

# ETSI TS 101 087 V8.11.0 (2009-06)

---

*Technical Specification*

**Digital cellular telecommunications system (Phase 2+);  
Base Station System (BSS) equipment specification;  
Radio aspects  
(3GPP TS 11.21 version 8.11.0 Release 1999)**

---



---

Reference

RTS/TSGG-011121v8b0

---

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**

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the 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

<http://portal.etsi.org/tb/status/status.asp>

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

[http://portal.etsi.org/chaicor/ETSI\\_support.asp](http://portal.etsi.org/chaicor/ETSI_support.asp)

---

**Copyright Notification**

No part may be reproduced except as authorized by written permission.  
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2009.  
All rights reserved.

**DECT**<sup>TM</sup>, **PLUGTESTS**<sup>TM</sup>, **UMTS**<sup>TM</sup>, **TIPHON**<sup>TM</sup>, the TIPHON logo and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.

**3GPP**<sup>TM</sup> is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

**LTE**<sup>TM</sup> is a Trade Mark of ETSI currently being registered

for the benefit of its Members and of the 3GPP Organizational Partners.

**GSM**<sup>®</sup> 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 (<http://webapp.etsi.org/IPR/home.asp>).

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 Specification (TS) 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>.

# Contents

Intellectual Property Rights .....	2
Foreword.....	2
Foreword.....	8
1 Scope .....	9
2 References .....	10
3 Definitions, abbreviations, frequency bands and channels.....	11
3.1 Definitions .....	11
3.2 Abbreviations .....	12
3.3 Frequency bands and channels .....	12
3.3.1 Frequency bands .....	12
3.3.2 Channels and channel numbering .....	13
4 General test conditions and declarations .....	13
4.1 Output power and determination of power class .....	13
4.2 Specified frequency range .....	14
4.3 Frequency hopping .....	14
4.4 RF power control.....	14
4.5 Downlink discontinuous transmission (DTX) .....	14
4.6 Test environments .....	15
4.6.1 Normal test environment .....	15
4.6.2 Extreme test environment .....	15
4.6.2.1 Extreme temperature .....	15
4.6.3 Vibration .....	16
4.6.4 Power supply .....	16
4.7 Acceptable uncertainty of measurement equipment.....	16
4.8 Interpretation of measurement results .....	20
4.9 Selection of configurations for testing.....	20
4.10 BTS Configurations.....	21
4.10.1 Receiver diversity .....	21
4.10.2 Duplexers .....	21
4.10.3 Power supply options.....	22
4.10.4 Ancillary RF amplifiers .....	22
4.10.5 BSS using antenna arrays .....	23
4.10.6 BTS supporting 8-PSK modulation .....	24
5 Format and interpretation of tests.....	24
6 Transmitter .....	25
6.1 Static Layer 1 functions.....	25
6.1.1 Test purpose.....	25
6.1.2 Test case .....	25
6.1.3 Essential conformance .....	25
6.1.4 Complete conformance .....	25
6.1.5 Requirement reference .....	26
6.2 Modulation accuracy .....	26
6.2.1 Test purpose.....	26
6.2.2 Test case .....	26
6.2.3 Essential conformance .....	27
6.2.4 Complete conformance .....	28
6.2.5 Requirement reference .....	28
6.3 Mean transmitted RF carrier power.....	28
6.3.1 Test purpose.....	28
6.3.2 Test case .....	28
6.3.3 Essential conformance .....	29
6.3.4 Complete conformance .....	30

