21 Received signal measurements

For evaluating the reception quality (the basis for handover and power control) the following two criteria are used:

- signal strength (RXLEV)
- signal quality (RXQUAL).

21.1 Signal strength

21.1.1 Definition and applicability

The MS reports RXLEV values related to the apparent received RF signal strength. It is necessary for these levels to attain sufficient accuracy for the correct functioning of the system.

The requirements and this test apply to all types of GSM 900, DCS 1 800 and multiband GSM 900 / DCS 1 800 MS.

21.1.2 Conformance requirement

1. The RMS received signal level at the receiver input shall be measured by the MS over the full range of -110 dBm to -48 dBm with a relative accuracy between signals with levels up to 20 dB difference according to table 21-1

   1.1 under normal conditions, GSM 05.08, 8.1.2 and GSM 05.05, 6.2.
   1.2 under extreme conditions, GSM 05.08, 8.1.2, GSM 05.05, annex D.1, D.2.

Table 21-1: Tolerance for relative accuracy of receive signal measurement

Absolute level of lower level signal dBm				Tolerance dB			
GSM Small MS	GSM Other MS	DCS1800 Class 1 & 2	DCS1800 Class 3	Lower limit Single	Lower limit Multi	Upper limit Single	Upper limit Multi
>= -88	>= -90	>= -86	>= -88	2	4	2	4
>= -101	>= -103	>= -99	>= -101	3	5	2	5
< -101	< -103	< -99	< -101	4	6	2	6

Single means that the measurements are on the same or different RF channel within the same frequency band.
Multi means that the measurements are on different RF channel on different frequency bands.

For measurements between ARFCN in different bands the ‘Absolute level of lower level signal’ column for the band including the lower level signal shall be used to determine which tolerance applies.

At extreme temperature conditions an extra 2 dB shall be added to the Multi limits in above table.

2. The RMS received signal level at the receiver input shall be measured with an absolute accuracy of +/-4 dB from -110 dBm to -70 dBm under normal conditions; GSM 05.08, 8.1.2.

3. The RMS received signal level at the receiver input shall be measured with an absolute accuracy of +/-6 dB over the full range of -110 dBm to -48 dBm under both normal and extreme conditions; GSM 05.08, 8.1.2.

4. If the received signal level falls below the reference sensitivity level for the type of MS then the MS shall report a level between the reference sensitivity level and the actual received level, but with the tolerances given in conformance requirements 2. and 3. above.

5. The measured signal level shall be mapped to an RXLEV value between 0 and 63 as specified in GSM 05.08; GSM 05.08, 8.1.4.

21.1.3 Test purpose

1. To verify that the RXLEV reported by the MS does not exceed conformance requirement 1.

   1.1 under normal conditions;
   1.2 under extreme conditions.

2. To verify that the RXLEV reported by the MS does not exceed conformance requirement 2 under normal conditions.

3. To verify that the RXLEV reported by the MS does not exceed conformance requirement 3 under extreme conditions and under normal conditions from -48 dBm to -70 dBm.

4. To verify that the RXLEV reported by the MS does not exceed conformance requirement 4.

   NOTE: Conformance requirement 5 is inherently tested in each of the test purposes 1. to 4.

21.1.4 Method of test

21.1.4.1 Initial conditions

The SS is set to produce the BCCH of the serving cell at 63 dBµVemf( ) and the BCCHs of 6 surrounding cells at 28 dBµVemf( ). The BCCH of the serving cell indicates these BCCHs, but not the BCCH of the serving cell. The ARFCN of the serving cell BCCH is chosen so as not to interfere with the other channels as shown in table 21-2. The fading profile for the BCCHs of the serving and surrounding cells will be set to static.

After 30 s, a call is set up according to the generic call set up procedure to an ARFCN, within the supported band of operation. The SACCH indicates the same surrounding cell BCCHs as the BCCH of the serving cell.

   NOTE: The 30 s is to allow the MS to scan and find all BCCHs.

21.1.4.2 Procedure

a) The levels of the TCH and BCCHs are set according to table 21-2 step 1. The SS waits 20 s before continuing.

