

Must-Have Reference

For Wireless Communication



The Must-Have Reference for Wireless Communication

This reference will help you understand the terminology associated with wireless telecom and data communications to let you make more informed decisions about new technology, products, and services. In addition, it shows which Anritsu products provide test and measurement solutions in each area.

Wireless Telecom Technology (Part 1)

Wireless Technology	CDMA IS-95	cdma2000 [®] 1xRTT	cdma2000 1xEV-DO	cdma2000 1xEV-DV	TDMA
Wireless Standard	TIA/EIA/IS-95A, TIA/EIS IS-95B	TIA/EIA/IS-2000 www.3gpp2.org	TIA/EIA/IS-856 www.3gpp2.org	TIA/EIA/IS-2000 Releases C & D www.3gpp2.org	TIA/EIA-136 www.tiaonline.org
US Operators	Verizon Wireless Sprint PCS	Verizon ("National Access") Sprint PCS Leap Wireless	Verizon ("Broadband Access")	Sprint (planned)	AT&T Cingular T-Mobile
Upgrade Path	cdma2000 1xRTT	cdma2000 1xEV-DO			GSM GPRS EDGE
Frequency Range	824-925 MHz 1750-1990 MHz	411-493 MHz 824-925 MHz 1750-1990 MHz	(same as 1xRTT)	(same as 1xRTT)	824-894 MHz 1850-1990 MHz
Channel Bandwidth	1.23 MHz or 1.25 MHz	1.23 MHz or 1.25 MHz	1.23 MHz or 1.25 MHz	1.23 MHz or 1.25 MHz	30 kHz
Data Rate	14.4 kbps	144-307 kbps	700-2.4 Mbps	3.09 Mbps max	9.6-19.2 kbps
Generation	2G (IS-95A) 2.5G (IS-95B)	2.5G	3G	3G	2G
Relevant Anritsu Test and Measurement Products					
Mobile Unit or Base Station	MS8608A MS8609A MS2681A/83A/87B MS2711D MT8212A S332D	MS8608A MS8609A MS2681A/83A/87B MS2711D MT8212A S332D	MS8608A MS8609A MG3681A ML2480A MS2681A/83A/87B MS2711D MT8212A S332D	MS2711D MT8212A S332D	MS8608A MS8609A MS2681A/83A/87B MS2711D MT8212A S332D
Mobile Unit Only	MT8801C MT8802A MT8820A CRCA Software MA8120A	MT8801C MT8802A MT8820A MA8120A	MT8820A MA8120A	MA8120A	MT8801C MT8802A CRCA Software MA8120A

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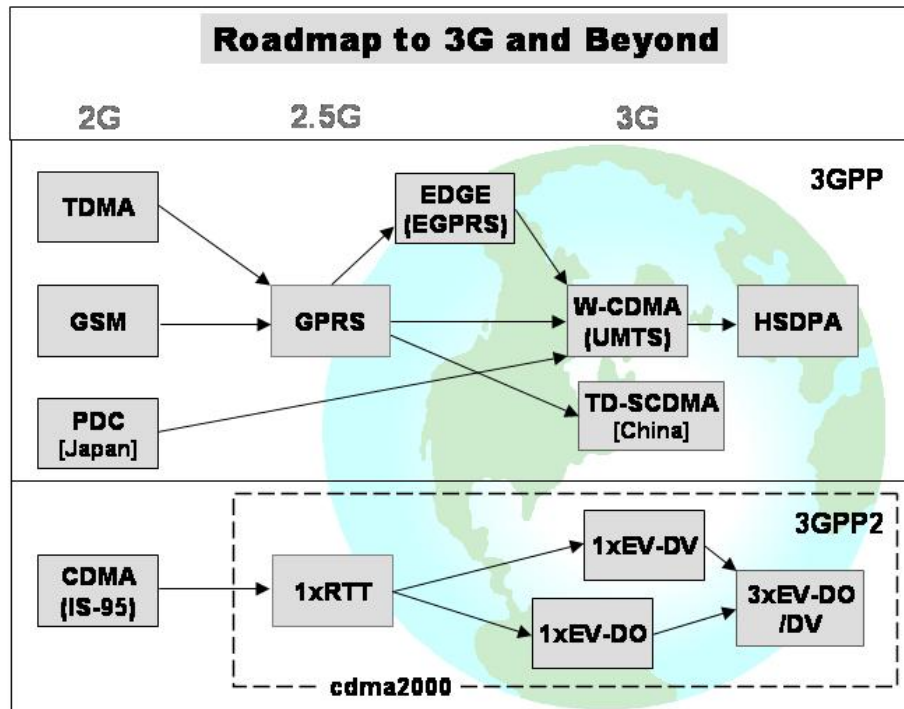
Wireless Telecom Technology (Part 2)

