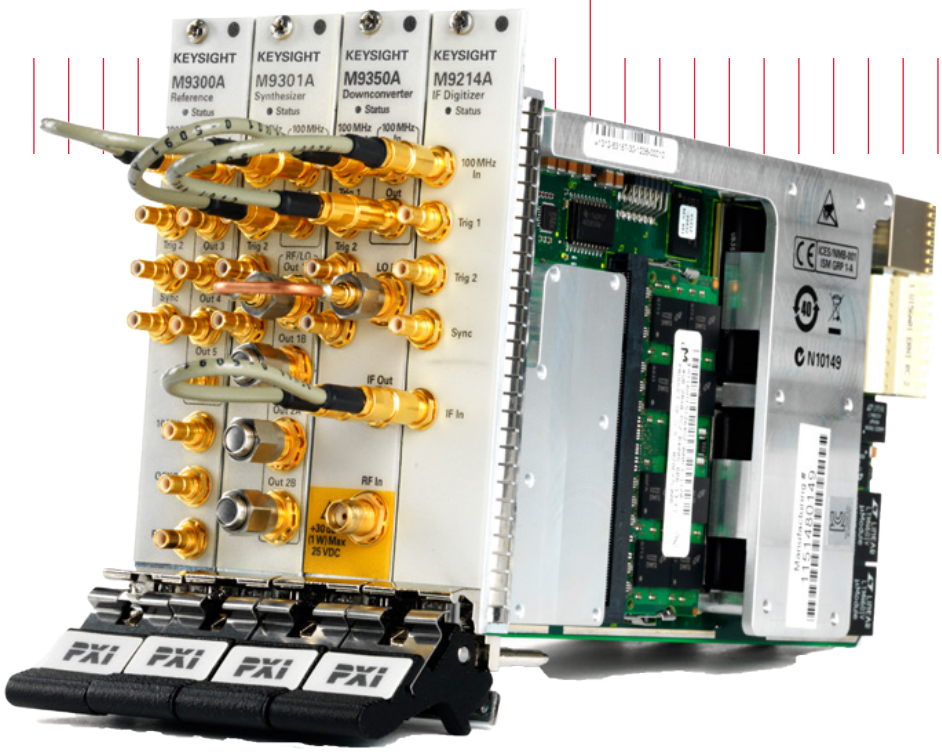
# Keysight Technologies
# M9391A PXIe
# Vector Signal Analyzer
## 1 MHz to 3 GHz or 6 GHz

Data Sheet




KEYSIGHT TECHNOLOGIES

# Overview

## Be ready for tomorrow - today

RF requirements keep growing while timelines keep shrinking. To help ease the technical and business pressures, the right test solution provides continuity in measurements and longevity in capability. The Keysight Technologies, Inc. M9391A PXIe Vector Signal Analyzer is the next logical step in RF signal analysis.

The M9391A PXI VSA, combined with the M9381A PXIe Vector Signal Generator - the PXI VSA/G - provides a complete solution for fast, high quality measurements optimized for RF manufacturing test environments.

To help you get proven results even faster, Keysight's PXI VSA/G can be used with its X-Series measurement applications for modular instruments, 89600 VSA software, SystemVue, Waveform Creator, and Signal Studio. These software applications enable you to investigate, validate and test your RF communications designs.

From fully modular hardware to software leverage to worldwide support, the PXI VSA/G is the low-risk way to manage change and be ready for tomorrow—today.

## Product description

The M9391A PXI VSA is a modular vector signal analyzer for frequencies from 1 MHz to 3 or 6 GHz. A typical PXI VSA configuration includes four individual PXI modules – M9300A frequency reference, M9301A synthesizer, M9350A downconverter and the M9214A digitizer – designed for fast data interfaces and high-speed automated test systems.

The M9391A PXI VSA was designed to work seamlessly with the M9381A PXI VSG, 89600 VSA software, SystemVue and X-Series measurement applications for modular instruments, supporting communications standards such as LTE, W-CDMA, 802,11 WLAN and more.

The PXI VSA can be used in a multi-channel configuration for LTE/LTE-A and WLAN design validation. MIMO transmitter testing is based on Keysight's industry-recognized 89600 VSA/WLA software with full support for PHY-layer measurements including MIMO EVM, cross-channel isolation and channel flatness.

For more information on product configurations for the M9391A PXI VSA, see the M9381A & M9391A Configuration Guide, literature number 5991-0897EN. For more information on the M9381A PXI VSG, see the M9381A Data Sheet, literature number 5991-0279EN.

## Applications

- Power amplifier and front-end-module design validation and manufacturing
- Radio transceiver design validation and production test
- MIMO & multi-channel device test

## Reference solutions

Application specific reference solutions, a combination of recommended hardware, software, and measurement expertise, provide the essential components of a test system. The following reference solutions include the M9391A PXI VSA as a hardware component.

- RF PA/FEM characterization and test, Reference Solution for the industry's fastest envelope tracking test, rapid waveform download, tight synchronization, automated calibration and digital pre-distortion. For more information, see www.keysight.com/find/solution-padvt
- LTE/LTE-A multi-channel test, Reference Solution for faster insight into carrier aggregation and spatial multiplexing designs. For more information, see **www.keysight.com/find/solution-LTE**

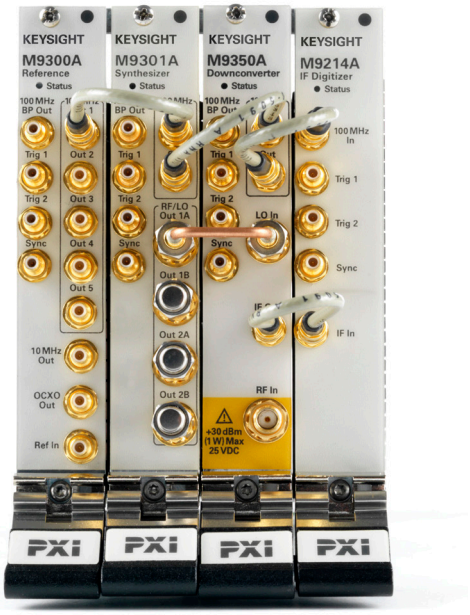



Figure 1. M9391A PXIe vector signal analyzer with four modules consisting of the M9300A frequency reference, M9301A synthesizer, the M9350A downconverter and the M9214A digitizer.

# Overview

## Accelerate RF test speed

The M9391A PXI VSA offers raw hardware speed and delivers proven results–faster through the following technology innovations.

- A unique embedded power measurement mode reduces test times by enabling power servos to converge faster with outstanding linearity.
- Rapid frequency and amplitude switching with fastune baseband adjustments.
- Real-time hardware resampling pinpoints answers faster with extremely fast modulation analysis.
- X-Series measurement applications for modular instruments include a unique resource manager, which lets you quickly switch between raw commands and standard-based measurements.

## Easily extend system capability

The M9391A PXI VSA was developed with system capability extensions in mind. Many of its options, such as memory, frequency range or analysis bandwidth can be easily upgraded through license keys.

The M9391A PXI VSA can also be configured with one or more PXI VSA's or M9381A PXI VSGs. A wide range of instrument drivers are available to support your development environment of choice. This enables you to programmatically extend the capability of your system.

## Achieve confidence and continuity in measurements

The M9391A extends Keysight's expertise in metrology to the modular form factor. It provides the same quality results you have come to expect in our signal analyzers. Here are a few examples of ways that we continue to provide measurement quality and continuity.

- Better than ±0.46 dB typical absolute amplitude accuracy.
- RF analysis bandwidth up to 160 MHz with ±0.17 dB IF channel flatness.
- ISO 17025 traceable calibration and Z540.3 compliance is supported by 17 accredited RF parameters. Innovative eCalibration certificates reside inside each module.
- Achieve proven results with X-Series measurement applications for modular instruments and 89600 VSA/WLA software support.
- Reduce design cycle times by tightening the linkage between design simulation and test with SystemVue.

## Worldwide support and services and standard 3 year warranty

Keysight performs its own calibrations at each of its 35 service centers worldwide. And we take pride in our product quality, as evidenced by our standard 3 year warranty.

The standard product repair time averages less than 14 days. You have the option to upgrade to our express warranty - the fastest repair service in the industry, with a 5 day typical turnaround time.

Figure 2. X-series measurement applications - the same applications developed for X-Series benchtop signal analyzers can be used with the M9391A PXIe Vector Signal Analyzer as well as the M9393A PXIe Performance Vector Signal Analyzer.

# Technical Specifications and Characteristics

## Definitions for specifications

Temperatures referred to in this document are defined as follows:

- Full temperature range = Individual module temperature of 25 to 75 °C, as reported by the module, and environment temperature of 0 to 55 °C.
- Controlled temperature range = Individual module temperature of 40 to 51 °C, as reported by the module, and environment temperature of 20 to 30 °C.

Specifications describe the warranted performance of calibrated instruments. Data represented in this document are specifications unless otherwise noted under the following conditions.

- Calibrated instruments have been stored for a minimum of 2 hours within the full temperature range
- 45 minute warm-up time
- Calibration cycle maintained
- When used with Keysight M9300A frequency reference and Keysight interconnect cables

***Characteristics describe product performance that is useful in the application of the product, but that is not covered by the product warranty. Characteristics are often referred to as Typical or Nominal values and are italicized.***

- ***Typical** describes characteristic performance, which 80% of instruments will meet when operated within the controlled temperature range.*
- ***Nominal** describes representative performance that is useful in the application of the product when operated within the controlled temperature range.*

## Recommended best practices in use

- Use slot blockers and EMC filler panels in empty module slots to ensure proper operating temperatures. Keysight chassis and slot blockers optimize module temperature performance and reliability of test.
- At environment temperatures above 45 °C, chassis fan should be set to high.

