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Characteristics of terrestrial IMT-2000 systems for frequency sharing/ interference analyses

M Series

Mobile, radiodetermination, amateur and related satellites services

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REPORT ITU-R M.2039-2

Characteristics of terrestrial IMT-2000 systems for frequency sharing/interference analyses

(2010)

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1 Introduction

International Mobile Telecommunications 2000 (IMT-2000) third generation mobile systems started service around the year 2000, and provide access by means of one or more radio links to a wide range of telecommunications services supported by the fixed telecommunication networks (e.g. PSTN/ISDN/ Internet protocol (IP)) and to other services specific to mobile users. Since then, IMT-2000 has been continually enhanced.

The Radiocommunication Assembly 2007 adopted Resolution ITU-R 56 that resolves that the term “IMT” be the root name that encompasses both IMT-2000 and IMT-Advanced collectively.

The following bands are identified for IMT in the Radio Regulations (RR):

TABLE 1

Frequency bands identified for IMT

Band (MHz)	Footnotes identifying the band for IMT
450-470	5.286AA
698-960	5.313A, 5.317A
1 710-2 025	5.384A, 5.388
2 110-2 200	5.388
2 300-2 400	5.384A
2 500-2 690	5.384A
3 400-3 600	5.430A, 5.432A, 5.432B, 5.433A

Frequency sharing studies and interference analyses involving IMT systems and other systems and services operating in bands identified for IMT may need to be undertaken within ITU-R. To perform the necessary sharing studies between IMT systems and systems in other services, characteristics of the terrestrial component of IMT systems are needed.

This Report provides the baseline characteristics of terrestrial IMT-2000 systems only for use in frequency sharing and interference analysis studies involving IMT-2000 systems and between IMT-2000 systems and other systems.

Recommendations ITU-R M.1457, ITU-R M.1580 and ITU-R M.1581 provide standardization information relating to IMT-2000 interfaces.

Parameters for IMT-Advanced interfaces are not addressed in this Report.

The characteristics of the IMT-2000 interfaces have been grouped by frequency bands:

– 450-470 MHz, 698-806 MHz, 790-862 MHz, 880-960 MHz.

– 1 800 MHz, 2 GHz, 2.3 GHz, 2.5 GHz.

– 3 400-3 600 MHz.

NOTE 1 – variations in the parameters may appear depending on the band that is considered, among those listed in a group of frequency bands. Such variations are reflected in the respected tables.

2 Acronyms and definitions

CDMA	Code-division multiple access
DECT	Digital enhanced cordless telecommunications
EDGE	Enhanced data rates for GSM evolution
E-UTRA	Evolved UTRA
FDD	Frequency division duplex
FDMA	Frequency-division multiple access
HRPD	High rate packet data
HSPA	High speed packet access
HSPA+	Evolved high speed packet access

IMT	International Mobile Telecommunications – root name that encompasses both IMT-2000 and IMT-Advanced collectively
IMT-2000	International Mobile Telecommunications 2000
IMT-Advanced	International Mobile Telecommunications-Advanced – previously known as systems beyond IMT-2000
LTE	Long term evolution
TDD	Time division duplex
TDMA	Time-division multiple access
TD-SCDMA	Time division synchronous code-division multiple access
UMB	Ultra mobile broadband
UMTS	Universal mobile telecommunication system
UTRA	Universal terrestrial radio access
UWC	Universal wireless communications
WCDMA	Wideband code-division multiple access
WiMAX	Worldwide interoperability for microwave access

3 IMT-2000 interfaces

Table 2 provides an explanation of the terminology used for the IMT-2000 terrestrial technologies.

TABLE 2

IMT-2000 terrestrial radio interfaces

Full name	Common names	Duplex mode
IMT-2000 CDMA Direct Spread (interface No. 1)	UTRA FDD WCDMA UMTS HSPA, HSPA+ E-UTRA FDD (LTE FDD)	FDD
IMT-2000 CDMA Multi-Carrier (interface No. 2)	CDMA2000 CDMA2000 1X and 3X CDMA2000 HRPD CDMA2000 1xEV-DV CDMA2000 1xEV-DO EVDOHRPD UMB	FDD and TDD
IMT-2000 CDMA TDD (time-code) (interface No. 3)	UTRA TDD 7.68 Mchip/s UTRA TDD 3.84 Mchip/s UTRA TDD 1.28 Mchip/s (TD-SCDMA) UMTS HSPA, HSPA+ E-UTRA TDD (LTE TDD)	TDD

TABLE 2 (*end*)

Full name	Common names	Duplex mode
IMT-2000 TDMA Single-Carrier (interface No. 4)	UWC-136 EDGE	FDD
IMT-2000 FDMA/TDMA (frequency-time) (interface No. 5)	DECT	TDD
IMT-2000 OFDMA TDD WMAN (interface No. 6)	Mobile WiMAX	FDD and TDD

4 Characteristics in the bands below 1 GHz

These parameters apply to the frequency bands:

– 450-470 MHz.

– 698-806 MHz.

– 790-862 MHz.

– 880-960 MHz.

4.1 Parameters for IMT-2000 CDMA DS and IMT-2000 OFDMA TDD WMAN

TABLE 3

Parameters for IMT-2000 CDMA DS and IMT-2000 OFDMA TDD WMAN

	IMT-2000 RADIO INTERFACES	**IMT-2000 CDMA Direct Spread**				**IMT-2000 OFDMA TDD WMAN**	
		UTRA		**E-UTRA**		**Mobile WiMAX (OFDMA)**	
No.	**Parameter**	**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
1.	Class of emission	5M00V7WEC	5M00V7WEC	For 1.4 MHz, 1M40V7WEW For 3 MHz, 3M00V7WEW For 5 MHz, 5M00V7WEW For 10 MHz, 10M0V7WEW (For 15 MHz, 15M0V7WEW For 20 MHz, 20M0V7WEW[1]	For 1.4 MHz, 1M40V7WEW For 3 MHz, 3M00V7WEW For 5 MHz, 5M00V7WEW For 10 MHz, 10M0V7WEW (For 15 MHz, 15M0V7WEW For 20 MHz, 20M0V7WEW[2]	5 MHz, OFDMA 7 MHz, OFDMA 10 MHz, OFDMA[3]	
2.	Modulation parameters	QPSK 16-QAM 64-QAM	QPSK 16-QAM	QPSK 16-QAM 64-QAM	QPSK 16-QAM 64-QAM	QPSK 16-QAM 64-QAM	QPSK 16-QAM 64-QAM (optional)
3.	Duplex mode	FDD		FDD(/TDD[4])		FDD/TDD	

TABLE 3 (*continued*)

	IMT-2000 RADIO INTERFACES	IMT-2000 CDMA Direct Spread				IMT-2000 OFDMA TDD WMAN	
		UTRA		E-UTRA		Mobile WiMAX (OFDMA)	
No.	**Parameter**	**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
4.	Spectral mask of signals, including	(5)	(6)	(7)	(8)	The final mobile WiMAX emission masks for equipment in these frequency ranges remain under development. An example of regulatory unwanted emission requirements can be found in the FCC regulations[9] §§ 27.53 and 90.543 for the 700 MHz band (698-806 MHz). These provide an example of the target levels that will be taken into consideration during development of the final mobile WiMAX emission masks	
4.1	−3 dB radiation bandwidth	–	–	–	–		
4.2	−30 dB radiation bandwidth	–	–	–	–		
4.3	−60 dB radiation bandwidth	–	–	–	–		
5.	Maximum spectral power density, dB(mW/Hz)	−22.8	−41.8[10]	−23.5	−43.5[11]	5 MHz: −23.6 7 MHz: −25.1 10 MHz: −26.6 See footnote[12]	5 MHz: −43.5[13] 7 MHz: –45.2 10 MHz: –46.6 See footnote[13]
6.	Signal bandwidth (MHz)	3.84	3.84	1.08, 2.7, 4.5, 9, 13.5 and 18	1.08, 2.7, 4.5, 9, 13.5 and 18	4.60, 6.57, 9.20 MHz footnote[14]	4.47, 6.57 and 9.20 MHz footnote[15]

TABLE 3 (*continued*)

	IMT-2000 RADIO INTERFACES	IMT-2000 CDMA Direct Spread				IMT-2000 OFDMA TDD WMAN	
		UTRA		E-UTRA		Mobile WiMAX (OFDMA)	
No.	**Parameter**	**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
7.	Transmitter e.i.r.p. (dBm)						
7.1	Maximum transmitter e.i.r.p. (dBm)	55	21	55	23[16]	55[16]	23[17]
7.2	Average transmitter e.i.r.p. (dBm)	Deployment dependant	1 (rural) −10 (urban)	Deployment dependant	3 (rural) −8 (urban)	Deployment dependant	Not communicated
8.	Typical height of the transmitting antenna (m)	20 to 30	1.5	20 to 30	1.5	15 to 32	1.5
9.	Transmitting antenna type (sectorized/omnidirectional)	3 sectors	Omnidirectional	3 sectors	Omnidirectional	Sectorized	Omnidirectional
10.	Transmitting antenna gain (dBi)	15	0	15	0	15	0
11.	Feeder loss (dB)	3	0	3	0	3	0
12.	Antenna pattern width (degrees)						
12.1	− in the horizontal plane (at 3 dB)	65°	N/A	65°	N/A	65°	Omnidirectional
12.2	− in the vertical plane	Recommendation ITU-R F.1336-2	N/A	Recommendation ITU-R F.1336-2	N/A	Recommendation ITU-R F.1336-2	N/A
12.3	− antenna downtilt	3°	N/A	3°	N/A	3°	N/A
13.	Relative level of side lobes	Not standardized[18]	N/A	−20 dB	N/A	−20 dB See footnote[19]	N/A
14.	Channel bandwidth (MHz)[20]	5	5	1.4, 3, 5, 10, 15,[18]	1.4, 3, 5, 10, 15,[18]	5, 7, 10	5, 7, 10
15.	Power control range (dB)	> 18	75	[21]	63	> 10	> 45

TABLE 3 (*continued*)

	IMT-2000 RADIO INTERFACES	IMT-2000 CDMA Direct Spread				IMT-2000 OFDMA TDD WMAN	
		UTRA		E-UTRA		Mobile WiMAX (OFDMA)	
No.	**Parameter**	**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
16.	density of the equipments (number/km^2)	Rural: 4.5 users equipment operating at the same time (average number of simultaneously active users) Urban: 4.5[22]				Deployment parameter	Deployment parameter
17.	density of the equipment (number/km^2) operating at co-frequency	Rural: 4.5 users equipment operating at the same time (average number of simultaneously active users) Urban: 4.5[22]				Deployment parameter	Deployment parameter
18.	Polarization discrimination (dB)	3[23]	0	3[23]	0	3 dB	0 dB
19.	Capacity criteria, including capacity per cell	Capacity in a cellular system can be measured in terms of simultaneous voice users per cell, data throughput per cell, etc. The actual capacity is dependent on the assumptions made about system configuration, loading, quality, and fairness, among other things				Deployment parameter	Deployment parameter
20.	Frequency reuse factor	1	1	1	1	Deployment parameter	Deployment parameter
21.	Receiver thermal noise	NF = 5 dB	NF = 9 dB	NF = 5 dB	NF = 9 dB	–109 dBm/MHz	–106 dBm/MHz
22.	Reference sensitivity	[24]	[25]	[26]	[27]	5 MHz QPSK 1/2: –91.6 dBm 7 MHz QPSK 1/2: –89.9 dBm 10 MHz QPSK 1/2: –88.5 dBm	5 MHz QPSK 1/2: −91.5 dBm 7 MHz QPSK 1/2: −89.9 dBm 10 MHz QPSK 1/2: −88.5 dBm
23.	Receiver blocking response	[28]	[29]	[30]	[31]		

TABLE 3 (*end*)

	IMT-2000 RADIO INTERFACES	IMT-2000 CDMA Direct Spread				IMT-2000 OFDMA TDD WMAN	
		UTRA		E-UTRA		Mobile WiMAX (OFDMA)	
No.	**Parameter**	**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
24.	Coverage radius	Rural: 3.46 km Urban: 2.698 km		Rural: 3.46 km Urban: 2.698 km		Rural: 3.46 km Urban: 2.698 km	
25.	ACLR1					45 dB	30 dB
26.	ACLR2					50 dB	44 dB
27.	ACS1					46 dB	33 dB
28.	ACS2					56 dB	47 dB

NOTE 1 – This table contains only parameters relevant to IMT emissions (i.e. when the IMT system is the source of potential interference). Further parameters (e.g. receiver performance) are relevant for the case where the IMT system is the victim of interference.

NOTE 2 – The density of the mobile terminals (number/km^2), operating at the same frequency at the same time and in the same geographical area, as well as the average transmit power of terminals are also important parameters when studying potential interference from IMT mobile terminals particularly in the case of stochastic analysis and should therefore be considered in the coexistence studies.

Notes relatives to Table 3:

(1) Future possible deployment.

(2) Future possible deployment.

(3) Recommendation ITU-R SM.1138 – Determination of necessary bandwidths including examples for their calculation and associated examples for the designation of emissions, does not explicitly cover OFDMA signalling, therefore an alternative simple description is used here.

