

EVM User's Guide: ADC3669EVM

ADC3669 Evaluation Module



Description

The ADC3669EVM is an evaluation module (EVM) designed to evaluate the ADC3669 family of high-speed ADCs. The ADC3669EVM is populated with an ADC3669. The ADC3669 is a 16-bit ADC, dual-channel ADC with an LVDS interface, and can operate at samples rates up to 500 MSPS. The ADC3669EVM allows for evaluation of all device speed grades, and number of channels.

Get Started

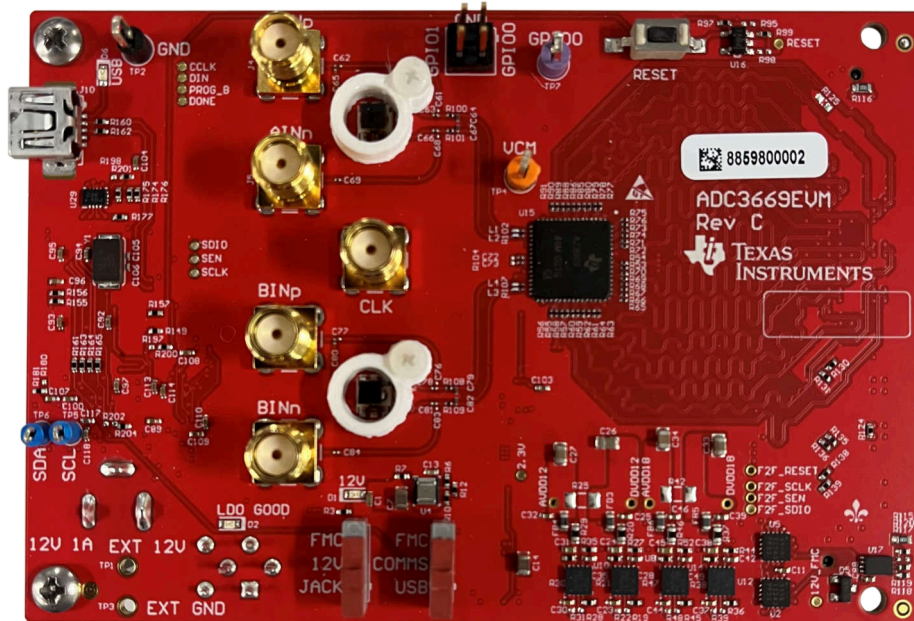
1. Order the EVM from ti.com ([ADC3669EVM](#)).
2. Download the latest revision of the data sheet ([SBASAL3](#)).
3. Download the latest software.
4. Download the comprehensive reference design files from the tools page of the EVM ([ADC3669EVM](#)).

Features

- Noise spectral density: -159 dBFS/Hz
- Thermal noise: 75 dBFS
- Full power input bandwidth (-3dB): 1.5GHz
- Power consumption: 300 mW/channel (500MSPS)
- Digital down-converters, up to two per channel, complex and real decimation up to 32768
- 48-bit NCO phase coherent frequency hopping
- DDR and 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 allows for evaluation of all the devices in the ADC3669 family, as the variants are all pin-to-pin compatible. The ADC3669EVM 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 and includes baluns for single-ended to differential conversion. The sample clock is sourced externally and is single-ended.

For data capture, the ADC3669EVM 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	PCB	1
Mini USB Type B Cable	Cable	1
JTAG-HS2 Programming Dongle	Dongle	1

1.3 Specifications 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 and software tools necessary to effectively use the ADC3669EVM.

2.1 Board Overview

The following image highlights some key features of the ADC3669EVM.

