

EVM User's Guide: ADC3669EVM-DC

ADC3669EVM-DC Evaluation Module



Description

The ADC3669EVM-DC is an evaluation module (EVM) designed to evaluate the ADC3669 family of high-speed analog-to-digital converters (ADCs) with a DC-coupled frontend circuit. The ADC3669EVM-DC is populated with an ADC3669. The ADC3669 is a 16-bit ADC, dual-channel ADC with a low-voltage differential signaling (LVDS) interface, and can operate at sample rates up to 500MSPS. The amplifier used on the ADC3669EVM-DC is the LMH5401, which is an 8GHz ultra wideband fully differential amplifier.

Get Started

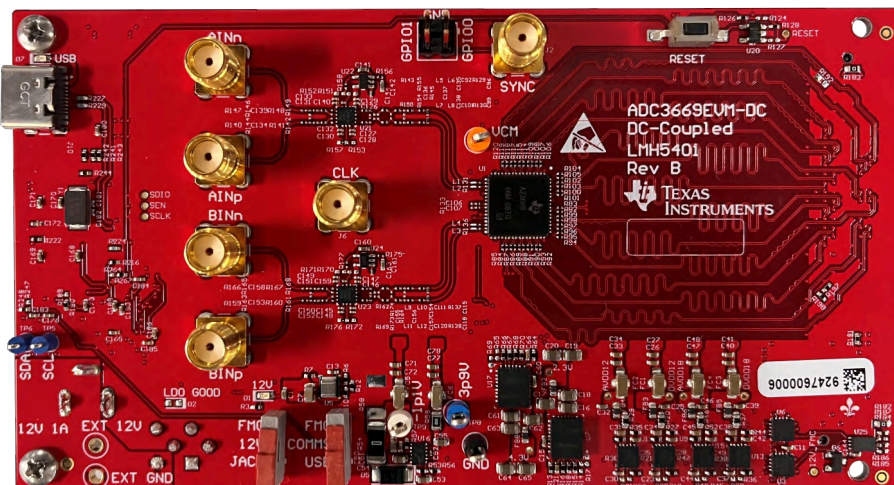
1. Order the [EVM](#) from ti.com
2. Download the latest revision of the [ADC3669 data sheet](#).
3. Download the latest revision of the [LMH5401 data sheet](#).
4. Download the latest [ADC3669EVM-GUI](#).
5. Download the comprehensive reference design files from the [tools page of the EVM](#).

Features

- Noise spectral density: -159dBFS/Hz
- Thermal noise: 75dBFS
- Full power input bandwidth (-3dB): 1.5GHz
- Power consumption: 300mW/channel (500MSPS)
- Digital down-converters, up to two per channel, complex and real decimation up to /16384
- 48-bit NCO phase coherent frequency hopping
- DDR/Serial LVDS interface: 16-bit or 32-bit output mode

Applications

- [Software defined radio](#)
- [Spectrum analyzer](#)
- [Radar](#)
- Spectroscopy
- Power amplifier linearization
- [Communications infrastructure](#)



ADC3669EVM

1 Evaluation Module Overview

1.1 Introduction

The ADC3669EVM-DC allows for evaluation of all the devices in the ADC3669 family, as the devices are all pin-to-pin compatible. The ADC3669EVM-DC is populated with an ADC3669, which can be configured to emulate the other variants in the device family. These devices include:

- ADC3669 (dual channel, 16-bit, 500MSPS)
- ADC3668 (dual channel, 16-bit, 250MSPS)
- ADC3649 (dual channel, 14-bit, 500MSPS)
- ADC3648 (dual channel, 14-bit, 250MSPS)
- ADC3569 (single channel, 16-bit, 500MSPS)
- ADC3568 (single channel, 16-bit, 250MSPS)
- ADC3549 (single channel, 14-bit, 500MSPS)
- ADC3548 (single channel, 14-bit, 250MSPS)

The EVM is configured to receive external single-ended analog inputs, or differential analog inputs as the EVM includes frontend circuitry with the LMH5401 fully differential amplifier. The sample clock is sourced externally and is single-ended.

For data capture, the ADC3669EVM-DC is paired with the TSWDC155EVM. The TSWDC155EVM is an FPGA data capture card which features the AMD Artix-7 FPGA. The ADC data, captured by the FPGA, is then transferred to the PC and displayed in the HSDC Pro capture software.

