Agilent
N4010A Wireless Connectivity Test Set and N4011A MIMO/Multi-port Adapter

Data Sheet

N4010A Introduction

The Agilent N4010A Wireless Connectivity Test Set is a measurement solution that enables efficient and lower cost test for products and components that incorporate *Bluetooth*® wireless technology, Wireless LAN (WLAN), and other emerging wireless connectivity technologies.

The *Bluetooth* (N4010A Option 101) feature set provides the ability to connect to *Bluetooth* version 1.1 and 1.2 devices in either test mode or normal mode, and make measurements in accordance with the *Bluetooth* RF test specification. *Bluetooth* EDR link plus measurements (Option 107) add BTv2.0+EDR support and Enhanced Data Rate (EDR) measurement capabilities.

Bluetooth audio generation and analysis (Option 113), simplifies *Bluetooth* audio test configurations and provides cost-effective functional test of *Bluetooth* audio devices by performing a basic set of audio measurements. Headset profile (Option 112) enables testing of *Bluetooth* voice channels, audio gateway, and headset products.

The N4017A *Bluetooth*® Graphical Measurement Application, a PC-based software product, works in a complementary manner with the N4010A test set and provides the ability to fully configure the test set and display both numerical and graphical results.

The Wireless LAN feature set (N4010A Option 102/102) combines a fully-calibrated vector signal generator and wide bandwidth signal analyzer into a single test set, which enables efficient and repeatable WLAN module test from R&D through to production. N4010A Option 108 provides the software license for the 802.11n MIMO modulation analysis measurements within the test set.

The N4010A test set also works with the Agilent 89601A and 89607A Vector Signal Analyzer software. This software provides the flexibility to make a broad range of measurements for evaluating wireless formats in the 2.4 GHz or 5 GHz band, including ZigBee/IEEE 802.15.4.

The test set will meet its warranted performance after one hour within the stated environmental operating range plus 40 minutes after turn on. Unless otherwise stated, all specifications are valid over the temperature range 20 to 30 °C. Supplemental characteristics are intended to provide additional information, useful in applying the instrument by giving typical (expected), but not warranted, performance parameters. These characteristics are shown in italics or labeled as nominal.

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Bluetooth Specifications

N4010A Option 101 *Bluetooth*

- provides ability to act as a Bluetooth master, perform inquiry, and establish a connection in test mode or normal mode
- makes measurements in accordance with Bluetooth RF Test Specification 1.2
- integral sequencer allows test plans to be created and edited easily
- all tests default to SIG standard settings – user may change settings to match particular test requirements

Bluetooth tests[1]

Output power

Link conditions	
Link mode	Test mode (loopback, Tx), normal mode (ACL, SCO)
Hopping[2]	On or off
Packet type[2]	DH1, DH3, DH5, HV3
Payload[2]	PRBS9, BSOO, BSFF, BSOF, BS55
Measurement	
Supported measurements	Average power, peak power
Number of measurement channels[3]	3
Range	+23 to –70 dBm
Measurement resolution	0.01 dB
Measurement accuracy	±0.5 dB

Power control

Link conditions	
Link mode	Test mode (loopback, Tx)
Hopping	On or off
Packet type	DH1, DH3, DH5, HV3
Payload	PRBS9, BSOO, BSFF, BSOF, BS55
Measurement	
Supported measurements	Average power, min/max step size
Number of measurement channels[3]	3
Range	+23 to –70 dBm
Measurement resolution	0.01 dB
Measurement accuracy	±0.5 dB

Modulation characteristics

Link conditions	
Link mode	Test mode (loopback, Tx), normal mode (ACL, SCO)
Hopping[2]	On or off
Packet type[2]	DH1, DH3, DH5, HV3
Payload[2]	BS55, BSOF
Measurement	
Supported measurements	Min/max $\Delta f1_{avg}$, min $\Delta f2_{max}$(kHz), total $\Delta f2_{max} > \Delta f2_{max}$ lower limit (%) min of min $\Delta f2_{avg}$ / max $\Delta f1_{avg}$, pseudo frequency deviation ($\Delta f1$ and $\Delta f2$) in normal mode
Number of measurement channels[3]	3
RF input level range	+23 to –70 dBm
Deviation range	–400 to +400 kHz
Deviation resolution	100 Hz
Ratio resolution	0.1%
Measurement accuracy[4]	As frequency reference ±100 Hz

[1] Performance of the N4010A signal source or signal analyzer over wider temperature (specified later in this document) applies to all *Bluetooth* tests listed.

[2] Normal mode measurements made with hopping on, NULL packet, and no payload.

[3] Internal sequencer enables three measurement channels to be measured consecutively. Measurements on all 79 *Bluetooth* channels are supported.

[4] Example, using the 10 MHz reference with accuracy of 10 Hz (1 ppm), at frequency of 2.402 GHz, frequency accuracy would be in the range of ±((2.402 GHz x 10 Hz)/ 10 MHz)± 100 Hz = ±2402 Hz ± 100 Hz = ±2502 Hz

Initial carrier frequency tolerance

Link conditions	
Link mode	Test mode (loopback, Tx), normal mode (ACL)
Hopping[1]	On or off
Packet type[1]	DH1, DH3, DH5, HV3
Payload[1]	PRBS9, BSOO, BSFF, BSOF, BS55
Measurement	
Supported measurements	Maximum and minimum error/channel
Number of measurement channels[2]	3
RF input level range	+23 to –70 dBm
Frequency	Nominal channel freq ±150 kHz
Measurement accuracy[3]	As frequency reference ±100 Hz

Carrier frequency drift

Link conditions	
Link mode	Test mode (loopback, Tx), normal mode (ACL)
Hopping[1]	On or off
Packet type[1]	DH1, DH3, DH5, HV3
Payload[1]	PRBS9, BSOO, BSFF, BSOF, BS55
Measurement	
Supported measurements	Maximum and minimum measurements drift at each frequency during the test, pseudo frequency drift in normal mode
Number of measurement channels[2]	3
RF input level range	+23 to –70 dBm
Measurement range	±100 kHz
Measurement accuracy[3]	As frequency reference ±100 Hz