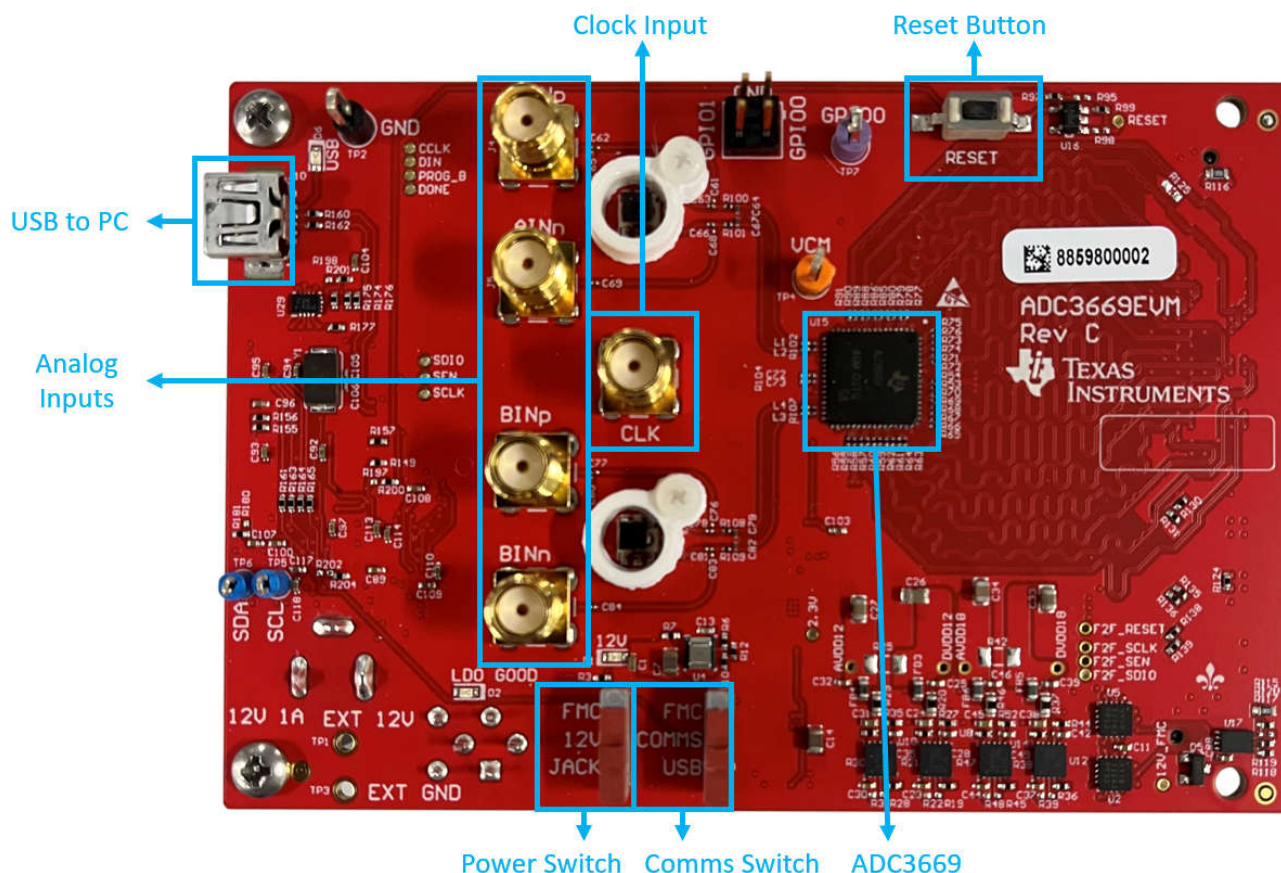


Figure 2-1. ADC3669EVM Features.

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. TI recommends to use filters with a narrow passband (within 5%-15% of the desired bandwidth), and minimal insertion loss
- SMA cables to connect the inputs.

2.2.1 TSW Hardware Modifications

The TSWDC155EVM needs the following hardware modification for the ADC evaluation and data capture to work appropriately:

- Remove the following resistors: R169; located on the top of the board.
- Remove the following resistors: R14, R187; located on the bottom of the board.
- Solder a 10kohm resistor in place of R34; located on the bottom of the board.
- Make sure Jumper J2 is connected across pins 1-2 (left to middle)

Refer to [Figure 2-2](#) for the location of these components.

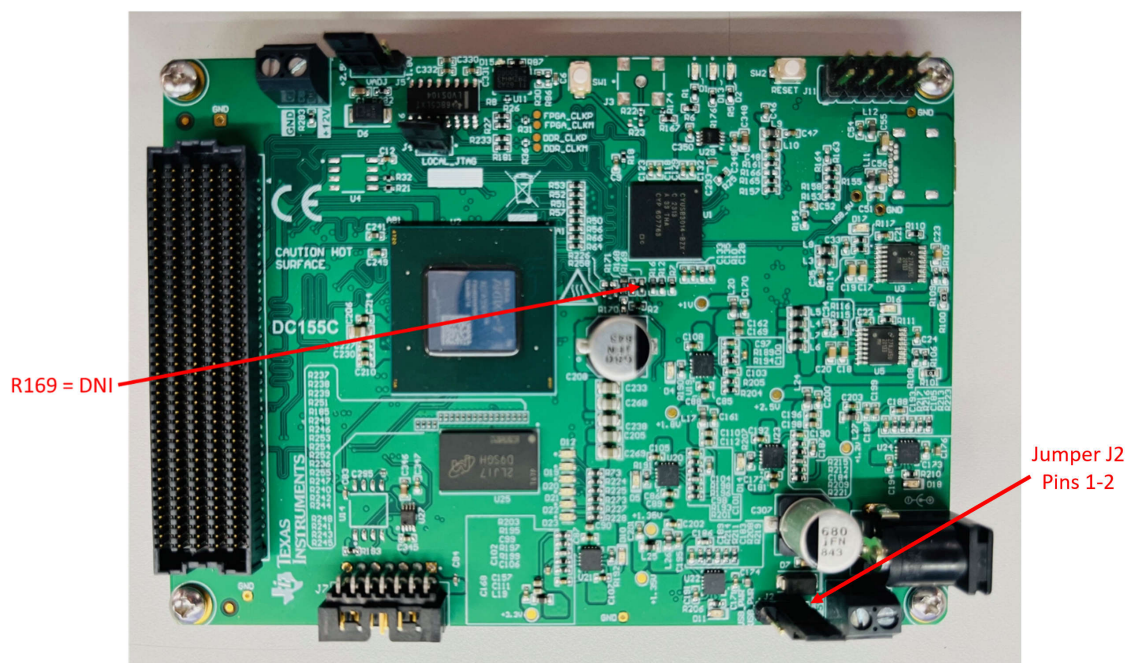


Figure 2-2. TSWDC155EVM Component Modification Locations (Top View)