## Conversion type definitions

| Conversion types | Frequency range |
|---|---|
| Auto | 1 MHz to 3 or 6 GHz |
| Image protect | 1 MHz to 3 or 6 GHz |
| Single high | 400 MHz to 3 or 6 GHz |
| Single low | 1.1 GHz to 3 or 6 GHz |

## Additional information

- Mixer level offset modifies the receiver gain prior to the first mixer of the receiver. A negative setting improves distortion (i.e., TOI) at the cost of noise performance (i.e., DANL). A positive setting improves noise performance at the cost of distortion.
- Total absolute amplitude accuracy is the total of all amplitude measurement errors. This specification includes the sum of the following individual specifications: linearity, expected input level switching uncertainty, IF bandwidth filter switching uncertainty, absolute amplitude accuracy. The wide range of settings used (i.e., expected input level, etc.) are tested independently. The individual error contributions are calculated as follows: a 99.8 % proportion and 95% confidence are computed for each parameter on a statistically significant number of instruments. The root-sum-square (RSS) of these four independent Gaussian parameters is then taken. To that RSS value, two environmental effects and measurement uncertainty are added. One environmental effect is that of temperature (full and controlled temperature range, as defined above) and the other is the temperature variation of ±3 degrees around a field alignment.

# Technical Specifications and Characteristics

## Additional information (cont'd)

- All graphs contain measured data from one unit and is representative of product performance within the controlled temperature range unless otherwise noted.
- The specifications contained in this document are subject to change.

## Block diagram

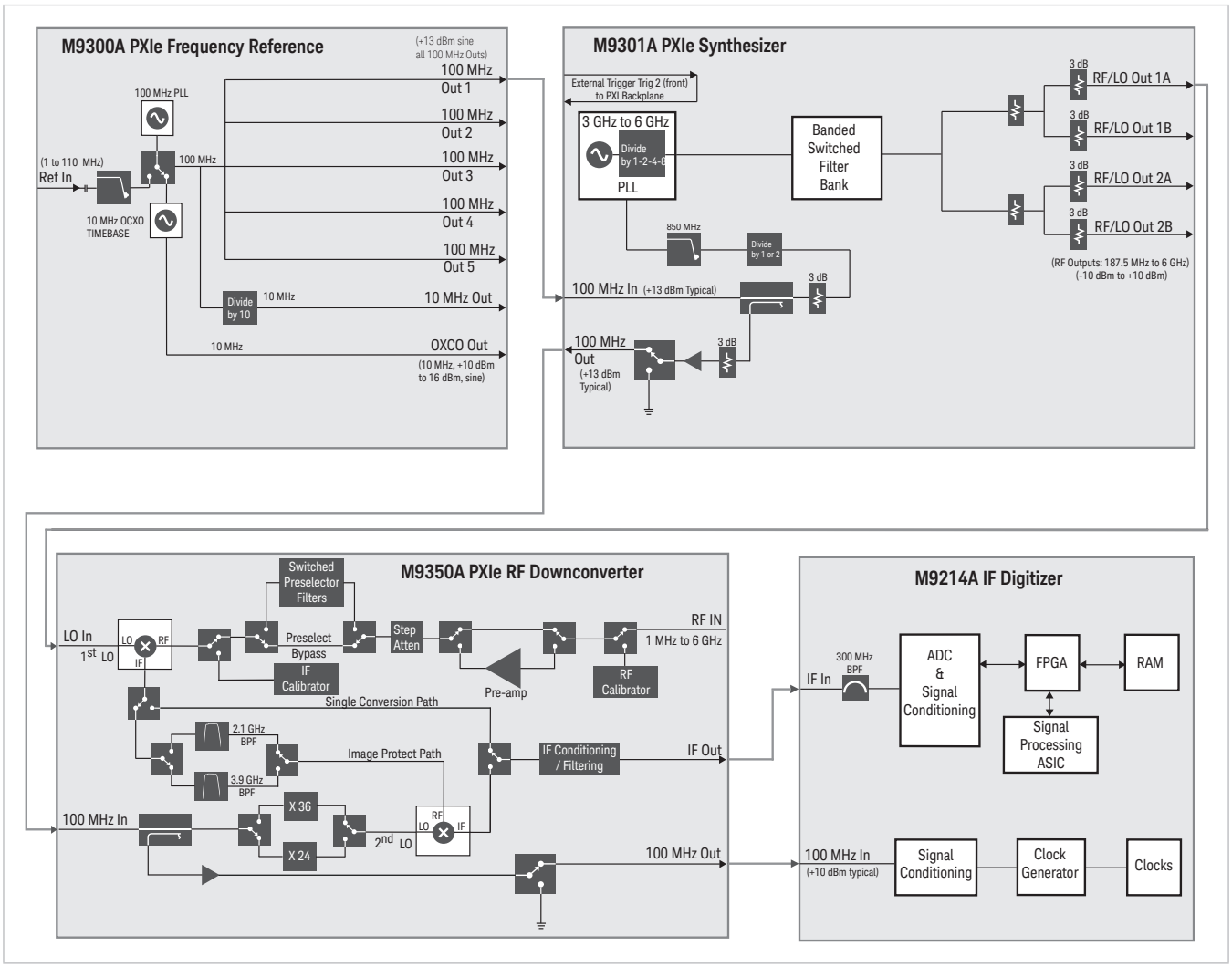



Figure 3. M9391A PXIe vector signal analyzer block diagram with four modules consisting of the M9301A synthesizer, M9350A downconverter, M9214A digitizer and the optional M9300A frequency reference.

# Technical Specifications and Characteristics

## Frequency

| **Frequency range and resolution** | | |
|---|---|---|
| Option F03 | 1 MHz to 3 GHz | |
| Option F06 | 1 MHz to 6 GHz | |
| Tuning resolution | 0.001 Hz | |
| **IF frequency** | | **Nominal** |
| | 15 MHz filter | *326 MHz* |
| | 40 MHz filter | *240 MHz* |
| | 160 MHz filter | *300 MHz* |

| **Analysis bandwidth** [1] | | |
|---|---|---|
| Maximum bandwidth | Option B04 | 40 MHz |
| | Option B10 | 100 MHz |
| | Option B16 | 160 MHz |

| **Frequency switching speed** [2,3] | | | | | |
|---|---|---|---|---|---|
| **List mode switching speed** [4] | **Conversion type** | **Sample rate** | **Acquisition bandwidth** | **Standard, nominal** | **Option UNZ, nominal** |
| Baseband frequency offset change [5] | All | ≤ 100 MHz | ≤ 80 MHz | *5 ms* | *27 µs* |
| | | > 100 MHz to < 180 MHz | > 80 MHz to < 144 MHz | *5 ms* | *102 µs* |
| | | ≥ 180 MHz | ≥ 144 MHz | *5 ms* | *15 µs* |
| Arbitrary frequency change | All | | | *5 ms* | *320 µs* |
| **Non-list mode switching speed** [6] | **Conversion type** | | | **Standard, nominal** | **Option UNZ, nominal** |
| Baseband frequency offset change [5] | All | | | *5 ms* | *310 µs* |
| Arbitrary frequency change | All | | | *5 ms* | *2.3 ms* |

1. Instantaneous bandwidth (1 dB bandwidth) available around a center frequency over which the input signal can be digitized for further analysis or processing in the time, frequency or modulation domain.
2. When used with the M9018A PXIe chassis (2-link configuration: 1 x 8 [factory default]) and M9036A PXIe embedded controller.
3. Settled to within 1 kHz or 1 ppm, whichever is greater of final value. Does not include data acquisition or processing time. Amplitude settled to within 0.1 dB. Channel filter set to none.
4. Time from trigger input to frequency and amplitude settled. Minimum IQ sample rate ≥ 6 MHz. Minimum spectrum acquisition ≥ 4.8 MHz. Minimum power acquisition channel filter bandwidth ≥ 4.8 MHz. For lists with first point < 400 MHz or for frequency changes from > 400 MHz to < 400 MHz, add 40 ms.
5. Baseband offset can be adjusted ± from carrier frequency within limits determined by RF analysis bandwidth and IF filter bandwidth. Synthesizer frequency and amplitude are not changing. Baseband offset settled to within 1 kHz.
6. Mean time from IVI command to carrier frequency settled to within 1 kHz or 1 ppm, whichever is greater. Amplitude settled within 0.1 dB. Simultaneous carrier frequency and amplitude switching. For frequency changes from > 400 MHz to < 400 MHz, add 40 ms.

