Agilent M9202A
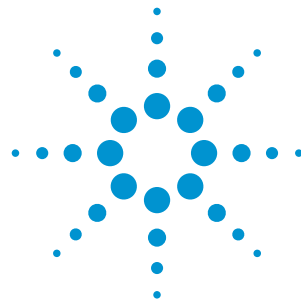
PXI-Express
Wideband IF Digitizer

Data Sheet

12-bit, 2 GS/s, 1 GHz
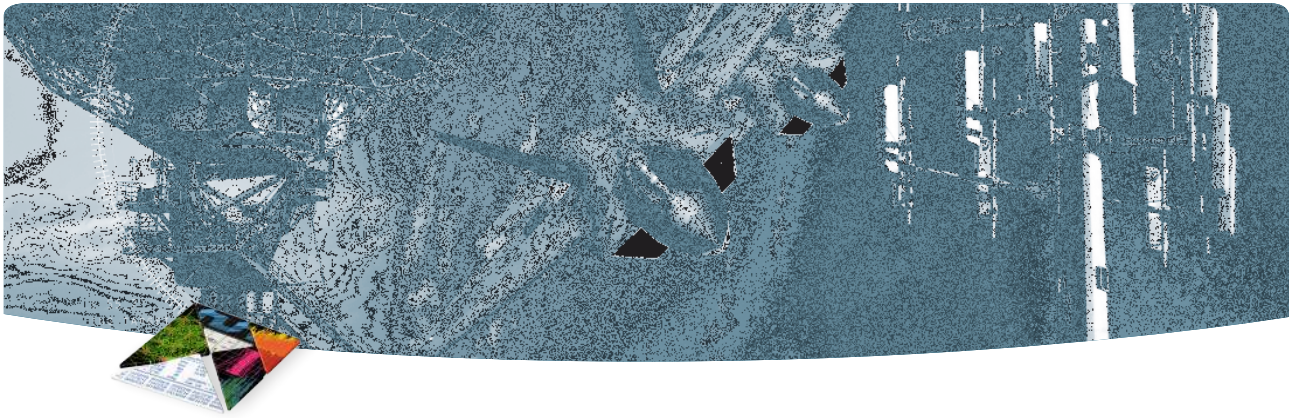
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Agilent Modular Products

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OVERVIEW

Introduction

The Agilent Technologies M9202A is a very fast PXIe IF digitizer featuring wide analog bandwidth, making it ideal for Automated Test Equipment (ATE) in Aerospace & Defense applications such as Military Mobile Repair Stations, Radar Test or any application requiring wideband signal capture and at the same time very high dynamic range. Thanks to its PXI Express backplane connection, the M9202A supports continuous data streaming to disk.

Product Description

The M9202A is a one-slot 3U PXIe 12-bit Wideband IF Digitizer running at 2 GS/s, with up to 1 GHz instantaneous analog bandwidth and providing a large 512 Mbytes DDR3 memory. The M9202A features a Xilinx Virtex-6 FPGA that can implement different functionalities depending on which firmware option you choose.

The BAS option provides basic digitizer functionality allowing capture of a signal, storing of data in the memory and/or transferring it through the backplane connectors for example.

The DDC option, in addition to basic digitizer functionality, implements a Digital Down Conversion (DDC) algorithm in the 300 MHz to 700 MHz band, improving the analog performance such as the Spurious Free Dynamic Range (SFDR) or Signal-to-Noise Ratio (SNR) and reducing data upload time.

The M9202A also provides a continuous digitized data streaming capability through the V05 and V10 options. The V05 option offers up to 50 MHz analog bandwidth streaming via the back-plane connector, whereas the V10 option allows an unprecedented gap-free analog bandwidth streaming of up to 100 MHz in PXI format.

When integrated in the Agilent M9392A PXI Vector Signal Analyzer, and combined with the 89601 software, the M9202A provides a complete signal analyzer solution enabling analysis of communications, radar and avionics signals up to 26.5 GHz in a modular open-system standard.

