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).

Unless otherwise specified all tests in clauses 21.1 to 21.4 are applicable for all MSs supporting the bands referred to in clause 1.

21.1 Signal strength

21.1.1 Definition

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.

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, 3GPP TS 05.08, subclause 8.1.2 and 3GPP TS 05.05, subclause 6.2.

   1.2 under extreme conditions, 3GPP TS 05.08, subclause 8.1.2, 3GPP TS 05.05, subclauses D.1 and 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	DCS 1800 Class 1&2	DCS 1800 Class 3	PCS 1900 Class 1&2	PCS 1900 Other MS	Lower limit Single	Lower limit Multi	Upper limit Single	Upper limit Multi
≥ -88	≥ -90	≥ -86	≥ -88	≥ -88	≥ -90	2	4	2	4
≥ -101	≥ -103	≥ -99	≥ -101	≥ -101	≥ -103	3	5	2	5
< -101	< -103	< -99	< -101	< -101	< -103	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; 3GPP TS 05.08, subclause 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; 3GPP TS 05.08, subclause 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 3GPP TS 05.08, subclause 8.1.4.

21.1.3 Test purpose

1. To verify that the RXLEV (or RXLEV_SERVING_CELL) / RXLEV_N 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 (or RXLEV_SERVING_CELL) / RXLEV_N reported by the MS does not exceed conformance requirement 2 under normal conditions.

3. To verify that the RXLEV (or RXLEV_SERVING_CELL) / RXLEV_N 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 (or RXLEV_SERVING_CELL) / RXLEV_N 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.

For circuit switch capable devices, 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.

For GPRS only devices, the Ready Timer (T3314) is indicated as disabled in the GMM ATTACH ACCEPT message. After 30s, a GPRS mode RLC unacknowledged mode downlink TBF is established on a single slot. Following TBF establishment, the SS transmits a PACKET MEASUREMENT ORDER message on downlink PACCH addressing the MS which sets the NETWORK_CONTROL_ORDER to '1' and indicates the value NC_REPORTING_PERIOD_T = 0.480ms. The PACKET MEASUREMENT ORDER does not modify the broadcast allocation list as indicated on the BCCH of the serving cell. Throughout the downlink TBF, the SS transmits two consecutive downlink RLC data blocks to the MS with the S/P bit set to '1' in the RLC/MAC header at least twice every 480ms. The PDTCH level is reported by the MS via the RXLEV_SERVING_CELL parameter and the neighbour cell BCCH levels are reported by the MS via the RXLEV_N parameters in the PACKET MEASUREMENT REPORT messages received on uplink PACCH.

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

Specific PICS statements:

- MS supporting packet switched services only (TSPC_operation_mode_C)

21.1.4.2 Procedure

a) The levels of the TCH / PDTCH 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( )

	ARFCN	TCH / PDTCH	BCCH1	BCCH2	BCCH3	BCCH4	BCCH5	BCCH6
Step	GSM 450	259	276	293	264	269	281	288
	GSM 480	306	323	340	311	316	328	335
	GSM 900:	1	62	124	20	40	80	100
	DCS 1 800	512	700	885	585	660	790	835
	PCS 1 900	512	700	805	585	660	790	550
	450/900	259	124	276	293	269	288	1
	480/900	306	124	323	340	316	335	1
	450/1 800	259	885	276	293	269	288	512
	480/1 800	306	885	323	340	316	335	512
	900/1 800	1	885	62	124	40	100	512
	450/900/1 800	259	124	276	885	293	1	512
	480/900/1 800	306	124	323	885	340	1	512
	GSM 850	128	189	251	150	170	210	230
	GSM 710	438	475	511	440	455	485	500
	T-GSM 810	438	475	511	440	455	485	500
	GSM 750	438	475	511	440	455	485	500
	750/850	438	251	475	511	455	485	128
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 / PDTCH 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.

For circuit switched speech calls 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 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( ). 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.

For circuit switched data calls and signalling only connection the SS simulates a base station with DTX off for step 1 to 105. At steps 1 to 105 the SS checks the accuracy of the measured signal strength of TCH by checking the values of the parameters RXLEV_FULL and RXLEV_SUB.

For GPRS only devices at steps 1 to 105 the SS checks the accuracy of the measured signal strength of the PDTCH by checking the value of the parameter RXLEV_SERVING_CELL received in the PACKET MEASUREMENT REPORT messages from the MS.

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 (or RXLEV_SERVING_CELL) / RXLEV_N values checked, the difference between the minimum reported RXLEV (or RXLEV_SERVING_CELL) / RXLEV_N value and the maximum reported RXLEV (or RXLEV_SERVING_CELL) / RXLEV_N 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 (or RXLEV_SERVING_CELL) / RXLEV_N values checked, the difference between the minimum reported RXLEV value and the maximum reported RXLEV (or RXLEV_SERVING_CELL) / RXLEV_N value shall be no more than 5 for small MS, DCS 1 800 and PCS 1 900 (Class 1 and 2) 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, DCS 1 800 and PCS 1 900 (Class 1 and 2) MS or 8 for other MS and other PCS 1 900 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 (or RXLEV_SERVING_CELL) / RXLEV_N values checked, the difference between the minimum reported RXLEV value and the maximum reported RXLEV (or RXLEV_SERVING_CELL) / RXLEV_N 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 (or RXLEV_SERVING_CELL) / RXLEV_N 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 $RXLEV_1$ / $RXLEV\_N_1 = 63$

$RXLEV_n$ / $RXLEV\_N_1 - (63 - n + r)$ shall be between:

-2 and +2

NOTE 1: This formula allows for an MS with an absolute accuracy worse than +0,5 dB and therefore reporting an RXLEV / RXLEV_N 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 / RXLEV_N of 63.

Otherwise:

$RXLEV_{(m*21+1)} / RXLEV\_N_{(m*21+1)} - RXLEV_{(m*21+n)} / RXLEV\_N_{(m*21+n)} - n + 1$ 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, PCS 1 900 (Class 1&2) and Small GSM MS; or 2 to 75 for other MS and other PCS 1 900 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, PCS 1 900 (Class 1 and 2) and Small GSM MS; or

76 to 100 for other MS and other PCS 1 900 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, PCS 1 900 (Class 1 and 2) and Small GSM MS; or 101 to 105 for other MS and other PCS 1 900 MS.

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

NOTE 2: It is not mandatory for the MS to report BCCH1 for steps greater than 99 for GSM 400, GSM 700, GSM 850, T_GSM 810 or GSM 900 Small MS or 101 for other GSM and other PCS 1 900 MS or 97 for a DCS 1 800 Class 1 or Class 2 MS and 99 for DCS 1 800 Class 3 and PCS 1 900 (Class 1 and 2) MS. If the MS reports a level and the upper limit for this step in the above formula 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, $|RXLEV_{MS} + m \times 10 - 62|$/ $|RXLEV\_N_{MS} + m \times 10 - 62|$ 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: $0 \leq m \leq 4$ as identified in table 21-2.

21.2 Signal strength selectivity

21.2.1 Definition

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.

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.

3GPP TS 05.08, subclause 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 450:

For circuit switch capable devices, a call is set up according to the generic call set up procedure on ARFCN 269 and with surrounding cell BCCH3 indicated in the BA list at ARFCN 281.

For GPRS only devices, the Ready Timer (T3314) is indicated as disabled in the GMM ATTACH ACCEPT message. A GPRS mode RLC unacknowledged mode downlink TBF is established on a single slot on ARFCN 269. Following TBF establishment, the SS transmits a PACKET MEASUREMENT ORDER message on downlink PACCH addressing the MS which sets the NETWORK_CONTROL_ORDER to '1' and indicates the value NC_REPORTING_PERIOD_T = 0.480ms. The PACKET MEASUREMENT ORDER does not modify the broadcast allocation list as indicated on the BCCH of the serving cell in which BCCH3 is indicated at ARFCN 281. Throughout the downlink TBF, the SS transmits two consecutive downlink RLC data blocks to the MS with the S/P bit set to '1' in the RLC/MAC header at least twice every 480ms. The PDTCH level is reported by the MS via the RXLEV_SERVING_CELL parameter and the neighbour cell BCCH levels are reported by the MS via the RXLEV_N parameters in the PACKET MEASUREMENT REPORT messages received on uplink PACCH.

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

BCCH1 and 2 at ARFCN 270 and 280 are off.

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

For GSM 480:

For circuit switch capable devices, a call is set up according to the generic call set up procedure on ARFCN 316 and with surrounding cell BCCH3 indicated in the BA list at ARFCN 328.

For GPRS only devices, the Ready Timer (T3314) is indicated as disabled in the GMM ATTACH ACCEPT message. A GPRS mode RLC unacknowledged mode downlink TBF is established on a single slot on ARFCN 316. Following TBF establishment, the SS transmits a PACKET MEASUREMENT ORDER message on downlink PACCH addressing the MS which sets the NETWORK_CONTROL_ORDER to '1' and indicates the value NC_REPORTING_PERIOD_T = 0.480ms. The PACKET MEASUREMENT ORDER does not modify the broadcast allocation list as indicated on the BCCH of the serving cell in which BCCH3 is indicated at ARFCN 328. Throughout the downlink TBF, the SS transmits two consecutive downlink RLC data blocks to the MS with the S/P bit set to '1' in the RLC/MAC header at least twice every 480ms. The PDTCH level is reported by the MS via the RXLEV_SERVING_CELL parameter and the neighbour cell BCCH levels are reported by the MS via the RXLEV_N parameters in the PACKET MEASUREMENT REPORT messages received on uplink PACCH.

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

BCCH1 and 2 at ARFCN 317 and 327 are off.

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

For GSM 710, GSM 750, T-GSM 810:

For circuit switch capable devices, a call is set up according to the generic call set up procedure on ARFCN 450 and with surrounding cell BCCH3 indicated in the BA list at ARFCN 485.

For GPRS only devices, the Ready Timer (T3314) is indicated as disabled in the GMM ATTACH ACCEPT message. A GPRS mode RLC unacknowledged mode downlink TBF is established on a single slot on ARFCN 450. Following TBF establishment, the SS transmits a PACKET MEASUREMENT ORDER message on downlink PACCH addressing the MS which sets the NETWORK_CONTROL_ORDER to '1' and indicates the value NC_REPORTING_PERIOD_T = 0.480ms. The PACKET MEASUREMENT ORDER does not modify the broadcast allocation list as indicated on the BCCH of the serving cell in which BCCH3 is indicated at ARFCN 485. Throughout the downlink TBF, the SS transmits two consecutive downlink RLC data blocks to the MS with the S/P bit set to '1' in the RLC/MAC header at least twice every 480ms. The PDTCH level is reported by the MS via the RXLEV_SERVING_CELL parameter and the neighbour cell BCCH levels are reported by the MS via the RXLEV_N parameters in the PACKET MEASUREMENT REPORT messages received on uplink PACCH.

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

BCCH1 and 2 at ARFCN 451 and 484 are off.

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

For GSM 850:

For circuit switch capable devices, a call is set up according to the generic call set up procedure on ARFCN 170 and with surrounding cell BCCH3 indicated in the BA list at ARFCN 210.

For GPRS only devices, the Ready Timer (T3314) is indicated as disabled in the GMM ATTACH ACCEPT message. A GPRS mode RLC unacknowledged mode downlink TBF is established on a single slot on ARFCN 170. Following TBF establishment, the SS transmits a PACKET MEASUREMENT ORDER message on downlink PACCH addressing the MS which sets the NETWORK_CONTROL_ORDER to '1' and indicates the value NC_REPORTING_PERIOD_T = 0.480ms. The PACKET MEASUREMENT ORDER does not modify the broadcast allocation list as indicated on the BCCH of the serving cell in which BCCH3 is indicated at ARFCN 210. Throughout the downlink TBF, the SS transmits two consecutive downlink RLC data blocks to the MS with the S/P bit set to '1' in the RLC/MAC header at least twice every 480ms. The PDTCH level is reported by the MS via the RXLEV_SERVING_CELL parameter and the neighbour cell BCCH levels are reported by the MS via the RXLEV_N parameters in the PACKET MEASUREMENT REPORT messages received on uplink PACCH.

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

BCCH1 and 2 at ARFCN 171 and 209 are off.

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

For GSM 900:

For circuit switch capable devices, 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.

For GPRS only devices, the Ready Timer (T3314) is indicated as disabled in the GMM ATTACH ACCEPT message. A GPRS mode RLC unacknowledged mode downlink TBF is established on a single slot on ARFCN 40. Following TBF establishment, the SS transmits a PACKET MEASUREMENT ORDER message on downlink PACCH addressing the MS which sets the NETWORK_CONTROL_ORDER to '1' and indicates the value NC_REPORTING_PERIOD_T = 0.480ms. The PACKET MEASUREMENT ORDER does not modify the broadcast allocation list as indicated on the BCCH of the serving cell in which BCCH3 is indicated at ARFCN 80. Throughout the downlink TBF, the SS transmits two consecutive downlink RLC data blocks to the MS with the S/P bit set to '1' in the RLC/MAC header at least twice every 480ms. The PDTCH level is reported by the MS via the RXLEV_SERVING_CELL parameter and the neighbour cell BCCH levels are reported by the MS via the RXLEV_N parameters in the PACKET MEASUREMENT REPORT messages received on uplink PACCH.

The RF level of the TCH/ PDTCH 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 and PCS 1 900:

For circuit switch capable devices, 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.

For GPRS only devices, the Ready Timer (T3314) is indicated as disabled in the GMM ATTACH ACCEPT message. A GPRS mode RLC unacknowledged mode downlink TBF is established on a single slot on ARFCN 690. Following TBF establishment, the SS transmits a PACKET MEASUREMENT ORDER message on downlink PACCH addressing the MS which sets the NETWORK_CONTROL_ORDER to '1' and indicates the value NC_REPORTING_PERIOD_T = 0.480ms. The PACKET MEASUREMENT ORDER does not modify the broadcast allocation list as indicated on the BCCH of the serving cell in which BCCH3 is indicated at ARFCN 790. Throughout the downlink TBF, the SS transmits two consecutive downlink RLC data blocks to the MS with the S/P bit set to '1' in the RLC/MAC header at least twice every 480ms. The PDTCH level is reported by the MS via the RXLEV_SERVING_CELL parameter and the neighbour cell BCCH levels are reported by the MS via the RXLEV_N parameters in the PACKET MEASUREMENT REPORT messages received on uplink PACCH.

The RF level of the TCH/ PDTCH 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.

Specific PICS statements:

- MS supporting packet switched services only (TSPC_operation_mode_C)

21.2.4.2 Procedure

a) The SS records the RXLEV (or RXLEV_SERVING_CELL) / RXLEV_N values reported for the TCH / PDTCH and BCCH3

b) BCCH1 and 2 are set to 9 dB above the signal level of the TCH / PDTCH 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 (or RXLEV_SERVING_CELL) / RXLEV_N values reported for the TCH / PDTCH and BCCH3.

21.2.5 Test requirements

The values of RXLEV (or RXLEV_SERVING_CELL) / RXLEV_N 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 (or RXLEV_SERVING_CELL) / RXLEV_N 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 (or RXLEV_SERVING_CELL) / RXLEV_N could increase by 1.

21.3 Signal quality under static conditions

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 have been increased. The following figures have been used (static propagation conditions):

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

21.3.1 Signal quality under static conditions - TCH/FS no DTX

21.3.1.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS has to map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. The error assessment is based on 104 TDMA frames: RXQUAL_FULL.

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 of frames, eight levels of RXQUAL are defined and shall be mapped to the equivalent BER before channel decoding as per the table in 3GPP TS 05.08, subclauses 8.2.2 and 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; 3GPP TS 05.08, subclause 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 3GPP TS 05.08, subclause 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.

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.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Full rate

The SS commands the MS to establish the TCH burst-by-burst loop (C), see subclause 36.

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(-85 dBm). 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 3GPP TS 05.08, subclause 8.4 is covered by one of the cases 1 to 13 of table 21.3.1.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.3.1.5). The SS shall take 10 samples.

c) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

d) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating steps (b) and (c) until case 14 is reached.

e) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

f) Steps b) through e) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 3300 (minimum total events(200)/minimum test limit(0.061)).

g) The SS removes the unwanted signal and releases the call.

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

*[3]NOTE: 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.

Maximum Duration of Test

40 minutes.

21.3.1.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$$\frac{\text{sum}_{i=0..14}\ ((\text{event counter}_i * 100) / \text{test limit}_i)}{\text{sum}_{i=0..14}\ (\text{sample counter}_i)}$$

A result of <1 is a pass, >=1 is a fail

Table 21.3.1.5: Test criteria and limits for RXQUAL_FULL errors for TCH/FS

Case (i)	BER estimated by MS/SS (all applicable bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit DTX Off (%)
0	<0.1	0	12.2
1	>=0.1, <0.26	0, 1	30.5
2	>=0.26, <0.3	1	30.5
3	>=0.3, <0.51	1, 2	30.5
4	>=0.51, <0.64	2	18.3
5	>=0.64, <1.0	2,3	18.3
6	>=1.0, <1.3	3	12.2
7	>=1.3, <1.9	3, 4	12.2
8	>=1.9, <2.7	4	12.2
9	>=2.7, <3.8	4, 5	12.2
10	>=3.8, <5.4	5	6.1
11	>=5.4, <7.6	5, 6	6.1
12	>=7.6, <11.0	6	6.1
13	>=11.0, <15.0	6, 7	6.1
14	>=15.0	7	6.1

21.3.2 Signal quality under static conditions - TCH/HS

21.3.2.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS shall map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 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.

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 3GPP TS 05.08, subclauses 8.2.2 and 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; 3GPP TS 05.08, subclause 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 3GPP TS 05.08, subclause 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.

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.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Half rate

The SS commands the MS to establish the TCH burst-by-burst loop (loop C), see subclause 36.

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 (-85 dBm). 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.

The SS sets downlink DTX off.

21.3.2.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BER of the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.3.2.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.3.2.5). The SS shall take 10 samples.

c) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

d) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating step (b) until case 14 is reached.

e) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) until case 0 is reached.

f) Steps d) and e) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 3300.

g) The SS releases the call

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

Maximum Duration of Test

40 minutes.

21.3.2.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$$\frac{\text{sum}_{i=0..14}\ ((\text{event counter}_i * 100) / \text{test limit}_i)}{\text{sum}_{i=0..14}\ (\text{sample counter}_i)}$$

A result of <1 is a pass, >=1 is a fail.

Table 21.3.2.5: Test criteria and limits for RXQUAL_FULL for TCH/AHS

Case (i)	BER estimated by MS/SS (all applicable bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit DTX Off (%)
0	<0.1	0	12.2
1	>=0.1, <0.26	0, 1	46
2	>=0.26, <0.3	1	46
3	>=0.3, <0.51	1, 2	46
4	>=0.51, <0.64	2	34.5
5	>=0.64, <1.0	2,3	34.5
6	>=1.0, <1.3	3	18.3
7	>=1.3, <1.9	3, 4	18.3
8	>=1.9, <2.7	4	18.3
9	>=2.7, <3.8	4, 5	18.3
10	>=3.8, <5.4	5	6.1
11	>=5.4, <7.6	5, 6	6.1
12	>=7.6, <11.0	6	6.1
13	>=11.0, <15.0	6, 7	6.1
14	>=15.0	7	6.1

21.3.3 Signal quality under static conditions - TCH/AFS – DTX off

21.3.3.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS has to map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. For the full rate channel without downlink DTX, the error assessment is based on 104 TDMA frames: RXQUAL_FULL.

21.3.3.2 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 3GPP TS 05.08, subclauses 8.2.2 and 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; 3GPP TS 05.08, subclause 8.2.3.

21.3.3.3 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 by the table in 3GPP TS 05.08, subclause 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.

21.3.3.4 Method of test

21.3.3.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH/AFS with an ARFCN in the Mid ARFCN range, power control level set to maximum power. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Full rate

The multirate configuration indicates the use of the following set of codecs modes:

Codec Mode	TCH/AFS in kbit/s
CODEC_MODE_4	12,2
CODEC_MODE_3	7,95
CODEC_MODE_2	5,9
CODEC_MODE_1	4,75

The Initial Codec Mode shall be set to the lowest codec mode (CODEC_MODE_1).

The SS sends a CMC and CMI corresponding to the lowest codec mode (CODEC_MODE_1).

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with static propagation characteristics. The SS transmits the wanted signal (Standard Test Signal C1) on the traffic channel at the nominal frequency of the receiver and its level is nominally 28 dBμVemf (-85 dBm). 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.

The SS commands the MS to establish the TCH burst-by-burst loop, see subclause 36.

21.3.3.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BER of the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.3.3.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.3.3.5). The SS shall take 10 samples.

c) When $sum_{i=0..14}$(sample counter(i)) = 800 the CMI shall be changed to indicate CODEC_MODE_2, at 1600 CMI = CODEC_MODE_3, and at 2400 CMI = CODEC_MODE_4.

d) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

e) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating steps (b) and (c) until case 14 is reached.

f) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

g) Steps d) and e) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 3300.

h) The SS releases the call

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

Maximum Duration of Test

40 minutes.

21.3.3.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$$\frac{sum_{i=0..14}((\text{event counter}_i * 100) / \text{test limit}_i)}{sum_{i=0..14}(\text{sample counter}_i)}$$

A result of <1 is a pass, >=1 is a fail.

Table 21.3.3.5: Test criteria and limits for RXQUAL_FULL for TCH/AFS

Case (i)	BER estimated by MS/SS (all applicable bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit DTX Off (%)
0	<0.1	0	12.2
1	>=0.1, <0.26	0, 1	30.5
2	>=0.26, <0.3	1	30.5
3	>=0.3, <0.51	1, 2	30.5
4	>=0.51, <0.64	2	18.3
5	>=0.64, <1.0	2,3	18.3
6	>=1.0, <1.3	3	12.2
7	>=1.3, <1.9	3, 4	12.2
8	>=1.9, <2.7	4	12.2
9	>=2.7, <3.8	4, 5	12.2
10	>=3.8, <5.4	5	6.1
11	>=5.4, <7.6	5, 6	6.1
12	>=7.6, <11.0	6	6.1
13	>=11.0, <15.0	6, 7	6.1
14	>=15.0	7	6.1

21.3.4 Signal quality under static conditions - TCH/AHS - DTX Off

21.3.4.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS shall map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. For the half rate channel without downlink DTX, the error assessment is based on 52 TDMA frames: RXQUAL_FULL.

21.3.4.2 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 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 3GPP TS 05.08, subclauses 8.2.2 and 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; 3GPP TS 05.08, subclause 8.2.3.

21.3.4.3 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 by the table in 3GPP TS 05.08, subclause 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.

21.3.4.4 Method of test

21.3.4.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH/AHS with an ARFCN in the Mid ARFCN range, power control level set to maximum power. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Half rate

The multirate configuration indicates the use of the following set of codecs modes:

Codec Mode	TCH/AHS in kbit/s
CODEC_MODE_3	7.95
CODEC_MODE_2	6.7
CODEC_MODE_1	4,75

The Initial Codec mode (ICM) shall be set to the lowest codec mode (CODEC_MODE_1).

The SS continuously sends a CMC corresponding to the lowest codec mode (CODEC_MODE_1).

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with static propagation characteristics. The SS transmits the wanted signal (Standard Test Signal C1 on the traffic channel using the Initial Codec Mode (ICM) at the nominal frequency of the receiver and its level is 28 dBμVemf (-85 dBm). 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.

The SS commands the MS to establish the TCH burst-by-burst loop, see subclause 36.

The SS sets downlink DTX off.

21.3.4.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BER of the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.3.4.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.3.4.5). The SS shall take 10 samples.

c) When $sum_{i=0..14}$(sample counter(i)) = 1100 the CMI shall be changed to indicate CODEC_MODE_2, at 2200 CMI = CODEC_MODE_3.

d) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

e) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating steps (b) and (c) until case 14 is reached.

f) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

g) Steps d) and e) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 3300.

h) The SS releases the call

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

Maximum Duration of Test

40 minutes.

21.3.4.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$sum_{i=0..14}$ ((event counter $_i$ * 100) / test limit $_i$)

$sum_{i=0..14}$ (sample counter $_i$)

A result of <1 is a pass, >=1 is a fail.

Table 21.3.4.5: Test criteria and limits for RXQUAL_FULL for TCH/AHS

Case (i)	BER estimated by MS/SS (all applicable bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit DTX Off (%)
0	<0.1	0	12.2
1	>=0.1, <0.26	0, 1	46
2	>=0.26, <0.3	1	46
3	>=0.3, <0.51	1, 2	46
4	>=0.51, <0.64	2	34.5
5	>=0.64, <1.0	2,3	34.5
6	>=1.0, <1.3	3	18.3
7	>=1.3, <1.9	3, 4	18.3
8	>=1.9, <2.7	4	18.3
9	>=2.7, <3.8	4, 5	18.3
10	>=3.8, <5.4	5	6.1
11	>=5.4, <7.6	5, 6	6.1
12	>=7.6, <11.0	6	6.1
13	>=11.0, <15.0	6, 7	6.1
14	>=15.0	7	6.1

21.3.5 Signal quality under static conditions - TCH/AFS – DTX on

21.3.5.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS has to map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. In case downlink DTX is used, the assessment is based on a subset of TDMA frames containing SID_UPDATE frames and SACCH frames: RXQUAL_SUB. On TCH/AFS and TCH/AHS, there is no fixed subset of TDMA frames that will always be transmitted during DTX, however a SID_UPDATE will be transmitted every 8 speech frames. A detection algorithm is required in the receiver which informs about whether a SID_UPDATE (see 3GPP TS 05.03 and 3GPP TS 06.93) frame was transmitted (and thus can be used for quality and signal level estimation) or not.

21.3.5.2 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 3GPP TS 05.08, subclauses 8.2.2 and 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; 3GPP TS 05.08, subclause 8.2.3.

21.3.5.3 Test purpose

1. To verify that, for downlink DTX, the reported parameter RXQUAL_SUB is the received signal quality, averaged over the correct frames (SID_UPDATE and SACCH), mapped by the MS to the eight levels RXQUAL scale in a manner that can be related to an equivalent average BER before channel decoding assessed over the reporting period of one SACCH multiframe. The probability that the correct RXQUAL band is reported shall meet the values given by the table in 3GPP TS 05.08, subclause 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.

21.3.5.4 Method of test

21.3.5.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH/AFS with an ARFCN in the Mid ARFCN range, power control level set to maximum power. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Full rate

The multirate configuration indicates the use of the following set of codecs modes:

Codec Mode	TCH/AFS in kbit/s
CODEC_MODE_4	12,2
CODEC_MODE_3	7,95
CODEC_MODE_2	5,9
CODEC_MODE_1	4,75

The Initial Codec Mode shall be arbitrarilyset to one of the codec modes of the codec set. *[3]

The SS sends a CMC and CMI corresponding to the initial codec mode selection.

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with static propagation characteristics. The SS transmits the wanted signal (Standard Test Signal C1) on the traffic channel at the nominal frequency of the receiver and its level is nominally 28 dBμVemf (-85 dBm). 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.

The SS commands the MS to establish the TCH burst-by-burst loop, see subclause 36.

The SS sets downlink DTX on.

21.3.5.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BER of the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.3.5.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.3.5.5). The SS shall take 10 samples.

c) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

d) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 14 is reached.

e) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

f) Steps c) and d) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 1100.

g) The SS releases the call

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

*[3] NOTE: Using varying codec modes does not improve the test depth because the channel coding of the SID_UPDATE frames are identical for all codec modes. (TS 3GPP 45.003).

Maximum Duration of Test

15 minutes.

21.3.5.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$$\frac{\text{sum}_{i=0..14}\left((\text{event counter}_i * 100) / \text{test limit}_i\right)}{\text{sum}_{i=0..14}\left(\text{sample counter}_i\right)}$$

A result of <1 is a pass, >=1 is a fail.

Table 21.3.5.5: Test criteria and limits for RXQUAL_SUB for TCH/AFS

Case (i)	BER measured by SS (12 of 16 bursts) (%)	Assumed BER estimated by MS (16 of 16 bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit (%)
0	<0.05	<0.11	0,	40.25
1	>=0.05, <0.2	>=0.055, <0.256	0, 1	71.5
2	>=0.2, <0.4	>=0.164, <0.475	0, 1, 2	71.5
3	>=0.4, <0.5	>=0.329, <0.548	1, 2	71.5
4	>=0.5, <0.8	>=0.384, <0.914	1, 2, 3	71.5
5	>=0.8, <0.9	>=0.603, <1.096	2, 3	60.5
6	>=0.9, <1.5	>=0.713, <1.827	2, 3, 4	60.5
7	>=1.5, <1.8	>=1.151, <2.193	3, 4	60.5
8	>=1.8, <3.0	>=1.371, <3.746	3, 4, 5	60.5
9	>=3.0, <3.6	>=2.303, <4.477	4, 5	46
10	>=3.6, <6.0	>=2.741, <7.493	4, 5, 6	46
11	>=6.0, <7.3	>=4.550, <9.046	5, 6	34.5
12	>=7.3, <12.1	>=5.482, <15.077	5, 6, 7	34.5
13	>=12.1, <24.15	>=9.101, <30.154	6, 7	24.4
14	>=24.15	>=18.147	7	18.3

21.3.6 Signal quality under static conditions - TCH/AHS – DTX On

21.3.6.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS has to map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. In case downlink DTX is used, the assessment is based on a subset of TDMA frames containing SID_UPDATE frames and SACCH frames: RXQUAL_SUB. On TCH/AHS, there is no fixed subset of TDMA frames that will always be transmitted during DTX, however a SID_UPDATE will be transmitted every 8 speech frames. A detection algorithm is required in the receiver that informs about whether a SID_UPDATE (see 3GPP TS 05.03 and 3GPP TS 06.93) frame was transmitted (and thus can be used for quality and signal level estimation) or not.

21.3.6.2 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 3GPP TS 05.08, subclauses 8.2.2 and 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; 3GPP TS 05.08, subclause 8.2.3.

21.3.6.3 Test purpose

1. To verify that, for downlink DTX, the reported parameter RXQUAL_SUB is the received signal quality, averaged over the correct frames (SID_UPDATE and SACCH), mapped by the MS to the eight levels RXQUAL scale in a manner that can be related to an equivalent average BER before channel decoding assessed over the reporting period of one SACCH multiframe. The probability that the correct RXQUAL band is reported shall meet the values given by the table in 3GPP TS 05.08, subclause 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.

21.3.6.4 Method of test

21.3.6.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH/AHS with an ARFCN in the Mid ARFCN range, power control level set to maximum power. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Half rate

The multirate configuration indicates the use of the following set of codecs modes:

Codec Mode	TCH/AHS in kbit/s
CODEC_MODE_3	7.95
CODEC_MODE_2	6.7
CODEC_MODE_1	4,75

The Initial Codec Mode shall be arbitrarily set to one of the codec modes of the codec set. *[3]

The SS sends a CMC and CMI corresponding to the initial codec mode selection.

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with static propagation characteristics. The SS transmits the wanted signal (Standard Test Signal C1) on the traffic channel at the nominal frequency of the receiver and its level is nominally 28 dBµVemf (-85 dBm). 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.

The SS commands the MS to establish the TCH burst-by-burst loop, see subclause 36.

The SS sets downlink DTX on.

21.3.6.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BER of the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.3.6.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.3.6.5). The SS shall take 10 samples.

c) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

d) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 14 is reached.

e) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

f) Steps c) and d) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 1200.

g) The SS releases the call

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

*[3] NOTE: Using varying codec modes does not improve the test depth because the channel coding of the SID_UPDATE frames are identical for all codec modes. (TS 3GPP 45.003).

