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QUY CHUẨN KỸ THUẬT QUỐC GIA VỀ MÁY DI ĐỘNG GSM (PHA 2 và 2+)

National technical regulation on GSM mobile stations (Phase 2 and 2+)

(for information only)

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Foreword

QCVN 12:2010/BTTTT is based on the review and convert of TCN 68-221:2004 "GSM Mobile Station (Phase 2 and phase 2+) - Technical Requirement", issued by decision no 31/2004/QĐ-BBCVT dated July 29, 2004 of Minister of Ministry of Post and Telecommunications (now the Ministry of Information and Communications).

Technical Requirements of QCVN 12:2010/BTTTT accordance with standard EN 301 511 V7.0.1 (2000-12) and EN 300 607-1 V8.1.1 (2000-10) of European Telecommunications Standards Institute (ETSI).

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QUY CHUẨN KỸ THUẬT QUỐC GIA
VỀ MÁY DI ĐỘNG GSM (PHA 2 VÀ 2+)

National technical regulation
on GSM mobile stations (Phase 2 and 2+)

1. GENERAL

1.1. Scope

This technical regulation applies to GSM mobile station operation in the GSM 900 and/or DCS 1800 frequency bands as shown in Table 1.1.

Table 1 - Frequency bands for GSM 900 and DCS 1800 Mobile Station system

Type	TX	RX
P-GSM 900	890 - 915 MHz	935 - 960 MHz
DCS 1800	1710 - 1785 MHz	1805 - 1880 MHz

with a channel separation of 200 kHz, utilizing constant envelope modulation and carrying traffic channels according to the Time Division Multiple Access (TDMA) principle.

1.2. Subjects of application

This technical regulation applies to all agencies, organizations manufacture, import and operate GSM mobile station.

1.3. Terms and Definitions

1.3.1. Environmental profile

Range of environmental conditions under which equipment within the scope of the technical regulation is required to comply with the provisions of this technical regulation.

1.3.2. Mobile Station (MS)

A device used while moving or stopped at any point. Mobile station Include mobile phones and handheld device on the car.

1.4. Abbreviations

ACCH	Associated Control CHannel
ACK	ACKnowledgement
ARFCN	Absolute Radio Frequency Channel Number
BA	BCCH Allocation
BCCH	Broadcast Control CHannel
BCF	Base station Control Function
BCIE	Bearer Capability Information Element
BER	Bit Error Rate
BFI	Bad Frame Indication
BS	Bearer Service
BSG	Basic Service Group
BSC	Base Station Controller

BSS	Base Station System
BTS	Base Transceiver Station
C	Conditional
CA	Cell Allocation
CB	Cell Broadcast
CBC	Cell Broadcast Centre
CCCH	Common Control CHannel
CCF	Conditional Call Forwarding
CCH	Control CHannel
CCM	Current Call Meter
CCP	Capability/Configuration Parameter
CCPE	Control Channel Protocol Entity
CIR	Carrier to Interference Ratio
C/R	Command/Response field bit
CSPDN	Circuit Switched Public Data Network
DTE	Data Terminal Equipment
EIR	Equipment Identity Register
EL	Echo Loss
EMC	Electro Magnetic Compatibility
EQ	Equalization test
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FB	Frequency correction Burst
FCCH	Frequency Correction CHannel
FEC	Forward Error Correction
FER	Frame Erasure Ratio
FH	Frequency Hopping
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
HANDO	HANDOver
HR	Half Rate
HSN	Hopping Sequence Number
HT	Hilly Terrain
M	Mandatory
ME	Mobile Equipment
MF	MultiFrame
MS	Mobile Station
MT	Mobile Terminated
MTM	Mobile-To-Mobile (call)

O	Optional
O&M	Operations & Maintenance
QOS	Quality Of Service
RA	Rural Area
RAB	Random Access Burst
RBER	Residual Bit Error Ratio
RF	Radio Frequency
RFC	Radio Frequency Channel
RMS	Root Mean Square (value)
RR	Radio Resource
RXLEV	Received Level
RXQUAL	Received Signal Quality
SAP	Service Access Point
SAPI	Service Access Point Indicator
SB	Synchronization Burst
SCH	Synchronization CHannel
TCH	Traffic CHannel
TU	Urban area

2. TECHNICAL REQUIREMENTS

2.1. Environmental profile

The technical requirements of this technical regulation 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 at all times when operating within the boundary limits of the required operational environmental profile.

2.2. Conformance requirements

2.2.1. Transmitter - Frequency error and phase error

2.2.1.1. Definition and applicability

The frequency error is the difference in frequency (after adjustment for the effect of the modulation and phase error) between the RF transmission from the MS and the RF transmission from the BS or the nominal frequency for the ARFCN used.

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

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

2.2.1.2. Conformance requirement

a) The MS carrier frequency shall be accurate to within 0.1 ppm, or accurate to within 0.1 ppm compared to signals received from the BS.

- Under normal conditions; GSM 05.10, 6.1.
- Under vibration conditions; GSM 05.10, 6.1.
- Under extreme conditions; GSM 05.10, 6.1.

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

- Under normal conditions; GSM 05.05, 4.6.
- Under vibration conditions; GSM 05.05, 4.6.
- Under extreme conditions; GSM 05.05, 4.6.

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

- Under normal conditions; GSM 05.05, 4.6.
- Under vibration conditions; GSM 05.05, 4.6.
- Under extreme conditions; GSM 05.05, 4.6.

2.2.1.3. Test purpose

a) To verify that the MS carrier frequency error does not exceed 0.1 ppm:

- Under normal conditions.
- When the MS is being vibrated.
- Under extreme conditions.

Note: The transmit frequency accuracy of the SS is expected to be sufficient to ensure that the difference between 0.1 ppm absolute and 0.1 ppm compared to signals received from the BS would be small enough to be considered insignificant.

b) To verify that the RMS phase error on the useful part of the bursts transmitted by the MS does not exceed conformance requirement 2.2.1.2.b):

- Under normal conditions.
- When the MS is being vibrated.
- Under extreme conditions.

c) To verify that the maximum phase error on the useful part of the bursts transmitted by the MS does not exceed conformance requirement 2.2.1.2.c).

- Under normal conditions.
- When the MS is being vibrated.
- Under extreme conditions.

2.2.1.4. Method of test

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

a) Initial conditions

A call is set up according to the Generic call setup procedure.

The SS commands the MS to hopping mode.

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

The SS activates ciphering mode.

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

The SS commands the MS to complete the traffic channel loop back without signalling of erased frames.

The SS generates Standard Test Signal C1 of annex A, A.6.

b) Procedure

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

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

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

(3a) The sampled array of at least 294 phase measurements is represented by the vector:

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

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

(3b) The calculated array, at the corresponding sampling instants, is represented by the vector: $\varnothing_c = \varnothing_c(0) \ldots \varnothing_c(n)$.

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

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

(3d) The corresponding sample numbers form a vector $t = t(0) \ldots t(n)$.

(3e) By regression theory the slope of the samples with respect to t is k where:

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

(3f) The frequency error is given by $k/(360^*\gamma)$, where γ is the sampling interval in s and all phase samples are measured in degrees.

(3g) The individual phase errors from the regression line are given by:

$$\varnothing_e(j) - k^*t(j)$$

(3h) The RMS value $\varnothing_e$ of the phase errors is given by:

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

(4) Steps (1) to (3) are repeated for 20 bursts, not necessarily contiguous.

(5) The SS instructs the MS to its maximum power control level, all other conditions remaining constant. Steps (1) to (4) are repeated.

(6) The SS instructs the MS to the minimum power control level, all other conditions remaining constant. Steps (1) to (4) are repeated.

(7) The MS is hard mounted on a vibration table and vibrated at the frequency/amplitudes specified in annex A, A.2.4. During the vibration steps (1) to (6) are repeated.

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

(8) The MS is re-positioned on the vibration table in the two orthogonal planes to the plane used in step (7). For each of the orthogonal planes step (7) is repeated.

(9) Steps (1) to (6) are repeated under extreme test conditions (see annex A, A.2).

Note: The series of samples taken to determine the phase trajectory could also be used, with different postprocessing, to determine the transmitter burst characteristics of 2.2.3. Although described independently, it is valid to combine the tests of 2.2.1 and 2.2.3, giving both answers from single sets of captured data.

2.2.1.5 Test requirements

a) Frequency error

For all measured bursts, the frequency error, derived in step (3f), shall be less than 0.1 ppm.

b) Phase error

For all measured bursts, the RMS phase error, derived in step (3h), shall not exceed 5 degrees.

For all measured bursts, each individual phase error, derived in step (3g), shall not exceed 20 degrees.

2.2.2 Transmitter - Frequency error under multipath and interference conditions

2.2.2.1 Definition and applicability

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

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

2.2.2.2 Conformance requirement

a) The MS carrier frequency error for each burst shall be accurate to within 0.1 ppm, or 0.1 ppm compared to signals received from the BS for signal levels down to 3 dB below the reference sensitivity level.

- Under normal conditions; GSM 05.10, 6.1;
- Under extreme conditions; GSM 05.10, 6.1.

b) The MS carrier frequency error for each burst shall be accurate to within 0.1 ppm, or 0.1 ppm compared to signals received from the BS for 3 dB less carrier to interference ratio than the reference interference ratios (GSM 05.10, 6.1).

2.2.2.3 Test purpose

a) To verify that the MS carrier frequency error at reference sensitivity, under conditions of multipath and Doppler shift does not exceed 0.1 ppm + the frequency error due to the Doppler shift of the received signal and the assessment error in the MS.

- Under normal conditions;
- Under extreme conditions.

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

b) To verify that the MS carrier frequency error, under interference conditions and TUlow fading profile, does not exceed 0.1 ppm + the frequency error due to the Doppler shift of the received signal and the assessment error in the MS.

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

2.2.2.4 Method of test

This test uses the same measurement process as test 2.2.1 for the MS operating under various RF conditions.

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

a) Initial conditions

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

b) Procedure

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

(2) The SS calculates the frequency accuracy of the captured burst as described in test 2.2.1.

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

(4) The SS shall capture subsequent bursts from the traffic channel in the manner described in test 2.2.1.

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

(5) The SS calculates the frequency accuracy of the captured burst as described in test 4.2.1.

(6) Steps (4) and (5) are repeated for 5 traffic channel bursts spaced over a period of not less than 20 s.

(7) The initial conditions are established again and steps (1) to (6) are repeated but with the fading function set to HT100.

(8) The initial conditions are established again and steps (1) to (6) are repeated but with the fading function set to TU50.

(9) The initial conditions are established again and steps (1) and (2) are repeated but with the following differences:

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

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

(11) Repeat steps (4) to (6), except that at step (6) the measurement period must be extended to 200 s and the number of measurements increased to 20.

(12) The initial conditions are established again and steps (1) to (10) are repeated for ARFCN in the Low ARFCN range.

(13) The initial conditions are established again and steps (1) to (10) are repeated for ARFCN in the High ARFCN range.

(14) Repeat step (8) under extreme test conditions (see annex A, A.2).

2.2.2.5. Test requirements

The frequency error, with reference to the SS carrier frequency as measured in repeats of step e), for each measured burst shall be less than the values shown in Table 2.

Table 2 - Requirements for frequency error under multipath, Doppler shift and interference conditions

GSM 900		DCS 1800	
Propagation condition	**Permitted Frequency error**	**Propagation condition**	**Permitted Frequency error**
RA250	+/- 300 Hz	RA130	+/- 400 Hz
HT100	+/- 180 Hz	HT100	+/- 350 Hz
TU50	+/- 160 Hz	TU50	+/- 260 Hz
TU3	+/- 230 Hz	TU1.5	+/- 320 Hz

2.2.3. Transmitter - Frequency error and phase error in HSCSD multislot configuration

2.2.3.1. Definition and applicability

The frequency error is the difference in frequency, after adjustment for the effect of the modulation and phase error, between the RF transmission from the MS and the RF transmission from the BS or the nominal frequency for the ARFCN used.

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

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

2.2.3.2 Conformance requirement

a) The MS carrier frequency shall be accurate to within 0.1 ppm, or accurate to within 0.1 ppm compared to signals received from the BS.

- Under normal conditions; GSM 05.10, 6.1;
- Under vibration conditions; GSM 05.10, 6.1;
- Under extreme conditions; GSM 05.10, 6.1.

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

- Under normal conditions; GSM 05.05, 4.6;
- Under vibration conditions; GSM 05.05, 4.6;
- Under extreme conditions; GSM 05.05, 4.6.

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

- Under normal conditions; GSM 05.05, 4.6;
- Under vibration conditions; GSM 05.05, 4.6;
- Under extreme conditions; GSM 05.05, 4.6.

2.2.3.3 Test purpose

a) To verify that in a multislot configuration the MS carrier frequency error does not exceed 0.1 ppm:

- Under normal conditions;
- When the MS is being vibrated;
- Under extreme conditions.

Note: The transmit frequency accuracy of the SS is expected to be sufficient to ensure that the difference between 0.1 ppm absolute and 0.1 ppm compared to signals received from the BS would be small enough to be considered insignificant.

b) To verify that the RMS phase error on the useful part of the bursts transmitted by the MS in a multislot configuration does not exceed conformance requirement 2.2.3.2.b):

- Under normal conditions;
- When the MS is being vibrated;
- Under extreme conditions.

c) To verify that the maximum phase error on the useful part of the bursts transmitted by the MS in a multislot configuration does not exceed conformance requirement 2.2.3.2.c).

- Under normal conditions;
- When the MS is being vibrated;
- Under extreme conditions.

2.2.3.4 Method of test

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

a) Initial conditions

A call is set up according to the generic call setup procedure for multislot HSCSD.

The SS commands the MS to hopping mode.

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

The SS activates ciphering mode.

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

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

The SS commands the MS to complete the traffic channel multislot loop back including signalling of erased frames.

The SS generates Standard Test Signal C1 (annex A, A.6).

b) Procedure

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

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

(3) From (1) and (2) the phase trajectory error is calculated, and a linear regression line computed through this phase trajectory error. The slope of this regression line is the frequency error of the mobile transmitter relative to the simulator reference. The difference between the regression line and the individual sample points is the phase error of that point.

(3a) The sampled array of at least 294 phase measurements is represented by the vector:

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

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

(3b) The calculated array, at the corresponding sampling instants, is represented by the vector:

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

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

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

(3d) The corresponding sample numbers form a vector t = t(0)...t(n).

