RECOMMENDATION ITU-R M.1581*

Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-2000

(Question ITU-R 229/8)

(2002)

The ITU Radiocommunication Assembly,

considering

a) that unwanted emissions consist of both spurious and out-of-band (OoB) emissions according to No. 1.146 of the Radio Regulations (RR) and that spurious and OoB emissions are defined in RR Nos. 1.145 and 1.144, respectively;

b) that limitation of the maximum permitted levels of unwanted emissions of IMT-2000 mobile stations is necessary to protect other radio systems and services from interference and to enable coexistence between different technologies;

c) that too stringent limits may lead to an increase in size or complexity of IMT-2000 radio equipment;

d) that every effort should be made to keep limits for unwanted emissions at the lowest possible values taking account of economic factors and technological limitations;

e) that Recommendation ITU-R SM.329 relates to the effects, measurements and limits to be applied to spurious domain emissions;

f) that the same spurious emission limits apply equally to mobile stations of all radio interfaces;

g) that Recommendation ITU-R SM.1541 relating to OoB emission specifies generic limits in the OoB domain which generally constitute the least restrictive OoB emission limits and encourages the development of more specific limits for each system;

h) that the levels of spurious emissions of IMT-2000 terminals shall comply with the limits specified in RR Appendix 3;

j) that Recommendation ITU-R M.1574 establishes the technical basis for global circulation of IMT-2000 mobile stations;

k) that one of the basic requirements of global circulation is that the mobile station does not cause harmful interference in any country where it is taken;

l) that the harmonization of unwanted emission limits will facilitate global use and access to a global market;

m) that additional work is needed in order to define unwanted emission limits for equipment operating in the bands identified for IMT-2000 at the World Radiocommunication Conference, (Istanbul, 2000) (WRC-2000);

---

* This Recommendation should be brought to the attention of Radiocommunication Study Group 1.

n) that unwanted emission limits are dependent on the transmitter emission characteristics in addition to depending on services operating in other bands,

noting

a) the work carried out by standardization bodies to define limits to protect other radio systems and services from interference and to enable coexistence between different technologies;

b) existing current national and regional unwanted emission limits have been taken into account,

recommends

1 that the unwanted emission characteristics of IMT-2000 mobile stations should be based on the limits contained in the technology specific Annexes 1 to 5 which correspond to the radio interface specifications described in § 5.1 to 5.5 of Recommendation ITU-R M.1457.

NOTE – The unwanted emission limits are only defined for mobile stations operating according to the following arrangement: frequency division duplex (FDD) uplink in the band 1 920-1 980 MHz, FDD downlink in the band 2 110-2 170 MHz and time division duplex (TDD) in the bands 1 885-1 980 and 2 010-2 025 MHz. Future versions of this Recommendation will include limits applicable to other frequency bands. Subject to further study, it is anticipated that such limits would be similar to those already contained in this Recommendation.

Annex 1: IMT-2000 code-division multiple access (CDMA) direct spread mobile stations (MSs)

Annex 2: IMT-2000 CDMA multi-carrier MSs

Annex 3: IMT-2000 CDMA TDD MSs

Annex 4: IMT-2000 time division multiple access (TDMA) single-carrier MSs

Annex 5: IMT-2000 frequency division multiple access (FDMA)/TDMA MSs

ANNEX 1

CDMA direct spread (universal terrestrial radio access (UTRA) FDD) MSs

1 Measurement uncertainty

Values specified in this Annex differ from those specified in Recommendation ITU-R M.1457 since values in this Annex incorporate test tolerances defined in Recommendation ITU-R M.1545.

2 Spectrum mask

The spectrum emission mask of the MS applies to frequencies, which are between 2.5 MHz and 12.5 MHz away from the MS centre carrier frequency.

The out of channel emission is specified relative to the MS output power measured in a 3.84 MHz bandwidth.

The power of any MS emission should not exceed –50 dBm/3.84 MHz or the levels specified in Table 1, whichever is higher.

TABLE 1

Spectrum emission mask requirement (UTRA FDD MS)

Frequency offset from carrier Δf	Measurement bandwidth	Minimum requirement
2.5 to 3.5 MHz	30 kHz(1)	–33.5 – 15*(Δf – 2.5) dBc
3.5 to 7.5 MHz	1 MHz(2)	–33.5 – 1*(Δf – 3.5) dBc
7.5 to 8.5 MHz	1 MHz(2)	–37.5 – 10*(Δf – 7.5) dBc
8.5 to 12.5 MHz	1 MHz(2)	–47.5 dBc

(1) The first and last measurement position with a 30 kHz filter is 2.515 MHz and 3.485 MHz.

