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Contents

Intellectual Property Rights	2
Foreword.....	2
Modal verbs terminology.....	2
Foreword.....	8
1 Scope	9
1.1 References	9
1.2 Abbreviations	11
1.3 Definitions	11
1.4 Restrictions.....	11
2 General	11
3 Handover	13
3.1 Overall process	13
3.2 MS measurement procedure	13
3.3 BSS measurement procedure.....	13
3.4 Strategy	13
4 RF power control.....	14
4.1 Overall process	14
4.2 MS implementation	14
4.2.1 General.....	14
4.2.2 (EC-)RACH	15
4.2.2.1 Random access procedure when not in EC-EGPRS operation.....	15
4.2.2.2 Random access procedure in EC-EGPRS operation	16
4.3 MS power control range	16
4.4 BSS implementation.....	17
4.4.1 VAMOS subchannel power control for BSS in downlink	17
4.5 BSS power control range.....	17
4.6 Strategy	17
4.7 Timing	17
4.7.1 Normal Power Control.....	17
4.7.2 Fast Power Control	18
4.7.3 Enhanced Power Control	18
4.8 Dedicated channels used for a voice group call or voice broadcast.....	18
5 Radio link failure.....	19
5.1 Criterion	19
5.2 MS procedure	19
5.3 BSS procedure.....	20
6 Idle mode tasks.....	20
6.1 Introduction	20
6.2 Measurements for normal cell selection	21
6.3 Measurements for stored list cell selection.....	22
6.4 Criteria for cell selection and reselection	22
6.5 Downlink signalling failure	24
6.6 Measurements for Cell Reselection.....	24
6.6.0 General.....	24
6.6.1 Monitoring of received signal level and BCCH data	25
6.6.1a Reduced Monitoring of received signal level and (EC-)BCCH data	26
6.6.2 Path loss criteria and timings for cell re-selection	27
6.6.3 Cell reselection algorithm for SoLSA.....	28
6.6.4 Measurements on cells of other radio access technologies	28
6.6.5 Algorithm for cell re-selection from GSM to UTRAN based on cell ranking.....	33
6.6.6 Algorithm for inter-RAT cell re-selection based on priority information.....	34

6.6.7	Cell selection and re-selection to CSG cells and hybrid cells.....	37
6.6.7.1	Cell re-selection to CSG cells	37
6.6.7.1a	Cell re-selection to hybrid cells.....	38
6.6.7.2	Manual CSG ID selection	38
6.7	Release of TCH, SDCCH and DBPSCH.....	38
6.7.1	Normal case	38
6.7.2	Call re-establishment	39
6.8	Abnormal cases and emergency calls.....	39
6.9	Received signal level measurements for EC-EGPRS.....	40
6.9.1	General.....	40
6.9.2	Physical parameter.....	40
6.9.3	Statistical parameter.....	40
6.9.4	Accuracy requirements	40
6.9.5	Range of parameter.....	41
6.10	Coverage class selection for EC-EGPRS	41
6.10.1	General.....	41
6.10.2	Downlink coverage class selection	41
6.10.3	Uplink coverage class selection	42
6.10.4	Coverage class adaptation for EC-CCCH.....	42
6.10.5	Downlink coverage class update.....	42
7	Network pre-requisites	43
7.1	BCCH carriers	43
7.2	Identification of surrounding BSS for handover measurements.....	44
7.3	Handover measurements on other radio access technologies.....	46
7.4	Handover measurements on UTRAN CSG cells and hybrid cells.....	49
8	Radio link measurements	50
8.1	Signal level.....	50
8.1.1	General.....	50
8.1.2	Physical parameter.....	50
8.1.3	Statistical parameters	51
8.1.4	Range of parameter.....	51
8.1.5	Measurement quantity for other radio access technologies	52
8.1.5.1	UTRAN FDD.....	52
8.1.5.2	UTRAN TDD.....	52
8.1.5.3	cdma2000.....	52
8.1.5.4	E-UTRAN FDD.....	53
8.1.5.5	E-UTRAN TDD.....	54
8.2	Signal quality.....	54
8.2.1	General.....	54
8.2.2	Physical parameter.....	54
8.2.3	Statistical parameters	55
8.2.3.1	RXQUAL.....	55
8.2.3.2	MEAN_BEP and CV_BEP.....	55
8.2.4	Range of parameter RXQUAL	56
8.2.5	Range of parameters MEAN_BEP and CV_BEP.....	57
8.3	Aspects of discontinuous transmission (DTX).....	61
8.4	Measurement reporting.....	62
8.4.1	Measurement reporting for the MS.....	62
8.4.1a	Measurement reporting for the MS in FPC mode	64
8.4.1b	Measurement reporting for the MS in EPC mode	64
8.4.2	Measurement reporting for the MS on a SDCCH.....	65
8.4.3	Additional cell reporting requirements for multi band MS.....	65
8.4.4	Common aspects for the MS on a TCH, a SDCCH or a DBPSCH.....	66
8.4.5	Measurement reporting for the BSS	66
8.4.6	Extended measurement reporting	67
8.4.7	Additional cell reporting requirements for multi-RAT MS	67
8.4.8	Enhanced Measurement Reporting.....	69
8.4.8.1	Reporting Priority	69
8.4.8.2	Measurement Reporting.....	70
8.4.8.3	NBR_RCVD_BLOCKS for FLO.....	71

