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QUY CHUẨN KỸ THUẬT QUỐC GIA VỀ THIẾT BỊ TRẠM GỐC THÔNG TIN DI ĐỘNG CDMA 2000–1X

National technical regulation on Cellular Mobile CDMA 2000–1x Base Station Equipment

(for information only)

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Foreword

QCVN 14:2010/BTTTT is based on the review and convert of TCN 68-223:2005 "Cellular mobile CDMA 1X base stations-Technical requirements", issued by decision no 28/2005/QĐ-BBCVT dated August 17, 2005 of Minister of Ministry of Post and Telecommunications (now the Ministry of Information and Communications).

Technical Requirements of QCVN 14:2010/BTTTT accordance with standard C.S0010-A/B: “Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Base Stations” of 3rd Generation Partnership Project 2 (3GPP2).

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QUY CHUẨN KỸ THUẬT QUỐC GIA VỀ THIẾT BỊ TRẠM GỐC THÔNG TIN DI ĐỘNG CDMA 2000-1X

National technical regulation on Cellular Mobile CDMA 2000-1x Base Station Equipment

1. GENERAL

1.1. Scope

This technical regulation specifies minimum performance characteristics, definitions and methods of measurement for Cellular Mobile CDMA 2000 1X Base Stations that operate in the bands: 450 MHz, 800 MHz and 2 GHz.

1.2. Subjects of application

This technical regulation applies to all agencies, organizations, manufacturers, importers and operators of Cellular Mobile CDMA 2000 1X Base Stations that operate in the bands: 450 MHz, 800 MHz and 2 GHz.

1.3. Definitions and abbreviations

In this technical regulation, the terms, abbreviations below are construed as follows:

1.3.1. Access Attempt.

A sequence of one or more access probe sequences on the Access Channel or Enhanced Access Channel containing the same message.

1.3.2. Access Channel

A Reverse CDMA Channel used by mobile stations for communicating to the base station. The Access Channel is used for short signaling message exchanges, such as call originations, responses to pages, and registrations. The Access Channel is a slotted random access channel.

1.3.3. Access Channel Preamble

The preamble of an access probe consisting of a sequence of all-zero frames that is sent at the 4800 bit/s rate

1.3.4. Access Probe

One Access Channel transmission consisting of a preamble and a message. The transmission is an integer number of frames in length, and transmits one Access Channel message. See also Access Probe Sequence and Access Attempt.

1.3.5. Access Probe Sequence

A sequence of one or more access probes on the Access Channel or Enhanced Access Channel. The same Access Channel or Enhanced Access Channel message is transmitted in every access probe of an access attempt. See also Access Probe, Enhanced Access Probe, and Access Attempt.

1.3.6. Active Frame

A frame that contains data and therefore is enabled in terms of traffic power.

1.3.7. Adjacent Channel Leakage Ratio.

The ratio of the on-channel transmit power to the power measured in one of the adjacent channels.

1.3.8. AWGN

Additive White Gaussian Noise.

1.3.9. Base Station

A fixed station used for communicating with mobile stations. Depending upon the context, the term base station may refer to a cell, a sector within a cell, an MSC, or other part of the wireless system.

1.3.10. Basic Access Mode

A mode used on the Enhanced Access Channel where a mobile station transmits an Enhanced Access Channel preamble and Enhanced Access data in a method similar to that used on the Access Channel.

1.3.11. CDMA

See Code Division Multiple Access.

1.3.12. CDMA Channel

The set of channels transmitted from the base station and the mobile stations on a given frequency.

1.3.13. CDMA Channel Number

An 11-bit number corresponding to the center of the CDMA frequency assignment.

1.3.14. CDMA Frequency Assignment

A 1.23 MHz segment of spectrum. For Band 800 MHz, the channel is centered on one of the 30 kHz channels. For Band 2 GHz, the channel is centered on one of the 50 kHz channels. For Band 450 MHz, the channel is centered on one of the 20 or 25 kHz channels.

1.3.15. CDMA Preferred Set

The set of CDMA channel numbers in a CDMA system corresponding to frequency assignments that a mobile station will normally search to acquire a CDMA Pilot Channel.

1.3.16. Code Channel

A subchannel of a Forward CDMA Channel or Reverse CDMA Channel. Each subchannel uses an orthogonal Walsh function or quasi-orthogonal function.

1.3.17. Code Division Multiple Access (CDMA)

A technique for spread-spectrum multiple-access digital communications that creates channels through the use of unique code sequences.

1.3.18. Code Symbol

The output of an error-correcting encoder. Information bits are input to the encoder and code symbols are output from the encoder.

1.3.19. Common Assignment Channel

A forward common channel used by the base station to acknowledge a mobile station accessing the Enhanced Access Channel, and in the case of Reservation Access Mode, to transmit the address of a Reverse Common Control Channel and associated Common Power Control Subchannel.

1.3.20. Common Power Control Channel

A forward common channel which transmits power control bits (i.e., common power control subchannels) to multiple mobile stations. The Common Power Control Channel is used by mobile stations operating in the Power Controlled Access Mode, Reservation Access Mode, or Designated Access Mode.

1.3.21. Common Power Control Subchannel

A subchannel on the Common Power Control Channel used by the base station to control the power of a mobile station when operating in the Power Controlled Access Mode on the Enhanced Access Channel or when operating in the Reservation Access Mode or the Designated Access Mode on the Reverse Common Control Channel.

1.3.22. Designated Access Mode

A mode of operation on the Reverse Common Control Channel where the mobile station responds to requests received on the Forward Common Control Channel.

1.3.23. E_b

Energy per information bit at the base station RF input port.

1.3.24. Enhanced Access Channel

A reverse channel used by the mobile for communicating to the base station. The Enhanced Access Channel operates in the Basic Access Mode, Power Controlled Access Mode, and Reservation Access Mode. It is used for transmission of short messages, such as signaling, MAC messages, response to pages, and call originations. It can also be used to transmit moderate-sized data packets.

1.3.25. Forward CDMA Channel

A CDMA Channel from a base station to mobile stations. The Forward CDMA Channel contains one or more code channels that are transmitted on a CDMA frequency assignment using a particular pilot PN offset.

1.3.26. Forward Common Control Channel

A control channel used for the transmission of digital control information from a base station to one or more mobile stations.

1.3.27. Forward Dedicated Control Channel

A portion of a Radio Configuration 3 through 9 Forward Traffic Channel used for the transmission of higher-level data, control information, and power control information from a base station to a mobile station.

1.3.28. Forward Fundamental Channel

A portion of a Forward Traffic Channel which carries a combination of higher-level data and power control information.

1.3.29. Forward Pilot Channel

An unmodulated, direct-sequence spread spectrum signal transmitted continuously by each CDMA base station. The Pilot Channel allows a mobile station to acquire the timing of the Forward CDMA Channel, provides a phase reference for coherent demodulation, and provides means for signal strength comparisons between base stations for determining when to handoff.

1.3.30. Forward Power Control Subchannel

A subchannel on the Forward Fundamental Channel or Forward Dedicated Control Channel used by the base station to control the power of a mobile station when operating on the Reverse Traffic Channel.

1.3.31. Forward Supplemental Channel

A portion of a Radio Configuration 3 through 9 Forward Traffic Channel which operates in conjunction with a Forward Fundamental Channel or a Forward Dedicated Control Channel in that Forward Traffic Channel to provide higher data rate services, and on which higher-level data is transmitted.

1.3.32. Forward Supplemental Code Channel

A portion of a Radio Configuration 1 and 2 Forward Traffic Channel which operates in conjunction with a Forward Fundamental Channel in that Forward Traffic Channel to provide higher data rate services, and on which higher-level data is transmitted.

1.3.33. Forward Traffic Channel

One or more code channels used to transport user and signaling traffic from the base station to the mobile station.

1.3.34. Frame

A basic timing interval in the system. For the Sync Channel, a frame is 26.666... ms long. For the Access Channel, the Paging Channel, the Broadcast Channel, the Forward Supplemental Code Channel, and the Reverse Supplemental Code Channel, a frame is 20 ms long. For the Forward Supplemental Channel and the Reverse Supplemental Channel, a frame is 20, 40, or 80 ms long. For the Enhanced Access Channel, the Forward Common Control Channel, and the Reverse Common Control Channel, a frame is 5, 10, or 20 ms long. For the Forward Fundamental Channel, Forward Dedicated Control Channel, Reverse Fundamental Channel, and Reverse Dedicated Control Channel, a frame is 5 or 20 ms long. For the Common Assignment Channel, a frame is 5 ms long.

1.3.35. Frame Activity

The ratio of the number of active frames to the total number of frames during channel operation.

1.3.36. Frame Quality Indicator

The CRC check applied to 9.6 and 4.8 kbit/s Traffic Channel frames of Radio Configuration 1, all Forward Traffic Channel frames for Radio Configurations 2 through 9, all Reverse Traffic Channel frames for Radio Configurations 2 through 6, the Broadcast Channel, Common Assignment Channel, Enhanced Access Channel, and the Reverse Common Control Channel.

1.3.37. Line Impedance Stabilization Network (LISN)

A network inserted in the supply mains lead of apparatus to be tested that provides, in a given frequency range, a specified load impedance for the measurement of disturbance voltages and that may isolate the apparatus from the supply mains in that frequency range.

1.3.38. LISN

See Line Impedance Stabilization Network.

1.3.39. Mcps

Megachips per second (106 chips per second).

1.3.40. MER

Message Error Rate.

1.3.41. Message Error Rate (MER)

The number of paging messages in error on the Paging Channel or Forward Common Control Channel divided by the total number of pages.

1.3.42. Mobile Station

A station intended to be used while in motion or during halts at unspecified points. Mobile stations include portable units (e.g., hand-held personal units) and units installed in vehicles.

1.3.43. Mobile Switching Center (MSC)

A configuration of equipment that provides cellular or PCS service.

1.3.44. N_0

The effective inband noise or interference power spectral density.

1.3.45. Orthogonal Transmit Diversity (OTD)

A forward link transmission method which distributes forward link channel symbols among multiple antennas and spreads the symbols with a unique Walsh or quasi-orthogonal function associated with each antenna.

1.3.46. OTD

See Orthogonal Transmit Diversity.

1.3.47. Paging Channel

A code channel in a Forward CDMA Channel used for transmission of control information and pages from a base station to a mobile station.

1.3.48. Pilot Channel

An unmodulated, direct-sequence spread spectrum signal transmitted by a CDMA base station or mobile station. A pilot channel provides a phase reference for coherent demodulation and may provide a means for signal strength comparisons between base stations for determining when to handoff.

1.3.49. Power Control Bit

A bit, sent in every 1.25 ms interval on the Forward Traffic Channel, to signal the mobile station to increase or decrease its transmit power.

1.3.50. Power Control Group

A 1.25 ms interval on the Forward Traffic Channel and the Reverse Traffic Channel. See also Power Control Bit.

1.3.51. Power Controlled Access Mode

A mode used on the Enhanced Access Channel where a mobile station transmits an Enhanced Access preamble, an Enhanced Access header, and Enhanced Access data in the Enhanced Access probe using closed loop power control.

1.3.52. Power Up Function (PUF)

A method by which the mobile station increases its output power to support location services.

1.3.53. Ppm

Parts per million.

1.3.54. Preamble

See Access Channel preamble, Enhanced Access Channel preamble, Reverse Common Control Channel preamble, and Reverse Traffic Channel Preamble.

1.3.55. Primary Paging Channel

The default code channel (code channel 1) assigned for paging on a CDMA Channel.

1.3.56. PUF

See Power Up Function.

1.3.57. PUF Probe

One or more consecutive frames on the Reverse Traffic Channel within which the mobile station transmits the PUF pulse.

1.3.58. PUF Pulse

Portion of PUF probe which may be transmitted at elevated output power.

1.3.59. Radio Configuration (RC)

A set of Forward Traffic Channel and Reverse Traffic Channel transmission formats that are characterized by physical layer parameters such as transmission rates, modulation characteristics, and spreading rate.

1.3.60. RC

See Radio Configuration.

1.3.61. Reservation Access Mode

A mode used on the Enhanced Access Channel and Reverse Common Control Channel where a mobile station transmits an Enhanced Access preamble and an Enhanced Access header in the Enhanced Access probe. The Enhanced Access data is transmitted on a Reverse Common Control Channel using closed loop power control.

1.3.62. Reverse CDMA Channel

The CDMA Channel from the mobile station to the base station. From the base stations perspective, the Reverse CDMA Channel is the sum of all mobile station transmissions on a CDMA frequency assignment.

1.3.63. Reverse Common Control Channel

A portion of a Reverse CDMA Channel used for the transmission of digital control information from one or more mobile stations to a base station. The Reverse

Common Control Channel can operate in a Reservation Access Mode or Designated Access Mode. It can be power controlled in the Reservation Access Mode or Designated Access Mode, and may support soft handoff in the Reservation Access Mode.

1.3.64. Reverse Common Control Channel Preamble

A non-data bearing portion of the Reverse Common Control Channel sent by the mobile station to assist the base station in initial acquisition and channel estimation.

1.3.65. Reverse Dedicated Control Channel

A portion of a Radio Configuration 3 through 6 Reverse Traffic Channel used for the transmission of higher-level data and control information from a mobile station to a base station.

1.3.66. Reverse Fundamental Channel

A portion of a Reverse Traffic Channel which carries higher-level data and control information from a mobile station to a base station.

