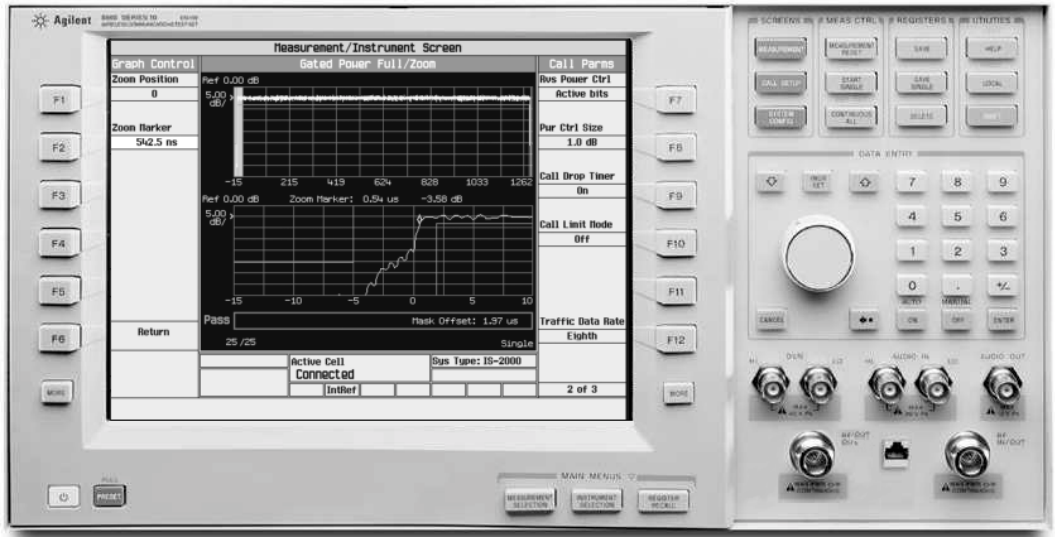
Preliminary

Agilent
E6702A cdma2000, IS-95, AMPS lab application

Data Sheet

For the E5515C (8960) wireless communication test set



Accelerate your design of cdma2000 wireless devices

Key Features

- External protocol logging and analysis software finds and resolves difficult signaling functionality and timing issues faster
- Simulate two CDMA base station signals that gives you the flexibility to test soft and softer handoff capabilities
- Troubleshoot design issues or test setup problems with enhanced frame error rate measurement
- Data channel connectivity tests high speed packet data connection to a network
- The E6702A includes all E1962B Test Application manufacturing-specific features and measurements helping smooth transition from development to manufacturing

What's New

- AM calibration functionality supports Qualcomm's RadioOne architecture (ZIF [zero intermediate frequency] based chipsets)
- F-SCH data rate changes while one a connection allows realistic simulation of packet data channel behavior in a real network and also saves time, as you no longer have to disconnect and re-establish the connection
- Free Upgrade

Agilent Technologies

The Agilent E6702A cdma2000 lab application for the 8960 wireless communication test set (E5515C) speeds wireless appliance development with one-box support for soft and softer handoffs, comprehensive parametric measurement capabilities including enhanced frame error rate, and wireless protocol advisor support.

The E6702A cdma2000 lab application contains external wireless protocol analyzer software, which allows users to find and resolve difficult signaling, functionality, and timing issues. This software operates on an external PC connected to the 8960 test set through the 10 base-T Ethernet port. You can capture targeted data with three levels of filtering and triggering; thereby reducing the time needed to view lengthy log files.

Simulate two CDMA base station signals

With a second independent base station emulation, the E6702A cdma2000 lab application loaded on the 8960 test set supports soft and softer handoffs in one box. Fully configurable settings, such as PN offset, cell power and secondary base station signal delay give you the flexibility to test the soft and softer handoff capabilities of cdma2000 wireless devices.

Troubleshoot mobile performance

The enhanced frame error rate measurement indicates the source of frame errors which helps troubleshoot design issues or test setup problems.

All cdma2000/IS-95/AMPS test application features smooth your transition from development to manufacturing

Utilizing the same test equipment and establishing test limits in product development as in manufacturing, minimizes required set up time. You can implement manufacturing test code development earlier in your process, and with less effort.

To ease your transition from R&D to manufacturing, get all the performance and features you've come to expect from the 8960 test set and the E1962B cdma2000 test application, plus lab applications focusing more on your design needs.

