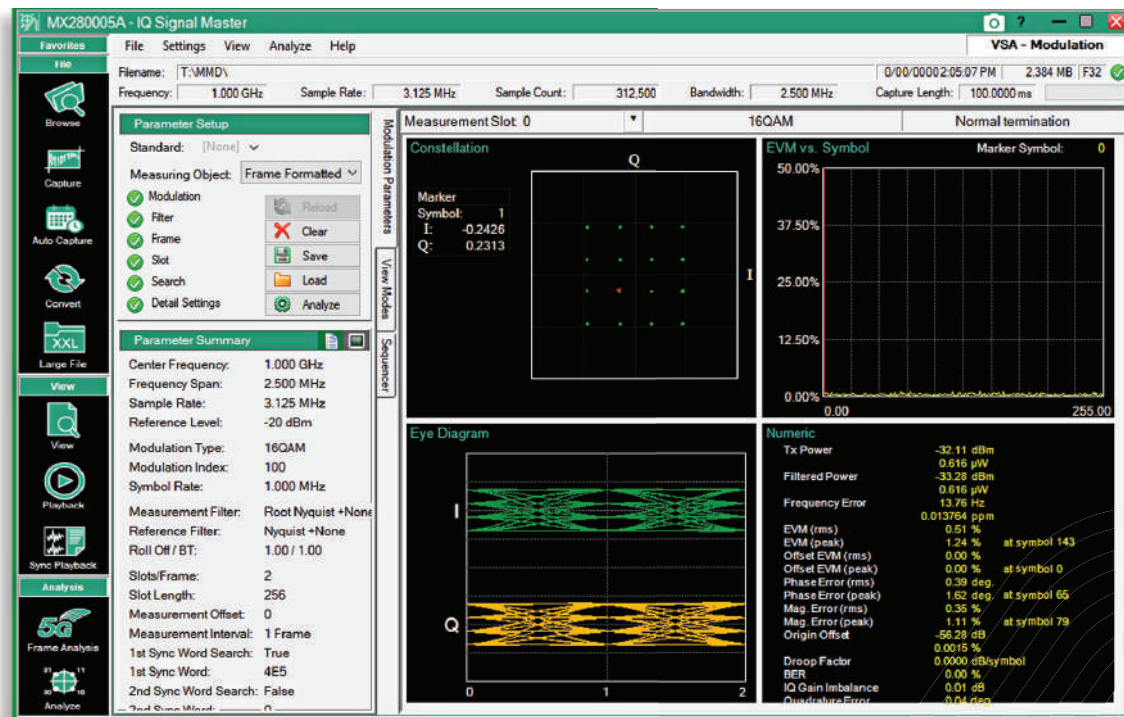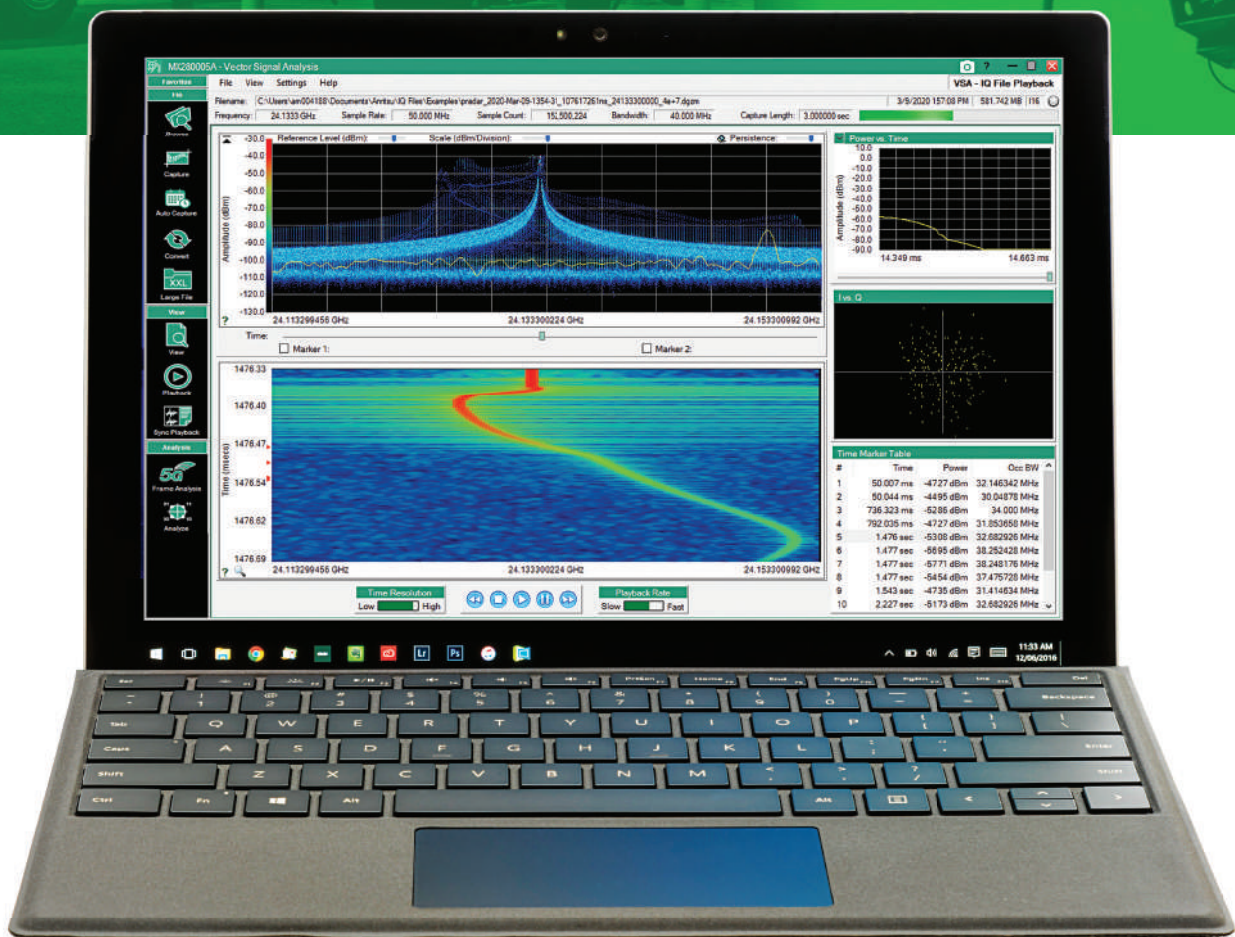**/Inritsu** Advancing beyond

