ETSI TS 101 978 V1.1.1 (2001-07)

Technical Specification

Terrestrial Trunked Radio (TETRA);
TETRA Advanced Packet Service (TAPS) Test Purposes

Reference

DTS/TETRA-04065

Keywords

data, radio, TETRA

ETSI

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Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

This Technical Specification (TS) has been produced by ETSI Project Terrestrial Trunked Radio (TETRA).

1 Scope

The present document specifies the test purposes for TAPS Mobile Stations, TAPS Base Transceiver Stations and TAPS Base Transceiver Station Repeaters.

The present document is applicable to Mobile Stations, Base Transceiver Stations and Base Transceiver Station Repeaters as described in TS 101 962.

In addition, the present document includes a detailed description of a selection of tests, mainly RF tests applicable to the equipment within the scope of the present document.

2 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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI TS 101 962: "Terrestrial Trunked Radio (TETRA); TETRA Advanced Packet Service (TAPS)".

[2] ETSI TS 101 293: "Digital cellular telecommunications system (Phase 2+) (GSM); Individual equipment type requirements and interworking; Special conformance testing functions (GSM 04.14 Release 1999)".

[3] ETSI EN 300 019-1-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations".

[4] ETSI EN 300 019-1-4: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations".

[5] ETSI ETR 027: "Radio Equipment and Systems (RES); Methods of measurement for private mobile radio equipment".

[6] ETSI ETR 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".

[7] ETSI EN 300 959: "Digital cellular telecommunications system (Phase 2+) (GSM); Modulation (GSM 05.04 Release 1999)".

[8] 3GPP TS 05.05: "3rd Generation Partnership Project; Technical Specification Group GERAN; Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (Release 1999)".

[9] 3GPP TS 05.08: "3rd Generation Partnership Project; Technical Specification Group GERAN; Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (Release 1999)".

[10] 3GPP TS 05.10: "3rd Generation Partnership Project; Technical Specification Group GERAN; Digital cellular telecommunications system (Phase 2+); Radio subsystem synchronization (Release 1999)".

[11] ETSI EN 300 607-1: "Digital cellular telecommunications system (Phase 2+) (GSM); Mobile Station (MS) conformance specification; Part 1: Conformance specification (GSM 11.10-1 Release 1999)".

[12] GSM 11.21: "Digital cellular telecommunications system (Phase 2 & Phase 2+);Base Station System (BSS) equipment specification;Radio aspects (3GPP TS 11.21 Release 1999)".

[13] GSM 11.23: "Digital cellular telecommunications system (Phase 2) (GSM);Base Station System (BSS) equipment specification;Part 2: Signalling aspects (GSM 11.23)".

[14] GSM 11.26: "Digital cellular telecommunications system (Phase 2 and Phase 2+) (GSM);Base Station System (BSS) equipment specification;Part 4: Repeaters (GSM 11.26 Release 1999)".

[15] 3GPP TR 21.905: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications (Release 1999)".

[16] ITU-R Recommendation SM.329-7: "Spurious emissions".

[17] ITU-T Recommendation O.151: "Error performance measuring equipment operating at the primary rate and above".

[18] ITU-T Recommendation Q.153: "Multifrequency signal sender".

[19] IEC 60068-2-1: "Environmental testing - Part 2: Tests. Tests A: Cold".

[20] IEC 60068-2-2: "Environmental testing - Part 2: Tests. Tests B: Dry heat".

[21] IEC 60721: "Classification of environmental conditions".

3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 and the following apply:

BTS Base Transceiver Station
MS Mobile Station
TAPS TETRA Advanced Packet Service

4 Test requirements for the MS

4.1 List of tests

Test requirements for the MS are adapted from GSM 11.10-1. The applicable tests are listed in table 1.

The test purpose and applicability from GSM 11.10-1 is applicable to a TAPS MS. The test method shall be considered as being for guidance only, as the implementation details will need to be modified in order for the test to be applied to a TAPS MS. Examples of such modifications include:

1) Modification of frequencies and power limits to operate in the TAPS frequency bands;

2) Modification of tests which make use of a TCH/FS or TCH/HS for measurement purposes, to use a FACCH/F or a FACCH/H instead;

3) Modification of message contents to match the capabilities of a TAPS network and MS;

4) Replacement of the Generic Call Setup Procedure with an equivalent procedure for setting up a generic GPRS TBF in order to achieve a stable RF connection so that the characteristics of the MS can be measured;

5) GPRS protocol tests may need to be modified in order to make them applicable to Class C MS instead of Class A or Class B;

6) SMS point-to-point tests will need to be modified so that the messages are exchanged in a GPRS TBF instead of in a FACCH or SDDCH.

Table 1 lists the test purposes of GSM 11.10-1 which are applicable to a TAPS MS. Detailed test descriptions of selected tests are included in annex A.

Table 1: Tests for TAPS MS from GSM 11.10-1

Clause	Title
12.1.1	Conducted spurious emissions, MS allocated a channel
12.1.2	Conducted spurious emissions, MS in idle mode
12.2.1	Radiated spurious emissions, MS allocated a channel
12.2.2	Radiated spurious emissions, MS in idle mode
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13.2	Frequency error under multipath and interference conditions
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13.6	Frequency error and phase error in HSCSD multislot configurations
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13.17.3	EGPRS Transmitter output power
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14.3	Usable receiver input level range
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14.4.5	Co-channel rejection - FACCH/H
14.4.7	Receiver performance in the case of frequency hopping and co-channel interference on one carrier
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14.6.2	Intermodulation rejection - control channels
14.7.2	Blocking and spurious response - control channels
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14.16.1	GPRS receiver tests, Minimum Input level for Reference Performance
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14.18.3	EGPRS receiver test, Adjacent channel rejection
14.18.4	EGPRS receiver test, Intermodulation rejection
14.18.5	EGPRS receiver test, Blocking and spurious response
15	Timing advance and absolute delay
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20.22.2	Cell reselection in Packet Idle mode
20.22.3	Priority of cells
20.22.4	Cell re-selection with cells in different routing area
20.22.5	Network controlled Cell re-selection in Transfer Mode
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20.22.7	Downlink signalling failure
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20.22.9	Cell reselection when the best cell does not support GPRS
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21.2	Signal strength selectivity
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22.3	GPRS Uplink Power Control - Use of α and Γ_{CH} parameters
22.4	GPRS Uplink Power Control - Independence of TS Power Control
22.8	EGPRS Uplink Power Control - Use of α and Γ_{CH} parameters
22.9	EGPRS Uplink Power Control - Independence of TS Power Control

Clause	Title
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25.2.1.1.2	Initialization when contention resolution required, Initialization failure
25.2.1.1.3	Initialization when contention resolution required, Initialization denial
25.2.1.1.4	Initialization when contention resolution required, Total initialization failure
25.2.1.2	Initialization, contention resolution not required
25.2.1.2.1	Initialization, contention resolution not required, Normal initialization without contention resolution
25.2.1.2.2	Initialization, contention resolution not required, Initialization failure
25.2.1.2.3	Initialization, contention resolution not required, Initialization denial
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Clause	Title
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Clause	Title
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Clause	Title
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42.1.2.1.6	Packet Uplink Assignment/Decoding of frequency parameters

Clause	Title
42.1.2.1.7	Packet Uplink Assignment/Most recently received Packet Uplink Assignment
42.1.2.1.8.1.1	Packet Uplink Assignment/One phase access/Contention resolution/Inclusion of TLLI in RLC data blocks
42.1.2.1.8.1.2	Packet Uplink Assignment/One phase access/Contention resolution/Counter N3104
42.1.2.1.8.1.3	Packet Uplink Assignment/One phase access/Contention resolution/Timer T3166
42.1.2.1.8.1.4	Packet Uplink Assignment/One phase access/Contention resolution/TLLI mismatch
42.1.2.1.8.1.5	Packet Uplink Assignment/One phase access/Contention resolution/4 access repetition attempts
42.1.2.1.8.2.1	Packet Uplink Assignment/One phase access/Timing Advance/TA Index present
42.1.2.1.8.2.2	Packet Uplink Assignment/One phase access/Timing Advance/TA Index not present
42.1.2.1.8.2.3	Packet Uplink Assignment/One phase access/Timing Advance/TA value field not provided
42.1.2.1.9.1	Packet Uplink Assignment/Two phase access/Packet Resource Request/RLC Octet Count
42.1.2.1.9.2.1	Packet Uplink Assignment/Two phase access/Contention resolution/Expiry of timer T3168
42.1.2.1.9.2.2	Packet Uplink Assignment/Two phase access/Contention resolution/TLLI mismatch
42.1.2.1.9.3	Packet Uplink Assignment/Two phase access/Packet Resource Request/No respond to Packet Downlink Assignment
42.1.2.1.10.1	Packet Uplink Assignment/Abnormal cases/Incorrect PDCH assignment
42.1.2.1.10.2	Packet Uplink Assignment/Abnormal cases/Expiry of timer T3164
42.1.2.2.1	Packet Downlink Assignment/Response to poll bit
42.1.2.2.2	Packet Downlink Assignment/PCCCH monitoring
42.1.2.2.3	Packet Downlink Assignment/Frequency hopping
42.1.2.2.4	Packet Downlink Assignment/Response to Packet Polling
42.1.2.2.5.1	Packet Downlink Assignment/Abnormal cases/Incorrect PDCH assignment
42.1.2.2.5.2	Packet Downlink Assignment/Abnormal cases/Expiry of timer T3190
42.2.1.1	Generic procedures to bring the MS into uplink transfer mode, One phase access
42.2.1.2	Generic procedures to bring the MS into uplink transfer mode, Two phase access
42.2.2.1.1	Fixed Allocation/Uplink Transfer/Normal operation/Blocks
42.2.2.1.2	Fixed Allocation/Uplink Transfer/Normal operation/Block Periods
42.2.2.2	Fixed Allocation/Uplink Transfer/Operation with TS_OVERRIDE for single-slot TX
42.2.2.3	Fixed Allocation/Uplink Transfer/Operation with TS_OVERRIDE for multi-slot TX
42.2.2.4	Fixed Allocation/Uplink Transfer/T3184 Expiry
42.2.2.5.1	Fixed Allocation/Uplink Transfer/T3188/Expiry
42.2.2.5.2	Fixed Allocation/Uplink Transfer/T3188/Stop with Packet Uplink Assignment
42.2.2.5.3	Fixed Allocation/Uplink Transfer/T3188/Stop with Packet Uplink Ack/Nack with REPEAT_ALLOCATION
42.2.2.6.1	Fixed Allocation/Uplink Transfer/MS requests new resources/T3168/Expiry
42.2.2.6.2	Fixed Allocation/Uplink Transfer/MS requests new resources/T3168/Stop with Packet Uplink Assignment
42.2.2.6.3	Fixed Allocation/Uplink Transfer/MS requests new resources/T3168/Stop with Packet Uplink Ack/Nack with REPEAT_ALLOCATION
42.2.2.6.4	Fixed Allocation/Uplink Transfer/MS requests new resources/T3168/Stop with Packet Access Reject
42.2.2.6.5	Fixed Allocation/Uplink Transfer/MS requests new resources/T3168/Continue with Packet Uplink Ack/Nack without REPEAT_ALLOCATION and without ALLOCATION_BITMAP
42.2.2.7.1	Fixed Allocation/Uplink Transfer/MS requests new resources/Successful/Packet Uplink Assignment with ALLOCATION_BITMAP
42.2.2.7.2	Fixed Allocation/Uplink Transfer/MS requests new resources/Successful/Multiple Packet Uplink Assignments
42.2.2.7.3	Fixed Allocation/Uplink Transfer/MS requests new resources/Successful/Packet Uplink Ack/Nack with ALLOCATION_BITMAP
42.2.2.7.4	Fixed Allocation/Uplink Transfer/MS requests new resources/Successful/Multiple Packet Uplink Ack/Nack with ALLOCATION_BITMAP
42.2.2.7.5	Fixed Allocation/Uplink Transfer/MS requests new resources/Successful/Multiple Packet Uplink Ack/Nack with REPEAT_ALLOCATION
42.2.2.8.1	Fixed Allocation/Uplink Transfer/MS requests new resources/Failure/Packet Access Reject
42.2.2.8.2	Fixed Allocation/Uplink Transfer/MS requests new resources/Failure/Packet Access Reject with WAIT_INDICATION during allocation in progress
42.2.2.9	Fixed Allocation/Uplink Transfer/Network initiates new resources
42.2.2.10.1	Fixed Allocation/Uplink Transfer/PACCH operation/Normal Operation
42.2.2.10.2	Fixed Allocation/Uplink Transfer/PACCH operation/PACCH message addressed to another MS
42.2.2.10.3	Fixed Allocation/Uplink Transfer/Abnormal cases/PACCH timeslot removed
42.2.2.11.1	Fixed Allocation/Uplink Transfer/Abnormal cases/Assignment without fixed allocation
42.2.2.11.2	Fixed Allocation/Uplink Transfer/Abnormal cases/Frequency not supported
42.2.2.11.3	Fixed Allocation/Uplink Transfer/Abnormal cases/Invalid MA_NUMBER
42.2.3.1.1	Fixed Allocation/Uplink Transfer with Downlink TBF Establishment/T3190/Half-Duplex
42.2.3.1.2	Fixed Allocation/Uplink Transfer with Downlink TBF Establishment/T3190/Non Half-Duplex
42.2.3.2.1	Fixed Allocation/Uplink Transfer with Downlink TBF Establishment/Ending uplink TBF/Half-Duplex

Clause	Title
42.2.3.2.2	Fixed Allocation/Uplink Transfer with Downlink TBF Establishment/Ending uplink TBF/Non Half-Duplex
42.2.3.3.1	Fixed Allocation/Uplink Transfer with Downlink TBF Establishment/Abnormal cases/Violation of multi-slot capabilities
42.2.3.3.2	Fixed Allocation/Uplink Transfer with Downlink TBF Establishment/Abnormal cases/No defined PDCH
42.2.4.1.1	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/T3168/Expiry
42.2.4.1.2	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/T3168/Stop with Packet Uplink Assignment
42.2.4.2.1	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/Packet Uplink Assignment/Non half-duplex
42.2.4.2.2	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/Packet Uplink Assignment/Half-duplex
42.2.4.3.1	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/Packet Timeslot Reconfigure/Starting time with AFN encoding
42.2.4.3.2	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/Packet Timeslot Reconfigure/Starting time with relative encoding
42.2.4.4.1	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/Packet Access Reject/With WAIT_INDICATION
42.2.4.4.2	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/Packet Access Reject/No WAIT_INDICATION
42.2.4.4.3	Fixed Allocation/Downlink Transfer with Uplink TBF Establishment/Packet Access Reject/With Polling
42.3.1.1.1	Dynamic Allocation/Uplink Transfer/Normal/Successful
42.3.1.1.2	Dynamic Allocation/Uplink Transfer/Normal/Request new resources
42.3.1.1.3	Dynamic Allocation/Uplink Transfer/Normal/Starting frame number encoding
42.3.1.1.4	Dynamic Allocation/Uplink Transfer/Normal/Starting time
42.3.1.1.5	Dynamic Allocation/Uplink Transfer/Normal/Close-ended TBF
42.3.1.1.6	Dynamic Allocation/Uplink Transfer/Normal/T3180 expiry
42.3.1.1.7	Dynamic Allocation/Uplink Transfer/Normal/PACCH operation
42.3.1.1.8	Dynamic Allocation/Uplink Transfer/Normal/Two uplink timeslots
42.3.1.1.9	Dynamic Allocation/Uplink Transfer/Normal/Frequency parameters
42.3.1.2.	Dynamic Allocation/Uplink Transfer/Abnormal
42.3.1.2.1	Dynamic Allocation/Uplink Transfer/Abnormal/with random access
42.3.1.2.2	Dynamic Allocation/Uplink Transfer/Abnormal/with cell reselection in acknowledged mode
42.3.1.2.3	Dynamic Allocation/Uplink Transfer/Abnormal/with cell reselection in unacknowledged mode
42.3.2.1.1	Dynamic Allocation/Uplink Transfer with Downlink TBF establishment/Normal/Successful
42.3.2.1.2	Dynamic Allocation/Uplink Transfer with Downlink TBF establishment/Normal/Multislot capabilities
42.3.2.2.1	Dynamic Allocation/Uplink Transfer with Downlink TBF establishment/Abnormal/with random access
42.3.2.2.2	Dynamic Allocation/Uplink Transfer with Downlink TBF establishment/Abnormal/Continuation of normal operation
42.3.3.1.1	Dynamic Allocation/Resource reallocation/Successful/Higher throughput class or higher radio priority
42.3.3.1.2	Dynamic Allocation/Resource reallocation/Successful/Lower throughput class
42.3.3.1.3	Dynamic Allocation/Resource reallocation/Successful/Different RLC mode and higher radio priority
42.3.3.2.1	Dynamic Allocation/Resource reallocation/Abnormal/T3168 expiry
42.3.3.2.2	Dynamic Allocation/Resource reallocation/Abnormal/Invalid assignment
42.3.3.3	Dynamic Allocation/Resource reallocation/Reject
42.3.4	Default message contents
42.4.1.1	Network Control measurement reporting/Uplink/Normal case
42.4.1.2	Network Control measurement reporting/Idle mode/New cell reselection
42.4.1.3	Network Control measurement reporting/Downlink transfer/Normal case
42.4.2.1.1	Cell change order procedure/Uplink transfer/Normal case
42.4.2.1.2	Cell change order procedure/Uplink transfer/Failure cases/T3174 expiry
42.4.2.1.3	Cell change order procedure/Uplink transfer/Failure cases/REJECT from the new cell
42.4.2.1.4	Cell change order procedure/Uplink transfer/Failure cases/Contention resolution failure
42.4.2.1.5	Cell change order procedure/Uplink transfer/Failure cases/REJECT from the new cell and T3176 expiry
42.4.2.1.6	Cell change order procedure/Uplink transfer/Failure cases/Frequency not implemented
42.4.2.2.1	Cell change order procedure/Downlink transfer/Normal case
42.4.2.2.2	Cell change order procedure/Downlink transfer/Failure cases/REJECT from the new cell
42.4.2.2.3	Cell change order procedure/Downlink transfer/Failure cases/Frequency not implemented
42.4.2.3.1	Cell change order procedure/Simultaneous uplink and downlink transfer/Normal case
42.4.2.3.2	Cell change order procedure/Simultaneous uplink and downlink transfer/Failure case/T3174 expiry
42.5.1.1	Downlink Transfer/Normal Operation/Relative Encoding TBF starting time
42.5.1.2	Downlink Transfer/Normal Operation/Without TBF starting time
42.5.2.1	Downlink Transfer/Polling/Normal operation/RLC data block
42.5.2.2	Downlink Transfer/Polling/Packet Polling Request/Access Burst format
42.5.2.3	Downlink Transfer/Polling/Packet Polling Request/Control block format
42.5.3.1	Downlink Transfer/T3190 Expiry/Initial allocation/Restart with valid RLC data block

Clause	Title
42.5.4.1	Downlink Transfer/T3190 Expiry/Resource reallocation/Without TBF starting time
42.5.4.2	Downlink Transfer/T3190 Expiry/Resource reallocation/With TBF starting time
42.5.4.3	Downlink Transfer/T3190 Expiry/Resource reallocation/Restart with valid RLC data block
42.5.5.1	Downlink Transfer/Reestablishment/T3192 Expiry
42.5.5.2	Downlink Transfer/Reestablishment/Packet Downlink Assignment
42.5.5.3	Downlink Transfer/Reestablishment/Invalid Frequency Parameters IE
43.1.1.1	Acknowledged mode/Uplink TBF/Send state variable V(S)
43.1.1.2	Acknowledged mode/Uplink TBF/Transmit window size
43.1.1.3	Acknowledged mode/Uplink TBF/Acknowledge state variable V(A)
43.1.1.4	Acknowledged mode/Uplink TBF/Negatively acknowledged RLC data blocks
43.1.1.5	Acknowledged mode/Uplink TBF/Invalid Negative Acknowledgment
43.1.1.6	Acknowledged mode/Uplink TBF/Decoding of Received Block Bitmap
43.1.2.1	Acknowledged mode/Downlink TBF/Receive state variable V(R)
43.1.2.2	Acknowledged mode/Downlink TBF/Receive window state variable V(Q)
43.1.2.3	Acknowledged mode/Downlink TBF/Re-assembly of RLC data blocks
43.1.2.4	Acknowledged mode/Downlink TBF/Re-assembly/Length Indicator
43.2.1	Control Blocks Re-assembly
44.2.1.1.1	GPRS attach/accepted
44.2.1.1.2	GPRS attach/rejected/IMSI invalid/illegal MS
44.2.1.1.3	GPRS attach/rejected/IMSI invalid/GPRS services not allowed
44.2.1.1.4	GPRS attach/rejected/PLMN not allowed
44.2.1.1.5	GPRS attach/rejected/roaming not allowed in this location area
44.2.1.1.6	GPRS attach/abnormal cases/access barred due to access class control
44.2.1.1.7	GPRS attach/abnormal cases/change of cell into new routing area
44.2.1.1.8	GPRS attach/abnormal cases/power off
44.2.1.1.9	GPRS attach/abnormal cases/GPRS detach procedure collision
44.2.2.1.1	GPRS detach/power off/accepted
44.2.2.1.2	GPRS detach/accepted
44.2.2.1.3	GPRS detach/abnormal cases/attempt counter check/procedure timeout
44.2.2.1.4	GPRS detach/abnormal cases/GMM common procedure collision
44.2.2.2.1	GPRS detach/re-attach not required/accepted
44.2.2.2.2	GPRS detach/rejected/IMSI invalid/GPRS services not allowed
44.2.3.1.1	Routing area updating/accepted
44.2.3.1.2	Routing area updating/rejected/IMSI invalid/illegal ME
44.2.3.1.3	Routing area updating/rejected/MS identity cannot be derived by the network
44.2.3.1.4	Routing area updating/rejected/location area not allowed
44.2.3.1.5	Routing area updating/abnormal cases/attempt counter check/miscellaneous reject causes
44.2.3.1.6	Routing area updating/abnormal cases/change of cell into new routing area
44.2.3.1.7	Routing area updating/abnormal cases/change of cell during routing area updating procedure
44.2.3.1.8	Routing area updating/abnormal cases/P-TMSI reallocation procedure collision
44.2.3.3.1	Periodic routing area updating/accepted
44.2.4	P-TMSI reallocation
44.2.5.1.1	Authentication accepted
44.2.5.1.2	Authentication rejected
44.2.5.2.1	Ciphering mode/start ciphering
44.2.5.2.2	Ciphering mode/stop ciphering
44.2.5.2.3	Ciphering mode/IMEISV request
44.2.6.1	General Identification
44.2.7	GMM READY timer handling
45.2.1.1	Attach initiated by context activation/QoS Offered by Network is the QoS Requested
45.2.1.2.1	QoS Accepted by MS
45.2.1.2.2	QoS Rejected by MS
45.2.2	PDP context activation requested by the network, successful and unsuccessful
45.2.4.1	T3380 Expiry
45.2.4.2	Collision of MS initiated and network requested PDP context activation
45.3.1	PDP context modification
45.4.1	PDP context deactivation initiated by the MS
45.4.2	PDP context deactivation initiated by the network
45.4.3.1	Abnormal cases, T3390 Expiry
45.4.3.2	Abnormal cases, Collision of MS and network initiated PDP context deactivation requests
45.5.1	Error cases
46.1.2.1.1	Data transmission in protected mode
46.1.2.1.2	Data transmission in unprotected mode
46.1.2.1.3	Reception of I frame in ADM

Clause	Title
46.1.2.2.1.1	Link establishment from MS to SS
46.1.2.2.1.2	Link establishment from SS to MS
46.1.2.2.1.3	Loss of UA frame
46.1.2.2.1.4	Total loss of UA frame
46.1.2.2.1.5	DM response
46.1.2.2.2.1	Checking N(S)
46.1.2.2.2.2	Busy condition at the peer, with RR sent for resumption of transmission
46.1.2.2.2.3	Busy condition at the peer, with ACK sent for resumption of transmission
46.1.2.2.2.4	SACK frame
46.1.2.2.3.1	Checking N(R)
46.1.2.2.3.2	MS handling busy condition during bi-directional data transfer
46.1.2.2.3.3	SACK frame
46.1.2.2.3.4	ACK frame
46.1.2.2.4.1	Reestablishment due to reception of SABM
46.1.2.2.4.2	Reestablishment due to N200 failures
46.1.2.2.4.3	Reestablishment due to reception of DM
46.1.2.3.1	Collision of SABM
46.1.2.3.2	Collision of SABM and DISC
46.1.2.3.3	Collision of SABM and XID commands
46.1.2.4.1	Unsolicited DM
46.1.2.5.1	Sending FRMR due to undefined command control field
46.1.2.5.2	Sending FRMR due to reception of an S frame with incorrect length
46.1.2.5.3	Sending FRMR due to reception of an I frame information field exceeding the maximum length
46.1.2.5.4	Frame reject condition during establishment of ABM
46.1.2.6.1	Simultaneous acknowledged and unacknowledged data transfer on the same SAPI
46.1.2.6.2	Simultaneous acknowledged and unacknowledged data transfer on different SAPIs
46.1.2.7.1	Negotiation initiated by the SS during ABM, for T200 and N200
46.1.2.7.2	Negotiation initiated by the SS during ADM, for N201-I
46.1.2.7.3	Negotiation initiated by the SS (using SABM, for IOV-I)
46.1.2.7.4	Negotiation initiated by the SS (during ADM, for N201-U)
46.1.2.7.5	Negotiation initiated by the SS (during ADM, for IOV-UI)
46.1.2.7.6	Negotiation initiated by the SS (during ABM, for Reset)
46.1.2.7.7	XID command with unrecognized type field
46.1.2.7.8	XID Response with out of range values
46.2.1	Default Conditions
46.2.2.1.1	Mobile originated normal data transfer with LLC in acknowledged mode
46.2.2.1.2	Mobile originated normal data transfer with LLC in unacknowledged mode
46.2.2.1.3	Usage of acknowledged mode for data transmission before and after PDP Context modification, on different SAPIs
46.2.2.1.4	Reset indication during unacknowledged mode
46.2.2.1.5	Reset indication during acknowledged mode
46.2.2.2.1	LLC link re-establishment on reception of SN-DATA PDU with F=0 in ack mode in the Receive First Segment state
46.2.2.2.2	LLC link re-establishment on receiving second segment with F=1 and with different PCOMP and DCOMP values in the acknowledged mode data transfer
46.2.2.2.3	Single segment N-PDU from MS
46.2.2.3.1	LLC link release on receiving DM from the SS during link establishment
46.2.2.4.1	Response from MS on receiving XID request from the SS
46.2.2.4.2	Response from MS on receiving an XID request from the SS with an unassigned entity number
46.2.2.4.3	Response from MS on receiving an XID response from the SS with unrecognized type field

5 Test requirements for the Base Transceiver Station

5.1 General

Test requirements for the BTS are adapted from GSM 11.21 and GSM 11.23. The applicable tests are listed in table 2 and table 3. Detailed test descriptions of selected tests are included in annex B.

The test purpose and applicability from GSM 11.21 and GSM 11.23 are applicable to a TAPS BTS. The test method shall be considered as being for guidance only, as the implementation details will need to be modified in order for the test to be applied to a TAPS BTS. Examples of such modifications include:

1) Modification of frequencies and power limits to operate in the TAPS frequency bands;

2) Modification of tests which make use of a TCH/FS or TCH/HS for measurement purposes, to use a FACCH/F or a FACCH/H instead;

3) Modification of message contents to match the capabilities of a TAPS network and MS;

4) Replacement of the Generic Call Setup Procedure with an equivalent procedure for setting up a generic GPRS TBF in order to achieve a stable RF connection so that the characteristics of the MS can be measured.

5.2 List of tests from GSM 11.21

Table 2: Tests for TAPS BTS from GSM 11.21

Clause	Title
6.1	Static Layer 1 functions
6.2	Modulation accuracy
6.3	Mean transmitted RF carrier power
6.4	Transmitted RF carrier power versus time
6.5.1	Spectrum due to modulation and wideband noise
6.5.2	Switching transients spectrum
6.6.1	Conducted spurious emissions from the transmitter antenna connector, inside the BTS transmit band
6.6.2.1	Conducted spurious emissions from the transmitter antenna connector, outside the BTS transmit band
6.6.2.2	Conducted spurious emissions from the transmitter antenna connector, outside the BTS transmit band
6.6.2.3	Conducted spurious emissions from the transmitter antenna connector, outside the BTS transmit band
6.7	Intermodulation attenuation
6.8	Intra Base Station System intermodulation attenuation
6.9	Intra Base Station System intermodulation attenuation, MXM 850 and MXM 1900
6.10	Intra Base Station System intermodulation attenuation, PCS 1900 and GSM 850
7	Receivers
7.1	Static Layer 1 receiver functions (nominal error ratios)
7.2	Erroneous Frame Indication Performance
7.3	Static Reference Sensitivity Level
7.4	Multipath Reference Sensitivity Level
7.5	Reference interference level
7.6	Blocking Characteristics
7.7	Intermodulation characteristics
7.8	AM suppression
7.9	Spurious emissions from the receiver antenna connector
8	Radiated spurious emissions
9.2	Synchronization
9.2.1	Timing Tolerance
9.3	Frame structure
9.3.1	Frame structure, BCCH Multiframe
9.3.2	Frame structure, TDMA-frame structure
9.4.1	Radio link measurements, Signal Strength
9.4.2	Radio link measurements, Signal quality
9.4.3	Idle channel signal level
9.4.4	Signal quality, EGPRS
9.5	Adaptive frame alignment

5.3 List of tests from GSM 11.23

Table 3: Tests for TAPS BTS from GSM 11.23

Clause	Title
5.5.1.1	Contention resolution on FACCH or SDCCH
5.5.1.2	No Contention resolution on FACCH or SDCCH
5.5.1.3	No Contention resolution on FACCH (No immediate Assign procedures)
5.5.1.4	No contention resolution on SACCH (Short Message Service)
5.5.2.1	Short Message Service
5.6.1	Release of the dedicated physical resource, MS-originated
5.6.2	Release of the dedicated physical resource, BSS-originated
5.7	LAPDm idle state
5.8.1.1	Normal initialization (contention resolution)
5.8.1.2.1	Repeated SABM (loss of UA frame)
5.8.1.2.2	SABMs with different information fields
5.8.1.3	Normal initialization (no contention resolution)
5.8.2.1	Sequence counting and I frame acknowledgements
5.8.2.2	Receipt of an I frame in the timer recovery state
5.8.2.3	Segmentation and Concatenation
5.8.2.4	Sequence of Segmented and non Segmented I frames
5.8.3	Normal Layer 2 release by MS
5.8.4	Normal Layer 2 release by BSS
5.8.5.1	Abnormal data link release
5.8.5.2	Layer 2 release by MS while segmented I frames being exchanged
5.8.5.3	Layer 2 release while BSS in the timer recovery state
5.8.6.1	I Frame loss (BSS to BSSTE)
5.8.6.2	RR Response frame loss (BSSTE to BSS)
5.8.6.3	RR response frame loss (BSS to BSSTE)
5.8.6.4	UA frame loss (BSS to MS)
5.8.7.1	Data link layer not in the timer recovery state
5.8.7.2	Data link layer in the timer recovery state, reception of a REJ response frame
5.8.7.3	Data link layer in the timer recovery state, reception of a REJ command frame
5.8.8.1	I frame with C bit set to one
5.8.8.2	SABM frame with C bit set to one
5.8.9	Link failure
5.8.10.1	N(S) sequence error
5.8.10.2	N(R) sequence error
5.8.10.3	Improper F bit
5.8.11	Receipt of invalid frames
5.9.1	Short Message Services (SMS) (SAPI=3), MS-originated link establishment
5.9.2.1	Normal initialization (no contention resolution)
5.9.2.2	Initialization failure (no contention resolution)
5.9.2.3	Initialization denial (no contention resolution)
5.9.2.4	Total initialization failure (no contention resolution)
5.9.3	Normal information transfer
5.9.4	Normal layer 2 release by MS
5.9.5	Normal Layer 2 release by BSS
5.9.6	Abnormal release
5.9.7	Frame loss
5.9.8.1	Reception of REJ frames, Data link layer not in the timer recovery state
5.9.8.2	Reception of REJ frames, Data link layer in the timer recovery state, reception of a REJ response frame
5.9.8.3	Reception of REJ frames, Data link layer in the timer recovery state, reception of a REJ command frame
5.9.9.1	Frame transmission with incorrect C/R values, I frame with C bit set to one
5.9.9.2	Frame transmission with incorrect C/R values, SABM frame with C bit set to one
5.9.10	Link failure
5.9.11	Errors in the Control Field
5.9.12	Receipt of invalid frames
5.10.1.1	Transmission and receipt of non segmented I frames on both SAPIs
5.10.2.1	Normal release on SAPI 3 while segmented I frames being exchanged simultaneously on both SAPIs
5.10.2.2	Normal release on SAPI 0 while segmented I frames being exchanged simultaneously on both SAPIs
5.10.3.1	Abnormal release on SAPI 3 while segmented I frames being exchanged simultaneously on both SAPIs

Clause	Title
5.10.3.2	Abnormal release on SAPI 0 while segmented I frames being exchanged simultaneously on both SAPIs
5.10.4.1	I frame loss simultaneously on both SAPIs
6.2.1.1	Successful TEI allocation - fixed TEI
6.2.1.2	Denied TEI allocation - fixed TEI
6.2.1.3	Successful TEI allocation - additional TEI
6.2.1.4	Denied TEI allocation - additional TEI
6.2.2.1	Successful TEI allocation - fixed TEI
6.2.2.2	Denied TEI allocation - fixed TEI
6.2.2.3	Successful TEI allocation - additional TEI
6.2.2.4	Denied TEI allocation - additional TEI
8.1.2.1	Messages from MSC to MS
8.1.2.2	Messages from MS to MSC
8.1.3.1.1	Dedicated resource set up
8.1.3.1.2	No dedicated resource established
8.1.3.2.1	Service requests in SABM frames, Allowed messages
8.1.3.2.2	Service requests in SABM frames, Not allowed messages
8.1.3.3.1	Random access by MS and immediate assignment, Normal Case - SDCCH
8.1.3.3.3	Random access by MS and immediate assignment, T3101 expiry case
8.1.3.3.4	Random access by MS and immediate assignment, No radio resources available
8.1.3.3.5	Random access by MS and immediate assignment, Immediate assignment extended
8.1.3.4.1	Paging, Normal case
8.1.3.4.2	Paging, Paging reorganization
8.1.3.4.3	Paging, Channel needed
8.1.3.5	Measurement reporting
8.1.3.7.1	External handover as seen from the old BSS, Normal case
8.1.3.7.2	External handover as seen from the old BSS, T8 expiry
8.1.3.7.3	External handover as seen from the old BSS, Reversion to old channel
8.1.3.8.1.1	External handover as seen from the new BSS, Non-synchronized network, Normal Case data/one speech version
8.1.3.8.1.3	External handover as seen from the new BSS, Non-synchronized network, No LAPDm connection
8.1.3.8.1.4	External handover as seen from the new BSS, Non-synchronized network, Wrong Handover Reference
8.1.3.8.1.5	External handover as seen from the new BSS, Non-synchronized network, Wrong physical channel
8.1.3.8.1.6	External handover as seen from the new BSS, Non-synchronized network, No radio resources available
8.1.3.8.1.7	External handover as seen from the new BSS, Non-synchronized network, Clear Command from the MSC
8.1.3.8.1.8	External handover as seen from the new BSS, Non-synchronized network, No terrestrial resource available
8.1.3.8.1.9	External handover as seen from the new BSS, Non-synchronized network, Handover - CLM2
8.1.3.8.1.10	External handover as seen from the new BSS, Non-synchronized network, Handover - CLM2 and CLM3
8.1.3.8.2	External handover as seen from the new BSS, Synchronized network,
8.1.3.9.1.1	Internal inter-cell handover, Normal case
8.1.3.9.1.2	Internal inter-cell handover, No LAPDm connection
8.1.3.9.2.1.1	Intra-cell handover by the assignment procedure, Normal case
8.1.3.9.2.1.2	Intra-cell handover by the assignment procedure, T10 expiry
8.1.3.9.2.1.3	Intra-cell handover by the assignment procedure, Revert to old channel
8.1.3.9.2.1.4	Intra-cell handover by the assignment procedure, CLM2
8.1.3.9.2.2.1	Intra-cell handover by the handover procedure, Normal case
8.1.3.9.2.2.2	Intra-cell handover by the handover procedure, T8 expiry
8.1.3.9.2.2.3	Intra-cell handover by the handover procedure, Reverse to old channel
8.1.3.12.1	Cipher Mode Complete
8.1.3.12.2	DTAP message
8.1.3.12.3	IMEISV request without starting encryption
8.1.3.12.4	IMEISV request with invalid answer
8.1.3.12.5	IMEISV not requested with invalid answer
8.1.3.15.1	Classmark change
8.1.3.15.2	Classmark Interrogation
8.1.3.16.1	Channel release, Normal case
8.1.3.16.2	Channel release, T3109 expiry
8.1.3.16.3	Channel release, Radio resources out of service
8.1.3.17	Radio link failure
8.1.3.18.1.1	Single circuit blocking, Normal Case
8.1.3.18.1.3	Single circuit blocking, No response to the Unblocking message

Clause	Title
8.1.3.18.1.4	Single circuit blocking, Unblocking, Normal case
8.1.3.18.1.5	Single circuit blocking, MSC Reset during Blocking procedure
8.1.3.18.2.1	Circuit group block - Normal case
8.1.3.18.2.2	Circuit group unblock - Normal case
8.1.3.19.1	Spontaneous indication
8.1.3.19.2	One single indication
8.1.3.19.3	Periodic indication
8.1.3.19.4	No indication
8.1.3.19.5	Extended resource indicator
8.1.3.20.1.1	Global reset at the BSS
8.1.3.20.1.2	Global reset at the MSC
8.1.3.20.2.1	Reset circuit at the BSS
8.1.3.20.2.2	Reset circuit at the MSC
8.1.3.21.1	Handover candidate enquiry for 3 MSs
8.1.3.21.2	Handover candidate enquiry for 1 MS.
8.1.3.21.3	Repetition of the Handover candidate enquiry message
8.1.3.22.2	Trace invoked by the BSS
8.1.3.24.1.1	MSC-originated transaction, Normal case
8.1.3.24.1.2	MSC-originated transaction, MS failure
8.1.3.24.1.3	MSC-originated transaction, SAPI 3 transactions rejected in the OMC
8.1.3.24.2.1	MS-originated transaction Normal case
8.1.3.25.1	Queuing indication, Assignment case
8.1.3.25.2	Queuing indication, Handover case
8.1.3.27.1	Unequipped circuit, Normal case
8.1.3.27.2	Unequipped circuit, Assignment request message
8.1.3.27.3	Unequipped circuit, Handover request message
8.1.3.27.4	Unequipped circuit, Blocking acknowledge message
8.1.3.27.5	Unequipped circuit, Unblocking acknowledge message
8.1.3.27.6	Unequipped circuit, Reset circuit message
8.1.3.27.7	Unequipped circuit, Circuit group blocking acknowledge message
8.1.3.27.8	Unequipped circuit, Circuit group unblocking acknowledge message
8.1.3.27.9	Unequipped circuit, Unequipped circuit message
8.1.3.28.1	Confusion, Reserved element used
8.1.3.28.2	Confusion, Zero length value
8.1.3.28.3	Confusion, Inconsistent length value
8.1.4.1	Multiband Management, Controlled Early Classmark Sending Option
8.1.4.2.1	External handover as seen from the new multiband BSS, Non-synchronized network
8.1.4.2.2	External handover as seen from the new multiband BSS, Synchronized network
8.1.4.2.3	External handover as seen from the new multiband BSS, No GSM resources available
8.1.4.2.4	External handover as seen from the new multiband BSS, No DCS 1800 resources available
8.1.4.3.1	External Directed Retry - No resources in one band
8.1.4.4	Internal Directed Retry
8.1.4.5	Internal handover
8.1.4.6.1	Specific System Information Management, No dedicated resource established
8.1.4.6.2	Specific System Information Management, Dedicated resource set up
9.1.3.1	Link establishment indication
9.1.3.2	Link establishment request
9.1.3.3	Link release indication
9.1.3.4	Link release request
9.1.3.5	Transmission of transparent L3-message in acknowledged mode
9.1.3.6	Reception of transparent L3-message in acknowledged mode
9.1.3.7	Transmission of transparent L3-message in unacknowledged mode
9.1.3.8	Reception of transparent L3-message in unacknowledged mode
9.1.3.9	Link error indication
9.1.3.10	Channel activation
9.1.3.12	Handover detection
9.1.3.13.1	Start of encryption
9.1.3.13.2	Stop of encryption
9.1.3.13.3	Failure case
9.1.3.14.1	Basic measurement reporting
9.1.3.14.2	Pre-processed measurement reporting (optional)
9.1.3.14.3	Pre-processing configuration (optional)
9.1.3.15	Deactivate SACCH
9.1.3.16	Radio channel release

Clause	Title
9.1.3.17	MS power control (optional)
9.1.3.18	Transmission power control (optional)
9.1.3.19	Connection failure
9.1.3.20	Physical context request (optional)
9.1.3.21	SACCH Info modify
9.1.3.22	Channel request by MS
9.1.3.23	Paging
9.1.3.24	Delete indication
9.1.3.25	CCCH load indication
9.1.3.26	Broadcast information modify
9.1.3.27	Immediate assignment
9.1.3.28	Short Message Service Cell Broadcast (SMSCB)
9.1.3.29	Radio resource indication
9.1.3.30	SACCH filling information modify
9.1.3.31	Flow control
9.1.3.32	Error reporting
10.1.3.1.1	Link establishment indication, SDCCH, Contention Resolution
10.1.3.1.3	Link establishment indication, No Contention Resolution, Normal Case
10.1.3.2.1	Normal Case
10.1.3.2.2	Link establishment request, T200 x (N200 + 1) times expiry
10.1.3.4.1	Link release request, Normal Case
10.1.3.4.2	Link release request, T200 x (N200 + 1) times expiry
10.1.3.5	Transmission of transparent L3-message in acknowledged mode
10.1.3.6	Reception of transparent L3-message in acknowledged mode
10.1.3.7	Transmission of transparent L3-message in unacknowledged mode
10.1.3.8	Reception of transparent L3-message in unacknowledged mode
10.1.3.9	Link error indication
10.1.3.10	Channel activation
10.1.3.12.1	Handover detection, Non-synchronized case
10.1.3.12.2	Handover detection, Synchronized case
10.1.3.13.1	Ciphering mode complete
10.1.3.13.2	DTAP message
10.1.3.13.3	Start of encryption with unavailable algorithm
10.1.3.13.4	Stop ciphering
10.1.3.13.5	Failure case
10.1.3.14.1	Basic measurement reporting
10.1.3.15	Deactivate SACCH
10.1.3.16	Radio channel release
10.1.3.17	MS power control
10.1.3.18	Transmission power control (optional)
10.1.3.19	Connection failure
10.1.3.20	Physical context request (optional)
10.1.3.21	Channel request by MS
10.1.3.22	Paging
10.1.3.25	Broadcast information modify
10.1.3.26.1	Immediate assignment, Normal case
10.1.3.26.2	Immediate assignment, Extended immediate assignment procedure
10.1.3.26.3	Immediate assignment, Reject immediate assignment procedure
10.1.3.27.1	SMS broadcast request
10.1.3.27.2	SMS broadcast command
10.1.3.28	Radio resource indication
10.1.3.29	SACCH filling information modify
10.1.3.30	Flow control
10.1.3.31	Error reporting
11.2.3.1.1.1.1	Location updating - revision level 00
11.2.3.1.1.1.2	Location updating - revision level 01
11.2.3.1.1.1.3	Location updating - revision level 10
11.2.3.1.1.1.4	Location updating - revision level 11
11.2.3.1.1.2.1	Location updating - encryption algorithm A5/1
11.2.3.1.2.1.1	CM Service - revision level 00
11.2.3.1.2.1.2	CM Service - revision level 01
11.2.3.1.2.1.3	CM Service - revision level 10
11.2.3.1.2.1.4	CM Service - revision level 11
11.2.3.1.2.2.1	CM Service - encryption algorithm A5/1

Clause	Title
11.2.3.1.2.3.1	Frequency capability, CM Service
11.2.3.1.2.4.1	CM Service - SS Screening Indicator 01
11.2.3.1.2.4.2	CM Service - SS Screening Indicator 10
11.2.3.1.2.4.3	CM Service - SS Screening Indicator 11
11.2.3.1.2.5.1	CM Service - PS Capability
11.2.3.1.2.6.1	CM Service - Encryption Algorithm A5/2
11.2.3.1.2.6.2	CM Service - Encryption Algorithm A5/3
11.2.3.1.2.6.3	CM Service - Encryption Algorithm A5/2, A5/3
11.2.3.1.3.1	Location Updating - Location -Updating Type
11.2.3.2.1.1	Assignment Failure - RR cause 09
11.2.3.2.1.2	Assignment Failure - RR cause 0A
11.2.3.4.1.1	Mobile Station Classmark 3

6 Test requirements for the Base Transceiver Station Repeater

6.1 List of tests from GSM 11.26

Test requirements for the BTS are adapted from GSM 11.26. The applicable tests are listed in table 2 and table 3. Detailed test descriptions of selected tests are included in annex C.

The test purpose and applicability from GSM 11.21 and GSM 11.23 are applicable to a TAPS BTS. The test method shall be considered as being for guidance only, as the implementation details will need to be modified in order for the test to be applied to a TAPS BTS. Examples of such modifications include:

1) Modification of frequencies and power limits to operate in the TAPS frequency bands;

2) Modification of tests which make use of a TCH/FS or TCH/HS for measurement purposes, to use a FACCH/F or a FACCH/H instead.

