1 "Normal" system

Test configuration:

Sent on C0:
Dummy bursts using training sequence from TCH.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Unacceptable; Several products exhibit frequent noises from undetected bad frames.

6.5.2 New training sequence

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.3 Alternative training sequence from the eight assigned

Test configuration:

Sent on C0:
Dummy bursts using alternative training sequence according to table in 6.4.2.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information not necessarily related to the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.4 Setting stealing flag for unintentionally transmitted bits

Test configuration:

Sent on C0:
Partial SID information from the two SID frames otherwise scheduled for transmission.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 1

Result:

Acceptable.

6.5.5 Setting stealing flag for unintentionally transmitted bits and modifying training sequence for Dummy Bursts

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Dummy burst mixed bits

Half burst stealing flags:
Set to 1

Result:

Acceptable; This configuration gave marginally the best performance of all tested.

6.5.6 Sending partial SID information on C0

Test configuration:

Sent on C0:
Part SID frames

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable for DCS 1800.

Annex A:
VoidAmendment Request 08.08 - 021 R4: Information on channel in use in HO REQUEST

NOTE: This Annex A reflects the Amendment Request 08.08 - 021 R4 which was approved by SMG#15 and is part of the TS GSM 08.08 version 4.9.0.

A.3.1.5.1.1 Generation of the HANDOVER REQUIRED message

Generation of the HANDOVER REQUIRED message can be for the following reasons:

- The BSS has detected that a radio reason exists for a handover to occur.
- The MSC has initiated a handover candidate enquiry procedure, and this MS is currently a candidate.
- A cell change is required at call setup due to congestion, e.g. directed retry.

The HANDOVER REQUIRED message contains the following information elements:

- Message Type;
- Cause;
- Cell Identifier List (preferred).

It should also contain the "Current channel" information element.

Sec. 3.2.1.9. gives coding details of the above message.

The "Cause" field indicates the reason for the HANDOVER REQUIRED message e.g. "uplink quality poor" or "response to MSC invocation" in the case of traffic reasons indicated by the MSC.

If present the "Response Request" Information Element indicates, that the BSS requires an indication if the HANDOVER REQUIRED message does not result in a HANDOVER COMMAND message.

If the BSS wants to change the CIC due to a channel change, the BSS sends a HANDOVER REQUIRED message with the cause "switch circuit pool" and the "circuit pool list" information element. The "circuit pool list" information element will allow the BSS to indicate to the MSC from which circuit pool or pools the new CIC should be chosen.

The "Cell Identifier List (preferred)" shall identify "n" preferred cells. The identified cells are given in order of preference. The algorithm by which the BSS produces this list is Operator dependent and is not addressed in this Technical Specification. The "n" number of preferred cells is a parameter set by O&M and shall range from 1 to 16. If "n" number of cells cannot be identified, then only as many as are available shall be encoded and sent (as specified in section 3.2.2.27).

It is mandatory for the BSS to be able to produce this "Cell Identifier List (preferred)". The sending of this list is controlled by the O&M parameter "n". It is mandatory for the MSC to be able to receive and interpret this Information Element.

The HANDOVER REQUIRED message shall be updated and repeated by the BSS with a periodicity of T7 until:

- A HANDOVER COMMAND message is received from the MSC, or;
- A RESET message is received, or;
- The reason for the original HANDOVER REQUIRED message disappears e.g. the MS transmission improves, or;
- All communication is lost with the MS as defined in Technical Specification GSM 04.08, and the transaction is abandoned, or;
- The transaction ends, e.g., call clearing.

A.3.1.5.2 Handover Resource allocation

This procedure has been defined to allow the MSC to request resources from a BSS in a manner similar to that used for the assignment case. However it does not result in the transmission of any messages over the radio interface, only in the reservation of the resource identified at the BSS, which awaits access of a MS on the reserved channel. These reserved resources are then indicated back to the MSC.

In order to support this procedure the MSC sets up a BSSAP SCCP connection to the BSS. This connection is then used to support all BSSAP messages related to this dedicated resource.

A.3.1.5.2.1 Operation of the procedure

The correct operation of the handover resource allocation procedure is as follows:

The MSC sends a HANDOVER REQUEST message to the new BSS (note 1) from which it requires radio resources. This message contains details of the resource that is required. If the requested resource is for speech or data it also indicates the terrestrial resource that shall be used between the MSC and the BSS. The type of channel required can be different from the type of channel in use, e.g. in the case of directed retry. The description of the resource can either specify it completely, or give the BSS some freedom in the selection. The message may also specify the channel in use.

On receipt of this message the new BSS shall choose a suitable idle radio resource.

The management of priority levels – relating to the Information Element "Priority" within the HANDOVER REQUEST message – is implementation dependent, under operator control.

If queueing is managed, new requests which cannot be served immediately are put in the queueing file according to the indicated priority levels.

(Refer to section 3.1.17 for Queuing Procedure)

As a further operator option, the preemption indicators may (alone or along with the priority levels) be used to manage the preemption process, which may lead to the forced release or forced handover of lower priority connections.

However, the preemption indicators (refer to section 3.2.2.18), if given in the HANDOVER REQUEST, shall be treated on a per connection basis as follows:

- the last received "Preemption Vulnerability" indicator and priority levels shall prevail.
- if the "Preemption Capability" bit is set to 1, then this allocation request can trigger the running of the preemption procedure.
- if the "Preemption Capability" bit is set to 0, then this allocation request cannot trigger the preemption procedure.
- if the "Preemption Vulnerability" bit is set to 1, then this connection is vulnerable and shall be included in the preemption process or procedure and as such may be subject to forced release or forced handover.
- if the "Preemption Vulnerability" bit is set to 0, then this connection is not vulnerable to preemption and shall not be included in the preemption process and as such may not be subject to forced release or forced handover.
- if no Priority Information Element has been received, both "Preemption Capability" and "Preemption Vulnerability" bits shall be regarded as set to 0.

If a radio resource is available then this will be reflected back to the MSC in a HANDOVER REQUEST ACKNOWLEDGE message. The HANDOVER REQUEST ACKNOWLEDGE message sent by the new BSS shall contain the radio interface message HANDOVER COMMAND within its "Layer 3 Information" Information Element. This "Layer 3 Information" (which is in fact the RR Layer 3 HANDOVER COMMAND) is transferred by the controlling MSC to the old BSS using the BSSMAP message HANDOVER COMMAND also within the Information Element "Layer 3 Information" of that BSSMAP message. The old BSS then sends to the MS over the radio interface the RR Layer 3 HANDOVER COMMAND message. Information about the appropriate new channels and a handover reference number chosen by the new BSS are contained in the HANDOVER COMMAND. Knowledge of the channel in use at the old BSS allows the new BSS to minimize the size of the HANDOVER COMMAND message (i.e. to decide whether the mode of the first channel IE need not be included in the HANDOVER COMMAND).

NOTE: The new BSS and the old BSS may be the same.

When several circuit pools are present on the BSS-MSC interface, the "circuit pool" information field shall be included in the HANDOVER REQUEST ACKNOWLEDGE. The "circuit pool" field will indicate to the MSC the circuit pool of the CIC given in the HANDOVER REQUEST message.

The sending of the HANDOVER REQUEST ACKNOWLEDGE by the new BSS to the MSC ends the Handover Resource Allocation procedure. The Handover Execution procedure can now proceed and this is given in section 3.1.5.3.

The new BSS shall then take all necessary action to allow the MS to access the radio resource that the new BSS has chosen, this is detailed in the GSM 05 series of Technical Specifications. If the radio resource is a traffic channel then the new BSS shall at this point switch it through to the terrestrial resource indicated in the HANDOVER REQUEST message, and the necessary transcoding/rate adaption/encryption equipment enabled as detailed in Technical Specification GSM 04.08.

The optimum procedure for switching through to the target cell at the MSC is not defined in these Technical Specifications.

A.3.2.1.8 HANDOVER REQUEST

This message is sent from the MSC to the BSS via the relevant SCCP connection to indicate that the MS is to be handed over to that BSS.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	MSC-BSS	M	1
Channel type	3.2.2.11	MSC-BSS	M	5
Encryption information	3.2.2.10	MSC-BSS	M	3-n
Classmark information 1 or	3.2.2.30	MSC-BSS	M#	2
Classmark information 2	3.2.2.19	MSC-BSS	M#	4-5
Cell identifier (serving)	3.2.2.17	MSC-BSS	M	5-10
Priority	3.2.2.18	MSC-BSS	O	3
Circuit identity code	3.2.2.2	MSC-BSS	O##	3
Downlink DTX flag	3.2.2.26	MSC-BSS	O*	2
Cell identifier (target)	3.2.2.17	MSC-BSS	M	3-10
Interference band to be used	3.2.2.21	MSC-BSS	O	2
Cause	3.2.2.5	MSC-BSS	O	3-4
Classmark information 3	3.2.2.20	MSC-BSS	O**	3-14
Current channel	3.2.2.49	MSC-BSS	O§	2

* This element may be included in the case of a speech TCH, and only in this case. If not included, this has no impact on the DTX function in the BSS.

** This element is included if the MSC has received such information.

One of these two elements is sent.

This element is included when the channel type Information Element indicates speech or data, and only in those cases.

§ This element is included at least when the message is sent as a reaction to reception of a HANDOVER REQUIRED message containing a "Current channel" information element. In this case it shall be equal to the received element.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength
- distance,
- better cell,
- response to MSC invocation
- O and M intervention,

- directed retry,
- switch circuit pool.

A.3.2.1.9 HANDOVER REQUIRED

This message is sent from the BSS to the MSC to indicate that for a given MS which already has a dedicated radio resource assigned, a handover is required for the reason given by the cause element.

The message is sent via the BSSAP-SCCP connection associated with the dedicated resource.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	BSS-MSC	M	1
Cause	3.2.2.5	BSS-MSC	M	3-4
Response request	3.2.2.28	BSS-MSC	O	1
Cell identifier list (preferred)	3.2.2.27	BSS-MSC	M	2n+3 to 7n+3
Circuit pool list	3.2.2.46	BSS-MSC	O*	V
Current channel	3.2.2.49	BSS-MSC	O**	2

* Shall be included when cause "switch circuit pool".

** This information element should always be included.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength,
- distance,
- better cell,
- response to MSC invocation,
- O&M intervention,
- directed retry,
- switch circuit pool.

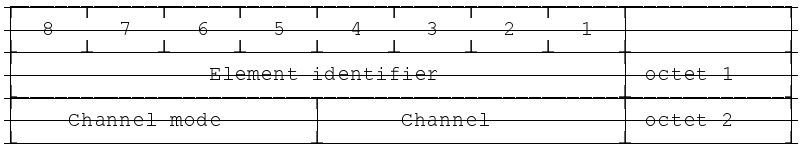
Element Identifier Coding	Element name	Reference
0000 0001	Circuit identity code	3.2.2.2.
0000 0010	Reserved	*
0000 0011	Resource available	3.2.2.4.
0000 0100	Cause	3.2.2.5.
0000 0101	Cell identifier	3.2.2.17.
0000 0110	Priority	3.2.2.18.
0000 0111	Layer 3 header information	3.2.2.9.
0000 1000	IMSI	3.2.2.6.
0000 1001	TMSI	3.2.2.7.
0000 1010	Encryption information	3.2.2.10.
0000 1011	Channel type	3.2.2.11.
0000 1100	Periodicity	3.2.2.12.
0000 1101	Extended resource indicator	3.2.2.13.
0000 1110	Number of MSs	3.2.2.8.
0000 1111	Reserved	*
0001 0000	Reserved	*
0001 0001	Reserved	*
0001 0010	Classmark information type 2	3.2.2.19.
0001 0011	Classmark information type 3	3.2.2.20.
0001 0100	Interference band to be used	3.2.2.21.
0001 0101	RR Cause	3.2.2.22.
0001 0110	Reserved	*
0001 0111	Layer 3 information	3.2.2.24.
0001 1000	DLCI	3.2.2.25.
0001 1001	Downlink DTX flag	3.2.2.26.
0001 1010	Cell identifier list	3.2.2.27.
0001 1011	Response request	3.2.2.28.
0001 1100	Resource indication method	3.2.2.29.
0001 1101	Classmark information type 1	3.2.2.30.
0001 1110	Circuit identity code list	3.2.2.31.
0001 1111	Diagnostic	3.2.2.32.
0010 0000	Layer 3 message contents	3.2.2.35.
0010 0001	Chosen channel	3.2.2.33.
0010 0010	Total resource accessible	3.2.2.14.
0010 0011	Cipher response mode	3.2.2.34.
0010 0100	Channel needed	3.2.2.36.
0010 0101	Trace type	3.2.2.37.
0010 0110	TriggerId	3.2.2.38.
0010 0111	Trace reference	3.2.2.39.
0010 1000	TransactionId	3.2.2.40.
0010 1001	Mobile identity	3.2.2.41.
0010 1010	OMCId	3.2.2.42.
0010 1011	Forward indicator	3.2.2.43.
0010 1100	Chosen encryption algorithm	3.2.2.44.
0010 1101	Circuit pool	3.2.2.45.
0010 1110	Circuit pool list	3.2.2.46.
0010 1111	Time indication	3.2.2.47.
0011 0000	Resource situation	3.2.2.48.
0011 0001	Current channel	3.2.2.49.

* Information Element codes marked as "reserved are reserved for use by previous versions of this interface specification.

A.3.2.2.49 CURRENT CHANNEL

This Information Element contains a description of the channel allocated to the MS.

It is coded as follows:



~~The channel mode field is coded as follows:~~

~~Bit 8765~~
~~— 0000 signalling only~~
~~— 0001 speech (full rate or half rate)~~
~~— 0011 data, 12.0 kbit/s radio interface rate~~
~~— 0100 data, 6.0 kbit/s radio interface rate~~
~~— 0101 data, 3.6 kbit/s radio interface rate~~

~~All other values are reserved.~~

~~The channel field is coded as follows:~~

~~Bit 4321~~
~~— 0001 SDCCH~~
~~— 1000 Full rate TCH~~
~~— 1001 Half rate TCH~~

~~All other values are reserved.~~

Annex B (informative): Change Request History

SPEC	SMG#	CR	PHS	VERS	NEW_V	SUBJECT
09.94	s30	A008	2	4.4.0	4.5.0	Change of Title, Scope and References Clauses 1 to 5)
09.94	s30	A009	2	4.4.0	4.5.0	Frequency Hopping using ARFCN=0

History

Document history		
Edition 1	August 1995	Publication as ETR 200
Edition 2	November 1995	Publication as ETR 200
Edition 3	September 1996	Publication as ETR 200
V4.5.0	November 1999	Publication

3GPP TSG-CN1 Meeting #24
Budapest, Hungary, 13. – 17. May 2002

Tdoc N1-021495
Revision of N1-021377

CR-Form-v5

CHANGE REQUEST

⌘ **09.94** **CR** **A013** ⌘ **rev** **2** ⌘ Current version: **4.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	QoS IE length
Source:	⌘	Nokia
Work item code:	⌘	TEI
Date:	⌘	6.5.2002
Category:	⌘	**A**
Release:	⌘	R98

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	One R97 ME implementation is known to handle QoS as fixed length IE and therefore it can not access R99 and later GPRS networks. It was not seen feasible in CN1 #23 to change the core specification due to this and therefore this specific mobile station problem needs to be described in the appropriate TR to document a workaround solution.
Summary of change:	⌘	SGSN can provide a workaround solution to overcome the problem by sending only the first 5 QoS octets to pre-R99 mobile stations. The workaround is defined in the latest version of the TR, the older versions only give a pointer to the currently latest version.
Consequences if not approved:	⌘	Lots of subscribers are not able to use GPRS services when 3G services are rolled out in GSM networks

Clauses affected:	⌘	2, 3, 4, 5, 6, and Annex A
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	Only one version of 09.94 did exist and this GSM phase 2 covered all releases. The intention is to keep just one version of the document but this should always be the latest one. The principle of creating corresponding RAN document and the scope of the document were agreed in RAN #14, tdoc RP-010928.

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

ETSI TR 101 646 V4.5.0 (1999-11)

Technical Report

Digital cellular telecommunications system (Phase 2 & Phase 2+); Recommended infrastructure measures to overcome specific Mobile Station (MS) faults (GSM 09.94 version 4.5.0)

Reference
RTR/SMG-000994PR4 (f8o021o4.PDF)

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Foreword

This Technical Report (TR) has been produced by the Special Mobile Group (SMG).

The present document supersedes ETR 200 version 4.4.0.

The contents of the present document is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will be re-released with an identifying change of release date and an increase in version number as follows:

Version 4.x.y

where:

- 4 indicates GSM Phase 2.
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document clarifies recommended measures which may be adopted by the GSM infrastructure to enable interworking to be obtained between the GSM infrastructure and various Mobile Station (MS) implementations of the GSM Phase 1 and Phase 2/2+ standard. The objective is to obtain compatibility without changing the consolidated set of Phase 1 and Phase 2/2+ specifications. The present document describes the recommended changes to the infrastructure to cater for specific faults within some MSs.

The lifetime of the herein described measures together with their potential impact on optimal network performance is out of the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] Void.~~GSM 01.04: "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".~~

[2] Void.~~GSM 04.08 Phase 1 (I-ETS 300 022-1): "Digital cellular telecommunications system (Phase 1); Mobile radio interface layer 3 specification Part 1: Generic".~~

[3] Void.~~GSM 04.08 (ETS 300 557): "European digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".~~

[4] Void.~~GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~

[5] Void.~~GSM 05.05 (ETS 300 577): "Digital cellular telecommunication system (Phase 2); Radio Performance Aspects.~~

[6] Void.~~GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio Performance Aspects.~~

[7] 3GPP TR 29.994: Digital cellular telecommunications system; Recommended infrastructure measures to overcome specific Mobile Station (MS) faults.

3 Abbreviations

~~Abbreviations used in the present document are listed in GSM 01.04 [1]~~Void.

4 General

The recommendations of the present document are provided in the latest major version of 3GPP TR 29.994 [7].~~In the implementation of the standard it has been found that some aspects of the specifications have been mis-interpreted by~~

some MS manufacturers. These MSs require specific implementations of the Phase 1 standard in the infrastructure, to provide completely compatible interworking.

It has been assumed throughout this TR that Phase 2 and later infrastructure will interwork with Phase 1 MSs in the same way as Phase 1 infrastructure.

The remainder of this ETR describes how to overcome the possible impacts of the above factors. Descriptions given are limited to specific implementations which are permissible for the Phase of the infrastructure.

5 Specific implementation on the radio interfaceVoid

This clause deals with the choice of specific infrastructure implementation options of the protocols at the radio interface. The protocols concerned are defined in GSM 04.08 Phase 1 [2] Phase2 [3] and Phase 2+ [4].

5.1 Handovers and "Synchronisation Indication"

5.1.1 Justification

In the HANDOVER COMMAND message there is a mandatory part consisting of nine octets followed by several optional information elements. The first optional information element is Synchronisation Indication which is a type 1 Information Element (IE) and as such is coded, with IE Identifier (IEI), on one octet. Other optional IE follow the Synchronisation Indication IE and are used to:

- indicate the frequency hopping sequence to use on the new channel;
- indicate the channel mode for the new channel;
- indicate a start time.

Some types of MS do not correctly decode these following information elements if the Synchronisation Indication information element is omitted.

5.1.2 Solution

To ensure correct operation the infrastructure should always send the Synchronisation Indication IE to a Phase 1 MS.

NOTE: In a few cases this will force an extra layer 2 segment to be sent to the MS.

5.2 "Directed Retry" type Handovers

5.2.1 Justification

In the HANDOVER COMMAND message there is an optional Channel Mode Information Element. When this information element is included in the handover command the MS should go to the new channel mode when it hands over to the new channel. This information element may be used for "directed retry" type handovers where a cell has an MS on a control channel but has no available traffic channel for the MS to use. The network may then choose to handover the MS to a new cell with traffic channel (TCH) capacity and change the channel mode at the same time.

Some MSs appear to accept the handover command, from Stand-alone Dedicated Control Channel (SDCCH) to TCH with speech mode, and make the required channel and mode change but do not through connect the speech path.

5.2.2 Solution

To ensure correct operation, of these MSs, the infrastructure should always initiate a channel mode change procedure according to TS GSM 04.08 (Phase 1) (I-ETS 300 022-1) [2] clause 3.4.6 once the MS has arrived at the new channel following a handover of a Phase 1 MS involving a channel mode change to full rate speech.

The additional channel mode change procedure shall only be performed for a directed retry handover to a full rate speech channel, and not for a data channel. First this will save performance in these cases, and secondly some MS's will release the call with this additional and unnecessary channel mode change procedure in case of fax or data calls.

For internal intra-Base Station System (BSS) handovers, this decision to initiate channel mode modify is taken by the BSS concerned. For external intra-BSS and inter-BSS handovers, the new BSS must know that there has been a change of mode from the previous BSS and that therefore a channel mode change procedure must be executed. The communication of this information is achieved by using the "current channel" element in the HANDOVER REQUEST and HANDOVER REQUIRED message as described in the Annex A.

