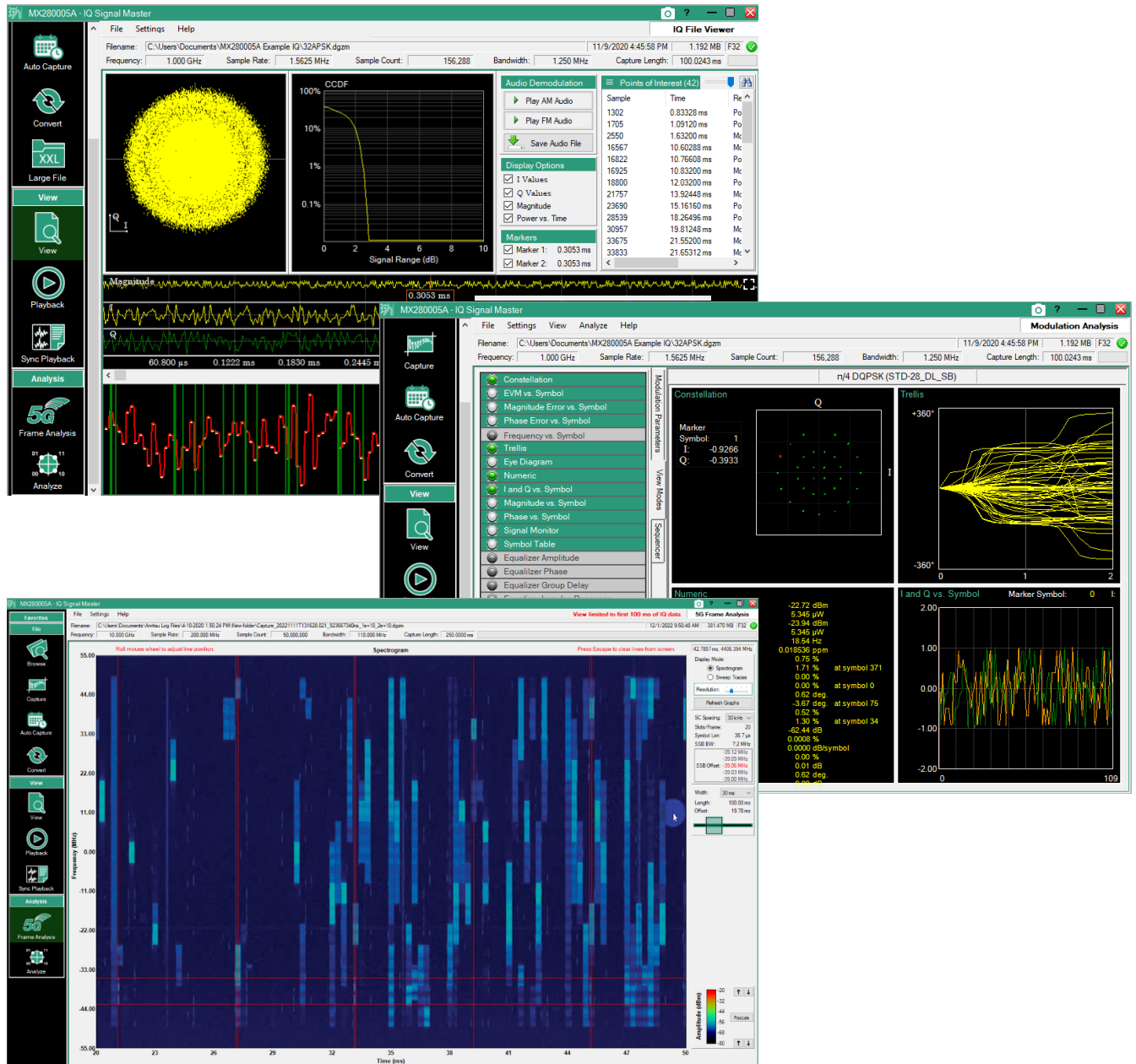


## User Guide

# IQ Signal Master™ MX280005A Vector Signal Analysis Software



Anritsu

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# Chapter 1 — General Information

## 1-1 Introduction

The MX280005A IQ Signal Master PC Software is used to analyze IQ data from Anritsu receivers and instruments enabled with IQ Signal Master options to analyze general purpose modulated signals such as QPSK, QAM, and more. This IQ Signal Master software is intended for testing physical layer modulation quality of various transmission standards.

Spectrum analyzers require Option 128 to be Vector Signal Analysis Enabled and requires Option 124 or 126 to use with MX280005A software.

The MX280005A provides the following measurement features:

- Modulation accuracy measurement
- Carrier frequency measurement
- Transmitter power measurement
- Imports IQ acquisition data from a Spectrum Analyzer with Option 128
- Initiates and saves IQ data streaming
- View and analyze IQ data – License required. See [“Licensing” on page 1-4](#).
- Convert IQ parameters of an existing file format and converts it to a different file format – License required. See [“Licensing” on page 1-4](#).
- Performs FFTs to create a sweep trace to display along with a Spectrogram – License required. See [“Licensing” on page 1-4](#).
- Increase time resolution to closely analyze IQ data – License required. See [“Licensing” on page 1-4](#).

## 1-2 Standard Features

Standard features for the MX280005A are listed in [Table 1-1](#).

**Table 1-1.** Standard Features

| Feature           | Description                                                                                                                                                            |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5G Frame Analysis | Analyze 5G data with a spectrogram or density plot.                                                                                                                    |
| Capture           | The Capture menu imports IQ acquisition data from a spectrum analyzer with Option 128.                                                                                 |
| Auto Capture      | Capture real time I/Q data stream on a set time schedule.                                                                                                              |
| Analyze           | The Analyze menu provides modulation analysis of IQ data files.                                                                                                        |
| Viewer            | The View menu displays I and Q vs time and a single spectrum line.                                                                                                     |
| Sync Playback     | Data sets that are captured using the same center frequency, capture bandwidth, capture bandwidth, but different time offsets can be synchronized using Sync Playback. |
| Large File        | The Large File menu provides tools to maximize file size reduction and reduce loading time without losing data set integrity.                                          |

## 1-3 MX280005A Software PC Requirements

### Hardware and Software

The following are the minimum PC requirements for installing and using MX280005A software:

- Intel Core i5 or higher processor
- 8 GB RAM
- Windows 10 or 11
- 200 MB Disk space
- Microsoft .NET 4.8.1
- Display resolution 1024 x 768

## 1-4 Data Capture Requirements

The following are data capture requirements for Ethernet IQ Streaming, PCIe IQ Streaming, IQ Auto-Capture, Capture, and Large File menus.

### Supporting Analyzers

The acquisition tools and their supporting analyzers:

- IQ streaming is supported over Ethernet for MS2710xA, MS2080A, MS2089A, MS2090A, MS27200A, and MS27201A.
- IQ Streaming over PCIe is supported on the MS2090A, MS27200A, and MS27201A.
- IQ Auto-Capture is supported over Ethernet for MS2089A, MS2090A, MS27200A, and MS27201A.

### MA25101A IQ Streaming PCIe Kit

Large data captures may require a PCIe card to be installed in the users PC. For PCIe installation instructions, see [Appendix A, “Installing PCIe Kit”](#).

## 1-5 Contacting Anritsu Sales and Service

To contact Anritsu, visit the following URL and select the services in your region:  
<http://www.anritsu.com/contact-us>.

## 1-6 Additional Documentation

Instrument operations of other Anritsu spectrum analyzers that can be used with the MX280005A IQ Signal Master software are explained in various document types as listed below. The Spectrum analyzer options required to run with the MX280005A are listed in their technical data sheets and explained in the user guides.

**Table 1-2.** Additional Documentation of MX280005A

| Document Part Number | Description                                                                                |
|----------------------|--------------------------------------------------------------------------------------------|
| 10100-00069          | MS2090A, Field Master Pro™, Spectrum Analyzer, Product Information, Compliance, and Safety |
| 10580-00444          | MS2090A Field Master Pro™ User Guide                                                       |
| 10580-00445          | MS2090A Field Master Pro™ Programming Manual                                               |
| 11410-01000          | MS2090A Field Master Pro™ Technical Data Sheet                                             |
| 11410-01001          | MS2080A Field Master™ Technical Data Sheet                                                 |
| 11410-02906          | MS2085A/89A Site Master™ Technical Data Sheet                                              |
| 11410-02941          | MS27200A Microwave Spectrum Monitor Module Technical Data Sheet                            |
| 10580-00419          | MS2710xA Remote Spectrum Monitor User Guide                                                |
| 10100-00064          | MS2710xA Remote Spectrum Monitor, Product Information, Compliance, and Safety              |
| 11410-00898          | MS27100A Remote Spectrum Monitor Technical Data Sheet                                      |
| 11410-00853          | MS27101A Remote Spectrum Monitor Technical Data Sheet                                      |
| 11410-00847          | MS27102A Remote Spectrum Monitor Technical Data Sheet                                      |
| 11410-00854          | MS27103A Technical Data Sheet                                                              |
| 10580-00476          | MA25101A IQ Streaming PCIe Kit and MX280005A IQ Signal Master Software                     |
| 10580-00480          | MS27201A Remote Spectrum Monitor User Guide                                                |
| 10580-00481          | MS27201A Remote Spectrum Monitor Programming Manual                                        |
| 11410-02833          | MS27201A Remote Spectrum Monitor Technical Data Sheet                                      |
| 10580-00499          | MS2085A/89A Site Master User Guide                                                         |
| 10580-00502          | MS2085A/89A Site Master Programming Manual                                                 |
| 10580-00483          | MS2080A Field Master User Guide                                                            |
| 10580-00484          | MS2080A Field Master Programming Manual                                                    |

## 1-7 Licensing Features

Licensing features for the MX280005A software are listed in [Table 1-3](#).

**Table 1-3.** Available Options

| License        | Feature                                         |
|----------------|-------------------------------------------------|
| 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 | WCAP file analysis with PC Node locked license. |

## 1-8 Licensing

The MX280005A software requires a node-locked license or a USB dongle for use of the IQ Player and IQ Converter applications.

### Licensing Option Requirements

The licensing requirements for the following options are described in [Table 1-4](#). To enable vector signal analysis, the spectrum analyzer must have Option 128 installed. Contact the Anritsu Service Center in your area for more information.

**Table 1-4.** Licensing Requirements

| MX280005A Function/Mode                                                                                            | Hardware Option                            | Software Option                                                                              |
|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------|
| IQ File Browser                                                                                                    | N/A                                        | Free                                                                                         |
| I/Q Capture - Block Mode (Ethernet)<br>MS27x0xA (captures < 256MB)<br>MS2090A/MS27x0xA (captures < 1 GB)           | Free when Option 0124 or 0126 is installed | Free                                                                                         |
| I/Q Capture - Streaming<br>(Ethernet or PCIe)<br>MS27x0xA (captures > 256MB)<br>MS2090A/MS27x0xA (captures > 1 GB) | Free when Option 0125 or 0127 is installed | Free                                                                                         |
| I/Q Auto-Capture                                                                                                   | Option 0124 or 0126                        | Free                                                                                         |
| Convert (All supported file types)<br>WCAP files for modulation analysis (MS2720T)                                 | N/A                                        | MX280005A-0005 <sup>a</sup> or<br>MX280005A-0006 <sup>b</sup><br>MX280005A-0024 <sup>a</sup> |
| Large File Support                                                                                                 | N/A                                        | Free                                                                                         |
| I/Q File Viewer                                                                                                    | N/A                                        | Free                                                                                         |
| I/Q Playback                                                                                                       | N/A                                        | 0001 or 0005                                                                                 |
| Synchronized Playback                                                                                              | N/A                                        | MX280005A-0001 <sup>a</sup> or<br>MX280005A-0002 <sup>b</sup>                                |
| 5G Frame Analysis                                                                                                  | N/A                                        | Free                                                                                         |

a. PC node-locked software license

b. USB dongle software license

## The PC License File Format

This license is delivered by email and provides a numeric key that enables the features on a single specified PC. This license is not transferable and if the specified PC is lost, a new license for the new PC must be purchased.

**Note**

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:

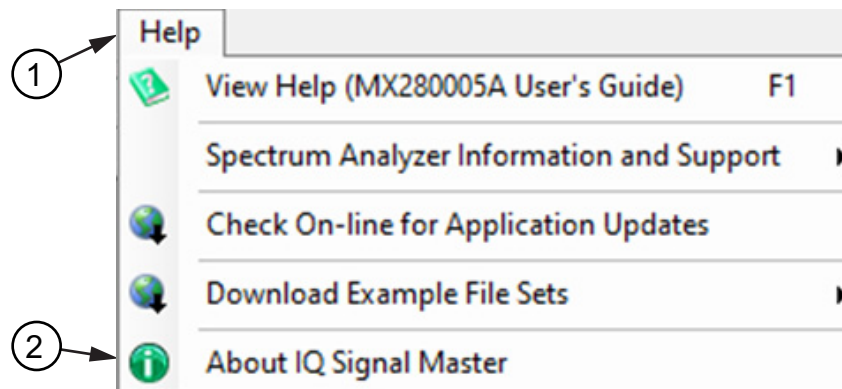
[www.anritsu.com/en-us/test-measurement/products/mx280005a](http://www.anritsu.com/en-us/test-measurement/products/mx280005a)

1. Download and install IQ Signal Master MX280005A software onto the target PC that will be used to run the licensed software.

**Note**

Microsoft .NET framework 4.8.1 must be installed on your PC. If .NET 4.8.1 is not present, the MX280005A software installer will prompt you to install this framework. In some Windows installations, there may be a file missing called vcredist\_x64.exe. This file is part of the Microsoft Visual C distribution. To use the MX280005A software, you may need to download and execute this file.

2. Launch IQ Signal Master and open the About IQ Signal Master dialog from the Help menu as shown in Figure 1-1. .



1. Help File
2. About IQ Signal Master

**Figure 1-1.** Help Menu

3. Press the "Generate Registration" button.

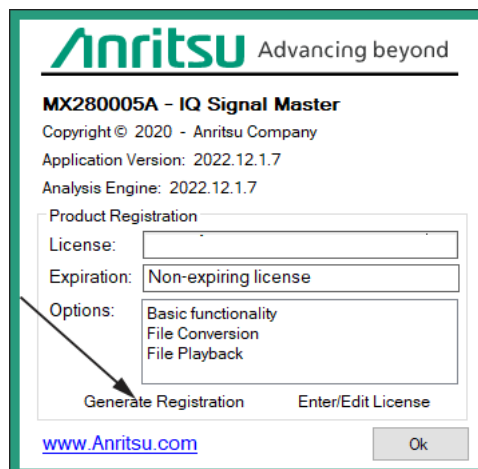


**Figure 1-2.** Generate Registration Button

4. Record the registration code from the information dialog shown in [Figure 1-3](#).

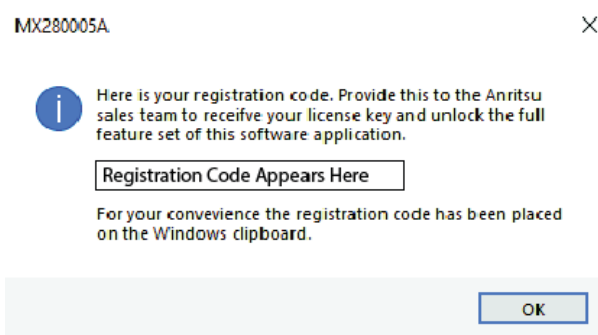


**Figure 1-3.** Registration Dialog

5. Contact Anritsu Sales and Service and provide the registration code for the PC to be licensed. For contact information, see: <https://www.anritsu.com/en-US/contact-us/corporate-information/anritsu-worldwide>. A license key will be emailed to you.

- When you receive your license key, launch IQ Signal Master and open the "About IQ Signal Master" dialog from the Help menu to display the Licensing dialog shown in [Figure 1-4](#).

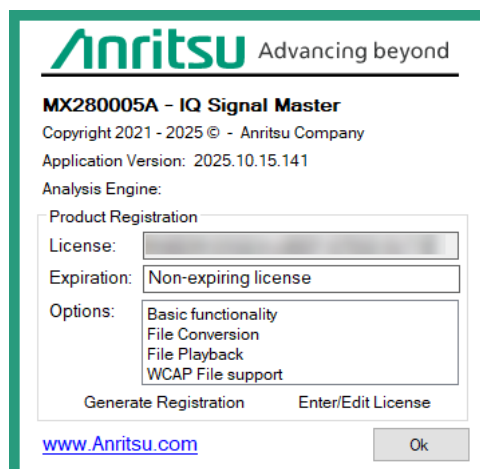


**Figure 1-4.** Licensing Dialog

- Press Enter/Edit License and enter the License key into the License field.

## The USB Dongle License Key format

The PC license is delivered in the form of a physical USB dongle. The licensed features will run on any PC that has the USB dongle inserted at the time of use. This means the software can be inserted on multiple PCs but will only run at any moment in time on the PC that has the dongle inserted. Removing the dongle will immediately disable the licensed features on the PC it was removed from. If the USB dongle is lost, a new license key dongle must be purchased. The Dongle registration is shown in [Figure 1-5](#).



**Figure 1-5.** Dongle Dialog





# Chapter 2 — Overview

## 2-1 Introduction

This chapter provides an Overview of the MX280005A.

## 2-2 Installing MX280005A

Follow the steps below as a guide for proper MX280005A software installation.

1. Download MX280005A IQ Signal Master software from:  
[www.anritsu.com/en-us/test-measurement/products/mx280005a](http://www.anritsu.com/en-us/test-measurement/products/mx280005a)

|             |                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Note</b> | Microsoft .NET framework 4.8.1 must be installed on your PC. If .NET 4.8.1 is not present, the MX280005A software installer will prompt you to install this framework.<br><br>In some Windows installations, there may be a file missing called vcredist_x64.exe. This file is part of the Microsoft Visual C distribution. To use the MX280005A software, you may need to download and execute this file. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

2. Click Install MX280005A.
3. Click Run to start the installation.
4. Click through the installation screens. When the installation is complete, MX280005A becomes a user interface for IQ signal analysis.

## 2-3 IQ Signal Master Overview

The IQ Signal Master program provides a set of robust Vector Signal Analysis menus for analyzing signal data.

### File Mode

The File mode provides the following menus.

**Browse Menu:** Provides a browse menu of IQ files stored on the PC to analyze. The file display provides a convenient view of the data file parameters: center frequency, bandwidth, sample rate, sample count, length, bit-depth, file size, file date, analyzer model, and GPS coordinates.

See “Browse Menu” on page 3-1.

**Capture Menu:** Provides a capture of IQ data from Anritsu spectrum analyzers. Enter the IP address of the spectrum analyzer into the Capture menu to communicate and capture the IQ data files. The Capture menu creates and stores an IQ data file in three formats, Raw IQ (DGZ), Binary IQ (biq) and Wave IQ (wav). The Capture menu supports the MS2090A, MS27201A, and MS2710xA series analyzers and can stream IQ data from the Ethernet port or to the MA25101A PCIe card.

See “Capture Menu” on page 3-7.

**Auto Capture Menu:** Provides a capture of real time I/Q data stream on a fixed time schedule. Add the IP address of the remote monitors. Define the IQ capture parameter sets and set the time interval for capture. Enter/edit configuration of the channels for capturing IQ data. View and select the captured data files to view and export to a user defined folder. The Auto Capture menu supports the MS2089A, MS2090A, MS2720xA, and MS2710xA series analyzers.

See “Auto Capture Menu” on page 3-21.

**Convert Menu:** Provides conversion of IQ file format for different target applications. IQ files are captured in a receivers file format that is incompatible with the file format of a signal generator. The Convert menu window provides file conversion tools for pulling in the IQ parameters of an existing incompatible file format and converts it to a compatible file format. Data can be loaded for playback and analysis after conversion completes. The Convert Menu also provides audio demodulation to play AM/FM audio from an import IQ data file.

See [“Convert Menu” on page 3-27](#).

**Large Files:** Large files consume file space and require long downloading time. The Large File menu provides tools to maximize file size reduction the and reduce loading time without losing data set integrity.

See [“Load Large File Menu” on page 3-36](#).

## View Mode

The View mode provides the following menus.

**View Menu:** Provides basic analysis tools that enable the user to find signals that are captured and identified as “power shifts” and “modulation shifts”. The severity of the signal changes flagged are determined by a sensitivity slider controlled by the user. The Magnitude, I, and Q data sweeps can also be manually scanned using a slider and spotting using markers. A power graph of time provides a visual of marked points of interest. These signal irregularities are added to a “Points of Interest” table. The signals collected in the “Points of Interest” table can be further reviewed and analyzed using the Playback Menu and other MX280005A program menus.

See [“View Menu” on page 4-1](#).

**Playback Menu:** Provides spectrum and time domain replaying of IQ data set files. The Playback menu provides tools to obtain IQ data and create time slices and perform FFTs to create a sweep trace to display along with a Spectrogram. A marked point of interest, such as a start time “ring”, can be analyzed in detail using a control panel to maximize and minimize time resolution and playback rate. Video playback controls and manual scan with a slider of the data set provide further analysis tools. Signal analysis are also provided with Power vs. Time, Occupied Bandwidth vs. Time graphs, and I vs. Q plots.

See [“Playback Menu” on page 4-8](#).

**Sync Playback Menu:** Provides data sets that are captured using the same center frequency, capture bandwidth, capture bandwidth, but different time offsets can be synchronized using a Playback Offset function. Use the Capture and View menus to collect time stamps and the points of interest to synchronize a data set in the Synchronize Playback menu.

See [“Sync Playback Menu” on page 4-23](#).

## Analysis Mode

The Analysis mode provides the following menus.

**5G Frame Analysis Menu:** Provides analysis of 5G data using a spectrogram or density plot. Communicate and capture IQ data from an Anritsu MS2090A spectrum analyzer to find the Synchronization Signal Block (SSB) using the MX280005A 5G frame analysis menu. The SSB offset value can then be communicated to the MS2090A for further demodulation analysis. Or use the Capture menu to capture and store data that can then be imported into the 5G Frame Analysis window for 5G analysis.

See [“5G Frame Analysis Menu” on page 5-1](#).

**Analyze Menu:** Provides a Vector Signal Analysis menu for testing physical layer modulation quality of various transmission standards. The MX280005A provides the following measurement features: modulation accuracy measurement, carrier frequency measurement, and transmitter power measurement. The MX280005A Vector Signal Analysis menu provides analysis options to analyze general purpose modulated signals such as QPSK, QAM, 16 QAM through 2048 QAM, Pi/2DBPSK and many more. The Frame modulation type measurement settings include frame length, symbols setting per slot, and measurement offset. Use the playback menu to view demodulated frames and what the IQ capture looks like in time based analysis, such as in Constellation, Trellis, Eye, Numeric, and using many more IQ modulation graphs.

See [“Analyze Menu” on page 5-11](#).

## Using API

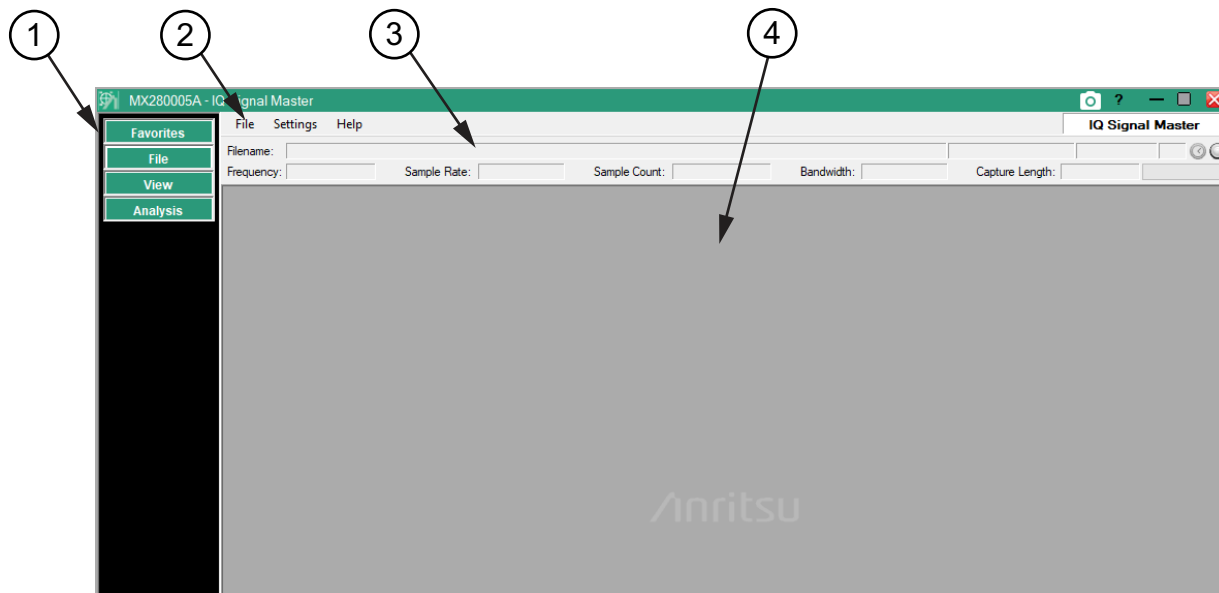
MX280005A IQ Signal Master software is a Microsoft Windows application, and the API is a .NET library.

**API:** The Application Programming Interface (API) allows developers and system integrators to develop their own front end, while using the Anritsu IQ Signal Master Analysis engine for backend processing. The API provides full parameter access and graphical output options for all supported modulation types.

See [Chapter 8, “API”](#).

## 2-4 Opening Screen

The opening screen of the MX280005A IQ Signal Master software is shown in [Figure 2-1](#).



1. See [“Mode Tabs”](#) on page 2-7.
2. Opening Screen Toolbar
3. Loaded File Parameters. Once a file is loaded, the preset parameters for the data file are displayed.
4. All menus provide pertaining user interface controls, parameter settings, and data set analysis in this window.

**Figure 2-1.** Opening Screen

### Opening Screen Toolbar

The opening screen toolbar is shown in [Figure 2-2](#).

A horizontal toolbar with three buttons: 'File', 'Settings', and 'Help'.

**Figure 2-2.** Opening Screen Toolbar

## Opening Screen File Menu

The Opening screen file menu provides the commands as shown in [Figure 2-3](#). This opening screen menu is intended as a quick access to files and analysis of pre-created user files.

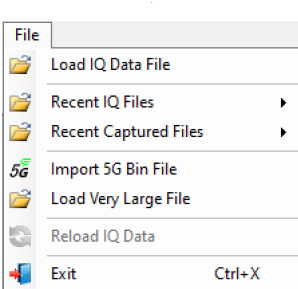
|                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>The image shows a file menu with the following items: File, Load IQ Data File, Recent IQ Files, Recent Captured Files, Import 5G Bin File, Load Very Large File, Reload IQ Data, and Exit (with a Ctrl+X shortcut).</p> | <p><b>Load IQ Data File:</b> Opens a browse dialog to find and load an user created IQ file.</p> <p><b>Recent IQ Files:</b> Open to display the recent user created IQ files that have been recently used. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place.</p> <p><b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.</p> <p><b>Import 5G Bin File:</b> Open the browse dialog to load a user created 5G data file for analysis. A selected .bin file will automatically open to a .dgzm file. See <a href="#">“5G Frame Analysis Menu” on page 5-1</a> for 5G frame analysis details.</p> <p><b>Load Very Large File:</b> Load a user created large file (&gt; 1 GB) See <a href="#">“Load Large File Menu” on page 3-36</a> for opening and using large data set files.</p> <p><b>Reload IQ Data:</b> Reload the most recent viewed file.</p> <p><b>Exit:</b> Exits the program.</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Figure 2-3.** Browse File Menu

## Settings Menu

The Application Settings menu is as shown in [Figure 2-4](#)

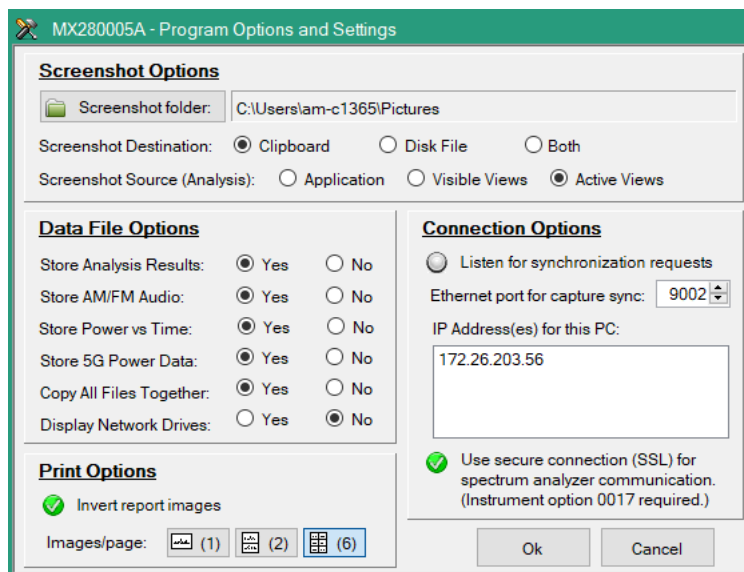


**Figure 2-4.** Settings Menu

**Screenshot Folder:** Open to browse to a folder location to store the screenshots.

**Screenshot Destination:** Select store to Clipboard, Disk File, or Both.

**Screenshot Source (Analysis):** Screenshot Source provides:

**Application:** Screenshot includes full application in Analysis mode.

**Visible Views:** Screenshot includes visible measurements only in Analysis mode.

**Active Views:** Screenshot includes all active measurements in Analysis mode.

## Data File Options

**Store Analysis Results:** Set Yes, reopening a file will load results without the need to do the modulation analysis again.

Set No, reopening a file will require the analysis to be performed again to see the results.

**Store AM/FM Audio:** Set Yes, store AM/FM results when extracting multiple audio signals from a wideband capture in Playback menu.

Set No, does not store audio output. Must re-do signal extraction and demodulation to recover results if a file is opened later.

**Store Power vs Time:** Set Yes, files will be loaded more quickly when opened again.

Set No, a reloaded data file will take longer for initial processing.

**Store 5G Power Data:** Set Yes, files will be loaded more quickly when opened again.

Set No, the spectrogram will need to be regenerated if the file is loaded again.

**Copy All Files Together:** Set yes, when selecting a file for copying, all related files will be added to the Windows clipboard so they are copied together.

Set No, when selecting a file for copying, only include the data and meta-data files, not analysis result and quick load support files.

**Display Network Drives:** Set yes, connect network drives for display and file access in the application File Browser screen.

Set No, does not connect network drives for display and file access in the application File Browser screen.

Connecting to network drives can slow down the application load time.

## Connection Options

Provides synchronized captures across several PCs running IQ Signal Master, each with its own connected SPA. Each IQ Signal Master has to have the "Listen for Synchronization requests" option turned on in order for it to hear and respond to the synchronized IQ capture requests.

**Listen for synchronization requests:** Check the radio button to synchronize captures across several PCs running IQ Signal master, each with its own connected SPA. To synchronize, all PCs involved must have the Listen for synchronization requests checked and have the same Port number setting.

**IP Addresses for this PC:** The current PC IP address or multiple IP addresses are shown if the PC is on multiple networks. Click an address to copy to the Windows clipboard. Identify the spectrum analyzer IP address by accessing the spectrum analyzers network configuration screen. To access the spectrum analyzer network access screen:

- Press the System menu (3-line icon on the upper left corner)
- Press System Information
- View the IP address on the Connectivity panel. Note the IP address may change once the spectrum analyzer is powered off and on again.

If multiple addresses are shown on the IQ Signal Master Connection Options screen, select the IP address that most closely matches the spectrum analyzer address. This can be identified by the first three numbers which are the same as the spectrum analyzers' IP address.

**Use secure connection (SSL) for spectrum analyzer communication (Instrument Option 0017 required):**

Select this radio button to successfully connect to the spectrum analyzer that is installed with Secure Communication, Option 17.

## Print Options

**Invert images:** Inverts black and white image scheme for printing. Press an Images/page icon to set the number of images per page as one, two or six.

Help Menu

The Help menu is the same for each menu within the MX280005A program.

Help

View Help (MX280005A User's Guide) F1

Spectrum Analyzer Information and Support

Check On-line for Application Updates

Download Example File Sets

About IQ Signal Master

**View Help (MX280005A User's Guide):** Provides the Online MX280005A Help File.

**Spectrum Analyzer Information and Support:** Provides the information menu shown below for the MS2080A, MS2090A, MS2089A, MS2720xA, and MS2710xA.

MS2080A - Field Master Homepage

MS2090A - Field Master Pro Homepage

MS2089A - Site Master Homepage

MS2720xA - Remote Spectrum Monitor Homepage

MS2710xA - Remote Spectrum Monitor Homepage

**Check Online for Application Updates:** Provides the installed MX280005A version software and if a version update is suggested as shown below.

MX280005A IQ Signal Master

Installed Version: 2025.9.5

Release Version: 2023.1.1

Installed version is up to date. No action necessary.

View Release Notes

Download

Close & Install

**Download Example File Sets:** See [Chapter 7, "Analysis Example Files"](#).

**About IQ Signal Master:** Provides the MX280005A software details as shown below. For licensing details, see ["Licensing" on page 1-4](#).

Anritsu Advancing beyond

**MX280005A – IQ Signal Master**

Copyright © 2020 - Anritsu Company

Application Version: 2022.12.1.4

Analysis Engine: 2022.12.1.4

Product Registration

License:

Expiration: Non-expiring license

Options:

Basic functionality  
File Conversion  
File Playback

Generate Registration

Enter/Edit License

[www.Anritsu.com](http://www.Anritsu.com)

Ok

Figure 2-5. Help Menu

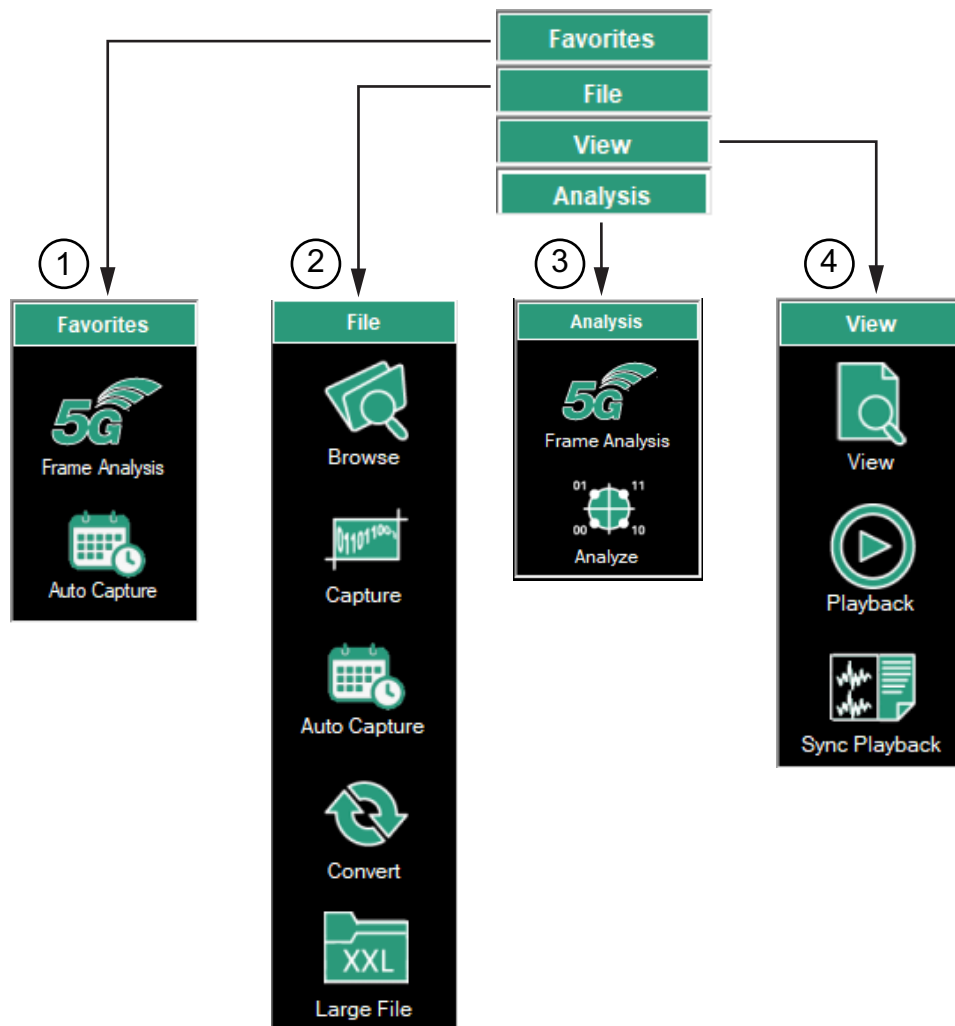
2-6

PN: 10580-00475 Rev. J

MX280005A UG

## 2-5 Mode Tabs

The MX280005A menus provide the setups, applications, and measurements user interface screens shown in [Figure 2-6](#).



1. Favorites Menu: See [“Favorites Folder”](#) on page 2-10.
2. File Mode: See [Chapter 3, “File Mode”](#).
3. Analysis Mode: See [Chapter 5, “Analysis Mode”](#).
4. View Mode: See [Chapter 4, “View Mode”](#).

**Figure 2-6.** MX280005A IQ Signal Master Menus



Analysis Mode

The Analysis mode menus are described in [Figure 2-7](#).

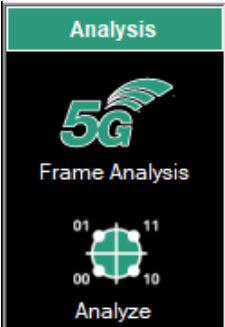
|                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  The icon for the Analysis Mode menu is a dark green rectangle. At the top, the word "Analysis" is written in white. Below it is a large "5G" logo with a signal wave. Underneath the logo, the words "Frame Analysis" are written. At the bottom, there is a circular diagram with four quadrants labeled "01", "11", "00", and "10", and the word "Analyze" below it. | <p><b>5G Frame Analyze Menu:</b> 5G analysis.<br/>See <a href="#">“5G Frame Analysis Menu” on page 5-1</a>.</p> <p><b>Analyze Menu:</b> Modulation analysis of IQ data files.<br/>See <a href="#">“Analyze Menu” on page 5-11</a>.</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 2-7. Analysis Mode

File Mode

The File mode menus are described in [Figure 2-8](#).

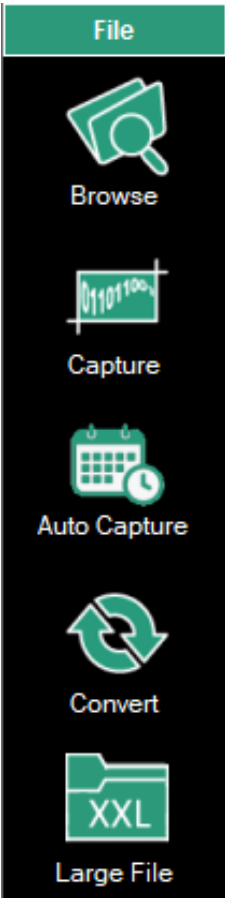
|                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  The icon for the File Mode menu is a dark green rectangle. At the top, the word "File" is written in white. Below it are five icons: a magnifying glass over a folder (Browse), a document with a binary code (Capture), a calendar with a clock (Auto Capture), a circular arrow (Convert), and a folder with "XXL" (Large File). | <p><b>Browse Menu:</b> Browse to the stored IQ files to analyze.<br/>See <a href="#">“Browse Menu” on page 3-1</a></p> <p><b>Capture Menu:</b> Capture IQ data from Anritsu analyzers.<br/>See <a href="#">“Capture Menu” on page 3-7</a>.</p> <p><b>Auto Capture Menu:</b> Time synchronized IQ capture on a fixed time interval schedule.<br/>See <a href="#">“Auto Capture Menu” on page 3-21</a>.</p> <p><b>Convert Menu:</b> Convert IQ files to a usable format.<br/>See <a href="#">“Convert Menu” on page 3-27</a>.</p> <p><b>Large File Menu:</b> Load and open large files using time resolution settings to use data power channel peaks to analyze.<br/>See <a href="#">“Load Large File Menu” on page 3-36</a>.</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 2-8. File Mode

View Mode

The View Mode menus are described in [Figure 2-8](#).

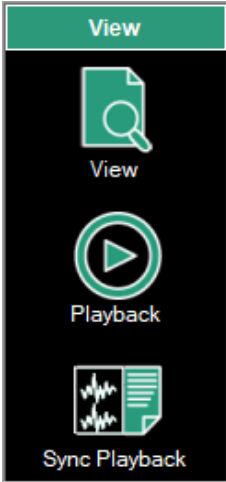
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>View Menu:</b> Basic I and Q data viewer.<br/>See <a href="#">“View Menu” on page 4-1</a>.</p> <p><b>Playback Menu:</b> Replay IQ data in frequency domain.<br/>See <a href="#">“View Menu” on page 4-1</a>.</p> <p><b>Sync Playback Menu:</b> Synchronized I/Q file playback.<br/>See <a href="#">“Sync Playback Menu” on page 4-23</a>.</p> |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 2-9. View Mode

## Favorites Folder

The Favorites folder is used as a preference location for users to access frequently used menus.

### Copy Menus to Favorites

The MX280005A menus offer a robust range of IQ analysis menus. Some IQ analysis requires navigating through interactive menus to capture and analyze a signal. Once a measurement setup is established, some menus may not require access often. As an alternative to repeatedly navigating through the menus listed, a user may store frequently used menus into the Favorite folder. The Favorites folder can be used as a repository for menus that are accessed frequently when performing IQ analysis.

To store a menu in the Favorites menu folder, right-click a frequently used menu to show the submenu shown in [Figure 2-10](#). Below, the 5G menu is copied and added to the Favorites folder. More menus can also be added and accessed through the Favorites folder.

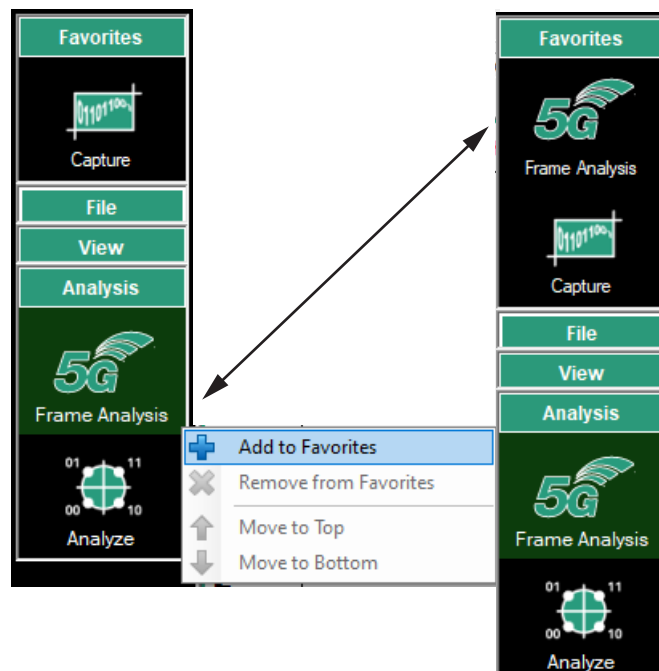


**Figure 2-10.** Add to Favorites

**Add to Favorites:** Click a submenu as described above to copy and move it to the Favorites Folder.

**Remove from Favorites:** Right-click a menu in the Favorites folder and click Remove from Favorites to remove it from the Favorites folder.

**Move to Top:** Right-click a menu in the Favorites folder and click Move to Top to move it to the top of the list.

**Move to Bottom:** Right-click a menu in the Favorites folder and click Move to Bottom to move it to the bottom of the list.

# Chapter 3 — File Mode

## 3-1 Introduction

This chapter describes the File Mode menus, functions, parameter contents, and the setting methods for the analyzing IQ data files. The main screen is the primary setup panel for designating the capture characteristics. The user must specify some basic analyzer setup parameters, the capture bandwidth, and data format. They also set the preamp and attenuation states, and they designate a location for data to be stored on the local hard disk. The File mode menus include:

“Browse Menu”

“Capture Menu” on page 3-7

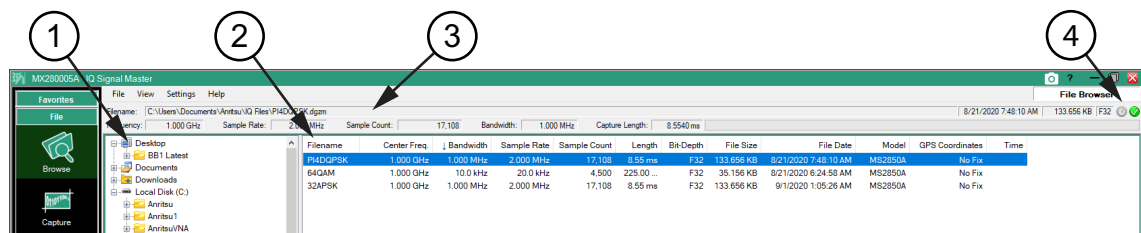
“Auto Capture Menu” on page 3-21

“Convert Menu” on page 3-27

“Load Large File Menu” on page 3-36

## 3-2 Browse Menu

Open the Browse menu. Navigate to the selected saved file location to view the metadata of the saved file as shown in [Figure 3-1](#).



1. Windows browse window. Search for a folder of interest.
2. Displays the opened folder's data parameters window. Click a file to view the captured signal parameters.
3. Open file's metadata and summary panel. The selected list of parameters displayed are active for the Capture, View, Playback, and Analyze applications and can be changed by selecting another file.
4. See “[Status Indicators](#)”.

**Figure 3-1.** Browse Menu

Status Indicators

The Browse menu status indicators are shown in [Figure 3-2](#).

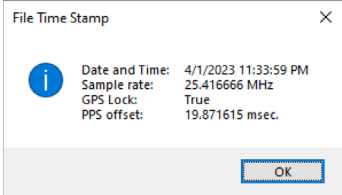
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Time Stamp:</b> Load a file into the summary panel. Press the time stamp icon to view the time stamp details as shown.</p> <div></div> <p><b>Check Indicator:</b> Click a file as shown in <a href="#">Figure 3-1</a>, then press the check-mark icon. If green, the IQ data file is valid for analysis. Valid files are collected on Anritsu spectrum analyzers with Option 128.</p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 3-2. Status Indicators

3-3 Browse Menu Bar

The Browse menu bar is shown in [Figure 3-3](#).

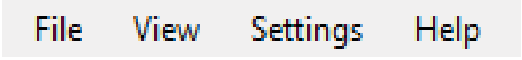
|                                                                                    |
|------------------------------------------------------------------------------------|
|  |
|------------------------------------------------------------------------------------|

Figure 3-3. Browse Menu Bar

File Menu

Displays the Browse File menu as shown in [Figure 3-4](#).

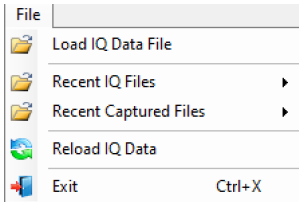
|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Load IQ Data File:</b> Browse to find and load an IQ file</p> <p><b>Recent IQ Files:</b> Open to display the recent IQ files that have been viewed. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place.</p> <p><b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.</p> <p><b>Reload IQ Data:</b> Reload the most recent viewed file.</p> <p><b>Exit:</b> Exits the program.</p> |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 3-4. Browse File Menu

View Menu

Displays the View menu is shown in [Figure 3-5](#). Use this menu to select the parameter columns for viewing the IQ data files. Each parameter is described in “[Browse IQ Data Files](#)”.

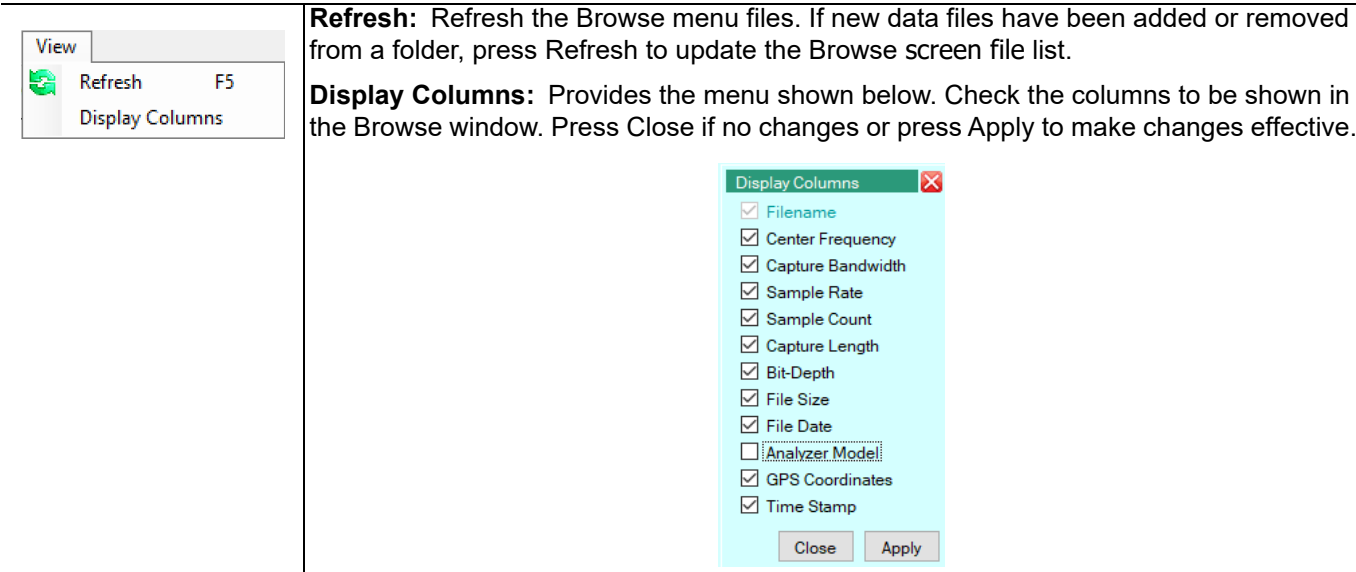


Figure 3-5. Browse View Menu

Browse IQ Data Files

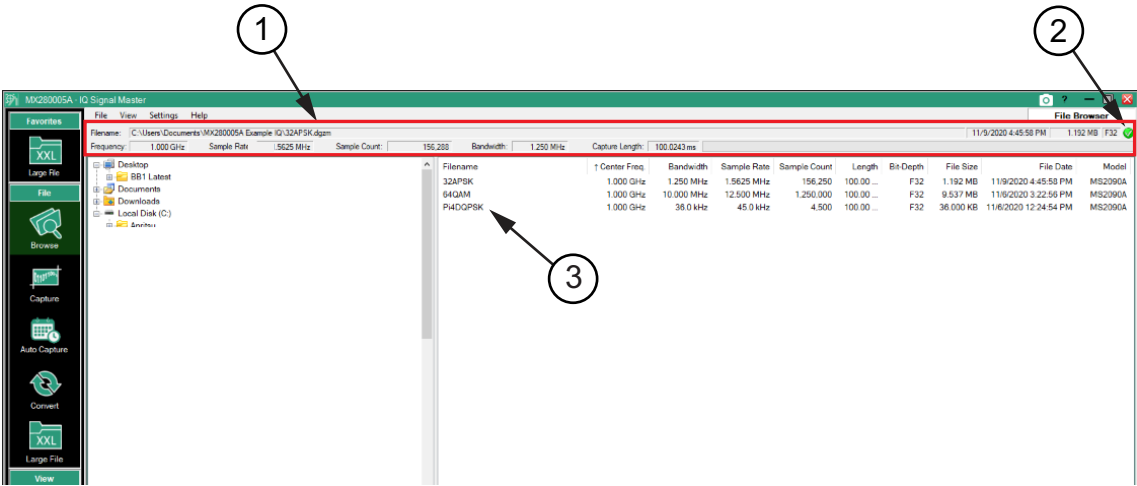
The Browse window metadata menu bar provides an easy way to browse the IQ data files. The column headings are shown in [Figure 3-6](#).

| Filename                                                                                      | Center Freq. | Bandwidth | Sample Rate | Sample Count | Length | Bit-Depth                                                                      | File Size | File Date | ↑ Model | GPS Coordinates | Time |
|-----------------------------------------------------------------------------------------------|--------------|-----------|-------------|--------------|--------|--------------------------------------------------------------------------------|-----------|-----------|---------|-----------------|------|
| 1. Filename: Displays the name of the file                                                    |              |           |             |              |        | 8. File Size: Size of the file                                                 |           |           |         |                 |      |
| 2. Center Freq: Signal center frequency                                                       |              |           |             |              |        | 9. File Date: Date file was saved                                              |           |           |         |                 |      |
| 3. Bandwidth: Signal bandwidth                                                                |              |           |             |              |        | 10. Model: Model of the signal analyzer                                        |           |           |         |                 |      |
| 4. Sample Rate: Signal sample rate per second                                                 |              |           |             |              |        | 11. GPS Coordinates: Monitored signal GPS coordinates                          |           |           |         |                 |      |
| 5. Sample Count: Signal sample count per second                                               |              |           |             |              |        | 12. Time: A displays Yes or No. Indicates if time stamp is available           |           |           |         |                 |      |
| 6. Length: IQ data file length                                                                |              |           |             |              |        | 13. Sort: Use the Sort arrows shown to sort the rows up or down by any column. |           |           |         |                 |      |
| 7. Bit Depth: The amount of information stored.<br>I: signifies Integer<br>F: signifies Float |              |           |             |              |        | <div><div>↑ GPS Coordinates</div><div>↓ GPS Coordinates</div></div>            |           |           |         |                 |      |

Figure 3-6. Metadata Columns

Load File

Double-click a file in the file list to load it as the active file for viewing and data analysis. The file parameters for the active file are displayed in the top section and will remain in view as shown in [Figure 3-7](#). The displayed file parameters are the same shown in the listed file. These parameters will remain in view at this location and become read-only (grayed) while analyzing the signal with other MX280005A program modes/menus.



- 1. **Signal Parameters:** The selected file opened from the browser displays the active signal parameters.
- 2. **Green Indicates Signed:** This file was captured from a spectrum analyzer with Option 128. See [“Signed/Unsigned Indicator” on page 3-6](#).
- 3. **User Selected File:** Double-click to load a file for analysis.

Figure 3-7. Active File Parameters

File Types

Each file listed in the Browse file window consists of two files.

- .dgz: raw IQ binary data
- .dgzm: metadata file

Paste files into a user selected folder as shown in [Figure 3-8](#). Although three files were copied, six will be pasted because as each file is paired as a .dgz and a .dgzm file. Deleting will perform the same transition and delete both the .dgz and .dgzm files.

| Name             | Date modified       | Type      | Size      |
|------------------|---------------------|-----------|-----------|
| IQ Stream.dgz    | 7/19/2021 11:02 AM  | DGZ File  | 15,000 KB |
| IQ Stream.dgzm   | 3/21/2022 6:14 PM   | DGZM File | 3 KB      |
| lte.dgz          | 10/13/2021 10:33 AM | DGZ File  | 5,958 KB  |
| lte.dgzm         | 10/15/2021 11:58 AM | DGZM File | 1 KB      |
| PocketRadio.dgz  | 10/30/2021 7:31 PM  | DGZ File  | 19,532 KB |
| PocketRadio.dgzm | 10/30/2021 7:31 PM  | DGZM File | 1 KB      |

Figure 3-8. Copy and Paste Browse Files

Copy-Delete-Rename

Right-click in the Browse window to display the Copy, Delete, Rename context menu shown in [Figure 3-9](#).

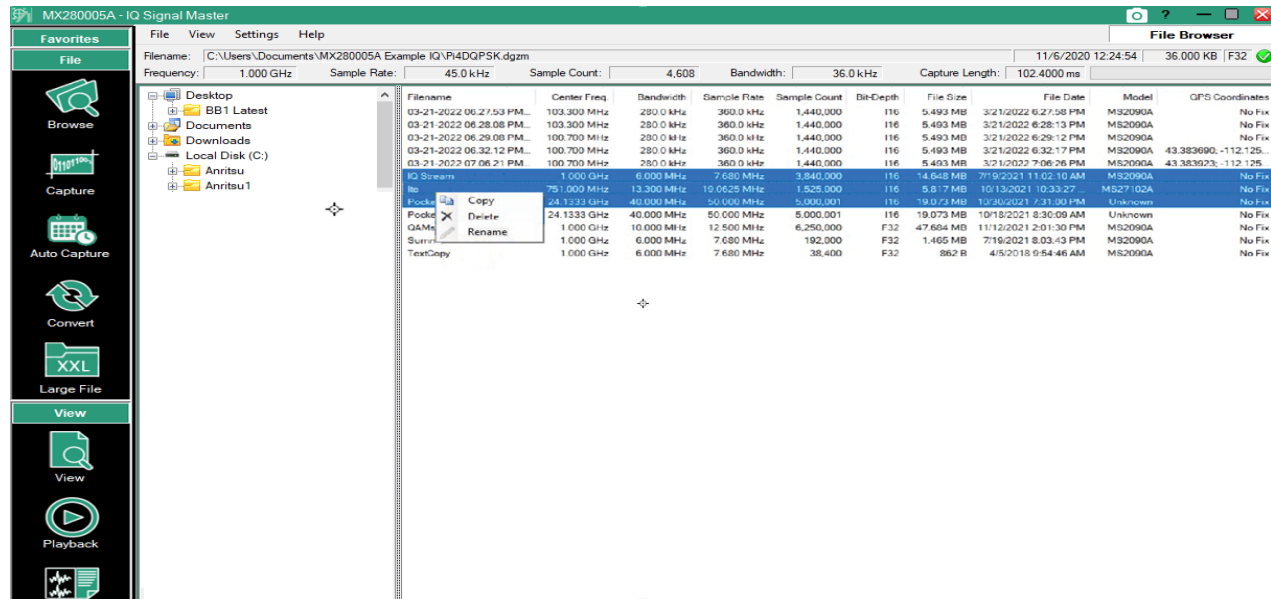


Figure 3-9. Browse File Edit Dialog

Renaming a file displays the dialog box shown in [Figure 3-10](#). In this example, the “Summer” file was renamed as “Fall” as shown in [Figure 3-11](#).

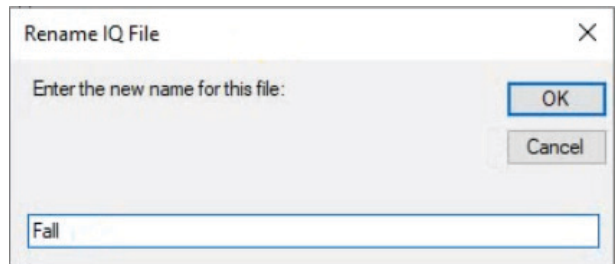


Figure 3-10. Rename IQ File Dialog

In the IQ data folder, renaming the file updates and renames both with .dgz and .dgzm extensions.

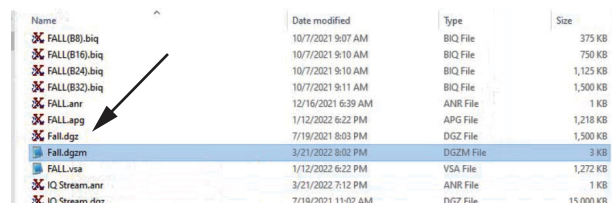


Figure 3-11. Renamed Files



Signal Parameters

The signal data displays the capture parameters set for the active IQ data file.

Table 3-1. Signal Data

|                                                                                                            |                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency: 1.000 GHz                                                                                       | <b>Frequency:</b> Displays the signal's center frequency.                                                                                                                                                                                                                                                                                |
| Sample Rate: 12.500 MHz                                                                                    | <b>Sample Rate:</b> Displays the signal sample rate. The number of I/Q values per second stored in the selected file. IQ sampling rate and capture bandwidth are interactive.                                                                                                                                                            |
| Sample Count: 6,250,000                                                                                    | <b>Sample Count:</b> The total samples captured.                                                                                                                                                                                                                                                                                         |
| Bandwidth: 10.000 MHz                                                                                      | <b>Bandwidth:</b> Bandwidth of the captured signal around the center frequency. IQ sampling rate and capture bandwidth are interactive.                                                                                                                                                                                                  |
| Capture Length: 500.000 ms                                                                                 | <b>Capture Length:</b> The duration of the waveform data capture.                                                                                                                                                                                                                                                                        |
| <div>47.685 MB F32 </div> | <b>Miscellaneous Data</b><br><b>47.685:</b> The size of the file.<br><b>F32:</b> The bit size.<br><b>Green Checked Indicator:</b> The signal is signed and the file is compatible with Option 128 units. See <a href="#">"Signed/Unsigned Indicator"</a> .<br><b>Status Indicator:</b> Displays the loading status of the selected file. |

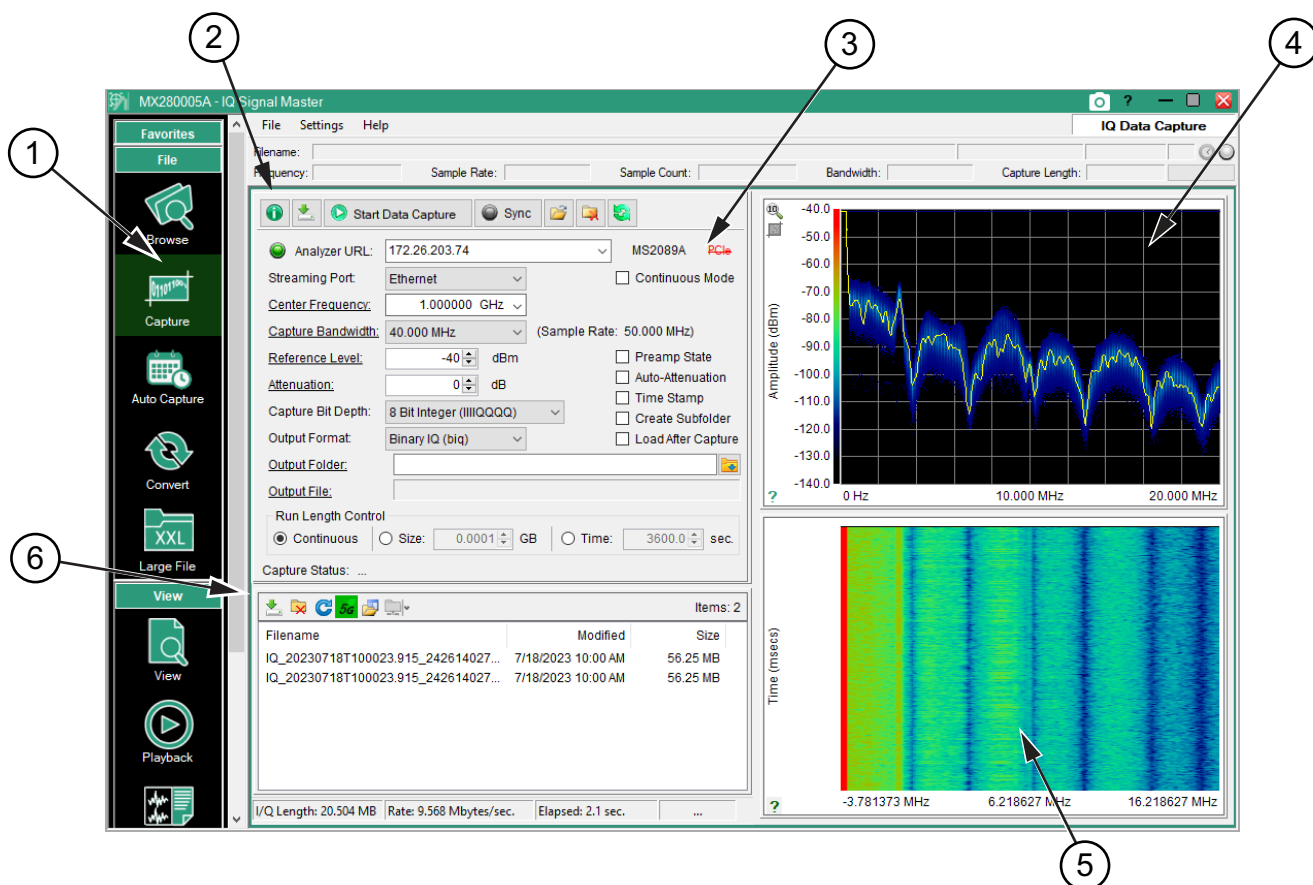
Signed/Unsigned Indicator

The signed/unsigned indicator displays the signals compatibility status.

|                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><br/></div> | <b>Signed/Unsigned Indicator</b><br><b>Green:</b> Indicates the selected file is signed to do demodulation analysis.<br><b>Gray:</b> Indicates the selected file from the file list catalog is unsigned. Unsigned files can still be viewed, and with licensing for separate options, can also be played back and converted regardless of signed or unsigned status. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 3-4 Capture Menu

The Capture menu provides tools to import IQ acquisition data from a spectrum analyzer with Option 128 installed. The Capture menu window is shown in [Figure 3-12](#).



1. **Capture Menu:** Press to display the Capture Menu.
2. **IQ Capture Menu Toolbar:** See [“IQ Capture Toolbar”](#) on page 3-10.
3. **IQ Acquisition Parameters Settings Window:** Use the Capture parameters window to set the IQ data streaming from supported Anritsu analyzers. It currently supports the MS2089A, MS2080A, MS2090A, MS27200A, MS27201A, and MS2710xA series analyzers and can stream IQ data from the Ethernet port or the MA25101A PCIe card. See [“IQ Acquisition Parameters Settings”](#) on page 3-9.
4. **Live IQ Data Window:** Live trace display window with peak-detect sensitivity control.
5. **Spectrogram Window:** Displays a spectrogram view of the signal.
6. **Remote File List Toolbar and Window:** Displays captured files from a remote spectrum analyzer. See [“Remote File List”](#) on page 3-18.

**Figure 3-12.** Capture Menu

### Capture Menu Toolbar

The Capture menu toolbar is shown in [Figure 3-13](#).

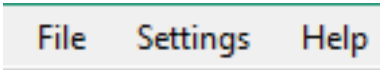


Figure 3-13. Capture Menu Toolbar

### File Menu

Displays the Capture File menu as shown in [Figure 3-14](#).

|                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><div>File</div><div><div>Load IQ Data File</div><div>Recent IQ Files</div><div>Recent Captured Files</div><div>Reload IQ Data</div><div>Exit</div></div></div> | <div><b>Load IQ Data File:</b> Browse to find and load an IQ file.</div> <div><b>Recent IQ Files:</b> Open to display the recent IQ files that have been viewed. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place.</div> <div><b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.</div> <div><b>Reload IQ Data:</b> Reload the most recent viewed file.</div> <div><b>Exit:</b> Exits the program.</div> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 3-14. Capture File Menu

### Settings Menu

The Settings menu is the same as described in “[Settings Menu](#)” on page 2-4.

### Help Menu

The Help menu is the same as described in “[Help Menu](#)” on page 2-6.

## IQ Acquisition Parameters Settings

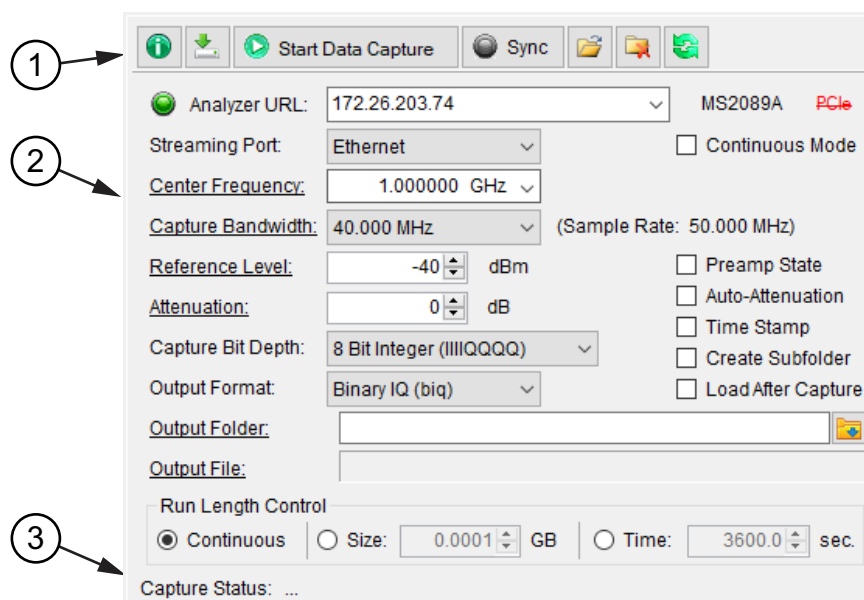
The IQ acquisition parameters settings window is the primary setup panel for designating the capture parameters. The user must specify the analyzer setup parameters, the capture bandwidth, data format, preamp and attenuation states, and designate a location for data to be stored on the local hard disk.

### Note

If streaming to local memory (Internal or USB), use the “Combine Files” switch located on the Anritsu MS2090A Spectrum Analyzer MEASURE menu. The Combine Files switch must be set to “on” as shown below to obtain a complete file set containing the entire IQ capture data set.

COMBINE FILES 

For more information on capturing data directly to the spectrum analyzer, refer to your Anritsu spectrum analyzer user guide.



1. See [“IQ Capture Toolbar”](#) on page 3-10.
2. See [“Capture Menu Settings Window”](#) on page 3-12.
3. See [“Capture Status”](#) on page 3-15.

**Figure 3-15.** IQ Acquisition Parameter Settings Window

IQ Capture Toolbar

The toolbar shown in [Figure 3-16](#) provides controls for saving streaming data and interfacing with the analyzer. The PC software initiates IQ streaming on the analyzer when the Stream IQ Data toolbar button is clicked. The software reads the IQ data stream over Ethernet or the PCIe interface and stores the data on the PC.

**Note** A high-speed SSD is recommended for PCIe streaming and high bandwidth settings.

The IQ streaming and storage can be set to a fixed time or stopped at any time by clicking the Stop IQ Stream button.

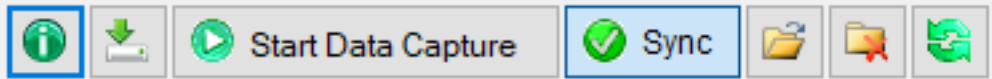


Figure 3-16. Capture Toolbar

The Capture menu toolbar icons are described in [Table 3-2](#).

Table 3-2. IQ Acquisition Toolbar

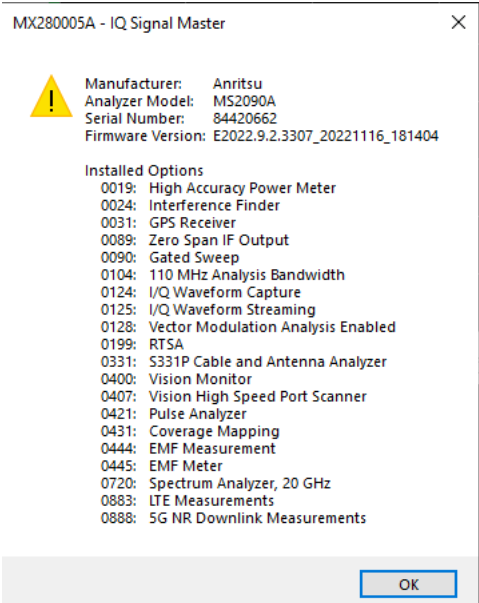
|                                                                                     |                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p>Opens a window to show details about the connected spectrum analyzer as shown below.</p> <div></div> |
|  | <p>Downloads the current analyzer settings to the <a href="#">“Capture Menu Settings Window”</a> on <a href="#">page 3-12</a>.</p>                                                         |

Table 3-2. IQ Acquisition Toolbar

|                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                              |         |          |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------|--|--|---------|--------|--------|-------|---------|---------|--------|--------|-------|----------|--------|--------|--------|-------|---------|--------|--------|--------|---------|--------|
| <div><div></div><div>Start Data Capture</div></div> <div><div></div><div>Stop Data Capture</div></div> | <p>Start Data Capture initiates IQ data streaming and saves the streaming data to the output folder (see “<a href="#">Capture Menu Settings Window</a>” on page 3-12). After it is pressed, the button changes to <b>Stop Data Capture</b>. Press and the data streaming is stopped. It is only enabled if the analyzer is connected and the correct options are installed. The button will be unavailable if a required option is missing or if a connection via the selected streaming port is not established.</p> <p>Captures that are performed when the Spectrum Analyzer is set to RTSA mode require the capture Bandwidth to be set as shown in the warning dialog below.</p> <div><p>The capture bandwidth could not be set as selected.</p><p>Likely causes are:</p><ol style="list-style-type: none"><li>1. Mistaken model for the connected SPA. Try reconnecting.</li><li>2. The monitor is in RTSA mode, rather than SPA mode.</li></ol></div> <table><tr><td colspan="5">For the FieldMaster and FieldMaster Pro,<br/>all capture bandwidths shown are supported in SPA mode.<br/>RTSA mode only supports the bandwidths shown in blue.</td></tr><tr><td>110 MHz</td><td>50 MHz</td><td>20 MHz</td><td>6 MHz</td><td>1.5 MHz</td></tr><tr><td>100 MHz</td><td>40 MHz</td><td>18 MHz</td><td>5 MHz</td><td>1.25 MHz</td></tr><tr><td>80 MHz</td><td>36 MHz</td><td>12 MHz</td><td>3 MHz</td><td>280 kHz</td></tr><tr><td>74 MHz</td><td>25 MHz</td><td>10 MHz</td><td>2.5 MHz</td><td>36 kHz</td></tr></table> | For the FieldMaster and FieldMaster Pro,<br>all capture bandwidths shown are supported in SPA mode.<br>RTSA mode only supports the bandwidths shown in blue. |         |          |  |  | 110 MHz | 50 MHz | 20 MHz | 6 MHz | 1.5 MHz | 100 MHz | 40 MHz | 18 MHz | 5 MHz | 1.25 MHz | 80 MHz | 36 MHz | 12 MHz | 3 MHz | 280 kHz | 74 MHz | 25 MHz | 10 MHz | 2.5 MHz | 36 kHz |
| For the FieldMaster and FieldMaster Pro,<br>all capture bandwidths shown are supported in SPA mode.<br>RTSA mode only supports the bandwidths shown in blue.                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                              |         |          |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
| 110 MHz                                                                                                                                                                                                                                                                  | 50 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 20 MHz                                                                                                                                                       | 6 MHz   | 1.5 MHz  |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
| 100 MHz                                                                                                                                                                                                                                                                  | 40 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 18 MHz                                                                                                                                                       | 5 MHz   | 1.25 MHz |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
| 80 MHz                                                                                                                                                                                                                                                                   | 36 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 12 MHz                                                                                                                                                       | 3 MHz   | 280 kHz  |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
| 74 MHz                                                                                                                                                                                                                                                                   | 25 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10 MHz                                                                                                                                                       | 2.5 MHz | 36 kHz   |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
| <div><div></div><div>Sync</div></div>                                                                                                                                                   | <p>The Sync function is not active when grayed. Press to provide synchronized capture across multiple PC/Monitor pairs. See “<a href="#">Sync Button</a>” on page 3-12.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                              |         |          |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
| <div></div>                                                                                                                                                                             | <p>Opens Windows Explorer to the output folder location.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                              |         |          |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
| <div></div>                                                                                                                                                                            | <p>Deletes all supported streaming files (.dgz, .dgzm, .biq, .xdat, .xml, .xhdr) in the specified output folder. (see “<a href="#">Capture Menu Settings Window</a>” on page 3-12)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                              |         |          |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |
| <div></div>                                                                                                                                                                           | <p>Factory reset restores the analyzer to the factory default settings for all measurement modes and system settings, including language and the display and audio settings. Ethernet settings and user files are not affected. The analyzer will automatically restart. Factory reset could be useful to correct an erroneous analyzer setting that might affect the IQ stream as it is the surest way to get the analyzer back into a known good state. A message is displayed and the user can choose whether to continue with this action.</p> <p>After the reset, the analyzer will need reconfiguring and the IQ Acquisition software will need to be restarted if using PCIe.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                              |         |          |  |  |         |        |        |       |         |         |        |        |       |          |        |        |        |       |         |        |        |        |         |        |

## Sync Button

Press Sync to display the dialog shown in [Figure 3-17](#) to synchronize IQ capture across multiple PCs and Spectrum monitors. This provides up to eight concurrent data sets synchronized for playback and comparison. Each IQ capture is on a separate PC and uses a separate spectrum monitor. Each PC must be running IQ Signal Master and be properly configured for IQ capture.

### Synchronize Across Several PCs

To obtain synchronized captures across several PCs running IQ Signal Master, see [“Connection Options” on page 2-5](#).

Press the Start Capture Button will start capture on remote PCs.

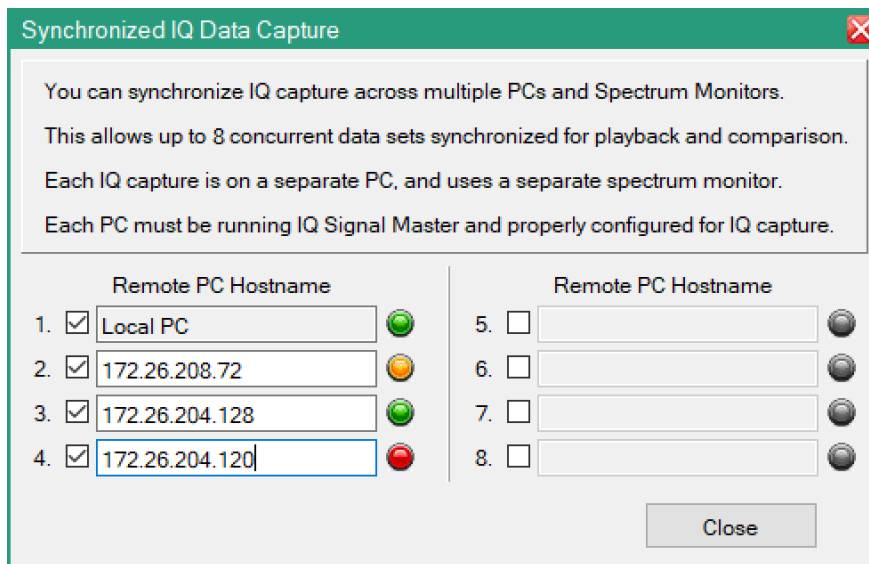


**Figure 3-17.** Synchronized IQ Data Capture Dialog

### Connection Indicators

The connection indicators provide a IQ capture connectivity status of the PC running IQ Signal Master to the spectrum analyzer.

**Green:** The PC with the IP Hostname entry is running the IQ Signal Master and is connected to a spectrum analyzer ready for data capture.

**Yellow:** The PC with the IP Hostname entry is running the IQ Signal Master and is not connected to a spectrum analyzer.

**Red:** The PC with the IP Hostname entry is not running the IQ Signal Master.

## Capture Menu Settings Window

The Capture menu settings window provides a variety of settings for the interface to the analyzer as well as some basic measurement setup parameters. The following underlined parameters (Center Frequency, Capture Bandwidth, Reference Level, and Attenuation) shown in [Figure 3-15 on page 3-9](#) are interactive with the analyzer. Click on the parameter label to send the setting immediately to the analyzer.

### Analyzer URL

Enter the analyzer URL or IP address. The indicator to the left is described below:

- **Green LED:** A connection has been established with the analyzer and the required option is installed. The "Stream IQ Data" button will be enabled.

- **Gray LED:** No connection to the analyzer has been attempted.
- **Red LED:** No analyzer is found or an analyzer is found missing option 125 or 127. Streaming is disabled.

### Streaming Port

Provides Ethernet and PCIe as streaming port types.

See [“Set Streaming Port” on page 3-15](#).

### Continuous Mode

IQ data will continue creating a series of output files until stopped. Each time the target file size or collection size is met, a new file will be created. The IQ stream will not be continuous across files and there will be a gap.

### Stop on Errors

Enabled for PCIe only. The PCIe interface can detect if a byte is wrong. This setting is on by default. Uncheck to continue streaming data even if a transfer error is detected.

### Center Frequency

Sets the analyzer's center frequency. The setting takes affect when the Stream IQ Data is clicked.

### Capture Bandwidth

Sets the analyzer's streaming bandwidth. The list of allowed streaming bandwidths is adjusted to match the specific analyzer option. The setting takes affect when the Stream IQ Data is clicked.

### Reference Level

Sets the analyzer's reference level. The setting takes affect when the Stream IQ Data is clicked.

### Attenuation

Press to send the set attenuation level to the spectrum analyzer.

### Auto-Attenuation

Turn On/Off the Auto-attenuation on the spectrum analyzer.

### Preamp State

Turn On/Off the preamp state on the spectrum analyzer. This may be overwritten by the analyzer firmware if the power is too high.

### Capture Bit Depth

Set the analyzer's streaming bit depth. The capture bit depth for MS27201A, MS2080A, MS2089A and MS2090A starts with I phase followed by Q phase, but for MS27100A, MS27101A, MS27102A and MS27103A it starts with Q phase followed by I phase. The capture bit depth can be structured with following options:

- 8 Bit Integer (IIIIQQQQ)
- 10 Bit Integer (IIIQQQ)
- 16 Bit Integer (IQIQ)
- 16 Bit Integer (IIQQ)
- 32 Bit Integer (IQ)
- 32 Bit Float (IQ)



### Time Stamp

Include time stamps in the IQ data. This will reduce the bit depth by one bit.

### Output Format

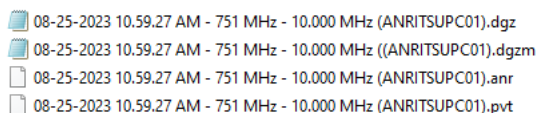
Sets the streamed data file and accompanying metadata file formats:

- **Raw IQ (DGZ):** This is the native format of the Anritsu SPA. For bit-depths < 32 bits, the I and Q values are ordered in a proprietary way, and programs not specifically designed to support our DGZ files will not be able to read these. Metadata is stored in an accompanying .dgzm file.
- **Binary IQ (BIQ):** This format undoes the I/Q pair ordering of Anritsu's proprietary format. I/Q values are written to the file in consecutive pairs. This file format is more easily read by third party software. For 32-bit files, there is no difference. Metadata is written to an .xml file. Binary IQ files cannot be loaded for Playback and Analysis.
- **Wave I/Q (wav):** This output format is restricted to a 4G limit.

### Output Folder

Underlined and active. Click to open the user designated output folder in Windows File Explorer. This field sets the streamed data file and accompanying metadata file location where each filename is the time stamp of the data stream. The PC hostname is now appended to the filename as shown below when:

- The capture location is on a network drive. This is to distinguish the source of a capture and to stop possible filename conflicts when doing synchronized captures to the same network location.
- The [“Listen for synchronization requests” on page 2-5](#) setting is active in the main program Settings dialog. When this is active, captures may be synchronized across several PCs.



08-25-2023 10.59.27 AM - 751 MHz - 10.000 MHz (ANRITSUPC01).dgz  
 08-25-2023 10.59.27 AM - 751 MHz - 10.000 MHz ((ANRITSUPC01).dgzm  
 08-25-2023 10.59.27 AM - 751 MHz - 10.000 MHz (ANRITSUPC01).anr  
 08-25-2023 10.59.27 AM - 751 MHz - 10.000 MHz (ANRITSUPC01).pvt

### Create Subfolder

A time stamped folder is created each time a new transfer is started. This is most useful if Continuous Mode is on as then all related files are stored in a common location.

### Load After Capture

A new data files will be automatically loaded for playback and analysis after the IQ capture is complete. Since loading a large file for the first time takes considerable time, this is automatically turned OFF if the expected file size is over 256 MB. The text changes to red to visually indicate the change. You can turn this back ON after setting the capture size if you want to load the file for playback and analysis.

### Output File

A display-only field of the current data transfer file name.

### Run Length Control

**Continuous:** Streaming will continue until:

- The user presses “Stop”
- Out of space (transfer stops with about 2 GB remaining).
- An error is detected (If Stop on Errors is checked).

**Size:** Size is in Gigabits. Streaming will continue until:

- The current file reaches the set file size and Continuous Mode is Off.

- Continuous Mode is set to Off during capture. The stream will end when the current file size limit is reached. The user presses “Stop”.
- Out of space (transfer stops with about 2 GB remaining).
- An error is detected (If Stop on Errors is checked).

**Time:** Streaming will continue until:

- The current stream time reaches the set time and Continuous Mode is Off.
- Continuous Mode is set to Off during capture. The stream will end when current file elapsed time reaches the set time. The user presses “Stop”.
- Out of space (transfer stops with about 2 GB remaining).
- An error is detected (If Stop on Errors is checked).

### Capture Status

The Capture Status field provides the following informational progress of the IQ capture.

- Block mode in progress
- Block capture in progress
- Streaming data over Ethernet
- Data stream in progress
- Connection lost. Stream aborted
- Data errors detected during the last transfer
- Transfer error detected. Data stream aborted
- No data errors detected in previous transfer
- Trying to stop data stream
- Data stream terminated

## 3-5 Set Streaming Port

Set as Ethernet or PCIe data streaming. Setting the streaming port depends on the speed of transfer required. Ethernet can be set for all model types, but for steaming files larger that 1 GHz, set to PCIe.

### Using Ethernet

The supported analyzers have Gigabit Ethernet ports. This will provide gapless streaming up to about 40 MHz at 8-bits, 20 MHz at 16-bits, or 10 MHz at 32-bits capture bandwidth. However, if any element in the Ethernet chain runs at a lower speed, such as at 100 Megabits, then performance will be seriously degraded. IQ Acquisition Tool cannot detect this, but it will be evident in data throughput. For best performance, a direct connection is recommended, using a single Gigabit Ethernet hub or switch.

### Using PCIe

PCIe capability is provided as a Streaming Port only for MS2090A, MS27200A and MS27201A and is used for very large data transfers as with large IQ captures. Note that MS2080A and MS2089A do not support PCIe due to the absence of PCIe port.

Recommendations for installing a PCIe card are:

- If total capture size is less than 1 GB, PCIe is not required.
- If total capture size is greater than 1 GB then:
  - a. For 8-bit capture, use PCIe if capture bandwidth is greater than 25 MHz.
  - b. For 16-bit capture, use PCIe if capture bandwidth is greater than 12 MHz.
  - c. For 32-bit capture, use PCIe if capture bandwidth is greater than 6 MHz.

When PCIe is set, but there is no PCIe connection to the PC, a context menu is displayed as shown in [Figure 3-18](#).

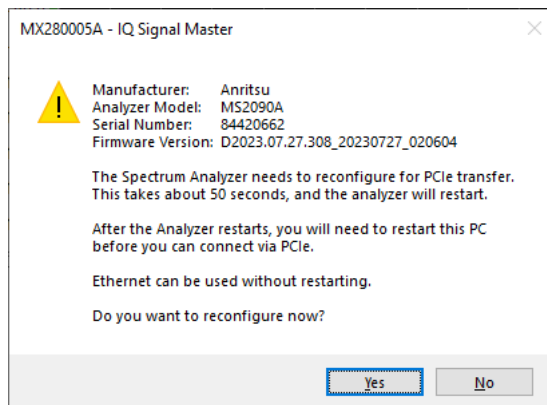
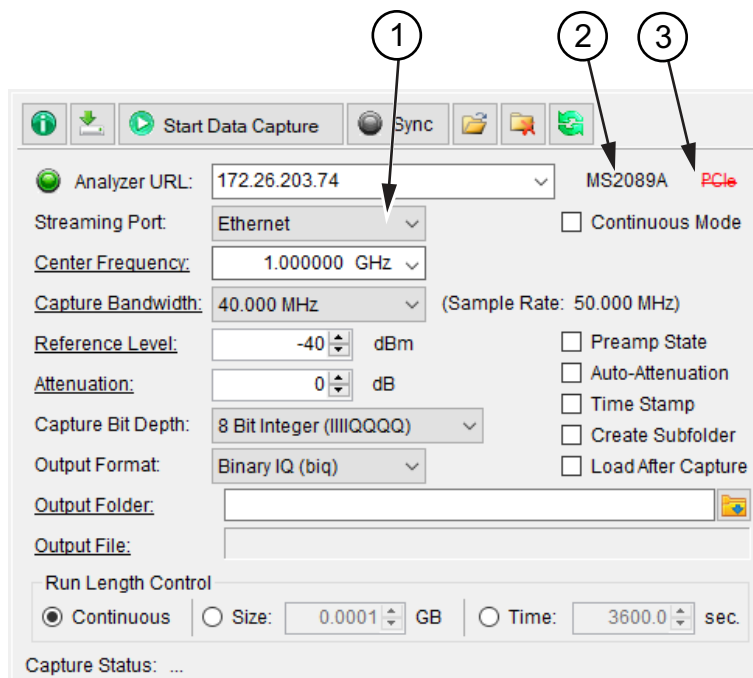


**Figure 3-18.** PCIe Context Menu

### Connection Type

The connected spectrum analyzer model is displayed to the right of the URL field. PCIe is only shown when a compatible analyzer (MS2090A or MS27102A) and PCIe hardware is detected. When the model displayed is detected as having PCIe compatibility, then the Streaming Port provides PCIe as a Streaming Port and the PCIe connection status is displayed as:

- **PCIe:** The PCIe interface is connected.
- **PCIe:** The spectrum analyzer requires PCIe interface support. For instructions on installing a PCIe card into the PC and interfacing with the MX280005A software, see [Appendix A, “Installing PCIe Kit”](#).

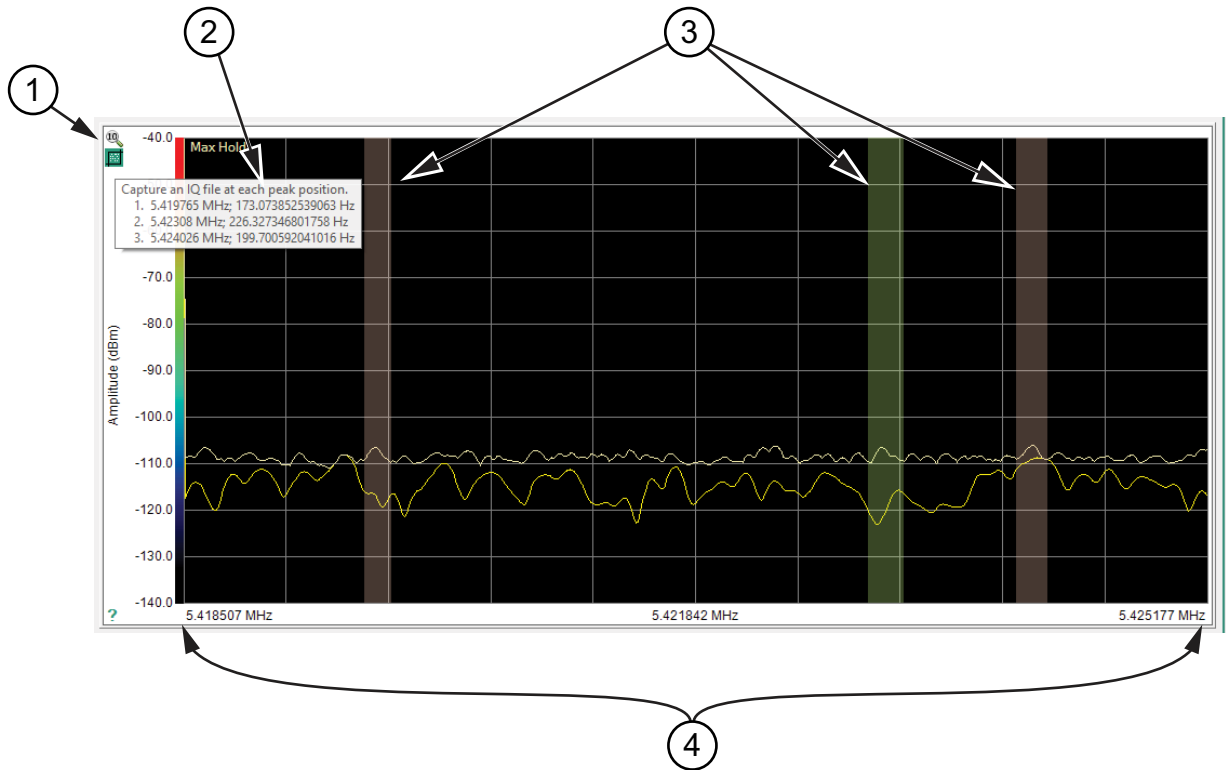


1. Set as PCIe
2. Shows the Spectrum Analyzer Model connected
3. PCIe is set and connected. See [“Connection Type”](#).

**Figure 3-19.** PCIe Window Settings

Peak Detection Window

The peak detection window shows the captured IQ data and peak detection tools.



- 1. IQ Detect Icons
- 2. Capture an IQ file at each peak position
- 3. Peaks detected
- 4. Center Frequency and bandwidth set. The settings are entered as shown in [“Capture Menu” on page 3-7](#).

Figure 3-20. Peak Detection

Use the Capture menu peak-detect icons to locate the peaks of the IQ data signal.

Table 3-3. Peak Detect Icons

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                     |               |                     |    |              |                     |    |               |                     |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------|---------------------|----|--------------|---------------------|----|---------------|---------------------|
|    | <p>Auto Peak Search: Click to initiate a peak search of the IQ data stream. Each click sequences 1 through 10 sensitivity search where 1 is the most sensitive. Shift-click to reverse sequence the count as 10 through 1. Press keyboard Shift Up/Down also sequences the sensitivity.</p> <p>Press keyboard Esc removes the peak indicators from the screen. Shift restores them. Press keyboard Shift Up/Down also sequences the sensitivity</p>                                                                                                                                                                |                     |               |                     |    |              |                     |    |               |                     |
|    | <p>Display Peak Details: Click to display the peak center frequency and bandwidth of the peak signals identified from the Auto Peak Search. This capture tool uses the current settings set in the IQ Acquisition Parameters setting window. See <a href="#">“IQ Acquisition Parameters Settings” on page 3-9</a>.</p> <div><p>Capture an IQ file at each peak position.</p><table><tr><td>1.</td><td>5.419765 MHz;</td><td>173.073852539063 Hz</td></tr><tr><td>2.</td><td>5.42308 MHz;</td><td>226.327346801758 Hz</td></tr><tr><td>3.</td><td>5.424026 MHz;</td><td>199.700592041016 Hz</td></tr></table></div> | 1.                  | 5.419765 MHz; | 173.073852539063 Hz | 2. | 5.42308 MHz; | 226.327346801758 Hz | 3. | 5.424026 MHz; | 199.700592041016 Hz |
| 1. | 5.419765 MHz;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 173.073852539063 Hz |               |                     |    |              |                     |    |               |                     |
| 2. | 5.42308 MHz;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 226.327346801758 Hz |               |                     |    |              |                     |    |               |                     |
| 3. | 5.424026 MHz;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 199.700592041016 Hz |               |                     |    |              |                     |    |               |                     |

## Remote File List

When using the MX280005A to capture IQ data, it is automatically transferred to the local PC. Other ways to capture IQ data directly on the spectrum analyzer include taking a MS2090A into the field and capturing data, return to the lab and copy it to a PC for playback and analysis. The remote file list shown in [Figure 3-21](#) displays files stored on the spectrum analyzer and provides a way for copying the files to the local PC. Double-click a file from the list to copy to the working folder. The selected file can then be viewed in the IQ data screen and Spectrogram screen shown in [Figure 3-12 on page 3-7](#).

**Note** MX2710xA does not support remote files.

**Note** On the spectrum analyzer's user interface, there is a command selection under the IQ Measurement menu labeled "SAVE TO FILE". This can be "Automatic" or "Manual". If it is "Automatic", then every time MX280005A performs a capture, the data is also stored redundantly on the spectrum analyzer. This will fill up the internal storage. It may be best to set to Manual while doing the capture with the MX280005A software. But set the analyzer to "Automatic" if doing captures from the front panel.

| Capture Status: 1.1 GB streamed; 1.3 GB expected (86%) ?                       |                      |           |
|--------------------------------------------------------------------------------|----------------------|-----------|
| Items: 1                                                                       |                      |           |
| Filename                                                                       | Modified             | Size      |
| Capture_20221111T131628.021_92366...                                           | 11/11/2022 1:16 PM   | 381.47 MB |
| Capture_20220621T162053.169_78188...                                           | 6/21/2022 4:20 PM    | 23.84 MB  |
| Capture_20220719T085127.900_95172...                                           | 7/19/2022 8:51 AM    | 3.05 MB   |
| Capture_20220719T085155.235_28297...                                           | 7/19/2022 8:51 AM    | 6.10 MB   |
| Capture_20220719T085156.718_75262...                                           | 7/19/2022 8:51 AM    | 9.16 MB   |
| Capture_20220719T091015.291_21462...                                           | 7/19/2022 8:51 AM    | 12.21 MB  |
| Capture_20220719T091016.289_21061...                                           | 7/19/2022 8:51 AM    | 3.05 MB   |
| Capture_20220719T085155.235_28297...                                           | 7/19/2022 8:51 AM    | 9.16 MB   |
| Capture_20220719T085156.718_75262...                                           | 7/19/2022 8:51 AM    | 30.52 MB  |
| Capture_20220719T091015.291_21462...                                           | 7/19/2022 9:10 AM    | 3.05 MB   |
| Capture_20220719T091016.289_21061...                                           | 7/19/2022 9:10 AM    | 6.10 MB   |
| Capture_20220719T091017.511_43103...                                           | 7/19/2022 9:10 AM    | 9.16 MB   |
| Capture_20220719T091019.007_91285...                                           | 7/19/2022 9:10 AM    | 30.52 MB  |
| Capture_20220719T091041.538_46241...                                           | 7/19/2022 9:10 AM    | 3.05 MB   |
| Capture_20220719T091042.539_46132...                                           | 7/19/2022 9:10 AM    | 6.10 MB   |
| Capture_20220719T091043.813_73320...                                           | 7/19/2022 9:10 AM    | 9.16 MB   |
| Capture_20220719T091045.305_18124...                                           | 7/19/2022 9:10 AM    | 76.29 MB  |
| Capture_20220719T101446.676_59811...                                           | 7/19/2022 10:14 AM   | 6.10 MB   |
| Capture_20220719T101447.907_82337...                                           | 7/19/2022 10:14 AM   | 9.16 MB   |
| Capture_20220719T101449.430_34498...                                           | 7/19/2022 10:14 AM   | 12.21 MB  |
| Capture_20221011T121735.464_26989...                                           | 10/11/2022 12:17 ... | 38.15 MB  |
| I/Q Length: 1.096 GB   Rate: 12.575 Mbytes/sec.   Elapsed: 89.3 sec.   2.47 GB |                      |           |

**Figure 3-21.** Remote File List

## Remote File List Capture Status

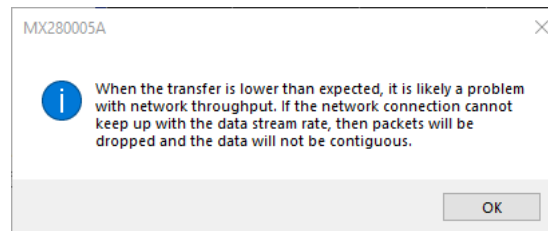
The Capture Status provides the IQ data stream size and expected size to capture and analyze properly. If the data stream is less than the expected size, the assistance indicator is displayed as shown in [Figure 3-22](#).

Capture Status: 1.1 GB streamed; 1.3 GB expected (86%)



**Figure 3-22.** Capture Status Assistance Indicator

Click the icon to display the information dialog as shown below.



Remote File List Toolbar

The remote file list toolbar shown in [Figure 3-33](#) provides file access management.

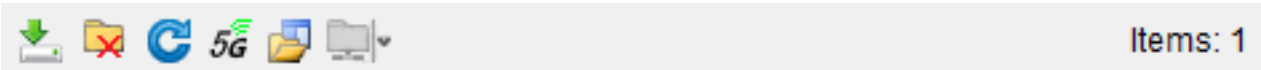


Figure 3-23. Remote File List Toolbar

Remote File List Menu

Displays the View File menu commands as shown in [Figure 3-24](#).

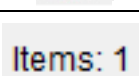
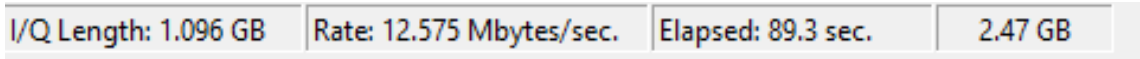
|                                                                                     |                                                                                                                                           |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>Access Files:</b> Download all remote IQ files.                                                                                        |
|    | <b>Delete Files:</b> Delete all IQ data files on the remote spectrum analyzer.                                                            |
|    | <b>Refresh:</b> Refresh the remote file list.                                                                                             |
|    | <b>5G Filter:</b> Press to filter and display either the .bin files or the .dgzm files in the window.                                     |
|   | <b>Open File:</b> Automatically load files when transferred from spectrum analyzer.                                                       |
|  | <b>MS2720T File Folder:</b> Active only when connected to an MS2720T. Drop-down shows the list of MS2720T sub-folders that can be opened. |
|  | <b>Items:</b> Shows the total number of files listed in the remote file list.                                                             |

Figure 3-24. View File Menu

Stream Status Information

At the bottom of the window is the stream status information bar. Stream status indicates if a stream is active or if the stream stops because of an error. The four boxes in the status bar show: total bytes downloaded (reset for each file in Continuous Mode), transfer rate, elapsed time, available disk space.



