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Candidate Harmonized European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 9: Harmonized standard for IMT-2000, TDMA Single-Carrier (UWC 136) (BS) covering essential requirements of article 3.2 of the R&TTE Directive

Reference

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Foreword

This Candidate Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document is part 9 of a multi-part deliverable covering the Electromagnetic compatibility and Radio spectrum Matters (ERM); IMT-2000 Base Stations (BS) and User Equipment (UE), as identified below:

Part 1: "Harmonized standard for IMT-2000, Introduction and common requirements, covering essential requirements of article 3.2 of the R&TTE Directive";

Part 2: "Harmonized standard for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive";

Part 3: "Harmonized standard for IMT-2000, CDMA Direct Spread (UTRA FDD) (BS) covering essential requirements of article 3.2 of the R&TTE Directive";

Part 4: "Harmonized standard for IMT-2000, CDMA Multi-Carrier (cdma2000) (UE) covering essential requirements of article 3.2 of the R&TTE Directive";

Part 5: "Harmonized standard for IMT-2000, CDMA Multi-Carrier (cdma2000) (BS) covering essential requirements of article 3.2 of the R&TTE Directive";

Part 6: "Harmonized standard for IMT-2000, CDMA TDD (UTRA TDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive";

Part 7: "Harmonized standard for IMT-2000, CDMA TDD (UTRA TDD) (BS) covering essential requirements of article 3.2 of the R&TTE Directive";

Part 8: "Harmonized standard for IMT-2000, TDMA Single-Carrier (UWC 136) (UE) covering essential requirements of article 3.2 of the R&TTE Directive";

Part 9: "Harmonized standard for IMT-2000, TDMA Single-Carrier (UWC 136) (BS) covering essential requirements of article 3.2 of the R&TTE Directive";

Part 10 "Harmonized standard for IMT-2000 FDMA/TDMA (DECT) covering essential requirements of article 3.2 of the R&TTE Directive".

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Directive 1999/5/EC [1] of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive").

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Introduction

The present document is part of a set of standards designed to fit in a modular structure to cover all radio and telecommunications terminal equipment under the R&TTE Directive. Each standard is a module in the structure. The modular structure is shown in figure 1.

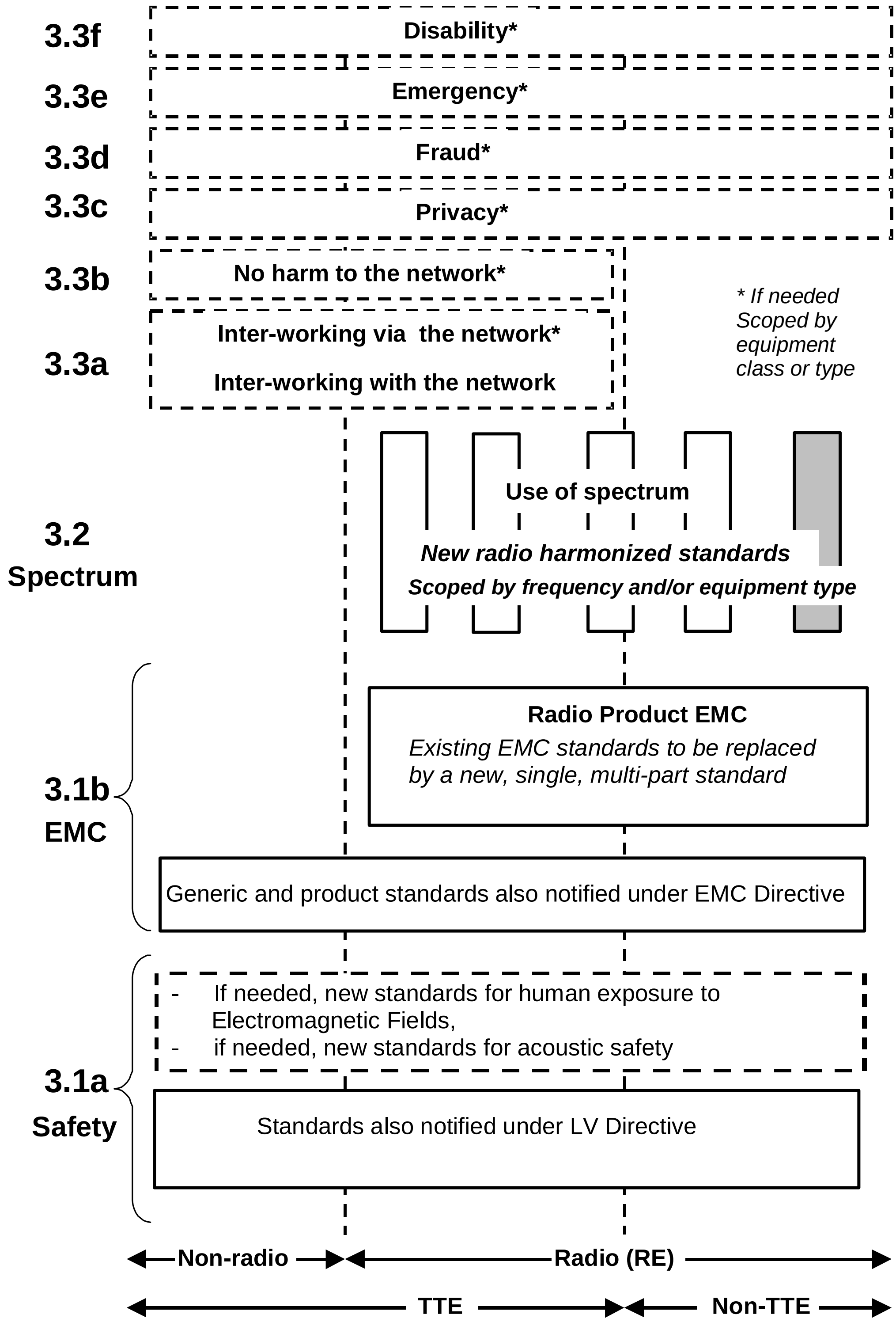


Figure 1: Modular structure for the various standards used under the R&TTE Directive

The left hand edge of the figure 1 shows the different clauses of article 3 of the R&TTE Directive.

For article 3.3 various horizontal boxes are shown. Dotted lines indicate that at the time of publication of the present document essential requirements in these areas have to be adopted by the Commission. If such essential requirements are adopted, and as far and as long as they are applicable, they will justify individual standards whose scope is likely to be specified by function or interface type.

The vertical boxes show the standards under article 3.2 for the use of the radio spectrum by radio equipment. The scopes of these standards are specified either by frequency (normally in the case where frequency bands are harmonized) or by radio equipment type.

For article 3.1b the diagram shows EN 301 489 [20], the multi-part product EMC standard for radio, and the existing collection of generic and product standards currently used under the EMC Directive [2].

For article 3.1a the diagram shows the existing safety standards currently used under the LV Directive [3] and new standards covering human exposure to electromagnetic fields. New standards covering acoustic safety may also be required.

The bottom of the figure shows the relationship of the standards to radio equipment and telecommunications terminal equipment. A particular equipment may be radio equipment, telecommunications terminal equipment or both. A radio spectrum standard will apply if it is radio equipment. An article 3.3 standard will apply as well only if the relevant essential requirement under the R&TTE Directive is adopted by the Commission and if the equipment in question is covered by the scope of the corresponding standard. Thus, depending on the nature of the equipment, the essential requirements under the R&TTE Directive may be covered in a set of standards.

The modularity principle has been taken because:

- it minimizes the number of standards needed. Because equipment may, in fact, have multiple interfaces and functions it is not practicable to produce a single standard for each possible combination of functions that may occur in an equipment;
- it provides scope for standards to be added:
  - under article 3.2 when new frequency bands are agreed; or
  - under article 3.3 should the Commission take the necessary decisions;
  - without requiring alteration of standards that are already published;
- it clarifies, simplifies and promotes the usage of Harmonized Standards as the relevant means of conformity assessment.

The product specifications upon which this multi-part deliverable is based, differ in presentation, and this is reflected in the present document.

1 Scope

The present document applies to the following radio equipment types:

1 IMT-2000 TDMA - Single-Carrier (SC) base station.

The IMT-2000 TDMA-SC specifies operation over 30 kHz and 200 kHz channels. The present document specifies the requirements for these channels in separate clauses.

These radio equipment types are capable of operating in all or any part of the frequency bands given in table 1.

Table 1: IMT-2000 service frequency bands

Direction of transmission	IMT-2000 service frequency bands
Transmit	2 110 MHz to 2 170 MHz
Receive	1 920 MHz to 1 980 MHz

The present document is intended to cover the provisions of Directive 1999/5/EC [1] (R&TTE Directive), article 3.2 which states that "….. radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the R&TTE Directive will apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site http://www.newapproach.org/.

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] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[2] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive).

[3] Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).

[4] ETSI EN 300 909: "Digital cellular telecommunications system (Phase 2+); Channel coding (GSM 05.03 version 8.5.1 Release 1999)".

[5] GSM 05.05 (ETSI EN 300 910): "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (GSM 05.05 version 8.3.1 Release 1999)".

[6] GSM 11.21 (ETSI EN 301 087): "Digital cellular telecommunications system (Phase 2 & Phase 2+); Base Station System (BSS) equipment specification; Radio aspects (GSM 11.21 version 8.1.1 Release 1999)".

[7] GSM 05.50 (ETSI TR 101 115): "Digital cellular telecommunications system (Phase 2+); Background for Radio Frequency (RF) requirements (GSM 05.50 version 8.2.0 Release 1999)".

[8] ITU-T Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".

[9] GSM 05.08 (ETSI EN 300 911): "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (GSM 05.08 version 8.4.1 Release 1999)".

[10] TIA/EIA-136-C: "TDMA Cellular PLS".

[11] TIA/EIA-136-131-B (2000): "TDMA Third Generation Wireless - Digital Traffic Channel Layer 1".

[12] TIA/EIA-136-270-B: "TDMA Third Generation Wireless - Mobile Station Minimum Performance".

[13] TIA/EIA-136-121-A (1999): "TDMA Cellular PCS - Digital Control Channel Layer 1".

[14] ETSI ETR 028 (1994): "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".

[15] GSM 05.04 (ETSI EN 300 959): "Digital cellular telecommunications system (Phase 2+); Modulation (GSM 05.04 version 8.1.2 Release 1999)".

[16] GSM 05.10 (ETSI TS 100 912): "Digital cellular telecommunications system (Phase 2+); Radio subsystem synchronization (GSM 05.10 version 8.4.0 Release 1999)".

[17] TIA/EIA-136-280-B: "TDMA Third Generation Wireless - Base Stations Minimum Performance".

[18] CEPT/ERC Recommendation 74-01 (1999): "Spurious emissions".

[19] ITU-R Recommendation SM.329-8: "Spurious emissions".

[20] ETSI EN 301 489: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the R&TTE Directive and the following apply:

environmental profile: range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ANS	American National Standard
BCCH	Broadcast Common Control CHannel
BER	Bit Error Rate
BLER	BLock Error Rate
BS	Base Station
BSS	Base Station System
BTS	Base Transceiver Station
DCCH	Digital Control CHannel
DQPSK	Differential Quadrature Phase Shift Keying
DTC	Digital Traffic Channel

DVCC	Digital Verification Color Code
EIA	Electronic Industry Association (USA)
EMC	Electro-Magnetic Compatibility
ERP	Effective Radiated Power
FCC	Federal Communications Committee
GMSK	Gaussian Minimum Shift Keying
GSM	Global Special Mobile
LV	Low Voltage
MS	Mobile Station (User Equipment)
MXM	Mixed Mode (a BS or network consisting of both 30 kHz and 200 kHz channels)
PCS	Personal Communication System
PSK	Phase Shift Keying
R&TTE	Radio and Telecommunications Terminal Equipment
RACH	Random Access CHannel
RBER	Raw Bit Error Rate
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RX	Receiver
Rx	Receive
SACCH	Slow Associated Control Channel
SC	Single Carrier
SFH	Slow Frequency Hopping
SWR	Standing Wave Ratio
TBD, tbd	To Be Defined
TDMA	Time Division Multiplexing
TIA	Telecommunication Industry Association
TRX	Transmitter-Receiver
TX	Transmitter
Tx	Transmit
UE	User Equipment

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

4.2 Conformance requirements

4.2.1 Introduction

To meet the essential requirement under article 3.2 of the R&TTE Directive [1] for IMT-2000 base station (BS), seven essential parameters have been identified. Tables 2 and 3 provide a cross reference between these essential parameters and the corresponding technical requirements for equipment within the scope of the present document.

Table 2: Cross references (30 kHz)

Essential parameter	Corresponding technical requirements
Spectrum emissions mask	4.3.1 Emission mask
Conducted spurious emissions from the transmitter antenna connector	4.3.2 Transmitter conducted spurious emissions
Accuracy of maximum output power	4.3.3 RF output power
Intermodulation attenuation of the transmitter	4.3.4 Transmitter intermodulation spurious emissions
Conducted spurious emissions from the receiver antenna connector	4.3.5 Receiver conducted spurious emissions
Impact of interference on receiver performance	4.3.6 Intermodulation spurious response attenuation
Receiver adjacent channel selectivity	4.3.7 Adjacent and alternate channel desensitization

Table 3: Cross references (200 kHz)

Essential parameter	Corresponding technical requirements
Spectrum emissions mask	4.4.1 Emissions mask
Conducted spurious emissions from the transmitter antenna connector	4.4.2 Transmitter conducted spurious emissions
Accuracy of maximum output power	4.4.3 Maximum RF output power
Intermodulation attenuation of the transmitter	4.4.4 Transmitter intermodulation spurious emissions
Conducted spurious emissions from the receiver antenna connector	4.4.5 Receiver conducted spurious emissions
Impact of interference on receiver performance	4.4.6 Receiver Intermodulation spurious response
Receiver adjacent channel selectivity	4.4.7 Receiver adjacent channel selectivity

4.3 Conformance requirements (30 kHz)

4.3.1 Emissions mask

4.3.1.1 Definition

The transmitter emission mask is defined as the attenuation requirements of the out-of-channel-band RF energy. This out-of-band emission is the result of the carrier modulation process, noise and filtering imperfections. The emissions of interest are those that fall into the immediate adjacent and first or second alternate channels.

4.3.1.2 Limit

The emission power in either adjacent channel, centred ±30 kHz from the carrier frequency, shall not exceed a level of 26 dB below the mean output power. The emission power in either alternate channel, centred ±60 kHz from the carrier frequency, shall not exceed a level of 45 dB below the mean output power. For output powers 50 W or less, the emission power in either second alternate channel, centred ±90 kHz from the carrier frequency, shall not exceed a level of 45 dB below the mean output power or -13 dBm, whichever is the lower power. For output powers greater than 50 W, the emission power in either second alternate channel, centred ±90 kHz from the carrier frequency, shall not exceed a level of 60 dB below the mean output power.

4.3.1.3 Conformance

Conformance tests described in clause 5.4.2 shall be performed.

4.3.2 Transmitter conducted spurious emissions

4.3.2.1 Definition

Conducted harmonic and spurious emissions are emissions measured at the antenna terminal on a frequency or frequencies that are outside the authorized bandwidth of the transmitter. Reduction in the level of these spurious emissions is essential for avoiding harmful interference and will not affect the quality of information being transmitted.

4.3.2.2 Limit

4.3.2.2.1 Spurious emissions, (Category B)

The power of any spurious emission shall not exceed the limits specified in table 4. This requirement is consistent with the recommendations of CEPT/ERC Recommendation 74-01 [18], annex 2.

Table 4: BS mandatory spurious emission limits, Category B

Band (f*)	Maximum level	Measurement bandwidth	Notes
9 kHz ≤ f ≤ 150 kHz	-36 dBm	1 kHz	1
150 kHz < f ≤ 30 MHz	-36 dBm	10 kHz	1
30 MHz < f ≤ 1 000 MHz	-36 dBm	100 kHz	1
1 000 MHz < f < 1 920 MHz	-30 dBm	1 MHz	1
1 920 MHz ≤ f ≤ 1 980 MHz	-70 dBm	30 kHz	2
1 980 MHz < f < 2 110 MHz	-30 dBm	1 MHz	1
2 110 MHz ≤ f ≤ 2 170 MHz	-13 dBm	30 kHz	3
2 170 MHz < f ≤ 12,75 GHz	-30 dBm	1 MHz	1
NOTE 1: In accordance with the applicable clauses of [19]. NOTE 2: BS receive band. NOTE 3: BS transmit band: * f is the frequency of the spurious emission.			

4.3.2.2.2 Co-existence with other systems

This requirement provides for the protection of MS receivers of served by the following GSM and 3G systems: GSM 400, GSM 900, DCS 1 800 and UTRA-TDD.

NOTE: UTRA FDD shares the same frequency band as UWC 136.

The power of any spurious emission shall not exceed the limits specified in table 5. Exceptions are defined in note 2 in table 5.

Table 5: Additional spurious emissions requirements

Service	Frequency Band	Measurement Bandwidth	Limit
GSM 450	460,4 ≤ f ≤ 467,6 MHz	100 kHz	-67 dBm
GSM 480	488,8 ≤ f ≤ 496,0 MHz	100 kHz	-67 dBm
R-GSM	921 MHz ≤ f ≤ 925 MHz	100 kHz	-60 dBm
R-GSM	925 MHz < f ≤ 935 MHz	100 KHz	-67 dBm
GSM 900/R-GSM	935 MHz < f ≤ 960 MHz	100 KHz	-79 dBm
DCS 1 800	1 805 MHz ≤ f ≤ 1 880 MHz	100 KHz	-71 dBm
UTRA TDD	1 900 MHz ≤ f ≤ 1 920 MHz	100 KHz	-62 dBm
UTRA TDD	2 010 MHz ≤ f ≤ 2 025 MHz	100 KHz	-62 dBm
NOTE 1: The measurements are made on frequencies which are integer multiples of 200 kHz. NOTE 2: Up to five exceptions of up to -36 dBm are permitted in the GSM 900, DCS 1 800 and UTRA bands, and up to three exceptions of up to -36 dBm are permitted in the GSM 400 bands.			

4.3.2.3 Conformance

Conformance tests described in clause 5.4.3 shall be performed.

4.3.3 RF output power

4.3.3.1 Definition

The base station output power shall be maintained at a constant level for the full duration of the frame when any slot is occupied, unless the base station is operating as part of a low power in-building system, in which case the base station may optionally discontinue transmissions for a maximum of one inactive slot per frame for an RF channel bearing a DCCH. For this type of operation, the base station shall continue transmissions during the inactive slot until after transmitting the synchronization word. The base station operating in this manner shall employ a ramp down interval of 3 symbols in duration (symbols 15, 16, and 17) after transmission of the synchronization word, and a ramp up interval of 3 symbols in duration (symbols 160, 161, and 162) prior to beginning transmission in the next slot.

RF power output measurement is a prerequisite in adjusting the transmit power at the cell site to the ERP specified for that site. Output power may be specified at the output connection of the transmitting equipment. The power output of the transmitter is the mean power during a frame observed at the measurement port when connected to its correct characteristic impedance and subjected to a set of given environmental conditions.

4.3.3.2 Limit

The power output shall meet the published specification for guaranteed output and shall be maintained in a range of +1 dB to -3 dB of its nominal value over the specified environmental limits.

4.3.3.3 Conformance

Conformance tests described in clause 5.4.4 shall be performed.

4.3.4 Transmitter intermodulation spurious emissions

4.3.4.1 Definition

Conducted transmitter intermodulation products at the antenna terminals are formed from the mixing of the output of one channel transmitter with the output of other channels. The generation of these spurious emissions shall not affect the quality of the information being transmitted.

The overall transmitter intermodulation performance shall take into consideration all transmitter combining and isolation equipment.

4.3.4.2 Limit

The transmitter intermodulation spurious emissions shall be attenuated at least 60 dB below the power level of either transmitter when all transmitter combining and isolation equipment is connected in its normal configuration.

A manufacturer of transmitters that are to be used with other manufacturers' combining and isolation equipment may choose to specify a different intermodulation performance for the transmitter itself with the understanding that the overall goal of 60 dB attenuation is to be achieved when all combining and isolation equipment is in place in a normal installation.

Radiated products from co-located transmitters shall not exceed spurious and harmonic level requirements that would apply to any of the transmitters operated singly.

4.3.4.3 Conformance

Conformance tests described in clause 5.4.5 shall be performed.

4.3.5 Receiver conducted spurious emissions

4.3.5.1 Definition

Conducted spurious-output signals are those generated or amplified in a receiver and appearing at the receiver antenna terminals.

4.3.5.2 Limit

No spurious-output signals appearing at the antenna terminals shall exceed 1 000 mV across 50 Ω (or equivalent output power of -47 dBm).