In the case of external handover, the following will ensure correct operation with mobiles suffering from fault 5.2.1:

i) The change described in Annex A shall be implemented by the MSC and BSS concerned.

ii) The new BSS, after receiving a HANDOVER REQUEST containing a current channel IE indicating "signalling only", and a channel type indicating full rate speech, shall behave as specified in TS GSM 08.08 and additionally, upon reception of the HANDOVER COMPLETE message, initiate a channel mode change procedure according to TS GSM 04.08 with the new mode indicating speech.

If the new BSS receives a HANDOVER REQUEST without the current channel IE but containing a cause value "directed retry", and a channel type indicating full rate speech, it shall also behave as ii) above.

NOTE: The performance of MSs not experiencing this problem has been checked for a sizeable subset of the MSs available in Phase 1, but it has not been possible to check all versions of all MSs.

5.3 Cell broadcast and frequency hopping

5.3.1 Justification

In the SYSTEM INFORMATION TYPE 4 message there is an optional Information Element "CBCH Channel Description" used when a cell broadcast channel is configured in the network.

Some Types of GSM 900 MSs may not obtain service whilst within reception range of a cell from any network having the CBCH configured with frequency hopping: i.e. the Hopping channel bit set to 1 in the "CBCH Channel description" information element.

5.3.2 Solution

To enable operation from the affected MS, the infrastructure could configure the CBCH on a non hopping channel:

- In combined type of configuration: the CBCH would be distributed on the SDCCH/4 with BCCH
- In non-combined type of configuration, two types of solution are considered:
  - Type 1 CBCH distributed on a non hopping SDCCH broadcasted on TSx of C0 (x=1,2,3)
  - Type 2 CBCH distributed on a non hopping SDCCH broadcasted on TS0 of Cx ($x \neq 0$)

5.4 Handling of Phase 2 and Phase2+ BCCH Messages

5.4.1 Justification

Some types of Phase1 GSM 900 MSs could fail to offer full services whilst System Information messages other than those specified in GSM 900 Phase1 are broadcast with a L2 Pseudo Length value greater than 1.

5.4.2 Solution

In order to provide service to these existing GSM 900 MS and not disturb Phase2 MS, the following restrictions and changes should be implemented in the P-GSM 900 band of the network.

~~For System Information 2ter, the value 0 of the L2 Pseudo Length shall be used instead of 18.~~

~~The System Information 2bis shall not be used in the P-GSM 900 band of the network.~~

~~Therefore, the EXT-IND bit in System Information 2 in the P-GSM 900 Band of the network shall not be set to 1.~~

~~5.5 Handling of Phase 2 and Phase2+ SACCH Messages~~

~~5.5.1 Justification~~

~~Some types of Phase1 MSs may experience performance degradation if the network sends System Information Messages other than those specified in Phase1.~~

~~5.5.2 Solution~~

~~In order not to degrade the performance of these Phase1 mobile stations it is recommended:~~

- ~~any new messages that are not defined in Phase1 shall not be sent to a Phase1 MS, e.g System Information 5bis and 5ter to a Phase1 P-GSM 900 mobile station and System Information 5ter to a Phase1 DCS 1800 mobile station.~~

~~5.6 Handling of assignment message using Mobile Allocation IE including ARFCN=0~~

~~5.6.1 Justification~~

~~Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network sends an assigning message (Immediate Assignment, Assignment Command or Handover Command) that uses the Mobile Allocation IE to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.6.2 Solution~~

~~To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence. When assigning a channel at RR connection establishment (Immediate Assignment), this solution should be used.~~

~~When a channel resource is assigned, using either the Assignment Command or the Handover Command message, the infrastructure may use the Frequency List or the Frequency Short List IEs in the assigning message to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.7 Hopping sequence generation including ARFCN=0~~

~~5.7.1 Justification~~

~~Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network assigns an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.7.2 Solution~~

~~To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence.~~

6 VoidUse of VAD/DTX in conjunction with frequency hopping for a speech call

6.1 Scope

The chapter six of this Technical Report is to identify limitations in the specification for phase 1 reflected in performance degradation in phase 1 terminal equipment. This report identifies possible ways of improving the service offered to subscribers using phase 1 terminals whilst using the two features - downlink DTX and frequency hopping at the same time.

6.2 General

The specification of acoustic performance of the MS when downlink DTX is implemented is in GSM 05.05 which restricts the MS performance to 1 undetected bad frame in 10s when in the presence of random RF. In reality the MS does not experience random RF exclusively when downlink DTX is implemented.

There is a SIlence Descriptor (SID) frame sent on eight bursts every 104 bursts. Due to the interleaving scheme, half of the bits of the frame preceding the SID and half of the bits of the frame following the SID are sent and there is no specific requirement covering what is sent for these bits but in most cases it is every other bit of a correctly coded frame. The MS receives these bits

In addition, when the ARFCN used is C0, dummy bursts are sent when there is neither speech nor signalling to be transmitted.

Finally, when frequency hopping is used as well as downlink DTX, the MS may receive random RF on some TDMA frames and dummy bursts on others (C0).

It is possible for the MS to receive combinations of transmitted bits at high confidence and random RF at low confidence. In some cases the MS can then decode the frame as good when in fact it was never intended to have been transmitted and the resultant bad frame can give a very annoying acoustic effect known as banjo noise. The occurance of these noises, even if no more frequent than one in 10s, is worse than one would expect from a high quality cellular system.

The three following sections refer to ways of improving the system performance for MS approved according to the existing phase 1 specification. Section 6.3 identifies some "normal" operation configurations which would improve undetected bad frame performance for MS's with the above fault (banjo noise), section 6.4 describes aspects for possible changed network implementation, section 6.5 relates the results of tests performed using combinations of the implementations described in section 6.4 and whether that combination was effective or not.

6.3 Implementation options to reduce the occurance of undetected bad frames by utilising normal system features

This section deals with a variety of options to improve the system performance which are implementable by normal system operational choices. These options typically improve matters in specific configurations and are not universal solutions for all configurations. It may be possible that some networks do not permit such configuration.

6.3.1 Number of frequency hopping channels

The number of undetected bad frames is related to the probability of getting sufficient dummy bursts transmitted to make a false good frame decision. The number of dummy bursts received depends on the number of ARFCN in the hopping list. Hence frequency hopping on 3 ARFCN gives better audio performance than frequency hopping on 2, likewise hopping on 4 ARFCN gives better performance than hopping on 3.

In tests of the comparison between hopping on 2 ARFCN and hopping on 3, some MS have been found to improve to approximately one tenth of the occurance of bad frames, while others have improved from a slightly annoying level when hopping on 2 ARFCN, to give no audible disruption when hopping on 3. Not all MS have been tested and it is believed that the improvement for some MS may be less noticeable.

This solution is obviously not trivial to implement in a frequency plan, but could also be used to enable frequency hopping on cells which naturally have 3 or more ARFCN operational whilst selecting a solution for other parts of the network and operational scenarios.

6.3.2 Frequency hopping type

When utilising pseudo-random frequency hopping, it is possible to get more dummy bursts in a speech frame than when utilising cyclic frequency hopping. As an alternative to random frequency hopping, cyclic hopping may be used. It will minimise the banjo noise effect experienced by the faulty mobiles. This will however be done at the expense of a possible degradation of performance during speech activity period for all mobiles due to the absence of interferer diversity.

In tests of the comparison between pseudo-random frequency hopping and cyclic frequency hopping, some phones were found to improve with the use of cyclic hopping to approximately one third of the occurance of bad frames when using pseudo-random hopping, while others have improved from a slightly annoying level to give no audible disruption. Not all phones have been tested for this.

6.3.3 Continuous SID frames on C0

At some times, a network implementing downlink DTX may hold a call on C0. In this case it would be possible for the network to send dummy bursts when it has nothing else to send. This is likely to cause a high level of unwanted noises for some MS. An alternative would be to send continuous SID frames in which case there should be no undesired effects.

6.4 Implementation options to reduce the occurance of undetected bad frames by changing normal system operation

This section deals with implementation options which improve the audio quality of the faulty mobiles, suffering from banjo noise, by making changes to the network equipment. The solutions give varying performance improvements but not all solutions would be possible on all networks.

6.4.1 Changing the training sequence of the dummy burst to a new (ninth) training sequence

If a different training sequence code is used for all dummy bursts forming part of the TCH on C0, the MS will have difficulty training to the dummy burst frames and this would cause the bits to be received as low confidence. This would then give a performance rather more like that for random RF input and should then meet the 05.05 requirement.

6.4.2 Using an alternative training sequence out of the eight assigned

This option is similar in concept and performance to the one described in section 6.4.1. The advantage is that it may be usable in some networks where it is not easily possible to add a ninth training sequence. The following table gives a list of training sequence codes for the TCH and the preferred choice of training sequence code for the dummy burst.

Training sequence code for TCH	Training sequence code for dummy bursts on C0
0	2
1	5
2	0
3	4
4	5
5	2
6	3
7	5

6.4.3 Setting the stealing flag for the bits transmitted which are not intended to be part of the TCH

When bits are transmitted which are not intended for reception in the TCH path, such as dummy bursts and the half burst before and after a discrete, wanted frame, it would be possible to set the stealing flag for these bits and so bias the decision of the majority vote on stealing flags in favour of routing the frame as control information rather than speech information. The channel protection on the control channel is much greater and the chance of getting an undetected bad control channel frame is very low.

6.4.4 Sending partial SID frames on C0

It has been observed that improvements in the undetected bad frame rate are seen when the BTS sends partial SID frames on the otherwise unused TCH bursts on C0. This is because the high confidence bits are correctly coded for the relevant speech frame and the normal design of the MS receiver is expected to cope with such errors. This proposal works best for DCS 1800 because very early GSM models are not represented in DCS 1800.

6.5 Tested Combinations

This section identifies tests that have been performed and the results that have been obtained. The reporting of result is limited to acceptable or not acceptable and a brief additional comment is sometimes made. If the result is deemed to be acceptable, most products which suffer from the described problem have been improved to a point where extraneous noises are significantly reduced to virtually nothing and no product has got worse. No solution completely corrected all products but significant improvements have been achieved if the result is deemed acceptable.

6.5.1 "Normal" system

Test configuration:

Sent on C0:
Dummy bursts using training sequence from TCH.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Unacceptable; Several products exhibit frequent noises from undetected bad frames.

6.5.2 New training sequence

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.3 Alternative training sequence from the eight assigned

Test configuration:

Sent on C0:
Dummy bursts using alternative training sequence according to table in 6.4.2.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information not necessarily related to the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.4 Setting stealing flag for unintentionally transmitted bits

Test configuration:

Sent on C0:
Partial SID information from the two SID frames otherwise scheduled for transmission.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 1

Result:

Acceptable.

6.5.5 Setting stealing flag for unintentionally transmitted bits and modifying training sequence for Dummy Bursts

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Dummy burst mixed bits

Half burst stealing flags:
Set to 1

Result:

Acceptable; This configuration gave marginally the best performance of all tested.

6.5.6 Sending partial SID information on C0

Test configuration:

Sent on C0:
Part SID frames

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable for DCS 1800.

Annex A:
VoidAmendment Request 08.08 - 021 R4: Information on channel in use in HO REQUEST

NOTE: This Annex A reflects the Amendment Request 08.08 - 021 R4 which was approved by SMG#15 and is part of the TS GSM 08.08 version 4.9.0.

A.3.1.5.1.1 Generation of the HANDOVER REQUIRED message

Generation of the HANDOVER REQUIRED message can be for the following reasons:

- The BSS has detected that a radio reason exists for a handover to occur.
- The MSC has initiated a handover candidate enquiry procedure, and this MS is currently a candidate.
- A cell change is required at call setup due to congestion, e.g. directed retry.

The HANDOVER REQUIRED message contains the following information elements:

- Message Type;
- Cause;
- Cell Identifier List (preferred).

It should also contain the "Current channel" information element.

Sec. 3.2.1.9. gives coding details of the above message.

The "Cause" field indicates the reason for the HANDOVER REQUIRED message e.g. "uplink quality poor" or "response to MSC invocation" in the case of traffic reasons indicated by the MSC.

If present the "Response Request" Information Element indicates, that the BSS requires an indication if the HANDOVER REQUIRED message does not result in a HANDOVER COMMAND message.

If the BSS wants to change the CIC due to a channel change, the BSS sends a HANDOVER REQUIRED message with the cause "switch circuit pool" and the "circuit pool list" information element. The "circuit pool list" information element will allow the BSS to indicate to the MSC from which circuit pool or pools the new CIC should be chosen.

The "Cell Identifier List (preferred)" shall identify "n" preferred cells. The identified cells are given in order of preference. The algorithm by which the BSS produces this list is Operator dependent and is not addressed in this Technical Specification. The "n" number of preferred cells is a parameter set by O&M and shall range from 1 to 16. If "n" number of cells cannot be identified, then only as many as are available shall be encoded and sent (as specified in section 3.2.2.27).

It is mandatory for the BSS to be able to produce this "Cell Identifier List (preferred)". The sending of this list is controlled by the O&M parameter "n". It is mandatory for the MSC to be able to receive and interpret this Information Element.

The HANDOVER REQUIRED message shall be updated and repeated by the BSS with a periodicity of T7 until:

- A HANDOVER COMMAND message is received from the MSC, or;
- A RESET message is received, or;
- The reason for the original HANDOVER REQUIRED message disappears e.g. the MS transmission improves, or;
- All communication is lost with the MS as defined in Technical Specification GSM 04.08, and the transaction is abandoned, or;
- The transaction ends, e.g., call clearing.

A.3.1.5.2 Handover Resource allocation

This procedure has been defined to allow the MSC to request resources from a BSS in a manner similar to that used for the assignment case. However it does not result in the transmission of any messages over the radio interface, only in the reservation of the resource identified at the BSS, which awaits access of a MS on the reserved channel. These reserved resources are then indicated back to the MSC.

In order to support this procedure the MSC sets up a BSSAP SCCP connection to the BSS. This connection is then used to support all BSSAP messages related to this dedicated resource.

A.3.1.5.2.1 Operation of the procedure

The correct operation of the handover resource allocation procedure is as follows:

The MSC sends a HANDOVER REQUEST message to the new BSS (note 1) from which it requires radio resources. This message contains details of the resource that is required. If the requested resource is for speech or data it also indicates the terrestrial resource that shall be used between the MSC and the BSS. The type of channel required can be different from the type of channel in use, e.g. in the case of directed retry. The description of the resource can either specify it completely, or give the BSS some freedom in the selection. The message may also specify the channel in use.

On receipt of this message the new BSS shall choose a suitable idle radio resource.

The management of priority levels – relating to the Information Element "Priority" within the HANDOVER REQUEST message – is implementation dependent, under operator control.

If queueing is managed, new requests which cannot be served immediately are put in the queueing file according to the indicated priority levels.

(Refer to section 3.1.17 for Queuing Procedure)

As a further operator option, the preemption indicators may (alone or along with the priority levels) be used to manage the preemption process, which may lead to the forced release or forced handover of lower priority connections.

However, the preemption indicators (refer to section 3.2.2.18), if given in the HANDOVER REQUEST, shall be treated on a per connection basis as follows:

- the last received "Preemption Vulnerability" indicator and priority levels shall prevail.
- if the "Preemption Capability" bit is set to 1, then this allocation request can trigger the running of the preemption procedure.
- if the "Preemption Capability" bit is set to 0, then this allocation request cannot trigger the preemption procedure.
- if the "Preemption Vulnerability" bit is set to 1, then this connection is vulnerable and shall be included in the preemption process or procedure and as such may be subject to forced release or forced handover.
- if the "Preemption Vulnerability" bit is set to 0, then this connection is not vulnerable to preemption and shall not be included in the preemption process and as such may not be subject to forced release or forced handover.
- if no Priority Information Element has been received, both "Preemption Capability" and "Preemption Vulnerability" bits shall be regarded as set to 0.

If a radio resource is available then this will be reflected back to the MSC in a HANDOVER REQUEST ACKNOWLEDGE message. The HANDOVER REQUEST ACKNOWLEDGE message sent by the new BSS shall contain the radio interface message HANDOVER COMMAND within its "Layer 3 Information" Information Element. This "Layer 3 Information" (which is in fact the RR Layer 3 HANDOVER COMMAND) is transferred by the controlling MSC to the old BSS using the BSSMAP message HANDOVER COMMAND also within the Information Element "Layer 3 Information" of that BSSMAP message. The old BSS then sends to the MS over the radio interface the RR Layer 3 HANDOVER COMMAND message. Information about the appropriate new channels and a handover reference number chosen by the new BSS are contained in the HANDOVER COMMAND. Knowledge of the channel in use at the old BSS allows the new BSS to minimize the size of the HANDOVER COMMAND message (i.e. to decide whether the mode of the first channel IE need not be included in the HANDOVER COMMAND).

NOTE: The new BSS and the old BSS may be the same.

When several circuit pools are present on the BSS-MSC interface, the "circuit pool" information field shall be included in the HANDOVER REQUEST ACKNOWLEDGE. The "circuit pool" field will indicate to the MSC the circuit pool of the CIC given in the HANDOVER REQUEST message.

The sending of the HANDOVER REQUEST ACKNOWLEDGE by the new BSS to the MSC ends the Handover Resource Allocation procedure. The Handover Execution procedure can now proceed and this is given in section 3.1.5.3.

The new BSS shall then take all necessary action to allow the MS to access the radio resource that the new BSS has chosen, this is detailed in the GSM 05 series of Technical Specifications. If the radio resource is a traffic channel then the new BSS shall at this point switch it through to the terrestrial resource indicated in the HANDOVER REQUEST message, and the necessary transcoding/rate adaption/encryption equipment enabled as detailed in Technical Specification GSM 04.08.

The optimum procedure for switching through to the target cell at the MSC is not defined in these Technical Specifications.

A.3.2.1.8 HANDOVER REQUEST

This message is sent from the MSC to the BSS via the relevant SCCP connection to indicate that the MS is to be handed over to that BSS.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	MSC-BSS	M	1
Channel type	3.2.2.11	MSC-BSS	M	5
Encryption information	3.2.2.10	MSC-BSS	M	3-n
Classmark information 1 or	3.2.2.30	MSC-BSS	M#	2
Classmark information 2	3.2.2.19	MSC-BSS	M#	4-5
Cell identifier (serving)	3.2.2.17	MSC-BSS	M	5-10
Priority	3.2.2.18	MSC-BSS	O	3
Circuit identity code	3.2.2.2	MSC-BSS	O##	3
Downlink DTX flag	3.2.2.26	MSC-BSS	O*	2
Cell identifier (target)	3.2.2.17	MSC-BSS	M	3-10
Interference band to be used	3.2.2.21	MSC-BSS	O	2
Cause	3.2.2.5	MSC-BSS	O	3-4
Classmark information 3	3.2.2.20	MSC-BSS	O**	3-14
Current channel	3.2.2.49	MSC-BSS	O§	2

* This element may be included in the case of a speech TCH, and only in this case. If not included, this has no impact on the DTX function in the BSS.

** This element is included if the MSC has received such information.

One of these two elements is sent.

This element is included when the channel type Information Element indicates speech or data, and only in those cases.

§ This element is included at least when the message is sent as a reaction to reception of a HANDOVER REQUIRED message containing a "Current channel" information element. In this case it shall be equal to the received element.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength
- distance,
- better cell,
- response to MSC invocation
- O and M intervention,

- directed retry,
- switch circuit pool.

A.3.2.1.9 HANDOVER REQUIRED

This message is sent from the BSS to the MSC to indicate that for a given MS which already has a dedicated radio resource assigned, a handover is required for the reason given by the cause element.

The message is sent via the BSSAP-SCCP connection associated with the dedicated resource.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	BSS-MSC	M	1
Cause	3.2.2.5	BSS-MSC	M	3-4
Response request	3.2.2.28	BSS-MSC	O	1
Cell identifier list (preferred)	3.2.2.27	BSS-MSC	M	2n+3 to 7n+3
Circuit pool list	3.2.2.46	BSS-MSC	O*	V
Current channel	3.2.2.49	BSS-MSC	O**	2

* Shall be included when cause "switch circuit pool".

** This information element should always be included.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength,
- distance,
- better cell,
- response to MSC invocation,
- O&M intervention,
- directed retry,
- switch circuit pool.

