



EVAL-ADXL100X and EVAL-ADAQ7980 Speaker Demo User Guide

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Evaluating the Low Noise, High Frequency MEMS ADXL1001/ADXL1002/ADXL1004 (ADXL100x) Accelerometers Coupled to the ADAQ7980 16-Bit, 1 MSPS, μ Module® Data Acquisition System in LGA

FEATURES

(ADC)

Full featured evaluation board for the ADAQ7980
Versatile analog signal conditioning circuitry
On-board reference, reference buffers, and ADC drivers
SDP board-compatible (EVAL-SDP-CB1Z)
PC software for control and data analysis of time and frequency domain

(MEMS)

2 sets of spaced vias for populating 6-pin headers Easily attaches to prototyping board or PCB Small size and board stiffness minimizes impact on the user system and acceleration measurements

EVALUATION KIT CONTENTS

Assembled Speaker Demo*:

EVAL-ADAQ7980SDZ evaluation board
EVAL-SDP-CB1Z data capture board
(2) EVAL-ADXL100x
3" Speaker with AUX Cable
USB Cable
Power supply, +7.5 V/-2.5 V (optional)
Speaker-to-Sensor Fixture
Short/Long Connectors
Plastic Mounting Base
Screws
Nylon Nuts

*If not assembled, refer to the Speaker Demo Assembly Guide.

EQUIPMENT NEEDED

PC running Windows® XP SP2, Windows Vista, Windows 7, or higher with USB 2.0 port
Audio Capable Device with 3.5mm AUX Port (optional)

GENERAL DESCRIPTION

The EVAL-ADAQ7980SDZ is an evaluation board designed to demonstrate the low power ADAQ7980 performance and provide an easy to understand interface for a variety of system applications. The ADAQ7980 is a 16-bit, 1 MSPS, μ Module data acquisition system that integrates four common signal processing and conditioning blocks into a system in package (SiP) design that supports a variety of applications.

The evaluation board is ideal for use with the Analog Devices, Inc., system demonstration platform (SDP) board, EVAL-SDP-CB1Z. The EVAL-ADAQ7980SDZ interfaces to the SDP board via a 120-pin connector. P1, P2, P3, and P4 SMA connectors are provided to connect a low noise analog signal source.

The ADAQ798x Evaluation Software executable controls the evaluation board over the USB through the EVAL-SDP-CB1Z. A modified version of the software implements measurement displays relative to the accelerometer.

The EVAL-ADXL100x are simple evaluation boards that allow users to quickly evaluate the performance of the ADXL1001 and ADXL1002 vibration sensors. The EVAL-ADXL1001Z and EVAL-ADXL1002Z are specifically designed to mount onto a mechanical shaker and are constructed of an extra thick printed circuit board (PCB), measuring 0.8 inches square. Screw holes are supplied for rigid mounting to the shaker block. This design allows users to evaluate the full performance range of the ADXL1001 or ADXL1002 vibration sensor without having to solder the device to a separate test board. A simple RC low-pass filter is provided at the output with a -3 dB bandwidth of about 20 kHz. Components can be replaced to allow users to implement their own application specific low-pass filter on the output of the device.

The demo brings together the capabilities of both parts to demonstrate an effective system for vibration sensing in condition based monitoring applications

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EVAL-ADXL100X AND EVAL-ADAQ7980 SPEAKER DEMO

Figure 1.

GETTING STARTED

The following section contains the installation instructions for the [ADAQ798x Evaluation Software](#) and the drivers for the SDP hardware required for operation of the software. The evaluation software provides a graphical user interface (GUI) for quick evaluation of the [ADAQ7980](#).

SOFTWARE INSTALLATION PROCEDURES

Download the evaluation board software from the [ADAQ7980](#) product page on the Analog Devices website.

To install the software, take the following steps:

- Run the [ADAQ798x Evaluation Software](#) installation
- Run the [EVAL-SDP-CB1Z](#) SDP board drivers installation

Warning

Install the evaluation board software and drivers before connecting the [EVAL-ADAQ7980SDZ](#) evaluation board and [EVAL-SDP-CB1Z](#) board to the USB port of the PC to ensure the evaluation system is correctly recognized when it connects to the PC.

Installing the [ADAQ7980](#) Evaluation Board Software

To install the [ADAQ798x Evaluation Software](#),

1. Start the Windows operating system and download the software from the [EVAL-ADAQ7980SDZ](#) product page on the Analog Devices website.
2. Unzip the downloaded file.
3. Double-click the **setup.exe** file to begin the evaluation board software installation (see Figure 2).

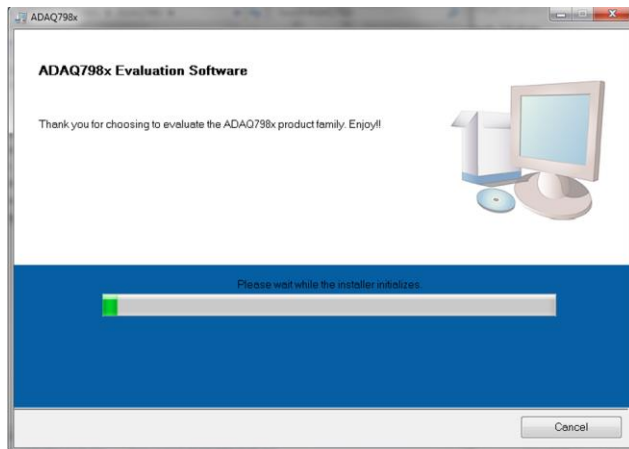


Figure 2. [ADAQ7980](#) Evaluation Board Software Installation—Installation Begins

4. Select a location to install the software and click **Next**. The default location is **C:\Program Files (x86)\Analog Devices\ADAQ798x**. This location also contains the executable software and example files.

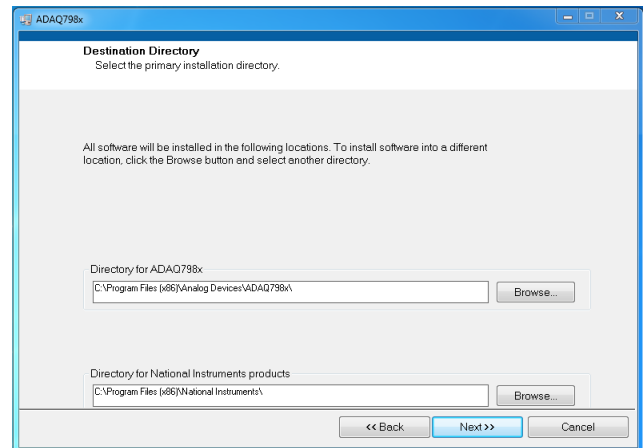


Figure 3. [ADAQ7980](#) Evaluation Board Software Installation—Selecting the Location for Software Installation (Default Location Shown)

5. A license agreement appears. Read the agreement, and then select **I accept the License Agreement**, and click **Next**.