(3e) By regression theory the slope of the samples with respect to t is k where:

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

(3f) The frequency error is given by k/(360*γ), where γ is the sampling interval in s and all phase samples are measured in degrees.

(3g) The individual phase errors from the regression line are given by:

$$\varnothing_e(j) - k^{*}t(j)$$

(3h) The RMS value $\varnothing_e$ of the phase errors is given by:

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

(4) Steps (1) to (3) are repeated for 20 bursts, not necessarily contiguous.

(5) The SS instructs the MS to its maximum power control level on each multislot subchannel, all other conditions remaining constant. Steps (1) to (4) are repeated.

(6) The SS instructs the MS to the minimum power control level on each multislot subchannel, all other conditions remaining constant. Steps (1) to (4) are repeated.

(7) The MS is hard mounted on a vibration table and vibrated at the frequency/amplitudes specified in annex A, A.2.4. During the vibration steps (1) to (6) are repeated.

Note: If the call is terminated when mounting the MS to the vibration table, it will be necessary to establish the initial conditions again before repeating steps (1) to (6).

(8) The MS is re-positioned on the vibration table in the two orthogonal planes to the plane used in step (7). For each of the orthogonal planes step (7) is repeated.

(9) Steps (1) to (6) are repeated under extreme test conditions (see annex A, A.2).

Note: The series of samples taken to determine the phase trajectory could also be used, with different postprocessing, to determine the transmitter burst characteristics of ‘Transmitter output power and burst timing in multislot configuration’. Although described independently, it is valid to combine these two tests, giving both answers from single sets of captured data.

2.2.3.5 Test requirements

a) Frequency error

For all measured bursts, the frequency error, derived in step (3f), shall be less than 10E-7.

b) Phase error

For all measured bursts, the RMS phase error, derived in step (3h), shall not exceed 5 degrees.

For all measured bursts, each individual phase error, derived in step (3g), shall not exceed 20 degrees.

2.2.4 Frequency error and phase error in GPRS multislot configuration

2.2.4.1 Definition and applicability

The frequency error is the difference in frequency, after adjustment for the effect of the modulation and phase error, between the RF transmission from the MS and the RF transmission from the BS or the nominal frequency for the ARFCN used.

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

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

2.2.4.2 Conformance requirement

a) The MS carrier frequency shall be accurate to within 0.1 ppm compared to signals received from the BS.

- Under normal conditions; GSM 05.10, 6.1;
- Under vibration conditions; GSM 05.10, 6.1;
- Under extreme conditions; GSM 05.10, 6.1.

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

- Under normal conditions; GSM 05.05, 4.6;
- Under vibration conditions; GSM 05.05, 4.6;
- Under extreme conditions; GSM 05.05, 4.6.

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

- Under normal conditions; GSM 05.05, 4.6;
- Under vibration conditions; GSM 05.05, 4.6;
- Under extreme conditions; GSM 05.05, 4.6.

2.2.4.3 Test purpose

a) To verify that in a multislot configuration the MS carrier frequency error does not exceed 0.1 ppm:

- Under normal conditions;
- When the MS is being vibrated;
- Under extreme conditions.

b) To verify that the RMS phase error on the useful parts of the bursts transmitted by the MS in a multislot configuration does not exceed conformance requirement 2.2.4.2.b):

- Under normal conditions;
- When the MS is being vibrated;
- Under extreme conditions.

c) To verify that the maximum phase error on the useful parts of the bursts transmitted by the MS in a multislot configuration does not exceed conformance requirement 2.2.4.2.c):

- Under normal conditions;
- When the MS is being vibrated;
- Under extreme conditions.

2.2.4.4 Method of the test

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

a) Initial conditions

A call is set up according to the generic call setup procedure for multislot GPRS. The SS commands the MS to hopping mode.

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

The SS activates ciphering mode.

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

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

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

The SS generates Standard Test Signal C1 of annex A, A.6.

b) Procedure

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

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

(3) From (1) and (2) the phase trajectory error is calculated, and a linear regression line computed through this phase trajectory error. The slope of this regression line is the frequency error of the mobile transmitter relative to the simulator reference. The difference between the regression line and the individual sample points is the phase error of that point.

(3a) The sampled array of at least 294 phase measurements is represented by the vector:

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

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

(3b) The calculated array, at the corresponding sampling instants, is represented by the vector:

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

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

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

(3d) The corresponding sample numbers form a vector t = t(0)...t(n).

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

(3e) By regression theory the slope of the samples with respect to t is k where:

(3f) The frequency error is given by k/(360*g), where g is the sampling interval in s and all phase samples are measured in degrees.

(3g) The individual phase errors from the regression line are given by:

$$\varnothing_e(j) - k^{*}t(j).$$

(3h) The RMS value $\varnothing_e$ of the phase errors is given by:

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

(4) Steps (1) to (2) are repeated for 20 bursts, not necessarily contiguous.

(5) The SS instructs the MS to its maximum power control level by setting the power control parameter ALPHA (α) to 0 and GAMMA_TN (Γ_{CH}) for each timeslot to the desired power level in the Packet Uplink Assignment message (see GSM 05.08. Annex B.2), all other conditions remaining constant. Steps (1) to (4) are repeated.

(6) The SS instructs the MS to the minimum power control level, all other conditions remaining constant. Steps (1) to (4) are repeated.

(7) The MS is hard mounted on a vibration table and vibrated at the frequency/amplitudes specified in annex A, A.2.4. During the vibration steps (1) to (6) are repeated.

Note: If the call is terminated when mounting the MS to the vibration table, it will be necessary to establish the initial conditions again before repeating steps (1) to (6).

(8) The MS is re-positioned on the vibration table in the two orthogonal planes to the plane used in step (7). For each of the orthogonal planes step (7) is repeated.

(9) Steps (1) to (6) are repeated under extreme test conditions (see annex A, A.2.3).

2.2.4.5. Test requirements

a) Frequency error

For all measured bursts, the frequency error, derived in step (3f), shall be less than 10E-7.

b) Phase error

For all measured bursts, the RMS phase error, derived in step (3h), shall not exceed 5 degrees.

For all measured bursts, each individual phase error, derived in step (3g), shall not exceed 20 degrees.

2.2.5 Transmitter output power and burst timing

2.2.5.1 Definition and applicability

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

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

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

2.2.5.2 Conformance requirement

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

b) The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of +/-2.5 dB under extreme conditions;

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

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

e) The output power actually transmitted by the MS at consecutive power control levels shall form a monotonic sequence and the interval between power control levels shall be 2 +/-1.5 dB; GSM 05.05, subclause 4.1.1.

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

- Under normal conditions; GSM 05.05, 4.5.2;
- Under extreme conditions; GSM 05.05, 4.5.2.

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

h) The transmissions from the MS to the BS, measured at the MS antenna, shall be 468.75 - TA bit periods behind the transmissions received from the BS, where TA is the last timing advance received from the current serving BS. The tolerance on these timings shall be +/-1 bit period:

- Under normal conditions; GSM 05.10, 6.4;
- Under extreme conditions; GSM 05.10, 6.4.

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

- Under normal conditions; GSM 05.05, 4.5.2;
- Under extreme conditions; GSM 05.05, 4.5.2.

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

- Under normal conditions; GSM 05.10, 6.6;
- Under extreme conditions; GSM 05.10, 6.6.

2.2.5.3 Test purpose

a) To verify that the maximum output power of the MS, under normal conditions, is within conformance requirement 2.2.5.2.a).

b) To verify that the maximum output power of the MS, under extreme conditions, is within conformance requirement 2.2.5.2.b).

c) To verify that all power control levels, relevant to the class of MS, are implemented in the MS and have output power levels, under normal conditions, within conformance requirement 2.2.5.2.c).

d) To verify that all power control levels have output power levels, under extreme conditions, within conformance requirement 2.2.5.2.d).

e) To verify that the step in the output power transmitted by the MS at consecutive power control levels is within conformance requirement 2.2.5.2.e) under normal conditions.

f) To verify that the output power relative to time, when sending a normal burst is within conformance requirement 2.2.5.2.f):

- Under normal conditions;
- Under extreme conditions.

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

h) To verify that, for normal bursts, the MS transmissions to the BS are timed within conformance requirement 2.2.5.2.h):

- Under normal conditions;
- Under extreme conditions.

i) To verify that the output power relative to time, when sending an access burst is within conformance requirement 2.2.5.2.i):

- Under normal conditions;
- Under extreme conditions.

k) To verify that, for an access burst, the MS transmission to the BS is timed within conformance requirement 2.2.5.2.k):

- Under normal conditions;

- Under extreme conditions.

2.2.5.4. Methods of test

Two methods of test are described, separately for:

- Equipment fitted with a permanent antenna connector and for
- Equipment fitted with an integral antenna, and which cannot be connected to an external antenna except by the fitting of a temporary test connector as a test fixture.

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

a) Method of test for equipment with a permanent antenna connector

(1) Initial conditions

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

(2) Procedure

(2a) Measurement of normal burst transmitter output power

The SS takes power measurement samples evenly distributed over the duration of one burst with a sampling rate of at least 2/T, where T is the bit duration. The samples are identified in time with respect to the modulation on the burst. The SS identifies the centre of the useful 147 transmitted bits, i.e. the transition from bit 13 to bit 14 of the midamble, as the timing reference. The transmitter output power is calculated as the average of the samples over the 147 useful bits. This is also used as the 0 dB reference for the power/time template.

(2b) Measurement of normal burst timing delay

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

(2c) Measurement of normal burst power/time relationship

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

(2d) Steps (2a) to (2c) are repeated with the MS commanded to operate on each of the power control levels defined, even those not supported by the MS.

(2e) The SS commands the MS to the maximum power control level supported by the MS and steps a) to c) are repeated for ARFCN in the Low and High ranges.

(2f) Measurement of access burst transmitter output power

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

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

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

(2g) Measurement of access burst timing delay

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

(2h) Measurement of access burst power/time relationship

The array of power samples measured in (2f) is referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in (2f).

(2i) Depending on the method used in step (2f) to cause the MS to send an Access Burst, the SS sends either a HANDOVER COMMAND with power control level set to 10 or it changes the System Information elements MS_TXPWR_MAX_CCH and for DCS 1800 the POWER_OFFSET on the serving cell BCCH in order to limit the MS transmit power on the Access Burst to power control level 10 (+23 dBm for GSM 900 or +10 dBm for DCS 1800) and then steps (2f) to (2h) are repeated.

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

b) Method of test for equipment with an integral antenna

Note: If the MS is equipped with a permanent connector, such that the antenna can be disconnected and the SS be connected directly, then the method of clause 2.2.5.4.b) will be applied.

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

(1) Initial conditions

The MS is placed in the anechoic shielded chamber (annex A, A.1.2) or on the outdoor test site, on an isolated support, in the position for normal use, at a distance of at least 3 metres from a test antenna, connected to the SS.

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

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

(2) Procedure

(2a) With the initial conditions set according to subclause (1) the test procedure in 2.2.5.4.a).(2) is followed up to and including step (2i), except that in step (2a), when measurements are done at maximum power for ARFCN in the Low, Mid and High range, the measurement is made eight times with the MS rotated by n*45 degrees for all values of n in the range 0 to 7.

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

(2b) Assessment of test site loss for scaling of received output power measurements.

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

The frequency of the RF signal generator is set to the frequency of the ARFCN used for the 24 measurements in step a), the output power is adjusted to reproduce the received transmitter output power averages recorded in step (2a).

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

For each channel number used compute:

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

from which: Pac (Tx dBm) = $10\log_{10}(\text{Pac}) + 30 + 2.15$

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

(2c) Temporary antenna connector calibration factors (transmit)

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

Under normal test conditions, the power measurement and calculation parts of steps (2a) to (2i) of 2.2.5.4.a).2 are repeated except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

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

(2d) Measurements at extreme test conditions.

Note: Basically the procedure for extreme conditions is:

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

Under extreme test conditions steps (2a) to (2i) of 2.2.5.4.a).2 are repeated except that the repeats at step (2d) are only performed for power control level 10 and the minimum power control level of the MS.

The transmitter output power under extreme test conditions is calculated for each burst type, power control level and for every frequency used by adding the frequency dependent calibration factor, determined in (2c), to the values obtained at extreme conditions in this step.

2.2.5.5 Test requirements

a) The transmitter output power, under every combination of normal and extreme test conditions, for normal bursts and access bursts, at each frequency and for each power control level applicable to the MS power class, shall be at the relevant level shown in Table 3 or Table 4 within the tolerances also shown in Table 3 or Table 4.

Table 3 - GSM 900 transmitter output power for different power classes

Power class				Power control level	Transmitter output power	Tolerances	
2	3	4	5		dBm	normal	extreme
●				2	39	+/-2 dB	+/-2.5 dB
●	●			3	37	+/-3 dB*)	+/-4 dB*)
●	●			4	35	+/-3 dB	+/-4 dB
●	●	●		5	33	+/-3 dB*)	+/-4 dB*)
●	●	●		6	31	+/-3 dB	+/-4 dB
●	●	●	●	7	29	+/-3 dB*)	+/-4 dB*)
●	●	●	●	8	27	+/-3 dB	+/-4 dB
●	●	●	●	9	25	+/-3 dB	+/-4 dB
●	●	●	●	10	23	+/-3 dB	+/-4 dB
●	●	●	●	11	21	+/-3 dB	+/-4 dB
●	●	●	●	12	19	+/-3 dB	+/-4 dB
●	●	●	●	13	17	+/-3 dB	+/-4 dB
●	●	●	●	14	15	+/-3 dB	+/-4 dB
●	●	●	●	15	13	+/-3 dB	+/-4 dB
●	●	●	●	16	11	+/-5 dB	+/-6 dB
●	●	●	●	17	9	+/-5 dB	+/-6 dB
●	●	●	●	18	7	+/-5 dB	+/-6 dB
●	●	●	●	19	5	+/-5 dB	+/-6 dB

**) When the power control level corresponds to the power class of the MS, then the tolerances shall be 2.0 dB under normal test conditions and 2.5 dB under extreme test conditions.*

Table 4 - DCS 1800 transmitter output power for different power classes

Power class			Power control level	Transmitter Output power	Tolerances	
1	2	3		dBm	normal	extreme
			29	36	+/-2.0 dB	+/-2.5 dB
		●	30	34	+/-3.0 dB	+/-4.0 dB
		●	31	32	+/-3.0 dB	+/-4.0 dB
●		●	0	30	+/-3.0 dB*)	+/-4 dB*)
●		●	1	28	+/-3 dB	+/-4 dB
●		●	2	26	+/-3 dB	+/-4 dB
●	●	●	3	24	+/-3 dB*)	+/-4 dB*)
●	●	●	4	22	+/-3 dB	+/-4 dB
●	●	●	5	20	+/-3 dB	+/-4 dB
●	●	●	6	18	+/-3 dB	+/-4 dB
●	●	●	7	16	+/-3 dB	+/-4 dB
●	●	●	8	14	+/-3 dB	+/-4 dB
●	●	●	9	12	+/-4 dB	+/-5 dB
●	●	●	10	10	+/-4 dB	+/-5 dB
●	●	●	11	8	+/-4 dB	+/-5 dB
●	●	●	12	6	+/-4 dB	+/-5 dB
●	●	●	13	4	+/-4 dB	+/-5 dB
●	●	●	14	2	+/-5 dB	+/-6 dB
●	●	●	15	0	+/-5 dB	+/-6 dB

**) When the power control level corresponds to the power class of the MS, then the tolerances shall be 2.0 dB under normal test conditions and 2.5 dB under extreme test conditions.*

b) The difference between the transmitter output power at two adjacent power control levels, measured at the same frequency, shall not be less than 0.5 dB and not be more than 3.5 dB.

