

# **ADC12DJxx00EVM Quick Start Guide**

**For Board Revisions E2 and E3**

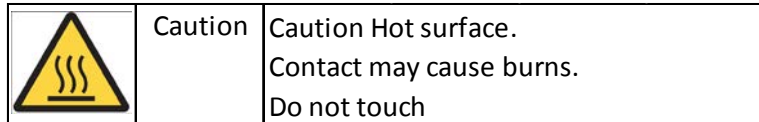
**Jim Brinkhurst, High Speed Data Converters**

**Rev. C January 11, 2017**

**SLAU709**

# Cautions

- The ADC device on this EVM can consume  $>3.5\text{W}$  power at maximum clock rate. Therefore the ADC surface temperature can exceed  $55^{\circ}\text{C}$  and should not be touched during operation. The EVM is labeled with a Do Not Touch symbol to re-iterate this warning.



- The EVM requires a +5V DC, **minimum 3A** power source. Since this power source is not provided with the EVM care must be taken regarding polarity and voltage setting when connecting the provided power cable to this supply.

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# Notes Regarding Silicon Version

General Note: Evaluation Modules with initial silicon are provided for early evaluation of the ADC12DJxx00 device. Internal evaluation is still underway and current device performance is not fully representative of the final production device. Performance and feature improvements will be made through the development cycle.

# Contents

This Quick Start guide is designed to help you get up and running with the preliminary version of the ADC12DJxx00EVM.

- Installing the software
- Hardware list, orientation, and setup
- ADC12DJxx00EVM bring up and GUI features
- TSW14J56 bring up and features
- TSW14J57 bring up and features
- Limitations / errata
- Revision history

# Installing the Software

There are three pieces of software required to use this system:

- ADC12DJxx00EVM GUI including configuration files
  - Purpose: To program the devices (clocks, ADC and temp sensor) on-board the EVM
  - Where to get it: Provided USB drive or by contacting local TI Support
  - How to install it: run “setup.exe” and restart if prompted.

# Installing the Software (continued)

- High Speed Data Converter Pro software for data capture and evaluation
  - Purpose: To capture the high speed serial data from the ADC12DJxx00, perform an FFT, and show performance results
  - Where to get it: “<http://www.ti.com/tool/dataconverterpro-sw>”
  - How to install it: run “High Speed Data Converter Pro - Installer.exe”
  - Note: Use default file locations to ensure any subsequent patches install correctly