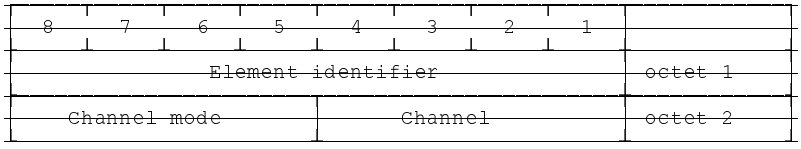
Element Identifier Coding	Element name	Reference
0000 0001	Circuit identity code	3.2.2.2.
0000 0010	Reserved	*
0000 0011	Resource available	3.2.2.4.
0000 0100	Cause	3.2.2.5.
0000 0101	Cell identifier	3.2.2.17.
0000 0110	Priority	3.2.2.18.
0000 0111	Layer 3 header information	3.2.2.9.
0000 1000	IMSI	3.2.2.6.
0000 1001	TMSI	3.2.2.7.
0000 1010	Encryption information	3.2.2.10.
0000 1011	Channel type	3.2.2.11.
0000 1100	Periodicity	3.2.2.12.
0000 1101	Extended resource indicator	3.2.2.13.
0000 1110	Number of MSs	3.2.2.8.
0000 1111	Reserved	*
0001 0000	Reserved	*
0001 0001	Reserved	*
0001 0010	Classmark information type 2	3.2.2.19.
0001 0011	Classmark information type 3	3.2.2.20.
0001 0100	Interference band to be used	3.2.2.21.
0001 0101	RR Cause	3.2.2.22.
0001 0110	Reserved	*
0001 0111	Layer 3 information	3.2.2.24.
0001 1000	DLCI	3.2.2.25.
0001 1001	Downlink DTX flag	3.2.2.26.
0001 1010	Cell identifier list	3.2.2.27.
0001 1011	Response request	3.2.2.28.
0001 1100	Resource indication method	3.2.2.29.
0001 1101	Classmark information type 1	3.2.2.30.
0001 1110	Circuit identity code list	3.2.2.31.
0001 1111	Diagnostic	3.2.2.32.
0010 0000	Layer 3 message contents	3.2.2.35.
0010 0001	Chosen channel	3.2.2.33.
0010 0010	Total resource accessible	3.2.2.14.
0010 0011	Cipher response mode	3.2.2.34.
0010 0100	Channel needed	3.2.2.36.
0010 0101	Trace type	3.2.2.37.
0010 0110	TriggerId	3.2.2.38.
0010 0111	Trace reference	3.2.2.39.
0010 1000	TransactionId	3.2.2.40.
0010 1001	Mobile identity	3.2.2.41.
0010 1010	OMCId	3.2.2.42.
0010 1011	Forward indicator	3.2.2.43.
0010 1100	Chosen encryption algorithm	3.2.2.44.
0010 1101	Circuit pool	3.2.2.45.
0010 1110	Circuit pool list	3.2.2.46.
0010 1111	Time indication	3.2.2.47.
0011 0000	Resource situation	3.2.2.48.
0011 0001	Current channel	3.2.2.49.

* Information Element codes marked as "reserved are reserved for use by previous versions of this interface specification.

A.3.2.2.49 CURRENT CHANNEL

This Information Element contains a description of the channel allocated to the MS.

It is coded as follows:



~~The channel mode field is coded as follows:~~

~~Bit 8765~~
~~— 0000 signalling only~~
~~— 0001 speech (full rate or half rate)~~
~~— 0011 data, 12.0 kbit/s radio interface rate~~
~~— 0100 data, 6.0 kbit/s radio interface rate~~
~~— 0101 data, 3.6 kbit/s radio interface rate~~

~~All other values are reserved.~~

~~The channel field is coded as follows:~~

~~Bit 4321~~
~~— 0001 SDCCH~~
~~— 1000 Full rate TCH~~
~~— 1001 Half rate TCH~~

~~All other values are reserved.~~

Annex B (informative): Change Request History

SPEC	SMG#	CR	PHS	VERS	NEW_V	SUBJECT
09.94	s30	A008	2	4.4.0	4.5.0	Change of Title, Scope and References Clauses 1 to 5)
09.94	s30	A009	2	4.4.0	4.5.0	Frequency Hopping using ARFCN=0

History

Document history		
Edition 1	August 1995	Publication as ETR 200
Edition 2	November 1995	Publication as ETR 200
Edition 3	September 1996	Publication as ETR 200
V4.5.0	November 1999	Publication

3GPP TSG-CN1 Meeting #23
Fort Lauderdale, Florida, USA 08. - 12. April 2002

Tdoc N1-020892
(rev of Tdoc N1-020731)

CR-Form-v5

CHANGE REQUEST

⌘ **24.007** **CR** **048** ⌘ **rev** **1** ⌘ Current version: **3.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Clarification of the extension mechanism for type 4 IEs
Source:	⌘	Siemens AG
Work item code:	⌘	TEI
Date:	⌘	02.04.02
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change: ⌘

1) In the past, type 4 IEs were in several cases extended by adding a new octet group at the end of the information element. Examples for this are the MS Classmark 2 IE (when changing from GSM phase 1 to GSM phase 2) and the QoS IE (when changing from R98 to R99, and again from Rel-4 to Rel-5).

Currently, the only hint in the standard to such an extension rule can be found in TS 24.008, subclause 8.1, and TS 24.007, subclause 11.4.2:

"… However it is not a syntactical error that a type 4 IE specifies in its length indicator a greater length than defined in clause 10."

To avoid wrong implementations which could cause backwards compatibility problems in the future, it is proposed add this rule to the other coding rules for type 4 IEs in TS 24.007.

2) Additionally, wrong references to "section 10.5.1 to 10.5.4" and to "section 9 and 10" are corrected.

3) The definition of the syntactical error in subclause 11.4.2 should take into account the possibility that an IE was shorter in an earlier version of the protocol.

Summary of change: ⌘

Explicit addition of the extension rule that was used in the past.

Addition of the requirement to accept a shorter length than in the current version of the specification if it is needed for backwards compatibility.

Consequences if not approved: ⌘

Possible backwards compatibility problems, if the receiver does not take into account that a type 4 IE was extended in the past or may be extended in the future:

- if an equipment receives a type 4 IE from an entity using a later version of the protocol it may diagnose a syntactical error, because the IE is "too long";
- if an equipment receives a type 4 IE from an entity using an earlier

	version of the protocol it may diagnose a syntactical error, because the IE is "too short" Dependent on the presence requirements of the IE (optional or mandatory IE), the receiver will then ignore the extended IE or the whole message.

Clauses affected:	⌘	11.2.2.1, 11.4.2		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘	If the present is agreed, then either CR 24.008-596 or a 'mirror CR' of the present CR to TS 24.008 is necessary.		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

11.2.2 Description methods for IE structure

Standard IEs can be further structured in parts called fields. Two description methods are recommended and described hereafter.

11.2.2.1 Tables

According to this description method, the IE is presented in its maximum format, i.e., T, TV or TLV, in a picture representing the bits in a table, each line representing an octet. Bits appear in the occidental order, i.e., from left of the page to right of the page, and from top of the page to bottom of the page.

Boxes so delimited contains typically the field name, possibly an indication of which bits in the field are in the box, and possibly a value (e.g., for spare bits).

A specific method can be used in the IE description to describe a branching structure, i.e., a structure variable according to the value of particular fields in the IE. This design is unusual outside type 4 IEs, and as, a design rule, should be used only in type 4 IEs.

a) The octet number of an octet within the IE is defined typically in the table. It consists of a positive integer, possibly of an additional letter, and possibly of an additional asterisk, see clause f). The positive integer identifies one octet or a group of octets.

b) Each octet group is a self contained entity. The internal structure of an octet group may be defined in alternative ways.

c) An octet group is formed by using some extension mechanism. The preferred extension mechanism is to extend an octet (N) through the next octet(s) (Na, Nb, etc.) by using bit 8 in each octet as an extension bit.

- The bit value "0" indicates that the octet group continues through to the next octet. The bit value "1" indicates that this octet is the last octet of the group. If one octet (Nb) is present, the preceding octets (N and Na) shall also be present.

- In the format descriptions of the individual information elements ~~appearing in section 10.5.1 to 10.5.4~~, bit 8 is marked "0/1 ext" if another octet follows. Bit 8 is marked "1 ext" if this is the last octet in the extension domain.

- Additional octets may be defined in later versions of the protocols ("1 ext" changed to "0/1 ext") and equipments shall be prepared to receive such additional octets; the contents of these octets shall be ignored. However the length indicated in the formal description of the messages and of the individual information elements ~~sections 9 and 10~~ only takes into account this version of the protocols.

d) In addition to the extension mechanism defined above, an octet (N) may be extended through the next octet(s) (N+1, N+2 etc.) by indications in bits 7-1 (of octet N).

e) The mechanisms in c) and d) may be combined.

f) Optional octets are marked with asterisks (*). As a design rule, the presence of absence of an optional octet should be determinable from information in the IE and preceding the optional octet. Care should be taken not to introduce ambiguities with optional octets.

g) At the end of the IE, additional octets may be added in later versions of the protocols also without using the mechanisms defined in c) and d). Equipments shall be prepared to receive such additional octets; the contents of these octets shall be ignored. However the length indicated in the formal description of the messages and of the individual information elements only takes into account this version of the protocols.

11.2.2.1.1 Compact notation

The compact notation described in Annex B can be used to describe the value part of a standard IE. This method is recommended for complex structures, or for a branching structure not respecting octet boundaries.

Next modified section

11.4 Handling of superfluous information

All equipment should be able to ignore any extra information present in an L3 message, which is not required for the proper operation of that equipment. For example, a mobile station may ignore the calling party BCD number if that number is of no interest to the Mobile Station when a SETUP message is received.

11.4.1 Information elements that are unnecessary in a message

The relevant protocol specification may define certain IEs to be under some conditions unnecessary in a L3 message. A protocol entity detecting an unnecessary IE in a received L3 message shall ignore the contents of that IE for treating the message; it is not obliged to check whether the contents of the IE are syntactically correct.

11.4.2 Other syntactic errors

This section applies to the analysis of the value part of an information element. It defines the following terminology:

- ~~-~~An IE is defined to be syntactically incorrect in a message if it contains at least one value defined as "reserved", or if its value part violates syntactic rules given in the specification of the value part.

- ~~However i~~It is not a syntactical error that a type 4 standard IE specifies in its length indicator a greater length than possible according to the value part specification~~-~~: extra bits shall be~~are~~ ignored.

- It should not be considered a syntactical error if a type 4 IE is received with a shorter length than defined in this version of the specification if the IE is correctly encoded according to an earlier version of the specification.

- A message is defined to have semantically incorrect contents if it contains information which, possibly dependant on the state of the receiver, is in contradiction to the resources of the receiver and/or to the procedural part.

3GPP TSG-CN1 Meeting #23
Fort Lauderdale, Florida, USA 08. - 12. April 2002

Tdoc N1-020893
(rev of Tdoc N1-020732)

CR-Form-v5

CHANGE REQUEST

⌘ **24.007** **CR** **049** ⌘ **rev** **1** ⌘ Current version: **4.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Clarification of the extension mechanism for type 4 IEs
Source:	⌘	Siemens AG
Work item code:	⌘	TEI
Date:	⌘	02.04.02
Category:	⌘	**A**
Release:	⌘	REL-4

Use one of the following categories:
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To avoid wrong implementations which could cause backwards compatibility problems in the future, it is proposed add this rule to the other coding rules for type 4 IEs in TS 24.007.

2) Additionally, wrong references to "section 10.5.1 to 10.5.4" and to "section 9 and 10" are corrected.

3) The definition of the syntactical error in subclause 11.4.2 should take into account the possibility that an IE was shorter in an earlier version of the protocol.

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Consequences if not approved: ⌘

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	version of the protocol it may diagnose a syntactical error, because the IE is “too short” Dependent on the presence requirements of the IE (optional or mandatory IE), the receiver will then ignore the extended IE or the whole message.

Clauses affected:	⌘	11.2.2.1		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	
Other comments:	⌘	If the present is agreed, then either CR 24.008-597 or a ‘mirror CR’ of the present CR to TS 24.008 is necessary.		

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- The bit value "0" indicates that the octet group continues through to the next octet. The bit value "1" indicates that this octet is the last octet of the group. If one octet (Nb) is present, the preceding octets (N and Na) shall also be present.

- In the format descriptions of the individual information elements ~~appearing in section 10.5.1 to 10.5.4~~, bit 8 is marked "0/1 ext" if another octet follows. Bit 8 is marked "1 ext" if this is the last octet in the extension domain.

- Additional octets may be defined in later versions of the protocols ("1 ext" changed to "0/1 ext") and equipments shall be prepared to receive such additional octets; the contents of these octets shall be ignored. However the length indicated in the formal description of the messages and of the individual information elements ~~sections 9 and 10~~ only takes into account this version of the protocols.

d) In addition to the extension mechanism defined above, an octet (N) may be extended through the next octet(s) (N+1, N+2 etc.) by indications in bits 7-1 (of octet N).

e) The mechanisms in c) and d) may be combined.

f) Optional octets are marked with asterisks (*). As a design rule, the presence of absence of an optional octet should be determinable from information in the IE and preceding the optional octet. Care should be taken not to introduce ambiguities with optional octets.

g) At the end of the IE, additional octets may be added in later versions of the protocols also without using the mechanisms defined in c) and d). Equipments shall be prepared to receive such additional octets; the contents of these octets shall be ignored. However the length indicated in the formal description of the messages and of the individual information elements only takes into account this version of the protocols.

11.2.2.1.1 Compact notation

The compact notation described in Annex B can be used to describe the value part of a standard IE. This method is recommended for complex structures, or for a branching structure not respecting octet boundaries.

Next modified section

11.4 Handling of superfluous information

All equipment should be able to ignore any extra information present in an L3 message, which is not required for the proper operation of that equipment. For example, a mobile station may ignore the calling party BCD number if that number is of no interest to the Mobile Station when a SETUP message is received.

11.4.1 Information elements that are unnecessary in a message

The relevant protocol specification may define certain IEs to be under some conditions unnecessary in a L3 message. A protocol entity detecting an unnecessary IE in a received L3 message shall ignore the contents of that IE for treating the message; it is not obliged to check whether the contents of the IE are syntactically correct.

11.4.2 Other syntactic errors

This section applies to the analysis of the value part of an information element. It defines the following terminology:

- ~~—~~An IE is defined to be syntactically incorrect in a message if it contains at least one value defined as "reserved", or if its value part violates syntactic rules given in the specification of the value part.

- ~~However i~~It is not a syntactical error that a type 4 standard IE specifies in its length indicator a greater length than possible according to the value part specification~~-~~: extra bits shall be~~are~~ ignored.

- It should not be considered a syntactical error if a type 4 IE is received with a shorter length than defined in this version of the specification if the IE is correctly encoded according to an earlier version of the specification.

- A message is defined to have semantically incorrect contents if it contains information which, possibly dependant on the state of the receiver, is in contradiction to the resources of the receiver and/or to the procedural part.

3GPP TSG-CN1 Meeting #24

Tdoc N1-021366
Revision of Tdoc N1-021192

Budapest, Hungary, 13. – 17. May 2002

CR-Form-v5

CHANGE REQUEST

⌘ **24.007** **CR** **052** ⌘ **rev** **1** ⌘ Current version: **3.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network **X** Core Network **X**

Title:	⌘	Various clean-up of wrong references, eg towards 04.18 and 23.171
Source:	⌘	CN1 secretary
Work item code:	⌘	TEI
Date:	⌘	01.05.2002
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	To list and make correct reference to 04.18, 23.171 and many other specifications.
Summary of change:	⌘	01.02 and 03.56 was never taken to UMTS. They are not refered to in the body but kept with the last release specified. Also 04.68 and 23.110 needed to be added in reference list since they were refered to in the text. 03.71 was expanded with 23.171 for UMTS in R99 only. (25.305 superceded 23.071 from R99 onwards,- not referenced) 04.08 split to 04.18 is missing.
Consequences if not approved:	⌘	Wrong and insufficient references made.

Clauses affected:	⌘	2, 3, 4.3.2, 4.3.4, 6.5.2, 6.6, 6.7, 6.8, 7.3, 7.4, 7.5.2, 7.6, 8, 9.3, 9.3.1, 9.4, 10.3.1, 11.2.3.1.1, 11.2.3.2.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] ~~3GPP TS~~GSM 01.02(R97): "Digital cellular telecommunications system (Phase 2+); General description of a GSM Public Land Mobile Network (PLMN)".

[1a] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS ~~03.01~~23.101: "General UMTS Architecture~~Digital cellular telecommunications system (Phase 2+); Network functions~~".

[3a] 3GPP TS 23.060: "General Packet Radio Service (GPRS) Description; Stage 2".

[3b] ~~3GPP TS~~GSM 03.56(R98): "Digital cellular telecommunications system (Phase 2+); GSM Cordless Telephony System (CTS), phase 1; CTS Architecture Description; Stage 2".

[3] 3GPP TS 04.01: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile Station - Base Station System (MS - BSS) interface General aspects and principles".

[3b] 3GPP TS 03.71: "~~Digital cellular telecommunications system (Phase 2+);~~ Location Services (LCS) Functional Description; Stage 2".

[3c] 3GPP TS 23.171: "Functional stage 2 description of location services in UMTS".

[4] 3GPP TS 04.05: "~~Digital cellular telecommunications system (Phase 2+);~~ Data Link (DL) layer General aspects".

[5] 3GPP TS 04.06: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[5a] 3GPP TS 04.14: "~~Digital cellular telecommunications system (Phase 2+); I~~ndividual equipment type requirements and interworking; Special conformance testing functions".

[6] 3GPP TS 24.008: "Mobile radio interface layer 3 specification Core Network Protocols-Stage 3".

[6a] 3GPP TS 23.108: "Mobile Radio Interface Layer 3 specification Core Network Protocols stage 2 (structured procedures)".

[6b] 3GPP TS 04.18: "Mobile radio interface layer 3 specification; Radio Resource Control Protocol".

[7] 3GPP TS 24.010: "Mobile radio interface layer 3 Supplementary services specification General aspects".

[8a] 3GPP TS 04.71: "~~Digital cellular telecommunications system (Phase 2+);~~ Location Services (LCS); Mobile radio interface layer 3 specification~~; Location Services (LCS)~~".

[8] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[9] 3GPP TS 24.080: "Mobile radio interface layer 3 supplementary services specification Formats and coding".

[10] 3GPP TS 24.081: "Line identification supplementary services - Stage 3".

[10a] 3GPP TS 04.60: " ~~Digital cellular telecommunications system (Phase 2+);~~
General Packet Radio Services (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control and medium Access Control (RLC~~S~~/MAC) layer specification".

[10b] 3GPP TS 04.56: " ~~Digital cellular telecommunications system (Phase 2+);~~
GSM Cordless Telephony System (CTS), phase 1; CTS Radio Interface Layer 3 specification".

[11] 3GPP TS 24.082: "Call Forwarding (CF) supplementary services - Stage 3".

[11a] 3GPP TS 04.64: "~~Digital cellular telecommunications system (Phase 2+);~~ General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification~~Mobile Station - GPRS support node (MS-SGSN) Logical Link Control Layer Specification~~".

[12] 3GPP TS 24.083: "Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 3".

[12a] 3GPP TS 04.65: "~~Digital cellular telecommunications system (Phase 2+);~~ General Packet Radio Service (GPRS); Mobile Station (MS) - Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[13] 3GPP TS 24.084: "MultiParty (MPTY) supplementary services - Stage 3".

[14] 3GPP TS 24.085: "Closed User Group (CUG) supplementary services - Stage 3".

[15] 3GPP TS 24.086: "Advice of Charge (AoC) supplementary services - Stage 3".

[16] 3GPP TS 24.088: "Call Barring (CB) supplementary services - Stage 3".

[17] 3GPP TS 24.090: "Unstructured supplementary services operation (USSD)- Stage 3".

[17a] 3GPP TS 34.109: “Terminal logical test interface; Special conformance testing functions”.

[18] ITU-T Recommendation X.200: "Reference Model of Open systems interconnection for ITU-T Applications".

[19] 3GPP TS 04.68: "Group Call Control (GCC) Protocol".

~~[20] GSM 04.63 (R98): " Digital cellular telecommunications system (Phase 2+); Packet Data on Signalling channels Service (PDS) Service Description, Stage 3".~~

[20~~1~~] 3GPP TS 23.110: "UMTS Access Stratum Services and Functions".

3 Abbreviations

~~Abbreviations used in the present document, are listed in GSM 01.04.~~

For the purposes of the present document, the abbreviations defined in 3GPP TR 21.905 [1a] and the following abbreviations apply:

GMM	GPRS Mobility Management
MNS	Mobile Network Signalling
N-PDU	Network Protocol Data Unit
SM	Session Management
UDT	User Data Transfer
CTS	Cordless Telephony System
LCS	Location Services

4.3.2 Abstract service primitives

The abstract service primitives consist of requests, responses, indications and confirmations. The general syntax of a primitive is specified in 3GPP T~~S~~R 21.905 [1a].

4.3.3 Protocols and peer-to-peer communication

By use of the services provided by lower (sub-)layers, peer entities in a (sub-)layer in the MS and the network exchange information. Exchange of information between two peer entities is performed according to the corresponding (sub-)layer protocols. A protocol is a set of rules and formats by which the information (control information and user data) is exchanged between the two peers. The information is exchanged by use of messages which are defined in the protocol. (Therefore, the messages are also called Protocol Data Units, PDUs).

There are several protocols of the RR sublayer, one protocol of the LLC sublayer, three protocols of the MM sublayer, and several protocols of the CM sublayer. For each functional block of the CM sublayer as defined in subclause 4.1 there is one protocol. The CM protocols are specified in the Technical Specifications identified in subclause 4.3.4.