Maximum Duration of Test

17 minutes.

21.3.6.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$$\frac{\text{sum}_{i=0..14}\ ((\text{event counter}_i * 100) / \text{test limit}_i)}{\text{sum}_{i=0..14}\ (\text{sample counter}_i)}$$

A result of <1 is a pass, >=1 is a fail.

Table 21.3.6.5: Test criteria and limits for RXQUAL_SUB for TCH/AHS

Case (i)	BER measured by SS (12 of 16 bursts) (%)	Assumed BER estimated by MS (16 of 16 bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit (%)
0	<0.05	<0.11	0,	40.25
1	>=0.05, <0.2	>=0.055, <0.256	0, 1	71.5
2	>=0.2, <0.4	>=0.164, <0.475	0, 1, 2	71.5
3	>=0.4, <0.5	>=0.329, <0.548	1, 2	71.5
4	>=0.5, <0.8	>=0.384, <0.914	1, 2, 3	71.5
5	>=0.8, <0.9	>=0.603, <1.096	2, 3	60.5
6	>=0.9, <1.5	>=0.713, <1.827	2, 3, 4	60.5
7	>=1.5, <1.8	>=1.151, <2.193	3, 4	60.5
8	>=1.8, <3.0	>=1.371, <3.746	3, 4, 5	60.5
9	>=3.0, <3.6	>=2.303, <4.477	4, 5	46
10	>=3.6, <6.0	>=2.741, <7.493	4, 5, 6	46
11	>=6.0, <7.3	>=4.550, <9.046	5, 6	34.5
12	>=7.3, <12.1	>=5.482, <15.077	5, 6, 7	34.5
13	>=12.1, <24.15	>=9.101, <30.154	6, 7	24.4
14	>=24.15	>=18.147	7	18.3

21.4 Signal quality under TUhigh propagation conditions

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 have been increased. The following figures have been used (TUHigh propagation conditions):

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

21.4.1 Signal quality under TUhigh propagation conditions - TCH/FS

21.4.1.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS has to map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. For the full rate channel without downlink DTX, the error assessment is based on 104 TDMA frames: RXQUAL_FULL.

21.4.1.2 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 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 subclause 8.2.4 of 3GPP TS 05.08 subclauses 8.2.2 and 8.2.4.

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

   3GPP TS 05.08, subclause 8.2.3.

21.4.1.3 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 3GPP TS 05.08 subclause 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.

21.4.1.4 Method of test

21.4.1.4.1 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.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Full rate

The SS commands the MS to establish the TCH burst-by-burst loop (C), see subclause 36.

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 (-85 dBm).

The SS also generates an independent, uncorrelated interfering (unwanted) signal with TUhigh propagation profile. The unwanted signal is the standard test signal I1, on the same timeslot and same ARFCN of the wanted signal.

21.4.1.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BERof the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.4.1.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.4.1.5). The SS shall take 10 samples.

c) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

d) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating steps (b) and (c) until case 14 is reached.

e) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

f) Steps b) through e) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 1650 (minimum total events(200)/minimum test limit(0.122)).

g) The SS removes the unwanted signal and releases the call.

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

Maximum Duration of Test

14 minutes.

21.4.1.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$$\frac{\mathrm{sum}_{i=0..14}\left((\text{event counter}_i * 100) / \text{test limit}_i\right)}{\mathrm{sum}_{i=0..14}\left(\text{sample counter}_i\right)}$$

A result of <1 is a pass, >=1 is a fail.

Table 21.4.1.5: Test criteria and limits for RXQUAL FULL errors for TCH/FS

Case (i)	BER estimated by MS/SS (all applicable bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit
0	<0.1	0, 1	18.3
1	>=0.1, <0.26	0, 1, 2	18.3
2	>=0.26, <0.3	0, 1, 2	18.3
3	>=0.3, <0.51	0, 1, 2, 3	18.3
4	>=0.51, <0.64	1, 2, 3	18.3
5	>=0.64, <1.0	1, 2, 3, 4	30.5
6	>=1.0, <1.3	2, 3, 4	30.5
7	>=1.3, <1.9	2, 3, 4, 5	30.5
8	>=1.9, <2.7	3, 4, 5	30.5
9	>=2.7, <3.8	3, 4, 5, 6	30.5
10	>=3.8, <5.4	4, 5, 6	12.2
11	>=5.4, <7.6	4, 5, 6, 7	12.2
12	>=7.6, <11.0	5, 6, 7	12.2
13	>=11.0, <15.0	5, 6, 7	12.2
14	>=15.0	6, 7	12.2

21.4.2 Signal quality under TUhigh propagation conditions - TCH/AFS

21.4.2.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS shall map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. For the full rate channel without downlink DTX, the error assessment is based on 104 TDMA frames: RXQUAL_FULL.

21.4.2.2 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 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 subclause 8.2.4 of 3GPP TS 05.08 subclauses 8.2.2 and 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; 3GPP TS 05.08, subclause 8.2.3.

21.4.2.3 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/AFS. The probability that the correct RXQUAL band is reported shall meet the values given by the table in 3GPP TS 05.08 subclause 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.

21.4.2.4 Method of test

21.4.2.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH/AFS with an ARFCN in the Mid ARFCN range, power control level set to maximum power. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Full rate

The multirate configuration indicates the use of the following set of codecs modes:

Codec Mode	TCH/AFS in kbit/s
CODEC_MODE_4	12,2
CODEC_MODE_3	7,95
CODEC_MODE_2	5,9
CODEC_MODE_1	4,75

The Initial Codec Mode shall be set to the lowest codec mode (CODEC_MODE_1).

The SS sends a CMC and CMI corresponding to the lowest codec mode (CODEC_MODE_1).

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with TUhigh propagation characteristics. The SS transmits the wanted signal (Standard Test Signal C1) on the traffic channel, with TUhigh propagation profile, at the nominal frequency of the receiver at a level of 28 dBµVemf (-85 dBm). The unwanted signal is the standard test signal I1, on the same timeslot and on same ARFCN of the wanted signal.

The SS commands the MS to establish the TCH burst-by-burst loop (C), see subclause 36.

21.4.2.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BER of the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.4.2.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.4.2.5). The SS shall take 10 samples.

c) When $sum_{i=0..14}$(sample counter(i)) = 400 the CMI shall be changed to indicate CODEC_MODE_2, at 800 CMI = CODEC_MODE_3, and at 1200 CMI = CODEC_MODE_4.

d) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

e) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating steps (b) and (c) until case 14 is reached.

f) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

g) Steps d) and e) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 1650.

h) The SS releases the call.

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

Maximum Duration of Test

14 minutes.

21.4.2.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$$\frac{sum_{i=0..14}\ ((\text{event counter}_i * 100) / \text{test limit}_i)}{sum_{i=0..14}\ (\text{sample counter}_i)}$$

A result of <1 is a pass, >=1 is a fail.

Table 21.4.2.5: Test criteria and limits for RXQUAL FULL errors for TCH/AFS

Case (i)	BER estimated by MS/SS (all applicable bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit
0	<0.1	0, 1	18.3
1	>=0.1, <0.26	0, 1, 2	18.3
2	>=0.26, <0.3	0, 1, 2	18.3
3	>=0.3, <0.51	0, 1, 2, 3	18.3
4	>=0.51, <0.64	1, 2, 3	18.3
5	>=0.64, <1.0	1, 2, 3, 4	30.5
6	>=1.0, <1.3	2, 3, 4	30.5
7	>=1.3, <1.9	2, 3, 4, 5	30.5
8	>=1.9, <2.7	3, 4, 5	30.5
9	>=2.7, <3.8	3, 4, 5, 6	30.5
10	>=3.8, <5.4	4, 5, 6	12.2
11	>=5.4, <7.6	4, 5, 6, 7	12.2
12	>=7.6, <11.0	5, 6, 7	12.2
13	>=11.0, <15.0	5, 6, 7	12.2
14	>=15.0	6, 7	12.2

21.4.3 Signal quality under TUhigh propagation conditions - TCH/AHS

21.4.3.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS shall map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. For the half rate channel without downlink DTX, the error assessment is based on 52 TDMA frames: RXQUAL_FULL.

21.4.3.2 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 subclause 8.2.4 of 3GPP TS 05.08 subclauses 8.2.2 and 8.2.4.

2. The reported parameters (RXQUAL) shall be the received signal quality, averaged over the reporting period of length one SACCH multiframe; 3GPP TS 05.08, subclause 8.2.3.

21.4.3.3 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/AHS. The probability that the correct RXQUAL band is reported shall meet the values given by the table in 3GPP TS 05.08 subclause 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.

21.4.3.4 Method of test

21.4.3.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH/AHS with in the Mid ARFCN range, power control level set to maximum power. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Half rate

The multirate configuration indicates the use of the following set of codecs modes:

Codec Mode	TCH/AHS in kbit/s
CODEC_MODE_3	7.95
CODEC_MODE_2	6.7
CODEC_MODE_1	4,75

The Initial Codec mode (ICM) shall be set to the lowest codec mode (CODEC_MODE_1).

The SS sends a CMC and CMI corresponding to the lowest codec mode (CODEC_MODE_1).

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with TUhigh propagation characteristics. The SS transmits the wanted signal (Standard Test Signal C1) on the traffic channel, with TUhigh propagation profile, at the nominal frequency of the receiver at a level of 28 dBµVemf (-85 dBm). The unwanted signal is the standard test signal I1, on the same timeslot and on same ARFCN of the wanted signal.

The SS commands the MS to establish the TCH burst-by-burst loop, see subclause 36.

21.4.3.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BER of the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.4.3.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where (i) corresponds to the case determined by the BER of the looped back bursts (table 21.4.3.5). The SS shall take 10 samples.

When $sum_{i=0..14}$(sample counter(i)) = 550 the CMI shall be changed to indicate CODEC_MODE_2, and at 1100 CMI = CODEC_MODE_3.

c) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

d) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating steps (b) and (c) until case 14 is reached.

e) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

f) Steps d) and e) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 1650.

g) The SS releases the call.

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

Maximum Duration of Test

14 minutes.

21.4.3.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$$\frac{sum_{i=0..14} ((\text{event counter}_i * 100) / \text{test limit}_i)}{sum_{i=0..14} (\text{sample counter}_i)}$$

A result of <1 is a pass, >=1 is a fail.

Table 21.4.3.5: Test criteria and limits for RXQUAL_FULL for TCH/AFS

Case (i)	BER estimated by MS/SS (all applicable bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit DTX Off (%)
0	<0.1	0, 1	18.3
1	>=0.1, <0.26	0, 1, 2	18.3
2	>=0.26, <0.3	0, 1, 2	18.3
3	>=0.3, <0.51	0, 1, 2, 3	18.3
4	>=0.51, <0.64	1, 2, 3	18.3
5	>=0.64, <1.0	1, 2, 3, 4	30.5
6	>=1.0, <1.3	2, 3, 4	30.5
7	>=1.3, <1.9	2, 3, 4, 5	30.5
8	>=1.9, <2.7	3, 4, 5	30.5
9	>=2.7, <3.8	3, 4, 5, 6	30.5
10	>=3.8, <5.4	4, 5, 6	12.2
11	>=5.4, <7.6	4, 5, 6, 7	12.2
12	>=7.6, <11.0	5, 6, 7	12.2
13	>=11.0, <15.0	5, 6, 7	12.2
14	>=15.0	6, 7	12.2

21.4.4 Signal quality under TU High propagation conditions - O-TCH/WFS

21.4.4.1 Definition

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 subclause 8.4 of 3GPP TS 05.08. The MS shall map this BER into RXQUAL values using the coding scheme defined in subclause 8.2.4 of 3GPP TS 05.08. For the full rate channel without downlink DTX, the error assessment is based on 104 TDMA frames: RXQUAL_FULL.

21.4.4.2 Conformance requirement

1. The received signal quality shall be measured by the MS and BSS 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 block; 3GPP TS 05.08 subclauses 8.2.2.

   When the quality is assessed over the full-set and sub-set of frames defined in subclause 8.4, eight levels of RXQUAL are defined and shall be mapped to the equivalent BER before channel decoding as follows:

RXQUAL_0			BER	<	0,2 %	Assumed value = 0,14 %
RXQUAL_1	0,2 %	<	BER	<	0,4 %	Assumed value = 0,28 %
RXQUAL_2	0,4 %	<	BER	<	0,8 %	Assumed value = 0,57 %
RXQUAL_3	0,8 %	<	BER	<	1,6 %	Assumed value = 1,13 %
RXQUAL_4	1,6 %	<	BER	<	3,2 %	Assumed value = 2,26 %
RXQUAL_5	3,2 %	<	BER	<	6,4 %	Assumed value = 4,53 %
RXQUAL_6	6,4 %	<	BER	<	12,8 %	Assumed value = 9,05 %
RXQUAL_7	12,8 %	<	BER			Assumed value = 18,10 %

   3GPP 05.08, subclause 8.2.4

2. For each channel, the measured parameters (RXQUAL) shall be the received signal quality, averaged on that channel over the reporting period of length one SACCH multiframe defined in subclause 8.4. In averaging, measurements made during previous reporting periods shall always be discarded; 3GPP TS 05.08, subclause 8.2.3.

21.4.4.3 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 O-TCH/WFS. The probability that the correct RXQUAL band is reported shall meet the values given by the table in 3GPP TS 05.08 subclause 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.

21.4.4.4 Method of test

21.4.4.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a O-TCH/WFS with an ARFCN in the Mid ARFCN range, power control level set to maximum power. The RADIO_LINK_TIMEOUT parameter value is set to maximum.

Specific PICS Statements:

-

PIXIT Statements:

- Loop C delay Full rate

The multirate configuration indicates the use of the following set of codecs modes:

Codec Mode	O-TCH/WFS in kbit/s
CODEC_MODE_4	23,85
CODEC_MODE_3	12,65
CODEC_MODE_2	8,85
CODEC_MODE_1	6,60

The Initial Codec Mode shall be set to the lowest codec mode (CODEC_MODE_1).

The SS sends a CMC and CMI corresponding to the lowest codec mode (CODEC_MODE_1).

The SS produces a wanted signal and an independent uncorrelated interfering (unwanted) signal, both with TUhigh propagation characteristics. The SS transmits the wanted signal (Standard Test Signal C1) on the traffic channel, with TUhigh propagation profile, at the nominal frequency of the receiver at a level of 28 dBμVemf (-85 dBm). The unwanted signal is the standard test signal I1, on the same timeslot and on same ARFCN of the wanted signal.

The SS commands the MS to establish the TCH burst-by-burst loop (C), see subclause 36.

21.4.4.4.2 Procedure

a) The SS sets the level of the unwanted signal such that the BER of the looped back bursts, averaged over the reporting period as defined in 3GPP TS 05.08, subclause 8.4, is covered by one of the cases 1 to 13 of table 21.4.4.5.

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 a sample counter(i), and then an event counter(i) for each incorrect MS reported RXQUAL level, where i corresponds to the case determined by the BER of the looped back bursts (table 21.4.4.5). The SS shall take 10 samples.

c) When $sum_{i=0..14}$(sample counter(i)) = 400 the CMI shall be changed to indicate CODEC_MODE_2, at 800 CMI = CODEC_MODE_3, and at 1200 CMI = CODEC_MODE_4.

d) If the previous RXQUAL_n >= 6 the SS shall set the unwanted signal to a level that ensures SACCH bursts will be successfully received by the MS. The SS shall wait 7 SACCH multiframe periods. The SS shall reapply the unwanted signal, then wait 1 SACCH multiframe period *[2]

e) The SS shall increase the level of the unwanted signal in small steps*[1], after each level change repeating steps (b) and (c) until case 14 is reached.

f) The SS shall decrease the level of the unwanted signal in small steps*[1], after each level change repeating step (b) and (c) until case 0 is reached.

g) Steps d) and e) should be repeated until the total number of samples, $sum_{i=0..14}$(sample counter(i)) is a minimum of 1650.

h) The SS releases the call.

*[1] NOTE: It is intended that the small steps are ~0.2dB, however the accuracy and linearity of these steps is inconsequential to the outcome of the test. It is intended that the test will be performed over a range of C/I which are representative of the normal operational range of the MS.

*[2] NOTE: This special case for poor RF conditions is intended to ensure that the RADIO_LINK_TIMEOUT does not expire. The values have been selected to guarantee a net SACCH/T FER less than 62% (effective limit before failure ~67%).

Maximum Duration of Test

14 minutes.

21.4.4.5 Test requirements

The sets of test results for sample counter (i) and event counter (i) should be combined as follows.

$sum_{i=0..14}$ ((event counter $_i$ * 100) / test limit $_i$)

----

sum $_{i=0..14}$ (sample counter $_i$)

A result of <1 is a pass, >=1 is a fail.

Table 21.4.4.5: Test criteria and limits for RXQUAL FULL errors for O-TCH/WFS

Case (i)	BER estimated by MS/SS (all applicable bursts) (%)	Expected RXQUAL (RXQUAL_)	Test limit
0	<0.1	0, 1	18.3
1	>=0.1, <0.26	0, 1, 2	18.3
2	>=0.26, <0.3	0, 1, 2	18.3
3	>=0.3, <0.51	0, 1, 2, 3	18.3
4	>=0.51, <0.64	1, 2, 3	18.3
5	>=0.64, <1.0	1, 2, 3, 4	30.5
6	>=1.0, <1.3	2, 3, 4	30.5
7	>=1.3, <1.9	2, 3, 4, 5	30.5
8	>=1.9, <2.7	3, 4, 5	30.5
9	>=2.7, <3.8	3, 4, 5, 6	30.5
10	>=3.8, <5.4	4, 5, 6	12.2
11	>=5.4, <7.6	4, 5, 6, 7	12.2
12	>=7.6, <11.0	5, 6, 7	12.2
13	>=11.0, <15.0	5, 6, 7	12.2
14	>=15.0	6, 7	12.2

21.5 to 21.7 Void

21.8 GMSK_MEAN_BEP Measurement for PDTCH

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 have been increased. The following figures have been used (static propagation conditions):

Specified error rate	Multiplication factor	Min. error events
≤ 25 %	1,22	200
30 - 40 %	1,15	300
> 40 %	1,1	400

21.8.1 Definition

The MS must be capable of measuring the MEAN_BEP parameters under static channel conditions, which is specified in terms of bit error probability (BEP) before channel decoding averaged over the four bursts in a radio block and then filtered for the measurement report. The MS has to map this filtered BEP into MEAN_BEP values in the table "MEAN_BEP mapping and accuracy for GMSK" in subclause 8.2.5 of 3GPP TS 45.008. The accuracy requirements in this table apply for static channel conditions for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS.

21.8.2 Conformance requirement

The mapping of the MEAN_BEP to the equivalent BEP and the accuracies to which an MS shall be capable of estimating the quality parameters under static channel conditions are given for EGPRS GMSK in table 21.8-1. The accuracy requirements below apply for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS, assuming no changes in transmitted downlink power. For EGPRS, filtering according to 3GPP TS 45.008 subclause 10.2.3.2.1 with forgetting factor of 0.03 is assumed.

Table 21.8-1: MEAN_BEP mapping and accuracy for EGPRS GMSK

MEAN_BEP	Range of log10(actual BEP)	Expected MEAN_BEP interval	Probability that the expected MEAN_BEP is reported shall not be lower than:
MEAN_BEP_0	> -0.60	MEAN_BEP_0/1	80 %
MEAN_BEP_1	-0.70 -- -0.60	MEAN_BEP_1/0/2	80 %
MEAN_BEP_2	-0.80 -- -0.70	MEAN_BEP_2/1/3	75 %
MEAN_BEP_3	-0.90 -- -0.80	MEAN_BEP_3/2/4	75 %
MEAN_BEP_4	-1.00 -- -0.90	MEAN_BEP_4/3/5	75 %
MEAN_BEP_5	-1.10 -- -1.00	MEAN_BEP_5/4/6	75 %
MEAN_BEP_6	-1.20 -- -1.10	MEAN_BEP_6/5/7	75 %
MEAN_BEP_7	-1.30 -- -1.20	MEAN_BEP_7/6/8	75 %
MEAN_BEP_8	-1.40 -- -1.30	MEAN_BEP_8/7/9	75 %
MEAN_BEP_9	-1.50 -- -1.40	MEAN_BEP_9/8/10	75 %
MEAN_BEP_10	-1.60 -- -1.50	MEAN_BEP_10/9/11	70 %
MEAN_BEP_11	-1.70 -- -1.60	MEAN_BEP_11/10/12	70 %
MEAN_BEP_12	-1.80 -- -1.70	MEAN_BEP_12/11/13	70 %
MEAN_BEP_13	-1.90 -- -1.80	MEAN_BEP_13/12/14	70 %
MEAN_BEP_14	-2.00 -- -1.90	MEAN_BEP_14/13/15	70 %
MEAN_BEP_15	-2.10 -- -2.00	MEAN_BEP_15/13/14/16/17	80 %
MEAN_BEP_16	-2.20 -- -2.10	MEAN_BEP_16/14/15/17/18	80 %
MEAN_BEP_17	-2.30 -- -2.20	MEAN_BEP_17/15/16/18/19	80 %
MEAN_BEP_18	-2.40 -- -2.30	MEAN_BEP_18/16/17/19/20	80 %
MEAN_BEP_19	-2.50 -- -2.40	MEAN_BEP_19/17/18/20/21	80 %
MEAN_BEP_20	-2.60 -- -2.50	MEAN_BEP_20/18/19/21/22	80 %
MEAN_BEP_21	-2.70 -- -2.60	MEAN_BEP_21/19/20/22/23	80 %
MEAN_BEP_22	-2.80 -- -2.70	MEAN_BEP_22/20/21/23/24	80 %
MEAN_BEP_23	-2.90 -- -2.80	MEAN_BEP_23/21/22/24/25	80 %
MEAN_BEP_24	-3.00 -- -2.90	MEAN_BEP_24/22/23/25/26	80 %
MEAN_BEP_25	-3.10 -- -3.00	MEAN_BEP_25/22/23/24/26/27/28	75 %
MEAN_BEP_26	-3.20 -- -3.10	MEAN_BEP_26/23/24/25/27/28/29	75 %
MEAN_BEP_27	-3.30 -- -3.20	MEAN_BEP_27/24/25/26/28/29/30	75 %
MEAN_BEP_28	-3.40 -- -3.30	MEAN_BEP_28/25/26/27/29/30/31	75 %
MEAN_BEP_29	-3.50 -- -3.40	MEAN_BEP_29/26/27/28/30/31	90 %
MEAN_BEP_30	-3.60 -- -3.50	MEAN_BEP_30/27/28/29/31	90 %
MEAN_BEP_31	< -3.60	MEAN_BEP_31/28/29/30	90 %

Reference: 3GPP TS 45.008 subclause 8.2.5.

21.8.3 Test purpose

To verify for EGPRS, under static channel conditions, that the BEP is measured and mapped to the MEAN_BEP values defined in subclause 8.2.5 of 3GPP TS 45.008 by the MS in a manner that can be related to an equivalent average BEP before channel decoding. The probability that the correct MEAN_BEP value is reported shall meet the values in the table "MEAN_BEP mapping and accuracy for GMSK" in subclause 8.2.5 of 3GPP TS 45.008.

21.8.4 Method of test

The SS compares the long-term BER average calculated by counting bit errors determined in EGPRS loop-back mode to a set of related MEAN_BEP values.

The MEAN_BEP values correspond to the same MS-received bits that are looped-back for calculation of the long-term BER average (one-phase approach). For acquiring these MEAN_BEP values, the SS periodically opens the test loop for a short period of time to poll the MS for a measurement report.

The testing of BEP accuracy is performed at 3 sample points inside the ranges given in table 21.8-2.

Table 21.8-2: MEAN_BEP GMSK test intervals

Interval	Range of log10(actual BEP)	Range of actual BEP [%]	Range of expected MEAN_BEP
High	< -3.6	< 0.025	31
Mid	-2.7 ... -2.1	0.2 ... 0.79	16 ... 21
Low	-2.0 ... -1.5	1.0 ... 3.16	10 ... 14

NOTE 1: At the beginning of the test procedure, the forgetting factor "e" is set to 0.03. It is not changed any more since the SS does not know if signalling messages are correctly received unless the MS misses the commands to open or close the loop which the SS can easily detect and which requires a retransmission.

NOTE 2: The MS is polled only after 150 radio blocks since only then the BEP contribution of the command to close the loop (which is not looped back) has decayed.

NOTE 3: For acquisition of measurement reports, the test loop has to be opened for a short period of time. During that period, no data shall be received by the MS that is used for calculating MEAN_BEP estimates.

NOTE 4: The above range of expected MEAN_BEP for intervals Mid and Low have been defined in a way that the accuracy requirements are the same for a given range.

21.8.4.1 Initial conditions

The SS produces a wanted signal and a white noise signal as an interferer (random signal) known as unwanted signal, both with static propagation characteristics. The SS transmits the wanted signal (standard test signal C1) on the PDTCH channel using the MCS-4 at the nominal frequency of the receiver and with a level of –82 dBm. The unwanted signal is the standard test signal I3, on the same nominal frequency.

The MS is EGPRS capable and in the state "idle, GMM-registered" with a P-TMSI allocated.

21.8.4.2 Procedure

a) The unwanted signal is switched off and the forgetting factor "e" is set to 0.03. The SS orders the MS into the EGPRS Switched Radio Block Loopback Mode as specified in 3GPP TS 44.014 Section 5.5.1. The SS commands the MS into Radio Block Loopback Sub-mode: OFF.

b) The SS commands the MS into Radio Block Loopback Sub-mode: ON. The SS sends 150 radio blocks to the MS. After these 150 radio blocks the SS commands the MS into Radio Block Loopback Sub-mode: OFF and polls the MS to send a measurement report. The SS starts sending data blocks with TFI not assigned to the DUT until it has received the measurement report. The SS stores the MEAN_BEP value reported by the MS and calculates (updates) the average BER of all looped back bits received so far.

c) The SS repeats the procedure described in step b) for a total of 1640 times.

d) The SS counts the number of MEAN_BEP values outside the expected MEAN_BEP interval corresponding to MEAN_BEP_31 and stores the result in error counter N_high. The BER calculation is reset.

e) The SS commands the MS into Radio Block Loopback Sub-mode: ON, switches the noise signal on and raises the level of the unwanted signal until the BER of the looped back data is between 0.25% and 0.63% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_21 and MEAN_BEP_16, respectively. During the measurements the level of the unwanted signal shall be kept constant.

f) The SS repeats the procedure described in step b) for a total of 820 times.

g) The SS determines the expected MEAN_BEP interval corresponding to the average BER of all looped back bits using table 21.8-1. The SS determines the number of MEAN_BEP values outside this interval and stores the result in error counter N_mid. The BER calculation is reset.

h) The SS commands the MS into Radio Block Loopback Sub-mode: ON and raises the level of the unwanted signal until the BER of the looped back data is between 1.26% and 2.51% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_14 and MEAN_BEP_10, respectively. During the measurements the level of the unwanted signal shall be kept constant.

i) The SS repeats the procedure described in step b) for a total of 870 times.

j) The SS determines the expected MEAN_BEP interval corresponding to the average BER of all looped back bits using table 21.8-1. The SS determines the number of MEAN_BEP values outside this interval and stores the result in error counter N_low.

Expected maximum test time for statistical error limit tests: 3h 30 min.

21.8.5 Test requirements

Testing of the conformance requirement can be done either with fixed minimum number of samples or based on the statistical test method that could lead to an early pass/fail decision with test time significantly reduced for a MS not on the limit.

21.8.5.1 Fixed limit test with minimum number of samples

The fixed testing of the conformance requirement is done using the minimum number of samples and the limit error rate given in table 21.8-3.

The number of error events determined in steps d), g) and j) stored in error counters N_high, N_mid and N_low shall not exceed the error event limit defined in table 21.8-3 for each of the error counters.

Table 21.8-3: Test criteria and error limits for MEAN_BEP_GMSK

Range	Specified error limit	Tested error limit	Number of test samples	Error event limit
High	10 %	12.2 %	1640	200
Mid	20 %	24.4 %	820	200
Low	30 %	34.5 %	870	300

21.8.5.2 Statistical test with early pass / fail decision

Specific details on statistical testing of performance are defined in Annex 7.

The calculation of the error rate for this test shall be done according to the values specified in tables 21.8-4.

Table 21.8-4: Statistical error limits for MEAN_BEP_GMSK

Range	Block per s	Org. error rate requirement	Derived test limit	Target number of samples	Target test time /s Note1	Target test time /hh:mm:ss
High	50	0,122	0,150548	2292	6875	01:54:35
Mid	50	0,244	0,301096	1146	3437	00:57:17
Low	50	0,345	0,42573	810	2431	00:40:31

Note1: Test time is based on the calculation that only every 150th radio block is used for error calculation.

21.9 8PSK_MEAN_BEP Measurement for PDTCH

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 have been increased. The following figures have been used (static propagation conditions):

Specified error rate	Multiplication factor	Min. error events
≤ 25 %	1,22	200
30 - 40 %	1,15	300
> 40 %	1,1	400

21.9.1 Definition

The MS must be capable of measuring the MEAN_BEP parameters under static channel conditions, which is specified in terms of bit error probability (BEP) before channel decoding averaged over the four bursts in a radio block and then filtered for the measurement report. The MS has to map this filtered BEP into MEAN_BEP values in the table "MEAN_BEP mapping and accuracy for 8PSK" in subclause 8.2.5 of 3GPP TS 45.008. The accuracy requirements in this table apply for static channel conditions for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS.

21.9.2 Conformance requirement

The mapping of the MEAN_BEP to the equivalent BEP and the accuracies to which an MS shall be capable of estimating the quality parameters under static channel conditions are given for EGPRS 8PSK in table 21.9-1. The accuracy requirements below apply for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS, assuming no changes in transmitted downlink power. For EGPRS, filtering according to 3GPP TS 45.008 subclause 10.2.3.2.1 with forgetting factor of 0.03 is assumed.