Wireless Technology	GSM	GPRS	EDGE (EGPRS)	W-CDMA (UMTS)	HSDPA
Wireless Standard	GSM 01.01 version 8.0.0 Release 1999 www.3gpp.org	GSM 01.60 version 6.0.0 www.3gpp.org	3GPP TS 43.051 version 5.9.0 Release 5 www.3gpp.org	3GPP Release 99 www.3gpp.org	3GPP Release 5 www.3gpp.org
US Operators	AT&T Cingular T-Mobile	AT&T Cingular T-Mobile	AT&T Cingular T-Mobile	AT&T (planned for late 2004)	
Upgrade Path	GPRS EDGE W-CDMA	EDGE W-CDMA	W-CDMA	HSDPA	
Frequency Range	450-486 MHz 824-894 MHz 876-960 MHz 1710-1880 MHz 1850-1990 MHz	450-486 MHz 824-894 MHz 876-960 MHz 1710-1880 MHz 1850-1990 MHz	450-486 MHz 824-894 MHz 876-960 MHz 1710-1880 MHz 1850-1990 MHz	824-894 MHz 830-885 MHz 1710-1880 MHz 1710-2155 MHz 1850-1990 MHz 1920-2170 MHz	824-894 MHz 830-885 MHz 1710-1880 MHz 1710-2155 MHz 1850-1990 MHz 1920-2170 MHz
Channel Bandwidth	200 kHz	200 kHz	200 kHz	5 MHz	5 MHz
Data Rate	9.6-19.2 kbps	44-171.2 kbps	384 kbps max; 120 kbps typ eff throughput	144 kbps-2 Mbps max; 384 kbps typ	14 Mbps max; 10.8 Mbps max eff throughput
Generation	2G	2.5G	2.5G+	3G	3.5G
Relevant Anritsu Test and Measurement Products					
Mobile Unit or Base Station	MS8608A MS8609A MS2681A/83A/87B MS2711D MT8212A S332D	MS8608A MS8609A MS2681A/83A/87B MS2711D MT8212A S332D	MS8608A MS8609A MS2681A/83A/87B MG3681A ML2480A MS2711D MT8212A S332D	MS8608A MS8609A MS2681A/83A/87B MG3681A ML2480A ML8721B (BS only) MS2711D MT8212A S332D	MS8608A MS8609A MG3681A
Mobile Unit Only	MT8801C MT8802A CRCA Software MT8820A MA8120A	MT8820A MA8120A	MT8820A MA8120A	MT8820A PTS Software RTD Software MD8480B MA8120A	MA8120A