No spurious-output signals appearing at the antenna terminals and falling within the associated base station receive band shall exceed 22,4 mV across 50 Ω (or equivalent output power of -80 dBm).

No spurious-output signals appearing at the antenna terminals and falling within the base station transmit band shall exceed 224 mV across 50 Ω (or equivalent output power of -60 dBm).

4.3.5.3 Conformance

Conformance tests described in clause 5.4.6 shall be performed.

4.3.6 Intermodulation spurious response attenuation

4.3.6.1 Definition

The intermodulation spurious response attenuation of the receiver is the measure of its ability to receive a modulated input RF signal frequency in the presence of one modulated signal and one unmodulated signal, so separated from the assigned input signal frequency and from each other that the nth order mixing of the two undesired signals can occur in the non-linear elements of the receiver, producing a third signal whose frequency is equal to that of the assigned input RF signal frequency.

4.3.6.2 Limit

The BER on the Data Field bits in each test shall be less than 3 %.

4.3.6.3 Conformance

Conformance tests described in clause 5.4.7 shall be performed.

4.3.7 Adjacent and alternate channel desensitization

4.3.7.1 Definition

The adjacent channel selectivity and desensitization of a receiver is a measure of its ability to receive a modulated input signal on its assigned channel frequency in the presence of a second modulated input frequency spaced either one channel (30 kHz) above or one channel (30 kHz) below the assigned channel frequency.

The alternate channel selectivity and desensitization of a receiver is a measure of its ability to receive a modulated input signal on its assigned channel frequency in the presence of a second modulated input frequency spaced either two channels (60 kHz) above or two channels (60 kHz) below the assigned channel frequency.

4.3.7.2 Limit

The adjacent-channel BER on the Data Field bits shall be below 3 %. The alternate-channel BER on the Data Field bits in each test shall be below 3 %.

4.3.7.3 Conformance

Conformance tests described in clause 5.4.8 shall be performed.

4.4 Conformance requirements (200 kHz)

4.4.1 Emissions mask

4.4.1.1 Definition

4.4.1.1.1 Introduction

The specifications contained in this clause apply to BTS in frequency hopping as well as in non frequency hopping mode, except that beyond 1 800 kHz offset from the carrier the BTS is not tested in frequency hopping mode.

Due to the bursty nature of the signal, the output RF spectrum results from two effects:

- the modulation process;
- the power ramping up and down (switching transients).

The two effects are specified separately; the measurement method used to analyse separately those two effects is specified in GSM 11.21 [6]. It is based on the "ringing effect" during the transients, and is a measurement in the time domain, at each point in frequency.

The limits specified thereunder are based on a 5-pole synchronously tuned measurement filter.

Unless otherwise stated, only one transmitter is active for the tests of this clause.

4.4.1.1.2 Spectrum due to the modulation and wide band noise

The output RF modulation spectrum is specified in the following tables. Masks representing this specification are shown in figures 2 and 3. This specification applies for all RF channels supported by the equipment.

The specification applies to the entire of the relevant transmit band and up to 2 MHz either side.

The specification shall be met under the following measurement conditions:

- Up to 1 800 kHz from the carrier:
  - zero frequency scan, filter bandwidth and video bandwidth of 30 kHz up to 1 800 kHz from the carrier and 100 kHz at 1 800 kHz and above from the carrier, with averaging done over 50 % to 90 % of the useful part of the transmitted bursts, excluding the midamble, and then averaged over at least 200 such burst measurements. Above 1 800 kHz from the carrier, only measurements centred on 200 kHz multiples are taken with averaging over 50 bursts.
- At 1 800 kHz and above from the carrier:
  - swept measurement with filter and video bandwidth of 100 kHz, minimum sweep time of 75 ms, averaging over 200 sweeps. All slots active, frequency hopping disabled.
- When tests are done in frequency hopping mode, the averaging shall include only bursts transmitted when the hopping carrier corresponds to the nominal carrier of the measurement. The specifications then apply to the measurement results for any of the hopping frequencies.

The figures in tables 6 through 8, at the vertically listed power level (dBm) and at the horizontally listed frequency offset from the carrier (kHz), are then the maximum allowed level (dB) relative to a measurement in 30 kHz on the carrier.

NOTE: This approach of specification has been chosen for convenience and speed of testing. It does however require careful interpretation if there is a need to convert figures in the following tables into spectral density values, in that only part of the power of the carrier is used as the relative reference, and in addition different measurement bandwidths are applied at different offsets from the carrier. Appropriate conversion factors for this purpose are given in GSM 05.50 [7].

The power level is the "actual absolute output power" defined in clause 4.1.2 of GSM 05.05 [5]. If the power level falls between two of the values in the table, the requirement shall be determined by linear interpolation.

Table 6: Normal BTS

	100	200	250	400	≥ 600 < 1 200	≥ 1 200 < 1 800	≥ 1 800 < 6 000	≥ 6 000
≥ 43	+0,5	-30	-33	-60 (note)	-70	-73	-75	-80
41	+0,5	-30	-33	-60 (note)	-68	-71	-73	-80
39	+0,5	-30	-33	-60 (note)	-66	-69	-71	-80
37	+0,5	-30	-33	-60 (note)	-64	-67	-69	-80
35	+0,5	-30	-33	-60 (note)	-62	-65	-67	-80
≤ 33	+0,5	-30	-33	-60 (note)	-60	-63	-65	-80
NOTE: For equipment supporting 8-PSK, the requirement for 8-PSK modulation is -56 dB.								

Table 7: Micro-BTS

	100	200	250	400	≥ 600 < 1 200	≥ 1 200 < 1 800	≥ 1 800
35	+0,5	-30	-33	-60 (note)	-62	-65	-76
≤ 33	+0,5	-30	-33	-60 (note)	-60	-63	-76
NOTE: For equipment supporting 8-PSK, the requirement for 8-PSK modulation is -56 dB.							

Table 8: Pico-BTS

	100	200	250	400	≥ 600 < 1 200	≥ 1 200 < 1 800	≥ 1 800
≤ 23	+0,5	-30	-33	-60 (note)	-60	-63	-76
NOTE: For equipment supporting 8-PSK, the requirement for 8-PSK modulation is -56 dB.							

The micro-BTS spectrum due to modulation and noise, at all frequency offsets greater than 1,8 MHz from carrier, shall be -76 dB for all micro-BTS classes. These are average levels in a measurement bandwidth of 100 kHz relative to a measurement in 30 kHz on carrier. The measurement will be made in non-frequency hopping mode under the conditions specified for the normal BTS.

The following exceptions shall apply, using the same measurement conditions as specified above:

i) in the combined range 600 kHz to 6 MHz above and below the carrier, 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;

ii) above 6 MHz offset from the carrier 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. Only one transmitter is active for this test.

Using the same measurement conditions as specified above, if a requirement in tables 6 through 8 is tighter than the limit given in tables 9 and 10, the latter shall be applied instead.

Table 9: For normal BTS

Frequency offset from the carrier	Limit
< 1 800 kHz	max {-88 dB, -57 dBm}
≥ 1 800 kHz	max {-83 dB, -57 dBm}
NOTE: The levels given here in dB are relative to the output power of the BTS at the lowest static power level measured in 30 kHz.	

Table 10 applies to the micro and pico-BTS, at 1 800 kHz and above offset from the carrier.

Table 10: Micro and Pico-BTS

Power Class	Limit
M1	-57 dBm
M2	-62 dBm
M3	-67 dBm
P1	-65 dBm

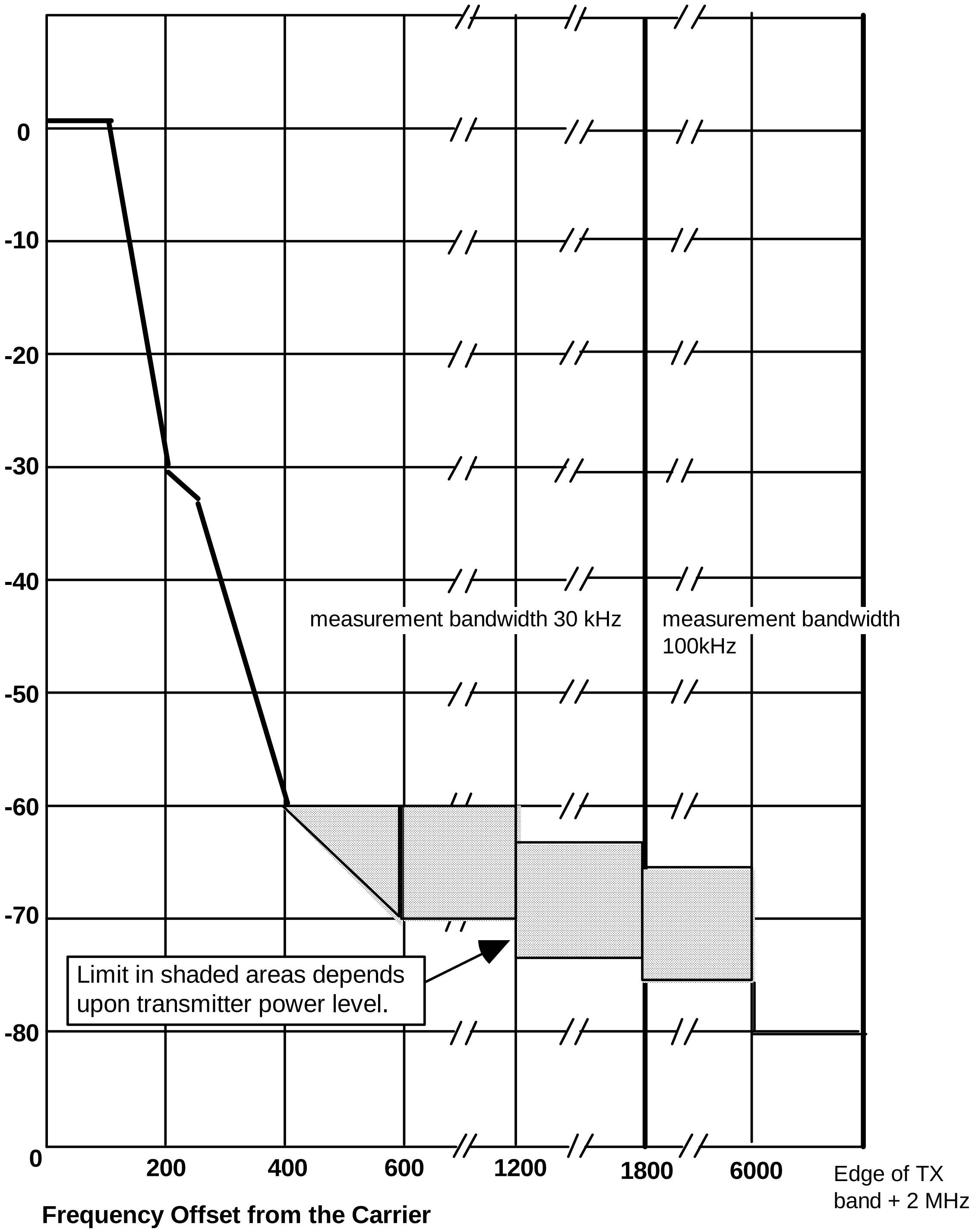


Figure 2: BTS Modulation and Noise Spectrum Mask due to GMSK modulation

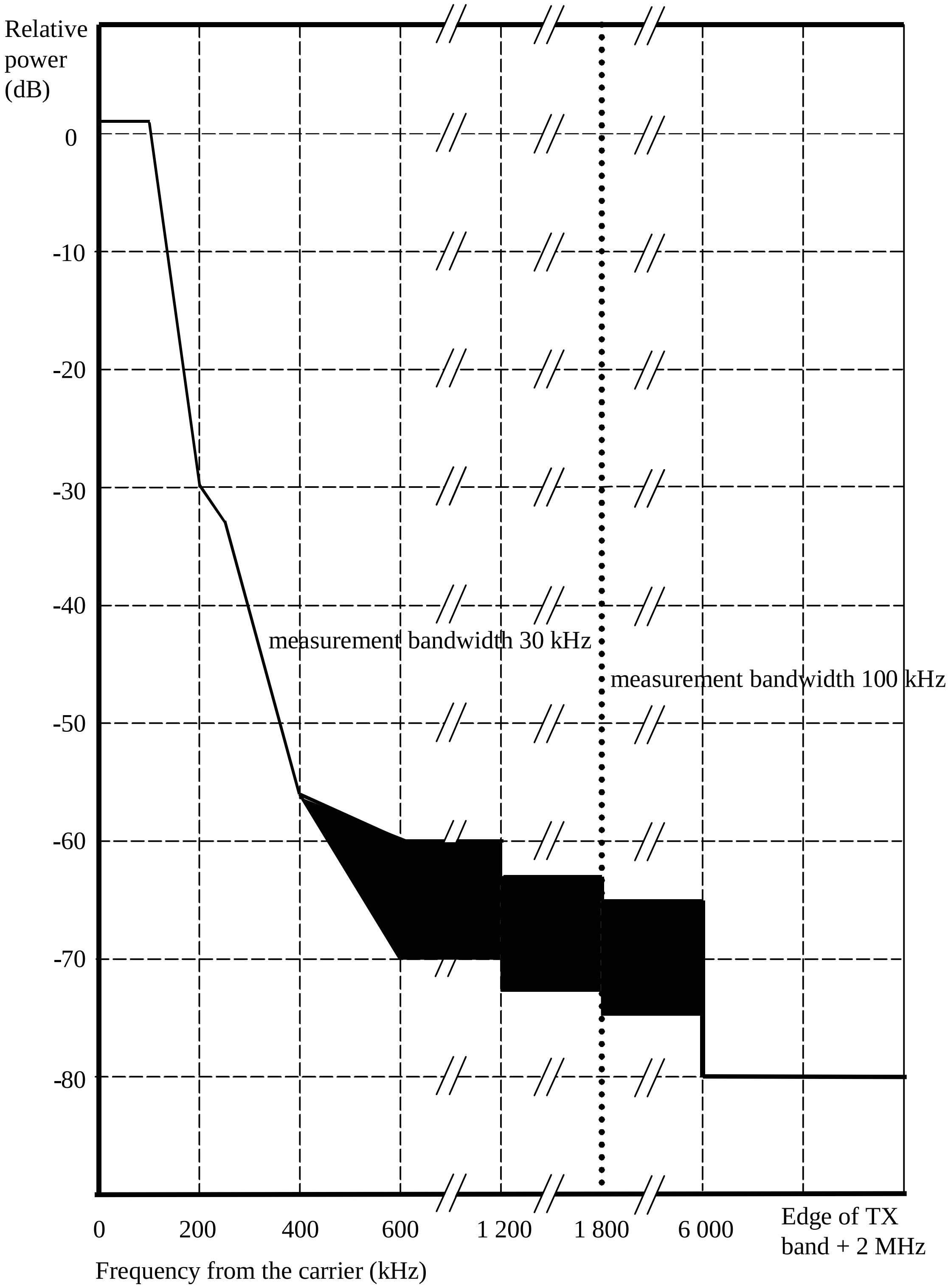


Figure 3: BTS modulation and noise spectrum mask due to 8-PSK modulation

4.4.1.1.3 Spectrum due to switching transients

Those effects are also measured in the time domain and the specifications assume the following measurement conditions: zero frequency scan, filter bandwidth 30 kHz, peak hold, and video bandwidth 100 kHz.

Examples of a wave-form due to a burst, as seen in a 30 kHz filter offset from the carrier, is given in figure 4.

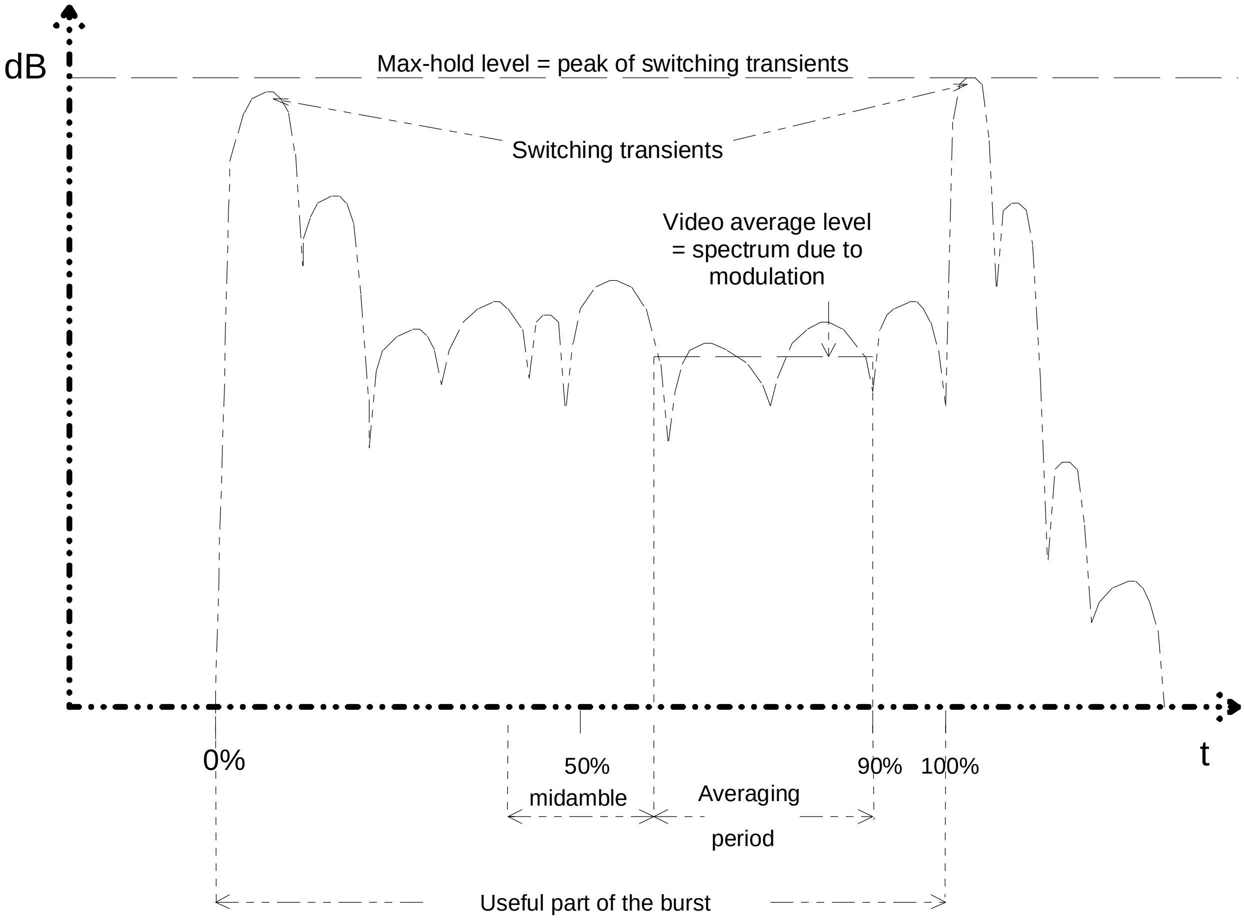


Figure 4: Example of a time waveform due to a burst as seen in a 30 kHz filter offset from the carrier

4.4.1.2 Limit

The maximum level measured, after any filters and combiners, at the indicated offset from the carrier, is as shown in table 11, or -36 dBm, whichever is the higher.

Table 11: Spectrum emission mask limits

Modulation	Maximum level measured			
	400 kHz	**600 kHz**	**1 200 kHz**	**1 800 kHz**
GMSK	-50 dBc	-58 dBc	-66 dBc	-66 dBc
8 PSK	-50 dBc	-58 dBc	-66 dBc	-66 dBc

NOTE: dBc means relative to the output power at the BTS, measured at the same point and in a filter bandwidth of 300 kHz.

4.4.1.3 Conformance

Conformance tests described in clause 5.5.1 shall be performed.

4.4.2 Transmitter conducted spurious emissions

4.4.2.1 Definition

Conducted spurious emissions, modulated and unmodulated, are unwanted emissions measured at the antenna terminal on a frequency or frequencies that are outside the authorized bandwidth of the transmitter.

4.4.2.2 Limit

4.4.2.2.1 BS spurious emissions, Category B

The spurious transmissions (whether modulated or unmodulated) and the switching transients are specified together by measuring the peak power in a given bandwidth at various frequencies. The bandwidth is increased as the frequency offset between the measurement frequency and, either the carrier, or the edge of the BTS transmit band, increases. The effect for spurious signals of widening the measurement bandwidth is to reduce the allowed total spurious energy per MHz. The effect for switching transients is to effectively reduce the allowed level of the switching transients (the peak level of a switching transient increases by 6 dB for each doubling of the measurement bandwidth). The measurement bandwidths are specified in tables 12 and 13, and a peak-hold measurement being assumed.