8.4.9	Requirements for measurement and reporting of CSG cells and hybrid cells	71
8.5	Absolute MS-BTS distance	72
8.5.1	General.....	72
8.5.2	Physical parameter.....	72
9	Control parameters	73
10	GPRS mode tasks	81
10.1	Cell Re-selection	81
10.1.0	General.....	81
10.1.1	Monitoring the received signal level and PBCCH data	82
10.1.1.0	General	82
10.1.1.1	Packet idle mode or MAC-Idle state	83
10.1.1.2	Packet transfer mode or MAC-Shared state	83
10.1.1.2a	Broadcast/multicast receive mode.....	84
10.1.1.3	Monitoring cells of other radio access technologies	85
10.1.2	Cell Re-selection Criteria.....	89
10.1.3	Cell Re-selection Algorithm	90
10.1.3.1	Abnormal cell reselection	91
10.1.3.2	Algorithm for cell re-selection from GSM to UTRAN based on cell ranking	92
10.1.3.3	Algorithm for inter-RAT cell re-selection based on priority information.....	93
10.1.3.4	Cell selection and re-selection to CSG cells and hybrid cells	93
10.1.4	Network controlled Cell re-selection	93
10.1.4.1	Measurement reporting	94
10.1.4.2	Cell re-selection command.....	99
10.1.4.3	Exceptional cases	99
10.1a	Measurement and Reporting of CSG Cells and hybrid cells	99
10.2	RF Power Control.....	100
10.2.1	MS output power	100
10.2.2	BTS output power.....	101
10.2.3	Measurements at MS side	102
10.2.3.1	Deriving the C value	103
10.2.3.1.1	Packet idle mode or MAC-Idle state	103
10.2.3.1.2	Packet transfer mode or MAC-Shared state	103
10.2.3.1.2.1	MS that have not enabled EC-EGPRS operation.....	103
10.2.3.1.2.2	MS that have enabled EC-EGPRS operation	105
10.2.3.2	Derivation of Channel Quality Report	105
10.2.3.2.1	Packet transfer mode or MAC-Shared state	105
10.2.3.2.2	Void.....	109
10.2.3.2.3	Measurement reporting.....	109
10.2.3.2.4	Measurement reporting - additional requirements for downlink dual carrier	110
10.2.3.2.5	Measurement reporting - additional requirements for downlink multi carrier.....	110
10.2.3.3	Range of parameters MEAN_BEP and CV_BEP for EGPRS2	111
10.2.4	Measurements at BSS side.....	115
10.2a	Packet-switched Handover	115
10.3	Measurement requirements	115
10.4	Control parameters	115
11	CTS mode tasks.....	123
11.1	CTS idle mode tasks.....	123
11.1.1	CTS cell selection	124
11.1.1.1	Synchronization and measurements for CTS cell selection	124
11.1.1.2	Initial sychronization of CTS-MS	124
11.1.2	Criterion for CTS cell selection	124
11.1.3	Monitoring of CTSBCH and CTSPCH.....	125
11.1.3.1	Monitoring of received signal level	125
11.1.3.2	Downlink beacon failure	125
11.1.3.3	Downlink paging failure	125
11.1.4	Procedures with reporting to the CTS-FP.....	125
11.1.4.1	AFA monitoring	125
11.1.4.2	BCCH detection	126
11.1.4.3	Observed Frequency Offset (OFO) measurement	126
11.2	Intra-cell handover	126