Sensitivity – single slot packets

Link conditions	
Link mode	Test mode (loopback, Tx), normal mode (ACL)
Hopping[1]	On or off
Packet type[1]	DH1, DH3, DH5
Payload[1]	PRBS9, BSOO, BSFF, BSOF, BS55
Number of bits	1 to 200,000,000
Impairments – default to table	
Frequency offset	±75 kHz
Modulation index	0.28 to 0.35
Modulation index resolution	0.01
Symbol timing	–20 ppm, 0, +20 ppm
Symbol timing resolution	1 ppm
Measurement	
Supported measurements	BER, number of bit errors, number of Rx bits, PER, number of NACK packets, number of errored packets, number of Tx packets. PER only in normal mode
Number of measurement channels[2]	3, hopping
Range	0 to –90 dBm
Resolution	0.1 dB
Accuracy[4,5]	±0.6 dB,–35 to –90 dBm, *±1 dB, > –35 dBm*

Sine impairments (applicable for single slot packets, multi-slot packets, and maximum input level)

Modulation frequency range	300 Hz to 1.6 kHz
Resolution	100 Hz
Maximum deviation range	0 Hz to 40 kHz
Resolution	1 kHz

'Dirty transmitter' impairments table for Rx sensitivity tests (applicable for single slot packets, multi-slot packets, and maximum input level)

Set of parameters	Carrier frequency offset (kHz)	Modulation index	Symbol timing error (ppm)
1	75	0.28	–20
2	14	0.30	–20
3	–2	0.29	+20
4	1	0.32	+20
5	39	0.33	+20
6	0	0.34	–20
7	–42	0.29	–20
8	74	0.31	–20
9	–19	0.28	–20
10	–75	0.35	+20

[1] Normal mode measurements made with hopping on, NULL packet, and no payload.
[2] Internal sequencer enables three measurement channels to be measured consecutively. Measurements on all 70 *Bluetooth* channels are supported.
[3] Example, using the 10 MHz reference with accuracy of 10 Hz (1 ppm), at frequency of 2.402 GHz, frequency accuracy would be in the range ±((2.402 GHz x 10 Hz)/ 10 MHz) ± 100 Hz = ±2402 Hz ± 100 Hz = ±2502 Hz.
[4] Verified using CW measurements.
[5] Add 0.01 dB/°C from 30 to 55 °C, add 0.07 dB/°C from 20 to 0 °C.

Sensitivity – multi-slot packets

Link conditions	
Link mode	Test mode (loopback)
Hopping	On or off
Packet type	DH1, DH3, DH5
Payload	PRBS9, BSOO, BSFF, BSOF, BS55
Number of bits	1 to 200,000,000
Impairments – default to table	
Frequency offset	±75 kHz
Modulation index	0.28 to 0.35
Modulation index resolution	0.01
Symbol timing	–20 ppm, 0, +20 ppm
Symbol timing resolution	1 ppm
Measurement	
Supported measurements	BER, number of bit errors, number of Rx bits, PER, number of NACK packets, number of errored packets, number of Tx packets
Number of measurement channels[1]	3, hopping
Range	0 to –91 dBm
Resolution	0.1 dB
Accuracy[2,3]	±0.6 dB,–35 to –90 dBm, *±1 dB, > –35 dBm*

Maximum input level

Link conditions	
Link mode	Test mode (loopback)
Hopping	On or off
Packet type	DH1, DH3, DH5
Payload	PRBS9, BSOO, BSFF, BSOF, BS55
Number of bits	1 to 200,000,000
Measurement	
Supported measurements	BER, number of bit errors, number of Rx bits, PER, number of NACK packets, number of errored packets, number of Tx packets
Number of measurement channels[1]	3
Range	0 to –90 dBm
Resolution	0.1 dB
Accuracy[2,3]	±0.6 dB,–35 to –90 dBm, *±1 dB, > –35 dBm*

[1] Internal sequencer enables three measurements channels to be measured consecutively. Measurements on all 79 *Bluetooth* channels are supported.
[2] Verified using CW measurements
[3] Add 0.01 dB/°C from 30 to 55 °C, add 0.07 dB/°C from 20 to 0 °C.

N4010A Option 107 *Bluetooth* EDR link plus measurements

Bluetooth EDR transmitter tests

EDR relative transmit power

Link conditions

Link mode	Test mode (loopback, Tx)
Hopping	On or off
Payload	PRBS9, BSOO, BSFF, BS55
Packet type	2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5

Measurement

Supported measurements	Power in GFSK header, power in PSK payload, relative power between GFSK header to PSK payload
Number of measurement channels[1]	3, hopping
Range	+23 to –70 dBm
Resolution	0.01 dB
Accuracy[2]	±0.5 dB

EDR modulation accuracy and carrier frequency stability

Link conditions

Link mode	Test mode (loopback, Tx)
Hopping	On or off
Payload	PRBS9, BSOO, BSFF, BS55
Packet type	2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5

Measurement

Supported measurements	Worst case initial frequency error (ω_i) for all packets (carrier frequency stability), worst case frequency error for all blocks (ω_o), ($\omega_o + \omega_i$) for all blocks, rms DEVM, peak DEVM, 99% DEVM
Number of measurement channels[1]	3, hopping
Range	+23 to –70 dBm
Resolution	±100 Hz carrier frequency stability and frequency error

Accuracy

Modulation accuracy	
N4010A receiver rms DEVM	*< 2% (nominal)*
N4010A source rms DEVM	*< 5% (nominal)*
Carrier frequency stability and frequency error[3]	As frequency reference ±100 Hz

[1] Internal sequencer enables three measurement channels to be measured consecutively. Measurements on all 79 *Bluetooth* channels are supported.