**IQ Length:** Total bytes downloaded in the most recent capture.

**Rate:** Data transfer rate for the most recent transfer.

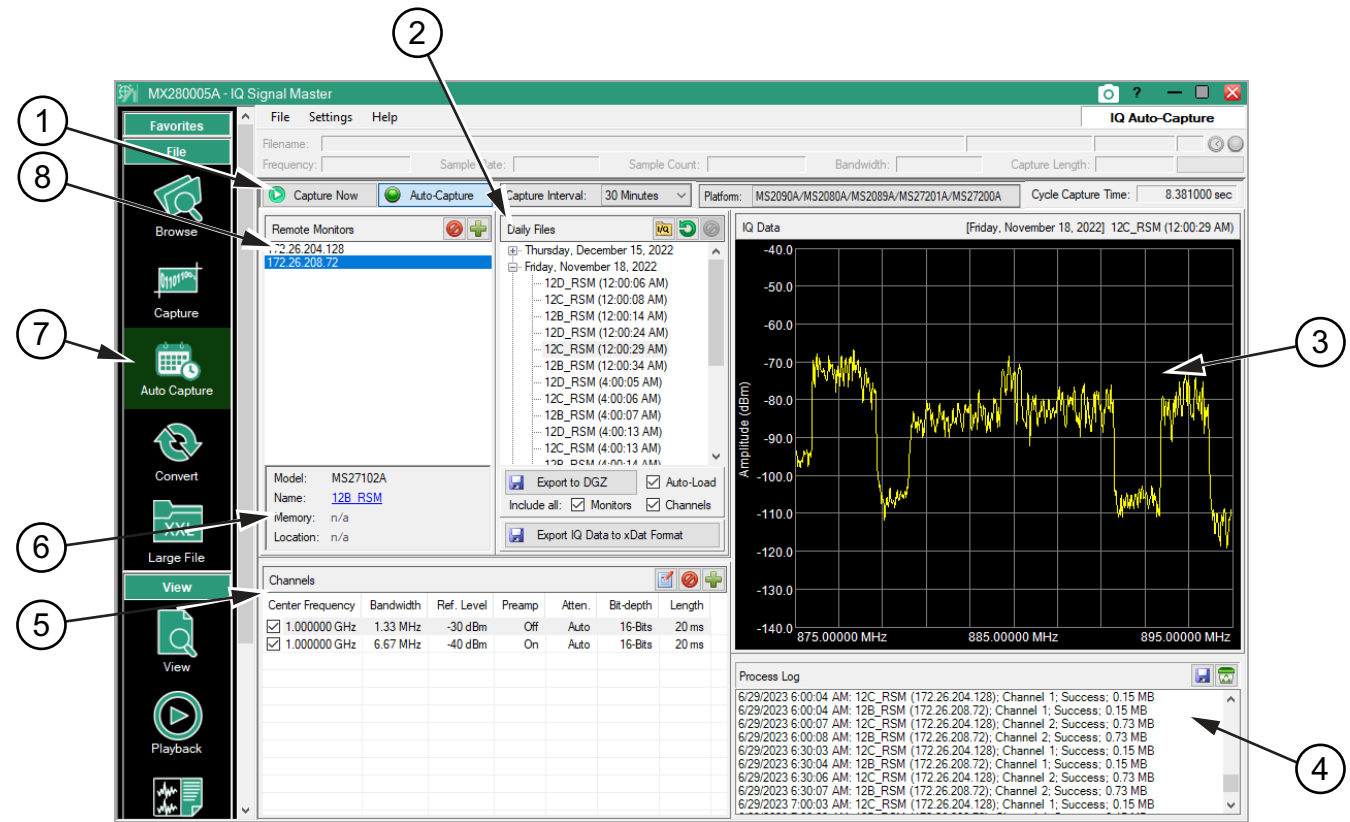
**Elapsed:** Elapsed time for the data transfer. Shows only the transfer time after the capture is complete on the spectrum analyzer. This does not include the capture time for block mode captures.

**Disk Space Available:** The available disk space for the IQ data transfer. If the active disk drive is the user's 'C:' drive, this will be 2.0 GB less than the actual free disk space. This is to provide margin so the boot-disk is not entirely filled. For other drives the margin is 20 MB. If you are using your 'C:' drive for data collection, and the drive has 10.0 GB of free space, this will show 8.0 GB, which is the space available for IQ capture.

Figure 3-25. Stream Status Information

### 3-6 Auto Capture Menu

Auto Capture menu provides tools to capture and log signals from remote monitors. The Auto Capture screen is shown in [Figure 3-26](#). The filename and parameters display is grayed as there are no stored files being loaded and analyzed. Auto Capture menu captures data sets from live remote spectrum analyzers. The captured signals can then be saved, recalled, and analyzed in the View and Analysis mode menus.



- |                                                                        |                                                                            |
|------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 1. See <a href="#">“Capture Control Panel”</a> on page 3-22.           | 5. See <a href="#">“Auto Capture Channels List”</a> on page 3-25.          |
| 2. See <a href="#">“Auto Capture Daily Files Window”</a> on page 3-23. | 6. See <a href="#">“Auto Capture Remote Monitors Window”</a> on page 3-26  |
| 3. See <a href="#">“Auto Capture Signal View”</a> on page 3-24.        | 7. Auto Capture Menu Button                                                |
| 4. See <a href="#">“Auto Capture Process Log”</a> on page 3-24.        | 8. See <a href="#">“Auto Capture Remote Monitors Window”</a> on page 3-26. |

**Figure 3-26.** Auto Capture User Interface

### Auto Capture Toolbar

The Auto Capture toolbar is shown in [Figure 3-27](#).

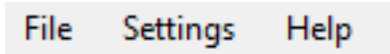


**Figure 3-27.** Auto Capture Toolbar



File Menu

Displays the Auto Capture File menu as shown in [Figure 3-28](#).

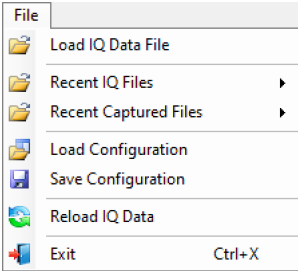
|                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Load IQ Data File:</b> Browse to find and load an IQ file</p> <p><b>Recent IQ Files:</b> Open to display the recent IQ files that have been viewed. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place.</p> <p><b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.</p> <p><b>Load Configuration:</b> Load a specific Auto Capture configuration file (.cfg)(*.cfg).</p> <p><b>Save Configuration:</b> Save to a specific Auto Capture configuration file location (.cfg)(*.cfg).</p> <p><b>Reload IQ Data:</b> Reload the most recent viewed file.</p> <p><b>Exit:</b> Exits the program.</p> |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 3-28. Auto Capture File Menu

Settings Menu

The Settings menu is the same as described in [“Settings Menu” on page 2-4](#).

Help Menu

The Help menu is the same as described in [“Help Menu” on page 2-6](#).

Capture Control Panel

The capture settings toolbar provides the settings described in [Figure 3-29](#).

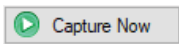
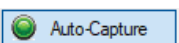
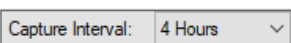
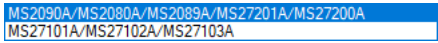
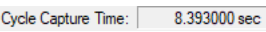
|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Capture Now:</b> Capture immediate IQ data on all channels.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|  | <p><b>Auto Capture:</b> Enable/Disable automatic IQ data capture. When enabled, the green light will blink when capture is being processed and displayed in the Process Log.</p>                                                                                                                                                                                                                                                                                                                                                                                                                               |
|  | <p><b>Capture Interval:</b> Use the pull down list to set capture interval for periodic IQ data acquisition.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|  | <p><b>Platform:</b> Select the analyzer platform family for I/Q data acquisition. This is one of the first settings to make before starting to capture data.</p> <p></p> <p>Select a product family from the list as the two product platforms can't be mixed to perform a capture. Each family supports a different set of SCPI commands and different capture bandwidths. Search the Anritsu's website product page for your specific product's Technical Data Sheet for the specific capture bandwidth performance.</p> |
|  | <p><b>Cycle Capture:</b> Displays the total capture time or previous capture set (all monitors/all channels)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

Figure 3-29. Capture Settings Toolbar

Auto Capture Daily Files Window

The Auto Capture Daily Files window displays the collected data files at the set “[Capture Interval](#)”. The data files collected are filed by date and each data file displays the name of the remote signal monitor, the model, and a time stamp of when it was collected as shown in [Figure 3-30](#). Click a file to show the signal in the display window as shown in [Figure 3-32](#).

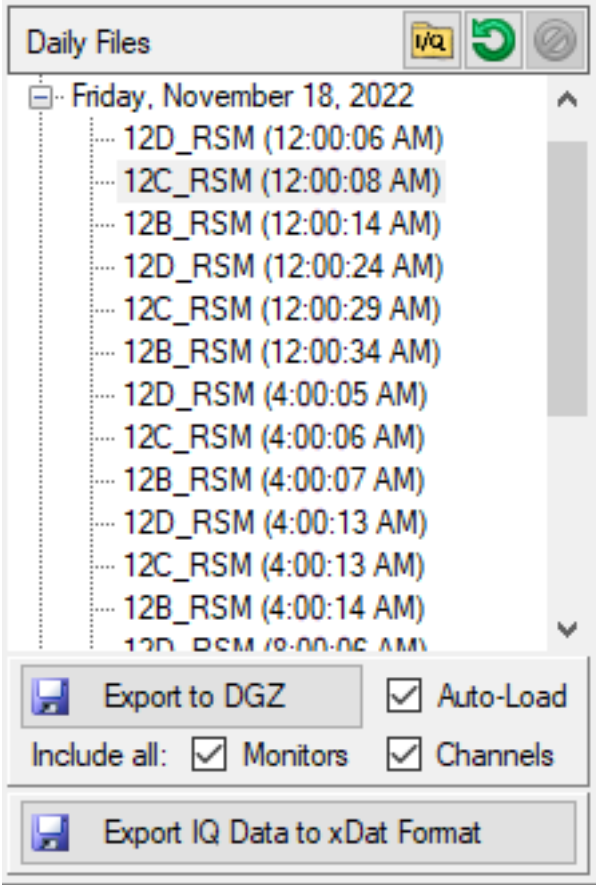


Figure 3-30. Daily Files Window

Daily File Toolbar

The Daily Files toolbar description is shown in [Figure 3-34](#).

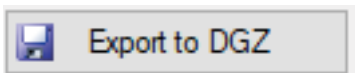
|                                                                                     |                                                                                                                                        |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>IQ File Folder:</b> Set an IQ data folder.                                                                                          |
|  | <b>Refresh:</b> Refresh the file list.                                                                                                 |
|  | <b>Delete:</b> The delete button will be grayed for individual capture files and is available only for deleting the entire daily file. |
|  | <b>Export to DGZ:</b> Export selected files from the Daily Files List to Anritsu DGZ format.                                           |

Figure 3-31. Daily File Toolbar

|                                                                                                                           |                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <div><input checked="" type="checkbox"/> Auto-Load</div>                                                                  | <b>Auto-Load:</b> For single file exports, load for normal Playback and Analysis. For multiple files, load for Synchronized Playback |
| <div>Include all: <input checked="" type="checkbox"/> Monitors <input checked="" type="checkbox"/> Channels</div>         | <b>Include All:</b> Check to Export from the same monitor at each channel in the same capture cycle as the selected file.            |
| <div> Export IQ Data to xDat Format</div> | <b>Export IQ Data to xDat Format:</b> Export selected files from the Daily Files List to xDAT format.                                |

Figure 3-31. Daily File Toolbar

Auto Capture Signal View

The Auto Capture signal view window shows the selected signal from the Daily Files list as shown in [Figure 3-32](#). Press the Export DGZ or Export xDat button to save the signal as either a (.dgz) or (xDat) file.\

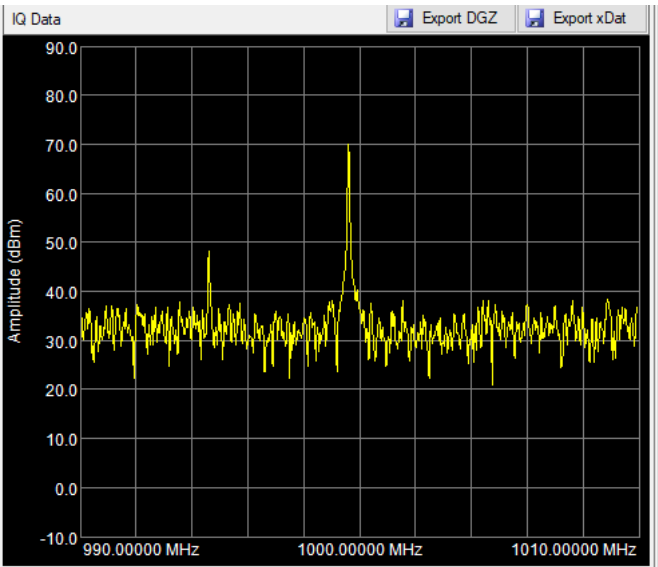


Figure 3-32. Auto Capture Signal View

Auto Capture Process Log

The Auto Capture process log updates the remote spectrum monitor capture status when the “[Capture Now:](#)” is pressed or “[Auto Capture](#)” button is active as shown in [Figure 3-33](#). Each line shows the date and time of the ping to each monitor, the name of the remote monitor, model, IP address, channel, if the communication was successful (if unsuccessful, the status line will be in red font), and the size of the each file capture.

Press the Save icon to save the process log to a user selected file location or the Clear icon to clear the entire process log.

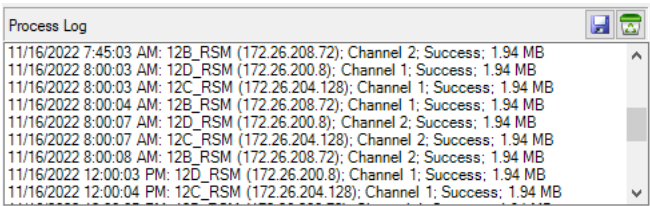


Figure 3-33. Process Log

Auto Capture Channels List

The Auto Capture channels section provides the channel definitions of the data capture parameters as shown in Figure 3-34.

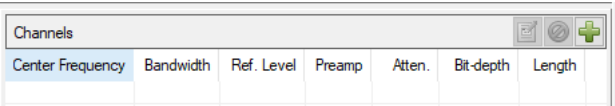


Figure 3-34. Channels Section

The Channels toolbar description is as follows:

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>Add:</b> Adds a new IQ capture parameter set. Press the green plus sign icon to display the Enter/Edit Capture Configuration dialog as shown below. Press Cancel &amp; Exit to cancel.</p> <div></div> <p>Edit the parameters in the dialog shown above and press the Save &amp; Exit button to add the channel as shown below.</p> <div></div> |
|  | <p><b>Delete:</b> Deletes the selected parameter set. You need to select the channel in order to active this icon. Note that only one channel can be deleted at a time.</p>                                                                                                                                                                                                                                        |
|  | <p><b>Edit:</b> Select the channel and press the edit button to display the Enter/Edit Capture Configuration dialog and continue to edit the desired parameter and click Save &amp; Exit.</p>                                                                                                                                                                                                                      |

Figure 3-35. Channel Definitions Toolbar

Auto Capture Remote Monitors Window

The Auto Capture remote monitors window provides a list of the user-added monitors that capture the data signals. Add or delete a monitor from the list as described in [Figure 3-36](#).

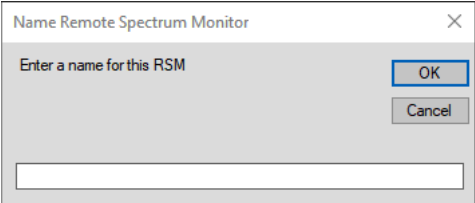
|                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                      | <b>Delete Button:</b> Delete the selected remote spectrum monitor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                                                                                                      | <b>Add Button:</b> Add a remote spectrum monitor to the list. Assure the remote spectrum monitor is from the same product “Platform” when adding to avoid capture conflicts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <div><div><div>Model: MS27102A<br/>Name: <a href="#">12C_RSM</a><br/>Memory: n/a<br/>Location: <a href="#">37.147520, -121.655273</a></div><div>Model: MS27201A<br/>Name: <a href="#">RSM1</a><br/>Memory: <a href="#">1.8 GB</a><br/>Location: n/a</div></div></div> | <p><b>Remote Monitor Details:</b> Double-click a remote monitor in the active remote monitor list to display the monitor’s details.</p> <p><b>Model:</b> The model type of the remote monitor.</p> <p><b>Name:</b> Enter a name of the remote monitor. Double click to display the dialog shown below to type a name of the RSM.</p> <div></div> <p><b>Memory:</b> The internal memory space available for IQ file storage on spectrum analyzer. The MS2710xA does not provide any memory for IQ file storage, so the status is displayed as n/a. The MS27210A RSM do have internal memory space allotted for storing IQ capture files as shown in the figure. Click on the memory size displayed to view the IQ capture files stored internally.</p> <p><b>Location:</b> The GPS coordinates of the remote monitor. Double-click to display a user selected map location of the remote monitor. If the instrument is not connected to a GNSS (GPS) antenna or if the capability is disabled the location status will appear as n/a as shown in the figure.</p> |

Figure 3-36. Remote Monitors Toolbar

### 3-7 Convert Menu

The Convert menu provides file conversion tools for pulling in the IQ parameters of an existing incompatible file format and converts it to a compatible file format. The Convert menu is shown in [Figure 3-37](#).

**Note** The convert menu is disabled if File Conversion option is not enabled.

The File Information area just below the main menu bar is grayed out in this mode. Other screens operate on the loaded DGZ file; however, Convert is for converting files between formats and the input file may not typically be a DGZ file. The Convert window is not exporting the file listed in the File Summary part of the screen - hence it is grayed out. There is a separate Import File button, so you can load a file in a format otherwise not supported in this application, and convert to a different format.

Only files in Anritsu specific formats (first four import options) can be exported to Anritsu specific formats.

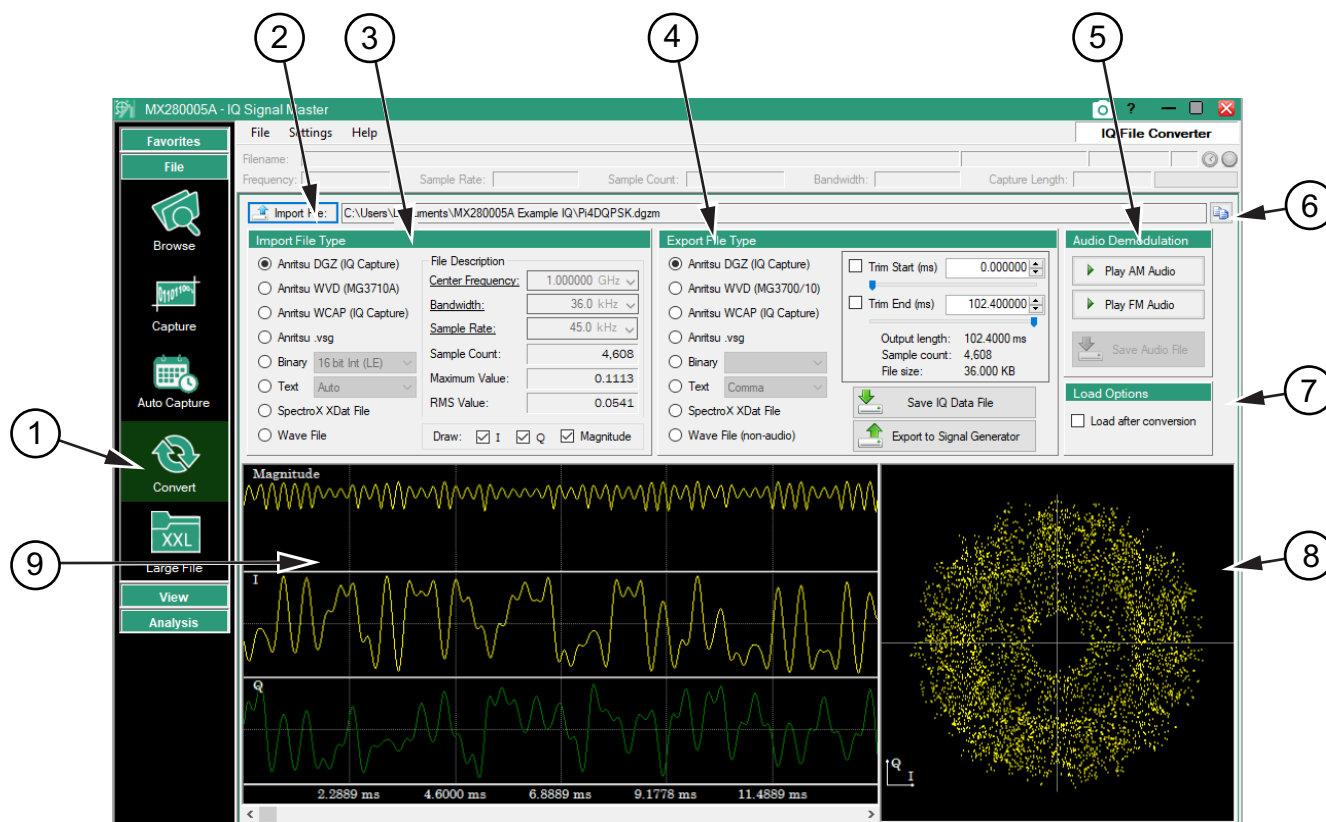


Figure 3-37. Convert Menu

- 
1. **Convert Menu:** Opens the Convert Menu.
  2. **Import File Button:** Load a file in a format not supported in this application, and convert to a different format.
  3. **Import File Type Menu:** See [Table 3-5 on page 3-30](#).
  4. **Export File Type Menu:** See [Table 3-6 on page 3-31](#).
  5. **Audio Demodulation Menu:** See [Table 3-7 on page 3-32](#).
  6. **Playback File Button:** Copy Playback file to Convert filename field
  7. **IQ Constellation Diagram:** The constellation diagram shows all the possible symbols that can be transmitted by the system as a collection of points in the Time (Vertical Axis), Frequency (Horizontal Axis), and Amplitude (Color) Domains.
  8. **CCDF Plot:** (Complementary Cumulative Distribution Function) The x-axis represents the power level above the average power and the y-axis represents the percentage of time the signal power is at or above the power represented at the x-axis.
  9. **Magnitude and IQ Graphs:** Displays the Magnitude, I (reference signal), and Q (quadrature shift signal) graphs for the data file.
- 

**Figure 3-37.** Convert Menu (Continued)

### Convert Menu Toolbar

The Convert menu toolbar is shown in [Figure 3-38](#).

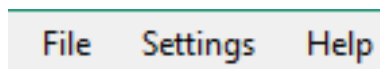
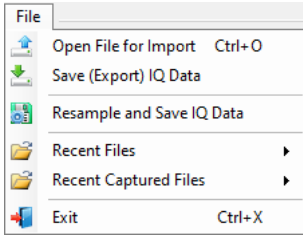


**Figure 3-38.** Convert Menu Toolbar

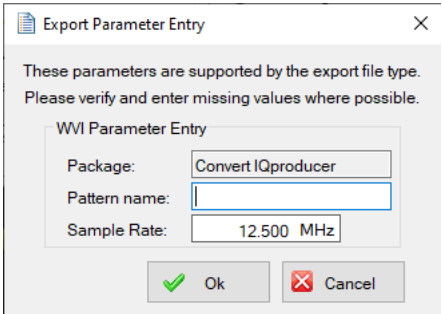
The File menu is described in [Table 3-5](#).

**Table 3-4.** File Menu

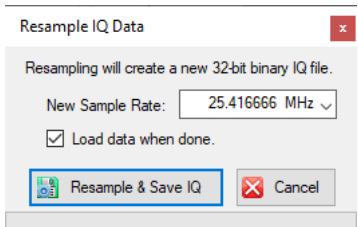


**Open File for Import:** Open the file browser to import a file.

**Save (Export) IQ Data:** Save most export files using the Microsoft save dialog. The Anritsu WVD (MG3700/10) export file types display the dialog below. Enter a pattern name and if required, type a sample rate to numerically manipulate the data to change the sample rate through interpolation and perform a resample of the IQ data and save it. The terminators are Hz, kHz, MHz, and GHz.



**Resample and Save IQ Data:** Displays the dialog below. If required, type a sample rate to numerically manipulate the data to change the sample rate through interpolation and perform a resample of the IQ data and save it. The terminators are Hz, kHz, MHz, and GHz.



**Recent Files:** Displays the last file sets opened.

**Recent Captured Files:** Displays the most recent Capture file sets.

**Exit:** Exits the program.



## Settings Menu

The Settings menu is the same as described in [“Settings Menu” on page 2-4](#).

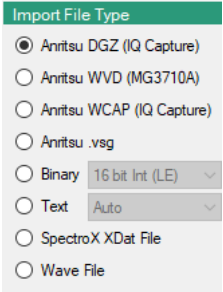
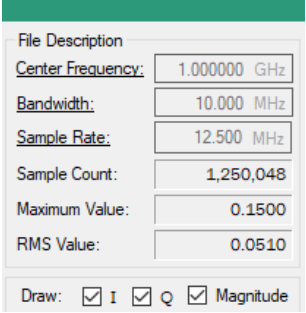
## Help Menu

The Help menu is the same as described in [“Help Menu” on page 2-6](#).

## Import File Type

The Import File Type menus are described in [Table 3-5](#).

**Table 3-5.** Import File Type

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>Anritsu DGZ (IQ Capture):</b> Set if importing from an Anritsu DGZ file.</p> <p><b>Anritsu WVD:</b> Set if importing from an Anritsu WVD file (Vector Signal Generator format).</p> <p><b>Anritsu WCAP (IQ Capture):</b> Set if importing from an Anritsu WCAP file.</p> <p><b>Anritsu.vsg:</b> Set if importing from an Anritsu.vsg file.</p> <p><b>Binary:</b> Set if importing from a single raw data file that has IQ values.<br/>Set the bit format as 8 bit, 16 bit, 24 bit, 32 bit Float, 32 bit Integer, or 5G Capture. Set the Endianness as (LE) Little Endian or (BE) Big Endian.</p> <p><b>Text:</b> Set the Text delimiter that appears between the I and Q values as Auto, Comma, Tab, or Semicolon. Auto automatically checks the delimiter.</p> <p><b>SpectroX XDat File:</b> Set if importing a SpectroX xdat file. The .xdat file format is the file format required for analyses using the X-Com SpectroX software; .xdat files are for use in the SpectroX software.</p> <p><b>Wave File:</b> Set if importing a Wave file. Supported Wave files are not audio files. Some I/Q capture applications appropriate the Wave file format, using the two stereo channels to hold I and Q value pairs and storing the capture parameters in the Wave file header.</p> |
|  | <p><b>Center Frequency:</b> Center frequency value of the imported IQ file. The underline indicates this value can be edited. Press Center Frequency to change the center frequency value.</p> <p><b>Bandwidth:</b> Bandwidth value of the imported IQ file. The underline indicates this value can be edited. Press Bandwidth to change the bandwidth value.</p> <p><b>Sample Rate:</b> Sample rate value of the imported IQ file. The underline indicates this value can be edited. Press Sample Rate to change the center frequency value.</p> <p><b>Sample Count:</b> sample count of the imported IQ file. This value cannot be changed. If the resulting sample count is over 1 Gs, then a warning message appears and the sample size is truncated to 1 Gs.</p> <p><b>Maximum Value:</b> Maximum value of the imported IQ file. This value cannot be changed.</p> <p><b>RMS Value:</b> RMS value of the imported IQ file. This value cannot be changed.</p> <p><b>Draw:</b> Set the Magnitude, IQ data screens to view by checking I, Q, or Magnitude.</p>                                                                                                                                                                                                                         |

Export File Type

The Import File Type menus are described in [Table 3-6](#).

Table 3-6. Export File Type

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><div>Export File Type</div><div><div><input checked="" type="radio"/> Anritsu DGZ (IQ Capture)</div><div><input type="radio"/> Anritsu WVD (MG3700/10)</div><div><input type="radio"/> Anritsu WCAP (IQ Capture)</div><div><input type="radio"/> Anritsu .vsg</div><div><input type="radio"/> Binary <div></div></div><div><input type="radio"/> Text <div>Comma</div></div><div><input type="radio"/> SpectroX XDat File</div><div><input type="radio"/> Wave File (non-audio)</div></div></div> | <p><b>Anritsu DGZ (IQ Capture):</b> Select if exporting to an Anritsu DGZ file.</p> <p><b>Anritsu WVD:</b> Select when exporting to an Anritsu WVD file (Vector Signal Generator format). Anritsu WCAP (IQ Capture)</p> <p>Select if exporting to an Anritsu WCAP file.</p> <p><b>Anritsu.vsg:</b> Select if exporting to an Anritsu.vsg file.</p> <p><b>Binary:</b> Select if exporting to single raw data file that has IQ values.</p> <p>Set the bit format as 8 bit, 16 bit, 24 bit, 32 bit Float, or 32 bit Integer.<br/>Set the Endianness as (LE) Little Endian or (BE) Big Endian.</p> <p><b>Text:</b> Set the Text delimiter that appears between the I and Q values as Comma, Tab, or Semicolon. Auto is not an option in the Export File Type menu.</p> <p><b>SpectroX XDat File:</b> Select if exporting to a SpectroX Xdat file. The .xdat file format is the file format required for analyses using the X-Com SpectroX software; .xdat files are for use in the SpectroX software. xdat files support 8, 10, 16, and 32 bits. 24-bit files will not be converted.</p> <p><b>Wave File:</b> Select if exporting to a Wave file.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Export Buttons

Use the Export Buttons shown in [Figure 3-39](#) to send the data file

Press Save IQ Data File to save the data file to a user designated file location.

Press Export to Signal Generator to export IQ data and install into a connected signal generator. When pressed, the dialog in [Figure 3-40](#) is displayed.

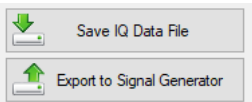


Figure 3-39. Export Buttons

Export to Signal Generator

Use the Export File Type window. Press the Export to Signal Generator button to display the dialog shown in [Figure 3-40](#).

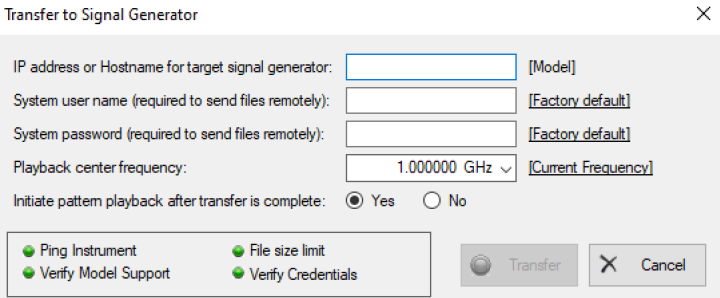


Figure 3-40. Transfer Entry Dialog

**IP Address or Hostname for target signal generator:** Enter the IP address of the MG3700A/E. Model is displayed when connection is successful.

**System User name (required to send files remotely):** Enter system user name. Click Factory default to copy user name to the user name field.

**System password (required to send files remotely):** Enter system password. Click Factory default to copy the default password to the password field.

**Playback Center Frequency:** The playback center frequency is the same as the Center Frequency in the file description column of the Import File Type window. Click to copy the current signal generator center frequency to the center frequency field.

**Initiate pattern playback after transfer is complete:** Check this box to display the signal after the transfer is complete. Left unchecked will store the file. In this case, the file will be stored as 64QAM-C in the Convert folder.

**Ping Instrument:** Mousing over this indicator turns the background color light blue, indicating that these are active elements. Clicking will test the remote connection and that it can ping the IP address. Indicator turns green if ping is successful. Indicator turns red if not successful.

**Verify Model Support:** Mousing over this indicator turns the background color light blue, indicating that these are active elements. Clicking will verify that the model type returned is a supported type. Indicator turns green if supported. Indicator turns red if not supported.

Queries the signal generator for free space and file size limitations.

Anritsu Signal Generators: Option control indicates the maximum IQ file size supported.

Indicator - Turns green if the IQ file size is supported or available; turns red if the IQ file size is not supported or available.

**Verify Credentials:** Mousing over this indicator turns the background color light blue, indicating that these are active elements. Clicking will cause the revalidation of the unit at the specified address. Anritsu signal generators run a version of Microsoft Windows. The user name and password are required Windows credentials to log into the unit.

Anritsu Signal Generators: Indicator turns green if credentials are available, turns red if the credential are not available.

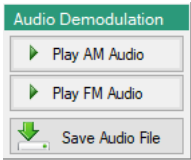
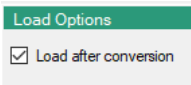
**Transfer:** Mousing over this indicator turns the background color light blue, indicating that these are active elements. Clicking will cause the revalidation of the unit at the specified address. The Transfer button is grayed if conditions not met. Indicator turns green when conditions are met. Press to export data to the signal generator.

**Figure 3-40.** Transfer Entry Dialog

## Audio Demodulation

The Audio Demodulation menu is shown in [Table 3-7](#). See [“Audio Demodulation” on page 4-3](#) for specific audio demodulation applications.

**Table 3-7.** Audio Demodulation

|                                                                                     |                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Play AM Audio:</b> Press to demodulate and play AM radio.</p> <p><b>Play FM Audio:</b> Press to demodulate and play FM radio.</p> <p><b>Save Audio File:</b> Press to save the file.</p> |
|  | <p><b>Load Options:</b> Active when the Export File Type “Anritsu DGZ” radio button is selected. Loads converted data file for playback and analysis after conversion is complete.</p>         |

## Trim Adjust Window

Adjust the trim start and stop times of the signal using the Trim Window shown in [Figure 3-41](#).

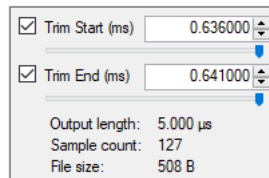


**Figure 3-41.** Trim Adjust Window

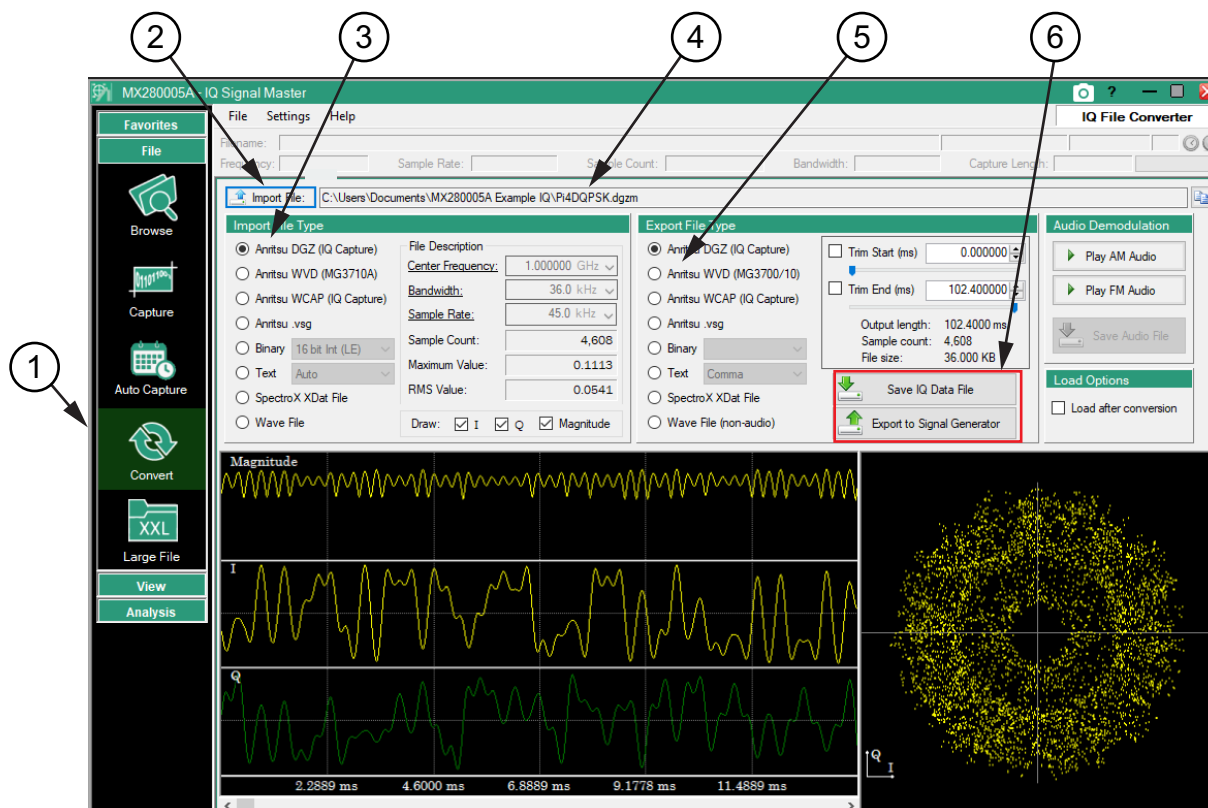
**Trim Start (ms):** Check to start the signal at the time set. The range is 0.000000 ms to 1.000000 ms.

**Trim Stop (ms):** Check to stop the signal at the time set. The range is 0.000000 ms to 1.000000 ms.

**Slider:** Manually move the slider to set the start trim and stop trim values. The resulting Output length, Sample count, and File size values are shown below the trim entry fields.

## 3-8 Import/Export Example

This section describes how to convert a file captured on an MS2090A signal analyzer and convert it to .WVD format and then export it to an MG3700 series signal generator. (WVD is the MG3700 default native format) Use the Convert menu to display the Import/Export menus as shown in [Figure 3-42](#).



1. Convert menu: Use this menu to convert file types.
2. Import Button: Import 64QAM.dgzm file as described in [“Import File” on page 3-34](#).
3. Anritsu DGZ (IQ Capture): Press to engage this file format.
4. Load 64QAM File: Load file.
5. Export to Anritsu WVD (MG3700): Press to export to the MG3700 series signal generator.
6. “Export to” or Save IQ Data Buttons: Press to initiate transfer process.

**Figure 3-42.** Convert Menu

### Import File

Because of the variety of files that can be used in the Convert menu, the top portion of the Convert window is grayed. To import a file for this example, open the 64QAM.dgzm file that is included in the sample files described in the [“Modulation Analysis” on page 7-1](#).

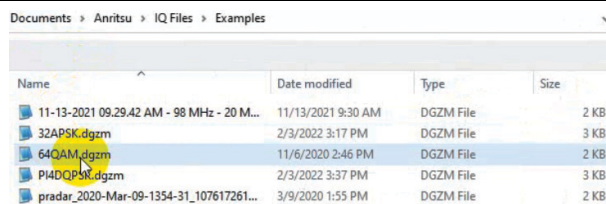


**Figure 3-43.** Import .dgzm File

Export Signal Display

Connect MS2090A Field Master Pro (or Remote Spectrum Monitor) to a MG3700 series signal generator.

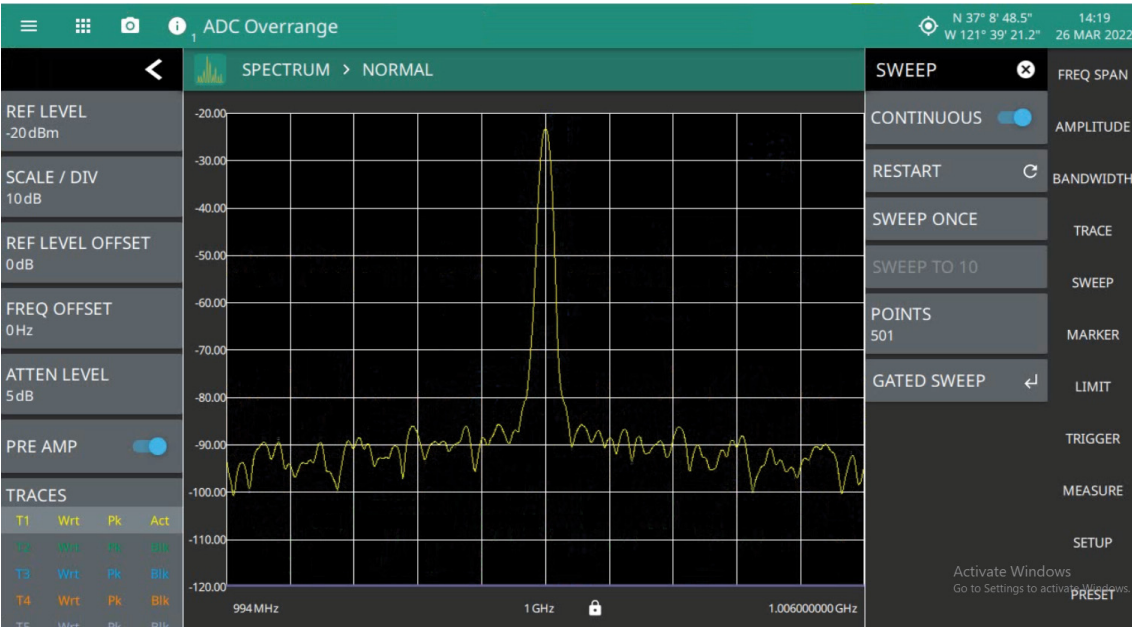


Figure 3-44. Export MS2090A DGZ File

During the transfer process, the captured signal on the MS2090A is converted to a file that can be played back on the MG3700 signal generator. Therefore, the FSK signal on the MS2090A shown in Figure 3-44 is converted to a file that can be played from the MG3700 and is displayed on the MS2090A as shown in Figure 3-45. The conversion is complete.

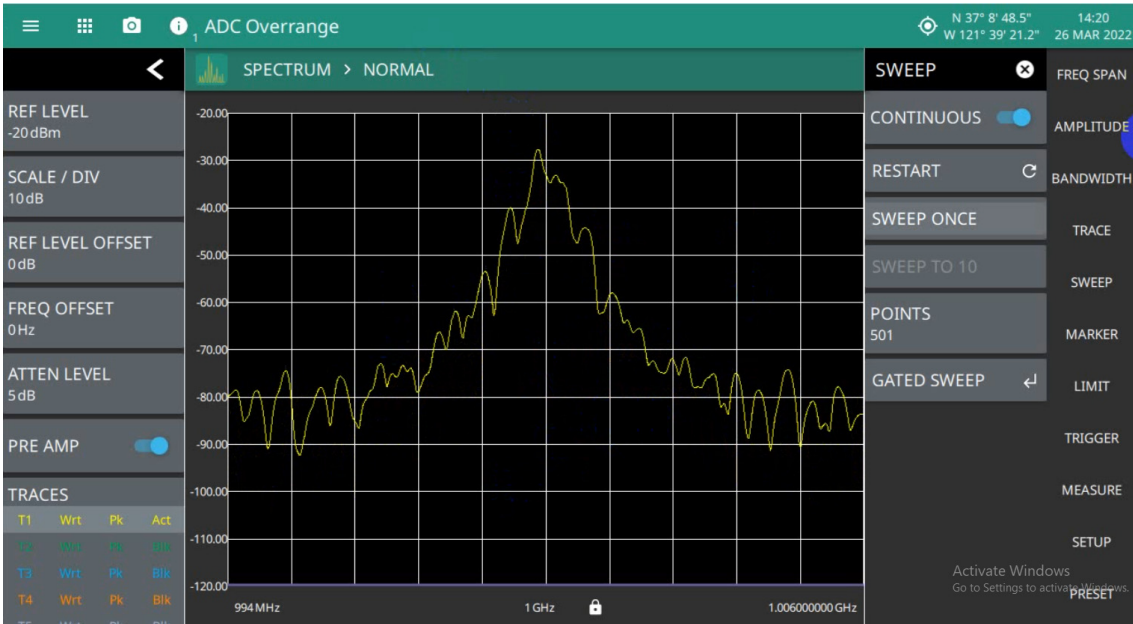
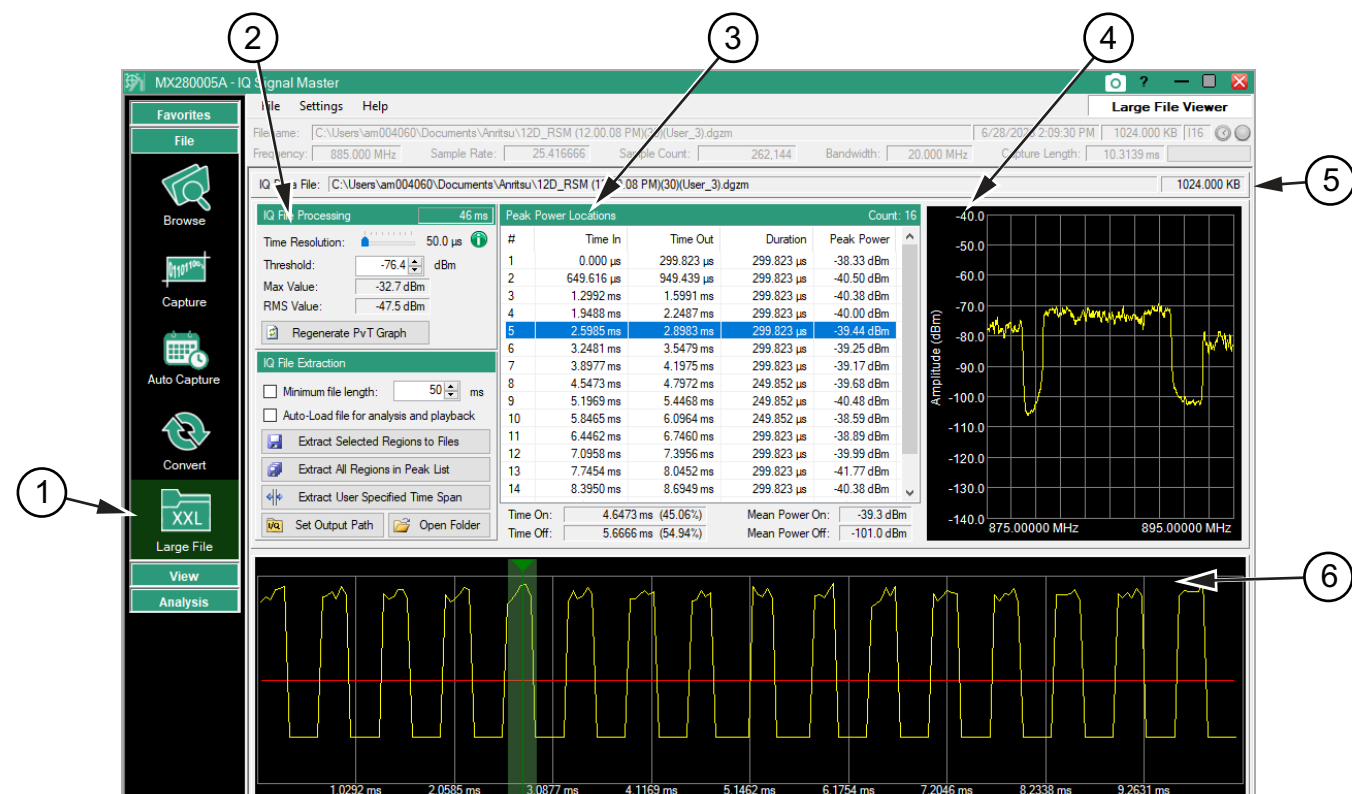


Figure 3-45. Import MS2090A WVD File

## 3-9 Load Large File Menu

Streaming large files consume storage space and require a long time to load. The Large File menu provides tools to condense and significantly reduce the size data files for analysis without losing integrity of the captured data stream. A reduced segment of the file can be viewed and analyzed, therefore reducing the length of the file from several minutes to milliseconds. The Large File menu is shown [Figure 3-46](#).



- |                                                    |                              |
|----------------------------------------------------|------------------------------|
| 1. IQ File Processing Window                       | 5. Power vs. Time graph      |
| 2. Peak Power Locations Table                      | 6. Large File Menu           |
| 3. Current Data File                               | 7. IQ File Extraction Window |
| 4. Signal Selected From Peak Power Locations Table | 8.                           |

**Figure 3-46.** Large File Menu



Large File Menu Toolbar

The Large File menu toolbar is shown in [Figure 3-13](#).

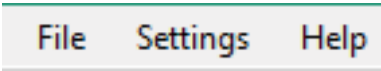


Figure 3-47. Large File Menu Toolbar

File Menu

Displays the Large File menu as shown in [Figure 3-14](#).

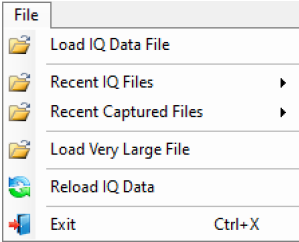
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Load IQ Data File:</b> Browse to find and load an IQ file.</p> <p><b>Recent IQ Files:</b> Open to display the recent IQ files that have been viewed. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place.</p> <p><b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.</p> <p><b>Load Very Large File:</b> Opens to a large data file location.</p> <p><b>Reload IQ Data:</b> Reload the most recent viewed file.</p> <p><b>Exit:</b> Exits the program.</p> |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 3-48. Large File - File Menu

Settings Menu

The Settings menu is the same as described in [“Settings Menu” on page 2-4](#).

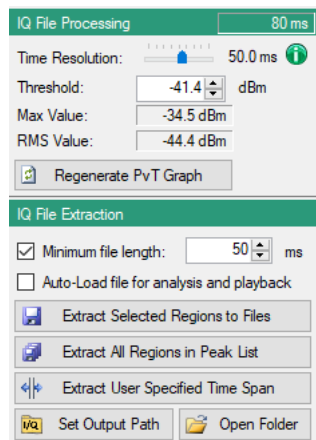
Help Menu

The Help menu is the same as described in [“Help Menu” on page 2-6](#).



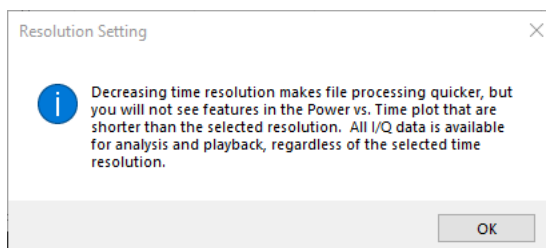
## IQ File Processing Window

The Time Resolution window provides data file parameter information, time resolution, and data file extraction controls.



**Time Resolution:** Provides a time resolution range of 50  $\mu$ s, 100  $\mu$ s, 250  $\mu$ s, 500  $\mu$ s, 1 ms, 2.5 ms, 5 ms, 10 ms, 25 ms, 50 ms, 100 ms, 250 ms, 500 ms, 1 s, 2.5 s, 5 s, and 10 s.

**Green Information Icon:** Resolution Setting. Press to display dialog shown.



**Threshold:** Set the power threshold for peak finding. Type or set the Threshold value into the Threshold box, or move the red line up or down in the PVT graph to set the threshold value. A change automatically triggers the peak finder and updates the list.

**Max Value:** The maximum power level detected in file data set.

**RMS Value:** The RMS value of measure points.

**Regenerate PVT Graph:** Reload the data file and process the IQ file stream at the set resolution. Press to activate edits in the time resolution window and display the updated data results in the power vs. time graph.

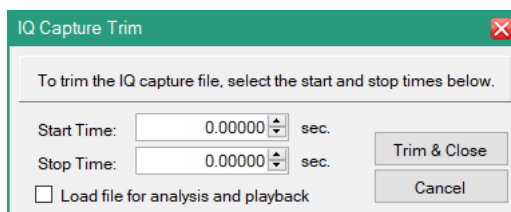
**Minimum File Length:** Check to extract and store selected channel peak regions, creating DGZ/DGZM files for each selected peak. Set the extraction field length for extraction from 60000ms to 10ms. Files can be opened in Playback menu.

**Auto Load-file for analysis and playback:** Press to load entire file for normal playback. Normal pre-processing is skipped, which can affect on-screen scaling of data graphs.

**Extract Selected Regions to Files:** Click more than one peaks from the Peak Power Locations list. Extract IQ data for the selected peak regions, creating DGZ/DGZM files for each selected peak.

**Extract All Regions in Peak List:** Select a Extract all peak regions in the current peak list. Each region is extracted to an individual DGZ/DFGZM file set.

**Extract User Specified Time Span:** Extract a user specified time span by entering precise time offsets. Click to enter the precise time in the dialog shown below. Check Load File for analysis. Press Trim and Close to trim file to set size.



**Set Output path:** Set the output folder for extracted files.

**Open Folder:** Open the output folder in Windows.

**Figure 3-49.** Large File Time Resolution Window

## Processing Large Files

The large data set file is reduced using the Time Resolution slider as shown the power vs. time graph in [Figure 3-50](#). The Process Time of each graph is reduced when the time resolution is increased.

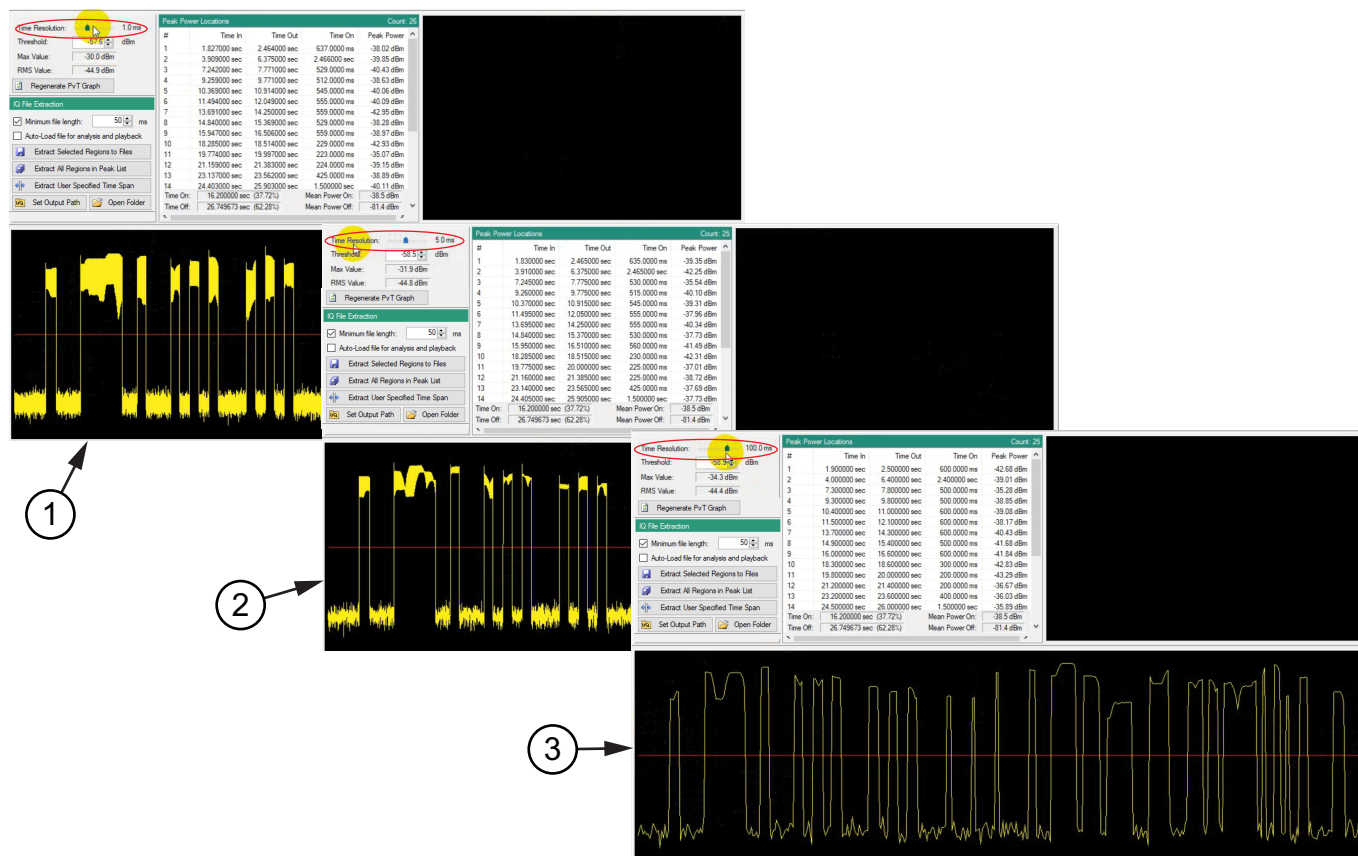


**Figure 3-50.** Time Resolution Change Displayed

## Peak Power Locations Table

The peak power points detected in the power vs. time graph are listed in the Peak Power Locations table as shown [Figure 3-51](#). In the top right corner of the image, Count 25 refers to the total number of power points detected. In the Peak Power Locations table, each power point listed is given a “#”.

| Peak Power Locations |               |                        |                 |            | Count: 25 |
|----------------------|---------------|------------------------|-----------------|------------|-----------|
| #                    | Time In       | Time Out               | Duration        | Peak Power |           |
| 1                    | 1.295000 sec  | 2.085000 sec           | 790.0000 ms     | -36.06 dBm |           |
| 2                    | 3.975000 sec  | 5.965000 sec           | 1.990000 sec    | -39.47 dBm |           |
| 3                    | 7.875000 sec  | 8.410000 sec           | 535.0000 ms     | -38.94 dBm |           |
| 4                    | 9.060000 sec  | 9.545000 sec           | 485.0000 ms     | -39.16 dBm |           |
| 5                    | 10.060000 sec | 10.570000 sec          | 510.0000 ms     | -36.22 dBm |           |
| 6                    | 11.130000 sec | 11.635000 sec          | 505.0000 ms     | -37.32 dBm |           |
| 7                    | 13.025000 sec | 14.205000 sec          | 1.180000 sec    | -35.60 dBm |           |
| 8                    | 15.780000 sec | 16.120000 sec          | 340.0000 ms     | -37.44 dBm |           |
| 9                    | 17.110000 sec | 17.375000 sec          | 265.0000 ms     | -37.19 dBm |           |
| 10                   | 18.425000 sec | 18.850000 sec          | 425.0000 ms     | -37.39 dBm |           |
| 11                   | 19.345000 sec | 19.790000 sec          | 445.0000 ms     | -36.24 dBm |           |
| 12                   | 21.775000 sec | 22.145000 sec          | 370.0000 ms     | -37.08 dBm |           |
| 13                   | 22.525000 sec | 22.895000 sec          | 370.0000 ms     | -37.17 dBm |           |
| 14                   | 23.280000 sec | 23.685000 sec          | 405.0000 ms     | -36.31 dBm |           |
| 15                   | 24.095000 sec | 24.505000 sec          | 410.0000 ms     | -35.59 dBm |           |
| 16                   | 25.710000 sec | 27.110000 sec          | 1.400000 sec    | -37.92 dBm |           |
| 17                   | 28.520000 sec | 30.520000 sec          | 2.000000 sec    | -38.46 dBm |           |
| Time On:             |               | 16.200000 sec (37.72%) | Mean Power On:  |            | -38.5 dBm |
| Time Off:            |               | 26.749673 sec (62.28%) | Mean Power Off: |            | -81.4 dBm |

**Time In:** Start time of selected peak from Power vs Time graph.

**Time Out:** End time of selected peak from Peak vs. Time graph.

**Duration:** Time duration of selected peak time in and time out.

**Peak Power:** The peak power of the selected peak from the Power vs. Time graph.

**Time On:** Total time duration of signal above the set power threshold (red horizontal line set in power vs. time graph).

**Time Out:** Total time duration of signal below the set power threshold (red horizontal line set in power vs. time graph).

**Mean Power On:** The mean power value for signals above the set power threshold.

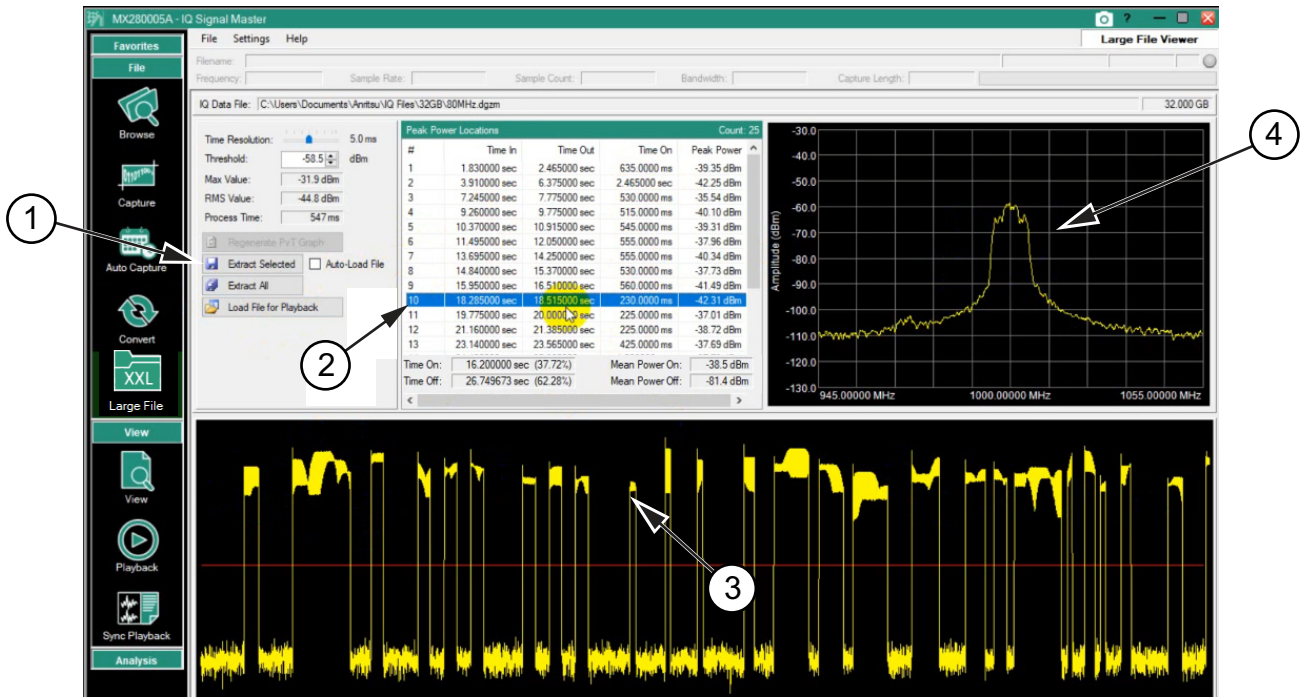
**Mean Power Off:** The mean power value for signals below the set power threshold.

**Figure 3-51.** Peak Power Locations

Extracting and Load File

Use the Extract Selected button to extract a file to a user selected file location.

- 1. Refer to [Figure 3-52](#).
- 2. Click a Peak Power location from the Peak Power Location table. Once clicked, a view of the peak power signal is displayed in the signal view window. Here, #10 corresponds to the 10th peak power channel in the power vs. time display.



- 1. Extract selected button
- 2. #10 peak power selected
- 3. 10th peak power channel on the power vs. time graph
- 4. View the 10th peak power channel set.

Figure 3-52. Extract Selected Peak Power Segment

- 3. Press the Extract Selected button. The file is stored in a user selected file location as shown in [Figure 3-53](#). In this example, the file is stored in the same location of the original file. The original file (80 MHz.dgz) is >33 GB in size. In comparison, and as a result of using the Time Resolution slider to find the peaks of the signal in 5 ms resolution, the 32 GB file is now a time slice of ~180 MB in size.

| Name           | Date modified      | Type      | Size          |
|----------------|--------------------|-----------|---------------|
| 80MHz.dgz      | 11/28/2022 4:34 PM | DGZ File  | 33,554,432 KB |
| 80MHz.dgzm     | 11/28/2022 4:36 PM | DGZM File | 2 KB          |
| 80MHz(10).dgz  | 12/1/2022 11:34 AM | DGZ File  | 179,712 KB    |
| 80MHz(10).dgzm | 12/1/2022 11:34 AM | DGZM File | 2 KB          |

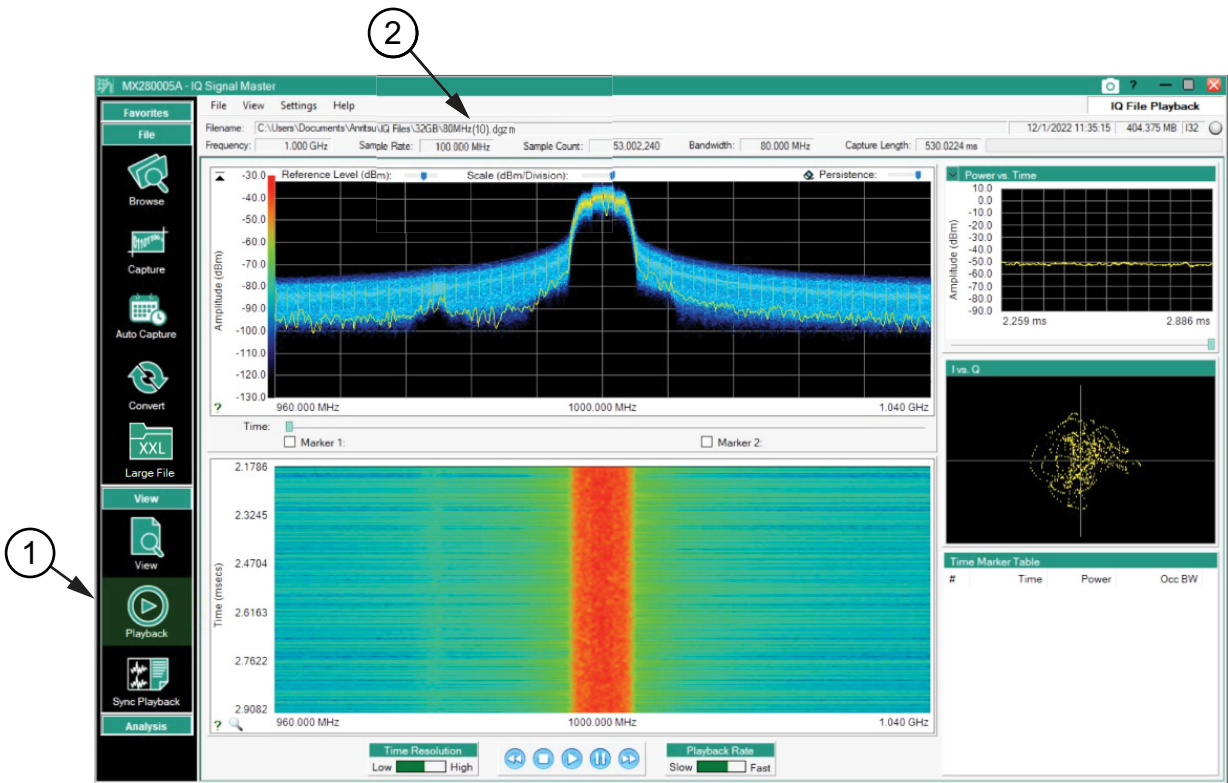
Figure 3-53. Stores File with (10) to Identify Power Channel Extracted

Selecting more files and pressing the Extract Selected button will store the files in the same way as shown in [Figure 3-54](#).

|  |                |                    |           |               |
|--|----------------|--------------------|-----------|---------------|
|  | 80MHz.dgz      | 11/28/2022 4:34 PM | DGZ File  | 33,554,432 KB |
|  | 80MHz.dgzm     | 11/28/2022 4:36 PM | DGZM File | 2 KB          |
|  | 80MHz(10).dgz  | 12/1/2022 11:34 AM | DGZ File  | 179,712 KB    |
|  | 80MHz(10).dgzm | 12/1/2022 11:34 AM | DGZM File | 2 KB          |
|  | 80MHz(3).dgz   | 12/1/2022 11:37 AM | DGZ File  | 414,080 KB    |
|  | 80MHz(3).dgzm  | 12/1/2022 11:37 AM | DGZM File | 2 KB          |
|  | 80MHz(3).anr   | 12/1/2022 11:35 AM | ANR File  | 1 KB          |
|  | 80MHz(3).pvt   | 12/1/2022 11:35 AM | PVT File  | 203 KB        |
|  | 80MHz(5).dgz   | 12/1/2022 11:37 AM | DGZ File  | 425,792 KB    |
|  | 80MHz(5).dgzm  | 12/1/2022 11:37 AM | DGZM File | 2 KB          |
|  | 80MHz(8).dgz   | 12/1/2022 11:37 AM | DGZ File  | 414,080 KB    |
|  | 80MHz(8).dgzm  | 12/1/2022 11:37 AM | DGZM File | 2 KB          |

Figure 3-54. Select and Store Files

Open the 80 MHz(10).dgzm file to view in Playback or other view menu as shown [Figure 3-55](#).



- 1. Playback Menu
- 2. 80 MHz(10).dgzm File

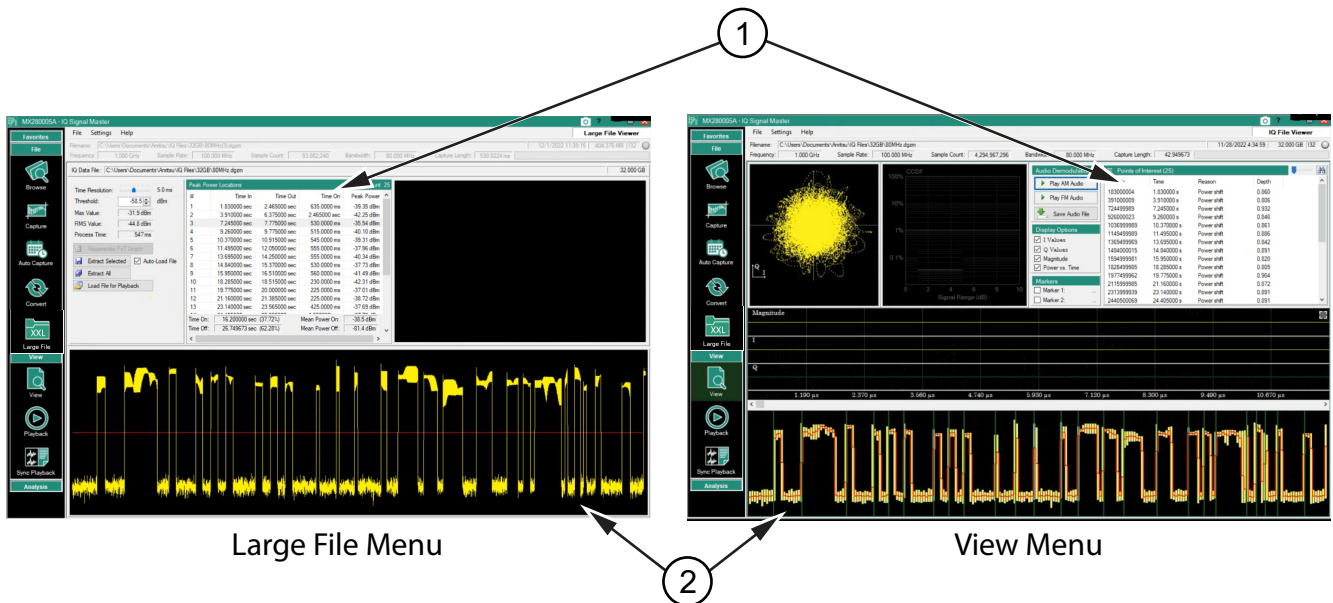
Figure 3-55. View 80 MHz(10).dgzm File



## Load File for Playback

The Load File for Playback button provides an easy way to use the Time Resolution setting and apply it to the large >32 GB file.

1. Refer to [Figure 3-56](#).
2. Set the Time Resolution in the Large File menu.
3. Press Load File To Playback. The example below uses the 5 ms resolution to process the 32 GHz file.
4. Go to the View menu. View menu shows that the Power Peak Locations of the Large File menu opens as Points of Interest in the View menu.



1. The Large File - Power Peak Locations opens as Points of Interest in the View Menu
2. Power vs. Time

**Figure 3-56.** Open View Menu

Import Points of Interest

In the Playback menu, right-click in the Time Marker Table and select Import Points of Interest. Large files imported into the Points of Interest table can take several minutes to load. See“Load Large File Menu” on page 3-36 for a description of large file management. Note that the Time Marker Table is a multi-function window and may be in Points of Interest mode. If in the Peak Table mode, right-click to display the context menu and then click Display Marker Table as shown in Figure 3-57.

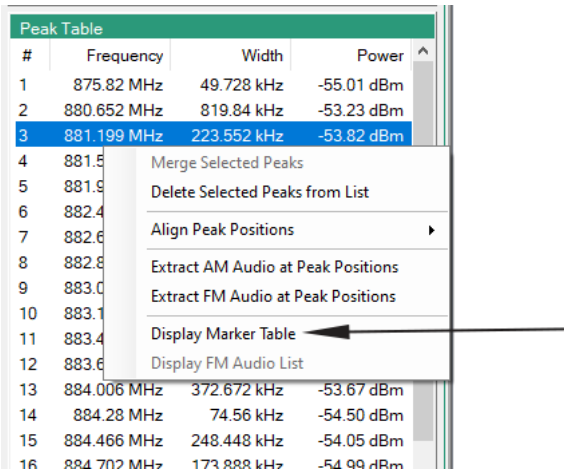


Figure 3-57. Display Marker Table

The Points of Interest are imported into the Playback Time Marker Table as shown in Figure 3-58. When the number of points located is less than 30, all the columns (Time, Power, Occ Bandwidth) are populated with parameter values.

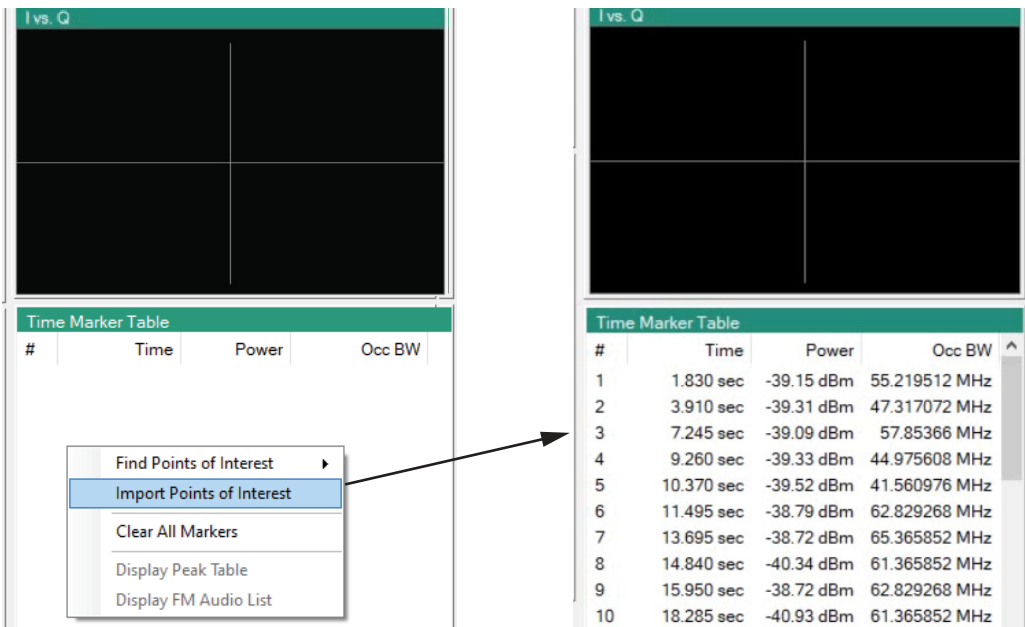


Figure 3-58. Playback Menu - Import Points of Interest to Marker Table

It is not unusual to have several hundred peaks of interest located. In the example shown in [Figure 3-59](#), there are 127 points found.

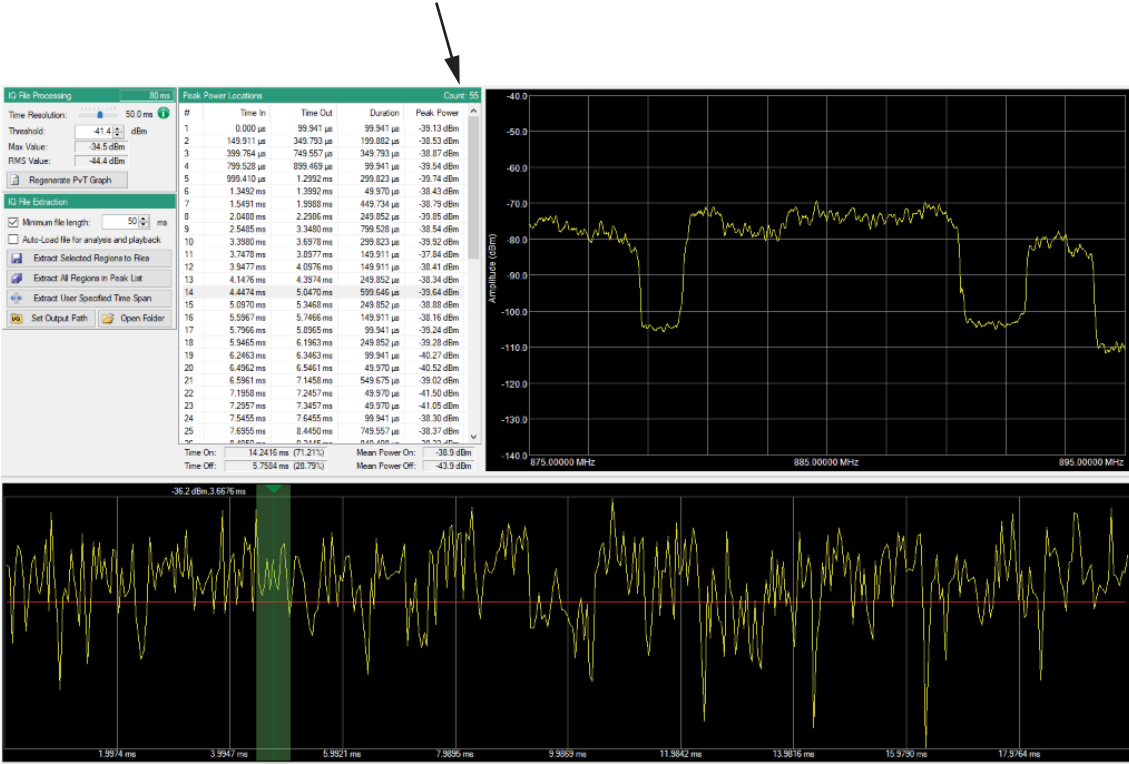


**Figure 3-59.** 127 Points of Interest

Importing over 30 points into the Time Marker Table results are shown in [Figure 3-60](#). Click a row to display the Power and Occ Bandwidth column.

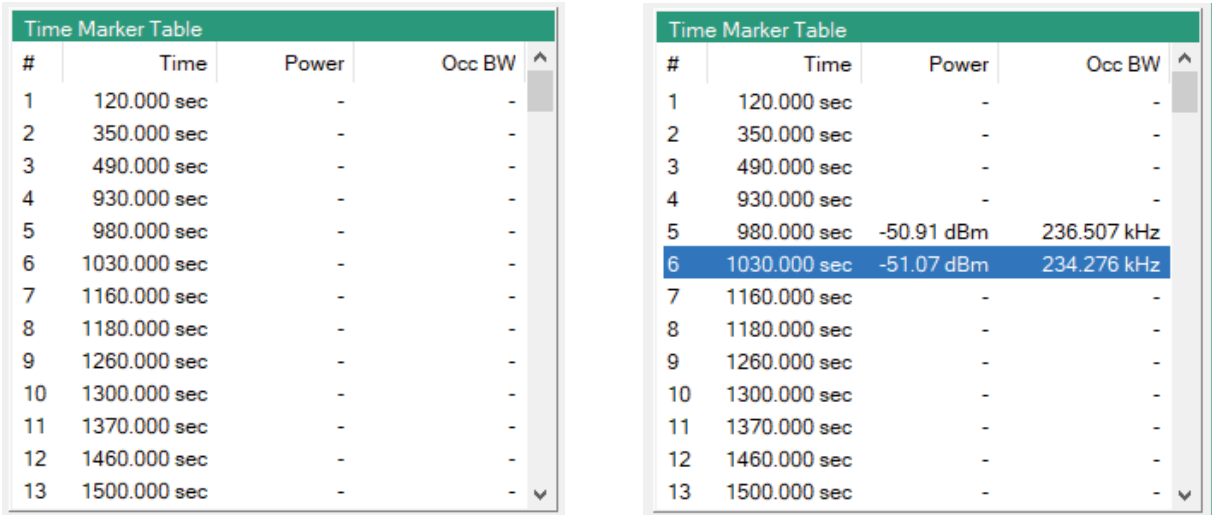
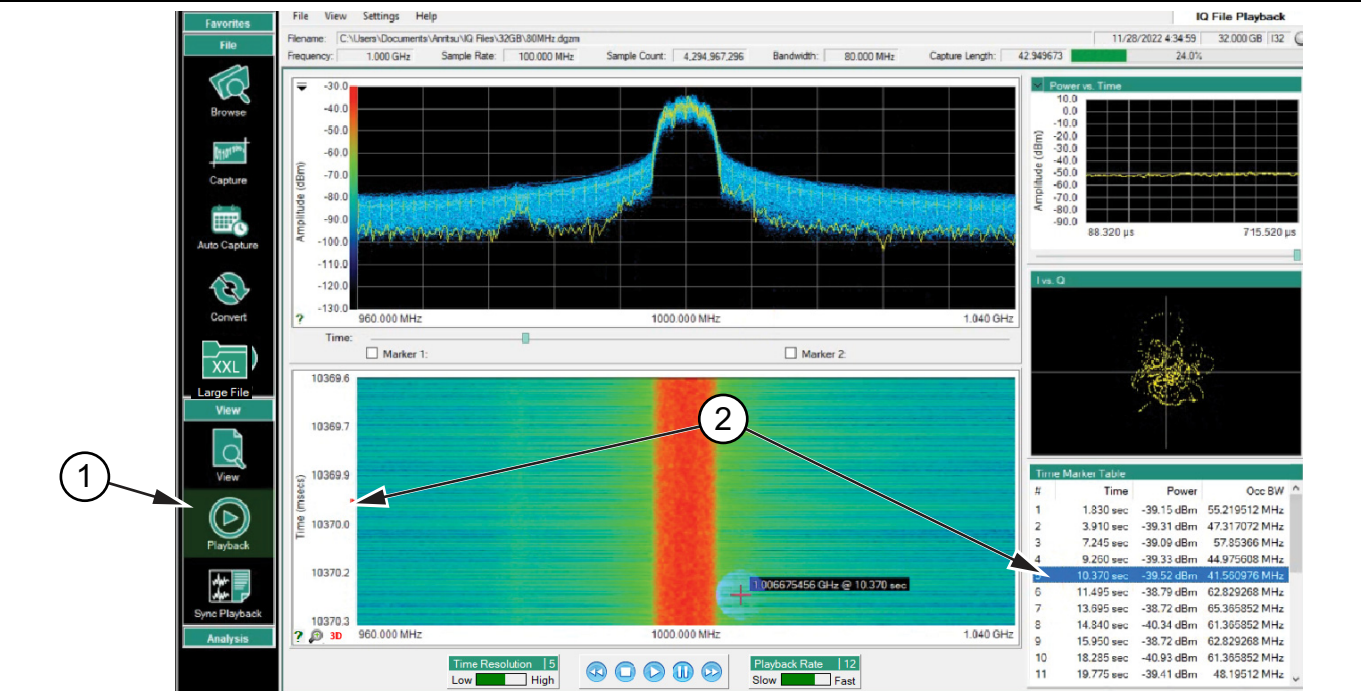


**Figure 3-60.** Click to Display Marker Parameters



Open a Point of Interest

In the Playback menu, open a time marker point of interest as shown in [Figure 3-61](#). In this example, the selected #5 marker is the same #5 peak power channel location from [Figure 3-46](#) on page 3-36.

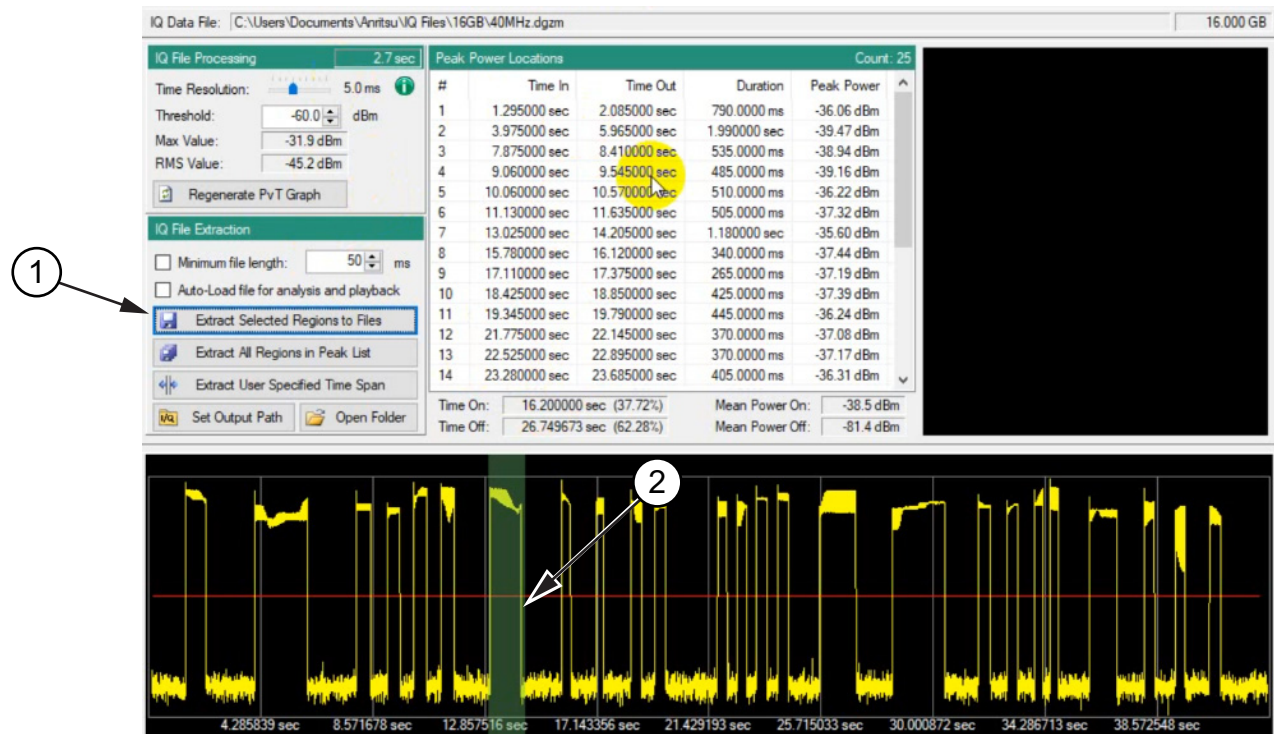


- 1. Playback Menu
- 2. Time Marker Table Point #5 Selected

Figure 3-61. View Time Marker in Playback Menu

## Capture Multiple Signals for Analysis

Capture several signals from the Large File menu using the Power vs Time display. The example shown in Figure 3-62 displays two signals selected in the Power vs. Time display.



1. Extract Selected Regions to File button
2. Shift-Click and slide mouse over a region of signals

**Figure 3-62.** Capture Multiple Files

To select and extract multiple peaks:

1. Shift-click-hold and slide the mouse over a region of signals in the Peak Power vs. Time display.
2. Check the Auto-load box.
3. Press Extract Selected to load and view in Playback menu.

## 3-10 Large File Menu Summary

The "Load File for Playback" button provides a simple tool to extract peak power channels signals from a large data set (over 1 GB) by extracting peak power channels at time intervals set by using the "Time Resolution" slider. The Large File menu provides a Peak Power Location table to view the channel power captured from the user set time resolution. The View menu automatically captures and shows peak power channel locations as Points of Interest. The Points of Interest can then be imported into the Time Marker Table of the Playback menu. Each signal channel in the Time Marker Table can then be selected to view in the Playback Menu.



# Chapter 4 — View Mode

## 4-1 Introduction

This chapter describes the View Mode menus, functions, parameter contents, and the setting methods for the analyzing IQ data files. The View mode menus include:

“View Menu”

“Playback Menu” on page 4-8

“Sync Playback Menu” on page 4-23

## 4-2 View Menu

The View menu window displays the IQ data in time.

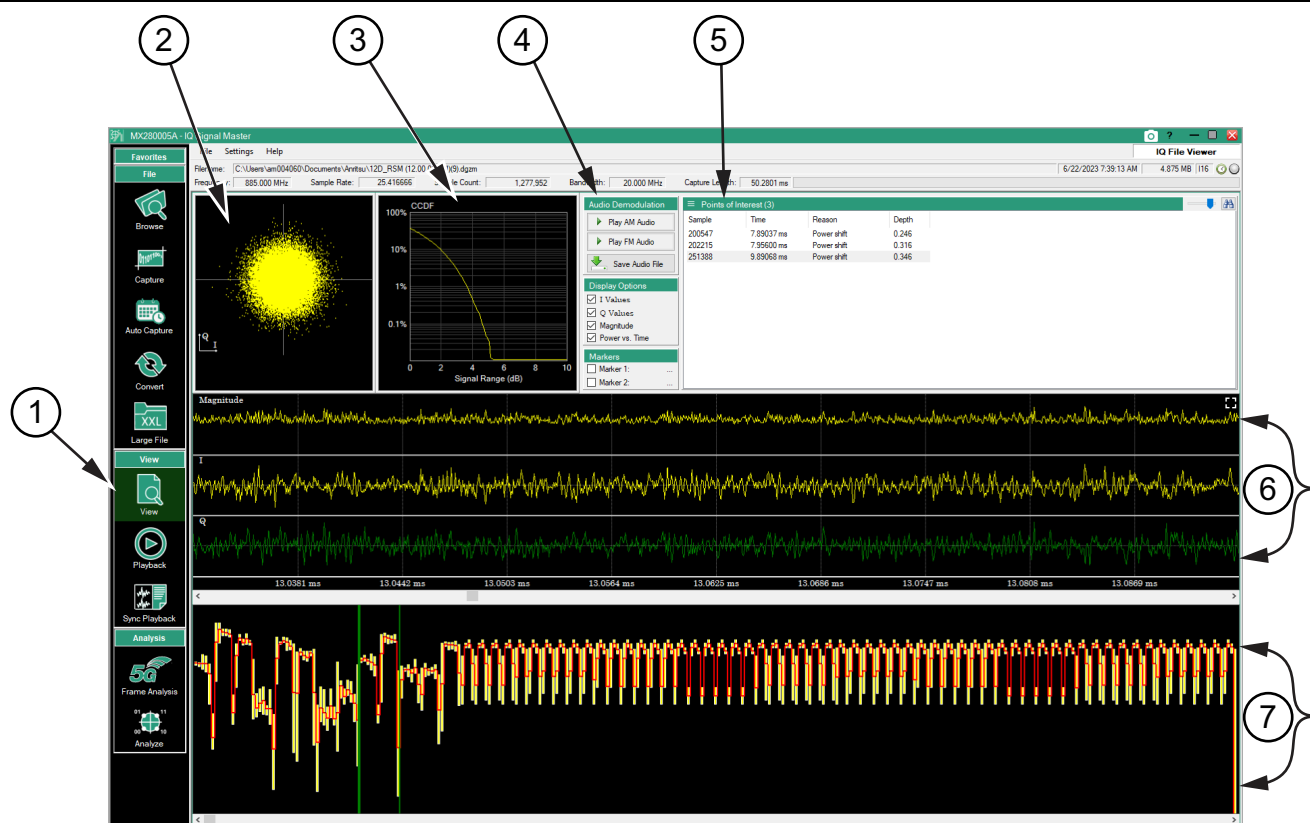


Figure 4-1. View Menu

1. **View Menu:** The View menu button.
2. **IQ Constellation Diagram:** The constellation diagram shows I/Q value pairs in the raw data file. As raw data, the location of the points depends on the sample rate and may appear more random than normal. In this display the modulation scheme is not known and no processing is taking place to display symbol points. Use the Analysis menu as described in [Chapter 5](#) to specify modulation details and extract the more familiar constellation diagram at symbol points.
3. **CCDF Plot:** (Complementary Cumulative Distribution Function) The x-axis represents the power level above the average power and the y-axis represents the percentage of time the signal power is at or above the power represented at the x-axis.
4. **Audio Demodulation/Display Options/Markers Panel:** See [Table 4-1 on page 4-3](#), [Table 4-2 on page 4-3](#), and [Table 4-3 on page 4-4](#).
5. **Points of Interest:** See [Table 4-4 on page 4-5](#).
6. **IQ Data Displayed in Time:** The Magnitude, I, and Q data display. Use the Scroll bar below the Q display to scan the data in the time spectrum.
7. **Power Vs. Time Data:** Displays the power vs. time. Use the Scroll bar below the Power vs. Time display to scan the data.

Figure 4-1. View Menu (Continued)

View Menu Toolbar

The View menu toolbar is shown in [Figure 4-2](#).

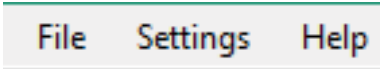


Figure 4-2. View Menu Toolbar

File Menu

Displays File menu as shown in [Figure 4-3](#).

|                                                                                         |                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  File | <b>Load IQ Data File:</b> Browse to find and load an IQ file                                                                                                                                                                                                                                |
|                                                                                         | <b>Recent IQ Files:</b> Open to display the recent IQ files that have been viewed. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place. |
|                                                                                         | <b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.                                                                                            |
|                                                                                         | <b>Reload IQ Data:</b> Reload the most recent viewed file.                                                                                                                                                                                                                                  |
|                                                                                         | <b>Exit:</b> Exits the program.                                                                                                                                                                                                                                                             |

Figure 4-3. View Mode File Menu

Settings Menu

The Settings menu is the same as described in [“Settings Menu” on page 2-4](#).

Help Menu

The Help menu is the same as described in [“Help Menu” on page 2-6](#).

### 4-3 Audio Demodulation

**Note**

The View menu, Convert menu, and the Playback menu have AM/FM audio playback features. They are different in how they work.

#### View and Capture Menus

In the View and Capture Menu displays, the AM/FM Audio demodulation is performed to the entire signal across the frequency band that was captured. For example, a wide-band capture of 20 MHz could have dozens of radio signals. The View and Capture Menu audio demodulation is for captures of a single audio signal. For highest quality audio, perform a narrow-band capture of just the signal of interest and demodulate the audio on the View menu and Capture menu displays. View Menu Audio Demodulation window is shown in [Table 4-1](#).

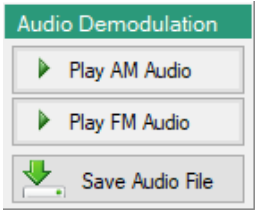
#### Playback Menu

On the Playback Menu display, the AM/FM audio extraction scans for audio signals at designated peak positions. In a 20 MHz capture, extract dozens of signals from the same capture data. The process of separating and extracting signals and the sound quality is not as clear as if a single audio signal had been captured and demodulated. If you are interested in capturing many signals simultaneously and do not require highest playback fidelity, then perform the AM/FM extraction in the Playback Menu. Am/FM demodulation in Playback menu requires at least one peak in the peak table. The menus for these function are unavailable (grayed) if there is no peak defined.

#### Audio Demodulation

The Audio Modulation window is described in [Table 4-2](#).

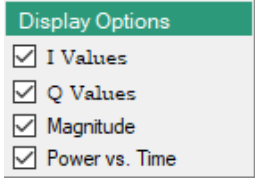
**Table 4-1.** Audio Demodulation

|                                                                                     |                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Play AM Radio:</b> Press to demodulate and play AM audio.</p> <p><b>Play FM Radio:</b> Press to demodulate and play FM audio.</p> <p><b>Save Audio File:</b> Press to save the last played audio, whether AM or FM.</p> |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### View Menu Display Options

Check the view to display as described in [Table 4-2](#). [Figure 4-1 on page 4-1](#) shows all the Display Options checked.

**Table 4-2.** Display Options

|                                                                                     |                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>I Values:</b> Draw I values in the graph or uncheck to remove it</p> <p><b>Q Values:</b> Draw Q values in the graph or uncheck to remove it</p> <p><b>Magnitude:</b> Draw Magnitude values in the graph or uncheck to remove it</p> <p><b>Power vs. Time:</b> Draw Power vs. Time bar graph</p> |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

View Menu Markers

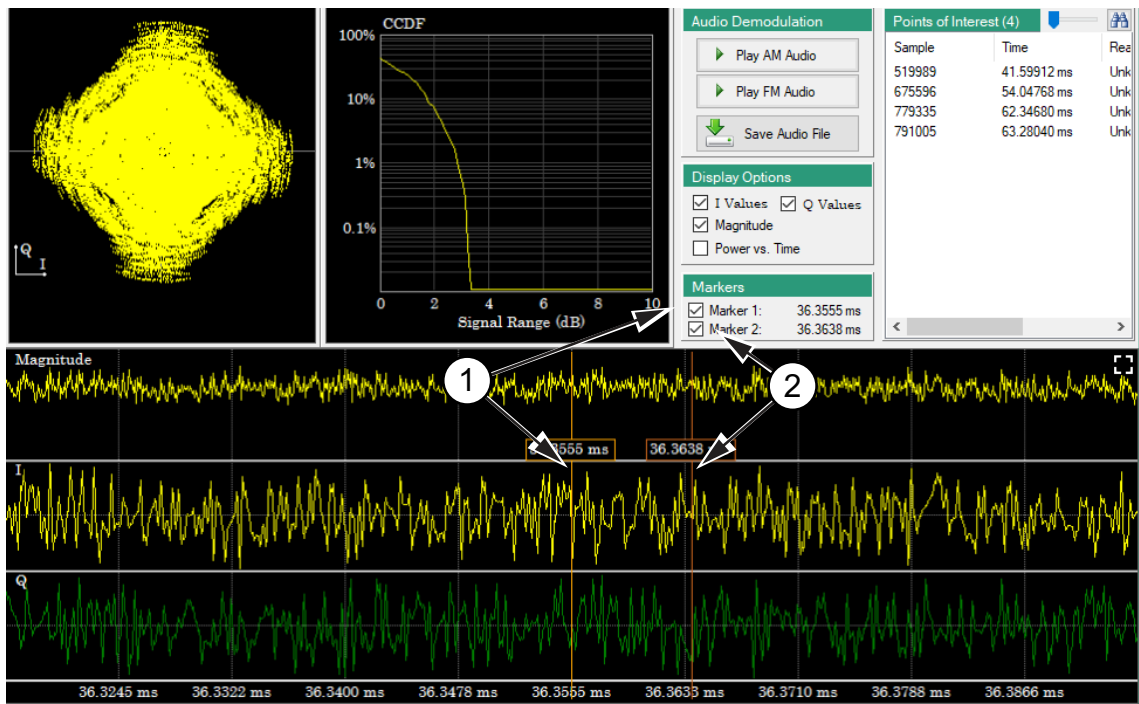
Markers window is shown in Table 4-3.

Table 4-3. Markers

| <table><tr><th colspan="2">Markers</th></tr><tr><td>Marker 1:</td><td>170.0682 ms</td></tr><tr><td>Marker 2:</td><td>170.0763 ms</td></tr></table> | Markers     |  | Marker 1: | 170.0682 ms | Marker 2: | 170.0763 ms | <p><b>Markers 1:</b> Click Marker 1 to jump to marker 1 location in the I/Q data plot.</p> <p><b>Markers 2:</b> Click Marker 2 to jump to marker 2 location in the I/Q data plot. See “Marker Position.” on page 4-4.</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--|-----------|-------------|-----------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Markers                                                                                                                                            |             |  |           |             |           |             |                                                                                                                                                                                                                           |
| Marker 1:                                                                                                                                          | 170.0682 ms |  |           |             |           |             |                                                                                                                                                                                                                           |
| Marker 2:                                                                                                                                          | 170.0763 ms |  |           |             |           |             |                                                                                                                                                                                                                           |

Marker Position.

To display the markers, use Shift + Click on the I/Q graph to set the Marker 1 position. Use Control + Click on I/Q data graph to set Marker 2 position. The active markers appear on the IQ graph as shown in Figure 4-4.



1. **Marker 1:** Shift-click puts a time marker 1 on the screen where the mouse is positioned.
2. **Marker 2:** Control-click puts a time marker 2 on the screen where the mouse is positioned.

Figure 4-4. IQ Plot with Markers



## Points of Interest

Refer to [Figure 4-5](#). The Points of Interest window is populated when the binoculars icon is pressed and searches the modulation data set to find points on the signal that show the most change. The Reason column displays a brief description of the captured point of interest. Right-click a point of interest to show the context menu for further analysis or distribution.

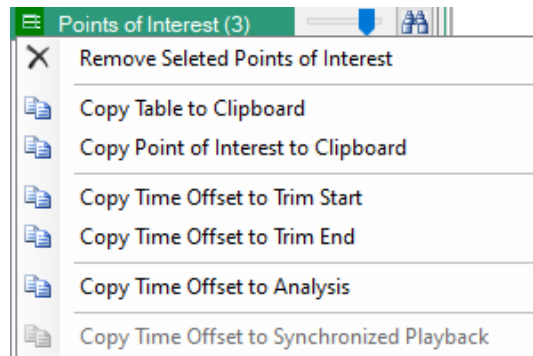


**Figure 4-5.** Points of Interest Window

For details of the Points of Interest window, see [Table 4-4](#).