NOTE: The measurement conditions for radiated and conducted spurious are specified separately in GSM 11.21 [6]. The frequency bands where these are actually measured may differ from one type to the other (see GSM 11.21 [6]).

Table 12: Measurement bandwidths, in-band

Band	Frequency offset	Measurement bandwidth
2 110 MHz to 2 170 MHz	(offset from carrier)	
	≥ 1,8 MHz	30 kHz
	≥ 6 MHz	100 kHz

Table 13: Measurement bandwidths, out-of-band

Band	Frequency offset	Measurement bandwidth
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)	
	≥ 2 MHz	30 kHz
	≥ 5 MHz	100 kHz
above 500 MHz outside the relevant transmit band	(offset from 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

The measurement settings assumed, correspond, for the resolution bandwidth, to the value of the measurement bandwidth in the table, and for the video bandwidth to approximately three times this value.

The limits specified hereunder are based on a 5-pole synchronously tuned measurement filter and are specified in table 14.

Table 14: BS mandatory spurious emission limits, Category B

Band (f*)	Maximum level	Measurement bandwidth (note 4)	Note
9 kHz ≤ f ≤ 150 kHz	-36 dBm	1 kHz	1
150 kHz < f ≤ 30 MHz	-36 dBm	10 kHz	1
30 MHz < f ≤ 1 000 MHz	-36 dBm	100 kHz	1
1 000 MHz < f < 1 920 MHz	-30 dBm	1 MHz	1
1 920 MHz ≤ f ≤ 1 980 MHz	see table 15	see table 15	2
1 980 MHz < f < 2 110 MHz	-30 dBm	1 MHz	1
2 110 MHz ≤ f ≤ 2 170 MHz	-36 dBm	30 kHz, 100 kHz (table 12)	3
2 170 MHz < f ≤ 12,75 GHz	-30 dBm	1 MHz	1
NOTE 1: In accordance with the applicable clauses of [19]. NOTE 2: BTS receive band. NOTE 3: BTS transmit band. NOTE 4: The measurement bandwidth is also dependant on the offset from the carrier frequency. The values in table 13 shall be used when appropriate: * f is the frequency of the spurious emission.			

In the BTS receive band, the power measured with a filter and video bandwidth of 100 kHz, shall be no more than that shown in table 15.

Table 15: BTS receive-band spurious emissions limits

BTS Type	Limit (dBm)
normal BTS	-98
micro BTS M1	-96
micro BTS M2	-91
micro BTS M3	-86
pico-BTS P1	-80
NOTE: These values assume a 30 dB coupling loss between transmitter and receiver. If BTSs of different classes are co-sited, the coupling loss must be increased by the difference between the corresponding values from the table above.	

4.3.2.2.2 Co-existence with other systems

This requirement provides for the protection of MS receivers served by the following GSM and 3G systems: GSM 400, GSM 900, DCS 1 800 and UTRA-TDD.

NOTE: UTRA-FDD operates in same frequency band as UWC-136.

The power of any spurious emission shall not exceed the limits specified in table 16.

Table 16: Additional Spurious Emissions Requirements

Service	Frequency Band	Measurement Bandwidth	Minimum Requirement
GSM 450	460,4 ≤ f ≤ 467,6 MHz	100 kHz	-67 dBm
GSM 480	488,8 ≤ f ≤ 496,0 MHz	100 kHz	-67 dBm
R-GSM	921 MHz ≤ f ≤ 925 MHz	100 kHz	-60 dBm
R-GSM	925 MHz ≤ f ≤ 935 MHz	100 kHz	-67 dBm
GSM 900/R-GSM	935 MHz < f ≤ 960 MHz	100 kHz	-79 dBm
DCS 1800	1 805 MHz ≤ f ≤ 1 880 MHz	100 kHz	-71 dBm
UTRA TDD	1 900 MHz ≤ f ≤ 1 920 MHz	100 kHz	-62 dBm
	2 010 MHz ≤ f ≤ 2 025 MHz	100 kHz	-62 dBm
NOTE 1: The measurements are made on frequencies which are integer multiples of 200 kHz. NOTE 2: Up to five exceptions of up to -36 dBm are permitted in the GSM 900, DCS 1 800 and UTRA bands, and up to three exceptions of up to -36 dBm are permitted in the GSM 400 bands.			

4.4.2.3 Conformance

Conformance tests described in clause 5.5.2 shall be performed.

4.4.3 Maximum RF output power

4.4.3.1 Definition

The maximum output power of the BS transmitter is the nominal RF average power measured at the transceiver antenna connector when all timeslots are active and frequency hopping is not active.

4.4.3.2 Limit

4.4.3.2.1 General

The Base Station Transmitter maximum output power measured at the input of the BSS TX combiner shall be, according to its class, as defined in table 17.

Table 17: Maximum output power

TRX Power class	Maximum Output power
1	20 - (< 40) W
2	10 - (< 20) W
3	5 - (< 10) W
4	2,5 - (< 5) W

The micro-BTS and pico-BTS maximum output power per carrier measured at the antenna connector, after all stages of combining, shall be according to its class, defined in table 18.

Table18: Micro-BTS and Pico-BTS maximum output power

TRX power class	Maximum output power
Micro-BTS	
M1	(> 27) - 32 dBm
M2	(> 22) - 27 dBm
M3	(> 17) - 22 dBm
Pico-BTS	
P1	(> 16) - 23 dBm

For BTS supporting 8-PSK, the manufacturer shall declare the output power capability at 8-PSK modulation. The class of a micro-BTS or a pico-BTS is defined by the highest output power capability for either modulation and the output power shall not exceed the maximum output power of the corresponding class.

The tolerance of the actual maximum output power of the BTS shall be ±2 dB under normal conditions and ±2,5 dB under extreme conditions. Settings shall be provided to allow the output power to be reduced from its maximum level in at least six steps of nominally 2 dB with an accuracy of ±1 dB to allow a fine adjustment of the coverage by the network operator. In addition, the actual absolute output power at each static RF power step (N) shall be 2*N dB below the absolute output power at static RF power step 0 with a tolerance of ±3 dB under normal conditions and ±4 dB under extreme conditions. The static RF power step 0 shall be the actual output power according to the TRX power class.

As an option the BSS can utilize downlink RF power control. In addition to the static RF power steps described above, the BSS may then utilize up to 15 steps of power control levels with a step size of 2 dB ±1,5 dB, in addition the actual absolute output power at each power control level (N) shall be 2*N dB below the absolute output power at power control level 0 with a tolerance of ±3 dB under normal conditions and ±4 dB under extreme conditions. The power control level 0 shall be the set output power according to the TRX power class and the six power settings defined above.

Network operators or manufacturers may also specify the BTS output power including any Tx combiner, according to their needs.

4.4.3.2.2 Additional requirements for base stations

The BTS transmitter maximum rated output power per carrier, measured at the input of the transmitter combiner, shall be, according to its TRX power class, as defined in table 17. The base station output power may also be specified by the manufacturer or system operator at a different reference point (e.g. after transmitter combining).

4.4.3.3 Conformance

Conformance tests described in clause 5.5.3 shall be performed.

4.4.4 Intermodulation attenuation of the transmitter

4.4.4.1 Definition

The intermodulation attenuation is the ratio of the power level of the wanted signal to the power level of an intermodulation component. It is a measure of the capability of the transmitter to inhibit the generation of signals in its non-linear elements caused by the presence of the carrier and an interfering signal reaching the transmitter via the antenna.

4.4.4.2 Limit

4.4.4.2.1 Base transceiver station

An interfering CW signal shall be applied within the relevant BTS TX band at a frequency offset of ≥ 800 kHz, and with a power level 30 dB below the power level of the wanted signal.

The intermodulation products shall meet the following requirements.

4.4.4.2.2 Intra BTS intermodulation attenuation

In a BTS intermodulation may be caused by combining several RF channels to feed a single antenna, or when operating them in the close vicinity of each other. The BTS shall be configured with each transmitter operating at the maximum allowed power, with a full complement of transceivers and with modulation applied. For the measurement in the transmit band the equipment shall be operated at equal and minimum carrier frequency spacing specified for the BSS configuration under test. For the measurement in the receive band the equipment shall be operated with such a channel configuration that at least 3rd order intermodulation products fall into the receive band.

All the following requirements relate to frequency offsets from the uppermost and lowermost carriers. For frequency offsets > 1,8 MHz to the edge of the relevant Tx band, measured in 300 kHz bandwidth, the average value of intermodulation components over a timeslot shall not exceed -70 dBc relative to the per carrier power, or -46 dBm, whichever is the higher. For offsets between 600 kHz and 1,8 MHz, the measurement technique and requirements are those specified in clause 4.4.2.1.2, except for offsets between 1,2 and 1,8 MHz, where the value of intermodulation components shall not exceed -70 dBc.

The other requirements of clause 4.4.3.2 in the band 9 kHz to 12,75 GHz shall still be met.

4.4.4.3 Conformance

Conformance tests described in clause 5.5.4 shall be performed.

4.4.5 Receiver conducted spurious emissions

4.4.5.1 Definition

Spurious emissions are emissions at frequencies other than those of the BTS transmitter operating and adjacent frequencies. This test measures spurious emissions at the BTS receiver antenna connector.

4.4.5.2 Limit

The spurious emissions from a BTS receiver, measured in the conditions specified in clause 4.4.2.1, shall be no more than:

- 2 nW (-57 dBm) in the frequency band 9 kHz to 1 GHz;
- 20 nW (-47 dBm) in the frequency band 1 GHz to 12,75 GHz.

4.4.5.3 Conformance

Conformance tests described in clause 5.5.5 shall be performed.

4.4.6 Impact of interference on receiver performance

The impact of interference on the receiver performance is characterized by these performance criteria:

a) AM suppression characteristics;

b) intermodulation characteristics;

c) receiver blocking.

4.4.6.1 AM suppression characteristics

4.4.6.1.1 Definition

Amplitude Modulation (AM) suppression is a measure of the receiver's rejection of the amplitude variations caused by interfering signals.

4.4.6.1.2 Limit

The reference sensitivity performance as specified in tables B.1 and B.1a) to B.1c) shall be met when the following signals are simultaneously input to the receiver.

- For normal BTS a useful signal, modulated with the relevant supported modulation (GMSK or 8-PSK), at frequency f_0, 3 dB above the reference sensitivity level or input level for reference performance, whichever is applicable.
- A single frequency (f), in the relevant receive band, $|f-f_0| > 6$ MHz, which is an integer multiple of 200 kHz, a GSM TDMA signal modulated in GMSK and by any 148-bit sequence of the 511-bit pseudo random bit sequence, defined in ITU-T Recommendation O.153 [8] fascicle IV.4, at a level as defined in table 19. The interferer shall have one timeslot active and the frequency shall be at least 2 channels separated from any identified spurious response. The transmitted bursts shall be synchronized to but delayed in time between 61 bit and 86 bit periods relative to the bursts of the wanted signal.

NOTE: When testing this requirement, a notch filter may be necessary to ensure that the co-channel performance of the receiver is not compromised.

Table 19: Blocking levels, Normal, Micro and Pico-BTS

BTS type	Normal	Micro and pico-BTS			
Level	(dBm)	M1 (dBm)	M2 (dBm)	M3 (dBm)	P1 (dBm)
	-35	-33	-28	-23	-26

4.4.6.1.3 Conformance

Conformance tests described in clause 5.5.6.1 shall be performed.

4.4.6.2 Intermodulation characteristics

4.4.6.2.1 Definition

The mixing of wanted and unwanted signals in the receiver may cause intermodulation products produced by non-linear characteristics of RF front-end elements of the receiver. The effect of these unwanted products is reduced receiver sensitivity.

4.4.6.2.2 Limit

The reference sensitivity performance as specified in tables B.1 and B.1a) to B.1c) shall be met when the following signals are simultaneously input to the receiver:

- a useful signal at frequency f_0, 3 dB above the reference sensitivity level or input level for reference performance, whichever is applicable, as specified in clause 4.4.2.1;
- a continuous, static sine wave signal at frequency f_1 and a level of -49 dBm;
- any 148-bits sub-sequence of the 511-bits pseudo-random sequence, defined in ITU-T Recommendation O.153 [8] fascicle IV.4 modulating a signal at frequency f_2, and a level of -49 dBm:
  - such that $f_0 = 2f_1 - f_2$ and $|f_2-f_1| = 800$ kHz.

NOTE: For clauses 4.4.6.1 (AM suppression) and 4.4.6.2 (Intermodulation), instead of any 148-bits sub-sequence of the 511-bits pseudo-random sequence, defined in ITU-T Recommendation O.153 [8] fascicle IV.4, it is also allowed to use a more random pseudo-random sequence.

4.4.6.2.3 Conformance

Conformance tests described in clause 5.5.6.2 shall be performed.

4.4.6.3 Receiver blocking characteristics

4.4.6.3.1 Definition

Receiver blocking is a measure of the receiver's ability to correctly detect and decode the wanted signal at sensitivity levels, when other signals, much stronger but of different frequency channels, are also present at the receiver input.

The blocking characteristics of the receiver are specified separately for in-band and out-of-band performance as identified in table 20.

Table 20: Frequency bands definition

Frequency band	Frequency range (MHz)
in-band (note)	1 900 to 2 000
out-of-band (a)	0,1 to < 1 900
out-of-band (b)	N/A
out-of band (c)	N/A
out-of band (d)	> 2 000 to 12 750
NOTE: Including 20 MHz either side.	

4.4.6.3.2 Limit

The reference sensitivity performance, as specified in tables B.1, B.1a, B.1b and B.1c shall be met when the signals specified in clause 4.4.6.1.2 are simultaneously input to the receiver:

- a useful signal, modulated with the relevant supported modulation (GMSK or 8-PSK), at frequency f_0, 3 dB above the reference sensitivity level or input level for reference performance, whichever is applicable;
- a continuous, static sine wave signal at a level specified in tables 21 and 22 and at a frequency (f) which is an integer multiple of 200 kHz.

with the following exceptions, called spurious response frequencies:

a) BTS in band, for a maximum of twelve occurrences (which if grouped, shall not exceed three contiguous occurrences per group);

b) BTS out of band, for a maximum of 24 occurrences (which if below f_0 and grouped, shall not exceed three contiguous occurrences per group).

For the above cases, a) and b), the performance shall be met when the continuous sine wave signal (f) is set to a level of 70 dBµV (emf) (i.e. -43 dBm).

Table 21: Blocking signal levels, normal BTS

Frequency band	Level	
	dBµV (emf)	dBm
in-band		
600 kHz ≤ $\|f - f_0\|$ < 800 kHz	78	-35
800 kHz ≤ $\|f - f_0\|$ < 1,6 MHz	88	-25
1,6 MHz ≤ $\|f - f_0\|$ < 3 MHz	88	-25
3 MHz ≤ $\|f - f_0\|$	88	-25
Out-of-band		
(a)	113	0
(b)	-	-
(c)	-	-
(d)	113	0

The following exceptions to the level of the sine wave signal (f) in the above table shall apply.

The blocking characteristics of the micro-BTS receiver are specified for in-band and out-of-band performance. The out-of-band blocking remains the same as a normal BTS and the in-band blocking performance shall be no worse than in the table 22.

Table 22: Blocking signal levels, Micro and Pico-BTS

Frequency band	Micro and Pico-BTS			
	M1 (dBm)	M2 (dBm)	M3 (dBm)	P1 (dBm)
in-band				
600 kHz ≤ $\|f - f_0\|$ < 800 kHz	-40	-35	-30	-41
800 kHz ≤ $\|f - f_0\|$ < 1,6 MHz	-30	-25	-20	-41
1,6 MHz ≤ $\|f - f_0\|$ < 3 MHz	-30	-25	-20	-31
3 MHz ≤ $\|f - f_0\|$	-30	-25	-20	-23

The blocking performance for the pico-BTS attempts, for the scenario of a close proximity uncoordinated MS, to balance the impact due to blocking by the MS with that due to wideband noise overlapping the wanted signal.

4.4.6.3.3 Conformance

Conformance tests described in clause 5.5.6.3 shall be performed.

4.4.7 Adjacent channel selectivity

4.4.7.1 Definition

The adjacent channel selectivity of a receiver is a measure of its ability to receive, without degradation of performance, a wanted input signal on its assigned channel frequency, in the presence of a second modulated signal at other frequencies.

4.4.7.2 Limit

The selectivity of the received signal level measurement shall be as follows:

- for adjacent (200 kHz) channel:≥ 16 dB;
- for adjacent (400 kHz) channel:≥ 48 dB;
- for adjacent (600 kHz) channel:≥ 56 dB.

The selectivity shall be met using random, continuous, GSM-modulated signals with the wanted signal at the level 20 dB above the reference sensitivity level.

4.4.7.3 Conformance

Conformance tests described in clause 5.5.7 shall be performed.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

Normally it should be sufficient for all tests to be conducted using normal test conditions (defined in clause 5.2.2) except where otherwise stated.

Some tests in the present document are performed with appropriate frequencies in the bottom, middle and top of the operating frequency band of the BS. These are denoted as RF channels B (bottom), M (middle) and T (top).

5.2 Test conditions

5.2.1 Standard test equipment

5.2.1.1 Standard test source

The standard test source shall consist of a configuration of test equipment complying with the following requirements:

a) it shall be tunable over the applicable range of radio frequencies;

b) it shall be capable of generating π/4 DQPSK modulation corresponding to a serial input data stream and associated data clock. The clock frequency shall be nominally 48,6 kHz for π/4 DQPSK. The output wave-form shall have an RMS error vector magnitude of no greater than 3,2 % and conform to the requirements of TIA/EIA-136-C [10]. It shall be capable of generating 8-PSK modulation corresponding to a serial input data stream and associated data clock. The clock frequency shall be nominally 72,9 kHz for 8-PSK. The output wave-form shall have an RMS error vector magnitude of no greater than 3,2 % and conform to the requirements of TIA/EIA-136-C [10];

c) it shall be capable of generating signal levels from -120 dBm to -15 dBm. It shall have an accuracy of ±1,5 dB up to 2 000 MHz;

d) it shall have an output impedance of 50W, with a maximum SWR of 1,5: 1 over the range specified in (a);

e) it shall be capable of generating a static channel without Rayleigh fading and without dispersion;

f) it shall have a frequency resolution of 10 Hz;

g) it shall have an amplitude resolution of 0,1 dB;

h) it shall maintain frequency stability of ±0,10 ppm;

i) it shall have adequate noise performance to perform adjacent and alternate channel measurements.

5.2.1.2 Standard test receiver

The standard test receiver shall consist of a configuration of test equipment complying with the following minimal requirements:

a) it shall be tunable over the applicable range of radio frequencies and shall have a nominal input impedance of 50 Ω;

b) it shall be capable of demodulating a π/4 DQPSK modulated signal, recovering the associated data clock and providing the serial data stream at the output. Its BER, when demodulating a signal that conforms to the modulation accuracy specifications in TIA/EIA-136-131-B [11] and having a carrier to noise ratio of at least 60 dB shall be no greater than 0,01 %. It shall be capable of demodulating an 8-PSK modulated signal, recovering the associated data clock and providing the serial data stream at the output. Its BER, when demodulating a signal that conforms to the modulation accuracy specifications in TIA/EIA-136-131-B [11] and having a carrier to noise ratio of at least 60 dB shall be no greater than 0,01 %;

c) it shall be capable of recovering data from a mobile station with 15 % error vector magnitude with BER no greater than 0,1 %;

d) it shall be capable of demodulating signals over a 51 dB range;

e) it shall be capable of demodulating signals with origin offsets < -20 dBc;

f) it shall be capable of demodulating signals with frequency offsets of ±1 kHz.

5.2.1.3 Spectrum analyzer or measuring receiver

The spectrum analyzer or measuring receiver shall have the following characteristics:

a) it shall be capable of measuring signals with levels from -90 dBm to +20 dBm over the applicable range of frequencies;

b) it shall have a dynamic range of at least 70 dB with a log fidelity accuracy of ±1 dB over this range;

c) it shall have a relative frequency response of ±1 dB over the frequency range of 10 MHz to 6 000 MHz;

d) it shall have synchronously tuned or Gaussian intermediate frequency filters of at least 3 poles with selectable bandwidths of 300 kHz, 30 kHz, 3 kHz and 1 kHz or narrower;

e) it shall have post detection video filtering bandwidths selectable in decade steps from 100 Hz to 1 MHz;

f) it shall provide the choice of peak and sample detection;

g) it shall have peak hold and video average functions;

h) it shall be capable of measuring the mean power of a modulated signal, using a passband equivalent to an ideal root raised-cosine receiver filter. The mean power measurement of a signal modulated with pseudo random data shall be within ±0,5 dB of the measurement of an unmodulated signal of the same power using the peak detector.

