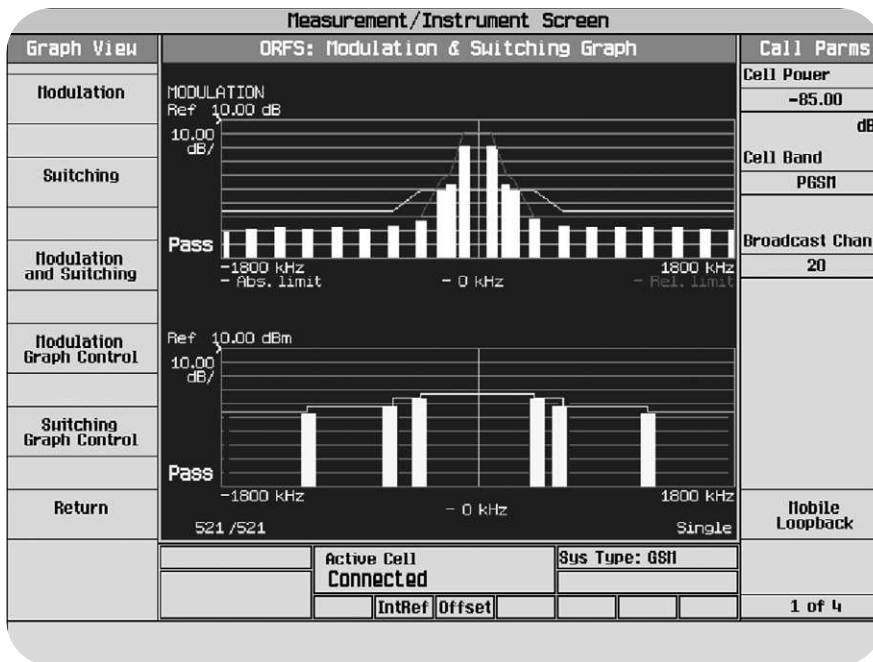


Agilent 8960 Series 10 with GSM

Data Sheet

For the E5515A/B/C/T mainframes and the E1960A and E1985A test applications



GSM functionality

- **mobile station power output level control:** meets GSM phase one and phase two power control levels
- **traffic channels:** TCH/FS — FR, EFR and HR speech modes
- **broadcast channel configuration:** BCCH + CCCH + SDCCH/4
- **signaling protocol setup:** FACCH
- **audio speech echo:** 1-second fixed delay
- **external trigger:** signal output each frame with user-settable timeslot and bit
- **measurement coordination:** flexible control of burst type, ARFCN and timeslot

Transmitter measurements

- frequency error
- transmit power
- phase error (peak and rms)
- power versus time (burst mask comparison)
- burst timing
- output RF spectrum due to switching
- output RF spectrum due to modulation
- IQ tuning
- decoded audio level

Audio functionality

- choice of speech encoded on downlink TCH: None, echo, 300 Hz sine, 1 kHz sine, 3 kHz sine, or PRBS-15
- audio generator
- analog audio measurement (audio level, distortion, frequency, SINAD)

Receiver measurements

- burst-by-burst bit error ratio (fast BER)
- normal bit error ratio (BER)



Call processing functionality

- GSM 450 MHz, GSM 480 MHz, GSM 750 MHz, GSM 850 MHz, PGSM 900 MHz, EGSM 900 MHz, RGSM 900 MHz, DCS 1800 MHz, PCS 1900 MHz bands
- MS origination
- BS origination
- MS release
- BS release
- intra-cell channel assignments
- inter-cell handovers
- BA table with 16 user-settable neighbor cells
- mobile loopback (off, type A, type B, type C)

Cell parameters

- user-settable MCC, MNC, LAC, NCC and BCC
- mobile DTX on or off
- paging mode reorganized or normal
- paging multiframes user-settable between 2 and 9
- repeat paging on or off
- retrieve mobile IMEI at call setup off or on
- maximum frames allowed for assignment user-settable between 15 and 999
- Tx level FACCH signaling off or on

SACCH reporting of servicing cell:

- Rx quality
- Rx level
- Tx level
- timing advance

SACCH reporting of first neighbor cell:

- channel number
- base station color code (BCC)
- Rx level
- network color code (NCC)

Counters reported:

- RACH count
- corrupt burst count
- page count
- decode error count
- missing burst count

Last location information reported:

- location area code (LAC)
- mobile country code (MCC)
- mobile network code (MNC)

Mobile-reported information:

- international mobile subscriber identity (IMSI)
- international mobile equipment identity (IMEI)
- revision level
- power class
- supported band
- called number

Operating modes

Full signaling call setup (active cell mode): Protocol used to establish, maintain, change channels and power levels, and terminate the link.

