MS2781B Spectrum Analysis and Vector Signal Analysis with Bandwidths to 50 MHz

MS2781B Signature™
100 Hz to 8 GHz

System Description

The Anritsu Signature™ High Performance Signal Analyzer is designed to provide exceptional spectrum analyzer performance and integrated vector signal analysis over the 100 Hz to 8 GHz frequency range.
Exceptional performance to 8 GHz without the need for a preselector or bandswitching

The Signature RF block diagram illustrates how a Signature uses a 9.5 to 17.5 GHz synthesized first local oscillator and 9.5 GHz first IF (see Figure 1). This fundamental mixing approach allows the 100 Hz to 8 GHz range to be covered without bandswitching. Also, a preselector is not needed to eliminate image responses of the first LO. Preselectors can degrade the overall amplitude accuracy as well as the modulation analysis bandwidth and accuracy. Fundamental mixing to 8 GHz improves the sensitivity, high signal level performance (TOI) and dynamic range.

This combination of high sensitivity and high TOI provides exceptional dynamic range, which is key for making spurious and on/off ratio measurements.

8 MHz Spectrum Analyzer resolution bandwidths

Signature offers standard resolution bandwidths from 0.1 Hz to 8 MHz. Three conversions are used to achieve a typical displayed dynamic range of 130 dB.

30 MHz Demodulation Bandwidth (Option 22)

Option 22, 30 MHz IF Bandwidth, extends single FFT spectrum and I-Q vector measurements to 30 MHz. Baseband differential I & Q inputs are also added. The ability to turn off the anti-alias filter extends the capture bandwidth to 50 MHz.

Comprehensive WCDMA/HSDPA/HSUPA Measurements (Option 30)

Option 30, WCDMA/HSDPA/HSUPA Measurements, allows a wide variety of Modulation Quality measurements on Handsets, Base Station (Node B) transmitters and related components. Combined with the standard RF measurements in Signature, these provide a complete suite of measurements for Engineering use, both in R&D and Manufacturing.

Fully integrated vector signal analysis (Option 38)

Option 38, QAM/PSK Modulation Analysis, allows you to select the symbol rate, modulation type, and filtering to demodulate captured signals. Measurements include EVM, carrier leakage, and I-Q imbalance. Symbol table, constellation and vector diagrams enhance viewing of measurement results.

Advanced connectivity

Signature can be remotely controlled via GPIB and Ethernet interfaces with SCPI commands that provide familiar spectrum analyzer function calls. IVI drivers simplify test system integration.

Open Windows® XP operating system

Signature’s Windows XP Professional environment and built-in PC provide a new level of connectivity, ease-of-use, and remote operation.

Integrated compatibility with MATLAB (Option 40)

Signature expands the ability to analyze RF signals with simulation and analysis tools from the industry leader, The MathWorks. Signature provides an interface to easily transfer captured trace data and I-Q Vectors into MATLAB® and Simulink® for further analysis. DSP demodulator models created in MATLAB and Simulink can be applied to Signature data to evaluate new or proprietary modulation formats.

WiMAX measurements (Option 41)

Mobile and Fixed WiMAX Modulation Measurements provides all the key measurements for your WiMAX device, including Relative Constellation Error (RCE), Carrier Frequency Offset, I/Q Offset, Constellation Diagrams, RCE versus Symbol, and RCE versus sub-carrier.

Phase Noise Measurements (Option 52)

Measure the frequency stability of oscillators, with a log plot of phase noise versus offset or phase noise versus time at one offset. Advanced capabilities include instrument noise & phase noise compensation, selectable FFT or swept operation by decade, and multiple measurements with color differentiation.

Figure 1, Signature RF block diagram (L.O. frequencies are nominal values)
Frequency Related Specifications

Frequency Range: 100 Hz to 8 GHz

Bands (Architecture): Single-band, fundamentally mixed, image free

Frequency Resolution: 1 Hz

Frequency Span Range: 10 Hz to 8 GHz, 0 Hz

Frequency Span Accuracy:
- Span ≤33 MHz: 0.3% of span
- 33 MHz < Span ≤80 MHz: 1.4%
- Span >80 MHz: 1.0% of span

Frequency Readout Accuracy: ± marker freq + reference accuracy + span accuracy + RBW accuracy + RBW + 0.5 + last digit