IQ Signal Master™ MX280005A
Vector Signal Analysis Software

WE'VE GOT YOU COVERED

The MX280005A IQ Signal Master
IQ Data Playback, Creation of
5G Frame Spectrograms
Modulation Quality Measurements
File Viewer and Conversion

Introduction

MX280005A IQ Signal Master software provides a comprehensive suite of measurements that deliver post processing and analysis of IQ data fi les captured on a range of Anritsu spectrum analyzers. The software is designed to bring together all the essential tools required to capture IQ data fi les and then gain critical insights into the nature of the captured signals.

Specifi c operating modes facilitate the interfacing to Anritsu spectrum analyzers which captures or streams IQ data into the PC memory. Modulation quality measurements and IQ playback modes then access the IQ data files within a common user interface.

MX280005A software is designed to interface to Anritsu's MS2090A, MS2720xA, MS2720T, and MS2710xA spectrum analyzers. A fi le conversion mode allows IQ data captured on these analyzers to be converted to the format required for playback using an Anritsu MG3710E IQ Signal Generator to 6 GHz.

The software is designed for national RF spectrum regulators, security agencies, and defense electronics companies who need to gain critical insight into RF signals that have been captured in the fi eld. It is also suitable for organizations that need to monitor and protect RF spectrum from unlicensed operators or unintended sources of interference.
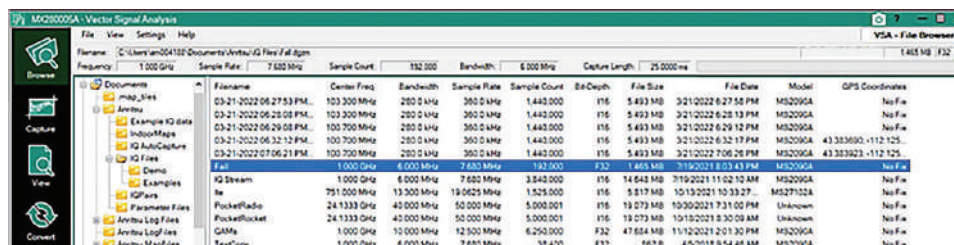
MS2090A	MS27201A	MS27101A	MS2720T

MX280005A IQ Signal Master Software

Browse Mode

Browse

Browse mode provides more detail about IQ files that have been saved to the PC than can be seen in the standard Windows file browser. This facilitates the operation of files in other modes since details including sample rate and sample count are clearly displayed.


Browse IQ Data Files on the PC with Detailed Capture Information

Displayed data for each file:
- Model number of instrument used for capture
- Center frequency of the capture
- GNSS location at which the spectrum analyzer was located (if GNSS lock was present at time of capture)
- Capture bandwidth
- Sample rate
- Number of IQ samples in capture
- Time period of original capture
- Capture bit depth
- File size

MX280005A IQ Signal Master Software
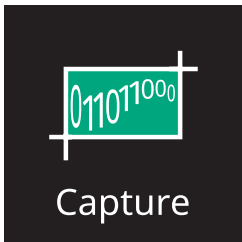
Capture Mode

Capture mode configures the spectrum analyzer and initiates the capturing of IQ data directly into the PC. Connection between the PC and spectrum analyzer can be Ethernet or PCIe. By integrating the capture mode into the MX280005A software, data is seamlessly captured into the PC memory. Data is immediately available to replay and analyze using the IQ analysis modes.
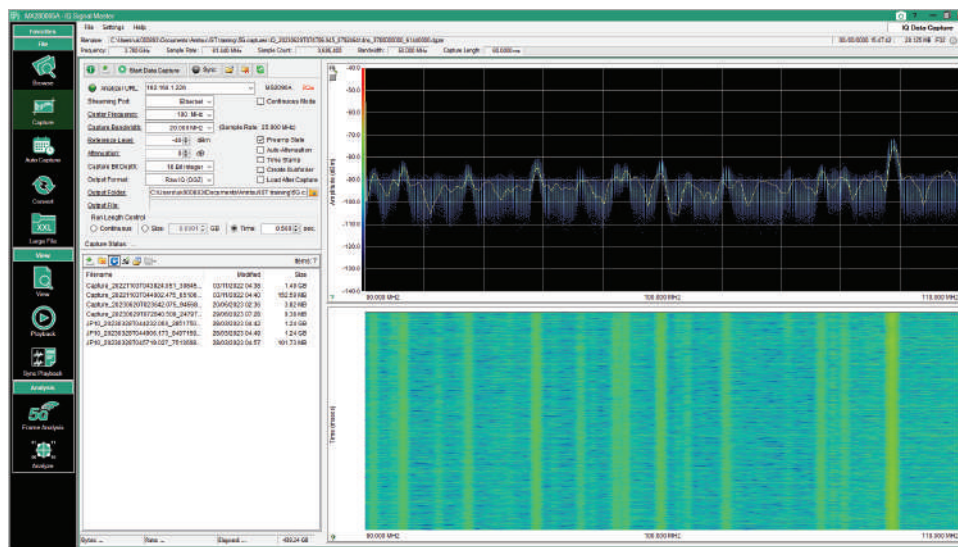
IQ Capture Screen Displays the Current Spectrum for which IQ Data will be Captured

IQ Capture features:
- Continuous or single file captures
- Preview of spectrum for which IQ data will be captured
- Configure capture conditions
- Capture control; Continuous (streaming), Fixed File Size (GB), Fixed Time Period (seconds)
- View IQ files saved in the spectrum analyzer memory and transfer to the PC

MX280005A IQ Signal Master Software
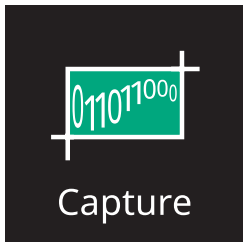
Capture Mode