[2] Example, using the 10 MHz reference with accuracy of 10 Hz (1 ppm), at frequency of 2.402 GHz, frequency accuracy would be in the range ±((2.402 GHz x 10 Hz)/ 10 MHz) ± 25 Hz = ±2402 Hz ± 25 Hz = ±2427 Hz

EDR differential phase encoding

Link conditions

Link mode	Test mode (Tx)
Hopping	On or off
Payload	PRBS9, BSOO, BSFF, BS55
Packet type	2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5

Measurement

Supported measurements	BER, number of bit errors, number of Rx bits, PER, number of NACK packets, number of errored packets, number of Tx packets, number of HEC, CRC, and NACK error
Number of measurement channels[1]	3, hopping
RF input level range	+23 to –70 dBm

Guard interval measurement

Link conditions

Link mode	Test mode (loopback, Tx)
Hopping	On or off
Payload	PRBS9, BSOO, BSFF, BS55
Packet type	2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5

Measurement

Supported measurements	Average, maximum, and minimum guard time
Number of measurement channels[1]	3, hopping
RF input level range	+23 to –70 dBm
Resolution	0.1 µs

[3] Example, using the 10 MHz reference with accuracy of 10 Hz (1 ppm), at frequency of 2.402 GHz, frequency accuracy would be in the range ±((2.402 GHz x 10 Hz)/ 10 MHz) ± 100 Hz = ±2402 Hz ± 100 Hz = ±2502 Hz

Bluetooth EDR receiver tests

EDR Rx sensitivity

Link conditions

Link mode	Test mode (loopback)
Payload	PRBS9, BSOO, BSFF, BS55
Packet type	2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5
Number of bits	1 to 200,000,000

Impairments

Frequency offset	±100 kHz
Frequency offset resolution	1 kHz
Symbol timing	–30 to +30 ppm
Symbol timing resolution	1 ppm

"Dirty transmitter" impairments for EDR Rx sensitivity measurements

Set of parameters	Carrier offset frequency (kHz)	Symbol timing offset (ppm)
1	0	0
2	+65	+20
3	–65	–20

Sine impairments for EDR Rx sensitivity measurements

Modulation frequency range	300 Hz to 10 kHz
Resolution	100 Hz
Maximum deviation range	0 Hz to 40 kHz
Resolution	1 kHz

Measurement

Supported measurements	BER, number of bit errors, number of Rx bits, PER, number of NACK packets, number of errored packets, number of Tx packets, number of HEC, CRC, and NACK error
Number of measurement channels[1]	3, hopping
Range	0 to –90 dBm
Resolution	0.1 dB
Accuracy[2,3]	±0.6 dB, –35 to –90 dBm *±1 dB, > –35 dBm*

EDR Rx BER floor sensitivity

Link conditions

Link mode	Test mode (loopback)
Hopping	On or off
Payload	PRBS9, BSOO, BSFF, BS55
Packet type	2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5
Number of bits	1 to 200,000,000

Measurement

Supported measurements	BER, number of bit errors, number of Rx bits, PER, number of NACK packets, number of errored packets, number of Tx packets, number of HEC, CRC, and NACK error
Number of measurement channels[1]	3, hopping
Range	0 to –90 dBm
Resolution	0.1 dB
Accuracy[2,3]	±0.6 dB, –35 to –90 dBm *±1 dB, > –35 dBm*

EDR Rx maximum input level

Link conditions

Link mode	Test mode (loopback)
Hopping	On or off
Payload	PRBS9, BSOO, BSFF, BS55
Packet type	2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5
Number of bits	1 to 200,000,000

Measurement

Supported measurements	BER, number of bit errors, number of Rx bits, PER, number of NACK packets, number of errored packets, number of Tx packets, number of HEC, CRC, and NACK error
Number of measurement channels[1]	3, hopping
Range	0 to –90 dBm
Resolution	0.1 dB
Accuracy[2,3]	±0.6 dB, –35 to –90 dBm *±1 dB, > –35 dBm*

[1] Internal sequencer enables three measurement channels to be measured consecutively. Measurements on all 79 *Bluetooth* channels are supported.
[2] Verified using CW measurements
[3] Add 0.01 dB/°C from 30 to 55 °C, add 0.07 dB/°C from 20 to 0 °C

N4010A Option 101 and Option 107 signal source

The N4010A signal source is used in *Bluetooth* test cases described earlier in this document.

Frequency	
Range	2.402 to 2.480 GHz ; 79 channels at 1 MHz spacing
Accuracy[1]	As frequency reference ±25 Hz
Offset range	*±300 kHz*
Offset accuracy	±210 Hz, *±200 Hz typical*
Output power	
Range	0 to –90 dBm
Resolution	0.1 dB
Accuracy[2,3]	±0.6 dB, –35 to –90 dBm *±1 dB, > –35 dBm*
Output VSWR	*1.5:1*
Modulation	
In accordance with Bluetooth Radio specification version 2.0+EDR	
Type	GFSK, DQPSK, D8PSK
Modulation index range	0.28 to 0.35
Modulation index resolution	0.01
GFSK depth accuracy[4]	±0.5 kHz
DQPSK and D8PSK rms differential error vector magnitude (DEVM)	*< 5% (nominal)*
Baseband filter	To *Bluetooth* specification
Symbol timing	–20 to +20 ppm
Symbol timing resolution	1 ppm

N4010A Option 101 and Option 107 signal analyzer

The N4010A signal analyzer is used in *Bluetooth* test cases described earlier in this document.

Frequency	
Range	2.402 to 2.480 GHz ; 79 channels at 1 MHz spacing
Accuracy[2] (center frequency ±400 kHz)	As frequency reference ±100 Hz
Power measurement	
Range	+23 to –70 dBm
Damage level	+25 dBm
Resolution	0.01 dB
Accuracy[5]	±0.5 dB
Input VSWR	< 1.5:1
Modulation	
Type	GFSK, DQPSK, D8PSK
Deviation range	±400 kHz
Deviation resolution	0.1 kHz
Modulation depth	As frequency reference ±100 Hz
DQPSK and D8PSK rms differential error vector magnitude (DEVM) accuracy[6] accuracy[6]	*< 2% (nominal)*
Baseband filter bandwidth	1.3 MHz (compliant to *Bluetooth* specification), 3 or 5 MHz

[1] Example, using the 10 MHz reference with accuracy of 10 Hz (1 ppm), at frequency of 2.402 GHz, frequency accuracy would be in the range ±((2.402 GHz x 10 Hz)/ 10 MHz) ± 25 Hz = ±2402 Hz ± 25 Hz = ±2427 Hz.

[2] Verified using CW measurements.

[3] Add 0.01 dB/°C from 30 to 55 °C, add 0.07 dB/°C from 20 to 0 °C.