**Table 4-4.** Points of Interest

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>3-bar Icon:</b> Press to provide the content menu shown in <a href="#">Figure 4-5</a>. Right-click the Points of Interest table provides the same context menu.</p> <p><b>Remove Selected Points of Interest:</b> Click one or multiple points from the Points of Interest table and click Remove Selected Points of Interest to delete them from the table.</p> <p><b>Copy Table to Clipboard:</b> Copies the entire Points of Interest table into the clipboard.</p> <p><b>Copy Point of Interest to Clipboard:</b> Copies a selected Point of Interest from the table into the clipboard.</p> <p><b>Copy Time Offset to Start:</b> Copy the time offset value of the selected Point of Interest into the Convert menu Start (ms) field.<br/>See <a href="#">“Trim Adjust Window” on page 3-33</a>.</p> <p><b>Copy Time Offset to End:</b> Copy the time offset value of the selected Point of Interest into the Convert menu Stop (ms) field.<br/>See <a href="#">“Trim Adjust Window” on page 3-33</a>.</p> <p><b>Copy Time Offset to Analysis:</b> Copy Time Offset value to the Analysis Menu.</p> <p><b>Copy Time Offset to Synchronized Playback :</b> Copy the Time Offset value into the Synchronized Playback Menu Playback Offset field for that file.</p> |
|  | <p><b>Sensitivity Slider:</b> Slide left provides a less sensitivity search where the bandwidth search is large and will result in the most significant signal changes. Slide right provides a more sensitive search where the bandwidth search is smaller and will result in capturing more signal point changes, but some changes may be less detectable when viewed on the graph display.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|  | <p><b>Find Icon:</b> Press to search for the Points of Interest of the I,Q, and M signal display. As points of interest are located, the signals parameters are logged as shown in <a href="#">Figure 4-5</a>. The field updates each time the resolution slider is moved to increase or decrease resolution,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |



Table 4-4. Points of Interest

| Sample                                                                                                                                                                                                                                                                                                                                          | Time | Reason | Depth |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|-------|
| <b>Sample:</b> Location of the POI. The sample number at which the signal change occurs.                                                                                                                                                                                                                                                        |      |        |       |
| <b>Time (µs):</b> Time of the occurrence. (Sample / sample rate)                                                                                                                                                                                                                                                                                |      |        |       |
| <b>Reason:</b> Type of signal change flagged as a POI. (Power shift or Modulation shift)                                                                                                                                                                                                                                                        |      |        |       |
| <b>Depth:</b> A dimensionless measure of how much the modulation or power has shifted. It is useful when comparing between entries in the table. You can sort on each column by clicking the column title. So 'Depth' is in the table so you can sort and see the points that had the largest power or modulation shift at the top of the list. |      |        |       |

Select Points of Interest

Right-click a data set in the Power vs. Time graph to display the “Add location to Points of Interest” tool tip shown in Figure 4-6. Click the dialog to select a point of interest and display it in the Points of Interest table.

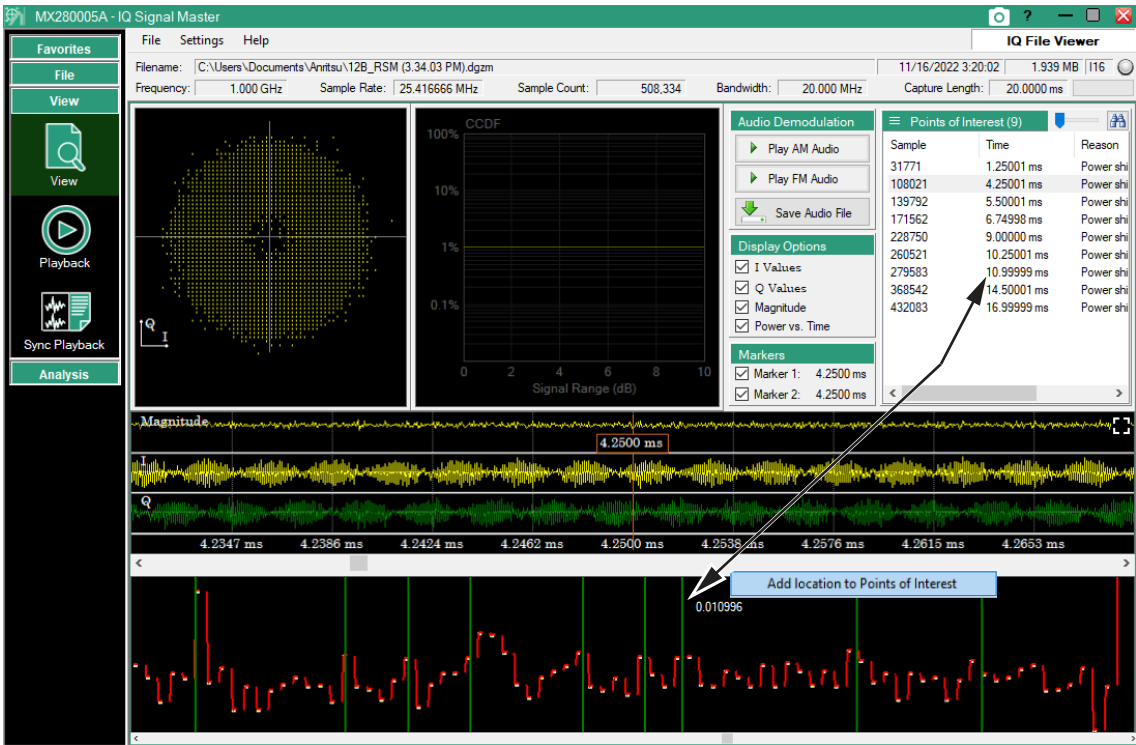


Figure 4-6. Select and Display Points of Interest

## Full Spectrum View

Press the top right button of the Magnitude data set to display a condensed full spectrum view as shown in [Figure 4-7](#). Press again to toggle back to the time display view.

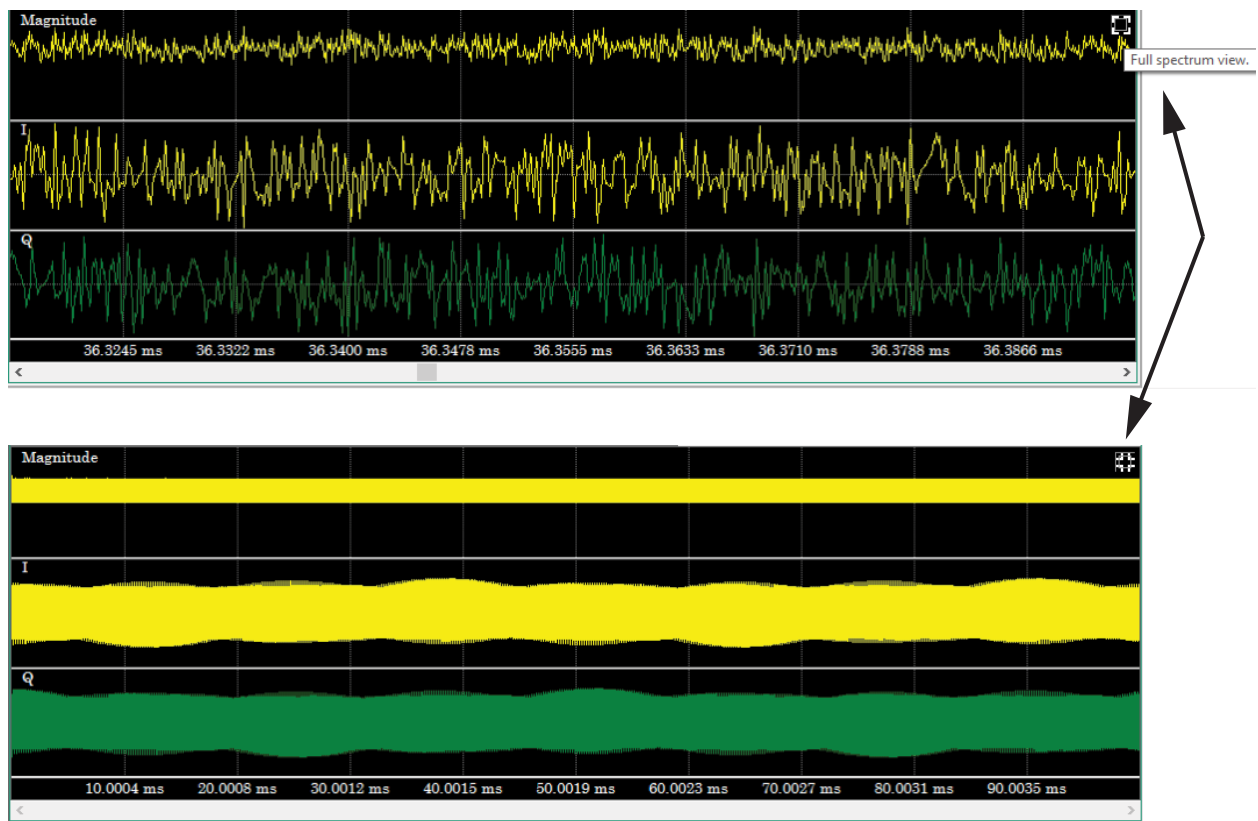
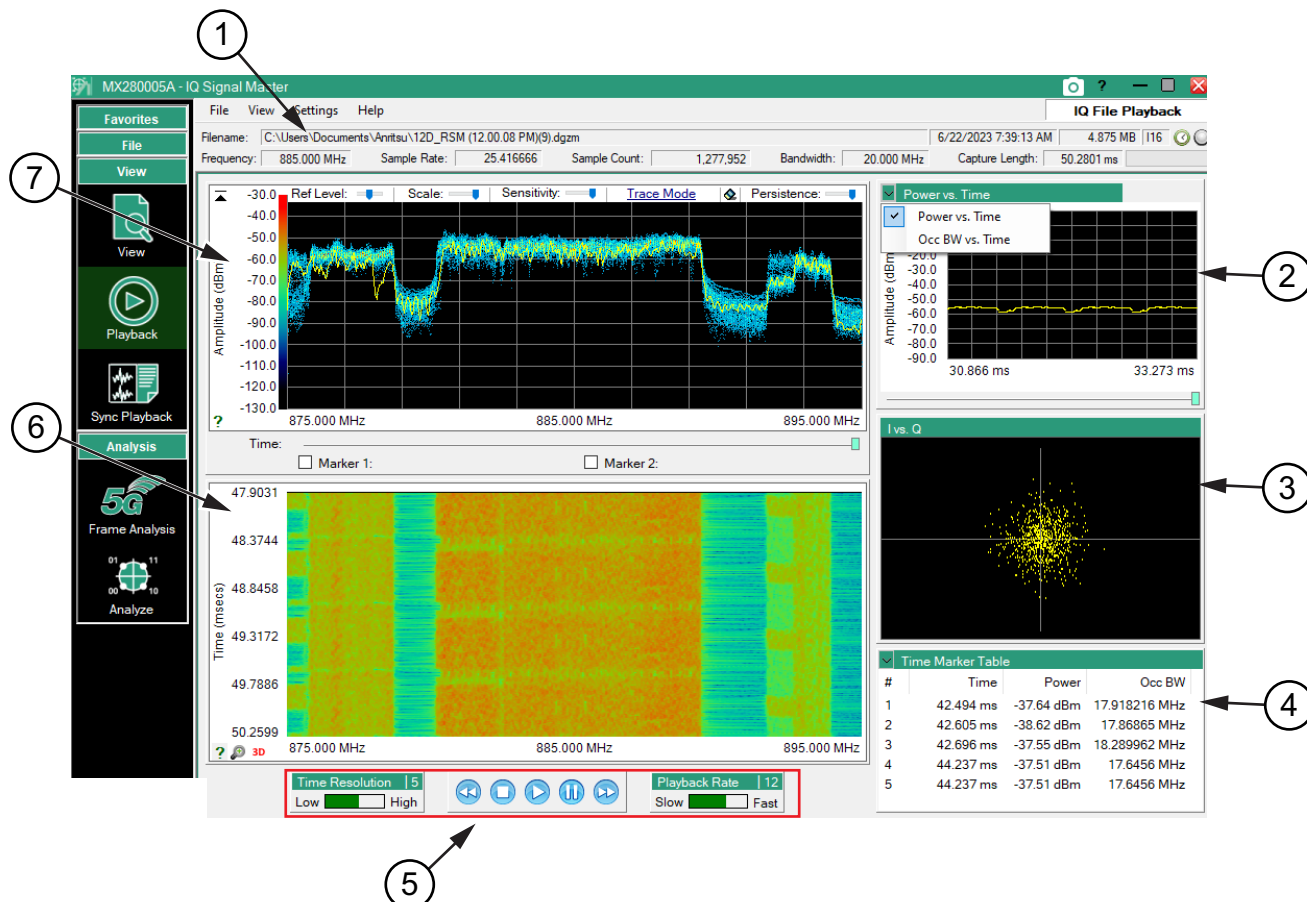


**Figure 4-7.** Full Spectrum View

## 4-4 Playback Menu

The Playback menu provides tools to obtain IQ data and create time slices and perform FFTs to create a sweep trace to display along with a Spectrogram. The IQ data is also displayed in a Power vs. Time and I vs. Q plot.

**Note** The playback menu is disabled if IQ File Playback option is not enabled.



1. **Signal Data Parameters:** See ["Signal Parameters" on page 3-6](#).
2. **Power vs. Time Graph:** Displays power vs time.
3. **IQ Constellation Plot:** Plots the raw I/Q value pairs from the data file used to generate each frequency plot. This is raw I/Q data and will not align with the symbol points in a more familiar constellation diagram.
4. **Peak Table (Shown):** Captures Points of Interest. This table also can be changed to AM Audio, FM Audio, Time Marker Table.
5. **Playback Toolbar:** See ["Playback Video Tools" on page 4-9](#).
6. **Spectrogram Window:** The display area shows spectrogram trace data in the time (vertical axis), frequency (horizontal axis), and amplitude (color) domains.
7. **Spectrum Window:** Spectrum trace data in the frequency domain.

**Figure 4-8.** Playback Menu

Playback Menu Bar

The Playback menu bar is shown in [Figure 4-9](#).

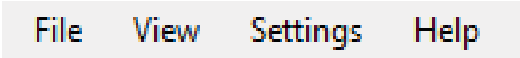


Figure 4-9. Playback Menu Bar

File Menu

Displays the Playback File menu as shown in [Figure 4-30](#).

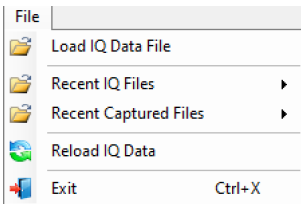
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Load IQ Data File:</b> Browse to find and load an IQ file</p> <p><b>Recent IQ Files:</b> Open to display the recent IQ files that have been viewed. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place.</p> <p><b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.</p> <p><b>Reload IQ Data:</b> Reload the most recent viewed file.</p> <p><b>Exit:</b> Exits the program.</p> |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 4-10. Playback File Menu

View Menu

Displays the Playback View menu command as shown in [Figure 4-11](#).

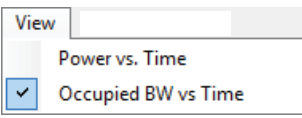
|                                                                                     |                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Power vs. Time:</b> Click to change the top right graph to Power vs. Time. A check mark indicates active.</p> <p><b>Occupied BW vs. Time:</b> Click to change the top right graph to Occupied Bandwidth. A check mark indicates active.</p> |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 4-11. Playback View Menu

Settings Menu

The Settings menu is the same as described in [“Settings Menu” on page 2-4](#).

Help Menu

The Help menu is the same as described in [“Help Menu” on page 2-6](#).

Playback Video Tools

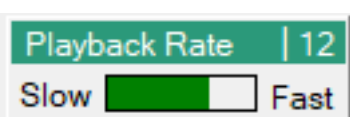
The Playback video tools as shown in [Figure 4-12](#) provide user controls of the spectrogram stream display.



Figure 4-12. Playback Toolbar

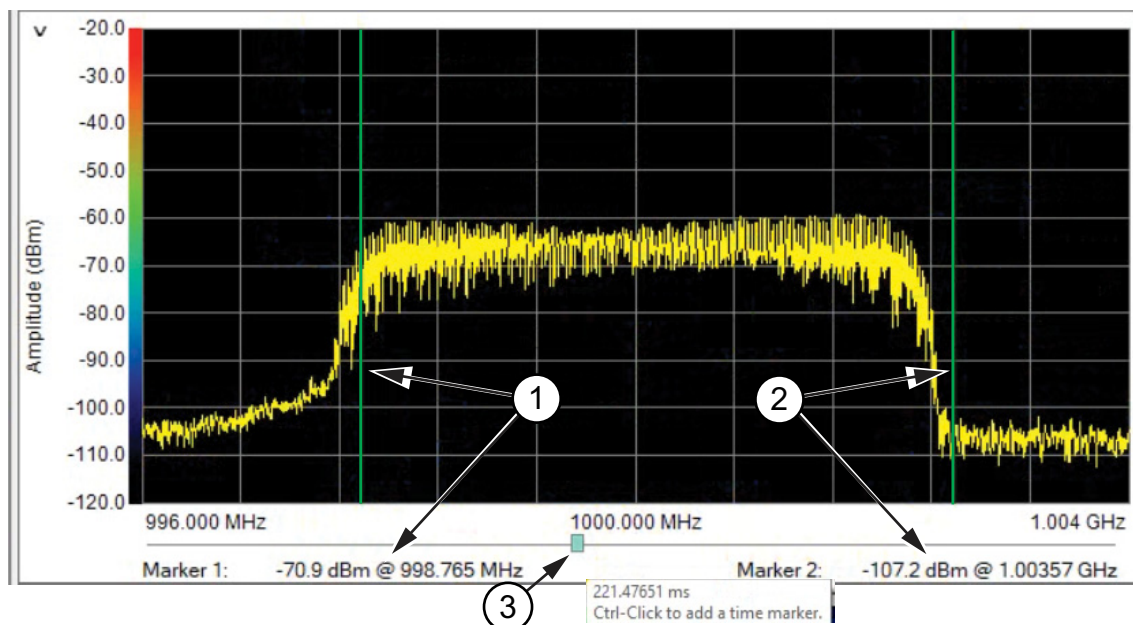
The spectrogram toolbar controls are described in [Table 4-5](#).

**Table 4-5.** Spectrogram Toolbar

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <p><b>Time Resolution:</b> Provides a time resolution zoom feature of the Spectrogram. Hover the mouse over the green bar and move the green bar to the left to decrease the resolution and to the right for more resolution. The range level of the slider's position is indicated by the number scale from 1 through 8 at the top right corner of the Time Resolution bar display.</p>                                                                                                                                                                                                                                                                                                                                                                                                       |
|  | <p><b>Rewind:</b> Click jumps back in the spectrogram time span. For example, click will jump back 20 ms and sweep for 10 ms and stop. Each click repeats this pattern until the sweep is pushed back to the beginning of the sweep.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  | <p><b>Stop:</b> Click to stop the playback stream. Click play starts from the beginning.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|  | <p><b>Play:</b> Click to play (resume) the playback stream.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|  | <p><b>Pause:</b> Click to pause the playback stream. Click play resumes play. You can also move the time slider (shown in <a href="#">Figure 4-13 on page 4-11</a>) and click play to resume from the new positioned location.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|  | <p><b>Double Arrow Right:</b> Click jumps forward in the spectrogram time span. For example, click will jump forward 10 ms and stop. Each click repeats this pattern until the sweep is pushed forward to the end of the sweep.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|  | <p><b>Playback Rate:</b> Provides speed control of the spectrogram. Click Slow to reduce the speed of the playback stream. Click Fast to increase the speed of the playback stream. The speed bar provides a view of the relative stream speed of the spectrograph display. The range level of the slider's position is indicated by the number scale from 1 through 17 at the top right corner of the Playback Rate bar display. To the left (Slow) runs the display at one sweep per second. A slow stream speed is useful for providing a view of every step in the stream, but takes much longer to complete a sweep. As the sweep is increased, the speed indicator displays yellow and then red, indicating that you are skipping over data as it sweeps to adjust to the set speed.</p> |

## Playback Menu Markers

The Playback menu frequency markers are set in the frequency graph as described in [Figure 4-13](#). The frequency markers retain the set frequency at the locations marked while the power changes during the sweep.



1. **Marker 1:** Position the mouse over a frequency region of interest in the frequency graph and perform a shift-click to set Marker 1 on that frequency on the graph. See [“Set Time Markers” on page 4-12](#).
2. **Marker 2:** Position the mouse over a second frequency region of interest and perform a control-click to set Marker 2 on that frequency on the graph. See [“Set Time Markers” on page 4-12](#).
3. **Time Slider:** Indicates the time position within the time spectrum of the sweep. The slider moves as the frequency sweep is performed. The slider can be repositioned manually to perform analysis of a specific bandwidth.

**Figure 4-13.** Set Frequency Markers



Set Time Markers

Time markers are set in the spectrogram by performing a control-click in the spectrogram graph. Each time a control-click is performed over a point of interest, the signal’s time, power, and occupied bandwidth is recorded to the Marker Table. The time markers can also be set by performing a control-click on the time slider as shown below.

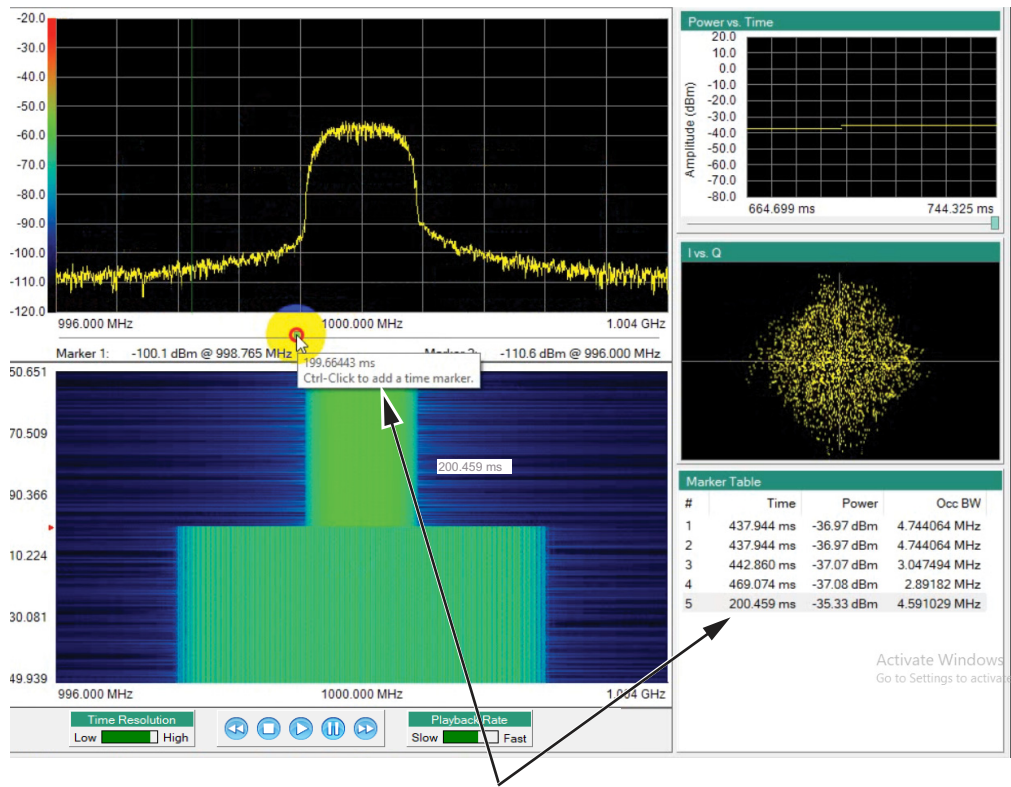


Figure 4-14. Add Time Marker

Marker Table

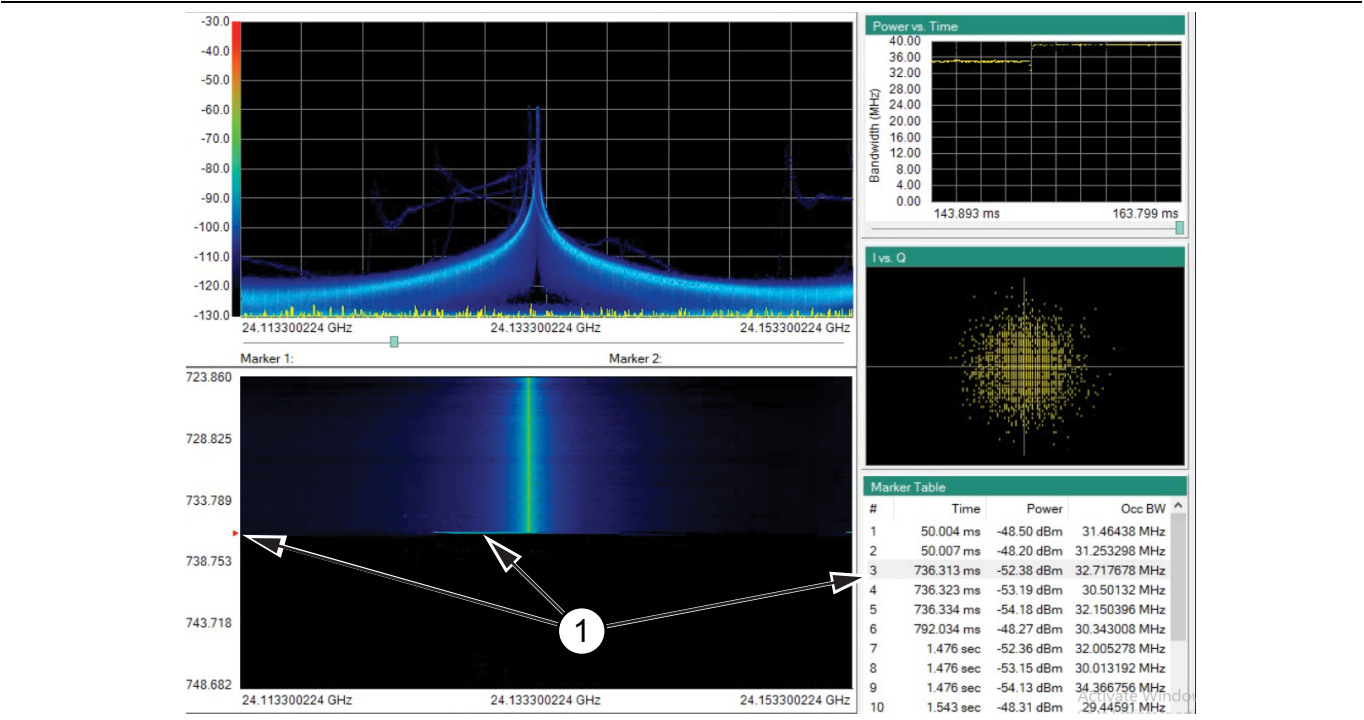
The Marker Table records the signals Time, Power, and Occupied Bandwidth of a user’s point of interest as shown in Figure 4-15. The points of interest that have been marked and recorded in the marker table can be selected for analysis by clicking a line of data in the marker table to display the saved signal on the spectrogram and frequency graph.

| Marker Table |            |            |              |
|--------------|------------|------------|--------------|
| #            | Time       | Power      | Occ BW       |
| 1            | 437.944 ms | -36.97 dBm | 4.744064 MHz |
| 2            | 437.944 ms | -36.97 dBm | 4.744064 MHz |
| 3            | 442.860 ms | -37.07 dBm | 3.047494 MHz |
| 4            | 469.074 ms | -37.08 dBm | 2.89182 MHz  |
| 5            | 200.459 ms | -35.33 dBm | 4.591029 MHz |

Figure 4-15. Marker Table

### 4-5 Analyzing a Point of Interest

When points of interest are logged in the Marker Table, each can be analyzed in detail. An example of a signal being analyzed is shown in [Figure 4-16](#). Double-clicking a point of interest will display one screen length of information in the spectrogram graph. In this example, marker #3 is double-clicked. By default, the spectrogram screen scrolls upward for one screen length and stops with the point of interest centered in the spectrogram display. The red arrowhead on the left of the screen points to the time marked in the marker table for marker #3 where the points of interest was captured. The spectrogram shows a frequency glitch that occurred at the end of the trace. This glitch can then be analyzed closer as shown in [Figure 4-17](#).



- 1. Point of Interest #3
- 2. Time Resolution

**Figure 4-16.** Analyzing a Points of Interest



### Increase Time Resolution

Increasing and the time resolution in the spectrogram is accomplished in two ways. To increase the time resolution in the spectrogram:

1. Manually move the “Time Resolution” the bar towards the right.
2. Hover the mouse over the spectrogram close to the point of interest and double-click. The Time Resolution bar will also increase at each double-click.

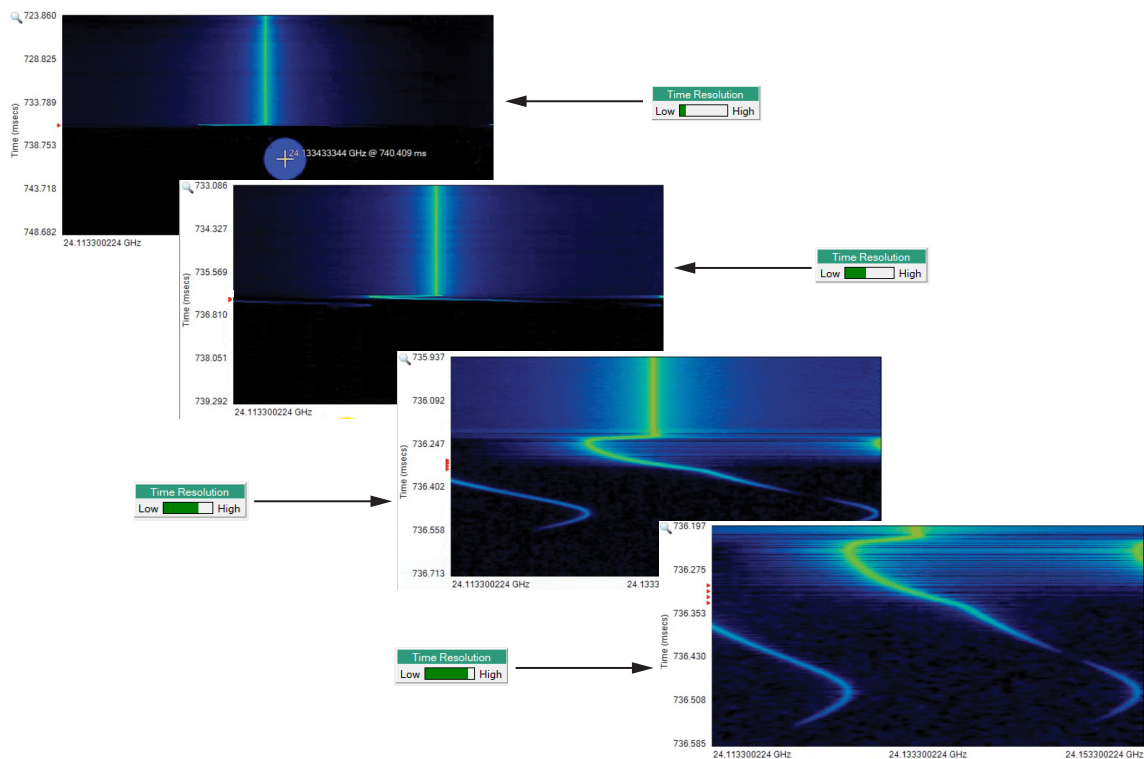


**Figure 4-17.** Increase Time Resolution

## Playback Menu Controls

The Playback menu controls that provide tools to analyze the signal display is shown in [Figure 4-18](#).

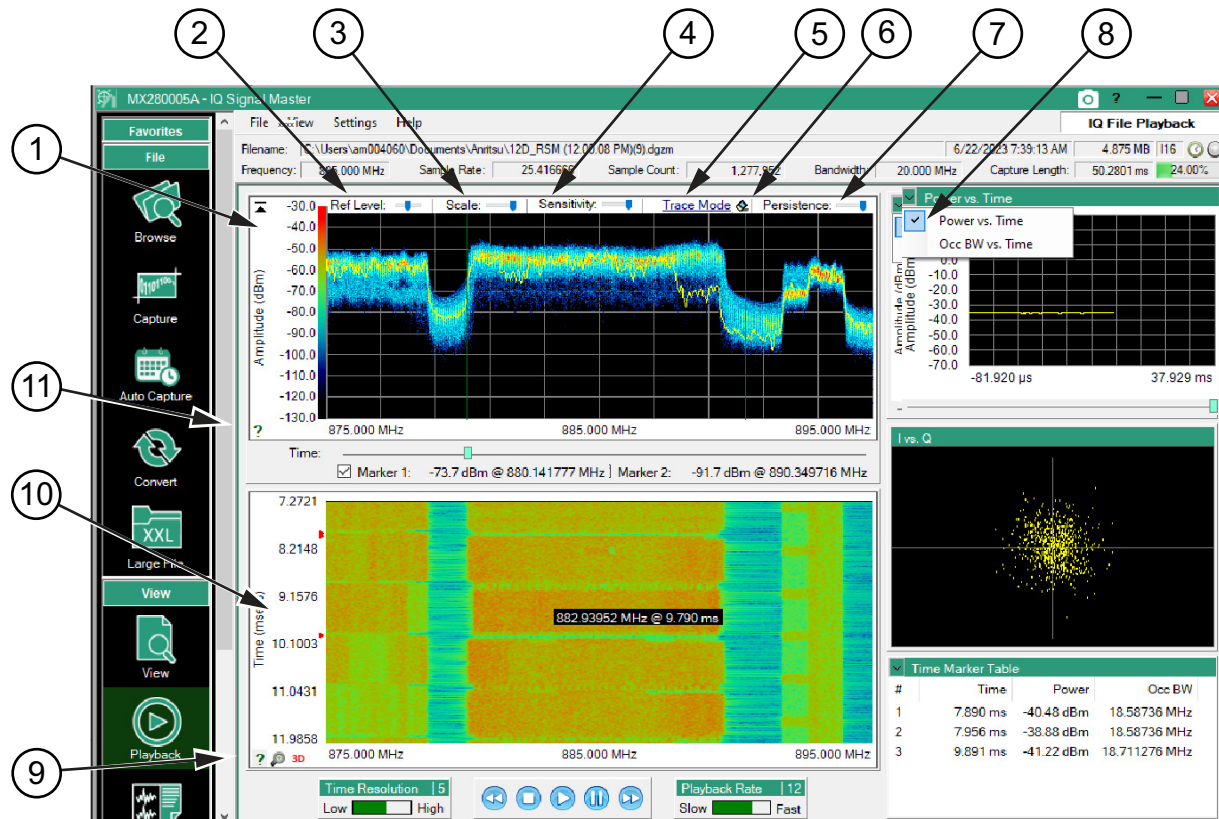
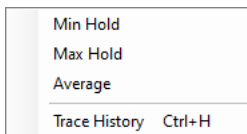


**Figure 4-18.** Playback Controls

1. **Trace Density Plot:** Displays the IQ data stream. Use the tools in this window for signal analyses
2. **Reference Level Slider:** Use the slider to increase or decrease the Amplitude resolution of the frequency/amplitude display. Changes are shown in the amplitude scale as the slider is moved.
3. **Scale Slider:** Use the slider to increase or decrease the Scale (dBm/Division) resolution.
4. **Sensitivity:** Use the slider to adjust the sensitivity of the density plot display.
5. **Trace Mode:** Press to show the Trace Mode menu shown below. Click Max Hold, Min Hold, Average, or Trace History for the density plot. Trace History is described in [“Trace History” on page 4-17](#).



6. **Clear Density Plot:** Press to clear the density plot graph.
7. **Persistence Slider:** Use the slider to increase or decrease the persistence level (how long traces are displayed) in the density plot.
8. **Graph Display Toggle:** Set the graph display as Occupied Bandwidth vs. Time or Power vs. Time
9. **Spectrogram Information Icon:** Hover over the spectrogram information icon to show the dialog shown.

Use the mouse buttons to control the waterfall display.

|              |                                    |
|--------------|------------------------------------|
| Left-Click:  | Toggle Play/Pause.                 |
| Shift+Click: | Play one screen centered at click. |
| Ctrl+Click:  | Set a time marker at click.        |

🔍 : Click to zoom in on the spectrogram diagram.  
 3D : Click to open 3-Dimensional spectrogram view.

10. **Spectrogram Window:** Displays the Spectrogram View. Red time-markers on the left edge display the data markers in the Time Marker Table. The tool tip readout is the mouse position on spectrogram that provides the frequency and time resolution of the mouse at that location on the spectrogram display.
11. **Trace/Density Information Icon:** Hover over the trace/density information icon to show the dialog shown.

Use the mouse buttons to control the trace/density graph display.

In Playback mode: (Press Esc to return to Playback mode.)

|                   |                             |
|-------------------|-----------------------------|
| Left-Click:       | Toggle Play/Pause.          |
| Ctrl+Left-Click:  | Add/Set frequency marker 1. |
| Ctrl+Right-Click: | Add/Set frequency marker 2. |
| Mouse Wheel:      | Shift time resolution       |

In Peak Finding mode: Press Shift key to enter Peak Finding)

|                    |                                               |
|--------------------|-----------------------------------------------|
| Left-Click:        | Exit Peak Finding mode.                       |
| Shift+Left-Click:  | (Within a peak) Select the peak.              |
| Shift+Left-Click:  | (Outside a peak) Create new peak.             |
| Shift-Mouse Wheel: | Adjust center frequency of the selected peak. |
| Ctrl-Mouse Wheel:  | Adjust the bandwidth of then selected peak.   |

▼ : Open controls for adjusting reference level and persistence.  
 ▲ : Close controls for adjusting reference level and persistence.

**Figure 4-18.** Playback Controls (Continued)

Trace History

Press Trace Mode from the density plot control panel and click Trace History as shown [Figure 4-19](#). The trace history shows the data in real time. The time axis is moved in on the display to provide a view of the past sweeps. The front yellow live trace is the true amplitude of the signal.

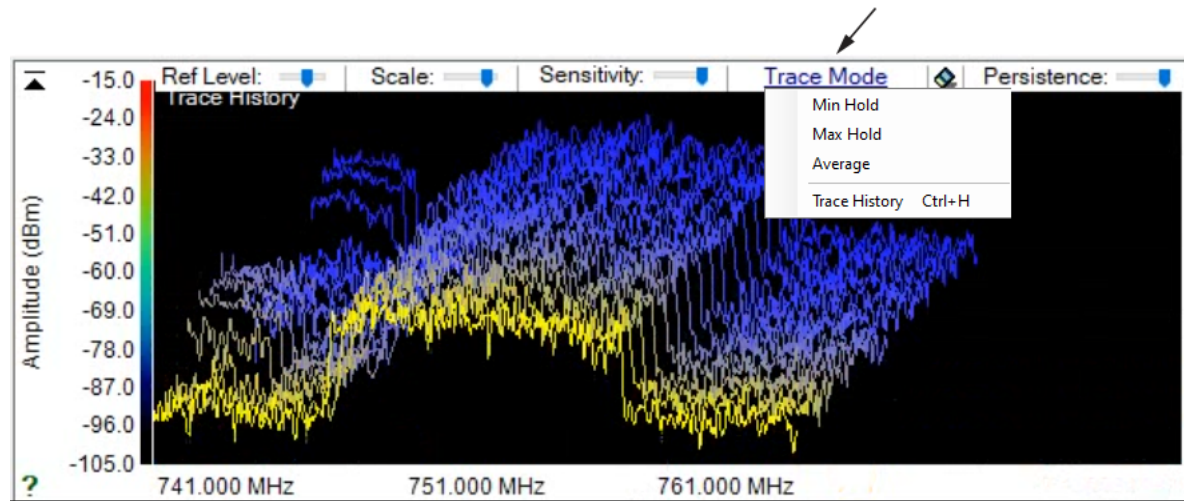


Figure 4-19. Trace History Display

Trace Density Analysis

Right click the trace density plot to display the analysis tools shown in [Figure 4-20](#).

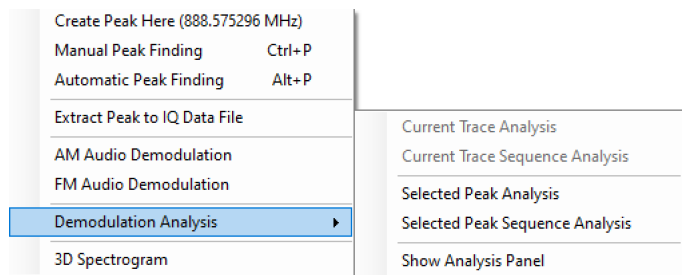


Figure 4-20. Density Plot Analysis Tools

## Trace Density Analysis Descriptions

The trace density analysis tools provide peak search, AM/FM, demodulation analysis, and 3D tools.

**Create Peak Here:** Click a desired peak in the density plot. The mouse readout of the navigation is shown. Click Create Peak Here from the Analysis tools shown in [Figure 4-20](#). The peak will appear as shown in [Figure 4-21](#).

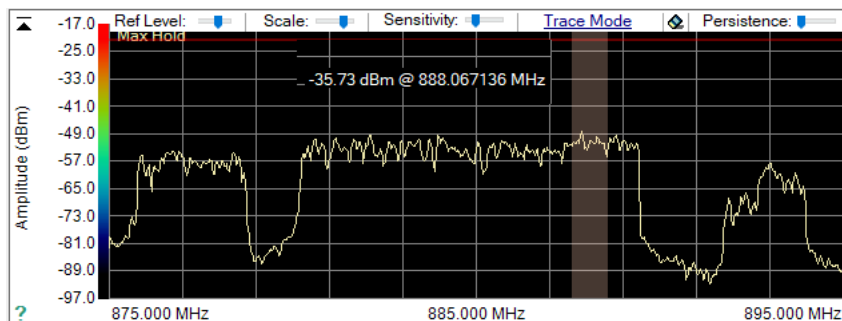


**Figure 4-21.** Create Peak

**Manual Peak Finding:** Manually move the red horizontal power reference line to set the signal peak power level threshold. Click to show the peaks as shown in [Figure 4-22](#)

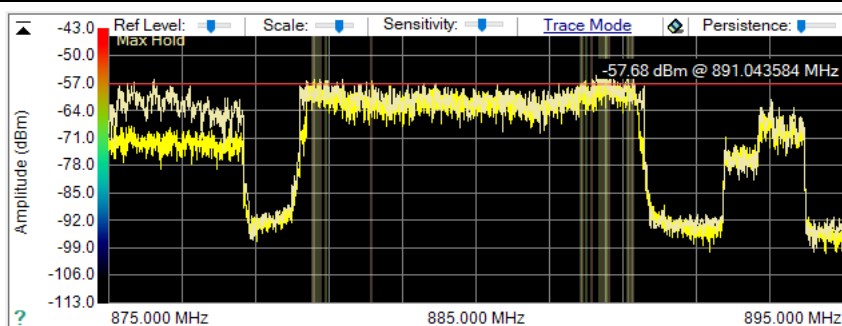


**Figure 4-22.** Manual Peak Detection

**Automatic Peak Finding:** The automatic peak finding tool is dependent on the control panel slider settings. Click Automatic Peak Finding detects and displays the peak signals as shown in [Figure 4-23](#).

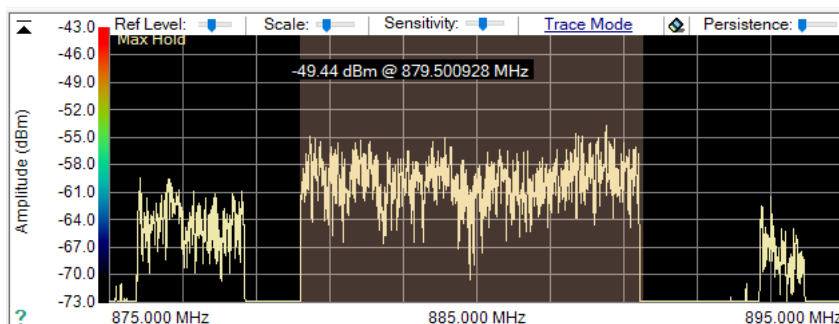


**Figure 4-23.** Automatic Peak Detection

**Extract Peak to IQ Data File:** Extract a selected peaks to a .dgz file.

**AM Audio Demodulation:** See [“AM Audio Demodulation”](#) on page 4-18.

**FM Audio Demodulation:** See [“FM Audio Demodulation”](#) on page 4-18.

**Demodulation Analysis:**

- Current Trace Analysis
- Current Trace Sequence Analysis
- Selected Peak Analysis
- Selected Peak Sequence Analysis
- Show Analysis Panel

**3D Spectrogram:** Click to view the Trace Density plot as a 3D Spectrogram.

**Peak Finder Example**

Use the density plot analysis menu shown in [Figure 4-20 on page 4-17](#). Use the mouse readout to determine a peak of interest and click Create Peak Here. Multiple peaks can be clicked and analyzed. Each click will display a peak on the density plot and provide details of the peak in the Peak Table. A red marker identifying the location of the peak is also displayed in the spectrogram as shown in [Figure 4-24](#).

**1. Peak Display**

**Figure 4-24.** Peak Finder Example

Peak Table Menu

Click the corner chevron icon to display the Peak Table menu commands shown in [Figure 4-25](#).

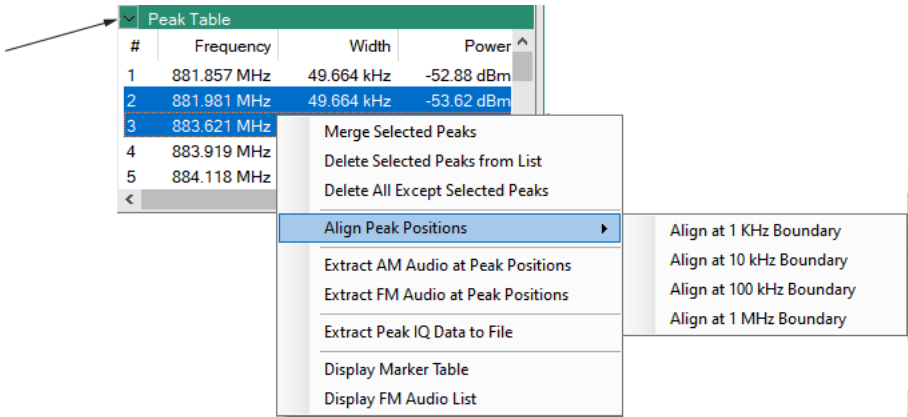


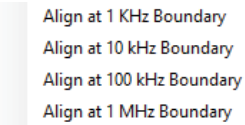
Figure 4-25. Peak Table Menu

**Merge Selected Peaks:** Shift-click the markers in the Peak Table to display as merged in the trace/Density display plot. Note the markers to merge must be in synchronous order. (i.e 1-2) (2-3) (1,2,3).

**Delete Selected Peaks From List:** Click the markers to delete from the Peak table and from the trace/density plot.

**Delete All Except Selected Peaks:** Deletes all markers except the selected peaks in the marker window.

**Align Peak Positions:** Provides the Boundary Menu shown below:



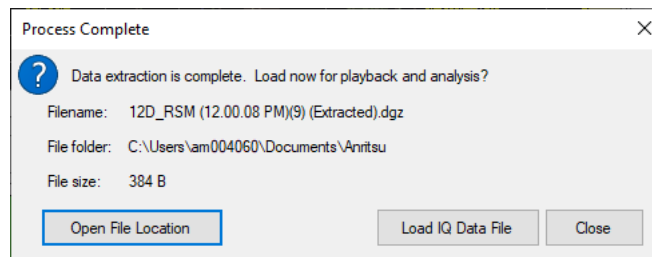
**Extract AM Audio at Peak Positions:** Extracts the identified AM Audio peak signals in the trace/density plot. The table changes to AM Audio and displays the signal markers frequency and power in the table. Right-click the AM audio table to display the menu shown below. FM Audio displays the same menu.

**Extract FM Audio at Peak Positions:** Extracts the identified FM Audio peak signals in the trace/density plot. The table changes to FM Audio and displays the signal markers frequency and power in the table. Right-click the FM audio table to display the menu shown below.

**Display Marker Table:** See [“Time Marker Table” on page 4-21](#).



**Extract Peak IQ Data to File:** Click a detected peak in the Peak Table and then click Extract Peak IQ Data to File. The dialog appears below.



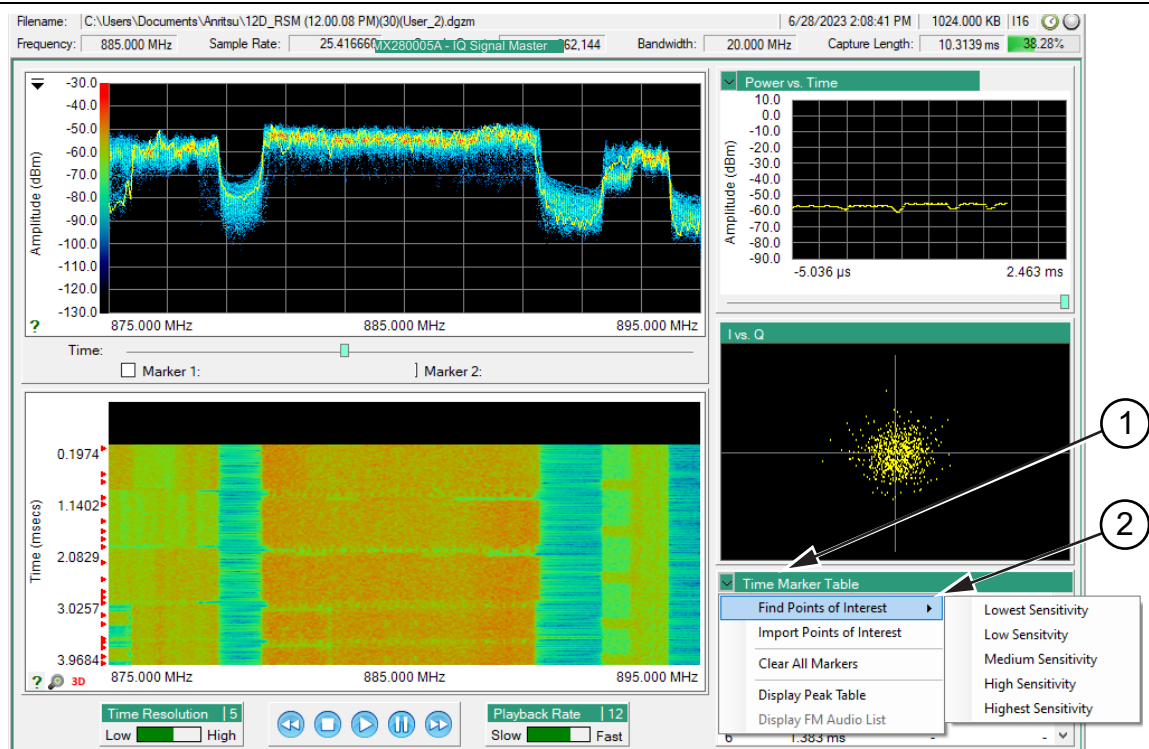
**Display Marker Table:** For quick access, the Audio table changes to the Marker Table. See [“Marker Table” on page 4-12](#).

**Display FM Audio List:** Displays the Frequency and Power parameters of the peak frequencies as shown below.

| AM/FM Audio |                |          |
|-------------|----------------|----------|
| #           | Frequency      | Power    |
| 1           | 996.907072 ... | 0.00 dBm |
| 2           | 997.261632 ... | 0.00 dBm |
| 3           | 997.457216 ... | 0.00 dBm |
| 4           | 997.500032 ... | 0.00 dBm |
| 5           | 997.579456 ... | 0.00 dBm |
| 6           | 997.616128 ... | 0.00 dBm |

## Time Marker Table

The Timer Marker Table displays a points of interest (signal differentiations) table. The points of interest displayed is dependent on the user selected sensitivity. The sensitivity levels are determined from the menu shown in [Figure 4-26](#). Click the level of sensitivity to determine the most substantial signal-time differentiation (Lowest Sensitivity) to the least substantial signal-time differentiation (Highest Sensitivity).



1. Time Marker Table: Displays time marker as points of interest.

2. Time Marker Menu: Time Marker Table controls menu. See [“Time Marker Table Menu” on page 4-22](#).

**Figure 4-26.** Time Marker Table Menu



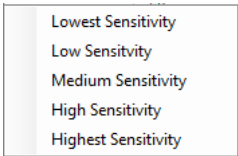
### Time Marker Table Menu

The Time Marker Table menu is shown in [Figure 4-27](#).



**Figure 4-27.** Time Table Marker Menu

**Find Points of Interest:** Click to display the sensitivity menu shown below. Set the Lowest Sensitivity displays the most points. Set the Highest Sensitivity displays the least points across the IQ data stream.

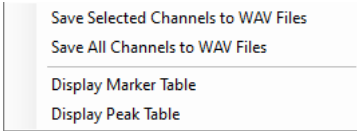


**Import Points of Interest:** Import the points of interest using the View menu’s Points of Interest Table. See [“Points of Interest” on page 4-5](#).

**Clear All markers:** Clear the Marker table.

**Display Peak Table:** Displays the Peak Table as described in [“Peak Table Menu” on page 4-20](#).

**Display FM Audio List:**



**Save Selected Channels to WAV Files:** Shift or Control-click particular frequencies in the list to select signals for saving as WAV files. Confirmation dialog shown below displays number of files and navigation to file location.

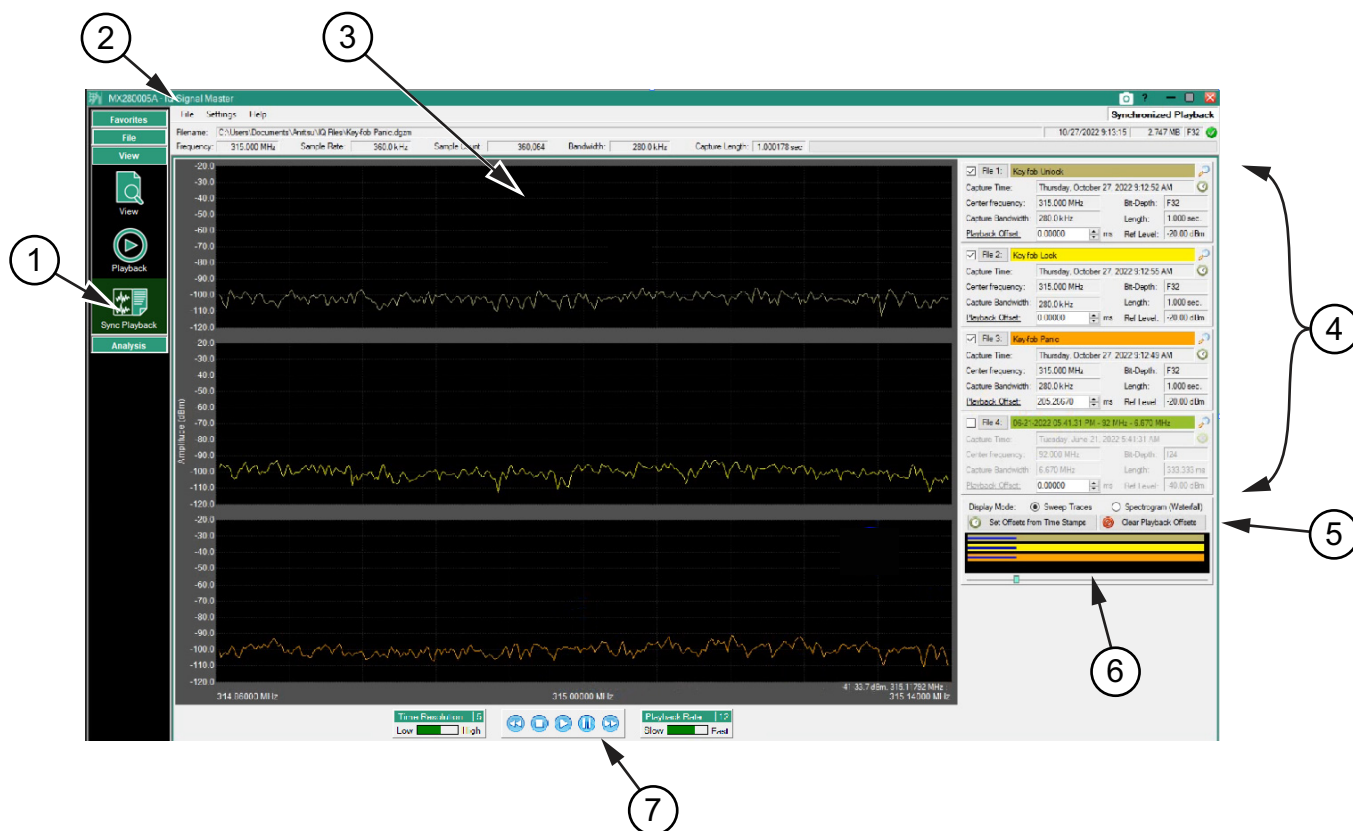
**Save All Channels to WAV Files:** Save all frequencies to WAV files. Confirmation dialog shown below displays number of files and navigation to file location. WAV files are saved to the same folder as the data file that is being processed.

**Display Marker Table:** Display the Time Marker Table described in [“Time Marker Table” on page 4-21](#).

**Display Peak Table:** Display the Peak Table described in [“Peak Table Menu” on page 4-20](#).

## 4-6 Sync Playback Menu

The Sync Playback menu provides tools to load multiple files, synchronize the data displayed, and view the files at the same time in the same time domain. The signal data displayed should have the same capture bandwidth and center frequency in order to synchronize.



1. Sync Playback menu
2. Sync Playback Toolbar
3. Data display windows
4. Listed files and parameters for synchronization
5. Display and offset tools (Sweep Traces view shown).
6. Time offset bars
7. Playback controls

**Figure 4-28.** Sync Playback Menu

## Sync Playback Toolbar

The Sync Playback toolbar is shown in [Figure 4-29](#).

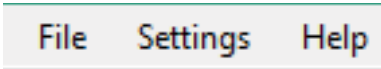


Figure 4-29. Sync Playback Toolbar

## File Menu

Displays the Sync Playback File menu as shown in [Figure 4-30](#).

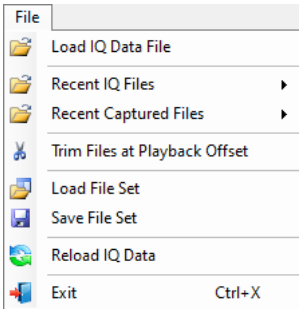
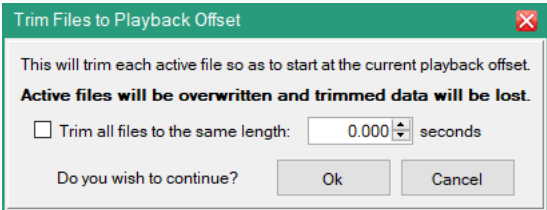
|                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Load IQ Data File:</b> Browse to find and load an IQ file</p> <p><b>Recent IQ Files:</b> Open to display the recent IQ files that have been viewed. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place.</p> <p><b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.</p> <p><b>Trim Files at Playback Offset:</b> Set the active files to the same length and start at the synchronized start time. This function overwrites the active Playback files, trimming the beginning of each file so that the file charts at the set Playback Offset point.</p> <div></div> <p><b>Load File Set:</b> Opens Windows browse dialog.</p> <p><b>Save File Set:</b> Save File to a users defined file folder.</p> <p><b>Reload IQ Data:</b> Reload the most recent viewed file.</p> <p><b>Exit:</b> Exits the program.</p> |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 4-30. Capture File Menu

## Settings Menu

The Settings menu is the same as described in “[Settings Menu](#)” on page 2-4.

## Help Menu

The Help menu is the same as described in “[Help Menu](#)” on page 2-6.

Sync Playback Data Display Window

Refer to [Figure 4-28](#).

The display window shows the data files from each of the listed files in the right column. Note that the top three use a 315 MHz center frequency and the fourth center frequency is set to 1.0 GHz. In this example, the synchronization will use the top three listed signals as the fourth is not using the same center frequency and will not be evaluated or synchronized with the top three.

The frequency and capture bandwidth of the displayed signals are required to be as close as possible in order to perform a synchronization. Use the listed files and their parameters column to synchronize the signals.

Parameters Window

The signal parameters window displays the file parameters as shown in [Figure 4-31](#).

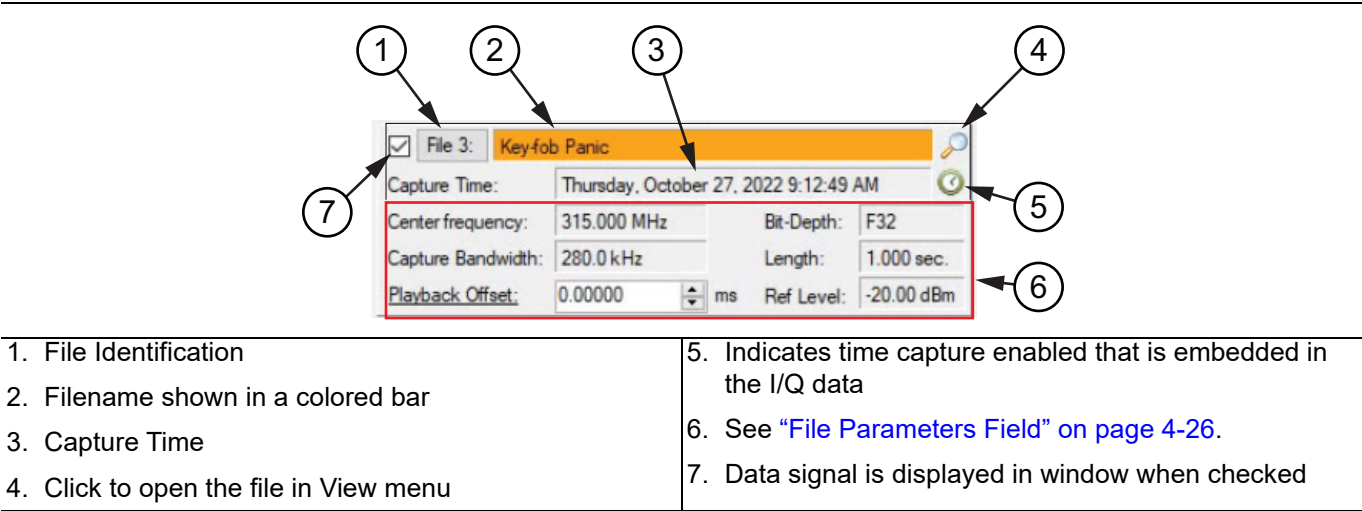
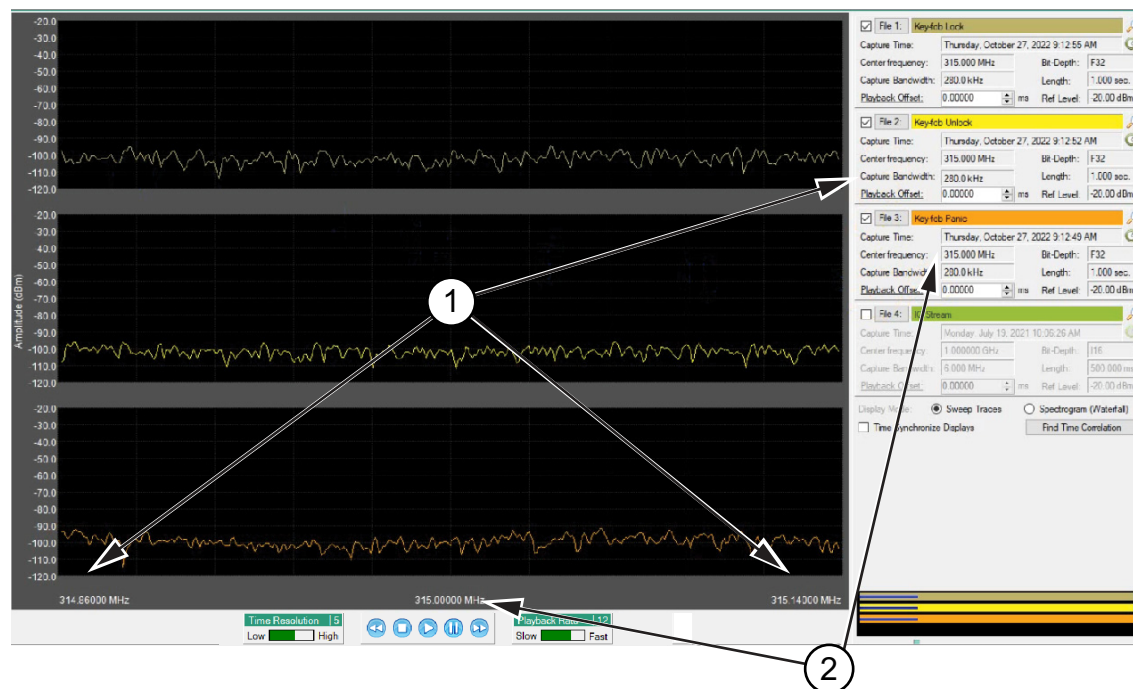


Figure 4-31. Signal Parameters Window

The signal data should have the same capture bandwidth and center frequency in order to synchronize as shown in [Figure 4-32](#).



1. Capture Bandwidth shown in the parameters settings and corresponding to the graph bandwidth
2. Center Frequency shown in the parameter settings and corresponding to the graph center frequency

**Figure 4-32.** Center Frequency and Capture Bandwidth

### File Parameters Field

The file parameters field displays the parameters described below.

**Center Frequency:** Displays the capture center frequency value. This value is not adjustable from this menu.

**Capture Bandwidth:** Displays the capture bandwidth value. This value is not adjustable from this menu.

**Playback Offset:** Displays the playback offset value as described in [“Finding the Offset” on page 4-29](#).

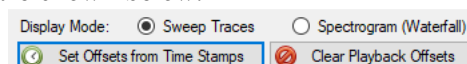
**Bit-Depth:** Displays the capture bit-depth value as described in [“Finding the Offset” on page 4-29](#).

**Length:** Displays the data length value. This value is not adjustable from this menu.

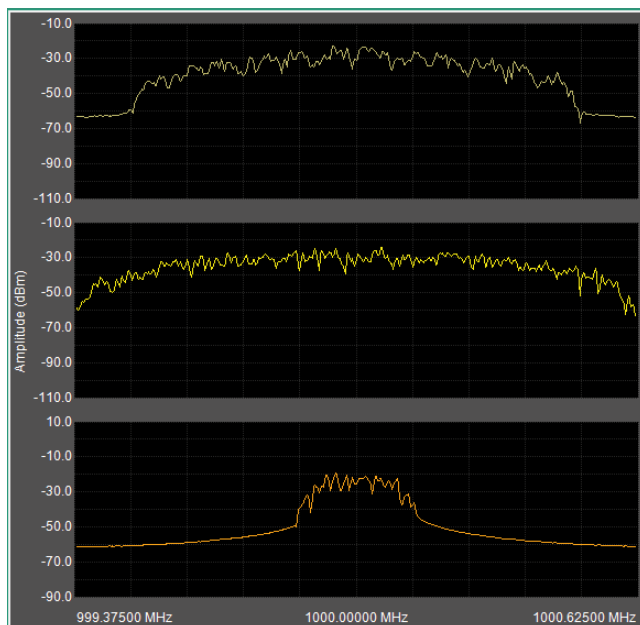
**Ref Level:** Displays the capture reference level value. This value is adjustable from this menu. Hover over the Ref. Level value. An “up-down” arrow appears over the value. Roll the mouse wheel to adjust the value. This tool can be used to adjust the display signal level if part of the signal is out of range when viewed.

### Sync Playback Display and Offset Tools

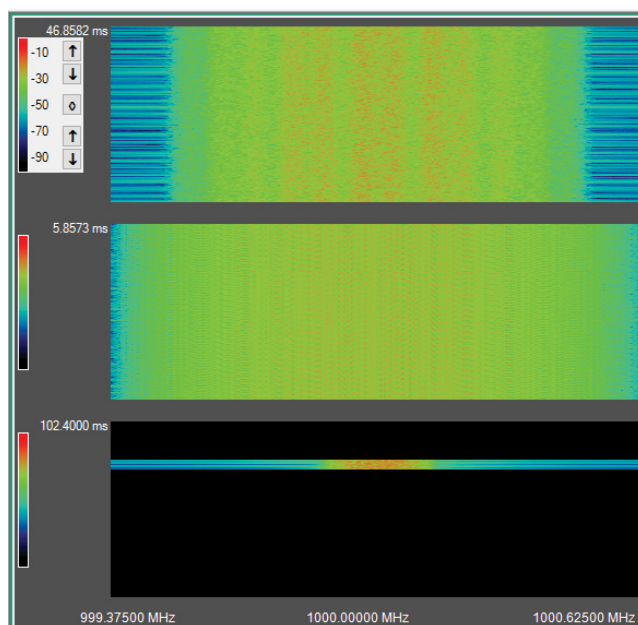
The display and offset tools are shown below.



**Display Mode:** Set the display to show the Sweep Traces view or Spectrogram view as shown in [Figure 4-33](#).



Sweep Traces View



Spectrogram (Waterfall) View

**Figure 4-33.** SyncPlayback Display Mode Views

Spectrogram view provides a heat map scale and controls as described below:

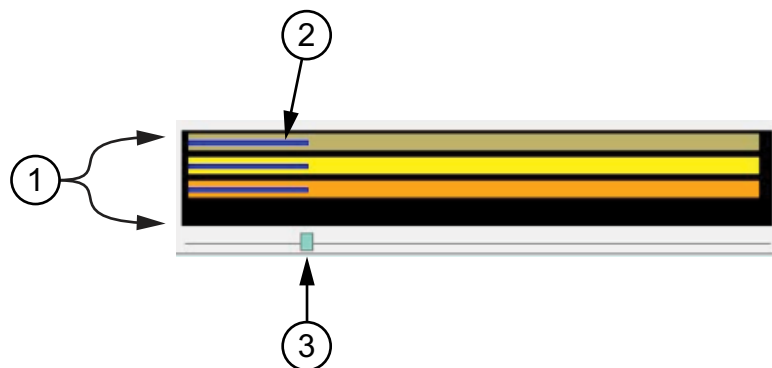
- Use the top pair of arrows to adjust reference level color mapping.
- Use the bottom pair of arrows to adjust the reference scale color mapping.
- Press the “0” button to reset the display to full scale (0 to -100 dBm).

**Set Offset from Time Stamps:** Press to use embedded time stamps to set playback offsets.

**Clear Playback Offsets:** Press to reset all playback offsets to zero. When synchronizing signals, setting the offsets to zero provides a synchronized offset starting point,

## Time Offset Bar Graph

The time offset bar displays time offset of the three data files as shown in [Figure 4-31](#). Each colored bar corresponds to the colored file name field displayed in [Figure 4-32](#). Note that the length of each data file in the file parameter window is 1.000 sec and is therefore the length of the bar represented in the graph. The time location in the Time Offset Graph is represented as a percentage of the sweep. The progress shows that each file sweep is at about 200 ms of time as indicated by the bar length. The signal peak of each graph occurs at a different segment of time. Initially, the signals are not synchronized. To view each signal as synchronized, adjust each signal to find the peak, then press the underlined “Playback Offset” button of each signal at the time offset. Although the signal length is 1.000 sec, the slider is used to find the Playback Offset as described in [“Finding the Offset” on page 4-29](#).



1. Data signal time offset bar graph
2. Time offset progress bar
3. Time offset slider

**Figure 4-34.** Time Offset Graph



## 4-7 Finding the Offset

Initially, the time offsets for the signals are not synchronized as shown in [Figure 4-35](#). The top signal is out of view. The second and third signals are not aligned.

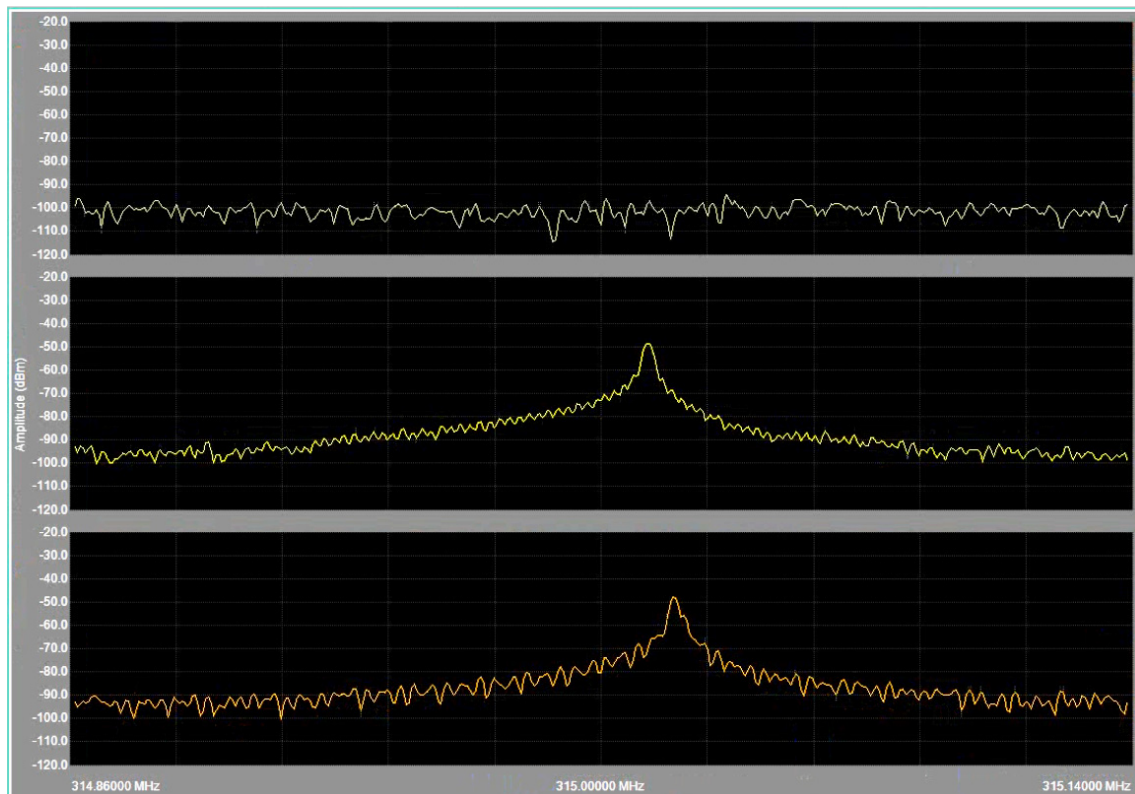


**Figure 4-35.** Unsynchronized Signals

### Locate Signal Peak

To locate a signal peak so that it can be synchronized with the other signals, move the Time Offset slider to the far left so that each progress bar is minimized to the beginning of the time offset graph as shown in [Figure 4-36](#).



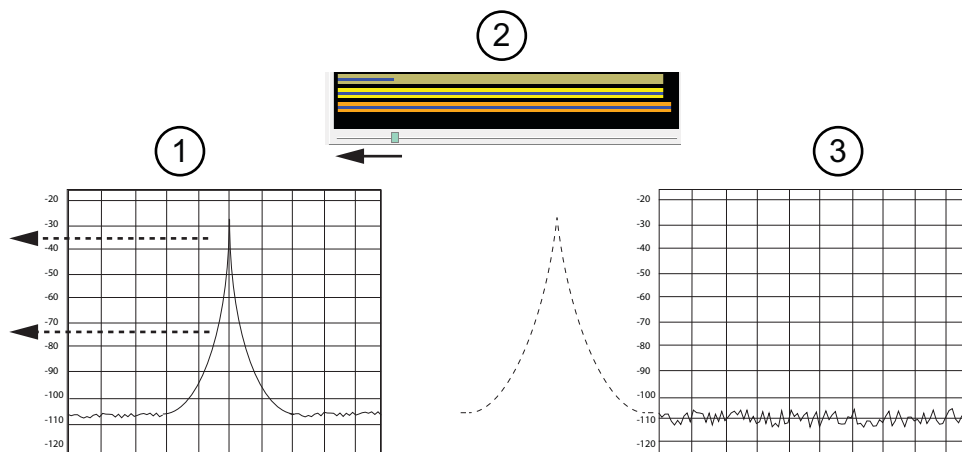
**Figure 4-36.** Minimize Offset Slider



### Approximate the Signal Synchronization

The signals synchronization is first performed as a rough estimate of the time offset between the signals.

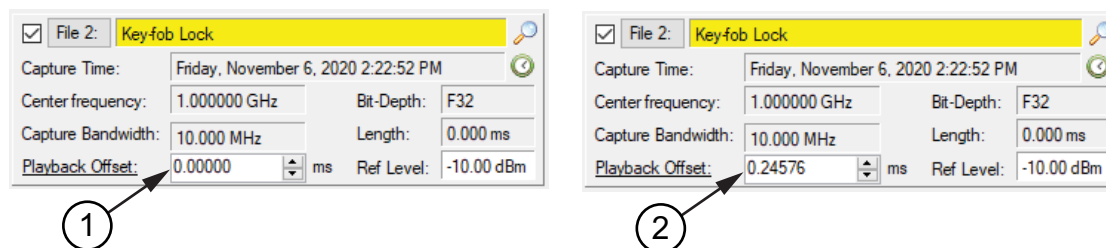
1. Move a signals sweeps using the time offset graph.
2. One at a time, locate each signal peak by moving the time offset slider slowly to the right until a peak appears in one of the data signal displays.
3. After a peak is found, move the slider slowly to the left until the peak just disappears at the left side of the screen as shown in [Figure 4-37](#). Do this for each signal. This is a roughly adjusted time offset.



1. Adjust signal to the left-side edge of display
2. Adjustment slider
3. Ideal adjustment

**Figure 4-37.** Synchronizing the Signals

4. Press “Playback Offset” in the parameters column for that signal. The offset value is then displayed in the Playback Offset field as shown in [Figure 4-38](#).
5. Perform the same process for the remainder of the signals displayed.



1. Playback Offset set to zero
2. Press Playback Offset to calculate the offset value

**Figure 4-38.** Playback Offset

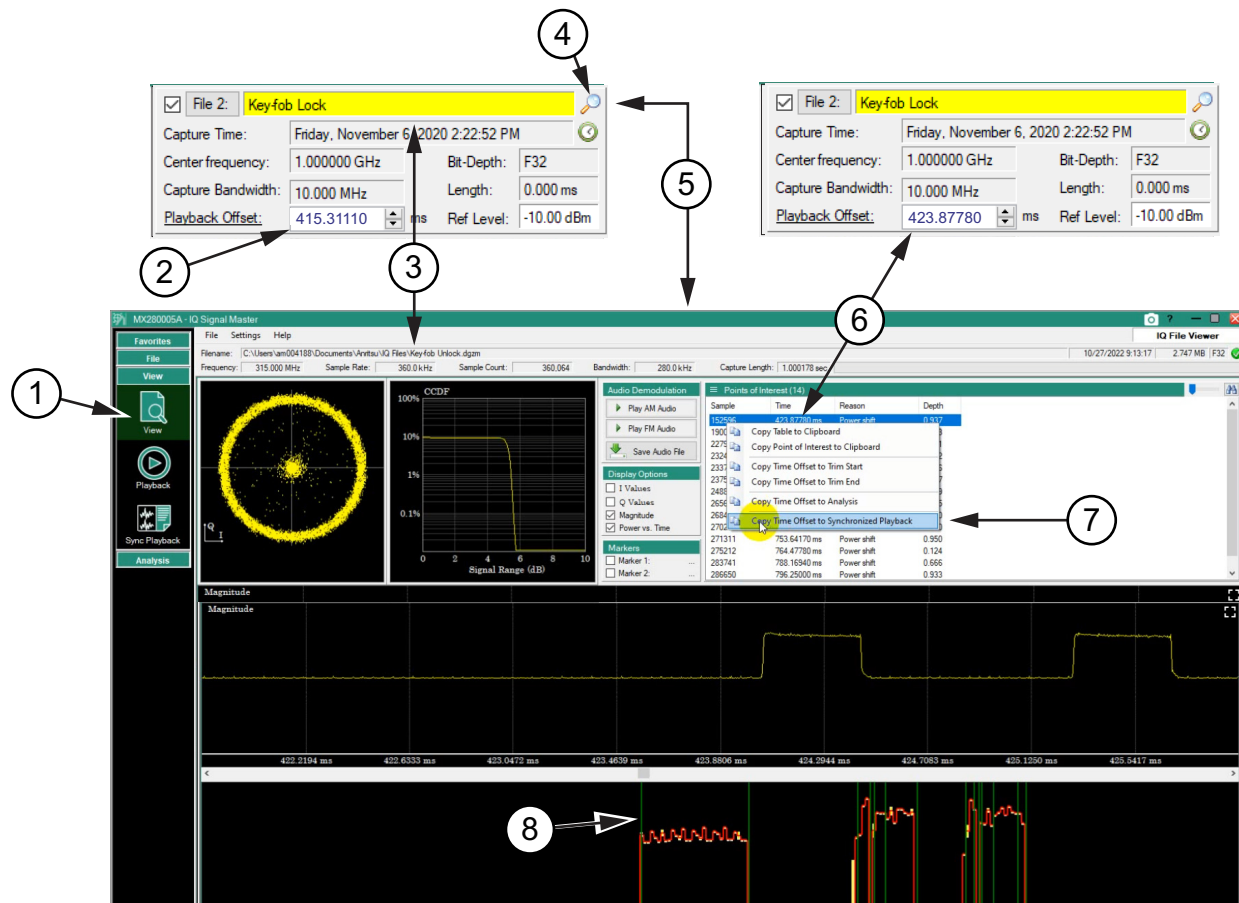
Note that the Time Offset bar-graph displays the time differentiation at intervals of time for each signal that the peaks occur when synchronized.

## Fine Tune the Synchronization

Use the “[Playback controls](#)” and press the playback button to view the signal sweep. The signals may not be perfectly aligned as a peak may drop in and out of view during the playback. To maximize the signals synchronization and alignment, use the View menu to fine-tune the signals starting time as described in “[Fine Tune Start of Offset](#)” on page 4-31.

### Fine Tune Start of Offset

Use the View menu to obtain a better aligned starting time offset for the signals as shown in [Figure 4-39](#).



1. View Menu
2. Playback Offset value before refining the signal alignment
3. View menu shows the same file as the parameter window
4. Magnifier Icon
5. Press magnifier icon to open View Menu.
6. Selected (highlighted) offset time value.
7. Right Click Points of Interest - Copy Time Offset to Synchronized Playback command
8. First Point of Interest Marker

**Figure 4-39.** Refine Offset Alignment

Refer to [Figure 4-39](#). In this example, find the best playback offset of File 2 - Key-fob Lock.

1. Press the magnifier icon to show the View menu. The View menu displays the signal data of the Key-fob Lock file.
2. Right-click the starting time in the Points of Interest table. In the Leading edge of the first Points of Interest signal. (This is the best starting time for the offset entry).
3. From the context menu list that is displayed, click “Copy Time Offset to Synchronized Playback”. The time value (ms) from the View menu is exported to the Playback Offset field of the SyncPlayback menu.
4. Repeat the process for each file window Playback Offset value.

The result is a maximized offset time alignment as shown in [Figure 4-40](#). Use the control buttons at the bottom of the window to sweep the signals with the same variations in the signal amplitudes, start, and stop times.

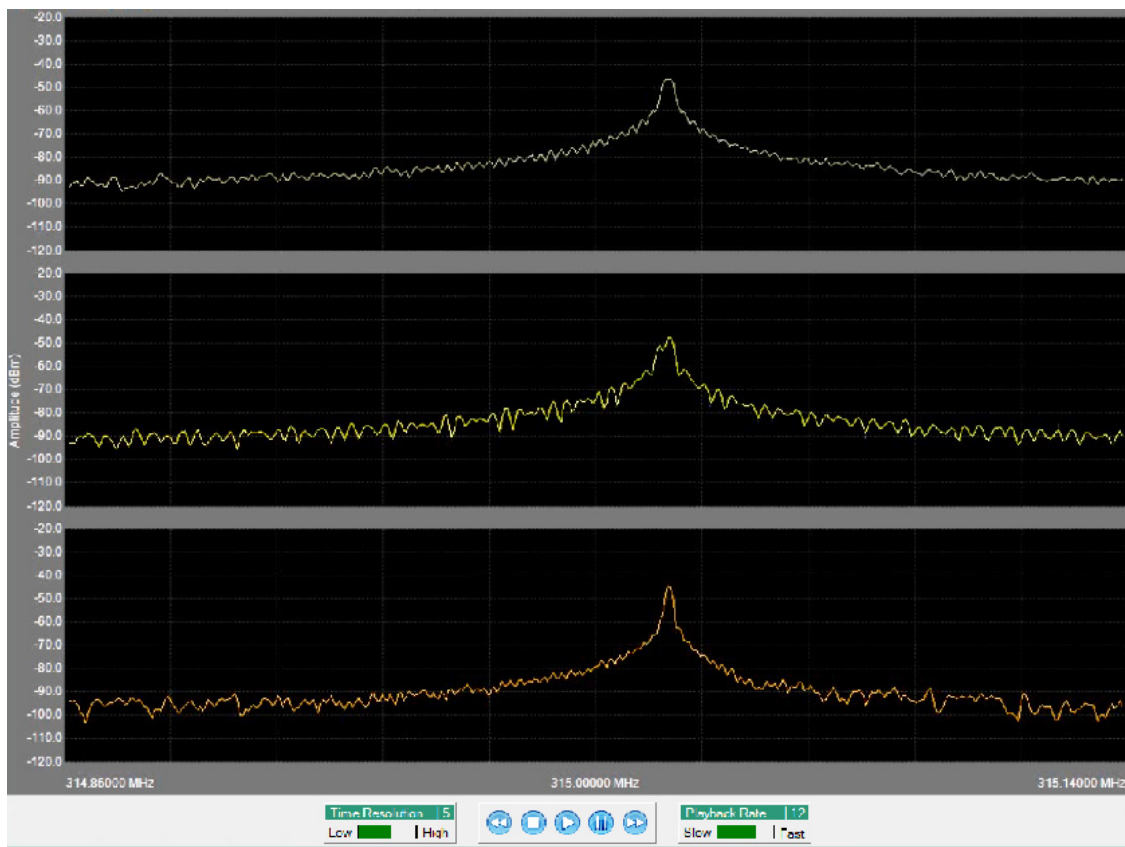


**Figure 4-40.** Signal Synchronization

# Chapter 5 — Analysis Mode

## 5-1 Introduction

This chapter describes the Analysis Mode menus, functions, parameter contents, and the setting methods for the analyzing IQ data files. The Analyze mode includes:

“5G Frame Analysis Menu”

“Analyze Menu” on page 5-11

## 5-2 5G Frame Analysis Menu

The 5G Frame Analysis menu provides tools to:

- Capture a streamed data set using a remote Anritsu remote monitor and perform 5G analysis.
- Load stored signals from an Anritsu Spectrum analyzer and perform 5G analysis.

The Synchronization Signal Block (SSB) can then be located and the parameters loaded back into the spectrum analyzer for demodulation. The 5G Frame Analysis menu is shown in [Figure 5-1](#).

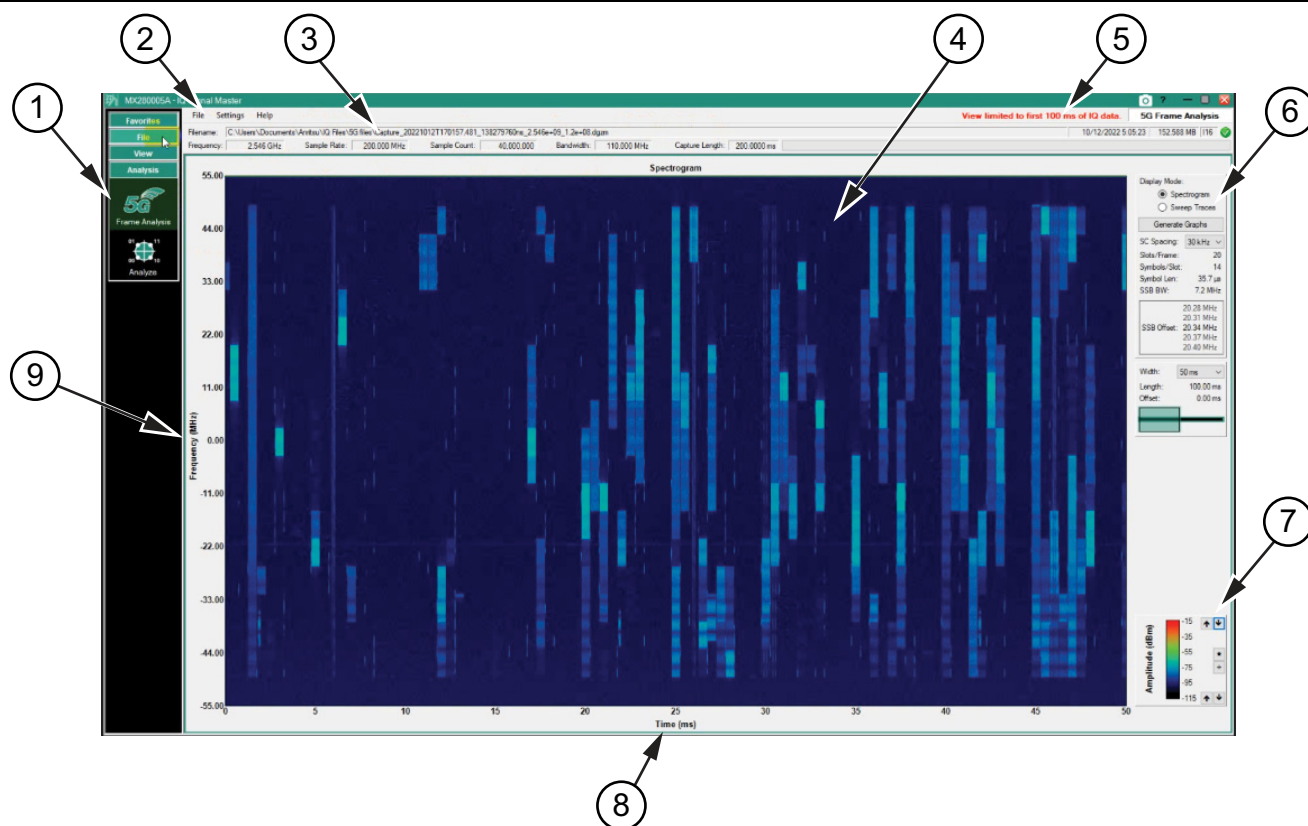


**Figure 5-1.** 5G Frame Analysis Menu

- 1. 5G Frame Analysis Button
- 2. Menu Bar
- 3. Data File
- 4. Analysis Window
- 5. View limited to first 100 ms of IQ data. (The signals analyzed capture length is 200 ms as indicated in the parameters window, but the 5G frame analysis view is limited to 100 ms).
- 6. 5G Frame Analysis Tools Window
- 7. Spectrogram Display Controls
- 8. Horizontal Axis - Time (ms)
- 9. Vertical Axis - Frequency (MHz)

Figure 5-1. 5G Frame Analysis Menu (Continued)

5G Frame Analysis Toolbar

The 5G Frame Analysis toolbar is shown in Figure 5-2.

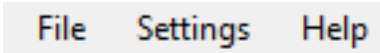


Figure 5-2. 5G Frame Analysis Toolbar

File Menu

Displays the 5G Analysis File menu as shown in Figure 5-3.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A screenshot of the 'File' menu. It contains the following items: 'Load IQ Data File', 'Recent IQ Files' (with a right-pointing arrow), 'Recent Captured Files' (with a right-pointing arrow), 'Import 5G Bin File' (with a 5G icon), '5G Capture from Instrument' (with a 5G icon and a download icon), 'Reload IQ Data' (with a circular arrow icon), and 'Exit' (with a red X icon). The 'Exit' item has the keyboard shortcut 'Ctrl+X' next to it. | <p><b>Load IQ Data File:</b> Browse to find and load an IQ file</p> <p><b>Recent IQ Files:</b> Open to display the recent IQ files that have been viewed. Basic information is stored and subsequently when the same file is opened again it is very fast. Along with the basic file description, user settings such as markers are also stored in the same place.</p> <p><b>Recent Captured Files:</b> Open to display the recently captured IQ files. This command minimizes the need to browse the file folders to search for the recently captured and saved IQ files.</p> <p><b>Import 5G Bin File:</b> Open the browse dialog to load a stored data file for 5G frame analysis. A selected .bin file will automatically open to a .dgzm file.</p> <p><b>5G Capture from Instrument:</b> Opens a 5G capture dialog as shown. Enter the IP address of the remote monitor or analyzer for direct communication with the MX280005A 5G Frame Analysis menu to initiate a live connection capture, data transfer, and generate the images with the single button press.</p> <div>A screenshot of the '5G Capture' dialog box. It has a title bar '5G Capture' with a close button (X). The text inside says 'Capture 5G data for frame analysis. Enter the remote monitor's host name or IP address:'. There are 'OK' and 'Cancel' buttons on the right. At the bottom, there is a text input field containing the IP address '192.168.0.9'.</div> <p><b>Reload IQ Data:</b> Reload the most recent viewed file.</p> <p><b>Exit:</b> Exits the program.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 5-3. 5G Frame Analysis File Menu

Settings Menu

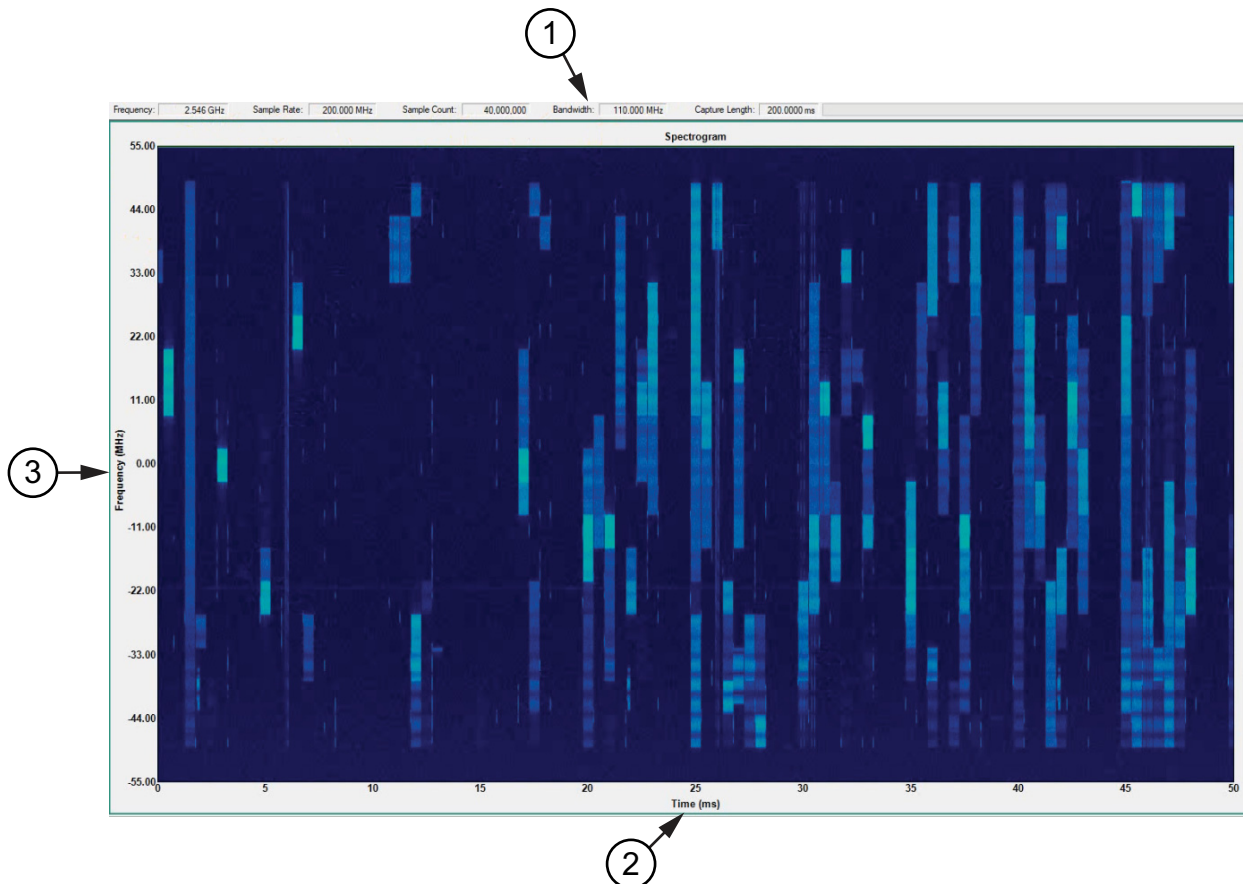
The Settings menu is the same as described in “Settings Menu” on page 2-4.

## Help Menu

The Help menu is the same as described in [“Help Menu”](#) on page 2-6.

## 5G Spectrogram View

The 5G spectrogram view below provides a graphical display with the horizontal axis in time and the vertical axis is in frequency. The frequency is centered at 0 MHz so that the 110 MHz frequency bandwidth, shown in the parameters panel, is covered with 55 MHz on each side of the centered 0 MHz frequency.



1. Data Bandwidth

2. Time Axis

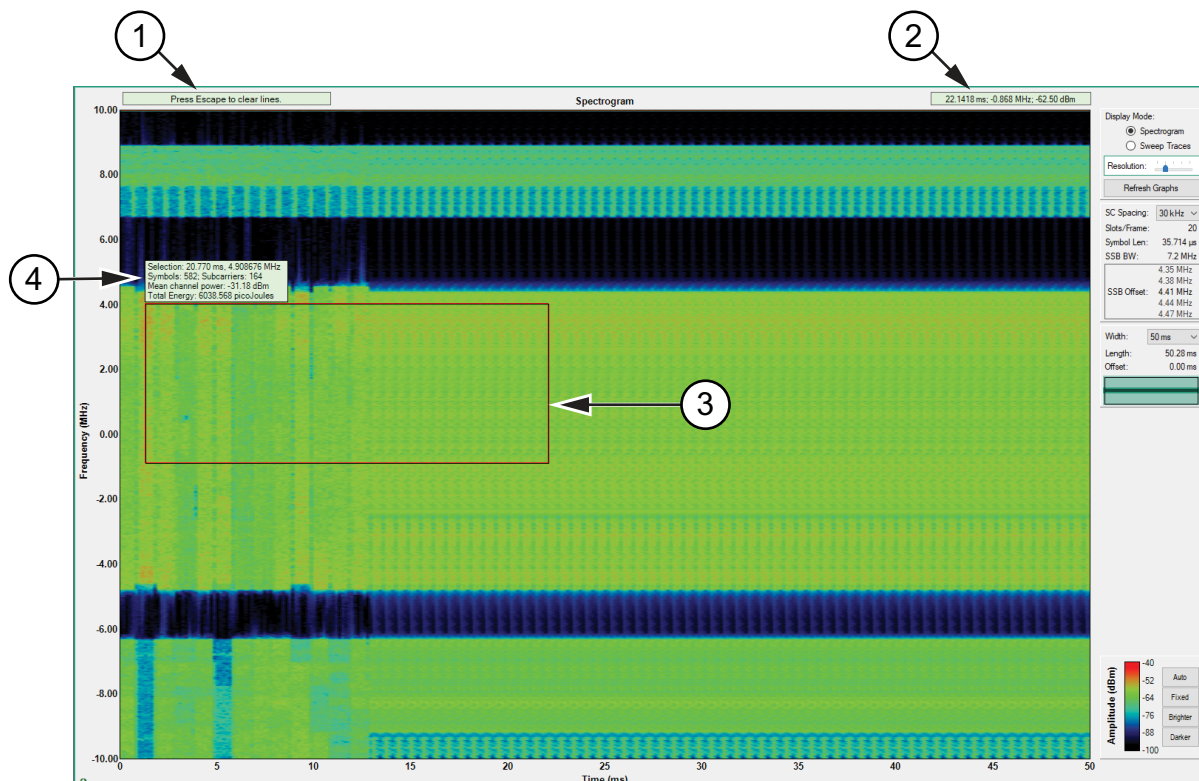
3. Frequency Axis

**Figure 5-4.** 5G Spectrogram View



## Cursor Control

Moving the cursor over the spectrogram provides a set of cross-hairs that identify the cursor position as a readout in time, frequency, and power level. Left-click for the SSB cursor position. Shift right-click and drag the cursor to draw a block over an area as shown in [Figure 5-5](#). The details of the area enclosed is shown in a readout as shown in [Figure 5-6](#). Press the keyboard Esc key to reset to the cursor readout.



1. Press Keyboard Escape to clear lines
2. Cursor location readout
3. Expanded red rectangle lines
4. Red rectangle area readout

**Figure 5-5.** Obtain IQ Data Details

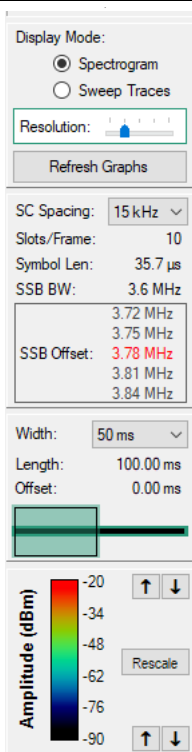
The details provide specific data parameters of the area captured.

Selection: 20.770 ms, 4.908676 MHz  
 Symbols: 582; Subcarriers: 164  
 Mean channel power: -31.18 dBm  
 Total Energy: 6038.568 picoJoules

**Figure 5-6.** Red-Bordered IQ File Details

## 5G Frame Analysis Tools Window

The 5G frame analysis tools window is described in [Figure 5-7](#)



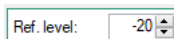
**Display Mode:** Provides Spectrogram or Sweep Trace Modes for 5G Frame Analysis.

**Spectrogram:** Display the Spectrogram view of the analyzed signal. Displayed when the Spectrogram radio button is selected and the Generate Graphs button is pressed.

**Sweep Traces:** Display the Sweep Traces (density plot) view of the analyzed signal. Displayed when the Sweep Traces radio button is selected and the Generate Graphs button is pressed.

**Resolution:** The Resolution slider is available when in Spectrogram mode. Use the slider to adjust the resolution of the spectral display. Press the Refresh Graphs button to update the display.

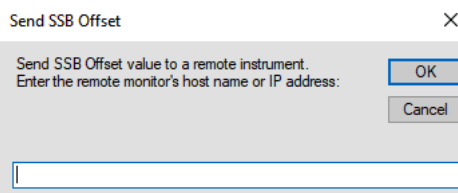
**Ref. level:** The Reference Level window shown below is available when in Sweep Trace mode. Use the Reference Level window to adjust the power level of the sweep trace display. Press the Refresh Graphs button to update the display.



**Refresh Graphs:** Press to refresh and view the Spectrogram mode display or Sweep Traces mode display.

**SC Spacing:** Use the drop-down to set a Subcarrier Spacing (SC). The set SC Spacing adjusts the Slots/Frame, Symbol Length, and SSB BW of the capture criteria.

**SSB Offset:** The (SSB) offset window provides the frequency readout of the SSB. Click an offset to display the dialog box shown below. See [“Send SSB to Signal Analyzer”](#) on page 5-7.