IS-95 and IS-2000 call processing

- Registration
- MS origination
- IS-2000 to IS-95 handoff
- Soft/softer handoff
- Protocol logging
- One button page
- Hard handoff (band & channel)
- AMPS handoff
- F/R-SCH support
- SO33 packet data

CDMA TX measurements

- Channel power
- Access probe power
- Code domain power
- Gated power
- TX spurious emissions
- Graphical access probe power
- Average power
- Modulation quality
- Code channel time/ phase error
- Time response of open loop power
- Spectrum monitor

CDMA RX measurements

- Sensitivity
- FER with AWGN
- TDSO (SO32) on F-SCH
- Dynamic range
- Loopback service options 2, 9, & 55

AMPS call processing

- Registration
- MS origination
- TX power level change
- One button page
- Hard handoff (channel)

AMPS measurements

- TX power
- TX FM distortion
- Audio level
- Spectrum monitor
- TX FM deviation
- TX audio frequency
- SINAD sensitivity

Technical specifications

These specifications apply to an E5515C mainframe with Option 003 for serial number US40410101, GB40410101, or higher when used with an E6702A test application of firmware revision A.03.XX 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"*, or *"supplemental"*. 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

Useage: 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 MHz to 420 MHz
- 450 MHz to 484 MHz
- 824 MHz to 934 MHz
- 1750 MHz to 1780 MHz
- 1850 MHz to 1980 MHz

Reference level: auto or manual.

Manual reference level range: +37 dBm to –50 dBm

Display dB per division: 20.0 dB to 0.1 dB per division

Level measurement accuracy: *(Calibrated against average power and within ±10 degrees of calibration temperature. Calibration must occur between 20°C to 55°C): typically <±1.0 dB 15°C 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 ms 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 MHz to 2700 MHz

Specified frequency ranges: 421 MHz to 494 MHz, 800 MHz to 960 MHz, and 1700 MHz 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 MHz to 1000 MHz

FM RF generator

Frequency

Frequency range: 800 MHz 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 dBm 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 MHz 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: user-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 Ω 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 MHz 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°C 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°C to 55°C)**:** <±0.32 dB for 800 MHz to 960 MHz, *typically <±0.14 dB for 800 MHz to 960 MHz*

Measurement resolution: *typically 0.01 dB*

Measurement repeatability: *typically <±0.1 dB*

VSWR at RF IN/OUT: <1.14:1, 800 MHz 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: user-selectable choices of rms, peak+, and peak–

Measurement filtering: user-settable choices of none, 100 Hz bandwidth band pass tunable over 300 Hz to 15 kHz, C-message, 50 Hz to 15 kHz band pass, or 300 Hz to 15 kHz band pass

Measurement de-emphasis: 750 μs user-settable as off or on

Measurement expandor: user-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: user 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: 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*

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 user-settable as off or on

Audio analyzer expandor: user-settable as off or on with reference level setting of 10 mV to 10 V

Audio analyzer filters: user–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 kHz to 15 kHz

Measurement THD plus noise: <200 μV rms

Measurement detector: user-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 Ω 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, minimum, maximum, average, 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, minimum, maximum, average 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, minimum, maximum, average 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*
Cell 1 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 - indicates if active page will be in the next paging channel slot
Cell 2 overhead channels:
F-Pilot - with user settable PN offset
Protocol stack: IS-2000 revision 0 with addendum (PREV = 6)
Base station parameters: NID, SID, country code (MCC), network code (MNC), paging rate, CDG esc mode, F-QPCH state, F-QPCH relative level, and reverse link traffic pilot gain
Access parameters: Nom_Pwr, Nom_Pwr_Ext, Init_Pwr, Pwr_Step, Num_Step, Max_Req_Seq, Max_Rsp_Seq, and Pam_Size
Threshold parameters: T_Add, T_Drop, T_Comp, T_Tdrop, Soft_Slope, Add_Intercept, and Drop_Intercept
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, and MS called party number
Status Request Query Control: user 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)

Paging channel data rate: user selectable from either full or half rate

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 encoder supported, convolutional encoded rate set 1 max data rate, convolutional encoded rate set 2 max data rate

TCH/FCH service option support:

- SO1 - 9.6 kbps voice
- SO2 - 9.6 kbps data loopback
- SO3 - 9.6 kbps EVRC voice
- SO9 - 14.4 kbps data loopback
- SO17 - 14.4 kbps voice
- SO55 - RC1/2/3/4/5 data loopback
- SO32768 14.4 kbps voice
- SO33 9.6/14.4 kbps packet data

Loopback service option traffic data source: PRBS (CCITT $2^{15}-1$ pattern)

Voice Service Option Modes: echo with variable delay, 400 Hz sinewave, 1 kHz sinewave, and swept sinewave

Echo Delay: user selectable short, medium and long

F-SCH service option support:

- SO32 (+F-SCH)- TDSO supporting all SR1 rates up to 153.6 kbps for F-RC3 and F-RC4
- SO32 (+SCH) - TDSO supporting all SR1 rates up to 153.6 kbps for F-RC3 or F-RC4 at the same time with R-RC3
- SO33 (+F-SCH) - High speed packet data supporting all SR1 rates up to 153.6 kbps for F-RC3 or F-RC4 on the F-SCH with reverse link packet data on the R-FCH (no R-SCH)

SO33 Data Channel Operation: allows the test set to emulate a complete data network by providing transparent connectivity to a packet data capable mobile. Supports simple IP connections. Requires that the test be connected to an external server via the rear panel LAN connector

Ping function: allows the user to test network connections required for SO33 data channel capability. Reports number of packets transmitted, number of packets received, percent lost and round trip time min/avg/max

Handoff support: hard handoff (new channel, band), PN offset handoff, soft handoff, softer handoff, IS-2000 to IS-95, IS-2000 to AMPS

Soft handoff type: user-selectable as either soft or softer. Cell 1 and cell 2 reverse power control can be set the same or independently without regard to the soft handoff type selected.

Soft handoff functions: on/off, request pilot strength message, and clear mobile pilot report

Soft handoff mobile reported parameters: pilot strength request timestamp (40 msec resolution), pilot strength received timestamp (40 msec resolution), PN status (candidate, active, to add, to drop), keep status, pilot strength, and PN offset

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

Supported TCH/FCH 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 TCH/FCH data rates:

RC1: 1.2, 2.4, 4.8, 9.6 kbps

RC2: 1.8, 3.6, 7.2, 14.4 kbps

RC3: 1.5, 2.7, 4.8, 9.6 kbps

RC4: 1.5, 2.7, 4.8, 9.6 kbps

RC5: 1.8, 3.6, 7.2, 14.4 kbps

Forward SCH support: 1 SCH only

Forward SCH data rates:

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

Forward SCH data rate switching: the data rate can be freely changed while on an SO33 data call without dropping the connection.

Forward SCH data source: eight bit fixed pattern or PRBS (default)

Forward SCH coding: convolutional or turbo

Reverse FCH data rate:

RC1: 1.2, 2.4, 4.8, 9.6 kbps

RC2: 1.8, 3.6, 7.2, 14.4 kbps

RC3: 1.5, 2.7, 4.8, 9.6 kbps

RC4: 1.8, 3.6, 7.2, 14.4 kbps

Reverse SCH support: SO32 assign

Reverse link closed loop bit rate: fixed to 800 per second

Cell 1 reverse link closed loop power control modes:

- Active
- Alternating - alternating 0 and 1 power bits
- Alt 20 up/down - alternating 20 up/20 down bits
- All up
- All down

Cell 2 reverse link closed loop power control modes:

- Active
- Alternating - alternating 0 and 1 power bits
- Alt 20 up/down - alternating 20 up/20 down bits
- All up
- All down
- Cell 1 bits – sets cell 2's bits identical to cell 1's

Forward link power control support: none, test set ignores all power control data sent by the mobile station

Protocol logging functionality

E6702A logging functions: start protocol logging and stop protocol logging

Protocol support: PREV=6 messages. Provides correct binary output for lower PREVs, but decodes using PREV=6 messages formats.

Wireless protocol advisor (WPA)

Logging software: Agilent wireless protocol advisor PC software included with the purchase of the E6702A.

Wireless protocol advisor hardware requirements: at least a Pentium™ III 700 MHz PC with 128 Mbytes of memory, 500 Mbytes of free disc space, and a TCP/IP LAN port

WPA supported operating systems: English versions of Windows 98™, Windows NT™ 4.0 (with at least service pack 4), and Windows 2000™

WPA connection: a 10 Mbit/sec 10baseT Ethernet connection (RJ-45 connector) using a crossover cable for direct connection to the PC or with a standard cable through a switch or hub.

WPA operating modes: real-time or post capture

WPA display modes: traffic overview of real-time messages, decode view with full detail of selected message, measurement setup view for trigger and filter configuration

Traffic overview functionality

Display: provides single line display of individual protocol messages in sequential order as received

Traffic overview configurable display columns: message number, message direction, CDMA system time, event type, timestamp (based on PC's real-time clock), channel type, L2 message, L3 message, and order

Measurement setup functionality

Display: provides a graphical block diagram of the available test set filters, triggers, real-time filters, data log, and post-capture filters available to the user. Also displays whether any triggers or filters are currently selected.