(4) Future possible deployment and the preliminary parameters can also be used for LTE TDD related sharing studies.

(5) See 3GPP Documents: TS 25 104 v 9. 3.0, see § 6.6.3 and TS 25 141 v 9. 3.0, see § 6.5.3.

(6) See 3GPP Documents: TS 25 101 v 9.3.0, see § 6.6.2.1 and TS 34.121-1 v9.1.0, see § 5.9.

(7) See 3GPP Documents: TS 36 104 v 9. 3.0, see § 6.6.3 and TS 36 141 v 9. 3.0, see § 6.6.

(8) See 3GPP Documents: TS 36 101 v 9.3.0, see Table 6.6.2.1.1-1 (General E-UTRA spectrum emission mask) and TS 36 521-1 v 9.0.0, see § 6.6.

(9) US Code of Federal Regulations, Title 47, FCC Rules Parts 27 and 90.

(10) Based on a bandwidth of 3.84 MHz.

(11) This value corresponds to a 4.5 MHz bandwidth, noting that other measurement bandwidth is possible: 1.08 MHz, 2.7 MHz, 9.0 MHz, 13.5 MHz and 18 MHz.

Notes relatives to Table 3 (end):

(12) These are average spectral power density values based on Item 7 over the specified channel bandwidth.

(13) This value is average spectral power density based on Item 7 and assumes the mobile station is transmitting on PUSC (partially used of sub-Channels) with all sub-Channels.

(14) These values are corresponding to the utilized spectrum within 5, 7 and 10 MHz channel bandwidths in Up Link when PUSC is used.

(15) These values are corresponding to the utilized spectrum within 5, 7 and 10 MHz channel bandwidths in Up Link when PUSC is used.

(16) This value does not take account of the effect of multiple transmit antennas.

(17) WiMAX numbers for MS related to Item 7 are preliminary numbers. WiMAX Forum profiles 7.A and 7.E of Table 2, in general, cover a range of power classes.

(18) See 3GPP Document TS 25.942, § 8.4.3.1 (Antenna installation) or § 10 (Antenna to antenna isolation).

(19) A front-to-back ratio of 25 dB should be assumed.

(20) This value refers to the block size.

(21) See 3GPP Document TS 36104-830, Table 6.3.2.1-1 (E-UTRA BS total power dynamic range).

(22) This figure can be used for sharing studies in urban areas, because the increase of population density in urban areas (compared with rural/suburban areas) is expected to be offset by the distribution of offered traffic to parallel networks deployed in the other available frequency bands. The networks expected to be deployed in the 800 MHz band will offer only limited capacity and thus will carry only a small fraction of the total offered traffic in urban areas.

(23) Typically base stations today use cross-polarized antennas (two sets of dipoles slanted at ±45° against the horizontal plane), usually transmitting on one of the two polarisation paths (either +45° or −45° for a given frequency) whilst receiving on both paths (to achieve polarisation diversity). Such signals provide an isolation of 3 dB against both horizontally and vertically polarized signals (e.g. DVB-T signals) due to cross-polarisation discrimination.

(24) See 3GPP Document TS 25.104, § 7.2.

(25) See 3GPP Document TS 25.101, § 7.3.

(26) See 3GPP Document TS 36.104, § 7.2.

(27) See 3GPP Document TS 36.101, § 7.3.

(28) See 3GPP Document TS 25.104, § 7.5.

(29) See 3GPP Document TS 25.101, § 7.6.

(30) See 3GPP Document TS 36.104, § 7.6.

(31) See 3GPP Document TS 36.101, § 7.6.

TABLE 4

Complementary information about IMT-2000 OFDMA TDD WMAN (Mobile WiMAX)

Band Class Group (BCG)	Frequency range UL (MHz)	Frequency range DL (MHz)	Channel bandwidth (MHz)	Duplex mode	Comments
7.A	698-862	698-862	5, 7 and 10	TDD	The bandwidths are applicable to both the MS and BS
7.B	776-787	746-757	2 x 5 and 2 x 10	FDD	
7.C	788-793, 793-798	758-763, 763-768	2 x 5	FDD	
7.D	788-798	758-768	2 x 10	FDD	
7.E	698-862	698-862	5, 7 and 10 (TDD) 2 x 5, 2 x 7 and 2 x 10 (FDD)	TDD/FDD	
7.G	880-915	925-960	2 x 5 and 2 x 10	FDD	

4.2 Parameters for IMT-2000 CDMA MC (CDMA 2000, HRPD and UMB)

The values for the system parameters are presented in Tables 5, 6 and 7.

TABLE 5[32]

Parameters for IMT-2000 CDMA MC (CDMA 2000, HRPD and UMB)

	IMT-2000 RADIO INTERFACES		IMT-2000 CDMA MC					
No.	**Parameter**		**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
			cdma2000		**HRPD**		**UMB**	
1.	Class of emission							
2.	Modulation parameters	Forward link or downlink	Data modulation: BPSK; QPSK, 8-PSK, 16-QAM Spreading modulation: QPSK		Data modulation: QPSK, 8-PSK, 16-QAM, and 64-QAM Spreading modulation: QPSK		Data modulation: QPSK, 8-PSK, 16-QAM, and 64-QAM	
		Reverse link or uplink	Data modulation: 64-ary Orthogonal Modulation, BPSK; QPSK, 8-PSK Spreading modulation: HPSK		Data modulation: BPSK; QPSK, 8-PSK Spreading modulation: HPSK		Data modulation: QPSK, 8-PSK, 16-QAM, and 64-QAM Spreading modulation: QPSK (CDMA control segment)	
3.	Duplex mode		FDD		FDD		FDD/TDD	
4.	Spectral mask of signals, including		See Recommendations ITU-R M.1580-2 and ITU-R M.1581-2 for CDMA-MC[33]	See Recommendations ITU-R M.1580-2 and ITU-R M.1581-2 for CDMA-MC[33]	See Recommendations ITU-R M.1580-2 and ITU-R M.1581-2 for CDMA-MC[33]	See Recommendations ITU-R M.1580-2 and ITU-R M.1581-2 for CDMA-MC[33]	To be provided	To be provided
4.1	−3 dB radiation bandwidth							
4.2	−30 dB radiation bandwidth							
4.3	−60 dB radiation bandwidth							
5.	Maximum spectral power density, dB(mW/Hz)		−17.9[34]	−37.9[35] for 1 x, –42.9 for 3 x	−17.9[36], [37] for n = 1	−37.9[37] for n = 1		

TABLE 5 (*continued*)

	IMT-2000 RADIO INTERFACES	IMT-2000 CDMA MC					
No.	**Parameter**	**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
		cdma2000		**HRPD**		**UMB**	
6.	Signal bandwidth (MHz)	1.2288 per carrier. One or three carriers can be used together, with carriers separated by 1.23 MHz for Band Class 0 and 1.25 MHz in other cases	1.2288 (1x) and 3.6864 (3x)	1.2288 per carrier. One to fifteen carriers can be used together, with carriers separated by 1.23 MHz for Band Class 0 and 1.25 MHz in other cases	1.2288 per carrier. One to fifteen carriers can be used together, separated by 1.23 MHz for Band Class 0 and 1.25 MHz in other cases	0.768-19.6608 with step size of 0.1536	0.768-19.6608 with step size of 0.1536
7.	Maximum transmitter e.i.r.p. (dBm)	Per licence typically 56 per carrier assuming 43 dBm transmitter power	See Table 6	Per licence typically 56 per carrier assuming 43 dBm transmitter power	See Table 6	To be provided	To be provided
8.	Typical height of the transmitting antenna (m)	30	1.5	30	1.5	32	1.5
9.	Transmitting antenna type (sectorized/omnidirectional)	3 sectors	Omnidirectional	3 sectors	Omnidirectional	3 sectors	Omnidirec-tional
10.	Transmitting antenna gain (dBi)	15	−1	15	−1	17	−1
11.	Feeder loss (dB)	2	2	2	2	2	2
12.	Antenna pattern width (degrees)						

TABLE 5 (*continued*)

	IMT-2000 RADIO INTERFACES	IMT-2000 CDMA MC					
No.	**Parameter**	**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
		cdma2000		**HRPD**		**UMB**	
12.1	– in the horizontal plane (at 3 dB)	70	NA	70	NA	70	NA
12.2	– in the vertical plane	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
12.3	– antenna downtilt	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
13.	Relative level of side lobes	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
14.	Channel bandwidth (MHz) Channel bandwidth(s), some systems being capable of multiple bandwidths	It has a chip rate of N = 1.2288 Mchip/s (currently, N = 1 and 3 are specified) Carrier spacing is 1.23 MHz for Band Class 0; 1.25 MHz for all other Band Classes		M carriers of 1.2288 Mchip/s can be aggregated in a single or multi-carrier operation, where M = 1, 2, 3, 4, …, 15. Carriers in a multi-carrier operation do not have to be contiguous and their spacing is multiple of 30, 50, 25 or 12.5 kHz depending on the Band Class		Native bandwidth can fit deployment of 1.25 to 20 MHz (0.768 + N × 0.1536 MHz, N × 0, …, 123). Also, multi-carrier configurations can be used to aggregate two or more carriers of possibly different native bandwidths and operating in non-contiguous spectral allocation	
15.	Power control range (dB)	Open loop and Closed loop (800, 400, 200, 50, 25, 12.5 Hz update rate) with power control steps: 0.25 × N, N = 1, 2, 4 dB		Open loop and Closed loop (600 and 150 Hz update rate) with power control steps: 0.5 × N, N = 1, 2, 3, 4 dB		Open loop and Closed loop (Once every N data frames (0.911 ms), N = 4, 8, 16, 32) with power control steps: 0.25 × N, N = 1, 2, 3, ..., 8 dB	
16.	Density of the equipments (number/km^2)	See footnote(36)	See footnote(36)	See footnote(36)	See footnote(36)	See footnote(36)	See footnote(36)
17.	Density of the equipments (number/km^2) operating at co-frequency	See footnote(36)	See footnote(36)	See footnote(36)	See footnote(36)	See footnote(36)	See footnote(36)

TABLE 5 (*end*)

	IMT-2000 RADIO INTERFACES		IMT-2000 CDMA MC					
No.	**Parameter**		**Base station**	**Mobile station**	**Base station**	**Mobile station**	**Base station**	**Mobile station**
			cdma2000		**HRPD**		**UMB**	
18.	Polarization		Not specified; typically vertical	Not specified; typically vertical	Not specified; typically vertical	Not specified; typically vertical	Not specified; typically vertical	Not specified; typically vertical
19.	Capacity criteria, including capacity per cell		Capacity in a cellular system can be measured in terms of simultaneous voice users per cell, data throughput per cell, etc. The actual capacity is dependent on the assumptions made about system configuration, loading, quality, and fairness, among other things. The actual capacity of the system is not part of the cdma2000 specifications					
20.	Frequency reuse factor		Frequency reuse of one is supported					
21.	Receiver thermal noise	Band Class 0, 3, 10	−108 dBm/ 1.23 MHz (5 dB NF)	−103 dBm/ 1.23 MHz (10 dB NF)	−108 dBm/ 1.23 MHz (5 dB NF)	−103 dBm/ 1.23 MHz (10 dB NF)	To be provided	To be provided
22.	Reference sensitivity	Band Class 0, 3, 10	−122 dBm/ 1.23 MHz 9 600 bit/s	−104 dBm/ 1.23 MHz (9 600 bit/s) Traffic/cell −15.6 dB	−122 dBm/ 1.23 MHz 9 600 bit/s	−105.5 dBm/ 1.23 MHz (307 kbit/s in 2 slots)	To be provided	To be provided

Notes relatives to Table 5:

(32) Note that some of the parameters in this table are typically not included in the cdma2000 specifications. These include: maximum spectral power density, transmitting antenna type, antenna gain, antenna height, antenna pattern, antenna downtilt, feeder loss, and polarization. Some information in these categories found in this table is listed in 3GPP2 report C.R1002 (cdma2000 Evaluation Methodology) and may be considered typical in some deployments.

(33) Note that these Recommendations are currently being reviewed by WP 5D.

(34) Assumes 43 dBm maximum transmit power over 1.2288 MHz.

(35) Assumes 23 dBm maximum transmit power over 1.2288 MHz.

(36) This is a function of frequency, coverage desired, propagation, data rates desired, etc.

(37) This value refers to the block size.

TABLE 6

Maximum power for IMT-2000 CDMA MC mobile stations and HRPD access terminals for band classes in the 698-862 MHz range

Band class	Mobile station class/ access terminal class	Radiating measurement	Lower limit	Upper limit
0 and 3	Class I	e.r.p.	1 dBW (1.25 W)	8 dBW (6.3 W)
	Class II	e.r.p.	−3 dBW (0.5 W)	4 dBW (2.5 W)
	Class III	e.r.p.	−7 dBW (0.2 W)	0 dBW (1.0 W)
7 and 10	Class I	e.r.p.	−3 dBW (0.5 W)	4 dBW (2.5 W)
	Class II	e.r.p.	−7 dBW (0.2 W)	0 dBW (1.0 W)

Table 7 maps the band classes defined in Table 6 to the actual frequencies.