In the model used in this specification, there is:

1) for non-GPRS services:

- one RR sub-layer entity in the MS and one RR sub-layer entity in the network;
- one MM sub-layer entity in the MS and one MM sub-layer entity in the network;
- for each functional block of the CM sublayer as defined in subclause 4.1 which is supported in the MS (in the network), there are, depending on the protocol, one or more entities in the MS (in the network). Two different entities of the same functional block in the MS (in the network) are called parallel entities. The entities of the same functional block in the MS correspond in a one-to-one relation to the entities of the functional block in the network. The corresponding entities are called peer entities;

2) for CTS services (in addition to non-GPRS services):

- one RR sub-layer entity in the MS and one in the CTS fixed part. These RR sub-layers include one CTS-RR sub-entity on each side;
- one MM sub-layer entity in the MS and one in the CTS fixed part These MM sub-layers include one CTS-MM sub-entity on each side;
- for each functional block of the CM sublayer as defined in subclause 4.1 which is supported in the MS (in the fixed part), there are, depending on the protocol, one or more entities in the MS (in the fixed part). Two different entities of the same functional block in the MS (in the fixed part) are called parallel entities. The entities of the same functional block in the MS correspond in a one-to-one relation to the entities of the functional block in the fixed part. The corresponding entities are called peer entities;

3) for GPRS services supporting Class C MSs:

- one RR sublayer entity (RR) in the MS and one RR sublayer entity in the network;
- six LLC sublayer entities (QoS1-QoS4, signalling, SMS) in the MS and six LLC sublayer entities in the network;
- one MM sublayer entity (GMM) in the MS and one MM sublayer entity in the network (GMM);
- one SM entity in the MS's CM sublayer and one SM sublayer entity in the network's CM sublayer;
- one or more GSMS functional blocks in the CM sublayer if supported;

4) for non-GPRS and GPRS services supporting Class A and Class B MSs:

- two RR sublayer entities (RR) in the MS and two RR sublayer entities in the network;
- six LLC sublayer entities (QoS1-QoS4, signalling, SMS) in the MS and six LLC sublayer entities in the network;
- two MM sublayer entities (GMM + MM) in the MS and one or two MM sublayer entities in the network (GMM or MM);
- one SM entity in the MS's CM sublayer and one SM entity in the network's CM sublayer;

- for each functional block of the CM sublayer as defined in subclause 4.1 which is supported in the MS (in the network), there are, depending on the protocol, one or more entities in the MS (in the network). Two different entities of the same functional block in the MS (in the network) are called parallel entities. The entities of the same functional block in the MS correspond in a one-to-one relation to the entities of the functional block in the network. The corresponding entities are called peer entities.

As each sub-layer entity is specified by one and only one protocol, it is also called a protocol entity or protocol control entity.

For GPRS-services supporting Class A and Class B MSs, the MM entities of the MM-sublayer are able to exchange information by means of GMM PDUs as well as MM PDU's. This means if a mobile is GPRS attached, non-GPRS mobility management procedures may make use of GRPS mobility management messages.

When two peer protocol entities exchange PDUs, a transaction is said to be established (or: to be active; or: to exist). It depends from the protocol when exactly a protocol entity considers the transaction to be active, normally this is the case:

- from the moment when it has passed the first suitable message to lower (sub-) layers or received the first suitable message from its peer entity;
- up to the moment when it has released the transaction.

4.3.4 Contents of layer 3 related Technical Specifications

- The Radio Resource (RR) management protocol is defined in ~~GSM~~ 3GPP TS ~~04.08~~04.18 [6b]:
- the Mobility Management (MM) protocol is defined in 3GPP TS 24.008;
- the Session Management (SM) protocol is defined in 3GPP TS 24.008;
- the Call Control (CC) protocol is defined in 3GPP TS 24.008;
- the Supplementary Services (SS) protocol is defined in 3GPP TS 24.010 [7], 3GPP TS 24.08x and 3GPP- TS 24.09x;
- the Short Message Service (SMS) protocol is defined in 3GPP TS 24.011 [8];
- the Group Call Control (GCC) protocol is defined in ~~GSM~~ 3GPP TS 04.68 [19];
- ~~the protocol for Packet Data on Signalling channels (PDS), PDSS1 is defined in GSM 04.63 [20];~~
- the Logical Link Control (LLC) protocol is defined in ~~GSM~~ 3GPP TS 04.64 [11a];
- the GPRS Radio Resource (GRR) protocol is defined in ~~GSM~~ 3GPP TS 04.60 [10a] and-3GPP TS 24.008 [6];
- the CTS Radio Resource (CTS-RR) sub-protocol is defined in ~~GSM~~ 3GPP TS 04.56 [10b];
- the CTS Mobility Management (CTS-MM) sub-protocol is defined in ~~GSM~~ 3GPP TS 04.56 [10b];
- the CTS additions to the Call Control (CC) protocol are defined in ~~GSM~~ 3GPP TS 04.56 [10b];
- the Location Services (LCS) protocol is defined in ~~GSM~~ 3GPP TS 03.71[3b], 23.171 [3c] and ~~GSM~~ 3GPP TS 04.71 [8a].

6.5.2 Session Management Services for SNSM-SAP (GSM only)

The SNSM-SAP service primitives are defined in ~~GSM~~ 3GPP TS 04.65 [12a].

6.6 Registration Services for GPRS-Services

The attach/detach procedures comprise the registration services which are provided at the GMMREG-SAP.

It shall be noted, that the registration services for mobiles of class A or B may depend on the service states for GPRS and non-GPRS services. Therefore the internal access points MMCOORD and the GMMCOORD (see figure 5.3) are used by GMM and MM to inform each other about the relevant conditions. No service primitives between the entities within the same sublayer, i.e. the MM sublayer, are defined in the present document~~04.07~~. The Mobility Management for class A and B mobiles is further specified in 3GPP TS 24.008 [6]~~04.08~~.

6.7 Services provided to SNDCP entities by GPRS Logical Link Control services

This section is informative, the service primitives are defined in ~~GSM~~ 3GPP TS 04.64 [11a]. They are included here to provide a complete overview of the radio interface protocol architecture.

Logical Link Control services are provided at the QoS1-SAP - QoS4 SAP towards the SNDCP and at the LLSMS-SAP towards SMS.

6.8 Location services at the MS side

The location services (initiation of positioning measurements at the MS are provided at the service access point MNLCS-SAP. The service provided by the CM sublayer to support the location services is defined in ~~GSM~~ 3GPP TS 04.71 [8a].

7.3 Short Message Services Support

The service provided by the CM sublayer to support the short message service are defined in 3GPP TS 24.011 [8].

7.4 Services provided to SNDCP and SMS entities by GPRS Logical Link Control services

This section is informative, the service primitives are defined in ~~GSM~~ 3GPP TS 04.64 [11a]. They are included here to provide a complete overview of the radio interface protocol architecture.

On the network side, Logical Link Control services are provided at the QoS1-SAP - QoS4 SAP towards the SNDCP and at the LLSMS-SAP towards SMS.

7.5.2 Session Management Services for SNSM-SAP

The SNSM-SAP service primitives are defined in ~~GSM~~ 3GPP TS 04.65 [12a].

7.6 Location services at the Network side

The location services (initiation of location measurements at the network) are provided at the service access point MNLCS-SAP. The service provided by the CM sublayer to support the location services is defined in ~~GSM~~ 3GPP TS 04.71 [8a].

8 Services assumed from signalling layers 1 and 2

The services provided by layer 2 are defined in detail in ~~GSM~~ 3GPP TS 04.05 [4]. A short summary is given below.

In addition, layer 1 communicates directly with layer 3 for information transfer related to channel management and to measurement control. See section 8.5 below.

9.3 Services provided by radio resource management entity for GPRS services

The service primitives for UMTS are defined in this document. The services provided by the Access Stratum (AS) are specified in 3GPP TS 23.110 [~~21~~20].

9.3.1 Service primitives for GRR-SAP (GSM only)

The GRR-SAP service primitives are defined in ~~GSM~~ 3GPP TS 04.64 [11a]

[[Table 9.3.1, and chapters 9.3.1.1 - 9.3.1.5 are Void]

9.4 Services provided by the LLC entity for GPRS services (GSM only)

This subclause is informative, the service primitives are defined in ~~GSM~~ 3GPP TS 04.64 [11a]. They are included here to provide a complete overview of the radio interface protocol architecture.

10.3.1 Service primitives for GRR-SAP

The GRR-SAP service primitives are defined in ~~GSM~~ 3GPP TS 04.64 [11a]

[Table 10.3.1, and chapters 10.3.1.1 - 10.3.1.5 are Void]

11.2.3 Imperative part of a standard L3 message

The imperative part of a standard L3 message is composed a header possibly followed by mandatory standard IEs having the format V or LV.

11.2.3.1 Header

The header of a standard L3 message is composed of two octets, and structured in three main parts, the protocol discriminator (1/2 octet), a message type octet, and a half octet used in some cases as a Transaction Identifier, in some other cases as a sub-protocol discriminator, and called skip indicator otherwise.

11.2.3.1.1 Protocol discriminator

Bits 1 to 4 of the first octet of a standard L3 message contain the protocol discriminator (PD) information element. The PD identifies the L3 protocol to which the standard layer 3 message belongs. The correspondence between L3 protocols and PDs is one-to-one.

For future evolution an extension mechanism is foreseen which allows the use of protocol discriminators with one octet length, where bits 4 to one are coded as 1 1 1 0. Messages of such protocols may not be standard L3 messages. In particular, the rest of the header may not respect the structure described in this sub-clause.

The PD can take the following values:

Table 11.2: Protocol discriminator values

bits 4 3 2 1	
0 0 0 0	group call control
0 0 0 1	broadcast call control
0 0 1 0	Reserved: was allocated in earlier phases of the protocol~~PDSS1~~
0 0 1 1	call control; call related SS messages
0 1 0 0	GPRS Transparent Transport Protocol (GTTP)
0 1 0 1	mobility management messages
0 1 1 0	radio resources management messages
1 0 0 0	GPRS mobility management messages
1 0 0 1	SMS messages
1 0 1 0	GPRS session management messages
1 0 1 1	non call related SS messages
1 1 0 0	Location services
1 1 1 0	reserved for extension of the PD to one octet length
1 1 1 1	reserved for tests procedures described in [5a] ~~GSM~~ 3GPP TS 04.14 and [17a] 3GPP TS 34.109.

If the network receives, on a SAP where it expects standard L3 messages, a message with a protocol discriminator different from those specified in table 11.2, the network may ignore the message or initiate the channel release procedure defined in ~~GSM~~ 3GPP TS 04.1~~0~~8 [6b].

If the Mobile Station receives, on a SAP where it expects standard L3 messages, a standard L3 message with a protocol discriminator different from those specified in table 11.2, or for a protocol that it does not support, the Mobile Station shall ignore the message.

11.2.3.2.3 Sequenced message transfer operation

Upper layer messages sent using the RR sub-layer transport service from the mobile station to the network can be duplicated by the data link layer in at least the following cases:

- in A/Gb mode, when a channel change of dedicated channels is required (assignment or handover procedure) and the last layer 2 frame has not been acknowledged by the peer data link layer before the mobile station leaves the old channel.

- in Iu mode, when an RLC re-establishment occurs (e.g. due to relocation) and the RLC layer has not acknowledged the last one or more RLC PDUs before RLC re-establishment

- an inter-system change from Iu mode to A/Gb mode is performed and the RLC layer has not acknowledged the last one or more RLC PDUs.

- an inter-system change from A/Gb mode to Iu mode is performed and the the last layer 2 frame in A/Gb mode has not been acknowledged by the peer data link layer before the mobile station leaves the old channel.

In these cases, the mobile station does not know whether the network has received the messages correctly. Therefore, the mobile station has to send the messages again when the channel change is completed.

The network must be able to detect the duplicated received messages. Therefore, each concerned upper layer messages must be marked with a send sequence number.

To allow for different termination points in the infrastructure of the messages of different PDs, the sequence numbering is specific to each PD. For historical reasons, an exception is that messages sent with the CC, SS and MM PDs share the same sequence numbering. In the following, the phrase **upper layer message flow** refers to a flow of messages sharing the same sequence numbering. The different upper layer flows are MM+CC+SS, GCC, BCC and LCS. The GMM, SM, SMS and TC (Test Control, see 3GPP TS 04.14 [5a] and 3GPP TS 34.109 [17a]) protocols do not use layer 3 sequence numbering.

3GPP TSG-CN1 Meeting #24
Budapest, Hungary, 13. – 17. May 2002

Tdoc N1-021496
Revision of N1-021378

CR-Form-v5

CHANGE REQUEST

⌘ **29.994** **CR** **A014** ⌘ **rev** **2** ⌘ Current version: **4.5.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	QoS IE length
Source:	⌘	Nokia
Work item code:	⌘	TEI
Date:	⌘	6.5.2002
Category:	⌘	**A**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	One R97 ME implementation is known to handle QoS as fixed length IE and therefore it can not access R99 and later GPRS networks. It was not seen feasible in CN1 #23 to change the core specification due to this and therefore this specific mobile station problem needs to be described in the appropriate TR to document a workaround solution.
Summary of change:	⌘	SGSN can provide a workaround solution to overcome the problem by sending only the first 5 QoS octets to pre-R99 mobile stations. The workaround is defined in the latest version of the TR, the older versions only give a pointer to the currently latest version.
Consequences if not approved:	⌘	Lots of subscribers are not able to use GPRS services when 3G services are rolled out in GSM networks

Clauses affected:	⌘	2, 3, 4, 5, 6, and Annex A
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	Only one version of 09.94 did exist and this GSM phase 2 covered all releases. The intention is to keep just one version of the document but this should always be the latest one. The principle of creating corresponding RAN document and the scope of the document were agreed in RAN #14, tdoc RP-010928.

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

ETSI TR 101 646 V4.5.0 (1999-11)

Technical Report

Digital cellular telecommunications system (Phase 2 & Phase 2+); Recommended infrastructure measures to overcome specific Mobile Station (MS) faults (GSM 09.94 version 4.5.0)

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Foreword

This Technical Report (TR) has been produced by the Special Mobile Group (SMG).

The present document supersedes ETR 200 version 4.4.0.

The contents of the present document is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will be re-released with an identifying change of release date and an increase in version number as follows:

Version 4.x.y

where:

- 4 indicates GSM Phase 2.
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document clarifies recommended measures which may be adopted by the GSM infrastructure to enable interworking to be obtained between the GSM infrastructure and various Mobile Station (MS) implementations of the GSM Phase 1 and Phase 2/2+ standard. The objective is to obtain compatibility without changing the consolidated set of Phase 1 and Phase 2/2+ specifications. The present document describes the recommended changes to the infrastructure to cater for specific faults within some MSs.

The lifetime of the herein described measures together with their potential impact on optimal network performance is out of the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] Void.~~GSM 01.04: "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".~~

[2] Void.~~GSM 04.08 Phase 1 (I-ETS 300 022-1): "Digital cellular telecommunications system (Phase 1); Mobile radio interface layer 3 specification Part 1: Generic".~~

[3] Void.~~GSM 04.08 (ETS 300 557): "European digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".~~

[4] Void.~~GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~

[5] Void.~~GSM 05.05 (ETS 300 577): "Digital cellular telecommunication system (Phase 2); Radio Performance Aspects.~~

[6] Void.~~GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio Performance Aspects.~~

[7] 3GPP TR 29.994: Digital cellular telecommunications system; Recommended infrastructure measures to overcome specific Mobile Station (MS) faults.

3 Abbreviations

~~Abbreviations used in the present document are listed in GSM 01.04 [1]~~Void.

4 General

The recommendations of the present document are provided in the latest major version of 3GPP TR 29.994 [7].~~In the implementation of the standard it has been found that some aspects of the specifications have been mis-interpreted by~~

some MS manufacturers. These MSs require specific implementations of the Phase 1 standard in the infrastructure, to provide completely compatible interworking.

It has been assumed throughout this TR that Phase 2 and later infrastructure will interwork with Phase 1 MSs in the same way as Phase 1 infrastructure.

The remainder of this ETR describes how to overcome the possible impacts of the above factors. Descriptions given are limited to specific implementations which are permissible for the Phase of the infrastructure.

5 Specific implementation on the radio interfaceVoid

This clause deals with the choice of specific infrastructure implementation options of the protocols at the radio interface. The protocols concerned are defined in GSM 04.08 Phase 1 [2] Phase2 [3] and Phase 2+ [4].

5.1 Handovers and "Synchronisation Indication"

5.1.1 Justification

In the HANDOVER COMMAND message there is a mandatory part consisting of nine octets followed by several optional information elements. The first optional information element is Synchronisation Indication which is a type 1 Information Element (IE) and as such is coded, with IE Identifier (IEI), on one octet. Other optional IE follow the Synchronisation Indication IE and are used to:

- indicate the frequency hopping sequence to use on the new channel;
- indicate the channel mode for the new channel;
- indicate a start time.

Some types of MS do not correctly decode these following information elements if the Synchronisation Indication information element is omitted.

5.1.2 Solution

To ensure correct operation the infrastructure should always send the Synchronisation Indication IE to a Phase 1 MS.

NOTE: In a few cases this will force an extra layer 2 segment to be sent to the MS.

5.2 "Directed Retry" type Handovers

5.2.1 Justification

In the HANDOVER COMMAND message there is an optional Channel Mode Information Element. When this information element is included in the handover command the MS should go to the new channel mode when it hands over to the new channel. This information element may be used for "directed retry" type handovers where a cell has an MS on a control channel but has no available traffic channel for the MS to use. The network may then choose to handover the MS to a new cell with traffic channel (TCH) capacity and change the channel mode at the same time.

Some MSs appear to accept the handover command, from Stand-alone Dedicated Control Channel (SDCCH) to TCH with speech mode, and make the required channel and mode change but do not through connect the speech path.

5.2.2 Solution

To ensure correct operation, of these MSs, the infrastructure should always initiate a channel mode change procedure according to TS GSM 04.08 (Phase 1) (I-ETS 300 022-1) [2] clause 3.4.6 once the MS has arrived at the new channel following a handover of a Phase 1 MS involving a channel mode change to full rate speech.

The additional channel mode change procedure shall only be performed for a directed retry handover to a full rate speech channel, and not for a data channel. First this will save performance in these cases, and secondly some MS's will release the call with this additional and unnecessary channel mode change procedure in case of fax or data calls.

For internal intra-Base Station System (BSS) handovers, this decision to initiate channel mode modify is taken by the BSS concerned. For external intra-BSS and inter-BSS handovers, the new BSS must know that there has been a change of mode from the previous BSS and that therefore a channel mode change procedure must be executed. The communication of this information is achieved by using the "current channel" element in the HANDOVER REQUEST and HANDOVER REQUIRED message as described in the Annex A.

In the case of external handover, the following will ensure correct operation with mobiles suffering from fault 5.2.1:

i) The change described in Annex A shall be implemented by the MSC and BSS concerned.

ii) The new BSS, after receiving a HANDOVER REQUEST containing a current channel IE indicating "signalling only", and a channel type indicating full rate speech, shall behave as specified in TS GSM 08.08 and additionally, upon reception of the HANDOVER COMPLETE message, initiate a channel mode change procedure according to TS GSM 04.08 with the new mode indicating speech.

If the new BSS receives a HANDOVER REQUEST without the current channel IE but containing a cause value "directed retry", and a channel type indicating full rate speech, it shall also behave as ii) above.

NOTE: The performance of MSs not experiencing this problem has been checked for a sizeable subset of the MSs available in Phase 1, but it has not been possible to check all versions of all MSs.

5.3 Cell broadcast and frequency hopping

5.3.1 Justification

In the SYSTEM INFORMATION TYPE 4 message there is an optional Information Element "CBCH Channel Description" used when a cell broadcast channel is configured in the network.

Some Types of GSM 900 MSs may not obtain service whilst within reception range of a cell from any network having the CBCH configured with frequency hopping: i.e. the Hopping channel bit set to 1 in the "CBCH Channel description" information element.

5.3.2 Solution

To enable operation from the affected MS, the infrastructure could configure the CBCH on a non hopping channel:

- In combined type of configuration: the CBCH would be distributed on the SDCCH/4 with BCCH
- In non-combined type of configuration, two types of solution are considered:
  - Type 1 CBCH distributed on a non hopping SDCCH broadcasted on TSx of C0 (x=1,2,3)
  - Type 2 CBCH distributed on a non hopping SDCCH broadcasted on TS0 of Cx (x≠0)

5.4 Handling of Phase 2 and Phase2+ BCCH Messages

5.4.1 Justification

Some types of Phase1 GSM 900 MSs could fail to offer full services whilst System Information messages other than those specified in GSM 900 Phase1 are broadcast with a L2 Pseudo Length value greater than 1.

5.4.2 Solution

In order to provide service to these existing GSM 900 MS and not disturb Phase2 MS, the following restrictions and changes should be implemented in the P-GSM 900 band of the network.

For System Information 2ter, the value 0 of the L2 Pseudo Length shall be used instead of 18.

The System Information 2bis shall not be used in the P-GSM 900 band of the network.

Therefore, the EXT-IND bit in System Information 2 in the P-GSM 900 Band of the network shall not be set to 1.

5.5 Handling of Phase 2 and Phase2+ SACCH Messages

5.5.1 Justification

Some types of Phase1 MSs may experience performance degradation if the network sends System Information Messages other than those specified in Phase1.

5.5.2 Solution

In order not to degrade the performance of these Phase1 mobile stations it is recommended:

- any new messages that are not defined in Phase1 shall not be sent to a Phase1 MS, e.g System Information 5bis and 5ter to a Phase1 P-GSM 900 mobile station and System Information 5ter to a Phase1 DCS 1800 mobile station.

5.6 Handling of assignment message using Mobile Allocation IE including ARFCN=0

5.6.1 Justification

Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network sends an assigning message (Immediate Assignment, Assignment Command or Handover Command) that uses the Mobile Allocation IE to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.6.2 Solution

To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence. When assigning a channel at RR connection establishment (Immediate Assignment), this solution should be used.