(2) The first and last measurement position with a 1 MHz filter is 4 MHz and 12 MHz. As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth can be different from the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth.

3 Adjacent channel leakage power ratio (ACLR)

ACLR is the ratio of the transmitted power to the power measured after a receiver filter in the adjacent channel(s). Both the transmitted power and the received power are measured through a matched filter (root raised cosine and roll-off of 0.22) with a noise power bandwidth equal to the chip rate. The requirements should apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

The limit for ACLR should be as specified in Table 2.

TABLE 2

MS ACLR limits

MS channel offset below the first or above the last carrier frequency used (MHz)	ACLR limit (dB)
5	32.2
10	42.2

4 Transmitter spurious emissions (conducted)

The limits shown in Tables 3 and 4 are only applicable for frequencies which are greater than 12.5 MHz away from the MS centre carrier frequency.

TABLE 3

General spurious emissions requirements

Frequency bandwidth	Measurement bandwidth	Minimum requirement (dBm)
9 kHz ≤ f < 150 kHz	1 kHz	–36
150 kHz ≤ f < 30 MHz	10 kHz	–36
30 MHz ≤ f < 1 000 MHz	100 kHz	–36
1 GHz ≤ f < 12.75 GHz	1 MHz	–30

TABLE 4

Additional spurious emissions requirements

Frequency bandwidth	Measurement bandwidth (kHz)	Minimum requirement (dBm)	Victim band
1 893.5 < f < 1 919.6 MHz	300	–41	PHS
925 ≤ f ≤ 935 MHz	100	–67 (1)	GSM 900
935 < f ≤ 960 MHz	100	–79 (1)	GSM 900
1 805 ≤ f ≤ 1 880 MHz	100	–71 (1)	DCS 1800

(1) The measurements are made on frequencies which are integer multiples of 200 kHz. As exceptions, up to five measurements with a level up to the applicable requirements defined in Table 3 are permitted for each RF channel used in the measurement.

5 Receiver spurious emissions (conducted)

The power of any narrow-band continuous wave (CW) spurious emission should not exceed the maximum level specified in Tables 5 and 6.

TABLE 5

General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level (dBm)	Note
30 MHz ≤ f < 1 GHz	100 kHz	–57	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz	–47	With the exception of the frequencies covered by Table 6, for which additional receiver spurious emission requirements apply

TABLE 6

Additional receiver spurious emission requirements

Frequency band	Measurement bandwidth (MHz)	Maximum level (dBm)	Note
1 920 ≤ f ≤ 1 980 MHz	3.84	–60	Mobile transmit band
2 110 ≤ f ≤ 2 170 MHz	3.84	–60	Mobile receive band

ANNEX 2

CDMA multi-carrier (cdma2000) MSs

1 Spectrum mask

When transmitting with spreading rate 1, the emissions should be less than the limits specified in Table 7.

TABLE 7

Transmitter spectrum emission limits for spreading rate 1

For $\|\Delta f\|$ within the range	Emission limit
1.25 to 1.98 MHz	less stringent of –42 dBc/30 kHz or –54 dBm/1.23 MHz
1.98 to 2.25 MHz	less stringent of –50 dBc/30 kHz or –54 dBm/1.23 MHz
2.25 to 4 MHz	$-[13 + 1 \times (\Delta f - 2.25\ \text{MHz})]$ dBm/1 MHz

Note 1 – All frequencies in the measurement bandwidth should satisfy the restrictions on $|\Delta f|$ where Δf = centre frequency – closer edge frequency, f, of the measurement filter.

When transmitting with spreading rate 3, the emissions should be less than the limits specified in Table 8.

TABLE 8

Transmitter spectrum emission limits for spreading rate 3

For $\|\Delta f\|$ within the range	Emission limit
2.5 to 2.7 MHz	–14 dBm/30 kHz
2.7 to 3.5 MHz	$-[14 + 15 \times (\Delta f - 2.7\ \text{MHz})]$ dBm/30 kHz
3.08 MHz	–33 dBc/3.84 MHz
3.5 to 7.5 MHz	$-[13 + 1 \times (\Delta f - 3.5\ \text{MHz})]$ dBm/1 MHz
7.5 to 8.5 MHz	$-[17 + 10 \times (\Delta f - 7.5\ \text{MHz})]$ dBm/1 MHz
8.08 MHz	–43 dBc/3.84 MHz
8.5 to 12.5 MHz	–27 dBm/1 MHz

NOTE 1 – All frequencies in the measurement bandwidth should satisfy the restrictions on $|\Delta f|$ where Δf = centre frequency – closer edge frequency, f, of the measurement filter.