**Width:** Set of the spectrogram time axis view bandwidth as 10, 20, 30, 40, or 50 ms.

**Length:** Total file length of spectrogram view.

**Offset:** Use the slider to scan the spectrogram length in time (ms) (Width set).

**Color Density:**

**Spectrogram Mode:** Use the top arrows to adjust the spectrogram power reference color to be lighter or darker. Use the bottom arrows to adjust the signal power reference scale density.

**Sweep Traces Mode:** The color density plot provides a visual of the power level density of the displayed trace. There are no adjustments in Sweep Traces mode.

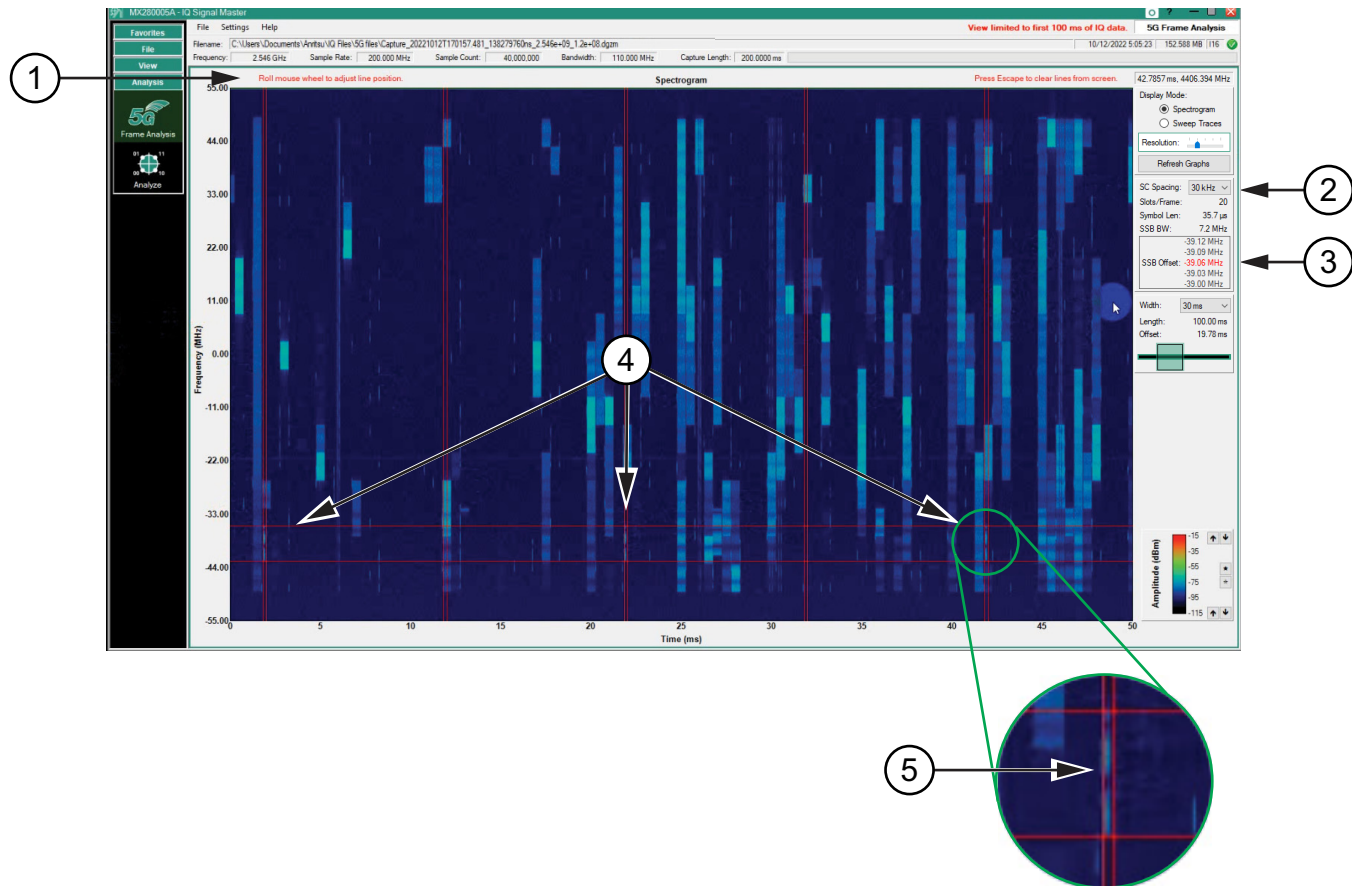
**Rescale:** Press to autoscale the color map in Spectrogram mode.

**Figure 5-7.** 5G Frame Analysis Tools



## Locate SSB Example

Locate the SSB to perform the 5G frame analysis as shown in [Figure 5-8](#)



1. Grid Mouse Instruction
2. Sub Carrier Spacing
3. SSB Offset
4. Locate SSB signal
5. Width and height of SSB with SSB located in center.

**Figure 5-8.** SSB Analysis

### Locate the SSB Example

Refer to [Figure 5-8](#).

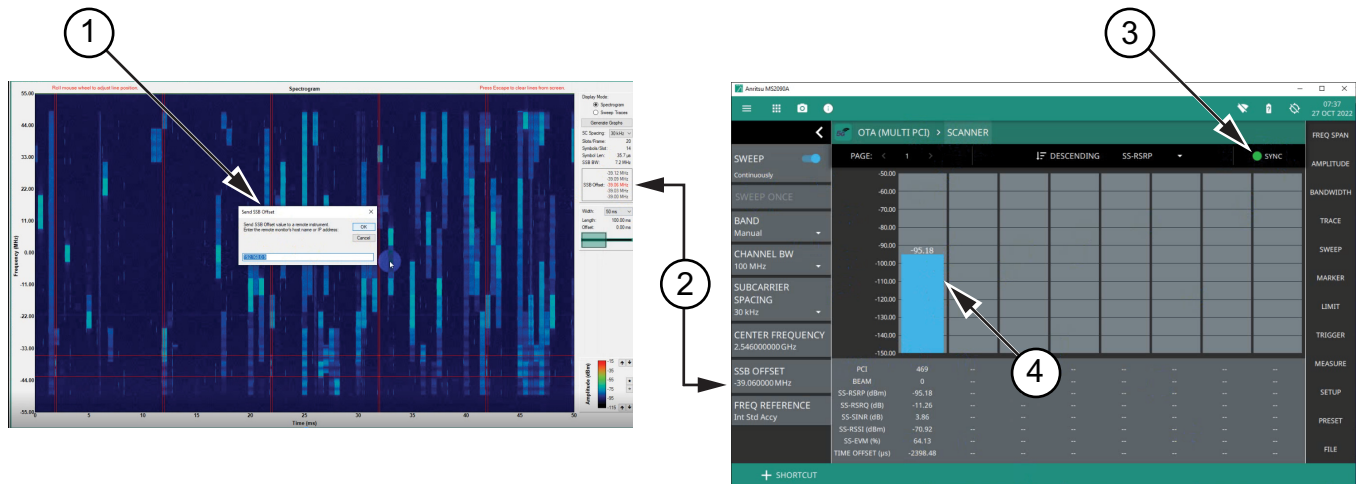
1. Set the Display Mode to Spectrogram.
2. Set the SC Spacing (this example is set to 30 kHz).
3. Click the spectrogram graph to display the SSB grid. The double grid lines display the width and height of the SSB.
4. Scan the spectrogram until the SSBs are identified as they align in the time intervals (20 ms) as shown. Once the SSB has been located, roll the mouse to optimize the SSB alignment between the SC spacing grid lines. This is the SSB as indicated in the red font of the SSB offset window.

## 5-3 Send SSB to Signal Analyzer

When the SSB has been identified, it is ready to be sent to a spectrum analyzer to be demodulated.

### Connect to Analyzer

Send the SSB signal to the analyzer to demodulate as shown in [Figure 5-9](#).



1. Send SSB Offset dialog.
2. SSB Offset sent from 5G frame analysis program to spectrum analyzer.
3. Sync indicator
4. SSB Offset Signal captured on the MS2090A and the power strength is indicated at the top of the power bar.

**Figure 5-9.** SSB Offset Captured on Analyzer

### Send SSB

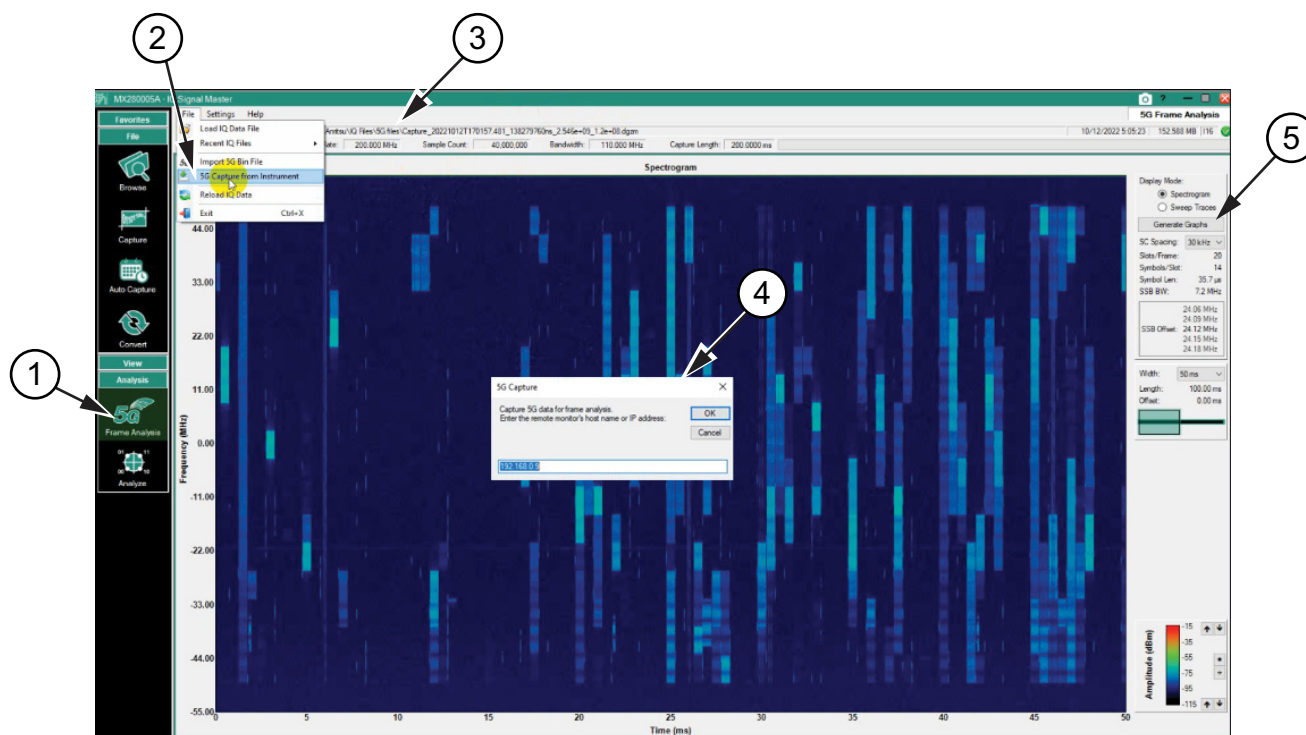
1. Click the SSB Offset value. A SSB Offset IP address dialog is shown in the spectrogram window.
2. Enter the IP address of the Spectrum Analyzer into the Send SSB Offset dialog.
3. Watch the MS2090A SYNC indicator. If it is red, the SSB is not synced. When it turns a solid green (not blinking), the SSB is synced and the power level is displayed on the MS2090A.
4. The signal is ready for demodulation with the MS2090A spectrum analyzer.

For more on the MS2090A and 5G NR measurements, visit the Anritsu website at:

<https://www.anritsu.com/en-us/> and search for the MS2090A product page.

## Import 5G IQ Data File from MS2090A

Importing 5G IQ data from an Anritsu Analyzer, such as the MS2090A, can be performed in a few steps. Use the MX280005A IQ Signal Master 5G Frame Analysis File menu to import the 5G capture file from an MS2090A Spectrum Analyzer.



1. 5G Frame Analysis Menu
2. File Menu - 5G Capture from Instrument command
3. File Loaded from MS2090A Spectrum Analyzer
4. 5G Capture IP address dialog
5. Capture Graphs button

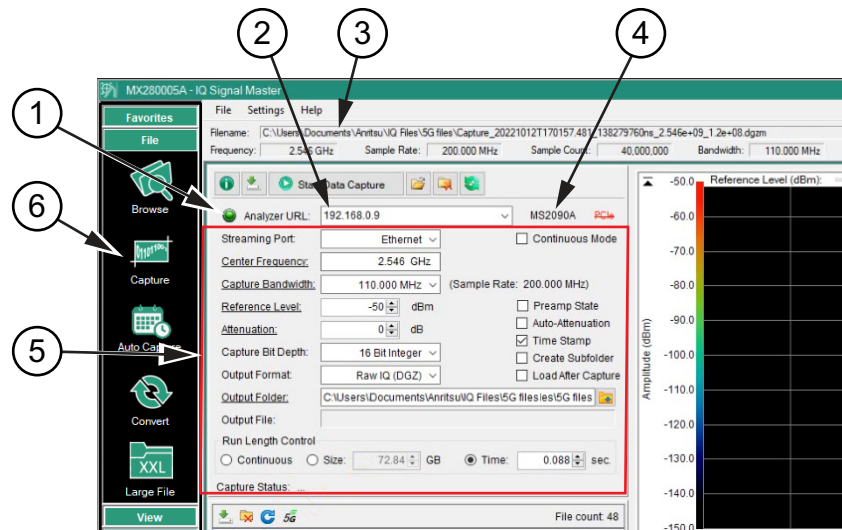
**Figure 5-10.** 5G Capture Using One Step

To import the IQ data for 5G analysis from an analyzer, refer to [Figure 5-10](#)

1. Click the 5G Frame Analysis button.
2. Click the File menu to display the pull-down menu.
3. Click the 5G “Capture from Instrument” command. The 5G Capture dialog is displayed.
4. Type the IP address of the 5G Capture dialog. This command initially simulates pressing the 5G CAPTURE button on the MS2090A. It will take a few seconds to capture the data and load the file into the MX280005A IQ Signal Master program. The .bin file imported from the MS2090A converts it to a .dgzm file in the MX280005A program automatically.
5. From the 5G Frame Analysis menu, press the Generate Graphs button to display the 5G data in the Spectrogram display.

## Obtaining Data for 5G Analysis

Use the Capture menu to obtain 5G data from a stored .dgzm file as shown in [Figure 5-11](#).



1. URL Connected Indicator
2. URL IP Address
3. Loaded File
4. Displays the Analyzer connected through the indicated IP Address
5. Set up Parameters
6. Capture Menu

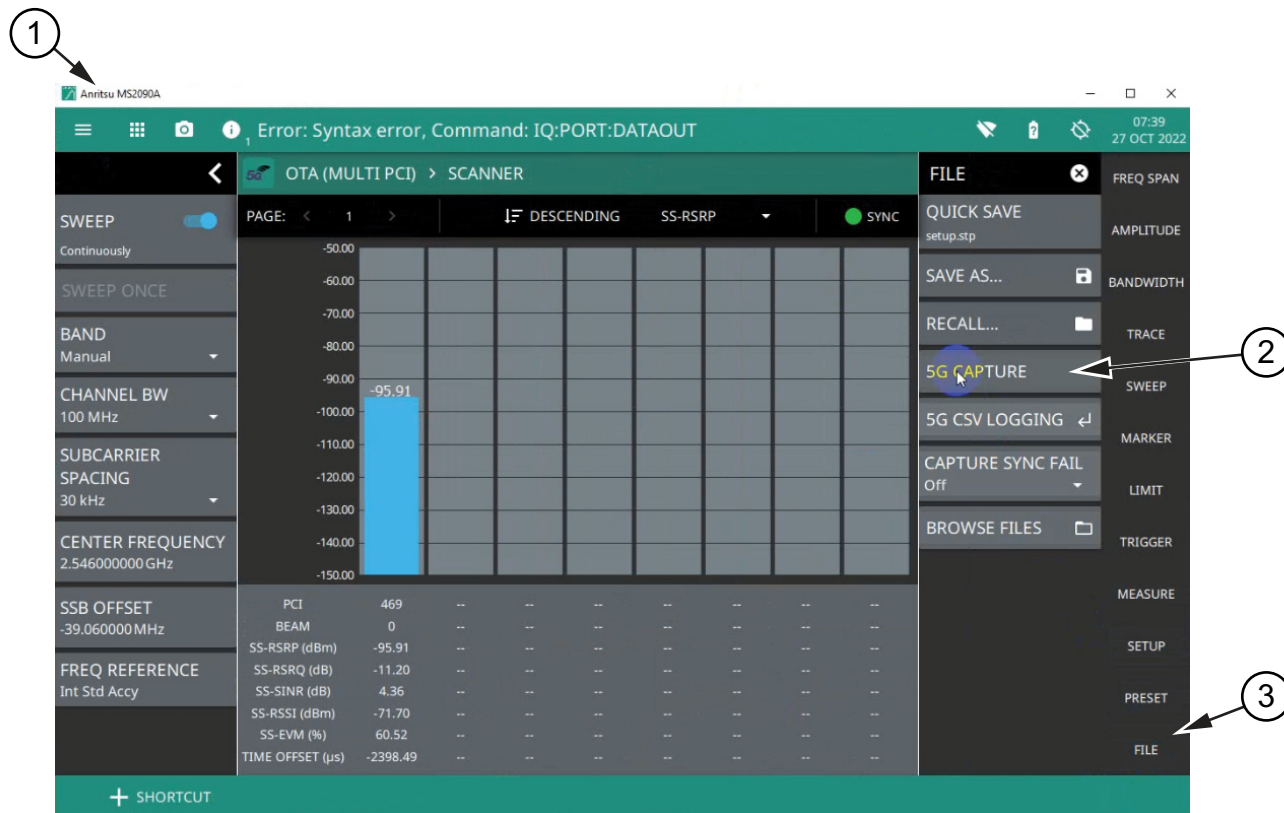
**Figure 5-11.** Capture Menu

1. Click the File menu.
2. Load the .dgzm file. The filename appears in the Filename field.
3. Set up the capture parameters such as Center Frequency, Center bandwidth, Reference Level and any settings required for the 5G analysis.
4. Type the URL of the spectrum analyzer into the URL field. The URL connected indicator will turn green when connected. The model number of the spectrum analyzer will display to the right of the URL field.
5. Go to the 5G Frame Analysis menu as shown in [Figure 5-8 on page 5-6](#).
6. Press the Generate Graphs button.

## Import from a MS2090A

Using an MS2090A to create IQ data and transfer to the MX280005A IQ Signal Master. Once data parameters are set up on the MS2090A, the data file created in the MS2090A can be exported to the MX280005A software to perform 5G analysis.

Pull into to MX280005A IQ Signal Master Software



1. Anritsu MS2090A Spectrum Analyzer
2. 5G Capture Button
3. File Menu

**Figure 5-12.** MS2090A 5G Capture Menu

To import IQ data for a MS2090A for 5G Frame analysis:

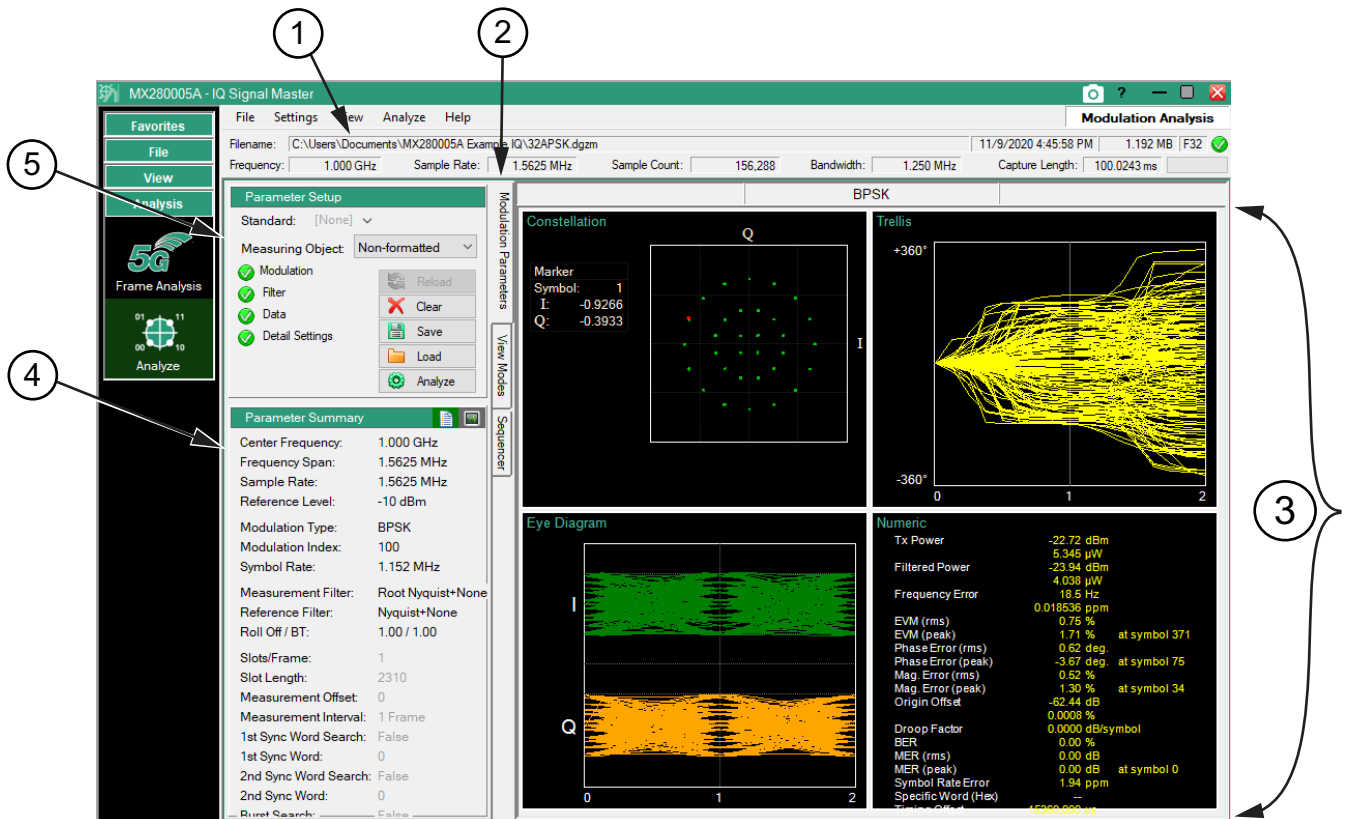
1. Refer to [Figure 5-11 on page 5-9](#).
2. Type the URL of the spectrum analyzer into the Capture menu URL field. The URL connected indicator will turn green when connected. The model number of the spectrum analyzer will display to the right of the URL field.
3. Press the File button on the MS2090A spectrum analyzer to display the 5G CAPTURE menu.
4. Press 5G CAPTURE to import the data to the MX280005A software program. Saves a 60 ms capture length of data that will be sent to the MX280005A IQ Signal Master for 5G analysis.
5. Go to the 5G Frame Analysis menu shown in [Figure 5-8 on page 5-6](#).
6. Load the .dgzm file.
7. Press the Generate Graphs button. The 5G spectrogram is displayed and is ready for analysis.

Double-click a file to send to the Output Folder. 5G frame analysis can be performed by loading the stored .bin folder.



## 5-4 Analyze Menu

The Analyze menu provides a complete analysis palette for captured IQ signals as shown in [Figure 5-13](#).



1. File loaded for IQ Signal Master. Load the file using the Toolbar File menu.
2. Analysis tabs:
  - The Analyze Help menu is the same as described in [“Help Menu”](#) on page 2-6.
  - [“View Modes Tab”](#) on page 5-42
  - [“Sequencer Tab”](#) on page 5-51
3. Analysis Window: Displays the modulation schemes selected in the [“View Modes Tab”](#) on page 5-42.
4. See [“Parameter Summary”](#) on page 5-40.
5. See [“Using Parameter Setup”](#) on page 5-16.

**Figure 5-13.** Analyze Menu

### Analyze Menu Bar

The Analyze menu bar is shown in [Figure 5-14](#)



Figure 5-14. Analyze Menu Bar

### File Menu

Displays the Browse View menu command as shown in [Figure 5-15](#).

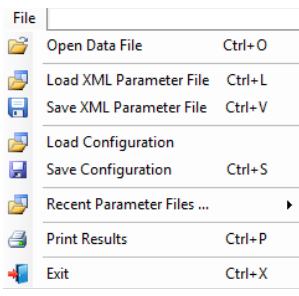
|                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Open Data File:</b> Open to display the recent data files that have been viewed.</p> <p><b>Load XML Parameter File:</b> Browse the XML parameter files to load. XML Parameter files contain all of the parameter settings used in the analysis. These files are user created and are a snapshot of previous settings.</p> <p><b>Save XML Parameter File:</b> Save an .xml file to a user specified file location. Saved XML Parameter files contain all of the parameter settings used in the analysis.</p> <p><b>Load Configuration:</b> Load from a user specified file location. Configuration files have the same information as XML parameter files and also include application settings such as the data file, active output view modes, screen capture and printing settings, etc.</p> <p><b>Save Configuration:</b> Save to a user specified file location. Saved Configuration files include the analysis parameters and also application settings such as the data file, the active output views, screen capture and printing settings, etc.</p> <p><b>Recent Parameter Files:</b> For convenience, provides a list of recently saved parameter and configuration files. Click a file to open.</p> <p><b>Print Results:</b> Opens the Print dialog. See <a href="#">"Print Results"</a>.</p> <p><b>Exit:</b> Close to exit the program.</p> |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 5-15. Analyze File Menu

Print Results

To print the analyzed data:

- 1. Click the File menu in the Analyze menu bar.
- 2. Click Print Results.

The printed data provides a IQ Signal Master Report as shown in [Figure 5-16](#). The application settings dialog includes options for printed output as shown in [Figure on page 3-3](#).

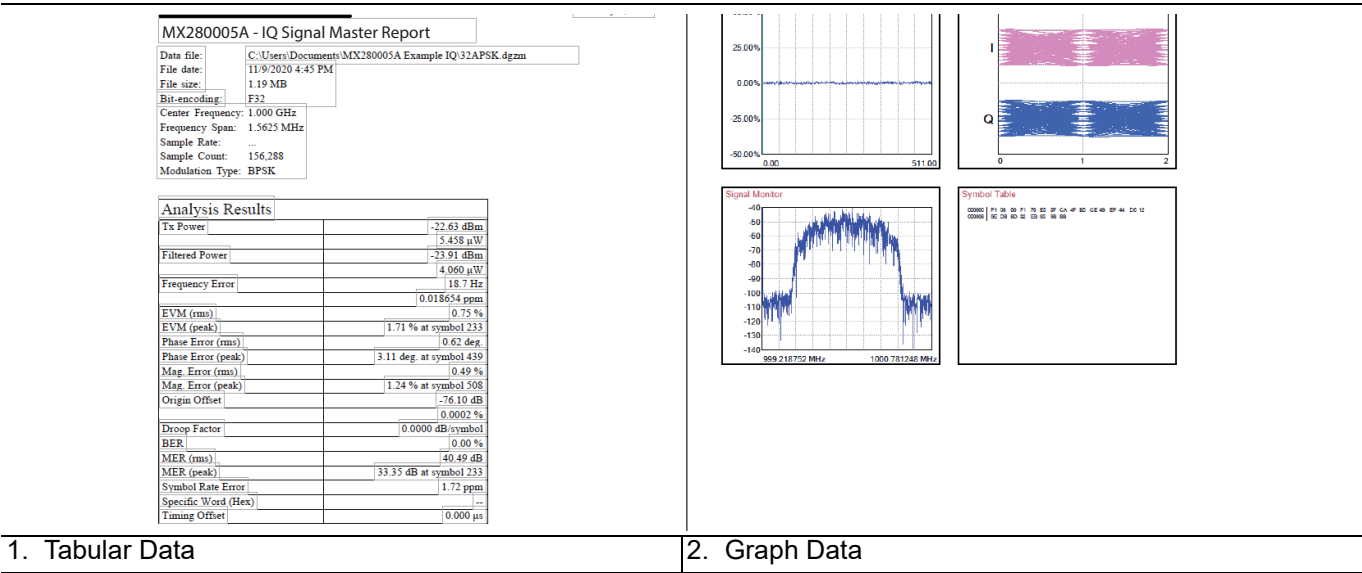


Figure 5-16. Analyze - Print Results

Settings Menu

The Analyze Settings menu is the same as described in [“Browse IQ Data Files” on page 3-3](#).

View Menu

Displays the Browse View menu command as shown in [Figure 5-17](#).

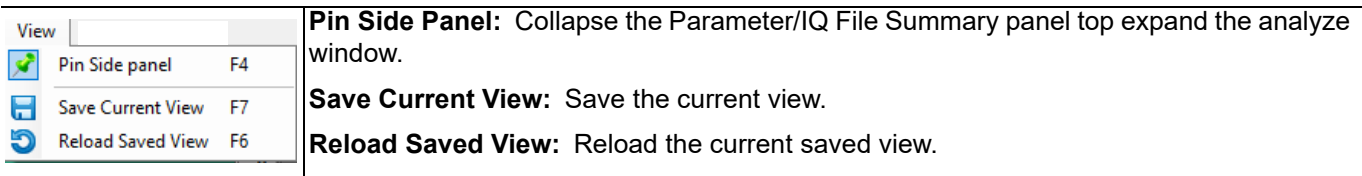


Figure 5-17. Analyze View Menu



Analyze Menu

The process menu command is shown in [Figure 5-18](#).

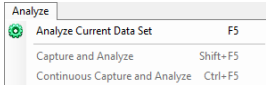
|                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Analyze Current Data Set:</b> Perform IQ data analysis. Performs same function as the Analyze button in the <a href="#">“Modulation Parameters Tab”</a> on page 5-15.</p> <p><b>Capture and Analyze:</b> Press to capture and analyze a vector signal from an active analyzer. Capture needs to be preconfigured in the Capture Menu display screen as described in <a href="#">“IQ Acquisition Parameters Settings”</a> on page 3-9.</p> <p><b>Continuous Capture and Analyze:</b> Performs a capture and analysis as described above, but runs continuously until stopped.</p> |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 5-18. Analyze Menu

Help Menu

The Help menu is the same as described in [“Help Menu”](#) on page 2-6.

## 5-5 Modulation Parameters Tab

The Modulation Parameters tab is shown in [Figure 5-19](#).

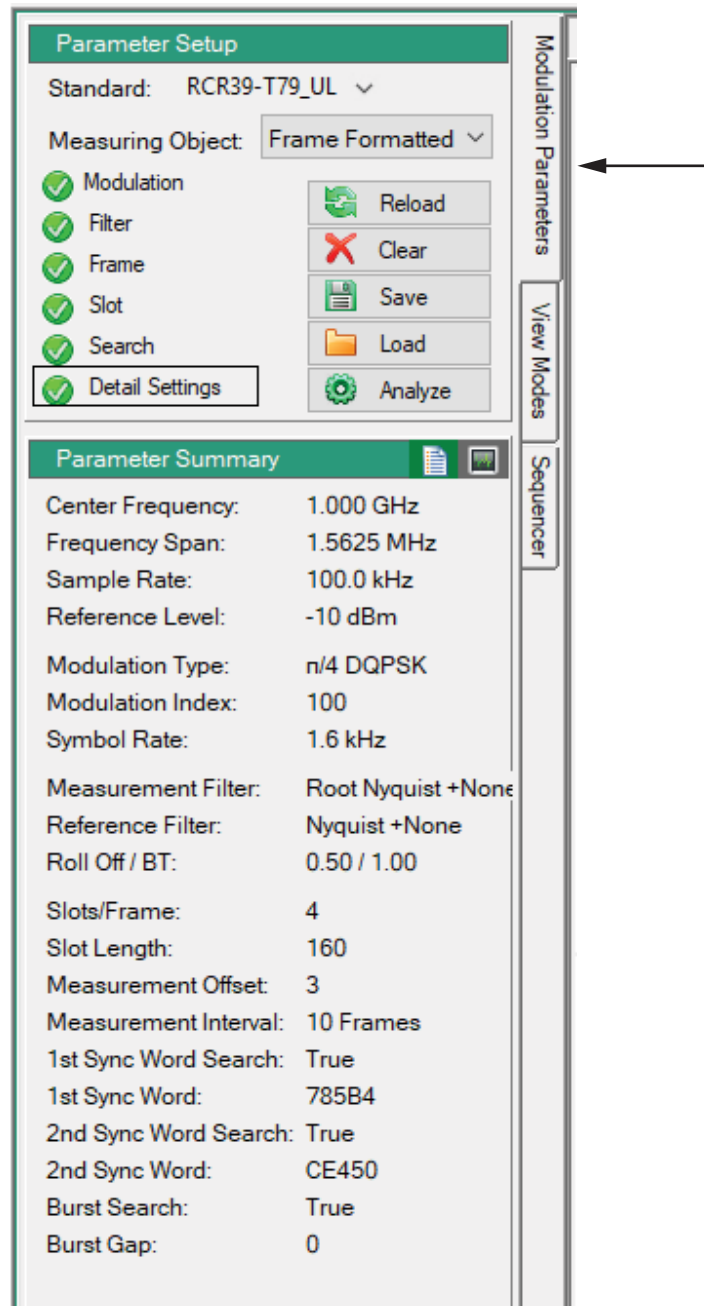
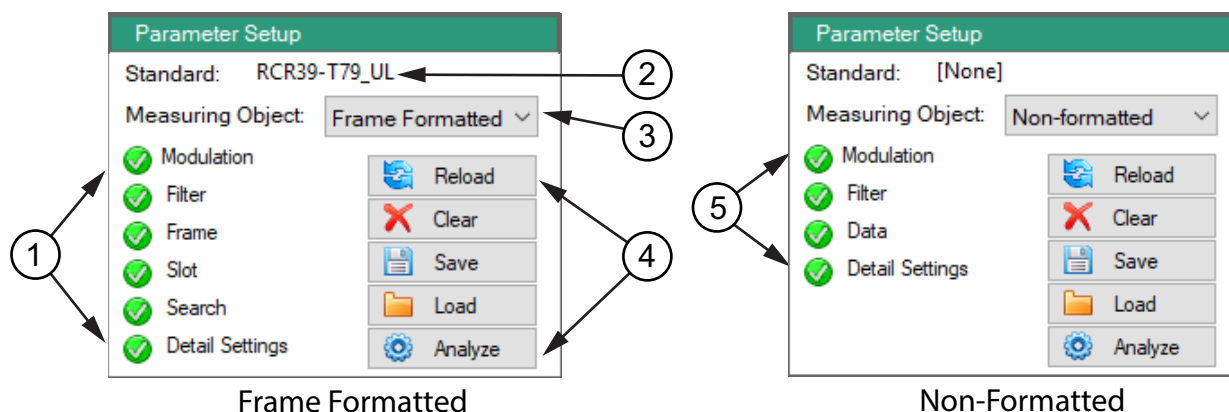


**Figure 5-19.** Modulation Parameters Tab

## Using Parameter Setup

Parameter Setup provides the Modulation type settings and related parameters setup. See [Figure 5-20](#).



1. Modulation Analysis Parameter Setup Buttons (Frame Formatted)

2. **Standard Template:** (Optional; loads a set of standards oriented predefined parameter values.) See [“Standard Setup” on page 5-17](#).

3. **Measuring Object:** Set as Frame-Formatted or Non-Formatted.

4. **File Management:** Press to set file actions.

5. Modulation Analysis Parameter Setup Buttons (Non-Formatted)

**Figure 5-20.** Parameter Setup Menus

## Entering Parameter Values

The full parameter set is large and it can be difficult to step through all of the dialogs and set meaningful values. Often the most efficient way to set parameter values is to load a file that closely matches your data set, then make manual changes as necessary.

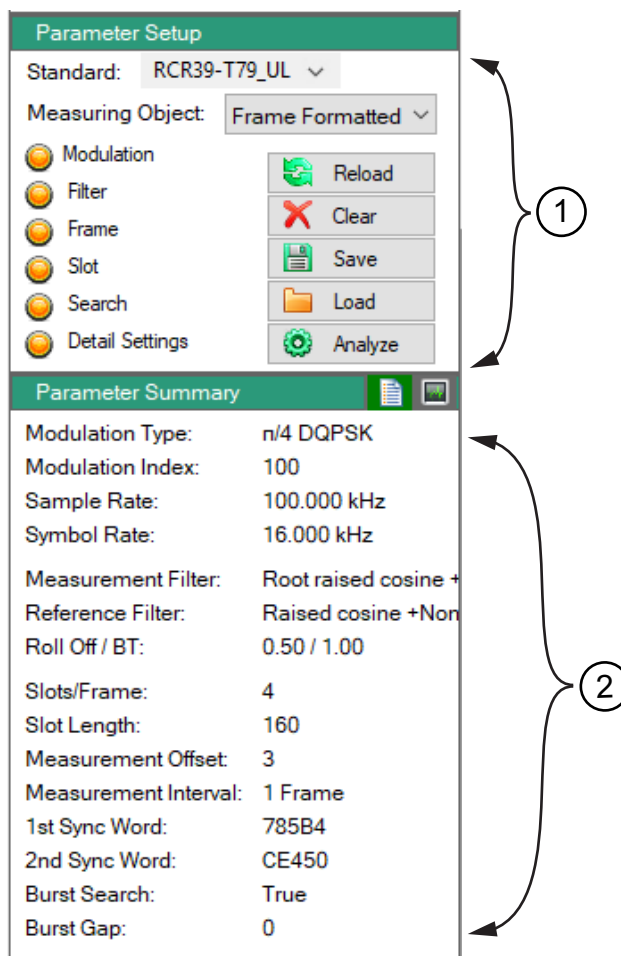
If starting from scratch, you can often get very close with just two parameters: the modulation scheme (i.e. 64-QAM or 2-FSK) and the symbol rate. If these two are set correctly, you can often accept default values on all other parameters and get back meaningful results. The other parameter to watch is the Measurement Interval. This is the number of symbols in the file or in a single frame, whichever is smaller. If Measurement Interval is set too large, the results will be inaccurate. (frame-formatted or non-formatted)

The methods of entering parameter values are:

- **Manual Entry:** Step through all of the parameter dialog boxes and enter the desired values.
- **Load an XML Parameter File:** Loading parameter values by loading an XML Parameter file. See [“Load XML Parameter File” on page 5-12](#).
- **Load a Configuration File:** Loading parameter values by loading a Configuration file. See [“Load Configuration” on page 5-12](#).
- **Load a Standards Based Parameter File:** These are a set of predefined parameter files that match industry standard definitions for official modulation schemes. See [“Set Standard Predefined Templates” on page 5-18](#) and [“Standard” on page 5-18](#).

## Standard Setup

Select a Standard predefined setup. For [Figure 5-21](#), template RCR39-T79\_DL template is selected. The Parameter Summary parameters are populated as shown in [Figure 5-21](#). Here, the “Modulation Type”  $\pi/4$  DQPSK parameters are displayed for this template. For a complete listing of the predefined parameters and their parameter settings, see [Appendix B, “Predefined Parameter Settings”](#).



1. See [“Set Standard Predefined Templates”](#) on page 5-18.

2. See [“Parameter Summary”](#) on page 5-40.

**Figure 5-21.** Parameter Setup

Set Standard Predefined Templates

Standards files are ‘read-only’ parameter files. The default screen displays the Standard template button as (None) as no settings have been selected. Once the Standard template button is pressed, a list of predefined templates are displayed as shown in [Figure 5-22](#). The selected Standard template title replaces (None).

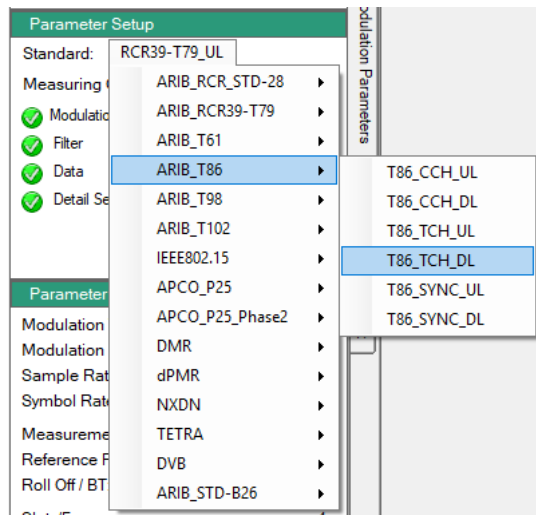


Figure 5-22. Standard Predefined Templates

Measuring Object

Select the format of the measuring object. If the signal to be measured has a frame structure, the part of the signal to analyze can be specified by setting the frame structure parameters.

**Frame Formatted:** Select if the measured signal has a frame structure.

**Non-Formatted:** Select if the measured signal does not have a frame structure.

If Non-Formatted is selected, the Frame, Slot, and Search parameters are not set. If frame specific analysis is not important, use the non-formatted parameter set.

The Parameter Setup provides defined parameter settings, measuring object setting, and dialog boxes that become accessible when the parameter buttons are selected. See [Figure 5-13](#).

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard: [None]                    | <b>Standard:</b> Provides a Standard Template list. Standard files are exactly like XML parameter files in file structure and parameter fields, but the values are preset to match specific standards. The predefined templates and descriptions are provided in <a href="#">Appendix B, “Predefined Parameter Settings”</a> .<br><b>[None]:</b> Indicates no standard templates are selected. |
| Measuring Object: Frame Formatted ▾ | <b>Measuring Object:</b> Select Frame Formatted or Non-Formatted. See <a href="#">“Set Standard Predefined Templates” on page 5-18</a> .                                                                                                                                                                                                                                                       |

Figure 5-23. Parameter Settings

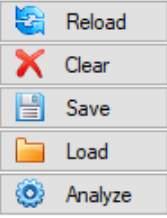
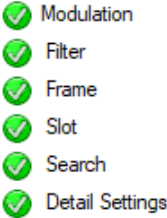
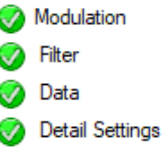
|                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             | <p><b>Reload:</b> If a standard has been selected, and any parameter value changed, Reload will restore to the parameter values as defined by the selected standard.</p> <p><b>Clear:</b> Clears all parameter settings.</p> <p><b>Save:</b> Saves the current parameter settings, data file that was last used, and the last displayed view. Performs the same function as the <a href="#">“Save Configuration” on page 5-12</a> button on the File menu tab.</p> <p><b>Load:</b> Loads the saved parameter settings, data file that was last used, and the last displayed view. Performs the same function as <a href="#">“Save Configuration” on page 5-12</a> on the File menu tab.</p> <p><b>Analyze:</b> Initiate IQ data demodulation.</p> |
|                             | <p><b>Frame Formatted Menu</b></p> <p><b>Modulation:</b> Set modulation parameters.<br/>See <a href="#">“Modulation Parameters Tab” on page 5-15</a>.</p> <p><b>Filter:</b> Set filter description for demodulation.<br/>See <a href="#">“Filter” on page 5-29</a>.</p> <p><b>Frame:</b> Specify frame formatting.<br/>See <a href="#">“Frame” on page 5-33</a>.</p> <p><b>Slot:</b> Specify options for slot configuration.<br/>See <a href="#">“Slot” on page 5-34</a>.</p> <p><b>Search:</b> Set options for symbol and burst search in demodulation.<br/>See <a href="#">“Search” on page 5-35</a>.</p> <p><b>Detail Settings:</b> Other demodulation settings and options.<br/>See <a href="#">“Detail Settings” on page 5-38</a>.</p>       |
| <p>Measuring Object:</p>  | <p><b>Non-formatted Menu</b></p> <p><b>Modulation:</b> Set modulation parameters.<br/>See <a href="#">“Modulation Parameters Tab” on page 5-15</a>.</p> <p><b>Filter:</b> Set filter description for demodulation.<br/>See <a href="#">“Filter” on page 5-29</a>.</p> <p><b>Data:</b> Set options for data descriptions.<br/>See <a href="#">“Data” on page 5-33</a>.</p> <p><b>Detail Settings:</b> Other demodulation settings and options. See <a href="#">“Detail Settings” on page 5-38</a>.</p>                                                                                                                                                                                                                                             |

**Figure 5-23.** Parameter Settings (Continued)

Modulation

Press the Modulation button to show the Symbol Mapping for the selected Modulation Type as shown in [Figure 5-24](#).

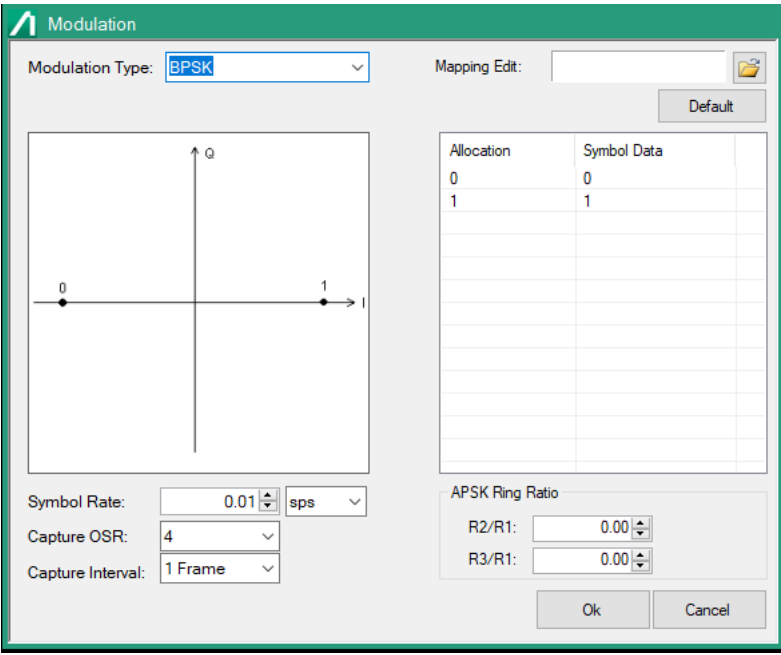


Figure 5-24. Symbol Mapping Menu

The Modulation settings are described in [Figure 5-25](#).

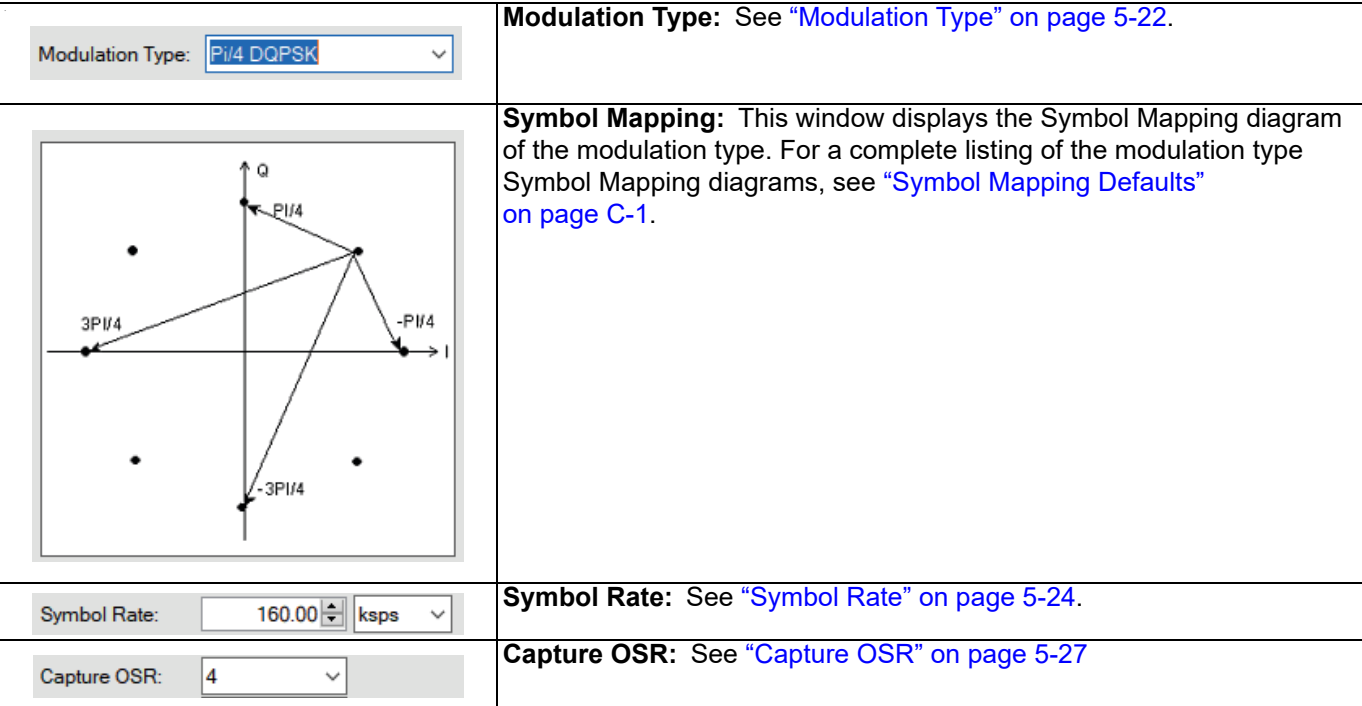


Figure 5-25. Modulation Menu

| Capture Interval: 10 Frame                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p><b>Capture Interval:</b> Sets Capture Interval (number of frames to capture) for one measurement. It is selectable only when set to Frame Formatted. When set to No Formatted, Capture Interval is fixed to “1 Frame”.</p> <p><b>Settings:</b> 1 Frame, 10 Frame</p>                              |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------|----|----------|----|-----------|----|----------|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mapping Edit:                                                                                                                                                                                                                                                                                                                                                                       | <p><b>Mapping Edit:</b> See <a href="#">“Mapping Edit” on page 5-23</a></p>                                                                                                                                                                                                                          |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
| Default                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><b>Default:</b> Change the parameters values to default settings.</p> <p>If <b>Frame Formatted</b> is selected for the signal to be measured, change the Frame Formatted values to the defaults.</p> <p>If <b>Non-Formatted</b> is selected, change the Non-Formatted values to the defaults.</p> |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
| <table border="1"> <thead> <tr> <th>Differential</th> <th>Symbol Data</th> </tr> </thead> <tbody> <tr> <td><math>\pi/4</math></td> <td>00</td> </tr> <tr> <td><math>3\pi/4</math></td> <td>01</td> </tr> <tr> <td><math>-3\pi/4</math></td> <td>11</td> </tr> <tr> <td><math>-\pi/4</math></td> <td>10</td> </tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </tbody> </table> | Differential                                                                                                                                                                                                                                                                                         | Symbol Data | $\pi/4$ | 00 | $3\pi/4$ | 01 | $-3\pi/4$ | 11 | $-\pi/4$ | 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | <p><b>Differential/Allocation and Symbol Data:</b> This window displays the Differential/Allocation and Symbol Data for the modulation type selected. For a complete listing of the modulation type Differential/Allocation and Symbol Data diagrams, see <a href="#">“Symbol Mapping Defaults” on page C-1</a>.</p> |
| Differential                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Symbol Data                                                                                                                                                                                                                                                                                          |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
| $\pi/4$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 00                                                                                                                                                                                                                                                                                                   |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
| $3\pi/4$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 01                                                                                                                                                                                                                                                                                                   |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
| $-3\pi/4$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 11                                                                                                                                                                                                                                                                                                   |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
| $-\pi/4$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 10                                                                                                                                                                                                                                                                                                   |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                      |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                      |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                      |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                      |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                      |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                      |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                      |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |
| R2/R1: 3.15 <br>R3/R1: 5.27                                                                                                                                                                                                                                                                                                                                                     | <p><b>APSK Ring Ratio</b></p> <p><b>R2/R1:</b> See <a href="#">“APSK Ring Ratio” on page 5-28</a>.</p> <p><b>R3/R1:</b> See <a href="#">“APSK Ring Ratio” on page 5-28</a>.</p>                                                                                                                      |             |         |    |          |    |           |    |          |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                      |

**Figure 5-25.** Modulation Menu



## Modulation Type

Select the modulation type for the measured signal shown in [Table 5-1](#). The modulation type are described in [Appendix C, “Symbol Mapping Defaults”](#).

**Table 5-1.** Modulation Type

| Modulation Type | Description                                            |
|-----------------|--------------------------------------------------------|
| BPSK            | Measures the signal as a BPSK-modulated signal.        |
| DBPSK           | Measures the signal as a DBPSK-modulated signal.       |
| PI/2DBPSK       | Measures the signal as a PI/2DBPSK-modulated signal.   |
| QPSK            | Measures the signal as a QPSK-modulated signal.        |
| O-QPSK          | Measures the signal as a Offset-QPSK-modulated signal. |
| DQPSK           | Measures the signal as a DQPSK-modulated signal.       |
| PI/4DQPSK       | Measures the signal as a PI/4DQPSK-modulated signal.   |
| 8PSK            | Measures the signal as an 8PSK-modulated signal.       |
| D8PSK           | Measures the signal as a D8PSK-modulated signal.       |
| 16QAM           | Measures the signal as a 16QAM-modulated signal.       |
| 32QAM           | Measures the signal as a 32QAM-modulated signal.       |
| 64QAM           | Measures the signal as a 64QAM-modulated signal.       |
| 128QAM          | Measures the signal as a 128QAM-modulated signal.      |
| 256QAM          | Measures the signal as a 256QAM-modulated signal.      |
| 2FSK            | Measures the signal as a 2-value FSK-modulated signal. |
| 4FSK            | Measures the signal as a 4-value FSK-modulated signal. |
| H-CPM           | Measures the signal as a H-CPM-modulated signal.       |
| 2ASK            | Measures the signal as a 2-value ASK-modulated signal. |
| 4ASK            | Measures the signal as a 4-value ASK-modulated signal. |
| MSK             | Measures the signal as a MSK-modulated signal.         |
| 16APSK          | Measures the signal as a 16APSK-modulated signal.      |
| 32APSK          | Measures the signal as a 32APSK-modulated signal.      |
| 512QAM          | Measures the signal as a 512QAM-modulated signal.      |
| 1024QAM         | Measures the signal as a 1024QAM-modulated signal.     |
| 2048QAM         | Measures the signal as a 2048QAM-modulated signal.     |
| 4096QAM         | Measures the signal as a 4096QAM-modulated signal.     |

## Mapping Edit

Mapping Edit is used to change the bit value in the symbol data column corresponding to that in the allocation column from the default setting.

The setting is changed by recalling the file that specifies the bit value in the symbol data column corresponding to that in the allocation column.

### Specifying Configuration File for Mapping Edit

The following example describes how to specify a configuration file used to edit mapping.

#### Example

Create the file in the text format. Any file name and extension can be specified. On each line, specify the symbol data bit sequence in binary. Refer to the 16QAM settings in [Table 5-2](#).

1. Specify the symbol data for allocation 0 on the first line. For 16QAM, type 1000 for the first line.
2. Specify the symbol data for allocation 1 on the second line. For 16QAM, type 1010 for the second line, type 0010 for the third line. Continue to specify symbol data for allocations until the number of symbols is reached. For 16QAM, 0100 is the last entry for specifying mapping editing.

The number of symbols depends on the specified modulation type. The number of symbols must match the number of lines.

**Table 5-2.** 16QAM Settings for Allocation and Symbol data

| Allocation | Symbol data | Allocation | Symbol data |
|------------|-------------|------------|-------------|
| 0          | 1000        | 8          | 1101        |
| 1          | 1010        | 9          | 1111        |
| 2          | 0010        | 10         | 0111        |
| 3          | 0000        | 11         | 0101        |
| 4          | 1001        | 12         | 1100        |
| 5          | 1011        | 13         | 1110        |
| 6          | 0011        | 14         | 0110        |
| 7          | 0001        | 15         | 0100        |

If **Frame Formatted** is selected for the signal to be measured, changes the Frame Formatted values to the defaults.

If **Non-Formatted** is selected, changes the Non-Formatted values to the defaults.

Symbol Rate

Sets the symbol rate of the measured signal.

Resolution

0.1 symbols per second (sps)

Symbol Rate Range

The entire measurement signal must not exceed the analysis bandwidth (SPAN) to perform the measurement correctly. Range of Symbol Rate is shown in [Table 5-3](#).

|                                |          |
|--------------------------------|----------|
| Max. Sampling Rate (max. SP)   | 1300 MHz |
| Max. Analysis Bandwidth (Span) | 1000 MHz |

Table 5-3. Symbol Rate Range

| Capture OSR | Max. Setting Symbol Rate (symbol/s) (0.1 k to max. SP / Capture OSR) <sup>1</sup> |            |
|-------------|-----------------------------------------------------------------------------------|------------|
|             | < 4 GHz                                                                           | ≥ 4GHz     |
| 32          | 20.3125 M/s                                                                       | 40.625 M/s |
| 16          | 40.625 M/s                                                                        | 81.25 M/s  |
| 8           | 81.25 M/s                                                                         | 162.5 M/s  |
| 4           | 162.5 M/s                                                                         | 325 M/s    |
| 2           | 325 M/s                                                                           | 650 M/s    |
| 1           | 650 M/s                                                                           | 1300 M/s   |

Span Width

Defines the span width for the symbol rate when Modulation Type is other than 2FSK, 4FSK, H-CPM, or O-QPSK. The span width is not displayed and Capture OSR is displayed.

Range

1 to 32

**Span/Sample Rate**

This value is used in the measuring instrument. This value is calculated based on the Modulation Type and Symbol Rate and is calculated as follows.

When Modulation Type is not 2FSK/4FSK/H-CPM/O-QPSK is shown in [Table 5-4](#).

**Table 5-4.** Modulation Type is Not 2FSK/4FSK/H-CPM/O-QPSK

| Span      | Symbol Rate (symbols per second)                        |
|-----------|---------------------------------------------------------|
| 1 kHz     | $0.1 \text{ ksps} \leq \text{SR} \leq 0.5 \text{ ksps}$ |
| 2.5 kHz   | $0.5 \text{ ksps} < \text{SR} \leq 1.25 \text{ ksps}$   |
| 5 kHz     | $1.25 \text{ ksps} < \text{SR} \leq 2.5 \text{ ksps}$   |
| 10 kHz    | $2.5 \text{ ksps} < \text{SR} \leq 5 \text{ ksps}$      |
| 25 kHz    | $5 \text{ ksps} < \text{SR} \leq 12.5 \text{ ksps}$     |
| 50 kHz    | $12.5 \text{ ksps} < \text{SR} \leq 25 \text{ ksps}$    |
| 100 kHz   | $25 \text{ ksps} < \text{SR} \leq 50 \text{ ksps}$      |
| 250 kHz   | $50 \text{ ksps} < \text{SR} \leq 125 \text{ ksps}$     |
| 500 kHz   | $125 \text{ ksps} < \text{SR} \leq 250 \text{ ksps}$    |
| 1 MHz     | $250 \text{ ksps} < \text{SR} \leq 500 \text{ ksps}$    |
| 2.5 MHz   | $500 \text{ ksps} < \text{SR} \leq 1.25 \text{ Msps}$   |
| 5 MHz     | $1.25 \text{ Msps} < \text{SR} \leq 2.5 \text{ Msps}$   |
| 10 MHz    | $2.5 \text{ Msps} < \text{SR} \leq 5 \text{ Msps}$      |
| 25 MHz    | $5 \text{ Msps} < \text{SR} \leq 12.5 \text{ Msps}$     |
| 31.25 MHz | $12.5 \text{ Msps} < \text{SR} \leq 35 \text{ Msps}$    |
| 50 MHz    | $12.5 \text{ Msps} < \text{SR} \leq 25 \text{ Msps}$    |
| 62.5 MHz  | $35 \text{ Msps} < \text{SR} \leq 70 \text{ Msps}$      |
| 100 MHz   | $25 \text{ Msps} < \text{SR} \leq 50 \text{ Msps}$      |
| 125 MHz   | $70 \text{ Msps} < \text{SR} \leq 140 \text{ Msps}$     |

When Modulation Type is 2FSK/4FSK/H-CPM is shown in [Table 5-5](#).

**Table 5-5.** Modulation Type is 2FSK/4FSK/H-CPM

| Span    | Symbol Rate (symbols per second)   |
|---------|------------------------------------|
| 1 kHz   | .1 ksps $\leq$ SR $\leq$ 0.25 ksps |
| 2.5 kHz | 0.25 ksps $<$ SR $\leq$ 0.625 ksps |
| 5 kHz   | 0.625 ksps $<$ R $\leq$ 1.25 ksps  |
| 10 kHz  | 1.25 ksps $<$ SR $\leq$ 2.5 ksps   |
| 25 kHz  | 2.5 ksps $<$ SR $\leq$ 6.25 ksps   |
| 50 kHz  | 6.25 ksps $<$ SR $\leq$ 12.5 ksps  |
| 100 kHz | 12.5 ksps $<$ SR $\leq$ 25 ksps    |
| 250 kHz | 25 ksps $<$ SR $\leq$ 62.5 ksps    |
| 500 kHz | 62.5 ksps $<$ SR $\leq$ 125 ksps   |
| 1 MHz   | 125 ksps $<$ SR $\leq$ 250 ksps    |
| 2.5 MHz | 250 ksps $<$ SR $\leq$ 625 ksps    |
| 5 MHz   | 625 ksps $<$ SR $\leq$ 1.25 Msps   |
| 10 MHz  | 1.25 Msps $<$ SR $\leq$ 2.5 Msps   |
| 25 MHz  | 2.5 Msps $<$ SR $\leq$ 6.25 Msps   |
| 50 MHz  | 6.25 Msps $<$ SR $\leq$ 12.5 Msps  |
| 100 MHz | 12.5 Msps $<$ SR $\leq$ 25 Msps    |

## Capture OSR

Sets the over sampling rate when capturing the reception signal. Using OSR changes the bandwidth. [Table 5-6](#) lists the operations.

When a value has not been set, the parameter is set to the default value.

When an out-of-range value is set, the value is changed to the optimal value. However, the measurement may not be performed correctly depending on the status of the reception signal.

**Table 5-6.** Operation of Capture (OSR)

| Function                        | Operation of Capture OSR    |                             |
|---------------------------------|-----------------------------|-----------------------------|
|                                 | When Decreasing Capture OSR | When Increasing Capture OSR |
| Reception Bandwidth             | Narrowed                    | Widened                     |
| Sampling Rate                   | Decreased                   | Increased                   |
| Capture Waveform Size           | Decreased                   | Increased                   |
| Frequency Error Detection Range | Narrowed                    | Widened                     |
| Analysis Speed                  | Increased                   | Decreased                   |

### Default

[Table 5-7](#) lists the default values.

**Table 5-7.** Capture OSR Default Value

| Modulation Type  | Capture OSR Default Value |
|------------------|---------------------------|
| 2FSK, 4FSK, HCPM | 8                         |
| OQPSK            | 16                        |
| Other            | 4                         |

APSK Ring Ratio

Sets the radius of the reference signal when Modulation Type is APSK. Restrictions of APSK Ring Ratio Setting is shown in [Table 5-8](#).

Table 5-8. Restrictions of APSK Ring Ratio Settings

| Modulation Type | R2/R1 | R3/R1 |
|-----------------|-------|-------|
| 16APSK Yes      | Yes   | No    |
| 32APSK          | Yes   | Yes   |
| Other           | No    | No    |

The APSK Ring Ratio diagrams for 16APSK and 32APSK are shown in [Figure 5-26](#).

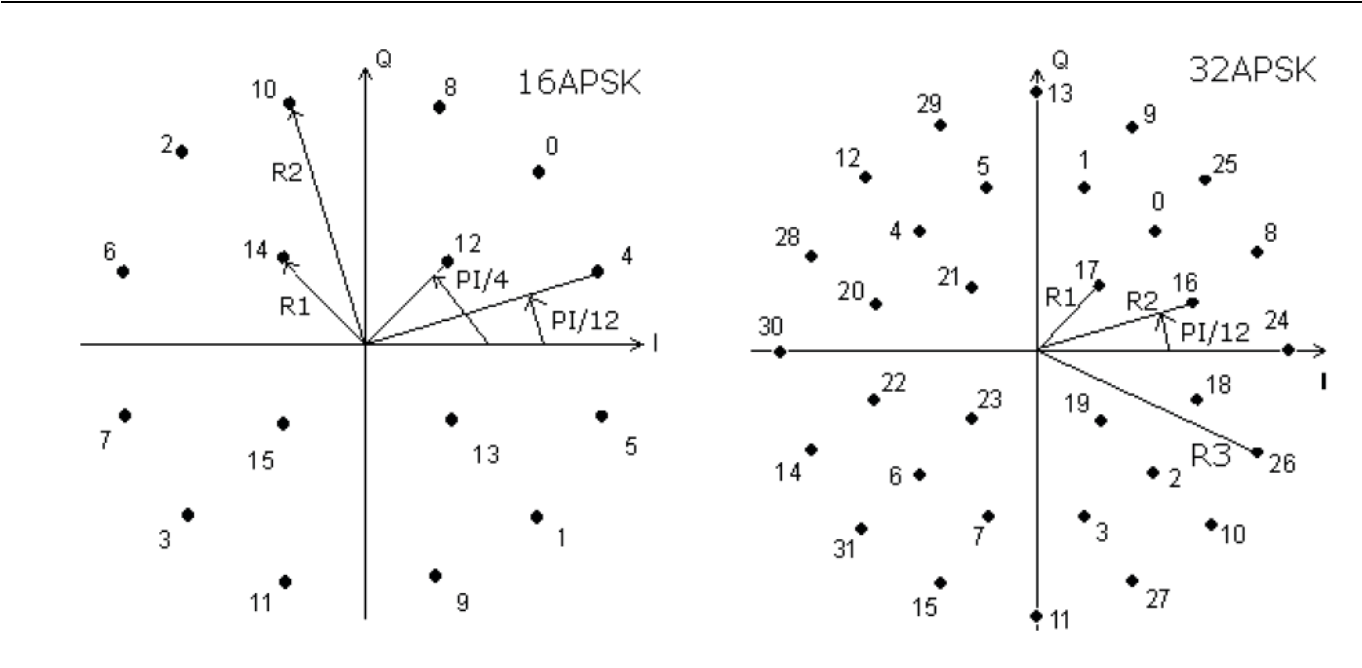


Figure 5-26. APSK Ring Ratio 16APSK and 32APSK

Range

R2/R1: 2.000 to 4.000

R3/R1: 4.000 to 9.000

When an out-of-range value is set, the value is rounded to a value within the Range.

Filter

The signal received by the measuring instrument passes through the measurement filter. Next, the signal is demodulated and the bit string of the transmission signal is generated. A symbol data string is generated through symbol mapping from the generated bit string. The symbol data string is then passed through the reference filter, and the resulting signal is used as the reference signal. The difference between the received signal that has passed through the measurement filter and the reference signal is used to calculate the modulation analysis result's EVM, Phase Error, and Magnitude Error. The Measurement and Reference Filter Settings are shown in [Table 5-9](#).

Table 5-9. Measurement and Reference Filter Settings

| Pulse-shaping Filter used in transmitter | Measurement Filter | Reference Filter |
|------------------------------------------|--------------------|------------------|
| Root Nyquist                             | Root Nyquist       | Nyquist          |
| Nyquist                                  | None               | Nyquist          |
| Gaussian                                 | None               | Gaussian         |

The Measurement and Reference Filter block diagram is shown in [Figure 5-27](#).

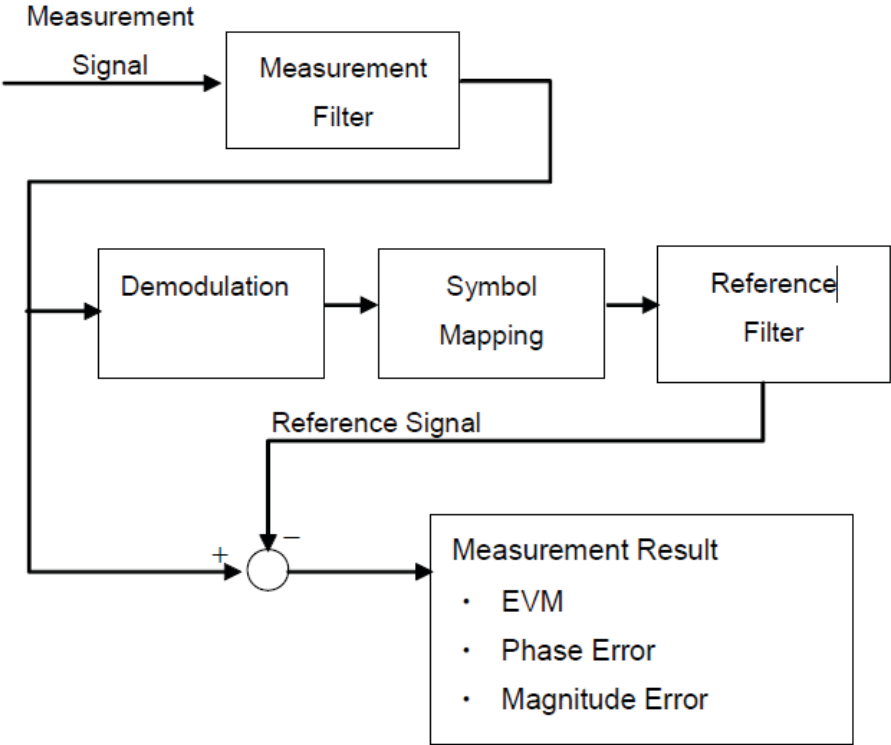


Figure 5-27. Measurement Block Diagram



Filter Button

Press the Filter button to display the filter parameter setting dialog box as shown in [Figure 5-28](#).

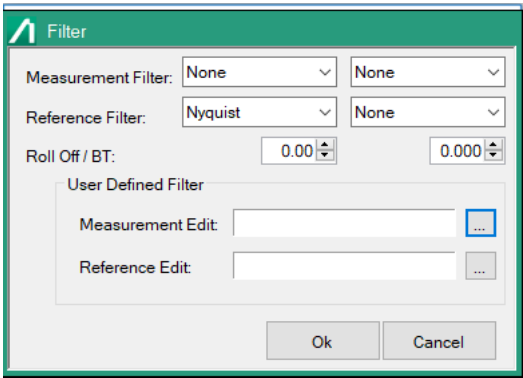


Figure 5-28. Formatted Frame Filter Dialog

Measurement Filter

Sets the reception filter. The Filter Parameter Setting dialog box shows the basic filter settings on the left and the 2nd filter on the right. Displayed characteristics are combined characteristics of 2 filters.

Measurement filter is used to filter the received signal just before demodulation. Some systems split the pulse-shaping filter between the transmitter and receiver side (e.g. Root Nyquist at transmitter and Root Nyquist at receiver) and in this case the filter at the receiver side is the measurement filter. The Filter settings are described in [Table 5-29](#).

|                                                                        |                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>Measurement Filter: <div>Root Nyquist</div> <div>None</div></div> | <p><b>Measurement Filter:</b> Selected modulation type settings for the first filter list is listed in <a href="#">Table 5-10</a>.</p> <p>Selected modulation type settings for the second filter list is listed in <a href="#">Table 5-11</a>.</p> <p>For more on Filter and Second Filter, see <a href="#">“Filter and Second Filter” on page 5-32</a>.</p>                    |
| <div>Reference Filter: <div>Nyquist</div> <div>None</div></div>        | <p><b>Reference Filter:</b> Settings are described in <a href="#">“Reference Filter” on page 5-32</a>.</p> <p>For more on Filter and Second Filter, see <a href="#">“Filter and Second Filter” on page 5-32</a>.</p>                                                                                                                                                             |
| <div>Roll Off / BT: <div>0.00</div> <div>0.000</div></div>             | <p><b>Roll Off / BT:</b> Sets the filter roll off ratio (Root Nyquist/Nyquist/ARIB STD-T98) or bandwidth time product. This is applied when the Measurement Filter or Reference Filter setting is set to Root Nyquist, Nyquist, ARIB STD-T98, Gaussian or Inverse Gaussian.</p> <p><b>First Filter Range:</b> 0.03 to 1.00</p> <p><b>Second Filter Range:</b> 0.030 to 1.000</p> |

Figure 5-29. Filter Settings

|                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>User Defined Filter</div> <div>Measurement Edit</div> <div>Reference Edit</div> | <b>User Defined Filter</b><br><b>Measurement Edit:</b> This selects the definition file for the filter used as the Measurement Filter. If no file is specified, the setting is Root Nyquist.<br><b>Reference Edit:</b> This selects the definition file for the filter that removes the adjacent waves. If no file is specified, it is regarded that Multicarrier Filter is set to None. Reference Filter settings are described in <a href="#">Table 5-12</a> . |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Figure 5-29.** Filter Settings**Measurement Filter Settings**

Availability of the basic measurement filter settings are shown in [Table 5-10](#) and the 2nd filter setting in [Table 5-11](#).

**Table 5-10.** Measurement Filter Settings

| Filter Type      | Modulation Type |      |       |       |
|------------------|-----------------|------|-------|-------|
|                  | 2FSK            | 4FSK | H-CPM | Other |
| Root Nyquist     | Yes             | Yes  | Yes   | Yes   |
| Nyquist          | Yes             | Yes  | Yes   | Yes   |
| None             | Yes             | Yes  | Yes   | Yes   |
| Gaussian         | Yes             | Yes  | Yes   | No    |
| ARIB STD-T98     | No              | Yes  | No    | No    |
| Rect             | No              | Yes  | No    | No    |
| Inverse Rect     | No              | Yes  | No    | No    |
| Inverse Gaussian | No              | Yes  | No    | No    |
| H-CPM_P25        | No              | No   | Yes   | No    |
| User Defined     | Yes             | Yes  | Yes   | Yes   |

**Table 5-11.** Settings of 2nd Measurement Filter

| Filter Type      | Modulation Type |       |
|------------------|-----------------|-------|
|                  | 4FSK            | Other |
| None             | Yes             | Yes   |
| Rect             | Yes             | No    |
| Inverse Rect     | Yes             | No    |
| Inverse Gaussian | Yes             | No    |
| Inverse Gaussian | Yes             | No    |

### Reference Filter

Sets the filter used for the reference signal. The Filter Parameter Setting dialog box shows the filter on the left and the 2nd filter on the right. Displayed characteristics are combined characteristics of 2 filters. Reference filter is used to filter the reference (no error) signal. It is the total filtering used in the system (transmitter filter plus receiver filter). Availability of the reference filter type settings are shown in [Table 5-12](#).

**Table 5-12.** Settings of Reference Filter

| Filter Type  | Modulation Type |      |      |       |           |     |       |
|--------------|-----------------|------|------|-------|-----------|-----|-------|
|              | O-QPSK          | 2FSK | 4FSK | H-CPM | 2ASK/4ASK | MSK | Other |
| Root Nyquist | Yes             | Yes  | Yes  | Yes   | Yes       | Yes | Yes   |
| Nyquist      | Yes             | Yes  | Yes  | Yes   | Yes       | Yes | Yes   |
| Gaussian     | No              | Yes  | Yes  | Yes   | Yes       | Yes | No    |
| Gaussian2    | No              | Yes  | Yes  | Yes   | Yes       | No  | No    |
| ARIB STD-T98 | No              | No   | Yes  | No    | No        | No  | No    |
| Half-sine    | Yes             | No   | No   | No    | No        | No  | No    |
| Rect         | No              | Yes  | Yes  | Yes   | No        | No  | No    |
| H-CPM_P25    | No              | No   | No   | Yes   | No        | No  | No    |
| User Defined | Yes             | Yes  | Yes  | Yes   | Yes       | Yes | Yes   |

### User Defined Filter

When User Defined is set at Measurement Filter or Reference Filter, any user filter can be used. For details on user filter and definition filter, refer to [Appendix D, “Filter Definition Settings”](#).

### Filter and Second Filter

For both Measurement Filter and Reference Filter, normally select the type of Filter only and select None for 2nd Filter. Then, the characteristics of Measurement Filter and Reference Filter shall be those set in the Filter Parameter Setting dialog box. If other than None is selected for both Filter and 2nd Filter, then the characteristics of Measurement Filter and Reference Filter are combined characteristics of Filter and 2nd Filter.

Data

The Data parameters can be set when the “Measuring Object” on page 5-18 is set to Non-Formatted. Set the measurement interval. Press the Data to display the data parameter setting dialog box as shown in Figure 5-30.

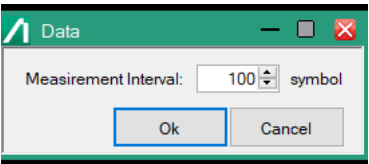


Figure 5-30. Non-Formatted Data Dialog Box

Measurement Interval

Sets the measurement interval in symbols. Measurement is performed for the symbol interval specified for Measurement Interval.

Range

10 to 4096

Frame

The Frame parameters can be set when Frame Formatted has been selected. Press the Frame button to display the Frame parameter setting dialog box as shown in Figure 5-31.

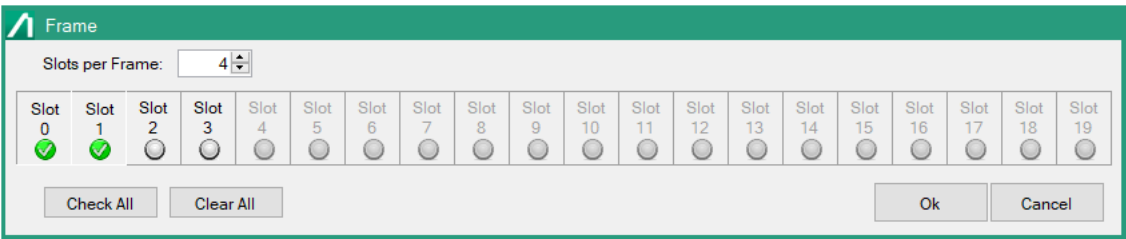


Figure 5-31. Frame Setting Dialog Box

The Frame dialog settings are described in Figure 5-32.

|  |                                                                                                                                                                                                                                                      |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Slots per Frame:</b> Select up to 20 slots. The number of slots selected become enabled. Clicking the Slot button to turn it green indicates that you want to analyze that particular slot.                                                       |
|  | <b>Slot:</b> The number of slots selected from the “Slots per Frame” box become enabled. This image shows 4 slots enabled, Slot 0 through Slot 3. Slot 0 and Slot 1 are selected for signal analysis. Not enabled slots remain unavailable (grayed). |
|  | <b>Check All:</b> All of slots selected in the “Slots per Frame” box will turn green indicating they are enabled for signal analysis.<br><b>Clear All:</b> All slots are cleared (grayed) and no longer active.                                      |

Figure 5-32. Frame Settings

Slot

The Slot parameters can be set when Frame Formatted has been selected. Press the Slot button to display the slot parameter setting dialog box as shown in [Figure 5-33](#).

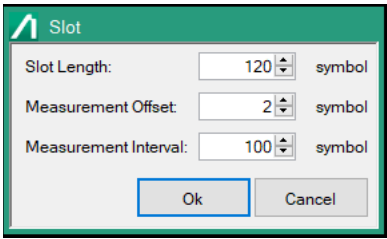


Figure 5-33. Slot Parameter Setting Dialog Box

The Slot dialog settings are described in [Figure 5-34](#)

|                                  |                                                                                                                                                                                                                          |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Slot Length: 120 symbol          | <b>Slot Length:</b> Set the number of symbols in one slot.<br><b>Range:</b> 10 to 4096                                                                                                                                   |
| Measurement Offset: 2 symbol     | <b>Measurement Offset:</b> Sets the start position of the measurement interval in symbols. The reference position of the measurement offset is the first symbol of the slot.<br><b>Range:</b> 0 to (Slot Length – 10)    |
| Measurement Interval: 110 symbol | <b>Measurement Interval:</b> Sets the measurement interval in symbols. The symbol interval set in Measurement Interval is displayed as the measurement result.<br><b>Range:</b> 10 to (Slot Length – Measurement Offset) |

Figure 5-34. Slot Settings

Setting Example

Refer to the settings in the Slot Parameter Setting dialog box shown in [Figure 5-33](#), “Slot Parameter Setting Dialog Box” on page 5-34. When one slot includes 120 symbols and the measured interval is the 110-symbol interval starting at the third symbol. The parameters in the slot parameter setting dialog box are set as:

- Slot Length = 120
- Measurement Offset = 2
- Measurement Interval = 110

The Slot Format Setting Parameter scheme is shown in [Figure 5-35](#).

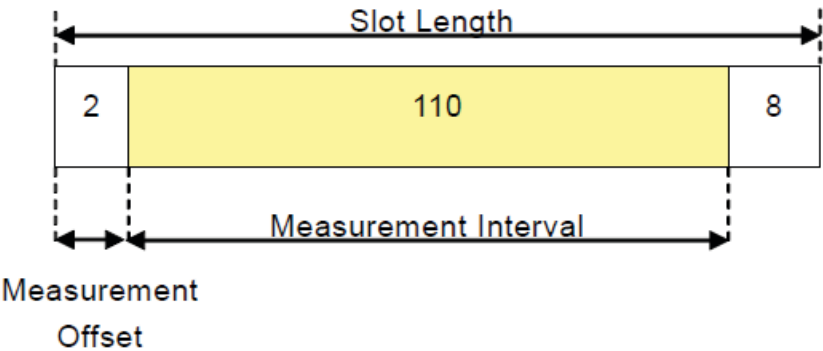


Figure 5-35. Slot Format Setting Parameter Scheme

Search

Set the Search parameter that determines the symbol positions in the slot. The search parameters can be set when Frame Formatted has been selected. Press the Search button to display the dialog box as shown in [Figure 5-36](#).

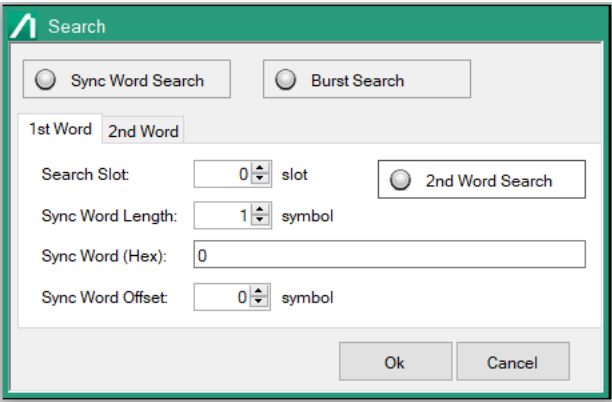


Figure 5-36. Search Parameter Setting Dialog Box

The Search dialog settings are described in [Figure 5-37](#).

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Sync Word Search:</b> Sets whether to search for a sync word consisting of a specific pattern. This setting is switched on or off by selecting a radio button. By executing a sync word search, the position of symbols in slots can be accurately detected.                                                                                                                                                                                                                                                                                                                                                                                                                              |
|  | <b>Burst Word Search:</b> Sets whether to detect burst signals. This setting is switched on or off by selecting the radio button. Set Burst Search to ON when a burst signal that makes up a ramp between slots is measured. Burst Search executes using Input Level (–20) dB as the level threshold.<br><b>Word Search Tabs:</b> 1st Word opens the 1st word search settings tab. The 2nd Word tab is enabled by clicking on the ‘2nd Word Search’ button from the 1st tab. The tabs setting for each are the same except the 2nd word tab does not have the “2nd word button”. Two types of Sync word patterns can be set. The settings on the 1st Word and 2nd Word tabs can be switched. |
|  | <b>Search Slot:</b> Sets the number of the slot in which a sync word was detected. Detection starts from the position at which the measured signal was captured, and a slot number is set for the position at which a sync word was first detected. If the same sync word is set in multiple slots, the detected slot number might differ from the actual slot number. To detect the actual slot number, use an external trigger.<br><b>Range:</b> 10 to (Slot Length – Measurement Offset)                                                                                                                                                                                                  |
|  | <b>Sync Word Length:</b> See <a href="#">“Sync Word Length”</a> on page 5-36.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

Figure 5-37. Search Settings

|                                                                        |                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sync Word (Hex): <input type="text" value="0000000000005575F5FF77FF"/> | <b>Sync Word Offset:</b> Sets the sync word. Specify the sync word as a left-aligned hexadecimal value, assuming the first bit in the sync word to be the MSB.<br><b>Number of Characters:</b> (Sync Word Length) × (Bits per symbol)/4, and round it up to the whole number.<br><b>Word:</b> 0 to F (HEX) |
| Sync Word Offset: <input type="text" value="0"/> symbol                | <b>Sync Word Offset:</b> Sets the interval between the first symbol in the slot and the first symbol in the sync word, in symbols.<br><b>Range:</b> 0 to (Slot Length (Symbol) - Sync Word Length (Symbol))                                                                                                |

Figure 5-37. Search Settings

### Sync Word Length

Sets the length of the sync word in Symbols. The length varies according to the Modulation Type setting and the character number of the input sync word (HEX).

### Range

The value for the sync word length needs to satisfy the Ranges listed in [Table 5-13](#) and [Table 5-14](#).

Table 5-13. Range for Sync Word Length (Modulation Type)

| Modulation Type                                   | Range (symbol)                                  |
|---------------------------------------------------|-------------------------------------------------|
| BPSK, DBPSK, PI/2DBPSK, 2FSK, 2ASK, MSK           | 1 to (128 or Slot Length, whichever is smaller) |
| QPSK, O-QPSK, DQPSK, PI/4DQPSK, 4FSK, H-CPM, 4ASK | 1 to (64 or Slot Length, whichever is smaller)  |
| 8PSK, D8PSK                                       | 1 to (42 or Slot Length, whichever is smaller)  |
| 16QAM, 16APSK                                     | 1 to (32 or Slot Length, whichever is smaller)  |
| 32QAM, 32APSK                                     | 1 to (25 or Slot Length, whichever is smaller)  |
| 64QAM                                             | 1 to (21 or Slot Length, whichever is smaller)  |
| 128QAM                                            | 1 to (18 or Slot Length, whichever is smaller)  |
| 256QAM                                            | 1 to (16 or Slot Length, whichever is smaller)  |
| 512QAM                                            | 1 to (14 or Slot Length, whichever is smaller)  |
| 1024QAM                                           | 1 to (12 or Slot Length, whichever is smaller)  |
| 2048QAM                                           | 1 to (11 or Slot Length, whichever is smaller)  |

The Sync Word Length (Number of characters of Sync Word (HEX)) is shown in [Table 5-14](#), Note that the decimal point is suppressed.

**Table 5-14.** Range for Sync Word Length

| Item    | Value (symbol)                                                                                     |
|---------|----------------------------------------------------------------------------------------------------|
| Maximum | $(\text{Number of characters of Sync Word (HEX)}) \times 4 / (\text{Bits per symbol})$             |
| Minimum | $\{(\text{Number of characters of Sync Word (HEX)}) - 1\} \times 4 / (\text{Bits per symbol}) + 1$ |

Bits per symbol of Modulation Type is shown in [Table 5-15](#).

**Table 5-15.** Bits per symbol of Modulation Type

| Modulation Type                                   | Bits/Symbol |
|---------------------------------------------------|-------------|
| BPSK, DBPSK, PI/2DBPSK, 2FSK, 2ASK, MSK           | 1           |
| QPSK, O-QPSK, DQPSK, PI/4DQPSK, 4FSK, H-CPM, 4ASK | 2           |
| 8PSK, D8PSK                                       | 3           |
| 16QAM, 16APSK                                     | 4           |
| 32QAM, 32APSK                                     | 5           |
| 64QAM                                             | 6           |
| 128QAM                                            | 7           |
| 256QAM                                            | 8           |
| 512QAM                                            | 9           |
| 1024QAM                                           | 10          |
| 2048QAM                                           | 11          |



Detail Settings

Details Settings dialog is shown in [Table 5-38](#).

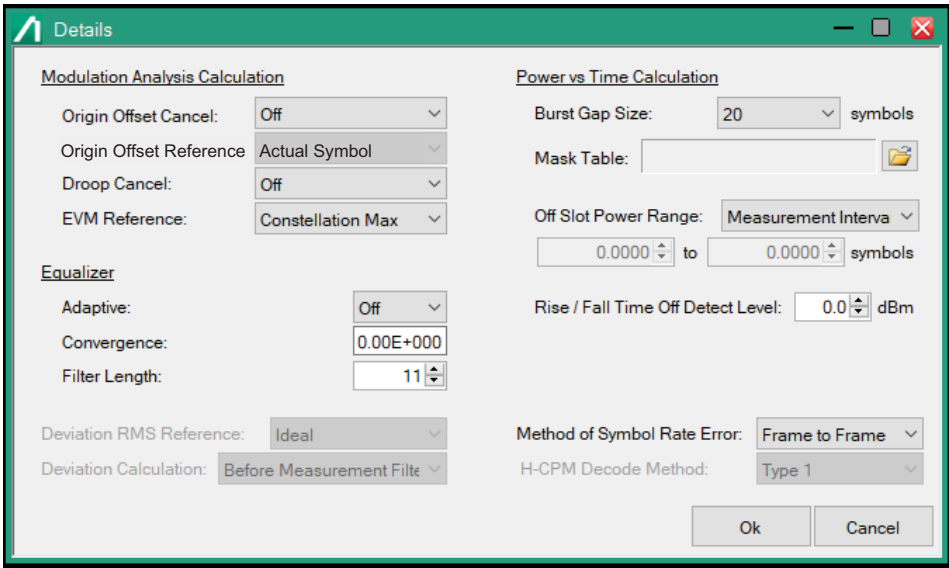


Figure 5-38. Detail Settings Dialog

The Details dialog settings are described in [Figure 5-39](#)

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>Origin Offset Cancel: On</div>               | <p><b>Origin Offset Cancel</b></p> <p><b>On:</b> The effect caused due to Origin Offset is removed from the measurement results.</p> <p><b>Off:</b> Does not calibrate Origin Offset.</p>                                                                                                                                                                                                                           |
| <div>Origin Offset Reference: Offset Symbol</div> | <p><b>Origin Offset Reference:</b> When Modulation Type is set to O-QPSK, the parameters for Origin Offset calculation criteria can be set.</p> <p><b>Offset Symbol:</b> Combined power with IQ symbol time shifted by 0.5 symbol.</p> <p><b>Actual Symbol:</b> IQ power of actual signals.</p>                                                                                                                     |
| <div>Droop Cancel: On</div>                       | <p><b>Droop Cancel</b></p> <p><b>On:</b> Performs Droop Cancel, and removes the effect caused due to Droop from the measurement results. (Default)</p> <p><b>Off:</b> Does not perform Droop Cancel.</p>                                                                                                                                                                                                            |
| <div>EVM Reference: Constellation Max</div>       | <p><b>EVM Reference:</b> Sets parameters related to the EVM measurement method. This function is available when Modulation Type is not FSK and ASK. Sets the EVM reference for the EVM measurement.</p> <p><b>Constellation Max:</b> Calculates EVM based on a symbol point located in the outermost layer of constellation.</p> <p><b>RMS:</b> Calculates EVM based on the average power of all symbol points.</p> |
| <div>Adaptive: Adaptive</div>                     | <p><b>Adaptive:</b> Can be set when Modulation Type is not 2FSK, 4FSK, H-CPM or MSK. Sets Equalizer Mode. Uses Equalizer. The filter coefficients of Equalizer are updated for each measurement.</p> <p><b>Hold:</b> Uses Equalizer. The filter coefficients are used, without updating from the values used before selecting of all symbol points.</p> <p><b>Off:</b> Does not use Equalizer.</p>                  |

Figure 5-39. Details Settings

|                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Convergence: <input type="text" value="1.00E-004"/>                          | <p><b>Convergence:</b> Can be set when Modulation Type is not 2FSK, 4FSK, H-CPM or MSK. Sets Convergence factor for updating the Equalizer filter.</p> <p><b>Range:</b> 1.0e-20 to 1</p>                                                                                                                                                                                                                                                                                                               |
| Filter Length: <input type="text" value="31"/>                               | <p><b>Filter Length:</b> Can be set when Modulation Type is not 2FSK, 4FSK, H-CPM or MSK. Sets Filter Length for Equalizer. At Filter Length, 8 means 1 symbol.</p> <p><b>Range:</b> 11 to 501 (1.375 (symbol) to 62.625 (symbol)). Only an odd number can be set. When an even number is entered, one is added to make it odd.</p>                                                                                                                                                                    |
| Deviation RMS Reference: <input type="text" value="Ideal"/>                  | <p><b>Deviation RMS Reference:</b> The parameter for calculating Deviation RMS is available when 2FSK is selected as Modulation Type and Deviation Auto is OFF. Sets reference value to calculate Deviation RMS.</p> <p><b>Ideal Average:</b> Calculates Deviation Error with signal deviation average as reference.</p> <p><b>Nominal settings:</b> Calculates Nominal Deviation from Symbol Rate and Modulation Index.</p>                                                                           |
| Deviation Calculation: <input type="text" value="After Measurement Filter"/> | <p><b>Deviation Calculation:</b> The parameters for Deviation calculation can be set when Modulation Type is 2FSK or 4FSK. This sets the timing to calculate Deviation.</p> <p><b>Before Measurement Filtering:</b> Calculates Deviation before applying Measurement Filter. Use for measuring frequency shift at 4FSK, based on ARIB STD-T98.</p> <p><b>After Measurement Filtering:</b> Calculates Deviation after applying Measurement Filter. Use for inputting general FSK modulation signal.</p> |

Figure 5-39. Details Settings (Continued)

Parameter Summary

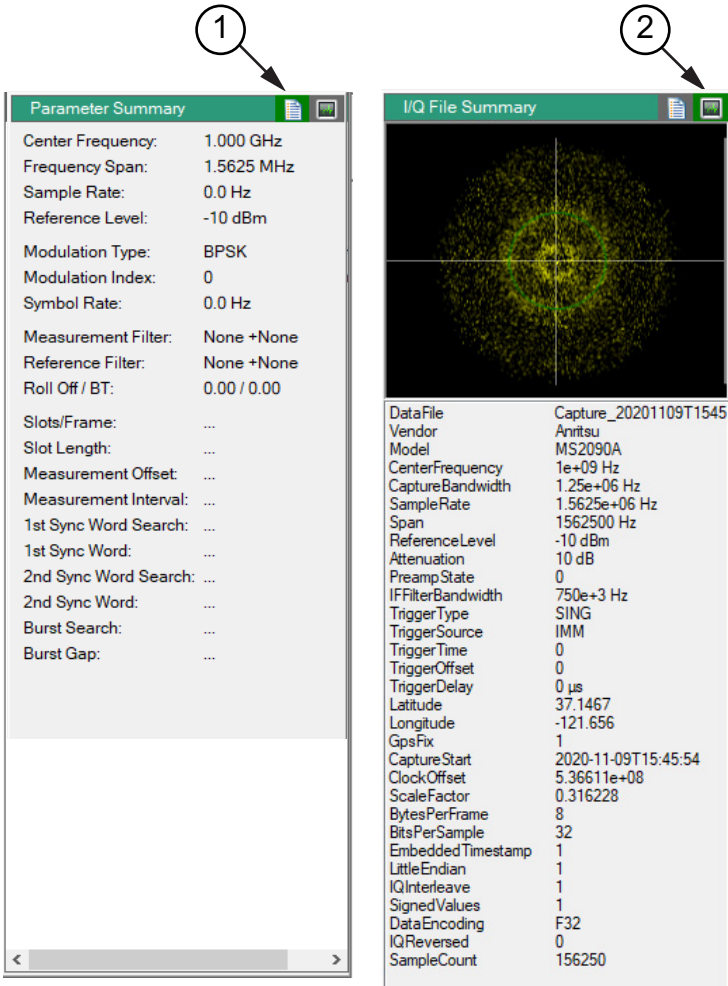
The Parameter Summary window displays the user defined modulation analysis parameters. These parameters can be entered manually through the Parameter Setup window setup or pre-populated by selecting a modulation scheme through the Parameter Setups Standard template button.



Figure 5-40. Parameter Summary Title Bar

|  |                                                                                                                                                   |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Parameter Summary:</b> Displays the current modulation parameter summary. See <a href="#">Section “Parameters Descriptions” on page 5-41</a> . |
|  | <b>IQ File Summary:</b> Displays the IQ file summary. See <a href="#">Section “IQ File Summary Descriptions” on page 5-41</a> .                   |

Figure 5-41. Parameter Summary/IQ File Summary Icons



- 1. Parameter Summary Icon, see [“Parameters Descriptions” on page 5-41](#).
- 2. IQ File Summary Icon, see [“IQ File Summary Descriptions” on page 5-41](#).

Figure 5-42. Parameter Summary and IQ File Summary

## Parameters Descriptions

Click the parameter Summary Icon to show the Parameters Settings listed in [Table 5-16](#).

**Table 5-16.** Description of Parameters (Frame Formatted)

| Parameter            | General Information                                                                                                 |
|----------------------|---------------------------------------------------------------------------------------------------------------------|
| Center Frequency     | Displays the center frequency of the signal.                                                                        |
| Capture Bandwidth    | Displays the Bandwidth of the captured signal.                                                                      |
| Sample Rate          | Displays the sample rate.                                                                                           |
| Reference Level      | Displays the reference level of the signal.                                                                         |
| Modulation Type      | Displays the modulation scheme.                                                                                     |
| Modulation Index     | Displays the modulation index, the ratio of amplitude of the message signal to the amplitude of the carrier signal. |
| Sample Rate          | Displays the sample rate.                                                                                           |
| Measurement Filter   | Shows the filter setting of the reception signal.                                                                   |
| Reference Filter     | Shows the filter setting of the reference signal.                                                                   |
| Roll Off / BT        | Displays the Roll Off rate and/or BT of the measurement filter and reference filter.                                |
| Slots / Frame        | Displays the number of slots per frame.                                                                             |
| Slot Length          | Displays the number of symbols per slot.                                                                            |
| Measurement Offset   | Displays the measurement start position in symbols.                                                                 |
| Measurement Interval | Displays the measurement interval.                                                                                  |
| 1st Sync Word Search | Displays the 1st sync word pattern.                                                                                 |
| 1st Sync Word        | Displays the 1st sync word pattern.                                                                                 |
| 2nd Sync Word Search | Displays the 2nd sync word pattern.                                                                                 |
| 2nd Sync Word        | Displays the 2nd sync word pattern.                                                                                 |
| Burst Search         | Displays whether burst search can be executed.                                                                      |
| Burst Gap            | Displays the number of data to measure before rise and fall of a burst waveform.                                    |

## IQ File Summary Descriptions

Click the IQ File summary icon to display information of the saved IQ data recorded.

The data file is created in binary format. From the beginning of the file, I-phase data and Q-phase data are recorded by 4 bytes. The I-phase data and Q-phase data are recorded as a float type.

Beginning of file: I-phase data 1 (4Byte)

Q-phase data 1 (4Byte)

I-phase data 2 (4Byte)

Q-phase data 2 (4Byte)

I-phase data 3 (4Byte)

Q-phase data 3 (4Byte)

The IQ data can be converted to power based on the following formula.

$$P = 10 \log_{10}(I^2 + Q^2)$$

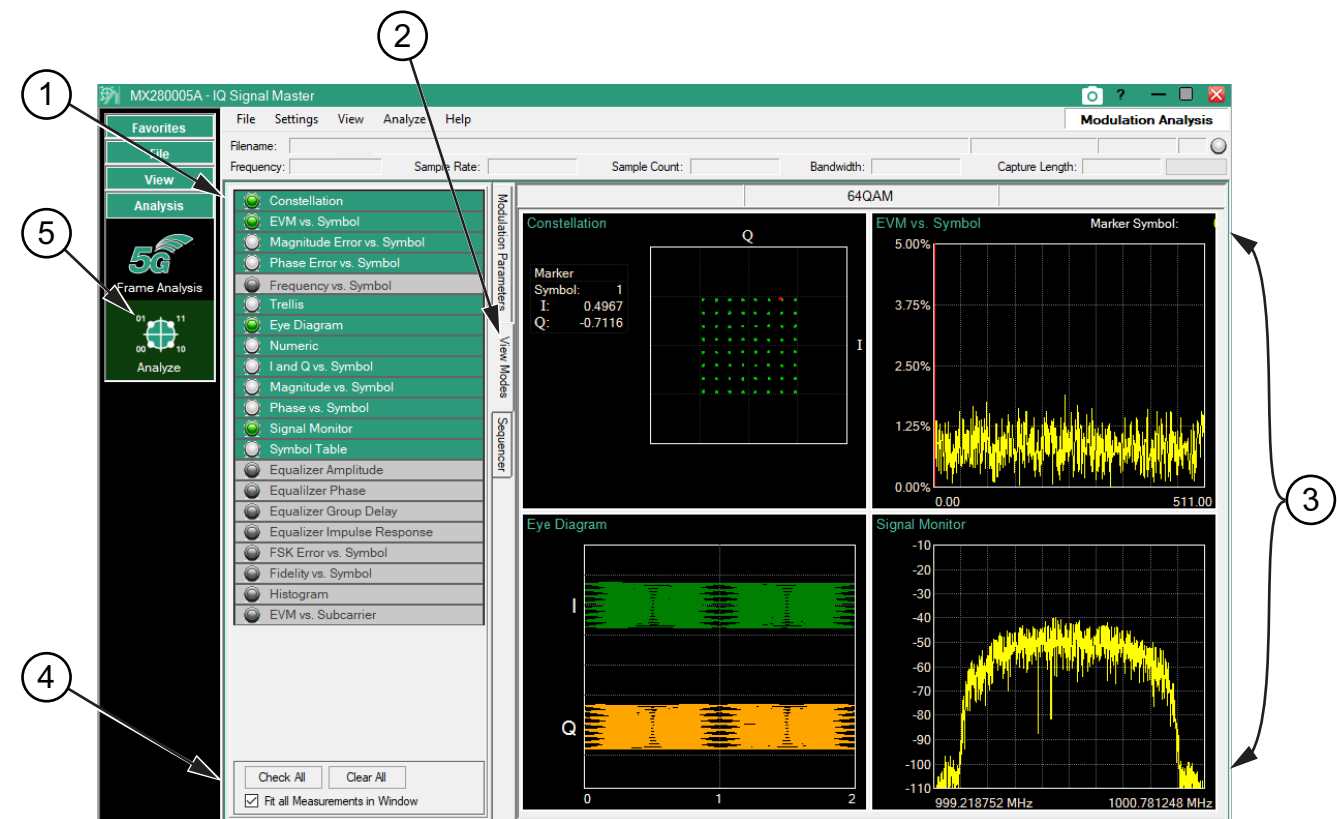
P: Power (dBm)

I: I-phase data

Q: Q-phase data

## 5-6 View Modes Tab

The view modes tab displays a list of the Modulation schemes of signal analysis as shown in [Figure 5-43](#). For complete descriptions of the modulation schemes, see [Chapter 6, “Modulation Analysis”](#).



