

Agilent N4010A Option H01 Wireless LAN 802.11b/g Tx/Rx Custom Option for the GS-8300 N4993A and N4994A

Technical Overview



**Significantly reduce
your cost of test
without sacrificing
performance**

- fully calibrated vector signal generator and wide bandwidth signal analyzer integrated in one test component
- flexible architecture to test 802.11b/g wireless LAN formats and *Bluetooth*[™]
- traceable measurement results from R&D to production environments



Agilent Technologies

Reduce your cost of test...

As an integral test component in the Agilent GS-8300 WLAN (wireless local area network) functional test system, Agilent N4010A with Option H01 reduces the equipment required in WLAN test systems. The N4010A replaces spectrum analyzers, power meters, power sensors, the golden radio, and other test system components. The N4010A is specifically designed to test the latest in wireless connectivity formats, including WLAN and *Bluetooth*¹ formats, to meet the needs of the production engineer. The N4010A with Option H01 integrates a wide bandwidth signal analyzer and vector signal generator in one test component. The wideband (22 MHz digitizer) signal analyzer captures complete WLAN signal bursts to meet demanding WLAN transmitter measurements, such as error vector magnitude (EVM). The vector signal generator emulates 802.11b/g signals for receiver measurements.² With the N4010A's integrated vector signal generator, the need for a golden radio is eliminated.

The N4010A with Option H01 is the ideal WLAN system component for the GS-8300 by providing efficient and repeatable testing of WLAN modules. Confidently test your WLAN modules in production with the N4010A. The same high performance measurements that were made during the design stages of the WLAN module, such as transmitter error vector magnitude, are also made with the N4010A.

The N4010A offers best-in-class RF performance with ± 0.5 dB amplitude accuracy in the 2.4 GHz ISM band, removing the need for power meters and power sensors that are traditionally used to calibrate WLAN chipset power levels. In the 2.4 GHz band, signals can be analyzed with power levels as low as -70 dBm and up to $+23$ dBm.



Key specifications at a glance

| | Frequency | RF power | Absolute amplitude accuracy | Error Vector Magnitude (EVM) | Maximum bandwidth |
|----------|--------------------|---------------------------------|-----------------------------|------------------------------|---------------------|
| Source | 2.402 to 2.483 GHz | -90 to -15 dBm | ± 1 dB ³ | $< 2\%$ ⁴ | 38 MHz ⁵ |
| Analyzer | 2.381 to 2.519 GHz | -70 to $+23$ dBm ³ | ± 0.5 dB ³ | $< 2\%$ ⁴ | 22 MHz |

1. Contact your local Agilent representative to learn more about optional *Bluetooth* test capability with the GS-8300.
2. WLAN signals in the GS-8300 are pre-programmed and loaded into the signal generator to emulate a specific device under test (DUT). These pre-programmed signals can not be modified.
3. Verified using CW measurements.
4. Nominal, for 802.11g (ODFM) formats.
5. Nominal -3 dB bandwidth.

...with the flexibility to meet your WLAN and *Bluetooth* test needs today and tomorrow...

Integrated RF vector signal generator and vector signal analyzer

With an integrated vector signal generator and vector signal analyzer, transmitter and receiver measurements can be made using a single test component. The N4010A Option H01 replaces general-purpose test components including spectrum analyzers, power meters, power sensors, and the golden radio.

The hardware architecture of the N4010A gives it the flexibility to test current and future WLAN technologies. With the built-in signal generator used for receiver measurements, it can be pre-programmed by Agilent to transmit and emulate any 802.11b or g format in the 2.4 GHz band. The flexibility to emulate WLAN signals makes it an ideal replacement for the golden radio. Contact Agilent to learn more about the WLAN chipsets that the GS-8300 WLAN test system currently supports.



Replacing the golden radio

The N4010A removes the need for a golden radio in the test system. Time previously spent calibrating the golden radio can now be used for testing WLAN modules¹. *Increase the utilization of your test equipment and reduce your overall cost of test.*

Golden radios have been traditionally used in manufacturing for cost effective data quality measurements. In golden radio based systems the golden radio is used to receive data packets from the DUT and then compare the transmitted packets with the received packets to calculate a packet error rate for the DUT. In R&D EVM is a commonly used metric for data quality measurements. EVM is a direct measure of the modulation quality of the transmitter. Measuring EVM requires a wideband digitizer, which has been cost prohibitive for manufacturing environments.