1.2 Kit Contents

Table 1-1. ADC3669EVM Kit Contents

Item	Description	Quantity
ADC3669EVM-DC	PCB	1
USB C Cable	Cable	1
DC Jack power supply pigtail	Cable	1
JTAG-HS2 Programming Dongle	Dongle	1

1.3 Specification and Device Information

Additional device information and specifications for the ADC3669 can be found in the ([ADC3668](#), [ADC3669 Dual-Channel, 16-Bit 250MSPS and 500MSPS Analog-to-Digital Converter \(ADC\)](#) data sheet).

2 Hardware

This section details the required hardware tools necessary to effectively use the ADC3669EVM-DC.

2.1 Board Overview

The following image highlights some key features of the ADC3669EVM-DC.

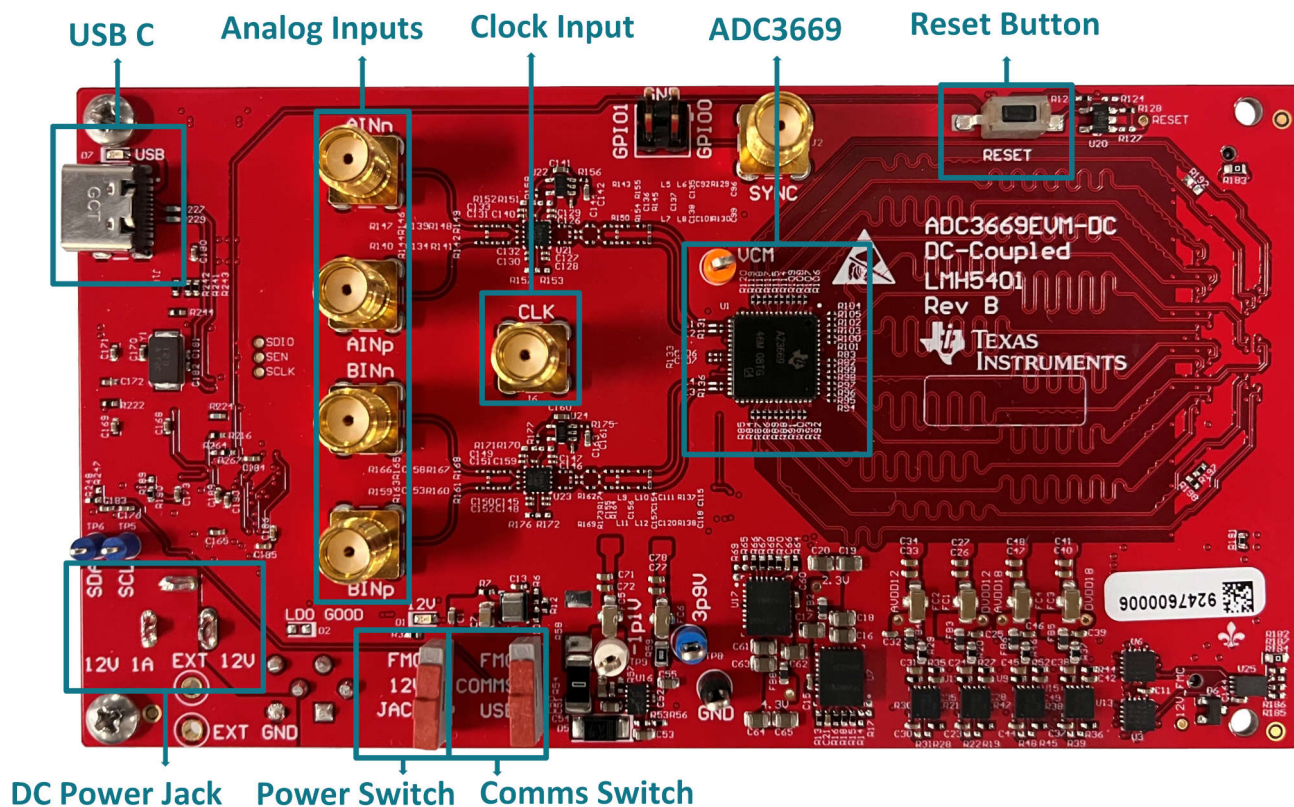


Figure 2-1. ADC3669EVM-DC Features

2.2 Required Equipment

The following equipment is not included with the EVM kit, but is required for proper evaluation.