The requirements at offsets of 3.08 MHz and 8.08 MHz are equivalent to ACLR requirements of 33 dB and 43 dB from a spreading rate 3 MS transmitter into a spreading rate 3 or IMT-2000 CDMA direct spread MS receiver offset by 5 MHz and 10 MHz respectively.

2 Transmitter spurious emissions (conducted)

When transmitting with spreading rate 1 or spreading rate 3, the spurious emissions should be less than the limits specified in Tables 9 and 10.

TABLE 9

Transmitter spurious emission limits for spreading rates 1 and 3 respectively

For $\|\Delta f\|$ within the range	Frequency bandwidth	Measurement bandwidth	Emission limit (dBm)
>4 MHz for spreading rate 1	9 kHz < f < 150 kHz	1 kHz	–36
	50 kHz < f < 30 MHz	10 kHz	–36
>12.5 MHz for spreading rate 3	30 MHz < f < 1 GHz	100 kHz	–36
	1 GHz < f < 12.75 GHz	1 MHz	–30

NOTE 1 – All frequencies in the measurement bandwidth should satisfy the restrictions on $|\Delta f|$ where Δf = centre frequency – closer edge frequency, f, of the measurement filter.

TABLE 10

Additional transmitter spurious emission limits for spreading rates 1 and 3 respectively

Measurement frequency	Measurement bandwidth (kHz)	Emission limit (dBm)	Victim band
1 893.5 to 1 919.6 MHz	300	–41	PHS
925 to 935 MHz	100	–67	GSM 900
935 to 960 MHz	100	–79	GSM 900
1 805 to 1 880 MHz	100	–71	DCS 1800

NOTE 1– Measurements apply only when the measurement frequency is at least 11.25 MHz (spreading rate 1) or 12.5 MHz (spreading rate 3) from the CDMA centre frequency. The non-PHS band measurements are made on frequencies which are integer multiples of 200 kHz. As exceptions, up to five measurements with a level up to the spurious emission limits in Table 9 are allowed.

3 Receiver spurious emissions (conducted)

The conducted spurious emissions when not transmitting for an MS station should be less than the limits in Table 11.

TABLE 11

General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level (dBm)	Note
30 MHz ≤ f < 1 GHz	100 kHz	–57	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz	–47	With the exception of the frequencies covered by Table 12, for which additional receiver spurious emission requirements apply

TABLE 12

Additional receiver spurious emission requirements

Frequency band	Measurement bandwidth (MHz)	Maximum level (dBm)	Note
1 920 ≤ f ≤ 1 980 MHz	1	–61	Mobile transmit band
2 110 ≤ f ≤ 2 170 MHz	1	–76	Mobile receive band

ANNEX 3

CDMA TDD (UTRA TDD) MSs

1 Measurement uncertainty

Values specified in the Annex differ from those specified in Recommendation ITU-R M.1457 since values in the Annex incorporate test tolerances defined in Recommendation ITU-R M.1545.

2 Spectrum mask

2.1 Spectrum mask (3.84 Mchip/s TDD option)

The spectrum emission mask of the MS applies to frequency offsets between 2.5 MHz and 12.5 MHz on both sides of the carrier frequency.

The out-of-channel emission is specified as a power level relative to the MS output power in a frequency band of 3.84 MHz bandwidth.

The power of any MS emission should not exceed –50 dBm/3.84 MHz or the levels specified in Table 13, whichever is higher.

TABLE 13

Spectrum emission mask requirement

Frequency offset from carrier Δf	Measurement bandwidth	Minimum requirement
2.5 to 3.5 MHz	30 kHz(1)	–33.5 – 15*(Δf – 2.5) dBc
3.5 to 7.5 MHz	1 MHz(2)	–33.5 – 1*(Δf – 3.5) dBc
7.5 to 8.5 MHz	1 MHz(2)	–37.5 – 10*(Δf – 7.5) dBc
8.5 to 12.5 MHz	1 MHz(2)	–47.5 dBc

(1) The first measurement position with a 30 kHz filter is 2.515 MHz; the last is 3.485 MHz.