Swept Resolution Bandwidth (RBW):
- RBW Range: 10 Hz to 8 MHz (1/2/3/5)
- RBW Shape Factor (60 dB/3 dB), nominal: 4.6
- RBW Accuracy: 10 Hz to 2 MHz: 5%
- 3 MHz and 5 MHz: 10%

Modulation Analysis Bandwidth:
- Standard: 8 MHz
- With Option 22: 30 MHz
- With Option 22 and anti-alias filter turned off: 50 MHz

FFT
- FFT RBWs: 0.1 Hz to 100 kHz (1,2,3,5)
- Wideband FFT (requires Option 22): 100 Hz to 3 MHz (1, 2, 3, 5)

FFT Span:
- Standard: 10 Hz to 1 MHz
- Wideband FFT (requires Option 22): 1 MHz to 30 MHz
- FFT Span/RBW: ≤30,000

Wideband FFT (requires Option 22): No restriction

Video Bandwidth (VBW): 1 Hz to 10 MHz (1/2/3/5)

SSB Phase Noise (dBc/Hz @ 1 GHz):
- 10 Hz Offset: <-90
- 100 Hz Offset: <-90
- 1 kHz Offset: <-109
- 10 kHz Offset: <-116
- 100 kHz Offset: <-116
- 1 MHz Offset: <-139
- 5 MHz Offset: <-142
- 10 MHz Offset: <-142

Residual FM: <1 Hz in 1 second, nominal

Reference Oscillator Aging Rate: 5x10^-9/day; 1x10^-7/year

Reference Oscillator Temperature Drift: 5x10^-6 over 0 to 50°C

Amplitude Related Specifications

Intermodulation Distortion (20°C to 30°C)

Third-Order Intercept (TOI):
- <100 MHz: >19 dBm
- ≥100 MHz: >22 dBm, +25 dBm typical

Second Harmonic Intercept: >38 dBm

1 dB Compression Point: >10 dBm

Noise

Displayed Average Noise Level (DANL) (note 5):
- 10 MHz to 1 GHz: <-167 dBm
- >1 GHz to 2.5 GHz: <-166 dBm
- >2.5 GHz to 5.5 GHz: <-165 dBm
- >5.5 GHz to 8 GHz: <-163 dBm

Noise Figure (0 dB input attenuation, <-20 dBm reference level):
- <16 dB typical @ 1 GHz

Amplitude Uncertainty (20°C to 30°C)

Amplitude Uncertainty at 50 MHz (note 2): <0.1 dB

Frequency Response at 10 dB Attenuation: <0.4 dB

Frequency Response from Attenuator Switching: <0.2 dB (note 8)

Additional Frequency Response in FFT Mode: <0.1 dB

Reference Level Switching Uncertainty:
- Without Attenuator Changes: <0.2 dB
- With Attenuator Changes: <0.25 dB

RBW Switching Uncertainty (RBW ≤3 MHz): <0.15 dB

Log Fidelity (<-10 dBm mixer level [note 4], 0 to 80 dB below reference level, signal to noise >25 dB): <0.07 dB

Power Bandwidth Uncertainty (RBW 10 Hz to 1 MHz): 0.1 dB

VSWR (≥10 dB attenuation):
- ≤3 GHz: <1.3
- >3 GHz: <1.5

Combined Amplitude Accuracy (95% confidence, note 3): <0.65 dB

Ranges

Reference Level Range: -150 to +30 dBm in 0.01 dB steps

Scale Type: Log or Linear

Log Scale per Division: 0.1 to 20 dB

Max Average Power (10 dB attn.) w/o Damage: +30 dBm

Input Attenuator Range: 0 to 62 dB, 2 dB steps nominal

Displayed Dynamic Range: 130 dB typical

Spurious

Spurious Responses (<10 dBm mixer level, span ≤3 MHz [note 6]):
- f <300 kHz from carrier, <-70 dBc
- f ≥300 kHz from carrier, <-80 dBc

Residual Responses (≥10 MHz): <-95 dBm

Image Rejection: <-90 dBc, <-105 dBc typical

IF Rejection: <-80 dBc, <-100 dBc typical

Other Amplitude Related

Calibrator Frequency: 50 MHz, internal connection

Amplitude Axis Units: dBm, dBmV, dBµV, W, and A
Sweep Related Characteristics

Trigger Source(s): Free Run, Line, External (±10V @ 10 kΩ), Video, IF Power (Wide BW)