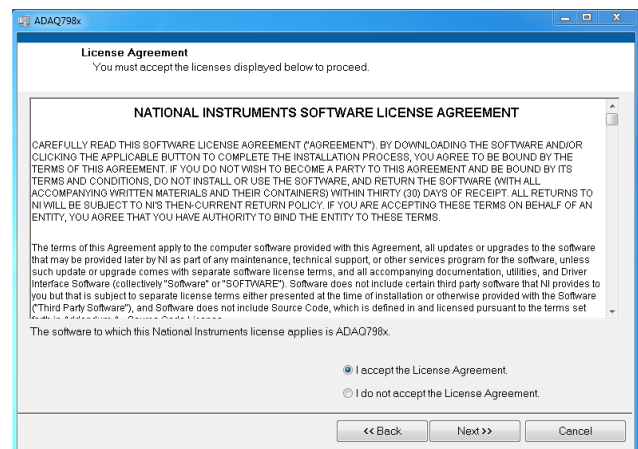


Figure 4. [ADAQ7980](#) Evaluation Board Software Installation—Accept the License Agreement

- An installation summary displays. Click **Next** to continue.

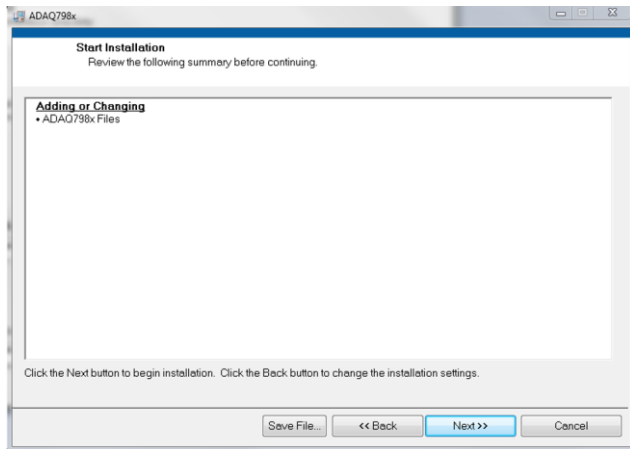


Figure 5. ADAQ7980 Evaluation Board Software Installation—Installation Summary

- A dialog box shows the installation progress.

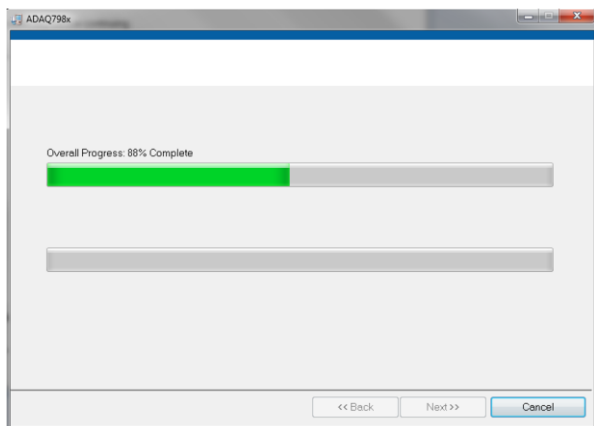


Figure 6. ADAQ7980 Evaluation Board Software Installation—Installation Progress

- The dialog box informs the user when the installation is complete. Click **Finish**.

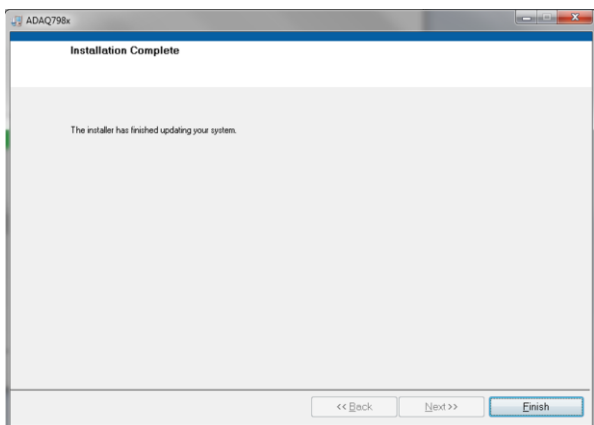


Figure 7. ADAQ7980 Evaluation Board Software Installation—Installation Complete

- The setup for the installation of the EVAL-SDP-CB1Z SDP board drivers automatically loads.



Figure 8. Loading the Setup for SDP Drivers Installation

Installing the EVAL-SDP-CB1Z SDP Board Drivers

After installation of the evaluation board software completes, a welcome window displays for the installation of the EVAL-SDP-CB1Z system demonstration platform board drivers. Then, take the following steps:

- Ensure all other applications are closed and click **Next**.



Figure 9. EVAL-SDP-CB1Z Drivers Setup: Beginning the Drivers Installation

- Select a location to install the drivers and click **Install**.

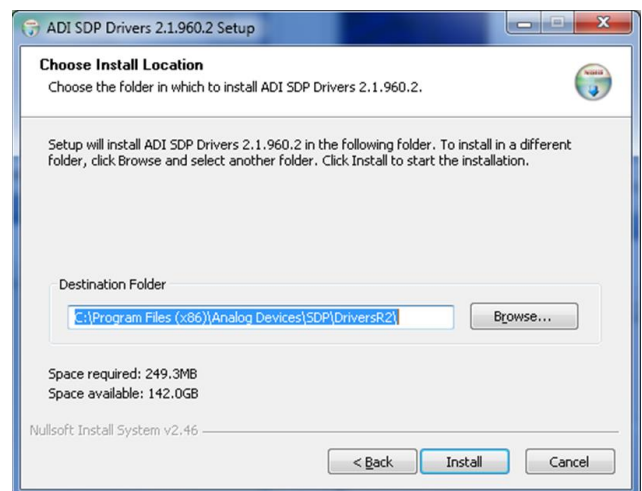


Figure 10. EVAL-SDP-CB1Z Drivers Setup: Selecting the Location for Drivers Installation

3. Installation of the SDP drivers begins.

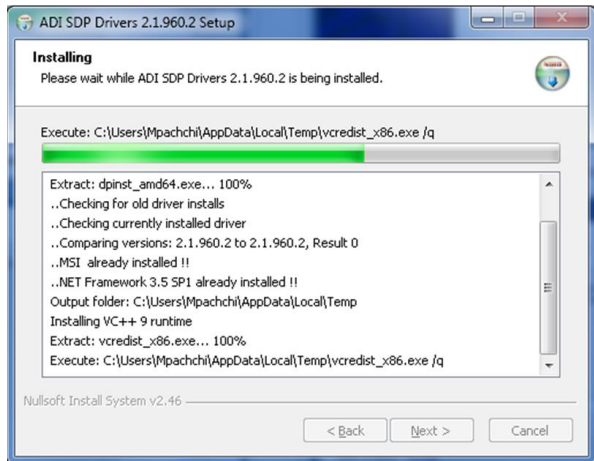


Figure 11. EVAL-SDP-CB1Z Drivers Setup—Beginning the Installation

4. A dialog box appears asking to install the SDP software available with the EVAL-SDP-CB1Z. Click **Install**.



Figure 12. EVAL-SDP-CB1Z Drivers Setup—Granting Permission to Install Drivers

5. To complete the drivers installation, click **Finish**, which closes the installation wizard.

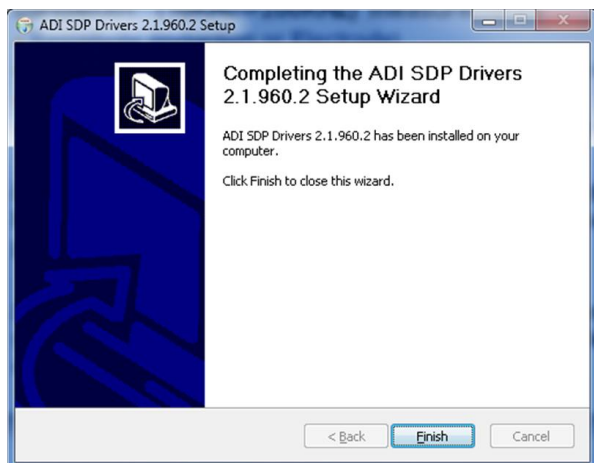


Figure 13. EVAL-SDP-CB1Z Drivers Setup: Completing the Drivers Setup Wizard

6. After installing the drivers, restart the PC prior to using the ADAQ798x Evaluation Software. A dialog box opens, giving the following options: **Restart**, **Shut Down**, and **Restart Later**. Click **Restart**.