Table 4: Tests for TAPS BTS repeater from GSM 11.26

Clause	Title
5	Spurious emissions
6	Intermodulation attenuation
7	Out of band gain
8	Frequency error
9	Modulation accuracy at GMSK modulation
10	Modulation accuracy at 8-PSK modulation

7 Measurement uncertainty

For these tests, the management of measurement uncertainty shall be according to GSM 11.10-1, clause A.5.

Annex A (normative): Specific tests for GSM MS

The following test cases are adapted from GSM 11.10-1, in order to make them applicable to a TAPS MS. The GSM 11.10-1 numbering scheme has been retained for ease of maintenance.

12.1 Conducted spurious emissions

12.1.1 MS allocated a channel

12.1.1.1 Definition and applicability

Conducted spurious emissions, when the MS has been allocated a channel, are emissions from the antenna connector at frequencies other than those of the carrier and sidebands associated with normal modulation.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS with a permanent antenna connector.

12.1.1.2 Conformance requirement

1. The conducted spurious power emitted by the MS, when allocated a channel, shall be no more than the levels in table 12.1.

   1.1 Under normal voltage conditions; GSM 05.05, 4.3/4.3.3.

   1.2 Under extreme voltage conditions; GSM 05.05, 4.3/4.3.3/D.2.

Table 12.1

Frequency range	Power level in dBm	
	GSM 400, GSM 900	DCS 1800
9 kHz to 1 GHz	-36	-36
1 GHz to 12,75 GHz	-30	
1 GHz to 1 710 MHz		-30
1 710 MHz to 1 785 MHz		-36
1 785 MHz to 12,75 GHz		-30

12.1.1.3 Test purpose

1. To verify that conducted spurious emissions, in the frequency band 100 kHz to 12,75 GHz excluding the GSM 400, GSM 900 and DCS 1800 receive bands, from the MS when allocated a channel do not exceed the conformance requirements.

   1.1 Under normal voltage conditions.

   1.2 Under extreme voltage conditions.

NOTE: The band 9 kHz to 100 kHz is not tested, because of test implementation problems.

12.1.1.4 Method of test

12.1.1.4.1 Initial conditions

Two-way data transfer is set up by the SS according to the generic GPRS test procedure on a channel in the Mid ARFCN range.

The SS commands the MS to loop back its channel decoder output to channel encoder input.

The SS sends Standard Test Signal C1.

The SS sets the MS to operate at its maximum output power.

12.1.1.4.2 Procedure

a) Measurements are made in the frequency range 100 kHz to 12,75 GHz. Spurious emissions are measured at the connector of the transceiver, as the power level of any discrete signal, higher than the requirement in table 12.1 minus 6 dB, delivered into a 50 Ω load.

   The measurement bandwidth based on a 5 pole synchronously tuned filter is according to table 12.2. The power indication is the peak power detected by the measuring system.

   The measurement on any frequency shall be performed for at least one TDMA frame period with the exception of the idle frame.

NOTE 1: This ensures that both the active times (MS transmitting) and the quiet times are measured.

b) The test is repeated under extreme voltage test conditions ([annex 1, TC2.2 and TC3]).

Table 12.2

Frequency range	Frequency offset	Filter bandwidth	Approx video bandwidth
100 kHz to 50 MHz	-	10 kHz	30 kHz
50 MHz to 500 MHz excl. relevant TX band: TETRA 380: 380 MHz to 390 MHz TETRA 410: 410 MHz to 420 MHz TETRA 450: 450 MHz to 460 MHz GSM 450: 450,4 MHz to 457,6 MHz; GSM 480: 478,8 MHz to 486 MHz, and the RX bands: 460,4 MHz to 467,6 MHz; 488,8 MHz to 496 MHz.	-	100 kHz	300 kHz
500 MHz to 12,75 GHz, excl. relevant TX band: TETRA 870: 870 MHz to 876 MHz P-GSM: 890 MHz to 915 MHz; E-GSM: 880 MHz to 915 MHz; DCS: 1 710 MHz to 1 785 MHz, and the RX bands: 915 MHz to 921 MHz 925 MHz to 960 MHz; 1 805 MHz to 1 880 MHz.	0 MHz to 10 MHz ≥ 10 MHz ≥ 20 MHz ≥ 30 MHz (offset from edge of relevant TX band)	100 kHz 300 kHz 1 MHz 3 MHz	300 kHz 1 MHz 3 MHz 3 MHz
relevant TX band: TETRA 380: 380 MHz to 390 MHz TETRA 410: 410 MHz to 420 MHz TETRA 450: 450 MHz to 460 MHz GSM 450: 450,4 MHz to 457,6 MHz GSM 480: 478,8 MHz to 486 MHz TETRA 870: 870 MHz to 876 MHz P-GSM: 890 MHz to 915 MHz E-GSM: 880 MHz to 915 MHz DCS: 1 710 MHz to 1 785 MHz	1,8 MHz to 6,0 MHz > 6,0 MHz (offset from carrier)	30 kHz 100 kHz	100 kHz 300 kHz

NOTE 2: The frequency ranges 390 MHz to 400 MHz, 420 MHz to 430 MHz, 460,4 MHz to 467,6 MHz, 488,8 MHz to 496 MHz, 915 MHz to 921 MHz, 925 MHz to 960 MHz and 1 805 MHz to 1 880 MHz are excluded as these ranges are tested in clause 13.4.

NOTE 3: The filter and video bandwidths, and frequency offsets are only correct for measurements on an MS transmitting on a channel in the Mid ARFCN range.

NOTE 4: Due to practical implementation, the video bandwidth is restricted to a maximum of 3 MHz.

12.1.1.5 Test requirement

The power of any spurious emission shall not exceed the levels given in table 12.3.

Table 12.3

Frequency range	Power level in dBm	
	GSM 400, GSM 900	DCS 1800
100 kHz to 1 GHz	-36	-36
1 GHz to 12,75 GHz	-30	
1 GHz to 1 710 MHz		-30
1 710 MHz to 1 785 MHz		-36
1 785 MHz to 12,75 GHz		-30

12.1.2 MS in idle mode

12.1.2.1 Definition and applicability

Conducted spurious emissions are any emissions from the antenna connector, when the MS is in idle mode.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS with a permanent antenna connector.

12.1.2.2 Conformance requirement

1. The conducted spurious power emitted by the MS, when in idle mode, shall be no more than the levels in table 12.4.

   1.1 Under normal voltage conditions; GSM 05.05, 4.3/4.3.3.

   1.2 Under extreme voltage conditions; GSM 05.05, 4.3/4.3.3/D.2.

Table 12.4

Frequency range	Power level in dBm
9 kHz to 870 MHz	-57
870 MHz to 915 MHz	-59
915 MHz to 1 000 MHz	-57
1 GHz to 1 710 MHz	-47
1 710 MHz to 1 785 MHz	-53
1 785 MHz to 12,75 GHz	-47

12.1.2.3 Test purpose

1. To verify that conducted spurious emissions, in the frequency band 100 kHz to 12,75 GHz from the MS when in idle mode do not exceed the conformance requirements.

   1.1 Under normal voltage conditions.

   1.2 Under extreme voltage conditions.

NOTE: The band 9 kHz to 100 kHz is not tested, because of test implementation problems.

12.1.2.4 Method of test

12.1.2.4.1 Initial conditions

The BCCH message content from the serving cell shall ensure that Periodic Location Updating is not used and that page mode is continuously set to Paging Reorganization and BS_AG_BLKS_RES is set to 0 so that the MS receiver will operate continually.

The CCCH_CONF shall be set to 000. 1 basic physical channel used for CCCH not combined with SDCCHs.

The BCCH allocation shall either be empty or contain only the serving cell BCCH.

NOTE: This is to ensure that the receiver does not scan other ARFCN. Scanning other ARFCN could lead to a moving in frequency of the spurious and therefore to the possibility of either not measuring a spurious emission or measuring it more than once.

The MS is in MM state "idle, updated".

12.1.2.4.2 Procedure

a) Measurements are made in the frequency range 100 kHz to 12,75 GHz. Spurious emissions are measured as the power level of any discrete signal, higher than the requirement in table 12.4 minus 6 dB, delivered into a 50 Ω load.

   The measurement bandwidth based on a 5 pole synchronously tuned filter is set according to table 12.5. The power indication is the peak power detected by the measuring system.

   The measurement time on any frequency shall be such that it includes the time during which the MS receives a TDMA frame containing the paging channel.

Table 12.5

Frequency range	Filter bandwidth	Video bandwidth
100 kHz to 50 MHz	10 kHz	30 kHz
50 MHz to 12,75 GHz	100 kHz	300 kHz

b) The test is repeated under extreme voltage test conditions ([annex 1, TC2.2 and TC3]).

12.1.2.5 Test requirement

The power of any spurious emission shall not exceed the levels given in table 12.6.

Table 12.6

Frequency range	Power level in dBm
100 kHz to 870 MHz	-57
870 MHz to 915 MHz	-59
915 MHz to 1 000 MHz	-57
1 GHz to 1 710 MHz	-47
1 710 MHz to 1 785 MHz	-53
1 785 MHz to 12,75 GHz	-47

12.2 Radiated spurious emissions

This test is performed either on an outdoor test site, fulfilling the requirements of [GC4 of annex 1], or in an anechoic shielded chamber, fulfilling the requirements of ([GC5 of annex 1)]. Performing the measurement in the anechoic shielded chamber is preferred. The sample shall be placed at the specified height on the support.

NOTE: The test method described has been written for measurement in an anechoic shielded chamber. If an outdoor test site is used then additional precautions are necessary to ensure correct measurement. These measures are familiar to test houses which perform spurious emissions tests and are:

a) Raise/lower the test antenna through the specified height range during both the emission detection and substitution parts of the test.

b) Perform a qualitative pre-search in a shielded environment for test sites where the ambient RF environment can prevent the detection of spurious emissions which exceed the limit.

c) Detect emissions at a more sensitive threshold to that specified in clause 12.2.1.4 to allow for destructive interference due to ground plane reflections at the test antenna search height.

12.2.1 MS allocated a channel

12.2.1.1 Definition and applicability

Radiated spurious emissions, when the MS has been allocated a channel, are any emissions radiated by the cabinet and structure of the mobile station, including all interconnecting cables.

This is also known as "cabinet radiation".

The requirements apply to all types of GSM 400, GSM 900 and DCS 1800 MS. The test applies to all types of GSM 400, GSM 900 and DCS 1800 MS with the exception of the test at extreme voltages for an MS where a practical connection, to an external power supply, is not possible.

NOTE: A "practical connection" shall be interpreted to mean it is possible to connect extreme voltages to the MS without interfering with the configuration of the MS in a way which could invalidate the test.

12.2.1.2 Conformance requirement

1. The radiated spurious power emitted by the MS, when allocated a channel, shall be no more than the levels in table 12.7 under normal voltage conditions; GSM 05.05, 4.3/4.3.3.

2. The radiated spurious power emitted by the MS, when allocated a channel, shall be no more than the levels in table 12.7 under extreme voltage conditions; GSM 05.05, 4.3/4.3.3/D.2.

Table 12.7

Frequency range	Power level in dBm	
	GSM 400, GSM 900	DCS 1800
30 MHz to 1 GHz	-36	-36
1 GHz to 4 GHz	-30	
1 GHz to 1 710 MHz		-30
1 710 MHz to 1 785 MHz		-36
1 785 MHz to 4 GHz		-30

12.2.1.3 Test purpose

1. To verify that radiated spurious emissions from the MS when allocated a channel do not exceed the conformance requirements under normal voltage conditions.

2. To verify that radiated spurious emissions from the MS when allocated a channel do not exceed the conformance requirements under extreme voltage conditions.

12.2.1.4 Method of test

12.2.1.4.1 Initial conditions

Two-way data transfer is set up by the SS according to the generic GPRS test procedure on a channel in the Mid ARFCN range.

NOTE: The power supply shall be connected to the MS such that the physical configuration does not change in a way that could have an effect on the measurement. In particular, the battery pack of the MS should not normally be removed. In cases where no practical connection can be made to the power supply, the MS's intended battery source shall be used.

The SS commands the MS to loop back its channel decoder output to its channel encoder input.

The SS sends Standard Test Signal C1.

The SS sets the MS to operate at its maximum output power.

12.2.1.4.2 Procedure

a) Initially the test antenna is closely coupled to the MS and any spurious emission radiated by the MS is detected by the test antenna and receiver in the range 30 MHz to 4 GHz.

NOTE 1: This is a qualitative step to identify the frequency and presence of spurious emissions which are to be measured in subsequent steps.

b) The test antenna separation is set to the appropriate measurement distance and at each frequency at which an emission has been detected, the MS shall be rotated to obtain maximum response and the effective radiated power of the emission determined by a substitution measurement. In case of an anechoic shielded chamber pre-calibration may be used instead of a substitution measurement.

c) The measurement bandwidth, based on a 5 pole synchronously tuned filter, is set according to table 12.8. The power indication is the peak power detected by the measuring system.

   The measurement on any frequency shall be performed for at least one TDMA frame period, with the exception of the idle frame.

NOTE 2: This ensures that both the active times (MS transmitting) and the quiet times are measured.

NOTE 3: For these filter bandwidths some difficulties may be experienced with noise floor above required measurement limit. This will depend on the gain of the test antenna, and adjustment of the measuring system bandwidth is permissible. Alternatively, for test frequencies above 900 MHz, the test antenna separation from the MS may be reduced to 1 metre.

d) The measurements are repeated with the test antenna in the orthogonal polarization plane.

e) The test is repeated under extreme voltage test conditions (see [Annex 1, TC2.2]).

Table 12.8

Frequency range	Frequency offset	Filter bandwidth	Approx video bandwidth
30 MHz to 50 MHz	-	10 kHz	30 kHz
50 MHz to 500 MHz	-	100 kHz	300 kHz
excl. relevant TX band:			
TETRA 380: 380 MHz to 390 MHz	0 MHz to 10 MHz	100 kHz	300 kHz
TETRA 410: 410 MHz to 420 MHz	≥ 10 MHz	300 kHz	1 MHz
TETRA 450: 450 MHz to 460 MHz	≥ 20 MHz	1 MHz	3 MHz
GSM 450: 450,4 MHz to 457,6 MHz;	≥ 30 MHz	3 MHz	3 MHz
GSM 480: 478,8 MHz to 486 MHz			
500 MHz to 4 GHz, ,	(offset from edge of relevant TX band)		
excl. relevant TX band: TETRA 870: 870 MHz to 876 MHz P-GSM: 890 MHz to MHz 915 MHz; E-GSM: 880 MHz to 915 MHz; DCS: 1 710 MHz to 1 785 MHz.			
relevant TX band: TETRA 380: 380 MHz to 390 MHz TETRA 410: 410 MHz to 420 MHz TETRA 450: 450 MHz to 460 MHz			
GSM 450: 450,4 MHz to 457,6 MHz	1,8 MHz to 6,0 MHz	30 kHz	100 kHz
GSM 480: 478,8 MHz to 486 MHz	> 6,0 MHz	100 kHz	300 kHz
TETRA 870: 870 MHz to 876 MHz P-GSM: 890 MHz to 915 MHz E-GSM: 880 MHz to 915 MHz DCS: 1 710 MHz to 1 785 MHz	(offset from carrier)		

NOTE 4: The filter and video bandwidths, and frequency offsets are only correct for measurements on an MS transmitting on a channel in the Mid ARFCN range.

NOTE 5: Due to practical implementation of a SS, the video bandwidth is restricted to a maximum of 3 MHz.

12.2.1.5 Test requirement

The power of any spurious emission shall not exceed the levels given in table 12.7.

12.2.2 MS in idle mode

12.2.2.1 Definition and applicability

Radiated spurious emissions, when the MS is in idle mode, are any emissions radiated by the cabinet and structure of the mobile station, including all interconnecting cables.

This is also known as "cabinet radiation".

The requirements apply to all types of GSM 400, GSM 900 and DCS 1800 MS. The test applies to all types of GSM 400, GSM 900 and DCS 1800 MS with the exception of the test at extreme voltages for an MS where a practical connection, to an external power supply, is not possible.

NOTE: A "practical connection" shall be interpreted to mean it is possible to connect extreme voltages to the MS without interfering with the configuration of the MS in a way which could invalidate the test.

12.2.2.2 Conformance requirement

1. The radiated spurious power emitted by the MS, when in idle mode, shall be no more than the levels in table 12.9. under normal voltage conditions; GSM 05.05, 4.3/4.3.3.

2. The radiated spurious power emitted by the MS, when in idle mode, shall be no more than the levels in table 12.9. under extreme voltage conditions; GSM 05.05, 4.3/4.3.3/D.2.

Table 12.9

Frequency range	Power level in dBm
30 MHz to 870 MHz	-57
870 MHz to 915 MHz	-59
915 MHz to 1 000 MHz	-57
1 GHz to 1 710 MHz	-47
1 710 MHz to 1 785 MHz	-53
1 785 MHz to 4 GHz	-47

12.2.2.3 Test purpose

1. To verify that radiated spurious emissions from the MS when in idle mode do not exceed the requirements under normal voltage conditions.

2. To verify that radiated spurious emissions from the MS when in idle mode do not exceed the requirements under extreme voltage conditions.

12.2.2.4 Method of test

12.2.2.4.1 Initial conditions

NOTE 1: The power supply shall be connected to the MS such that the physical configuration does not change in a way that could have an effect on the measurement. In particular, the battery pack of the MS should not normally be removed. In cases where no practical connection can be made to the power supply, the MS's intended battery source shall be used.

The BCCH message content from the serving cell shall ensure that Periodic Location Updating is not used and that page mode is continuously set to Paging Reorganization and BS_AG_BLKS_RES is set to 0 so that the MS receiver will operate continually.

The CCCH_CONF shall be set to 000. 1 basic physical channel used for CCCH not combined with SDCCHs.

The BCCH allocation shall either be empty or contain only the serving cell BCCH.

NOTE 2: This is to ensure that the receiver does not scan other ARFCN. Scanning other ARFCN could lead to a moving in frequency of the spurious and therefore to the possibility of either not measuring a spurious emission or measuring it more than once.

The MS is in MM state "idle, updated".

12.2.2.4.2 Procedure

a) Initially the test antenna is closely coupled to the MS and any spurious emission radiated by the MS are detected by the test antenna and receiver in the range 30 MHz to 4 GHz.

NOTE 1: This is a qualitative step to identify the frequency and presence of spurious emissions which are to be measured in subsequent steps.

b) The test antenna separation is set to the appropriate measurement distance and at each frequency at which a spurious emission has been detected the MS is rotated to obtain a maximum response. The effective radiated power of the emission is determined by a substitution measurement. In case of an anechoic shielded chamber pre-calibration may be used instead of a substitution measurement.

c) The measurement bandwidth based on a 5 pole synchronously tuned filter shall be according to table 12.10. The power indication is the peak power detected by the measuring system.

   The measurement time on any frequency shall be such that it includes the time during which the MS receives a TDMA frame containing the paging channel.

NOTE 2: For these filter bandwidths some difficulties may be experienced with noise floor above required measurement limit. This will depend on the gain of the test antenna, and adjustment of the measuring system bandwidth is permissible. Alternatively, for test frequencies above 900 MHz, the test antenna separation from the MS may be reduced to 1 metre.

Table 12.10

Frequency range	Filter bandwidth	Video bandwidth
30 MHz to 50 MHz	10 kHz	30 kHz
50 MHz to 4 GHz	100 kHz	300 kHz

d) The measurements are repeated with the test antenna in the orthogonal polarization plane.

e) The test is repeated under extreme voltage test conditions (see [annex 1, TC2.2]).

12.2.2.5 Test requirement

The power of any spurious emission shall not exceed the levels given in table 12.9.

13 Transmitter

13.1 Frequency error and phase error

13.1.1 Definition and applicability

The frequency error is the difference in frequency, after adjustment for the effect of the modulation and phase error, between the RF transmission from the MS and either:

- the RF transmission from the BS; or
- the nominal frequency for the ARFCN used.

The phase error is the difference in phase, after adjustment for the effect of the frequency error, between the RF transmission from the MS and the theoretical transmission according to the intended modulation.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS.

13.1.2 Conformance requirement

1. The MS carrier frequency shall be accurate to within 0,1 ppm, or accurate to within 0,1 ppm compared to signals received from the BS. For GSM 400 MS a value of 0,2 ppm shall be used in both cases.

   1.1 Under normal conditions; GSM 05.10, 6.1.

   1.2 Under vibration conditions; GSM 05.10, 6.1; GSM 05.05, D D.2.3.

   1.3 Under extreme conditions; GSM 05.10, 6.1; GSM 05.05, 4.4; GSM 05.05, D D.2.1, D.2.2.

2. The RMS phase error (difference between the phase error trajectory and its linear regression on the active part of the time slot) for each burst shall not be greater than 5 degrees.

   2.1 Under normal conditions; GSM 05.05, 4.6.

   2.2 Under vibration conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.3.

   2.3 Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

3. The maximum peak deviation during the useful part of each burst shall not be greater than 20 degrees.

   3.1 Under normal conditions; GSM 05.05, 4.6.

   3.2 Under vibration conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.3.

   3.3 Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

13.1.3 Test purpose

1. To verify that the MS carrier frequency error does not exceed 0,1 ppm (0,2 ppm for GSM 400):

   1.1 Under normal conditions.

   1.2 When the MS is being vibrated.

   1.3 Under extreme conditions.

NOTE: The transmit frequency accuracy of the SS is expected to be sufficient to ensure that the difference between 0,1 ppm (0,2 ppm for GSM 400) absolute and 0,1 ppm (0,2 ppm for GSM 400) compared to signals received from the BS would be small enough to be considered insignificant.

2. To verify that the RMS phase error on the useful part of the bursts transmitted by the MS does not exceed conformance requirement 2:

   2.1 Under normal conditions.

   2.2 When the MS is being vibrated.

   2.3 Under extreme conditions.

3. To verify that the maximum phase error on the useful part of the bursts transmitted by the MS does not exceed conformance requirement 3.

   3.1 Under normal conditions.

   3.2 When the MS is being vibrated.

   3.3 Under extreme conditions.

13.1.4 Method of test

NOTE: In order to measure the accuracy of the frequency and phase error a sampled measurement of the transmitted phase trajectory is obtained. This is compared with the theoretically expected phase trajectory. The regression line of the difference between the expected trajectory and the measured trajectory is an indication of the frequency error (assumed constant through the burst), whilst the departure of the phase differences from this trajectory is a measure of the phase error. The peak phase error is the value furthest from the regression line and the RMS phase error is the root mean square average of the phase error of all samples.

13.1.4.1 Initial conditions

Two-way data transfer is set up according to the generic GPRS test procedure.

The SS commands the MS to hopping mode (table 6.1).

NOTE 1: It is not necessary to test in hopping mode but is done here as a simple means of making the MS change channel, it would be sufficient to test in non hopping mode and to make sure bursts are taken from a few different channels.

The SS activates ciphering mode.

NOTE 2: Ciphering mode is active during this test to give a pseudo-random bit stream to the modulator.

The SS commands the MS to complete the traffic channel loop back without signalling of erased frames (see clause 36.2.1.1).

The SS generates Standard Test Signal C1 of annex 5.

13.1.4.2 Procedure

a) For one transmitted burst, the SS captures the signal as a series of phase samples over the period of the burst. These samples are evenly distributed over the duration of the burst with a minimum sampling rate of 2/T, where T is the modulation symbol period. The received phase trajectory is then represented by this array of at least 294 samples.

b) The SS then calculates, from the known bit pattern and the formal definition of the modulator contained in GSM 05.04, the expected phase trajectory.

c) From a) and b) the phase trajectory error is calculated, and a linear regression line computed through this phase trajectory error. The slope of this regression line is the frequency error of the mobile transmitter relative to the simulator reference. The difference between the regression line and the individual sample points is the phase error of that point.

c.1) The sampled array of at least 294 phase measurements is represented by the vector:

$\varnothing_m = \varnothing_m(0)...\varnothing_m(n)$.

where the number of samples in the array $n+1 \geq 294$.

c.2) The calculated array, at the corresponding sampling instants, is represented by the vector:

$\varnothing_c = \varnothing_c(0)...\varnothing_c(n)$.

c.3) The error array is represented by the vector:

$\varnothing_e = \{\varnothing_m(0) - \varnothing_c(0)\}.........\{\varnothing_m(n) - \varnothing_c(n)\} = \varnothing_e(0)...\varnothing_e(n)$.

c.4) The corresponding sample numbers form a vector $t = t(0)...t(n)$.

c.5) By regression theory the slope of the samples with respect to t is k where:

$$k = \frac{\sum_{j=0}^{j=n} t(j) * \varnothing_e(j)}{\sum_{j=0}^{j=n} t(j)^2}$$

c.6) The frequency error is given by $k/(360 \times \gamma)$, where γ is the sampling interval in s and all phase samples are measured in degrees.

c.7) The individual phase errors from the regression line are given by:

$\varnothing_e(j) - k \times t(j)$.

c.8) The RMS value $\varnothing_e$ of the phase errors is given by:

$$\varnothing_e(RMS) = \left[\frac{\sum_{j=0}^{j=n} \{\varnothing_e(j) - k * t(j)\}^2}{n+1} \right]^{1/2}$$

d) Steps a) to c) are repeated for 20 bursts, not necessarily contiguous.

e) The SS instructs the MS to its maximum power control level, all other conditions remaining constant. Steps a) to d) are repeated.

f) The SS instructs the MS to the minimum power control level, all other conditions remaining constant. Steps a) to d) are repeated.

g) The MS is hard mounted on a vibration table and vibrated at the frequency/amplitudes specified in annex 1, TC4.

During the vibration steps a) to f) are repeated.

NOTE 1: If the call is terminated when mounting the MS to the vibration table, it will be necessary to establish the initial conditions again before repeating steps a) to f).

h) The MS is re-positioned on the vibration table in the two orthogonal planes to the plane used in step g). For each of the orthogonal planes step g) is repeated.

i) Steps a) to f) are repeated under extreme test conditions (see annex 1, TC2.2).

NOTE 2: The series of samples taken to determine the phase trajectory could also be used, with different post-processing, to determine the transmitter burst characteristics of 13.3. Although described independently, it is valid to combine the tests of 13.1 and 13.3, giving both answers from single sets of captured data.

13.1.5 Test requirements

13.1.5.1 Frequency error

For all measured bursts, the frequency error, derived in step c.6), shall be less than 0,1 ppm, except for GSM 400 MS where a value of 0,2 ppm shall be used.

13.1.5.2 Phase error

For all measured bursts, the RMS phase error, derived in step c.8), shall not exceed 5 degrees.

For all measured bursts, each individual phase error, derived in step c.7), shall not exceed 20 degrees.

13.2 Frequency error under multipath and interference conditions

13.2.1 Definition and applicability

The frequency error under multipath and interference conditions is a measure of the ability of the MS to maintain frequency synchronization with the received signal under conditions of Doppler shift, multipath reception and interference.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS.

13.2.2 Conformance requirement

1. The MS carrier frequency error for each burst shall be accurate to within 0,1 ppm (0,2 ppm for GSM 400), or 0,1 ppm (0,2 ppm for GSM 400) compared to signals received from the BS for signal levels down to 3 dB below the reference sensitivity level.

   1.1 Under normal conditions; GSM 05.10, 6/6.1.

   1.2 Under extreme conditions; GSM 05.10, 6/6.1; GSM 05.05, D D.2.1, D.2.2.

2. The MS carrier frequency error for each burst shall be accurate to within 0,1 ppm (0,2 ppm for GSM 400), or 0,1 ppm (0,2 ppm for GSM 400) compared to signals received from the BS for 3 dB less carrier to interference ratio than the reference interference ratios (GSM 05.10, 6/6.1).

13.2.3 Test purpose

1. To verify that the MS carrier frequency error at reference sensitivity, under conditions of multipath and Doppler shift does not exceed 0,1 ppm (0,2 ppm for GSM 400) + the frequency error due to the Doppler shift of the received signal and the assessment error in the MS.

   1.1 Under normal conditions.

   1.2 Under extreme conditions.

NOTE 1: Although the conformance requirement states that frequency synchronization should be maintained for input signals 3 dB below reference sensitivity. Due to the Radio Link Failure counter this test condition cannot be established. Hence all tests in this clause are conducted at reference sensitivity level.

2. To verify that the MS carrier frequency error, under interference conditions and TUlow fading profile, does not exceed 0,1 ppm (0,2 ppm for GSM 400) + the frequency error due to the Doppler shift of the received signal and the assessment error in the MS.

NOTE 2: The test adds the effect of Doppler shift to the requirements as the conformance requirement refers to signals input to the MS receiver whereas the frequency reference for measurement will not take account of the Doppler shift.

13.2.4 Method of test

This test uses the same measurement process as test 13.1 for the MS operating under various RF conditions.

NOTE: The BA list sent on the BCCH and the SACCH will indicate at least six surrounding cells with at least one near to each band edge. It is not necessary to generate any of these BCCH but if they are provided none will be within 5 channels of the ARFCN used for the serving BCCH or TCH.

13.2.4.1 Initial conditions

The MS is brought into the idle updated state on a serving cell with BCCH in the mid ARFCN range.

13.2.4.2 Procedure

a) The level of the serving cell BCCH is set to 10 dB above the reference sensitivity level( ) and the fading function set to RA. The SS waits 30 s for the MS to stabilize to these conditions. The SS is set up to capture the first burst transmitted by the MS during call establishment. Two-way data transfer is initiated by the SS on a channel in the mid ARFCN range as described for the generic GPRS test procedure but to a TCH at level 10 dB above the reference sensitivity level( ) and fading function set to RA.

b) The SS calculates the frequency accuracy of the captured burst as described in test 13.1.

c) The SS sets the serving cell BCCH and TCH to the reference sensitivity level( ) applicable to the type of MS, still with the fading function set to RA and then waits 30 s for the MS to stabilize to these conditions.

d) The SS shall capture subsequent bursts from the traffic channel in the manner described in test 13.1.

NOTE: Due to the very low signal level at the MS receiver input the MS receiver is liable to error. The "looped back" bits are therefore also liable to error, and hence the SS does not know the expected bit sequence. The SS will have to demodulate the received signal to derive (error free) the transmitter burst bit pattern. Using this bit pattern the SS can calculate the expected phase trajectory according to the definition within GSM 05.04.

e) The SS calculates the frequency accuracy of the captured burst as described in test 13.1.

f) Steps d) and e) are repeated for 5 traffic channel bursts spaced over a period of not less than 20 s.

g) The initial conditions are established again and steps a) to f) are repeated but with the fading function set to HT100 (HT200 for GSM 400).

h) The initial conditions are established again and steps a) to f) are repeated but with the fading function set to TU50 (TU100 for GSM 400).

i) The initial conditions are established again and steps a) and b) are repeated but with the following differences:

- the levels of the BCCH and TCH are set to 18 dB above reference sensitivity level( ).

- two further independent interfering signals are sent on the same nominal carrier frequency as the BCCH and TCH and at a level 10 dB below the level of the TCH and modulated with random data, including the midamble.

- the fading function for all channels is set to TUlow.

j) The SS waits 100 s for the MS to stabilize to these conditions.

k) Repeat steps d) to f), except that at step f) the measurement period must be extended to 200 s and the number of measurements increased to 20.

l) The initial conditions are established again and steps a) to k) are repeated for ARFCN in the Low ARFCN range.

m) The initial conditions are established again and steps a) to k) are repeated for ARFCN in the High ARFCN range.

n) Repeat step h) under extreme test conditions (see annex 1, TC2.2).

13.2.5 Test requirements

The frequency error, with reference to the SS carrier frequency as measured in repeats of step e), for each measured burst shall be less than the values shown in tables 13-1a and 13-1b.

Table 13-1a: Requirements for frequency error under multipath, Doppler shift and interference conditions

GSM 900		DCS 1800	
Propagation condition	**Permitted frequency error**	**Propagation condition**	**Permitted frequency error**
RA250	±300 Hz	RA130	±400 Hz
HT100	±180 Hz	HT100	±350 Hz
TU50	±160 Hz	TU50	±260 Hz
TU3	±230 Hz	TU1,5	±320 Hz

Table 13-1b: Requirements for frequency error under multipath, Doppler shift and interference conditions

GSM 450		GSM 480	
Propagation condition	**Permitted frequency error**	**Propagation condition**	**Permitted frequency error**
RA500	±300 Hz	RA500	±300 Hz
HT200	±180 Hz	HT200	±180 Hz
TU100	±160 Hz	TU100	±160 Hz
TU6	±230 Hz	TU6	±230 Hz

13.3 Transmitter output power and burst timing

13.3.1 Definition and applicability

The transmitter output power is the average value of the power delivered to an artificial antenna or radiated by the MS and its integral antenna, over the time that the useful information bits of one burst are transmitted.

The transmit burst timing is the envelope of the RF power transmitted with respect to time. The timings are referenced to the transition from bit 13 to bit 14 of the Training Sequence ("midamble") before differential decoding. The timing of the modulation is referenced to the timing of the received signal from the SS.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS.

13.3.2 Conformance requirement

1. The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of ±2 dB under normal conditions; GSM 05.05, 4.1.1, first table.

2. The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of ±2,5 dB under extreme conditions; GSM 05.05, 4.1.1, first table; GSM 05.05, annex D, D.2.1, D.2.2.

3. The power control levels shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, second table (for GSM 400 and GSM 900) or third table (for DCS 1800), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements 1), with a tolerance of ±3, 4 or 5 dB under normal conditions; GSM 05.05, 4.1.1, second or third table.

4. The power control levels shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, second table (for GSM 400 and GSM 900) or third table (for DCS 1800), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements 2), with a tolerance of ± 4, 5 or 6 dB under extreme conditions; GSM 05.05, 4.1.1, second or third table; GSM 05.05, clauses D D.2.1, D.2.2.

5. The output power actually transmitted by the MS at consecutive power control levels shall form a monotonic sequence and the interval between power control levels shall be 2 ± 1,5 dB; GSM 05.05, 4.1.1.

6. The transmitted power level relative to time for a normal burst shall be within the power/time template given in GSM 05.05, annex B top figure:

   6.1 Under normal conditions; GSM 05.05, 4.5.2.

   6.2 Under extreme conditions; GSM 05.05, 4.5.2, GSM 05.05, D D.2.1, D.2.2.

7. When accessing a cell on the RACH and before receiving the first power command during a communication on a DCCH or TCH (after an IMMEDIATE ASSIGNMENT), all GSM and class and class 2 DCS 1800 MS shall use the power control level defined by the MS_TXPWR_MAX_CCH parameter broadcast on the BCCH of the cell, or if MS_TXPWR_MAX_CCH corresponds to a power control level not supported by the MS as defined by its power class, the MS shall act as though the closest supported power control level had been broadcast. A Class 3 DCS 1800 MS shall use the POWER_OFFSET parameter.

8. The transmissions from the MS to the BS, measured at the MS antenna, shall be 468,75 - TA bit periods behind the transmissions received from the BS, where TA is the last timing advance received from the current serving BS. The tolerance on these timings shall be ±1 bit period:

   8.1 Under normal conditions; GSM 05.10, 6.4.

   8.2 Under extreme conditions; GSM 05.10, 6.4, GSM 05.05, D D.2.1, D.2.2.

9. The transmitted power level relative to time for a random access burst shall be within the power/time template given in GSM 05.05, annex B bottom figure:

   9.1 Under normal conditions; GSM 05.05, 4.5.2.

   9.2 Under extreme conditions; GSM 05.05, 4.5.2, GSM 05.05, D D.2.1, D.2.2.

10. The MS shall use a TA value of 0 for the Random Access burst sent:

    10.1 Under normal conditions; GSM 05.10, 6.6.

    10.2 Under extreme conditions; GSM 05.10, 6.6, GSM 05.05, D D.2.1, D.2.2.

13.3.3 Test purpose

1. To verify that the maximum output power of the MS, under normal conditions, is within conformance requirement 1.

2. To verify that the maximum output power of the MS, under extreme conditions, is within conformance requirement 2.

3. To verify that all power control levels, relevant to the class of MS, are implemented in the MS and have output power levels, under normal conditions, within conformance requirement 3.

4. To verify that all power control levels have output power levels, under extreme conditions, within conformance requirement 4.

5. To verify that the step in the output power transmitted by the MS at consecutive power control levels is within conformance requirement 5 under normal conditions.

6. To verify that the output power relative to time, when sending a normal burst is within conformance requirement 6:

   6.1 Under normal conditions.

   6.2 Under extreme conditions.

7. To verify that the MS uses the maximum power control level according to its power class if commanded to a power control level exceeding its power class.

8. To verify that, for normal bursts, the MS transmissions to the BS are timed within conformance requirement 8:

   8.1 Under normal conditions.

   8.2 Under extreme conditions.

9. To verify that the output power relative to time, when sending an access burst is within conformance requirement 9:

   9.1 Under normal conditions.

   9.2 Under extreme conditions.

10. To verify that, for an access burst, the MS transmission to the BS is timed within conformance requirement 10:

    10.1 Under normal conditions.

    10.2 Under extreme conditions.

13.3.4 Methods of test

Two methods of test are described, separately for:

1) equipment fitted with a permanent antenna connector; and for

2) equipment fitted with an integral antenna, and which cannot be connected to an external antenna except by the fitting of a temporary test connector as a test fixture.

NOTE: The behaviour of the MS in the system is determined to a high degree by the antenna, and this is the only transmitter test in this EN using the integral antenna. Further studies are ongoing on improved testing on the integral antenna, taking practical conditions of MS use into account.

13.3.4.1 Method of test for equipment with a permanent antenna connector

13.3.4.1.1 Initial conditions

Two-way data transfer is set up by the SS according to the generic GPRS test procedure on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power. MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test. For DCS 1800 mobile stations the POWER_OFFSET parameter is set to 6 dB.

13.3.4.1.2 Procedure

a) Measurement of normal burst transmitter output power:

   The SS takes power measurement samples evenly distributed over the duration of one burst with a sampling rate of at least 2/T, where T is the bit duration. The samples are identified in time with respect to the modulation on the burst. The SS identifies the centre of the useful 147 transmitted bits, i.e. the transition from bit 13 to bit 14 of the midamble, as the timing reference.

   The transmitter output power is calculated as the average of the samples over the 147 useful bits. This is also used as the 0 dB reference for the power/time template.

b) Measurement of normal burst timing delay:

   The burst timing delay is the difference in time between the timing reference identified in a) and the corresponding transition in the burst received by the MS immediately prior to the MS transmit burst sampled.

c) Measurement of normal burst power/time relationship:

   The array of power samples measured in a) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in a).

d) Steps a) to c) are repeated with the MS commanded to operate on each of the power control levels defined, even those not supported by the MS.

e) The SS commands the MS to the maximum power control level supported by the MS and steps a) to c) are repeated for ARFCN in the Low and High ranges.

f) Measurement of access burst transmitter output power

   The SS causes the MS to generate an Access Burst on an ARFCN in the Mid ARFCN range, this could be either by a handover procedure or a new request for radio resource. In the case of a handover procedure the Power Level indicated in the HANDOVER COMMAND message is the maximum power control level supported by the MS. In the case of an Access Burst the MS shall use the Power Level indicated in the MS_TXPWR_MAX_CCH parameter. If the power class of the MS is DCS 1800 Class 3, the MS shall also use the POWER_OFFSET parameter.

   The SS takes power measurement samples evenly distributed over the duration of the access burst as described in a). However, in this case the SS identifies the centre of the useful bits of the burst by identifying the transition from the last bit of the synch sequence. The centre of the burst is then five data bits prior to this point and is used as the timing reference.

The transmitter output power is calculated as the average of the samples over the 87 useful bits of the burst. This is also used as the 0 dB reference for the power/time template.

g) Measurement of access burst timing delay

The burst timing delay is the difference in time between the timing reference identified in f) and the MS received data on the common control channel.

h) Measurement of access burst power/time relationship

The array of power samples measured in f) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in f).

i) Depending on the method used in step f) to cause the MS to send an Access Burst, the SS sends either a HANDOVER COMMAND with power control level set to 10 or it changes the System Information elements MS_TXPWR_MAX_CCH and for DCS 1800 the POWER_OFFSET on the serving cell BCCH in order to limit the MS transmit power on the Access Burst to power control level 10 (+23 dBm for GSM 400 and GSM 900 or +10 dBm for DCS 1800) and then steps f) to h) are repeated.

j) Steps a) to i) are repeated under extreme test conditions (annex 1, TC2.2) except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

13.3.4.2 Method of test for equipment with an integral antenna

NOTE: If the MS is equipped with a permanent connector, such that the antenna can be disconnected and the SS be connected directly, then the method of clause 13.3.4.1 will be applied.

The tests in this clause are performed on an unmodified test sample.

13.3.4.2.1 Initial conditions

The MS is placed in the anechoic shielded chamber (annex 1, GC5) or on the outdoor test site, on an isolated support, in the position for normal use, at a distance of at least 3 metres from a test antenna, connected to the SS.

NOTE: The test method described has been written for measurement in an anechoic shielded chamber. If an outdoor test site is used then, in addition, it is necessary to raise/lower the test antenna through the specified height range to maximize the received power levels from both the test sample and the substitution antenna.

Two-way data transfer is set up by the SS according to the generic GPRS test procedure on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power. MS_TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test. For DCS 1800 mobile stations the POWER_OFFSET parameter is set to 6 dB.

13.3.4.2.2 Procedure

a) With the initial conditions set according to clause 13.3.4.2.1 the test procedure in 13.3.4.1.2 is followed up to and including step i), except that in step a), when measurements are done at maximum power for ARFCN in the Low, Mid and High range, the measurement is made eight times with the MS rotated by n×45 degrees for all values of n in the range 0 to 7.

The measurements taken are received transmitter output power measurements rather than transmitter output power measurements, the output power measurement values can be derived as follows.

b) Assessment of test site loss for scaling of received output power measurements.

The MS is replaced by a half-wave dipole, resonating at the centre frequency of the transmit band, connected to an RF generator.

The frequency of the RF signal generator is set to the frequency of the ARFCN used for the 24 measurements in step a), the output power is adjusted to reproduce the received transmitter output power averages recorded in step a).

For each indication the power, delivered by the generator (in Watts) to the half-wave dipole, is recorded. These values are recorded in the form Pnc, where n = MS rotation and c = channel number.

For each channel number used compute:

$$\text{Pac(Watts into dipole)} = \frac{1}{8} * \sum_{n=0}^{n=7} \text{Pnc}$$

from which: Pac (Tx dBm) = $10\log_{10}$(Pac) + 30 + 2,15

The difference, for each of the three channels, between the actual transmitter output power averaged over the 8 measurement orientations and the received transmitter output power at orientation n = 0 is used to scale the received measurement results to actual transmitter output powers for all measured power control levels and ARFCN, which can then be checked against the requirements.

c) Temporary antenna connector calibration factors (transmit).

A modified test sample equipped with a temporary antenna connector is placed in a climatic test chamber and is linked to the SS by means of the temporary antenna connector.

Under normal test conditions, the power measurement and calculation parts of steps a) to i) of clause 13.3.4.1.2 are repeated except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

NOTE 1: The values noted here are related to the output transmitter carrier power levels under normal test conditions, which are known after step b). Therefore frequency dependent calibration factors that account for the effects of the temporary antenna connector can be determined.

d) Measurements at extreme test conditions.

NOTE 2: Basically the procedure for extreme conditions is:

- the power/time template is tested in the "normal" way;

- the radiated power is measured by measuring the difference with respect to the radiated power under normal test conditions.

Under extreme test conditions steps a) to i) of clause 13.3.4.1.2 are repeated except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

The transmitter output power under extreme test conditions is calculated for each burst type, power control level and for every frequency used by adding the frequency dependent calibration factor, determined in c), to the values obtained at extreme conditions in this step.

13.3.5 Test requirements

a) The transmitter output power, under every combination of normal and extreme test conditions, for normal bursts and access bursts, at each frequency and for each power control level applicable to the MS power class, shall be at the relevant level shown in table 13-2 or table 13-3 within the tolerances also shown in table 13-2 or table 13-3.

GSM 400 and GSM 900 only - begin

Table 13-2: GSM 400 and GSM 900 transmitter output power for different power classes

Power class				Power control level	Transmitter output power	Tolerances	
2	3	4	5		dBm	normal	extreme
·				2	39	±2 dB	±2,5 dB
·	·			3	37	±3 dB (see note)	±4 dB (see note)
·	·			4	35	±3 dB	±4 dB
·	·	·		5	33	±3 dB (see note)	±4 dB (see note)
·	·	·		6	31	±3 dB	±4 dB
·	·	·	·	7	29	±3 dB (see note)	±4 dB (see note)
·	·	·	·	8	27	±3 dB	±4 dB
·	·	·	·	9	25	±3 dB	±4 dB
·	·	·	·	10	23	±3 dB	±4 dB
·	·	·	·	11	21	±3 dB	±4 dB
·	·	·	·	12	19	±3 dB	±4 dB
·	·	·	·	13	17	±3 dB	±4 dB
·	·	·	·	14	15	±3 dB	±4 dB
·	·	·	·	15	13	±3 dB	±4 dB
·	·	·	·	16	11	±5 dB	±6 dB
·	·	·	·	17	9	±5 dB	±6 dB
·	·	·	·	18	7	±5 dB	±6 dB
·	·	·	·	19	5	±5 dB	±6 dB
NOTE: When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.							

GSM 400 and GSM 900 only - end

DCS 1800 only - begin

Table 13-3: DCS 1800 transmitter output power for different power classes

Power class			Power control level	Transmitter output power	Tolerances	
1	2	3		dBm	normal	extreme
		·	29	36	±2,0 dB	±2,5 dB
		·	30	34	±3,0 dB	±4,0 dB
		·	31	32	±3,0 dB	±4,0 dB
·		·	0	30	±3,0 dB (see note)	±4 dB (see note)
·		·	1	28	±3 dB	±4 dB
·		·	2	26	±3 dB	±4 dB
·	·	·	3	24	±3 dB (see note)	±4 dB (see note)
·	·	·	4	22	±3 dB	±4 dB
·	·	·	5	20	±3 dB	±4 dB
·	·	·	6	18	±3 dB	±4 dB
·	·	·	7	16	±3 dB	±4 dB
·	·	·	8	14	±3 dB	±4 dB
·	·	·	9	12	±4 dB	±5 dB
·	·	·	10	10	±4 dB	±5 dB
·	·	·	11	8	±4 dB	±5 dB
·	·	·	12	6	±4 dB	±5 dB
·	·	·	13	4	±4 dB	±5 dB
·	·	·	14	2	±5 dB	±6 dB
·	·	·	15	0	±5 dB	±6 dB
NOTE: When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.						