- TSWDC155EVM FPGA Capture card for capturing data from the ADC, and everything required for operation according to the [TSWDC155EVM User's Guide](#).
- One 12V power supply capable of supplying 1A.
- At least two low-noise signal generators to provide the ADC sample clock and analog input. TI recommends either of the following signal generators:
 - Rohde & Schwarz SMA100A
 - Rohde & Schwarz SMA100B
- Bandpass filters for the sample clock and analog inputs. Use filters with a narrow passband (within 5%-15% of the desired bandwidth), and minimal insertion loss.
- SMA cables to connect the inputs.

2.3 Hardware Setup

1. Verify jumper J2 on the TSWDC155EVM is connected across pins 1-2

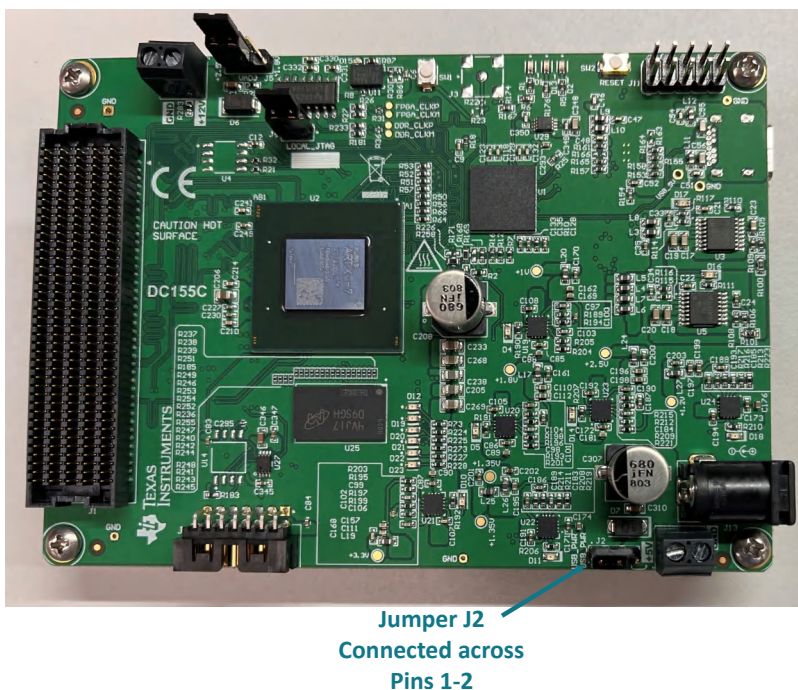


Figure 2-2. TSWDC155EVM Jumper Configuration

2. Verify that the “12V Power” switch on the ADC3669EVM-DC is switched to “JACK”
3. Verify the “Comms” switch on the ADC3669EVM-DC is switched to “USB”
4. Connect the ADC3669EVM-DC to the TSWDC155EVM via the FMC connectors.
5. Connect the USB Cconnector on the ADC3669EVM-DC to your PC using the USB C cable provided in the EVM kit.
6. Connect the 12V 1A Power supply to the Barrel Jack of the ADC3669EVM-DC
7. Using the included Micro USB Cable, connect your PC to the JTAG dongle and connect the JTAG dongle to the JTAG header J7 on the TSWDC155EVM.
8. Using the included USB-C® Cable, connect your PC to the USB C port J8 on the TSWDC155EVM.
9. Using an SMA cable and an inline 500 MHz band pass filter, connect the signal generator to the SMA connector labeled CLK on the ADC3669EVM-DC. Set the signal generator’s output signal frequency to 500 MHz and the signal amplitude to +10dBm.
10. By default, the EVM is configured to take a single ended input, so analog inputs should be applied to connectors AINp and BINp on the ADC3669EVM-DC. Using an SMA cable and an inline 10MHz band pass filter, apply an input signal to Channel A by connecting the signal generator output to the SMA connector on the ADC3669EVM labeled AINp. Set the signal generator’s output signal frequency to 10MHz and the signal amplitude to 0dBm.

Note

Reference lock all signal generators for clock, analog input, and DCLK using the 10MHz REF on the back of the signal generators.

Figure 2-3 shows what the user's setup looks like.