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

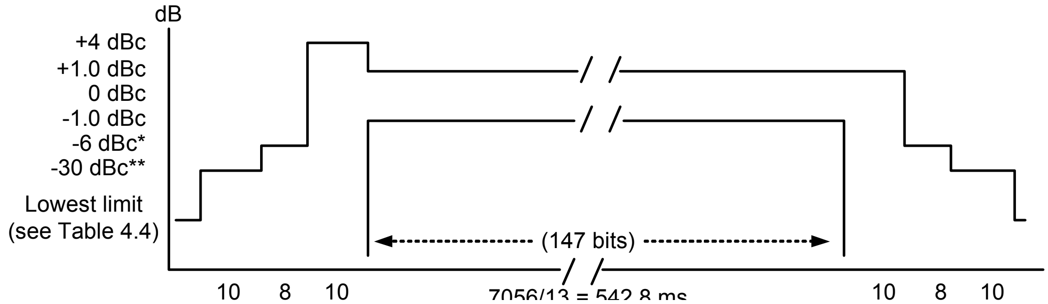

Figure 1 - Power / time template for normal bursts

(1) For GSM 400 and GSM 900 MS:

-4 dBc for power control level 16

-2 dBc for power control level 17

For DCS 1800 MS:

-4 dBc for power control level 11

-2 dBc for power control level 12

-1 dBc for power control levels 13, 14 and 15

(2) For GSM 900 MS: -30 dBc or -17 dBm, whichever is the higher

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

Table 5 - Lowest measurement limit for power/time template

	Lowest limit
GSM 900	-59 dBc or -54 dBm whichever is the highest, except for the timeslot preceding the active slot, for which the allowed level is equal to -59 dBc or –36 dBm, whichever is the highest
DCS 1800	-48 dBc or -48 dBm whichever is the highest

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

e) When the transmitter is commanded to a power control level outside of the capability corresponding to the type and power class of the MS as stated by the manufacturer, then the transmitter output power shall be within the tolerances for the closest power control level corresponding to the type and power class as stated by the manufacturer.1

f) The centre of the transmitted normal burst as defined by the transition of bits 13/14 of the midamble shall be 3 timeslot periods (1731 μs) +/-1 bit period (+/-3.69μs) after the centre of the corresponding received burst.

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

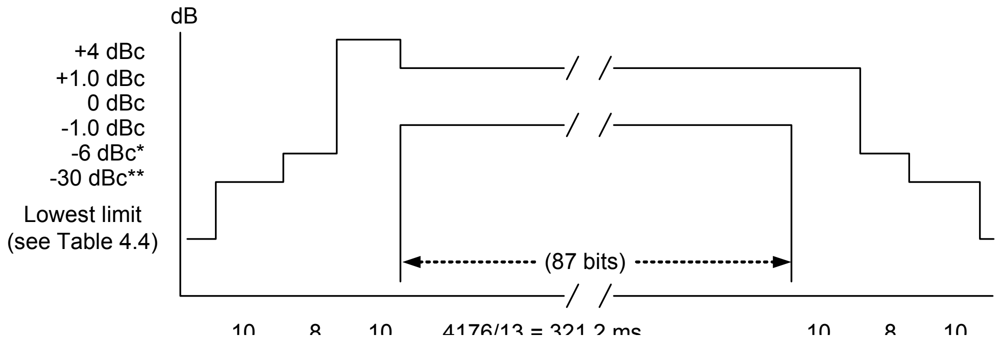

Figure 2 - Power / time template for access burst

(1) For GSM 400 and GSM 900 MS:

-4 dBc for power control level 16

-2 dBc for power control level 17

-1 dBc for power control levels 18 and 19

For DCS 1800 MS:

-4 dBc for power control level 11

-2 dBc for power control level 12

-1 dBc for power control levels 13, 14 and 15

(2) For GSM400 and GSM 900 MS: -30 dBc or -17 dBm, whichever is the higher

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

h) The centre of the transmitted access burst shall be an integer number of timeslot periods less 30 bit periods relative to any CCCH midamble centre with a tolerance of +/- 1 bit period (+/- 3.69μs).

2.2.6 Transmitter - Output RF spectrum

2.2.6.1 Definition and applicability

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

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

2.2.6.2 Conformance requirement

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

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

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

- up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz in the combined range 600 kHz to 6000 kHz above and below the carrier,
- up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz at more than 6 000 kHz offset from the carrier.

- Under normal conditions; GSM 05.05, 4.2.1;
- Under extreme conditions; GSM 05.05, 4.2.1.

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

- Under normal conditions; GSM 05.05, 4.2.2;
- Under extreme conditions; GSM 05.05, 4.2.2.

c) When allocated a channel, the power emitted by the MS, in the band 935 - 960 MHz shall be no more than -79 dBm, in the band 925 - 935 MHz shall be no more than -67 dBm and in the band 1805 -1880 MHz shall be no more than -71 dBm except in five measurements in each of the bands 925 - 960 MHz and 1805 - 1880 MHz where exceptions at up to -36 dBm are permitted. Under normal conditions; GSM 05.05, 4.3.3.

2.2.6.3 Test purpose

a) To verify that the output RF spectrum due to modulation does not exceed conformance requirement 2.2.6.2.a).

- Under normal conditions;
- Under extreme conditions.

b) To verify that the output RF spectrum due to switching transients does not exceed conformance requirement 2.2.6.2.b) when a reasonable margin is allowed for the effect of spectrum due to modulation.

- Under normal conditions;
- Under extreme conditions.

c) To verify that the MS spurious emissions in the MS receive band do not exceed conformance requirement 2.2.6.2.c).

2.2.6.4 Method of test

a) Initial conditions

A call is set up according to the generic call set up procedure.

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

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

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

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

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

b) Procedure

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

(1) In steps (2) to (8) the FT is equal to the hop pattern ARFCN in the Mid ARFCN range.

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

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

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

The MS is commanded to its maximum power control level.

(3) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 50 bursts at all multiples of 30 kHz offset from FT to < 1800 kHz.

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

- On every ARFCN from 1800 kHz offset from the carrier to the edge of the relevant transmit band for each measurement over 50 bursts.
- At 200 kHz intervals over the 2 MHz either side of the relevant transmit band for each measurement over 50 bursts.
- At 200 kHz intervals over the band 925 - 960 MHz for each measurement over 50 bursts.
- At 200 kHz intervals over the band 1805 - 1880 MHz for each measurement over 50 bursts.

(5) The MS is commanded to its minimum power control level. The spectrum analyser is set again as in (2).

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

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

where N = 2, 3, 4, 5, 6, 7, 8; FT = RF channel nominal centre frequency.

(7) The spectrum analyser settings are adjusted to:

- Zero frequency scan

- Resolution bandwidth: 30 kHz
- Video bandwidth: 100 kHz
- Peak hold

The spectrum analyser gating of the signal is switched off.

The MS is commanded to its maximum power control level.

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

FT + 400 kHz	FT - 400 kHz
FT + 600 kHz	FT - 600 kHz
FT + 1.2 MHz	FT - 1.2 MHz
FT + 1.8 MHz	FT - 1.8 MHz

where FT = RF channel nominal centre frequency.

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

(9) Step (8) is repeated for power control levels 7 and 11.

(10) Steps (2), (6), (7) and (8) are repeated with FT equal to the hop pattern ARFCN in the Low ARFCN range except that in step (7) the MS is commanded to power control level 11 rather than maximum power.

(11) Steps (2), (6), (7) and (8) are repeated with FT equal to the hop pattern ARFCN in the High ARFCN range except that in step (7) the MS is commanded to power control level 11 rather than maximum power.

(12) Steps (1), (2), (6), (7) and (8) are repeated under extreme test conditions (annex A, A.2) except that at step (7) the MS is commanded to power control level 11.

2.2.6.5 Test requirements

For absolute measurements, performed on a temporary antenna connector, in the frequency band 880 – 915 MHz or 1710 - 1785 MHz, the temporary antenna connector coupling factor, determined according to 0 and annex A, A.1.3 for the nearest relevant frequency, will be used.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 925 to 960 MHz, the temporary antenna connector coupling factor, will be as determined according to annex A, A.1.3 for GSM 900 MS. For DCS 1800 MS, 0 dB will be assumed.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 1805 - 1880 MHz, the temporary antenna connector coupling factor, will be as determined according to annex A, A.1.3 for DCS 1800 MS. For GSM 900 MS 0 dB will be assumed.

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

a) For the modulation sidebands out to less than 1800 kHz offset from the carrier frequency (FT) measured in step c), f), h), j), k) and l) the measured power level in dB relative to the power level measured at FT, for all types of MS, shall not exceed the limits derived from the values shown in Table 6 for GSM 900 or Table 7 for DCS 1800 according to the actual transmit power and frequency offset from FT. However any failures in the combined range 600 kHz to less than 1800 kHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below.

Table 6 - GSM 900 Spectrum due to modulation out to less than 1800 kHz offset

	Power levels in dB relative to the measurement at FT				
Power level (dBm)	**Frequency offset (kHz)**				
	0-100	200	250	400	600 to <1800
39	+0.5	-30	-33	-60	-66
37	+0.5	-30	-33	-60	-64
35	+0.5	-30	-33	-60	-62
<= 33	+0.5	-30	-33	-60	-60
The values above are subject to the minimum absolute levels (dBm) below.					
	-36	-36	-36	-36	-51

Table 7 - DCS 1800 Spectrum due to modulation out to less than 1800 kHz offset

	Power levels in dB relative to the measurement at FT				
Power level (dBm)	**Frequency offset (kHz)**				
	0-100	200	250	400	600 to <1800
<= 33	+0.5	-30	-33	-60	-60
The values above are subject to the minimum absolute levels (dBm) below.					
	-36	-36	-36	-36	-56

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

b) For the modulation sidebands from 1800 kHz offset from the carrier frequency (FT) and out to 2 MHz beyond the edge of the relevant transmit band, measured in step d), the measured power level in dB relative to the power level measured at FT, shall not exceed the values shown in Table 8 according to the actual transmit power, frequency offset from FT and system on which the MS is designed to operate. However any failures in the combined range 1800 kHz to 6 MHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below, and any other failures may be counted towards the exceptions allowed in test requirements d) below.

Table 8 - Spectrum due to modulation from 1800 kHz offset to the edge of the transmit band (wideband noise)

Power levels in dB relative to the measurement at FT						
GSM 900				DCS 1800		
Power level (dBm)	Frequency offset (kHz)			Power level (dBm)	Frequency offset (kHz)	
	1800 to < 3000	3000 to < 6000	≥ 6000		1800 to < 6000	≥ 6000
39	-69	-71	-77	36	-71	-79
37	-67	-69	-75	34	-69	-77
35	-65	-67	-73	32	-67	-75
≤ 33	-63	-65	-71	30	-65	-73
				28	-63	-71
				26	-61	-69
				≤ 24	-59	-67
The values above are subject to the minimum absolute levels (dBm) below.						
	-46	-46	-46		-51	-51

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

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

e) The MS spurious emissions in the bands 925 - 935 MHz, 935 - 960 MHz and 1805 - 1880 MHz, measured in step d), for all types of MS, shall not exceed the values shown in Table 9 except in up to five measurements in the band 925 - 960 MHz and five measurements in the band 1805 - 1880 MHz where a level up to -36 dBm is permitted.

Table 9 - Spurious emissions in the MS receive bands

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

1805 to 1880	-71

f) For the power ramp sidebands of steps h) and i) the power levels must not exceed the values shown in Table 10 for GSM 900 or Table 11 for DCS 1800.

Table 10 - GSM Spectrum due to switching transients

Power level	**Maximum level for various offsets from carrier Frequency**			
	400 kHz	600 kHz	1200 kHz	1800 kHz
39 dBm	-13 dBm	-21 dBm	-21 dBm	-24 dBm
37 dBm	-15 dBm	-21 dBm	-21 dBm	-24 dBm
35 dBm	-17 dBm	-21 dBm	-21 dBm	-24 dBm
33 dBm	-19 dBm	-21 dBm	-21 dBm	-24 dBm
31 dBm	-21 dBm	-23 dBm	-23 dBm	-26 dBm
29 dBm	-23 dBm	-25 dBm	-25 dBm	-28 dBm
27 dBm	-23 dBm	-26 dBm	-27 dBm	-30 dBm
25 dBm	-23 dBm	-26 dBm	-29 dBm	-32 dBm
23 dBm	-23 dBm	-26 dBm	-31 dBm	-34 dBm
≤ +21 dBm	-23 dBm	-26 dBm	-32 dBm	-36 dBm

Table 11 - DCS 1800 Spectrum due to switching transients

Power level	**Maximum level for various offsets from carrier Frequency**			
	400 kHz	600 kHz	1200 kHz	1800 kHz
36 dBm	-16 dBm	-21 dBm	-21 dBm	-24 dBm
34 dBm	-18 dBm	-21 dBm	-21 dBm	-24 dBm
32 dBm	-20 dBm	-22 dBm	-22 dBm	-25 dBm
30 dBm	-22 dBm	-24 dBm	-24 dBm	-27 dBm
28 dBm	-23 dBm	-25 dBm	-26 dBm	-29 dBm
26 dBm	-23 dBm	-26 dBm	-28 dBm	-31 dBm
24 dBm	-23 dBm	-26 dBm	-30 dBm	-33 dBm
22 dBm	-23 dBm	-26 dBm	-31 dBm	-35 dBm
≤ +20 dBm	-23 dBm	-26 dBm	-32 dBm	-36 dBm

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

Note 3: The figures for Table 10 and Table 11 assume that, using the peak hold measurement, the lowest level measurable is 8 dB above the level of the modulation specification using the 30 kHz bandwidth gated average technique for 400 kHz offset from the carrier. At 600 and 1200 kHz offset the level is 6 dB above and at 1800 kHz offset the level is 3 dB above. The figures for 1800 kHz have assumed the 30 kHz bandwidth spectrum due to modulation specification at < 1800 kHz.