6.3.5	Requirement reference .....	30
6.4	Transmitted RF carrier power versus time .....	30
6.4.1	Test purpose.....	30
6.4.2	Test case .....	30
6.4.3	Essential conformance .....	31
6.4.4	Complete conformance .....	31
6.4.5	Requirement reference .....	33
6.5	Adjacent channel power .....	33
6.5.1	Spectrum due to modulation and wideband noise.....	33
6.5.1.1	Test purpose .....	33
6.5.1.2	Test case.....	33
6.5.1.3	Essential Conformance.....	34
6.5.1.4	Complete conformance .....	36
6.5.1.5	Requirement reference .....	36
6.5.2	Switching transients spectrum .....	36
6.5.2.1	Test purpose .....	36
6.5.2.2	Test case.....	36
6.5.2.3	Essential conformance .....	38
6.5.2.4	Complete conformance .....	38
6.5.2.5	Requirement reference .....	38
6.6	Spurious emissions from the transmitter antenna connector .....	38
6.6.1	Conducted spurious emissions from the transmitter antenna connector, inside the BTS transmit band.....	39
6.6.1.1	Test Purpose.....	39
6.6.1.2	Test Case .....	39
6.6.1.3	Essential conformance .....	39
6.6.1.4	Complete conformance .....	39
6.6.1.5	Requirement Reference.....	39
6.6.2	Conducted spurious emissions from the transmitter antenna connector, outside the BTS transmit band .....	39
6.6.2.1	Applicability (Phase 2).....	39
6.6.2.1.1	Test Purpose .....	40
6.6.2.1.2	Test Case .....	40
6.6.2.1.3	Essential conformance.....	41
6.6.2.1.4	Complete conformance.....	41
6.6.2.1.5	Requirement Reference .....	41
6.6.2.2	Applicability (Phase 2+) .....	41
6.6.2.2.1	Test Purpose .....	41
6.6.2.2.2	Test Case .....	42
6.6.2.2.3	Essential conformance.....	43
6.6.2.2.4	Complete conformance.....	43
6.6.2.2.5	Requirement Reference .....	44
6.6.2.3	Applicability (Phase 2+ Release 1999 GSM 400, GSM 900 and DCS 1800).....	44
6.6.2.3.1	Test Purpose .....	44
6.6.2.3.2	Test Case .....	44
6.6.2.3.3	Essential conformance.....	45
6.6.2.3.4	Complete conformance.....	45
6.6.2.3.5	Requirement Reference .....	45
6.7	Intermodulation attenuation (GSM 400, GSM 900 and DCS 1800) .....	45
6.7.1	Test purpose.....	45
6.7.2	Test case .....	46
6.7.3	Essential Conformance .....	46
6.7.4	Complete conformance .....	47
6.7.5	Requirement reference.....	48
6.8	Intra Base Station System intermodulation attenuation.....	48
6.8.1	Test purpose.....	48
6.8.2	Test case .....	48
6.8.3	Essential conformance .....	49
6.8.4	Complete conformance .....	49
6.8.5	Requirement reference.....	50
6.9	Intra Base Station System intermodulation attenuation, MXM 850 and MXM 1900 .....	50
6.9.1	Test purpose.....	50
6.9.2	Test cases .....	50

6.9.2.1	200 kHz carriers-only.....	50
6.9.2.2	200 kHz and ANSI-136 30 kHz carriers .....	50
6.9.3	Essential conformance .....	50
6.9.4	Complete conformance .....	51
6.9.5	Requirement reference .....	51
6.10	Intra Base Station System intermodulation attenuation, PCS 1900 and GSM 850 .....	51
6.10.1	Test purpose.....	51
6.10.2	Test case .....	51
6.10.3	Essential conformance .....	52
6.10.4	Complete conformance .....	52
6.10.5	Requirement reference .....	52
6.11	Intermodulation attenuation (GSM 850, MXM 850, PCS 1900 and MXM 1900).....	52
6.11.1	Test purpose.....	52
6.11.2	Test case .....	52
6.11.3	Essential Conformance .....	53
6.11.4	Complete conformance .....	54
6.11.5	Requirement reference .....	55
7	Receivers .....	55
7.1	Static Layer 1 receiver functions (nominal error ratios).....	55
7.1.1	Test Purpose.....	55
7.1.2	Test Case.....	55
7.1.3	Essential conformance .....	57
7.1.4	Complete conformance .....	57
7.1.5	Requirement Reference.....	58
7.2	Erroneous Frame Indication Performance .....	58
7.2.1	Test Purpose.....	58
7.2.2	Test Case.....	58
7.2.3	Essential conformance .....	59
7.2.4	Complete conformance .....	59
7.2.5	Requirement reference .....	59
7.3	Static Reference Sensitivity Level.....	59
7.3.1	Test Purpose.....	59
7.3.2	Test Case.....	59
7.3.3	Essential conformance .....	61
7.3.4	Complete conformance .....	61
7.3.5	Requirements Reference .....	62
7.4	Multipath Reference Sensitivity Level .....	63
7.4.1	Test Purpose.....	63
7.4.2	Test Case.....	63
7.4.3	Essential conformance .....	65
7.4.4	Complete conformance .....	66
7.4.5	Requirement Reference.....	70
7.5	Reference interference level .....	70
7.5.1	Test Purpose.....	70
7.5.2	Test Case.....	70
7.5.3	Essential conformance .....	73
7.5.4	Complete conformance .....	76
7.5.5	Requirements Reference .....	81
7.6	Blocking Characteristics.....	81
7.6.1	Test Purpose.....	81
7.6.2	Test Case.....	81
7.6.3	Essential conformance .....	85
7.6.4	Complete conformance .....	86
7.6.5	Requirements reference .....	86
7.7	Intermodulation characteristics .....	86
7.7.1	Test Purpose.....	86
7.7.2	Test Case.....	87
7.7.3	Essential conformance .....	88
7.7.4	Complete conformance .....	88
7.7.5	Requirement Reference.....	89
7.8	AM suppression.....	89