[4] Verified by interpolation to static frequency offset measurements.

[5] Add 0.02 dB/°C from 30 to 55 °C and 0.025 dB/°C from 20 to 0 °C.

[6] Example, using the 10 MHz reference with accuracy of 10 Hz (1 ppm), at frequency of 2.402 GHz, frequency accuracy would be in the range ±((2.402 GHz x 10 Hz)/10 MHz) ± 100 Hz = ±2402 Hz ± 10 Hz = 2502 Hz

N4010A Option 113 *Bluetooth* audio generation and analysis[1]

N4010A Option 113 simplifies *Bluetooth* audio test configurations and provides cost-effective functional test of *Bluetooth* audio devices by performing a basic set of audio measurements (level, SINAD, and THD+N).

Audio routing settings	Loopback, audio input/output, audio generator/analyzer
Audio generator	
Frequency	*125 Hz to 3.875 kHz, default of 1.0 kHz*
Frequency resolution	*125 Hz*
Level	*–75 to +3 dBm0, default –15 dBm0*
Level resolution	*1 dBm0*
Audio analyzer	
Range	*125 Hz to 3.875 kHz in 125 Hz steps*
Measurements	*SINAD (dB), total harmonic distortion + noise (%) frequency (Hz), level (dBm0)*
Frequency accuracy	*Accuracy as frequency reference, resolution 7.8125 Hz*
Measurement variation (at frequency 1.125 kHz, level –15 dBm0 and EUT in SCO loopback)[2,3]	
Level	*< ±0.2%*
Distortion + noise	*< ±1%*
SINAD	*< ±1 dB*
Number of averages	*1 to 100*

N4010A *Bluetooth* audio system performance and SINAD floor specification[2,3]

Number of SCO channels supported	*1*
CODEC air interfaces supported	*CVSD, A-law, µ-law*
Frequency response	*+0.6 to –1.0 dB (320 to 3200 Hz[4,5]* *See Figure 1 for CVSD frequency response*
Maximum input/output signal levels	*3.28 V pk-pk = 1.16 Vrms[5,6]* *For CVSD, recommend level < 138 mVrms[6]*
Distortion/noise (THD+N)	*Better than –52 dB (A-law, µ-law)* *Better than –35 dB (CVSD[5,6])* *See Figure 2 for CVSD distortion characteristics*
Variation of gain (–55 to +3 dBm, 225 to 2040 Hz)	*< 0.5 dB[5,6]*
Idle noise (200 Hz to 20 kHz)	*Better than –64 dBm*
SINAD floor for N4010A audio paths (at 1.125 kHz frequency and –15 dBm0 level)	*> 29 dB*
Out of band performance (4 to 32 kHz)	*Better than –30 dB (A-law, µ-law)* *Better than –42 dB (CVSD)*
Input/output connectors	*BNC input, BNC output*
Input impedance	*150 kΩ*
Output impedance	*50 kΩ (AC coupled)*
Minimum output load	*0 Ω (AC coupled, no damage caused by short)*

[1] Qualified in accordance to ITU specification G.711 [8], where 775 mVrms (0 dBm) analog sine wave input voltage is translated to 0 dBm0 digital CVSD transmit signal and 0 dBm0 sine wave CVSD receive signal is output as 775 mVrms (0 dBm) analog voltage. All audio characteristics are nominal.

[2] When using N010A audio frequencies which are multiples of 1 kHz, harmonic distortion components may cause variations in SINAD measurements. Frequency setting of 1.125 kHz is recommended for optimum internal audio/generator measurements.

[3] N4010A *Bluetooth* audio system performance (frequency response, distortion/noise, etc) will also contribute to the overall measurement performance of Option 113 audio analyzer. This also applies to the use of external audio analyzers/generators with the N4010A.

[4] For CVSD this performance only applies within the CVSD linear range.

[5] CVSD linear range is defined as signals of 320 to 3200 Hz and level < –15 dBm0 (138 mVrms analogue). Outside the CVSD linear range (e.g. signals of frequencies above 600 Hz with levels > –15 dBm0) the response rolls of due to the slew-rate limitations set by *Bluetooth's* CVSD algorithm parameters.

[6] CVSD distortion (THD+N) at 1020 Hz and level –15 dBm0 is better than 4 percent.

