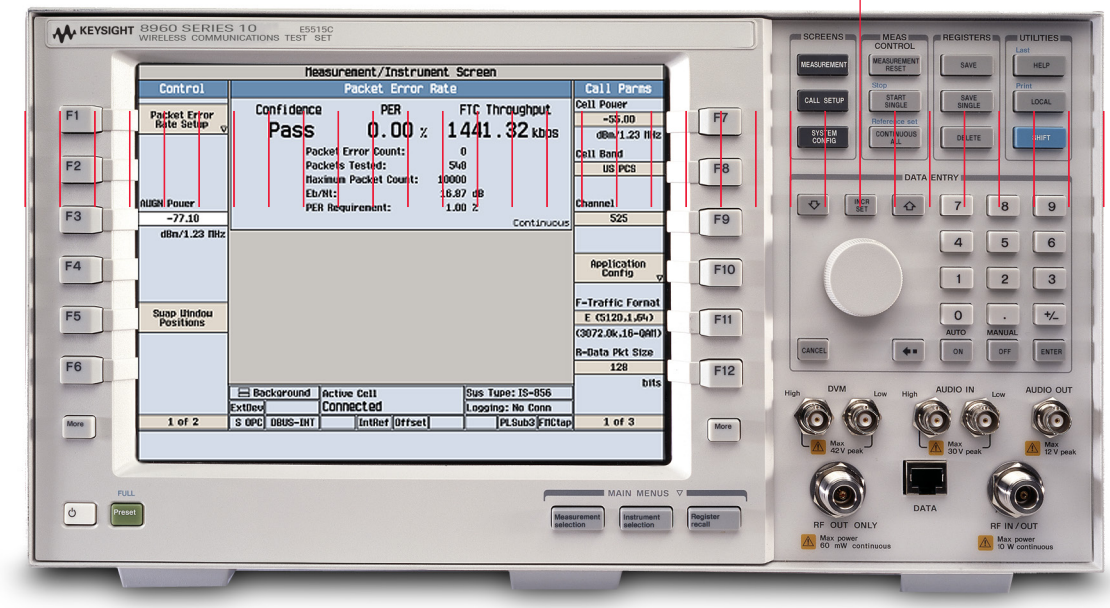
Keysight E1962B

cdma2000/IS-95/AMPS Mobile Test Application

For the 8960 Series 10 (E5515C/E) Wireless Communications Test Set

Technical Overview



KEYSIGHT TECHNOLOGIES

Achieve your cdma2000® wireless device production goals

Growing demand for high-speed data services means the roll out of cdma2000 wireless devices is essential. As the first one-box test solution to support cdma2000 Release A and 1x Advanced, the Keysight Technologies, Inc. E1962B cdma2000 mobile test application, combined with the 8960 Series 10 (E5515C/E) wireless communications test set, provides critical capabilities to verify the RF performance of your cdma2000, IS-95, and AMPS devices. This test application, designed for high-volume manufacturing and wireless device development, allows you to finalize product designs and minimize time to volume.

Key features

- Option E1962B-410 adds cdma2000 1x Advanced capabilities, including new radio configurations (forward RC11, reverse RC8), new service options (SO73 and SO75), smart blanking, early termination, slower closed loop reverse power control, and related measurement updates to support 1x Advanced
- Flexible radio configuration and service option negotiation for quicker call setup, SMS reject cause for testing, and different SMS failure errors
- Extremely fast cdma2000, IS-95, and AMPS transmitter measurements
- Simultaneous receiver and transmitter measurements enable maximum test throughput
- Call processing and key RF parametric test capability for assessing the quality and RF performance of IS-2000-based wireless devices
- Flexible cdma2000 and IS-95 forward-link emulation for control of the pilot, sync, paging, AWGN, and other channels, levels, and data rates used in R&D and production-test applications
- Supports all latest Service Options (1, 2, 3, 6, 9, 14, 17, 32, 33, 55, 68, 70, 73, 75, and 32768), commercialized bands (0, 1, 3, 4, 5, 6, 7, 10, 11, 12, 14, 15, 18, and 19) and other potential bands (2, 8, 9, 13, 16, 17)
- Option E1962B-401 adds cdma2000 Release A protocol support along with the new F-BCCH, F-CCCH, and R-EACH channels
- Options E1962B-405, -406, -407 and -409 offer fading, multi-unit synchronization, protocol logging, and SMS features for mobile design and verification
- Advanced calibration features such as fast device tune (requires E1999A-202) and dynamic power for enhanced productivity
- Single channel GPS source simulating C/A code carried by L1 with default navigation messages, can be used for GPS receiver calibration (requires E1999A-206)
- PESQ measurement provides an objective method for prediction of vocoder speech quality using the industry standard PESQ algorithm (requires E1999A-301)

E1962B functionality overview

With advanced features and superior performance, the E1962B is designed for high-volume manufacturing and wireless device development, allowing you to finalize product designs and minimize time to volume.

CDMA forward link emulation

The fully-coded IS-2000 forward-link emulation supports radio configurations 1 through 5, and 11, as well as all supplemental channel data rates associated with those configurations. Comprehensive signal generation capabilities including all applicable CDMA channels, modulation, and an AWGN source (1.8 MHz minimum bandwidth). Flexible user control of the forward link emulation is provided through easy-to-use front panel control and remote GPIB. Option E1962B-401 adds cdma2000 Release A protocol support and includes the F-BCCH and F-CCCH channels. E1962B-410 adds cdma2000 1x Advanced support and includes the F-ACK channel for early termination.

CDMA authentication

Option E1962B-403 adds authentication capabilities when operating in the active cell modes using the IS-95 or IS-2000 systems. Authentication supports two, one-button commands: unique challenge and SSD update. The global challenge function can be turned on or off to support authentication with most call processing functions. User authentication parameters include A-key (decimal), RAND (hex), RANDU (hex), and RANDSSD (hex). The reported global challenge results include the AUTHU expected value, the AUTHU received value and a pass/fail result and the RANDC expected value, the RANDC received value, and a pass/fail result. Other results include the count and AUTH_MODE. The reported unique challenge results include the AUTHU expected value, the AUTHU received value and a pass/fail result. Pass/fail results are also available for SSD updates.

CDMA transmitter tests

- Maximum power
- Minimum power
- Multi-coded waveform quality
- Handoff waveform quality
- Open loop power accuracy
- Open loop power calibration
- Access probe power
- Code domain power
- Gated power
- Code channel timing and phase
- Spurious emissions
- Time response of open loop
- Tx dynamic power
- DTX support

CDMA receiver tests

- Fundamental/Traffic channel sensitivity
- Supplemental channel sensitivity
- Dynamic range
- Demodulation with AWGN

E1962B functionality overview (continued)

AMPS transmitter tests

- RF power output
- RF frequency and frequency error
- FM deviation and distortion
- FM modulation limiting
- Audio frequency response
- Audio distortion
- FM hum and noise
- SAT deviation and frequency error
- Compressor response
- Signaling tone frequency and deviation (Option E1962B-402)
- DTMF symbol, frequency, and deviation (Option E1962B-402)
- Wideband data deviation (Option E1962B-402)

AMPS receiver tests

- SINAD
- Audio frequency response
- Audio distortion
- FM hum and noise
- Expander response

Fading tests

E5515C/E Option 004 adds a rear panel digital bus that enables fading when it is used with Keysight's Baseband Studio for fading solution. In conjunction with the E5106A PXB baseband generator and channel emulator, the E1962B provides receiver fading tests with unprecedented accuracy and repeatability, at a very attractive price point. Baseband I/Q data from the Keysight E5515C/E wireless communications test set is sent via the digital bus to the N5101A fading card in an external PC. N5106A and associated software can be used to perform the user-selected fading profile. After digital fading, AWGN can be digitally added to the waveform. The resulting waveform is then returned to the test set via the digital bus for modulation. This solution eliminates almost all associated calibrations and provides rock-solid repeatability.

Multi-unit synchronization

Option 406 allows any test set to be time-synchronized to another test set that is running either a CDMA or 1xEV-DO test application or lab application. The multi-unit synchronization supports simulation of mobile behaviors with two base stations. Typical applications are idle/softer handoff, pilot detection, and hybrid mode simulation.

E1962B functionality overview (continued)

More functions

- Fast call setup
- Spectrum monitor
- Code domain power supports dated IS-98E standard
- Protocol logging
- SMS

Get the proven benefits of the Keysight 8960 test set

Because this cdma2000 test solution is based on the high-performance 8960 test set, you gain the additional benefits of extremely fast measurement speed, ease of programming, accuracy, reliability, and worldwide service and support. These proven features help you shorten test development time, increase throughput, and minimize support costs.

Keep up with changing test needs

To help you keep up with the hyper pace of the mobile phone industry, the 8960 is designed to quickly support changing and emerging standards enabling you to meet your time-to-market and production goals.

Technical specifications

These specifications apply to the E5515E, or E5515C mainframes with Option 003, with an E1962B test application of firmware revision B.20.12 or higher.

Specifications describe the test set's warranted performance and are valid for the unit's operation within the stated environmental ranges unless otherwise noted. All specifications are valid after a 30-minute warm-up period of continuous operation.

Supplemental characteristics are intended to provide typical, but non-warranted, performance parameters that may be useful in applying the instrument. These characteristics are shown in italics and labeled as "typical". All units shipped from the factory meet these typical numbers at 25 °C ambient temperature without including measurement uncertainty.

Analog specifications

AMPS active cell call processing functionality

- Call control ("one button commands"): Register, BS call originate, BS call disconnect, MS call originate (auto answer), and MS call disconnect
- Call setup parameters: Control channel, voice channel, SID, SAT, and power level
- Handoff support: Hard handoff to new channel
- Registration reported mobile information: ESN in decimal, ESN in hex, MIN1, MIN2, phone number, station class mark (SCM), and called number

AMPS test mode functionality

Usage: The mobile station must be setup on a channel without the test set (using internal test mode commands in the mobile); the test set provides RF generator output, and RF and audio analysis input; this mode provides no signaling

Spectrum monitor

- Input frequency ranges:
  - 411 to 420 MHz
  - 450 to 484 MHz
  - 824 to 934 MHz
  - 1700 to 1980 MHz
- Reference level: Auto or manual
- Manual reference level range: +37 to –50 dBm
- Display dB per division: 20.0 to 0.1 dB per division
- Level measurement accuracy: Typically < ± 1.0 dB, 15 to 55 °C (calibrated against average power and within ± 10 degrees of calibration temperature; calibration must occur between 20 to 55 °C)

Display frequency span and resolution bandwidth (coupled):	
0 Hz span	
125 kHz span	300 Hz RBW
500 kHz span	1 kHz RBW
1.25 MHz span	1 kHz RBW
2.5 MHz span	10 kHz RBW
4 MHz span	30 kHz RBW
5 MHz span	30 kHz RBW
10 MHz span	100 kHz RBW
12 MHz span	100 kHz RBW
20 MHz span	100 kHz RBW
40 MHz span	300 kHz RBW
80 MHz span	1 MHz RBW
100 MHz span	5 MHz RBW

- Trigger: Immediate, RF rise, protocol, or external
- Trigger arm: Single or continuous
- Trigger delay: –50 to 50 ms
- Zero span trace time: 60 µs to 70 ms
- Zero span resolution bandwidth: 100 kHz, 300 kHz, or 1 MHz
- Detector: Peak detection or sample detection
- Trace mode: Clear write, max hold, or min hold
- Markers: Three user markers
- Marker modes: Off, position, or delta
- Marker functions: Peak search, marker to expected frequency, and marker to expected power