# Technical Specifications and Characteristics

## Frequency (cont'd)

| **Frequency reference (M9300A PXIe frequency reference module)** | | |
|---|---|---|
| **Reference outputs** | | |
| 100 MHz Out (Out 1 through Out 5) | | |
| Amplitude | ≥ 10 dBm | *13 dBm, typical* |
| Connectors | 5 SMB snap-on | |
| Impedance | *50 Ω, nominal* | |
| 10 MHz Out | | |
| Amplitude | *9.5 dBm, nominal* | |
| Connectors | 1 SMB snap-on | |
| Impedance | *50 Ω, nominal* | |
| OCXO Out | | |
| Amplitude | *11.5 dBm, nominal* | |
| Connectors | 1 SMB snap-on | |
| Impedance | *50 Ω, nominal* | |
| **Frequency accuracy** | | |
| Same as accuracy of internal time base or external reference input | | |
| **Internal timebase** | | |
| Accuracy | ± [(time since last adjustment x aging rate) ± temperature effects ± calibration accuracy] | |
| Frequency stability<br>Aging rate | | |
| Daily | < *±0.5 ppb/day, after 72 hours of warm-up* | |
| Yearly | < *±0.1 ppm/year, after 72 hours of warm-up* | |
| Total 10 years | < *±0.6 ppm/10yrs, after 72 hours of warm-up* | |
| Achievable initial calibration accuracy (at time of shipment) | $\pm 5 \times 10^{-8}$ | |
| Temperature effects | | |
| 20 to 30 °C | < *±10 ppb* | |
| Full temperature range | < *±50 ppb* | |
| Warm up | | |
| 5 minutes over +20 to +30 °C, with respect to 1 hour | < *±0.1 ppm* | |
| 15 minutes over +20 to +30 °C, with respect to 1 hour | < *±0.01 ppm* | |
| **External reference input** | | |
| Frequency | 1 to 110 MHz, sine wave | |
| Lock range | *±1 ppm, nominal* | |
| Amplitude | *0 to 10 dBm, nominal* | |
| Connector | 1 SMB snap-on | |
| Impedance | *50 Ω, nominal* | |

# Technical Specifications and Characteristics

## Amplitude

| **Input level** | | |
|---|---|---|
| Max safe average total power | +30 dBm (1 W) | |
| Max DC voltage | 25 Vdc | |
| Max RF input (specified performance) | 1 to 2 MHz | 0 dBm |
| | 2 to 4 MHz | +4 dBm |
| | 4 to 100 MHz | +12 dBm |
| | 100 MHz to 6 GHz | +30 dBm |
| Expected input level setting resolution | 0.1 dB | |

| **Expected input level setting range** | |
|---|---|
| Pre-amp ON | –50 to 0 dBm |
| Pre-amp OFF | –50 to +30 dBm |
| Pre-amp AUTO [7] | –50 to +30 dBm |

| **Absolute amplitude accuracy & total absolute amplitude accuracy** | | | | | | |
|---|---|---|---|---|---|---|
| 40 MHz IF filter | | Module temperature within ± 3 °C of field alignment | | | | |
| **Pre-Amp ON & OFF** | | **Full temperature range** | | **Controlled temperature range** | | **@ 46 °C module temp[10], typical** |
| Conversion type | Frequency | Total absolute amplitude accuracy [8] | Absolute amplitude accuracy [9] | Total absolute amplitude accuracy [8] | Absolute amplitude accuracy [9] | Total absolute amplitude accuracy [8] |
| Image protect | ≤ 3 GHz | ±1.78 dB | ±1.72 dB | ±1.27 dB | ±1.21 dB | *±0.46 dB* |
| | > 3 GHz | ±1.54 dB | ±1.48 dB | ±1.19 dB | ±1.13 dB | *±0.46 dB* |
| Single | All | ±1.47 dB | ±1.41 dB | ±1.22 dB | ±1.17 dB | *±0.45 dB* |
| **160 MHz IF filter** | | Module temperature within ±3 °C of field alignment | | | | |
| **Pre-amp OFF[11]** | | | | | | |
| Image protect | ≤ 3 GHz | ±1.46 dB | ±1.34 dB | ±0.96 dB | ±0.85 dB | *±0.33 dB* |
| | > 3 GHz | ±1.54 dB | ±1.48 dB | ±1.16 dB | ±1.09 dB | *±0.45 dB* |
| Single | All | ±1.18 dB | ±1.08 dB | ±0.94 dB | ±0.86 dB | *±0.36 dB* |
| **Pre-amp ON[12]** | | | | | | |
| Image protect | ≤ 3 GHz | ±1.68 dB | ±1.60 dB | ±1.18 dB | ±1.10 dB | *±0.39 dB* |
| | > 3 GHz | ±1.55 dB | ±1.49 dB | ±1.21 dB | ±1.15 dB | *±0.45 dB* |
| Single | ≤ 3 GHz | ±1.09 dB | ±0.96 dB | ±0.85 dB | ±0.72 dB | *±0.29 dB* |
| | > 3 GHz | ±1.36 dB | ±1.28 dB | ±1.04 dB | ±0.96 dB | *±0.39 dB* |

7. At expected input level ≤ –37 dBm, pre-amp is switched on.
8. As described in more detail under Definitions of Specifications (page 4), total absolute amplitude accuracy is the total of all amplitude measurement errors, and applies over the following subset of settings and conditions: expected input level –50 dBm to +30 dBm; input signals within 60 dB below expected input level; 40 MHz and 160 MHz IF filters; input signal at center frequency over full frequency range.
9. The absolute amplitude accuracy is the amplitude measurement error when only changing frequency. The expected input level, conversion type and IF bandwidth settings remain the same and the error introduced by those parameters are not included. Pre-amp auto/OFF expected input level +10 dBm and –12 dBm. Pre-amp ON expected input level –30 dBm.
10. Typical specifications shown at M9350A downconverter reported module temperature of 46 °C and a corresponding environment temperature of 25 °C.
11. When using pre-amp auto mode, applies for signal level within expected input level >–37 dBm.
12. When using pre-amp auto mode, applies for signal level within expected input level ≤–37 dBm.

# Technical Specifications and Characteristics

## Amplitude (cont'd)

| **Amplitude repeatability and linearity** | | |
|---|---|---|
| | **Input signal relative to expected input level setting** | **Specification** |
| Repeatability | | *<0.05 dB, nominal* |
| Linearity [13] | >–35 dB | ±0.12 dB<br>*±0.03 dB, nominal* |
| | ≤–35 dB | ±0.21 dB<br>*±0.04 dB, nominal* |

| **IF flatness [14, 15]** | | |
|---|---|---|
| **Analysis bandwidth** | **IF filter** | **Nominal** |
| 40 MHz | 40 MHz | *± 0.08 dB* |
| 100 MHz | 160 MHz | *± 0.09 dB* |
| 160 MHz | 160 MHz | *± 0.10 dB* |

| **IF phase linearity [15]** | | |
|---|---|---|
| **Analysis bandwidth** | **Conversion type** | **Peak to peak, nominal** |
| 40 MHz | All | *1.0 °* |
| 100 MHz | Single | *0.8 °* |
| | Image protect | *1.7 °* |
| 160 MHz | Single | *1.4 °* |
| | Image protect | *1.8 °* |

13. Input level 20 dB above the noise floor and dither on, no change in hardware settings, below expected input level.
14. Amplitude deviation from the mean error of the entire bandwidth, all conversion types.
15. Expected input level 0 dBm. Center frequency ≥ 250 MHz.

# Technical Specifications and Characteristics

## Amplitude (cont'd)

| IF bandwidth filter switching uncertainty [16] | Specification | Typical | Nominal |
|---|---|---|---|
| | ±0.4 dB | *±0.15 dB* | *±0.09 dB* |

| Expected input level switching uncertainty | Specification | Typical | Nominal |
|---|---|---|---|
| Pre-amp Auto/OFF | | | |
| Max input to +5 dBm | ±0.45 dB | *±0.14 dB* | *±0.10 dB* |
| Crossing +5 dBm | ±0.63 dB | *±0.24 dB* | *±0.17 dB* |
| Pre-amp OFF | | | |
| +5 to –50 dBm | ±0.41 dB | *±0.16 dB* | *±0.11 dB* |
| Pre-amp ON | | | |
| +0 to –50 dBm | ±0.64 dB | *±0.27 dB* | *±0.21 dB* |
| Pre-amp AUTO | | | |
| Crossing –37 dBm | ±0.95 dB | *±0.19 dB* | *±0.12 dB* |

| Amplitude switching speed | | |
|---|---|---|
| **Arbitrary amplitude change** | **Standard, nominal** | **Option UNZ, nominal** |
| List mode switching speed [17] | *≤ 5 ms* | *≤ 136 µs* |
| Non-list mode switching speed [18] | *≤ 5 ms* | *≤ 1.5 ms* |

| Input voltage standing wave ratio (VSWR) | Nominal |
|---|---|
| < 10 MHz | *1.7:1* |
| 10 MHz to 2.5 GHz | *1.4:1* |
| > 2.5 GHz | *1.7:1* |

16. Amplitude error relative to the reference IF bandwidth filter of 40 MHz.
17. Settled to within 0.1 dB of final value. Does not include data acquisition or processing time.
    When used with the M9018A PXIe chassis (2-link configuration: 1 x 8 [factory default]) and the M9036A PXIe embedded controller.
18. Mean time from IVI command to amplitude settled.