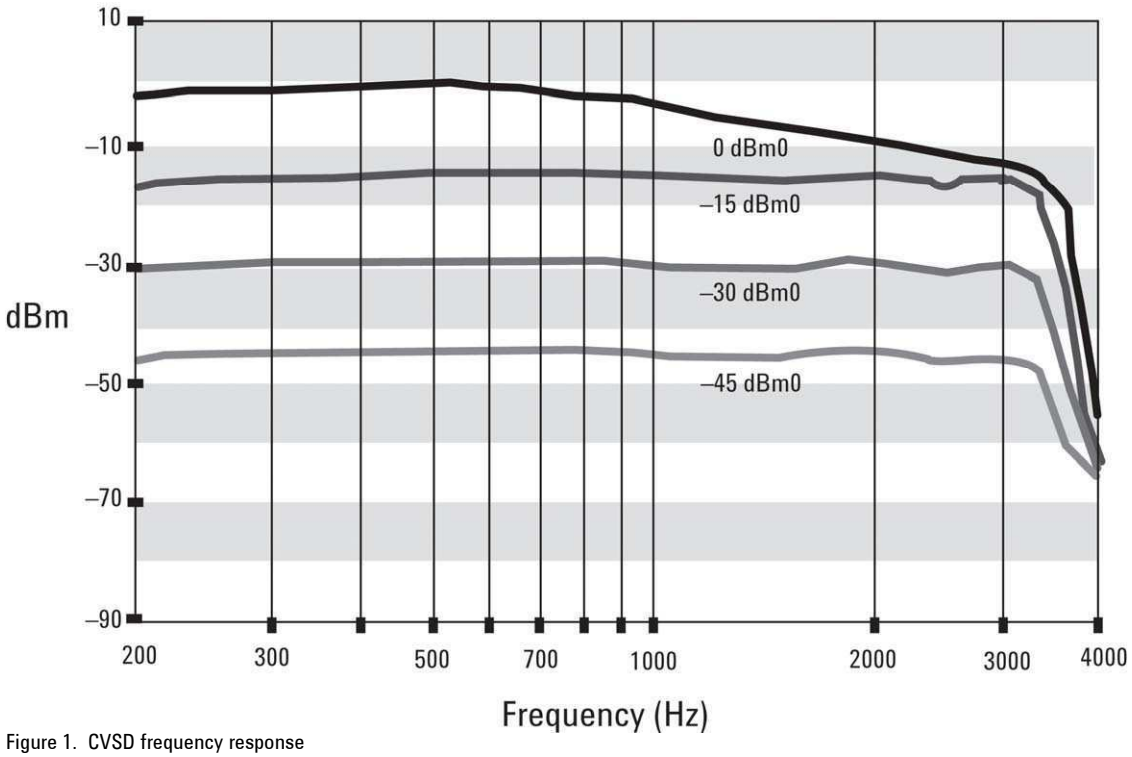

Figure 1. CVSD frequency response

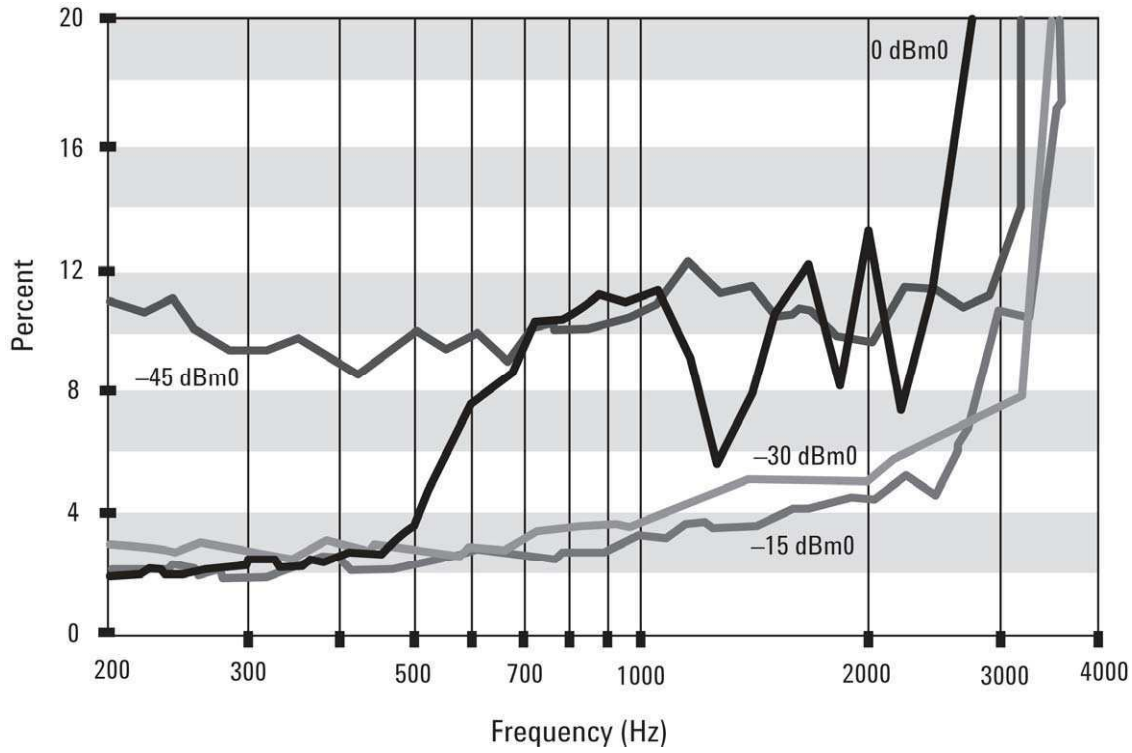

Figure 2a. CVSD distortion percentage characteristic

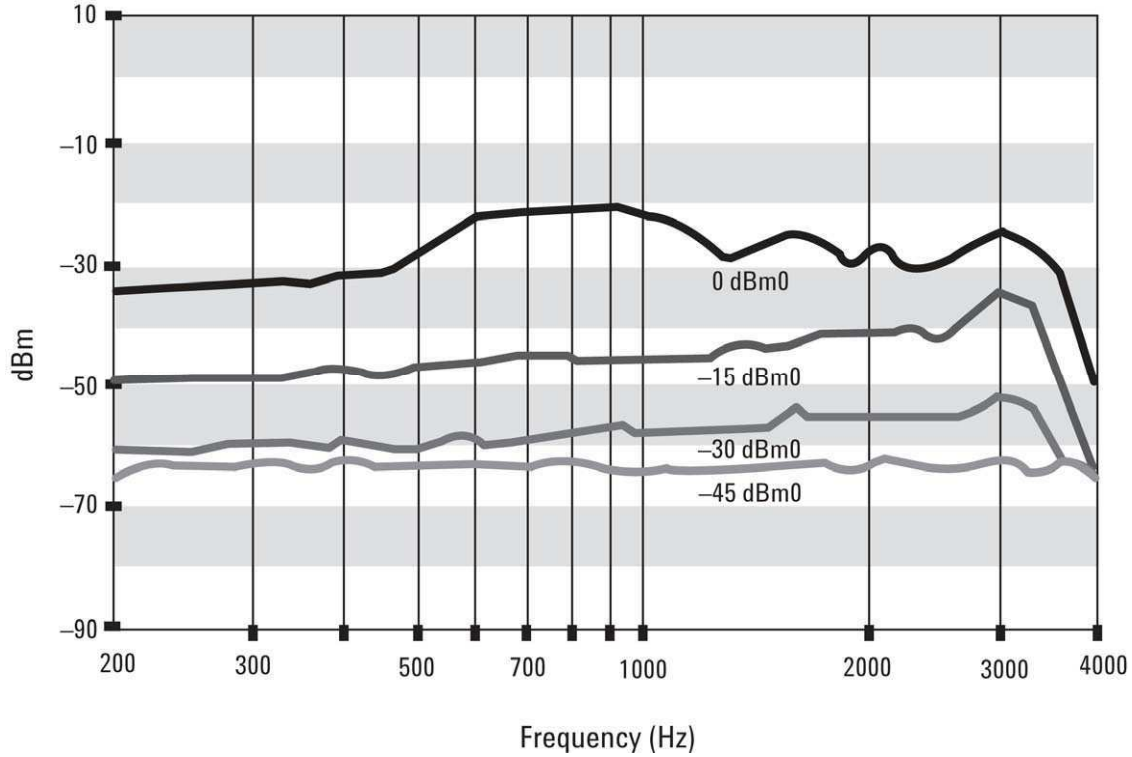

Figure 2b. CVSD distortion dBm characteristic

Wireless LAN specifications

N4010A Options 102/103 WLAN Tx/Rx analysis

Measurements

The table below shows the key measurements covered by the N4010A Options 102/103 and the 89607A WLAN test suite software. For further N4010A/89607A data, refer to the application note *Agilent N4010A Wireless Connectivity Test Set Performance Guide Using the 89601 Vector Signal Analysis Software and the 89607A WLAN Test Suite Software*, literature number 5989-0637EN.

Transmitter functionality	N4010A Options 102/103	89607A
Auto-range	Yes	Yes
CW		
Average power	Yes	No
CW frequency offset	Yes	No
Bursted OFDM		
Average power	Yes	Yes
Peak power	No	Yes
Center frequency tolerance	Yes (Frequency error)	Yes
Clock frequency tolerance	Yes	Yes
Constellation error (EVM)	Yes	Yes
Center frequency leakage	Yes	Yes
Spectral flatness	Yes	Yes
Spectral mask	Yes	Yes
Fast OFDM demodulation measurement		
EVM	Yes	No
Frequency error	Yes	No
IQ offset	Yes	No
Gated power	Yes	No
Gated spectrum	Yes	No
Bursted DSSS		
Average power	Yes	Yes
Peak power	No	Yes
Center frequency tolerance	Yes (Frequency error)	Yes
Chip clock frequency tolerance	Yes	Yes
Center frequency leakage	Yes (Carrier suppression)	Yes
Predicted suppression	Yes	Yes
EVM (RMS)	Yes	Yes
EVM (peak)	Yes	Yes
Power up ramp	Yes	Yes
Power down ramp	Yes	Yes
Spectral mask	Yes	Yes
Fast DSSS demodulation measurement		
EVM (peak)	Yes	No
EVM (RMS)	Yes	No
Frequency error	Yes	No
IQ offset	Yes	No
Gated power	Yes	No
Gated spectrum	Yes	No

Receiver functionality	N4010A Options 102/103	89607A
Standard DSSS waveform file	Yes	No
Standard DSSS sequence file	Yes	No
Standard OFDM waveform file	Yes	No
Standard OFDM sequence file	Yes	No
Blanking marker files	Yes	No
High power mode	Yes	No
CW tone	Yes	No
Sampling rate	Yes	No

N4010A vector signal generator specifications