(2) The first measurement position with a 1 MHz filter is 4 MHz; the last is 12 MHz. As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth can be different from the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth.

2.2 Spectrum mask (1.28 Mchip/s TDD option)

The spectrum emission mask of the MS applies to frequency offsets between 0.8 MHz and 4 MHz on both sides of the carrier frequency.

The out-of-channel emission is specified as a power level relative to the MS output power in a frequency band of 1.6 MHz bandwidth.

The power of any MS emission should not exceed –55 dBm/1.28 MHz or the levels specified in Table 14, whichever is higher.

TABLE 14

Spectrum emission mask requirement

Frequency offset from carrier Δf	Measurement bandwidth	Minimum requirement
0.8 MHz	30 kHz(1)	–35 + *TT* dBc (3)
0.8 to 1.8 MHz	30 kHz(1)	–35 – 14*(Δf – 0.8) + *TT* dBc (3)
1.8 to 2.4 MHz	30 kHz(1)	–49 – 25*(Δf – 1.8) + *TT* dBc (3)
2.4 to 4 MHz	1 MHz(2)	–49 + *TT* dBc(3)

(1) The first measurement position with a 30 kHz filter is 0.815 MHz; the last is 2.385 MHz.

(2) The first measurement position with a 1 MHz filter is 2.9 MHz; the last is 3.5 MHz. As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth can be different from the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth.

(3) *TT*: test tolerance. A provisional value is 1.5 dB. This requires further studies.

3 ACLR

ACLR is the ratio of the transmitted power to the power measured after a receiver filter in the adjacent channel(s). Both the transmitted power and the received power are measured through a matched filter (root raised cosine and roll-off = 0.22) with a noise power bandwidth equal to the chip rate. The requirements should apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

The limit for ACLR should be as specified in Table 15a.

TABLE 15a

MS ACLR limits

MS channel offset below the first or above the last carrier frequency used (MHz)	ACLR limit (dB)
5	32.2
10	42.2

TABLE 15b

MS ACLR limits for 1.28 Mchip/s TDD option

MS channel offset below the first or above the last carrier frequency used (MHz)	ACLR limit (dB)
1.6	33 + *TT*(1)
3.2	43 + *TT*(1)

(1) *TT*: test tolerance. A provisional value is 0.8 dB. This requires further studies.

4 Transmitter spurious emissions (conducted)

The spurious emissions should be less than the limits specified in Tables 16 and 17. The following requirements are only applicable for MS centre carrier frequency offsets greater than 12.5 MHz (3.84 Mchip/s TDD option) or 4 MHz (1.28 Mchip/s TDD option).

TABLE 16

General spurious emission requirements

Frequency band	Measurement bandwidth	Minimum requirement (dBm)
9 kHz ≤ f < 150 kHz	1 kHz	–36
150 kHz ≤ f < 30 MHz	10 kHz	–36
30 MHz ≤ f < 1 000 MHz	100 kHz	–36
1 GHz ≤ f < 12.75 GHz	1 MHz	–30

TABLE 17

Additional spurious emission requirements

Frequency band	Measurement bandwidth (kHz)	Minimum requirement (dBm)
925 ≤ f ≤ 935 MHz	100	–67
935 < f ≤ 960 MHz	100	–79
1 805 ≤ f ≤ 1 880 MHz	100	–71

NOTE 1 – The measurements are made on frequencies which are integer multiples of 200 kHz. As exceptions, up to five measurements with a level up to the applicable requirements defined in Table 16 are permitted for each absolute RF channel used in the measurement.

5 Receiver spurious emissions (conducted)

The power of any spurious emissions from the receiver should not exceed the limits given in Tables 18, 19a and 19b.

TABLE 18

General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level (dBm)	Note
30 MHz ≤ f < 1 GHz	100 kHz	–57	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz	–47	With the exception of the frequencies covered by Table 19, for which additional receiver spurious emission requirements apply

TABLE 19a

Additional receiver spurious emission requirements for 3.84 Mchip/s TDD option

Frequency band	Measurement bandwidth (MHz)	Maximum level (dBm)	Note(1)
1 900 ≤ f ≤ 1 920 MHz	3.84	–60	TDD
2 010 ≤ f ≤ 2 025 MHz	3.84	–60	TDD
2 110 ≤ f ≤ 2 170 MHz	3.84	–60	FDD mobile receive band

(1) With the exception of frequencies between 12.5 MHz below the first carrier frequency and 12.5 MHz above the last carrier frequency used by the MS.