11.2.1	Overall process	126
11.2.2	CTS-MS measurement procedure.....	126
11.2.3	CTS-FP measurement procedure	127
11.2.4	Strategy	127
11.3	RF power control.....	127
11.3.1	Overall process	127
11.3.2	CTS-MS implementation	127
11.3.3	CTS-MS power control range.....	127
11.3.4	CTS-FP implementation	128
11.3.5	CTS-FP power control range	128
11.3.6	Strategy	128
11.3.7	Timing	128
11.4	Radio link failure.....	128
11.4.1	Criterion.....	128
11.4.2	CTS-MS procedure.....	128
11.4.3	CTS-FP procedure	129
11.5	Radio link measurements	129
11.5.1	Signal strength	129
11.5.1.1	General	129
11.5.1.2	Physical parameter	129
11.5.1.3	Statistical parameters	129
11.5.1.4	Range of parameter	129
11.5.2	Signal quality	130
11.5.2.1	General	130
11.5.2.2	Physical parameter	130
11.5.2.3	Statistical parameters	130
11.5.2.4	Range of parameter	130
11.5.3	Aspects of discontinuous transmission (DTX)	130
11.5.4	Measurement reporting for the CTS-MS on a TCH.....	130
11.6	Control of CTS-FP service range	131
11.7	Control parameters	131
12	COMPACT Mode Tasks	133
12.1	Introduction	133
12.2	Network Pre-requisites	133
12.2.1	CPBCCH carriers.....	133
12.3	COMPACT Idle Mode Tasks	133
12.3.1	Introduction.....	133
12.3.2	Measurements for COMPACT Cell Selection.....	133
12.3.3	Measurements for COMPACT Stored List Cell Selection	134
12.3.4	Criteria for COMPACT Cell Selection.....	134
12.3.5	Downlink Signalling Failure.....	134
12.4	COMPACT Cell Reselection	134
12.4.1	Monitoring the received signal level and CPBCCH data.....	135
12.4.1.1	Packet idle mode or MAC-Idle state	135
12.4.1.2	Packet transfer mode or MAC-Shared state	135
12.4.2	COMPACT cell reselection criteria.....	136
12.4.3	COMPACT cell reselection algorithm.....	136
12.4.4	Network controlled Cell reselection	136
12.4.5	COMPACT cell reselection measurement opportunities	136
Annex A (informative):	Definition of a basic GSM or DCS 1 800 handover and RF power control algorithm	137
A.1	Scope.....	137
A.2	Functional requirement.....	137
A.3	BSS pre-processing and threshold comparisons.....	138
A.3.1	Measurement averaging process.....	138
A.3.2	Threshold comparison process	139
A.3.2.1	RF power control process	139
A.3.2.2	Handover Process	140

A.4	BSS decision algorithm	141
A.4.1	Internal intracell handover according to radio criteria: (Interference problems)	141
A.4.2	Internal handover according to other criteria	142
A.4.3	General considerations	142
A.5	Channel allocation	142
A.6	Handover decision algorithm in the MSC	143
Annex B (informative):	Power Control Procedures	145
B.1	Open loop control	145
B.2	Closed loop control	146
B.3	Quality based control	146
B.4	BTS power control	147
B.5	Example	147
B.6	Interworking between normal and fast power control for ECSD	148
B.7	Interworking between normal and enhanced power control (EPC)	149
Annex C (informative):	Example Interference Measurement Algorithm	151
Annex D (informative):	Example Selection of Modulation and Coding Schemes based on Link Quality Reports	152
Annex E (informative):	Change history	153
History		163

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1 Scope

The present document specifies the Radio sub-system link control implemented in the Mobile Station (MS), Base Station System (BSS) and Mobile Switching Centre (MSC) of the digital cellular telecommunications systems GSM.

Unless otherwise specified, references to GSM also include operation in any band.