Limited signaling call setup (test mode): Protocol used only to maintain a link established by the mobile station. Over-the-air signaling and capability to demodulate and decode uplink random access channel (RACH) bursts are not available. Three options exist as follows.

- **BCH only:** A broadcast channel (BCH) without a traffic channel (TCH) is generated on the downlink and mobile station level information is carried on the broadcast control channel (BCCH).

- **BCH+TCH:** BCH and TCH are generated on the downlink, mobile station level information is carried on the BCCH and the downlink slow associated control channel (SACCH), timing advance changes are sent on the downlink SACCH. A call can be established by manually synchronizing the mobile station with the TCH and turning on the mobile station's TCH at the same absolute radio frequency channel number (ARFCN) and timeslot as the test set's TCH. During a call, demodulation and channel decoding of the uplink are available, although no messages are decoded.

- **CW:** An unmodulated continuous wave (CW) signal is generated on the downlink. The level and frequency of the CW signal can be changed. No uplink demodulation or channel decoding is available.

Technical specifications

These specifications apply to the following hardware and software.

- E5515A mainframes with GPRS upgrade installed (E5515BU 085)
- E5515B mainframes with serial numbers lower than US40300311 or lower than GB40300127 with GPRS upgrade installed (E5515BU 085)
- E5515B mainframes with serial numbers US40300311 and higher or GB40300127 and higher
- E5515C mainframes
- E5515T mainframes with cdma2000 upgrade installed (E5515TU x62)
- E1960A test application of firmware revision A.10
- E1985A test application of firmware revision B.01

Specifications describe the test set's warranted performance and are valid over the entire operation and environmental ranges unless otherwise noted. All specifications are valid after a 30-minute warm-up period of continuous operation, and within the frequency ranges of 450 to 496 MHz, 810 to 960 MHz and 1.7 to 1.99 GHz.

Supplemental characteristics are intended to provide additional information useful in applying the instrument by giving typical, but non-warranted performance parameters. These characteristics are shown in Italics and labeled as "typical," or "supplemental," and apply at +25 °C.

RF (downlink) generator specifications

RF generator specifications apply to both RF generators in the 8960.

RF frequency

Frequency ranges: 450 to 496 MHz, 810 to 960 MHz, 1.7 to 1.99 GHz

Accuracy and stability: same as timebase reference

Supplemental characteristics

Typical CW frequency switching speed: < 10 ms to be within < 0.1 ppm of final frequency

Operating frequency range: 292 to 2700 MHz

Setting resolution: 1 Hz

RF amplitude

Output level range: -110 to -13 dBm

Absolute output level accuracy: < ±1.0 dB

VSWR at RF IN/OUT: < 1.14:1 for 450 to 496 MHz and 810 to 960 MHz, < 1.2:1 for 1.7 to 1.99 GHz

Reverse power: < 2.5 W continuous, < 5 W peak burst power

Supplemental characteristics

Typical output level accuracy: < ±0.5 dB

Typical output level repeatability (returning to the same frequency and level): < ±0.1 dB

Operating level range: -127 to -10 dBm

Output level setting resolution: 0.1 dB

Typical output level switching time: < 50 ms to be within 0.05 dB of final level (non-burst)

GSM signal generation

Peak phase error: < ±4 degrees

rms phase error: < 1 degree

Frequency error: < ±0.01 ppm plus timebase reference

Amplitude flatness: < ±0.3 dB

Supplemental characteristics

Typical burst modulation on/off ratio: > 50 dB

Spectral purity

Harmonics: ≤ -25 dBc for levels ≤ -17 dBm

Subharmonics: ≤ -40 dBc

Non-Harmonics: < -55 dBc for 100 to ≤ 1500 kHz offsets from carrier
< -68 dBc for > 1500 kHz offsets from carrier

Supplemental characteristics

Typical non-harmonic performance: < -55 dBc for 3 to < 100 kHz offsets
< -53 dBc for line-related non-harmonics

Typical spurious due to receiver LO leakage: < -50 dBm for spurious at 105 ±2.5 MHz below expected transmitter frequency and its second harmonic

RF analyzer functionality

RF frequency

Ranges applied to demodulation and transmitter specifications: 450 to 496 MHz, 810 to 960 MHz and 1.7 to 1.99 GHz

Supplemental characteristics

Operating range: 292.5 to 2700 MHz

Transmitter and receiver measurement specifications

The time until a measurement times-out and returns control to the user can be set independently for each measurement. All measurements return a measurement integrity result indicating the accuracy and usefulness of each measurement's results.