7.8.1	Test Purpose.....	89
7.8.2	Test Case.....	89
7.8.3	Essential conformance .....	90
7.8.4	Complete conformance .....	91
7.8.5	Requirement Reference.....	91
7.9	Spurious emissions from the receiver antenna connector.....	91
7.9.1	Test Purpose.....	91
7.9.2	Test Case.....	91
7.9.3	Essential conformance .....	91
7.9.4	Complete conformance .....	92
7.9.5	Requirement Reference.....	92
8	Radiated spurious emissions .....	92
8.1	Test Purpose .....	92
8.2	Test Case .....	92
8.3	Essential conformance.....	93
8.4	Complete conformance.....	94
8.5	Requirement reference .....	94
9	Radio link management.....	94
9.1	General .....	94
9.2	Synchronization.....	94
9.2.1	Timing Tolerance.....	95
9.2.1.1	Test purpose .....	95
9.2.1.2	Test case.....	95
9.2.1.3	Essential conformance .....	95
9.2.1.4	Complete conformance .....	95
9.2.1.5	Requirement reference .....	96
9.3	Frame structure.....	96
9.3.1	BCCH Multiframe .....	96
9.3.1.1	Test purpose .....	96
9.3.1.2	Test case.....	96
9.3.1.3	Essential conformance .....	96
9.3.1.4	Complete conformance .....	96
9.3.1.5	Requirement reference .....	96
9.3.2	TDMA-frame structure .....	97
9.3.2.1	Test purpose .....	97
9.3.2.2	Test case.....	97
9.3.2.3	Essential conformance .....	97
9.3.2.4	Complete conformance .....	97
9.3.2.5	Requirement reference .....	97
9.4	Radio link measurements .....	97
9.4.1	Signal Strength.....	98
9.4.1.1	Measurement Accuracy.....	98
9.4.1.1.1	Test purpose .....	98
9.4.1.1.2	Test case .....	98
9.4.1.1.3	Essential conformance .....	98
9.4.1.1.4	Complete conformance.....	98
9.4.1.2	Selectivity of signal strength measurements .....	99
9.4.1.2.1	Test purpose .....	99
9.4.1.2.2	Test case .....	99
9.4.1.2.3	Essential conformance.....	100
9.4.1.2.4	Complete conformance.....	100
9.4.1.2.5	Requirement reference.....	100
9.4.2	Signal quality .....	101
9.4.2.1	Test purpose .....	101
9.4.2.2	Test case.....	101
9.4.2.3	Essential conformance .....	101
9.4.2.4	Complete conformance .....	101
9.4.2.5	Requirement reference .....	102
9.4.3	Idle channel signal level .....	102
9.4.3.1	Test purpose .....	102