CW RF generator

Frequency	
Available frequency range	292 to 2700 MHz
Specified frequency ranges	421 to 494 MHz
	800 to 960 MHz
	1700 to 2000 MHz
Accuracy and stability	Same as listed under FM RF generator
Test signal	CW, AM (56% depth with 20 kHz rate), or DSB-SC (carrier + upper side-band spaced 20 kHz apart); requires approximately 3 seconds to switch between test signal selections
Amplitude	
Available output level range	–127 to –10 dBm
Specified output level range	–116 to –15 dBm
Absolute output level accuracy	< ± 1.0 dB, typically < ± 0.5 dB (level accuracy at RF generator output levels > –30 dBm may be degraded by simultaneous reception and transmission when applied Tx power is > 32 dBm)
VSWR at RF IN/OUT	< 1.14:1, 400 to 1000 MHz
Nominal ambient test signal level accuracy	< ± 1.1 dB

FM RF generator

Frequency	
Frequency range	800 to 960 MHz
Accuracy and stability	Same as timebase reference
CW frequency switching speed	Typically < 10 ms to be within < 0.1 ppm of final frequency
Setting resolution	Typically 1 Hz
Amplitude	
Output level range	–116 to –15 dBm
Absolute output level accuracy	< ± 1.0 dB, typically < ± 0.5 dB (level accuracy at RF generator output levels > –30 dBm may be degraded by simultaneous reception and transmission when applied Tx power is > 32 dBm)
RF IN/OUT reverse power	+37 dBm peak (5 W peak)
VSWR at RF IN/OUT	< 1.14:1, 400 to 1000 MHz
Output level repeatability (returning to the same frequency and level)	Typically < ± 0.1 dB
Output level setting resolution	Typically 0.1 dB
Output level switching time	Typically < 50 ms to be within 0.1 dB of final level

Spectral purity

Harmonics	–25 dBc for levels < –17 dBm
Subharmonics	< –40 dBc
Non-harmonics	< –55 dBc for 100 kHz to < 1500 kHz offsets from carrier
	< –68 dBc for > 1500 kHz offsets from carrier
	Typically < –55 dBc for 3 kHz to < 100 kHz offsets
	Typically < –53 dBc for line-related non-harmonics
Spurious due to receiver LO leakage	Spurious at 105 ± 2.5 MHz below expected transmitter frequency and its second harmonic is typically < –50 dBm

FM and SAT signal generation

FM rate range	100 Hz to 20 kHz
FM deviation range	0 to 20 kHz for combined SAT, internal and external deviation
Residual FM	< 7 Hz rms in a CCITT bandwidth
Internal FM accuracy	< ±(3.5% + residual FM) at a 1 kHz rate
External FM accuracy	< ±(5% + residual FM) at a 1 kHz rate
FM flatness	< ±5% relative to a 1 kHz rate
FM distortion (THD plus noise)	< 0.5% for > 4 kHz deviation at a 1 kHz rate in a CCITT bandwidth
External FM input sensitivity	20 kHz deviation per V
Maximum external FM input level	1 V peak
SAT frequencies	5970, 6000, or 6030 Hz
SAT deviation	Fixed at 2 kHz
FM rate resolution	Typically 5 Hz
FM deviation resolution	Typically 5 Hz

Audio generator

Frequency	
Operating range	100 Hz to 20 kHz, typically 1 Hz to 20 kHz
Accuracy	Same as timebase reference
Frequency resolution	Typically 0.1 Hz
Output level (from AUDIO OUTPUT connector)	
Ranges	0 to 1 V peak, 1 to 9 V peak (into > 600 Ω)
Accuracy	< ± (1.5% of setting + resolution) when output is DC coupled
Distortion	< 0.1% for 0.2 to 9 V peak into > 600 Ω
Coupling mode	Selectable as DC or AC (5 µF in series with output)
Maximum output current	Typically 100 mA peak into 8 Ω
Output impedance	Typically < 1.5 W at 1 kHz when output is DC coupled
DC offset (when output is DC coupled)	Typically < 1 mV peak for 0 to 1 V peak
	Typically < 10 mV peak for 1 to 9 V peak
Output level resolution	Typically < 0.5 mV for 0 to 1 V peak output, < 5.0 mV for 1 to 9 V peak output

AMPS RF analyzer

Unless otherwise noted, all specifications apply to frequencies of 800 to 960 MHz for signals with peak input power at the test set's RF IN/OUT not higher than +34 dBm and temperatures of 0 to 55 °C. Input signal Tx power at the test set's RF IN/OUT must be within ± 3 dB of the test set's expected power for warranted performance.

Analog Tx power measurement	
Types of signals measured	CW or AMPS signals with or without SAT
Frequency capture range	Signal must be within ± 100 kHz of test set's expected frequency
Maximum input level	+37 dBm peak (5 W peak)
Minimum input level	> –30 dBm
Extended amplitude range	Typically results are provided for signals at test set's RF IN/OUT with analog Tx power within –10 and +5 dB of expected power
Measurement accuracy (for 20 to 55 °C)	< ± 0.32 dB for 800 to 960 MHz, typically < ± 0.14 dB for 800 to 960 MHz
Measurement resolution	Typically 0.01 dB
Measurement repeatability	Typically < ± 0.1 dB
VSWR at RF IN/OUT	< 1.14:1, 800 to 1000 MHz
Measurement trigger source	Immediate
Available result	Output power
Multi-measurement capabilities	1 to 999 bursts, minimum, maximum, average, and standard deviation results
Concurrency capabilities	Analog Tx power measurements can be made concurrently with all analog and audio measurements
Frequency modulation measurement	
Types of signals measured	Analog and AMPS signals with or without SAT
Frequency capture range	Signal must be within ± 2.5 kHz of test set's expected frequency
Deviation and frequency measurement rate range	100 Hz to 15 kHz
Distortion measurement rate range	100 Hz to 10 kHz
Measurement deviation range	0 to 16 kHz
Minimum input level	Signal at test set's RF IN/OUT must have analog Tx power > –15 dBm
Rms deviation measurement accuracy	< ± (2% of reading + residual FM effects)
Peak deviation measurement accuracy	< ± (3% of reading + residual FM effects)
Distortion measurement accuracy	< ± 12% of reading (± 1.0 dB) ± residual FM effects
Frequency measurement accuracy (for input signals with ratio of deviation to residual FM > 30 dB)	< ± 0.1 Hz averaged over 10 measurements < ± 1.0 Hz for a single measurement
Residual FM	< 7 Hz rms in a C-message bandwidth, < 1.5 Hz rms in a 100 Hz bandwidth using the tunable band pass filter
Measurement trigger source	Immediate
Measurement detector	Selectable choices of rms, peak+, peak-, peak ± max, and peak ± max/2
Measurement gate time	50 ms to 6.0 s with 50 ms resolution, default value of 50 ms

AMPS RF analyzer

Frequency modulation measurement (continued)	
Measurement filtering	Settable choices of none, 100 Hz bandwidth band pass tunable over 300 Hz to 15 kHz, C-message, 50 Hz to 3 kHz band pass, 50 Hz to 15 kHz band pass, or 300 Hz to 15 kHz band pass
Measurement de-emphasis	750 µs settable as off or on
Measurement expander	Settable as off or on
Available results	FM deviation level, FM distortion, and modulation frequency
Multi-measurement capabilities	1 to 999 measurements, minimum, maximum, average, and standard deviation results
Concurrency capabilities	Frequency modulation measurements can be made concurrently with all analog and audio measurements
Deviation measurement resolution	Typically 1 Hz
Distortion measurement resolution	Typically 0.1%
Frequency measurement resolution	Typically 0.1 Hz
External audio output	Selectable source for the front panel Audio Out port of either the audio source (default) or the demodulated FM output
Frequency stability measurement	
Types of signals measured	Analog and AMPS signals with or without SAT and with frequency modulation index (β) < 3.0 radians
Frequency capture range	Signal must be within ± 200 kHz of test set's expected frequency
Measurement rate range	100 Hz to 15 kHz
Minimum input level	Signal at test set's RF IN/OUT must have analog Tx power > –30 dBm

Frequency and frequency error measurement accuracy:

Measurement accuracy	**Input signal modulation**	**Input signal frequency range**
< ± (1 Hz + time-base accuracy)	None	800 to 960 MHz
< ± (10 Hz + time-base accuracy)	Frequency modulation with β < 3.0 radians	800 to 960 MHz

Measurement accuracy	Typically < ± (1 Hz + timebase accuracy) for an input signal with SAT, < ± (3.3 Hz + timebase accuracy) for an input signal with β = 1 radian
Measurement trigger source	Immediate
Available results	RF frequency and RF frequency error
Multi-measurement capabilities	Multi-1 to 999 measurements, minimum, maximum, average, and standard deviation in Hz for all results and worst case RF frequency error in ppm result
Concurrency capabilities	Frequency stability measurements can be made concurrently with all analog and audio measurements
Measurement resolution for frequency and frequency error measurement results in Hz	Typically 1 Hz
Measurement resolution for frequency error measurement result in ppm	Typically 0.01 ppm

Option E1962B-402 Advanced AMPS specifications

This option adds enhanced call processing capabilities and three additional measurements for AMPS: signaling tone measurement, DTMF measurement, and wideband data deviation measurement.

AMPS active cell call control ("one button commands"): Adds send maintenance order message and send alert order message

Frequency modulation measurement	
Types of signals measured	AMPS 10 kHz signaling tone with or without SAT
Measurement setup requirements	In the AMPS active cell mode, the user must trigger the test set to send a maintenance order in order to force the DUT to transmit the signaling tone; in the AVC test mode, the user must force the DUT to transmit the signaling tone using a test mode in the DUT
Frequency capture range	RF signal must be within ±2.5 kHz of test set's expected frequency
Measurement deviation range	0 to 16 kHz
Minimum input level	Signal at test set's RF IN/OUT must have analog Tx power > –15 dBm
Peak deviation measurement accuracy	Same as FM measurement
Residual FM	Same as FM measurement
Measurement trigger source	Immediate
Measurement detector	Peak+ and peak–
Measurement filtering	Fixed to 100 Hz band pass filter centered on the 10 kHz signaling tone
Available results	Signaling tone peak+ and peak- deviation level, signaling tone frequency, and signaling tone frequency error
DTMF measurement	
Types of signals measured	AMPS DTMF modulated signals
Measurement setup requirements	In the AMPS active cell mode or AVC test mode, the user must trigger the DUT to transmit the desired DTMF symbols
Supported DTMF symbols	1, 2, 3, A, 4, 5, 6, B, 7, 8, 9, C, *, 0, #, and D
DTMF symbol frequency capture range	DTMF symbols individual high and low tones must be within ± 2% of their defined frequencies for correct detection

DTMF symbol defined frequencies:

	1209 Hz	**1336 Hz**	**1477 Hz**	**1633 Hz**
697 Hz	1	2	3	A
770 Hz	4	5	6	B
852 Hz	7	8	9	C
941 Hz	*	0	#	D

DTMF measurement (continued)	
Measurement deviation range	2.0 to 6.0 radians
Minimum input level	Signal at test set's RF IN/OUT must have analog Tx power > –15 dBm
Peak deviation measurement accuracy	Same as FM measurement
Residual FM	Same as FM measurement
Measurement trigger source	Immediate
Measurement detector	Rms, peak+, peak-, peak +/- max, and peak +/- max/2
Measurement gate time	100 ms to 6.0 s with 100 ms resolution, default value of 2.0 s
Measurement filtering	Fixed to 100 Hz band pass filter centered on the symbol's nominal high and low tone frequencies
Available results	Reports the following parameters for up to 16 DTMF symbols (those captured during the measurement gate time): detected symbol; low tone frequency, frequency error, radian deviation; high tone frequency, frequency error, radian deviation; symbol on time; and symbol off time
Wideband data deviation measurement	
Types of signals measured	AMPS wideband data bursts
Measurement setup requirements	In the AMPS active cell mode, the user must arm the measurement and then force the DUT to send a wideband data burst by changing the MS Tx level (causes the test set to send a signaling message that the DUT must respond to); in the AVC test mode, the user must force the DUT to transmit a wideband data burst using a test mode in the DUT
Frequency capture range	RF signal must be within ± 2.5 kHz of test set's expected frequency
Measurement deviation range	4 to 16 kHz
Minimum input level	Signal at test set's RF IN/OUT must have analog Tx power > –15 dBm
Peak deviation measurement accuracy	Same as FM measurement
Residual FM	Same as FM measurement
Measurement trigger source	Immediate
Measurement detector	Peak+ and peak-
Measurement gate time	100 ms to 6.0 s with 100 ms resolution; default value of 2.0 s
Measurement filtering	Fixed to 50 Hz high-pass filter
Available results	Wideband data peak+ and peak- frequency deviation, and wideband data settled peak+ and peak- frequency deviation; settled results are taken 30 ms after the detected front edge of the wideband data burst

