

## 14 Receiver

In this section on receiver measurements, the procedures to test equipment which is fitted with a permanent antenna connector, and the procedures to test equipment which is designed to only be used with an integral antenna, are in general combined into one single test description.

Tests on Mobile Stations fitted with an integral antenna and having no means of connecting an external antenna are specified in terms of received field strength. In order to perform tests on such Mobile Stations without the need for separated access to a calibrated test site a temporary antenna connector is used as defined in annex 1 section 1.1.3 (General Conditions).

In practice the temporary antenna connector may be used for transmitter measurements described in section 3, but the calibration factors determined in [Annex 1] will not be directly usable. The detailed calibration, when needed, for transmission tests are described in the relevant sections of 3.

Wherever in this section, for FACCH tests, the SS is required to send a Layer 3 message not requiring a Layer 3 response from the MS the message can be a TEST INTERFACE message or a STATUS message, possibly with an unknown Protocol Discriminator.

### Testing philosophy

Certain assumptions concerning the functional mechanisms of GSM receivers have been made in order to define tests that will verify the receiver performance without excessive redundancy and excessive test times.

The receiver functions can be divided into:

- Analogue RF and IF stages that are affected by input levels, temperature and power supply levels.
- Demodulator that is affected by input levels and interfering signals.
- Decoders that are affected by the different logical channels and input levels.

The tests are designed to stress each of these blocks with a minimum of redundancy.

### Statistical testing of receiver BER/FER performance

#### Error Definition

##### 1) Frame Erasure Ratio (FER)

A frame is defined as erased if the error detection functions in the receiver, operating in accordance with GSM 05.03, indicate an error (BFI = 1). For full rate or half rate speech this is the result of the 3 bit cyclic redundancy check (CRC) as well as other processing functions that cause a Bad Frame Indication (BFI). For signalling channels it is the result of the FIRE code or any other block code used. For data traffic FER is not defined.

##### 2) Residual Bit Error Ratio (RBER)

The Residual Bit Error Ratio is defined as the Bit Error Ratio (BER) in frames which have not been declared as erased.

##### 3) Bit Error Ratio (BER)

The Bit Error Ratio is defined as the ratio of the bits wrongly received to all data bits sent.

##### 4) Unreliable Frame Ratio (UFR)

The Unreliable Frame Ratio is defined as the ratio of frames declared as erased (BFI=1), or unreliable (UFI=1), to the total number of frames transmitted. An unreliable frame is indicated by setting the UFI flag (UFI=1) and an erased frame is indicated by setting the BFI flag (BFI=1). (See GSM 06.21.)

##### 5) Erased SID Frame Ratio (ESIDR)



A SID Frame is erased (SID=0) when the MS does not detect a valid transmitted SID frame as a valid SID frame (SID=2), or an invalid SID frame (SID=1). The Erased SID Frame Ratio is defined as the ratio of erased SID frames (SID=0), to the total number of valid SID frames transmitted. (See GSM 06.41.)

6) Erased Valid SID Frame Ratio (EVSIDR).

An Erased Valid SID Frame is declared when the MS does not detect a valid transmitted SID frame as a valid SID frame (SID=2) and (BFI=0 and UFI=0). The Erased Valid SID Frame Ratio is defined as the ratio of erased valid SID frames (SID=0), or (SID=1), or ((BFI or UFI)=1), to the total number of valid SID frames transmitted. (See GSM 06.41.)

### Test method

Each test is performed in the following manner:

- a) Set up the required test conditions.
- b) Perform the test for at least the minimum number of samples (frames, bits or bits from non erased frames) and record the number of offered samples and the number of occurred events (frame, bit or residual bit errors).
- c) Terminate the test and determine the test result ("pass" or "fail") by comparing the measured error rate against the test limit error rate.

It is permitted to run the test over more samples than the value stated for minimum number of samples. The effect of increasing the number of samples is always to give a higher probability that a good unit will pass and a lower risk that a bad unit will pass, according to the definitions of good and bad unit in this section.

### Test criteria

The limits on number of samples and test limit error rate shall be defined in order to comply with different requirements:

- 1) to keep reasonably low the risk of passing a bad unit for each individual test;
- 2) to have high probability of passing a good unit for each individual test;
- 3) to perform measurements with a high degree of statistical significance;
- 4) to keep the test time as low as possible.

The risk of passing a bad unit (point 1) should be kept lower than 0,2 %. The performance on a full rate channel, or a half rate data channel, is generally considered "bad" if its BER (or FER) performance is 1,5 times worse than that specified in AWGN (Additive White Gaussian Noise) and 1,26 times worse than that specified in multipath environment. These values have been adopted (taking into account the expected shapes of the BER performance) in order not to pass a unit with performance worse than the specifications by more than 1 dB.

The performance on a half rate speech channel, is generally considered "bad" if the BER (or FER, or UFR) is worse than that specified, multiplied by the factors given in table 14-1. These values have been adopted (taking into account the expected shapes of the BER performance) in order not to pass a unit with performance worse than the specifications by more than 1 dB.



Table 14-1: TCH/HS "bad" unit multiplication factors

Propagation Conditions	GSM 900				DCS 1 800			
	TUlow (No FH)	TUhigh (FH/ No FH)	HT (No FH)	RA (No FH)	TUlow (No FH)	TUhigh (FH/ No FH)	HT (No FH)	RA (No FH)
Reference sensitivity:								
TCH/HS FER		1,7				1,7		
TCH/HS class Ib (BFI=0)		2,2				2,0		
TCH/HS class II (BFI=0)		1,2	1,2	1,2		1,2	1,2	1,2
TCH/HS UFR		2,0				1,9		
TCH/HS class Ib (BFI=0 and UFI=0)		1,8				1,7		
Reference interference:								
TCH/HS FER		1,6				1,6		
TCH/HS class Ib (BFI=0)		1,8				1,8		
TCH/HS class II (BFI=0)		1,2				1,2		
TCH/HS UFR		1,6				1,6		
TCH/HS class Ib (BFI or UFI)=0		1,4				1,4		
EVSDR	1,2				1,2			
RBER (SID=2 & (BFI or UFI)=0	1,3				1,3			
ESDR	1,3				1,3			
RBER (SID=1 or SID=2)	1,3				1,3			

The probability of passing a good unit operating on the specification limit of performance (point 2) should be at least 99,7 %.

If the error events can be assumed to be random independent variables, outputs of stationary random processes with identical Gaussian distributions, the previous figures suggest a number of events (point 3) not lower than 200 in AWGN channel and not lower than 600 in a multipath environment, and to test a BER (or FER) performance 1,22 times worse than that specified in AWGN and 1,12 times worse than that specified in a multipath environment (this corresponds to testing a performance, at the most, 0,5 dB worse than that specified).

For multipath propagation conditions the hypothesis of stationary random processes does not generally hold. In case of non frequency hopping operation mode, the radio channel may be assumed to change 10 times per wavelength of travelled distance and to be short term stationary in between. So, in this case, the required observation time for having good statistical properties should not be lower (with some rounding) than that reported in table 14-1.

Table 14-2: Minimum test time according to propagation profile

Propagation Conditions	GSM 900				DCS 1 800			
	TUlow	TUhigh	HT	RA	TUlow	TUhigh	HT	RA
Min. test time (s)	500	30	15	6	500	15	7,5	6

Tables 14-3 and 14-4 detail, for the different test conditions, the minimum number of samples required in order to meet points 1) to 3): the corresponding test time (point 4) can be consequently computed.

As can be seen in the tables, in some of the cases in which both FER and RBER have to be tested on the same channel, the length of time for the FER measurement has been adopted for the RBER measurement. This is longer than that required for the RBER only according to the discussed criteria, but allows the use of a test limit error rate closer to the specified error rate while maintaining the same statistical significance. When, as is normal, it is desired to perform the FER and RBER tests, the closer test limit error rate for the RBER measurement can be achieved without increasing the total test time. It is always possible to extend the length of any test and further improve the statistical significance of that test.



Table 14-3: Test conditions for GSM 900

Type of test	Type of channel	Propagation/ frequency conditions	Speci- fied FER/ BER %	Test limit FER/ BER %	Minimum No of samples	Prob that good unit will pass %	Bad unit BER/ FER %	Risk that bad unit will pass
BFI	TCH/FS	Static	0,033	0,044	492000	99,813	0,050	0,140
	TCH/FS	Static / FH	0,033	0,041	492000	99,813	0,050	0,140
Sensitivity	TCH/FS	Static/FH	$0,100 \cdot \alpha$	$0,122 \cdot \alpha$	164000	99,717	$0,150 \cdot \alpha$	0,140
„	TCH/FS Class Ib	Static/FH	$0,400/\alpha$	$0,410/\alpha$	20000000	100,000	$0,600/\alpha$	<0,001
„	TCH/FS Class II	Static/FH	2,000	2,439	8200	99,714	3,000	0,001
„	TCH/FS	TUhigh/No FH	$6,000 \cdot \alpha$	$6,742 \cdot \alpha$	8900	99,825	$7,560 \cdot \alpha$	0,162
„	TCH/FS Class Ib	TUhigh/No FH	$0,400/\alpha$	$0,420/\alpha$	1000000	99,919	$0,504/\alpha$	<0,001
„	TCH/FS Class II	TUhigh/No FH	8,000	8,333	120000	99,999	10,080	<0,001
„	TCH/FS Class II	HT/No FH	9,000	9,333	60000	99,779	11,340	<0,001
„	TCH/FS Class II	RA/No FH	7,000	7,500	24000	99,873	8,694	<0,001
„	TCH/EFS	Static/FH	0,100	0,122	164000	99,758	0,150	0,171
„	TCH/EFS Class Ib	Static/FH	0,100	0,110	20000000	100	0,150	<0,001
„	TCH/EFS Class II	Static/FH	2,000	2,439	8200	99,753	3,000	0,168
„	TCH/EFS	TUhigh/No FH	8,000	8,867	8900	99,808	10,080	0,016
„	TCH/EFS Class Ib	TUhigh/No FH	0,210	0,224	1000000	99,887	0,265	<0,001
„	TCH/EFS Class II	TUhigh/No FH	7,000	7,500	120000	99,999	8,820	<0,001
„	TCH/EFS Class II	HT/No FH	9,000	9,350	60000	99,787	11,340	<0,001
„	TCH/EFS Class II	RA/No FH	7,000	7,500	24000	99,829	8,820	<0,001
„	TCH/HS (FER)	TUhigh/No FH	4,100	4,598	13050	99,776	6,970	<0,001
„	TCH/HS Class Ib	TUhigh/No FH	0,360	0,404	148500	99,750	0,792	<0,001
„	TCH/HS Class II (BFI=0)	TUhigh/No FH	6,900	7,725	25500	100,00	8,280	0,061
„	TCH/HS Class II (BFI=0)	HT/No FH	7,600	8,500	20000	100,00	9,120	0,110
„	TCH/HS Class II (BFI=0)	RA/No FH	6,800	7,600	20000	100,00	8,160	0,182
„	TCH/HS (UFR)	TUhigh/No FH	5,600	6,250	9600	99,702	11,200	<0,001
„	TCH/HS Class Ib (BFI or UFI=0)	TUhigh/No FH	0,240	0,269	227000	99,721	0,432	<0,001
„	FACCH/F	TUhigh/No FH	8,000	8,961	6696	99,798	10,080	0,108
„	FACCH/H	TUhigh/No FH	6,900	7,728	7764	99,785	8,694	0,115
„	TCH/F9,6&H4,8	HT/No FH	0,700	0,778	180000	99,995	0,882	<0,001
„	TCH/F4,8	HT/No FH	0,010	0,011	5350000	99,732	0,013	0,197
„	TCH/F2,4	HT/No FH	0,001	0,001	11900000	99,734	0,002	<0,001
„	TCH/H2,4	HT/No FH	0,010	0,011	5350000	99,732	0,013	0,197
Input level	TCH/FS Class II	Static<-40dBm	0,010	0,012	1640000	99,716	0,015	0,141
Input level range	TCH/FS Class II	Static<-15dBm	0,100	0,122	164000	99,717	0,150	0,140
	TCH/FS Class II	EQ	3,000	3,250	120000	100,000	3,780	<0,001
Co-channel rejection	TCH/FS	TUlow/No FH	$21,000 \cdot \alpha$	$24,000 \cdot \alpha$	25000	100,000	$27,720 \cdot \alpha$	<0,001
„	TCH/FS Class Ib	TUlow/No FH	$2,000/\alpha$	$2,091/\alpha$	3300000	100,000	$2,520/\alpha$	<0,001
„	TCH/FS Class II	TUlow/No FH	4,000	4,300	2000000	100,000	5,040	<0,001
„	TCH/FS	TUhigh/FH	$3,000 \cdot \alpha$	$3,371 \cdot \alpha$	17800	99,797	$3,780 \cdot \alpha$	0,194
„	TCH/FS Class Ib	TUhigh/FH	$0,200/\alpha$	$0,215/\alpha$	2000000	100,000	$0,252/\alpha$	<0,001
„	TCH/FS Class II	TUhigh/FH	8,000	8,333	1200000	100,000	10,080	<0,001
„	TCH/EFS	TUlow/No FH	23,000	24,000	25000	99,951	27,720	<0,001
„	TCH/EFS Class Ib	TUlow/No FH	0,2000	0,209	3300000	99,987	0,252	<0,001
„	TCH/EFS Class II	TUlow/No FH	3,000	3,039	2000000	99,927	3,780	<0,001
„	TCH/EFS	TUhigh/FH	3,000	3,357	17800	99,702	3,780	0,185
„	TCH/EFS Class Ib	TUhigh/FH	0,100	0,115	2000000	100,00	0,126	<0,001
„	TCH/EFS Class II	TUhigh/FH	8,000	8,333	1200000	99,998	10,08	<0,001
„	FACCH/F	TUlow/No FH	22,000	24,000	25000	100,000	27,720	<0,001
„	FACCH/H	TUlow/No FH	22,000	24,000	25000	100,000	27,720	<0,001
„	TCH/F9,6 or H4,8	TUhigh/FH	0,300	0,336	178500	99,716	0,378	0,180
„	TCH/F4,8	TUhigh/FH	0,010	0,011	5350000	99,732	0,013	0,197
„	TCH/F2,4	TUhigh/FH	0,001	0,001	11900000	99,734	0,002	<0,001
„	TCH/H2,4	TUhigh/FH	0,010	0,011	5350000	99,732	0,013	0,197



Table 14-3: Test conditions for DCS 900 (concluded)

Type of test	Type of channel	Propagation/ frequency conditions	Specified FER/BER %	Test limit FER/BER %	Minimum No of samples	Prob that good unit will pass %	Bad unit BER/FER %	Risk that bad unit will pass
Adjacent channel 200 kHz	TCH/FS	TUhigh/No FH	6,000* $\alpha$	6,742* $\alpha$	8900	99,825	7,560* $\alpha$	0,162
	TCH/FS Class Ib	TUhigh/No FH	0,400/ $\alpha$	0,420/ $\alpha$	1000000	99,919	0,504/ $\alpha$	<0,001
	TCH/FS Class II	TUhigh/No FH	8,000	8,333	600000	100,000	10,080	<0,001
	TCH/HS (FER)	TUhigh/FH	5,000	5,607	10700	99,787	8,000	<0,001
	TCH/HS Class Ib	TUhigh/FH	0,290	0,325	184700	99,711	0,522	<0,001
	(BFI=0)							
	TCH/HS Class II	TUhigh/FH	7,100	7,961	25500	100,00	8,520	0,065
	(BFI=0)							
	TCH/HS (UFR)	TUhigh/FH	6,100	6,834	8780	99,781	9,760	<0,001
	TCH/HS Class Ib (BFI or UFI)=0	TUhigh/FH	0,210	0,235	255000	99,715	0,294	<0,001
	EVSDR	TUlow/No FH	21,900	24,000	25000	100,000	26,280	<0,001
	SID RBER (SID=2 and (BFI or UFI)=0)	TUlow/No FH	0,020	0,022	2678500	99,705	0,026	0,010
	ESIDR	TUlow/No FH	17,100	19,152	25000	100,000	22,230	<0,001
	SID RBER (SID=1 or SID=2)	TUlow/No FH	0,500	0,560	500000	100,000	0,650	<0,001
	FACCH/F	TUhigh/No FH	9,500	10,640	5639	99,812	11,970	0,096
Adjacent channel 400 kHz	TCH/FS	TUhigh/No FH	10,200* $\alpha$	11,461* $\alpha$	8900	99,995	12,852* $\alpha$	0,004
	TCH/FS Class Ib	TUhigh/No FH	0,720/ $\alpha$	0,756/ $\alpha$	1000000	99,999	0,9077/ $\alpha$	<0,001
	TCH/FS Class II	TUhigh/No FH	8,800	9,167	600000	100,000	11,088	<0,001
	FACCH/F	TUhigh/No FH	17,100	19,152	3133	99,878	21,546	<0,052
Intermod.	TCH/FS Class II	Static	2,000	2,439	8200	99,741	3,000	0,122
	FACCH/F	TUhigh/No FH	8,000	8,961	6696	99,798	10,080	0,108
Blocking & spurious resp.	TCH/FS Class II	Static	2,000	2,439	8200	99,741	4,000	<0,001
	FACCH/F	TUhigh/No FH	8,000	8,961	6696	99,798	10,080	0,108