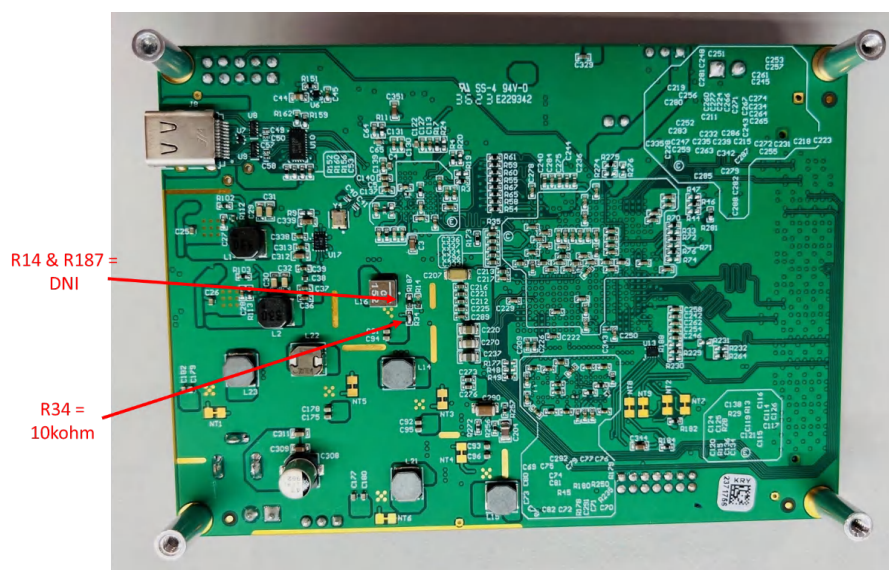


Figure 2-3. TSWDC155EVM Component Modification Locations (Bottom View)

2.3 Hardware Setup

1. Make sure that the *12V Power* switch on the ADC3669EVM is switched to *JACK*
2. Make sure the *Comms* switch on the ADC3669EVM is switched to *USB*
3. Connect the ADC3669EVM to the TSWDC155EVM by the FMC connectors
4. Connect the mini-USB connector on the ADC3669EVM to the PC using the mini-USB cable provided in the EVM kit
5. Connect the 12V 1A power supply to the barrel jack of the ADC3669EVM
6. Using the included mini-USB cable, connect the PC to the JTAG dongle and connect the JTAG dongle to the JTAG header J7 on the TSWDC155EVM
7. Using the included USB-C® cable, connect the PC to the USB-C port J8 on the TSWDC155EVM
8. Using an SMA cable and an inline 500MHz band pass filter, connect the signal generator to the SMA connector labeled CLK on the ADC3669EVM. Set the output signal frequency of the signal generator to 500MHz and the signal amplitude to +10dBm
9. By default, the EVM is configured to take a single ended input, so analog inputs are applied to connectors AINp and BINp on the ADC3669EVM. 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 output signal frequency of the signal generator to 10MHz and the signal amplitude to roughly +10dBm

Note

All signal generators for clock, analog input and DCLK are referenced locked using the 10MHz REF on the back of the signal generators

Figure 2-4 shows what the setup looks like.