Synchronous Capture:
- Capture IQ Data from up to 8 MS2090A simultaneously
- Each MS2090A requires a PC running MX280005A IQ Signal Master
- Embedded time stamps enable synchronous playback of files using the Synchronous Playback mode

MX280005A IQ Signal Master Software
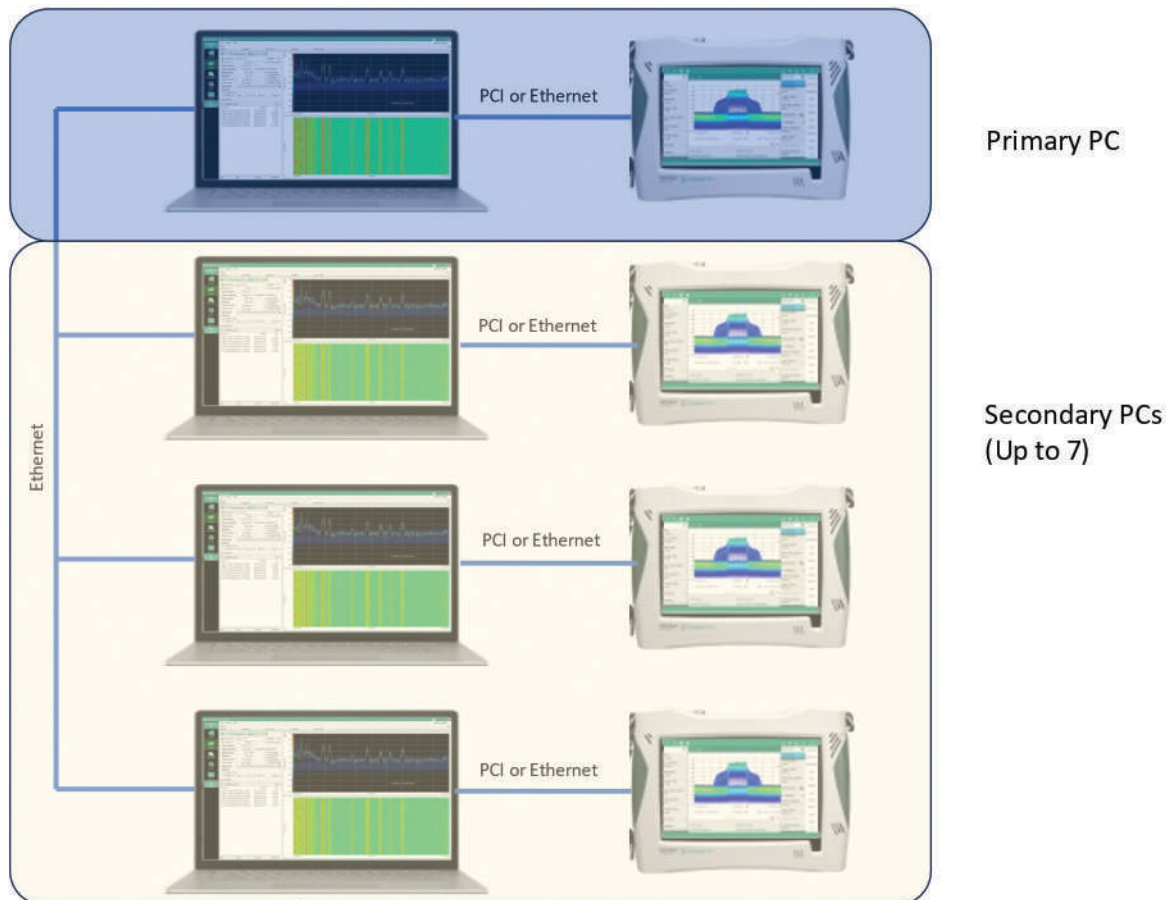
View Mode

The basic IQ data viewer, View, is designed to provide a quick and easy image of any captured IQ data file. It is used to validate that the captured file contains information of interest before using the IQ Player or Vector Signal Analysis modes for more detailed examination.

The file viewer provides trace windows of the I, Q, and overall magnitude of data. An IQ phase/amplitude graph plots all IQ data points and a CCDF plot displays their power distribution in the same format as a wideband power meter.
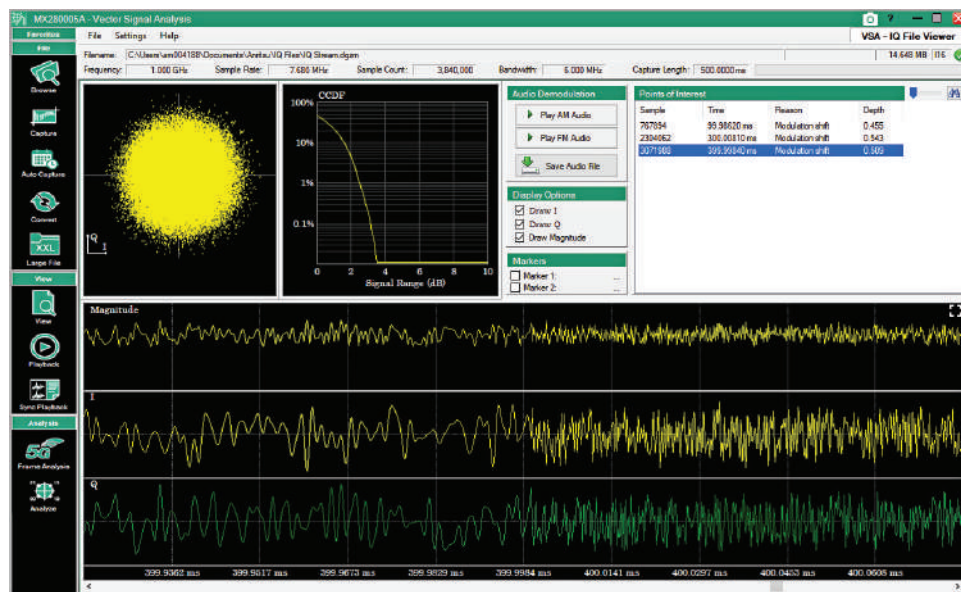
File Viewer Display Showing I and Q Data of Captured File

File View features:
- Preview I and Q data verses time
- AM/FM demodulation for single carrier captures
- Raw IQ data plot
- CCDF plot of power distribution
- Auto identification of points-of-interest (POI) such as IQ level changes or modulation format changes

MX280005A IQ Signal Master Software

Convert Mode

Convert

Convert mode captures IQ data with Anritsu MS2090A, MS2710xA, and MS2720xA spectrum analyzers generates two files; the raw IQ datafile and an associated file with the meta data. The files are pairs and have .dgz and .dgzm extensions.

