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Digitalni celiļ ni telekomunikacijski sistem (faza 2) ï Krmiljenje povezave radijskega podsistema (GSM 05.08, razliļ ica 4.18.3)

Digital cellular telecommunications system (Phase 2) (GSM); Radio subsystem link control (GSM 05.08 version 4.18.3)

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This ETS specifies the Radio sub system link control implemented in the Mobile Station (MS), Base Station System (BSS) and Mobile Switching Centre (MSC) of the GSM and DCS 1 800 systems of the Digital cellular telecommunications system (Phase 2). Unless stated, references to GSM also include DCS 1 800.

The specification from which this ETS has been derived was originally based on CEPT documentation, hence the presentation of this draft ETS is not in accordance with the ETSI/PNE Rules.

Transposition dates	
Date of adoption:	25 July 1997
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1 Scope

This European Telecommunications Standard (ETS) specifies the Radio sub-system link control implemented in the Mobile Station (MS), Base Station System (BSS) and Mobile Switching Centre (MSC) of the GSM and DCS 1 800 systems.

Unless otherwise specified, references to GSM also include DCS 1 800.

1.1 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] GSM 01.04 (ETR 100): "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".

[2] GSM 03.03 (ETS 300 523): "Digital cellular telecommunications system (Phase 2); Numbering, addressing and identification".

[3] GSM 03.09 (ETS 300 527): "Digital cellular telecommunications system (Phase 2); Handover procedures".

[4] GSM 03.22 (ETS 300 535): "Digital cellular telecommunications system (Phase 2); Functions related to Mobile Station (MS) in idle mode".

[5] GSM 04.04 (ETS 300 553): "Digital cellular telecommunications system (Phase 2); Layer 1; General requirements".

[6] GSM 04.06 (ETS 300 555): "Digital cellular telecommunications system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface; Data Link (DL) layer specification".

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

[8] GSM 05.02 (ETS 300 574): "Digital cellular telecommunications system (Phase 2); Multiplexing and multiple access on the radio path".

[9] GSM 05.05 (ETS 300 577): "Digital cellular telecommunications system (Phase 2); Radio transmission and reception".

[10] GSM 05.10 (ETS 300 579): "Digital cellular telecommunications system (Phase 2); Radio subsystem synchronization".

[11] GSM 06.11 (ETS 300 580-3): "Digital cellular telecommunications system (Phase 2); Substitution and muting of lost frames for full rate speech channels".

[12] GSM 08.08 (ETS 300 590): "Digital cellular telecommunications system (Phase 2); Mobile Switching Centre - Base Station System (MSC - BSS) interface; Layer 3 specification".

[13] GSM 08.58 (ETS 300 596): "Digital cellular telecommunications system (Phase 2); Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification".

[14] GSM 11.10 (ETS 300 607): "Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformity specification".

1.2 Abbreviations

Abbreviations used in this ETS are listed in GSM 01.04.

2 General

The radio sub-system link control aspects that are addressed are as follows:

- Handover;
- RF Power control;
- Radio link Failure;
- Cell selection and re-selection in Idle mode.

Handover is required to maintain a call in progress as a MS passes from one cell coverage area to another and may also be employed to meet network management requirements, e.g. relief of congestion.

Handover may occur during a call from TCH to TCH, it may also occur from DCCH to DCCH or from DCCH to TCH, e.g. during the initial signalling period at call set-up.

The handover may be either from a channel on one cell to another channel on a surrounding cell, or between channels on the same cell which are carried on the same frequency band. Examples are given of handover strategies, however, these will be determined in detail by the network operator.

For a multiband MS, specified in GSM 02.06, the handover described is also allowed between any channels on different cells which are carried on different frequency bands, e.g. between a GSM 900/TCH and a DCS 1 800/TCH. Handover between two co-located cells, carried on different frequency bands, is considered as inter-cell handover irrespective of the handover procedures used.

Adaptive control of the RF transmit power from an MS and optionally from the BSS is implemented in order to optimize the uplink and downlink performance and minimize the effects of co-channel interference in the system.

The criteria for determining radio link failure are specified in order to ensure that calls which fail either from loss of radio coverage or unacceptable interference are satisfactorily handled by the network. Radio link failure may result in either re-establishment or release of the call in progress.

Procedures for cell selection and re-selection whilst in Idle mode (i.e. not actively processing a call), are specified in order to ensure that a mobile is camped on a cell with which it can reliably communicate on both the radio uplink and downlink. The operations of an MS in Idle Mode are specified in GSM 03.22.

Information signalled between the MS and BSS is summarized in tables 1 and 2. A full specification of the Layer 1 header is given in GSM 04.04, and of the Layer 3 fields in GSM 04.08.

3 Handover

3.1 Overall process

The overall handover process is implemented in the MS, BSS and MSC. Measurement of radio subsystem downlink performance and signal strengths received from surrounding cells, is made in the MS. These measurements are signalled to the BSS for assessment. The BSS measures the uplink performance for the MS being served and also assesses the signal strength of interference on its idle traffic channels. Initial assessment of the measurements in conjunction with defined thresholds and handover strategy may be performed in the BSS. Assessment requiring measurement results from other BTS or other information resident in the MSC, may be performed in the MSC.