2.2.7 Transmitter output power and burst timing in HSCSD multislot configurations

2.2.7.1 Definition and applicability

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

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

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

2.2.7.2 Conformance requirement

a) The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of +/-2 dB under normal conditions.
b) The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of +/-2.5 dB under extreme conditions.
c) The power control levels shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, third table (for GSM 900) or fourth table (for DCS 1800), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements 1), with a tolerance of +/-3, 4 or 5 dB under normal conditions.
d) The power control levels shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, third table (for GSM 900) or fourth table (for DCS 1800), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements 2), with a tolerance of +/-4, 5 or 6 dB under extreme conditions.
e) The output power actually transmitted by the MS at consecutive power control levels shall form a monotonic sequence and the interval between power control levels shall be 2 +/-1.5 dB; GSM 05.05, 4.1.1.
f) The transmitted power level relative to time for a normal burst shall be within the power/time template given in GSM 05.05, annex B. In multislot configurations where the bursts in two or more consecutive time slots are actually transmitted at the same frequency, the template of annex B, GSM 05.05 shall be respected at the beginning and the end of the series of consecutive bursts. The output power during the guard period between every two consecutive active timeslots shall not exceed the level allowed for the useful part of the first timeslot or the level allowed for the useful part of the second timeslot plus 3 dB, whichever is the highest:
    - Under normal conditions; GSM 05.05, 4.5.2;
    - Under extreme conditions; GSM 05.05, 4.5.2.
g) In multislot configurations, bidirectional subchannels shall be individually power controlled; GSM 05.08, 4.2.
h) When accessing a cell on the RACH and before receiving the first power command during a communication on a DCCH or TCH (after an IMMEDIATE ASSIGNMENT), all GSM and class 1 and class 2 DCS 1800 MS shall use the

power control level defined by the MS_TXPWR_MAX_CCH parameter broadcast on the BCCH of the cell, or if MS_TXPWR_MAX_CCH corresponds to a power control level not supported by the MS as defined by its power class, the MS shall act as though the closest supported power control level had been broadcast. A Class 3 DCS 1800 MS shall use the POWER_OFFSET parameter.

i) The transmissions from the MS to the BS, measured at the MS antenna, shall be 468.75-TA bit periods behind the transmissions received from the BS, where TA is the last timing advance received from the current serving BS. The tolerance on these timings shall be +/-1 bit period:
   - Under normal conditions; GSM 05.10, 6.4;
   - Under extreme conditions; GSM 05.10, 6.4.

k) The transmitted power level relative to time for a random access burst shall be within the power/time template given in GSM 05.05, annex B bottom figure:
   - Under normal conditions; GSM 05.05, 4.5.2;
   - Under extreme conditions; GSM 05.05, 4.5.2.

l) The MS shall use a TA value of 0 for the Random Access burst sent:
   - Under normal conditions; GSM 05.10, 6.6;
   - Under extreme conditions; GSM 05.10, 6.6.

2.2.7.3. Test purpose

a) To verify that the maximum output power of the MS in HSCSD multislot configuration, under normal conditions, is within conformance requirement 2.2.7.2.a).

b) To verify that the maximum output power of the MS in HSCSD multislot configuration, under extreme conditions, is within conformance requirement 2.2.7.2.b).

c) To verify that all power control levels, relevant to the class of MS, are implemented in the MS in HSCSD multislot configuration and have output power levels, under normal conditions, within conformance requirement 2.2.7.2.c).

d) To verify that all power control levels have output power levels, under extreme conditions, within conformance requirement 2.2.7.2.d).

e) To verify that the step in the output power transmitted by the MS in HSCSD multislot configuration at consecutive power control levels is within conformance requirement 2.2.7.2.e) under normal conditions.

f) To verify that the output power relative to time, when sending a normal burst is within conformance requirement 2.2.7.2.f) in HSCSD multislot configuration:
   - Under normal conditions;
   - Under extreme conditions.

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

h) To verify that, for normal bursts, the MS transmissions to the BS are timed within conformance requirement 2.2.7.2.h) in HSCSD multislot configuration:
   - Under normal conditions;
   - Under extreme conditions.

i) To verify that the output power relative to time, when sending an access burst is within conformance requirement 2.2.7.2.i) in HSCSD multislot configuration:
   - Under normal conditions;
   - Under extreme conditions.

k) To verify that, for an access burst, the MS transmission to the BS is timed within conformance requirement 2.2.7.2.k) in HSCSD multislot configuration:
   - Under normal conditions;

- Under extreme conditions.

l) To verify that, power is individually controlled on bidirectional HSCSD subchannels.

2.2.7.4. Methods of test

Two methods of test are described, separately for:

- Equipment fitted with a permanent antenna connector and for.
- Equipment fitted with an integral antenna, and which cannot be connected to an external antenna except by the fitting of a temporary test connector as a test fixture.

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

a) Method of test for equipment with a permanent antenna connector

(1) Initial conditions

A call is set up by the SS according to the generic call set up procedure for HSCSD multislot configuration on a channel with ARFCN in the Mid ARFCN range, power control level set to Max power and MS to operate in its highest number of uplink slots. MS TXPWR_MAX_CCH is set to the maximum value supported by the Power Class of the Mobile under test. For DCS 1800 mobile stations the POWER_OFFSET parameter is set to 6 dB.

(2) Procedure

(2a) Measurement of normal burst transmitter output power

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

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

(2b) Measurement of normal burst timing delay

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

(2c) Measurement of normal burst power/time relationship

The array of power samples measured in a) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in (2a).

(2d) Steps (2a) to (2c) are repeated on each multislot subchannel with the MS commanded to operate on each of the power control levels defined, even those not supported by the MS.

(2e) The SS commands the MS to the maximum power control level supported by the MS and steps (2a) to (2c) are repeated on each multislot subchannel for ARFCN in the Low and High ranges.

(2f) The SS commands the MS to the maximum power control level in the first multislot subchannel allocated and to the minimum power control level in the second multislot subchannel allocated. Any further timeslots allocated are to be set to the maximum power control level. Steps (2a) to (2c) and corresponding measurements on each subchannel are repeated.

(2g) Measurement of access burst transmitter output power

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

The SS takes power measurement samples evenly distributed over the duration of the access burst as described in (2a). However, in this case the SS identifies the centre of the useful bits of the burst by identifying the transition from the last bit of the synch sequence. The centre of the burst is then five data bits prior to this point and is used as the timing reference.

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

(2h) Measurement of access burst timing delay

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

(2i) Measurement of access burst power/time relationship

The array of power samples measured in (2g) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in (2g).

(2j) Depending on the method used in step (2g) to cause the MS to send an Access Burst, the SS sends either a HANDOVER COMMAND with power control level set to 10 or it changes the System Information elements MS_TXPWR_MAX_CCH and for DCS 1800 the POWER_OFFSET on the serving cell BCCH in order to limit the MS transmit power on the Access Burst to power control level 10 (+23 dBm for GSM 900 or +10 dBm for DCS 1800) and then steps (2g) to (2i) are repeated.

(2k) Steps (2a) to (2j) are repeated under extreme test conditions (annex A, A.2.3) except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

b) Method of test for equipment with an integral antenna

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

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

(1) Initial conditions

The MS is placed in the anechoic shielded chamber (annex A, A.1.2) or on the outdoor test site, on an isolated support, in the position for normal use, at a distance of at least 3 metres from a test antenna, connected to the SS.

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

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

(2) Procedure

(2a) With the initial conditions set according to subclause (1) the test procedure in 2.2.7.4.a) is followed up to and including step (2j), except that in step (2a), when measurements are done at maximum power for ARFCN in the Low, Mid and High range, the measurement is made eight times with the MS rotated by n*45 degrees for all values of n in the range 0 to 7.

(2b) The measurements taken are received transmitter output power measurements rather than transmitter output power measurements, the output power measurement values can be derived as follows.

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

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

The frequency of the RF signal generator is set to the frequency of the ARFCN used for the 24 measurements in step (2a), the output power is adjusted to reproduce the received transmitter output power averages recorded in step (2a).

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

For each channel number used compute:

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

from which: Pac (Tx dBm) = $10\log_{10}$(Pac) + 30 + 2.15

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

(2c) Temporary antenna connector calibration factors (transmit)

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

Under normal test conditions, the power measurement and calculation parts of steps (2a) to (2j) of 2.2.7.4.a) are repeated except that the repeats at step (2d) are only performed for power control level 10 and the minimum power control level of the MS.

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

(2d) Measurements at extreme test conditions.

Note: Basically the procedure for extreme conditions is:

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

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

Under extreme test conditions steps (2a) to (2j) of 4.2.7.4.a) are repeated except that the repeats at step (2d) are only performed for power control level 10 and the minimum power control level of the MS.

The transmitter output power under extreme test conditions is calculated for each burst type, power control level and for every frequency used by adding the frequency dependent calibration factor, determined in (2c), to the values obtained at extreme conditions in this step.

2.2.7.5 Test requirements

a) The transmitter output power on each subchannel, under every combination of normal and extreme test conditions, for normal bursts and access bursts, at each frequency and for each power control level applicable to the MS power class, shall be at the relevant level shown in Table 4 or Table 3 within the tolerances also shown in Table 4 or Table 3.

b) The difference between the transmitter output power at two adjacent power control levels, measured at the same frequency, shall not be less than 0.5 dB and not be more than 3.5 dB.

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

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

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

f) The centre of the transmitted normal burst as defined by the transition of bits 13/14 of the midamble shall be 3 imeslot periods (1731 μs) +/-1 bit period (+/-3.69 μs) after the centre of the corresponding received burst.

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

h) The centre of the transmitted access burst shall be an integer number of timeslot periods less 30 bit periods relative to any CCCH midamble centre with a tolerance of +/-1 bit period (+/-3.69 μs).

2.2.8 Transmitter - Output RF spectrum in HSCSD multislot configuration

2.2.8.1 Definition and applicability

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

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

2.2.8.2 Conformance requirement

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

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

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

- up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz in the combined range 600 kHz to 6000 kHz above and below the carrier,
- up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz at more than 6000 kHz offset from the carrier.
  - Under normal conditions; GSM 05.05, 4.2.1;
  - Under extreme conditions; GSM 05.05, 4.2.1.

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

- Under normal conditions; GSM 05.05, 4.2.2;
- Under extreme conditions; GSM 05.05, 4.2.2.

c) When allocated a channel, the power emitted by the MS, in the band 935 - 960 MHz shall be no more than -79 dBm, in the band 925 - 935 MHz shall be no more than -67 dBm and in the band 1805 - 1880 MHz shall be no more than -71 dBm except in five measurements in each of the bands 925 - 960 MHz and 1805 - 1880 MHz where exceptions at up to -36 dBm are permitted. Under normal conditions; GSM 05.05, 4.3.3.

2.2.8.3 Test purpose

a) To verify that the output RF spectrum due to modulation does not exceed conformance requirement 2.2.8.2.a) in the multislot configurations.

- Under normal conditions;
- Under extreme conditions.

b) To verify that the output RF spectrum due to switching transients does not exceed conformance requirement 2.2.8.2.b) in the multislot configurations when a reasonable margin is allowed for the effect of spectrum due to modulation.

- Under normal conditions;
- Under extreme conditions.

c) To verify that the MS spurious emissions in the MS receive band do not exceed conformance requirement 2.2.8.2.c) in the multislot configurations.

2.2.8.4 Method of test

a) Conditions

A call is set up according to the generic call set up procedure for multislot HSCSD.

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

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

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

The SS sends Standard Test Signal C1 (annex A, A.6) to the MS at a level of 23 dBμVemf().

The SS sets the MS to operate in a multislot configuration where is maximum number of transmitting timeslots.

Maximum power level is set in all channels.

b) Procedure

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

(1) In steps (2) to (8) the FT is equal to the hop pattern ARFCN in the Mid ARFCN range.

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

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

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

(3) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 50 bursts at all multiples of 30 kHz offset from FT to <1800 kHz.

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

- On every ARFCN from 1800 kHz offset from the carrier to the edge of the relevant transmit band for each measurement over 50 bursts.
- At 200 kHz intervals over the 2 MHz either side of the relevant transmit band for each measurement over 50 bursts.
- At 200 kHz intervals over the band 925 - 960 MHz for each measurement over 50 bursts.
- At 200 kHz intervals over the band 1805 - 1880 MHz for each measurement over 50 bursts.

(5) The MS is commanded to its minimum power control level. The spectrum analyser is set again as in (2).

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

FT

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

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

And FT = RF channel nominal centre frequency.

(7) Steps (1) to (6) is repeated except that in step (1) the spectrum analyzer is gated so that the burst of the next active time slot is measured.

(8) The spectrum analyser settings are adjusted to:

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

The spectrum analyser gating of the signal is switched off.

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

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

FT + 400 kHz	FT - 400 kHz
FT + 600 kHz	FT - 600 kHz
FT + 1.2 MHz	FT - 1.2 MHz
FT + 1.8 MHz	FT - 1.8 MHz

where FT = RF channel nominal centre frequency.

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

(10) Step (9) is repeated for power control levels 7 and 11.

(11) Steps (2), (6), (8) and (9) are repeated with FT equal to the hop pattern ARFCN in the Low ARFCN range except that in step (8) the MS is commanded to power control level 11 rather than maximum power.

(12) Steps (2), (6), (8) and (9) are repeated with FT equal to the hop pattern ARFCN in the High ARFCN range except that in step (8) the MS is commanded to power control level 11 rather than maximum power.