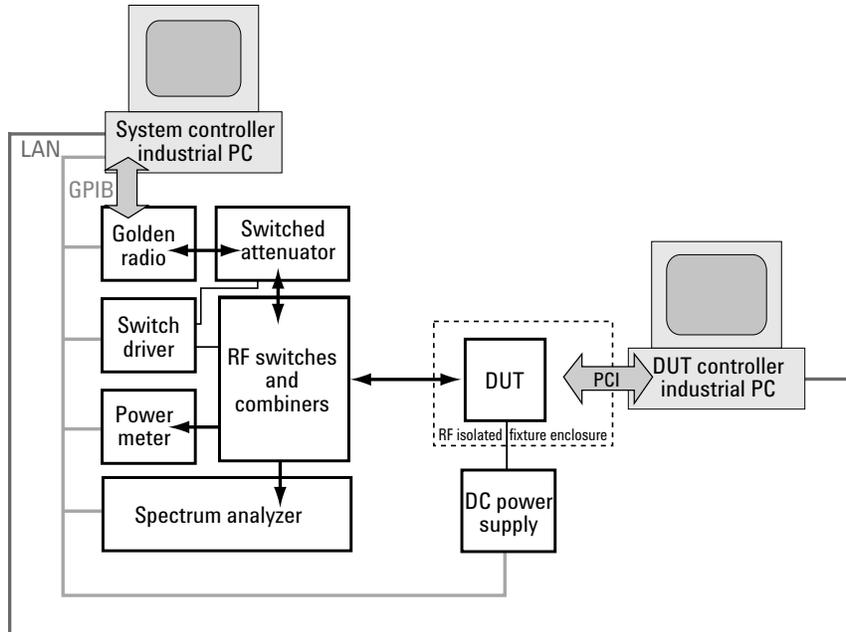
The N4010A, with its wide bandwidth digitizer, cost-effectively performs transmitter EVM measurements to ensure that the modulation error of the DUT meets the IEEE WLAN performance requirements. IEEE 802.11g transmitter constellation error tests, 17.3.9.6 and 17.3.9.7, and IEEE 802.11b transmitter modulation accuracy test, 18.4.7.8, can be measured quickly and accurately with the N4010A. The N4010A allows manufacturing engineers and technicians to make accurate and repeatable measurements, with high confidence that their WLAN modules are meeting the design requirements. By using EVM to measure modulation quality of the transmitter you have the confidence that your transmitter meets the IEEE 802.11 performance requirements.

1. Calibration is still required for other system components. Golden radio calibration is not required in this case.

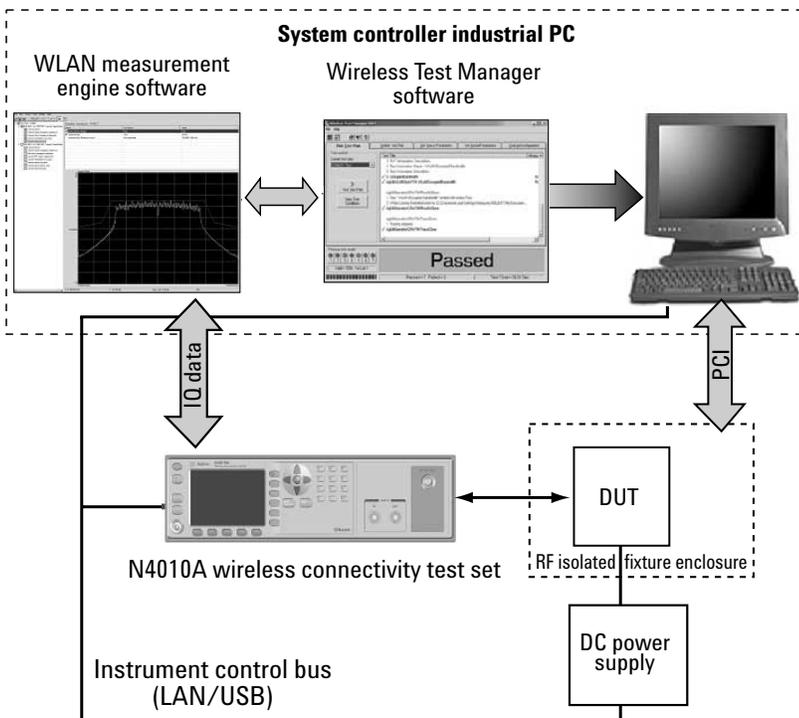
...with an integrated test solution

Evolve your test systems to the next generation in wireless LAN test

The majority of current WLAN production test systems consist of general-purpose test equipment (as shown below) and a golden radio.



With the Agilent GS-8300 WLAN test system using the N4010A to test WLAN modules, the general-purpose test equipment (spectrum analyzers and power meters) plus, RF switches, combiners, and the golden radio can be replaced with the N4010A as illustrated below.



WLAN measurement engine software

An external PC is required to capture and analyze data from the N4010A. The N4010A's WLAN measurement software is based on Agilent's industry-leading 89600 VSA software. GS-8300 Wireless Test Manager software integrates the 89600 VSA software into an automated test solution.