Table 21.9-1: MEAN_BEP mapping and accuracy for EGPRS 8PSK

MEAN_BEP	Range of log10(actual BEP)	Expected MEAN_BEP interval	Probability that the expected MEAN_BEP is reported shall not be lower than:
MEAN_BEP_0	> -0.60	MEAN_BEP_0/1/2	85 %
MEAN_BEP_1	-0.64 -- -0.60	MEAN_BEP_1/0/2/3	85 %
MEAN_BEP_2	-0.68 -- -0.64	MEAN_BEP_2/0/1/3/4	85 %
MEAN_BEP_3	-0.72 -- -0.68	MEAN_BEP_3/1/2/4/5	85 %
MEAN_BEP_4	-0.76 -- -0.72	MEAN_BEP_4/2/3/5/6	85 %
MEAN_BEP_5	-0.80 -- -0.76	MEAN_BEP_5/3/4/6/7	85 %
MEAN_BEP_6	-0.84 -- -0.80	MEAN_BEP_6/4/5/7/8	85 %
MEAN_BEP_7	-0.88 -- -0.84	MEAN_BEP_7/5/6/8/9	85 %
MEAN_BEP_8	-0.92 -- -0.88	MEAN_BEP_8/6/7/9/10	80 %
MEAN_BEP_9	-0.96 -- -0.92	MEAN_BEP_9/7/8/10/11	80 %
MEAN_BEP_10	-1.00 -- -0.96	MEAN_BEP_10/8/9/11/12	80 %
MEAN_BEP_11	-1.04 -- -1.00	MEAN_BEP_11/9/10/12/13	80 %
MEAN_BEP_12	-1.08 -- -1.04	MEAN_BEP_12/10/11/13/14	80 %
MEAN_BEP_13	-1.12 -- -1.08	MEAN_BEP_13/11/12/14/15	80 %
MEAN_BEP_14	-1.16 -- -1.12	MEAN_BEP_14/12/13/15/16	85 %
MEAN_BEP_15	-1.20 -- -1.16	MEAN_BEP_15/13/14/16	85 %
MEAN_BEP_16	-1.36 -- -1.20	MEAN_BEP_16/14/15/17	85 %
MEAN_BEP_17	-1.52 -- -1.36	MEAN_BEP_17/16/18	95 %
MEAN_BEP_18	-1.68 -- -1.52	MEAN_BEP_18/17/19	95 %
MEAN_BEP_19	-1.84 -- -1.68	MEAN_BEP_19/18/20	95 %
MEAN_BEP_20	-2.00 -- -1.84	MEAN_BEP_20/19/21	95 %
MEAN_BEP_21	-2.16 -- -2.00	MEAN_BEP_21/20/22	85 %
MEAN_BEP_22	-2.32 -- -2.16	MEAN_BEP_22/21/23	85 %
MEAN_BEP_23	-2.48 -- -2.32	MEAN_BEP_23/22/24	85 %
MEAN_BEP_24	-2.64 -- -2.48	MEAN_BEP_24/23/25	85 %
MEAN_BEP_25	-2.80 -- -2.64	MEAN_BEP_25/23/24/26/27	85 %
MEAN_BEP_26	-2.96 -- -2.80	MEAN_BEP_26/24/25/27/28	85 %
MEAN_BEP_27	-3.12 -- -2.96	MEAN_BEP_27/25/26/28/29	80 %
MEAN_BEP_28	-3.28 -- -3.12	MEAN_BEP_28/26/27/29/30	80 %
MEAN_BEP_29	-3.44 -- -3.28	MEAN_BEP_29/27/28/30/31	80 %
MEAN_BEP_30	-3.60 -- -3.44	MEAN_BEP_30/28/29/31	90 %
MEAN_BEP_31	< -3.60	MEAN_BEP_31/29/30	90 %

Reference: 3GPP TS 45.008 subclause 8.2.5.

21.9.3 Test purpose

To verify for EGPRS, under static channel conditions, that the BEP is measured and mapped to the MEAN_BEP values defined in subclause 8.2.5 of 3GPP TS 45.008 by the MS in a manner that can be related to an equivalent average BEP before channel decoding. The probability that the correct MEAN_BEP value is reported shall meet the values in the table "MEAN_BEP mapping and accuracy for 8PSK" in subclause 8.2.5 of 3GPP TS 45.008.

21.9.4 Method of test

The SS compares the long-term BER average calculated by counting bit errors determined in EGPRS loop-back mode to a set of related MEAN_BEP values.

The MEAN_BEP values correspond to the same MS-received bits that are looped-back for calculation of the long-term BER average (one-phase approach). For acquiring these MEAN_BEP values, the SS periodically opens the test loop for a short period of time to poll the MS for a measurement report.

The testing of BEP accuracy is performed at 3 sample points inside the ranges given in table 21.9-2.

Table 21.9-2: MEAN_BEP 8PSK test intervals

Interval	Range of log10(actual BEP)	Range of actual BEP [%]	Range of expected MEAN_BEP
High	< -3.6	< 0.025	31
Mid	-2.0 ... -1.36	1.0 ... 4.37	17 ... 20
Low	-1.12 ... -0.88	7.59 ... 13.2	8 ... 13

NOTE 1: At the beginning of the test procedure, the forgetting factor “e” is set to 0.03. It is not changed any more since the SS does not know if signalling messages are correctly received unless the MS misses the commands to open or close the loop which the SS can easily detect and which requires a retransmission.

NOTE 2: The MS is polled only after 150 radio blocks since only then the BEP contribution of the command to close the loop (which is not looped back) has decayed.

NOTE 3: For acquisition of measurement reports, the test loop has to be opened for a short period of time. During that period, no data shall be received by the MS that is used for calculating MEAN_BEP estimates.

NOTE 4: The above range of expected MEAN_BEP for intervals Mid and Low have been defined in a way that the accuracy requirements are the same for a given range.

21.9.4.1 Initial conditions

The SS produces a wanted signal and a white noise signal as an interferer (random signal) known as unwanted signal, both with static propagation characteristics. The SS transmits the wanted signal (standard test signal C1) on the PDTCH channel using the MCS-9 at the nominal frequency of the receiver and with a level of –82 dBm. The unwanted signal is the standard test signal I3, on the same nominal frequency.

The MS is EGPRS capable and in the state "idle, GMM-registered" with a P-TMSI allocated.

21.9.4.2 Procedure

a) The unwanted signal is switched off and the forgetting factor “e” is set to 0.03. The SS orders the MS into the EGPRS Switched Radio Block Loopback Mode as specified in 3GPP TS 44.014 Section 5.5.1. The SS commands the MS into Radio Block Loopback Sub-mode: OFF.

b) The SS commands the MS into Radio Block Loopback Sub-mode: ON. The SS sends 150 radio blocks to the MS. After these 150 radio blocks the SS commands the MS into Radio Block Loopback Sub-mode: OFF and polls the MS to send a measurement report. The SS starts sending data blocks with TFI not assigned to the DUT until it has received the measurement report. The SS stores the MEAN_BEP value reported by the MS and calculates (updates) the average BER of all looped back bits received so far.

c) The SS repeats the procedure described in step b) for a total of 1640 times.

d) The SS counts the number of MEAN_BEP values outside the expected MEAN_BEP interval corresponding to MEAN_BEP_31 and stores the result in error counter N_high. The BER calculation is reset.

e) The SS commands the MS into Radio Block Loopback Sub-mode: ON, switches the noise signal on and raises the level of the unwanted signal until the BER of the looped back data is between 1.4% and 3% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_20 and MEAN_BEP_17, respectively. During the measurements the level of the unwanted signal shall be kept constant.

f) The SS repeats the procedure described in step b) for a total of 3279 times.

g) The SS determines the expected MEAN_BEP interval corresponding to the average BER of all looped back bits using table 21.9-1. The SS determines the number of MEAN_BEP values outside this interval and stores the result in error counter N_mid. The BER calculation is reset.

h) The SS commands the MS into Radio Block Loopback Sub-mode: ON and raises the level of the unwanted signal until the BER of the looped back data is between 8.3% and 12% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_13 and MEAN_BEP_8, respectively. During the measurements the level of the unwanted signal shall be kept constant.

i) The SS repeats the procedure described in step b) for a total of 820 times.

j) The SS determines the expected MEAN_BEP interval corresponding to the average BER of all looped back bits using table 21.9-1. The SS determines the number of MEAN_BEP values outside this interval and stores the result in error counter N_low.

Expected maximum test time for statistical error limit tests: 6h 40 min.

21.9.5 Test requirements

Testing of the conformance requirement can be done either with fixed minimum number of samples or based on the statistical test method that could lead to an early pass/fail decision with test time significantly reduced for a MS not on the limit.

21.9.5.1 Fixed limit test with minimum number of samples

The fixed testing of the conformance requirement is done using the minimum number of samples and the limit error rate given in table 21.9-3.

The number of error events determined in steps d), g) and j) stored in error counters N_high, N_mid and N_low shall not exceed 200 for each of the error counters.

Table 21.9-3: Test criteria and error limits for MEAN_BEP_8PSK

Range	Specified error limit	Tested error limit	Number of test samples	Error event limit
High	10 %	12.2 %	1640	200
Mid	5 %	6.1 %	3279	200
Low	20 %	24.4 %	820	200

21.9.5.2 Statistical test with early pass / fail decision

Specific details on statistical testing of performance are defined in Annex 7.

The calculation of the error rate for this test shall be done according to the values specified in tables 21.8-4.

Table 21.9-4: Statistical error limits for MEAN_BEP_8PSK

Range	Block per s	Org. error rate requirement	Derived test limit	Target number of samples	Target test time /s Note1	Target test time /hh:mm:ss
High	50	0,122	0,150548	2292	6875	01:54:35
Mid	50	0,061	0,075274	4583	13750	03:49:10
Low	50	0,244	0,301096	1146	3437	00:57:17

NOTE 1: Test time is based on the calculation that only every 150th radio block is used for error calculation.

21.10 Measurement accuracy for inter-RAT system (TDD)

21.10.1 1,28Mcps TDD Option

21.10.1.1 1.28Mcps TDD / P-CCPCH RSCP Measurement absolute accuracy in AWGN propagation condition

21.10.1.1.1 Definition

The P-CCPCH_RSCP measurement absolute accuracy in GSM(GPRS) cell is defined as the P-CCPCH_RSCP measured from UE in GSM(GPRS) cell compared to the actual neighbor TD-SCDMA cell P-CCPCH_RSCP.

21.10.1.1.2 Minimum Requirements

The accuracy requirements in Table 21.10.1.1.2-1 are valid under the following conditions:

P-CCPCH RSCP ≥ -102 dBm

P-CCPCH Ec/Io ≥ -8 dB

DwPCH_Ec/Io ≥ -5 dB

Table 21.10.1.1.2-1: P-CCPCH_RSCP absolute accuracy

Parameter	Unit	Accuracy [dB]		Conditions
		Normal condition	Extreme condition	Io [dBm/ 1.28 MHz]
P-CCPCH_RSCP	dBm	± 6	± 9	-94...-70
	dBm	± 8	± 11	-70...-50

The rate of correct measurements observed during repeated tests shall be at least 90%.

The normative reference for this requirement is TS 45.008 clauses 8.1.5.2.

21.10.1.1.3 Test Purpose

The purpose of this test is to verify that the relative P-CCPCH RSCP measurement accuracy is within the specified limits.

21.10.1.1.4 Method of test

21.10.1.1.4.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; see TS 34.122 clauses G.2.1 and G.2.2.

Frequencies to be tested: mid range; see TS 34.122 clause G.2.4.

Cell 1 is a GSM cell and cell 2 is a UTRA TDD cell. In the measurement information message it is indicated to the UE that periodic reporting of the UTRA TDD *PCCPCH RSCP* measurement is used.

Table 21.10.1.1.4.1-1 Cell 1 GSM cell test parameters

Parameter	Unit	Test 1	Test 2	Test 3
UTRA RF Channel	2			
Cell Level	dBm/200KHz	-70		

Table 21.10.1.1.4.1-2: P-CCPCH RSCP test parameters

		Test 1	
Parameter	**Unit**	**Cell 2**	
Timeslot Number		**0**	**DwPTS**
UTRA RF Channel Number		Channel 1	
PCCPCH_Ec/Ior	dB	-3	
DwPCH_Ec/Ior	dB		0
OCNS_Ec/Ior	dB	-3	
$\hat{I}_{or}/I_{oc}$	dB	5	
I_{oc}	dBm/ 1.28 MHz	-75.2	
PCCPCH RSCP, Note 1	dBm	-73.2	
Io, Note 1	dBm/ 1.28 MHz	-69	
Propagation condition		AWGN	
		Test 2	
Parameter	**Unit**	**Cell 2**	
Timeslot Number		**0**	**DwPTS**
UTRA RF Channel Number		Channel 1	
PCCPCH_Ec/Ior	dB	-3	
DwPCH_Ec/Ior	dB		0
OCNS_Ec/Ior	dB	-3	
$\hat{I}_{or}/I_{oc}$	dB	2	
I_{oc}	dBm/ 1.28 MHz	-54.1	
PCCPCH RSCP, Note 1	dBm	-55.1	
Io, Note 1	dBm/ 1.28 MHz	-50	
Propagation condition		AWGN	
		Test 3	
Parameter	**Unit**	**Cell 2**	
Timeslot Number		**0**	**DwPTS**
UTRA RF Channel Number		Channel 1	
PCCPCH_Ec/Ior	dB	-3	
DwPCH_Ec/Ior	dB		0
OCNS_Ec/Ior	dB	-3	
$\hat{I}_{or}/I_{oc}$	dB	0	
I_{oc}	dBm/ 1.28 MHz	-97	
PCCPCH RSCP, Note 1	dBm	-100	
Io, Note 1	dBm/ 1.28 MHz	-94	
Propagation condition		AWGN	
Note 1: PCCPCH RSCP and Io levels have been calculated from other parameters for information purposes. They are not settable parameters themselves.			

21.10.1.1.4.2 Procedure

1) Initial cell configured according to table 21.10.1.1.4.1-1 and table 21.10.1.1.4.1-2 a call is set up on cell1.

2) SS shall transmit MEASUREMENT INFORMATION message to indicate cell 2 neighbor cell description information based on table 21.10.1.1.4.1-2.

3) UE shall transmit periodically MEASUREMENT REPORT messages.

4) SS shall check PCCPCH_RSCP value of Cell 2 in MEASUREMENT REPORT messages.

5) The result of step 3) is compared to actual power level of PCCPCH RSCP of Cell 2.

6) SS shall count number of MEASUREMENT REPORT messages transmitted by UE. After 1000 MEASUREMENT REPORT messages have been received from UE, the RF parameters are set up according to table 21.10.1.1.4.1-1 and table 21.10.1.1.4.1-2 for Test 2. While RF parameters are being set up, MEASUREMENT REPORT messages from UE are ignored. SS shall wait for additional 1s and ignore the MEASUREMENT REPORT messages during this period. Then, steps 4) and 5) above are repeated.

7) SS shall count number of MEASUREMENT REPORT messages transmitted by UE. After 1000 MEASUREMENT REPORT messages have been received from UE, the RF parameters are set up according to table 21.10.1.1.4.1-1 and table 21.10.1.1.4.1-2 for Test 3. While RF parameters are being set up, MEASUREMENT REPORT messages from UE are ignored. SS shall wait for additional 1s and ignore the MEASUREMENT REPORT messages during this period. Then, steps 4) and 5) above are repeated.

8) After further 1000 MEASUREMENT REPORT messages have been received from UE, the SS shall transmit CHANNEL RELEASE message.

21.10.1.1.5 Test requirements

The P-CCPCH RSCP measurement accuracy shall meet the minimum requirements in clause 21.10.1.1.2 for at least 900 of the 1000 measurement reports in step 4.

NOTE: If the above Test Requirements differ from the Minimum Requirement, then the Test Tolerance applied for this test is non-zero. The Test Tolerance for this test is defined in 34.122 clause F.2 and the explanation of how the Minimum Requirement has been relaxed by the Test Tolerance is given in 34.122 clause F.4.

21.11a MEAN_BEP 16-QAM in EGPRS2-A Configuration

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 have been increased. The following figures have been used (static propagation conditions):

Specified error rate	Multiplication factor	Min. error events
≤ 25 % 30 - 40 % > 40 %	1,22 1,15 1,1	200 300 400

21.11a.1 Definition

The MS must be capable of measuring the MEAN_BEP parameters under static channel conditions, which is specified in terms of bit error probability (BEP) before channel decoding averaged over the four bursts in a radio block and then filtered for the measurement report. The MS has to map this filtered BEP into MEAN_BEP values in the table "MEAN_BEP mapping and accuracy for 16-QAM (EGPRS2-A and EGPRS2-B)" in subclause 10.2.3.3 of 3GPP TS 45.008. The accuracy requirements in this table apply for static channel conditions for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS.

21.11a.2 Conformance requirement

The mapping of the MEAN_BEP to the equivalent BEP and the accuracies to which an MS shall be capable of estimating the quality parameters under static channel conditions are given for EGPRS2-A 16-QAM in table 21.11a-1. The accuracy requirements below apply for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS, assuming no changes in transmitted downlink power. The requirements apply for PDTCH/F in *A/Gb mode*, and the estimated values are averaged applying filtering according to subclause 10.2.3.2.1 with forgetting factor of 0.03.

Table 21.11a-1: MEAN_BEP mapping and accuracy for EGPRS2-A 16-QAM

MEAN_BEP	Range of log10(actual BEP)	Expected MEAN_BEP interval	Probability that the expected MEAN_BEP for EGPRS2-A is reported shall not be lower than see:
MEAN_BEP_0	[> -0.60]	MEAN_BEP_0/1/2	90 %
MEAN_BEP_1	[-0.64 -- -0.60]	MEAN_BEP_1/0/2/3	90 %
MEAN_BEP_2	[-0.68 -- -0.64]	MEAN_BEP_2/0/1/3/4	90 %
MEAN_BEP_3	[-0.72 -- -0.68]	MEAN_BEP_3/1/2/4/5	90 %
MEAN_BEP_4	[-0.76 -- -0.72]	MEAN_BEP_4/2/3/5/6	90 %
MEAN_BEP_5	[-0.80 -- -0.76]	MEAN_BEP_5/3/4/6/7	90 %
MEAN_BEP_6	[-0.84 -- -0.80]	MEAN_BEP_6/4/5/7/8	90 %
MEAN_BEP_7	[-0.88 -- -0.84]	MEAN_BEP_7/5/6/8/9	90 %
MEAN_BEP_8	[-0.92 -- -0.88]	MEAN_BEP_8/6/7/9/10	90 %
MEAN_BEP_9	[-0.96 -- -0.92]	MEAN_BEP_9/7/8/10/11	90 %
MEAN_BEP_10	[-1.00 -- -0.96]	MEAN_BEP_10/8/9/11/12	90 %
MEAN_BEP_11	[-1.04 -- -1.00]	MEAN_BEP_11/9/10/12/13	90 %
MEAN_BEP_12	[-1.08 -- -1.04]	MEAN_BEP_12/10/11/13/14	90 %
MEAN_BEP_13	[-1.12 -- -1.08]	MEAN_BEP_13/11/12/14/15	90 %
MEAN_BEP_14	[-1.16 -- -1.12]	MEAN_BEP_14/12/13/15/16	90 %
MEAN_BEP_15	[-1.20 -- -1.16]	MEAN_BEP_15/13/14/16	90 %
MEAN_BEP_16	[-1.36 -- -1.20]	MEAN_BEP_16/14/15/17	90 %
MEAN_BEP_17	[-1.52 -- -1.36]	MEAN_BEP_17/16/18	90 %
MEAN_BEP_18	[-1.68 -- -1.52]	MEAN_BEP_18/17/19	90 %
MEAN_BEP_19	[-1.84 -- -1.68]	MEAN_BEP_19/18/20	90 %
MEAN_BEP_20	[-2.00 -- -1.84]	MEAN_BEP_20/19/21	90 %
MEAN_BEP_21	[-2.16 -- -2.00]	MEAN_BEP_21/20/22	90 %
MEAN_BEP_22	[-2.32 -- -2.16]	MEAN_BEP_22/21/23	90 %
MEAN_BEP_23	[-2.48 -- -2.32]	MEAN_BEP_23/22/24	90 %
MEAN_BEP_24	[-2.64 -- -2.48]	MEAN_BEP_24/23/25	90 %
MEAN_BEP_25	[-2.80 -- -2.64]	MEAN_BEP_25/23/24/26/27	90 %
MEAN_BEP_26	[-2.96 -- -2.80]	MEAN_BEP_26/24/25/27/28	90 %
MEAN_BEP_27	[-3.12 -- -2.96]	MEAN_BEP_27/25/26/28/29	90 %
MEAN_BEP_28	[-3.28 -- -3.12]	MEAN_BEP_28/26/27/29/30	90 %
MEAN_BEP_29	[-3.44 -- -3.28]	MEAN_BEP_29/27/28/30/31	90 %
MEAN_BEP_30	[-3.60 -- -3.44]	MEAN_BEP_30/28/29/31	90 %
MEAN_BEP_31	[< -3.60]	MEAN_BEP_31/29/30	90 %

Reference: 3GPP TS 45.008 subclause 10.2.3.3.

21.11a.3 Test purpose

To verify for EGPRS2-A, under static channel conditions, that the BEP is measured and mapped to the MEAN_BEP values defined in subclause10.2.3.3 of 3GPP TS 45.008 by the MS in a manner that can be related to an equivalent average BEP before channel decoding. The probability that the correct MEAN_BEP value is reported shall meet the values in the table "MEAN_BEP mapping and accuracy for 16-QAM" in subclause 10.2.3.3 of 3GPP TS 45.008.

21.11a.4 Method of test

The SS compares the long-term BER average calculated by counting bit errors determined in EGPRS loop-back mode to a set of related MEAN_BEP values.

The MEAN_BEP values correspond to the same MS-received bits that are looped-back for calculation of the long-term BER average (one-phase approach). For acquiring these MEAN_BEP values, the SS periodically opens the test loop for a short period of time to poll the MS for a measurement report.

The testing of BEP accuracy is performed at 3 sample points inside the ranges given in table 21.11a-2.

Table 21.11a-2: MEAN_BEP 16-QAM test intervals

Interval	Range of log10(actual BEP)	Range of actual BEP [%]	Range of expected MEAN_BEP
High	< -3.6	< 0.025	31
Mid	-2.0 ... -1.36	1.0 ... 4.37	17 ... 20
Low	-1.12 ... -0.88	7.59 ... 13.2	8 ... 13

NOTE 1: At the beginning of the test procedure, the forgetting factor “e” is set to 0.03. It is not changed any more since the SS does not know if signalling messages are correctly received unless the MS misses the commands to open or close the loop which the SS can easily detect and which requires a retransmission.

NOTE 2: The MS is polled only after 150 radio blocks since only then the BEP contribution of the command to close the loop (which is not looped back) has decayed.

NOTE 3: For acquisition of measurement reports, the test loop has to be opened for a short period of time. During that period, no data shall be received by the MS that is used for calculating MEAN_BEP estimates.

NOTE 4: The above range of expected MEAN_BEP for intervals Mid and Low have been defined in a way that the accuracy requirements are the same for a given range.

21.11a.4.1 Initial conditions

The SS produces a wanted signal and a white noise signal as an interferer (random signal) known as unwanted signal, both with static propagation characteristics. The SS transmits the wanted signal (standard test signal C1) on the PDTCH channel using the DAS-5-DAS-12 at the nominal frequency of the receiver and with a level of –82 dBm. The unwanted signal is the standard test signal I3, on the same nominal frequency.

The MS is EGPRS2-A capable and in the state "idle, GMM-registered" with a P-TMSI allocated.

21.11a.4.2 Procedure

a) The unwanted signal is switched off and the forgetting factor “e” is set to 0.03. The SS orders the MS into the EGPRS2-A Switched Radio Block Loopback Mode as specified in 3GPP TS 44.014 Section 5.5.6. The SS commands the MS into Radio Block Loopback Sub-mode: OFF.

b) The SS commands the MS into Radio Block Loopback Sub-mode: ON. The SS sends 150 radio blocks to the MS. After these 150 radio blocks the SS commands the MS into Radio Block Loopback Sub-mode: OFF and polls the MS to send a measurement report. The SS starts sending data blocks with TFI not assigned to the DUT until it has received the measurement report. The SS stores the MEAN_BEP value reported by the MS and calculates (updates) the average BER of all looped back bits received so far.

c) The SS repeats the procedure described in step b) for a total of 1640 times.

d) The SS counts the number of MEAN_BEP values outside the expected MEAN_BEP interval corresponding to MEAN_BEP_31 and stores the result in error counter N_high. The BER calculation is reset.

e) The SS commands the MS into Radio Block Loopback Sub-mode: ON, switches the noise signal on and raises the level of the unwanted signal until the BER of the looped back data is between 1.4% and 3% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_20 and MEAN_BEP_17, respectively. During the measurements the level of the unwanted signal shall be kept constant.

f) The SS repeats the procedure described in step b) for a total of 1640 times.

g) The SS determines the expected MEAN_BEP interval corresponding to the average BER of all looped back bits using table 21.11a-1. The SS determines the number of MEAN_BEP values outside this interval and stores the result in error counter N_mid. The BER calculation is reset.

h) The SS commands the MS into Radio Block Loopback Sub-mode: ON and raises the level of the unwanted signal until the BER of the looped back data is between 8.3% and 12% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_13 and MEAN_BEP_8, respectively. During the measurements the level of the unwanted signal shall be kept constant.

i) The SS repeats the procedure described in step b) for a total of 1640 times.

j) The SS determines the expected MEAN_BEP interval corresponding to the average BER of all looped back bits using table 21.11a-1. The SS determines the number of MEAN_BEP values outside this interval and stores the result in error counter N_low.

Expected maximum test time for statistical error limit tests: 5h 45 min.

21.11a.5 Test requirements

Testing of the conformance requirement can be done either with fixed minimum number of samples or based on the statistical test method that could lead to an early pass/fail decision with test time significantly reduced for a MS not on the limit.

21.11a.5.1 Fixed limit test with minimum number of samples

The fixed testing of the conformance requirement is done using the minimum number of samples and the limit error rate given in table 21.11a-3.

The number of error events determined in steps d), g) and j) stored in error counters N_high, N_mid and N_low shall not exceed the error event limit as defined in Table 21.11a-3 for each of the error counters.

Table 21.11a-3: Test criteria and error limits for MEAN_BEP_16-QAM

Range	Specified error limit	Tested error limit	Number of test samples	Error event limit
High	10 %	12.2 %	1640	200
Mid	10 %	12.2 %	1640	200
Low	10 %	12.2 %	1640	200

21.11a.5.2 Statistical test with early pass / fail decision

Specific details on statistical testing of performance are defined in Annex 7.

The calculation of the error rate for this test shall be done according to the values specified in tables 21.11a-4.

Table 21.11a-4: Statistical error limits for MEAN_BEP_16-QAM

Range	Block per s	Org. error rate requirement	Derived test limit	Target number of samples	Target test time /s (Note)	Target test time /hh:mm:ss
High	50	0,122	0,150548	2292	6875	01:54:35
Mid	50	0,122	0,150548	2292	6875	01:54:35
Low	50	0,122	0,150548	2292	6875	01:54:35
NOTE: Test time is based on the calculation that only every 150th radio block is used for error calculation.						

21.12a MEAN_BEP 32-QAM in EGPRS2-A Configuration

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 have been increased. The following figures have been used (static propagation conditions):

Specified error rate	Multiplication factor	Min. error events
≤ 25 %	1,22	200
30 - 40 %	1,15	300
> 40 %	1,1	400

21.12a.1 Definition

The MS must be capable of measuring the MEAN_BEP parameters under static channel conditions, which is specified in terms of bit error probability (BEP) before channel decoding averaged over the four bursts in a radio block and then filtered for the measurement report. The MS has to map this filtered BEP into MEAN_BEP values in the table "MEAN_BEP mapping and accuracy for 32-QAM (EGPRS2-A and EGPRS2-B)" in subclause 10.2.3.3 of 3GPP TS

45.008. The accuracy requirements in this table apply for static channel conditions for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS.

21.12a.2 Conformance requirement

The mapping of the MEAN_BEP to the equivalent BEP and the accuracies to which an MS shall be capable of estimating the quality parameters under static channel conditions are given for EGPRS2-A 32-QAM in table 21.12a-1. The accuracy requirements below apply for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS, assuming no changes in transmitted downlink power. The requirements apply for PDTCH/F in *A/Gb mode*, and the estimated values are averaged applying filtering according to subclause 10.2.3.2.1 with forgetting factor of 0.03.

Table 21.12a-1: MEAN_BEP mapping and accuracy for EGPRS2-A 32-QAM

MEAN_BEP	Range of log10(actual BEP)	Expected MEAN_BEP interval	Probability that the expected MEAN_BEP for EGPRS2-A is reported shall not be lower than:
MEAN_BEP_0	[> -0.60]	MEAN_BEP_0/1/2	90 %
MEAN_BEP_1	[-0.64 -- -0.60]	MEAN_BEP_1/0/2/3	90 %
MEAN_BEP_2	[-0.68 -- -0.64]	MEAN_BEP_2/0/1/3/4	90 %
MEAN_BEP_3	[-0.72 -- -0.68]	MEAN_BEP_3/1/2/4/5	90 %
MEAN_BEP_4	[-0.76 -- -0.72]	MEAN_BEP_4/2/3/5/6	90 %
MEAN_BEP_5	[-0.80 -- -0.76]	MEAN_BEP_5/3/4/6/7	90 %
MEAN_BEP_6	[-0.84 -- -0.80]	MEAN_BEP_6/4/5/7/8	90 %
MEAN_BEP_7	[-0.88 -- -0.84]	MEAN_BEP_7/5/6/8/9	90 %
MEAN_BEP_8	[-0.92 -- -0.88]	MEAN_BEP_8/6/7/9/10	90 %
MEAN_BEP_9	[-0.96 -- -0.92]	MEAN_BEP_9/7/8/10/11	90 %
MEAN_BEP_10	[-1.00 -- -0.96]	MEAN_BEP_10/8/9/11/12	90 %
MEAN_BEP_11	[-1.04 -- -1.00]	MEAN_BEP_11/9/10/12/13	90 %
MEAN_BEP_12	[-1.08 -- -1.04]	MEAN_BEP_12/10/11/13/14	90 %
MEAN_BEP_13	[-1.12 -- -1.08]	MEAN_BEP_13/11/12/14/15	90 %
MEAN_BEP_14	[-1.16 -- -1.12]	MEAN_BEP_14/12/13/15/16	90 %
MEAN_BEP_15	[-1.20 -- -1.16]	MEAN_BEP_15/13/14/16	90 %
MEAN_BEP_16	[-1.36 -- -1.20]	MEAN_BEP_16/14/15/17	90 %
MEAN_BEP_17	[-1.52 -- -1.36]	MEAN_BEP_17/16/18	90 %
MEAN_BEP_18	[-1.68 -- -1.52]	MEAN_BEP_18/17/19	90 %
MEAN_BEP_19	[-1.84 -- -1.68]	MEAN_BEP_19/18/20	90 %
MEAN_BEP_20	[-2.00 -- -1.84]	MEAN_BEP_20/19/21	90 %
MEAN_BEP_21	[-2.16 -- -2.00]	MEAN_BEP_21/20/22	90 %
MEAN_BEP_22	[-2.32 -- -2.16]	MEAN_BEP_22/21/23	90 %
MEAN_BEP_23	[-2.48 -- -2.32]	MEAN_BEP_23/22/24	90 %
MEAN_BEP_24	[-2.64 -- -2.48]	MEAN_BEP_24/23/25	90 %
MEAN_BEP_25	[-2.80 -- -2.64]	MEAN_BEP_25/23/24/26/27	90 %
MEAN_BEP_26	[-2.96 -- -2.80]	MEAN_BEP_26/24/25/27/28	90 %
MEAN_BEP_27	[-3.12 -- -2.96]	MEAN_BEP_27/25/26/28/29	90 %
MEAN_BEP_28	[-3.28 -- -3.12]	MEAN_BEP_28/26/27/29/30	90 %
MEAN_BEP_29	[-3.44 -- -3.28]	MEAN_BEP_29/27/28/30/31	90 %
MEAN_BEP_30	[-3.60 -- -3.44]	MEAN_BEP_30/28/29/31	90 %
MEAN_BEP_31	[< -3.60]	MEAN_BEP_31/29/30	90 %

Reference: 3GPP TS 45.008 subclause 10.2.3.3.

21.12a.3 Test purpose

To verify for EGPRS2-A, under static channel conditions, that the BEP is measured and mapped to the MEAN_BEP values defined in subclause10.2.3.3 of 3GPP TS 45.008 by the MS in a manner that can be related to an equivalent average BEP before channel decoding. The probability that the correct MEAN_BEP value is reported shall meet the values in the table “MEAN_BEP mapping and accuracy for 32-QAM” in subclause 10.2.3.3 of 3GPP TS 45.008.

21.12a.4 Method of test

The SS compares the long-term BER average calculated by counting bit errors determined in EGPRS2-A loop-back mode to a set of related MEAN_BEP values.

The MEAN_BEP values correspond to the same MS-received bits that are looped-back for calculation of the long-term BER average (one-phase approach). For acquiring these MEAN_BEP values, the SS periodically opens the test loop for a short period of time to poll the MS for a measurement report.

