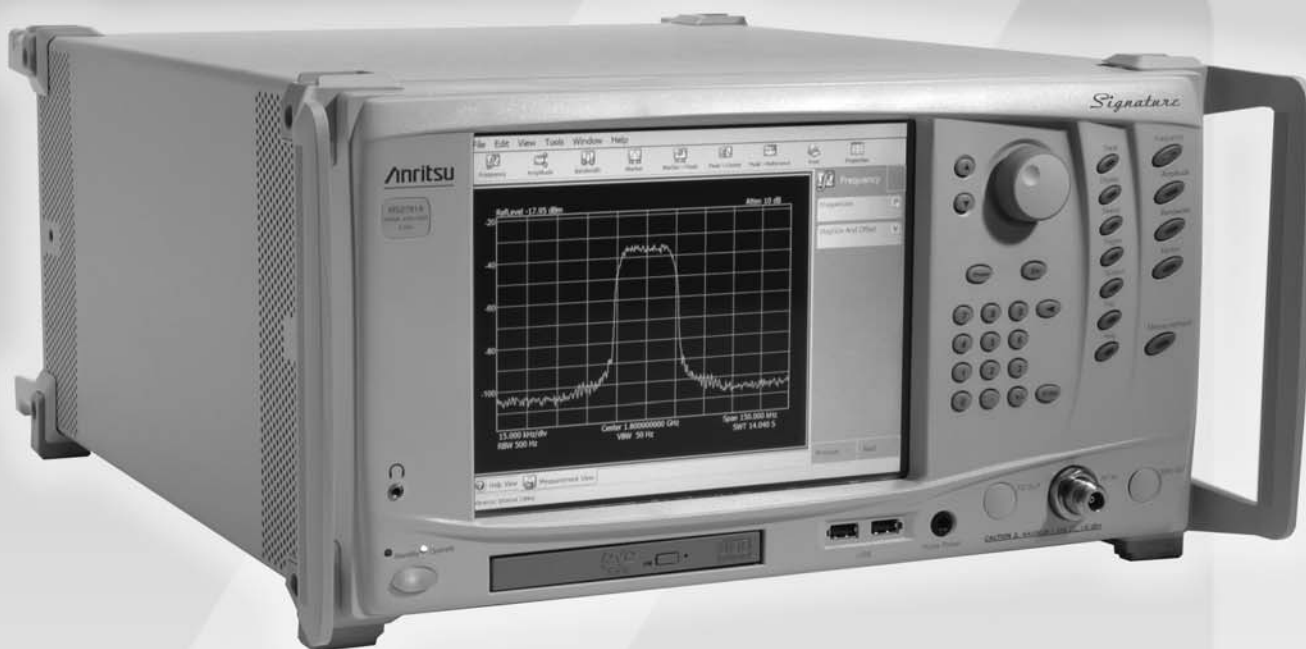


*Signature*TM

High Performance Signal Analyzer

100 Hz to 8 GHz



MS2781A Spectrum Analysis and Vector Signal Analysis with Bandwidths to 30 MHz

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.

8 MHz Spectrum Analyzer Resolution Bandwidths

Signature offers standard resolution bandwidths from 0.1 Hz to 8 MHz. Four conversions are used to achieve a typical displayed dynamic range of 120 dB.

Option 22, 30 MHz IF Bandwidth

Option 22, 30 MHz IF Bandwidth, extends single FFT spectrum and I-Q vector measurements to 30 MHz and enables vector signal analysis capability (Option 38). Baseband differential I & Q inputs are also added. Option 22 can operate with the anti-aliasing filter removed to allow demodulation of 50 MHz bandwidth signals.

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 with SCPI commands via GPIB and Ethernet interfaces. In addition, IVI drivers provide familiar spectrum analyzer function calls. Finally, Signature supports Web Services, greatly simplifying the task of programming.

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 Industry-Leading Simulation Tools

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.