Frequency Domain Sweep Time:
- Span ≤4 GHz: 5 ms to 10,000 seconds
- Span >4 GHz: 16 ms to 10,000 seconds

Time Domain (Zero Span) Sweep Time: 200 µsec to 10,000 seconds

Sweep Time Accuracy:
- Span = 0 Hz: 0.1%
- Span >0 Hz (Swept): 1%
- Pre/Post Trigger: ~Sweep Time to 65 ms

Display Related Characteristics

Detector Modes: Auto, Normal, Max Peak, Min Peak, RMS, Average, Sample (available simultaneously)

Trace Functions: Normal, View, Max Hold, Min Hold, Average, Blank

Traces per Graph: Up to 5

Waveform Math: User can export trace data in CSV format for external processing. Additional math available using MATLAB from The Mathworks. See Connectivity to MATLAB (Option 40) for more details.

Marker Related Characteristics

Markers: Normal, Delta, Display Line, Noise, Phase Noise (Delta CW to Noise)

Marker Frequency Resolution: 0.2% of span

Marker Amplitude Resolution: 0.01 dB

Marker Functions: Marker to peak, marker to next peak, marker to min., marker to reference level, marker to center frequency

Peak Functions: Peak to center, peak to reference level

“Smart” Signal Analyzer Measurements

Channel Power:
- Standards Measured: WCDMA (UMTS), user defined
- Channel Power Uncertainty: 0.67 dB (Note 10)

Adjacent Channel Power Ratio (ACPR):
- Standards Measured: WCDMA (UMTS), user defined
- Offsets Measured: Up to 6
- ACPR Uncertainty: 0.5 dB (Note 11)

Multi-Carrier Channel Power:
- Standards Measured: WCDMA (UMTS), user defined
- Number of Carriers: 1 to 12, plus adjacent and 2 alternate channels
- Channel Power Uncertainty: 0.67 dB (Note 10)

Occupied Bandwidth:
- Frequency Accuracy: ±Span/500 Nominal

Third-Order Intercept (TOI): Measure third order products and intercept from two tones

Internal PC Functionality

Interfaces: USB, Ethernet, VGA, Parallel printer

USB Functionality: USB access to printers, CDs, disks, cameras, memory devices

Internal Hard Disk Drive: ≥40 GB
“Restore” partition on internal Hard Disk Drive

Removable Media Drive: CD R/W + DVD-ROM

Processor: Pentium 4 or greater
Options

**GPIB Interface (Option 3)**

SH1, AH1, T6, SR1, RL1, PP0, DC1, C0 or C1

Note: Programming for options 41 and 52 are not supported via GPIB.

**External Hard Disk Drive (Option 4)**

Internal disk drive removed, rear panel Serial-ATA connector provides connection to external hard drives. Includes two external disk drives with complete Signature software.

**30 MHz Demodulation Bandwidth (Option 22)**

Complex modulated signals with up to 50 MHz bandwidth can be captured and analyzed. Also includes baseband differential I & Q inputs. Option 22 must be factory installed and calibrated.

- **Max Single-FFT Span**: 30 MHz (Note 9)
- **Modulation Analysis BW**: 30 MHz, 50 MHz with anti-alias filter turned off
- **I-Q Inputs**: 30 MHz combined BW
- **Additional Frequency Response Error in Wideband FFT mode**: 1 dB (nominal)

**WCDMA and HSDPA/HSUPA Modulation Analysis (Option 30)**

- **Link Direction**: Downlink and Uplink
- **Inputs**: RF
- **Measurements Functions**: See page 7
- **Specifications**: See page 7