Table 14-4: Test conditions for DCS 1 800

Type of test	Type of channel	Propagation/ Frequency conditions	Speci- fied FER/ BER	Test limit FER/BER %	Mini-mum No of samples	Prob that good unit will pass %	Bad unit FER/BER %	Risk that bad unit will pass
BFI	TCH/FS	Static	0,033	0,041	492000	99,813	0,050	0,140
	TCH/FS	Static/FH	0,033	0,041	492000	99,813	0,050	0,140
Sensitivity	TCH/FS	Static/FH	0,100* $\alpha$	0,122* $\alpha$	164000	99,717	0,150* $\alpha$	0,140
	TCH/FS Class Ib	Static/FH	0,400/ $\alpha$	0,410/ $\alpha$	20000000	100,000	0,600/ $\alpha$	<0,001
	TCH/FS Class II	Static/FH	2,000	2,439	8200	99,714	3,000	0,001
	TCH/FS	TUhigh/No FH	4,000* $\alpha$	4,478* $\alpha$	13400	99,743	5,040* $\alpha$	0,133
	TCH/FS Class Ib	TUhigh/No FH	0,300/ $\alpha$	0,320/ $\alpha$	1500000	100,000	0,378/ $\alpha$	<0,001
	TCH/FS Class II	TUhigh/No FH	8,000	8,333	60000	99,865	10,080	<0,001
	TCH/FS Class II	HT/No FH	9,000	9,333	30000	97,826	11,340	<0,001
	TCH/FS Class II	RA/No FH	7,000	7,500	24000	99,873	8,820	<0,001
	TCH/EFS	Static/FH	0,100	0,122	164000	99,758	0,150	0,171
	TCH/EFS Class Ib	Static/FH	0,100	0,110	20000000	100,00	0,150	<0,001
	TCH/EFS Class II	Static/FH	2,000	2,439	8200	99,753	3,000	0,168
	TCH/EFS	TUhigh/No FH	4,000	4,475	13400	99,701	5,040	0,179
	TCH/EFS Class Ib	TUhigh/No FH	0,120	0,130	1500000	99,979	0,151	<0,001
	TCH/EFS Class II	TUhigh/No FH	8,000	8,333	60000	99,804	10,080	<0,001
	TCH/EFS Class II	HT/No FH	9,000	9,498	30000	99,798	11,340	<0,001
	TCH/EFS Class II	RA/No FH	7,000	7,500	24000	99,829	8,820	<0,001
	TCH/HS (FER)	TUhigh/No FH	4,200	4,706	12750	99,763	7,140	<0,001
	TCH/HS Class Ib	TUhigh/No FH	0,380	0,426	141000	99,706	0,760	<0,001
	(BFI=0)							
	TCH/HS Class II	TUhigh/No FH	6,900	7,725	25500	100,00	8,280	0,061
	(BFI=0)							
	TCH/HS Class II	HT/No FH	7,800	8,735	20000	100,00	9,360	0,114
	(BFI=0)							
	TCH/HS Class II	RA/No FH	6,800	7,600	20000	100,00	8,160	0,182
	(BFI=0)							
	TCH/HS (UFR)	TUhigh/No FH	5,700	6,383	9400	99,769	10,830	<0,001
	TCH/HS Class Ib	TUhigh/No FH	0,260	0,291	206000	99,712	0,442	<0,001
	(BFI or UFI=0)							
	FACCH/F	TUhigh/No FH	3,900	4,368	13736	99,752	4,914	0,140
	FACCH/H	TUhigh/No FH	7,200	7,752	7440	97,027	9,072	0,002



Table 14-4: Test conditions for DCS 1 800 (concluded)

Type of test	Type of channel	Propagation/ frequency conditions	Speci-fied FER/ BER %	Test limit FER/ BER %	Minimum No of samples	Prob that good unit will pass %	Bad unit BER/ FER %	Risk that bad unit will pass
,,	TCH/F9,6	HT/No FH	0,700	0,784	76500	99,721	0,882	0,176
	TCH/F4,8	HT/No FH	0,010	0,011	5350000	99,732	0,013	0,197
	TCH/F2,4	HT/No FH	0,001	0,001	11900000	99,734	0,002	<0,001
Input level range	TCH/FS Class II	Static-23dBm	0,100	0,122	164000	99,717	0,150	0,140
	TCH/FS Class II	Static<-40dBm	0,010	0,012	1640000	99,716	0,015	0,141
	TCH/FS Class II	EQ	3,000	3,250	60000	99,981	3,780	<0,001
Co-channel rejection	TCH/FS	TUlow/No FH	21,00* $\alpha$	24,00* $\alpha$	25000	100,000	26,460* $\alpha$	<0,001
	TCH/FS Class Ib	TUlow/No FH	2,000/ $\alpha$	2,091/ $\alpha$	3300000	100,000	2,520/ $\alpha$	<0,001
	TCH/FS Class II	TUlow/No FH	4,000	4,300	2000000	100,000	5,040	<0,001
	TCH/FS	TUhigh/FH	3,000* $\alpha$	3,371* $\alpha$	17800	99,797	3,780* $\alpha$	0,194
	TCH/FS Class Ib	TUhigh/FH	0,200/ $\alpha$	0,215/ $\alpha$	2000000	100,000	0,252/ $\alpha$	<0,001
	TCH/FS Class II	TUhigh/FH	8,000	8,333	1200000	100,000	10,080	<0,001
	TCH/EFS	TUlow/No FH	23,000	24,000	25000	99,999	26,680	<0,001
	TCH/EFS Class Ib	TUlow/No FH	0,200	0,209	3300000	100,000	0,252	<0,001
	TCH/EFS Class II	TUlow/No FH	3,000	3,039	2000000	100,000	3,780	<0,001
	TCH/EFS	TUhigh/FH	3,000	3,357	17800	99,815	3,780	0,185
	TCH/EFS Class Ib	TUhigh/FH	0,100	0,115	2000000	99,999	0,126	<0,001
	TCH/EFS Class II	TUhigh/FH	8,000	8,333	1200000	100,000	10,080	<0,001
	FACCH/F	TUlow/No FH	22,000	24,000	25000	100,000	27,720	<0,001
	FACCH/H	TUlow/No FH	22,000	24,000	25000	100,000	27,720	<0,001
	TCH/F9,6 or H4,8	TUhigh/FH	0,300	0,336	178500	99,716	0,378	0,180
	TCH/F4,8	TUhigh/FH	0,010	0,011	5350000	99,732	0,013	0,197
	TCH/F2,4	TUhigh/FH	0,001	0,001	11900000	99,734	0,002	<0,001
	TCH/H2,4	TUhigh/FH	0,010	0,011	5350000	99,732	0,013	0,197
Adjacent channel 200 kHz	TCH/FS	TUhigh/No FH	3,000* $\alpha$	3,371* $\alpha$	17800	99,797	3,780* $\alpha$	0,194
	TCH/FS Class Ib	TUhigh/No FH	0,250/ $\alpha$	0,270/ $\alpha$	2000000	100,000	0,315/ $\alpha$	<0,001
	TCH/FS Class II	TUhigh/No FH	8,100	8,333	1200000	100,000	10,206	<0,001
	TCH/HS (FER)	TUhigh/FH	5,000	5,607	10700	99,787	8,000	<0,001
	TCH/HS Class Ib (BFI=0)	TUhigh/FH	0,290	0,325	184700	99,711	0,522	<0,001
	TCH/HS Class II (BFI=0)	TUhigh/FH	7,200	8,078	25500	100,00	8,640	0,066
	TCH/HS (UFR)	TUhigh/FH	6,100	6,834	8780	99,781	9,760	<0,001
	TCH/HS Class Ib (BFI or UFI)=0)	TUhigh/FH	0,210	0,235	255000	99,715	0,294	<0,001
	EVSIDR	TUlow/No FH	21,900	24,000	25000	100,000	26,280	<0,001
	SID RBER (SID=2 and (BFI or UFI)=0)	TUlow/No FH	0,020	0,022	2678500	99,705	0,026	0,010
	ESIDR	TUlow/No FH	17,100	19,152	25000	100,000	22,230	<0,001
	SID RBER (SID=1 or SID=2)	TUlow/No FH	0,500	0,560	500000	100,000	0,650	<0,001
	FACCH/F	TUhigh/No FH	3,400	3,808	15756	99,746	4,284	0,145
Adjacent channel 400 kHz	TCH/FS	TUhigh/No FH	5,100* $\alpha$	5,714* $\alpha$	10500	99,773	6,426* $\alpha$	0,134
	TCH/FS Class Ib	TUhigh/No FH	0,450/ $\alpha$	0,483/ $\alpha$	1200000	100,000	0,567/ $\alpha$	<0,001
	TCH/FS Class II	TUhigh/No FH	8,900	9,167	720000	100,000	11,214	<0,001
	FACCH/F	TUhigh/No FH	6,100	6,832	8782	99,777	7,686	0,122
Intermod,	TCH/FS Class II	Static	2,000	2,439	8200	99,741	3,000	0,122
	FACCH/F	TUhigh/No FH	3,900	4,368	13736	99,752	4,914	0,140
Blocking & spurious resp.	TCH/FS Class II	Static	2,000	2,439	8200	99,741	4,000	<0,001
	FACCH/F	TUhigh/No FH	3,900	4,368	13736	99,752	4,914	0,140

NOTE 1:  $\alpha$  is a parameter which ranges from 1 to 1,6. The value of  $\alpha$  for a RBER test on TCH/FS class Ib bits under particular measurement conditions shall be the same as that determined in the FER test on TCH/FS under the same conditions. For example, the value of  $\alpha$  may be different for a TUhigh sensitivity test and an RA sensitivity test. The value of  $\alpha$  is determined by dividing the measured error rate for the FER test by the value of the test limit error rate listed in the limits section of the test corresponding to  $\alpha=1$ ; if the result of the division is lower than 1, a value of  $\alpha=1$  shall be used, if the value of  $\alpha > 1,6$  the FER test has failed (the normal treatment of stimulus uncertainties applies). The probabilities that a good unit will pass and the risks that a bad unit will pass, listed in the table are valid for  $\alpha=1$ , and would be slightly different for other values of  $\alpha$ .

NOTE 2: In order to save time the sensitivity and co-channel rejection tests for the TCH/F2,4 channel does not comply with the above said constraints.



In fact, a bad unit which performs 2 times (instead of 1,26) worse than that specified is accounted for, so reducing the required number of events to 150, instead of 600. On the other hand, the specified RBER is in this case  $10E-5$  and, on the basis of simulations and hardware validation results, doubling this RBER results in a drop in performance of less than 1 dB.

## **14.1 Bad frame indication**

### **14.1.1 Bad frame indication - TCH/FS**

#### **14.1.1.1 Bad frame indication - TCH/FS - Random RF input**

##### **14.1.1.1.1 Definition and applicability**

The performance of the Bad Frame Indication (BFI) is a measure of the effectiveness of the MS under DTX conditions. It includes the effect of the 3 bit Cyclic Redundancy Check (CRC) and all other processing associated with the DTX function. The BFI is measured on a full rate speech TCH (TCH/FS) by counting the number of undetected bad frames whilst the input signal is a randomly modulated carrier.

The requirements and this test only apply to MS supporting speech.

##### **14.1.1.1.2 Conformance requirement**

On a full rate speech TCH (TCH/FS) with a random RF input, the overall reception performance shall be such that, on average, less than one undetected bad speech frame (false bad frame indication) in 60 seconds will be measured; GSM 05.05, 6.4 b

##### **14.1.1.1.3 Test purpose**

1. To verify that the BFI performance does not exceed the conformance requirement with an allowance for the statistical significance of the test.
2. To verify that on reception of a SID frame the BFI is not set.

##### **14.1.1.1.4 Method of test**

###### **14.1.1.1.4.1 Initial conditions**

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

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

NOTE: DTX is used during the test to prevent the MS dropping the call.

###### **14.1.1.1.4.2 Procedure**

- a) The SS simulates a BSS in DTX mode. During the period when no transmission would occur the SS transmits a GSM carrier modulated with random data at a level 11 dB above reference sensitivity level( ). The SACCH is transmitted normally at a level 20 dB above reference sensitivity( ). The SID frame is transmitted in its correct time interval with valid information at a level 20 dB above reference sensitivity level( ). During transmission of SACCH or SID frames the random data is discontinued.



- b) The SS transmits at least the minimum number of samples of frames of TCH/FS information and checks the BFI of the looped back signal from the MS. The SS records the number of frames where the bad frame indication is not set. During transmission by the SS of SID frames the SS checks that the BFI is not set.

NOTE 1: Further explanations on the mechanism of signalling the BFI to the SS will be found in clause 36.

NOTE 2: In some cases the MS decodes half SID frames correctly even if these are not transmitted completely. Therefore, in case that a MS detects a good SID frame, the SS has to consider the received bits in detail.

#### **14.1.1.1.5 Test requirements**

The BFI performance is accepted if the measured rate of undetected bad frames does not exceed the test limit error rate:

Test limit error rate:	0,041 %
Minimum number of samples:	492 000 (excluding SID frames).

During loop back of SID frames no BFI shall be set.

#### **14.1.1.2 Bad frame indication - TCH/FS - Frequency hopping and downlink DTX**

##### **14.1.1.2.1 Definition and applicability**

The performance of the Bad Frame Indication (BFI) is a measure of the effectiveness of the MS under DTX conditions. It includes the effect of the 3 bit Cyclic Redundancy Check (CRC) and all other processing associated with the DTX function. The BFI is measured on a full rate speech TCH (TCH/FS) by counting the number of undetected bad frames whilst the input signal is a randomly modulated carrier.

The requirements and this test only apply to MS supporting speech.

##### **14.1.1.2.2 Conformance requirement**

On a speech TCH (TCH/FS or TCH/HS), when DTX is activated with frequency hopping through C0 where bursts comprising SID frames, SACCH frames and dummy bursts are received at a level 20 dB above the reference sensitivity level and with no transmissions at the other bursts of the TCH, the overall reception performance shall be such that, on average less than one undetected bad speech frame (false bad frame indication BFI) shall be measured in one minute for MS. GSM 05.05, 6.4 c.

##### **14.1.1.2.3 Test purpose**

1. To verify that the BFI performance in case of frequency hopping including the C0 radio frequency does not exceed the conformance requirement with an allowance for the statistical significance of the test.
2. To verify that on reception of a SID frame the BFI is not set.

##### **14.1.1.2.4 Method of test**

###### **14.1.1.2.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH/FS with a transmitted burst 20 dB above reference sensitivity. Random frequency hopping on two channels including the C0 radio frequency with ARFCNs with at least 5 channels separation shall be used, power control level set to maximum power.

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

NOTE: DTX is used during the test to prevent the MS dropping the call.



#### **14.1.1.2.4.2 Procedure**

- a) The SS sets downlink DTX on.
- b) The SS performs the measurement over at least the minimum number of samples of frames of TCH/FS information and checks the BFI of the looped back signal from the MS. The SS only transmits SID frames, SACCH frames and dummy bursts, with no transmission of TCH bursts. The SS records the number of frames where the bad frame indication is not set. During transmission by the SS of SID frames the SS checks that the BFI is not set.

NOTE 1: Further explanations on the mechanism of signalling the BFI to the SS will be found in clause 36.

NOTE 2: In some cases the MS decodes half SID frames correctly even if these are not transmitted completely. Therefore, in case that a MS detects a good SID frame, the SS has to consider the received bits in detail.

#### **14.1.1.2.5 Test requirements**

The BFI performance is accepted if the measured rate of undetected bad frames does not exceed the test limit error rate:

Test limit error rate:	0,041 %	
Minimum number of samples:	492 000	(excluding SID frames).