Applications

- Aerospace and defense
- Wireless communication
- Radar and Wideband signal capture

Features

- 2 GS/s sampling rate
- Up to 1 GHz bandwidth
- SFDR = 60 dBc (*typical*) in basic digitizer mode
- SFDR = 84 dBc (*typical*) after digital downconversion (with DDC option)[1]
- Dither function[2]
- AC-coupled 50 Ω input impedance
- +4 dBm full scale range (dither disabled[2])
- Basic digitizer functionality
- Real-time digital Down Conversion algorithm (with DDC option)
- On-board Xilinx Virtex-6 FPGA
- 512 MB DDR3 Memory
- Data streaming through PXI Express backplane
- IVI-C, IVI-COM, LabVIEW and MATLAB drivers

Customer values

- Fast PXIe 12-bit IF Digitizer
- Capture wide bandwidth signals
- High dynamic range acquisition for better measurement fidelity
- Large on-board memory
- Data decimation for analog performance and data upload time improvement
- Continuous stream of wideband signals (up to 100 MHz)
- Software support including multiple programmatic interfaces for easy integration into existing test environments
- Reduced development time

[1] *Depends on DDC parameters settings (only with DDC firmware option)*
[2] *Dither only available with DDC option*

EASY SETUP ... TEST ... AND MAINTENANCE

Hardware platform

Compliance

The M9202A is PXI Express compliant, using either a PXIe or a PXIe Hybrid slot. Designed to benefit from fast data interfaces, the products can be integrated with other test and automation modules in PXIe and Hybrid chassis. The PXI format offers high performance in a small, rugged package. It is an ideal deployment platform for many automated test systems. A wide array of complementary PXI products are currently available, including multimeters, waveform generators, local oscillators, digitizers, downconverters and switch multiplexers.

Software platform

IO Libraries

Agilent IO Libraries Suite offers FAST and EASY connection to instruments and the newest version extends that capability to include modular instruments.

The Agilent IO Libraries Suite helps you by displaying ALL the modules in your system, whether they are PXI, PXIe, or PCIe. From here you can view information about the installed software or launch the modules' soft front panel directly from Agilent Connection Expert.

In addition, the Agilent Connection Expert (ACE) offers an easy way to find the correct driver for your instrument.

Drivers

The M9202A Wideband IF Digitizer is supplied with a comprehensive portfolio of module drivers, documentation, examples, and software tools to help you quickly develop test systems with your software platform of choice. The module comes with IVI-COM, IVI-C, LabVIEW and MATLAB software drivers that work in the most popular T&M development environments including, LabVIEW and LabWindows/CVI from National Instruments, MATLAB from The MathWorks, Microsoft C/ C++, C#, and VB.NET.

Easy software integration

To help you get started and complete complex tasks quickly, the module software is provided with context sensitive help, complete documentation and code examples that allow a quick module set up and basic acquisition functionalities. These code examples can be easily modified, so that the card can be quickly integrated into a measurement system.

Included are application code examples for LabVIEW, LabWindows/CVI, Visual Studio C, C++, and C#, Visual Basic, and MATLAB which provide digitizer set up and basic acquisition functionality. These application code examples are easily modified to quickly integrate the module into your measurement system.

Software applications

In addition, the M9202A includes the Agilent MD1 soft front panel (SFP) graphical interface. This simple software application can be used to control, verify the functionality and explore the capabilities of the Agilent modular high-speed digitizers. The MD1 SFP provides several different measurement and display capabilities, one being a real-time FFT plot of the acquired signal.
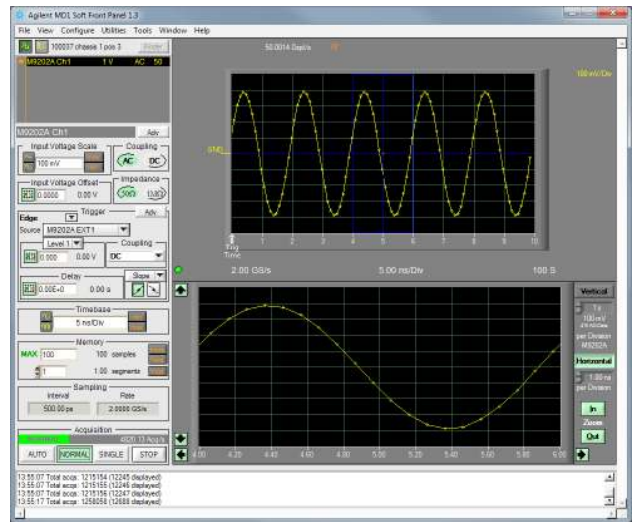
The Agilent MD1 soft front panel software has two main windows, the acquisition parameters to control the module and the acquired waveform display.
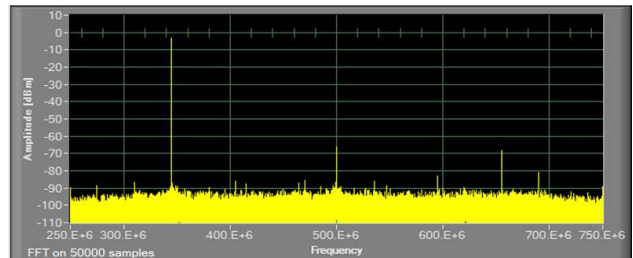
Agilent MD1 SFP acquired signal FFT display.