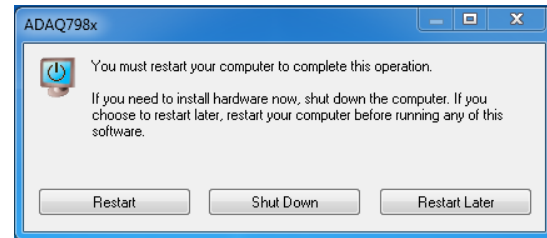


Figure 14. EVAL-SDP-CB1Z Drivers Setup: Restarting the PC

Verifying the Board Connection

To verify the evaluation board connection, take the following steps:

1. Allow the **Found New Hardware Wizard** to run after the **EVAL-SDP-CB1Z** board is plugged into the PC. If using Windows XP, the user may need to search for the **EVAL-SDP-CB1Z** drivers. Choose to automatically search for the drivers for the **EVAL-SDP-CB1Z** board if prompted by the operating system.
2. Verify that the **EVAL-ADAQ7980SDZ** is connected to the PC correctly using the **Device Manager** of the PC.
 - a. Access the **Device Manager** as follows:
 - i. Right-click **My Computer** and then click **Manage**.
 - ii. A dialog box appears asking for permission to allow the program to make changes to the PC. Click **Yes**.
 - iii. The **Computer Management** window appears. From the list of **System Tools**, click **Device Manager**.
 - b. Under **ADI Development Tools**, **Analog Devices System Development Platform SDP-B** appears (see Figure 15), indicating the **EVAL-SDP-CB1Z** driver software is installed and the **EVAL-ADAQ7980SDZ** is connected to the PC correctly.

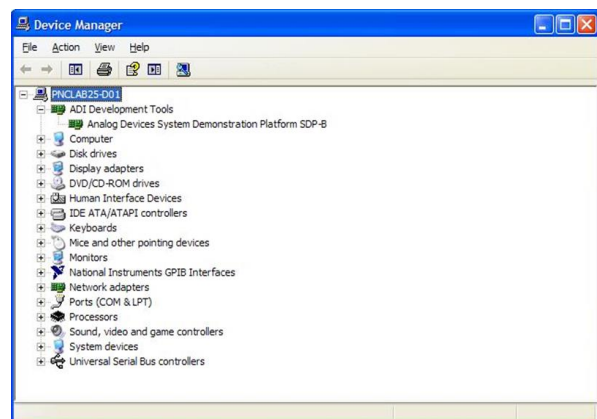


Figure 15. Device Manager: Checking the EVAL-ADAQ7980SDZ Is Connected to the PC Correctly

EVALUATION BOARD SOFTWARE SETUP PROCEDURES

EVALUATION BOARD CONNECTION SEQUENCE

With the evaluation software installed, use the following evaluation board operation/connection sequence:

1. Connect the SDP controller board to the evaluation board via the P8 connector (secure the connection using nylon screws). The software is configured to find the evaluation board on the J2 connector of the SDP board.
2. Power the [EVAL-ADAQ7980SDZ](#) with the appropriate supply, as described in the [ERROR! REFERENCE SOURCE NOT FOUND.](#) section.
3. Connect the [EVAL-SDP-CB1Z](#) board to a PC using the USB cable.
4. Start the evaluation software. Click **Start > All Programs > Analog Devices > ADAQ798x > ADAQ798x Evaluation Software**.

When the software starts running, it searches for Analog Devices hardware connected to the PC, first attempting to detect and connect to any SDP boards connected to the PC via the USB ports. If SDP boards are connected, the software attempts to detect the [EVAL-ADAQ7980SDZ](#) evaluation board connected to the SDP board. If the [EVAL-ADAQ7980SDZ](#) connects, the software runs in the standard operation mode. If it does not connect, a dialog box appears and prompts the user to either repeat the connection attempt or run the software in standalone mode.

With Hardware Connected

To run the program with hardware connected,

1. Follow Step 1 to Step 4 in the Evaluation Board Connection Sequence section.
2. The software then attempts to connect to the SDP board and the [EVAL-ADAQ7980SDZ](#). If the SDP board is not found, an error window displays (see Figure 16). If the SDP board is found but the [EVAL-ADAQ7980SDZ](#) is not detected, a different error window displays (see Figure 17). If either connectivity error displays, ensure the hardware is properly connected to the USB port of the PC, wait a few seconds, click **Rescan**, and follow the instructions.

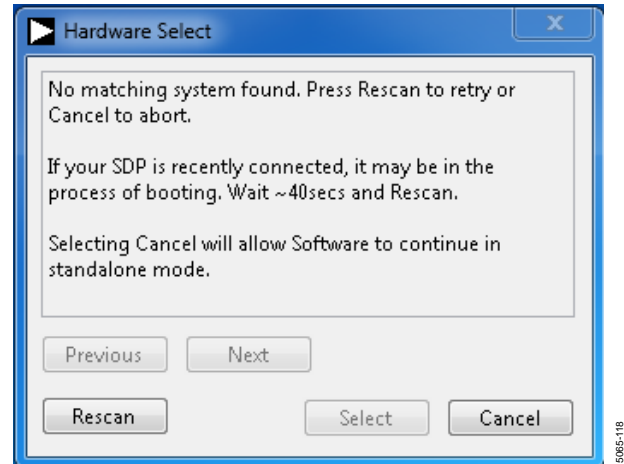


Figure 16. SDP Board Not Connected to the USB Port Pop-Up Window Error

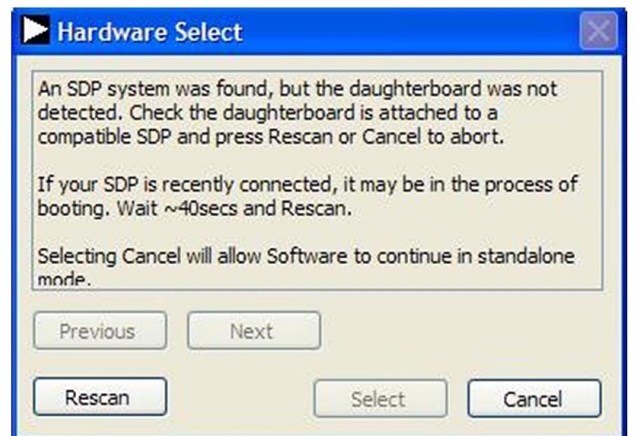


Figure 17. [EVAL-ADAQ7980SDZ](#) Not Connected to the USB Port Pop-Up Window Error

3. After finding the evaluation board, the software connects to the [EVAL-ADAQ7980SDZ](#) and displays the pop-up window shown in Figure 18.