1.3.67. Reverse Pilot Channel

An unmodulated, direct-sequence spread spectrum signal transmitted continuously by a CDMA mobile station. A reverse pilot channel provides a phase reference for coherent demodulation and may provide a means for signal strength measurement.

1.3.68. Reverse Supplemental Channel

A portion of a Radio Configuration 3 through 6 Reverse Traffic Channel which operates in conjunction with the Reverse Fundamental Channel or the Reverse Dedicated Control Channel in that Reverse Traffic Channel to provide higher data rate services, and on which higher-level data is transmitted.

1.3.69. Reverse Supplemental Code Channel

A portion of a Radio Configuration 1 and 2 Reverse Traffic Channel which operates in conjunction with the Reverse Fundamental Channel in that Reverse Traffic Channel, and (optionally) with other Reverse Supplemental Code Channels to provide higher data rate services, and on which higher-level data is transmitted.

1.3.70. Reverse Traffic Channel

A traffic channel on which data and signaling are transmitted from a mobile station to a base station. The Reverse Traffic Channel is composed of up to one Reverse Dedicated Control Channel, up to one Reverse Fundamental Channel, zero to two Reverse Supplemental Channels, and zero to seven Reverse Supplemental Code Channels.

1.3.71. Reverse Traffic Channel Preamble

A non-data bearing portion of the Reverse Pilot Channel sent by the mobile station to aid the base station in initial acquisition and channel estimation for the Reverse Dedicated Control Channel and Reverse Fundamental Channel.

1.3.72. RMS

Root of Mean Square.

1.3.73. RSQI

See Received Signal Quality Indicator.

1.3.74. Received Signal Quality Indicator (RSQI)

A Reverse Traffic Channel measure of signal quality related to the received Eb/N0. See also Eb.

1.3.75. Space Time Spreading (STS)

A forward link transmission method which transmits all forward link channel symbols on multiple antennas and spreads the symbols with complementary Walsh or quasi-orthogonal functions.

1.3.76. Spreading Rate (SR)

The PN chip rate of the Forward CDMA Channel or the Reverse CDMA Channel, defined as a multiple of 1.2288 Mcps.

1.3.77. Spreading Rate 1

Spreading Rate 1 is often referred to as “1X”. A Spreading Rate 1 Forward CDMA Channel uses a single direct-sequence spread carrier with a chip rate of 1.2288 Mcps. A Spreading Rate 1 Reverse CDMA Channel uses a single direct-sequence spread carrier with a chip rate of 1.2288 Mcps.

1.3.78. SR

See Spreading Rate.

1.3.79. STS

See Space Time Spreading.

1.3.80. Sync Channel

Code channel 32 in the Forward CDMA Channel, which transports the synchronization message to the mobile station.

1.3.81. System Time

The time reference used by the system. System Time is synchronous to UTC time (except for leap seconds) and uses the same time origin as Global Positioning

System (GPS) time. All base stations use the same System Time (within a small error). Mobile stations use the same System Time, offset by the propagation delay from the base station to the mobile station.

1.3.82. TD

Transmit Diversity schemes, including OTD and STS.

1.3.83. Traffic Channel

A communication path between a mobile station and a base station used for user and signaling traffic. The term Traffic Channel implies a Forward Traffic Channel and Reverse Traffic Channel pair. See also Forward Traffic Channel and Reverse Traffic Channel.

1.3.84. Transmit Diversity Pilot Channel

An unmodulated, direct-sequence spread spectrum signal transmitted continuously by a CDMA base station to support forward link transmit diversity. The pilot channel and the transmit diversity pilot channel provide phase references for coherent demodulation of forward link CDMA channels which employ transmit diversity.

1.3.85. Turbo Code

A type of error-correcting code. A code symbol is based on the outputs of the two recursive convolutional codes (constituent codes) of the Turbo code.

1.3.86. Valid Power Control Bit

A valid power control bit is sent on the Forward Traffic Channel in the second power control group following the corresponding Reverse Traffic Channel power control group which was not gated off and in which the signal was estimated.

1.3.87. Walsh Function

One of 2N time orthogonal binary functions.

2. TECHNICAL REQUIREMENTS

2.1. CDMA Receiver technical requirement

The CDMA base station receiving equipment shall include two diversity RF input ports. Receiver tests employ both inputs, unless otherwise specified. The equipment setups referenced in this section are functional. Other configurations may be necessary for actual testing due to equipment limitations and tolerances.

2.1.1. Frequency Coverage Requirements

2.1.1.1. For 800 MHz Band

The channel spacings, CDMA channel designations, and transmit center frequencies shall be as specified in Table 1. The base station receive CDMA frequency assignments are associated on a one-to-one basis with transmit CDMA frequency assignments.

Table 1- CDMA Channel Number to CDMA Frequency Assignment Correspondence for 800 MHz Band

Transmitter	CDMA Channel Number	CDMA Frequency Assignment, MHz
Mobile Station	N = 1 to 799	0.03 N + 825
	N = 991 to 1023	0.03 (N – 1023) + 825
Base Station	N = 1 to 799	0.03 N + 870
	N = 991 to 1023	0.03 (N – 1023) + 870

2.1.1.2. For 2 GHz Band

The channel spacings, CDMA channel designations, and transmit center frequencies shall be as specified in Table 2. The base station receive CDMA frequency assignments are associated on a one-to-one basis with transmit CDMA frequency assignments.

Table 2 - CDMA Channel Number to CDMA Frequency Assignment Correspondence for 2 GHz Band

Transmitter	CDMA channel number	Center Frequency for CDMA Channel (MHz)
Mobile Station	$0 \leq N \leq 1199$	1920.00 + 0.05 N
Base Station	$0 \leq N \leq 1199$	2110.00 + 0.05 N

2.1.1.3. For 450 MHz Band

The channel spacings, CDMA channel designations, and transmit center frequencies shall be as specified in Table 3. The base station receive CDMA frequency assignments are associated on a one-to-one basis with transmit CDMA frequency assignments.

Table 3 - CDMA Channel Number to CDMA Frequency Assignment Correspondence for 450 MHz Band

Transmitter	CDMA channel number	Center Frequency for CDMA Channel (MHz)
Mobile Station	N = 1 to 300	0.025(N - 1) + 450.000
Base Station	N = 1 to 300	0.025(N - 1) + 460.000

2.1.2. Receiver Performance

2.1.2.1. Receiver Sensitivity

a) Definition

The receiver sensitivity of the base station receiver is defined as the minimum received power, measured at the base station RF input ports, at which the Reverse Traffic Channel FER is maintained at 1%.

b) Method of Measurement

1. Configure the base station under test and a mobile station simulator as shown in Figure 2.
2. For each band that the base station supports, configure the base station to operate in that band and perform steps 3 through 8.
3. Disable the AWGN generators (set their output powers to zero).
4. If the base station supports demodulation of Radio Configuration 1, 2, 3, or 4, set up a call using Fundamental Traffic Channel Test Mode 1 or 3 or Dedicated Control Channel Test Mode 3 and perform steps 6 through 8.
5. If the base station supports demodulation of Radio Configuration 5 or 6, set up a call using Fundamental Channel Test Mode 7 or Dedicated Control Channel Test Mode 7 and perform steps 6 through 8.
6. Adjust the equipment to ensure that a signal power of -117 dBm (for 800 MHz and 450 MHz bands) or -119 dBm (for 2 GHz band) per RF input port is not exceeded. Reverse Traffic Channel closed loop power control in the mobile station simulator should be disabled.
7. Transmit random data to the mobile station simulator at full data rate.
8. Measure the frame error rate as described in 2.6.7.

b) Minimum technical requirement

The FER shall be 1.0% or less with 95% confidence.

2.1.2.2. Receiver Dynamic Range

a) Definition

The receiver dynamic range is the input power range at the base station RF input ports over which the FER does not exceed a specific value. Its lower limit is the sensitivity as measured by the test in 3.2.1. Its upper limit is the maximum total power per RF input port at which an FER of 1% is maintained.

b) Method of Measurement

1. Configure the base station under test and a mobile station simulator as shown in Figure 2.
2. If the base station supports demodulation of Radio Configuration 1 or 2, set up a call using Fundamental Channel Test Mode 1 and perform steps 5 through 7.
3. If the base station supports demodulation of Radio Configuration 3 or 4, set up a call using Fundamental Channel Test Mode 3 or Dedicated Control Channel Test Mode 3 and perform steps 5 through 7.

4. If the base station supports demodulation of Radio Configuration 5 or 6, set up a call using Fundamental Channel Test Mode 7 or Dedicated Control Channel Test Mode 7 and perform steps 5 through 7.
5. Adjust the equipment for a noise power spectral density at each RF input port of not less than -65 dBm/1.23 MHz and a signal power corresponding to an E_b/N_0 of 10 dB ±1 dB. Reverse Traffic Channel closed loop power control in the mobile station simulator may be disabled.
6. Transmit random data to the mobile station simulator at full data rate.
7. Measure the frame error rate as described in 2.6.7.

c) Minimum technical requirement

The FER shall be 1.0% or less with 95% confidence.

2.1.2.3. Single Tone Desensitization

a) Definition

Single tone desensitization is a measure of the ability to receive a CDMA signal on the assigned channel frequency in the presence of a single tone that is offset from the center frequency of the assigned channel.

This test is apply to all bands except 2 GHz band, where no narrow-band interferers are currently known.

b) Method of Measurement

1. Configure the base station under test and a mobile station simulator as shown in Figure 3.
2. For each band that the base station supports, except 2 GHz band, configure the base station to operate in that band and perform steps 3 through 12.
3. Adjust the equipment to ensure path losses of at least 100 dB. All power control mechanisms shall be enabled and set at nominal values.
4. If the base station supports demodulation of Radio Configuration 1 or 2, set up a call using Fundamental Channel Test Mode 1 and perform steps 7 through 11.
5. If the base station supports demodulation of Radio Configuration 3 or 4, set up a call using Fundamental Channel Test Mode 3 or Dedicated Control Channel Test Mode 3 and perform steps 7 through 11.
6. If the base station supports demodulation of Radio Configuration 5 or 6, set up a call using Fundamental Channel Test Mode 7 or Dedicated Control Channel Test Mode 7 and perform steps 7 through 11.
7. Transmit random data to the mobile station simulator at full data rate.
8. Measure the mobile station simulator output power.
9. If the base station is operating with 800 MHz band, perform steps 11 and 12 with the CW generator adjusted to offsets of +750 kHz, -750 kHz, +900 kHz, and -900 kHz from the CDMA frequency assignment.
10. If the base station is operating with 450 MHz band, perform steps 11 and 12 with the CW generator adjusted to offsets of +900 kHz, and -900 kHz from the CDMA frequency assignment.

11. If the offset is ±750 kHz, then adjust the CW generator power to be 50 dB above the mobile station simulator output power at the RF input ports as measured in step 8.

    If the offset is ±900 kHz, then adjust the CW generator power to be 87 dB above the mobile station simulator output power at the RF input ports as measured in step 8.

12. Measure the mobile station simulator output power and FER of the base station receiver.

c) Minimum technical requirement

The output power of the mobile station simulator shall increase by no more than 3 dB and the FER shall be less than 1.5% with 95% confidence.

In the case of adjacent Reverse CDMA Channels supported by the base station, the CW generator frequencies that occur between adjacent carrier center frequencies should not be tested.

2.1.2.4. Intermodulation Spurious Response Attenuation

a) Definition

The intermodulation spurious response attenuation is a measure of a receiver's ability to receive a CDMA signal on its assigned channel frequency in the presence of two interfering CW tones. These tones are separated from the assigned channel frequency and from each other such that the third order mixing of the two interfering CW tones can occur in the non-linear elements of the receiver, producing an interfering signal in the band of the desired CDMA signal.

b) Method of Measurement

1. Configure the base station under test and a mobile station simulator as shown in Figure 4.
2. For each band that the base station supports, configure the base station to operate in that band and perform steps 3 through 11.
3. Adjust the equipment to ensure path losses of at least 100 dB. All power control mechanisms shall be enabled and set at nominal values.
4. If the base station supports demodulation of Radio Configuration 1, 2, 3, or 4, set up a call using Fundamental Channel Test Mode 1 or 3 or Dedicated Control Channel Test Mode 3 and perform steps 6 through 11.
5. If the base station supports demodulation of Radio Configuration 5 or 6, set up a call using Fundamental Channel Test Mode 7 or Dedicated Control Channel Test Mode 7 and perform steps 6 through 11.
6. Transmit random data to the mobile station simulator at full data rate.
7. Measure the mobile station simulator output power.
8. If the base station is operating with 800 MHz Band or 450 MHz Band, perform steps 10 and 11 with the CW generators is adjusted to offsets of +900 kHz and +1700 kHz, and -900 kHz and -1700 kHz from the CDMA frequency assignment.
9. If the base station is operating with 2 GHz Band, perform steps 10 and 11 with the CW generators is adjusted to offsets of +1.25 MHz and

+2.05 MHz, and -1.25 MHz and -2.05 MHz from the CDMA frequency assignment.

10. Adjust the CW generator powers to be 72 dB for 800 MHz Band, 450 MHz Band or 70 dB for 2 GHz Band above the mobile station simulator output power at the RF input ports as measured in step 7.
11. Measure the mobile station simulator output power and the FER of the base station receiver.

c) Minimum technical requirement

The output power of the mobile station simulator shall increase by no more than 3 dB and the FER shall be less than 1.5% with 95% confidence.