Audio analyzer specifications

- All specifications for the audio analyzer apply to signals present at test set's AUDIO IN ports.
- Audio analyzer de-emphasis: 750 µs, de-emphasis settable as off or on
- Audio analyzer expander: Settable as off or on with reference level setting of 10 mV to 10 V
- Audio analyzer filters: Settable choices of none, C-message, 50 Hz to 15 kHz band pass, 300 Hz to 15 kHz band pass, or 100 Hz bandwidth tunable band pass tunable over 300 Hz to 15 kHz

Audio level measurement	
Types of signals measured	Sinusoidal audio signals
Measurement frequency range	100 Hz to 15 kHz
AUDIO IN level range	7.1 mV to 20 V peak (5 mV to 14.1 V rms)
Measurement accuracy	< ± (2% of reading + resolution) for 100 Hz to 8 kHz, < ± (3% of reading + resolution) for 8 to 15 kHz
Measurement THD plus noise	< 200 µV rms
Measurement detector	Selectable choices of rms and peak
Measurement trigger source	Immediate
Available result	Audio level
Multi-measurement capabilities	1 to 999 measurements, average, minimum, maximum, and standard deviation results
Concurrency capabilities	Audio level measurements can be made concurrently with all other measurements
External input impedance	Typically 100 k W in parallel with 105 pF
Measurement resolution	Typically 0.3% of expected level setting or 0.2 mV, whichever is greater
SINAD measurement	
Types of signals measured	Sinusoidal audio signals
Measurement frequency range	100 Hz to 10 kHz
AUDIO IN level range	42.4 mV to 20 V peak (30 mV to 14.1 V rms)
Measurement accuracy	< ± 1.0 dB for SINAD < 44 dB
Residual THD plus noise	< –60 dB or 200 µV rms, whichever is greater
Measurement trigger source	Immediate
Available result	SINAD ratio
Multi-measurement capabilities	1 to 999 measurements, average, minimum, maximum, and standard deviation results
Concurrency capabilities	SINAD measurements can be made concurrently with all analog and audio measurements
Measurement resolution	Typically 0.01 dB

Distortion measurement	
Types of signals measured	Sinusoidal audio signals
Measurement frequency range	100 Hz to 10 kHz
AUDIO IN level range	42.4 mV to 20 V peak (30 mV to 14.1 V rms)
Measurement accuracy	< ± 12% of reading (± 1.0 dB) for distortion > 0.67%
Residual THD plus noise	< –60 dB or 200 µV rms, whichever is greater
Measurement trigger source	Immediate
Available result	Audio distortion
Multi-measurement capabilities	1 to 999 measurements, average, minimum, maximum, and standard deviation results
Concurrency capabilities	Distortion measurements can be made concurrently with all analog and audio measurements
Measurement resolution	Typically 0.1%
Audio frequency measurement	
Types of signals measured	Sinusoidal audio signals
Measurement frequency range	100 Hz to 15 kHz
AUDIO IN level range	7.1 mV to 20 V peak (5 mV to 14.1 V rms)
AUDIO IN signal conditions	Signal at test set's AUDIO IN must have signal-to-noise ratio > 30 dB
Measurement accuracy	< 0.1 Hz averaged over 10 measurements, < 1.0 Hz for a single measurement
Measurement THD plus noise	< 200 µV rms
Measurement trigger source	Immediate
Available result	Audio frequency
Multi-measurement capabilities	1 to 999 measurements, average, minimum, maximum, and standard deviation results
Concurrency capabilities	Frequency measurements can be made concurrently with all other measurements
Measurement resolution	Typically 0.1 Hz

CDMA specifications

cdma2000 active cell call processing functionality	
Resident formats	IS-2000 SR1 (cdma2000)
Call processing timing tolerance	Mobile transmissions typically must be within ± 6 µs of test set's transmitted pilot channel clock timing for proper reverse channel acquisition
Protocol stack	IS-2000 revision 0 with addendum (PREV=6)
Cell overhead channels for PREV=6	F-Pilot: With user-settable PN offset
	F-Sync: With real-time long code and system time update and updates for user entered parameters
	F-Paging: With real-time overhead messages
	F-QPCH: Indicates if active page will be in the next paging channel slot
Cell parameters	NID, SID, country code (MCC), network code (MNC), CDG esc mode, max slot cycle index, and reverse link traffic pilot gain
Control channel parameters (PREV=6)	Paging rate, F-QPCH rate, F-QPCH state, F-QPCH relative level
Paging channel data rate (PREV=6)	Selectable from either full or half rate
F-QPCH data rate	Selectable from either full or half rate
Access parameters (PREV=6)	Nom_Pwr, Nom_Pwr_Ext, Init_Pwr, Pwr_Step, Num_Step, Max_Req_Seq, Max_Rsp_Seq, and Pam_Size
Call control ("one button commands")	Register
	BS call originate
	BS call disconnect
	MS call originate (auto answer)
	MS call disconnect
Registration support	User-initiated (zone-based), power up (with on/off support), timer based (with on/off support), implicit registration (mobile originated call), or direct user entry of mobile IMSI
Registration reported mobile information	ESN (hex), ESN (decimal), MCC, MNC, MSIN, slot class, slot cycle index, protocol revision, band class, operating mode, MAX EIRP, registration type, QPCH support, enhanced RC support, minimum power control step size, MS called party number, MEID supported, MEID (hex), and MEID (decimal)
Status request query control	Selectable between on and off; default of "on" causes test set to perform the status queries during registration or mobile origination when a new ESN is received by the test set
Max EIRP	User must enter the mobile's maximum power in dBW when the status request query field is set to off
IMSI support	Class 0 only
Supported IMSI class 0 types	MSIN only (00), MNC + MSIN (01), MCC + MSIN (10), or MCC + MNC + MSIN (11)

cdma2000 active cell call processing functionality (continued)	
Query mobile capabilities function	Uses signaling to request the mobile's capabilities; requested parameters include:
	FCH: FCH supported, FCH 5 ms frames supported, F-FCH radio configurations, R-FCH radio configurations
	DCCH: DCCH supported, DCCH frame size, F-DCCH radio
	configurations, R-DCCH radio configurations
	F-SCH: F-SCH supported, number of F-SCH channels supported, turbo encoder supported, turbo encoded rate set 1 max data rate, turbo encoded rate set 2 max data rate, convolutional encoder supported, convolutional encoded rate set 1 max data rate, convolutional encoded rate set 2 max data rate
	R-SCH: R-SCH supported, number of R-SCH channels supported, turbo encoder supported, turbo encoded rate set 1 max data rate, turbo encoded rate set 2 max data rate, convolutional encoded rate set 1 max data rate, convolutional encoded rate set 2 max data rate
Supported TCH/FCH radio configuration combinations	Forward RC1, reverse RC1 (F-RC1, R-RC1)
	Forward RC2, reverse RC2 (F-RC2, R-RC2)
	Forward RC3, reverse RC3 (F-RC3, R-RC3)
	Forward RC4, reverse RC4 3 (F-RC4, R-RC3)
	Forward RC5, reverse RC4 (F-RC5, R-RC4)
	Forward RC11, reverse RC8 (F-RC11, R-RC8)
TCH/FCH service option support	SO1 9.6 kbps voice
	SO2 9.6 kbps data loopback
	SO3 9.6 kbps EVRC voice
	SO6 Short message service (Rate Set 1)
	SO9 14.4 kbps data loopback
	SO14 Short message service (Rate Set 2)
	SO17 14.4 kbps voice
	SO55 9.6 or 14.4 kbps data loopback
	SO68 9.6 kbps EVRC-B voice
	SO70 9.6 kbps EVRC-WB voice (fully supported with special ADC hardware E5515C-H05 or E5515CU- H05 and the latest software)
	SO73 9.6 kbps EVRC-NW voice (RC11, RC8)
	SO75 9.6 kbps data loopback (RC11, RC8)
	SO32768 14.4 kbps voice
Loopback service option traffic data source	PRBS (CCITT 215–1 pattern)
Voice service option modes	Echo with variable delay, 400 Hz sine wave, 1 kHz sine wave, swept sine wave, multi-tone audio, real-time vocoder, and null frames
Echo delay	Selectable as short, medium, and long
F-SCH service option support	SO32 (+F-SCH) or SO32 (+SCH): TDSO supporting all SR1 rates up to 153.6 kbps in (F-RC3, R-RC3), (F-RC4, R-RC3), or (F-RC11, R-RC8)
	IS-2000 to IS-95 handoff parameters: Execute, channel, band, protocol, and service option
	IS-2000 to AMPS handoff parameters: Execute, channel, SAT, and power level

cdma2000 active cell call processing functionality (continued)	
Forward TCH/FCH data rates	F-RC1: Random (40% duty cycle), 1.2, 2.4, 4.8, 9.6 kbps
	F-RC2: Random (40% duty cycle), 1.8, 3.6, 7.2, 14.4 kbps
	F-RC3: Random (40% duty cycle), 1.5, 2.7, 4.8, 9.6 kbps
	F-RC4: Random (40% duty cycle), 1.5, 2.7, 4.8, 9.6 kbps
	F-RC5: Random (40% duty cycle), 1.8, 3.6, 7.2, 14.4 kbps
	F-RC11: Random (40% duty cycle), 0, 1.8, 3.0, 5.0, 9.6 kbps
Forward SCH support	1 SCH only
Forward SCH data rates	F-RC3: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
	F-RC4: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
	F-RC11: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
Forward SCH data rates	F-RC3: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
	F-RC4: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
	F-RC11: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
Forward SCH data source	Eight bit fixed pattern or PRBS (default)
Forward SCH coding	Convolutional or turbo
Reverse link access support	Access channel for PREV=6
Reverse FCH data rate	R-RC1: 1.2, 2.4, 4.8, 9.6 kbps
	R-RC2: 1.8, 3.6, 7.2, 14.4 kbps
	R-RC3: 1.5, 2.7, 4.8, 9.6 kbps
	R-RC4: 1.8, 3.6, 7.2, 14.4 kbps
	R-RC8: 0, 1.8, 3.0, 5.0, 9.6 kbps
Reverse SCH support	SO32 assign for a single channel
Reverse SCH data rates	R-RC3: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
	R-RC8: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
Reverse link closed loop bit rate	F-RC1 to F-RC5: Fixed to 800 bps
	F-RC11: 200 to 400 bps
Reverse link closed loop power control modes	Active
	Alternating – alternating 0 and 1 power bits
	All up
	All down
Reverse link closed loop power control transient	User start function that interrupts the current reverse link closed loop power control mode and substitutes the user-defined number and direction of closed loop power control bits; once the transient is sent, the closed loop power control reverts to the original state
Reverse link closed loop power control transient modes	Up, down, and up-down-up
Transient number of steps	1 to 400
Forward link power control support	Test set ignores all power control data sent by the mobile station