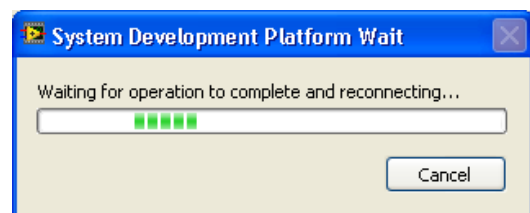


Figure 18. Software Connects to SDP Board

4. After the [EVAL-ADAQ7980SDZ](#) is detected, the main window of the software appears (see Figure 20), showing that the [EVAL-ADAQ7980SDZ](#) is connected.

Without Hardware Connected

The software can run in standalone mode when no evaluation board hardware is connected to the USB port. Use this mode to load previously saved states of the [ADAQ798x Evaluation Software](#) and view previously captured sets of data in the various windows of the software.

1. Click **Start > All Programs > Analog Devices > ADAQ798x > ADAQ798x Evaluation Software**.
2. The software attempts to connect to the evaluation hardware. If the hardware is not found, either of the error messages in Figure 16 or Figure 17 display. To continue without hardware in standalone mode, click **Cancel**.
3. If operating in standalone mode, the window in Figure 19 displays.
4. Load example files or previously saved files via **File > Load data**. The contents of the loaded file update the various plots in the software.
5. To connect the [EVAL-ADAQ7980SDZ](#) and run the software in standard operation, close and relaunch the software to allow it to repeat the search for the SDP board and the [EVAL-ADAQ7980SDZ](#) evaluation board.

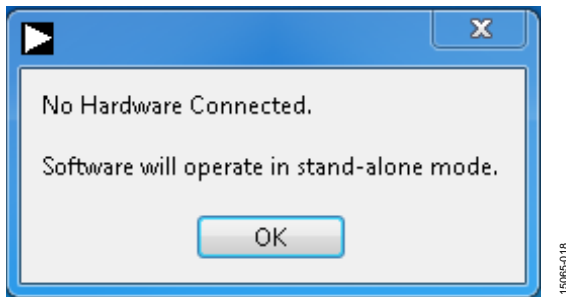


Figure 19. Software Indicates Operating in Standalone Mode

EVALUATION BOARD SOFTWARE

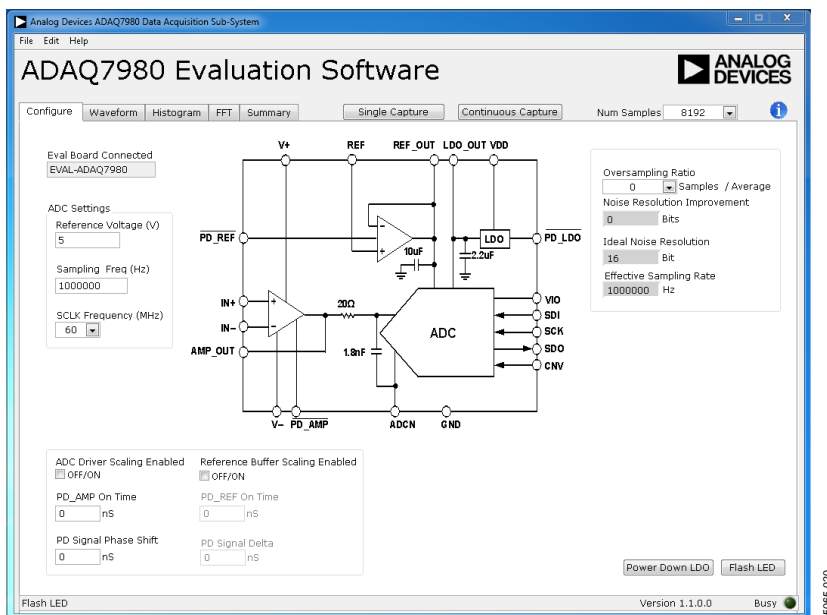


Figure 20. GUI Main Window

The following section gives a detailed description of the various controls and indicators in the [ADAQ798x Evaluation Software](#). For instructions on how to capture and analyze data, see the Evaluation Hardware and Software Operation section.

OVERVIEW OF THE MAIN WINDOW

The main window of the software is shown in Figure 20. The following sections describe the various controls that are accessible via this window.

File Menu

The **File** menu provides the following options:

- **Load data**—load previously captured data.
- **Save Data as .tsv**—save captured data in .tsv format for future analysis.
- **Save Picture**—save the current screen capture as a JPEG file.
- **Print**—print the current window to the default printer.
- **Exit**—close the application.

Edit Menu

The **Edit** dropdown menu provides the **Reinitialize Default Values** option that resets controls to their default state.

Help Menu

The **Help** menu provides the following options:

- The **Analog Devices Website** option opens the Analog Devices website in the default browser.
- The **User Guide** option opens the [EVAL-ADAQ7980SDZ](#) user guide.
- The **Context Help** option opens a window containing information about the controls of the software. Help

text displays in the window when the mouse hovers over a control.

- The **About** option opens a window displaying the software version information.

Tabs

There are five tabs available in the tabs area of the main window: **Configure**, **Waveform**, **Histogram**, **FFT**, and **Summary**. These tabs display the data in different formats. Navigation tools are provided within each tab to allow the user to control the cursor, zooming, and panning (see Figure 21) within the graphs displayed.

Each tab and their respective controls and functions are described in the following sections.

Single Capture Button

Click **Single Capture** to perform a single set of captures from the ADC. The number of captures is determined by the value in **Num Samples**.

Continuous Capture Button

Click **Continuous Capture** to perform repeated sets of captures from the ADC. The number of samples per capture set is determined by the value in **Num Samples**.

Num Samples Dropdown Box

The **Num Samples** dropdown box allows the user to select the number of samples to analyze per capture window.

Busy Indicator

The **Busy** indicator indicates when the software is performing operations, for example, when running conversions and analysis.

Exit Button

Click the **Exit** button to close the software; alternatively, users can select **Exit** from the **File** menu.

CONFIGURE TAB

The following contains information on the various controls accessible in the **Configure** tab.

Eval Board Connected Field

The **Eval Board Connected** field displays **EVAL-ADAQ7980** when the evaluation board is connected to the USB port.

When an evaluation board is not connected to the USB port, the software can operate in standalone mode for data analysis.

ADC Settings

The **ADC Settings** allow changing the sampling rate and serial clock frequency via the **Sampling Freq (Hz)** field and **SCLK Frequency (MHz)** dropdown menu, respectively.

The reference voltage for the [ADAQ7980](#) must be specified in the **Reference Voltage (V)** field. Use this field for data analysis only; it does not alter nor detect the reference voltage on the [EVAL-ADAQ7980SDZ](#). For correct data interpretation, input the reference voltage being used on the evaluation board.

By default, the external reference voltage is 5 V ([ADR4550](#) on-board reference). The minimum and maximum voltage calculations are based on this reference voltage. When changing the reference voltage, change this input accordingly.

The **Sampling Freq (Hz)** field sets the sample rate of the [ADAQ7980](#), which is equivalent to the frequency of the contingent negative variation (CNV) signal of the device. The maximum sample rate of the [ADAQ7980](#) is 1 MHz; therefore, the **Sampling Freq (Hz)** field does not allow values larger than 1,000,000. This control can interpret SI prefixes. Units can be entered as, for example, **10k** for 10,000 Hz.