Table 21-2: Signal levels at receiver input in dBµVemf( )

Step	ARFCN	TCH	BCCH1	BCCH2	BCCH3	BCCH4	BCCH5	BCCH6
	GSM900:	1	62	124	20	40	80	100
	DCS1800	512	700	885	585	660	790	835
	Multiband	1	885	62	124	40	100	512
1+m*21		64,5-m*10	64,5-m*10	64,5-m*10	64,5-m*10	64,5-m*10	64,5-m*10	64,5-m*10
2+m*21		54,5-m*10	63,5-m*10	54,5-m*10	54,5-m*10	54,5-m*10	54,5-m*10	54,5-m*10
3+m*21		54,5-m*10	62,5-m*10	44,5-m*10	44,5-m*10	44,5-m*10	44,5-m*10	44,5-m*10
.		.	.	.	.	.	44,5-m*10	44,5-m*10
17+m*21		54,5-m*10	.	.	.	.	44,5-m*10	44,5-m*10
18+m*21		44,5-m*10	.	.	.	.	44,5-m*10	44,5-m*10
.		.	.	.	.	.	44,5-m*10	44,5-m*10
21+m*21		44,5-m*10	44,5-m*10	44,5-m*10	44,5-m*10	44,5-m*10	44,5-m*10	44,5-m*10

m = 0, 1, 2, 3, 4.

b) The measurement is done in 105 steps. The initial signal levels of the TCH of the serving cell and the BCCHs of the surrounding cells are adjusted according to table 21-2. At each step the SS keeps the signal levels stable for one reporting period, except at steps 21+m*21 where the level is held stable for 1,75 reporting periods. The RXLEV value for the period in which the change occurs (reported in the following period) is discarded. The SS records the RXLEV values reported for the surrounding cell BCCHs in steps 1 + m * 21 and 21 + m * 21. The RXLEV values for BCCH 1 are recorded by the SS for all 105 steps.

NOTE: This extension at steps 21+m*21 is to allow an extra quarter reporting period for the MS to stabilize for steps 1+m*21.

At steps 1 to 30 the SS simulates a base station with DTX off and at steps 31 to 105 the SS simulates a base station with DTX on.

At steps 1 to 30 the SS checks the accuracy of the measured signal strength of TCH by checking the values of the parameters RXLEV_FULL and RXLEV_SUB. At steps 31 to 105 the SS shall check only the value of the parameter RXLEV_SUB.

At step 64, within every 480 ms reporting period, out of the 4 SACCH and 8 SID timeslots the SS transmits the first six active timeslots of the TCH with signal level 39,5 dBµVemf( ) and the last six active timeslots of the TCH with signal level 29,5 dBµVemf( ).

c) Step b) is repeated under extreme conditions (annex 1, TC2,2 and TC3).

21.1.5 Test requirements

21.1.5.1 Relative accuracy of measurements on different ARFCN

For normal and each of the 4 extreme conditions tested the following applies;

a) For each of the steps 1, 21, 22, 42, 43, and 64, of the 7 reported RXLEV values checked, the difference between the minimum reported RXLEV value and the maximum reported RXLEV value shall be no more than 4 if the measurements are on the same or on different RF channel within the same frequency band and no more than 8 (12 for extreme temperature conditions) if the measurements are on different frequency bands.

b) For each of the steps 63 and 85, of the 7 reported RXLEV values checked, the difference between the minimum reported RXLEV value and the maximum reported RXLEV value shall be no more than 5 for small MS and DCS 1 800 MS or 4 for other MS if the measurements are on the same or on different RF channel within the same frequency band and no more than 9 for small MS and DCS 1 800 MS or 8 for other MS (13 and 12 for extreme temperature conditions) if the measurements are on different frequency bands.

c) For step 84, of the 7 reported RXLEV values checked, the difference between the minimum reported RXLEV value and the maximum reported RXLEV value shall be no more than 5 if the measurements are on the same or on different RF channel within the same frequency band and no more than 9 (13 for extreme temperature conditions) if the measurements are on different frequency bands.

d) For step 105, of the reported RXLEV values checked, the difference between the minimum reported RXLEV value and the maximum reported RXLEV value shall be no more than 6 if the measurements are on the same or on different RF channel within the same frequency band and no more than 10 (14 for extreme temperature conditions) if the measurements are on different frequency bands.

NOTE: It is not mandatory for the MS to report any of the BCCHs in step 105.