When a channel resource is assigned, using either the Assignment Command or the Handover Command message, the infrastructure may use the Frequency List or the Frequency Short List IEs in the assigning message to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.7 Hopping sequence generation including ARFCN=0

5.7.1 Justification

Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network assigns an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.7.2 Solution

To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence.

6 VoidUse of VAD/DTX in conjunction with frequency hopping for a speech call

6.1 Scope

The chapter six of this Technical Report is to identify limitations in the specification for phase 1 reflected in performance degradation in phase 1 terminal equipment. This report identifies possible ways of improving the service offered to subscribers using phase 1 terminals whilst using the two features - downlink DTX and frequency hopping at the same time.

6.2 General

The specification of acoustic performance of the MS when downlink DTX is implemented is in GSM 05.05 which restricts the MS performance to 1 undetected bad frame in 10s when in the presence of random RF. In reality the MS does not experience random RF exclusively when downlink DTX is implemented.

There is a SIlence Descriptor (SID) frame sent on eight bursts every 104 bursts. Due to the interleaving scheme, half of the bits of the frame preceding the SID and half of the bits of the frame following the SID are sent and there is no specific requirement covering what is sent for these bits but in most cases it is every other bit of a correctly coded frame. The MS receives these bits

In addition, when the ARFCN used is C0, dummy bursts are sent when there is neither speech nor signalling to be transmitted.

Finally, when frequency hopping is used as well as downlink DTX, the MS may receive random RF on some TDMA frames and dummy bursts on others (C0).

It is possible for the MS to receive combinations of transmitted bits at high confidence and random RF at low confidence. In some cases the MS can then decode the frame as good when in fact it was never intended to have been transmitted and the resultant bad frame can give a very annoying acoustic effect known as banjo noise. The occurance of these noises, even if no more frequent than one in 10s, is worse than one would expect from a high quality cellular system.

The three following sections refer to ways of improving the system performance for MS approved according to the existing phase 1 specification. Section 6.3 identifies some "normal" operation configurations which would improve undetected bad frame performance for MS's with the above fault (banjo noise), section 6.4 describes aspects for possible changed network implementation, section 6.5 relates the results of tests performed using combinations of the implementations described in section 6.4 and whether that combination was effective or not.

6.3 Implementation options to reduce the occurance of undetected bad frames by utilising normal system features

This section deals with a variety of options to improve the system performance which are implementable by normal system operational choices. These options typically improve matters in specific configurations and are not universal solutions for all configurations. It may be possible that some networks do not permit such configuration.

6.3.1 Number of frequency hopping channels

The number of undetected bad frames is related to the probability of getting sufficient dummy bursts transmitted to make a false good frame decision. The number of dummy bursts received depends on the number of ARFCN in the hopping list. Hence frequency hopping on 3 ARFCN gives better audio performance than frequency hopping on 2, likewise hopping on 4 ARFCN gives better performance than hopping on 3.

In tests of the comparison between hopping on 2 ARFCN and hopping on 3, some MS have been found to improve to approximately one tenth of the occurance of bad frames, while others have improved from a slightly annoying level when hopping on 2 ARFCN, to give no audible disruption when hopping on 3. Not all MS have been tested and it is believed that the improvement for some MS may be less noticeable.

This solution is obviously not trivial to implement in a frequency plan, but could also be used to enable frequency hopping on cells which naturally have 3 or more ARFCN operational whilst selecting a solution for other parts of the network and operational scenarios.

6.3.2 Frequency hopping type

When utilising pseudo-random frequency hopping, it is possible to get more dummy bursts in a speech frame than when utilising cyclic frequency hopping. As an alternative to random frequency hopping, cyclic hopping may be used. It will minimise the banjo noise effect experienced by the faulty mobiles. This will however be done at the expense of a possible degradation of performance during speech activity period for all mobiles due to the absence of interferer diversity.

In tests of the comparison between pseudo-random frequency hopping and cyclic frequency hopping, some phones were found to improve with the use of cyclic hopping to approximately one third of the occurance of bad frames when using pseudo-random hopping, while others have improved from a slightly annoying level to give no audible disruption. Not all phones have been tested for this.

6.3.3 Continuous SID frames on C0

At some times, a network implementing downlink DTX may hold a call on C0. In this case it would be possible for the network to send dummy bursts when it has nothing else to send. This is likely to cause a high level of unwanted noises for some MS. An alternative would be to send continuous SID frames in which case there should be no undesired effects.

6.4 Implementation options to reduce the occurance of undetected bad frames by changing normal system operation

This section deals with implementation options which improve the audio quality of the faulty mobiles, suffering from banjo noise, by making changes to the network equipment. The solutions give varying performance improvements but not all solutions would be possible on all networks.

6.4.1 Changing the training sequence of the dummy burst to a new (ninth) training sequence

If a different training sequence code is used for all dummy bursts forming part of the TCH on C0, the MS will have difficulty training to the dummy burst frames and this would cause the bits to be received as low confidence. This would then give a performance rather more like that for random RF input and should then meet the 05.05 requirement.

6.4.2 Using an alternative training sequence out of the eight assigned

This option is similar in concept and performance to the one described in section 6.4.1. The advantage is that it may be usable in some networks where it is not easily possible to add a ninth training sequence. The following table gives a list of training sequence codes for the TCH and the preferred choice of training sequence code for the dummy burst.

Training sequence code for TCH	Training sequence code for dummy bursts on C0
0	2
1	5
2	0
3	4
4	5
5	2
6	3
7	5

6.4.3 Setting the stealing flag for the bits transmitted which are not intended to be part of the TCH

When bits are transmitted which are not intended for reception in the TCH path, such as dummy bursts and the half burst before and after a discrete, wanted frame, it would be possible to set the stealing flag for these bits and so bias the decision of the majority vote on stealing flags in favour of routing the frame as control information rather than speech information. The channel protection on the control channel is much greater and the chance of getting an undetected bad control channel frame is very low.

6.4.4 Sending partial SID frames on C0

It has been observed that improvements in the undetected bad frame rate are seen when the BTS sends partial SID frames on the otherwise unused TCH bursts on C0. This is because the high confidence bits are correctly coded for the relevant speech frame and the normal design of the MS receiver is expected to cope with such errors. This proposal works best for DCS 1800 because very early GSM models are not represented in DCS 1800.

6.5 Tested Combinations

This section identifies tests that have been performed and the results that have been obtained. The reporting of result is limited to acceptable or not acceptable and a brief additional comment is sometimes made. If the result is deemed to be acceptable, most products which suffer from the described problem have been improved to a point where extraneous noises are significantly reduced to virtually nothing and no product has got worse. No solution completely corrected all products but significant improvements have been achieved if the result is deemed acceptable.

6.5.1 "Normal" system

Test configuration:

Sent on C0:
Dummy bursts using training sequence from TCH.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Unacceptable; Several products exhibit frequent noises from undetected bad frames.

6.5.2 New training sequence

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.3 Alternative training sequence from the eight assigned

Test configuration:

Sent on C0:
Dummy bursts using alternative training sequence according to table in 6.4.2.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information not necessarily related to the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.4 Setting stealing flag for unintentionally transmitted bits

Test configuration:

Sent on C0:
Partial SID information from the two SID frames otherwise scheduled for transmission.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 1

Result:

Acceptable.

6.5.5 Setting stealing flag for unintentionally transmitted bits and modifying training sequence for Dummy Bursts

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Dummy burst mixed bits

Half burst stealing flags:
Set to 1

Result:

Acceptable; This configuration gave marginally the best performance of all tested.

6.5.6 Sending partial SID information on C0

Test configuration:

Sent on C0:
Part SID frames

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable for DCS 1800.

Annex A:
VoidAmendment Request 08.08 - 021 R4: Information on channel in use in HO REQUEST

NOTE: This Annex A reflects the Amendment Request 08.08 - 021 R4 which was approved by SMG#15 and is part of the TS GSM 08.08 version 4.9.0.

A.3.1.5.1.1 Generation of the HANDOVER REQUIRED message

Generation of the HANDOVER REQUIRED message can be for the following reasons:

- The BSS has detected that a radio reason exists for a handover to occur.
- The MSC has initiated a handover candidate enquiry procedure, and this MS is currently a candidate.
- A cell change is required at call setup due to congestion, e.g. directed retry.

The HANDOVER REQUIRED message contains the following information elements:

- Message Type;
- Cause;
- Cell Identifier List (preferred).

It should also contain the "Current channel" information element.

Sec. 3.2.1.9. gives coding details of the above message.

The "Cause" field indicates the reason for the HANDOVER REQUIRED message e.g. "uplink quality poor" or "response to MSC invocation" in the case of traffic reasons indicated by the MSC.

If present the "Response Request" Information Element indicates, that the BSS requires an indication if the HANDOVER REQUIRED message does not result in a HANDOVER COMMAND message.

If the BSS wants to change the CIC due to a channel change, the BSS sends a HANDOVER REQUIRED message with the cause "switch circuit pool" and the "circuit pool list" information element. The "circuit pool list" information element will allow the BSS to indicate to the MSC from which circuit pool or pools the new CIC should be chosen.

The "Cell Identifier List (preferred)" shall identify "n" preferred cells. The identified cells are given in order of preference. The algorithm by which the BSS produces this list is Operator dependent and is not addressed in this Technical Specification. The "n" number of preferred cells is a parameter set by O&M and shall range from 1 to 16. If "n" number of cells cannot be identified, then only as many as are available shall be encoded and sent (as specified in section 3.2.2.27).

It is mandatory for the BSS to be able to produce this "Cell Identifier List (preferred)". The sending of this list is controlled by the O&M parameter "n". It is mandatory for the MSC to be able to receive and interpret this Information Element.

The HANDOVER REQUIRED message shall be updated and repeated by the BSS with a periodicity of T7 until:

- A HANDOVER COMMAND message is received from the MSC, or;
- A RESET message is received, or;
- The reason for the original HANDOVER REQUIRED message disappears e.g. the MS transmission improves, or;
- All communication is lost with the MS as defined in Technical Specification GSM 04.08, and the transaction is abandoned, or;
- The transaction ends, e.g., call clearing.

A.3.1.5.2 Handover Resource allocation

This procedure has been defined to allow the MSC to request resources from a BSS in a manner similar to that used for the assignment case. However it does not result in the transmission of any messages over the radio interface, only in the reservation of the resource identified at the BSS, which awaits access of a MS on the reserved channel. These reserved resources are then indicated back to the MSC.

In order to support this procedure the MSC sets up a BSSAP SCCP connection to the BSS. This connection is then used to support all BSSAP messages related to this dedicated resource.

A.3.1.5.2.1 Operation of the procedure

The correct operation of the handover resource allocation procedure is as follows:

The MSC sends a HANDOVER REQUEST message to the new BSS (note 1) from which it requires radio resources. This message contains details of the resource that is required. If the requested resource is for speech or data it also indicates the terrestrial resource that shall be used between the MSC and the BSS. The type of channel required can be different from the type of channel in use, e.g. in the case of directed retry. The description of the resource can either specify it completely, or give the BSS some freedom in the selection. The message may also specify the channel in use.

On receipt of this message the new BSS shall choose a suitable idle radio resource.

The management of priority levels – relating to the Information Element "Priority" within the HANDOVER REQUEST message – is implementation dependent, under operator control.

If queueing is managed, new requests which cannot be served immediately are put in the queueing file according to the indicated priority levels.

(Refer to section 3.1.17 for Queuing Procedure)

As a further operator option, the preemption indicators may (alone or along with the priority levels) be used to manage the preemption process, which may lead to the forced release or forced handover of lower priority connections.

However, the preemption indicators (refer to section 3.2.2.18), if given in the HANDOVER REQUEST, shall be treated on a per connection basis as follows:

- the last received "Preemption Vulnerability" indicator and priority levels shall prevail.
- if the "Preemption Capability" bit is set to 1, then this allocation request can trigger the running of the preemption procedure.
- if the "Preemption Capability" bit is set to 0, then this allocation request cannot trigger the preemption procedure.
- if the "Preemption Vulnerability" bit is set to 1, then this connection is vulnerable and shall be included in the preemption process or procedure and as such may be subject to forced release or forced handover.
- if the "Preemption Vulnerability" bit is set to 0, then this connection is not vulnerable to preemption and shall not be included in the preemption process and as such may not be subject to forced release or forced handover.
- if no Priority Information Element has been received, both "Preemption Capability" and "Preemption Vulnerability" bits shall be regarded as set to 0.

If a radio resource is available then this will be reflected back to the MSC in a HANDOVER REQUEST ACKNOWLEDGE message. The HANDOVER REQUEST ACKNOWLEDGE message sent by the new BSS shall contain the radio interface message HANDOVER COMMAND within its "Layer 3 Information" Information Element. This "Layer 3 Information" (which is in fact the RR Layer 3 HANDOVER COMMAND) is transferred by the controlling MSC to the old BSS using the BSSMAP message HANDOVER COMMAND also within the Information Element "Layer 3 Information" of that BSSMAP message. The old BSS then sends to the MS over the radio interface the RR Layer 3 HANDOVER COMMAND message. Information about the appropriate new channels and a handover reference number chosen by the new BSS are contained in the HANDOVER COMMAND. Knowledge of the channel in use at the old BSS allows the new BSS to minimize the size of the HANDOVER COMMAND message (i.e. to decide whether the mode of the first channel IE need not be included in the HANDOVER COMMAND).

NOTE: The new BSS and the old BSS may be the same.

When several circuit pools are present on the BSS-MSC interface, the "circuit pool" information field shall be included in the HANDOVER REQUEST ACKNOWLEDGE. The "circuit pool" field will indicate to the MSC the circuit pool of the CIC given in the HANDOVER REQUEST message.

The sending of the HANDOVER REQUEST ACKNOWLEDGE by the new BSS to the MSC ends the Handover Resource Allocation procedure. The Handover Execution procedure can now proceed and this is given in section 3.1.5.3.

The new BSS shall then take all necessary action to allow the MS to access the radio resource that the new BSS has chosen, this is detailed in the GSM 05 series of Technical Specifications. If the radio resource is a traffic channel then the new BSS shall at this point switch it through to the terrestrial resource indicated in the HANDOVER REQUEST message, and the necessary transcoding/rate adaption/encryption equipment enabled as detailed in Technical Specification GSM 04.08.

The optimum procedure for switching through to the target cell at the MSC is not defined in these Technical Specifications.

A.3.2.1.8 HANDOVER REQUEST

This message is sent from the MSC to the BSS via the relevant SCCP connection to indicate that the MS is to be handed over to that BSS.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	MSC-BSS	M	1
Channel type	3.2.2.11	MSC-BSS	M	5
Encryption information	3.2.2.10	MSC-BSS	M	3-n
Classmark information 1 or	3.2.2.30	MSC-BSS	M#	2
Classmark information 2	3.2.2.19	MSC-BSS	M#	4-5
Cell identifier (serving)	3.2.2.17	MSC-BSS	M	5-10
Priority	3.2.2.18	MSC-BSS	O	3
Circuit identity code	3.2.2.2	MSC-BSS	O##	3
Downlink DTX flag	3.2.2.26	MSC-BSS	O*	2
Cell identifier (target)	3.2.2.17	MSC-BSS	M	3-10
Interference band to be used	3.2.2.21	MSC-BSS	O	2
Cause	3.2.2.5	MSC-BSS	O	3-4
Classmark information 3	3.2.2.20	MSC-BSS	O**	3-14
Current channel	3.2.2.49	MSC-BSS	O§	2

* This element may be included in the case of a speech TCH, and only in this case. If not included, this has no impact on the DTX function in the BSS.

** This element is included if the MSC has received such information.

One of these two elements is sent.

This element is included when the channel type Information Element indicates speech or data, and only in those cases.

§ This element is included at least when the message is sent as a reaction to reception of a HANDOVER REQUIRED message containing a "Current channel" information element. In this case it shall be equal to the received element.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength
- distance,
- better cell,
- response to MSC invocation
- O and M intervention,

- directed retry,
- switch circuit pool.

A.3.2.1.9 HANDOVER REQUIRED

This message is sent from the BSS to the MSC to indicate that for a given MS which already has a dedicated radio resource assigned, a handover is required for the reason given by the cause element.

The message is sent via the BSSAP-SCCP connection associated with the dedicated resource.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	BSS-MSC	M	1
Cause	3.2.2.5	BSS-MSC	M	3-4
Response request	3.2.2.28	BSS-MSC	O	1
Cell identifier list (preferred)	3.2.2.27	BSS-MSC	M	2n+3 to 7n+3
Circuit pool list	3.2.2.46	BSS-MSC	O*	V
Current channel	3.2.2.49	BSS-MSC	O**	2

* Shall be included when cause "switch circuit pool".

** This information element should always be included.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength,
- distance,
- better cell,
- response to MSC invocation,
- O&M intervention,
- directed retry,
- switch circuit pool.

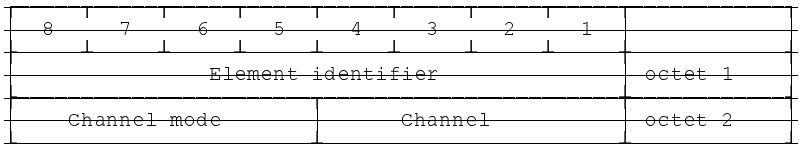
Element Identifier Coding	Element name	Reference
0000 0001	Circuit identity code	3.2.2.2.
0000 0010	Reserved	*
0000 0011	Resource available	3.2.2.4.
0000 0100	Cause	3.2.2.5.
0000 0101	Cell identifier	3.2.2.17.
0000 0110	Priority	3.2.2.18.
0000 0111	Layer 3 header information	3.2.2.9.
0000 1000	IMSI	3.2.2.6.
0000 1001	TMSI	3.2.2.7.
0000 1010	Encryption information	3.2.2.10.
0000 1011	Channel type	3.2.2.11.
0000 1100	Periodicity	3.2.2.12.
0000 1101	Extended resource indicator	3.2.2.13.
0000 1110	Number of MSs	3.2.2.8.
0000 1111	Reserved	*
0001 0000	Reserved	*
0001 0001	Reserved	*
0001 0010	Classmark information type 2	3.2.2.19.
0001 0011	Classmark information type 3	3.2.2.20.
0001 0100	Interference band to be used	3.2.2.21.
0001 0101	RR Cause	3.2.2.22.
0001 0110	Reserved	*
0001 0111	Layer 3 information	3.2.2.24.
0001 1000	DLCI	3.2.2.25.
0001 1001	Downlink DTX flag	3.2.2.26.
0001 1010	Cell identifier list	3.2.2.27.
0001 1011	Response request	3.2.2.28.
0001 1100	Resource indication method	3.2.2.29.
0001 1101	Classmark information type 1	3.2.2.30.
0001 1110	Circuit identity code list	3.2.2.31.
0001 1111	Diagnostic	3.2.2.32.
0010 0000	Layer 3 message contents	3.2.2.35.
0010 0001	Chosen channel	3.2.2.33.
0010 0010	Total resource accessible	3.2.2.14.
0010 0011	Cipher response mode	3.2.2.34.
0010 0100	Channel needed	3.2.2.36.
0010 0101	Trace type	3.2.2.37.
0010 0110	TriggerId	3.2.2.38.
0010 0111	Trace reference	3.2.2.39.
0010 1000	TransactionId	3.2.2.40.
0010 1001	Mobile identity	3.2.2.41.
0010 1010	OMCId	3.2.2.42.
0010 1011	Forward indicator	3.2.2.43.
0010 1100	Chosen encryption algorithm	3.2.2.44.
0010 1101	Circuit pool	3.2.2.45.
0010 1110	Circuit pool list	3.2.2.46.
0010 1111	Time indication	3.2.2.47.
0011 0000	Resource situation	3.2.2.48.
0011 0001	Current channel	3.2.2.49.

* Information Element codes marked as "reserved are reserved for use by previous versions of this interface specification.

A.3.2.2.49 CURRENT CHANNEL

This Information Element contains a description of the channel allocated to the MS.