TABLE 7

Band class designations in the 698-862 MHz range

Band class	Transmit frequency band (MHz)	
	Mobile station	Base station
0	815-849	860-894
3	887-889 893-901 915-925	832-834 838-846 860-870
7	776-788	746-758
10	806-824 896-901	851-869 935-940
18	787-799	757-769
19	698-716	728-746

With regard to the band class 5 (450-470 MHz band), the following parameters have to be adjusted:

– BS antenna gain, which would be 14 dBi.

– The MS power levels are given below. A typical MS uses class III.

TABLE 8

Maximum power for IMT-2000 CDMA MC terminals for band classes in the 450-470 MHz range

Band class	Mobile station class/ access terminal class	Radiating measurement	Lower limit	Upper limit
5	Class I	e.r.p.	3 dBW (2 W)	10 dBW (10 W)
	Class II	e.r.p.	−2 dBW (0.63 W)	5 dBW (3.2 W)
	Class III	e.r.p.	−7 dBW (0.2 W)	0 dBW (1.0 W)
	Class IV	e.r.p.	–12 dBW (0.063 W)	–5 dBW (0.32 W)

5 Characteristics in the 1 800 MHz, 2 GHz, 2.3 GHz and 2.5 GHz frequency bands

Tables 9 and 10 contain typical technical and operational characteristics of IMT-2000 mobile and base stations systems, respectively.

Additional information is contained in the references given at the end of this Report.

TABLE 9a (INTERFACES No. 1, 2 and 3)

Characteristics of IMT-2000 mobile stations

Parameter	IMT-2000 CDMA Direct Spread [1], [25]	IMT-2000 CDMA Multi-Carrier(1)				IMT-2000 CDMA TDD (time-code) [2], [25]
Carrier spacing	5 MHz ± n × 0.2 MHz(29) For E-UTRA: Nominal Channel spacing = $(BW_{Channel(1)} + BW_{Channel(2)})/2$(30)	1.25 MHz (1X)	3.75 MHz (3X)	1.25×n MHz n = 1, ..., 15	0.768-19.6608 MHz with step size of 0.1536	1.28 Mchip/s: 1.6 MHz ± n × 0.2 MHz 3.84 Mchip/s: 5 MHz ± n × 0.2 MHz 7.68 Mchip/s: 10 MHz ± n × 0.2 MHz For E-UTRA: Nominal Channel spacing = $(BW_{Channel(1)} + BW_{Channel(2)})/2$(30)
Duplex method	FDD	FDD	FDD	FDD	FDD/TDD	TDD
Transmitter power (dBm) (typical)(3)	20	20	20	20 (total for all carriers)	20	20
TDD activity	N/A	N/A	N/A	N/A		
Transmitter power (dBm) (maximum)	24 or 21 For E-UTRA: 23	24	24	24 (total for all carriers)	24	24 or 21 For E-UTRA: 23

TABLE 9A (*continued*)

Parameter	IMT-2000 CDMA Direct Spread [1], [25]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [2], [25]
Antenna gain (dBi)	0	0	0	0	0	0
Antenna height (m)	1.5	1.5	1.5	1.5	1.5	1.5
Access techniques	CDMA[6] For E-UTRA: OFDM in DL SC-FDMA in UL	CDMA	CDMA	CDMA	CDMA/ OFDMA	TDMA/ CDMA For E-UTRA: OFDM in DL SC-FDMA in UL
Data rates supported	Pedestrian: 384 kbit/s, Vehicular: 144 kbit/s, Indoors: 2 Mbit/s Higher data rates up to 42 Mbit/s on dowlink and 11.5 Mbit/s on uplink are supported by technology enhancements (HSDPA, HSUPA, HSPA+) [23] [27] [28] For E-UTRA: Up to 299.5 Mbit/s on downlink and 75.3 Mbit/s on uplink, with 20 MHz bandwidth [29]	Up to 625.35 kbit/s on forward link and up to 433.35 kbit/s on reverse link Higher data rates up to 2 457 kbit/s are supported by technology enhancements (HRPD) [22]	Up to 2 084.55 kbit/s on forward link and up to 1 354.95 kbit/s on reverse link	Up to 18.739 Mbps/1.25MHz on forward link and Up to 4.3 Mbps/ 1.25 MHz on reverse link	Up to 288 M bits/s in 20 MHz BW on forward link and up to 75 M bits/s on reverse link	Pedestrian: 384 kbit/s, Vehicular: 144 kbit/s, Indoors: 2 Mbit/s Higher data rates up to 20.4 Mbit/s on donwlink and 17.7 Mbit/s on uplink are supported by technology enhancements (HSDPA, HSUPA, HSPA+) [23] [27] [28] For E-UTRA: Up to 299.5 Mbit/s on downlink and 75.3 Mbit/s on uplink, with 20 MHz bandwidth [29]

TABLE 9A (*continued*)

Parameter	**IMT-2000 CDMA Direct Spread [1], [25]**	**IMT-2000 CDMA Multi-Carrier[1]**				**IMT-2000 CDMA TDD (time-code) [2], [25]**
Modulation type	HPSK[10] /16-QAM For E-UTRA: QPSK/16-QAM/ 64-QAM	QPSK/BPSK	QPSK/BPSK	BPSK/QPSK/ 8-PSK/16-QAM	BPSK/QPSK/ 8-PSK	1.28 Mchip/s: QPSK/16-QAM 8-PSK 3.84 Mchip/s: QPSK/16-QAM 7.68 Mchip/s: QPSK/16-QAM For E-UTRA: QPSK/16-QAM/64-QAM
Emission bandwidth	[1], [25]	[20]	[20]			[2], [25]
–3 dB						
–20 dB						
–60 dB						
Receiver NF (worst case)	9 dB	9 dB	9 dB	9 dB	9 dB	9 dB

TABLE 9A (*continued*)

Parameter	IMT-2000 CDMA Direct Spread [1], [25]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [2], [25]
Thermal noise in specified bandwidth[12]	–108 dBm in 3.84 MHz For E-UTRA: –112.5 dBm in 1.4 MHz –109.2 dBm in 3 MHz –107 dBm in 5 MHz –104 dBm in 10 MHz –102.2 dBm in 15 MHz –101 dBm in 20 MHz	–113 dBm	–108 dBm	–113 dBm in 1.25 MHz	–101 dBm in 20 MHz	1.28 Mchip/s: –113 dBm in 1.28 MHz 3.84 Mchip/s: –108 dBm in 3.84 MHz 7.68 Mchip/s: –105 dBm in 7.68 MHz For E-UTRA: –112.4 dBm in 1.4 MHz –109.2 dBm in 3 MHz –107 dBm in 5 MHz –104 dBm in 10 MHz –102.2 dBm in 15 MHz –101 dBm in 20 MHz
Receiver thermal noise level	–99 dBm in 3.84 MHz For E-UTRA: –103.5 dBm in 1.4 MHz –100.2 dBm in 3 MHz –98 dBm in 5 MHz –95 dBm in 10 MHz –93.2 dBm in 15 MHz –92 dBm in 20 MHz	–125 dBm[15] –113 dBm –104 dBm[16]	–125 dBm[17] –113 dBm –99 dBm[18]	–104[16] dBm in 1.25 MHz	–92 dBm in 20 MHz	1.28 Mchip/s: –104 dBm in 1.28 MHz 3.84 Mchip/s: –99 dBm in 3.84 MHz 7.68 Mchip/s: –96 dBm in 7.68 MHz For E-UTRA: –103.5 dBm in 1.4 MHz –100.2 dBm in 3 MHz –98 dBm in 5 MHz –95 dBm in 10 MHz –93.2 dBm in 15 MHz –92 dBm in 20 MHz

TABLE 9A (*continued*)

Parameter	IMT-2000 CDMA Direct Spread [1], [25]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [2], [25]
Receiver bandwidth	[1], [25]	[20]	[20]	[22]		[2], [25]
E_b/N_0 for $P_e = 10^{-3}$		[20]	Performance not available	[22]		
SNR_{min} for $P_e = 10^{-6}$ (19)						
SNR including implementation loss and pilot boosting offset, SNR_{IL} (20)						
Receiver reference sensitivity (21), $\hat{I}_{or}$	–117 dBm in 3.84 MHz (21) For E-UTRA (31): –100 dBm in 5 MHz –97 dBm in 10 MHz –95.2 dBm in 15 MHz –94 dBm in 20 MHz	–104 dBm total received power in fully loaded system. Single 9 600 bit/s traffic channel is at –119.6 dBm in AWGN for 0.5% FER (21)	–99 dBm total received power in fully loaded system. Single 9 600 bit/s traffic channel is at –119.6 dBm in AWGN for 0.5% FER (21)	Single 307.2 kbit/s channel at –105.5 dBm in AWGN for 0.5% FER		–108 dBm in 1.28 MHz (21) –105 dBm in 3.84 MHz (21) –105 dBm in 7.68 MHz (21) For E-UTRA (31), (zz): –100 dBm in 5 MHz –97 dBm in 10 MHz –95.2 dBm in 15 MHz –94 dBm in 20 MHz
Interference criterion, *I*/*N* (dB) (23)						

TABLE 9A (*continued*)

Parameter	IMT-2000 CDMA Direct Spread [1], [25]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [2], [25]
Interference threshold[23]	–105 dBm in 3.84 MHz For E-UTRA: –109.5 dBm in 1.4 MHz –106.2 dBm in 3 MHz –104 dBm in 5 MHz –101 dBm in 10 MHz –99.2 dBm in 15 MHz –98 dBm in 20 MHz	–110 dBm in 1.25 MHz	–105 dBm in 3.75 MHz	–110 dBm in 1.25 MHz		–110 dBm in 1.28 MHz –105 dBm in 3.84 MHz –102 dBm in 7.68 MHz For E-UTRA: –109.5 dBm in 1.4 MHz –106.2 dBm in 3 MHz –104 dBm in 5 MHz –101 dBm in 10 MHz –99.2 dBm in 15 MHz –98 dBm in 20 MHz
Transmitter ACLR	[1], [25]	[20], (24)	[20], (25)	[22], (24)		[2], [25]
1st adjacent channel	$UTRA_{ACLR1}$ = 33 dB @ ± 5 MHz For E-UTRA[33]: $E\text{-}UTRA_{ACLR1}$ = 30 dB @ ± BW MHz[32]	31.6 dB @ ± 3.75 MHz	–33 dBc in 3.84 MHz @ ± 3.08 MHz	31.6 dB @ ± 3.75 MHz for n = 1		$UTRA_{ACLR1}$ = 33 dB @ ± 5 MHz For E-UTRA[33]: $E\text{-}UTRA_{ACLR1}$ = 30 dB @ ± BW MHz[32]
2nd adjacent channel	43 dB @ ± 10 MHz For E-UTRA[33]: $UTRA_{ACLR2}$ = 36 dB @ ± 5 MHz	48.2 dB @ ± 8.75 MHz	–43 dBc in 3.84 MHz @ ± 8.08 MHz	48.2 dB @ ± 8.75 MHz for n = 1		43 dB For E-UTRA[33]: $UTRA_{ACLR2}$ = 36 dB @ ± 5 MHz
Transmitter spurious emissions	[1], [25]	[20]	[20]	[22]		[2], [25]

TABLE 9A (*end*)

Parameter	IMT-2000 CDMA Direct Spread [1], [25]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [2], [25]
Receiver ACS	33 dB For E-UTRA: 33 dB (up to 10 MHz channel bandwidth) 30 dB (BW = 15 MHz) 27 dB (BW = 20 MHz)	64 dB[27]	50 dB	64 dB[27] for n = 1		33 dB For E-UTRA: 33 dB (up to 10 MHz channel bandwidth) 30 dB (BW = 15 MHz) 27 dB (BW = 20 MHz)
Receiver ACS_2						
Receiver blocking levels	[1], [25]	[20]	[20]	[22]		[2], [25]

TABLE 9B (INTERFACES No. 4, 5 and 6)

Characteristics of IMT-2000 mobile stations

Parameter	IMT-2000 TDMA Single-Carrier		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN[2]		
Carrier spacing	30 kHz [14]	200 kHz [7]	1.728 MHz	5 MHz	8.75MHz[34]	10 MHz
Duplex method	FDD	FDD	TDD	TDD	TDD	TDD
Transmitter power (dBm) (typical)[3]	20	20	10	20[4]	20[4]	20[4]
TDD activity factor (dB)[5]				3 dB[5]	3 dB[5]	3 dB[5]
Transmitter power (dBm) (maximum)	30 [15]	30 [8]	24	24	24	24
Antenna gain (dBi)	0	0	0	0	0	0
Antenna height (m)	1.5	1.5	1.5	≤ 1.5	≤ 1.5	≤ 1.5
Access techniques	TDMA [15]	TDMA[7]	MC/TDMA[8]	TDMA/ OFDMA	TDMA/OFDMA	TDMA/ OFDMA

TABLE 9B (*continued*)

