



## Digital cellular telecommunications system (Phase 2+) (GSM); Background for Radio Frequency (RF) requirements (3GPP TR 45.050 version 13.1.0 Release 13)

ITEH STANDARDS PREVIEW  
(standard.iteh.ai)  
Full standard at <https://standards.iteh.ai/catalog/standard/3gpp-tr-45.050-v13.1.0-dedc-4901-b616-7c1385099a7>  
2016-08



---

Reference

RTR/TSGG-0145050vd10

---

Keywords

GSM

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

**Important notice**

The present document can be downloaded from:  
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.  
All rights reserved.

**DECT™, PLUGTESTS™, UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.  
**3GPP™** and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and

of the 3GPP Organizational Partners.

**GSM®** and the GSM logo are Trade Marks registered and owned by the GSM Association.

---

## Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

---

## Foreword

This Technical Report (TR) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under  
<http://webapp.etsi.org/key/queryform.asp>.

---

## Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are NOT allowed in ETSI deliverables except when used in direct citation.

---

## Contents

Intellectual Property Rights .....	2
Foreword.....	2
Modal verbs terminology.....	2
Foreword.....	22
1    Scope .....	23
1.1    General .....	23
1.2    References .....	23
2    Information available .....	23
3    DCS1800 system scenarios .....	23
4    GSM900 small cell system scenarios .....	24
5    GSM900 and DCS1800 microcell system scenarios .....	24
6    Conversion factors.....	25
7    Repeaters .....	26
8    Error Patterns for Speech Coder Developments.....	26
9    Simulations of Performance .....	26
10    GSM900 railway system scenarios .....	26
11    Simulation results for GPRS receiver performance.....	27
12    Pico BTS RF scenarios.....	27
13    CTS system scenarios.....	27
14    GSM400 system scenarios .....	27
15    MXM system scenarios .....	28
16    LCS scenarios.....	28
17    8-PSK Scenarios.....	28
18    T-GSM 900 System Scenarios .....	28
19    MBMS System Scenarios.....	28
20    T-GSM 810 System Scenarios .....	28
21    Multicarrier BTS Class.....	28
22    ER-GSM band introduction.....	28
23    Extended Training Sequence Code Sets.....	29
23.1    Background .....	29
23.2    Extended TSC Sets .....	29
23.2.1    Scope .....	29
23.2.2    Design criteria.....	29
23.2.3    Design methodology .....	29
23.2.4    Evaluation methodology .....	30
23.2.5    Performance evaluation .....	30
24    Machine-type-communication (MTC) deployment, including EC-GSM-IoT, in a reduced BCCH spectrum allocation.....	30
24.1    Introduction .....	30
24.2    Simulation campaign.....	31

*iTEH STANDARD REVIEW*  
*https://standardsiteh.ieee.org/catalog/standards/sist/145-050-v13.1.0*  
*dca0-4901-b016-7c13856099a7/etsi-tr-145-050-v13.1.0*  
*2016-08*

24.2.1	Introduction.....	31
24.2.2	Idle mode procedures.....	32
24.2.2.1	General .....	32
24.2.2.1.1	Simulator support .....	32
24.2.2.1.2	Performance metrics .....	32
24.2.2.1.3	Simulation assumptions .....	33
24.2.2.2	PLMN selection .....	33
24.2.2.3	Cell selection.....	33
24.2.2.3.1	General .....	33
24.2.2.3.2	GPRS/EGPRS .....	34
24.2.2.3.3	EC-GSM-IoT.....	35
24.2.2.4	Cell reconfirmation .....	35
24.2.2.4.1	GPRS/EGPRS .....	35
24.2.2.4.2	EC-GSM-IoT .....	37
24.2.3	Common control channel performance.....	39
24.2.3.1	General .....	39
24.2.3.2	GPRS/EGPRS .....	39
24.2.3.2.1	Resource usage .....	39
24.2.3.2.2	Common control signaling delay.....	40
24.2.3.2.3	Failed attempts .....	40
24.2.3.3	EC-GSM-IoT .....	40
24.2.3.3.1	Resource usage .....	40
24.2.3.3.2	Common control signaling delay.....	41
24.2.3.3.3	Failed attempts .....	41
24.2.3.3.4	Coverage class distribution.....	41
24.2.4	Data traffic and control channel performance.....	42
24.2.4.1	General .....	42
24.2.4.2	GPRS/EGPRS .....	42
24.2.4.2.1	PDCH resource usage.....	42
24.2.4.2.2	Latency .....	42
24.2.4.2.4	Failed Attempts .....	43
24.2.4.2.5	Capacity.....	43
24.2.4.3	EC-GSM-IoT .....	43
24.2.4.3.1	PDCH resource usage .....	43
24.2.4.3.2	Latency of MAR periodic reports.....	44
24.2.4.3.3	Latency of Downlink Application Ack.....	44
24.2.4.3.3	Failed attempts .....	44
24.2.4.3.4	Capacity.....	44
24.2.4.3.5	Coverage Class Distribution.....	45
24.3	Conclusion.....	45

