ADC3910D125 Evaluation Module

Description

The ADC3910D125EVM is an evaluation module (EVM) designed to evaluate the ADC3910D125 family of high speed ADCs. The ADC3910D125EVM is populated with a ADC3910D125, 10-bit ADC, dual-channel, LVCMOS interface, and can operate up to 125MSPS. The ADC3910D125EVM allows for evaluation of all device speed grades, 25MSPS, 65MSPS, and 125MSPS.

Get Started

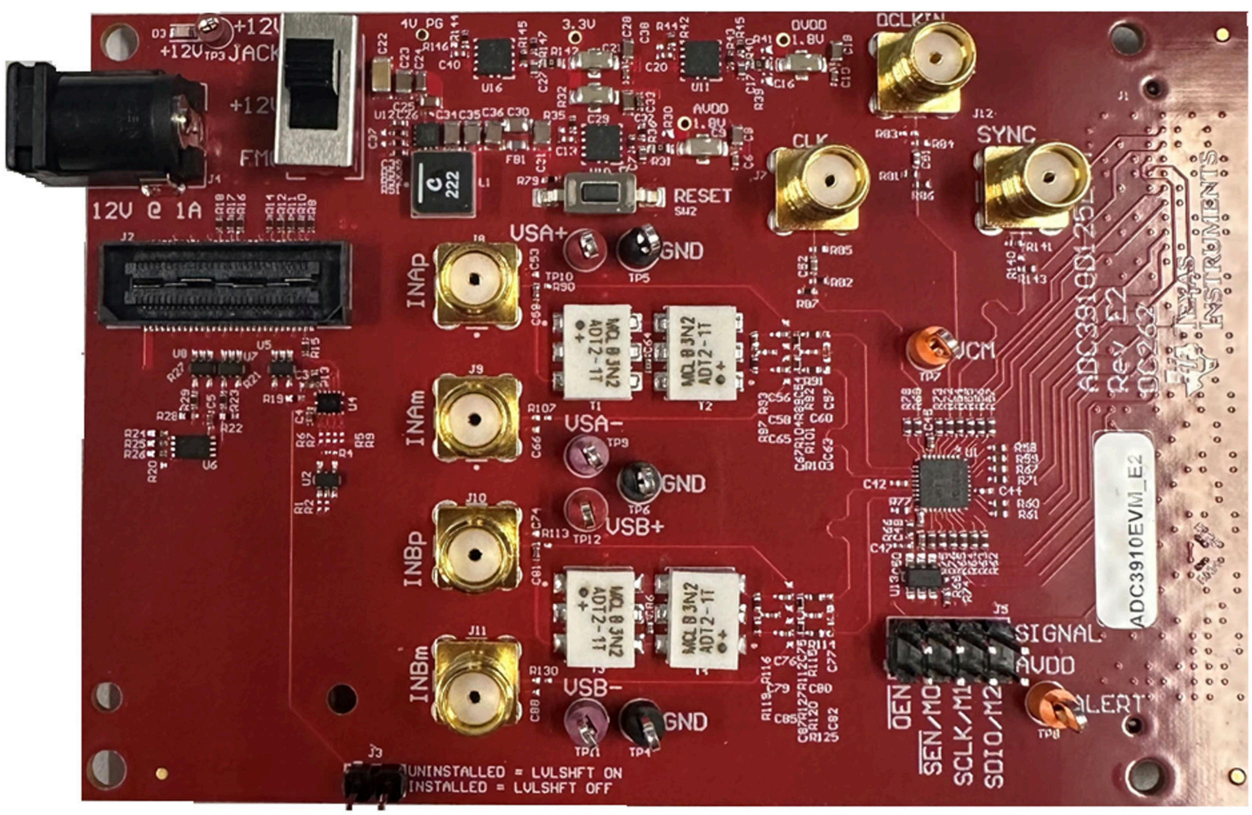
1. Order the EVM on ti.com.
2. Download the latest revision of the data sheet (SBASAD1).
3. Download High Speed Data Converter Pro (HSDC Pro).