Wireless Datacom Technology

Wireless Technology	IEEE 802.15 Bluetooth	IEEE 802.11a Wi-Fi	IEEE 802.11b Wi-Fi	IEEE 802.11g Wi-Fi	IEEE 802.16a WiMax
Wireless Standard	www.bluetooth.org	www.ieee.org/11	www.ieee.org/11	www.ieee.org/11	www.ieee802.org/16
Frequency Range	2.4 GHz	5 GHz	2.4 GHz	2.4 GHz	2-11 GHz
Channel Bandwidth	1 MHz	20 MHz	10-30 MHz	25 MHz	1.25-20 MHz
Max Link Length	10 m	60-100 ft	150-300 ft		31 mi
Data Rate	1 Mbps	54 Mbps max; 1-2 Mbps common	11 Mbps max; 8-10 Mbps common	54 Mbps max	70 Mbps
Relevant Anritsu Test and Measurement Products					
Mobile Unit or Base Station	MS2681A/83A/87B ML2480A MT8850A MT8852A ME7865A MA8120A	MT8860A MS8608A MS8609A MS2681A/83A/87B ML2480A S332D+FCN4760 MS2711D+FCN4760	MT8860A MS8608A MS8609A MS2681A/83A/87B ML2480A MS2711D MT8212A S332D	MT8860A MS8608A MS8609A MS2681A/83A/87B ML2480A MS2711D MT8212A S332D	
Mobile Unit Only	[Not applicable]		MA8120A	MA8120A	MA8120A

The Must-Have Reference for Wireless Communication



Terms and Mnemonics

1G First Generation Cellular Wireless

The first generation of cellular wireless (1G) was based on analog technology. The systems were designed only to carry voice technology.

1xEV-DO 1x Evolution Data Only

1xEV-DO (cdma2000) is a 3G mobile standard that delivers a peak data rate of 2.4 Mbps using just 1.25 MHz of spectrum. This is the next EVolution of cdma2000, intended to provide powerful data transmission capabilities for mobile phones. This upgrade to cdma2000 requires a second 1.25-MHz channel that is used exclusively for data. Most cdma2000 network operators are expected to combine 1x and 1xEV-DO channels in their systems to provide varying voice and data capacities as required by customer demand. Qualcomm is driving this standard. Verizon began deploying 1xEV-DO service trials in late 2003.

1xEV-DV 1X Evolution Data and Voice

1xEV-DV (cdma2000) is a 3G mobile standard that promises to provide data-rate speeds of 1.2 Mbps for mobile users, with peak data speeds up to 5.2 Mbps for stationary users. This standard will integrate voice and simultaneous high-speed packet data multimedia services. Nokia and Motorola are backing this standard. Sprint has proposed this service for 2005-2006.

1xRTT

1xRTT (cdma2000), the next generation of standard CDMA, offers between 1.5 and 2 times the number of voice channels as a standard CDMA system, peak data rates of 153 kbps and backwards compatibility with cdmaOne networks. 1x stands for one times 1.25 MHz carrier, as used in 2G CDMA. RTT stands for Radio Transmission Technology. cdma2000 1x is 21 times more efficient than analog cellular and 4 times more efficient than TDMA networks.

2G Second Generation Cellular Wireless

2G cellular wireless technology converts voice to digital data for transmission over the air and then back to voice. Most 2G systems provide 9.6-14.4 Kbps circuit-switched data service.

2.5G Second Generation + Cellular Wireless

2.5G refers to technology that is added to a 2G network to provide packet-data service. In practice, 2.5G is synonymous with the GPRS technology that has been added to GSM networks.

3G Third Generation Cellular Wireless

3G systems have been designed for both voice and data. By International Telecommunications Union (ITU) definition, 3G systems must provide a minimum of 144 kbps packet-data service.

3GPP Third Generation Partnership Project

[3GPP](#) is a global body dedicated to developing 3G specifications. In 1997-98, Nokia was active in establishing 3GPP as the organization for developing global 3G standards based on W-CDMA technology. Specifications for W-CDMA radio access networks were rapidly established and in 2000, Nokia promoted the transfer of GSM/EDGE standardization to 3GPP. The first commercial W-CDMA products were released based on the 3GPP Release99. Standardization continues with Releases 4, 5 and 6.