# Technical Specifications and Characteristics

## Dynamic range specifications

| **Displayed average noise level (DANL)** [19] | | | |
|---|---|---|---|
| **Conversion type** | **Frequency** | **Specification** | **Nominal** |
| Pre–amp OFF | | | |
| Image protect | < 100 MHz | | *–145 dBm/Hz* |
| | 100 to < 700 MHz | –137 dBm/Hz | *–147 dBm/Hz* |
| | 700 MHz to < 5.75 GHz | –140 dBm/Hz | *–148 dBm/Hz* |
| | 5.75 to 6 GHz | –129 dBm/Hz | *–146 dBm/Hz* |
| Single | <1.2 GHz | –148 dBm/Hz | *–154 dBm/Hz* |
| | 1.2 to 3.1 GHz | –143 dBm/Hz | *–152 dBm/Hz* |
| | > 3.1 to < 5.4 GHz | –138 dBm/Hz | *–149 dBm/Hz* |
| | 5.4 to 6 GHz | –133 dBm/Hz | *–148 dBm/Hz* |
| Pre–amp ON | | | |
| Image protect | < 100 MHz | | *–162 dBm/Hz* |
| | 100 MHz to < 2.7 GHz | –156 dBm/Hz | *–161 dBm/Hz* |
| | 2.7 to 4.4 GHz | –155 dBm/Hz | *–160 dBm/Hz* |
| | > 4.4 to < 5.6 GHz | –152 dBm/Hz | *–157 dBm/Hz* |
| | 5.6 to 6 GHz | –141 dBm/Hz | *–154 dBm/Hz* |
| Single | <1.1 GHz | –157 dBm/Hz | *–161 dBm/Hz* |
| | 1.1 to < 3.6 GHz | –154 dBm/Hz | *–158 dBm/Hz* |
| | 3.6 to 5 GHz | –151 dBm/Hz | *–156 dBm/Hz* |
| | > 5 to 6 GHz | –146 dBm/Hz | *–153 dBm/Hz* |

| **Third order intermodulation distortion (TOI)** [20] | | **TOI**[23] | | **Distortion**[24] |
|---|---|---|---|---|
| **Conversion type: auto** | **Frequency** | **Specification** | **Typical** | **Specification** |
| Pre–amp OFF [21] | ≤ 400 MHz | +15 dBm | *+20.5 dBm* | *–52 dBc* |
| | > 400 MHz to 3 GHz | +18 dBm | *+23 dBm* | *–52 dBc* |
| | > 3 GHz | +20 dBm | *+23.5 dBm* | *–52 dBc* |
| Pre–amp ON [22] | ≤ 100 MHz | –9.9 dBm | *–2.5 dBm* | *–56 dBc* |
| | > 100 to 850 MHz | –7.9 dBm | *+2 dBm* | *–58 dBc* |
| | > 850 MHz to 2 GHz | –4.3 dBm | *+5 dBm* | *–47 dBc* |
| | > 2 to 3 GHz | –0.9 dBm | *+7 dBm* | *–41 dBc* |
| | > 3 to 6 GHz | +1 dBm | *+5 dBm* | *–32 dBc* |

19. Expected input level of –50 dBm. Mixer level offset +10 dB.
20. Two tone, 100 kHz tone spacing.
21. Expected input level –5 dBm. Mixer level offset +10 dB.
22. Expected input level –25 dBm. Mixer level offset +15 dB.
23. TOI = third order intercept. The TOI is given by the input tone level (in dBm) minus (distortion/2) where distortion is the relative level of the distortion tones in dBc.
24. Expected input level -10 dBm with preamp off and -30 dBm with preamp on.

# Technical Specifications and Characteristics

## Dynamic range specifications (cont'd)

| Second harmonic distortion (SHI) | | | |
|---|---|---|---|
| **Conversion type: image protect** | **Frequency** | **SHI, Nominal[26]** | **Distortion, Nominal[27]** |
| Pre-amp OFF [25] | ≤ 1.35 GHz | *+35 dBm* | *– 45 dBc* |
| | > 1.35 GHz | *+95 dBm* | *–105 dBc* |

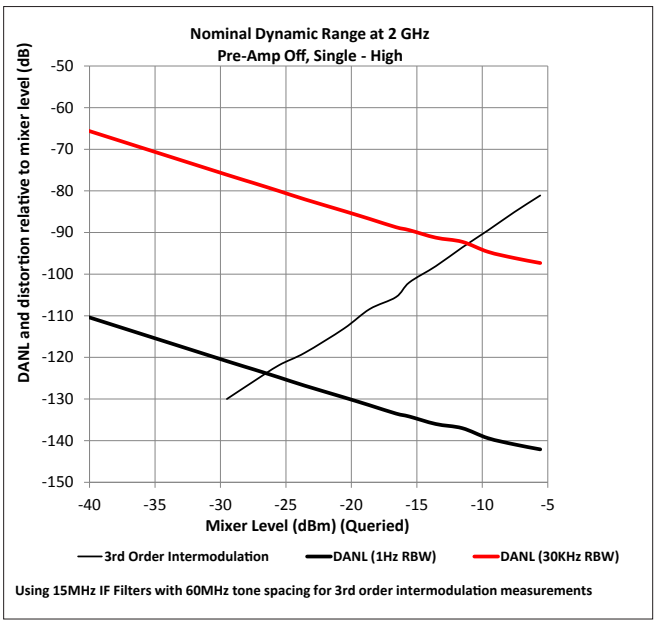



Figure 4. Dynamic range at 2 GHz, pre-amp OFF, single-high conversion type.

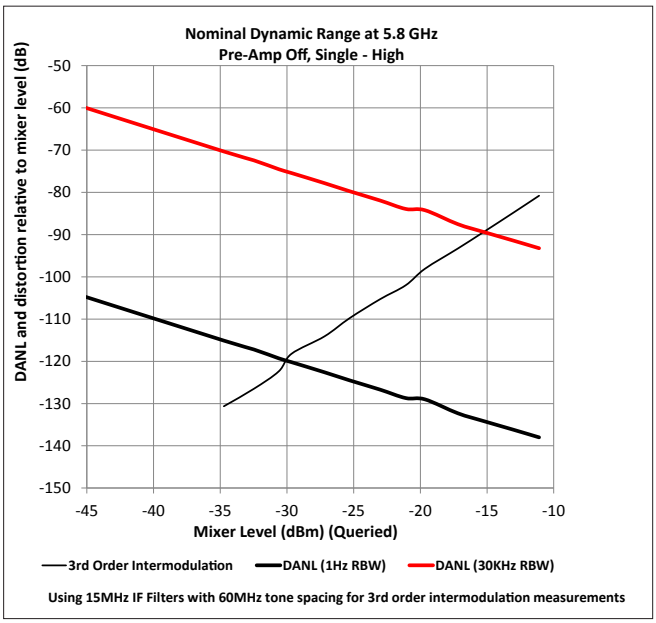



Figure 5. Dynamic range at 5.8 GHz, pre-amp OFF, single-high conversion type.

25. Expected input level -10 dBm. Mixer level offset +10 dB.
26. SHI = second harmonic intercept. The SHI is given by the input power in dBm minus the second harmonic distortion level relative to the input signal in dBc.
27. For 0 dBm input signal.

# Technical Specifications and Characteristics

## Dynamic range specifications (cont'd)

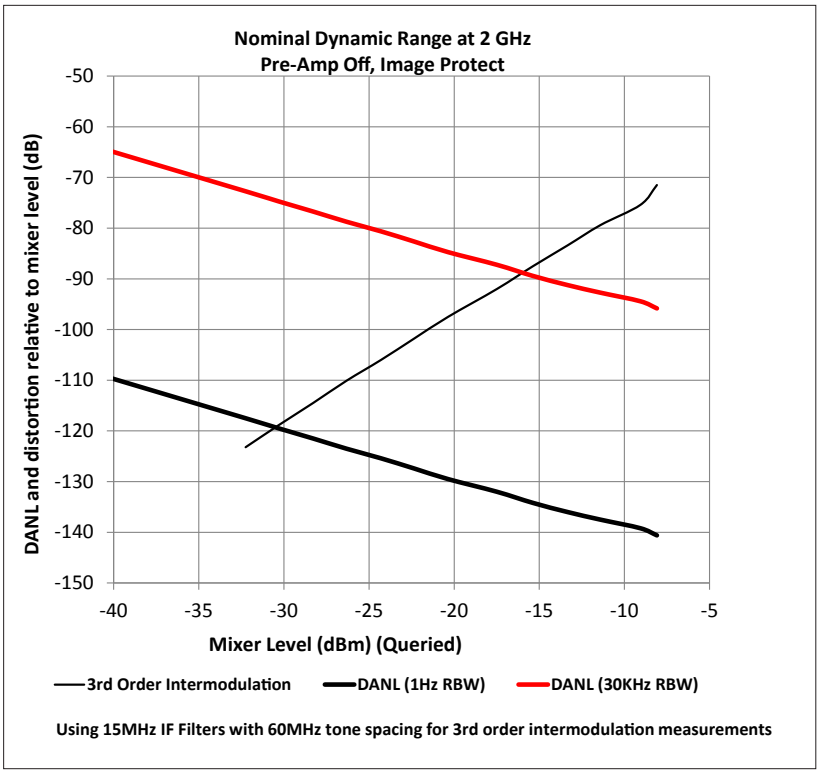



Figure 6. Dynamic range at 2 GHz, pre-amp OFF, image protect conversion type.