Features and Benefits

| Feature | Benefit |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Cost of test | |
| Calibrated signal analyzer and signal source | Remove the golden radio from the test system and reduce calibration time spent on the golden radio |
| Integrated test set | Decrease system complexity with analyzer, source, RF switching, and cabling inside one test component |
| Flexibility | |
| Hardware and software flexibility to test multiple WLAN module types independent of the chipset | Use one test component to cover WLAN test needs today and tomorrow with no additional instruments required |
| Extensible – grow with WLAN standards changes and WLAN evolution | Adapt test lines quickly to test new modules with new chipsets and have the ability to quickly set-up new production lines |
| Capable of testing both WLAN and <i>Bluetooth</i> standards | Reduce capital cost of test equipment by using one test component to perform the test duties for two different wireless formats |
| Performance | |
| EVM modulation accuracy | Easily correlate transmitter modulation accuracy measurements in manufacturing with those made in the R&D lab during the design stage of the module |
| Excellent RF performance | With ± 0.5 dB amplitude accuracy, power meters and power sensors can be replaced with the N4010A |
| Ease-of-use | |
| Go/No-go testing | Quickly determine if a module passes or fails parametric transmitter or receiver tests |
| Modern I/O connectivity | Select between USB and LAN to integrate with other systems, networks, or instruments to maximize throughput speeds |
| Easily integrate with other test instruments | Quickly and efficiently add spectrum analyzers, signal sources, power meters, or other test equipment to increase test capability |

N4010A Option H01 – IEEE 802.11b/g measurement capability

Transmitter measurements¹

- Transmit output power (calibration)
- Transmit spectrum mask
- Transmit center frequency tolerance
- RF carrier suppression
- Transmit modulation accuracy
- Transmit center frequency leakage
- Transmit constellation error
- Transmit antenna diversity
- ² Transmit mode current

Receiver measurements¹

- Receiver minimum input level sensitivity
- Receiver maximum input level
- RSSI (receiver signal strength intensity) calibration
- Receiver antenna diversity
- ² Sleep mode current
- ² Receive mode current

N4010A Option H02 – *Bluetooth* measurement capability

In addition to testing transmitter and receiver WLAN tests, the N4010A can be also be equipped with Option H02 for *Bluetooth* testing. Tests include output power, power control, modulation characteristics, initial carrier frequency tolerance, carrier frequency drift, receiver sensitivity, maximum input level, and more. With Option H02, *Bluetooth* measurements can only be accessed via remote connection to the N4010A. Options N4010A-H02 and N4010A-101 are identical in functionality and measurement capability, except that the front panel interface is not available with Option N4010A-H02. For more information on *Bluetooth* testing capabilities see the *Agilent N4010A Wireless Connectivity Test Set Bluetooth* data sheet (literature number 5989-0251EN).



1. N4010A transmitter and receiver parametric testing includes RF physical (PHY) layer measurements.
2. PHY layer measurements, such as “transmit/receive mode current” and “sleep mode current” measurements, are not made by the N4010A. Other components included in the Agilent GS-8300 make these measurements. See the *Agilent GS-8300 Wireless LAN Manufacturing Functional Test System Data Sheet* (literature number 5988-9413EN) for more detail.

N4010A Option H01 Specifications

The test set will meet its warranted performance after two hours within the stated environmental operating range, plus 40 minutes after turn on. Unless otherwise stated, all specifications are valid over a temperature range of 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”.

Vector signal analyzer specifications

Frequency specifications

| | |
|------------------------|-----------------------------------------------------------------------------------------------|
| Frequency range | 2.37 to 2.53 GHz (total frequency range) 2.381 to 2.519 GHz (center frequency range) |
|------------------------|-----------------------------------------------------------------------------------------------|

| | |
|----------------------------|----------|
| Frequency reference | |
| Frequency reference | 10 MHz |
| Frequency accuracy | ±0.5 ppm |

| | |
|-----------------------------|--------|
| Maximum IF bandwidth | 22 MHz |
|-----------------------------|--------|

Stability (noise sidebands)

| | |
|---------------|--------------|
| <i>Offset</i> | |
| 10 kHz | < -75 dBc/Hz |
| 100 kHz | < -95 dBc/Hz |

Amplitude specifications

| | |
|--------------------|----------------|
| Power range | -70 to +23 dBm |
|--------------------|----------------|

| | |
|---------------------------------|---------|
| Maximum safe input level | +25 dBm |
|---------------------------------|---------|

| | |
|-----------------------|----------------------|
| Power accuracy | ±0.5 dB ¹ |
|-----------------------|----------------------|

| | |
|----------------------|---------|
| RF input VSWR | < 1.5:1 |
|----------------------|---------|

| | |
|------------------------------|----------------------|
| Signal-to-Noise ratio | > 44 dB ² |
|------------------------------|----------------------|