1. See [“Parameters List” on page 5-43](#).
2. View Modes Tab.
3. Selected Modulation Type Measurement Display.
4. See [“View Menu Buttons” on page 5-43](#).
5. Analyze Menu. View modes is in the Analyze menu.

**Figure 5-43.** View Mode Screen

Parameters List

Refer to [Figure 5-44](#). The View Mode Parameters window displays the data sets available for analysis. A complete listing of the analysis types and their supporting modulation types are shown in [Table 6-2 on page 6-3](#).

- Green Bar:** The modulation type is available for analysis.
- Green Radio Button:** The modulation type is selected and can be viewed on the measurement display.
- The Grayed Bars:** Not available for analysis for the selected modulation type.

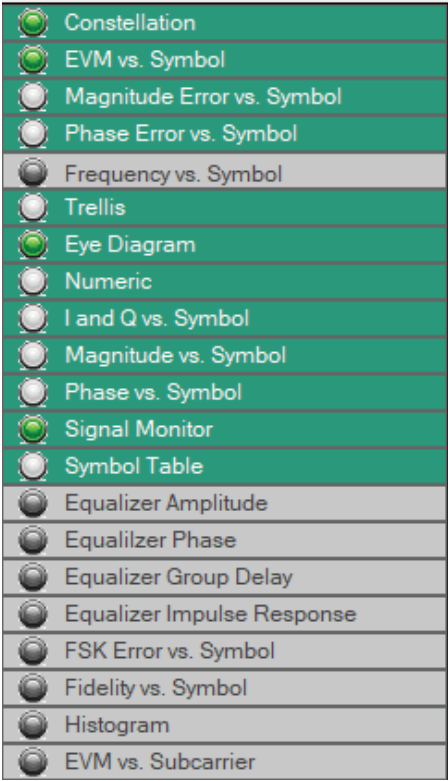


Figure 5-44. Parameters List

View Menu Buttons

The View menu buttons are described in [Figure 5-45](#).

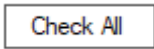
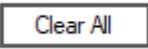
|                                                                                     |                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Check All:</b> Selects all the view modes. All the buttons turn green and all the view modes are displayed. See <a href="#">Section “Parameters Descriptions” on page 5-41</a> .        |
|  | <b>Clear All:</b> Clears all view modes. All the buttons turn gray and all the view modes are cleared from view. See <a href="#">Section “IQ File Summary Descriptions” on page 5-41</a> . |
| <input checked="" type="checkbox"/> <b>Fit all Measurements in Window</b>           | <b>Fit All Measurements in Window:</b> One up to all view modes will be enhanced to fit in the display window.                                                                             |

Figure 5-45. View Modes Buttons

## 5-7 Loading an IQ Data File

This section assumes that an IQ data file has already been imported from an Anritsu receiver or instrument. For instructions on creating and importing an IQ Data File from the receiver or instrument to the MX280005A IQ Signal Master software application, find your product on the Anritsu product page:

<https://www.anritsu.com/en-US/>

### Procedure

A data file location is created when the MX285000A IQ Signal Master software has been loaded. The default location is created in the Documents folder. The path is: Documents | Anritsu | IQ Files. From the MX285000A menu bar, click File and select Open Data File as shown in Figure 5-46.

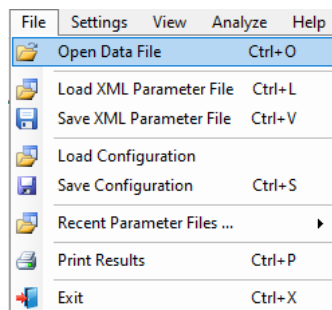


**Figure 5-46.** Open Data File

### Open the .dgzm File

1. Go to the IQ Files folder. Unless renamed by a user, all the .dgzm files are saved with a time stamp. Select the user renamed file as indicated in Figure 5-47.

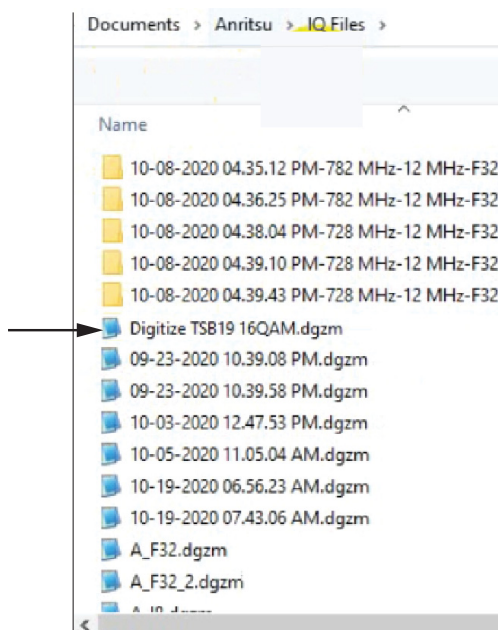
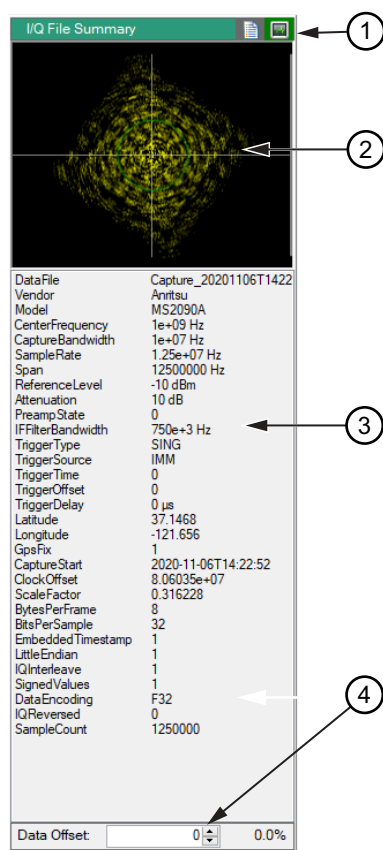


**Figure 5-47.** .dgzm File Time Stamp

2. Open the .dgzm file.
3. View the displayed MX280005A UI.

- Click the IQ Summary Icon to show the IQ Summary window as shown in [Figure 5-48](#).



- IQ Summary Icon
- IQ Summary Quick View
- IQ Summary Parameters
- Data Offset: The Data Offset field allows the user to select the point in the data file where the analysis begins. The default is 0, and the analysis will be at the first frame found in the I/Q data file. Setting this value higher will provide an offset into the data file, such that frames beyond the first can be analyzed. This is a byte offset, not a frame offset. Pressing up and down will move the offset by 1% increments. To the right of the Offset control is a display of the percent offset into the file.

**Figure 5-48.** View IQ Summary

- Verify the data pattern displayed in the quick view window a composed view and not random data.
- View the selected Data File to confirm this is the file that will be analyzed.



Set Up Parameters

If a data file had been preselected from the “Standard Setup” on page 5-17, the Modulation, Filter, Data, and Detail settings dialogs would be preset. For this example, data for these dialogs is entered as follows:

- 1. Click the Modulation button.
- 2. Click the Modulation button to open the Modulation dialog.
- 3. Click the Modulation Type drop-down.
- 4. Click the modulation type list. For this example, 16QAM is selected.

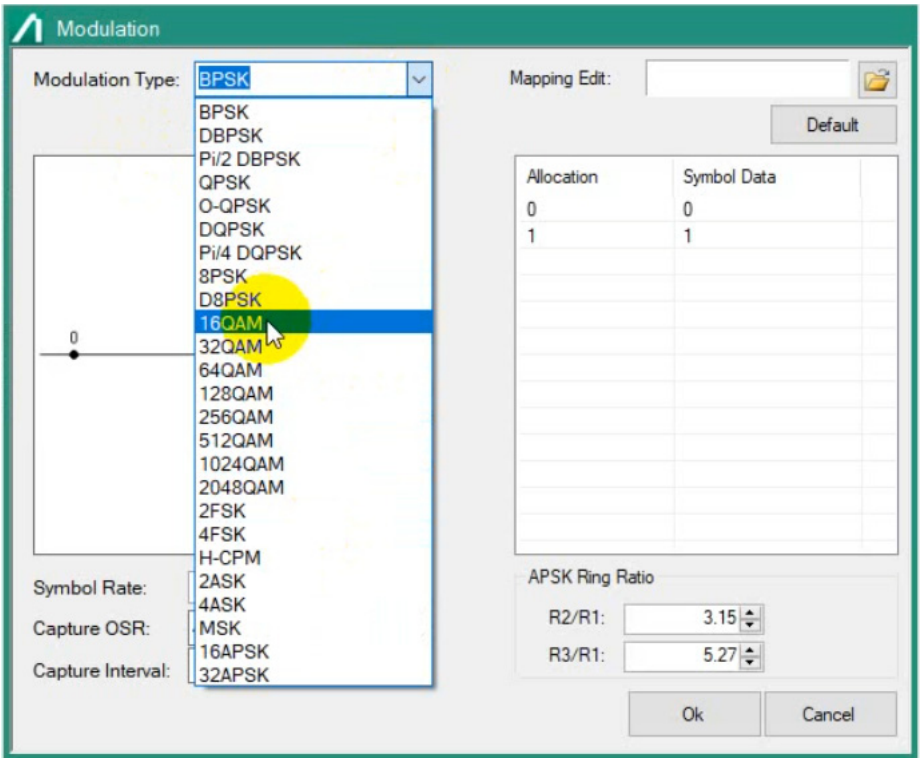


Figure 5-49. Modulation Type List

5. Type Corresponding Capture Parameters. For this example, the only change from the default settings is Symbol Rate set to 10 Msps.

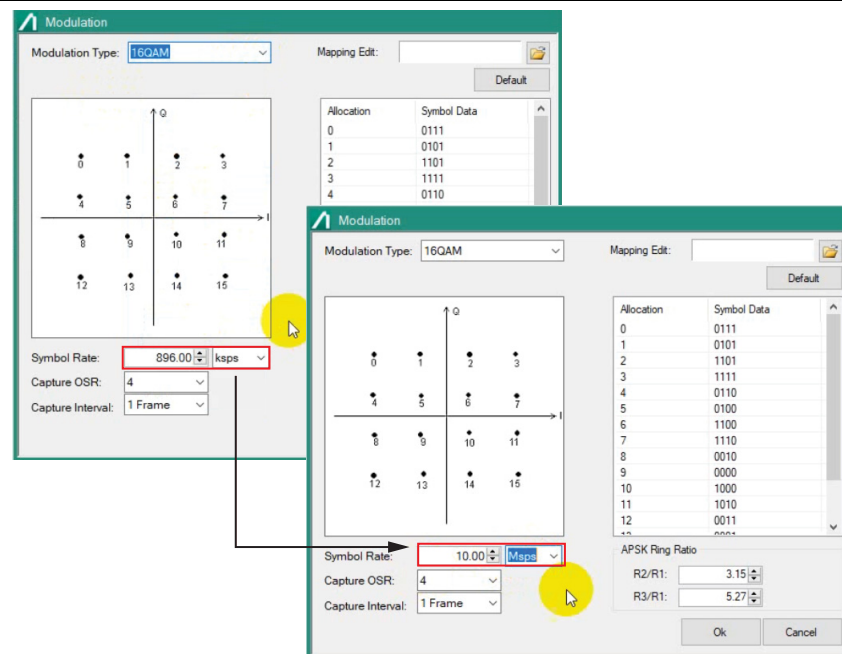


**Figure 5-50.** Type Symbol Rate

After each Parameter Setup is clicked Ok, the corresponding button turns green.

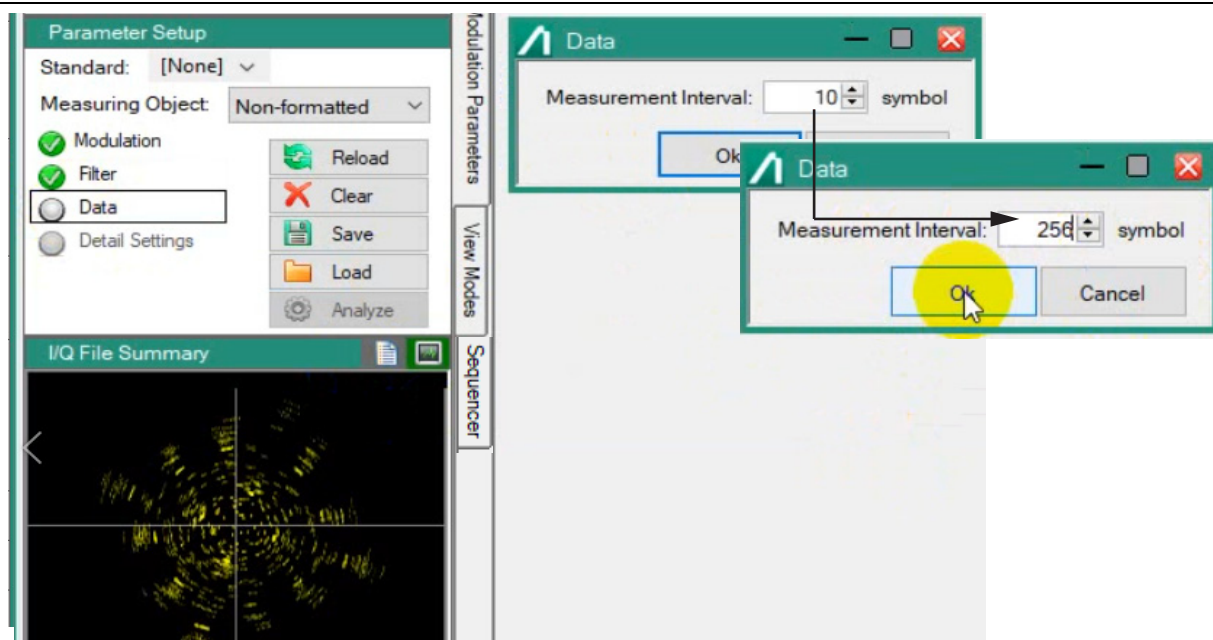


**Figure 5-51.** Type Filter Parameters

### Set Up Data Parameters

1. Click the Data button.
2. Review and change the Measurement Interval per your data measurement requirement. In this example, the amount of symbols that defines a frame is 256.

### Set Up Details Settings Parameters

The Detail Settings sets up the measurement display.

1. Open the Detail Settings dialog.
2. Set the parameters to create the type of modulation analysis desired. Refer to [Figure 5-52](#). In this example, the detail settings have been set as follows:
3. Set Origin Offset Cancel to On.
4. Set Origin Offset Reference to Offset Symbol.
5. Set Droop Cancel to On.
6. Set Adaptive to Adaptive.
7. Set Deviation Calculation to Before Measurement Filter. All other default settings are set.
8. Click Ok,

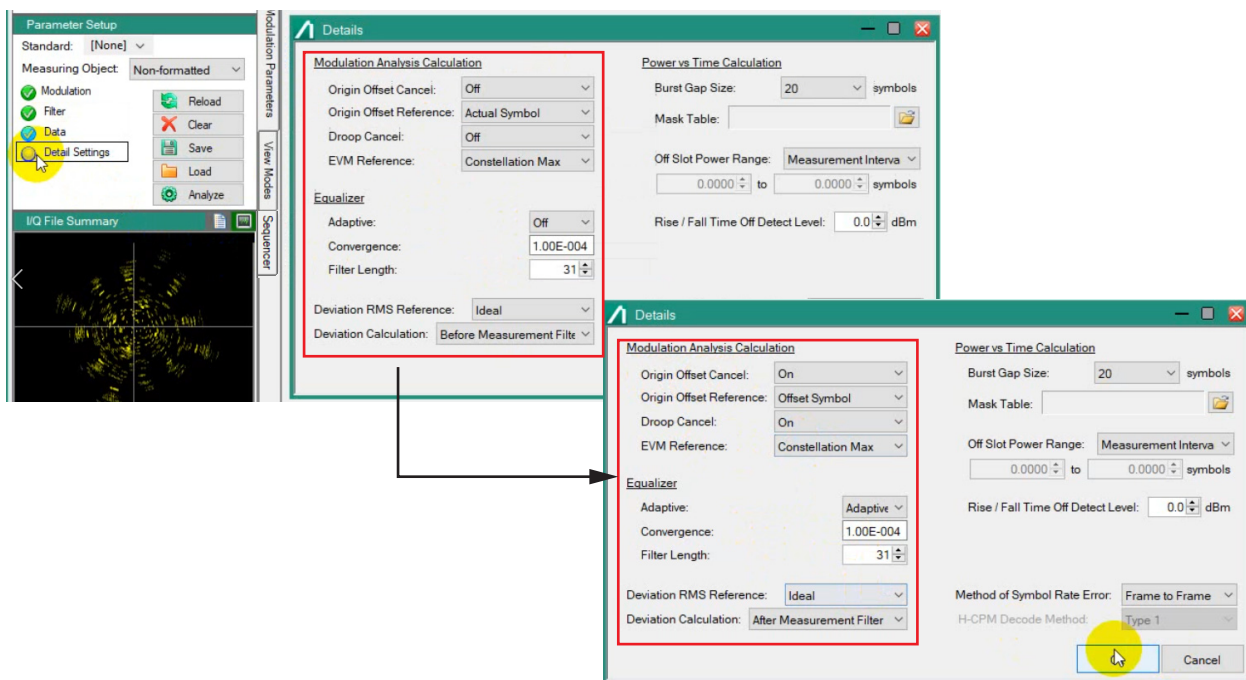


**Figure 5-52.** Set Up Details Settings

Initiate IQ Data Demodulation

To initiate the IQ data demodulation analysis, click Analyze as shown in [Figure 5-52](#). Note all of the Parameter Setup buttons should be green.

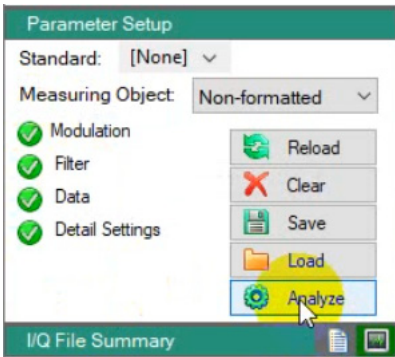


Figure 5-53. Analyze IQ Data

The data processing will take a few seconds to complete. In this example, no prior “View Modes Tab” had been selected so the default view mode is Numeric as shown in [Figure 5-54](#).

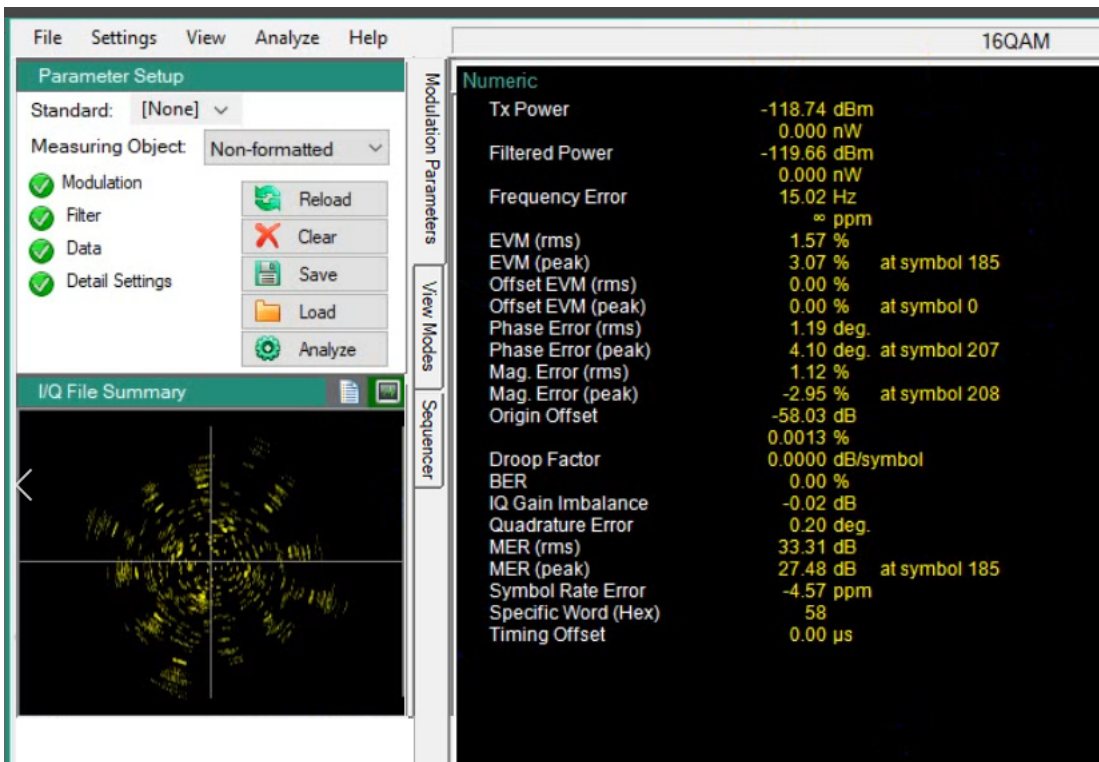


Figure 5-54. Results in Numeric View

If other View modes are already selected, those view modes will also be populated with the new results. As the modulation data is analyzed, different view modes can then be selected as well. In this example, Constellation, EVM vs. Symbol, and Eye Diagram have been selected along with the default Numeric view as shown in [Figure 5-55](#). Additional modulation analysis views can be selected and added to the views. Click “Check All” at the bottom-left section of the display screen to select and display all of the modulation analysis views.

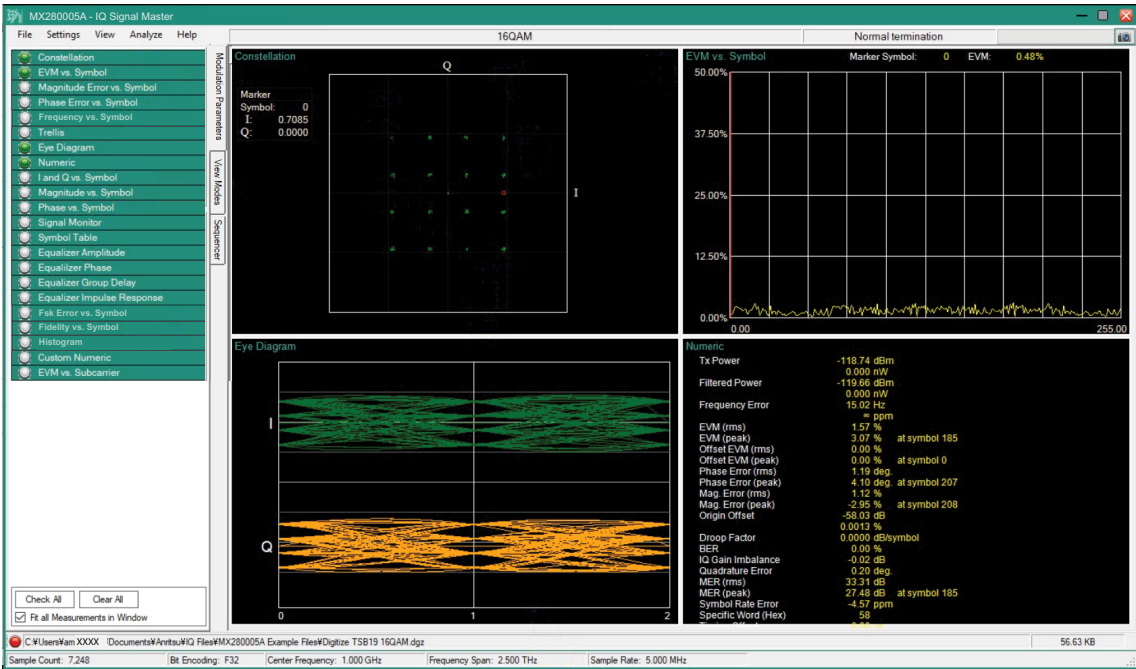
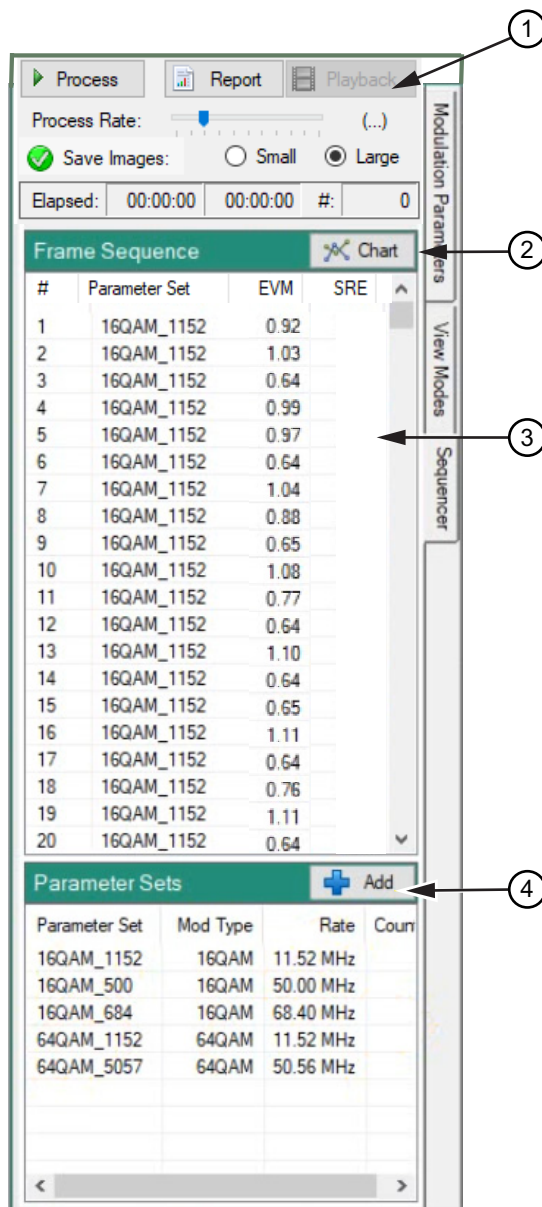


Figure 5-55. Four View Modes

## 5-8 Sequencer Tab

After a capture, use the Sequencer tab to analyze signals that are long with hundreds of frames where the signal changes, such as in satellite radio signals with a specified bandwidth and the modulation type can change over time. The Sequencer tab provides a tool for the user to separate that out.



1. Sequencer Toolbar
2. Chart Button
3. Provides signal analysis results of the parameter sets
4. Add a parameter set to the Parameter Sets list

**Figure 5-56.** Sequencer tab



Sequencer Toolbar

The Sequencer toolbar is shown in [Figure 5-57](#).

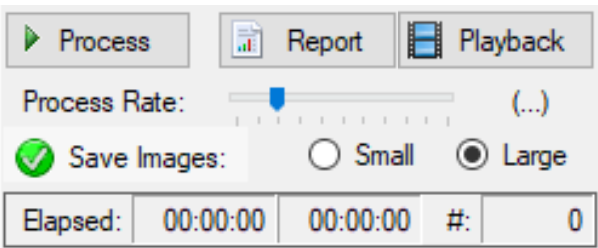


Figure 5-57. Sequencer Toolbar

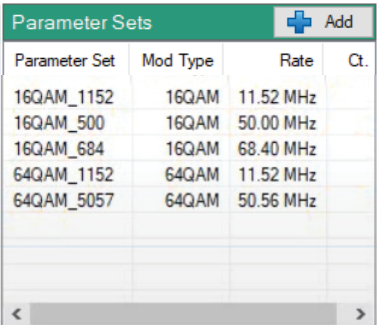
The Sequencer toolbar elements are described in [Table 5-17](#).

Table 5-17. Sequencer Toolbar

|  |                                                                                                                                                                                                                                                                                                                                |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Process:</b> Process the loaded IQ data file to produce a sequence of demodulated frame results.                                                                                                                                                                                                                            |
|  | <b>Report:</b> Generate a process report. See <a href="#">“Report” on page 5-56</a> .                                                                                                                                                                                                                                          |
|  | <b>Playback:</b> View saved images of demodulated frames. See <a href="#">“Playback” on page 5-58</a> .                                                                                                                                                                                                                        |
|  | <b>Process Rate:</b> Adjust the slider to view frame count activity. Set the slider to left-most for maximum frame count. Faster rates are achieved by skipping ahead in the data set. Only the slowest setting processes all data in the IQ capture file.                                                                     |
|  | <b>Save Images:</b> Check to save each frame that is processed.<br><div><input type="radio"/> Small <input checked="" type="radio"/> Large</div><br><b>Small:</b> Saves small image size (640 x 480) pixels<br><b>Large:</b> Saves large image size (1024 x 768) pixels                                                        |
|  | <b>Elapsed:</b> Elapsed time for fame sequencing<br><div><div>00:00:00</div><div>00:00:00</div><div>#:</div><div>0</div></div><br><b>Timer 1:</b> Tracks the elapsed time of frame sequencing.<br><b>Timer 2:</b> Tracks the remaining time of frame sequencing.<br><b>#:</b> Tracks the number of frames sequenced in a file. |

Parameter Sets

The Parameter Sets window is shown in [Figure 5-58](#). Press the Add button to browse and add sets to the Parameters Sets window. Several sets can be added for frame sequencing analysis. Parameter files loaded here are XML Parameter files as shown in [Figure 5-15 on page 5-12](#).



| Parameter Sets |          |           |     | + | Add |
|----------------|----------|-----------|-----|---|-----|
| Parameter Set  | Mod Type | Rate      | Ct. |   |     |
| 16QAM_1152     | 16QAM    | 11.52 MHz |     |   |     |
| 16QAM_500      | 16QAM    | 50.00 MHz |     |   |     |
| 16QAM_684      | 16QAM    | 68.40 MHz |     |   |     |
| 64QAM_1152     | 64QAM    | 11.52 MHz |     |   |     |
| 64QAM_5057     | 64QAM    | 50.56 MHz |     |   |     |
|                |          |           |     |   |     |
|                |          |           |     |   |     |
|                |          |           |     |   |     |
|                |          |           |     |   |     |

Figure 5-58. Parameter Sets Window

The Parameter Sets toolbar and parameter headings are described in [Table 5-18](#).

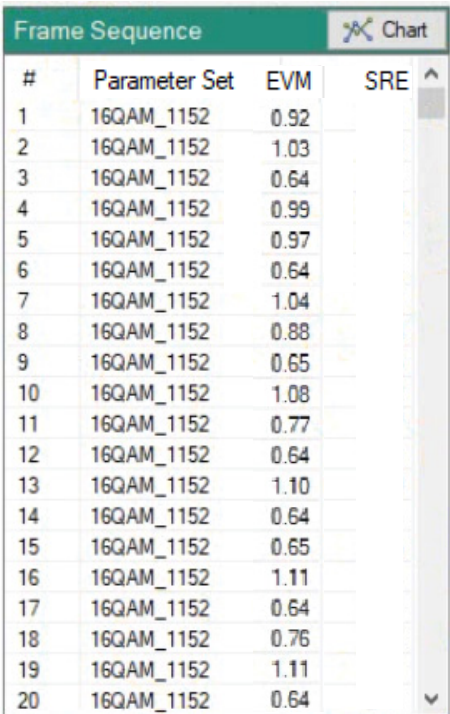
Table 5-18. Parameter Sets Toolbar and Columns

|                                                                                   |                                                                                                                                                                           |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Add:</b> Press to browse files in a user selected sets folder. Add a set or sets to the list for analysis.                                                             |
| Parameter Set                                                                     | <b>Parameter Set:</b> This column displays the loaded parameter set.                                                                                                      |
| Mod Type                                                                          | <b>Mod Type:</b> This column displays the sets mod type.                                                                                                                  |
| Rate                                                                              | <b>Rate:</b> This column displays the signal rate of the set.                                                                                                             |
| Ct.                                                                               | <b>Ct:</b> This column displays the number of frames found in the file that fits best with the given parameter set. The count number increments as the file is processed. |



Frame Sequence

To provide the results that are loaded from “Parameter Sets”, press the “Process:” button. Vector signal analysis is performed by searching each of the sets and then lists the lowest EVM of each frame. The results are shown in Figure 5-59. The results can then be manually scanned to find changes.

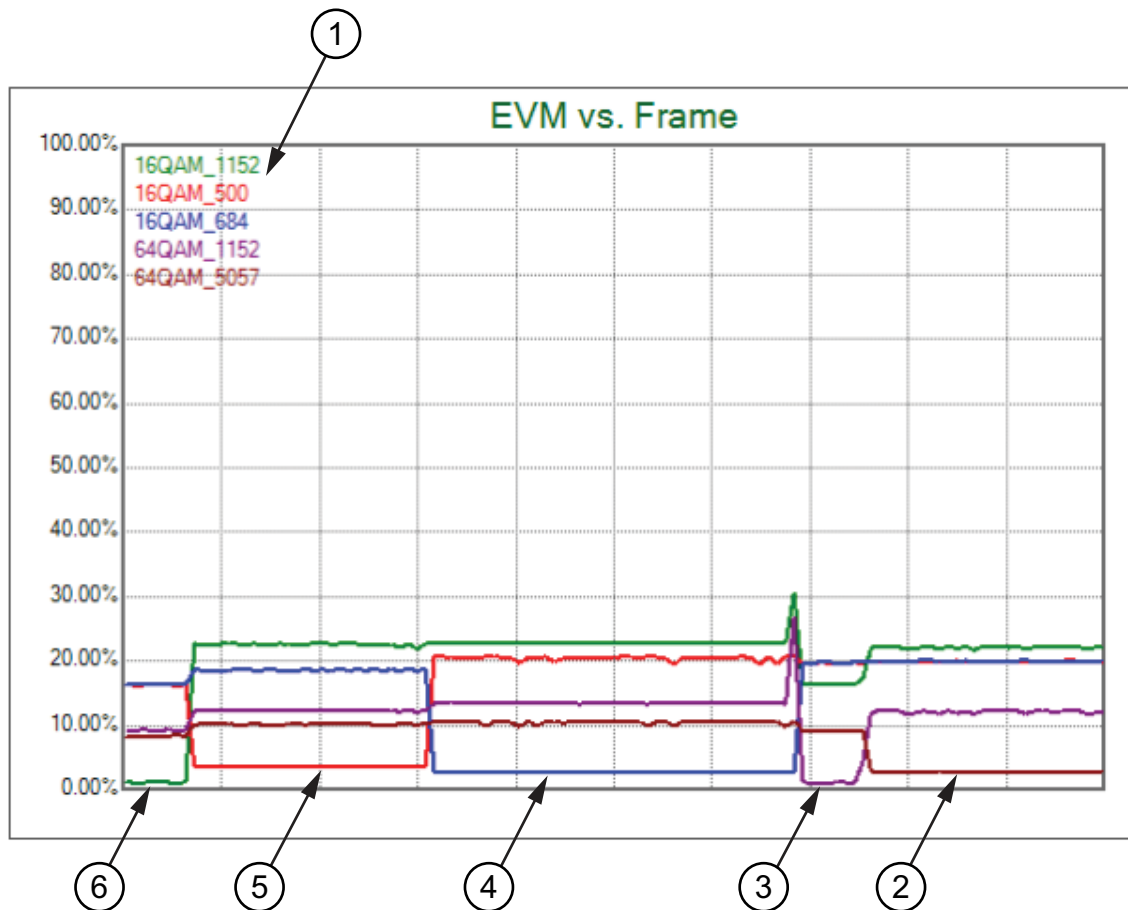


| #  | Parameter Set | EVM  | SRE |
|----|---------------|------|-----|
| 1  | 16QAM_1152    | 0.92 |     |
| 2  | 16QAM_1152    | 1.03 |     |
| 3  | 16QAM_1152    | 0.64 |     |
| 4  | 16QAM_1152    | 0.99 |     |
| 5  | 16QAM_1152    | 0.97 |     |
| 6  | 16QAM_1152    | 0.64 |     |
| 7  | 16QAM_1152    | 1.04 |     |
| 8  | 16QAM_1152    | 0.88 |     |
| 9  | 16QAM_1152    | 0.65 |     |
| 10 | 16QAM_1152    | 1.08 |     |
| 11 | 16QAM_1152    | 0.77 |     |
| 12 | 16QAM_1152    | 0.64 |     |
| 13 | 16QAM_1152    | 1.10 |     |
| 14 | 16QAM_1152    | 0.64 |     |
| 15 | 16QAM_1152    | 0.65 |     |
| 16 | 16QAM_1152    | 1.11 |     |
| 17 | 16QAM_1152    | 0.64 |     |
| 18 | 16QAM_1152    | 0.76 |     |
| 19 | 16QAM_1152    | 1.11 |     |
| 20 | 16QAM_1152    | 0.64 |     |

Figure 5-59. Frame Sequence

## EVM vs. Frame

Press the Chart button to generate an EVM vs. Frame graph as shown in [Figure 5-60](#). The sets listed in the Parameter Sets window are shown in the top left corner of the graph. The EVM response identifies which sets are on. Note that each frame per set has a lowest set.



1. List of Parameter Sets
2. Set 64 QAM 5057 - Low Point
3. Set 64 QAM 1152 - Low Point
4. Set 16 QAM 684 - Low Point
5. Set 16 QAM 500 - Low Point
6. Set 16 QAM 1152 - Low Point

**Figure 5-60.** EVM vs. Frame Graph

## Report

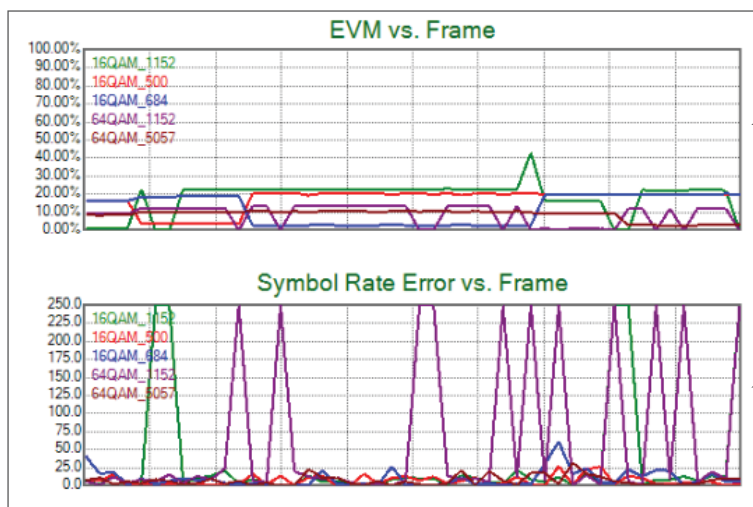
Press the “Report” button to generate a Frame Sequence Report as shown in Figure 5-61.

## MX280005A - Frame Sequence Report

Date: 5/20/2022 9:02:13 AM

Filename: C:\Users\am00xxx\Documents\Anritsu\IQ Files\IQ Stream.dgzm

| Parameter Set | Mod Type | Rate      | Ct. |
|---------------|----------|-----------|-----|
| 16QAM_1152    | 16QAM    | 1.152 MHz | 9   |
| 16QAM_500     | 16QAM    | 5.000 MHz | 8   |
| 16QAM_684     | 16QAM    | 6.840 MHz | 21  |
| 64QAM_1152    | 64QAM    | 1.152 MHz | 3   |
| 64QAM_5057    | 64QAM    | 5.057 MHz | 7   |



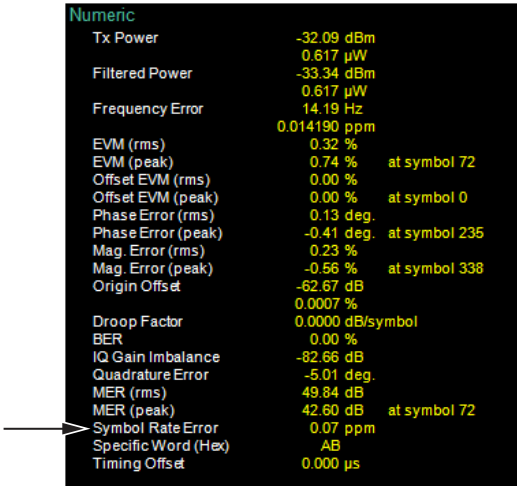
| #  | Parameter Set | EVM  | SRE       |
|----|---------------|------|-----------|
| 1  | 16QAM_1152    | 1.28 | 7.36      |
| 2  | 16QAM_1152    | 1.11 | 1.61      |
| 3  | 16QAM_1152    | 1.37 | 16.95     |
| 4  | 16QAM_1152    | 1.11 | 2.04      |
| 5  | 16QAM_500     | 3.53 | 3.58      |
| 6  | 16QAM_1152    | 0.00 | 99,999.00 |
| 7  | 16QAM_1152    | 0.00 | 99,999.00 |
| 8  | 16QAM_500     | 3.53 | 2.62      |
| 9  | 16QAM_500     | 3.54 | 2.47      |
| 10 | 16QAM_500     | 3.52 | 1.11      |
| 11 | 16QAM_500     | 3.50 | 2.11      |
| 12 | 16QAM_500     | 3.52 | 1.43      |
| 13 | 16QAM_684     | 2.73 | 3.12      |

1. See “Parameter Sets” on page 5-53.
2. See “EVM vs. Frame” on page 5-55.
3. See Symbol Rate Error vs. Frame: The Symbol Rate Error is a calculated parameter in the analysis. See “Symbol Rate Error”.
4. See “Frame Sequence” on page 5-54.

Figure 5-61. Frame Sequence Report

Symbol Rate Error

The Symbol Rate is an input parameter to the analysis. The Symbol Rate Error is a calculated value indicating how closely the found symbols aligned with the expected rate. This value is displayed in each Numeric display as shown in [Figure 5-62](#).

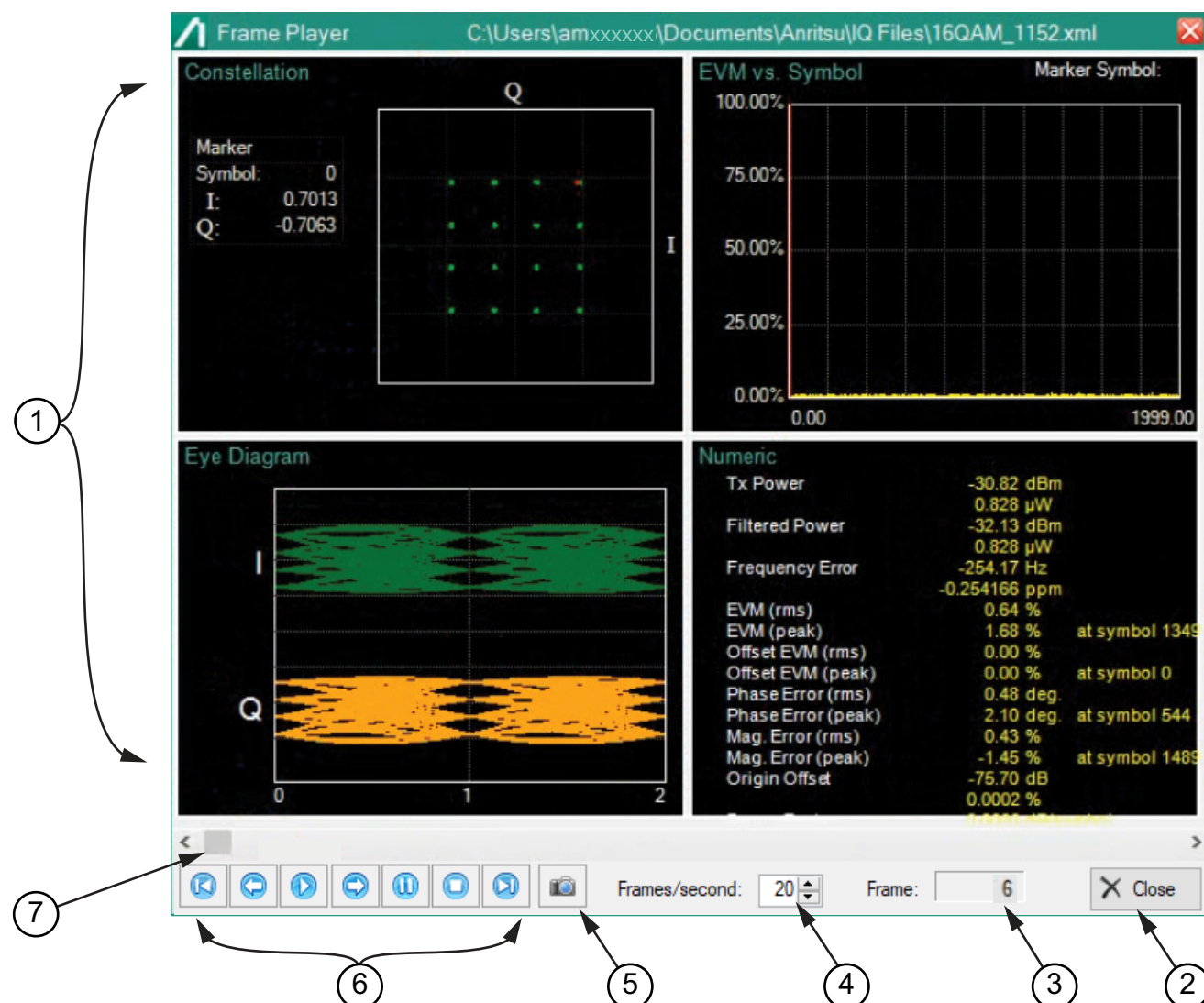


|                     |                  |               |
|---------------------|------------------|---------------|
| Numeric             |                  |               |
| Tx Power            | -32.09 dBm       |               |
|                     | 0.617 μW         |               |
| Filtered Power      | -33.34 dBm       |               |
|                     | 0.617 μW         |               |
| Frequency Error     | 14.19 Hz         |               |
|                     | 0.014190 ppm     |               |
| EVM (rms)           | 0.32 %           |               |
| EVM (peak)          | 0.74 %           | at symbol 72  |
| Offset EVM (rms)    | 0.00 %           |               |
| Offset EVM (peak)   | 0.00 %           | at symbol 0   |
| Phase Error (rms)   | 0.13 deg.        |               |
| Phase Error (peak)  | -0.41 deg.       | at symbol 235 |
| Mag. Error (rms)    | 0.23 %           |               |
| Mag. Error (peak)   | -0.56 %          | at symbol 338 |
| Origin Offset       | -62.67 dB        |               |
|                     | 0.0007 %         |               |
| Droop Factor        | 0.0000 dB/symbol |               |
| BER                 | 0.00 %           |               |
| IQ Gain Imbalance   | -82.66 dB        |               |
| Quadrature Error    | -5.01 deg.       |               |
| MER (rms)           | 49.84 dB         |               |
| MER (peak)          | 42.60 dB         | at symbol 72  |
| Symbol Rate Error   | 0.07 ppm         |               |
| Specific Word (Hex) | AB               |               |
| Timing Offset       | 0.000 μs         |               |

Figure 5-62. Symbol Rate Error

## Playback

Press “Playback” to playback and view images of each demodulated frame and what the IQ capture looks like in time based analysis as shown in Figure 5-63.



1. IQ Measurement Screens: All screens are available selected from View Modes Tab.
2. Close Button: Close the Playback window.
3. Frame Count: Displays the frame count of the signal. Use the scrollbar to locate a point of interest and note the Frame number to reference a location.
4. Frame Speed Per Second: Playback speed control.
5. Capture Screen to Clipboard: Press to capture the Playback window display to the Microsoft clipboard.
6. Playback Controls: Typical video controls.
7. Scrollbar: Use to scan signal for points of interest. The Frame count window tracks the scrollbar. If a signal of interest was noted as occurring at a particular frame count, the user can move the scroll bar to the frame count noted and view the parameters of each EVM window displayed.

**Figure 5-63.** Playback View

Right-click on the Constellation window displays the menu shown in [Figure 5-64](#). Each modulation scheme will display a similar window that pertains to its characteristics. All modulation schemes and their menu boxes are described in [Chapter 6](#).

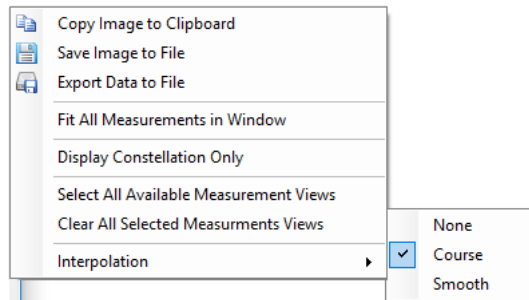


**Figure 5-64.** Constellation Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Constellation Only:** Only Constellation view is displayed in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**Interpolation:** Sets the data interpolation between the symbols displayed on the graph and the display complementation. On the interpolation display, data is interpolated by using the number of splits between symbols specified in Points/Symbol and a graph is displayed with each data connected with straight lines.



# Chapter 6 — Modulation Analysis

## 6-1 Introduction

This chapter describes the measurement function, parameter contents, and IQ modulation graphs captured by the MX280005A IQ Signal Master Software.

## 6-2 Modulation Analysis Graphs

The modulation analysis types are shown in [Table 6-1](#).

**Table 6-1.** Analysis Type

| Analysis Type              | Description                                                                                                                                                       |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Constellation              | Displays the waveform of the analysis interval on IQ coordinate or frequency axis graph.<br>See <a href="#">“Constellation” on page 6-4</a> .                     |
| EVM vs. Symbol             | Displays the EVM of each symbol on a graph.<br>See <a href="#">“EVM vs. Symbol” on page 6-6</a> .                                                                 |
| Magnitude Error vs. Symbol | Displays the amplitude error of each symbol on a graph.<br>See <a href="#">“Magnitude Error vs. Symbol” on page 6-7</a> .                                         |
| Phase Error vs. Symbol     | Displays the phase error of each symbol on a graph.<br>See <a href="#">“Phase Error vs. Symbol” on page 6-8</a> .                                                 |
| Frequency vs. Symbol       | Displays the FM frequency deviation of the waveform in the analysis interval on a graph.<br>See <a href="#">“Frequency vs. Symbol” on page 6-9</a> .              |
| Trellis                    | Displays the phase transition of the waveform in the analysis interval on a graph.<br>See <a href="#">“Trellis” on page 6-10</a> .                                |
| Eye Diagram                | Displays the amplitude of the I phase and Q phase of the waveform in the analysis interval on a graph.<br>See <a href="#">“Eye Diagram” on page 6-11</a> .        |
| Numeric                    | Displays the numeric results.<br>See <a href="#">“Numeric” on page 6-12</a> .                                                                                     |
| I and Q vs. Symbol         | Displays the amplitude of the I phase and Q phase of the waveform in the analysis interval on a graph.<br>See <a href="#">“I and Q vs. Symbol” on page 6-16</a> . |
| Magnitude vs. Symbol       | Displays the amplitude of the waveform in the analysis interval on a graph.<br>See <a href="#">“Magnitude vs. Symbol” on page 6-17</a> .                          |
| Phase vs. Symbol           | Displays the phase of the waveform in the analysis interval on a graph.<br>See <a href="#">“Phase vs. Symbol” on page 6-18</a> .                                  |
| Signal Monitor             | Displays the spectrum of the waveform in the analysis interval on a graph.<br>See <a href="#">“Signal Monitor” on page 6-19</a> .                                 |
| Symbol Table               | Displays the demodulation bit for each symbol.<br>See <a href="#">“Symbol Table” on page 6-20</a> .                                                               |
| Equalizer Amplitude        | Displays the equalizer amplitude characteristics.<br>See <a href="#">“Equalizer Amplitude” on page 6-21</a> .                                                     |
| Equalizer Phase            | Displays the equalizer phase characteristics.<br>See <a href="#">“Equalizer Phase” on page 6-22</a> .                                                             |



**Table 6-1.** Analysis Type

| Analysis Type              | Description                                                                                                                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Equalizer Group Delay      | Displays the equalizer group delay characteristics.<br>See <a href="#">“Equalizer Group Delay” on page 6-23.</a>            |
| Equalizer Impulse Response | Displays the equalizer impulse response.<br>See <a href="#">“Equalizer Impulse Response” on page 6-24.</a>                  |
| FSK Error vs. Symbol       | Displays the FSK error of each symbol on a graph.<br>See <a href="#">“FSK Error vs. Symbol” on page 6-25.</a>               |
| Fidelity vs. Symbol        | Displays the analysis results of Modulation Fidelity vs. Symbol.<br>See <a href="#">“Fidelity vs. Symbol” on page 6-26.</a> |
| Histogram                  | Displays the appearance frequency of each symbol.<br>See <a href="#">“Histogram” on page 6-27.</a>                          |
| EVM vs. Subcarrier         | Displays the EVM per subcarrier in the graph.<br>See <a href="#">“EVM vs. Subcarrier” on page 6-28.</a>                     |

Table 6-2 shows the analysis type and if measurement results are displayed. 'Not Supported' is displayed in the trace area if the measurement result is not displayed.

**Table 6-2.** Modulation Type and Result Display

| Analysis Type              | Modulation Type |     |       |
|----------------------------|-----------------|-----|-------|
|                            | 2FSK 4FSK H-CPM | MSK | Other |
| Constellation              | Yes             | Yes | Yes   |
| EVM vs. Symbol             | Yes             | Yes | Yes   |
| Magnitude Error vs. Symbol | Yes             | Yes | Yes   |
| Phase Error vs. Symbol     | Yes             | Yes | Yes   |
| Frequency vs. Symbol       | Yes             | Yes | No    |
| Trellis                    | Yes             | Yes | Yes   |
| Eye Diagram                | Yes             | Yes | Yes   |
| Numeric                    | Yes             | Yes | Yes   |
| I and Q vs. Symbol         | Yes             | Yes | Yes   |
| Magnitude vs. Symbol       | Yes             | Yes | Yes   |
| Phase vs. Symbol           | Yes             | Yes | Yes   |
| Signal Monitor             | Yes             | Yes | Yes   |
| Symbol Table               | Yes             | Yes | Yes   |
| Equalizer Amplitude        | No              | No  | Yes   |
| Equalizer Phase            | No              | No  | Yes   |
| Equalizer Group Delay      | No              | No  | Yes   |
| Equalizer Impulse Response | No              | No  | Yes   |
| FSK Error vs. Symbol       | Yes             | Yes | No    |
| Fidelity vs. Symbol        | Yes             | Yes | No    |
| Histogram                  | Yes             | Yes | No    |
| EVM vs. Subcarrier         | No              | No  | No    |

## 6-3 Constellation

Displays the Constellation analysis result in the trace area. The result of each analysis is displayed.

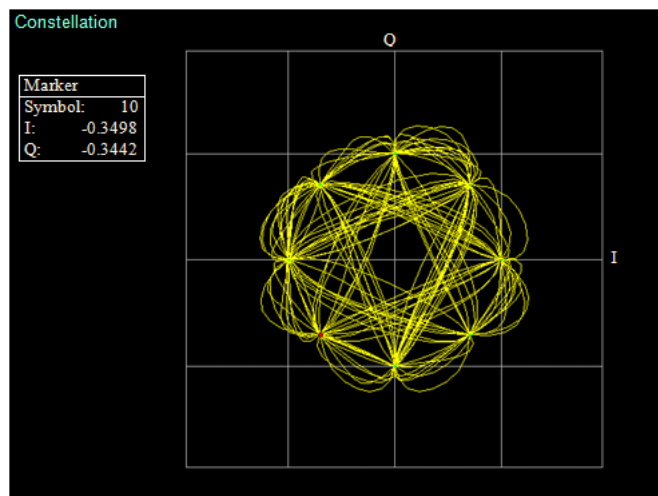


Figure 6-1. Constellation Result

### Graph Display Result

Displays the waveform in the analysis interval on the IQ axis. The IQ waveform is normalized and displayed with the vector of the outermost symbol position. When the modulation is set to 2FSK, 4FSK, or H-CPM, the frequency deviation of each symbol can be displayed with the horizontal axis as normalized frequency. Right-click the measurement screen to display the menu shown below.

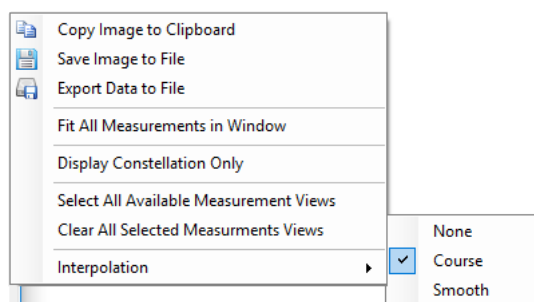


Figure 6-2. Constellation Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Constellation Only:** Only Constellation view is displayed in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**Interpolation:** Sets the data interpolation between the symbols displayed on the graph and the display complementation. On the interpolation display, data is interpolated by using the number of splits between symbols specified in Points/Symbol and a graph is displayed with each data connected with straight lines.

**Settings**

None: No interpolation applied to display.

Coarse: Coarse sampling rate applied to display.

Smooth: Increased sampling rate applied to display.

**Resolution**

Resolution when Frame Formatted or Non-Formatted is selected.

1 symbol: When Interpolation is set to None, Interpolation and Points/Symbol is set to 1 point.

0.5 symbol: When Interpolation is set to Coarse, Interpolation and Points/Symbol is set to 2 points.

0.125 symbol: When Interpolation is set to Smooth, Interpolation and Points/Symbol is set to 8 points.

**Range**

0 to (FFT Size – (Lower Guard Subcarrier) – (Upper Guard Subcarrier) – 1)

**Resolution**

1 subcarrier

**Marker**

Click and rotate mouse-wheel to position a marker on point.

# 6-4 EVM vs. Symbol

Displays EVM vs. Symbol analysis result in the trace.

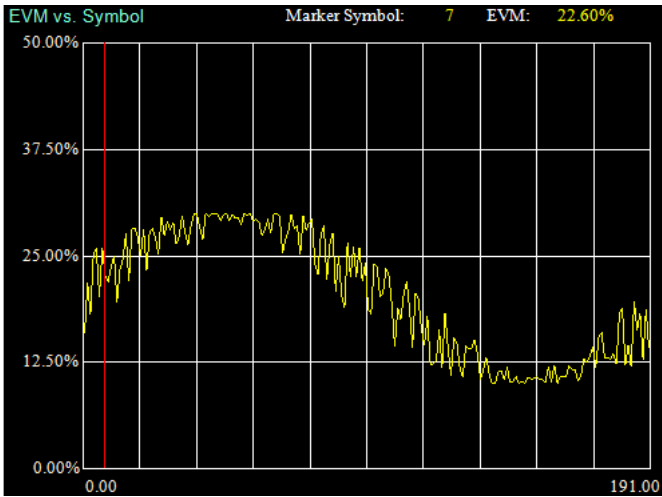


Figure 6-3. EVM vs. Symbol Display

## Graph Display Result

The result of each analysis is displayed, regardless of the storage mode. Displays EVM of each symbol in the analysis interval as a percentage RMS. Right-click the measurement screen to display the menu shown below.

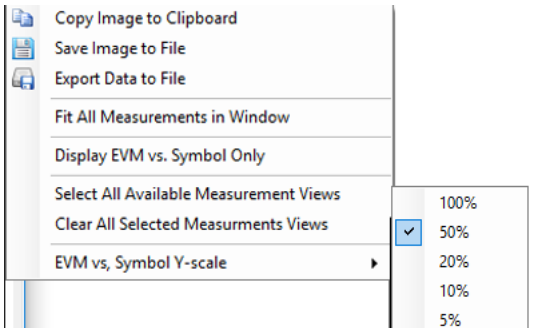


Figure 6-4. EVM vs. Symbol Display Menu

- Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.
- Save Image to File:** Name and save the image to a user selected file.
- Export Data to File:** Export the data to a user selected file.
- Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.
- Display EVM vs. Symbol Only:** Only EVM vs. Symbol view is displayed in full view.
- Select all Available Measurement Views:** All measurement views are displayed in the window.
- Clear All Selected Measurements Views:** Clears out all views.
- EVM vs. Symbol Y-scale:** Sets the Y-scale of a graphical result.  
Range: 5%, 10%, 20%, 50%, 100%

## Marker

Click and rotate mouse-wheel to position a marker.

## 6-5 Magnitude Error vs. Symbol

Displays Magnitude Error vs. Symbol analysis result in the trace as shown in. The result of each analysis is displayed, regardless of the storage mode.

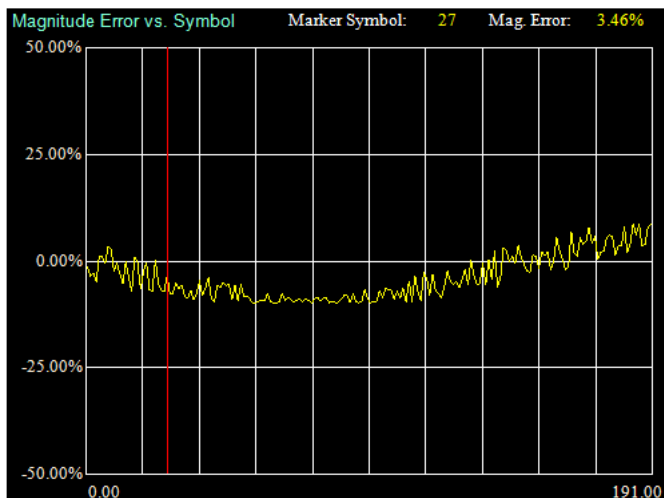


Figure 6-5. Magnitude Error vs. Symbol

### Graph Display Result

Displays the amplitude error of each symbol in the analysis interval as a percentage. Right-click the measurement screen to display the menu shown below.

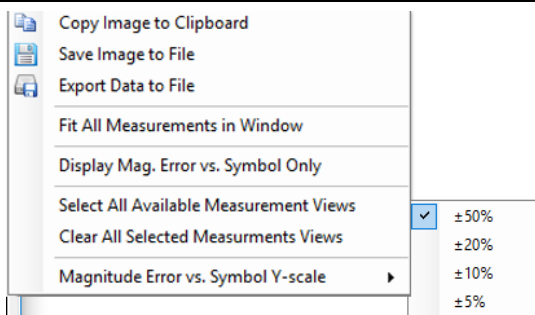


Figure 6-6. Magnitude Error vs. Symbol Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Magnitude Error vs. Symbol:** Only Magnitude Error vs. Symbol displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**Magnitude Error vs. Symbol Y-scale:** Sets the Y-scale of a graphical result.

Range:  $\pm 5\%$ ,  $\pm 10\%$ ,  $\pm 20\%$ ,  $\pm 50\%$

### Marker

Click and rotate mouse-wheel to position a marker.

## 6-6 Phase Error vs. Symbol

Displays Phase Error vs. Symbol analysis result in the trace. The result of each analysis is displayed.

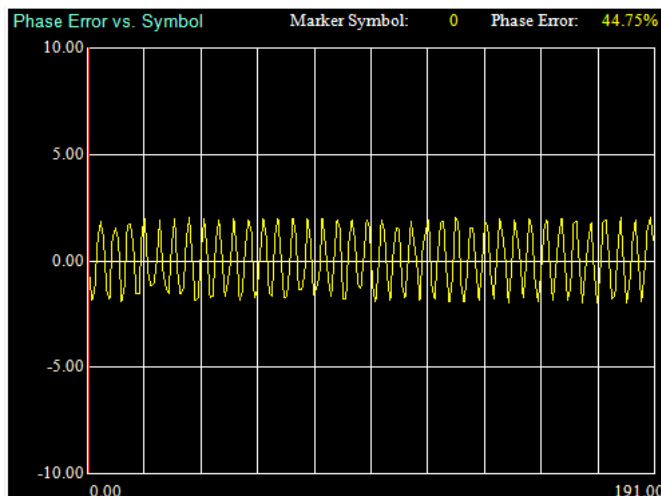


Figure 6-7. Phase Error vs. Symbol

### Graph Display Result

Displays the phase error of each symbol in the analysis interval in degrees. Right-click the measurement screen to display the menu shown below.

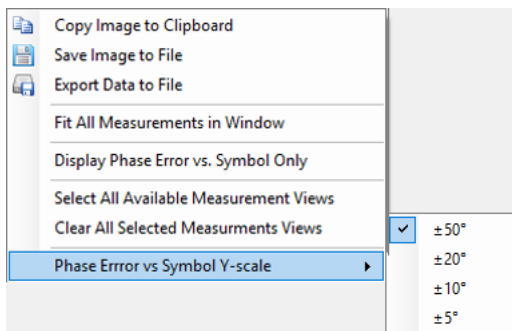


Figure 6-8. Phase Error vs. Symbol Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Phase Error vs. Symbol Only:** Only Phase Error vs. Symbol displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**Phase Error vs. Symbol Y-scale:**  $\pm 5$  degree,  $\pm 10$  degree,  $\pm 20$  degree,  $\pm 50$  degree

### Marker

Click and rotate mouse-wheel to position a marker.

## 6-7 Frequency vs. Symbol

Displays Frequency vs. Symbol analysis result in the trace area. The result of each analysis is displayed, regardless of the storage mode.

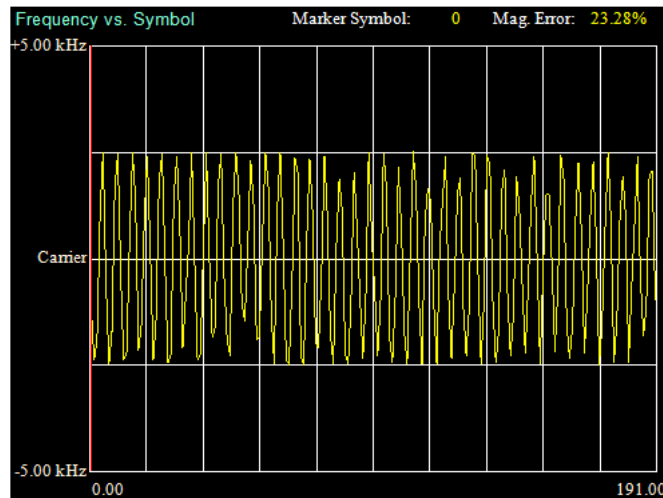


**Figure 6-9.** Frequency vs. Symbol Result

### Graph Display Result

Displays the frequency deviation of each 1/8th of the symbol interval in the analysis interval in Hz units. Right-click the measurement screen to display the menu shown below.

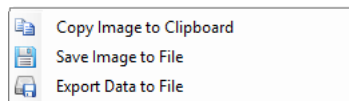


**Figure 6-10.** Frequency vs. Symbol Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

### Marker

Click and rotate mouse-wheel to position a marker.



## 6-8 Trellis

Displays the analysis result of the phase transition in the trace area. The result of each analysis is displayed.

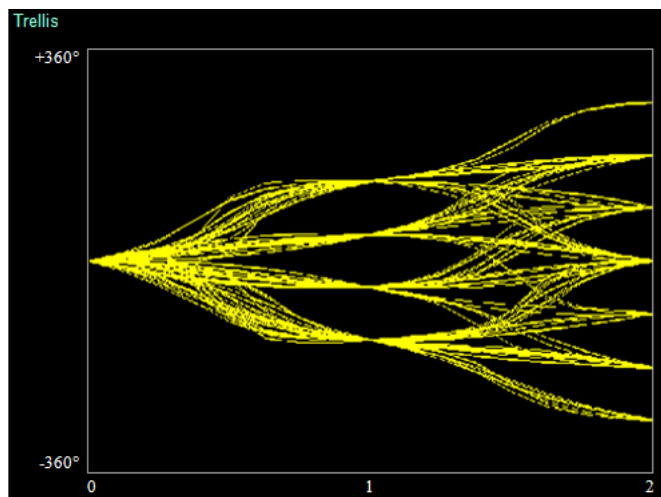


Figure 6-11. Trellis

### Graph Display Result

Displays the phase transition for each 1/8th of the symbol in the analysis interval, in degrees. The graph's horizontal axis is displayed in intervals of 2 symbols. Right-click the measurement screen to display the menu shown below.

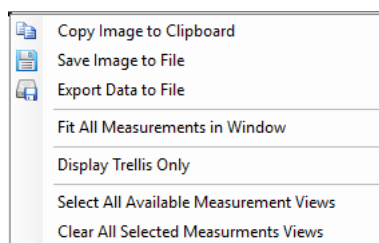


Figure 6-12. Trellis Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Trellis Only:** Only Trellis is displayed in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

### Scale

The graph's vertical axis scale is fixed to  $\pm 360$  degrees.

### Marker

No marker function is available.

## 6-9 Eye Diagram

Displays the amplitude analysis result of the I phase and Q phase, in the trace area. The result of each analysis is displayed.

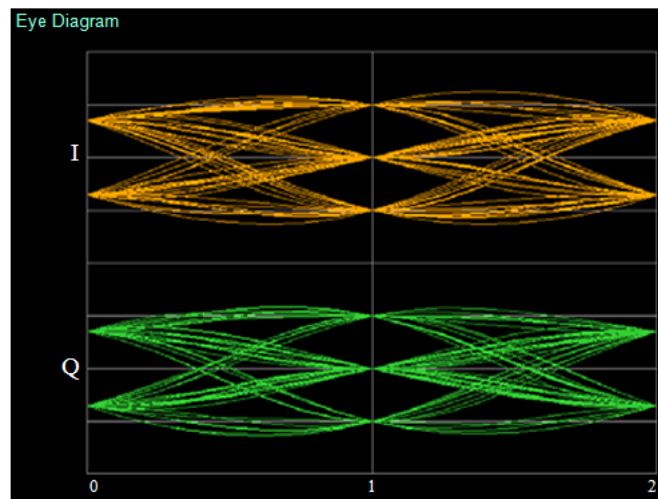


Figure 6-13. Eye Diagram

### Graph Display Result

Displays the normalized amplitude of the I phase and Q phase for each 1/8th of the symbol in the analysis interval. When modulation is set to 2FSK, 4FSK, or H-CPM, the frequency deviation of each symbol can be displayed with the horizontal axis as normalized frequency. The graph's horizontal axis is displayed in 2-symbol intervals. Right-click the measurement screen to display the menu shown below.

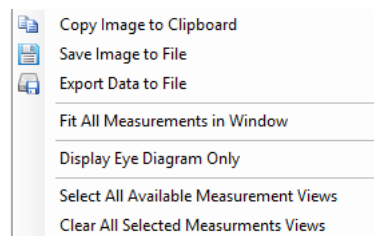


Figure 6-14. Eye Diagram Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Eye Diagram Only:** Only Eye Diagram displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

## 6-10 Numeric

Displays the numeric result of modulation analysis in the trace area. According to the storage mode specified, the results in a single measurement are displayed for Off, the averages of the results in the specified number of measurements for Average, and the averages and the maximums of the results in the specified number of measurements for Average and Max, respectively. The measurements depend on the Modulation Type setting.

If a 4-trace split screen is displayed, Filtered Power, Frequency Error (ppm), Droop Factor, MER (RMS, peak), or Deviation at Ts/2 is not displayed on the screen.

| Numeric           |                    |                      |                    |
|-------------------|--------------------|----------------------|--------------------|
| Tx Power          | 0.00 dBm           | Mod. Fidelity (rms)  | 0.00 %             |
| Tx Power          | 0.00 kW            | Mod. Fidelity (peak) | 0.00 % at symbol 0 |
| Filtered Power    | 0.00 dBm           | Symbol Rate Error    | 0.00 ppm           |
|                   | 1.000 mW           | Jitter P-P Min       | 0.00 %             |
| Frequency Error   | 0.00 Hz            | Jitter P-P Max       | 0.00 %             |
|                   | 0.000000 ppm       | Deviation            |                    |
| Mag. Error (rms)  | 0.00 %             | Average              | 0.00 Hz            |
| Mag. Error (peak) | 0.00 % at symbol 0 | +Peak                | 0.00 Hz            |
| FSK Error (rms)   | 0.00 %             | -Peak                | 0.00 Hz            |
| FSK Error (peak)  | 0.00 % at symbol 0 | (Peak-Peak)/2        | 0.00 Hz            |
| BER               | 0.00 %             | Specific Word (Hex)  | 0                  |
| Deviation at Ts/2 |                    | Timing Offset        | 0.00 $\mu$ s       |
| +3 Average        | 0.00 Hz            | -3 Average           | 0.00 Hz            |
| +3 +Max Peak      | 0.00 Hz            | -3 +Max Peak         | 0.00 Hz            |
| +3 +Min Peak      | 0.00 Hz            | -3 +Min Peak         | 0.00 Hz            |
| +3 -Max Peak      | 0.00 Hz            | -3 -Max Peak         | 0.00 Hz            |
| +3 -Min Peak      | 0.00 Hz            | -3 -Min Peak         | 0.00 Hz            |
| +3 (Peak-Peak)/2  | 0.00 Hz            | -3 (Peak-Peak)/2     | 0.00 Hz            |
| +3 Max Peak%      | 0.00 %             | -3 Max Peak%         | 0.00 Hz            |
| +3 Min Peak%      | 0.00 %             | -3 Min Peak%         | 0.00 Hz            |
| +1 Average        | 0 Hz               | -1 Average           | 0 Hz               |
| +1 +Max Peak      | 0 Hz               | -1 +Max Peak         | 0 Hz               |
| +1 +Min Peak      | 0 Hz               | -1 +Min Peak         | 0 Hz               |
| +1 -Max Peak      | 0 Hz               | -1 -Max Peak         | 0 Hz               |
| +1 -Min Peak      | 0 Hz               | -1 -Min Peak         | 0 Hz               |
| +1 (Peak-Peak)/2  | 0 Hz               | -1 (Peak-Peak)/2     | 0 Hz               |
| +1 Max Peak%      | 0 Hz               | -1 Max Peak%         | 0 Hz               |
| +1 Min Peak%      | 0.00 %             | -1 Min Peak%         | 0.00 %             |

Figure 6-15. Numeric (Modulation Type is Pi/4DQPSK)

## Graph Display Result

Displays the normalized amplitude of the I phase and Q phase for each 1/8th of the symbol in the analysis interval. When modulation is set to 2FSK, 4FSK, or H-CPM, the frequency deviation of each symbol can be displayed with the horizontal axis as normalized frequency. The graph's horizontal axis is displayed in 2-symbol intervals. Right-click the measurement screen to display the menu shown below.

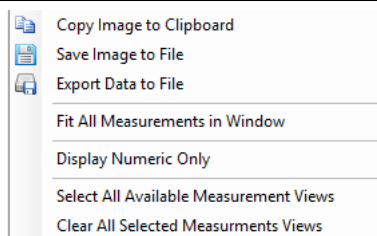


Figure 6-16. Numeric Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Numeric Only:** Only Numeric displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

## Numeric Parameters

The Numeric parameters are described below.

**Scale – (Power):** Toggles between (dBm) and (W) for the unit of measurement result. Select the Unit menu by pressing (Unit) at Scale menu, select Unit-Power menu by pressing (Power), and select either (dBm) or (W).

**Scale – (Symbol Rate):** Sets the unit of numeric results, selecting one from (ppm), (mHz), and (Hz). On the Scale menu (Unit), select the Unit menu, select (Symbol Rate), select the Unit-Symbol Rate menu, and then select (ppm), (mHz), or (Hz).

Measured type display status is listed in [Table 6-3](#).

**Table 6-3.** Measured Type

| Modulation Parameters      | Measured Type    |                  |                  |
|----------------------------|------------------|------------------|------------------|
|                            | 2FSK 4FSK H-CPM  | 2ASK 4ASK        | Other            |
| Tx Power                   | Yes              | Yes              | Yes              |
| Filtered Power             | Yes              | Yes              | Yes              |
| Frequency Error            | Yes              | Yes              | Yes              |
| EVM (RMS)                  | No               | Yes              | Yes              |
| EVM (peak)                 | No               | Yes              | Yes              |
| Phase Error (RMS)          | No               | No               | Yes              |
| Phase Error (peak)         | No               | No               | Yes              |
| Magnitude Error (RMS)      | Yes              | Yes              | Yes              |
| Magnitude Error (peak)     | Yes              | Yes              | Yes              |
| FSK Error (RMS)            | Yes              | No               | No               |
| FSK Error (peak)           | Yes              | No               | No               |
| Modulation Fidelity (RMS)  | Yes              | No               | No               |
| Modulation Fidelity (peak) | Yes              | No               | No               |
| Symbol Rate Error          | Yes              | Yes              | Yes              |
| Jitter P-P Min             | Yes              | No               | No               |
| Jitter P-P Max             | Yes              | No               | No               |
| Deviation                  | Yes              | No               | No               |
| Deviation RMS (%)          | Yes <sup>1</sup> | No               | No               |
| Deviation at Ts/2          | Yes <sup>2</sup> | No               | No               |
| BER                        | Yes <sup>3</sup> | Yes <sup>3</sup> | Yes <sup>3</sup> |
| Specific Word (Hex)        | Yes              | Yes              | Yes              |
| Origin Offset              | No               | No               | Yes              |
| Droop Factor               | No               | Yes              | Yes              |
| IQ Gain Imbalance          | No               | No               | Yes <sup>4</sup> |
| Quadrature Error           | No               | No               | Yes <sup>4</sup> |
| MER (RMS)                  | No               | Yes              | Yes              |
| MER (peak)                 | No               | Yes              | Yes              |
| Offset EVM (RMS)           | No               | No               | Yes <sup>5</sup> |
| Offset EVM (peak)          | No               | No               | Yes <sup>5</sup> |
| Modulation Index (RMS)     | No               | Yes <sup>6</sup> | No               |

**Table 6-3.** Measured Type

| Modulation Parameters     | Measured Type   |                  |       |
|---------------------------|-----------------|------------------|-------|
|                           | 2FSK 4FSK H-CPM | 2ASK 4ASK        | Other |
| Eye Opening (X-Time)      | No              | Yes <sup>6</sup> | No    |
| Eye Opening (Y-Amplitude) | No              | Yes <sup>6</sup> | No    |
| Timing Offset             | Yes             | Yes              | Yes   |

1. Only O-QPSK
2. Only 2FSK
3. Only 2FSK and 4FSK
4. Only BER = On
5. Only 2ASK and 4ASK
6. Non-BPSK

**Tx Power:** Displays the average RF level before the signal has passed through the measurement filter.

**Filtered Power:** Displays the average RF level after the signal has passed through the measurement filter.

**Frequency Error:** Displays the frequency error.

**EVM (RMS):** Displays RMS value of EVM.

**EVM (peak):** Displays the EVM Peak value and the number of the symbol for which the peak value was detected.

**Phase Error (RMS):** Displays RMS value of Phase Error.

**Phase Error (peak):** Displays the Phase Error Peak value and the number of the symbol for which the peak value was detected.

**Magnitude Error (RMS):** Displays RMS value of Magnitude Error.

**Magnitude Error (peak):** Displays the Magnitude Error Peak value and the number of the symbol for which the peak value was detected.

**FSK Error (RMS):** Displays RMS value of FSK Error.

**FSK Error (peak):** Displays the FSK Error Peak value and the number of the symbol for which the peak value was detected.

**Modulation Fidelity (RMS):** Displays RMS value of Modulation Fidelity.

**Modulation Fidelity (peak):** Displays the Modulation Fidelity Peak value and the number of the symbol for which the peak value was detected.

**Symbol Rate Error:** Displays Symbol Rate Error. Select a measurement mode with Method of Symbol Rate Error.

**Jitter P-P Min:** Displays the minimum peak-to-peak value for jitter.

**Jitter P-P Max:** Displays the maximum peak-to-peak value for jitter.

**Deviation:** Displays the average value, peak value, and peak-to-peak value of the frequency deviation.

**Deviation RMS (%):** Displays RMS value of Deviation in %.

**Deviation at Ts/2:** Displays the average value, the maximum + frequency peak value, the minimum + frequency peak value, the maximum – frequency peak value, the minimum – frequency peak value, and peak-to-peak value of the frequency deviation.

**BER:** Displays the Bit Error Rate.

**Specific Word:** Displays an extracted part of specific bits.

**Origin Offset:** Displays origin offset value.

**Droop Factor:** Displays droop factor.

**IQ Gain Imbalance:** Displays the amplitude difference between the I phase and the Q phase.

**Quadrature Error:** Displays how perpendicular the I phase is to the Q phase.

**MER (RMS):** Displays RMS value of MER.

**MER (peak):** Displays the MER peak value and the number of the symbol for which the peak value was detected.

**Offset EVM (RMS):** Displays RMS value of Offset EVM.

**Offset EVM (peak):** Displays the Offset EVM peak value and the number of the symbol for which the peak value was detected.

**Modulation Index (RMS):** Displays the Modulation Index in ratio (no unit).

**Eye Opening (X-Time):** Displays the Eye Opening (X-Time) in %.

**Eye Opening (Y-Amplitude):** Displays the Eye Opening (Y-Amplitude) in %.

**Timing Offset:** Displays the time difference between external trigger and Symbol (0), in units of  $\mu\text{s}$ .

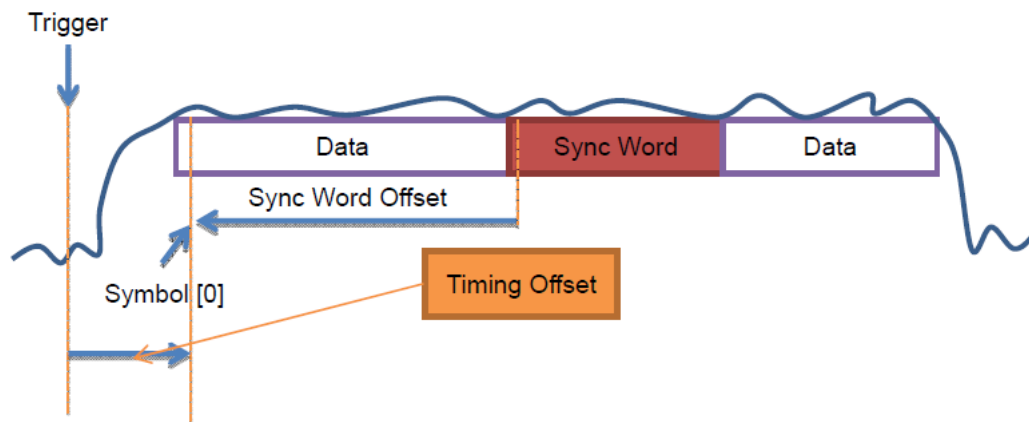


**Figure 6-17.** Timing Offset Measurement Mode

## 6-11 I and Q vs. Symbol

Displays the amplitude analysis results of the I phase and the Q phase each 1/8th of the symbol in the analysis interval in the trace area. The result of each analysis is displayed.

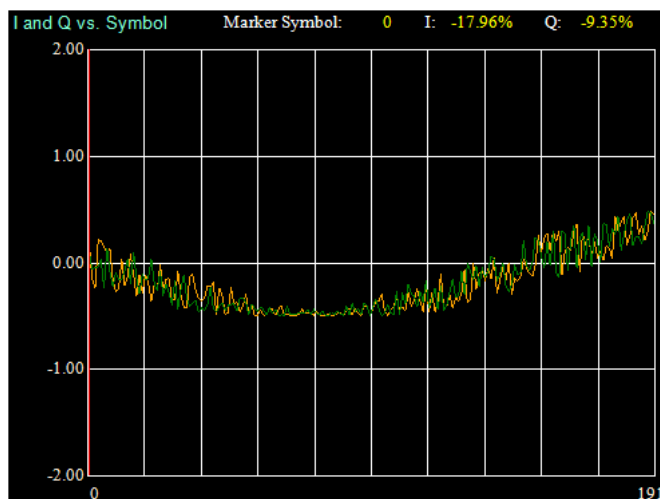


**Figure 6-18.** I and Q vs. Symbol Result

### Graph Display Result

Displays the normalized amplitude of the I and Q phase as a percentage for each 1/8th of the symbol in the analysis interval. Right-click the measurement screen to display the menu shown below.

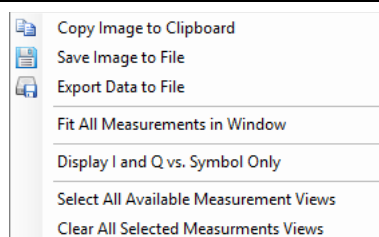


**Figure 6-19.** I and Q vs. Symbol Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display I and Q vs. Symbol Only:** Only I and Q vs. Symbol displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

### Scale

The graph's vertical axis scale is fixed to  $\pm 2.0$ .

### Marker

Click and rotate mouse-wheel to position a marker.

## 6-12 Magnitude vs. Symbol

Displays Magnitude vs. Symbol analysis result in the trace. The amplitude for each 1/8th of the symbol in the analysis interval in volts. The result of each analysis is displayed.

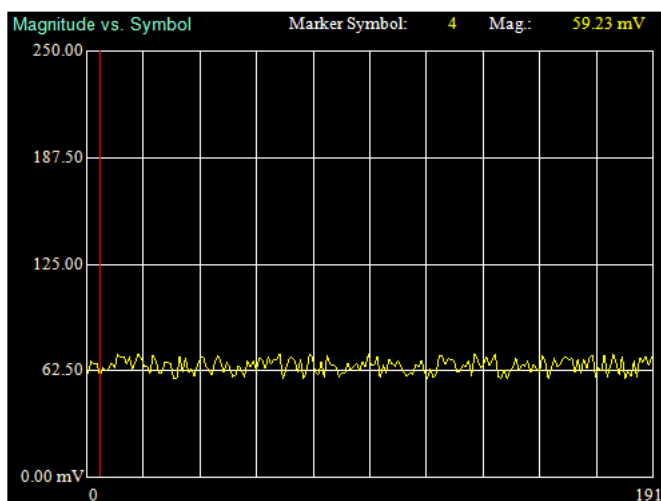


Figure 6-20. Magnitude vs. Symbol

### Graph Display Result

Displays the amplitude for each 1/8th of the symbol in the analysis interval in volts. Right-click the measurement screen to display the menu shown below.

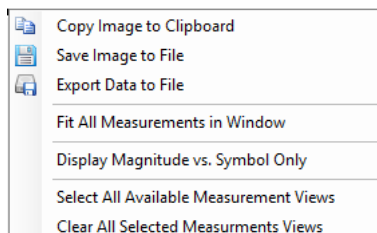


Figure 6-21. Magnitude vs. Symbol Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Magnitude vs. Symbol Only:** Only Magnitude vs. Symbol displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

### Scale

The graph's vertical axis scale is fixed to the Input Level setting  $0$  to  $\sqrt{(50 \times 1000 \times 10^{(\text{InputLevel} + 10)}) / 10 \text{ mV}}$

### Marker

Click and rotate mouse-wheel to position a marker.



### 6-13 Phase vs. Symbol

Displays the analysis result of Phase vs. Symbol in the trace area. The result of each analysis is displayed, regardless of the storage mode.

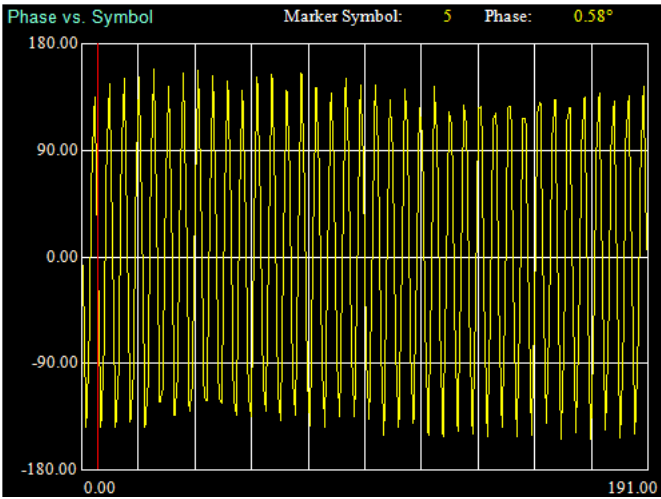


Figure 6-22. Phase vs. Symbol Result

#### Graph Display Result

Displays the phase for each 1/8th of the symbol in the analysis interval, in degrees. Right-click the measurement screen to display the menu shown below.

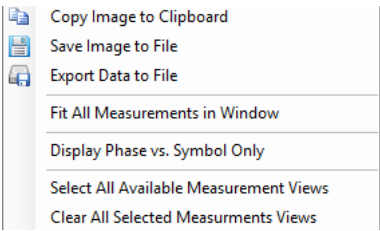


Figure 6-23. Phase vs. Symbol Display Menu

- Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.
- Save Image to File:** Name and save the image to a user selected file.
- Export Data to File:** Export the data to a user selected file.
- Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.
- Display Phase vs. Symbol Only:** Only Phase vs. Symbol displays in full view.
- Select all Available Measurement Views:** All measurement views are displayed in the window.
- Clear All Selected Measurements Views:** Clears out all views.

#### Scale

The graph's vertical axis scale is up to  $\pm 180$  degrees.

#### Marker

Click and rotate mouse-wheel to position a marker.

## 6-14 Signal Monitor

Displays the spectrum in the trace area. The result of each analysis is displayed.

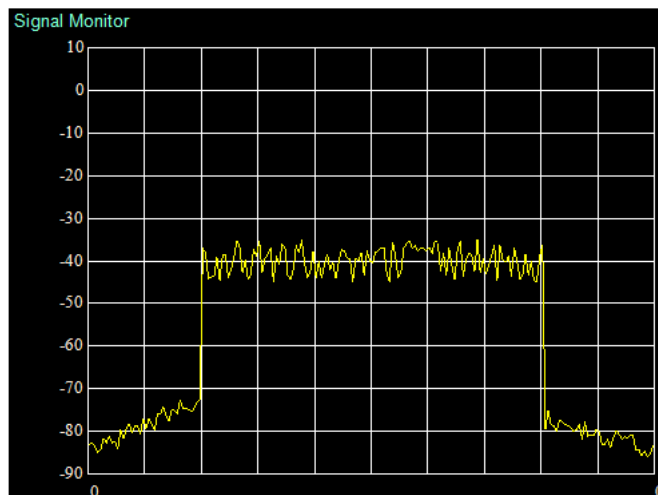


Figure 6-24. Signal Monitor

### Graph Display Result

Displays the spectrum in the analysis interval. The range of the graph's horizontal axis is fixed to  $\pm(\text{Span}/2)$  (Hz). The value of Span is calculated from the Modulation setting and the Symbol Rate setting. Right-click the measurement screen to display the menu shown below.

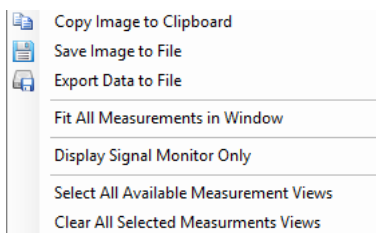


Figure 6-25. Signal Monitor Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can then be viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export the data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Signal Monitor Only:** Only Signal Monitor displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

### Marker

No marker function is available.

## 6-15 Symbol Table

Displays the analysis result of Symbol Table in the trace area. The result of each analysis is displayed.

Symbol Table

|        |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 000000 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| 000008 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1A | 1B | 1C | 1D | 1E | 1F |
| 000010 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 2A | 2B | 2C | 2D | 2E | 2F |
| 000018 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 3A | 3B | 3C | 3D | 3E | 3F |
| 000020 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |
| 000028 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 5A | 5B | 5C | 5D | 5E | 5F |
| 000030 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 6A | 6B | 6C | 6D | 6E | 6F |
| 000038 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 7A | 7B | 7C | 7D | 7E | 7F |
| 000040 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 8A | 8B | 8C | 8D | 8E | 8F |
| 000048 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 9A | 9B | 9C | 9D | 9E | 9F |
| 000050 | A0 | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | AA | AB | AC | AD | AE | AF |
| 000058 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | BA | BB | BC | BD | BE | BF |
| 000060 | C0 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | CA | CB | CC | CD | CE | CF |
| 000068 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | DA | DB | DC | DD | DE | DF |
| 000070 | E0 | E1 | E2 | E3 | E4 | E5 | E6 | E7 | E8 | E9 | EA | EB | EC | ED | EE | EF |
| 000078 | F0 | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | FA | FB | FC | FD | FE | FF |
| 000080 | 01 | 01 | 03 | 03 | 05 | 05 | 07 | 07 | 09 | 09 | 0B | 0B | 0D | 0D | 0F | 0F |
| 000088 | 11 | 11 | 13 | 13 | 15 | 15 | 17 | 17 | 19 | 19 | 1B | 1B | 1D | 1D | 1F | 1F |
| 000090 | 21 | 21 | 23 | 23 | 25 | 25 | 27 | 27 | 29 | 29 | 2B | 2B | 2D | 2D | 2F | 2F |
| 000098 | 31 | 31 | 33 | 33 | 35 | 35 | 37 | 37 | 39 | 39 | 3B | 3B | 3D | 3D | 3F | 3F |

Figure 6-26. Symbol Table

### Graph Display Result

Displays the demodulation result for each symbol. Depending on the position of the sync words found, the sync word and the sync word found may not be the same hexadecimal numbers.

### Scale

Right-click the measurement screen to display the menu shown below. Switches the measurement unit of numeric result between Binary and Hex.

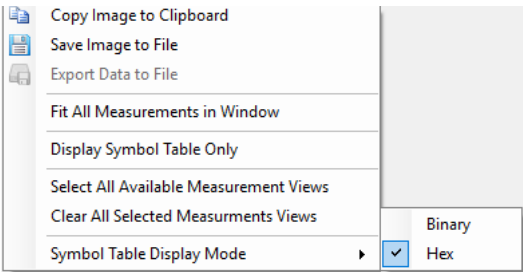


Figure 6-27. Symbol Table Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export data to file is unavailable.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Signal Table Only:** Only Signal Table displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**Symbol Table Display Mode:** Sets table results to Hex or Binary.

# 6-16 Equalizer Amplitude

This function displays the Equalizer Amplitude analysis results at trace. The analysis results are displayed each time irrespective of the Storage mode setting. The analysis results are displayed when either On or Hold is selected at the Adaptive setting of Equalizer.

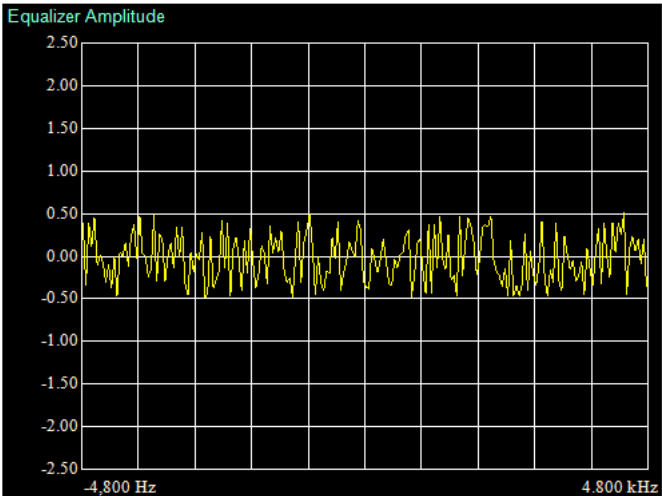


Figure 6-28. Equalizer Amplitude

## Graph Display Result

Displays the equalizer amplitude characteristics in dB. Right-click the measurement screen to display the menu shown below.

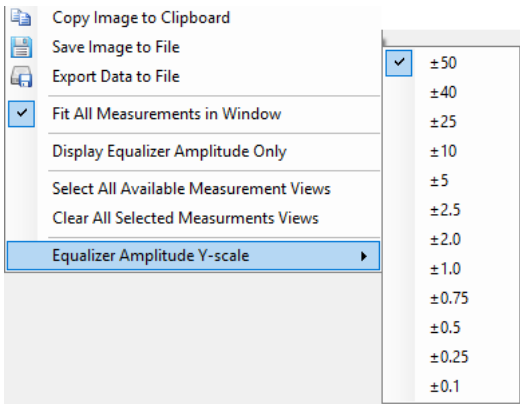


Figure 6-29. Equalizer Amplitude Display Menu

- Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.
- Save Image to File:** Name and save the image to a user selected file.
- Export Data to File:** Export data to a user selected file.
- Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.
- Display Equalizer Amplitude Only:** Only Equalizer Amplitude displays in full view.
- Select all Available Measurement Views:** All measurement views are displayed in the window.
- Clear All Selected Measurements Views:** Clears out all views.
- Equalizer Amplitude Y-scale:** Sets the upper limit of the vertical axis (Y-scale) of the graph result.  
Settings:  $\pm 0.1$  dB to  $\pm 50$  dB

# 6-17 Equalizer Phase

This displays the Equalizer Phase analysis results. The analysis results are displayed each time irrespective of the Storage mode setting. The analysis results are displayed when either On or Hold is selected at the Adaptive setting of Equalizer.

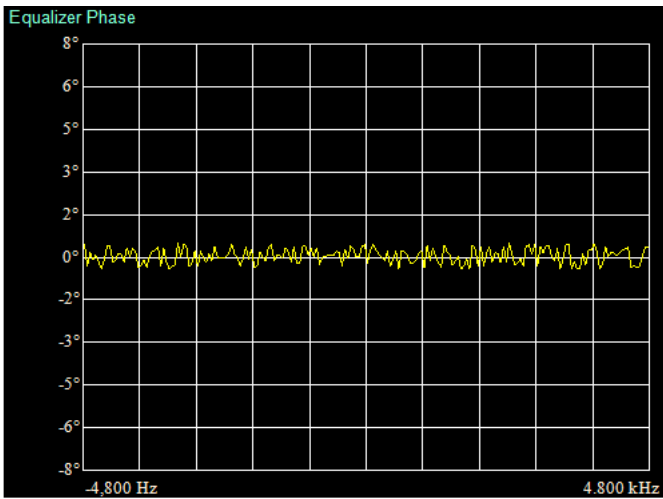


Figure 6-30. Equalizer Phase

## Graph Display Result

Displays the equalizer phase characteristics in degree. Right-click the measurement screen to display the menu shown below.

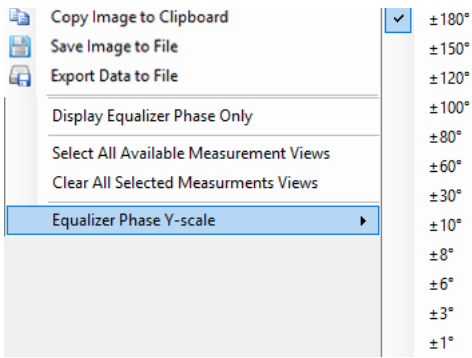


Figure 6-31. Equalizer Phase Display Menu

- Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.
- Save Image to File:** Name and save the image to a user selected file.
- Export Data to File:** Export data to a user selected file.
- Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.
- Display Equalizer Phase Only:** Only Equalizer Phase displays in full view.
- Select all Available Measurement Views:** All measurement views are displayed in the window.
- Clear All Selected Measurements Views:** Clears out all views.
- Equalizer Phase Y-scale:** Sets the upper limit of the vertical axis (Y-scale) of the graph result.

Settings: ±1 Degree to ±180 degrees

No marker function is available.

# 6-18 Equalizer Group Delay

This displays the Equalizer Group Delay analysis results at trace. The analysis results are displayed each time irrespective of the Storage mode setting. The analysis results are displayed when either On or Hold is selected at the Adaptive setting of Equalizer.

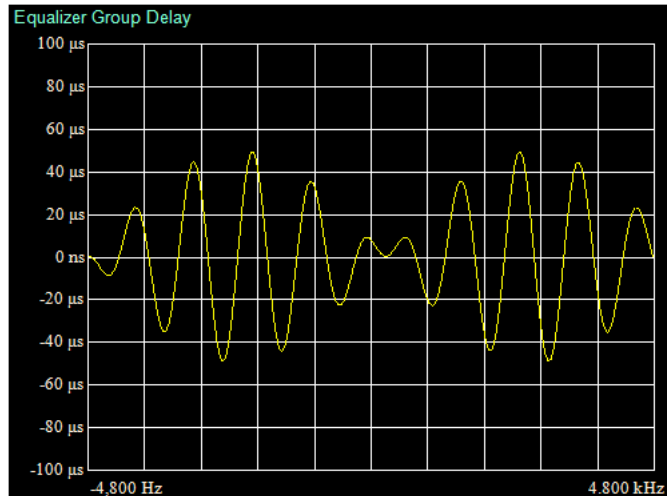


Figure 6-32. Equalizer Group Delay

## Graph Display Result

Right-click to display the menu shown below.

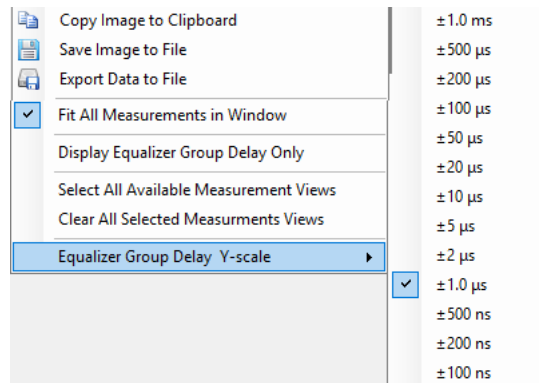


Figure 6-33. Equalizer Group Delay Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Equalizer Group Delay Only:** Only Equalizer Group Delay displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**Equalizer Group Delay Y-scale:** Sets the upper limit of the vertical axis scale of the graph result.

Settings:  $\pm 100$  ns to  $\pm 1$  ms

No marker function is available.

## 6-19 Equalizer Impulse Response

This displays the Equalizer Impulse Response analysis results at trace. The analysis results are displayed each time irrespective of the Storage mode setting. The analysis results are displayed when either On or Hold is selected at the Adaptive setting of Equalizer.