5.2.1.4 Modulation accuracy measurement equipment

The modulation accuracy measurement equipment shall consist of a configuration of test equipment complying with the following minimal requirements:

a) it shall be tunable over the applicable range of radio frequencies;

b) it shall be capable of measuring RMS error vector magnitude as specified in clause 3.3.2 of TIA/EIA-136-270-B [12] of with the following accuracies and residuals:

   1) accuracy: greater of residual or 5 % of reading;

   2) residual: 0,5 %;

c) it should be capable of demodulating signals from -18 dBm to +39 dBm;

d) it shall be capable of measuring origin offset as specified in clause 3.3.2 of TIA/EIA-136-270-B [12] with an accuracy of ±1 dB;

e) it shall be capable of resolving frequency offsets averaged over a burst to ±10 Hz.

5.2.1.5 Standard BER/WER test equipment

a) Data Generation: It shall be capable of generating a pseudo-random bit stream that is interleaved and built into time slots in accordance with TIA/EIA-136-131-B [11] (DTC) and TIA/EIA-136-121-A [13] (DCCH).

b) Data Reception: It shall be capable of receiving the data in time slot format. Data from the user part of the DTC, BCCH and RACH will be de-interleaved for comparison to the original pseudo-random bit stream.

c) BER shall be measured up to rates of 40 %.

d) WER shall be measured up to rates of 100 % provided BER is less than 40 %.

5.2.1.6 Standard protocol test equipment

The standard Protocol test equipment shall have the necessary signalling and protocol capability to perform:

a) call origination and mobile station paging;

b) handoffs within digital or analog modes and across mode boundaries;

c) time alignment tests;

d) mobile assisted handoff tests.

5.2.1.7 Standard channel simulator

Measurements requiring the standard channel simulator will be performed at a nominal mobile station receive center frequency and a nominal base station receive center frequency.

The maximum Doppler frequency referred to in this clause is a function of the receive center frequency of the unit under test and the simulated vehicle speed, as follows:

$$f_d = \left(\frac{v}{c}\right) f_c$$

where v is simulated vehicle speed, c is 2,997 925 x 10^8 ms^{-1}, the speed of light in vacuum, and fc is 1 960,020 MHz for mobile station testing and 1 879,980 MHz for base station testing. Table 23 gives the corresponding values of v and fd.

Table 23: Vehicular speed and Doppler frequency

Vehicle Speed in km/h	MS fd in Hz	BS fd in Hz
8	14,529	13,935
50	90,804	87,096
100	181,609	174,193

The standard channel simulator shall at a minimum be capable of the following:

a) RF input and output center frequencies between 1 920 MHz to 1 980 MHz and 2 110 MHz to 2 170 MHz;

b) simulate a flat fading channel for simulated vehicle speeds varying from 8 to 100 km/h. Specifically for 8 km/h, 50 km/h and 100 km/h (nominally 5 mph, 30 mph and 60 mph);

c) simulate two rays with independent fading statistics. Each Rayleigh faded ray shall have a time delay of up to 1 symbol (41,6 ms) with delay resolution of 0,1 ms;

d) have sufficient bandwidth to accommodate co-channel and adjacent channel measurements. The passband characteristics of the channel simulator shall not degrade the modulated signal, as specified in clause 3.3.2 of TIA/EIA-136-270-B [12].

5.2.1.8 Rayleigh fading conditions

Generation of the Rayleigh fading conditions shall conform to the following (all measurements shall hold for simulated vehicle speeds of 8 km/h and 100 km/h upon an unmodulated carrier).

a) The measured Rayleigh Cumulative Probability Distribution Function (CPDF) shall be compared against a calculated CPDF:

   For P < 0: F(P) ≥ 0; For P = 0: F(P) = 1 - exp{-P/P_{ave}}, where P is the signal power level and P_{ave} is the mean power level.

   1) Measured CPDF of Power shall be within ±1 dB of the calculated CPDF of Power from 10 dB above the mean power level to 20 dB below the mean power level.

   2) Measured CPDF of Power shall be within ±5 dB of the calculated CPDF of Power from 20 dB below the mean power level to 30 dB below the mean power level.

b) The Level Crossing Rate (LCR) shall be compared against a calculated LCR. The calculated Rayleigh level crossing rate, L(P), is as follows:

   For P < 0: L(P) = 0; For P = 0: L(P) = $(2p\ P/Pave)^{0,5}$ f_d exp{-P/Pave}, where P is the signal power level, Pave is the mean power level, and f_d is the Doppler frequency offset associated with the simulated vehicle speed.

   1) The measured LCR curve shall not deviate from the calculated LCR curve by more than 5 % of the simulated vehicle speed. This shall hold for 10 dB above the mean power level to 30 dB below the mean power level.

c) The measured power spectral density, S(f), shall meet the requirements specified below. The power spectrum measurement shall be made on an unmodulated carrier (at frequency f_c) applied to the input of the channel simulator:

   1) The maximum power spectral density level, S_{max}, shall exceed $S(f_c)$ by at least 6 dB.

   2) The simulated Doppler frequency offset, f_d, shall be within ±5 % of the theoretical Doppler frequency offset associated with the vehicle speed. The simulated Doppler frequency offset shall be calculated from the measured power spectral density as follows:

   $f_d = (1/2\pi)(2b_2/b_0)^{0,5}$,

where $b_n = (2\pi)^n \int_0^\infty S(f)(f-f_c)^n df$

b_n is the n^{th} moment of S(f).

3) S(f) shall be at least 30 dB below $S(f_c)$ for $|f-f_c| > 2f_d$.

The correlation coefficient of the unwrapped phase of the emulated, received signal shall be compared against the calculated theoretical correlation coefficient of the phase of a Rayleigh faded signal. The theoretical correlation coefficient, is well approximated by:

$$\rho(\tau) \approx \frac{3}{2\pi}\sin^{-1}(h(\tau)) + 6\left(\frac{1}{2\pi}\sin^{-1}(h(\tau))\right)^2 - \frac{3}{4\pi^2}\sum_{n=1}^{\infty}\frac{h(\tau)^{2n}}{n^2}$$

where:

$$h(\tau) = J_0(2\pi f_d \tau) * \frac{\sin(2\pi f_d \tau)}{(2\pi f_d \tau)}$$

and * is the convolution function.

4) The measured correlation coefficient of the phase shall be 0,8 ± 0,1 at a lag of $0{,}05/f_d$, and 0,5 ± 0,1 at a lag of $0{,}15/f_d$. The theoretical curve is shown in figure 5.

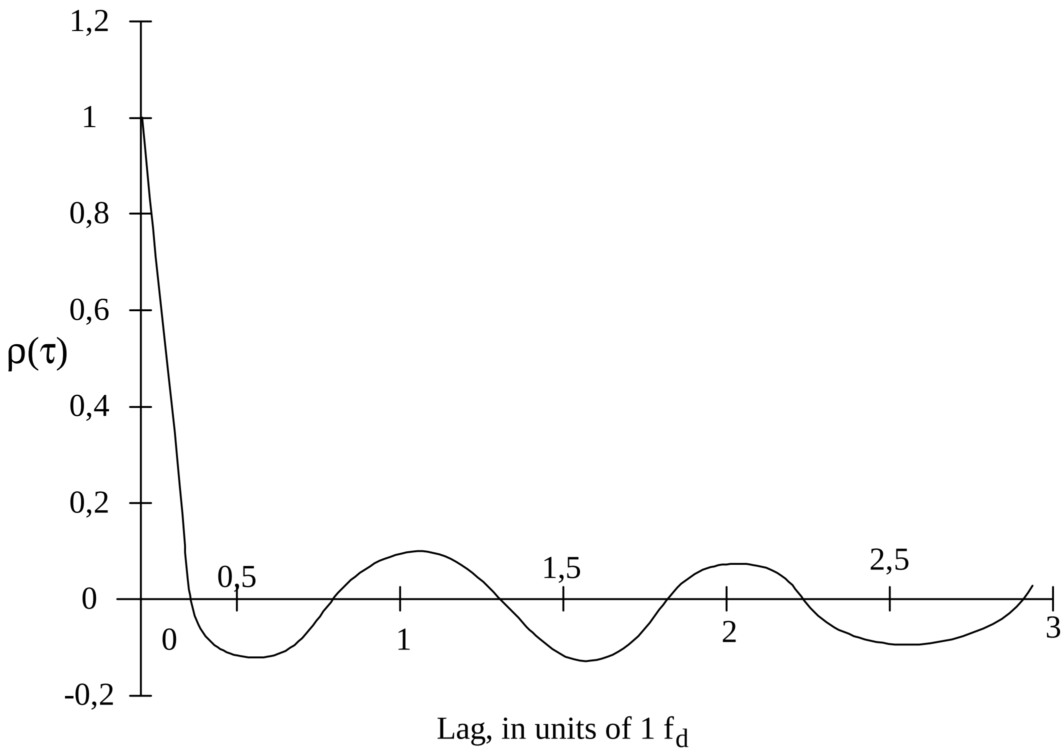


Figure 5: Theoretical correlation coefficient

5.2.2 Standard test environment

Pressure ±5 kPa
Temperature ±2 degrees
Relative Humidity ±5 %
DC Voltage ±1,0 %
AC Voltage ±1,5 %
Vibration 10 %
Vibration frequency 0,1 Hz
The above values shall apply unless the test environment is controlled and the specification for the control of the test environment specifies the uncertainty for the parameter.

5.3 Interpretation of the test results

5.3.1 Measurement uncertainties

The maximum acceptable uncertainty of measurement equipment is specified separately for each test, where appropriate. The measurement equipment shall enable the stimulus signals in the test case to be adjusted to within the specified tolerance, and the conformance requirement to be measured with an uncertainty not exceeding the specified values. All tolerances and uncertainties are absolute values, unless otherwise stated.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with ETR 028 [14] and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian). Table 24 is a summary of all measurement uncertainties.

Table 24: Measurement uncertainty values for the essential tests

Clause	Test	Parameter	Conditions		Uncertainty
	Emission mask	RF power, absolute	-		±1,0 dB
		RF power, relative	Offset from carrier, (MHz)	Power difference (dB)	-
			Δ f ≤ 0,1 MHz	All	±0,5 dB
			0,1 MHz < Δf ≤1,8 MHz	< 50 dB	±0,7 dB
			0,1 MHz < Δf ≤1,8 MHz	≥ 50 dB	±1,5 dB
			Δf > 1,8 MHz	All	±2,0 dB
	Transmitter conducted spurious emissions	RF power	In the TX band		±1,5 dB
			In the RX band		±3 dB
			F ≤2 GHz		±1,5 dB
			2 GHz < f ≤ 4 GHz		±2,0 dB
			F > 4 GHz		±4,0 dB
	RF power output	Carrier power	Static		±1,0 dB
			Relive power steps		±0,7 dB
		Carrier power versus time	RF power (0 dB reference)		±1,0 dB
			RF power relative to 0 dB reference		±1,0 dB
	Transmitter intermodulation spurious emissions	Relative RF power	Injected signal		±1,5 dB
			Outside the RX band, absolute limits		±1,5 dB
			Outside the RX band, relative measurements		±2,0 dB
			Inside the RX band, absolute limits		+4 dB - 3 dB
	Receiver conducted spurious emissions	RF power	F ≤ 2 GHz		±1,5 dB
			2 GHz < f ≤ 4 GHz		±2,0 dB
			F > 4 GHz		±4,0 dB
	AM suppression characteristics	RF power	Wanted signal		±1,0 dB
	Intermodulation spurious response		Interfering signals		±0,7 dB
	Adjacent and alternate channel desensitization	RF power	Static reference sensitivity		±1,0 dB
			Sensitivity, adjacent timeslots		±3,0 dB
	Blocking characteristics		Wanted signal		±1,0 dB
			Interfering signal, f ≤ 2 GHz		±0,7 dB
			Interfering signal, 2 GHz < f ≤ 4 GHz		±1,5 dB
			F > 4 GHz		±3,0 dB
	Adjacent channel selectivity	Relative RF power			±1,0 dB

NOTE: Where a measurement uncertainty of +X dB -0 dB is specified for an input signal, the measured value of the input signal should be increased by an amount equal to the uncertainty with which it can be measured. This will ensure that the true value of the input signal is not below the specified nominal.

5.3.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measurement value related to the corresponding limit shall be used to decide whether an equipment meets a requirement in the present document;
- the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value for the measurement uncertainty shall be, for each measurement, equal to or lower than the appropriate value in table 24.

NOTE: The following procedure is recommended in ETR 028 [14].

If the measurement apparatus for a test is known to have a measurement uncertainty greater than that specified in table 20, it is still permitted to use this apparatus provided that an adjustment is made to the measured value as follows:

- the adjustment is made by subtracting the modulus of the specified measurement uncertainty from the measurement uncertainty of the apparatus. The measured value is then increased or decreased by the result of the subtraction, whichever is most unfavourable in relation to the limit.

For the 30 kHz channel measurements, the following shall also apply:

- the value of the measurement uncertainty or the accuracy of each piece of test equipment used for the measurement of each parameter shall be included in the test report; only test equipment meeting the performance requirements for standard test equipment as defined in clause 5.2.1, shall be used;

- the recorded value of the accuracy of each piece of test equipment shall be equal to or better than the figures in clause 5.2.1.

- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 24.

5.4 Essential radio test suites (30 kHz)

5.4.1 General requirements

Measurements for 30 kHz operations are performed using measuring equipment that complies with the requirements in clause 5.2.1.

5.4.2 Emissions mask

Modulate the base station transmitter for all time slots with pseudo-random Data Field bits. The output of the transmitter will be on continuously, and the modulation will be present during all the time slots. Using a spectrum analyzer or measuring receiver, see clause 5.2.1.3, tuned to the transmitter nominal carrier frequency, obtain the mean output power as a reference.

Measure the emission power at frequency offsets of ±30 kHz (adjacent channel), ±60 kHz (alternate channel), and ±90 kHz. Frequency offset is the separation between the nominal carrier frequency of the transmitter and the center of the bandwidth within which the measurement is made.

The analyzer or receiver shall make a mean power measurement using frequency selection with a passband equivalent to an ideal root raised-cosine receiver filter. The passband and average power may be obtained from analog circuits or through numerical calculations.

The results obtained shall be compared to the limits in clause 4.3.1.2 in order to prove compliance.

5.4.3 Transmitter conducted spurious emissions

The transmitter shall be modulated with pseudo-random Data Field bits. Filler code will be transmitted on the SACCH. DVCC shall be set to binary 1. Measurements shall be taken in the frequency bands and corresponding resolution bandwidths specified in the tables of clause 4.3.2.2. The levels of the carrier frequency and the various conducted spurious emission frequencies shall be measured in an averaging mode with a spectrum analyzer or highly selective receiver as specified in clause 5.2.1.3.

The results obtained shall be compared to the limits in clause 4.3.2.2 in order to prove compliance.

5.4.4 RF power output

The transmitter power output shall be measured with normal $\pi/4$ DQPSK modulation, and 8-PSK modulation. Modulate the base station transmitter for all time slots with pseudo-random Data Field bits. The test meter shall contain a detector which does not attempt to track the instantaneous peaks, but will display the mean power of the transmitted bursts.

The results obtained shall be compared to the limits in clause 4.3.3.2 in order to prove compliance.

5.4.5 Transmitter intermodulation spurious emissions

With two or more channel transmitters keyed simultaneously with the same output power and set to the minimum channel separation specified by the manufacturer, measure the levels of the intermodulation products that are present at the common antenna port to which the transmitters are connected. Record in dB the ratio of the observed intermodulation levels to the levels of the individual transmitter carriers.

The results obtained shall be compared to the limits in clause 4.3.4.2 in order to prove compliance.

5.4.6 Receiver conducted spurious emissions

A frequency selective voltmeter (or other suitable test equipment) of nominal 50 Ω input impedance shall be connected to the receiver antenna terminals and tuned over a frequency range from the lowest intermediate frequency or lowest oscillator frequency used in the receiver, whichever is lower, to at least 6 000 MHz. This measurement is made with the transmitter off.

The results obtained shall be compared to the limits in clause 4.3.5.2 in order to prove compliance.

5.4.7 Intermodulation spurious response attenuation

For π/4 DQPSK, equally couple a π/4 DQPSK test signal and two interfering RF signal generators to the base station antenna terminal. Set the π/4 DQPSK test signal to the assigned channel and set its RF level at the receiver to -107 dBm. Transmitted Data Field bits shall consist of pseudo-random data. Adjust the second RF generator to a frequency 120 kHz above the assigned input frequency, and the third generator to a frequency 240 kHz above the assigned frequency. Adjust the level of the second and third generators to -45 dBm and modulate the third generator with pseudo-random π/4 DQPSK data. The base station shall provide a monitoring means for Data Field bits with no correction. All tests shall be performed with the delay interval compensation operational.

For 8-PSK, equally couple a 8-PSK test signal and two interfering RF signal generators to the base station antenna terminal. Set the 8-PSK test signal to the assigned channel and set its RF level at the receiver to -105 dBm. Transmitted Data Field bits shall consist of pseudo-random data. Adjust the second RF generator to a frequency 120 kHz above the assigned input frequency, and the third generator to a frequency 240 kHz above the assigned frequency. Adjust the level of the second and third generators to -45 dBm and modulate the third generator with pseudo-random 8-PSK data. The base station shall provide a monitoring means for Data Field bits with no correction. All tests shall be performed with the delay interval compensation operational if so equipped.

Repeat the above measurement with the second RF generator set to 120 kHz below and the third generator to 240 kHz below the assigned input frequency.

The results obtained shall be compared to the limits in clause 4.3.6.2 in order to prove compliance.

5.4.8 Adjacent and alternate channel desensitization

For π/4 DQPSK, equally couple a π/4 DQPSK test signal and an interfering RF generator to the base station antenna terminal through a suitable matching network. Set the π/4 DQPSK test signal to the assigned channel and set its RF level at the receiver to -107 dBm. Transmitted Data Field bits shall consist of pseudo-random data. Set the interfering RF generator to 30 kHz and 60 kHz above the frequency of the RF Test Generator and modulate it with pseudo-random π/4 DQPSK data. Adjust the level of the interfering RF generator to -94 dBm for the 30 kHz offset and -65 dBm for 60 kHz offset. The base station shall provide a monitoring means for Data Field bits with no correction. All tests shall be performed with the delay interval compensation operational.

For 8-PSK, equally couple a 8-PSK test signal and an interfering RF generator to the base station antenna terminal through a suitable matching network. Set the 8-PSK test signal to the assigned channel and set its RF level at the receiver to -105 dBm. Transmitted Data Field bits shall consist of pseudo-random data. Set the interfering RF generator to 30 kHz and 60 kHz above the frequency of the RF test generator and modulate it with pseudo-random 8-PSK data. Adjust the level of the interfering RF generator to -94 dBm for the 30 kHz offset and -65 dBm for 60 kHz offset. The base station shall provide a monitoring means for Data Field bits with no correction. All tests shall be performed with the delay interval compensation operational if so equipped.

Repeat the above procedure with the frequency of the interfering RF generator set to 30 kHz and 60 kHz below the frequency of the Digital RF test generator.

The results obtained shall be compared to the limits in clause 4.3.7.2 in order to prove compliance.

5.5 Essential radio test suites (200 kHz)

5.5.1 Emission mask

5.5.1.1 Spectrum due to modulation and wideband noise

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 shall be measured using the method of clause 5.5.3 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 kHz, 200 kHz, 250 kHz, 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 5.5.3).

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 5.5.3).

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.

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 25 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 normal-GSM BTS (comprising 200 kHz channels-only) or MXM BTS (including both 30 kHz and 200 kHz channels)(operating in the IMT-2000 band), if the limit according to table 25 is below -57 dBm, a value of -57 dBm shall be used instead.

2) 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.

3) 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 25: Continuous modulation spectrum - maximum limits for BTS

Power Level (dBm) as measured in step b)	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
	Measurement (filter) bandwidth; 30 kHz						Measurement (filter) bandwidth; 100 kHz	
≥ 43	+0,5	-30	-33	-60 (note)	-70	-73	-75	-80
41	+0,5	-30	-33	-60 (note)	-68	-71	-73	-80
39	+0,5	-30	-33	-60 (note)	-66	-69	-71	-80
37	+0,5	-30	-33	-60 (note)	-64	-67	-69	-80
35	+0,5	-30	-33	-60 (note)	-62	-65	-67	-80
≤ 33	+0,5	-30	-33	-60 (note)	-60	-63	-65	-80
NOTE: For equipment supporting 8-PSK, the requirement at 8-PSK modulation is -56 dB.								

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 26 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 26, except where one or more of the micro or pico-BTS exceptions and minimum measurement levels apply.

Table 26: Continuous modulation spectrum - maximum limits for 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
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 26, then the values in table 27 shall be used instead.