Frequency coverage and amplitude range

Unless otherwise noted, all specifications apply to frequencies of 450 to 496 MHz, 810 to 960 MHz and 1.7 to 1.99 GHz, signals with peak input power at the test set's RF IN/OUT not higher than +37 dBm and temperatures of 0 to +55 °C. Input signal transmit power (defined as the average power over the useful part of the burst) at the test set's RF IN/OUT must be within ± 3 dB of the test set's expected power for warranted performance.

Receiver measurement specifications

Simultaneous demodulation and measurements

The test set's RF analyzer provides dedicated signal paths for demodulation (maintaining the link) and measurements to be performed simultaneously.

Demodulation frequency capture range: Signal must be within ± 200 Hz of test set's expected frequency for warranted performance.

Demodulation sensitivity: ≥ -30 dBm for BER measurements

Supplemental characteristics

Typical demodulation sensitivity: ≥ -40 dBm for maintaining a link

Bit error ratio (BER) measurement

Types of signals measured: compares 260 bits of speech data using mobile phone loopback with or without signaling of erased speech frames

Minimum input level: Signal at test set's RF IN/OUT must have transmit power ≥ -30 dBm.

Measurement data pattern: PRBS-15

Type of bits to measure: user-selectable as residual type Ia, residual type Ib, residual type II, type Ia, type Ib or type II

Mobile loopback: user-selectable in active cell operating mode as type A, type B, type C or off

Signaling loopback control: on or off

Closed-loop signaling delay: user-settable between 0 and 5 seconds

Speech frame delay: user-settable between 1 and 15 or automatically determined

Measurement unit: user-selectable as percent or count

Numerical results: number of bits tested, BER, number of bad bits, CRC ratio (without frame erasure), number of bad CRCs (without frame erasure), frame erasure ratio (FER) (with frame erasure), number of frames erased (with frame erasure), speech frame delay, Rx level, Rx qual

Multi-measurement capabilities: 1 to 999,000 bits

Concurrency capabilities: BER measurements cannot be made concurrently with FBER measurements, decoded audio level measurements or while speech is provided on the downlink TCH. BER measurements can be made concurrently with all transmitter measurements and with audio measurements.

Supplemental characteristics

Measurement resolution: 0.01 percent

Fast bit error ratio (FBER) measurement

Types of signals measured:

comparison of 114 bits of interleaved data with mobile phone in burst-by-burst loopback

Minimum input level: signal at test set's RF IN/OUT must have transmit power ≥ -30 dBm

Measurement data pattern: PRBS-15

Mobile loopback: user-selectable in active cell operating mode as type A, type B, type C or off

Signaling loopback control: on or off

Closed-loop signaling delay: user-settable between 0 and 5 seconds

TDMA frame delay: user-settable between 0 and 26 or automatically determined

Measurement unit: user-selectable as percent or count

Numerical results: number of bits tested, FBER, number of bad bits, TDMA frame delay, Rx level, Rx qual

Multi-measurement capabilities: 1 to 999,000 bits

Concurrency capabilities: FBER measurements cannot be made concurrently with BER measurements, decoded audio level measurements or while speech is provided on the downlink TCH. FBER measurements can be made concurrently with all transmitter measurements and with audio measurements.

Supplemental characteristics

Measurement resolution: 0.01 percent

Transmitter measurement specifications

Phase and frequency error measurement

Types of signals measured: normal and RACH bursts

Frequency capture range (for any mobile burst): Signal must be within ± 100 kHz of test set's expected frequency for warranted performance.

Minimum input level: Signal at test set's RF IN/OUT must have transmit power ≥ -15 dBm for warranted performance.

Frequency error measurement accuracy: $< \pm 12$ Hz plus timebase accuracy for normal bursts, $< \pm 18$ Hz plus timebase accuracy for RACH bursts

When using the RF generator as the RF reference frequency for the mobile, the RF generator frequency error relative to the timebase reference must be added.

rms phase error measurement accuracy: < 1 degree

Peak phase error measurement accuracy: < 4 degrees

Measurement trigger sources: RF rise, protocol, immediate, auto

Measurement trigger delay: user-settable between ± 2.31 ms

Measurement synchronization: midamble, RF amplitude, none

Confidence level: user-settable from 80 to 99.99 percent

Peak phase error pass/fail maximum limit: user-settable from 0 to 20 degrees

rms phase error pass/fail maximum limit: user-settable from 0 to 5 degrees

Frequency error pass/fail maximum magnitude limit: user-settable from 0 to 0.1 ppm

