# Agilent
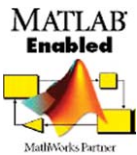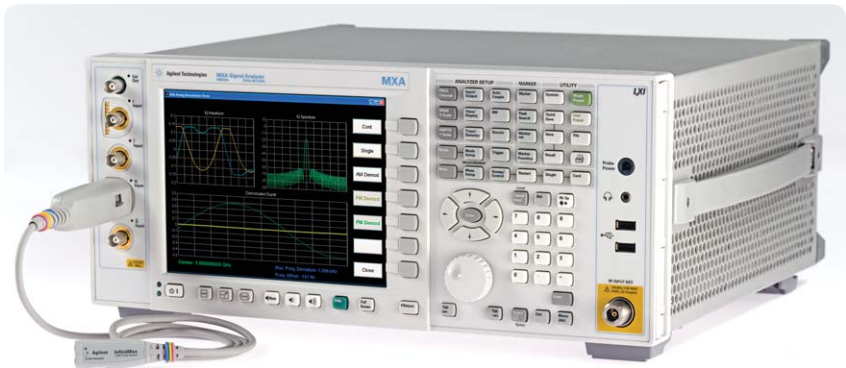# N6171A MATLAB Data Analysis Software for EXA, MXA, and PSA Series Signal and Spectrum Analyzers

## Technical Overview

**MATLAB Enabled**

MathWorks Partner

- Enhance your Agilent signal and spectrum analyzers with the data analysis power of MATLAB® software

- Analyze and visualize your wireless data, execute and test modulation schemes, and develop automated tests

- Develop and execute custom analysis applications directly on your signal analyzer or on a remote PC

- Acquire MATLAB software that has been tested and qualified by Agilent on the same purchase order as your signal and spectrum analyzers

### *Create and execute your own analysis routines and applications*

Have you ever wished your signal or spectrum analyzer had additional signal analysis capabilities? Have you ever wanted to create your own custom application – or modify an existing one – for your specific testing needs? Have you ever wanted your signal analyzer to provide tools to test unique or proprietary communications signals? With today's increasingly complex signals, the standard analysis routines provided with a signal or spectrum analyzer are sometimes not enough.

Agilent Technologies now has the perfect solution to meet your specific testing needs – Agilent now enables you to add the MATLAB data analysis software environment (as Agilent option N6171A) when you purchase an EXA (N9010A), MXA (N9020A), and PSA (E444xA) series signal or spectrum analyzer. Users can obtain this high-quality instrumentation and data analysis software from a single source – a benefit provided only by Agilent Technologies.

## Agilent Technologies

# MATLAB Overview

MATLAB is a well known and respected data analysis software environment and programming language developed by The MathWorks and now available for purchase directly from Agilent. MATLAB software can be used to make measurements, analyze and visualize data, generate arbitrary waveforms, control instruments, and build test systems. It provides interactive tools and command-line functions for a wide range of applications, including signal processing, signal modulation, digital filtering, and curve fitting. MATLAB has over 1,000,000 users in diverse industries and disciplines, and it is a standard at more than 3,500 colleges and universities worldwide.

MATLAB extends the functionality of Agilent signal and spectrum analyzers by enabling you to analyze and visualize your wireless data, execute and test modulation schemes, and develop automated tests. You can develop and execute your own custom analysis applications for your signal

analyzer directly on the instrument itself or using a remote PC. You can also design your own digital filters in MATLAB and apply them to signals acquired from your instrument. With these capabilities, you can:

- Test the functionality of electronic devices by making measurements with Agilent instruments and comparing them against known baselines in MATLAB

- Excite electronic devices using Agilent instruments with simple or complex waveforms created in MATLAB

- Characterize an electronic device to determine how closely it matches the design

- Verify new algorithms or measurement routines using live data from Agilent instruments

MATLAB can be installed and executed directly on these Agilent instruments or on a remote computer using GPIB, LAN, or USB connectivity.