## Annex A: DCS1800 System scenarios.....**47**

A.0	INTRODUCTION.....	47
A.1	SCENARIO 1 - SINGLE BTS AND MS.....	47
A.1.1	Constraints.....	47
A.1.1.1	Frequency Bands and Channel Arrangement (Clause 2 of GSM 05.05) .....	47
A.1.1.2	Proximity .....	48
A.1.1.3	Range .....	48
A.1.3	Inputs needed.....	49
A.2	SCENARIO 2 - MULTIPLE MS AND BTS, COORDINATED .....	49
A.2.1	Constraints.....	49
A.2.3	Inputs needed.....	50
A.3	SCENARIO 3 - MULTIPLE MS AND BTS, UNCOORDINATED.....	51
A.3.1	Constraints.....	51
A.3.3	Inputs needed.....	51
A.4	SCENARIO 4 - COLOCATED MS.....	52
A.4.1	Constraints.....	52
A.4.3	Inputs needed.....	53

A.5	SCENARIO 5 - COLOCATED BTS .....	53
A.5.1	Constraints.....	53
A.5.3	Inputs needed.....	53
A.6	SCENARIO 6 - COLOCATION WITH OTHER SYSTEMS .....	54
A.6.1	Constraints.....	54
A.6.3	Inputs needed.....	54
A.7	Title: Justifications for the proposed Rec. 05.05_DCS .....	55
A.7.1	Transmitter .....	56
A.7.1.1	Modulation, Spurs and Noise.....	56
A.7.1.1.1	Co-ordinated, BTS -> MS (Scenario 2, figure 2.1) .....	56
A.7.1.1.2	Uncoordinated, BTS -> MS (Scenario 3, figure 3.1) .....	56
A.7.1.1.3	Co-ordinated & Uncoordinated MS -> BTS (Scenarios 2 and 3, figures 2.1 and 3.1).....	56
A.7.1.1.4	Co-ordinated & Uncoordinated MS->MS (Scenario 4) .....	56
A.7.1.1.5	Co-ordinated & Uncoordinated BTS->BTS (Scenario 5) .....	56
A.7.1.2	Switching Transients.....	56
A.7.1.2.1	Uncoordinated MS -> BTS (Scenario 3, figure 3.1) .....	56
A.7.1.2.2	Uncoordinated BTS -> MS (Scenario 3, figure 3.1) .....	56
A.7.1.3	Intermodulation.....	57
A.7.1.3.1	Co-ordinated, BTS -> MS (Scenario 2, figures 2.2 and 2.3) .....	57
A.7.1.3.2	Uncoordinated, BTS ->MS (Scenario 3, figure 3.2 top) .....	57
A.7.1.3.3	Uncoordinated, MS&MS-> BTS (Scenario 4, figure 4.1 bottom) .....	57
A.7.1.3.4	Uncoordinated MS&MS-> MS (Scenario 4, figure 4.1 top) .....	57
A.7.2	Receiver.....	57
A.7.2.1	Blocking.....	57
A.7.2.1.1	Co-ordinated & Uncoordinated BTS-> MS (Scenarios 2 and 3, figures 2.1 and 3.1).....	57
A.7.2.1.2	Co-ordinated MS-> BTS (Scenario 2, figure 2.1) .....	57
A.7.2.1.3	Uncoordinated MS-> BTS (Scenario 3, figure 3.1) .....	57
A.7.2.1.4	Co-ordinated & Uncoordinated MS-> MS (Scenario 4) .....	57
A.7.2.1.5	Co-ordinated & Uncoordinated BTS-> BTS (Scenario 5) .....	57
A.7.2.2	Intermodulation.....	58
A.7.2.2.1	Co-ordinated & Uncoordinated BTS-> MS (Scenarios 2 and 3, figure 3.2 middle) .....	58
A.7.2.2.2	Co-ordinated MS & MS -> BTS (Scenario 4) .....	58
A.7.2.2.3	Uncoordinated MS & MS -> BTS (Scenario 4, figure 3.2 lower).....	58
A.7.2.3	Maximum level .....	58
A.7.2.3.1	Co-ordinated MS -> BTS (Scenario 1).....	58
A.7.2.3.2	Co-ordinated BTS -> MS (Scenario 1).....	58
A.8.1	SCOPE .....	58
A.8.2	FREQUENCY BANDS AND CHANNEL ARRANGEMENT .....	58
A.8.3	REFERENCE CONFIGURATION .....	58
A.8.4	TRANSMITTER CHARACTERISTICS.....	59
A.8.4.1	Output power .....	59
A.8.4.1.1	Mobile Station.....	59
A.8.4.1.2	Base Station.....	59
A.8.4.2	Output RF spectrum.....	59
A.8.4.2.1	Spectrum due to the modulation.....	59
A.8.4.2.2	Spectrum due to switching transients.....	60
A.8.4.3	Spurious emissions .....	60
A.8.4.3.1	Principle of the specification.....	60
A.8.4.3.2	Base Station.....	60
A.8.4.3.3	Mobile Station.....	60
A.8.4.4	Radio frequency tolerance .....	61
A.8.4.5	Output level dynamic operation.....	61
A.8.4.5.1	Base station .....	61
A.8.4.5.2	Mobile station: .....	61
A.8.4.6	Phase accuracy .....	61
A.8.4.7	Intermodulation attenuation .....	61
A.8.4.7.1	Base transceiver station.....	61
A.8.4.7.2	Intra BTS intermodulation attenuation.....	61
A.8.4.7.3	Intermodulation between MS .....	61
A.8.5	RECEIVER CHARACTERISTICS .....	62

A.8.5.1	Blocking characteristics .....	62
A.8.5.2	Intermodulation characteristics .....	63
A.8.5.3	Spurious response rejection .....	63
A.8.5.4	Spurious emissions .....	63
A.8.6	TRANSMITTER/RECEIVER PERFORMANCE .....	63
A.8.6.1	Nominal error rates (NER) .....	63
A.8.6.2	Reference sensitivity level .....	63
A.8.6.3	Reference interference level .....	64
A.8.6.4	Erroneous frame indication performance .....	64