Numerical results: rms and peak phase error, frequency error, pass/fail for each result

Displayed graphical results: peak phase error in degrees versus bits with user-settable marker and pass/fail limits, pass/fail indicators, variable bit and amplitude axes

Multi-measurement capabilities: 1 to 999 bursts; maximum, minimum and average phase and frequency error, and worst case frequency error results

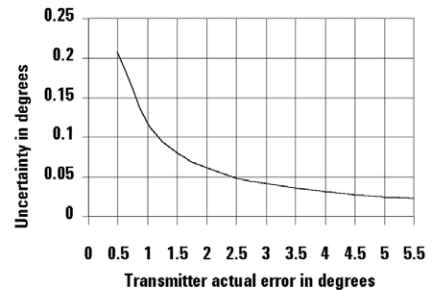
Concurrency capabilities: phase and frequency error measurements can be made concurrently with all other measurements.

Supplemental characteristics

Frequency error measurement resolution: 0.01 Hz

Phase error measurement resolution: 0.01 degrees

Typical rms phase error uncertainty versus transmitter actual error:



Transmit power measurement

Types of signals measured: normal and RACH bursts, CW

Frequency capture range: Signal must be within ± 100 kHz frequency for warranted performance.

Minimum input level: Signal at test set's RF IN/OUT must have transmit power ≥ -30 dBm for warranted performance.

Measurement accuracy (for +20 to +55 °C): $< \pm 0.27$ dB for 810 to 960 MHz, $< \pm 0.29$ dB for 450 to 496 MHz and 1.7 to 1.99 GHz

VSWR at RF IN/OUT: $< 1.14:1$ for 450 to 496 MHz and 810 to 960 MHz, $< 1.2:1$ for 1.7 to 1.99 GHz

Measurement trigger sources: RF rise, protocol, immediate, auto

Measurement trigger delay: user-settable between ± 2.31 ms

Measurement synchronization: RF amplitude (midamble-synchronized output power result is available as part of the power versus time measurement)

Numerical result: output power

Multi-measurement capabilities: 1 to 999 bursts; minimum, maximum, average and standard deviation results

Concurrency capabilities: Transmit power measurements can be made concurrently with all other measurements.

Supplemental characteristics

Extended amplitude range: Results are provided for signals at test set's RF IN/OUT for transmit power within -10 and $+5$ dB of expected power.

Typical measurement accuracy:

Specification	Ranges
$< \pm 0.10$ dB	450 to 496 MHz -30 to +37 dBm
$< \pm 0.11$ dB	810 to 960 MHz -10 to +37 dBm
$< \pm 0.13$ dB	810 to 960 MHz -30 to < 10 dBm
$< \pm 0.14$ dB	1.7 to 1.99 GHz -30 to +37 dBm

Typical measurement repeatability: $< \pm 0.05$ dB

Measurement resolution: 0.01 dB

Power versus time measurement

All specifications for the power versus time measurement are valid between $+20$ and $+55$ °C. Transmit power measurement accuracy specifications apply to output power result.

Types of signals measured: normal and RACH bursts, CW

Frequency capture range: Signal must be within ± 10 kHz of test set's expected frequency for warranted performance.

Minimum input level: Signal at test set's RF IN/OUT must have transmit power ≥ -15 dBm for warranted performance.

Mask placement timing accuracy: $< \pm 0.1$ bits (0.3692 μ s) with midamble synchronization

Relative measurement accuracy (referenced to average output power during useful part of burst):

Specification	Power range
$< \pm 0.5$ dB	-7 to +1 dB
$< \pm 1.0$ dB	-20 to < -7 dB
$< \pm 2.0$ dB	-32 to < -20 dB
$< \pm 2.5$ dB	-45 to < -32 dB
$< \pm 2.7$ dB	-50 to < -45 dB, ≥ -46 dBm
$< \pm 3.0$ dB	-60 to < -50 dB, ≥ -46 dBm

Measurement trigger sources: RF rise, protocol, immediate, auto

Measurement trigger delay: user-settable between ± 2.31 ms

Measurement synchronization: midamble, RF amplitude, none

Marker measurement points: Twelve time points within a burst are user-definable.