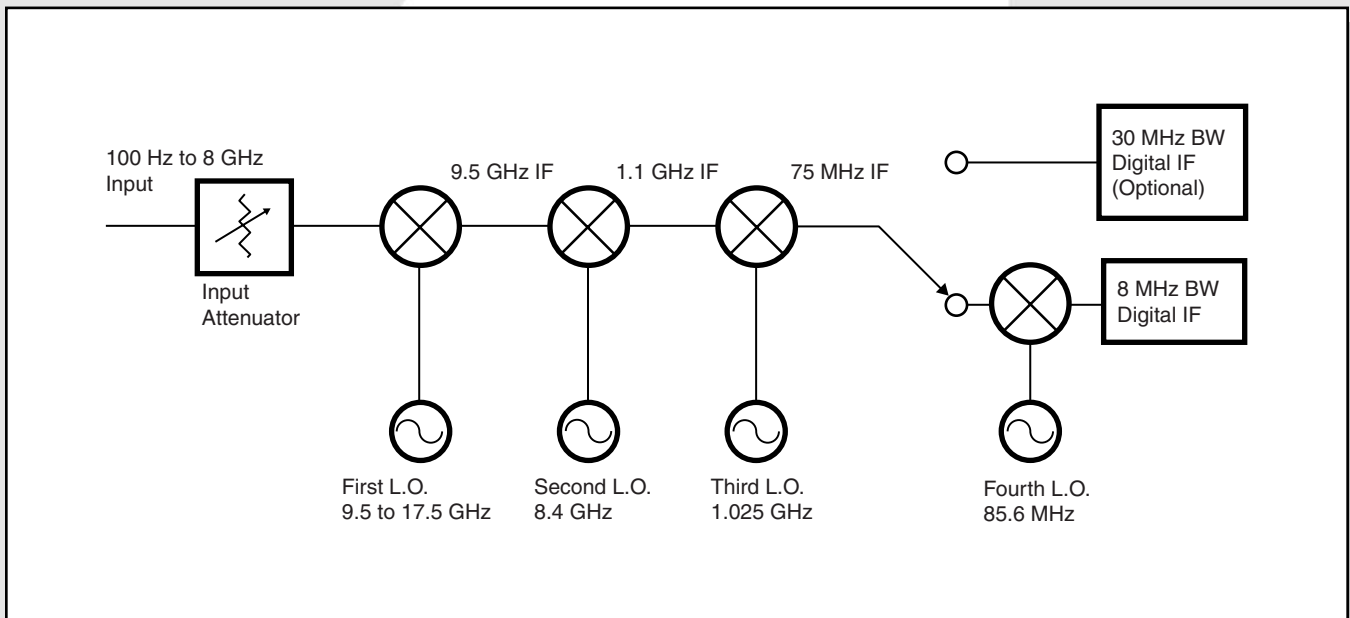


Figure 1, Signature RF block diagram (L.O. frequencies are nominal values)

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: 0.3% of span
1% for >33 MHz spans & sweep time <0.5 s/GHz (note 1)

Frequency Readout Accuracy:
 \pm marker freq * reference accuracy + span accuracy +
5% * 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%

Power Bandwidth Accuracy:

10 Hz to 2 MHz: 2%

3 MHz and 5 MHz: 5%

Modulation Analysis Bandwidth (With Option 22):

30 MHz (50 MHz nominal, without anti-aliasing filter) (note 2)

FFT

FFT RBWs: 0.1 Hz to 100 kHz (1,2,3,5)

Maximum Span for Single FFT:

Standard: 5 MHz

With Option 22: 30 MHz

With Option 22 and Anti-Aliasing filter off (note 2): 50 MHz

FFT Span/RBW: 10 to 1 M

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

SSB Phase Noise (dBc/Hz @ 1 GHz):

100 Hz Offset : <-80, -86 typical

1 kHz Offset: <-106

10 kHz Offset: <-114

100 kHz Offset: <-115

1 MHz Offset: <-136

5 MHz Offset: <-140

Residual FM: <1 Hz in 1 second, nominal

Reference Oscillator aging rate:

5×10^{-10} /day; 1×10^{-7} /year

Reference Oscillator temperature drift:

5×10^{-9} over 0 to 50°C

Amplitude Related Specifications

Intermodulation Distortion

Third-Order Intercept (TOI):

<100 MHz: >19 dBm

\geq 100 MHz: >23 dBm, >27 dBm typical

Second Harmonic Intercept: >40 dBm

1 dB Compression Point: >10 dBm

Noise

Displayed Average Noise Level (DANL) (note 7):

10 MHz to 2.5 GHz: <-147 dBm

2.5 GHz to 8 GHz: <-145 dBm

Noise Figure: <29 dB typical @ 1 GHz

Amplitude Uncertainty (20° to 30°C):

Amplitude Uncertainty at 50 MHz (note 3): <0.1 dB

Frequency Response at 10 dB Attenuation: <0.4 dB

Frequency Response from Attenuator Switching:

\leq 3 GHz: <0.2 dB

>3 GHz: <0.3 dB

Additional Frequency Response in FFT mode: <0.1 dB

Reference Level Switching Uncertainty:

Without Attenuator Changes: 0.1 dB

With Attenuator Changes: 0.2 dB

RBW Switching Uncertainty (RBW \leq 3 MHz): <0.1 dB

Log Fidelity (<-10 dBm mixer level [note 5],

0 to 80 dB below reference level, signal to noise >25 dB):

<0.07 dB

VSWR (>10 dB attenuation):

\leq 3 GHz: <1.2

>3 GHz: <1.5

Combined Amplitude Accuracy

(95% confidence, note 4): <0.65 dB

Ranges

Reference Level Range:

-150 to +30 dBm in 0.01 dB steps

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

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

Displayed Dynamic Range: 120 dB typical

Spurious

Spurious Responses (-10 dBm mixer level):

f <200 kHz from carrier, -73 dBc

f \geq 200 kHz from carrier, -80 dBc, -95 dBc typical

Residual Responses (\geq 10 MHz): <-100 dBm

Image Rejection: <-85 dBc, <-100 dBc typical

IF Rejection: <-90 dBc, <-100 dBc typical

Other Amplitude Related

Calibrator Frequency: 50 MHz, internal connection

Amplitude Axis Units: dBm, dBmV, dB μ V, Volts, Watts

Sweep Related Characteristics

Trigger Source(s): Free run, Line, External ($\pm 10V @ 10 k\Omega$), Video, Wideband IF power

Frequency Domain Sweep Time:

Span ≤ 4 GHz: 8 ms to 10000 seconds

Span > 4 GHz: 16 ms to 10000 seconds

Time Domain (Zero Span) Sweep Time:

1 μ sec to 10000 seconds

Sweep Time Accuracy:

Span = 0 Hz: 0.1%

Span > 0 Hz (Swept): 1%

Display Related

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 data in CSV format for external processing. Additional math available using MATLAB from The Mathworks. See the MATLAB connectivity option (40) for more details.

Marker Related Characteristics

Limits: Segmented limit line, with Pass/Fail indication

Markers: Normal, Counted, Delta, Display Line

Marker Frequency Resolution:

Normal: 0.2% of span

Counted: 1 Hz

Marker Amplitude Resolution: 0.01 dB

Marker Functions: Marker to peak, marker to center, marker to reference level

Peak Functions: Peak to center, peak to reference level

"Smart" Signal Analyzer Measurements

Channel Power:

Standards Measured: W-CDMA, user defined

Uncertainty for W-CDMA: ± 0.68 dB, typical

Adjacent Channel Power Ratio (ACPR):

Standards Measured: W-CDMA, user defined

Offsets Measured: Up to 6

Dynamic Range (typical, note 6):

WCDMA, 5 MHz Offset: -80 dB

WCDMA, 10 MHz Offset: -82 dB

Uncertainty, WCDMA: < 0.5 dB (ACPR < 60 dB, typical)

Occupied Bandwidth:

Frequency Accuracy: \pm Span/500 Nominal

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

Internal PC Functionality

Interfaces: USB (1.1), Ethernet (10BASE-T/100BASE-TX), VGA, Parallel printer

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

Internal Hard Disk Drive: > 20 GB

"Restore" partition on internal Hard Disk Drive

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

GPIB Interface (Option 3)

SH1, AH1, T6, SR1, RL1, PP0, DC1, C0/C1 switchable

30 MHz IF Bandwidth (Option 22)

Complex modulated signals with up to 30 MHz bandwidth can be captured and analyzed (50 MHz without anti-aliasing filter) (note 2). Also includes baseband differential I & Q inputs. Option 22 must be factory installed and calibrated.

Max Single-FFT Span:

30 MHz, 50 MHz without anti-aliasing filter

Modulation Analysis BW:

30 MHz, 50 MHz without anti-aliasing filter

I-Q Inputs: 30 MHz combined BW

QAM/PSK Modulation Analysis (Option 38, Requires Option 22)

Modulation Analysis BW:

30 MHz (50 MHz without anti-aliasing filter) (note 2)

Symbol Rate Range: 10 kS/s to 20 MS/s

Modulation Formats: QPSK, $\pi/4$ DQPSK, 8 PSK, $3\pi/8$ - 8PSK, 16 QAM, 64 QAM

Filtering: Root-raised-cosine, $\alpha=0.1$ to 1

EVM: 1% < 10 MS/s; 2% 10 to 20 MS/s

MATLAB Connectivity (Option 40)

Allows seamless transfer of Signature measurements and setup information into the MATLAB workspace. Simulink can access this information via the "To Workspace" and "From Workspace" blocks.