## **Annex B: GSM900 Small Cell System scenarios.....65**

B.1	Transmitter .....	66
B.1.1	Modulation, Spurs and Noise .....	66
B.1.1.1	Co-ordinated, BTS -> MS .....	66
B.1.1.2	Uncoordinated, BTS -> MS .....	66
B.1.1.3	Co-ordinated & Uncoordinated MS -> BTS .....	66
B.1.1.4	Co-ordinated & Uncoordinated MS -> MS .....	66
B.1.1.5	Co-ordinated & Uncoordinated BTS -> BTS .....	67
B.1.2	Switching Transients .....	67
B.1.2.1	Uncoordinated MS -> BTS .....	67
B.1.2.2	Uncoordinated BTS -> MS .....	67
B.1.3	Intermodulation .....	67
B.1.3.1	Coordinated, BTS -> MS .....	67
B.1.3.2	Uncoordinated, BTS -> MS .....	67
B.1.3.3	Uncoordinated, MS&MS -> BTS .....	67
B.1.3.4	Uncoordinated MS&MS -> MS .....	67
B.2	Receiver.....67	67
B.2.1	Blocking .....	67
B.2.1.1	Co-ordinated & Uncoordinated BTS -> MS .....	67
B.2.1.2	Co-ordinated MS -> BTS .....	67
B.2.1.3	Uncoordinated MS -> BTS .....	68
B.2.1.4	Co-ordinated & Uncoordinated MS -> MS .....	68
B.2.1.5	Co-ordinated and Uncoordinated BTS -> BTS .....	68
B.2.2	Intermodulation .....	68
B.2.2.1	Co-ordinated & Uncoordinated BTS -> MS .....	68
B.2.2.2	Co-ordinated MS & MS -> BTS .....	68
B.2.2.3	Uncoordinated MS & MS -> BTS .....	68
B.2.3	Maximum level .....	68
B.2.3.1	Co-ordinated MS -> BTS .....	68
B.2.3.2	Co-ordinated BTS -> MS .....	68
B.3.1	Transmitter .....	69
B.3.1.1	Modulation, Spurs and Noise .....	69
B.3.1.1.1	Co-ordinated, BTS -> MS .....	69
B.3.1.1.2	Uncoordinated, BTS -> MS .....	69
B.3.1.1.3	Co-ordinated & Uncoordinated MS -> BTS .....	69
B.3.1.1.4	Co-ordinated & Uncoordinated MS -> MS .....	69
B.3.1.1.5	Co-ordinated & Uncoordinated BTS -> BTS .....	69
B.3.1.2	Switching Transients.....69	69
B.3.1.2.1	Uncoordinated MS -> BTS .....	69
B.3.1.2.2	Uncoordinated BTS -> MS .....	69
B.3.1.3	Intermodulation.....70	70
B.3.1.3.1	Coordinated, BTS -> MS .....	70
B.3.1.3.2	Uncoordinated, BTS -> MS .....	70
B.3.1.3.3	Uncoordinated, MS&MS -> BTS .....	70
B.3.1.3.4	Uncoordinated MS&MS -> MS .....	70
B.3.2	Receiver.....70	70
B.3.2.1	Blocking .....	70
B.3.2.1.1	Co-ordinated & Uncoordinated BTS -> MS .....	70
B.3.2.1.2	Co-ordinated MS -> BTS .....	70
B.3.2.1.3	Uncoordinated MS -> BTS .....	70
B.3.2.1.4	Co-ordinated & Uncoordinated MS -> MS .....	70