Decode view functionality

Decode view displayed information types:

Test set information (indicated by blue text): CDMA system time message was sent or received with frame accuracy (20ms), event type (PDU or duplicate PDU), and channel type

Message contents (indicated by green text): individual octet display of message or line per field display of each parameter in the message

Decode view configurable display columns: Octet number, decimal value, binary value, hex value, and field description (English)

Test filter functionality

WPA test set filter: user selectable list of message types to be sent from the test set to the logging PC via the LAN connection. Message types not selected are NOT transmitted to the PC.

Test set filter message types: Sync channel messages, overhead messages, mobile station directed messages, access channel messages, forward traffic channel messages, reverse traffic channel messages, forward fundamental channel frames, reverse fundamental channel frames, and quick paging channel slots

Trigger functionality

Logging triggers: user selectable start logging trigger and stop logging trigger. Defined triggers may be saved and recalled.

Trigger start and stop criteria: start and stop triggers can be configured to pre-capture or post-capture a

specific number of messages. Stop trigger can also be defined as a time duration after the start trigger occurred.

Trigger types: event, message match, time, and trigger counts

Event trigger: message dropped, received message, and received message overflow

Message match parameters: triggers can be defined as any fields, not a match to, or any specific values for the following parameters:

- f-csch (f-synch) MSG_TYPE
- f-csch MSG_TYPE
- CONFIG_MSG_SEQ
- ACC_MSG_SEQ
- f-csch/f-dsch ORDER
- ORDQ
- PAGE_CLASS
- MSG_ID
- r-csch/r-dsch ORDER
- f-dsch MSG_TYPE
- r-dsch MSG_TYPE
- paging indicator 1
- paging indicator 2

Time trigger: user definable start trigger on specific timestamp and day based on PC real-time clock

Trigger Counts: user specified number of start trigger occurrences before log capture begins

Log filter functionality

Log filter: user definable filter for data is captured into the log file. Defined filters may be saved and recalled.

Filter types: event, message match, and time

Event filter: message received

Message match parameters: filters can be defined as any fields, not a match to, or any specific values for the following parameters:

- f-csch (f-synch) MSG_TYPE
- f-csch MSG_TYPE
- CONFIG_MSG_SEQ
- ACC_MSG_SEQ
- f-csch/f-dsch ORDER
- ORDQ
- PAGE_CLASS
- MSG_ID
- r-csch/r-dsch ORDER
- f-dsch MSG_TYPE
- r-dsch MSG_TYPE
- paging indicator 1
- paging indicator 2

Time filter: allow events to pass though if timestamp is after user specified time, before user specified time, or between user specified start and stop time

Log file

WPA log file storage: captured log file can be saved in proprietary binary format that allows full functionality of WPA features in the post capture mode. The real-time overview log can also be saved in a comma-separated file. The user can also select a range of messages in the overview mode to be saved in an ASCII text file using the decode view format.

View filter functionality

View filter: user definable filter that limits what data is displayed on a previously captured log file. Defined filters may be saved and recalled.

Filter types: event, message match, time, and message validity

Event filter: message dropped, received message, and received message overflow

Message match parameters: filters can be defined as any fields, not a match to, or any specific values for the following parameters:

- f-csch (f-synch) MSG_TYPE
- f-csch MSG_TYPE
- CONFIG_MSG_SEQ
- ACC_MSG_SEQ
- f-csch/f-dsch ORDER
- ORDQ
- PAGE_CLASS
- MSG_ID
- r-csch/r-dsch ORDER
- f-dsch MSG_TYPE
- r-dsch MSG_TYPE
- paging indicator 1
- paging indicator 2

Time filter: allow events to pass though if timestamp is after user specified time, before user specified time, or between user specified start and stop time

Message validity: show unsuccessfully decoded messages, and show successfully decoded messages

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 1 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

Cell 2 overhead channels:

F-pilot - with user settable PN offset

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

Threshold parameters: T_Add, T_Drop, T_Comp, T_Tdrop, Soft_Slope, Add_Intercept, and Drop_Intercept.

Registration support: user-initiated (zone-based), power up, timer based, implicit registration (mobile originated call), or direct user entry of mobile IMSI

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: user selectable full or half rate

Service option support:

- SO1 - 9.6 kbps voice
- SO2 - 9.6 kbps data loopback
- SO3 - 9.6 kbps EVRC voice
- SO9 - 14.4 kbps data loopback
- SO17 - 14.4 kbps 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 sinewave, 1 kHz sinewave, and swept sinewave

Echo Delay: user selectable short, medium and long

Handoff support: hard handoff (new channel, band), PN offset handoff, soft handoff, softer handoff, and IS-95 to AMPS

Soft handoff type: user-selectable as either soft or softer. Cell 1 and cell 2 reverse power control can be set the same or independently without regard to the soft handoff type selected.