Table 27: Continuous modulation spectrum - minimum levels for micro and pico-BTS

Power Class	Maximum spectrum due to modulation and noise in 100 kHz (dBm)
M1	-57
M2	-62
M3	-67
P1	-65

5.5.1.2 Switching transients spectrum

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 kHz, 600 kHz, 1 200 kHz, and 1 800 kHz;

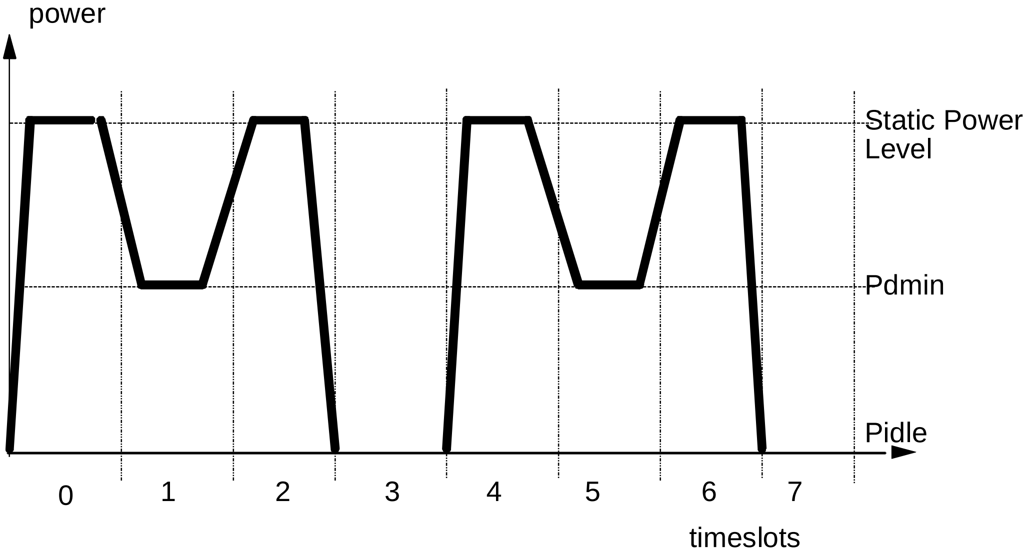
b) all timeslots of the TRX or TRXs under test shall be activated at the highest level of static power control and the power measured as described in step a). If synthesizer SFH is supported, the test shall be repeated for the TRX or TRXs which are activated and which do not support the BCCH, with them 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 7 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 7 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 6 and the power measured as described in step a).



NOTE: Pdmin = The lowest dynamic power step measured in clause 5.5.3.

Figure 6: Power/time slot configuration (RF power control)

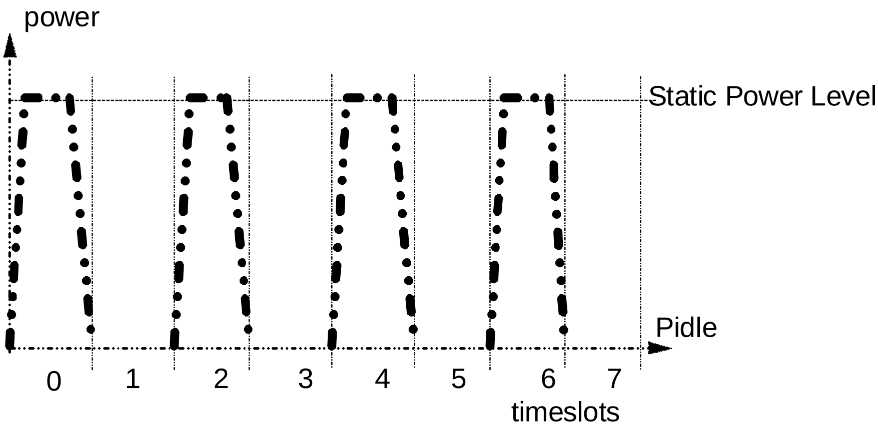


Figure 7: Power/time slot configuration (no RF power control)

The power measured shall not exceed the limits shown in table 28, or -36 dBm, whichever value is higher.

Table 28: Switching transients spectrum - maximum limits

Offset (kHz)	GMSK Power (dBc)	8-PSK Power (dBc)
400	-50	-50
600	-58	-58
1 200	-66	-66
1 800	-66	-66

The results obtained shall be compared to the limits in clause 4.4.1.2 in order to prove compliance.

5.5.2 Transmitter conducted spurious emissions

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 [5].

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, f, 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.

For frequencies outside the TX band, the measurement bandwidths specified in clause 4.4.2.2 shall apply and the spurious emission levels measured and checked for compliance with the limits specified there.

The results obtained shall be compared to the limits in clause 4.4.2.2 in order to prove compliance.

5.5.3 RF power output

For a normal BTS, 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 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 (figures 9 and 10).

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 each be tested at B, M and T;

2 TRX: the TRXs shall 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 (SFH) 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.

For the definition of the useful part of the time slot, see clause 4.4.1.1.3, figure 4, and for further details see GSM 05.04 [15] (EN 300 959). For timing, on a per time slot basis, each time slot may contain 156,25 modulating bits, or 2 time slots may contain 157 bits, while the remaining 6 time slots contain 156 modulating bits, according to GSM 05.10 [16] (TS 100 912).

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 static power step zero.

The results obtained shall be compared to the limits in clause 4.4.3.2 in order to prove compliance.

5.5.4 Transmitter intermodulation spurious emissions

5.5.4.1 Introduction

The general test requirements for this test are specified in clause 5.5.4.2.

The test method applicable to normal-GSM (non-MXM) transmitters, shall be as specified in clause 5.5.4.3.

The test method for MXM transmitters (configured with both 30 kHz and 200 kHz carriers) shall be as described in clause 5.5.4.4.

5.5.4.2 Intermodulation attenuation, general test requirements

The purpose of this test is 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, or by non-linear mixing and amplification of multiple carriers within the same BTS.

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 clause 4.4.5.2.

Only the TRX under test shall be active. All remaining TRXs shall be idle on other frequency channels 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. 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 static power level zero and the test signal power level shall be adjusted 30 dB below this value. The test signals are illustrated in figure 8. 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 C. The reference power for relative measurements is the power measured in a bandwidth of 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 nonlinearity 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 suggested measurement set-up is shown in GSM 11.21 [6], clause B.2.

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 (Bottom, Middle and Top);

2 TRX: one test shall be performed at 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.

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 5.5.1.1, Continuous Modulation Spectrum. The exceptions given in clause 5.5.1.1 also apply.

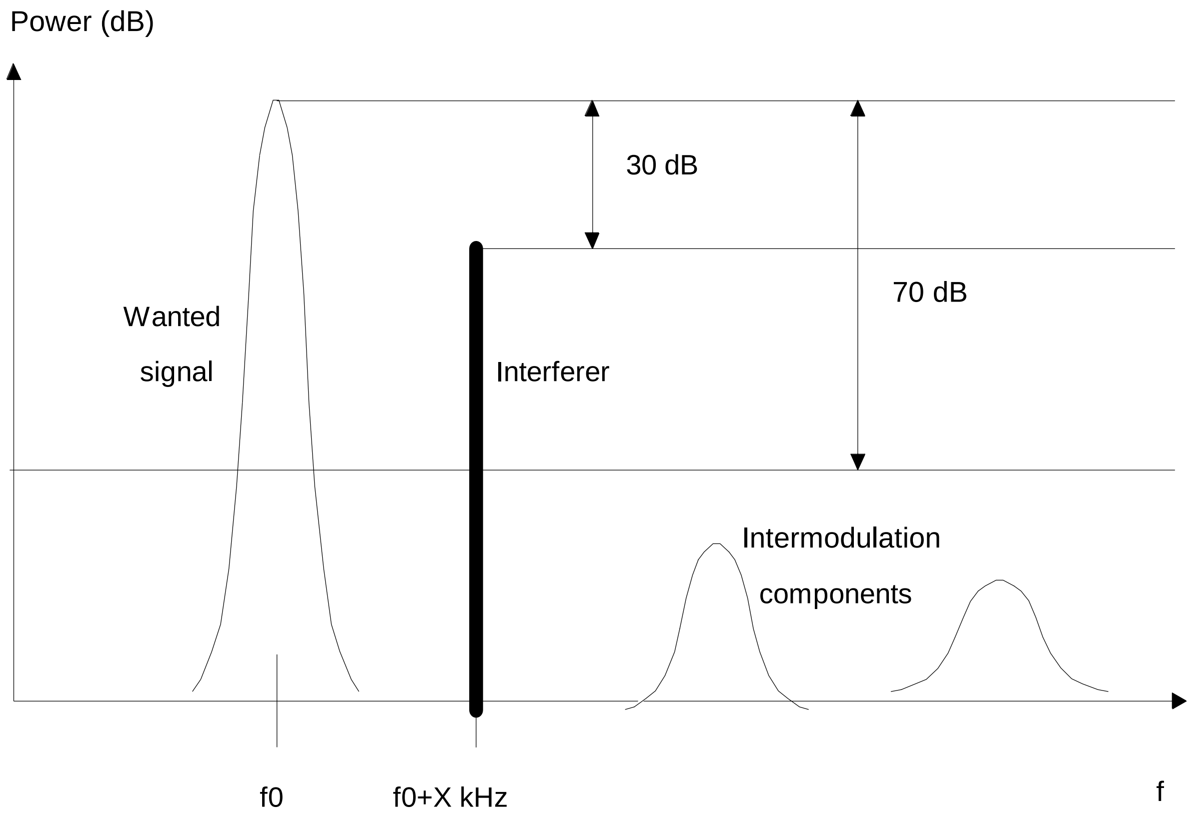


Figure 8: Example of TX intermodulation attenuation

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 29, under normal test conditions.

Table 29: Maximum receive - band transmitter intermodulation limits

BTS type	DBm
normal BTS	-98
micro-BTS M1	-96
micro-BTS M2	-91
micro-BTS M3	-86
pico-BTS P1	-80

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 5.5.1, Continuous Modulation Spectrum. The exceptions given in clause 5.5.1 also apply.

5.5.4.3 Intra base station system intermodulation attenuation, non-MXM systems

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.

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 (Static Level 0, clause 5.5.3) and with modulation of a pseudo random sequence applied.

All intermodulation product frequencies in the relevant TX band and operating RX band shall be identified and measured according to the process below.

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 0,6 MHz to 1,8 MHz 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 above the uppermost and below the lowermost carrier frequencies of more than 1,8 MHz the average power of any intermodulation components shall be measured with a bandwidth of 300 kHz, zero frequency span, over a time slot period. The reference power for relative measurements is the power measured in a bandwidth of at least 300 kHz for the TRX under test. In the operating RX band the power of any intermodulation components shall be measured with a filter and video bandwidth of 100 kHz, frequency scan mode, minimum sweep time of 75 ms and averaged over 200 sweeps.

For the measurement in the operating RX band

The equipment shall be operated with an assigned frequency channel 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 suggested measurement set-up for this test is shown in GSM 11.21 [6], 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.

In the operating receive band the measured intermodulation components shall never exceed the values given in table 40 under normal test conditions.

In the relevant transmit band, at offsets greater than 0,6 MHz and up to 1,8 MHz, the requirements are that specified in clause 5.5.1.1, Continuous Modulation Spectrum except that for offset 1,2 MHz to 1,8 MHz the measured power shall not exceed -70 dBc. The exceptions given there shall also apply.

In the relevant transmit band for offsets greater than 1,8 MHz the measured power shall not exceed -70 dBc relative to the per carrier power or -46 dBm whichever is the higher.

5.5.4.4 Intra Base Station System intermodulation attenuation, MXM systems

Purpose: to verify that the level of intermodulation products (due to non-linear mixing and amplification of multiple carriers within one BTS or 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.

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 (Static Level 0 clause 5.5.3) and with modulation of a pseudo random sequence applied.

The equipment shall be operated at equal and minimum frequency spacing specified for the BSS configuration under test.

For frequency offsets above the uppermost and below the lowermost carrier frequencies of more than 1,2 MHz and within the relevant TX band the average power of any intermodulation components shall be measured with a bandwidth of 200 kHz, zero frequency span, over a time slot period. The reference power for relative measurements is the power measured in a bandwidth of 300 kHz for the TRX under test.

The measured power shall not exceed -60 dBc relative to the per carrier power.

The results obtained shall be compared to the limits in clause 4.4.4.2 in order to prove compliance.

5.5.5 Receiver conducted spurious emissions

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 5.5.2 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's resolution bandwidth 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 30.

Table 30: 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		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

The results obtained shall be compared to the limits in clause 4.4.5.2 in order to prove compliance.

5.5.6 Impact of interference on receiver performance

5.5.6.1 AM suppression characteristics

This test shall be performed at any one of the assigned frequency channels, on one TRX and on supported channels. 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 31.

Table 31: Test signal input level

BTS Type	Test signal Input Level to receiver TCH/FS
normal BTS	-101 dBm
micro-BTS M1	-99 dBm
micro-BTS M2	-94 dBm
micro-BTS M3	-89 dBm
pico-BTS P1	-92 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 [8] fascicle IV.4 is recommended.

Its frequency (f) shall be in the relevant receive band, at least 6 MHz separated from the assigned frequency channel under test. Frequency f is an integer multiple of 200 kHz and at least 2 frequency channels separated from any identified spurious response in step 9 of the test case in clause 5.5.6.1.

The interferer shall have one timeslot active, meeting the power/time mask of figures 2 and 3. 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 32.

Table 32: Interfering signal level

Normal BTS	Micro-BTS			Pico-BTS
	M1	M2	M3	P1
(dBm)	(dBm)	(dBm)	(dBm)	(dBm)
-35	-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.

5.5.6.2 Intermodulation characteristics

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. 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 33.

The second signal is an interfering signal, 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 [8] fascicle IV.4, and the power shall be -49 dBm.

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 -49 dBm.

The various signals are illustrated in figure 9.

Table 33: Wanted signal level for testing of intermodulation characteristics

BTS Type	Power level of Wanted Signal TCH/FS
normal BTS	-101 dBm
micro-BTS M1	-99 dBm
micro-BTS M2	-94 dBm
micro-BTS M3	-89 dBm
pico-BTS P1	-92 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 RBER of the TCH/FS class II bits and BLER of E-TCH/F43,2 NT and PDTCH/MCS-5 shall be measured.

The measurement shall be repeated with the unwanted signal frequencies below the carrier frequency of the wanted signal.

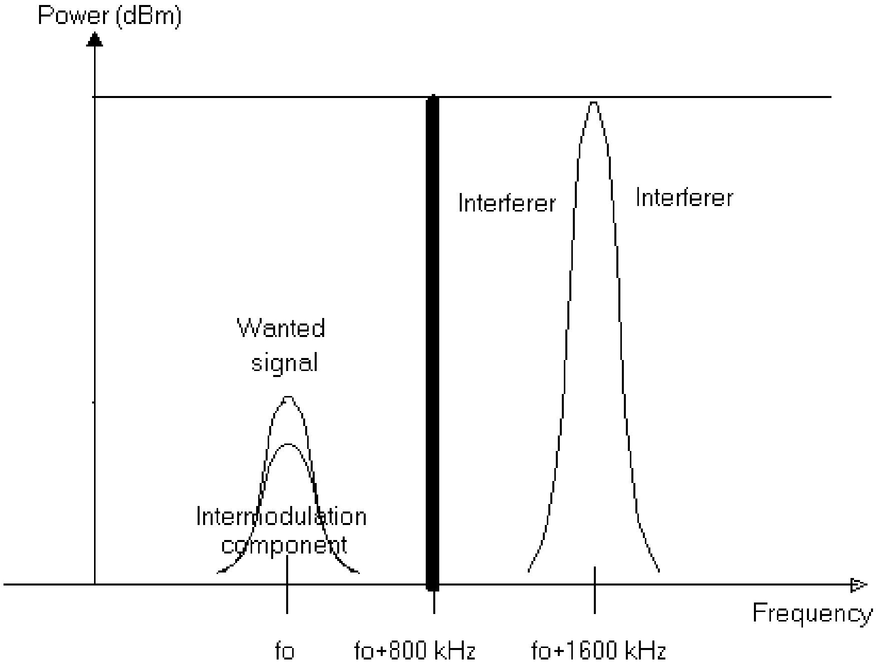


Figure 9: Example of RX intermodulation rejection

5.5.6.2.1 Reference interference level

The reference interference performance (for cochannel, C/Ic, or adjacent channel, C/Ia) in terms of frame erasure, bit error or residual bit error rates (whichever appropriate) is specified in table B.2, according to the type of channel and the propagation condition. The actual interference ratio is defined as the interference ratio for which this performance is met. The actual interference ratio shall be less than a specified limit, called the reference interference ratio. The reference interference ratio shall be:

-	for cochannel interference	:	C/Ic	=	9 dB
-	for adjacent (200 kHz) interference	:	C/Ia1	=	-9 dB
-	for adjacent (400 kHz) interference	:	C/Ia2	=	-41 dB
-	for adjacent (600 kHz) interference	:	C/Ia3	=	-49 dB

For GMSK modulated packet switched channels and for 8-PSK modulated channels, packet switched and ECSD, the minimum interference ratio for which the reference performance for cochannel interference (C/Ic) shall be met is specified in tables B.2a, B.2b and B.2c, respectively, according to the type of channel, the propagation condition and type of equipment. The reference performance is the same as defined in clause 4.4.2.1. For equipment supporting 8-PSK, the requirements apply for both GMSK and 8-PSK modulated interfering signals. The corresponding interference ratio for adjacent channel interference shall be:

Modulation of wanted signal					**GMSK**	**8-PSK**
-	for adjacent (200 kHz) interference	:	C/Ia1	=	C/Ic - 18 dB	see table 2f, 2g, 2h and 2I [5]
-	for adjacent (400 kHz) interference	:	C/Ia2	=	C/Ic - 50 dB	C/Ic - 50 dB
-	for adjacent (600 kHz) interference	:	C/Ia3	=	C/Ic - 58 dB	C/Ic - 58 dB

NOTE: The C/Ia3 figure is given for information purposes and will not require testing. It was calculated for the case of an equipment with an antenna connector, operating at output power levels of +33 dBm and below. Rejection of signals at 600 kHz is specified in clause 4.4.2.1.

These specifications apply for a wanted signal input level of 20 dB above the reference sensitivity level, and for a random, continuous, GSM-modulated interfering signal. For packet switched, GMSK modulated channels the wanted input signal level shall be: -93 dBm + Ir + Corr, where:

Ir = the interference ratio according to table B.2a;
Corr = the correction factor for reference performance according to clause 4.4.2.1.

For 8-PSK modulated channels, the wanted input signal level shall be: -89 dBm + Ir + Corr, where:

Ir = the interference ratio according to table B.2b for packets switched channels and tables B.2d and B.2e for ECSD;
Corr = the correction factor for reference performance according to clause 4.4.2.1.

In case of frequency hopping, the interference and the wanted signals shall have the same frequency hopping sequence. In any case the wanted and interfering signals shall be subject to the same propagation profiles (see annex C), independent on the two channels.

For pico-BTS, propagation conditions other than static and T15 are not specified and only the no FH case need be tested. The performance requirement for PCS 1 900, MXM 850 and MXM 1 900 pico-BTS with TI5 propagation condition is the same as theTU50 no FH (GSM 900 MHz) performance requirement. The interference ratio at which this requirement shall be met is, for GMSK modulated wanted signals, 4 dB above the interference ratio specified above in this clause (in combination with table B.2a for packet service). For 8-PSK modulated wanted signals, the interference ratio for this requirement is 4 dB above the interference ratio specified above in this clause (in combination with tables B.2b to B.2c for packet service). For adjacent channel interference propagation conditions other than TU50 need not be tested. There is an exception in the case of the pico-BTS in that the specified propagation condition is TI5 instead of TU50; the respective test for pico-BTS is described in the paragraph following the table below. If, in order to ease measurement, a TU50 (no FH) faded wanted signal, and a static adjacent channel interferer are used, the reference interference performance shall be:

	PCS 1 900
TCH/FS (FER):	5,1 α %
Class Ib (RBER):	0,45 /α %
Class II (RBER):	8,9 %
FACCH (FER):	6,1 %

For pico-BTS, adjacent channel interference propagation conditions other than TI5 need not be tested. If, in order to ease measurement, a TI5 (no FH) faded wanted signal, and a static adjacent channel interferer are used, the interference performance shall be the same as that specified above for a TU50 no FH channel (GSM 900 MHz). The interference ratio at which this performance shall be met is 4 dB above the reference interference ratio specified above in this clause.

5.5.6.3 Blocking characteristics

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 34. The measurement is only performed under static propagation conditions.