Parameter	IMT-2000 TDMA Single-Carrier		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN[2]		
Data rates supported	13.0 kbit/s (π/4 DQPSK) 19.95 kbit/s (8-PSK downlink) 18.6 kbit/s (8-PSK uplink)	144 kbit/s [9] 384 kbit/s	1.152 Mbit/s 32 kbit/s/ timeslot (> 2 Mbit/s with aggregated time slots and 8 level modulation)	Max per user (Mbit/s)[9]: SIMO (1 x 2): DL = 10.08, UL = 2.52 MIMO (2 x 2): DL = 20.16, UL = 2.52 [24]		Max per user (Mbit/s)[9]: SIMO (1 x 2): DL = 20.16, UL = 5.04 MIMO (2 x 2): DL = 40.32, UL = 5.04 [24]
Modulation type	π/4-DQPSK 8-PSK	GMSK 8-PSK	GMSK (BT = 0.5) (+ multi-level modulation options)	QPSK 16-QAM 64-QAM (64-QAM optional), Repetition factor (*R*) 2, 4, 6	QPSK 16-QAM 64-QAM (64-QAM optional), Repetition factor (*R*) 2, 4, 6	QPSK 16-QAM 64-QAM, (64-QAM optional), Repetition factor (*R*) 2, 4, 6
Emission bandwidth	[16]		[5]	4.75 MHz as defined by –1 dB bandwidth[11]	8.447 MHz	9.5 MHz as defined by –1 dB bandwidth[11]
–3 dB		0.12 MHz [10], 0.12 MHz [11]				
–20 dB		0.18 MHz [10], 0.18 MHz [11]				

TABLE 9B (*continued*)

Parameter	IMT-2000 TDMA Single-Carrier		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN[2]		
–60 dB		0.40 MHz [10], 0.60 MHz [11]				
Receiver NF (worst case)	9 dB	9 dB	10 dB	5 dB for single band and 8 dB for multi-band designs	5 dBm	5 dB for single band and 8 dB for multi-band designs
Thermal noise in specified bandwidth[12]	–128 dBm[13]	–121 dBm[14]	–113 dBm in 1.152 MHz	–107 dBm in 4.75 MHz	–104.51 dBm in 8.447 MHz	–104 dBm in 9.5 MHz
Receiver thermal noise level	–119 dBm	–112 dBm	–102 dBm in 1.728 MHz	–102 dBm in 4.75 MHz for 5 dB NF and –99 for 8 dB NF	–99.51 dBm In 8.447 MHz	–99 dBm in 9.5 MHz for 5 dB NF and –96 for 8 dB NF
Receiver bandwidth	[17]	[12]	[5]	4.75 MHz as defined by –1 dB bandwidth[11]	8.447 MHz	9.5 MHz as defined by –1 dB bandwidth[11]
E_b/N_0 for $P_e = 10^{-3}$	7.8 dB	8.4 dB	11 dB (non-coherent detection)	N/A		N/A
SNR_{min} for $P_e = 10^{-6}$ [19]				2.9 (QPSK 1/2 rate convolutional turbo code in AWGN)	2.9 (QPSK 1/2 rate convolutional turbo code in AWGN)	2.9 (QPSK 1/2 rate convolutional turbo code in AWGN)
SNR including implementation loss and pilot boosting offset, SNR_{IL}[20]				8.4 dB (QPSK 1/2 rate convolutional turbo code in AWGN)	8.4 dB (QPSK 1/2 rate convolutional turbo code in AWGN)	8.4 dB (QPSK 1/2 rate convolutional turbo code in AWGN)

TABLE 9B (*continued*)

Parameter	IMT-2000 TDMA Single-Carrier		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN[2]		
Receiver reference sensitivity[21], $\hat{I}_{or}$	–113 dBm[21] [18]	–102 dBm[21] [9]	–94 dBm typical (spec.: –86 dBm for speech and generally –83 dBm)[21]	–91.0 dBm (QPSK 1/2 rate convolutional turbo code in AWGN)[22]	–88.51 dBm	–88.0 dBm (QPSK 1/2 rate convolutional turbo code in AWGN)[22]
Receiver reference sensitivity[21], $\hat{I}_{or}$	–113 dBm[21] [18]	–102 dBm[21] [9]	–94 dBm typical (spec.: –86 dBm for speech and generally –83 dBm)[21]	–91.0 dBm (QPSK 1/2 rate convolutional turbo code in AWGN)[22]	–88.51 dBm	–88.0 dBm (QPSK 1/2 rate convolutional turbo code in AWGN)[22]
Interference criterion, I/N (dB)[23]				–6 dB		–6 dB
Interference threshold[23]	No equivalent	[13]	–105 dBm typical (–97 dBm for specification speech)	–108 dBm or in 4.75 MHz for single band and –105 dBm for multi-band devices	–105.51 dBm in 8.447 MHz for single band and –102.51 dBm for multi-band devices	–105 dBm in 9.5 MHz for single band and –102 dBm for multi-band devices
Transmitter ACLR			[5]	[26]		[26]
1st adjacent channel				33 dB (3.84 MHz Rx) 30 dB (4.75 MHz Rx) @ ± 5 MHz	30 dB (8.447 MHz Rx) @ ± 8.75 MHz	33 dB (7.68 MHz Rx) 30 dB (9.5 MHz Rx) @ ± 10 MHz

TABLE 9B (*end*)

Parameter	IMT-2000 TDMA Single-Carrier		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN[2]		
2nd adjacent channel				43 dB (3.84 MHz Rx) 44 dB (4.75 MHz Rx) @ ± 10 MHz	44 dB (8.447 MHz Rx) @ ± 17.5 MHz	43 dB (7.68 MHz Rx) 44 dB (9.5 MHz Rx) @ ± 20 MHz
Transmitter spurious emissions			[5]	(11)		(11)
Receiver ACS				33 dB[28]		33 dB
Receiver ACS_2				47 dB[28]		47 dB
Receiver blocking levels			[5]			

ACS Adjacent channel selectivity.

ACLR Adjacent channel leakage power ratio.

AWGN Additive white Gaussian noise.

FER Frame error rate.

GMSK Gaussian filtered minimum shift keying.

N/A Not applicable.

NF Noise figure.

Notes relatives to Tables 9A and 9B:

(1) The IMT-2000 minimum performance requirements recorded here for IMT-2000 CDMA multicarrier are defined in the band class 6 (i.e. 2 GHz band) requirements in [20]. This is also relevant to the technology enhancements (HRPD) requirements contained in [22].

(2) The OFDMA TDD WMAN parameters are for the 2 500 to 2 690 MHz band.

(3) May not be appropriate for all scenarios, for example when calculating aggregate interference from all users in a cell.

(4) TX power reported is typical and higher values may be available based on region. TX power is the RF power averaged during the transmit burst, without considering traffic statistics or lowered-power operation or UL/DL ratio.

(5) A function of UL/DL ratio of the TDD mode; this parameter is not applicable to FDD operation.

(6) Desired signal at sensitivity, $I/N = -6$ dB for a 10% loss in range applicable to cases where interference effects a limited number of cells. In other cases, e.g. international coordination with BSS sound in the 2.5 GHz band a trigger value of $I/N = -10$ dB is appropriate.

(7) TDMA, comprising 8 timeslots (577 µs) per single TDMA frame (4.615 ms). For user packet data service, 1-4 timeslots per frame may be used by mobile stations having multi-slot classes that do not require simultaneous transmission and reception, i.e. classes for which a duplexer is not required.

(8) Ten frequency channels with 24 time slots (32 kbit/s) per frame. The frame length is 10 ms.

(9) The rates provided are for the case of DL:UL ratio of 2:1. For more information, please refer to [24].

(10) Hybrid phase shift keying: a method peculiar to IMT-2000 CDMA Direct Spread in which the peak to average ratio is reduced in comparison to a QPSK signal by mixing the orthogonal variable spreading factor (OSVF) with both information sources as real signals, i.e. those destined for I and Q modulation components, and then shifting one component by 90° to produce an equivalent imaginary signal and then utilizing gain control on the Q channel to preserve orthogonality.

(11) Please refer to Recommendation ITU-R M.1581, Annex 6 for more information.

(12) $10 \log (k\ T\ b) + 30$ (dBm)

where:

k: Boltzman's constant = 1.38×10^{-23}, T: reference temperature = average Earth temperature = 277 K, b: noise equivalent bandwidth (Hz).

(13) In the receiver bandwidth.

(14) In the receiver bandwidth.

(15) In bandwidth equal to data rate: for IMT-2000 CDMA multicarrier, values are given for 9 600 bit/s speech services and nominal supported rate (153.6 kbit/s) for data services.

(16) In the receiver bandwidth.

(17) In bandwidth equal to data rate: for IMT-2000 CDMA multicarrier, values are given for 9 600 bit/s speech services and nominal supported rate (153.6 kbit/s) for data services.

(18) In the receiver bandwidth.

Notes relatives to Table 9A and 9B (continued):

(19) SNR_{min} is minimum required signal to noise ratio for BER probability of 1×10^{-6}.

(20) $SNR_{IL} = SNR_{min}$ + implementation loss + pilot boosting offset. Implementation loss is 5 dB and pilot boosting offset is 0.46 dB for mandatory PUSC on the downlink.

(21) For a 10–3 raw bit error rate, $\hat{I}_{or}$, the received power spectral density (integrated in a bandwidth of $(1 + \alpha)$ times the chip rate and normalized to the chip rate) of the downlink signal as measured at the UE antenna connector.

(22) Receiver sensitivity = $-114 + SNR_{min} - 10 \log_{10}(R) + 10 \log_{10}$ (receiver bandwidth (MHz)) + implementation loss + pilot boosting offset + receiver NF. The sensitivity value given in the Table is calculated with a NF of 8 dB and a repetition factor, R, of 1.

(23) $I/N = -6$ dB for a 10% loss in range applicable to cases where interference effects a limited number of cells. In other cases, e.g. sharing with BSS (sound) in the 2 630-2 655 MHz band, a value of $I/N = -10$ dB is appropriate. The I/N of –10 dB, corresponding to about half a dB impact on the receiver sensitivity, is a stringent criterion which is recommended in certain cases including in some ITU-R Recommendations. The number –6 dB, corresponding to 1 dB impact on the receiver sensitivity, however, is also recommended in Recommendation ITU-R F.758-3.

(24) Currently [19], [20], [21] and [22] do not contain explicit 1X and HRPD mobile station or base station ACLR requirements. Nevertheless, the 1X spectrum emission limits described in [20] and [22] already provide protection of adjacent channels. A lower bound for the effective ACLR can be calculated by integrating the maximum allowed 1X and HRPD emissions over a 3.84 MHz integration bandwidth centered at the specified frequency offset are considered. Results summarized in this Table are calculated by assuming a 24 dBm mobile station output power, and a one 43 dBm output power base station. The actual 1X ACLR value in practical implementations will be considerably better since the emission limits (i.e. flat mask, no slope) in the region of the second adjacent channel do not realistically model a power amplifier emissions roll-off.

(25) The requirements at offsets of 3.08 and 8.08 MHz are equivalent to ACLR requirements of 33 and 43 dB from a 3X mobile station transmitter into a 3X or IMT-DS mobile station receiver offset by 5 and 10 MHz respectively. With regard to base stations, [19] currently does not contain an explicit ACLR requirement for base stations. Nevertheless, the 1X spectrum emission limits described in [19] already provide protection of adjacent channels. A lower bound for the effective ACLR can be calculated by integrating the maximum allowed emissions of three neighbouring IMT-MC 1X channels over a 3.84 MHz integration bandwidth centered at the specified frequency offset. Results summarized in this Table are produced assuming three adjacent 38 dBm output power 1X base stations; the aggregate output power over the 5 MHz of assigned.

(26) ACLR values are specified in Recommendation ITU-R M.1581, Annex 6.

(27) The test equipment ACLR (i.e. in-band emissions contributions) effectively limits the mobile station ACS that can be tested.

(28) ACS = SNR_{min} + implementation loss + pilot boosting offset + M $-10 \log_{10}(10^{M/10} - 1)$ + ACR, where the test margin, M , is given in IEEE802.16 as 3 dB, and the ACR values are contained in the global core specification (WiMAX Forum Mobile Radio Specification version 0.3.1).

(29) In DC-HSDPA and DB-DC-HSDPA mode, the UE receives two cells simultaneously.

(30) $BW_{Channel(1)}$ and $BW_{Channel(2)}$ are the channel bandwidths of the two respective E-UTRA carriers. Supported channel bandwidths: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz.

(31) For QPSK modulation, the minimum mean power applied to both the UE antenna ports at which the throughput shall be $\geq 95\%$ of the maximum throughput for the specified reference measurement channel.

Notes relatives to Table 9A and 9B (end):

(32) BW represents the channel bandwidth. Supported channel bandwidths: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz.

(33) The ACLR value provided in the table applies to a single-UE occupying the whole channel bandwidth.

(34) Only applicable to the band 2 300-2 400 MHz band.

(35) These values have been copied from the E-UTRAN FDD parameters (it is noted that the values for E-UTRAN FDD BS and E-UTRAN TDD BS are identical).