**Tip:** Uninstall any older versions of HSDC Pro before installing the latest version.

# Installing the Software (continued)

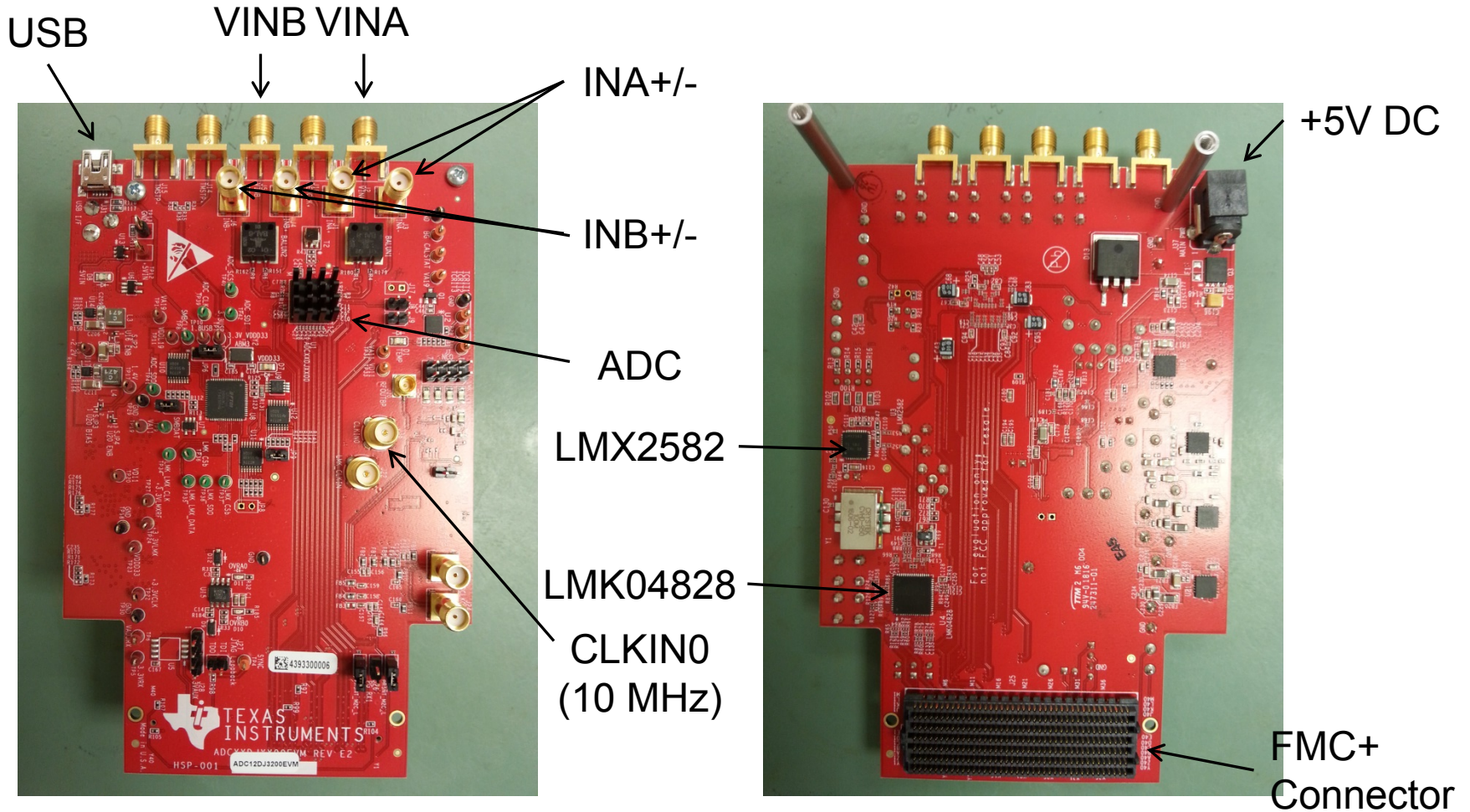
- Add necessary files to HSDC Pro for ADC12DJxx00EVM and TSW14J56EVM and/or TSW14J57EVM
- Purpose: To add EVM specific configuration files for the ADC12DJxx00EVM
  - Where to get it: Provided USB drive or by contacting local TI Support
  - Copy files to the following locations
    - Files for TSW14J56EVM Rev D  
C:\Program Files (x86)\Texas Instruments\High Speed Data Converter Pro\14J56revD Details\ADC files
    - Files for TSW14J57EVM  
C:\Program Files (x86)\Texas Instruments\High Speed Data Converter Pro\14J57 Details\ADC files

# Hardware List

- Verify that the contents of the EVM package are present:
  - (1) ADC12DJxx00EVM
  - (1) FMC+ to FMC adapter (only needed with TSW14J56EVM)
  - (1) 5V power cable
  - (1) mini-USB cable