## Benefits of purchasing MATLAB from Agilent

Adding MATLAB software to the purchase of your Agilent signal or spectrum analyzer provides five key benefits:

- **Convenience:** Acquire software and analyzer on a single purchase order

- **Confidence:** MATLAB software sold through Agilent has been tested and qualified by Agilent

- **Support:** Contact either Agilent or The MathWorks for help with installation and technical questions

- **Quick start:** Acquire numerous application examples directly from Agilent to get started

- **Reliability:** Ensure that your MATLAB software is always available to you when you need it
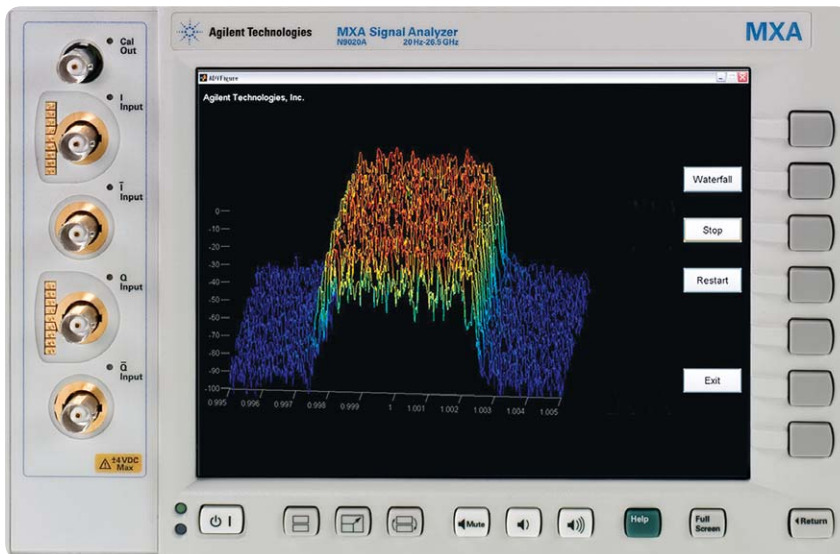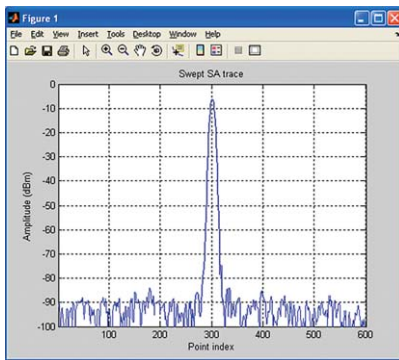


*Figure 1. Visualize a live wireless signal on a 3-D "waterfall plot" using a MATLAB application available from Agilent. Execute this application directly on the signal analyzer or remotely over GPIB, LAN, or USB connectivity. Modify as needed to meet your specific testing needs.*

## Three N6171A MATLAB packages available

Agilent has carefully chosen to offer three MATLAB software packages to its customers which represent typical packages needed by its signal and spectrum analyzer users. These packages range from basic MATLAB capabilities to acquire and analyze data to full support for signal processing, communications systems, filter design, and automated testing:

*Figure 2. Develop a new MATLAB application or modify an existing MATLAB application using the MATLAB Editor provided by MATLAB.*

| Option | Description | Additional Information |
|---|---|---|
| N6171A – M01 | MATLAB – Basic Signal Analysis Package | This basic configuration includes the MATLAB software environment and the Instrument Control Toolbox. Use this configuration to configure, control, and acquire data from an Agilent EXA, MXA, or PSA signal or spectrum analyzer to perform basic signal analysis and visualization tasks. |
| N6171 – M02 | MATLAB – Standard Signal Analysis Package | Includes the products in the MATLAB – Basic Signal Package plus the Communications Toolbox and Signal Processing Toolbox. This configuration extends MATLAB software by providing graphical user interfaces (GUIs), plots, and command-line functions to build, execute, analyze, and test digital filters and modulation schemes. Use this configuration to filter or demodulate signals, automate measurements, analyze or visualize data, or build test systems using an Agilent EXA, MXA, or PSA signal or spectrum analyzer. |
| N6171A – M03 | MATLAB – Advanced Signal Analysis Package | Includes the products in the MATLAB – Standard Signal Package plus the Filter Design Toolbox and RF Toolbox. This configuration extends MATLAB software by providing advanced filter design methods including FIR, IIR, adaptive, and multi-rate. This configuration also provides GUIs, plots, and command-line functions for designing, analyzing, and visualizing networks of radio frequency (RF) components. |