**QAM/PSK Modulation Analysis (Option 38)**

- **Modulation Analysis BW**: 8 MHz
  - With Option 22: 30 MHz, 50 MHz with anti-alias filter turned off
- **Symbol Rate Range**: 10 kHz to 4 MHz
  - With Option 22: 10 kHz to 20 MHz, 30 MHz with anti-alias filter turned off
- **Modulation Formats**: BPSK, QPSK, 1/4 DQPSK, 8 PSK, 3π/8 - 8PSK, 16 QAM, 32 QAM, 64 QAM, 128 QAM, 256 QAM
- **Filtering**: Root-raised-cosine, a=0.1 to 1
- **Analysis Length**: 100 to 10k symbols
- **EVM**: (20°C to 30°C) Test Conditions >-20 dBm, QPSK and 64 QAM modulation, alpha = 0.22, reference level optimized
  - For Carrier Frequency <3 GHz (Note 7): 1.25% 0.1 to 6 MHz, 2% 6 to 15 MHz, 2.5% 15 to 20 MHz
  - For Carrier Frequency from 3 GHz to 6 GHz: Error due to frequency response = 1%

**Connectivity to MATLAB (Option 40)**

Allows seamless transfer of Signature measurements and setup information into the MATLAB workspace. Supports MATLAB 7 (revision 14 or R2007a). Simulink can access this information via the “To Workspace” and “From Workspace” blocks.

Allows viewing of MATLAB computed results, superimposed on the Signature measurement display. MATLAB computed results may be set to automatically update with current measurements. Handshake between Signature and MATLAB ensures synchronization, such as for averaging. MATLAB must be purchased from The MathWorks (www.mathworks.com).

**Signature Measurements Transferred to MATLAB:**

- Traces (in dBm)
- IQ vectors (in Volts)

**IQ Vector Parameters:**

- **Sample rate**: 428 kHz to 21.4 MHz (9 settings)
  - With Option 22: 100 kHz to 50 MHz (21 settings)
- **Capture Length**: 2 million samples (>4.5 seconds for the minimum sample rate)
  - With Option 22: 10 million samples (1.28 sec max for some sample rates)
- **Bandwidth**: Varies with sample rate; 8 MHz max
  - With Option 22: 30 MHz max, 50 MHz with anti-alias filter off
- **Handshake**: On/Off
**WIMAX Modulation Analysis (Option 41)**

Supports IEEE 802.16d/e with compliance to WiBro (requires Option 22)

**Conformance:** 802.16 OFDMA (Mobile WiMAX/WiBro), 802.16 OFDM (Fixed WiMAX)

**Link Type:** Uplink, Downlink

**Duplexing Mode:** TDD, FDD (Burst transmission required on both Uplink and Downlink)

**Max. Capture Duration:** 200 ms to 1.28s, depending on bandwidth

**Bandwidths:** All WiMAX permissible values (1.25, 1.5, 1.75, 2.5, 3, 3.5, 5, 6, 7, 8.75, 10, 12, 14, 15, 17.5, 20, 24, and 28 MHz)

**Cyclic Prefix Values:** 1/4, 1/8, 1/16, 1/32

**Auto Cyclic Prefix detection:** OFDMA: Yes, OFDM: No

**FFT sizes:** OFDMA: 128, 512, 1024, 2048, OFDM: 256

**Modulation Formats:** BPSK (pilots) QPSK, 16QAM, 64QAM (auto detection (OFDM only) or manual)

**Preamble Detection**
- OFDMA: Auto Detection
- OFDM: Manually Set

**Analysis Configuration**

**OFDMA:**
- Zone selection within RF burst
- Number of Zones that can be analyzed simultaneously: 1
- Zone types supported:
  - Downlink: PUSC, FUSC, and OFUSC
  - Uplink: PUSC and OPUSC
- Number of Bursts in measurements: up to 8

**OFDM:**
- Number of Bursts in measurements: 1
- Selective analysis by symbol range and carrier number

**Pilot Tracking**
- OFDMA Downlink, OFDM: Amplitude, Phase, or Timing (user selectable)
- OFDMA Uplink: Timing

**Equalizer Training**
- OFDM: Channel Estimation Sequence, with or without Pilots
- OFDMA Downlink: Channel Estimation Sequence, with or without Pilots and Data Symbols
- OFDMA Uplink: Pilots, with or without Data Symbols

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**RF Measurements**

- Power (RSSI), Burst Carrier to Interference and Noise Ratio (CINR), Power vs. Time, Spectrum (FFT), Spectral Flatness (absolute and Delta between Adjacent Channels), Complementary Cumulative Distribution Function (CCDF), Crest Factor

**Modulation Measurements**

- EVM (RCE) including Peak and Peak Position, EVM vs. Carrier and vs. Symbol, IQ Offset, IQ Gain Imbalance, Quadrature Error, Carrier Frequency Error, Symbol Clock Error, Data Symbols (not decoded), FCH information fields, MAP information fields