When using MX280005A software to analyze these IQ data files the process is seamless and captured files are analyzed with no further action.

To use captured IQ files with third party software, such as X-Com, SpectroX, or MatLab, IQ files need to be converted to conform to those software requirements. MX280005A has a file converter to simplify the conversion of Anritsu .dgz files to formats required by common third party applications.

MX280005A can convert files into the format required for export into an Anritsu MG3710E 6 GHz Vector Signal Generator. Captured RF signals can then be played back enabling an insight into how RF receivers respond to hostile threat signals.

Capture RF signal OTA with MS2090A

Use Convert Mode to change from dgz to wvd for playback with Anritsu MG3710E.

Load the wvd file directly to MG3710E over Ethernet

Playback original signal from VSG
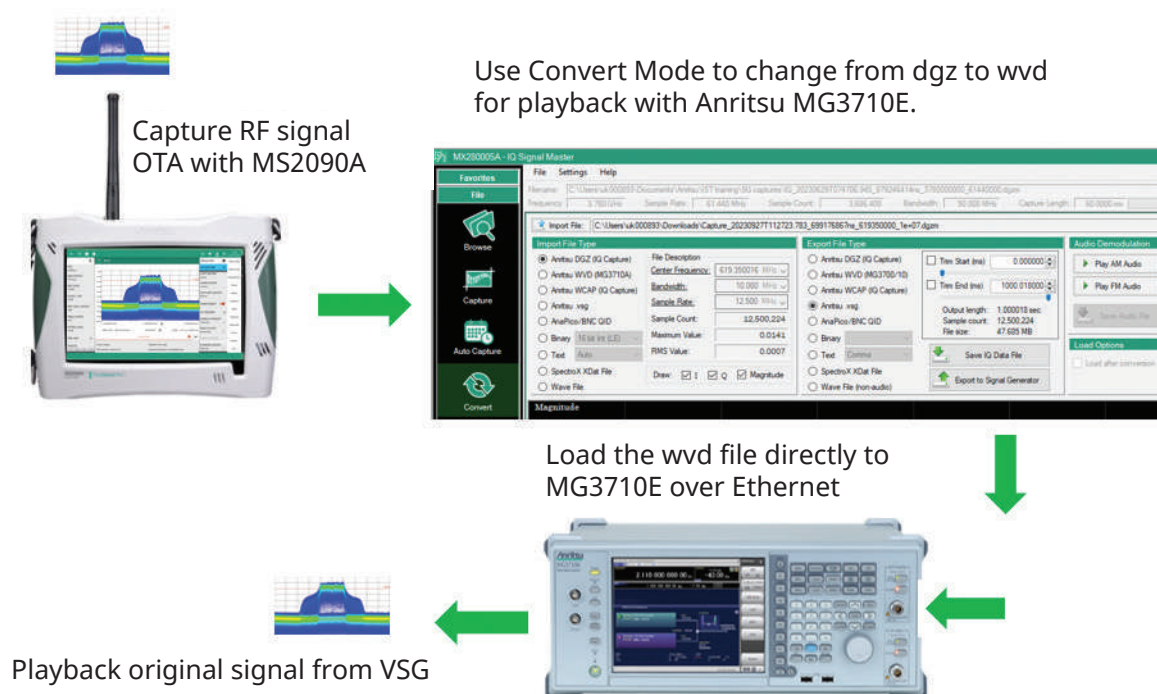
File Converter features:
- Load IQ files captured on Anritsu spectrum analyzers and convert to common formats required by third party software.
- Capture RF signals using Anritsu spectrum analyzers and convert to files supported by Anritsu vector signal generators for continuous playback.
- Single key export of files directly to Anritsu vector signal generators memory through Ethernet interface.

MX280005A IQ Signal Master Software
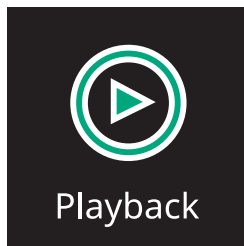
Playback

IQ Playback mode provides the ultimate insight into IQ data files by replaying all the IQ FFT captures at a user configurable speed and resolution. Changes in a RF signal characteristic that are not possible to see in real time are captured and displayed enabling detailed analysis.

In IQ playback mode, the POI identified in the basic viewer mode are imported so users can jump immediately to critical points in the file.

Time resolution is as short as 160 ns and allows for signal frequency lock times to be displayed.
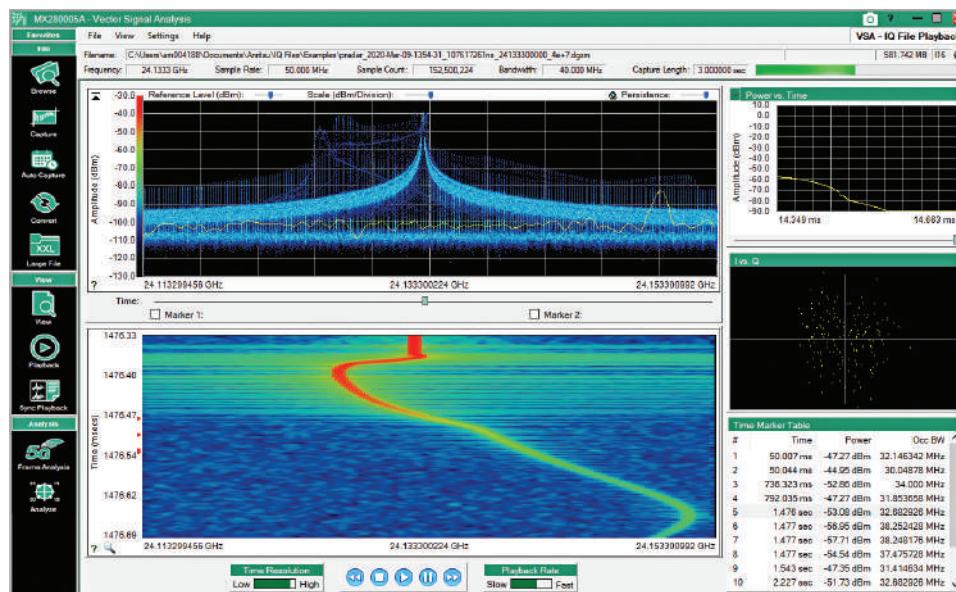
IQ Player Mode Showing the Frequency Lock Characteristics of a Pulsed Radar