During loop back of SID frames no BFI shall be set.

### **14.1.2 Bad frame indication - TCH/HS**

#### **14.1.2.1 Bad frame indication - TCH/HS - Random RF input**

##### **14.1.2.1.1 Definition and applicability**

The performance of the Bad Frame Indication (BFI) is a measure of the effectiveness of the MS under DTX conditions. It includes the effect of the 3 bit Cyclic Redundancy Check (CRC) and all other processing associated with the DTX function. The BFI is measured on a half rate speech TCH (TCH/HS) by counting the number of undetected bad frames whilst the input signal is a randomly modulated carrier.

The requirements and this test only apply to MS supporting half rate speech.

##### **14.1.2.1.2 Conformance requirement**

On a half rate speech TCH (TCH/HS) with a random RF input, the overall reception performance shall be such that, on average, less than one undetected bad speech frame (false bad frame indication) in 60 seconds will be measured; GSM 05.05, 6.4 b.

##### **14.1.2.1.3 Test purpose**

- 1. To verify that the BFI performance does not exceed the conformance requirement with an allowance for the statistical significance of the test.
- 2. To verify that on reception of a SID frame the BFI is not set.

##### **14.1.2.1.4 Method of test**

###### **14.1.2.1.4.1 Initial conditions**

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



The SS commands the MS to complete traffic channel loop back A and signal frames detected with BFI=1 as erased.

NOTE 1: Test loop A is defined in clause 36. Frames detected with BFI=1 are signalled as erased on the uplink.

NOTE 2: DTX is used during the test to prevent the MS dropping the call.

#### **14.1.2.1.4.2 Procedure**

- a) The SS simulates a BSS in DTX mode. During the periods when no transmission would occur, the SS transmits a GSM carrier modulated with random data, at a level 11 dB above reference sensitivity level( ). The SACCH is transmitted normally, at a level 20 dB above reference sensitivity( ). The SID frame is transmitted in its correct time interval, with valid information, at a level 20 dB above reference sensitivity level( ). During transmission of SACCH or SID frames, the random data is discontinued.
- b) The SS transmits at least the minimum number of samples of frames of TCH/HS information and checks the BFI of the looped back signal from the MS. The SS records the number of frames where the bad frame indication is not set. During transmission by the SS of SID frames the SS checks that the BFI is not set.

#### **14.1.2.1.5 Test requirements**

The BFI performance is accepted if the measured rate of undetected bad frames does not exceed the test limit error rate:

Test limit error rate:	0,041 %	
Minimum number of samples:	492 000	(excluding SID frames).

During loop back of SID frames no BFI shall be set.

#### **14.1.2.2 Bad frame indication - TCH/HS - Frequency hopping and downlink DTX**

##### **14.1.2.2.1 Definition and applicability**

The performance of the Bad Frame Indication (BFI) is a measure of the effectiveness of the MS under DTX conditions. It includes the effect of the 3 bit Cyclic Redundancy Check (CRC) and all other processing associated with the DTX function. The BFI is measured on a half rate speech TCH (TCH/HS) by counting the number of undetected bad frames whilst the input signal is a randomly modulated carrier.

The requirements and this test only apply to MS supporting half rate speech.

##### **14.1.2.2.2 Conformance requirement**

On a half rate speech TCH (TCH/HS), when DTX is activated with frequency hopping through C0 where bursts comprising SID frames, SACCH frames and dummy bursts are received at a level 20 dB above the reference sensitivity level and with no transmissions at the other bursts of the TCH, the overall reception performance shall be such that, on average less than one undetected bad speech frame (false bad frame indication BFI) shall be measured in one minute for MS. GSM 05.05, 6.4 c.

##### **14.1.2.2.3 Test purpose**

1. To verify that the BFI performance in case of frequency hopping including the C0 radio frequency does not exceed the conformance requirement with an allowance for the statistical significance of the test.
2. To verify that on reception of a SID frame the BFI is not set.



**14.1.2.2.4 Method of test****14.1.2.2.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH/HS with a transmitted burst 20 dB above reference sensitivity. Random frequency hopping on two channels including the C0 radio frequency with ARFCNs with at least 5 channels separation shall be used, power control level set to maximum power.

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

NOTE: DTX is used during the test to prevent the MS dropping the call.

**14.1.2.2.4.2 Procedure**

- a) The SS sets downlink DTX on.
- b) The SS performs the measurement over at least the minimum number of samples of frames of TCH/HS information and checks the BFI of the looped back signal from the MS. The SS only transmits SID frames, SACCH frames and dummy bursts, with no transmission of TCH bursts. The SS records the number of frames where the bad frame indication is not set. During transmission by the SS of SID frames the SS checks that the BFI is not set.

NOTE 1: Further explanations on the mechanism of signalling the BFI to the SS will be found in clause 36.

NOTE 2: In some cases the MS decodes half SID frames correctly even if these are not transmitted completely. Therefore, in case that a MS detects a good SID frame, the SS has to consider the received bits in detail.

**14.1.2.2.5 Test requirements**

The BFI performance is accepted if the measured rate of undetected bad frames does not exceed the test limit error rate:

Test limit error rate:	0,041 %	
Minimum number of samples:	492 000	(excluding SID frames).

During loop back of SID frames no BFI shall be set.

**14.1.3 Bad frame indication - TCH/FS - Frequency hopping and downlink DTX - Phase 2 MS in a phase 1 network****14.1.3.1 Definition and applicability**

The performance of the Bad Frame Indication (BFI) is a measure of the effectiveness of the MS under DTX conditions. It includes the effect of the 3 bit Cyclic Redundancy Check (CRC) and all other processing associated with the DTX function. The BFI is measured on a full rate speech TCH (TCH/FS) by counting the number of undetected bad frames whilst the input signal is a randomly modulated carrier.

Annex A of GSM 05.02 requires that a phase 2 MS behave properly in a phase 1 network.

The requirements and this test only apply to MS supporting speech.

**14.1.3.2 Conformance requirement**

On a full rate speech TCH (TCH/FS) in DTX conditions with a transmitted burst 20 dB above reference sensitivity and static conditions, the overall reception performance shall be such that, on average, less than one undetected bad speech frame (false bad frame indication) in 60 seconds will be measured; GSM 05.05, 6.4 b.



**14.1.3.3 Test purpose**

1. To verify that the BFI performance in case of frequency hopping including the C0 radio frequency does not exceed the conformance requirement with an allowance for the statistical significance of the test.
2. To verify that on reception of a SID frame the BFI is not set.

**14.1.3.4 Method of test****14.1.3.4.1 Initial conditions**Initial conditions 1

A call is set up according to the generic call set up procedure on a TCH/FS with a transmitted burst 20 dB above reference sensitivity. Random frequency hopping on two channels including the C0 radio frequency with ARFCNs with at least 5 channels separation shall be used, power control level set to maximum power.

When downlink DTX is activated with frequency hopping including the C0 radio frequency, the following configuration applies for filling the bursts on the C0 carrier:

<b>C0 filling on the TCH</b>	<b>Half burst filling</b>	<b>Dummy bursts stealing flag</b>	<b>Half burst Filling stealing flag</b>
Dummy bursts with (BN61, BN 62,...) mapped from the TSC bits of normal bursts. See section A.2.1.3 of GSM 05.02	Partial SID information. See section A.2.2.1 of GSM 05.02.	0	0

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

Initial conditions 2

A call is set up according to the generic call set up procedure on a TCH/FS with a transmitted burst 20 dB above reference sensitivity. Random frequency hopping on two channels including the C0 radio frequency with ARFCNs with at least 5 channels separation shall be used, power control level set to maximum power.

When downlink DTX is activated with frequency hopping including the C0 radio frequency, the following configuration applies for filling the bursts on the C0 carrier:

<b>C0 filling on the TCH</b>	<b>Half burst filling</b>	<b>Dummy bursts stealing flag</b>	<b>Half burst Filling stealing flag</b>
Partial SID information. See section A.2.1.4 of GSM 05.02	Partial SID information. See section A.2.2.1 of GSM 05.02.	1	1

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

Initial conditions 3

A call is set up according to the generic call set up procedure on a TCH/FS with a transmitted burst 20 dB above reference sensitivity. Random frequency hopping on two channels including the C0 radio frequency with ARFCNs with at least 5 channels separation shall be used, power control level set to maximum power.



When downlink DTX is activated with frequency hopping including the C0 radio frequency, the following configuration applies for filling the bursts on the C0 carrier:

<b>C0 filling on the TCH</b>	<b>Half burst filling</b>	<b>Dummy bursts stealing flag</b>	<b>Half burst Filling stealing flag</b>
Dummy bursts with 'C0 filling training sequence'. See section A.2.1.4 of GSM 05.02	Dummy bursts mixed bits. See section A.2.2.2 of GSM 05.02.	1	1

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

NOTE: DTX is used during the test to prevent the MS dropping the call.

#### **14.1.3.4.2 Procedure**

The two following steps are repeated 3 times, once for each initial condition specified in the previous clause.

- a) The SS sets downlink DTX on.
- b) The SS transmits at least the minimum number of samples of frames of TCH/FS information and checks the BFI of the looped back signal from the MS. The SS records the number of frames where the bad frame indication is not set. During transmission by the SS of SID frames the SS checks that the BFI is not set.

NOTE 1: Further explanations on the mechanism of signalling the BFI to the SS will be found in clause 36.

NOTE 2: In some cases the MS decodes half SID frames correctly even if these are not transmitted completely. Therefore, in case that a MS detects a good SID frame, the SS has to consider the received bits in detail.

#### **14.1.3.5 Test requirements**

after each repetition of steps a) + b) the following requirements are applied:

The BFI performance is accepted if the measured rate of undetected bad frames does not exceed the test limit error rate:

Test limit error rate:	0,041 %	
Minimum number of samples:	492 000	(excluding SID frames).

During loop back of SID frames no BFI shall be set.

### **14.1.4 Bad frame indication - TCH/HS - Frequency hopping and downlink DTX - Phase 2 MS in a phase 1 network**

#### **14.1.4.1 Definition and applicability**

The performance of the Bad Frame Indication (BFI) is a measure of the effectiveness of the MS under DTX conditions. It includes the effect of the 3 bit Cyclic Redundancy Check (CRC) and all other processing associated with the DTX function. The BFI is measured on a half rate speech TCH (TCH/HS) by counting the number of undetected bad frames whilst the input signal is a randomly modulated carrier.

Annex A of GSM 05.02 requires that a phase 2 MS behave properly in a phase 1 network.

The requirements and this test only apply to MS supporting half rate speech.



**14.1.4.2 Conformance requirement**

On a half rate speech TCH (TCH/HS) in DTX conditions with a transmitted burst 20 dB above reference sensitivity and static conditions, the overall reception performance shall be such that, on average, less than one undetected bad speech frame (false bad frame indication) in 60 seconds will be measured; GSM 05.05, 6.4 b.

**14.1.4.3 Test purpose**

1. To verify that the BFI performance in case of frequency hopping including the C0 radio frequency does not exceed the conformance requirement with an allowance for the statistical significance of the test.
2. To verify that on reception of a SID frame the BFI is not set.

**14.1.4.4 Method of test****14.1.4.4.1 Initial conditions**Initial conditions 1

A call is set up according to the generic call set up procedure on a TCH/HS with a transmitted burst 20 dB above reference sensitivity. Random frequency hopping on two channels including the C0 radio frequency with ARFCNs with at least 5 channels separation shall be used, power control level set to maximum power.

When downlink DTX is activated with frequency hopping including the C0 radio frequency, the following configuration applies for filling the bursts on the C0 carrier:

<b>C0 filling on the TCH</b>	<b>Half burst filling</b>	<b>Dummy bursts stealing flag</b>	<b>Half burst Filling stealing flag</b>
Dummy bursts with (BN61, BN 62,...) mapped from the TSC bits of normal bursts. See section A.2.1.3 of GSM 05.02	Partial SID information. See section A.2.2.1 of GSM 05.02.	0	0

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

Initial conditions 2

A call is set up according to the generic call set up procedure on a TCH/HS with a transmitted burst 20 dB above reference sensitivity. Random frequency hopping on two channels including the C0 radio frequency with ARFCNs with at least 5 channels separation shall be used, power control level set to maximum power.

When downlink DTX is activated with frequency hopping including the C0 radio frequency, the following configuration applies for filling the bursts on the C0 carrier:

<b>C0 filling on the TCH</b>	<b>Half burst filling</b>	<b>Dummy bursts stealing flag</b>	<b>Half burst Filling stealing flag</b>
Partial SID information. See section A.2.1.4 of GSM 05.02	Partial SID information. See section A.2.2.1 of GSM 05.02.	1	1

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.



### Initial conditions 3

A call is set up according to the generic call set up procedure on a TCH/HS with a transmitted burst 20 dB above reference sensitivity. Random frequency hopping on two channels including the C0 radio frequency with ARFCNs with at least 5 channels separation shall be used, power control level set to maximum power.

When downlink DTX is activated with frequency hopping including the C0 radio frequency, the following configuration applies for filling the bursts on the C0 carrier:

<b>C0 filling on the TCH</b>	<b>Half burst filling</b>	<b>Dummy bursts stealing flag</b>	<b>Half burst Filling stealing flag</b>
Dummy bursts with 'C0 filling training sequence'. See section A.2.1.4 of GSM 05.02	Dummy bursts mixed bits. See section A.2.2.2 of GSM 05.02.	1	1

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

NOTE: DTX is used during the test to prevent the MS dropping the call.

#### **14.1.4.4.2 Procedure**

The two following steps are repeated 3 times, once for each initial condition specified in the previous clause.

- a) The SS sets downlink DTX on.
- b) The SS transmits at least the minimum number of samples of frames of TCH/HS information and checks the BFI of the looped back signal from the MS. The SS records the number of frames where the bad frame indication is not set. During transmission by the SS of SID frames the SS checks that the BFI is not set.

NOTE 1: Further explanations on the mechanism of signalling the BFI to the SS will be found in clause 36.

NOTE 2: In some cases the MS decodes half SID frames correctly even if these are not transmitted completely. Therefore, in case that a MS detects a good SID frame, the SS has to consider the received bits in detail.

#### **14.1.4.5 Test requirements**

After each repetition of steps a) + b) the following requirements are applied:

The BFI performance is accepted if the measured rate of undetected bad frames does not exceed the test limit error rate:

Test limit error rate:	0,041 %	
Minimum number of samples:	492 000	(excluding SID frames).

During loop back of SID frames no BFI shall be set.



## 14.2 Reference sensitivity

### 14.2.1 Reference sensitivity - TCH/FS

#### 14.2.1.1 Definition and applicability

The reference sensitivity is the signal level at the MS receiver input at which a certain BER and FER must be achieved.

The requirements and this test apply to MS supporting speech.

For E-GSM 900 MS this test is only performed in the P-GSM band.

#### 14.2.1.2 Conformance requirement

1. At reference sensitivity level, the TCH/FS FER shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 6.2.
2. At reference sensitivity level, the TCH/FS class I RBER shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 6.2.
3. At reference sensitivity level, the TCH/FS class II RBER shall meet the reference sensitivity, performance of table 1 in GSM 05.05; GSM 05.05, 6.2.
4. At reference sensitivity level, the TCH/FS class II RBER shall meet the reference sensitivity, performance of table 1 in GSM under extreme conditions; GSM 05.05, 6.2, GSM 05.05, annex D D.2.1, D.2.2.

#### 14.2.1.3 Test purpose

NOTE: This test is performed under STATIC propagation conditions to allow implicit testing of the ability of the MS to hop over the full band. The tests under dynamic propagation conditions are better suited to test the reference sensitivity conformance but cannot test hopping over the full band due to limited bandwidth of available fading simulators.

1. To verify that the MS does not exceed conformance requirement 1 under STATIC and TUhigh propagation conditions with an allowance for the statistical significance of the test.
2. To verify that the MS does not exceed conformance requirement 2 under STATIC and TUhigh propagation conditions with an allowance for the statistical significance of the test.
3. To verify that the MS does not exceed conformance requirement 3 under STATIC, TUhigh, RA and HT propagation conditions with an allowance for the statistical significance of the test.
4. To verify that the MS does not exceed conformance requirement 4 under STATIC and TUhigh propagation conditions with an allowance for the statistical significance of the test.