3GPP2 Third Generation Partnership Project 2

[3GPP2](#) is a collaborative Third Generation (3G) telecommunications specification-setting project comprising North American and Asian interests on the development of the next generation cdma2000 wireless communications. 3GPP2 is largely based on Qualcomm cdma2000 product standards.

3GSM

3GSM is another name for the W-CDMA 3G standard. (See 3G.)

3GSP 3G Service Provider

A mobile operator that has a 3G license to provide 3G services to customers.

3xEV-DO/DV 3X Evolution Data Only/Data and Voice

Enhanced versions of 1xEV-DO or 1xEV-DV with three channels of data/voice. The details of 3xEV are unclear, and this service is likely 4-5 years in the future.

802.11 Wireless LANs (Wi-Fi)

802.11, known as Wi-Fi, defines standards for wireless LANs (WLANs) and was approved in Jul'97. WLANs provide half-duplex (not simultaneous bidirectional) connections that are shared, not switched. IEEE 802.11a and 802.11b (standardized in Sept'99) and 802.11g (standardized in mid-2003) define different physical layer standards for WLANs, and the 802.11 standard offers no provisions for interoperability between these physical layers. Microsoft certification applies to both 802.11a and 802.11b. The [IEEE 802.11 Working Group](#) page has helpful information. Toshiba said it shipped the industry's first laptop PC with built-in dual 802.11a/b connectivity in Dec'02. By the end of 2003, unit shipments of 802.11g interfaces surpassed shipments of 802.11b and continue to grow while 802.11b shipments decline.

The Wi-Fi Alliance (www.wi-fi.org), previously known as WECA, promotes the standard, tests products for interoperability, and awards the "Wi-Fi" mark to those that pass. Wi-Fi Alliance certified over 500 products by November '02.

Security is one of the biggest issues with wireless LANs – see WPA and WEP, as well as 802.11i (below).

802.11a

802.11a operates at 5 GHz and provides data rates up to 54 Mbps using OFDM (Orthogonal Frequency Division Multiplexing) modulation, like European digital TV. 802.11a supports a maximum of 24 unique connections per access point, far more than the three connections supported by 802.11b and 802.11g. Compared to 802.11b, 802.11a offers higher (2X-5X) throughput, more available frequencies, avoiding multipath echoes, but shorter range (60-100 feet). Actual throughput is often only 1-2 Mbps. 802.11a products did not become available from most U.S. vendors until early 2002.

802.11b

802.11b operates at 2.4 GHz (along with cordless phones and microwave ovens) and provides data rates up to 11 Mbps over links of 150-300 feet using Direct Sequence Spread Spectrum (DSMM) modulation. Actual throughput is often only 8-10 Mbps. 802.11b supports a maximum of three unique connections per access point. 802.11 Planet has a helpful paper comparing [802.11a vs. 802.11b](#). 802.11b-compatible products were the first ones to become available in the U.S.

802.11e

Describes error correction and bandwidth management to be used in 802.11a and 802.11b. 802.11e will include a mandatory Enhanced Digital Control Access (EDCA) operating mode and an optional Polled Access mode. EDCA will define eight levels of access priority, a feature that is expected to be important for properly handling voice over WLAN. The IEEE is expected to ratify this standard around mid-2004.

802.11g

802.11g is an extension to 802.11b to provide data rates up to 54 Mbps while operating at 2.4 GHz like 802.11b but using OFDM modulation like 802.11a. Products are expected to have RF interference problems similar to 802.11b. Like 802.11b, 802.11g supports a maximum of three unique connections per access point. The IEEE approved the specification in June '03, and the first products claiming compatibility with the draft standard shipped in Jan'03. In July '03 the Wi-Fi Alliance completed successful interoperability testing of the first products. 802.11 Planet has a helpful [tutorial](#) comparing 802.11a with 802.11g.