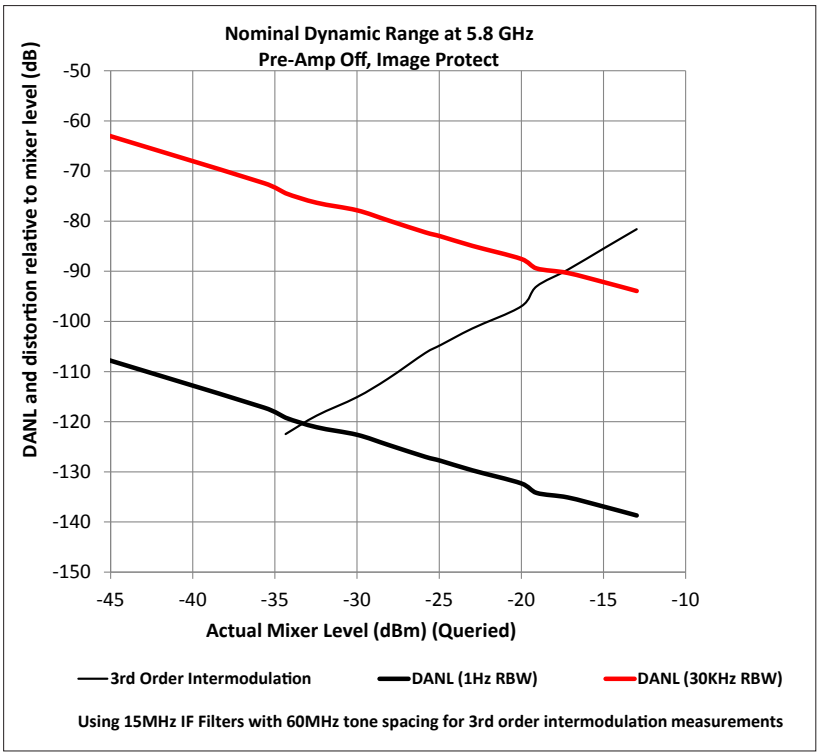



Figure 7. Dynamic range at 5.8 GHz, pre-amp OFF, image protect conversion type.

# Technical Specifications and Characteristics

## Spectral purity

| Phase noise [28] | | | |
|---|---|---|---|
| | Offset | Conversion type | Nominal |
| Noise sidebands (CF = 1.1 GHz for single low)<br>(CF = 1 GHz for single high) | 10 kHz | Single - low | *–120 dBc/Hz* |
| | | Single - high | *–119 dBc/Hz* |

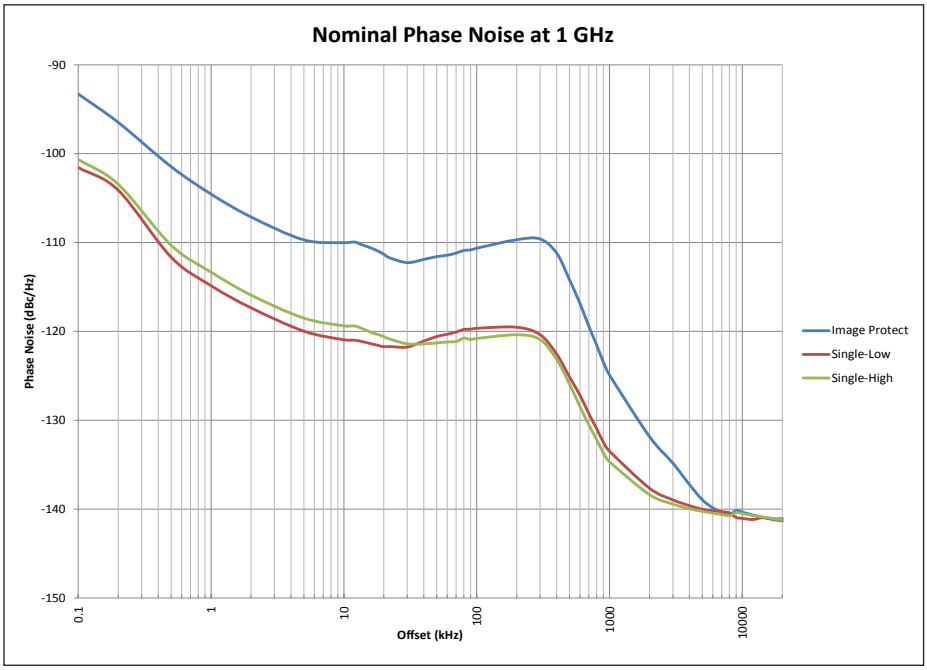



Figure 8. Phase noise at 1 GHz
(1.1 GHz for single-low conversion type).


Figure 9. Phase noise at 5.8 GHz.

28. Mixer level offset +20 dB.

# Technical Specifications and Characteristics

## Spectral purity (cont'd)

| **Residuals, images & spurious responses** | | | |
|---|---|---|---|
| **Non-input related spurs** [29] | **Conversion type** | **Frequency** | **Nominal** |
| Expected input level | | | |
| **Pre-amp ON** | | | |
| ≤ 0 dBm (measured at –50 dBm) | Single | All | *< –120 dBm* |
| | Image protect | All [30] | *< –120 dBm* |
| **Pre-amp OFF** | | | |
| < +5 dBm (measured at –50 dBm) | Single | ≤ 3 GHz | *< –120 dBm* |
| | | > 3 GHz | *< –116 dBm* |
| | Image protect | All [31] | *< –105 dBm* |
| ≥ +5 dBm (measured at +6 dBm) | Single | All | *< –98 dBm* |
| | Image protect | All [32] | *< –90 dBm* |
| **LO related spurs** [33] | **Offsets from carrier** | **Frequency** | **Nominal** |
| | 200 to 10 kHz | All | *– 82 dBc* |
| | 10 kHz to 10 MHz | All | *– 55 dBc* |
| **First order RF spurious responses** [34] | **Offsets from carrier** | **Frequency** | **Nominal** |
| | ≥ 10 MHz | ≥ 200 MHz to 6 GHz | *–60 dBc* |
| **Higher order RF spurious responses** [34] | **Offsets from carrier** | **Frequency** | **Nominal** |
| | ≥ 10 MHz | ≥ 200 MHz to 6 GHz | *–60 dBc* |
| **Image responses** [35] | **Conversion type** | **Frequency** | **Nominal** |
| | Image protect | All | *< –68 dBc* |
| **IF rejection** [36] | **IF bandwidth filter** | **Frequency** | **Nominal** |
| | 15 MHz | ≤ 400 MHz | *< –57 dBc* |
| | | > 400 MHz | *< –105 dBc* |
| | 40 MHz | ≤ 450 MHz | *< –57 dBc* |
| | | > 450 MHz | *< –98 dBc* |
| | 160 MHz | All | *< –85 dBc* |
| **LO emission** [37] | **Conversion type** | **Frequency** | **Nominal** |
| | Single | ≤ 3 GHz | *–72 dBm* |
| | | > 3 GHz | *–62 dBm* |
| | Image protect | All | *–88 dBm* |

29. Mixer level offset at 10 dB, input terminated, with 50Ω load.
30. From 4.72 to 4.88 GHz, specification at <-108 dBm, nominal.
31. From 4.72 to 4.88 GHz, specification at <-96 dBm, nominal.
32. From 4.72 to 4.88 GHz, specification at <-80 dBm, nominal.
33. Expected input level 0 dBm. Mixer offset level -10 dB.
34. Conversion type: image protect, pre-amp OFF, expected input level -20 dBm and mixer level offset 0 dB.
35. Excitation frequency: [F=2*Final IF] MHz, expected input level -20 dBm, mixer level offset -30 dB.
36. Suppression of signal at IF frequencies when tuned at least 2 x IF BW away.
    All input paths, image protect, expected input level -30 dBm. Input signal at -30 dBm and mixer level offset 0 dB.
37. Expected input level -50 dBm. Mixer level offset +10 dB.

# Technical Specifications and Characteristics

## Data acquisition

| Maximum capture memory | Non-list mode | List mode |
|---|---|---|
| Option M01 | 128 MSample (512 MB) | 128 MSample (512 MB) |
| Option M05 | 512 MSample (2 GB) | 512 MSample (2 GB) |
| Option M10 | 1 GSample (4 GB) [38] | 512 MSample (2 GB) to ~ 1 GSample (3.999 GB) [39] |
| **Segments** | | |
| Minimum length | 1 sample [40] | |
| Maximum length | Full capture memory [38] | |
| **Maximum sample rate** | **Specification** | |
| Option B04 / 40 MHz | 50 MS/s complex, 100 MS/s real | |
| Option B10 / 100 MHz | 125 MS/s complex, 250 MS/s real | |
| Option B16 / 160 MHz | 200 MS/s complex, 400 MS/s real | |
| **List mode** | | |
| Maximum number of segments | 3201 | |
| Trigger sources | External, magnitude | |
| Trigger modes | Per acquisition, interval timer trigger | |
| **Triggering** | | |
| Delay range [41] | –500 ms to +500 ms, nominal | |
| Delay resolution | 1 sample, nominal | |
| External trigger signal frequency range | 10 to 30 MHz for pulse | |
| External trigger signal level | TTL | |
| External trigger signal duty cycle range | 20% to 80% | |
| External trigger signal waveform | Sine, pulse/square, ramp (symmetry 0% to 100%) | |

| **Timing [42]** | |
|---|---|
| Channel-to-channel synchronization | ≤ ±*5 ns, nominal* |

38. The default mode for allocation of capture memory is AgM9391MemoryModeNormal, where the digitizer's memory is shared by both the default single acquisition (capture ID = 0) and all the other acquisitions with non-zero capture IDs. In particular, the memory for the default single acquisition is allocated from the area unused by the list acquisitions. If the available memory is not sufficient for the single acquisition, the user must release memory allocated for the non-zero capture ID acquisitions manually, thus increasing free space. Total memory usage is limited according to the memory option. Note that the maximum size of acquisition is 2 GB in this mode. To perform the default single acquisition with memory size larger than 2 GB, AgM9391MemoryModeLargeAcquisition must be selected. The non-zero capture ID acquisitions cannot be per formed in this mode. All data acquired with AGM9391MemoryMode Normal will be invalidated.
39. The maximum size for a single list point capture is limited to 512 MSamples (2 GB). However, with option M10, total capture of up to 3.999 GB is available across all list mode captures.
40. 64-bit mode, 2 samples for 32-bit mode.
41. Negative trigger delay limited to capture size.
42. MIMO capability only supported when configured with a Keysight M9018A PXIe chassis. 89600 VSA software required for MIMO analysis.