(13) Steps (1) (2) (6) (8), and (9) are repeated under extreme test conditions (annex A, A.2) except that at step (8) the MS is commanded to power control level 11.

2.2.8.5. Test requirements

For absolute measurements, performed on a temporary antenna connector, in the frequency band 880 - 915 MHz or 1710 - 1785 MHz, the temporary antenna connector coupling factor, determined according to annex A, A.1.3, for the nearest relevant frequency, will be used.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 925 - 960 MHz, the temporary antenna connector coupling factor, will be as determined according to annex A, A.1.3 for GSM 900 MS. For a DCS 1800 MS 0 dB will be assumed.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 1805 - 1880 MHz, the temporary antenna connector coupling factor, will be as determined according to annex A, A.1.3 for DCS 1800 MS. For GSM 900 MS 0 dB will be assumed.

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

a) For the modulation sidebands out to less than 1800 kHz offset from the carrier frequency (FT) measured in step c), f), i), k), l) and m) the measured power level in dB relative to the power level measured at FT, for all types of MS, shall not exceed the limits derived from the values shown in Table 6 for GSM 900 or Table 7 for DCS 1800 according to the actual transmit power and frequency offset from FT. However any failures in the combined range 600 kHz to less than 1800 kHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below.

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

b) For the modulation sidebands from 1800 kHz offset from the carrier frequency (FT) and out to 2 MHz beyond the edge of the relevant transmit band, measured in step d), the measured power level in dB relative to the power level measured at FT, shall not exceed the values shown in Table 8 according to the actual transmit power, frequency offset from FT and system on which the MS is designed to operate. However any failures in the combined range 1800 kHz to 6 MHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below, and any other failures may be counted towards the exceptions allowed in test requirements d) below.

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

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

e) The MS spurious emissions in the bands 925 - 935 MHz, 935 - 960 MHz and 1805 - 1880 MHz, measured in step d), for all types of MS, shall not exceed the values shown in Table 9 except in up to five measurements in the band 925 - 960 MHz and five measurements in the band 1805 - 1880 MHz where a level up to -36 dBm is permitted.

f) For the power ramp sidebands of steps h), i) and k) the power levels must not exceed the values shown in Table 10 for GSM 900 Table 11 for DCS 1800.

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

Note 3: The figures for Table 10 and Table 11 assume that, using the peak hold measurement, the lowest level measurable is 8 dB above the level of the modulation specification using the 30 kHz bandwidth gated average technique for 400 kHz offset from the carrier. At 600 kHz and 1200 kHz offset the level is 6 dB above and at 1800 kHz offset the level is 3 dB above. The figures for 1800 kHz have assumed the 30 kHz bandwidth spectrum due to modulation specification at <1800 kHz.

2.2.9. Transmitter output power in GPRS multislot configuration

2.2.9.1. Definition and applicability

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

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

2.2.9.2. Conformance requirement

a) The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of +/-2 dB under normal conditions.
b) The MS maximum output power shall be as defined in GSM 05.05, 4.1.1, first table, according to its power class, with a tolerance of +/-2.5 dB under extreme conditions.
c) The power control levels shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, third table (for GSM 900) or fourth table (for DCS 1800), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements a), with a tolerance of +/-3, 4 or 5 dB under normal conditions.
d) The power control levels shall have the nominal output power levels as defined in GSM 05.05, 4.1.1, third table (for GSM 900) or fourth table (for DCS 1800), from the lowest power control level up to the maximum output power corresponding to the class of the MS (for tolerance on maximum output power see conformance requirements b), with a tolerance of +/-4.5 or 6 dB under extreme conditions.
e) The output power actually transmitted by the MS at consecutive power control levels shall form a monotonic sequence and the interval between power control levels shall be 2 +/-1.5 dB.
f) The transmitted power level relative to time for a normal burst shall be within the power/time template given in GSM 05.05, annex B top figure. In multislot configurations where the bursts in two or more consecutive time slots are actually transmitted at the same frequency the template of annex B shall respected during the useful part of each burst and at the beginning and the end of the series of consecutive bursts. The output power during the guard period between every two consecutive active timeslots shall not exceed the level allowed for the useful part of the first timeslot or the level allowed for the useful part of the second timeslot plus 3 dB, whichever is the highest:
    - Under normal conditions; GSM 05.05, 4.5.2;
    - Under extreme conditions; GSM 05.05, 4.5.2.
g) When accessing a cell on the PRACH or RACH and before receiving the first power control parameters during packet transfer on PDCH, all GSM and class 1

and class 2 DCS 1800 MS shall use the power control level defined by the GPRS_MS_TXPWR_MAX_CCH parameter broadcast on the PBCCH or MS_TXPWR_MAX_CCH parameter broadcast on the BCCH of the cell. When MS_TXPWR_MAX_CCH is received on the BCCH, a class 3 DCS 1800 MS shall add to it the value POWER_OFFSET broadcast on the BCCH. If MS_TXPWR_MAX_CCH or the sum defined by: MS_TXPWR_MAX_CCH plus POWER_OFFSET corresponds to a power control level not supported by the MS as defined by its power class, the MS shall act as though the closest supported power control level had been broadcast.

h) The transmitted power level relative to time for a Random Access burst shall be within the power/time template given in GSM 05.05, annex B bottom figure:
   - Under normal conditions; GSM 05.05, 4.5.2;
   - Under extreme conditions; GSM 05.05, 4.5.2.

2.2.9.3. Test purpose

a) To verify that the maximum output power of the MS in GPRS multislot configuration, under normal conditions, is within conformance requirement 2.2.9.2.a).
b) To verify that the maximum output power of the MS in GPRS multislot configuration, under extreme conditions, is within conformance requirement 2.2.9.2.b).
c) To verify that all power control levels, relevant to the class of MS, are implemented in the MS in GPRS multislot configuration and have output power levels, under normal conditions, within conformance requirement 2.2.9.2.c).
d) To verify that all power control levels have output power levels, under extreme conditions, within conformance requirement 2.2.9.2.d).
e) To verify that the step in the output power transmitted by the MS in GPRS multislot configuration at consecutive power control levels is within conformance requirement 2.2.9.2.e) under normal conditions.
f) To verify that the output power relative to time, when sending a normal burst is within conformance requirement 2.2.9.2.f) in GPRS multislot configuration;
   - Under normal conditions;
   - Under extreme conditions.
g) To verify that the MS in GPRS multislot configuration uses the maximum power control level according to its power class if commanded to a power control level exceeding its power class.
h) To verify that the output power relative to time, when sending an access burst is within conformance requirement 2.2.9.2.h) in GPRS multislot configuration:
   - Under normal conditions;
   - Under extreme conditions.

2.2.9.4. Methods of test

Two methods of test are described, separately for:

- Equipment fitted with a permanent antenna connector and for
- Equipment fitted with an integral antenna, and which cannot be connected to an external antenna except by the fitting of a temporary test connector as a test fixture.

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

a) Method of test for equipment with a permanent antenna connector

(1) Initial conditions

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

(2) Procedure

(2a) Measurement of normal burst transmitter output power

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

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

(2b) Measurement of normal burst power/time relationship

The array of power samples measured in (2a) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in (2a).

(2c) Steps (2a) to (2b) are repeated on each timeslot within the multislot configuration with the MS commanded to operate on each of the power control levels defined, even those not supported by the MS.

(2d) The SS commands the MS to the maximum power control level supported by the MS and steps (2a) to (2b) are repeated on each timeslot within the multislot configuration for ARFCN in the Low and High ranges.

(2e) The SS commands the MS to the maximum power control level in the first timeslot allocated within the multislot configuration and to the minimum power control level in the second timeslot allocated. Any further timeslots allocated are to be set to the maximum power control level. Steps (2a) to (2b) and corresponding measurements on each timeslot within the multislot configuration are repeated.

(2f) Measurement of access burst transmitter output power

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

The SS takes power measurement samples evenly distributed over the duration of the access burst as described in (2a). However, in this case the SS identifies the centre of the useful bits of the burst by identifying the transition from the last bit of the synch sequence. The centre of the burst is then five data bits prior to this point and is used as the timing reference.

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

(2g) Measurement of access burst power/time relationship

The array of power samples measured in (2f) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in (2f).

(2h) Depending on the method used in step (2f) to cause the MS to send an Access Burst, the SS sends either a PACKET CELL CHANGE ORDER along with power control level set to 10 in PSI3 parameter GPRS_MS_TXPWR_MAX_CCH or it changes the (Packet) System Information elements (GPRS_) MS_TXPWR_ MAX_CCH and for DCS 1800 the POWER_OFFSET on the serving cell PBCCH/BCCH in order to limit the MS transmit power on the Access Burst to power control level 10 (+23 dBm for GSM 900 or +10 dBm for DCS 1800) and then steps (2f) to (2g) are repeated.

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

b) Method of test for equipment with an integral antenna

Note: If the MS is equipped with a permanent connector, such that the antenna can be disconnected and the SS be connected directly, then the method of clause 4.2.9.4.a) will be applied.

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

(1) Initial conditions

The MS is placed in the anechoic shielded chamber (annex A, A.1.2) or on the outdoor test site, on an isolated support, in the position for normal use, at a distance of at least 3 metres from a test antenna, connected to the SS.

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

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

(2) Procedure

(2a) With the initial conditions set according to subclause 0 the test procedure in 0 is followed up to and including step (2h), except that in step (2a), when measurements are done at maximum power for ARFCN in the Low, Mid and High range, the measurement is made eight times with the MS rotated by n*45 degrees for all values of n in the range 0 to 7.

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

(2b) Assessment of test site loss for scaling of received output power measurements.

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

The frequency of the RF signal generator is set to the frequency of the ARFCN used for the 24 measurements in step (2a), the output power is adjusted to reproduce the received transmitter output power averages recorded in step (2a).

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

For each channel number used compute:

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

from which: Pac (Tx dBm) = $10\log_{10}(\text{Pac}) + 30 + 2.15$

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

(2c) Temporary antenna connector calibration factors (transmit)

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

Under normal test conditions, the power measurement and calculation parts of steps (2a) to (2j) of 0 are repeated except that the repeats at step (2d) are only performed for power control level 10 and the minimum power control level of the MS.

Note: The values noted here are related to the output transmitter carrier power levels under normal test conditions, which are known after step (2b). Therefore frequency dependent calibration factors that account for the effects of the temporary antenna connector can be determined.

(2d) Measurements at extreme test conditions.

Note: Basically the procedure for extreme conditions is:

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

Under extreme test conditions steps (2a) to (2h) of 0 are repeated except that the repeats at step (2d) are only performed for power control level 10 and the minimum power control level of the MS.

The transmitter output power under extreme test conditions is calculated for each burst type, power control level and for every frequency used by adding the frequency dependent calibration factor, determined in (2c), to the values obtained at extreme conditions in this step.

2.2.9.5 Test requirements

a) The transmitter output power, under every combination of normal and extreme test conditions, for normal bursts nd access bursts, at each frequency and for each power control level applicable to the MS power class, shall be t the relevant level shown in Table 3 or Table 4 within the tolerances also shown in Table 3 or Table 4.

b) The difference between the transmitter output power at two adjacent power control levels, measured at the same frequency, shall not be less than 0.5 dB and not be more than 3.5 dB.

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

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

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

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

2.2.10. Output RF spectrum in GPRS multislot configuration

2.2.10.1. Definition and applicability

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

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

2.2.10.2. Conformance requirement

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

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

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

- up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz in the combined range 600 kHz to 6000 kHz above and below the carrier,

- up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz at more than 6000 kHz offset from the carrier.
    - Under normal conditions; GSM 05.05, 4.2.1;
    - Under extreme conditions; GSM 05.05, 4.2.1.

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

- Under normal conditions; GSM 05.05, 4.2.2;
- Under extreme conditions; GSM 05.05, 4.2.2.

c) When allocated a channel, the power emitted by the MS, in the band 935 - 960 MHz shall be no more than -79 dBm, in the band 925 - 935 MHz shall be no more than -67 dBm and in the band 1805 - 1880 MHz shall be no more than -71 dBm except in five measurements in each of the bands 925 - 960 MHz and 1805 -1880 MHz where exceptions at up to -36 dBm are permitted. Under normal conditions; GSM 05.05, 4.3.3.

2.2.10.3 Test purpose

a) To verify that the output RF spectrum due to modulation does not exceed conformance requirement 2.2.10.2.a) in the GPRS multislot configurations.

- Under normal conditions;
- Under extreme conditions.

b) To verify that the output RF spectrum due to switching transients does not exceed conformance requirement 2.2.10.2.b) in the GPRS multislot configurations when a reasonable margin is allowed for the effect of spectrum due to modulation.

- Under normal conditions;
- Under extreme conditions.

c) To verify that the MS spurious emissions in the MS receive band do not exceed conformance requirement 2.2.10.2.c) in the GPRS multislot configurations.

2.2.10.4. Method of test

a) Initial conditions

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

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

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

The SS sends Standard Test Signal C1 (annex A, A.6) to the MS at a level of 23 dBμVemf().

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

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

b) Procedure

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

(1) In steps (2) to (8) the FT is equal to the hop pattern ARFCN in the Mid ARFCN range.

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

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

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

(3) By tuning the spectrum analyser centre frequency to the measurement frequencies the power level is measured over 50 bursts at all multiples of 30 kHz offset from FT to <1800 kHz.

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

- On every ARFCN from 1800 kHz offset from the carrier to the edge of the relevant transmit band for each measurement over 50 bursts.
- At 200 kHz intervals over the 2 MHz either side of the relevant transmit band for each measurement over 50 bursts.
- At 200 kHz intervals over the band 925 - 960 MHz for each measurement over 50 bursts.
- At 200 kHz intervals over the band 1805 - 1880 MHz for each measurement over 50 bursts.

(5) The MS is commanded to its minimum power control level. The spectrum analyser is set again as in (2).

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

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

where N = 2, 3, 4, 5, 6, 7, 8 and FT = RF channel nominal centre frequency.

(7) Steps (1) to (6) is repeated except that in step a) the spectrum analyzer is gated so that the burst of the next active time slot is measured.

(8) The spectrum analyser settings are adjusted to:

- Zero frequency scan

- Resolution bandwidth: 30 kHz
- Video bandwidth: 100 kHz
- Peak hold

The spectrum analyser gating of the signal is switched off.