MEID	
MEID functionality	User on or off control
PLCM type	ESN based, BS assigned, or MEID
Query MEID	One button command that query's the mobile station for its MEID information
Real-time vocoder	
Functionality	Provides real-time encoding of external audio applied to the front panel audio in port and real-time decoding of audio output via the front panel audio out port
Real-time vocoder support	13 k vocoder in service options 17 and 32768 and the EVRC vocoder in service option 3
Encoder data rate mode	Auto, fixed, or limited; in auto mode the vocoder algorithm selects the rate based on the sampled audio; fixed mode locks the rate to the user selected rate; limited allows the vocoder to use the user selected rate and any lower rate, if available
Encoder data rate	Full, half, quarter, or eighth
Expected input voltage	0 to 2 V; sets the input gain for external audio applied to the front panel audio in port
Max output voltage	0 to 5 V; sets the output level of the decoded audio routed to the front panel audio out port
Vocoder limitations	When active, no measurements are allowed during real-time vocoding
Settable system time	
Functionality	Allows user to set the system time for the CDMA system; system time is retained during power-off using the internal real-time clock
CDMA system date	Settable in the format of yyyy.mm.dd for the year, month, and day
CDMA system time	Settable in the format of hh.mm.ss for the hour, minute, and seconds; input resolution is 2 seconds
Leap seconds	Settable from 0 to 255 seconds
Local time offset	Settable in the format of hh.mm from 00.00 to 15.30 in 30 minute increments
Daylight savings time indicator	On or off

IS-2000 test mode functionality

Resident formats	IS-2000 SR1
Cell overhead channels	F-Pilot: With user-settable PN offset
	F-Sync: With real-time long code and system time update and updates for user entered parameters
	F-Paging: With real-time overhead messages
	F-QPCH: With all indicators on or all off
Protocol stack	Limited to IS-2000 revision 0 with addendum sync channel message and paging channel overhead messages
Base station parameters	NID, SID, country code (MCC), network code (MNC), paging rate, CDG esc mode, F-QPCH state, F-QPCH relative level, F-QPCH data bits (all on or all off), and reverse link traffic pilot gain
Call control ("one button commands")	None
Access parameters	None
Registration support	None
Service option support	None
Handoff support	None
R-Access channel	Not supported
Chip rate	1.2288 Mcps
Supported radio configuration combinations	Forward RC-1 + reverse RC-1
	Forward RC-2 + reverse RC-2
	Forward RC-3 + reverse RC-3
	Forward RC-4 + reverse RC-3
	Forward RC-5 + reverse RC-4
	Forward RC-11 + reverse RC-8
Channel coding	Convolutional or turbo
Traffic data source	PRBS (CCITT 215–1 pattern)
Forward FCH data rate	RC1: Random (40% duty cycle), 1.2, 2.4, 4.8, 9.6 kbps
	RC2: Random (40% duty cycle), 1.8, 3.6, 7.2, 14.4 kbps
	RC3: Random (40% duty cycle), 1.5, 2.7, 4.8, 9.6 kbps
	RC4: Random (40% duty cycle), 1.5, 2.7, 4.8, 9.6 kbps
	RC5: Random (40% duty cycle), 1.8, 3.6, 7.2, 14.4 kbps
	RC11: Random (40% duty cycle), 0, 1.8, 3.0, 5.0, 9.6 kbps
Forward SCH support	One supplemental channel
F-SCH data rate	RC3: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
	RC4: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
	RC11: 9.6, 19.2, 38.4, 76.8, or 153.6 kbps
Power control groups	16 per frame
Reverse link closed loop support	Transmits bits only (no reverse link demodulation)
Reverse link closed loop bit rate	Fixed to 800 per second
Reverse link closed loop power control modes	Alternating – alternating 0 and 1 power bits
	Alt 20 up/down – alternating 20 up/20 down bits
	All up
	All down
Reverse link closed loop power control transient	User start function that interrupts the current reverse link closed loop power control mode and substitutes the user-defined number and direction of closed loop power control bits; once the transient is sent, the closed loop power control reverts to the original state

IS-2000 test mode functionality (continued)

Reverse link closed loop power control transient modes	Up, down, and up-down-up
Transient number of steps	1 to 400
Forward link power support	None
Mobile station identification	User entry of ESN (hex); entry of all "F" hex data results in using a zero long code mask on the source

Option E1962B-401 cdma2000 Release A

Adds support for cdma2000 Release A protocol (PREV=7) along with support for the Release A F-BCCH, F-CCCH, and R-EACH channels in the IS-2000 active cell and IS-2000 test modes.

Protocol stack	IS-2000 Release 0 with addendum (PREV=6) or IS-2000 Release A (PREV=7)
Control channel configuration (PREV=7 only)	PCH/ACH or BCCH/CCCH/EACH
Cell overhead channels (PREV=6 and PREV=7 with Control Channels=PCH/ACH)	F-Pilot: With user-settable PN offset
	F-Sync: With real-time long code and system time update and updates for user entered parameters
	F-Paging: With real-time overhead messages
	F-QPCH: Indicates if active page will be in the next paging channel slot
Cell overhead channels (PREV=7 with Control Channels=BCCH/CCCH/EACH)	F-Pilot: With user-settable PN offset
	F-Sync: With real-time long code and system time update and updates for user entered parameters
	F-BCCH: With real-time overhead messages
	F-CCCH: With real-time signaling messages
	F-QPCH: Indicates if active page will be in the next paging channel slot
Cell overhead messages (PREV=6 and PREV=7 with Control Channels=PCH/ACH)	System parameters message, channel list message, access parameters message, extended system parameters message, and extended neighbor list message
Cell overhead messages (PREV=7 with Control Channels= BCCH/CCCH/EACH)	ANSI-41 system parameters message, MM-RC parameters message, extended channel list message, enhanced access parameters
Control channel parameters (PREV=7 and Control Channels= BCCH/CCCH/EACH)	F-BCCH rate, F-CCCH rate, F-QPCH rate, F-QPCH state, F-QPCH relative level
F-BCCH rate (PREV=7 and Control Channels=BCCH/ CCCH/ EACH)	4.8 kbps (1/2 rate coding, 160 ms slot), 9.6 kbps (1/2 rate coding, 80 ms slot), or 19.2 kbps (1/2 rate coding, 40 ms slot)
F-CCCH rate (PREV=7 and Control Channels=BCCH/ CCCH/ EACH)	9.6 kbps (1/4 rate coding, 20 ms frame), 9.6 kbps
(1/2 rate coding, 20 ms frame), and 19.2 kbps (1/2 rate coding, 20 ms frame)	(1/2 rate coding, 20 ms frame), and 19.2 kbps (1/2 rate coding, 20 ms frame)
Enhanced access parameters (PREV=7 and Control Channels= BCCH/CCCH/EACH)	(not applicable to IS-2000 test mode) 9.6 kbps with a 20 ms frame only, 19.2 kbps with a 20 ms frame only or all rates with a 20 ms frame

Option E1962B-405 fading (digital bus)

Functionality	Allows baseband, digital I/Q data from the signal generator to be sent to an external N5106B (PXB) and then returns the signal to the test set for modulation
Connector	Rear panel, 50-pin, high density
Signal generator ALC mode	Closed or open (default of closed); open loop mode must be used during fading to maintain the desired signal characteristics
ALC open loop calibration	Calibrates the RF source when operating in the ALC open loop mode; the accuracy remains valid with a ± 5 °C window of the temperature at which the calibration was performed
ALC open loop RF IN/OUT composite absolute output level accuracy degradation (must add this to the main level accuracy specification for temperatures within ± 5 °C of the last ALC open loop calibration)	< ± 0.75 dB, –109 to –70 dBm/1.23 MHz < ± 0.50 dB, –70 to –35 dBm/1.23 MHz < ± 0.75 dB, –35 to –13 dBm/1.23 MHz
ALC open loop carrier feedthrough	Typically < 40 dBc (nominal ambient < 47 dBc after IQ calibration)

Option E1962B-406 multi-unit synchronization

Functionality	Allows any test set to be time-synchronized to another test set running either CDMA or 1xEV-DO test application or lab application; synchronization requires one unit to be designated as the time server and the other as the client; timebase and trigger outputs of the server must be connected to the client's timebase and trigger inputs; the test sets must also be on a LAN using the same address segment
Sync to external test set	One button command to perform the synchronization
External test set LAN address	User entry of the time server's LAN address (IPv4 address)
Synchronization fanout	Maximum of four client test sets can be driven from a single timing server; unlimited number can be synchronized when they are daisy-chained together (one unit to another)
Synchronization results	Server operation complete and client operation complete
Synchronization accuracy	Typically < 1 µs

Option E1962B-407 protocol logging

Functionality	Start protocol logging and stop protocol logging
Protocol support	PREV=6 and PREV=7 messages; provides correct binary output for lower PREVs but decodes using PREV=6 messages formats

Option E1962B-409 SMS

SMS support	Mobile terminated or mobile originated
SMS mobile terminated service types	Point-to-point or broadcast
SMS mobile terminated teleservice types	Wireless paging teleservice, wireless messaging teleservice, voice mail notification, or WAP
SMS broadcast service categories	Unknown, broadcast emergency, administrative, maintenance, general news local, general news regional, general news national, general news international, business and financial news local, business and financial news regional, business and financial news national, business and financial news international, sports news local, sports news regional, sports news national, sports news international, entertainment news local, entertainment news regional, entertainment news national, entertainment news international, local weather, area traffic reports, local flight schedules, restaurants, lodgings, retail directory, advertisements, stock quotes, employment opportunities, medical, technology news, and multi-category
SMS mobile terminated originating address	Maximum of 14 numeric digits
SMS mobile terminated message priority	None, normal, interactive, urgent, and emergency
SMS mobile terminated message privacy	None, not restricted, restricted, confidential, and secret
SMS mobile terminated message alert	Default, low, medium, high, and none
SMS mobile terminated message encoding	Octet, 7-bit ASCII, IA5, UNICODE, shift-JIS, Korean, Latin/Hebrew, Latin, and GSM 7-bit default alphabet
SMS mobile terminated message optional user data	Include or exclude
SMS mobile terminated call back number	Include or exclude; set to the originating address when included
SMS mobile terminated message entry	Hex or ASCII
SMS mobile terminated message length	Maximum of 255 ASCII characters or 510 hex characters
SMS mobile terminated message repeat	1 up to 255 repetitions of the entered data
SMS mobile terminated messaging editing	Append data, overwrite data, insert data, clear to end, backspace, and delete character
SMS mobile terminated message status	Provides status of SMS message transmission and reports cause codes
SMS mobile originated protocol control	Enabled, disabled, not supported, or unknown address
SMS mobile originated display	Auto, ASCII, or hex
SMS mobile originated message status	Message count, tele service type, destination address, destination address encoding, priority, call back number, call back number encoding, message encoding, and message length

Option E1962B-410 cdma2000 1x advanced

Adds support for 1x Advanced functions including new radio configurations, SO73, SO75, smart blanking, frame early termination, slower reverse power control, general extension message (GEM) as well as related measurement enhancements

New radio configurations	(forward RC11, reverse RC8)
New service options	SO75: 9.6 kbps data loopback (RC11, RC8))
	SO73: 9.6 kbps EVRC-NW voice
New settings/results for smart blanking	F-FCH blanking duty cycle: Blanking disabled, 1 out of 4 frames, or 1 out of 8 frames
	R-FCH blanking duty cycle: Blanking disabled, 1 out of 4 frames, or 1 out of 8 frames
	FCH 1/8 rate non-critical frames ratio: 0 to 100%
	FCH 1/8 rate non-critical frames direction: Forward or reverse smart blanking statistic counters
New settings for early termination	F-FCH ACK mask - RL blanking: 16 bits, each bit can be '0' or '1' character
	F-FCH ACK mask - No RL blanking: 16 bits, each bit can be '0' or '1' character
	R-FCH ACK mask: 16 bits, each bit can be '0' or '1' character
New settings for slower reverse power control	Reverse power control mode: 200 to 400 bps, or 200 bps
	Zero rate power control step size: 0.25, 0.5, 1.0, 1.5, or 2.0 dB
Measurements enhanced for 1x advanced testing	Frame error rate
	Code domain power
	Code channel time/phase error