#### 14.2.1.4 Method of test

NOTE 1: The BA list sent on the BCCH and SACCH will indicate at least six surrounding cells with at least one near to each band edge. It is not necessary to generate any of these BCCHs but, if provided the signal strengths of BCCHs shall be in the range  $15 \text{ dB}\mu\text{Vemf}(\text{ })$  to  $35 \text{ dB}\mu\text{Vemf}(\text{ })$ .

NOTE 2: The ARFCN of any BCCH shall not be co-channel or on adjacent channels to the wanted traffic channel.

NOTE 3: When frequency hopping is used, the traffic channel may fall on any of the ARFCNs defined in section 6.



**14.2.1.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH/FS with an ARFCN in the Mid ARFCN range for DCS 1800 and ARFCN 70 for GSM 900, power control level set to maximum power.

NOTE: For GSM 900 ARFCN 70 is tested since this is the 73rd harmonic of the 13 MHz clock normally used internally in a MS.

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

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

**14.2.1.4.2 Procedure**

- a) The fading function is set to TUhigh.
- b) the SS sets the amplitude of the wanted signal to reference sensitivity level ( ).
- c) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- d) The SS determines the number of residual bit error events for the bits of class II, by examining sequences of at least the minimum number of samples of consecutive bits of class II. Bits are taken only from those frames not signalled as erased.
- e) The SS determines the number of residual bit error events for the bits of the class Ib, by examining sequences of at least the minimum number of samples of consecutive bits of class Ib. Bits are only taken from those frames not signalled as erased.
- f) The SS also determines the frame erasure events by examining sequences of at least the minimum number of samples of consecutive frames and assuming a frame is received successfully, if it is not signalled as erased.
- g) Steps a) to d) are repeated under extreme test conditions.
- h) Steps a) to g) are repeated for TCH/FS with ARFCNs in the Low ARFCN range for DCS 1800 and ARFCN 5 for GSM 900 and the High ARFCN range.

NOTE: For GSM 900 ARFCN 5 is tested since this is the 72nd harmonic of the 13 MHz clock normally used internally in a MS.

- i) Steps b) to d) are repeated with the SS fading function set in turn to RA and HT.
- j) Steps b) to g) are repeated, with the SS fading function set to static and the MS is commanded by the SS into hopping mode using the hopping sequence defined in section 6.

The amplitude of the wanted signal is set according to step b). All the other time slots, except the active ones, are set to 20 dB above reference sensitivity level( ). This implicitly tests adjacent time slot rejection.

**14.2.1.5 Test requirements**

The error rates measured for different channels and under the different propagation conditions, under any combination of normal and extreme test voltages and ambient temperatures, shall not exceed the test limit error rate values given in table 14-4 or 14-5:



Table 14-5: Limits for GSM 900 sensitivity

Channels	Propagation conditions TUhigh		Propagation conditions RA		Propagation conditions HT		Static conditions	
	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
TCH/FS								
FER	$6,742 \cdot \alpha$	8900					$0,122 \cdot \alpha$	164000
class Ib(RBER)	$0,42/\alpha$	1000000					$0,41/\alpha$	20000000
class II(RBER)	8,33	120000	7,5	24000	9,333	60000	2,439	8200

Table 14-5: Limits for DCS 1 800 sensitivity

Channels	Propagation conditions TUhigh		Propagation conditions RA		Propagation conditions HT		Static conditions	
	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
TCH/FS								
FER	$4,478 \cdot \alpha$	13400					$0,122 \cdot \alpha$	164000
class Ib(RBER)	$0,32/\alpha$	1500000					$0,41/\alpha$	20000000
class II(RBER)	8,333	60000	7,5	24000	9,333	30000	2,439	8200

where  $\alpha$  is a parameter which can range from 1 to 1.6. The value of  $\alpha$  for a RBER test on TCH/FS class Ib bits under particular measurement conditions shall be the same as that determined in the FER test on TCH/FS under the same conditions.

## 14.2.2 Reference sensitivity - TCH/HS (Speech frames)

### 14.2.2.1 Definition and applicability

The reference sensitivity level is the signal level at the MS receiver input at which a certain BER and FER and UFR for speech frames must be achieved.

The requirements and this test apply to MS supporting half rate speech.

### 14.2.2.2 Conformance requirement

1. At reference sensitivity level, the TCH/HS FER shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 6.2.
2. At reference sensitivity level, the TCH/HS class Ib RBER (BFI=0) shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05 6.2.
3. At reference sensitivity level, the TCH/HS class II RBER (BFI=0) shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 6.2.
4. At reference sensitivity level, the TCH/HS UFR shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05 6.2.
5. At reference sensitivity level, the TCH/HS class Ib RBER ((BFI or UFI)=0) shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 6.2.



#### 14.2.2.3 Test purpose

1. To verify that the MS does not exceed conformance requirement 1 under TUhigh propagation conditions with an allowance for the statistical significance of the test.
2. To verify that the MS does not exceed conformance requirement 2 under TUhigh propagation conditions with an allowance for the statistical significance of the test.
3. To verify that the MS does not exceed conformance requirement 3 under TUhigh, RA and HT propagation conditions with an allowance for the statistical significance of the test.
4. To verify that the MS does not exceed conformance requirement 4 under TUhigh propagation conditions with an allowance for the statistical significance of the test.
5. To verify that the MS does not exceed conformance requirement 5 under TUhigh propagation conditions with an allowance for the statistical significance of the test.

#### 14.2.2.4 Method of test

##### 14.2.2.4.1 Initial conditions

The BA list sent on the BCCH and SACCH indicates at least six surrounding cells, with at least one near to each band edge. It is not necessary to generate any of these BCCHs, but if provided, the signal strengths of BCCHs shall be in the range  $15 \text{ dB}\mu\text{Vemf}(\text{ })$  to  $35 \text{ dB}\mu\text{Vemf}(\text{ })$ .

The ARFCN of any BCCH shall not be co-channel or on adjacent channels to the wanted traffic channel.

A call is set up according to the generic call set up procedure on a TCH/HS with an ARFCN in the mid ARFCN range, power control level set to maximum power.

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

##### 14.2.2.4.2 Procedure

- a) The SS commands the MS to create traffic channel loop back signalling erased frames using test loop A.  
  
NOTE: Test loop A is defined in clause 36. Frames detected with BFI=1 are signalled as erased on the uplink.
- b) The fading function is set to TUhigh.
- c) The SS sets the amplitude of the wanted signal to reference sensitivity level ( ).
- d) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- e) The SS determines the number of residual bit error events for the bits of class II, by examining sequences of at least the minimum number of samples of consecutive bits of class II. Bits are taken only from those frames not signalled as erased.
- f) The SS determines the number of residual bit error events for the bits of the class Ib, by examining sequences of at least the minimum number of samples of consecutive bits of class Ib. Bits are only taken from those frames not signalled as erased.
- g) The SS also determines the frame erasure events by examining sequences of at least the minimum number of samples of consecutive frames and assuming a frame is received successfully, if it is not signalled as erased.
- h) Steps d) and e) are repeated, with the SS fading function set in turn to RA and HT.
- j) The SS increases the amplitude of the wanted signal to 20 dB above reference sensitivity level.



- k) The SS commands the MS to open test loop A and close test loop D.

NOTE: Test loop D is defined in clause 36. Frames marked as erased (BFI=1) or unreliable (UFI=1) are signalled to the SS on the uplink.

- l) The fading function is set to TUhigh.
- m) The SS sets the amplitude of the wanted signal to reference sensitivity level ( ).
- n) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the erased/unreliable frame indication.
- p) The SS determines the number of residual bit error events for the bits of the class Ib, by examining sequences of at least the minimum number of samples of consecutive bits of class Ib. Bits are only taken from those frames not signalled as erased/unreliable.
- q) The SS also determines the unreliable frame events by examining sequences of at least the minimum number of samples of consecutive frames and assuming a frame is received successfully it is not signalled as erased/unreliable.

#### 14.2.2.5 Test requirements

The error rates measured for different channels and under the different propagation conditions, shall not exceed the test limit error rate values given in table 14-7 or 14-8:

**Table 14-7: Limits for GSM 900 sensitivity**

Channels	Propagation conditions TUhigh		Propagation conditions RA		Propagation conditions HT	
	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
TCH/HS (FER)	4,598	13050	8,500	20000	7,600	20000
TCH/HS Class Ib (BFI=0)	0,404	148500				
TCH/HS Class II (BFI=0)	7,725	25500				
TCH/HS (UFR)	6,250	9600				
TCH/HS Class Ib ((BFI or UFI)=0)	0,269	227000				

**Table 14-8: Limits for DCS 1800 sensitivity**

Channels	Propagation conditions TUhigh		Propagation conditions RA		Propagation conditions HT	
	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
TCH/HS (FER)	4,706	12750	8,735	20000	7,600	20000
TCH/HS Class Ib (BFI=0)	0,426	141000				
TCH/HS Class II (BFI=0)	7,725	25500				
TCH/HS (UFR)	6,383	9400				
TCH/HS Class Ib ((BFI or UFI)=0)	0,291	206000				



## 14.2.3 Reference sensitivity - FACCH/F

### 14.2.3.1 Definition and applicability

The reference sensitivity for control channels is the signal level at the MS receiver input at which a certain FER must be achieved.

The requirements and this test apply to all types of MS.

### 14.2.3.2 Conformance requirement.

At reference sensitivity level, the FACCH/F FER shall meet the reference sensitivity performance of table 1 in GSM 05.05; (GSM 05.05, 6.2).

### 14.2.3.3 Test purpose.

To verify that the MS does not exceed the conformance requirement under TUhigh propagation condition with an allowance for the statistical significance of the test.

### 14.2.3.4 Method of test

#### 14.2.3.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH/F with an ARFCN in the Low ARFCN range, power control level set to maximum power.

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

#### 14.2.3.4.2 Procedure

- a) The fading function is set to TUhigh.
- b) The SS sets the amplitude of the wanted signal to reference sensitivity level ( ).
- c) The SS sends a Layer 3 message which does not require a Layer 3 response from the MS. Due to the low signal level the MS may not be able to acknowledge the Layer 2 frame with an RR frame and the SS will repeat the Layer 2 frame. Each repeated L2 frame will be counted and will indicate a frame erasure event.
- d) The SS determines the frame erasure events during at least the minimum number of samples of FACCH/F frames.

NOTE: These frames will not be consecutive but it is expected that the statistical significance of the tests will not be unduly degraded.

### 14.2.3.5 Test Requirements

The error rates measured shall not exceed the test limit error rate values given in table 14-9.

**Table 14-9: Limits for FACCH/F sensitivity**

Channels	Type of measurements	Propagation	GSM 900		DCS 1 800	
			Test limit error rate %	Minimum No of samples	Test limit error rate %	Minimum No of samples
FACCH/F	FER	TUhigh	8,961	6696	4,368	13736



**14.2.4 Reference sensitivity - FACCH/H****14.2.4.1 Definition and applicability**

The reference sensitivity for control channels is the signal level at the MS receiver input at which a certain FER must be achieved.

The requirements and this test apply to MS supporting half rate channels.

**14.2.4.2 Conformance requirement.**

At reference sensitivity level, the FACCH/H FER shall meet the reference sensitivity performance of table 1 in GSM 05.05; (GSM 05.05, 6.2).

**14.2.4.3 Test purpose.**

To verify that the MS does not exceed the conformance requirement under TUhigh propagation condition with an allowance for the statistical significance of the test.

**14.2.4.4 Method of test****14.2.4.4.1 Initial conditions**

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

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

**14.2.4.4.2 Procedure**

- a) The fading function is set to TUhigh.
- b) The SS sets the amplitude of the wanted signal to reference sensitivity level ( ).
- c) The SS sends a Layer 3 message which does not require a Layer 3 response from the MS. Due to the low signal level the MS may not be able to acknowledge the Layer 2 frame with an RR frame and the SS will repeat the Layer 2 frame. Each repeated L2 frame will be counted and will indicate a frame erasure event.
- d) The SS determines the frame erasure events during at least the minimum number of samples of FACCH/H frames.

NOTE: These frames will not be consecutive but it is expected that the statistical significance of the tests will not be unduly degraded.

**14.2.4.5 Test requirements**

The error rates measured shall not exceed the test limit error rate values given in table 14-10.

**Table 14-10: Limits for FACCH/H sensitivity**

Channels	Type of measurements	Propagation	GSM 900		DCS 1 800	
			Test limit error rate %	Minimum No of samples	Test limit error rate %	Minimum No of samples
FACCH/H	FER	TUhigh	7,728		8,064	



**14.2.5 Reference sensitivity - full rate data channels****14.2.5.1 Definition and applicability**

The reference sensitivity for data channels is the signal level at the MS receiver input at which a certain BER must be achieved.

The requirements and this test apply to MS supporting data.

**14.2.5.2 Conformance Requirement.**

1. At reference sensitivity level, the TCH/F9,6, TCH/F4,8 and TCH/F2,4 BER shall meet the reference sensitivity performance of table 1 in GSM 05.05; (GSM 05.05, 6,2).

**14.2.5.3 Test purpose**

1. To verify that the MS does not exceed conformance requirement 1 under HT propagation condition with an allowance for the statistical significance of the test.

**14.2.5.4 Method of test****14.2.5.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH with an ARFCN in the Mid ARFCN range. One of the supported TCH/(F9,6, F4,8, or F2,4) shall be used. The power control level is set to maximum power.

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

The SS commands the MS to create the traffic channel loop back signalling erased frames. (36.2.1.1.1).

**14.2.5.4.2 Procedure**

- a) The fading function is set to HT.
- b) The SS sets the amplitude of the wanted signal level to reference sensitivity level ( ).
- c) The SS compares transmitted data with received data for at least the minimum number of samples of consecutive bits and records every error bit as an error event.
- d) The SS sets the wanted signal level to 28 dB $\mu$ V<sub>emf</sub>.
- e) The SS commands the MS to open the TCH loop.
- f) The SS commands the MS to another of the supported data channels.
- g) Steps b) to f) are repeated for all supported full rate data channels.

**14.2.5.5 Test requirements**

The Max-events measured for different channels shall not exceed the values given in table 14-11.

**Table 14-11: Limits for full rate data channel sensitivity**

Channels	Type of measurements	Propagation	GSM 900		DCS 1 800	
			Test limit error rate %	Minimum No of samples	Test limit error rate %	Minimum No of samples
TCH/F9,6	BER	HT	0,778	180000	0,784	76500
TCH/F4,8	BER	HT	0,011	5350000	0,011	5350000
TCH/F2,4	BER	HT	0,001	11900000	0,001	11900000



**14.2.6 Reference sensitivity - half rate data channels****14.2.6.1 Definition and applicability**

The reference sensitivity for data channels is the signal level at the MS receiver input at which a certain BER must be achieved.

The requirements and this test apply to MS supporting half rate data.

**14.2.6.2 Conformance Requirement.**

1. At reference sensitivity level, the TCH/H4,8 and TCH/H2,4 BER shall meet the reference sensitivity performance of table 1 in GSM 05.05; (GSM 05.05, 6.2).

**14.2.6.3 Test purpose**

1. To verify that the MS does not exceed conformance requirement 1 under HT propagation condition with an allowance for the statistical significance of the test.

**14.2.6.4 Method of test****14.2.6.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH with an ARFCN in the Mid ARFCN range. One of the supported TCH/(H4,8 or H2,4) shall be used. The power control level is set to maximum power.

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

The SS commands the MS to create the traffic channel loop back signalling erased frames. (36.2.1.1.1).

**14.2.6.4.2 Procedure**

- a) The fading function is set to HT.
- b) The SS sets the amplitude of the wanted signal level to reference sensitivity level ( ).
- c) The SS compares transmitted data with received data for at least the minimum number of samples of consecutive bits and records every error bit as an error event.
- d) The SS sets the wanted signal level to 28 dBμVemf.
- e) The SS commands the MS to open the TCH loop.
- f) The SS commands the MS to another of the supported data channels.
- g) Steps b) to f) are repeated for all supported data channels.

**14.2.6.5 Test requirements**

The Max-events measured for different channels shall not exceed the values given in table 14-12.

**Table 14-12: Limits for half rate data channel sensitivity**

			GSM 900		DCS 1 800	
Channels	Type of measurements	Propagation	Test limit error rate %	Minimum No of samples	Test limit error rate %	Minimum No of samples
TCH/H4,8	BER	HT	0,778	180000	-	-
TCH/H2,4	BER	HT	0,011	5350000	-	-



## 14.2.7 Reference sensitivity - TCH/EFS

### 14.2.7.1 Definition and applicability

The reference sensitivity is the signal level at the MS receiver input at which a certain BER and FER must be achieved.