2.1.2.5. Adjacent Channel Selectivity

a) Definition

Adjacent channel selectivity is a measure of the ability to receive a CDMA signal on the assigned channel frequency in the presence of another CDMA signal that is offset from the center frequency of the assigned channel by ±2.5 MHz.

b) Method of Measurement

1. Configure the base station under test and a mobile station simulator as shown in Figure 9.
2. Adjust the equipment to ensure path losses of at least 100 dB. All power control mechanisms shall be enabled and set at nominal values.
3. If the base station supports demodulation of Radio Configuration 1 or 2, set up a call using Fundamental Channel Test Mode 1 and perform steps 6 through 9.
4. If the base station supports demodulation of Radio Configuration 3 or 4, set up a call using Fundamental Channel Test Mode 3 or Dedicated Control Channel Test Mode 3 and perform steps 6 through 9.
5. If the base station supports demodulation of Radio Configuration 5 or 6, set up a call using Fundamental Channel Test Mode 7 or Dedicated Control Channel Test Mode 7 and perform steps 6 through 9.
6. Transmit random data to the mobile station simulator at full data rate.
7. Measure the mobile station simulator output power.
8. The mobile station simulator 2 adjusted to offsets of +2.5 MHz and -2.5 MHz from the CDMA frequency assignment with an output power of -53 dBm. The mobile station simulator shall be one mobile station transmitting a full rate RC 3 signal.
9. Measure the mobile station simulator output power and FER of the base station receiver.

c) Minimum technical requirement

The output power of the mobile station simulator shall increase by no more than 3 dB and the FER shall be less than 1.5% with 95% confidence.

2.1.3. Limitations on Emissions

2.1.3.1. Conducted Spurious Emissions

a) Definition

Conducted spurious emissions are spurious emissions generated or amplified in the base station equipment and appearing at the receiver RF input ports.

b) Method of Measurement

1. Connect a spectrum analyzer (or other suitable test equipment) to a receiver RF input port.
2. Disable all transmitter RF outputs.
3. Perform step 4 for all receiver input ports.
4. Sweep the spectrum analyzer over a frequency range from the lowest intermediate frequency or lowest oscillator frequency used in the receiver or 1 MHz, whichever is lower, to at least 2600 MHz and measure the spurious emission levels.

c) Minimum technical requirement

The conducted spurious emissions shall be:

1. Less than -80 dBm, measured in a 30 kHz resolution bandwidth at the base station RF input ports, for frequencies within the base station receiver band.
2. Less than -60 dBm, measured in a 30 kHz resolution bandwidth at the base station RF input ports, for frequencies within the base station transmit band.
3. Less than -47 dBm, measured in a 30 kHz resolution bandwidth at the base station RF input ports, for all other frequencies.

2.1.3.2 Radiated Spurious Emissions

No receiver radiated spurious emissions are explicitly stated. In general, received radiated spurious emissions are tested together with transmitter radiated spurious emissions.

2.2. CDMA transmitter Minimum technical requirements

Unless otherwise specified, all tests in this section shall be performed with a single antenna connector enabled for output.

2.2.1. Frequency Requirements

2.2.1.1. Frequency Coverage

Channel frequencies and designations are given for CDMA base stations and mobile stations in 2.1.1. The base station receiver CDMA frequency assignments are associated on a one-to-one basis with the transmitter CDMA frequency assignments. Each CDMA frequency assignment shall be centered at one of the indicated frequencies. Note that the base station transmitter may be fixed to a specific CDMA frequency assignment or may be designed to cover a subset of the available frequency assignments.

2.2.1.2. Frequency Tolerance

a) Definition

Frequency tolerance is defined as the maximum allowed difference between the actual CDMA transmit carrier frequency and the specified CDMA transmit frequency assignment. This test shall apply to every band that the base station supports.

b) Method of Measurement

Frequency shall be measured using appropriate test equipment with sufficient accuracy to ensure compliance with the Minimum technical requirement. Frequency should be measured as part of the waveform quality test.

c) Minimum technical requirement

For all operating temperatures specified by the manufacturer, the average frequency difference between the actual CDMA transmit carrier frequency and specified CDMA transmit frequency assignment shall be less than $\pm 5 \times 10^{-8}$ of the frequency assignment (±0.05 ppm).

2.2.2. Modulation Requirements

2.2.2.1 Waveform Quality

a) Definition

Waveform quality is measured by determining the normalized correlated power between the actual waveform and the ideal waveform.

b) Method of Measurement

Figure 5 for a functional block diagram of the test setup.

1. Connect the base station RF output port that contains the Forward Pilot Channel to the test equipment described in 2.6.4.2.
2. For each band that the base station supports, configure the base station to operate in that band and perform steps 5 through 6.
3. Configure the base station to transmit the Forward Pilot Channel only and perform steps 5 and 6.
4. If the base station supports transmit diversity, connect the base station RF output port that contains the Transmit Diversity Pilot Channel to the test equipment described in 2.6.4.2. Configure the base station to transmit the Transmit Diversity Pilot Channel only and perform steps 5 and 6.
5. Trigger the test equipment from the system time reference signal from the base station.
6. Measure the waveform quality factor.

c) Minimum technical requirement

The normalized cross correlation coefficient, ρ, shall be greater than 0.912 (excess power < 0.4 dB).

2.2.3. RF Output Power Requirements

2.2.3.1. Total Power

a) Definition

Total power is the mean power delivered to a load with resistance equal to the nominal load impedance of the transmitter.

b) Method of Measurement

1. Connect the power measuring equipment to the base station RF output port.
2. For each band that the base station supports, configure the base station to operate in that band and perform steps 3 and 4.
3. Set the base station to transmit a signal modulated with a combination of Pilot, Sync, Paging, and Traffic Channels as stated in 2.6.5.2.
4. Measure the mean power at the RF output port.

c) Minimum technical requirement

The total power shall remain within +2 dB and -4 dB of the manufacturers rated power for the equipment over the environmental conditions described in Section 2.3.

2.2.3.2. Pilot Power

a) Definition

The Pilot Channel power to total power ratio is the power attributed to the Pilot Channel divided by the total power, and is expressed in dB. The Code Domain Power Analyzer is used to determine the ratio of the Pilot Channel power to the total power. This equipment is described in 2.6.4.2.

b) Method of Measurement

1. Connect the base station RF output port to the Code Domain Power Analyzer using an attenuator or directional coupler if necessary.
2. For each band that the base station supports, configure the base station to operate in that band and perform steps 3 and 4.
3. Configure the base station to transmit a signal modulated with a combination of Pilot, Sync, Paging, and Traffic Channels as described in 2.6.5.2.
4. Measure the Pilot Channel power to total power ratio.

c) Minimum technical requirement

The Pilot Channel power to total power ratio shall be within ±0.5 dB of the configured value.

2.2.3.3. Code Domain Power

a) Definition

Code domain power is the power in each code channel of a CDMA Channel. The CDMA time reference used in the code domain power test is derived from the Pilot Channel and is used as the reference for demodulation of all other code channels. This test verifies that orthogonality is maintained between the code channels. When transmit diversity is enabled, this test also verifies that time alignment is maintained.

b) Method of Measurement

1. Configure the base station to operate in that band as shown in Figure 6 and 7.
2. For each band that the base station supports, configure the base station to operate in that band and perform steps 3 through 8.
3. If the base station supports demodulation of Radio Configuration 1 or 2, set up a call using Fundamental Channel Test Mode 1 and perform steps 6 through 8.

4. If the base station supports demodulation of Radio Configuration 3 or 4, set up a call using Fundamental Channel Test Mode 3 or Dedicated Control Channel Test Mode 3 and perform steps 6 through 8.
5. If the base station supports demodulation of Radio Configuration 5 or 6, set up a call using Fundamental Channel Test Mode 7 or Dedicated Control Channel Test Mode 7 and perform steps 6 through 8.
6. Set the base station to transmit at the manufacturers maximum rated power.
7. Measure the base station transmitter output at the RF output port with a Code Domain Power Analyzer described in 2.6.4.2 with transmit diversity disabled.
8. If the base station supports transmit diversity for the radio configuration under test, measure the base station transmitter output at the RF output port with a Code Domain Power Analyzer described in 2.6.4.2 with transmit diversity enabled.
9. Equal cabling delays shall be used when connecting the two antenna ports to the summer in Figure 7.

c) Minimum technical requirement

When operating with the Fundamental Channel Test Mode 1, the code domain power in each inactive W_n^{64} channel shall be 27 dB or more below the total output power.

When operating with the Fundamental Channel Test Mode 3 or Dedicated Control Channel Test Mode 3, the code domain power in each inactive W_n^{128} channel shall be 30 dB or more below the total output power.

When operating with the Fundamental Channel Test Mode 7 or Dedicated Control Channel Test Mode 7, the code domain power in each inactive W_n^{256} channel shall be 33 dB or more below the total output power of each carrier.

2.2.4. Limitations on Emissions

2.2.4.1. Conducted Spurious Emissions

a) Definition

Conducted spurious emissions are emissions at frequencies that are outside the assigned CDMA Channel, measured at the base station RF output port.

b) Method of Measurement

1. Connect a spectrum analyzer (or other suitable test equipment) to each base station RF output port, using an attenuator or directional coupler if necessary.
2. For each band that the base station supports, configure the base station to operate in that band and perform steps 3 through 11.
3. Configure the base station to transmit a single carrier and perform steps 4 through 6.
4. Set the base station to transmit a signal modulated with a combination of Pilot, Sync, Paging, and Traffic Channels. Total power at the RF output port shall be the maximum power as specified by the manufacturer.
5. Measure the power level at the carrier frequency.
6. Measure the spurious emission levels.

7. If the base station supports two carriers through a single RF output port with a carrier-to-carrier spacing of 1.23 MHz (800 MHz Band) or 1.25 MHz (all other bands), configure the base station to transmit two adjacent carriers and perform steps 10 and 11.
8. If the base station supports two carriers through a single RF output port with a carrier-to-carrier spacing of greater than 1.23 MHz (800 MHz Band) or 1.25 MHz (all other bands), configure the base station to transmit two non-adjacent carriers and perform steps 10 and 11.
9. If the base station supports three or more carriers through a single RF output port, configure the base station to transmit all carriers with the smallest carrier-to-carrier spacing specified by the manufacturer and perform steps 10 and 11.
10. Set the base station to transmit multiple signals modulated with a combination of Pilot, Sync, Paging, and Traffic Channels. Total power at the RF output port shall be the maximum power as specified by the manufacturer for the multiple-carrier configuration under test.
11. Measure the spurious emission levels.

c) Minimum technical requirement

The spurious emissions shall be less than all of the limits specified in Table 4 bellow:

Table 4 - 800 MHz, 450 MHz Band transmitter spurious emission limits

For $|\Delta f|$ Within the range	Applies to multiple carriers	Emission limit
750 kHz to 1.98 MHz	No	-45 dBc / 30 kHz
1.98 MHz to 4.00 MHz	No	-60 dBc / 30 kHz; $P_{out} \geq$ 33 dBm -27 dBm / 30 kHz; 28 dBm $\leq P_{out}$ < 33 dBm -55 dBc / 30 kHz; P_{out} < 28 dBm
> 4.00 MHz (ITU Category A only)	Yes	-13 dBm / 1 kHz; 9 kHz < f < 150 kHz -13 dBm / 10 kHz; 150 kHz < f < 30 MHz -13 dBm / 100 kHz; 30 MHz < f < 1 GHz -13 dBm / 1 MHz; 1 GHz < f < 5 GHz
> 4.00 MHz (ITU Category B only)	Yes	-36 dBm / 1 kHz; 9 kHz < f < 150 kHz -36 dBm / 10 kHz; 150 kHz < f < 30 MHz -36 dBm / 100 kHz; 30 MHz < f < 1

		GHz -30 dBm / 1 MHz; 1 GHz < f < 12.5 GHz

Note: All frequencies in the measurement bandwidth shall satisfy the restrictions on |Δf| where Δf = center frequency - closer measurement edge frequency (f). Compliance with the -35 dBm / 6.25 kHz limit is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral power in a 6.25 kHz segment. For multiple-carrier testing, Δf is defined for positive Δf as the center frequency of the highest carrier - closer measurement edge frequency (f) and for negative Δf as the center frequency of the lowest carrier - closer measurement edge frequency (f).