DCS 1800 only - end

b) The difference between the transmitter output power at two adjacent power control levels, measured at the same frequency, shall not be less than 0,5 dB and not be more than 3,5 dB.

c) The power/time relationship of the measured samples for normal bursts shall be within the limits of the power time template of figure 13-1 at each frequency, under every combination of normal and extreme test conditions and at each power control level measured.

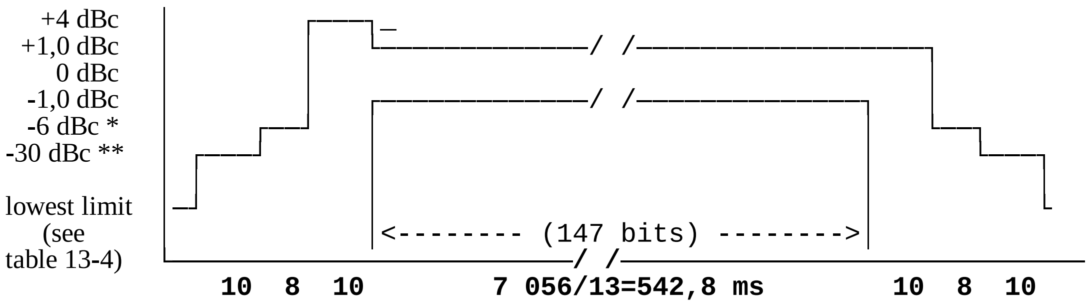


Figure 13-1: Power/time template for normal bursts

*	For GSM 400 and GSM 900 MS:	-4 dBc for power control level 16
		-2 dBc for power control level 17
		-1 dBc for power control levels 18 and 19
	For DCS 1800 MS:	-4 dBc for power control level 11
		-2 dBc for power control level 12
		-1 dBc for power control levels 13, 14 and 15
**	For GSM 400 and GSM 900 MS:	-30 dBc or -17 dBm, whichever is the higher
	For DCS 1800 MS:	-30 dBc or -20 dBm, whichever is the higher

Table 13-4: Lowest measurement limit for power/time template

	lowest limit
GSM 400, GSM900	-59 dBc or -54 dBm whichever is the highest, except for the timeslot preceding the active slot, for which the allowed level is equal to -59 dBc or -36 dBm, whichever is the highest
DCS1 800	-48 dBc or -48 dBm whichever is the highest

d) All the power control levels, for the type and power class of the MS as stated by the manufacturer, shall be implemented in the MS.

e) When the transmitter is commanded to a power control level outside of the capability corresponding to the type and power class of the MS as stated by the manufacturer, then the transmitter output power shall be within the tolerances for the closest power control level corresponding to the type and power class as stated by the manufacturer.

f) The centre of the transmitted normal burst as defined by the transition of bits 13/14 of the midamble shall be 3 timeslot periods (1 731 µs) ± 1 bit period (±3,69 µs) after the centre of the corresponding received burst.

g) The power/time relationship of the measured samples for access bursts shall be within the limits of the power time template of figure 13-2 at each frequency, under every combination of normal and extreme test conditions and at each power control level measured.

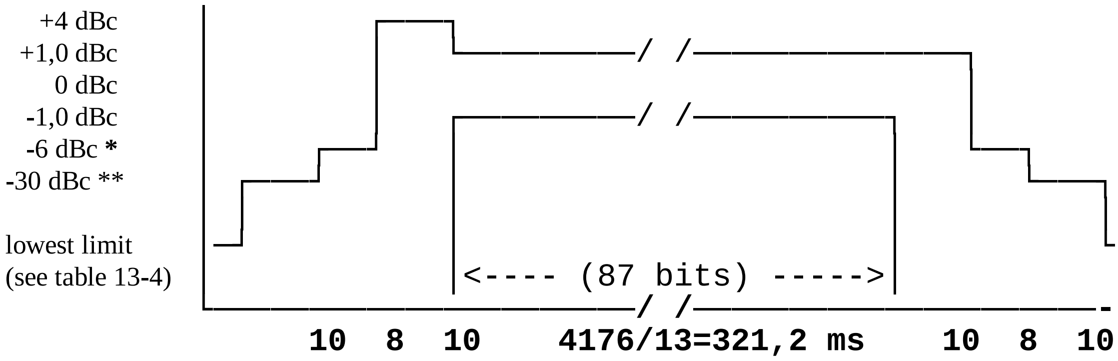


Figure 13-2: Power/time template for access burst

*	For GSM 400 and GSM 900 MS:	-4 dBc for power control level 16
		-2 dBc for power control level 17
		-1 dBc for power control levels 18 and 19
	For DCS 1800 MS:	-4 dBc for power control level 11
		-2 dBc for power control level 12
		-1 dBc for power control levels 13, 14 and 15
**	For GSM 400 and GSM 900 MS:	-30 dBc or -17 dBm, whichever is the higher
	For DCS 1800 MS:	-30 dBc or -20 dBm, whichever is the higher

h) The centre of the transmitted access burst shall be an integer number of timeslot periods less 30 bit periods relative to any CCCH midamble centre with a tolerance of ±1 bit period (±3,69 µs).

13.4 Output RF spectrum

13.4.1 Definition and applicability

The output RF spectrum is the relationship between the frequency offset from the carrier and the power, measured in a specified bandwidth and time, produced by the MS due to the effects of modulation and power ramping.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS.

13.4.2 Conformance requirement

1. The level of the output RF spectrum due to modulation shall be no more than that given in GSM 05.05, 4.2.1, table a) for GSM 400 and GSM 900 or table b) for DCS 1800, with the following lowest measurement limits:

   - -36 dBm below 600 kHz offset from the carrier;
   - -51 dBm for GSM 400 and GSM 900 or -56 dBm for DCS 1800 from 600 kHz out to less than 1 800 kHz offset from the carrier;
   - -46 dBm for GSM 400 and GSM 900 or -51 dBm for DCS 1800 at and beyond 1 800 kHz offset from the carrier;

   but with the following exceptions at up to -36 dBm:

   - up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz in the combined range 600 kHz to 6 000 kHz above and below the carrier;
   - up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz at more than 6 000 kHz offset from the carrier.

1.1 Under normal conditions; GSM 05.05, 4.2.1.

1.2 Under extreme conditions; GSM 05.05, 4.2.1; GSM 05.05, D D.2.1, D.2.2.

2. The level of the output RF spectrum due to switching transients shall be no more than given in GSM 05.05, 4.2.2, table "a) Mobile Station:".

   2.1 Under normal conditions; GSM 05.05, 4.2.2.

   2.2 Under extreme conditions; GSM 05.05, 4.2.2; GSM 05.05, D D.2.1, D.2.2.

3. When allocated a channel, the power emitted by the MS, in the band 915 MHz to 921 MHz shall be no more than -67 dBm (TETRA 870 only), in the band 935 MHz to 960 MHz shall be no more than -79 dBm, in the band 925 MHz to 935 MHz shall be no more than -67 dBm, and in the band 1 805 MHz to 1 880 MHz shall be no more than -71 dBm except in five measurements in each of the bands 925 MHz to 960 MHz and 1 805 MHz to 1 880 MHz where exceptions at up to -36 dBm are permitted. For GSM 400 MS excluding TETRA, in addition, the power emitted by MS, in the bands of 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz shall be no more than -67 dBm except in three measurements in each of the bands 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz where exceptions at up to -36 dBm are permitted. For TETRA 380, TETRA 410 and TETRA 450, in addition, the power emitted by MS, in the bands 390 MHz to 400 MHz and 420 MHz to 430 MHz and 460 MHz to 470 MHz shall be no more than -62 dBm except in three measurements in each band where exceptions at up to -36 dBm are permitted.

Under normal conditions; GSM 05.05, clause 4.3.3.

13.4.3 Test purpose

1. To verify that the output RF spectrum due to modulation does not exceed conformance requirement 1.

   1.1 Under normal conditions.

   1.2 Under extreme conditions.

2. To verify that the output RF spectrum due to switching transients does not exceed conformance requirement 2 when a reasonable margin is allowed for the effect of spectrum due to modulation.

   2.1 Under normal conditions.

   2.2 Under extreme conditions.

3. To verify that the MS spurious emissions in the MS receive band do not exceed conformance requirement 3.

13.4.4 Method of test

13.4.4.1 Initial conditions

Two-way data transfer is set up according to the generic GPRS test procedure.

The SS commands the MS to hopping mode. The hopping pattern includes only three channels, namely one with an ARFCN in the Low ARFCN range, a second one with an ARFCN in the Mid ARFCN range and the third one with an ARFCN in the High ARFCN range.

NOTE 1: Although the measurement is made whilst the MS is in hopping mode, each measurement is on one single channel.

NOTE 2: This test is specified in hopping mode as a simple means of making the MS change channel, it would be sufficient to test in non hopping mode and to handover the MS between the three channels tested at the appropriate time.

The SS commands the MS to complete the traffic channel loop back without signalling of erased frames (see clause 36.2.1.1). This is to set a defined random pattern for the transmitter.

The SS sends Standard Test Signal C1 (annex 5) to the MS at a level of 23 dBμVemf( ).

13.4.4.2 Procedure

NOTE: When averaging is in use during frequency hopping mode, the averaging only includes bursts transmitted when the hopping carrier corresponds to the nominal carrier of the measurement.

a) In steps b) to h) the FT is equal to the hop pattern ARFCN in the Mid ARFCN range.

b) The other settings of the spectrum analyser are set as follows:

- Zero frequency scan
- Resolution bandwidth: 30 kHz
- Video bandwidth: 30 kHz
- Video averaging: may be used, depending on the implementation of the test

The video signal of the spectrum analyser is "gated" such that the spectrum generated by at least 40 of the bits 87 to 132 of the burst is the only spectrum measured. This gating may be analogue or numerical, dependent upon the design of the spectrum analyser. Only measurements during transmitted bursts on the nominal carrier of the measurement are included. The spectrum analyser averages over the gated period and over 200 or 50 such bursts, using numerical and/or video averaging.

The MS is commanded to its maximum power control level.

c) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 50 bursts at all multiples of 30 kHz offset from FT to < 1 800 kHz.

d) The resolution and video bandwidth on the spectrum analyser are adjusted to 100 kHz and the measurements are made at the following frequencies:

- on every ARFCN from 1 800 kHz offset from the carrier to the edge of the relevant transmit band for each measurement over 50 bursts.
- at 200 kHz intervals over the 2 MHz either side of the relevant transmit band for each measurement over 50 bursts.
- at 200 kHz intervals over the band 915 MHz to 921 MHz for each measurement over 50 bursts. (TETRA 870 only).
- at 200 kHz intervals over the band 925 MHz to 960 MHz for each measurement over 50 bursts.
- at 200 kHz intervals over the band 1 805 MHz to 1 880 MHz for each measurement over 50 bursts.

In addition for GSM 400 MS:

- at 200 kHz intervals over the band 390 MHz to 400 MHz for each measurement over 50 bursts.
- at 200 kHz intervals over the band 420 MHz to 430 MHz for each measurement over 50 bursts.
- at 200 kHz intervals over the band 460 MHz to 470 MHz for each measurement over 50 bursts.
- at 200 kHz intervals over the band 488,8 MHz to 496 MHz for each measurement over 50 bursts.

e) The MS is commanded to its minimum power control level. The spectrum analyser is set again as in b).

f) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 200 bursts at the following frequencies:

- FT
- FT + 100 kHz FT - 100 kHz
- FT + 200 kHz FT - 200 kHz
- FT + 250 kHz FT - 250 kHz

- FT + 200 kHz × N FT - 200 kHz × N

  where N = 2, 3, 4, 5, 6, 7, and 8

  and FT = RF channel nominal centre frequency.

g) The spectrum analyser settings are adjusted to:

- Zero frequency scan
- Resolution bandwidth: 30 kHz
- Video bandwidth: 100 kHz
- Peak hold

The spectrum analyser gating of the signal is switched off.

The MS is commanded to its maximum power control level.

h) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured at the following frequencies:

- FT + 400 kHz FT - 400 kHz
- FT + 600 kHz FT - 600 kHz
- FT + 1,2 MHz FT - 1,2 MHz
- FT + 1,8 MHz FT - 1,8 MHz

  where FT = RF channel nominal centre frequency.

The duration of each measurement (at each frequency) will be such as to cover at least 10 burst transmissions at FT.

i) Step h) is repeated for power control levels 7 and 11.

j) Steps b), f), g) and h) are repeated with FT equal to the hop pattern ARFCN in the Low ARFCN range except that in step g) the MS is commanded to power control level 11 rather than maximum power.

k) Steps b), f), g) and h) are repeated with FT equal to the hop pattern ARFCN in the High ARFCN range except that in step g) the MS is commanded to power control level 11 rather than maximum power.

l) Steps a) b) f) g) and h) are repeated under extreme test conditions (annex 1, TC2.2). except that at step g) the MS is commanded to power control level 11.

13.4.5 Test requirements

For absolute measurements, performed on a temporary antenna connector, in the frequency bands 380 MHz to 390 MHz, 410 MHz to 420 MHz, 450 MHz to 460 MHz, 478,8 MHz to 486 MHz, 870 MHz to 915 MHz or 1 710 MHz to 1 785 MHz, the temporary antenna connector coupling factor, determined according to 13.3.4.2.2 and annex 1 GC7, for the nearest relevant frequency, will be used.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 915 MHz to 960 MHz, the temporary antenna connector coupling factor, will be as determined according to annex 1 GC7 for GSM 900 MS. For a GSM 400 or DCS 1800 MS 0 dB will be assumed.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 1 805 MHz to 1 880 MHz, the temporary antenna connector coupling factor, will be as determined according to annex 1 GC7 for DCS 1800 MS. For GSM 400 or GSM 900 MS 0 dB will be assumed.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 390 MHz to 400 MHz, 420 MHz to 430 MHz, 460 MHz to 470 MHz or 488,8 MHz to 496 MHz, the temporary antenna connector coupling factor, will be as determined according to annex 1 GC7 for GSM 400 MS. For a GSM 900 or DCS 1800 MS 0 dB will be assumed.

The figures in the tables below, at the listed frequencies from the carrier (kHz), are the maximum level (dB) relative to a measurement in 30 kHz bandwidth on the carrier (reference GSM 05.05 clause 4.2.1).

a) For the modulation sidebands out to less than 1 800 kHz offset from the carrier frequency (FT) measured in step c), f), h), j), k) and l) the measured power level in dB relative to the power level measured at FT, for all types of MS, shall not exceed the limits derived from the values shown in table 13-5 for GSM 400 and GSM 900 or table 13-6 for DCS 1800 according to the actual transmit power and frequency offset from FT. However any failures in the combined range 600 kHz to less than 1 800 kHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below.

Table 13-5a: GSM 400 and GSM 900 Spectrum due to modulation out to less than 1 800 kHz offset

	power levels in dB relative to the measurement at FT				
Power level	**Frequency offset (kHz)**				
(dBm)	**0-100**	**200**	**250**	**400**	**600 to < 1 800**
39	+0,5	-30	-33	-60	-66
37	+0,5	-30	-33	-60	-64
35	+0,5	-30	-33	-60	-62
≤ 33	+0,5	-30	-33	-60	-60
The values above are subject to the minimum absolute levels (dBm) below.					
	-36	-36	-36	-36	-51

Table 13-6: DCS 1800 Spectrum due to modulation out to less than 1 800 kHz offset

	power levels in dB relative to the measurement at FT				
Power level	**Frequency offset (kHz)**				
(dBm)	**0-100**	**200**	**250**	**400**	**600 to < 1 800**
≤ 36	+0,5	-30	-33	-60	-60
The values above are subject to the minimum absolute levels (dBm) below.					
	-36	-36	-36	-36	-56

NOTE 1: For frequency offsets between 100 kHz and 600 kHz the requirement is derived by a linear interpolation between the points identified in the table with linear frequency and power in dB relative.

b) For the modulation sidebands from 1 800 kHz offset from the carrier frequency (FT) and out to 2 MHz beyond the edge of the relevant transmit band, measured in step d), the measured power level in dB relative to the power level measured at FT, shall not exceed the values shown in table 13-7 according to the actual transmit power, frequency offset from FT and system on which the MS is designed to operate. However any failures in the combined range 1 800 kHz to 6 MHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below, and any other failures may be counted towards the exceptions allowed in test requirements d) below.

Table 13-7: Spectrum due to modulation from 1 800 kHz offset to the edge of the transmit band (wideband noise)

power levels in dB relative to the measurement at FT						
GSM 400 and GSM 900				DCS 1800		
Power level (dBm)	Frequency offset kHz			Power level (dBm)	Frequency offset kHz	
	1 800 to < 3 000	3 000 to < 6 000	≥ 6 000		1 800 to < 6 000	≥ 6 000
39	-69	-71	-77	36	-71	-79
37	-67	-69	-75	34	-69	-77
35	-65	-67	-73	32	-67	-75
≤ 33	-63	-65	-71	30	-65	-73
				28	-63	-71
				26	-61	-69
				≤ 24	-59	-67
The values above are subject to the minimum absolute levels (dBm) below.						
	-46	-46	-46		-51	-51

c) Any failures (from a) and b) above) in the combined range 600 kHz to 6 MHz above and below the carrier should be re-checked for allowed spurious emissions. For each of the three ARFCN used, spurious emissions are allowed in up to three 200 kHz bands centred on an integer multiple of 200 kHz so long as no spurious emission exceeds -36 dBm. Any spurious emissions measured in a 30 kHz bandwidth which spans two 200 kHz bands can be counted towards either 200 kHz band, whichever minimizes the number of 200 kHz bands containing spurious exceptions.

d) Any failures (from b) above) beyond 6 MHz offset from the carrier should be re-checked for allowed spurious emissions. For each of the three ARFCN used, up to twelve spurious emissions are allowed so long as no spurious emission exceeds -36 dBm.

e) The MS spurious emissions in the bands 925 MHz to 935 MHz, 935 MHz to 960 MHz and 1 805 MHz to 1 880 MHz, measured in step d), for all types of MS, shall not exceed the values shown in table 13-8 except in up to five measurements in the band 925 MHz to 960 MHz and five measurements in the band 1 805 MHz to 1 880 MHz where a level up to -36 dBm is permitted. For TETRA 870, in addition, the MS spurious emissions in the bands 915 MHz to 921 MHz, 935 MHz to 960 MHz and 1 805 MHz to 1 880 MHz, measured in step d), for all types of MS, shall not exceed the value of -67 dBm. For GSM 400 MS, in addition, the MS spurious emissions in the bands 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz shall not exceed the value of -67 dBm, except in up to three measurements in each of the bands 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz where a level up to -36 dBm is permitted. For TETRA 380, TETRA 410 and TETRA 450, in addition, the power emitted by MS, in the bands 390 MHz to 400 MHz and 420 MHz to 430 MHz and 460 MHz to 470 MHz shall be no more than -62 dBm except in three measurements in each band where exceptions at up to -36 dBm are permitted.

Table 13-8: Spurious emissions in the MS receive bands

Band (MHz)	Spurious emissions level (dBm)
925 to 935	-67
935 to 960	-79
1 805 to 1 880	-71

f) For the power ramp sidebands of steps h) and i) the power levels must not exceed the values shown in table 13-9 for GSM 400 and GSM 900 or table 13-10 for DCS 1800.

Table 13-9: GSM Spectrum due to switching transients

Power level	Maximum level for various offsets from carrier frequency			
	400 kHz	600 kHz	1 200 kHz	1 800 kHz
39 dBm	-13 dBm	-21 dBm	-21 dBm	-24 dBm
37 dBm	-15 dBm	-21 dBm	-21 dBm	-24 dBm
35 dBm	-17 dBm	-21 dBm	-21 dBm	-24 dBm
33 dBm	-19 dBm	-21 dBm	-21 dBm	-24 dBm
31 dBm	-21 dBm	-23 dBm	-23 dBm	-26 dBm
29 dBm	-23 dBm	-25 dBm	-25 dBm	-28 dBm
27 dBm	-23 dBm	-26 dBm	-27 dBm	-30 dBm
25 dBm	-23 dBm	-26 dBm	-29 dBm	-32 dBm
23 dBm	-23 dBm	-26 dBm	-31 dBm	-34 dBm
≤+21 dBm	-23 dBm	-26 dBm	-32 dBm	-36 dBm

Table 13-10: DCS 1800 Spectrum due to switching transients

Power level	Maximum level for various offsets from carrier frequency			
	400 kHz	600 kHz	1 200 kHz	1 800 kHz
36 dBm	-16 dBm	-21 dBm	-21 dBm	-24 dBm
34 dBm	-18 dBm	-21 dBm	-21 dBm	-24 dBm
32 dBm	-20 dBm	-22 dBm	-22 dBm	-25 dBm
30 dBm	-22 dBm	-24 dBm	-24 dBm	-27 dBm
28 dBm	-23 dBm	-25 dBm	-26 dBm	-29 dBm
26 dBm	-23 dBm	-26 dBm	-28 dBm	-31 dBm
24 dBm	-23 dBm	-26 dBm	-30 dBm	-33 dBm
22 dBm	-23 dBm	-26 dBm	-31 dBm	-35 dBm
≤+20 dBm	-23 dBm	-26 dBm	-32 dBm	-36 dBm

NOTE 2: These figures are different from the requirements in GSM 05.05 because at higher power levels it is the modulation spectrum which is being measured using a peak hold measurement. This allowance is given in these tables.

NOTE 3: The figures for table 13-9 and table 13-10 assume that, using the peak hold measurement, the lowest level measurable is 8 dB above the level of the modulation specification using the 30 kHz bandwidth gated average technique for 400 kHz offset from the carrier. At 600 and 1 200 kHz offset the level is 6 dB above and at 1 800 kHz offset the level is 3 dB above. The figures for 1 800 kHz have assumed the 30 kHz bandwidth spectrum due to modulation specification at 1 800 kHz.

13.16 GPRS transmitter tests

13.16.1 Frequency error and phase error in GPRS multislot configuration

13.16.1.1 Definition and applicability

The frequency error is the difference in frequency, after adjustment for the effect of the modulation and phase error, between the RF transmission from the MS and either:

- the RF transmission from the BS; or
- the nominal frequency for the ARFCN used.

The phase error is the difference in phase, after adjustment for the effect of the frequency error, between the RF transmission from the MS and the theoretical transmission according to the intended modulation.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS which are capable of GPRS multislot operation.

13.16.1.2 Conformance requirement

1. The MS carrier frequency shall be accurate to within 0,1 ppm compared to signals received from the BS.

   1.1 Under normal conditions; GSM 05.10, 6.1.

   1.2 Under vibration conditions; GSM 05.10, 6.1; GSM 05.05, D D.2.3.

   1.3 Under extreme conditions; GSM 05.10, 6.1; GSM 05.05, 4.4; GSM 05.05, D D.2.1, D.2.2.

2. The RMS phase error (difference between the phase error trajectory and its linear regression on the active part of the time slot) for each burst shall not be greater than 5 degrees.

   2.1 Under normal conditions; GSM 05.05, 4.6.

   2.2 Under vibration conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.3.

   2.3 Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

3. The maximum peak deviation during the useful part of each burst shall not be greater than 20 degrees.

   3.1 Under normal conditions; GSM 05.05, 4.6.

   3.2 Under vibration conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.3.

   3.3 Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

13.16.1.3 Test purpose

1. To verify that in a multislot configuration the MS carrier frequency error does not exceed 0,1 ppm:

   1.1 Under normal conditions.

   1.2 When the MS is being vibrated.

   1.3 Under extreme conditions.

2. To verify that the RMS phase error on the useful parts of the bursts transmitted by the MS in a multislot configuration does not exceed conformance requirement 2:

   2.1 Under normal conditions.

   2.2 When the MS is being vibrated.

   2.3 Under extreme conditions.

3. To verify that the maximum phase error on the useful parts of the bursts transmitted by the MS in a multislot configuration does not exceed conformance requirement 3:

   3.1 Under normal conditions.

   3.2 When the MS is being vibrated.

   3.3 Under extreme conditions.

13.16.1.4 Method of the test

NOTE: In order to measure the accuracy of the frequency and phase error a sampled measurement of the transmitted phase trajectory is obtained. This is compared with the theoretically expected phase trajectory. The regression line of the difference between the expected trajectory and the measured trajectory is an indication of the frequency error (assumed constant through the burst), whilst the departure of the phase differences from this trajectory is a measure of the phase error. The peak phase error is the value furthest from the regression line and the RMS phase error is the root mean square average of the phase error of all samples.

13.16.1.4.1 Initial conditions

Two-way data transfer is set up according to the generic call setup procedure for multislot GPRS. The SS commands the MS to hopping mode (table 13.6.1, GSM 11.10).

NOTE 1: It is not necessary to test in hopping mode but is done here as a simple means of making the MS change channel, it would be sufficient to test in non hopping mode and to make sure bursts are taken from a few different channels.

The SS activates ciphering mode.

NOTE 2: Ciphering mode is active during this test to give a pseudo-random bit stream to the modulator.

The SS sets the MS to operate in a multislot configuration with maximum number of transmitted time slots.

The SS commands the MS to complete the multislot PDTCH loop back, type (G), see GSM 04.14, 5.2.1.

The SS generates Standard Test Signal C1 of annex 5.

13.16.1.4.2 Procedure

a) For one transmitted burst on the last slot of the multislot configuration, the SS captures the signal as a series of phase samples over the period of the burst. These samples are evenly distributed over the duration of the burst with a minimum sampling rate of 2/T, where T is the modulation symbol period. The received phase trajectory is then represented by this array of at least 294 samples.

b) The SS then calculates, from the known bit pattern and the formal definition of the modulator contained in GSM 05.04, the expected phase trajectory.

c) From a) and b) the phase trajectory error is calculated, and a linear regression line computed through this phase trajectory error. The slope of this regression line is the frequency error of the mobile transmitter relative to the simulator reference. The difference between the regression line and the individual sample points is the phase error of that point.

c.1) The sampled array of at least 294 phase measurements is represented by the vector:

$\varnothing_m = \varnothing_m(0)...\varnothing_m(n)$

where the number of samples in the array $n+1 \geq 294$.

c.2) The calculated array, at the corresponding sampling instants, is represented by the vector:

$\varnothing_c = \varnothing_c(0)...\varnothing_c(n)$.

c.3) The error array is represented by the vector:

$\varnothing_e = \{\varnothing_m(0) - \varnothing_c(0)\}.........\{\varnothing_m(n) - \varnothing_c(n)\} = \varnothing_e(0)...\varnothing_e(n)$.

c.4) The corresponding sample numbers form a vector $t = t(0)...t(n)$.

c.5) By regression theory the slope of the samples with respect to t is k where:

$$k = \frac{\sum_{j=0}^{j=n} t(j) * \varnothing_e(j)}{\sum_{j=0}^{j=n} t(j)^2}$$

c.6) The frequency error is given by $k/(360 \times g)$, where g is the sampling interval in s and all phase samples are measured in degrees.

c.7) The individual phase errors from the regression line are given by:

$\varnothing_e(j) - k \times t(j)$.

c.8) The RMS value $\varnothing_e$ of the phase errors is given by:

$$\varnothing_e(\mathrm{RMS}) = \left[\frac{\sum_{j=0}^{j=n} \{\varnothing_e(j) - k * t(j)\}^2}{n+1} \right]^{1/2}$$

d) Steps a) to c) are repeated for 20 bursts, not necessarily contiguous.

e) The SS instructs the MS to its maximum power control level by setting the power control parameter ALPHA (α) to 0 and GAMMA_TN (Γ_{CH}) for each timeslot to the desired power level in the Packet Uplink Assignment message (Closed Loop Control, see 05.08, clause B.2), all other conditions remaining constant. Steps a) to d) are repeated.

f) The SS instructs the MS to the minimum power control level, all other conditions remaining constant. Steps a) to d) are repeated.

g) The MS is hard mounted on a vibration table and vibrated at the frequency/amplitudes specified in annex 1, TC4.

During the vibration steps a) to f) are repeated.

NOTE: If the call is terminated when mounting the MS to the vibration table, it will be necessary to establish the initial conditions again before repeating steps a) to f).

h) The MS is re-positioned on the vibration table in the two orthogonal planes to the plane used in step g). For each of the orthogonal planes step g) is repeated.

i) Steps a) to f) are repeated under extreme test conditions (see annex 1, TC2.2).

13.16.1.5.1 Frequency error

For all measured bursts, the frequency error, derived in step c.6), shall be less than 10^{-7}.

13.16.1.5.2 Phase error

For all measured bursts, the RMS phase error, derived in step c.8), shall not exceed 5 degrees.

For all measured bursts, each individual phase error, derived in step c.7), shall not exceed 20 degrees.

13.16.2 Transmitter output power in GPRS multislot configuration

13.16.2.1 Definition and applicability

The transmitter output power is the average value of the power delivered to an artificial antenna or radiated by the MS and its integral antenna, over the time that the useful information bits of one burst are transmitted.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS and any multiband MS, which are capable of GPRS multislot operation.

13.16.2.2 Conformance requirement

1. The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of ±2 dB under normal conditions; GSM 05.05, 4.1.1, first table.

2. The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of ±2,5 dB under extreme conditions; GSM 05.05, 4.1.1, first table; GSM 05.05, annex D, D.2.1, D.2.2.

3. The power control levels shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, third table (for GSM 400 and GSM 900) or fourth table (for DCS 1800), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements 1), with a tolerance of ±3, 4 or 5 dB under normal conditions; GSM 05.05, 4.1.1, third or fourth table.

4. The power control levels shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, third table (for GSM 400 and GSM 900) or fourth table (for DCS 1800), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements 2), with a tolerance of ±4, 5 or 6 dB under extreme conditions; GSM 05.05, 4.1.1, third or fourth table; GSM 05.05, D D.2.1, D.2.2.

5. The output power actually transmitted by the MS at consecutive power control levels shall form a monotonic sequence and the interval between power control levels shall be 2 ± 1,5 dB; GSM 05.05, 4.1.1.

6. The transmitted power level relative to time for a normal burst shall be within the power/time template given in GSM 05.05, annex B top figure. In multislot configurations where the bursts in two or more consecutive time slots are actually transmitted at the same frequency the template of annex B shall respected during the useful part of each burst and at the beginning and the end of the series of consecutive bursts. The output power during the guard period between every two consecutive active timeslots shall not exceed the level allowed for the useful part of the first timeslot or the level allowed for the useful part of the second timeslot plus 3 dB, whichever is the highest.:

   6.1 Under normal conditions; GSM 05.05, 4.5.2.

   6.2 Under extreme conditions; GSM 05.05, 4.5.2, GSM 05.05, D D.2.1, D.2.2.

7. When accessing a cell on the PRACH or RACH and before receiving the first power control parameters during packet transfer on PDCH, all GSM and class 1 and class 2 DCS 1800 MS shall use the power control level defined by the GPRS_MS_TXPWR_MAX_CCH parameter broadcast on the PBCCH or MS_TXPWR_MAX_CCH parameter broadcast on the BCCH of the cell. When MS_TXPWR_MAX_CCH is received on the BCCH, a class 3 DCS 1800 MS shall add to it the value POWER_OFFSET broadcast on the BCCH. If MS_TXPWR_MAX_CCH or the sum defined by: MS_TXPWR_MAX_CCH plus POWER_OFFSET corresponds to a power control level not supported by the MS as defined by its power class, the MS shall act as though the closest supported power control level had been broadcast.

8. The transmitted power level relative to time for a Random Access burst shall be within the power/time template given in GSM 05.05, annex B bottom figure:

   9.1 Under normal conditions; GSM 05.05, 4.5.2.

   9.2 Under extreme conditions; GSM 05.05, 4.5.2, GSM 05.05, D D.2.1, D.2.2.

13.16.2.3 Test purpose

1. To verify that the maximum output power of the MS in GPRS multislot configuration, under normal conditions, is within conformance requirement 1.

2. To verify that the maximum output power of the MS in GPRS multislot configuration, under extreme conditions, is within conformance requirement 2.

3. To verify that all power control levels, relevant to the class of MS, are implemented in the MS in GPRS multislot configuration and have output power levels, under normal conditions, within conformance requirement 3.

4. To verify that all power control levels have output power levels, under extreme conditions, within conformance requirement 4.

5. To verify that the step in the output power transmitted by the MS in GPRS multislot configuration at consecutive power control levels is within conformance requirement 5 under normal conditions.

6. To verify that the output power relative to time, when sending a normal burst is within conformance requirement 6 in GPRS multislot configuration:

   6.1 Under normal conditions.

   6.2 Under extreme conditions.

7. To verify that the MS in GPRS multislot configuration uses the maximum power control level according to its power class if commanded to a power control level exceeding its power class.

8. To verify that the output power relative to time, when sending an access burst is within conformance requirement 8 in GPRS multislot configuration:

   9.1 Under normal conditions.

   9.2 Under extreme conditions.

13.16.2.4 Methods of test

Two methods of test are described, separately for:

1) equipment fitted with a permanent antenna connector; and for

2) equipment fitted with an integral antenna, and which cannot be connected to an external antenna except by the fitting of a temporary test connector as a test fixture.

NOTE: The behaviour of the MS in the system is determined to a high degree by the antenna, and this is the only transmitter test in this ETS using the integral antenna. Further studies are ongoing on improved testing on the integral antenna, taking practical conditions of MS use into account.

13.16.2.4.1 Method of test for equipment with a permanent antenna connector

13.16.2.4.1.1 Initial conditions

Two-way data transfer is set up by the SS according to the generic call set up procedure for GPRS multislot configuration on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power and MS to operate in its highest number of uplink slots. The SS controls the power level by setting the concerned time slot’s power control parameter ALPHA (α) to 0 and GAMMA_TN (Γ_{CH}) to the desired power level in the Packet Uplink Assignment message (Closed Loop Control, see GSM 05.08, clause B.2) GPRS_ MS TXPWR_MAX_CCH/MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test. For DCS 1800 mobile stations the POWER_OFFSET parameter is set to 6 dB.

13.16.2.4.1.2 Procedure

a) Measurement of normal burst transmitter output power:

   The SS takes power measurement samples evenly distributed over the duration of one burst with a sampling rate of at least 2/T, where T is the bit duration. The samples are identified in time with respect to the modulation on the burst. The SS identifies the centre of the useful 147 transmitted bits, i.e. the transition from bit 13 to bit 14 of the midamble, as the timing reference.

   The transmitter output power is calculated as the average of the samples over the 147 useful bits. This is also used as the 0 dB reference for the power/time template.

b) Measurement of normal burst power/time relationship:

   The array of power samples measured in a) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in a).

c) Steps a) to b) are repeated on each timeslot within the multislot configuration with the MS commanded to operate on each of the power control levels defined, even those not supported by the MS.

d) The SS commands the MS to the maximum power control level supported by the MS and steps a) to b) are repeated on each timeslot within the multislot configuration for ARFCN in the Low and High ranges.

e) The SS commands the MS to the maximum power control level in the first timeslot allocated within the multislot configuration and to the minimum power control level in the second timeslot allocated. Any further timeslots allocated are to be set to the maximum power control level. Steps a) to b) and corresponding measurements on each timeslot within the multislot configuration are repeated.

f) Measurement of access burst transmitter output power:

The SS causes the MS to generate an Access Burst on an ARFCN in the Mid ARFCN range, this could be either by a cell re-selection or a new request for radio resource. In the case of a cell re-selection procedure the Power Level indicated in the PSI3 message is the maximum power control level supported by the MS. In the case of an Access Burst the MS shall use the Power Level indicated in the GPRS_MS_TXPWR_MAX_CCH parameter. If the power class of the MS is DCS 1800 Class 3 and the Power Level is indicated by the MS_TXPWR_MAX_CCH parameter, the MS shall also use the POWER_OFFSET parameter.

The SS takes power measurement samples evenly distributed over the duration of the access burst as described in a). However, in this case the SS identifies the centre of the useful bits of the burst by identifying the transition from the last bit of the synch sequence. The centre of the burst is then five data bits prior to this point and is used as the timing reference.

The transmitter output power is calculated as the average of the samples over the 87 useful bits of the burst. This is also used as the 0 dB reference for the power/time template.

g) Measurement of access burst power/time relationship:

The array of power samples measured in f) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in f).

h) Depending on the method used in step f) to cause the MS to send an Access Burst, the SS sends either a PACKET CELL CHANGE ORDER along with power control level set to 10 in PSI3 parameter GPRS_MS_TXPWR_MAX_CCH or it changes the (Packet) System Information elements (GPRS_)MS_TXPWR_MAX_CCH and for DCS 1800 the POWER_OFFSET on the serving cell PBCCH/BCCH in order to limit the MS transmit power on the Access Burst to power control level 10 (+23 dBm for GSM 400 and GSM 900 or +10 dBm for DCS 1800) and then steps f) to g) are repeated.

i) Steps a) to h) are repeated under extreme test conditions (annex 1, TC2.2) except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

13.16.2.4.2 Method of test for equipment with an integral antenna

NOTE: If the MS is equipped with a permanent connector, such that the antenna can be disconnected and the SS be connected directly, then the method of clause 13.16.2.4.1 will be applied.

The tests in this clause are performed on an unmodified test sample.

13.16.2.4.2.1 Initial conditions

The MS is placed in the anechoic shielded chamber (annex 1, GC5) or on the outdoor test site, on an isolated support, in the position for normal use, at a distance of at least 3 metres from a test antenna, connected to the SS.

NOTE: The test method described has been written for measurement in an anechoic shielded chamber. If an outdoor test site is used then, in addition, it is necessary to raise/lower the test antenna through the specified height range to maximize the received power levels from both the test sample and the substitution antenna.

A call is set up by the SS according to the generic call set up procedure for GPRS multislot configuration on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power and MS to operate in its highest number of uplink slots. The SS controls the power level by setting the concerned timeslot's power control parameter ALPHA (α) to 0 and GAMMA_TN (Γ_{CH}) to the desired power level in the Packet Uplink Assignment message (Closed Loop Control, see 05.08 clause B.2) GPRS_ MS TXPWR_MAX_CCH/MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test. For DCS 1800 mobile stations the POWER_OFFSET parameter is set to 6 dB.

13.16.2.4.2.2 Procedure

a) With the initial conditions set according to clause 13.16.2.4.2.1 the test procedure in 13.16.2.4.1.2 is followed up to and including step h), except that in step a), when measurements are done at maximum power for ARFCN in the Low, Mid and High range, the measurement is made eight times with the MS rotated by n×45 degrees for all values of n in the range 0 to 7.

The measurements taken are received transmitter output power measurements rather than transmitter output power measurements, the output power measurement values can be derived as follows.

b) Assessment of test site loss for scaling of received output power measurements.

The MS is replaced by a half-wave dipole, resonating at the centre frequency of the transmit band, connected to an RF generator.

The frequency of the RF signal generator is set to the frequency of the ARFCN used for the 24 measurements in step a), the output power is adjusted to reproduce the received transmitter output power averages recorded in step a).

For each indication the power, delivered by the generator (in Watts) to the half-wave dipole, is recorded. These values are recorded in the form Pnc, where n = MS rotation and c = channel number.

For each channel number used compute:

$$\text{Pac(Watts into dipole)} = \frac{1}{8} * \sum_{n=0}^{n=7} \text{Pnc}$$

from which: Pac (Tx dBm) = $10\log_{10}$(Pac) + 30 + 2,15

The difference, for each of the three channels, between the actual transmitter output power averaged over the 8 measurement orientations and the received transmitter output power at orientation n = 0 is used to scale the received measurement results to actual transmitter output powers for all measured power control levels and ARFCN, which can then be checked against the requirements.

c) Temporary antenna connector calibration factors (transmit)

A modified test sample equipped with a temporary antenna connector is placed in a climatic test chamber and is linked to the SS by means of the temporary antenna connector.

Under normal test conditions, the power measurement and calculation parts of steps a) to j) of clause 13.16.2.4.1.2 are repeated except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

NOTE 1: The values noted here are related to the output transmitter carrier power levels under normal test conditions, which are known after step b). Therefore frequency dependent calibration factors that account for the effects of the temporary antenna connector can be determined.

d) Measurements at extreme test conditions.

NOTE 2: Basically the procedure for extreme conditions is:

- the power/time template is tested in the "normal" way;
- the radiated power is measured by measuring the difference with respect to the radiated power under normal test conditions.

Under extreme test conditions steps a) to h) of clause 13.16.2.4.1.2 are repeated except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

The transmitter output power under extreme test conditions is calculated for each burst type, power control level and for every frequency used by adding the frequency dependent calibration factor, determined in c), to the values obtained at extreme conditions in this step.

13.16.2.5 Test requirements

a) The transmitter output power, under every combination of normal and extreme test conditions, for normal bursts and access bursts, at each frequency and for each power control level applicable to the MS power class, shall be at the relevant level shown in table 13.16.2-1 or table 13.16.2-2 within the tolerances also shown in table 13.16.2-1 or table 13.16.2-2.

GSM 400 and GSM 900 only - begin

Table 13.16.2-1: GSM 400 and GSM 900 transmitter output power for different power classes

Power class				Power control level	Transmitter output power	Tolerances	
2	3	4	5		dBm	normal	extreme
·				2	39	±2 dB	±2,5 dB
·	·			3	37	±3 dB (see note)	±4 dB (see note)
·	·			4	35	±3 dB	±4 dB
·	·	·		5	33	±3 dB (see note)	±4 dB (see note)
·	·	·		6	31	±3 dB	±4 dB
·	·	·	·	7	29	±3 dB (see note)	±4 dB (see note)
·	·	·	·	8	27	±3 dB	±4 dB
·	·	·	·	9	25	±3 dB	±4 dB
·	·	·	·	10	23	±3 dB	±4 dB
·	·	·	·	11	21	±3 dB	±4 dB
·	·	·	·	12	19	±3 dB	±4 dB
·	·	·	·	13	17	±3 dB	±4 dB
·	·	·	·	14	15	±3 dB	±4 dB
·	·	·	·	15	13	±3 dB	±4 dB
·	·	·	·	16	11	±5 dB	±6 dB
·	·	·	·	17	9	±5 dB	±6 dB
·	·	·	·	18	7	±5 dB	±6 dB
·	·	·	·	19	5	±5 dB	±6 dB
NOTE: When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.							

GSM 400 and GSM 900 only - end

DCS 1800 only - begin

Table 13.16.2-2: DCS 1800 transmitter output power for different power classes

Power class			Power control level	Transmitter output power	Tolerances	
1	**2**	**3**		**dBm**	**normal**	**extreme**
		·	29	36	±2,0 dB	±2,5 dB
		·	30	34	±3,0 dB	±4,0 dB
		·	31	32	±3,0 dB	±4,0 dB
·		·	0	30	±3,0 dB (see note)	±4 dB (see note)
·		·	1	28	±3 dB	±4 dB
·		·	2	26	±3 dB	±4 dB
·	·	·	3	24	±3 dB (see note)	±4 dB (see note)
·	·	·	4	22	±3 dB	±4 dB
·	·	·	5	20	±3 dB	±4 dB
·	·	·	6	18	±3 dB	±4 dB
·	·	·	7	16	±3 dB	±4 dB
·	·	·	8	14	±3 dB	±4 dB
·	·	·	9	12	±4 dB	±5 dB
·	·	·	10	10	±4 dB	±5 dB
·	·	·	11	8	±4 dB	±5 dB
·	·	·	12	6	±4 dB	±5 dB
·	·	·	13	4	±4 dB	±5 dB
·	·	·	14	2	±5 dB	±6 dB
·	·	·	15	0	±5 dB	±6 dB
NOTE: When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.						

DCS 1800 only - end

b) The difference between the transmitter output power at two adjacent power control levels, measured at the same frequency, shall not be less than 0,5 dB and not be more than 3,5 dB.

c) The power/time relationship of the measured samples for normal bursts shall be within the limits of the power time template of figure 13-7-2 (GSM 11.10) at each frequency, under every combination of normal and extreme test conditions and at each power control level measured.

```
+4 dBc          |        +---+_
+1,0 dBc        |        |   +-------------/ /-----------------+
0 dBc           |        |                                     |
-1,0 dBc        |        |   +-------------/ /-------------+   |
-6 dBc *        |     +--+   |                             |   +--+
-30 dBc **      | +---+      |                             |      +---+
                | |          |                             |          |
lowest limit    |-+          |                             |          +
(see            |            |<-------- (147 bits) -------->|
table 13-7-3)   +-------------------------/ /-----------------------------
                    10  8  10        7056/13=542,8 ms        10  8  10
```

Figure 13.16.2-1: Power/time template for normal bursts

*	For GSM 400 and GSM 900 MS:	-4 dBc for power control level 16
		-2 dBc for power control level 17
		-1 dBc for power control levels 18 and 19
	For DCS 1800 MS:	-4 dBc for power control level 11
		-2 dBc for power control level 12
		-1 dBc for power control levels 13, 14 and 15
**	For GSM 400 and GSM 900 MS:	-30 dBc or -17 dBm, whichever is the higher
	For DCS 1800 MS:	-30 dBc or -20 dBm, whichever is the higher

Table 13.16.2-3: Lowest measurement limit for power/time template

	lowest limit
GSM 400, GSM900	-59 dBc or -54 dBm whichever is the highest, except for the timeslot preceding the active slot, for which the allowed level is -59 dBc or -36 dBm, whichever is the highest
DCS1 800	-48 dBc or -48 dBm whichever is the highest

d) All the power control levels, for the type and power class of the MS as stated by the manufacturer, shall be implemented in the MS.

e) When the transmitter is commanded to a power control level outside of the capability corresponding to the type and power class of the MS as stated by the manufacturer, then the transmitter output power shall be within the tolerances for the closest power control level corresponding to the type and power class as stated by the manufacturer.

f) The power/time relationship of the measured samples for access bursts shall be within the limits of the power time template of figure 13-7-3 at each frequency, under every combination of normal and extreme test conditions and at each power control level measured.