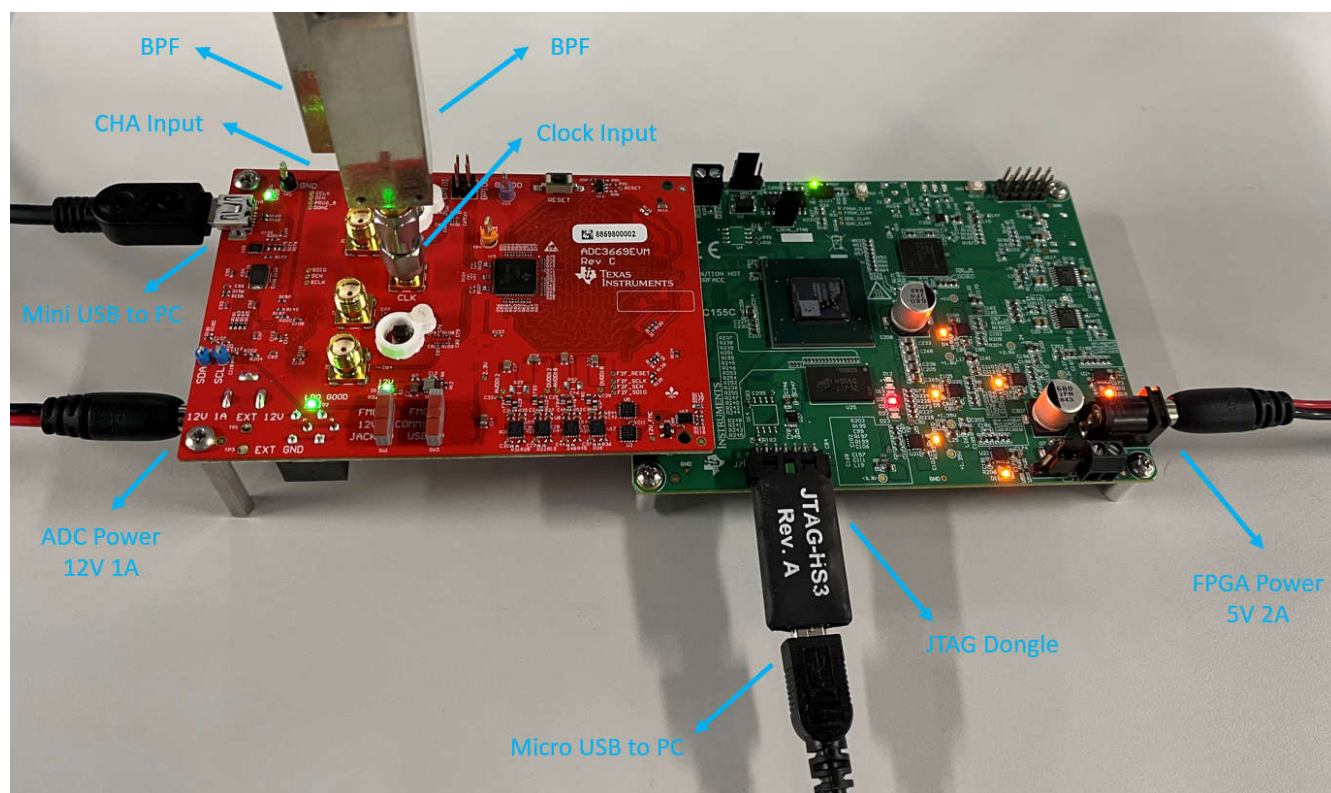


Figure 2-4. Assembled Setup of the ADC3669EVM

3 Software

3.1 Required Software

- [ADC3669 GUI](#)
- [Vivado™ Lab Solutions](#)
- [HSDC Pro Software](#)

3.2 Software Setup

1. Download and install the ADC3669 GUI. This .exe is ran launches two installers: one for the ADC3669 GUI and one for the MSPS_FPGA_Server. Both of these are required.
2. Download and install HSDC Pro. This is used to view the captured data.
3. Download and install Vivado Lab Solutions. This is required to capture data from the FPGA.
 - a. Make sure that the Vivado Lab bin folder is added to the PATH system environment variable. Depending on where Vivado Lab is installed and which version is installed, the path to the bin folder typically looks something like this: `C:\Xilinx\Vivado_Lab\2023.1.1\bin`