Figure 1. Soft front panel

Firmware options

The M9202A provides two main firmware options: BAS (basic digitizer firmware) and DDC (digital downconversion firmware).

The BAS option features a basic digitizer firmware that allows digitizing signals up to 1 GHz at 2 GS/s with a resolution of 12-bit. The digitized data can be stored in the on-board memory and/or transferred through the PXIe backplane.

The DDC option, in addition to the basic digitizer functionality, implements a real-time digital downconversion and decimation on the digitized data, allowing to fully analyzing signals of up to 250 MHz bandwidth. DDC settings as dithering level, data bandwidth, trigger bandwidth and frequency shift are variable in order to satisfy customer needs. One can change the center frequency, set the amount of digital filtering applied to the data and make dramatic improvements in the ADC's harmonic distortion performance by changing these parameters settings. In order to get the best results from the DDC firmware, anti-alias filtering should be performed on the signal prior to entering the digitizer. A bandpass filter, with a passband of 375 to 625 MHz with excellent stopband rejection at the nearest image band centered at 1.5 GHz on the upper side, and nominal stopband rejection up to the highest sub-harmonic of an in-band signal (625 / 2 = 312.5 MHz) on the lower side is recommended. The signal should peak to -2 dBm at the digitizer input for optimum performance with the DDC algorithm.

In addition, the M9202A also provides the V05 and V10 options, which feature continuous digitized data streaming capability through the PXI Express backplane. The V05 option allows to stream up to 50 MHz analog bandwidth, whereas the V10 option doubles the data transfer speed in order to reach an unprecedented 100 MHz gap-free analog bandwidth streaming in PXI format.

Product configuration

The M9202A is based on a modular architecture allowing various product configuration options according to customer requirements. Any configuration must include the product base (M9202A), a number of channels, the sampling rate, amount of memory size and one firmware option.

Calibration intervals

The M9202A is factory calibrated and shipped with a calibration certificate.

Calibration is recommended every year in order to verify product performance.
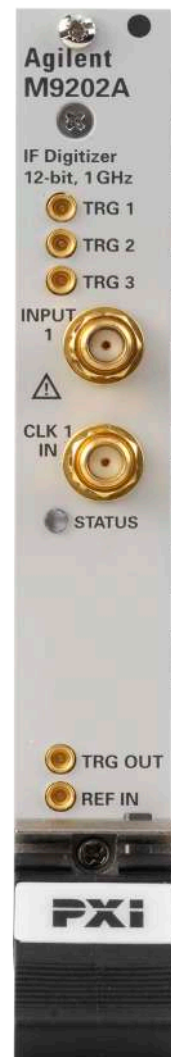
TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

Analog Input (INPUT 1 SMA connector)