TABLE 19b

Additional receiver spurious emission requirements for 1.28 Mchip/s TDD option

Frequency band	Measurement bandwidth (MHz)	Maximum level (dBm)	Note(1)
1 900 ≤ f ≤ 1 920 MHz	1.28	–64	TDD
2 010 ≤ f ≤ 2 025 MHz	1.28	–64	TDD
2 110 ≤ f ≤ 2 170 MHz	1.28	–64	FDD mobile receive band

(1) With the exception of frequencies between 4 MHz below the first carrier frequency and 4 MHz above the last carrier frequency used by the MS.

ANNEX 4

TDMA single-carrier (UWC-136) MSs

PART A

Conformance requirements (30 kHz)

1 Spectrum mask

Spectrum noise suppression is the restraint of sideband energy outside the active transmit channel. This RF spectrum is the result of power ramping, modulation and all sources of noise. The spectrum is primarily the result of events that do not occur at the same time: digital modulation and power ramping (switching transients). The RF spectrum from these two events are specified separately.

Adjacent and first or second alternate channel power is that part of the mean power output of the transmitter resulting from the modulation and noise which falls within a specified passband centred on either of the adjacent or first or second alternate channels.

The emission power should not exceed the limits specified in Table 20.

TABLE 20

Adjacent and alternate channel power requirements

Channel	Maximum level
In either adjacent channel, centred ±30 kHz from the centre frequency	26 dB below the mean output power
In either alternate channel, centred ±60 kHz from the centre frequency	45 dB below the mean output power
In either second alternate channel centred ±90 kHz from the centre frequency	45 dB below the mean output power or –13 dBm measured in 30 kHz bandwidth, whichever is the lower power

OoB power arising from switching transients is the peak power of the spectrum, arising from the ramping-on and ramping-off of the transmitter, that fall within defined frequency bands outside the active transmit channel.

The peak emission power should not exceed the limits specified in Table 21.

TABLE 21

Switching transients requirements

Channel	Maximum level
In either adjacent channel, centred ±30 kHz from the centre frequency	26 dB below the peak output power reference
In either alternate channel, centred ±60 kHz from the centre frequency	45 dB below the peak output power reference
In either second alternate channel centred ±90 kHz from the centre frequency	45 dB below the peak output power reference or –13 dBm measured in 30 kHz bandwidth, whichever is the lower power

2 Transmitter spurious emissions (conducted)

The power of any spurious emission should not exceed the limits specified in Table 22.

TABLE 22

MS spurious emission limits

Band (f)[1]	Maximum level (dBm)	Measurement bandwidth	Note
9 kHz ≤ f ≤ 150 kHz	–36	1 kHz	(2)
150 kHz < f ≤ 30 MHz	–36	10 kHz	(2)
30 MHz < f ≤ 1 000 MHz	–36	100 kHz	(2)
1 000 MHz < f < 1 920 MHz	–30	1 MHz	(2)
1 920 MHz ≤ f ≤ 1 980 MHz	–30	30 kHz	(3)
1 980 MHz < f < 2 110 MHz	–30	1 MHz	(2)
2 110 MHz ≤ f ≤ 2 170 MHz	–70	30 kHz	(4)
2 170 MHz < f ≤ 12.75 GHz	–30	1 MHz	(2)

(1) f: frequency of the spurious emission.

(2) In accordance with the applicable clauses of Recommendation ITU-R SM.329.

(3) MS transmit band.

(4) MS receive band.

2.1 Coexistence with services in adjacent frequency bands

This requirement provides for the protection of receivers operating in bands adjacent to the MS transmit frequency band of 1 920 MHz to 1 980 MHz: GSM 900, R-GSM and UTRA TDD.

NOTE 1 – UTRA FDD operates in the same frequency band as UWC-136.

The power of any spurious emission should not exceed the limits specified in Table 23.