PCS ETSI limit: user selection of narrow or relaxed mask in PCS 1900 MHz band

Numerical results: pass/fail, output power, worst case upper mask limit margin and time, worst case lower mask limit margin and time, amplitude at marker measurement points

Displayed graphical results: fixed dBc versus μ s views of full, rising edge, falling edge and useful part of burst, ETSI-defined mask, pass/fail indicators, user-settable marker, variable time and amplitude axes

Multi-measurement capabilities: 1 to 999 bursts; minimum, maximum, average and standard deviation results

Concurrency capabilities: Power versus time measurements can be made concurrently with all other measurements.

Supplemental characteristics

Typical relative measurement accuracy: $< \pm 0.25$ dB for -7 to $+1$ dB

Typical dynamic range: > 74 dB, or
Typical noise floor: < -62 dBm, whichever dominates

Measurement resolution: 0.01 dB

Burst timing error measurement

Burst timing error measurement result is available on Call Setup screen.

Types of signals measured: normal and RACH bursts

Measurement capture range: signal must be within ± 3 T (bit periods) of test set's expected position.

Minimum input level: signal at test set's RF IN/OUT must have transmit power ≥ -30 dBm

Numerical result: burst timing error

Concurrency capabilities: Burst timing error measurements can be made concurrently with all other measurements, but burst timing result is not available when test mode with CW is selected.

Supplemental characteristics

Typical measurement repeatability: $< \pm 0.25$ T (0.923 μ s)

Measurement resolution: 0.25 T (0.923 μ s)

Output RF spectrum (ORFS) due to modulation measurement

All specifications for the ORFS due to modulation measurement are valid between +20 and +55 °C. Transmit power measurement accuracy specifications apply to output power result.

Measurement implementation

The ORFS due to modulation measurement is performed using a five-pole, synchronously tuned 30 kHz RBW filter averaged over 40 bits, with a video bandwidth of 30 kHz.

Types of signals measured: normal bursts

Frequency capture range: Signal must be within ±200 Hz of test set's expected frequency for warranted performance.

Minimum input level: Signal at test set's RF IN/OUT must have transmit power ≥ -10 dBm for warranted performance.

Measurement accuracy (referenced to output power in a 30 kHz bandwidth and averaged over 100 measurements): < ±1.5 dB for the following conditions

Offset from reference carrier	Power below (whichever is highest)
±100 kHz	-10 dB or -46 dBm
±200 kHz	-40 dB or -46 dBm
±250 kHz	-43 dB or -46 dBm
±400 to	-62 dB or -66 dBm
±1800 kHz	

Measurement trigger sources: RF rise, protocol, immediate, auto

Measurement trigger delay: user-settable between ±2.31 ms

Measurement synchronization: RF amplitude

Measurement offsets: 22 offsets from carrier are user-definable

Pass/fail limits: ETSI or user-defined

Numerical results: modulation result at each selected offset, output power, output power in 30 kHz bandwidth, modulation and switching pass/fail indicators

Displayed graphical results: fixed dB versus frequency views of modulation and both modulation and switching, user-settable marker and pass/fail limits, modulation and switching pass/fail indicators, variable frequency and amplitude axes

Multi-measurement capabilities: 1 to 999 measurements, average result

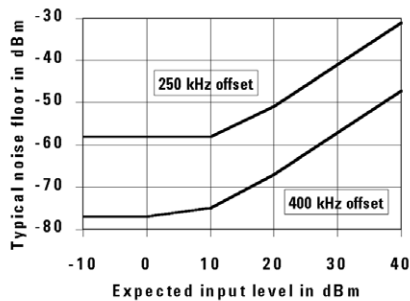
Concurrency capabilities: ORFS measurements can be made concurrently with all other measurements

Supplemental characteristics

Typical measurement accuracy: < ±0.7 dB for ±400 kHz offsets from carrier

Measurement resolution: 0.01 dB

Typical ORFS due to modulation measurement noise floor versus expected input level at 900 MHz:



Output RF spectrum (ORFS) due to switching measurement

All specifications for the ORFS due to switching measurement are valid between +20 and +55 °C. Transmit power measurement accuracy specifications apply to output power result.

Measurement implementation

The ORFS due to switching measurement is performed using a five-pole, synchronously tuned 30 kHz RBW filter with peak hold during the whole burst, and a video bandwidth of 100 kHz.

Types of signals measured: normal bursts

Frequency capture range: Signal must be within ±200 Hz of test set's expected frequency for warranted performance.

Minimum input level: Signal at test set's RF IN/OUT must have transmit power ≥ -10 dBm for warranted performance.