Number of channels	1 (one)
Impedance	50 Ω *(nominal)*
Coupling	AC
VSWR	< 1.5, *(nominal)* @ 500 MHz
Full scale (FS) ranges	+4 dBm (1 V pk-pk in 50 Ω)
Maximum input level	+30 dBm (continuous without damage)
-3dB Bandwidth (no filters)	30 MHz *(nominal)* to 1 GHz
Frequency response flatness	± 1 dB, typical for a frequency range of 100 MHz to 800 MHz
No digital processing (Digitizer mode)	
Spurious-Free Dynamic Range (SFDR) [1]	
@ 125 MHz	54 dBc *(60 dBc, typical)*
@ 410 MHz	54 dBc *(60 dBc, typical)*
@ 925 MHz	49 dBc *(55 dBc, typical)*
Total Harmonic Distortion (THD) [1]	
@ 125 MHz	–59 dBc *(–65 dBc, typical)*
@ 410 MHz	–57 dBc *(–63 dBc, typical)*
@ 925 MHz	–49 dBc *(–55 dBc, typical)*
Signal to Noise Ratio [2]	
@ 125 MHz	52 dBc *(56 dBc, typical)*
@ 410 MHz	51 dBc *(55 dBc, typical)*
@ 925 MHz	48 dBc *(52 dBc, typical)*
ENOB [2]	
@ 125 MHz	9 bits *(typical)*
@ 410 MHz	8.8 bits *(typical)*
@ 925 MHz	8.2 bits *(typical)*
With Digital Downconversion (DDC mode) [3]	
Spurious-Free Dynamic Range (SFDR) [4]	
@ 300 MHz (frequency shift = 187.5 MHz)	78 dBc *(84 dBc, typical)*
@ 410 MHz (frequency shift = 93.75 MHz)	78 dBc *(84 dBc, typical)*
@ 650 MHz (frequency shift = –156.25 MHz)	77 dBc *(83 dBc, typical)*

[1]   *Measured for a −1 dBFS input signal in internal clock mode.*
[2]   *Measured for a −1 dBFS input signal in internal clock mode, considering the 2nd through 6th harmonics.*
[3]   *Only with DDC option*
[4]   *Average of 20 measurements on 16384 complex points for a -1 dBFS input signal in internal clock mode. Data Bandwidth = 50 MHz and Dither level = 12 as DDC parameters.*

Digital Conversion	
Digitizer modes	Basic digitizer or DDC digitizer [1]
Resolution	12 bits
Acquisition memory	512 MB (256 MSamples real, 128 MSamples complex)
Sample clock sources	Internal or external
Internal clock source	Internal or external reference
Real-time sampling rates	2 GS/s
Sampling jitter (internal reference)	200 fs RMS (*nominal*)
Clock accuracy	± 2 ppm
External clock source (CLK 1 IN SMA connector)	
Impedance	50 Ω (*nominal*)
Modes	Continuous
Frequency range	1 GHz
Signal power level	+7 dBm (1.4 V pk-pk in 50 Ω) ± 3 dB
Coupling	AC
External Reference clock (REF IN MMCX connector)	
Impedance	50 Ω (*nominal*)
Frequency range	100 MHz ± 1% (*nominal*)
Signal power level	+2 dBm ± 5 dB (*nominal*)
Coupling	AC
Maximum power level	+7 dBm
Time stamps	Records trigger time differences with 250 ps (*nominal*) resolution
Acquisition modes	Single shot

Digital Downconversion (DDC option only)	
Digitizer modes	Basic digitizer or DDC digitizer
Recommended input signal peak level	−2 dBm
Flip band	Enabled or disabled
IF Frequency	500 MHz
Usable data bandwidth (DBW)	250 MHz and 200 MHz/2^n (n = 0, 1, 2, …, 18)
Trigger bandwidth	250 MHz and 200 MHz/2^n (n = 0, 1, 2, …, 18)
Frequency shift	[0, ±Y] + [0, ±2Y] + [0, ±4Y] + … + [0, ±125 MHz], where Y = 2.5xDBW/4 for DBW ≤ 200 MHz
Dither levels	0, 1, 2, …, 31, where 31 = FS/2 (recommended: 14)

[1] *Only with DDC option*

Trigger

Trigger modes	Edge (positive, negative)
Trigger sources	External (TRG 1, TRG 2, TRG 3), Software and Magnitude (only with DDC option)
Trigger delay	
Pre-trigger	Adjustable to 100% of acquisition window
Post-trigger	Adjustable up to 2^{31}-1 samples
External trigger (TRG 1, TRG 2, TRG 3 MMCX connectors)	
Coupling	DC
Impedance	50 Ω
Level range	± 5 V (nominal)
Maximum overload protection	± 5 V
Amplitude range	0.5 V pk-pk

Environmental and physical [1]