Features

- 10-bit, 125 MSPS ADC
- Dual-channel
- Ultra-low power
- Latency: 1 clock cycle
- Buffered inputs
- Small footprint: 32-VQFN (4mm x 4mm)

Applications

- Radio receiver
- LiDAR
- Low latency control loops
- Laser scanners
- GPS
- SMU
- Detection equipment



ADC3910D125EVM

1 Evaluation Module Overview

1.1 Introduction

The ADC3910D125EVM allows for evaluation of all ADC39XX versions as the versions are all P2P compatible. By default, the ADC3910D125EVM, has the ADC3910D125 (10-bit, 125MSPS). The EVM is configured to receive external single-ended analog inputs as the EVM includes baluns for single-ended to differential conversion. The sample clock is also sourced externally and is single-ended LVCMOS.

To capture data from the ADC3910D125EVM, the EVM is connected to a TSW1418EVM through an FMC connector. The TSW1418EVM has an AMD Atrix-7 FPGA to capture the ADC3910D125EVM output. The ADC data, captured by the FPGA, is then transferred to the PC and displayed in HSDC Pro.

1.2 Kit Contents

Table 1-1. ADC3910D125EVM Kit Contents

Item	Description	Quantity
ADC3910D125EVM	PCB	1
FTDI board	PCB	1
Mini USB cable		1
EVM barrel power cable		1

1.3 Specification

The specifications for ADC3910D125 are available in the data sheet (SBASAD1).

1.4 Device Information

The detailed device information is available in the data sheet (SBASAD1).

2 Hardware

2.1 Board Overview

This section details the required tools, both hardware and software, needed to effectively use the ADC3910D125EVM.

- The following image highlights the key aspects of the ADC3910D125EVM.

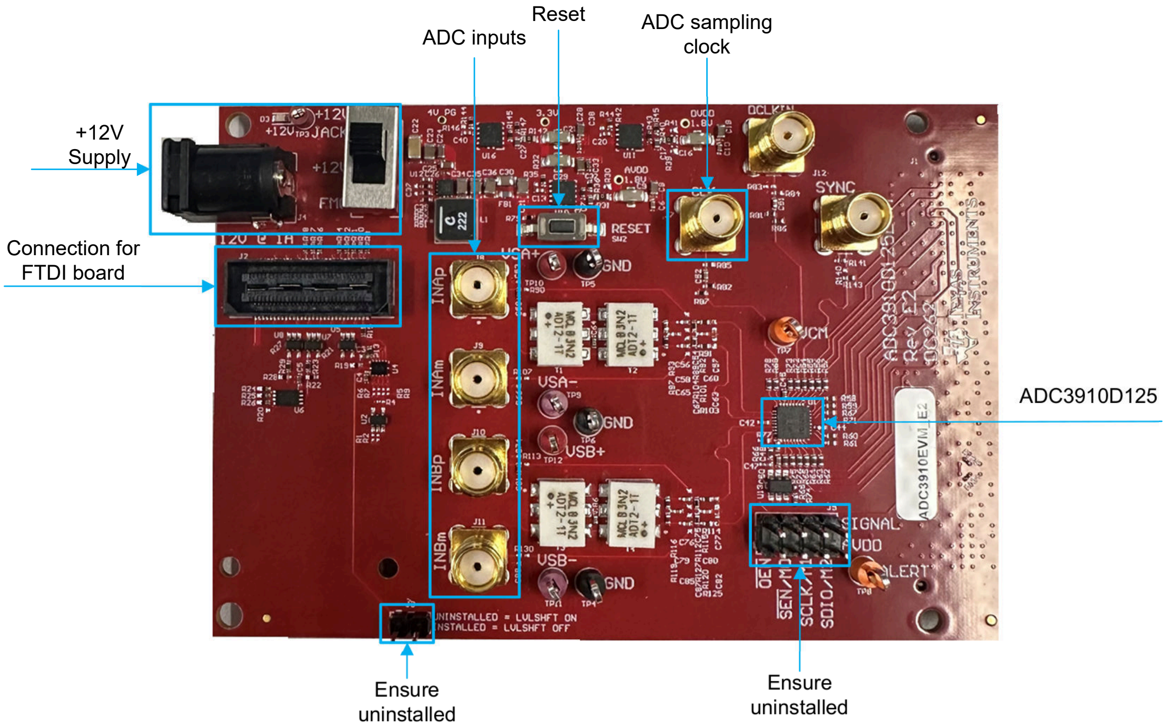


Figure 2-1. ADC3910D125EVM Feature Identification

- Make sure that SW1 is set to take power from the +12V jack, the included FTDI board is connected to J2, and jumpers J3 & J5 remain uninstalled.