Playback also supports the demodulation of all AM or FM signals in the capture bandwidth, including saved IQ files. For regulators needing to identify all transmitters within the licensed band, the ability to listen to the audio provides useful information about each radio station. All stations exceeding a defined threshold are identified in frequency and demodulated.

MX280005A IQ Signal Master Software
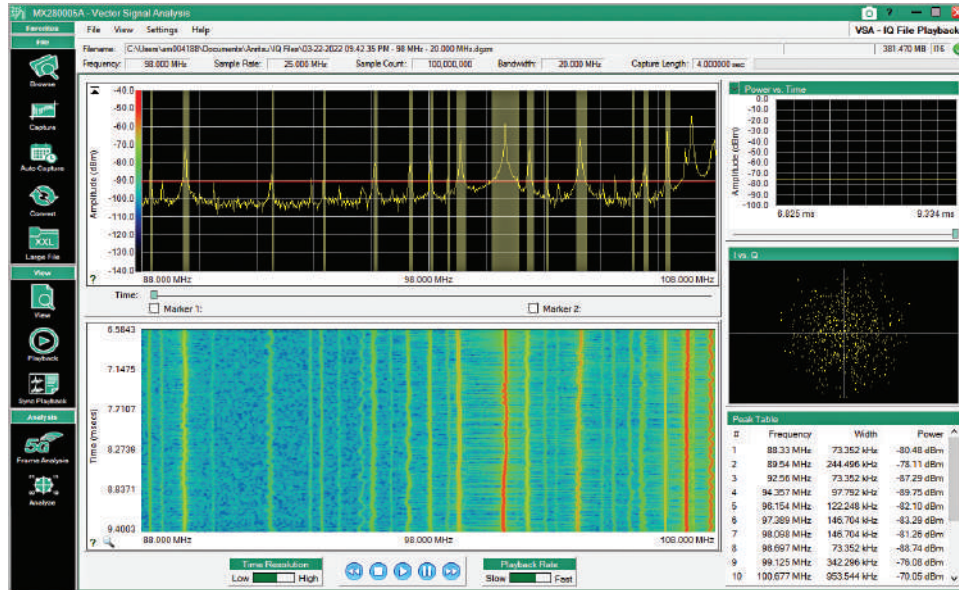
Monitor and Demodulate All FM Transmitters within the Capture Span

File Playback features:

- View frequency spectrum with persistence display. Displays current sample spectrum with persistence to maintain an image of short duration events. The persistence level is configurable.
- High resolution Frequency vs Time Display highlights short term events including frequency lock characteristics, oscillator drift, and modulation deviations.
- Jump to captured POIs imported from the basic viewer saves time searching through every captured sample.
- Demodulate all AM and FM transmitters within a saved capture span for station identification.

MX280005A IQ Signal Master Software

IQ Signal Analyzer

The IQ Signal Analyzer mode performs modulation quality measurements on all common digital modulation standards including Phase Shift keying, Frequency Shift keying, QAM, and QPSK. Graphical and numeric results of modulation quality are displayed in multiple windows on the PC screen.
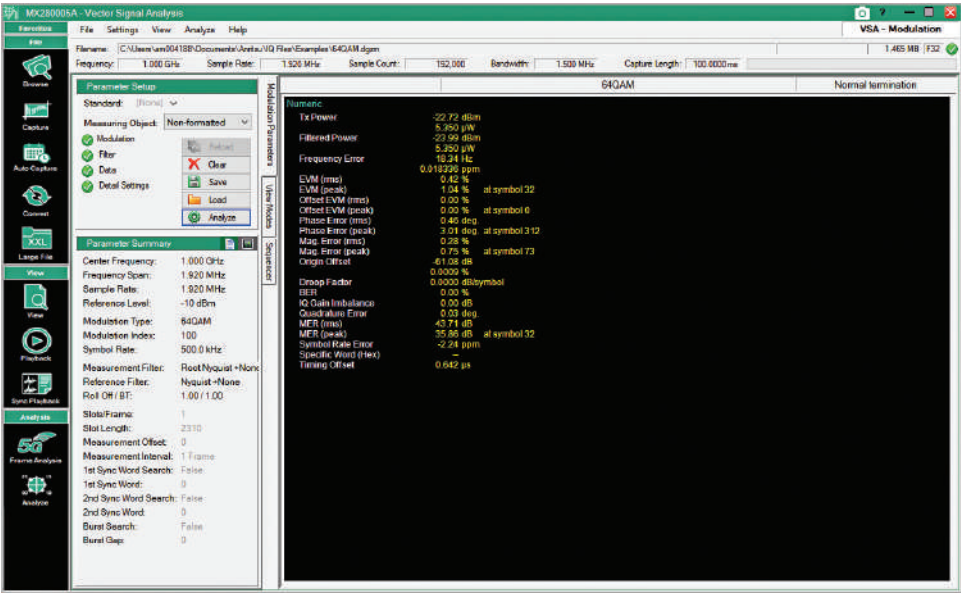
Modulation Quality Measurement Results for a 64QAM IQ Data Capture

MX280005A IQ Signal Master Software

Supported Modulation Standards and Measurements

The MX280005A IQ Signal Master software analyzes all common modulation standards and provides a comprehensive suite of layer 1 measurement results in numeric and graphical formats.

