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**Digital cellular telecommunications system (Phase 2+) (GSM);
Discontinuous Reception (DRX) in the GSM system
(3GPP TS 43.013 version 15.0.0 Release 15)**



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Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document provides a system wide view of the operation of discontinuous reception on the GSM system.

The support of DRX is mandatory in GSM PLMNs.

The detailed coding and procedural details are defined in the relevant Technical Specifications dealing with the specific interfaces that are involved, for instance GSM 08.08 and GSM 04.08. Reference is also made to the framing on the air interface which is defined in Technical Specification GSM 05.02.

The present document gives an overview of the implementation of discontinuous reception DRX within the GSM system, the actions required at MSC, BSS, and MS, the support of the facility via the air interface, and some operational aspects of the facility.

2 References

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

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- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
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- [1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".
- [3] GSM 05.02: "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path".
- [4] GSM 08.02: "Digital cellular telecommunications system (Phase 2+); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface Interface principles".
- [5] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface Layer 3 specification".
- [6] GSM 03.68: "Digital cellular telecommunications system (Phase 2+); Voice Group Call Service (VGCS) Stage 2".
- [7] GSM 03.69: "Digital cellular telecommunications system (Phase 2+); Voice Broadcast Service (VBS) Stage 2".
- [8] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [9] 3GPP TS 45.002: "Technical Specification Group GSM/EDGE Radio Access Network; Multiplexing and multiple access on the radio path"

3 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04 [1] and in 3GPP TS 21.905 [8].

4 Overview of discontinuous reception

DRX/eDRX is a technique that allows the mobile station to power down significant amounts of its internal circuitry for a high percentage of the time when it is in the idle mode.

It also ensures that the MS is aware of exactly when page requests for it may be transmitted and it can then therefore schedule other tasks such that it avoids the problem of not decoding valid page requests transmitted by the network in the idle mode periods.

The technique works by dividing the MSs within a cell into a set of groups. The group in which an MS resides is then known locally at both the MS and the BSS. All paging requests to each group are then scheduled and sent at a particular time which is derived from the TDMA frame number in conjunction with the IMSI of the MS and some BCCH transmitted data. When a MS uses eDRX the BSS derives the precise paging time applicable to the radio interface using IMSI and the eDRX cycle length information provided within a paging request (received from the SGSN) and, when paging on PCH, some BCCH data. In addition, for an EC-EGPRS MS, when paging on EC-PCH, the downlink coverage class is also included in the paging request.

Thus both the BSS and the MS know when relevant page requests will be sent and the MS can power down for the period when it knows that page requests will not occur.

The page request can contain the IMSI and may contain the TMSI in order to identify the MS concerned. The IMSI is however always used to identify the paging population. Paging by means of the IMEI is for further study.

Mechanisms for the application of DRX for the voice group call and voice broadcast services are defined in stage 2 descriptions in GSM 03.68 [6] and GSM 03.69 [7], respectively.

5 MSC functions

The MSC is almost transparent to DRX, since it has no real time knowledge of the absolute frame numbers on the air interface (refer to Technical Specification GSM 08.02).

It should be noted, however, that the MSC does define which cells are to be paged in order to locate a particular MS. Normally this will be a location area.

The MSC therefore constructs page requests and sends them to a specific set of BSSs. Each page request always includes the IMSI. The timer to detect non receipt of a page response may require alteration depending upon the number of page groups that are involved. If this is the case, then the timer will be set by O and M command at the same time as the number of paging groups at the cell is altered.

6 BSS functions

At the BSS page requests are received. It is implicit (single cell BSSs) or explicit (multi cell BSSs) within the page requests from the MSC to which cell the page request is destined (Technical Specifications GSM 08.08 and GSM 08.02 refers).

The BSS analyses the IMSI in order to derive the page group of the MS involved. The air interface page request is then constructed and transmitted in the appropriate TDMA burst. If the page request includes a TMSI and IMSI then the IMSI is used to derive the page population and the TMSI is inserted into the actual page request message. The scheduling of the page requests is therefore completely controlled by the BSS.

The relationship between paging group and TDMA burst, and IMSI and paging group is given in Technical Specification 3GPP TS 45.002 [9].

The exact scheduling mechanism used at the BSS is not defined in the present document.

However, when DRX is used the BSS may set the "page mode" bits as described in Technical Specification GSM 04.08. This can be used to optimise paging load and reduce missed page requests during system reconfiguration. An exception case is when EC-EGPRS is used in which case paging load can be optimized and missed pages can be reduced using "paging extension" information sent within EC-AGCH and EC-PCH messages (see 3GPP TS 44.018).

7 MS functions

The MS shall derive its paging group as defined in Technical Specification GSM 05.02.

The MS shall interpret all paging requests in its paging group according to the paging mode bits as described in Technical Specification GSM 04.08.

8 Support via the air interface

The BCCH and paging channel messages are defined in Technical Specification GSM 04.08. Technical Specification GSM 05.02 defines the algorithms which enable an MS to know the exact frame and burst when page requests relevant to it might be transmitted.

9 Operational aspects

There will be occasions when it is necessary to alter the parameters of cell such that the paging group of the MS may alter.

If (referring to Technical Specification GSM 05.02) any of the parameters BS_AG_BLKES_RES, BS_CC_CHANS_COMB, BS_CC_CHANS or BS_PA_MFRMS have to be altered, then the period when page requests may be lost can be minimised for example by:

Firstly setting the page mode to "page reorganisation" in all page requests on the affected cell for the exact duration of one paging period (i.e. BS_PA_MFRMS multiframes). At the completion of this announcement period, the BCCH parameters are set to the new values and the BSS starts scheduling the paging messages according to the new parameters. The page mode is reset to any of the values "normal mode" or "extended mode" as required.

10 SGSN functions

The SGSN maintains knowledge of the cells that are to be paged, and when the paging group occurs in the respective cell(s), in order to locate a particular MS for packet data delivery. In addition, when eDRX is used the SGSN maintains the value of the eDRX value it has negotiated with the MS. The SGSN constructs paging requests and sends them to a specific set of BSSs. Each page request always includes the IMSI. If a MS uses eDRX then the page request also includes the negotiated eDRX value. If EC-EGPRS is used, the downlink coverage class applicable to the MS is also included in the page request.

Annex A (informative): Change History

Change history					
SMG No.	TDoc. No.	CR. No.	Section affected	New version	Subject/Comments
SMG#07				4.0.4	ETSI Publication
SMG#17				5.0.0	Release 1996 version
SMG#27				6.0.0	Release 1997 version
SMG#29				7.0.0	Release 1998 version
SMG#31				8.0.0	Release 1999 version

Change history							
Date	TSG GERAN#	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2001-04	4				Release 4 version		4.0.0
2002-06	10				Release 5 version	4.0.0	5.0.0
2005-01	23				Release 6 version	5.0.0	6.0.0
2007-08	35				Release 7 version	6.0.0	7.0.0
2008-12	40				Release 8 version	7.0.0	8.0.0
2009-12	44				Release 9 version	8.0.0	9.0.0
2011-03	49				Release 10 version	9.0.0	10.0.0
2012-09	55				Release 11 version	10.0.0	11.0.0
2014-09	63				Release 12 version (frozen at SP-65)	11.0.0	12.0.0
2015-11	68	GP-151190	0003	2	Introduction of EC-EGPRS and PEO	12.0.0	13.0.0
2017-03	75				Release 14 version (frozen at TSG-75)	13.0.0	14.0.0

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
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History

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