Oversampling Ratio

The **Oversampling Ratio** dropdown menu allows users to select the oversampling ratio to improve system dynamic range. The oversampling ratio is calculated as 2^{2N} , where N is the number of bits selected. For example, if N is selected as 2, then 16 consecutive samples are averaged together to produce one sample. This effectively reduces the ADC Nyquist rate by

a factor of the over-sampling ratio, but at the benefit of increased resolution.

Dynamic Power Scaling

The Dynamic Power Scaling pane provides dynamic power scaling (DPS) configuration options for both the ADC driver and the reference buffer. DPS is a power-saving functionality of the [ADAQ7980](#). See the [ADAQ7980/ADAQ7988](#) data sheet for a description of DPS.

Both ADC driver DPS settings are controlled by the **ADC Driver Scaling Enabled OFF/ON** box, the **PD_AMP On Time** field, and **PD Signal Phase Shift** field. The reference buffer DPS settings are controlled by the **Reference Buffer Scaling Enabled OFF/ON** check box, the **PD_REF On Time** field, and the **PD Signal Delta** field. These controls do the following:

- **ADC Driver Scaling Enabled OFF/ON** activates DPS for the ADC driver when checked. When unchecked, DPS is deactivated, leaving the device on constantly.
- **PD_AMP On Time** sets the ADC driver on time in a sample period. If the value in **PD_AMP On Time** is larger than the sample period, the amplifier remain active.
- **PD Signal Phase Shift** sets the offset of the ADC driver on time relative to the CNV signal.
- **Reference Buffer Scaling Enabled OFF/ON** activates DPS for the reference buffer when checked. When unchecked, DPS is deactivated, leaving the device on constantly.
- **PD_REF On Time** sets the reference buffer on time in a sample period. If the value in **PD_REF On Time** is larger than the sample period, the amplifier remains active.
- **PD Signal Delta** sets the offset of the reference buffer on time relative to the CNV signal.

Power Down LDO Button

The **Power Down LDO** button powers down the [ADAQ7980](#) integrated LDO, which allows evaluation of the power consumption of the [ADAQ7980](#) while in its power-down state.

The **Power Down LDO** button is not part of the evaluation software DPS functionality (see the Dynamic Power Scaling section for more information).

Flash LED Button

The **Flash LED** button flashes the LED on the [EVAL-SDP-CB1Z](#) board. Verify that the [EVAL-ADAQ7980SDZ](#) and the [EVAL-SDP-CB1Z](#) are connected.

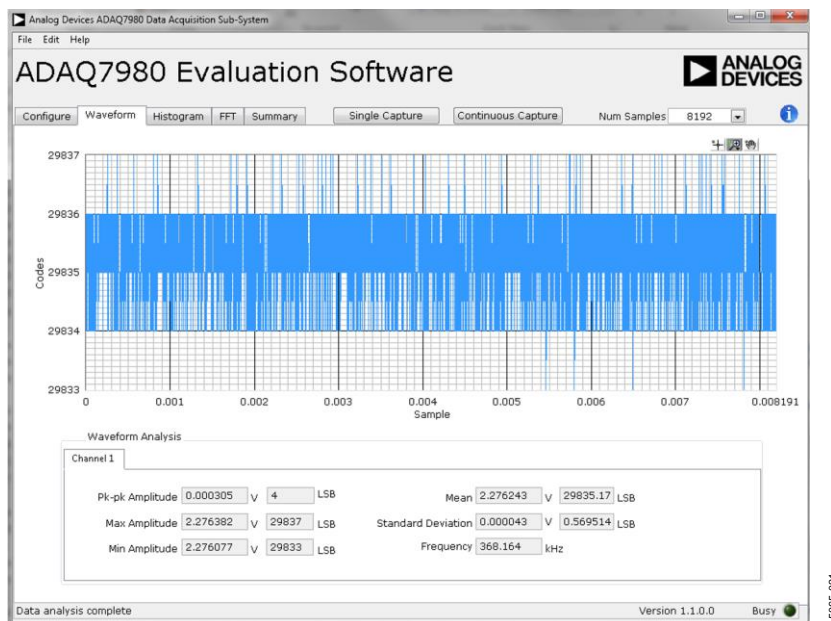


Figure 21. Waveform Tab

WAVEFORM TAB

The following sections contain information on the contents of the **Waveform** tab (see Figure 21).

Waveform Plot

The waveform plot displays the raw [ADAQ7980](#) results obtained during the most recent capture burst. See the Generating a Waveform Analysis Report section for more information.

Waveform Analysis

The **Waveform Analysis** pane displays important analysis parameters on the data in the waveform plot. The indicators (except **Frequency**) are displayed in both volts (V) and codes (LSB). The analysis items reference the signal at the AMP_OUT pin of the [ADAQ7980](#).

The indicators include the following:

- **Pk-pk Amplitude** displays the difference between the maximum and minimum values in the data.
- **Max Amplitude** displays the maximum value in the data.
- **Min Amplitude** displays the minimum value in the data.
- **Mean** displays the average value of the data.
- **Standard Deviation** displays the standard deviation of the data.
- **Frequency** displays the frequency with the largest amplitude in the data and is only displayed in **kHz** (see FFT Analysis section).

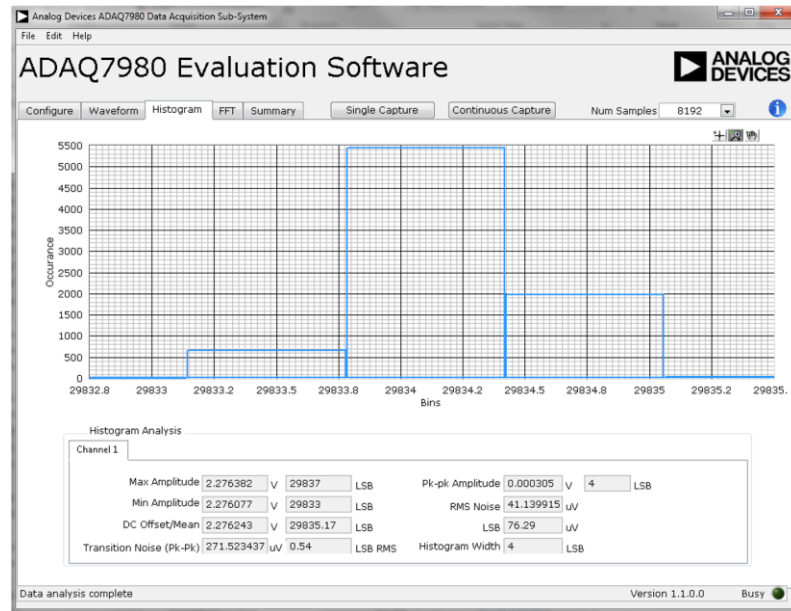


Figure 22. Histogram Tab

HISTOGRAM TAB

Histogram Plot

The histogram plot contains a histogram of the results obtained during the most recent capture burst (see Figure 22). This plot shows the number of occurrences for each code in the results. See the Generating a Histogram of the ADC Code Distribution section for more information.

Histogram Analysis

The **Histogram Analysis** pane displays important analysis parameters on the data in the histogram plot. The indicators are displayed in volts (V) and codes (LSB), unless otherwise specified. The analysis items reference the signal at the AMP_OUT pin of the [ADAQ7980](#).