TABLE 23

Additional spurious emission requirements

Service	Frequency band	Measurement bandwidth (kHz)	Limit (dBm)
R-GSM	$921 \leq f \leq 925$ MHz	100	–60
R-GSM	$925 < f \leq 935$ MHz	100	–67
GSM 900/R-GSM	$935 < f \leq 960$ MHz	100	–79
DCS 1800	$1\,805 \leq f \leq 1\,880$ MHz	100	–71
UTRA TDD	$1\,900 \leq f \leq 1\,920$ MHz	100	–62
UTRA TDD	$2\,010 \leq f \leq 2\,025$ MHz	100	–62

NOTE 1 – The measurements are made on frequencies which are integer multiples of 200 kHz. Up to five exceptions of up to –36 dBm are permitted in the GSM 900, DCS 1800 and UTRA bands, and up to three exceptions of up to –36 dBm are permitted in the GSM 400 bands.

3 Receiver spurious emissions (idle mode)

The power of any spurious emissions should not exceed the limits given in Table 24.

TABLE 24

General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level (dBm)	Note
$30\text{ MHz} \leq f < 1\text{ GHz}$	100 kHz	–57	
$1\text{ GHz} \leq f \leq 12.75\text{ GHz}$	1 MHz	–47	With the exception of the frequencies covered by the Table below, for which additional receiver spurious emission requirements apply (1)

(1) (Editorial note) – In TFES Harmonized Standard v1.0.2, no additional receiver spurious emission is specified; yet, it is expected that there will be a table added, in the same form as for the other technologies (see Tables 5, 12 and 19).

PART B

Conformance requirements (200 kHz)

The 200 kHz channel provides packet data service and employs both octaphase shift keying (8-PSK) and Gaussian filtered minimum shift keying (GMSK) modulations.

1 Spectrum mask

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

The specifications contained in this subclause apply in frequency hopping as well as in non-frequency hopping modes.

Due to the bursty nature of the signal, the output RF spectrum results from two effects: the modulation process, and the power ramping up and down (switching transients).

– The level of the output RF spectrum due to GMSK and 8-PSK modulations should be no more than that given in Tables 25 and 26.

– The level of the output RF spectrum due to switching transients should be no more than that given in Table 27.

– The power emitted should not exceed –71 dBm in frequency band 2 110-2 170 MHz.

2 Spectrum due to the modulation and wideband noise

The output RF modulation spectrum is specified in Tables 25 and 26. This specification applies for all RF channels supported by the equipment.

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

The limits should be met under the following measurement conditions:

– Zero frequency scan, filter bandwidth and video bandwidth of 30 kHz up to 1 800 kHz from the carrier and 100 kHz at 1 800 kHz and above from the carrier, with averaging done over 50% to 90% of the useful part of the transmitted bursts, excluding the midamble, and then averaged over at least 200 such burst measurements. Above 1800 kHz from the carrier, only measurements centred on 200 kHz multiples are taken with averaging over 50 bursts.

– When tests are done in frequency hopping mode, the averaging should include only bursts transmitted when the hopping carrier corresponds to the nominal carrier of the measurement. The limits then apply to the measurement results for any of the hopping frequencies.

The figures in Table 25, at the vertically listed power level (dBm) and at the horizontally listed frequency offset from the carrier (kHz), are then the maximum allowed level (dB) relative to a measurement in 30 kHz on the carrier.

NOTE 1 – This approach of specification has been chosen for convenience and speed of testing. It does however require careful interpretation if there is a need to convert figures in the following tables into spectral density values, in that only part of the power of the carrier is used as the relative reference, and in addition different measurement bandwidths are applied at different offsets from the carrier.

TABLE 25

Relative maximum level due to modulation

Carrier power (dBm)	**Frequency offset (kHz)**							
	100	200	250	400	≥600 <1 200	≥1 200 <1 800	≥1 800 <6 000	≥6 000
≥33	+0.5	–30	–33	–60	–60	–60	–68	–76
32	+0.5	–30	–33	–60	–60	–60	–67	–75
30	+0.5	–30	–33	–60	–60(1)	–60	–65	–73
28	+0.5	–30	–33	–60	–60(1)	–60	–63	–71
26	+0.5	–30	–33	–60	–60(1)	–60	–61	–69
≤24	+0.5	–30	–33	–60	–60(1)	–60	–59	–67

(1) For equipment supporting 8-PSK, the requirement for 8-PSK modulation is –54 dB.

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

– In the combined range of 600 kHz to 6 MHz above and below the carrier, in up to three bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz, exceptions levels of up to –36 dBm are allowed.