- **Residual EVM (RCE):** <0.5% (46 dB, see note 12)

**Phase Noise Measurements (Option 52)**

Plot of Single-Sideband Phase Noise versus Offset

**Displays:**
- Multiple phase noise trace plots on the same scale, each in a different color
- Smoothed Traces
- Instrument Phase Noise Specification
- Limit Lines
- Phase Noise vs. time at a user-specified offset
- Integrated noise in seconds, degrees, or Hz

**Instrument Noise Compensation:**
- Phase Noise (requires low-phase-noise reference signal at the test frequency)

**Sweep Mode:** FFT and Swept, controllable by decade

**Averaging (specifiable by decade):**
- Trace averaging for FFT
- VBW for swept

**Minimum Offset:** 10 Hz

**Maximum Offset:** 100 MHz
### Comprehensive WCDMA and HSDPA Measurements

#### Modulation Measurements

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#### Code-Domain Graphs

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<td>Downlink and Uplink</td>
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<td>Downlink and Uplink</td>
<td>Downlink and Uplink</td>
<td>Downlink and Uplink</td>
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#### RF Measurements

- **Channel Power**
- **ACLR**
- **Multi-Carrier Power**
- **Occupied Bandwidth**
- **CCDF**
- **Spectrum Masks**

#### Specifications

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<td>&lt;0.7 dB</td>
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<td>CPICH Power Uncertainty</td>
<td>6.2.2</td>
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<td>&lt;0.8 dB</td>
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<tr>
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<td>6.3</td>
<td>&lt;10 Hz</td>
<td>&lt;12 Hz</td>
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<td>Power Control Step Uncertainty</td>
<td>6.4.2</td>
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<td>&lt;0.1 dB</td>
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<tr>
<td>Power Control Dynamic Range Uncertainty</td>
<td>6.4.3</td>
<td>&lt;0.3 dB</td>
<td>&lt;1.1 dB</td>
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<tr>
<td>Total Power Dynamic Range Uncertainty</td>
<td>6.4.4</td>
<td>&lt;0.2 dB</td>
<td>&lt;0.3 dB</td>
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<td>Occupied Bandwidth Uncertainty</td>
<td>6.5.1</td>
<td>&lt;38 kHz</td>
<td>100 kHz</td>
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<td>Code Domain Power Floor</td>
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<td>&lt;50 dB</td>
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<td>ACLR</td>
<td>6.5.2.2</td>
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<td>Nominal, optimum mixer level and reference level</td>
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<tr>
<td>EVM</td>
<td>6.7.1</td>
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<td>Composite, Single-Code, or QPSK Optimal Reference Level and Attenuation</td>
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<td>Peak Code-Domain Error (PCDE)</td>
<td>6.7.2</td>
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<td>EVM 15 to 20%</td>
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<td>Transmitted Code Power Absolute Uncertainty</td>
<td>H.3</td>
<td>&lt;0.64 dB</td>
<td>&lt;0.9 dB</td>
<td>Note 3</td>
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<td>Transmitted Code Power Relative Uncertainty</td>
<td>H.3</td>
<td>&lt;0.2 dB</td>
<td>&lt;0.2 dB</td>
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<tr>
<td>Transmitted Carrier Power Uncertainty</td>
<td>H.4</td>
<td>&lt;0.07 dB</td>
<td>&lt;0.3 dB</td>
<td></td>
</tr>
</tbody>
</table>

General Specifications

Power Requirements
AC: 85-264 VAC, 47-63 Hz

Power Consumption:
- Operating: 400 VA
- Standby: 30 VA

Display: 26.6 cm (10.4 inches) XGA Color with touch screen

Weight: <28 kg (62 lbs)

Dimensions: 242 H x 432 W x 508 D mm
(9.5 H x 17 W x 20 D in.)