The parameters include the following:

- **Max Amplitude** displays the maximum value in the data.
- **Min Amplitude** displays the minimum value in the data.
- **DC Offset/Mean** displays the average value of the data.
- **Transition Noise (Pk-Pk)** displays the peak-to-peak value of the noise of the signal (displayed in μ V and LSB RMS).
- **Pk-pk Amplitude** displays the difference between the maximum and minimum values in the data.
- **RMS Noise** displays the rms value of the data (displayed in μ V).
- **LSB** displays the equivalent voltage difference between each code value (displayed in μ V). This value is determined by the **Reference Voltage (V)** control in the **Configure** tab.
- **Histogram Width** displays the maximum code in the histogram minus the minimum code in the histogram (displayed in LSB).

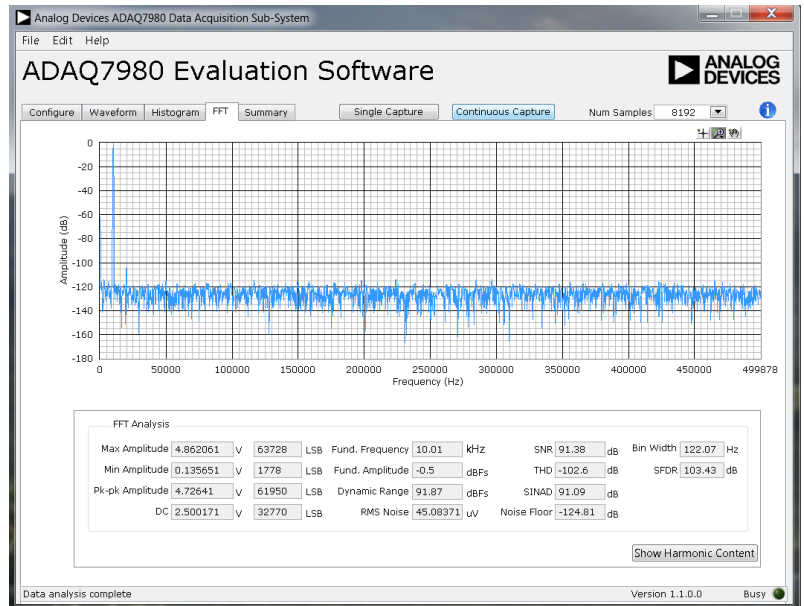


Figure 23. FFT Tab

FFT TAB

The following contains information on the contents of the **FFT** tab (see Figure 23).

FFT Plot

The FFT plot displays frequency analysis of the raw [ADAQ7980](#) results from the most recent capture burst. See the Generating an FFT of AC Characteristics section for more information.

FFT Analysis

The **FFT Analysis** pane displays important ac analysis parameters of the data in the FFT plot. The analysis items reference the signal at the AMP_OUT pin of the [ADAQ7980](#).

The parameters include the following:

- **Max Amplitude** displays the maximum value in the data (displayed in **V** and **LSB**).
- **Min Amplitude** displays the minimum value in the data (displayed in **V** and **LSB**).
- **Pk-pk Amplitude** displays the difference between the maximum and minimum values in the data (displayed in **V** and **LSB**).
- **DC** displays the average value of the data (displayed in **V** and **LSB**).
- **Fund. Frequency** displays the frequency with the largest amplitude in the FFT (displayed in **kHz**).
- **Fund. Amplitude** displays the amplitude of the **Fund. Frequency** value (displayed in **dBFS**, which is dB relative to the reference voltage).
- **Dynamic Range** displays the ratio of a full-scale signal (which is the largest signal the [ADAQ7980](#) can accept with amplitude equal to the reference voltage) to the noise floor value (displayed in **dBFS**).
- **RMS Noise** displays the rms voltage of the noise floor in the FFT plot. Specifically, this calculation includes all frequency bins in the FFT plot that are not displayed in the **Show Harmonic Content** window. This value is used in calculations for **Dynamic Range**, **SNR**, **SINAD**, and **SFDR** values.
- **SNR** displays the ratio of the **Fund. Amplitude** value to the **RMS Noise** value displayed in **dB**.
- **THD** displays the ratio of the energy in second through fifth harmonic frequencies to that of the **Fund. Frequency** value (displayed in **dB**).
- **SINAD** displays the ratio of the **Fund. Amplitude** value to the **RMS Noise** value and amplitude of the second through fifth harmonic frequencies (displayed in **dB**).
- **Noise Floor** displays the ratio of the **RMS Noise** value and the full-scale range of the [ADAQ7980](#) set by **Reference Voltage** in the **Configure** tab (displayed in **dB**).
- **Bin Width** displays the range of frequencies included in each point drawn on the FFT plot. A smaller **Bin Width** value corresponds with higher resolution in frequency amplitude information in the FFT plot, affected by the **Sampling Freq** and **Num Samples** in the **Configure** tab values. For example, increasing the **Num Samples** value while leaving **Sampling Freq** constant results in a smaller **Bin Width** value.
- **SFDR**, the spurious-free dynamic range, displays the ratio of the **Fund. Amplitude** value to the largest spurious frequency amplitude (displayed in **dB**).
- The **Show Harmonic Content** button toggles a display showing the **Fund. Frequency** value and the harmonics amplitudes. Frequencies are displayed in **kHz** and amplitudes in **dBFS**.

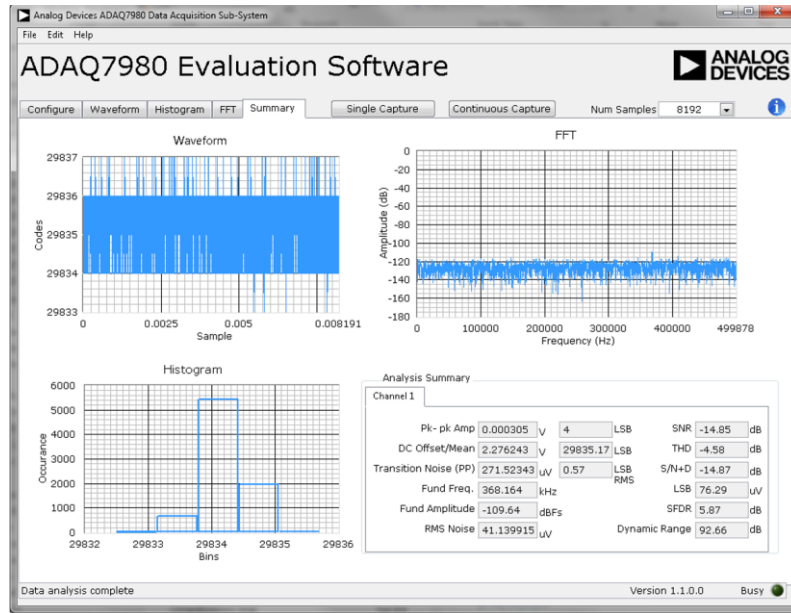


Figure 24. Summary Tab

SUMMARY TAB

The following contains information on the contents of the **Summary** tab (see Figure 24).

Waveform Plot

The **Waveform** plot displays the raw **ADAQ7980** results obtained during the most recent capture burst. See the Generating a Waveform Analysis Report section for more information.

Histogram Plot

The **Histogram** plot contains a histogram of the results obtained during the most recent capture burst. This shows the number of occurrences for each code in the results. See the Generating a Histogram of the ADC Code Distribution section for more information.

FFT Plot

The **FFT** plot displays frequency analysis of the raw **ADAQ7980** results from the most recent capture burst. See the Generating an FFT of AC Characteristics section for more information.