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

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

FT + 400 kHz	FT - 400 kHz
FT + 600 kHz	FT - 600 kHz
FT + 1.2 MHz	FT - 1.2 MHz
FT + 1.8 MHz	FT - 1.8 MHz

where FT = RF channel nominal centre frequency.

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

(10) Step (9) is repeated for power control levels 7 and 11.

(11) Steps (2), (6), (8) and (9) are repeated with FT equal to the hop pattern ARFCN in the Low ARFCN range except that in step (8) the MS is commanded to power control level 11 rather than maximum power.

(12) Steps (2), (6), (8) and (9) are repeated with FT equal to the hop pattern ARFCN in the High ARFCN range except that in step (8) the MS is commanded to power control level 11 rather than maximum power.

(13) Steps (1), (2), (6), (8), and (9) are repeated under extreme test conditions (annex A, A.2.3) except that at step (8) the MS is commanded to power control level 11.

2.2.10.5 Test requirements

For absolute measurements, performed on a temporary antenna connector, in the frequency band 880 - 915 MHz or 1710 - 1785 MHz, the temporary antenna connector coupling factor, determined according to 2.2.7.4.b) and annex A, A.1.3 for the nearest relevant frequency, will be used.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 925 - 960 MHz, the temporary antenna connector coupling factor, will be as determined according to annex A, A.1.3 for GSM 900 MS. For a DCS 1800 MS 0 dB will be assumed.

For absolute measurements, performed on a temporary antenna connector, in the frequency band 1805 - 1880 MHz, the temporary antenna connector coupling factor, will be as determined according to annex A, A.1.3 for DCS 1800 MS. For a GSM 900 MS 0 dB will be assumed.

The figures in the tables from 6 through 11, at the listed frequencies from the carrier (kHz), are the maximum level (dB) relative to a measurement in 30 kHz bandwidth on the carrier (reference GSM 05.05 clause 4.2.1).

a) For the modulation sidebands out to less than 1800 kHz offset from the carrier frequency (FT) measured in step c), f), i), k), l) and m) the measured power level in dB relative to the power level measured at FT, for all types of MS, shall not exceed the limits derived from the values shown in Table 6 for GSM 900 or Table 7 for DCS 1800 according to the actual transmit power and frequency offset from FT. However any failures in the combined range 600 kHz to less than 1800 kHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below.

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

b) For the modulation sidebands from 1800 kHz offset from the carrier frequency (FT) and out to 2 MHz beyond the edge of the relevant transmit band, measured in step d), the measured power level in dB relative to the power level measured at FT, shall not exceed the values shown in Table 8 according to the actual transmit power, frequency offset from FT and system on which the MS is designed to operate. However any failures in the combined range 1800 kHz to 6 MHz above and below the carrier may be counted towards the exceptions allowed in test requirements c) below, and any other failures may be counted towards the exceptions allowed in test requirements d) below.

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

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

e) The MS spurious emissions in the bands 925 - 935 MHz, 935 - 960 MHz and 1805 - 1880 MHz, measured in step d), for all types of MS, shall not exceed the values shown in Table 9 except in up to five measurements in the band 925 to 960 MHz and five measurements in the band 1805 to 1880 MHz where a level up to -36 dBm is permitted.

f) For the power ramp sidebands of steps h), i) and k) the power levels must not exceed the values shown in Table 10 for GSM 900 or Table 11 for DCS 1800.

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

Note 3: The figures for Table 10 and Table 11 assume that, using the peak hold measurement, the lowest level measurable is 8 dB above the level of the modulation specification using the 30 kHz bandwidth gated average technique for 400 kHz offset from the carrier. At 600 and 1200 kHz offset the level is 6 dB above and at 1800 kHz offset the level is 3 dB above. The figures for 1800 kHz have assumed the 30 kHz bandwidth spectrum due to modulation specification at <1800 kHz.

2.2.11. Conducted spurious emissions - MS allocated a channel

2.2.11.1 Definition and applicability

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

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

2.2.11.2 Conformance requirement

The conducted spurious power emitted by the MS, when allocated a channel, shall be no more than the levels in Table 12.

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

Table 12

Frequency range	Power level in dBm	
	GSM 900	**DCS 1800**
9 kHz to 1 GHz	-36	-36
1 GHz to 12.75 GHz	-30	
1 GHz to 1710 MHz		-30
1710 MHz to 1785 MHz		-36
1785 MHz to 12.75 GHz		-30

2.2.11.3 Test purpose

To verify that conducted spurious emissions, in the frequency band 100 kHz to 12.75 GHz excluding the GSM 900 and DCS 1800 receive bands, from the MS when allocated a channel do not exceed the conformance requirements.

- Under normal voltage conditions;
- Under extreme voltage conditions.

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

2.2.11.4 Method of test

a) Initial conditions

A call is set up by the SS according to the generic call set up procedure on a channel in the Mid ARFCN range.

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

The SS sends Standard Test Signal C1.

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

b) Procedure

(1) Measurements are made in the frequency range 100 kHz to 12.75 GHz. Spurious emissions are measured at the connector of the transceiver, as the power level of

any discrete signal, higher than the requirement in Table 12 minus 6 dB, delivered into a 50 Ohm load.

The measurement bandwidth based on a 5 pole synchronously tuned filter is according to table Table 13. The power indication is the peak power detected by the measuring system.

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

Note: The present documentsures that both the active times (MS transmitting) and the quiet times are measured.

(2) The test is repeated under extreme voltage test conditions (Annex A, A.2).

Table 13

Frequency range	**Frequency offset**	**Filter bandwidth**	**Approx video bandwidth**
100 kHz to 50 MHz	-	10 kHz	30 kHz
50 to 500 MHz	-	100 kHz	300 kHz
500 MHz to 12.75 GHz, excl. relevant TX band: P-GSM: 890 to 915 MHz; DCS: 1710 to 1785 MHz, and the RX bands: 935 to 960 MHz; 1805 to 1880 MHz.	0 to 10 MHz ≥ 10 MHz ≥ 20 MHz ≥ 30 MHz (offset from edge of relevant TX band)	100 kHz 300 kHz 1 MHz 3 MHz	300 kHz 1 MHz 3 MHz 3 MHz
Relevant TX band: P-GSM: 890 to 915 MHz DCS: 1710 to 1785 MHz	1.8 to 6.0 MHz > 6.0 MHz (offset from carrier)	30 kHz 100 kHz	100 kHz 300 kHz

Note 1: The frequency ranges 935 MHz to 960 MHz and 1805 MHz to 1880 MHz are excluded as these ranges are tested in clause 2.2.6.

Note 2: The filter and video bandwidths, and frequency offsets are only correct for measurements on an MS transmitting on a channel in the Mid ARFCN range.

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

2.2.11.5 Test requirement

The power of any spurious emission shall not exceed the levels given in Table 14.

Table 14

Frequency range	**Power level in dBm**	
	GSM 900	DCS 1800
100 kHz to 1 GHz	-36	-36
1 GHz to 12.75 GHz	-30	

1 GHz to 1710 MHz		-30
1710 MHz to 1785 MHz		-36
1785 MHz to 12.75 GHz		-30

2.2.12 Conducted spurious emissions - MS in idle mode

2.2.12.1 Definition and applicability

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

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

2.2.12.2 Conformance requirement

The conducted spurious power emitted by the MS, when in idle mode, shall be no more than the levels in Table 15.

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

Table 15

Frequency range	Power level in dBm
9 kHz to 880 MHz	-57
880 MHz to 915 MHz	-59
915 MHz to 1000 MHz	-57
1 GHz to 1710 MHz	-47
1710 MHz to 1785 MHz	-53
1785 MHz to 12.75 GHz	-47

2.2.12.3 Test purpose

To verify that conducted spurious emissions, in the frequency band 100 kHz to 12.75 GHz from the MS when in idle mode do not exceed the conformance requirements.

- Under normal voltage conditions;
- Under extreme voltage conditions.

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

2.2.12.4 Method of test

a) Initial conditions

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

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

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

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

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

b) Procedure

(1) Measurements are made in the frequency range 100 kHz to 12.75 GHz. Spurious emissions are measured as the power level of any discrete signal, higher than the requirement in Table 15 minus 6 dB, delivered into a 50 Ohm load.

The measurement bandwidth based on a 5 pole synchronously tuned filter is set according to Table 16. The power indication is the peak power detected by the measuring system.

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

Table 16

Frequency range	Filter bandwidth	Video bandwidth
100 kHz to 50 MHz	10 kHz	30 kHz
50 MHz to 12.75 GHz	100 kHz	300 kHz

(2) The test is repeated under extreme voltage test conditions (AnnexA, A.2).

2.2.12.5 Test requirement

The power of any spurious emission shall not exceed the levels given in Table 17.

Table 17

Frequency range	Power level in dBm
100 kHz to 880 MHz	-57
880 MHz to 915 MHz	-59
915 MHz to 1000 MHz	-57
1 GHz to 1710 MHz	-47
1710 MHz to 1785 MHz	-53
1785 MHz to 12.75 GHz	-47

2.2.13. Radiated spurious emissions - MS allocated a channel

2.2.13.1. Definition and applicability

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

This is also known as "cabinet radiation".

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

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

2.2.13.2 Conformance requirement

a) The radiated spurious power emitted by the MS, when allocated a channel, shall be no more than the levels in Table 18 under normal voltage conditions; GSM 05.05, 4.3/4.3.3.

b) The radiated spurious power emitted by the MS, when allocated a channel, shall be no more than the levels in Table 18 under extreme voltage conditions; GSM 05.05, 4.3/4.3.3.

Table 18

Frequency range	Power level in dBm	
	GSM 900	DCS 1800
100 kHz to 1 GHz	-36	-36
1 GHz to 12.75 GHz	-30	
1 GHz to 1710 MHz		-30
1710 MHz to 1785 MHz		-36
1785 MHz to 12.75 GHz		-30

2.2.13.3 Test purpose

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

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

2.2.13.4 Method of test

a) Initial conditions

A call is set up by the SS according to the generic call set up procedure on a channel in the Mid ARFCN range.

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

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

The SS sends Standard Test Signal C1.

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

b) Procedure

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

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

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

(3) The measurement bandwidth, based on a 5 pole synchronously tuned filter, is set according to Table 19. The power indication is the peak power detected by the measuring system.

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

Note 1: The present document sures that both the active times (MS transmitting) and the quiet times are measured.

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

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

The test is repeated under extreme voltage test conditions (see Annex A, A.2).

Table 19

Frequency range	Frequency offset	Filter bandwidth	Approx video bandwidth
30 to 50 MHz	-	10 kHz	30 kHz
50 to 500 MHz	-	100 kHz	300 kHz
500 MHz to 4 GHz, excl. relevant TX band: P-GSM: 890 to 915 MHz; DCS: 1710 to 1785 MHz.	0 to 10 MHz >= 10 MHz >= 20 MHz >= 30 MHz (offset from edge of relevant TX band)	100 kHz 300 kHz 1 MHz 3 MHz	300 kHz 1 MHz 3 MHz 3 MHz
Relevant TX band: P-GSM: 890 to 915 MHz DCS: 1710 to 1785 MHz	1.8 to 6.0 MHz > 6.0 MHz (offset from carrier)	30kHz 100 kHz	100 kHz 300 kHz

Note 1: The filter and video bandwidths, and frequency offsets are only correct for measurements on an MS transmitting on a channel in the Mid ARFCN range.

Note 2: Due to practical implementation of a SS, the video bandwidth is restricted to a maximum of 3 MHz.

2.2.13.5. Test requirement

The power of any spurious emission shall not exceed the levels given in Table 18.

2.2.14. Radiated spurious emissions - MS in idle mode

2.2.14.1. Definition and applicability

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

This is also known as "cabinet radiation".

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

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

2.2.14.2 Conformance requirement

a) The radiated spurious power emitted by the MS, when in idle mode, shall be no more than the levels in Table 20. Under normal voltage conditions; GSM 05.05, 4.3/4.3.3.

b) The radiated spurious power emitted by the MS, when in idle mode, shall be no more than the levels in Table 20. under extreme voltage conditions; GSM 05.05, 4.3/4.3.3.

Table 20

Frequency range	Power level in dBm
30 kHz to 880 MHz	-57
880 MHz to 915 MHz	-59
915 MHz to 1000 MHz	-57
1 GHz to 1710 MHz	-47
1710 MHz to 1785 MHz	-53
1785 MHz to 12.75 GHz	-47

2.2.14.3 Test purpose

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

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

2.2.14.4 Method of test

a) Initial conditions

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

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

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

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

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

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

b) Procedure

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

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

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

(3) The measurement bandwidth based on a 5 pole synchronously tuned filter shall be according to Table 21. The power indication is the peak power detected by the measuring system.

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

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

Table 21

Frequency range	Filter bandwidth	Video bandwidth
30 kHz to 50 MHz	10 kHz	30 kHz
50 MHz to 12.75 GHz	100 kHz	300 kHz

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

(5) The test is repeated under extreme voltage test conditions.

2.2.14.5 Test requirement

The power of any spurious emission shall not exceed the levels given in Table 20.

2.2.15 Receiver Blocking and spurious response - speech channels

2.2.15.1 Definition and applicability

Blocking is a measure of the ability of the receiver to receive a modulated wanted input signal in the presence of an unwanted input signal, on frequencies other than those of the spurious responses or the adjacent channels, without exceeding a given degradation.

The requirements and this test apply to MS supporting speech.

2.2.15.2 Conformance requirement

The blocking characteristics of the receiver are specified separately for in-band and out-of-band performance as identified in GSM 05.05 clause 5.1.

The reference sensitivity performance as specified in table 1 of GSM 05.05 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 as specified in GSM 05.05 clause 6.2;
- A continuous, static sine wave signal at a level as in the table of GSM 05.05 clause 5.1 and at a frequency (f) which is an integer multiple of 200 kHz.

With the following exceptions, called spurious response frequencies:

- GSM 900: in band, for a maximum of six occurrences (which if grouped shall not exceed three contiguous occurrences per group);
  DCS 1800: in band, for a maximum of twelve occurrences (which if grouped shall not exceed three contiguous occurrences per group);
- Out of band, for a maximum of 24 occurrences (which if below f_0 and grouped shall not exceed three contiguous occurrences per group).
  Where the above performance shall be met when the continuous sine wave signal (f) is set to a level of 70 dBμV (emf) (i.e. -43 dBm). GSM 05.05, 5.1.