21.1.5.2 Relative accuracy at a single frequency (BCCH1)

For normal and each of the 4 extreme conditions tested the following applies;

For n <= 21 and $RXLEV_1 = 63$

$RXLEV_n$ - (63 - n + r) shall be between:

-2 and +2

NOTE: This formula allows for an MS with an absolute accuracy worse than +0,5 dB and therefore reporting an RXLEV of 63 for more than one step. The formula checks the relative accuracy from the lowest input level for which the MS last reports RXLEV of 63.

Otherwise

$RXLEV_{(m*21+1)}$ - $RXLEV_{(m*21+n)}$ - n + 1 shall be between:

-2 and +2
: for steps 2 to 62 and 65 to 71 for DCS 1 800 class 1/2 MS; or steps 2 to 62 and 65 to 73 for DCS 1 800 class 3 and Small GSM MS; or 2 to 75 for other MS.

-3 and +2
: for steps 63 and 72 to 96 for DCS 1 800 class 1/2 MS; or steps 63 and 74 to 98 for DCS 1 800 class 3 and Small GSM MS; or 76 to 100 for other MS.

-4 and +2
: for steps 97 to 105 for DCS 1 800 class 1/2 MS; or steps 99 to 105 for DCS 1 800 class 3 and Small GSM MS; or 101 to 105 for other MS.

where: 1 < n <= 21 and 0 <= m <= 4 as identified in table 21-2, and r is the number of the last step where RXLEV of 63 was reported.

NOTE: It is not mandatory for the MS to report BCCH1 for steps greater than 99 for GSM 900 Small MS or 101 for other GSM MS or 97 for a DCS 1 800 Class 1 or Class 2 MS and 99 for DCS 1 800 Class 3 MS. If the MS reports a level and the upper limit for this step in the above formulae implies a level below the reference sensitivity level for the type of MS, then the upper limit shall be considered as equal to a value corresponding to the reference sensitivity level.

21.1.5.3 Absolute accuracy

For each BCCH reported, $|RXLEV_{MS} + m * 10 - 62|$ shall be no more than:

4 for steps 64 and 85 under normal conditions.

6 for steps 64 and 85 under extreme conditions.

6 for steps 1, 22 and 43 under normal and extreme conditions.

where: 0 <= m <= 4 as identified in table 21-2.

21.2 Signal strength selectivity

21.2.1 Definition and applicability

The signal strength selectivity is a measure of the ability of the signal strength measuring part of the MS to discriminate against RF power from adjacent ARFCN. The RXLEV selectivity figure corresponds to the amount by which the adjacent channel power shall be attenuated.

The requirements and this test apply to all types of GSM 900 and DCS 1 800 MS.

21.2.2 Conformance requirement

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

- for adjacent (200 kHz) channel; >= 16 dB
- for adjacent (400 kHz) channel; >= 48 dB
- for adjacent (600 kHz) channel; >= 56 dB

GSM 05.08, 8.1.2.

21.2.3 Test purpose

To verify that the MS meets the conformance requirement at the 200 kHz adjacent channel above and below the wanted.

21.2.4 Method of test

21.2.4.1 Initial conditions

For GSM 900:

A call is set up according to the generic call set up procedure on ARFCN 40 and with surrounding cell BCCH3 indicated in the BA list at ARFCN 80.

The RF level of the TCH and BCCH3 is set to 20 dB above reference sensitivity level( ).

BCCH1 and 2 at ARFCN 41 and 79 are off.

These conditions are kept for 30 s to ensure the MS has time to decode the BCCH.

For DCS 1 800:

A call is set up according to the generic call set up procedure on ARFCN 690 and with surrounding cell BCCH3 indicated in the BA list at ARFCN 790.

The RF level of the TCH and BCCH3 is set to 20 dB above reference sensitivity level( ).

BCCH1 and 2 at ARFCN 691 and 789 are off.

These conditions are kept for 30 s to ensure the MS has time to decode the BCCH.

21.2.4.2 Procedure

a) The SS records the RXLEV values reported for the TCH and BCCH3.

b) BCCH1 and 2 are set to 9 dB above the signal level of the TCH and BCCH3.

NOTE: The first adjacent channel interference requirement limits the level of BCCHs 1 and 2 to 9 dB. This ensures that the MS can maintain the call, and read BCCH3.

c) These conditions are kept for 30 s.

d) The SS records the RXLEV values reported for the TCH and BCCH3.