Absolute measurement accuracy (peak hold over 10 measurements): < ±1.5 dB for offsets of ±(400 to 1800) kHz

Measurement trigger sources: RF rise, protocol, immediate, auto

Measurement trigger delay: user-settable between ±2.31 ms

Measurement synchronization: RF amplitude

Measurement offsets: eight offsets from carrier are user-definable

Pass/fail limits: ETSI or user-defined

Numerical results: switching result at each selected offset, output power, modulation and switching pass/fail indicators

Displayed graphical results: fixed dBm versus frequency views of switching and both modulation and switching, user-settable marker and pass/fail limits, modulation and switching pass/fail indicators, variable frequency and amplitude axes

Multi-measurement capabilities: 1 to 999 bursts; maximum, average and standard deviation results

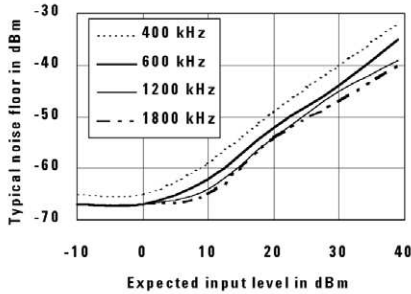
Concurrency capabilities: ORFS measurements can be made concurrently with all other measurements

Supplemental characteristics

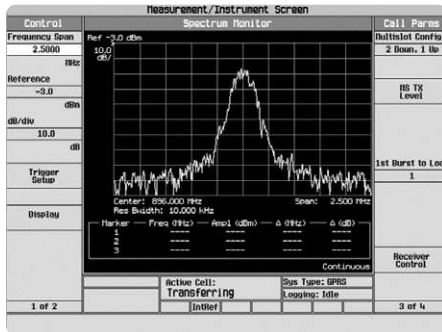
Typical absolute measurement accuracy (peak hold over 10 measurements):
 < ±1.0 dB for offsets of ±(400 to 1800) kHz

Measurement resolution: 0.01 dB

Typical ORFS due to switching measurement noise floor versus expected input level at 900 MHz:



General-purpose spectrum monitor



Operating modes: active cell and test mode

Measurement modes: swept mode or zero span

Frequency ranges: although the spectrum monitor is available at any frequency supported by the test set, specifications apply only inside of the calibrated bands: 450 to 496 MHz, 810 to 960 MHz and 1.7 to 1.99 GHz

Frequency spans, resolution bandwidth, displayed dynamic range: coupled with the following combinations available:

Span	RBW	Displayed dynamic range
100 MHz	5 MHz	50 dB
80 MHz	1 MHz	55 dB
40 MHz	300 kHz	60 dB
20 MHz	100 kHz	65 dB
12 MHz	100 kHz	65 dB
10 MHz	100 kHz	65 dB
5 MHz	30 kHz	70 dB
4 MHz	30 kHz	70 dB
2.5 MHz	10 kHz	75 dB
1.25 MHz	3 kHz	80 dB
500 kHz	1 kHz	80 dB
125 kHz	300 Hz	80 dB
0	1 MHz	55 dB
0	300 kHz	60 dB
0	100 kHz	65 dB

RBW filter types: flattop in swept mode, Gaussian in zero span

Zero span sweep time: user-settable from 50 μs to 70 ms

Zero span offset time: user-settable from 0 to 10 s

Reference level range: user-settable from -50 to +37 dBm or automatically determined

Amplitude scaling: user-settable from 0.1 to 20 dB/division in 0.1 dB steps

Trigger source: immediate, protocol, RF rise, external, auto

Trigger delay: user-settable between ±50 ms

Peak threshold: user-settable from -120 to +37 dBm

Peak excursion: user-settable from 1 to 100 dB

Trace functions: clear write, max hold, min hold

Detector types: peak or sample

Averaging capabilities: user-settable between 1 and 999 or off

Marker functions: three independent markers with modes of normal, delta and off. Operations are peak search, marker to expected power and marker to expected frequency.

Concurrency capabilities: spectrum monitor analysis can be performed concurrently with all measurements

Supplemental characteristics

Typical level accuracy: < ±2 dB for signals within 50 dB of a reference level ≥ -10 dBm and RBW < 5 MHz

< ±2 dB for signals within 30 dB of a reference level ≥ -10 dBm and RBW = 5 MHz using 5 averages

< ±3.5 dB for signals > -70 dBm and within 50 dB of a reference level < -10 dBm with RBW < 5 MHz

Displayed average noise level: < -90 dBm for reference level of -40 dBm and 30 kHz bandwidth

Typical residual responses: < -70 dB with input terminated, reference level of -10 dBm and RF generator power < -80 dBm

Typical spurious responses: < -50 dBc with expected frequency tuned to carrier, carrier > 420 MHz, signal and reference level at -10 dBm and all spectral components within 100 MHz of carrier

Frequency resolution: 1 Hz

Marker amplitude resolution: 0.01 dB

IQ tuning measurement

Types of signals measured: normal bursts

Frequency capture range (for any mobile burst): signal must be within ±1 kHz expected frequency for warranted performance

Minimum input level: Signal at test set's RF IN/OUT must have transmit power ≥ -10 dBm for warranted performance.