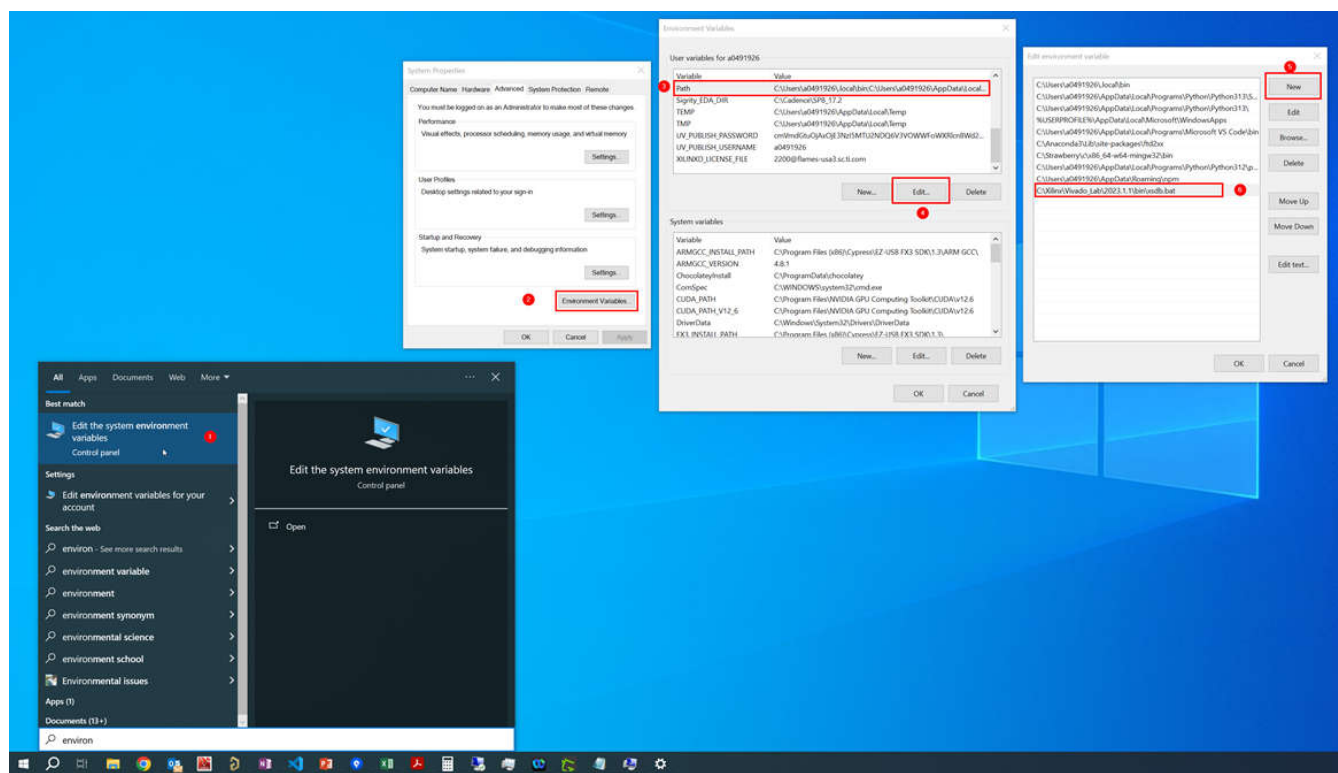


Figure 3-1. Environment Path Example

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.

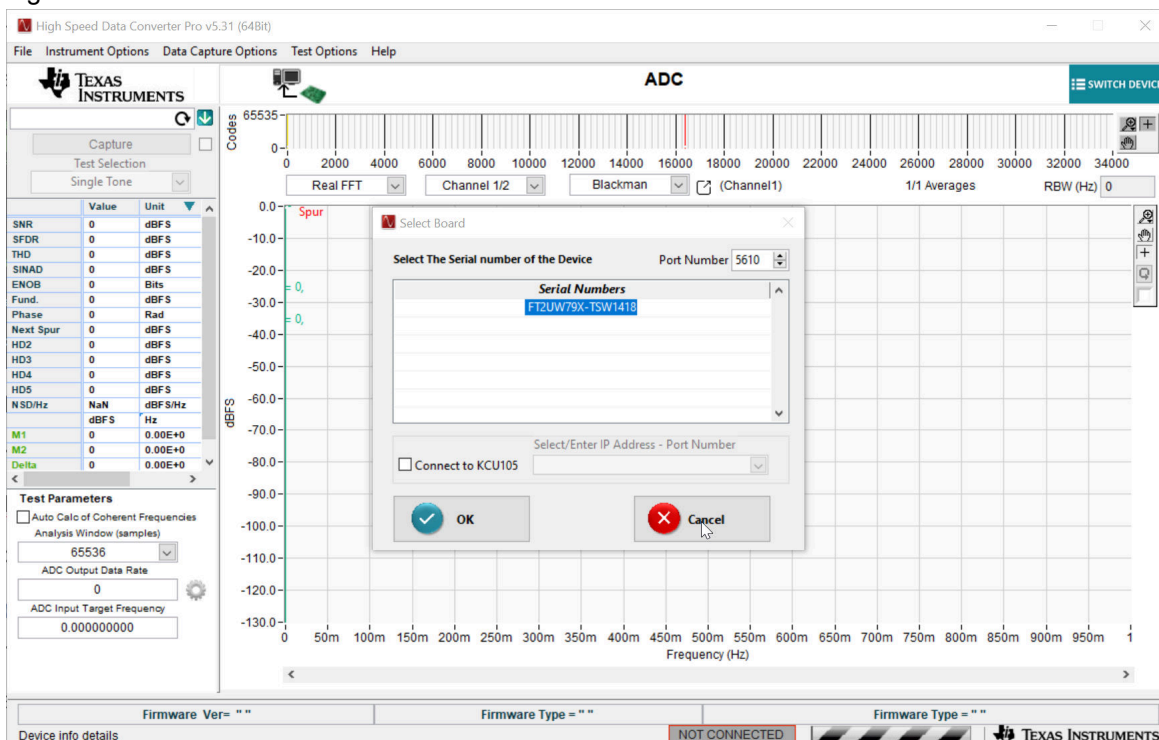


Figure 3-2. Opening HSDCPro from Start

2. Always make sure that the MSPS_FPGA_Server is open before opening the GUI. This server allows the GUI to communicate with the FPGA on the TSWDC155EVM. Open the MSPS_FPGA_Server and wait until this connects to the TSWDC155EVM.