– Above 6 MHz offset from the carrier in up to 12 bands of 200 kHz width centred on a frequency which is an integer multiple of 200 kHz, exceptions levels of up to –36 dBm are allowed.

Using the same measurement conditions as specified above, if a requirement in Table 25 results in lower than the power limit given in Table 26, then the latter should be applied instead.

TABLE 26

Absolute maximum level due to modulation

Frequency offset from the carrier (kHz)	Level (dBm)
< 600	–36
≥ 600, < 1 800	–56
≥ 1 800	–51

3 Spectrum due to switching transients

These effects are also measured in the time domain and the specifications assume the following measurement conditions: zero frequency scan, filter bandwidth 30 kHz, peak hold, and video bandwidth 100 kHz. Table 27 specifies the limits.

TABLE 27

Maximum levels due to switching transients

Carrier power level (dBm)	Maximum level measured at various frequency offsets			
	400 kHz	600 kHz	1 200 kHz	1 800 kHz
39	–21 dBm	–26 dBm	–32 dBm	–36 dBm
≤ 37	–23 dBm	–26 dBm	–32 dBm	–36 dBm

NOTE 1 – The relaxation for carrier power level 39 dBm is in line with the modulated spectra and thus causes negligible additional interference to an analogue system by an UWC-136 200 kHz signal.

NOTE 2 – The near-far dynamics with this specification has been estimated to be approximately 58 dB for MS operating at a power level of 8 W or 49 dB for MS operating at a power level of 1 W. The near-far dynamics then gradually decreases by 2 dB per power level down to 32 dB for MS operating in cells with a maximum allowed output power of 20 mW or 29 dB for MS operating at 10 mW.

NOTE 3 – The possible performance degradation due to switching transient leaking into the beginning or the end of a burst, was estimated and found to be acceptable with respect to the bit error ratio due to co-channel interference (*C*/*I*).

4 Transmitter spurious emissions (conducted)

The power of any spurious emission should not exceed the limits specified in Table 28.

TABLE 28

MS spurious emission limits

Band (f) (1)	Measurement bandwidth	Maximum level (dBm)	Note
9 kHz ≤ f ≤ 150 kHz	1 kHz	–36	(2)
150 kHz < f ≤ 30 MHz	10 kHz	–36	(2)
30 MHz < f ≤ 1 000 MHz	100 kHz	–36	(2)
1 000 MHz < f < 1 920 MHz	1 MHz	–30	(2)
1 920 MHz ≤ f ≤ 1 980 MHz	100 kHz	–36	(3)
1 980 MHz < f < 2 110 MHz	1 MHz	–30	(2)
2 110 MHz ≤ f ≤ 2 170 MHz	100 kHz	–66	(4)
2 170 MHz < f ≤ 12.75 GHz	1 MHz	–30	(2)

(1) f: frequency of the spurious emission.

(2) In accordance with the applicable clauses of Recommendation ITU-R SM.329.

(3) MS transmit band.

(4) MS receive band.

5 Coexistence with services in adjacent frequency bands

This requirement provides for the protection of receivers operating in bands adjacent to the MS transmit frequency band of 1 920 MHz to 1 980 MHz: GSM 900, R-GSM, UTRA TDD.

The power of any spurious emission should not exceed the limits specified in Table 29.

TABLE 29

Additional spurious emission requirements

Service	Frequency band	Measurement bandwidth (kHz)	Minimum requirement (dBm)
R-GSM	921 ≤ f ≤ 925 MHz	100	–60
R-GSM	925 < f ≤ 935 MHz	100	–67
GSM 900/R-GSM	935 < f ≤ 960 MHz	100	–79
DCS 1800	1 805 ≤ f ≤ 1 880 MHz	100	–71
UTRA TDD	1 900 ≤ f ≤ 1 920 MHz	100	–62
UTRA TDD	2 010 ≤ f ≤ 2 025 MHz	100	–62

NOTE 1 – The measurements are made on frequencies which are integer multiples of 200 kHz. Up to five exceptions of up to –36 dBm are permitted in the GSM 900, DCS 1800 and UTRA bands, and up to three exceptions of up to –36 dBm are permitted in the GSM 400 bands.

6 Receiver spurious emissions (idle mode)

The power of any spurious emissions should not exceed the limits given in Table 30.