Table 5 - 2 GHz Band Transmitter Spurious Emission Limits

For |Δf| Within the Range	Applies to Multiple Carriers	Emission Limit
885 kHz to 1.25 MHz	No	-45 dBc/30 kHz
1.25 to 1.98 MHz	No	More stringent of -45 dBc/30 kHz or -9 dBm / 30 kHz
1.25 to 2.25 MHz	Yes	-9 dBm/30 kHz
1.25 to 1.45 MHz (2 GHz Band only)	Yes	-13 dBm/30 kHz
1.45 to 2.25 MHz (2 GHz Band only)	Yes	-[13 + 17(Δf - 1.45 MHz)] dBm/30 kHz
1.98 to 2.25 MHz	No	-55 dBc/30 kHz; $P_{out} \geq$ 33 dBm -22 dBm/30 kHz; 28 dBm $\leq P_{out} <$ 33 dBm -50 dBc/30 kHz; $P_{out} <$ 28 dBm
2.25 to 4.00 MHz	Yes	-13 dBm/1 MHz
> 4.00 MHz (ITU Category A only)	Yes	-13 dBm/1 kHz; 9 kHz < f < 150 kHz -13 dBm/10 kHz; 150 kHz < f < 30 MHz -13 dBm/100 kHz; 30 MHz < f < 1 GHz -13 dBm/1 MHz; 1 GHz < f < 5 GHz
> 4.00 MHz (ITU Category B	Yes	-36 dBm/1 kHz; 9 kHz < f < 150 kHz

only)		-36 dBm/10 kHz; 150 kHz < f < 30 MHz -36 dBm/100 kHz; 30 MHz < f < 1 GHz -30 dBm/1 MHz; 1 GHz < f < 12.5 GHz

Note: All frequencies in the measurement bandwidth shall satisfy the restrictions on |Δf| where Δf = center frequency - closer measurement edge frequency (f). The -9 dBm requirement is based on CFR 47 Part 24 - 13 dBm/12.5 kHz specification. For multiple-carrier testing, Δf is defined for positive Δf as the center frequency of the highest carrier - closer measurement edge frequency (f) and for negative Δf as the center frequency of the lowest carrier - closer measurement edge frequency (f).

Table 6 - Additional 2 GHz Band Transmitter Spurious Emission Limits

Measurement Frequency	Applies to Multiple Carriers	Emission Limit	When Coverage Overlaps With
1893.5 to 1919.6 MHz	No	-41 dBm/300 kHz	PHS
876 to 915 MHz	No	-98 dBm/100 kHz (co-located only)	GSM 900
921 to 960 MHz	Yes	-57 dBm/100 kHz	GSM 900
1710 to 1785 MHz	No	-98 dBm/100 kHz (co-located only)	DCS 1800
1805 to 1880 MHz	Yes	-47 dBm/100 kHz	DCS 1800
1900 to 1920 MHz and 2010 to 2025 MHz	No	-86 dBm/1 MHz (co-located only)	UTRA TDD
1900 to 1920 MHz and 2010 to 2025 MHz	Yes	-52 dBm/1 MHz	UTRA TDD
1920 to 1980 MHz	No	-86 dBm/1 MHz (co-located only)	Always

2.2.4.2. Radiated Spurious Emissions

Radiated Spurious Emissions shall not exceed values listed in the following table.

Table 7- Attenuation values and absolute mean power levels used to calculate maximum permitted spurious emission power levels for use with radio equipment

Frequency band containing the assignment (lower limit exclusive, upper limit inclusive)	For any spurious component, the attenuation (mean power within the necessary bandwidth relative to the mean power of the spurious component concerned) shall be at least that specified below and the absolute mean power levels given shall not be exceeded
235 MHz to 960 MHz	
Mean power above 25 W	60 dB 20 mW
Mean power 25 W or less	40 dB 25 μW
960 MHz to 17.7 GHz	
Mean power above 10 W	50 dB 100 mW
Mean power 10 W or less	100 μW

2.2.4.3. Inter-Base Station Transmitter Intermodulation

a) Definition

Inter-base station transmitter intermodulation occurs when an external signal source is introduced to the antenna connector of the base station. This test verifies that conducted spurious emissions are still met with the presence of the interfering source.

b) Method of Measurement

1. Connect a spectrum analyzer (or other suitable test equipment) and the external base station to the base station RF output port, using attenuators or directional couplers if necessary as shown in Figure 8.
2. For each band that the base station supports, configure the base station to operate in that band and perform steps 3 through 6.
3. Set the base station under test to transmit a signal modulated with a combination of Pilot, Sync, Paging, and Traffic Channels. Total power at the RF output port shall be the maximum power as specified by the manufacturer.
4. Set the second base station to transmit a signal modulated with a combination of Pilot, Sync, Paging, and Traffic Channels with a total power that is 30 dB less than the power of the other base station with an offset of 1.25 MHz between the center of the CDMA center frequencies.
5. Measure the power level at the carrier frequency.
6. Measure the spurious emission level at the image of the base station transmitter and the interference source. The image is centered at a frequency of 2 times the center frequency of the base station under test minus the center frequency of the

second base station. The bandwidth of the image is the same as the bandwidth of the RC in effect.

c) Minimum technical requirement

The base station shall meet the conducted spurious emission requirements in 2.2.4.1 that apply to the image.

2.2.4.4. Occupied Bandwidth

This test applies to 2 GHz Band only.

a) Definition

The occupied bandwidth is define as the frequency range, whereby the power of emissions averaged over the frequency above and under the edge frequency are 0.5% each of the total radiation power of a modulated carrier.

b) Method of Measurement

1. Connect the spectrum analyzer (or other suitable test equipment) to the base station RF output port using an attenuator.
2. Set the base station to transmit a single modulated with a combination of Pilot, Syns, Paging, and Traffic Channels. Total power at the RF output port shall be the normal power as specified by the manufacturer.
3. Set the resolution bandwidth of the spectrum analyzer to 30 kHz. The value of the occupied bandwidth is calculated by an external or internal computer by summing all samples stored as "total power".

c) Minimum technical requirement

The occupied bandwidth shall not exceed 1.48 MHz.

2.3. CDMA general requirements

2.3.1. Temperature and Power Supply Voltage

a) Definition

The temperature and voltage ranges denote the ranges of ambient temperature and power supply input voltages over which the base station will operate and meet the requirements of this Standard. The ambient temperature is the average temperature of the air surrounding the base station equipment. The power supply voltage is the voltage applied at the input terminals of the base station equipment. The manufacturer is to specify the temperature range and the power supply voltage over which the equipment is to operate.

b) Method of Measurement

The base station equipment shall be installed in its normal configuration (i.e., in its normal cabinet or rack mounting arrangement with all normally supplied covers installed) and placed in a temperature chamber. Optionally, the equipment containing the frequency determining element(s) may be placed in the temperature chamber if the frequency stability is to be maintained over a different temperature from that specified for the rest of the base station equipment.

The temperature chamber shall be stabilized at the manufacturer's highest specified operating temperature and then shall be operated in accordance with the standard duty cycle test conditions specified in Section 6, and over the power supply input voltage range specified by the manufacturer. With the base station equipment operating, the temperature is to be maintained at the specified test temperature without forced circulation of air from the temperature chamber being directly applied to the base station equipment.

During the entire duty cycle, the transmitter frequency accuracy, timing reference, output power, and waveform quality shall be measured as specified in Section 4.

Turn the base station equipment off, stabilize the equipment in the chamber at room temperature, and repeat the above measurements after a 15-minute standby warm up period.

Turn the base station equipment off, stabilize the equipment in the chamber at the coldest operating temperature specified by the manufacturer, and repeat the above measurements above after a 15-minute standby warm up period.

For transmitter frequency stability measurements, the above procedure shall be repeated every 10^0C over the operating temperature range specified by the manufacturer. The equipment shall be allowed to stabilize at each step before a frequency measurement is made.

c) Minimum technical requirement

Over the ambient temperature and power supply ranges specified by the manufacturer, the operation of the base station equipment shall conform to the limits shown in Table 7.

Table 7- Environmental test limits

Parameter	Limit	Reference
Frequency Tolerance	±0.05 ppm	4.1.2
Time Reference	±10 μs	4.2.1.1
Pilot Waveform Quality	$\rho > 0.912$	4.2.2
RF Power Output Variation	+2 dBm, –4 dB	4.3.1

2.3.2. High Humidity

a) Definition

The term "high humidity" denotes the relative humidity at which the base station will operate with no more than a specified amount of degradation in performance.

b) Method of Measurement

The base station equipment, after having been adjusted for normal operation under standard test conditions, shall be placed, inoperative, in a humidity chamber with the humidity maintained at 0.024 gm H_2O/gm Dry Air at 50^0C (40% relative humidity) for a period of not less than eight hours. While in the chamber and at the end of this period, the base station transmitting equipment shall be tested for frequency accuracy, timing reference, output power, and waveform quality. No readjustment of the base station equipment shall be allowed during this test.

c) Minimum technical requirement

Under the above humidity conditions, the operation of the base station equipment shall conform to the limits specified in Table 7.

2.3.3. AC Power Line Conducted Emissions

a) Definition

AC power line conducted emissions tests shall be performed on all equipment that directly connects to the public utility power line. For equipment that receives power from a device that is directly connected to the public utility power line (such as a DC power supply), the conducted emissions tests shall be performed on the power supply device, with the equipment under test connected, to insure that the supply continues to meet the current emissions standards. AC power line conducted emissions tests are not required for equipment that contains an internal power source or battery supply with no means for connection to the public utility power line.

b) Method of Measurement

The conducted measurement procedures described in 2.2.4.1 shall be used for measuring conducted spurious emissions.

c) Minimum technical requirement

The radio frequency voltage, as measured in 2.3.3.2, shall not exceed 1 mV for frequencies between 450 and 1705 kHz and shall not exceed 3 mV for frequencies between 1.705 and 30 MHz.

2.4. Test Modes

The Forward Traffic Channel and Reverse Traffic Channel are verified by invoking Fundamental Channel test modes, Dedicated Control Channel test modes, Supplemental Channel test modes, and Supplemental Code Channel test modes. Table 8 lists the nine test modes and the mapping to radio configurations.

Table 8 - Test modes

Test mode	Forward Traffic Channel Radio Configuration	Reverse Traffic Channel Radio Configuration
1	1	1
2	2	2
3	3	3
4	4	3
5	5	4

6	6	5
7	7	5
8	8	6
9	9	6

Fundamental Channel Test Mode 1 is entered by setting up a call using the Loopback Service Option (Service Option 2 or 55) or the Markov Service Option (Service Option 54). Supplemental Code Channel Test Mode 1 is entered by setting up a call using the Loopback Service Option (Service Option 30).

Fundamental Channel Test Mode 2 is entered by setting up a call using the Loopback Service Option (Service Option 9 or 55) or the Markov Service Option (Service Option 54). Supplemental Code Channel Test Mode 2 is entered by setting up a call using the Loopback Service Option (Service Option 31).

Fundamental Channel Test Modes 3 through 9 are entered by setting up a call using the Loopback Service Option (Service Option 55), Markov Service Option (Service Option 54), or Test Data Service Option (Service Option 32).

Dedicated Control Channel Test Modes 3 through 9 and Supplemental Channel Test Modes 3 through 9 are entered by setting up a call using the Test Data Service Option (Service Option 32).

2.5. Standard Emissions Measurement Procedures

2.5.1. Radiated Emissions Measurement

2.5.1.1. Standard Radiation Test Site

The test site shall be on level ground that is of uniform electrical characteristics. The site shall be clear of metallic objects, overhead wires, etc., and shall be as free as possible from undesired signals, such as ignition noise and other carriers. Reflecting objects, such as rain gutters and power cables, shall lie outside an ellipse measuring 60 meters on the major axis by 52 meters on the minor axis for a 30-meter site, or an ellipse measuring 6 meters on the major axis by 5.2 meters on the minor axis for a 3-meter site. The equipment under test shall be located at one focus of the ellipse and the measuring antenna at the other focus. If desired, shelters may be provided at the test site to protect the equipment and personnel. All such construction shall be of wood, plastic, or other non-metallic material. All power, telephone, and control circuits to the site shall be buried at least 0.3 meter under ground.

A turntable, essentially flush with the ground, shall be provided that can be remotely controlled. A platform 1.2 meters high shall be provided on this turntable to hold the equipment under test. Any power and control cables that are used for this equipment should extend down to the turntable, and any excess cabling should be coiled on the turntable.

If the equipment to be tested is mounted in racks and is not easily removed for testing on the above platform, then the manufacturer may elect to test the equipment when it is mounted in its rack (or racks). In this case, the rack (or racks) may be placed directly on the turntable.

If a transmitter with an external antenna is being tested, then the RF output of this transmitter shall be terminated in a non-radiating load that is placed on the turntable. A non-radiating load is used in lieu of an antenna to avoid interference with other radio users. The RF cable to this load should be of minimum length. The transmitter shall be tuned and adjusted to its rated output value before starting the tests.

2.5.1.2. Search Antenna

For narrow-band dipole adjustable search antennas, the dipole length shall be adjusted for each measurement frequency. This length may be determined from a calibration ruler that is normally supplied with the equipment.

The search antenna shall be mounted on a movable non-metallic horizontal boom that can be raised or lowered on a wooden or other non-metallic pole. The cable connected to the search antenna shall be at a right angle to the antenna. The cable shall be dressed at least 3 meters, either through or along the horizontal boom, in a direction away from the equipment being measured. The search antenna cable may then be dropped from the end of the horizontal boom to ground level for connection to the field-strength measuring equipment.

The search antenna shall be capable of being rotated 90 degrees on the end of the horizontal boom to allow measurement of both vertically and horizontally polarized signals. When the antenna length of a vertically mounted antenna does not permit the horizontal boom to be lowered to its minimum specified search range, adjust the minimum height of the boom for 0.3 meter clearance between the end of the antenna and the ground.

2.5.1.3. Field-Strength Measurement

A field-strength meter shall be connected to a search antenna. The field-strength meter shall have sufficient sensitivity and selectivity to measure signals over the required frequency ranges at levels at least 10 dB below the levels specified in any document, standard, or specification that references this measurement procedure. The calibration of the measurement instruments (field-strength meter, antennas, etc.) shall be checked frequently to ensure that their accuracy is in accordance with the current standards. Such calibration checks shall be performed at least once per year.