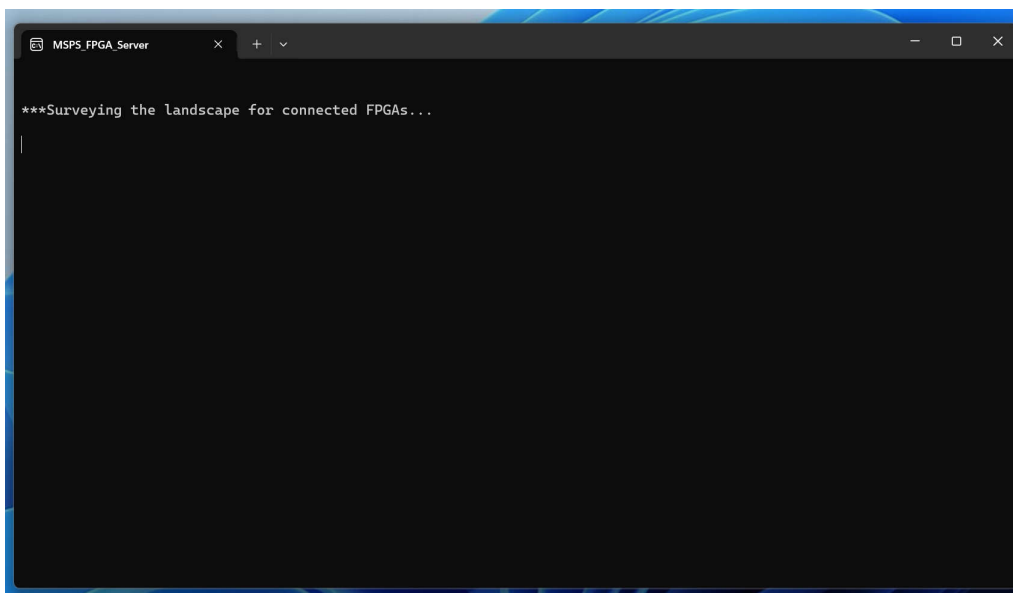
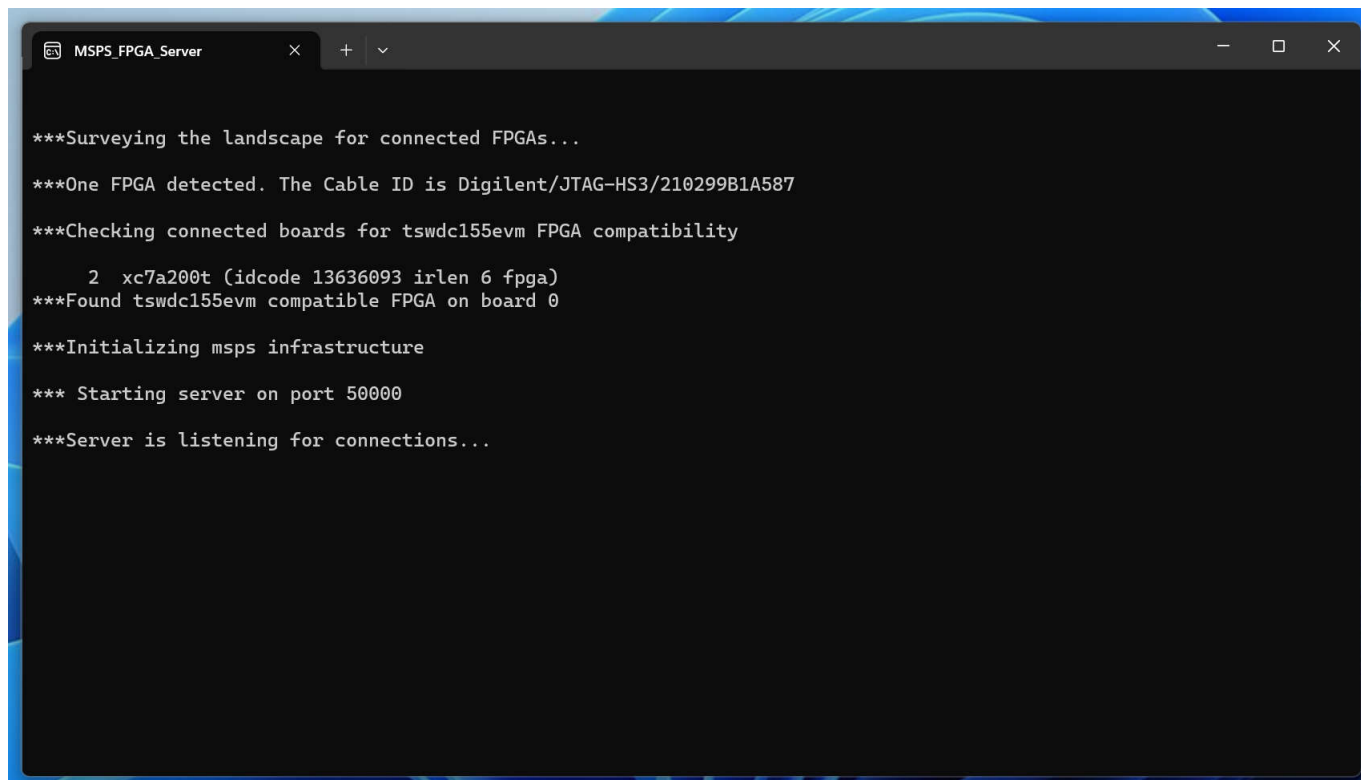