TABLE 30

General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level (dBm)	Note
30 MHz ≤ f < 1 GHz	100 kHz	–57	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz	–47	With the exception of the frequencies covered by the Table below, for which additional receiver spurious emission requirements apply

ANNEX 5

FDMA/TDMA (digital enhanced cordless telecommunications (DECT)) MSs

1 Spectrum mask

If the equipment under test (EUT) is equipped with antenna diversity, the EUT should have the diversity operation defeated for the following tests.

2 Emissions due to modulation

The unwanted emission(s) due to modulation is the power measured in any DECT RF channel other than the one in which the EUT is transmitting, integrated over a bandwidth of 1 MHz.

With transmissions on physical channel Ra (K, L, M, N) in successive frames, the power in physical channel Ra (K, L, Y, N) should be less than the values given in Table 31.

TABLE 31

Emissions modulation

Emissions on RF channel Y	Measurement bandwidth	Maximum power level
$Y = M \pm 1$	(1)	160 µW (–8 dBm)
$Y = M \pm 2$	(1)	1 µW (–30 dBm)
$Y = M \pm 3$	(1)	80 nW (–41 dBm)
Y = any other DECT channel	(1)	40 nW (–44 dBm)(2)

(1) The power in RF channel Y is defined by integration over a bandwidth of 1 MHz centred on the nominal centre frequency, F_Y, averaged over at least 60% but less than 80% of the physical packet, and starting before 25% of the physical packet has been transmitted but after the synchronization word.

(2) For Y = any other DECT channel, the maximum power level should be less than 40 nW (–44 dBm) except for one instance of a 500 nW (–33 dBm) signal.

3 Emissions due to transmitter transients

The power level of all modulation products (including amplitude modulation (AM) components due to the switching on or off of the modulated RF carrier) in a DECT RF channel as a result of a transmission on another DECT RF channel.

The power level of all modulation products (including AM products due to the switching on or off of a modulated RF carrier) arising from a transmission on RF channel M should, when measured using a peak hold technique, be less than the values given in Table 32.

TABLE 32

Emissions due to transmitter transients

Emissions on RF channel Y	Measurement bandwidth	Maximum power level
$Y = M \pm 1$	(1)	250 µW (–6 dBm)
$Y = M \pm 2$	(1)	40 µW (–14 dBm)
$Y = M \pm 3$	(1)	4 µW (–24 dBm)
Y = any other DECT channel	(1)	1 µW (–30 dBm)

(1) The measurement bandwidth should be 100 kHz and the power should be integrated over a 1 MHz bandwidth centred on the DECT frequency, F_Y.

4 Transmitter spurious emissions (conducted)

4.1 Spurious emissions when allocated a transmit channel

The spurious emissions, when a radio end point has an allocated physical channel, should meet the requirements of Table 33. The requirements of Table 33 are only applicable for frequencies which are greater than 12.5 MHz away from the centre frequency, *fc*, of a carrier.

TABLE 33

Spurious emissions requirements

Frequency	Minimum requirement/ reference bandwidth
30 MHz $\leq f <$ 1 000 MHz	–36 dBm/100 kHz
1 GHz $\leq f <$ 12.75 GHz	–30 dBm/1 MHz
f_c – 12.5 MHz $< f < f_c$ + 12.5 MHz	Not defined

Measurements should not be made for transmissions on the RF channel closest to the nearest band edge for frequency offsets of up to 2 MHz.

5 Receiver spurious emissions (idle mode)

5.1 Spurious emissions when the EUT has no allocated transmit channel

The power level of any spurious emissions when the radio end point has no allocated transmit channel should not exceed the limits specified in Table 34.

TABLE 34

Receiver spurious emissions

Frequency band	Measurement bandwidth	Maximum level (dBm)	Note
30 MHz ≤ f < 1 GHz	100 kHz(1)	–57	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz(1)	–47	With the exception of the frequencies within the DECT band, covered by Table 35

(1) The power should be measured using a peak hold technique.

5.2 In the DECT band

The power level of any receiver spurious emissions within the DECT band should not exceed the limit in Table 35.

TABLE 35

Receiver spurious emissions within DECT band

Frequency band	Measurement bandwidth (MHz)	Maximum level (dBm)
1 900 to 1 920 MHz 2 010 to 2 025 MHz	1	–57(1)

(1) The following exceptions are allowed:

– in one 1 MHz band, the maximum allowable effective radiated power (ERP) should be less than 20 nW;

– in up to two bands of 30 kHz, the maximum ERP should be less than 250 nW.