The specifications apply to the N4010A with Options 102 or 103 installed. The vector signal generator is used in WLAN receiver tests described earlier in this document. N4010A-101 and 107 *Bluetooth* signal source specifications are different and are given in the *Bluetooth* section in this document.

Frequency range	2.402 to 2.484 GHz; 4.800 to 5.875 GHz (Option 103 only)
Frequency accuracy[1]	As frequency reference ±25 Hz[2]
Output power range	2.402 to 2.484 GHz: –10 to –95 dBm[1] 802.11b DSSS: *–8 dBm maximum (nominal)* 4.800 to 5.875 GHz: –15 to –95 dBm[1] 802.11a/g OFDM: *–13 dBm maximum (nominal)*
Absolute amplitude accuracy1	2.402 to 2.484 GHz: ±0.9 dB[3] (–10 to –90 dBm) *±0.6 dB[4] (–10 to –90 dBm)* *±0.9dB (> –90 to –95 dBm)* 4.800 to 5.875 GHz: ±0.9 dB[3] (–15 to –90 dBm) *±0.6 dB[4] (–15 to –90 dBm)* *±0.9 dB (> –90 to –95 dBm)*
Resolution	0.1 dB
Output impedance	50 Ω (nominal)
Modulation type	Arbitrary based on downloaded file
Arbitrary waveform memory	64 Msa (256 MB RAM; 1 sample = 4 bytes)
Error vector magnitude	802.11a: <2%[5] 802.11b: < 5%[5,6] 802.11g: < 2%[5] 802.11n: < 2%[5,7]

[1] Verified using CW measurements.

[2] Example, using the 10 MHz reference with accuracy of 10 Hz (1 ppm), at frequency of 2.402 GHz, frequency accuracy would be in the range ±((2.402 GHz x 10 Hz)/10 MHz) ±25 Hz = ±2402 Hz ±25Hz = ±2427 Hz.

[3] Add 0.013 dB/°C from 30 to 55 °C, add 0.02 dB/°C from 20 to 0 °C.

[4] Typical specification applies to instruments serial number GB4617 or greater, or instruments with the serial number starting MY.

[5] Up to 40 MHz bandwidth.

[6] Specification applies to instruments serial number GB4617 or greater, or instruments with the serial number starting MY; otherwise this specification is < 10%.

[7] Specification applies to instruments with Option 108.

N4010A vector signal analyzer specifications

When used with 89601A/89607A (requires Option 110 and at least one of Option 101, 102, or 103). For the full N4010A/89601A performance guide refer to application note *Agilent N4010A Wireless Connectivity Test Set Performance Guide Using the 89601A Vector Signal Analysis Software and the 89607A WLAN Test Suite Software*, literature number 5989-0637EN.