Figure 3-3. Opening the Server and Searching for FPGA



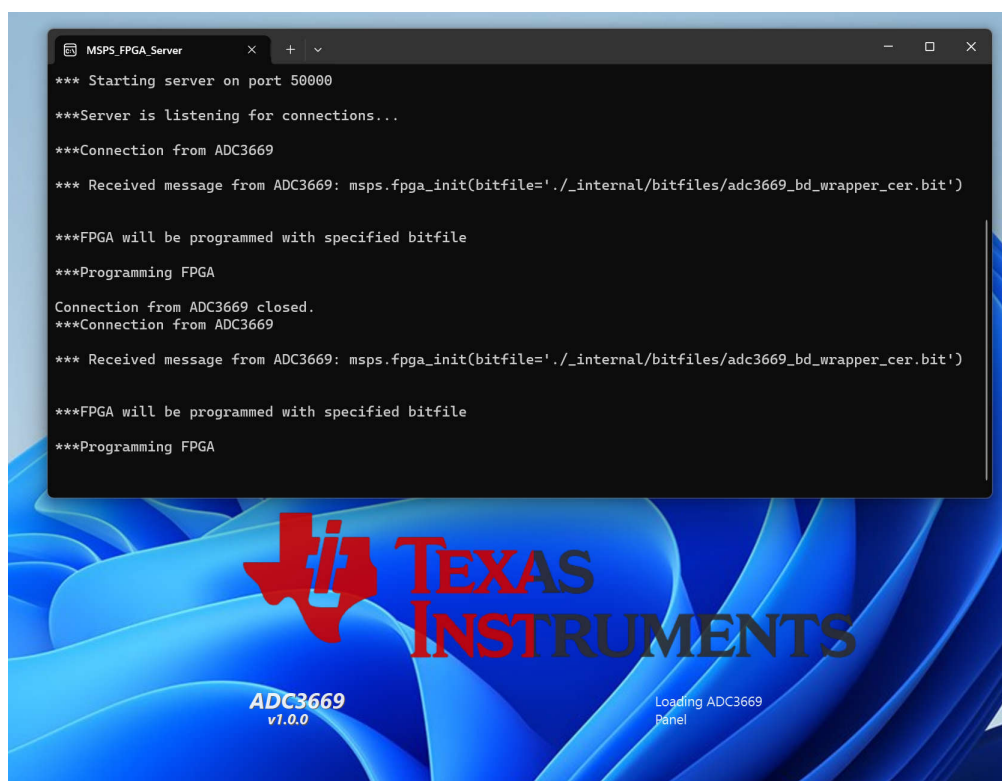
```

MSPS_FPGA_Server
***Surveying the landscape for connected FPGAs...
***One FPGA detected. The Cable ID is Digilent/JTAG-HS3/210299B1A587
***Checking connected boards for tswdc155evm FPGA compatibility
    2 xc7a200t (idcode 13636093 irlen 6 fpga)
***Found tswdc155evm compatible FPGA on board 0
***Initializing mspms infrastructure
*** Starting server on port 50000
***Server is listening for connections...

```

Figure 3-4. FPGA Found

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



```

MSPS_FPGA_Server
*** Starting server on port 50000
***Server is listening for connections...
***Connection from ADC3669
*** Received message from ADC3669: mspms.fpga_init(bitfile='./_internal/bitfiles/adc3669_bd_wrapper_cer.bit')
***FPGA will be programmed with specified bitfile
***Programming FPGA
Connection from ADC3669 closed.
***Connection from ADC3669
*** Received message from ADC3669: mspms.fpga_init(bitfile='./_internal/bitfiles/adc3669_bd_wrapper_cer.bit')
***FPGA will be programmed with specified bitfile
***Programming FPGA

```

Figure 3-5. Server Programming FPGA

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

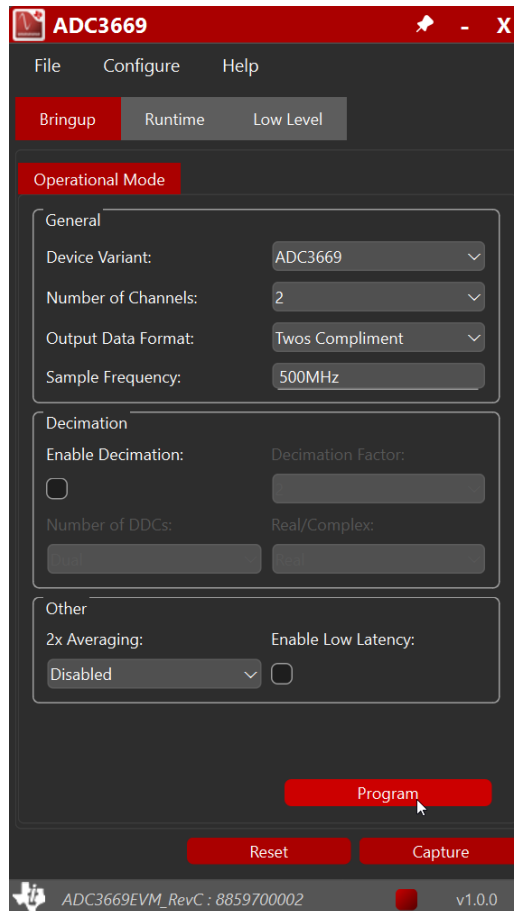


Figure 3-6. Programming the ADC Using the ADC3669 GUI

- 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.