Trigger ranges

| | |
|---------------------------------------|------------------|
| <i>Internal trigger power range</i> | 60 to +23 dBm |
| <i>External trigger voltage range</i> | 3.3 V (TTL) |
| <i>Trigger delay range</i> | -4.5 to +5.2 ms |
| <i>Trigger hold off range</i> | 20 ns to 0.65 ms |

802.11 measurement specifications

| | |
|----------------------------------------------|------|
| Residual error vector magnitude (EVM) | |
| 802.11g (OFDM) | < 2% |

Vector signal generator specifications

Frequency specifications

| | |
|------------------------|--------------------|
| Frequency range | 2.402 to 2.483 GHz |
|------------------------|--------------------|

| | |
|----------------------------|----------|
| Frequency reference | |
| Frequency reference | 10 MHz |
| Frequency accuracy | ±0.5 ppm |

Output power

| | |
|--------------|----------------|
| Range | -90 to -15 dBm |
|--------------|----------------|

| | |
|-------------------|--------|
| Resolution | 0.1 dB |
|-------------------|--------|

| | |
|-----------------------------|------------------|
| Accuracy¹ | |
| -15 to -90 dBm | ±1.0 dB at 25 °C |

802.11 modulation specifications

| | |
|------------------------|------------------------------------|
| Modulation type | Arbitrary based on downloaded file |
|------------------------|------------------------------------|

| | |
|-------------------------------------|------|
| Error vector magnitude (EVM) | |
| 802.11g (OFDM) | < 2% |

General specifications

Environmental

| | |
|-----|---------------------------------------------------------------------------|
| EMC | Radiated emission is in compliance with CISPR Pub 11/1990 Group 1 Class A |
|-----|---------------------------------------------------------------------------|

Power requirements

| | |
|---------|---------------------------|
| Voltage | 100 to 240 V, 47 to 63 Hz |
| Power | 150 VA maximum |

Size and weight

| | |
|----------------------------|--------------------------------------|
| Dimensions | |
| with handle and bumpers | 105 mm (H) x 370 mm (W) x 390 mm (D) |
| without handle and bumpers | 105 mm (H) x 330 mm (W) x 375 mm (D) |
| Weight | 6.82 kg (15.04 lbs) |

Inputs/Outputs

| | |
|--------------------|------------------|
| Front panel | |
| RF input/output | 50 Ω, type-N (f) |

| | |
|---------------------|------------------|
| Rear panel | |
| AUX RF input/output | 50 Ω, type-N (f) |
| 75 MHz input/output | 50 Ω, SMA (f) |
| Baseband digital | 15-way, type-D |
| 10 MHz REF IN | 50 Ω, BNC (f) |
| 10 MHz REF OUT | 50 Ω, BNC (f) |
| TRIG IN | 50 Ω, BNC (f) |
| TRIG OUT | 50 Ω, BNC (f) |
| GPIB | IEEE-488 |
| LAN | RJ-45, 10/100-T |
| USB | USB 1.0/2.0 |

1. Verified using CW measurements.

2. 0 dBm input, 22 MHz bandwidth.

Ordering Information

The Agilent N4010A with Option H01 can only be ordered as part of the Agilent GS-8300 N4993A or N4994A systems. See *GS-8300 Product Overview* (literature number 5989-0225EN) for information on the GS-8300 N4993A WLAN manufacturing functional test system and the N4994 WLAN integrated bundle.

Related Literature

Agilent GS-8300 WLAN Manufacturing Functional Test System, data sheet, literature number 5988-9413EN

Agilent GS-8300 WLAN Manufacturing Functional Test System, product overview, literature number 5989-0225EN

Agilent N4010A Wireless Connectivity Test Set Bluetooth, data sheet, literature number 5989-0251EN

RF Testing of Wireless LAN Products, application note 1380-1, literature number 5988-3762EN

IEEE 802.11 Wireless LAN PHY Layer (RF) Operation and Measurement, application note 1380-2, literature number 5988-5411EN

802.11a/g Manufacturing Test Application Note - A Guide to Getting Started, application note 1380-3, literature number 5988-6788EN

Making 802.11g Transmitter Measurements, application note 1380-4, literature number 5988-7813EN

Wireless LAN and Bluetooth Test Products, Systems and Services, brochure, literature number 5988-4438EN

For more information on the N4010A Option H01 visit www.agilent.com/find/wlanspecial

For more information on Agilent's complete WLAN offerings visit www.agilent.com/find/wlan

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