21.2.5 Test requirements

The values of RXLEV recorded in step d) shall be no more than 1 above the values recorded in step a).

NOTE: This one change in the reported value of RXLEV is calculated as follows: The level of the first adjacent interfering signal is such that C/I is -9 dB. With an RXLEV selectivity for the first adjacent channel of 16 dB, the power from the adjacent channel is equal to -7 dB with respect to the power level of the useful signal. The increase in power therefore is equal to $10\log(1 + 10^{-0,7}) = 0,71$ dB. Thus, the value of RXLEV could increase by 1.

21.3 Signal quality under static conditions

21.3.1 Signal quality under static conditions - TCH/FS

21.3.1.1 Definition and applicability

The MS must be capable of measuring the received signal quality, which is specified in terms of bit error ratio (BER) before channel decoding averaged over the reporting period of length of one SACCH multiframe defined in section 8.4 of GSM 05.08. The MS has to map this BER into RXQUAL values using the coding scheme defined in section 8.2.4 of GSM 05.08. For the full rate channel without downlink DTX, the error assessment is based on 104 TDMA frames: RXQUAL_FULL. In case downlink DTX is used, the assessment is based on 12 TDMA frames: RXQUAL_SUB.

The requirement and this test apply to all types of GSM 900 and DCS 1 800 MS supporting speech on a full rate channel.

21.3.1.2 Conformance requirement

1. The received signal quality shall be measured by the MS in a manner that can be related to an equivalent average BER before channel decoding (i.e. chip error ratio), assessed over the reporting period of one SACCH multiframe. When the quality is assessed over the full-set and sub-set of frames, eight levels of RXQUAL are defined and shall be mapped to the equivalent BER before channel decoding as per the table in GSM 05.08, 8.2.4; GSM 05.08, 8.2.2 & 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; GSM 05.08, 8.2.3.

21.3.1.3 Test purpose

1. To verify, under static propagation conditions, that the received signal quality is measured and mapped to the eight levels of RXQUAL_FULL by the MS in a manner that can be related to an equivalent average BER before channel decoding (i.e. chip error ratio), assessed over the reporting period of one SACCH multiframe. The probability that the correct RXQUAL band is reported shall meet the values given in as per the table in GSM 05.08, 8.2.4.

2. To verify that the reported parameters (RXQUAL) are the received signal quality, averaged over the reporting period of length one SACCH multiframe.

3. To verify that, for downlink DTX, the reported parameter RXQUAL_SUB is the received signal quality, averaged over the correct frames (SID).

21.3.1.4 Method of test

21.3.1.4.1 Initial conditions

A call is set up by the SS according to the generic call set up procedure on a full rate speech channel in the mid ARFCN range. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

The SS commands the MS to establish the TCH burst-by-burst loop, see subclause 36.2.1.1.3.

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with static propagation characteristics. The wanted signal is the standard test signal C1. It is at the nominal frequency of the receiver and its level is 28 dBµVemf( ). The unwanted signal is the standard test signal I1, on the same timeslot on a nominal frequency 200 kHz above the nominal frequency of the wanted signal.

21.3.1.4.2 Procedure

a) The SS sets the level of the unwanted signal at a value for which the BER of the looped back bursts, averaged over the reporting period as defined in GSM 05.08, clause 8.4, is in the "Range of actual BER" for "Quality band" RXQUAL_i, given in the table of GSM 05.08, subclause 8.2.4, with i equal to 0.

b) The SS verifies that the MS reports RXQUAL and whether or not the reported level is correct by comparison with the RXQUAL level of the corresponding looped back bursts. The SS increases an event counter for each incorrect MS reported RXQUAL level and continues the test for Max-samples, as given in subclause 21.3.1.5 for every i. For i = 7, the test is performed in steps using 60 SACCH blocks. In between steps, at least 35 SACCH blocks, are transmitted with a level of the unwanted signal that allows the radio link counter in the MS to reach the maximum value.

   NOTE 1: This special procedure for i = 7 is due to the high error rates involved with testing RXQUAL_7, that could lead to the MS experiencing a radio link time-out.

c) The SS repeats steps a) to b) for i equals 1, 2, ...,7.

d) The SS removes the unwanted signal and sets downlink DTX on.

e) The SS verifies that the MS reports RXQUAL_SUB = 0 and RXQUAL_FULL = 7.