B.3.2.1.5	Co-ordinated and Uncoordinated BTS -> BTS .....	70
B.3.2.2	Intermodulation.....	70
B.3.2.2.1	Co-ordinated & Uncoordinated BTS -> MS .....	70
B.3.2.2.2	Co-ordinated MS & MS -> BTS .....	71
B.3.2.2.3	Uncoordinated MS & MS -> BTS.....	71
B.3.2.3	Maximum level.....	71
B.3.2.3.1	Co-ordinated MS -> BTS .....	71
B.3.2.3.2	Co-ordinated BTS -> MS .....	71
<b>Annex C:</b>	<b>Microcell System Scenarios.....</b>	<b>72</b>
<b>Annex D:</b>	<b>Conversion factors .....</b>	<b>85</b>
<b>Annex E:</b>	<b>Repeater Scenarios.....</b>	<b>89</b>
E.1	INTRODUCTION.....	89
E.2	REPEATER APPLICATIONS - OUTDOOR AND INDOOR .....	89
E.3	OUTDOOR REPEATER SCENARIO .....	89
E.4	OUTDOOR REPEATER PERFORMANCE Requirements.....	90
E.4.1	Wideband Noise .....	90
E.4.2	Intermodulation Products and Spurious Emissions .....	91
E.4.3	Output Power.....	91
E.4.4	Blocking by Uncoordinated BTS .....	91
E.4.5	Summary of Outdoor Repeater Requirements.....	92
E.5	INDOOR REPEATER SCENARIO .....	92
E.6	INDOOR REPEATER PERFORMANCE REQUIREMENTS.....	92
E.6.1	Wideband Noise .....	92
E.6.2	Intermodulation Products and Spurious Emissions .....	93
E.6.3	Output Power.....	93
E.6.4	Blocking by Uncoordinated BTS .....	94
E.6.5	Summary of Indoor Repeater Requirements.....	94
E.7	Title: Repeater Scenarios.....	95
E.7.1	Introduction .....	95
E.7.2	Repeater performance.....	95
E.7.2.1	Link Equations .....	95
E.7.2.2	Co-ordinated Scenario .....	96
E.7.2.3	Uncoordinated Scenario .....	97
E.7.2.4	Wideband Noise.....	97
E.7.2.5	3rd order Intermodulation (IM3) performance/Spurious emissions: .....	97
E.7.3	Repeater scenarios .....	97
E.7.3.1	Rural scenario .....	98
E.7.3.2	Urban Scenario .....	98
E.7.4	Summary .....	99
E.7.4.1	Repeater Specification .....	99
E.7.4.2	Planning considerations .....	99
E.7.5	Out of band Gain .....	100
E.7.6	Planning guidelines for repeaters.....	100
E.7.7	Indoor Repeater Scenario .....	100
<b>Annex F:</b>	<b>Error Patterns for Speech Coder Development.....</b>	<b>104</b>
F.0	Introduction .....	104
F.1	Channel Conditions .....	104
F.1.1	Simulation Conditions .....	104
F.1.2	Available Error Patterns .....	104
F.2	Test Data for the half rate speech coder .....	105
F.2.1	File description.....	105
F.2.2	Soft decision values and chip error patterns .....	105