TABLE 10A (INTERFACES No. 1, 2 and 3)

Characteristics of IMT-2000 base stations

Parameter	**IMT-2000 CDMA Direct Spread [3], [6], [26]**	**IMT-2000 CDMA Multi-Carrier[1]**				**IMT-2000 CDMA TDD (time-code) [4], [26]**
Carrier spacing	5 MHz ± n × 0.2 MHz For E-UTRA: Nominal Channel spacing = $(BW_{Channel(1)} + BW_{Channel(2)})/2$ (34)	1.25 MHz (1X)	3.75 MHz (3X)	1.25×n MHz n = 1, ..., 15	0.768-19.6608 MHz with step size of 0.1536	1.28 Mchip/s: 1.6 MHz ± n × 0.2 MHz 3.84 Mchip/s: 5 MHz ± n × 0.2 MHz 7.68 Mchip/s: 10 MHz ± n × 0.2 MHz For E-UTRA: Nominal Channel spacing = $(BW_{Channel(1)} + BW_{Channel(2)})/2$ (34)
Duplex method	FDD	FDD	FDD	FDD	FDD/TDD	TDD
Reuse factor				K=1, K=2, K >1		
TDD activity factor (dB)(3)				N/A		

TABLE 10A (*continued*)

Parameter	**IMT-2000 CDMA Direct Spread [3], [6], [26]**				**IMT-2000 CDMA Multi-Carrier[1]**												**IMT-2000 CDMA TDD (time-code) [4], [26]**		
Cell type	Macro	Micro	Pico	Femto	Macro	Micro	Pico	Macro	Micro	Pico	Macro	Micro			Macro	Pico	Macro	Micro	Pico
Transmitter power dBm[4]	43 (E-UTRAN) 43 for BW = 1.4, 3, 5 MHz 46 for BW = 10, 15, 20 MHz	38	24	20 (w/o MIMO) 17 (with MIMO) (E-UTRAN) 20 (1 transmit antenna) 17 (2 transmit antennas) 14 (4 transmit antennas)	40			40			43			40			43 (E-UTRAN) 43 for BW = 1.4, 3, 5 MHz 46 for BW = 10, 15, 20 MHz		(E-UTRAN) 24 (1 transmit antenna) 21 (2 transmit antennas) 18 (4 transmit antennas)
Antenna gain[6, 7] (dBi/120° sector)	17	5	0	0	17			17			17[33]			17[33]			17	5	0
Antenna height (m)[4]	30	5	2	2	30			30			30	5	1.5	30	5	1.5	30	5	2
Tilt of antenna (degrees down)[4]	2.5	0	0	0	2.5[33]			2.5[33]			2.5[33]			2.5[33]			2.5	0	0
Access techniques	CDMA (E-UTRAN) OFDM in DL SC-FDMA in UL				CDMA			CDMA			CDMA/OFDMA			OFDMA			TDMA/CDMA (E-UTRAN) OFDM in DL SC-FDMA in UL		

TABLE 10A (*continued*)

Parameter	**IMT-2000 CDMA Direct Spread [3], [6], [26]**	**IMT-2000 CDMA Multi-Carrier[1]**				**IMT-2000 CDMA TDD (time-code) [4], [26]**
Data rates supported	Pedestrian: 384 kbit/s, Vehicular: 144 kbit/s, Indoors: 2 Mbit/s Higher data rates up to 42 Mbit/s on downlink and 11.5 Mbit/s on uplink are supported by technology enhancements (HSDPA, HSUPA, HSPA+) [23] [27] [28] (E-UTRAN) Up to 299.5 Mbit/s on downlink and 75.3 Mbit/s on uplink, with 20 MHz bandwidth [29]	Up to 625.35 kbit/s on forward link and up to 433.35 kbit/s on reverse link Higher data rates up to 2 457 kbit/s are supported by technology enhancements (HRPD) [21]	Up to 2 084.55 kbit/s on forward link and up to 1 354.95 kbit/s on reverse link	Up to 18.739 Mbit/s/ 1.25 MHz on forward link and Up to 4.3 Mbit/s/ 1.25 MHz on reverse link	Up to 288 Mbits/s in 20 MHz BW on forward link and up to 75 Mbits/s on reverse link	Pedestrian: 384 kbit/s, Vehicular: 144 kbit/s, Indoors: 2 Mbit/s Higher data rates up to 20.4 Mbit/s on downlink and 17.7 Mbit/s on uplink are supported by technology enhancements (HSDPA) [23] Pedestrian: 384 kbit/s, Vehicular: 144 kbit/s, Indoors: 2 Mbit/s Higher data rates up to 10.2 Mbit/s are supported by technology enhancements (HSDPA, HSUPA, HSPA+) [23] [27] [28] (E-UTRAN) Up to 299.5 Mbit/s on downlink and 75.3 Mbit/s on uplink, with 20 MHz bandwidth [29]
Modulation type	QPSK/16-QAM For E-UTRA: QPSK/16-QAM/64-QAM	QPSK/BPSK 8-PSK/ 16-QAM[11]	QPSK/BPSK	BPSK/QPSK/ 8-PSK/ 16-QAM/ 64-QAM	QPSK/ 8-PSK/ 16-QAM/ 64-QAM	1.28 Mchip/s: QPSK/ 8-PSK/16-QAM 3.84 Mchip/s: QPSK/16-QAM 7.68 Mchip/s: QPSK/16-QAM For E-UTRA: QPSK/16-QAM/64-QAM
Emission bandwidth	[3] [26]	[19]	[19]	[21]		[4], [26]
–3 dB						
–20 dB						

TABLE 10A (*continued*)

Parameter	IMT-2000 CDMA Direct Spread [3], [6], [26]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [4], [26]
–60 dB						
Thermal noise density (dBm/Hz)						
Receiver NF (worst case)	5 dB for macro BS	5 dB	5 dB	5 dB for macro BS	5 dB for macro BS	1.28 Mchip/s: 7 dB for macro BS 3.84 Mchip/s: 5 dB for macro BS
Receiver thermal noise level[12]	–103 dBm in 3.84 MHz for macro BS For E-UTRA: –107.5 dBm in 1.4 MHz –104.2 dBm in 3 MHz –102 dBm in 5 MHz –99 dBm in 10 MHz –97.2 dBm in 15 MHz –96 dBm in 20 MHz	–129 dBm –117 dBm[13] –108 dBm[14]	–129 dBm –117 dBm[15] –103 dBm[16]	–108 dBm in 1.25 MHz[14]	–96 dBm in 20 MHz[14]	1.28 Mchip/s: –106 dBm in 1.28 MHz for macro BS 3.84 Mchip/s: –103 dBm in 3.84 MHz for macro BS 7.68 Mchip/s: –100 dBm in 7.68 MHz for macro BS For E-UTRA: –107.5 dBm in 1.4 MHz –104.2 dBm in 3 MHz –102 dBm in 5 MHz –99 dBm in 10 MHz –97.2 dBm in 15 MHz –96 dBm in 20 MHz
Receiver bandwidth	< 5 MHz [3] For E-UTRA: < BW, where BW is the channel bandwidth [35]	[19]	[19]	[21]		1.28 Mchip/s: < 1.6 MHz [4] 3.84 Mchip/s: < 5 MHz [4] 7.68 Mchip/s: < 10 MHz [4] For E-UTRA: < BW, where BW is the channel bandwidth [35]

TABLE 10A (*continued*)

Parameter	IMT-2000 CDMA Direct Spread [3], [6], [26]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [4], [26]
−3 dB						
−20 dB						
−60 dB						
Eb/N_0 for $P_e = 10^{-3}$	[3]	[19]	Performance not available	[21]		
SNR_{min} for $P_e = 10^{-6}$ (20)						
SNR including implementation loss, SNR_{IL} (21)						

TABLE 10A (*continued*)

Parameter	IMT-2000 CDMA Direct Spread [3], [6], [26]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [4], [26]
Receiver reference sensitivity[22]	−121 dBm[23] for macro BS −111 dBm for micro BS −107 dBm for pico and femto BS For E-UTRA: macro BS: −106 dBm in 1.4 MHz −103 dBm in 3 MHz −101.5 dBm in 5, 10, 15, 20 MHz pico and femto BS: –98.8 dBm in 1.4 MHz –95 dBm in 3 MHz –93.5 dBm in 5, 10, 15, 20 MHz	−119 dBm for fundamental channel in AWGN	−119 dBm for fundamental channel in AWGN	−117 (Band Group 1900) /−119 (Band Group 450 and 800) dBm for 9600 bit/s in AWGN		1.28 Mchip/s: −110 dBm for macro and micro BS –96 dBm for pico BS 3.84 Mchip/s: −109 dBm for macro and micro BS –95 dBm for pico BS 7.68 Mchip/s: −109 dBm for macro and micro BS –95 dBm for pico BS For E-UTRA: macro BS: −106 dBm in 1.4 MHz −103 dBm in 3 MHz −101.5 dBm in 5, 10, 15, 20 MHz pico and femto BS: –98.8 dBm in 1.4 MHz –95 dBm in 3 MHz –93.5 dBm in 5, 10, 15, 20 MHz
Interference criterion, I/N (dB)[25]						

TABLE 10A (*continued*)

Parameter	IMT-2000 CDMA Direct Spread [3], [6], [26]	IMT-2000 CDMA Multi-Carrier[1]				IMT-2000 CDMA TDD (time-code) [4], [26]
Interference threshold for macro BS 1[25]	–109 dBm in 3.84 MHz[26] For E-UTRA[26]: –113.5 dBm in 1.4 MHz –110.2 dBm in 3 MHz –108 dBm in 5 MHz –105 dBm in 10 MHz –103.2 dBm in 15 MHz –102 dBm in 20 MHz	–114 dBm in 1.25 MHz	–109 dBm in 3.75 MHz	–114 dBm in 1.25 MHz		1.28 Mchip/s: –112 dBm in 1.28 MHz 3.84 Mchip/s: –109 dBm in 3.84 MHz 7.68 Mchip/s: –106 dBm in 7.68 MHz For E-UTRA[26]: –113.5 dBm in 1.4 MHz –110.2 dBm in 3 MHz –108 dBm in 5 MHz –105 dBm in 10 MHz –103.2 dBm in 15 MHz –102 dBm in 20 MHz
Transmitter ACLR for macro/micro/ pico BS	[3], [6], [26]	[19][27]	[19][28]	[19][27] for n = 1		[4], [26]
1st adjacent	45 dB @ ± 5 MHz For E-UTRA: 45 dB @ ± BW MHz[35]	50.8 dB @ ± 3.75 MHz	49.3 dB @ ± 5 MHz	50.8 dB @ ± 3.75 MHz for n = 1		1.28 Mchip/s: 40 dB @ ± 1.6 MHz 3.84 Mchip/s: 45 dB @ ± 5 MHz 7.68 Mchip/s: 45 dB @ ± 10 MHz For E-UTRA: 45 dB @ ± BW MHz[35]
2nd adjacent	50 dB @ ± 10 MHz For E-UTRA: 45 dB @ ± 2 x BW MHz[35]	67.2 dB @ ± 8.75 MHz	62.2 dB @ ± 10 MHz	67.2 dB @ ± 8.75 MHz for n = 1		1.28 Mchip/s: 45 dB @ ± 3.2 MHz 3.84 Mchip/s: 55 dB @ ± 10 MHz 7.68 Mchip/s: 55 dB @ ± 20 MHz For E-UTRA: 45 dB @ ± 2 x BW MHz[35]

TABLE 10A (*continued*)

Parameter	**IMT-2000 CDMA Direct Spread [3], [6], [26]**	**IMT-2000 CDMA Multi-Carrier[1]**				**IMT-2000 CDMA TDD (time-code) [4], [26]**
Transmitter spurious emissions	[3], [6], [26]	[19]	[19]	[21]		[4], [26]
Macro BS receiver ACS (relative ACS)	–52 dBm (46 dB)[31] For E-UTRA: –49 dBm	–53 dBm	–49 dBm	–53 dBm for n = 1		1.28 Mchip/s: –55 dBm (46 dB)[26] 3.84 Mchip/s: –52 dBm (46 dB)[26] 7.68 Mchip/s: –49 dBm (46 dB)[31] For E-UTRA: –49 dBm
Macro BS receiver ACS_2						
Micro BS receiver ACS (relative ACS)	–42 dBm (46 dB)[26]					
Pico and Femto BS receiver ACS (relative ACS)	–38 dBm (46 dB)[26] For E-UTRA: –41 dBm					1.28 Mchip/s: –41 dBm (46 dB)[26] 3.84 Mchip/s: –38 dBm (46 dB)[26] 7.68 Mchip/s: –35 dBm (46 dB)[26] For E-UTRA: –41 dBm

TABLE 10A (*end*)

Parameter	**IMT-2000 CDMA Direct Spread [3], [6], [26]**	**IMT-2000 CDMA Multi-Carrier[1]**				**IMT-2000 CDMA TDD (time-code) [4], [26]**
Femto BS receiver ACS (relative ACS)	–38 dBm (46 dB)[26] For E-UTRA: –33 dBm					
Receiver blocking levels	[3], [6], [26]	[19]	[19]	[19]	[21]	[4], [26]
Co-located antenna minimum coupling loss (dB)[32]						

TABLE 10B (INTERFACES No. 4, 5 and 6)