The requirements and this test apply to MS supporting speech.

For E-GSM 900 MS this test is only performed in the P-GSM band.

### 14.2.7.2 Conformance requirement

1. At reference sensitivity level, the TCH/EFS FER shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 6.2.
2. At reference sensitivity level, the TCH/EFS class I RBER shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 6.2.
3. At reference sensitivity level, the TCH/EFS class II RBER shall meet the reference sensitivity, performance of table 1 in GSM 05.05; GSM 05.05, 6.2.
4. At reference sensitivity level, the TCH/EFS class II RBER shall meet the reference sensitivity, performance of table 1 in GSM under extreme conditions; GSM 05.05, 6.2, GSM 05.05, annex D D.2.1, D.2.2.

### 14.2.7.3 Test purpose

NOTE: This test is performed under STATIC propagation conditions to allow implicit testing of the ability of the MS to hop over the full band. The tests under dynamic propagation conditions are better suited to test the reference sensitivity conformance but cannot test hopping over the full band due to limited bandwidth of available fading simulators.

1. To verify that the MS does not exceed conformance requirement 1 under STATIC and TUhigh propagation conditions with an allowance for the statistical significance of the test.
2. To verify that the MS does not exceed conformance requirement 2 under STATIC and TUhigh propagation conditions with an allowance for the statistical significance of the test.
3. To verify that the MS does not exceed conformance requirement 3 under STATIC, TUhigh, RA and HT propagation conditions with an allowance for the statistical significance of the test.
4. To verify that the MS does not exceed conformance requirement 4 under STATIC and TUhigh propagation conditions with an allowance for the statistical significance of the test.

### 14.2.7.4 Method of test

NOTE 1: The BA list sent on the BCCH and SACCH will indicate at least six surrounding cells with at least one near to each band edge. It is not necessary to generate any of these BCCHs but, if provided the signal strengths of BCCHs shall be in the range 15 dBmV<sub>emf</sub>( ) to 35 dBmV<sub>emf</sub>( ).

NOTE 2: The ARFCN of any BCCH shall not be co-channel or on adjacent channels to the wanted traffic channel.

NOTE 3: When frequency hopping is used, the traffic channel may fall on any of the ARFCNs defined in section 6.



**14.2.7.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH/EFS with an ARFCN in the Mid ARFCN range for DCS 1800 and ARFCN 70 for GSM 900, power control level set to maximum power.

NOTE: For GSM 900 ARFCN 70 is tested since this is the 73rd harmonic of the 13 MHz clock normally used internally in a MS.

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

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

**14.2.7.4.2 Procedure**

- a) The fading function is set to TUhgh.
- b) the SS sets the amplitude of the wanted signal to reference sensitivity level ( ).
- c) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- d) The SS determines the number of residual bit error events for the bits of class II, by examining sequences of at least the minimum number of samples of consecutive bits of class II. Bits are taken only from those frames not signalled as erased.
- e) The SS determines the number of residual bit error events for the bits of the class Ib, by examining sequences of at least the minimum number of samples of consecutive bits of class Ib. Bits are only taken from those frames not signalled as erased.
- f) The SS also determines the frame erasure events by examining sequences of at least the minimum number of samples of consecutive frames and assuming a frame is received successfully, if it is not signalled as erased.
- g) Steps a) to d) are repeated under extreme test conditions.
- h) Steps a) to g) are repeated for TCH/EFS with ARFCNs in the Low ARFCN range for DCS 1800 and ARFCN 5 for GSM 900 and the High ARFCN range.

NOTE: For GSM 900 ARFCN 5 is tested since this is the 72nd harmonic of the 13 MHz clock normally used internally in a MS.

- i) Steps b) to d) are repeated with the SS fading function set in turn to RA and HT.
- j) Steps b) to g) are repeated, with the SS fading function set to static and the MS is commanded by the SS into hopping mode using the hopping sequence defined in section 6.

The amplitude of the wanted signal is set according to step b). All the other time slots, except the active ones, are set to 20 dB above reference sensitivity level( ). This implicitly tests adjacent time slot rejection.

**14.2.7.5 Test requirements**

The error rates measured for different channels and under the different propagation conditions, under any combination of normal and extreme test voltages and ambient temperatures, shall not exceed the test limit error rate values given in table 14-4 or 14-13a, 14-13b:



Table 14-13a: Limits for GSM 900 sensitivity

Channels	Propagation conditions TUhigh		Propagation conditions RA		Propagation conditions HT		Static conditions	
	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
TCH/EFS								
FER	8,867	8900					0,122	164000
class Ib(RBER)	0,224	1000000					0,110	20000000
class II (RBER)	7,500	120000	7,500	24000	9,350	60000	2,439	8200

Table 14-13b: Limits for DCS 1 800 sensitivity

Channels	Propagation conditions TUhigh		Propagation conditions RA		Propagation conditions HT		Static conditions	
	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
TCH/EFS								
FER	4,475	13400					0,122	164000
class Ib(RBER)	0,130	1500000					0,110	20000000
class II(RBER)	8,333	60000	7,500	24000	9,498	30000	2,439	8200

### 14.3 Usable receiver input level range

#### 14.3.1 Definition and applicability

The usable receiver input level range is the range of the radio frequency input level of a specified modulated signal over which bit error ratio or frame erasure ratios stay between specified limits.

The requirements and this test apply to MS supporting speech.

#### 14.3.2 Conformance requirement

1. The receiver input level range requirements of GSM 05.05 section 6.1 for TCH/FS class II RBER under static and EQ propagation conditions shall be met:
  - 1.1 Under normal conditions.
  - 1.2 Under extreme conditions.

#### 14.3.3 Test purpose

1. To verify that the MS does not exceed the conformance requirement with an allowance for the statistical significance of the test.
  - 1.1 Under normal conditions.
  - 1.2 Under extreme conditions.

#### 14.3.4 Method of test

##### 14.3.4.1 Initial conditions

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

The SS transmits Standard Test Signal C1 on the TCH/FS.

The SS commands the MS to create traffic channel loop back signalling erased frames. (36.2.1.1.2).



#### 14.3.4.2 Procedure

- a) The SS compares the data that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding.

The SS tests the bit error ratio for the non-protected bits of TCH/FS class II, by examining sequences of at least the minimum number of samples of consecutive bits of class II. The number of error events is recorded.

- b) Step a) is repeated with the amplitude of the wanted signal increased to an input level at the receiver input of 73 dB $\mu$ V<sub>emf</sub>( ).
- c) Step a) is repeated with the amplitude of the wanted signal increased to an input level at the receiver input of:

GSM 900: 98 dB $\mu$ V<sub>emf</sub>( )

DCS 1 800: 90 dB $\mu$ V<sub>emf</sub>( ).

- d) The SS fading function is set to EQ.
- e) Step a) is repeated with the amplitude of the wanted signal set to respectively 20 dB above reference sensitivity level( ) and 73dB $\mu$ V<sub>emf</sub>( ) at the receiver input.
- f) The test is repeated under extreme test conditions.

#### 14.3.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-14. This shall apply for any combination of normal and extreme test voltages and ambient temperature, for the different propagation conditions and for any level of input signal to the receiver.

**Table 14-14: Limits for input level range**

Propagation conditions	GSM 900		DCS 1 800	
	Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
Static $\leq 73$ dB $\mu$ V <sub>emf</sub> ( )	0,012	1640000	0,012	1640000
Static 98 dB $\mu$ V <sub>emf</sub> ( )	0,122	164000		
Static 90 dB $\mu$ V <sub>emf</sub> ( )			0,122	164000
EQ	3,25	120000	3,25	60000

### 14.4 Co-channel rejection

#### 14.4.1 Co-channel rejection - TCH/FS.

##### 14.4.1.1 Definition and applicability

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

The requirements and this test apply to MS supporting speech.



**14.4.1.2 Conformance requirement**

1. At reference co-channel interference the TCH/FS FER shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
2. At reference co-channel interference the TCH/FS class Ib BER shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
3. At reference co-channel interference the TCH/FS class II BER shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.

**14.4.1.3 Test purpose**

1. To verify that the MS does not exceed conformance requirement 1 under propagation condition TU<sub>high</sub> with frequency hopping and TU<sub>low</sub> with no frequency hopping with an allowance for the statistical significance of the test.
2. To verify that the MS does not exceed conformance requirement 2 under propagation condition TU<sub>high</sub> with frequency hopping and TU<sub>low</sub> with no frequency hopping, with an allowance for the statistical significance of the test.
3. To verify that the MS does not exceed conformance requirement 3 under propagation condition TU<sub>high</sub> with frequency hopping and TU<sub>low</sub> with no frequency hopping with an allowance for the statistical significance of the test.

**14.4.1.4 Method of test****14.4.1.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH/FS with an ARFCN in the mid ARFCN range, power control level set to maximum power.

The SS transmits Standard Test Signal C1 on the traffic channel (wanted signal).

The SS commands the MS to create the traffic channel loop back, signalling erased frames. (36.1.2.1.1.1).

**14.4.1.4.2 Procedure**

- a) In addition to the wanted signal, the SS produces an independent, uncorrelated interfering signal, Standard Test Signal I1 (unwanted signal).

The unwanted signal is continuous and has no fixed relationship with the bit transitions of the wanted signal. Its amplitude is 9 dB below that of the wanted signal.

The fading characteristic of the wanted and the interfering signal is TU<sub>low</sub>.

- b) The SS compares the modulation of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- c) The SS determines the number of residual bit error events for the bits of class II, by examining at least the minimum number of samples of consecutive bits of class II. Bits are taken only from those frames not signalled as erased.
- d) The SS determines the number of residual bit error events for the bits of the class Ib, by examining at least the minimum number of samples of consecutive bits of class Ib. Bits are only taken from those frames not signalled as erased.
- e) The SS also determines the frame erasure events by examining at least the minimum number of samples of consecutive frames and assuming a frame is received successfully it is not signalled as erased.



- f) Steps a) to e) are repeated except that in step a) both the wanted and interfering signal are TUhigh hopping and the SS commands the MS into hopping mode. A hop pattern covering at least 10 frequencies in a range not exceeding 5 MHz is used.

The hopping band is centred around an ARFCN in the Mid ARFCN range. The hopping frequencies are chosen from those defined in section 6.

#### 14.4.1.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-15.

**Table 14-15: Limits for co-channel rejection**

Channel	Type of measurement	Propagation condition	Test limit error rate %	Minimum No. of samples
TCH/FS	FER	TUlow/No FH	$24 \cdot \alpha$	25000
TCH/FS Class Ib	RBER	TUlow/No FH	$2,091/\alpha$	3300000
TCH/FS Class II	RBER	TUlow/No FH	4,3	2000000
TCH/FS	FER	TUhigh/FH	$3,371 \cdot \alpha$	17800
TCH/FS class Ib	RBER	TUhigh/FH	$0,215/\alpha$	2000000
TCH/FS class II	RBER	TUhigh/FH	8,333	1200000

The parameter  $\alpha$  can range from 1 to 1.6. The value of  $\alpha$  for the RBER test on TCH/FS class Ib bits under particular measurement conditions shall be the same as that determined in the FER test on TCH/FS under the same conditions.

#### 14.4.2 Co-channel rejection - TCH/HS

##### 14.4.2.1 Definition and applicability

The requirements and this test apply to MS supporting half rate speech.

##### 14.4.2.2 Conformance requirement

1. At reference cochannel interference, the TCH/HS FER (shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
2. At reference cochannel interference, the TCH/HS class Ib BER (BFI=0) shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
3. At reference cochannel interference, the TCH/HS class II BER (BFI=0) shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
4. At reference cochannel interference, the TCH/HS UFR shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
5. At reference cochannel interference, the TCH/HS class Ib RBER ((BFI or UFI)=0) shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.

##### 14.4.2.3 Test purpose

1. To verify that the MS does not exceed conformance requirement 1, under propagation conditions TUhigh with frequency hopping, with an allowance for the statistical significance of the test.
2. To verify that the MS does not exceed conformance requirement 1, under propagation conditions TUhigh with frequency hopping, with an allowance for the statistical significance of the test.
3. To verify that the MS does not exceed conformance requirement 1, under propagation conditions TUhigh with frequency hopping, with an allowance for the statistical significance of the test.



4. To verify that the MS does not exceed conformance requirement 4, under propagation condition TUhigh with frequency hopping, with an allowance for the statistical significance of the test.
5. To verify that the MS does not exceed conformance requirement 4, under propagation condition TUhigh with frequency hopping, with an allowance for the statistical significance of the test.

#### **14.4.2.4 Method of test**

##### **14.4.2.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH/HS with an ARFCN in the mid ARFCN range, power control level set to maximum power.

The SS transmits Standard Test Signal C1 on the traffic channel (wanted signal).

##### **14.4.2.4.2 Procedure**

- a) In addition to the wanted signal, the SS produces an independent, uncorrelated interfering signal, Standard Test Signal I1 (unwanted signal).

The unwanted signal is continuous and has no fixed relationship with the bit transitions of the wanted signal. Its amplitude is 9 dB below that of the wanted signal.

- b) The fading characteristic of the wanted and the interfering signal is set to TUhigh. The SS commands the MS into hopping mode. A hop pattern covering at least 10 frequencies in a range not exceeding 5 MHz is used.

The hopping pattern is centred around an ARFCN in the Mid ARFCN range. The hopping frequencies are chosen from those defined in section 6.

- c) The SS commands the MS to create traffic channel loop back signalling erased frames using test loop A.

NOTE: Test loop A is defined in clause 36. Frames marked with BFI=1 are signalled as erased on the uplink.

- d) The SS compares the modulation of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- e) The SS determines the number of residual bit error events for the bits of class II, by examining at least the minimum number of samples of consecutive bits of class II. Bits are taken only from those frames not signalled as erased.
- f) The SS determines the number of residual bit error events for the bits of the class Ib, by examining at least the minimum number of samples of consecutive bits of class Ib. Bits are only taken from those frames not signalled as erased.
- g) The SS also determines the frame erasure events by examining at least the minimum number of samples of consecutive frames and assuming a frame is received successfully it is not signalled as erased.
- h) The SS commands the MS to open test loop A and close test loop D.

NOTE: Test loop D is defined in clause 36. Frames marked as erased (BFI=1), or unreliable (UFI=1), are signalled to the SS on the uplink.

- j) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the erased/unreliable frame indication.
- k) The SS determines the number of residual bit error events for the bits of the class Ib, by examining sequences of at least the minimum number of samples of consecutive bits of class Ib. Bits are only taken from those frames not signalled as erased/unreliable.



- l) The SS also determines the unreliable frame events by examining sequences of at least the minimum number of samples of consecutive frames and assuming a frame is received successfully it is not signalled as erased/unreliable.

#### 14.4.2.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-16 or table 14-17.

**Table 14-16: Limits for GSM 900 co-channel rejection**

Channel/Type of measurement	Propagation condition	Test limit error rate %	Minimum No. of samples
TCH/HS FER	TUhigh/FH	5,607	10700
TCH/HS Class Ib RBER (BFI=0)	TUhigh/FH	0,325	184700
TCH/HS Class II RBER (BFI=0)	TUhigh/FH	7,961	25500
TCH/HS UFR	TUhigh/FH	6,834	8780
TCH/HS Class Ib RBER ((BFI or UFI)=0)	TUhigh/FH	0,235	255000

**Table 14-17: Limits for DCS 1800 co-channel rejection**

Channel/Type of measurement	Propagation condition	Test limit error rate %	Minimum No. of samples
TCH/HS FER	TUhigh/FH	5,607	10700
TCH/HS Class Ib RBER (BFI=0)	TUhigh/FH	0,325	184700
TCH/HS Class II RBER (BFI=0)	TUhigh/FH	7,961	25500
TCH/HS UFR	TUhigh/FH	6,834	8780
TCH/HS Class Ib RBER ((BFI or UFI)=0)	TUhigh/FH	0,235	255000

#### 14.4.3 Co-channel rejection - TCH/HS (SID frames)

##### 14.4.3.1 Definition and applicability

The requirements and this test apply to MS supporting half rate speech.