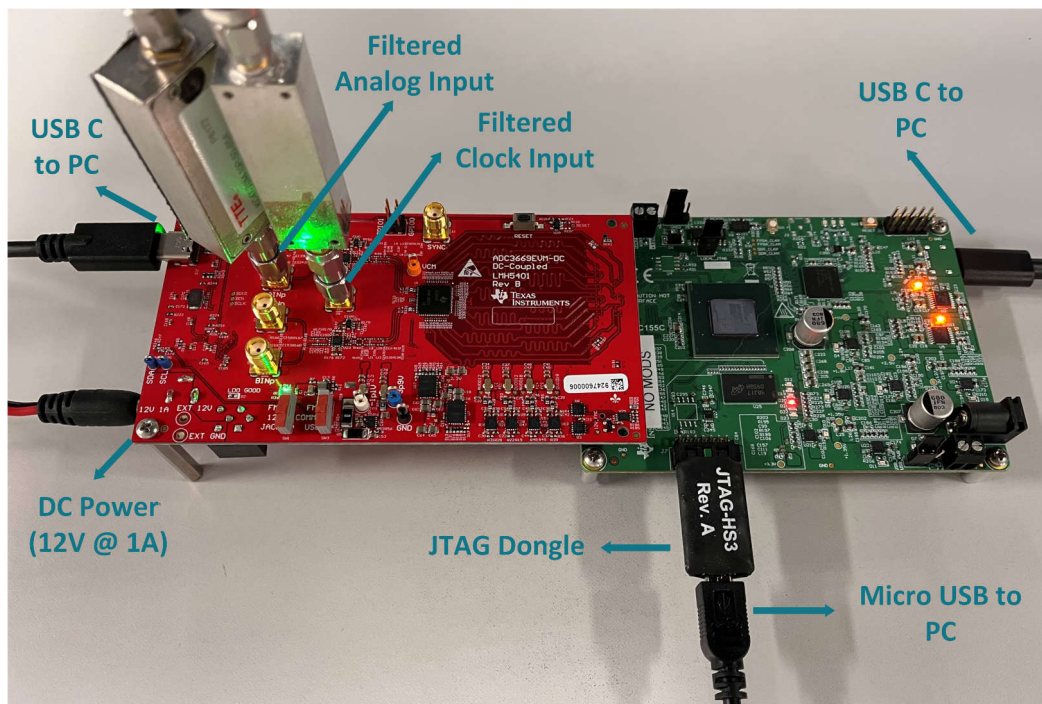


Figure 2-3. Assembled Setup of the ADC3669EVM-DC

3 Software

This section details the required software tools necessary to effectively use the ADC3669EVM-DC.

3.1 Required Software

- [ADC3669EVM-GUI](#)
- [Vivado™ Lab Solutions](#)
- [HSDC Pro Software](#)

3.2 Software Setup

1. Download and install the ADC3669 GUI. This will be used to program the ADC.
2. Download and install HSDC Pro. This will be used to view the captured data.
3. Download and install Vivado Lab Solutions. This is required to capture data from the FPGA.
4. Make sure that the Vivado Lab bin folder is added to your PATH system environment variable.
 - a. Search for *System Environment Variables* in the start menu
 - b. Click on *Environment Variables...*
 - c. Under System Variables, locate and click on the *Path* variable
 - d. Click on *Edit...*
 - e. Click on *New* to add a new path
 - f. Add the path to your Vivado Lab installation, depending on where you installed Vivado Lab and what version you installed. The path to the bin folder typically looks something like this:
`C:\Xilinx\Vivado_Lab\2023.1.1\bin.`