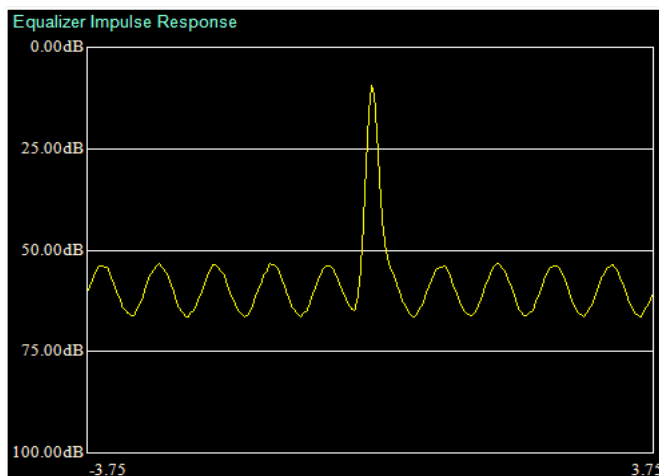


Figure 6-34. Equalizer Impulse Response

### Graph Display Result

Displays the equalizer impulse response in dB. Right-click to display the menu shown below.

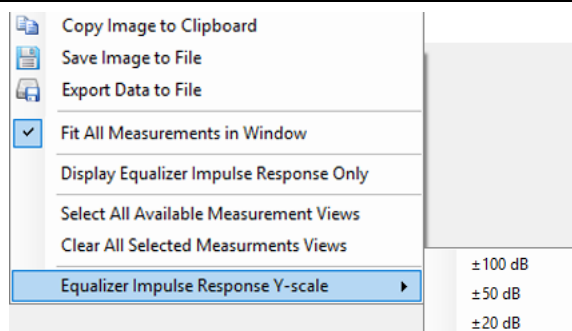


Figure 6-35. Equalizer Impulse Response Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can then be viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display Equalizer Impulse Response Only:** Only Equalizer Impulse Response displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**Equalizer Impulse Response Y-scale:** Sets the upper limit of the vertical axis scale of the graph result.

Settings:  $\pm 100$  dB,  $\pm 50$  dB,  $\pm 20$  dB

### Marker

No marker function is available.

6-20 FSK Error vs. Symbol

Displays FSK Error vs. Symbol analysis result in the trace. The result of each analysis is displayed, regardless of the storage mode setting.

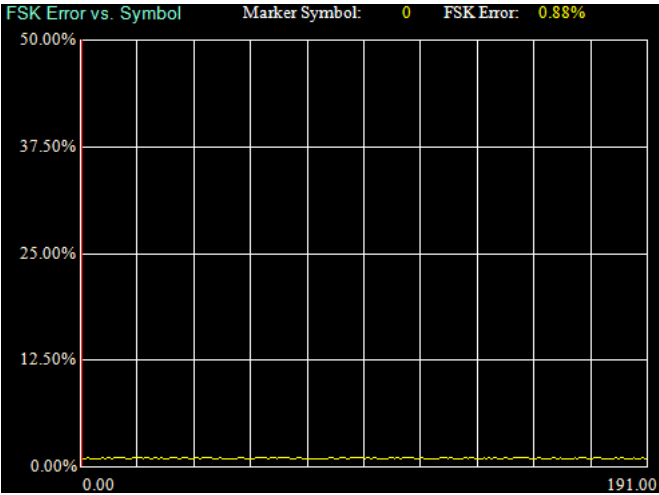


Figure 6-36. FSK Error vs. Symbol

Graph Display Result

This displays the FSK Error for each symbol in the analysis segment in % units. Right-click the measurement screen to display the menu shown below.

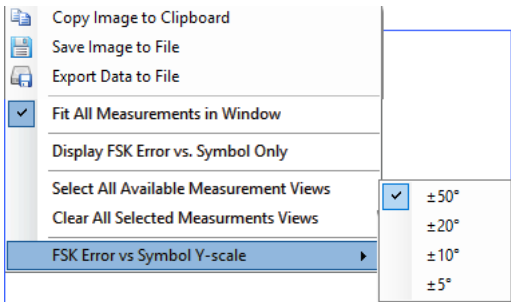


Figure 6-37. FSK Error vs. Symbol Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can then be viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export data to a user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display FSK Error vs. Symbol Only:** Only FSK Error vs. Symbol displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**FSK Error vs. Symbol Y-scale:** Sets the upper limit of the vertical axis scale of the graph result.

Settings: 5%, 10%, 20%, 50%

Marker

Click and rotate mouse-wheel to position a marker.



# 6-21 Fidelity vs. Symbol

Displays the analysis results of Modulation Fidelity vs. Symbol in trace. The results are displayed only when the modulation is set to 2FSK, 4FSK, or H-CPM. The result of each analysis is displayed, regardless of the storage mode setting.

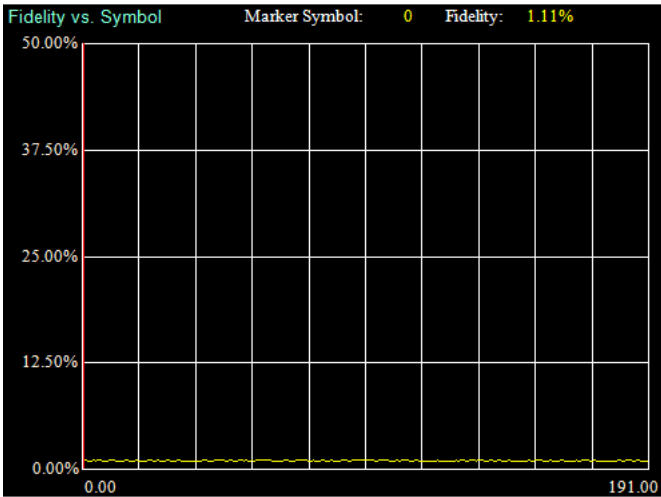


Figure 6-38. Fidelity vs. Symbol

## Graph Display Result

Displays Modulation Fidelity of each symbol in the analysis interval in percentage. Right-click the measurement screen to display the menu shown below.

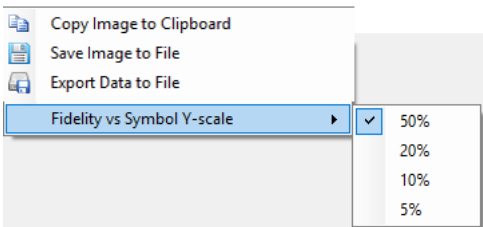


Figure 6-39. Fidelity vs. Symbol Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export data to a user selected file.

**Fidelity vs. Symbol Y-scale:** Sets the upper limit of the vertical axis scale of the graph result.

Settings: 5%, 10%, 20%, 50%

## Marker

Click and rotate mouse-wheel to position a marker.

## 6-22 Histogram

Displays the appearance frequency of each symbol in trace. The results are displayed only when the modulation is set to 2FSK, 4FSK, or H-CPM.

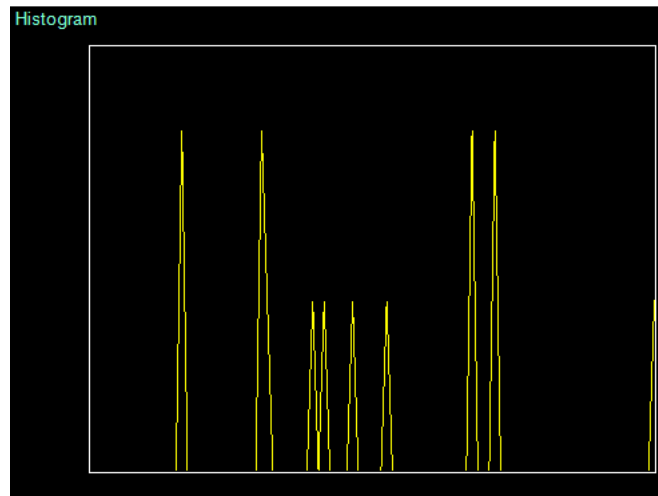


Figure 6-40. Histogram

### Graph Display Result

Displays the frequency elements of each symbol. The horizontal axis represents normalized frequency and the vertical axis represents appearance frequency. Right-click the measurement screen to display the menu shown below.

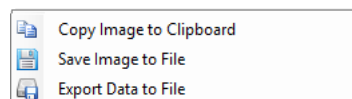


Figure 6-41. Histogram Display Menu

**Copy Image to Clipboard:** Copies image to clipboard. Image can be then viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export data to a user selected file.

### Scale

The graph's vertical axis scale is fixed to 0 to 1.

### Marker

No marker function is available.

### 6-23 EVM vs. Subcarrier

Displays analysis result of EVM vs. Subcarrier in trace. The result of each analysis is displayed.

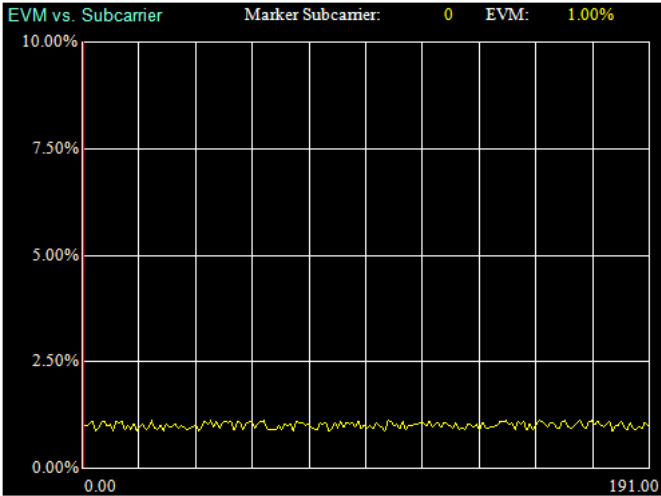


Figure 6-42. EVM vs. Subcarrier

#### Results Displayed in Graph

Displays EVM per subcarrier between analysis intervals in percent. Right-click to display the menu shown below.

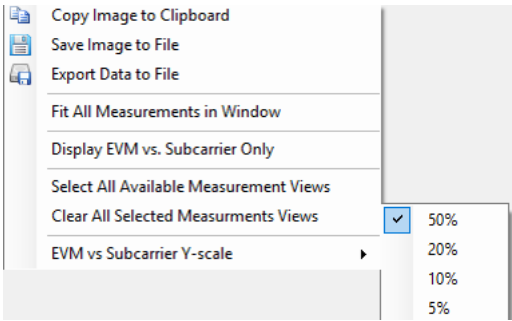


Figure 6-43. EVM vs. Subcarrier Display Menu

**Copy Image to Clipboard:** Copies image to clipboard and image can then be viewed with a graphics editor.

**Save Image to File:** Name and save the image to a user selected file.

**Export Data to File:** Export data file to user selected file.

**Fit All Measurements in Window:** Only the current active measurements are fit in the window for full view.

**Display EVM vs. Subcarrier Only:** Only EVM vs. Subcarrier displays in full view.

**Select all Available Measurement Views:** All measurement views are displayed in the window.

**Clear All Selected Measurements Views:** Clears out all views.

**EVM vs. Subcarrier Y-scale:** Sets the upper limit of the vertical axis scale of the graph result.

Settings: 5%, 10%, 20%, 50%

#### Marker

Click and rotate mouse-wheel to position a marker.

# Chapter 7 — Analysis Example Files

## 7-1 Introduction

Examples of the MX280005A IQ Signal Master are discussed in this chapter. The examples are included in the Help file menu and provide an overview of analyzing a captured IQ data file. Included are Modulation Analysis, FM Radio, and Radar Gun.

## 7-2 Modulation Analysis

Open the example files menus from the HELP menu as shown on [Figure 7-1](#). For this example, download Modulation Analysis.

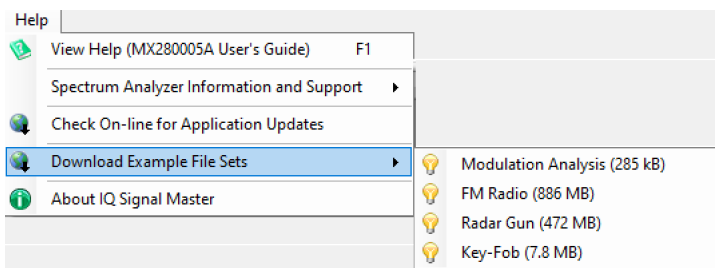


**Figure 7-1.** Example Files - Modulation Analysis

Create a folder to store the Modulation Analysis example file. Click Modulation Analysis opens a Browser dialog. Press OK to download the files into the user created file. Here, the Modulation Analysis example files have been loaded in the folder: Documents > Anritsu > IQ Files as shown in [Figure 7-2](#). Three file sets are downloaded, the IQ raw data file (.dgz) and metadata file (.dgzm) for each 32APSK, 64QAM, and P14DQPSK file.

| Documents > Anritsu > IQ Files |                    |             |        |
|--------------------------------|--------------------|-------------|--------|
| Name                           | Date modified      | Type        | Size   |
| Archive                        | 12/20/2022 9:00 AM | File folder |        |
| 32APSK.dgz                     | 9/1/2020 1:05 AM   | DGZ File    | 134 KB |
| 32APSK.dgzm                    | 2/3/2022 3:17 PM   | DGZM File   | 3 KB   |
| 64QAM.dgz                      | 8/21/2020 6:24 AM  | DGZ File    | 36 KB  |
| 64QAM.dgzm                     | 2/3/2022 3:24 PM   | DGZM File   | 3 KB   |
| Analysis.htm                   | 2/3/2022 2:24 PM   | Chrome H... | 2 KB   |
| P14DQPSK.dgz                   | 8/21/2020 7:48 AM  | DGZ File    | 134 KB |
| P14DQPSK.dgzm                  | 2/3/2022 3:37 PM   | DGZM File   | 3 KB   |

**Figure 7-2.** Download Modulation Analysis

**Analysis.htm File**

Included in the download file is the Analysis.htm file. Open to display the parameters shown for each file as shown in [Figure 7-3](#). Use these parameters to perform analysis of the files loaded in [Figure 7-2](#).

**MX280005A - Analysis Example Files**

| 32 APSK              |               |
|----------------------|---------------|
| Parameter            | Value         |
| Measurement Object   | Non-formatted |
| Modulation type      | 32 APSK       |
| Symbol Rate          | 500.0 kbps    |
| Measurement Filter   | Root Nyquist  |
| Reference Filter     | Nyquist       |
| Measurement Interval | 512           |

| 64 QAM               |               |
|----------------------|---------------|
| Parameter            | Value         |
| Measurement Object   | Non-formatted |
| Modulation type      | 64 QAM        |
| Symbol Rate          | 4.0 kbps      |
| Measurement Filter   | Root Nyquist  |
| Reference Filter     | Nyquist       |
| Measurement Interval | 200           |

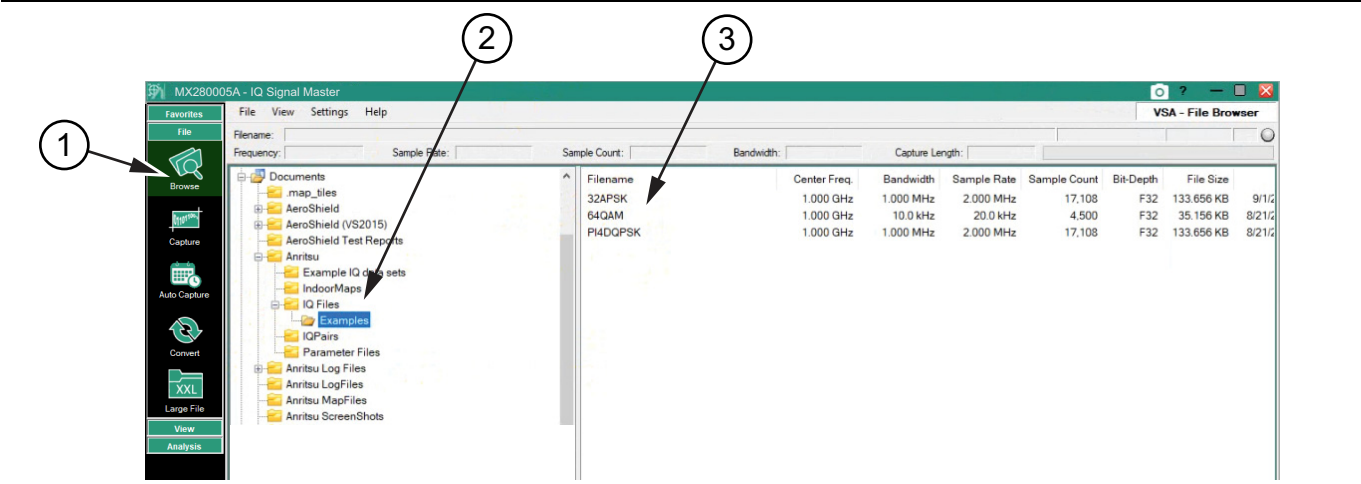
  

| Pi/4 DQPSK           |               |
|----------------------|---------------|
| Parameter            | Value         |
| Measurement Object   | Non-formatted |
| Modulation type      | Pi/4 DQPSK    |
| Symbol Rate          | 500.0 kbps    |
| Measurement Filter   | Root Nyquist  |
| Reference Filter     | Nyquist       |
| Measurement Interval | 512           |

**Figure 7-3.** Analysis.htm Parameters

Use the Browse Menu

Use the MX280005A IQ Signal Master Browse menu and open the Example folder for the 32APSK, 64QAM, and P14DQPSK files as shown in Figure 7-4.

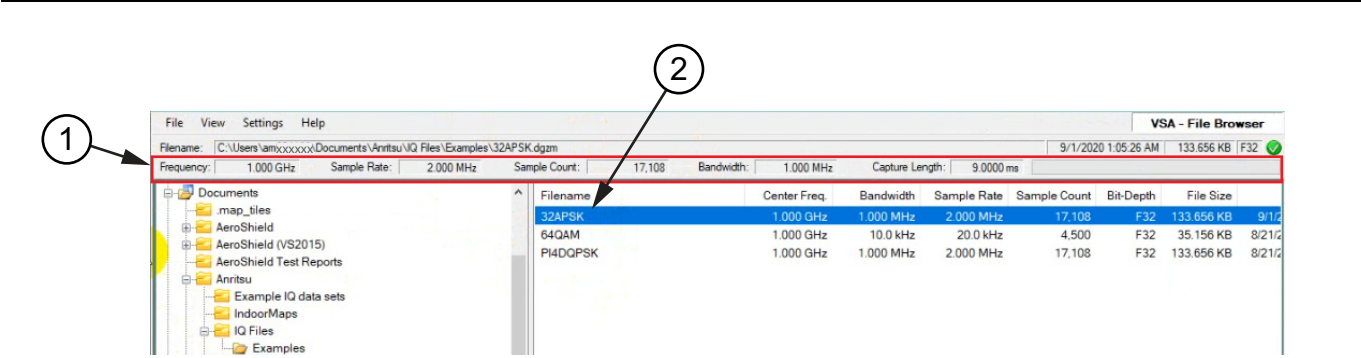


1. Browse Menu
2. Example File Folder
3. Analysis Files Types

Figure 7-4. Analysis Files

Load File

Click the 32APSK file to load it into the analysis program. When loading is complete, the files parameters are shown in the top menu bar as shown in Figure 7-5.



1. File Parameters
2. Select 32APSK File

Figure 7-5. 32APSK File

Confirm the loaded file by pressing Playback menu to view the loaded file IQ data as shown in [Figure 7-6](#).

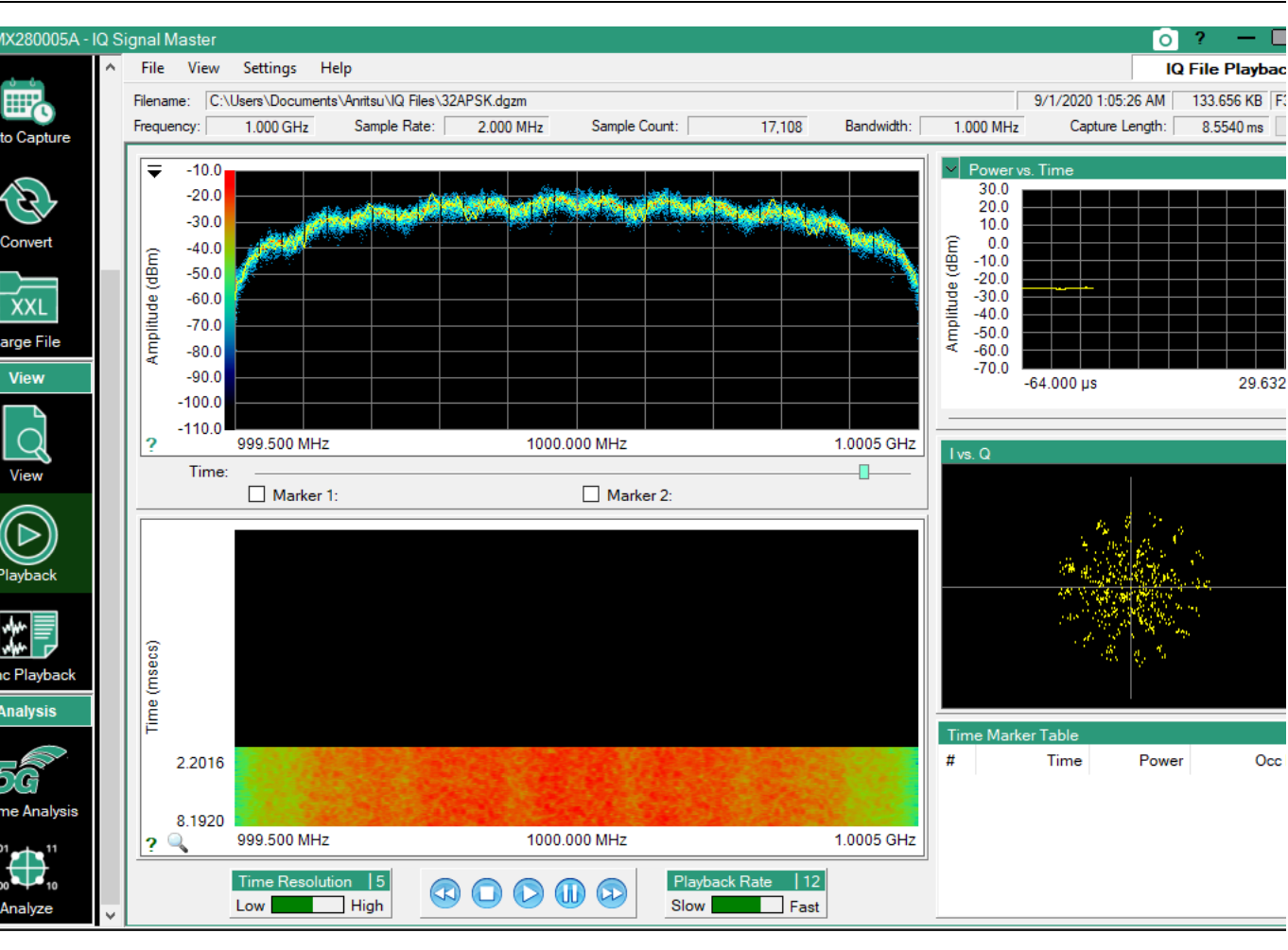


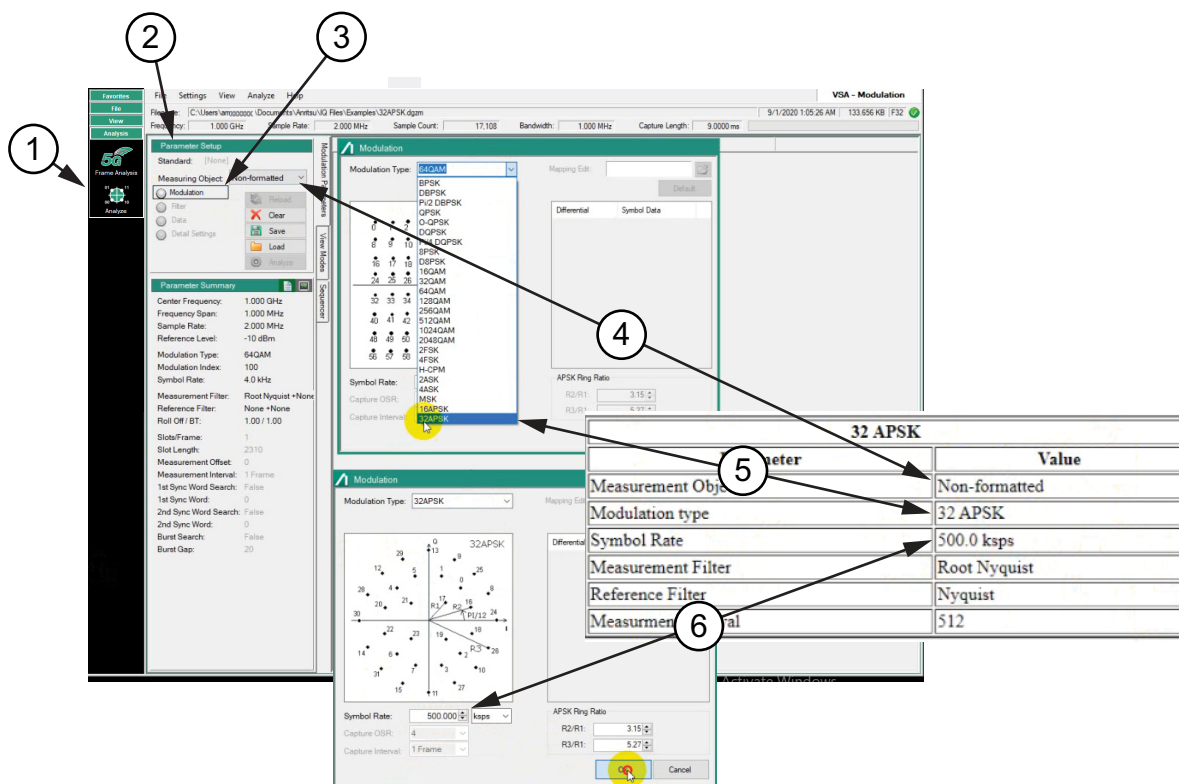
Figure 7-6. Playback Menu

## Analyze the Signal

Use the 32APSK parameters listed in [Figure 7-3 on page 7-2](#) to setup the 32APSK modulation parameters shown in [Figure 7-7](#).

### Procedure

1. Refer to the Parameter Setup window.
2. Press the Modulation radio button to view the Modulation window.
3. Set the Measuring Object to Non-formatted.
4. Set the Modulation type by pressing the drop-down arrow and selecting 32APSK.
5. Set the Symbol Rate to 500.0 kps.
6. Press OK.



1. Analyze Menu
2. Parameter Setup Window
3. Modulation Parameter
4. Modulation Object - Non-Formatted
5. Modulation Type - 32APSK
6. Symbol Rate - 500.000 kps

**Figure 7-7.** Modulation Parameter Setup Entry's

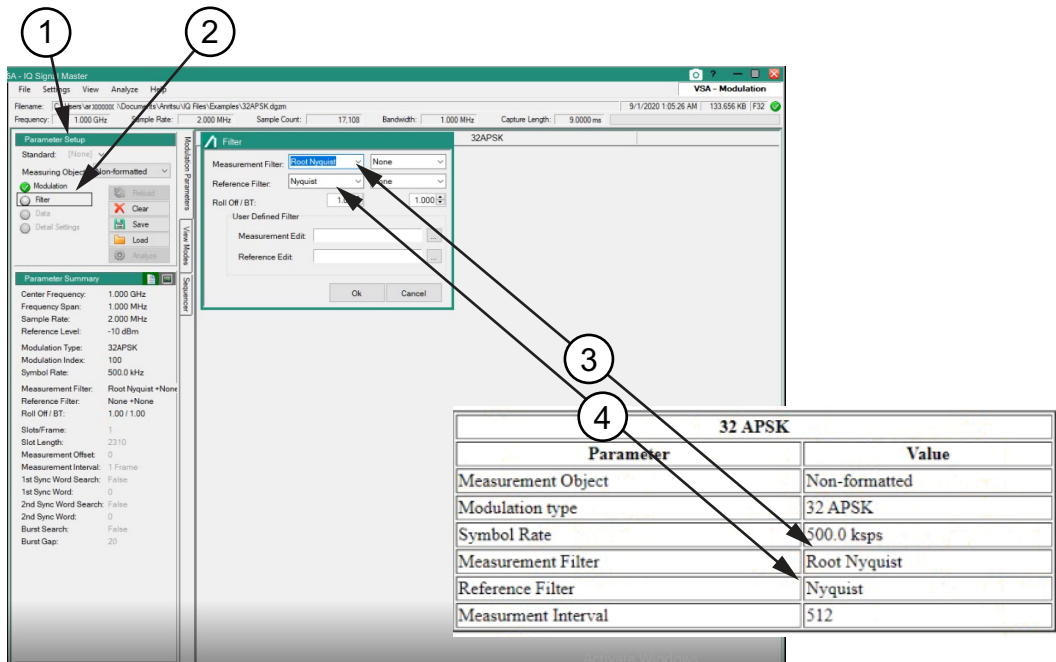


Set Up the 32APSK Filter Parameters

Set up the 32APSK modulation parameters as shown in Figure 7-8.

Procedure

- 1. Refer to the Parameter Setup window.
- 2. Press Filter.
- 3. Set the Measurement Filter to Root Nyquist.
- 4. Set the Reference Filter to Nyquist.
- 5. Press OK.



- 1. Parameter Setup Window
- 2. Filter Parameter
- 3. Measurement Filter - Root Nyquist
- 4. Reference Filter - Nyquist

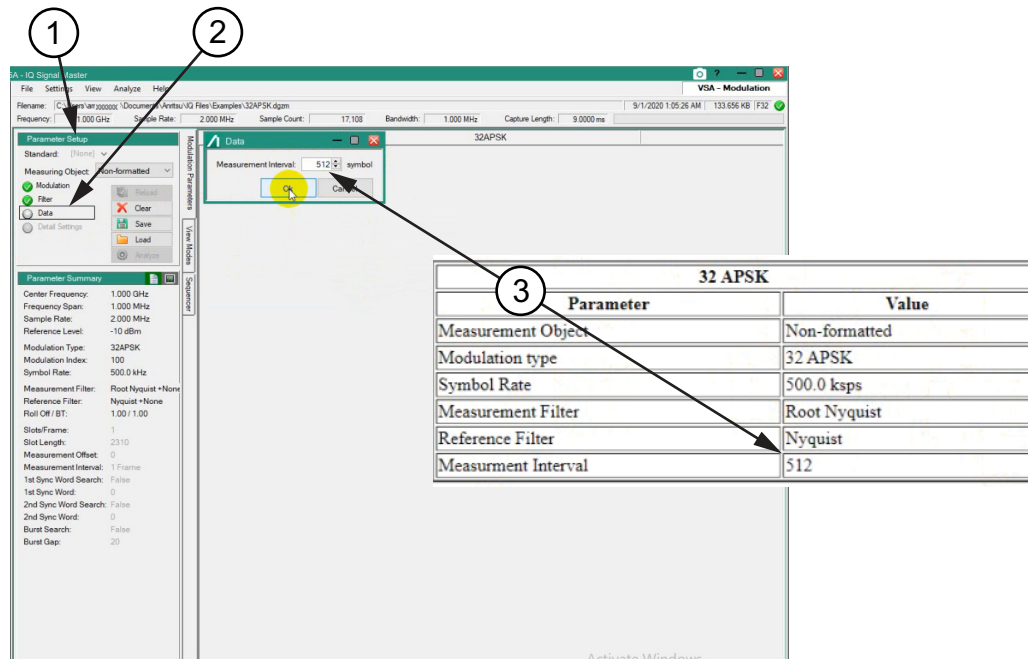
Figure 7-8. Filter Parameter Setup Entry's

## Set Up the 32APSK Data Parameters

Set up the 32APSK modulation parameters as shown in [Figure 7-9](#).

### Procedure

1. Refer to the Parameter Setup window.
2. Press Data.
3. Set the Measurement Interval to 512 Symbol.
4. Press OK.



1. Parameter Setup Window
2. Data Parameter
3. Measurement Interval - 512 Symbol

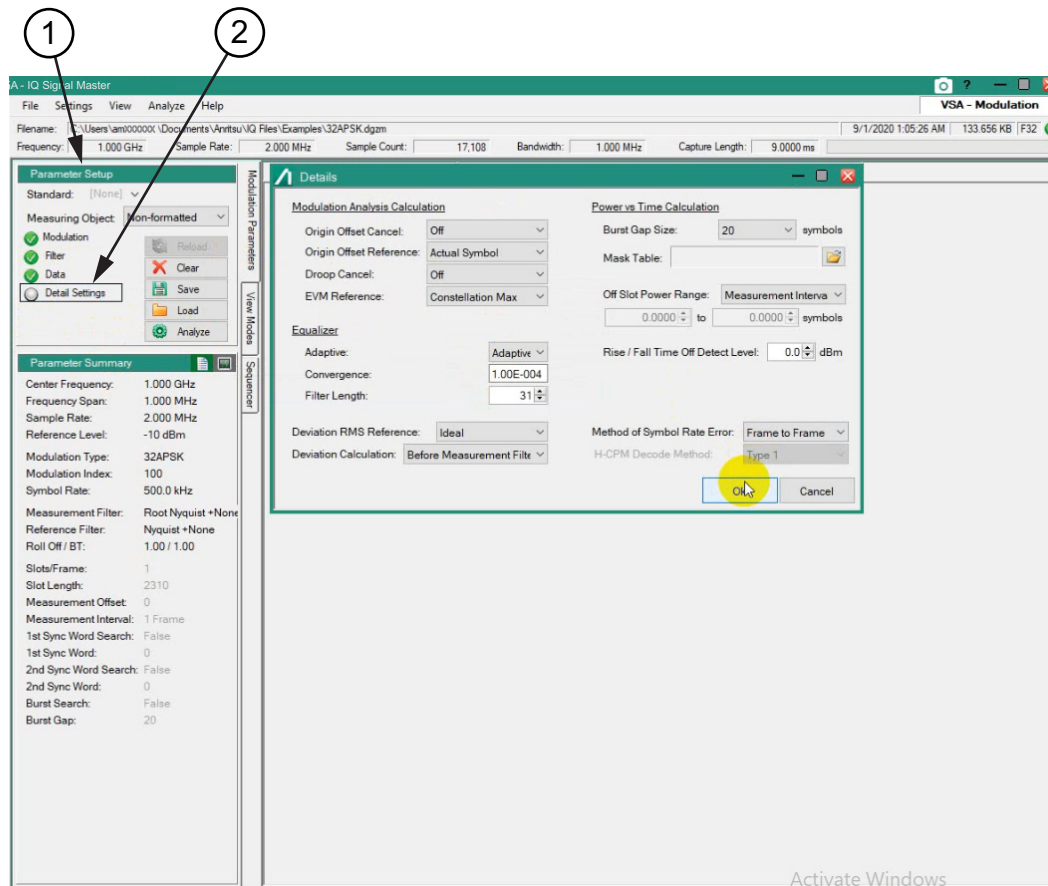
**Figure 7-9.** Data Parameter Setup Entry's

## Set Up the 32APSK Detail Settings Parameters

Set up the 32APSK modulation parameters as shown in [Figure 7-10](#).

### Procedure

1. Refer to the Parameter Setup window.
2. Press Detail Settings. For this example, no settings are required as the default settings are correct as is.
3. Press OK.



1. Parameter Setup Window

2. Detail Settings

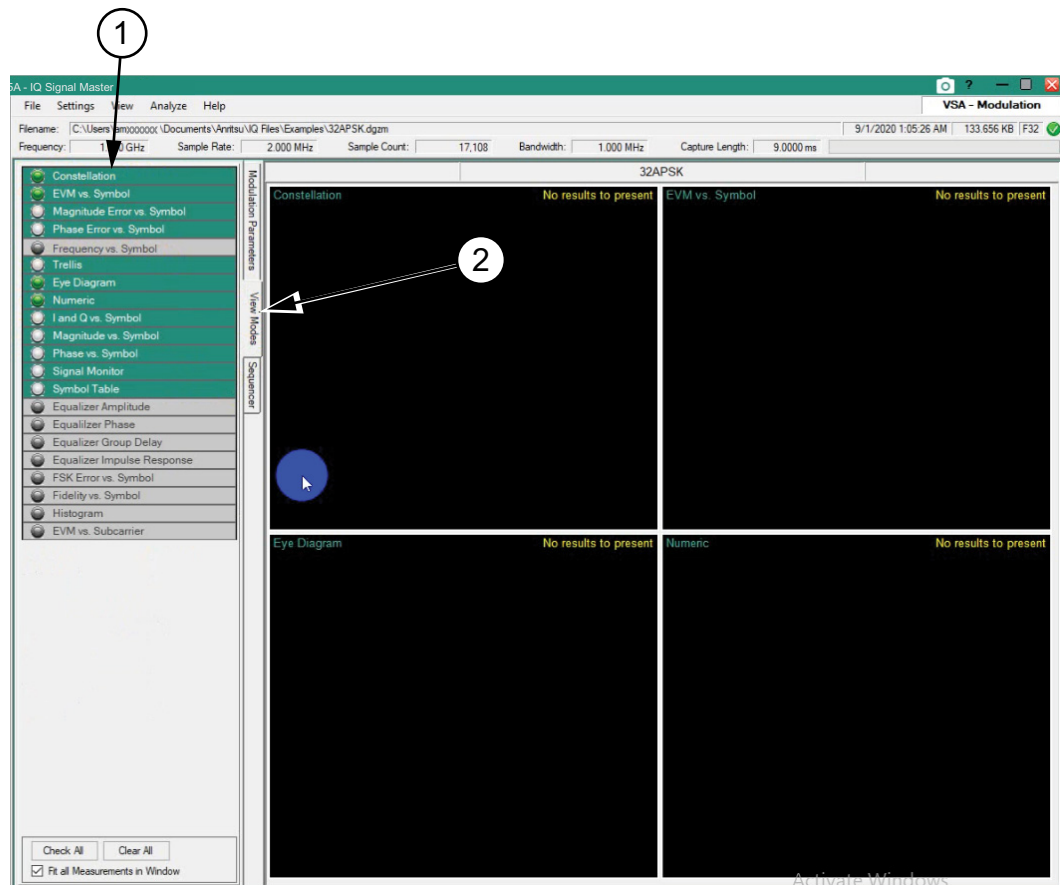
**Figure 7-10.** Data Parameter Setup Entry's

## Set Analysis Types

Set the Analysis types as shown in [Figure 7-11](#).

### Procedure

1. Click the View tab.
2. Set analysis types. For this example, click Constellation, EVM vs. Symbol, Eye Diagram, and Numeric.



1. Analysis Types

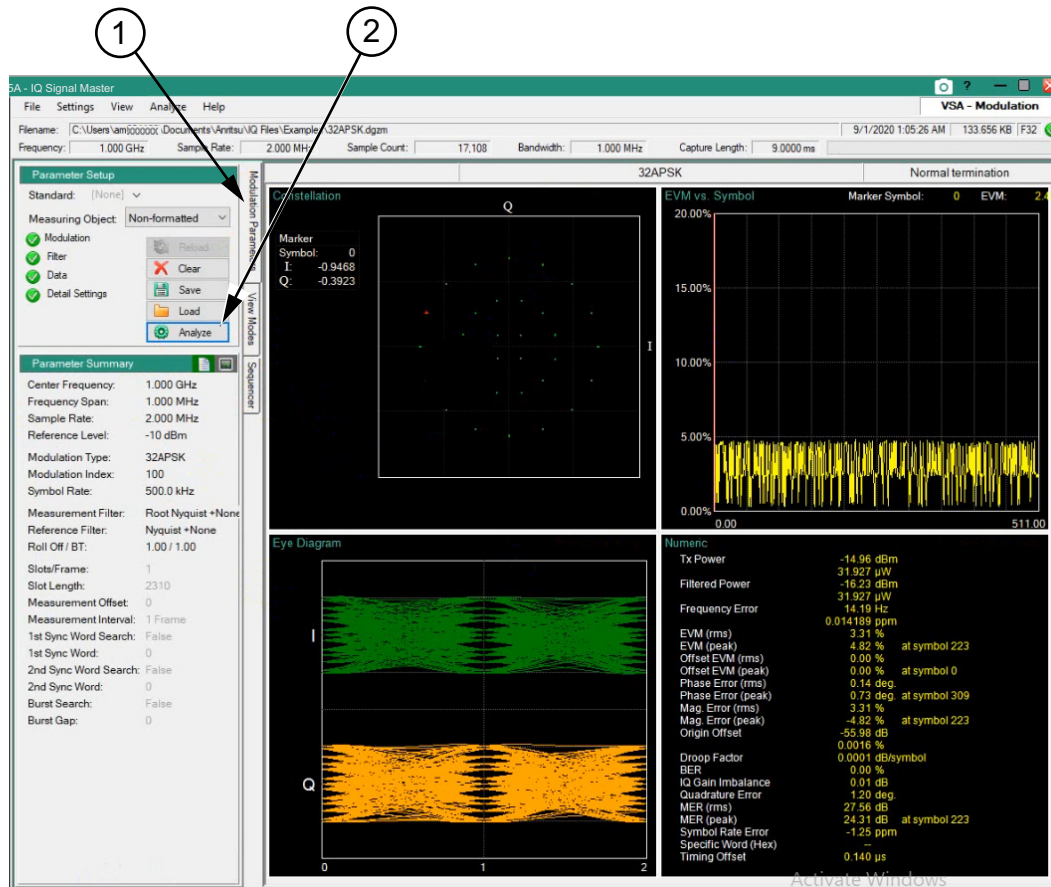
2. View Tab

**Figure 7-11.** View Types

## Analyze the 32APSK Data

1. Click the Modulation Parameters tab.
2. Press the Analyze button.

The Analysis of the set up 32APSK parameters is shown in [Figure 7-12](#).

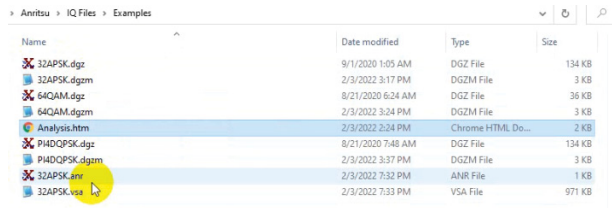


1. Modulation Parameters Tab
2. Analyze Button

**Figure 7-12.** Analyze 32APSK

Added Files

The analysis process has added the 32ASPK.anr and 32APSK.vsa files to the IQ Files Examples folder as shown in Figure 7-13. When an IQ file is loaded for the first time, additional processing is required. The (.anr) file stores this information so that subsequent loading is faster. This will be more evident when we work with larger files. The time to process the loading is greatly reduced. The .vsa file is the analysis file that produces the metadata for analysis.



| Name         | Date modified     | Type              | Size   |
|--------------|-------------------|-------------------|--------|
| 32ASPK.dgz   | 9/1/2020 1:05 AM  | DGZ File          | 134 KB |
| 32APSK.dgz   | 2/3/2022 3:17 PM  | DGZM File         | 3 KB   |
| 64QAM.dgz    | 8/21/2020 6:24 AM | DGZ File          | 36 KB  |
| 64QAM.dgz    | 2/3/2022 3:24 PM  | DGZM File         | 3 KB   |
| Analysis.htm | 2/3/2022 2:24 PM  | Chrome HTML Do... | 2 KB   |
| P14DQPSK.dgz | 8/21/2020 7:48 AM | DGZ File          | 134 KB |
| P14DQPSK.dgz | 2/3/2022 3:37 PM  | DGZM File         | 3 KB   |
| 32ASPK.anr   | 2/3/2022 7:32 PM  | ANR File          | 1 KB   |
| 32APSK.vsa   | 2/3/2022 7:33 PM  | VSA File          | 971 KB |

Figure 7-13. Analysis Files Added

64QAM File Example

Click the 64QAM file to load it into the analysis program. When the program loads, the files parameters are shown in the top menu bar as shown in Figure 7-14. Set the 64QAM parameters in the same way as the 32APSK parameters, using the parameter values in the 64QAM section of the Analysis.htm information file.

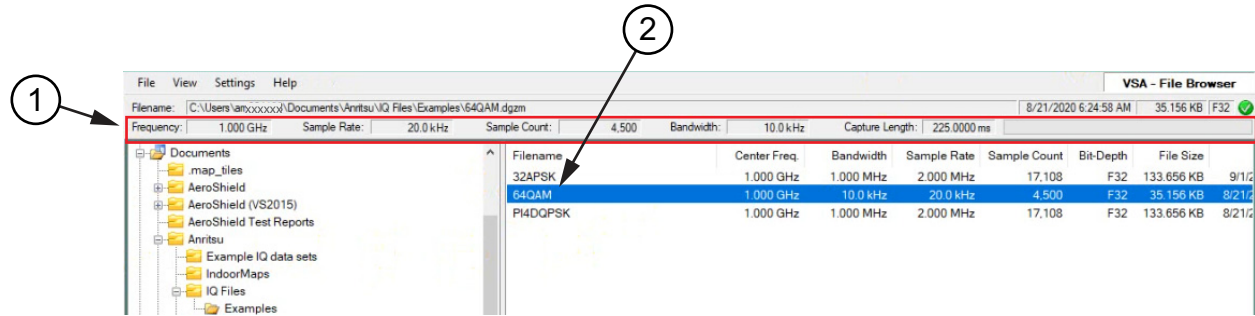
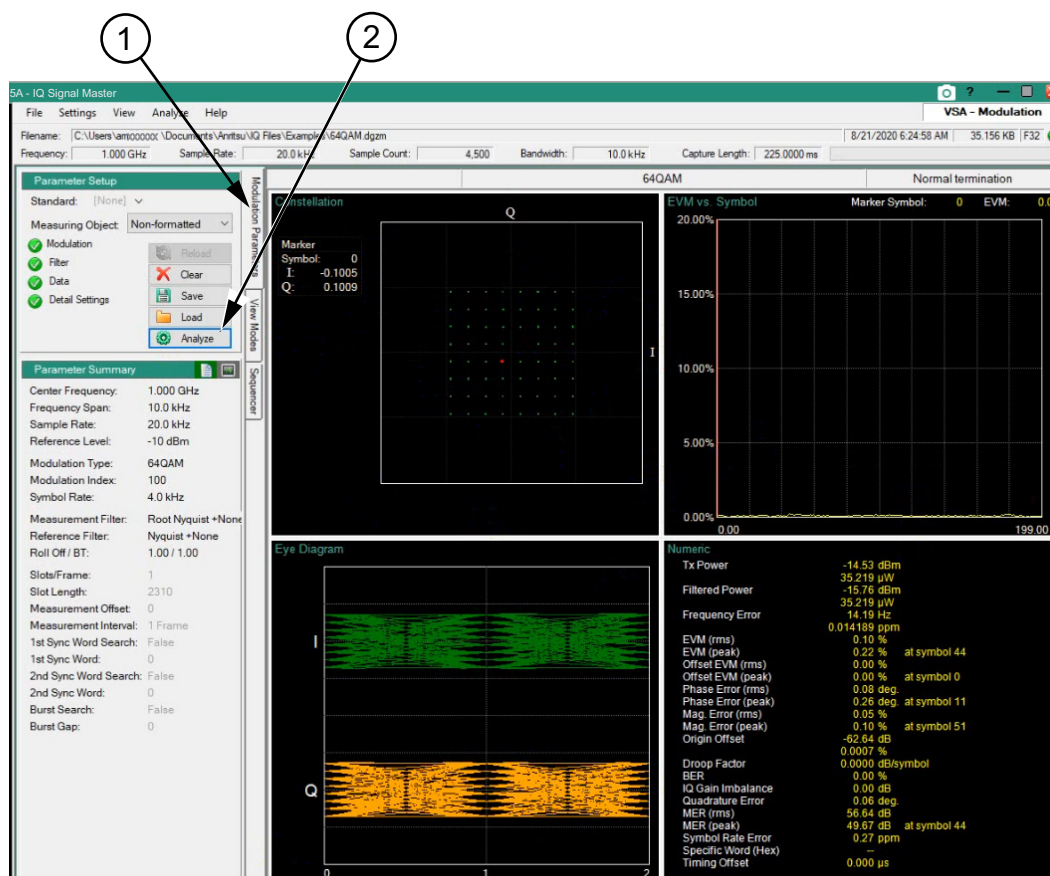


Figure 7-14. 64QAM File

The Analysis of the set up 64QAM parameters is shown in Figure 7-15.



1. Modulation Parameters Tab

2. Analyze Button

**Figure 7-15.** Analyze 64QAM Data Set



## 7-3 FM Radio

Examples of the IQ Signal Master are provided in a MX280005A Help file. Open the example files menus from the HELP menu as shown on [Figure 7-16](#). Download FM Radio to the same folder as the Modulation Analysis file location: (Documents > Anritsu > IQ Files > Example Files). This 886 Mb file may take several minutes to load.

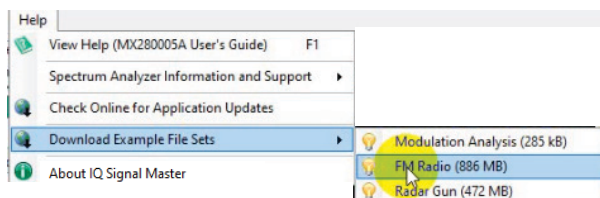


**Figure 7-16.** Example Files - FM Radio

After the download is complete, additional files have been added to the IQ files folder as shown in [Figure 7-17](#).

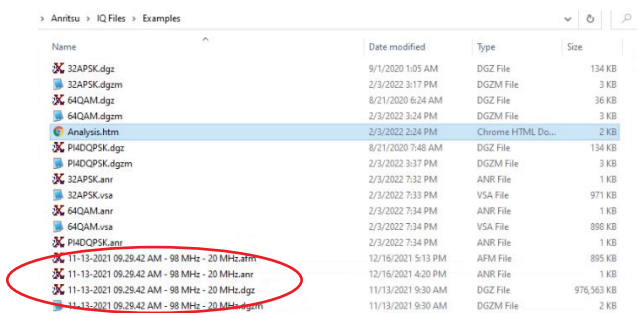
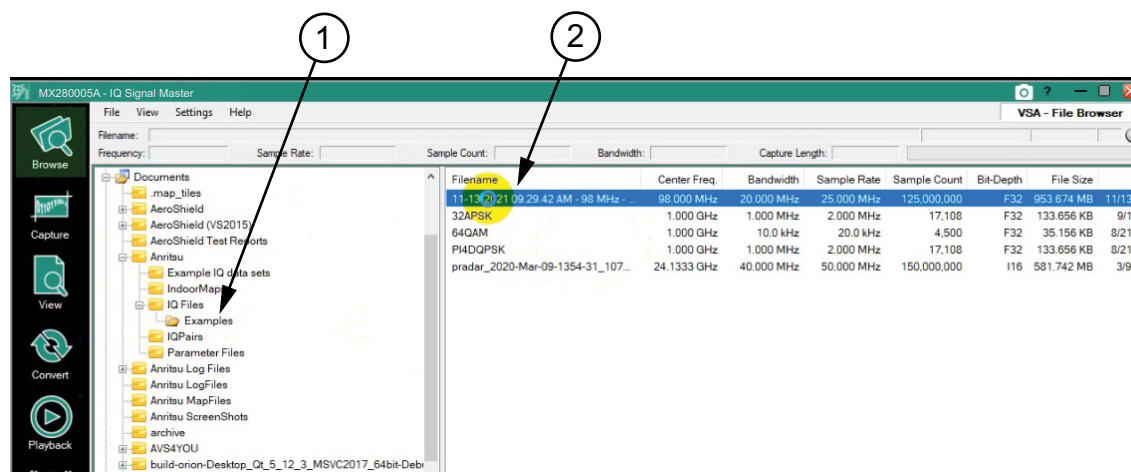


**Figure 7-17.** FM Radio - Added Files

From the IQ files > Example Files folder, load the file shown in [Figure 7-18](#).



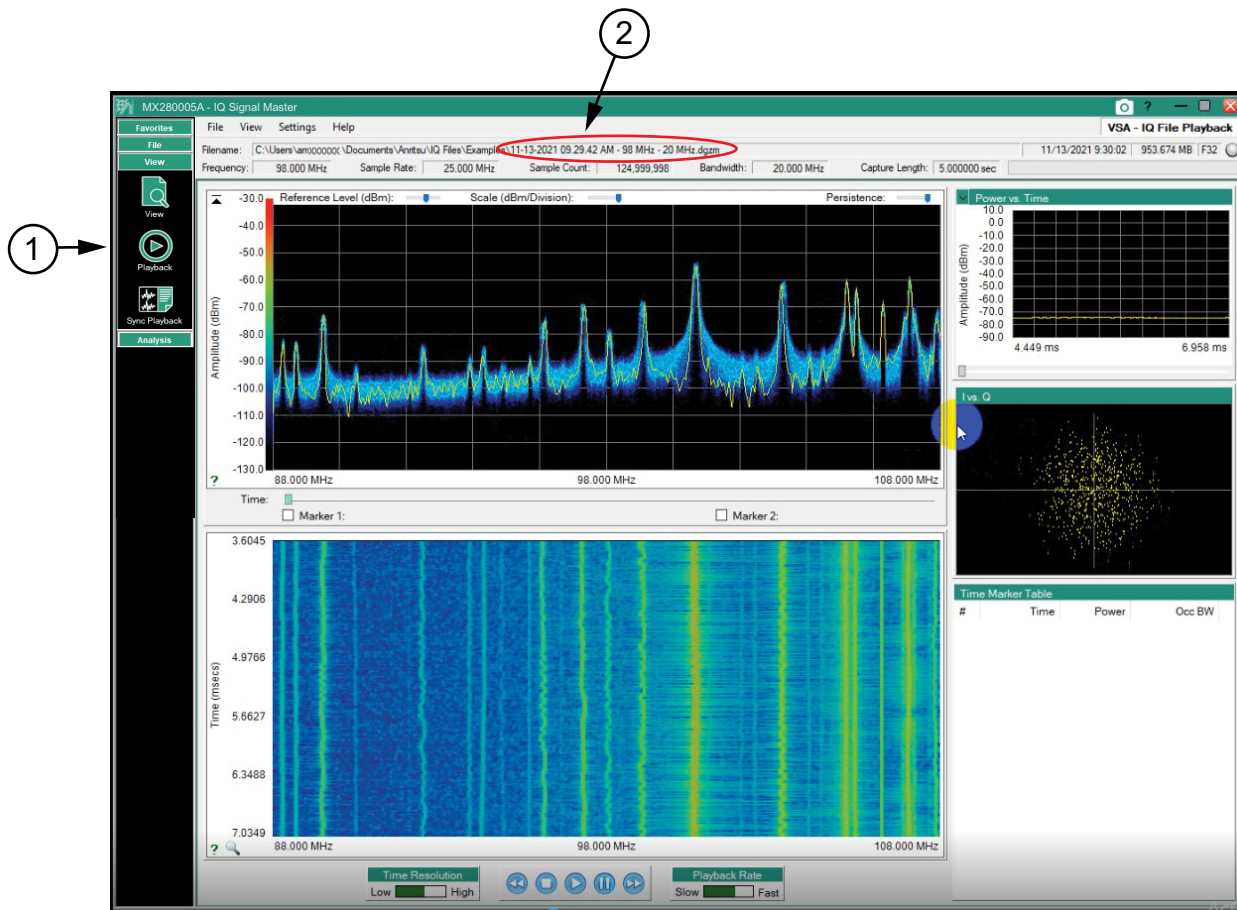
1. Example Folder

2. Open File

**Figure 7-18.** Load FM File



Click the Playback menu button. The FM Radio file is displayed in the Playback window as shown in Figure 7-19.



1. Playback Button

2. Opened File

**Figure 7-19.** Opened FM File - Playback Window

Right-click the trace display to show the menu in [Figure 7-20](#).

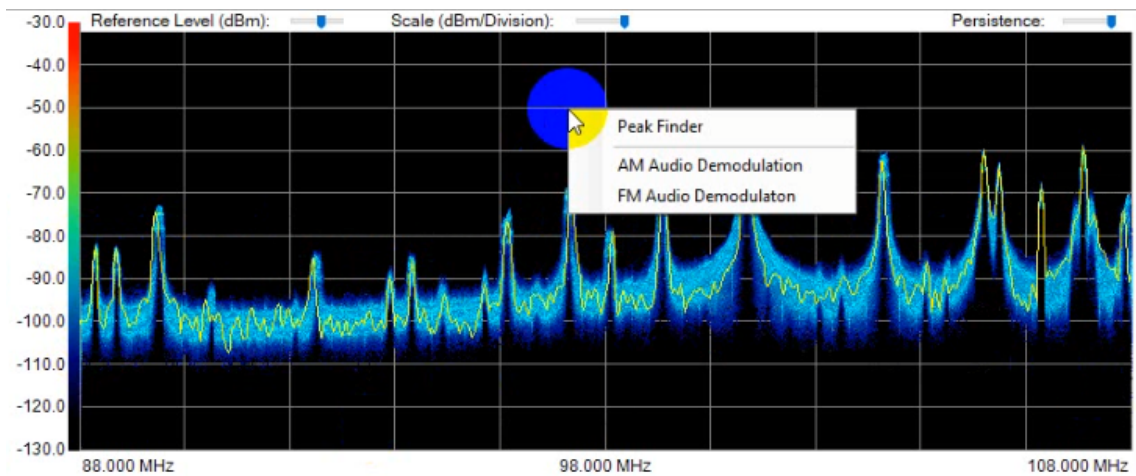
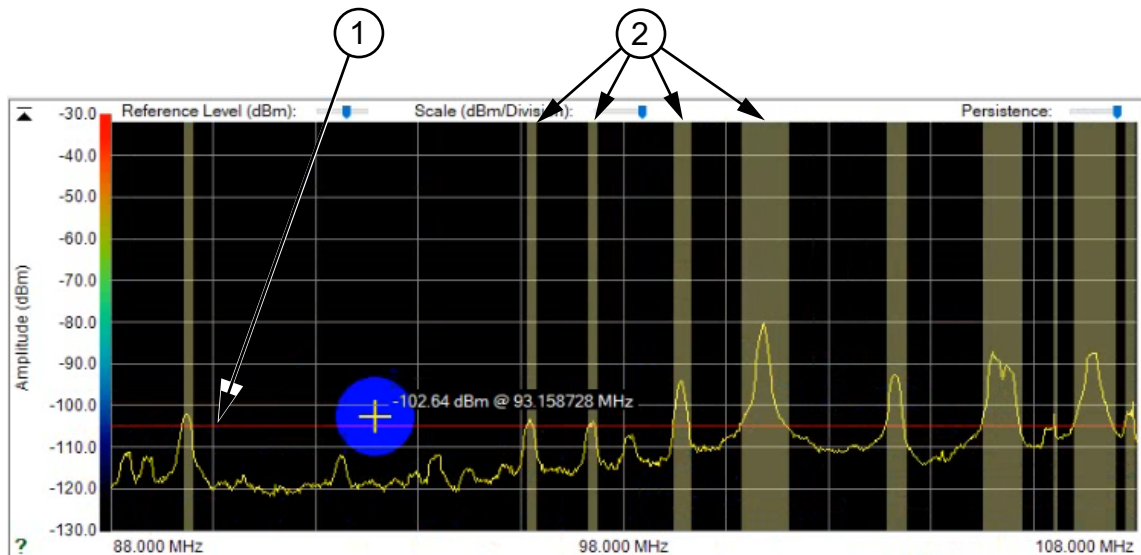


**Figure 7-20.** Peak Finder

Click Peak Finder. Peak Finder finds the peaks in the display. Continuing to lower or raise the peak finder also changes the signals detected bandwidth.

Click and drag the mouse up and down the display to move the red reference level line.

Position the line on the display to optimize the peaks of interest as shown in [Figure 7-21](#).



1. Peak Finder
2. Detected Peaks

**Figure 7-21.** Detected Peaks

Peak Table

The Peak Table lists the peaks that are displayed in the Trace Display as shown in Figure 7-22. Each peak is identified by:

- Frequency:** Center frequency of the signal.
- Width:** The bandwidth of the signal at the power level of the detected peak finder.
- Power:** The power level of the signal's peak.

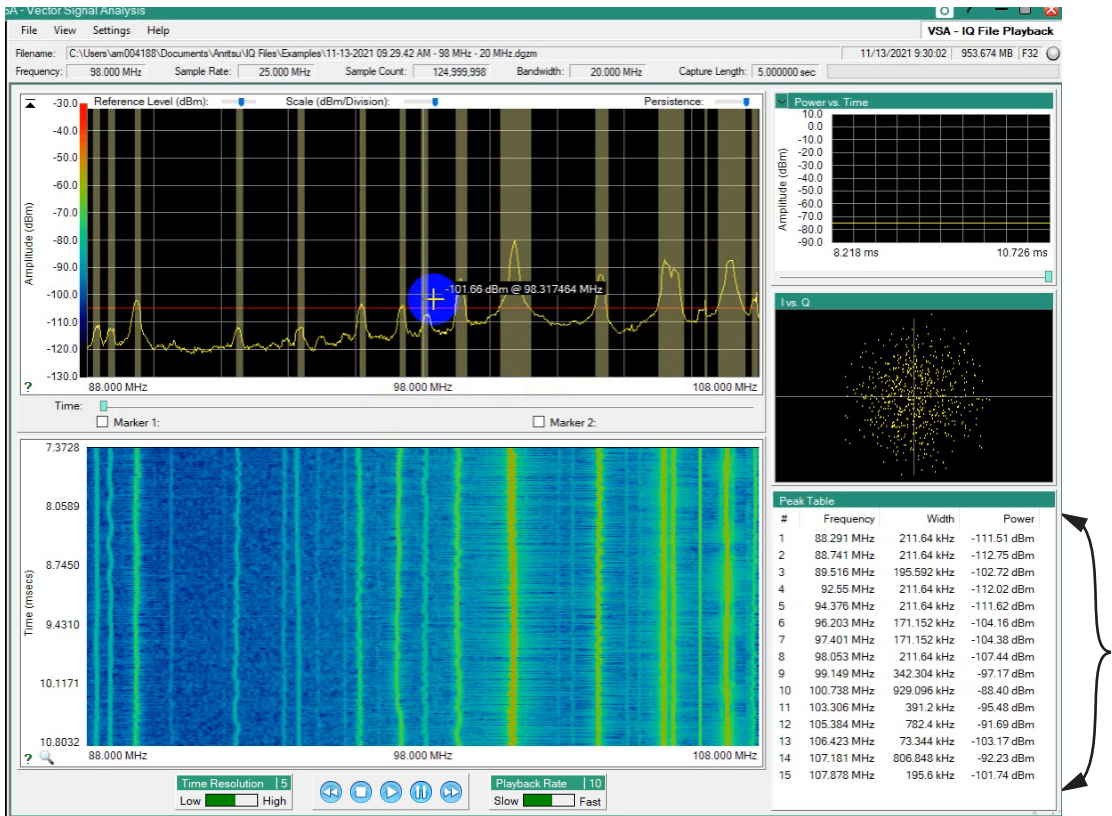
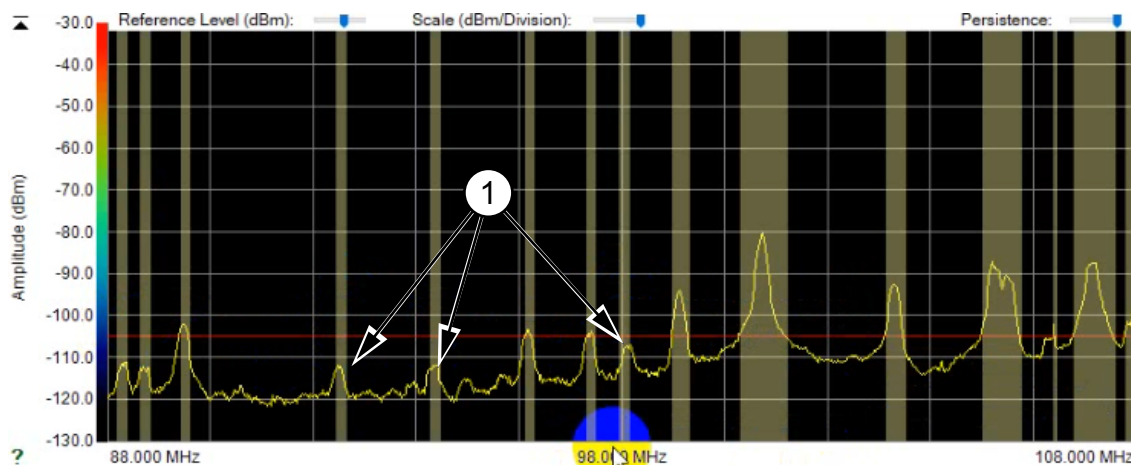


Figure 7-22. Peak Table

### Add Peaks Manually

It may be difficult to find all the desirable peaks as lowering the peak finder closer to the noise floor may show more peak bandwidth than is desired. Add peaks of interest by performing a Shift-Click on signals as shown in [Figure 7-21](#).



1. Added Peaks

**Figure 7-23.** Add Peaks

### Remove and Align Markers

The FM peaks may not align at a particular snapshot on the display because of the characteristics of Frequency Modulation (FM). There may also be unwanted signals that are also present on the trace display.

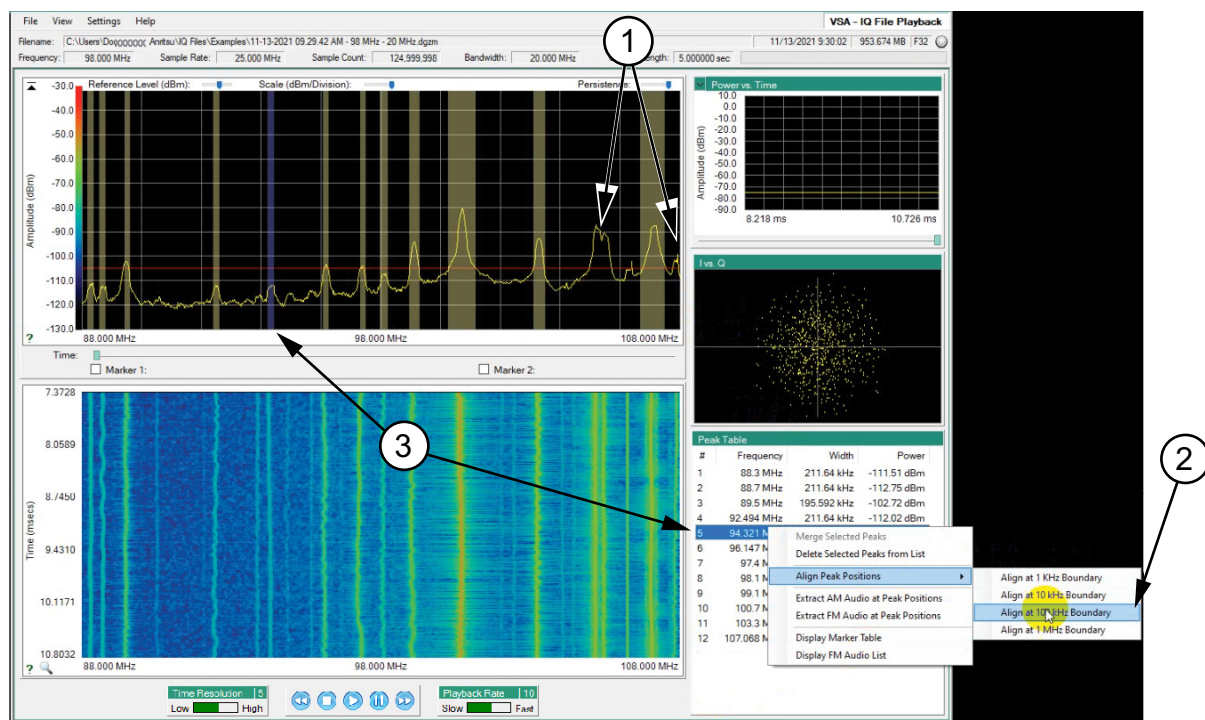
#### Remove Marker

Remove a marker by first selecting it in the display (either click the marker in the graph, or click the marker entry in the Peak Marker table.) Then press the delete key. Note the marker is removed and the signal remains in the display. The marker is also removed from the Peak Marker table.

#### Align Marker

Manually align markers towards center of the signal by clicking a marker to select it, and then hold down the shift key and scroll the mouse wheel. This will adjust the frequency of the peak marker. At the same time, view the marker table. A selected marker highlights in purple in the trace display and the same marker is indicated in the Peak Table highlighted blue. Cursor movement is indicated in the frequency readout in the Peak Table. When the markers are close to a desired odd 100 kHz value (odd for FM station frequency), right click the marker table to display the menu shown in [Figure 7-24](#).





1. Removed Markers
2. Align at 100 kHz Boundary
3. Highlighted Marker/Peak Table Marker

**Figure 7-24.** Align Markers

Click “Align at 100 kHz Boundary”. The results of the alignment shows each marked signal has been aligned to a 100 kHz frequency value as shown in [Figure 7-25](#).

If after the 100 kHz alignment is performed and there are still “even” 100 kHz frequency values, redo the manual alignment and then click the Align at 100 kHz Boundary again. Continue until each 100 kHz frequency value is aligned to an odd FM frequency to optimize the audio.

| Peak Table |           |             |             |
|------------|-----------|-------------|-------------|
| #          | Frequency | Width       | Power       |
| 1          | 88.3 MHz  | 211.64 kHz  | -111.51 dBm |
| 2          | 88.7 MHz  | 211.64 kHz  | -112.75 dBm |
| 3          | 89.5 MHz  | 195.592 kHz | -102.72 dBm |
| 4          | 92.5 MHz  | 211.64 kHz  | -112.02 dBm |
| 5          | 94.3 MHz  | 211.64 kHz  | -111.62 dBm |
| 6          | 96.1 MHz  | 171.152 kHz | -104.16 dBm |
| 7          | 97.3 MHz  | 171.152 kHz | -104.38 dBm |
| 8          | 98.1 MHz  | 264.55 kHz  | -107.44 dBm |
| 9          | 99.1 MHz  | 342.304 kHz | -97.17 dBm  |
| 10         | 100.7 MHz | 329.096 kHz | -88.40 dBm  |
| 11         | 103.3 MHz | 391.2 kHz   | -95.48 dBm  |
| 12         | 107.1 MHz | 806.848 kHz | -92.23 dBm  |

**Figure 7-25.** Peak Table - Aligned Markers to FM Frequency

## Extract FM Audio

With the peak markers aligned, right-click the Peak Table and click “Extract FM Audio at Peak Positions” as shown in [Figure 7-26](#). The FM extraction process may take a few minutes to complete. When the extraction is complete, the peak table changes to the AM/FM Audio table as shown. Double-click each of the signals listed in the AM/FM Audio table to listen to each captured FM audio.

| #  | Frequency | Width      | Power       |
|----|-----------|------------|-------------|
| 1  | 88.3 MHz  | 211.64 kHz | -111.51 dBm |
| 2  | 88.7 MHz  | 211.64 kHz | -112.75 dBm |
| 3  |           |            |             |
| 4  |           |            |             |
| 5  |           |            |             |
| 6  |           |            |             |
| 7  |           |            |             |
| 8  |           |            |             |
| 9  |           |            |             |
| 10 |           |            |             |
| 11 |           |            |             |
| 12 |           |            |             |

| #  | Frequency   | Power       |
|----|-------------|-------------|
| 1  | 88.300 MHz  | -108.29 dBm |
| 2  | 88.700 MHz  | -108.67 dBm |
| 3  | 89.500 MHz  | -98.28 dBm  |
| 4  | 92.500 MHz  | -109.30 dBm |
| 5  | 94.300 MHz  | -110.71 dBm |
| 6  | 96.100 MHz  | -101.15 dBm |
| 7  | 97.300 MHz  | -94.19 dBm  |
| 8  | 98.100 MHz  | -103.85 dBm |
| 9  | 99.100 MHz  | -92.65 dBm  |
| 10 | 100.700 MHz | -78.30 dBm  |
| 11 | 103.300 MHz | -86.11 dBm  |
| 12 | 107.100 MHz | -84.16 dBm  |

**Figure 7-26.** Extract FM

## Save Files

Right-click the AM/FM Audio table and click “Save All Channels to WAV Files” as shown in [Figure 7-27](#). The dialog displays the number of files saved and the path to the location of the folder it is being stored to.

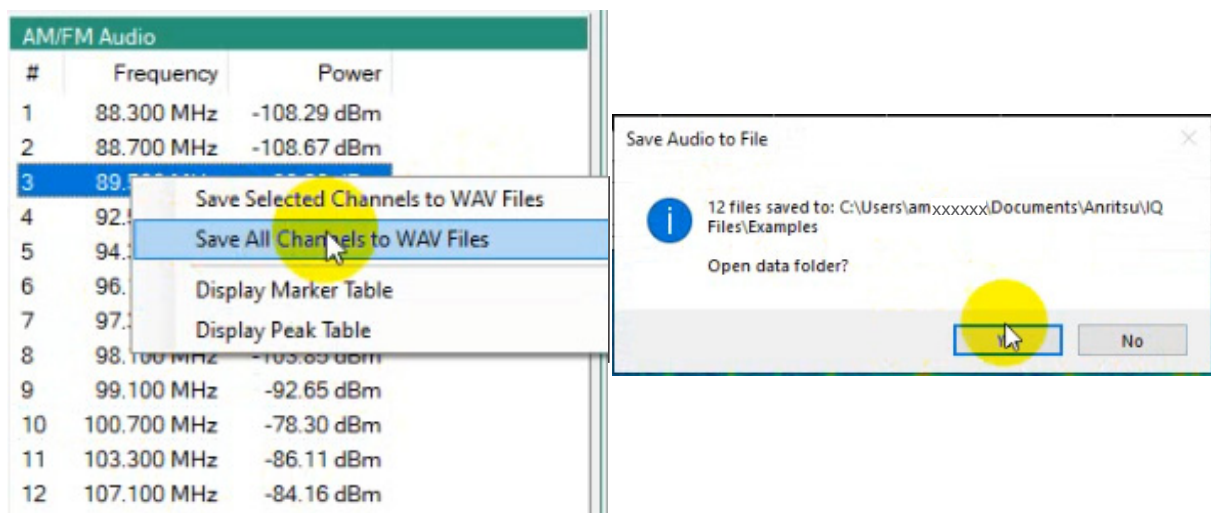
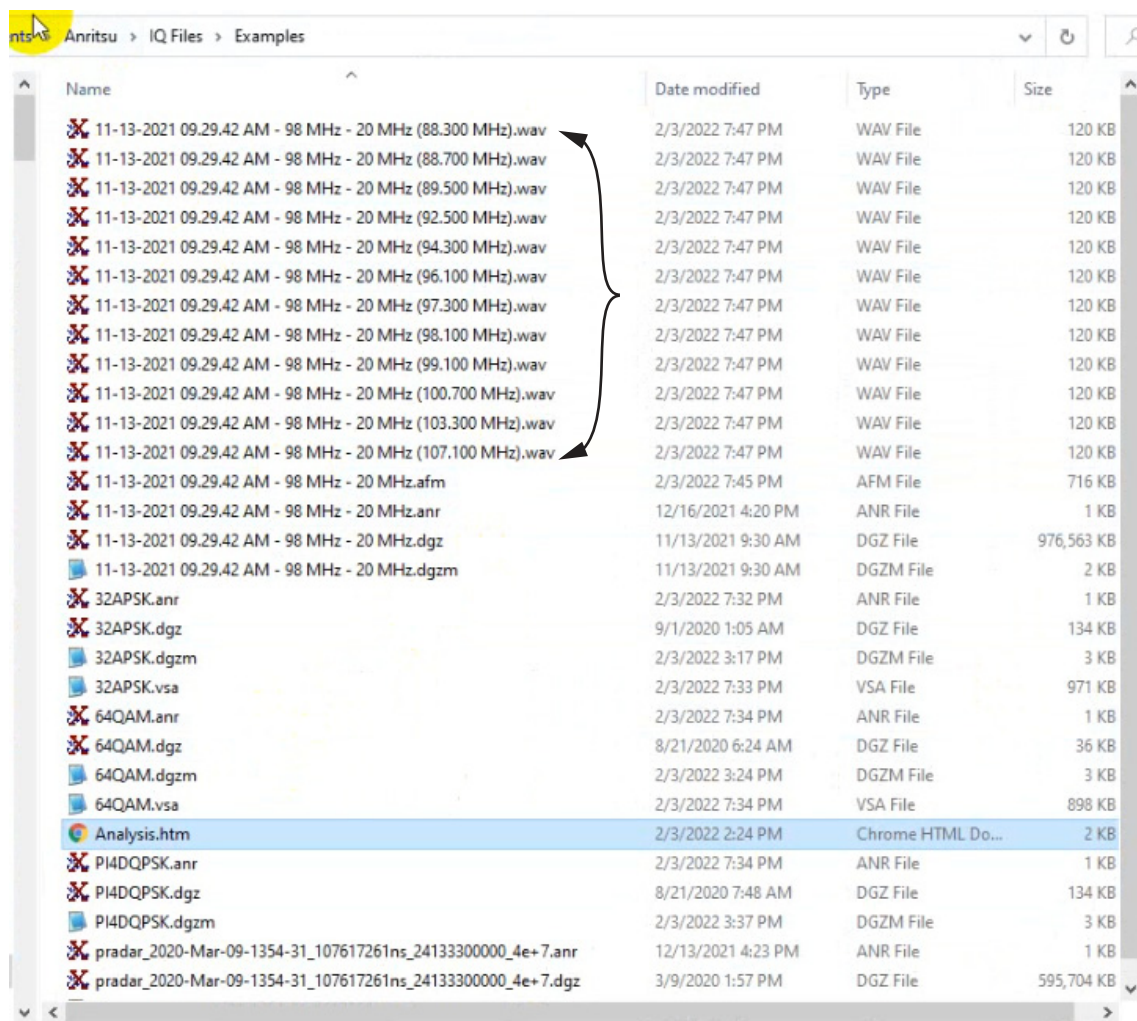


**Figure 7-27.** Save WAV Files

The stored wave files saved are shown in [Figure 7-28](#).



| Name                                                        | Date modified      | Type              | Size       |
|-------------------------------------------------------------|--------------------|-------------------|------------|
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (88.300 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (88.700 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (89.500 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (92.500 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (94.300 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (96.100 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (97.300 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (98.100 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (99.100 MHz).wav   | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (100.700 MHz).wav  | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (103.300 MHz).wav  | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz (107.100 MHz).wav  | 2/3/2022 7:47 PM   | WAV File          | 120 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz.afm                | 2/3/2022 7:45 PM   | AFM File          | 716 KB     |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz.anr                | 12/16/2021 4:20 PM | ANR File          | 1 KB       |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz.dgz                | 11/13/2021 9:30 AM | DGZ File          | 976,563 KB |
| 11-13-2021 09.29.42 AM - 98 MHz - 20 MHz.dgzm               | 11/13/2021 9:30 AM | DGZM File         | 2 KB       |
| 32APSK.anr                                                  | 2/3/2022 7:32 PM   | ANR File          | 1 KB       |
| 32APSK.dgz                                                  | 9/1/2020 1:05 AM   | DGZ File          | 134 KB     |
| 32APSK.dgzm                                                 | 2/3/2022 3:17 PM   | DGZM File         | 3 KB       |
| 32APSK.vsa                                                  | 2/3/2022 7:33 PM   | VSA File          | 971 KB     |
| 64QAM.anr                                                   | 2/3/2022 7:34 PM   | ANR File          | 1 KB       |
| 64QAM.dgz                                                   | 8/21/2020 6:24 AM  | DGZ File          | 36 KB      |
| 64QAM.dgzm                                                  | 2/3/2022 3:24 PM   | DGZM File         | 3 KB       |
| 64QAM.vsa                                                   | 2/3/2022 7:34 PM   | VSA File          | 898 KB     |
| Analysis.htm                                                | 2/3/2022 2:24 PM   | Chrome HTML Do... | 2 KB       |
| PI4DQPSK.anr                                                | 2/3/2022 7:34 PM   | ANR File          | 1 KB       |
| PI4DQPSK.dgz                                                | 8/21/2020 7:48 AM  | DGZ File          | 134 KB     |
| PI4DQPSK.dgzm                                               | 2/3/2022 3:37 PM   | DGZM File         | 3 KB       |
| pradar_2020-Mar-09-1354-31_107617261ns_24133300000_4e+7.anr | 12/13/2021 4:23 PM | ANR File          | 1 KB       |
| pradar_2020-Mar-09-1354-31_107617261ns_24133300000_4e+7.dgz | 3/9/2020 1:57 PM   | DGZ File          | 595,704 KB |

**Figure 7-28.** Stored WAV Files



## 7-4 Example Files - Radar Gun

Examples of the IQ Signal Master are provided in a MX280005A Help file. Open the example files menus from the HELP menu as shown on [Figure 7-29](#). Download Radar Gun to the same folder as the Modulation Analysis and FM Radio location: (Documents > Anritsu > IQ Files > Example Files)

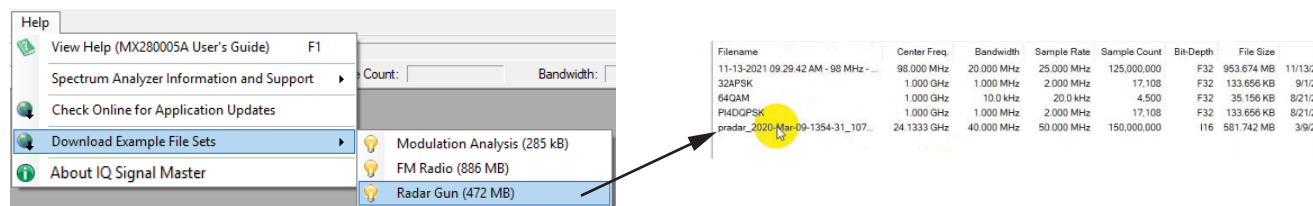
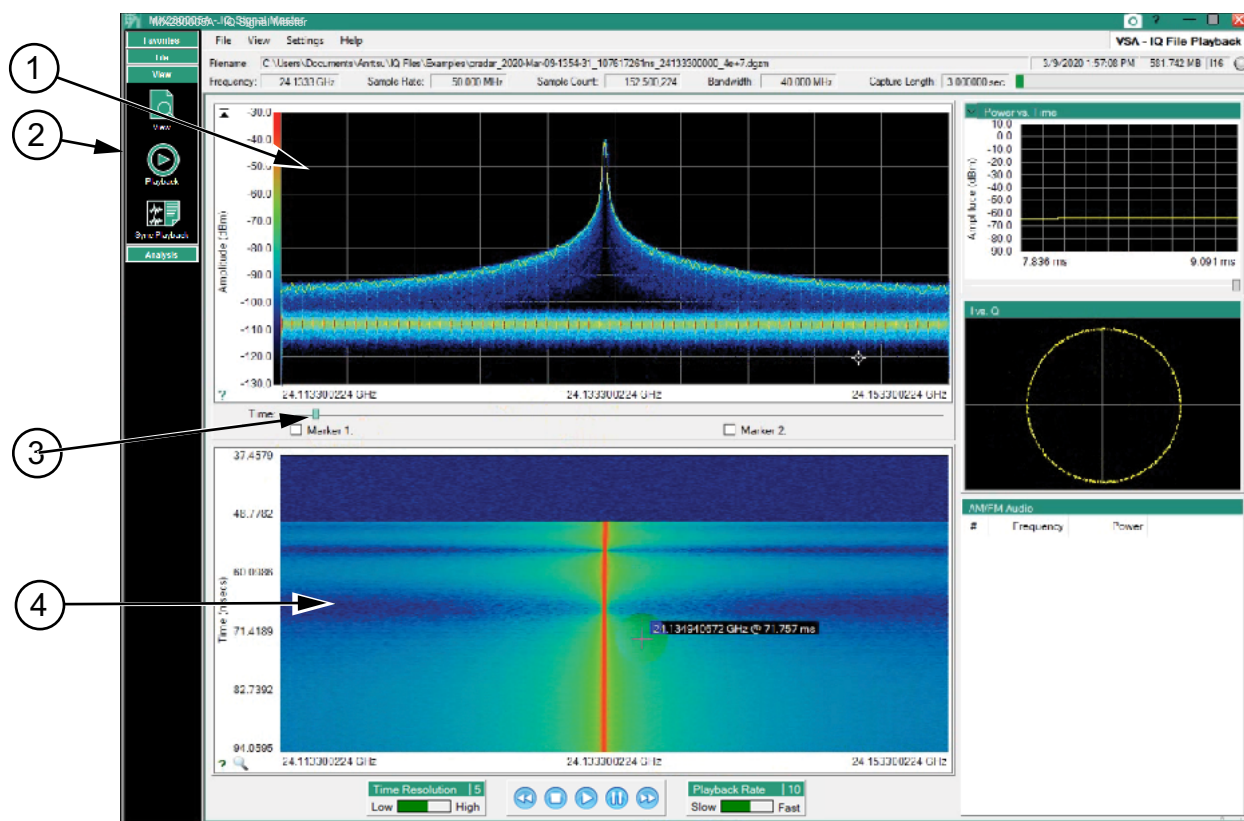


**Figure 7-29.** Radar Gun File

Open the MX280005A program and click the Playback menu button. Because the captured signal file is large, it may take several seconds to view the signal shown in [Figure 7-30](#). The time slider indicates the position in signal time.



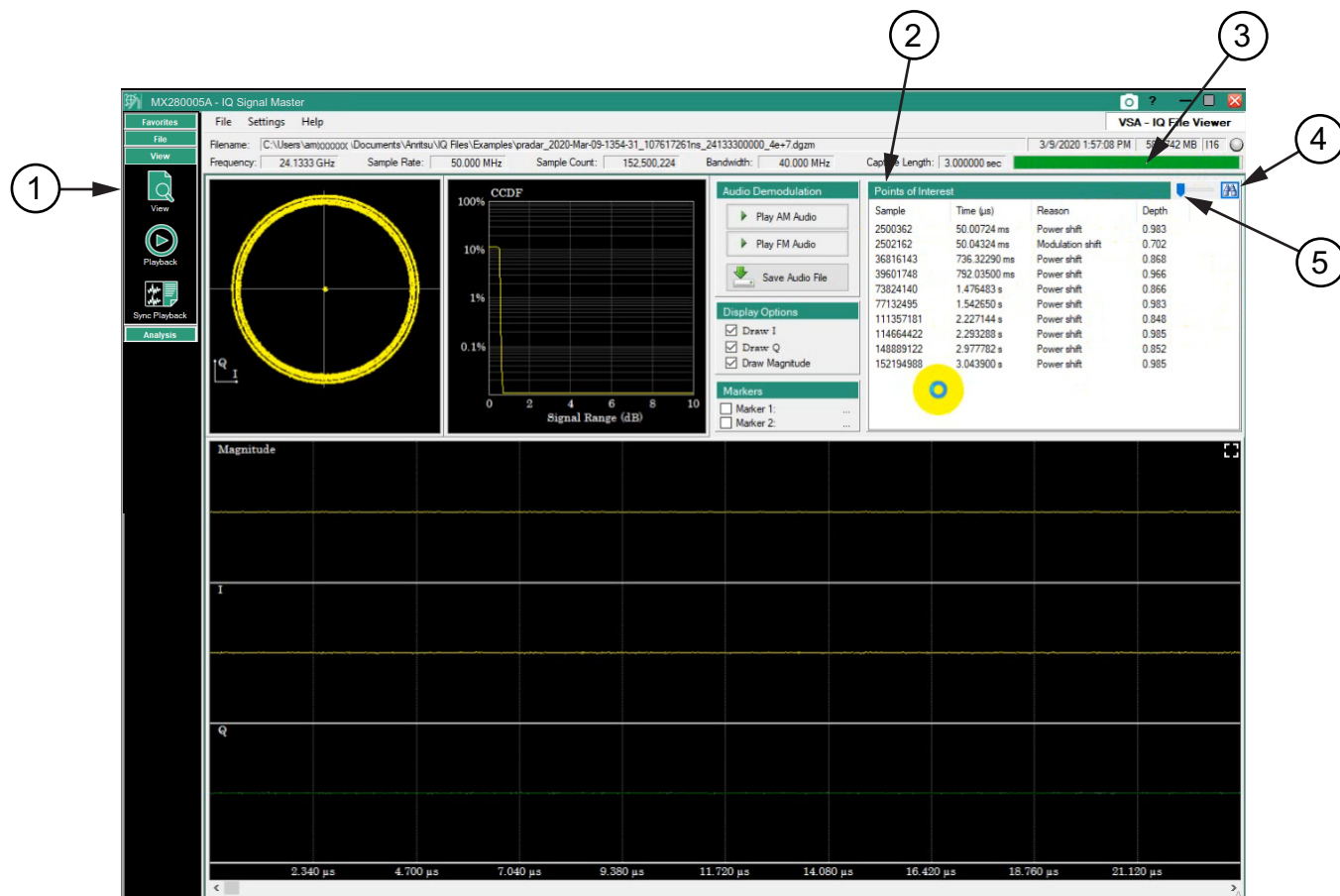
1. Trace Display
2. Playback Menu Button
3. Time Indicator/Slider
4. Spectrogram Display

**Figure 7-30.** Radar File Playback Menu



## View Menu

In the MX280005A program window, press the View menu button. Find the Points of Interest within a captured IQ data file. The Points of Interest window locates data points on the signal where power or modulation shifts occur. The results are displayed in the Points of Interest window as shown in [Figure 7-31](#). The Points of Interest window is described in “Points of Interest” on page 4-5.



1. View Menu

2. Points of Interest window: Displays signal changes. Sensitivity of changes detected dependent on the sensitivity slider setting.

3. File scan progress bar

4. Press to refresh the Points of Interest list

5. Sensitivity Slider: Move to the left to decrease sensitivity. Move to the right to increase sensitivity.

**Figure 7-31.** Radar File - View Menu

Click a line in the Points of Interest window to view the change in power or modulation that has been detected as shown in [Figure 7-32](#). In this example, the power shift is captured on IQ data view at 2.293288 sec of the signal.

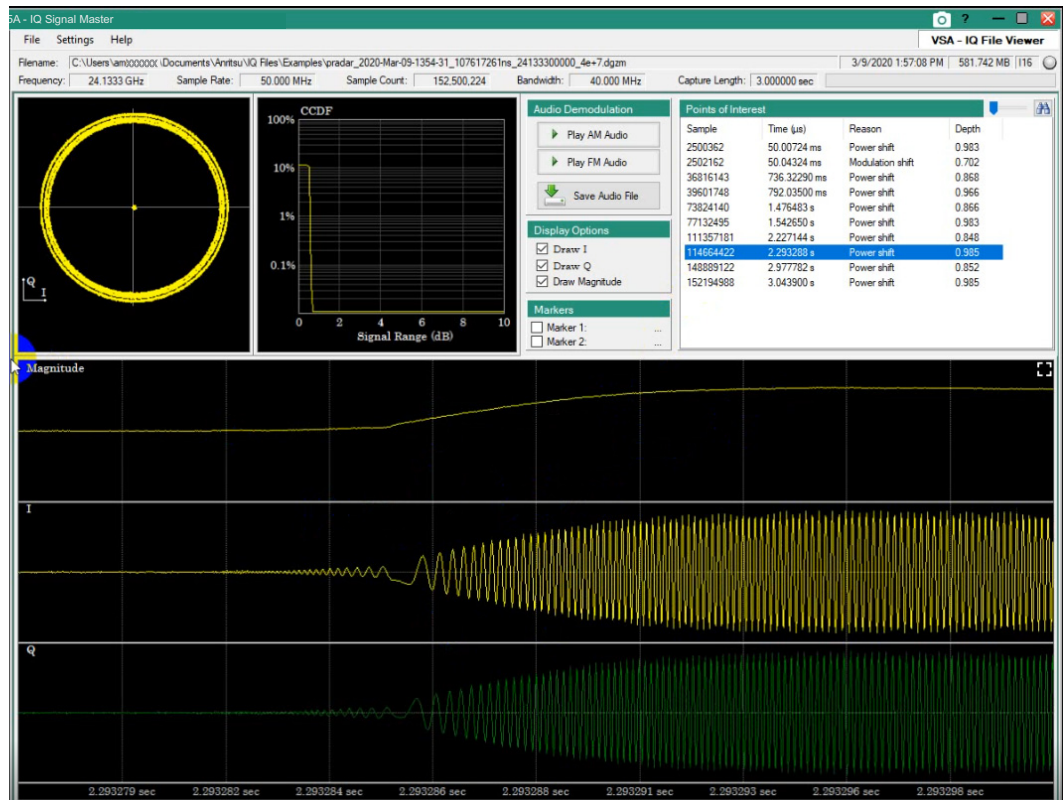


Figure 7-32. Point of Interest View

### Import Points of Interest

In Playback menu, right-click in the Time Marker Table window. The Points of Interest list can be imported into and viewed in the Playback window. Click “Import Points of Interest” as shown in [Figure 7-33](#).

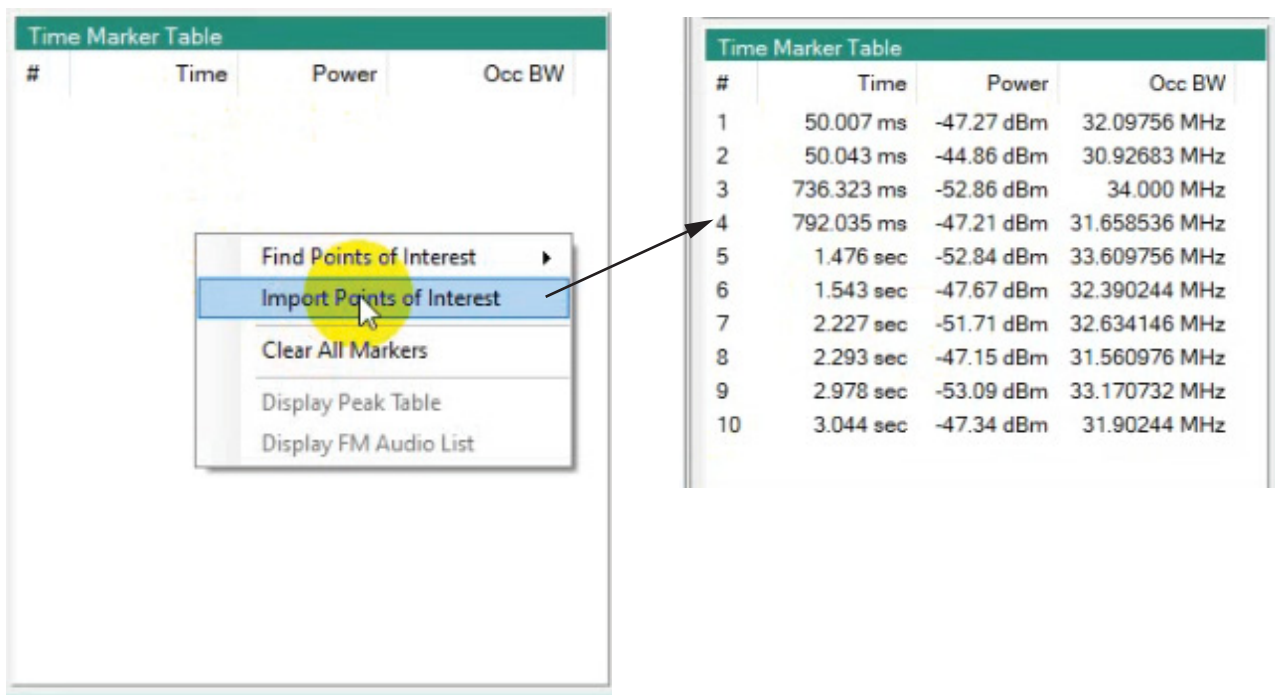
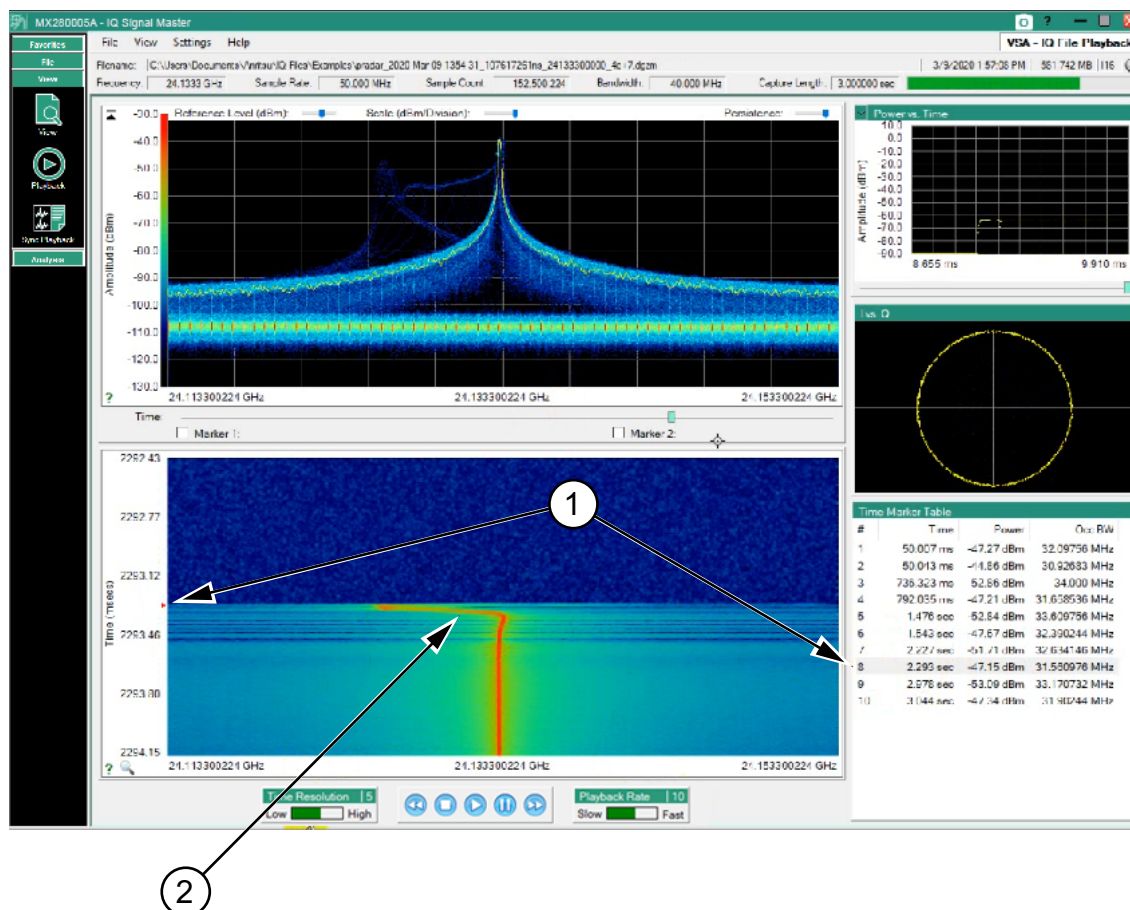


**Figure 7-33.** Import Points of Interest

For this example, click point of interest #8 in the Time Marker Table to view the signal. The time of the signal occurrence captured is 2.293 sec as noted in the Time column of the Time Marker Table and is also indicated by a time marker in the spectrogram display shown in [Figure 7-34](#). This signal change occurred at the beginning of the captured signal sweep. Move the Time Resolution bar to the right and click the center of the spectrogram signal to zoom in and view the signal for a closer analysis.



1. Playback Menu
2. Time Marker #8
3. Point of Interest

**Figure 7-34.** Point of Interest View

### Time Resolution

Increase the Time Resolution of [Figure 7-34 on page 7-25](#). Move the Time Resolution bar to the right and then click the center of the display to zoom-in and obtain a closer view of the signal as shown in [Figure 7-35](#).