■ **Numeric Result Display**

BPSK, QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, MSK, 16APSK, 32APSK

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm)
- Vector Error (EVM) [Peak/RMS]
- Offset Vector Error (EVM) [Peak/RMS] (O-QPSK)
- Phase Error (Peak/RMS)
- Magnitude Error (Peak/RMS)
- Symbol Rate Error
- BER (only BER = On)
- Specific Word (Hex)
- Origin Offset
- Droop Factor (BPSK, π/4DQPSK, 8PSK, MSK)
- IQ Gain Imbalance (QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, MSK)
- Quadrature Error (QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, MSK)
- MER (Peak/RMS)
- Offset EVM [Peak/RMS] (O-QPSK)
- Timing Offset

2FSK, 4FSK, H-CPM*

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm)
- Magnitude Error (Peak/RMS)
- FSK Error (Peak/RMS)
- BER (only BER = On)
- Modulation Fidelity (Peak/RMS)
- Symbol Rate Error
- Specific Word (Hex)
- Jitter (P-P Min, P-P Max)
- Deviation (Average, +Peak, –Peak, (Peak-Peak)/2)
- Deviation RMS [%] (2FSK)
- Deviation at Ts/2 [Average, +Max Peak, +Min Peak, –Max Peak, –Min Peak, (Peak-Peak)/2, +Max Peak%, –Min Peak%] (2FSK, 4FSK)
- Timing Offset
  * Used at APCO-P25 Phase 2 Inbound Measurement

2ASK

- Tx Power
- Filtered Power
- Frequency Error (Hz, ppm)
- Vector Error (EVM) [Peak/RMS]
- Magnitude Error (Peak/RMS)
- BER (only BER = On)
- Specific Word (Hex)
- Droop Factor
- MER (Peak/RMS)
- Symbol Rate Error
- Modulation Index (RMS)
- Eye Opening (X-Time), Eye Opening (Y-Amplitude)
- Timing Offset

MX280005A IQ Signal Master Software

■ Graph Display

BPSK, QPSK, O-QPSK, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, 2ASK, 4ASK, 16APSK, 32APSK

- Constellation
- EVM vs Symbol
- Magnitude Error vs Symbol
- Phase Error vs Symbol
- Trellis
- Eye Diagram
- I and Q vs Symbol
- Magnitude vs Symbol
- Phase vs Symbol
- Signal Monitor
- Symbol Table
- Equalizer Amplitude
- Equalizer Phase
- Equalizer Group Delay
- Equalizer Impulse Response

2FSK, 4FSK, H-CPM[*], MSK

- Constellation
- EVM vs Symbol
- Magnitude Error vs Symbol
- Phase Error vs Symbol
- Frequency vs Symbol
- Trellis
- Eye Diagram
- I and Q vs Symbol
- Magnitude vs Symbol
- Phase vs Symbol
- Signal Monitor
- Symbol Table
- FSK Error vs Symbol
- Fidelity vs Symbol (2FSK, 4FSK, H-CPM)
- Histogram
  [*]Used at APCO-P25 Phase 2 Inbound measurement

Predefined Standards for Easy Setup

The MX280005A IQ Signal Master software has predefined parameters for common wireless communications standards, including:

ARIB	dPMR
IEEE 802.15	NXDN
P25	TETRA
DMR	DVB

MX280005A IQ Signal Master Software
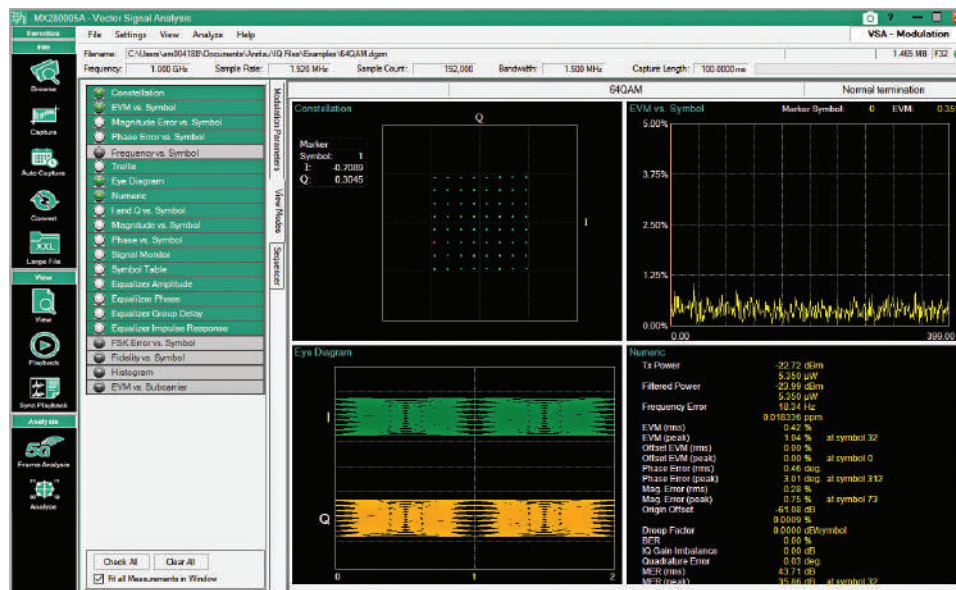
Multiple Windows Provide Simultaneous Display of Numeric Results and Graphical Data

IQ Signal Master features:

- Analyze multiple common digital modulation standards.
- Multiple windows present comprehensive overview of modulation quality and potential causes of impairments.
- Capture and display results in single or continuous modes.