## Specifications

**Modern connectivity:**

Choose the best connection to meet specific requirements:

- USB
- LAN – 100 based-T
- GPIB
- LXI – Class C compliant

| Spectrum and signal analyzers | Required software revision |
|---|---|
| EXA (N9010A) | Rev 1.05 or later |
| MXA (N9020A) | Rev 1.24 or later |
| PSA (E444xA) | Rev 2.07 or later |
| MATLAB software | R2008a or later |

## Ordering Information

| Model | Description |
|---|---|
| N6171A – M01 | MATLAB - Basic Signal Analysis Package |
| N6171A – M02 | MATLAB - Standard Signal Analysis Package |
| N6171A – M03 | MATLAB - Advanced Signal Analysis Package |

| Related Literature | Agilent Literature Number |
|---|---|
| PSA data sheet | 5980-1284EN |
| MXA data sheet | 5989-4942EN |
| EXA data sheet | 5989-6529EN |
| MATLAB applications for X-Series analyzers | 5989-9377EN |

## Additional details on toolboxes provided in the MATLAB packages

Instrument Control Toolbox lets you communicate with instruments, such as oscilloscopes, function generators, and signal analyzers, directly from MATLAB. The toolbox enables you to communicate with instruments via instrument drivers, such as IVI and VXIplug&play, and commonly-used communication protocols, such as GPIB, VISA, TCP/IP, and UDP. With the Instrument Control Toolbox product, you can generate data in MATLAB to send out to an instrument, or read data into MATLAB for analysis and visualization.

Communications Toolbox extends the MATLAB software environment with functions, plots, and a graphical user interface (GUI) for exploring, designing, analyzing, and simulating algorithms for the physical layer of communication systems. Communications Toolbox helps you create algorithms for commercial or defense systems, such as mobile handsets and base stations, wired and wireless local area networks, and digital subscriber lines. You can also use it in research and education for communication systems engineering.

Signal Processing Toolbox is a collection of industry-standard algorithms for analog and digital signal processing (DSP). Signal Processing Toolbox also provides graphical user interfaces for interactive design and analysis and command-line functions for advanced algorithm development.

Filter Design Toolbox product is a collection of tools that provide advanced techniques for designing, simulating, and analyzing digital filters. It extends Signal Processing Toolbox with filter architectures and design methods for complex real-time DSP applications, including adaptive and multi-rate filtering.

RF Toolbox extends the MATLAB product with functions and a graphical user interface (GUI) for designing, modeling, analyzing, and visualizing networks of radio frequency (RF) components. You can use RF Toolbox for working on wireless communications, radar, and signal integrity projects.

## Added value from Agilent

Organizations that purchase MATLAB software through Agilent are provided a MATLAB instruments driver that is tested and supported by Agilent for the signal or spectrum analyzer that they purchase. In addition, MATLAB installation and technical support is available from Agilent.

Agilent has also developed a suite of MATLAB example applications for the PSA, MXA and EXA to assist customers in their development and testing needs. The example programs start with basic data acquisition and plotting. In addition, there are advanced programs that allow users to create their own complete applications. Agilent provides an extensive white paper which helps describe how to interface MATLAB with its instruments and how to use MATLAB to create both beginner and advanced testing solutions.
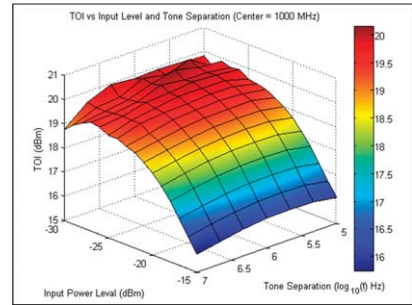


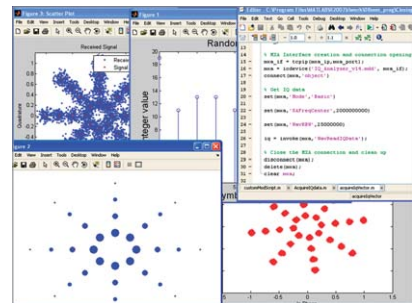Figure 3. Use MATLAB to analyze third order intercept vs. input level and tone separation



Figure 4. Analyze and test standard and new modulation schemes using MATLAB software and Agilent signal generators and analyzers.