1.1 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.
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- [1] 3GPP TR 21.905: 'Vocabulary for 3GPP Specifications'.
- [2] 3GPP TS 23.003: 'Numbering, addressing and identification'.
- [3] 3GPP TS 23.009: 'Handover procedures'.
- [4] 3GPP TS 23.122: 'NAS Functions related to Mobile Station (MS) in idle mode'.
- [5] 3GPP TS 25.101: 'UE Radio transmission and reception (FDD)'.
- [6] 3GPP TS 25.123: 'Requirements for support of Radio Resource Management (TDD)'.
- [7] 3GPP TS 25.133: 'Requirements for support of Radio Resource Management (FDD)'.
- [8] 3GPP TS 25.304: 'UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode'.
- [9] 3GPP TS 25.331: 'Radio Resource Control (RRC); Protocol Specification'.
- [10] 3GPP TS 26.093: 'AMR Speech Codec; Source Controlled Rate operation'.
- [11] 3GPP TS 43.022: 'Functions related to Mobile Station (MS) in idle mode and group receive mode'.
- [12] 3GPP TS 43.064: 'Overall description of the GPRS Radio Interface; Stage 2'.
- [13] 3GPP TS 43.246: 'Multimedia Broadcast Multicast Service (MBMS) in the GERAN; Stage 2'.
- [14] 3GPP TS 43.068: 'Voice Group Call Service (VGCS); Stage 2'.
- [15] 3GPP TS 44.004: 'Layer 1; General requirements'.
- [16] 3GPP TS 44.006: 'Mobile Station - Base Station System (MS - BSS) interface; Data Link (DL) layer specification'.
- [17] 3GPP TS 44.018: 'Mobile radio interface layer 3 specification; Radio Resource Control Protocol'.
- [18] 3GPP TS 44.056: 'GSM Cordless Telephony System (CTS), Phase 1; CTS radio interface layer 3 specification'.
- [19] 3GPP TS 44.060: 'General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control (RLC) / Medium Access Control (MAC) protocol'.

- [20] 3GPP TS 44.118: 'Mobile radio interface layer 3 specification, Radio Resource Control (RRC) Protocol, Iu Mode'.
- [21] 3GPP TS 44.160: 'Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; Iu mode'.
- [22] 3GPP TS 45.002: 'Multiplexing and multiple access on the radio path'.
- [23] 3GPP TS 45.003: 'Channel coding'
- [24] 3GPP TS 45.005: 'Radio transmission and reception'.
- [25] 3GPP TS 45.010: 'Radio subsystem synchronization'.
- [26] 3GPP TS 45.056: 'CTS-FP radio subsystem'.
- [27] 3GPP TR 45.902: 'Flexible Layer One'.
- [28] 3GPP TS 46.011: 'Full rate speech; Substitution and muting of lost frames for full rate speech channels'.
- [29] 3GPP TS 46.012: 'Full rate speech; Comfort noise aspect for full rate speech traffic channels'.
- [30] 3GPP TS 46.031: 'Full rate speech; Discontinuous Transmission (DTX) for full rate speech traffic channels'.
- [31] 3GPP TS 48.008: 'Mobile-services Switching Centre - Base Station System (MSC - BSS) interface, Layer 3 specification'.
- [32] 3GPP TS 48.058: 'Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification'.
- [33] 3GPP TS 51.010: 'Mobile Station (MS) conformity specification'.
- [34] 3GPP TS 51.011: 'Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface'.
- [35] TIA/EIA/IS-2000-5-A: 'Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems'.
- [36] TIA/EIA/IS-833: 'Multi-Carrier Specification for Spread Spectrum Systems on GSM MAP (MC-MAP) (Lower Layers Air Interface)'.
- [37] 3GPP TS 36.101: 'Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception'.
- [38] 3GPP TS 36.104: 'Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception'.
- [39] 3GPP TS 36.133: 'Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management'.
- [40] 3GPP TS 36.304: 'Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode'.
- [41] 3GPP TS 36.331: 'Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol Specification'.
- [42] 3GPP TS 31.102: 'Characteristics of the Universal Subscriber Identity Module (USIM) application'.
- [43] 3GPP TS 24.301: 'Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3'.
- [44] 3GPP TS 22.268: 'Public Warning System (PWS) requirements; Stage 1'.
- [45] 3GPP TS 23.251: "Network sharing; Architecture and functional description".

- [46] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols - Stage 3".
- [47] 3GPP TS 25.306: "UE Radio Access capabilities".
- [48] 3GPP TR 45.926: 'Solutions for GSM/EDGE BTS Energy Saving'.

1.2 Abbreviations

Abbreviations used in the present document are listed in 3GPP TR 21.905.

UFPS Unique Frequency Parameter Set

1.3 Definitions

Coverage Class: see definition in 3GPP TS 43.064 [12].

CSG Whitelist: A list provided by NAS containing all the CSG identities and their PLMN IDs of the CSGs to which the subscriber belongs, see 3GPP TS 23.122 [4].