# Technical Specifications and Characteristics

## Measurement speed[43]

| IQ data capture [44] | Nominal | |
|---|---|---|
| Large block (50 MSamples) | *1.5 s* | Transferred in 100 kSa or 1 MSa blocks |
| Small block (100 captures, 100 ksamples each) | *292 ms* | Transferred in 10 kSa blocks |
| Adjust level, freq (10 ksamples) | *1.7 ms* | Transferred in 10 kSa blocks |

| Power measurements [45] | | | |
|---|---|---|---|
| **Channel power settings & filter bandwidth** | **Acquisition Time** | **Averages** | **Nominal** |
| 3.84 MHz | 400 µs | None | *1.8 ms* |
| | | 10 | *7.6 ms* |
| | 100 µs | None | *1.3 ms* |
| | | 10 | *4.1 ms* |
| | 50 µs | None | *1.3 ms* |
| | | 10 | *3.4 ms* |
| 30 kHz | 100 µs | None | *3.9 ms* |
| | | 10 | *30.4 ms* |

## Format specific measurement data

| GSM [46, 47] | | |
|---|---|---|
| | **Parameters** | **Nominal** |
| Global phase error | 0.9, 1.8, 1.9, 2.0, 2.1, 2.2 GHz | *0.17 °* |
| ORFS dynamic range | 200 kHz offset | *–36 dBc* |
| | 250 kHz offset | *–41 dBc* |
| | 400 kHz offset | *–69 dBc* |
| | 600 kHz offset | *–73 dBc* |
| | 800 kHz offset | *–77 dBc* |
| | 1200 kHz offset | *–80 dBc* |
| | 1800 kHz offset | *–78 dBc* |

| EDGE [46, 47] | | |
|---|---|---|
| | **Parameters** | **Nominal** |
| Residual EVM | 0.9, 1.8, 1.9, 2.0, 2.1, 2.2 GHz | *0.23% rms* |
| ORFS dynamic range | 200 kHz offset | *–37 dBc* |
| | 250 kHz offset | *–42 dBc* |
| | 400 kHz offset | *–69 dBc* |
| | 600 kHz offset | *–73 dBc* |
| | 800 kHz offset | *–77 dBc* |
| | 1200 kHz offset | *–80 dBc* |
| | 1800 kHz offset | *–77 dBc* |

43. EVM, ACPR and servo loop test times for the RF power amplifier test, reference solution are included in the solution brochure 5991-4104EN.
44. Capture block, transfer to host memory, 160 MHz BW, excludes frequency transitions below 400 MHz, with M9037A embedded controller (2-link configuration: 1 x 8 [factory default]).
45. Transfer to host memory, 160 MHz IF bandwidth filter, excludes frequency transitions below 400 MHz, with M9037A embedded controller (2-link configuration: 1 x 8 [factory default]).
46 Synthesizer PLL mode set to PLL mode best wide offset.
47. Expected input level 0 dBm, input signal (total power) 0 dBm, mixer level offset +10 dB, conversion type: Auto, PeakToAverage set per signal peak to average.

# Technical Specifications and Characteristics

## Format Specific measurement (cont'd)

| **W–CDMA** [48, 49] | **Parameters** | | **Typical** | **Nominal** |
|---|---|---|---|---|
| Residual EVM | 2 GHz, 1 DPCH, 1 carrier | | | *0.5%* |
| ACLR dynamic range | 2 GHz, 1 DPCH, 1 carrier (power mode) | Adjacent | *–68.1 dBc* | *–69.8 dBc* |
| | | Alternate | *–70.7 dBc* | *–71.7 dBc* |

| **802.11g** [48, 49, 53] | **Parameters** | **Nominal** |
|---|---|---|
| EVM | 2.4 GHz, 20 MHz BW | *–52.8 dB* |

| **802.11a** [48, 49, 53] | **Parameters** | **Nominal** |
|---|---|---|
| EVM | 5.8 GHz, 20 MHz BW | *–48.1 dB* |

| **802.11n** [48, 49, 53] | **Parameters** | **Nominal** | | | |
|---|---|---|---|---|---|
| | | **1-channel** | **2-channel** [51] | **3-channel** [51] | **4-channel** [51] |
| EVM | 2.4 GHz, 40 MHz BW | *–52.0 dB* | *–51.6 dB* | *–50.6 dB* | *–50.9 dB* |
| | 5.8 GHz, 40 MHz BW | *–48.6 dB* | *–46.6 dB* | *–45.3 dB* | *–46.0 dB* |

| **802.11ac** [48, 49] | **Parameters** | **Nominal** | | | |
|---|---|---|---|---|---|
| | | **1-channel** | **2-channel** [51] | **3-channel** [51] | **4-channel** [51] |
| | | | | Preamble only | |
| EVM [52] | 5.8 GHz, 80 MHz BW | *–46.5 dB* | *–44.3 dB* | *–43.0 dB* | *–43.6 dB* |
| | 5.8 GHz, 160 MHz BW | *–44.7 dB* | *–43.4 dB* | *–41.7 dB* | *–43.3 dB* |
| | | | | Preamble, pilots & data | |
| EVM [52] | 5.8 GHz, 80 MHz BW | *–49.4 dB* | *–48.6 dB* | *–47.3 dB* | *–46.4 dB* |
| | 5.8 GHz, 160 MHz BW | *–47.5 dB* | *–47.5 dB* | *–44.7 dB* | *–45.1 dB* |
| SEM | 5.8 GHz, 80 MHz BW | see Figure 10 | | | |

| **802.11a/g** [48, 49] | **Parameters** | |
|---|---|---|
| SEM | 2.4 GHz | see Figure 11 |
| | 5.5 GHz | see Figure 12 |

| **802.11e** [48, 49, 54] | **Parameters** | |
|---|---|---|
| OFDMA WiMAX™ EVM | 2.5, 3.5, & 5.8 GHz | *–48.3 dB, nominal* |

48. Synthesizer PLL mode set to PLL mode best wide offset.
49. Expected input level 0 dBm, input signal (total power) 0 dBm, conversion type: Auto. PeakToAverage set per signal peak to average.
50. Synthesizer PLL mode set to PLL mode normal.
51. 2-channel, 3-channel and 4-channel configurations require M9391A instrument driver version 1.1 or greater.
52. Mixer level offset = +5 dB
53. Mixer level offset = +10 dB
54. Mixer level offset = +15 dB

# Technical Specifications and Characteristics

## Format specific measurement (cont'd)

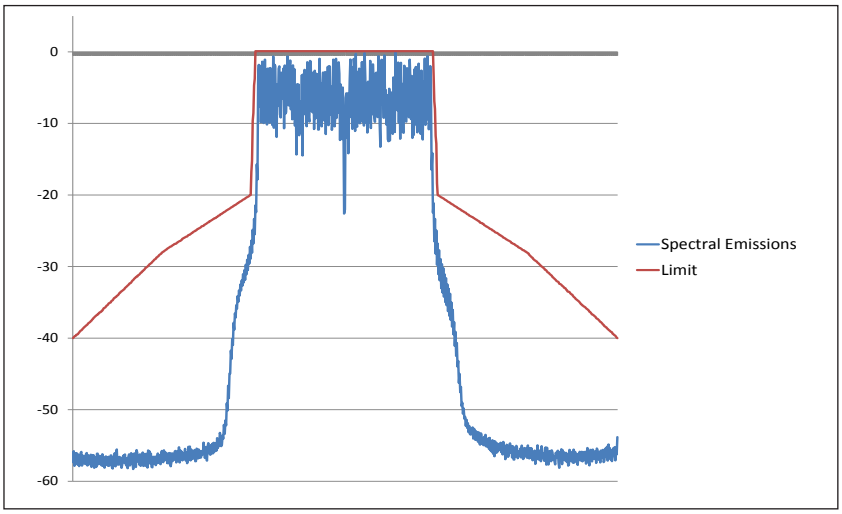



Figure 10. WLAN 802.11ac SEM at 5.8 GHz, 80 MHz bandwidth.

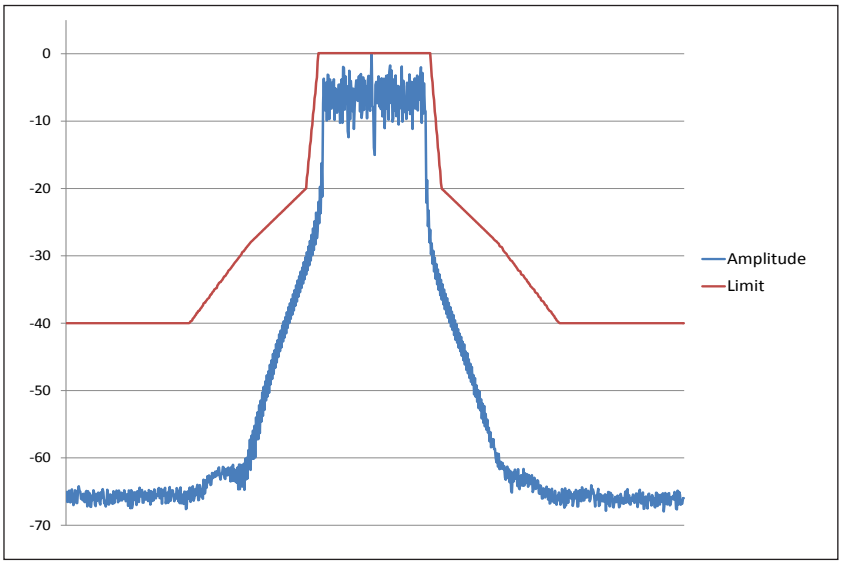



Figure 11. WLAN 802.11a/g SEM at 2.4 GHz, 20 MHz bandwidth.