Table 34: Power level of wanted signal for test of blocking characteristics

BTS Type	Power level of Wanted Signal TCH/FS
normal BTS	-101 dBm
micro-BTS M1	-99 dBm
micro-BTS M2	-94 dBm
micro-BTS M3	-89 dBm
pico-BTS P1	-92 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) Band: 1 900 MHz to 2 000 MHz inclusive:

      - from Flo - (IF1 + IF2 + ... + IFn + 30 MHz) to

      - Flo + (IF1 + IF2 + ... + IFn + 30 MHz).

   b) from IF1 - 400 kHz to IF1 + 400 kHz.

   c) All of the ranges:

      - mFlo - IF1 - 200 kHz to mFlo - IF1 + 200 kHz; and

      - mFlo + IF1 - 200 kHz to mFlo + IF1 + 200 kHz.

   d) 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 C 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: 80 MHz or less:

   - the level of the interfering signal at the receiver input shall be: -15 dBm;

   - for greater separations, the level of the interfering signal shall be: +10 dBm;

   - the Residual Bit Error Ratio (RBER) for the TCH/FS channel using class II bits shall be measured. All frequencies at which the RBER exceeds 10 % 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 35.

9) The channels below shall, if supported, be measured. All frequencies at which the limit below is exceeded shall be recorded.

Channel: TCH/FS Limit: class II (RBER) = 2,0 %.

Channel: E-TCH/F43,2 NT
or for the highest supported data speed Limit: according to table 36.

Channel: PDTCH/MCS-5 Limit: BLER = 10 %.

For this test, in band frequencies are defined as follows:

- 1 900 MHz to 2 000 MHz;

NOTE: The methodology for the measurement of BER is described in annex C.

f_0 is the frequency of the wanted signal.

Table 35: Level of interfering signal for blocking

Frequency band	Normal-GSM (dBm)				
		Micro and pico-BTS			
	BTS	**M1**	**M2**	**M3**	**P1**
in - band:					
fo ±600 kHz	-35	-40	-35	-30	-41
800 kHz ≤ $\|f - f_0\|$ < 1,6 MHz	-25	-30	-25	-20	-41
1,6 MHz ≤ $\|f - f_0\|$ < 3 MHz	-25	-30	-25	-20	-31
3 MHz ≤ $\|f - f_0\|$	-25	-30	-25	-20	-23
out - of - band	0	0	0	0	0
Frequency band	**MXM (dBm)**				
		Micro and pico-BTS			
	BTS	**M1**	**M2**	**M3**	**P1**
in - band:					
fo ±600 kHz	-43	-40	-35	-30	-41
800 kHz ≤ $\|f - f_0\|$ < 1,6 MHz	-38	-30	-25	-20	-41
1,6 MHz ≤ $\|f - f_0\|$ < 3 MHz	-33	-30	-25	-20	-31
3 MHz ≤ $\|f - f_0\|$	-33	-30	-25	-20	-23
Out - of - band	0	0	0	0	0

Table 36: Static error performance limits at RX sensitivity level

Channel type:	Error Parameter	Limit Value
FACCH/H	FER	0,10 %
FACCH/F	FER	0,10 %
E-FACCH/F	BLER	5 %
SDCCH and SACCH	FER	0,10 %
RACH	FER	0,50 %
E-TCH/F43,2 NT	BLER	10 %
E-TCH/F32,0 T	BER	0,1 %
E-TCH/F28,8 T	BER	0,1 %
E-TCH/F28,8 NT	BLER	10 %
TCH/F 14.4	BER	10^{-5}
TCH/F9.6	BER	10^{-5}
TCH/H4.8	BER	10^{-5}
TCH/FS	FER	0,10 α %
- class Ib	RBER	0,40 /α %
- class II	RBER	2,0 %
TCH/HS	FER	0,025 %
- class Ib, BFI=0	RBER	0,001 %
- class II, BFI=0	RBER	0,72 %
-	UFR	0,048 %
- class Ib, UFI=0	RBER	0,001 %
-	EVSIDR	0,06 %
SID=0 and BFI=0	RBER	0,001 %
-	ESIDR	0,01 %
SID=1 or 2	RBER	0,003 %
TCH/EFS	FER	0,1 %
- class Ib	RBER	0,1 %
- class II	RBER	2,0 %
TCH/AFS12.2, class Ib	RBER	0,001 %
TCH/AFS10.2, class Ib	RBER	0,001 %
TCH/AHS7.95	FER	0,01 %
- class Ib	RBER	0,004 %
- class II	RBER	0,66 %
TCH/AHS7.4	FER	0,01 %
- class Ib	RBER	0,001 %
- class II	RBER	0,66 %
TCH/AHS6.7	FER	0,01 %
- class Ib	RBER	0,001 %
- class II	RBER	0,66 %
TCH/AHS5.9, class II	RBER	0,66 %
TCH/AHS5.15, class II	RBER	0,66 %
TCH/AHS4.75, class II	RBER	0,66 %
TCH/AHS-INB	FER	0,013 %
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 36 may be between 1 and 1,6, but should be the same for both occurrences.

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 RBER for TCH/FS channel using class II bits and BLER for E-TCH/F43,2 NT or for the highest supported data speed and PDTCH/MCS-5 channels shall be measured.

The results obtained shall be compared to the limits in clauses 4.4.6.1, 4.4.6.2 and 4.4.6.3 in order to prove compliance.

5.5.7 Adjacent channel selectivity

5.5.7.1 Test purpose

The received signal level (RXLEV) shall be able to discriminate between a wanted signal in an actual RF channel and interfering signal in adjacent channel.

5.5.7.2 Test case

If the manufacturer does provide appropriate logical or physical access to perform all the tests in this clause, the tests shall be performed according to the test cases below.

If Slow Frequency Hopping (SFH) is supported by BSS, it shall be disabled during this test.

a) As a minimum the test shall be performed on one TRX on one timeslot on one frequency channel.

b) One of the following test set-ups is used:

Test- set-up A
Two input signals shall be connected to the receiver via a combining network. The test signal with normal GSM modulation shall have a power level 20 dB above the reference sensitivity level. The interfering signal shall be continuous, and have GSM modulation of pseudo-random bitstream without midamble.

Test - set-up B
The BSSTE shall establish a call set-up with the BSS and the RXLEV of the assigned channel shall be output from the BSS. The test signal with normal GSM modulation shall have a power level 20 dB above the reference sensitivity level.

c) Register the signal strength (RXLEV value) with only the wanted signal present at the RX input port.

d)

i) In test set-up A repeat the measurements with interferer input signal frequency offset and input level increased for each offset according to table 37.

Table 37: Interferer offset and input level for RXLEV selectivity measurements

Interferer frequency offset	Relative input level
±200 kHz	9 dB
±400 kHz	41 dB

ii) In test set-up B repeat the measurements with the input signal at frequency offsets and signal levels according to table 38.

Table 38: Test signal offset and input level for RXLEV selectivity measurements

Frequency offset	Relative input level
200 kHz	16 dB
400 kHz	48 dB

e) The measurements shall be performed under static propagation conditions only.

5.5.7.3 Complete conformance

Test environment: Normal.

Conformance requirements.

The reported RXLEV value shall in test case d) not exceed:

- the value in test case c) with more than 1 for test set-up A;
- the value in test case c) for test set-up B.

The results obtained shall be compared to the limits in clause 4.4.7.2 in order to prove compliance.

Annex A (normative): The EN Requirements Table (EN-RT)

The EN Requirements Table (EN-RT) serves a number of purposes, as follows:

- it provides a tabular summary of all the requirements;
- it shows the status of each EN-R, whether it is essential to implement in all circumstances (Mandatory), or whether the requirement is dependent on the supplier having chosen to support a particular optional service or functionality (Optional). In particular it enables the EN-Rs associated with a particular optional service or functionality to be grouped and identified;
- when completed in respect of a particular equipment it provides a means to undertake the static assessment of conformity with the EN.

Table A.1: EN Requirements Table (EN-RT)

EN Reference		EN 301 908-9				Comment
No.	Reference	EN-R (note)	Status			
1	4.3.1	Emission mask	M			30 kHz
2	4.3.2	Transmitter conducted spurious emission	M			30 kHz
3	4.3.3	RF power output	M			30 kHz
4	4.3.4	Transmitter intermodulation spurious emissions	M			30 kHz
5	4.3.5	Receiver conducted spurious emission	M			30 kHz
6	4.3.6	Intermodulation spurious response attenuation	M			30 kHz
7	4.3.7	Adjacent and alternate channel desensitization	M			30 kHz
8	4.4.2	Emission mask	M			200 kHz
9	4.4.3	Transmitter conducted spurious emissions	M			200 kHz
10	4.4.4	RF power output	M			200 kHz
11	4.4.5	Transmitter intermodulation spurious emissions	M			200 kHz
12	4.4.6	Receiver conducted spurious emission	M			200 kHz
13	4.4.7	Intermodulation spurious response attenuation	M			200 kHz
14	4.4.8	Adjacent and alternate channel desensitization	M			200 kHz
NOTE: These EN-Rs are justified under article <X> of the R&TTE Directive.						

Key to columns:

No Table entry number;

Reference Clause reference number of conformance requirement within the present document;

EN-R Title of conformance requirement within the present document;

Status Status of the entry as follows:

- M Mandatory, shall be implemented under all circumstances;
- O Optional, may be provided, but if provided shall be implemented in accordance with the requirements;
- O.n this status is used for mutually exclusive or selectable options among a set. The integer "n" shall refer to a unique group of options within the EN-RT. A footnote to the EN-RT shall explicitly state what the requirement is for each numbered group. For example, "It is mandatory to support at least one of these options", or, "It is mandatory to support exactly one of these options".

Comments To be completed as required.

Annex B (normative): Reference tables

NOTE: These tables have been taken from the source documentation even though the information contained therein is incomplete. They will be updated as soon as practicable and the present document will then be re-issued.

Table B.1: Reference sensitivity performance

Type of Channel		Propagation conditions				
		static	**TU50 (no FH)**	**TU50 (ideal FH)**	**RA130 (no FH)**	**HT100 (no FH)**
FACCH/H	(FER)	0,1 %	7,2 %	7,2 %	5,7 %	10,4 %
FACCH/F	(FER)	0,1 %	3,9 %	3,9 %	3,4 %	7,4 %
SDCCH	(FER)	0,1 %	9 %	9 %	8 %	13 %
RACH	(FER)	0,5 %	13 %	13 %	12 %	13 %
SCH	(FER)	1 %	19 %	19 %	15 %	25 %
TCH/F14,4	(BER)	10-5	2,1 %	2 %	2 %	6,5 %
TCH/F9,6 & H4,8	(BER)	10-5	0,4 %	0,4 %	0,1 %	0,7 %
TCH/F4,8	(BER)	-	10-4	10-4	10-4	10-4
TCH/F2,4	(BER)	-	10-5	10-5	10-5	10-5
TCH/H2,4	(BER)	-	10-4	10-4	10-4	10-4
TCH/FS	(FER)	0,1α %	3α %	3α %	2α %	7α %
	Class Ib (RBER)	0,4/α %	0,3/α %	0,3/α %	0,2/α %	0,5/α %
	Class II (RBER)	2 %	8 %	8 %	7 %	9 %
TCH/EFS	(FER)	< 0,1 %	4 %	4 %	3 %	7 %
	(RBER Ib)	< 0,1 %	0,12 %	0,12 %	0,10 %	0,24 %
	(RBER II)	2,0 %	8 %	8 %	7 %	9 %
TCH/HS	(FER)	0,025 %	4,2 %	4,2 %	4,1 %	5,0 %
	class Ib (RBER, BFI=0)	0,001 %	0,38 %	0,38 %	0,28 %	0,63 %
	class II (RBER, BFI=0)	0,72 %	6,9 %	6,9 %	6,8 %	7,8 %
	(UFR)	0,048 %	5,7 %	5,7 %	5,0 %	8,1 %
	class Ib (RBER, (BFI or UFI)=0)	0,001 %	0,26 %	0,26 %	0,21 %	0,35 %
	(EVSIDR)	0,06 %	7,0 %	7,0 %	6,0 %	9,9 %
	(RBER, SID=2 and (BFI or UFI)=0)	0,001 %	0,01 %	0,01 %	0,01 %	0,02 %
	(ESIDR)	0,01 %	3,0 %	3,0 %	3,2 %	3,9 %
	(RBER, SID=1 or SID=2)	0,003 %	0,33 %	0,33 %	0,21 %	0,45 %
TCH/AFS12,2	(FER)	-	2 %	2,0 %	1,3 %	4,6 %
	Class Ib (RBER)	< 0,001 %	1,4 %	1,4 %	1,2 %	2,1 %
TCH/AFS10,2	(FER)	-	0,65 %	0,65 %	0,41 %	1,6 %
	Class Ib (RBER)	< 0,001 %	0,12 %	0,12 %	0,084 %	0,26 %
TCH/AFS7,95	(FER)	-	0,025 %	0,025 %	0,018 %	0,089 %
	Class Ib (RBER)	-	0,023 %	0,023 %	0,016 %	0,061 %
TCH/AFS7,4	(FER)	-	0,036 %	0,036 %	0,023 %	0,13 %
	Class Ib (RBER)	-	0,013 %	0,013 %	0,007 %	0,031 %
TCH/AFS6,7	(FER)	-	< 0,01 %(*)	< 0,01 %(*)	< 0,01 %(*)	0,031 %
	Class Ib (RBER)	-	0,017 %	0,017 %	0,01 %	0,041 %
TCH/AFS5,9	(FER)	-	< 0,01 %(*)	< 0,01 %(*)	< 0,01 %(*)	< 0,01 %(*)
	Class Ib (RBER)	-	< 0,001 %	< 0,001 %	< 0,001 %	0,002 %
TCH/AFS5,15	(FER)	-	< 0,01 %(*)	< 0,01 %(*)	-	< 0,01 %(*)
	Class Ib (RBER)	-	< 0,001 %	< 0,001 %	< 0,001 %	0,003 %
TCH/AFS4,75	(FER)	-	< 0,01 %(*)	-	-	< 0,01 %(*)
	Class Ib (RBER)	-	< 0,001 %	< 0,001 %	< 0,001 %	< 0,001 %
TCH/AFS-INB	(FER)	-	0,011 %	0,011 %	0,006 %	0,021 %
TCH/AFS	(EVSIDUR)	-	0,19 %	0,19 %	0,17 %	0,25 %
TCH/AFS	(EVRFR)	-	0,007 %	0,007 %	0,002 %	0,01 %
TCH/AHS7,95	(FER)	0,002 %	20 %	20 %	17 %	27 %
	Class Ib (RBER)	0,004 %	2,3 %	2,3 %	2 %	2,9 %
	Class II (RBER)	0,66 %	5 %	5 %	4,8 %	5,7 %
TCH/AHS7,4	(FER)	< 0,01 %(*)	16 %	16 %	13 %	22 %
	Class Ib (RBER)	< 0,001 %(*)	1,4 %	1,4 %	1,1 %	1,9 %
	Class II (RBER)	0,66 %	5,3 %	5,3 %	5,1 %	6 %
TCH/AHS6,7	(FER)	< 0,01 %(*)	9,4 %	9,4 %	7,5 %	13 %
	Class Ib (RBER)	< 0,001 %	1,1 %	1,1 %	0,92 %	1,5 %

Type of Channel		Propagation conditions				
		static	TU50 (no FH)	TU50 (ideal FH)	RA130 (no FH)	HT100 (no FH)
	Class II (RBER)	0,66 %	5,8 %	5,8 %	5,5 %	6,6 %
TCH/AHS5,9	(FER)	-	5,9 %	5,9 %	4,6 %	8,5 %
	Class Ib (RBER)	-	0,52 %	0,52 %	0,39 %	0,72 %
	Class II (RBER)	0,66 %	6,1 %	6,1 %	5,8 %	6,8 %
TCH/AHS5,15	(FER)	-	2,6 %	2,6 %	2 %	3,7 %
	Class Ib (RBER)	-	0,53 %	0,53 %	0,4 %	0,76 %
	Class II (RBER)	0,66 %	6,3 %	6,3 %	6,1 %	7,2 %
TCH/AHS4,75	(FER)	-	1,2 %	1,2 %	1,1 %	1,7 %
	Class Ib (RBER)	-	0,18 %	0,18 %	0,13 %	0,25 %
	Class II (RBER)	0,66 %	6,5 %	6,5 %	6,2 %	7,3 %
TCH/AHS-INB	(FER)	0,013 %	0,64 %	0,64 %	0,53 %	0,94 %
TCH/AHS	(EVSIDUR)	-	1,3 %	1,3 %	2,1 %	1,5 %
TCH/AHS	(EVRFR)	-	0,24 %	0,24 %	0,25 %	0,24 %

NOTE 1: The specification for SDCCH applies also for BCCH, AGCH, PCH, SACCH. The actual performance of SACCH should be better.

NOTE 2: Definitions:
FER: Frame erasure rate (frames marked with BFI=1).
UFR: Unreliable frame rate (frames marked with (BFI or UFI)=1).
EVSIDR: Erased Valid SID frame rate (frames marked with (SID=0) or (SID=1) or ((BFI or UFI)=1) if a valid SID frame was transmitted).
EVSIDUR: Erased Valid SID_UPDATE frame rate associated to an adaptive speech traffic channel.
ESIDR: Erased SID frame rate (frames marked with SID=0 if a valid SID frame was transmitted).
EVRFR: Erased Valid RATSCCH frame rate associated to an adaptive speech traffic channel. This relates to the erasure of the RATSCCH message due to the failure to detect the RATSCCH identifier or due to a CRC failure.
BER: Bit error rate.
RBER, BFI=0: Residual bit error rate (defined as the ratio of the number of errors detected over the frames defined as "good" to the number of transmitted bits in the "good" frames).
RBER, (BFI or UFI)=0: Residual bit error rate (defined as the ratio of the number of errors detected over the frames defined as "reliable" to the number of transmitted bits in the "reliable" frames).
RBER, SID=2 and (BFI or UFI)=0: Residual bit error rate of those bits in class I which do not belong to the SID codeword (defined as the ratio of the number of errors detected over the frames that are defined as "valid SID frames" to the number of transmitted bits in these frames, under the condition that a valid SID frame was sent).
RBER, SID=1 or SID=2: Residual bit error rate of those bits in class I which do not belong to the SID codeword (defined as the ratio of the number of errors detected over the frames that are defined as "valid SID frames" or as "invalid SID frames" to the number of transmitted bits in these frames, under the condition that a valid SID frame was sent).
TCH/AxS-INB FER: The frame error rate for the in-band channel. Valid for both Mode Indication and Mode Command/Mode Request. When testing all four code words shall be used an equal amount of time and the mode of both in-band channels (Mode Indication and Mode Command/Mode Request) shall be changed to a neighbouring mode not more often than every 22 speech frames (440 ms).

NOTE 3: $1 \leq \alpha \leq 1{,}6$. The value of α can be different for each channel condition but must remain the same for FER and class Ib RBER measurements for the same channel condition.

NOTE 4: FER for CCHs takes into account frames which are signalled as being erroneous (by the FIRE code, parity bits, or other means) or where the stealing flags are wrongly interpreted.

NOTE 5: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz.

NOTE 6: For AMR, the complete conformance should not be restricted to the channels identified with (*).

Table B.1a: Input signal level (for normal BTS) at reference performance for GMSK modulated signals

Type of Channel		Propagation conditions				
		static	TU50 (no FH)	TU50 (ideal FH)	RA130 (no FH)	HT100 (no FH)
PDTCH/CS-1	dBm	-104$^{(x)}$	-104	-104	-104$^{(x)}$	-103
PDTCH/CS-2	dBm	-104$^{(x)}$	-100	-100	-101	-99
PDTCH/CS-3	dBm	-104$^{(x)}$	-98	-98	-98	-94
PDTCH/CS-4	dBm	-101	-88	-88	*	*
USF/CS-1	dBm	-104$^{(x)}$	-103	-103	-103	-101
USF/CS-2 to 4	dBm	-104$^{(x)}$	-104$^{(x)}$	-104$^{(x)}$	-104$^{(x)}$	-103
PRACH/11 bits	dBm	-104$^{(x)}$	-104	-104	-103	-103
PRACH/8 bits	dBm	-104$^{(x)}$	-104	-104	-v103	-103
PDTCH/MCS-1	dBm	-104$^{(x)}$	[-102,5]	[-103]	-103	[-101,5]
PDTCH/MCS-2	dBm	-104$^{(x)}$	[-100,5]	[-101]	-100,5	[-99,5]
PDTCH/MCS-3	dBm	-104$^{(x)}$	[-96,5]	[-96,5]	-92,5	[-94,5]
PDTCH/MCS-4	dBm	-101,5	[-90,5]	[-90,5]	*	[*]
USF/MCS-1 to 4	dBm	-104$^{(x)}$	-104	-104	-104$^{(x)}$	-102,5
PRACH/11 bits	dBm	-104$^{(x)}$	-104	-104	-103	-103
PRACH/8 bits	dBm	-104$^{(x)}$	-104	-104	-103	-103

NOTE 1: The specification for PDTCH/CS-1 applies also for PACCH, PBCCH, PAGCH, PPCH, PTCCH/D and PNCH.
NOTE 2: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz.
NOTE 3: PDTCH/CS-4 and PDTCH/MCS-x cannot meet the reference performance for some propagation conditions (*).
NOTE 4: The complete conformance should not be restricted to the logical channels and channel models identified with (x).