Warranty: 3 years
Calibration Interval: 1 year

Temperature Range:
- Operating Temperature Range: 0 to +50°C
- Storage Temperature Range: –40 to +75°C

EMI Compatibility: Meets the emission and immunity requirements of:
- EN61326: 1998
- EN55011: 1998 / CISPR 11: 1997 Group 1 Class A
- EN61000-3-2: 1995 + A14
- EN61000-3-3: 1995
- EN61000-4-2: 1995 – 4 kV CD, 8 kV AD
- EN61000-4-3: 1997 – 3 V/m
- EN61000-4-4: 1995 – 0.5 kV DM, 1 kV CM
- EN61000-4-6: 1996 – 3V
- EN61000-4-11: 1994 – 100%/1 cycle


Notes to Specifications

Note 1
For swept spectrum measurements

Note 2
50 MHz, 0 dBm input, Source VSWR <1.1, 10 dB input attenuation, 500 kHz RBW, 0 dBm reference level

Note 3
95% Confidence Amplitude Error Calculation, (CW Signals, 20 to 30°C) 95% confidence level is determined by RSS combination of the individual standard errors. Uniform distribution is used for all contributors except VSWR error. U-shaped distribution is used for VSWR error.

<table>
<thead>
<tr>
<th>Error Specification (dB)</th>
<th>σ</th>
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<tbody>
<tr>
<td>Amplitude Uncertainty at 50 MHz [dB]</td>
<td>0.1 0.06</td>
</tr>
<tr>
<td>Frequency Response at 10 dB Attenuation [dB]</td>
<td>0.4 0.23</td>
</tr>
<tr>
<td>Frequency Response from Attenuator Switching [dB]</td>
<td>0.2 0.12</td>
</tr>
<tr>
<td>Reference Level Switching Uncertainty with Attenuator Changes [dB]</td>
<td>0.25 0.14</td>
</tr>
<tr>
<td>RBW Switching Uncertainty [dB]</td>
<td>0.15 0.09</td>
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<tr>
<td>Log Fidelity [dB]</td>
<td>0.07 0.04</td>
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<tr>
<td>VSWR 1.5 Error (DUT VSWR 1.2)</td>
<td>0.15 0.11</td>
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<tr>
<td>RSS Combined Error</td>
<td>0.33</td>
</tr>
<tr>
<td>95% Confidence Level for Combined Errors (Combined Errors x 1.96)</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Note 4
Mixer level = signal level minus attenuation

Note 5
RBW = 0.1 Hz, FFT mode, 0 dB attenuation, average detector

Note 6
Specifications apply to mixer level ≤–30 dBm for signals near 3186 MHz and ≤–50 dBm for signals near 4780 MHz

Note 7
For symbol rates ≥10 MHz, the carrier frequency must be >500 MHz

Note 8
Compared to 10 dB attenuator setting, for 20, 30, and 40 dB attenuator settings. For other attenuator settings:
≤3 GHz: <0.4 dB
>3 GHz: <0.65 dB

Note 9
Spurious performance for 30 MHz FFT span may be degraded when attenuation is set manually

Note 10
95% Confidence Amplitude Error Calculation, similar to note 3. However Power Bandwidth Uncertainty is included. Uses RMS detection and sufficient averaging to reduce the measurement variance (Swept Method only).

Note 11
The most significant contribution to ACPR uncertainty is the instruments measurement floor.

Note 12
0 dBm signal level, optimum reference level and attenuation settings. For OFDMA, Residual EVM measured over a 100 symbol 64 QAM, 1024 FFT, 10 MHz bandwidth, fully loaded PUSC segment with PN sequence data. For OFDM, Residual EVM measured over a 100 symbol 64 QAM PN packet.

Specification Conditions

The specifications presented are covered by the product warranty unless indicated as typical or nominal. Specifications apply under the following conditions unless otherwise noted:

- The analyzer has been calibrated within the specified Calibration Interval
- No error or warning messages
- Over the 0°C to 50°C operating range
- After a 30 minute warm up at ambient temperature
- At least 2 hours of storage or operation at the operating temperature
- Sweep Time Coupling = Accy for amplitude and frequency specifications

Typical specifications describe expected performance beyond the warranted values.