NOTE 2: When testing RXQUAL_SUB , on a full rate speech channel, the MS has approximately twice as many bits as the SS to assess BER. The MS has both SID and SACCH bits, whereas the SS only has the looped back SID bits. Therefore it is only tested that the MS uses the correct frames for RXQUAL_SUB reporting by checking both RXQUAL_SUB and RXQUAL_FULL reports. No quantitative assessment is done.

f) The SS releases the call.

21.3.1.5 Test requirements

The number of errors in reporting the RXQUAL bands recorded in each of the considered cases shall not exceed the corresponding value of max-events shown in the following tables, when the number of samples relevant to the case under test is equal to max-samples.

Table 21.3: Maximum number of incorrectly reported RXQUAL_FULL for TCH/FS

CASE	Expected RXQUAL_FULL	Specified reporting error rate	Max-events	Max-samples
0	RXQUAL_0	10%	200	1640
1	RXQUAL_1	25%	200	666
2	RXQUAL_2	15%	200	1093
3	RXQUAL_3	10%	200	1640
4	RXQUAL_4	10%	200	1640
5	RXQUAL_5	5%	200	3279
6	RXQUAL_6	5%	200	3279
7	RXQUAL_7	5%	201	3300

NOTE: In order to have a testing performance corresponding to that in clause 14 for high error rates, the multiplication factor of the tested error rate with respect to the specified error rate, and the minimum number for Max-events, need to be increased. The following figures are used for static propagation conditions:

specified error rate	multiplication factor	min. Max-events
≤ 25 %	1,22	200

21.3.2 Signal quality under static conditions - TCH/HS

21.3.2.1 Definition and applicability

The MS shall be capable of measuring the received signal quality, which is specified in terms of bit error ratio (BER) before channel decoding averaged over the reporting period of length of one SACCH multiframe defined in section 8.4 of GSM 05.08. The MS shall map this BER into RXQUAL values using the coding scheme defined in section 8.2.4 of GSM 05.08. For the half rate channel without downlink DTX, the error assessment is based on 52 TDMA frames: RXQUAL_FULL. In case downlink DTX is used, the assessment is based on 12 TDMA frames: RXQUAL_SUB.

The requirement and this test apply to all types of GSM 900 and DCS 1 800 MS supporting speech on a half rate channel.

21.3.2.2 Conformance requirement

1. The received signal quality shall be measured by the MS in a manner that can be related to an equivalent average BER before channel decoding (i.e. chip error ratio), assessed over the reporting period of one SACCH multiframe. When the quality is assessed over the full-set and sub-set of

frames, eight levels of RXQUAL are defined and shall be mapped to the equivalent BER before channel decoding as per the table in GSM 05.08, 8.2.4; GSM 05.08, 8.2.2 & 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; GSM 05.08, 8.2.3.

21.3.2.3 Test purpose

1. To verify, under static propagation conditions, that the received signal quality is measured and mapped to the eight levels of RXQUAL_FULL by the MS in a manner that can be related to an equivalent average BER before channel decoding (i.e. chip error ratio), assessed over the reporting period of one SACCH multiframe. The probability that the correct RXQUAL band is reported shall meet the values given as per the table in GSM 05.08, 8.2.4.

2. To verify that the reported parameters (RXQUAL) are the received signal quality, averaged over the reporting period of length one SACCH multiframe.

3. To verify that, for downlink DTX, the reported parameter RXQUAL_SUB is the received signal quality, averaged over the correct frames (SID).

21.3.2.4 Method of test

21.3.2.4.1 Initial conditions

A call is set up by the SS according to the generic call set up procedure on a half rate speech channel in the mid ARFCN range. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

The SS commands the MS to establish the TCH burst-by-burst loop, see subclause 36.2.1.1.3.

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with static propagation characteristics. The wanted signal is the standard test signal C1. It is at the nominal frequency of the receiver and its level is 28 dBµVemf( ). The unwanted signal is the standard test signal I1, on the same timeslot on a nominal frequency 200 kHz above the nominal frequency of the wanted signal.