Temperature range	Operating Non-Operating	0 °C to 50 °C -40 °C to +70 °C
Relative humidity		Type tested at 95%, +40°C (non-condensing)
Safety		Complies with EN61010-1
EMC		Complies with European EMC Directive 2004/108/EC • IEC/EN 61326-1 or IEC/EN 61326-2-1 • CISPR Pub 11 Group 1, class A • AS/NZS CISPR 11 • ICES/NMB-001 This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.
Warm-up time		15 minutes, max

Power dissipation

+3.3 V	+12 V	Total power
2.1 A (nominal)	1.8 A (nominal)	28.5 W (nominal)

Dimensions	• 3U/1-slot PXI-Express • Chassis slot compatibility: PXIe Hybrid, PXIe • Front panel complies with IEEE1101.10 certification
Weight	0.8 lb/0.4 kg

System requirements

Operating Systems	Windows XP, Service Pack 3 or later (32-bit)	Windows Vista, SP1 and SP2 (32-bit and 64-bit), Business, Ultimate, Enterprise, Home Basic, and Home Premium	Windows 7 (32-bit and 64-bit) Starter, Home Basic, Home Premium, Professional, Ultimate, and Enterprise
Processor speed	600 MHz or higher required 800 MHz recommended	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium 64	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium 64
Available Memory	256 MB minimum (1 GB or greater recommended)	1 GB minimum	1 GB minimum
Available Disk Space [1]	1.5 GB available hard disk space, includes: • 1 GB available for Microsoft .NET Framework 3.5 SP1 [2] • 100 MB for Agilent IO Libraries Suite	1.5 GB available hard disk space, includes: • 1 GB available for Microsoft .NET Framework 3.5 SP1 [2] • 100 MB for Agilent IO Libraries Suite	1.5 GB available hard disk space, includes: • 1 GB available for Microsoft .NET Framework 3.5 SP1 [2] • 100 MB for Agilent IO Libraries Suite
Video	Super VGA (800x600) 256 colors or more	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 6.0 or greater	Microsoft Internet Explorer 7 or greater	Microsoft Internet Explorer 7 or greater

[1] Samples of this product have been type tested in accordance with the Agilent 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.

[2] 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.

CONFIGURATION

Hardware

Model [1]	Description
● Base	
☑ M9202A	PXIe IF Digitizer: 12-bit, 1 GHz
● Channels	
☑ M9202A-C01	Single channel
● Frequency range/Sampling rate	
☑ M9202A-F02	Frequency range: 2 GS/s
● Memory	
☑ M9202A-M05	Standard memory: 512 MB
● Firmware	
☐ M9202A-DDC	Digital down-conversion firmware
☑ M9202A-BAS	Basic Digitizer firmware
Streaming	
☐ M9202A-V05	Streaming, 50 MHz bandwidth
☐ M9202A-V10	Streaming, 100 MHz bandwidth

● *Required options: at least one option has to be selected in each of these groups.*

☑ *Recommended configuration*

[1] *For the M9202A to work properly, at least one PXI Express chassis and one PXI controller type must be available.*

Accessories

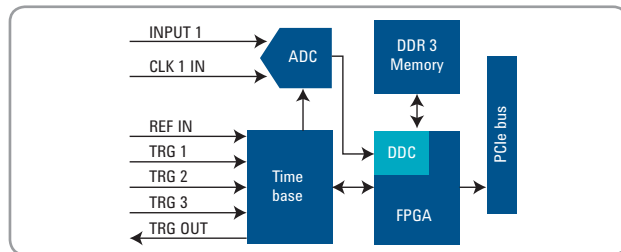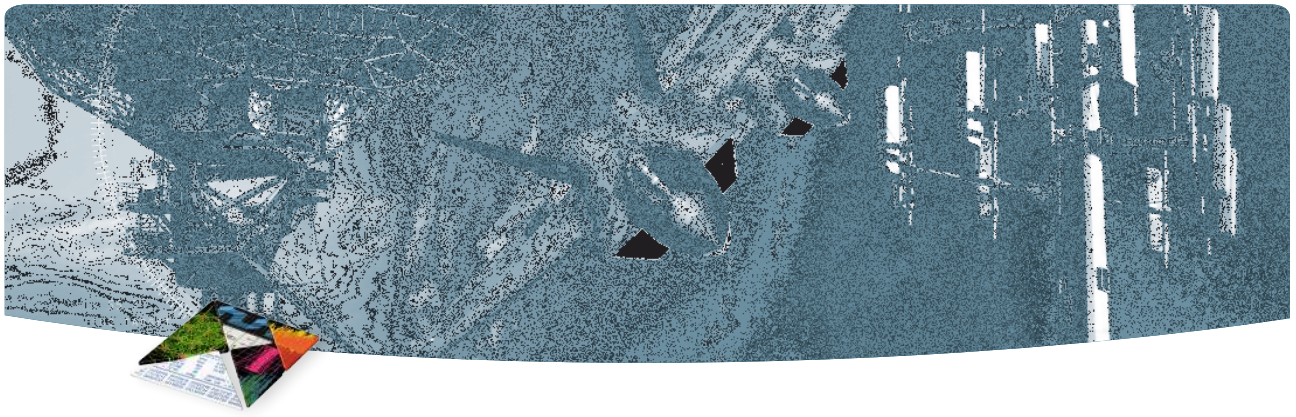| Description |
|---|
| Software and product information on CD *(included)* |
| Cables *(included)* |

