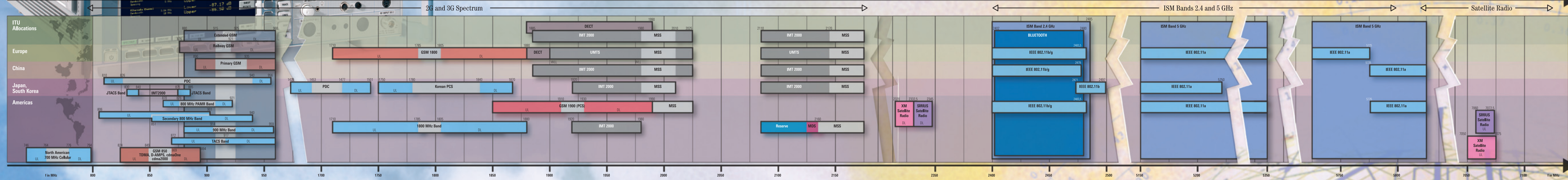




Wireless Communication Standards



	DIGITAL CELLULAR PHONES/DATA							DIG. CORDLESS PHONES		WIRELESS LAN & BROADBAND WIRELESS ACCESS																
	GSM	PDC	IS-54 and IS-136	cdmaOne	cdma2000	1x EV-DO	1x EV-DV	WCDMA 3GPP FDD	WCDMA 3GPP TDD	TD-SCDMA	DECT	PHS	Bluetooth	IEEE 802.11a	IEEE 802.11b	IEEE 802.11g	IEEE 802.15.3*	IEEE 802.15.4*	IEEE 802.16*	IEEE 802.16*	IEEE 802.16*	IEEE 802.20*				
Frequency Range	DL: 889 - 894 MHz UL: 824 - 849 MHz	DL: 940 - 956 MHz UL: 810 - 826 MHz	IS-54 and IS-136 DL: 889 - 894 MHz UL: 824 - 849 MHz	DL: 889 - 894 MHz UL: 824 - 849 MHz	400 MHz European PAMR Band, UL: 410 - 458 MHz, DL: 420 - 468 MHz North America 700 MHz Cellular, UL: 710 - 794 MHz, DL: 746 - 764 MHz US Cellular, UL: 824 - 849 MHz, DL: 889 - 894 MHz TACS Band, UL: 872 - 915 MHz, DL: 917 - 960 MHz 800 MHz PAMR Band, UL: 930 - 970 MHz, DL: 915 - 921 MHz Secondary 800 MHz Band, UL: 806 - 901 MHz, DL: 851 - 940 MHz 900 MHz Band, UL: 880 - 914 MHz, DL: 925 - 959 MHz 1900 MHz Band, UL: 1710 - 1785 MHz, DL: 1805 - 1880 MHz Korean PCS, UL: 1750 - 1780 MHz, DL: 1840 - 1870 MHz North American PCS, UL: 1850 - 1910 MHz, DL: 1930 - 1990 MHz IMT2000, UL: 1920 - 1980 MHz, DL: 2110 - 2170 MHz	DL: 1930 - 1990 MHz UL: 1850 - 1910 MHz	DL: 1885 - 1910 MHz	DL: 1880 - 1990 MHz (Worldwide)	DL: 2110 - 2170 MHz UL: 1900 - 1920 MHz	2010 - 2025 MHz 1900 - 1920 MHz	2010 - 2025 MHz 1900 - 1920 MHz	1880 - 1900 MHz (Europe)	1885 - 1910 MHz	2402 - 2480 MHz	5.15 - 5.35 GHz (USA)	2.4 - 2.4835 GHz (North America, Europe)	2.4 - 2.4835 GHz (Japan)	2.4 - 2.4835 GHz	2.4 - 2.4835 GHz	3.1 - 10.6 GHz	2.4 GHz (World)	2.4 GHz (Americas)	10 - 66 GHz	2 - 11 GHz	5 - 6 GHz	< 3.5 GHz
Modulation	GMSK 8-PSK (EDGE only)	π/4 DQPSK	π/4 DQPSK	QPSK/QDPSK	QPSK DQPSK, HPSK	HPSK	DQPSK DQPSK, HPSK	UL: Dual QPSK DL: QPSK, 16QAM, OFDM (HSDPA only)	UL: DL: QPSK DL: 8PSK (HSDPA only)	UL: DL: QPSK DL: 16QAM (HSDPA only)	GFSK	π/4 DQPSK	GFSK	BPSK, QPSK, 16QAM, 64QAM, OFDM	BPSK, QPSK, COX, P8B3C	BPSK, QPSK, 16-64QAM, OFDM, COX, P8B3C	BPSK, QPSK, 16-64QAM, 32QAM, 64QAM	BPSK, QPSK, 16-64QAM, 32QAM, 64QAM, 256QAM	BPSK, QPSK, 16-64QAM, 32QAM, 64QAM, 256QAM	BPSK, QPSK, 16-64QAM, 32QAM, 64QAM, 256QAM	BPSK, QPSK, 16-64QAM, 32QAM, 64QAM, 256QAM	under definition				