802.11i

A standard approved in June'04 that provides security enhancements based on WPA, TKIP, and AES. It incorporates key management and authentication. 802.11i may eventually replace WEP and WPA for WLAN security.

802.11n

A standard in development for WLANs having at least 100 Mbps throughput. Also see MIMO.

802.15 Wireless Personal Area Networking (WPAN)

The IEEE [Wireless Overview](#) Web site is helpful to explain what is happening in this area.

802.15.1 – Bluetooth

A standard defining wireless networking with a 1 Mbps data rate that operates at 2.4 GHz over a range of up to 10 meters. Bluetooth is intended for short-range links between computers, personal digital assistants, mobile phones, printers, digital cameras, keyboards, and other PC peripherals. The 1 Mbps data rate is a serious limitation that prevents this technology from acting as a USB replacement except for very low-speed peripherals such as keyboards. The [Bluetooth.com](#) and [Bluetooth.org](#) sites have helpful information.

802.15.3 and .3a

Project group planning high rate WPANs with 10-500 Mbps data rates. Ultra wideband is a key technology being considered here (see UWB).

802.15.4 – ZigBee

This addresses the low cost and low power needs that remote monitoring and control and sensory network applications have, including the ability to run for years on standard batteries. These products, first expected in early 2005, operate with rates up to 250 Kbps in the unlicensed bands that include 2.4 GHz globally, 915 MHz in the Americas, and 868 Mhz in Europe. The [ZigBee Alliance](#) is promoting this technology.

802.16 WiMax (Worldwide Interoperability for Microwave Access)

This IEEE standard defines broadband wireless for the metropolitan area to address the "last mile" problem of providing connections to individual homes and offices. The initial version, approved in Dec'01, operates in the 10-66 GHz frequency band with line-of-sight towers to fixed locations. The 802.16a extension, ratified in Jan'03, does not require line-of-sight transmission and allows use of lower 2-11 GHz frequencies for both fixed and portable applications. 802.16a claims up to a 30-mile range and 75 Mbps data transfer (at 20 MHz channelization) that can support thousands of users, plus improved latency and per-connection QoS features. 802.16a provides selectable channel bandwidths from 1.25 to 20 MHz with up to 16 logical sub-channels. A typical cell radius is probably 3-5 miles. Interoperability forums have been held, and the first commercial products are expected to ship in 2H'04. Also see MIMO.

WiMax was planned from the beginning to be compatible with European standards. The [WiMax Forum](#) of over 100 companies was established in 2001 by Nokia, Ensemble Communications, and the Orthogonal Frequency Division Multiplexing Forum and now works to promote deployment of broadband wireless access networks based on 802.16 and to certify product interoperability. Intel and Alcatel announced that they are working together on this technology in an effort to deliver products by 2H'2005.

802.16d, planned for Q3'2004, will update 802.16a to incorporate the many amendments associated with it. 802.16e, planned for late 2005, will regional roaming for broadband wireless applications up to 15 Mbps (at 5 MHz channelization) with a typical cell radius of 1-3 miles.

AMR Adaptive Multi Rate

A system used in W-CDMA and GSM to adapt the data rate based on demand.

AP Access Point

See the *Must-Have Reference for IP and Next Generation Networking*.

BLER Block Error Rate

Bluetooth

See 802.15.1.

BS Base Station

The location of the radio equipment for one or more cells. In 3GPP2, a Base Station comprises a Base Station Controller and one or more Base Transceiver Stations (see BTS).

BTS Base Transceiver Station

The termination of a radio interface in a cellular system.

CCDF Complementary Cumulative Distribution Function

CCDF of envelope power is used in digital communications test equipment and shows the cumulative probability of a particular peak-to-average power occurring.