Table B.1b: Input signal level (for normal BTS) at reference performance for 8-PSK modulated signals

Type of Channel		Propagation conditions				
		static	TU50 (no FH)	TU50 (ideal FH)	RA130 (no FH)	HT100 (no FH)
PDTCH/MCS-5	dBm	[-101]	[-95,5]	[-96,5]	[-96,5]	[tbd]
PDTCH/MCS-6	dBm	[-99,5]	[-93,5]	[-94]	[-93]	[tbd]
PDTCH/MCS-7	dBm	[tbd]	[-89]	[tbd]	[tbd]	[tbd]
PDTCH/MCS-8	dBm	[tbd]	[tbd]	[tbd]	[*]	[*]
PDTCH/MCS-9	dBm	[tbd]	[tbd]	[tbd]	[*]	[*]

Performance is specified at 30 % BLER for those cases identified with mark **.
NOTE 1: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz.
NOTE 2: PDTCH for MCS-x cannot meet the reference performance for some propagation conditions (*).

Table B.1c: Input signal level (for normal BTS) at reference performance for 8-PSK modulated signals

8-PSK						
Type of Channel		Propagation conditions				
		Static	TU50 (no FH)	TU50 (ideal FH)	RA130 (no FH)	HT100 (no FH)
E-FACCH/F	dBm	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F28,8 T	dBm	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F 32 T	dBm	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F28,8 NT	dBm	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F43,2 NT	dBm	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]

NOTE: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz.

Table B.2: Reference interference performance

Non-MXM					
Type of Channel	**Propagation conditions**				
	TU1,5 (no FH)	**TU1,5 (ideal FH)**	**TU50 (no FH)**	**TU50 (ideal FH)**	**RA130 (no FH)**
FACCH/H (FER)	22 %	6,7 %	6,9 %	6,9 %	5,7 %
FACCH/F (FER)	22 %	3,4 %	3,4 %	3,4 %	3,5 %
SDCCH (FER)	22 %	9 %	9 %	9 %	8 %
RACH (FER)	15 %	15 %	16 %	16 %	13 %
SCH (FER)	17 %	17 %	19 %	19 %	18 %
TCH/F14,4 (BER)	10 %	3 %	4 %	3,1 %	3 %
TCH/F9,6 & H4,8 (BER)	8 %	0,3 %	0,8 %	0,3 %	0,2 %
TCH/F4,8 (BER)	3 %	10^{-4}	10^{-4}	10^{-4}	10^{-4}
TCH/F2,4 (BER)	3 %	10^{-5}	10^{-5}	10^{-5}	10^{-5}
TCH/H2,4 (BER)	4 %	10^{-4}	10^{-4}	10^{-4}	10^{-4}
TCH/FS (FER)	21α %	3α %	3α %	3α %	3α %
Class Ib (RBER)	2/α %	0,2/α %	0,25/α %	0,25/α %	0,2/α %
Class II (RBER)	4 %	8 %	8,1 %	8,1 %	8 %
TCH/EFS (FER)	23 %	3 %	3 %	3 %	4 %
(RBER Ib)	0,20 %	0,10 %	0,10 %	0,10 %	0,13 %
(RBER II)	3 %	8 %	8 %	8 %	8 %
TCH/HS (FER)	19,1 %	5,0 %	5,0 %	5,0 %	4,7 %
class Ib (RBER, BFI=0)	0,52 %	0,27 %	0,29 %	0,29 %	0,21 %
class II (RBER, BFI=0)	2,8 %	7,1 %	7,2 %	7,2 %	7,0 %
(UFR)	20,7 %	6,2 %	6,1 %	6,1 %	5,6 %
class Ib (RBER, (BFI or UFI)=0)	0,29 %	0,20 %	0,21 %	0,21 %	0,17 %
(EVSIDR)	21,9 %	7,1 %	7,0 %	7,0 %	6,3 %
(RBER, SID=2 and (BFI or UFI)=0)	0,02 %	0,01 %	0,01 %	0,01 %	0,01 %
(ESIDR)	17,1 %	3,6 %	3,6 %	3,6 %	3,4 %
(RBER, SID=1 or SID=2)	0,5 %	0,27 %	0,26 %	0,26 %	0,20 %
TCH/AFS12,2 (FER)	22 %	3,5 %	2,7 %	2,7 %	1,8 %
Class Ib (RBER)	0,92 %	1,7 %	1,6 %	1,6 %	1,4 %
TCH/AFS10,2 (FER)	18 %	1,4 %	0,98 %	0,98 %	0,56 %
Class Ib (RBER)	0,54 %	0,21 %	0,17 %	0,17 %	0,12 %
TCH/AFS7,95 (FER)	13 %	0,13 %	0,07 %	0,07 %	0,029 %
Class Ib (RBER)	0,67 %	0,068 %	0,042 %	0,042 %	0,03 %
(FER@-3 dB)	25 %	2,7 %	2 %	2 %	1,2 %
Class Ib (RBER@-3 dB)	1,2 %	0,8 %	0,68 %	0,68 %	0,48 %
TCH/AFS7,4 (FER)	14 %	0,17 %	0,083 %	0,083 %	0,047 %
Class Ib (RBER)	0,43 %	0,032 %	0,02 %	0,02 %	0,012 %
(FER@-3 dB)	26 %	3 %	2,3 %	2,3 %	1,4 %
Class Ib (RBER@-3 dB)	0,8 %	0,38 %	0,32 %	0,32 %	0,22 %
TCH/AFS6,7 (FER)	11 %	0,051 %	0,025 %	0,025 %	< 0,01 % (*)
Class Ib (RBER)	0,76 %	0,047 %	0,028 %	0,028 %	0,016 %
(FER@-3 dB)	22 %	1,2 %	0,82 %	0,82 %	0,41 %
Class Ib (RBER@-3 dB)	1,4 %	0,61 %	0,51 %	0,51 %	0,34 %
TCH/AFS5,9 (FER)	10 %	0,018 %	< 0,01 % (*)	< 0,01 % (*)	< 0,01 % (*)
Class Ib (RBER)	0,38 %	0,005 %	0,002 %	0,002 %	0,001 %
(FER@-3 dB)	21 %	0,68 %	0,41 %	0,41 %	0,2 %
Class Ib (RBER@-3 dB)	0,72 %	0,12 %	0,079 %	0,079 %	0,046 %
TCH/AFS5,15 (FER)	9,2 %	0,013 %	< 0,01 % (*)	< 0,01 % (*)	< 0,01 % (*)
Class Ib (RBER)	0,45 %	0,004 %	0,001 %	0,001 %	< 0,001 %
(FER@-3 dB)	19 %	0,45 %	0,26 %	0,26 %	0,13 %
Class Ib (RBER@-3 dB)	0,84 %	0,11 %	0,072 %	0,072 %	0,038 %
TCH/AFS4,75 (FER)	7,9 %	< 0,01 % (*)	< 0,01 % (*)	< 0,01 % (*)	-
Class Ib (RBER)	0,31 %	< 0,001 %	< 0,001 %	< 0,001 %	< 0,001 %
(FER@-3 dB)	17 %	0,2 %	0,1 %	0,1 %	0,051 %
Class Ib (RBER@-3 dB)	0,61 %	0,033 %	0,021 %	0,021 %	0,009 %
TCH/AFS-INB (FER)	1,5 %	0,016 %	0,013 %	0,013 %	0,008 %
(FER@-3 dB)	3,5 %	0,16 %	0,12 %	0,12 %	0,1 %

Non-MXM						
Type of Channel		Propagation conditions				
		TU1,5 (no FH)	TU1,5 (ideal FH)	TU50 (no FH)	TU50 (ideal FH)	RA130 (no FH)
TCH/AFS	(EVSIDUR)	11 %	0,41 %	0,3 %	0,3 %	0,36 %
	(EVSIDUR@-3 dB)	21 %	3,5 %	2,8 %	2,8 %	2,8 %
TCH/AFS	(EVRFR)	10 %	0,028 %	0,022 %	0,022 %	0,005 %
	(EVRFR @ -3 dB)	21	0,73 %	0,78 %	0,78 %	0,28 %
TCH/AHS7,95	(FER)	27 %	23 %	23 %	23 %	20 %
	Class Ib (RBER)	0,85 %	2,2 %	2,3 %	2,3 %	2,1 %
	Class II (RBER)	1,7 %	5,1 %	5,1 %	5,1 %	5,1 %
	(FER@+3 dB)	14 %	7 %	6,7 %	6,7 %	6,5 %
	Class Ib (RBER@+3 dB)	0,49 %	1 %	1 %	1 %	0,98 %
	Class II (RBER@+3 dB)	1 %	3,1 %	3,1 %	3,1 %	3,1 %
TCH/AHS7,4	(FER)	26 %	18 %	18 %	18 %	16 %
	Class Ib (RBER)	0,69 %	1,4 %	1,4 %	1,4 %	1,3 %
	Class II (RBER)	1,9 %	5,4 %	5,5 %	5,5 %	5,4 %
	(FER@+3 dB)	13 %	5,2 %	4,9 %	4,9 %	4,8 %
	Class Ib (RBER@+3 dB)	0,39 %	0,51 %	0,51 %	0,51 %	0,47 %
	Class II (RBER@+3 dB)	1,2 %	3,3 %	3,3 %	3,3 %	3,3 %
TCH/AHS6,7	(FER)	23 %	12 %	12 %	12 %	9,9 %
	Class Ib (RBER)	0,71 %	1,2 %	1,2 %	1,2 %	1 %
	Class II (RBER)	2,3 %	6 %	6 %	6 %	6 %
	(FER@+3 dB)	11 %	2,7 %	2,5 %	2,5 %	2,5 %
	Class Ib (RBER@+3 dB)	0,39 %	0,39 %	0,38 %	0,38 %	0,37 %
	Class II (RBER@+3 dB)	1,4 %	3,5 %	3,5 %	3,5 %	3,5 %
TCH/AHS5,9	(FER)	21 %	7,8 %	7,7 %	7,7 %	6,4 %
	Class Ib (RBER)	0,55 %	0,59 %	0,6 %	0,6 %	0,48 %
	Class II (RBER)	2,6 %	6,3 %	6,4 %	6,4 %	6,3 %
TCH/AHS5,15	(FER)	17 %	3,8 %	3,8 %	3,8 %	3,1 %
	Class Ib (RBER)	0,8 %	0,65 %	0,66 %	0,66 %	0,53 %
	Class II (RBER)	3,1 %	6,7 %	6,8 %	6,8 %	6,6 %
TCH/AHS4,75	(FER)	15 %	2,2 %	2,1 %	2,1 %	1,8 %
	Class Ib (RBER)	0,6 %	0,25 %	0,25 %	0,25 %	0,19 %
	Class II (RBER)	3,6 %	6,9 %	7 %	7 %	6,8 %
TCH/AHS-INB	(FER)	2,8 %	0,76 %	0,71 %	0,71 %	0,6 %
	(FER@-3 dB)	5,9 %	2,2 %	2,2 %	2,2 %	1,8 %
TCH/AHS	(EVSIDUR)	15 %	3,1 %	3,1 %	3,1 %	3,5 %
	(EVSIDUR@-3 dB)	28 %	15 %	15 %	15 %	14 %
TCH/AHS	(EVRFR)	11 %	0,55 %	0,53 %	0,53 %	0,52 %
	(EVRFR @ -3 dB)	22 %	4,3 %	4,5 %	4,5 %	3,8 %

NOTE 1: The specification for SDCCH applies also for BCCH, AGCH, PCH, SACCH. The actual performance of SACCH, particularly for the C/I TU3 (no FH) and TU 1,5 (no FH) cases should be better.

NOTE 2: Definitions:
FER: Frame erasure rate (frames marked with BFI=1).
FER@-3 dB: Frame erasure rate for an input signal level 3 dB below the reference interference level.
FER@+3 dB: Frame erasure rate for an input signal level 3 dB above the reference interference level.
UFR: Unreliable frame rate (frames marked with (BFI or UFI)=1).
EVSIDR: Erased Valid SID frame rate (frames marked with (SID=0) or (SID=1) or ((BFI or UFI)=1) if a valid SID frame was transmitted).
EVSIDUR: Erased Valid SID_UPDATE frame rate associated to an adaptive speech traffic channel.
EVSIDUR@-3 dB: Erased Valid SID_UPDATE frame rate associated to an adaptive speech traffic channel for an input signal level 3 dB below the reference interference level.
ESIDR: Erased SID frame rate (frames marked with SID=0 if a valid SID frame was transmitted).
EVRFR: Erased Valid RATSCCH frame rate associated to an adaptive speech traffic channel This relates to the erasure of the RATSCCH message due to the failure to detect the RATSCCH identifier or due to a CRC failure.
EVRFR@-3 dB: Erased Valid RATSCCH frame rate associated to an adaptive speech traffic channel for an input signal level 3 dB below the reference interference level.
BER: Bit error rate.
RBER, BFI=0: Residual bit error rate (defined as the ratio of the number of errors detected over the frames defined as "good" to the number of transmitted bits in the "good" frames).

Non-MXM					
Type of Channel	**Propagation conditions**				
	TU1,5 (no FH)	**TU1,5 (ideal FH)**	**TU50 (no FH)**	**TU50 (ideal FH)**	**RA130 (no FH)**
RBER@-3 dB: Residual bit error rate for an input signal level 3 dB below the reference interference level. RBER@+3 dB: Residual bit error rate for an input signal level 3 dB above the reference interference level. RBER, (BFI or UFI)=0: Residual bit error rate (defined as the ratio of the number of errors detected over the frames defined as "reliable" to the number of transmitted bits in the "reliable" frames). RBER, SID=2 and (BFI or UFI)=0: Residual bit error rate of those bits in class I which do not belong to the SID codeword (defined as the ratio of the number of errors detected over the frames that are defined as "valid SID frames" to the number of transmitted bits in these frames, under the condition that a valid SID frame was sent). RBER, SID=1 or SID=2: Residual bit error rate of those bits in class I which do not belong to the SID codeword (defined as the ratio of the number of errors detected over the frames that are defined as "valid SID frames" or as "invalid SID frames" to the number of transmitted bits in these frames, under the condition that a valid SID frame was sent). TCH/AxS-INB FER: The frame error rate for the in-band channel. Valid for both Mode Indication and Mode Command/Mode Request. When testing all four code words shall be used an equal amount of time and the mode of both in-band channels (Mode Indication and Mode Command/Mode Request) shall be changed to a neighbouring mode not more often than every 22 speech frames (440 ms). NOTE 3: $1 \leq \alpha \leq 1,6$. The value of α can be different for each channel condition but must remain the same for FER and class Ib RBER measurements for the same channel condition. NOTE 4: FER for CCHs takes into account frames which are signalled as being erroneous (by the FIRE code, parity bits, or other means) or where the stealing flags are wrongly interpreted. NOTE 5: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz. The TU3 (ideal FH) and TU1,5 (ideal FH), sufficient decorrelation cannot easily be achieved. These performance requirements are given for information purposes and need not be tested. NOTE 6: For AMR, the complete conformance should not be restricted to the channels identified with (*).					

Table B.2a: Interference ratio at reference performance for GMSK modulated signals

CS-1 to CS-4						
Type of Channel		**Propagation conditions**				
		TU1,5 (no FH)	**TU1,5 (ideal FH)**	**TU50 (no FH)**	**TU50 (ideal FH)**	**RA130 (no FH)**
PDTCH/CS-1	dB	13	9	9	9	9
PDTCH/CS-2	dB	15	13	13	13	13
PDTCH/CS-3	dB	16	15	16	16	16
PDTCH/CS-4	dB	21	23	27	25	*
USF/CS-1	dB	19	10	10	10	10
USF/CS-2 to 4	dB	18	9	9	9	7
PRACH/11 bits	dB	9	9	9	9	10
PRACH/8 bits	dB	8	8	8	8	9
MCS-1 to MCS-4						
Type of Channel		**Propagation conditions**				
		TU1,5 (no FH)	**TU1,5 (ideal FH)**	**TU50 (no FH)**	**TU50 (ideal FH)**	**RA130 (no FH)**
PDTCH/MCS-1	dB	13	9,5	10	9,5	10
PDTCH/MCS-2	dB	15	12	12	12	12
PDTCH/MCS-3	dB	16,5	16,5	17	18	19
PDTCH/MCS-4	dB	19	21,5	23	[tbd**]	*
USF/MCS-1 to 4	dB	18	10	9,5	9,5	9,5
PRACH/11 bits	dB	9	9	9	9	10
PRACH/8 bits	dB	8	8	8	8	9
Performance is specified at 30 % BLER for those cases identified with mark **. NOTE 1: The specification for PDTCH/CS-1 applies also for PACCH, PBCCH, PAGCH, PPCH, PTCCH/D and PNCH. NOTE 2: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz. The TU3 (ideal FH) and TU1,5 (ideal FH), sufficient decorrelation cannot easily be achieved. These performance requirements are given for information purposes and need not be tested. NOTE 3: PDTCH/CS-4 and PDTCH/MCS-x cannot meet the reference performance for some propagation conditions (*).						

Table B.2b: Cochannel interference ratio (for normal BTS) at reference performance for 8-PSK modulated signals

Type of Channel		Propagation conditions				
		TU1,5 (no FH)	**TU1,5 (ideal FH)**	**TU50 (no FH)**	**TU50 (ideal FH)**	**RA130 (no FH)**
PDTCH/MCS-5	dB	[18]	[14,5]	[tbd]	[14]	[15,5]
PDTCH/MCS-6	dB	[tbd]	[18]	[tbd]	[17,5]	[20]
PDTCH/MCS-7	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
PDTCH/MCS-8	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
PDTCH/MCS-9	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]

Performance is specified at 30 % BLER for those cases identified with mark **.

NOTE 1: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz. The TU3 (ideal FH) and TU1,5 (ideal FH), sufficient decorrelation cannot easily be achieved. These performance requirements are given for information purposes and need not be tested.

NOTE 2: PDTCH for MCS-x cannot meet the reference performance for some propagation conditions (*).

Table B.2c: Cochannel interference ratio (for normal BTS) at reference performance for ECSD

Type of Channel		Propagation conditions				
		TU1,5 (no FH)	**TU1,5 (ideal FH)**	**TU50 (no FH)**	**TU50 ideal FH)**	**RA130 (no FH)**
E-FACCH/F	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F28.8 T	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F 32 T	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F28.8 NT	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F43.2 NT	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]

NOTE: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz. The TU3 (ideal FH) and TU1,5 (ideal FH), sufficient decorrelation cannot easily be achieved. These performance requirements are given for information purposes and need not be tested.

Table B.2d: Adjacent channel interference ratio (for normal BTS) at reference performance for 8-PSK modulated signals

Type of Channel		Propagation conditions				
		TU1,5 (no FH)	**TU1,5 (ideal FH)**	**TU50 (no FH)**	**TU50 (ideal FH)**	**RA130 (no FH)**
PDTCH/MCS-5	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
PDTCH/MCS-6	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
PDTCH/MCS-7	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
PDTCH/MCS-8	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
PDTCH/MCS-9	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]

NOTE 1: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz. The TU3 (ideal FH) and TU1,5 (ideal FH), sufficient decorrelation cannot easily be achieved. These performance requirements are given for information purposes and need not be tested.

NOTE 2: PDTCH for MCS-x cannot meet the reference performance for some propagation conditions (*).

Table B.2e: Adjacent channel interference (for normal BTS) ratio at reference performance for ECSD

Type of Channel		Propagation conditions				
		TU1,5 (no FH)	**TU1,5 (ideal FH)**	**TU50 (no FH)**	**TU50 ideal FH)**	**RA130 (no FH)**
E-FACCH/F	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F28.8 T	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F 32 T	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F28.8 NT	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]
E-TCH/F43.2 NT	dB	[tbd]	[tbd]	[tbd]	[tbd]	[tbd]

NOTE: Ideal FH case assumes perfect decorrelation between bursts. This case may only be tested if such a decorrelation is ensured in the test. For TU50 (ideal FH), sufficient decorrelation may be achieved with 4 frequencies spaced over 5 MHz. The TU3 (ideal FH) and TU1,5 (ideal FH), sufficient decorrelation cannot easily be achieved. These performance requirements are given for information purposes and need not be tested.