Relative measurement accuracy (referenced to highest signal component and averaged over 10 measurements):

Specification	Power below reference
< ±1 dB	0 to -35 dB
< ±2 dB	-35 to -55 dB

Valid at the reference frequency and at the following offsets from the reference frequency:

- ±67.708 kHz
- ±135.417 kHz
- ±203.125 kHz
- ±270.833 kHz
- ±(1 to 15) MHz

Measurement trigger sources:
RF rise, immediate

Measurement trigger delay: user-settable between ±2.31 ms

Measurement synchronization:
RF amplitude

Reference offset frequency:
0, ±67 kHz, auto

Spur measurement frequency: user-settable over ±(1 to 15) MHz or off

Numerical results: each offset frequency level in dB referenced to level at reference offset frequency and spur power in dB referenced to level at reference offset frequency

Displayed graphical results: fixed dBc versus frequency view of all offsets with user-settable marker

Multi-measurement capabilities:
1 to 999 bursts, average results

Concurrency capabilities:
IQ tuning measurements can be made concurrently with all other measurements.

Supplemental characteristics

Level measurement resolution: 0.01 dB

Decoded audio level measurement

The mobile phone needs to be stimulated with a pulsed audio signal at a 10 Hz rate with 50 percent duty cycle for the decoded audio level measurement to provide accurate results.

Types of signals measured: encoded audio present on uplink TCH

Measurement range: 200 Hz to 3.6 kHz

Measurement accuracy: Observed inaccuracies are due to mobile phone encoder errors since the algorithm in the 8960 contributes no bit errors.

Band pass filter capabilities:
100 Hz bandwidth, tunable from 200 Hz to 3.6 kHz, user-selectable as on or off

Measurement trigger source:
immediate

Measurement synchronization:
none required

Numerical result: rms audio level

Multi-measurement capabilities:
1 to 999 measurements; average, minimum, maximum and standard deviation results

Concurrency capabilities: Decoded audio level measurements cannot be made concurrently with BER or FBER measurements. Decoded audio level measurements can be made concurrently with all transmitter measurements and audio measurements.

Supplemental characteristics

Measurement resolution: 0.01 percent

Audio generator specifications

Frequency

Operating range: 100 Hz to 20 kHz

Accuracy: same as timebase reference

Supplemental characteristics

Typical operating range: 1 Hz to 20 kHz

Frequency resolution: 0.1 Hz

Output level from AUDIO OUT connector

Ranges: 0 to 1 V peak, 1 to 9 V peak (into ≥ 600 Ω)

Accuracy: < ±(1.5 percent of setting + resolution) when output is DC coupled

Distortion: < 0.1 percent for 0.2 to 9 V peak into ≥ 600 Ω

Pulse mode: pulsed audio signal at a 10 Hz rate with 50 percent duty cycle, user-selectable as on or off (for use with the decoded audio level measurement)

Coupling mode: user-selectable as DC or AC (5 μF in series with output)

Supplemental characteristics

Typical maximum output current: 100 mA peak into 8 Ω

Typical output impedance: < 1.5 Ω at 1 kHz when output is DC coupled

*Typical DC offset (when output is DC coupled):
< 1 mV for 0 to 1 V peak output,
< 10 mV peak for 1 to 9 V peak output*

Output level resolution: < 0.5 mV for 0 to 1 V peak output, < 5.0 mV for 1 to 9 V peak output

Analog audio measurement specifications

All analog audio measurement specifications apply to signals present at test set's AUDIO IN ports.

De-emphasis: 750 μ s de-emphasis user-selectable as off or on

Expander: user-selectable as off or on with reference level setting of 10 mV to 10 V

Filters: 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

Analog 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: $< \pm(2$ percent of reading + resolution) for 100 Hz to ≤ 8 kHz, $< \pm(3$ percent of reading + resolution) for > 8 to 20 kHz

Measurement THD plus noise: < 200 μ V rms

Measurement detectors: rms or peak

Measurement trigger source: immediate

Measurement synchronization: none required

Numerical result: audio level

Multi-measurement capabilities: 1 to 999 measurements; average, minimum, maximum and standard deviation results

Concurrency capabilities: Analog audio level measurements can be made concurrently with all other measurements.