2.5.1.4. Frequency Range of Measurements

When measuring radiated signals from transmitting equipment, the measurements shall be made from the lowest radio frequency (but no lower than 25 MHz) generated in the equipment to the tenth harmonic of the carrier, except for that region close to the carrier equal to ±250% of the authorized bandwidth.

When measuring radiated signals from receiving equipment, the measurements shall be made from 25 MHz to at least 6 GHz.

2.5.1.5. Test Ranges

a) 30-Meter Test Range

Measurement of radiated signals shall be made at a point 30 meters from the center of the turntable. The search antenna is to be raised and lowered from 1 to 4 meters in both horizontally and vertically polarized orientations.

The field-strength measuring meter may be placed on a suitable table or tripod at the foot of the mast.

When measuring radiated emissions from receivers, equipment that contains its own receive antenna shall be tested with the antenna in place. Equipment that is connected to an external receive antenna via a cable shall be tested without the antenna, and the receive ports on the equipment under test shall be terminated in a 50 Ω on-radiating resistive load.

b) 3-Meter Test Range

Measurement of radiated signals may be made at a point 3 meters from the center of the turntable, provided the following three conditions can be met:

1. A ground screen that covers an elliptical area at least 6 meters on the major axis by 5.2 meters on the minor axis is used, with the measuring antenna and turntable mounted 3 meters apart. The measuring antenna and turntable shall lie on the major axis and shall be equidistant from the minor axis of the elliptical area.
2. The maximum dimension of the equipment shall be 3 meters or less. When measuring radiated signals from receivers, the maximum dimension shall include the antenna if it is an integral part of the device.
3. The field-strength measuring equipment is either mounted below the ground level at the test site or is located a sufficient distance away from the equipment being tested and from the search antenna to prevent corruption of the measured data.

The search antenna is to be raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations. When the search antenna is vertically oriented, the minimum height of the center of the search antenna shall be defined by the length of the lower half of the search antenna.

When measuring radiated emissions from receivers, equipment that contains its own receive antenna shall be tested with the antenna in place. Equipment that is connected to an external receive antenna via a cable shall be tested without the antenna, and the receive ports on the equipment under test shall be terminated in a 50 Ω non-radiating resistive load. The 3-meter test range may be used for determining compliance with limits specified at 30 meters (or other distances), provided that:

1. The ground reflection variations between the two distances have been calibrated for the frequencies of interest at the test range, or
2. A 5 dB correction factor is added to the specified radiation limit(s) to allow for average ground reflections.

Radiated field strength (volt/meter) varies inversely with distance, so that a measurement made on the 3-meter test range divided by 10 gives the equivalent value that would be measured on a 30-meter test range for the same EIRP (effective isotropic radiated power). The 30-meter field strength in volt/meter can be calculated from the EIRP by using the following formula:

$$\mu V/m \text{ @ } 30 \text{ meters} = 5773.5 \times 10^{EIRP(dBm)/20}$$

2.5.1.6. Radiated Signal Measurement Procedures

Radiated signals having significant levels shall be measured on the 30-meter or 3-meter test range by using the following procedure:

1. For each observed radiated signal, raise and lower the search antenna to obtain a maximum reading on the field-strength meter with the antenna horizontally polarized. Then rotate the turntable to maximize the reading. Repeat this procedure of raising and lowering the antenna and rotating the turntable until the highest possible signal has been obtained. Record this maximum reading.
2. Repeat step 1 for each observed radiated signal with the antenna vertically polarized.
3. Remove the equipment being tested and replace it with a half-wave antenna. The center of the half-wave antenna should be at the same approximate location as the center of the equipment being tested.
4. Feed the half-wave antenna replacing the equipment under test with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized and with the signal generator tuned to the observed radiated signal, raise and lower the search antenna to obtain a maximum reading on the field-strength measuring meter. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. Record the signal generator power output.
5. Repeat step 4 above with both antennas vertically polarized.
6. Calculate the power into a reference ideal isotropic antenna by:
   a) First reducing the readings obtained in steps 4 and 5 above by the power loss in the cable between the generator and the source antenna, and
   b) Then correcting for the gain of the source antenna used relative to an ideal isotropic antenna. The reading thus obtained is the equivalent effective isotropic radiated power (EIRP) level for the spurious signal being measured.
7. Repeat steps 1 through 6 above for all observed signals from the equipment being tested.

2.5.2. AC Power Line Conducted Emissions Measurement

2.5.2.1. Standard AC Power Line Conducted Emissions Test Site

The test site shall be on level ground that is covered with an earth-grounded, conductive surface that is at least 2 meters by 2 meters in size. The ground plane shall extend at least 0.5 meter beyond the foot print of the equipment under test.

A vertical conducting plane is optional for a standard (open area) test site and is only required for measurements made on table-top devices. If a vertical conducting plane is used, it shall be at least 2 meters by 2 meters in size and shall be electrically attached to the conductive ground plane at maximum intervals of one meter along its entire length.

2.5.2.2. Line Impedance Stabilization Network (LISN) Unit

A Line Impedance Stabilization Network (LISN) shall be used for equipment that is tested on a standard test site and connects directly to the public utility power line, or receives power from a device that connects to the public utility power line. The LISN shall be placed on top of or directly underneath the conductive ground plane and shall be electrically grounded to it. Power line filters between the power source and LISN may be used to reduce the ambient noise level on the public utility line.

2.5.2.3. Standard Test Site Measurements

a) Floor Standing Equipment

Floor standing equipment shall be placed directly on the conductive ground plane. If a vertical conducting plane is used, the equipment under test shall be located 40 cm from the vertical conducting surface. All other conductive objects (including the LISN) shall be located at least 80 cm from any surface on the equipment under test.

b) Table Top Mounted Equipment

Table top equipment shall be placed on top of a non-conductive platform, with nominal long dimension of 1.5 meters, and located 80 cm above the horizontal conducting ground plane. The equipment under test shall be placed 40 cm from the vertical conductive surface, with all other conductive objects located at least 80 cm from any surface on the equipment under test.

c) Measurement Procedure

A radio noise meter employing a quasi-peak detector shall be used to test for radio noise between each current carrying conductor and the ground conductor. Each current carrying conductor shall be tested individually with all unused connections on the LISN terminated in a 50 Ω resistive load. The ground (safety) conductor on the equipment under test shall be individually connected to the power source through the LISN. Any adapters used between the LISN power socket and the equipment under test shall be no more than 20 cm long and shall contain only one input and only one output.

The equipment under test shall be tested in various modes of operation with numerous cable orientations. The emissions level shall be recorded for the mode of operation and cable orientation that maximizes the radio noise level. This maximizing technique shall be repeated for measurements on each current carrying conductor.

d) Frequency Range of Measurements

When measuring AC power line conducted emissions, the measurements shall be made at frequencies between 450 kHz and 30 MHz.

2.5.2.4. End User or Manufacturing Plant Test Sites

For equipment that cannot be tested at a standard (open area) test site, an AC power line conducted emissions test may be performed at the end users location or at the manufacturing plant.

2.6. CDMA standard test conditions

2.6.1. Standard Equipment

2.6.1.1. Basic Equipment

The equipment shall be assembled and any necessary adjustments shall be made in accordance with the manufacturer's instructions for the mode of operation required. When alternative modes are available, the equipment shall be assembled and adjusted in accordance with the relevant instructions. A complete series of measurements shall be made for each mode of operation.

2.6.1.2. Associated Equipment

The base station equipment may include associated equipment during tests if the associated equipment is normally used in the operation of the equipment under test. This would include power supplies, cabinets, antenna couplers, and receiver multi-couplers.

2.6.2. Standard Environmental Test Conditions

Measurements under standard atmospheric conditions shall be carried out under any combination of the following conditions:

- Temperature: +15^{0}C to +35^{0}C;
- Relative Humidity: 45% to 75%;
- Air Pressure: 86,000 to 106,000 Pa (860 to 1060 mbar).

If desired, the results of the measurements can be corrected by calculation to the standard reference temperature of 25^{0}C and the standard reference air pressure of 101,300 Pa (1013 mbar).

2.6.3. Standard Conditions for the Primary Power Supply

2.6.3.1. General

The standard test voltages shall be those specified by the manufacturer as minimum, normal, and maximum operating values. The voltage shall not deviate from the stated values by more than ±2% during a series of measurements carried out as part of one test on the same equipment.

2.6.3.2. Standard DC Test Voltage from Accumulator Batteries

The standard (or nominal) DC test voltage battery specified by the manufacturer shall be equal to the standard test voltage of the type of accumulator to be used multiplied by the number of cells minus an average DC power cable loss value that the manufacturer determines as being typical (or applicable) for a given installation. Since accumulator batteries may or may not be under charge and, in fact, may be in a state of discharge when the equipment is being operated, the manufacturer shall also test the equipment at anticipated voltage extremes above and below the standard voltage. The test voltages shall not deviate from the stated values by more than ±2% (nominal float voltage) during a series of measurements carried out as part of one test on the same equipment.

2.6.3.3. Standard AC Voltage and Frequency

For equipment that operates from the AC mains, the standard AC test voltage shall be equal to the nominal voltage specified by the manufacturer. If the equipment is provided with different input taps, the one designated nominal shall be used. The standard test frequency and the test voltage shall not deviate from their nominal values by more than ±2%.

The equipment shall operate without degradation with input voltage variations of up to ±10% and shall maintain its specified transmitter frequency stability for input voltage variations of up to ±15%. The frequency range over which the equipment is to operate shall be specified by the manufacturer.

2.6.4. Standard Test Equipment

2.6.4.1 Channel Simulator

The channel simulator shall support the following channel model parameters:

- All paths are independently faded.
- The fading is Rayleigh. The probability distribution function of power, F(P), is:

$$F(P) = \begin{cases} 1 - e^{-P/P_{ave}}, & P > 0 \\ 0, & P \le 0 \end{cases}$$

where P is the signal power level and P_{ave} is the mean power level.

- The level crossing rate, L(P) is:

$$L(P) = \begin{cases} \sqrt{2\pi P/P_{ave}}.f_d.e^{-P/P_{ave}}, & P > 0 \\ 0, & P \le 0 \end{cases}$$

where f_d is the Doppler frequency offset associated with the simulated vehicle speed given by:

$$f_d = \left(\frac{v}{c}\right) f_c,$$

f_c is the carrier frequency, v is the vehicle speed, and c is the speed of light in a vacuum.

- The power spectral density, S(f), is:

$$S(f) = \begin{cases} \dfrac{1}{\sqrt{1 - \left(\dfrac{f - f_c}{f_d}\right)^2}}, & f_c - f_d \le f \le f_c + f_d \\ 0 & \text{otherwise} \end{cases}$$

- The autocorrelation coefficient of the unwrapped phase, ρ(t), is:

$$\rho(t) = \frac{3}{2\pi}\sin^{-1}\left[J_0(2\pi f_d.t)\right] + 6\left\{\frac{1}{2\pi}\sin^{-1}\left[J_0(2\pi f_d.t)\right]\right\}^2 - \frac{3}{4\pi^2}\sum_{n=1}^{\infty}\frac{\left[J_0(2\pi f_d.t)\right]^{2n}}{n^2}$$

where $J_0(\ )$ is a zero-order Bessel function of the first kind.

This autocorrelation coefficient is shown in Figure 1.

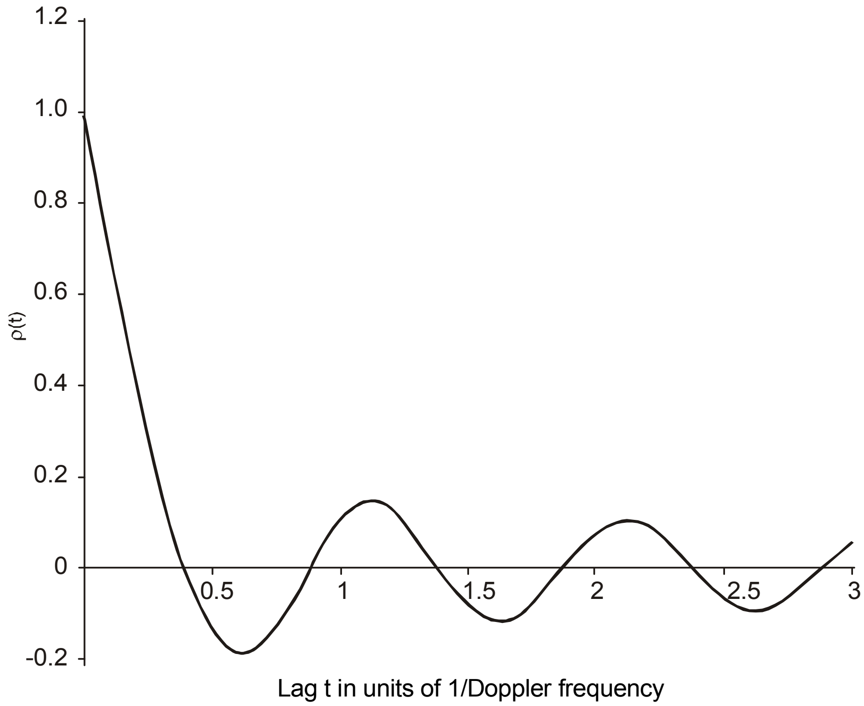

Figure 1 - Autocorrelation Coefficient of the Phase

The following standard conditions and tolerances on the channel model parameters shall be supported by the channel simulator:

- Vehicle Speed, v, as shown in Table 9.