F.2.3	Error patterns of corresponding TCH/FS .....	106
<b>Annex G:</b>	<b>Simulation of Performance .....</b>	<b>108</b>
G.1	Implementation Losses and Noise Figure .....	108
G.1.1	Assumed Equalizer.....	108
G.1.2	Accuracy of Simulations .....	108
G.1.3	Simulation Results.....	108
G.2	Reference Structure .....	117
G.2.1	Error Concealment .....	118
G.2.2	Implementation Losses and Noise Figure .....	118
G.2.3	Assumed Equalizer.....	118
G.2.4	Simulation Results.....	118
G.2.5	Proposed Values for Recommendation GSM 05.05.....	118
G.3	Simulation of performance for AMR .....	119
G.3.1	System Configuration.....	119
G.3.2	Error Concealment .....	119
G.3.3	Implementation Losses and Noise Figure .....	120
G.3.4	Assumed Equalizer.....	120
G.3.5	Simulation Methods .....	120
G.3.5.1	Simulation for speech .....	120
G.3.5.2	Simulation for DTX.....	120
G.3.5.3	Simulation for inband channel .....	120
G.3.6	Remarks to the Data in GSM 05.05.....	121
<b>Annex H:</b>	<b>GSM900 Railway System Scenarios.....</b>	<b>122</b>
H.1	Scope .....	122
H.1.1	List of some abbreviations.....	122
H.2	Constraints.....	122
H.2.1	GSM based systems in the 900 MHz band.....	122
H.2.2	Other systems .....	123
H.2.3	UIC systems outline .....	123
H.2.4	Fixed UIC RF parameters.....	123
H.3	Methodology .....	123
H.3.1	Scenarios .....	124
H.3.2	Format of calculations .....	125
H.3.3	GSM900 systems parameters .....	125
H.3.4	Minimum Coupling Loss.....	126
H.3.5	Interference margins.....	127
H.3.6	Differences between E- and P-GSM .....	127
H4	Transmitter requirements .....	127
H.4.1	Transmitter requirements summary.....	128
H.5	Receiver requirements .....	128
H.5.1	Receiver requirements summary .....	129
H.6	Wanted signals levels .....	129
H.6.1	Maximum wanted signal level.....	130
H.6.2	Dynamic range of wanted signals.....	130
<b>Annex I:</b>	<b>Void .....</b>	<b>131</b>
<b>Annex J:</b>	<b>GSM900 Railway System Scenarios.....</b>	<b>132</b>
J.1	Introduction .....	132
J.2	Basic considerations .....	132
J.2.1	Types of equipment and frequency ranges .....	132
J.3	Discussion of the individual sections in GSM 05.05 .....	133
J.3.1	Scope .....	133