21.3.2.4.2 Procedure

a) The SS sets the level of the unwanted signal at a value for which the BER of the looped back bursts, averaged over the reporting period as defined in GSM 05.08, clause 8.4, is in the "Range of actual BER" for "Quality band" RXQUAL_i, given in the table of GSM 05.08, subclause 8.2.4, with i equal to 0.

b) The SS verifies that the MS reports RXQUAL and whether or not the reported level is correct by comparison with the RXQUAL level of the corresponding looped back bursts. The SS increases an event counter for each incorrect MS reported RXQUAL level and continues the test for Max-samples, as given in subclause 21.3.2.5 for every i. For i = 7, the test is performed in steps using 60 SACCH blocks. In between steps, at least 35 SACCH blocks, are transmitted with a level of the unwanted signal that allows the radio link counter in the MS to reach the maximum value.

   NOTE1: This special procedure for i = 7 is due to the high error rates involved with testing RXQUAL_7, that could lead to the MS experiencing a radio link time-out.

c) The SS repeats steps a) to b) for i equals 1, 2, ...,7.

d) The SS removes the unwanted signal and sets downlink DTX on.

e) The SS verifies that the MS reports RXQUAL_SUB = 0 and RXQUAL_FULL = 7.

NOTE 2: When testing RXQUAL_SUB , on a half rate speech channel, the MS has approximately twice as many bits as the SS to assess BER. The MS has both SID and SACCH bits, whereas the SS only has the looped back SID bits. Therefore it is only tested that the MS uses the correct frames for RXQUAL_SUB reporting reporting by checking both RXQUAL_SUB and RXQUAL_FULL reports. No quantitative assessment is done.

f) The SS releases the call.

21.3.2.5 Test requirements

The number of errors in reporting the RXQUAL bands recorded in each of the considered cases shall not exceed the corresponding value of max-events shown in the following tables, when the number of samples relevant to the case under test is equal to max-samples.

Table 21.4: Maximum number of incorrectly reported RXQUAL_FULL for TCH/HS

CASE	Expected RXQUAL_FULL	Specified reporting error rate	Max-events	Max-samples
0	RXQUAL_0	10%	200	1640
1	RXQUAL_1	40%	300	660
2	RXQUAL_2	30%	300	870
3	RXQUAL_3	15%	200	1093
4	RXQUAL_4	15%	200	1093
5	RXQUAL_5	5%	200	3279
6	RXQUAL_6	5%	200	3279
7	RXQUAL_7	5%	201	3300

NOTE: In order to have a testing performance corresponding to that in clause 14 for high error rates, the multiplication factor of the tested error rate with respect to the specified error rate, and the minimum number for Max-events, need to be increased. The following figures are used for static propagation conditions:

specified error rate	multiplication factor	min. Max-events
≤ 25 %	1,22	200
30 - 40 %	1,15	300
> 40 %	1,1	400

21.4 Signal quality under TU50 propagation conditions

21.4.1 Definition and applicability

The MS must be capable of measuring the received signal quality, which is specified in terms of bit error ratio (BER) before channel decoding averaged over the reporting period of length of one SACCH multiframe defined in section 8.4 of GSM 05.08. The MS has to map this BER into RXQUAL values using the coding scheme defined in section 8.2.4 of GSM 05.08. For the full rate channel without downlink DTX, the error assessment is based on 104 TDMA frames: RXQUAL_FULL.

The requirement and this test apply to all types of GSM 900 and DCS 1800 MS supporting speech on a full rate channel.

21.4.2 Conformance requirement

1. The received signal quality shall be measured by the MS in a manner that can be related to an equivalent average BER before channel decoding (i.e. chip error ratio), assessed over the reporting period of 1 SACCH multiframe. The assessed equivalent BER before channel decoding shall be mapped to the eight levels of RXQUAL using the coding scheme defined in section 8.2.4 of GSM 05.08; GSM 05.08 8.2.2, 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe.

   GSM 05.08, 8.2.3.

21.4.3 Test purpose

1. To verify, under TUhigh conditions, that the received signal quality is measured and reported to the eight levels of RXQUAL_FULL by the MS in a manner that can be related to an equivalent average BER before channel decoding (i.e. chip error ratio), assessed over the reporting period of length one SACCH multiframe for the TCH/FS. The probability that the correct RXQUAL band is reported shall meet the values given as per the Table in GSM 05.08 8.2.