IS-95 active cell call processing functionality

Resident formats	IS-95
Call processing timing tolerance	Mobile transmissions must be typically within ± 6 µs of test set's transmitted pilot channel clock timing for proper reverse channel acquisition
Cell overhead channels	F-Pilot: With user-settable PN offset
	F-Sync: With real-time long code and system time update and updates for user entered parameters such as SID, NID, PRAT, CDMA_FREQ, and PN OFFSET
	F-Paging: With real-time overhead messages
Protocol stack	TSB-74, J-STD-008, TIA/EIA-95-B, ARIB T53, and Korean PCS
Base station parameters	NID, SID, country code (MCC), network code (MNC), paging rate, and CDG esc mode
Call control ("one button commands")	Register
	BS call originate
	BS call disconnect
	MS call originate (auto answer)
	MS call disconnect
Access parameters	Nom_Pwr, Nom_Pwr_Ext, Init_Pwr, Pwr_Step, Num_Step, Max_Req_Seq, Max_Rsp_Seq, and Pam_Size
Registration support	User-initiated (zone-based), power up, timer based, implicit registration (mobile originated call), or direct user entry of mobile IMSI

IS-95 active cell call processing functionality (continued)

IMSI support	Class 0 only
Supported IMSI class 0 types	MSIN only (00), MNC + MSIN (01), MCC + MSIN (10), or MCC + MNC + MSIN (11)
Paging channel data rate	Selectable full or half rate
TCH/FCH service option support	SO1 9.6 kbps voice
	SO2 9.6 kbps data loopback
	SO3 9.6 kbps EVRC voice
	SO6 Short message service (Rate Set 1)
	SO9 14.4 kbps data loopback
	SO14 Short message service (Rate Set 2)
	SO17 14.4 kbps voice
	SO68 9.6 kbps EVRC-B voice
	SO70 9.6 kbps EVRC-WB voice
	SO32768 14.4 kbps voice
Loopback service option traffic data source	PRBS (CCITT 2^{15} – 1 pattern)
Voice service option modes	Echo with variable delay, 400 Hz sine wave, 1 kHz sine wave, swept sine wave, multi-tone audio, real-time vocoder, and null frames
Echo delay	Selectable short, medium, and long
Handoff support	Hard handoff (new channel, band), PN offset handoff, and IS-95 to AMPS
CDMA to AMPS handoff parameters	Execute, system type, channel, SAT, and power level
Reverse link closed loop power control modes	Active
	Alternating – alternating 0 and 1 power bits
	All up
	All down
Reverse link closed loop power control transient	User start function that interrupts the current reverse link closed loop power control mode and substitutes the user-defined number and direction of closed loop power control bits; once the transient is sent, the closed loop power control reverts to the original state
Reverse link closed loop power control transient modes	Up, down, and up-down-up
Transient number of steps	1 to 400

IS-95 active cell call processing functionality (continued)

Real-time vocoder	
Functionality	Provides real-time encoding of external audio applied to the front panel audio in port and real-time decoding of audio output via the front panel audio out port
Real-time vocoder support	13 k vocoder in service options 17 and 32768 and the EVRC vocoder in service option 3
Encoder data rate mode	Auto, fixed, or limited; in auto mode the vocoder algorithm selects the rate based on the sampled audio; fixed mode locks the rate to the user selected rate; limited allows the vocoder to use the user selected rate and any lower rate, if available
Encoder data rate	Full, half, quarter, or eighth
Expected input voltage	0 to 2 V; sets the input gain for external audio applied to the front panel audio in port
Max output voltage	0 to 5 V; sets the output level of the decoded audio routed to the front panel audio out port
Vocoder limitations	When active, no measurements are allowed during real-time vocoding
Settable system time	
Functionality	Allows user to set the system time for the CDMA system; system time is retained during power-off using the internal real-time clock
CDMA system date	Settable in the format of yyyy.mm.dd for the year, month, and day
CDMA system time	Settable in the format of hh.mm.ss for the hour, minute, and seconds; input resolution is 2 seconds
Leap seconds	Settable from 0 to 255 seconds
Local time offset	Settable in the format of hh.mm from 00.00 to 15.30 in 30 minute increments
Daylight savings time indicator	On or off

Option E1962B-403 CDMA authentication

Adds support for IS-95/cdma2000 active cell authentication. Does not support encryption.

CDMA authentication	
Functionality	Provides basic authentication capabilities for call processing; does not support encryption.
Authentication commands	Unique challenge and SSD update
Global challenge	On or off
Authentication user parameters	A-key (decimal), RAND (hex), RANDU (hex), and RANDSSD (hex)
Global challenge results	AUTHU expected value, AUTHU received value and pass/fail result; RANDC expected value, RANDC received value and pass/fail result; COUNT (call history); AUTH_MODE
Unique challenge results	AUTHU expected value, AUTHU received value, and pass/fail result
SSD update results	Pass/fail result

CDMA RF generator

Channels	
Additive white gaussian noise source	Yes
AWGN bandwidth	Typically 1.8 MHz < BW < 2.1 MHz
CDMA channels	CDMA code channels (PREV ≤ 6):
	F-Pilot: Fixed at Walsh code 0
	F-Sync: Fixed at Walsh code 32
	F-Paging: Fixed at Walsh code 1
	F-QPCH (IS-2000 only): Fixed at Walsh code 80
	F-FCH: Selectable Walsh code from the following set: 10, 14, 26, 30, 42, 46, 58, or 62
	F-SCH (IS-2000 only): Fixed to Walsh code 3
	F-OCNS: Selectable Walsh code from the following set: 5, 13, 21, 29, 37, 45, 53, and 61
CDMA PN offset	Selectable from 0 to 511
Frequency	
Frequency range – US cellular band (860.04-893.97 MHz, channels 1-799, – 991-1023, 1024-1323, 1324-1424) – Japan CDMA band (approx. 832-869.9875 MHz, channels 1-799, 801-1039, 1041-1199, 1201-1600) – US PCS band (1930-1990 MHz, channels 1-1199) – Korean PCS band (1840-1870 MHz, channels 0-599) – NMT-450 band (420-494 MHz, channels 1-300, 539-871, – 1039-1473, 1792-2016) – IMT-2000 band (2110-2169.950 MHz, channels 0-1199) – Secondary 800 MHz band (approx. 851-869 MHz, and 935-940 MHz, channels 0-719, 720-919) – US PCS 1.9 GHz band (1930-1994.950 MHz, channels 0-1299) – AWS band (2110-2154.950 MHz, channels 0-899) – Cellular upper 700 band (776-788 MHz, channels 0-240) – 400 MHz European PAMR band (420-494MHz, channels 1-2016) – 800 MHz PAMR band (915-921MHz, channels 0-239) – 700 MHz public safety band (757-769MHz, channels 0-240) – Lower 700 MHz band (728-746MHz, channels 0-360)	
Frequency setting	By channel number or MHz (IS-2000 test mode only)
Frequency setting resolution	Typically 1 Hz
Amplitude	
Output port control	User control of RF source routing to either the RF IN/OUT port or the RF OUT ONLY port
RF IN/OUT composite signal level	Sum of the user-set values of the CDMA cell power and the AWGN source power
RF IN/OUT CDMA cell output level range (AWGN off)	–120 dBm/1.23 MHz to –13 dBm/1.23 MHz
RF IN/OUT AWGN output level range	–120 dBm/1.23 MHz to –20 dBm/1.23 MHz, over-range available with reduced performance to –15 dBm/1.23 MHz
RF IN/OUT CDMA cell absolute output level accuracy (AWGN off)	RF generator level accuracy is derived from 99th percentile observations with 95 percent confidence (corresponds to an expanded uncertainty with a 95 percent confidence (k = 2)) at ambient conditions, then qualified to include the environmental effects of temperature and humidity.
	< ± 1.1 dB, –109 to –15 dBm/1.23 MHz
	Typically ±0.62 dB, –109 to –15 dBm/1.23 MHz
RF IN/OUT composite absolute output level accuracy (AWGN on)	< ± 1.2 dB, –109 to –20 dBm/1.23 MHz
	Typically ± 0.7 dB, –109 to –20 dBm/1.23 MHz

Amplitude (continued)	
RF IN/OUT reverse power	+37 dBm peak (5 W peak)
RF IN/OUT VSWR	< 1.14:1, 400 to 1000 MHz
	< 1.2:1, 1700 to 2000 MHz
	< 1.32:1, 2010 to 2180 MHz
RF OUT ONLY composite signal level	Sum of the user-set values of the CDMA cell power and the AWGN source power
RF OUT ONLY CDMA cell output level range (AWGN off)	–115 dBm/1.23 MHz to –5 dBm/1.23 MHz
RF OUT ONLY AWGN output level range	–115 dBm/1.23 MHz to –12 dBm/1.23 MHz, over-range available with reduced performance to –7 dBm/1.23 MHz
RF OUT ONLY CDMA cell absolute output level accuracy (AWGN off)	< ± 1.1 dB, –109 to –7 dBm/1.23 MHz,
	Typically < ± 0.62 dB, –109 to –7 dBm/1.23 MHz
RF OUT ONLY composite absolute output level accuracy (AWGN on)	< ±1.2 dB, –109 to –12 dBm/1.23 MHz,
	Typically < ±0.7 dB, –109 to –12 dBm/1.23 MHz
RF OUT ONLY reverse power	+24 dBm peak (250 mW peak)
RF OUT ONLY VSWR	Typically < 1.3:1 for 400 to 500 MHz, < 1.4:1 for 800 to 1000 MHz, and < 1.45:1 for 1.7 to 2.2 GHz
Isolation (from RF OUT ONLY port to RF IN/OUT when the RF source is routed to the RF OUT ONLY port)	Typically > 40 dB
F-pilot relative level	–20 to 0 dB or off
F-sync relative level	–20 to 0 dB or off
F-paging relative level (PREV ≤ 6)	–20 to 0 dB or off
F-FCH channel relative level	Settable from –30 to 0 dB with 0.01 dB resolution or off
F-SCH channel relative level	Settable from –20 to 0 dB with 0.01 dB resolution or off
AWGN channel relative level range	Settable to ± 15 dB relative to the user-set CDMA cell power with 0.01 dB resolution
F-OCNS Walsh code length	Fixed to 64 bits
F-OCNS relative level range	Automatically calculated from other code channel relative levels to provide the set CDMA cell power (range of –30 to 0 dB or off)
Relative CDMA channel level accuracy	Typically < ± 0.2 dB
CDMA modulation	
Modulation type	Parallel BPSK for IS-95 channels and IS-2000 pilot, sync, and paging channels, and complex QPSK for the F-FCH per IS-2000
Modulation quality	IS-95, F-RC1, and F-RC2 residual rho: > 0.98, typically > 0.995
	F-RC3, F-RC4, and F-RC5 residual rho (pilot only): > 0.98, typically > 0.995
Residual EVM	< 10%, typically < 3.1%
Carrier feedthrough	Typically < –25 dBc

CDMA RF analyzer (measurements only)

Frequency range (reverse channels)

Band	Frequency	Channel
US cellular band	815 to 849 MHz	1 to 799 991 to 1023 1024 to 1323 1324 to 1424
US PCS band	1850 to 1910 MHz	1 to 1199
Korean PCS band	1750 to 1780 MHz	0 to 599
Japan CDMA band	887 to 925 MHz	1 to 799 801 to 1039 1041 to 1199 1201 to 1600
IMT-2000 band	1920 to 1980 MHz	0 to 1199
NMT-450 band	410 to 484 MHz	1 to 300 539 to 871 1039 to 1473 1792 to 2016
Secondary 800 band	806 to 824 896 to 901 MHz	0 to 719 720 to 919
US PCS 1.9 GHz band	1850 to 1915 MHz	0 to 1299
AWS band	1710 to 1755 MHz	0 to 899
Cellular upper 700 band		0 to 240
400 MHz European PAMR	410 to 420 450 to 460 479 to 483 MHz	1 to 2016
800 MHz PAMR band	870 to 876 MHz	0 to 239
700 MHz public safety band	787 to 799 MHz	0 to 240
Lower 700 MHz band	698 to 716 MHz	0 to 360