Characteristics of IMT-2000 base stations

Parameter	IMT-2000 TDMA Single-Carrier[2]			IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN		
Carrier spacing	30 kHz		200 kHz	1.728 MHz	5 MHz	8.75 MHz	10 MHz
Duplex method	FDD		FDD	TDD	TDD	TDD	TDD
Reuse factor					1:1; 1:3	1:1; 1:3	1:1; 1:3
TDD activity factor (dB)[3]					3 dB[4]	3 dB[4]	3 dB[4]
Cell type	Macro	Micro	Pico	Omni	Macro	Macro	Macro
Transmitter power dBm[4]	40			24	36[5]	36[5]	36[5]
Antenna gain[6], [7] (dBi/120° sector)	17			Maximum 12 Normal 0	18[8], [9]	18[8], [9]	18[8], [9]
Antenna height (m)[4]	30			1.5-10 (typical 2.5)	15-30	15-30	15-30
Tilt of antenna (degrees down)[4]	2.5				2.5	2.5	2.5
Access techniques	TDMA		TDMA	MC/ TDMA	TDMA/ OFDMA	TDMA/ OFDMA	TDMA/ OFDMA
Data rates supported	30 kbit/s 44 kbit/s		384 kbit/s	1.152 Mbit/s 32 kbit/s/ timeslot (> 2 Mbit/s with aggregated time slots and 8 level modulation)	Max per user (Mbit/s)[10]: SIMO (1x2): DL=10.08, UL=2.52		Max per user (Mbit/s)[10]: SIMO (1x2): DL=20.16, UL=5.04 MIMO (2x2): DL=20.16, UL=2.52 [24]

TABLE 10B (*continued*)

Parameter	IMT-2000 TDMA Single-Carrier[2]		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN		
Modulation type	π/4-DQPSK 8-PSK	GMSK 8-PSK	GMSK (BT = 0.5) (+ multi-level modulation options)	QPSK 16-QAM 64-QAM, Repetition factor (R) 2, 4, 6	QPSK 16-QAM 64-QAM, Repetition factor (R) 2, 4, 6	QPSK 16-QAM 64-QAM, Repetition factor (R) 2, 4, 6
Emission bandwidth			[5]	4.75 MHz as defined by –1 dB bandwidth [12]	8.447MHz as defined by –1 dB bandwidth	9.5 MHz as defined by –1 dB bandwidth [12]
–3 dB	0.03 MHz	0.18 MHz				
–20 dB	0.03 MHz	0.22 MHz				
–60 dB	0.04 MHz	0.24 MHz				
Thermal noise density (dBm/Hz)				–174 dBm/Hz	–174 dBm/Hz	–174 dBm/Hz
Receiver NF (worst case)	5 dB	5 dB	10 dB	3 dB with tower top LNA, 5 dB otherwise	3 dB with tower top LNA, 5 dB otherwise	3 dB with tower top LNA, 5 dB otherwise
Receiver thermal noise level[12]	–125 dBm [17]	–117 dBm [18]	–103 dBm in 1.152 MHz	–104 dBm for tower top LNA case and –102 dBm for other cases in 4.75 MHz	–101.51 dBm for tower top LNA case and –99.51 dBm for other cases in 8.447 MHz	–101 dBm for tower top LNA case and –99 dBm for other cases in 9.5 MHz
Receiver bandwidth			[5]	4.75 MHz as defined by –1 dB bandwidth[19]	8.447 MHz as defined by –1 dB bandwidth	9.5 MHz as defined by –1 dB bandwidth[22]
–3 dB	0.03 MHz	0.18 MHz				

TABLE 10B (*continued*)

Parameter	IMT-2000 TDMA Single-Carrier[2]		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN		
–20 dB	0.04 MHz	0.25 MHz				
–60 dB	0.09 MHz	0.58 MHz				
Eb/N_0 for $P_e = 10^{-3}$	7.8 dB	8.4 dB	11 dB (non-coherent detection)			
SNRmin for $Pe = 10^{-6}$ [20]				2.9 dB (QPSK 1/2 rate convolutional turbo code in AWGN)	2.9 dB (QPSK 1/2 rate convolutional turbo code in AWGN)	2.9 dB (QPSK 1/2 rate convolutional turbo code in AWGN)
SNR including implemen-tation loss, *SNRIL*[21]				7.9 dB (QPSK 1/2 rate convolutional turbo code in AWGN)	7.9 dB (QPSK 1/2 rate convolutional turbo code in AWGN)	7.9 dB (QPSK 1/2 rate convolutional turbo code in AWGN)
Receiver reference sensitivity[22]	–117 dBm	–108 dBm	–94 typical (specification: –86 dBm for speech and generally –83 dBm)	–94.5 dBm [24]		–91.5 dBm[24]
Interference criterion, *I*/*N* (dB)[25]	–131 dBm	–123 dBm	–105 dBm typical (–97 dBm for speech specification)	–110 dBm with 3 dB NF and –108 dBm with 5 dB NF in 4.75 MHz	–107.51 dBm with 3 dB NF and –105.51 dBm with 5 dB NF in 8.447 MHz	–107 dBm with 3 dB NF and –105 dBm with 5 dB NF in 9.5 MHz
Interference threshold for macro BS 1[25]				[29]		[30]
Transmitter ACLR for macro/micro/ pico BS						

TABLE 10B (*continued*)

Parameter	IMT-2000 TDMA Single-Carrier[2]		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN		
1st adjacent				45 53.5 dB (3.84 MHz Rx) @ ± 5 MHz inter-system case[36] 45 dB (4.75 MHz Rx) @ ± 5 MHz Intra-system case		45 53.5 dB (7.68 MHz Rx) @ ± 10 MHz inter-system case[36] 45 dB (9.5 MHz Rx) @ ± 10 MHz Intra-system case
2nd adjacent				50[37] 66 dB (3.84 MHz Rx) @ ± 10 MHz Inter-system case[36] 55 dB (4.75 MHz Rx) @ ± 10 MHz Intra-system case[36]		50[37] 66 dB (7.68 MHz Rx) @ ± 20 MHz inter-system case[36] 55 dB (9.5 MHz Rx) @ ± 20 MHz Intra-system case[36]
Transmitter spurious emissions				[19]		[19]
Macro BS receiver ACS (relative ACS)				46 dB[30]		46 dB[30]
Macro BS receiver ACS_2				56 dB[30]		56 dB[30]

TABLE 10B (*end*)

Parameter	IMT-2000 TDMA Single-Carrier[2]		IMT-2000 FDMA/ TDMA (frequency-time) [5]	IMT-2000 OFDMA TDD WMAN		
Micro BS receiver ACS (relative ACS)						
Pico BS receiver ACS (relative ACS)						
Receiver blocking levels						
Co-located antenna minimum coupling loss (dB)[32]				30 dB		30 dB

Notes relative to Tables 10A and 10B:

(1) The IMT-2000 minimum performance requirements recorded here for IMT-2000 CDMA multicarrier are defined in the band class 6 (i.e. 2 GHz band) requirements in [19]. This is also relevant to the technology enhancements (HRPD) requirements contained in [21].

(2) IMT-2000 TDMA single carrier consists of three components: enhancements to the 30 kHz channels (designated as 136+) for advanced voice and data capabilities, a 200 kHz carrier component for high speed data (384 kbit/s) accommodating high mobility (designated as 136HS outdoor), and a 1.6 MHz carrier component for very high speed data (2 Mbit/s) in low mobility applications (designated as 136HS indoor). The combined result constitutes the IMT-2000 radio interface referred to as IMT-2000 TDMA single carrier.

(3) A function of UL/DL ratio of the TDD mode, this parameter is not applicable to FDD operation.

(4) May not be appropriate for all scenarios.

(5) TX power reported is typical and higher values may be available based on region. TX power is the RF power averaged during the transmit burst, without considering traffic statistics or lowered-power operation or UL/DL ratio.

(6) Feeder losses are not included in the values and should be considered in the sharing/compatibility issues. In the case of using a tower top LNA, this loss is negligible and does not need to be included in the sharing/compatibility studies.

(7) The reference pattern is specified in Recommendation ITU-R F.1336 with (k = 0.2).

(8) See 3GPP TR 25.892 v2.0.0 2004-06.

Notes relative to Tables 10A and 10B (continued):

(9) See Recommendation ITU-R M.1646/Recommendation ITU-R F.1336-1.

(10) The rates provided are for the case of DL:UL ratio of 2:1. For more information, please refer to [24].

(11) Both HRPD and IMT-2000 CDMA multicarrier revision C support 8-PSK and 16-QAM on the forward packet channel.

(12) Receiver thermal noise level as defined by thermal noise in specified bandwidth + receiver NF.

(13) In bandwidth equal to data rate: for IMT-2000 CDMA multicarrier, values are given for 9 600 bit/s speech services and nominal supported rate for data services.

(14) In the receiver bandwidth.

(15) In bandwidth equal to data rate: for IMT-2000 CDMA multicarrier, values are given for 9 600 bit/s speech services and nominal supported rate for data services.

(16) In the receiver bandwidth.

(17) In bandwidth equal to data rate: for IMT-2000 CDMA multicarrier, values are given for 9 600 bit/s speech services and nominal supported rate for data services.

(18) In bandwidth equal to data rate: for IMT-2000 CDMA multicarrier, values are given for 9 600 bit/s speech services and nominal supported rate for data services.

(19) Please refer to Recommendation ITU-R M.1580, Annex 6 for more information.

(20) *SNRmin* is minimum required signal to noise ratio for BER probability of 1×10^{-6}.

(21) $SNRIL = SNR_{min}$ + implementation loss. Implementation loss is 5 dB. Note that pilots are not boosted in mandatory PUSC on the uplink.

(22) For a 10^{-3} raw bit error rate, theoretical E_b/N_0.

(23) The thermal noise figure for a WCDMA receiver is –108 dBm based on k T f where k is Boltzmann's constant (1.38×10^{-23}), T is the temperature (K), and f is the bandwidth (Hz). For a noise figure of 4 dB (typical value for a base station receiver), the thermal noise becomes –104 dBm. However, receiver sensitivity depends on the service (i.e. voice, packet, etc.). For example, the voice (DTCH 32) sensitivity for the base station receiver is –121 dBm for BER < 0.001.

(24) Receiver sensitivity = $-114 + SNR_{min} - 10 \log_{10}(R) + 10 \log_{10}$ (receiver bandwidth (MHz)) + implementation loss + receiver NF. The sensitivity value given in the Table is calculated with a NF of 5 dB and a repetition factor, *R*, of 1.

(25) $I/N = -6$ dB for a 10% loss in range applicable to cases where interference effects a limited number of cells. In other cases, e.g. sharing with BSS (sound) in the 2 630-2 655 MHz band a value of $I/N = -10$ dB is appropriate. The I/N of –10 dB, corresponding to about half a dB impact on the receiver sensitivity, is a stringent criterion which is recommended in certain cases including in some ITU-R Recommendations. The number –6 dB, corresponding to 1 dB impact on the receiver sensitivity, however, is also recommended in Recommendation ITU-R F.758-3.

(26) The tolerable I/N thresholds are as follows: coordinated use (–6 dB), agreement trigger (–10 dB), licence exempt (–20 dB).

Notes relative to Tables 10A and 10B (end):

(27) Currently [19], [20], [21] and [22] do not contain explicit 1X mobile station or base station ACLR requirements. Nevertheless, the 1X spectrum emission limits described in [19] and [21] already provide protection of adjacent channels. A lower bound for the effective ACLR can be calculated by integrating the maximum allowed 1X emissions over a 3.84 MHz integration bandwidth centered at the specified frequency offset are considered. Results summarized in this Table are calculated by assuming a 24 dBm mobile station output power, and a one 43 dBm output power base station. The actual 1X ACLR value in practical implementations will be considerably better since the emission limits (i.e. flat mask, no slope) in the region of the second adjacent channel do not realistically model a power amplifier emissions roll-off.

(28) The requirements at offsets of 3.08 and 8.08 MHz are equivalent to ACLR requirements of 33 and 43 dB from a 3X mobile station transmitter into a 3X or IMT-DS mobile station receiver offset by 5 and 10 MHz respectively. With regard to base stations, [19] currently does not contain an explicit ACLR requirement for base stations. Nevertheless, the 1X spectrum emission limits described in [19] already provide protection of adjacent channels. A lower bound for the effective ACLR can be calculated by integrating the maximum allowed emissions of three neighbouring IMT-MC 1X channels over a 3.84 MHz integration bandwidth centered at the specified frequency offset. Results summarized in this Table are produced assuming three adjacent 38 dBm output power 1X base stations; the aggregate output power over the 5 MHz of assigned channels is 43 dBm.

29) ACLR values are specified in Recommendation ITU-R M.1580, Annex 6.

(30) ACS = SNR_{min} + implementation loss + M –10 $\log_{10}$ ($10^{M/10}$ – 1) + ACR, where the test margin, M, and the ACR are contained in the global core specification (WiMAX Forum Mobile Radio Specification version 0.3.1).

(31) The absolute ACS values are the test values as specified in 3GPP TS25.104 and TS 25.105. The following conversion formula:

ACS_relative = ACS_test – Noise_floor – 10 $\log_{10}$ ($10^{M/10}$ – 1)

can be used to derive relative ACS values, where M is the margin (dB) used in the ACS test, which is the useful signal level above the reference sensitivity level. For both IMT-2000 CDMA direct spread and IMT-2000 CDMA TDD (time code), M = 6 dB. ACS relative values are often used in sharing studies.