2. To verify that the reported parameters (RXQUAL) is the received signal quality, averaged over the reporting period of length one SACCH multiframe.

21.4.4 Method of test

21.4.4.1 Initial conditions

The SS sets up a call according to the generic call set up procedure on a full rate speech channel in the mid ARFCN range. The RADIO_LINK_TIMEOUT parameter is set to maximum.

The SS commands the MS to establish the TCH burst-by-burst loop, see subclause 36.2.1.1.3.

The SS produces the standard test signal C1, with TUhigh propagation profile. It shall be at the nominal frequency of the receiver at a level of 28 dBµVemf( ).

21.4.4.2 Procedure

a) The SS counts the number of bit errors occurring in 50 SACCH multiframes and the relevant BER is computed. If this BER does correspond to one out of the 8 different cases shown in Table 21.5, the procedure is continued from step c).

Table 21.5

CASE	Average BER (%)
0	< 0,10
1	0,26 to 0,30
2	0,51 to 0,64
3	1,0 to 1,3
4	1,9 to 2,7
5	3,8 to 5,4
6	7,6 to 11
7	> 15

b) The SS generates an independent, uncorrelated interfering (unwanted) signal with TUhigh propagation profile. The unwanted signal is on the same channel as the wanted signal but has no fixed relationship with the bit transitions of the wanted signal, and is modulated with random data. The SS sets the level of this signal such that the BER computed on the basis of the number of bit errors occuring in 50 SACCH multiframes corresponds to one of the cases: case_i in Table 21.5.

c) The SS verifies that the MS reports RXQUAL. The SS also computes the RXQUAL level for the multiframe based on the looped back bits. The SS compares the RXQUAL level it computed based on the looped back bits of the multiframe with the RXQUAL level reported by the MS for that multiframe. The reported level is considered correct if RXQUAL reported by the MS is equal to RXQUAL_i (with i = 0, 1, ... 7), or to one of the adjacent bands RXQUAL_(i-1) (with i = 1, 2, ..., 7) and RXQUAL_(i+1) (with i = 0, 1, ..., 6). For each failure (to be in the correct or one of the adjacent bands) that is found, if any, a counter Max-events_i is increased by one. This step is continued for Max_samples_i RXQUAL_i based on the looped back bits.

If the MS reports RXQUAL = 7 during the test period, then at least 35 SACCH multiframes, are transmitted with a level of the unwanted signal that allows the radio link counter in the MS to reach the maximum value.

NOTE: This special procedure for RXQUAL = 7 is due to the high error, that could lead to the MS experiencing a radio link time-out.

d) The SS repeats steps b) and c) for all of the eight case_i.

21.4.5 Test requirements

The number of errors in reporting the RXQUAL bands recorded in each of the considered cases shall not exceed the corresponding value of Max-events shown in Table 21.6, when the number of samples relevant for the case is equal to Max_samples.

Table 21.6: Maximum number of incorrectly reported RXQUAL_FULL for TCH/FS

CASE	Expected RXQUAL_FULL	Specified reporting error rate	Max-events	Max_samples
0	RXQUAL_0/1	15%	200	1093
1	RXQUAL_1/0/2	15%	200	1093
2	RXQUAL_2/1/3	15%	200	1093
3	RXQUAL_3/2/4	10%	200	1640
4	RXQUAL_4/3/5	10%	200	1640
5	RXQUAL_5/4/6	10%	200	1640
6	RXQUAL_6/5/7	10%	200	1640
7	RXQUAL_7/6	10%	200	1640

22 Transmit power control timing and confirmation

22.1 Definition and applicability

The RF power level to be employed by the MS is indicated by means of the 5 bit TXPWR field sent in the layer 1 header of each downlink SACCH message block and may be sent in a dedicated signalling block.

When a power change is signalled the MS must change its power control level to the new level at a certain rate of change.

The MS shall confirm the power level that it is currently employing by setting the MS_TXPWR_CONF field in the uplink SACCH L1 header.

The requirements and this test apply to all types of GSM 900 and DCS 1 800 MS.

22.2 Conformance requirement

1. The RF power control level to be employed by the MS is indicated by means of the power control information sent in the layer 1 header of each downlink SACCH message block and may be sent in a dedicated signalling block; GSM 05.08, 4.2.