9.4.3.2	Test case .....	102
9.4.3.3	Essential conformance .....	103
9.4.3.4	Complete conformance .....	103
9.4.3.5	Requirement reference .....	103
9.5	Adaptive frame alignment .....	103
9.5.1	Test purpose .....	103
9.5.2	Test case .....	104
9.5.3	Essential conformance .....	104
9.5.4	Complete conformance .....	104
9.5.5	Requirement reference .....	105
<b>Annex A (informative): Testing of statistical parameters.....</b>		<b>106</b>
A.1	General theoretical methodology .....	106
A.2	Detailed theoretical methodology .....	108
A.3	Limitations and corrections to the theoretical methodology .....	109
A.3.1	Independent errors .....	109
A.3.2	Gaussian distribution .....	109
A.3.3	Stationary random processes .....	109
A.3.4	Low error ratios .....	110
A.3.5	Total corrections .....	110
A.4	Alternative experimental methodology .....	110
A.5	Detailed definition of error events .....	111
<b>Annex B (informative): Description of special test equipment.....</b>		<b>112</b>
B.1	Base Station System Test Equipment (BSSTE) .....	112
B.1.1	Fading and multipath propagation simulator .....	112
B.2	Measurement set ups for TX intermodulation .....	112
B.2.1	Test set-up for Intermodulation Attenuation (6.7.) .....	112
B.2.1.1	RX-Band .....	113
B.2.1.2	Outside RX Band .....	113
B.2.2	Test set-up for Intra BSS Intermodulation Attenuation (6.8.) .....	114
B.2.2.1	RX-Band .....	114
B.2.2.2	TX-Band .....	114
<b>Annex C (informative): Number of samples needed for statistical testing.....</b>		<b>115</b>
C.1	GSM 900; Number of samples for testing .....	115
C.2	DCS 1800; Number of Samples for Testing .....	136
<b>Annex D (informative): Change history .....</b>		<b>157</b>
History .....		160



---

# Foreword

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

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

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- 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 specifies the Radio Frequency (RF) test methods and conformance requirements for GSM 400, GSM 900 and DCS 1800, PCS 1900, GSM 850, MXM 850 and MXM 1900 Base Station Systems (BSS)s. These have been derived from, and are consistent with, the core GSM specifications specified in the requirements reference subclause of each test with the exception that requirements expressed as a reference to regulatory documents (e.g. FCC) have not been included in the present document.

The present document is applicable to BSS meeting the requirements of either GSM Phase 2 or GSM Phase 2+. Unless otherwise stated, all tests are applicable to BSS meeting Phase 2 and/or Phase 2+ GSM requirements, because the requirements of the Phase 2 and Phase 2+ core GSM specifications which are referenced in the test are consistent. Most differences between Phase 2 and Phase 2+ requirements represent Phase 2+ features which are optional for the BSS to support.

For each test, two conformance requirements are specified:

- essential conformance requirements;
- complete conformance requirements.

Essential conformance requirements are those which are required:

- a) to ensure compatibility between the radio channels in the same cell;
- b) to ensure compatibility between cells, both co-ordinated and unco-ordinated;
- c) to ensure compatibility with existing systems in the same or adjacent frequency bands;
- d) to verify the important aspects of the transmission quality of the system.

Essential conformance requirements are sufficient to verify the performance of the equipment for radio type approval purposes, in countries where this is applicable. For GSM 850, MXM 850, PCS 1900 and MXM 1900 only the complete conformance requirements are applicable.

Complete conformance requirements may be tested to verify all aspects of the performance of a BSS. These requirements are intended to be used by manufacturers and operators to allow conformance and acceptance testing to be performed in a consistent manner; the tests to be performed should be agreed between the parties.

In some tests there are separate requirements for micro-BTS and BTS. If there is no separate requirement for a micro-BTS, the requirements for the BTS apply to a micro-BTS.

In the present document, the reference point for RF connections (except for the measurement of mean transmitted RF carrier power) is the antenna connector, as defined by the manufacturer. The present document does not apply to repeaters or RF devices which may be connected to an antenna connector of a BSS, except as specified in subclause 4.10.

**NOTE:** The present document contains both essential conformance requirements and complete conformance requirements. Essential conformance requirements are those requirements which may be deemed sufficient for radio type approval purposes, complete conformance requirements cover all conformance aspects.