The tolerance on Doppler shall be ±5%.

- Power distribution function, F(P)
  1. The tolerance shall be within ±1 dB of calculated, for power levels from 10 dB above to 20 dB below the mean power level.
  2. The tolerance shall be within ±5 dB of calculated, for power levels from 20 dB below to 30 dB below the mean power level.
- Level crossing rate, L(P)

  The tolerance shall be within ±10% of calculated, for power levels from 3 dB above to 30 dB below the mean power level.
- Measured power spectral density, S(f), around the carrier, f_c:
  1. At frequency offsets $|f - f_c| = f_d$, the maximum power spectral density S(f) shall;

     exceed $S(f_c)$ by at least 6 dB.
  2. For frequency offsets $|f - f_c| > 2f_d$, the maximum power spectral density S(f) shall be less than $S(f_c)$ by at least 30 dB.
- Simulated Doppler frequency, f_d, shall be computed from the measured S(f) as:

$$f_d = \left[\frac{2\int (f - f_c)^2 S(f)\,df}{\int S(f)\,df} \right]^{1/2}$$

- Measured autocorrelation coefficient of the unwrapped phase, $\rho(t)$
  1. At a lag of $0.05/f_d$ shall be 0.8 ± 0.1.
  2. At a lag of $0.15/f_d$ shall be 0.5 ± 0.1.

Table 9 - Standard Channel Simulator Configurations

Channel Simulator Configuration	1	2	3	4
Vehicle Speed [km/h]	3	8	30	100
Number of Paths	1	2	1	3
Path 2 Power (Relative to Path 1) [dB]	N/A	0	N/A	0
Path 3 Power (Relative to Path 1) [dB]	N/A	N/A	N/A	-3
Delay from Path 1 to Input [μs]	0	0	0	0
Delay from Path 2 to Input [μs]	N/A	2.0	N/A	2.0
Delay from Path 3 to Input [μs]	N/A	N/A	N/A	14.5

2.6.4.2. Waveform Quality Measurement Equipment

a) Rho Meter

Equipment capable of performing waveform cross-correlation shall be used for the measurement of forward link frequency tolerance, pilot time tolerance, and waveform compatibility.

Various equipment implementations are possible. The equipment used shall provide results equivalent to those produced by equipment that use the following algorithms:

The ideal transmitter signal is given as

$$s(t) = \sum_i R_i(t) e^{-j\omega_c t}$$

where

ω_c is the nominal carrier frequency of the signal

$R_e[s]$ denotes the real part of the complex number s

$R_i(t)$ is the complex envelope of the ideal i^{th} code channel, given as:

$$R_i(t) = a_i \left[\sum_k g(t - kT_c)\cos(\phi_{i,k}) + j\sum_k g(t - kT_c)\sin(\phi_{i.k}) \right]$$

where

a_i is the amplitude of the i^{th} code channel,

g(t) is the unit impulse response of the cascaded transmit filter and phase equalizer described in 3.1.3.1.14 of [3],

$\phi_{i,k}$ is the phase of the k^{th} chip for the i^{th} code channel, occurring at discrete time $t_k = kT_c$.

Modulation accuracy is the ability of the transmitter to generate the ideal signal s(t).

The actual transmitter signal is given by:

$$x(t) = \sum_i b_i\left[R_i\left(t+\tau_i\right)+E_i(t)\right]e^{-j\left[(\omega_c+\Delta\omega)(t+\tau_i)+\theta_i\right]}$$

where

b_i is the amplitude of the actual signal relative to the ideal signal for the i^{th} code channel,

τ_i is the time offset of the actual signal relative to the ideal signal for the i^{th} code channel,

$\Delta\omega$ is the radian frequency offset of the signal,

θ_i is the phase offset of the actual signal relative to the ideal signal for the i^{th} code channel, and $E_i(t)$ is the complex envelope of the error (deviation from ideal) of the actual transmit signal for the ith code channel.

Estimates of the radian frequency offset $\Delta\omega = 2\pi\Delta f$ and the time offset τ_0, of the pilot shall be obtained to the accuracy specified below in Table 10. These estimates $\Delta\hat{\omega}, \hat{\tau}_0$ and $\hat{\theta}_0$, shall be used to compensate x(t) by introducing a time correction and a complex multiplicative factor to produce y(t), a compensated version of x(t):

$$y(t) = x\left(t-\hat{\tau}_0\right)e^{j\left[(\omega_c+\Delta\hat{\varpi})t+\hat{\theta}_0\right]}$$

The radian frequency offset $\Delta\hat{\varpi}$ is converted to hertz frequency offset $\Delta\hat{f}$ by:

$$\Delta\hat{f} = \frac{\Delta\hat{\varpi}}{2\pi}$$

The compensated signal, y(t), shall be passed through a complementary filter to remove the inter-symbol interference (ISI) introduced by the transmit filter and by the transmit phase equalizer to yield an output z(t). The overall impulse response of the filter chain resulting from cascading the complementary filter with the ideal transmit filter and equalizer shall approximately satisfy Nyquist criterion for zero ISI. The Nyquist criterion shall be approximated by filter null levels at least 50 dB below the on-time response at the appropriate sample times. The noise bandwidth of the complementary low pass filter shall be less than 625 kHz.

The idealized output of the complementary filter is:

$$r(t) = \sum_i \widetilde{R}_i(t)$$

where

$$\widetilde{R}_i(t_k) = a_i\left[\cos\left(\phi_{i,k}\right)+j\sin\left(\phi_{i,k}\right)\right]$$

Modulation accuracy is measured by determining the fraction of power at the complementary filter output, z(t), that correlates with $\widetilde{R}_0(t_k)$, the compensated pilot signal. The filter output is sampled at the ideal decision points when the transmitter is modulated only by the Pilot Channel (the 0^{th} code channel). The waveform quality factor (ρ) is defined as:

$$\rho = \frac{\left|\sum_{k=1}^{M} Z_k R_{0,k}^{*}\right|^2}{\left\{\sum_{k=1}^{M}\left|\tilde{R}_{0,k}\right|^2 \sum_{k=1}^{M}\left|Z_k\right|^2\right\}},$$

where

Zk = z[k] is the kth sample of the output of the complementary filter, and $\tilde{R}_{0,k} = \tilde{R}_0[k]$ is the corresponding sample of the ideal output of the complementary filter for the Pilot Channel.

Modulation accuracy shall be measured by using the k complex-valued samples, $z(t_k)$, over a time interval M, in chips, of at least one power control group and an integer multiple of 512 chips.

The accuracy of the waveform quality measurement equipment shall be as shown in Table 10.

Table 10 - Accuracy of waveform Quality Measurement Equipment

Parameter	Symbol	Accuracy Requirement
Waveform Quality	ρ	$\pm 5 \times 10^{-4}$ from 0.09 to 1.0
Frequency Offset (exclusive of test equipment time base errors)	Δf	±10 Hz
Pilot Time Alignment Offset	τ_0	± 135 ns

b) Code Domain Measurement Equipment

See a) for definition of signal parameters. Code domain measurement equipment estimates:

1. Walsh code domain power coefficients $\rho_0, \rho_1, \rho_2, \ldots, \rho_{L-1}$ (see below for definition).
2. Walsh code domain time offsets relative to pilot $\Delta\tau_i$, where:

$$\Delta\tau_i = \tau_i - \tau_0$$

3. Walsh code domain phase offsets relative to pilot $\Delta\theta_i$, where:

$$\Delta\theta_i = \theta_i - \theta_0$$

4. Frequency offset:

$$\Delta f = f_c - f_0$$

Code domain power is defined as the fraction of power in $z(t_k)$ that correlates with each $R_i(t_k)$ when the transmitter is modulated according to a known code symbol sequence. The actual signal is compensated in frequency offset $\Delta\varpi$, pilot time alignment offset τ_0, and pilot phase θ_0.

Code domain power coefficients ρ_i are defined as:

$$\rho_i = \frac{\sum_{j=1}^{N}\left|\sum_{k=1}^{64} Z_{j,k} R_{i,j,k}^{*}\right|^2}{\left\{\sum_{k=1}^{64}\left|R_{i,j,k}\right|^2\right\}\left\{\sum_{j=1}^{N}\sum_{k=1}^{64}\left|Z_{j,k}\right|^2\right\}} \quad i = 0, 1, 2, ..., L-1$$

where Z_k is defined in 6.4.2.1, is the maximum Walsh function length, $\tilde{R}_{i,j,k} = \tilde{R}_i[k]$ is the k_{th} sample of the ideal output of the complementary filter for the i_{th} code channel, and N is the measurement interval in units of the longest Walsh length, which shall be at least one power control group in length and an integer multiple of 512 chips.

The code domain time offsets τ_i and phase offsets θ_i shall be determined by creating the reference signal:

$$\hat{R}_k = \sum_i R_i(t_k + \hat{\tau}_i)e^{-j[\Delta\hat{\varpi}(t_k+\hat{\tau}_i)+\hat{\theta}_i]}$$

and finding the estimates $\Delta\hat{\varpi}$, $\hat{\tau}_i$, $\hat{a}_i$ and $\hat{\theta}_i$ to minimize the sum-square-error:

$$\varepsilon^2 = \sum_{k=1}^{N}\left|Z_k - \hat{R}_k\right|^2$$

where $Z_k = z(t_k)$ is the output of the complementary filter at the k_{th} sample time.

The accuracy of the code domain measurement equipment shall be as shown in Table 11 for the nominal Base Station Test Model (refer to 2.6.5.2).

Table 11- Accuracy of Code Domain Measurement Equipment

Parameter	Symbol	Accuracy Requirement
Code domain power coefficients	ρ_i	$\pm 5 \times 10^{-4}$ from 5×10^{-4} to 1.0
Frequency Offset (exclusive of test equipment time base errors)	Δf	±10 Hz
Code domain time offset relative to pilot	$\Delta\tau_i$	± 10 ns
Code domain phase offset relative to pilot	$\Delta\theta_i$	± 0.01 radians

2.6.4.3. Mobile Station Simulator

The mobile station simulator shall be compliant with 3GPP2 C.S0002-A-1 and C.S0011-A. The mobile station simulator shall support Service Option 2, 9, and 55 of 3GPP2 C.S0013-A and Service Option 32 of 3GPP2 C.S0026 and may support Service Option 54 of 3GPP2 C.S0025.

It shall be possible to disable reverse link closed loop power control in the mobile station simulator. This includes reverse link closed loop power control commands sent on the Forward Power Control Subchannel and the Common Power Control Channel. When closed loop power control is disabled, it shall be possible to set the mobile station simulator transmit power to any fixed level with a resolution of ±0.1 dB over the full dynamic range.

The mobile station simulator shall include a power control test program. The program function is to cycle the transmit power as shown in Figure 4.2.3.2-1. The transitions of output power shall be aligned with the power control group boundaries as defined in 6.1 of 3GPP2 C.S0002-A-1. It shall also provide a timing reference signal aligned to the power cycles and it may provide the value of the power control bits received on the forward link. The duration of the high and low power period shall be at least 5 ms (4 power control groups).

When testing Radio Configuration 3 through 6 demodulation (2.1.2, 2.1.3 and 2.1.4), the mobile station simulator shall apply the Nominal Reverse Common Channel Attribute Gain Table and Reverse Link Nominal Attribute Gain Table values specified in Section 2.1.2.3.3.1 and 2.1.2.3.3.2 of [3], respectively.

2.6.4.4. AWGN Generator

The AWGN generator shall meet the following minimum performance requirements:

- Minimum Bandwidth: 1.8 MHz for Spreading Rate 1
- Frequency Ranges:

  824 MHz to 894 MHz;

  411 MHz to 484 MHz;

  1920 MHz to 1980 MHz.
- Frequency Resolution: 1 kHz
- Output Accuracy: ±2 dB for outputs ≥ -80 dBm
- Output Settability: 0.1 dB
- Output Range: -20 to -95 dBm
- Gain Flatness: 1.0 dB over the minimum bandwidth.
- The AWGN generators shall be uncorrelated to the ideal transmitter signal and to each other.

2.6.4.5. CW Generator

- Output Frequency Range: Tunable over applicable range of radio frequencies for band under test.
- Frequency Accuracy: ± 1 ppm.
- Frequency Resolution: 100 Hz.
- Output Range: -50 dBm to -10 dBm, and off.
- Output Accuracy: ± 1.0 dB.
- Output Resolution: 0.1 dB.
- Output Phase Noise at -20 dBm Power:

-149 dBc/Hz at a frequency of 1 GHz as measured at a 285 kHz offset (800 and 450 MHz bands)

-144 dBc/Hz at a frequency of 2 GHz as measured at a 655 kHz offset (2 GHz band).

2.6.4.6. Spectrum Analyzer

The spectrum analyzer shall provide the following functionality:

- General purpose frequency domain measurements.
- Integrated channel power measurements (power spectral density in 1.23 MHz)

The spectrum analyzer shall meet the following minimum performance requirements:

- Frequency Range: Tunable over applicable range of radio frequencies.
- Frequency Resolution: 1 kHz.
- Frequency Accuracy: ± 0.2 ppm.
- Displayed Dynamic Range: 70 dB.
- Display Log Scale Fidelity: ±1 dB over the above displayed dynamic range.
- Amplitude Measurement Range for signals from 10 MHz to either 2.6 GHz for 800, 450 MHz bands or 6 GHz for 2 GHz band:

Power measured in 30 kHz Resolution Bandwidth: -90 to +20 dBm.