##### 14.4.3.2 Conformance requirement

1. At reference cochannel interference, the TCH/HS ESIDR, for SID frames indicated as SID=0 shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
2. At reference cochannel interference, the TCH/HS RBER for SID frames indicated as SID=1 or SID=2, shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
3. At reference cochannel interference, the TCH/HS EVSIDR for SID frames indicated as (SID=0), or (SID=1), or ((BFI or UFI)=1), shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
4. At reference cochannel interference, the TCH/HS RBER for SID frames indicated as SID=2 and (BFI or UFI)=0, shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.

##### 14.4.3.3 Test purpose

1. To verify that the MS does not exceed conformance requirement 1 under propagation condition TUlow, with an allowance for the statistical significance of the test.
2. To verify that the MS does not exceed conformance requirement 2 under propagation condition TUlow, with an allowance for the statistical significance of the test.



3. To verify that the MS does not exceed conformance requirement 3 under propagation condition TULow, with an allowance for the statistical significance of the test.
4. To verify that the MS does not exceed conformance requirement 4 under propagation condition TULow, with an allowance for the statistical significance of the test.

#### **14.4.3.4 Method of test**

##### **14.4.3.4.1 Initial conditions**

The BCCH data indicates that uplink DTX shall be disabled.

A call is set up according to the generic call set up procedure on a TCH/HS with an ARFCN in the mid ARFCN range, power control level set to maximum power.

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

##### **14.4.3.4.2 Procedure**

- a) In addition to the wanted signal, the SS produces an independent, uncorrelated interfering signal, Standard Test Signal I1 (unwanted signal).

The unwanted signal is continuous and has no fixed relationship with the bit transitions of the wanted signal. Its amplitude is 9 dB below that of the wanted signal.

- b) The fading function is set to TULow.
- c) The SS commands the MS to create traffic channel loop back signalling erased frames using test loop E.

NOTE: Test loop E is defined in clause 36. Frames marked with (SID=0) shall be signalled as erased on the uplink.

- d) The SS transmits continuously SID frames on the downlink. The SID codeword is transmitted correctly, but the SID information contains random data.
- e) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- f) The SS determines the number of residual bit error events for the class 1 SID bits, which do not belong to the SID codeword, by examining sequences of at least the minimum number of samples of consecutive class 1 SID bits. Bits are taken only from those frames not signalled as erased.
- g) The SS also determines the erased SID events by examining sequences of at least the minimum number of samples of consecutive frames and assuming a frame is received successfully it is not signalled as erased. Bits comprising the SID codeword are excluded.
- h) The SS commands the MS to open test loop E and close test loop F.

NOTE: Test loop F is defined in clause 36. Frames marked with (SID=0), or (SID=1), or ((BFI or UFI)=1), shall be signalled as erased on the uplink.

- i) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- k) The SS determines the number of residual bit error events for the class 1 SID bits, which do not belong to the SID codeword, by examining sequences of at least the minimum number of samples of consecutive class 1 SID bits. Bits are taken only from those frames not signalled as erased.
- l) The SS also determines the erased valid SID events by examining sequences of at least the minimum number of samples of consecutive frames and assuming a frame is received successfully it is not signalled as erased.



**14.4.3.5 Test requirements**

The error rates measured in this test shall not exceed the test limit error rate values given in table 14-18.

**Table 14-18: Limits for co-channel rejection**

Channel/Type of measurement	Propagation condition	Test limit error rate %	Minimum No. of samples
ESIDR	TUlow	19,152	25000
SID RBER (SID=1 or 2)	TUlow	0,560	500000
EVSIDR	TUlow	24,000	25000
SID RBER (SID=2 and (BFI or UFI)=0)	TUlow	0,022	2678000

**14.4.4 Co-channel rejection - FACCH/F****14.4.4.1 Definition and applicability**

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

The requirements and this test apply to all types of MS.

**14.4.4.2 Conformance requirement**

At reference cochannel interference the FACCH/F FER shall meet the reference interference performance of table 2 in GSM 05.05; (GSM 05.05, 6.3).

**14.4.4.3 Test purpose**

To verify that the MS does not exceed the conformance requirement under propagation condition TUlow with an allowance for the statistical significance of the test.

**14.4.4.4 Method of test****14.4.4.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH with an ARFCN in the mid ARFCN range. For MS supporting speech this shall be a TCH/FS. For MS not supporting speech one of the supported TCH/ (F9,6, F4,8, or F2,4) shall be used. The power control level is set to maximum power.

The SS transmits Standard Test Signal C1 on the traffic channel (wanted signal).

**14.4.4.4.2 Procedure**

- a) In addition to the wanted signal, the SS produces an independent, uncorrelated interfering signal, Standard Test Signal I1 (unwanted signal).

The unwanted signal is continuous and has no fixed relationship with the bit transitions of the wanted signal. Its amplitude is 9 dB below that of the wanted signal.

The fading characteristic of the wanted and the interfering signal is TUlow.

- d) The SS sends a Layer 3 message which does not require a Layer 3 response from the MS. Due to the co-channel interference, the MS may not be able to acknowledge the Layer 2 frame. Each repeated L2 frame indicates a frame erasure event. The SS determines the number of frame erasure events during at least the minimum number of samples of FACCH/F frames.



NOTE: These frames will not be consecutive but it is expected that the statistical significance of the tests will not be unduly degraded.

#### 14.4.4.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-14.

**Table 14-19: Limits for co-channel rejection**

Channel	Type of measurement	Propagation condition	Test limit error rate %	Minimum No. of samples
FACCH/F	FER	TUlow/No FH	24	25000

#### 14.4.5 Co-channel rejection - FACCH/H

##### 14.4.5.1 Definition and applicability

The requirements and this test apply to MS supporting half rate channels.

##### 14.4.5.2 Conformance requirement

At reference cochannel interference the FACCH/H FER shall meet the reference interference performance of table 2 in GSM 05.05; (GSM 05.05, 6.3).

##### 14.4.5.3 Test purpose

To verify that the MS does not exceed the conformance requirement under propagation condition TUlow with an allowance for the statistical significance of the test.

##### 14.4.5.4 Method of test

###### 14.4.5.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH with an ARFCN in the mid ARFCN range. For MS supporting half rate speech this shall be a TCH/HS. For MS not supporting speech one of the supported TCH/(H4,8, or H2,4) shall be used. The power control level is set to maximum power.

The SS transmits Standard Test Signal C1 on the traffic channel (wanted signal).

###### 14.4.5.4.2 Procedure

- a) In addition to the wanted signal, the SS produces an independent, uncorrelated interfering signal, Standard Test Signal I1 (unwanted signal).

The unwanted signal is continuous and has no fixed relationship with the bit transitions of the wanted signal. Its amplitude is 9 dB below that of the wanted signal.

The fading characteristic of the wanted and the interfering signal is TUlow.

- d) The SS sends a Layer 3 message which does not require a Layer 3 response from the MS. Due to the co-channel interference, the MS may not be able to acknowledge the Layer 2 frame. Each repeated L2 frame indicates a frame erasure event. The SS determines the number of frame erasure events during at least the minimum number of samples of FACCH/H frames.

NOTE: These frames will not be consecutive but it is expected that the statistical significance of the tests will not be unduly degrade.



**14.4.5.5 Test requirements**

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-20.

**Table 14-20: Limits for co-channel rejection**

Channel	Type of measurement	Propagation condition	Test limit error rate %	Minimum No. of samples
FACCH/H	FER	TUlow/No FH	24,000	25000

**14.4.6 Co-channel rejection - TCH/EFS.****14.4.6.1 Definition and applicability**

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

The requirements and this test apply to MS supporting speech.

**14.4.6.2 Conformance requirement**

1. At reference co-channel interference the TCH/EFS FER shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
2. At reference co-channel interference the TCH/EFS class Ib BER shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.
3. At reference co-channel interference the TCH/EFS class II BER shall meet the reference interference performance of table 2 in GSM 05.05; GSM 05.05, 6.3.

**14.4.6.3 Test purpose**

1. To verify that the MS does not exceed conformance requirement 1 under propagation condition TUhigh with frequency hopping and TUlow with no frequency hopping with an allowance for the statistical significance of the test.
2. To verify that the MS does not exceed conformance requirement 2 under propagation condition TUhigh with frequency hopping and TUlow with no frequency hopping, with an allowance for the statistical significance of the test.
3. To verify that the MS does not exceed conformance requirement 3 under propagation condition TUhigh with frequency hopping and TUlow with no frequency hopping with an allowance for the statistical significance of the test.

**14.4.6.4 Method of test****14.4.6.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH/EFS with an ARFCN in the mid ARFCN range, power control level set to maximum power.

The SS transmits Standard Test Signal C1 on the traffic channel (wanted signal).

The SS commands the MS to create the traffic channel loop back, signalling erased frames. (36.1.2.1.1.1).



#### 14.4.6.4.2 Procedure

- a) In addition to the wanted signal, the SS produces an independent, uncorrelated interfering signal, Standard Test Signal I1 (unwanted signal).

The unwanted signal is continuous and has no fixed relationship with the bit transitions of the wanted signal. Its amplitude is 9 dB below that of the wanted signal.

The fading characteristic of the wanted and the interfering signal is TUlow.

- b) The SS compares the modulation of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- c) The SS determines the number of residual bit error events for the bits of class II, by examining at least the minimum number of samples of consecutive bits of class II. Bits are taken only from those frames not signalled as erased.
- d) The SS determines the number of residual bit error events for the bits of the class Ib, by examining at least the minimum number of samples of consecutive bits of class Ib. Bits are only taken from those frames not signalled as erased.
- e) The SS also determines the frame erasure events by examining at least the minimum number of samples of consecutive frames and assuming a frame is received successfully it is not signalled as erased.
- f) Steps a) to e) are repeated except that in step a) both the wanted and interfering signal are TUhigh hopping and the SS commands the MS into hopping mode. A hop pattern covering at least 10 frequencies in a range not exceeding 5 MHz is used.

The hopping band is centred around an ARFCN in the Mid ARFCN range. The hopping frequencies are chosen from those defined in section 6.

#### 14.4.6.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-21.

**Table 14-21: Limits for co-channel rejection**

Channel	Type of measurement	Propagation condition	Test limit error rate %	Minimum No. of samples
TCH/EFS	FER	TUlow/No FH	24	25000
TCH/EFS Class Ib	RBER	TUlow/No FH	0,209	3300000
TCH/EFS Class II	RBER	TUlow/No FH	3,039	2000000
TCH/EFS	FER	TUhigh/FH	3,357	17800
TCH/EFS class Ib	RBER	TUhigh/FH	0,115	2000000
TCH/EFS class II	RBER	TUhigh/FH	8,333	1200000

#### 14.5 Adjacent channel rejection

##### 14.5.1 Adjacent channel rejection - speech channels

##### 14.5.1.1 Definition and applicability

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal in the adjacent channel.



The adjacent channel can be adjacent in the RF spectrum or in time. There are therefore two types of adjacent channel selectivity:

- 1) Adjacent RF channel selectivity which is specifically tested in this section.
- 2) Adjacent Time Slot selectivity, which is implicitly tested in test .2.1.

The requirements and this test apply to MS supporting speech.

#### 14.5.1.2 Conformance requirement

1. With adjacent channel interference at 200 kHz above and below the wanted signal and signal level 9 dB above the wanted signal level:
  - 1.1 For a TUhigh faded wanted signal and a TUhigh adjacent channel interferer, the FER for TCH/FS shall be within the requirements of table 2 in GSM 05.05; GSM 05.05, 6.3.
  - 1.2 For a TUhigh faded wanted signal and a TUhigh adjacent channel interferer, the Class Ib RBER shall be within the requirements of table 2 in GSM 05.05; GSM 05.05, 6.3.
  - 1.3 For a TUhigh faded wanted signal and a TUhigh adjacent channel interferer, the Class II RBER shall be within the requirements of table 2 in GSM 05.05; GSM 05.05, 6.3.
  - 1.4 For a TUhigh faded wanted signal and a TUhigh adjacent channel interferer, the Class II RBER shall be within the requirements of table 2 in GSM 05.05 under extreme test conditions; GSM 05.05, 6.3, GSM 05.05, annex D D.2.1, D.2.2.
2. For adjacent channel interference at 400 kHz above and below the wanted signal frequency and signal level 41 dB above the wanted signal level:
  - 2.1 For a TUhigh faded wanted signal and a static adjacent channel interferer, the FER for TCH/FS shall be better than:  
 GSM 900:  $10,2 \cdot \alpha$  %; GSM 05.05, 6.3  
 DCS 1 800:  $5,1 \cdot \alpha$  %; GSM 05.05, 6.3.
  - 2.2 For a TUhigh faded wanted signal and a static adjacent channel interferer, the Class Ib RBER shall be better than:  
 GSM 900:  $0,72/\alpha$  %; GSM 05.05, 6.3  
 DCS 1 800:  $0,45/\alpha$  %; GSM 05.05, 6.3.
  - 2.3 For a TUhigh faded wanted signal and a static adjacent channel interferer, the Class II RBER shall be better than:  
 GSM 900: 8,8 %; GSM 05.05, 6.3  
 DCS 1 800: 8,9 %; GSM 05.05, 6.3.
  - 2.4 For a TUhigh faded wanted signal and a static adjacent channel interferer, the Class II RBER shall be better than:  
 GSM 900: 8,8 %;  
 DCS 1 800: 8,9 %;.

under extreme test conditions; GSM 05.05, 6.3, annex D D.2.1, D.2.2.

#### 14.5.1.3 Test purpose

- 1 To verify that with a TUhigh adjacent channel interferer at 200 kHz above and below the wanted TUhigh signal frequency and signal level 9 dB above the wanted signal level:
  - 1.1 Conformance requirement 1.1 is met with an allowance for the statistical significance of the test.
  - 1.2 Conformance requirement 1.2 is met with an allowance for the statistical significance of the test.
  - 1.3 Conformance requirement 1.3 is met with an allowance for the statistical significance of the test.
  - 1.4 Conformance requirement 1.4 is met with an allowance for the statistical significance of the test.



2. To verify that with a static adjacent channel interferer at 400 kHz above and below a TUhigh wanted signal frequency and signal level 41 dB above the wanted signal level:
  - 2.1 Conformance requirement 2.1 is met with an allowance for the statistical significance of the test.
  - 2.2 Conformance requirement 2.2 is met with an allowance for the statistical significance of the test.
  - 2.3 Conformance requirement 2.3 is met with an allowance for the statistical significance of the test.
  - 2.4 Conformance requirement 2.4 is met with an allowance for the statistical significance of the test.

#### **14.5.1.4 Method of test**

##### **14.5.1.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH/FS with an ARFCN in the mid ARFCN range, power control level set to maximum power.

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

The SS transmits Standard Test Signal C1 on the TCH (wanted signal).

##### **14.5.1.4.2 Procedure**

- a) In addition to the wanted signal, the SS transmits an independent, uncorrelated interfering signal, Standard Test Signal I1 (unwanted signal).

The unwanted signal is continuous and has no fixed relationship with the bit transitions of the wanted signal.

The fading characteristic of the wanted and the unwanted signal is set to TUhigh.

The unwanted signal is transmitted at a nominal frequency 200 kHz above the nominal frequency of the wanted signal. Its amplitude is set to 9dB above that of the wanted signal.

- b) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- c) The SS tests the frame erasure compliance for the TCH/FS by examining at least the minimum number of samples of consecutive frames. The number of frame erasure events is recorded.
- d) The SS determines the number of residual bit error events for the bits of the class Ib and class II, by examining sequences of at least the minimum number of samples of consecutive bits of class Ib and class II, Bits are only taken from those frames for which no bad frame indication was given.
- e) The measurement of steps c) and d) is repeated with the unwanted signal on a frequency at the same displacement from, but below, the frequency of the wanted signal.
- f) The measurement of steps c) to e) shall be repeated for a displacement of the unwanted signal of 400 kHz, and with the amplitude of the unwanted signal 41 dB above the level of the wanted input signal, and the unwanted signal static.
- g) Steps c) to f) are repeated under extreme test conditions.



**14.5.1.5 Test requirements****Table 14-22: Limits for adjacent channel selectivity**

Interference at	Channel	Type of measurement	GSM 900		DCS 1 800	
			Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
200 kHz	TCH/FS class Ib class II	FER	6,742* $\alpha$	8900	3,371* $\alpha$	17800
		RBER	0,420/ $\alpha$	1000000	0,270/ $\alpha$	2000000
		RBER	8,333	600000	8,333	1200000
400 kHz	TCH/FS class Ib class II	FER	11,461* $\alpha$	8900	5,714* $\alpha$	10500
		RBER	0,756/ $\alpha$	1000000	0,483/ $\alpha$	1200000
		RBER	9,167	600000	9,167	720000

The error rates measured in this test shall not exceed the test limit error rate given in table 14-22. This shall apply for any combination of normal and extreme test voltages and ambient temperature, and with the interfering signals at either side of the wanted frequency.