Soft handoff functions: on/off, request pilot strength message, and clear mobile pilot report

Soft handoff mobile reported parameters: pilot strength message request timestamp (20 msec resolution), pilot strength message received timestamp (20 msec resolution), PN status (candidate, active, to add, to drop), keep status, pilot strength, and PN offset

CDMA to AMPS handoff parameters: execute, system type, channel, SAT, and power level

Cell 1 reverse link closed loop power control modes:

- Active
- Alternating - alternating 0 and 1 power bits
- Alt 20 up/down - alternating 20 up/20 down bits
- All up
- All down

Cell 2 reverse link closed loop power control modes:

- Active
- Alternating - alternating 0 and 1 power bits
- Alt 20 up/down - alternating 20 up/20 down bits
- All up
- All down
- Cell 1 bits – sets cell 2's bits identical to cell 1's

IS-2000 test mode functionality

Resident formats: IS-2000 SR1

Cell 1 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

F-QPCH - with all indicators on or all off

Cell 2 Overhead channels:

F-pilot - with user settable PN offset

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

Channel coding: convolutional or turbo on all rates with the exception that turbo coding is not available

on RC3 at 9.6 kbps, RC4 at 9.6kbps, or RC5 at 14.4 kbps per IS-2000

Traffic data source: PRBS (CCITT 2^{15}–1 pattern)

Forward FCH data rate:

RC1: 1.2, 2.4, 4.8, 9.6 kbps

RC2: 1.8, 3.6, 7.2, 14.4 kbps

RC3: 1.5, 2.7, 4.8, 9.6 kbps

RC4: 1.5, 2.7, 4.8, 9.6 kbps

RC5: 1.8, 3.6, 7.2, 14.4 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, 153.6, or 307.2 kbps

RC5: 14.4, 28.8, 57.6, 115.2, or 230.4 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

Cell 1 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

Cell 2 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
- Cell 1 bits – sets cell 2's bits identical to cell 1's

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.

CDMA RF generator

Channels

Additive white Gaussian noise source: yes

AWGN bandwidth: *typically 1.8 MHz <BW <2.1 MHz*

CDMA channels:

CDMA cell 1 consisting of these code channels:

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 - user 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 – user-selectable Walsh code from the following set: 5, 13, 21, 29, 37, 45, 53, and 61

CDMA cell 1 PN offset: user selectable from 0 to 511

CDMA cell 2 consisting of these code channels:

F-pilot - fixed at Walsh code 0

F-FCH - user selectable Walsh code from the following set: 10, 14, 26, 30, 42, 46, 58, or 62

F-OCNS – user-selectable Walsh code from the following set: 5, 13, 21, 29, 37, 45, 53, and 61

CDMA cell 2 PN offset: user selectable from 0 to 511

Frequency

Frequency range:

- US cellular band (869.04 MHz to 893.97 MHz)
- Japan CDMA band (approx. 832 MHz to 869.9875 MHz)
- US PCS band (1930 MHz to 1990 MHz)
- Korean PCS band (1840 MHz to 1870 MHz)
- NMT- 450 band (approx. 421 MHz to 494 MHz)
- IMT- 2000 band (2110 MHz to 2169.950 MHz)
- Secondary 800 MHz band (approx. 851 MHz to 869 MHz, and 935 MHz to 940 MHz)

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 1 power, CDMA cell 2 power, and the AWGN source power

RF in/out CDMA cell 1 output level range (AWGN Off):

–120 dBm/1.23 MHz to –13 dBm/1.23 MHz

RF in/out CDMA cell 2 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):

<±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

RF in/out reverse power: +37 dBm peak (5 W peak)

RF in/out VSWR: <1.14:1, 400 MHz to 1000 MHz,
<1.2:1, 1700 MHz to 2000 MHz,
<1.32:1, 2010 MHz to 2180 MHz

RF out only composite signal level: sum of the user set values of the CDMA cell 1 power, CDMA cell 2 power, and the AWGN source power

RF out only CDMA cell 1 output level range (AWGN off):

–115 dBm/1.23 MHz to –5 dBm/1.23 MHz

RF out only CDMA cell 2 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.
o*ver-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: –20 to 0 dB, or off

F-FCH channel relative level: user-settable from –30 to 0 dB with 0.01 dB resolution, or off

F-SCH channel relative level: user-settable from –20 to 0 dB with 0.01 dB resolution, or off

AWGN channel relative level range: user-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*

Cell 2 delay: user-settable timing delay of cell 2 signal relative to cell 1 timing in 0.813 µs (1 chip) intervals from 0.0 µs to –13.02 µs (0 to 15 chips)

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, RC1, and RC2 residual Rho: >0.98, *typically >0.995*