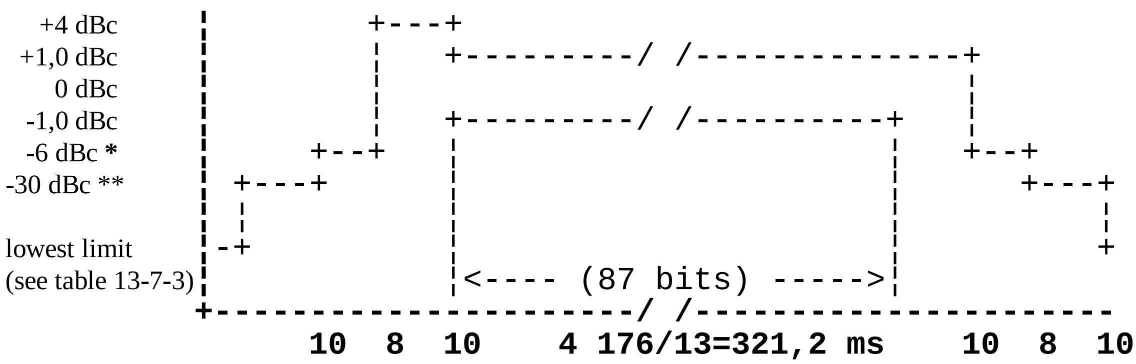


Figure 13.16.2-2: Power/time template for access burst

*	For GSM 400 and GSM 900 MS:	-4 dBc for power control level 16
		-2 dBc for power control level 17
		-1 dBc for power control levels 18 and 19
	For DCS 1800 MS:	-4 dBc for power control level 11
		-2 dBc for power control level 12
		-1 dBc for power control levels 13, 14 and 15
**	For GSM 400 and GSM 900 MS:	-30 dBc or -17 dBm, whichever is the higher

For DCS 1800 MS: -30 dBc or -20 dBm, whichever is the higher

13.16.3 Output RF spectrum in GPRS multislot configuration

13.16.3.1 Definition and applicability

The output RF spectrum is the relationship between the frequency offset from the carrier and the power, measured in a specified bandwidth and time, produced by the MS due to the effects of modulation and power ramping.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS and any multiband MS, which are capable of GPRS multislot operation.

13.16.3.2 Conformance requirement

1. The level of the output RF spectrum due to modulation shall be no more than that given in GSM 05.05, 4.2.1, table a) for GSM 400 and GSM 900 or table b) for DCS 1800, with the following lowest measurement limits:

   - -36 dBm below 600 kHz offset from the carrier,
   - -51 dBm for GSM 400 and GSM 900 or -56 dBm for DCS 1800 from 600 kHz out to less than 1 800 kHz offset from the carrier,
   - -46 dBm for GSM 400 and GSM 900 or -51 dBm for DCS 1800 at and beyond 1 800 kHz offset from the carrier,

   but with the following exceptions at up to -36 dBm:

   - up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz in the combined range 600 kHz to 6 000 kHz above and below the carrier,
   - up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz at more than 6 000 kHz offset from the carrier.

   1.1 Under normal conditions; GSM 05.05, 4.2.1.

   1.2 Under extreme conditions; GSM 05.05, 4.2.1; GSM 05.05, D D.2.1, D.2.2.

2. The level of the output RF spectrum due to switching transients shall be no more than given in GSM 05.05, 4.2.2, table "a) Mobile Station:".

   2.1 Under normal conditions; GSM 05.05, 4.2.2.

   2.2 Under extreme conditions; GSM 05.05, 4.2.2; GSM 05.05, D D.2.1, D.2.2.

3. When allocated a channel, the power emitted by the MS, in the band 915 MHz to 921 MHz shall be no more than -67 dBm (TETRA 870 only), in the band 935 MHz to 960 MHz shall be no more than -79 dBm, in the band 925 MHz to 935 MHz shall be no more than -67 dBm and in the band 1 805 MHz to 1 880 MHz shall be no more than -71 dBm except in five measurements in each of the bands 925 MHz to 960 MHz and 1 805 MHz to 1 880 MHz where exceptions at up to -36 dBm are permitted. For GSM 400 MS excluding TETRA, in addition, the power emitted by MS, in the bands of 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz shall be no more than -67 dBm except in three measurements in each of the bands 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz where exceptions at up to -36 dBm are permitted. For TETRA 380, TETRA 410 and TETRA 450, in addition, the power emitted by MS, in the bands 390 MHz to 400 MHz and 420 MHz to 430 MHz and 460 MHz to 470 MHz shall be no more than -62 dBm except in three measurements in each band where exceptions at up to -36 dBm are permitted. Under normal conditions; GSM 05.05, 4.3.3.

13.16.3.3 Test purpose

1. To verify that the output RF spectrum due to modulation does not exceed conformance requirement 1 in the GPRS multislot configurations.

   1.1 Under normal conditions.

   1.2 Under extreme conditions.

2. To verify that the output RF spectrum due to switching transients does not exceed conformance requirement 2 in the GPRS multislot configurations when a reasonable margin is allowed for the effect of spectrum due to modulation.

   2.1 Under normal conditions.

   2.2 Under extreme conditions.

3. To verify that the MS spurious emissions in the MS receive band do not exceed conformance requirement 3 in the GPRS multislot configurations.

13.16.3.4 Method of test

13.16.3.4.1 Initial conditions

A call is set up according to the generic call set up procedure for multislot GPRS with the highest number of uplink slots.

The SS commands the MS to hopping mode. The hopping pattern includes only three channels, namely one with an ARFCN in the Low ARFCN range, a second one with an ARFCN in the Mid ARFCN range and the third one with an ARFCN in the High ARFCN range.

The SS commands the MS to complete the multislot loop back type G (see GSM 04.14, 5.2). This is to set a defined random pattern for the transmitter.

The SS sends Standard Test Signal C1 (annex 5) to the MS at a level of 23 dBμVemf( ).

NOTE 1: Although the measurement is made whilst the MS is in hopping mode, each measurement is on one single channel.

NOTE 2: This test is specified in hopping mode as a simple means of making the MS change channel, it would be sufficient to test in non hopping mode and to cell re-select the MS between the three channels tested at the appropriate time.

13.16.3.4.2 Procedure

NOTE: When averaging is in use during frequency hopping mode, the averaging only includes bursts transmitted when the hopping carrier corresponds to the nominal carrier of the measurement.

a) In steps b) to h) the FT is equal to the hop pattern ARFCN in the Mid ARFCN range.

b) The other settings of the spectrum analyser are set as follows:

   - Zero frequency scan
   - Resolution bandwidth: 30 kHz
   - Video bandwidth: 30 kHz
   - Video averaging: may be used, depending on the implementation of the test

   The video signal of the spectrum analyser is "gated" such that the spectrum generated by at least 40 of the bits 87 to 132 of the burst in one of the active time slots is the only spectrum measured. This gating may be analogue or numerical, dependent upon the design of the spectrum analyser. Only measurements during transmitted bursts on the nominal carrier of the measurement are included. The spectrum analyser averages over the gated period and over 200 or 50 such bursts, using numerical and/or video averaging.

c) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 50 bursts at all multiples of 30 kHz offset from FT to < 1 800 kHz.

d) The resolution and video bandwidth on the spectrum analyser are adjusted to 100 kHz and the measurements are made at the following frequencies:

- on every ARFCN from 1 800 kHz offset from the carrier to the edge of the relevant transmit band for each measurement over 50 bursts.
- at 200 kHz intervals over the 2 MHz either side of the relevant transmit band for each measurement over 50 bursts.
- at 200 kHz intervals over the band 915 MHz to 921 MHz for each measurement over 50 bursts. (TETRA 870 only)
- at 200 kHz intervals over the band 925 MHz to 960 MHz for each measurement over 50 bursts.
- at 200 kHz intervals over the band 1 805 MHz to 1 880 MHz for each measurement over 50 bursts.

in addition for GSM 400 MS:

- at 200 kHz intervals over the band 390 MHz to 400 MHz for each measurement over 50 bursts.
- at 200 kHz intervals over the band 420 MHz to 430 MHz for each measurement over 50 bursts.
- at 200 kHz intervals over the band 460 MHz to 470 MHz for each measurement over 50 bursts.
- at 200 kHz intervals over the band 488,8 MHz to 496 MHz for each measurement over 50 bursts.

e) The MS is commanded to its minimum power control level. The spectrum analyser is set again as in b).

f) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 200 bursts at the following frequencies:

- FT
- FT + 100 kHz FT - 100 kHz
- FT + 200 kHz FT - 200 kHz
- FT + 250 kHz FT - 250 kHz
- FT + 200 kHz × N FT - 200 kHz × N

  where N = 2, 3, 4, 5, 6, 7, and 8

  and FT = RF channel nominal centre frequency.

g) Steps a) to f) is repeated except that in step a) the spectrum analyser is gated so that the burst of the next active time slot is measured.

h) The spectrum analyser settings are adjusted to:

- Zero frequency scan
- Resolution bandwidth: 30 kHz
- Video bandwidth: 100 kHz
- Peak hold

The spectrum analyser gating of the signal is switched off.

The MS is commanded to its maximum power control level in every transmitted time slot.

i) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured at the following frequencies:

- FT + 400 kHz FT - 400 kHz
- FT + 600 kHz FT - 600 kHz
- FT + 1,2 MHz FT - 1,2 MHz
- FT + 1,8 MHz FT - 1,8 MHz

where FT = RF channel nominal centre frequency.

The duration of each measurement (at each frequency) will be such as to cover at least 10 burst transmissions at FT.

j) Step i) is repeated for power control levels 7 and 11.

k) Steps b), f), h) and i) are repeated with FT equal to the hop pattern ARFCN in the Low ARFCN range except that in step h) the MS is commanded to power control level 11 rather than maximum power.

l) Steps b), f), h) and i) are repeated with FT equal to the hop pattern ARFCN in the High ARFCN range except that in step h) the MS is commanded to power control level 11 rather than maximum power.

m) Steps a) b) f) h), and i) are repeated under extreme test conditions (annex 1, TC2.2). except that at step h) the MS is commanded to power control level 11.

13.16.3.5 Test requirements

For absolute measurements, performed on a temporary antenna connector, in the frequency band 380 MHz to 390 MHz, 410 MHz to 420 MHz, 450 MHz to 460 MHz, 478,8 MHz to 486 MHz, 880 MHz to 915 MHz or 1 710 MHz to 1 785 MHz, the temporary antenna connector coupling factor, determined according to 13.3.4.2.2 and annex 1 GC7, for the nearest relevant frequency, will be used.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 915 MHz to 960 MHz, the temporary antenna connector coupling factor, will be as determined according to annex 1 GC7 for GSM 900 MS. For a GSM 400 or DCS 1800 MS 0 dB will be assumed.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 1 805 MHz to 1 880 MHz, the temporary antenna connector coupling factor, will be as determined according to annex 1 GC7 for DCS 1800 MS. For a GSM 400 or GSM 900 MS 0 dB will be assumed.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 390 MHz to 400 MHz, 420 MHz to 430 MHz,460 MHz to 470 MHz or 488,8 MHz to 496 MHz, the temporary antenna connector coupling factor, will be as determined according to annex 1 GC7 for GSM 400 MS. For a GSM 900 or DCS 1800 MS 0 dB will be assumed.

The figures in the tables below, at the listed frequencies from the carrier (kHz), are the maximum level (dB) relative to a measurement in 30 kHz bandwidth on the carrier (reference GSM 05.05 clause 4.2.1).

a) For the modulation sidebands out to less than 1 800 kHz offset from the carrier frequency (FT) measured in step c), f), i), k), l) and m) the measured power level in dB relative to the power level measured at FT, for all types of MS, shall not exceed the limits derived from the values shown in table 13.16.3-1 for GSM 400 and GSM 900 or table 13.16.3-2 for DCS 1800 according to the actual transmit power and frequency offset from FT. However any failures in the combined range 600 kHz to less than 1 800 kHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below.

Table 13.16.3-1: GSM 400 and GSM 900 Spectrum due to modulation out to less than 1 800 kHz offset

	power levels in dB relative to the measurement at FT				
Power level	Frequency offset (kHz)				
(dBm)	0-100	200	250	400	600 to < 1 800
39	+0,5	-30	-33	-60	-66
37	+0,5	-30	-33	-60	-64
35	+0,5	-30	-33	-60	-62
≤ 33	+0,5	-30	-33	-60	-60
The values above are subject to the minimum absolute levels (dBm) below.					
	-36	-36	-36	-36	-51

Table 13.16.3-2: DCS 1800 Spectrum due to modulation out to less than 1 800 kHz offset

	power levels in dB relative to the measurement at FT				
Power level	Frequency offset (kHz)				
(dBm)	0-100	200	250	400	600 to < 1 800
≤ 36	+0,5	-30	-33	-60	-60
The values above are subject to the minimum absolute levels (dBm) below.					
	-36	-36	-36	-36	-56

NOTE 1: For frequency offsets between 100 kHz and 600 kHz the requirement is derived by a linear interpolation between the points identified in the table with linear frequency and power in dB relative.

b) For the modulation sidebands from 1 800 kHz offset from the carrier frequency (FT) and out to 2 MHz beyond the edge of the relevant transmit band, measured in step d), the measured power level in dB relative to the power level measured at FT, shall not exceed the values shown in table 13.16.3-3 according to the actual transmit power, frequency offset from FT and system on which the MS is designed to operate. However any failures in the combined range 1 800 kHz to 6 MHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below, and any other failures may be counted towards the exceptions allowed in test requirements d) below.

Table 13.16.3-3: Spectrum due to modulation from 1 800 kHz offset to the edge of the transmit band (wideband noise)

power levels in dB relative to the measurement at FT						
GSM 400 and GSM 900				DCS 1800		
Power level (dBm)	Frequency offset kHz			Power level (dBm)	Frequency offset kHz	
	1 800 to < 3 000	3 000 to < 6 000	≥ 6 000		1 800 to < 6 000	≥ 6 000
39	-69	-71	-77	36	-71	-79
37	-67	-69	-75	34	-69	-77
35	-65	-67	-73	32	-67	-75
≤ 33	-63	-65	-71	30	-65	-73
				28	-63	-71
				26	-61	-69
				≤ 24	-59	-67
The values above are subject to the minimum absolute levels (dBm) below.						
	-46	-46	-46		-51	-51

c) Any failures (from a) and b) above) in the combined range 600 kHz to 6 MHz above and below the carrier should be re-checked for allowed spurious emissions. For each of the three ARFCN used, spurious emissions are allowed in up to three 200 kHz bands centred on an integer multiple of 200 kHz so long as no spurious emission exceeds -36 dBm. Any spurious emissions measured in a 30 kHz bandwidth which spans two 200 kHz bands can be counted towards either 200 kHz band, whichever minimizes the number of 200 kHz bands containing spurious exceptions.

d) Any failures (from b) above) beyond 6 MHz offset from the carrier should be re-checked for allowed spurious emissions. For each of the three ARFCN used, up to twelve spurious emissions are allowed so long as no spurious emission exceeds -36 dBm.

e) The MS spurious emissions in the bands 925 MHz to 935 MHz, 935 MHz to 960 MHz and 1 805 MHz to 1 880 MHz, measured in step d), for all types of MS, shall not exceed the values shown in table 13.16.3-4 except in up to five measurements in the band 925 MHz to 960 MHz and five measurements in the band 1 805 MHz to 1 880 MHz where a level up to -36 dBm is permitted. For TETRA 870, in addition, the MS spurious emissions in the bands 915 MHz to 921 MHz, 935 MHz to 960 MHz and 1 805 MHz to 1 880 MHz, measured in step d), for all types of MS, shall not exceed the value of -67 dBm. For GSM 400 MS (excluding TETRA), in addition, the MS spurious emissions in the bands 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz shall not exceed the value of -67 dBm, except in up to three measurements in each of the bands 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz where a level up to -36 dBm is permitted. For TETRA 380, TETRA 410 and TETRA 450, in addition, the power emitted by MS, in the bands 390 MHz to 400 MHz and 420 MHz to 430 MHz and 460 MHz to 470 MHz shall be no more than -62 dBm except in three measurements in each band, where exceptions at up to -36 dBm are permitted.

Table 13.16.3-4: Spurious emissions in the MS receive bands

Band (MHz)	Spurious emissions level (dBm)
925 to 935	-67
935 to 960	-79
1805 to 1880	-71

f) For the power ramp sidebands of steps h), i) and k) the power levels must not exceed the values shown in table 13.16.3-5 for GSM 400 and GSM 900 or table 13.16.3-6 for DCS 1800.

Table 13.16.3-5: GSM Spectrum due to switching transients

Power level	Maximum level for various offsets from carrier frequency			
	400 kHz	**600 kHz**	**1 200 kHz**	**1 800 kHz**
39 dBm	-13 dBm	-21 dBm	-21 dBm	-24 dBm
37 dBm	-15 dBm	-21 dBm	-21 dBm	-24 dBm
35 dBm	-17 dBm	-21 dBm	-21 dBm	-24 dBm
33 dBm	-19 dBm	-21 dBm	-21 dBm	-24 dBm
31 dBm	-21 dBm	-23 dBm	-23 dBm	-26 dBm
29 dBm	-23 dBm	-25 dBm	-25 dBm	-28 dBm
27 dBm	-23 dBm	-26 dBm	-27 dBm	-30 dBm
25 dBm	-23 dBm	-26 dBm	-29 dBm	-32 dBm
23 dBm	-23 dBm	-26 dBm	-31 dBm	-34 dBm
≤+21 dBm	-23 dBm	-26 dBm	-32 dBm	-36 dBm

Table 13.16.3-6: DCS 1800 Spectrum due to switching transients

Power level	Maximum level for various offsets from carrier frequency			
	400 kHz	600 kHz	1 200 kHz	1 800 kHz
36 dBm	-16 dBm	-21 dBm	-21 dBm	-24 dBm
34 dBm	-18 dBm	-21 dBm	-21 dBm	-24 dBm
32 dBm	-20 dBm	-22 dBm	-22 dBm	-25 dBm
30 dBm	-22 dBm	-24 dBm	-24 dBm	-27 dBm
28 dBm	-23 dBm	-25 dBm	-26 dBm	-29 dBm
26 dBm	-23 dBm	-26 dBm	-28 dBm	-31 dBm
24 dBm	-23 dBm	-26 dBm	-30 dBm	-33 dBm
22 dBm	-23 dBm	-26 dBm	-31 dBm	-35 dBm
≤+20 dBm	-23 dBm	-26 dBm	-32 dBm	-36 dBm

NOTE 2: These figures are different from the requirements in GSM 05.05 because at higher power levels it is the modulation spectrum which is being measured using a peak hold measurement. This allowance is given in the table.

NOTE 3: The figures for table 13.16.3-5 and table 13.16.3-6 assume that, using the peak hold measurement, the lowest level measurable is 8 dB above the level of the modulation specification using the 30 kHz bandwidth gated average technique for 400 kHz offset from the carrier. At 600 and 1 200 kHz offset the level is 6 dB above and at 1 800 kHz offset the level is 3 dB above. The figures for 1 800 kHz have assumed the 30 kHz bandwidth spectrum due to modulation specification at < 1 800 kHz.

13.17 EGPRS transmitter tests

13.17.1 Frequency error and Modulation accuracy in EGPRS Configuration

13.17.1.1 Definition and applicability

The frequency error is the difference in frequency, after adjustment for the effect of the modulation accuracy between the RF transmission from the MS and either:

- the RF transmission from the BS; or
- the nominal frequency for the ARFCN used.

Modulation Accuracy

For GMSK, the modulation accuracy of the transmitted signal is described as the phase accuracy (phase error) of the GMSK modulated signal. The phase error for GSMK modulation is the difference in phase, after adjustment for the effect of the frequency error, between the RF transmission from the MS and the theoretical transmission according to the intended modulation.

For 8-PSK, the error vector between the vector representing the transmitted signal and the vector representing the error-free modulated signal defines modulation accuracy. The magnitude of the error vector is called Error Vector Magnitude (EVM). Origin suppression is defined to be the ratio of the carrier leakage to the modulated signal.

The requirements and this test apply to all types of GSM 400, GSM 900, DCS 1800, and PCS 1900 which are capable of EGPRS operation. For multiband MS, requirements and this test apply to all applicable bands.

13.17.1.2 Conformance requirement

1. The carrier frequency under GMSK and 8PSK modulation shall be accurate to within 0,2 ppm for GSM 400 and 0,1 ppm for all other bands compared to signals received from the BS.

   1.1 Under normal conditions; GSM 05.10, 6.1.

   1.2 Under vibration conditions; GSM 05.10, 6.1; GSM 05.05, D D.2.3.

   1.3 Under extreme conditions; GSM 05.10, 6.1; GSM 05.05, 4.4; GSM 05.05, D D.2.1, D.2.2.

2. The RMS phase error for GMSK modulated signal (difference between the phase error trajectory and its linear regression on the active part of the time slot) for each burst shall not be greater than 5 degrees.

   2.1 Under normal conditions; GSM 05.05, 4.6.

   2.2 Under vibration conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.3.

   2.3 Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

3. The maximum peak deviation for GMSK modulated signal during the useful part of each burst shall not be greater than 20 degrees.

   3.1 Under normal conditions; GSM 05.05, 4.6.

   3.2 Under vibration conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.3.

   3.3 Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

4. The RMS EVM over the useful part of any burst of the 8-PSK modulated signal shall not exceed:

   4.1 9,0% Under normal conditions; GSM 05.05, 4.6.

   4.2 10,0% Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

5. The peak EVM values of any burst of the 8PSK modulated signal shall be ≤ 30 %.

   5.1 Under normal conditions; GSM 05.05, 4.6.

   5.2 Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

6. The 95:th-percentile value of any burst of the 8-PSK modulated signal shall be ≤15 %.

   6.1 Under normal conditions; GSM 05.05, 4.6.

   6.2 Under extreme conditions; GSM 05.05, 4.6; GSM 05.05, D D.2.1, D.2.2.

7. The Origin Offset for any 8PSK modulated signal shall be -30 dBc.

   7.1 Under normal conditions; 05.05, 4.6.

   7.2 Under extreme conditions; 05.05 4.6.2.2; GSM 05.05, D D.2.1, D.2.2.

13.17.1.3 Test purpose

1 To verify that the carrier frequency error does not exceed conformance requirement 1:

   1.1 Under normal conditions.

   1.2 When the MS is being vibrated.

   1.3 Under extreme conditions.

2 To verify that the RMS phase error on the useful parts of the bursts transmitted by the MS does not exceed conformance requirement 2:

   2.1 Under normal conditions.

   2.2 When the MS is being vibrated.

   2.3 Under extreme conditions.

3 To verify that the maximum phase error on the useful parts of the bursts transmitted by the MS configuration does not exceed conformance requirement 3:

   3.1 Under normal conditions.

   3.2 When the MS is being vibrated.

3.3 Under extreme conditions.

4 To verify that the RMS EVM over the useful part of the burst, excluding tail bits, transmitted by the MS does not exceed conformance requirement 4:

4.1 Under normal conditions.

4.2 When the MS is being vibrated.

4.3 Under extreme conditions.

5 To verify that the peak EVM values over the useful part of the burst, excluding tail bits, transmitted by the MS does not exceed conformance requirement 5:

5.1 Under normal conditions.

5.2 When the MS is being vibrated.

5.3 Under extreme conditions.

6 To verify that the 95:th percentile EVM over the useful part of any burst, excluding tail bits, does not exceed conformance requirement 6:

6.1 Under normal conditions.

6.2 When the MS is being vibrated.

6.3 Under extreme conditions.

7 To verify that the origin suppression does not exceed conformance requirement 7:

7.1 Under normal conditions.

7.2 When the MS is being vibrated.

7.3 Under extreme conditions.

13.17.1.4 Method of the test

Initial conditions

A downlink TBF is set up according to the generic procedure in clause 40. The SS orders the MS to transmit on the uplink in hopping mode. This is achieved using the EGPRS test mode by transmitting a EGPRS TEST_CMD (see GSM 04.14).

NOTE: It is not necessary to test in hopping mode but is done here as a simple means of making the MS change channel, it would be sufficient to test in non hopping mode and to make sure bursts are taken from a few different channels.

The SS controls the power level by setting the concerned timeslot's power control parameter ALPHA (α) to 0 and GAMMA_TN (Γ_{CH}) to the desired power level in the Packet Uplink Assignment message (Closed Loop Control, see GSM 05.08, B.2) GPRS_ MS TXPWR_MAX_CCH/MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test. For DCS 1800 mobile stations the POWER_OFFSET parameter is set to 6 dB.

For the GMSK and 8PSK procedures described below, the initial power value of each active timeslot shall be set to a mid-range power value.

13.17.1.4.2 Test procedure

Procedure for GMSK Frequency error measurement and Phase error

a) For one transmitted burst on the last slot of the multislot configuration, the SS captures the signal as a series of phase samples over the period of the burst. These samples are evenly distributed over the duration of the burst with a minimum sampling rate of 2/T, where T is the modulation symbol period. The received phase trajectory is then represented by this array of at least 294 samples.

b) The SS then calculates, from the known bit pattern and the formal definition of the modulator contained in GSM 05.04, the expected phase trajectory.

c) From a) and b) the phase trajectory error is calculated, and a linear regression line computed through this phase trajectory error. The slope of this regression line is the frequency error of the mobile transmitter relative to the simulator reference. The difference between the regression line and the individual sample points is the phase error of that point.

   c.1) The sampled array of at least 294 phase measurements is represented by the vector:

   $\varnothing_m = \varnothing_m(0)...\varnothing_m(n)$

   where the number of samples in the array $n+1 \geq 294$.

   c.2) The calculated array, at the corresponding sampling instants, is represented by the vector:

   $\varnothing_c = \varnothing_c(0)...\varnothing_c(n)$.

   c.3) The error array is represented by the vector:

   $\varnothing_e = \{\varnothing_m(0) - \varnothing_c(0)\}.........\{\varnothing_m(n) - \varnothing_c(n)\} = \varnothing_e(0)...\varnothing_e(n)$.

   c.4) The corresponding sample numbers form a vector t = t(0)...t(n).

   c.5) By regression theory the slope of the samples with respect to t is k where:

$$k = \frac{\sum_{j=0}^{j=n} t(j) * \varnothing_e(j)}{\sum_{j=0}^{j=n} t(j)^2}$$

   c.6) The frequency error is given by k/(360 × g), where g is the sampling interval in s and all phase samples are measured in degrees.

   c.7) The individual phase errors from the regression line are given by:

   $\varnothing_e(j) - k \times t(j)$.

   c.8) The RMS value $\varnothing_e$ of the phase errors is given by:

$$\varnothing_e(RMS) = \left[\frac{\sum_{j=0}^{j=n} \{\varnothing_e(j) - k * t(j)\}^2}{n+1} \right]^{1/2}$$

d) Steps a) to c) are repeated for 20 bursts, not necessarily contiguous.

e) The SS instructs the MS to its maximum power control level by setting the power control parameter ALPHA (α) to 0 and GAMMA_TN (Γ_{CH}) for each timeslot to the desired power level in the Packet Uplink Assignment message (Closed Loop Control, see GSM 05.08, B.2), all other conditions remaining constant. Steps a) to d) are repeated.

f) The SS instructs the MS to the minimum power control level, all other conditions remaining constant. Steps a) to d) are repeated.

g) The MS is hard mounted on a vibration table and vibrated at the frequency/amplitudes specified in annex 1, TC4.

During the vibration steps a) to f) are repeated.

NOTE: If the call is terminated when mounting the MS to the vibration table, it will be necessary to establish the initial conditions again before repeating steps a) to f).

h) The MS is re-positioned on the vibration table in the two orthogonal planes to the plane used in step g). For each of the orthogonal planes step g) is repeated.

i) Steps a) to f) are repeated under extreme test conditions (see annex 1, TC2.2).

Procedure for 8PSK Frequency error and modulation accuracy measurements

j) For one transmitted burst on the last slot of the multislot configuration, the SS captures the transmitted signal by taking at least four samples per symbol. The transmitted signal is modelled by:

$$Y(t) = C1\{R(t) + D(t) + C0\}W^t$$

R(t) is defined to be an ideal transmitter signal.

D(t) is the residual complex error on signal R(t).

C0 is a constant origin offset representing carrier feed through.

C1 is a complex constant representing the arbitrary phase and output power of the transmitter.

$W = e^{\alpha + j\,2\pi f}$ accounts for both a frequency offset of "$2\pi f$" radians per second phase rotation and an amplitude change of "α" nepers per second.

The symbol timing phase of Y(t) is aligned with R(t).

k) The SS shall generate the ideal transmitter signal as a reference. The ideal transmitter signal can be constructed from a priori knowledge of the transmitted symbols or from the demodulated symbols of the transmitted burst. In the latter case, unknown symbols shall be detected with an error rate sufficiently small to ensure the accuracy of the measurement equipment (see annex 5).

l.1)The transmitted signal Y(t) is compensated in amplitude, frequency and phase by multiplying with the factor:

$$W^{-t}/C1$$

The values for W and C1 are determined using an iterative procedure. $W(\alpha,f)$, C1 and C0 are chosen to minimize the RMS value of EVM on a burst-by-burst basis.

l.2)After compensation, Y(t) is passed through the specified measurement filter (GSM 05.05, 4.6.2) to produce the signal

$$Z(k) = S(k) + E(k) + C0$$

where

S(k) is the ideal transmitter signal observed through the measurement filter

$k = \text{floor}(t/T_s)$, where T_s =1/270.833 kHz corresponding to the symbol times l.3)The error vector is defined to be:

$$E(k) = Z(k) - C0 - S(k)$$

It is measured and calculated for each instant k over the useful part of the burst excluding tail bits. The RMS vector error is defined as:

$$\text{RMS EVM} = \sqrt{\sum_{k \in K} \left|E(k)\right|^2 / \sum_{k \in K} \left|S(k)\right|^2}$$

l.4)Steps l.1) to l.3) are repeated with successive approximations of W(α,f), C1 and C0 until the minimum value of RMS EVM is found. The minimized value of RMS EVM and the final values for C1, C0 and f are noted. (f represents the frequency error of the burst).

m) For each symbol in the useful part of the burst excluding tail bits, the SS shall calculate the error vector magnitude as:

$$\text{EVM}(k) = \sqrt{\frac{\left|E(k)\right|^2}{\frac{\sum_{k \in K} \left|S(k)\right|^2}{N}}}$$

The peak value of symbol EVM in the useful part of the burst, excluding tail bits, is noted.

n) The SS shall calculate the value for Origin Offset Suppression for the burst as:

$$\text{OOS (dB)} = -10\log_{10}\left(\frac{\left|C_0\right|^2}{\frac{1}{N}\sum_{k \in K}\left|S(k)\right|^2}\right)$$

o) Steps j) to n) are repeated for a total of 200 bursts.

p) The peak values of symbol EVM noted in step m) are averaged for the 200 measured bursts.

q) From the distribution of symbol EVM values calculated in step m) for the 200 measured bursts, the SS shall determine the 95:th percentile value.

r) The SS instructs the MS to its maximum power control level by setting the power control parameter ALPHA (α) to 0 and GAMMA_TN (Γ_{CH}) for each timeslot to the desired power level in the Packet Uplink Assignment message (Closed Loop Control, see 05.08, B.2), all other conditions remaining constant. Steps j) to q) are repeated.

s) The SS instructs the MS to the minimum power control level, all other conditions remaining constant. Steps j) to q) are repeated.

t) The MS is hard mounted on a vibration table and vibrated at the frequency/amplitudes specified in annex 1, TC4.

During the vibration steps j) to q) are repeated.

NOTE: If the call is terminated when mounting the MS to the vibration table, it will be necessary to establish the initial conditions again before repeating steps a) to f).

u) The MS is re-positioned on the vibration table in the two orthogonal planes to the plane used in step t). For each of the orthogonal planes step t) is repeated.

v) Steps j) to q) are repeated under extreme test conditions (see annex 1, TC2.2).

13.17.1.5 Test Requirements

1. For all measured bursts, the frequency error, derived in steps c.6) and l.4), shall be less than 10^{-7}.
2. For all measured bursts, the RMS phase error, derived in step c.8), shall not exceed 5 degrees.
3. For all measured bursts, each individual phase error, derived in step c.7), shall not exceed 20 degrees.
4. For all measured bursts, the RMS EVM, derived in step l.3) shall not exceed 9,0 % under normal conditions and 10,0 % under extreme conditions.
5. The (averaged) value of peak EVM derived in step p) shall not exceed 30 %.
6. The 95:th percentile value derived in step q) shall not exceed 15 %.
7. For all measured bursts, the origin offset suppression derived in step n) shall not exceed 30 dB.

13.17.2 Frequency error under multipath and interference conditions.

13.17.2.1 Definition and applicability

The frequency error under multipath and interference conditions is a measure of the ability of the MS to maintain frequency synchronization with the received signal under conditions of Doppler shift, multipath reception and interference.

The requirements and this test apply to all types of EGPRS GSM 400, GSM 900 and DCS 1800 MS, PCS 1900.

13.17.2.2 Conformance requirement

1. The MS carrier frequency error for each burst shall be accurate to within 0,1 ppm for GSM 900, DCS 1800 and 0,2 ppm for GSM 400 compared to signals received from the BS for signal levels down to 3 dB below the reference sensitivity level.

   1.1 Under normal conditions; GSM 05.10, 6/6.1.

   1.2 Under extreme conditions; GSM 05.10, 6/6.1; GSM 05.05, D D.2.1, D.2.2.

2. The MS carrier frequency error for each burst shall be accurate to within 0,1 ppm, for GSM 900, DCS 1800 and PCS 1900 and 0,2 ppm for GSM 400 compared to signals received from the BS for 3 dB less carrier to interference ratio than the reference interference ratios; GSM 05.10, 6/6.1.

13.17.2.3 Test purpose

1. To verify that the MS carrier frequency error at reference sensitivity, under conditions of multipath and Doppler shift does not exceed 0,1 ppm for GSM 900, DCS 1800 and PCS 1900 and 0,2 ppm for GSM 400 + the frequency error due to the Doppler shift of the received signal and the assessment error in the MS.

   1.1 Under normal conditions.

   1.2 Under extreme conditions.

NOTE 1: Although the conformance requirement states that frequency synchronization should be maintained for input signals 3 dB below reference sensitivity. Due to the Radio Link Failure counter this test condition cannot be established. Hence all tests in this clause are conducted at reference sensitivity level.

2. To verify that the MS carrier frequency error, under interference conditions and TUlow fading profile, does not exceed 0,1 ppm for GSM 900, DCS 1800 and PCS 1900 and 0,2 ppm for GSM 400 + the frequency error due to the Doppler shift of the received signal and the assessment error in the MS.

NOTE 2: The test adds the effect of Doppler shift to the requirements as the conformance requirement refers to signals input to the MS receiver whereas the frequency reference for measurement will not take account of the Doppler shift.

13.17.2.4 Method of test

This test uses the same measurement process as test 13.17.1 for the MS operating under various RF conditions.

NOTE: The BA list sent on the BCCH will indicate at least six surrounding cells with at least one near to each band edge. It is not necessary to generate any of these BCCH but if they are provided none will be within 5 channels of the ARFCN used for the serving BCCH or PDTCH.

13.17.2.4.1 Initial conditions

The MS is brought into the packet idle GPRS attached state on a serving cell with BCCH in the mid ARFCN range. The level of the serving cell BCCH is set to 10 dB above the reference sensitivity level( ) and the fading function set to RA. The SS waits 30 s for the MS to stabilize to these conditions.

13.17.2.4.2 Procedure

a) The SS is set up to capture the first burst transmitted by the MS during the uplink TBF. The SS orders the MS to transmit on the uplink for the duration of the test. This is achieved using the EGPRS test mode by transmitting a EGPRS TEST_CMD (see GSM 04.14). A downlink TBF is initiated by the SS on a channel in the mid ARFCN range. This downlink TBF is established according to the generic procedure in clause 10 with the exceptions that the PDTCH level is set to 10 dB above the reference sensitivity level( ) and the fading function is set to RA The TBF is maintained for the duration of the test.

b) The SS calculates the frequency accuracy of the captured burst as described in test 13.1.

c) The SS sets the serving cell BCCH and PDTCH to the reference sensitivity level( ) applicable to the type of MS, still with the fading function set to RA and then waits 30 s for the MS to stabilize to these conditions.

d) The SS shall capture subsequent bursts from the traffic channel in the manner described in test 13.1.

NOTE: Due to the very low signal level at the MS receiver input the MS receiver is liable to error. The "looped back" bits are therefore also liable to error, and hence the SS does not know the expected bit sequence. The SS will have to demodulate the received signal to derive (error free) the transmitter burst bit pattern. Using this bit pattern the SS can calculate the expected phase trajectory according to the definition within GSM 05.04.

e) The SS calculates the frequency accuracy of the captured burst as described in test 13.1.

f) Steps d) and e) are repeated for 5 traffic channel bursts spaced over a period of not less than 20 s.

g) Both downlink and uplink TBFs are terminated. The initial conditions are established again and steps a) to f) are repeated but with the fading function set to HT200 for GSM 400 and HT100 for all other bands.

h) The initial conditions are established again and steps a) to f) are repeated but with the fading function set to TU100 for GSM 400 and TU50 for all other bands.

i) The initial conditions are established again and steps a) and b) are repeated but with the following differences:

- the levels of the BCCH and PDTCH are set to 18 dB above reference sensitivity level( ).
    - two further independent 8-PSK modulated interfering signals are sent on the same nominal carrier frequency as the BCCH and PDTCH and at a level 10 dB below the level of the PDTCH and modulated with random data, including the midamble.
    - the fading function for all channels is set to TUlow.

j) The SS waits 100 s for the MS to stabilize to these conditions.

k) Repeat steps d) to f), except that at step f) the measurement period must be extended to 200 s and the number of measurements increased to 20.

l) The initial conditions are established again and steps a) to k) are repeated for ARFCN in the Low ARFCN range.

m) The initial conditions are established again and steps a) to k) are repeated for ARFCN in the High ARFCN range.

n) Repeat step h) under extreme test conditions (see annex 1, TC2.2).

13.17.2.5 Test requirements

The frequency error, with reference to the SS carrier frequency as measured in repeats of step e), for each measured burst shall be less than the values shown in table 13-17-1.

Table 13-17-1: Requirements for frequency error under multipath, Doppler shift and interference conditions

GSM 400		GSM 900		DCS 1800 and PCS 1900	
Propagation condition	Permitted frequency error	Propagation condition	Permitted frequency error	Propagation condition	Permitted frequency error
RA500	± 300 Hz	RA250	± 300 Hz	RA130	± 400 Hz
HT200	± 180 Hz	HT100	± 180 Hz	HT100	± 350 Hz
TU100	± 160 Hz	TU50	± 160 Hz	TU50	± 260 Hz
TU6	± 230 Hz	TU3	± 230 Hz	TU1,5	± 320 Hz

13.17.3 EGPRS Transmitter output power

13.17.3.1 Definition and applicability

The transmitter output power is the average value of the power delivered to an artificial antenna or radiated by the MS and its integral antenna, over the time that the useful information bits of one burst are transmitted.

The requirements and this test apply to all types of GSM 400, GSM 900 and DCS 1800 MS, PCS 1900 which are capable of EGPRS multislot operation. 8-PSK requirements are only applicable to EGPRS class B.

13.17.3.2 Conformance requirement

1. The MS maximum output power for GMSK modulated signal shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of ± 2 dB under normal conditions; GSM 05.05, 4.1.1, first table.

2. The MS maximum output power for GMSK modulated signal shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of ± 2,5 dB under extreme conditions; GSM 05.05, 4.1.1, first table; GSM 05.05, D D.2.1, D.2.2.

3. The MS maximum output power for 8-PSK modulated signal shall be as defined in GSM 05.05, 4.1.1, second table, according to its power class, with a tolerances of ±2; ±3; +3/-4 dB defined under normal conditions in the GSM 05.05, 4.1.1, second table.

4. The MS maximum output power for 8-PSK modulated signal shall be as defined in GSM 05.05, 4.1.1, second table, according to its power class, with a tolerances of ±2,5; ±4; +4/-4,5 dB defined under extreme conditions in the GSM 05.05, 4.1.1, second table.

5. The power control levels for both GMSK and 8-PSK shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, third table (for GSM 400 and GSM 900), fourth table (for DCS 1800) or fifth table (for PCS 1900), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements 1), with a tolerance of ±2 dB; ±3 dB, 4 dB or 5 dB under normal conditions; GSM 05.05, 4.1.1, third, fourth or fifth table.

6. The power control levels for both GMSK and 8-PSK shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, third table (for GSM 400 and GSM 900), fourth table (for DCS 1800) or fifth table (for PCS 1900), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements 2), with a tolerance of ±2,5 dB; ±4 dB, 5 dB or 6 dB under extreme conditions; GSM 05.05, 4.1.1, third, fourth or fifth table; GSM 05.05, D.2.1, D.2.2.

7. For both GMSK and 8-PSK, the output power actually transmitted by the MS at consecutive power control levels shall form a monotonic sequence and the interval between power control levels shall be 2 dB ± 1,5 dB; GSM 05.05, 4.1.1.

8. The transmitted power level relative to time for a normal burst shall be within the power/time template given in GSM 05.05, annex B top figure for GMSK modulated signal. In multislot configurations where the bursts in two or more consecutive time slots are actually transmitted at the same frequency, no requirements are specified to the power ramping in the guard times between the active slots, and the template of annex B shall respected at the beginning and the end of the series of consecutive bursts:

   8.1 Under normal conditions; GSM 05.05, 4.5.2.

   8.2 Under extreme conditions; GSM 05.05, 4.5.2, GSM 05.05, D D.2.1, D.2.2.

9. The transmitted power level relative to time for a normal burst shall be within the power/time template given in GSM 05.05, annex B bottom figure for 8PSK modulated signal. In the case of Multislot Configurations where the bursts in two or more consecutive time slots are actually transmitted at the same frequency, the template of annex B shall be respected during the useful part of each burst and at the beginning and the end of the series of consecutive bursts. The output power during the guard period between every two consecutive active timeslots shall not exceed the level allowed for the useful part of the first timeslot, or the level allowed for the useful part of the second timeslot plus 3 dB, whichever is the highest.

   9.1 Under normal conditions; GSM 05.05, 4.5.2.

   9.2 Under extreme conditions; GSM 05.05, 4.5.2, GSM 05.05, D D.2.1, D.2.2.

10. When accessing a cell on the PRACH or RACH (random access) and before receiving the first power control parameters during packet transfer on PDCH, the MS shall use the output power defined by PMAX. MS_TXPWR_MAX_CCH is broadcast on the BCCH of the cell. A class 3 DCS 1800 MS shall add to it the value POWER OFFSET broadcast on the BCCH PMAX is the maximum allowed output power in the cell =GPRS_MS_TXPWR_MAX_CCH if PBCCH exists MS_TXPWR_MAX_CCH otherwise. GSM05.08, 10.2.1

11. The transmitted power level relative to time for a Random Access burst shall be within the power/time template given in GSM 05.05, annex B figure 3:

    11.1 Under normal conditions; GSM 05.05, 4.5.2.

    11.2 Under extreme conditions; GSM 05.05, 4.5.2, GSM 05.05, D D.2.1, D.2.2.

13.17.3.3 Test purpose

1. To verify that the maximum output power of the GMSK modulated signal of the MS in EGPRS multislot configuration, under normal conditions, is within conformance requirement 1.

2. To verify that the maximum output power of the GMSK modulated signal of the MS in EGPRS multislot configuration, under extreme conditions, is within conformance requirement 2.

3. To verify that the maximum output power of the 8-PSK modulated signal of the MS in EGPRS multislot configuration, under normal conditions, is within conformance requirement 3.

4. To verify that the maximum output power of the 8-PSK modulated signal of the MS in EGPRS multislot configuration, under extreme conditions, is within conformance requirement 4.

5. To verify that all power control levels, relevant to the class of MS, are implemented in the MS in EGPRS multislot configuration and have output power levels, under normal conditions, within conformance requirement 5.

6. To verify that all power control levels have output power levels, under extreme conditions, within conformance requirement 6.

7. To verify that the step in the output power transmitted by the MS in EGPRS multislot configuration at consecutive power control levels is within conformance requirement 7 under normal conditions.

8. To verify that the output power relative to time, when sending a normal burst of the GMSK modulated signal is within conformance requirement 8 in EGPRS multislot configuration:

   8.1 Under normal conditions.

   8.2 Under extreme conditions.

9. To verify that the output power relative to time, when sending a normal burst of the 8-PSK modulated signal is within conformance requirement 9 in EGPRS multislot configuration:

   9.1 Under normal conditions.

   9.2 Under extreme conditions.

10. To verify that the MS in EGPRS is within conformance requirement 10., when accessing the cell on RACH or PRACH.

11. To verify that the output power relative to time, when sending an access burst is within conformance requirement 11 in EGPRS multislot configuration:

   11.1 Under normal conditions.

   11.2 Under extreme conditions.

13.17.3.4 Methods of test

Two methods of test are described, separately for:

1) equipment fitted with a permanent antenna connector; and for

2) equipment fitted with an integral antenna, and which cannot be connected to an external antenna except by the fitting of a temporary test connector as a test fixture.

NOTE: The behaviour of the MS in the system is determined to a high degree by the antenna, and this is the only transmitter test in this ETS using the integral antenna. Further studies are ongoing on improved testing on the integral antenna, taking practical conditions of MS use into account.

13.17.3.4.1 Method of test for equipment with a permanent antenna connector

Initial conditions

A downlink TBF is set up according to the generic procedure in clause 40. The SS orders the MS to transmit on the uplink on a mid range ARFCN, power control level set to Max power and MS to operate in its highest number of uplink slots. This is achieved using the EGPRS test mode by transmitting a EGPRS TEST_CMD (see 04.14)

The SS controls the power level by setting the concerned timeslot's power control parameter ALPHA (α) to 0 and GAMMA_TN (Γ_{CH}) to the desired power level in the Packet Uplink Assignment message (Closed Loop Control, see 05.08, B.2) GPRS_ MS TXPWR_MAX_CCH/MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test. For DCS 1800 mobile stations the POWER_OFFSET parameter is set to 6 dB.