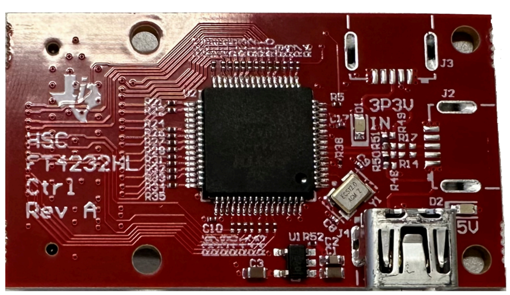


Figure 2-2. FTDI board Included with ADC3910D125EVM That Connects to J2

2.2 Required Equipment

- The following equipment is included in the EVM kit:
  - ADC3910D125EVM
  - FTDI board
  - Mini USB cable
  - Barrel power cable
- The following equipment is not included with the EVM kit, but is required for proper evaluation.
  - TSW1418EVM for capturing the data from the ADC3910D125
  - HSDC Pro
  - Python (3.10.9)
  - Vivado Lab Solutions (2023.2)
  - Visual Studio Code (VS Code) or preferred IDE
  - At least two, low-noise, signal generators for to provide the ADC sampling clock and an analog input. TI recommends either of the following signal generators:
    - Rohde & Schwarz SMA100A
    - Rohde & Schwarz SMA100B
  - Bandpass filters for the sample clock and the analog inputs. The filters has a narrow passband within 5%-15% of the desired bandwidth and minimal insertion loss.
  - SMA cables for signal connections.

2.3 Hardware Setup

1. Connect the ADC3910D125EVM to the TSW1418EVM through the FMC connector.
2. Connect the FTDI board to the ADC3910D125EVM onto J2 of the ADC3910D125EVM.
3. Install the JTAG dongle provided with the TSW1418EVM onto J3 of the TSW1418EVM.
4. Make sure J13 on TSW1418EVM is between pin two and three.
5. Connect a +12V power supply to the barrel connector (power supply cable included with EVM) of the ADC3910D125EVM.
6. Connect a mini USB cable from the PC to the FTDI board installed on the ADC3910D125EVM.
7. Connect a mini USB cable from the PC to J2 on the TSW1418EVM.
8. Connect a micro USB cable from the PC to the JTAG dongle (on the TSW1418EVM) that was installed in step three.
9. Connect a bandpass filtered clock signal source to J7 labeled CLK of the ADC3910D125EVM.
10. Connect a bandpass filtered analog input source to J8 and/or J10 of the ADC3910D125EVM labeled INAp and INBp, respectively.

If all the steps above were followed correctly, then the final setup looks like the following:

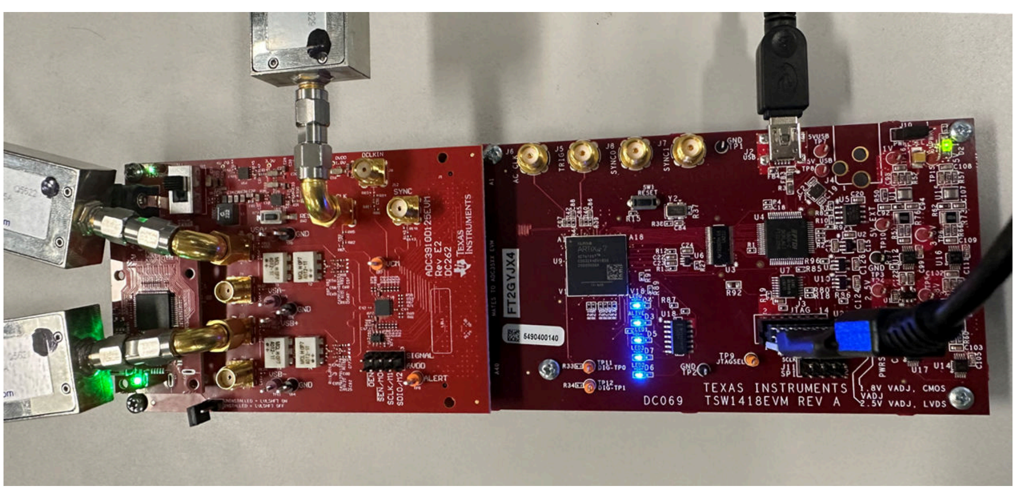


Figure 2-3. Final Setup of ADC3910D125EVM

3 Software

3.1 Software Setup

1. Download and install the latest version of HSDC Pro.
2. Download and install Python (3.10.9).
3. Install Vivado Lab Solutions (2023.2).
4. Download and install VS Code and install the Python extension by Microsoft®.
5. Download the ADC3910D125EVM_API_Rev0.1 supplemental software folder found in the ADC3910D125EVM product folder or provided by TI.

4 Implementation Results

4.1 Evaluation Setup

Once the software setup and hardware setups are completed. Follow these steps to get a capture on the ADC3910D125EVM:

1. Connect a bandpass filtered 125 MHz clock signal to the ADC.
2. Connected a bandpass filtered 10.097503662MHz input signal to either ADC input.
3. Launch a PowerShell terminal and change current directory to the location of the ADC3910D125EVM_API_Rev0.1. From within the ADC3910D125EVM_API_Rev0.1 folder, run the following command: pip install -r requirements.txt.
   a. This installs the required python packages to run the provided software files.
4. Launch the tcl_client.tcl file, found in the ADC3910D125EVM_API_Rev0.1 folder, in a text editor and update the path in line six to your path.

```
write_hw_ila_data -csv_file -force {YOUR PATH HERE/ADC3910D125EVM_API_Rev0.1/OutputCaptures/iladata.csv} $ila_data_buffer
```

Figure 4-1. Path that needs to be edited in "tcl_client.tcl"

5. Launch and run ADC3910D125EVM_API_Rev0.1.py file provided in the software suite.
   a. By default, this file is setup to provide a hardware and software reset to the ADC.
   b. The ADC is placed in the default dual-channel, 10-bit, low latency, DDR interface mode.
   c. R67 can be probed to confirm that DCLK is active.
6. Launch Vivado Lab 2023.2:
   a. Click on *Open Hardware Manager*.
   b. Click on *Open target* at the top with the green background.
   c. Click on *Auto Connect* from the pop up menu.
      i. This connects to the xc7a100t_0 FPGA.
   d. Right-click xc7a100t_0, then select *Program Device* in the pop-up menu.

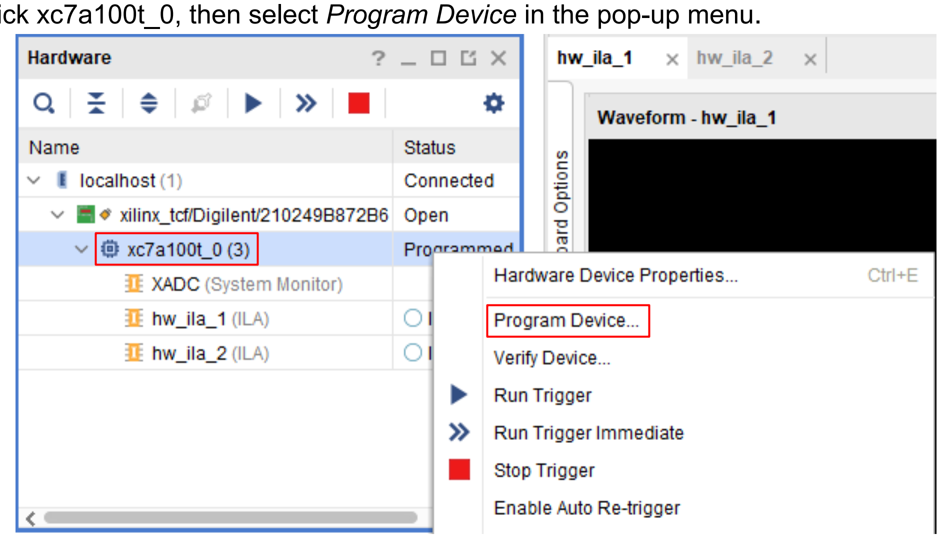


Figure 4-2. Programming FPGA Menu

e. In the pop up menu click on ... on the *Bitstream file* row and navigate to the bitfiles folder in the ADC3910D125EVM_API_Rev0.1 folder. Select the *10b_DDR.bit* file.