RC3, RC4, and 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):
US Cellular Band, Japan CDMA Band, US PCS Band, Korean PCS Band, NMT-450 Band, and IMT-2000 Band

Maximum input level: +37 dBm peak (5 W peak)

Input level range: –71 to +30 dBm/1.23 MHz

Receiver ranging:

Auto mode: Autoranges 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 MHz to 484 MHz
- 800 MHz to 1000 MHz
- 1700 MHz to 2000 MHz

Detector types:

Peak detector – in IS-95, R-RC1 and R-RC2 modes

Thermal detector – in R-RC3 and R-RC4 modes

Maximum input level: +37 dBm peak (5 W peak)

Measurement range: –10 dBm 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°C to 55°C, after calibration, IS-95 or reverse RC1, 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%, <±8.3% when the RF Out Only port is selected, *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%, <±5.6% when the RF Out Only port is selected*

Thermal detector measurement accuracy (accuracy with 10 internal averages; reverse RC3 or RC4):

–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%, <±8.2% when the RF Out only port is selected, *typically <±3.3%*

Measurement repeatability: *typically <±0.05 dB*

Measurement resolution: 0.01 dBm

Zero function: auto zeroes (no user control)

Tuned channel power measurement

Input frequency ranges:

- 411 MHz to 420 MHz
- 450 MHz to 484 MHz
- 824 MHz to 934 MHz
- 1750 MHz to 1780 MHz
- 1850 MHz 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 (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 dBm to +30 dBm, *usable to <–69 dBm/1.23 MHz with reduced accuracy*

Measurement level ranging: auto and manual

Measurement accuracy: (Calibrated against average power and within ±10 degrees of calibration temperature. Calibration must occur between 20°C to 55°C): <±1 dB 15°C to 55°C, *typically <±0.5 dB*

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 seconds*

Access probe power measurement

Input frequency ranges:

- 411 MHz to 420 MHz
- 450 MHz to 484 MHz
- 824 MHz to 934 MHz
- 1750 MHz to 1780 MHz
- 1850 MHz 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: 2.5 ms

Measurement trigger: amplitude rise only

Maximum input level: +37 dBm/1.23 MHz peak (5 W peak)

Measurement range: –54 dBm to +30 dBm

Measurement level ranging: auto and manual

Measurement accuracy: (Calibrated against average power and within ±10 degrees of calibration temperature. Calibration must occur between 20°C to 55°C): <±1 dB 15°C to 55°C, *typically <±0.5 dB*

Measurement result: access probe power in a 1.23 MHz bandwidth

Concurrency capabilities: none

Graphical access probe power measurement

Input frequency ranges:

- 411 MHz to 420 MHz
- 450 MHz to 484 MHz
- 824 MHz to 934 MHz
- 1750 MHz to 1780 MHz
- 1850 MHz 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: 2.5 ms

Measurement trigger: amplitude rise only

Maximum input level: +37 dBm/1.23 MHz peak (5 W peak)

Measurement range: –54 dBm to +30 dBm

Measurement level ranging: auto and manual. In auto mode, the test set ranges based on the user set values of the parameters power step, number of steps, and maximum response sequence.

Measurement Dynamic Range: *auto- ranges to each ideal power step, typically providing accurate measurement results for access probes within ±9 dB of the ideal probe power.*

Measurement accuracy: (Calibrated against average power and within ±10 degrees of calibration temperature. Calibration must occur between 20°C to 55°C): <±1 dB 15°C to 55°C, *typically <±0.5 dB*

Measurement results: Provides a bar graph for up to 20 captured probes and a result table that reports absolute power in each probe and the power delta from the previous access probe. Access probe power is reported in a 1.23 MHz bandwidth.

Concurrency capabilities: none - selecting graphical access probe power closes all other active measurements

Handoff modulation quality measurement

Input frequency ranges:

- 411 MHz to 484 MHz
- 800 MHz to 1000 MHz
- 1700 MHz to 2000 MHz

Measurement chip rate: 1.2288 Mcps

Modulation measurement method: PN offset handoff for IS-2000 R-RC3 or R-RC4 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 to 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 MHz to 484 MHz
- 800 MHz to 1000 MHz
- 1700 MHz to 2000 MHz

Measurement chip rate: 1.2288 Mcps

Modulation measurement method:

IS-95, RC1, or RC2: single code rho

RC3, RC4, or RC5: 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, RC1, or RC2: 0.40 to 1.00 rho

RC3, RC4, or RC5: 1% to 40% EVM

Measurement interval: 1.042 ms (5 Walsh symbols)

Modulation quality measurement accuracy:

IS-95, RC1, or RC2 rho: <±0.003 + residual error for 0.8 < rho <1.0

RC3, RC4, or RC5 EVM: <±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

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 indicate active channels, while yellow bars indicate inactive channels.

