

## RECOMMENDATION ITU-R M.1823

**Technical and operational characteristics of digital cellular land mobile systems for use in sharing studies**

(Questions ITU-R 1/8 and ITU-R 7/8)

(2007)

**Scope**

This Recommendation provides technical and operational characteristics of digital cellular land mobile systems for use in sharing studies. It provides the relevant characteristics for some specific systems used for digital cellular land mobile communications, and complements the information available in Recommendation ITU-R M.1073-2.

The ITU Radiocommunication Assembly,

*considering*

- a) that digital cellular land mobile systems are heavily used in the land mobile service bands;
- b) that there is a need for technical and operational characteristics of digital cellular land mobile systems to be used in sharing studies;
- c) that the minimum receiver performance figures contained in equipment standards are not necessarily those on which systems are planned;
- d) that receiver performance characteristics vary for different digital modulation schemes;
- e) that previous radiocommunication conferences have invited ITU-R to continue its studies for all services,

*noting*

- a) that Recommendation ITU-R M.478-5 contains technical characteristics of equipment and principles governing the allocation of frequency channels between 25 and 3 000 MHz for the FM land mobile service;
- b) that Recommendation ITU-R M.1073-2 describes digital, cellular land mobile telecommunication systems;
- c) that Recommendation ITU-R M.1032 addresses the technical and operational characteristics of land mobile systems using multi-channel access techniques without a central controller;
- d) that Report ITU-R M.2014-1 contains description of digital land mobile systems for dispatch traffic;
- e) that Report ITU-R M.2039 contains characteristics of terrestrial IMT-2000 systems for frequency sharing/interference analyses;

- f) that Recommendation ITU-R SM.329-10 contains material on spurious emissions;
- g) that Recommendation ITU-R SM.1541-2 contains material on unwanted emissions in the out-of-band domain;
- h) that Recommendation ITU-R SM.1539-1 contains variations of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU-R SM.1541 and ITU-R SM.329;
- j) that Recommendation ITU-R SM.1540 deals with unwanted emissions in the out-of-band domain falling into adjacent allocated bands;
- k) that degradation of mobile reception curves in Report ITU-R M.358-5 can be used to determine protection ratios for mobile digital systems;
- l) that Recommendation ITU-R M.1808 describes the technical characteristics of conventional and trunked land mobile systems operating in the mobile service allocations below 960 MHz to be used in sharing studies,

*recommends*

**1** that, for interservice and intraservice frequency sharing studies, the representative technical and operational characteristics of digital cellular land mobile systems given in Annex 1 should be used.





TABLE 1 (continued)

Feature	GSM	TIA-136 TDMA	TIA-95 <sup>(1)</sup> , CDMA2000 (1X), HRPD <sup>(2)</sup> <i>Note – BC is band class.</i>	PDC <sup>(3)</sup>
<b>System (cont.):</b>				
Transmission rate (kbit/s)	270.833 for GMSK (812.5 for 8-PSK)	48.6 for DQPSK 72.9 for 8-PSK	9.6 or 14.4 kbit/s (IS-95) CDMA2000 and HRPD up to 1.8 Mbit/s on the reverse link and up to 3.1 Mbit/s on the forward link	42
Base station antenna gain (dBd)	*	*	Typically 15 (1 900 MHz and higher) typically 9 (800 MHz and lower)	9 dBi (includes cable loss)
Base station total loss (dB)	*	*	3	
Base station antenna height (m)	*	*	Typically 30	40
Base station radiation pattern	*	*	Horizontal	90° horizontal (typical)
Base station antenna polarization	*	*	Vertical	Vertical
Mobile station antenna gain (dBd)	*	*	Typically –2 to 0	0 dBi (includes cable loss)
Mobile station antenna height (m)	*	*	Typically 1.5	1.5
Mobile station total loss (dB)	*	*	2	
Mobile station radiation pattern	*	*	Omni (variable)	Omni
Mobile station antenna polarization	*	*	Vertical	Vertical
<b>Transmitter:</b>				
Nominal maximum base station transmit power (W)	Output power, at combiner input (class 1-8 for GSM) (W): 320 - (< 640), 160 - (< 320), 80 - (< 160), 40 - (< 80), 20 - (< 40), 10 - (< 20), 5 - (< 10), 2,5 - (< 5) (GSM 900/ GSM 850/GSM700/ GSM400) 20 - (< 40), 10 - (< 20), 5 - (< 10), 2,5 - (< 5) (GSM1800/1900) Max output power, at combiner input, micro- and pico-BTS {classes M1, M2, M3, P1 for GSM} (dBm) (> 19) - 24, (> 14) - 19, (> 9) - 14, (> 13) - 20 (GSM900/850/700) (> 27) - 32, (> 22) - 27, (> 17) - 22, (> 16) - 23	*	25 W	*
		*	*	32 W (15 dBW) / cell

TABLE 1 (continued)