Performance

Sampling frequency	100 MHz digital down-conversion
Quantization	14 bits
Sampling resolution	10 ns
Acquisition buffer	5 ms

Frequency specifications

Frequency range[1]	2.381 to 2.519 GHz 4.800 to 5.875 GHz (Option 103 only)
Frequency resolution	1 MHz
Frequency accuracy[2]	As frequency reference ±50 Hz
IF bandwidth	Switchable between 22 and 40 MHz
Stability (noise sidebands) offset	*10 kHz: < –75 dBc/Hz (nominal)* *100 kHz: < –95 dBc/Hz (nominal)*

Amplitude specifications

Power measurement range	+23 to –70 dBm (2.381 to 2.519 GHz) +23 to –50 dBm (4.800 to 5.875 GHz)
Maximum safe input level	+25 dBm
Absolute power measurement accuracy[2]	±0.5 dB[3] (2.381 to 2.519 GHz) *±0.3 dB[4] (+23 to –55 dBm)* *±0.35[4] dB (< –55 dBm)* ±0.8 dB[3] (4.800 to 5.875 GHz) *±0.35 dB[4] (+23 to –55 dBm)*
RF input VSWR	< 1.5:1 (return loss: > 14 dB) (2.381 to 2.519 GHz) *< 1.8:1 (return loss: > 10 dB) (4.800 to 5.875 GHz)*
Signal-to-noise ratio[5,6]	*>52 dB for 22 MHz bandwidth (2.381 to 2.519 GHz)* *> 45 dB for 22 MHz bandwidth (4.800 to 5.875 GHz)*
Spurious responses	*< –90 dBm (2.381 to 2.519 GHz)*
In-band spurious[7]	*< –60 dBm (4.800 to 5.875 GHz)*
Trigger ranges	
Internal trigger power	*–60 to +23 dBm for 22 MHz bandwidth; –65 to +23 dBm for 5 MHz bandwidth (2.381 to 2.519 GHz) –65 to 0 dBm for 22 MHz bandwidth (4.800 to 5.875 GHz)*
External trigger voltage	3.3 V (TTL)
Trigger delay range	*–4.5 to 5.2 ms, or time capture length, whichever is shorter (see performance guide 5989-0637EN)*
Trigger hold-off range	20 ns to 0.65 ms

Modulation specifications

Residual error vector magnitude (EVM)	*802.11a: 5 GHz band; 54 Mbps 64QAM OFDM: < 2.25% (power range 0 to -20 dBm)* *802.11b: DSSS: < 3.0% (power range 0 to -30 dBm)* *802.11g: 2.4 GHz band; 54 Mbps 64QAM OFDM: < 1.25%[8] (power range 0 to -30 dBm)* *802.11g: 2.4 GHz band; 54 Mbps 64QAM OFDM: < 2.5% (power range +5 to 0 dBm)* *802.11n: 54 Mbps 64QAM OFDM: < 1.75%[9] (power range 0 to -10 dBm)* *802.11n: 54 Mbps 64QAM OFDM: < 3.0%[9](power range -10 to -20 dBm)* *Bluetooth EDR: < 2% (rms DEVM)*

[1] This is the center frequency tuning range for a 22 MHz span. With a 40 MHz span, the frequency ranges are 2.39 to 2.51 GHz and 4.809 to 5.866 GHz.

[2] Verified using CW measurements.

[3] Add 0.02 dB/°C from 30 to 55 °C, add 0.025 dB/°C from 20 to 0 °C.

[4] Typical specification applies to instruments serial number GB4617 or greater, or instruments with the serial number starting MY.

[5] 0 dBm input.

[6] Specification applies to instruments serial number GB45460101 or greater, otherwise this specification for the 2.4 GHz band is > 46 dB (22 MHz bandwidth), > 50 dB (5 MHz bandwidth).

[7] Specification applies to instruments serial number GB45460101 or greater, otherwise this specification is < –70 dBm (2.381 to 2.519 GHz).

[8] Typical specification applies to instruments serial number GB4617 or greater, or instruments with the serial number starting MY; otherwise the specification is <2.0%.

[9] Specification applies to instruments with Option 108.

PC Hardware Specifications

- Microsoft® Windows® 2000 and XP® only
- 2.4 GHz Pentium® or equivalent minimum, 2.8 GHz recommended
- 200 MH available on hard drive
- 256 MB RAM minimum, 500 MB RAM recommended
- USB 2.0, TCP-IP LAN, or GPIB connection to test set
- Agilent I/O Libraries Suite 14.1 or greater. For information on Agilent I/O Libraries Suite features and installation requirements, please go to: **www.agilent.com/find/iosuite/datasheet**

N4010A General Specifications

Frequency reference	
Frequency	10 MHz
Accuracy	
20 to 30 °C	$\pm 1 \times 10^{-6}$ (± 1 ppm)
0 to 55 °C	$\pm 1.5 \times 10^{-6}$ (± 1.5 ppm)
Aging (first year)	$\pm 1 \times 10^{-6}$/year
10 MHz input	BNC(f), 50 Ω
10 MHz output	BNC(f), 50 Ω
Power requirements	
Voltage	100 to 240 VAC, 47 to 63 Hz
Power	150 VA maximum
Environmental	
Operating temperature	0 to 55 °C
Storage temperature	–40 to +70 °C
Operating humidity	15 to 95% relative humidity (non-condensing)
EMI compatibility	Radiated emission is in compliance with CISPR Pub 11/1990 Group 1 Class A

Inputs/Outputs

Front panel	
RF input/output	Type-N (f), 50 Ω
Rear panel	
10 MHz REF IN	BNC(f), 50 Ω
10 MHz REF OUT	BNC(f), 50 Ω
GPIB	IEEE-488
LAN	RJ-45, 10/100-T
USB	USB 1.0/2.0

Additional rear panel connectivity with N4010A input/output connectivity Option 110

AUX RF input/output	Type-N (f), 50 Ω
TRIG IN	BNC(f), 50 Ω; input has TTL compatible logic levels
TRIG OUT	BNC(f), 50 Ω; output has TTL compatible logic levels
75 MHz IF output	SMA (f), 50 Ω
Event 1	BNC(f), 50 Ω
Event 2	BNC(f), 50 Ω
Bluetooth and WLAN triggers, data, and clock	25-way D (f)

Size and weight

Dimensions	**(H x W x D)**
With handle and bumpers	105 mm x 370 mm x 390 mm
Without handles and bumpers	105 mm x 330 mm x 375 mm
Weight	5.9 kg (12.98 lbs) for N4010A-101 7.2 kg (15.84 lbs) for N4010A-102, 103

Regulatory information

Product safety	Conforms to the following product specifications: IEC61010-1:2001/ EN61010-1:2001 CAN/CSA-C22.2 No 1010.1-92 Low voltage directive 72/23/EEC
General conditions	The conformity assessment requirements have been met using the technical construction file route for compliance with the requirements of the EMC Directive 89/336/EEC

N4011A Introduction

The N4011A MIMO/Multi-port Adapter is a 1/4 rack-width unit, used in conjunction with a N4010A test set to provide additional features to support production testing of multi-port MIMO-capable devices and modules. It provides a switch matrix to connect the multi-ports of the device-under-test (DUT) to the single RF In/Out port of the N4010A. In addition, the N4011A provides interfaces to allow the DUT to be connected to a reference (golden) radio.