2. The MS shall confirm the power level that it is currently employing in the uplink SACCH L1 header. The indicated value shall be the power control level actually used by the MS for the last burst of the previous SACCH period; GSM 05.08, 4.2.

3. Upon receipt of a command on the SACCH to change its RF power level, the MS shall change to the new level at a rate of one nominal 2 dB power control step every 60 ms; GSM 05.08, 4.7.

4. The change (in conformance requirement 3) shall commence at the first TDMA frame belonging to the next reporting period; GSM 05.08, 4.7.

5. In case of channel change the commanded power level shall be applied on the new channel immediately; GSM 05.08, 4.7.

22.3 Test purpose

1. To verify that the MS will set its transmitter output power in accordance with conformance requirement 1.

2. To verify that the MS will confirm the power level it is currently employing according to conformance requirement 2.

3. To verify that the MS, upon receipt of a command from the SACCH to change its RF power level, will change according to conformance requirement 3.

4. To verify that the MS will commence the change of power level at least by the sixth TDMA frame belonging to the next reporting period.

5. To verify that in case of new channel assignment the commanded power level is applied on the new channel according to conformance requirement 5.

22.4 Method of test

NOTE: The method of measuring the MS transmitter output power is given in section 13.3.

22.4.1 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 (ref. table 3.3), power control level set to maximum power.

22.4.2 Procedure

a) The SS signals minimum power control level to the MS in the SACCH.

b) The SS measures the MS transmitter output power on TDMA frames 6, 19, 32 and every subsequent 13th TDMA frame to TDMA frame 214. The SS also monitors the MS_TXPWR_CONF field in the uplink SACCH L1 header for the four SACCH multiframes after the SS signals the power change.

c) The SS now sets TXPWR in the SACCH to the maximum peak power appropriate to the class of the MS.

d) The SS measures the MS transmitter output power on TDMA frames 6, 19, 32 and every subsequent 13th TDMA frame to TDMA frame 214. The SS also monitors the MS_TXPWR_CONF field in the uplink SACCH L1 header for the four SACCH multiframes after the SS signals the power change.

e) The SS now sets the SACCH TXPWR to 8.

f) After 3 s the SS sets the SACCH TXPWR to 9.

g) The SS measures the MS transmitter output power on TDMA frame 6.

h) The SS sets the SACCH TXPWR to 8.

i) The SS measures the MS transmitter output power on TDMA frame 6.

j) The channel assignment is changed and the demanded power within the channel assignment is set to the minimum power control level of the MS.

k) When the MS has changed channel its output power is measured on the first burst on the new channel.

22.5 Test requirements

NOTE: Refer to tables 13-2 and 13-4 for relationship between the power class, power control level, transmitter output power and the relevant tolerances.

a) In steps b) and d), the transmitter output power shall change by one power step towards the new level signalled for each measured burst until the MS is operating at the closest supported power control level and from then on, all transmissions shall be at that level.

b) In steps b) and d), the value of the MS_TXPWR_CONF field in the uplink SACCH L1 header shall correspond to the actual power control level used for the last transmitted burst of the previous SACCH multiframe. The first one shall indicate the initial transmitted power control level, the subsequent ones shall change by 8 each time until the final power control level has been reached in which case that value shall be indicated.

c) In steps g) and i) the transmitter output power of TDMA frame 6 shall correspond to the new commanded power control level.

d) In step k) the MS output power, measured on the new channel shall correspond to the power control level in the channel assignment.

23 Single frequency reference

23.1 Definition and applicability

The MS is required to use one single frequency reference for both RF generation/reception and baseband signals. A test method to verify this is not available.

The requirement applies to all types of GSM 900and DCS 1 800 MS.

23.2 Conformance requirement

The MS shall use the same frequency source for both RF frequency generation and clocking the timebase; GSM 05.10, 6.1.

23.3 Test purpose

There is no test specified.

24 Tests of the layer 1 signalling functions

Testing of Layer 1 signalling functions is included in the tests in sections 15, 16, 17, 18, 19, 20, 21, 22, 23. Other Layer 1 functions are tested in sections 12, 13 and 14. Some testing of Layer 1 functions is integrated with Layer 3 signalling testing (26).