J.3.2	Frequency bands and channel arrangement .....	133
J.3.3	Reference configuration .....	134
J.3.4	Transmitter characteristics.....	134
J.3.4.1	Output power .....	134
J.3.4.2	Void .....	134
J.3.4.2.1	Spectrum due to the modulation and wide band noise .....	134
J.3.4.2.2a	MS spectrum due to switching transients.....	134
J.3.4.2.2b	BTS spectrum due to switching transients .....	135
J.3.4.3.1	Spurious emissions.....	135
J.3.4.3.2	BTS spurious emissions .....	136
J.3.4.3.3	MS spurious emissions.....	136
J.3.4.3.4	MS spurious emissions onto downlinks .....	137
J.3.4.4	Radio frequency tolerance .....	138
J.3.4.5	Output level dynamic operation.....	138
J.3.4.5.1	BTS output level dynamic operation.....	138
J.3.4.5.2	MS output level dynamic operation .....	139
J.3.4.6	Phase accuracy.....	139
J.3.4.7.1	Intra BTS intermod attenuation.....	139
J.3.4.7.2	Intermodulation between MS (DCS1800 only).....	139
J.3.4.7.3	Mobile PBX .....	139
J.3.5	Receiver characteristics .....	140
J.3.5.1	Blocking characteristics .....	140
J.3.5.2	Blocking characteristics (in-band).....	140
J.3.5.3	Blocking characteristics (out-of-band).....	141
J.3.5.4	AM suppression characteristics.....	141
J.3.5.5	Intermodulation characteristics .....	141
J.3.5.6	Spurious emissions .....	141
J.3.6	Transmitter/receiver performance .....	141
J.3.6.1	Nominal error rates .....	141
J.3.6.2	Reference sensitivity level .....	141

## Annex K: Block Erasure Rate Performance for GPRS ..... 143

K.1	Introduction .....	143
K.2	Simulation Model.....	143
K.3	Results .....	143
K.4	Conclusions .....	144

## Annex L: Proposal on how to report GPRS performance into GSM 05.05 ..... 145

L.1	Introduction .....	145
L.2	GPRS BLER performance.....	145
L.3	GPRS throughput analyses.....	146
L.3.1	TU50 ideal FH.....	147
L.3.2	TU3 no FH .....	148
L.4	Proposals for GPRS performance in GSM 05.05 .....	148
L.4.1	TU50 ideal FH.....	148
L.4.2	TU3 no FH .....	149
L.5	Conclusions .....	149

## Annex M: GPRS simulation results in TU 3 and TU 50 no FH ..... 150

M.1	Introduction .....	150
M.2	Simulation Model.....	150
M.3	Maximum GPRS throughput.....	152
M.4	Conclusion.....	153