Multiple Access	TDMA/FDMA	TDMA/FDMA	TDMA/FDMA	CDMA/FDMA	CDMA	TDMA/CDMA	CDMA	CDMA	CDMA/TDMA	CDMA/TDMA	FDMA/TDMA	FDMA/TDMA	FHSS	CSMA/CA	CSMA/CA	CSMA/CA	CSMA/CA	CSMA/CA	Single Carrier	TDMA/OFDMA	TDMA/OFDMA	TDMA/OFDMA	TDMA/OFDMA	TDMA/OFDMA	under definition	
Duplex (Uplink/Downlink)	FDD	FDD	FDD	FDD	FDD	FDD	FDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD/FDD	
Channel Bandwidth	200 kHz	25 kHz	30 kHz	1.25 MHz	1.25 MHz	1.25 MHz	1.25 MHz	5 MHz	5 MHz	1.6 MHz	1.728 MHz	300 kHz	1 MHz	20 MHz	20 MHz	20 MHz	15 MHz	1.388 - 2.736 GHz or 528 MHz	5 MHz	20 MHz/25 MHz (USA) 28 MHz (EU)	20 MHz/25 MHz (USA) 28 MHz (EU)	20 MHz/25 MHz (USA) 28 MHz (EU)	under definition			
Number of Channels	GSM: 850 / 900 / E / R / 1800 / 1900 124 / 124 / 174 / 194 / 374 / 289 (8 users per channel)	1600 (3 users per channel)	832 (3 users per channel)	depends on service	depends on service	depends on service	depends on service	depends on service	depends on service	depends on service	10 (12 users per channel)	300 (4 users per channel)	79	12	3 (non overlapping)	3 (non overlapping)	4 (or 3)	2 or 13	1 (868 MHz) 10 (915 MHz) 16 (2.4 GHz)	8 (110 MHz channelization)	8 (110 MHz channelization)	8 (110 MHz channelization)	8 (110 MHz channelization)	under definition		
Peak Data Rate	14.4 kbit/s 13.8 kbit/s (GPRS) 384 kbit/s (EDGE)	42 kbit/s	13.2 kbit/s (IS-54) 28.8 kbit/s (IS-95-A) 115.2 kbit/s (IS-95-B)	14.4 kbit/s (IS-95-A) 115.2 kbit/s (IS-95-B)	307.7 kbit/s (cdma2000 1X) 2.4 Mbit/s (cdma2000 3x)	153.6 kbit/s (reverse) 2.4 Mbit/s (forward)	153.6 kbit/s (reverse) 3.09 Mbit/s (forward)	2 Mbit/s 10 Mbit/s (HSDPA)	2 Mbit/s 10 Mbit/s (HSDPA)	2 Mbit/s 2.8 Mbit/s (HSDPA)	1152 kbit/s	384 kbit/s	723.2 kbit/s	54 Mbit/s	11 Mbit/s	54 Mbit/s	up to 55 Mbit/s	480 Mbit/s	20 kbit/s (868 MHz) 40 kbit/s (915 MHz) 250 kbit/s (2.4 GHz)	134 Mbit/s (20 MHz channel bandwidth)	134 Mbit/s (20 MHz channel bandwidth)	70 Mbit/s	70 Mbit/s	under definition		