The testing of BEP accuracy is performed at 3 sample points inside the ranges given in table 21.12a-2.

Table 21.12a-2: MEAN_BEP 32-QAM test intervals

Interval	Range of log10(actual BEP)	Range of actual BEP [%]	Range of expected MEAN_BEP
High	< -3.6	< 0.025	31
Mid	-2.0 ... -1.36	1.0 ... 4.37	17 ... 20
Low	-1.12 ... -0.88	7.59 ... 13.2	8 ... 13

NOTE 1: At the beginning of the test procedure, the forgetting factor “e” is set to 0.03. It is not changed any more since the SS does not know if signalling messages are correctly received unless the MS misses the commands to open or close the loop which the SS can easily detect and which requires a retransmission.

NOTE 2: The MS is polled only after 150 radio blocks since only then the BEP contribution of the command to close the loop (which is not looped back) has decayed.

NOTE 3: For acquisition of measurement reports, the test loop has to be opened for a short period of time. During that period, no data shall be received by the MS that is used for calculating MEAN_BEP estimates.

NOTE 4: The above range of expected MEAN_BEP for intervals Mid and Low have been defined in a way that the accuracy requirements are the same for a given range.

21.12a.4.1 Initial conditions

The SS produces a wanted signal and a white noise signal as an interferer (random signal) known as unwanted signal, both with static propagation characteristics. The SS transmits the wanted signal (standard test signal C1) on the PDTCH channel using the DAS-5-DAS-12 at the nominal frequency of the receiver and with a level of –82 dBm. The unwanted signal is the standard test signal I3, on the same nominal frequency.

The MS is EGPRS2-A capable and in the state "idle, GMM-registered" with a P-TMSI allocated.

21.12a.4.2 Procedure

a) The unwanted signal is switched off and the forgetting factor “e” is set to 0.03. The SS orders the MS into the EGPRS2-A Switched Radio Block Loopback Mode as specified in 3GPP TS 44.014 Section 5.5.6. The SS commands the MS into Radio Block Loopback Sub-mode: OFF.

b) The SS commands the MS into Radio Block Loopback Sub-mode: ON. The SS sends 150 radio blocks to the MS. After these 150 radio blocks the SS commands the MS into Radio Block Loopback Sub-mode: OFF and polls the MS to send a measurement report. The SS starts sending data blocks with TFI not assigned to the DUT until it has received the measurement report. The SS stores the MEAN_BEP value reported by the MS and calculates (updates) the average BER of all looped back bits received so far.

c) The SS repeats the procedure described in step b) for a total of 1640 times.

d) The SS counts the number of MEAN_BEP values outside the expected MEAN_BEP interval corresponding to MEAN_BEP_31 and stores the result in error counter N_high. The BER calculation is reset.

e) The SS commands the MS into Radio Block Loopback Sub-mode: ON, switches the noise signal on and raises the level of the unwanted signal until the BER of the looped back data is between 1.4% and 3% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_20 and MEAN_BEP_17, respectively. During the measurements the level of the unwanted signal shall be kept constant.

f) The SS repeats the procedure described in step b) for a total of 1640 times.

g) The SS determines the expected MEAN_BEP interval corresponding to the average BER of all looped back bits using table 21.11a-1. The SS determines the number of MEAN_BEP values outside this interval and stores the result in error counter N_mid. The BER calculation is reset.

h) The SS commands the MS into Radio Block Loopback Sub-mode: ON and raises the level of the unwanted signal until the BER of the looped back data is between 8.3% and 12% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_13 and MEAN_BEP_8, respectively. During the measurements the level of the unwanted signal shall be kept constant.

i) The SS repeats the procedure described in step b) for a total of 1640 times.

j) The SS determines the expected MEAN_BEP interval corresponding to the average BER of all looped back bits using table 21.12a-1. The SS determines the number of MEAN_BEP values outside this interval and stores the result in error counter N_low.

Expected maximum test time for statistical error limit tests: 5h 45 min.

21.12a.5 Test requirements

Testing of the conformance requirement can be done either with fixed minimum number of samples or based on the statistical test method that could lead to an early pass/fail decision with test time significantly reduced for a MS not on the limit.

21.12a.5.1 Fixed limit test with minimum number of samples

The fixed testing of the conformance requirement is done using the minimum number of samples and the limit error rate given in table 21.12a-3.

The number of error events determined in steps d), g) and j) stored in error counters N_high, N_mid and N_low shall not exceed the error event limit as defined in Table 21.12a-3 for each of the error counters.

Table 21.12a-3: Test criteria and error limits for MEAN_BEP_32-QAM

Range	Specified error limit	Tested error limit	Number of test samples	Error event limit
High	10 %	12.2 %	1640	200
Mid	10 %	12.2 %	1640	200
Low	10 %	12.2 %	1640	200

21.12a.5.2 Statistical test with early pass / fail decision

Specific details on statistical testing of performance are defined in Annex 7.

The calculation of the error rate for this test shall be done according to the values specified in tables 21.12a-4.

Table 21.12a-4: Statistical error limits for MEAN_BEP_32-QAM

Range	Block per s	Org. error rate requirement	Derived test limit	Target number of samples	Target test time /s (Note)	Target test time /hh:mm:ss
High	50	0,122	0,150548	2292	6875	01:54:35
Mid	50	0,122	0,150548	2292	6875	01:54:35
Low	50	0,122	0,150548	2292	6875	01:54:35
Note: Test time is based on the calculation that only every 150th radio block is used for error calculation.						

21.13 AQPSK_MEAN_BEP measurement for VAMOS –I/II

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 have been increased. The following figures have been used (static propagation conditions):

Specified error rate	Multiplication factor	Min. error events
≤ 25 %	1,22	200
30 - 40 %	1,15	300
> 40 %	1,1	400

21.13.1 Definition

The MS must be capable of measuring the MEAN_BEP parameters under static channel conditions, which is specified in terms of bit error probability (BEP) before channel decoding averaged over the four bursts of a Speech frame and then filtered for the measurement report. The MS has to map this filtered BEP into MEAN_BEP values in the table "MEAN_BEP mapping and accuracy for AQPSK (for VAMOS-I MS and for VAMOS-II MS) " in sub clause 8.2.5 of 3GPP TS 45.008. The accuracy requirements in this table apply for static channel conditions for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS.

21.13.2 Conformance requirement3GPP TS 45.008 subclause 8.2.5

The mapping of the MEAN_BEP to the equivalent BEP and the accuracies to which an MS shall be capable of estimating the quality parameters under static channel conditions are given in the following tables for GMSK, 8-PSK and AQPSK respectively. The accuracy requirements below apply for sensitivity limited operation for signal levels above the reference sensitivity level for the type of MS, assuming no changes in transmitted downlink power. In *A/Gb mode*, the requirements apply for full rate TCH, E-TCH and O-TCH (no DTX). Similarly in *Iu mode,* the requirements apply to DBPSCH/F (no DTX). The estimated values are averaged (cf. subclause 8.2.3.2) over the reporting period of length 104 TDMA frames (480 ms). Furthermore, in both *A/Gb mode* and *Iu mode*, different requirements are given for EGPRS, in which case filtering according to subclause 10.2.3.2.1 with forgetting factor of 0.03 is assumed. The requirements for VAMOS mode shall apply for values of SCPIR from -4 dB to +4 dB for VAMOS-I and for values of SCPIR from -10 dB to +10 dB for VAMOS-II.

MEAN_BEP mapping and accuracy for AQPSK (for VAMOS-I MS and for VAMOS-II MS)

MEAN_BEP	Range of log10(actual BEP)	Expected MEAN_BEP interval	Probability that the expected MEAN_BEP is reported shall not be lower than:
			see NOTE *)
MEAN_BEP_0	> -0.60	[MEAN_BEP_0/1/2]	[80 %]
MEAN_BEP_1	-0.70 -- -0.60	[MEAN_BEP_1/0/2/3/4]	[80 %]
MEAN_BEP_2	-0.80 -- -0.70	[MEAN_BEP_2/1/3/4/5]	[70 %]
MEAN_BEP_3	-0.90 -- -0.80	[MEAN_BEP_3/2/4/5]	[70 %]
MEAN_BEP_4	-1.00 -- -0.90	[MEAN_BEP_4/3/5/6]	[70 %]
MEAN_BEP_5	-1.10 -- -1.00	[MEAN_BEP_5/3/4/6/7]	[70 %]
MEAN_BEP_6	-1.20 -- -1.10	[MEAN_BEP_6/4/5/7/8]	[70 %]
MEAN_BEP_7	-1.30 -- -1.20	[MEAN_BEP_7/5/6/8/9]	[70 %]
MEAN_BEP_8	-1.40 -- -1.30	[MEAN_BEP_8/5/6/7/9/10]	[70 %]
MEAN_BEP_9	-1.50 -- -1.40	[MEAN_BEP_9/6/7/8/10/11]	[70 %]
MEAN_BEP_10	-1.60 -- -1.50	[MEAN_BEP_10/7/8/9/11/12]	[65 %]
MEAN_BEP_11	-1.70 -- -1.60	[MEAN_BEP_11/8/9/10/12/13]	[65 %]
MEAN_BEP_12	-1.80 -- -1.70	[MEAN_BEP_12/9/10/11/13/14]	[65 %]
MEAN_BEP_13	-1.90 -- -1.80	[MEAN_BEP_13/10/11/12/14/15]	[65 %]
MEAN_BEP_14	-2.00 -- -1.90	[MEAN_BEP_14/11/12/13/15/16]	[65 %]
MEAN_BEP_15	-2.10 -- -2.00	[MEAN_BEP_15/11/12/13/14/16/17]	[70 %]
MEAN_BEP_16	-2.20 -- -2.10	[MEAN_BEP_16/13/14/15/17/18]	[70 %]
MEAN_BEP_17	-2.30 -- -2.20	[MEAN_BEP_17/14/15/16/18/19]	[70 %]
MEAN_BEP_18	-2.40 -- -2.30	[MEAN_BEP_18/14/15/16/17/19/20]	[70 %]
MEAN_BEP_19	-2.50 -- -2.40	[MEAN_BEP_19/15/16/17/18/20/21]	[70 %]
MEAN_BEP_20	-2.60 -- -2.50	[MEAN_BEP_20/16/17/18/19/21/22]	[70 %]
MEAN_BEP_21	-2.70 -- -2.60	[MEAN_BEP_21/17/18/19/20/22/23]	[70 %]
MEAN_BEP_22	-2.80 -- -2.70	[MEAN_BEP_22/18/19/20/21/23/24]	[70 %]
MEAN_BEP_23	-2.90 -- -2.80	[MEAN_BEP_23/19/20/21/22/24/25]	[70 %]
MEAN_BEP_24	-3.00 -- -2.90	[MEAN_BEP_24/20/21/22/23/25/26]	[70 %]
MEAN_BEP_25	-3.10 -- -3.00	[MEAN_BEP_25/21/22/23/24/26/27/28]	[65 %]
MEAN_BEP_26	-3.20 -- -3.10	[MEAN_BEP_26/22/23/24/25/27/28/29]	[65 %]
MEAN_BEP_27	-3.30 -- -3.20	[MEAN_BEP_27/23/24/25/26/28/29/30]	[65 %]
MEAN_BEP_28	-3.40 -- -3.30	[MEAN_BEP_28/23/24/25/26/27/29/30/31]	[65 %]
MEAN_BEP_29	-3.50 -- -3.40	[MEAN_BEP_29/23/24/25/26/27/28/30/31]	[80 %]
MEAN_BEP_30	-3.60 -- -3.50	[MEAN_BEP_30/24/25/26/27/28/29/31]	[80 %]
MEAN_BEP_31	< -3.60	[MEAN_BEP_31/27/28/29/30]	[80 %]
NOTE *) The values in this column apply in *A/Gb mode* for full rate TCH (no DTX) in VAMOS mode.			

21.13.3 Test purpose

To verify for VAMOS –I/II, under static channel conditions, that the BEP is measured and mapped to the MEAN_BEP values defined in subclause 8.2.5 of 3GPP TS 45.008 by the MS in a manner that can be related to an equivalent average BEP before channel decoding. The probability that the correct MEAN_BEP value is reported shall meet the values in the table "MEAN_BEP mapping and accuracy for AQPSK for VAMOS-I MS and for VAMOS-II MS" in sub clause 8.2.5 of 3GPP TS 45.008.

21.13.4 Method of test

The SS compares the long term BER average calculated by counting bit errors determined in loop-back type C mode over a SACCH multi frame period to a set of related MEAN_BEP values.

The MEAN_BEP values correspond to the same MS received bits that are looped-back for calculation of the long-term BER average (one-phase approach). For acquiring these MEAN_BEP values, MS will report MEAN BEP in Enhanced Measurement Report for every SACCH multi-frame period.

The testing of BEP accuracy is performed at 4 sample points inside the ranges given in table 21.13.4-1.

Table 21.13.4-1: MEAN_BEP AQPSK test intervals

Interval	Range of log10(actual BEP)	Range of actual BEP [%]	Range of expected MEAN_BEP
High	< -3.6	< 0.025	31
Mid_High	-3.2…-2.8	0.0631…0.158	23-26
Mid_low	-2.7 ... -2.1	0.2 ... 0.79	16 ... 21
Low	-2.0 ... -1.5	1.0 ... 3.16	10 ... 14

NOTE 1: The above range of expected MEAN_BEP for intervals Mid and Low have been defined in a way that the accuracy requirements are the same for a given range.

21.13.4.1 Initial conditions

The SS transmits a Standard Test Signal C1 (AQPSK) (wanted signal) on the active VAMOS subchannel (subchannel 2) using trainings sequence 5 from TSC set 2 on the TCH channel using the VAMOS TCH/AFS 12.2 at the nominal frequency of the receiver and with a level of –82 dBm and the other VAMOS subchannel (subchannel 1) uses trainings sequences 5 from TSC set 1. The SCPIR_DL is set to +4 dB.

The SS transmits a white noise signal as an interferer (random signal) known as unwanted signal. The unwanted signal is the standard test signal I3 as specified in TS 51.010 annex 5.2, on the same nominal frequency. Both wanted and unwanted signal contains static propagation characteristics.

RADIO_LINK_TIMEOUT is set to maximum.

Specific PICS Statements:

- VAMOS type I supported (TSPC_VAMOS_Type1)
- VAMOS type II supported (TSPC_VAMOS_Type 2)21.13.4.2 Procedure

a) The unwanted signal is switched off and the SS commands the MS to create traffic channel loop back signalling Type C: ON

   The SS sends 6000 speech frames to the MS. During this period for 250 times, the MS will report MEAN BEP in Enhanced Measurement Report for every SACCH multi-frame period. For each reported Mean_BEP value the SS calculates (updates) the average BER of all looped back bits received until the previous SACCH multi frame containing the MEAN_BEP value. The SS commands the MS traffic channel loop back signalling Type C: OFF.

b) The SS counts the number of MEAN_BEP values outside the expected MEAN_BEP interval corresponding to MEAN_BEP_31 and stores the result in error counter N_high. The BER calculation is reset.

c) The SS commands the MS traffic channel loop back signalling Type C: ON, switches the noise signal on and raises the level of the unwanted signal until the BER of the looped back data is between 0.158% and 0.501% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_23 and

MEAN_BEP_27, respectively. During the measurements the level of the unwanted signal shall be kept constant.

d) The SS repeats the procedure described in step a.

e) The SS determines the expected MEAN_BEP interval corresponding to the each BER using table “MEAN_BEP mapping and accuracy for AQPSK (for VAMOS-I MS and for VAMOS-II MS)” in subclause 8.2.5 of 3GPP TS 45.008. The SS determines the number of MEAN_BEP values outside of these intervals and stores the result in error counter N_mid_high. The BER calculation is reset.

f) The SS commands the MS traffic channel loop back signalling Type C: ON, switches the noise signal on and raises the level of the unwanted signal until the BER of the looped back data is between 0.2% and 0.79% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_21 and MEAN_BEP_16, respectively. During the measurements the level of the unwanted signal shall be kept constant.

g) The SS repeats the procedure described in step a.

h) The SS determines the expected MEAN_BEP interval corresponding to the each BER using table “MEAN_BEP mapping and accuracy for AQPSK (for VAMOS-I MS and for VAMOS-II MS)” in subclause 8.2.5 of 3GPP TS 45.008. The SS determines the number of MEAN_BEP values outside of these intervals and stores the result in error counter N_mid_low. The BER calculation is reset.

i) The SS commands the MS traffic channel loop back signalling Type C: ON, switches the noise signal on and raises the level of the unwanted signal until the BER of the looped back data is between 1.0% and 3.16% (calculated based on at least 100 bit errors), corresponding to the inner limits of MEAN_BEP_14 and MEAN_BEP_10, respectively. During the measurements the level of the unwanted signal shall be kept constant.

j) The SS repeats the procedure described in step a).

k) The SS determines the expected MEAN_BEP interval corresponding to each BER of all looped back bits using table “MEAN_BEP mapping and accuracy for AQPSK (for VAMOS-I MS and for VAMOS-II MS)” in subclause 8.2.5 of 3GPP TS 45.008. The SS determines the number of MEAN_BEP values outside of these intervals and stores the result in error counter N_low.

l) The SS repeats step a) to k) with SCPIR_DL values 0 dB and -4 dB.

m) If the MS signals VAMOS type II support step a) to k) shall be repeated with SCPIR_DL values 10 dB, -8 dB and -10 dB.

Expected maximum test time for statistical error limit tests: 300 min.

21.13.5 Test requirements

Testing of the conformance requirement can be done either with fixed minimum number of samples or based on the statistical test method that could lead to an early pass/fail decision with test time significantly reduced for a MS not on the limit.

21.13.5.1 Fixed limit test with minimum number of samples

The fixed testing of the conformance requirement is done using the minimum number of samples and the limit error rate given in table 21.13.5-1.

The number of error events determined in steps b), e) and h) stored in error counters N_high, N_mid_high, N_mid_low and N_low shall not exceed the error event limit as defined in Table 21.13.5-1 for each of the error counters.

Table 21.13.5-1: Test criteria and error limits for MEAN_BEP_AQPSK

Range	Specified error limit	Tested error limit	Number of test samples	Error event limit
High	10 %	12.2 %	6000	[200]
Mid_high	10 %	12.2 %	6000	[200]
Mid_low	10 %	12.2 %	6000	[200]
Low	10 %	12.2 %	6000	[200]

21.13.5.2 Statistical test with early pass / fail decision

Specific details on statistical testing of performance are defined in Annex 7.

The calculation of the error rate for this test shall be done according to the values specified in table 21.13.5-2.

Table 21.13.5-2: Statistical error limits for MEAN_BEP_AQPSK

Range	Block per s	Org. error rate requirement	Derived test limit	Target number of samples	Target test time /s (Note)	Target test time /hh:mm:ss
High	50	0,122	0,150548	6000	6875	01:54:35
Mid_high	50	0,122	0,150548	6000	6875	01:54:35
Mid_low	50	0,122	0,150548	6000	6875	01:54:35
Low	50	0,122	0,150548	6000	6875	01:54:35

22 Transmit power control timing and confirmation

Unless otherwise specified all tests in clauses 22.1 to 22.10 are applicable for all MSs supporting the bands referred to in clause 1.

22.1 Transmit power control timing and confirmation, single slot

22.1.1 Definition

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.

22.1.2 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; 3GPP TS 05.08, subclause 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; 3GPP TS 05.08, subclause 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; 3GPP TS 05.08, subclause 4.7.

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

5. In case of channel change the commanded power level shall be applied on the new channel immediately; 3GPP TS 05.08, subclause 4.7.

22.1.3 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.

22.1.4 Method of test

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

22.1.4.1 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 (see table 3.3), power control level set to maximum power.

22.1.4.2 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.

22.1.5 Test requirements

NOTE: Refer to tables 13-2, 13-3 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.

22.2 Void

22.3 GPRS Uplink Power Control - Use of α and Γ_{CH} parameters

22.3.1 Definition

Power control is important for spectrum efficiency as well as for power consumption in a cellular system. Power control for a packet oriented connection is more complicated than for a circuit switched connection, since there is no continuous two-way connection.

The RF output power, P_{CH}, to be employed by the MS on each individual uplink PDCH shall be:

$$P_{CH} = \min(\Gamma_0 - \Gamma_{CH} - \alpha \times (C + 48), PMAX),$$

Where:

Γ_{CH} is an MS and channel specific power control parameter, sent to the MS in an RLC control message (see 3GPP TS 04.60).

Γ_0 = 36 dBm for DCS 1 800 and PCS 1900
= 39 dBm for all other bands.

α is a system parameter, broadcast on PBCCH or optionally sent to MS in an RLC control message (see 3GPP TS 04.08 / 3GPP TS 24.008 and 3GPP TS 04.60).

C is the normalised received signal level at the MS as defined in 3GPP TS 05.08, subclause 10.2.3.1.

PMAX is the maximum allowed output power in the cell =
GPRS_MS_TXPWR_MAX_CCH if PBCCH exists
MS_TXPWR_MAX_CCH otherwise

All power values are expressed in dBm. (Note that the constants Γ_0 and 48 are included only for optimising the coding of Γ_{CH} and C-value).

This is a flexible tool that can be used for different power control algorithms.

A pure open loop is achieved by setting $\alpha = 1$ and keeping Γ_{CH} constant. With this method the output power is based on the received signal level assuming the same path loss in uplink and downlink. This is useful in the beginning of a packet transmission.

A pure closed loop is achieved by setting $\alpha = 0$. With this method the output power is commanded by the network based on received signal level measurements made in the BTS in a similar way as for a circuit switched connection.

22.3.2 Conformance requirement

The MS shall use the same output power on all four bursts within one radio block. 3GPP TS 05.08, subclause 10.2.1.

If a calculated output power is not supported by the MS, the MS shall use the supported output power which is closest to the calculated output power. 3GPP TS 05.08, subclause 10.2.1.

When the MS receives new Γ_{CH} or α values, the MS shall use the new value to update P_{CH} 2 radio blocks after the end of the frame containing the last timeslot of the message block containing the new value. 3GPP TS 05.08, subclause 10.2.1.

The transmitted power shall be a monotonic function of the calculated output power and any change of 2 dB in the calculated value shall correspond to a change of 2 $\pm$ 1,5 dB in the transmitted value. The MS may round the calculated output power to the nearest nominal output power value. 3GPP TS 05.08, subclause 10.2.1.

22.3.3 Test purpose

To verify the MS uses that the same output power on all four bursts of a radio block under normal conditions.

To verify that the highest power supported by the MS is used if the calculated power is greater.

To verify that the MS applies new Γ_{CH} or α values 2 radio blocks after the end of the frame containing the last timeslot of the message block containing the new value.

To verify that any change of 2 dB in the calculated power corresponds to a change of 2 ± 1,5 dB in the transmitted value under normal conditions.

NOTE: For changes in calculated power which are less than the tolerances specified for absolute power accuracy in a MS, the transmitted power as a function of calculated power cannot be tested for monotonicity. Monotonicity between power control steps is implicitly tested in subclause 13.16.

22.3.4 Method of test

22.3.4.1 Initial conditions

The SS establishes a BCCH, and optionally a PBCCH on the same carrier, in the mid ARFCN range. GPRS_MS_TXPWR_MAX_CCH is set to the maximum level (39 dBm for GSM and 36 dBm for DCS and PCS). The Γ_{CH} value is set such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the Power Class of the MS under test. The α value is set to 0.

The SS establishes a downlink TBF on the same ARFCN as the BCCH and PBCCH, and send data blocks to poll the MS for channel quality reports. The downlink power level is adjusted until a stable RXLEV-value of 58 is reported by the MS in the channel quality report (see 3GPP TS 05.08, subclause 8.1.4 and 10.2.3) – corresponding to a used C value in the range of -52dBm to -53dBm.

MS shall transmit on the uplink. This is achieved using the GPRS test mode by transmitting a GPRS_TEST_MODE_CMD (see 3GPP TS 04.14, subclause 5.4).

22.3.4.2 Procedure

a) The SS shall trigger a transmitter output power measurement on each of the four bursts of any radio block.

   The method of power measurement is described in subclause 13.16.

b) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the minimum power control level supported by the MS under test (0dBm for DCS 1 800 and PCS 1 900 and 5dBm for all other bands). If the transmission of the RLC control message containing the new Γ_{CH} value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

c) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the power class of the MS under test. If the transmission of the RLC control message containing the new Γ_{CH} value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

d) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the value 5dB below the maximum power control level supported by the power class of the MS under test. The α value is set to 1.

e) The SS shall decrement the α value with a step size of 0.1 until α equals 0. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

f) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step e). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

NOTE: If the power values measured for the four bursts of the radio block with α equal to 1.0 are:

- P_{m0} ,$P_{m1,}$ $P_{m2,}$ P_{m3}.

And, the power values measured for the four bursts of the radio block with α equal to 0.5 are:

- $P_{n0}, P_{n1}, P_{n2}, P_{n3}$.

Then:

- $P_{m(max)} = MAX(P_{m0}, P_{m1}, P_{m2}, P_{m3})$;
- $P_{m(min)} = MIN(P_{m0}, P_{m1}, P_{m2}, P_{m3})$;
- $P_{n(max)} = MAX(P_{n0}, P_{n1}, P_{n2}, P_{n3})$;
- $P_{n(min)} = MIN(P_{n0}, P_{n1}, P_{n2}, P_{n3})$.

The maximum and minimum step sizes are:

- $STEP(MAX) = P_{m(max)} - P_{n(min)}$;
- $STEP(MIN) = P_{m(min)} - P_{n(max)}$.

g) The SS shall modify the Γ_{CH} value such that ($\Gamma_0 - \Gamma_{CH}$) equals the midrange power control level supported by the MS under test. The α value is set to 0.

h) The SS shall increment the α value with a step size of 0.1 until α equals 1. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

i) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step h). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

j) The SS shall modify the Γ_{CH} value such that ($\Gamma_0 - \Gamma_{CH}$) equals the minimum power control level supported by the MS under test (0dBm for DCS 1 800 and PCS 1 900 and 5dBm for all other bands). The α value is set to 0.

k) The SS shall increment the α value with a step size of 0.1 until α equals 1. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

l) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step k). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

22.3.5 Test requirements

1. The power of all four bursts within the radio block measured in step a) and c) shall be within the accuracies specified for the power class of the mobile under test, as indicated in the following table.

Power class	Bands other than DCS 1 800 and PCS 1 900 Nominal Maximum output power	DCS 1 800 Nominal Maximum output power	PCS 1900 Nominal Maximum output power	Tolerance (dB) for normal conditions
1	- - - - - -	1 W (30 dBm)	1 W (30dBm)	±2
2	8 W (39 dBm)	0,25 W (24 dBm)	0,25 W (24 dBm)	±2
3	5 W (37 dBm)	4 W (36 dBm)	2 W (33 dBm)	±2
4	2 W (33 dBm)			±2
5	0,8 W (29 dBm)			±2

2. The power of all four bursts within the radio block measured in step b) shall be 0dBm for DCS 1 800 and PCS 1 900 and 5dBm for all other bands with an accuracy of ±5 dB in both cases.

3. In steps f), i) and l), the maximum change in transmitted power between each identified pair of α values shall be ≤ 4,5 dB for either set1 or set2.

4. In steps f), i) and l), the minimum change in transmitted power between each identified pair of α values shall be ≥ -0,5 dB for either set1 or set2.

Note: 1 dB tolerance is to be included in test requirements 3. and 4.
The same alpha value set (either set1 or set2) shall be used in all the steps f), i) and l) and for both test requirements 3. and 4.

22.4 GPRS Uplink Power Control - Independence of TS Power Control

22.4.1 Definition

-

22.4.2 Conformance requirement

For a GPRS multislot MS supporting 2 or more uplink PDCHs, power control shall be employed by the MS on each individual uplink PDCH. 3GPP TS 05.08, subclause 10.2.1.

On a multislot uplink configuration the MS may restrict the interslot output power control range to a 10 dB window, on a TDMA frame basis. On those timeslots where the ordered power level is more than 10 dB lower than the applied power level of the highest power timeslot, the MS shall transmit at a lowest possible power level within 10 dB range from the highest applied power level, if not transmitting at the actual ordered power level. 3GPP TS 45.005, subclause 4.1.1.

22.4.3 Test purpose

To verify that for a GPRS multislot MS supporting 2 or more uplink PDCHs, power control shall be employed by the MS on each individual uplink PDCH.

22.4.4 Method of test

22.4.4.1 Initial conditions

The MS shall transmit on the uplink with the maximum number of TS for the multislot class of the MS.. This is achieved using the GPRS test mode by first establishing a downlink TBF and transmitting a GPRS_TEST_MODE_CMD (see 3GPP TS 04.14, subclause 5.4). Each TS is transmitting on its maximum power. The α-value is set to 0.

Specific PICS Statements:

- MS using reduced interslot dynamic range in multislot configurations (TSPC_Addinfo_Red_IntSlotRange_Mult_Conf)

PIXIT Statements:

-

22.4.4.2 Procedure

a) The SS shall modify the Γ_{CH} value of one TS such that (Γ_0 - Γ_{CH}) equals the minimum power control level supported by the MS under test (0dBm for DCS 1 800 and PCS 1 900 and 5dBm for all other bands).

b) The SS shall trigger a transmitter output power measurement on each of the four bursts of any radio block of the TS under test.

c) The SS shall trigger a transmitter output power measurement on each of the four bursts of any radio block of the other active TS.

d) The SS shall modify the Γ_{CH} value for the TS under test such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the MS under test.

e) Steps a) to d) shall be repeated for each TS of the multislot configuration.

22.4.5 Test requirements

1. The power of all four bursts within the radio block measured in step b) shall be 0dBm for DCS 1 800 and PCS 1 900 and 5dBm for all other bands with an accuracy of ±5 dB in both cases. For an MS using reduced interslot dynamic range, the power measured in step b) shall be within 10dB ± 3dB of the average power of the timeslots measured in step c).

2. For all TS, the power of all four bursts within the radio block measured in step c) shall be within the accuracies specified for the power class of the mobile under test, as indicated in table 22.4-1 (see also 3GPP TS 45.005).

Table 22.4-1: The MS maximum output power

Power class	Bands other than DCS 1 800 and PCS 1 900 Nominal Maximum output power	DCS 1 800 Nominal Maximum output power	PCS 1900 Nominal Maximum output power	Tolerance (dB) for normal conditions
1	- - - - - -	1 W (30 dBm)	1 W (30dBm)	±2
2	8 W (39 dBm)	0,25 W (24 dBm)	0,25 W (24 dBm)	±2
3	5 W (37 dBm)	4 W (36 dBm)	2 W (33 dBm)	±2
4	2 W (33 dBm)			±2
5	0,8 W (29 dBm)			±2

From R99 onwards, in order to manage mobile terminal heat dissipation resulting from transmission on multiple uplink timeslots, the mobile station shall reduce its maximum output power on a per-assignment basis by the values given in table 22.4-2 or 22.4-3:

Table 22.4-2: R99 and Rel-4 MS: Allowed maximum output power reduction in a multislot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power, (dB)
1	0
2	0 to 3,0
3	1,8 to 4,8
4	3,0 to 6,0

Table 22.4-3: From Rel-5 onwards: Allowed maximum output power reduction in a multislot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power, (dB)
1	0
2	3,0
3	4,8
4	6,0
5	7,0
6	7,8
7	8,5
8	9,0

From Rel-5 onwards, the actual supported maximum output power shall be in the range indicated by the parameters GMSK_MULTISLOT_POWER_PROFILE (See 3GPP TS 24.008) for n allocated uplink timeslots:

$a \le$ MS maximum output power $\le \min(MAX\_PWR, a + b)$

Where:

a = min (MAX_PWR, MAX_PWR + GMSK_MULTISLOT_POWER_PROFILE – 10log(n));

MAX_PWR equals to the MS maximum output power according to the relevant power class and

GMSK_MULTISLOT_POWER_PROFILE 0 = 0 dB;
GMSK_MULTISLOT_POWER_PROFILE 1 = 2 dB;
GMSK_MULTISLOT_POWER_PROFILE 2 = 4 dB;
GMSK_MULTISLOT_POWER_PROFILE 3 = 6 dB.