## Getting started

A MATLAB technical kit containing over 20 of these MATLAB example applications and programs, tested MATLAB instrument drivers, technical white paper, and data sheet are available from Agilent for using MATLAB software with your Agilent wireless instruments. Download this kit today at **www.agilent.com/find/N6171a.**
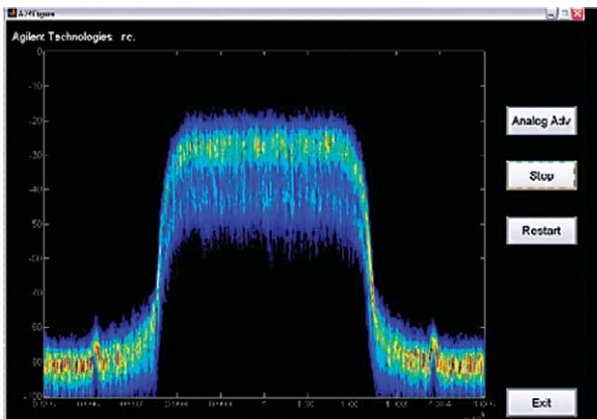


*Figure 5. Persistence display using MATLAB software.*

MATLAB applications can be executed directly on an Agilent signal analyzer or on a remote PC using GPIB, LAN, or USB connectivity. Users can modify the Agilent applications developed with MATLAB to meet their specific testing needs. While running inside the instrument, the analog demodulation application can be driven with the front panel of the instrument or using a remote PC and operating the application with a mouse.
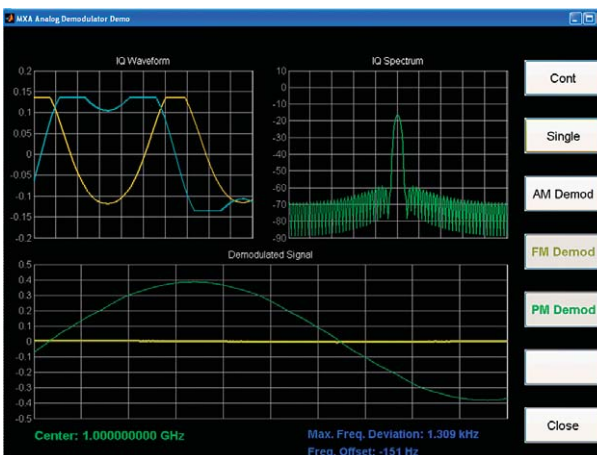


*Figure 6. Analog demodulation of an FM signal using a MATLAB application.*

Agilent tests and verifies a MATLAB driver and supports customers who use it for development. IQ data can be acquired with one command using the MATLAB instrument driver. This data can then be used for demodulation and analysis of complex signals.
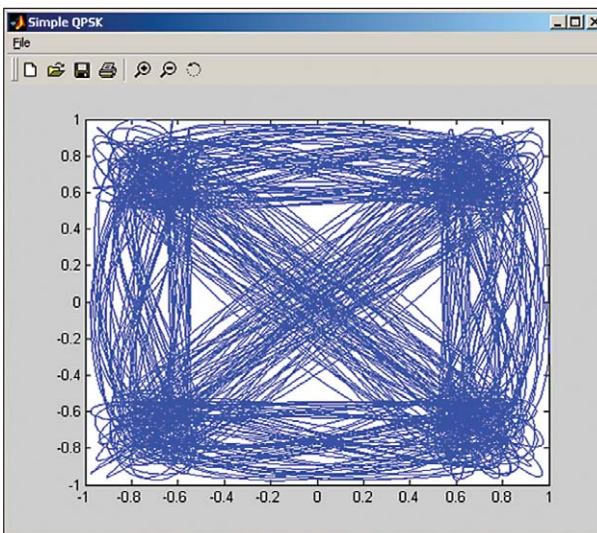


*Figure 7. A MATLAB plot of a QPSK signal that used the MATLAB instrument driver for IQ data acquisition.*

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**LXI**

**www.lxistandard.org**
LXI is the LAN-based successor to GPIB, providing faster, more efficient connectivity. Agilent is a founding member of the LXI consortium.

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Revised: October 1, 2008

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