Code domain table: Displays the Walsh code, spread factor, code domain power (at SF=16), total code domain power, and code power relative 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 & 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 measurement

Input frequency ranges:

- 411 MHz to 484 MHz
- 800 MHz to 1000 MHz
- 1700 MHz to 2000 MHz

Measurement chip rate: 1.2288 Mcps

Measurement method (IS-2000 R-RC3 and R-RC4 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)

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:

Measurement residuals:

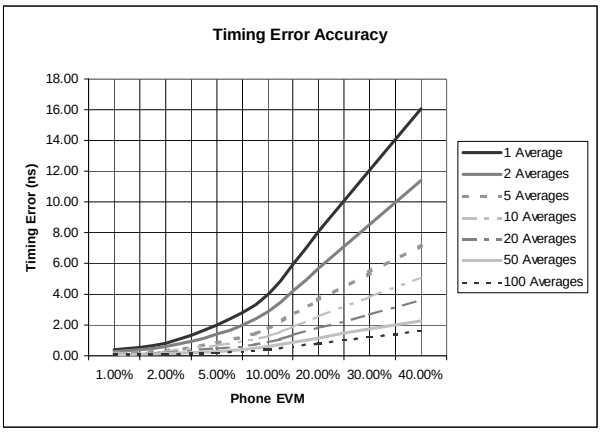
Code channel residual time error: ±3 ns, *typically ±16 ns at –50 dBm/1.23 MHz*

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.

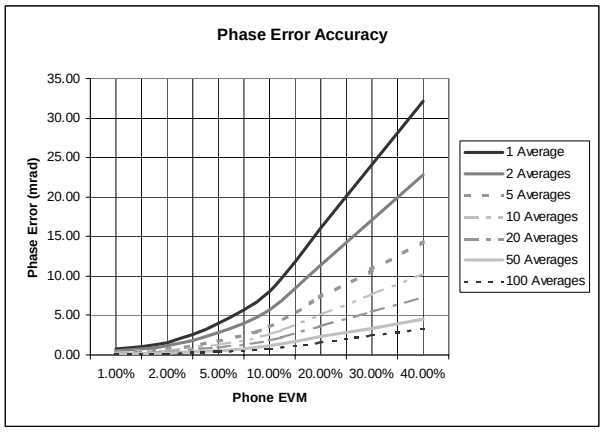
Code channel phase error graph: Displays the relative phase error in all 15 Walsh coded channels (16 bit) for both the I channel and the Q channel



relative to the R-Pilot channel. Red bars 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: user-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

Time response of open loop power control measurement

Input frequency ranges:

- 411 MHz to 420 MHz
- 450 MHz to 484 MHz
- 824 MHz to 934 MHz
- 1750 MHz to 1780 MHz
- 1850 MHz 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 dBm to +30 dBm (final level after ±20 dB step in cell power)

Measurement level ranging: Auto

Measurement cell power step size: +20, –20 dB

Marker relative level accuracy: ±0.5 dB

Marker time accuracy: ±540 µs

Measurement limits: time vs. 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 ms 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

TX spurious emissions

Input frequency ranges:

- 411 MHz to 420 MHz

- 450 MHz to 484 MHz
- 824 MHz to 934 MHz
- 1750 MHz to 1780 MHz
- 1850 MHz 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 support 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 dBm to +30 dBm

Measurement level ranging: auto

Marker relative level accuracy:

±885 kHz, ±1.25 MHz offsets: <±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 offsets: <–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:

- –42 dBc/30 kHz for ±1.25 MHz offsets
- –50 dBc/30 kHz for ±1.98 MHz offsets

Manual mode: User settable from –10 dBc 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.

Gated power measurement

Input frequency ranges:

- 411 MHz to 420 MHz
- 450 MHz to 484 MHz
- 824 MHz to 934 MHz
- 1750 MHz to 1780 MHz
- 1850 MHz 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 dBm to +30 dBm

Measurement averaging: default of 100, user-selectable

Marker relative level accuracy (averages >25):

+5 dB to –22 dB: <±0.4 dB + 0.1 dB for signal fall times less than 2 µs, *typically <±0.30 dB*

–22 dB 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 µs to +1262 µs

Level display range: –35 dB 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 dB to +5 dB

Graphical results: rise / fall view

Rise trace:

Time display range: –15 µs to +1262 µs

Time display resolution: 68 ns

Level display range: –35 dB to +5 dB

Fall trace:

Time display range: –15 µs to +1262 µs

Time display resolution: 68 ns

Level display range: –35 dB to +5 dB

Other measurement results: Pass/Fail indicator, first fail 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 GP-IB.