M.5	References .....	153
<b>Annex N:</b>	<b>C/I<sub>c</sub> and E<sub>b</sub>/N<sub>0</sub> Radio Performance for the GPRS Coding Schemes.....</b>	<b>154</b>
N.1	Introduction .....	154
N.2	C/I simulation results.....	154
N.3	E <sub>b</sub> /N <sub>0</sub> performance.....	156
N.4	Conclusions .....	158
N.5	References .....	158
<b>Annex O:</b>	<b>Void .....</b>	<b>159</b>
<b>Annex P:</b>	<b>Block Error Rate and USF Error Rate for GPRS .....</b>	<b>160</b>
P.1	Introduction .....	160
P.2	Simulation Assumptions.....	160
P.3	Simulation Results.....	161
P.3.1	Interference Simulations.....	161
P.3.1.1	TU50 Ideal Frequency Hopping .....	161
P.3.1.2	TU50 No Frequency Hopping .....	162
P.3.1.3	TU3 Ideal Frequency Hopping .....	163
P.3.1.4	TU3 No Frequency Hopping .....	164
P.3.1.5	RA250 No Frequency Hopping .....	165
P.3.2	Sensitivity Simulations.....	166
P.3.2.1	TU50 Ideal Frequency Hopping .....	166
P.3.2.2	TU50 No Frequency Hopping .....	167
P.3.2.3	HT100 No Frequency Hopping .....	168
P.3.2.4	RA250 No Frequency Hopping .....	169
P.3.2.5	Static Channel .....	170
<b>Annex Q:</b>	<b>Block Error Rate and USF Error Rate for GPRS, 1800 MHz.....</b>	<b>171</b>
Q.1	Introduction .....	171
Q.2	Simulation Assumptions.....	171
Q.3	Simulation Results.....	172
Q.3.1	Interference Simulations, 1 800 MHz.....	172
Q.3.1.2	TU50, Ideal Frequency Hopping .....	172
Q.3.1.3	TU50 No Frequency Hopping .....	173
Q.3.2	Sensitivity Simulations, 1800 MHz.....	174
Q.3.2.1	TU50 Ideal Frequency Hopping .....	174
Q.3.2.2	TU50 No Frequency Hopping .....	175
Q.3.2.3	HT100 No Frequency Hopping .....	176
<b>Annex R:</b>	<b>Pico BTS RF Scenarios.....</b>	<b>177</b>
R.1	Introduction .....	177
R.2	Fixed parameters .....	177
R.3	Maximum BTS Output Power.....	178
R.4	BTS Receiver Sensitivity .....	179
R.4.1	Balanced link (zero interference scenario) .....	179
R.4.2	Interferer at MCL scenario .....	179
R.4.3	Power control (zero interference scenario).....	180
R.4.4	Sensitivity overview .....	180
R.5	BTS Power Control Range .....	180
R.6	BTS Spectrum due to modulation and wideband noise.....	180

R.7	Spurious Emissions .....	181
R.8	Radio Frequency Tolerance.....	181
R.9	Blocking Characteristics.....	182
R.10	pico- BTS AM suppression characteristics .....	183
R.10.1	Modulation sidebands.....	184
R.10.1.1	Uncoordinated BTS->MS .....	184
R.10.1.2	Uncoordinated MS->BTS .....	184
R.10.2	Switching transients .....	184
R.10.2.1	Uncoordinated BTS->MS .....	184
R.10.2.2	Uncoordinated MS->BTS .....	184
R.10.3	Blocking .....	185
R.10.3.1	Uncoordinated BTS->MS .....	185
R.10.3.2	Uncoordinated MS->BTS .....	185
R.10.4	The AM suppression requirement .....	185
R.10.4.1	Downlink, BTS->MS.....	185
R.10.4.2	Uplink, MS->BTS.....	185
R.10.4.3	Interference levels.....	186
R.11	intermodulation .....	186
R.11.1	co-ordinated and uncoordinated BTS -> MS (scenarios 2 & 3, figure 3.2 middle).....	186
R.11.2	coordinated MS&MS -> BTS (scenario 4).....	186
R.11.3	uncoordinated MS&MS -> BTS (scenario 4, figure 3.2 lower) .....	186
R.11.4	MCL relaxation .....	187
R.12	Pico BTS TI1.5 performance requirements.....	187
R.12.1	Nominal Error Rates for Pico-BTS .....	187
R.13	timing and synchronisation .....	188
R.13.1	Steady state timing advance error.....	188
R.13.2	Conventional BTS .....	189
R.13.3	Pico-BTS .....	189
R.13.3.1	Pico-BTS relaxation.....	189
R.13.3.2	MS impact of Pico-BTS relaxation.....	189
<b>Annex S:</b>	<b>CTS system scenarios .....</b>	<b>191</b>
S.1	Introduction .....	191
S.1.1	Parameter Set.....	191
S.1.1.1	Transmitter Parameter.....	191
S.1.1.2	Receiver Parameter .....	192
S.1.1.3	Minimum coupling loss values .....	192
S.1.1.4	Path loss models .....	192
S.1.1.5	Margins .....	193
S.2	Transmitter characteristics .....	193
S.2.1	Maximum CTS-FP Transmit Power limited by MS blocking.....	193
S.2.2	Maximum CTS-FP Transmit Power limited by Spectrum due to Modulation and WBN .....	194
S.2.3	Specification of max. CTS-FP Transmit Power and CTS-FP Spectrum due to modulation and wide band noise .....	195
S.2.3.1	Maximum CTS-FP transmit power.....	195
S.2.3.2	Spectrum due to modulation and wide band noise.....	196
S.2.4	Balanced link for zero interference scenario (Interferer at MCL scenario) .....	197
S.2.5	Range of Coverage for CTS: .....	197
S.2.6	Minimum CTS-FP transmit power .....	198
S.2.7	Power Level Distribution .....	199
S.2.8	Spurious Emission.....	199
S.3	Receiver characteristics .....	200
S.3.1	Blocking .....	200
S.3.2	AM suppression.....	201
S.3.2.1	Spectrum due to modulation .....	201
S.3.2.2	Switching transients.....	202