# ADC12DJxx00EVM Key Components

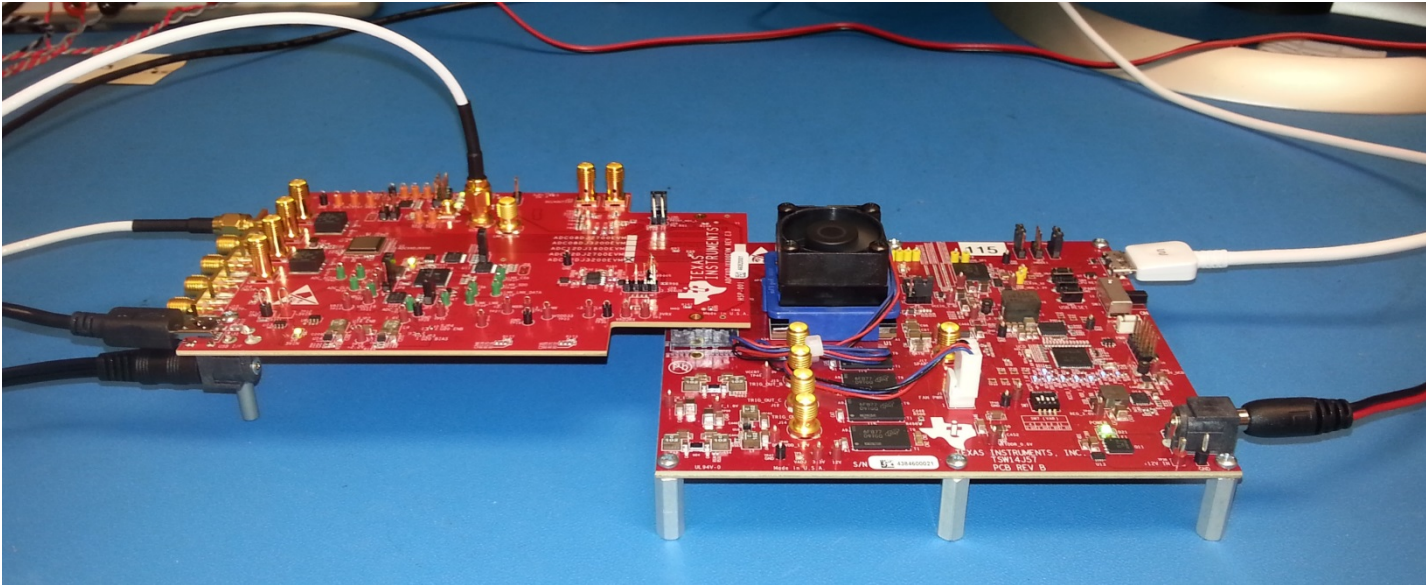


# ADC12DJxx00EVM Features

ADC Block	EVM Feature	Benefits
Serial Configuration Interfaces	ADC, temp sensor, LMK and LMX programmed via header, FMC, and/or mini USB	Program devices via HSDC Pro; compatible with Xilinx® data capture boards; multiple methods for debug
Analog Inputs	Populate options for differential AC-coupled, DC-coupled or S/E-in to balun	Optimized solution for flexibility and performance
Serial data / NCO pins	Serial data to FPGA only; NCO pins to header and FMC	Smaller board reduces cost, more true mezzanine form factor yields better reference design
Power	External 5V supply to switching regulators and LDOs to devices	Simplifies power supply scheme, provides reference design
Clocking	LMK04828+LMX2582 on-board solution; external generator option planned	No external generators required for ADC CLK up to 3.2GHz; external generators for maximum flexibility
TimeStamp / SYNC~	S/E and differential SYNC~ ; TimeStamp applied externally	Both features simultaneously available
Temperature Sensor	Read ADC internal and board ambient temperature	Can monitor ADC temp via EVM GUI
Over-range	OR outputs to FMC, header, and LEDs on-board	Visual confirmation is convenience to customer