It is coded as follows:



~~The channel mode field is coded as follows:~~

~~Bit 8765~~
~~— 0000 signalling only~~
~~— 0001 speech (full rate or half rate)~~
~~— 0011 data, 12.0 kbit/s radio interface rate~~
~~— 0100 data, 6.0 kbit/s radio interface rate~~
~~— 0101 data, 3.6 kbit/s radio interface rate~~

~~All other values are reserved.~~

~~The channel field is coded as follows:~~

~~Bit 4321~~
~~— 0001 SDCCH~~
~~— 1000 Full rate TCH~~
~~— 1001 Half rate TCH~~

~~All other values are reserved.~~

Annex B (informative): Change Request History

SPEC	SMG#	CR	PHS	VERS	NEW_V	SUBJECT
09.94	s30	A008	2	4.4.0	4.5.0	Change of Title, Scope and References Clauses 1 to 5)
09.94	s30	A009	2	4.4.0	4.5.0	Frequency Hopping using ARFCN=0

History

Document history		
Edition 1	August 1995	Publication as ETR 200
Edition 2	November 1995	Publication as ETR 200
Edition 3	September 1996	Publication as ETR 200
V4.5.0	November 1999	Publication

3GPP TSG-CN1 Meeting #24
Budapest, Hungary, 13. – 17. May 2002

Tdoc N1-021497
Revision of N1-021379

CR-Form-v5

CHANGE REQUEST

⌘ **29.994** **CR** **A015** ⌘ **rev** **2** ⌘ Current version: **4.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	QoS IE length
Source:	⌘	Nokia
Work item code:	⌘	TEI4
Date:	⌘	6.5.2002
Category:	⌘	**A**
Release:	⌘	Rel-4

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	One R97 ME implementation is known to handle QoS as fixed length IE and therefore it can not access R99 and later GPRS networks. It was not seen feasible in CN1 #23 to change the core specification due to this and therefore this specific mobile station problem needs to be described in the appropriate TR to document a workaround solution.
Summary of change:	⌘	SGSN can provide a workaround solution to overcome the problem by sending only the first 5 QoS octets to pre-R99 mobile stations. The workaround is defined in the latest version of the TR, the older versions only give a pointer to the currently latest version.
Consequences if not approved:	⌘	Lots of subscribers are not able to use GPRS services when 3G services are rolled out in GSM networks

Clauses affected:	⌘	2, 3, 4, 5, 6, and Annex A
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	Only one version of 09.94 did exist and this GSM phase 2 covered all releases. The intention is to keep just one version of the document but this should always be the latest one. The principle of creating corresponding RAN document and the scope of the document were agreed in RAN #14, tdoc RP-010928.

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

ETSI TR 101 646 V4.5.0 (1999-11)

Technical Report

Digital cellular telecommunications system (Phase 2 & Phase 2+); Recommended infrastructure measures to overcome specific Mobile Station (MS) faults (GSM 09.94 version 4.5.0)

Reference
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Foreword

This Technical Report (TR) has been produced by the Special Mobile Group (SMG).

The present document supersedes ETR 200 version 4.4.0.

The contents of the present document is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will be re-released with an identifying change of release date and an increase in version number as follows:

Version 4.x.y

where:

- 4 indicates GSM Phase 2.
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document clarifies recommended measures which may be adopted by the GSM infrastructure to enable interworking to be obtained between the GSM infrastructure and various Mobile Station (MS) implementations of the GSM Phase 1 and Phase 2/2+ standard. The objective is to obtain compatibility without changing the consolidated set of Phase 1 and Phase 2/2+ specifications. The present document describes the recommended changes to the infrastructure to cater for specific faults within some MSs.

The lifetime of the herein described measures together with their potential impact on optimal network performance is out of the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] Void.~~GSM 01.04: "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".~~

[2] Void.~~GSM 04.08 Phase 1 (I-ETS 300 022-1): "Digital cellular telecommunications system (Phase 1); Mobile radio interface layer 3 specification Part 1: Generic".~~

[3] Void.~~GSM 04.08 (ETS 300 557): "European digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".~~

[4] Void.~~GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~

[5] Void.~~GSM 05.05 (ETS 300 577): "Digital cellular telecommunication system (Phase 2); Radio Performance Aspects.~~

[6] Void.~~GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio Performance Aspects.~~

[7] 3GPP TR 29.994: Digital cellular telecommunications system; Recommended infrastructure measures to overcome specific Mobile Station (MS) faults.

3 Abbreviations

~~Abbreviations used in the present document are listed in GSM 01.04 [1]~~Void.

4 General

The recommendations of the present document are provided in the latest major version of 3GPP TR 29.994 [7].~~In the implementation of the standard it has been found that some aspects of the specifications have been mis-interpreted by~~

some MS manufacturers. These MSs require specific implementations of the Phase 1 standard in the infrastructure, to provide completely compatible interworking.

It has been assumed throughout this TR that Phase 2 and later infrastructure will interwork with Phase 1 MSs in the same way as Phase 1 infrastructure.

The remainder of this ETR describes how to overcome the possible impacts of the above factors. Descriptions given are limited to specific implementations which are permissible for the Phase of the infrastructure.

5 Specific implementation on the radio interfaceVoid

This clause deals with the choice of specific infrastructure implementation options of the protocols at the radio interface. The protocols concerned are defined in GSM 04.08 Phase 1 [2] Phase2 [3] and Phase 2+ [4].

5.1 Handovers and "Synchronisation Indication"

5.1.1 Justification

In the HANDOVER COMMAND message there is a mandatory part consisting of nine octets followed by several optional information elements. The first optional information element is Synchronisation Indication which is a type 1 Information Element (IE) and as such is coded, with IE Identifier (IEI), on one octet. Other optional IE follow the Synchronisation Indication IE and are used to:

- indicate the frequency hopping sequence to use on the new channel;
- indicate the channel mode for the new channel;
- indicate a start time.

Some types of MS do not correctly decode these following information elements if the Synchronisation Indication information element is omitted.

5.1.2 Solution

To ensure correct operation the infrastructure should always send the Synchronisation Indication IE to a Phase 1 MS.

NOTE: In a few cases this will force an extra layer 2 segment to be sent to the MS.

5.2 "Directed Retry" type Handovers

5.2.1 Justification

In the HANDOVER COMMAND message there is an optional Channel Mode Information Element. When this information element is included in the handover command the MS should go to the new channel mode when it hands over to the new channel. This information element may be used for "directed retry" type handovers where a cell has an MS on a control channel but has no available traffic channel for the MS to use. The network may then choose to handover the MS to a new cell with traffic channel (TCH) capacity and change the channel mode at the same time.

Some MSs appear to accept the handover command, from Stand-alone Dedicated Control Channel (SDCCH) to TCH with speech mode, and make the required channel and mode change but do not through connect the speech path.

5.2.2 Solution

To ensure correct operation, of these MSs, the infrastructure should always initiate a channel mode change procedure according to TS GSM 04.08 (Phase 1) (I-ETS 300 022-1) [2] clause 3.4.6 once the MS has arrived at the new channel following a handover of a Phase 1 MS involving a channel mode change to full rate speech.

The additional channel mode change procedure shall only be performed for a directed retry handover to a full rate speech channel, and not for a data channel. First this will save performance in these cases, and secondly some MS's will release the call with this additional and unnecessary channel mode change procedure in case of fax or data calls.

For internal intra-Base Station System (BSS) handovers, this decision to initiate channel mode modify is taken by the BSS concerned. For external intra-BSS and inter-BSS handovers, the new BSS must know that there has been a change of mode from the previous BSS and that therefore a channel mode change procedure must be executed. The communication of this information is achieved by using the "current channel" element in the HANDOVER REQUEST and HANDOVER REQUIRED message as described in the Annex A.

In the case of external handover, the following will ensure correct operation with mobiles suffering from fault 5.2.1:

i) The change described in Annex A shall be implemented by the MSC and BSS concerned.

ii) The new BSS, after receiving a HANDOVER REQUEST containing a current channel IE indicating "signalling only", and a channel type indicating full rate speech, shall behave as specified in TS GSM 08.08 and additionally, upon reception of the HANDOVER COMPLETE message, initiate a channel mode change procedure according to TS GSM 04.08 with the new mode indicating speech.

If the new BSS receives a HANDOVER REQUEST without the current channel IE but containing a cause value "directed retry", and a channel type indicating full rate speech, it shall also behave as ii) above.

NOTE: The performance of MSs not experiencing this problem has been checked for a sizeable subset of the MSs available in Phase 1, but it has not been possible to check all versions of all MSs.

5.3 Cell broadcast and frequency hopping

5.3.1 Justification

In the SYSTEM INFORMATION TYPE 4 message there is an optional Information Element "CBCH Channel Description" used when a cell broadcast channel is configured in the network.

Some Types of GSM 900 MSs may not obtain service whilst within reception range of a cell from any network having the CBCH configured with frequency hopping: i.e. the Hopping channel bit set to 1 in the "CBCH Channel description" information element.

5.3.2 Solution

To enable operation from the affected MS, the infrastructure could configure the CBCH on a non hopping channel:

- In combined type of configuration: the CBCH would be distributed on the SDCCH/4 with BCCH
- In non-combined type of configuration, two types of solution are considered:
  - Type 1 CBCH distributed on a non hopping SDCCH broadcasted on TSx of C0 (x=1,2,3)
  - Type 2 CBCH distributed on a non hopping SDCCH broadcasted on TS0 of Cx (x≠0)

5.4 Handling of Phase 2 and Phase2+ BCCH Messages

5.4.1 Justification

Some types of Phase1 GSM 900 MSs could fail to offer full services whilst System Information messages other than those specified in GSM 900 Phase1 are broadcast with a L2 Pseudo Length value greater than 1.

5.4.2 Solution

In order to provide service to these existing GSM 900 MS and not disturb Phase2 MS, the following restrictions and changes should be implemented in the P-GSM 900 band of the network.

~~For System Information 2ter, the value 0 of the L2 Pseudo Length shall be used instead of 18.~~

~~The System Information 2bis shall not be used in the P-GSM 900 band of the network.~~

~~Therefore, the EXT-IND bit in System Information 2 in the P-GSM 900 Band of the network shall not be set to 1.~~

~~5.5 Handling of Phase 2 and Phase2+ SACCH Messages~~

~~5.5.1 Justification~~

~~Some types of Phase1 MSs may experience performance degradation if the network sends System Information Messages other than those specified in Phase1.~~

~~5.5.2 Solution~~

~~In order not to degrade the performance of these Phase1 mobile stations it is recommended:~~

- ~~any new messages that are not defined in Phase1 shall not be sent to a Phase1 MS, e.g System Information 5bis and 5ter to a Phase1 P-GSM 900 mobile station and System Information 5ter to a Phase1 DCS 1800 mobile station.~~

~~5.6 Handling of assignment message using Mobile Allocation IE including ARFCN=0~~

~~5.6.1 Justification~~

~~Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network sends an assigning message (Immediate Assignment, Assignment Command or Handover Command) that uses the Mobile Allocation IE to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.6.2 Solution~~

~~To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence. When assigning a channel at RR connection establishment (Immediate Assignment), this solution should be used.~~

~~When a channel resource is assigned, using either the Assignment Command or the Handover Command message, the infrastructure may use the Frequency List or the Frequency Short List IEs in the assigning message to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.7 Hopping sequence generation including ARFCN=0~~

~~5.7.1 Justification~~

~~Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network assigns an RF hopping channel that includes ARFCN=0 in the hopping sequence.~~

~~5.7.2 Solution~~

~~To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence.~~

6 VoidUse of VAD/DTX in conjunction with frequency hopping for a speech call

6.1 Scope

The chapter six of this Technical Report is to identify limitations in the specification for phase 1 reflected in performance degradation in phase 1 terminal equipment. This report identifies possible ways of improving the service offered to subscribers using phase 1 terminals whilst using the two features - downlink DTX and frequency hopping at the same time.

6.2 General

The specification of acoustic performance of the MS when downlink DTX is implemented is in GSM 05.05 which restricts the MS performance to 1 undetected bad frame in 10s when in the presence of random RF. In reality the MS does not experience random RF exclusively when downlink DTX is implemented.

There is a SIlence Descriptor (SID) frame sent on eight bursts every 104 bursts. Due to the interleaving scheme, half of the bits of the frame preceding the SID and half of the bits of the frame following the SID are sent and there is no specific requirement covering what is sent for these bits but in most cases it is every other bit of a correctly coded frame. The MS receives these bits

In addition, when the ARFCN used is C0, dummy bursts are sent when there is neither speech nor signalling to be transmitted.

Finally, when frequency hopping is used as well as downlink DTX, the MS may receive random RF on some TDMA frames and dummy bursts on others (C0).

It is possible for the MS to receive combinations of transmitted bits at high confidence and random RF at low confidence. In some cases the MS can then decode the frame as good when in fact it was never intended to have been transmitted and the resultant bad frame can give a very annoying acoustic effect known as banjo noise. The occurance of these noises, even if no more frequent than one in 10s, is worse than one would expect from a high quality cellular system.

The three following sections refer to ways of improving the system performance for MS approved according to the existing phase 1 specification. Section 6.3 identifies some "normal" operation configurations which would improve undetected bad frame performance for MS's with the above fault (banjo noise), section 6.4 describes aspects for possible changed network implementation, section 6.5 relates the results of tests performed using combinations of the implementations described in section 6.4 and whether that combination was effective or not.

6.3 Implementation options to reduce the occurance of undetected bad frames by utilising normal system features

This section deals with a variety of options to improve the system performance which are implementable by normal system operational choices. These options typically improve matters in specific configurations and are not universal solutions for all configurations. It may be possible that some networks do not permit such configuration.

6.3.1 Number of frequency hopping channels

The number of undetected bad frames is related to the probability of getting sufficient dummy bursts transmitted to make a false good frame decision. The number of dummy bursts received depends on the number of ARFCN in the hopping list. Hence frequency hopping on 3 ARFCN gives better audio performance than frequency hopping on 2, likewise hopping on 4 ARFCN gives better performance than hopping on 3.

In tests of the comparison between hopping on 2 ARFCN and hopping on 3, some MS have been found to improve to approximately one tenth of the occurance of bad frames, while others have improved from a slightly annoying level when hopping on 2 ARFCN, to give no audible disruption when hopping on 3. Not all MS have been tested and it is believed that the improvement for some MS may be less noticeable.

This solution is obviously not trivial to implement in a frequency plan, but could also be used to enable frequency hopping on cells which naturally have 3 or more ARFCN operational whilst selecting a solution for other parts of the network and operational scenarios.

6.3.2 Frequency hopping type

When utilising pseudo-random frequency hopping, it is possible to get more dummy bursts in a speech frame than when utilising cyclic frequency hopping. As an alternative to random frequency hopping, cyclic hopping may be used. It will minimise the banjo noise effect experienced by the faulty mobiles. This will however be done at the expense of a possible degradation of performance during speech activity period for all mobiles due to the absence of interferer diversity.

In tests of the comparison between pseudo-random frequency hopping and cyclic frequency hopping, some phones were found to improve with the use of cyclic hopping to approximately one third of the occurance of bad frames when using pseudo-random hopping, while others have improved from a slightly annoying level to give no audible disruption. Not all phones have been tested for this.

6.3.3 Continuous SID frames on C0

At some times, a network implementing downlink DTX may hold a call on C0. In this case it would be possible for the network to send dummy bursts when it has nothing else to send. This is likely to cause a high level of unwanted noises for some MS. An alternative would be to send continuous SID frames in which case there should be no undesired effects.

6.4 Implementation options to reduce the occurance of undetected bad frames by changing normal system operation

This section deals with implementation options which improve the audio quality of the faulty mobiles, suffering from banjo noise, by making changes to the network equipment. The solutions give varying performance improvements but not all solutions would be possible on all networks.

6.4.1 Changing the training sequence of the dummy burst to a new (ninth) training sequence

If a different training sequence code is used for all dummy bursts forming part of the TCH on C0, the MS will have difficulty training to the dummy burst frames and this would cause the bits to be received as low confidence. This would then give a performance rather more like that for random RF input and should then meet the 05.05 requirement.

6.4.2 Using an alternative training sequence out of the eight assigned

This option is similar in concept and performance to the one described in section 6.4.1. The advantage is that it may be usable in some networks where it is not easily possible to add a ninth training sequence. The following table gives a list of training sequence codes for the TCH and the preferred choice of training sequence code for the dummy burst.

Training sequence code for TCH	Training sequence code for dummy bursts on C0
0	2
1	5
2	0
3	4
4	5
5	2
6	3
7	5

6.4.3 Setting the stealing flag for the bits transmitted which are not intended to be part of the TCH

When bits are transmitted which are not intended for reception in the TCH path, such as dummy bursts and the half burst before and after a discrete, wanted frame, it would be possible to set the stealing flag for these bits and so bias the decision of the majority vote on stealing flags in favour of routing the frame as control information rather than speech information. The channel protection on the control channel is much greater and the chance of getting an undetected bad control channel frame is very low.

6.4.4 Sending partial SID frames on C0

It has been observed that improvements in the undetected bad frame rate are seen when the BTS sends partial SID frames on the otherwise unused TCH bursts on C0. This is because the high confidence bits are correctly coded for the relevant speech frame and the normal design of the MS receiver is expected to cope with such errors. This proposal works best for DCS 1800 because very early GSM models are not represented in DCS 1800.

6.5 Tested Combinations

This section identifies tests that have been performed and the results that have been obtained. The reporting of result is limited to acceptable or not acceptable and a brief additional comment is sometimes made. If the result is deemed to be acceptable, most products which suffer from the described problem have been improved to a point where extraneous noises are significantly reduced to virtually nothing and no product has got worse. No solution completely corrected all products but significant improvements have been achieved if the result is deemed acceptable.

6.5.1 "Normal" system

Test configuration:

Sent on C0:
Dummy bursts using training sequence from TCH.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Unacceptable; Several products exhibit frequent noises from undetected bad frames.

6.5.2 New training sequence

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.3 Alternative training sequence from the eight assigned

Test configuration:

Sent on C0:
Dummy bursts using alternative training sequence according to table in 6.4.2.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information not necessarily related to the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.4 Setting stealing flag for unintentionally transmitted bits

Test configuration:

Sent on C0:
Partial SID information from the two SID frames otherwise scheduled for transmission.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 1

Result:

Acceptable.

6.5.5 Setting stealing flag for unintentionally transmitted bits and modifying training sequence for Dummy Bursts

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Dummy burst mixed bits

Half burst stealing flags:
Set to 1

Result:

Acceptable; This configuration gave marginally the best performance of all tested.

6.5.6 Sending partial SID information on C0

Test configuration:

Sent on C0:
Part SID frames

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable for DCS 1800.

Annex A:
VoidAmendment Request 08.08 - 021 R4: Information on channel in use in HO REQUEST

NOTE: This Annex A reflects the Amendment Request 08.08 - 021 R4 which was approved by SMG#15 and is part of the TS GSM 08.08 version 4.9.0.

A.3.1.5.1.1 Generation of the HANDOVER REQUIRED message

Generation of the HANDOVER REQUIRED message can be for the following reasons:

- The BSS has detected that a radio reason exists for a handover to occur.
- The MSC has initiated a handover candidate enquiry procedure, and this MS is currently a candidate.
- A cell change is required at call setup due to congestion, e.g. directed retry.

The HANDOVER REQUIRED message contains the following information elements:

- Message Type;
- Cause;
- Cell Identifier List (preferred).

It should also contain the "Current channel" information element.

Sec. 3.2.1.9. gives coding details of the above message.

The "Cause" field indicates the reason for the HANDOVER REQUIRED message e.g. "uplink quality poor" or "response to MSC invocation" in the case of traffic reasons indicated by the MSC.

If present the "Response Request" Information Element indicates, that the BSS requires an indication if the HANDOVER REQUIRED message does not result in a HANDOVER COMMAND message.

If the BSS wants to change the CIC due to a channel change, the BSS sends a HANDOVER REQUIRED message with the cause "switch circuit pool" and the "circuit pool list" information element. The "circuit pool list" information element will allow the BSS to indicate to the MSC from which circuit pool or pools the new CIC should be chosen.

The "Cell Identifier List (preferred)" shall identify "n" preferred cells. The identified cells are given in order of preference. The algorithm by which the BSS produces this list is Operator dependent and is not addressed in this Technical Specification. The "n" number of preferred cells is a parameter set by O&M and shall range from 1 to 16. If "n" number of cells cannot be identified, then only as many as are available shall be encoded and sent (as specified in section 3.2.2.27).

It is mandatory for the BSS to be able to produce this "Cell Identifier List (preferred)". The sending of this list is controlled by the O&M parameter "n". It is mandatory for the MSC to be able to receive and interpret this Information Element.

The HANDOVER REQUIRED message shall be updated and repeated by the BSS with a periodicity of T7 until:

- A HANDOVER COMMAND message is received from the MSC, or;
- A RESET message is received, or;
- The reason for the original HANDOVER REQUIRED message disappears e.g. the MS transmission improves, or;
- All communication is lost with the MS as defined in Technical Specification GSM 04.08, and the transaction is abandoned, or;
- The transaction ends, e.g., call clearing.

A.3.1.5.2 Handover Resource allocation

This procedure has been defined to allow the MSC to request resources from a BSS in a manner similar to that used for the assignment case. However it does not result in the transmission of any messages over the radio interface, only in the reservation of the resource identified at the BSS, which awaits access of a MS on the reserved channel. These reserved resources are then indicated back to the MSC.

In order to support this procedure the MSC sets up a BSSAP SCCP connection to the BSS. This connection is then used to support all BSSAP messages related to this dedicated resource.

A.3.1.5.2.1 Operation of the procedure

The correct operation of the handover resource allocation procedure is as follows:

The MSC sends a HANDOVER REQUEST message to the new BSS (note 1) from which it requires radio resources. This message contains details of the resource that is required. If the requested resource is for speech or data it also indicates the terrestrial resource that shall be used between the MSC and the BSS. The type of channel required can be different from the type of channel in use, e.g. in the case of directed retry. The description of the resource can either specify it completely, or give the BSS some freedom in the selection. The message may also specify the channel in use.

On receipt of this message the new BSS shall choose a suitable idle radio resource.

The management of priority levels – relating to the Information Element "Priority" within the HANDOVER REQUEST message – is implementation dependent, under operator control.

If queueing is managed, new requests which cannot be served immediately are put in the queueing file according to the indicated priority levels.