Analysis Summary Window

The **Analysis Summary** pane displays important analysis parameters on the various plots in the **Summary** tab, including the following:

- **Pk-pk Amp** displays the difference between the maximum and minimum values in the data (displayed in **V** and **LSB**).

- **DC Offset/Mean** displays the average value of the data (displayed in **V** and **LSB**).
- **Transition Noise (PP)** displays the peak-to-peak value of the noise of the signal (displayed in μ V and **LSB RMS**).
- **Fund Freq.** displays the frequency with the largest amplitude in the **FFT** plot (displayed in **kHz**).
- **Fund Amplitude** displays the amplitude of the **Fund Freq.** value (displayed in **dBFS**).
- **RMS Noise** displays the rms voltage of the noise floor in the **FFT** plot (displayed in μ V).
- **SNR** displays the ratio of the **Fund Amplitude** value to the **RMS Noise** value (displayed in **dB**).
- **THD** displays the ratio of the energy in second through fifth harmonic frequencies to that of the **Fund Freq.** value (displayed in **dB**).
- **S/N+D** displays the ratio of the **Fund Amplitude** value to the **RMS Noise** value and amplitude of the second through fifth harmonic frequencies (displayed in **dB**).
- **LSB** displays the equivalent voltage difference between each code value (displayed in μ V).
- **SFDR** displays the ratio of the **Fund Amplitude** value to the largest spurious frequency amplitude (displayed in **dB**).
- **Dynamic Range** displays the ratio of a full-scale signal, which is the largest signal the **ADAQ7980** can accept with amplitude equal to the **Reference Voltage (V)** value (in the **Configure** tab) to the noise floor value (displayed in **dBFS**).

EVALUATION HARDWARE AND SOFTWARE OPERATION

The following sections outline how to use the [ADAQ798x Evaluation Software](#) to capture, analyze and view conversion results from the [ADAQ7980](#).

CAPTURING CONVERSION RESULTS

The following describes how to collect conversion results from the [EVAL-ADAQ7980SDZ](#):

1. Set the various controls in the **Configure** tab to the desired values. See the **Configure Tab** section for a detailed description of these controls.
2. Once these controls are set, press either the **Single Capture** or the **Continuous Capture** buttons in the main window to initial conversions. See the **Overview of the Main Window** section for more information on these controls.

GENERATING A WAVEFORM ANALYSIS REPORT

Figure 21 illustrates the **Waveform** tab for a dc input signal when using the on-board 5 V external reference.

The **Waveform Analysis** pane reports the amplitudes recorded from the captured signal and the frequency of the signal tone.

GENERATING A HISTOGRAM OF THE ADC CODE DISTRIBUTION

The **Histogram** tab can perform ac testing or, more commonly, dc testing. This tab shows the ADC code distribution of the input and computes the mean and standard deviation, which are displayed as **DC Offset/Mean** and **Transition Noise (Pk-Pk)**, respectively, in the **Histogram Analysis** pane.

Figure 22 shows the histogram of a dc signal applied to the ADC input along with the resulting calculations.

AC Input

To perform a histogram test of ac input,

1. Apply a sinusoidal signal with low distortion (better than 100 dB) to the evaluation board at the P1/P2 input SMA connector pair.
2. Click the **Histogram** tab from the main window.
3. Click the **Single Capture** or **Continuous Capture** button.

Raw data is then captured and passed to the PC for statistical computations, and various measured values are displayed in the **Histogram Analysis** pane.

DC Input

To perform a histogram test of dc input,

1. If using an external source, apply a signal to the evaluation board at the P1/P2 input SMA connector pair. It can be required to filter the signal to ensure that the dc source is noise compatible with the ADC.
2. Click the **Histogram** tab from the main window.
3. Click the **Single Capture** or **Continuous Capture** button.

Raw data is then captured and passed to the PC for statistical computations, and various measured values are displayed in the **Histogram Analysis** pane.

GENERATING AN FFT OF AC CHARACTERISTICS

Figure 23 shows the **FFT** tab. This feature tests the traditional ac characteristics of the ADC and displays an FFT plot of the results.

To perform an ac FFT test,

1. Apply a sinusoidal signal with low distortion (better than 100 dB) to the evaluation board at the P1/P2 input SMA connector pair. To attain the requisite low distortion, which is necessary to allow true evaluation of the [ADAQ7980](#), one option is to
 - a. Filter the input signal from the ac source. A band-pass filter can be used; its center frequency must match the test frequency of interest.
 - b. If using a low frequency band-pass filter when the full-scale input range is more than a few volts peak-to-peak, use the on-board amplifiers to amplify the signal, thus preventing the filter from distorting the input signal.
2. Click the **FFT** tab from the main window.
3. Click the **Single Capture** button or **Continuous Capture** button.

As in the histogram test, raw data is then captured and passed to the PC, which performs the FFT and displays the resulting signal-to-noise ratio (SNR), signal-to-noise-and-distortion ratio (SINAD), total harmonic distortion (THD), and spurious-free dynamic range (SFDR).

The **FFT Analysis** pane displays the results of the captured data.

GENERATING A SUMMARY OF THE WAVEFORM, HISTOGRAM, AND FAST FOURIER TRANSFORM

Figure 24 shows the **Summary** tab. The **Summary** tab captures all the display information and provides it in one pane with a synopsis of the information, including key performance parameters such as SNR and THD.

OPERATING THE EVALUATION SOFTWARE IN STANDALONE MODE

The software can run in standalone mode when no evaluation board hardware is connected to the USB port. Conversions cannot be performed in this mode, but previously acquired results can be loaded and viewed in the evaluation software environment. Selecting **File > Load Data** loads a dialogue box prompting the file to load. The results can then be viewed in the **Waveform**, **Histogram**, **FFT**, and **Summary** tabs.

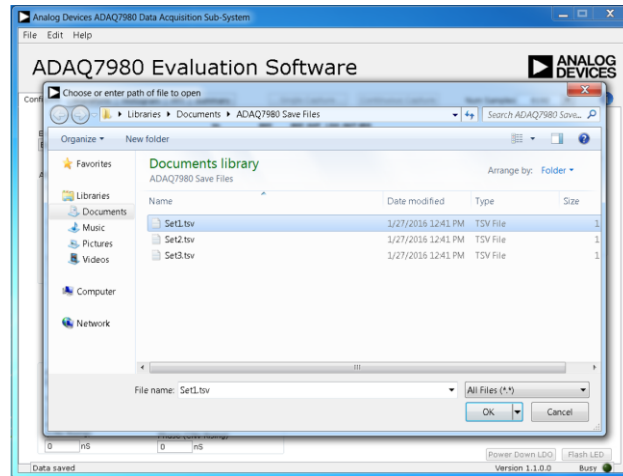


Figure 25. Loading File Menu

MODIFIED SOFTWARE

The modified version of the software includes extra features in the FFT tab related to the accelerometer. The plot units can be adjusted to display G, mV, and ug/rt(Hz). The X and Y scale can be adjusted to be linear or logarithmic. The sensitivity of the accelerometer can be entered to act as a scaling factor, as well as noise bandwidth. There is also an indicator for noise level.