The parameter  $\alpha$  can range from 1 to 1,6. The value of  $\alpha$  for the RBER test on TCH/FS class Ib bits under particular measurement conditions shall be the same as that determined in the FER test on TCH/FS under the same conditions.

NOTE: A static unwanted signal is used to avoid a potential problem with the implementation of the fading simulator.

**14.5.2 Adjacent channel rejection - control channels****14.5.2.1 Definition and applicability**

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal in the adjacent channel.

The adjacent channel can be the adjacent in the RF spectrum or in time. There are therefore two types of adjacent channel selectivity:

- 1) Adjacent RF channel selectivity which is specifically tested in this section.
- 2) Adjacent Time Slot selectivity, which is implicitly tested in test 14.2.1.

The requirements and this test apply to MS not supporting speech.

**14.5.2.2 Conformance requirement**

1. For adjacent channel interference at 200 kHz above and below the wanted signal frequency and signal level 9 dB above the wanted signal level:
  - 1.1 For a TUhigh faded wanted signal and a TUhigh adjacent channel interferer, the FER for the FACCH/F does not exceed the requirements of table 2 in GSM 05.05; GSM 05.05, 6.3.
  - 1.2 For a TUhigh faded wanted signal and a TUhigh adjacent channel interferer, the FER for the FACCH/F does not exceed the requirements of table 2 in GSM 05.05 under extreme test conditions; GSM 05.05, 6.3, annex D D.2.1, D.2.2.
2. With adjacent channel interference at 400 kHz above and below the wanted signal frequency and signal level 41 dB above the wanted signal level:
  - 2.1 For a TUhigh faded wanted signal and a static adjacent channel interferer, the FER for the FACCH/F shall be better than:
 

GSM 900: 17,1 %; GSM 05.05, 6.3

DCS 1 800: 6,1 %; GSM 05.05, 6.3.



- 2.2 For a TUhigh faded wanted signal and a static adjacent channel interferer, the FACCH/F shall be better than:  
 GSM 900: 17,1 %  
 DCS 1 800: 6,1 %.

under extreme test conditions; GSM 05.05, 6.3, annex D D.2.1, D.2.2.

#### **14.5.2.3 Test purpose**

- 1 To verify that with TUhigh adjacent channel interference at 200 kHz above and below a TUhigh wanted signal frequency and signal level 9 dB above the wanted signal level:
  - 1.1 Conformance requirement 1.1 is met with an allowance for the statistical significance of the test.
  - 1.2 Conformance requirement 1.2 is met with an allowance for the statistical significance of the test.
2. To verify that with static adjacent channel interference at 400 kHz above and below a TUhigh wanted signal frequency and signal level 41 dB above the wanted signal level:
  - 2.1 Conformance requirement 2.1 is met with an allowance for the statistical significance of the test.
  - 2.2 Conformance requirement 2.2 is met with an allowance for the statistical significance of the test.

#### **14.5.2.4 Method of test**

##### **14.5.2.4.1 Initial conditions**

A call is set up according to the generic call set up procedure on a TCH in the mid ARFCN range. Any one of the supported TCH/(F9,6, F4,8, or F2,4) shall be used.

The SS transmits the Standard Test Signal C1 on the TCH (wanted signal).

##### **14.5.2.4.2 Procedure**

- a) In addition to the wanted signal, the SS transmits an independent, uncorrelated interfering signal, Standard Test Signal I1 (unwanted signal).

The unwanted signal is continuous and has no fixed relationship with the bit transitions of the wanted signal. The fading characteristic of the wanted and the unwanted signal is TUhigh. The unwanted signal is transmitted at a nominal frequency 200 kHz above the nominal frequency of the wanted signal. Its amplitude is set to 9dB above that of the wanted signal.

- b) The SS sends a Layer 3 message which does not require a Layer 3 response from the MS. Due to the adjacent channel interference, the MS may not be able to acknowledge the Layer 2 frame. Each repeated L2 frame indicates a frame erasure event. The SS determines the number of frame erasure events during at least the minimum number of samples of FACCH/F frames.

NOTE: These frames will not be consecutive but it is expected that the statistical significance of the tests will not be unduly degraded.

- c) The measurement of step b) is repeated with the unwanted signal on a frequency at the same displacement from, but below, the frequency of the wanted signal.
- d) The measurement of steps a) to c) is repeated for a displacement of the unwanted signal of 400 kHz, and with the amplitude of the unwanted signal 41 dB above the level of the wanted input signal, and the unwanted signal static.
- e) Steps a) to d) are repeated under extreme test conditions.



**14.5.2.5 Test requirements****Table 14-23: Limits for adjacent channel selectivity**

Interference at	Channel	Type of measurement	GSM 900		DCS 1 800	
			Test limit error rate %	Minimum No. of samples	Test limit error rate %	Minimum No. of samples
200 kHz	FACCH/F	FER	10,640	5639	3,808	15756
400 kHz	FACCH/F	FER	19,152	3133	6,832	8782

The error rates measured in this test shall not exceed the test limit error rates given in table 14-23. This shall apply for any combination of normal and extreme test voltages and ambient temperature, and with the interfering signals at either side of the wanted frequency.

NOTE: A static unwanted signal is used to avoid a potential problem with the noise floor of the fading simulator.

**14.6 Intermodulation rejection****14.6.1 Intermodulation rejection - speech channels****14.6.1.1 Definition and applicability**

The intermodulation rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

The requirements and this test apply to MS supporting speech.

For E-GSM 900 MS this test is only performed in the P-GSM band.

**14.6.1.2 Conformance requirement**

In the presence of two unwanted signals with a specific frequency relationship to the wanted signal frequency the Class II RBER for TCH/FS shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 5.2.

**14.6.1.3 Test purpose**

To verify that the MS does not exceed the conformance requirement with an allowance for the statistical significance of the test.

**14.6.1.4 Method of test**

NOTE: The measurements address the third order intermodulation, which represents the most serious case.

**14.6.1.4.1 Initial conditions**

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

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

**14.6.1.4.2 Procedure**

- a) The amplitude of the wanted signal is set to 4 dB above the reference sensitivity level (see table 14-24).
- b) The SS commands the MS to create the loop back facility signalling erased frames.



- c) The SS produces a static wanted signal, and two static interfering (unwanted) signals at the same time. There is no correlation in the modulation between the signals.

The first interfering signal is on a frequency equal to the centre frequency of an ARFCN four above that of the receiver. This signal is static and unmodulated.

The second interfering signal is on an ARFCN eight above that of the receiver. This signal is static, continuous and modulated by random data.

The amplitude of both the interfering signals is set according to table 14-24.

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

The SS tests the RBER compliance of class II bits by examining at least the minimum number of samples of consecutive bits. Bits only taken from those frames which do not signal frame erasure. The number of error events is recorded.

- e) The measurement of step d) is repeated with the two unwanted signals having frequencies corresponding to ARFCN four and eight below the ARFCN of the wanted signal.
- f) Steps b) to e), are repeated but with the receiver operating on an ARFCN in the Low ARFCN range.
- g) Steps b) to e), are repeated but with the receiver operating on an ARFCN in the High ARFCN range.
- h) Steps a) to g) are repeated under extreme test conditions.

**Table 14-24: Intermodulation test signal levels**

	GSM 900		DCS 1 800	
	Small MS	Other MS	Class 1 & 2	Class 3
WANTED SIGNAL dB $\mu$ Vemf( )	15	13	17	15
FIRST INTERFERER dB $\mu$ Vemf( )	64	74	64	68
SECOND INTERFERER dB $\mu$ Vemf( )	63	63	64	68

NOTE: Some of the levels in table 14-24 are different to those specified in GSM 05.05 due to the consideration of the effect of modulation sideband noise from the second interferer.

#### 14.6.1.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-25.

This shall apply under normal condition and under any combination of normal and extreme test voltages and ambient temperature, and with the two interfering signals at either side of the wanted frequency.

**Table 14-25: Limits for intermodulation rejection**

Channel	Propagation conditions	Type of measurement	Test limit error rate %	Minimum No. of samples
TCH/FS Class II	Static	RBER	2,439	8200



## **14.6.2 Intermodulation rejection - control channels**

### **14.6.2.1 Definition and applicability**

The intermodulation rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

The requirements and this test apply to MS not supporting speech.

For E-GSM 900 MS this test is only performed in the P-GSM band.

### **14.6.2.2 Conformance requirement**

In the presence of two unwanted signals with a specific frequency relationship to the wanted signal frequency the FER for FACCH/F shall meet the reference sensitivity performance of table 1 in GSM 05.05; GSM 05.05, 5.2.

### **14.6.2.3 Test purpose**

To verify that the MS does not exceed the conformance requirement with an allowance for the statistical significance of the test.

### **14.6.2.4 Method of test**

NOTE: The measurements address the third order intermodulation, which represents the most serious case.

#### **14.6.2.4.1 Initial conditions**

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

The SS transmits Standard Test Signal C1 on the traffic channel. The amplitude of the wanted signal is set to 4 dB above the reference sensitivity level (see table 14-25).

#### **14.6.2.4.2 Procedure**

- a) The SS produces a TUhigh wanted signal, and two static interfering (unwanted) signals at the same time. There is no correlation in the modulation between the signals.  
The first interfering signal is on a frequency equal to the centre frequency of an ARFCN four above that of the receiver. This signal is static and unmodulated.

The second interfering signal is on an ARFCN eight above that of the receiver. This signal is static, continuous and modulated by random data.

The amplitude of both the interfering signals is set according to table 14-26.

- b) The SS sends a Layer 3 message which does not require a Layer 3 response from the MS. The SS determines the number of frame erasure events during at least the minimum number of samples of FACCH/F frames.

NOTE: These frames will not be consecutive but it is expected that the statistical significance of the tests will not be unduly degraded.

- c) The measurement of step b) is repeated with the two unwanted signals having frequencies corresponding to ARFCN four and eight below the ARFCN of the wanted signal.
- d) Steps a) to c), are repeated but with the receiver operating on an ARFCN in the Low ARFCN range.
- e) Steps a) to c), are repeated but with the receiver operating on an ARFCN in the High ARFCN range.



- f) Steps a) to e) are repeated under extreme test conditions.

**Table 14-26: Intermodulation test signal levels**

	GSM 900		DCS 1 800	
	Small MS	Other MS	Class 1 & 2	Class 3
WANTED SIGNAL dB $\mu$ V <sub>emf</sub> ( )	15	13	17	15
FIRST INTERFERER dB $\mu$ V <sub>emf</sub> ( )	64	74	64	68
SECOND INTERFERER dB $\mu$ V <sub>emf</sub> ( )	63	63	64	68

NOTE: Some of the levels in table 14-26 are different to those specified in GSM 05.05 due to the consideration of the effect of modulation sideband noise from the second interferer.

#### 14.6.2.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-27.

This shall apply under normal condition and under any combination of normal and extreme test voltages and ambient temperature, and with the two interfering signals at either side of the wanted frequency.

**Table 14-27: Limits for intermodulation rejection**

Channel	Propagation conditions	Type of measurement	GSM 900		DCS 1 800	
			Test limit error rate %	Minimum No. of max-samples	Test limit error rate %	Min No. of max-samples
FACCH/F	TUhigh/No FH	FER	8,961	6696	4,368	13736

### 14.7 Blocking and spurious response

#### 14.7.1 Blocking and spurious response - speech channels

##### 14.7.1.1 Definition and applicability

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

The requirements and this test apply to MS supporting speech.

##### 14.7.1.2 Conformance requirement

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

The reference sensitivity performance as specified in table 1 of GSM 05.05 shall be met when the following signals are simultaneously input to the receiver:

- a useful signal at frequency  $f_0$ , 3 dB above the reference sensitivity level as specified in GSM 05.05 section 6.2;



- a continuous, static sine wave signal at a level as in the table of GSM 05.05 section 5.1 and at a frequency (f) which is an integer multiple of 200 kHz.

with the following exceptions, called spurious response frequencies:

- a) GSM 900: in band, for a maximum of six occurrences (which if grouped shall not exceed three contiguous occurrences per group);  
  
DCS 1 800: in band, for a maximum of twelve occurrences (which if grouped shall not exceed three contiguous occurrences per group);
- b) out of band, for a maximum of 24 occurrences (which if below  $f_0$  and grouped shall not exceed three contiguous occurrences per group).

where the above performance shall be met when the continuous sine wave signal (f) is set to a level of 70 dB $\mu$ V (emf) (i.e. -43 dBm). GSM 05.05, 5.1.

#### 14.7.1.3 Test purpose

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

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

#### 14.7.1.4 Method of test

##### 14.7.1.4.1 Initial conditions

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

The SS transmits Standard Test Signal C1 on the traffic channel. (TCH frequency FR).

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

##### 14.7.1.4.2 Procedure

- a) The SS produces a static wanted signal and a static interfering signal at the same time. The amplitude of the wanted signal is set to 4 dB above the reference sensitivity level.
- b) The unwanted signal is a C.W. signal (Standard test signal IO) of frequency FB. It is applied in turn on the subset of frequencies calculated in step c) in the overall range 100 kHz to 12,75 GHz, where FB is an integer multiple of 200 kHz.

However, frequencies in the range FR  $\pm$  600 kHz are excluded.

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

- c) The frequencies at which the test is performed (adjusted to an integer multiple of 200 kHz channels most closely approximating the absolute frequency of the calculated blocking signal frequency) are the combined frequencies from i), ii) and iii) below:-
  - i) The total frequency range formed by:-  
P-GSM 900 the frequencies between  $F_{10} + (IF_1 + IF_2 + \dots + IF_n + 12,5 \text{ MHz})$   
and  $F_{10} - (IF_1 + IF_2 + \dots + IF_n + 12,5 \text{ MHz})$ .



E-GSM 900 the frequencies between  $F_{lo} + (IF_1 + IF_2 + \dots + IF_n + 17,5 \text{ MHz})$   
and  $F_{lo} - (IF_1 + IF_2 + \dots + IF_n + 17,5 \text{ MHz})$ .

DCS 1 800 the frequencies between  $F_{lo} + (IF_1 + IF_2 + \dots + IF_n + 37,5 \text{ MHz})$   
and  $F_{lo} - (IF_1 + IF_2 + \dots + IF_n + 37,5 \text{ MHz})$ .

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

Measurements are made at 200 kHz intervals.

- ii) The three frequencies  $IF_1$ ,  $IF_1 + 200 \text{ kHz}$ ,  $IF_1 - 200 \text{ kHz}$ .
- iii) The frequencies:  
 $mF_{lo} + IF_1$ ,  
 $mF_{lo} - IF_1$ ,  
 $mFR$ ,  
 where  $m$  is all positive integers greater than or equal to 2 such that either sum lies in the range 100 kHz to 12,75 GHz.

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

Where:-

$F_{lo}$  - local oscillator applied to first receiver mixer  
 $IF_1 \dots IF_n$  - are the  $n$  intermediate frequencies  
 $F_{lo}, IF_1, IF_2 \dots IF_n$  shall be declared by the manufacturer in the PIXIT statement GSM 11.10 annex 3.

- d) The level of the unwanted signal is set according to table 14-28.

**Table 14-28: Level of unwanted signals**

	GSM 900		DCS 1 800
	Small MS	Other MS	
FREQUENCY	LEVEL IN dB $\mu$ Vemf( )		
FR +/- 600 kHz to FR +/- 800 kHz	70	75	70
FR +/- 800 kHz to FR +/- 1,6 MHz	70	80	70
FR +/- 1,6 MHz to FR +/- 3 MHz	80	90	80
915 MHz to FR - 3 MHz	90	90	-
FR + 3 MHz to 980 MHz	90	90	-
1785 MHz to FR - 3 MHz	-	-	87
FR + 3 MHz to 1920 MHz	-	-	87
835 MHz to <915 MHz	113	113	
>980 MHz to 1000 MHz	113	113	
100 kHz to <835 MHz	90	90	
>1000 MHz to 12,75 GHz	90	90	
100 kHz to 1705 MHz	-	-	113
>1705 MHz to <1785 MHz	-	-	101
>1920 MHz to 1980 MHz	-	-	101
>1980 MHz to 12,75 GHz	-	-	90

NOTE 1: These values differ from GSM 05.05 because of practical generator limits in the SS.