Maximum input level	+37 dBm peak (5 W peak)
Input level range	–71 to +30 dBm/1.23 MHz
Receiver ranging	Auto mode: Auto-ranges to the ideal RF power level for the nominally expected open loop response; provides calibrated results if actual received power is within ±9 dB of the expected open loop power
	Manual mode: User enters expected power; if the “active” mode is selected, the test set uses closed loop power control to drive the mobile to the expected power; otherwise, the mobile’s Tx power must be within ± 9 dB of the expected power to provide calibrated results

CDMA analyzer

Average power measurement	
Input frequency ranges	411 to 484 MHz
	800 to 1000 MHz
	1700 to 2000 MHz
Detector types	Peak detector: In IS-95, R-RC1, and R-RC2 modes
	Thermal detector: In R-RC3, R-RC4, and R-RC8 modes
Maximum input level	+37 dBm peak (5 W peak)
Measurement range	–10 to +30 dBm; usable from –10 to –20 dBm with reduced accuracy (peak detector only)
Measurement level ranging	Auto
Measurement data capture period	10 ms
Measurement result	Average power
Concurrency support	Average power measurements can be made concurrently with all CDMA measurements that support concurrency

Peak detector measurement accuracy (20 to 55 °C, after calibration, IS-95, R-RC1, or R-RC2):

- –10 to +30 dBm:
  - 400 to 500 MHz < ± 7.3%, typically < ± 3.0%
  - 800 to 1000 MHz < ± 7.0%, typically < ± 3.0%
  - 1700 to 2000 MHz < ± 7.4%
  - RF OUT ONLY port < ± 8.3%, typically < ± 4.4%
- –10 to –20 dBm:
  - 400 to 500 MHz typically < ± 4.4%
  - 800 to 1000 MHz typically < ± 4.2%
  - 1700 to 2000 MHz typically < ± 4.8%
  - RF OUT ONLY port is selected typically < ± 5.6%

Thermal detector measurement accuracy (accuracy with 10 internal averages; R-RC3, R-RC4, or R-RC8):

- –10 to +30 dBm:
  - 400 to 500 MHz < ± 6.6%, typically < ± 3.0%
  - 800 to 1000 MHz < ± 6.0%, typically < ± 3.0%
  - 1700 to 2000 MHz < ± 7.2%
  - RF OUT ONLY port < ± 8.2%, typically < ± 3.3%

Measurement repeatability	Typically < ± 0.05 dB
Measurement resolution	0.01 dBm
Zero function	Auto zeroes (no user control)

CDMA analyzer (continued)

Tuned channel power measurement	
Input frequency ranges	411 to 420 MHz
	450 to 484 MHz
	824 to 934 MHz
	1700 to 1980 MHz
Measurement method	Measures the total power in a 1.23 MHz bandwidth centered on the active reverse channel center frequency
Measurement data capture period	0.3125 ms (very fast mode), 1.25 ms (fast mode), or 10 ms (normal mode)
Measurement trigger	20 ms clock (frame trigger)
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Measurement range	–61 to +30 dBm, usable to < –69 dBm/ 1.23 MHz with reduced accuracy
Measurement level ranging	Auto and manual
Measurement accuracy	< ± 1 dB 15 to 55 °C, typically < ± 0.5 dB, for the normal and fast modes
	< ± 1.1 dB 15 to 55 °C, typically < ± 0.5 dB, for the very fast mode (calibrated against average power and within ± 10 degrees of calibration temperature; calibration must occur between 20 to 55 °C)
Measurement resolution	0.01 dBm/1.23 MHz
Measurement result	Channel power in a 1.23 MHz bandwidth
Concurrency capabilities	Channel power measurements can be made concurrently with all CDMA measurements that support concurrency
Calibrate function	Calibrates the channel power measurement over the entire operating frequency range of the test set against the average power measurement; no external cabling is required
Calibration time	Typically < 120 s
Access probe power measurement	
Input frequency ranges	411 to 420 MHz
	450 to 484 MHz
	824 to 934 MHz
	1700 to 1980 MHz
Measurement method	Measures the total power in a 1.23 MHz bandwidth centered on the active reverse channel center frequency
Measurement data capture period	1.25 ms
Measurement trigger	Amplitude rise only
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Measurement range	–54 to +30 dBm
Measurement level ranging	Auto and manual
Measurement accuracy	< ± 1 dB 15 to 55 °C, typically < ± 0.5 dB (calibrated against average power and within ± 10 degrees of calibration temperature; calibration must occur between 20 to 55 °C)
Measurement result	Access probe power in a 1.23 MHz bandwidth
Concurrency capabilities	None

CDMA analyzer (continued)

Handoff modulation quality measurement	
Input frequency ranges	411 to 484 MHz
	800 to 1000 MHz
	1700 to 2000 MHz
Measurement chip rate	1.2288 Mcps
Modulation measurement method	PN offset handoff for IS-2000 R-RC3, R-RC4, or R-RC8 to generate reverse pilot only preamble; measures single code rho on the preamble with HPSK (R-Pilot only); performs two handoffs: one to initiate the preamble and a second to return the initial PN offset
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Input level range	–25 to +30 dBm/1.23 MHz, usable to –50 dBm/1.23 MHz with reduced accuracy
Modulation quality measurement range (for signals with < ± 6 µs time error and < ± 1 kHz frequency error)	0.40 to 1.00 rho
Measurement interval	1.042 ms (5 Walsh symbols)
Modulation quality measurement accuracy	< ± 0.003 + residual error for 0.8 < rho < 1.0
Modulation quality measurement residuals	Residual rho: > 0.999
	Residual EVM: < 4% rms
	Residual time error: ± 0.11 µs
Frequency error	± 15 Hz plus timebase error
Measurement results	rho, frequency error, time error, carrier feedthrough, phase error, amplitude error, and EVM
Concurrency capabilities	None
Modulation quality measurement	
Input frequency ranges	411 to 484 MHz
	800 to 1000 MHz
	1700 to 2000 MHz
Measurement chip rate	1.2288 Mcps
Modulation measurement method	IS-95, R-RC1, or R-RC2: Single code rho
	R-RC3, R-RC4, or R-RC8: Multi-code rho and EVM with code domain results
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Input level range	–25 to +30 dBm/1.23 MHz, usable to –50 dBm/1.23 MHz with reduced accuracy
Modulation quality measurement range (for signals with < ± 6 µs time error and < ± 1 kHz frequency error)	IS-95, R-RC1, or R-RC2: 0.40 to 1.00 rho
	R-RC3, R-RC4, or R-RC8: 1 to 40% EVM
Measurement interval	1.042 ms (5 Walsh symbols)
Modulation quality measurement accuracy	IS-95, RC1, or RC2: < ± 0.003 + residual error for 0.8 < rho < 1.0
	R-RC3, R-RC4, or R-RC8: < 1.25% rms + residual error for 1% < EVM < 20%
Modulation quality measurement residuals	Residual rho: > 0.999
	Residual EVM: < 4% rms, typically < 3.1% rms
	Residual time error: ± 0.11 µs
	Frequency error: ± 15 Hz plus timebase error
	Residual code domain power: < –35 dBc

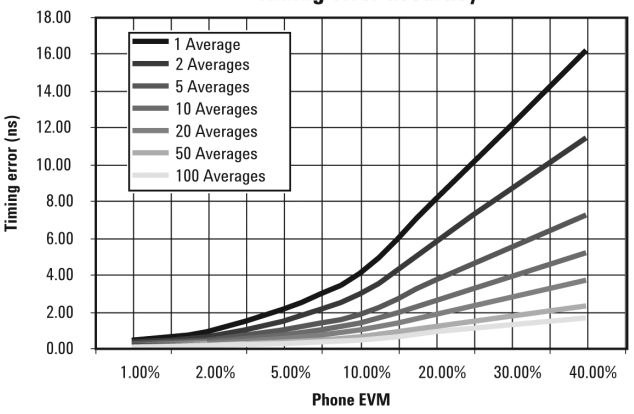
CDMA analyzer (continued)

Modulation quality measurement (continued)	
Code domain power relative measurement accuracy (IS-2000 R-RC3 and R-RC4 only)	< ± 0.005 relative to total power for linear code domain powers from 0.05 to 1.0
Code domain power offset relative to reverse pilot channel (IS-2000 R-RC3 and R-RC4 only)	< ± 0.20 dB
Code domain results (IS-2000 R-RC3 and R-RC4 only)	Code domain power graph: Displays the power in all 16 Walsh coded channels (16 bit) for both the I channel and the Q channel; reported power in each graph is relative to the total combined I and Q channel power; red bars indicated active
	Code domain table: Displays the Walsh code, spread factor, code domain power (at SF=16), total code domain power, and code relative power to the R-Pilot channel for each active reverse channel; possible active channels per IS-2000 include the R-Pilot, R-FCH, R-DCCH, R-SCH1, and R-SCH2
	Code domain power and noise graph: Displays the power and noise in all 16 Walsh coded channels (16 bit) for both the I channel and the Q channel; reported power in each graph is relative to the total combined I and Q channel power; red bars indicate active channels, while yellow bars indicate noise in each channel
	Code domain measurement results: Pass/fail indication based on IS-98E standard specifications
	Modulation quality measurement results: Rho, frequency error, time error, carrier feedthrough, phase error, amplitude error, and EVM
	Statistical measurement results: Provides minimum, maximum, and average for rho, frequency error, time error, carrier feedthrough, phase error, amplitude error, and EVM when multi-measurement mode is active; no statistical results are available for any of the code domain power results
	Concurrency capabilities: Modulation quality measurements can be made concurrently with all CDMA measurements that support concurrency
Code channel time and phase error	
Input frequency ranges	411 to 484 MHz
	800 to 1000 MHz
	1700 to 2000 MHz
Measurement chip rate	1.2288 Mcps
Measurement method (IS-2000 R-RC3, R-RC4 and R-RC8 only)	Measures all active reverse code channel's time and phase error relative to the mobile's transmitted R-Pilot channel
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Input level range	–25 to +30 dBm/1.23 MHz, usable to –50 dBm/1.23 MHz with reduced accuracy
Code channel time and phase error measurement range (for signals with < ± 6 µs static time error and < ± 1 kHz frequency error)	Code channel time error: Up to ± 100 ns
	Code channel phase error: Up to ±0.5 radians
Measurement interval	1.042 ms (5 Walsh symbols)

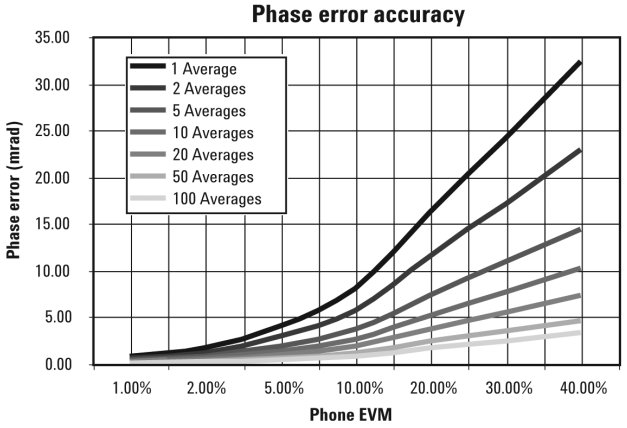
CDMA analyzer (continued)