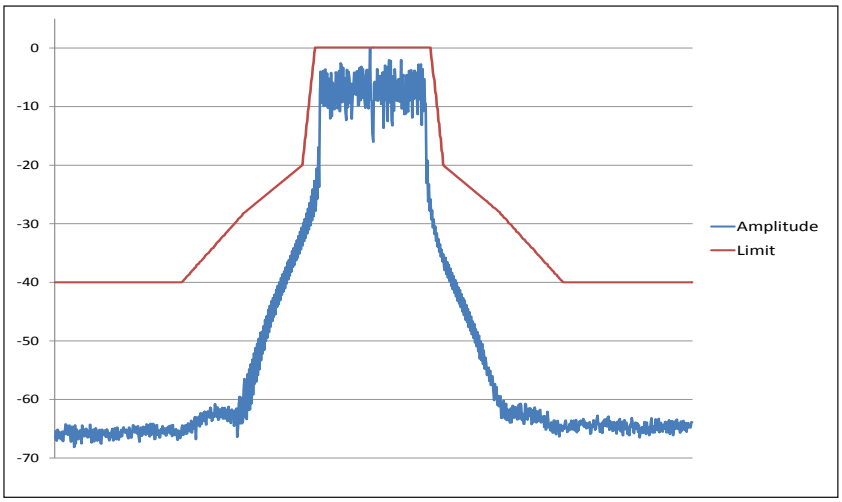



Figure 12. WLAN 802.11a/g SEM at 5.5 GHz, 20 MHz bandwidth.

# Technical Specifications and Characteristics

## Format specific measurement (cont'd)

| **LTE FDD - single channel** [55, 56] | **Parameters** | | **1-channel, nominal** |
|---|---|---|---|
| 10 MHz BW EVM, E–TM 3.1 [58, 59] | 0.7, 0.9 GHz | | *–52.2 dB (0.25%)* |
| | 1.8, 1.9, 2.0, 2.1, 2.2 GHz | | *–51.0 dB (0.28%)* |
| 10 MHz BW ACLR, E–TM 1.1 [60] | 0.7, 0.9, 1.8, 1.9, 2.0, 2.1, 2.2 GHz (power mode) | Adjacent | *–64.2 dBc* |
| | | Alternate | *–65.5 dBc* |

| **LTE FDD - MIMO** [55, 56, 57] | **Parameters** | **2-channel, nominal** | **4-channel, nominal** |
|---|---|---|---|
| 10 MHz BW EVM, R9 downlink, 64 QAM, open loop spacial multiplexing | 0.9 GHz | *–49.8 dB (0.32%)* | *–50.1 dB (0.31%)* |
| | 2.0 GHz | *–49.2 dB (0.35%)* | *–49.3 dB (0.34%)* |

| **LTE TDD - MIMO** [55, 56, 57] | **Parameters** | **2-channel, nominal** | **4-channel, nominal** |
|---|---|---|---|
| 10 MHz BW EVM, R9 downlink, 64 QAM, open loop spacial multiplexing | 0.9 GHz | *–50.7 dB (0.29%)* | *–50.3 dB (0.31%)* |
| | 2.0 GHz | *–49.0 dB (0.36%)* | *–49.0 dB (0.36%)* |

55. Expected input level 0 dBm, input signal (total power) 0 dBm, conversion type: Auto. PeakToAverage set per signal peak to average.
56. Synthesizer PLL mode set to PLL mode normal.
57. MIMO configurations require M9391A instrument driver version 1.1 or greater.
58. PDCCH power boost = 1.065 dB
59. Mixer level offset = +10 dB
60. Mixer level offset = +15 dB

# Technical Specifications and Characteristics

| **Environmental and physical specifications** | | | | |
|---|---|---|---|---|
| Temperature | Operating | | Individual module temp 25 to 75 °C as reported by the module and environment temp of 0 to 55 °C | |
| | Non-operating (storage) | | Environment temp of –40 to +70 °C | |
| Humidity[61] | | | Type tested at 95%, +40 °C (non-condensing) | |
| Shock/vibration[61] | Operating random vibration<br>Survival random vibration<br>Functional shock<br>Bench handling | | Type tested at 5 to 500 Hz, 0.21 g rms<br>Type tested at 5 to 500 Hz, 2.09 g rms<br>Type tested at half-sine, 30 g, 11 ms<br>Type tested per MIL-PRF-28800F | |
| Altitude | | | Up to 15,000 feet (4,572 meters)[62] | |
| Connectors | RF In | | SMA female | |
| EMC | | | Complies with European EMC Directive 2004/108/EC<br>– IEC/EN 61326-2-1<br>– CISPR Pub 11 Group 1, class A<br>– AS/NZS CISPR 11<br>– ICES/NMB-001<br>This ISM device complies with Canadian ICES-001.<br>Cet appareil ISM est conforme a la norme NMB-001 du Canada. | |
| Warm-up time | | | 45 minutes | |
| Size | M9300A<br>M9301A<br>M9350A<br>M9214A | | 1 PXIe slot<br>1 PXIe slot<br>1 PXIe slot<br>1 PXIe slot | |
| Dimensions | Module | Length | Width | Height |
| | M9300A | 210 mm | 22 mm | 130 mm |
| | M9301A | 210 mm | 22 mm | 130 mm |
| | M9350A | 210 mm | 22 mm | 130 mm |
| | M9214A | 210 mm | 22 mm | 130 mm |
| Weight | M9300A<br>M9301A<br>M9350A<br>M9214A | | 0.55 kg (1.21 lbs)<br>0.54 kg (1.19 lbs)<br>0.56 kg (1.23 lbs)<br>0.36 kg (0.79 lbs) | |
| Power drawn from chassis | M9300A<br>M9301A<br>M9350A<br>M9214A | | ≤ 18 W<br>≤ 25 W<br>≤ 30 W<br>≤ 35 W | |

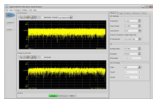
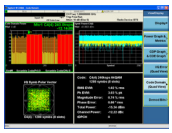
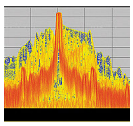
61. Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation and end-use--those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power-line conditions. Test methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.
62. At 15,000 feet, the maximum environmental temperature is de-rated to 52 °C.

# Technical Specifications and Characteristics

| **System requirements** | | |
|---|---|---|
| **Topic** | **Windows 7 and Vista requirements** | **Windows XP requirements** |
| Operating systems | Windows 7 (32-bit and 64-bit)<br>Windows Vista, SP1 and SP2 (32-bit and 64-bit) | Windows XP, SP 3 |
| Processor speed | 1 GHz 32-bit (x86), 1 GHz 64-bit (x64)<br>(no support for Itanium 64) | 600 MHz or higher required<br>800 MHz recommended |
| Available memory | 4 GB minimum<br>8 GB or greater recommended | 3 GB minimum |
| Available disk space [63] | 1.5 GB available hard disk space, includes:<br>1 GB available for Microsoft .NET Framework 3.5 SP1 [64]<br>100 MB for Keysight IO Libraries Suite | |
| Video | Support for DirectX 9 graphics with 128 MB graphics memory recommended<br>(Super VGA graphics is supported) | Super VGA (800 x 600) 256 colors or more |
| Browser | Microsoft Internet Explorer 7 or greater | Microsoft Internet Explorer 6 or greater |
| **M9391A vector signal analyzer instrument drivers** | | |
| Keysight IO libraries | Version 16.3 or greater | |
| M9391A instrument driver | Version 1.1 or greater | |

63. Because of the installation procedure, less disk space may be required for operation than is required for installation.
64. NET Framework Runtime Components are installed by default with Windows Vista and Windows 7. Therefore, you may not need this amount of available disk space.

# Software

| | | | |
|---|---|---|---|
| **Instrument connection software** | | | |
|  | Keysight IO library | The IO library suite offers a single entry point for connection to the most common instruments including AXIe, PXI, GPIB, USB, Ethernet/ LAN, RS-232, and VXI test instruments from Keysight and other vendors. It automatically discovers interfaces, chassis, and instruments. The graphical user interface allows you to search for, verify, and update IVI instrument and soft front panel drivers for modular and traditional instruments. The IO suite safely installs in side-by-side mode with NI I/O software. | Free software download at **www.keysight.com/find/iosuite** |
| **Module setup and usage** | | | |
|  | Keysight soft front panel | The PXI module includes a soft front panel (SFP), a software-based graphical user interface (GUI) which enables the instrument's capabilities from your PC. | Included on CD-ROM shipped with module or **online** |
| **Module management** | | | |
| Keysight connection expert | | Connection expert is the graphical user interface included in the IO libraries suite that allows you to search for, verify and update IVI instrument and soft front panel drivers for modular and traditional instruments | Free software download at **www.keysight.com/find/iosuite** |
| **Programming** | | | |
| **Driver** | | **Development environments** | |
| IVI-COM, IVI-C LabVIEW, MATLAB | | Visual Studio (VB.NET, C#, C/C++), VEE LabVIEW, LabWindows/CVI, MATLAB | Included on CD-ROM shipped with module. |
| **Programming assitance** | | | |
|  | Command expert | Assists in finding the right instrument commands and setting correct parameters. A simple interface includes documentation, examples, syntax checking, command execution, and debug tools to build sequences for integration in Excel, MATLAB, Visual Studio, LabVIEW, VEE, and SystemVue. | Free software download at **www.keysight.com/find/commandexpert** |
| | Programming examples | Each module includes programming examples for Visual Studio.net, LabVIEW, MATLAB, LabWindows, and Keysight VEE Pro. | Included on CD-ROM shipped with module. |
| **Signal analysis software** | | | |
|  | X-Series measurement applications for modular instruments | The X-Series measurement applications transform modular PXI VSAs into standards based RF transmitter testers. Provides conformance measurements for many communications standards including : LTE, WLAN 802.11ac and others. | Licensed software. For more information, visit **www.keysight.com/find/pxi-x-series_apps** |
|  | 89600 VSA | 89600 VSA software sees through the complexity of emerging and existing industry standards, serving as your window into complex signal interactions. Quickly characterize spurs and harmonics with speed-optimized stepped spectrum measurement provided by 89601B-SSA option. | Licensed software. For more information, visit **www.keysight.com/find/vsa** |
|  | SystemVue | SystemVue is a system-level EDA platform for designing communications and defense systems. Used with the M9391A, SystemVue enables you to create model-based design validation tests to ensure consistency from design to manufacturing. | Licensed software. For more information, visit **www.keysight.com/find/systemvue** |