(Refer to section 3.1.17 for Queuing Procedure)

As a further operator option, the preemption indicators may (alone or along with the priority levels) be used to manage the preemption process, which may lead to the forced release or forced handover of lower priority connections.

However, the preemption indicators (refer to section 3.2.2.18), if given in the HANDOVER REQUEST, shall be treated on a per connection basis as follows:

- the last received "Preemption Vulnerability" indicator and priority levels shall prevail.
- if the "Preemption Capability" bit is set to 1, then this allocation request can trigger the running of the preemption procedure.
- if the "Preemption Capability" bit is set to 0, then this allocation request cannot trigger the preemption procedure.
- if the "Preemption Vulnerability" bit is set to 1, then this connection is vulnerable and shall be included in the preemption process or procedure and as such may be subject to forced release or forced handover.
- if the "Preemption Vulnerability" bit is set to 0, then this connection is not vulnerable to preemption and shall not be included in the preemption process and as such may not be subject to forced release or forced handover.
- if no Priority Information Element has been received, both "Preemption Capability" and "Preemption Vulnerability" bits shall be regarded as set to 0.

If a radio resource is available then this will be reflected back to the MSC in a HANDOVER REQUEST ACKNOWLEDGE message. The HANDOVER REQUEST ACKNOWLEDGE message sent by the new BSS shall contain the radio interface message HANDOVER COMMAND within its "Layer 3 Information" Information Element. This "Layer 3 Information" (which is in fact the RR Layer 3 HANDOVER COMMAND) is transferred by the controlling MSC to the old BSS using the BSSMAP message HANDOVER COMMAND also within the Information Element "Layer 3 Information" of that BSSMAP message. The old BSS then sends to the MS over the radio interface the RR Layer 3 HANDOVER COMMAND message. Information about the appropriate new channels and a handover reference number chosen by the new BSS are contained in the HANDOVER COMMAND. Knowledge of the channel in use at the old BSS allows the new BSS to minimize the size of the HANDOVER COMMAND message (i.e. to decide whether the mode of the first channel IE need not be included in the HANDOVER COMMAND).

NOTE: The new BSS and the old BSS may be the same.

When several circuit pools are present on the BSS-MSC interface, the "circuit pool" information field shall be included in the HANDOVER REQUEST ACKNOWLEDGE. The "circuit pool" field will indicate to the MSC the circuit pool of the CIC given in the HANDOVER REQUEST message.

The sending of the HANDOVER REQUEST ACKNOWLEDGE by the new BSS to the MSC ends the Handover Resource Allocation procedure. The Handover Execution procedure can now proceed and this is given in section 3.1.5.3.

The new BSS shall then take all necessary action to allow the MS to access the radio resource that the new BSS has chosen, this is detailed in the GSM 05 series of Technical Specifications. If the radio resource is a traffic channel then the new BSS shall at this point switch it through to the terrestrial resource indicated in the HANDOVER REQUEST message, and the necessary transcoding/rate adaption/encryption equipment enabled as detailed in Technical Specification GSM 04.08.

The optimum procedure for switching through to the target cell at the MSC is not defined in these Technical Specifications.

A.3.2.1.8 HANDOVER REQUEST

This message is sent from the MSC to the BSS via the relevant SCCP connection to indicate that the MS is to be handed over to that BSS.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	MSC-BSS	M	1
Channel type	3.2.2.11	MSC-BSS	M	5
Encryption information	3.2.2.10	MSC-BSS	M	3-n
Classmark information 1 or	3.2.2.30	MSC-BSS	M#	2
Classmark information 2	3.2.2.19	MSC-BSS	M#	4-5
Cell identifier (serving)	3.2.2.17	MSC-BSS	M	5-10
Priority	3.2.2.18	MSC-BSS	O	3
Circuit identity code	3.2.2.2	MSC-BSS	O##	3
Downlink DTX flag	3.2.2.26	MSC-BSS	O*	2
Cell identifier (target)	3.2.2.17	MSC-BSS	M	3-10
Interference band to be used	3.2.2.21	MSC-BSS	O	2
Cause	3.2.2.5	MSC-BSS	O	3-4
Classmark information 3	3.2.2.20	MSC-BSS	O**	3-14
Current channel	3.2.2.49	MSC-BSS	O§	2

* This element may be included in the case of a speech TCH, and only in this case. If not included, this has no impact on the DTX function in the BSS.

** This element is included if the MSC has received such information.

One of these two elements is sent.

This element is included when the channel type Information Element indicates speech or data, and only in those cases.

§ This element is included at least when the message is sent as a reaction to reception of a HANDOVER REQUIRED message containing a "Current channel" information element. In this case it shall be equal to the received element.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength
- distance,
- better cell,
- response to MSC invocation
- O and M intervention,

- directed retry,
- switch circuit pool.

A.3.2.1.9 HANDOVER REQUIRED

This message is sent from the BSS to the MSC to indicate that for a given MS which already has a dedicated radio resource assigned, a handover is required for the reason given by the cause element.

The message is sent via the BSSAP SCCP connection associated with the dedicated resource.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	BSS-MSC	M	1
Cause	3.2.2.5	BSS-MSC	M	3-4
Response request	3.2.2.28	BSS-MSC	O	1
Cell identifier list (preferred)	3.2.2.27	BSS-MSC	M	2n+3 to 7n+3
Circuit pool list	3.2.2.46	BSS-MSC	O*	V
Current channel	3.2.2.49	BSS-MSC	O**	2

* Shall be included when cause "switch circuit pool".

** This information element should always be included.

Typical Cause values are:

- uplink quality,
- uplink strength,
- downlink quality,
- downlink strength,
- distance,
- better cell,
- response to MSC invocation,
- O&M intervention,
- directed retry,
- switch circuit pool.

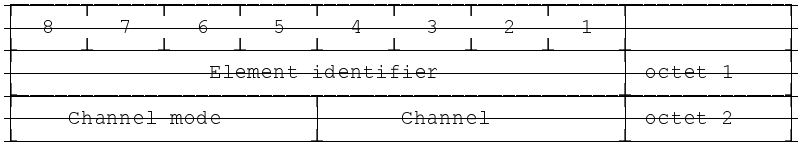
Element Identifier Coding	Element name	Reference
0000 0001	Circuit identity code	3.2.2.2.
0000 0010	Reserved	*
0000 0011	Resource available	3.2.2.4.
0000 0100	Cause	3.2.2.5.
0000 0101	Cell identifier	3.2.2.17.
0000 0110	Priority	3.2.2.18.
0000 0111	Layer 3 header information	3.2.2.9.
0000 1000	IMSI	3.2.2.6.
0000 1001	TMSI	3.2.2.7.
0000 1010	Encryption information	3.2.2.10.
0000 1011	Channel type	3.2.2.11.
0000 1100	Periodicity	3.2.2.12.
0000 1101	Extended resource indicator	3.2.2.13.
0000 1110	Number of MSs	3.2.2.8.
0000 1111	Reserved	*
0001 0000	Reserved	*
0001 0001	Reserved	*
0001 0010	Classmark information type 2	3.2.2.19.
0001 0011	Classmark information type 3	3.2.2.20.
0001 0100	Interference band to be used	3.2.2.21.
0001 0101	RR Cause	3.2.2.22.
0001 0110	Reserved	*
0001 0111	Layer 3 information	3.2.2.24.
0001 1000	DLCI	3.2.2.25.
0001 1001	Downlink DTX flag	3.2.2.26.
0001 1010	Cell identifier list	3.2.2.27.
0001 1011	Response request	3.2.2.28.
0001 1100	Resource indication method	3.2.2.29.
0001 1101	Classmark information type 1	3.2.2.30.
0001 1110	Circuit identity code list	3.2.2.31.
0001 1111	Diagnostic	3.2.2.32.
0010 0000	Layer 3 message contents	3.2.2.35.
0010 0001	Chosen channel	3.2.2.33.
0010 0010	Total resource accessible	3.2.2.14.
0010 0011	Cipher response mode	3.2.2.34.
0010 0100	Channel needed	3.2.2.36.
0010 0101	Trace type	3.2.2.37.
0010 0110	TriggerId	3.2.2.38.
0010 0111	Trace reference	3.2.2.39.
0010 1000	TransactionId	3.2.2.40.
0010 1001	Mobile identity	3.2.2.41.
0010 1010	OMCId	3.2.2.42.
0010 1011	Forward indicator	3.2.2.43.
0010 1100	Chosen encryption algorithm	3.2.2.44.
0010 1101	Circuit pool	3.2.2.45.
0010 1110	Circuit pool list	3.2.2.46.
0010 1111	Time indication	3.2.2.47.
0011 0000	Resource situation	3.2.2.48.
0011 0001	Current channel	3.2.2.49.

* Information Element codes marked as "reserved are reserved for use by previous versions of this interface specification.

A.3.2.2.49 CURRENT CHANNEL

This Information Element contains a description of the channel allocated to the MS.

It is coded as follows:



~~The channel mode field is coded as follows:~~

~~Bit 8765~~
~~— 0000 signalling only~~
~~— 0001 speech (full rate or half rate)~~
~~— 0011 data, 12.0 kbit/s radio interface rate~~
~~— 0100 data, 6.0 kbit/s radio interface rate~~
~~— 0101 data, 3.6 kbit/s radio interface rate~~

~~All other values are reserved.~~

~~The channel field is coded as follows:~~

~~Bit 4321~~
~~— 0001 SDCCH~~
~~— 1000 Full rate TCH~~
~~— 1001 Half rate TCH~~

~~All other values are reserved.~~

Annex B (informative): Change Request History

SPEC	SMG#	CR	PHS	VERS	NEW_V	SUBJECT
09.94	s30	A008	2	4.4.0	4.5.0	Change of Title, Scope and References Clauses 1 to 5)
09.94	s30	A009	2	4.4.0	4.5.0	Frequency Hopping using ARFCN=0

History

Document history		
Edition 1	August 1995	Publication as ETR 200
Edition 2	November 1995	Publication as ETR 200
Edition 3	September 1996	Publication as ETR 200
V4.5.0	November 1999	Publication

3GPP TSG-CN1 Meeting #24
Budapest, Hungary, 13. – 17. May 2002

Tdoc N1-021374
Revision of N1-021270

CR-Form-v5

CHANGE REQUEST

⌘ **29.994** **CR** **A016** ⌘ **rev** **1** ⌘ Current version: **4.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	QoS IE length
Source:	⌘	Nokia
Work item code:	⌘	TEI5
Date:	⌘	6.5.2002
Category:	⌘	**A**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	One R97 ME implementation is known to handle QoS as fixed length IE and therefore it can not access R99 and later GPRS networks. It was not seen feasible in CN1 #23 to change the core specification due to this and therefore this specific mobile station problem needs to be described in the appropriate TR to document a workaround solution.
Summary of change:	⌘	SGSN can provide a workaround solution to overcome the problem by sending only the first 5 QoS octets to pre-R99 mobile stations. The workaround is defined in the latest version of the TR, the older versions only give a pointer to the currently latest version.
Consequences if not approved:	⌘	Lots of subscribers are not able to use GPRS services when 3G services are rolled out in GSM networks

Clauses affected:	⌘	1, 2 and 5
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	Only one version of 09.94 did exist and this GSM phase 2 covered all releases. The intention is to keep just one version of the document but this should always be the latest one. The principle of creating corresponding RAN document and the scope of the document were agreed in RAN #14, tdoc RP-010928.

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

ETSI TR 101 646 V4.5.0 (1999-11)

Technical Report

Digital cellular telecommunications system (Phase 2 & Phase 2+); Recommended infrastructure measures to overcome specific Mobile Station (MS) faults (GSM 09.94 version 4.5.0)

Reference
RTR/SMG-000994PR4 (f8o021o4.PDF)

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Foreword

This Technical Report (TR) has been produced by the Special Mobile Group (SMG).

The present document supersedes ETR 200 version 4.4.0.

The contents of the present document is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will be re-released with an identifying change of release date and an increase in version number as follows:

Version 4.x.y

where:

- 4 indicates GSM Phase 2.
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document clarifies recommended measures which may be adopted by ~~the GSM infrastructure to enable interworking to be obtained between the GSM infrastructure and various Mobile Station (MS) implementations of the GSM Phase 1 and Phase 2/2+ standard~~3GPP infrastructure utilising GSM or GERAN as access network to enable interworking to be obtained between network and various User Equipment (UE) implementations of the 3GPP specification. The objective is to obtain compatibility without changing the consolidated set of ~~Phase 1 and Phase 2/2+~~ specifications. The present document describes the recommended changes to the infrastructure to cater for specific faults within some types of UE ~~MSs~~.

The lifetime of the herein described measures together with their potential impact on optimal network performance is out of the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".

[2] GSM 04.08 Phase 1 (I-ETS 300 022-1): "Digital cellular telecommunications system (Phase 1); Mobile radio interface layer 3 specification Part 1: Generic".

[3] GSM 04.08 (ETS 300 557): "European digital cellular telecommunications system (Phase 2); Mobile radio interface layer 3 specification".

[4] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[5] GSM 05.05 (ETS 300 577): "Digital cellular telecommunication system (Phase 2); Radio Performance Aspects.

[6] GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio Performance Aspects.

[7] 3GPP TS 24.007: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3 General aspects".

[8] 3GPP TS 24.008: "Mobile radio interface layer 3 specification Core Network Protocols-Stage 3".

[9] 3GPP TS 23.107: "Quality of Service, Concept and Architecture".

3 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04 [1].

4 General

In the implementation of the standard it has been found that some aspects of the specifications have been mis-interpreted by some MS manufacturers. These MSs require specific implementations of the Phase 1 standard in the infrastructure, to provide completely compatible interworking.

It has been assumed throughout this TR that Phase 2 and later infrastructure will interwork with Phase 1 MSs in the same way as Phase 1 infrastructure.

The remainder of this ETR describes how to overcome the possible impacts of the above factors. Descriptions given are limited to specific implementations which are permissible for the Phase of the infrastructure.

5 Specific implementation on the radio interface

This clause deals with the choice of specific infrastructure implementation options of the protocols at the radio interface. The protocols concerned are defined in GSM 04.08 Phase 1 [2] Phase2 [3] and Phase 2+ [4]. The corresponding protocol definitions for R99 and later releases are in 24.007 [7] and 24.008 [8].

5.1 Handovers and "Synchronisation Indication"

5.1.1 Justification

In the HANDOVER COMMAND message there is a mandatory part consisting of nine octets followed by several optional information elements. The first optional information element is Synchronisation Indication which is a type 1 Information Element (IE) and as such is coded, with IE Identifier (IEI), on one octet. Other optional IE follow the Synchronisation Indication IE and are used to:

- indicate the frequency hopping sequence to use on the new channel;
- indicate the channel mode for the new channel;
- indicate a start time.

Some types of MS do not correctly decode these following information elements if the Synchronisation Indication information element is omitted.

5.1.2 Solution

To ensure correct operation the infrastructure should always send the Synchronisation Indication IE to a Phase 1 MS.

NOTE: In a few cases this will force an extra layer 2 segment to be sent to the MS.

5.2 "Directed Retry" type Handovers

5.2.1 Justification

In the HANDOVER COMMAND message there is an optional Channel Mode Information Element. When this information element is included in the handover command the MS should go to the new channel mode when it hands over to the new channel. This information element may be used for "directed retry" type handovers where a cell has an MS on a control channel but has no available traffic channel for the MS to use. The network may then choose to handover the MS to a new cell with traffic channel (TCH) capacity and change the channel mode at the same time.

Some MSs appear to accept the handover command, from Stand-alone Dedicated Control Channel (SDCCH) to TCH with speech mode, and make the required channel and mode change but do not through connect the speech path.

5.2.2 Solution

To ensure correct operation, of these MSs, the infrastructure should always initiate a channel mode change procedure according to TS GSM 04.08 (Phase 1) (I-ETS 300 022-1) [2] clause 3.4.6 once the MS has arrived at the new channel following a handover of a Phase 1 MS involving a channel mode change to full rate speech.

The additional channel mode change procedure shall only be performed for a directed retry handover to a full rate speech channel, and not for a data channel. First this will save performance in these cases, and secondly some MS's will release the call with this additional and unnecessary channel mode change procedure in case of fax or data calls.

For internal intra-Base Station System (BSS) handovers, this decision to initiate channel mode modify is taken by the BSS concerned. For external intra-BSS and inter-BSS handovers, the new BSS must know that there has been a change of mode from the previous BSS and that therefore a channel mode change procedure must be executed. The communication of this information is achieved by using the "current channel" element in the HANDOVER REQUEST and HANDOVER REQUIRED message as described in the Annex A.

In the case of external handover, the following will ensure correct operation with mobiles suffering from fault 5.2.1:

i) The change described in Annex A shall be implemented by the MSC and BSS concerned.

ii) The new BSS, after receiving a HANDOVER REQUEST containing a current channel IE indicating "signalling only", and a channel type indicating full rate speech, shall behave as specified in TS GSM 08.08 and additionally, upon reception of the HANDOVER COMPLETE message, initiate a channel mode change procedure according to TS GSM 04.08 with the new mode indicating speech.

If the new BSS receives a HANDOVER REQUEST without the current channel IE but containing a cause value "directed retry", and a channel type indicating full rate speech, it shall also behave as ii) above.

NOTE: The performance of MSs not experiencing this problem has been checked for a sizeable subset of the MSs available in Phase 1, but it has not been possible to check all versions of all MSs.

5.3 Cell broadcast and frequency hopping

5.3.1 Justification

In the SYSTEM INFORMATION TYPE 4 message there is an optional Information Element "CBCH Channel Description" used when a cell broadcast channel is configured in the network.

Some Types of GSM 900 MSs may not obtain service whilst within reception range of a cell from any network having the CBCH configured with frequency hopping: i.e. the Hopping channel bit set to 1 in the "CBCH Channel description" information element.

5.3.2 Solution

To enable operation from the affected MS, the infrastructure could configure the CBCH on a non hopping channel:

- In combined type of configuration: the CBCH would be distributed on the SDCCH/4 with BCCH
- In non-combined type of configuration, two types of solution are considered:
  - Type 1 CBCH distributed on a non hopping SDCCH broadcasted on TSx of C0 (x=1,2,3)
  - Type 2 CBCH distributed on a non hopping SDCCH broadcasted on TS0 of Cx ($x \neq 0$)

5.4 Handling of Phase 2 and Phase2+ BCCH Messages

5.4.1 Justification

Some types of Phase1 GSM 900 MSs could fail to offer full services whilst System Information messages other than those specified in GSM 900 Phase1 are broadcast with a L2-Pseudo Length value greater than 1.

5.4.2 Solution

In order to provide service to these existing GSM 900 MS and not disturb Phase2 MS, the following restrictions and changes should be implemented in the P-GSM 900 band of the network.

For System Information 2ter, the value 0 of the L2 Pseudo Length shall be used instead of 18.

The System Information 2bis shall not be used in the P-GSM 900 band of the network.

Therefore, the EXT-IND bit in System Information 2 in the P-GSM 900 Band of the network shall not be set to 1.

5.5 Handling of Phase 2 and Phase2+ SACCH Messages

5.5.1 Justification

Some types of Phase1 MSs may experience performance degradation if the network sends System Information Messages other than those specified in Phase1.

5.5.2 Solution

In order not to degrade the performance of these Phase1 mobile stations it is recommended:

> any new messages that are not defined in Phase1 shall not be sent to a Phase1 MS, e.g System Information 5bis and 5ter to a Phase1 P GSM 900 mobile station and System Information 5ter to a Phase1 DCS 1800 mobile station.

5.6 Handling of assignment message using Mobile Allocation IE including ARFCN=0

5.6.1 Justification

Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network sends an assigning message (Immediate Assignment, Assignment Command or Handover Command) that uses the Mobile Allocation IE to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.6.2 Solution

To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence. When assigning a channel at RR connection establishment (Immediate Assignment), this solution should be used.

When a channel resource is assigned, using either the Assignment Command or the Handover Command message, the infrastructure may use the Frequency List or the Frequency Short List IEs in the assigning message to specify an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.7 Hopping sequence generation including ARFCN=0

5.7.1 Justification

Some type of Phase 2 and Phase 2+ MSs may not access the assigned channel correctly if the network assigns an RF hopping channel that includes ARFCN=0 in the hopping sequence.

5.7.2 Solution

To enable operation of all MSs, the infrastructure can avoid using RF hopping channels that include ARFCN=0 in the hopping sequence.

5.8 QoS IE length between R97 and R99 implementations

5.8.1 Justification

Quality of Service was initially defined in R97 specifications as a type 4 TLV coded IE but with fixed length of 5 octets.

Subsequently the length of the IE was extended to maximum 13 octets in R99 and further on to 14 octets in Rel-5.

Some types of R97 MS do not accept new length for this IE which used to be fixed in R97 reference version. Such MS will diagnose an erroneous mandatory IE and consequently reject the PDU containing the IE and send back SM status with cause #96.

This means that such a R97 MS can not support GPRS procedures for PDP context activation or PDP context modification in R99 network.

5.8.2 Solution

To enable operation of all MSs, the infrastructure may adapt the length of the QoS IE it sends to MS according to the served MS by sending only the first 5 QoS octets to pre-R99 GSM mobiles. This can be done either based on the MS Classmark revision level or alternatively the infrastructure may check how many octets were received from the MS in the QoS IE.