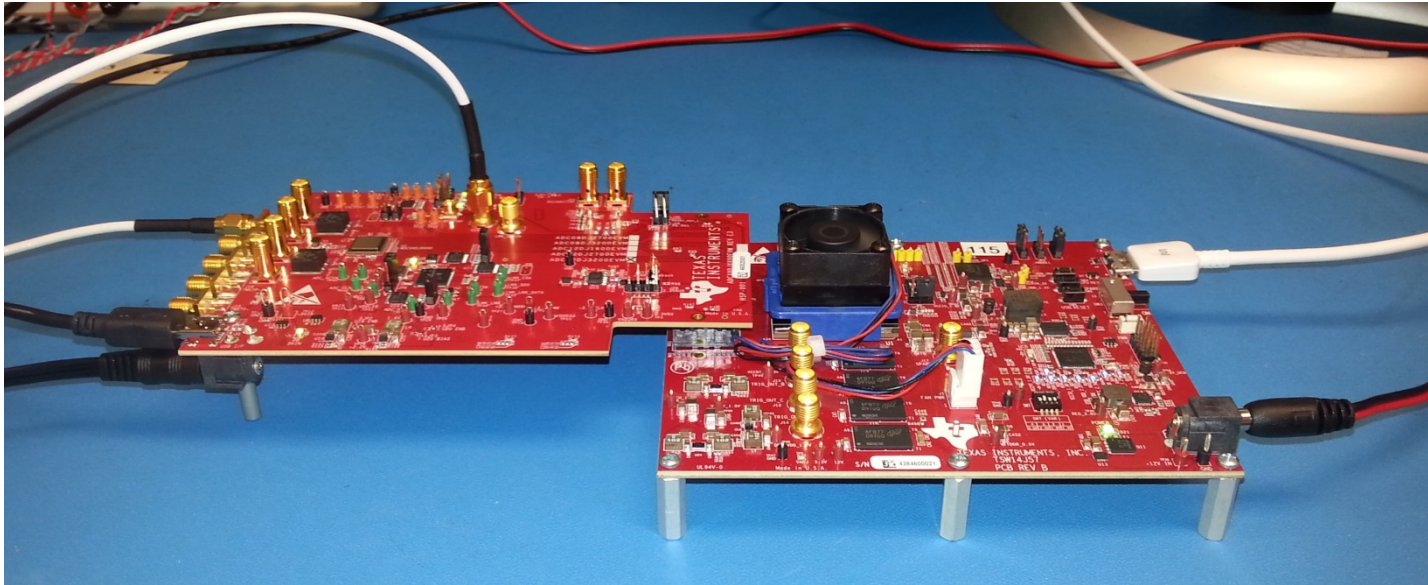
# Hardware Setup

1. Connect the ADC12DJxx00EVM FMC+ connector to the TSW14J56 FMC connector via the supplied FMC+ to FMC adapter.
2. Connect 5VDC  $\geq$  3A power to the TSW14J56. Center pin of connector is +5V. Output ring is GND.
3. Connect 5VDC  $\geq$  3A bench supply to power cable for the ADC12DJxx00EVM. (Red plug or wire is +5V, Black plug or wire is GND) Center pin of connector is +5V. Output ring is GND.



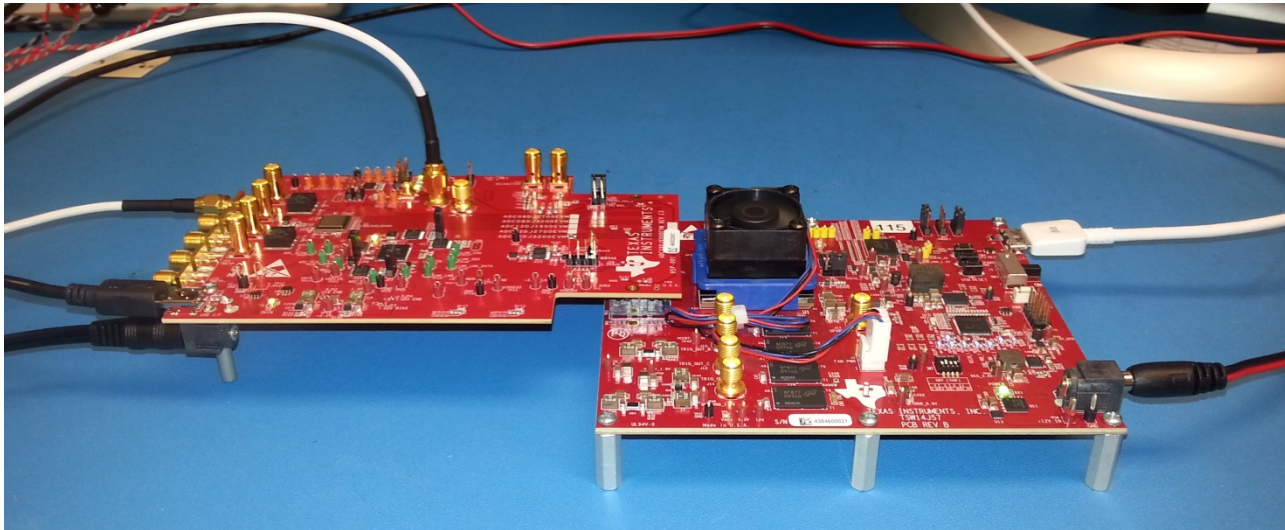
# Hardware Setup (continued)

1. Connect the USB cable from the TSW14J56 to the PC  
(USB 3.0 Cable for TSW14J56 Rev D shown below)
2. Connect the USB cable from the ADC12DJxx00EVM to the PC



# Hardware Setup (continued)

1. Connect the input signals to the INA+/- and/or INB+/- top mounted SMA connectors as needed. Diagram below shows connections to INA+/- only.
2. Optional: Connect the 10 MHz +6dBm signal to the CLKIN0 (J38) SMA connector.
  1. This signal should be frequency locked with the signal generators used for the analog inputs.
  2. This will allow coherent sampling of signals with respect to the sampling clock and eliminate the need to do windowed FFTs.