MX280005A IQ Signal Master Software

5G Frame Analyzer

The MX280005A software provides two methods to capture 5G IQ frame data. Use the standard capture mode for direct input of IQ .dgz files from the MS2090A of any length. The MS2090A IQ 5G Frame capture feature imports a fixed 60 ms of 5G IQ frame data directly into the PC. If the 5G Frame capture method is selected, files are automatically converted from .bin files to .dgz files and the frame spectrogram is displayed in a single action.
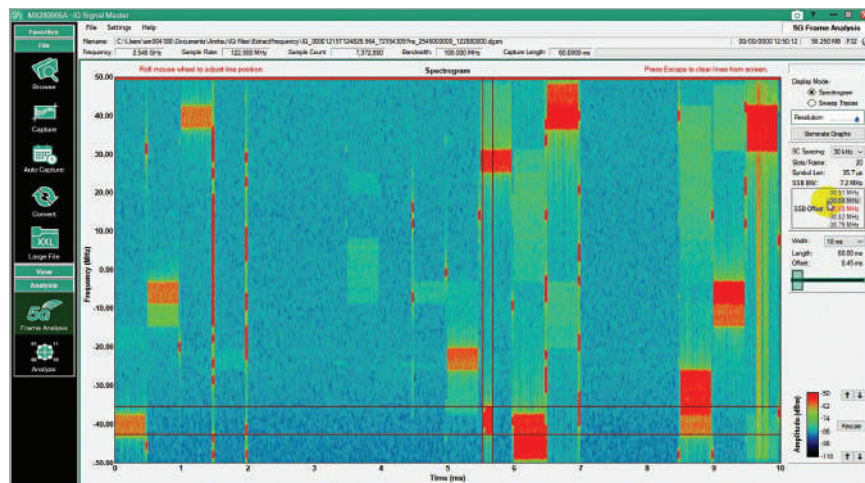

5G Frames Analysis Mode Displays the Full 5G Frame with Cursers
to Help Identify the Location of the SSB

Two display formats are available, a spectrogram of resource block power on a frequency verses time graph or a spectrum density plot of all the spectral traces overlaid in a power verses frequency format.

With the spectrogram displayed, users can change the time/frequency resolution and zoom into specific areas of interest such as the SSB. The spectrogram also provides a visual overview of the base station load with active data being highlighted in color. A special tool is provided to help locate the position of the SSB in the frame. Opening the SSB locate tool brings up a matrix of cursers that are the correct shape of the SSB for the set subcarrier spacing.
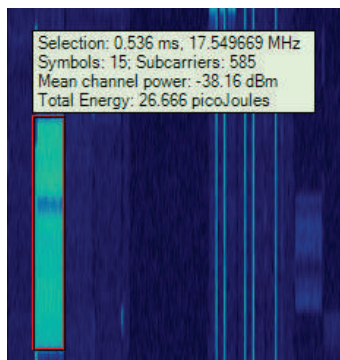

When Analyzing LTE or 5G Frames, MX280005A Measures
the Power and Energy in User Definable Resource Blocks

MX280005A IQ Signal Master Software

Synchronous Playback of Multiple Files

Sync Playback

The synchronous playback feature enables simultaneous playback and display of up to four IQ files captured from four different analyzers. Time stamps referenced to the GPS receiver in the analyzers means that playback is precisely time aligned. This gives a comprehensive visual display of the spectrum from multiple locations on a single screen.
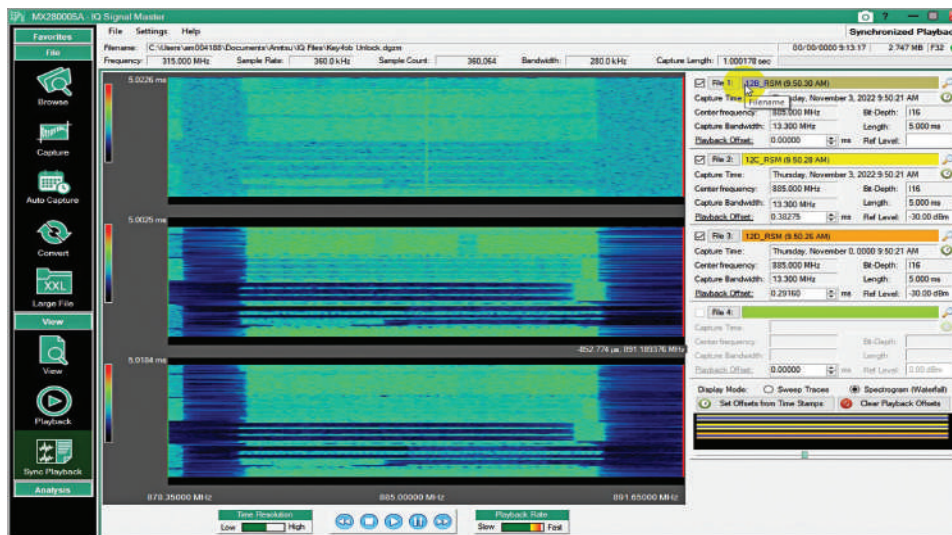
Spectrograms Captured from Three Different Remote Spectrum Monitors
Displayed with Time Alignment on the Same Screen

The setup of synchronized IQ captures from multiple instruments is configured in the auto capture mode which includes a feature to embed time stamps in captured files.

An icon gives quick transition to the View mode for any of the traces for detailed analysis of a selected signal. All the standard features of View mode are active including identification of points of interest. This means that all traces can be aligned to a point of interest identified from a specific analyzer, potentially helping to understand the cause of interference or lost data.

Auto Capture of IQ Files

Auto Capture is designed to enable the user to set up a schedule for repeated and regular IQ captures from multiple analyzers. Scheduled signal capture provides a valuable automated spectrum archiving tool for regulators who need to monitor spectral activity across a wide geographic area and maintain a database of the recorded files. Searching through the archive of IQ captures provides the ability to look back at historical data to spot events that may have occurred associated with a report of interference or illegal radio activity. As the captured files are of IQ data, this also facilitates the use of the MX280005A playback and analyze tools to gain in-depth understanding of the nature and possible origin of any signals detected.
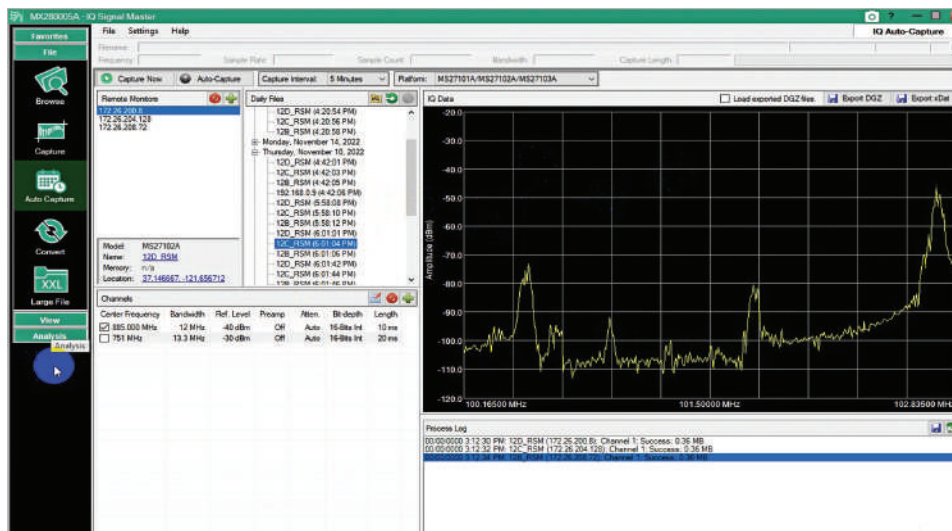