NOTE 2: For an E-GSM 900 MS the level of the unwanted signal in the band 905 MHz to <915 MHz is relaxed to 108 dB $\mu$ Vemf( ).

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



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

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

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

#### 14.7.1.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate values given in table 14-29.

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

**Table 14-29: Limits for blocking**

Channel	Type of measurement	Test limit error rate %	Minimum number of samples
TCH/FS Class II	RBET	2,439	8200

The following exceptions are allowed:

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

A maximum of 24 failures in the combined bands 100 kHz to 915 MHz and 980 MHz to 12,75 GHz (which, if below FR and grouped, shall not exceed three 200 kHz channels per group).

DCS 1 800: A maximum of twelve failures in the band 1785 MHz to 1920 MHz (which, if grouped, shall not exceed three 200 kHz channels per group).

A maximum of 24 in the combined bands 100 kHz to 1785 MHz and 1920 MHz to 12,75 GHz (which, if below FR and grouped, shall not exceed three 200 kHz channels per group).

If the number of failures do not exceed the maximum allowed figures stated above, the test of 14.7.1.4 is repeated at the frequencies at which the failures occurred. The level of the unwanted signal is set to 70 dBμVemf( ) and the performance requirement is once again that that stated in the table above.

The number Error rate measured in this test shall not exceed the test limit error rate values given in table 14-29.

No failures are allowed at this lower unwanted signal level.

#### 14.7.2 Blocking and spurious response - control channels

##### 14.7.2.1 Definition and applicability

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

The requirements and this test apply to MS not supporting speech.



**14.7.2.2 Conformance requirement**

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

The reference sensitivity performance as specified in table 1 of GSM 05.05 shall be met when the following signals are simultaneously input to the receiver:

- a useful signal at frequency  $f_0$ , 3 dB above the reference sensitivity level as specified in GSM 05.05 section 6.2;
- a continuous, static sine wave signal at a level as in the table of GSM 05.05 section 5.1 and at a frequency (f) which is an integer multiple of 200 kHz.

with the following exceptions, called spurious response frequencies:-

- a) GSM 900: in band, for a maximum of six occurrences (which if grouped shall not exceed three contiguous occurrences per group),  
DCS 1 800: in band, for a maximum of twelve occurrences (which if grouped shall not exceed three contiguous occurrences per group).
- b) out of band, for a maximum of 24 occurrences (which if below  $f_0$  and grouped shall not exceed three contiguous occurrences per group).

where the above performance shall be met when the continuous sine wave signal (f) is set to a level of 70 dB $\mu$ V (emf) (i.e. -43 dBm). GSM 05.05, 5.1.

**14.7.2.3 Test purpose**

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

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

**14.7.2.4 Method of test****14.7.2.4.1 Initial conditions**

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

The SS transmits Standard Test Signal C1 on the traffic channel. (TCH frequency FR).

**14.7.2.4.2 Procedure**

- a) The SS sends a Layer 3 message which does not require a Layer 3 response from the MS. Due to interfering signals, the MS may not be able to acknowledge the Layer 2 frame. Frame erasures are indicated by repeated L2 frames.
- b) The SS is set to produce a TUhigh wanted signal and a static interfering signal at the same time. The SS sets the amplitude of the wanted signal to 4 dB above the reference sensitivity level.
- c) The unwanted signal is a C.W. signal (Standard test signal IO) of frequency FB. It is applied in turn on the subset of frequencies calculated at step f) in the overall range 100 kHz to 12,75 GHz, where FB is an integer multiple of 200 kHz.



However, frequencies in the range  $F_R \pm 600$  kHz are excluded.

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

d) The frequencies at which the test is performed (adjusted to an integer multiple of 200 kHz channels most closely approximating the absolute frequency of the calculated blocking signal frequency) are the combined frequencies from i), ii) and iii) which follow:

i) The total frequency range formed by:-

P-GSM 900 the frequencies between  $F_{lo} + (IF_1 + IF_2 + \dots + IF_n + 12,5 \text{ MHz})$   
and  $F_{lo} - (IF_1 + IF_2 + \dots + IF_n + 12,5 \text{ MHz})$ .

E-GSM 900 the frequencies between  $F_{lo} + (IF_1 + IF_2 + \dots + IF_n + 17,5 \text{ MHz})$   
and  $F_{lo} - (IF_1 + IF_2 + \dots + IF_n + 17,5 \text{ MHz})$ .

DCS 1 800 the frequencies between  $F_{lo} + (IF_1 + IF_2 + \dots + IF_n + 37,5 \text{ MHz})$   
and  $F_{lo} - (IF_1 + IF_2 + \dots + IF_n + 37,5 \text{ MHz})$ .

and

the frequencies  $+ 100$  MHz and  $- 100$  MHz from the edge of the relevant receive band.  
Measurement are made at 200 kHz intervals.

ii) The three frequencies  $IF_1$ ,  $IF_1 + 200$  kHz,  $IF_1 - 200$  kHz.

iii) The frequencies:

$mF_{lo} + IF_1$ ,  
 $mF_{lo} - IF_1$ ,  
 $mF_R$ ,

where  $m$  is all positive integers greater than or equal to 2 such that either sum lies in the range 100 kHz to 12,75 GHz.

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

Where:-

$F_{lo}$ -	local oscillator applied to first receiver mixer
$IF_1 \dots IF_n$ -	are the $n$ intermediate frequencies
$F_{lo}, IF_1, IF_2 \dots IF_n$	shall be declared by the manufacturer in the PIXIT statement GSM 11.10 annex 3.

e) The level of the unwanted signal is set according to table 14-30.



Table 14-30: Level of unwanted signals

	GSM 900		DCS 1 800
	Small MS	Other MS	
FREQUENCY	LEVEL IN dBμVemf( )		
FR +/- 600 kHz to FR +/- 800 kHz	70	75	70
FR +/- 800 kHz to FR +/- 1,6 MHz	70	80	70
FR +/- 1,6 MHz to FR +/- 3 MHz	80	90	80
915 MHz to FR - 3 MHz	90	90	-
FR + 3 MHz to 980 MHz	90	90	-
1785 MHz to FR - 3 MHz	-	-	87
FR + 3 MHz to 1920 MHz	-	-	87
835 MHz to <915 MHz	113	113	
>980 MHz to 1000 MHz	113	113	
100 kHz to <835 MHz	90	90	
>1000 MHz to 12,75 GHz	90	90	
100 kHz to 1705 MHz	-	-	113
>1705 MHz to <1785 MHz	-	-	101
>1920 MHz to 1980 MHz	-	-	101
>1980 MHz to 12,75 GHz	-	-	90

NOTE 1: These values differ from GSM 05.05 because of practical generator limits in the SS.

NOTE 2: For an E-GSM 900 MS the level of the unwanted signal in the band 905 MHz to < 915 MHz is relaxed to 108 dBμVemf( ).

- f) The SS determines the number of frame erasure events during at least the minimum number of samples. If a failure is indicated, it is noted and counted towards the allowed exemption total.

In the case of failures discovered at the predicted frequencies at steps f ii), iii) or iv) the test is repeated on the adjacent channels +/- 200 kHz away. If either of these two frequencies fail then the next channel 200 kHz beyond is also to be tested. This process is repeated until all channels constituting the group of failures is known.

#### 14.7.2.5 Test requirements

The error rate measured in this test shall not exceed the test limit error rate given in table 14-31.

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

Table 14-31: Limits for blocking

		GSM 900		DCS 1 800	
Channel	Type of measurement	Test limit error rate	Minimum No. of samples	Test limit error rate	Minimum No. of samples
FACCH/F	FER	8,961	6696	4,368	13736

The following exceptions are allowed:

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

A maximum of 24 in the combined bands 100 kHz to 915 MHz and 980 MHz to 12,75 GHz (which, if below FR and grouped, shall not exceed three 200 kHz channels per group).



DCS 1 800: A maximum of twelve failures in the band 1785 MHz to 1 920 MHz (which, if grouped, shall not exceed three 200 kHz channels per group).

A maximum of 24 in the combined bands 100 kHz to 1785 MHz and 1 920 MHz to 12,75 GHz (which, if below FR and grouped, shall not exceed three 200 kHz channels per group).

If the number of failures do not exceed the maximum allowed figures stated above, the test of 14.7.2.4 is repeated at the frequencies at which the failures occurred. The level of the unwanted signal is set to 70 dB $\mu$ V<sub>emf</sub>( ) and the performance requirement is once again that stated above.

The number of Error Events recorded in this test shall not exceed the test limit error rate values given above, when using the maximum number of samples.

No failures are allowed at this lower unwanted signal level.

## 14.8 AM suppression

### 14.8.1 AM suppression - speech channels

#### 14.8.1.1 Definition and applicability

AM suppression is a measure of the ability of the receiver to receive a modulated wanted input signal in the presence of an unwanted TDMA modulated interferer.

The requirements and this test apply to MS supporting speech.

#### 14.8.1.2 Conformance requirement

The reference sensitivity performance as specified in table 1 shall be met when the following signals are simultaneously input to the receiver:

- a useful signal at frequency  $f_0$ , 3 dB above the reference sensitivity level as specified in GSM 05.05 section 5.2.
- a single frequency (f), in the relevant receive band,  $|f - f_0| \geq 6\text{MHz}$ , which is an integer multiple of 200 kHz, a GSM TDMA signal modulated by any 148-bits subsequence of the 511-bits pseudo random bit sequence, defined in CCITT Recommendation O.153 fascicle IV.4, at a level as defined in the table below. The interferer shall have one timeslot active and the frequency shall be at least 2 channels separated from any identified spurious responses. The transmitted bursts shall be synchronized to but, delayed in time between 61 and 86 bit periods relative to the bursts of the wanted signal. GSM 05.05, 5.2.

MS type	Signal level
GSM900	-31 dBm
DCS1800	-29 dBm

#### 14.8.1.3 Test purpose

To verify that the AM suppression performance of the MS meets the conformance requirement with an allowance for the statistical significance of the test.

#### 14.8.1.4 Method of test

##### 14.8.1.4.1 Initial conditions

A call is set up according to the generic call set up procedure, on a TCH/FS with an ARFCN in the mid ARFCN range. The power control level is set to maximum power.

The SS transmits standard Test Signal C1 on the traffic channel (TCH frequency FR).

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



This test is performed after test 14.7.

#### 14.8.1.4.2 Procedure

- a) The SS produces a static wanted signal with an amplitude 4 dB above reference sensitivity level.
- b) The SS produces an interfering signal as described below:
  - static fading profile;
  - at an in band frequency greater than 6 MHz separated from FR and separated by at least two ARFCNs from any spurious responses.

NOTE: Spurious responses are identified by test cases 14.7.1 and 14.7.2.

- at a level as described in table 14-32.
- GSM TDMA modulated by random data with one timeslot active.
- synchronized to, but delayed between 61 and 86 bit periods to the bursts of the wanted signal.

**Table 14-32: Interferer signal level**

MS type	Signal level (dB $\mu$ V <sub>emf</sub> )
GSM900	82
DCS1800	84

- c) The SS compares the data of the signal that it sends to the MS with the signal which is looped back from the receiver after demodulation and decoding, and checks the frame erasure indication.
- d) The SS tests the RBER compliance of class II bits by examining at least the minimum number of samples of consecutive bits. Bits only taken from those frames which do not signal frame erasure. The number of error events is recorded.

#### 14.8.1.5 Test requirements

The error rates measured in this test shall not exceed the test limit error rate values given in table 14.27.

**Table 14-33: Limits for AM suppression**

Channel	Propagation conditions	Type of measurement	Test limit error rate %	Minimum No. of samples
TCH/FS Class II	Static	RBER	2,439	8200

### 14.8.2 AM suppression - control channels

#### 14.8.2.1 Definition and applicability

AM suppression is a measure of the ability of the receiver to receive a modulated wanted input signal in the presence of an unwanted TDMA modulated interferer.

The requirements and this test apply to MS not supporting speech.

#### 14.8.2.2 Conformance requirement

The reference sensitivity performance as specified in table 1 shall be met when the following signals are simultaneously input to the receiver:

- a useful signal at frequency  $f_0$ , 3 dB above the reference sensitivity level as specified in GSM 05.05 section 5.2.



- a single frequency (f), in the relevant receive band,  $|f - f_0| \geq 6\text{MHz}$ , which is an integer multiple of 200 kHz, a GSM TDMA signal modulated by any 148-bits subsequence of the 511-bits pseudo random bit sequence, defined in CCITT Recommendation O.153 fascicle IV.4, at a level as defined in the table below. The interferer shall have one timeslot active and the frequency shall be at least 2 channels separated from any identified spurious responses. The transmitted bursts shall be synchronized to but, delayed in time between 61 and 86 bit periods relative to the bursts of the wanted signal. GSM 05.05, 5.2.

MS type	Signal level
GSM900	-31 dBm
DCS1800	-29 dBm

#### 14.8.2.3 Test purpose

To verify that the AM suppression performance of the MS meets the conformance requirement with an allowance for the statistical significance of the test.

#### 14.8.2.4 Method of test

##### 14.8.2.4.1 Initial conditions

A call is set up according to the generic call set up procedure, on a TCH with an ARFCN in the mid ARFCN range. The power control level is set to maximum power.

The SS transmits standard Test Signal C1 on the traffic channel (TCH frequency FR).

This test is performed after test 14.7.

##### 14.8.2.4.2 Procedure

- The SS produces a TUhigh wanted signal with an amplitude 4 dB above reference sensitivity level.
- The SS produces an interfering signal as described below:
  - static fading profile;
  - at an in band frequency greater than 6 MHz separated from FR and separated by at least two ARFCNs from any spurious responses.

NOTE: Spurious responses are identified by test cases 14.7.1 and 14.7.2.

- at a level as described in table 14-34.
- GSM TDMA modulated by random data with one timeslot active.
- synchronized to, but delayed between 61 and 86 bit periods to the bursts of the wanted signal.

**Table 14-34: Interferer signal level**

MS type	Signal level (dB $\mu$ V <sub>emf</sub> )
GSM900	82
DCS1800	84

- The SS sends the status message. Due to interfering signals, the MS may not be able acknowledge the Layer 2 frame. Frame erasures are indicated by repeated L2 frames.
- The SS determines the number of frame erasure events during at least the minimum number of samples. If a failure is indicated, it is noted and counted towards the allowed exemption total.

#### 14.8.2.5 Test requirements

The error rates measured in this test shall not exceed the test limit error rate values given in table 14-35.



Table 14-35: Limits for AM suppression

			GSM 900		DCS 1 800	
Channel	Propagation conditions	Type of measurement	Test limit error rate %	Minimum No. of max-samples	Test limit error rate %	Min No. of max-samples
FACCH/F	TUhigh/No FH	FER	8,961	6696	4,368	13736

## 14.9 Paging performance at high input levels

### 14.9.1 Definition and applicability

The paging performance at high input levels is the signal level at the MS receiver input at which a certain FER for the PCH must be achieved.

The requirements and this test apply to all types of MS.

### 14.9.2 Conformance requirement

The paging performance at high input levels requirements of GSM 05.05 section 6.5 a) for PCH under static propagation conditions shall be met from 20 dB above reference sensitivity level up to -15 dBm for GSM900 and -23 dBm for DCS1800.

### 14.9.3 Test purpose

To verify that the MS does not exceed the conformance requirement with an allowance for the statistical significance of the test.

### 14.9.4 Method of test

#### 14.9.4.1 Initial conditions

System Simulator:

1 cell, Tx-Integer = 3, MAX RETRANS is set to minimum. The CCCH is combined with SDCCH. BS\_PA\_MFRMS = 9 to achieve worst case sleep mode (DRX). The signal level at the receiver input is set to:

GSM 900: -15 dBm

DCS 1800: -23 dBm.

Mobile Station:

The MS has a valid TMSI. It is "idle updated". The MS should have been powered up immediately before running the test, i.e. if a Location update is necessary the MS must be switched off and on again.

#### 14.9.4.2 Procedure

The MS is paged and the SS starts timer T3113. If a CHANNEL REQUEST is received before expiry of T3113 the SS sends an IMMEDIATE ASSIGNMENT REJECT. The sequence is performed 4 times.

Between two consecutive executions the SS must wait for an amount of time which is enough to guarantee that the MS is in service (listening to its paging subchannel).

### 14.9.5 Test requirements

If the MS answers all pagings with a CHANNEL REQUEST the requirements are met.

NOTE: The probability for a good MS to fail this test is less than 1%.