For DCS 1800 and PCS 1900 frequency bands b = 3 dB, for all other bands b = 2 dB.

22.5 Void

22.6 Normal transmit power control timing and confirmation in ECSD

22.6.1 Definition

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 b lock.

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.

22.6.2 Test conformance

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; 3GPP TS 05.08, subclause 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; 3GPP TS 05.08, subclause 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; 3GPP TS 05.08, subclause 4.7.

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

5. In case of channel change the commanded power level shall be applied on the new channel immediately; 3GPP TS 05.08, subclause 4.7.

22.6.3 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.

22.6.4 Test method

NOTE: The method of measuring the MS transmitter output power is given in subclause 13.3. For 8PSK modulation, a measurement method for estimating the long term average power from a single burst shall be employed. See subclause 13.17.3.

22.6.4.1 Initial conditions

A call is set up by the SS according to the generic call set up procedure for multislot configuration on a channel with ARFCN in the Mid ARFCN range (see table 3.3), power control level set to maximum power.

The SS commands the MS to operate in multislot configuration where it has highest possible number of Tx slots.

22.6.4.2 Procedure

If the MS supports both GMSK and 8PSK modulation on the uplink, the test is repeated with each modulation format.

a) The SS signals minimum power control level to the MS in the SACCH for one of the subchannels.

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.

l) Steps a) to k) are repeated on the next subchannel until each is tested.

22.6.5 Test requirement

NOTE: Refer to tables 13.17.3-1, 13.17.3-2, 13.17.3-3 and 13.17.3-4 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.

22.7 ECSD Fast Power Control (FPC) timing and interworking with normal power control

22.7.1 Definition

Using the SACCH L1 header, normal uplink power control modifies the MS transmit power at a maximum rate of one power control level change per SACCH period (480ms). Under Fast Power Control the output power of an MS, in E-TCH mode, is updated each fast power reporting period. There are 24 fast power reporting periods in a 104 frame SACCH period.

22.7.2 Test conformance

1. In the E-TCH mode, the MS shall, if so indicated by the BSS in the SACCH L1 header or Assignment command, use FPC (fast power control); 3GPP TS 05.08, subclause 4.2

2. Switching between the normal power control mechanism and FPC shall be done if FPC is enabled or disabled via signalling in the SACCH L1 header. The respective power control mechanism to be used shall then be active as from the first TDMA frame belonging to the next reporting period; 3GPP TS 05.08, subclause 4.7

3. The initial power control level to be used by the MS immediately after switching between normal and fast power control mechanisms shall, in both cases, be the level last commanded by the normal power control mechanism; 3GPP TS 05.08, subclause 4.7

4. The fast power control mechanism shall use the differential power control mechanism defined in the table of 3GPP TS 05.08, subclause 4.3

5. The MS shall employ the most recently commanded fast power control level on each uplink E-TCH channel; 3GPP TS 05.08, subclause 4.2

6. If a power control command is received but the requested output power is not supported by the MS, the MS shall use the supported output power which is closest to the requested output power; 3GPP TS 05.08, subclause 4.3

7. If FPC is in use, the MS shall report, in the SACCH L1 header, the power control level used at the end of the normal power control reporting period; 3GPP TS 05.08, subclause 4.2

8. In case of a multislot configuration, each bi-directional channel shall be power controlled individually by the corresponding SACCH or fast inband signalling link, whichever is applicable; 3GPP TS 05.08, subclause 4.2

22.7.3 Test purpose

1. To verify that the MS switches between normal power control and fast power control mechanisms in accordance with conformance requirements 1 and 2.

2. To verify that the initial power control level used by the MS after switching between normal and fast power control mechanisms is in accordance with conformance requirement 3.

3. To verify that power level changes using the fast power control are implemented by the MS in accordance with conformance requirements 4 and 5.

4. To verify that power control commands requesting levels not supported by the MS are treated in accordance with conformance requirement 6.

5. To verify that the power reported by the MS at the end of the normal power control reporting period is in accordance with conformance requirement 7.

6. To verify that in a multislot configuration the MS implements fast power control independently on each bi-directional E-TCH in accordance with conformance requirement 8.

22.7.4 Test method

22.7.4.1 Initial conditions

A call is set up by the SS according to the generic call set up procedure for multislot configuration on a channel with ARFCN in the Mid ARFCN range (see table 3.3).

The SS commands the MS to operate in multislot configuration where it has the highest possible number of bi-directional E-TCHs. Using normal power control, the level of each TX slot is set to maximum power.

22.7.4.2 Procedure

For the purpose of this test the SS shall randomly select one bi-directional E-TCH to exercise. All other E-TCHs shall maintain the state defined under the initial conditions. In this procedure these other E-TCHs are referred to as the active but unselected channels.

a) Using the normal power control mechanism, the SS shall command the MS to transmit at power level 8 in the case of DCS 1 800 and PCS 1 900 or power level 15 in the case of all other bands on the selected E-TCH. After 1s, a power measurement shall be made on each TX slot of the multislot configuration.

NOTE: The method of measuring the MS transmitter output power is given in subclause 13.3. For 8PSK modulation, a measurement method for estimating the long term average power from a single burst shall be employed. See subclause 13.17.3.

b) The SS shall command the MS to switch between the normal power control and the fast power control mechanism by means of the SACCH L1 header (see 3GPP TS 04.04). Each power control mechanism shall be maintained for a single SACCH period. This cycle shall be repeated until all power measurements specified in steps c) to h) have been completed.

During the SACCH periods when normal power control is active, the SS shall command the MS to maintain the power levels set in step a). During the SACCH period when Fast Power Control is active, the SS shall command the MS to follow the schedule of fast power control detailed in the table below.

FPC Reporting Period Number	Fast Power Control Command	Nominal Output Power during FPC Reporting period Bands other than DCS 1 800 and PCS 1 900	Nominal Output Power during FPC Reporting Period DCS 1 800 & PCS 1 900	Pn
0	1 Step Decrease	13 dBm	14 dBm	P0
1	1 Step Decrease	11 dBm	12 dBm	
2	1 Step Decrease	9 dBm	10 dBm	
3	1 Step Decrease	7 dBm	8 dBm	
4	1 Step Decrease	5 dBm	6 dBm	
5	1 Step Decrease	5 dBm	4 dBm	
6	1 Step Decrease	5 dBm	2 dBm	
7	1 Step Decrease	5 dBm	0 dBm	
8	2 Step Increase	5 dBm	0 dBm	P34
9	2 Step Increase	9 dBm	4 dBm	
10	2 Step Increase	13 dBm	8 dBm	
11	2 Step Increase	17 dBm	12 dBm	
12	2 Step Increase	21 dBm	16 dBm	
13	2 Step Increase	Min (25 dBm, Pmax)	20 dBm	
14	2 Step Increase	Min (29 dBm, Pmax)	Min (24 dBm, Pmax)	
15	2 Step Increase	Min (33 dBm, Pmax)	Min (28 dBm, Pmax)	
16	2 Step Decrease	Pmax	Pmax	P69
17	1 Step Increase	Pmax – 4 dB	Pmax – 4 dB	P73
18	2 Step Decrease	Pmax – 2 dB	Pmax – 2 dB	P78
19	3 Step Increase	Pmax – 6 dB	Pmax – 6 dB	P82
20	2 Step Decrease	Pmax	Pmax	P86
21	2 Step Decrease	Pmax – 4 dB	Pmax – 4 dB	P91
22	4 Step Increase	Pmax – 8 dB	Pmax – 8 dB	P95
23	No Change	Pmax	Pmax	P99

Pmax is the maximum power for the mobile class.

Pn values refer to the power measured in the nth frame of the SACCH period.

a) The SS shall make power measurements on each active, but unselected timeslot of the multislot configuration during frames 0 and 103 of the SACCH period when normal power control is active.

b) The SS shall make power measurements on each active, but unselected timeslot of the multislot configuration during frames 0, 34, 69, 73, 78, 82, 86, 91, 95 and 99 of the SACCH period when fast power control is active.

c) The SS shall make power measurements of the selected timeslots during frames 0 and 103 of the SACCH period when normal power control is active.

d) The SS shall make power measurements on the selected timeslot during frames 0, 34, 69, 73, 78, 82, 86, 91, 95 and 99 of the SACCH period when fast power control is active. These power measurements shall be referred to as P0, P34, P69, P73, P78, P82, P86, P91, P95 and P99 respectively.

e) The SS shall note the MS TX power reported by the MS for the selected timeslot in the SACCH reporting period following the change from fast power control to normal power control.

f) The SS shall note the MS TX power reported by the MS for the selected timeslot in the SACCH reporting period following the change from normal power control to fast power control.

22.7.5 Test requirement

a) The powers measured for the unselected timeslots in steps a), c) and d) shall conform with the Pmax specification for the MS power class given in the following table.

Power class	Bands other than DCS 1 800 and PCS 1 900 Nominal Maximum output power (MS TX Level)	Bands other than DCS 1 800 and PCS 1 900 Tolerance (dB) for normal conditions	DCS 1 800 Nominal Maximum output power	PCS 1900 Nominal Maximum Output Power (MS TX Level)	DCS 1 800 & PCS 1 900 Tolerance (dB) for normal conditions
E1	33 dBm (5)	±2	30 dBm	30 dBm (0)	±2
E2	27 dBm (8)	±3	26 dBm	26 dBm (2)	-4/+3
E3	23 dBm (10)	±3	22 dBm	22 dBm (4)	±3

b) The power measured for the selected timeslot in steps a) and e) shall be 14dBm in the case of DCS 1 800 and PCS 1 900 and 13dBm in the case of all other bands. In all cases the tolerance shall be ±3 dB.

c) The powers measured in step f) shall conform with the power specifications in the following table.

Pn	Bands other than DCS 1 800 and PCS 1 900	DCS 1 800/PCS 1 900	Tolerance
P0	13 dBm	14 dBm	±3 dB
P34	5 dBm	0 dBm	±5 dB
P69	Pmax	Pmax	±2 dB
P73	Pmax – 4 dB	Pmax – 4 dB	±3 dB
P78	Pmax – 2 dB	Pmax – 2 dB	±3 dB
P82	Pmax – 6 dB	Pmax – 6 dB	±3 dB
P86	Pmax	Pmax	±2 dB
P91	Pmax – 4 dB	Pmax – 4 dB	±3 dB
P95	Pmax – 8 dB	Pmax – 8 dB	±3 dB
P99	Pmax	Pmax	±2 dB

See table in test requirement a) for Pmax value for MS power class.

a) The power level reported by the MS in step g) shall be MS TX level corresponding to Pmax for the MS power class. See the table in test requirement a).

b) The power level reported by the MS in step h) shall be MS TX Level 8 in the case of DSC1800 and PCS 1 900 and MS TX Level 15 in the case of all other bands.

22.8 EGPRS Uplink Power Control - Use of α and Γ_{CH} parameters

22.8.1 Definition

Power control is important for spectrum efficiency as well as for power consumption in a cellular system. Power control for a packet oriented connection is more complicated than for a circuit switched connection, since there is no continuous two-way connection.

The RF output power, P_{CH} , to be employed by the MS on each individual uplink PDCH shall be:

$$P_{CH} = \min(\Gamma_0 - \Gamma_{CH} - \alpha \times (C + 48), PMAX),$$

Where:

Γ_{CH} is an MS and channel specific power control parameter, sent to the MS in an RLC control message (see 3GPP TS 04.60).

Γ_0 = 36 dBm for DCS 1 800 and PCS 1 900
= 39 dBm for all other bands.

α is a system parameter, broadcast on PBCCH or optionally sent to MS in an RLC control message (see 3GPP TS 04.08 / 3GPP TS 24.008 and 3GPP TS 04.60).

C is the normalised received signal level at the MS as defined in 3GPP TS 05.08, subclause 10.2.3.1.

PMAX is the maximum allowed output power in the cell =
GPRS_MS_TXPWR_MAX_CCH if PBCCH exists
MS_TXPWR_MAX_CCH otherwise.

All power values are expressed in dBm. (Note that the constants Γ_0 and 48 are included only for optimising the coding of Γ_{CH} and C-value).

This is a flexible tool that can be used for different power control algorithms.

A pure open loop is achieved by setting $\alpha = 1$ and keeping Γ_{CH} constant. With this method the output power is based on the received signal level assuming the same path loss in uplink and downlink. This is useful in the beginning of a packet transmission.

A pure closed loop is achieved by setting $\alpha = 0$. With this method the output power is commanded by the network based on received signal level measurements made in the BTS in a similar way as for a circuit switched connection.

22.8.2 Conformance requirement

1. The MS shall use the same output power on all four bursts within one radio block. 3GPP TS 3GPP TS 05.08, subclause 10.2.1.

2. If a calculated output power is not supported by the MS, the MS shall use the supported output power which is closest to the calculated output power. 3GPP TS 05.08, subclause 10.2.1.

3. When the MS receives new Γ_{CH} or α values, the MS shall use the new value to update P_{CH} 2 radio blocks after the end of the frame containing the last timeslot of the message block containing the new value. 3GPP TS 05.08, subclause 10.2.1.

4. The transmitted power shall be a monotonic function of the calculated output power and any change of 2 dB in the calculated value shall correspond to a change of 2 ± 1,5 dB in the transmitted value. The MS may round the calculated output power to the nearest nominal output power value. 3GPP TS 05.08, subclause 10.2.1.

22.8.3 Test purpose

1. To verify the MS uses that the same output power on all four bursts of a radio block under normal conditions.

2. To verify that the highest power supported by the MS is used if the calculated power is greater.

3. To verify that the MS applies new Γ_{CH} or α values 2 radio blocks after the end of the frame containing the last timeslot of the message block containing the new value.

4. To verify that any change of 2 dB in the calculated power corresponds to a change of 2 ± 1,5 dB in the transmitted value under normal conditions.

NOTE: For changes in calculated power which are less than the tolerances specified for absolute power accuracy in a MS, the transmitted power as a function of calculated power cannot be tested for monotonicity. Monotonicity between power control steps is implicitly tested in subclause 13.16.

22.8.4 Test method

22.8.4.1 Initial conditions

The SS establishes a BCCH and optionally a PBCCH on the same carrier in the mid ARFCN range. GPRS_MS_TXPWR_MAX_CCH is set to the maximum level (36dBm for DCS 1 800 and PCS 1 900 and 39dBm for all other bands). The Γ_{CH} value is set such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the Power Class of the MS under test. The α value is set to 0.

The SS establishes a downlink TBF on the same ARFCN as the BCCH and PBCCH, and send data blocks to poll the MS for channel quality reports. The downlink power level is adjusted until a stable RXLEV-value of 58 is reported by the MS in the channel quality report (see 3GPP TS 05.08, subclause 8.1.4 and 10.2.3) – corresponding to a used C value in the range of -52dBm to -53dBm.

The SS orders the MS to transmit on the uplink. This is achieved using the GPRS test mode by transmitting a GPRS_TEST_MODE_CMD (see 3GPP TS 04.14, clause 5.4).

22.8.4.2 Procedure

If the MS supports both GMSK and 8PSK modulation on the uplink, the test is repeated with each modulation format.

a) The SS shall trigger a transmitter output power measurement on each of the four bursts of any radio block.

b) The method of power measurement is described in subclause 13.17.3.

NOTE 1: For 8PSK modulation, a measurement method for estimating the long term average power from a single burst shall be employed. See subclause 13.17.3.

c) Void.

d) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the minimum power control level supported by the MS under test (0dBm for DCS 1 800 and PCS 1 900 and5dBm for all other bands). If the transmission of the RLC control message containing the new Γ_{CH} value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

e) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the power class of the MS under test. If the transmission of the RLC control message containing the new Γ_{CH} value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

f) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the value 5dB below the maximum power control level supported by the power class of the MS under test. The α value is set to 1.

g) The SS shall decrement the α value with a step size of 0.1 until α equals 0. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

h) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step e). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

NOTE 2: If the power values measured for the four bursts of the radio block with α equal to 1.0 are:

- $P_{m0}, P_{m1}, P_{m2}, P_{m3}$.

And, the power values measured for the four bursts of the radio block with α equal to 0.5 are:

- $P_{n0}, P_{n1}, P_{n2}, P_{n3}$.

Then:

- $P_{m(max)} = MAX(P_{m0}, P_{m1}, P_{m2}, P_{m3})$;
- $P_{m(min)} = MIN(P_{m0}, P_{m1}, P_{m2}, P_{m3})$;
- $P_{n(max)} = MAX(P_{n0}, P_{n1}, P_{n2}, P_{n3})$;
- $P_{n(min)} = MIN(P_{n0}, P_{n1}, P_{n2}, P_{n3})$.

The maximum and minimum step sizes are:

- $STEP(MAX) = P_{m(max)} - P_{n(min)}$;
- $STEP(MIN) = P_{m(min)} - P_{n(max)}$.

g) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the midrange power control level supported by the MS under test. The α value is set to 0.

h) The SS shall increment the α value with a step size of 0.1 until α equals 1. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

i) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step h). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

j) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the minimum power control level supported by the MS under test (0dBm for DCS 1 800 and PCS 1 900 and5dBm for all other bands). The α value is set to 0.

k) The SS shall increment the α value with a step size of 0.1 until α equals 1. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

l) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step k). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

22.8.5 Test requirement

1. The power of all four bursts within the radio block measured in step a) and c) shall be within the accuracies specified for the power class of the mobile under test, as indicated in the following table.

Power class	Bands except DCS 1 800 and PCS 1 900 Nominal Maximum output power	Bands except DCS 1 800 and PCS 1 900 Tolerance (dB) for normal conditions	DCS 1 800 Nominal Maximum output power	PCS 1900 Nominal Maximum Output power	DCS 1 800 & PCS 1 900 Tolerance (dB) for normal conditions
1 2 3 4 5	- - - - - - 39 dBm 37 dBm 33 dBm 29 dBm		30 dBm 24 dBm 36 dBm	30 dBm 24 dBm 33 dBm	±2 ±2 ±2 ±2 ±2
E1	33 dBm	±2	30 dBm	30 dBm	±2
E2	27 dBm	±3	26 dBm	26 dBm	-4/+3
E3	23 dBm	±3	22 dBm	22 dBm	±3

2. The power of all four bursts within the radio block measured in step b) shall be 0dBm for a DCS 1 800 or PCS 1 900 MS and 5dBm for all other MS with an accuracy of ±5 dB in all cases.

3. In steps f), i) and l), the maximum change in transmitted power between each identified pair of α values shall be ≤ 4,5 dB for either set1 or set2.

4. In steps f), i) and l), the minimum change in transmitted power between each identified pair of α values shall be ≥ -0,5 dB for either set1 or set2.

Note: 1 dB tolerance is included in test requirements 3. and 4.
The same alpha value set (either set1 or set2) shall be used in all the steps f), i) and l) and for both test requirements 3. and 4.

22.8a EGPRS2A Uplink Power Control - Use of α and Γ_{CH} parameters

22.8a.1 Definition

Power control is important for spectrum efficiency as well as for power consumption in a cellular system. Power control for a packet oriented connection is more complicated than for a circuit switched connection, since there is no continuous two-way connection.

Since the conformance requirements, test procedures and test requirements for EGPRS uplink power control – use of α and Γ_{CH} are defined in subclause 22.8 only 16QAM specific requirements and procedures are handled with this subclause. The RF output power, P_{CH} , to be employed by the MS on each individual uplink PDCH shall be:

$$P_{CH} = \min(\Gamma_0 - \Gamma_{CH} - \alpha \times (C + 48), PMAX),$$

Where:

Γ_{CH} is an MS and channel specific power control parameter, sent to the MS in an RLC control message (see 3GPP TS 44.060).

Γ_0 = 36 dBm for DCS 1800 and DCS 1900
= 39 dBm for all other bands.

α is a system parameter sent to MS in an RLC control message (see 3GPP TS 44.008 / 3GPP TS 24.008 and 3GPP TS 44.060).

C is the normalised received signal level at the MS as defined in 3GPP TS 45.008, subclause 10.2.3.1.

PMAX is the maximum allowed output power in the cell = GPRS_MS_TXPWR_MAX_CCH

All power values are expressed in dBm. (Note that the constants Γ_0 and 48 are included only for optimising the coding of Γ_{CH} and C-value).

This is a flexible tool that can be used for different power control algorithms.

A pure open loop is achieved by setting $\alpha = 1$ and keeping Γ_{CH} constant. With this method the output power is based on the received signal level assuming the same path loss in uplink and downlink. This is useful in the beginning of a packet transmission.

A pure closed loop is achieved by setting $\alpha = 0$. With this method the output power is commanded by the network based on received signal level measurements made in the BTS in a similar way as for a circuit switched connection.

22.8a.2 Conformance requirement

1. The MS shall use the same output power on all four bursts within one radio block. 3GPP TS 3GPP TS 45.008, subclause 10.2.1.

2. If a calculated output power is not supported by the MS, the MS shall use the supported output power which is closest to the calculated output power. 3GPP TS 45.008, subclause 10.2.1.

3. When the MS receives new Γ_{CH} or α values, the MS shall use the new value to update P_{CH} 2 radio blocks after the end of the frame containing the last timeslot of the message block containing the new value. 3GPP TS 45.008, subclause 10.2.1.

4. The transmitted power shall be a monotonic function of the calculated output power and any change of 2 dB in the calculated value shall correspond to a change of 2 ± 1,5 dB in the transmitted value. The MS may round the calculated output power to the nearest nominal output power value. 3GPP TS 45.008, subclause 10.2.1.

22.8a.3 Test purpose

1. To verify the MS uses that the same output power on all four bursts of a radio block under normal conditions.

2. To verify that the highest power supported by the MS is used if the calculated power is greater.

3. To verify that the MS applies new Γ_{CH} or α values 2 radio blocks after the end of the frame containing the last timeslot of the message block containing the new value.

4. To verify that any change of 2 dB in the calculated power corresponds to a change of 2 ± 1,5 dB in the transmitted value under normal conditions.

NOTE: For changes in calculated power which are less than the tolerances specified for absolute power accuracy in a MS, the transmitted power as a function of calculated power cannot be tested for monotonicity. Monotonicity between power control steps is implicitly tested in subclause 13.16.

22.8a.4 Test method

22.8a.4.1 Initial conditions

The SS establishes a BCCH in the mid ARFCN range. GPRS_MS_TXPWR_MAX_CCH is set to the maximum level (36dBm for DCS 1800 and DCS 1900 and 39dBm for all other bands). The Γ_{CH} value is set such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the Power Class of the MS under test. The α value is set to 0.

The SS establishes a downlink TBF on the same ARFCN as the BCCH and send data blocks to poll the MS for channel quality reports. The downlink power level is adjusted until a stable RXLEV-value of 58 is reported by the MS in the channel quality report (see 3GPP TS 45.008, subclause 8.1.4 and 10.2.3) – corresponding to a used C value in the range of -52dBm to -53dBm.

The SS orders the MS to transmit on the uplink. This is achieved using the GPRS test mode by transmitting a GPRS_TEST_MODE_CMD (see 3GPP TS 44.014, clause 5.4).

22.8a.4.2 Procedure

a) The SS shall trigger a transmitter output power measurement on each of the four bursts of any radio block.

b) The method of power measurement is described in subclause 13.17.3a.

NOTE 1: For 16QAM modulation, a measurement method for estimating the long term average power from a single burst shall be employed. See subclause 13.17.3a.

c) Void.

d) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the minimum power control level supported by the MS under test (0dBm for DCS 1800 and DCS 1900 and5dBm for all other bands). If the transmission of the RLC control message containing the new Γ_{CH} value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

e) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the power class of the MS under test. If the transmission of the RLC control message containing the new Γ_{CH} value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

f) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the value 5dB below the maximum power control level supported by the power class of the MS under test. The α value is set to 1.

g) The SS shall decrement the α value with a step size of 0.1 until α equals 0. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

h) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step e). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

NOTE 2: If the power values measured for the four bursts of the radio block with α equal to 1.0 are:

- P_{m0} ,$P_{m1,}$ $P_{m2,}$ P_{m3}.

And, the power values measured for the four bursts of the radio block with α equal to 0.5 are:

- P_{n0} ,$P_{n1,}$ $P_{n2,}$ P_{n3}.

Then:

- $P_{m(max)}$ = MAX(P_{m0} ,$P_{m1,}$ $P_{m2,}$ P_{m3});
- $P_{m(min)}$ = MIN(P_{m0} ,$P_{m1,}$ $P_{m2,}$ P_{m3});
- $P_{n(max)}$ = MAX(P_{n0} ,$P_{n1,}$ $P_{n2,}$ P_{n3});
- $P_{n(min)}$ = MIN(P_{n0} ,$P_{n1,}$ $P_{n2,}$ P_{n3}).

The maximum and minimum step sizes are:

- STEP(MAX)= $P_{m(max)}$ - $P_{n(min)}$;
- STEP(MIN) = $P_{m(min)}$ - $P_{n(max)}$.

g) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the midrange power control level supported by the MS under test. The α value is set to 0.

h) The SS shall increment the α value with a step size of 0.1 until α equals 1. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

i) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step h). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

j) The SS shall modify the Γ_{CH} value such that (Γ_0 - Γ_{CH}) equals the minimum power control level supported by the MS under test (0dBm for DCS 1800 and DCS 1900 and5dBm for all other bands). The α value is set to 0.

k) The SS shall increment the α value with a step size of 0.1 until α equals 1. For each step change in α value, if the transmission of the RLC control message containing the new α value is completed in radio block N, the SS shall trigger a transmitter output power measurement on each of the four bursts of radio block N+3.

l) For each value of α, the SS shall note the maximum and minimum power values measured from the four bursts of the radio block in step k). The SS shall then calculate the maximum and minimum changes in output power measured for the following two sets of pairs of α values, set1: 1.0 and 0.5; 0.9 and 0.4; 0.8 and 0.3; 0.7 and 0.2; 0.6 and 0.1; 0.5 and 0, set2: 1.0 and 0.6; 0.9 and 0.5; 0.8 and 0.4; 0.7 and 0.3; 0.6 and 0.2; 0.5 and 0.1; 0.4 and 0.0. The maximum change is calculated by subtracting the minimum power measured from the smaller value of α from the maximum power measured for the larger value of α. The minimum step change is calculated by subtracting the maximum power measured from the smaller value of α from the minimum power measured for the larger value of α.

22.8a.5 Test requirement

1. The power of all four bursts within the radio block measured in step a) to e) shall be within the accuracies specified for the power class of the mobile under test, as indicated in the following table.

Power class	Bands except DCS 1800 and DCS 1900 Nominal Maximum output power	Bands except DCS 1800 and DCS 1900 Tolerance (dB) for normal conditions	DCS 1800 Nominal Maximum output power	PCS 1900 Nominal Maximum Output power	DCS 1800 & DCS 1900 Tolerance (dB) for normal conditions
E1	31 dBm	±2	28 dBm	28 dBm	±2
E2	25 dBm	±3	24 dBm	24 dBm	-4/+3
E3	21 dBm	±3	20 dBm	20 dBm	±3

2. The power of all four bursts within the radio block measured in step b) shall be 0dBm for a DCS 1800 or DCS 1900 MS and 5dBm for all other MS with an accuracy of ±5 dB in all cases.

3. In steps f), i) and l), the maximum change in transmitted power between each identified pair of α values shall be ≤ 4,5 dB for either set1 or set2.

4. In steps f), i) and l), the minimum change in transmitted power between each identified pair of α values shall be ≥ -0,5 dB for either set1 or set2.

NOTE: 1 dB tolerance is included in test requirements 3. and 4.
The same alpha value set (either set1 or set2) shall be used in all the steps h), i) and l) and for both test requirements 3. and 4.

22.9 EGPRS Uplink Power Control - Independence of TS Power Control

22.9.1 Definition

-

22.9.2 Test conformance

For an EGPRS multislot MS supporting 2 or more uplink PDCHs, power control shall be employed by the MS on each individual uplink PDCH. 3GPP TS 05.08, subclause 10.2.1.

On a multislot uplink configuration the MS may restrict the interslot output power control range to a 10 dB window, on a TDMA frame basis. On those timeslots where the ordered power level is more than 10 dB lower than the applied power level of the highest power timeslot, the MS shall transmit at a lowest possible power level within 10 dB range from the highest applied power level, if not transmitting at the actual ordered power level. 3GPP TS 45.005, subclause 4.1.1.

22.9.3 Test purpose

To verify that EGPRS power control is applied to each PDCH in a multislot configuration independently.

22.9.4 Test method

22.9.4.1 Initial conditions

The SS establishes a downlink TBF. The SS orders the MS to transmit on the maximum number of timeslots for the multislot class of the MS on the uplink. This is achieved using the GPRS test mode by transmitting a GPRS_TEST_MODE_CMD (see 3GPP TS 04.14, subclause 5.4).

Each timeslot is transmitting on its maximum power. The α-value is set to 0.

Specific PICS Statements:

- MS using reduced interslot dynamic range in multislot configurations

PIXIT Statements:

-

22.9.4.2 Procedure

If the MS supports both GMSK and 8PSK modulation on the uplink, the test is repeated with each modulation format.

a) The SS shall modify the Γ_{CH} value of one timeslot such that (Γ_0 - Γ_{CH}) equals the minimum power control level supported by the MS under test (0dBm for DCS 1 800 and PCS 1 900 and 5dBm for all other bands).

b) The SS shall make a transmitter output power measurement on each of the four bursts of any radio block of the timeslot under test.

NOTE: For 8PSK modulation, a measurement method for estimating the long term average power from a single burst shall be employed. See subclause 13.17.3.

c) The SS shall make a transmitter output power measurement on each of the four bursts of any radio block of the other active timeslots.

d) The SS shall modify the Γ_{CH} value for the timeslot under test such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the MS under test.

e) Steps a) to d) shall be repeated for each timeslot of the multislot configuration.

22.9.5 Test requirement

1. The power of all four bursts within the radio block measured in step b) shall be 0dBm for a DCS 1 800 or PCS 1 900 MS and 5dBm for all other MS with an accuracy of ±5 dB in all cases. For an MS using reduced interslot dynamic range, the power measured in step b) shall be within 10dB ± 3dB of the average power of the timeslots measured in step c).

2. For all TS, the power of all four bursts within the radio block measured in step c) shall be within the accuracies specified for the power class of the mobile under test, as indicated in table 22.9-1 (see also 3GPP TS 05.05 / 3GPP TS 45.005).