Code channel time and phase error (continued)	
Relative code channel measurement accuracy	These tables display the accuracy versus the residual EVM of the phone for a given number of measurement averages. These graphs are valid for all reverse channel configurations where each active channel has at least 10% of the total power

Timing error accuracy



Phase error accuracy



Measurement residuals	Code channel residual time error: ± 3 ns, typically ± 16 ns at –50 dBm/1.23 MHz
	Code channel residual phase error: ± 7 milli-radians, typically ± 26 milli-radians at –50 dBm/1.23 MHz
Graphical results	Code channel time error graph: Displays the relative time error in all 15 Walsh coded channels (16 bit) for both the I channel and the Q channel relative to the R-Pilot channel; red bars indicate time error in each detected active channel
	Code channel phase error graph: Displays the relative phase error in all 15 Walsh coded channels (16 bit) for both the I channel and the Q channel relative to the R-Pilot channel; red bards indicate phase error in each detected active channel
	Concurrency capabilities: Code channel time and phase error measurements can be made concurrently with all CDMA
	measurements that support concurrency
	Pass/fail limits: Settable with default value set to the IS-98D limits of ± 10 ns for code channel time error and ± 0.15 radians for code channel phase error
	Other measurement results: Pass/fail for each graph

CDMA analyzer (continued)

Time response of open loop power control measurement	
Input frequency ranges	411 to 420 MHz
	450 to 484 MHz
	824 to 934 MHz
	1700 to 1980 MHz
Measurement method	Measures the open loop power versus time response of a mobile to a 20 dB step in the test set's cell power
Measurement data capture period	100 ms
Measurement trigger	User-initiated
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Measurement range	–46 to +30 dBm (final level after ± 20 dB step in cell power)
Measurement level ranging	Auto
Measurement cell power step size	+20 dB, –20 dB
Marker relative level accuracy	± 0.5 dB
Marker time accuracy	± 540 µs
Measurement limits	Time versus amplitude mask per IS-98D
Graphical results	Graph: Single trace with IS-98D standard limit lines
	Time display resolution: 270 µs
	Time display range: 0 to +100 ms
	Amplitude range: –5 to +30 dB
Available results	Pass or fail result and trace of 371 data points available via GPIB
Concurrency capabilities	None; selecting this measurement automatically closes all other active measurements

CDMA analyzer (continued)

Tx spurious emissions	
Input frequency ranges:	411 to 420 MHz
	450 to 484 MHz
	824 to 934 MHz
	1700 to 1980 MHz
Measurement method	Measures the active carrier power in a 1.23 MHz bandwidth, then measures the power in a 30 kHz bandwidth at two offsets above and below the active carrier and displays the ratio of the offset powers to the active carrier power in dBc; measurement returns valid results for full rate only in R-RC1 or R-RC2; all rates are supported in R-RC3 and R-RC4
Measurement data capture period	5 ms
Measurement offsets	Frequencies < 1000 MHz: ± 885 kHz, ± 1.98 MHz
	Frequencies > 1000 MHz: ± 1.25 MHz, ± 1.98 MHz
Measurement bandwidth	Active carrier: 1.23 MHz
	Offsets: 30 kHz synchronously tuned, five pole filter with approximately gaussian shape
Measurement trigger	20 ms frame clock
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Measurement range	0 to +30 dBm
Measurement level ranging	Auto
Marker relative level accuracy	± 885 kHz, ± 1.25 MHz offets: < ± 0.4 dB, typically < ± 0.2 dB
	± 1.98 MHz offsets: < ± 0.8 dB, typically < ± 0.5 dB
Measurement residual relative power	± 885 kHz, ± 1.25 MHz offets: < –62 dBc/ 30 kHz BW
	± 1.98 MHz offsets: < –66 dBc/30 kHz BW
Mobile pass/fail limits (per IS-98D) – Auto mode: – Frequencies < 1000 MHz: – –42 dBc/30 kHz for ± 885 kHz offsets – –54 dBc/30 kHz for ± 1.98 MHz offsets – Frequencies < 1000 MHz: – Frequencies > 1000 MHz: – –42 dBc/30 kHz for ± 1.25 MHz offsets – –50 dBc/30 kHz for ± 1.98 MHz offsets	
Manual mode	Settable from –10 to –65 dBc with 0.01 dB resolution
Numeric results	Relative power in dBc/30 kHz for each of the four offset frequencies
Graphical results	Graph: Single trace with IS-98D standard limit lines and one bar representing the channel power and four bars representing the relative power at the four offset frequencies
	Amplitude range: 0 to –80 dB
Concurrency capabilities	Tx spurious emissions measurements can be made concurrently with all CDMA measurements that support concurrency

CDMA analyzer (continued)

Gated power measurement	
Input frequency ranges	411 to 420 MHz
	450 to 484 MHz
	824 to 934 MHz
	1700 to 1980 MHz
Measurement method	Displays the time domain pulse of an IS-95, RC1, or RC2, 1/8th rate frame
Measurement data capture period	1.277 ms
Measurement trigger	20 ms clock (frame trigger)
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Measurement input level range	–20 to +30 dBm
Measurement averaging	Default of 100, selectable
Marker relative level accuracy (averages > 25)	+5 to –22 dB: <± 0.4 dB + 0.1 dB for signal fall times less than 2 µs, typically < ± 0.30 dB
	–22 to –25 dB: < ± 0.7 dB + 0.2 dB for signal fall times less than 2 µs, typically < ± 0.55 dB
Marker level resolution	0.01 dB
Measurement limits	Time domain mask per IS-98D
Graphical results	Zoom view
	Full trace: Displays a time window of 1277 µs centered on the burst; grey bar indicates which section of the full trace appears in the zoomed trace
	Time display range: –15 to +1262 µs
	Level display range: –35 to +5 dB
	Zoom position: 0 to 13
Zoomed trace	Displays a zoomed section of the full graph
Zoomed time display resolution	Zoom views 0, 13: 68 ns
	Zoom views 1 to 12: 276 ns
Time display range	Zoom view 0: –15.06 to +10.04 µs
	Zoom view 1: +10.21 to +112.21 µs
	Zoom view 2: +112.47 to +214.47 µs
	Zoom view 3: +214.74 to +316.74 µs
	Zoom view 4: +317.00 to +419.01 µs
	Zoom view 5: +419.28 to +521.27 µs
	Zoom view 6: +521.55 to +623.54 µs
	Zoom view 7: +623.81 to +725.54 µs
	Zoom view 8: +725.81 to +827.81 µs
	Zoom view 9: +828.08 to +930.07 µs
	Zoom view 10: +930.35 to +1032.34 µs
	Zoom view 11: +1032.61 to +1134.61 µs
	Zoom view 12: +1134.88 to +1236.88 µs
	Zoom view 13: +1237.05 to +1262.14 µs
Level display range	–35 to +5 dB
Graphical results: Rise/fall view – Rise trace: – Time display range: –15 to +1262 µs – Time display resolution: 68 ns – Level display range: –35 to +5 dB – Fall trace: – Time display range: –15 to +1262 µs – Time display resolution: 68 ns – Level display range: –35 to +5 dB	
Other measurement results	Pass/fail indicator, first all point time and level, and mask shift (indicates the time shift required to center IS-98D mask on the burst); full trace is available via GPIB
Concurrency capabilities	None

CDMA analyzer (continued)

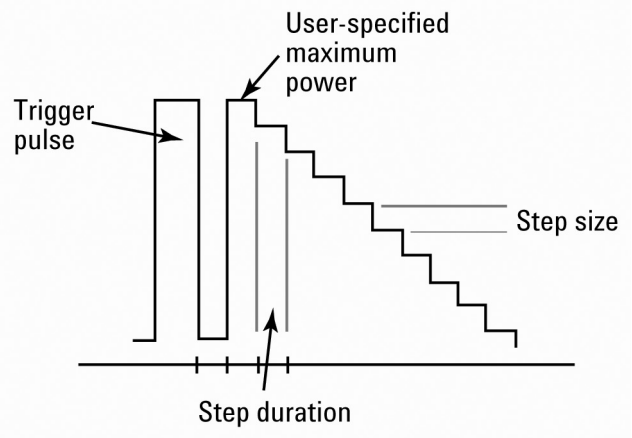
Frame error rate measurement	
FER measurement method	Data loopback in service options 002, 009, and 055 with confidence limits
FER input level measurement range	–65 dBm/1.23 MHz to +30 dBm/1.23 MHz
FER measurement residual error rate	< 1 x 10-6 for input levels in the specified input level range and within ± 9 dB of the expected input power
Confidence limit range	Definable from 80.0 to 99.9% and off
FER reported parameters	Intermediate results: Measured FER, number of errors, and number of frames tested (updated every 25 frames)
	Final results: Measured FER, number of errors, number of frames tested, and one of the following: passed confidence limit, failed confidence limit, or max frames
Concurrency capabilities	FER measurements can be made concurrently with all CDMA measurements that support concurrency
Conditions for terminating FER test	Max frames: Maximum number of frames to test completed – indeterminate test result
	Failed: Measured FER failed the specified FER limit with specified confidence specified confidence
	Passed: Measured FER passed the specified FER limit with specified confidence
FER measurement indicators	Testing, passed, failed, and max frames all are available over GPIB

CDMA analyzer (continued)

Tx dynamic power measurement	
Input frequency ranges	411 to 420 MHz
	450 to 484 MHz
	824 to 934 MHz
	1700 to 1980 MHz
Measurement method	Captures a user-defined trace consisting of 20, 40, or 80 ms duration power steps with user-defined step size produced by a test mode in the mobile station under test; measures the total power in a 1.23 MHz bandwidth centered on the active reverse channel center frequency in each step period
Measurement data capture period	1.25 ms
Measurement trigger	Tx signal output by the mobile station must provide a pulse (off-on-off) followed by the stepped power burst beginning at the user-specified output power

CDMA analyzer (continued)

Tx dynamic power measurement (continued)	
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Measurement range	Measurement range: –61 to +30 dBm, usable to < –69 dBm/ 1.23 MHz with reduced accuracy
Measurement level ranging	None, user must set the test set's receiver power control field to manual and set the receiver power to the expected full power of the power sweep produced by the mobile station
Measurement accuracy	< ± 1 dB 15 to 55 °C, typically < ± 0.5 dB (calibrated against average power and within ± 10 degrees of calibration temperature; calibration must occur between 20 to 55 °C)
Measurement resolution	0.01 dBm/1.23 MHz
Measurement step duration (time)	20, 40, or 80 ms
Measurement step size	–0.01 to –90.00 dB
Measurement number of steps	0 to 99
Measurement result	A graph displaying the discrete power at each step along with numeric power results for each step
Measurement graphical controls	Marker on/off with position, trace start step, trace span, and return to default scale
Concurrency capabilities	None
Calibrate function	Uses the channel power calibration function



CDMA analyzer (continued)