Test procedure

a) Measurement of normal burst transmitter output power

For GMSK, average power is determined for each burst as follows:

- The SS takes power measurement samples evenly distributed over the duration of one burst with a sampling rate of at least 2/T, where T is the symbol duration. The samples are identified in time with respect to the modulation on the burst. The SS identifies the centre of the useful 147 transmitted symbols, i.e. the transition from symbol 13 to 14 of the midamble, as the timing reference.

- The transmitter output power is calculated as the average of the samples over the 147 useful symbols. This is also used as the 0 dB reference for the power/time template.

For 8PSK, power may be determined by applying the technique described for GMSK above and then averaging over multiple bursts to achieve sufficient accuracy (see annex 5). Alternatively, an estimation technique based on a single burst which can be demonstrated to yield the same result as the long term average may be used. The long term average or the estimate of long term average is used as the 0dB reference for the power/time template.

b) Measurement of normal burst power/time relationship. The array of power samples measured in a) are referenced in time to the centre of the useful transmitted symbols and in power to the 0 dB reference, both identified in a).

c) Steps a) to b) are repeated on each timeslot within the multislot configuration with the MS commanded to operate on each of the power control levels defined, even those not supported by the MS.

d) The SS commands the MS to the maximum power control level supported by the MS and steps a) to b) are repeated on each timeslot within the multislot configuration for ARFCN in the Low and High ranges.

e) The SS commands the MS to the maximum power control level in the first timeslot allocated within the multislot configuration and to the minimum power control level in the second timeslot allocated. Any further timeslots allocated are to be set to the maximum power control level. Steps a) to b) and corresponding measurements on each timeslot within the multislot configuration are repeated. This step is only applicable to MS which support more than one uplink time slot.

f) Measurement of access burst transmitter output power

The SS causes the MS to generate an Access Burst on an ARFCN in the Mid ARFCN range, this could be either by a cell re-selection or a new request for radio resource. In the case of a cell re-selection procedure the Power Level indicated in the PSI3 message is the maximum power control level supported by the MS. The Power Level of the Access Burst shall be as indicated in the GPRS_MS_TXPWR_MAX_CCH parameter. If the power class of the MS is DCS 1800 Class 3 and the Power Level is indicated by the MS_TXPWR_MAX_CCH parameter, the MS shall also use the POWER_OFFSET parameter.

The SS takes power measurement samples evenly distributed over the duration of the access burst as described in a). However, in this case the SS identifies the centre of the useful symbols of the burst by identifying the transition from the last bit of the synch sequence. The centre of the burst is then five data symbols prior to this point and is used as the timing reference.

The transmitter output power is calculated as the average of the samples over the 87 useful symbols of the burst. This is also used as the 0 dB reference for the power/time template.

g) Measurement of access burst power/time relationship

The array of power samples measured in f) are referenced in time to the centre of the useful transmitted symbols and in power to the 0 dB reference, both identified in f).

h) Depending on the method used in step f) to cause the MS to send an Access Burst, the SS sends either a PACKET CELL CHANGE ORDER along with power control level set to 10 in PSI3 parameter GPRS_MS_TXPWR_MAX_CCH or it changes the (Packet) System Information elements (GPRS_)MS_TXPWR_MAX_CCH and for DCS 1800 the POWER_OFFSET on the serving cell PBCCH/BCCH in order to limit the MS transmit power on the Access Burst to power control level 10 (+23 dBm for GSM 400 and GSM 900 or +10 dBm for DCS 1800 and PCS 1900) and then steps f) to g) are repeated.

i) Steps a) to h) are repeated under extreme test conditions (annex 1, TC2.2) except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

13.17.3.4.2 Method of test for equipment with an integral antenna

NOTE 1: If the MS is equipped with a permanent connector, such that the antenna can be disconnected and the SS be connected directly, then the method of clause 13.17.3.4.1 will be applied.

The tests in this clause are performed on an unmodified test sample.

Initial conditions

The MS is placed in the anechoic shielded chamber (annex 1, GC5) or on the outdoor test site, on an isolated support, in the position for normal use, at a distance of at least 3 metres from a test antenna, connected to the SS.

NOTE 2: The test method described has been written for measurement in an anechoic shielded chamber. If an outdoor test site is used then, in addition, it is necessary to raise/lower the test antenna through the specified height range to maximize the received power levels from both the test sample and the substitution antenna.

The initial conditions for the MS are defined in 13.17.3.4.1.1

Test procedure

a) With the initial conditions set according to clause 13.17.3.4.2.1 the test procedure in 13.17.3.4.1.2 is followed up to and including step h), except that in step a), when measurements are done at maximum power for ARFCN in the Low, Mid and High range, the measurement is made eight times with the MS rotated by n×45 degrees for all values of n in the range 0 to 7.

   The measurements taken are received transmitter output power measurements rather than transmitter output power measurements, the output power measurement values can be derived as follows.

b) Assessment of test site loss for scaling of received output power measurements.

   The MS is replaced by a half-wave dipole, resonating at the centre frequency of the transmit band, connected to an RF generator.

   The frequency of the RF signal generator is set to the frequency of the ARFCN used for the 24 measurements in step a), the output power is adjusted to reproduce the received transmitter output power averages recorded in step a).

   For each indication the power, delivered by the generator (in Watts) to the half-wave dipole, is recorded. These values are recorded in the form Pnc, where n = MS rotation and c = channel number.

   For each channel number used compute:

$$\text{Pac(Watts into dipole)} = \frac{1}{8} * \sum_{n=0}^{n=7} \text{Pnc}$$

   from which: Pac (Tx dBm) = $10\log_{10}$(Pac) + 30 + 2,15

   The difference, for each of the three channels, between the actual transmitter output power averaged over the 8 measurement orientations and the received transmitter output power at orientation n = 0 is used to scale the received measurement results to actual transmitter output powers for all measured power control levels and ARFCN, which can then be checked against the requirements.

c) Temporary antenna connector calibration factors (transmit)

   A modified test sample equipped with a temporary antenna connector is placed in a climatic test chamber and is linked to the SS by means of the temporary antenna connector.

Under normal test conditions, the power measurement and calculation parts of steps a) to j) of 13.17.3.4.1.2 are repeated except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

NOTE 3: The values noted here are related to the output transmitter carrier power levels under normal test conditions, which are known after step b). Therefore frequency dependent calibration factors that account for the effects of the temporary antenna connector can be determined.

d) Measurements at extreme test conditions.

NOTE 4: Basically the procedure for extreme conditions is:

- the power/time template is tested in the "normal" way;
- the radiated power is measured by measuring the difference with respect to the radiated power under normal test conditions.

Under extreme test conditions steps a) to h) of 13.17.3.4.1.2 are repeated except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

The transmitter output power under extreme test conditions is calculated for each burst type, power control level and for every frequency used by adding the frequency dependent calibration factor, determined in c), to the values obtained at extreme conditions in this step.

13.17.3.5 Test requirements

a) The transmitter output power for the GMSK modulated signals, under every combination of normal and extreme test conditions, for normal bursts and access bursts, at each frequency and for each power control level applicable to the MS power class, shall be at the relevant level shown in table 13.17.3-1 or table 13.17.3-3 within the tolerances also shown in table 13.17.3-1 or table 13.17.3-3.

b) The transmitter output power for the 8-PSK modulated signals, under every combination of normal and extreme test conditions, for normal bursts and access bursts, at each frequency and for each power control level applicable to the MS power class, shall be at the relevant level shown in table 13.17.3-2 or table 13.17.3-4 within the tolerances also shown in table 13.17.3-2 or table 13.17.3-4.

GSM 400 and GSM 900 beginning

Table 13.17.3-1: GSM 400 and GSM 900 transmitter output power for different power classes GMSK

Power class				Power control level	Transmitter output power	Tolerances	
2	3	4	5		dBm	normal	extreme
·				2	39	±2 dB	±2,5 dB
·	·			3	37	±3 dB (see note)	±4 dB (see note)
·	·			4	35	±3 dB	±4 dB
·	·	·		5	33	±3 dB (see note)	±4 dB (see note)
·	·	·		6	31	±3 dB	±4 dB
·	·	·	·	7	29	±3 dB (see note)	±4 dB (see note)
·	·	·	·	8	27	±3 dB	±4 dB
·	·	·	·	9	25	±3 dB	±4 dB
·	·	·	·	10	23	±3 dB	±4 dB
·	·	·	·	11	21	±3 dB	±4 dB
·	·	·	·	12	19	±3 dB	±4 dB
·	·	·	·	13	17	±3 dB	±4 dB
·	·	·	·	14	15	±3 dB	±4 dB
·	·	·	·	15	13	±3 dB	±4 dB
·	·	·	·	16	11	±5 dB	±6 dB
·	·	·	·	17	9	±5 dB	±6 dB
·	·	·	·	18	7	±5 dB	±6 dB
·	·	·	·	19	5	±5 dB	±6 dB
NOTE: When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.							

Table 13.17.3-2: GSM 400 and GSM 900 transmitter output power for different power classes 8 PSK Modulated Signals

Power class			Power control level	Transmitter output power	Tolerances	
E1	E2	E3				
·			5	33	±2 dB	±2,5dB
			6	31	±3 dB	±4 dB
			7	29	±3 dB	±4 dB
	·		8	27	±3 dB	±4 dB
	·		9	25	±3 dB	±4 dB
	·	·	10	23	±3 dB	±4 dB
	·	·	11	21	±3 dB	±4 dB
	·	·	12	19	±3 dB	±4 dB
	·	·	13	17	±3 dB	±4 dB
	·	·	14	15	±3 dB	±4 dB
	·	·	15	13	±3 dB	±4 dB
	·	·	16	11	±5 dB	±6 dB
	·	·	17	9	±5 dB	±6 dB
	·	·	18	7	±5 dB	±6 dB
	·	·	19	5	±5 dB	±6 dB

GSM 400 and GSM 900 - end

DCS 1800 and PCS 1900 - beginning

Table 13.17.3-3: DCS 1800 and PCS 1900 transmitter output power for different power classes GMSK Modulated signal

Power class			Power control level	Transmitter output power	Tolerances	
1	**2**	**3**		**dBm**	**normal**	**extreme**
		·	29	36	±2,0 dB	±2,5 dB
		·	30	34	±3,0 dB	±4,0 dB
		·	31	32	±3,0 dB	±4,0 dB
·		·	0	30	±3,0 dB (see note)	±4 dB (see note)
·		·	1	28	±3 dB	±4 dB
·		·	2	26	±3 dB	±4 dB
·	·	·	3	24	±3 dB (see note)	±4 dB (see note)
·	·	·	4	22	±3 dB	±4 dB
·	·	·	5	20	±3 dB	±4 dB
·	·	·	6	18	±3 dB	±4 dB
·	·	·	7	16	±3 dB	±4 dB
·	·	·	8	14	±3 dB	±4 dB
·	·	·	9	12	±4 dB	±5 dB
·	·	·	10	10	±4 dB	±5 dB
·	·	·	11	8	±4 dB	±5 dB
·	·	·	12	6	±4 dB	±5 dB
·	·	·	13	4	±4 dB	±5 dB
·	·	·	14	2	±5 dB	±6 dB
·	·	·	15	0	±5 dB	±6 dB
NOTE: When the power control level corresponds to the power class of the MS, then the tolerances shall be 2,0 dB under normal test conditions and 2,5 dB under extreme test conditions.						

Table 13.17.3-4: DCS 1800 and PCS 1900 transmitter output power for different power classes 8-PSK Modulated Signals

Power class			Power control level	Transmitter output power	Tolerances	
E1	E2	E3			NORMAL	EXTREME
·			0	30	±3 dB	±4dB
			1	28	±3 dB	±4 dB
	·		2	26	±3 dB	±4 dB
	·		3	24	±3 dB	±4 dB
	·	·	4	22	±3 dB	±4 dB
	·	·	5	20	±3 dB	±4 dB
	·	·	6	18	±3 dB	±4 dB
	·	·	7	16	±3 dB	±4 dB
	·	·	8	14	±4 dB	±4 dB
	·	·	9	12	±4 dB	±5 dB
	·	·	10	10	±4 dB	±5 dB
	·	·	11	8	±4 dB	±5 dB
	·	·	12	6	±4 dB	±5 dB
	·	·	13	4	±5 dB	±5 dB
	·	·	14	2	±5 dB	±6 dB

DCS 1800 and PCS 1900 - end

c) The difference between the transmitter output power at two adjacent power control levels, measured at the same frequency, shall not be less than 0,5 dB and not be more than 3,5 dB.

d) The power/time relationship of the measured samples for normal bursts shall be within the limits of the power time template of figure 13.17.3-1for GMSK and figure 13.17.3-2 for 8-PSK at each frequency, under every combination of normal and extreme test conditions and at each power control level measured.

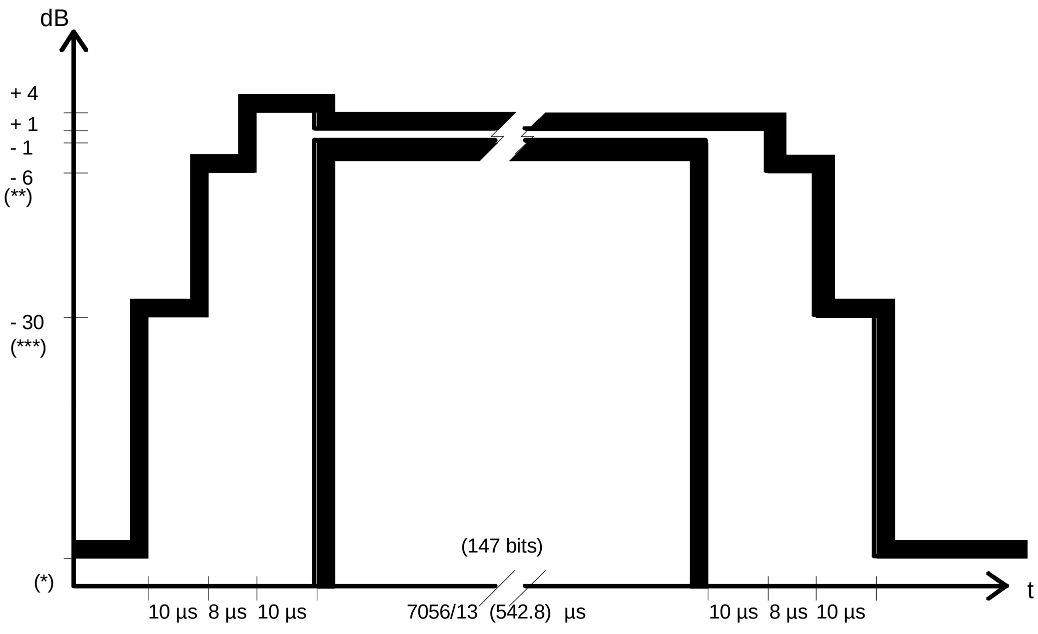


Figure 13.17.3-1: Power/time template for normal bursts (GMSK modulation)

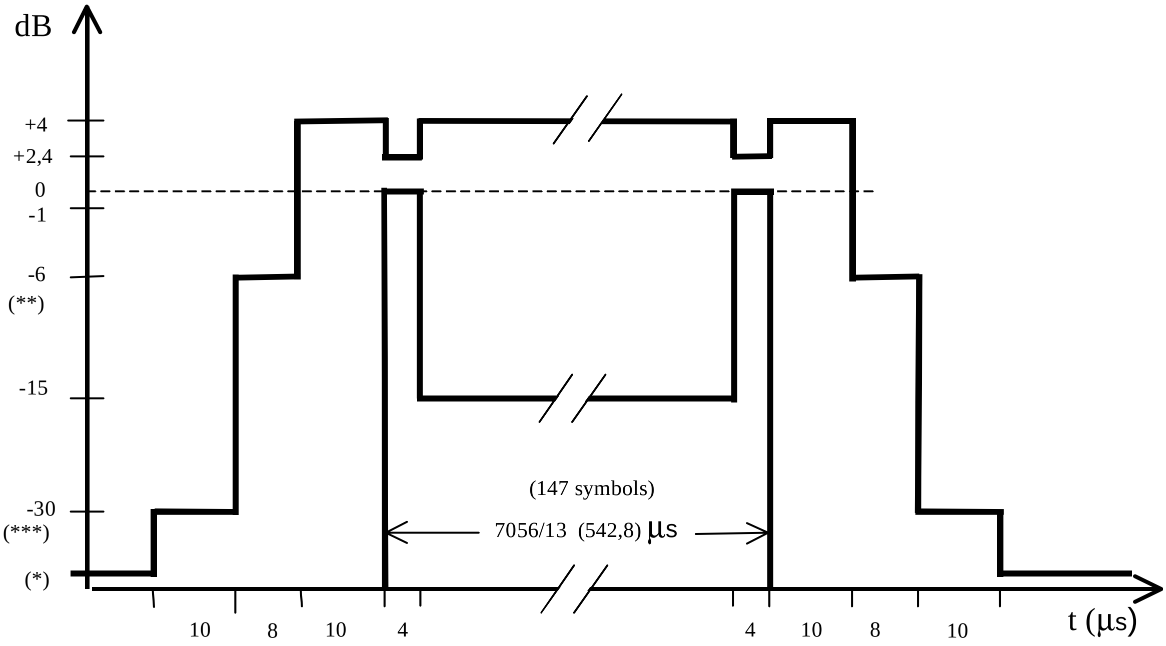


Figure 13.17.3-2: Time mask for normal duration bursts (NB) at 8-PSK modulation

d) All the power control levels, for the type and power class of the MS as stated by the manufacturer, shall be implemented in the MS.

f) When the transmitter is commanded to a power control level outside of the capability corresponding to the type and power class of the MS as stated by the manufacturer, then the transmitter output power shall be within the tolerances for the closest power control level corresponding to the type and power class as stated by the manufacturer.

g) The power/time relationship of the measured samples for access bursts shall be within the limits of the power time template of figure 13.17.3-3 at each frequency, under every combination of normal and extreme test conditions and at each power control level measured.

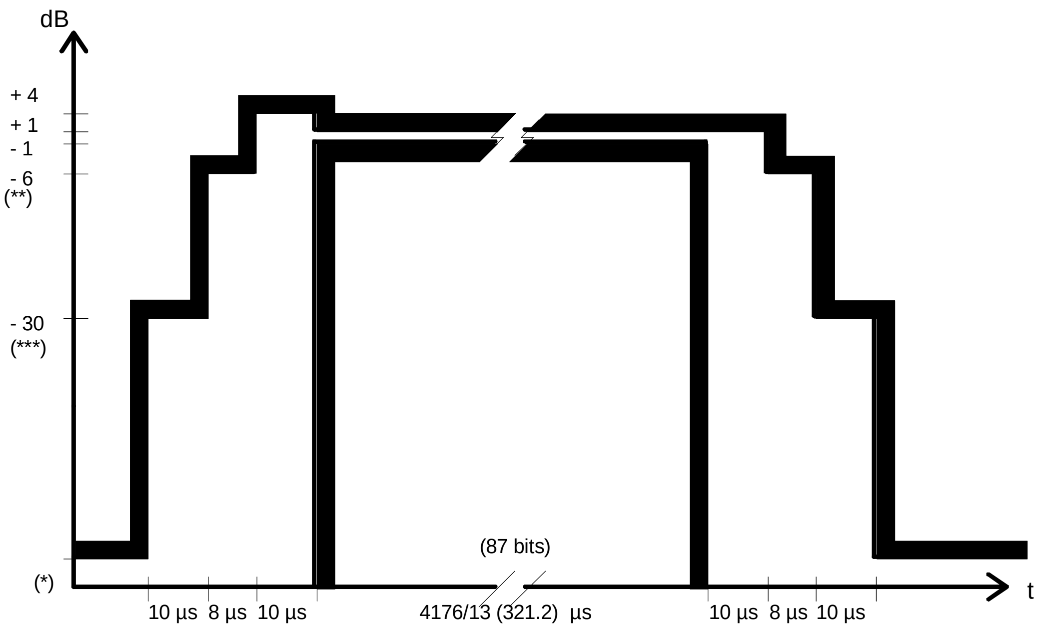


Figure 13.17.3-3: Power/time template for access burst

Table 13.17.3-3: Lowest measurement limit for power/time template

(*)	For GSM 400 and GSM 900 MS	:	59 dBc or -54 dBm whichever is the highest, except for the timeslot preceding the active slot, for which the allowed level is -59 dBc or -36 dBm, whichever is the highest
	For DCS 1800 MS and PCS 1900 MS	: :	-48 dBc or -48 dBm, whichever is the higher; no requirement below -30 dBc (see 4.5.1).
(**)	For GSM 400 and GSM 900 MS	:	-4 dBc for power control level 16; -2 dBc for power level 17; -1 dBc for power level controls levels 18 and 19.
	For DCS 1800 MS		-4 dBc for power control level 11; -2 dBc for power level 12; -1 dBc for power control levels 13,14 and 15.
(***)	For GSM 400 and GSM 900 MS	:	-30 dBc or -17 dBm, whichever is the higher.
	For DCS 1800 MS		-30 dBc or -20 dBm, whichever is the higher.

13.17.4 Output RF spectrum in EGPRS configuration

13.17.4.1 Definition and applicability

The output RF spectrum is the relationship between the frequency offset from the carrier and the power, measured in a specified bandwidth and time, produced by the MS due to the effects of modulation and power ramping.

The requirements and this test apply to all types of GSM 400, GSM 900, DCS 1800 MS and PCS 1900 and multiband GSM 900/DCS 1800/PCS 1900 which are capable of EGPRS multislot operation.

13.17.4.2 Conformance requirement

1. The level of the output RF spectrum due to GMSK and 8PSK modulations shall be no more than that given in GSM 05.05, 4.2.1, with the following lowest measurement limits:

   - 36 dBm below 600 kHz offset from the carrier;

   - 51 dBm for GSM 400 and GSM 900 or -56 dBm for DCS 1800 and PCS 1900 from 600 kHz out to less than 1 800 kHz offset from the carrier;

   - 46 dBm for GSM 400 and GSM 900 or -51 dBm for DCS 1800 and PCS 1900 at and beyond 1 800 kHz offset from the carrier;

   but with the following exceptions at up to -36 dBm:

   - up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz in the combined range 600 kHz to 6 000 kHz above and below the carrier;

   - up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz at more than 6 000 kHz offset from the carrier.

   1.1 Under normal conditions; GSM 05.05, 4.2.1.

   1.2 Under extreme conditions; GSM 05.05, 4.2.1; GSM 05.05, D D.2.1, D.2.2.

2. The level of the output RF spectrum due to switching transients shall be no more than given in GSM 05.05, 4.2.2, table "a) Mobile Station:".

   2.1 Under normal conditions; GSM 05.05, 4.2.2.

   2.2 Under extreme conditions; GSM 05.05, 4.2.2; GSM 05.05, D D.2.1, D.2.2.

3. When allocated a channel, the power emitted by the GSM 400, GSM 900 and DCS 1800 MS, in the band 915 MHz to 921 MHz shall be no more than -67 dBm (TETRA 870 only), in the band 935 MHz to 960 MHz shall be no more than -79 dBm, in the band 925 MHz to 935 MHz shall be no more than -67 dBm and in the band 1 805 MHz to 1 880 MHz shall be no more than -71 dBm, except in five measurements in each of the bands 925 MHz to 960 MHz and 1 805 MHz to 1 880 MHz, where exceptions at up to -36 dBm are permitted. For GSM 400 mobiles excluding TETRA, in addition, a limit of -67 dBm shall apply in the frequency bands 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz. For TETRA 380, TETRA 410 and TETRA 450, in addition, the power emitted by MS, in the bands 390 MHz to 400 MHz and 420 MHz to 430 MHz and 460 MHz to 470 MHz shall be no more than -62 dBm except in three measurements in each band where exceptions at up to -36 dBm are permitted.

   The power emitted by the PCS 1900 shall not exceed -71 dBm in frequency band 1 930 MHz to 1 990 MHz, Under normal conditions; GSM 05.05, 4.3.3.

13.17.4.3 Test purpose

1. To verify that the output RF spectrum due to modulation does not exceed conformance requirement 1 in the EGPRS multislot configurations.

   1.1 Under normal conditions.

   1.2 Under extreme conditions.

2. To verify that the output RF spectrum due to switching transients does not exceed conformance requirement 2 in the EGPRS multislot configurations when a reasonable margin is allowed for the effect of spectrum due to modulation.

   2.1 Under normal conditions.

   2.2 Under extreme conditions.

3. To verify that the MS spurious emissions in the MS receive band do not exceed conformance requirement 3 in the EGPRS multislot configurations.

13.17.4.4 Method of test

Initial conditions

The MS is ordered to transmit EGPRS RLC data blocks containing random data with the highest number of uplink slots. This is achieved using the EGPRS test mode by transmitting a EGPRS TEST_CMD (see GSM 04.14)

The SS commands the MS to hopping mode. The hopping pattern includes only three channels, namely one with an ARFCN in the Low ARFCN range, a second one with an ARFCN in the Mid ARFCN range and the third one with an ARFCN in the High ARFCN range.

In the case that loop-back method of the EGPRS test mode is used, the SS sends the pseudo-random signal specified for the uplink only transmission method of EGPRS test mode in GSM 04.14. The SS shall use a level of 23 dBµVemf( ).

NOTE 1: Although the measurement is made whilst the MS is in hopping mode, each measurement is on one single channel.

NOTE 2: This test is specified in hopping mode as a simple means of making the MS change channel, it would be sufficient to test in non hopping mode and to cell re-select the MS between the three channels tested at the appropriate time.

13.17.4.4.2 Test procedure

This procedure shall apply to both GMSK and 8PSK modulations.

NOTE: When averaging is in use during frequency hopping mode, the averaging only includes bursts transmitted when the hopping carrier corresponds to the nominal carrier of the measurement.

a) In steps b) to h) the FT is equal to the hop pattern ARFCN in the Mid ARFCN range.

b) The other settings of the spectrum analyser are set as follows:

- Zero frequency scan
- Resolution bandwidth: 30 kHz
- Video bandwidth: 30 kHz
- Video averaging: may be used, depending on the implementation of the test

The video signal of the spectrum analyser is "gated" such that the spectrum generated by at least 40 of the symbols 87 to 132 of the burst in one of the active time slots is the only spectrum measured. This gating may be analogue or numerical, dependent upon the design of the spectrum analyser. Only measurements during transmitted bursts on the nominal carrier of the measurement are included. The spectrum analyser averages over the gated period and over 200 or 50 such bursts, using numerical and/or video averaging.

c) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 50 bursts at all multiples of 30 kHz offset from FT to < 1 800 kHz.

d) The resolution and video bandwidth on the spectrum analyser are adjusted to 100 kHz and the measurements are made at the following frequencies:

- on every ARFCN from 1 800 kHz offset from the carrier to the edge of the relevant transmit band for each measurement over 50 bursts;
- at 200 kHz intervals over the 2 MHz either side of the relevant transmit band for each measurement over 50 bursts;
- at 200 kHz intervals over the band 915 MHz to 921 MHz for each measurement over 50 bursts, (TETRA 870 only);
- at 200 kHz intervals over the band 925 MHz to 960 MHz for each measurement over 50 bursts;
- at 200 kHz intervals over the band 1 805 MHz to 1 880 MHz for each measurement over 50 bursts;
- at 200 kHz intervals over the band 1 930 MHz to 1 990 MHz for each measurement over 50 bursts.

in addition for GSM 400 MS:

- at 200 kHz intervals over the band 390 MHz to 400 MHz for each measurement over 50 bursts;
- at 200 kHz intervals over the band 420 MHz to 430 MHz for each measurement over 50 bursts;
- at 200 kHz intervals over the band 460 MHz to 470 MHz for each measurement over 50 bursts.

e) The MS is commanded to its minimum power control level. The spectrum analyser is set again as in b).

f) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 200 bursts at the following frequencies:

- FT
- FT + 100 kHzFT - 100 kHz
- FT + 200 kHzFT - 200 kHz
- FT + 250 kHzFT - 250 kHz
- FT + 200 kHz × N FT - 200 kHz × N

where N = 2, 3, 4, 5, 6, 7, and 8

and FT = RF channel nominal centre frequency.

g) Steps a) to f) is repeated except that in step a) the spectrum analyser is gated so that the burst of the next active time slot is measured.

h) The spectrum analyser settings are adjusted to:

- Zero frequency scan
- Resolution bandwidth: 30 kHz
- Video bandwidth: 100 kHz
- Peak hold

The spectrum analyser gating of the signal is switched off.

The MS is commanded to its maximum power control level in every transmitted time slot.

i) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured at the following frequencies:

- FT + 400 kHzFT - 400 kHz
- FT + 600 kHzFT - 600 kHz
- FT + 1,2 MHz FT - 1,2 MHz
- FT + 1,8 MHz FT - 1,8 MHz

where FT = RF channel nominal centre frequency.

The duration of each measurement (at each frequency) will be such as to cover at least 10 burst transmissions at FT.

j) Step i) is repeated for power control levels 7 and 11.

k) Steps b), f), h) and i) are repeated with FT equal to the hop pattern ARFCN in the Low ARFCN range except that in step h) the MS is commanded to power control level 11 rather than maximum power.

l) Steps b), f), h) and i) are repeated with FT equal to the hop pattern ARFCN in the High ARFCN range except that in step h) the MS is commanded to power control level 11 rather than maximum power.

m) Steps a) b) f) h), and i) are repeated under extreme test conditions (annex 1, TC2.2). except that at step h) the MS is commanded to power control level 11.

13.17.4.5 Test requirements

For absolute measurements, performed on a temporary antenna connector, in the frequency band 380 MHz to 390 MHz, 410 MHz to 420 MHz, 450 MHz to 460 MHz or 880 MHz to 915 MHz or 1 710 MHz to 1 785 MHz or 1 850 MHz to1 910 MHz, the temporary antenna connector coupling factor, determined according to 13.3.4.2.2 and annex 1 GC7, for the nearest relevant frequency, will be used.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 380 MHz to 390 MHz, 410 MHz to 420 MHz, 450 MHz to 460 MHz or 915 MHz to 960 MHz, the temporary antenna connector coupling factor, will be as determined according to annex 1 GC7 for GSM 400 or GSM 900 MS respectively. For a DCS 1800 MS and PCS 1900 MS 0 dB will be assumed.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 1 805 MHz to 1 880 MHz, the temporary antenna connector coupling factor, will be as determined according to annex 1 GC7 for DCS 1800 MS. For GSM 400 MS and GSM 900 MS 0 dB will be assumed.

The figures in the tables below, at the listed frequencies from the carrier (kHz), are the maximum level (dB) relative to a measurement in 30 kHz bandwidth on the carrier (reference GSM 05.05, 4.2.1).

a) For the modulation sidebands out to less than 1 800 kHz offset from the carrier frequency (FT) measured in step c), f), i), k), l) and m) the measured power level in dB relative to the power level measured at FT, for all types of MS, shall not exceed the limits derived from the values shown in table 13.17.4-1 for GSM 400 and GSM 900 or table 13.17.4-2 for DCS 1800 and PCS 1900 MS, according to the actual transmit power and frequency offset from FT. However any failures in the combined range 600 kHz to less than 1 800 kHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below.

Table 13.17.4-1: GSM 400 and GSM 900 Spectrum due to modulation out to less than 1 800 kHz offset

	power levels in dB relative to the measurement at FT				
Power level	**Frequency offset (kHz)**				
(dBm)	**0-100**	**200**	**250**	**400**	**600 to < 1 800**
39	+0,5	-30	-33	-60	-66
37	+0,5	-30	-33	-60	-64
35	+0,5	-30	-33	-60	-62
≤ 33	+0,5	-30	-33	-60*	-60
The values above are subject to the minimum absolute levels (dBm) below.					
	-36	-36	-36	-36	-51
NOTE: * For equipment supporting 8PSK, the requirement for 8-PSK modulation is -54dB.					

Table 13.17.4-2: DCS 1800/PCS 1900 Spectrum due to modulation out to less than 1 800 kHz offset

	power levels in dB relative to the measurement at FT				
Power level	**Frequency offset (kHz)**				
(dBm)	**0-100**	**200**	**250**	**400**	**600 to < 1 800**
≤ 36	+0,5	-30	-33	-60	-60
34	+0.5	-30	-33	-60	-60
32	+0.5	-30	-33	-60	-60
30	+0.5	-30	-33	-60*	-60
The values above are subject to the minimum absolute levels (dBm) below.					
	-36	-36	-36	-36	-56
NOTE: * For equipment supporting 8-PSK, the requirement for 8-PSK modulation is -54dB.					

NOTE 1: For frequency offsets between 100 kHz and 600 kHz the requirement is derived by a linear interpolation between the points identified in the table with linear frequency and power in dB relative.

b) For the modulation sidebands from 1 800 kHz offset from the carrier frequency (FT) and out to 2 MHz beyond the edge of the relevant transmit band, measured in step d), the measured power level in dB relative to the power level measured at FT, shall not exceed the values shown in table 13.17.4-3 according to the actual transmit power, frequency offset from FT and system on which the MS is designed to operate. However any failures in the combined range 1 800 kHz to 6 MHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below, and any other failures may be counted towards the exceptions allowed in test requirements d) below.

Table 13.17.4-3: Spectrum due to modulation from 1 800 kHz offset to the edge of the transmit band (wideband noise)

power levels in dB relative to the measurement at FT						
GSM 400 and GSM 900				DCS 1800 and PCS 1900		
Power level (dBm)	Frequency offset kHz			Power level (dBm)	Frequency offset kHz	
	1 800 to < 3 000	3 000 to < 6 000	≥ 6 000		1 800 to < 6 000	≥ 6 000
39	-69	-71	-77	36	-71	-79
37	-67	-69	-75	34	-69	-77
35	-65	-67	-73	32	-67	-75
≤ 33	-63	-65	-71	30	-65	-73
				28	-63	-71
				26	-61	-69
				≤ 24	-59	-67
The values above are subject to the minimum absolute levels (dBm) below.						
	-46	-46	-46		-51	-51

c) Any failures (from a) and b) above) in the combined range 600 kHz to 6 MHz above and below the carrier should be re-checked for allowed spurious emissions. For each of the three ARFCN used, spurious emissions are allowed in up to three 200 kHz bands centred on an integer multiple of 200 kHz so long as no spurious emission exceeds -36 dBm. Any spurious emissions measured in a 30 kHz bandwidth which spans two 200 kHz bands can be counted towards either 200 kHz band, whichever minimizes the number of 200 kHz bands containing spurious exceptions.

d) Any failures (from b) above) beyond 6 MHz offset from the carrier should be re-checked for allowed spurious emissions. For each of the three ARFCN used, up to twelve spurious emissions are allowed so long as no spurious emission exceeds -36 dBm.

e) The MS spurious emissions in the bands 460,4 MHz to 467,6 MHz, 488,8 MHz to 496 MHz, 925 MHz to 935 MHz, 935 MHz to 960 MHz, 1 805 MHz to 1 880 MHz and 1 850 MHz to1 910 MHz measured in step d), for all types of MS, shall not exceed the values shown in table 13.16.4-4 except in up to 3 measurements in the band 460,4 MHz to 467,6 MHz and 488,8 MHz to 496 MHz, in up to five measurements in the band 925 MHz to 960 MHz and five measurements in the band 1 805 MHz to 1 880 MHz where a level up to -36 dBm is permitted. For TETRA 870, in addition, the MS spurious emissions in the bands 915 MHz to 921 MHz, 935 MHz to 960 MHz and 1 805 MHz to 1 880 MHz, measured in step d), for all types of MS, shall not exceed the value of -67 dBm. For TETRA 380, TETRA 410 and TETRA 450, in addition, the power emitted by MS, in the bands 390 MHz to 400 MHz and 420 MHz to 430 MHz and 460 MHz to 470 MHz shall be no more than -62 dBm except in three measurements in each band, where exceptions at up to -36 dBm are permitted.

Table 13.17.4-4: Spurious emissions in the MS receive bands

Band (MHz)	Spurious emissions level (dBm)
460-496	-67 Applicable only for GSM 400 mobiles
925 to 935 935 to 960 1 805 to 1 880	-67 -79 -71
1 850 to 1 910	Comply with FCC rules for wideband PCS services (see GSM 05.05, 4.3)

f) For the power ramp sidebands of steps h), i) and k) the power levels must not exceed the values shown in table 13.17.4-5 for GSM 900 or table 13.17.4-6 for DCS 1800.

Table 13.17.4-5: GSM Spectrum due to switching transients

Power level	Maximum level for various offsets from carrier frequency			
	400 kHz	600 kHz	1 200 kHz	1 800 kHz
39 dBm	-13 dBm	-21 dBm	-21 dBm	-24 dBm
37 dBm	-15 dBm	-21 dBm	-21 dBm	-24 dBm
35 dBm	-17 dBm	-21 dBm	-21 dBm	-24 dBm
33 dBm	-19 dBm	-21 dBm	-21 dBm	-24 dBm
31 dBm	-21 dBm	-23 dBm	-23 dBm	-26 dBm
29 dBm	-23 dBm	-25 dBm	-25 dBm	-28 dBm
27 dBm	-23 dBm	-26 dBm	-27 dBm	-30 dBm
25 dBm	-23 dBm	-26 dBm	-29 dBm	-32 dBm
23 dBm	-23 dBm	-26 dBm	-31 dBm	-34 dBm
≤ +21 dBm	-23 dBm	-26 dBm	-32 dBm	-36 dBm

Table 13.17.4-6: DCS 1800/PCS1 900 Spectrum due to switching transients

Power level	Maximum level for various offsets from carrier frequency			
	400 kHz	600 kHz	1 200 kHz	1 800 kHz
36 dBm	-16 dBm	-21 dBm	-21 dBm	-24 dBm
34 dBm	-18 dBm	-21 dBm	-21 dBm	-24 dBm
32 dBm	-20 dBm	-22 dBm	-22 dBm	-25 dBm
30 dBm	-22 dBm	-24 dBm	-24 dBm	-27 dBm
28 dBm	-23 dBm	-25 dBm	-26 dBm	-29 dBm
26 dBm	-23 dBm	-26 dBm	-28 dBm	-31 dBm
24 dBm	-23 dBm	-26 dBm	-30 dBm	-33 dBm
22 dBm	-23 dBm	-26 dBm	-31 dBm	-35 dBm
≤ +20 dBm	-23 dBm	-26 dBm	-32 dBm	-36 dBm

NOTE 2: These figures are different from the requirements in GSM 05.05 because at higher power levels it is the modulation spectrum which is being measured using a peak hold measurement. This allowance is given in the table.

NOTE 3: The figures for table 13.17.3-5 and table 13.17.3-6 assume that, using the peak hold measurement, the lowest level measurable is 8 dB above the level of the modulation specification using the 30 kHz bandwidth gated average technique for 400 kHz offset from the carrier. At 600 kHz and 1 200 kHz offset the level is 6 dB above and at 1 800 kHz offset the level is 3 dB above. The figures for 1 800 kHz have assumed the 30 kHz bandwidth spectrum due to modulation specification at < 1 800 kHz.

13.17.5 Intermodulation attenuation

13.17.5.1 Definition and applicability

The intermodulation attenuation is the ratio, in dB, of the power level of the wanted signal to the power level of the highest intermodulation component.

The requirements and this test apply to all types of DCS 1800 MS and PCS 1900.

13.17.5.2 Conformance requirement

The maximum level of any intermodulation product shall be no less than 50 dB below the level of the wanted signal when an interfering CW signal is applied, within the transmit band, at a frequency offset of 800 kHz and with a power level 40 dB below the power level of the wanted signal; GSM 05.05, 4.7.3.

13.17.5.3 Test purpose

To verify that the MS intermodulation attenuation is no less than conformance requirement 1.

13.17.5.4 Method of test

NOTE 1: When the measurements are performed precautions must be taken, so that non-linearities in the selective measuring device do not influence the results appreciably. Furthermore it should be ensured that intermodulation components which may be generated by non-linear elements in the test equipment (e.g. signal generator, circulators, selective measuring device) are sufficiently reduced. The RF transmit equipment under test and the test signal source should be physically separated in such a way that the measurement is not influenced by direct radiation.

NOTE 2: In the case of an MS which does not normally include an antenna connector, the coupling loss of the temporary antenna connector must be taken into account.

13.17.5.4.1 Initial conditions

The antenna output of the MS is connected to the SS via a coupling device, presenting to the MS a load with an impedance of 50 Ω. The coupling device may consist of a circulator with one port connected by a coaxial cable to the output terminal of the MS, the second port correctly terminated with 50 Ω into a selective measuring device (e.g. a spectrum analyser) and the third port connected to the interfering test signal source via an isolator.

The MS is ordered to transmit EGPRS RLC data blocks containing random data with the highest number of uplink slots. This is achieved using the EGPRS test mode by transmitting a EGPRS TEST_CMD (see 04.14) The ARFCN is set to a Mid range value and POWER control level is set to maximum.

13.17.5.4.2 Procedure

This procedure shall apply to both GMSK and 8PSK modulations.

a) The interfering test signal will be unmodulated and the frequency will be 800 kHz above the transmit frequency of the MS under test. the power level is adjusted to give the equivalent of 40 dB below the transmit power level of the MS, if both the MS transmit power and the interfering test signal were measured with a correct termination but with the other signal absent.

b) The frequency selective measuring device is set to measure peak hold in a bandwidth of 300 kHz. Any intermodulation components in the MS transmit band, are then measured.

c) Steps a) and b) are repeated with the test signal at a frequency 800 kHz below the transmitted frequency.

13.17.5.5 Test requirements

The level of each intermodulation component, in the MS transmit band, shall be no less than 50 dB below the level of the transmit power of the wanted MS carrier.

Annex B (normative): Specific tests for GSM BTS

The following test cases are adapted from GSM 11.21, in order to make them applicable to a TAPS BTS. The GSM 11.21 numbering scheme has been retained for ease of maintenance.

6.2 Modulation accuracy

6.2.1 Test purpose

1) To verify the correct implementation of the pulse shaping filtering.
2) To verify that the phase error during the active part of the time slot does not exceed the specified limits under normal and extreme test conditions and when subjected to vibration.
3) To verify that the frequency error during the active part of the time slot does not exceed the specified limits under normal and extreme test conditions and when subjected to vibration.

6.2.2 Test case

All TRXs in the configuration shall be switched on transmitting full power in all time slots for at least 1 hour before starting the test.

If the Manufacturer declares that Synthesizer Slow Frequency Hopping is supported by the BSS, the BSS shall be configured with the maximum number of TRXs with ARFCNs which shall be distributed over the entire declared bandwidth of operation for the BSS under test, and including B, M and T, and three tests shall be performed. These tests may either use a test apparatus which employs the same hopping sequence as the BSS, or a fixed frequency apparatus on the radio frequency channels B, M and T. If only Baseband SFH is supported or SFH is not supported, one test shall be performed for each of the radio frequency channels B, M and T, using different TRXs to the extent possible for the configuration. As a minimum, one time slot shall be tested on each TRX specified to be tested.

GMSK modulation

The transmitted GMSK modulated signal from the TRX under test shall be extracted in the BSSTE for a pseudo-random known bit stream of encrypted bits into the TRX modulator (the BSSTE is defined in clause B.1). The pseudo-random bit stream shall be any 148 bit sub-sequence of the 511 bit pseudo-random bit stream defined in ITU-T Recommendation Q.153 fascicle IV.4. This pseudo-random bit stream may be generated by another pseudo-random bit stream inserted before channel encoding in the TRX and shall generate at least 200 different bursts. The phase trajectory (phase versus time) for the useful part of the time slots (147 bits in the centre of the burst - see GSM 05.04 (EN 300 959) and GSM 05.10 (EN 300 912) for further information) shall be extracted with a resolution of at least 2 samples per modulating bit. The RF receiver parts of the BSSTE shall not limit the measurement.

The theoretical phase trajectory from the known pseudo-random bit stream shall be calculated in the BSSTE.

The phase difference trajectory shall be calculated as the difference between the measured and the theoretical phase trajectory. The mean frequency error across the burst shall then be calculated as the derivative of the regression line of the phase difference trajectory. The regression line shall be calculated using the Mean Square Error (MSE) method.

The phase error is then finally the difference between the phase difference trajectory and its linear regression line.

8-PSK modulation

The transmitted 8-PSK modulated signal from the TRX under test shall be extracted in the BSSTE for a pseudo-random known bit stream of encrypted bits into the TRX modulator (the BSSTE is defined in annex B.1). The pseudo-random bit stream shall be any bit sub-sequence of the 32767-bit pseudo-random bit stream defined in ITU-T Recommendation O.151.

The following steps 1) to 5) shall be performed according to GSM 05.05 (EN 300 910) clause 4.6.2 and annex G.

1) The RMS EVM shall be measured and calculated over the useful part of the burst (excluding tail bits) for at least 200 bursts.

2) The origin offset suppression shall be measured and calculated.

3) The frequency offset shall be measured and calculated.

4) The peak EVM shall be measured and calculated. The peak EVM is the peak error deviation within a burst, measured at each symbol interval, averaged over at least 200 bursts. The bursts shall have a minimum distance in time of 7 idle timeslots between them. The peak EVM values are acquired during the useful part of the burst, excluding tail bits.

5) The 95:th percentile EVM shall be measured and calculated. The 95:th percentile EVM is the point where 95 % of the individual EVM, measured at each symbol interval, is below that point. That is, only 5 % of the symbols are allowed to have an EVM exceeding the 95:th-percentile point. The EVM values are acquired during the useful part of the burst, excluding tail bits, over 200 bursts.

6.2.3 Essential conformance

Test Environment

Normal: One test shall be performed on each of B, M and T.

Extreme Power supply: One test shall be performed on each of B, M and T.

NOTE: tests under extreme power supply are carried out at extreme temperature limits.

Conformance requirement

GMSK modulation

The phase error shall not exceed:

- 5 degrees rms;

- 20 degrees peak.

For normal and micro BTSs the mean frequency error across the burst shall not exceed:

- 0,05 ppm.

For pico BTSs the mean frequency error across the burst shall not exceed:

- 0,1 ppm.