Concurrency capabilities: none

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 inputs levels in the specified input level range and within ±9 dB of the expected input power

Confidence limit range: user-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

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

TDSO measurement

TDSO measurement method: Once a SO32 call is connected, up to a 10.24 second wait is required to synchronize the mobile and test set. Once sync is achieved, the first measurement result will be returned in 10.24 seconds (one sync frame)

TDSO test length (frame count): settable in 512 frame increments from 512 to 999,936 frames

FER requirement: Settable from 0.1% to 10%

TDSO measurement data pattern: User selectable eight bit data pattern to fill each frame in whole bytes (padded with zeroes to fill each frame as needed, pattern 00000000 not allowed) or PRBS

TDSO reported parameters:

Intermediate results: TX good frames sent, TX blank frames sent, RX blank frames received, RX good frames received, confidence, and FER. Results are updated every 512 frames

Final results: TX good frames sent, TX blank frames sent, RX blank frames received, RX good frames received, confidence, and FER

Concurrency capabilities: TDSO measurements can be made concurrently with all other concurrent measurements except for frame error rate

General Specifications

Timebase specifications

Internal high stability 10 MHz oven-controlled crystal oscillator (OCXO)

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.

General specifications

Dimensions (H × W × D): 8.75 × 16.75 × 24.63 inches (222 × 426 × 625 mm), 7 rack spaces high

Weight: 66 lbs. (30 kg)

Display: 10.5 inches (26.7 cm), active matrix, color, liquid crystal

LAN (Local area network) port (for firmware upgrades and protocol logging only): RJ-45 connector, 10 base T Ethernet with TCP/IP support

Operating temperature: 0 to +55°C

Storage temperature: –20 to +70°C

Power: 100 to 240 Vac, 50 to 60 Hz, 550 VA maximum

Calibration interval: two years

EMI: conducted and radiated interference meets CISPR-11

***Radiated leakage due to RF generator**: typically <1 μV induced in a resonant dipole antenna one inch from any surface except the underside and rear panel at set RF generator output frequency and output level of–40 dBm*

***Spurious leakage**: typically <5 μV induced in a resonant dipole antenna one inch from any surface except the underside and rear panel at frequencies other than the RF generator output frequency and output level of –40 dBm*

***Power consumption:** typically 400 to 450 W continuous*

***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. 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.*

Analog measurements

Measurement name	*One measurement*	*Five measurements*
Analog TX power	*15 ms*	*41 ms*
Frequency modulation (with deviation result)	*134 ms*	*448 ms*
Frequency modulation (with deviation and distortion results)	*163 ms*	*528 ms*
Frequency stability	*174 ms*	*754 ms*
Audio analyzer (with level result)	*65 ms*	*284 ms*
Audio analyzer (with level, SINAD and distortion results)	*96 ms*	*314 ms*

CDMA measurements

Measurement name	*One measurement*	*Ten measurements*
Channel power (normal mode)	*73 ms*	*616 ms*
Channel power (fast mode)	*28 ms*	*210 ms*
Average power (RC3)	*199 ms*	*1773 ms*
Waveform quality IS-95, RC1, or RC2	*170 ms*	*1001*
Waveform quality IS-2000 RC3/4	*202 ms*	*1385 ms*
Code channel time & phase error	*299 ms*	*2326 ms*
Handoff waveform quality	*735 ms*	*NA*
Gated power (100 measurements)	*157 ms*	*3352 ms*
TX spurious response	*338 ms*	*2566 ms*
Time response of open loop power	*1210 ms*	*NA*

For more information please visit our Web Site at:
www.agilent.com/find/8960

Agilent Email Updates

www.agilent.com/find/email updates
Get the latest information on the products and applications you select.

Agilent Technologies' Test and Measurement Support, Services and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

By internet, phone, or fax, get assistance with all your test and measurement needs.

Online assistance:
www.agilent.com/find/assist

Phone or Fax

United States:
(tel) 1 800 452 4844

Canada:
(tel) 1 877 894 4414
(fax) (905) 282 6495

China:
(tel) 800 810 0189
(fax) 1 0800 650 0121

Europe:
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Latin America:
(tel) (305) 269 7500
(fax) (305) 269 7599

Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Korea:
(tel) (82 2) 2004 5004
(fax) (82 2) 2004 5115

Taiwan:
(tel) 080 004 7866
(fax) (886 2) 2545 6723

Other Asia Pacific Countries:
(tel) (65) 375 8100
(fax) (65) 836 0252

Email: tm_asia@agilent.com

Product specifications and descriptions in this document subject to change without notice.

5988-6180EN - PRELIMINARY

Agilent Technologies