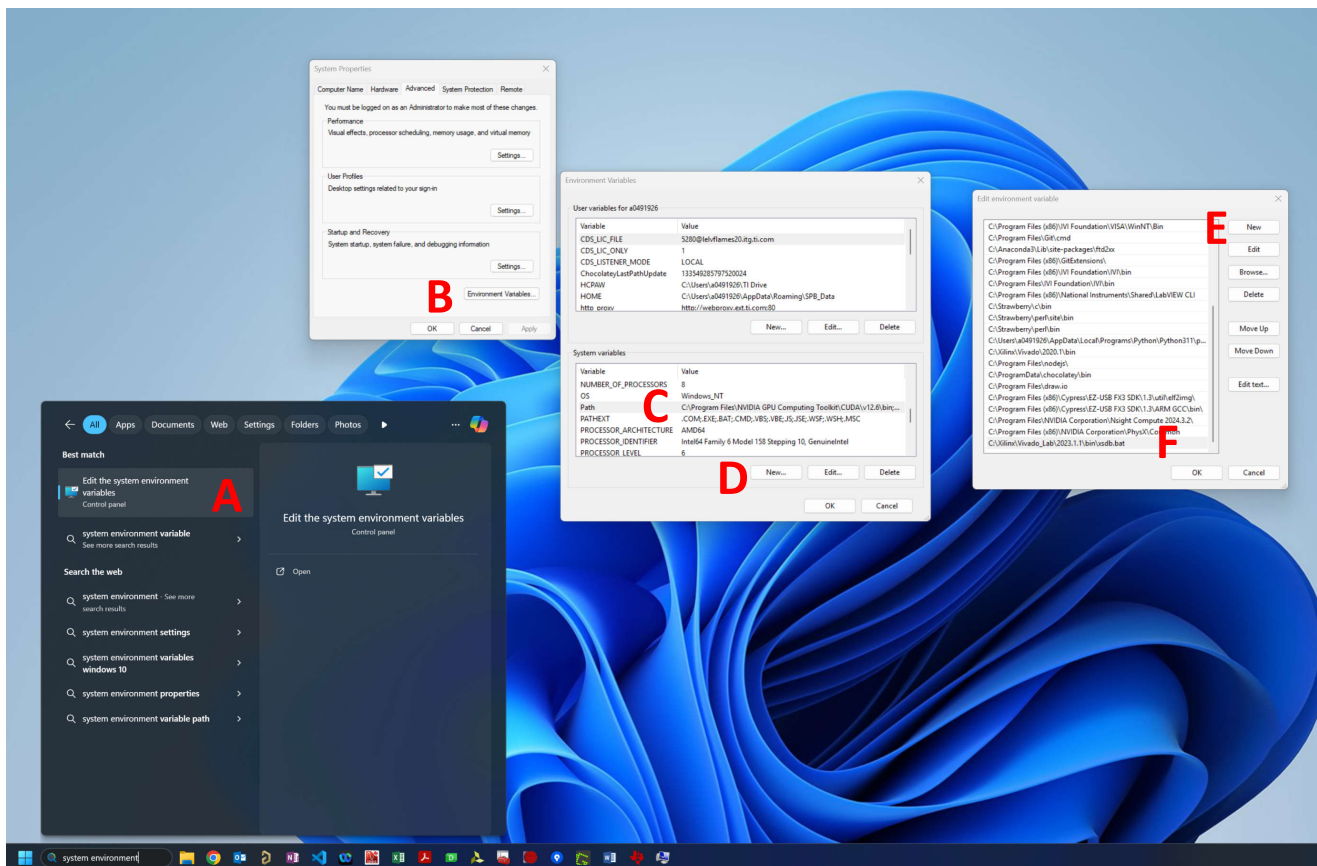


Figure 3-1. Environment Path Example

3.3 Using the GUI

1. Always make sure that HSDC Pro is open *before* opening the GUI. Open HSDC Pro and click on *Cancel* when prompted to connect to a board. The GUI handles all of the other HSDC Pro capture and configurations.