8-PSK modulation

The RMS EVM values, measured after any active element and excluding the effect of passive combining equipment, shall not exceed:

- Under normal conditions 7,0 %;

- Under extreme conditions 8,0 %.

The RMS EVM values, measured after any active element and including the effect of passive combining equipment, shall not exceed:

- Under normal conditions 8,0 %;

- Under extreme conditions 9,0 %.

The origin offset suppression shall exceed:

- 35 dB.

For normal and micro BTSs the frequency offset shall not exceed:

- 0,05 ppm.

For pico BTSs the frequency offset shall not exceed:

- 0,1 ppm.

The peak EVM values, excluding the effect of passive combining equipment, shall not exceed:

- 22 %.

The 95:th percentile EVM value, excluding the effect of passive combining equipment, shall not exceed:

- 11 %.

6.2.4 Complete conformance

Test Environment

Normal: The test shall be repeated until 3 TRXs or all TRXs (whichever is the less) have each been tested on B, M and T.

Extreme Power supply: One test shall be performed on each of B, M and T.

NOTE: tests under extreme power supply are carried out at extreme temperature limits.

Vibration : One test shall be performed on each of B, M and T.

Conformance requirement

The requirement of essential conformance shall apply.

6.2.5 Requirement reference

[GSM 05.04 (ETS 300 959), clause 2; GSM 05.05 (ETS 300 910), clause 4.6; GSM 05.10 (EN 300 912), clause 5.1].

6.3 Mean transmitted RF carrier power

6.3.1 Test purpose

To verify the accuracy of the mean transmitted RF carrier power across the frequency range and at each power step.

This test is also used to determine the parameter "power level", used in clause 6.5.1.2.

6.3.2 Test case

For a normal BTS, this measurement the power shall be measured at the input of the TX combiner or at the BSS antenna connector. For a micro-BTS, the power shall be measured at the BSS antenna connector. The Manufacturer shall declare the maximum output power of the BSS for each supported modulation at the same reference point as the measurement is made. The TX combiner shall have the maximum number of TRXs connected to it so that the measurement can be used as a reference for the measurement of transmitted carrier power versus time in clause 6.4.

NOTE: The value of the output power measured at the antenna connector is generally more useful for cell planning, and may be required for regulatory purposes.

All TRXs in the configuration shall be switched on transmitting full power in all time slots for at least 1 hour before starting the test.

The Manufacturer shall declare how many TRXs the BSS supports:

1 TRX: The TRX shall be tested at B, M and T;

2 TRX: The TRXs shall be each be tested at B, M and T;

3 TRX or more: Three TRXs shall each be tested at B, M and T.

If the Manufacturer declares that Synthesizer Slow Frequency Hopping is supported by the BSS, the BSS shall be configured with the number of TRXs and frequency allocation defined above and SFH enabled.

The BSS under test shall be set to transmit at least 3 adjacent time slots in a TDMA-frame at the same power level. The power level shall then be measured on a time slot basis over the useful part of one of the active time slots and the average of the logarithmic value taken over at least 200 time slots. Only active bursts shall be included in the averaging process. Whether SFH is supported or not, the measurement shall be carried out on all of the 3 frequencies in turn.

For the definition of the useful part of the time slot see figure 2, and for further details GSM 05.04 (ETS 300 959) and GSM 05.10 (EN 300 912). For timing on a per time slot basis each time slot may contain 156.25 modulating bits, or 2 time slots may contain 157 and 6 time slots 156 modulating bits according to GSM 05.10 (EN 300 912).

The power shall be measured at each nominal power level as specified. As a minimum, one time slot shall be tested on each TRX. Any TRX which is a dedicated BCCH shall only be tested at highest static power step.

6.3.3 Essential conformance

Test Environment

Normal: Each TRX specified in the test case shall be tested.

Extreme power supply: One TRX shall be tested, on one ARFCN, for highest static power step only.

NOTE: tests under extreme power supply are carried out at extreme temperature limits.

Conformance requirement

The BSS shall support at least Nmax steps of Static Power Control for each supported modulation with respect to the declared output power. For the modulation with the highest output power, Nmax shall be at least 6.

The static power step N has the range from the highest static power level to Nmax inclusive.

The Highest Static Power Level corresponds to the maximum output power declared by the manufacturer.

The power measured when the TRX is set to Highest Static Power Control Level shall have a tolerance of ±2 dB under normal conditions and ±2,5 dB under extreme conditions, relative to the maximum power declared by the manufacturer for the modulation under test. In this test, this measured power is termed the maximum BTS output power. Static power control shall allow the RF output power to be reduced from the maximum BTS output power for the modulation with the highest output power capability in at least 6 steps of nominally 2 dB with a tolerance of ±1 dB for each modulation referenced to the previous level of the same modulation. In addition, the actual absolute output power for each supported modulation at each static RF power step (N) , with the exception below for the highest RF power level for 8-PSK, shall be 2×N dB below the maximum BTS output power for the modulation with the highest output power capability with a tolerance of ±3 dB under normal conditions and ±4 dB under extreme conditions.

In addition to the Static Power Control levels the BSS may utilize up to M steps of dynamic Downlink Power Control. M can have an upper limit of 0 to 15.

Dynamic Downlink power control shall allow the RF output power to be reduced in M steps with a step size of 2 dB with a tolerance of ±1,5 dB referenced to the previous level.

Each dynamic Downlink Power Control level shall have a tolerance of ±3 dB under normal conditions and ±4 dB under extreme conditions relative to 2×Y dB below the maximum BTS output power for the modulation with the highest output power capability, where Y is the sum of the number of static and dynamic steps below Highest Static Power Control Level for the modulation with the highest output power capability.

For BTS supporting 8-PSK, the output power for both GMSK and 8-PSK shall be nominally the same for any supported static and dynamic power control level. An exception is allowed for the maximum output power of 8-PSK, which may be lower than the GMSK output power for the same static or dynamic power control level, i.e. the nominal size of the first step down from maximum power level for 8-PSK may be in the range 0 to 2 dB. The output power of 8-PSK for the second highest static or dynamic power control level shall be the same as the GMSK power for the same static or dynamic power control level within a tolerance of ±1 dB The number of static RF power steps and the total number of power control steps may be different for GMSK and 8-PSK.

6.3.4 Complete conformance

The requirement of essential conformance shall apply.

6.3.5 Requirement reference

GSM 05.05 (ETS 300 910) clause 4.1.2.

6.4 Transmitted RF carrier power versus time

6.4.1 Test purpose

To verify:

1) the time during which the transmitted power envelope should be stable (the useful part of the time slot);

2) the stability limits;

3) the maximum output power when nominally off between time slots.

It is not the purpose of this test to measure the detail of the power ramps; this is measured as adjacent channel power in clause 6.5.

6.4.2 Test case

The Manufacturer shall declare how many TRXs the BSS supports, and declare any TRXs which are a dedicated BCCH carrier:

1 TRX: The BSS shall not be tested.

2 TRX: One TRX shall be configured to support the BCCH and the other shall be tested. Tests shall be performed on B, M and T, and both TRXs shall be tested on at least one frequency.

3 TRX: One TRX shall be configured to support the BCCH and the other two shall be tested at B, T and B, M. Tests shall be performed on B, M and T and both TRXs shall be tested on at least one frequency.

4 TRX or more: One TRX shall be configured to support the BCCH and three TRXs tested, one on B, one on M and one on T.

If the Manufacturer declares that Synthesizer Slow Frequency Hopping is supported by the BSS, the BSS shall be configured with the number of TRXs activated and frequency allocation defined above and SFH enabled. The TRX configured to support the BCCH shall not be tested.

If the TRX under test supports 8-PSK modulation, the test shall be performed at both GMSK and 8-PSK modulation.

A single time slot in a TDMA-frame shall be activated in all TRXs to be tested, all other time slots in the TDMA-frame shall be at Pidle.

Power measurements are made with a detector bandwidth of at least 300 kHz at the BTS antenna connector, at each frequency tested. Timing is related to T0 which is the transition time from symbol 13 to symbol 14 of the midamble training sequence for each time slot. For timing on a per time slot basis each time slot may contain 156.25 modulating symbols, or 2 time slots may contain 157 and 6 time slots 156 modulating symbols according to GSM 05.10 (EN 300 912). Measurements shall be made at Pmax and Pmin. The time slots measured shall be displayed or stored for at least 100 complete cycles of the time slot power sequence for each measurement.

Pmax = Power measured in clause 6.3 (Highest Static Power Control Level).

Pmin = the lowest static level measured in clause 6.3.

Pidle Pmax - 30 dB, or Pmin - 30 dB.

As a minimum, one time slot shall be tested on each TRX under test which is not a dedicated BCCH.

6.4.3 Essential conformance

Test Environment

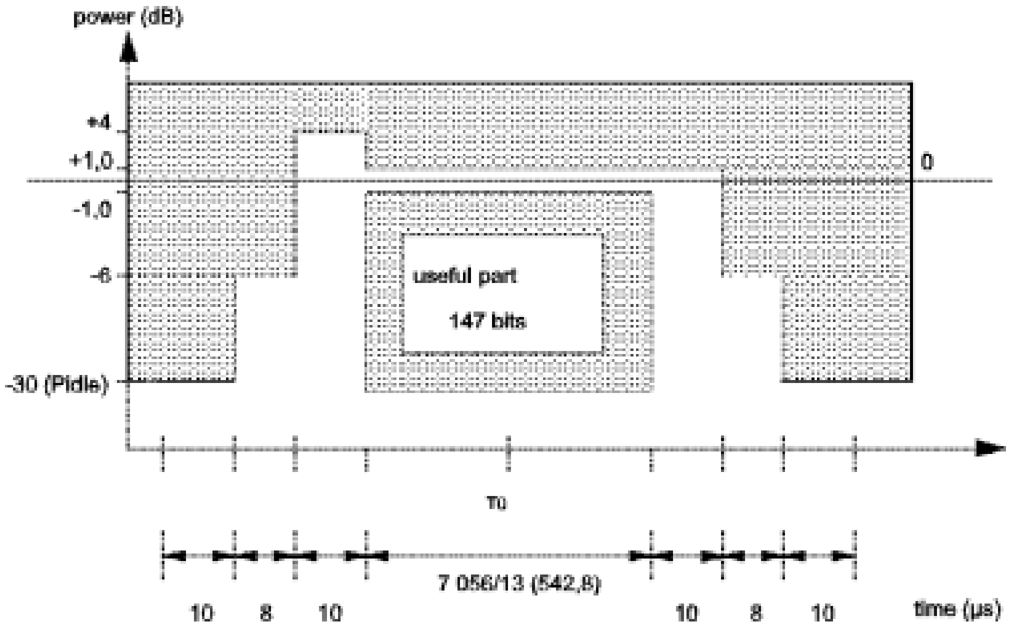
Normal.

Conformance requirement

The output power of each time slot tested relative to time shall conform with that illustrated in figure 2 and 2a. The residual output power, if a time slot is not activated, shall be maintained at, or below, the level of -30 dBc (300 kHz measurement bandwidth).

6.4.4 Complete conformance

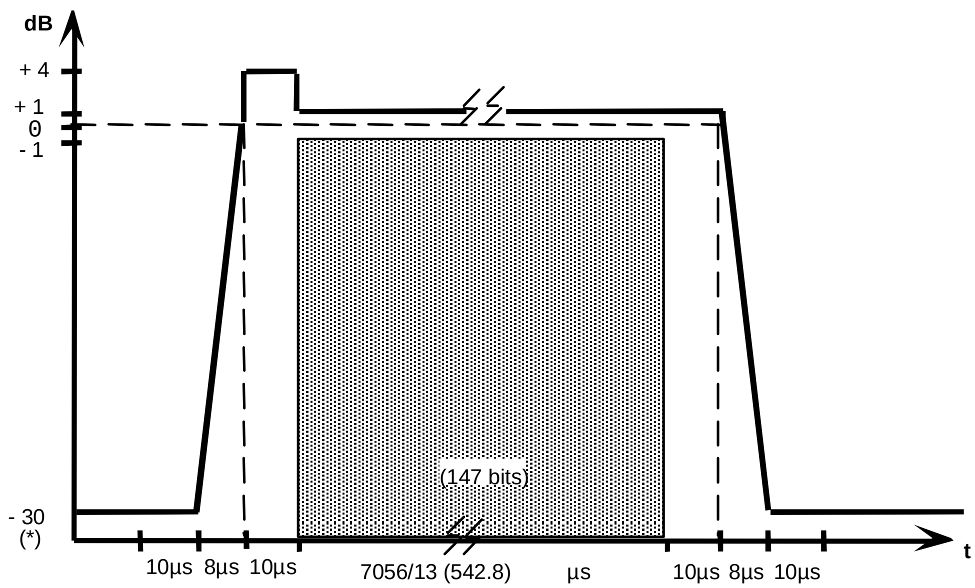
The requirement of essential conformance shall apply.



147 bits = 542,8 µs = 7 056/13 µs

1 timeslot = 576,9 µs = 156,25 bits

Power/time mask for GSM 400, GSM 900, DCS 1800, GSM 850 and MXM 850

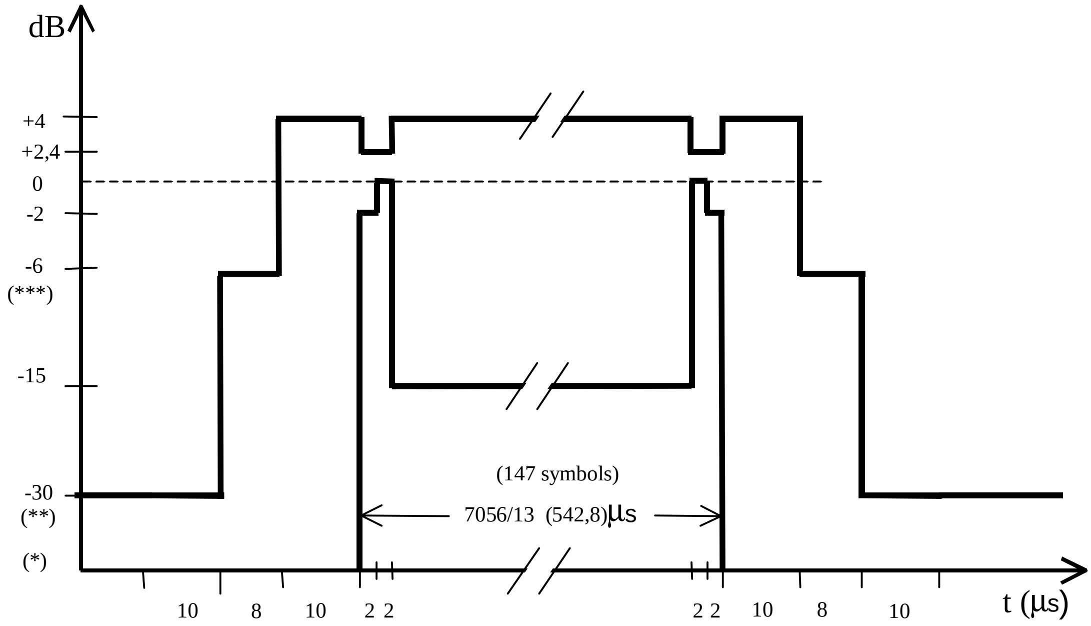


Dashed Lines indicate reference points only

Power/time mask for PCS 1900 and MXM 1900

NOTE: The 0 dB reference is equal to the power Pmax or Pmin.

Figure 2: Power/time mask for power ramping of normal bursts at GMSK modulation



NOTE: The 0 dB reference is equal to the power Pmax or Pmin.

Figure 2a: Power/time mask for power ramping of normal bursts at 8-PSK modulation

6.4.5 Requirement reference

GSM 05.05 (EN 300 910) clause 4.5.1.

6.5 Adjacent channel power

The modulation, wideband noise and power level switching spectra can produce significant interference in the relevant TX and adjacent bands. The requirements for adjacent channel emissions are tested in two separate tests which intend to measure different sources of emission:

1) continuous modulation spectrum and wideband noise;

2) switching transients spectrum.

NOTE: Both requirements must be met, irrespective of the source of the emission at any particular frequency.

6.5.1 Spectrum due to modulation and wideband noise

6.5.1.1 Test purpose

To verify that the output RF spectrum due to modulation and wideband noise does not exceed the specified levels for an individual transceiver.

6.5.1.2 Test case

The system under test shall be tested with one TRX active or with the BTS equipped with only one TRX., at three frequencies (B, M and T).

a) All time slots shall be set up to transmit full power GMSK modulated with a pseudo-random bit sequence of encrypted bits apart from time slot 0 which shall be set up to transmit at full power but may be modulated with normal BCCH data. The pseudo-random bit sequence may be generated by another pseudo-random bit sequence inserted before channel encoding in the BSS.

b) The power level (as used in table 5) shall be measured using the method of clause 6.3 for each power step to be tested.

c) Using a filter and video bandwidth of 30 kHz the power shall be measured at the antenna connector on the carrier frequency. The measurement shall be gated over 50 % to 90 % of the useful part of the time slot excluding midamble, and the measured value over this part of the burst shall be averaged. The averaging shall be over at least 200 time slots and only the active burst shall be included in the averaging process. The test is performed on one timeslot and not on timeslot 0.

d) Step c) shall be repeated with the following offsets above and below the carrier frequency:

- 100, 200, 250, 400 kHz; and

- 600 kHz to 1 800 kHz in steps of 200 kHz.

e) With all time slots at the same power level, step c) and d) shall be repeated for all static power levels specified for the equipment (clause 6.3).

f) With a filter and video bandwidth of 100 kHz and all time slots active, the power shall be measured at the antenna connector for frequency offsets beyond 1 800 kHz up to 2 MHz outside either side of the relevant TX band. This test shall be made in a frequency scan mode, with a minimum sweep time of 75 ms and averaged over 200 sweeps.

g) With all time slots at the same power level, step f) shall be repeated for all static power levels specified for the equipment (clause 6.3).

h) If the TRX supports 8-PSK modulation, step a) to g) shall be repeated with all time slots set up to transmit 8-PSK modulation apart from timeslot 0 which may be modulated with normal BCCH data.

6.5.1.3 Essential Conformance

Test Environment

Normal.

Normal BTS Conformance requirement

The test shall be performed for one TRX.

For each static power step, the power measured in steps d) to g) of the test cases shall not exceed the limits shown in table 5 for the power level measured in step b), except where one or more of the following exceptions and minimum measurement levels applies:

1) For a GSM 400, GSM 900, GSM 850 or MXM 850 BTS, if the limit according to table 5 is below -65 dBm, a value of -65 dBm shall be used instead.

2) For a DCS 1800, PCS 1900 or MXM 1900 BTS, if the limit according to table 5 is below -57 dBm, a value of -57 dBm shall be used instead.

3) In the combined range 600 kHz to 6 MHz above and below the carrier frequency, in up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz, exceptions at up to -36 dBm are allowed.

4) Above 6 MHz offset from the carrier frequency, in up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz, exceptions at up to -36 dBm are allowed.

Table 5: Continuous modulation spectrum - maximum limits for BTS

Power level (dBm)	Maximum relative level (dB) at specified carrier offsets (kHz), using specified measurement (filter)bandwidths (kHz):							
	100	200	250	400	600 to < 1 200	1 200 to < 1 800	1 800 to < 6 000	>6 000
as measured in step b)	Measurement (filter)bandwidth; 30 kHz						Measurement (filter) bandwidth; 100 kHz	
≥ 43	+0,5	-30	-33	-6 (see note)	-70	-73	-75	-80
41	+0,5	-30	-33	-6 (see note)	-68	-71	-73	-80
39	+0,5	-30	-33	-60 (see note)	-66	-69	-71	-80
37	+0,5	-30	-33	-6 (see note)	-64	-67	-69	-80
35	+0,5	-30	-33	-6 (see note)	-62	-65	-67	-80
≤ 33	+0,5	-30	-33	-6 (see note)	-60	-63	-65	-80
NOTE: For equipment supporting 8-PSK, the requirement at 8-PSK modulation is -56 dB.								

The limit values in table 5, at the listed offsets from carrier frequency (kHz), are the ratio of the measured power to the measured power in step c) for the same static power step.

Table 5 provides requirements at discrete power levels. For powers between those specified, linear interpolation should be applied.

Micro and Pico-BTS Conformance requirement

The test shall be performed for one TRX.

For each static power step, the power measures in steps d) and e) of the test case shall not exceed the limits shown in table 5 for the power level measured in step b), except where one or more of the micro or pico-BTS exceptions and minimum measurement levels applies.

For each static power step, the ratio of the power measured in steps f) and g) of the test case to the power measured in step c) for the same static power step shall not exceed the limits specified in table 5a for GSM 900, GSM 850 and MXM 850 and table 5b for DCS 1800, PCS 1900 and MXM 1900 systems, except where one or more of the micro or pico-BTS exceptions and minimum measurement levels applies.

Table 5a: Continuous modulation spectrum - maximum limits for GSM 900, GSM 850 and MXM 850 Micro and Pico-BTS

Power Class	Maximum relative level (dB) at specified carrier offsets (kHz), using specified measurement (filter)bandwidths (kHz):	
	1 800 to < 6 000	> 6 000
	Measurement (filter) bandwidth; 100 kHz	
M1 to M3	-70	-70
P1	-70	-80

Table 5b: Continuous modulation spectrum - maximum limits for DCS 1800, PCS 1900 and MXM 1900 Micro and Pico-BTS

Power Class	Maximum relative level (dB) at specified carrier offsets (kHz), using specified measurement (filter)bandwidths (kHz):	
	1 800 to < 6 000	> 6 000
	Measurement (filter) bandwidth; 100 kHz	
M1 to M3	-76	-76
DCS 1800 P1	-76	-80
PCS 1900 and MXM 1900 P1	-76	-76

The following exceptions and minimum measurement levels shall apply for the micro and pico-BTS.

1) In the combined range 600 kHz to 6 MHz above and below the carrier frequency, in up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz, exceptions at up to -36 dBm are allowed.

2) Above 6 MHz offset from the carrier frequency, in up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz, exceptions at up to -36 dBm are allowed.

3) If the limit as specified above is below the values in table 6, then the values in table 6 shall be used instead.

Table 6: Continuous modulation spectrum - minimum levels for micro and pico-BTS

Power Class	Maximum spectrum due to modulation and noise in 100 kHz	
	GSM 900, GSM 850 and MXM 850 (dBm)	DCS 1800, PCS 1900 and MXM 1900 (dBm)
M1	-59	-57
M2	-64	-62
M3	-69	-67
P1	-68	-65

6.5.1.4 Complete conformance

Test Environment:

Normal.

Conformance requirement

The test shall be repeated until each TRX in the configuration has been tested. The essential conformance requirement shall be met for each TRX.

6.5.1.5 Requirement reference

GSM 05.05 (EN 300 910) clause 4.2.1.

6.5.2 Switching transients spectrum

6.5.2.1 Test purpose

To verify that the output RF spectrum due to switching transients does not exceed the specified limits.

6.5.2.2 Test case

The Manufacturer shall declare how many TRXs the BSS supports:

1 TRX: The TRX shall be tested at B, M and T.

2 TRX: One shall be configured to support the BCCH and the second TRX shall be activated and tested at B, M and T.

3 TRX: One shall be configured to support the BCCH and the other two shall be activated and tested. Tests shall be performed on B, M and T and both TRXs shall be tested on at least one frequency.

4 TRX or more: One shall be configured to support the BCCH and three TRXs shall be tested, one on B, one on M and one on T.

If the TRX supporting the BCCH is physically different from the remaining TRX(s), it shall also be tested on B, M and T.

a) All active time slots shall be GMSK or 8-PSK modulated with a pseudo-random bit sequence apart from time slot 0 of the TRX supporting the BCCH which may be modulated with normal data. The power shall be measured at the offsets listed below from one of the carrier frequencies in the configuration with the test equipment parameters below. The reference power for relative measurements is the power measured in a bandwidth of at least 300 kHz for the TRX under test for the time slot in this test with the highest power.

Resolution bandwidth: 30 kHz

Video bandwidth: 100 kHz

Zero frequency scan

Peak hold enabled

The following offsets from the carrier frequency shall be used:

400, 600, 1 200 and 1 800 kHz.

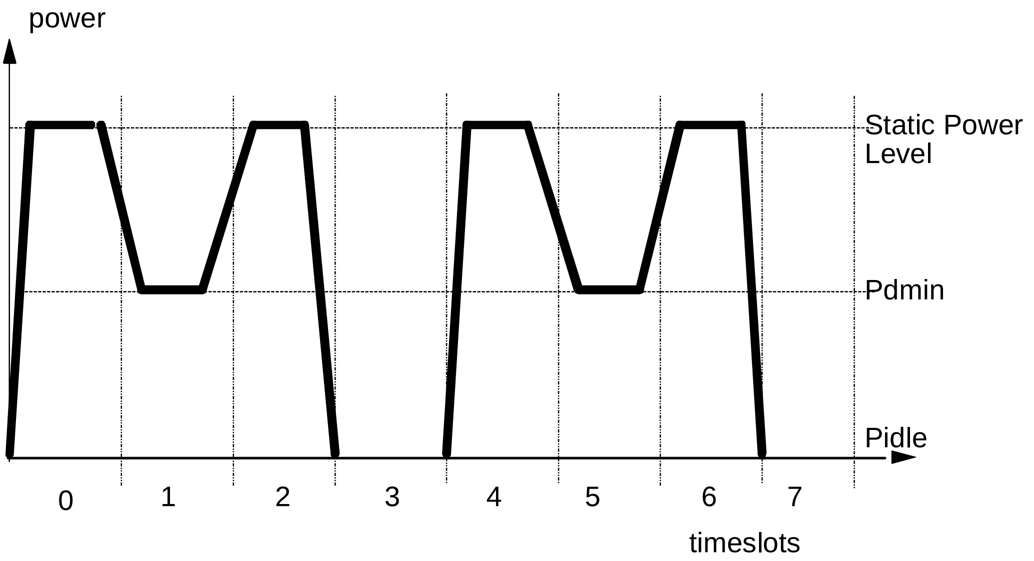
b) All timeslots of the TRX or TRXs under test shall be activated at the highest level of static power control and the power measured as described in step a). If synthesizer SFH is supported, the test shall be repeated for the TRX or TRXs which are activated and which do not support the BCCH, with them hopping between B, M and T.

c) All timeslots of the TRX or TRXs under test shall be activated at the lowest level of static power control and the power measured as described in step a). If synthesizer SFH is supported, the test shall be repeated for the TRX or TRXs which are activated and which do not support the BCCH, with them hopping between B, M and T.

d) Any active TRX which does not support the BCCH shall be configured with alternate timeslots active at the highest level of static power control and the remaining timeslots idle as illustrated in figure 4 and the power measured as described in step a).

e) Any active TRX which does not support the BCCH shall be configured with alternate timeslots active at the lowest level of static power control and the remaining timeslots idle as illustrated in figure 4 and the power measured as described in step a).

f) If the BSS supports dynamic downlink power control, any active TRX which does not support the BCCH shall be configured with transitions between timeslots active at the highest level of static power control and timeslots active at the lowest available level of dynamic power control and idle timeslots, as illustrated in figure 3 and the power measured as described in step a).



NOTE: Pdmin = The lowest dynamic power step measured in clause 6.3.

Figure 3: Power/time slot configuration (RF power control)

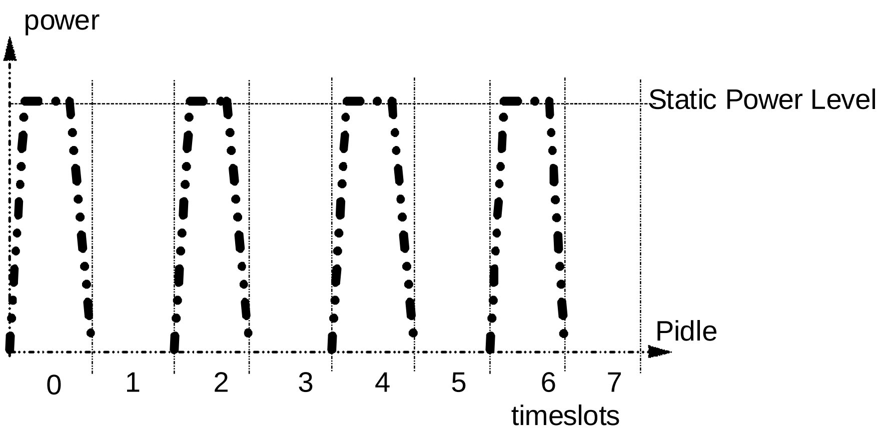


Figure 4: Power/time slot configuration (no RF power control)

6.5.2.3 Essential conformance

Test environment:

Normal.

Conformance requirement

The power measured shall not exceed the limits shown in table 7, or -36 dBm, whichever value is highest.

6.5.2.4 Complete conformance

Test environment:

Normal.

Conformance requirement

The test shall be repeated until all the TRXs specified to be tested have each been tested on the B, M and T.

The power measured shall not exceed the limits shown in table 7, or -36 dBm, whichever value is highest.

Table 7: Switching transients spectrum - maximum limits

Offset (kHz):	Power (dBc): GSM 400, GSM 900, GSM 850 and MXM 850 (GMSK)	Power (dBc): GSM 400, GSM 900, GSM 850 and MXM 850 (8-PSK)	Power (dBc) DCS 1800, PCS 1900 and MXM 1900 (GMSK)	Power (dBc) DCS 1800, PCS 1900 and MXM 1900 (8-PSK)
400	-57	-52	-50	-50
600	-67	-62	-58	-58
1 200	-74	-74	-66	-66
1 800	-74	-74	-66	-66

6.5.2.5 Requirement reference

GSM 05.05 (EN 300 910) clause 4.2.2.

6.6 Spurious emissions from the transmitter antenna connector

The test conditions for conducted emissions are defined separately for the BSS relevant transmit band, and elsewhere.

6.6.1 Conducted spurious emissions from the transmitter antenna connector, inside the BTS transmit band

6.6.1.1 Test Purpose

This test measures spurious emissions from the BSS transmitter antenna connector inside the BSS relevant transmit band, while one transmitter is in operation.

6.6.1.2 Test Case

The BTS shall be configured with one TRX active at its maximum output power on all time slots. The test shall be performed at RF channels B, M and T. Slow frequency hopping shall be disabled.

NOTE: It may be necessary to take steps to ensure that emissions from other transmitters which are not active do not influence the results. This may be achieved by, for example, equipping the BTS with only one TRX or by muting the outputs of the transmitters to a greater degree than otherwise required in GSM 05.05 (ETS 300 577 or ETS 300 910).

The transmitter antenna connector shall be connected to a spectrum analyser or selective voltmeter with the same characteristic impedance. Peak hold shall be enabled. The power shall be measured.

For frequencies with an offset of 1,8 MHz ≤ f < 6 MHz from the carrier frequency, and which fall within the relevant TX band:

- The detecting device shall be configured with a resolution bandwidth of 30 kHz and a video bandwidth of approximately three times this value.

For frequencies with an offset of ≥ 6 MHz from the carrier frequency, and which fall within the relevant TX band:

- The detecting device shall be configured with a resolution bandwidth of 100 kHz and a video bandwidth of approximately three times this value.

6.6.1.3 Essential conformance

Test Environment

Normal.

Conformance requirement

The maximum power measured shall not exceed -36 dBm.

6.6.1.4 Complete conformance

The requirement of essential conformance shall apply.

6.6.1.5 Requirement Reference

GSM 05.05 (ETS 300 577) clause 4.3, or GSM 05.05 (ETS 300 910) clause 4.3.

6.6.2 Conducted spurious emissions from the transmitter antenna connector, outside the BTS transmit band

6.6.2.2 Applicability (Phase 2+)

This test is applicable to equipment meeting the requirements of EN 300 910 clauses 4.3 and 4.7.2.

6.6.2.2.1 Test Purpose

This test measures spurious emissions from the BSS transmitter antenna connector outside the BSS relevant transmit band, while the transmitters are in operation. It also tests the intra-BTS intermodulation requirements for GSM 400, GSM 850, GSM 900, DCS 1800 and PCS 1900 outside the BTS transmit and receive bands.

6.6.2.2.2 Test Case

a) The BSS shall be configured with all transmitters active at their maximum output power on all time slots. If a TRX is designated as being a dedicated BCCH, it shall be allocated to RF channel M. All remaining TRXs shall be allocated in the following order; first to RF channel B, then to T, then distributed as evenly as possible throughout the BSS operating transmit band. Slow frequency hopping shall be disabled.

b) The transmitter antenna connector shall be connected to a spectrum analyser or selective voltmeter with the same characteristic impedance.

   The detecting device shall be configured with a resolution and video bandwidth of 100 kHz. The minimum sweep time shall be at least 75 ms and the response shall be averaged over 200 sweeps.

   The power shall be measured over the BSS operating receive band.

c) Step b) shall be repeated for the following frequency band:

   - for a GSM 900 or GSM 400 BSS, the band 1 805 MHz to 1 880 MHz.
   - for a DCS 1800 or GSM 400 BSS, the band 915 MHz to 960 MHz.
   - for a GSM 850 or MXM 850 BSS, the band 1 930 MHz to 1 990 MHz.
   - for a PCS 1900 or MXM 1900 BSS, the band 869 MHz to 894 MHz.

d) If the manufacturer declares that the BSS is suitable for the co-siting of GSM 400, GSM 900 and DCS 1800 BSSs or co-siting of MXM 850 and MXM 1900 BSS or co-siting of GSM 850 and PCS 1900 BSS the following test shall be performed:

   Step b) shall be repeated for the following frequency band:

   - for a GSM 900 or GSM 400 BSS, the band 1 710 MHz to 1 785 MHz.
   - for a DCS 1800 or GSM 400 BSS, the band 870 MHz to 915 MHz.
   - for a GSM 900 or DCS 1800 BSS suitable for co-siting with a GSM 400 BSS, the bands 450,4 MHz to 457,6 MHz and 478,8 MHz to 486,0 MHz.
   - for a GSM 850 or MXM 850 BSS, the band 1 850 MHz to 1 910 MHz.
   - for a PCS 1900 or MXM 1900 BSS, the band 824 MHz to 849 MHz.

e) The BSS shall be configured as in step a) except that each TRX which is not a dedicated BCCH shall transmit on full power on alternate time slots. The active timeslots should be the same for all TRXs. Either odd or even timeslots may be tested. If slow frequency hopping is supported, each TRX which is not a dedicated BCCH shall hop over the full range of frequencies defined in step a).

   The detecting device shall be configured as defined in table 9a. Peak hold shall be enabled, and the video bandwidth shall be approximately three times the resolution bandwidth. If this video bandwidth is not available on the detecting device, it shall be the maximum available, and at least 1 MHz.

The power shall be measured over those parts of the frequency range 100 kHz to 12,75 GHz which are outside the BTS relevant transmit band.

f) If the manufacturer declares that the BSS protects co-coverage GSM 400 systems the following test shall be performed:

Step b) shall be repeated for the following frequency band:

- for a GSM 900 or DCS 1800 BSS, the bands 460,4 MHz to 467,6 MHz and 488,8 MHz to 496,0 MHz.

Table 9a: Spurious Emissions Measurements outside the transmit band

Frequency Band	Frequency offset	Resolution Bandwidth
100 kHz to 50 MHz		10 kHz
50 MHz to 500 MHz and outside the relevant transmit band	(offset from the edge of the relevant transmit band)	
	≥ 2 MHz	30 kHz
	≥ 5 MHz	100 kHz
500 MHz to 12,75 GHz and outside the relevant transmit band	(offset from the edge of the relevant transmit band)	
	≥ 2 MHz	30 kHz
	≥ 5 MHz	100 kHz
	≥ 10 MHz	300 kHz
	≥ 20 MHz	1 MHz
	≥ 30 MHz	3 MHz

6.6.2.2.3 Essential conformance

Test Environment

Normal.

Conformance requirement

i) The maximum power measured at step c) shall not exceed:

- -47 dBm for a GSM 900, GSM 850 or MXM 850 BTS;
- -57 dBm for a DCS 1800, PCS 1900 or MXM 1900 BTS;
- -47 dBm for a GSM 400 BTS in the band 1 805 MHz to 1 880 MHz;
- -57 dBm for a GSM 400 BTS in the band 915 MHz to 960 MHz.

ii) The maximum power measured at step e) or f) shall not exceed:

- -36 dBm for frequencies up to 1 GHz;
- -30 dBm for frequencies above 1 GHz.

6.6.2.2.4 Complete conformance

Test Environment

Normal.

Conformance requirement

1) The maximum power measured at step b) shall not exceed the requirements in table 9b.

Table 9b: Requirements for transmitter spurious emissions in receiver bands

	GSM 400, GSM 900, GSM 850 and MXM 850 BSS receive band (dBm)	DCS 1800, PCS 1900 and MXM 1900 BSS receive band (dBm)
Normal BTS	-98	-98
Micro BTS M1	-91	-96
Micro BTS M2	-86	-91
Micro BTS M3	-81	-86
Pico-BTS P1	-70	-80
R-GSM 900 BTS	-89	
NOTE: Micro and pico-BTS is not defined for GSM 400.		

2) The maximum power measured at step c) shall not exceed:

- -47 dBm for a GSM 900, GSM 850 or MXM 850 BSS;
- -57 dBm for a DCS 1800, PCS 1900 or MXM 1900 BSS;
- -47 dBm for a GSM 400 BTS in the band 1 805 MHz to 1 880 MHz;
- -57 dBm for a GSM 400 BTS in the band 915 MHz to 960 MHz.

3) The maximum power measured at step e) shall not exceed:

- -36 dBm for frequencies up to 1 GHz;
- -30 dBm for frequencies above 1 GHz.

4) If the manufacturer declares that the BSS is suitable for co-siting of GSM 400, GSM 900 and DCS 1800 BSSs, the power measured in step d) shall not exceed the requirements in table 9b.

5) If the manufacturer declares that the BSS is suitable for co-siting of MXM 850 and MXM 1900 BSSs or co-siting of GSM 850 and PCS 1900 BSSs, the power measured in step d) shall not exceed the requirements in table 9b.

6) If the manufacturer declares that the BSS protects co-coverage GSM 400 systems the maximum power measured at step f) shall not exceed:

- -57 dBm for a GSM 900, or DCS 1800 BSS.

6.6.2.2.5 Requirement Reference

GSM 05.05 (EN 300 910) clauses 4.3, 4.7.2.

6.6.2.3 Applicability (Phase 2+ Release 1999 GSM 400, GSM 900 and DCS 1800)

If this test is applicable clause 6.6.2.2 is also applicable.

This test is applicable to GSM 400, GSM 900 and DCS 1800 equipment supporting any of the release 1999 features GSM 400 or 8-PSK modulation with the following exceptions:

- If a BTS is built to a specification for Release 98 or earlier and is upgraded to Release 99 or later, by exchange to or addition of transceivers supporting 8-PSK, any transmitters not supporting 8-PSK shall be excluded in step a) in clause 6.6.2.3.2.

6.6.2.3.1 Test Purpose

This test measures spurious emissions from the BSS transmitter antenna connector in the UTRA UE and BS receive bands, while the transmitters are in operation.

6.6.2.3.2 Test Case

a) The BSS shall be configured with all transmitters, not excluded according to clause 6.6.2.3, active at their maximum output power on all time slots. If a TRX is designated as being a dedicated BCCH, it shall be allocated to RF channel M. All remaining TRXs shall be allocated in the following order; first to RF channel B, then to T, then distributed as evenly as possible throughout the BSS operating transmit band. Slow frequency hopping shall be disabled.

b) The transmitter antenna connector shall be connected to a spectrum analyser or selective voltmeter with the same characteristic impedance.

   The detecting device shall be configured with a resolution and video bandwidth of 100 kHz. The minimum sweep time shall be at least 75 ms and the response shall be averaged over 200 sweeps.

   The power shall be measured for the following frequency band:

   - the band 1 900 MHz to 1 920 MHz;
   - the band 1 920 MHz to 1 980 MHz;
   - the band 2 010 MHz to 2 025 MHz;
   - the band 2 110 MHz to 2 170 MHz.

c) The BSS shall be configured with all transmitters active at their maximum output power on all time slots. If a TRX is designated as being a dedicated BCCH, it shall be allocated to RF channel M. All remaining TRXs shall be allocated in the following order; first to RF channel B, then to T, then distributed as evenly as possible throughout the BSS operating transmit band. Slow frequency hopping shall be disabled.

d) If the manufacturer declares that the BSS is suitable for the co-siting with UTRA BTS the following test shall be performed (with configuration according to step c):

   The transmitter antenna connector shall be connected to a spectrum analyser or selective voltmeter with the same characteristic impedance;

   The detecting device shall be configured with a resolution and video bandwidth of 100 kHz. The minimum sweep time shall be at least 75 ms and the response shall be averaged over 200 sweeps;

   The power shall be measured for the following frequency band:

   - the band 1 900 MHz to 1 920 MHz and 2 010 MHz to 2 025 MHz for a BTS intended for co-siting with a UTRA/TDD BS;
   - the band 1 920 MHz to 1 980 MHz for a BTS intended for co-siting with a UTRA/FDD BS.

6.6.2.3.3 Essential conformance

Test Environment

Normal.

Conformance requirement

The maximum power measured at step b) shall not exceed -62 dBm.

6.6.2.3.4 Complete conformance

Test Environment

Normal.

Conformance requirement

1) The maximum power measured at step b) shall not exceed -62 dBm;

2) If the manufacturer declares that the BSS is suitable for co-siting with one or more types of UTRA BTS, the power measured in step d) shall not exceed -96 dBm.

6.6.2.3.5 Requirement Reference

GSM 05.05 (EN 300 910) clause 4.3.2.

6.7 Intermodulation attenuation

6.7.1 Test purpose

To verify that the RF transmit equipment is able to restrict the generation of signals in its non-linear elements caused by the presence of the RF output from the transmitter and an interfering signal reaching the transmitter via its antenna to below specified levels.

6.7.2 Test case

If SFH is supported by the BSS, it shall be disabled during this measurement.

The Manufacturer shall declare how many TRXs the BSS supports. The BSS shall be configured with the maximum number of TRXs supported. The test shall be performed for the number of TRXs and the frequencies defined in the conformance requirement.

Only the TRX under test shall be active. All remaining TRXs shall be idle on an ARFCN within the transmit ***operating*** band for the BSS.

NOTE 1: It is particularly important, for a BSS which uses a tuned transmitter combiner, that all sections of the combiner are set to frequencies within the transmit ***operating*** band of the BSS during this test.

The antenna output of the RF transmit equipment under test, including the combiner, shall be connected to a coupling device, presenting to the RF equipment a load with an impedance of 50 Ω. The frequency of the test signal shall be within the transmit operating band (see clause 4.2). The test signal shall be unmodulated and the frequency shall be X MHz offset from the frequency of the RF transmit equipment under test. The TRX under test shall be set to highest static power control level and the test signal power level shall be adjusted 30 dB below this value. The test signals are illustrated in figure 5. The power level of the test signal shall be measured at the antenna output end of the coaxial cable, when disconnected from the RF transmit equipment and then correctly matched into 50 Ω. The antenna output power of the RF transmit equipment shall be measured directly at the antenna output terminal connected to an artificial antenna. Intermodulation product frequencies in the relevant TX band and relevant RX band shall be identified and measured according to the following process.

For the measurements in the relevant RX band:

Use a measurement and filter bandwidth of 100 kHz, frequency scan mode, averaged over 200 sweeps, with a sweep time of at least 75 ms. The frequency offset X shall be chosen to cause the lowest order intermodulation product to fall in the operating RX band.

For measurements in the relevant TX band:

The measurement shall be made for frequency offsets X of: 0,8 MHz, 2,0 MHz, 3,2 MHz, 6,2 MHz. The power of all third and fifth order intermodulation products shall be measured. The method of measurement specified below depends on the frequency offset of the intermodulation product from the carrier frequency:

- For measurements at frequency offsets from the active TRX of more than 6 MHz the peak power of any intermodulation components shall be measured with a bandwidth of 300 kHz, zero frequency span, over a time slot period. This shall be measured over sufficient time slots to ensure conformance according to methodology of annex A. The reference power for relative measurements is the power measured in a bandwidth of at least 300 kHz for the TRX under test;

- For measurements at frequency offsets from the active TRX 1.8 MHz or less the intermodulation product power shall be measured selectively using video averaging over 50 % to 90 % of the useful part of the time slot excluding the mid-amble. The averaging shall be over at least 200 time slots and only active bursts shall be included in the averaging process. The RF and video filter bandwidth of the measuring instrument shall be 30 kHz;
- For measurements at frequency offsets in the range 1,8 MHz to 6 MHz the intermodulation product power shall be measured in a frequency scan mode, with a minimum sweep time of 75 ms and averaged over 200 sweeps. The RF and video filter bandwidth of the measuring instrument shall be 100 kHz.

NOTE 2: When the above measurements are performed precautions should be taken, so that non-linearity in the selective measuring device does not influence the results appreciably. Furthermore it should be ensured that intermodulation components which may be generated by non-linear elements in the test equipment (e.g. signal generator, coupling device, selective measuring device) are sufficiently reduced. The RF transmit equipment under test and the test signal source should be physically separated in such a way that the measurement is not influenced by direct radiation. A possible measurement set-up is shown in clause B.2.

6.7.3 Essential Conformance

Test Environment

Normal.

The following tests shall be performed, depending on the number of TRXs supported by the BSS:

1 TRX: The TRX shall be tested at B, M, and T.

2 TRX: One test shall be performed on B, M, and T. Each TRX shall be tested at least once.

3 or more TRX: One TRX shall be tested at B, one at M and one at T.

Conformance requirement

At frequencies offset from the wanted signal carrier frequency by more than 6 MHz and up to the edge of the relevant transmit band, the intermodulation components measured shall not exceed -70 dBc or -36 dBm, whichever is the higher. 1 in 100 time slot periods may fail the requirement by up to 10 dB.

At frequencies offset from the wanted signal carrier frequency of less than 6 MHz, the requirements are that specified in clause 6.5.1.3 "Continuous Modulation Spectrum". The exceptions given in clause 6.5.1.3 also apply.

6.7.4 Complete conformance

Test Environment

Normal.