GSM 03.09 describes the handover procedures to be used in PLMNs.

3.2 MS measurement procedure

A procedure shall be implemented in the MS by which it monitors the downlink RX signal level and quality from its serving cell and the downlink RX signal level and BSIC of surrounding BTS. The method of identification of surrounding BTS is described in subclause 7.2. The requirements for the MS measurements are given in subclause 8.1.

3.3 BSS measurement procedure

A procedure shall be implemented in the BSS by which it monitors the uplink RX signal level and quality from each MS being served by the cell. A procedure shall be implemented by which the BSS monitors the levels of interference on its idle traffic channels.

3.4 Strategy

The handover strategy employed by the network for radio link control determines the handover decision that will be made based on the measurement results reported by the MS/BSS and various parameters set for each cell. Network directed handover may also occur for reasons other than radio link control, e.g. to control traffic distribution between cells. The exact handover strategies will be determined by the network operator, a detailed example of a basic overall algorithm appears in annex A. Possible types of handover are as follows:

Inter-cell handover:

Intercell handover from the serving cell to a surrounding cell will normally occur either when the handover measurements show low RXLEV and/or RXQUAL on the current serving cell and a better RXLEV available from a surrounding cell, or when a surrounding cell allows communication with a lower TX power level. This typically indicates that an MS is on the border of the cell area.

Intercell handover may also occur from the DCCH on the serving cell to a TCH on another cell during call establishment. This may be used as a means of providing successful call establishment when no TCH resource is available on the current serving cell.

Inter-cell handover between cells using different frequency bands is allowed for a multi band MS.

Intra-cell handover:

Intra-cell handover from one channel/timeslot in the serving cell to another channel/timeslot in the same cell will normally be performed if the handover measurements show a low RXQUAL, but a high RXLEV on the serving cell. This indicates a degradation of quality caused by interference even though the MS is situated within the serving cell. The intra-cell handover should provide a channel with a lower level of interference. Intra-cell handover can occur either to a timeslot on a new carrier or to a different timeslot on the same carrier.

GSM 08.08 defines the causes for handover that may be signalled from BSS to MSC.

4 RF power control

4.1 Overall process

RF power control is employed to minimize the transmit power required by MS or BSS whilst maintaining the quality of the radio links. By minimizing the transmit power levels, interference to co-channel users is reduced.

4.2 MS implementation

RF power control shall be implemented in the MS.

The power control level to be employed by the MS is indicated by means of the power control information sent either in the layer 1 header of each downlink SACCH message block (see GSM 04.04), or in a dedicated signalling block (see GSM 04.08).

The MS shall employ the most recently commanded power control level appropriate to the channel for all transmitted bursts on either a TCH (including handover access burst), FACCH, SACCH or SDCCH.

The MS shall confirm the power control level that it is currently employing in the uplink SACCH L1 header. The indicated value shall be the power control level actually used by the mobile for the last burst of the previous SACCH period.

When accessing a cell on the RACH (random access) and before receiving the first power command during a communication on a DCCH or TCH (after an IMMEDIATE ASSIGNMENT), all GSM and class 1 and class 2 DCS 1 800 MS shall use the power level defined by the MS_TXPWR_MAX_CCH parameter broadcast on the BCCH of the cell. The class 3 DCS 1 800 MS shall use the power level defined by MS TXPWR MAX CCH plus the value POWER OFFSET also broadcast on the BCCH of the cell.

If a power control level defined in GSM 05.05 is received but the level is not supported by the MS, the MS shall use the supported output power which is closest to the output power indicated by the received power control level.

4.3 MS power control range

The range over which a MS shall be capable of varying its RF output power shall be from its maximum output down to its minimum, in steps of nominally 2 dB.

GSM 05.05 gives a detailed definition of the RF power level step size and tolerances.

4.4 BSS implementation

RF power control may optionally be implemented in the BSS.

4.5 BSS power control range

The range over which the BSS shall be capable of reducing its RF output power from its maximum level shall be nominally 30 dB, in 15 steps of nominally 2 dB.

GSM 05.05 gives a detailed definition of the RF power level step size and tolerances.

4.6 Strategy

The RF power control strategy employed by the network determines the ordered power level that is signalled to the MS, and the power level that is employed by the BSS.

The power level to be employed in each case will be based on the measurement results reported by the MS/BTS and various parameters set for each cell. The exact strategies will be determined by the network operator. A detailed example of a basic algorithm appears in annex A.

4.7 Timing

Upon receipt of a command from the SACCH to change its power level, the MS shall change to the new level at a rate of one nominal 2 dB power control step every 60 ms (13 TDMA frames), i.e. a range change of 15 steps should take about 900 ms. The change shall commence at the first TDMA frame belonging to the next reporting period (as specified in subclause 8.4). The MS shall change the power one nominal 2 dB step at a time, at a rate of one step every 60 ms following the initial change, irrespective of whether actual transmission takes place or not.

In case of channel change, the commanded power level shall be applied on the new channel immediately.

5 Radio link failure

5.1 Criterion

The criterion for determining Radio Link Failure in the MS shall be based on the success rate of decoding messages on the downlink SACCH.