# Configure the ADC12DJxx00EVM

Step	To observe
1. Turn on the EVM power supply and slide the TSW14J56 power switch to ON	The EVM “5VIN” and “VDDD33” LEDs are lit.
2. Open the ADC12DJxx00 GUI, using the Low Level tab, program the EVM as directed on the following slides.	After programming, the “LCKD” and “PLL2 LCKD” LEDs are lit to show the LMK04828 has been configured and PLL1 is locked. Note: If a 10MHz reference at CLKIN0 is not supplied the LCKD LED will not be lit but the board will be functional. Coherent sampling will not be possible.

# Available EVM Quick-Start Configuration Settings

The screenshot displays the ADC12DJxx00 GUI with the following elements:

- Window Title:** ADC12DJxx00 GUI
- Menu Bar:** File, Debug, Settings, Help
- Section Header:** ADC12DJxx00 GUI
- Navigation Tabs:** EVM, Control, JESD204B, NCO Configuration, Trim, LMK04828, LMX2582, Low Level View (selected)
- Status:** USB Status (green light), Reconnect? button
- 1. User Inputs:**
  - #1. Clock Source: On-board
  - #2a. On-board Fclk Selection: Fclk = 2700 MHz
  - #2b. External Fclk Selection: 1000 MHz
  - #3. Decimation and Serial Data Mode: JMODE0
  - Program Clocks and ADC button
- 2. Temp Sensor:**
  - ADC Temp: 0 degrees C
  - LM95233 Local Temp: 0 degrees C
  - Update Temperatures button
- START HERE! Section:**

This tab is used to control the EVM to program the clocks, basic mode of the ADC, and read the temperature. Once the EVM is programmed, the other tabs allow the user to configure the ADC.

1. User Inputs - How to program the EVM clocks and ADC:  
#1. Clock Source - the DEVCLK to the ADC may be supplied by the on-board PLL/VCO or externally by the user. If the on-board clock is selected, choose the Fs at #2a. If the external clock is selected, enter the Fs at #2b.  
#2a. On-board Fclk Selection - The PLL/VCO will be programmed to provide any of the available sampling clock frequencies to the DEVCLK, as well as provide the clock for distribution via the LMK04828 for the JESD204B clocks.  
#2b. External Fclk Selection - The user must enter the external Fclk supplied (in MHz). The PLL/VCO will be powered down; see the Users Guide for details regarding external clocks required.  
#3. Decimation and Serial Data Mode - Choose the decimation mode and serial data mode for the ADC.  
#4. Program Clocks and ADC - once all modes have been selected, press this button to write selections to the PLL/VCO, LMK04828, and ADC.

2. Temp Sensor - the temperature for the device and ambient (board) may be read.
- Bottom Bar:** Idle, HARDWARE CONNECTED, TEXAS INSTRUMENTS logo

# Available Quick-Start Configuration Settings

- JMODES
  - 0,1,2,3,4,5,6,7,9,10,11,13,14,15,16,17,18,19
- Clock Source
  - On-board (default)
  - External
- F\_CLK (MHz)
  - 800
  - 1000
  - 1250
  - 1500
  - 1600
  - 2000
  - 2500
  - 2700
  - 3000
  - 3100
  - 3200