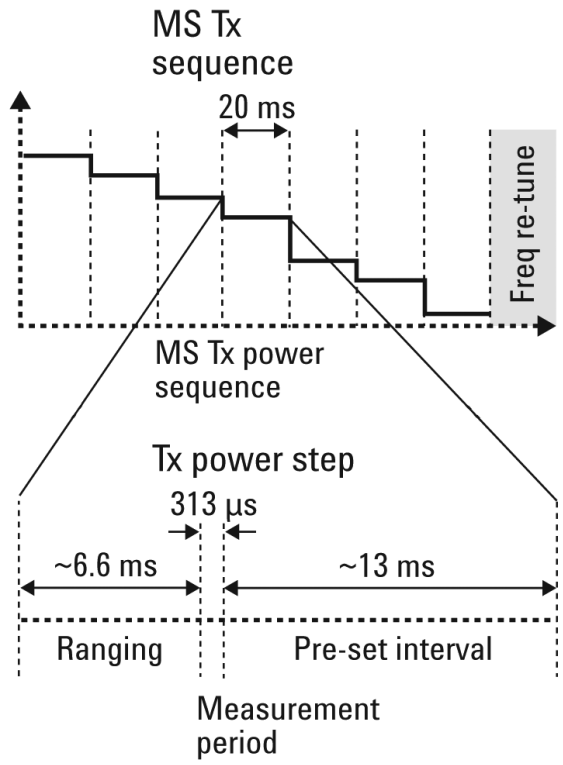
Maximum/minimum power measurement	
Input frequency ranges	411 to 420 MHz
	450 to 484 MHz
	824 to 934 MHz
	1700 to 1980 MHz
Measurement method	Performs this sequence: – Sets the test set source to a user-specified value for the maximum power measurement – Ranges the receiver to the expected power – Sends all up power control bits – Uses the average power meter to measure the maximum power – Sets the test set source to a user-specified value for the minimum power measurement – Ranges the receiver to the expected power – Sends all down power control bits – Uses the channel power meter to measure the minimum power – Returns the test set to the same state before the measurement was initiated
Measurement data capture period	1.25 ms
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Measurement range	Maximum power measurement: –10 to +30 dBm; usable from –10 to –20 dBm with reduced accuracy (peak detector only)
	Minimum power measurement: –61 to +30 dBm; usable to < –69 dBm/1.23 MHz with reduced accuracy
Measurement level ranging:	Auto for the maximum power measurement, and either auto or manual for the minimum power measurement
Measurement accuracy	Maximum power measurement: Same as the average power measurement accuracy
	Minimum power measurement: Same as the channel power measurement accuracy
	Measurement settings: Maximum power measurement cell power, maximum power measurement F-FCH level, maximum power measurement F-Pilot level, minimum power measurement cell power, minimum power measurement F-FCH level, minimum power measurement F-Pilot level
Measurement result	The measured maximum power and minimum power
Concurrency capabilities	None
Calibrate function	Uses the channel power calibration function

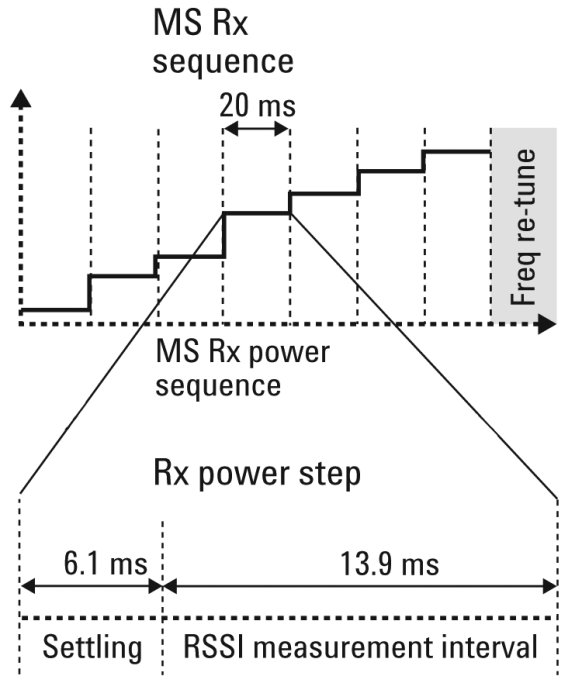
CDMA analyzer (continued)

Multi-tone audio measurement	
Multi-tone analyzer supported service options	SO1, SO3 (EVRC vocoder), SO17, and SO32768 (13 k vocoder)
Multi-tone audio measurement mode	Downlink audio (base station to mobile station) or uplink audio (mobile station to base station)
Multi-tone analyzer 0 dB reference mode	Relative or absolute
Multi-tone analyzer 0 dB reference tone (relative mode)	Tone 0 through 20
Multi-tone analyzer downlink reference level (absolute mode)	1 mV to 5.000 V
Multi-tone analyzer uplink reference level (absolute mode)	0.1 to 100%
Multi-tone analyzer expected audio input peak voltage (downlink mode)	1 mV to 20.000 V
Multi-tone analyzer device setting time	10 to 1000 ms
Multi-tone analyzer SINAD/distortion state (in the 1 tone mode only)	Selectable on or off
Multi-tone analyzer downlink encoder setting	0 to 100 frames
Multi-tone downlink generator frequency presets:	Narrow: 300 Hz, 400 Hz, 500 Hz, 600 Hz, 700 Hz, 800 Hz, 900 Hz, 1 kHz, 1.1 kHz, 1.2 kHz, 1.3 kHz, 1.4 kHz, 1.6 kHz, 1.8 kHz, 2.0 kHz, 2.2 kHz, 2.4 kHz, 2.6 kHz, 2.8 kHz, and 3.0 kHz
	Normal: 300 Hz, 600 Hz, 800 Hz, 1 kHz, 1.2 kHz, 1.6 kHz, 2.0 kHz, 2.4 kHz, and 3.0 kHz
	Wide: 100 Hz, 200 Hz, 300 Hz, 400 Hz, 500 Hz, 600 Hz, 700 Hz, 800 Hz, 900 Hz, 1 kHz, 1.2 kHz, 1.4 kHz, 1.6 kHz, 1.8 kHz, 2.0 kHz, 2.4 kHz, 2.8 kHz, 3.0 kHz, 3.3 kHz, and 3.6 kHz
Multi-tone downlink generator frequency level	10, 30, or 50% of total level
Multi-tone uplink generator frequency presets	Same as downlink presets or selectable for up to 20 tones; user frequency range from 10 Hz to 4.0 kHz
Multi-tone uplink generator frequency level	Specified total rms voltage range from 20 mV to 1.42 V
Multi-tone analyzer measurement results (SINAD/distortion mode off)	Graphical display of up to 20 tones with level (frequency response)
Multi-tone analyzer measurement results (SINAD/distortion mode on)	Tone audio level, tone audio frequency, tone SINAD, and tone distortion
Multi-tone analyzer measurement limits	Upper and lower tone pass/fail limit for each active tone; range of –100 to +100 dB for each limit
Concurrency capabilities	None

CDMA analyzer (continued)

Fast device tune measurement
E1999A-202 FDT-enhanced





CDMA analyzer (continued)

Fast device tune measurement	
Input frequency ranges	411 to 420 MHz
	450 to 484 MHz
	824 to 934 MHz
	1700 to 1980 MHz
Measurement method	Allows user definition of an RF source power output sequence simultaneously with a Tx power measurement sequence each consisting of 10 or 20 ms duration steps with a user-defined step size. Sequence can be defined to repeat over a number of frequencies inside of a single frequency band. This measurement requires a test mode in the mobile station in order to operate. Measures the total power in a 1.23 MHz bandwidth centered on the active reverse channel center frequency in each step period
Measurement data capture period	0.313 µs
Maximum input level	+37 dBm/1.23 MHz peak (5 W peak)
Measurement range	–61 to +30 dBm, usable to < –69 dBm/ 1.23 MHz with reduced accuracy
Measurement capture range	Mobile station's transmit power must be within ± 9 dB of the expected power per the ranging configuration
Measurement accuracy	< ± 1 dB 15 to 55 °C for the fast mode, typically < ± 0.5 dB (calibrated against average power and within ±10 degrees of calibration temperature. Calibration must occur between 20 to 55 °C)
Measurement resolution	0.01 dBm/1.23 MHz
Measurement step duration (time)	10ms or 20ms
Number of frequency steps	1 to 20
Number of amplitude steps	1 to 20 steps at each specified frequency
Maximum steps in a sequence	Up to 20 out of the possible 40 entries in each table
MS Tx frequency step table	1 to 40 entries, with each value in MHz
MS Tx power step table	1 to 40 entries, with each value in dBm
MS Rx frequency step table	1 to 40 entries, with each value in MHz
MS Rx power step table	1 to 40 entries, with each value in dBm
MS Tx frequency step start index	0 to 39
MS Tx power step start index	0 to 39
MS Rx frequency step start index	0 to 39
MS Rx power step start index	0 to 39
RF generator settling time	< 5.7 ms to be within ± 0.1 dB of the final value
RF generator modulation accuracy	Typically < 3.1%
RF generator level accuracy	Same as listed under 1xEV-DO RF generator specifications
Concurrency capabilities	None
Calibrate function	Calibrates all measurement functions

CDMA analyzer (continued)

Single channel GPS source	
E1999A-206 single channel GPS source	
GPS signal output	RF IN/OUT or RF OUTPUT only
GPS signal frequency	1.57542 GHz
GPS signal output level range	–70 to –125 dBm
GPS signal output level accuracy	< ± 1.0 dB, –70 to –116 dBm, < ± 1.5 dB, –116 to –125 dBm
Code type	Coarse/Acquisition (C/A)
Chip rate	1.023 Mcps
Settable parameter	Satellite ID, data patterns, and filters
Perceptual evaluation of speech quality (PESQ) measurement	
E1999A-301 PESQ measurement	
The PESQ measurement provides an objective method for prediction of vocoder speech quality using the industry standard PESQ algorithm	
Supported service options	SO1, SO3 (EVRC vocoder), SO17, and SO32768 (13 k vocoder), SO68 (EVRC-B), SO70 (EVRC-WB)
Measurement mode	Downlink audio, uplink audio, or downlink and uplink simultaneously
Speech source	Male or female
Expected audio input peak voltage (downlink mode)	1 mV to 2.000 V
Maximum audio output peak voltage (downlink mode)	0 to 5.0000 V
Uplink PESQ score	–0.50 to +4.50
Downlink PESQ score	–0.50 to +4.50
PESQ uplink headroom	0 to 100.0 dB
PESQ downlink headroom	0 to 100.0 dB

General specifications

Timebase specifications	
Internal high stability 10 MHz oven-controlled crystal oscillator (OCXO)	
Aging rates	Aging rates: < ± 0.1 ppm per year, < ± 0.005 ppm peak-to-peak per day during any 24-hour period starting 24 hours or more after a cold start
Temperature stability	< ± 0.01 ppm frequency variation from 25 °C over the temperature range 0 to 55 °C
Warm-up times	5 minutes to be within ± 0.1 ppm of frequency at one hour, 15 minutes to be within ± 0.01 ppm of frequency at one hour
Accuracy after a 30-minute warm-up period of continuous operation is derived from	Typically ± (time since last calibration) x (aging rate) + (temperature stability) + (accuracy of calibration)
Initial adjustment	Typically ± 0.03 ppm

External reference input

Input frequency	10 MHz
Input frequency range	Typically < ± 5 ppm of nominal reference frequency
Input level range	Typically 0 to +13 dBm
Input impedance	Typically 50 Ω

External reference output

Output frequency	Same as timebase (internal 10 MHz OCXO or external reference input)
Output level	Typically > 0.5 V rms
Output impedance	Typically 50 Ω

Trigger output

Frame clock output	User-selectable output of 20 ms, 80 ms, or 2 s

Remote programming

GPIB	IEEE Standard 488.2
GPIB help	Pressing the front panel help key and then any other key will cause the test set to display the GPIB syntax for that command at the bottom of the front panel display; pressing the help key again exits this mode of operation
Remote front panel lockout	Allows remote user to disable the front panel display to improve GPIB measurement speed
Implemented functions	T6, TE0, L4, LE0, SH1, AH1, RL1, SR1, PP0, DC1, DT0, C0, and E2

Save/Recall registers

Storage capacity	Five registers that store the complete instrument state except for active cell call processing status (fixed labels of register 1 to 5); registers are non-volatile
Recall	Allows user to recall one of the 5 stored instrument states

Measurement speed

Typical measurement speed based on using at least a 600 MHz Pentium II processor PC and with the display off mode selected on the E5515C/E; measurement speeds include the total time from GPIB measurement request until the controller receives the result using the INT/FETCH commands; due to variations of trigger latencies and internal test set processor loading, individual measurement times may be faster or slower; measurement speeds also vary depending on the controller GPIB environment and processor speed.

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