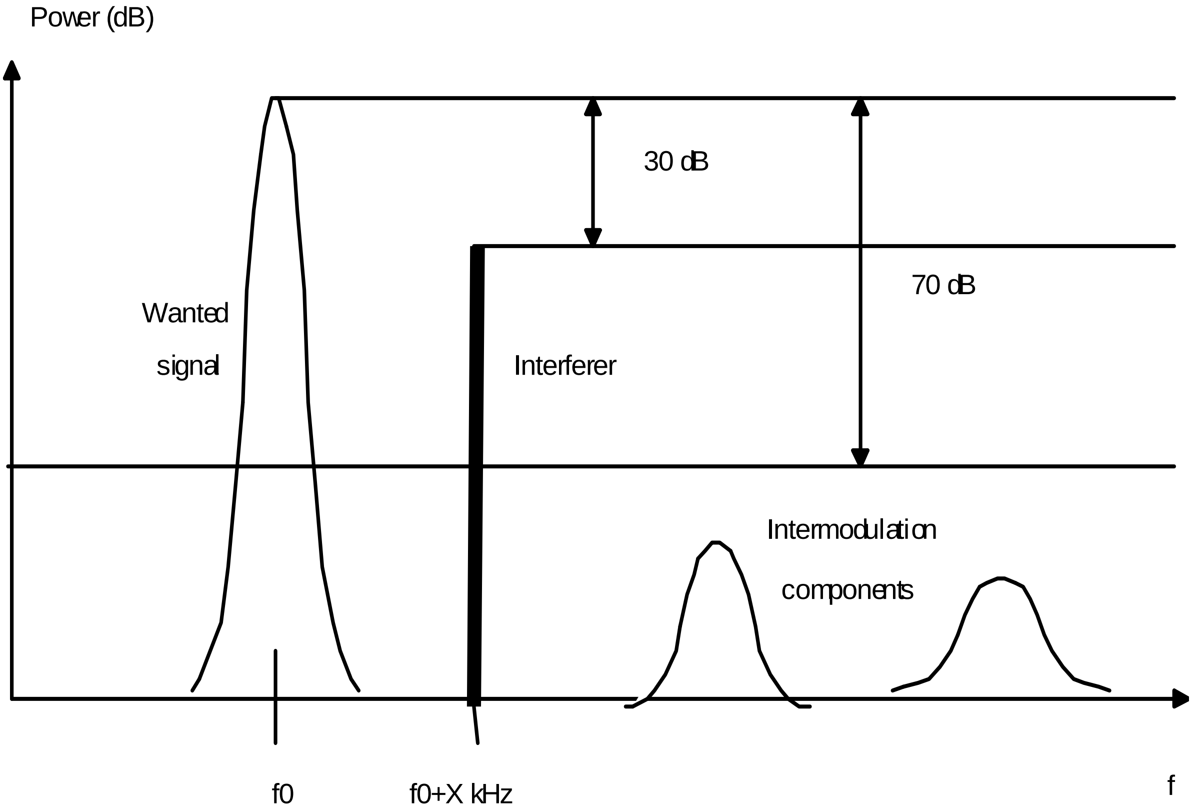


Figure 5: Example of TX intermodulation attenuation

Conformance requirement

The test shall be performed until three TRXs, or the maximum number supported by the BSS (whichever is the less) have each been tested at B, M, and T.

In the operating receive band the measured intermodulation components shall never exceed the values given in table 10 under normal test conditions.

Table 10: Maximum Receive Band transmitter intermodulation limits

	GSM 400, GSM 900, GSM 850 and MXM 850 (dBm)	DCS 1800, PCS 1900 and MXM 1900 (dBm)
Normal BTS	-98	-98
Micro-BTS M1	-91	-96
Micro-BTS M2	-86	-91
Micro-BTS M3	-81	-86
Pico-BTS P1	-70	-80
R-GSM 900 BTS	-89	n/a
NOTE: Micro and pico-BTS is not defined for GSM 400.		

At frequencies offset from the wanted signal carrier frequency by more than 6 MHz and up to the edge of the relevant transmit band, the intermodulation components measured shall not exceed -70 dBc or -36 dBm, whichever is the higher. 1 in 100 time slot periods may fail the requirement by up to 10 dB.

At frequencies offset from the wanted signal carrier frequency by less than 6 MHz, the requirements are that specified in clause 6.5.1.3, Continuous Modulation Spectrum. The exceptions given in clause 6.5.1.3 also apply.

6.7.5 Requirement reference

GSM 05.05 (EN 300 910) clause 4.7.1.

6.8 Intra Base Station System intermodulation attenuation

6.8.1 Test purpose

To verify that the level of intermodulation products produced inside the RX and TX bands (due to the leakage of RF power between transmitters that are operating in close vicinity of each other inside the BSS, or are combined to feed a single antenna) do not exceed the specified limit. The test is not applicable for GSM 850, MXM 850, PCS 1900 and MXM 1900.

6.8.2 Test case

If SFH is supported by the BSS, it shall be disabled during this measurement.

The BSS shall be configured with a full compliment of transceivers. Each RF transmit equipment shall be operated at the maximum power specified (Highest Static Power Control Level clause 6.3) and with modulation of a pseudo random sequence applied.

In the relevant transmit band, the intermodulation components shall be measured at frequency offsets above the uppermost and below the lowermost carrier frequencies.

All intermodulation product frequencies in the relevant TX band and operating RX band shall be identified and measured according to the process below.

For the measurement in the operating RX band

The equipment shall be operated with ARFCNs such that the lowest order intermodulation product falls into the operating receive band. The measurement shall be carried out at the antenna connector of the BSS, using a frequency selective instrument.

A possible measurement set-up for this test is shown in clause B.2.

For measurements in the RX band the following is the test set up:

- A filter and video bandwidth of 100 kHz.
- Frequency scan mode.
- Minimum sweep time of 75 ms and averaged over 200 sweeps.

For measurements in the relevant TX band

The equipment shall be operated at equal and minimum frequency spacing specified for the BSS configuration under test.

- For frequency offsets of more than 6 MHz the peak power of any intermodulation components shall be measured with a bandwidth of 300 kHz, zero frequency span, over a time slot period. This shall be measured over sufficient time slots to ensure conformance according to methodology of clause A.1. The reference power for relative measurements is the power measured in a bandwidth of at least 300 kHz for the TRX under test;
- For frequency offsets 1.8 MHz or less the intermodulation product power shall be measured selectively using video averaging over 50 % to 90 % of the useful part of the time slot excluding the mid-amble. The averaging shall be over at least 200 time slots and only active bursts shall be included in the averaging process. The RF and video filter bandwidth of the measuring instrument shall be 30 kHz;
- For frequency offsets in the range 1,8 MHz to 6 MHz the intermodulation product power shall be measured in a frequency scan mode, with a minimum sweep time of 75 ms and averaged over 200 sweeps. The RF and video filter bandwidth of the measuring instrument shall be 100 kHz.

6.8.3 Essential conformance

Test Environment

Normal.

Conformance requirement

In the relevant transmit band, at offsets greater than 0,6 MHz and up to 6 MHz, the requirements are that specified in clause 6.5.1, Continuous Modulation Spectrum. The exceptions given there shall also apply.

At frequencies offset from the wanted signal carrier frequency by more than 6 MHz and up to the edge of the relevant transmit band, the intermodulation components measured shall not exceed -70 dBc or -36 dBm, whichever is the higher. 1 in 100 time slot periods may fail the requirement by up to 10 dB.

6.8.4 Complete conformance

Test Environment

Normal.

Conformance requirement

In the operating receive band the measured intermodulation components shall never exceed the values given in table 11 under normal test conditions.

Table 11: Maximum intra-BSS Receive Band transmitter intermodulation limits

	GSM 400, GSM 850 and GSM 900 (dBm)	DCS 1800 and PCS 1900 (dBm)
Normal BTS	-98	-98
Micro-BTS M1	-91	-96
Micro-BTS M2	-86	-91
Micro-BTS M3	-81	-86
Pico-BTS P1	-70	-80
R-GSM 900 BTS	-89	n/a
NOTE: Micro and pico-BTS is not defined for GSM 400.		

In the relevant transmit band, at offsets greater than 0.6 MHz and up to 6 MHz, the requirements are that specified in clause 6.5.1, Continuous Modulation Spectrum. The exceptions given there shall also apply.

At frequencies offset from the wanted signal carrier frequency by more than 6 MHz and up to the edge of the relevant transmit band, the intermodulation components measured shall not exceed -70 dBc or -36 dBm, whichever is the higher. 1 in 100 time slot periods may fail the requirement by up to 10 dB.

6.8.5 Requirement reference

GSM 05.05 (EN 300 910) clause 4.7.2.

7.3 Static Reference Sensitivity Level

7.3.1 Test Purpose

The static reference sensitivity level of the receiver is the level of signal at the receiver input with a standard test signal at which the receiver will produce after demodulation and channel decoding data with a Frame Erasure Ratio (FER), Residual Bit Error Ratio (RBER) Bit Error Ratio (BER) or Block Error Ratio (BLER) better than or equal to that specified for a specific logical channel type under static propagation conditions.

7.3.2 Test Case

The test shall be performed for the specified ARFCNs. As a minimum, one time slot shall be tested on one TRX.

All TRXs in the BSS configuration shall be on and transmitting full power in all time slots.

For packet switched channels, a test signal with normal GSM modulation shall be applied to the BSS RX antenna connector, with a power specified in table 14b, on a chosen time slot. For BTS types other than normal, the test signal input level shall be increased by the values in table 14c.

The two adjacent time slots shall have a level 50 dB above reference sensitivity requirement specified in table 14b. The content of this signal shall allow the receiver of the TRX under test to either be activated or to detect valid GMSK modulated GSM signals (as specified in the conformance requirement) on the adjacent timeslots for the duration of the test. No signal should be applied during the remaining timeslots.

If Synthesizer Slow Frequency Hopping is supported by the BSS, the test shall be repeated with the following changes:

a) The BSS shall be hopping over the maximum range and number of ARFCNs possible for the test environment and which are available in the BSS configuration.

b) The test signal should only be applied for the timeslot under test; no signal should be applied during the remaining timeslots.

Table 14a: Test Signal input level for Static reference sensitivity measurement for circuit switched channels except ECSD

BTS Type	Test signal Input Level GMSK
GSM 400/GSM 850/GSM 900/DCS 1800/PCS 1900/MXM 850/MXM 1900 BTS	-104 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M1	-97 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M2	-92 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M3	-87 dBm
GSM 900/GSM 850/MXM 850 pico-BTS P1	-88 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M1	-102 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M2	-97 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M3	-92 dBm
DCS 1800/PCS 1900/MXM 1900 pico-BTS P1	-95 dBm

Table 14b: Test Signal input level for Static reference sensitivity measurement for packet switched channels

Normal BTS (GSM 400, GSM 850, GSM 900, DCS 1800, PCS 1900, MXM 850*, MXM 1900 (see note)		
Type of Channel		Static
PDTCH/CS-1 to 3	dBm	-104
PDTCH/CS-4	dBm	-101
PRACH/11 bits	dBm	-104
PRACH/8 bits	dBm	-104
PACCH	dBm	-104
PDTCH/MCS-1	dBm	-104
PDTCH/MCS-2	dBm	-104
PDTCH/MCS-3	dBm	-104
PDTCH/MCS-4	dBm	-101,5
PDTCH/MCS-5	dBm	-101
PDTCH/MCS-6	dBm	-99,5
PDTCH/MCS-7	dBm	-96
PDTCH/MCS-8	dBm	-93
PDTCH/MCS-9	dBm	-91,5
NOTE: PDTCH/CS-1 to 4 are not applicable for MXM 850 and MXM 1900.		

Table 14c: Test signal input level corrections for different BTS Types (for table 14b)

BTS Type	Test signal Average Input Level corrections
GSM 400/GSM 850/GSM 900/MXM 850 micro-BTS M1	+7 dB
GSM 900/GSM 850/MXM 850 micro-BTS M2	+12 dB
GSM 900/GSM 850/MXM 850 micro-BTS M3	+17 dB
GSM 900/GSM 850/MXM 850 pico-BTS P1	+16 dB
DCS 1800/PCS 1900/MXM 1900 micro-BTS M1	+2 dB
DCS 1800/PCS 1900/MXM 1900 micro-BTS M2	+7 dB
DCS 1800/PCS 1900/MXM 1900 micro-BTS M3	+12 dB
DCS 1800/PCS 1900/MXM 1900 pico-BTS P1	+9 dB

The input signal before channel encoding in the BSSTE shall be compared with the signal which is obtained from the BSS receiver after channel decoding.

7.3.3 Essential conformance

Test Environment:

Normal.

Conformance Requirement

For tests with SFH disabled, the tests shall be performed at one ARFCN. For tests with SFH enabled, the tests shall be performed with the range of hopping frequencies centred around RF channel M.

If GPRS is supported by the BSS, the error performance given in table 15 shall be met for PDTCH/CS-1 channel (BLER).

The error performance given in table 15 shall be met for PDTCH/MCS-5 or, if not supported, for the PDTCH/MCS-x with the next higher supported number x.

For all tests where a signal is present on adjacent timeslots, the receiver of the TRX under test shall be activated for the duration of the test on the adjacent time slots. As a minimum, this shall include the automatic gain control (AGC) of the receiver being operational on the adjacent timeslots.

7.3.4 Complete conformance

Test Environment:

Normal.

Extreme Temperature: FACCH/F only, for one time slot of one transceiver.

Extreme power supply: FACCH/F only, for one time slot of one transceiver.

NOTE: tests under extreme power supply are carried out at extreme temperature limits.

Conformance Requirement

For tests with SFH disabled, the tests shall be performed at RF channels B, M, and T. For tests with SFH enabled, the tests shall be performed with the range of hopping frequencies centred around M.

The error performance given in table 15 shall be met for all logical channel types supported by the BSS.

For all tests where a signal is present on adjacent timeslots, the BTS shall detect valid GMSK modulated GSM signals with an RXQUAL of 6 or less for the duration of the test on the adjacent time slots.

Table 15: Static error performance limits at RX sensitivity level

Channel type:	Error Parameter	Limit Value
FACCH/H	FER	0,10 %
FACCH/F	FER	0,10 %
SDCCH and SACCH	FER	0,10 %
RACH	FER	0,50 %
PDTCH/CS-1 to 4	BLER	10 %
PDTCH/MCS-1 to 9	BLER	10 %
PRACH/11 bits	BLER	15 %
PRACH/8 bits	BLER	15 %
PACCH	BLER	10 %

NOTE: The value of α in table 15 may be between 1 and 1.6, but should be the same for both occurrences.

7.3.5 Requirements Reference

GSM 05.05 (ETS 300 910) clause 6.2.

7.4 Multipath Reference Sensitivity Level

7.4.1 Test Purpose

The multipath reference sensitivity level of the receiver is the level of signal at the receiver input with a standard test signal at which the receiver will produce after demodulation and channel decoding data with a Frame Erasure Ratio (FER), Residual Bit Error Ratio (RBER), Bit Error Ratio (BER) or Block Error Ratio (BLER) better than or equal to that specified for a specific logical channel type, under multipath propagation conditions.

7.4.2 Test Case

As a minimum, one time slot shall be tested on one TRX.

A test signal with normal GSM modulation shall be applied to the BSS RX antenna connector through a Multipath Fading Simulator as described in clause B.1, on the chosen time slot.

For packet switched channels (GPRS and EGPRS), the average signal level at the receiver antenna connector of a normal BTS for which the reference performance shall be met is specified in table 16a, according to the type of channel and the propagation condition. For the TI5 propagation profile used for testing GSM 900 and DCS 1800 pico BTS P1 the column headed "TU50 (no FH)" shall be used. For BTS types other than normal, the levels specified in table 16a shall be increased by the values specified in table 16b.

In all cases, the average signal level at the receiver shall be measured by taking the mean powers of the sum of the individual paths.

All TRXs in the BSS configuration shall be on and transmitting full power in all time slots.

For tests with TU50 (ideal SFH):

- The BSS shall be hopping over the maximum range and number of ARFCNs possible for the test environment and which are available in the BSS configuration.

For TU50 (no SFH), RA250 (no SFH), HT100 (no SFH) and TI5 (no SFH):

- If slow frequency hopping is supported by the BSS, it shall be disabled. The test shall be performed for the specified ARFCNs. A test signal with GMSK modulation shall also be applied to the RX antenna connector on the two adjacent time slots at a static power level 50 dB above the reference sensitivity requirement specified in table 16of the chosen time slot over the useful part of the burst as defined in GSM 05.05 (EN 300 910) for the MS. The content of this signal shall allow the receiver of the TRX under test to either be activated or to detect valid GMSK modulated GSM signals (as specified in the conformance requirement) on the adjacent timeslots for the duration of the test.

Table 16a: Test signal input level for Multipath Reference Sensitivity measurements for packet switched

Normal BTS (GSM 400, GSM 900, GSM 850 and MXM 850***)					
Type of Channel		Propagation conditions			
		TU50 (no FH)	TU50 (ideal FH)	RA250 (no FH)	HT100 (no FH)
PDTCH/CS-1	dBm	-104	-104	-104	-103
PDTCH/CS-2	dBm	-100	-101	-101	-99
PDTCH/CS-3	dBm	-98	-99	-98	-96
PDTCH/CS-4	dBm	-90	-90	*	*
PDTCH/MCS-1	dBm	-102,5	-103	-103	-102
PDTCH/MCS-2	dBm	-100,5	-101	-100,5	-100
PDTCH/MCS-3	dBm	-96,5	-96,5	-92,5	-95,5
PDTCH/MCS-4	dBm	-91	-91	*	*
PDTCH/MCS-5	dBm	-96,5	-97	-96	-95
PDTCH/MCS-6	dBm	-94	-94,5	-91	-91
PDTCH/MCS-7	dBm	-89	-88,5	-87**	-86**
PDTCH/MCS-8	dBm	-84	-84	*	-81,5**
PDTCH/MCS-9	dBm	-80	--80	*	*
PRACH/11 bits	dBm	-104	-104	-103	-103
PRACH/8 bits	dBm	-104	-104	-103	-103
PACCH	dBm	-104	-104	-104	-103
Normal BTS (DCS 1800, PCS 1900 and MXM 1900*)**					
Type of Channel		**Propagation conditions**			
		TU50 (no FH)	**TU50 (ideal FH)**	**RA130 (no FH)**	**HT100 (no FH)**
PDTCH/CS-1	dBm	-104	-104	-104	-103
PDTCH/CS-2	dBm	-100	-100	-101	-99
PDTCH/CS-3	dBm	-98	-98	-98	-94
PDTCH/CS-4	dBm	-88	-88	*	*
PDTCH/MCS-1	dBm	-102,5	-103	-103	-101,5
PDTCH/MCS-2	dBm	-100,5	-101	-100,5	-99,5
PDTCH/MCS-3	dBm	-96,5	-96,5	-92,5	-94,5
PDTCH/MCS-4	dBm	-90,5	-90,5	*	*
PDTCH/MCS-5	dBm	-96,5	-97	-96	-93
Normal BTS (DCS 1800, PCS 1900 and MXM 1900*)**					
Type of Channel		**Propagation conditions**			
		TU50 (no FH)	**TU50 (ideal FH)**	**RA130 (no FH)**	**HT100 (no FH)**
PDTCH/MCS-6	dBm	-94	-94	-91	-85,5
PDTCH/MCS-7	dBm	-87	-86,5	-87**	*
PDTCH/MCS-8	dBm	-86,5**	-86,5**	*	*
PDTCH/MCS-9	dBm	-83**	-83**	*	*
PRACH/11 bits	dBm	-104	-104	-103	-103
PRACH/8 bits	dBm	-104	-104	-103	-103
PACCH	dBm	-104	-104	-104	-103
NOTE 1: PDTCH/CS-4 and MCS-x shall not be tested for the propagation conditions marked as (*). NOTE 2: For GSM 400 the speeds shall be doubled (e.g. TU50 shall be TU100). NOTE 3: Performance is specified at 30 % BLER for those cases marked as (**). NOTE 4: *** PDTCH/CS-1 to 4 are not applicable for MXM 850 and MXM 1900.					

Table 16b: Test signal input level corrections for different BTS Types (for table 16a)

BTS Type	Test signal Average Input Level corrections
GSM 400/GSM 850/GSM 900/MXM 850 micro-BTS M1	+7 dB
GSM 900/GSM 850/MXM 850 micro-BTS M2	+12 dB
GSM 900/GSM 850/MXM 850 micro-BTS M3	+17 dB
GSM 900/GSM 850/MXM 850 pico-BTS P1	+19 dB
DCS 1800/PCS 1900/MXM 1900 micro-BTS M1	+2 dB
DCS 1800/PCS 1900/MXM 1900 micro-BTS M2	+7 dB
DCS 1800/PCS 1900/MXM 1900 micro-BTS M3	+12 dB
DCS 1800/PCS 1900/MXM 1900 pico-BTS P1	+12 dB

The input signal before channel encoding in the BSSTE shall be compared with the signal which is obtained from the BSS receiver after channel decoding.

7.4.3 Essential conformance

Test Environment:

Normal.

Normal and Micro-BTS Conformance Requirement

The error performance of each of the following logical channel types supported by the BSS shall be measured, each on one ARFCN, for the specified propagation profiles:

SDCCH: TU50 (no SFH), HT100, RA130 or RA250

PDTCH/CS-1: TU50(no SFH), HT100, RA130 or RA250

PDTCH/MCS-1 or, if not supported,
PDTCH/MCS-x with the
next higher supported number x: TU50(no SFH), HT100, RA130 or RA250

PDTCH/MCS-5 or, if not supported,
PDTCH/MCS-x with the
next higher supported number x: TU50(no SFH), HT100, RA130 or RA250

The error performance given in table 17b shall be met for all combinations of logical channel type, frequency and multipath propagation profile tested.

Pico-BTS Conformance Requirement

The error performance of each of the following logical channel types supported by the BSS shall also be measured, each on one ARFCN, for propagation profile TI5 (no SFH) only:

SDCCH: TI5

PDTCH/CS-1 TI5

PDTCH/MCS-1 or, if not supported,
for the PDTCH/MCS-x with the
next higher supported number x: TI5

PDTCH/MCS-5 or, if not supported,
PDTCH/MCS-x with the
next higher supported number x: TI5

The error performance given in table 17a-b for the TI5 (no SFH) multipath propagation profile shall be met for all the above logical channel types tested.

7.4.4 Complete conformance

Test Environment:

Normal.

Normal and Micro-BTS Conformance Requirement

The error performance given in table 17 shall be met for all logical channel types supported by the BSS and for all the multipath propagation profiles (excluding TI5) given in table 17a-b.

For tests without SFH, the BTS shall detect valid GMSK modulated GSM signals with an RXQUAL of 6 or less for the duration of the test on the adjacent time slots.

Pico-BTS Conformance Requirement.

The error performance given in table 17a-b for the TI5 (no SFH) multipath propagation profile shall be met for all logical channel types defined in table 17a-b.

Table 17a: GSM 400, GSM 850, GSM 900 and MXM 850 Multipath error performance limits at RX sensitivity level

Channel Type	Error Measure	Error Ratios for the specified propagation conditions				
		TU50 (no SFH)	TU50 (ideal SFH)	RA250 (no SFH)	HT100 (no SFH)	TI5 (no SFH)
FACCH/H	(FER)	6,9 %	6,9 %	5,7 %	10,0 %	6,9 %
FACCH/F	(FER)	8,0 %	3,8 %	3,4 %	6,3 %	8,0 %
SDCCH and SACCH	(FER)	13 %	8,0 %	8,0 %	12,0 %	13 %
RACH	(FER)	13 %	13 %	12 %	13 %	13 %
PDTCH/CS-1 to 4	(BLER)	10 %	10 %	10 %	10 %	10 %
PDTCH/MCS-1 to 6	(BLER)	10 %	10 %	10 %	10 %	10 %
PDTCH/MCS-7	(BLER)	10 %	10 %	30 %	30 %	10 %
PDTCH/MCS-8	(BLER)	10 %	10 %	-	30 %	10 %
PDTCH/MCS-9	(BLER)	10 %	10 %	-	-	10 %
PRACH/11 bits	(BLER)	15 %	15 %	15 %	15 %	15 %
PRACH/8 bits	(BLER)	15 %	15 %	15 %	15 %	15 %
PACCH	(BLER)	10 %	10 %	10 %	10 %	10 %
NOTE : For GSM 400 the speeds shall be doubled (e.g. TU50 shall be TU100).						

Table 17b: DCS 1800, PCS 1900 and MXM 1900 Multipath error performance limits at RX sensitivity level

Channel Type	Error Measure	Error Ratios for the specified propagation conditions				
		TU50 (no SFH)	TU50 (ideal SFH)	RA130 (no SFH)	HT100 (no SFH)	TI5 (no SFH)
FACCH/H	(FER)	7,2 %	7,2 %	5,7 %	10,4 %	6,9 %
FACCH/F	(FER)	3,9 %	3,9 %	3,4 %	7,4 %	8,0 %
SDCCH and SACCH	(FER)	9,0 %	9,0 %	8,0 %	13,0 %	13 %
RACH	(FER)	13 %	13 %	12 %	13 %	13 %
PDTCH/CS-1 to 4	(BLER)	10 %	10 %	10 %	10 %	10 %
PDTCH/MCS-1 to 6	(BLER)	10 %	10 %	10 %	10 %	10 %
PDTCH/MCS-7	(BLER)	10 %	10 %	30 %	-	10 %
PDTCH/MCS-8	(BLER)	30 %	30 %	-	-	30 %
PDTCH/MCS-9	(BLER)	30 %	30 %	-	-	30 %
PRACH/11 bit	(BLER)	15 %	15 %	15 %	15 %	15 %
PRACH/8 bit	(BLER)	15 %	15 %	15 %	15 %	15 %
PACCH	(BLER)	10 %	10 %	10 %	10 %	10 %

The value of α in table 17a,b shall be between 1 and 1.6, and shall be the same for both occurrences in each propagation condition; it may be different for different propagation conditions.

NOTE: For each TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz.

7.4.5 Requirement Reference

GSM 05.05 (EN 300 910) clause 6.2.

7.5 Reference interference level

7.5.1 Test Purpose

The reference interference level is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal at the same carrier frequency (co-channel interference) or at any adjacent carrier frequencies (adjacent channel interference).

7.5.2 Test Case

If Slow Frequency Hopping (SFH) is supported by the BSS, it shall be disabled during this measurement, except when performing tests using propagation conditions with ideal SFH.

When SFH is used in the test, the BSS shall hop over the maximum range and number of ARFCNs possible for the test environment and which are available in the BSS configuration. If SFH is not supported, the test shall be performed on the specified number of ARFCNs. As a minimum, one time slot shall be tested on one TRX.

Two input signals shall be connected to the receiver via a combining network. When testing each signal shall be connected through a Multipath Fading Simulator (MFS) as described in clause B.1, except in the cases of frequency offsets of the interfering signal from the wanted signal of 400 kHz or greater, where the interferer shall be static. The two multipath fading propagation conditions shall be uncorrelated.

The referred power level for both signals shall be the average power into the BSS RX antenna connector. This shall be measured by taking the mean powers of the sum of the individual paths.

For packet switched channels, the wanted signal level shall be (X-9dB+Ir), where "X" is the power level defined in table 18 and "Ir" is the co-channel interference ratio defined in table 19b.

Table 18: Test signal average input level for Reference Interference Level measurements

BTS Type	Test signal average input level to receiver
GSM 400/GSM 850/GSM 900/DCS 1800/PCS 1900/MXM 850/MXM 1900 BTS	-84 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M1	-77 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M2	-72 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M3	-67 dBm
GSM 900/GSM 850/MXM 850 pico-BTS P1	-68 dBm *
DCS 1800/PCS 1900/MXM 1900 micro-BTS M1	-82 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M2	-77 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M3	-72 dBm
DCS 1800/PCS 1900/MXM 1900 pico-BTS P1	-75 dBm *

The interfering signal shall be continuous and have GSM modulation of a pseudo-random bitstream without midamble. If the TRX supports 8-PSK it shall be tested with the interfering signal having GMSK modulation and with the interfering signal having 8-PSK modulation, unless it can be demonstrated that it is sufficient to test either with GMSK or 8-PSK modulated interfering signal. If the TRX does not support 8-PSK it shall be tested with the interfering signal having GMSK modulation. For SFH this interferer shall consist of either one signal which hops in synchronization with the time slot under test or a number of fixed frequency signal sources. In the latter case the number of interfering sources determines the number of frequencies over which the time slot under test can hop in the test environment irrespective of the upper limit of the BTS.

For packet switched channels, the test shall be performed with frequency offsets of the interfering signal from the wanted signal, for a carrier to interferer ratio, relative to the co-channel interference ratio (C/Ic), as specified in table 19a. The minimum co-channel interference ratio (C/Ic) for all the combinations of packet switched logical channel type and propagation condition are as specified in table 19b.

In the case of Slow Frequency Hopping (SFH) the interfering signal shall be on the same ARFCN as the wanted signal over the useful part of the time slot burst. For offsets greater than 0 kHz only the multipath propagation condition TU50 (no SFH) need be tested for normal and micro-BTS systems, and only the multipath propagation condition TI5 (no SFH) need be tested for pico-BTS systems.

Table 19a: Co-channel and adjacent channel interference ratios for packet switched channels

Interferers offset:	Carrier to Interferer Ratio GMSK	Carrier to Interferer Ratio 8-PSK	Fading of interferer
0 kHz	C/Ic (table 19b)	C/Ic (table 19b)	yes
200 kHz	C/Ic - 18 dB	table 19c	yes
400 kHz	C/Ic - 50 dB	C/Ic - 50 dB	yes

Table 19b: Co-channel interference ratios (C/Ic) for packet switched channels

GSM 400, GSM900, GSM 850 and MXM 850***						
Channel Type	**Unit**	**Carrier to Interferer Ratios for specified propagation conditions**				
		TU3 (no SFH)	TU50 (no SFH)	TU50 (ideal SFH)	RA250 (no SFH)	TI5 (no SFH)
PDTCH/CS-1	dB	13	10	9	9	14
PDTCH/CS-2	dB	15	14	13	13	18
PDTCH/CS-3	dB	16	16	15	16	20
PDTCH/CS-4	dB	19	24	24	*	27
PDTCH/MCS-1	dB	13	10,5	9,5	10	14,5
PDTCH/MCS-2	dB	15	12,5	12	12	16,5
PDTCH/MCS-3	dB	16,5	17	17	19	21
PDTCH/MCS-4	dB	19	22	22	*	26
PDTCH/MCS-5	dB	18	15.5	14,5	16	19.5
PDTCH/MCS-6	dB	20	18	17,5	21	22
PDTCH/MCS-7	dB	23,5	24	24,5	26,5**	28
PDTCH/MCS-8	dB	28,5	30	30	*	34
PDTCH/MCS-9	dB	30	33	35	*	37
PACCH	dB	13	10	9	9	14
PRACH/11 bits	dB	8	8	8	10	12
PRACH/8 bits	dB	8	8	8	9	12
DCS1 800, PCS 1900 and MXM 1900* **						
Channel Type	**Unit**	**Carrier to Interferer Ratios for specified propagation conditions**				
		TU1.5 (no SFH)	TU50 (no SFH)	TU50 (ideal SFH)	RA130 (no SFH)	TI5 (no SFH)
PDTCH/CS-1	dB	13	9	9	9	14
PDTCH/CS-2	dB	15	13	13	13	18
PDTCH/CS-3	dB	16	16	16	16	20
PDTCH/CS-4	dB	19	27	27	*	27
PDTCH/MCS-1	dB	13	10	9.5	10	14.5
PDTCH/MCS-2	dB	15	12	12	12	16.5
PDTCH/MCS-3	dB	16,5	17	18	19	21
PDTCH/MCS-4	dB	19	23	23	*	26
PDTCH/MCS-5	dB	18	15	15	16	19.5
PDTCH/MCS-6	dB	20	17,5	18	21	22
PDTCH/MCS-7	dB	23,5	26	26,5	27**	28
PDTCH/MCS-8	dB	28,5	25**	24,5**	*	34
PDTCH/MCS-9	dB	30	29**	29**	*	37

GSM 400, GSM900, GSM 850 and MXM 850***						
Channel Type	**Unit**	**Carrier to Interferer Ratios for specified propagation conditions**				
		TU3 (no SFH)	TU50 (no SFH)	TU50 (ideal SFH)	RA250 (no SFH)	TI5 (no SFH)
PACCH	dB	13	9	9	9	14
PRACH/11 bits	dB	9	9	9	10	12
PRACH/8 bits	dB	8	8	8	9	12
NOTE 1: PDTCH/CS-4 and MCS-x shall not be tested for the propagation conditions marked as (*). NOTE 2: For GSM 400 the speeds shall be doubled (e.g. TU50 shall be TU100). NOTE 3: Performance is specified at 30 % BLER for those cases marked as (**). NOTE 4: *** PDTCH/CS-1 to 4 are not applicable for MXM 850 and MXM 1900.						

Table 19c: adjacent channel interference ratios (C/Ia) for EGPRS channels

GSM 400, GSM 900, GSM 850 and MXM 850***						
Channel Type	**Unit**	**Carrier to Interferer Ratios for specified propagation conditions**				
		TU3 (no SFH)	TU50 (no SFH)	TU50 (ideal SFH)	RA250 (no SFH)	TI5 (no SFH)
PDTCH/MCS-5	dB	2,5	-2	-2	1	2
PDTCH/MCS-6	dB	4,5	1	1	6,5	5
PDTCH/MCS-7	dB	8	8,5	8,5	13,5**	12,5
PDTCH/MCS-8	dB	10,5	9**	9,5**	*	13**
PDTCH/MCS-9	dB	12	13,5**	13,5**	*	17,5**
DCS1 800, PCS 1900 and MXM1 900* **						
Channel Type	**Unit**	**Carrier to Interferer Ratios for specified propagation conditions**				
		TU1,5 (no SFH)	TU50 (no SFH)	TU50 (ideal SFH)	RA130 (no SFH)	TI5 (no SFH)
PDTCH/MCS-5	dB	2,5	-2	-1,5	1	2
PDTCH/MCS-6	dB	4,5	1,5	1,5	6,5	5
PDTCH/MCS-7	dB	8	10,5	11	13,5**	12,5
PDTCH/MCS-8	dB	10,5	10**	9,5**	*	13**
PDTCH/MCS-9	dB	12	16**	16**	*	17,5**
NOTE 1: PDTCH/MCS-x shall not be tested for the propagation conditions marked as (*). NOTE 2: For GSM 400 the speeds shall be doubled (e.g. TU50 shall be TU100). NOTE 3: Performance is specified at 30 % BLER for those cases marked as (**).						

All TRXs in the BSS configuration shall be on and transmitting full power in all time slots.

The input signal before channel encoding in the BSSTE shall be compared with the signal which is obtained from the BSS receiver after channel decoding.

7.5.3 Essential conformance

Test Environment:

Normal.

Normal and Micro-BTS Conformance Requirement

1) Co-channel:

With SFH disabled, the error performance for each of the following logical channel types supported by the BSS shall be measured, each on one ARFCN, for the specified propagation conditions:

FACCH/F: TU1.5 or TU3

FACCH/H: TU1.5 or TU3

SDCCH: TU1.5 or TU3

PDTCH/CS-1: TU1.5 or TU3, TU50

PDTCH/MCS-1 or, if not supported,
for the PDTCH/MCS-x with the
next higher supported number x: TU1.5 or TU3, TU50

PDTCH/MCS-5 or, if not supported,
PDTCH/MCS-x with the
next higher supported number x: TU1.5 or TU3, TU50

2) 200 kHz offset:

With SFH disabled, the error performance for each of the following logical channel types supported by the BSS shall be measured, each on one ARFCN, for the specified propagation conditions:

FACCH/F: TU50

PDTCH/MCS-5 or, if not supported,
PDTCH/MCS-x with the
next higher supported number x: TU50

3) 400 kHz offset:

With SFH disabled, the error performance for each of the following logical channel types supported by the BSS shall be measured, each on RF channels B, M and T, for the specified propagation conditions:

PDTCH/MCS-5 or, if not supported,
PDTCH/MCS-x with the
next higher supported number x: TU50

With SFH disabled, the error performance for each of the following logical channel types supported by the BSS shall be measured, each on one ARFCN, for the specified propagation profiles:

FACCH/F: TU50

In cases 1) and 2) above, the error performance given in table 20a-b shall be met for all combinations of logical channel type, frequency of wanted signal, 0 kHz and 200 kHz frequency offset of interfering signal and multipath propagation condition tested.

In case 3) above, the error performance given in table 20 a-b for EGPRS channels and table 20c-d for other channels shall be met for all combinations of logical channel type, frequency of wanted signal, 400 kHz frequency offset of interfering signal and multipath propagation condition tested.

The value of α in table 20a-d shall be in the range 1 to 1.6, and shall be the same for both occurrences in each propagation condition; it may be different for different propagation conditions.

Pico-BTS Conformance Requirement

1) Co-channel:

With SFH disabled, the error performance for each of the following logical channel types supported by the BSS shall be measured, each on one ARFCN, for the TI5 multipath propagation profile:

FACCH/F: TI5

FACCH/H: TI5

SDCCH: TI5

PDTCH/CS-1 TI5

PDTCH/MCS-1 or, if not supported,
PDTCH/MCS-x with the
next higher supported number x: TI5

PDTCH/MCS-5 or, if not supported,
PDTCH/MCS-x with the
next higher supported number x: TI5

2) 200 kHz offset:

With SFH disabled, the error performance for each of the following logical channel types supported by the BSS shall be measured, each on one ARFCN, for the TI5 multipath propagation profile:

FACCH/F: TI5

PDTCH/MCS-5 or, if not supported,
PDTCH/MCS-x with the next
higher supported number x: TI5

3) 400 kHz offset:

With SFH disabled, the error performance for each of the following logical channel types supported by the BSS shall be measured, each on one ARFCN, for the TI5 multipath propagation profile:

FACCH/F: TI5

PDTCH/MCS-5 or, if not supported,
PDTCH/MCS-x with the next
higher supported number x: TI5

In cases 1) and 2) above, the error performance given in table 20 a-b shall be met for all combinations of logical channel type, frequency of wanted signal, 0 kHz and 200 kHz frequency offset of interfering signal and TI5 multipath propagation condition tested.

In case 3) above, the error performance given in table 20a-b for EGPRS channels and table 20c-d for other channels shall be met for all combinations of logical channel type, frequency of wanted signal, 400 kHz frequency offset of interfering signal and multipath propagation condition tested.

The value of α in table 20a-d shall be in the range 1 to 1.6, and shall be the same for both occurrences in the TI5 propagation condition.

7.5.4 Complete conformance

Test Environment:

Normal.

Normal and Micro-BTS Conformance Requirement

The error performance of any logical channel type supported by the BSS for any multipath propagation condition (excluding TI5) given in table 20a-d shall not be worse than the error ratios given in table 20a-d with the exception that for EGPRS channels the requirements in table 20a-b apply. The requirements for propagation conditions with ideal SFH shall only apply if SFH is supported by the BSS.

For the propagation conditions with ideal SFH, the tests shall be performed with the range of hopping frequencies centred around RF channel M. For propagation conditions with no SFH, the tests shall be performed at the RF channels B, M, and T.

The value of α in table 20a-d shall be in the range 1 to 1.6, and shall be the same for both occurrences in each propagation condition; it may be different for different propagation conditions.

NOTE 1: For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz.

Pico-BTS Conformance Requirement

The error performance of any logical channel type for the TI5 multipath propagation condition shall not be worse than the error ratios given in table 20a-d. The tests shall be performed with SFH disabled, at the RF channels B, M, and T. The value of α in table 20a-d shall be in the range 1 to 1.6, and shall be the same for both occurrences in the TI5 propagation condition.

Table 20a: GSM 400, GSM 900, GSM 850 and MXM 850 Multipath error performance limits at RX interference level

Channel Type	Error Measure	Error Ratios for the specified propagation conditions				
		TU3 (no SFH)	TU50 (no SFH)	TU50 (ideal SFH)	RA250 (no SFH)	TI5 (no SFH)
FACCH/H	(FER)	22 %	6,7 %	6,7 %	5,7 %	6,7 %
FACCH/F	(FER)	22 %	9,5 %	3,4 %	3,5 %	9,5 %
SDCCH and SACCH	(FER)	22 %	13 %	9 %	8,0 %	13 %
SACCH (TCH/AxS)	(FER at -3 dB)	40 %	-	-	-	-
RACH	(FER)	15 %	16 %	16 %	13 %	16 %
PDTCH/CS-1 to 4	(BLER)	10 %	10 %	10%	10 %	10 %
PDTCH/MCS-1 to 6	(BLER)	10 %	10 %	10%	10 %	10 %
PDTCH/MCS-7	(BLER)	10 %	10 %	10 %	30 %	10 %
PDTCH/MCS-8	(BLER)	10 %	30 %	30 %	-	30 %
PDTCH/MCS-9	(BLER)	10 %	30 %	30 %	-	30 %
PRACH/11 bit	(BLER)	15 %	15 %	15 %	15 %	15 %
PRACH/8 bit	(BLER)	15 %	15 %	15 %	15 %	15 %
PACCH	(BLER)	10 %	10 %	10 %	10 %	10 %
NOTE: For GSM 400 the speeds shall be doubled (e.g. TU50 shall be TU100).						

Table 20b: DCS 1800, PCS 1900 and MXM 1900 Multipath error performance limits at RX interference level

Channel Type	Error Measure	Error Ratios for the specified propagation conditions				
		TU1.5 (no SFH)	TU50 (no SFH)	TU50 (ideal SFH)	RA130 (no SFH)	TI5 (no SFH)
FACCH/H	(FER)	22 %	6,9 %	6,9 %	5,7 %	6,7 %
FACCH/F	(FER)	22 %	3,4 %	3,4 %	3,5 %	9,5 %
SDCCH and SACCH	(FER)	22 %	9,0 %	9,0 %	8,0 %	13 %
SACCH (TCH/AxS)	(FER at-3 dB)	40 %	-	-	-	-
RACH	(FER)	15 %	16 %	16 %	13 %	16 %
PDTCH/CS-1 to 4	(BLER)	10 %	10 %	10 %	10 %	10 %
PDTCH/MCS-1 to 6	(BLER)	10 %	10 %	10 %	10 %	10 %
PDTCH/MCS-7	(BLER)	10 %	10 %	10 %	30 %	10 %
PDTCH/MCS-8	(BLER)	10 %	30 %	30 %	-	30 %
PDTCH/MCS-9	(BLER)	10 %	30 %	30 %	-	30 %
PRACH/11 bit	(BLER)	15 %	15 %	15 %	15 %	15 %
PRACH/8 bit	(BLER)	15 %	15 %	15 %	15 %	15 %
PACCH	(BLER)	10 %	10 %	10 %	10 %	10 %

Table 20 c: GSM 400, GSM 900, GSM 850 and MXM 850 Multipath error performance limits at RX interference level offset 400 kHz

Channel Type	Error Measure	Error Ratios for the specified propagation conditions	
		TU50 (no SFH)	TI5 (no SFH)
FACCH/F	(FER)	17,1 %	17,1 %
NOTE: For GSM 400 the speeds shall be doubled (e.g. TU50 shall be TU100).			

Table 20 d: DCS 1800, PCS 1900 and MXM 1900 Multipath error performance limits at RX interference level offset 400 kHz

Channel Type	Error Measure	Error Ratios for the specified propagation conditions	
		TU50 (no SFH)	TI5 (no SFH)
FACCH/F	(FER)	6,1 %	17,1 %

NOTE 2: For TU 6 (ideal FH), TU3 (ideal FH) and TU1.5 (ideal FH), sufficient decorrelation cannot readily be achieved between the channel propagation conditions for each frequency hopped on. The requirements in GSM 05.05 (EN 300 910) for performance with TU1.5, TU3 or TU6(ideal FH) propagation condition cannot hence be tested and are thus absent in this test specification. They are inherently tested by TU50 (ideal FH) together with TU3 (no FH), TU 6 (no FH) or TU1.5 (no FH).

7.5.5 Requirements Reference

GSM 05.05 (EN 300 910) clause 6.3.

7.6 Blocking Characteristics

7.6.1 Test Purpose

Blocking and spurious response rejection is a measure of the ability of a BSS receiver to receive a wanted GSM modulated signal in the presence of an interfering signal; the level of the interfering signal is higher for the test of blocking than for spurious response.

7.6.2 Test Case

The manufacturer shall declare any intermediate frequencies (IF1 to IFn) used within the receiver, and the frequency of the local oscillator applied to the first receiver mixer.

1) This measurement is carried out in three stages:

   a) an optional preliminary test to identify frequencies of interfering signal which require more detailed investigation.

   b) measurement of blocking performance.

   c) measurement of spurious response performance; this test need only be performed at those frequencies of interfering signal at which the specification for blocking is not met.

2) The BSS shall be configured to operate as close to the centre of the operating receive band as is possible. If Slow frequency hopping is supported by the BSS, it shall be disabled during these measurements.

3) The two RF signals shall be fed into the receiver antenna connector of the BSS using a combining network. The wanted signal shall be at the operating frequency of the receiver, shall be modulated with normal GSM modulation, and shall be at a level as specified in table 21. The measurement is only performed under static propagation conditions.

The highest supported of PDTCH/MCS-1 to MCS-4 shall be measured using a wanted signal level 3 dB above the test signal level specified in clause 7.3, with the exception for GSM 850, MXM 850 and MXM 1900 normal BTSs, where a wanted signal 1 dB above the test signal level specified in clause 7.3 shall be used.