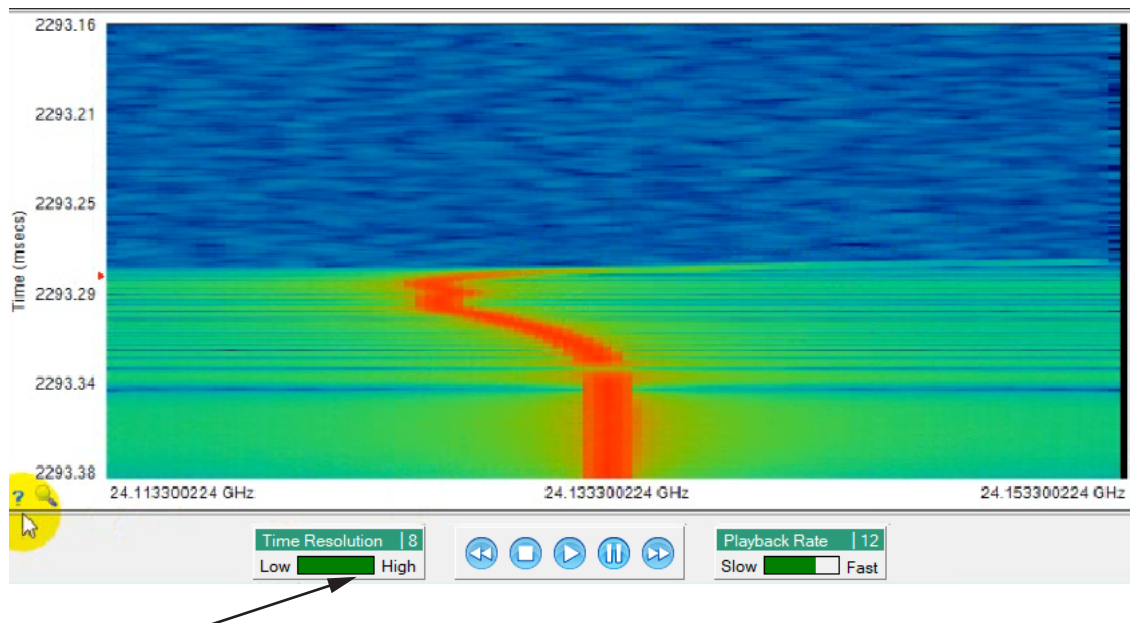
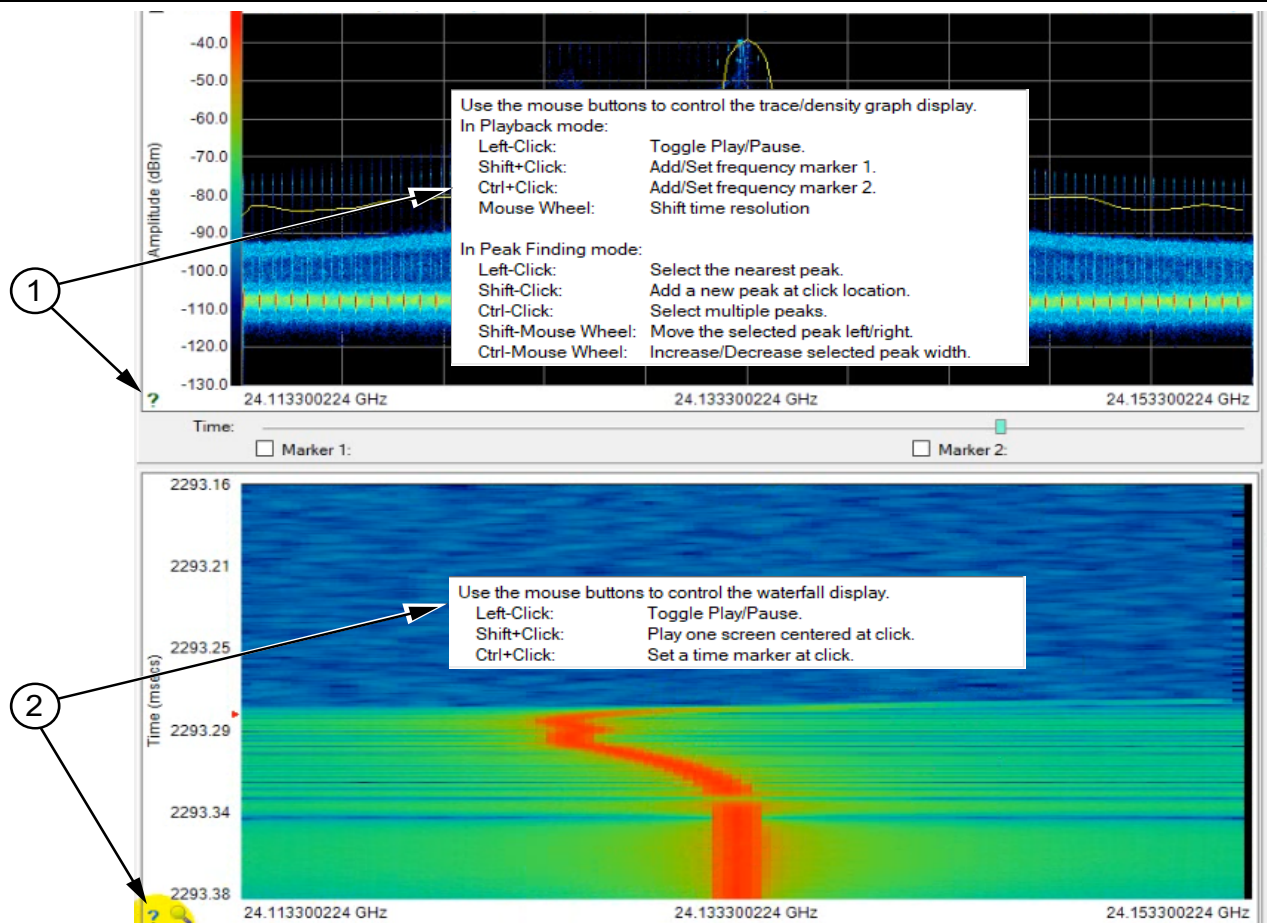


**Figure 7-35.** Increase Time Resolution

## Playback Help Menus

The Trace and the Spectrograph displays provide a Help icon as shown in [Figure 7-36](#). Hover over the icons to show the Help dialogs that provide mouse and keyboard instructions for each display.



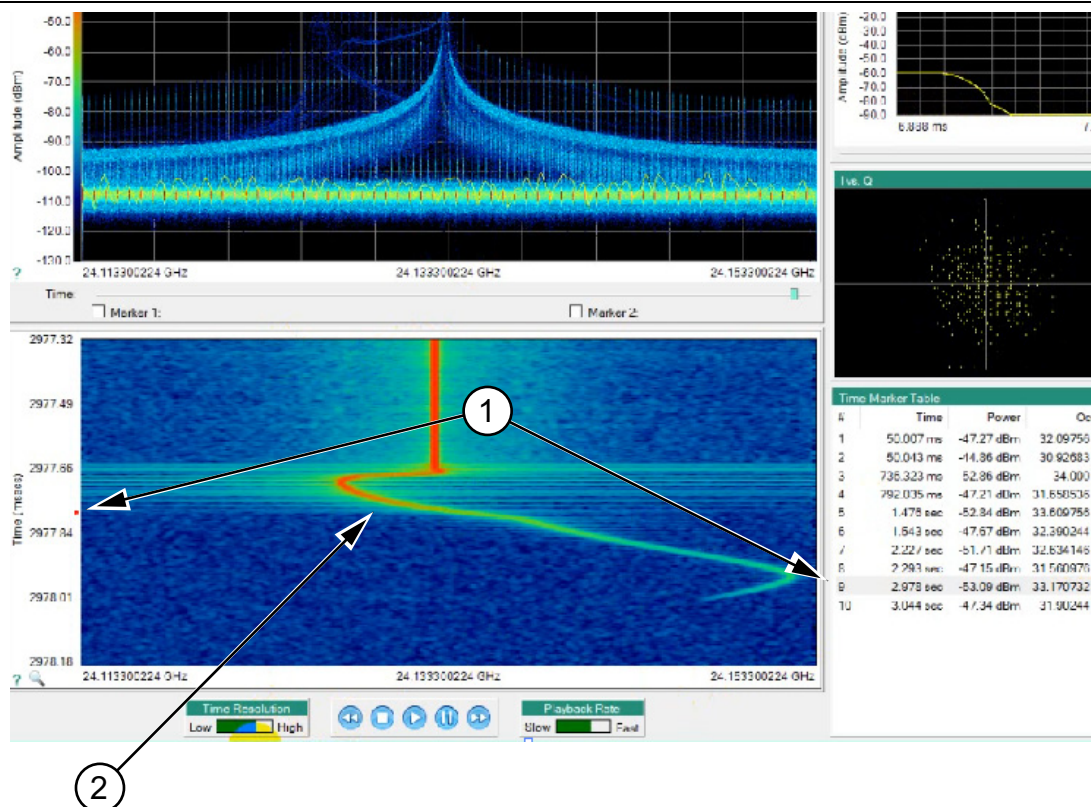
1. Trace Display Help
2. Spectrograph Display Help

**Figure 7-36.** Playback Help



### Select #9 Time Marker

In this example, click point of interest #9 in the Time Marker Table to view the signal. The time of the signal occurrence captured is 2.978 sec as noted in the Time column of the Time Marker Table and is also indicated by a red time marker in the spectrogram display shown in Figure 7-37. This signal change occurred at the end of the captured signal sweep. Move the Time Resolution bar to the right and click the center of the spectrogram signal to zoom in and view the signal for a closer analysis.



1. Time Marker #9

2. Point of Interest

**Figure 7-37.** Point of Interest View

# Chapter 8 — API

## 8-1 Introduction

MX280005A IQ Signal Master software includes a full API that allows developers and system integrators to develop their own front end, while using the Anritsu IQ Signal Master Analysis engine for backend processing. The API provides full parameter access and graphical output options for all supported modulation types.

## 8-2 Using API

The MX280005A IQ Signal Master API requires IQ data files captured from instruments with Option 128. The quality of the results will depend on the quality of the receiver and how well it is configured when capturing IQ data.

MX280005A IQ Signal Master software is a Microsoft Windows application, and the API is a .NET library. The Library that can be integrated easily into a .NET application.

1. Install the MX280005A software.
2. Open your application solution in Visual Studio.
3. Add a reference in your project to the API library. (MX280005A.dll)
4. Add API methods and properties according to your needs. The first call should be `AnalysisAPI.Initialize`.

## 8-3 License Control

Refer to [“Licensing” on page 1-4](#) for complete licensing information.

### Display Parameters

The API provides different analysis type result screens. A sub-set of these is available for each modulation type. Some of the measurement results have scaling options or display parameters. The following properties set these display options.

#### **InterpolateConstellation**

Command Type: Set and Get

Return Type: Byte

Values : 0: no interpolation  
1: course interpolation  
2: smooth interpolation

#### **EqualizerAmplScale**

Command Type: Set and Get

Return Type: Single

Value Range: 0.1 to 50



**EqualizerGDScale**

Command Type: Set and Get

Return Type: Integer

Value Range: 100 ns to 1 ms (Set value in nanoseconds)

**EqualizerIRScale**

Command Type: Set and Get

Return Type: Integer

Value Range: 5 dB to -50 dB

**EqualizerPhaseScale**

Command Type: Set and Get

Return Type: Integer

Value Range: 1° to 180°

**EVMvsSubcarrierScale**

Command Type: Set and Get

Return Type: Single

Value Range: 5 % to 50 %

**EVMvsSymbolScale**

Command Type: Set and Get

Return Type: Single

Value Range: 5 % to 50 %

**FidelityvsSymbolScale**

Command Type: Set and Get

Return Type: Single

Value Range: 5 % to 50 %

**FSKErrvsSymbolScale**

Command Type: Set and Get

Return Type: Single

Value Range: 5 % to 50 %

**PhaseErrorvsSymbolScale**

Command Type: Set and Get

Return Type: Single

Value Range: 5 % to 50 %

**MagErrvsSymbolScale**

Command Type: Set and Get

Return Type: Single

Value Range: 5 % to 50 %

**SymbolTableHex**

Command Type: Set and Get

Return Type: Boolean

Values: True: Hex display  
False: Binary display

**Data Description Parameters****CenterFrequency**

Description: Center frequency of data capture. Set value in Hz.

Command Type: Set and Get

Return Type: Long

**FrequencySpan**

Description: Frequency span of data capture. Set value in Hz.

Command Type: Set and Get

Return Type: Long

**ReferenceLevel**

Description: The display reference level of the data capture. Set in dBm.

Command Type: Set and Get

Return Type: Single

**IQData**

Description: Sets the IQ data set for analysis. This is an array of 32-bit floats. The values alternate between I and Q.

Command Type: Set Only

Return Type: Single

Parameters: IQData() as Single

**Modulation Description Parameters**

All modulation parameters are described in detail in the M280005A User's Guide (10580-00475).

**ModulationTypeList**

Description: Returns a list of supported modulation types.

Command Type: Get Only

Return Type: String

**ModulationType**

Command Type: Set and Get

Return Type: String

**FrameFormatted**

Command Type: Set and Get

Return Type: Boolean

**ModulationIndex**

Command Type: Set and Get

Return Type: Single

**APSK\_RingRatio\_R2toR1**

Command Type: Set and Get

Return Type: Single

**APSK\_RingRatio\_R3toR1**

Command Type: Set and Get

Return Type: Single

**ModulationIndexSwitch**

Command Type: Set and Get

Return Type: Boolean

**MaxFreqDeviation**

Command Type: Set and Get

Return Type: Single

**MaxFreqDeviationSwitch**

Command Type: Set and Get

Return Type: Boolean

**SymbolRate**

Command Type: Set and Get

Return Type: Single

**SamplingRate**

Command Type: Set and Get

Return Type: Single

**SpanUp**

Command Type: Set and Get

Return Type: Boolean

**CaptureOverSampling**

Command Type: Set and Get

Return Type: Integer

**CaptureInterval**

Command Type: Set and Get

Return Type: eAnaCaptureInterval

**MappingNumberOfSymbols**

Command Type: Set and Get

Return Type: Integer

**MappingNumberOfBits**

Command Type: Set and Get

Return Type: Integer

**MappingData**

Command Type: Set and Get

Return Type: String

**MappingFilename**

Command Type: Set and Get

Return Type: String

**FilterMeas1stName**

Command Type: Set and Get

Return Type: String

**FilterRef1stName**

Command Type: Set and Get

Return Type: String

**FilterMeas2ndName**

Command Type: Set and Get

Return Type: String

**FilterRef2ndName**

Command Type: Set and Get

Return Type: String

**FilterRollOff**

Command Type: Set and Get

Return Type: Single

**FilterRollOff2nd**

Command Type: Set and Get

Return Type: Single

**SlotsPerFrame**

Command Type: Set and Get

Return Type: Integer

**SlotOn\_01**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_02**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_03**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_04**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_05**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_06**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_07**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_08**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_09**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_10**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_11**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_12**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_13**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_14**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_15**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_16**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_17**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_18**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_19**

Command Type: Set and Get

Return Type: Boolean

**SlotOn\_20**

Command Type: Set and Get

Return Type: Boolean

**SlotLength**

Command Type: Set and Get

Return Type: Integer

**MeasurementOffset**

Command Type: Set and Get

Return Type: Integer



**MeasurementInterval**

Command Type: Set and Get

Return Type: Integer

**SyncWordSearchOn**

Command Type: Set and Get

Return Type: Boolean

**BurstSearchOn**

Command Type: Set and Get

Return Type: Boolean

**Enable2ndSyncWord**

Command Type: Set and Get

Return Type: Boolean

**First\_SearchSlot**

Command Type: Set and Get

Return Type: Integer

**First\_SyncWordLength**

Command Type: Set and Get

Return Type: Integer

**First\_SyncWord**

Command Type: Set and Get

Return Type: ULong

**First\_SyncWordOffset**

Command Type: Set and Get

Return Type: Integer

**Second\_SearchSlot**

Command Type: Set and Get

Return Type: Integer

**Second\_SyncWordLength**

Command Type: Set and Get

Return Type: Integer

**Second\_SyncWord**

Command Type: Set and Get

Return Type: ULong

**Second\_SyncWordOffset**

Command Type: Set and Get

Return Type: Integer

**DeviationCalculation**

Command Type: Set and Get

Return Type: eFSKDevMeasSw

**DeviationRmsRef**

Command Type: Set and Get

Return Type: eFSKDevRmsRef

**Convergence**

Command Type: Set and Get

Return Type: Single

**FilterLength**

Command Type: Set and Get

Return Type: Integer

**Adaptive**

Command Type: Set and Get

Return Type: eEquOperationMode

**MethodOfSymbolRateError**

Command Type: Set and Get

Return Type: eSymRateErrMeasMethod

**HcpmDecodeMethod**

Command Type: Set and Get

Return Type: eHcpmDecodeMethod

**OriginOffsetCancel**

Command Type: Set and Get

Return Type: Boolean

**OriginOffsetRef**

Command Type: Set and Get

Return Type: eOORefPwr

**DroopCancel**

Command Type: Set and Get

Return Type: Boolean

**EVMReference**

Command Type: Set and Get

Return Type: eEvmReference

## MeasurementFilters

(Optional ModType, Optional Number) As String()

Command Type: Get Only

Return Type: String()

Parameters: ModType: eDigModFormat (Default: -1)

Number: Integer (Default: -1)

Description: Returns a string array containing the valid measurement filter names. If ModType is -1, then the list is complete for all modulation types. Otherwise it is only the valid filters for the given modulation type. Number designations the 1st or 2nd measurement filter.

## ReadOnly ReferenceFilters (

Optional ModType, (Optional Number) As String()

Description: Returns a string array containing the valid reference filter names. If ModType is -1, then the list is complete for all modulation types. Otherwise it is only the valid filters for the given modulation type. Number designations the 1st or 2nd reference filter

Command Type: Get Only

Return Type: String()

Parameters: ModType: eDigModFormat (Default: -1)

Number: Integer (Default -1) .

## Anritsu IQ Data File Methods

These methods are for handling Anritsu DGZM/DGZ IQ data files. If you use Anritsu IQ data files, the API can read the metadata and automatically retrieve parameters required for analysis.

### DGZ\_CenterFrequency(Filename As String)

Description: Returns the center frequency of the IQ data set.

Command Type: Get Only

Return Type: Single

### DGZ\_FrequencySpan(Filename As String)

Description: Returns the frequency span of the IQ data set.

Command Type: Get Only

Return Type: Single

### DGZ\_SampleRate(Filename As String)

Description: Returns the sample rate of the IQ data set.

Command Type: Get Only

Return Type: Single

**DGZ\_BitDepth(Filename As String)**

Description: Returns the capture bit-depth of the IQ data set.

Command Type: Get Only

Return Type: Single

**ReadDGZ(Filename, PairCount)**

Description: Returns IQ data from the capture file. PairCount is the maximum number of IQ data pairs to read. If this value is higher than what the file contains, the method will return only the available IQ pairs. Capture files are often longer than required – containing many frames of data. Reading more data than is necessary is inefficient.

Return Type: Single()

Parameters: Filename

StringPair

Count

Integer

**Methods****Initialize()**

Description: Always call this method when you create an instance of the analysis engine (when you declare an entity of type `AnalysysAPI`).

**LoadParameterFile(Filename As String)**

Description: Rather than enter modulation parameters by hand, you can read a file. Parameter files can be created using the full MX280005A application.

**GetDataView(ViewIndex, Width, Height, g)**

Description: Once the analysis is complete (Analyze method return true), you can get results as a set of images.

Parameters: ViewIndexMeasuretypes (This is the modulation type)

Width: The width, in pixels, of the image to return

Height: The height, in pixels, of the image to return

**Analyze(IQData())**

Description: This calls the analysis engine and produces the demodulation results. Set up all parameter values, manually, or by loading a file, then call this method, passing in the IQ data set.

Return Type: Boolean

Parameters: IQData Array of single

## 8-4 Example Application

Provided with the MX280005A IQ Signal Master software is an example application using the IQ Signal Master API. This application includes full source code and demonstrates how to access and utilize all API function calls.

The API, and its documentation, does not provide an introduction to IQ Signal Master analysis. The developer should become familiar with the MX280005A application before attempting to develop with the API. There are many analysis parameters that must be set in order to successfully demodulate a captured signal. The required parameters vary with the modulation type, and the supported output screens vary as well. A user will rarely need to set all of the parameters presented in the API.

The source code for the example application is contained in a zip archive 'MX280005A\_API\_Demo.zip' found in the application folder (C:\Program Files\Anritsu Company\MX280005A). This needs to be unzipped to a location of the user's choice. The example solution can be opened by double-clicking on the file 'APITest.sln'. The example program provides a demonstration only of the functions and methods of the API, To clearly show method and function calls, normal error handling has been omitted.

The Anritsu IQ Signal Master API is implemented as a 64-bit .NET dll (MX280005A.dll). Set the project type to x64 in Visual Studio when you build the example, and any derivative applications. The API has several dependencies that must be in the same application folder in order for the example code to run correctly. These dependencies are including in the .\bin\debug folder of the sample application solution. Depending on how you configure Visual Studio, you may need to copy these files to the correct output folder. The required files are: ipp\_custom.dll, iVSA.exe, libguide40.dll, mkl\_custom.dll, MX280005A.dll, and VMAAnalysis.dll.

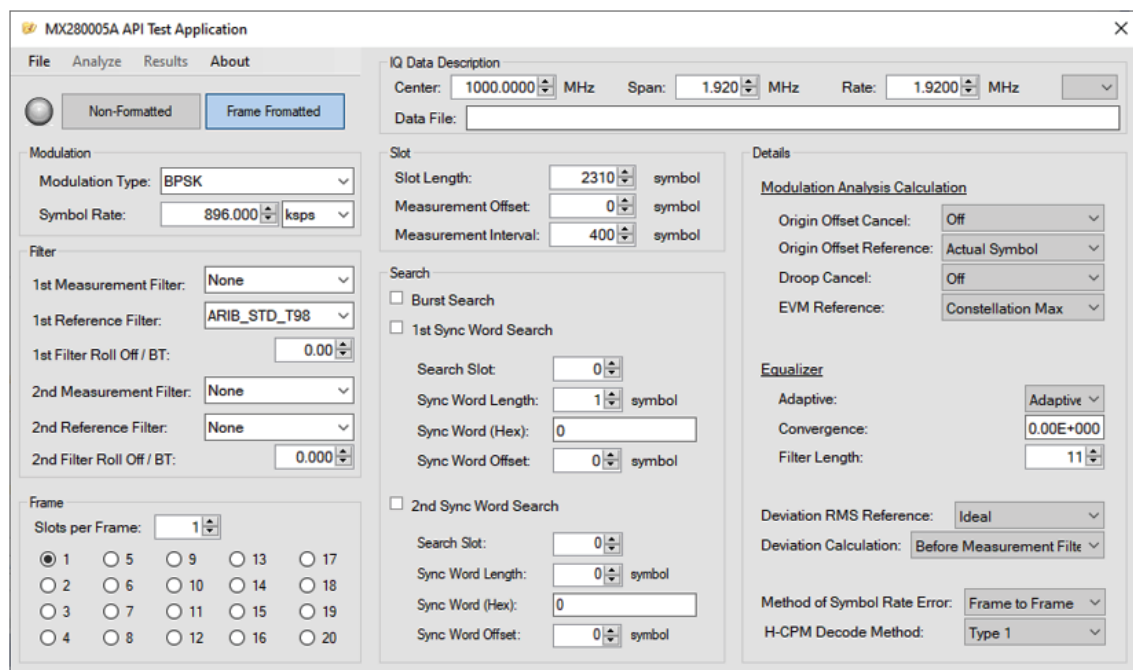


**Figure 8-1.** API Test Application



# Appendix A — Installing PCIe Kit

## A-1 Introduction

This appendix provides installation instructions for the PCIe card, PCIe card software driver, and user interface software for use with the MS2090A and the MS27201A spectrum analyzers.

Be sure to read the “[ESD Caution](#)” below before starting [Section A-2 “PCIe Card Installation”](#).

### ESD Caution

The equipment discussed in this manual is susceptible to electrostatic discharge (ESD) damage. Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices. Because these apply to the user’s PC and the analyzer, it is recommended that any static charges that may be present are dissipated before disassembling the computer case or connecting cables or antennas to the analyzer. It is important to remember that the operator may carry a static charge that can cause damage and these charges should be dissipated through proper grounding. Following the practices outlined in the above standards will ensure a safe environment for both personnel and equipment.

## A-2 PCIe Card Installation

The PCIe driver is not automatically installed when the MX280005 software is installed, but must be manually installed into the PC.

1. Disconnect power from the desktop PC.
2. Remove the PC cover to access the motherboard and PCIe expansion slots.
3. Install the PCIe card into an available PCIe slot as illustrated in [Figure A-1](#). Ensure that the PCIe card is fully seating into the slot.

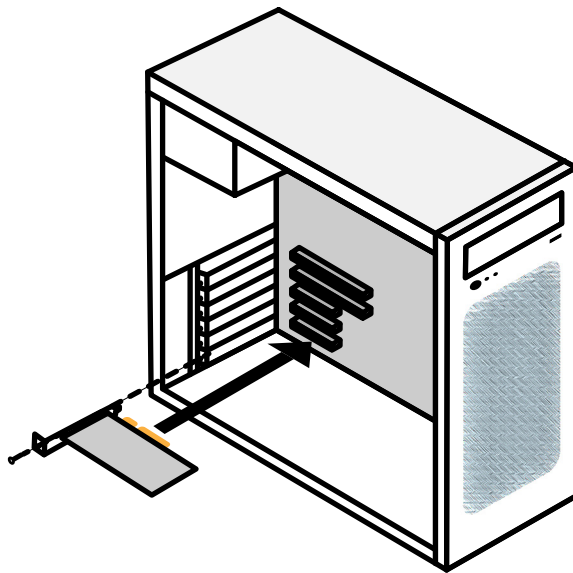


**Figure A-1.** PCIe Card Installation

4. Replace the PC cover and proceed to [Section A-3 “Ethernet and PCIe Connections”](#).



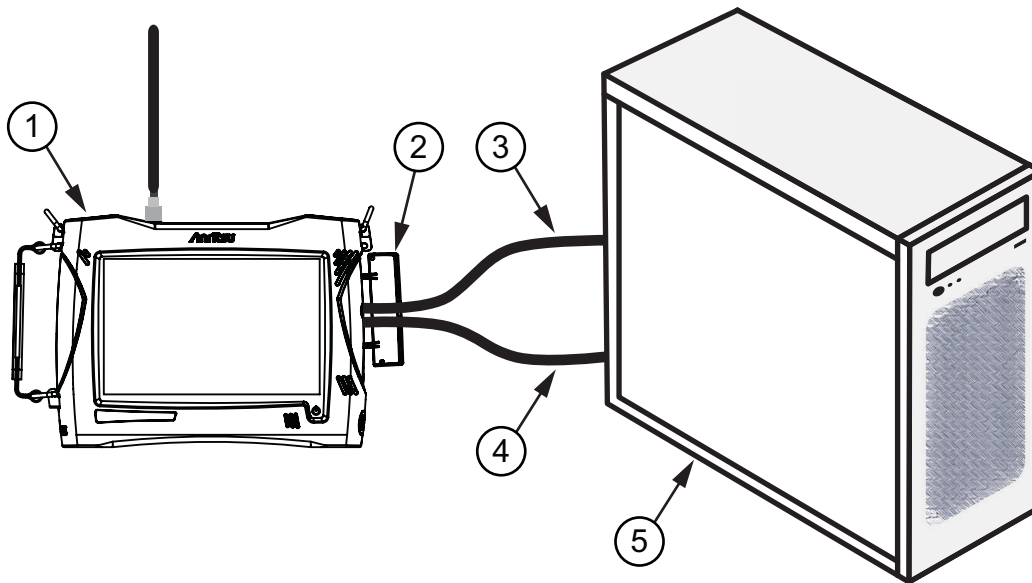
## A-3 Ethernet and PCIe Connections

The PC/PCIe connections to the Anritsu MS2090A and MS27201A analyzers are described below.

- [“Connect the MS2090A”](#)
- [“Connect the MS27201A” on page A-3](#)

### Connect the MS2090A

1. Refer to [Figure A-2](#).
2. Open the side cover of the MS2090A to locate the Data Out and Ethernet ports.
3. Use a PCIe nano pitch cable to connect the MS2090A Data Out port to the PCIe expansion card port on the Personal Computer.
4. Use an Ethernet cable to connect the MS2090A Ethernet port to the Personal Computer.

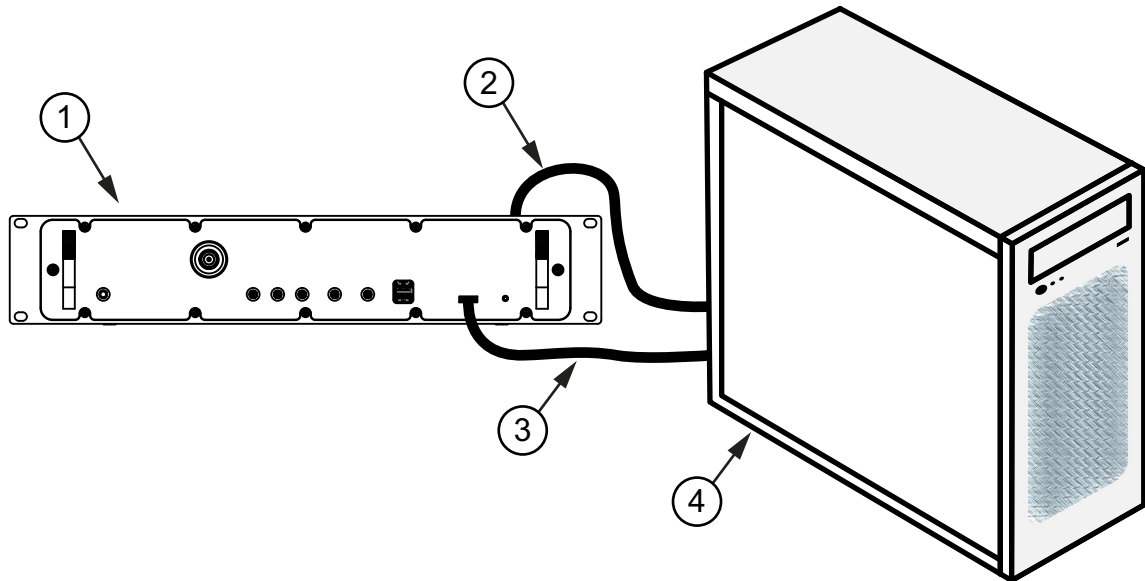


1. MS2090A Spectrum Analyzer
2. Side Cover
3. Ethernet Cable
4. PCIe Nano Pitch Cable
5. Personal Computer

**Figure A-2.** MS2090A PCIe Connection

**Connect the MS27201A**

1. Locate the Data Out port on the front panel of the MS27201A.
2. Use a PCIe nano pitch cable to connect the MS27201A front panel Data Out port to the PCIe expansion card port on the Personal Computer.
3. Use an Ethernet cable to connect the MS27201A rear panel Ethernet port to the Personal Computer.



1. MS27201A Spectrum Analyzer
2. Ethernet Cable
3. PCIe Nano Pitch Cable
4. Personal Computer

**Figure A-3.** MS27201A PCIe Connection

For low speed IQ acquisitions, data can be transferred through just the Ethernet cable. Once the connections are made, turn on the analyzer and wait for it to start sweeping and then turn on the PC. Proceed to [Figure A-5 on page A-4](#).

## A-4 Loading the PCIe Card for Streaming

The analyzer does not automatically load the Field Programmable Gate Arrays (FPGA) image that supports PCIe data transfer during power up. The analyzer detects when it is connected to an active PCIe card and will prompt to load the image. Loading the FPGA image will cause the analyzer to reboot. The PC must be started after the analyzer fully reboots and begins sweeping. This means that the PC must also be powered up or rebooted after the analyzer is set up properly.

It is important that the analyzer already be connected and running in the supported mode. If you turn on the analyzer after the PC, it will not be found on the PCIe bus. Use the following power-on procedure to connect the PCIe card to the spectrum analyzer.

1. Power up the analyzer and wait for it to start sweeping.
2. Set the MS2090A or MS27201A with the MA25101A PCIe card as follows.
  - IQ Capture Mode: Streaming
  - Output Port: Data Out
  - Data Out Format: PCIe
3. Turn on the PC and launch the IQ Signal Master MX280005A Vector Signal Analysis Software as described in “[Installing MX280005A](#)”.

Check the IQ Signal Master MX280005A Vector Signal Analysis programs Capture menu to confirm connection has been established. See “[Capture Menu](#)” on page 3-7.

## A-5 Installing MX280005A

Follow the steps below as a guide for proper MX280005A software installation.

1. Download MX280005A IQ Signal Master software from:  
<https://www.anritsu.com/en-us/test-measurement/products/mx280005a>

**Note**

Microsoft .NET framework 4.5.2 or higher must be installed on your PC. If .NET 4.5.2 is not present, the MX280005A software installer will prompt you to install this framework.

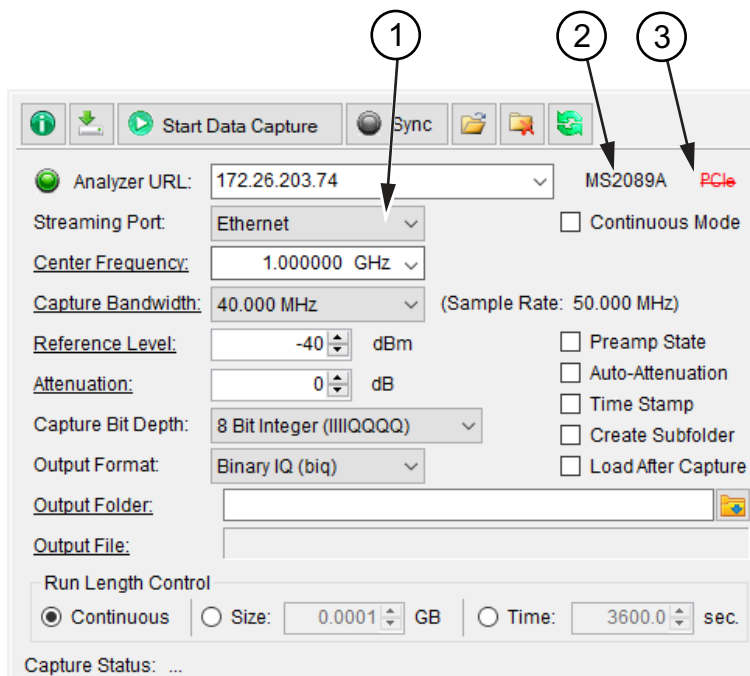
In some Windows installations, there may be a file missing called vcredist\_x64.exe. This file is part of the Microsoft Visual C distribution. To use the MX280005A software, you may need to download and execute this file.

2. Click Install MX280005A.
3. Click Run to start the installation.
4. Click through the installation screens. When the installation is complete, MX280005A becomes a user interface for IQ signal analysis.

## A-6 MX280005A Capture Menu

The MX280005A Capture menu shown in [Figure A-4](#) is used to connect the analyzer to the PCIe interface.

1. Use the MX280005A Capture menu Streaming Port pull-down list and click PCIe. If the PCIe selection is not available (only Ethernet), refer to “[Ethernet and PCIe Connections](#)” on [page A-2](#) to install and activate the PCIe card connection.
2. Verify the connected analyzer model shows to the right of the IP address.
3. Verify PCIe is displayed. If a strike-through (~~PCIe~~) is displayed, then the PCIe card is not connected.



1. Press to display the connected spectrum analyzer information as shown in [Figure A-5](#).
2. Displays the spectrum analyzer model type connected.
3. Displays PCIe is not connected to the spectrum analyzer. PCIe with a strike-through (~~PCIe~~) is displayed if not connected.
4. Streaming Port list. Connect as PCIe.
5. Analyzer URL button. Press to display the PCIe connection status dialog as shown in [Figure A-6](#).

**Figure A-4.** MX280005A Capture Menu

### Spectrum Analyzer Information

The MX280005A spectrum analyzer context menu displays the information of the connected spectrum analyzer as shown in [Figure A-5](#). Displayed are the manufacturer, model type, serial number of the analyzer, firmware, and installed options.

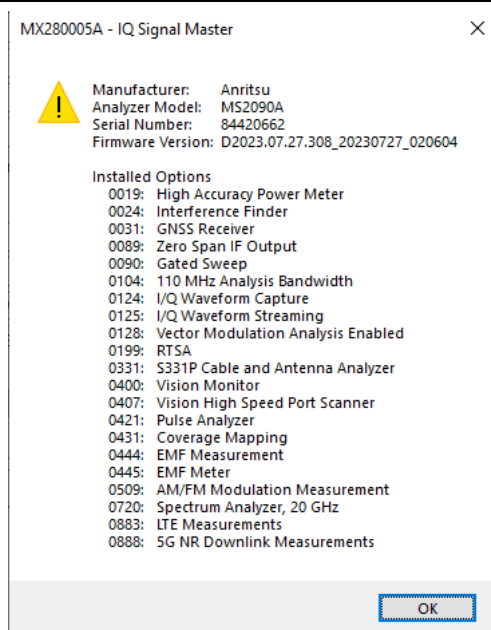


**Figure A-5.** Connected Spectrum Analyzer Information

### PCIe Connection Status

Press the Analyzer URL button to display the context menu shown in [Figure A-6](#). Follow the instruction shown to connect to the PCIe to provide the PC transfer. This completes the installation of the PCIe card for the MX280005A IQ Signal Master Software.

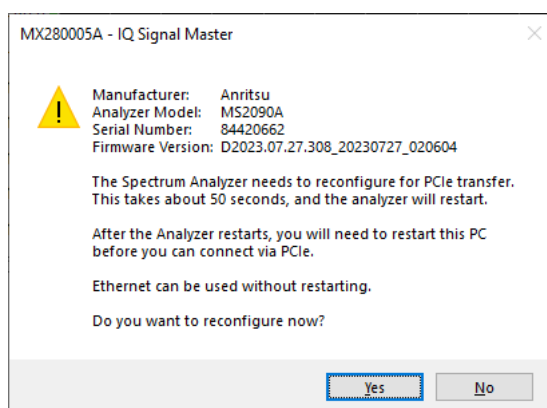


**Figure A-6.** PCIe Context Menu

## A-7 Command Line Interface

### Introduction

Use the command-line interface if you require controlling the IQ stream through another software package, or if you want to script the data transfer, is very convenient.

To run the command-line interface, open a console window to the application folder (typically C:\Program Files\Anritsu Company\IQ Acquisition Tool). You can easily open a console window by browsing to the application folder using Windows File Explorer, then entering 'cmd' in the address bar.

#### Note

Note: if you want to use the command-line interface to stop services that might interfere with data transfer, you will need to open the console window in Administrator mode

The command-line application is named 'IQConsole.exe'. All options and settings are entered with this application as command-line directives. Some directives can be entered together on a single command-line, and some need to be entered singly. All commands begin with a hyphen (-). Many commands take an argument, and a colon separates the directive from its argument.

As an example for format, consider the directive to set the ip address (analyzer hostname).

```
Iqconsole -h:192.168.0.22
```

The '-h' tells the application that we are setting the hostname. The colon separates the directive from the value passed in, and the hostname follows.

As another example, we can set the output filename:

```
Iqconsole -n:C:\datafiles\Data.bin
```

The '-n' tells the application we are setting the output filename. The colon separates the directive from the filename, and the filename follows. Please note, the default value is 'Data.bin'. The default value does not contain a path specifier, so the file will be written to the current folder. If you are running from the application folder, this is write protected and the transfer will fail. Specify a folder that you have write privileges to.

In the descriptions below, angle brackets ('< >') represent input values. Do not include the angle brackets, and replace the text between the brackets with the desired value. A vertical bar ('|') should be read as 'or'. Include a single value from the list separated by vertical bars.

For convenience, certain common directives can be shortened to a single letter:

- s for stream
- a for abort
- d for display
- m for metadata

Use any combination of the following command-line directives to configure and control the spectrum analyzer. These can be used together on a single line.

|                  |                                                                                          |
|------------------|------------------------------------------------------------------------------------------|
| -h:<Hostname>    | => IP address or hostname of the spectrum analyzer.                                      |
| -f:<Frequency>   | => The center frequency in MHz.                                                          |
| -b:<BW>          | => The capture bandwidth in MHz.                                                         |
| -r:<RefLevel>    | => The reference level in dBm.                                                           |
| -a:<Attenuation> | => The attenuation in dBm (Use 'Auto' to set auto-attenuation).                          |
| -d:<8 16 32 F32> | => The bit-depth.                                                                        |
| -p:<on off>      | => Turn preamp on or off.                                                                |
| -c:<count>       | => The number of 4 MB packets to transfer in I/Q stream.                                 |
| -e:<yes no>      | => Indicates if data capture should continue if an error in the data stream is detected. |

-n:<filename>                   => Set the output filename (Default: 'Data.bin'.)

All of the above settings are remembered and do not need to be re-entered, except to change settings.

The following commands should be used singly. Other commands will be ignored.

-? or -help                   => Display a summary list of all command directives.

-pcie                         Set output port to PCIe

-Ethernet                   Set output port to Ethernet

-stream                   => Start streaming I/Q data.

-metadata                   => Create metadata file (.dgzm) for most recent capture. (May be invalid if not done promptly)

-abort                      => Abort IQ streaming.

-display                   => Display all saved parameter values.

-info                      => Display PCIe interface summary information.

-kill                      => Stop many common Windows processes that might interfere with data throughput.

-scpi:<cmd>               => Pass through any supported SCPI command to the analyzer.

-reset                     => Reset the spectrum analyzer to factory default settings.

-restart                   => Reboot the spectrum analyzer.

The following commands are for testing the interface. If source is set to 'test' then a test pattern is returned. You can use the -t directive to set the transfer rate of the test pattern (for instance, to test at 50 MHz, use '-t:50')

-s:<source>               => Source is either 'iq' or 'test'.

-t:<rate>                 => The transfer rate when using test ramp data.

-wt                       => Perform disk write test to verify disk performance is adequate for IQ stream.

-verify                   => Perform verification of all file formats.

When streaming over Ethernet, the transfer is accomplished by a series of network packets. As the size of these packets are not controlled, the application has no control over the size of the transfer. The transfer will stop when the time or size requirement is met. However, the actual time and file size may be much longer or larger than anticipated depending on the size and transfer time of the last packet.

# Appendix B — Predefined Parameter Settings

## B-1 Introduction

The following Parameter values are specified when the Preset Dialog Parameter function is used.

Table B-1, “RCR39\_PI4DQPSK\_TCH\_UL and RCR39\_PI4DQPSK\_TCH\_DL Parameters” on page B-3

Table B-2, “T61\_SCPC\_v1\_0\_SC and T61\_SCPC\_v1\_1\_40ms\_SC Parameters” on page B-4

Table B-3, “T61\_SCPC\_v1\_1\_20ms\_SC and T61\_FDMA\_PSC\_UL Parameters” on page B-5

Table B-4, “T61\_FDMA\_PSC\_DL and T86\_CCH\_UL Parameters” on page B-6

Table B-5, “T86\_CCH\_DL and T86\_TCH\_ULParameters” on page B-7

Table B-6, “T86\_TCH\_DL and T98\_PI4DQPSK\_SC Parameters” on page B-8

Table B-7, “T98\_4FSK\_SC and BPSK-20kbps Parameters” on page B-9

Table B-8, “GFSK-100kbps Parameters” on page B-10

Table B-9, “O-QPSK-250ksps and O-QPSK-250ksps\_2 Parameters” on page B-11

Table B-10, “T102\_PART1 and T102\_PART2 Parameters” on page B-12

Table B-11, “P25\_C4FM and P25\_CQPSK Parameters” on page B-13

Table B-12, “P25\_LSM and P25\_WCQPSK Parameters” on page B-14

Table B-13, “P25\_IB\_Burst\_STD\_Type1 and P25\_IB\_Burst\_STD\_Type2 Parameters” on page B-15

Table B-14, “P25\_IB\_LCH0\_STD\_Type1 and P25\_IB\_LCH0\_STD\_Type2 Parameters” on page B-16

Table B-15, “P25\_IB\_LCH0\_Symmetrical\_Type1 and P25\_IB\_LCH0\_Symmetrical\_Type2 Parameters” on page B-17

Table B-16, “P25\_IB\_LCH1\_STD\_Type1 and P25\_IB\_LCH1\_STD\_Type2 Parameters” on page B-19

Table B-17, “P25\_OB\_STD and P25\_OB\_STD\_BER Parameters” on page B-20

Table B-18, “DMR\_BSsourced\_Voice and DMR\_BSsourced\_Data Parameters” on page B-21

Table B-19, “DMR\_MSsourced\_Voice and DMR\_MSsourced\_Data Parameters” on page B-22

Table B-20, “DMR\_MSsourced\_RC and NXDN\_2\_4ksps Parameters” on page B-23

Table B-21, “NXDN\_4\_8ksps Parameters” on page B-24

Table B-22, “T86\_SYNC\_UL and T86\_SYNC\_DL Parameters” on page B-25

Table B-23, “DMR\_BSsourced\_Voice\_2 and DMR\_BSsourced\_Data\_2 Parameters” on page B-26

Table B-24, “DMR\_MSsourced\_Voice\_2 and DMR\_MSsourced\_Data\_2 Parameters” on page B-27

Table B-25, “DMR\_Normal\_Burst and DMR\_RC\_Burst Parameters” on page B-28

Table B-26, “dPMR446\_80ms and dPMR446\_HeaderBurst Parameters” on page B-29

Table B-27, “dPMR446\_320ms\_FS2 Parameters” on page B-30

Table B-28, “dPMR\_BCH\_STD Parameters” on page B-31

Table B-29, “dPMR\_BCH\_110ms\_FS1 and dPMR\_BCH\_Uplink\_FS1 Parameters” on page B-32

Table B-30, “dPMR\_TCH\_STD Parameters” on page B-33

Table B-31, “dPMR\_TCH\_Payload80ms\_FS2 and dPMR\_TCH\_PacketHead\_FS4 Parameters” on page B-34

Table B-32, “TETRA\_DL\_NORMAL\_CONT and TETRA\_DL\_NORMAL\_DISCONT Parameters” on page B-35



Table B-33, “TETRA\_UL\_NORMAL Parameters” on page B-36

Table B-34, “DVB-S\_BW26M DVB-S\_BW54M Parameters” on page B-37

Table B-35, “DVB-S2\_16APSK\_Rxxx and DVB-S2\_32APSK\_Rxxx Parameters” on page B-39

Table B-36, “DSNG\_BW\_3M\_xxxx, DSNG\_BW\_36M\_16QAM and DSNG\_BW\_72M\_QPSK Parameters” on page B-41

Table B-37, “DSNG\_MODExxx and DSNG\_MODExxx Parameters” on page B-43

Table B-38, “STD-28\_xx\_SB and STD-28\_xx\_TCH Parameters” on page B-45

Table B-39, “RCR39\_T79\_MS-xxx and RCR39-T79\_DC-xx Parameters” on page B-47

.

## B-2 Parameter Settings

**Table B-1.** RCR39\_PI4DQPSK\_TCH\_UL and RCR39\_PI4DQPSK\_TCH\_DL Parameters

| Parameter                 | RCR39_PI4DQPSK_TCH_UL | RCR39_PI4DQPSK_TCH_DL |
|---------------------------|-----------------------|-----------------------|
| Measuring Object          | Frame Formatted       | Frame Formatted       |
| Modulation Type           | PI/4DQPSK             | PI/4DQPSK             |
| Symbol Rate               | 16000 sps             | 16000 sps             |
| Span Up                   | On                    | On                    |
| Measurement Filter        | Root Nyquist          | Root Nyquist          |
| 2nd Measurement Filter    | None                  | None                  |
| Reference Filter          | Nyquist               | Nyquist               |
| 2nd Reference Filter      | None                  | None                  |
| Roll Off                  | 0.50                  | 0.50                  |
| 2nd Roll Off              | 1.00                  | 1.00                  |
| Slots per Frame           | 4 slot                | 4 slot                |
| Slot length               | 160 symbol            | 160 symbol            |
| Measurement Offset        | 3 symbol              | 3 symbol              |
| Measurement Interval      | 153 symbol            | 157 symbol            |
| Sync Word Search          | ON                    | ON                    |
| Burst Search              | ON                    | OFF                   |
| 1st Word Search Slot      | Slot 0                | Slot 0                |
| 1st Word Sync Word Length | 10 symbol             | 10 symbol             |
| 1st Word Sync Word        | 785B4                 | 87A4B                 |
| 1st Word Sync Word Offset | 78 symbol             | 60 symbol             |
| 2nd Word Search           | Enable                | Enable                |
| 2nd Word Search Slot      | Slot 0                | Slot 0                |
| 2nd Word Sync Word Length | 10 symbol             | 10 symbol             |
| 2nd Word Sync Word        | CE450                 | 31BAF                 |
| 2nd Word Sync Word Offset | 78 symbol             | 60 symbol             |

**Table B-2.** T61\_SCPC\_v1\_0\_SC and T61\_SCPC\_v1\_1\_40ms\_SC Parameters

| Parameter                 | T61_SCPC_v1_0_SC | T61_SCPC_v1_1_40ms_SC        |
|---------------------------|------------------|------------------------------|
| Measuring Object          | Frame Formatted  | Frame Formatted              |
| Modulation Type           | PI/4DQPSK        | PI/4DQPSK                    |
| Symbol Rate               | 4800 sps         | 4800 sps                     |
| Span Up                   | Off              | Off                          |
| Measurement Filter        | Root Nyquist     | Root Nyquist                 |
| 2nd Measurement Filter    | None             | None                         |
| Reference Filter          | Nyquist          | Nyquist                      |
| 2nd Reference Filter      | None             | None                         |
| Roll Off                  | 0.20             | 0.20                         |
| 2nd Roll Off              | 1.00             | 1.00                         |
| Slots per Frame           | 1 slot           | 4 slot                       |
| Slot length               | 192 symbol       | 192 symbol                   |
| Measurement Offset        | 15 symbol        | 4 symbol                     |
| Measurement Interval      | 177 symbol       | 182 symbol                   |
| Sync Word Search          | ON               | ON                           |
| Burst Search              | OFF              | ON                           |
| 1st Word Search Slot      | Slot 0           | Slot 0                       |
| 1st Word Sync Word Length | 10 symbol        | 10 symbol                    |
| 1st Word Sync Word        | 1E56F            | 1E56F                        |
| 1st Word Sync Word Offset | 92 symbol        | 4 symbol                     |
| 2nd Word Search           | Disable          | Disable                      |
| 2nd Word Search Slot      | —                | —                            |
| 2nd Word Sync Word Length | —                | —                            |
| 2nd Word Sync Word        | —                | —                            |
| 2nd Word Sync Word Offset | —                | —                            |
| Mask Table                | —                | T61 Service Channel 20,40 ms |

Table B-3. T61\_SCPC\_v1\_1\_20ms\_SC and T61\_FDMA\_PSC\_UL Parameters

| Parameter                 | T61_SCPC_v1_1_20ms_SC         | T61_FDMA_PSC_UL |
|---------------------------|-------------------------------|-----------------|
| Measuring Object          | Frame Formatted               | Frame Formatted |
| Modulation Type           | PI/4DQPSK                     | PI/4DQPSK       |
| Symbol Rate               | 4800 sps                      | 4800 sps        |
| Span Up                   | On                            | On              |
| Measurement Filter        | Root Nyquist                  | Root Nyquist    |
| 2nd Measurement Filter    | None                          | None            |
| Reference Filter          | Nyquist                       | Nyquist         |
| 2nd Reference Filter      | None                          | None            |
| Roll Off                  | 0.20                          | 0.20            |
| 2nd Roll Off              | 1.00                          | 1.00            |
| Slots per Frame           | 8 slot                        | 1 slot          |
| Slot length               | 96 symbol                     | 192 symbol      |
| Measurement Offset        | 4 symbol                      | 15 symbol       |
| Measurement Interval      | 86 symbol                     | 177 symbol      |
| Sync Word Search          | ON                            | ON              |
| Burst Search              | ON                            | OFF             |
| 1st Word Search Slot      | Slot 0                        | Slot 0          |
| 1st Word Sync Word Length | 10 symbol                     | 10 symbol       |
| 1st Word Sync Word        | 31BAF                         | E1A90           |
| 1st Word Sync Word Offset | 4 symbol                      | 92 symbol       |
| 2nd Word Search           | Disable                       | Enable          |
| 2nd Word Search Slot      | –                             | Slot 0          |
| 2nd Word Sync Word Length | –                             | 10 symbol       |
| 2nd Word Sync Word        | –                             | 62DC9           |
| 2nd Word Sync Word Offset | –                             | 92 symbol       |
| Mask Table                | T61 Service Channel 20, 40 ms | –               |

**Table B-4.** T61\_FDMA\_PSC\_DL and T86\_CCH\_UL Parameters

| Parameter                 | T61_FDMA_PSC_DL | T86_CCH_UL          |
|---------------------------|-----------------|---------------------|
| Measuring Object          | Frame Formatted | Frame Formatted     |
| Modulation Type           | PI/4DQPSK       | 16QAM               |
| Symbol Rate               | 4800 sps        | 11250 sps           |
| Span Up                   | On              | On                  |
| Measurement Filter        | Root Nyquist    | Root Nyquist        |
| 2nd Measurement Filter    | None            | None                |
| Reference Filter          | Nyquist         | Nyquist             |
| 2nd Reference Filter      | None            | None                |
| Roll Off                  | 0.20            | 0.20                |
| 2nd Roll Off              | 1.00            | 1.00                |
| Slots per Frame           | 1 slot          | 6 slot              |
| Slot length               | 192 symbol      | 150 symbol          |
| Measurement Offset        | 15 symbol       | 4 symbol            |
| Measurement Interval      | 177 symbol      | 141 symbol          |
| Sync Word Search          | ON              | ON                  |
| Burst Search              | OFF             | ON                  |
| 1st Word Search Slot      | Slot 0          | Slot 0              |
| 1st Word Sync Word Length | 10 symbol       | 10 symbol           |
| 1st Word Sync Word        | 1E56F           | 000A0AA00A          |
| 1st Word Sync Word Offset | 92 symbol       | 69 symbol           |
| 2nd Word Search           | Enable          | Disable             |
| 2nd Word Search Slot      | Slot 0          | –                   |
| 2nd Word Sync Word Length | 10 symbol       | –                   |
| 2nd Word Sync Word        | 9D236           | –                   |
| 2nd Word Sync Word Offset | 92 symbol       | –                   |
| Mask Table                | –               | STD-T86 UL,DL Burst |

Table B-5. T86\_CCH\_DL and T86\_TCH\_ULParameters

| Parameter                 | T86_CCH_DL          | T86_TCH_UL          |
|---------------------------|---------------------|---------------------|
| Measuring Object          | Frame Formatted     | Frame Formatted     |
| Modulation Type           | 16QAM               | 16QAM               |
| Symbol Rate               | 11250 sps           | 11250 sps           |
| Span Up                   | On                  | On                  |
| Measurement Filter        | Root Nyquist        | Root Nyquist        |
| 2nd Measurement Filter    | None                | None                |
| Reference Filter          | Nyquist             | Nyquist             |
| 2nd Reference Filter      | None                | None                |
| Roll Off                  | 0.20                | 0.20                |
| 2nd Roll Off              | 1.00                | 1.00                |
| Slots per Frame           | 6 slot              | 6 slot              |
| Slot length               | 150 symbol          | 150 symbol          |
| Measurement Offset        | 4 symbol            | 4 symbol            |
| Measurement Interval      | 141 symbol          | 141 symbol          |
| Sync Word Search          | ON                  | ON                  |
| Burst Search              | ON                  | ON                  |
| 1st Word Search Slot      | Slot 0              | Slot 0              |
| 1st Word Sync Word Length | 10 symbol           | 10 symbol           |
| 1st Word Sync Word        | 000A0A00A0          | 00A000000A          |
| 1st Word Sync Word Offset | 69 symbol           | 69 symbol           |
| 2nd Word Search           | Disable             | Disable             |
| 2nd Word Search Slot      | –                   | –                   |
| 2nd Word Sync Word Length | –                   | –                   |
| 2nd Word Sync Word        | –                   | –                   |
| 2nd Word Sync Word Offset | –                   | –                   |
| Mask Table                | STD-T86 UL,DL Burst | STD-T86 UL,DL Burst |

**Table B-6.** T86\_TCH\_DL and T98\_PI4DQPSK\_SC Parameters

| Parameter                 | T86_TCH_DL          | T98_PI4DQPSK_SC |
|---------------------------|---------------------|-----------------|
| Measuring Object          | Frame Formatted     | Frame Formatted |
| Modulation Type           | 16QAM               | PI/4DQPSK       |
| Symbol Rate               | 11250 sps           | 4800 sps        |
| Span Up                   | On                  | On              |
| Measurement Filter        | Root Nyquist        | Root Nyquist    |
| 2nd Measurement Filter    | None                | None            |
| Reference Filter          | Nyquist             | Nyquist         |
| 2nd Reference Filter      | None                | None            |
| Roll Off                  | 0.20                | 0.20            |
| 2nd Roll Off              | 1.00                | 1.00            |
| Slots per Frame           | 6 slot              | 1 slot          |
| Slot length               | 150 symbol          | 192 symbol      |
| Measurement Offset        | 4 symbol            | 15 symbol       |
| Measurement Interval      | 141 symbol          | 177 symbol      |
| Sync Word Search          | ON                  | ON              |
| Burst Search              | ON                  | OFF             |
| 1st Word Search Slot      | Slot 0              | Slot 0          |
| 1st Word Sync Word Length | 10 symbol           | 10 symbol       |
| 1st Word Sync Word        | 00A000AAAA          | 1E56F           |
| 1st Word Sync Word Offset | 69 symbol           | 92 symbol       |
| 2nd Word Search           | Disable             | Disable         |
| 2nd Word Search Slot      | –                   | –               |
| 2nd Word Sync Word Length | –                   | –               |
| 2nd Word Sync Word        | –                   | –               |
| 2nd Word Sync Word Offset | –                   | –               |
| Mask Table                | STD-T86 UL,DL Burst | –               |

Table B-7. T98\_4FSK\_SC and BPSK-20kbps Parameters

| Parameter                 | T98_4FSK_SC               | BPSK-20kbps                        |
|---------------------------|---------------------------|------------------------------------|
| Measuring Object          | Frame Formatted           | Frame Formatted                    |
| Modulation Type           | 4FSK                      | BPSK                               |
| Auto Deviation            | –                         | –                                  |
| Symbol Rate               | 2400 sps                  | 300 ksps                           |
| Span Up                   | On                        | On                                 |
| Measurement Filter        | ARIB STD-T98              | None                               |
| 2nd Measurement Filter    | None                      | None                               |
| Reference Filter          | ARIB STD-T98              | Nyquist                            |
| 2nd Reference Filter      | None                      | None                               |
| Roll Off                  | 0.20                      | 1.00                               |
| 2nd Roll Off              | 1.00                      | 1.00                               |
| Slots per Frame           | 1 slot                    | 2 slot                             |
| Slot length               | 192 symbol                | 1080 symbol                        |
| Measurement Offset        | 0 symbol                  | 0 symbol                           |
| Measurement Interval      | 192 symbol                | 1000 symbol                        |
| Sync Word Search          | ON                        | ON                                 |
| Burst Search              | OFF                       | ON                                 |
| 1st Word Search Slot      | Slot 0                    | Slot 0                             |
| 1st Word Sync Word Length | 10 symbol                 | 120 symbol                         |
| 1st Word Sync Word        | CDF59                     | 0A67EB2029985330A67EB23D640<br>533 |
| 1st Word Sync Word Offset | 0 symbol                  | 480 symbol                         |
| 2nd Word Search           | Disable                   | Disable                            |
| 2nd Word Search Slot      | –                         | –                                  |
| 2nd Word Sync Word Length | –                         | –                                  |
| 2nd Word Sync Word        | –                         | –                                  |
| 2nd Word Sync Word Offset | –                         | –                                  |
| Deviation Calculation     | Pre-Measurement Filtering | –                                  |



**Table B-8.** GFSK-100kbps Parameters

| Parameter                 | GFSK-100kbps               |
|---------------------------|----------------------------|
| Measuring Object          | Frame Formatted            |
| Modulation Type           | 2FSK                       |
| Auto Deviation            | OFF                        |
| Modulation Index          | 1                          |
| Symbol Rate               | 100 ksps                   |
| Span Up                   | On                         |
| Measurement Filter        | None                       |
| 2nd Measurement Filter    | None                       |
| Reference Filter          | Gaussian                   |
| 2nd Reference Filter      | None                       |
| Roll Off                  | 0.50                       |
| 2nd Roll Off              | 1.00                       |
| Slots per Frame           | 2                          |
| Slot length               | 168 symbol                 |
| Measurement Offset        | 0 symbol                   |
| Measurement Interval      | 160 symbol                 |
| Sync Word Search          | ON                         |
| Burst Search              | ON                         |
| 1st Word Search Slot      | Slot 0                     |
| 1st Word Sync Word Length | 8 symbol                   |
| 1st Word Sync Word        | E5                         |
| 1st Word Sync Word Offset | 32 symbol                  |
| 2nd Word Search           | Disable                    |
| 2nd Word Search Slot      | —                          |
| 2nd Word Sync Word Length | —                          |
| 2nd Word Sync Word        | —                          |
| 2nd Word Sync Word Offset | —                          |
| Deviation Calculation     | Post-Measurement Filtering |

Table B-9. O-QPSK-250ksps and O-QPSK-250ksps\_2 Parameters

| Parameter                 | O-QPSK-250ksps   | O-QPSK-250ksps_2 |
|---------------------------|------------------|------------------|
| Measuring Object          | Frame Formatted  | Frame Formatted  |
| Modulation Type           | O-QPSK           | O-QPSK           |
| Auto Deviation            | –                | –                |
| Modulation Index          | –                | –                |
| Symbol Rate               | 1 Msps           | 1 Msps           |
| Span Up                   | On               | On               |
| Measurement Filter        | None             | None             |
| 2nd Measurement Filter    | None             | None             |
| Reference Filter          | Half-sine        | Half-sine        |
| 2nd Reference Filter      | None             | None             |
| Roll Off                  | 1.00             | 1.00             |
| 2nd Roll Off              | 1.00             | 1.00             |
| Slots per Frame           | 2                | 2                |
| Slot length               | 1128 symbol      | 1128 symbol      |
| Measurement Offset        | 2 symbol         | 2 symbol         |
| Measurement Interval      | 1000 symbol      | 1000 symbol      |
| Sync Word Search          | Off              | Off              |
| Burst Search              | ON               | ON               |
| 1st Word Search Slot      | Slot 0           | Slot 0           |
| 1st Word Sync Word Length | 32 symbol        | 32 symbol        |
| 1st Word Sync Word        | 9C3522ED7B8C9607 | 9C3522ED7B8C9607 |
| 1st Word Sync Word Offset | 128 symbol       | 128 symbol       |
| 2nd Word Search           | Disable          | Disable          |
| 2nd Word Search Slot      | –                | –                |
| 2nd Word Sync Word Length | –                | –                |
| 2nd Word Sync Word        | –                | –                |
| 2nd Word Sync Word Offset | –                | –                |
| Deviation Calculation     | –                | –                |
| Origin Offset Cancel      | On               | Off              |
| Origin Offset Reference   | Offset           | Offset           |

Table B-10. T102\_PART1 and T102\_PART2 Parameters

| Parameter                 | T102_PART1                | T102_PART2                |
|---------------------------|---------------------------|---------------------------|
| Measuring Object          | Frame Formatted           | Frame Formatted           |
| Modulation Type           | 4FSK                      | 4FSK                      |
| Auto Deviation            | ON                        | ON                        |
| Modulation Index          | –                         | –                         |
| Symbol Rate               | 2.4 ksps                  | 2.4 ksps                  |
| Span Up                   | On                        | On                        |
| Measurement Filter        | Root Nyquist              | ARIB STD-T98              |
| 2nd Measurement Filter    | Inverse Gaussian          | None                      |
| Reference Filter          | Nyquist                   | ARIB STD-T98              |
| 2nd Reference Filter      | None                      | None                      |
| Roll Off                  | 0.20                      | 0.20                      |
| 2nd Roll Off              | 0.769                     | 1.00                      |
| Slots per Frame           | 1                         | 1                         |
| Slot length               | 192 symbol                | 192 symbol                |
| Measurement Offset        | 0 symbol                  | 0 symbol                  |
| Measurement Interval      | 192 symbol                | 192 symbol                |
| Sync Word Search          | OFF                       | OFF                       |
| Burst Search              | OFF                       | OFF                       |
| 1st Word Search Slot      | Slot 0                    | Slot 0                    |
| 1st Word Sync Word Length | 10 symbol                 | 10 symbol                 |
| 1st Word Sync Word        | CDF59                     | CDF59                     |
| 1st Word Sync Word Offset | 72 symbol                 | 0 symbol                  |
| 2nd Word Search           | Disable                   | Disable                   |
| 2nd Word Search Slot      | –                         | –                         |
| 2nd Word Sync Word Length | –                         | –                         |
| 2nd Word Sync Word        | –                         | –                         |
| 2nd Word Sync Word Offset | –                         | –                         |
| Deviation Calculation     | Pre-Measurement Filtering | Pre-Measurement Filtering |

Table B-11. P25\_C4FM and P25\_CQPSK Parameters

| Parameter                 | P25_C4FM                   | P25_CQPSK       |
|---------------------------|----------------------------|-----------------|
| Measuring Object          | Frame Formatted            | Frame Formatted |
| Modulation Type           | 4FSK                       | PI/4 DQPSK      |
| Auto Deviation            | Off                        | –               |
| Modulation Index          | –                          | –               |
| Symbol Rate               | 4.8 ksps                   | 4.8 ksps        |
| Span Up                   | On                         | On              |
| Measurement Filter        | None                       | None            |
| 2nd Measurement Filter    | Rect                       | None            |
| Reference Filter          | Nyquist                    | Nyquist         |
| 2nd Reference Filter      | None                       | None            |
| Roll Off                  | 0.20                       | 0.20            |
| 2nd Roll Off              | 1.000                      | 1.00            |
| Slots per Frame           | 1                          | 1               |
| Slot length               | 864 symbol                 | 864 symbol      |
| Measurement Offset        | 0 symbol                   | 0 symbol        |
| Measurement Interval      | 864 symbol                 | 864 symbol      |
| Sync Word Search          | Off                        | Off             |
| Burst Search              | Off                        | Off             |
| 1st Word Search Slot      | –                          | –               |
| 1st Word Sync Word Length | –                          | –               |
| 1st Word Sync Word        | –                          | –               |
| 1st Word Sync Word Offset | –                          | –               |
| 2nd Word Search           | Disable                    | Disable         |
| 2nd Word Search Slot      | –                          | –               |
| 2nd Word Sync Word Length | –                          | –               |
| 2nd Word Sync Word        | –                          | –               |
| 2nd Word Sync Word Offset | –                          | –               |
| Deviation Calculation     | Post-Measurement Filtering | –               |

Table B-12. P25\_LSM and P25\_WCQPSK Parameters

| Parameter                 | P25_LSM         | P25_WCQPSK      |
|---------------------------|-----------------|-----------------|
| Measuring Object          | Frame Formatted | Frame Formatted |
| Modulation Type           | PI/4 DQPSK      | PI/4 DQPSK      |
| Auto Deviation            | Off             | –               |
| Modulation Index          | –               | –               |
| Symbol Rate               | 4.8 ksps        | 4.8 ksps        |
| Span Up                   | On              | On              |
| Measurement Filter        | None            | None            |
| 2nd Measurement Filter    | None            | None            |
| Reference Filter          | User Defined    | User Defined    |
| 2nd Reference Filter      | None            | None            |
| Roll Off                  | 1.00            | 1.00            |
| 2nd Roll Off              | 1.000           | 1.00            |
| Slots per Frame           | 1               | 1               |
| Slot length               | 864 symbol      | 864 symbol      |
| Measurement Offset        | 0 symbol        | 0 symbol        |
| Measurement Interval      | 864 symbol      | 864 symbol      |
| Sync Word Search          | Off             | Off             |
| Burst Search              | Off             | Off             |
| 1st Word Search Slot      | –               | –               |
| 1st Word Sync Word Length | –               | –               |
| 1st Word Sync Word        | –               | –               |
| 1st Word Sync Word Offset | –               | –               |
| 2nd Word Search           | Disable         | Disable         |
| 2nd Word Search Slot      | –               | –               |
| 2nd Word Sync Word Length | –               | –               |
| 2nd Word Sync Word        | –               | –               |
| 2nd Word Sync Word Offset | –               | –               |
| Deviation Calculation     | –               | –               |

Table B-13. P25\_IB\_Burst\_STD\_Type1 and P25\_IB\_Burst\_STD\_Type2 Parameters

| Parameter                   | P25_IB_Burst_STD_Type1     | P25_IB_Burst_STD_Type2     |
|-----------------------------|----------------------------|----------------------------|
| Measuring Object            | Frame Formatted            | Frame Formatted            |
| Modulation Type             | H-CPM                      | H-CPM                      |
| Auto Deviation              | Off                        | Off                        |
| Modulation Index            | –                          | –                          |
| Maximum Frequency Deviation | 3000                       | 3000                       |
| Symbol Rate                 | 6 ksps                     | 6 ksps                     |
| Span Up                     | –                          | –                          |
| Measurement Filter          | H-CPM_P25                  | H-CPM_P25                  |
| 2nd Measurement Filter      | None                       | None                       |
| Reference Filter            | H-CPM_P25                  | H-CPM_P25                  |
| 2nd Reference Filter        | None                       | None                       |
| Roll Off                    | 1.00                       | 1.00                       |
| 2nd Roll Off                | 1.000                      | 1.000                      |
| Slots per Frame             | 3                          | 3                          |
| Slot length                 | 180 symbol                 | 180 symbol                 |
| Measurement Offset          | 4 symbol                   | 14 symbol                  |
| Measurement Interval        | 164 symbol                 | 140 symbol                 |
| Sync Word Search            | Off                        | Off                        |
| Burst Search                | On                         | On                         |
| 1st Word Search Slot        | –                          | –                          |
| 1st Word Sync Word Length   | –                          | –                          |
| 1st Word Sync Word          | –                          | –                          |
| 1st Word Sync Word Offset   | –                          | –                          |
| 2nd Word Search             | Disable                    | Disable                    |
| 2nd Word Search Slot        | –                          | –                          |
| 2nd Word Sync Word Length   | –                          | –                          |
| 2nd Word Sync Word          | –                          | –                          |
| 2nd Word Sync Word Offset   | –                          | –                          |
| Deviation Calculation       | Post-Measurement Filtering | Post-Measurement Filtering |
| Deviation RMS Reference     | Ideal average              | Ideal average              |
| H-CPM Decode Method         | Type1                      | Type2                      |

Table B-14. P25\_IB\_LCH0\_STD\_Type1 and P25\_IB\_LCH0\_STD\_Type2 Parameters

| Parameter                   | P25_IB_LCH0_STD_Type1      | P25_IB_LCH0_STD_Type2      |
|-----------------------------|----------------------------|----------------------------|
| Measuring Object            | Frame Formatted            | Frame Formatted            |
| Modulation Type             | H-CPM                      | H-CPM                      |
| Auto Deviation              | Off                        | Off                        |
| Modulation Index            | –                          | –                          |
| Maximum Frequency Deviation | 3000                       | 3000                       |
| Symbol Rate                 | 6 ksps                     | 6 ksps                     |
| Span Up                     | –                          | –                          |
| Measurement Filter          | H-CPM_P25                  | H-CPM_P25                  |
| 2nd Measurement Filter      | None                       | None                       |
| Reference Filter            | H-CPM_P25                  | H-CPM_P25                  |
| 2nd Reference Filter        | None                       | None                       |
| Roll Off                    | 1.00                       | 1.00                       |
| 2nd Roll Off                | 1.000                      | 1.000                      |
| Slots per Frame             | 12                         | 12                         |
| Slot length                 | 180 symbol                 | 180 symbol                 |
| Measurement Offset          | 8 symbol                   | 20 symbol                  |
| Measurement Interval        | 164 symbol                 | 140 symbol                 |
| Sync Word Search            | On                         | On                         |
| Burst Search                | On                         | On                         |
| 1st Word Search Slot        | Slot10                     | Slot10                     |
| 1st Word Sync Word Length   | 18 Symbol                  | 18 Symbol                  |
| 1st Word Sync Word          | 577D577FF                  | 577D577FF                  |
| 1st Word Sync Word Offset   | 10 Symbol                  | 10 Symbol                  |
| 2nd Word Search             | On                         | On                         |
| 2nd Word Search Slot        | Slot10                     | Slot10                     |
| 2nd Word Sync Word Length   | 18 Symbol                  | 18 Symbol                  |
| 2nd Word Sync Word          | 576D577EF                  | 576D577EF                  |
| 2nd Word Sync Word Offset   | 10 Symbol                  | 10 Symbol                  |
| Deviation Calculation       | Post-Measurement Filtering | Post-Measurement Filtering |
| Deviation RMS Reference     | Ideal average              | Ideal average              |
| H-CPM Decode Method         | Type1                      | Type2                      |

Table B-15. P25\_IB\_LCH0\_Symmetrical\_Type1 and P25\_IB\_LCH0\_Symmetrical\_Type2 Parameters

| Parameter                   | P25_IB_LCH0_Symmetrical_Type1 | P25_IB_LCH0_Symmetrical_Type2 |
|-----------------------------|-------------------------------|-------------------------------|
| Measuring Object            | Frame Formatted               | Frame Formatted               |
| Modulation Type             | H-CPM                         | H-CPM                         |
| Auto Deviation              | Off                           | Off                           |
| Modulation Index            | –                             | –                             |
| Maximum Frequency Deviation | 3000                          | 3000                          |
| Symbol Rate                 | 6 ksps                        | 6 ksps                        |
| Span Up                     | –                             | –                             |
| Measurement Filter          | H-CPM_P25                     | H-CPM_P25                     |
| 2nd Measurement Filter      | None                          | None                          |
| Reference Filter            | H-CPM_P25                     | H-CPM_P25                     |
| 2nd Reference Filter        | None                          | None                          |
| Roll Off                    | 1.00                          | 1.00                          |
| 2nd Roll Off                | 1.000                         | 1.000                         |
| Slots per Frame             | 12                            | 12                            |
| Slot length                 | 180 symbol                    | 180 symbol                    |
| Measurement Offset          | 8 symbol                      | 20 symbol                     |
| Measurement Interval        | 164 symbol                    | 140 symbol                    |
| Sync Word Search            | On                            | On                            |
| Burst Search                | On                            | On                            |
| 1st Word Search Slot        | Slot11                        | Slot11                        |
| 1st Word Sync Word Length   | 18 Symbol                     | 18 Symbol                     |
| 1st Word Sync Word          | 577D577FF                     | 577D577FF                     |
| 1st Word Sync Word Offset   | 10 Symbol                     | 10 Symbol                     |
| 2nd Word Search             | On                            | On                            |
| 2nd Word Search Slot        | Slot10                        | Slot10                        |
| 2nd Word Sync Word Length   | 18 Symbol                     | 18 Symbol                     |
| 2nd Word Sync Word          | 576D577EF                     | 576D577EF                     |
| 2nd Word Sync Word Offset   | 10 Symbol                     | 10 Symbol                     |
| Deviation Calculation       | Post-Measurement Filtering    | Post-Measurement Filtering    |
| Deviation RMS Reference     | Ideal average                 | Ideal average                 |
| H-CPM Decode Method         | Type1                         | Type2                         |



**Table B-15.** P25\_IB\_LCH0\_Symmetrical\_Type1 and P25\_IB\_LCH0\_Symmetrical\_Type2 Parameters

| Parameter                            | P25_IB_LCH0_Symmetrical_Type1  | P25_IB_LCH0_Symmetrical_Type2 |
|--------------------------------------|--------------------------------|-------------------------------|
| Mask Table                           | P25 Phase2 H-CPM Meas164       | –                             |
| Off Slot Power Range (Start to Stop) | User (1.125 to 178.875 symbol) | –                             |
| Rise / Fall Time Off Detect Level    | –57.00 dBm                     | –                             |

Table B-16. P25\_IB\_LCH1\_STD\_Type1 and P25\_IB\_LCH1\_STD\_Type2 Parameters

| Parameter                   | P25_IB_LCH1_STD_Type1      | P25_IB_LCH1_STD_Type2      |
|-----------------------------|----------------------------|----------------------------|
| Measuring Object            | Frame Formatted            | Frame Formatted            |
| Modulation Type             | H-CPM                      | H-CPM                      |
| Auto Deviation              | Off                        | Off                        |
| Modulation Index            | –                          | –                          |
| Maximum Frequency Deviation | 3000                       | 3000                       |
| Symbol Rate                 | 6 ksps                     | 6 ksps                     |
| Span Up                     | –                          | –                          |
| Measurement Filter          | H-CPM_P25                  | H-CPM_P25                  |
| 2nd Measurement Filter      | None                       | None                       |
| Reference Filter            | H-CPM_P25                  | H-CPM_P25                  |
| 2nd Reference Filter        | None                       | None                       |
| Roll Off                    | 1.00                       | 1.00                       |
| 2nd Roll Off                | 1.000                      | 1.000                      |
| Slots per Frame             | 12                         | 12                         |
| Slot length                 | 180 symbol                 | 180 symbol                 |
| Measurement Offset          | 8 symbol                   | 20 symbol                  |
| Measurement Interval        | 164 symbol                 | 140 symbol                 |
| Sync Word Search            | On                         | On                         |
| Burst Search                | On                         | On                         |
| 1st Word Search Slot        | Slot11                     | Slot11                     |
| 1st Word Sync Word Length   | 18 Symbol                  | 18 Symbol                  |
| 1st Word Sync Word          | 577D577FF                  | 577D577FF                  |
| 1st Word Sync Word Offset   | 10 Symbol                  | 10 Symbol                  |
| 2nd Word Search             | On                         | On                         |
| 2nd Word Search Slot        | Slot11                     | Slot11                     |
| 2nd Word Sync Word Length   | 18 Symbol                  | 18 Symbol                  |
| 2nd Word Sync Word          | 576D577EF                  | 576D577EF                  |
| 2nd Word Sync Word Offset   | 10 Symbol                  | 10 Symbol                  |
| Deviation Calculation       | Post-Measurement Filtering | Post-Measurement Filtering |
| Deviation RMS Reference     | Ideal average              | Ideal average              |
| H-CPM Decode Method         | Type1                      | Type2                      |

Table B-17. P25\_OB\_STD and P25\_OB\_STD\_BER Parameters

| Parameter                   | P25_OB_STD                 | P25_OB_STD_BER             |
|-----------------------------|----------------------------|----------------------------|
| Measuring Object            | No Formatted               | Frame Formatted            |
| Modulation Type             | 4FSK                       | 4FSK                       |
| Auto Deviation              | Off                        | Off                        |
| Modulation Index            | –                          | –                          |
| Maximum Frequency Deviation | 2250                       | 2250                       |
| Symbol Rate                 | 6 ksps                     | 6 ksps                     |
| Span Up                     | –                          | –                          |
| Measurement Filter          | Rect                       | Rect                       |
| 2nd Measurement Filter      | None                       | None                       |
| Reference Filter            | Rect                       | Rect                       |
| 2nd Reference Filter        | None                       | None                       |
| Roll Off                    | 1.00                       | 1.00                       |
| 2nd Roll Off                | 1.000                      | 1.000                      |
| Slots per Frame             | –                          | 4                          |
| Slot length                 | –                          | 2160 symbol                |
| Measurement Offset          | –                          | 0 symbol                   |
| Measurement Interval        | 180 symbol                 | 2160 symbol                |
| Sync Word Search            | –                          | On                         |
| Burst Search                | –                          | Off                        |
| 1st Word Search Slot        | –                          | Slot0                      |
| 1st Word Sync Word Length   | –                          | 20 Symbol                  |
| 1st Word Sync Word          | –                          | 184229D461                 |
| 1st Word Sync Word Offset   | –                          | 0 Symbol                   |
| 2nd Word Search             | –                          | On                         |
| 2nd Word Search Slot        | –                          | Slot0                      |
| 2nd Word Sync Word Length   | –                          | 20 Symbol                  |
| 2nd Word Sync Word          | –                          | 184239D460                 |
| 2nd Word Sync Word Offset   | –                          | 0 Symbol                   |
| Deviation Calculation       | Post-Measurement Filtering | Post-Measurement Filtering |
| Deviation RMS Reference     | Ideal average              | Ideal average              |

Table B-18. DMR\_BSsourced\_Voice and DMR\_BSsourced\_Data Parameters

| Parameter                 | DMR_BSsourced_Voice        | DMR_BSsourced_Data         |
|---------------------------|----------------------------|----------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted            |
| Modulation Type           | 4FSK                       | 4FSK                       |
| Auto Deviation            | On                         | On                         |
| Modulation Index          | –                          | –                          |
| Symbol Rate               | 4.8 ksps                   | 4.8 ksps                   |
| Span Up                   | On                         | On                         |
| Measurement Filter        | Root Nyquist               | Root Nyquist               |
| 2nd Measurement Filter    | None                       | None                       |
| Reference Filter          | Nyquist                    | Nyquist                    |
| 2nd Reference Filter      | None                       | None                       |
| Roll Off                  | 0.20                       | 0.20                       |
| 2nd Roll Off              | 1.000                      | 1.000                      |
| Slots per Frame           | 1                          | 1                          |
| Slot length               | 144 symbol                 | 144 symbol                 |
| Measurement Offset        | 0 symbol                   | 0 symbol                   |
| Measurement Interval      | 144 symbol                 | 144 symbol                 |
| Sync Word Search          | On                         | On                         |
| Burst Search              | Off                        | Off                        |
| 1st Word Search Slot      | Slot 0                     | Slot 0                     |
| 1st Word Sync Word Length | 24 symbol                  | 24 symbol                  |
| 1st Word Sync Word        | 755FD7DF75F7               | DFF57D75DF5D               |
| 1st Word Sync Word Offset | 60 symbol                  | 60 symbol                  |
| 2nd Word Search           | Disable                    | Disable                    |
| 2nd Word Search Slot      | –                          | –                          |
| 2nd Word Sync Word Length | –                          | –                          |
| 2nd Word Sync Word        | –                          | –                          |
| 2nd Word Sync Word Offset | –                          | –                          |
| Deviation Calculation     | Post-Measurement Filtering | Post-Measurement Filtering |

Table B-19. DMR\_MSsourced\_Voice and DMR\_MSsourced\_Data Parameters

| Parameter                 | DMR_MSsourced_Voice        | DMR_MSsourced_Data         |
|---------------------------|----------------------------|----------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted            |
| Modulation Type           | 4FSK                       | 4FSK                       |
| Auto Deviation            | On                         | On                         |
| Modulation Index          | –                          | –                          |
| Symbol Rate               | 4.8 ksps                   | 4.8 ksps                   |
| Span Up                   | On                         | On                         |
| Measurement Filter        | Root Nyquist               | Root Nyquist               |
| 2nd Measurement Filter    | None                       | None                       |
| Reference Filter          | Nyquist                    | Nyquist                    |
| 2nd Reference Filter      | None                       | None                       |
| Roll Off                  | 0.20                       | 0.20                       |
| 2nd Roll Off              | 1.000                      | 1.000                      |
| Slots per Frame           | 1                          | 1                          |
| Slot length               | 144 symbol                 | 144 symbol                 |
| Measurement Offset        | 0 symbol                   | 0 symbol                   |
| Measurement Interval      | 132 symbol                 | 132 symbol                 |
| Sync Word Search          | On                         | On                         |
| Burst Search              | On                         | On                         |
| 1st Word Search Slot      | Slot 0                     | Slot 0                     |
| 1st Word Sync Word Length | 24 symbol                  | 24 symbol                  |
| 1st Word Sync Word        | 7F7D5DD57DFD               | D5D7F77FD757               |
| 1st Word Sync Word Offset | 54 symbol                  | 54 symbol                  |
| 2nd Word Search           | Disable                    | Disable                    |
| 2nd Word Search Slot      | –                          | –                          |
| 2nd Word Sync Word Length | –                          | –                          |
| 2nd Word Sync Word        | –                          | –                          |
| 2nd Word Sync Word Offset | –                          | –                          |
| Deviation Calculation     | Post-Measurement Filtering | Post-Measurement Filtering |

Table B-20. DMR\_MSsourced\_RC and NXDN\_2\_4ksps Parameters

| Parameter                 | DMR_MSsourced_RC           | NXDN_2_4ksps              |
|---------------------------|----------------------------|---------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted           |
| Modulation Type           | 4FSK                       | 4FSK                      |
| Auto Deviation            | On                         | On                        |
| Modulation Index          | –                          | –                         |
| Symbol Rate               | 4.8 ksps                   | 2.4 ksps                  |
| Span Up                   | On                         | On                        |
| Measurement Filter        | Root Nyquist               | Root Nyquist              |
| 2nd Measurement Filter    | None                       | Inverse Rect              |
| Reference Filter          | Nyquist                    | Nyquist                   |
| 2nd Reference Filter      | None                       | None                      |
| Roll Off                  | 0.20                       | 0.20                      |
| 2nd Roll Off              | 1.000                      | 1.000                     |
| Slots per Frame           | 1                          | 1                         |
| Slot length               | 144 symbol                 | 192 symbol                |
| Measurement Offset        | 0 symbol                   | 0 symbol                  |
| Measurement Interval      | 48 symbol                  | 192 symbol                |
| Sync Word Search          | On                         | On                        |
| Burst Search              | On                         | Off                       |
| 1st Word Search Slot      | Slot 0                     | Slot 0                    |
| 1st Word Sync Word Length | 24 symbol                  | 10 symbol                 |
| 1st Word Sync Word        | 77D55F7DFD77               | CDF59                     |
| 1st Word Sync Word Offset | 12 symbol                  | 0 symbol                  |
| 2nd Word Search           | Disable                    | Disable                   |
| 2nd Word Search Slot      | –                          | –                         |
| 2nd Word Sync Word Length | –                          | –                         |
| 2nd Word Sync Word        | –                          | –                         |
| 2nd Word Sync Word Offset | –                          | –                         |
| Deviation Calculation     | Post-Measurement Filtering | Pre-Measurement Filtering |

Table B-21. NXDN\_4\_8kps Parameters

| Parameter                 | NXDN_4_8kps               |
|---------------------------|---------------------------|
| Measuring Object          | Frame Formatted           |
| Modulation Type           | 4FSK                      |
| Auto Deviation            | On                        |
| Modulation Index          | —                         |
| Symbol Rate               | 4.8 kps                   |
| Span Up                   | On                        |
| Measurement Filter        | Root Nyquist              |
| 2nd Measurement Filter    | Inverse Rect              |
| Reference Filter          | Nyquist                   |
| 2nd Reference Filter      | None                      |
| Roll Off                  | 0.20                      |
| 2nd Roll Off              | 1.000                     |
| Slots per Frame           | 1                         |
| Slot length               | 192 symbol                |
| Measurement Offset        | 0 symbol                  |
| Measurement Interval      | 192 symbol                |
| Sync Word Search          | On                        |
| Burst Search              | Off                       |
| 1st Word Search Slot      | Slot 0                    |
| 1st Word Sync Word Length | 10 symbol                 |
| 1st Word Sync Word        | CDF59                     |
| 1st Word Sync Word Offset | 0 symbol                  |
| 2nd Word Search           | Disable                   |
| 2nd Word Search Slot      | —                         |
| 2nd Word Sync Word Length | —                         |
| 2nd Word Sync Word        | —                         |
| 2nd Word Sync Word Offset | —                         |
| Deviation Calculation     | Pre-Measurement Filtering |

Table B-22. T86\_SYNC\_UL and T86\_SYNC\_DL Parameters

| Parameter                 | T86_SYNC_UL              | T86_SYNC_DL               |
|---------------------------|--------------------------|---------------------------|
| Measuring Object          | Frame Formatted          | Frame Formatted           |
| Modulation Type           | 16QAM                    | 16QAM                     |
| Symbol Rate               | 11250 sps                | 11250 sps                 |
| Span Up                   | On                       | On                        |
| Measurement Filter        | Root Nyquist             | Root Nyquist              |
| 2nd Measurement Filter    | None                     | None                      |
| Reference Filter          | Nyquist                  | Nyquist                   |
| 2nd Reference Filter      | None                     | None                      |
| Roll Off                  | 0.20                     | 0.20                      |
| 2nd Roll Off              | 1.00                     | 1.00                      |
| Slots per Frame           | 6 slot                   | 6 slot                    |
| Measurement Slot          | Slot 0: On, Slot1-5: Off | Slot 0: On, Slot1-5: Off  |
| Slot length               | 150 symbol               | 150 symbol                |
| Measurement Offset        | 4 symbol                 | 4 symbol                  |
| Measurement Interval      | 141 symbol               | 141 symbol                |
| Sync Word Search          | ON                       | ON                        |
| Burst Search              | ON                       | ON                        |
| 1st Word Search Slot      | Slot 0                   | Slot 0                    |
| 1st Word Sync Word Length | 10 symbol                | 10 symbol                 |
| 1st Word Sync Word        | 0000AAA0AA               | 0000AA0A0A                |
| 1st Word Sync Word Offset | 69 symbol                | 69 symbol                 |
| 2nd Word Search           | Disable                  | Disable                   |
| 2nd Word Search Slot      | –                        | –                         |
| 2nd Word Sync Word Length | –                        | –                         |
| 2nd Word Sync Word        | –                        | –                         |
| 2nd Word Sync Word Offset | –                        | –                         |
| Mask Table                | STD-T86 UL,DL            | Burst STD-T86 UL,DL Burst |



Table B-23. DMR\_BSsourced\_Voice\_2 and DMR\_BSsourced\_Data\_2 Parameters

| Parameter                 | DMR_BSsourced_Voice_2      | DMR_BSsourced_Data_2       |
|---------------------------|----------------------------|----------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted            |
| Modulation Type           | 4FSK                       | 4FSK                       |
| Auto Deviation            | Off                        | Off                        |
| Max Deviation             | 1944                       | 1944                       |
| Modulation Index          | –                          | –                          |
| Symbol Rate               | 4.8 kbps                   | 4.8 kbps                   |
| Span Up                   | On                         | On                         |
| Measurement Filter        | Root Nyquist               | Root Nyquist               |
| 2nd Measurement Filter    | None                       | None                       |
| Reference Filter          | Nyquist                    | Nyquist                    |
| 2nd Reference Filter      | None                       | None                       |
| Roll Off                  | 0.20                       | 0.20                       |
| 2nd Roll Off              | 1.000                      | 1.000                      |
| Slots per Frame           | 12                         | 12                         |
| Measurement Slot          | Slot 0: On, Slot1-11: Off  | Slot 0: On, Slot1-11: Off  |
| Slot length               | 144 symbol                 | 144 symbol                 |
| Measurement Offset        | 0 symbol                   | 0 symbol                   |
| Measurement Interval      | 144 symbol                 | 144 symbol                 |
| Sync Word Search          | On                         | On                         |
| Burst Search              | Off                        | Off                        |
| 1st Word Search Slot      | Slot 0                     | Slot 0                     |
| 1st Word Sync Word Length | 24 symbol                  | 24 symbol                  |
| 1st Word Sync Word        | 755FD7DF75F7               | DFF57D75DF5D               |
| 1st Word Sync Word Offset | 60 symbol                  | 60 symbol                  |
| 2nd Word Search           | Disable                    | Disable                    |
| 2nd Word Search Slot      | –                          | –                          |
| 2nd Word Sync Word Length | –                          | –                          |
| 2nd Word Sync Word        | –                          | –                          |
| 2nd Word Sync Word Offset | –                          | –                          |
| Deviation Calculation     | Post-Measurement Filtering | Post-Measurement Filtering |

Table B-24. DMR\_MSsourced\_Voice\_2 and DMR\_MSsourced\_Data\_2 Parameters

| Parameter                 | DMR_MSsourced_Voice_2      | DMR_MSsourced_Data_2       |
|---------------------------|----------------------------|----------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted            |
| Modulation Type           | 4FSK                       | 4FSK                       |
| Auto Deviation            | Off                        | Off                        |
| Max Deviation             | 1944                       | 1944                       |
| Modulation Index          | –                          | –                          |
| Symbol Rate               | 4.8 ksps                   | 4.8 ksps                   |
| Span Up                   | On                         | On                         |
| Measurement Filter        | Root Nyquist               | Root Nyquist               |
| 2nd Measurement Filter    | None                       | None                       |
| Reference Filter          | Nyquist                    | Nyquist                    |
| 2nd Reference Filter      | None                       | None                       |
| Roll Off                  | 0.20                       | 0.20                       |
| 2nd Roll Off              | 1.000                      | 1.000                      |
| Slots per Frame           | 12                         | 12                         |
| Measurement Slot          | ON: Slot 0,2,4..10         | ON: Slot 0,2,4..10         |
| Slot length               | 144 symbol                 | 144 symbol                 |
| Measurement Offset        | 0 symbol                   | 0 symbol                   |
| Measurement Interval      | 132 symbol                 | 132 symbol                 |
| Sync Word Search          | On                         | On                         |
| Burst Search              | On                         | On                         |
| 1st Word Search Slot      | Slot 0                     | Slot 0                     |
| 1st Word Sync Word Length | 24 symbol                  | 24 symbol                  |
| 1st Word Sync Word        | 7F7D5DD57DFD               | D5D7F77FD757               |
| 1st Word Sync Word Offset | 54 symbol                  | 54 symbol                  |
| 2nd Word Search           | Disable                    | Disable                    |
| 2nd Word Search Slot      | –                          | –                          |
| 2nd Word Sync Word Length | –                          | –                          |
| 2nd Word Sync Word        | –                          | –                          |
| 2nd Word Sync Word Offset | –                          | –                          |
| Deviation Calculation     | Post-Measurement Filtering | Post-Measurement Filtering |

Table B-25. DMR\_Normal\_Burst and DMR\_RC\_Burst Parameters

| Parameter                 | DMR_Normal_Burst           | DMR_RC_Burst               |
|---------------------------|----------------------------|----------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted            |
| Modulation Type           | 4FSK                       | 4FSK                       |
| Auto Deviation            | Off                        | Off                        |
| Max Deviation             | 1944                       | 1944                       |
| Modulation Index          | –                          | –                          |
| Symbol Rate               | 4.8 ksps                   | 4.8 ksps                   |
| Span Up                   | On                         | On                         |
| Measurement Filter        | Root Nyquist               | Root Nyquist               |
| 2nd Measurement Filter    | None                       | None                       |
| Reference Filter          | Nyquist                    | Nyquist                    |
| 2nd Reference Filter      | None                       | None                       |
| Roll Off                  | 0.20                       | 0.20                       |
| 2nd Roll Off              | 1.000                      | 1.000                      |
| Slots per Frame           | 2                          | 2                          |
| Measurement Slot          | Slot0: On, Slot1: Off      | Slot0: On, Slot1: Off      |
| Slot length               | 144 symbol                 | 144 symbol                 |
| Measurement Offset        | 5 symbol                   | 0 symbol                   |
| Measurement Interval      | 132 symbol                 | 48 symbol                  |
| Sync Word Search          | Off                        | Off                        |
| Burst Search              | On                         | On                         |
| 1st Word Search Slot      | –                          | –                          |
| 1st Word Sync Word Length | –                          | –                          |
| 1st Word Sync Word        | –                          | –                          |
| 1st Word Sync Word Offset | –                          | –                          |
| 2nd Word Search           | –                          | –                          |
| 2nd Word Search Slot      | –                          | –                          |
| 2nd Word Sync Word Length | –                          | –                          |
| 2nd Word Sync Word        | –                          | –                          |
| 2nd Word Sync Word Offset | –                          | –                          |
| Deviation Calculation     | Post-Measurement Filtering | Post-Measurement Filtering |
| Mask Table                | DMR Normal Burst           | DMR RC Burst               |

Table B-26. dPMR446\_80ms and dPMR446\_HeaderBurst Parameters

| Parameter                 | dPMR446_80ms               | dPMR446_HeaderBurst        |
|---------------------------|----------------------------|----------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted            |
| Modulation Type           | 4FSK                       | 4FSK                       |
| Auto Deviation            | On                         | On                         |
| Max Deviation             | –                          | –                          |
| Modulation Index          | –                          | –                          |
| Symbol Rate               | 2.4 ksps                   | 2.4 ksps                   |
| Span Up                   | On                         | On                         |
| Measurement Filter        | Root Nyquist               | Root Nyquist               |
| 2nd Measurement Filter    | Inverse Rect               | Inverse Rect               |
| Reference Filter          | Nyquist                    | Nyquist                    |
| 2nd Reference Filter      | None                       | None                       |
| Roll Off                  | 0.20                       | 0.20                       |
| 2nd Roll Off              | 1.000                      | 1.000                      |
| Slots per Frame           | 1                          | 2                          |
| Measurement Slot          | Slot0: On                  | Slot0: On, Slot1: Off      |
| Slot length               | 192 symbol                 | 192 symbol                 |
| Measurement Offset        | 0 symbol                   | 12 symbol                  |
| Measurement Interval      | 192 symbol                 | 160 symbol                 |
| Sync Word Search          | Off                        | Off                        |
| Burst Search              | On                         | On                         |
| 1st Word Search Slot      | –                          | –                          |
| 1st Word Sync Word Length | –                          | –                          |
| 1st Word Sync Word        | –                          | –                          |
| 1st Word Sync Word Offset | –                          | –                          |
| 2nd Word Search           | –                          | –                          |
| 2nd Word Search Slot      | –                          | –                          |
| 2nd Word Sync Word Length | –                          | –                          |
| 2nd Word Sync Word        | –                          | –                          |
| 2nd Word Sync Word Offset | –                          | –                          |
| Deviation Calculation     | Post-Measurement Filtering | Post-Measurement Filtering |

Table B-27. dPMR446\_320ms\_FS2 Parameters

| Parameter                 | dPMR446_320ms_FS2          |
|---------------------------|----------------------------|
| Measuring Object          | Frame Formatted            |
| Modulation Type           | 4FSK                       |
| Auto Deviation            | On                         |
| Max Deviation             | –                          |
| Modulation Index          | –                          |
| Symbol Rate               | 2.4 ksps                   |
| Span Up                   | On                         |
| Measurement Filter Root   | Nyquist                    |
| 2nd Measurement Filter    | Inverse Rect               |
| Reference Filter          | Nyquist                    |
| 2nd Reference Filter      | None                       |
| Roll Off                  | 0.20                       |
| 2nd Roll Off              | 1.000                      |
| Slots per Frame           | 2                          |
| Measurement Slot          | Slot0: On, Slot1: Off      |
| Slot length               | 384 symbol                 |
| Measurement Offset        | 0 symbol                   |
| Measurement Interval      | 384 symbol                 |
| Sync Word Search          | On                         |
| Burst Search              | On                         |
| 1st Word Search Slot      | Slot0                      |
| 1st Word Sync Word Length | 12 Symbol                  |
| 1st Word Sync Word        | 5FF77D                     |
| 1st Word Sync Word Offset | 0                          |
| 2nd Word Search           | Disable                    |
| 2nd Word Search Slot      | –                          |
| 2nd Word Sync Word Length | –                          |
| 2nd Word Sync Word        | –                          |
| 2nd Word Sync Word Offset | –                          |
| Deviation Calculation     | Post-Measurement Filtering |

Table B-28. dPMR\_BCH\_STD Parameters

| Parameter                 | dPMR_BCH_STD               |
|---------------------------|----------------------------|
| Measuring Object          | Frame Formatted            |
| Modulation Type           | 4FSK                       |
| Auto Deviation            | On                         |
| Max Deviation             | —                          |
| Modulation Index          | —                          |
| Symbol Rate               | 2.4 ksps                   |
| Span Up                   | On                         |
| Measurement Filter        | Root Nyquist               |
| 2nd Measurement Filter    | Inverse Rect               |
| Reference Filter          | Nyquist                    |
| 2nd Reference Filter      | None                       |
| Roll Off                  | 0.20                       |
| 2nd Roll Off              | 1.000                      |
| Slots per Frame           | 4                          |
| Measurement Slot          | Slot0: On, Slot1-3: Off    |
| Slot length               | 192 symbol                 |
| Measurement Offset        | 10 symbol                  |
| Measurement Interval      | 160 symbol                 |
| Sync Word Search          | Off                        |
| Burst Search              | On                         |
| 1st Word Search Slot      | —                          |
| 1st Word Sync Word Length | —                          |
| 1st Word Sync Word        | —                          |
| 1st Word Sync Word Offset | —                          |
| 2nd Word Search           | —                          |
| 2nd Word Search Slot      | —                          |
| 2nd Word Sync Word Length | —                          |
| 2nd Word Sync Word        | —                          |
| 2nd Word Sync Word Offset | —                          |
| Deviation Calculation     | Post-Measurement Filtering |

**Table B-29.** dPMR\_BCH\_110ms\_FS1 and dPMR\_BCH\_Uplink\_FS1 Parameters

| Parameter                 | dPMR_BCH_110ms_FS1         | dPMR_BCH_Uplink_FS1        |
|---------------------------|----------------------------|----------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted            |
| Modulation Type           | 4FSK                       | 4FSK                       |
| Auto Deviation            | On                         | On                         |
| Max Deviation             | –                          | –                          |
| Modulation Index          | –                          | –                          |
| Symbol Rate               | 2.4 ksps                   | 2.4 ksps                   |
| Span Up                   | On                         | On                         |
| Measurement Filter        | Root Nyquist               | Root Nyquist               |
| 2nd Measurement Filter    | Inverse Rect               | Inverse Rect               |
| Reference Filter          | Nyquist                    | Nyquist                    |
| 2nd Reference Filter      | None                       | None                       |
| Roll Off                  | 0.20                       | 0.20                       |
| 2nd Roll Off              | 1.000                      | 1.000                      |
| Slots per Frame           | 2                          | 4                          |
| Measurement Slot          | Slot0: On, Slot1: Off      | Slot0: On, Slot1-3: Off    |
| Slot length               | 264 symbol                 | 192 symbol                 |
| Measurement Offset        | 0 symbol                   | 8 symbol                   |
| Measurement Interval      | 264 symbol                 | 184 symbol                 |
| Sync Word Search          | On                         | On                         |
| Burst Search              | On                         | On                         |
| 1st Word Search Slot      | Slot 0                     | Slot 0                     |
| 1st Word Sync Word Length | 24                         | 24                         |
| 1st Word Sync Word        | 57FF5F75D577               | 57FF5F75D577               |
| 1st Word Sync Word Offset | 108                        | 36                         |
| 2nd Word Search           | Disable                    | Disable                    |
| 2nd Word Search Slot      | –                          | –                          |
| 2nd Word Sync Word Length | –                          | –                          |
| 2nd Word Sync Word        | –                          | –                          |
| 2nd Word Sync Word Offset | –                          | –                          |
| Deviation Calculation     | Post-Measurement Filtering | Post-Measurement Filtering |

Table B-30. dPMR\_TCH\_STD Parameters

| Parameter                 | dPMR_TCH_STD               |
|---------------------------|----------------------------|
| Measuring Object          | Frame Formatted            |
| Modulation Type           | 4FSK                       |
| Auto Deviation            | On                         |
| Max Deviation             | —                          |
| Modulation Index          | —                          |
| Symbol Rate               | 2.4 ksps                   |
| Span Up                   | On                         |
| Measurement Filter        | Root Nyquist               |
| 2nd Measurement Filter    | Inverse Rect               |
| Reference Filter          | Nyquist                    |
| 2nd Reference Filter      | None                       |
| Roll Off                  | 0.20                       |
| 2nd Roll Off              | 1.000                      |
| Slots per Frame           | 4                          |
| Measurement Slot          | Slot0: On, Slot1-3: Off    |
| Slot length               | 192 symbol                 |
| Measurement Offset        | 12 symbol                  |
| Measurement Interval      | 164 symbol                 |
| Sync Word Search          | Off                        |
| Burst Search              | On                         |
| 1st Word Search Slot      | —                          |
| 1st Word Sync Word Length | —                          |
| 1st Word Sync Word        | —                          |
| 1st Word Sync Word Offset | —                          |
| 2nd Word Search           | —                          |
| 2nd Word Search Slot      | —                          |
| 2nd Word Sync Word Length | —                          |
| 2nd Word Sync Word        | —                          |
| 2nd Word Sync Word Offset | —                          |
| Deviation Calculation     | Post-Measurement Filtering |