Table 22.9-1: The MS maximum output power

Power class	Bands except DCS 1 800 and PCS 1 900Nominal Maximum output power	Bands except DCS 1 800 and PCS 1 900 Tolerance (dB) for normal conditions	DCS 1 800 Nominal Maximum output power	PCS 1900 Nominal Maximum Output power	DCS 1 800 & PCS 1 900 Tolerance (dB) for normal conditions
1 2 3 4 5	- - - - - - 39 dBm 37 dBm 33 dBm 29 dBm		30 dBm 24 dBm 36 dBm	30 dBm 24 dBm 33 dBm	±2 ±2 ±2 ±2 ±2
E1	33 dBm	±2	30 dBm	30 dBm	±2
E2	27dBm	±3	26 dBm	26 dBm	-4/+3
E3	23dBm	±3	22 dBm	22 dBm	±3

From R99 onwards, in order to manage mobile terminal heat dissipation resulting from transmission on multiple uplink timeslots, the mobile station shall reduce its maximum output power on a per-assignment basis by the values given in table 22.9-2 or 22.9-3:

Table 22.9-2: R99 and Rel-4: Allowed maximum output power reduction in a multislot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power (dB)
1	0
2	0 to 3,0
3	1,8 to 4,8
4	3,0 to 6,0

Table 22.9-3: From Rel-5 onwards: Allowed maximum output power reduction in a multislot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power (dB)
1	0
2	3,0
3	4,8
4	6,0
5	7,0
6	7,8
7	8,5
8	9,0

From Rel-5 onwards, the actual supported maximum output power shall be in the range indicated by the parameters XXX_MULTISLOT_POWER_PROFILE (See 3GPP TS 24.008) for n allocated uplink timeslots:

a ≤ MS maximum output power ≤ min(MAX_PWR, a + b)

Where:

a = min (MAX_PWR, MAX_PWR + XXX_MULTISLOT_POWER_PROFILE – 10log(n));

MAX_PWR equals to the MS maximum output power according to the relevant power class;

XXX_MULTISLOT_POWER_PROFILE refers either to GMSK_MULTISLOT_POWER PROFILE or 8-PSK_MULTISLOT_POWER_PROFILE depending on the modulation type concerned, and

XXX_MULTISLOT_POWER_PROFILE 0 = 0 dB;
XXX_MULTISLOT_POWER_PROFILE 1 = 2 dB;

XXX_MULTISLOT_POWER_PROFILE 2 = 4 dB;
XXX_MULTISLOT_POWER_PROFILE 3 = 6 dB.

For DCS 1800 and PCS 1900 frequency bands b = 3 dB, for all other bands b = 2 dB.

22.9a EGPRS2A Uplink Power Control - Independence of TS Power Control

22.9a.1 Definition

Since the conformance requirements, test procedures and test requirements for EGPRS uplink power control – Independence of TS Power control are defined in subclause 22.9, only 16QAM specific requirements and procedures are handled with this subclause.

22.9a.2 Test conformance

For an EGPRS2A multislot MS supporting 2 or more uplink PDCHs, power control shall be employed by the MS on each individual uplink PDCH. 3GPP TS 05.08, subclause 10.2.1.

On a multislot uplink configuration the MS may restrict the interslot output power control range to a 10 dB window, on a TDMA frame basis. On those timeslots where the ordered power level is more than 10 dB lower than the applied power level of the highest power timeslot, the MS shall transmit at a lowest possible power level within 10 dB range from the highest applied power level, if not transmitting at the actual ordered power level. 3GPP TS 45.005, subclause 4.1.1.

22.9a.3 Test purpose

To verify that EGPRS power control is applied to each PDCH in a multislot configuration independently.

22.9a.4 Test method

22.9a.4.1 Initial conditions

The SS establishes a downlink TBF. The SS orders the MS to transmit on the maximum number of timeslots for the multislot class of the MS on the uplink. This is achieved using the GPRS test mode by transmitting a GPRS_TEST_MODE_CMD (see 3GPP TS 04.14, subclause 5.4).

Each timeslot is transmitting on its maximum power. The α-value is set to 0.

Specific PICS Statements:

- MS using reduced interslot dynamic range in multislot configurations

PIXIT Statements:

-

22.9a.4.2 Procedure

a) The SS shall modify the Γ_{CH} value of one timeslot such that (Γ_0 - Γ_{CH}) equals the minimum power control level supported by the MS under test (0dBm for DCS 1 800 and PCS 1 900 and 5dBm for all other bands).

b) The SS shall make a transmitter output power measurement on each of the four bursts of any radio block of the timeslot under test.

NOTE: For 16QAM modulation, a measurement method for estimating the long term average power from a single burst shall be employed. See subclause 13.17.3a.

c) The SS shall make a transmitter output power measurement on each of the four bursts of any radio block of the other active timeslots.

d) The SS shall modify the Γ_{CH} value for the timeslot under test such that (Γ_0 - Γ_{CH}) equals the maximum power control level supported by the MS under test.

e) Steps a) to d) shall be repeated for each timeslot of the multislot configuration.

22.9a.5 Test requirement

1. The power of all four bursts within the radio block measured in step b) shall be 0dBm for a DCS 1 800 or PCS 1 900 MS and 5dBm for all other MS with an accuracy of ±5 dB in all cases. For an MS using reduced interslot dynamic range, the power measured in step b) shall be within 10dB ± 3dB of the average power of the timeslots measured in step c).

2. For all TS, the power of all four bursts within the radio block measured in step c) shall be within the accuracies specified for the power class of the mobile under test, as indicated in table 22.9-1 (see also 3GPP TS 05.05 / 3GPP TS 45.005).

Table 22.9-1: The MS maximum output power

Power class	Bands except DCS 1 800 and PCS 1 900Nominal Maximum output power	Bands except DCS 1 800 and PCS 1 900 Tolerance (dB) for normal conditions	DCS 1 800 Nominal Maximum output power	PCS 1900 Nominal Maximum Output power	DCS 1 800 & PCS 1 900 Tolerance (dB) for normal conditions
E1	31 dBm	±2	28 dBm	28 dBm	±2
E2	25 dBm	±3	24 dBm	24 dBm	-4/+3
E3	21 dBm	±3	20 dBm	20 dBm	±3

In order to manage mobile terminal heat dissipation resulting from transmission on multiple uplink timeslots, the mobile station shall reduce its maximum output power on a per-assignment basis by the values given in 22.9-3:

Table 22.9-3: From Rel-5 onwards: Allowed maximum output power reduction in a multislot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power (dB)
1	0
2	3,0
3	4,8
4	6,0
5	7,0
6	7,8
7	8,5
8	9,0

From Rel-5 onwards, the actual supported maximum output power shall be in the range indicated by the parameters XXX_MULTISLOT_POWER_PROFILE (See 3GPP TS 24.008) for n allocated uplink timeslots:

a ≤ MS maximum output power ≤ min(MAX_PWR, a + b)

Where:

a = min (MAX_PWR, MAX_PWR + XXX_MULTISLOT_POWER_PROFILE – 10log(n));

MAX_PWR equals to the MS maximum output power according to the relevant power class;

XXX_MULTISLOT_POWER_PROFILE refers to 8-PSK_MULTISLOT_POWER_PROFILE

XXX_MULTISLOT_POWER_PROFILE 0 = 0 dB;
XXX_MULTISLOT_POWER_PROFILE 1 = 2 dB;
XXX_MULTISLOT_POWER_PROFILE 2 = 4 dB;
XXX_MULTISLOT_POWER_PROFILE 3 = 6 dB.

For DCS 1800 and PCS 1900 frequency bands b = 3 dB, for all other bands b = 2 dB.

22.10 Void

22.11 Power control in exclusive allocation mode

22.11.1 Conformance requirements

Sub-clauses 10.2.1 and 10.2.2 do not apply for the PDCH/H in Exclusive MAC mode while in DTM. In this case:

- The MS shall apply the output power ordered by the network on the SACCH to all channels (both for the TCH/H and the PDCH/H).
- The network shall use the same output power on the dedicated connection and on all the blocks on the PDCH/H addressed to the MS. Blocks not addressed to the MS may be transmitted at a lower power level. As an exception, the bursts transmitted on the BCCH carrier shall be transmitted at the BCCH level.

NOTE: Power control is not applicable to point-to-multipoint services.

References

3GPP TS 05.08/45.008, sub-clause 10.2

22.11.2 Test purpose

To verify that MS applies the output power ordered by the network on the SACCH to all channels.

22.11.3 Method of test

Initial Conditions

System Simulator:

1 cell, DTM supported.

Mobile Station:

The MS is in the active state (U10) of a call.
The MS is GPRS idle with a P-TMSI allocated and the PDP context 1 activated.

Test Procedure

The MS is triggered to initiate packet uplink transfer data and sends a DTM REQUEST message to the SS. On receiving the DTM REQUEST message, requesting uplink resources, the SS assigns the MS PS resources in a timeslot adjoining the CS resource. The SS accomplishes the resource assignment by passing a PACKET ASSIGNMENT message to the MS. Once the SS has verified that the MS is correctly sending RLC data blocks to the SS, the SS sets TXPWR in the SACCH to the maximum peak power appropriate to the class of the MS. The SS measures the MS transmitter output power, on the timeslot(s), which changes 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. The SS then sets the TXPWR to a lower random value and then verifies that the MS lowers the output power of the transmitter for both the PDTCH and the TCH to this level. After the SS has received approximately 9k octets of data from the MS, the SS commands the change of transit power by passing the PACKET POWER / TIMING ADVANCE message to the MS on the PACCH. Whilst the MS continues with the transmission of the 10k octets, the SS verifies that the MS has not followed the order to change power as indicated in the PACKET POWER / TIMING ADVANCE message.

Maximum Duration of Test

5 minutes

Expected Sequence

Step	Direction	Message	Comments
1	MS		MS in the active state (U10) of a call on Timeslot N with set to Channel Type=TCH/H.
2	MS		Trigger the MS to initiate an uplink packet transfer containing 10k octets.
3	MS->SS	DTM REQUEST	
4	SS->MS	PACKET ASSIGNMENT	See specific message contents.
5	MS<->SS	{ Uplink data transfer }	Macro –transmission of ~9k octets.
6	SS->MS	PACKET POWER CONTROL / TIMING ADVANCE	Sent after approximately 9k octets have been correctly passed to the MS. The message only changes the output power of the MS by setting the Γ_{CH} parameter to maximum for each of the timeslots the MS is utilising. Setting the parameter to maximum indicates the MS should turn down the output power in the timeslots indicated.
7	MS<->SS	{ Uplink data transfer }	Macro – Completion on transmission of 10k octets.
8	SS		Verify that no the MS does not change the transmission power after receiving the PACKET POWER CONTROL / TIMING ADVANCE message.

Specific message contents

PACKET ASSIGNMENT (Step 4):

As default message contents except: RR Packet Uplink Assignment IE - TIMESLOT_ALLOCATION RR Packet Downlink Assignment IE	 N Not included

22.12 Downlink power control, PR mode A, GPRS TBF

22.12.1 Conformance requirements

The MS is required to meet the 05.05 specification when the downlink power control is used in PR mode A.

References

3GPP TS 05.08/45.008, sub-clause 10.2.2

22.12.2 Test purpose

To verify that MS still correctly decodes RLC data blocks while the BSS applies power control mode A and PR mode A and makes downlink power variations on an EGPRS TBF which shares the same PDCH.

22.12.3 Method of test

Initial Conditions

System Simulator:

1 cell, GPRS and EGPRS supported.

The test is performed in TU50 radio environment, at the reference point of c/i = 16dB.

Mobile Station:

The MS is in GPRS idle mode with a P-TMSI allocated and the PDP context 2 activated; it is allocated a GPRS TBF.

Test Procedure

The GPRS MS is allocated a downlink TBF (TBF1) and a downlink EGPRS transfer is simulated as if an EGPRS downlink TBF (TBF2) were allocated on the same PDCHs. Downlink RLC data blocks are sent to MS using the same power level while on TBF2 different power levels are used: on the EGPRS TBF, downlink RLC data blocks are sent at the BCCH (P0 = 0 dB) power level, then RLC data blocks with different attenuations and valid PR fields are sent.

During the transfer, the RLC data blocks shall be correctly received by the GPRS MS (TBF1) under the 05.05 requirements.

Maximum Duration of Test

1 minute

Expected Sequence

Step	Direction	Message	Comments
1.	SS		The SS initiates with MS1 an GPRS Downlink packet transfer containing 20k octets, in BTS_PWR_CTRL_MODE mode A and PR Mode A.
2.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks in 8PSK (MCS9) to MS2 at the BCCH power-2dB level (PR=00), alternately with MS1 so that one block out of 2 is sent to MS2.
3.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks (CS3) are sent to the MS at the BCCH power level (PR=00), alternately with MS2 so that one block out of 2 is sent to MS1, and trigger a Packet downlink Ack/Nack on the 12th RLC data block.
4.	MS -> SS	Packet downlink Ack/Nack	The Packet downlink Ack/Nack acknowledges at least 90% of the RLC data blocks
5.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks with a 4dB attenuation and a valid PR=01 field in 8PSK (MCS9), alternately with MS1 so that one block out of 2 is sent to MS2.
6.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks (CS3) are sent to the MS at the BCCH power level (PR=00), alternately with MS2 so that one block out of 2 is sent to MS1, and trigger a Packet downlink Ack/Nack on the 12th RLC data block.
7.	MS -> SS	Packet downlink Ack/Nack	The Packet downlink Ack/Nack acknowledges at least 90% of the RLC data blocks
8.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks with a 6dB attenuation and a valid PR=01 field in 8PSK (MCS9), alternately with MS1 so that one block out of 2 is sent to MS2.
9.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks (CS3) are sent to the MS at the BCCH power level (PR=00), alternately with MS2 so that one block out of 2 is sent to MS1, and trigger a Packet downlink Ack/Nack on the 12th RLC data block.
10.	MS -> SS	Packet downlink Ack/Nack	The Packet downlink Ack/Nack acknowledges at least 90% of the RLC data blocks
11.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks to the MS at the BCCH power-2 dB level (PR=00) in GMSK (MCS4) alternately with MS1 so that one block out of 2 is sent to MS2.
12.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks (CS3) are sent to the MS at the BCCH power level (PR=00), alternately with MS2 so that one block out of 2 is sent to MS1, and trigger a Packet downlink Ack/Nack on the 12th RLC data block.
13.	MS -> SS	Packet downlink Ack/Nack	The Packet downlink Ack/Nack acknowledges at least 90% of the RLC data blocks
14.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks with a 10dB attenuation and a valid PR (PR=10) field in GMSK (MCS4) alternately with MS1 so that one block out of 2 is sent to MS2.
15.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks (CS3) are sent to the MS at the BCCH power level (PR=00), alternately with MS2 so that one block out of 2 is sent to MS1, and trigger a Packet downlink Ack/Nack on the 12th RLC data block.
16.	MS -> SS	Packet downlink Ack/Nack	The Packet downlink Ack/Nack acknowledges at least 90% of the RLC data blocks
17.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks with a 8dB attenuation and a valid PR (PR=10) field in GMSK (MCS4) alternately with MS1 so that one block out of 2 is sent to MS2.

18.	SS -> MS	RLC DATA BLOCK	Send 12 Downlink RLC data blocks (CS3) are sent to the MS at the BCCH power level (PR=00), alternately with MS2 so that one block out of 2 is sent to MS1, and trigger a Packet downlink Ack/Nack on the 12th RLC data block.
19.	MS -> SS	Packet downlink Ack/Nack	The Packet downlink Ack/Nack acknowledges at least 90% of the RLC data blocks
20.	SS<->MS	{ Downlink data transfer }	Macro – Completion on transmission of 20k octets.

Specific message contents

PACKET DOWNLINK ASSIGNMENT (Step 1):

As default message contents except:	
BTS_PWR_CTRL_MODE	0 (mode A)
PR_MODE	0 (PR mode A : for one addressed MS)
P0	0000 (0 dB)

22.13 Enhanced Power Control (EPC) timing and measurement reporting in single slot operation.

22.13.1 Definition

The EPC is Rel-5 feature which is part of GERAN Feature Package 2, see 3GPP TS 24.008. The EPC signalling is mapped onto every SACCH burst, allowing a control interval of 120 ms. It can be used with any speech traffic channel (both GMSK and 8PSK modulated) and does not impact the speech channel coding. The EPC is based on differential control to adjust the employed RF power level, see 3GPP TS 45.008.

22.13.2 Test conformance

1. The MS shall employ the most recently commanded EPC power control level, as indicated by the EPC Uplink Power Control Command sent on the corresponding EPCCH in the downlink. The EPC Uplink Power Control Command is sent once every EPC reporting period, see 3GPP TS 45.008 subclause 8.4.1b. The MS shall ignore the Ordered MS Power Level sent in the SACCH L1 header in the downlink, 3GPP TS 45.008, subclause 4.2.

2. When on a channel in EPC mode, the MS shall use the EPCCH in the uplink for EPC measurement reporting, 3GPP TS 45.008 subclause 4.2.

3. When on a channel in EPC mode, the MS shall confirm, in the SACCH L1 header on the uplink, the RF power control level at the last burst of the previous SACCH period, as specified for normal power control, 3GPP TS 45.008, subclause 4.2

4. If a power control command is received but the requested output power is not supported by the MS, the MS shall use the supported output power which is closest to the requested output power, 3GPP TS 45.008, subclause 4.3

5. The enhanced power control mechanism shall use the differential power control mechanism defined in 3GPP TS 45.008, subclause 4.3

6. When the MS is ordered to obey the Ordered MS Power Level, the timing according to 3GPP TS 45.008 subclause 4.7.1 applies, see 3GPP TS 45.008, subclause 4.7.3

7. When the MS is ordered to obey the EPC Uplink Power Control Command, it shall, upon receipt of an EPC Uplink Power Control Command on an EPCCH in the downlink, change to the new power level on the corresponding uplink channel at the first TDMA frame belonging to the next EPC reporting period (as specified in 3GPP TS 45.008 subclause 8.4.1b), see 3GPP TS 45.008, subclause 4.7.3

22.13.3 Test purpose

1. To verify that power level changes using EPC are implemented by the MS in accordance with conformance requirements 1, 5 and 7.

2. To verify that power control commands requesting levels not supported by the MS are treated in accordance with conformance requirement 4.

3. To verify that the RF power control level confirmed by the MS is in accordance with conformance requirement 3.

4. To verify that the EPC measurement reporting in accordance with conformance requirement 2.

5. To verify that the timing cycle in EPC mode is in accordance with conformance requirements 6 and 7.

22.13.4 Test method

22.13.4.1 Initial conditions

A call is set up by the SS according to the generic call set up procedure for single slot configuration on a channel with ARFCN in the Mid ARFCN range (see table 3.3). The power control level is set to maximum power using normal power control.

Specific PICS statements:

-

PIXIT statements:

-

22.13.4.2 Procedure

If the MS supports both GMSK and 8PSK modulation on the uplink, the test is repeated with each modulation format.

a) Using the normal power control mechanism, the SS shall command the MS to transmit at power level 8 (14dBm) in the case of DCS 1 800 and PCS 1 900 or power level 15 (13 dBm) in the case of all other bands on the TCH/O-TCH, see 3GPP TS 45.005, clause 4. After 1s, see 3GPP TS45.008, clause 4.71 a power measurement shall be made.

NOTE: The method of measuring the MS transmitter output power is given in subclause 13.3. For 8PSK modulation, a measurement method for estimating the long term average power from a single burst shall be employed. See subclause 13.17.3.

b) The SS shall command the MS to switch from normal power control to EPC by means of the SACCH L1 header (see 3GPP TS 44.004). The SS shall note the MS TX power reported by the MS in the EPC reporting period following the change from normal power control to EPC.

c) The SS shall command the MS to follow the schedule of enhanced power control detailed in table 22.13-1 below. The SS shall make power measurements during frame n of each SACCH period when enhanced power control is active. These power measurements shall be referred to as Pn,m respectively.

Table 22.13-1: EPC Timing and Reporting

EPC Reporting Period Number	EPC Uplink Power Control Command	Nominal Output Power during EPC Reporting Period Bands other than DCS 1 800 and PCS 1 900	Nominal Output Power during EPC Reporting Period DCS 1 800 & PCS 1 900	Pm,n
0	1 Step Decrease	13 dBm	14 dBm	P1,0
1	1 Step Decrease	11 dBm	12 dBm	P1,12
2	1 Step Decrease	9 dBm	10 dBm	P1,38
3	1 Step Decrease	7 dBm	8 dBm	P1,64
4	1 Step Decrease	5 dBm	6 dBm	P1,90
5	1 Step Decrease	5 dBm	4 dBm	P2,12
6	1 Step Decrease	5 dBm	2 dBm	P2,38
7	1 Step Decrease	5 dBm	0 dBm	P2,64
8	2 Step Increase	5 dBm	0 dBm	P2,90
9	2 Step Increase	9 dBm	4 dBm	P3,12
10	2 Step Increase	13 dBm	8 dBm	P3,38
11	2 Step Increase	17 dBm	12 dBm	P3,64
12	2 Step Increase	21 dBm	16 dBm	P3,90
13	2 Step Increase	Min (25 dBm, Pmax) for 8PSK 25 dBm for GMSK	20 dBm	P4,12
14	2 Step Increase	Min (29 dBm, Pmax) for 8PSK 29 dBm for GMSK	Min (24 dBm, Pmax) for 8PSK 24 dBm for GMSK	P4,38
15	4 Step Increase	Min (33 dBm, Pmax)	Min (28 dBm, Pmax)	P4,64
16	2 Step Decrease	Pmax	Pmax	P4,90
17	1 Step Increase	Pmax – 4 dB	Pmax – 4 dB	P5,12
18	2 Step Decrease	Pmax – 2 dB	Pmax – 2 dB	P5,38
19	3 Step Increase	Pmax – 6 dB	Pmax – 6 dB	P5,64
20	2 Step Decrease	Pmax	Pmax	P5,90
21	2 Step Decrease	Pmax – 4 dB	Pmax – 4 dB	P6,12
22	4 Step Increase	Pmax – 8 dB	Pmax – 8 dB	P6,38
23	No Change	Pmax	Pmax	P6,64

Pmax is the maximum power for the mobile class, see table 22.13-3.

Pm,n values refer to the power measured in the n-th frame of the m-th SACCH multiframe.

d) The SS shall command the MS to switch to normal power control. The SS shall note the MS TX power reported by the MS in the SACCH reporting period following the change from EPC to normal power control.

22.13.5 Test requirement

a) The power measured in steps a) and b) shall be 14dBm in the case of DCS 1 800 and PCS 1 900 and 13dBm in the case of all other bands. In all cases the tolerance shall be ±3 dB.

b) The powers measured in step c) shall conform with the power specifications in the following table 22.13-2.

Table 22.13-2: EPC Power Measurements

Pm,n	Bands other than DCS 1 800 and PCS 1 900	DCS 1 800/PCS 1 900	Tolerance
P1,0	13 dBm	14 dBm	±3 dB
P2,90	5 dBm	0 dBm	±5 dB
P4,90	Pmax	Pmax	±2 dB
P5,12	Pmax – 4 dB	Pmax – 4 dB	±3 dB
P5,38	Pmax – 2 dB	Pmax – 2 dB	±3 dB
P5,64	Pmax – 6 dB	Pmax – 6 dB	±3 dB
P5,90	Pmax	Pmax	±2 dB
P6,12	Pmax – 4 dB	Pmax – 4 dB	±3 dB
P6,38	Pmax – 8 dB	Pmax – 8 dB	±3 dB
P6,64	Pmax	Pmax	±2 dB

c) The power level reported by the MS in step d) shall be MS TX level corresponding to Pmax for the MS power class, see bellow table 22.13-3.

Table 22.13-3: The MS maximum output power for GMSK and 8PSK modulation

Power class	Bands except DCS 1 800 and PCS 1 900Nominal Maximum output power	Bands except DCS 1 800 and PCS 1 900 Tolerance (dB) for normal conditions	DCS 1 800 Nominal Maximum output power	PCS 1900 Nominal Maximum Output power	DCS 1 800 & PCS 1 900 Tolerance (dB) for normal conditions
1	- - - - - -		30 dBm	30 dBm	±2
2	39 dBm		24 dBm	24 dBm	±2
3	37 dBm		36 dBm	33 dBm	±2
4	33 dBm				±2
5	29 dBm				±2
E1	33 dBm	±2	30 dBm	30 dBm	±2
E2	27dBm	±3	26 dBm	26 dBm	-4/+3
E3	23dBm	±3	22 dBm	22 dBm	±3

22.14 Enhanced Power Control (EPC) timing and measurement reporting in multislot operation.

22.14.1 Definition

The EPC is Rel-5 feature which is part of GERAN Feature Package 2, see 3GPP TS 24.008. The EPC is based on differential control to adjust the employed RF power level, see 3GPP TS 45.008.

High Speed Circuit Switched Data (HSCSD) is one possibility for EPC operation in multislot configuration, see 3GPP TS 45.002, clause 6.4.2.1

22.14.2 Test conformance

8. The MS shall employ the most recently commanded EPC power control level, as indicated by the EPC Uplink Power Control Command sent on the corresponding EPCCH in the downlink. The EPC Uplink Power Control Command is sent once every EPC reporting period, see 3GPP TS 45.008 subclause 8.4.1b. The MS shall ignore the Ordered MS Power Level sent in the SACCH L1 header in the downlink, 3GPP TS 45.008, subclause 4.2.

9. In case of a multislot configuration, each bi-directional channel shall be power controlled individually by the corresponding SACCH, E-IACCH or EPCCH, whichever is applicable, 3GPP TS 45.008, subclause 4.2

10. When on a channel in EPC mode, the MS shall use the EPCCH in the uplink for EPC measurement reporting, 3GPP TS 45.008 subclause 4.2.

11. When on a channel in EPC mode, the MS shall confirm, in the SACCH L1 header on the uplink, the RF power control level at the last burst of the previous SACCH period, as specified for normal power control, 3GPP TS 45.008, subclause 4.2

12. If a power control command is received but the requested output power is not supported by the MS, the MS shall use the supported output power which is closest to the requested output power, 3GPP TS 45.008, subclause 4.3

13. The enhanced power control mechanism shall use the differential power control mechanism defined in 3GPP TS 45.008, subclause 4.3

14. When the MS is ordered to obey the Ordered MS Power Level, the timing according to 3GPP TS 45.008 subclause 4.7.1 applies, see 3GPP TS 45.008, subclause 4.7.3

15. When the MS is ordered to obey the EPC Uplink Power Control Command, it shall, upon receipt of an EPC Uplink Power Control Command on an EPCCH in the downlink, change to the new power level on the corresponding uplink channel at the first TDMA frame belonging to the next EPC reporting period (as specified in 3GPP TS 45.008 subclause 8.4.1b), see 3GPP TS 45.008, subclause 4.7.3

22.14.3 Test purpose

1. To verify that power level changes using EPC are implemented by the MS in accordance with conformance requirements 1, 6 and 8.

2. To verify that power control commands requesting levels not supported by the MS are treated in accordance with conformance requirement 5.

3. To verify that the RF power control level confirmed by the MS is in accordance with conformance requirement 4.

4. To verify that in a multislot configuration the MS implements enhanced power control independently on each bi-directional SACCH or EPCCH in accordance with conformance requirement 2.

5. To verify that the EPC measurement reporting in accordance with conformance requirement 3.

6. To verify that the timing cycle in EPC mode is in accordance with conformance requirement 7 and 8.

22.14.4 Test method

22.14.4.1 Initial conditions

A call is set up by the SS according to the generic call set up procedure for multislot configuration on a channel with ARFCN in the Mid ARFCN range (see table 3.3).

The SS commands the MS to operate in multislot configuration where it has the highest possible number of bi-directional TCHs or O-TCHs. Using normal power control, the level of each TX slot is set to maximum power.

Specific PICS statements:

-

PIXIT statements:

-

22.14.4.2 Procedure

If the MS supports both GMSK and 8PSK modulation on the uplink, the test is repeated with each modulation format.

For the purpose of this test the SS shall randomly select one bi-directional TCH (in case of GMSK modulation) or O-TCH (in case of 8PSK) to exercise. All other channels shall maintain the state defined under the initial conditions. In this procedure these other TCHs/O-TCHs are referred to as the active but unselected channels.

a) Using the normal power control mechanism, the SS shall command the MS to transmit at power level 8 (14dBm) in the case of DCS 1 800 and PCS 1 900 or power level 15 (13 dBm) in the case of all other bands on the selected TCH/O-TCH, see 3GPP TS 45.005, clause 4. After 1s, a power measurement shall be made on each TX slot of the multislot configuration.

NOTE: The method of measuring the MS transmitter output power is given in subclause 13.3. For 8PSK modulation, a measurement method for estimating the long term average power from a single burst shall be employed. See subclause 13.17.3.

b) The SS shall command the MS to switch between the normal power control and the enhanced power control mechanism on the selected TCH/O-TCH by means of the SACCH L1 header (see 3GPP TS 44.004). Each power control mechanism shall be maintained for 6 SACCH multiframes. This cycle shall be repeated until all power measurements specified in steps iii) to vi) below have been completed.

During the SACCH periods when normal power control is active, the SS shall command the MS to maintain the power levels set in step a). During the SACCH periods when Enhanced Power Control is active, the SS shall command the MS to follow the schedule of enhanced power control detailed in table 22.14-1 below.

Table 22.14-1: EPC Timing and Reporting

EPC Reporting Period Number	EPC Uplink Power Control Command	Nominal Output Power during EPC Reporting Period Bands other than DCS 1 800 and PCS 1 900	Nominal Output Power during EPC Reporting Period DCS 1 800 & PCS 1 900	Pm,n
0	1 Step Decrease	13 dBm	14 dBm	P1,0
1	1 Step Decrease	11 dBm	12 dBm	P1,12
2	1 Step Decrease	9 dBm	10 dBm	P1,38
3	1 Step Decrease	7 dBm	8 dBm	P1,64
4	1 Step Decrease	5 dBm	6 dBm	P1,90
5	1 Step Decrease	5 dBm	4 dBm	P2,12
6	1 Step Decrease	5 dBm	2 dBm	P2,38
7	1 Step Decrease	5 dBm	0 dBm	P2,64
8	2 Step Increase	5 dBm	0 dBm	P2,90
9	2 Step Increase	9 dBm	4 dBm	P3,12
10	2 Step Increase	13 dBm	8 dBm	P3,38
11	2 Step Increase	17 dBm	12 dBm	P3,64
12	2 Step Increase	21 dBm	16 dBm	P3,90
13	2 Step Increase	Min (25 dBm, Pmax) for 8PSK 25 dBm for GMSK	20 dBm	P4,12
14	2 Step Increase	Min (29 dBm, Pmax) for 8PSK 29 dBm for GMSK	Min (24 dBm, Pmax) for 8PSK 24 dBm for GMSK	P4,38
15	4 Step Increase	Min (33 dBm, Pmax)	Min (28 dBm, Pmax)	P4,64
16	2 Step Decrease	Pmax	Pmax	P4,90
17	1 Step Increase	Pmax – 4 dB	Pmax – 4 dB	P5,12
18	2 Step Decrease	Pmax – 2 dB	Pmax – 2 dB	P5,38
19	3 Step Increase	Pmax – 6 dB	Pmax – 6 dB	P5,64
20	2 Step Decrease	Pmax	Pmax	P5,90
21	2 Step Decrease	Pmax – 4 dB	Pmax – 4 dB	P6,12
22	4 Step Increase	Pmax – 8 dB	Pmax – 8 dB	P6,38
23	No Change	Pmax	Pmax	P6,64

Pmax is the maximum power for the mobile class, see table 22.14-2.

Pm,n values refer to the power measured in the n-th frame of the m-th SACCH multiframe.

i) The SS shall make power measurements on each active, but unselected timeslot of the multislot configuration during frames 0 and 103 of each SACCH period when normal power control is active.

ii) The SS shall make power measurements on each active, but unselected timeslot of the multislot configuration during frame n of each SACCH period when enhanced power control is active.

iii) The SS shall make power measurements of the active and selected timeslot during frames 0 and 103 of each SACCH period when normal power control is active.

iv) The SS shall make power measurements on the active and selected timeslot during frame n of each SACCH period when enhanced power control is active. These power measurements shall be referred to as Pn,m respectively.

v) The SS shall note the MS TX power reported by the MS for the active and selected timeslot in the SACCH reporting period following the change from enhanced power control to normal power control.

vi) The SS shall note the MS TX power reported by the MS for the active and selected timeslot in the EPC reporting period following the change from normal power control to enhanced power control.