Allows viewing of MATLAB, superimposed on the Signature measurement display. A numeric or text display is also available in the Signature environment for displaying MATLAB results. MATLAB results may be set to automatically update with current measurements. MATLAB must be purchased from The MathWorks (www.mathworks.com).

Signature measurements transferred to MATLAB

Traces

Markers

"Smart" Measurement results

IQ vectors

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: < 32 kg (70 lbs)

Dimensions: 242 H x 432 W x 508 mm D
(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 – 4kV CD, 8kV AD
- EN61000-4-3: 1997 – 3V/m
- EN61000-4-4: 1995 – 0.5kV SL, 1kV PL
- EN61000-4-5: 1995 – 0.5kV DM, 1kV CM
- EN61000-4-6: 1996 – 3V
- EN61000-4-11: 1994 – 100%/1 cycle

Safety: Meets safety requirements of Low Voltage/Safety Standard 72/73/EEC – EN61010-1: 2001

Notes to Specifications

Note 1

For swept spectrum measurements

Note 2

Frequency range for operation of option 22 without anti-aliasing filter is limited to 250 MHz to 8 GHz

Note 3

50 MHz, 0 dBm input, Source VSWR <1.1, 10 dB input attenuation, 10 kHz RBW, +1 dBm reference level

Note 4

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.

	Error Specification (dB)	σ
Amplitude Uncertainty at 50 MHz [dB]	0.1	0.06
Frequency Response at 10 dB Attenuation [dB]	0.4	0.23
Frequency Response from Attenuator Switching [dB]	0.3	0.17
Reference Level Switching Uncertainty with Attenuator Changes [dB]	0.2	0.12
RBW Switching Uncertainty [dB]	0.1	0.06
Log Fidelity [dB]	0.07	0.04
VSWR 1.3 Error (DUT VSWR 1.2)	0.1	0.07
RSS Combined Errors		0.33
95% Confidence Level for Combined Errors (Combined Errors * 1.96)		0.65

Note 5

Mixer level = signal level minus attenuation

Note 6

Swept, with noise compensation on, (ref document 3GPP TS 25.141, test model 1, 2.14 GHz)