2.2.15.3 Test purpose

a) To verify that the in band blocking performance is met without exceeding the total number of allowed in band spurious responses. An allowance is made for the statistical significance of the test.

b) To verify that at selected out of band frequencies, the out of band blocking performance is met without exceeding the total number of allowed out of band spurious responses. An allowance is made for the statistical significance of the test.

Note: Not all of the possible out of band frequencies are tested as this results in excessive test time. However, the total number of out of band spurious responses, specified in GSM 05.05, are allowed to ensure a fair test of the MS.

2.2.15.4 Method of test

a) Initial conditions

A call is set up according to the generic call set up procedure, except the BCCH frequency list shall be empty, on a TCH with an arbitrary ARFCN in the range supported by the MS. The power control level is set to maximum power.

The SS transmits Standard Test Signal C1 on the traffic channel.

The SS commands the MS to create traffic channel loop back signalling erased frames.

b) Procedure

(1) The SS produces a static wanted signal and a static interfering signal at the same time. The amplitude of the wanted signal is set to 4 dB above the reference sensitivity level.

(2) The unwanted signal is a C.W. signal (Standard test signal IO) of frequency FB. It is applied in turn on the subset of frequencies calculated in step (3) in the overall range 100 kHz to 12.75 GHz, where FB is an integer multiple of 200 kHz.

However, frequencies in the range FR +/- 600 kHz are excluded.

Note: Allowance must be made for possible spurious signals arising from the SS. These are particularly likely at sub harmonic frequencies nFB where n = 2, 3, 4, 5, etc.

(3) The frequencies at which the test is performed (adjusted to an integer multiple of 200 kHz channels most closely approximating the absolute frequency of the calculated blocking signal frequency) are the combined frequencies from (3a), (3b) and (3c) below:-

(3a) The total frequency range formed by:-

P-GSM 900: the frequencies between Flo + (IF1 + IF2 +... + IFn + 12.5 MHz) and Flo - (IF1 + IF2 +... + IFn + 12.5 MHz).

DCS 1800: the frequencies between Flo + (IF1 + IF2 +... + IFn + 37.5 MHz) and Flo - (IF1 + IF2 +... + IFn + 37.5 MHz).

and the frequencies + 100 MHz and - 100 MHz from the edge of the relevant receive band.

Measurements are made at 200 kHz intervals.

(3b) The three frequencies IF1, IF1 + 200 kHz, IF1 - 200 kHz.

(3c) The frequencies: mFlo + IF1, mFlo - IF1, mFR,

where m is all positive integers greater than or equal to 2 such that either sum lies in the range 100 kHz to 12.75 GHz.

The frequencies in step ii) and iii) lying in the range of frequencies defined by step (3a) above need not be repeated.

Where:

Flo: local oscillator applied to first receiver mixer

IF1... IFn: are the n intermediate frequencies

Flo, IF1, IF2... IFn shall be declared by the manufacturer in the PIXIT statement GSM 11.10 annex 3.

(4) The level of the unwanted signal is set according to Table 22.

Table 22: Level of unwanted signals

Frequency	GSM 900		DCS 1800
	Small MS	Other MS	
	LEVEL IN dBμVemf()		
FR +/- 600 kHz to FR +/- 800 kHz	70	75	70
FR +/- 800 kHz to FR +/- 1.6 MHz	70	80	70
FR +/- 1.6 MHz to FR +/- 3 MHz	80	90	80
915 MHz to FR - 3 MHz	90	90	-
FR + 3 MHz to 980 MHz	90	90	-
1785 MHz to FR - 3 MHz	-	-	87

FR + 3 MHz to 1920 MHz	-	-	87
835 MHz to <915 MHz	113	113	
>980 MHz to 1000 MHz	113	113	
100 kHz to <835 MHz	90	90	
>1000 MHz to 12.75 GHz	90	90	
100 kHz to 1705 MHz	-	-	113
>1705 MHz to <1785 MHz	-	-	101
>1920 MHz to 1980 MHz	-	-	101
>1980 MHz to 12.75 GHz	-	-	90

Note: These values differ from GSM 05.05 because of practical generator limits in the SS.

(5) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.

The SS tests the RBER compliance for the bits of class II, by examining sequences of at least the minimum number of samples of consecutive bits of class II, where bits are taken only from those frames for which no bad frame indication was given. The number of error events is recorded.

If a failure is indicated it is noted and counted towards the allowed exemption totals.

In the case of failures discovered at the predicted frequencies at steps (3b), (3c) the test is repeated on the adjacent channels +/-200 kHz away. If either of these two frequencies fail then the next channel 200 kHz beyond is also tested. This process is repeated until all channels constituting the group of failures is known.

2.2.15.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in Table 23.

This shall apply under normal test voltage and ambient temperature, and with the interfering signal at any frequency in the range specified.

Table 23: Limits for blocking

Channel	Type of measurement	Test limit error rate %	Minimum number of Samples
TCH/FS Class II	RBER	2.439	8200

The following exceptions are allowed:

GSM 900: A maximum of six failures in the frequency band 915 MHz to 980 MHz (which, if grouped, shall not exceed three 200 kHz channels per group).

A maximum of 24 failures in the combined bands 100 kHz to 915 MHz and 980 MHz to 12.75 GHz (which, if below FR and grouped, shall not exceed three 200 kHz channels per group).

DCS 1800: A maximum of twelve failures in the band 1785 MHz to 1920 MHz (which, if grouped, shall not exceed three 200 kHz channels per group).

A maximum of 24 in the combined bands 100 kHz to 1785 MHz and 1920 MHz to 12.75 GHz (which, if below FR and grouped, shall not exceed three 200 kHz channels per group).

If the numbers of failures do not exceed the maximum allowed figures stated above, the test of 0 is repeated at the frequencies at which the failures occurred. The level of the unwanted signal is set to 70 dBμVemf() and the performance requirement is once again that that stated in the table above.

The number Error rate measured in this test shall not exceed the test limit error rate values given in Table 23.

No failures are allowed at this lower unwanted signal level.

3. MANAGEMENT REGULATIONS

GSM mobile stations (Phase 2 and 2+) must comply with requirements in this technical regulation.

4. RESPONSIBILITY OF ORGANISATIONS/INDIVIDUALS

Organisations/individuals in Vietnam are responsible to comply with this technical regulation and to accept supervision of regulatory authority as existing regulations.

5. IMPLEMENTATION

5.1. Vietnam Telecommunication Authority and local departments of Information and Communications are responsible for guidance and implementation of this technical regulation.

5.2. This Technical Regulation replace standard TCN 68-221:2004 "GSM Mobile Station (Phase 2 and phase 2+) - Technical Requirement".

5.3. In cases of having referencing regulations specified in this technical regulation changed, modified or superseded, the new reference versions are applied.

ANNEX A
(Normative)
REFERENCE TEST METHODS

A.1. General Conditions

A.1.1. Outdoor test site and general arrangements for measurements involving the use of radiated fields

The outdoor test site shall be on a reasonably level surface or ground. At one point on the site a ground plane of at least 5 metres diameter shall be provided. In the middle of this ground plane a non-conducting support capable of rotation through 360 degrees in the horizontal plane shall be used to support the test sample at 1.5 metres above the ground plane.

The test site shall be large enough to allow the erection of a measuring or transmitting antenna at a distance of half a wavelength or at least 3 metres whichever is the greater. Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site and ground reflections do not degrade the measurement results.

The test antenna is used to detect the radiation from both the test sample and the substitution antenna, when the site is used for radiation measurements. Where necessary the substitution antenna is used as a transmitting antenna, when the site is used for the measurement of receiver characteristics. This antenna is mounted on a support such as to allow the antenna to be used in either the horizontal or vertical polarization and for the height of its centre above ground to be varied over the range 1 to 4 metres.

Preferably test antennas with pronounced directivity should be used. The size of the test antenna along the measurement axis shall not exceed 20 % of the measuring distance.

For radiation measurements the test antenna is connected to a test receiver capable of being tuned to any frequency under investigation and of measuring accurately the relative levels of signals at its input. When necessary (for receiver measurements) the test receiver is replaced by a signal source.

The substitution antenna shall be a half wave dipole, resonant at the frequency under consideration, or a shortened dipole, or (in the range 1 to 4 GHz) a horn radiator. Antennas other than a half wave dipole shall have been calibrated to the half wave dipole. The centre of this antenna shall coincide with the reference point of the test sample it has replaced. This reference point shall be the volume centre of the sample when its antenna is mounted inside the cabinet, or the point where an external antenna is connected to the cabinet. The distance between the lower extremity of the dipole and the ground shall be at least 30 cm.

The substitution antenna shall be connected to a calibrated signal generator when the site is used for radiation measurements and to a calibrated measuring receiver when the site is used for measurements of receiver characteristics. The signal generator and the receiver shall be operating at the frequencies under investigation and shall be connected to the antenna through suitable matching and balancing network.

A.1.2 Anechoic shielded chamber

As an alternative to the above mentioned outdoor test site an indoor test site, being a well shielded anechoic chamber simulating free space environment may be used. If such a chamber is used, this shall be recorded in the test report.

Note: The anechoic shielded chamber is the preferred test site for testing to this technical regulation. The measurement site may be an electrically shielded anechoic chamber being 10 m long, 5 m broad and 5 m high. Walls and ceiling should be coated with RF absorbers of 1 m height. The ground should be covered with absorbing material 1 m thick able to carry test equipment and operators. A measuring distance of 3 to 5 m in the long middle axis of the chamber can be used for measurements up to at least 10 GHz.

The test antenna, test receiver, substitution antenna and calibrated signal generator are used in a way similar to that of the outdoor test site method with the exception that, because the floor absorbers reject floor reflections, the antenna height need not be changed and shall be at the same height as the test sample. In the range between 30 MHz and 100 MHz some additional calibration may be necessary.

A.1.3 Temporary antenna connector

If the MS to be tested does not normally have a permanent external 50 ohm connector then for test purposes only it may be modified to fit a temporary 50 ohm antenna connector.

The permanent integral antenna shall be used for measurement of:

- Transmitter effective radiated power.
- Radiated spurious emissions.

For tests in the MS Receive band (925 - 960 MHz):- The temporary antenna coupling factor is determined using the procedure defined in annex A.1.5.3. When using the temporary antenna connector, the temporary antenna coupling factor needs to be taken into consideration when determining a stimulus or measured level in the receive band.

For tests in the MS Transmit band (880 - 915 MHz):- The temporary antenna coupling factor is determined using the procedure defined in 4.2.3.4.2. When using the temporary antenna connector, the temporary antenna coupling factor needs to be taken into consideration when determining a stimulus or measured level in the transmit band.

For frequencies outside the GSM bands (880 - 915 MHz and 925 - 960 MHz) the temporary antenna coupling factor is assumed to be 0 dB.

Note 1: The uncertainty in the determined value of the temporary antenna coupling factor is directly related to the uncertainty of the field strength value measured in 2.2.3.4.b) and annex A, A.1.5.2 (approximately +/-[3dB]). By mutual agreement, between the MS manufacturer and the testing authority, a value of 0 dB for the temporary antenna coupling factor could be used.

Note 2: The accommodation of the uncertainty in the temporary antenna coupling factor in the MS receive band (925 - 960 MHz) for the tests in section 4.2.9 is for further study.

Note 3: The uncertainty in the temporary antenna coupling factor in the MS transmit band (880 - 915 MHz) can be accommodated with appropriate adjustment of the measured levels by the uncertainty.

Testing must be performed in the following order to ensure that all the free field measurements are performed before the MS is modified.

- Section 2.2.6.
- Sections annex A, A.1.5.1 and A.1.5.2.
- Section 2.2.3.4.b) (during this step the MS is modified).
- Annex A, A.1.5.3.
- All remaining tests of sections 2.

A.1.4 Temporary antenna connector characteristics

The method of connection of the temporary connector shall allow secure and repeatable connections to be made to the device under test.

The antenna connector shall present a nominal 50 ohm impedance over the GSM receive and transmit frequency ranges. The maximum loss within the frequency range 100 kHz to 12.75 GHz shall be less than 1 dB.

The connection circuitry shall be maximally broadband and shall contain no non-linear or active devices.

The characteristics of the connector shall not be significantly affected by temperatures in the range -25 to +60 degrees Celsius.

A.1.5. Calibration of the temporary antenna connector

For equipments fitted with an integral antenna and not provided with a permanent means for connection to an external antenna a calibration procedure is required to allow subsequent measurements to be performed on the temporary antenna connector.

Once calibrated this temporary antenna connector enables all receiver test procedures to be identical for equipments with an integral antenna and for equipments with an antenna connector.

The calibration procedure shall be carried out at three frequencies, namely an ARFCN in the low mid and high ARFCN ranges. The procedure consists of three distinct stages as follows:

1) Establish the MS antenna radiation pattern for the three selected frequencies.

2) Calibrate the test range (or anechoic shielded chamber) for the conditions needed in 1).

3) Determine the temporary antenna connector coupling factor.

A.1.5.1 Antenna radiation pattern

a) The MS shall be in the anechoic shielded chamber, or on an outdoor test site, on an isolated support in a vertical position at an orientation specified by the manufacturer. This position is the 0 degree position.

A test antenna, connected to the SS shall be in the anechoic shielded chamber, or on the outdoor test site, at a distance of at least 3 metres from the MS.

b) A call shall be originated by the SS to the MS on a frequency in the low ARFCN range. The MS shall be made to answer the call. The SS shall command the MS to maximum transmit power.

c) The SS shall, using estimated parameters for the outdoor test site or anechoic shielded chamber, set its output level "E" to give an MS receiver input level of approximately 32 dBμVemf. This corresponds to a field strength of 55.5 dBμV/m at the MS position. The signal shall be the Standard Test Signal C1.

Note 1: The absolute value of the received signal level is not critical. The value suggested however will ensure that the MS receiver is operating essentially error free, yet is low enough to avoid any non linear effects in the receiver.

d) The SS shall use the RXLEV message from the MS to determine a measure of the received field strength. The procedure detailed in the flow chart of figure A.1 shall now be followed.