CDMA Code Division Multiple Access

CDMA is a spread-spectrum technology that spreads multiple conversations across a wide segment of the spectrum as opposed to splitting a channel into time slots. With CDMA, unique digital codes are used to differentiate subscribers that are simultaneously using the same spectrum.

cdma2000

cdma2000 represents a family of technologies that includes cdma2000 1X and cdma2000 1XEV. cdma2000 1XEV includes 1XEV-DO and 1xEV-DV. cdma2000 services are being implemented in North America and Asia, but not in Europe.

cdmaOne IS-95

cdmaOne is the brand name for IS-95 CDMA technology and was introduced by Qualcomm. cdmaOne provides a family of related services including cellular, PCS and fixed wireless (wireless local loop). See IS-95.

DCCH Digital Control Channel

A channel for communications between a mobile phone and the network.

DL Downlink

DMR Digital Mobile Radio

EDGE Enhanced Data Rates for Global Evolution

EDGE is a 2.5G technology being promoted by the TDMA and GSM communities that is capable of both voice and 3G data rates. It extends the GPRS 10-50 Kbps service to 100 Kbps or more. Cingular promised a full deployment by around mid-2004, and AT&T is expected to install EDGE technology in 6500 U.S. cities in 2004.

EGPRS Enhanced General Packet Radio Service

See EDGE.

EV-DO or EV-DV

See 1xEV-DO, 1xEV-DV, and 3xEV-DO/DV.

EVM Error Vector Magnitude

Used to determine errors and their causes. Error Vector = Measured Vector (actual signal magnitude and phase) – Reference Vector (the ideal signal).

FOMA Freedom of Mobile Multimedia Access

The Japan NTT DoCoMo brand name for 3G services based on W-CDMA.

GCF Global Certification Forum

GCF (gcf.gsm.org) is a partnership between network operators and terminal manufacturers that provides an independent process to ensure global interoperability and other functionality of 2G and 3G mobile wireless terminals. A GCF-certified terminal has been tested to a suite of test cases based on criteria developed by the global standards-making community and validated through the GCF Agreement Group.

GPRS GSM Packet Radio Service or General Packet Radio Service

GPRS is an upgrade to a GSM network that adds packet data to the voice network. GPRS uses the same time slots as voice calls and each time slot is capable of approximately 9.6 Kbps of data throughput. A GPRS network that offers 28.8 Kbps down to the phone and 9.6 Kbps from the phone back to the network is using three time slots down and one up.

GSM Global System for Mobile Communications

GSM is a TDMA digital technology deployed first in Europe. Today 65-70% of all wireless voice networks use GSM technology. GSM uses a combination of Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA). In FDMA, the 25 MHz band is divided into 125 frequencies of 200 kHz each. One or more of those frequencies are assigned to each base station. In TDMA, each of those frequencies uses 8 time slots. A list of GSM US operators can be found at www.gsmworld.com/roaming/gsminfo/cou_us.shtml.

HiperLAN2 High Performance Radio LAN

A 3GPP standard specifying a broadband wireless LAN that supports data rates of 25 to 54 Mbps on a carrier frequency of 5 GHz.

HiSWANa High Speed Wireless Access Network Type a

An ARIB standard "ARIB STD-T70" that uses the 5.15 to 5.25GHz band with a variable transmission rate from 6 to 36 Mbps. This system guarantees bandwidth usage and can manage bandwidth for each user.

HSDPA High Speed Downlink Packet Access

HSDPA, part of the 3GPP Release 5 W-CDMA specification, is a packet-based data service in a W-CDMA downlink with data transmission up to 8-10 Mbps (and 20 Mbps for MIMO systems) over a 5MHz bandwidth in a W-CDMA downlink. For users who are close to the base station with good connections, it creates an improvement for W-CDMA similar to that which EDGE does for GSM, providing a 2X increase in air interface capacity and a 5X increase in downlink data speeds. Such a fast service could ultimately reduce the appeal of 802.11 Wi-Fi by providing equivalent speed with much more widespread deployment. Some service providers are planning 2005-2006 roll outs -- NTT DoCoMo, for example, has stated a plan for providing HSDPA service by 2H'2005. [ARCchart](#) has a helpful HSDPA overview.

iDEN

iDEN is a Motorola proprietary version of TDMA with a unique "push-to-talk" two-way radio capability. Nextel Communications is the largest iDEN operator in the U.S. Anritsu products currently do not support iDEN.