The N4011A will operate functionally at power-up, within the stated environmental operating range, and perform to specification after power-on assuming the unit is in the temperature range 20 to 30 °C.

Note: The power cable from the N4010A test set must be connected to the N4011A adapter with the power off.

Unless otherwise stated all specifications are valid over the temperature range 20 to 30 °C. Supplemental characteristics are intended to provide additional information, useful in applying the adapter by giving typical (expected), but not warranted, performance parameters. These characteristics are shown in italics or labeled as nominal.

General RF performance

Frequency range[1]	As N4010A-103
Maximum specified input power	+23 dBm, CW (applies to all ports)
Damage level (maximum safe input level)	+25 dBm, CW (applies to all ports)

RF input and output specifications

The following characteristics are calculated using a proportion (P) of ≥ 99% and a confidence level (C) of 90%.

Input match for DUT ports[1]	*< –15 dB*
Insertion loss (RF IN/OUT – DUT)[1,2]	*< 12 dB (2.0 to 2.6 GHz)* *< 14 dB (> 2.6 to 6.0 GHz)*
Insertion loss (REF – DUT)[1]	*< 25 dB*
Isolation (DUT – DUT)	*> 50 dB*
Channel flatness (RF IN/OUT – DUT) (pk-pk ripple across any 40 MHz 802.11n channel span)	*< 0.2 dB*
Channel matching (difference between gain of individual N4011A DUT channels)	*< 1.0 dB*
Input match (RF IN/OUT Port)[1]	*< –11.5 dB*
Input match for REF ports[1] (golden radio)	*< –12 dB*
Insertion loss (REF – RF IN/OUT)[1]	*< 36 dB*
Isolation (REF – RF IN/OUT)	*> 60 dB*

Power

Power consumption	160 mA at +5 V; 160 mA at +12 V; 20 mA at –12 V

Size and weight

Dimensions (H x W x D)	88 mm x 107 mm x 353 mm
Weight	1.9 kg (net) 2.5 kg (shipping)

Environmental characteristics

Operating temperature	0 to 55 °C
Storage temperature	–40 to 70 °C
Operating humidity	15 to 95% relative humidity (non condensing)
General conditions	The conformity assessment requirements have been met using the technical construction file route for compliance with the requirements of the EMC Directive 89/336/EEC

[1] Actual S-parameter data, over the frequency range 2 to 6 GHz, is stored within the N4011A.

[2] Automatic path loss compensation performed by the N4010A is applied between RF RF IN/OUT and DUT ports.

Ordering Information

Model no	Description
N4010A	Wireless Connectivity Test Set
N4010A-101	*Bluetooth* test
N4010A-107	*Bluetooth* EDR link plus measurements
N4010A-113	*Bluetooth* audio generation and analysis
N4010A-112	*Bluetooth* headset profile
N4010A-102	2.4 GHz wireless LAN Tx/Rx analysis
N4010A-103	2.4 GHz/5 GHz wireless LAN Tx/Rx analysis
N4010A-104	Fully-flexible arbitrary waveform generation
N4010A-108	802.11n MIMO modulation analysis
N4010A-204	N4010A Signal Studio license
N4010A-110[1]	Additional input/output connectivity (required with N4010A-102/103)
N4010A-AX4[1]	Rack flange kit
N4010A-191[1]	Carry handle kit

Related hardware products

N4011A	MIMO-Multiport Adapter

Related software products

N4017A	*Bluetooth* Graphical Measurement Application
N4017A-205	*Bluetooth* EDR
N4019C	*Bluetooth* and WLAN Wireless Test Manager, development license and software
89601A	Vector signal analysis software (version 5.20 or greater required)
89601A-200	Basic vector signal analysis software
89601A-300	Hardware connectivity
89601A-AYA	Vector modulation analysis
89601A-B7R	WLAN modulation analysis (OFDM and DSSS/CCK/PBCC)
or	
89607A-100	Basic WLAN test suite (with hardware connectivity)

[1] Options 110, AX4, and 191 are supplied as standard with N4010A products ordered after March 2006.

Related Literature

Agilent N4010A Wireless Connectivity Test Set Configuration Guide, literature number 5989-3486EN

Test Multiple Wireless Connectivity Technologies with One Test Platform, brochure, literature number 5989-4150EN

Agilent N4017A Bluetooth Graphical Measurement Application, product overview, literature number 5989-2771EN

Agilent N4018C and N4019C, Bluetooth® and WLAN Wireless Test Manager, brochure, literature number 5989-5809EN

Agilent N4010A Wireless Connectivity Test Set Performance Guide Using the 89601A Vector Signal Analysis Software and the 89607A WLAN Test Suite Software, literature number 5989-0637EN

89600 Series Wide-Bandwidth Vector Signal Analyzer, brochure, literature number 5980-0723E

Agilent 89600 Series Vector Signal Analysis Software 89601A/89601N12, data sheet, literature number 5989-1786EN

89607A WLAN Test Suite Software, technical overview, literature number 5988-9547EN

Agilent – Next Generation of WLAN Manufacturing Test Solutions, brochure, literature number 5989-1194EN

Test ZigBee™ modules and appliances – today!, product overview, literature number 5989-3980EN

For More Information

For more information on the N4010A and N4011A visit:
www.agilent.com/find/n4010a
www.agilent.com/find/n4011a

For more information on the N4017A Graphical Measurement Application visit:
www.agilent.com/find/n4017a

For more information on the *Bluetooth* and WLAN Wireless Test Manager visit:
www.agilent.com/find/n4019c

For more information on Agilent Technologies' *Bluetooth*, WLAN, ZigBee, and MIMO solutions visit:
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www.agilent.com
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