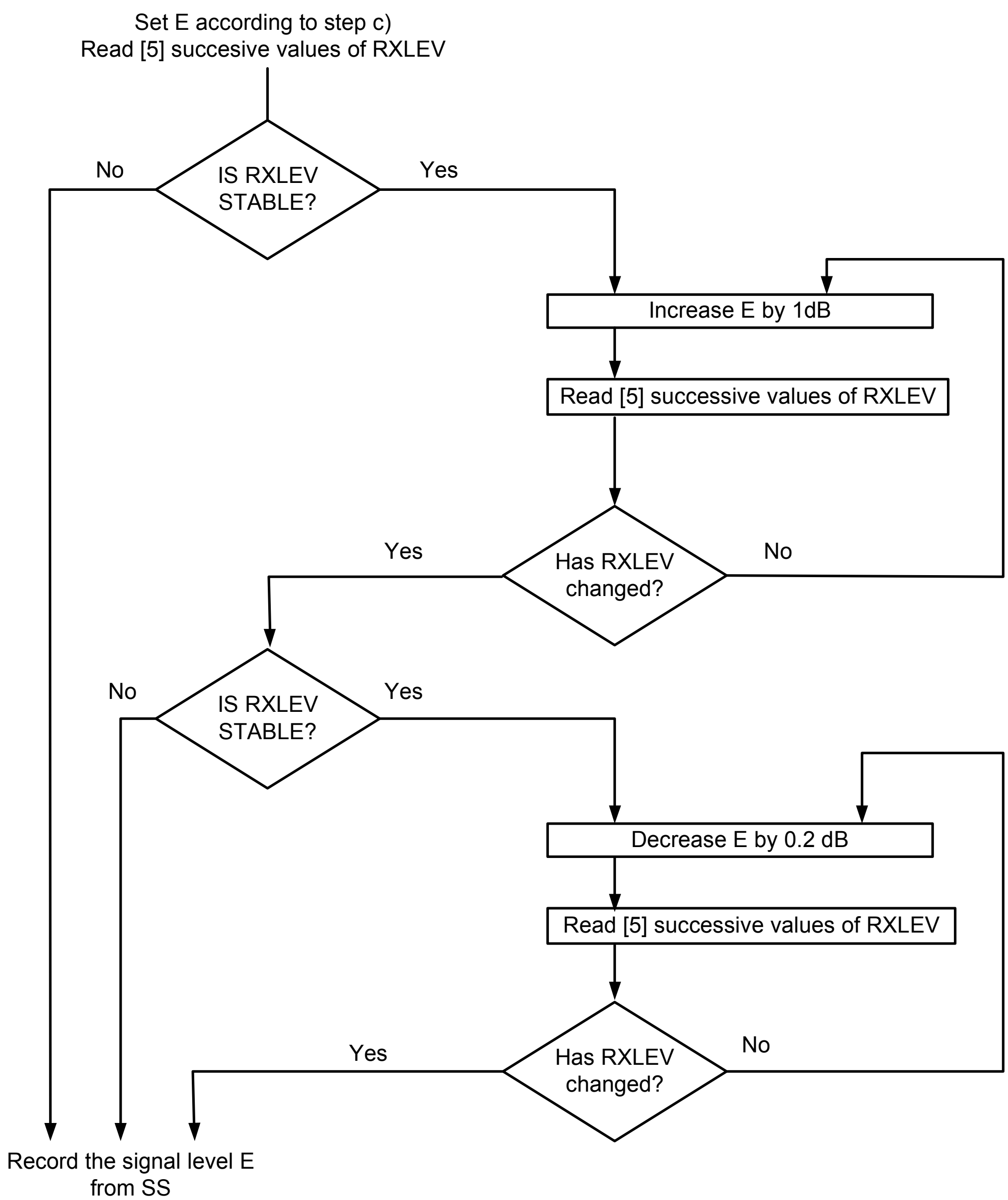

Figure A.1

The signal level from the SS that just results in the transition from $RXLEV_a$ to $RXLEV_b$ shall be recorded as E_i.

Note 2: The actual values of RXLEVa and RXLEVb will need to be recorded, because this transition will be used as the reference point for all further stages of the calibration procedure.

e) Step d) shall be repeated after the MS has been rotated by n*45 degrees in the horizontal plane. Ensuring that the same RXLEV transition is used, the signal levels from the SS shall be recorded as E_{in}.

f) Calculate the effective mean signal level from the RMS value of the eight signal levels obtained in d) and e) above by using the following formula:

$$E_1 = \left[\frac{8}{\sum_{n=0}^{n=7} \frac{1}{E_{in}}} \right]^{1/2}$$

g) Repeat steps b) to f), except in step b) use an ARFCN in the mid ARFCN range to obtain a mean signal level E_2. Ensure the same RXLEV transition is used.

h) Repeat steps b) to f), except in step b) use an ARFCN in the high ARFCN range to obtain a mean signal level E_3.

Ensure the same RXLEV transition is used.

A.1.5.2 Test range calibration

The objective of this step is to determine the actual field strength at the MS corresponding to the three signal levels E_1, E_2 and E_3 established in annex A.1.5.1. The following procedure shall be used:

a) Replace the MS by a calibrated reception antenna connected to a measuring receiver.

b) For each frequency used in annex A.1.5.1 measure the field strength E_{fr} corresponding to the respective signal levels Er determined in steps f), g) and h) of annex A.1.5.1 record these values as E_{f1}, E_{f2}, E_{f3}.

A.1.5.3 Temporary antenna connector coupling factor

The coupling factor of the temporary antenna connector is the relationship expressed in dB, between the output signal of the SS and the effective receiver input signal for the MS.

The test sample MS is modified to fit a temporary antenna connector in accordance with Annex A.1.3. or alternatively a second MS shall be provided, fitted with such a temporary antenna connector.

Note: If only one MS is supplied for testing, the tests of radiated spurious emissions (transmit and receive) and receiver sensitivity shall be performed before the MS is modified to accept a temporary antenna connector.

The calibration procedure shall be as follows:

a) The MS temporary connector is connected to the output of the SS.

b) A call shall be originated by the SS to the MS using a frequency in the low ARFCN range. The MS shall be made to answer the call. The SS shall command the MS to maximum transmit power, non hopping encrypted mode.

c) The SS shall, using the procedures of annex A.1.5.1, adjust its output signal level to determine the $RXLEV_a$ to $RXLEV_b$ transition. This signal level shall be recorded as E_{c1}.

d) Repeat steps b) and c) for frequencies in the mid ARFCN range and the high ARFCN range. Record the RXLEV transitions as E_{c2} and E_{c3} respectively.

e) The temporary antenna connector coupling factor F is then calculated from:

$$F_n = 20\log_{10}\left[\frac{E_{cn}}{E_{fn} * K_n}\right]$$

where K_n = conversion factor of an isotropic antenna expressed as μV/m at the frequency corresponding to the ARCFN used.

f) The mean antenna coupling factor F_m to be used for measurements requiring hopping shall be calculated from the RMS value of all parameters in e) as follows:

$$E_{cm} = \left[\frac{3}{1/E_{cl} + 1/E_{c2} + 1/E_{c3}}\right]^{1/2}$$

$$E_{fm} = \left[\frac{3}{1/E_{fl} + 1/E_{f2} + 1/E_{f3}}\right]^{1/2}$$

$$k_m = \left[\frac{k_1 + k_2 + k_3}{3}\right]^{1/2}$$

$$F_m = 20\lg\left[\frac{E_{cm}}{E_{fm} + k_m}\right]$$

g) In all tests in which a MS with integral antenna is the unit under test, the signal level at the temporary antenna connector is determined from:

$$\mathbf{E_{in} = E_{req} + F}$$

where: E_{in} = signal level at coupling device (dBμVemf)

E_{req} = signal level required by the test (dBμVemf)

F = coupling factor at the respective ARFCN (dB)

This is indicated in the test procedures as E_{req}, dBμVemf(), where the empty parenthesis is to be read as E_{in}.

For frequencies not in the receive band or the transmit band, 0 dBi antenna gain shall be assumed.

A.2. Normal and extreme Test Conditions

A.2.1 Power sources and ambient temperatures

During type approval tests the power source of the equipment shall be replaced by a test power source, capable of producing normal and extreme test voltages. The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the purpose of tests, the voltage of the power source shall be measured at the input terminals of the equipment. If the equipment is provided with a permanently connected power cable, the test voltage shall be that measured at the point of connection of the power cable to the equipment. In equipment with incorporated batteries the test power source shall be applied as close to the battery terminals as practicable.

During tests the power source voltages shall be maintained within a tolerance of +/- 3% relative to the voltage at the beginning of each test.

A.2.2 Normal test conditions

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- Temperature: +15^{0}C to +35^{0}C (degrees Celsius)
- Relative humidity: 20% to 75%

Note: When it is impracticable to carry out the tests under the conditions stated above, the actual temperature and relative humidity during the tests shall be recorded in the test report.

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage.

For the purpose of these specifications, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment was designed. The frequency of the test power source corresponding to the mains shall be within 1 Hz of the nominal mains frequency.

When the radio equipment is intended for operation from the usual types of regulated lead-acid battery power source of vehicles, the normal test voltage shall be 1.1 times the nominal voltage of the battery (6 volts, 12 volts etc.).

For operation from other power sources or types of battery (primary or secondary) the normal test voltage shall be that declared by the equipment manufacturer.

A.2.3 Extreme test conditions

For tests under extreme test conditions the 4 combinations of extreme voltages and extreme temperatures in Table A.1 shall be applied.

Table A.1

	1	2	3	4
Temperature	High	High	Low	Low
Voltage	High	Low	High	Low

For tests at extreme ambient temperatures measurements shall be made at the temperatures given in Table A.2, following the testing procedures given in IEC publications 68-2-1 and 68-2-2 for the low and high temperature tests.

For tests at the high temperature, after thermal balance has been achieved, the MS is switched on in the transmit condition (non DTX) for a period of one minute followed by 4 minutes in the idle mode (non DRX) after which the MS shall meet the specified requirements.

For tests at the low temperature, after thermal balance has been achieved, the MS is switched to the idle mode (non DRX) for a period of one minute after which the MS shall meet the specified requirements.

Table A.2

	Temperature (degrees Celsius)	
	Low	High
Handheld	-10	+55
Vehicular or Portable	-20	+55

For tests at extreme voltages measurements shall be made at the lower and higher extreme voltages as declared by the MS manufacturer. For MS that can be operated from one or more of the power sources listed below, the lower extreme voltage shall not be higher, and the higher extreme voltage shall not be lower than that specified in Table A.3.

Table A.3

	Voltage (relative to nominal)		
	Lower extreme	Higher extreme	Normal cond
Power source:			
AC mains	0.9	1.1	1.0
Regulated lead acid battery	0.9	1.3	1.1
Non regulated batteries:			
Leclanche'/lithium	0.85	1.0	1.0
mercury/ nickel cadmium	0.9	1.0	1.0

A.2.4 Vibration requirements

When the MS is to be tested under vibration, then random vibration is used, where the acceleration spectral densities (ASD) and the frequency ranges in table A.4.

Table A.4

Frequency in Hz	ASD in m^2/s^3
5 - 20	0.96
20 - 500	0.96 at 20 Hz, thereafter -3 dB / octave

The test shall be performed as described in IEC publication 68-2-36.

A.3. Terms on radio test

The radio propagation conditions refer to multipath propagation models of GSM 05.05. They are expressed by typical profiles:

- Static;
- Rural area (RA);
- Hilly terrain (HT);
- Urban area (TU); or for
- Equalization test (EQ).

The non-static profiles are also related to typical speeds of movement of the MS expressed in km/h, e.g. TU1.5, TU3, TU50, HT100, EQ50. In this ETS the following conventions are used:

Table A.5

Term	GSM 900	DCS 1800
RA	RA250	RA130
HT	HT100	HT100
TUhigh	TU50	TU50
TUlow	TU3	TU1.5
EQ	EQ50	EQ50

For tests using ARFCN ranges the following table shall be used.

Table A.6

Term	P-GSM 900	DCS 1800
Low ARFCN range	1 to 5	513 to 523
Mid ARFCN range	60 to 65	690 to 710
High ARFCN range	120 to 124	874 to 884

A.4. Choice of frequencies in the frequency hopping mode

For the tests using frequency hopping, 38 frequencies are used over

- P-GSM 900: 21 MHz band
- DCS 1800: 75 MHz band

Table A.7 - Hopping frequencies

	ARFCN
P-GSM 900	10, 14, 17, 18, 22, 24, 26, 30, 31, 34, 38, 42, 45, 46, 50, 52, 54, 58, 59, 62, 66, 70, 73, 74, 78, 80, 82, 86, 87, 90, 94, 98, 101, 102, 106, 108, 110, 114
DCS 1800	522, 539, 543, 556, 564, 573, 585, 590, 606, 607, 624, 627, 641, 648, 658, 669, 675, 690, 692, 709, 711, 726, 732, 743, 753, 760, 774, 777, 794, 795, 811, 816, 828, 837, 845, 858, 862, 879

Note: The range of frequencies available during tests under simulated fading conditions is restricted by the fading simulator bandwidth.

A.5. "Ideal" radio conditions

In this ETS the following conditions are referenced by the term "ideal" radio conditions:

No multipath conditions

MS power control level:

GSM 900: 7

DCS 1800: 3

RF level to MS: 63 dBμVemf()

RF level to MS: 20 dB above reference sensitivity level ()

RF level to MS: 28 dBμVemf()

A.6. Standard test signals

The Cx signals represent the wanted signals and the Ix signals represent the unwanted signals.

Signal C0	Unmodulated continuous carrier.
Signal C1	A standard GSM signal with the modulation derived by applying a data reversals signal to the input of a channel coder. The channel coder will depend on the test and the cipher mode shall be selectable by the test method. When using this signal in the non hopping mode, the unused seven time slots shall also contain dummy bursts, with power levels variable with respect to the used timeslot.
Signal I0	Unmodulated continuous carrier.
Signal I1	A GMSK modulated carrier following the structure of the GSM signals, but with all modulating bits (including the midamble period) derived directly from a random or pseudo random data stream.
Signal I2	A standard GSM signal with valid midamble, different from C1. The data bits (including bits 58 and 59) shall be derived from a random or pseudo random data stream.

A.7. Power (control) levels

In this ETS, except where explicitly stated otherwise, if the MS is commanded to its minimum power (control) level, the SS is allowed to signal power control level 19 for GSM 900, and 15 for DCS 1800.

Furthermore, except where explicitly stated otherwise, if the MS is commanded to its maximum power (control) level, and if MS_TXPWR_MAX_CCH is set to the maximum output power of the MS, the SS is allowed to signal the power control level corresponding to the maximum output power for the power class of the MS. For a GSM 900 power class 2 MS, the SS is allowed to signal power control level 2.