22.14.5 Test requirement

a) The powers measured for the active but unselected timeslots in steps i), ii) shall conform with the Pmax specification for the MS power class given in the table 22.14-2 (see 3GPP TS 45.005, clause 4.1.1).

Table 22.14-2: The MS maximum output power for GMSK and 8PSK modulation

Power class	Bands except DCS 1 800 and PCS 1 900Nominal Maximum output power	Bands except DCS 1 800 and PCS 1 900 Tolerance (dB) for normal conditions	DCS 1 800 Nominal Maximum output power	PCS 1900 Nominal Maximum Output power	DCS 1 800 & PCS 1 900 Tolerance (dB) for normal conditions
1	- - - - - -		30 dBm	30 dBm	±2
2	39 dBm		24 dBm	24 dBm	±2
3	37 dBm		36 dBm	33 dBm	±2
4	33 dBm				±2
5	29 dBm				±2
E1	33 dBm	±2	30 dBm	30 dBm	±2
E2	27dBm	±3	26 dBm	26 dBm	-4/+3
E3	23dBm	±3	22 dBm	22 dBm	±3

In order to manage mobile terminal heat dissipation resulting from transmission on multiple uplink timeslots, the mobile station shall reduce its maximum output power on a per-assignment basis, see 3GPP TS 45.005, clause 4.1.1. For Rel-5 onwards these power reductions are shown in the table 22.14-3.

Table 22.14-3: From Rel-5 onwards: Allowed maximum output power reduction in a multislot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power (dB)
1	0
2	3,0
3	4,8
4	6,0
5	7,0
6	7,8
7	8,5
8	9,0

From Rel-5 onwards, the actual supported maximum output power shall be in the range indicated by the parameters XXX_MULTISLOT_POWER_PROFILE (See 3GPP TS 24.008) for n allocated uplink timeslots:

a ≤ MS maximum output power ≤ min(MAX_PWR, a + b)

Where:

a = min (MAX_PWR, MAX_PWR + XXX_MULTISLOT_POWER_PROFILE – 10log(n));

MAX_PWR equals to the MS maximum output power according to the relevant power class;

XXX_MULTISLOT_POWER_PROFILE refers either to GMSK_MULTISLOT_POWER PROFILE or 8-PSK_MULTISLOT_POWER_PROFILE depending on the modulation type concerned, and

XXX_MULTISLOT_POWER_PROFILE 0 = 0 dB;
XXX_MULTISLOT_POWER_PROFILE 1 = 2 dB;
XXX_MULTISLOT_POWER_PROFILE 2 = 4 dB;
XXX_MULTISLOT_POWER_PROFILE 3 = 6 dB.

For DCS 1 800 and PCS 1 900 frequency bands b = 3 dB, for all other bands b = 2 dB.

b) The power measured for the selected timeslot in step iii) shall be 14 dBm in the case of DCS 1 800 and PCS 1 900 and 13 dBm in the case of all other bands. In all cases the tolerance shall be ±3 dB.

c) The powers measured in step iv) shall conform to the power specifications in the following table 22.14-4.

Table 22.14-4: EPC Power Measurements

Pm,n	Bands other than DCS 1 800 and PCS 1 900	DCS 1 800/PCS 1 900	Tolerance
P1,0	13 dBm	14 dBm	±3 dB
P2,90	5 dBm	0 dBm	±5 dB
P4,90	Pmax	Pmax	±2 dB
P5,12	Pmax – 4 dB	Pmax – 4 dB	±3 dB
P5,38	Pmax – 2 dB	Pmax – 2 dB	±3 dB
P5,64	Pmax – 6 dB	Pmax – 6 dB	±3 dB
P5,90	Pmax	Pmax	±2 dB
P6,12	Pmax – 4 dB	Pmax – 4 dB	±3 dB
P6,38	Pmax – 8 dB	Pmax – 8 dB	±3 dB
P6,64	Pmax	Pmax	±2 dB

d) The power level reported by the MS in step v) shall be MS TX level corresponding to Pmax for the MS power class. See the table 22.14-2 in test requirement a).

e) The power level reported by the MS in step vi) shall be MS TX Level 8 in the case of DCS 1 800 and PCS 1 900 and MS TX Level 15 in the case of all other bands.

23 Single frequency reference

23.1 Definition

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.

23.2 Conformance requirement

The MS shall use the same frequency source for both RF frequency generation and clocking the time base;
3GPP TS 05.10, subclause 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 clauses 15, 16, 17, 18, 19, 20, 21, 22, 23. Other Layer 1 functions are tested in clauses 12, 13 and 14. Some testing of Layer 1 functions is integrated with Layer 3 signalling testing (26).

25 Tests of the layer 2 signalling functions

References:

1 3GPP TS 04.06 and 3GPP TS 04.08/ 3GPP TS 24.008 / 3GPP TS 44.018, 3GPP TS 04.05.

2 ITU-T Recommendation X.290: OSI Conformance Testing Methodology and Framework for CCITT applications, Part 2: Abstract Test Suite Specification.

25.1 Introduction, objective and scope

25.1.1 General

The objective of clause 25 is to provide detail of how Layer 2 of the MS is tested to verify conformance to the testable parameters given in 3GPP TS 04.06. The tests cover SAPI = 0, and they will be carried out on SDCCH and FACCH/F and on FACCH/H if the MS supports half-rate. Testing of unnumbered information transfer on SACCHs is covered implicitly by the test in subclause 26.6.3.

The testing is performed using the test configuration described in subclause 25.1.1.2. This configuration does not provide for testing of conformance of any maintenance functions.

The MS under test shall conform to the test configuration, and the Remote Single layer (RS) test method (ITU-T Recommendation X.290, subclause 8.1.4) will be used.

25.1.2 Test configurations

The Layer 2 test configuration defines the Layer 2 functional blocks of a MS being tested and the access arrangement between MS and tester.

NOTE: These functional blocks provide the Layer 2 basic capabilities which have to be implemented in accordance with the specification given in 3GPP TS 04.06. However, the definition of Layer 2 in the form of a number of functional blocks places no requirements on the Layer 2 implementation in a MS.

An example of a functional composition of the MS Layer 2 is given in 3GPP TS 04.05. These function blocks provide basic capabilities which have to be implemented in accordance with 3GPP TS 04.05 and 3GPP TS 04.06.

Also there are alternatives or options included in 3GPP TS 04.05 and 3GPP TS 04.06, these are provided as complementary capabilities.

25.1.3 Pre-conditions

Before carrying out any Layer 2 tests the tests specified in clauses 12, 13, 14 and 15 to 23 (Layer 1 tests) shall be performed.

Apart from powering up the MS to be tested and being able to establish a call the only access to the MS needed and used for Layer 2 testing is the radio interface. It therefore is necessary that the MS is able to synchronize to the System Simulator and to decode its BCCH and CCCH. Furthermore, the MS must be able to perform the following elementary Layer 3 procedures:

- Paging;
- Immediate Assignment;
- Dedicated Channel Assignment;
- Handover;
- Channel Release.

It is necessary that the tests are performed in the order specified, except where the starting point is set (subclause 25.1.5).

The data link is maintained by the MS and the SS sending fill frames (see 3GPP TS 04.06, subclause 5.4.2.3) on the SDCCH when no other frames are to be transmitted. Fill frames are also sent on the FACCH while the channel mode is set to signalling. The default mode is signalling. The tests will normally be performed with the MS sending fill frames on the main DCCH (i.e. FACCH or SDCCH). Consequently throughout the tests fill frames will be sent and received even while waiting for other Layer 2 frames. The scheduling of the fill frame sending cannot be specified as this sending is closely linked to the processing times in the MS. Therefore, the instants of transmission of fill frames cannot be tested nor the number of these transmissions however, in certain circumstances, the fact that a fill frame is sent can be used as proof that the MS requirement has been fulfilled.

25.1.4 Layer 2 test frames

The Layer 2 conformance test is accomplished by sequences of those frames which are contained in 3GPP TS 04.06 (Layer 2 frame repertoire etc.).

These frame sequences are under control of the System Simulator and are related to the state that the System Simulator perceives the MS to be in as a result of frames transferred across the MS-BS interface.

These frame sequences shall comply with the following rules:

1) The test sequences exchanged between the System Simulator and MS are assumed to be free from transmission errors.

2) The tester may introduce errors in the direction tester to MS by inserting wrong parameters in the address, control and length indication field.

3) The tester may simulate errors in the direction MS to tester by ignoring the receipt of frames from the MS.

4) The tester may violate the protocol rules related to the control of state variables to provoke sequence gaps.

5) There is no contention on the Dm channel at Layer 1 (Layer 1 point-to-point).

6) With respect to contention on the Dm channel at Layer 2, two distinct situations are defined:

   i) Test of the protocol procedure supported by a single entity. In this case there is no contention on the Dm channel (one peer-to-peer information transfer invoked at a time). This test applies to all MSs and is performed for SAPI = 0.

   ii) Test of Layer 2 multiplexing and MS processing capacity in terms of the number of SAPs and links which a MS is able to support simultaneously. In this case there is contention on the Dm channel at Layer 2 and this contention is resolved within Layer 2 based on the SAPI. This test applies to MSs which are designed for supporting SAPI in addition to SAPI = 0.

Examples of special GSM Layer 2 functions to be tested:

- Correct L2 functions on specific GSM control channels;
- Length indication;
- Segmentation, more data bit;
- SABM/UA containing information for contention resolution;
- Abnormal release.

25.1.5 Establishment of the dedicated physical resource

The System Simulator shall simulate a BS with BCCH/CCCH on one carrier. The MS shall be listening to this CCCH and able to respond to paging messages. The system simulator sends Paging Request to the MS on the paging channel. The MS shall respond with Channel Request on the random access channel. The system simulator sends Immediate Assign to the MS, thereby ordering the MS either to a SDCCH or to a TCH, that is FACCH. Each test is performed once on SDCCH, once on FACCH/F and once on FACCH/H if the MS supports half-rate. However tests that explicitly check SDCCH and FACCH are performed once if the MS does not support half-rate and twice (once with FACCH/F and once with FACCH/H) if the MS supports half-rate.

25.1.6 Release of the dedicated physical resource

After a test has been performed the System Simulator shall initiate the release of the SDCCH or FACCH, as laid out in 3GPP TS 04.08 / 3GPP TS 23.108, subclause 7.1.6. This shall return the MS to the idle mode, i.e. the MS shall again be listening to the CCCH of the System Simulator.

25.2 Test sequences

Timing requirement:

The MS shall respond to a command within T200 as defined in 3GPP TS 04.06.

The MS shall repeat a command after time-out of T200 if the command has not been acknowledged as defined in 3GPP TS 04.06.

Constant bit values:

In each frame from the MS:

- bits 6 through 8 of the address field shall be set to zero as defined in 3GPP TS 04.06.

- except for test 25.2.7, the address extension bit (EA bit) shall be set to 1 as defined in 3GPP TS 04.06.
- except for test 25.2.7, the length indicator field extension bit (EL bit) shall be set to 1 as defined in 3GPP TS 04.06.

This shall be checked each time a frame from the MS is received.

Fill bits:

The fill bits transmitted with each frame from the MS whose length indicator L is less than N201 as defined in 3GPP TS 04.06 shall be set as defined in 3GPP TS 04.06.

Frame format description

The frames are described by the following parameter sets:

SABM (C, P, M = 0, L = 0) (* SABM without an information field*)

SABM (C, P, M = 0, L > 0) (* SABM with an information field*)

DISC (C, P, M = 0, L = 0)

UA, (F, M = 0, L = 0) (* UA without an information field*)

UA, (F, M = 0, L > 0) (* UA with an information field*)

DM (R, F, M = 0, L = 0)

RR (C, P, M = 0, L = 0, N(R))

RR (R, F, M = 0, L = 0, N(R))

REJ (C, P, M = 0, L = 0, N(R))

REJ (R, F, M = 0, L = 0, N(R))

I (C, P, M = 0, L < N201, N(S), N(R))

I (C, P, M = 1, L = N201, N(S), N(R))

UI (C, P = 0, M = 0, L = 0)

UI (C, P = 0, M = 0, L < N201)

where:

C = command

R = response

P = poll

F = final

M = M bit

L = length indicator

N(S) = send sequence number

N(R) = receive sequence number

25.2.1 Initialization

25.2.1.1 Initialization when contention resolution required

25.2.1.1.1 Normal initialization

25.2.1.1.1.1 Test purpose

To test the normal establishment of multiple frame operation between the SS and the MS when contention resolution is required.

25.2.1.1.1.2 Method of test

The MS is paged as described in the Layer 2 tests general section at 25.1.5.

The MS shall then continue the setup by sending a SABM frame.

The SS responds with a UA frame.

The MS shall send a UI fill frame.

The SS waits for at least T200 after the UA to ensure the SABM frame is not repeated. This confirms that the UA has been received.

The MS is returned to the idle state as described in subclause 25.1.1.6.

Expected sequence

```
MS                                                                  SS

1------------------------------------SABM (SAPI, C, P, M, L) -------------------------------------->

&lt;-----------------------------------------UA (SAPI, R, F, M, L)------------------------------------------2
                 Fill
3--------------------------------------------UI (C, P, M, L)--------------------------------------------->
                 Frame


                 Wait T200
```

The frames from the SS will be:

2: One UA frame containing:

SAPI = 0, R = 0, F = 1, M = 0, L = L of SABM.

information field = information field of SABM.

25.2.1.1.1.3 Test requirements

The frames from the MS shall be:

1: One SABM frame containing:

SAPI = 0, C = 0, P = 1, M = 0, $0 \le L \le N201$.

information field = Page Response.

3: One UI frame containing:

C = 0, P = 0, M = 0, L = 0.

25.2.1.1.2 Initialization failure

25.2.1.1.2.1 Loss of UA frame

25.2.1.1.2.1.1 Test purpose

To test the MS response to the loss of a Layer 2 UA frame during initialization.

25.2.1.1.2.1.2 Method of test

The MS is paged as described in the Layer 2 tests general section at 25.1.5.

The MS shall then continue the setup by sending an SABM frame.

The SS ignores the first SABM frame from the MS.

The MS shall wait for time-out of timer T200 and then send a second SABM frame.

The SS responds with a UA frame.

The MS shall send a UI fill frame.

The SS waits for at least T200 to ensure the SABM frame is not repeated

The MS is returned to the initial condition by clearing of the call (not part of this test).

Expected sequence

```
MS                                                                          SS

1-------------------------------------SABM (SAPI, C, P, M, L) -------------------------------------->
                  Time-out of T200
1-------------------------------------SABM (SAPI, C, P, M, L) -------------------------------------->

<----------------------------------------UA (SAPI, R, F, M, L)-----------------------------------------2
                  Fill
3---------------------------------------------UI (C, P, M, L)--------------------------------------------->
                  Frame
                  Wait T200
```

The frames from the SS will be:

2: One UA frame containing:

SAPI = 0, R = 0, F = 1, M = 0, L = L of SABM.

information field = information field of SABM.

25.2.1.1.2.1.3 Test requirements

The frames from the MS shall be:

1: One SABM frame (occurs twice) containing:

SAPI = 0, C = 0, P = 1, M = 0, $0 \leq L \leq N201$.

information field = Page Response.

The second SABM frame shall follow the first SABM frame after.

time-out of timer T200.

3: One UI frame containing:

C = 0, P = 0, M = 0, L = 0.

25.2.1.1.2.2 UA frame with different information field

25.2.1.1.2.2.1 Test purpose

To test that the MS will leave the channel and return to the idle state when multiple frame establishment fails because a UA frame with a different information field is received in response to the SABM frame.

To test that the MS will thereafter repeat the immediate assignment procedure returning to the idle state when multiple frame establishment fails because a UA frame with a different information field is received in response to the SABM frame.

To test that MS will not attempt to perform the immediate assignment procedure after the first repetition.

25.2.1.1.2.2.2 Method of test

The MS is paged as described in the general section for Layer 2 testing in subclause 25.1.5. The MS is now in a condition to test the Layer 2 aspects of multiple frame establishment with contention resolution and a UA frame with an information field different from the one in its SABM frame.

The MS shall send an SABM frame.

The SS shall respond with an UA frame whose information field is different from the one in the SABM frame.

The MS shall send an SABM frame.

The SS shall respond with an UA frame whose information field is different from the one in the SABM frame.

The SS shall wait for 3 × T200 to check that the MS does not send any L2 frames other than L2 fill frames on the assigned channel.

After a time equal to 3 × T200 the SS checks that there are no more Layer 2 frames on the assigned channel, for a period of 1 s.

NOTE 1: Possible fill frames are allowed in order to take into account processing time inside the MS.

NOTE 2: There are no further attempts of immediate assignment procedure after the repetition.

15 s after sending the UA frame in response to the repetition of the immediate assignment procedure the SS pages the MS according to subclause 25.2.1.1.1, to make sure that the MS has returned to the idle state.

```
MS                                                                    SS
<-----------------------------------PAGING REQUEST--------------------------------------1
2---------------------------------------CHANNEL REQUEST ---------------------------------------->
<------------------------------------IMMEDIATE ASSIGNMENT ------------------------------------3
4-------------------------------------SABM (SAPI, C, P, M, L) -------------------------------------->
<----------------------------------------UA (SAPI, R, F, M, L)-----------------------------------------5
6---------------------------------------CHANNEL REQUEST ---------------------------------------->
<------------------------------------IMMEDIATE ASSIGNMENT ------------------------------------7
8-------------------------------------SABM (SAPI, C, P, M, L) -------------------------------------->
<----------------------------------------UA (SAPI, R, F, M, L)-----------------------------------------9
Wait for at least 3*T200, fill frames may occur.
There are no Layer 2 frames on the assigned channel for 1 s.
The MS is paged 15 s after step 9.
MS is in idle state.
<-----------------------------------PAGIGNG REQUEST----------------------------------10
11              CHANNEL REQUEST                                                    >
```

The frames from the SS will be:

5, 9: Two UA frames containing:

SAPI = 0, R = 0, F = 1, M = 0, L = 0.

25.2.1.1.2.2.3 Test requirements

The frames from the MS shall be:

4, 8: Two SABM frames containing:

SAPI = 0, C = 0, P = 1, M = 0, 0 < L ≤ N201.

information field = Page Response.

25.2.1.1.2.3 Information frame and supervisory frames in response to an SABM frame

25.2.1.1.2.3.1 Test purpose

To test that the MS will ignore receipt of frames other than a UA when received in response to the SABM frame.

25.2.1.1.2.3.2 Method of test

As in subclause 25.2.1.1.2.2, but instead of returning a UA frame the SS will respond with an I frame, RR frame, REJ frame. (So this test will actually be performed 3 times.) The MS shall ignore receipt of the frames sent by the SS and therefore resend its SABM frame after time-out of T200.

Expected Sequence

```
MS                                                                        SS

1------------------------------------- SABM (SAPI, C, P, M, L) ---------------------------------------->

<-------------------------- I, RR, REJ (SAPI, C, P, M, L, N(R), N(S)) ---------------------------2
                   Time-out of T200
1------------------------------------- SABM (SAPI, C, P, M, L) ---------------------------------------->
```

The frames from the SS will be:

2: One I frame containing:

SAPI = 0, C = 1, P = 1, M = 0, 0 <= L <= N201 (arbitrary), N(R), N(S) arbitrary.

information field arbitrary.

or One RR frame containing:

SAPI = 0, C = 1, P = 1, N(R) arbitrary.

or One REJ frame containing:

SAPI = 0, C = 1, P = 1, N(R) arbitrary.

25.2.1.1.2.3.3 Test requirements

The frames from the MS shall be:

1: One SABM frame (occurs twice) containing:

SAPI = 0, C = 0, P = 1, M = 0, 0 ≤ L ≤ N201.

information field = Page Response.

The second SABM frame shall follow the first SABM frame after time-out of timer T200.

25.2.1.1.3 Initialization denial

25.2.1.1.3.1 Test purpose

To test that the MS takes appropriate action if the network side indicates that it can not enter the multiple frame established state.

25.2.1.1.3.2 Method of test

The MS is paged as described in the Layer 2 tests general section at 25.1.5.

The MS shall then continue the setup by sending a SABM frame.

The SS responds with a DM frame.

The SS then waits at least T200 for the MS to transmit.

The MS shall not repeat the SABM frame.

Expected Sequence

```
MS                                                                          SS

1--------------------------------------SABM (SAPI, C, P, M, L)------------------------------------------>

<---------------------------------------- DM (SAPI, R, F, M, L) -----------------------------------------2
                  Wait for at least T200.
```

The frames from the SS will be:

2: One DM frame containing:

SAPI = 0, R = 0, F = 1, M = 0, L = 0.

25.2.1.1.3.3 Test requirements

The frames from the MS shall be:

1: One SABM frame containing:

SAPI = 0, C = 0, P = 1, M = 0, $0 \leq L \leq N201$.

information field = Page Response.

25.2.1.1.4 Total initialization failure

25.2.1.1.4.1 Test purpose

To test the MS response to the lack of the system to respond to requests to initialize the data link.

25.2.1.1.4.2 Method of test

The MS is paged as described in the Layer 2 tests general section at 25.1.5.

The MS shall then continue the setup by sending a SABM frame.

The SS ignores the first SABM frame from the MS.

The MS shall wait for time-out of timer T200 and then send a second SABM frame.

This is repeated until the MS has sent the SABM frame six times. The MS shall not send the SABM any more than six times.

The SS continues to send paging messages on the BCCH/CCCH and the test continues as in test 25.2.1.1.1.

Expected Sequence

```
MS                                                                  SS

1-------------------------------- SABM (SAPI, C, P, M, L) -------------------------------->
              Time-out of T200
1-------------------------------- SABM (SAPI, C, P, M, L) -------------------------------->
              Time-out of T200
1-------------------------------- SABM (SAPI, C, P, M, L) -------------------------------->
              Time-out of T200
1-------------------------------- SABM (SAPI, C, P, M, L) -------------------------------->
              Time-out of T200
1-------------------------------- SABM (SAPI, C, P, M, L) -------------------------------->
              Time-out of T200
1-------------------------------- SABM (SAPI, C, P, M, L) -------------------------------->
```

25.2.1.1.4.3 Test requirements

The frames from the MS shall be:

1: One SABM frame (occurs six times) containing:

SAPI = 0, C = 0, P = 1, M = 0, ≤ L ≤ N201.

information field = Page Response.

The subsequent SABM frames shall follow the previous SABM frame after time-out of timer T200.

25.2.1.2 Initialization, contention resolution not required

This procedure is used after a data link has been established with contention resolution and a new data link is established on a new channel e.g. handover, dedicated channel assignment.

25.2.1.2.1 Normal initialization without contention resolution

25.2.1.2.1.1 Test purpose

To test the normal initialization of multiple-frame operation when contention resolution is not required.

25.2.1.2.1.2 Method of test

The data link is setup between the MS and the SS as in test 25.2.1.1.1.

After the MS has sent the UI frame the SS initiates the dedicated channel assignment procedure to assign an SDCCH.

The MS shall then continue the setup by sending a SABM frame without contention resolution.

The SS responds with a UA frame.

The MS shall then send an I frame containing the assignment complete message.

The SS shall acknowledge the I frame with an RR frame.

The SS then waits for the MS to send a UI fill frame.

The SS then initiates the dedicated channel assignment procedure to assign an FACCH.

The expected sequence is then repeated. The SS waits for at least T200 to ensure that the SABM is not repeated.

Expected Sequence

```
MS                                                                 SS

1-------------------------------------SABM (SAPI, C, P, M, L) -------------------------------------->

<-----------------------------------------UA (SAPI, R, F, M, L)-----------------------------------------2

3---------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<------------------------------------RR (SAPI, R, F, M, L, N(R)) ------------------------------------4
                   Fill
5---------------------------------------------UI (C, P, M, L)------------------------------------------->
                   Frame
```

The frames from the SS will be:

2: One UA frame containing:

SAPI = 0, R = 0, F = 1, M = 0, L = 0.

4: One RR frame containing:

SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1.

25.2.1.2.1.3 Test requirements

The frames from the MS shall be:

1: One SABM frame containing:

SAPI = 0, C = 0, P = 1, M = 0, L = 0.

3: One I frame containing:

SAPI = 0, C = 0, P = 0, M = 0, $0 \leq L \leq N201$, N(S) = 0, N(R) = 0.

Information field = Assignment Complete.

5: One UI frame containing:

C = 0, P = 0, M = 0, L = 0.

25.2.1.2.2 Initialization failure

25.2.1.2.2.1 Test purpose

To test the MS response to the loss of a Layer 2 UA frame during initialization.

25.2.1.2.2.2 Method of test

The SS initiates the dedicated channel assignment procedure to assign an SDCCH.

The MS shall then continue the setup by sending a SABM frame.

The SS ignores the first SABM frame from the MS.

The MS shall wait for time-out of timer T200 and then send a second SABM frame.

The SS responds with a UA frame.

The MS shall then send an I frame containing the assignment complete message.

The SS shall acknowledge the I frame with an RR frame.

The SS then waits for the MS to send a UI fill frame.

The SS then initiates the dedicated channel assignment procedure to assign a FACCH.

The expected sequence is then repeated. The SS waits for at least T200 to ensure that the SABM is not repeated.

The MS is returned to the idle state as described in subclause 25.1.1.6.

Expected Sequence

```
MS                                                                                   SS

1-------------------------------------SABM (SAPI, C, P, M, L) -------------------------------------->
                  Time-out of T200
1-------------------------------------SABM (SAPI, C, P, M, L) -------------------------------------->

<-----------------------------------------UA (SAPI, C, F, M, L)-----------------------------------------2

3---------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<-----------------------------------RR (SAPI, R, F, M, L, N(R)) ------------------------------------4
                  Fill
5---------------------------------------------UI (C, P, M, L)---------------------------------------------->
                  Frame
```

The frames from the SS will be:

2: One UA frame containing:

SAPI = 0, R = 0, F = 1, M = 0, L = 0.

4: One RR frame containing:

SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1.

25.2.1.2.2.3 Test requirements

The frames from the MS shall be:

1: One SABM frame (occurs twice) containing:

SAPI = 0, C = 0, P = 1, M = 0, L = 0.

The second SABM frame shall follow the first SABM frame after time-out of timer T200.

3: One I frame containing:

SAPI = 0, C = 0, P = 0, M = 0, 0 ≤ L ≤ N201, N(S) = 0, N(R) = 0

Information field = Assignment Complete

5: One UI frame containing:

C = 0, P = 0, M = 0, L = 0.

25.2.1.2.3 Initialization denial

25.2.1.2.3.1 Test purpose

To test that the MS takes appropriate action if the data link can not be initialized if the network side indicates the Layer 3 process is busy.

25.2.1.2.3.2 Method of test

The data link is setup between the MS and the SS as in test 25.2.1.1.1.

After the MS has sent the UI frame the SS initiates the dedicated channel assignment procedure to assign a SDCCH.

The MS shall then continue the setup by sending a SABM frame.

The SS responds with a DM frame.

The SS then waits at least T200.

The MS shall not repeat the SABM frame. However the MS will attempt to re-establish the link on the previous channel.

The test is repeated, but a FACCH is assigned in place of the SDCCH.

Expected Sequence

```
MS                                                                                SS

1-------------------------------------SABM (SAPI, C, P, M, L) --------------------------------------->

<--------------------------------------- DM (SAPI, C, P, M, L) -----------------------------------------2
```

The frames from the SS will be:

2: One DM frame containing:

SAPI = 0, R = 0, F = 1, M = 0, L = 0.

25.2.1.2.3.3 Test requirements

The frames from the MS shall be:

1: One SABM frame containing:

SAPI = 0, C = 0, P = 1, M = 0, L = 0.

25.2.1.2.4 Total initialization failure

25.2.1.2.4.1 Test purpose

To test the MS response to the lack of the system to respond to requests to initialize the data link.

25.2.1.2.4.2 Method of test

The data link is setup between the MS and the SS as in test 25.2.1.1.1.

After the MS has sent the UI frame the SS initiates the dedicated channel assignment procedure to assign a SDCCH.

The MS shall then continue the setup by sending a SABM frame.

The SS ignores the first SABM frame from the MS.

The MS shall wait for time-out of timer T200 and then send a second SABM frame.

This is repeated until the MS has sent the SABM frame six times.

The MS shall not send the SABM any more than six times.

The test is repeated, but a FACCH is assigned in place of the SDCCH.

Expected Sequence

```
MS                                                                              SS

1-------------------------------------- SABM (SAPI, C, P, M, L) --------------------------------------->
                    Time-out of T200
1-------------------------------------- SABM (SAPI, C, P, M, L) --------------------------------------->
                    Time-out of T200
1-------------------------------------- SABM (SAPI, C, P, M, L) --------------------------------------->
                    Time-out of T200
1-------------------------------------- SABM (SAPI, C, P, M, L) --------------------------------------->
                    Time-out of T200
1-------------------------------------- SABM (SAPI, C, P, M, L) --------------------------------------->
                    Time-out of T200
1-------------------------------------- SABM (SAPI, C, P, M, L) --------------------------------------->
```

25.2.1.2.4.3 Test requirements

The frames from the MS shall be:

1: One SABM frame (occurs six times) containing:

SAPI = 0, C = 0, P = 1, M = 0, L = 0.

The subsequent SABM frames shall follow the previous SABM frame after time-out of timer T200.

25.2.2 Normal information transfer

25.2.2.1 Sequence counting and I frame acknowledgements

25.2.2.1.1 Test purpose

To test the operation of Layer 2 sequence numbering. Since there are 8 sequence numbers the test cycles through 9 information frame transfers.

25.2.2.1.2 Method of test

The MS is brought into the multiple frame established state as described in test 25.2.1.1.1.

The SS sends an Identity Request message asking for IMEI to the MS.

The MS shall acknowledge this I frame with an Identity Response I frame or a RR frame.

This is repeated a further 8 times as rapidly as possible assuming a window size 1.

The MS Layer 3 response time should be less than 4*T200 and therefore the MS responses to at least the 5th, 6th, 7th, 8th and 9th I frames must be an I frame on the SDCCH. On the FACCH it is possible that all MS responses at Layer 2 will be RR frames.

The frames from the SS will be:

1, 3, 5, 7, 9, 11, 13, 15, 17: One I frame (occurs nine times) containing:

SAPI = 0, C = 1, P = 0, M = 0, $0 \leq L \leq N201$.

N(S) = 0, 1, 2, 3 .... 7, 0.

N(R) = (number of I frames received in the test sequence hitherto) mod 8.

information field = Identity Request (IMEI).

19, 21, and so on, until the SS has received 9 I frames from the MS: One RR frame containing:

SAPI = 0, R = 0, F = 0, M = 0, L = 0.

N(R) = (number of I frames received in the test sequence hitherto) mod 8.

25.2.2.1.3 Test requirements

There shall be an integer k >= 0 such that for i = 1, 2, ..., k + 9 the following conditions (a) and (b) both hold:

(a) The MS sends 9 I frames and k RR frames during the test.

(b) The frames sent by the MS in step 2×i are:

(b1) If the frame is an RR frame (occurs k times): one RR frame containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0.

N(R) = ((Value of N(S) in the last received I frame from the SS) + 1) mod 8.

(b2) If the frame is an I frame (occurs 9 times): one I frame containing:

SAPI = 0, C = 0, P = 0, M = 0, 0 <= L <= N201.

N(R) = ((Value of N(S) in the last received I frame from the SS) + 1) mod 8.