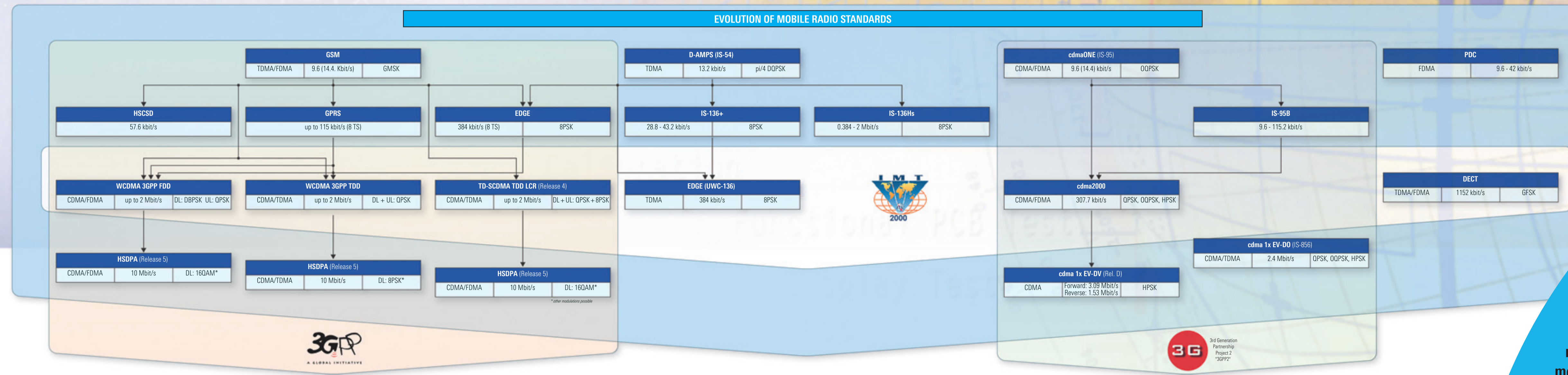
Classification	OFDM COMMUNICATION SYSTEMS (Orthogonal Frequency Division Multiplexing)			
	Peak Data Rate	Channel Bandwidth	Number of Carriers	Carrier Spacing
System Application				
Wireless LAN IEEE 802.11a	6 - 54 Mbit/s	20 MHz	64 (52 used)	312.5 kHz
IEEE 802.11g	6 - 54 Mbit/s	20 MHz	64 (52 used)	312.5 kHz
Broadband Wireless Access IEEE 802.16 WirelessMAN	134 Mbit/s (28 MHz channel bandwidth)	20 MHz / 25 MHz (USA) 28 MHz (EU)	under definition	under definition
IEEE 802.16 WiMAX	70 Mbit/s	20 MHz / 25 MHz (USA) 28 MHz (EU)	200	under definition
IEEE 802.16b WirelessHUMAN	under definition			
Broadcasting				
DAB	0.6 - 1.7 Mbit/s	1.536 MHz	192 / 384 / 768 / 1536	8 / 4 / 2 / 1 kHz
DVB-T	3.73 - 31.67 Mbit/s	6 MHz, 7 MHz, 8 MHz	1705 (2K Mode) 6817 (8K Mode)	0.84 kHz / 3.34 kHz (6 MHz CH) 0.97 kHz / 3.9 kHz (7 MHz CH) 1.1 kHz / 4.4 kHz (8 MHz CH)
DRM	6 - 55 kbit/s	9 kHz	88 to 228	42 / 47 / 68 / 107 kHz
Wind Communications				
ADSL	DL: 8 Mbit/s UL: 640 kbit/s	4.3125 kHz	DS: 256 US: 32	-
VDSL	DS: 52 Mbit/s US: 6.4 Mbit/s	4.3125 kHz	4048	-
Satellite Radio				
SIRIUS Satellite Radio (Repeater)	64 kbit/s (audio) / 0.5 - 64 kbit/s (service)	12.5 MHz	100 (music) / 30 (talk) / 50 and 50 simultaneously	-
XM Satellite Radio (Repeater)	64 kbit/s (audio) / 0.5 - 64 kbit/s (service)	12.5 MHz	100 (music) / 30 (talk) / 50 or 50	-
IBOC (HBOC DAB / iDAB) (AM / FM)	Hybrid AM IBOC: 36 - 56 kbit/s (audio) / 4 - 4 kbit/s (data) All Digital AM IBOC: 40 - 60 kbit/s (audio) / 4 - 4 kbit/s (data) Hybrid FM IBOC: 64 - 96 kbit/s (audio) / 33 - 1 kbit/s (data), correct. to audio data rate Extended Hybrid FM IBOC: 94 - 96 kbit/s (audio) / 83 - 51 kbit/s (data), correct. to audio data rate All Digital FM IBOC: 64 - 96 kbit/s (audio) / 213 - 181 kbit/s (data), correct. to audio data rate	10 kHz & 2x 5 kHz (AM & 2x OFDM band) 10 kHz & 2x 5 kHz (AM & 2x OFDM band) 258 kHz & 2x 70 kHz (FM & 2x OFDM band) 258 kHz & 2x 70 kHz (FM & 2x OFDM band)	1 audio (digital, analog) min. / 1 data channel 1 audio (digital, analog) min. / 1 data channel 1 audio (digital, analog) min. / 1 data channel 1 audio (digital, analog) min. / 1 data channel	10 kHz 10 kHz 40 kHz 40 kHz

* Standard not yet final, changes possible
Date: June 2004

Abbreviations: CCX = Complementary Code Keying; CH = Channel; DL = Downlink; DS = DSSS; HUMAN = Highspeed Unlicensed Metropolitan Area Network; IBOC = In-Band-On-Channel; IMT 2000 = International Mobile Telecommunication 2000; JTACS = Japanese Total Access Communication System; LCR = Low Chip Rate; MAN = Metropolitan Area Network; MBWA = Mobile Broadband Wireless Access; MDS = Multiplex Service; Mobile Data Service; MSS = Mobile Satellite Service; PAMR = Public Access Mobile Radio; P8B3C = Parker Binary Convolution Coding; TACS = Total Access Communication System; TD = TDD; UL = Uplink; US = Universal Wireless Communication; UWB = Ultra Wideband; WiMAX = Worldwide Interoperability for Microwave Access.

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pushing limits