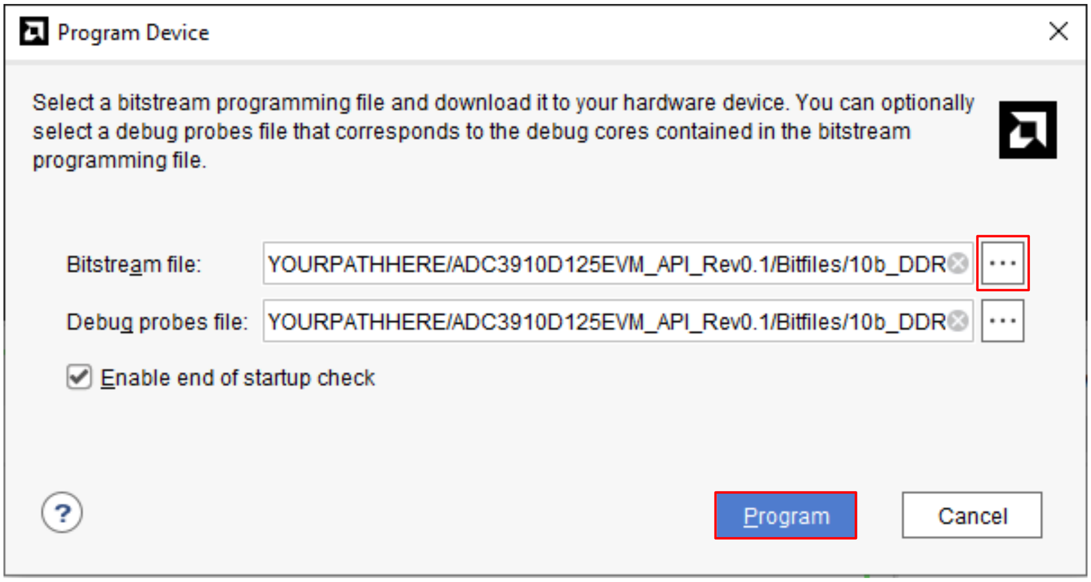


Figure 4-3. Bitfiles to Program FPGA

f. Click on *Program*
   i. There is a new window now called *hw_ila_1*.
g. In the hw_ila_1 waveform view, select all the values and right click. In the pop-up menu, hover over *Radix* and in the next pop-up menu, select *Signed Decimal*.