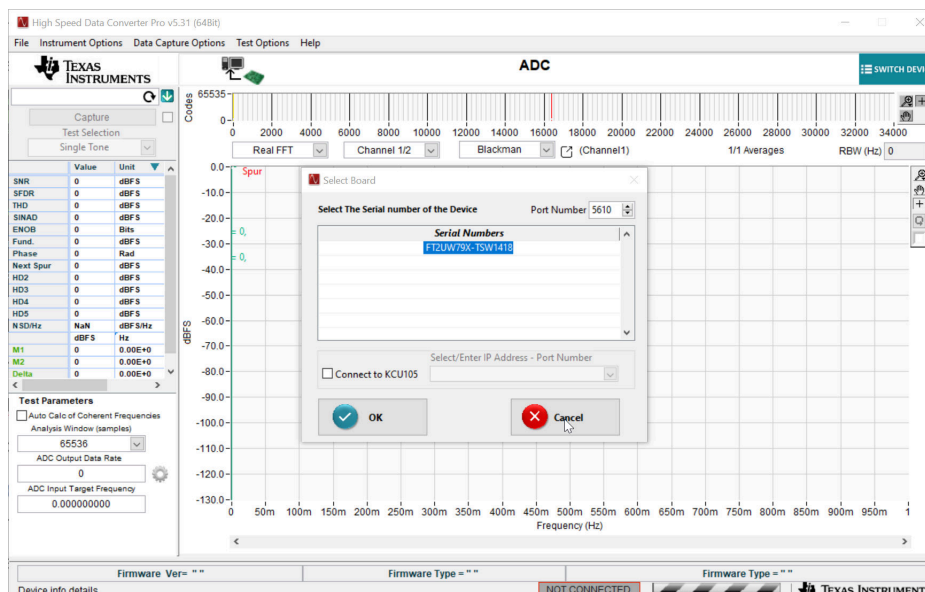


Figure 3-2. Opening HSDC Pro From Start

2. Open the ADC3669 GUI and wait for the GUI to program the FPGA firmware. This can take up to 20 seconds.



Figure 3-3. Server Programming FPGA

- Once the GUI opens successfully, a few additional LEDs illuminate on the TSWDC155EVM.

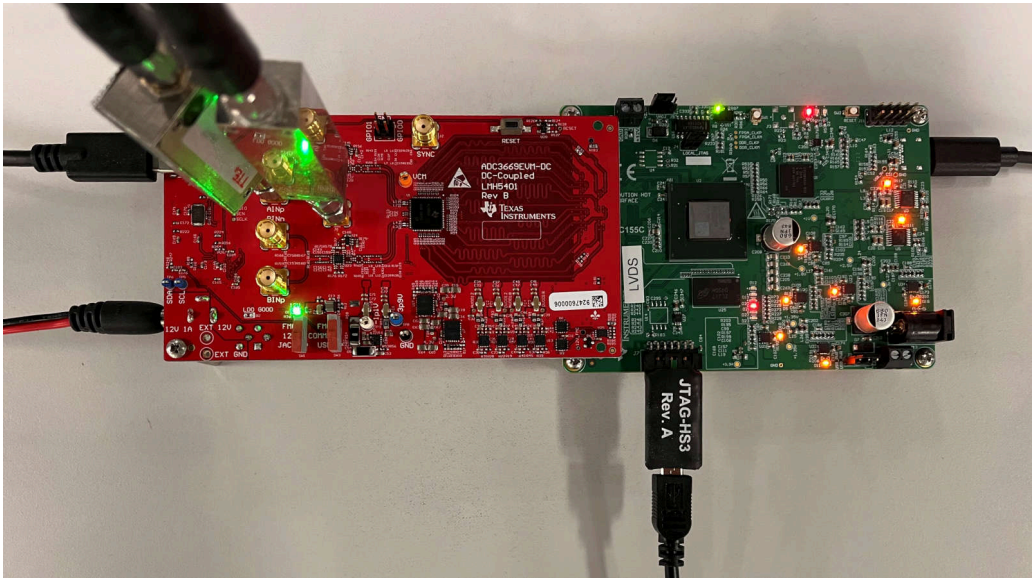


Figure 3-4. TSWDC155EVM After GUI is Opened

- In the GUI, click the *Program* button to program the ADC into the default DDC bypass mode and perform FPGA IO calibration.

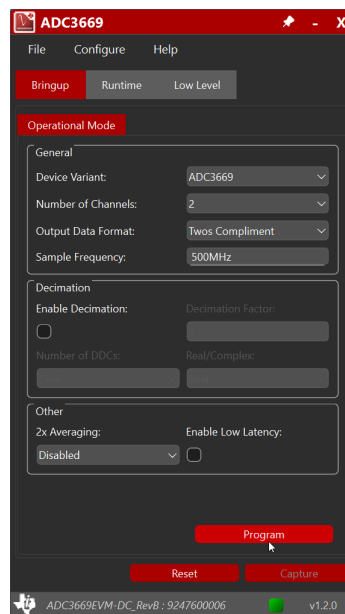


Figure 3-5. Programming the ADC Using the ADC3669 GUI

- When the ADC is programmed, the *Capture* button is enabled. Click the *Capture* button to capture data in HSDC Pro. Data capture can take several seconds.