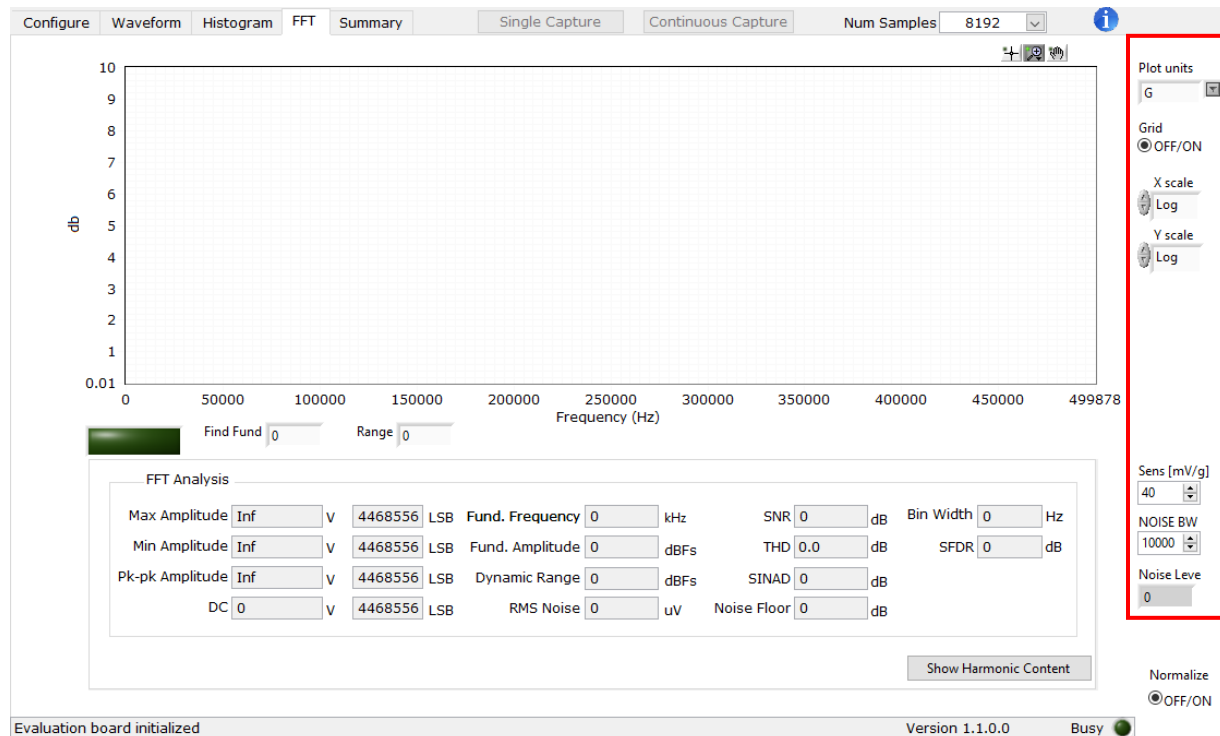


Figure 28. Software Modifications

GENERATING SIGNALS WITH THE SPEAKER

To utilize the software once it is downloaded, an audio file must be played through the speaker. To ensure proper function, it is advised to test the system with discrete tones to ensure that the software yields the proper response in the FFT window. For example, generating a 100Hz tone should generate a peak at 100Hz in the FFT window. Another good test is to perform a frequency sweep and view the FFT window. The peak should travel across the frequency range.

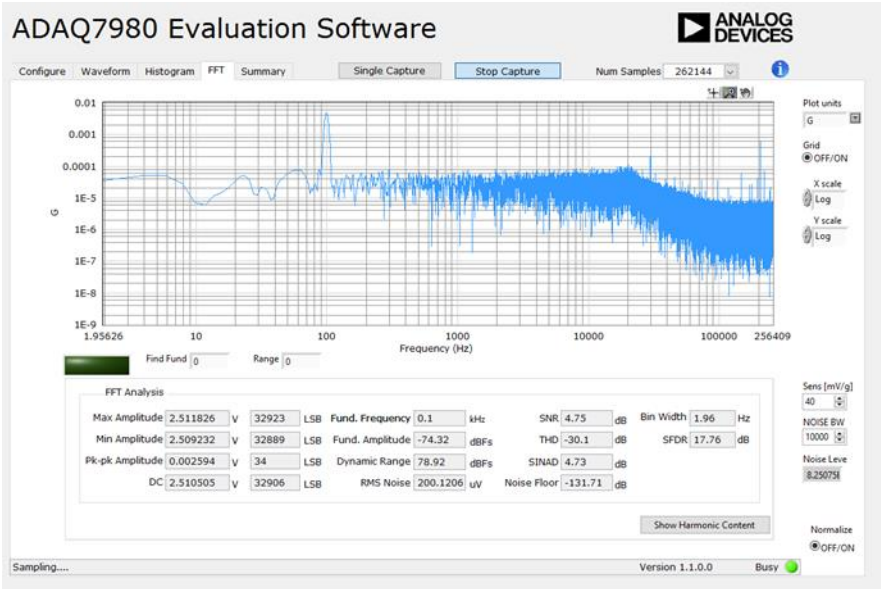


Figure 29. 100Hz Tone in FFT Window

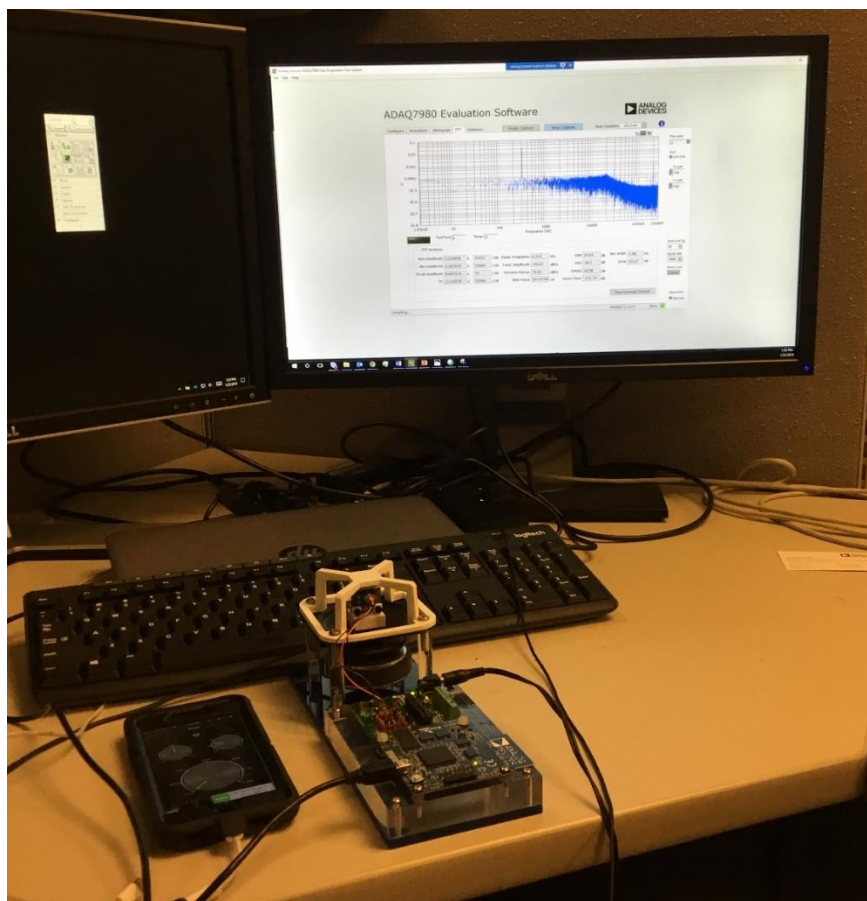


Figure 30. Example of a Full System Setup



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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