Integrated 1.23 MHz Channel Power: -70 to +47 dBm.

Note: The Standard RF Output Load described in 6.4.8 may be used to meet the high power end of these measurements.

- Absolute Amplitude Accuracy in the CDMA transmit and receive bands for integrated 1.23 MHz channel power measurements:

  ±1 dB over the range of -40 dBm to +20 dBm

  ±1.3 dB over the range of -70 dBm to +20 dBm
- Relative Flatness: ±1.5 dB over frequency range 10 MHz to either 2.6 GHz
- Resolution Bandwidth Filter: Synchronously tuned or Gaussian (at least 3 poles) with 3 dB bandwidth selections of 1 MHz, 300 kHz, 100 kHz, and 30 kHz.
- Post Detection Video Filters: Selectable in decade steps from 100 Hz to at least 1 MHz.
- Detection Modes: Selectable to be either Peak or Sample.
- RF Input Impedance: Nominal 50 ohm

2.6.4.7. Average Power Meter

The power meter shall provide the following functionality:

- Average power measurements.
- True RMS detection for both sinusoidal and non-sinusoidal signals
- Absolute power in linear (watt) and logarithmic (dBm) units.
- Relative (offset) power in dB and % units.
- Automatic calibration and zeroing.

- Averaging of multiple readings.

The power meter shall meet the following minimum performance requirements:

- Frequency Range: 10 MHz to either 1 GHz
- Power Range: -70 dBm (100 pW) to +47 dBm (50 W)

Different sensors may be required to optimally provide this power range. The RF output load described in 6.4.8 may be used to meet the high power end of these measurements.

- Absolute and Relative Power Accuracy: ±0.2 dB (5%)

Excludes sensor and source mismatch (VSWR) errors, zeroing errors (significant at bottom end of sensor range), and power linearity errors (significant at top end of sensor range).

- Power Measurement Resolution: Selectable 0.1 and 0.01 dB.
- Sensor VSWR: 1.15:1

2.6.4.8. RF Output Load

The base station transmitter output shall be connected through suitable means to the measurement equipment or mobile station simulator. The means shall be non-radiating and capable of continuously dissipating the full transmitter output power. The VSWR seen by the transmitter over the 1.23 MHz band centered at the nominal transmit frequency under test shall be less than 1.1:1.

The base station transmitter signal may be terminated and sampled using a dummy load, attenuator, directional coupler, or combination thereof.

2.6.5. Test Setups

2.6.5.1. Functional System Setups

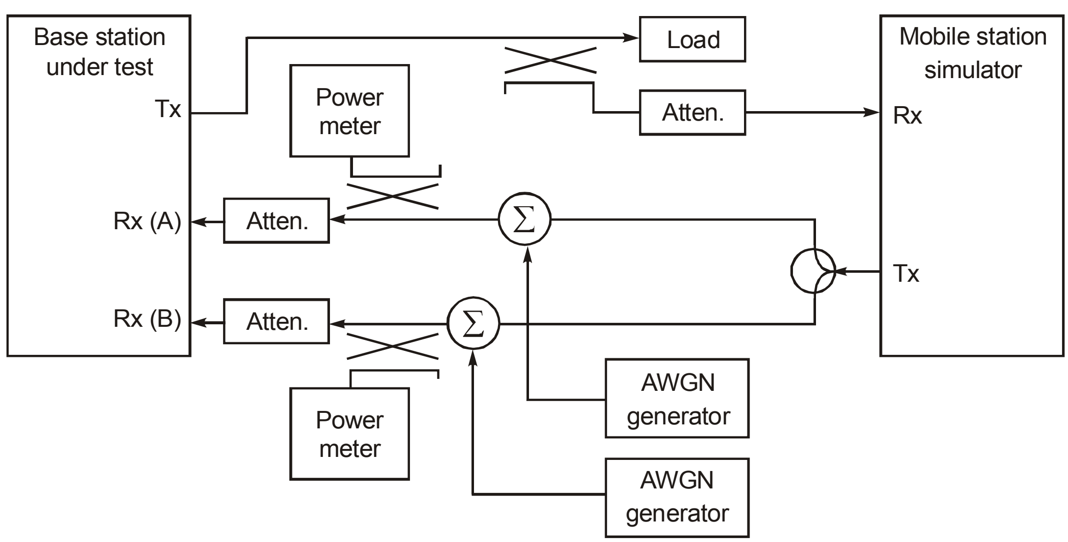

Figure 2 - Functional Setup for Base Statione Sensivity Tests

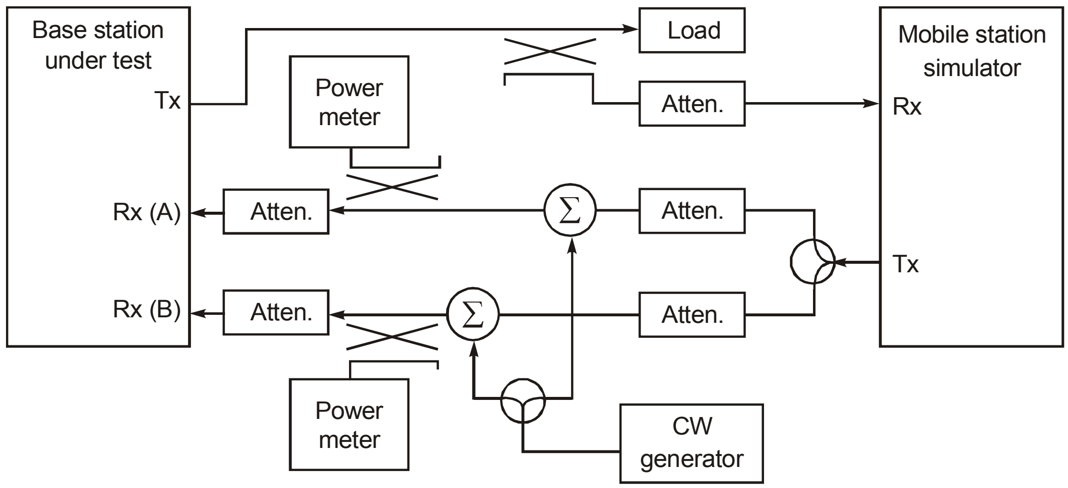

Figure 3 - Functional Setup for Base Station Desensitization Tests

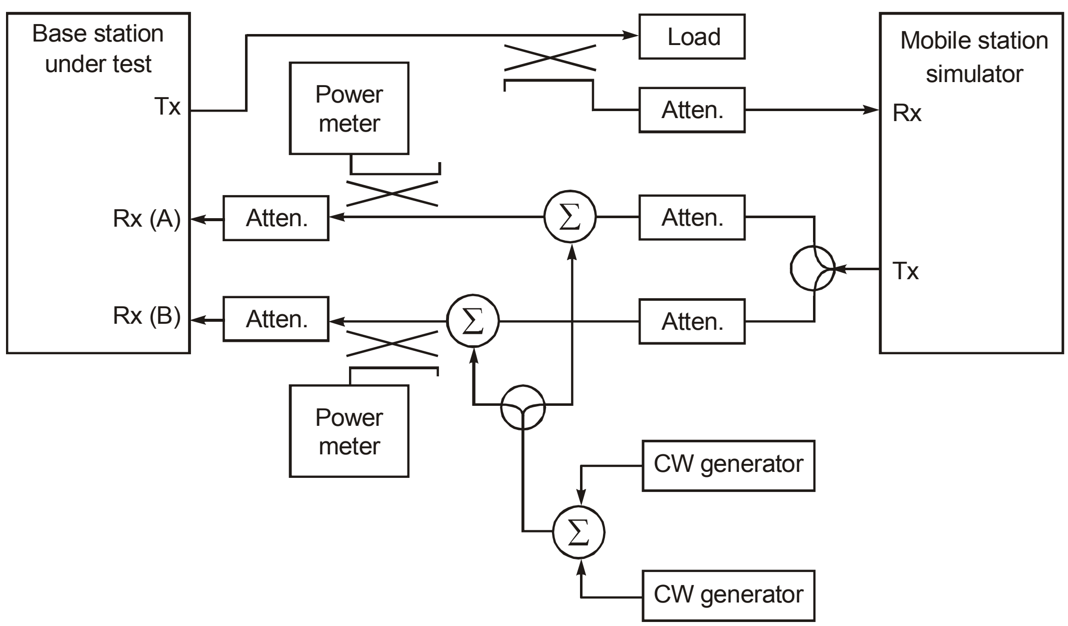

Figure 4 - Functional Setup for Base Station Intermodulation Spurious Response Tests

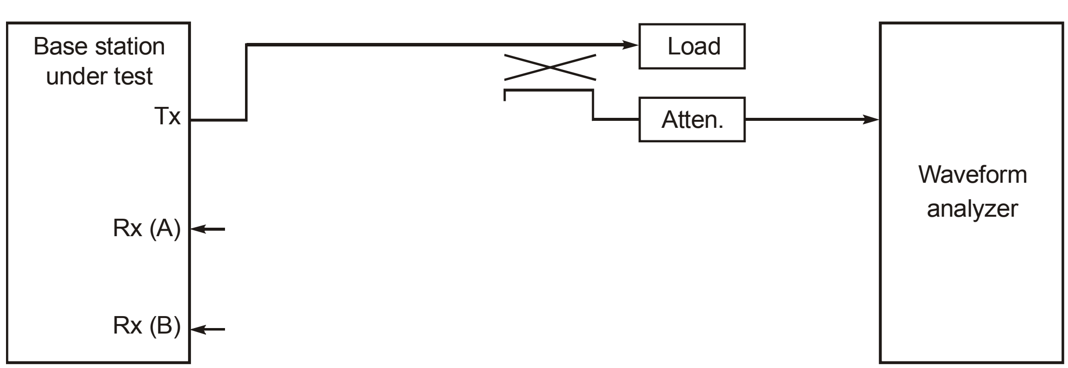

Figure 5 - Functional Setup for Waveform Quality Test

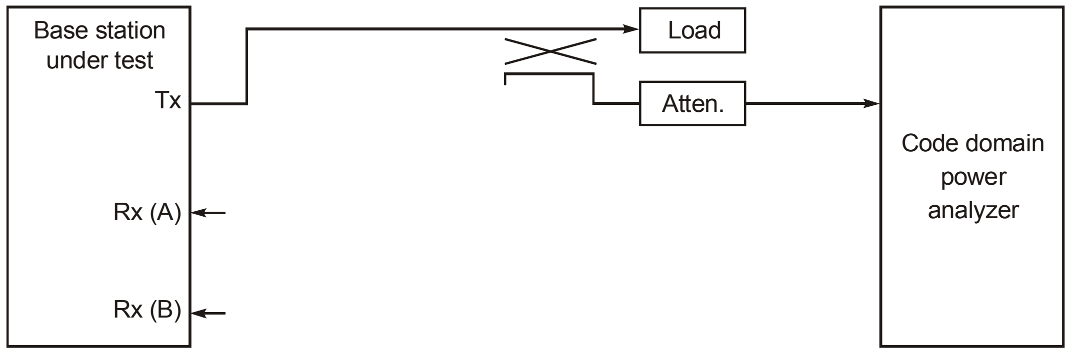

Figure 6 - Functional Setup for Code Domain Power Test for Non-transmit Diversity Configuration

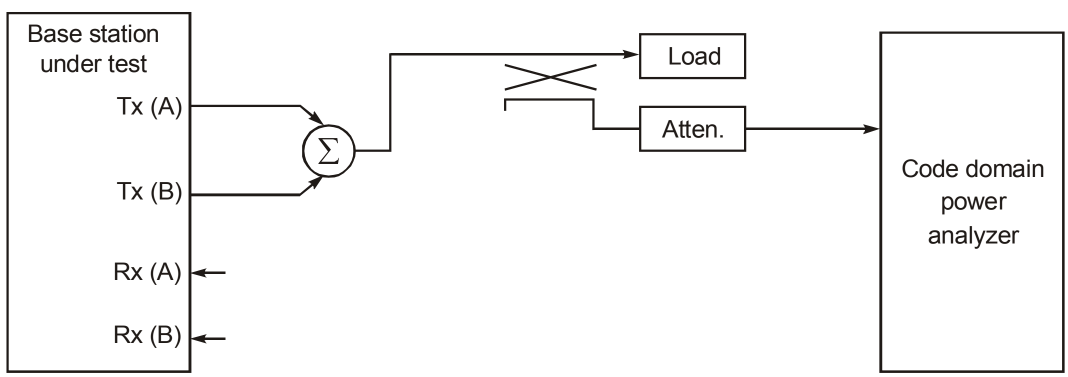

Figure 7- Functional Setup for Code Domain Power Test for Transmit Diversity Configuration