Characteristics or nominal specifications describe expected product performance as designed or performance that may not be measured in the manufacturing process.
Front Panel Inputs and Outputs

RF Input: Type-N Female, 50Ω, DC coupled
Probe Power: +15V ±7%/130 mA, –12.6V ±10%/45 mA
Touch Screen Display: Contact sensitive
Front Panel Keypad: Preset, Menu keys, Help key, Measurement key, Numerical entry pad, Entry/Knob, Increment/Decrement keys
Operate/Standby
CD R/W + DVD-ROM
USB: 2 ports Type A, Version 1.1
Headphone Jack: CD audio
Rear Panel Inputs and Outputs

Power Supply Input Voltage: 85-264 VAC; 47 to 63 Hz
AC Power Switch: Mains power switch
Wide Bandwidth Log Video Output: 2.5V nominal, full scale into 50Ω
75 MHz Wide Band IF Output:
  Frequency: 75 MHz nominal
  Level (–10 dBm @ 1st mixer): –11.5 dBm ±3 dB
  Bandwidth: >40 MHz
IF Input: Not Used
Reference Frequency (EXT REF) Input:
  Input Level: –6 dBm <Input signal <+10 dBm
  Frequency: Any frequency from 1 to 25 MHz with 1 MHz resolution and 1.544 or 2.048 MHz.
  (Derate SSB Phase Noise by 3 dB w/Ext Ref of 1.544 MHz)
Reference Frequency Output:
  Output Level: 8 dBm ±3 dB
  Frequency:
    If external reference not used: 10 MHz
    If external reference used: Same as external reference frequency
Sweep Output: Not used
Sweep Status Output: TTL, active low when sweeping
External Trigger Input: BNC (±10 V nominal, into 10 kΩ)
Noise Source Power: 28 VDC (switchable), >60 mA available current
GPIB: See Option 3 description
Ethernet: 10BASE-T, 100BASE-TX, 1000BASE-T
VGA Monitor Output: Matches instrument front panel display resolution
I and Q Inputs (Option 22): 50Ω or 1 MΩ, switchable unbalanced or differential,
  ±2.5V max (signal to ground or between differential inputs)
USB: Type A Port, Version 2.0
Keyboard: PS/2
Mouse: PS/2
Ordering Information

Models
MS2781B High Performance Signal Analyzer (100 Hz to 8 GHz)

Options
MS2780/1 Rack Mount Adapter, with slides
MS2780/1A Rack Mount Adapter, no slides
MS2780/3 GPIB Interface
MS2780/4 External Hard Disk Drive
MS2780/22 30 MHz Demodulation Bandwidth (includes baseband differential I & Q inputs)
MS2780/30 WCDMA and HSDPA/HSUPA Modulation Analysis
MS2780/38 QAM/PSK Modulation Analysis
MS2780/40 Connectivity to MATLAB
MS2780/41 WiMAX Modulation Analysis supports 802.16d/e with compliance to WiBro (requires Option 22)
MS2780/52 Phase Noise Measurements
Es50MMD Extends warranty to 5 years
MS2780/98 Z540/ISO Guide 25 Calibration
MS2780/99 Premium Calibration

Included Accessories
Power Cord, Operating and Programming Manual (printed and CD-ROM), Restore software CD set, USB Optical Mouse, Blank CD R/W disc, Spare Fuse

Option Requirements
Option 1 Not Option 1A
Option 1A Not Option 1
Option 3 None
Option 4 None
Option 22 None
Option 30 None
Option 38 None
Option 40 None
Option 41 Option 22 (30 MHz Demodulation Bandwidth)
Option 52 None
Option 98 Not Option 99 (Option 99 includes Option 98)
Option 99 Not Option 98 (Option 99 includes Option 98)

Optional Accessories
10410-00273 Additional printed Operation Manual
10410-00274 Additional printed Programming Manual
10410-00275 Signature Maintenance Manual
1N50B Limiter/DC Block, N(m), to N(f), 50Ω, 1 MHz to 3 GHz.
1N50C Limiter, N(m) to N(f), 50Ω, 10 MHz to 18 GHz
42N50A-30 30 dB Attenuator, 50 Watt N(m) to N(f)
12N50-75B 75W Matching Pad, DC to 3 GHz, 50Ω N(m) to 75Ω N(f)
11N50B Power Divider, 1 MHz to 3 GHz, 50Ω, N(f) input, N(f) output
2100-1 GPIB Cable 1M
2100-2 GPIB Cable 2M

1N50B Limiter, N(m) to N(f), 50Ω, 10 MHz to 18 GHz
42N50A-30 30 dB Attenuator, 50 Watt N(m) to N(f)
12N50-75B 75W Matching Pad, DC to 3 GHz, 50Ω N(m) to 75Ω N(f)
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