NOTE: This list is known as 'Allowed CSG List' in Rel-8 specifications.

CSG cell: The definition of CSG cell for UTRAN is given in 3GPP TS 25.304 [8]; the definition of CSG cell for E-UTRAN is given in 3GPP TS 36.304 [40].

EC-EGPRS: see definitions in 3GPP TS 43.064 [12].

Hybrid cell: The definition of hybrid cell for UTRAN is given in 3GPP TS 25.304 [8]; the definition of hybrid cell for E-UTRAN is given in 3GPP TS 36.304 [40].

Network sharing: network sharing is an optional feature that allows different core network operators to connect to the same shared radio access network (see 3GPP TS 23.251 [45]). When network sharing is in use within a given cell, the network broadcasts within system information the PLMN identities of the PLMNs sharing the cell. A mobile station supporting network sharing uses this information for its PLMN (re)selection processes and indicates the selected PLMN to the BSS.

Power Efficient Operation (PEO): see definition in 3GPP TS 43.064 [12].

Power Saving Mode (PSM): see definition in 3GPP TS 43.064 [12].

Unique Frequency Parameter Set: defined by a single ARFCN or a MA. In case of a radio frequency channel assigned a frequency parameter set consisting of a single ARFCN, the UFPS is defined by that ARFCN. In case of a radio frequency channel assigned a frequency parameter set consisting of a MA, MAIO and HSN, that radio frequency channel belong to the same UFPS as other radio frequency channels assigned the same MA.

1.4 Restrictions

Independently of what is stated elsewhere in this and other 3GPP specifications, mobile station support for PBCCH and PCCCH is optional for A/Gb-mode of operation. The network shall never enable PBCCH and PCCCH.

2 General

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

- Handover;
- RF Power control in *A/Gb mode*, including fast power control for E-TCH and enhanced power control for TCH and O-TCH;

- RF Power control in *Iu mode*, including fast power control for E-TCH and enhanced power control for DBPSCH (in MAC-Dedicated and MAC-DTM states);
- Radio link Failure;
- Cell selection and re-selection in Idle mode, in Group Receive mode, in GPRS mode and in broadcast/multicast receive mode (see 3GPP TS 43.022);
- CTS mode tasks.

NOTE: A distinction is made between *A/Gb mode* and *Iu mode* only when necessary. Procedures and mechanisms described in this TS apply to both modes of operation unless otherwise stated. In *Iu mode*, unless otherwise stated, DBPSCH covers TCH, PDTCH and FLO.

Handover is required to maintain a call in progress as a MS engaged in a point-to-point call or with access to the uplink of a channel used for a voice group call 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 one TCH or multiple TCHs (in the case of multislot configuration) to another TCH or multiple TCHs. It may also occur from DCCH to DCCH or from DCCH to one or multiple TCH(s), e.g. during the initial signalling period at call set-up. Additionally in *Iu mode*, handover may occur in MAC-Dedicated and MAC-DTM states:

- on PDTCH or multiple PDTCHs (in the case of multislot configuration) on DBPSCH(s) to another PDTCH or multiple PDTCHs on DBPSCH(s);
- for FLO, from one DBPSCH or multiple DBPSCHs (in the case of multislot configuration) to another DBPSCH or multiple DBPSCHs.

The handover may be either from channel(s) on one cell to other channel(s) 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, 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.

For a multi-RAT MS, i.e. an MS supporting multiple radio access technologies, handover is allowed between GSM and other radio access technologies.

NOTE: At handover, the MS will normally not be able to verify the PLMN of the target cell and will thus assume that the same system information apply after the handover unless the network provides new system information.

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. For channels used for a voice group call, a radio uplink failure results in the freeing up of the uplink.

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 3GPP TS 43.022.

Cell re-selection is also performed by the MS when attached to GPRS, except when the MS simultaneously has a circuit switched connection. Optional procedures are also specified for network controlled cell re-selection for GPRS. Cell re-selection for GPRS is defined in subclause 10.1.

For a multi-RAT MS, cell selection and re-selection is allowed between GSM and other radio access technologies.

An MS listening to a voice group call or a voice broadcast use cell re-selection procedures to change cell. This may be supported by a list of cells carrying the voice group or voice broadcast call downlink, provided to the MS by the network. The operations of an MS in Group Receive Mode are specified in 3GPP TS 43.022.