Note: The mapping between the information in the original R97/98 part of QoS and later extension part is defined in TS 23.107.

Note 2: This subclause was added to the present document in 3GPP TSGN #16.

6 Use of VAD/DTX in conjunction with frequency hopping for a speech call

6.1 Scope

The chapter six of this Technical Report is to identify limitations in the specification for phase 1 reflected in performance degradation in phase 1 terminal equipment. This report identifies possible ways of improving the service offered to subscribers using phase 1 terminals whilst using the two features - downlink DTX and frequency hopping at the same time.

6.2 General

The specification of acoustic performance of the MS when downlink DTX is implemented is in GSM 05.05 which restricts the MS performance to 1 undetected bad frame in 10s when in the presence of random RF. In reality the MS does not experience random RF exclusively when downlink DTX is implemented.

There is a SIlence Descriptor (SID) frame sent on eight bursts every 104 bursts. Due to the interleaving scheme, half of the bits of the frame preceding the SID and half of the bits of the frame following the SID are sent and there is no specific requirement covering what is sent for these bits but in most cases it is every other bit of a correctly coded frame. The MS receives these bits

In addition, when the ARFCN used is C0, dummy bursts are sent when there is neither speech nor signalling to be transmitted.

Finally, when frequency hopping is used as well as downlink DTX, the MS may receive random RF on some TDMA frames and dummy bursts on others (C0).

It is possible for the MS to receive combinations of transmitted bits at high confidence and random RF at low confidence. In some cases the MS can then decode the frame as good when in fact it was never intended to have been transmitted and the resultant bad frame can give a very annoying acoustic effect known as banjo noise. The occurance of these noises, even if no more frequent than one in 10s, is worse than one would expect from a high quality cellular system.

The three following sections refer to ways of improving the system performance for MS approved according to the existing phase 1 specification. Section 6.3 identifies some "normal" operation configurations which would improve undetected bad frame performance for MS's with the above fault (banjo noise), section 6.4 describes aspects for possible changed network implementation, section 6.5 relates the results of tests performed using combinations of the implementations described in section 6.4 and whether that combination was effective or not.

6.3 Implementation options to reduce the occurance of undetected bad frames by utilising normal system features

This section deals with a variety of options to improve the system performance which are implementable by normal system operational choices. These options typically improve matters in specific configurations and are not universal solutions for all configurations. It may be possible that some networks do not permit such configuration.

6.3.1 Number of frequency hopping channels

The number of undetected bad frames is related to the probability of getting sufficient dummy bursts transmitted to make a false good frame decision. The number of dummy bursts received depends on the number of ARFCN in the hopping list. Hence frequency hopping on 3 ARFCN gives better audio performance than frequency hopping on 2, likewise hopping on 4 ARFCN gives better performance than hopping on 3.

In tests of the comparison between hopping on 2 ARFCN and hopping on 3, some MS have been found to improve to approximately one tenth of the occurance of bad frames, while others have improved from a slightly annoying level when hopping on 2 ARFCN, to give no audible disruption when hopping on 3. Not all MS have been tested and it is believed that the improvement for some MS may be less noticeable.

This solution is obviously not trivial to implement in a frequency plan, but could also be used to enable frequency hopping on cells which naturally have 3 or more ARFCN operational whilst selecting a solution for other parts of the network and operational scenarios.

6.3.2 Frequency hopping type

When utilising pseudo-random frequency hopping, it is possible to get more dummy bursts in a speech frame than when utilising cyclic frequency hopping. As an alternative to random frequency hopping, cyclic hopping may be used. It will minimise the banjo noise effect experienced by the faulty mobiles. This will however be done at the expense of a possible degradation of performance during speech activity period for all mobiles due to the absence of interferer diversity.

In tests of the comparison between pseudo-random frequency hopping and cyclic frequency hopping, some phones were found to improve with the use of cyclic hopping to approximately one third of the occurance of bad frames when using pseudo-random hopping, while others have improved from a slightly annoying level to give no audible disruption. Not all phones have been tested for this.

6.3.3 Continuous SID frames on C0

At some times, a network implementing downlink DTX may hold a call on C0. In this case it would be possible for the network to send dummy bursts when it has nothing else to send. This is likely to cause a high level of unwanted noises for some MS. An alternative would be to send continuous SID frames in which case there should be no undesired effects.

6.4 Implementation options to reduce the occurance of undetected bad frames by changing normal system operation

This section deals with implementation options which improve the audio quality of the faulty mobiles, suffering from banjo noise, by making changes to the network equipment. The solutions give varying performance improvements but not all solutions would be possible on all networks.

6.4.1 Changing the training sequence of the dummy burst to a new (ninth) training sequence

If a different training sequence code is used for all dummy bursts forming part of the TCH on C0, the MS will have difficulty training to the dummy burst frames and this would cause the bits to be received as low confidence. This would then give a performance rather more like that for random RF input and should then meet the 05.05 requirement.

6.4.2 Using an alternative training sequence out of the eight assigned

This option is similar in concept and performance to the one described in section 6.4.1. The advantage is that it may be usable in some networks where it is not easily possible to add a ninth training sequence. The following table gives a list of training sequence codes for the TCH and the preferred choice of training sequence code for the dummy burst.

Training sequence code for TCH	Training sequence code for dummy bursts on C0
0	2
1	5
2	0
3	4
4	5
5	2
6	3
7	5

6.4.3 Setting the stealing flag for the bits transmitted which are not intended to be part of the TCH

When bits are transmitted which are not intended for reception in the TCH path, such as dummy bursts and the half burst before and after a discrete, wanted frame, it would be possible to set the stealing flag for these bits and so bias the decision of the majority vote on stealing flags in favour of routing the frame as control information rather than speech information. The channel protection on the control channel is much greater and the chance of getting an undetected bad control channel frame is very low.

6.4.4 Sending partial SID frames on C0

It has been observed that improvements in the undetected bad frame rate are seen when the BTS sends partial SID frames on the otherwise unused TCH bursts on C0. This is because the high confidence bits are correctly coded for the relevant speech frame and the normal design of the MS receiver is expected to cope with such errors. This proposal works best for DCS 1800 because very early GSM models are not represented in DCS 1800.

6.5 Tested Combinations

This section identifies tests that have been performed and the results that have been obtained. The reporting of result is limited to acceptable or not acceptable and a brief additional comment is sometimes made. If the result is deemed to be acceptable, most products which suffer from the described problem have been improved to a point where extraneous noises are significantly reduced to virtually nothing and no product has got worse. No solution completely corrected all products but significant improvements have been achieved if the result is deemed acceptable.

6.5.1 "Normal" system

Test configuration:

Sent on C0:
Dummy bursts using training sequence from TCH.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Unacceptable; Several products exhibit frequent noises from undetected bad frames.

6.5.2 New training sequence

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.3 Alternative training sequence from the eight assigned

Test configuration:

Sent on C0:
Dummy bursts using alternative training sequence according to table in 6.4.2.

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information not necessarily related to the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable.

6.5.4 Setting stealing flag for unintentionally transmitted bits

Test configuration:

Sent on C0:
Partial SID information from the two SID frames otherwise scheduled for transmission.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 1

Result:

Acceptable.

6.5.5 Setting stealing flag for unintentionally transmitted bits and modifying training sequence for Dummy Bursts

Test configuration:

Sent on C0:
Dummy bursts using new (ninth) training sequence.

Stealing flag on C0:
Set to 1

Half burst filling bits:
Dummy burst mixed bits

Half burst stealing flags:
Set to 1

Result:

Acceptable; This configuration gave marginally the best performance of all tested.

6.5.6 Sending partial SID information on C0

Test configuration:

Sent on C0:
Part SID frames

Stealing flag on C0:
Set to 0

Half burst filling bits:
Partial SID information from the SID frame otherwise scheduled for transmission.

Half burst stealing flags:
Set to 0

Result:

Acceptable for DCS 1800.

Annex A:
Amendment Request 08.08 - 021 R4: Information on channel in use in HO REQUEST

NOTE: This Annex A reflects the Amendment Request 08.08 - 021 R4 which was approved by SMG#15 and is part of the TS GSM 08.08 version 4.9.0.

A.3.1.5.1.1 Generation of the HANDOVER REQUIRED message

Generation of the HANDOVER REQUIRED message can be for the following reasons:

- The BSS has detected that a radio reason exists for a handover to occur.
- The MSC has initiated a handover candidate enquiry procedure, and this MS is currently a candidate.
- A cell change is required at call setup due to congestion, e.g. directed retry.

The HANDOVER REQUIRED message contains the following information elements:

- Message Type;
- Cause;
- Cell Identifier List (preferred).

It should also contain the "Current channel" information element.

Sec. 3.2.1.9. gives coding details of the above message.

The "Cause" field indicates the reason for the HANDOVER REQUIRED message e.g. "uplink quality poor" or "response to MSC invocation" in the case of traffic reasons indicated by the MSC.

If present the "Response Request" Information Element indicates, that the BSS requires an indication if the HANDOVER REQUIRED message does not result in a HANDOVER COMMAND message.

If the BSS wants to change the CIC due to a channel change, the BSS sends a HANDOVER REQUIRED message with the cause "switch circuit pool" and the "circuit pool list" information element. The "circuit pool list" information element will allow the BSS to indicate to the MSC from which circuit pool or pools the new CIC should be chosen.

The "Cell Identifier List (preferred)" shall identify "n" preferred cells. The identified cells are given in order of preference. The algorithm by which the BSS produces this list is Operator dependent and is not addressed in this Technical Specification. The "n" number of preferred cells is a parameter set by O&M and shall range from 1 to 16. If "n" number of cells cannot be identified, then only as many as are available shall be encoded and sent (as specified in section 3.2.2.27).

It is mandatory for the BSS to be able to produce this "Cell Identifier List (preferred)". The sending of this list is controlled by the O&M parameter "n". It is mandatory for the MSC to be able to receive and interpret this Information Element.

The HANDOVER REQUIRED message shall be updated and repeated by the BSS with a periodicity of T7 until:

- A HANDOVER COMMAND message is received from the MSC, or;
- A RESET message is received, or;
- The reason for the original HANDOVER REQUIRED message disappears e.g. the MS transmission improves, or;
- All communication is lost with the MS as defined in Technical Specification GSM 04.08, and the transaction is abandoned, or;
- The transaction ends, e.g., call clearing.

A.3.1.5.2 Handover Resource allocation

This procedure has been defined to allow the MSC to request resources from a BSS in a manner similar to that used for the assignment case. However it does not result in the transmission of any messages over the radio interface, only in the reservation of the resource identified at the BSS, which awaits access of a MS on the reserved channel. These reserved resources are then indicated back to the MSC.

In order to support this procedure the MSC sets up a BSSAP SCCP connection to the BSS. This connection is then used to support all BSSAP messages related to this dedicated resource.

A.3.1.5.2.1 Operation of the procedure

The correct operation of the handover resource allocation procedure is as follows:

The MSC sends a HANDOVER REQUEST message to the new BSS (note 1) from which it requires radio resources. This message contains details of the resource that is required. If the requested resource is for speech or data it also indicates the terrestrial resource that shall be used between the MSC and the BSS. The type of channel required can be different from the type of channel in use, e.g. in the case of directed retry. The description of the resource can either specify it completely, or give the BSS some freedom in the selection. The message may also specify the channel in use.

On receipt of this message the new BSS shall choose a suitable idle radio resource.

The management of priority levels - relating to the Information Element "Priority" within the HANDOVER REQUEST message - is implementation dependent, under operator control.

If queueing is managed, new requests which cannot be served immediately are put in the queueing file according to the indicated priority levels.

(Refer to section 3.1.17 for Queuing Procedure)

As a further operator option, the preemption indicators may (alone or along with the priority levels) be used to manage the preemption process, which may lead to the forced release or forced handover of lower priority connections.

However, the preemption indicators (refer to section 3.2.2.18), if given in the HANDOVER REQUEST, shall be treated on a per connection basis as follows:

- the last received "Preemption Vulnerability" indicator and priority levels shall prevail.
- if the "Preemption Capability" bit is set to 1, then this allocation request can trigger the running of the preemption procedure.
- if the "Preemption Capability" bit is set to 0, then this allocation request cannot trigger the preemption procedure.
- if the "Preemption Vulnerability" bit is set to 1, then this connection is vulnerable and shall be included in the preemption process or procedure and as such may be subject to forced release or forced handover.
- if the "Preemption Vulnerability" bit is set to 0, then this connection is not vulnerable to preemption and shall not be included in the preemption process and as such may not be subject to forced release or forced handover.
- if no Priority Information Element has been received, both "Preemption Capability" and "Preemption Vulnerability" bits shall be regarded as set to 0.

If a radio resource is available then this will be reflected back to the MSC in a HANDOVER REQUEST ACKNOWLEDGE message. The HANDOVER REQUEST ACKNOWLEDGE message sent by the new BSS shall contain the radio interface message HANDOVER COMMAND within its "Layer 3 Information" Information Element. This "Layer 3 Information" (which is in fact the RR-Layer 3 HANDOVER COMMAND) is transferred by the controlling MSC to the old BSS using the BSSMAP message HANDOVER COMMAND also within the Information Element "Layer 3 Information" of that BSSMAP message. The old BSS then sends to the MS over the radio interface the RR-Layer 3 HANDOVER COMMAND message. Information about the appropriate new channels and a handover reference number chosen by the new BSS are contained in the HANDOVER COMMAND. Knowledge of the channel in use at the old BSS allows the new BSS to minimize the size of the HANDOVER COMMAND message (i.e. to decide whether the mode of the first channel IE need not be included in the HANDOVER COMMAND).

NOTE: The new BSS and the old BSS may be the same.

When several circuit pools are present on the BSS MSC interface, the "circuit pool" information field shall be included in the HANDOVER REQUEST ACKNOWLEDGE. The "circuit pool" field will indicate to the MSC the circuit pool of the CIC given in the HANDOVER REQUEST message.

The sending of the HANDOVER REQUEST ACKNOWLEDGE by the new BSS to the MSC ends the Handover Resource Allocation procedure. The Handover Execution procedure can now proceed and this is given in section 3.1.5.3.

The new BSS shall then take all necessary action to allow the MS to access the radio resource that the new BSS has chosen, this is detailed in the GSM 05 series of Technical Specifications. If the radio resource is a traffic channel then the new BSS shall at this point switch it through to the terrestrial resource indicated in the HANDOVER REQUEST message, and the necessary transcoding/rate adaption/encryption equipment enabled as detailed in Technical Specification GSM 04.08.

The optimum procedure for switching through to the target cell at the MSC is not defined in these Technical Specifications.

A.3.2.1.8 HANDOVER REQUEST

This message is sent from the MSC to the BSS via the relevant SCCP connection to indicate that the MS is to be handed over to that BSS.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	MSC-BSS	M	1
Channel type	3.2.2.11	MSC-BSS	M	5
Encryption information	3.2.2.10	MSC-BSS	M	3-n
Classmark information 1 or	3.2.2.30	MSC-BSS	M#	2
Classmark information 2	3.2.2.19	MSC-BSS	M#	4-5
Cell identifier (serving)	3.2.2.17	MSC-BSS	M	5-10
Priority	3.2.2.18	MSC-BSS	O	3
Circuit identity code	3.2.2.2	MSC-BSS	O##	3
Downlink DTX flag	3.2.2.26	MSC-BSS	O*	2
Cell identifier (target)	3.2.2.17	MSC-BSS	M	3-10
Interference band to be used	3.2.2.21	MSC-BSS	O	2
Cause	3.2.2.5	MSC-BSS	O	3-4
Classmark information 3	3.2.2.20	MSC-BSS	O**	3-14
Current channel	3.2.2.49	MSC-BSS	O§	2

* This element may be included in the case of a speech TCH, and only in this case. If not included, this has no impact on the DTX function in the BSS.

** This element is included if the MSC has received such information.

\# One of these two elements is sent.

This element is included when the channel type Information Element indicates speech or data, and only in those cases.

§ This element is included at least when the message is sent as a reaction to reception of a HANDOVER REQUIRED message containing a "Current channel" information element. In this case it shall be equal to the received element.

Typical Cause values are:

uplink quality,
uplink strength,
downlink quality,
downlink strength
distance,
better cell,
response to MSC invocation
O and M intervention,

directed retry,
switch circuit pool.

A.3.2.1.9 HANDOVER REQUIRED

This message is sent from the BSS to the MSC to indicate that for a given MS which already has a dedicated radio resource assigned, a handover is required for the reason given by the cause element.

The message is sent via the BSSAP SCCP connection associated with the dedicated resource.

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LEN
Message type	3.2.2.1	BSS-MSC	M	1
Cause	3.2.2.5	BSS-MSC	M	3-4
Response request	3.2.2.28	BSS-MSC	O	1
Cell identifier list (preferred)	3.2.2.27	BSS-MSC	M	2n+3 to 7n+3
Circuit pool list	3.2.2.46	BSS-MSC	O*	V
Current channel	3.2.2.49	BSS-MSC	O**	2

* Shall be included when cause "switch circuit pool".

** This information element should always be included.

Typical Cause values are:
uplink quality,
uplink strength,
downlink quality,
downlink strength,
distance,
better cell,
response to MSC invocation,
O&M intervention,
directed retry,
switch circuit pool.

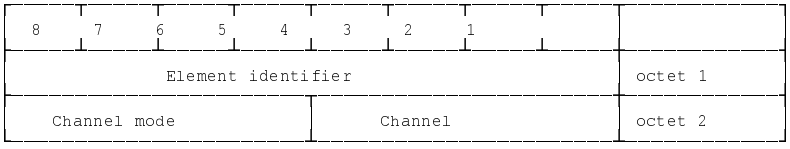
Element Identifier Coding	Element name	Reference
0000 0001	Circuit identity code	3.2.2.2.
0000 0010	Reserved	*
0000 0011	Resource available	3.2.2.4.
0000 0100	Cause	3.2.2.5.
0000 0101	Cell identifier	3.2.2.17.
0000 0110	Priority	3.2.2.18.
0000 0111	Layer 3 header information	3.2.2.9.
0000 1000	IMSI	3.2.2.6.
0000 1001	TMSI	3.2.2.7.
0000 1010	Encryption information	3.2.2.10.
0000 1011	Channel type	3.2.2.11.
0000 1100	Periodicity	3.2.2.12.
0000 1101	Extended resource indicator	3.2.2.13.
0000 1110	Number of MSs	3.2.2.8.
0000 1111	Reserved	*
0001 0000	Reserved	*
0001 0001	Reserved	*
0001 0010	Classmark information type 2	3.2.2.19.
0001 0011	Classmark information type 3	3.2.2.20.
0001 0100	Interference band to be used	3.2.2.21.
0001 0101	RR Cause	3.2.2.22.
0001 0110	Reserved	*
0001 0111	Layer 3 information	3.2.2.24.
0001 1000	DLCI	3.2.2.25.
0001 1001	Downlink DTX flag	3.2.2.26.
0001 1010	Cell identifier list	3.2.2.27.
0001 1011	Response request	3.2.2.28.
0001 1100	Resource indication method	3.2.2.29.
0001 1101	Classmark information type 1	3.2.2.30.
0001 1110	Circuit identity code list	3.2.2.31.
0001 1111	Diagnostic	3.2.2.32.
0010 0000	Layer 3 message contents	3.2.2.35.
0010 0001	Chosen channel	3.2.2.33.
0010 0010	Total resource accessible	3.2.2.14.
0010 0011	Cipher response mode	3.2.2.34.
0010 0100	Channel needed	3.2.2.36.
0010 0101	Trace type	3.2.2.37.
0010 0110	TriggerId	3.2.2.38.
0010 0111	Trace reference	3.2.2.39.
0010 1000	TransactionId	3.2.2.40.
0010 1001	Mobile identity	3.2.2.41.
0010 1010	OMCId	3.2.2.42.
0010 1011	Forward indicator	3.2.2.43.
0010 1100	Chosen encryption algorithm	3.2.2.44.
0010 1101	Circuit pool	3.2.2.45.
0010 1110	Circuit pool list	3.2.2.46.
0010 1111	Time indication	3.2.2.47.
0011 0000	Resource situation	3.2.2.48.
0011 0001	Current channel	3.2.2.49.

* Information Element codes marked as "reserved are reserved for use by previous versions of this interface specification.

A.3.2.2.49 CURRENT CHANNEL

This Information Element contains a description of the channel allocated to the MS.

It is coded as follows:



The channel mode field is coded as follows:

Bit 8765
- 0000 signalling only
- 0001 speech (full rate or half rate)
- 0011 data, 12.0 kbit/s radio interface rate
- 0100 data, 6.0 kbit/s radio interface rate
- 0101 data, 3.6 kbit/s radio interface rate

All other values are reserved.

The channel field is coded as follows:

Bit 4321
- 0001 SDCCH
- 1000 Full rate TCH
- 1001 Half rate TCH

All other values are reserved.

Annex B (informative): Change Request History

SPEC	SMG#	CR	PHS	VERS	NEW_V	SUBJECT
09.94	s30	A008	2	4.4.0	4.5.0	Change of Title, Scope and References Clauses 1 to 5)
09.94	s30	A009	2	4.4.0	4.5.0	Frequency Hopping using ARFCN=0

History

Document history		
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