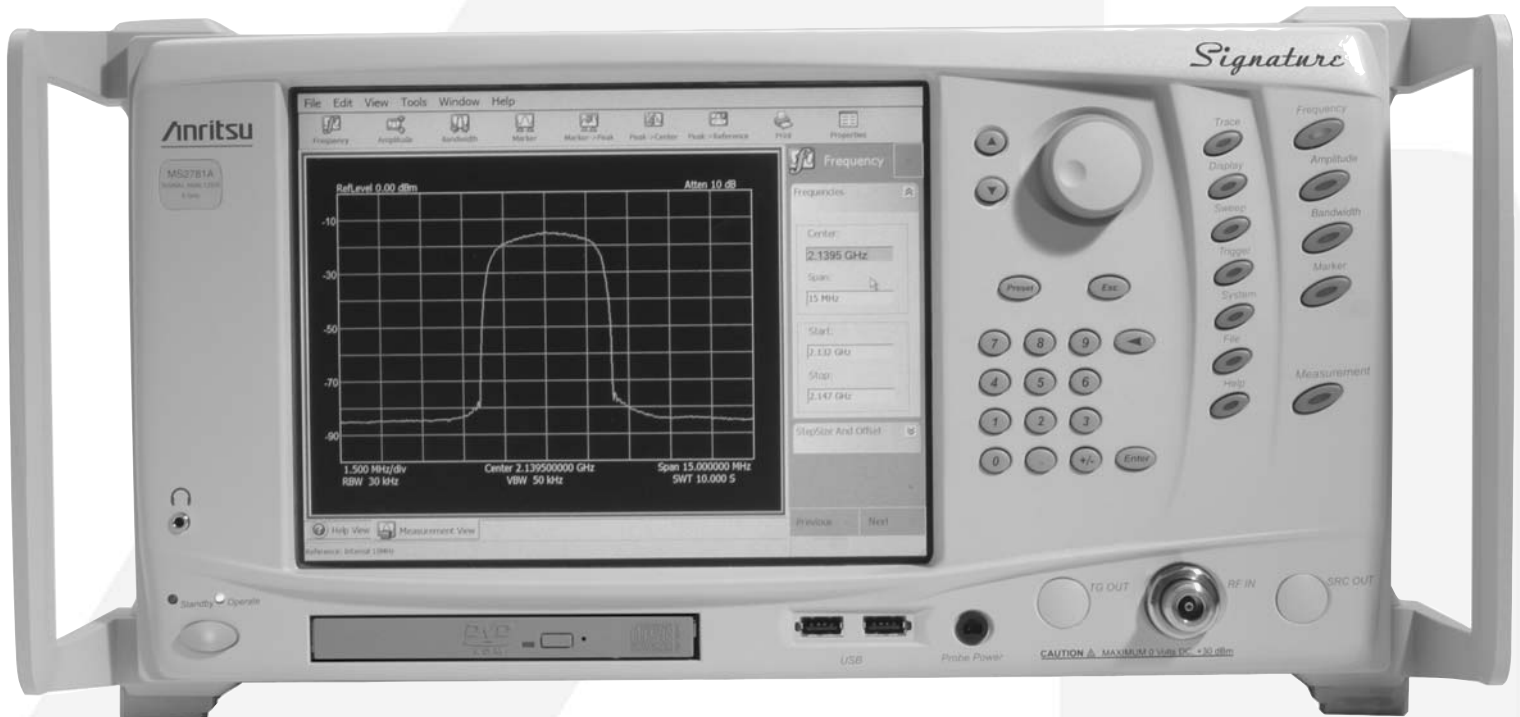
Note 7

RBW = 1 Hz, FFT mode, 0 dB attenuation, average detector

Specification Conditions

The specifications presented are covered by the product warranty unless indicated as typical or nominal. Specifications apply over the 0° to 50°C operating range, and after a 30 minute warm up at ambient temperature, unless otherwise noted. 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



Front Panel View

RF Input: Type-N Female, 50 Ω

Probe Power: +15V \pm 7%/130 mA, -12.6V \pm 10%/45 mA

Touch Screen Display: Contact sensitive

Front Panel Keypad:

Preset, Menu keys, Help key, Automatic Measurement key,
Numerical entry pad, Entry/Knob, Increment/decrement keys