Annex C (normative): Testing of statistical parameters

C.1 Introduction

When measuring statistical parameters like Bit Error Rates (BERs) or Frame Erasure Rates (FERs), the statistical nature of the error events may result in a natural variance in the observed test results. This variance will depend on the number of events observed. Consequently, due to such statistical limitations with the aim to reduce the test time to a minimum, some overall requirements should be met, indicating a certain confidence in the observed results.

Defining a "good" BSS as a BSS which on a long term basis (tested over an infinite time) meets the system requirement for an individual test, and a "bad" BSS as a BSS which on a long term basis fails the system requirement for an individual test, the overall requirements are the following:

1) the probability of passing a "good" BSS should be as high as possible;

2) the probability of passing a "bad" BSS should be as low as possible.

C.2 General theoretical methodology

Statistical parameters are measured as a number of error events M within a set of observed events (or samples) N, and the ratio M/N is used as the estimated value. This estimate has a given uncertainty due to the limited statistical material, i.e. the number of samples N. The general methodology to ensure correct PASS/FAIL decisions is outlined in the following.

Given a random variable Xi output from a random process indicating error/no error, the probability of an error is p and consequently, the probability of no error is p. The expected value E(Xi) and variance Var(Xi) as given in (Eq 1), according to the binomial probability distribution.

$$E(Xi) = p \qquad \text{(Eq 1a)}$$

$$Var(Xi) = p - p2 \qquad \text{(Eq 1b)}$$

If the number of samples of the event is N, the average X of the random variables Xi is of interest, which has the expected value E(X) and variance Var(X) given in (Eq 2), assuming that the random variables Xi are independent.

$$E(X) = p \qquad \text{(Eq 2a)}$$

$$Var(X) = (p - p2) / N \qquad \text{(Eq 2b)}$$

Assuming that the error probability p is small, the formula can be simplified as in (Eq 3).

$$E(X) = p \qquad \text{(Eq 3a)}$$

$$Var(X) = p / N \qquad \text{(Eq 3b)}$$

Furthermore, if the number of samples N is great, the probability density of X may be assumed to be Gaussian and the confidence intervals needed can easily be found.

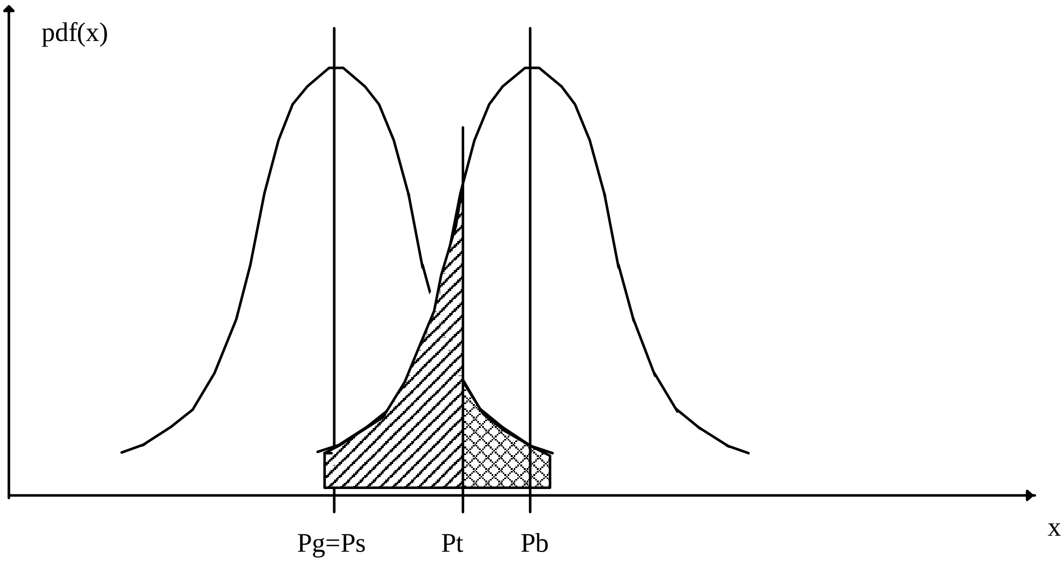
Assuming that a "good" BSS has the real performance Pg when measured over an infinite time and that a "bad" BSS has the corresponding performance Pb, the relationships to the system requirement Ps are the following:

$$Pg <= Ps \qquad \text{(Eq 4a)}$$

$$Pb > Ps \qquad \text{(Eq 4b)}$$

Irrespective of the values of Pg and Pb, the aim would ideally be to guarantee that the probabilities of passing a "good" BSS, P(PASS|Pg) and the probability of failing a "bad" BSS, P(FAIL|Pb) are as high as possible. Given a certain Pg and a certain Pb, this can be done by increasing the number of samples N until the distributions around Pg and Pb are "narrow" enough, i.e. the variances are sufficiently reduced, so that there is sufficient space in between for a test requirement Pt with the required confidence. The principle is illustrated in figure C.1 with Pg=Ps.

In practice, the above ideal approach cannot be used since when Pg or Pb get very close to Ps, the needed number of samples to reduce the variances would be infinite. However, what can be done is to represent Pg by the worst case Ps and to have a certain confidence of failing a BSS which is a given amount worse than Ps, i.e. with a fixed Pb. This will, however, give less confidence in failing a "bad" BSS which has a performance closer to Ps. This is the exact principle illustrated in figure C.1.



Ps = system requirement.
Pt = test requirement.
Pg = real performance of a "good" BTS.
Pb = real performance of a "bad" BTS.

Figure C.1: Statistical testing

The test requirement Pt will then be as in equation (Eq 5) for the overall requirements depending on Ps and Pb, and on the needed number of samples N:

Pt = Ps + G (Ps/N)1/2 (Eq 5a)

Pt = Pb - B (Pb/N)1/2 (Eq 5b)

G and B are the ordinates (in fact the inverse Gaussian Q-function) giving the normalized Gaussian distribution confidence intervals required for passing a "good" BSS and failing a "bad" BSS, respectively.

Finally, if the ratio Pb/Ps is fixed, the number of samples is given by the following equations (Eq 6).

$$N = \frac{(G + \sqrt{K}\ B)^2}{(K - 1)^2\ Ps} \qquad \text{(Eq 6a)}$$

Pb = K Ps (Eq 6b)

C.3 Detailed theoretical methodology

The total number of statistical tests indicated in annex C (excluding blocking, intermodulation etc.) are:

- PCS 1 900: 95;
- MXM 1 900: 96;

and the rules of the tests are as follows:

- in order to pass a BSS it should pass all tests;
- a single test which fails should be repeated once. If the BSS fails a 2nd time, the BSS has failed.

This means that the overall probability of passing a good BSS through all the tests is lower than for the individual tests.

Taking into account the total of:

- PCS 1 900: 95 tests;
- MXM 1 900: 96 tests;

assuming that the outcomes of the tests are independent, and requiring that the total probability of passing a "good" BSS should be equal to the total probability of failing a "bad" BSS, the overall confidence requirements in this annex should be as follows on a test by test basis:

- P(PASS|Ps) > = 99,9 % (i.e. G = 3,09);
- P(FAIL|Pb) > = 95,0 % (i.e. B = 1,65).

With the above assumptions, the total probabilities of passing a "good" BSS and failing a "bad" BSS will be around 91,0 %.

NOTE 1: If for some reason not all tests are carried out, then the probability of failing a "bad" BSS, P(FAIL|Pb), should be increased accordingly.

Since the test requirement Pt will lie somewhere in between the system requirement Ps and Pb, and that an uncertainty in test equipment resulting from imperfections in the randomness of pseudo-random generators etc. can be expected to give errors of the order of ±5 %, the ratio Pb/Ps should be 2.

Under idealized assumptions, the resulting minimum number of samples needed to meet the overall confidence requirements is indicated as a function of the system requirement Ps using (Eq 6) in table C.1.

The ratio of the test requirement Pt to the system requirement Ps will in this case be:

- Pt = 1,57 Ps.

NOTE 2: It is possible to reduce the needed number of samples. In that case the ratio Pb/Ps should be increased, or the confidence levels should be reduced, see equation (Eq 5). It is preferable to keep the confidence and to increase Pb/Ps. However, the accepted error rate Pt, and Pb, should not deviate too much from the system requirement Ps, especially for high Ps. In order to have meaningful requirements it may even be desirable to reduce Pb/Ps for high Ps.

Table C.1: Minimum number of samples for statistical testing

Error rate Ps	Minimum number of samples
1,0 E-1	300
1,0 E-2	3 000
1,0 E-3	30 000
1,0 E-4	300 000
1,0 E-5	3 000 000

C.4 Limitations and corrections to the theoretical methodology

The idealized assumptions resulting in table C.1 are:

1) all random variables Xi (error events) are assumed to be independent;
2) the observed random variable X is assumed to have a Gaussian distribution;
3) all random variables Xi (error events) are assumed to be outputs of stationary random processes with identical distributions;
4) the system requirement Ps is assumed to be sufficiently small.

C.4.1 Independent errors

The assumption that all error events are independent does not strictly hold. The fact that error events are mutually dependent, would increase the variance of the observed random variable X, and consequently, the number of samples needed for the confidence required should be multiplied by some factor indicating the number of error events which on average are completely correlated.

- For FERs the events occur so seldom that the events may be regarded as independent (factor of 1), the exception being TCH/FS, FACCH, TCH/AxS which should have a factor of 2.
- Since a convolutional decoder on average will produce burst errors of the order of the constraint length, BERs and RBERs should have a factor of 5.

Generally, the situation will be such that a "good" BSS will have a performance Pg which is better than Ps. Consequently, the number of samples found in all cases by (Eq 6) should be multiplied by an additional factor of 2.

C.4.2 Gaussian distribution

The assumption of a Gaussian distribution for the observed random variable X should hold in most cases due to the high number of samples used.

C.4.3 Stationary random processes

The assumption that the error events are outputs of stationary random processes with identical distributions holds generally for static propagation conditions. However, for multipath propagation conditions this is not true. On the other hand, the multipath propagation condition may be assumed to be stationary for short periods of time. Taking into account the worst-case situation of flat fading where the distance between fades is a wavelength, the characteristics of the propagation condition may be assumed to change e.g. 10 times per wavelength and to be short term stationary in between. This means that all the different random variables Xi (error events) have a different pi and consequently different E(Xi) and Var(Xi). Since all pi are unknown and only the random variable X, which is the average of all Xi, is observed against a system requirement Ps, the statistical parameters of (Eq 7) result in the case of multipath propagation conditions assuming that all pi are independent.

$$E(X) = \frac{1}{N}\sum_{i=1}^{N} pi = p \qquad \text{(Eq 7a)}$$

$$Var(X) = \frac{p}{N} - \tfrac{1}{N^2}\sum_{i=1}^{N} pi^2 \qquad \text{(Eq 7b)}$$

Also in this case the variance can (and should) be simplified to p/N if all pi are small. However, in this case the second term of (Eq 7b) is dominated by the greatest pi and the simplification is less valid than for static propagation conditions. Nevertheless, the needed number of samples given by (Eq 6) is conservative because the variance would ideally be lower. On the other hand, if the fact that the different pi are likely to be correlated with positive correlation is taken into account, Var(X) will increase and the simplification to p/N might be adequate.

Since under multipath conditions the observed random variable X results from an average of a set of random processes, we should ensure that the average takes into account a sufficient number of processes to get an overall stationary process. Requiring an average over 1 000 wavelengths (or 10 000 processes if the multipath propagation condition is updated every 10^{th} of a wavelength), the resulting observation period needed is indicated in table C.2 if the logical channel in question occupies the basic physical channel all the time. The percentage of the time "on the air" for the logical channel should also be taken into account and consequently, the observation period indicated in table C.2 will be increased by an inverse frame filling factor.

Table C.2: Required observation periods under multipath

Multipath condition	Time per Wavelength	Required observation period
TU1,5	800 ms	800 s
TU3	400 ms	400 s
TU50	24 ms	24 s
HT100	12 ms	12 s
RA250	5 ms	5 s
RA130	9,6 ms	9,6 s
TI5	240 ms	240 s

C.4.4 Low error ratios

The assumption that the system requirement Ps is sufficiently small holds generally. However, when reaching a high Ps, e.g. around 10 E-1, the approximation in (Eq 3) is not strictly accurate. However, using the correct variance would decrease the needed number of samples, so the assumptions give conservative results.

C.4.5 Total corrections

As a conclusion, the various limitations of the assumptions discussed in the above clauses all lead to different increases of the needed number of samples to obtain the required confidence. The different increases should all be taken into account by taking the highest increase, and calculated number of samples are indicated in annex C. The overall confidence resulting is possibly slightly lower than 99,9 % and 95,0 %, but it should be quite close. Considering as well that the different tests are likely to be correlated, will make the overall probabilities of passing a "good" BSS and failing a "bad" BSS higher than indicated.

NOTE: The worst case in terms of test time it is the static sensitivity performance for the SACCH/T, giving 7,9 hours. On average, the test times are around 35,6 min and range from 5,0 s.

C.5 Alternative experimental methodology

The alternative experimental methodology indicated in this clause could be used to verify, or possibly modify, the needed number of samples indicated in the previous clauses. This would be most useful in the case of multipath propagation conditions where the statistics are very complicated and cannot easily fit into simple formulae.

The approach is indicated in the following, and should be carried out once and for all for each multipath propagation condition, for each logical channel and for each type of error event according to clause A.5 to assess the needed number of samples. Then, it can be used ever after for any BSS.

1) Record the number of error events for Np periods of Ns samples (events) under static propagation conditions for an average system requirement Ps and for a given type of error event on a given logical channel.

2) Estimate the error ratio ERi = Mi/Ns for each of the Np periods.

3) Consider the average ER of all ERi and estimate the expected value E(ER) and the variance Var(ER):

$$m = E(ER) = \frac{1}{Np}\sum_{i=1}^{Np} ERi \qquad \text{(Eq 8a)}$$

$$s^2 = Var(ER) = \frac{1}{Np}\sum_{i=1}^{Np} ERi^2 - m^2 \qquad \text{(Eq 8b)}$$

The test requirement Pt is found as follows:

Pt = Ps + G s (Eq 9a)

and

Pt = K Ps - B s (Eq 9b)

4) The test shall be repeated with a different number of samples Ns until the test requirement Pt differs with less than ±5 % in (Eq 9a) and (Eq 9b).

The initial number of samples Ns should be as indicated in clause 3 and the number of tests Np should be 100.

The average system requirement Ps should be around 1.0 E-2. It can then be assumed that the needed number of samples Ns is inversely proportional to Ps.

C.6 Detailed definition of error events

1) Frame Erasure Ratio (FER):

- the frame is defined as erased if the error detection functions in accordance with GSM 05.03 (EN 300 909 [4]) indicate an error. For full-rate speech this is the result of a 3 bit Cyclic Redundancy Check (CRC), for signalling the result of the FIRE code or other block code used. For data traffic the FER is not defined.

NOTE: For full-rate speech it would ideally be better if the Bad Frame Indication (BFI) is used as frame erasure indication since this is what is directly related to the subjective quality of the perceived speech. For the moment no requirements relate to the BFI, however, it is very difficult to assess what is subjectively the optimum combination of Frame Erasure Ratio (FER) and Residual Bit Error Ratio (RBER). This should therefore be avoided and it is essential that the BFI is optimized towards the ideal frame erasures independent of the processing to obtain it, and that the BFI is not biased towards BFI = 0 or BFI = 1.

2) Residual Bit Error Ratio (RBER):

- the RBER is defined as the residual Bit Error Ratio (BER) in frames which have not been declared as erased.

3) Bit Error Ratio (BER):

- the BER is the overall Bit Error Ratio (BER) independent of frame erasures or when erased frames are not defined.

Annex D (informative): Source specifications for clauses 4 and 5

The test suites in clause 5 are derived from other specifications. This annex identifies these specifications and the clause number within them. In some cases, editorial modifications have been made to improve the clarity. These changes include:

- deletion of text relating to aspects of the source specification which are outside the scope of the present document;
- where the text contains a reference to another document, the reference is replace by the applicable text from the document which is referenced;
- clarification that a requirement is mandatory for the purposes of the present document.

The changes are listed in table D.1:

Table D.1

Clause No	Source specification	Clause(s)	Part modified	Details of change
4.3.1.1	TIA/EIA-136-280-B [17]	3.4.1.2.1		
4.3.1.2	TIA/EIA-136-280-B [17]	3.4.1.2.3		
4.3.2.1	TIA/EIA-136-280-B [17]	3.4.2.2.1		
4.3.2.2	TIA/EIA-136-280-B [17]	3.4.2.2.3.2		Within the base station transmit band, measured within the associated base station receive band.
4.3.3.1	TIA/EIA-136-280-B [17]	3.2.1.2		Included only first paragraph, excluded optional downlink power control
4.3.3.2	TIA/EIA-136-280-B [17]	3.2.1.2.2		
4.3.4	TIA/EIA-136-280-B [17]	3.4.4.1.1		Shall not exceed FCC spurious and harmonic
4.3.4.2	TIA/EIA-136-280-B [17]	3.4.4.1.3		
4.3.5.1	TIA/EIA-136-280-B [17]	2.4.1		
4.3.5.1	TIA/EIA-136-280-B [17]	2.4.3		
4.3.6.1	TIA/EIA-136-280-B [17]	2.3.2.3.1		
4.3.6.2	TIA/EIA-136-280-B [17]	2.3.2.3.3		
4.3.7.1	TIA/EIA-136-280-B [17]	2.3.2.2.1		
4.3.7.2	TIA/EIA-136-280-B [17]	2.3.2.2.3		
4.4.1	GSM 05.05 [5]	4.2		
4.4.2	GSM 05.05 [5]	4.3		
4.4.3	GSM 05.05 [5]	4.1.2		
4.4.4	GSM 05.05 [5]	4.7		
4.4.5	GSM 05.05 [5]	5.4		
4.4.6.1	GSM 05.05 [5]	5.2		
4.4.6.2	GSM 05.05 [5]	5.3		
4.4.6.3	GSM 05.05 [5]	5.1		
4.4.7	GSM 05.08 [9]	8.1.2		
4.5	1,6 MHz channel			For further study
5.4.2 Emission mask	TIA/EIA-136-280-B [17]	3.4.1.2.2		Emission mask the analyzer or receiver shall make a mean power measurement using frequency selection with a passband equivalent to an ideal root raised-cosine receiver filter
5.4.3	TIA/EIA-136-280-B [17]	3.4.2.2.2		TX conducted spurious emissions
5.4.4	TIA/EIA-136-280-B [17]	3.2.1.2.3		RF Power output
5.4.5	TIA/EIA-136-280-B [17]	3.4.4.1.2		TX intermodulation spurious emissions
5.4.6	TIA/EIA-136-280-B [17]	2.4.2		RX conducted spurious emissions Change1: "to at least 6 000 MHz"
5.4.7	TIA/EIA-136-280-B [17]			RX intermodulation spurious emissions
5.4.8	TIA/EIA-136-280-B [17]	2.3.2.2.2		RX Adjacent and alternate channel desensitization
5.5.1.1	GSM 11.21 [6]	6.5.1		Emission mask - due to modulation and wideband noise
5.5.1.2	GSM 11.21 [6]	6.5.2		Emission mask - switching transients

Clause No	Source specification	Clause(s)	Part modified	Details of change
5.5.2	GSM 11.21 [6]	6.6		TX conducted spurious emissions
5.5.3	GSM 11.21 [6]			RF output power
5.5.4	GSM 11.21 [6]	6.7, 6.8, 6.9, 6.10		TX intermodulation spurious emissions
5.5.5	GSM 11.21 [6]	7.9		RX conducted spurious emissions
5.5.6.1	GSM 11.21 [6]	7.8		RX AM suppression characteristics
5.5.6.2	GSM 11.21 [6]	7.7		RX intermodulation characteristics
5.5.6.3	GSM 11.21 [6]	7.6		Receiver blocking
5.5.7	GSM 11.21 [6]	9.4.1.2		Adjacent channel selectivity
5.6	1,6 MHz channel			For further study
Figures 2 and 3	TIA/EIA-136-280-B [17]	6.6.2		

Annex E (informative): Bibliography

TIA/EIA-136-290: "TDMA Third Generation Wireless; RF Minimum Performance for 136HS Outdoor and 136HS Indoor Bearers".

TIA/EIA-136-110-A (2000): "TDMA Third Generation Wireless; RF Channel Assignments".

Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

Annex F (informative): The EN title in the official languages

Language	EN title
Danish	
Dutch	
English	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third-Generation cellular networks; Part 9: Harmonized standard for IMT-2000, TDMA Single-Carrier (UWC 136) (BS) covering essential requirements of article 3.2 of the R&TTE Directive
Finnish	
French	
German	
Greek	
Icelandic	
Italian	
Portuguese	
Spanish	
Swedish	

History

Document history		
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