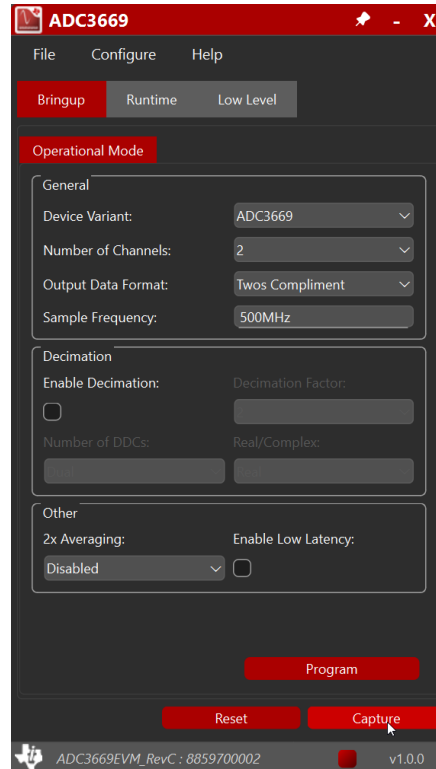


Figure 3-7. Capturing ADC Data Using the ADC3669 GUI

- When the data is captured, an FFT capture appears 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](#).

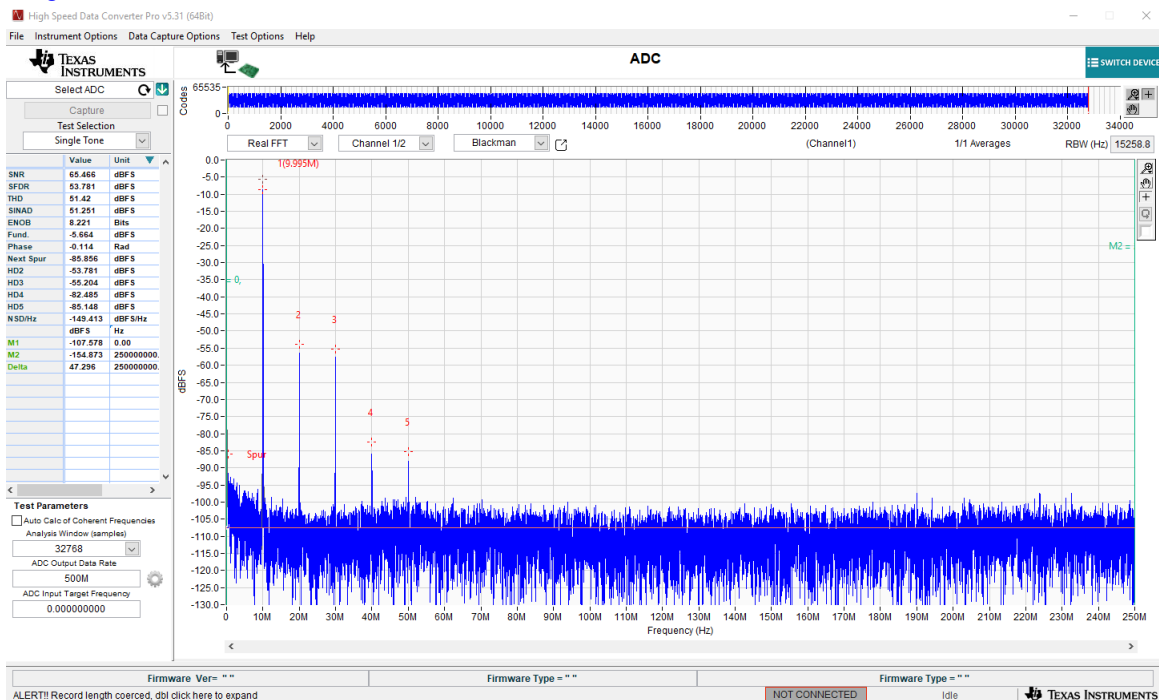


Figure 3-8. Successful Capture in HSDC Pro

- The GUI can now be used to configure the ADC into your desired mode. The GUI automatically handles IO calibration and configuring HSDC Pro for capture.

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.

All trademarks are the property of their respective owners.

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

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (March 2024) to Revision A (June 2025)	Page
<ul style="list-style-type: none"> • Updated document to reflect changes made to evaluation board and software. If customers are using an ADC3669EVM RevB or older, reach out to E2E for support..... 	1

STANDARD TERMS FOR EVALUATION MODULES

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 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits 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 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.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

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 instruction manual, 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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3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

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.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

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.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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