S.3.2.3	Blocking.....	203
S.3.2.4	Specification of AM Suppression.....	203
S.3.3	Intermodulation .....	204
S.3.3.1	uncoordinated CTS-MSs -> GSM-BTS.....	204
S.3.3.2	uncoordinated CTS-FPs -> MS.....	204
S.3.3.3	uncoordinated GSM-MSs -> CTS-FP.....	205
S.4	CTS-FP TI5 performance requirements .....	205
S.4.1	Nominal Error Rates for the CTS-FP .....	205
S.5	Conclusion.....	206
<b>Annex T:</b>	<b>GSM400 system scenarios .....</b>	<b>207</b>
T.0	Introduction .....	207
T.1	Frequency bands and channel arrangement.....	207
T.2	System Scenario Calculations for GSM400 systems .....	208
T.2.1	Worst case proximity scenarios.....	208
T.3	Worst Case Scenario Requirements .....	210
T.3.1	Transmitter .....	210
T.3.1.1	Modulation, Spurs and noise.....	210
T.3.1.1.1	Co-ordinated BTS -> MS .....	210
T.3.1.1.2	Uncoordinated BTS -> MS .....	210
T.3.1.1.3	Coordinated & Uncoordinated MS -> BTS.....	210
T.3.1.1.4	Coordinated & Uncoordinated MS -> MS .....	210
T.3.1.1.5	Coordinated & Uncoordinated BTS -> BTS .....	210
T.3.1.2	Switching transients.....	210
T.3.1.2.1	Uncoordinated MS -> BTS .....	210
T.3.1.2.2	Uncoordinated BTS -> MS .....	210
T.3.1.3	Intermodulation.....	211
T.3.1.3.1	Coordinated BTS -> MS .....	211
T.3.1.3.2	Uncoordinated BTS -> MS .....	211
T.3.1.3.3	Uncoordinated MSs -> BTS .....	211
T.3.1.3.4	Uncoordinated MS & MS -> MS .....	211
T.3.2	Receiver.....	211
T.3.2.1	Blocking.....	211
T.3.2.1.1	Coordinated & Uncoordinated BTS -> MS .....	211
T.3.2.1.2	Coordinated MS -> BTS .....	211
T.3.2.1.3	Uncoordinated MS -> BTS .....	211
T.3.2.1.4	Coordinated & Uncoordinated MS -> MS .....	211
T.3.2.1.5	Coordinated & Uncoordinated BTS -> BTS .....	211
T.3.2.2	Intermodulation.....	211
T.3.2.2.1	Coordinated & Uncoordinated BTS -> MS .....	211
T.3.2.2.2	Coordinated MS -> BTS .....	212
T.3.2.2.3	Uncoordinated MS -> BTS .....	212
T.3.2.3	Maximum level.....	212
T.3.2.3.1	Coordinated MS -> BTS .....	212
T.3.2.3.2	Coordinated BTS -> MS .....	212
T.4	Transmitter characteristics .....	212
T.4.1	Output power.....	212
T.4.1.1	Mobile Station .....	212
T.4.1.2	Base Station .....	212
T.4.2	Output RF Spectrum.....	212
T.4.2.1	Spectrum due to the modulation and wideband noise.....	212
T.4.2.2	Spectrum due to switching transients .....	213
T.4.3	Spurious emissions .....	213
T.4.3.1	Principle of the specification .....	213
T.4.3.2	Base transceiver station .....	214
T.4.3.3	Mobile station .....	214
T.4.4	Radio frequency tolerance .....	214