N(S) = (number of I frame sent hitherto by the MS to SS excluding the actual I frame) mod 8.

information field = Identity Response (IMEI).

Example of expected sequence (assuming 3 x T200 < L3 reaction time < 4 x T200):

MS SS

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------1

2------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------>

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------3

4------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------>

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------5

6------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------>

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------7

8------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------>

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------9

10--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------11

12--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------13

14--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------15

16--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------17

18--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<------------------------------------RR (SAPI, R, M, L, N(R), F) -----------------------------------19

20--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<------------------------------------RR (SAPI, R, M, L, N(R), F) -----------------------------------21

22--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<------------------------------------RR (SAPI, R, M, L, N(R), F) -----------------------------------23

24--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<------------------------------------RR (SAPI, R, M, L, N(R), F) -----------------------------------25

26--------------------------------I (SAPI, C, P, M, L, N(S), N(R))---------------------------------->

<------------------------------------RR (SAPI, R, M, L, N(R), F) -----------------------------------27

The frames from the SS will be:

1, 3, 5, 7, 9, 11, 13, 15, 17: One I frame (occurs nine times) containing:

SAPI = 0, C = 1, P = 0, M = 0, 0 ≤ L ≤ N201.

N(S) = 0, 1, 2, 3....7, 0.

N(R) = 0, 0, 0, 0, 0, 1, 2, 3, 4.

information field = Identity Request (IMEI).

19, 21, 23, 25, 27: One RR frame (occurs five times) containing:

SAPI = 0, R = 0, F = 0, M = 0, L = 0.

N(R) = 5, 6, 7, 0, 1.

The frames from the MS shall be:

2, 4, 6, 8: One RR frame (occurs four times) containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0.

N(R) = 1, 2, 3, 4.

10, 12, 14, 16, 18, 20, 22, 24, 26: One I frame (occurs nine times) containing:

SAPI = 0, C = 0, P = 0, M = 0, 0 ≤ L ≤ N201.

N(R) = 5, 6, 7, 0, 1, 1, 1, 1, 1.

N(S) = 0, 1, 2, 3, 4, 5, 6, 7, 0.

information field = Identity Response (IMEI).

25.2.2.2 Receipt of an I frame in the timer recovery state

25.2.2.2.1 Test purpose

To test that the MS is able to respond to I frames whilst in the timer recovery state.

25.2.2.2.2 Method of test

The MS is brought into the multiple frame established state as described in test 25.2.1.1.1.

The SS sends an Identity Request message asking for IMEI to the MS.

The MS shall respond with a RR frame though this may be incorporated with the Identity Response I frame.

The SS does not respond to the I frame.

The MS shall wait for expiry of timer T200 and then repeat the I frame but with the P bit set to 1.

The SS then sends a valid Identity Request I frame asking for IMEI which does not acknowledge receipt of the I frame from the MS.

On the FACCH the MS may send an RR frame acknowledging the I frame.

The MS shall repeat the I frame, this frame will acknowledge receipt of the second I frame from the SS.

The SS then acknowledges receipt of the MS I frame by sending a RR frame.

The MS shall send the next I frame. The SS acknowledges this I frame.

Expected Sequence

```
MS                                                                              SS

<----------------------------------I (SAPI, C, P, M, L, N(S), N(R))-----------------------------------1

2------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------->
                    May be incorporated
3----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->
                    Time-out of T200
4----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->

<----------------------------------I (SAPI, C, P, M, L, N(S), N(R))-----------------------------------5

5 bis--------------------------------RR(SAPI, R, M, L, N(R), F)--------------------------------------->

6----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->

<------------------------------------RR (SAPI, R, M, L, N(R), F) -------------------------------------7
                    Time-out of T200
8----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->

<------------------------------------RR (SAPI, R, M, L, N(R), F) -------------------------------------9
```

The frames from the SS will be:

1, 5: One I frame (occurs twice) containing:

SAPI = 0, C = 1, P = 0, M = 0, 0 ≤ L ≤ N201, N(S) = 0, 1, N(R) = 0.

information field = Identity Request.

7, 9: One RR frame (occurs twice) containing:

SAPI = 0, R = 0, F = 1, 0, M = 0, L = 0, N(R) = 1, 2.

25.2.2.2.3 Test requirements

The frames from the MS shall be:

2: One RR frame containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0, N(R) = 1.

3, 8: One I frame (occurs twice) containing:

SAPI = 0, C = 0, P = 0, M = 0, 0 ≤ L ≤ N201, N(R) = 1, 2, N(S) = 0, 1

information field = Identity Response

4, 6: One I frame (occurs twice) containing:

SAPI = 0, C = 0, P = 1, M = 0, 0 ≤ L ≤ N201, N(R) = 1, 2, N(S) = 0.

information field = Identity Response.

5 bis: (possible only on the FACCH) One RR frame containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0, N(R) = 2.

25.2.2.3 Segmentation and concatenation

25.2.2.3.1 Test purpose

To test the proper use of segmentation and concatenation, suspend and resume.

25.2.2.3.2 Method of test

Specific PICS statements:

- MS supporting USSD (TSPC_Serv_SS_unstruct)

- MS supporting CC protocol for at least one Bearer Capability (TSPC_Addinfo_CCprotocol_oneBC)

If the MS supports the UnStructuredSSData operation, then the MS is made to activate an unknown supplementary service as defined in 3GPP TS 02.30 with the following sequence *NN*si#: NN is chosen to be undefined in 3GPP TS 02.30 annex 2 and is an IA5. Total length of *NN*si# shall be 20 characters.

If the MS does not support the UnStructuredSSData operation, then the MS is made to initiate a call.

The SS responds with the Immediate Assign procedure firstly allocating a SDCCH and on the second repeat of the test a TCH.

The MS is brought into the multiple frame established state by continuing as described in test 25.2.1.1.1. The layer three message element in the SABM will be CM Serv Request.

The SS sends the UA and waits for 10 s. The SS then sends an I frame with CM Serv Accept.

The MS sends either:

- a REGISTER message which is segmented between two I frames; or

- a SETUP message.

The SS shall acknowledge only the I frame with more bit set to 1 (if any) but it shall not acknowledge the I frame with more bit set to 0.

The SS then performs a handover (in the case of SDCCH this shall be finely synchronized) while still on the assigned channel and without acknowledging the last I frame of the MS layer 3 message, making sure to fill the handover command to more than 21 octets (for example by using the cell channel description element).

On the SDCCH the MS will go into timer recovery and resend the last I frame of the layer 3 message with the P bit set to 1 when it acknowledges the two I frames of the handover command. On the FACCH the MS may simply acknowledge both I frames.

The MS does not attempt to resend the last I frame of the REGISTER or SETUP message on the old channel but instead goes to the new channel where it performs a random access using the Handover Access message and then multiple frame establishment without contention resolution as described in test 25.2.1.2.1.

The MS shall then send an I frame with the Handover complete message. Assuming this is a finely synchronized handover.

The SS acknowledges this I frame.

The MS shall then resend the previous REGISTER or SETUP message, that is all frames which are acknowledged in the usual way.

The test has to be repeated on the FACCH.

Expected Sequence

```
MS                                                                    SS

1------------------------------- SABM (SAPI, C, P, M, L) ------------------------------->

<----------------------------------UA (SAPI, R, F, M, L)----------------------------------2

<-----------------------------I (SAPI, C, P, M, L, N(S), N(R))-----------------------------3

4------------------------------ RR (SAPI, R, F, M, L, N(R)) ------------------------------>
              May be incorporated
5-----------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------->
              May be absent
<------------------------------ RR (SAPI, R, M, L, N(R), F) ------------------------------6

7-----------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------->

<-----------------------------I (SAPI, C, P, M, L, N(S), N(R))-----------------------------8

9-----------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------->
              (see Note 1)
<-----------------------------I (SAPI, C, P, M, L, N(S), N(R))-----------------------------10

11 ----------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------->
              (see Note 2)
```

************************* Channel Change ************************

******************* including Handover Access *******************

```
12 ------------------------------ SABM (SAPI, C, P, M, L) ------------------------------->

<----------------------------------UA (SAPI, R, F, M, L)----------------------------------13

14 ----------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------->

<------------------------------ RR (SAPI, R, F, M, L, N(R)) ------------------------------15

16 ----------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------->
              May be absent
<------------------------------ RR (SAPI, R, M, L, N(R), F) ------------------------------17

18 ----------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------->

<------------------------------ RR (SAPI, R, M, L, N(R), F) ------------------------------19
              Fill
20 ------------------------------------ UI (C, P, M, L)------------------------------------->
              Frame
```

NOTE 1: The MS may send RR frames on the FACCH in addition to the I frames in 9 and 11.

NOTE 2: The I frame in 11 is optional.

The frames from the SS will be:

2: One UA frame containing:

SAPI = 0, R = 0, F = 1, M = 0, L = L of SABM.

information field = information field of SABM.

3: One I frame containing:

SAPI = 0, C = 1, P = 0, M = 0, 0 < L <N201, N(S) = 0, N(R) = 0.

information field = CM Service Accept.

6: One RR frame containing: (This frame is sent only if frame 5 was received)

SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1.

8, 10: Two I frames containing:

SAPI = 0, C = 1, P = 0, M = 1, 0, L = N201, <= N201, N(S) = 1, 2, N(R) = 1 or 0.

information field = Handover.

13: One UA frame containing:

SAPI = 0, R = 0, F = 1, M = 0, L = 0.

15, 17, 19: Two or three RR frames containing:

SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1, 2 or 1, 2, 3.

25.2.2.3.3 Test requirements

The frames from the MS shall be:

1: One SABM frame containing:

SAPI = 0, C = 0, P = 1, M = 0, 0 ≤ L ≤ N201.

information field = CM Service Request.

4: One RR frame containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0, N(R) = 1.

5, 7: Two I frames containing: (The first I frame may be missing)

SAPI = 0, C = 0, P = 0, M = 1, 0, L = N201, ≤ N201, N(S) = 0, 1 or 0, N(R) = 1.

information field = Register or Setup.

9, 11: Two I frames containing:

SAPI = 0, C = 0, P = 1, M = 0, 0 < L ≤ N201, N(S) = 1 or 0, N(R) = 2, 3.

information field = Register or Setup.

NOTE: The I frame in 11 is optional.

12: One SABM frame containing:

SAPI = 0, C = 0, P = 1, M = 0, L = 0.

14: One I frame containing:

SAPI = 0, C = 0, P = 0, M = 0, 0 < L < N201, N(S) = 0, N(R) = 0.

information field = Handover Complete.

16, 18: Two I frames containing: (The first I frame may be missing)

SAPI = 0, C = 0, P = 0, M = 1, 0, L = N201, 0 < L ≤ N201, N(S) = 1, 2 or 1, N(R) = 0.

information field = Register or Setup.

20: UI frame containing:

C = 0, P = 0, M = 0, L = 0.

25.2.3 Normal layer 2 disconnection

25.2.3.1 Test purpose

To test the normal data link disconnection sequences.

25.2.3.2 Method of test

The data link is setup between the MS and the SS as in test 25.2.1.1.1.

The SS sends a Layer 2 Disconnect message to the MS.

The MS shall respond with a UA frame and return to the idle state; no more Layer 2 (I, S or U) frames, except possibly one or more "Fill" frames, shall be sent. The SS may receive "Fill" frames after the sending of the DISC frame. If this occurs this may only happen for up to T200 after the sending of the DISC frame. The checking for Layer 2 frames, and the recording of any "Fill" frames, is done for a time defined as 4 × T200.

The SS confirms that the MS has returned to the idle state by performing test 25.2.1.1.1.

Expected Sequence

```
MS                                                                          SS

<--------------------------------------DISC (SAPI, C, P, M, L) ---------------------------------------1

2----------------------------------------UA (SAPI, R, M, L, F)----------------------------------------->
```

The frames from the SS will be:

1: One DISC frame containing:

SAPI = 0, C = 1, P = 1, M = 0, L = 0.

25.2.3.3 Test requirements

The frames from the MS shall be:

2: One UA frame containing:

SAPI = 0, R = 1, F = 1, M = 0, L = 0.

No other Layer 2 (I, S or U) frames shall occur. If "Fill" frames are sent this may only be done for up to T200 after the sending of the DISC frame.

25.2.4 Test of link failure

25.2.4.1 I frame loss (MS to SS)

25.2.4.1.1 Test purpose

To test that the MS repeats an I frame N200 times with T200 between two I frames and that the MS releases the layer 2 link after N200 repetitions of the I frame in the case when no answer to the I frame is received.

25.2.4.1.2 Method of test

The MS is brought into the multiple frame established state as described in test 25.2.1.1.1.

The SS sends an Identity Request message asking for IMEI to the MS.

The MS shall respond with a RR frame though this may be incorporated with the Identity Response I frame.

The SS does not respond to the I frame.

The MS shall wait for expiry of timer T200 and then repeat the I frame but with the P bit set to 1.

This is repeated until the MS has sent the I frame N200+1 times. The MS shall not send any layer 2 frame. This is checked for a time of 4 × T200. The MS shall return to the idle state. This is checked by performing test 25.2.1.1.1.

Expected Sequence

```
MS                                                                      SS

<----------------------------------I (SAPI, C, P, M, L, N(S), N(R))-----------------------------------1

2------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------->
                 May be incorporated
3----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->
                 Time-out of T200
4----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->
                 Time-out of T200
4----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->
                 Time-out of T200
                 .                                                      .
                 .                                                      .
                 .                                                      .
4----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->
                 Time-out of T200
4----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------->
```

The frames from the SS will be:

1: One I frame containing:

SAPI = 0, C = 1, P = 0, M = 0, 0 ≤ L ≤ N201, N(S) = 0, N(R) = 0.

information field = Identity Request.

25.2.4.1.3 Test requirements

The frames from the MS shall be:

2: One RR frame containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0, N(R) = 1.

3: One I frame containing:

SAPI = 0, C = 0, P = 0, M = 0, 0 ≤ L ≤ N201, N(R) = 1, N(S) = 0.

information field = Identity Response.

4: One I frame (occurs N200 times) containing:

SAPI = 0, C = 0, P = 1, M = 0, 0 ≤ L ≤ N201, N(R) = 1, N(S) = 0.

information field = Identity Response.

25.2.4.2 RR response frame loss (SS to MS)

Covered in test 25.2.2.2.

25.2.4.3 RR response frame loss (MS to SS)

25.2.4.3.1 Test purpose

To test the Layer 2 recovery mechanism in the event of RR frame loss.

25.2.4.3.2 Method of test

The MS is brought into the multiple frame established state as described in test 25.2.1.1.1.

The SS sends a I frame containing a Layer 3 message using PD = 1111 (e.g. 0FH) to the MS. The L3 message is TEST INTERFACE with tested device equal to 0.

The MS shall respond with a RR frame.

The SS ignores the RR frame from the MS but after T200 from the I frame sent by the SS the SS repeats the I frame but with the P bit set to 1. This simulates loss of the RR from the MS.

The MS shall respond with either an RR or REJ frame.

NOTE: This requirement is less restrictive than 3GPP TS 04.06.

Expected Sequence

```
MS                                                                    SS

<----------------------------------I (SAPI, C, P, M, L, N(S), N(R))-----------------------------------1

2------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------->
                  Time-out of T200
<----------------------------------I (SAPI, C, P, M, L, N(S), N(R))-----------------------------------3

4------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------->

OR

4----------------------------------- REJ (SAPI, R, M, L, N(R), F) ------------------------------------>
```

The frames from the SS will be:

1: One I frame containing:

SAPI = 0, C = 1, P = 0, M = 0, L = 3, N(S) = 0, N(R) = 0.

3: One I frame containing:

SAPI = 0, C = 1, P = 1, M = 0, L = 3, N(S) = 0, N(R) = 0.

25.2.4.3.3 Test requirements

The frames from the MS shall be:

2: One RR frame containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0, N(R) = 1.

4: One RR frame containing:

SAPI = 0, R = 1, F = 1, M = 0, L = 0, N(R) = 1.

OR

4: One REJ frame containing:

SAPI = 0, R = 1, F = 1, M = 0, L = 0, N(R) = 1.

25.2.5 Test of frame transmission with incorrect C/R values

Purpose of tests

To test that the MS will react correctly upon the reception of a frame with incorrect C/R value.

Initial Conditions

Perform the establishment of the dedicated physical resource according to 25.1.5 and initialize the link as in subclause 25.2.1.1.1. Then proceed as stated below.

25.2.5.1 I frame with C bit set to zero

25.2.5.1.1 Test purpose

To test that the MS will take no action when it receives an I frame with the C bit set to zero (R).

25.2.5.1.2 Method of test

The data link is set up between the MS and the SS as in test 25.2.1.1.1.

The SS shall send an I frame with the C bit set to zero to the MS.

The SS shall then wait for at least 4 times T200 to make sure that the MS does not respond to that I frame but that the MS keeps sending fill frames.

The SS shall after 4 times T200 send a RR command, P bit set to 1.

The MS shall respond with a RR response, F bit set to 1.

Expected Sequence

```
MS                                                                          SS

<----------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------1
                   Fill
2---------------------------------------------UI (C, P, M, L)----------------------------------------------->
                   Frame
<------------------------------------RR (SAPI, C, M, L, N(R), P) ------------------------------------3

4------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------>
```

The frames from the SS will be:

1: One I frame containing:

SAPI = 0, C = 0, P = 1, M = 0, 0 ≤ L ≤ N201, N(R) = 0, N(S) = 0.

Information field = Identity Request.

3: One RR frame containing:

SAPI = 0, C = 1, P = 1, M = 0, L = 0, N(R) = 0.

25.2.5.1.3 Test requirements

The frames from the MS shall be:

2: UI frames containing:

C = 0, P = 0, M = 0, L = 0.

4: One RR frame containing:

SAPI = 0, R = 1, F = 1, M = 0, L = 0, N(R) = 0.

25.2.5.2 SABM frame with C bit set to zero

25.2.5.2.1 Test purpose

To test that the MS will take no action when it receives an SABM frame with the C bit set to zero (R).

25.2.5.2.2 Method of test

The MS is brought into the multiple frame established state as described in test 25.2.1.1.1.

The SS sends an I frame containing a Layer 3 message using PD=1111 (e.g. 0FH) in order to raise V(R) in the MS to 1. The L3 message is TEST INTERFACE with tested device equal to 0.

The MS shall acknowledge this by the appropriate RR frame.

The SS sends SABM with the C bit set to zero.

The SS shall after 4 times T200 send a RR command, P bit set to 1.

The MS shall respond with a RR response, F bit set to 1.

The MS is returned to the idle state as described in subclause 25.2.1.1.6.

Expected Sequence

```
MS                                                                        SS

<---------------------------------I (SAPI, C, P, M, L, N(S), N(R))----------------------------------1

2-----------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------>

<-------------------------------------SABM (SAPI, C, P, M, L) --------------------------------------3
                     Fill
4--------------------------------------------UI (C, P, M, L)-------------------------------------------->
                     Frame
<-----------------------------------RR (SAPI, C, M, L, N(R), P) ------------------------------------5

6-----------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------>
```

The frames from the SS will be:

1: One I frame containing:

SAPI = 0, C = 1, P = 0, M = 0, L = 3, N(S) = 0, N(R) = 0.

3: One SABM frame containing:

SAPI = 0, C = 0, P = 1, M = 0, L = 0.

5: One RR frame containing:

SAPI = 0, C = 1, P = 1, M = 0, L = 0, N(R) = 0.

25.2.5.2.3 Test requirements

The frames from the MS shall be:

2: One RR frame containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0, N(R) = 1.

4: One UI frame containing:

C = 0, P = 0, M = 0, L = 0.

6: One RR frame containing:

SAPI = 0, R = 1, F = 1, M = 0, L = 0, N(R) = 1.

25.2.6 Test of errors in the control field

Purpose of tests

To test that the MS will react in the proper way to errors in the Control Field.

25.2.6.1 N(S) sequence error

25.2.6.1.1 Test purpose

To test that the MS will ignore the contents of the I field of an out-of-sequence I frame from the SS.

25.2.6.1.2 Method of test

The MS is brought into the multiple frame established state as described in test 25.2.1.1.1.

The SS shall send a correct I frame containing Identity Request.

The MS shall acknowledge this in a RR frame or piggy back the acknowledgement onto the I frame carrying Identity Response.

The SS shall then send an I frame containing Identity Request with incorrect N(S) but correctly acknowledging the MS's I frame; P bit set to zero.

The MS shall send a REJ frame.

The SS shall, after T200, send another I frame with incorrect N(S), P bit set to 1 this time.

The MS shall respond with a REJ, F bit set to 1.

The MS shall resume the transmission of fill frames.

Expected Sequence

```
MS                                                                    SS

<-----------------------------------I (SAPI, C, P, M, L, N(S), N(R))------------------------------------1

2------------------------------------RR (SAPI, R, M, L, N(R), F) ------------------------------------->
                May be incorporated
3-----------------------------------I (SAPI, C, P, M, L, N(S), N(R))------------------------------------>

<-----------------------------------I (SAPI, C, P, M, L, N(S), N(R))------------------------------------4

5----------------------------------- REJ (SAPI, R, P, M, L, N(R)) ------------------------------------->
                Time out of T200.
<-----------------------------------I (SAPI, C, P, M, L, N(S), N(R))------------------------------------6

7----------------------------------- REJ (SAPI, R, F, M, L, N(R)) ------------------------------------->
                Fill
8----------------------------------------------UI (C, P, M, L)------------------------------------------------>
                Frame
```

The frames from the SS will be:

1: One I frame containing:

SAPI = 0, C = 1, P = 0, M = 0, 0 ≤ L ≤ N201, N(S) = 0, N(R) = 0.

information field = Identity Request.

4: One I frame containing:

SAPI = 0, C = 1, P = 0, M = 0, 0 ≤ L ≤ N201, N(S) = 0, N(R) = 1

information field = Identity Request

6: One I frame containing:

SAPI = 0, C = 1, P = 1, M = 0, 0 ≤ L ≤ N201, N(S) = 0, N(R) = 1

information field = Identity Request

25.2.6.1.3 Test requirements

The frames from the MS shall be:

2: One RR frame containing:

SAPI = 0, R = 1, F = 0, M = 0, L = 0, N(R) = 1.

3: One I frame containing:

SAPI = 0, C = 0, P = 0, M = 0, 0 ≤ L ≤ N201, N(R) = 1, N(S) = 0.

information field = Identity Response.

5: One REJ frame containing:

SAPI = 0, R = 1, P = 0, M = 0, L = 0, N(R) = 1.

7: One REJ frame containing:

SAPI = 0, R = 1, F = 1, M = 0, L = 0, N(R) = 1.

8: One UI frame containing:

C = 0, P = 0, M = 0, L = 0.

25.2.6.2 N(R) sequence error

25.2.6.2.1 Test purpose

To test that the MS will detect a N(R) sequence error and react in the proper way to it.

25.2.6.2.2 Method of test

The MS is brought into the multiple frame established state as described in test 25.2.1.1.1.

The SS shall send an I frame containing an information field of length N201 and an incorrect receive sequence number.

The MS may:

a) send a DISC frame within N200×T200; or

b) perform a "local end release".

In case a) the SS shall respond with a UA frame. In case b) it detects a lower layer failure.

NOTE: The delay N200×T200 is specified for test purpose only. It is assumed that the L3 reaction time within the MS to command a release is less than this delay, which is less than the delay before the SS would detect a L2 failure.

Expected Sequence

```
MS                                                                  SS

<---------------------------------I (SAPI, C, P, M, L, N(R), N(S))----------------------------------1
                optional
2------------------------------------------DISC (C, P, M, L)------------------------------------------>

<------------------------------------------- UA (R, F, M, L) -------------------------------------------3
```

The frames from the SS are:

1: One I frame:

SAPI 0, C = 1, P = 0, M = 1, L = N201, N(R) = 1, N(S) = 0.

In case a):

3: One UA frame:

SAPI = 0, R = 0, F = 1, M = 0, L = 0.

25.2.6.2.3 Test requirements

The frame from the MS in case a) shall be:

2: One DISC frame:

SAPI = 0, C = 0, P = 1, M = 0, L = 0.

25.2.6.3 Improper F bit

25.2.6.3.1 Test purpose

To test that the MS, being in the timer recovery state, will return to the multiple frame established state only after having received an RR response with the F bit set to 1. This test is covered in test 25.2.2.2.

25.2.7 Test on receipt of invalid frames

25.2.7.1 Test purpose

To test that the MS will ignore all invalid frames.

25.2.7.2 Method of test

The data link is set up between the MS and the SS as in test 25.2.1.1.1.

The SS shall then transmit an:

- RR frame with the Length indicator greater than zero and a faulty N(R);
- REJ frame with the EA bit set to zero and a faulty N(R);
- SABM frame with the EL bit set to zero;
- DM frame with the Length indicator greater than zero;
- DISC frame with the M bit set to 1;
- UA frame with the EA bit set to zero;
- I frame with the Length indicator greater than N201;
- I frame with the M bit set to 1 and the Length indicator less than N201;
- command frames with correct Address and Length indicator field and a non-implemented control field.

After T200 the SS shall in every case transmit an RR command, P bit set to 1.

The MS shall respond with an RR response, F bit set to 1.

Expected Sequence

```
MS                                                                              SS

<------------------------------------ RR (SAPI, R, F, M, L, N(R)) ------------------------------------1
                  Fill
2--------------------------------------------- UI (C, P, M, L)----------------------------------------------->
                  Frame
<------------------------------------ RR (SAPI, C, P, M, L, N(R)) ------------------------------------10

11 --------------------------------- RR (SAPI, R, F, M, L, N(R)) ------------------------------------->

<------------------------------------ REJ (SAPI, R, F, M, L, N(R) ------------------------------------3
                  Fill
2--------------------------------------------- UI (C, P, M, L)----------------------------------------------->
                  Frame
<------------------------------------ RR (SAPI, C, P, M, L, N(R)) ------------------------------------10

11 --------------------------------- RR (SAPI, R, F, M, L, N(R)) ------------------------------------->

<-------------------------------------- SABM (SAPI, C, P, M, L) ---------------------------------------4
                  Fill
2--------------------------------------------- UI (C, P, M, L)----------------------------------------------->
                  Frame
<------------------------------------ RR (SAPI, C, P, M, L, N(R)) ------------------------------------10

11 --------------------------------- RR (SAPI, R, F, M, L, N(R)) ------------------------------------->

<----------------------------------------- DM (SAPI, R, F, M, L) -----------------------------------------5
                  Fill
2--------------------------------------------- UI (C, P, M, L)----------------------------------------------->
                  Frame
<------------------------------------ RR (SAPI, C, P, M, L, N(R)) ------------------------------------10

11 --------------------------------- RR (SAPI, R, F, M, L, N(R)) ------------------------------------->

<---------------------------------------DISC (SAPI, C, P, M, L) ----------------------------------------6
                  Fill
2--------------------------------------------- UI (C, P, M, L)----------------------------------------------->
                  Frame
<------------------------------------ RR (SAPI, C, P, M, L, N(R)) ------------------------------------10

11 --------------------------------- RR (SAPI, R, F, M, L, N(R)) ------------------------------------->

<-----------------------------------------UA (SAPI, R, F, M, L)------------------------------------------>7
                  Fill
2--------------------------------------------- UI (C, P, M, L)----------------------------------------------->
                  Frame
<------------------------------------ RR (SAPI, C, P, M, L, N(R)) ------------------------------------10

11 --------------------------------- RR (SAPI, R, F, M, L, N(R)) ------------------------------------->

<---------------------------------I (SAPI, C, P, M, L, N(R), N(S))----------------------------------8
                  Fill
2--------------------------------------------- UI (C, P, M, L)----------------------------------------------->
                  Frame
<------------------------------------ RR (SAPI, C, P, M, L, N(R)) ------------------------------------10

11 --------------------------------- RR (SAPI, R, F, M, L, N(R)) ------------------------------------->

<---------------------------------I (SAPI, C, P, M, L, N(R), N(S))----------------------------------9
                  Fill
```

2---UI (C, P, M, L)-->
Frame
<-------------------------------------RR (SAPI, C, P, M, L, N(R)) -------------------------------------10

11---------------------------------RR (SAPI, R, F, M, L, N(R)) -------------------------------------->

<---12
Fill
2---UI (C, P, M, L)-->
Frame
<-------------------------------------RR (SAPI, C, P, M, L, N(R)) -------------------------------------10

11---------------------------------RR (SAPI, R, F, M, L, N(R)) -------------------------------------->

<---13
Fill
2---UI (C, P, M, L)-->
Frame
<-------------------------------------RR (SAPI, C, P, M, L, N(R)) -------------------------------------10

11---------------------------------RR (SAPI, R, F, M, L, N(R)) -------------------------------------->

<---14
Fill
2---UI (C, P, M, L)-->
Frame
<-------------------------------------RR (SAPI, C, P, M, L, N(R)) -------------------------------------10

11---------------------------------RR (SAPI, R, F, M, L, N(R)) -------------------------------------->

<---15
Fill
2---UI (C, P, M, L)-->
Frame
<-------------------------------------RR (SAPI, C, P, M, L, N(R)) -------------------------------------10

11---------------------------------RR (SAPI, R, F, M, L, N(R)) -------------------------------------->

<---16
Fill
2---UI (C, P, M, L)-->
Frame
<-------------------------------------RR (SAPI, C, P, M, L, N(R)) -------------------------------------10

11---------------------------------RR (SAPI, R, F, M, L, N(R)) -------------------------------------->

<---17
Fill
2---UI (C, P, M, L)-->
Frame
<-------------------------------------RR (SAPI, C, P, M, L, N(R)) -------------------------------------10

11---------------------------------RR (SAPI, R, F, M, L, N(R)) -------------------------------------->

<---18
Fill
2---UI (C, P, M, L)-->
Frame
<-------------------------------------RR (SAPI, C, P, M, L, N(R)) -------------------------------------10

11---------------------------------RR (SAPI, R, F, M, L, N(R)) -------------------------------------->

The frames from the SS are:

1: One RR frame:

SAPI = 0, R = 0, F = 0, M = 0, L > 0, N(R) = 1.

3: One REJ frame:

SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1, EA = 0.

4: One SABM frame:

SAPI = 0, C = 1, P = 1, M = 0, L = 0, EL = 0.

5: One DM frame:

SAPI = 0, R = 0, F = 1, M = 0, L > 0.

6: One DISC frame:

SAPI = 0, C = 1, P = 1, M = 1, L = 0.

7: One UA frame:

SAPI = 0, R = 0, F = 0, M = 0, L = 0, EA = 0.

8: One I frame:

SAPI = 0, C = 1, P = 0, M = 0, L > N201, N(R) = 0, N(S) = 6.

9: One I frame:

SAPI = 0, C = 1, P = 0, M = 1, L < N201, N(R) = 0, N(S) = 7.

10: One RR frame:

SAPI = 0, C = 1, P = 1, M = 0, L = 0, N(R) = 0.

12: One command frame with

Control Field = xxx1 1101.

13: One command frame with

Control field = xxx1 1011.

14: One command frame with

Control field = xxx1 0111.

15: One command frame with

Control field = 01x1 1111.

16: One command frame with

Control field = 1xx1 1111.

17: One command frame with

Control field = 0011 0011.

18: One command frame with

Control field = 1xx1 0011.

NOTE: An "x" stands for an arbitrary bit value.

25.2.7.3 Test requirements

The frames from the MS shall be:

2: One UI frame (occurs fifteen times):

C = 0, P = 0, M = 0, L = 0.

11: One RR frame (occurs fifteen times):

SAPI = 0, R = 1, F = 1, M = 0, L = 0, N(R) = 0.