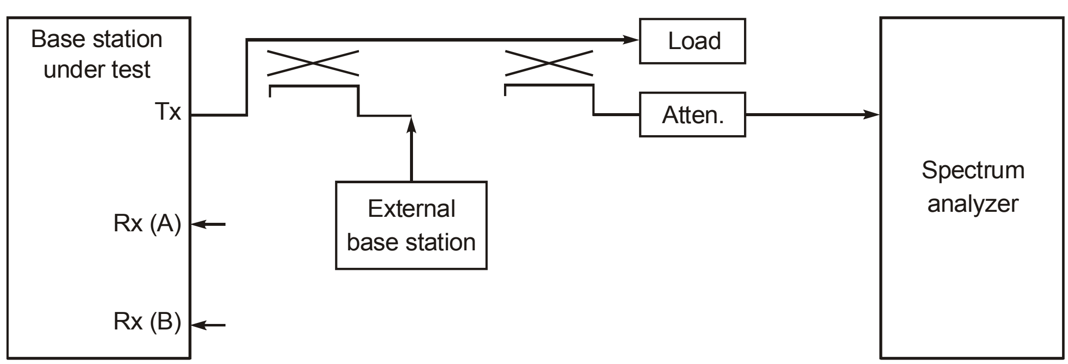

Figure 8 - Functional Setup for Inter-Base Station Intermodulation Tests

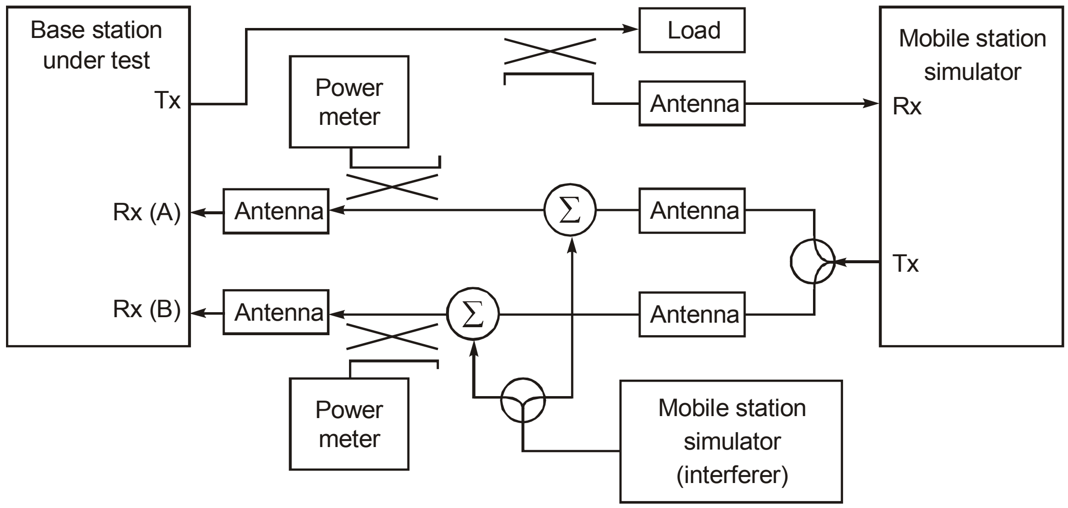

Figure 9 - Functional Setup for Base Station ACS Tests

2.6.5.2. Test Model for Base Station

For those base station equipment tests that require multiple code channels be active simultaneously, the configuration shown in Table 12 should be used. Table 13 should be used for base station equipment tests for the transmit diversity that require multiple code channels be active simultaneously.

If a different number of Traffic Channels is used, unless otherwise specified, the partitioning of power shall be as shown in Table 14.

For Tables 12, 13, and 14, the fraction of power noted for each traffic channel shall be inclusive of power control bits.

Table 12 - Base Station Test Model, Nominal for Main Path

Channel Type	Number of Channel	Fraction of Power (linear)	Fraction of Power (dB)	Comments
Forward pilot	1	0.2000	-7.0	Code channel W_0^{128}
Sync	1	0.0471	-13.3	Code channel W_{32}^{64}; always 1/8 rate
Paging	1	0.1882	-7.3	Code channel W_1^{64}; full rate only
Traffic	6	0.09412	-10.3	Variable code channel assignments; full rate only

Table 13 - Base Station Teat Model, Nominal for Transmit Diversity Path

Channel Type	Number of Channel	Fraction of Power (linear)	Fraction of Power (dB)	Comments
Transmit Diversity Pilot	1	0.2000	-7.0	Code channel W_{16}^{128}
Traffic	6	0.09412	-10.3	Variable code channel assignments; full rate only

Table 14 - Base Station Test Model, General

Channel Type	Relative Power
Pilot	0.2 of total power (linear)
Sync + Paging + Traffic	Remainder (0.8) of total power (linear)
Sync	3 dB less than one Fundamental Traffic Channel; always 1/8 rate
Paging	3 dB greater than one Fundamental Traffic Channel; full rate only
Traffic	Equal power in each Fundamental Traffic Channel; full rate only

2.6.5.3. General Comments

The following comments apply to all CDMA tests:

1. Unless specified otherwise, test configurations should use the nominal base station parameter settings specified by the base station manufacturer.
2. Overhead message fields should be those needed for normal operation of the mobile station and the base station unless stated differently below or in s specific test.

Special field values of the *Enhanced Access Parameters Message*

Field	Value (Decimal)
NUM_MODE_SELECTION_ENTRIES	0 (only access mode specified)
ACCESS _ MODE	0 (Basic Access Mode)
RLGAIN_COMMON_PILOT	0 (0 dB)
NUM_MODE_PARAM_REC	0 (only Basic Access Mode specific

	parameter records)
APPLICABLE_MODES	1 (parameters are for Basic Access Mode)
EACH_NOM_PWR	0 (0 dB)
EACH_INIT_PWR	0 (0 dB)
EACH_PWR_STEP	0 (0 dB)
EACH_NUM_STEP	4 (5 probes per sequence)
EACH_ACCESS_THRESH	63 (effectively disable pilot threshold detection)
EACH_SLOT_OFFSET 1	0 (no offset)
EACH_SLOT_OFFSET 2	0 (no offset)
NUM_EACH_BA	1 (one Enhanced Access Channel)
EACH_BA_RATES_SUPPORTED	0 (9600 bit/s, 20 ms frame size)

2.6.6. Standard Duty Cycle

The transmitter shall be capable of operating continuously at full rated power for a period of twenty-four (24) hours. The equipment shall operate with all specified transmitter and receiver performance parameters being met during and after the 24-hour period.

2.6.7. Frame Error Rate Measurement

The Reverse Common Control Channel FER is calculated as:

$$\text{FER} = 1 - \frac{\text{Number of RCCCH frames received correctly}}{\text{Number of RCCCH frames transmitted}}$$

The physical layer provides Reverse Traffic Channel frames at a multiplicity of rates. When demodulating the Reverse Fundamental Channel, receivers must determine both the transmitted rate of each frame, and its contents. For purposes of this specification, a Reverse Traffic Channel frame error is defined as either a rate determination or content error. The Reverse Traffic Channel FER is calculated for active frames only and is calculated as:

$$\text{FER}_X = 1 - \frac{\text{Number of active frames received correctly at rate x}}{\text{Number of active frames transmitted at rate x}}$$

The Loopback Service Option, Markov Service Option, and Test Data Service Option (see 1.3) provide a convenient means for measuring the packet error rate of one link, provided the other link is operating at high E_b/N_0. During the base station Reverse Traffic Channel demodulation performance tests signaling may be disabled, in which case the packet error rate is identical to the Reverse Traffic Channel frame error rate.

2.6.8. Confidence Limits

Some tests in this Standard include confidence limits. The requirement is stated in terms of the confidence level with which the error rate of the equipment under test is known to be below some specified maximum.

Error rate confidence testing typically requires E_b/N_0 values above expected values. Specific E_b/N_0 values have been chosen to allow manufacturers to conduct tests in a timely manner for the specified confidence levels.

Any reliable statistical procedure may be used to establish the confidence level. The tests may be either single-sided or two-sided. They also may be either fixed length or variable length. The procedure shall satisfy the following requirements:

- An established procedure shall be employed. It shall include:
  - Specification of minimum and maximum test length.
  - Criteria for early termination.
- Objective pass-fail criteria shall be established.
- Steps to be taken to rerun the test in case of a failure shall be specified.

Trial-to-trial correlations of errors, as may occur in frame error measurements in slow fading scenarios, should be taken into account. In addition to statistical variations in measurements, systematic errors due to test equipment tolerances and calibration should be considered in interpretation of results.

An acceptable procedure is as follows. Assume independent Bernoulli trials, where the outcome of each trial is classified as either "error" or "no error" The specification error rate limit is λ_{lim} and the required confidence level is C.

1. Choose a suitable test length in terms of a maximum number of errors, K_{max}. The exact value is not critical, but must be large enough to ensure that compliant units pass with very high probability. This probability depends on the design rate ratio λ/λ_{lim} between the design error rate and the specification error rate limit. Values of Kmax in the range of 30-100 should be suitable based on the margins in this Standard.
2. Carry out N_{max} or more trials under specified test conditions, where

$$N_{max} = \frac{\chi^2(1-C,2K_{max})}{2\lambda_{lim}}$$

and $x^2(P, n)$ is the inverse x^2-distribution corresponding to probability P and n degrees-of-freedom. Table 15 gives N_{max} versus the actual number of errors (K) for C = 95% and representative λ_{lim}. Table 16 gives N_{max} versus the actual number of errors (K) for C = 90% and representative λ_{lim}.

3. Compute the empirical error rate

$$\lambda_N = K_N/N$$

and the empirical rate ratio λ/λ_{lim}, where K_N is the number of errors in the N trials actually performed.

4. If the rate ratio is less than the confidence limit:

$$N_{max} = \frac{2K_N}{\chi^2(1-C,2K_N+2)}$$

or equivalently:

$$N > \frac{\chi^2(1-C,2K_N+2)}{2\lambda_{lim}}$$

then the unit under test has passed; otherwise the unit has failed.

5. If the unit fails, repeat steps 2-4 twice more. If the unit passes both individual tests then it passes overall; otherwise the unit has failed. This procedure may be modified to permit early termination. A test may be performed at every trial, or after a block of trials. Steps 3 and 4 are modified as follows:

3'. After each trial or block of trials compute the empirical error rate as

$$\lambda_N = K_N/N$$

where K_N is the number of errors up to and including the current (N_{th}) trial, and the rate ratio $\lambda_N\lambda_{lim}$.

4'. If after the N_{th} trial the rate ratio is less than the confidence limit

$$\lambda_N/\lambda_{lim} < \frac{2K_N}{\chi^2(1-C,2K_N+2)}$$

or equivalently:

$$N > \frac{\chi^2(1-C,2K_N+2)}{2\lambda_{lim}}$$

then the unit under test has passed and the testing stops. If the number of trials reaches N_{max} then the unit has failed and the testing stops.

Table 15 - Trial Count (N) Thresholds for 95% Confidence

K	**λ_{lim}**			**General**
	0.5%	1.0%	5.0%	
0	599	300	60	$3.00/\lambda_{lim}$
1	599	300	60	$3.00/\lambda_{lim}$
2	949	474	95	$4.74/\lambda_{lim}$
3	1259	630	126	$6.30/\lambda_{lim}$
4	1551	775	155	$7.75/\lambda_{lim}$
5	1831	915	183	$9.15/\lambda_{lim}$
6	2103	1051	210	$10.51/\lambda_{lim}$
7	2368	1184	237	$11.84/\lambda_{lim}$
8	2630	1315	263	$13.15/\lambda_{lim}$
9	2887	1443	289	$14.43/\lambda_{lim}$
10	3141	1571	314	$15.71/\lambda_{lim}$
32	8368	4184	837	$41.84/\lambda_{lim}$
64	15540	7770	1554	$77.70/\lambda_{lim}$
128	29432	14716	2943	$147.16/\lambda_{lim}$
256	56575	28287	5657	$282.87/\lambda_{lim}$

Table 16 - Trial Count (N) Thresholds for 90% confidence

K	λ_{lim}		General
	10.0%	50.0%	
0	24	5	N/A
1	24	5	$2.30/\lambda_{lim}$
2	39	8	$3.89/\lambda_{lim}$
3	54	11	$5.32/\lambda_{lim}$
4	67	14	$6.63/\lambda_{lim}$
5	80	16	$8.00/\lambda_{lim}$
6	93	19	$9.28/\lambda_{lim}$
7	106	22	$10.53/\lambda_{lim}$
8	118	24	$11.77/\lambda_{lim}$
9	130	26	$13.00/\lambda_{lim}$
10	143	29	$14.21/\lambda_{lim}$
32	395	79	$39.43/\lambda_{lim}$
64	745	149	$74.44/\lambda_{lim}$
128	1427	286	$142.70/\lambda_{lim}$
256	2768	554	$276.71/\lambda_{lim}$

3. MANAGEMENT REGULATIONS

Handsets use CDMA 2000-1x technology must comply with requirements in this technical regulation.

4. RESPONSIBILITY OF ORGANISATIONS/INDIVIDUALS

Organisations/individuals in Vietnam are responsible to comply with this technical regulation and to accept supervision of regulatory authority as existing regulations.

5. IMPLEMENTATION

5.1. Vietnam Telecommunication Authority and local departments of Information and Communications are responsible for guidance and implementation of this technical regulation.

5.2. This Technical regulation replace standard TCN 68-223:2005 “Cellular mobile CDMA 1X base stations-Technical requirements”.

5.3. In cases of having referencing regulations specified in this technical regulation changed, modified or superseded, the new reference versions are applied.