# Setup and Calibration Services

| | | |
|---|---|---|
| **Assistance** | | |
| One day startup assistance | Gain access to a technical expert who will help you get started quickly with the M9391A PXI VSA and its powerful software tools. The flexible instruction format is designed to get you to your first measurements and familiarize you with ways to adapt the equipment to a specific application. | Included in base configuration |
| **Calibration and traceability** | | |
| Factory calibration | The M9391A PXI VSA ships factory calibrated with an ISO-9002, NIST-traceable calibration certificate. | Included in base configuration |
| Calibration cycle | A one year calibration cycle is recommended. | |
| Calibration sites | – At Keysight worldwide service xenters<br>– On-site by Keysight<br>– By self-maintainers | For more information visit **www.keysight.com/find/infoline** |
| N7800A calibration and adjustment software | The M9391A PXI VSA is supported by Keysight's calibration and adjustment software. This is the same software used at Keysight service centers to automate calibration. The software offers compliance tests for ISO 17025:2005, ANSI/NCSL Z540.3-2006, and measurement uncertainty per ISO Guide to Expression of Measurement Uncertainty. | Licensed software.<br>For more information, visit **www.keysight.com/find/calibrationsoftware** |
| Keysight calibration status utility | The Keysight calibration status utility helps ensure your M9391A is calibrated by managing the calibration interval and providing messages regarding instrument and module calibration status. | Included in base configuration |

# Support and Warranty

| **Warranty** | | |
|---|---|---|
| Global warranty | Keysight's warranty service provides standard coverage for the country where product is used.<br>– All parts and labor necessary to return to full specified performance<br>– Recalibration for products supplied originally with a calibration certificate<br>– Return shipment | Included |
| Standard | Return to Keysight warranty–3 years<br>15 days typical turnaround repair service | Included |
| R-51B-001-5Z | Return to Keysight warranty–5 years<br>15 days typical turnaround repair service | Optional |
| R-51B-001-3X<br>Express warranty<br>3 years | The express warranty upgrades the global warranty to provide, for 3 years, a 5 day typical turnaround repair service in the US, Japan, China and many EU countries. | Optional |
| R-51B-001-5X<br>Express warranty<br>5 years | The express warranty upgrades the global warranty to provide, for 5 years, a 5 day typical turnaround repair service in the US, Japan, China and many EU countries. | Optional |

| **Support** | | |
|---|---|---|
| Core exchange program | Keysight's replacement core exchange program allows fast and easy module repairs. A replacement core assembly is a fully functioning pre-calibrated module replacement that is updated with the defective module serial number, allowing the replacement module to retain the original serial number. | For qualified self-maintainers in US only |
| Self-test utility | A self-test utility runs a set of internal tests which verifies the health of the modules and reports their status. | Included in base configuration |

# Configuration and Ordering Information

## Ordering information

| Model | Description |
|---|---|
| M9391A | PXIe vector signal analyzer:<br>1 MHz to 3 or 6 GHz<br>Includes:<br>M9301A PXIe synthesizer<br>M9350A PXIe downconverter<br>M9214A PXIe IF digitizer<br>One day startup assistance<br>Module interconnect cables<br>Software, example programs and product information on CD<br>Return to Keysight warranty–3 Years |

| Base configuration | |
|---|---|
| M9391A-F03 | Frequency range: 1 MHz to 3 GHz |
| M9391A-B04 | Analysis bandwidth, 40 MHz |
| M9391A-M01 | Memory, 128 MSa |
| M9391A-300<br>Required for warranted specifications | PXIe frequency reference:<br>10 and 100 MHz<br>Adds M9300A PXIe frequency reference:<br>10 and 100 MHz (M9300A module can support multiple M9391A modular instruments) |

For configurations of the M9391A PXI VSA, including combinations with a single or multiple M9381A PXI VSGs, please consult the M9391A & M9381A configuration guide, literature number 5991-0897EN.

| Configurable options | |
|---|---|
| **Frequency** | |
| M9391A-F03 | 1 MHz to 3 GHz |
| ✓ M9391A-F06 | 1 MHz to 6 GHz |
| **Switching speed** | |
| ✓ M9391A-UNZ | Fast switching |
| **Analysis bandwidth** | |
| M9391A-B04 | 40 MHz |
| M9391A-B10 | 100 MHz |
| ✓ M9391A-B16 | 160 MHz |
| **Memory** | |
| M9391A-M01 | 128 MSa |
| M9391A-M05 | 512 MSa |
| ✓ M9391A-M10 | 1024 MSa |
| **Other** | |
| M9391A-UK6 | Commercial calibration certificate with test data for M9391A (M9301A, M9350A, M9214A) |
| M9300A-UK6 | Commercial calibration certificate with test data for M9300A (module only) |
| **Related products in recommended configuration** | |
| ✓ M9037A | PXIe embedded controller |
| ✓ M9018A | 18-slot PXIe chassis |

✓ Indicates recommended configuration

# Configuration and Ordering Information

## Software information

| | |
|---|---|
| Supported operating systems | Microsoft Windows XP (32-bit)<br>Microsoft Windows 7 (32/64-bit)<br>Windows Vista, SP1 and SP2 (32-bit and 64-bit) |
| Standard compliant drivers | IVI-COM, IVI-C, LabVIEW, MATLAB |
| Supported application development environments (ADE) | VisualStudio (VB.NET, C#, C/C++), VEE, LabVIEW, LabWindows/CVI, MATLAB |
| Keysight IO libraries (version 16.3 or newer) | Includes: VISA libraries, Keysight Connection Expert, IO monitor |
| Keysight Command Expert | Instrument control for SCPI or IVI-COM drivers |
| 89600 VSA Software (version 17.21 or newer; Option SSA added in version 18.5) | 89600B-200 Basic VSA software<br>89601B-300 Hardware connectivity<br>89601B-SSA Spectrum analysis<br>89601B-AYA GP analysis<br>89601B-B7T cdma2000®/1xEV-DO<br>89601B-B7U W-CDMA/HSPA+<br>89601B-B7R WLAN 802.11a/b/g/j/p<br>89601B-B7X TD-SCDMA<br>89601B-BHD LTE FDD<br>89601B-BHG LTE FDD - Advanced<br>89601B-BHE LTE TDD<br>89601B-BHH LTE TDD - Advanced |
| X-Series Measurement Applications for Modular Instruments transportable perpetual license. | M9063A Analog demodulation<br>M9064A Vector signal analysis<br>M9071A GSM/EDGE/Evo<br>M9072A cdma2000®/cdmaOne<br>M9073A W-CDMA/HSPA+<br>M9076A 1xEV-DO<br>M9077A WLAN 802.11a/b/g/n/ac<br>M9079A TD-SCDMA/HSDPA<br>M9080B LTE/LTE-A FDD<br>M9081A *Bluetooth*®<br>M9082B LTE/LTE-A TDD |

## Accessories

| Model | Description |
|---|---|
| Y1212A | Slot blocker kit: 5 modules |
| Y1213A | PXI EMC filler panel kit: 5 slots |
| Y1214A | Air inlet kit: M9018A 18-slot chassis |
| Y1215A | Rack mount kit: M9018A 18-slot chassis |
| Y1299-001 | PXI solutions startup kit - MIMO solution |

## Related products

| Model | Description |
|---|---|
| M9381A | PXIe vector signal generator |
| M9380A | PXIe CW source |
| M9300A | PXIe frequency reference |
| M9021A | PCIe cable interface |
| M9018A | PXIe 18-slot chassis |
| M9037A | PXIe embedded controller |
| M9045B | PCIe express card adaptor for laptop connectivity |
| Y1200B | PCIe cable for laptop connectivity |
| M9048A | PCIe desktop adaptor for desktop connectivity |
| Y1202A | PCIe cable for desktop connectivity |

| **Advantage services: Calibration and warranty** | |
|---|---|
| Keysight Advantage Services is committed to your success throughout your equipment's lifetime | |
| R-51B-001-5Z | Return to Keysight warranty - 5 years |
| R-51B-001-3X | Express warranty - 3 years |
| R-51B-001-5X | Express warranty - 5 years |
| N7800A | Calibration & adjustment software |

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| | |
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