IMT-2000 Third Generation Mobile Systems

A global standard for third generation (3G) wireless communications linking terrestrial and satellite networks, and defined by a set of interdependent ITU recommendations. IMT-2000 is the result of collaboration between groups inside the ITU (ITU-R and ITU-T) and outside the ITU (such as 3GPP, 3GPP2, TTA). The [IMT-2000 Web site](#) has more information.

IS-136 Interim Standard 136

IS-136, an evolved version of IS-54, is the U.S. standard for TDMA for both the cellular (850 MHz) and PCS (1.9 GHz) spectrums. Unlike IS-54, IS-136 utilizes time division multiplexing for transmitting both voice and the control channel. The Digital Control Channel (DCCH) is a key element of IS-136. [privateline.com](#) has a helpful [reference](#) explaining IS-136.

IS-95

A TTA/EIA standard that was the first widely used CDMA system, and is heavily installed in North America. The initial specification, known as IS-95A, was later upgraded to IS-95B. IS-95B combines cellular and PCS systems. In addition to voice, IS-95A is able to carry data at rates up to 14.4 kbps, and IS-95B supports data rates up to 115 kbps. [Radio-Electronics.com](#) has a helpful explanation of IS-95.

Mcps Million Chips Per Second

The number of million bits (chips) per second in the spreading sequence of a direct sequence spreading code. Each user's voice or data information is separated by multiplying the information by pseudo-random bits called chips.

MIMO Multiple-Input Multiple-Output

A process in which information is sent over two or more antennas. The signals reflect off objects and create multiple paths that cause interference and fading in conventional radios. MIMO uses these paths to carry more information, which is recombined on the receiving side based on MIMO algorithms. MIMO is expected to greatly increase performance and range but handle existing 802.11a/b/g radios with only a slight cost increase. Some form of MIMO may be used by the IEEE 802.11n Task Group, which is creating a specification for WLANs having at least 100 Mbps throughput (see 802.11), and for WiMax/802.16 wireless "last mile" access. [Airgo Networks](#) was the first company to produce chipsets supporting MIMO (see 802.11n and 802.16).

MS Mobile Station

The term used in GSM to describe a mobile phone.

Node B Base Station

A 3G term for the base station transceiver system.

OBW Occupied Bandwidth

Occupied Bandwidth is a measure of the bandwidth containing 99% of the total integrated power of the transmitted spectrum, centered on the assigned channel frequency. Interference to other channels or to other systems can occur if OWB is too large.

OCNS Orthogonal Channel Noise Simulation

PDC Personal Digital Cellular

PDC is a version of TDMA technology used exclusively in Japan.

PHS Personal HandyFone System

PHS is a Japan-only TDMA technology. Originally, the difference between PDC and PHS systems was that PDC was true cellular while PHS provided voice and data access but did not support moving from one cell to another.

RC Radio Configuration

Radio Configuration (RC) in cdma2000 systems indicates the channel data rate. RC1 (9600 bps) and RC2 (14440 bps) are backward compatible with IS-95B. RC3 and above use cdma2000 coding for higher capacity. The Spreading Rate (SR) indicates the multiples of 1.2288 Mcps (see Mcps), where SR1 is 1.2288 Mcps and SR3 is 3.6864 Mcps:

RC	Forward Channel	Reverse Channel
1	1200-9600 bps (SR1)	1200-9600 bps (SR1)
2	1800-14,400 bps (SR1)	1800-14400 bps (SR1)
3	1500-153,600 bps (SR1)	1500-153,600 bps (SR1)
4	1500-307,200 bps (SR1)	1800-230,400 bps (SR1)
5		1500-614,400 bps (SR3)
6		1800-1,036,800bps (SR3)

ROF Radio On Fiber

A system where an optical signal modulated with a radio signal is transmitted via optical fiber to roadside receiver stations, where it is then converted back to a radio signal for broadcasting from antennas. This technique can be used to transmit wideband wireless signals with relatively low noise.