(32) For co-located base stations, this parameter captures the minimum coupling loss between two systems. NOTE – Higher values are achievable. For example, Report ITU-R M.2045 suggests that a coupling loss of up to 70 dB is achievable with a few meters of antenna separation. In real deployment conditions, a coupling loss of up to 45 dB may be achievable.

(33) Antenna gains and downtilts are for 2 GHz.

(34) $BW_{Channel(1)}$ and $BW_{Channel(2)}$ are the channel bandwidths of the two respective E-UTRA carriers. Supported channel bandwidths: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz.

(35) BW represents the channel bandwidth. Supported channel bandwidths: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz.

(36) For the 2.5 GHz band only.

(37) Applicable to the 1 800 MHz and 2.3 GHz bands.

TABLE 11

An example of IMT-2000 assumed traffic model characteristics for a mature network(1)

Parameter	Value
Traffic environments	Rural Vehicular Pedestrian In-building (central business district)
Maximum data rates	Rural – 9.6 kbit/s Vehicular – 144 kbit/s Pedestrian – 384 kbit/s In-building – 2 Mbit/s
Cell size	Rural – 10 km radius Vehicular – 1 000 m radius Pedestrian – 315 m radius In-building – 40 m radius
Users per cell during busy hour	Rural – not significant Vehicular – 4 700 Pedestrian – 42 300 In-building – 1 275
Percent of total uplink traffic > 64 kbit/s during busy hour	Rural – not significant Vehicular – 34% Pedestrian – 30% In-building – 28%
Percent of total downlink traffic > 64 kbit/s during busy hour	Rural – not significant Vehicular – 78% Pedestrian – 74% In-building – 73%
Average number of users per cell per MHz during busy hour assuming frequency duplex operation	Rural – not significant Vehicular < 64 kbit/s – 16 > 64 kbit/s – 4 Pedestrian < 64 kbit/s – 150 > 64 kbit/s – 64 In-building < 64 kbit/s – 4 > 64 kbit/s – 2

(1) Values in Table 11 were derived from Report ITU-R M.2023.

6 Characteristics in the 3 400-3 600 MHz band

6.1 Parameters for IMT-2000 OFDMA TDD WMAN

The information contains technical and operational characteristics of IMT-2000 OFDMA TDD WMAN system to be used for sharing studies for both mobile stations and base stations.

TABLE 12

Technical and operational characteristics of base stations for use in sharing studies in the 3.4-3.6 GHz band

	IMT-2000 OFDMA TDD WMAN		
Parameter			
Deployment scenario	**Specific cellular deployment rural with expected nomadic BWA use**	**Typical cellular deployment rural**	**Typical cellular deployment urban**
Channel bandwidth (MHz)	7 (5, 7 and 10)[6]	7 (5, 7 and 10)[6]	7 (5, 7 and 10)[6]
Carrier frequency	3.5 GHz	3.5 GHz	3.5 GHz
Modulation type	QPSK, 16-QAM, 64-QAM	QPSK, 16-QAM, 64-QAM	QPSK, 16-QAM, 64-QAM
Duplex method	TDD/FDD	TDD/FDD	TDD/FDD
Access technique	TDMA/OFDMA	TDMA/OFDMA	TDMA/OFDMA
No. of sectors	3	3	3
Reuse factor	1:3 (1:1)[7]	1:3 (1:1)[7]	1:3 (1:1)[7]
Antennas per sector	Depending on deployment	Depending on deployment	Depending on deployment
Co-located antenna minimum coupling loss (dB)	50	50	50
Peak antenna gain (dBi)	17	17	9
Antenna 3 dB beamwidth (degrees)	60 and 90 (sectorized)	60 and 90 (sectorized)	Omnidirectional
Antenna downtilt (degrees)[1]	0-8 (1º)	0-8 (2º)	0-8 (4º)
Antenna height a.g.l. (m)	50	30	15
Antenna gain pattern	Recommendation ITU-R F.1336	Recommendation ITU-R F.1336	Recommendation ITU-R F.1336
Transmitter			
TX peak output power (dBm)	43	35	32
Feeder loss (dB)	3	3	3
Power control (dB)	> 10	> 10	> 10
e.i.r.p. (dBm)	57	49	38
Unwanted emissions	ECC Recommendation (04)05[3]		
Adjacent Channel Leakage Ratio (ACLR) (dB)			
ACLR_1 (dB)	37 (51)[4]	37 (51)[4]	37 (51)[4]
ACLR_2 (dB)	48 (87)[4]	48 (87)[4]	48 (87)[4]
Receiver			
Noise figure (dB)	5	5	5
Thermal noise density (dBm/Hz)	–174	–174	–174

TABLE 12 (*end*)

	IMT-2000 OFDMA TDD WMAN		
Parameter			
Deployment scenario	**Specific cellular deployment rural with expected nomadic BWA use**	**Typical cellular deployment rural**	**Typical cellular deployment urban**
Receiver			
Noise figure (dB)	5	5	5
Thermal noise density (dBm/Hz)	–174	–174	–174
Adjacent Channel Selectivity (ACS) (dB)			
ACS_1 (dB)	20(5)	20(5)	20(5)
ACS_2 (dB)	39(5)	39(5)	39(5)
Required SINR (dB)	2.9 (for CTC QPSK ½)	2.9 (for CTC QPSK ½)	2.9 (for CTC QPSK ½)
Max. tolerable interference power (dBm)	–45	–45	–45

Notes relative to Table 12:

(1) A range of values is indicated, recognizing that the value for each situation depends on the actual deployment scenario taking into account the topology of the terrain. In parentheses, a typical value is given for use in the compatibility studies.

(3) WiMAX base stations may comply with a specific regional regulatory requirement to the lowermost and uppermost edges of an operator's block assignment. The regulatory requirement is detailed as a Block Edge Mask. The Block Edge Mask regulatory requirement imposes a more stringent out of block emission performance on the operator and therefore implies a correspondingly more stringent unwanted emission performance across the edges of the system operating block which can be deduced from analysis of the defined Block Edge Mask. The block edge mask is as specified in § 2 Annex 2 of ECC Recommendation (04)05.

(4) Additional ACLR values for the base station are provided in parentheses. These additional ACLR values result from the application of a specific regional regulatory requirement to the lowermost and uppermost edges of an operator's block assignment. The regulatory requirement is detailed as a Block Edge Mask. The Block Edge Mask regulatory requirement imposes a more stringent out of block emission performance on the operator and therefore implies a correspondingly more stringent ACLR performance across the edges of the system operating block which can be deduced from analysis of the defined Block Edge Mask.

(5) The numbers provided are for receiver adjacent channel rejection that is a measure of the capability of the receiver to receive a wanted signal without exceeding a given degradation due to the presence of an unwanted signal (interferer) either in the first or second adjacent channel. Receiver adjacent channel rejection is expressed as the ratio, in dB, of the level of the unwanted signal to the level of the wanted signal, at the receiver input. The minimum receiver adjacent channel rejection for a bit error rate (BER) $\leq 10^{-6}$.

(6) Other values of 5 and 10 MHz channel bandwidth in parenthesis are also supported.

(7) Other values or reuse 3 (1:3) in parenthesis are also supported.

TABLE 13

Technical and operational characteristics of terminal/mobile stations for use in sharing studies in the 3.4-3.6 GHz band

	IMT-2000 OFDMA TDD WMAN			
	Fixed-outdoor	**Fixed-indoor**	**Nomadic**	**Mobile**
Parameters				
Channel bandwidth (MHz)	7 (5, 10)[7]	7 (5, 10)[7]	7 (5, 10)[7]	7 (5, 10)[7]
Carrier frequency	3.5 GHz	3.5 GHz	3.5 GHz	3.5 GHz
Modulation type	QPSK, 16-QAM, 64-QAM	QPSK, 16-QAM, 64-QAM	QPSK, 16-QAM, 64-QAM	QPSK, 16-QAM, 64-QAM
Duplex method	TDD/FDD	TDD/FDD	TDD/FDD	TDD/FDD
Access technique	TDMA/OFDMA	TDMA/OFDMA	TDMA/OFDMA	TDMA/OFDMA
No. of sectors	Not applicable	Not applicable	Not applicable	Not applicable
Reuse factor	1:3 (1:1)[8]	1:3 (1:1)[8]	1:3 (1:1)[8]	1:3 (1:1)[8]
Co-located antenna minimum coupling loss (dB)	N/A	N/A	N/A	N/A
Peak antenna gain (dBi)	17	5	5	0
Antenna gain pattern	Recommendation ITU-R F.1245	Omnidirectional	Omnidirectional	Omnidirectional
Antenna 3 dB beamwidth (degrees)	24°	N/A	N/A	N/A
Antenna height a.g.l. (m)	10	1.5	1.5	1.5
Number of co-channel TSs per BS	10 users for uplink activity factor[4] of 38% in a 5 ms frame	10 users for uplink activity factor of 38% in a 5 ms frame	10 users for uplink activity factor of 38% in a 5 ms frame	10 users for uplink activity factor of 38% in a 5 ms frame
Transmitter				
TX peak output power (dBm)	26(1)	26	22	20
Feeder loss (dB)	1	1	1	1
Power control (dB)[2]	> 45	> 45	> 45	> 45
e.i.r.p. (dBm)	42	30	26	19
Unwanted emissions	See Note 1			
Adjacent channel leakage ratio (ACLR) (dB)				
ACLR_1 (dB)	33	33	33	33
ACLR_2 (dB)	43	43	43	43

TABLE 13 (*end*)

	IMT-2000 OFDMA TDD WMAN			
	Fixed-outdoor	**Fixed-indoor**	**Nomadic**	**Mobile**
Parameters				
Receiver				
Noise figure (dB)	8	8	8	8
Thermal noise density (dBm/Hz)	–174	–174	–174	–174
Feeder loss (dB)	1	1	1	1
Adjacent channel selectivity (ACS) (dB)				
ACS_1 (dB)	28	28	28	28
ACS_2 (dB)	47	47	47	47
Required SINR (dB)	2.9 (for CTC QPSK ½)	2.9 (for CTC QPSK ½)	2.9 (for CTC QPSK ½)	2.9 (for CTC QPSK ½)
Max. tolerable interference power (dBm)	–30	–30	–30	–30
Nominal reference sensitivity (dBm)(9)	–98 dBm/MHz	–98 dBm/MHz	–98 dBm/MHz	–98 dBm/MHz

Notes relative to Table 13:

(1) WiMAX numbers for Tx peak output power are preliminary numbers. Mobile WiMAX Band Class Groups 5L.A, 5.L.B and 5L.C, in general, cover a range of power classes. (See Recommendations ITU-R M.1580 and ITU-R 1581 for a description of band class groups.)

(2) The 45 dB is based on the minimum dynamic range requirements.

(4) Uplink activity factor for TDD mode is defined by the ratio of uplink subframe over the entire frame, that is uplink plus downlink subframes.

(5) A range of values is indicated, with a typical value given in parenthesis for use in the studies.

(7) Other values of 5 and 10 MHz channel bandwidth in parenthesis are also supported.

(8) Other values of Reuse 1 (1:1) in parenthesis are also supported.

(9) An example value for the cases of no repetition (QPSK ½), SISO AWGN. The value is dependent on many parameters including the channel bandwidth, downlink allocated bandwidth, channel model and repetition factor. For the 7 MHz channel bandwidth, the above sensitivity levels (per MHz) need to be increased by 10 log (7) = 8.45 dB.

NOTE 1 – The following information on the spectrum emission mask is an extract from the WiMAX Forum mobile radio specification [30].

Spectrum emission mask for terminal/mobile station equipment operating in the band 3 400-3 600 MHz

Emission mask for 5 MHz channel bandwidth

The spectrum emission mask of the MS applies to frequency offsets between 2.5 MHz and 12.5 MHz on both sides of the MS centre carrier frequency. The out-of-channel emission is specified as power level measured over the specified measurement bandwidth relative to the total mean power of the MS carrier measured in the 5 MHz channel.

The MS emission shall not exceed the levels specified in Table 14. Assuming specific power classes, the relative requirements of Table 14 can be converted to absolute values for testing purposes.

TABLE 14

Spectrum emission mask requirement for 5 MHz channel bandwidth

Frequency offset Δf	Minimum requirement	Measurement bandwidth
2.5 MHz to 3.5 MHz	$\left\{-33.5-15\times\left(\frac{\Delta f}{\text{MHz}}-2.5\right)\right\}$ dBc	30 kHz
3.5 to 7.5 MHz	$\left\{-33.5-1\times\left(\frac{\Delta f}{\text{MHz}}-3.5\right)\right\}$ dBc	1 MHz
7.5 to 8.5 MHz	$\left\{-37.5-10\times\left(\frac{\Delta f}{\text{MHz}}-7.5\right)\right\}$ dBc	1 MHz
8.5 to 12.5 MHz	−47.5 dBc	1 MHz

NOTE 1 − Δf is the separation between the carrier frequency and the centre of the measuring filter.

NOTE 2 − The first measurement position with a 30 kHz filter is at Δf equals 2.515 MHz; the last is at Δf equals 3.485 MHz.