**Table B-31.** dPMR\_TCH\_Payload80ms\_FS2 and dPMR\_TCH\_PacketHead\_FS4 Parameters

| Parameter                 | dPMR_TCH_Payload80ms_FS2   | dPMR_TCH_PacketHead_FS4    |
|---------------------------|----------------------------|----------------------------|
| Measuring Object          | Frame Formatted            | Frame Formatted            |
| Modulation Type           | 4FSK                       | 4FSK                       |
| Auto Deviation            | On                         | On                         |
| Max Deviation             | –                          | –                          |
| Modulation Index          | –                          | –                          |
| Symbol Rate               | 2.4 ksps                   | 2.4 ksps                   |
| Span Up                   | On                         | On                         |
| Measurement Filter        | Root Nyquist               | Root Nyquist               |
| 2nd Measurement Filter    | Inverse Rect               | Inverse Rect               |
| Reference Filter          | Nyquist                    | Nyquist                    |
| 2nd Reference Filter      | None                       | None                       |
| Roll Off                  | 0.20                       | 0.20                       |
| 2nd Roll Off              | 1.000                      | 1.000                      |
| Slots per Frame           | 4                          | 4                          |
| Measurement Slot          | Slot0: On, Slot1-3: Off    | Slot0: On, Slot1-3: Off    |
| Slot length               | 192 symbol                 | 192 symbol                 |
| Measurement Offset        | 0 symbol                   | 8 symbol                   |
| Measurement Interval      | 192 symbol                 | 184 symbol                 |
| Sync Word Search          | On                         | On                         |
| Burst Search              | On                         | On                         |
| 1st Word Search Slot      | Slot 0                     | Slot 0                     |
| 1st Word Sync Word Length | 12                         | 24                         |
| 1st Word Sync Word        | 5FF77D                     | FD55F5DF7FDD               |
| 1st Word Sync Word Offset | 0                          | 36                         |
| 2nd Word Search           | Disable                    | Disable                    |
| 2nd Word Search Slot      | –                          | –                          |
| 2nd Word Sync Word Length | –                          | –                          |
| 2nd Word Sync Word        | –                          | –                          |
| 2nd Word Sync Word Offset | –                          | –                          |
| Deviation Calculation     | Post-Measurement Filtering | Post-Measurement Filtering |

Table B-32. TETRA\_DL\_NORMAL\_CONT and TETRA\_DL\_NORMAL\_DISCONT Parameters

| Parameter                   | TETRA_DL_NORMAL_CONT    | TETRA_DL_NORMAL_DISCONT |
|-----------------------------|-------------------------|-------------------------|
| Measuring Object            | Frame Formatted         | Frame Formatted         |
| Modulation Type             | PI/4DQPSK               | PI/4DQPSK               |
| Symbol Rate                 | 18000 sps               | 18000 sps               |
| Span Up                     | On                      | On                      |
| Measurement Filter          | Root Nyquist            | Root Nyquist            |
| 2nd Measurement Filter      | None                    | None                    |
| Reference Filter            | Nyquist                 | Nyquist                 |
| 2nd Reference Filter        | None                    | None                    |
| Roll Off                    | 0.35                    | 0.35                    |
| 2nd Roll Off                | 1.00                    | 1.00                    |
| Slots per Frame             | 4 slot                  | 4 slot                  |
| Measurement Slot            | Slot0: On, Slot1-3: Off | Slot0: On, Slot1-3: Off |
| Slot length                 | 255 symbol              | 255 symbol              |
| Measurement Offset          | 0 symbol                | 5 symbol                |
| Measurement Interval        | 255 symbol              | 246 symbol              |
| Sync Word Search            | On                      | On                      |
| Burst Search                | On                      | On                      |
| 1st Word Search Slot        | Slot 0                  | Slot 0                  |
| 1st Word Sync Word Length   | 11 symbol               | 11 symbol               |
| 1st Word Sync Word          | 343A74                  | 343A74                  |
| 1st Word Sync Word Offset   | 122 symbol              | 122 symbol              |
| 2nd Word Search             | Disable                 | Disable                 |
| 2nd Word Search Slot        | –                       | –                       |
| 2nd Word Sync Word Length   | –                       | –                       |
| 2nd Word Sync Word          | –                       | –                       |
| 2nd Word Sync Word Offset   | –                       | –                       |
| Origin Offset Cancel        | On                      | On                      |
| Droop Cancel                | On                      | On                      |
| Method of Symbol Rate Error | Slot                    | Slot                    |
| Mask Table                  | –                       | TETRA DL Normal Discont |

Table B-33. TETRA\_UL\_NORMAL Parameters

| Parameter                   | TETRA_UL_NORMAL         |
|-----------------------------|-------------------------|
| Measuring Object            | Frame Formatted         |
| Modulation Type             | PI/4DQPSK               |
| Symbol Rate                 | 18000 sps               |
| Span Up                     | On                      |
| Measurement Filter Root     | Nyquist                 |
| 2nd Measurement Filter      | None                    |
| Reference Filter            | Nyquist                 |
| 2nd Reference Filter        | None                    |
| Roll Off                    | 0.35                    |
| 2nd Roll Off                | 1.00                    |
| Slots per Frame             | 4 slot                  |
| Measurement Slot            | Slot0: On, Slot1-3: Off |
| Slot length                 | 255 symbol              |
| Measurement Offset          | 17 symbol               |
| Measurement Interval        | 231 symbol              |
| Sync Word Search            | On                      |
| Burst Search                | On                      |
| 1st Word Search Slot        | Slot 0                  |
| 1st Word Sync Word Length   | 11 symbol               |
| 1st Word Sync Word          | 343A74                  |
| 1st Word Sync Word Offset   | 127 symbol              |
| 2nd Word Search             | Disable                 |
| 2nd Word Search Slot        | –                       |
| 2nd Word Sync Word Length   | –                       |
| 2nd Word Sync Word          | –                       |
| 2nd Word Sync Word Offset   | –                       |
| Origin Offset Cancel        | On                      |
| Droop Cancel                | On                      |
| Method of Symbol Rate Error | Slot                    |
| Mask Table                  | TETRA UL Normal         |

Table B-34. DVB-S\_BW26M DVB-S\_BW54M Parameters

| Parameter                 | DVB-S_BW26M DVB-S_BW54M           |
|---------------------------|-----------------------------------|
| Measuring Object          | Non-Formatted                     |
| Modulation Type           | QPSK                              |
| Symbol Rate               | 20.3 Msps(BW26M) 40.2 Msps(BW54M) |
| Capture OSR               | 4                                 |
| Capture Interval          | 1 Frame                           |
| APSK Ring Ratio (R2/R1)   | —                                 |
| APSK Ring Ratio (R3/R1)   | —                                 |
| Measurement Filter        | Root Nyquist                      |
| 2nd Measurement Filter    | None                              |
| Reference Filter          | Nyquist                           |
| 2nd Reference Filter      | None                              |
| Roll Off                  | 0.35                              |
| 2nd Roll Off              | 1.00                              |
| Slots per Frame           | —                                 |
| Measurement Slot          | —                                 |
| Slot length               | —                                 |
| Measurement Offset        | —                                 |
| Measurement Interval      | 1000 symbol                       |
| Sync Word Search          | —                                 |
| Burst Search              | —                                 |
| 1st Word Search Slot      | —                                 |
| 1st Word Sync Word Length | —                                 |
| 1st Word Sync Word        | —                                 |
| 1st Word Sync Word Offset | —                                 |
| 2nd Word Search           | —                                 |
| 2nd Word Search Slot      | —                                 |
| 2nd Word Sync Word Length | —                                 |
| 2nd Word Sync Word        | —                                 |
| 2nd Word Sync Word Offset | —                                 |
| Origin Offset Cancel      | On                                |
| Droop Cancel              | On                                |

Table B-34. DVB-S\_BW26M DVB-S\_BW54M Parameters

| Parameter                   | DVB-S_BW26M DVB-S_BW54M |
|-----------------------------|-------------------------|
| Method of Symbol Rate Error | Slot                    |

Table B-35. DVB-S2\_16APSK\_Rxxx and DVB-S2\_32APSK\_Rxxx Parameters

| Parameter                 | DVB-S2_16APSK_Rxxx                                                                                        | DVB-S2_32APSK_Rxxx                                                                      |
|---------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Measuring Object          | Non-Formatted                                                                                             | Non-Formatted                                                                           |
| Modulation Type           | 16APSK                                                                                                    | 32APSK                                                                                  |
| Symbol Rate               | 25 Msps                                                                                                   | 25 Msps                                                                                 |
| Capture OSR               | 4                                                                                                         | 4                                                                                       |
| Capture Interval          | 1 Frame                                                                                                   | 1 Frame                                                                                 |
| APSK Ring Ratio (R2/R1)   | 3.150 ( R2_3 )<br>2.850 ( R3_4 )<br>2.750 ( R4_5 )<br>2.700 ( R5_6 )<br>2.600 ( R8_9 )<br>2.570 ( R9_10 ) | 2.840 ( R3_4 )<br>2.720 ( R4_5 )<br>2.640 ( R5_6 )<br>2.540 ( R8_9 )<br>2.530 ( R9_10 ) |
|                           |                                                                                                           |                                                                                         |
|                           |                                                                                                           |                                                                                         |
|                           |                                                                                                           |                                                                                         |
|                           |                                                                                                           |                                                                                         |
|                           |                                                                                                           |                                                                                         |
| APSK Ring Ratio (R3/R1)   | —                                                                                                         | 5.270 ( R3_4 )<br>4.870 ( R4_5 )<br>4.640 ( R5_6 )<br>4.330 ( R8_9 )<br>4.300 ( R9_10 ) |
|                           |                                                                                                           |                                                                                         |
|                           |                                                                                                           |                                                                                         |
|                           |                                                                                                           |                                                                                         |
|                           |                                                                                                           |                                                                                         |
| Measurement Filter        | Root Nyquist                                                                                              | Root Nyquist                                                                            |
| 2nd Measurement Filter    | None                                                                                                      | None                                                                                    |
| Reference Filter          | Nyquist                                                                                                   | Nyquist                                                                                 |
| 2nd Reference Filter      | None                                                                                                      | None                                                                                    |
| Roll Off                  | 0.35                                                                                                      | 0.35                                                                                    |
| 2nd Roll Off              | —                                                                                                         | —                                                                                       |
| Slots per Frame           | —                                                                                                         | —                                                                                       |
| Measurement Slot          | —                                                                                                         | —                                                                                       |
| Slot length               | —                                                                                                         | —                                                                                       |
| Measurement Offset        | —                                                                                                         | —                                                                                       |
| Measurement Interval      | 1000 symbol                                                                                               | 1000 symbol                                                                             |
| Sync Word Search          | —                                                                                                         | —                                                                                       |
| Burst Search              | —                                                                                                         | —                                                                                       |
| 1st Word Search Slot      | —                                                                                                         | —                                                                                       |
| 1st Word Sync Word Length | —                                                                                                         | —                                                                                       |

**Table B-35.** DVB-S2\_16APSK\_Rxxx and DVB-S2\_32APSK\_Rxxx Parameters

| Parameter                   | DVB-S2_16APSK_Rxxx | DVB-S2_32APSK_Rxxx |
|-----------------------------|--------------------|--------------------|
| 1st Word Sync Word          | –                  | –                  |
| 1st Word Sync Word Offset   | –                  | –                  |
| 2nd Word Search             | –                  | –                  |
| 2nd Word Search Slot        | –                  | –                  |
| 2nd Word Sync Word Length   | –                  | –                  |
| 2nd Word Sync Word          | –                  | –                  |
| 2nd Word Sync Word Offset   | –                  | –                  |
| Origin Offset Cancel        | On                 | On                 |
| Droop Cancel                | On                 | On                 |
| Method of Symbol Rate Error | Slot               | Slot               |

Table B-36. DSNG\_BW\_3M\_xxxx, DSNG\_BW\_36M\_16QAM and DSNG\_BW\_72M\_QPSK Parameters

| Parameter                 | DSNG_BW_3M_xxxx | DSNG_BW_36M_16QAM | DSNG_BW_72M_QPSK |
|---------------------------|-----------------|-------------------|------------------|
| Measuring Object          | Non-Formatted   | Non-Formatted     | Non-Formatted    |
| Modulation Type           | QPSK (_QPSK)    | 16QAM             | QPSK             |
|                           | 8PSK (_8PSK)    |                   |                  |
|                           | 16QAM (_16QAM)  |                   |                  |
| Symbol Rate               | 2.222 Msps      | 26.666 Msps       | 53.333 Msps      |
| Capture OSR               | 4               | 4                 | 4                |
| Capture Interval          | 1 Frame         | 1 Frame           | 1 Frame          |
| APSK Ring Ratio (R2/R1)   | –               | –                 | –                |
| APSK Ring Ratio (R3/R1)   | –               | –                 | –                |
| Measurement Filter        | Root Nyquist    | Root Nyquist      | Root Nyquist     |
| 2nd Measurement Filter    | None            | None              | None             |
| Reference Filter          | Nyquist         | Nyquist           | Nyquist          |
| 2nd Reference Filter      | None            | None              | None             |
| Roll Off                  | 0.35            | 0.35              | 0.35             |
| 2nd Roll Off              | –               | –                 | –                |
| Slots per Frame           | –               | –                 | –                |
| Measurement Slot          | –               | –                 | –                |
| Slot length               | –               | –                 | –                |
| Measurement Offset        | –               | –                 | –                |
| Measurement Interval      | 1000 symbol     | 1000 symbol       | 1000 symbol      |
| Sync Word Search          | –               | –                 | –                |
| Burst Search              | –               | –                 | –                |
| 1st Word Search Slot      | –               | –                 | –                |
| 1st Word Sync Word Length | –               | –                 | –                |
| 1st Word Sync Word        | –               | –                 | –                |
| 1st Word Sync Word Offset | –               | –                 | –                |
| 2nd Word Search           | –               | –                 | –                |
| 2nd Word Search Slot      | –               | –                 | –                |
| 2nd Word Sync Word Length | –               | –                 | –                |



**Table B-36.** DSNG\_BW\_3M\_xxxx, DSNG\_BW\_36M\_16QAM and DSNG\_BW\_72M\_QPSK Parameters

| Parameter                   | DSNG_BW_3M_xxxx | DSNG_BW_36M_16QAM | DSNG_BW_72M_QPSK |
|-----------------------------|-----------------|-------------------|------------------|
| 2nd Word Sync Word          | –               | –                 | –                |
| 2nd Word Sync Word Offset   | –               | –                 | –                |
| Origin Offset Cancel        | On              | On                | On               |
| Droop Cancel                | On              | On                | On               |
| Method of Symbol Rate Error | Slot            | Slot              | Slot             |

Table B-37. DSNG\_MODExxx and DSNG\_MODExxx Parameters

| Parameter                 | DSNG_MODExxx          | DSNG_MODExxx  |
|---------------------------|-----------------------|---------------|
| Measuring Object          | Non-Formatted         | Non-Formatted |
| Modulation Type           | QPSK                  | QPSK          |
| Symbol Rate               | 29.8240 Msps(Mode1)   | 25 Msps       |
|                           | 22.3680 Msps(Mode2)   |               |
|                           | 24.7680 Msps(Mode3-1) |               |
|                           | 22.3680 Msps(Mode3-2) |               |
|                           | 12.2226 Msps(Mode4)   |               |
| Capture OSR               | 4                     | 4             |
| Capture Interval          | 1 Frame               | 1 Frame       |
| APSK Ring Ratio (R2/R1)   | —                     | —             |
| APSK Ring Ratio (R3/R1)   | —                     | —             |
| Measurement Filter        | Root Nyquist          | Root Nyquist  |
| 2nd Measurement Filter    | None                  | None          |
| Reference Filter          | Nyquist               | Nyquist       |
| 2nd Reference Filter      | None                  | None          |
| Roll Off                  | 0.35                  | 0.35          |
| 2nd Roll Off              | —                     | —             |
| Slots per Frame           | —                     | —             |
| Measurement Slot          | —                     | —             |
| Slot length               | —                     | —             |
| Measurement Offset        | —                     | —             |
| Measurement Interval      | 1000 symbol           | 1000 symbol   |
| Sync Word Search          | —                     | —             |
| Burst Search              | —                     | —             |
| 1st Word Search Slot      | —                     | —             |
| 1st Word Sync Word Length | — —                   |               |
| 1st Word Sync Word        | —                     | —             |
| 1st Word Sync Word Offset | —                     | —             |
| 2nd Word Search           | —                     | —             |
| 2nd Word Search Slot      | —                     | —             |
| 2nd Word Sync Word Length | —                     | —             |
| 2nd Word Sync Word        | —                     | —             |

Table B-37. DSNG\_MODExxx and DSNG\_MODExxx Parameters

| Parameter                   | DSNG_MODExxx | DSNG_MODExxx |
|-----------------------------|--------------|--------------|
| 2nd Word Sync Word Offset   | –            | –            |
| Origin Offset Cancel        | On           | On           |
| Droop Cancel                | On           | On           |
| Method of Symbol Rate Error | Slot         | Slot         |

Table B-38. STD-28\_xx\_SB and STD-28\_xx\_TCH Parameters

| Parameter                 | STD-28_xx_SB                   | STD-28_xx_TCH           |
|---------------------------|--------------------------------|-------------------------|
| Measuring Object          | Frame Formatted                | Frame Formatted         |
| Modulation Type           | PI/4DQPSK                      | PI/4DQPSK               |
| Symbol Rate               | 192 kbps                       | 192 kbps                |
| Capture OSR               | 4                              | 4                       |
| Capture Interval          | 10 Frame                       | 10 Frame                |
| APSK Ring Ratio (R2/R1)   | –                              | –                       |
| APSK Ring Ratio (R3/R1)   | –                              | –                       |
| Measurement Filter        | Root Nyquist                   | Root Nyquist            |
| 2nd Measurement Filter    | None                           | None                    |
| Reference Filter          | Nyquist                        | Nyquist                 |
| 2nd Reference Filter      | None                           | None                    |
| Roll Off                  | 0.50                           | 0.50                    |
| 2nd Roll Off              | –                              | –                       |
| Slots per Frame           | 8 slot                         | 8 slot                  |
| Measurement Slot          | Slot0: On, Slot1-7: Off        | Slot0: On, Slot1-7: Off |
| Slot length               | 120 symbol                     | 120 symbol              |
| Measurement Offset        | 2 symbol                       | 2 symbol                |
| Measurement Interval      | 110 symbol                     | 110 symbol              |
| Sync Word Search          | On                             | On                      |
| Burst Search              | On                             | On                      |
| 1st Word Search Slot      | Slot 0                         | Slot 0                  |
| 1st Word Sync Word Length | 16 symbol                      | 8 symbol                |
| 1st Word Sync Word        | 50EF2993 (DL)<br>6B899AF0 (UL) | 3D4C (DL)<br>E149 (UL)  |
| 1st Word Sync Word Offset | 34 symbol                      | 6 symbol                |
| 2nd Word Search           | –                              | –                       |
| 2nd Word Search Slot      | –                              | –                       |
| 2nd Word Sync Word Length | –                              | –                       |
| 2nd Word Sync Word        | –                              | –                       |
| 2nd Word Sync Word Offset | –                              | –                       |
| Origin Offset Cancel      | On                             | On                      |

**Table B-38.** STD-28\_xx\_SB and STD-28\_xx\_TCH Parameters

| Parameter                                | STD-28_xx_SB         | STD-28_xx_TCH        |
|------------------------------------------|----------------------|----------------------|
| <b>Droop Cancel</b>                      | On                   | On                   |
| <b>Method of Symbol Rate Error</b>       | Frame To Frame       | Frame To Frame       |
| <b>Burst Gap Size</b>                    | 20 symbol            | 20 symbol            |
| <b>Mask Table</b>                        | STD28 UP,DN TCH,SYNC | STD28 UP,DN TCH,SYNC |
| <b>Rise / Fall Time Off Detect Level</b> | −40.96 dBm           | −40.96 dBm           |

Table B-39. RCR39\_T79\_MS-xxx and RCR39-T79\_DC-xx Parameters

| Parameter                 | RCR39_T79_MS-xxx                                         | RCR39-T79_DC-xx                      |
|---------------------------|----------------------------------------------------------|--------------------------------------|
| Measuring Object          | Frame Formatted                                          | Frame Formatted                      |
| Modulation Type           | PI/4DQPSK                                                | PI/4DQPSK                            |
| Symbol Rate               | 16000 sps                                                | 16000 sps                            |
| Span Up                   | –                                                        | –                                    |
| Measurement Filter        | Root Nyquist                                             | Root Nyquist                         |
| 2nd Measurement Filter    | None                                                     | None                                 |
| Reference Filter          | Nyquist                                                  | Nyquist                              |
| 2nd Reference Filter      | None                                                     | None                                 |
| Roll Off                  | 0.50                                                     | 0.50                                 |
| 2nd Roll Off              | 1.000                                                    | 1.000                                |
| Slots per Frame           | 4 slot                                                   | 4 slot                               |
| Measurement Slot          | Slot0: On,<br>Slot1-3: Off                               | Slot0: On,<br>Slot1-3: Off           |
| Slot length               | 160 symbol                                               | 160 symbol                           |
| Measurement Offset        | 3 symbol (TCH)<br>21 symbol (CCH)<br>46 symbol (SYNC)    | 7 symbol (CH)<br>46 symbol (SYNC)    |
| Measurement Interval      | 153 symbol (TCH)<br>127 symbol (CCH)<br>94 symbol (SYNC) | 145 symbol (CH)<br>106 symbol (SYNC) |
| Sync Word Search          | ON                                                       | ON                                   |
| Burst Search              | ON                                                       | ON                                   |
| 1st Word Search Slot      | Slot 0                                                   | Slot 0                               |
| 1st Word Sync Word Length | 10 symbol (TCH)<br>10 symbol (CCH)<br>16 symbol (SYNC)   | 10 symbol (CH)<br>16 symbol (SYNC)   |
| 1st Word Sync Word        | 785B4 (TCH)<br>785B4 (CCH)<br>D06B2F94 (SYNC)            | 5164C (CH)<br>2F94D06B (SYNC)        |
| 1st Word Sync Word Offset | 78 symbol (TCH)<br>78 symbol (CCH)<br>72 symbol (SYNC)   | 78 symbol (CH)<br>72 symbol (SYNC)   |
| 2nd Word Search           | Enable                                                   | Enable                               |
| 2nd Word Search Slot      | Slot                                                     | 0 Slot 0                             |
| 2nd Word Sync Word Length | 10 symbol (TCH)<br>10 symbol (CCH)<br>16 symbol (SYNC)   | 10 symbol (CH)<br>16 symbol (SYNC)   |

**Table B-39.** RCR39\_T79\_MS-xxx and RCR39-T79\_DC-xx Parameters

| Parameter                        | RCR39_T79_MS-xxx                                                                                  | RCR39-T79_DC-xx                                                       |
|----------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>RCR39_T79_MS-xxx</b>          | RCR39-T79_DC-xx                                                                                   |                                                                       |
| <b>2nd Word Sync Word</b>        | CE450 (TCH)<br>CE450 (CCH)<br>E2B11D4E (SYNC)                                                     | 4D9DE (CH)<br>1D4EE2B1 (SYNC)                                         |
| <b>2nd Word Sync Word Offset</b> | 78 symbol (TCH)<br>78 symbol (CCH)<br>72 symbol (SYNC)                                            | 78 symbol (CH)<br>72 symbol (SYNC)                                    |
| <b>Burst Gap Size</b>            | 20 symbol (TCH)<br>40 symbol (CCH)<br>40 symbol (SYNC)                                            | 20 symbol (CH)<br>60 symbol (SYNC)                                    |
| <b>Mask Table</b>                | STD39,T79,T85 MS TCH (TCH)<br>STD39,T79,T85 MS CCH,SYNC (CCH)<br>STD39,T79,T85 MS CCH,SYNC (SYNC) | STD39,T79 Direct Channel (CH)<br>STD39,T79 Direct Sync Channel (SYNC) |

# Appendix C — Symbol Mapping Defaults

## C-1 Introduction

The following lists the initial symbol data (symbol mapping) values that correspond to the symbol allocation values for each modulation method and describes the file specification method for changing the symbol mapping.

### BPSK

BPSK Symbol Allocation is shown in [Figure C-1](#).

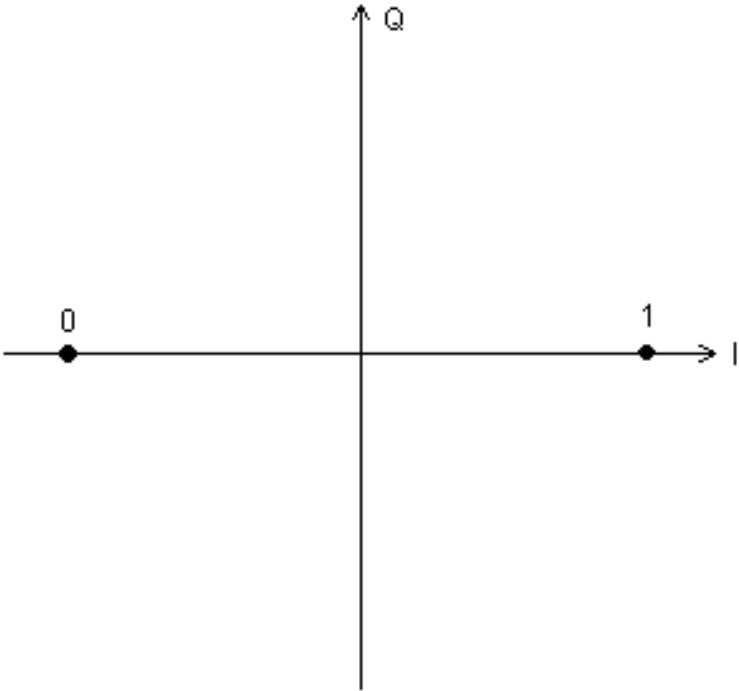


**Figure C-1.** BPSK Symbol Allocation

BPSK Symbol Data is shown in [Table C-1](#).

**Table C-1.** BPSK Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 0          | 0           |
| 1          | 1           |



## DBPSK

DBPSK Symbol Allocation is shown in [Figure C-2](#).

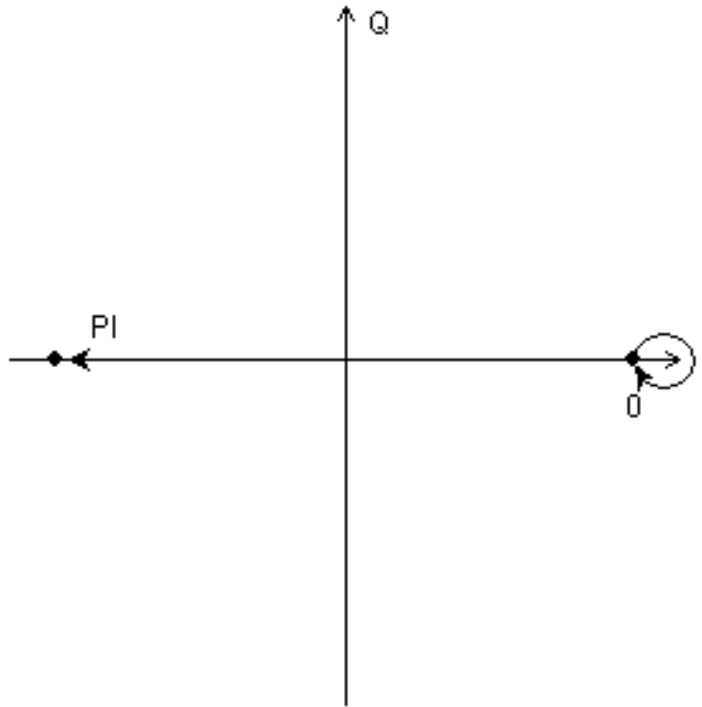


**Figure C-2.** DBPSK Symbol Allocation

DBPSK Symbol Data is shown in [Table C-2](#).

**Table C-2.** DBPSK Symbol Data

| Differential | Symbol data |
|--------------|-------------|
| $\pi$        | 0           |
| 1            | 1           |

Pi/2 DBPSK

Pi/2 DBPSK Symbol Allocation is shown in [Figure C-3](#).

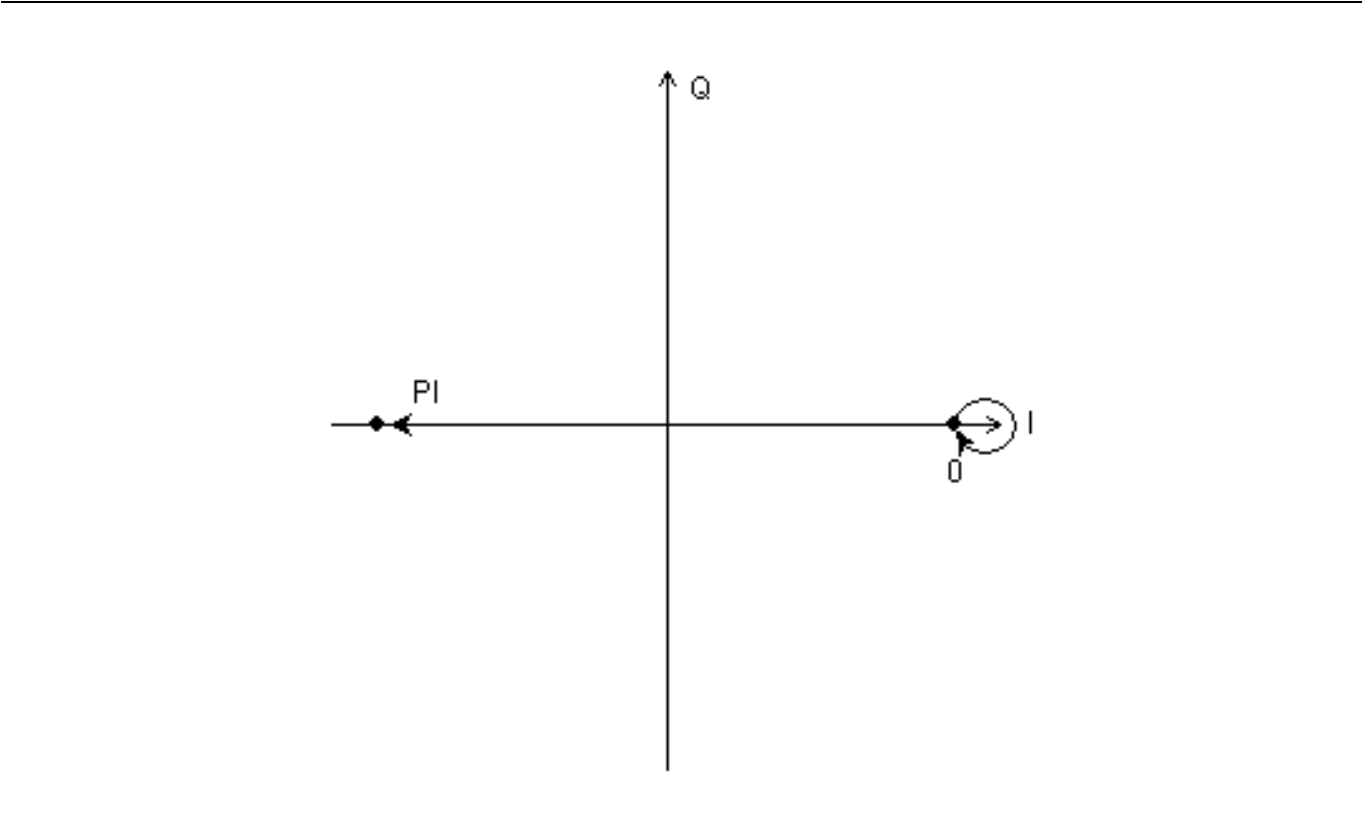


**Figure C-3.** Pi/2 DBPSK Symbol Allocation

Pi/2 DBPSK Symbol Data is shown in [Table C-3](#)

**Table C-3.** Pi/2 DBPSK Symbol Data

| Differential | Symbol data |
|--------------|-------------|
| $+\pi/2$     | 0           |
| $-\pi/2$     | 1           |

## QPSK

QPSK Symbol Allocation is shown in [Figure C-4](#).

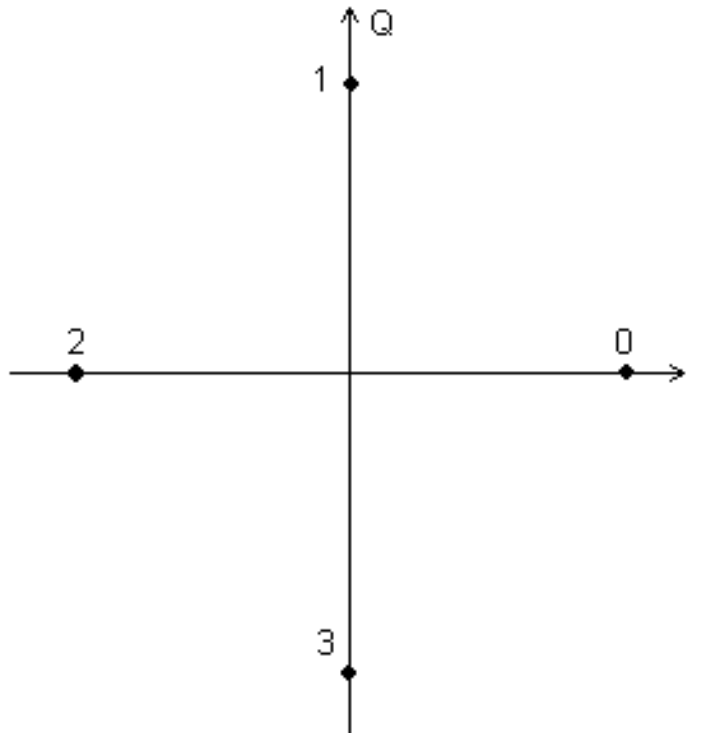


**Figure C-4.** QPSK Symbol Allocation

QPSK Symbol Data is shown in [Table C-4](#)

**Table C-4.** QPSK Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 0          | 11          |
| 1          | 01          |
| 2          | 00          |
| 3          | 10          |

O-QPSK

O-QPSK Symbol Allocation is shown in [Figure C-5](#).

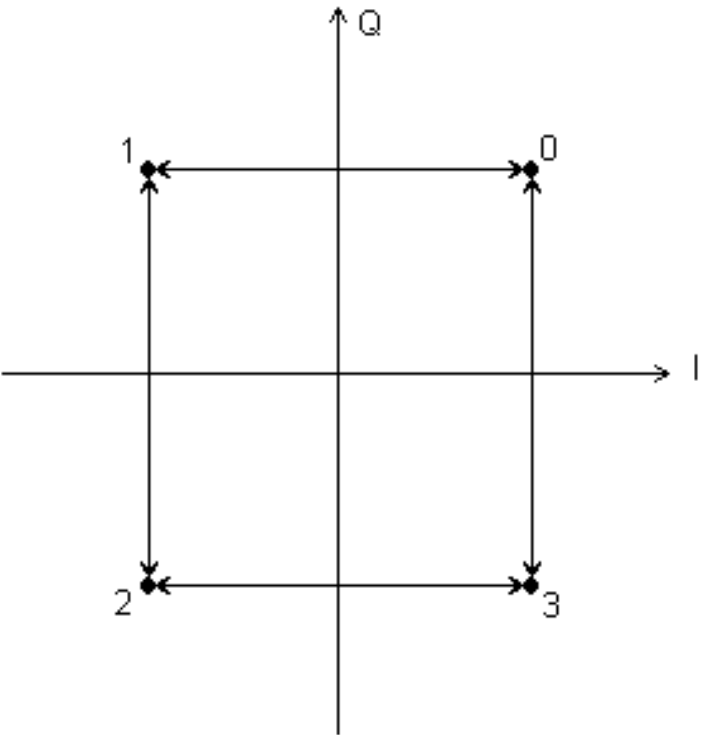


**Figure C-5.** O-QPSK Symbol Allocation

O-QPSK Symbol Data is shown in [Table C-5](#)

**Table C-5.** O-QPSK Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 0          | 11          |
| 1          | 01          |
| 2          | 00          |
| 3          | 10          |

## DQPSK

DQPSK Symbol Allocation is shown in [Figure C-6](#).

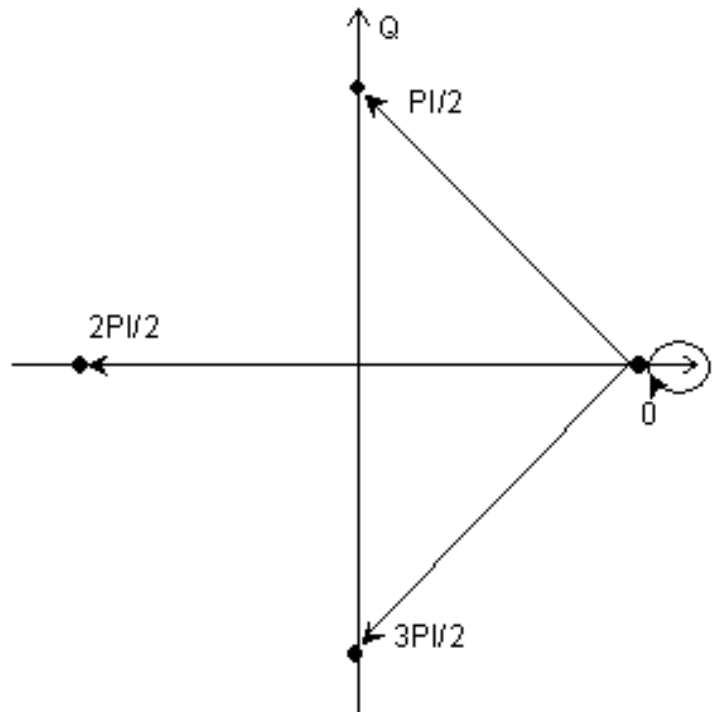


**Figure C-6.** DQPSK Symbol Allocation

DQPSK Symbol Data is shown in [Table C-6](#)

**Table C-6.** DQPSK Symbol Data

| differential | Symbol data |
|--------------|-------------|
| $\pi/2$      | 00          |
| $2\pi/2$     | 01          |
| $3\pi/2$     | 10          |
| 0            | 11          |

Pi/4 DQPSK

Pi/4 DQPSK Symbol Allocation is shown in [Figure C-7](#).

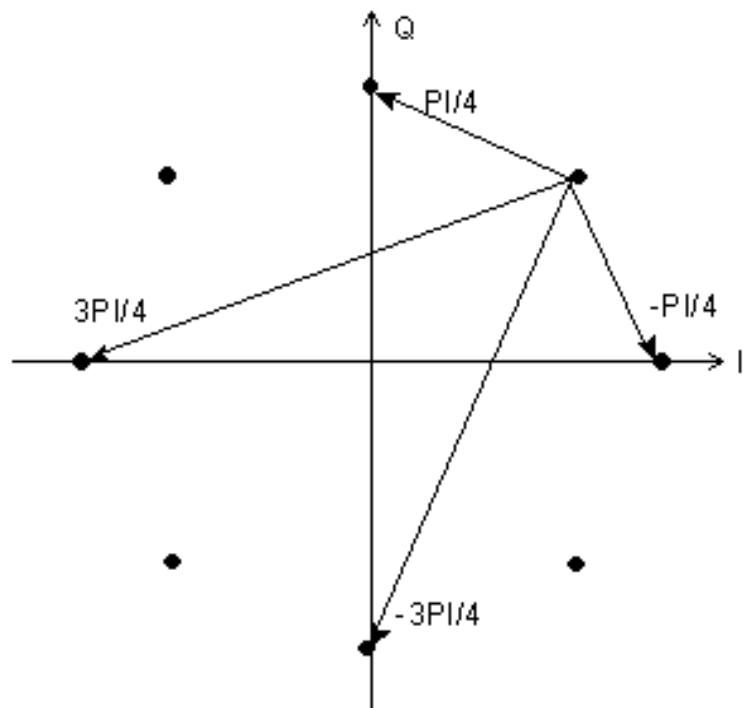


**Figure C-7.** Pi/4 DQPSK Symbol Allocation

Pi/4 DQPSK Symbol Data is shown in [Table C-7](#)

**Table C-7.** Pi/4DQPSK Symbol Data

| Differential | Symbol data |
|--------------|-------------|
| $+\pi/4$     | 00          |
| $+3\pi/4$    | 01          |
| $-\pi/4$     | 11          |
| $-3\pi/4$    | 10          |

## 8PSK

8PSK Symbol Allocation is shown in [Figure C-8](#).

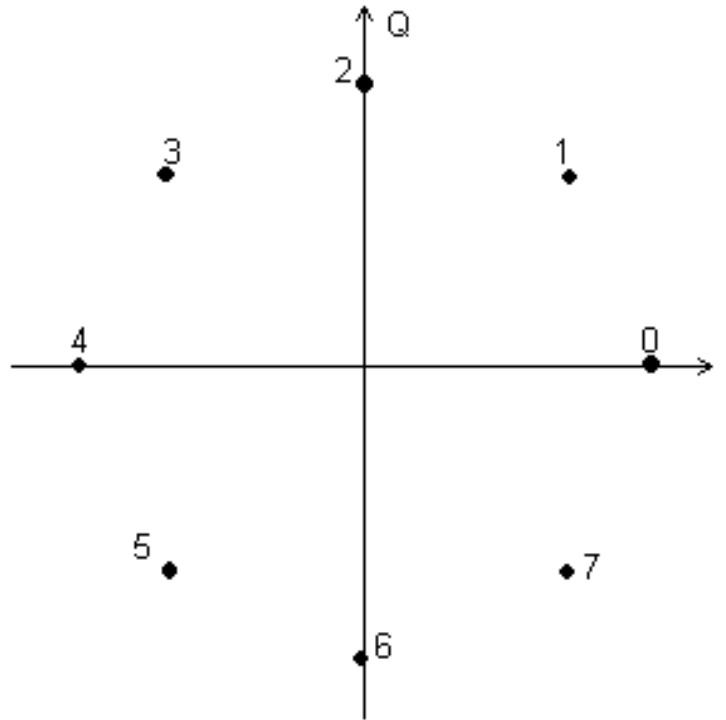


**Figure C-8.** 8PSK Symbol Allocation

8PSK Symbol Data is shown in [Table C-8](#)

**Table C-8.** 8PSK Symbol Data

| Allocation | Symbol data |  |
|------------|-------------|--|
| 0          | 111         |  |
| 1          | 110         |  |
| 2          | 010         |  |
| 3          | 011         |  |
| 4          | 001         |  |
| 5          | 000         |  |
| 6          | 100         |  |
| 7          | 101         |  |

## D8PSK

D8PSK Symbol Allocation is shown in [Figure C-9](#).

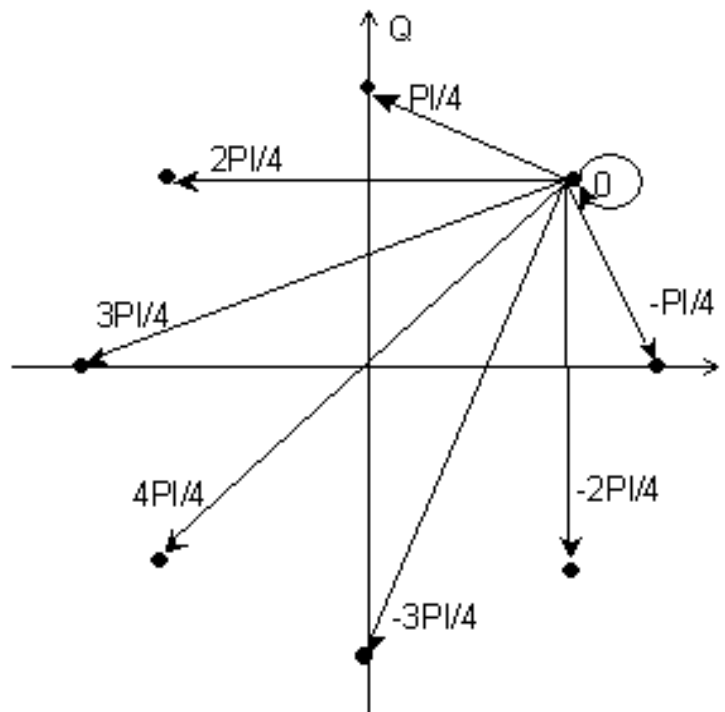


**Figure C-9.** D8PSK Symbol Allocation

D8PSK Symbol Data is shown in [Table C-8](#).

**Table C-9.** D8PSK Symbol Data

| Differential | Symbol data |  |
|--------------|-------------|--|
| $\pi/4$      | 110         |  |
| $2\pi/4$     | 010         |  |
| $3\pi/4$     | 011         |  |
| $4\pi/4$     | 001         |  |
| $-3\pi/4$    | 000         |  |
| $-2\pi/4$    | 100         |  |
| $-\pi/4$     | 101         |  |
| 0            | 111         |  |



## 16QAM

16QAM Symbol Allocation is shown in [Figure C-10](#).

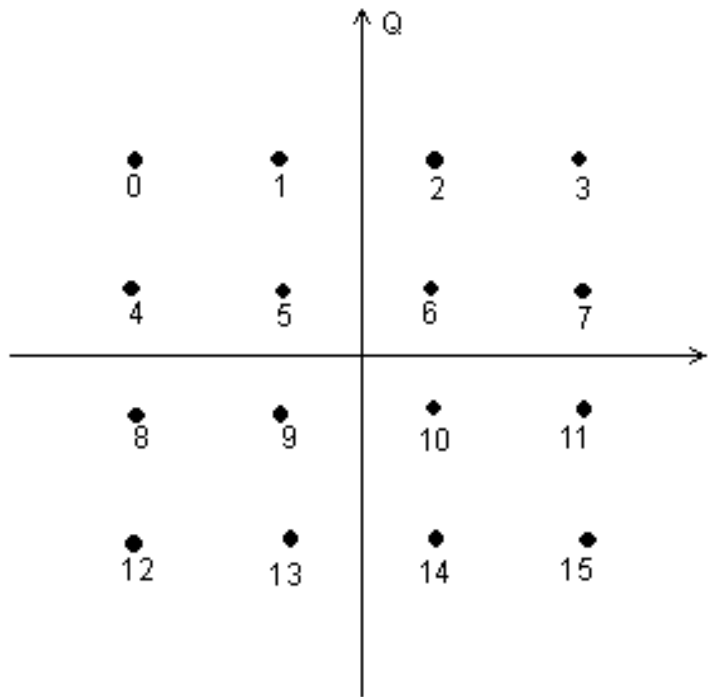


**Figure C-10.** 16QAM Symbol Allocation

16QAM Symbol Data is shown in [Table C-10](#).

**Table C-10.** 16QAM Symbol data

| Allocation | Symbol data | Allocation | Symbol data |
|------------|-------------|------------|-------------|
| 0          | 0111        | 8          | 0010        |
| 1          | 0101        | 9          | 0000        |
| 2          | 1101        | 10         | 1000        |
| 3          | 1111        | 11         | 1010        |
| 4          | 0110        | 12         | 0011        |
| 5          | 0100        | 13         | 0001        |
| 6          | 1100        | 14         | 1001        |
| 7          | 1110        | 15         | 1011        |

32QAM

32QAM Symbol Allocation is shown in [Figure C-11](#).

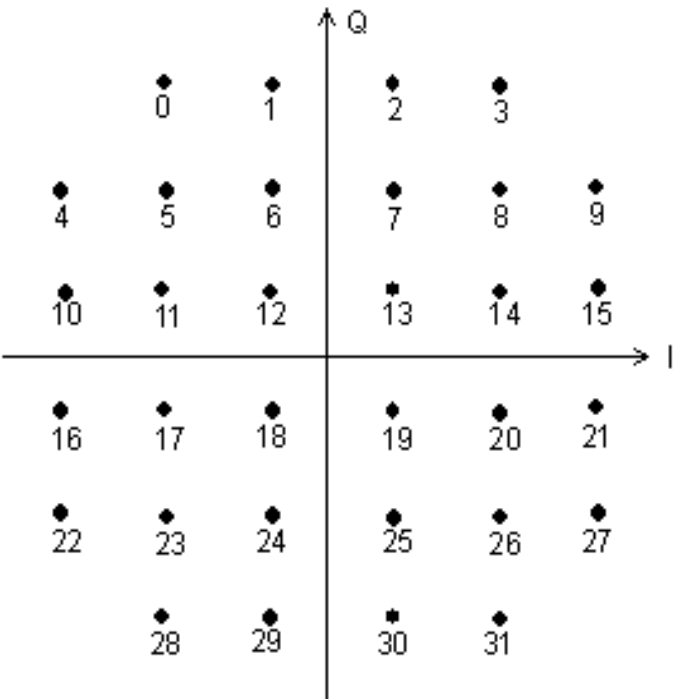


Figure C-11. 32QAM Symbol Allocation

32QAM Symbol Data is shown in [Table C-11](#).



**Table C-11.** 32QAM Symbol Data

| Allocation | Symbol data | Allocation | Symbol data |
|------------|-------------|------------|-------------|
| 0          | 11101       | 16         | 00110       |
| 1          | 01010       | 17         | 10011       |
| 2          | 11010       | 18         | 00000       |
| 3          | 01101       | 19         | 10000       |
| 4          | 00111       | 20         | 00011       |
| 5          | 10100       | 21         | 10110       |
| 6          | 00001       | 22         | 01111       |
| 7          | 10001       | 23         | 11100       |
| 8          | 00100       | 24         | 01001       |
| 9          | 10111       | 25         | 11001       |
| 10         | 01110       | 26         | 01100       |
| 11         | 11011       | 27         | 11111       |
| 12         | 01000       | 28         | 10101       |
| 13         | 11000       | 29         | 00010       |
| 14         | 01011       | 30         | 10010       |
| 15         | 11110       | 31         | 00101       |

## 64QAM

64QAM Symbol Allocation is shown in [Figure C-12](#).

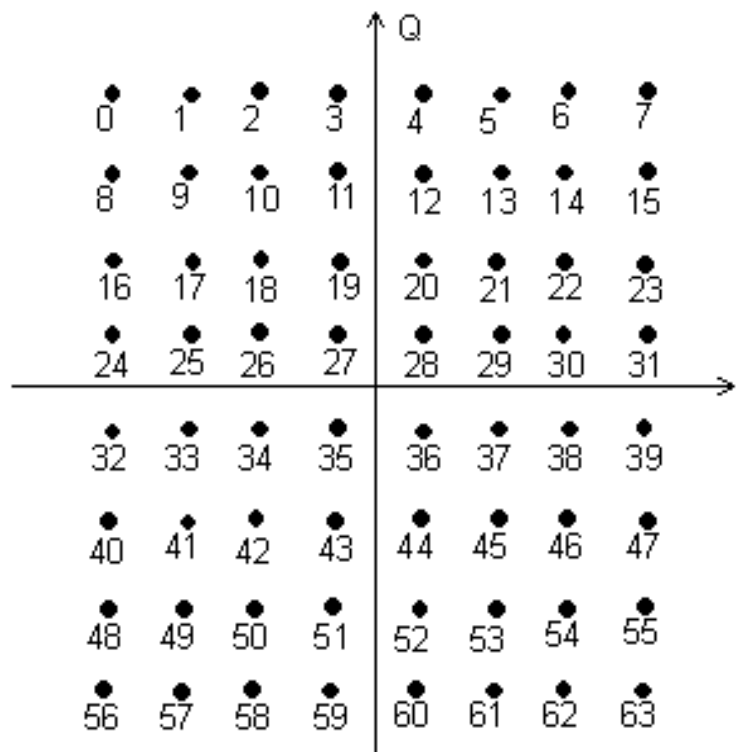


**Figure C-12.** 64QAM Symbol Allocation

64QAM Symbol Data is shown in [Table C-12](#).

**Table C-12.** 64QAM Symbol Data

| Allocation | Symbol data | Allocation | Symbol data | Allocation | Symbol data | Allocation | Symbol data |
|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| 0          | 100010      | 16         | 100111      | 32         | 110111      | 48         | 110010      |
| 1          | 100000      | 17         | 100101      | 33         | 110101      | 49         | 110000      |
| 2          | 101000      | 18         | 101101      | 34         | 111101      | 50         | 111000      |
| 3          | 101010      | 19         | 101111      | 35         | 111111      | 51         | 111010      |
| 4          | 001000      | 20         | 001101      | 36         | 011101      | 52         | 011000      |
| 5          | 001010      | 21         | 001111      | 37         | 011111      | 53         | 011010      |
| 6          | 000010      | 22         | 000111      | 38         | 010111      | 54         | 010010      |
| 7          | 000000      | 23         | 000101      | 39         | 010101      | 55         | 010000      |
| 8          | 100011      | 24         | 100110      | 40         | 110110      | 56         | 110011      |
| 9          | 100001      | 25         | 100100      | 41         | 110100      | 57         | 110001      |
| 10         | 101001      | 26         | 101100      | 42         | 111100      | 58         | 111001      |

**Table C-12.** 64QAM Symbol Data

| <b>Allocation</b> | <b>Symbol data</b> | <b>Allocation</b> | <b>Symbol data</b> | <b>Allocation</b> | <b>Symbol data</b> | <b>Allocation</b> | <b>Symbol data</b> |
|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|
| <b>11</b>         | 101011             | 27                | 101110             | 43                | 111110             | 59                | 111011             |
| <b>12</b>         | 001001             | 28                | 001100             | 44                | 011100             | 60                | 011001             |
| <b>13</b>         | 001011             | 29                | 001110             | 45                | 011110             | 61                | 011011             |
| <b>14</b>         | 000011             | 30                | 000110             | 46                | 010110             | 62                | 010011             |
| <b>15</b>         | 000001             | 31                | 000100             | 47                | 010100             | 63                | 010001             |

## 128QAM

128QAM Symbol Allocation is shown in [Figure C-13](#)

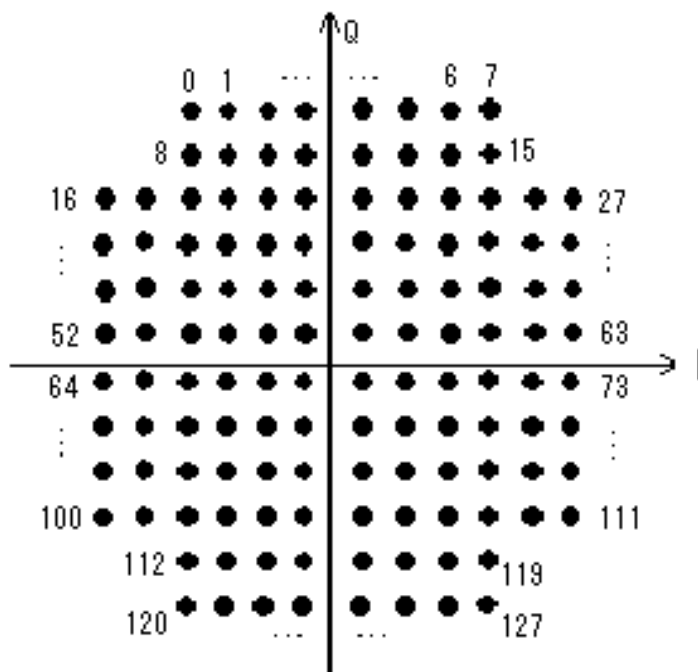


**Figure C-13.** 128QAM Symbol Allocation

128QAM Symbol Data is shown in [Table C-13](#).

**Table C-13.** 128QAM Symbol Data

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| 0          | 1011101     | 32         | 1000111     | 64         | 1101101     | 96         | 0110111     |
| 1          | 1011111     | 33         | 1000101     | 65         | 1101100     | 97         | 0110101     |
| 2          | 1001111     | 34         | 0010010     | 66         | 1100100     | 98         | 0101001     |
| 3          | 1001101     | 35         | 0010011     | 67         | 1100101     | 99         | 0101011     |
| 4          | 0011010     | 36         | 0010111     | 68         | 1100001     | 100        | 1111101     |
| 5          | 0011011     | 37         | 0010110     | 69         | 1100000     | 101        | 1111100     |
| 6          | 0001011     | 38         | 0011110     | 70         | 0100000     | 102        | 1110100     |
| 7          | 0001010     | 39         | 0011111     | 71         | 0100010     | 103        | 1110101     |
| 8          | 1011100     | 40         | 1011011     | 72         | 0110010     | 104        | 1110001     |
| 9          | 1011110     | 41         | 1011001     | 73         | 0110000     | 105        | 1110000     |
| 10         | 1001110     | 42         | 1010001     | 74         | 0111000     | 106        | 0100100     |

Table C-13. 128QAM Symbol Data

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| 11         | 1001100     | 43         | 1010011     | 75         | 0111010     | 107        | 0100110     |
| 12         | 0011000     | 44         | 1000011     | 76         | 1101111     | 108        | 0110110     |
| 13         | 0011001     | 45         | 1000001     | 77         | 1101110     | 109        | 0110100     |
| 14         | 0001001     | 46         | 0000010     | 78         | 1100110     | 110        | 0101000     |
| 15         | 0001000     | 47         | 0000011     | 79         | 1100111     | 111        | 0101010     |
| 16         | 1001010     | 48         | 0000111     | 80         | 1100011     | 112        | 1101000     |
| 17         | 1001000     | 49         | 0000110     | 81         | 1100010     | 113        | 1101001     |
| 18         | 1010100     | 50         | 0001110     | 82         | 0100001     | 114        | 1111001     |
| 19         | 1010110     | 51         | 0001111     | 83         | 0100011     | 115        | 1111000     |
| 20         | 1000110     | 52         | 1011010     | 84         | 0110011     | 116        | 0101100     |
| 21         | 1000100     | 53         | 1011000     | 85         | 0110001     | 117        | 0101110     |
| 22         | 0010000     | 54         | 1010000     | 86         | 0111001     | 118        | 0111110     |
| 23         | 0010001     | 55         | 1010010     | 87         | 0111011     | 119        | 0111100     |
| 24         | 0010101     | 56         | 1000010     | 88         | 1111111     | 120        | 1101010     |
| 25         | 0010100     | 57         | 1000000     | 89         | 1111110     | 121        | 1101011     |
| 26         | 0011100     | 58         | 0000000     | 90         | 1110110     | 122        | 1111011     |
| 27         | 0011101     | 59         | 0000001     | 91         | 1110111     | 123        | 1111010     |
| 28         | 1001011     | 60         | 0000101     | 92         | 1110011     | 124        | 0101101     |
| 29         | 1001001     | 61         | 0000100     | 93         | 1110010     | 125        | 0101111     |
| 30         | 1010101     | 62         | 0001100     | 94         | 0100101     | 126        | 0111111     |
| 31         | 1010111     | 63         | 0001101     | 95         | 0100111     | 127        | 0111101     |

## 256QAM

256QAM Symbol Allocation is shown in [Figure C-14](#)

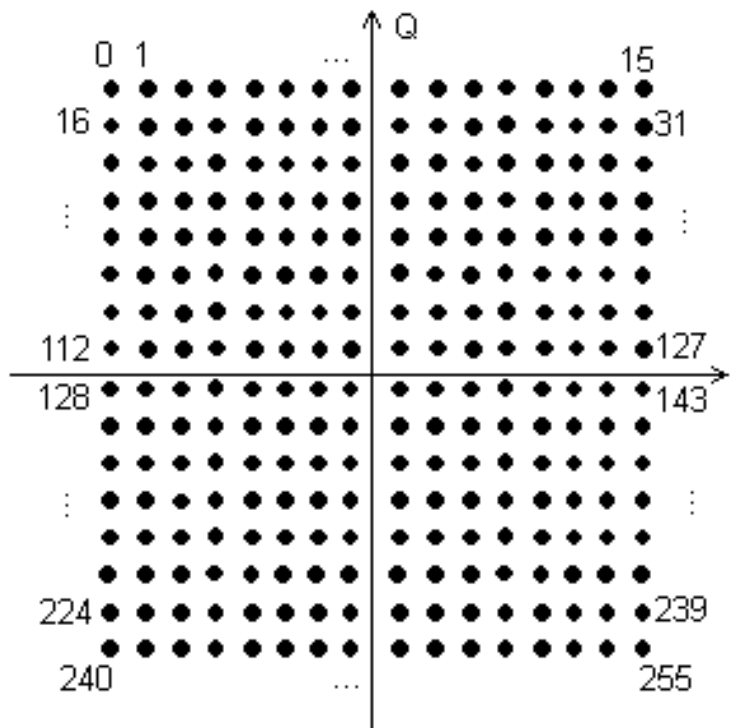


**Figure C-14.** 256QAM Symbol Allocation

128QAM Symbol Data is shown in [Table C-14](#).

**Table C-14.** 128QAM Symbol Data

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| 0          | 10001000    | 64         | 10011101    | 128        | 11011101    | 192        | 11001000    |
| 1          | 10001010    | 65         | 10011111    | 129        | 11011111    | 193        | 11001010    |
| 2          | 10000010    | 66         | 10010111    | 130        | 11010111    | 194        | 11000010    |
| 3          | 10000000    | 67         | 10010101    | 131        | 11010101    | 195        | 11000000    |
| 4          | 10100010    | 68         | 10110111    | 132        | 11110111    | 196        | 11100010    |
| 5          | 10100000    | 69         | 10110101    | 133        | 11110101    | 197        | 11100000    |
| 6          | 10101000    | 70         | 10111101    | 134        | 11111101    | 198        | 11101000    |
| 7          | 10101010    | 71         | 10111111    | 135        | 11111111    | 199        | 11101010    |
| 8          | 00100010    | 72         | 00110111    | 136        | 01110111    | 200        | 01100010    |
| 9          | 00100000    | 73         | 00110101    | 137        | 01110101    | 201        | 01100000    |
| 10         | 00101000    | 74         | 00111101    | 138        | 01111101    | 202        | 01101000    |

Table C-14. 128QAM Symbol Data

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| 11         | 00101010    | 75         | 00111111    | 139        | 01111111    | 203        | 01101010    |
| 12         | 00001000    | 76         | 00011101    | 140        | 01011101    | 204        | 01001000    |
| 13         | 00001010    | 77         | 00011111    | 141        | 01011111    | 205        | 01001010    |
| 14         | 00000010    | 78         | 00010111    | 142        | 01010111    | 206        | 01000010    |
| 15         | 00000000    | 79         | 00010101    | 143        | 01010101    | 207        | 01000000    |
| 16         | 10001001    | 80         | 10011100    | 144        | 11011100    | 208        | 11001001    |
| 17         | 10001011    | 81         | 10011110    | 145        | 11011110    | 209        | 11001011    |
| 18         | 10000011    | 82         | 10010110    | 146        | 11010110    | 210        | 11000011    |
| 19         | 10000001    | 83         | 10010100    | 147        | 11010100    | 211        | 11000001    |
| 20         | 10100011    | 84         | 10110110    | 148        | 11110110    | 212        | 11100011    |
| 21         | 10100001    | 85         | 10110100    | 149        | 11110100    | 213        | 11100001    |
| 22         | 10101001    | 86         | 10111100    | 150        | 11111100    | 214        | 11101001    |
| 23         | 10101011    | 87         | 10111110    | 151        | 11111110    | 215        | 11101011    |
| 24         | 00100011    | 88         | 00110110    | 152        | 01110110    | 216        | 01100011    |
| 25         | 00100001    | 89         | 00110100    | 153        | 01110100    | 217        | 01100001    |
| 26         | 00101001    | 90         | 00111100    | 154        | 01111100    | 218        | 01101001    |
| 27         | 00101011    | 91         | 00111110    | 155        | 01111110    | 219        | 01101011    |
| 28         | 00001001    | 92         | 00011100    | 156        | 01011100    | 220        | 01001001    |
| 29         | 00001011    | 93         | 00011110    | 157        | 01011110    | 221        | 01001011    |
| 30         | 00000011    | 94         | 00010110    | 158        | 01010110    | 222        | 01000011    |
| 31         | 00000001    | 95         | 00010100    | 159        | 01010100    | 223        | 01000001    |
| 32         | 10001101    | 96         | 10011000    | 160        | 11011000    | 224        | 11001101    |
| 33         | 10001111    | 97         | 10011010    | 161        | 11011010    | 225        | 11001111    |
| 34         | 10000111    | 98         | 10010010    | 162        | 11010010    | 226        | 11000111    |
| 35         | 10000101    | 99         | 10010000    | 163        | 11010000    | 227        | 11000101    |
| 36         | 10100111    | 100        | 10110010    | 164        | 11110010    | 228        | 11100111    |
| 37         | 10100101    | 101        | 10110000    | 165        | 11110000    | 229        | 11100101    |
| 38         | 10101101    | 102        | 10111000    | 166        | 11111000    | 230        | 11101101    |
| 39         | 10101111    | 103        | 10111010    | 167        | 11111010    | 231        | 11101111    |
| 40         | 00100111    | 104        | 00110010    | 168        | 01110010    | 232        | 01100111    |
| 41         | 00100101    | 105        | 00110000    | 169        | 01110000    | 233        | 01100101    |

Table C-14. 128QAM Symbol Data

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| 42         | 00101101    | 106        | 00111000    | 170        | 01111000    | 234        | 01101101    |
| 43         | 00101111    | 107        | 00111010    | 171        | 01111010    | 235        | 01101111    |
| 44         | 00001101    | 108        | 00011000    | 172        | 01011000    | 236        | 01001101    |
| 45         | 00001111    | 109        | 00011010    | 173        | 01011010    | 237        | 01001111    |
| 46         | 00000111    | 110        | 00010010    | 174        | 01010010    | 238        | 01000111    |
| 47         | 00000101    | 111        | 00010000    | 175        | 01010000    | 239        | 01000101    |
| 48         | 10001100    | 112        | 10011001    | 176        | 11011001    | 240        | 11001100    |
| 49         | 10001110    | 113        | 10011011    | 177        | 11011011    | 241        | 11001110    |
| 50         | 10000110    | 114        | 10010011    | 178        | 11010011    | 242        | 11000110    |
| 51         | 10000100    | 115        | 10010001    | 179        | 11010001    | 243        | 11000100    |
| 52         | 10100110    | 116        | 10110011    | 180        | 11110011    | 244        | 11100110    |
| 53         | 10100100    | 117        | 10110001    | 181        | 11110001    | 245        | 11100100    |
| 54         | 10101100    | 118        | 10111001    | 182        | 11111001    | 246        | 11101100    |
| 55         | 10101110    | 119        | 10111011    | 183        | 11111011    | 247        | 11101110    |
| 56         | 00100110    | 120        | 00110011    | 184        | 01110011    | 248        | 01100110    |
| 57         | 00100100    | 121        | 00110001    | 185        | 01110001    | 249        | 01100100    |
| 58         | 00101100    | 122        | 00111001    | 186        | 01111001    | 250        | 01101100    |
| 59         | 00101110    | 123        | 00111011    | 187        | 01111011    | 251        | 01101110    |
| 60         | 00001100    | 124        | 00011001    | 188        | 01011001    | 252        | 01001100    |
| 61         | 00001110    | 125        | 00011011    | 189        | 01011011    | 253        | 01001110    |
| 62         | 00000110    | 126        | 00010011    | 190        | 01010011    | 254        | 01000110    |
| 63         | 00000100    | 127        | 00010001    | 191        | 01010001    | 255        | 01000100    |



## 512QAM

512QAM Symbol Allocation is shown in [Figure C-15](#)

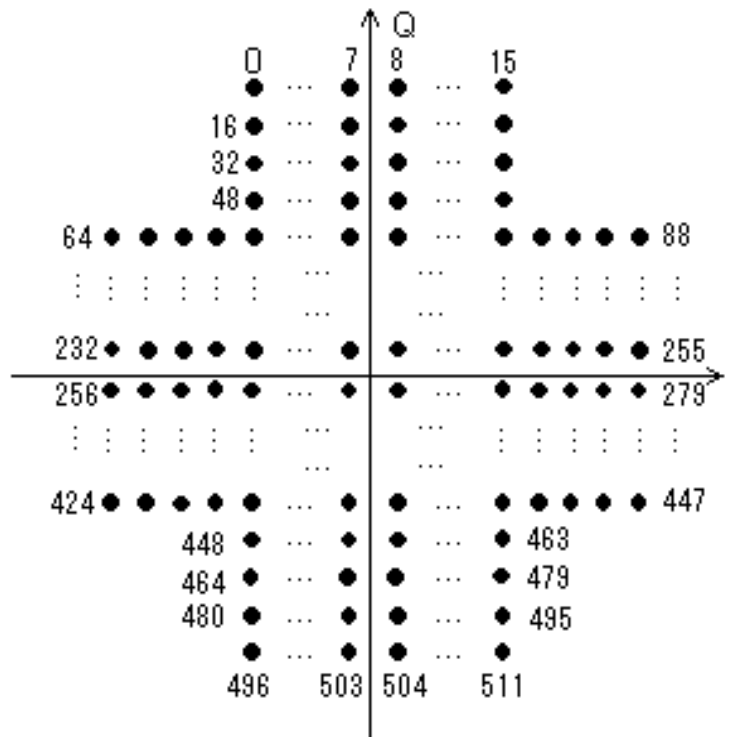


**Figure C-15.** 512QAM Symbol Allocation

512QAM Symbol Data is shown in [Table C-15](#).

**Table C-15.** 512 Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 0          | 000000000   |
| 1          | 000000001   |
| 2          | 000000010   |
| ...        | ...         |
| 509        | 111111101   |
| 510        | 111111110   |
| 511        | 111111111   |

1024QAM

1024QAM Symbol Allocation is shown in [Figure C-16](#)

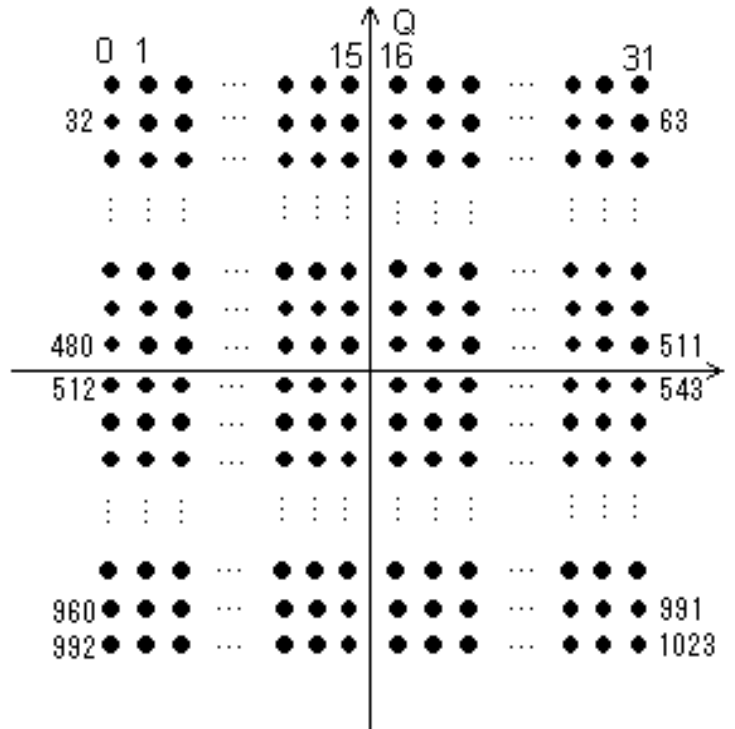


**Figure C-16.** 1024QAM Symbol Allocation

1024QAM Symbol Data is shown in [Table C-16](#).

**Table C-16.** 1024QAM Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 0          | 0000000000  |
| 1          | 0000000001  |
| 2          | 0000000010  |
| ...        | ...         |
| 1021       | 1111111101  |
| 1022       | 1111111110  |
| 1023       | 1111111111  |

## 2048QAM

2048QAM Symbol Allocation is shown in [Figure C-17](#)

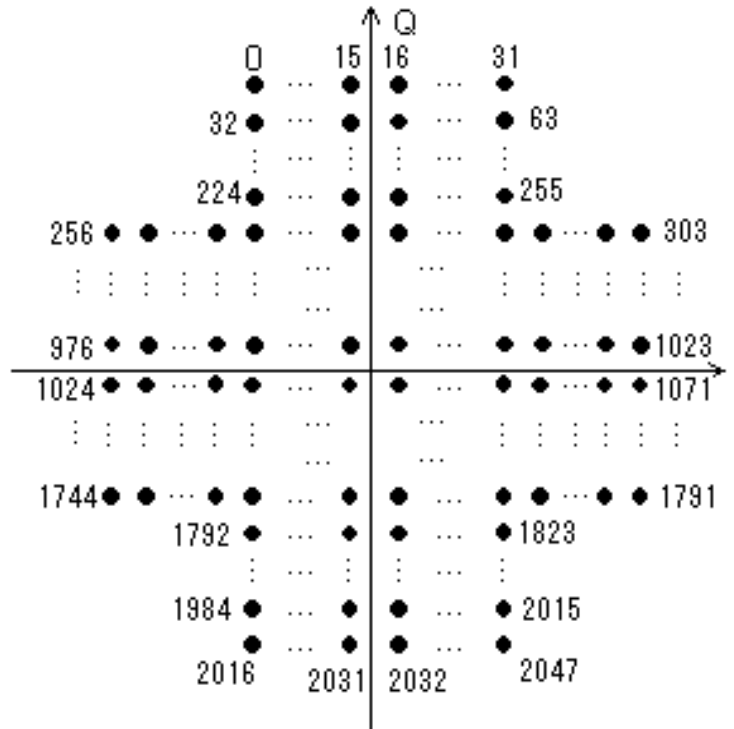


**Figure C-17.** 2048QAM Symbol Allocation

2048QAM Symbol Data is shown in [Table C-17](#).

**Table C-17.** 2048QAM Symbol Data

| Allocation  | Symbol data |
|-------------|-------------|
| <b>0</b>    | 0000000000  |
| <b>1</b>    | 0000000001  |
| <b>2</b>    | 0000000010  |
| ...         | ...         |
| <b>2045</b> | 1111111101  |
| <b>2046</b> | 1111111110  |
| <b>2047</b> | 1111111111  |

2FSK

2FSK Symbol Allocation is shown in [Figure C-18](#).



**Figure C-18.** 2FSK Symbol Allocation

2FSK Symbol Data is shown in [Table C-18](#).

**Table C-18.** 2FSK Symbol Data

| Direction | Symbol data |
|-----------|-------------|
| +         | 1           |
| -         | 0           |

## 4FSK/H-CPM

4FSK/H-CPM Symbol Allocation is shown in [Figure C-19](#).

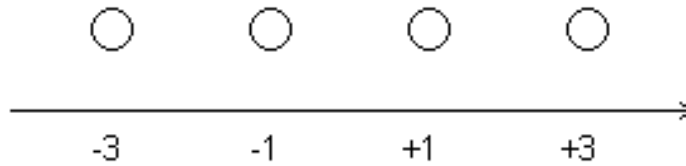


**Figure C-19.** 4FSK/H-CPM Symbol Allocation

4FSK/H-CPM Symbol Data is shown in [Table C-19](#).

**Table C-19.** 4FSK/H-CPM Symbol Data

| Direction | Symbol data |
|-----------|-------------|
| +3        | 01          |
| +1        | 00          |
| -1        | 10          |
| -3        | 11          |

2ASK

2ASK Symbol Allocation is shown in [Figure C-20](#).

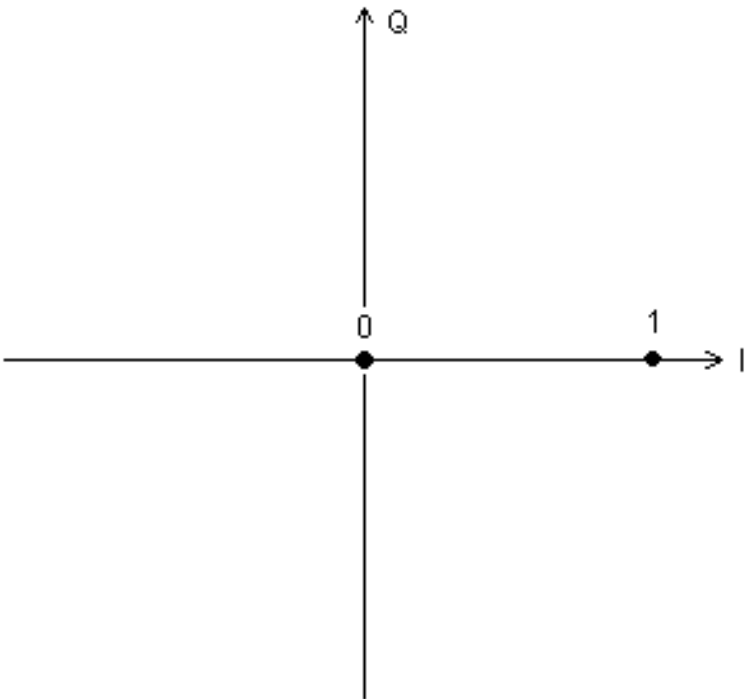


**Figure C-20.** 2ASK Symbol Allocation

2ASK Symbol Data is shown in [Table C-20](#).

**Table C-20.** 2ASK Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 0          | 0           |
| 1          | 1           |

## 4ASK

4ASK Symbol Allocation is shown in [Figure C-21](#).

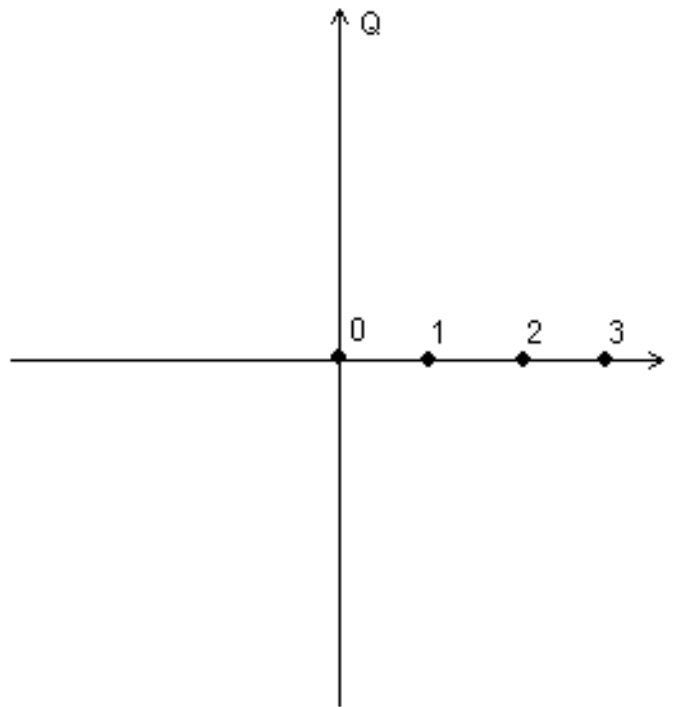


**Figure C-21.** 4ASK Symbol Allocation

4ASK Symbol Data is shown in [Table C-21](#).

**Table C-21.** 4ASK Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 0          | 00          |
| 1          | 01          |
| 2          | 11          |
| 3          | 10          |

MSK

MSK Symbol Allocation is shown in [Figure C-22](#).

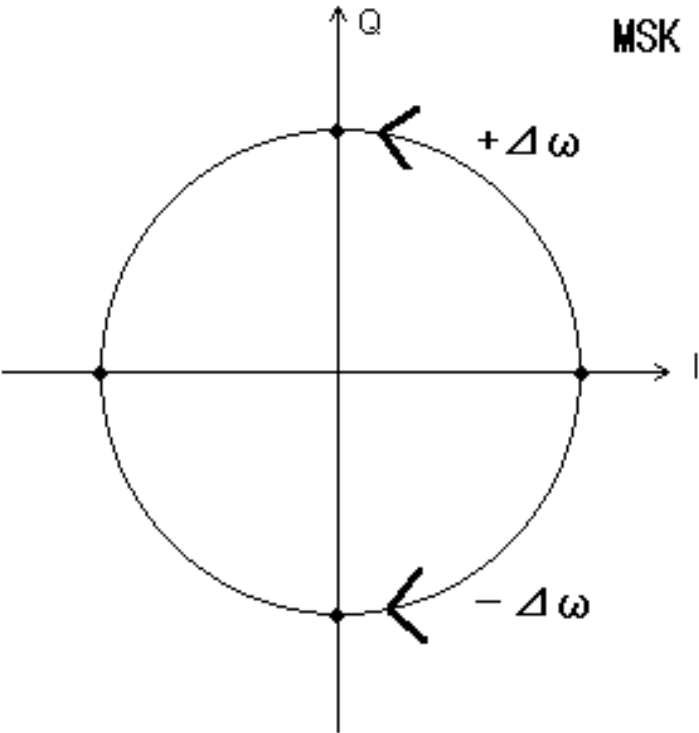


**Figure C-22.** MSK Symbol Allocation

MSK Symbol Data is shown in [Table C-22](#).

**Table C-22.** MSK Symbol Data

| Direction | Symbol data |
|-----------|-------------|
| +         | 1           |
| -         | 0           |



## 16APSK

16APSK Symbol Allocation is shown in [Figure C-23](#).

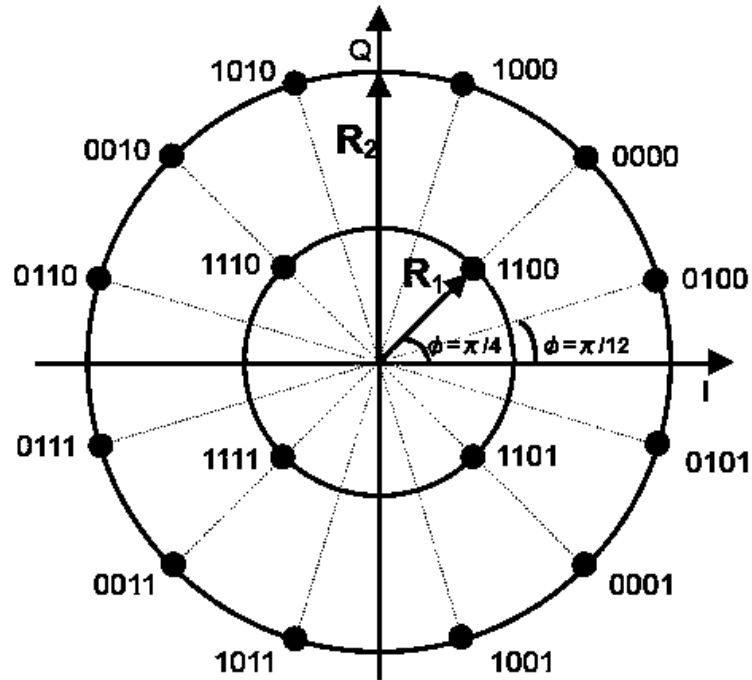


**Figure C-23.** 16APSK Symbol Allocation

16APSK Symbol Data is shown in [Table C-23](#).

**Table C-23.** 16APSK Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 0          | 0111        |
| 1          | 0101        |
| 2          | 1101        |
| 3          | 1111        |
| 4          | 0110        |
| 5          | 0100        |
| 6          | 1100        |
| 7          | 1110        |
| 8          | 0010        |
| 9          | 0000        |
| 10         | 1000        |
| 11         | 1010        |
| 12         | 0011        |

Table C-23. 16APSK Symbol Data

| Allocation | Symbol data |
|------------|-------------|
| 13         | 0001        |
| 14         | 1001        |
| 15         | 1011        |

## 32APSK

32APSK Symbol Allocation is shown in [Figure C-24](#).

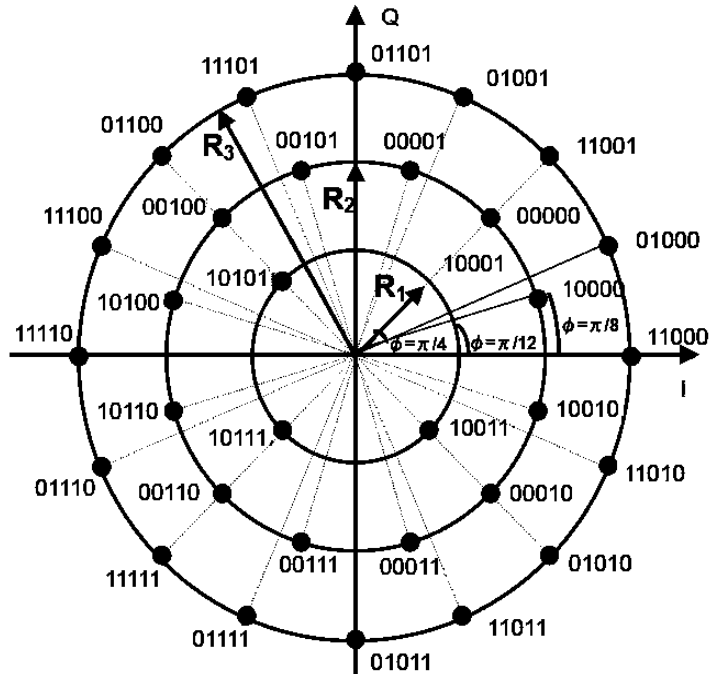


**Figure C-24.** 32APSK Symbol Allocation

32APSK Symbol Data is shown in [Table C-24](#).

**Table C-24.** 32APSK Symbol Data

| Allocation | Symbol data | Allocation | Symbol data |
|------------|-------------|------------|-------------|
| 0          | 11101       | 16         | 00110       |
| 1          | 01010       | 17         | 10011       |
| 2          | 11010       | 18         | 00000       |
| 3          | 01101       | 19         | 10000       |
| 4          | 00111       | 20         | 00011       |
| 5          | 10100       | 21         | 10110       |
| 6          | 00001       | 22         | 01111       |
| 7          | 10001       | 23         | 11100       |
| 8          | 00100       | 24         | 01001       |
| 9          | 10111       | 25         | 11001       |
| 10         | 01110       | 26         | 01100       |
| 11         | 11011       | 27         | 11111       |
| 12         | 01000       | 28         | 10101       |

Table C-24. 32APSK Symbol Data

| Allocation | Symbol data | Allocation | Symbol data |
|------------|-------------|------------|-------------|
| 13         | 11000       | 29         | 00010       |
| 14         | 01011       | 30         | 10010       |
| 15         | 11110       | 31         | 00101       |



# Appendix D — Filter Definition Settings

## D-1 Introduction

This section explains the User Defined Filter definition and the filter definition file description method.

## D-2 User Defined Filter Definition

The User Defined Filter is defined as shown below. When the Measuring Object is Frame Formatted or Non-Formatted.

- There must be a FIR filter coefficient string expressing the 8 times oversampling time response (as real number) for the symbol rate.
- The filter coefficient tap number must be an odd number in the range 1 to 501.
- The filter coefficient center must match the symbol timing.
- The FIR filter coefficient must be expressed by time response (as real number) at sampling rate of 5 MHz.
- The filter coefficient tap number must be an odd number in the range 1 to 10001.
- The delay of the filter that removes adjacent waves must be  $(\text{Filter coefficient tap number} - 1) / 2$ .
- Because the analysis software does not adjust the gain of filter coefficient, the gain adjustment must be made to the filter coefficient.

## D-3 User Defined Filter Definition File Description Method

This section explains the User Defined Filter definition file. The definition file is created in text format. Any file name and extension can be specified.

Observe the following rules when writing a configuration file:

1. The filter coefficient string is described sequentially as one real number declaration per line.
2. The line count must match the tap count. When the last line is just an LF code, it is not included in the line count.

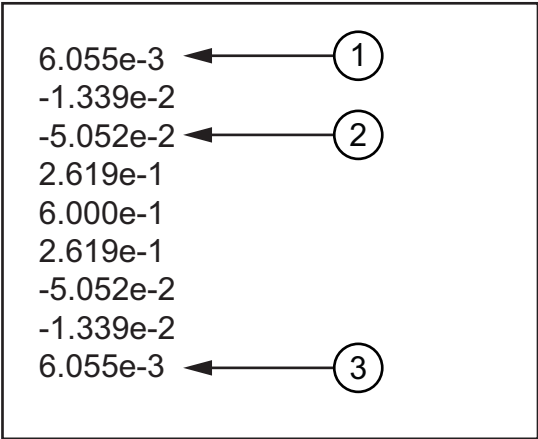
## D-4 Mapping Edit Setting File Description Example

Definition file description for 9 tap FIR filter example.

When the filter coefficient string is set as shown in [Table D-1](#), the setting file is described as shown in [Figure D-1](#)

Table D-1. 9 Tap FIR Filter Coefficient String

| Allocation | Filter Coefficient | Allocation | Filter Coefficient |
|------------|--------------------|------------|--------------------|
| 0          | 6.055e-3           | 5          | 2.619e-1           |
| 1          | -1.339e-2          | 6          | -5.052e-2          |
| 2          | -5.052e-2          | 7          | -1.339e-2          |
| 3          | 2.619e-1           | 8          | 6.055e-3           |
| 4          | 6.000e-1           | -          | -                  |



- 1. Specify the symbol data for allocation 0 on the first line.
- 2. LF code at end of each line.
- 3. The line count must match tap count but if the last line is an LF code, it is not included in line count.

Figure D-1. Mapping Edit Setting File Description Example

# Appendix E — Measurement Ranges and Settings

## E-1 Introduction

This section defines the MX280005A IQ Signal Master Software measurement range and settings when performing modulation IQ analysis.

- [“Measurement Symbol Rate Range”](#)
- [“Frequency Setting Range” on page E-2](#)
- [“Setting Capture Time” on page E-2](#)
- [“Carrier Frequency Accuracy” on page E-3](#)
- [“Residual EVM” on page E-4](#)
- [“Symbol Rate Error” on page E-5](#)
- [“Modulation/Frequency Measurement” on page E-6](#)

### Measurement Symbol Rate Range

**Table E-1.** Measurement Symbol Rate Range

| Modulation Method                                                                                   | Measurement Symbol Rate Range (symbol/s) |
|-----------------------------------------------------------------------------------------------------|------------------------------------------|
| QPSK<br>$\pi/4$ DQPSK<br>8PSK<br>16QAM<br>32QAM<br>64QAM<br>128QAM<br>256QAM<br>2ASK<br>4ASK<br>MSK | 0.1 k to 12.5 M                          |
| 2FSK<br>4FSK                                                                                        | 0.1 k to 6.25 M                          |



## Frequency Setting Range

**Table E-2.** Frequency Setting Range

| Condition                                                                           |                                 |                        |                                             |
|-------------------------------------------------------------------------------------|---------------------------------|------------------------|---------------------------------------------|
| Modulation Method                                                                   | Measuring Object                | Symbol Rate (symbol/s) | Frequency Setting Range                     |
| BPSK QPSK $\pi/4$ DQPSK<br>8PSK 16QAM 32QAM<br>64QAM 128QAM 256QAM<br>2ASK 4ASK MSK | Frame Format                    | >12.5 M                | 300 MHz to the upper limit of the main unit |
|                                                                                     | Non-Formatted (Capture OSR = 4) | >12.5 M                |                                             |
|                                                                                     | Non-Formatted (Capture OSR = 4) | >35 M                  |                                             |
|                                                                                     | 2FSK 4FSK                       | -                      |                                             |
| O-QPSK                                                                              | -                               | >3.125 M               |                                             |
| Other than above                                                                    |                                 |                        | 100 kHz to the upper limit of the main unit |

## Setting Capture Time

This mode specifies the capture time for each measurement. Sets the capture mode from Capture Time and the capture time length from Capture Time Length. The Capture Time Length setting range changes according to the Span. The Span is determined by the Symbol Rate See [Table E-3](#).

**Table E-3.** Maximum Capture Time

| Span      | Maximum Capture Time (s) |
|-----------|--------------------------|
| 1 kHz     | 2000                     |
| 2.5 kHz   | 2000                     |
| 5 kHz     | 2000                     |
| 10 kHz    | 2000                     |
| 25 kHz    | 2000                     |
| 50 kHz    | 1000                     |
| 100 kHz   | 500                      |
| 250 kHz   | 200                      |
| 500 kHz   | 100                      |
| 1 MHz     | 50                       |
| 2.5 MHz   | 20                       |
| 5 MHz     | 10                       |
| 10 MHz    | 5                        |
| 25 MHz    | 2                        |
| 31.25 MHz | 2                        |
| 50 MHz    | 0.5                      |
| 62.5 MHz  | 0.5                      |
| 100 MHz   | 0.5                      |
| 125 MHz   | 0.5                      |

## Symbol Rate Setting Range

**Table E-4.** Symbol Rate Setting Range

| Capture OSR | Modulation Method Applied as Default Value                                                                                                                          |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16          | O-QPSK                                                                                                                                                              |
| 8           | 2FSK, 4FSK, H-CPM                                                                                                                                                   |
| 4           | BPSK, DBPSK, $\pi/2$ DBPSK, QPSK, DQPSK, $\pi/4$ DQPSK, 8PSK, D8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, 2ASK, 4ASK, MSK, 16APSK, 32APSK |

## Carrier Frequency Accuracy

The Carrier Frequency Accuracy condition and is listed in [Table E-5](#).

**Table E-5.** Modulation/Frequency Measurement

| Modulation/Frequency Measurement                                                                  |                                                                                                                                                                           |                                                                            |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Measurement Level Range                                                                           | –15 to +30 dBm (at Pre-Amp Off, or Pre-Amp not installed.) –25 to +10 dBm (at Pre-Amp On)<br>After CAL performed at 18 to 28°C, For a signal of EVM = 1%, Capture OSR = 4 |                                                                            |
|                                                                                                   | Condition                                                                                                                                                                 | Carrier Frequency Accuracy                                                 |
| BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, MSK, $\pi/4$ DQPSK, 2ASK, 4ASK | Carrier Frequency 30 MHz to 3.5 GHz<br>(Symbol rate: 4 ksps to 5 Msps)                                                                                                    | $\pm$ (accuracy of reference frequency $\times$ carrier frequency + 10 Hz) |
| (512QAM, 1024QAM, 2048QAM)                                                                        | Carrier Frequency 800 MHz to 3.5 GHz<br>(Symbol rate: 5 to 50 Msps)                                                                                                       |                                                                            |
|                                                                                                   | Carrier Frequency 30 MHz to 3.5 GHz<br>(Symbol rate: 500ksps to 50 Msps)                                                                                                  |                                                                            |
| 16APSK, 32APSK)                                                                                   | Carrier Frequency 30 MHz to 3.5 GHz<br>(Symbol rate: 500ksps to 5 Msps)                                                                                                   |                                                                            |
|                                                                                                   | Carrier Frequency:<br>800 MHz to 3.5 GHz<br>(symbol rate 5 to 50 Msps)                                                                                                    |                                                                            |

## Residual EVM

The Residual EVM specifications are listed in [Table E-6](#).

**Table E-6.** Residual EVM

| Modulation/Frequency Measurement                        |                                                                                                                                                                                                         |              |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Measurement Level Range                                 | After CAL performed at 18 to 28°C when: Filter Type: Root Nyquist or Nyquist<br>The signal measured is within the measurement level range and less than or equal to Input Level and Average = 20 times. |              |
| Residual EVM                                            | Condition                                                                                                                                                                                               | Residual EVM |
| (BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM) | Symbol rate: 4 to 500 ksps,<br>Measurement time length: 50 ms or lower,<br>Carrier Frequency: 50 to 500 MHz                                                                                             | <0.5% (rms)  |
|                                                         | Symbol rate: 500 ksps to 5 Msps,<br>Carrier Frequency: 50 MHz to 3.5 GHz                                                                                                                                | <1.0% (RMS)  |
|                                                         | Symbol rate: 5 to 50 Msps,<br>Carrier Frequency: 800 MHz to 3.5 GHz                                                                                                                                     | <1.0% (RMS)  |
| $(\pi/4)$ DQPSK                                         | Symbol rate: 4 to 500 ksps,<br>Measurement time length: 50 ms or lower,<br>Carrier Frequency: 50 to 500 MHz                                                                                             | <0.5% (RMS)  |
|                                                         | Symbol rate: 500 ksps to 5 Msps,<br>Carrier Frequency: 50 MHz to 3.5 GHz                                                                                                                                | <1.0% (RMS)  |
|                                                         | Symbol rate: 5 to 50 Msps,<br>Carrier Frequency: 800 MHz to 3.5 GHz                                                                                                                                     | <1.0% (RMS)  |
| MSK                                                     | Symbol rate: 4 to 500 ksps,<br>Measurement time length: 50 ms or lower,<br>Carrier Frequency: 50 to 500 MHz                                                                                             | <0.5% (RMS)  |
|                                                         | Symbol rate: 500 ksps to 5 Msps,<br>Carrier Frequency: 50 MHz to 3.5 GHz                                                                                                                                | <1.0% (RMS)  |
|                                                         | Symbol rate: 5 to 50 Msps,<br>Carrier Frequency: 800 MHz to 3.5 GHz                                                                                                                                     | <1.0% (RMS)  |

**Table E-6.** Residual EVM

| Modulation/Frequency Measurement |                                                                                                                                                                                                         |              |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Measurement Level Range          | After CAL performed at 18 to 28°C when: Filter Type: Root Nyquist or Nyquist<br>The signal measured is within the measurement level range and less than or equal to Input Level and Average = 20 times. |              |
| Residual EVM                     | Condition                                                                                                                                                                                               | Residual EVM |
| 512QAM, 1024QAM, 2048QAM,)       | Symbol rate: 500 kbps to 5 Msps,<br>Carrier Frequency: 50 MHz to 3.5 GHz                                                                                                                                | <1.0% (RMS)  |
|                                  | Symbol rate: 5 to 50 Msps,<br>Carrier Frequency: 800 MHz to 3.5 GHz<br>(In the condition "Equalizer = On")                                                                                              | <1.0% (RMS)  |
| 16APSK, 32APSK)                  | Symbol rate: 500 kbps to 5 Msps,<br>Carrier Frequency: 50 MHz to 3.5 GHz                                                                                                                                | <1.0% (RMS)  |
|                                  | Symbol rate: 5 to 50 Msps,<br>Carrier Frequency: 800 MHz to 3.5 GHz                                                                                                                                     | <1.0% (RMS)  |

## Symbol Rate Error

The Symbol Rate error is listed in [Table E-7](#)

**Table E-7.** Symbol Rate Error

|                   |                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symbol Rate Error | After CAL execution at 18 to 28°C, according to the 10 MHz reference. when: Modulation Type: 2FSK, Filter Type: Gaussian, BT=0.5,<br>Symbol Rate 100 kbps, slot length 160 symbol,<br>The signal measured is within the measurement level range and less than or equal to Input Level, and Average = 10 times<br>30 MHz to 3.5 GHz,<br>Symbol rate error: <±1.0 ppm |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Amplitude Measurement

The Amplitude Measurement Specifications are listed in [Table E-8](#).

**Table E-8.** Amplitude Measurement

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement Level Range    | At Pre-Amp Off, or Pre-Amp not installed, refer to your Anritsu receiver or instrument Technical Data Sheet.<br><a href="https://www.anritsu.com/en-US/">https://www.anritsu.com/en-US/</a>                                                                                                                                                                                                                                             |
| Transmitter Power Accuracy | After CAL execution at 18 to 28°C, input attenuator $\geq 10$ dB, SPAN $\leq 31.25$ MHz. The signal measured is within the measurement level range and less than or equal to Input Level - 30 MHz to 3.5 GHz, $\pm 0.6$ dB (at Pre-Amp Off, or Pre-Amp not installed).<br>Transmitter power accuracy is calculated from an RSS (root summed square) error of the absolute amplitude accuracy and the in-band frequency characteristics. |

## Modulation/Frequency Measurement

The Modulation/Frequency Measurement Specifications are listed in [Table E-9](#)

**Table E-9.** Modulation/Frequency Measurement

| Modulation/Frequency Measurement                                                                  |                                                                                                                                                                                                                                                                          |                                                                                                |
|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Measurement Level Range                                                                           | At Pre-Amp Off, or Pre-Amp not installed, refer to your Anritsu receiver or instrument Technical Data Sheet. <a href="https://www.anritsu.com/en-US/">https://www.anritsu.com/en-US/</a><br>After CAL performed at 18 to 28°C, For a signal of EVM = 1%, Capture OSR = 4 |                                                                                                |
| Carrier Frequency Accuracy                                                                        | Condition                                                                                                                                                                                                                                                                | Carrier Frequency Accuracy                                                                     |
| BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, MSK, $\pi/4$ DQPSK, 2ASK, 4ASK | Carrier Frequency 30 MHz to 3.5 GHz<br>(Symbol rate: 4 ksps to 5 Msps)                                                                                                                                                                                                   | $\pm (\text{accuracy of reference frequency} \times \text{carrier frequency} + 10 \text{ Hz})$ |
| (512QAM, 1024QAM, 2048QAM)                                                                        | Carrier Frequency 800 MHz to 3.5 GHz<br>(Symbol rate: 5 to 50 Msps)                                                                                                                                                                                                      |                                                                                                |
|                                                                                                   | Carrier Frequency 30 MHz to 3.5 GHz<br>(Symbol rate: 500ksps to 50 Msps)                                                                                                                                                                                                 |                                                                                                |
| 16APSK, 32APSK)                                                                                   | Carrier Frequency 30 MHz to 3.5 GHz<br>(Symbol rate: 500ksps to 5 Msps)                                                                                                                                                                                                  |                                                                                                |
|                                                                                                   | Carrier Frequency:<br>800 MHz to 3.5 GHz<br>(symbol rate<br>5 to 50 Msps)                                                                                                                                                                                                |                                                                                                |





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