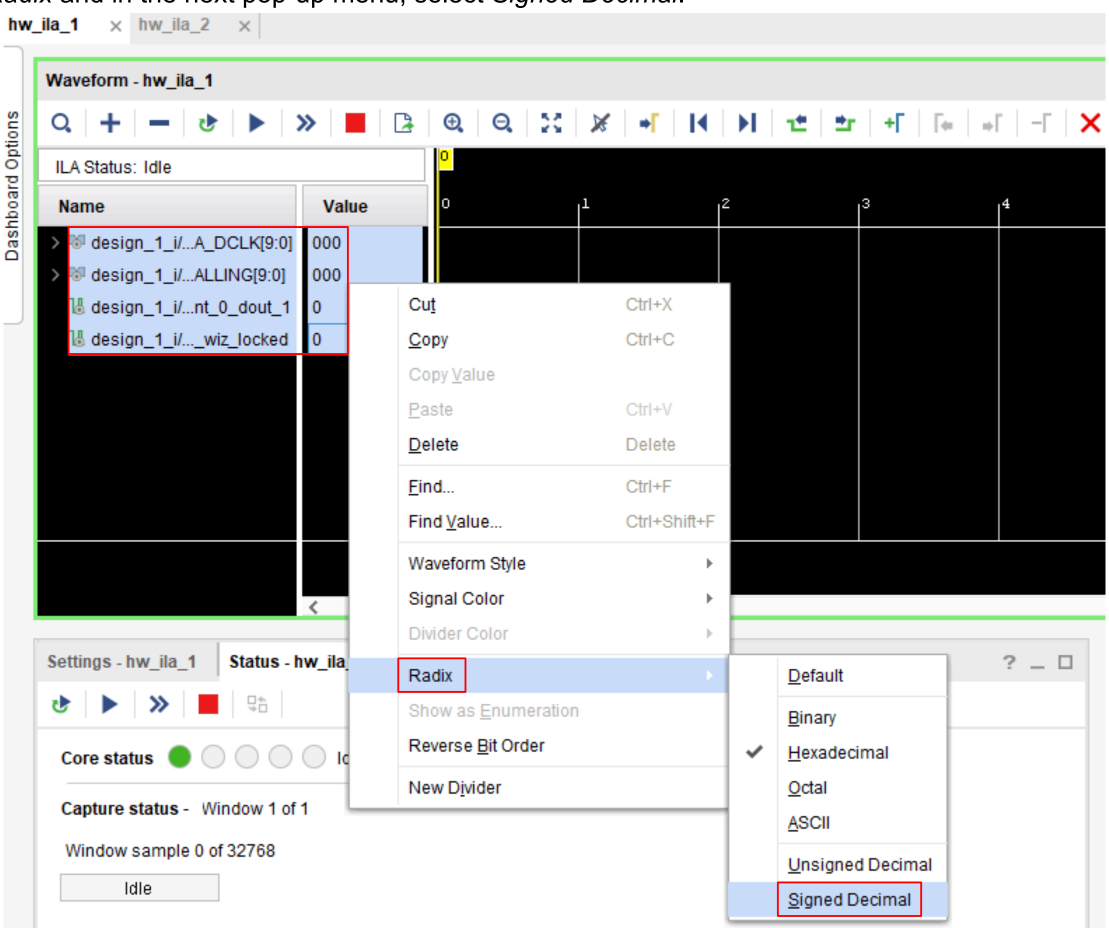


Figure 4-4. Changing ILA radix to signed decimal

h. In the *Tcl Console* command line, change the current directory to the location of the ADC3910D125EVM_API_Rev0.1 folder.

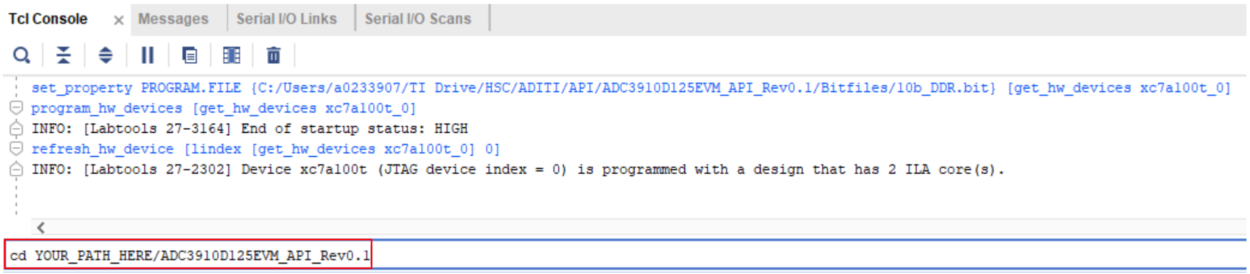


Figure 4-5. Change Current Directory in Vivado Lab 2023.2

a. Launch and run py_server.py from ADC3910D125EVM_API_Rev0.1 folder.
   i. After the running the file, *STARTING THE SERVER....* is printed by the python terminal.
b. Launch HSDC Pro, click *OK* in the first pop-up menu and click *OK* again in the next pop-up window.
c. In Vivado™ Lab 2023.2 in the *Tcl Console* type the following command: source ./tcl_client.tcl
d. Now, the py_server.py python terminal shows *Input a command*.
   i. The available commands are *Capture* and *Quit*.
e. In the py_server.py python terminal, type *Capture* (this is case sensitive).
f. In HSDC Pro, an FFT of the input signals needs to be captured.