Auto Capture Control Panel Highlighting All Files Archived for Analysis

MX280005A IQ Signal Master Software

Management of Very Large Files

MX280005A software allows the continuous capture of IQ data for extended time periods. This is required when trying to capture a signal that occurs very irregularly. If the capture is run for minutes or even hours, the file may become many Gigabytes or even Terabytes in size.
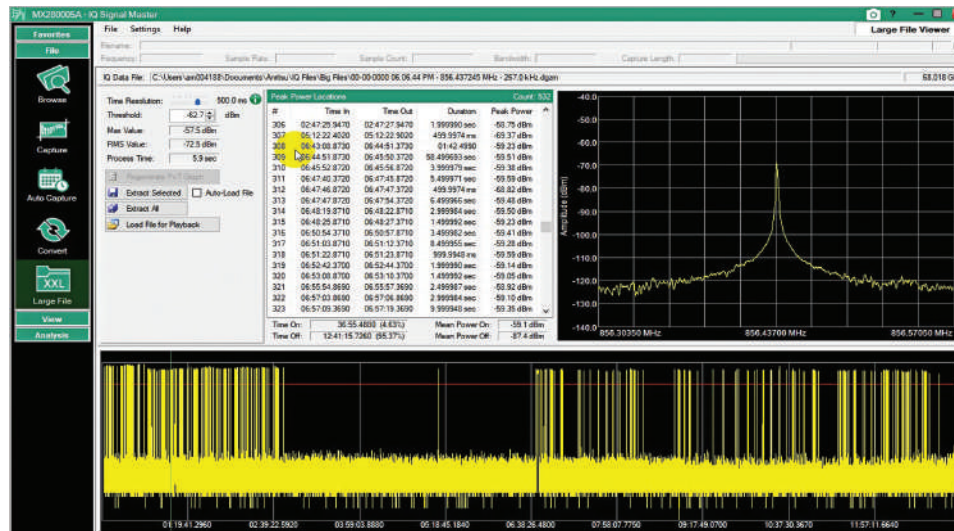
The File Displayed is from a 13 Hour IQ Recording That Created a 68 GB File. Any Individual Signal Activity Can be Selected for Playback with Close to Real-Time Signal Processing

MX280005A IQ Signal Master includes a large file mode to facilitate the analysis of very large files by preprocessing the data at a lower time resolution to search for signals of interest. A power vs. time for the full capture chart is displayed that identifies the times when a signal was present. Any individual signal can then be selected for analysis in the Playback mode by importing it as a point of interest.

Large file mode is essential for the analysis and processing of very large IQ files that can easily be created when monitoring the spectrum for extended time periods. It enables the full suite of measurements offered in MX280005A to access all file sizes.

Support for Files Captured on the MS2720T

The MS2720T with Option 24 supports the capture of IQ data with up to 32 MHz bandwidth. IQ files captured on the MS2720T have a .wcap extension and are formatted differently from IQ files captured on the MS2090A. The file Convert feature of MX280005A (MX280005A-0005/0006) supports the importing of .wcap files and their conversion to .dgz files.

Options, MX280005A-0024 (PC Node locked license) or MX280005A-0025 (USB Dongle license) enables IQ files captured on the MS2720T to be processed using the Playback and Analyze features of IQ Signal Master software.

MX280005A IQ Signal Master Software

Ordering Information

MX280005A software is freely downloaded from the Anritsu web site. The following features are available without any licensing requirements.

- Browse Mode
- Capture Mode
- View Mode
- Auto Capture Mode
- Large File Mode
- 5G Frame Analyzer Mode

The following features require license key files to be ordered from your local Anritsu sales office.

- File format Converter – Requires a PC software license or USB dongle, see table below for details
- IQ Playback Mode – Requires a PC software license or USB dongle, see table below for details
- IQ Signal Analyzer Mode
  - For MS2090A, MS2710xA, and MS2720xA, Option 128 must be installed in the instrument for analysis in the IQ Analyzer Mode
  - For MS2720T, a PC software license or USB dongle is required; see the table below for details

The PC License File Format
The option license is delivered by email and provides a numeric key that enables the option on a single specified PC. This license is not transferable.

The USB Dongle License Key Format
The PC license is delivered in the form of a physical USB dongle. The option will run on any PC that has the USB dongle installed at the time of use. The software can be installed on multiple PCs but will only run on the PC that has the dongle installed.

Part Number	Description
MX280005A-0001	IQ Player with PC node locked license*
MX280005A-0002	IQ Player with USB dongle PC license key
MX280005A-0005	IQ File converter with PC node locked license*
MX280005A-0006	IQ File converter with USB dongle PC license
MX280005A-0024	VSA Analysis software for MS2720T (PC node locked license)
MX280005A-0025	VSA Analysis software for MS2720T (USB longle PC license key)

*Note: **IMPORTANT:** The end user's email address AND a generated PC registration code must be provided to enable the generation and delivery of the PC node locked license. A voucher will be shipped with the order so that the license can be redeemed once these details are available. Instructions for obtaining the PC registration code are available at the following Anritsu web page: www.anritsu.com/en-us/test-measurement/products/mx280005a

For orders placed for node locked license keys only (for existing/owned units), if the end-user's address and the PC registration code are included at order placement, the license will be delivered via email vs. shipment of the voucher.

Anritsu Advancing beyond

Specifications are subject to change without notice.

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