Figure 2. Simplified block diagram of the M9202A PXIe IF Digitizer.

Related products

Model	Description
M9302A	PXI Local Oscillator: 3 GHz to 10 GHz
M9351A	PXI Downconverter: 50 MHz to 2.9 GHz
M9361A	PXI Downconverter: 2.75 GHz to 26.5 GHz
M9362A-D01	PXIe Microwave Quad Downconverter: 10 MHz to 26.5 GHz
M9360A	PXI Attenuator/Preselector: 100 kHz to 26.5 GHz
M9392A	PXI Vector Signal Analyzer
M9211A	PXI-H UWB IF Digitizer: 10-bit, 4 GS/s, 3 GHz
M9018A	18-slot PXIe Chassis
M9021A	PCIe Cable Interface
89601	VSA software

Software

Model	Description
Supported operating systems	Microsoft Windows XP (32-bit), Microsoft Windows Vista (32/64-bit), Microsoft Windows 7 (32/64-bit)
Standard compliant drivers	IVI-COM, IVI-C, LabVIEW, MATLAB
Supported application development environments (ADE)	VisualStudio (VB.NET, C#, C/C++), LabVIEW, LabWindows/CVI, MATLAB
Agilent IO Libraries	Includes: VISA Libraries, Agilent Connection Expert, IO Monitor

ORDERING

Model [1]	Description
M9202A	PXIe IF Digitizer: 12-bit, 1 GHz
M9202A-C01	Single channel
M9202A-F02	Frequency range: 2 GS/s
M9202A-M05	Standard memory: 512 MB
M9202A-BAS	Basic Digitizer firmware
M9202A-DDC	Digital down-conversion firmware
M9202A-V05	Streaming, 50 MHz bandwidth
M9202A-V10	Streaming, 100 MHz bandwidth

[1] For the M9202A to work properly, at least one PXI Express chassis and one PXI controller type must be available.

WARRANTY AND CALIBRATION

Advantage Services: Calibration and Warranty	
Agilent Advantage Services is committed to your success throughout your equipment's lifetime.	
Included	3-year warranty (return to Agilent), standard
R-51B-001-5Z	5-year return to Agilent warranty assurance plan

Definitions for specifications

Specifications describe the warranted performance of calibrated instruments that have been stored for a minimum of 2 hours within the operating temperature range of 0 to 50 °C, unless otherwise stated, and after a 45 minute warm-up period. Data represented in this document are specifications unless otherwise noted.

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.

- **Typical** describes characteristic performance, which 80% of instruments will meet when operated over a 20 to 30 °C temperature range. Typical performance is not warranted.

- **Nominal** describes representative performance that is useful in the application of the product when operated over a 20 to 30 °C temperature range. Nominal performance is not warranted.

Note: All graphs contain measured data from several units at room temperature unless otherwise noted.

The Modular Tangram

The four-sided geometric symbol that appears in this document is called a tangram. The goal of this seven-piece puzzle is to create identifiable shapes—from simple to complex. As with a tangram, the possibilities may seem infinite as you begin to create a new test system. With a set of clearly defined elements—hardware, software—Agilent can help you create the system you need, from simple to complex.

Challenge the Boundaries

Agilent Modular Products

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Product specifications and descriptions in this document subject to change without notice.

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