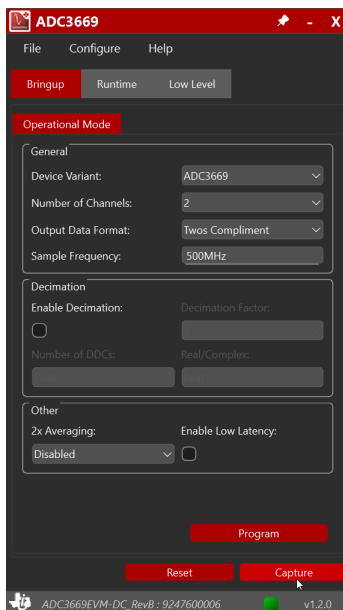


Figure 3-6. Capturing ADC Data Using the ADC3669 GUI

- When the data is captured, the FFT capture is displayed in HSDC Pro, where users can view the performance of the device. For more functions and features of HSDC Pro, refer to the [High Speed Data Converter Pro GUI user's guide](#).

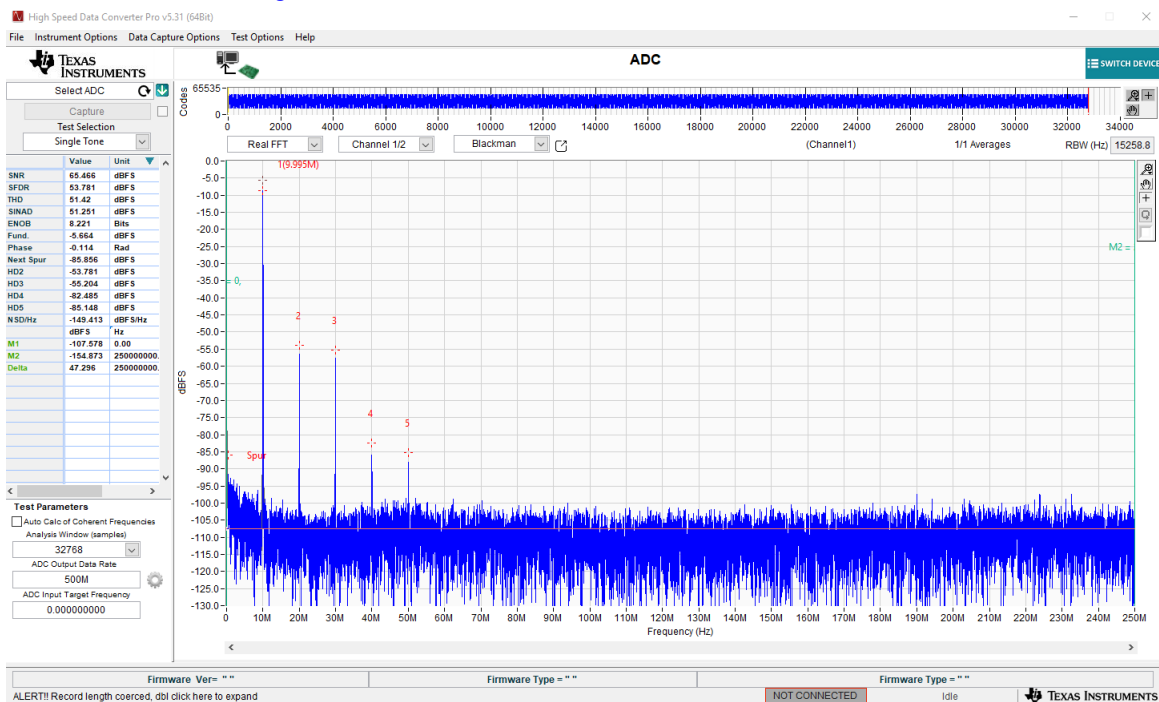


Figure 3-7. Successful Capture in HSDC Pro

4 Hardware Design Files

The schematics, PCB Layout files, and Bill of Materials (BOM) are all available for download on the EVM product page: [ADC3669EVM](#).

5 Additional Information

5.1 Trademarks

Vivado™ is a trademark of Xilinx, Inc.

USB-C® is a registered trademark of USB Implementers Forum.

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5.2 References

- Texas Instruments, [ADC3669EVM product page](#)
- Texas Instruments, [ADC3668, ADC3669 Dual-Channel, 16-Bit 250MSPS and 500MSPS Analog-to-Digital Converter \(ADC\)](#), data sheet
- Texas Instruments, [TSWDC155EVM User's Guide](#)
- Texas Instruments, [High-Speed Data Converter Pro GUI](#), user's guide

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User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

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3.1 United States

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3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/sds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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4.3 Safety-Related Warnings and Restrictions:

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4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

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