4.2 EVM Capture

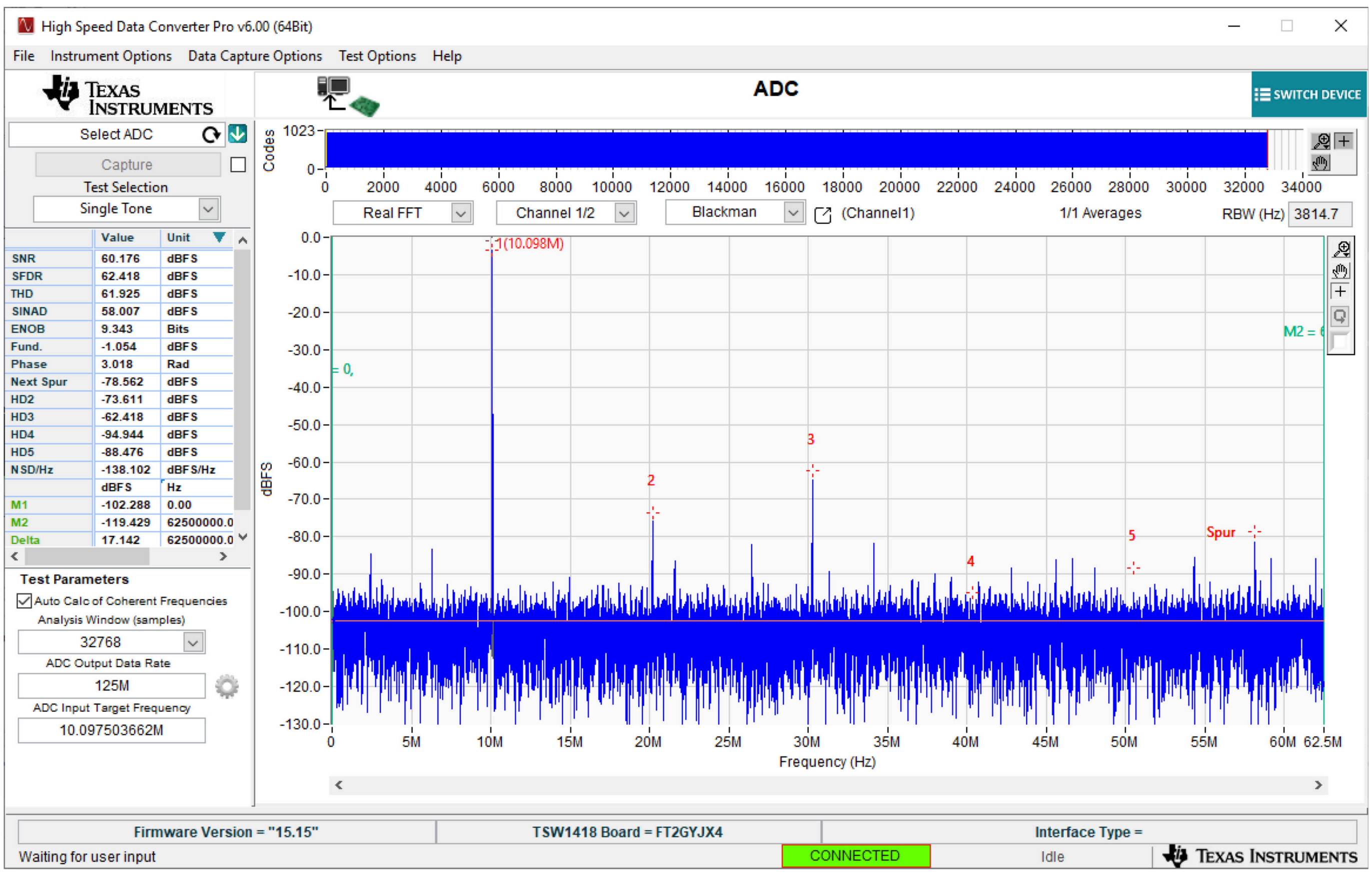


Figure 4-6. FS = 125MSPS; Fin = 10.097503662M @ 8.2dBm

5 Hardware Design Files

5.1 Schematics

The schematics are available on the product page of ADC3910D125EVM.

5.2 PCB Layouts

The board layout is available on the product page of ADC3910D125EVM.

5.3 Bill of Materials (BOM)

The bill of materials is available on the product page of ADC3910D125EVM.

6 Additional Information

6.1 Trademarks

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7 References

- TSW1418 Evaluation Module User's Guide (Rev. A)
- High-Speed Data Converter Pro GUI User's Guide (Rev. E)

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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.

NOTE:

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

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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*

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

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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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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.

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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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7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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