NOTE 3 − The first measurement position with a 1 MHz filter is at Δf equals 4 MHz; the last is at Δf equals 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 in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

NOTE 4 − Note that equivalent PSD type mask can be derived by applying 10*log ((5 MHz)/(30 kHz)) = 22.2 dB and 10*log((5 MHz)/(1 MHz)) = 7 dB scaling factor for 30 kHz and 1 MHz measurement bandwidth respectively.

Emission mask for 7 MHz channel bandwidth

The spectrum emission mask of the MS applies to frequency offsets between 3.5 MHz and 17.5 MHz on both sides of the MS centre carrier frequency. The out-of-channel emission is specified as power level measured over the specified measurement bandwidth relative to the total mean power of the MS carrier measured in the 7 MHz channel.

The MS emission shall not exceed the levels specified in Table 15. Assuming specific power classes, the relative requirements of Table 15 can be converted to absolute values for testing purposes.

TABLE 15

Spectrum emission mask requirement for 7 MHz channel bandwidth

Frequency offset Δf	Minimum requirement	Measurement bandwidth
3.5 MHz to 4.75 MHz	$\left\{-33.5-13.5\times\left(\frac{\Delta f}{\text{MHz}}-3.5\right)\right\}$ dBc	30 kHz
4.75 to 10.5 MHz	$\left\{-35-0.7\times\left(\frac{\Delta f}{\text{MHz}}-4.75\right)\right\}$ dBc	1 MHz
10.5 to 11.9 MHz	$\left\{-39.0-7\times\left(\frac{\Delta f}{\text{MHz}}-10.5\right)\right\}$ dBc	1 MHz
11.9 to 17.5 MHz	−49.0 dBc	1 MHz

NOTE 1 − Δf is the separation between the carrier frequency and the centre of the measuring filter.

NOTE 2 −The first measurement position with a 30 kHz filter is at Δf equals 3.515 MHz; the last is at Δf equals 4.735 MHz.

NOTE 3 − The first measurement position with a 1 MHz filter is at Δf equals 5.25 MHz; the last is at Δf equals 17 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 in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

NOTE 4 − Note that equivalent PSD type mask can be derived by applying 10*log ((7 MHz)/(30 kHz)) = 23.7 dB and 10*log((7 MHz)/(1 MHz)) = 8.5 dB scaling factor for 30 kHz and 1 MHz measurement bandwidth respectively.

Emission mask for 10 MHz channel bandwidth

The spectrum emission mask of the MS applies to frequency offsets between 5.0 MHz and 25.0 MHz on both sides of the MS centre carrier frequency.

The out-of-channel emission is specified as power level measured over the specified measurement bandwidth relative to the total mean power of the MS carrier measured in the 10 MHz channel.

The MS emission shall not exceed the levels specified in Table 16. Assuming specific power classes, the relative requirements of Table 16 can be converted to absolute values for testing purposes.

TABLE 16

Spectrum emission mask requirement for 10 MHz channel bandwidth

Frequency offset Δf	Minimum requirement	Measurement bandwidth
5.0 MHz to 7.0 MHz	$\left\{-33.5-9\times\left(\frac{\Delta f}{\text{MHz}}-5.0\right)\right\}$ dBc	30 kHz
7.0 to 15.0 MHz	$\left\{-36.5-0.5\times\left(\frac{\Delta f}{\text{MHz}}-7.0\right)\right\}$ dBc	1 MHz
15.0 to 17.0 MHz	$\left\{-40.5-5\times\left(\frac{\Delta f}{\text{MHz}}-15.0\right)\right\}$ dBc	1 MHz
17.0 to 25.0 MHz	−50.5 dBc	1 MHz

Notes relative to Table 16:

NOTE 1 − Δf is the separation between the carrier frequency and the centre of the measuring filter.

NOTE 2 − The first measurement position with a 30 kHz filter is at Δf equals 510.015 MHz; the last is at Δf equals 6.985 MHz.

NOTE 3 − The first measurement position with a 1 MHz filter is at Δf equals 7.5 MHz; the last is at Δf equals 24.5 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 in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

NOTE 4 − Equivalent PSD type mask can be derived by applying 10*log ((10 MHz)/(30 kHz)) = 25.2 dB and 10*log((10 MHz)/(1 MHz)) = 10 dB scaling factor for 30 kHz and 1 MHz measurement bandwidth respectively.

References

[1] 3GPP TS 25.101 v9.3.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; UE Radio Transmission and Reception (FDD) (Release 9).

[2] 3GPP TS 25.102 v9.1.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; UE Radio Transmission and Reception (TDD) (Release 9).

[3] 3GPP TS 25.104 v9.3.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; BS Radio Transmission and Reception (FDD) (Release 9).

[4] 3GPP TS 25.105 v9.1.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; BS Radio Transmission and Reception (TDD) (Release 9).

[5] Final Draft ETSI EN 300 175-2 v1.6.0 (2001-04): Digital Enhanced Telecommunications (DECT) Common Interface (CI) part 2: Physical Layer.

[6] 3GPP TR 25.951 v9.0.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks, FDD Base Station Classification (Release 9).

[7] TR45 technical specification, TIA/EIA-136-290); RF Minimum performance requirements 136HS Outdoor and 136HS Indoor Bearers, clause 2.

[8] TR45 technical specification, TIA/EIA-136-290; RF Minimum performance requirements 136HS Outdoor and 136HS Indoor Bearers, clause 4.1.1.2 refers to Power Class II mobile station.

[9] TR45 technical specification, TIA/EIA-136-290; RF Minimum performance requirements 136HS Outdoor and 136HS Indoor Bearers, clause 6.2 specifies data rates and reference sensitivity. Reference sensitivity listed for 144 kbit/s at a 10% block erasure rate (BLER).

[10] TR45 technical specification, TIA/EIA-136-290; RF Minimum performance requirements 136HS Outdoor and 136HS Indoor Bearers, Table A3a: Modulation and noise spectrum mask due to GMSK modulation. Measurement bandwidth is 30 kHz.

[11] TR45 technical specification, TIA/EIA-136-290; RF Minimum performance requirements 136HS Outdoor and 136HS Indoor Bearers, Table A3b: Modulation and noise spectrum mask due to 8-PSK modulation. Measurement bandwidth is 30 kHz.

[12] TR45 technical specification, TIA/EIA-136-290; RF Minimum performance requirements 136HS Outdoor and 136HS Indoor Bearers, clause 5.1:

The mobile station shall meet the requirements set forth in clause 6.2 in the presence of an unmodulated carrier at the following frequencies and amplitudes:

TABLE 17

Requirements of clause 6.2

Frequency of blocking signal	Amplitude of blocking signal (dBm)
600 kHz < $\lvert f - f_0 \rvert$ < 800 kHz	–43
800 kHz < $\lvert f - f_0 \rvert$ < 1.6 MHz	–43
1.6 MHz < = < $\lvert f - f_0 \rvert$ < 3 MHz	–33
3 MHz = $\lvert f - f_0 \rvert$	–26

[13] TR45 technical specification, TIA/EIA-136-290; RF Minimum performance requirements 136HS Outdoor and 136HS Indoor Bearers, clause 6.3:

In Table 18 the reference co-channel interference (C/I_c), block error rate (BLER) performance is defined for each of the channel conditions. The actual interference ratio is defined as the interference ratio for which this performance is met. The actual interference ratio shall be less than a specified limit, called the reference interference ratio. For 200 kHz bearers the reference interference ratio shall be, for BTS and all types of MS:

TABLE 18

Input signal level and interference ratio for outdoor BTS at reference performance

Bearer	Environment	Speed (km/h)	Coding scheme	Error rate	*C*/*I* (dB)
136HS Outdoor	Pedestrian A	3	GCS-1	10% BLER	7
136HS Outdoor	Pedestrian A	3	GCS-2	10% BLER	8.5
136HS Outdoor	Pedestrian A	3	GCS-3	10% BLER	9.5
136HS Outdoor	Pedestrian A	3	GCS-4	10% BLER	13.5
136HS Outdoor	Pedestrian A	3	PCS-1	10% BLER	13
136HS Outdoor	Pedestrian A	3	PCS-2	10% BLER	16
136HS Outdoor	Pedestrian A	3	PCS-3	10% BLER	18
136HS Outdoor	Pedestrian A	3	PCS-4	10% BLER	19.5
136HS Outdoor	Pedestrian A	3	PCS-5	10% BLER	21
136HS Outdoor	Pedestrian A	3	PCS-6	10% BLER	24.5
136HS Outdoor	Vehicular A	50	GCS-1	10% BLER	3.5
136HS Outdoor	Vehicular A	50	GCS-2	10% BLER	7
136HS Outdoor	Vehicular A	50	GCS-3	10% BLER	8.5
136HS Outdoor	Vehicular A	50	GCS-4	10% BLER	17
136HS Outdoor	Vehicular A	50	PCS-1	10% BLER	9
136HS Outdoor	Vehicular A	50	PCS-2	10% BLER	13
136HS Outdoor	Vehicular A	50	PCS-3	10% BLER	14.5
136HS Outdoor	Vehicular A	50	PCS-4	10% BLER	18
136HS Outdoor	Vehicular A	50	PCS-5	10% BLER	21

TABLE 18 (*end*)

Bearer	Environment	Speed (km/h)	Coding scheme	Error rate	*C*/*I* (dB)
136HS Outdoor	Vehicular A	50	PCS-6	10% BLER	(see Note 1)
136HS Outdoor	Vehicular A	120	GCS-1	10% BLER	7
136HS Outdoor	Vehicular A	120	GCS-2	10% BLER	8.5
136HS Outdoor	Vehicular A	120	GCS-3	10% BLER	9.5
136HS Outdoor	Vehicular A	120	GCS-4	10% BLER	13.5
136HS Outdoor	Vehicular A	120	PCS-1	10% BLER	13
136HS Outdoor	Vehicular A	120	PCS-2	10% BLER	16
136HS Outdoor	Vehicular A	120	PCS-3	10% BLER	18
136HS Outdoor	Vehicular A	120	PCS-4	10% BLER	19.5
136HS Outdoor	Vehicular A	120	PCS-5	10% BLER	21
136HS Outdoor	Vehicular A	120	PCS-6	10% BLER	24.5

NOTE 1 – This is the GMSK interfering channel. The channel models in the above Table are taken directly from Recommendation ITU-R M.1225.

[14] TR45 technical specification, SP-4027-270b); Mobile Station Minimum Performance, clause 2.3.1.3.1.

[15] TR45 technical specification, SP-4027-270b); Mobile Station Minimum Performance, clause 1.4 and clause 3.2.2. Refers To Power Class Ii Mobile Station.

[16] TR45 technical specification, SP-4027-270b); Mobile Station Minimum Performance, clause 3.4.1.1.3.

[17] TR45 technical specification, SP-4027-270b); Mobile Station Minimum Performance, clause 2.3.2.4.3:

TABLE 19

Blocking and spurious response rejection

Frequency band	Desired signal (frequency, F_c)	Blocking signal (frequency, F_0)	Spurious response limit (frequency, F_0)	Error rate (%)
$\lvert fc - f_0 \rvert > 3$ MHz (π/4 DQPSK)	–102	–30	–45	3
3 MHz > $\lvert fc - f_0 \rvert$ > 90 kHz (π/4 DQPSK)	–102	–45	–45	3
$\lvert f_c - f_0 \rvert > 3$ MHz (8-PSK)	–99	–30	–45	3
3 MHz > $\lvert f_c - f_0 \rvert$ > 90 kHz (8-PSK)	–99	–45	–45	3

[18] TR45 technical specification, SP-4027-270b); Mobile Station Minimum Performance, clause 2.3.1.1.3.

[19] TR45 technical specification, TIA-97-F; Recommended minimum performance Standards for cdma2000® spread spectrum base stations.

[20] TR45 technical specification, TIA-98-F; Recommended minimum performance Standards for cdma2000® spread spectrum mobile stations.

[21] TR45 technical specification, TIA-864-A; Recommended minimum performance Standards for cdma2000® High Rate Packet Data Access Network.

[22] TR45 technical specification, TIA-866-A; Recommended minimum performance Standards for cdma2000® High Rate Packet Data Access Terminal.

[23] 3GPP TS 25.308 v9.2.0 (2010-03); 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; High Speed Downlink Packet Access (HSDPA); Overall description; Stage 2 (Release 9).

[24] Mobile WiMAX – Part I: A Technical Overview and Performance Evaluation, August, 2006, WiMAX Forum®.

[25] 3GPP TS 36.101 v9.3.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (Release 9).

[26] 3GPP TS 36.104 v9.3.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception (Release 9).

[27] 3GPP TS 25.319 v9.3.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; Enhanced uplink; Overall description; Stage 2 (Release 9).

[28] 3GPP TS 25.306 v9.2.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; UE Radio Access capabilities (Release 9).

[29] 3GPP TS 36.306 v9.1.0 (2010-03): 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities (Release 9).

[30] WiMAX Forum® Mobile Radio Specification, WMF-T23-005-R015v04.

Bibliography

[1] TR45 technical specification, TIA/EIA 136-131; Digital Traffic Channel Layer 1, clause 1.3.

[2] 3GPP TS 25.942; 3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; RF System Scenarios, clause 4.1.1.2. Body loss expectation is that values are similar for all technologies. Footnote retained for information purposes.