Feature	GSM	TIA-136 TDMA	TIA-95 <sup>(1)</sup> , CDMA2000 (1X), HRPD <sup>(2)</sup> <i>Note – BC is band class.</i>	PDC <sup>(3)</sup>
<b>Transmitter (cont.):</b>				
Base station ERP (dBm) <sup>(9)</sup>	*	56 at 800 MHz 60 at 1.9 GHz	55(1 900 MHz and higher) 50 (800 MHz and lower)	54
Necessary bandwidth (kHz)	*	*	1 250	32
Nominal maximum mobile station transmit power (W)	GMSK Modulation (class 1-5): 8, 5, 2, 0.8 (GSM 900/GSM 850/GSM700/GSM400) 1, 0.25, 4 (GSM 1800) 1, 0.25, 2 (GSM 1900)	9, 3  0.006, 0.0004	0.2	Class I 3
	8-PSK Modulation (class E1, E2, E3) (dBm): 33, 27, 23 (GSM 900/GSM 850/GSM700/GSM400) 30, 26, 22(GSM1800/1900)	Class II 4.8, 1.6		Class II 2
		Class III 1.0, 0.6, 0.33, 0.002 1.8, 0.6		Class III 0.8 (typical) Class IV 0.3
Mobile station ERP (dBm) <sup>(10)</sup>	*	*	23 <sup>(11)</sup>	*
Necessary bandwidth (kHz)	*	*	1 250	32
<b>Receiver:</b>				
MS reference sensitivity level	(GMSK, 8-PSK): (small MS, MS dBm: -102, -104 (GSM450/700/ 850/900) -100, -102, -102 (GSM1800 class 1,2,3)** -102, -102, -104 (GSM1900 class 1, 2, 3) For other than normal conditions, -100 should be used for classes M1, M2.	*	-104 dBm/1.23 MHz (NF = 9 dB – worst case) -116.3 dBm (Traffic channel: RC2 <sup>(12)</sup> and RC5 <sup>(13)</sup> ) -119.6 dBm (Traffic channel: RC1 <sup>(14)</sup> and RC3 <sup>(15)</sup> )	-109 dBm/ 21 kHz
BTS reference sensitivity level	(GMSK, 8-PSK): (normal, M1, M2, M3, P1) dBm : -104 (GSM450) -104, -97, -92, -87, -88 (GSM750/850/900) -104, -102, -97, -92, -95 (GSM1800/1900)	*	-117 dBm (for band classes 0, 2, 3, 5, 7, 9, 10, 11, or 12) and -119 dBm (for band classes 1, 4, 6 or 8) (NF = 5 dB –typical) Reverse traffic channel at FER 1%	-109 dBm/ 21 kHz

TABLE 1 (continued)

Feature	GSM	TIA-136 TDMA	TIA-95 <sup>(1)</sup> , CDMA2000 (1X), HRPD <sup>(2)</sup> <i>Note – BC is band class.</i>	PDC <sup>(3)</sup>
<b>Receiver (cont.):</b>				
BTS, MS reference interference ratio	(cochannel, adjacent (200 kHz), adj (400 kHz), adj (600 kHz)), C/I (dB): 9, -9, -41, -49	*	BTS <sup>(16)</sup> (IS-97F): co-channel NS, -50 dB @ ±750 kHz (BC0), -87 dB @ ±900 kHz (BC0, 2, 3, 5, 9, 11, 12) -80 dB @ ±1.25 MHz (BC1, 4, 6, 7, 8, 10, 14, 15) MS (IS-98F): co-channel NS, -61 dB @ ±900 kHz (BC0, 2, 3, 5, 7, 9, 10, 11, 12) -71 dB @ ±1.25 MHz (BC1, 4, 6, 8, 14, 15)	Co-channel: CIR = 13 dB, I/N = -10 dB (BTS) I/N = -6 dB (MS)  Adjacent: -43 dBm (BTS, MS)
Base station IF filter bandwidth (kHz)	*	*	1 230, except at 1 900 MHz (Band Class 1) where it is 1 250	21
Base station noise figure (worst case) (dB)	*	*	5	5
Mobile station IF filter bandwidth (kHz)	*	*	1 230, except at 1 900 MHz (Band Class 1) where it is 1 250	*
Mobile station noise figure (worst case) (dB)	*	*	9	*

\* Value not specified, or implementation dependant.

(1) CDMA2000 (1X) refers to the TIA-2000 series; TIA-2000-D being the latest version. cdma2000® is the trademark for the technical nomenclature for certain specifications and standards of the Organizational Partners (OPs) of 3GPP2 and geographically (and as of the date of publication) is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States of America. CDMA2000 1X is a direct evolution of TIA-95 or cdmaOne and included because it can also operate in bands other than those identified for IMT-2000. The term “cdmaOne” relates to the Family of IS-95 CDMA Technologies.

(2) HRPD refers to TIA-856 – cdma2000® – High Rate Packet Data Air Interface Specification. TIA-856-A being the latest version.

(3) The Personal Digital Cellular System used in Japan.

(4) See TIA-1030-A – Band Class Specification for cdma2000® Spread Spectrum Systems.

(5) GSM 1800 is also referred to as DCS 1800.

(6) GSM 1900 is also referred to as PCS 1900.

(7) TIA-95-x (ANSI/TIA-95-x). TIA-95-B being the latest version.

(8) CDMA2000 (1X). Note cdma2000 provides backward compatibility with TIA-95.

(9) ERP is equal to the output power (dBm) plus the antenna gain (dBd) minus the total loss (dB).

(10) ERP is equal to the output power (dBm) plus the antenna gain (dBd) minus the total loss (dB).

(11) This is the minimum required output power when commanded to maximum output. BC0, BC3, BC5, BC7, BC9, BC10, BC11, and BC12 are specified in terms of ERP; all other band classes are specified in terms of EIRP.

(12) RC2: 1 800, 3 600, 7 200, 14 400 kbit/s.

(13) RC5: 1 200, 1 350, 1 500, 2 400, 2 700, 4 800, 9 600, 19 200, 38 400, 76 800, 153 600 kbit/s.

(14) RC1: 1 200, 2 400, 4 800, 9 600 kbit/s.

(15) RC3: 1 200, 1 350, 1 500, 2 400, 2 700, 4 800, 9 600, 19 200, 38 400, 76 800, 153 600 kbit/s.

(16) Due to the use of duplex filters in actual implementations, BTS and MS emissions may be more stringent.