RRM Radio Resource Management

The methods used in a digital cellular network to manage the allocation of radio channels, frequencies, and characteristics to match the requirements of the users on the network.

RBW Resolution Bandwidth

For spectrum analyzers, a narrow band filter is swept across a frequency span to create the spectrum display. The filter bandwidth (RBW) determines the frequency resolution across the frequency axis.

SR Spreading Rate

See RC (Radio Configuration).

SPA Spectrum Analyzer

TDMA Time Division Multiple Access

TDMA is an air interface that allows mobile stations to use the same frequency separated by time slots. TDMA uses its spectrum by assigning each user on a channel a different "slot" in time. IS-136 and iDen have 3 slots per channel, while GSM has 8 slots per channel.

TD-SCDMA Time Division - Synchronous Code Division Multiple Access

TD-SCDMA is a 3G technology developed by Siemens Mobile in conjunction with partners in China, and became part of 3GPP UMTS Release Phase 4 in March 2001. Using the Time Division Duplex (TDD) UMTS transmission mode, traffic is sent and received in different time slots over the same frequency band. The synchronous aspect of TD-SCDMA means that it can handle synchronous circuit-switched services such as speech and video as well as asynchronous packet-switched services such as Internet access. It will be deployed initially in China. The China [TD-SCDMA](#) Web site provides more information.

TRX Tx/Rx or Transceiver**TTCN Tree and Tabular Combined Notation**

Tree and tabular combined notation is an ISO/IEC standard (9646-3) for specifying communication systems conformance tests. Anritsu's MX785201A W-CDMA (UMTS) Protocol Test System (PTS) provides an environment that supports TTCN.

UE User Equipment

Refers to a mobile phone, PDA, or other user device. "UE" is a 3G term normally used only in connection with W-CDMA, and typically only in Europe. (See MS.)

UL Uplink**UMTS Universal Mobile Telecommunications System**

UMTS is a part of the International Telecommunications Union's IMT-2000 vision of a global family of third-generation (3G) mobile communications systems. This version of 3G is a W-CDMA technology being developed primarily by Europe's GSM community; UMTS is synonymous with W-CDMA in Europe. UMTS is the planned 3G technology for GSM networks worldwide.

UWB Ultra Wideband

As applied to local area networking, UWB is a wireless technology that uses narrow (picosecond or nanosecond) pulses at very low power to transmit high data rates over distances up to approximately 10-100m across all frequencies at once. UWB uses spread-spectrum technology spread over about 7.5 GHz with such low power that it does not interfere with other wireless transmission. Current product data rates are around 50 to 500 Mbps. This communications technology, also called digital pulse wireless or carrierless, can carry data through doors and other obstacles that obstruct other signals. UWB could be an alternative to Bluetooth (see 802.15).

W-CDMA Wideband CDMA

W-CDMA is a version of CDMA that uses 10 MHz of wireless spectrum: a 5-MHz uplink from the mobile terminal and a 5-MHz downlink to the mobile terminal. The version of W-CDMA used by NTT DoCoMo in Japan is called FOMA or J-W-CDMA; the European version is referred to as UMTS or E-W-CDMA. AT&T and Cingular are planning W-CDMA service in the U.S.

WiMax Worldwide Interoperability for Microwave Access

See 802.16.

WPAN Wireless Personal Area Network

See the *Must-Have Reference for IP and Next Generation Networking*.

ZigBee Wireless Personal Area Networking

See 802.15.4.

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