Supplemental characteristics

Typical measurement accuracy: $< \pm 1.2$ percent of reading for 100 Hz to ≤ 8 kHz and 20 mV to 20 V peak

Typical external input impedance: 100 k Ω in parallel with 105 pF

Measurement resolution: 0.3 percent of expected level setting or 0.2 mV, whichever is greater

Analog audio 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: $< \pm 12$ percent of reading (± 1.0 dB) for distortion > 0.67 percent

Residual THD plus noise: < -60 dB or 200 μ V rms, whichever is greater

Measurement trigger source: immediate

Measurement synchronization: none required

Numerical result: audio distortion

Multi-measurement capabilities: 1 to 999 measurements; average, minimum, maximum and standard deviation results

Concurrency capabilities: Analog audio distortion measurements can be made concurrently with all other measurements.

Supplemental characteristics

Measurement resolution: 0.1 percent

Analog 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 for warranted performance

Measurement accuracy: < 0.1 Hz averaged over 10 measurements, < 1.0 Hz for a single measurement

Measurement THD plus noise: < 200 μ V rms

Measurement trigger source: immediate

Measurement synchronization: none required

Numerical result: audio frequency

Multi-measurement capabilities: 1 to 999 measurements; average, minimum, maximum and standard deviation results

Concurrency capabilities: Analog audio frequency measurements can be made concurrently with all other measurements.

Supplemental characteristics

Measurement resolution: 0.1 Hz

Analog audio 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 < 43.5 dB

Residual THD plus noise: < -60 dB or 200 µV rms, whichever is greater

Measurement trigger source:
immediate

Measurement synchronization:
none required

Numerical result: SINAD ratio

Multi-measurement capabilities:
1 to 999 measurements; average, minimum, maximum and standard deviation results

Concurrency capabilities: Analog audio SINAD measurements can be made concurrently with all other measurements.

Supplemental characteristics

Measurement resolution: 0.01 dB

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

Supplemental characteristics

Typical accuracy after a 30-minute warm-up period of continuous operation is derived from: ±[(time since last calibration) x (aging rate) + (temperature stability) + (accuracy of calibration)]

Typical initial adjustment: ±0.03 ppm

External reference input

Input frequency: 10 MHz

Supplemental characteristics

Input frequency range: < ±5 ppm of nominal reference frequency

Input level range: 0 to +13 dBm

Input impedance: 50 Ω nominal

External reference output

Output frequency: same as timebase (internal 10 MHz OCXO or external reference input)

Supplemental characteristics

Typical output level: ≥ 0.5 V rms

Output impedance: 50 Ω nominal

Remote programming

GPIB: IEEE standard 488.2

Remote front panel lockout: allows remote user to disable the front panel display to improve GPIB measurement speed

Functions implemented: T6, TE0, L4, LE0, SH1, AH1, RL1, SR1, PP0, DC1, DT0, C0, E2

General specifications

Dimensions (H x W x D):
8.75 x 16.75 x 24.63 inches
(222 x 426 x 625 mm)

Weight: 66 lbs. (30 kg)

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

LAN (local area network) port:

RJ-45 connector, 10 Base T Ethernet with TCP/IP support

Operating temperature: 0 to +55 °C

Storage temperature: -20 to +70 °C

Power: 88 to 135 VAC, 193 to 269 VAC, 50 to 60 Hz, 550 VA maximum

Calibration interval: 2 years

EMI: conducted and radiated interference meets CISPR-11, susceptibility meets IEC 1000-4-2, 1000-4-3 and 1000-4-4

Supplemental characteristics

Typical power consumption: 400 to 450 W continuous

Typical radiated leakage due to RF generator: < 2.5 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

Typical spurious leakage: < 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

Typical measurement speed: measured using a 600 MHz Pentium processor. Measurement speeds may vary depending on controller GPIB environment and processor speed.

	One measurement	Five measurements
Phase and frequency error		
	19 ms	66 ms
Transmit power		
	12 ms	27 ms
Power versus time (8 time offsets)		
	24 ms	89 ms
ORFS (2 modulation & 4 switching offsets)		
	192 ms	302 ms
Analog audio level		
	59 ms	271 ms
Analog audio level, distortion, SINAD		
	91 ms	305 ms

Ordering information

For the most up-to-date ordering information, please refer to the configuration guide, literature number 5968-7873E, on the web at: www.agilent.com/find/8960.



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