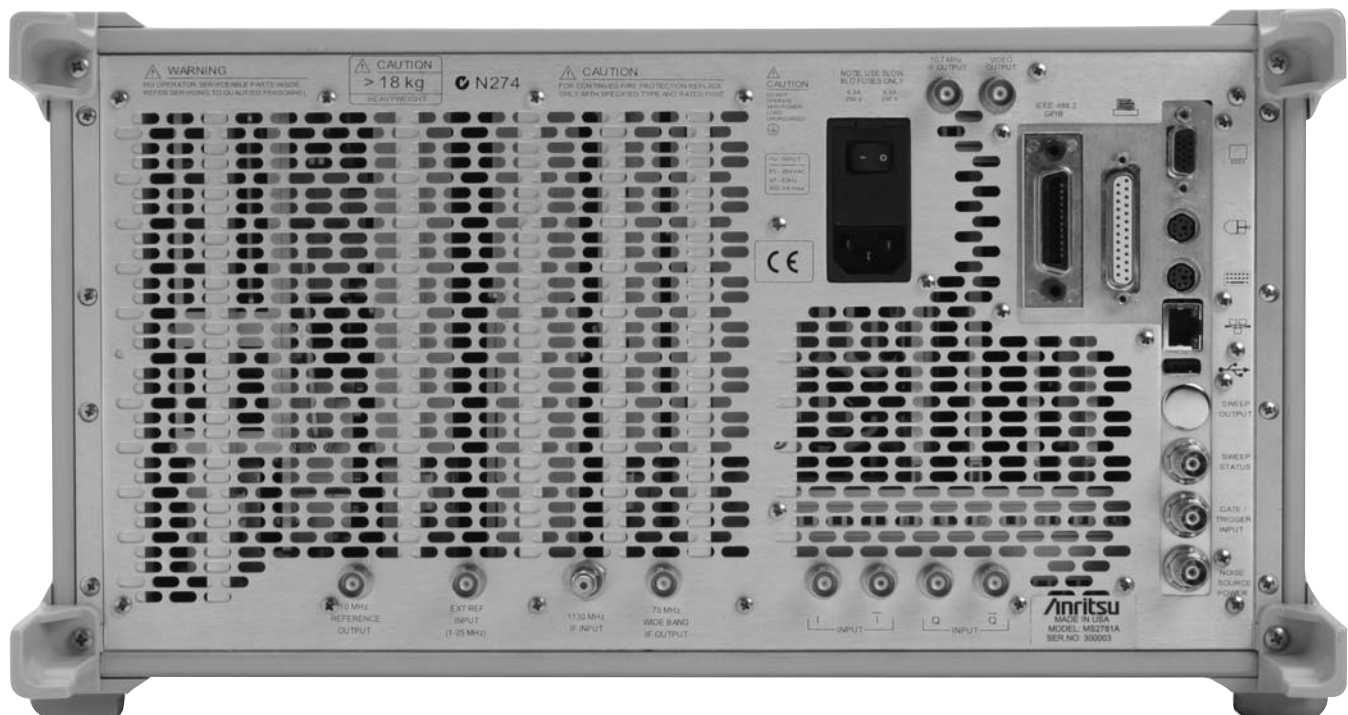
Operate/Standby

CD R/W + DVD-ROM

USB: 2 ports Type A, Version 1.1

Headphone Jack: CD audio

Rear Panel Inputs and Outputs



Rear Panel View

Power Supply Input Voltage: 85-264 VAC; 47 to 63 Hz

AC Power Switch: Mains power switch

Wide Bandwidth Log Video Output:

0 to 2 V \pm 0.1V into 50 Ω

IF Output #1:

Frequency: 75 MHz nominal

Level (-10 dBm @ 1st mixer): -8 dBm \pm 3 dB

BW: >40 MHz, >120 MHz without image reject filter

IF Output #2

Frequency: 10.7 MHz

Level (-10 dBm @ 1st mixer): -8 dBm \pm 3 dB

BW: varies with RBW, 3 kHz min, 8 MHz max

IF Input: Not used

Reference Frequency 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 \pm 3 dB

Frequency:

If external reference not used: 10 MHz

If external reference used:

Same as external reference frequency

Sweep Status Output: TTL, active low when sweeping

GPIB: See option description

Ethernet: 10BASE-T, 100BASE-TX

External Trigger Input: BNC

VGA Monitor Output:

Matches instrument front panel display resolution

I and Q inputs (Option 22): 50 Ω or 1 M Ω , switchable unbalanced or differential, 1 volt max

Sweep Output: Not used

USB: Type A plug, Version 1.1

Keyboard: PS2

Mouse: PS2

Parallel Printer Port: ECP

Noise Source Power: +28 V / 100 mA; Software Enabled

Ordering Information

Models

MS2781A High Performance Signal Analyzer (100 Hz to 8 GHz)

Options

MS2780/1	Rack Mount Adapter
MS2780/1A	Slide Mount Adapter
MS2780/3	GPIB Interface
MS2780/22	30 MHz IF Bandwidth (includes baseband differential I & Q inputs)
MS2780/38	QAM/PSK modulation analysis (requires Option 22)
MS2780/40	MATLAB Connectivity
Es50MMD	Extends warranty to 5 years
MS2780/98	Z540/ISO Guide 25 Calibration
MS2780/99	Premium Calibration

Included Accessories

Power Cord, Operating Manual on CD-ROM,
Restore software DVD-ROM, USB Optical Mouse,
Blank CD R/W disc, Spare Fuse

Optional Accessories

10410-00252	Signature Operation Manual
10410-00253	Signature Programming Manual
10410-00256	Signature Maintenance Manual
1N50B	Limiter/DC Block, N(m), to N(f), 50 Ω , 1 MHz to 3 GHz.
1N50C	Limiter, N(m) to N(f), 50 Ω , 10 MHz to 18 GHz
42N50A-30	30 dB Attenuator, 50 Watt N(m) to N(f)
12N50-75B	75 Ω Matching Pad, DC to 3 GHz, 50 Ω N(m) to 75 Ω N(f)
11N50B	Power Divider, 1 MHz to 3 GHz, 50 Ω , N(f) input, N(f) output
2100-1	GPIB Cable 1M
2100-2	GPIB Cable 2M
70-28	Headset

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South America 55 (21) 2527-6922	Asia-Pacific (65) 6282-2400

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