Table 21: Power level of wanted signal for test of Blocking Characteristics

BTS Type	Power level of Wanted Signal				
	PDTCH/ MCS-5	PDTCH/ MCS-6	PDTCH/ MCS-7	PDTCH/ MCS-8	PDTCH/ MCS-9
GSM 400/GSM 900/DCS 1800/PCS 1900 BTS	-98 dBm	-96,5 dBm	-93 dBm	-90 dBm	-88,5 dBm
GSM 850/MXM 850*/MXM 1900* BTS	-100 dBm	-98,5 dBm	-95 dBm	-92 dBm	-90,5 dBm
GSM 900/GSM 850/MXM 850* micro-BTS M1	-91 dBm	-89,5 dBm	-86 dBm	-83 dBm	-81,5 dBm
GSM 900/GSM 850/MXM 850* micro-BTS M2	-86 dBm	-84,5 dBm	-81 dBm	-78 dBm	-76,5 dBm
GSM 900/GSM 850/MXM 850* micro-BTS M3	-81 dBm	-79,5 dBm	-76 dBm	-73 dBm	-71,5 dBm
GSM 900/GSM 850/MXM 850* pico-BTS P1	-82 dBm	-80,5 dBm	-93 dBm	-74 dBm	-72,5 dBm
DCS 1800/PCS 1900/MXM 1900* micro-BTS M1	-96 dBm	-94,5 dBm	-91 dBm	-88 dBm	-86,5 dBm
DCS 1800/PCS 1900/MXM 1900* micro-BTS M2	-91 dBm	-89,5 dBm	-86 dBm	-83 dBm	-81,5 dBm
DCS 1800/PCS 1900/MXM 1900* micro-BTS M3	-86 dBm	-84,5 dBm	-81 dBm	-78 dBm	-76,5 dBm
DCS 1800/PCS 1900/MXM 1900* pico-BTS P1	-89 dBm	-87,5 dBm	-84 dBm	-81 dBm	-79,5 dBm

PRELIMINARY TEST

4) This optional test may be performed to reduce the number of measurements required in step 8. If it is performed, this shall be at the frequencies specified below.

5) The test shall be performed for an interfering signal at all frequencies which are integer multiples of 200 kHz , and which fall within one or more of the frequency ranges listed below, but excluding frequencies which exceed 12,75 GHz or are less than 600 kHz from the wanted signal:

   a) from

      PGSM 900: 790 MHz to 1 015 MHz inclusive.

      EGSM 900: 780 MHz to 1 015 MHz inclusive.

      RGSM 900: 776 MHz to 1 015 MHz inclusive.

      DCS 1800: 1 610 MHz to 1 885 MHz inclusive.

      PCS 1900 and MXM 1900: 1 750 MHz to 2 010 MHz inclusive.

      GSM 850 and MXM 850: 724 MHz to 949 MHz inclusive.

      GSM 450: 350 MHz to 558 MHz inclusive.

      GSM 480: 378 MHz to 586 MHz inclusive.

      TETRA 380: 280 MHz to 490 MHz inclusive

      TETRA 410: 310 MHz to 520 MHz inclusive

      TETRA 350: 280 MHz to 560 MHz inclusive

      TETRA 870: 760 MHz to 976 MHz inclusive

   b) GSM 850, MXM 850, PGSM 900 (including TETRA 870), EGSM 900 and RGSM 900:

      from Flo - (IF1 + IF2 + ... + IFn + 12,5 MHz) to

      Flo + (IF1 + IF2 + ... + IFn + 12,5 MHz).

DCS 1800:

from Flo - (IF1 + IF2 + ... + IFn + 37,5 MHz) to

Flo + (IF1 + IF2 + ... + IFn + 37,5 MHz).

GSM 400:

from Flo - (IF1 + IF2 + ... + IFn + 3,6 MHz) to

Flo + (IF1 + IF2 + ... + IFn + 3,6 MHz).

PCS 1900 and MXM 1900:

from Flo - (IF1 + IF2 + ... + IFn + 30 MHz) to

Flo + (IF1 + IF2 + ... + IFn + 30 MHz).

c) from IF1 - 400 kHz to IF1 + 400 kHz.

d) All of the ranges:

mFlo - IF1 - 200 kHz to mFlo - IF1 + 200 kHz

and

mFlo + IF1 - 200 kHz to mFlo + IF1 + 200 kHz

e) All integer multiples of 10 MHz

Where:	Flo	is the frequency of the local oscillator applied to the first receiver mixer.
IF1 ... IFn		are the n intermediate frequencies.
m		is all positive integers.

To reduce test time, a shortened test procedure according to annex A of the present document may be used, with an upper limit of measurement of 4 GHz.

6) The interfering signal shall be frequency modulated with a modulation frequency of 2 kHz and a peak deviation of ±100 kHz.

7) For separations between the wanted and interfering signals of:

PGSM 900 (including TETRA 870), EGSM 900, RGSM 900, GSM 850 and MXM 850 :	45 MHz or less;
DCS 1800:	95 MHz or less;
PCS 1900 and MXM 1900:	80 MHz or less;
GSM 400:	10 MHz or less.

the level of the interfering signal at the receiver input shall be:

GSM 400, GSM 900, GSM 850 and MXM 850:	-3 dBm.
DCS 1800, PCS 1900 and MXM 1900:	-15 dBm.

For greater separations, the level of the interfering signal shall be +10 dBm.

The Block Error Ratio (BLER) for one supported PDTCH/MCS-x with lowest number x and 8PSK modulation (x=5, if the BSS supports all coding schemes)shall be measured the BLER for the tested PDTCH/MCS-1 to MCS-4. All frequencies at which the RBER exceeds 10 % and/or at which the BLER exceeds 25 % or the BER exceeds 0,25 % respectively shall be recorded for further study. A relaxed statistical significance may be used for this measurement, compared to that of step 9).

BLOCKING TEST

8) If the preliminary test has been performed, this test shall be performed at all frequencies which have been recorded at step 7. If the preliminary test has not been performed, this test shall be performed at all frequencies specified in step 5.

   The interfering signal shall be unmodulated, and shall have a level at the receiver input as specified in table 22. For GSM 850 normal BTS, MXM 850 normal BTS and MXM 1900 normal BTS at frequency offsets ≥ 3 000 kHz the interfering signal shall be GMSK modulated by any 148-bit sequence of the 511-bit pseudo random bit sequence, defined in ITU-T Recommendation O.153 fascicle IV.4.

9) The channels below shall, if supported, be measured. All frequencies at which the limit below is exceeded shall be recorded.

   Channel: PDTCH/MCS-5
   or, if not supported,
   PDTCH/MCS-x with the
   next higher supported number x Limit: according to table 15

   Channel: PDTCH/MCS-1 to MCS-4 Limit: according to table 15

   For this test, in band frequencies are defined as follows:

   PGSM 900 (excluding TETRA 870): 870 MHz to 925 MHz;

   EGSM 900: 860 MHz to 925 MHz;

   RGSM 900: 856 MHz to 921 MHz;

   TETRA 870: 850 MHz to 915 MHz;

   DCS 1800: 1 690 MHz to 1 805 MHz.

   GSM 450: 444,4 MHz to 460,4 MHz;

   GSM 480: 472,8 MHz to 488,8 MHz;

   TETRA 380, TETRA 410, TETRA 450 : (ML-6) MHz to (MU+2) MHz where ML= Lowest Mobile Tx frequency and MU=Highest Mobile Tx frequency

   GSM 850 and MXM 850: 804 MHz to 859 MHz;

   PCS 1900 and MXM 1900: 1 830 MHz to 1 930 MHz;

NOTE: The methodology for the measurement of BER is described in annex A.

fo is the frequency of the wanted signal

Table 22: Level of interfering signal for blocking

	GSM 400 and GSM 900 (dBm)					DCS 1800 and PCS 1900 (dBm)				
Frequency band		micro and pico-BTS					micro and pico-BTS			
	BTS	M1	M2	M3	P1	BTS	M1	M2	M3	P1
in - band:										
fo ± 600 kHz	-26	-31	-26	-21	-34	-35	-40	-35	-30	-41
800 kHz ≤ |f-fo| < 1,6 MHz	-16	-21	-16	-11	-34	-25	-30	-25	-20	-41
1,6MHz ≤ |f-fo| < 3 MHz	-16	-21	-16	-11	-26	-25	-30	-25	-20	-31
3 MHz≤ |f-fo|	-13	-21	-16	-11	-18	-25	-30	-25	-20	-23
out - of - band	8	8	8	8	8	0	0	0	0	0
	GSM 850 and MXM 850 (dBm)					MXM 1900 (dBm)				
Frequency band		micro and pico-BTS					micro and pico-BTS			
	BTS	M1	M2	M3	P1	BTS	M1	M2	M3	P1
in - band:										
fo ± 600 kHz	-37	-31	-26	-21	-34	-43	-40	-35	-30	-41
800 kHz ≤ |f-fo| < 1,6 MHz	-35	-21	-16	-11	-34	-38	-30	-25	-20	-41
1,6MHz ≤ |f-fo| < 3 MHz	-33	-21	-16	-11	-26	-33	-30	-25	-20	-31
3 MHz≤ |f-fo|	-33	-21	-16	-11	-18	-33	-30	-25	-20	-23
out - of - band	8	8	8	8	8	0	0	0	0	0
NOTE: Micro and pico-BTS is not defined for GSM 400.										

For PGSM 900 and EGSM 900, the blocking level in the band 925 MHz to 935 MHz is relaxed to 0 dBm.

For RGSM 900 at offsets 600 kHz ≤ |f-fo| < 3 MHz, the blocking level in the band 876 MHz to 880 MHz shall be reduced by 5 dB.

Spurious response

10) This test shall be performed at all frequencies and channels which have been recorded at step 9. The interfering signal shall be unmodulated, and shall have a level of -43 dBm.

11) The BLER for one supported PDTCH/MCS-x with lowest number x and 8PSK modulation (x=5, if the BSS supports all coding schemes) the BLER for the tested PDTCH/MCS-1 to MCS-4 shall be measured.

7.6.3 Essential conformance

Test environment

Normal: One TRX shall be tested.

Conformance Requirement

For step 9) (blocking), the recorded frequencies for the channel type tested shall meet all of the following requirements:

a) For measurement frequencies which are:

GSM 900: 45 MHz or less from the wanted signal, the total number does not exceed six.

GSM 850 and MXM 850: in band frequencies, the total number does not exceed six.

DCS 1800: 95 MHz or less from the wanted signal, the total number does not exceed twelve.

PCS 1900 and MXM 1900: in band frequencies, the total number does not exceed twelve.

GSM 400: in band frequencies, the total number does not exceed three.

b) For measurement frequencies which are:

GSM 900: 45 MHz or less from the wanted signal, no more than three are consecutive.

GSM 850 and MXM 850: in band frequencies, no more than three are consecutive.

DCS 1800: 95 MHz or less from the wanted signal, no more than three are consecutive.

PCS 1900 and MXM 1900: in band frequencies , no more than three are consecutive.

c) For measurement frequencies which are:

GSM 900:	more than 45 MHz from the wanted signal, the total number does not exceed twenty four.
GSM 850 and MXM 850:	out band frequencies, the total number does not exceed twenty four.
DCS 1800:	more than 95 MHz from the wanted signal, the total number does not exceed twenty four.
PCS 1900 and MXM 1900:	out band frequencies, the total number does not exceed twenty four.
GSM 400:	out band frequencies, the total number does not exceed twenty four.

d) For measurement frequencies which are:

GSM 900:	more than 45 MHz below the wanted signal, no more than three are consecutive.
GSM 850 and MXM 850:	out band frequencies below the wanted signal, no more than three are consecutive.
DCS 1800:	more than 95 MHz below the wanted signal, no more than three are consecutive.
PCS 1900 and MXM 1900:	out band frequencies below the wanted signal, no more than three are consecutive.
GSM 400:	out band frequencies below the wanted signal, no more than three are consecutive.

For step 11) (spurious response), the limits below shall never be exceeded.

Channel: PDTCH/MCS-5

or, if not supported,

PDTCH/MCS-x with the

next higher supported number x	Limit: according to table 15.
Channel: PDTCH/MCS-1 to MCS-4	Limit: according to table 15.

7.6.4 Complete conformance

The requirements of essential conformance shall apply.

7.6.5 Requirements reference

GSM 05.05 (EN 300 910) clause 5.1.

7.7 Intermodulation characteristics

7.7.1 Test Purpose

This test measures the linearity of the receiver RF parts. It expresses the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

7.7.2 Test Case

If SFH is supported by the BSS, it shall be disabled during this measurement. The measurement is performed only under static conditions. The measurement shall be performed for the radio frequency channels B, M and T and for the supported channels in table 23. As a minimum, one time slot shall be tested on one TRX to be tested.

Three signals shall be applied to the receiver via a combining network The powers of the signals are measured at the receiver antenna connector.

The wanted signal shall have a power level as defined in table 23.

The second signal is an interfering signal, GMSK modulated by a pseudo-random bit sequence, and shall be 1,6 MHz above the wanted signal frequency. During the useful part of the burst of the wanted signal, the modulation of this interfering signal shall be any 148-bits subsequent of the 511-bits sequence, defined in ITU-T Recommendation O.153 fascicle IV.4, and the power shall be -43 dBm for GSM 400, GSM 900, GSM 850 and MXM 850 and -49 dBm for DCS 1800, PCS 1900 and MXM 1900.

NOTE: This signal can be a continuous signal modulated by the 511-bits sequence.

The third signal is an interfering signal and shall be unmodulated. It shall be 800 kHz above the wanted signal frequency, and the power shall be -43 dBm for GSM 400, GSM 900, GSM 850 and MXM 850 and -49 dBm for DCS 1800, PCS 1900 and MXM 1900.

The various signals are illustrated in figure 6.

The highest supported of PDTCH/MCS-1 to MCS-4 shall be measured using a wanted signal level 3 dB above the test signal level specified in clause 7.3.

Table 23: Wanted signal level for testing of Intermodulation Characteristics

BTS Type	Power level of Wanted Signal				
	PDTCH/ MCS-5	PDTCH/MC S-6	PDTCH/MC S-7	PDTCH/M CS-8	PDTCH/M CS-9
GSM 400/GS M850/GSM 900/DCS 1800/PCS 1900/MXM 850/MXM 1900 BTS	-98 dBm	-96,5 dBm	-93 dBm	-90 dBm	-88,5 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M1	-91 dBm	-89,5 dBm	-86 dBm	-83 dBm	-81,5 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M2	-86 dBm	-84,5 dBm	-81 dBm	-78 dBm	-76,5 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M3	-81 dBm	-79,5 dBm	-76 dBm	-73 dBm	-71,5 dBm
GSM 900/GSM 850/MXM 850 pico-BTS P1	-82 dBm	-80,5 dBm	-93 dBm	-74 dBm	-72,5 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M1	-96 dBm	-94,5 dBm	-91 dBm	-88 dBm	-86,5 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M2	-91 dBm	-89,5 dBm	-86 dBm	-83 dBm	-81,5 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M3	-86 dBm	-84,5 dBm	-81 dBm	-78 dBm	-76,5 dBm
DCS 1800/PCS 1900/MXM 1900 pico-BTS P1	-89 dBm	-87,5 dBm	-84 dBm	-81 dBm	-79,5 dBm

The unprotected class II bits obtained from the BSS receiver after channel decoding and before any extrapolation shall be compared with the unprotected class II bits originating from the BSSTE.

The BLER of one supported PDTCH/MCS-x with lowest number x and 8PSK modulation (x=5, if the BSS supports all coding schemes) and the BLER for the tested PDTCH/MCS-1 to MCS-4 shall be measured.

The measurement shall be repeated with the unwanted signal frequencies below the carrier frequency of the wanted signal.

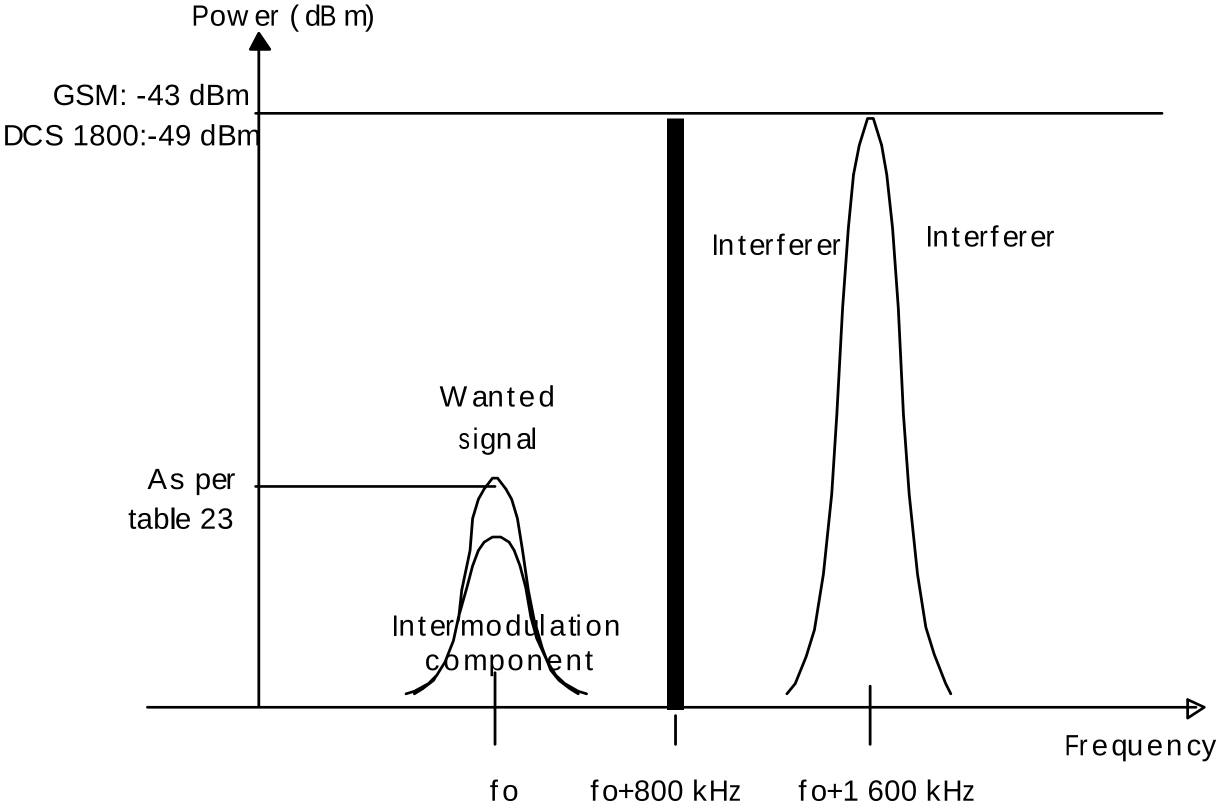


Figure 6: Example of RX intermodulation rejection

7.7.3 Essential conformance

Test Environment:

Normal: One TRX shall be tested.

Conformance Requirement

The BLER of PDTCH/MCS-5

or, if not supported, of PDTCH/MCS-x

with the next higher supported number x shall not exceed 10 %.

The BLER of the tested PDTCH/MCS-1 to MCS-4 shall not exceed the values given in table 15.

NOTE: This conformance requirement together with conformance to clause 7.5 (Reference Interference Level) is sufficient to demonstrate compliance to GSM 05.05 (EN 300 910) clause 5.3 for all logical channel types.

7.7.4 Complete conformance

Test Environment:

Test Environment: Each TRX shall be tested.

Conformance Requirement

The BLER of PDTCH/MCS-5

or, if not supported, of PDTCH/MCS-x

with the next higher supported number x shall not exceed 10 %.

NOTE: This conformance requirement together with conformance to clause 7.5 (Reference Interference Level) is sufficient to demonstrate compliance to GSM 05.05 (EN 300 910) clause 5.3 for all logical channel types.

7.7.5 Requirement Reference

GSM 05.05 (EN 300 910) clause 5.3

7.8 AM suppression

7.8.1 Test Purpose

AM suppression is a measure of the ability of a BSS receiver to receive a wanted GSM modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal.

7.8.2 Test Case

This test shall be performed at any one ARFCN on one TRX and on supported channels in table 24. If Slow Frequency Hopping (SFH) is supported by the BSS, it shall be disabled during this measurement. The measurement is performed only under static conditions.

The wanted signal shall have normal GSM modulation with a power level as defined in table 24.

The highest supported of PDTCH/MCS-1 to MCS-4 shall be measured using a wanted signal level 3 dB above the test signal level specified in clause 7.3, with the exception for MXM 850 and MXM 1900 normal BTSs, where a wanted signal 1 dB above the test signal level specified in clause 7.3 shall be used.

Table 24: Test signal input level

BTS Type	Test signal Input Level to receiver TCH/FS	Power level of Wanted Signal					
		E-TCH/ F43.2 NT	PDTCH/M CS-5	PDTCH/M CS-5	PDTCH/M CS-7	PDTCH/M CS-8	PDTCH/M CS-9
GSM 400/GSM 850/GSM 900/DCS 1800/PCS 1900 BTS	-101 dBm	-94 dBm	-98 dBm	-96,5 dBm	-93 dBm	-90 dBm	-88,5 dBm
MXM 850/MXM 1900 BTS	*	*	-100 dBm	-98,5 dBm	-95 dBm	-92 dBm	-90,5 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M1	-94 dBm	-87 dBm	-91 dBm	-89,5 dBm	-86 dBm	-83 dBm	-81,5 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M2	-89 dBm	-82 dBm	-86 dBm	-84,5 dBm	-81 dBm	-78 dBm	-76,5 dBm
GSM 900/GSM 850/MXM 850 micro-BTS M3	-84 dBm	-77 dBm	-81 dBm	-79,5 dBm	-76 dBm	-73 dBm	-71,5 dBm
GSM 900/GSM 850/MXM 850 pico-BTS P1	-85 dBm	-78 dBm	-82 dBm	-80,5 dBm	-93 dBm	-74 dBm	-72,5 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M1	-99 dBm	-92 dBm	-96 dBm	-94,5 dBm	-91 dBm	-88 dBm	-86,5 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M2	-94 dBm	-87 dBm	-91 dBm	-89,5 dBm	-86 dBm	-83 dBm	-81,5 dBm
DCS 1800/PCS 1900/MXM 1900 micro-BTS M3	-89 dBm	-82 dBm	-86 dBm	-84,5 dBm	-81 dBm	-78 dBm	-76,5 dBm
DCS 1800/PCS 1900/MXM 1900 pico-BTS P1	-92 dBm	-85 dBm	-89 dBm	-87,5 dBm	-84 dBm	-81 dBm	-79,5 dBm

The interfering signal is GMSK modulated according to GSM characteristics (with or without a midamble) with a pseudo random bit sequence of at least 511 bits length.

NOTE 1: A 148-bit sequence of the 511-bit of a pseudo-random bit sequence as defined in ITU-T Recommendation O.153 fascile IV.4 is recommended.

Its frequency (f) shall be in the relevant receive band, at least 6 MHz separated from the ARFCN under test. Frequency f is an integer multiple of 200 kHz and at least 2 ARFCNs separated from any identified spurious response in step 9 of the test case in clause 7.6.2.

The interferer shall have one timeslot active, meeting the power/time mask of figure 1. The transmitted bursts shall be synchronized to but delayed in time between 61 and 86 symbol periods relative to the bursts of the wanted signal. The mean level of the interferer over the useful part of the burst is defined in table 25.

Table 25: Interfering signal level

		Micro-BTS			Pico-BTS
	BTS (dBm)	M1 (dBm)	M2 (dBm)	M3 (dBm)	P1 (dBm)
GSM 400	-31	-	-	-	-
GSM 900	-31	-34	-29	-24	-21
GSM 850	-31	-34	-29	-24	-21
MXM 850	-33	-34	-29	-24	-21
DCS 1800	-35	-33	-28	-23	-26
PCS 1900	-35	-33	-28	-23	-26
MXM 1900	-33	-33	-28	-23	-26

The two input signals shall be connected to the receiver via a combining network. The referred power level for both signals shall be the power into the BSS RX antenna connector.

NOTE 2: When testing this requirement, a notch filter may be necessary to ensure that the co channel performance of the receiver is not compromised.

7.8.3 Essential conformance

Test Environment:

Normal.

Conformance Requirement

For a PDTCH/MCS-5 or, if not supported, for a PDTCH/MCS-x
with the next higher supported number x the BLER performance shall not exceed the values given in table 15.

The BLER of the tested PDTCH/MCS-1 to MCS-4 shall not exceed the values given in table 15.

7.8.4 Complete conformance

Test Environment:

Normal.

Conformance Requirement

The requirements of essential conformance shall apply.

7.8.5 Requirement Reference

GSM 05.05 clause 5.2.

7.9 Spurious emissions from the receiver antenna connector

7.9.1 Test Purpose

Spurious emissions are emissions at frequencies other than those of the BTS transmitter ARFCNs and adjacent frequencies. This test measures spurious emissions from the BTS receiver antenna connector.

7.9.2 Test Case

The transmitter shall be configured with one TRX active. It shall be allocated to RF Channel M and shall transmit at full power on all time slots.

For a BTS equipped with diversity, the requirements of this clause apply to each receiver dedicated antenna connector.

For a BTS equipped with a duplexer or duplexers, the requirements of clause 6.6 apply to any antenna connector which is a port for both transmitter(s) and receiver(s). Therefore, this test need not be performed on these ports.

The receiver antenna connector shall be connected to a spectrum analyser or selective voltmeter with the same characteristic impedance.

The detecting device shall be configured as defined in table 26. Peak hold shall be enabled, and the video bandwidth shall be approximately three times the resolution bandwidth. If this bandwidth is not available on the detecting device, it shall be the maximum available, and at least 1 MHz.

The power shall be measured over the frequency ranges specified in table 26.

7.9.3 Essential conformance

Test Environment:

Normal.

Table 26: measurement conditions for Conducted Emissions from the Receiver Antenna Connector

Frequency Band	Frequency offset	Resolution Bandwidth
100 kHz to 50 MHz		10 kHz
50 MHz to 500 MHz and outside the relevant transmit band	(offset from the edge of the relevant transmit band)	
	≥ 2 MHz	30 kHz
	≥ 5 MHz	100 kHz
500 MHz to 12,75 GHz and outside the relevant transmit band	(offset from the edge of the relevant transmit band)	
	≥2 MHz	30 kHz
	≥5 MHz	100 kHz
	≥10 MHz	300 kHz
	≥20 MHz	1 MHz
	≥30 MHz	3 MHz
Inside the relevant transmit band	(offset from the transmit carrier frequency)	
	≥1,8 MHz	30 kHz
	≥6 MHz	100 kHz

Conformance Requirement

The measured power shall not exceed:

- -57 dBm for all frequencies up to 1 GHz.
- -47 dBm for all frequencies above 1 GHz.

7.9.4 Complete conformance

The requirements of essential conformance shall apply.

7.9.5 Requirement Reference

GSM 05.05 (ETS 300 910) clause 5.4.

8 Radiated spurious emissions

8.1 Test Purpose

This test measures radiated spurious emissions from the BSS cabinet, including emissions due to the transmitters.

8.2 Test Case

a) A test site fulfilling the requirements of ITU-R Recommendation SM.329-7 shall be used. The BTS shall be placed on a non-conducting support and shall be operated from a power source via an RF filter to avoid radiation from the power leads. The method of ITU-R Recommendation SM.329-7 shall be used, except in any case where it conflicts with the present document.

Radiation of any spurious components shall be detected by the test antenna and measuring receiver (e.g. a spectrum analyser). At each frequency at which a component is detected, the BSS shall be rotated and the height of the test antenna adjusted to obtain maximum response, and the effective radiated power of that component determined by a substitution measurement. The measurement shall be repeated with the test antenna in the orthogonal polarization plane.

b) The BTS shall be configured with one transmitter active, at its maximum output power on all time slots, on the specified ARFCNs. Slow frequency hopping shall be disabled.

NOTE: It may be necessary to take steps to ensure that emissions from other transmitters which are not active do not influence the results. This may be achieved by, for example, equipping the BTS with only one TRX or by muting the outputs of the transmitters to a greater degree than otherwise required in GSM 05.05 (ETS 300 910).

c) The measuring receiver shall be configured with a resolution bandwidth of 30 kHz and a video bandwidth of approximately three times this value. Peak hold shall be enabled. The received power shall be measured for frequencies with an offset of 1,8 MHz $\leq f <$ 6 MHz from the carrier frequency, and which fall within the BTS relevant transmitter band.

At each frequency at which a component is detected, the maximum effective radiated power of that component shall be determined, as described in step a).

d) The measuring receiver shall be configured with a resolution bandwidth of 100 kHz and a video bandwidth of approximately three times this value. Peak hold shall be enabled. The received power shall be measured for frequencies with an offset of $\geq$ 6 MHz from the carrier frequency, and which fall within the BTS relevant transmitter band.

At each frequency at which a component is detected, the maximum effective radiated power of that component shall be determined, as described in step a).

e) The BSS shall be configured with all transmitters active at their maximum output power on all time slots. If a TRX is designated as being a dedicated BCCH, it shall be allocated to RF channel M. All remaining TRXs shall be allocated in the following order; first to RF channel B, then to T, then distributed as evenly as possible throughout the BSS operating transmit band. Slow frequency hopping shall be disabled.

The measuring receiver shall be configured as defined in table 27. Peak hold shall be enabled, and the video bandwidth shall be approximately three times the resolution bandwidth. If this video bandwidth is not available on the measuring receiver, it shall be the maximum available, and at least 1 MHz. The received power shall be measured over the frequency range 30 MHz to 4 GHz, excluding the BTS relevant transmitter band.

Table 27: Spurious Emissions Measurements outside the transmit band

Frequency Band	Frequency offset	Resolution Bandwidth
30 MHz to 50 MHz		10 kHz
50 MHz to 500 MHz and outside the relevant transmit band	(offset from the edge of the relevant transmit band)	
	≥ 2 MHz	30 kHz
	≥ 5 MHz	100 kHz
500 MHz to 4 GHz and outside the relevant transmit band	(offset from the edge of the relevant transmit band)	
	≥ 2 MHz	30 kHz
	≥ 5 MHz	100 kHz
	≥ 10 MHz	300 kHz
	≥ 20 MHz	1 MHz
	≥ 30 MHz	3 MHz

At each frequency at which a component is detected, the maximum effective radiated power of that component shall be determined, as described in step a).

8.3 Essential conformance

Test Environment:

Normal: Inside the relevant TX band: The test shall be performed with the TRX active on one ARFCN.

Outside the relevant TX band: The test shall be performed once.

Conformance Requirement

a) The power measured at steps c) and d) shall not exceed -36 dBm.

b) The power measured at step e) shall not exceed:

- -36 dBm for frequencies up to 1 GHz.
- -30 dBm for frequencies above 1 GHz.

8.4 Complete conformance

Test Environment:

Normal: Inside the relevant TX band: The test shall be performed three times with the TRX on one of the RF channels B, M, and T.

Outside the relevant TX band: The test shall be repeated until a measurement has been made with a TRX active on B, M and T

NOTE: For a BSS with 3 or more TRX, this requires only one measurement.

Conformance Requirement

a) The power measured at steps c) and d) shall not exceed -36 dBm.

b) The power measured at step e) shall not exceed:

- -36 dBm for frequencies up to 1 GHz.
- -30 dBm for frequencies above 1 GHz.

8.5 Requirement reference

GSM 05.05 (ETS 300 910), clause 4.3.

Annex C (normative): Specific tests for GSM BTS repeaters

The following test cases are adapted from GSM 11.26, in order to make them applicable to a TAPS BTS repeater. The GSM 11.26 numbering scheme has been retained for ease of maintenance.

4 General

A repeater can be designed to amplify the whole transmit RF band or just a part of the band. In the latter case the repeater can be either Broadband, with frequency band selective filtering, or channelized, with channel selective filtering.

4.1 Radio frequency bands

A repeater, as a bi-directional amplifier, can amplify and transmit a received MS signal in the MS transmit band, simultaneously it can amplify and transmit a received BTS signal in the BTS transmit band. The relevant MS and BTS transmit bands for the present document, which is a subset of the MS and BTS transmit bands as defined in GSM 05.05, are given in table 1.

Table 1: MS and BTS transmit RF bands

	MS transmit band	BTS transmit band
TETRA 380	380 MHz to 390 MHz	390 MHz to 400 MHz
TETRA 410	410 MHz to 420 MHz	420 MHz to 430
TETRA 450	450 MHz to 460 MHz	460 MHz to 470 MHz
GSM 450	450,4 MHz to 457,6 MHz	460,4 MHz to 467,6 MHz
GSM 480	478,8 MHz to 486,0 MHz	488,8 MHz to 496,0 MHz
TETRA 870	870 MHz to 876 MHz	915 MHz to 921
P-GSM 900	890 MHz to 915 MHz	935 MHz to 960 MHz
E-GSM 900	880 MHz to 915 MHz	925 MHz to 960 MHz
DCS 1800	1 710 MHz to 1 785 MHz	1 805 MHz to 1 880 MHz
R-GSM 900	876 MHz to 915 MHz	921 MHz to 960 MHz

NOTE: In some circumstances, for instance when an operator (or more than one operator who co-ordinate the use of repeaters), is not allocated a complete band as defined in table 1, it may be necessary to restrict the frequency range of operations of repeaters. In these circumstances, the test of "Gain outside operating band" in annex A may be used to verify the performance of the repeater.

4.2 Test environments

For each test in the present document, the environmental conditions under which the repeater is to be tested are defined.

4.2.1 Normal test environment

When a normal test environment is specified for a test, the test should be performed under any combination of conditions between the minimum and maximum limits stated in table 2.

Table 2: Limits of conditions for Normal Test Environment

Condition	Minimum	Maximum
Barometric pressure	86 kPa	106 kPa
Temperature	15ºC	30ºC
Relative Humidity	20 %	85 %
Power supply	Nominal, as declared by the manufacturer	
Vibration	Negligible	

The ranges of barometric pressure, temperature and humidity represent the maximum variation expected in the uncontrolled environment of a test laboratory. If it is not possible to maintain these parameters within the specified limits, the actual values shall be recorded in the test report.

NOTE: This may, for instance, be the case for measurements of radiated emissions performed on an open field test site.

4.2.2 Extreme test environment

The manufacturer shall declare one of the following:

a) the equipment class for the equipment under test, as defined in ETS 300 019-1-3;

b) the equipment class for the equipment under test, as defined in ETS 300 019-1-4;

c) for equipment that does not comply to an ETS 300 019-1 class, the relevant classes from IEC 721 documentation for temperature, humidity and vibration shall be declared.

NOTE: Reduced functionality for conditions that fall out side of the standard operational conditions are not tested in the present document. These may be stated and tested separately.

4.2.3 Extreme temperature

When an extreme temperature test environment is specified for a test, the test shall be performed at the standard minimum and maximum operating temperatures defined by the manufacturer's declaration for the equipment under test.

Minimum temperature:

- the test shall be performed with the environmental test equipment and methods of inducing the required environmental phenomena into the equipment, conforming to the test procedure of IEC 68-2-1. The equipment shall be maintained at the stabilized condition for the duration of the test sequence.

Maximum temperature:

- the test shall be performed with the environmental test equipment and methods of inducing the required environmental phenomena into the equipment, conforming to the test procedure of IEC 68-2-2. The equipment shall be maintained at the stabilized condition for the duration of the test sequence.

NOTE: It is recommended that the equipment is made fully operational prior to the equipment being taken to its lower operating temperature.

4.3 Manufacturers declarations

The manufacturer shall declare:

a) the operating band or bands of the repeater;

b) the maximum rated output power per channel;

c) the number of channels supported by the repeater;

d) the supported modulation methods.

4.4 Methods of measurement

The general methods of measurement and measurement uncertainty shall be according to ETR 027 and ETR 028 except where they conflict with the present document.

5 Spurious emissions

5.1 Test purpose

This test measures the conducted spurious emissions (see clause 3.1) at the antenna ports and the effective power of spurious emissions radiated by the cabinet and structure.

5.2 Test case

The repeater shall be set to maximum gain. All measurement steps, as described in this clause, apply to all antenna ports of the repeater.

a) Spurious emissions from the antenna port:

- one antenna port of the repeater shall be connected to a selective RF measurement device presenting to the repeater a load with an impedance of 50 Ω. An average power measurement of spurious emissions shall be performed for frequency offsets from the carrier frequency greater than 600 kHz under the following two conditions:

  i) without any RF input signal. The relevant input antenna port of the repeater shall be terminated with 50 Ω;

  ii) with an RF input signal. The relevant antenna input port of the repeater shall be connected to an RF signal generator. A continuous sinusoidal RF signal shall be input at a level which will result, when measured, in the maximum rated RF output power per channel, as declared by the manufacturer. The RF input signal shall be set to the centre frequency of the repeaters operating band. In the case of a channelized repeater, the RF input signal shall be set to the centre of the supported ARFCN closest to the centre of the range of ARFCNs supported by the repeater.

b) Radiated spurious emissions:

- a test site fulfilling the requirements of ETS 300 113 shall be used, except when it conflicts with the present document. The repeater shall be placed on a non-conducting support and shall be operated from a power source as recommended by the manufacturer via an RF filter, to prevent the power source or cable from influencing the result of the measurement;

- the relevant output antenna port of the repeater shall be terminated with 50 Ω. The relevant antenna input port of the repeater shall be connected to a RF signal generator in such a way that the connection does not influence the result of the measurement. The RF input signal shall be set to the centre frequency of the repeaters operating band. A continuous sinusoidal RF signal shall be input at a level which will result, when measured, in the maximum rated output power per channel, as declared by the manufacturer.

- an average RF power measurement shall be performed for frequency offsets from the carrier frequency greater than 600 kHz over the frequency range 30 MHz to 4 GHz. The repeater shall be rotated through 360° in the horizontal plane and the test antenna shall be raised or lowered until the maximum spurious signal level is detected. The effective radiated power of each spurious component shall be determined by a substitution measurement;

- the measurements shall be repeated with orthogonal polarization of the test antenna;

- the measurements shall be repeated with no RF input signal, in this case the relevant antenna input port of the repeater shall be terminated with 50 Ω.

Table 3: Measurement bandwidth for spurious emissions

Band	Frequency offset	Measurement bandwidth
	(offset from carrier)	
In the relevant BTS transmit Band or MS transmit band	≥ 100 kHz	3 kHz
100 kHz to 50 MHz	-	10 kHz
50 MHz to 500 MHz outside the relevant transmit band	(offset from edge of the relevant transmit band) > 0 MHz ≥ 2 MHz ≥ 5 MHz	 10 kHz 30 kHz 100 kHz
Above 500 MHz outside the Relevant transmit band	(offset from edge of the relevant transmit band) > 0 MHz ≥ 2 MHz ≥ 5 MHz ≥ 10 MHz ≥ 20 MHz ≥ 30 MHz	 10 kHz 30 kHz 100 kHz 300 kHz 1 MHz 3 MHz

Test environment: Normal

5.3 Conformance requirement

The measured power in test case clause 5.2.a) as well as the effective radiated power in test case clause 5.2.b) shall not exceed:

- -36 dBm (250 nW) in the frequency band 9 kHz to 1 GHz;
- -30 dBm (1 µW) in the frequency band 1 GHz to 12,75 GHz.

5.4 Reference requirement

GSM 05.05, annex E.

6 Intermodulation attenuation

6.1 Test purpose

To verify that the level of intermodulation products, generated in non-linear elements of the repeater, in the presence of two RF input signals, do not exceed the specified limits.

6.2 Test case

The repeater shall be set to maximum gain. Two continuous sinusoidal RF signals shall be fed to the input antenna port of the repeater using a combining device. The frequencies of both RF signals shall be within the repeater's operating band. The spacing between both RF signals shall be the minimum possible spacing applied in a network, i.e. 600 kHz.

The level of both RF input signals shall be increased, until the maximum rated output power per channel, as declared by the manufacturer, is reached.

In case of a repeater only supporting one channel, one RF input signal shall be set to the operating frequency and the other RF input signal at an offset of 400 kHz to either side successively. In this case the input signal at the repeaters operating frequency shall be increased, until the maximum rated output power per channel, as declared by the manufacturer, is reached. The second signal shall be set to the same input level.

The level of the third order intermodulation products shall be measured by means of a selective measurement device presenting to the repeater a load with an impedance of 50 Ω.

The test shall be repeated with both RF input signals increased by 10 dB each.

NOTE: In this case, the automatic gain (level) control may reduce the gain to a value less than maximum gain in order to keep the maximum rated output power per channel, as declared by the manufacturer.

An average power measurement shall be performed using a bandwidth of 3 kHz.

The measurements shall apply to all antenna ports of the repeater.

Test environment: Normal

6.3 Conformance requirement

The maximum level of intermodulation product shall be not greater than:

- -36 dBm (250 nW) in the frequency band 9 kHz to 1 GHz;
- -30 dBm (1 µW) in the frequency band 1 GHz to 12,75 GHz.

6.4 Reference requirement

GSM 05.05 annex E.

7 Out of band gain

7.1 Test purpose

To test the net gain of the repeater outside the relevant MS or BTS transmit band. This test shall also check the net gain at harmonic frequencies.

7.2 Test case

The repeater shall be set to maximum gain. In case of a channel selective repeater, two of the channel selective modules shall be set to the lowermost and the uppermost ARFCN within the repeater's operating band.

A continuous sinusoidal RF signal shall be fed successively at frequency offsets Y from the edges of the relevant MS or BTS transmit frequency band into the relevant input port of the repeater. The frequency offsets Y shall have the following values:

- 400 kHz, 600 kHz, 800 kHz, 1 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz.

This shall be repeated with an RF input signal successively set to all harmonic frequencies of the repeaters operating band up to 12,75 GHz (i.e. multiples of the centre frequency of the repeaters operating band up to 12,75 GHz).

The power level of the RF input signal shall be at least 5 dB below the power level which would produce, when applied within the operating band, maximum rated output power, as declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.

The average output power in each case shall be measured and the net gain shall be recorded.

The measurements shall apply to all antenna ports of the repeater.

Test environment: Normal
Extreme temperature

7.3 Conformance requirement

The net gain in both directions through the repeater shall be less than:

- 50 dB at 400 kHz offset and greater;
- 40 dB at 600 kHz offset and greater;
- 35 dB at 1 MHz offset and greater;
- 25 dB at 5 MHz offset and greater;

from the edges of the relevant MS or BTS transmit bands.

7.4 Reference requirement

GSM 05.05, annex E.

8 Frequency error

8.1 Test purpose

This clause applies only to repeater systems using frequency shift and describes the test of the frequency error.

8.2 Test case

The repeater system shall be levelled according to the recommendations of the manufacturer. For the purpose of the frequency synchronization of the repeater system it might be necessary to connect the system to a BTS or an equivalent test equipment like a mobile tester. In all cases an accurate frequency synchronization source has to be used to synchronize the measurement setup.

The test of the repeater system shall be performed at the lowest and the highest ARFCN supported by the repeater system. For the measurement of the frequency error a continuous, sinusoidal and synchronized RF signal shall be fed successively at a frequency of the relevant MS or BTS transmit frequency band into the relevant input port of the repeater. The power level of the RF input signal shall be at least 5 dB below the power level which would produce, when applied within the operating band, maximum rated output power, as declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.

The average output frequency shall be measured with a frequency counter.

The frequency error of single elements within the repeater system such as master unit or remote unit may be measured as well.

Test environment: Normal
Extreme temperature

8.3 Conformance requirement

The average frequency error of the repeater system shall not exceed 0,1 ppm. If tested, the average frequency error of a single repeater shall not exceed 0,05 ppm.

8.4 Reference requirement

GSM 05.05, annex E.

9 Modulation accuracy at GMSK modulation

9.1 Test purpose

This clause applies only to repeater systems using frequency shift and describes the test of the phase error.

9.2 Test case

The repeater system shall be levelled according to the recommendations of the manufacturer. For the purpose of the frequency synchronization of the repeater system it might be necessary to connect the system to a BTS or an equivalent test equipment like a mobile tester. In all cases an accurate frequency synchronization source has to be used to synchronize the measurement setup.

For the measurement of the phase error a continuous and synchronized GMSK signal modulated with a pseudo random bit sequence shall be fed successively at one frequency of the relevant MS or BTS transmit frequency band into the relevant input port of the repeater. The power level of the RF input signal shall be at least 5 dB below the power level which would produce, when applied within the operating band, maximum rated output power, as declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.

The phase trajectory shall be measured at the equivalent output of the repeater system and the calculation of the phase error shall be performed according to GSM 11.10-1 or GSM 11.21.

The phase error of single elements within the repeater system such as master unit or remote unit may be measured as well.

The GMSK signal source shall have a phase error below the following values:

- 5 degrees rms;
- 20 degrees peak.

Test environment: Normal
Extreme temperature

9.3 Conformance requirement

The phase error of a complete repeater system shall not exceed:

- 7 degrees rms;
- 28 degrees peak.

If tested, the phase error of a single repeater unit shall not exceed:

- 6,1 degrees rms;
- 24,5 degrees peak.

9.4 Reference requirement

GSM 05.05, annex E.

10 Modulation accuracy at 8-PSK modulation

10.1 Test purpose

This clause applies only to repeater systems supporting 8-PSK modulation and describes the test of the modulation accuracy.

10.2 Test case

The repeater system shall be levelled according to the recommendations of the manufacturer. For the purpose of the frequency synchronization of the repeater system it might be necessary to connect the system to a BTS or an equivalent test equipment like a mobile tester. In all cases an accurate frequency synchronization source has to be used to synchronize the measurement setup.

For the measurement of the modulation accuracy a continuous and synchronized 8-PSK signal modulated with a pseudo random bit sequence shall be fed successively at one frequency of the relevant MS or BTS transmit frequency band into the relevant input port of the repeater. The power level of the RF input signal shall be at least 5 dB below the power level which would produce, when applied within the operating band, maximum rated output power, as declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.

The EVM shall be measured at the equivalent output of the repeater system and the calculation of the EVM shall be performed according to GSM 11.21.

The modulation accuracy of single elements within the frequency shifting repeater system such as master unit or remote unit may be measured as well.

Test environment: Normal
Extreme temperature

10.3 Conformance requirement

For a single repeater with no shift in frequency the EVM shall not exceed:

- 8 % RMS.

For a complete repeater system using frequency shift the EVM shall not exceed:

- 14,5 % RMS.

If tested, the EVM of a single repeater unit in a frequency shifting repeater system shall not exceed:

- 12 % RMS.

10.4 Reference requirement

GSM 05.05, annex E.

History

Document history		
V1.1.1	July 2001	Publication