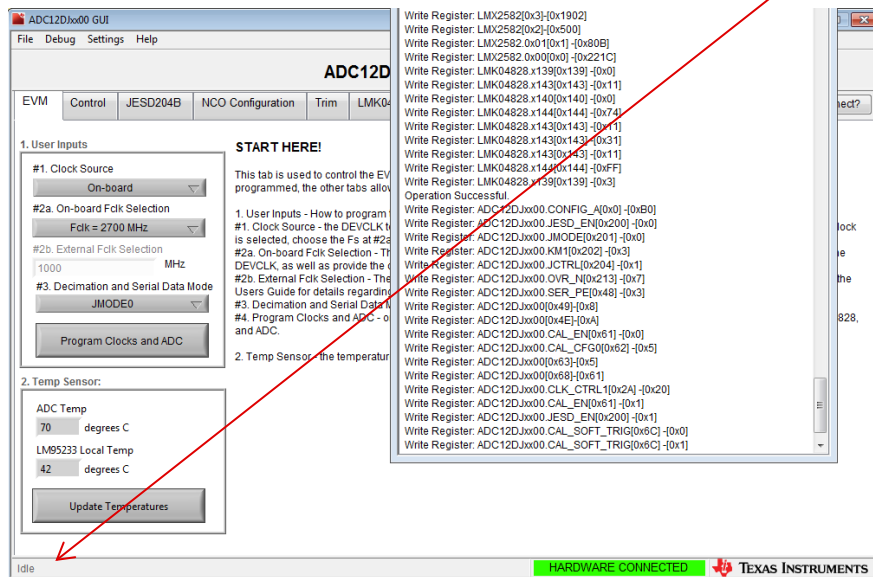


# First Configuration

- Keep the default GUI settings:
  - On-board clocking
  - 2700 MHz
  - JMODE0
- Click Program Clocks and ADC

# Devices on EVM are Programmed

- If desired, double-click on “Idle” word in lower left corner of GUI to see what registers were written.
- The Status Log Display shown on the following slide will be launched.



# Read ADC and Board Temperatures

The screenshot displays the ADC12DJxx00 GUI with the following elements:

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- Menu Bar:** File, Debug, Settings, Help
- Section Header:** ADC12DJxx00 GUI
- Navigation Tabs:** EVM, Control, JESD204B, NCO Configuration, Trim, LMK04828, LMX2582, Low Level View (selected)
- Status:** USB Status (green light), Reconnect? button
- 1. User Inputs:**
  - #1. Clock Source: On-board
  - #2a. On-board Fclk Selection: Fclk = 2700 MHz
  - #2b. External Fclk Selection: 1000 MHz
  - #3. Decimation and Serial Data Mode: JMODE0
  - Program Clocks and ADC button
- START HERE!**

This tab is used to control the EVM to program the clocks, basic mode of the ADC, and read the temperature. Once the EVM is programmed, the other tabs allow the user to configure the ADC.

1. User Inputs - How to program the EVM clocks and ADC:  
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#2a. On-board Fclk Selection - The PLL/VCO will be programmed to provide any of the available sampling clock frequencies to the DEVCLK, as well as provide the clock for distribution via the LMK04828 for the JESD204B clocks.  
#2b. External Fclk Selection - The user must enter the external Fclk supplied (in MHz). The PLL/VCO will be powered down; see the Users Guide for details regarding external clocks required.  
#3. Decimation and Serial Data Mode - Choose the decimation mode and serial data mode for the ADC.  
#4. Program Clocks and ADC - once all modes have been selected, press this button to write selections to the PLL/VCO, LMK04828, and ADC.

2. Temp Sensor - the temperature for the device and ambient (board) may be read.
- 2. Temp Sensor:**
  - ADC Temp: 70 degrees C
  - LM95233 Local Temp: 42 degrees C
  - Update Temperatures button
- Bottom Bar:** Idle, HARDWARE CONNECTED, TEXAS INSTRUMENTS logo

# ADC Configuration Tabs - Control

The screenshot displays the ADC12DJxx00 GUI with the following sections:

- Power and Reset:** Includes a 'Soft Reset' button labeled 'Reset Device Registers' and a 'POWER DOWN' button.
- Identification:** Shows fields for 'Chip Type' (3), 'Chip Version' (1), and 'Vendor ID' (451), with a 'Read All Fields' button.
- ADC Test Pattern Mode:** Features an 'Enable Test Pattern Mode' button.
- Input Resistor Trim:** Shows a 'Termination Resistor Trim' set to 36.000 Ohms.
- Calibration:** Contains several enable buttons: 'Enable Calibration Block', 'Enable Foreground Cal', 'Enable Foreground Offset CAL', 'Enable Background Cal', and 'Enable Background Offset CAL'. It also includes a 'CAL Status Select' dropdown (set to 'CALSTAT matches FG\_DONE') and a 'CAL Trigger Source' dropdown (set to 'CAL\_SOFT\_TRIG').
- Gain and Offset:** Divided into 'Input A' and 'Input B' sections. Each section shows 'Gain Full Scale' (42180, 789.190 mVpp) and 'Offset' values for ADC A, B, and C (all 2047, -0.007 mV).
- Over-range:** Shows 'Over-range Threshold T0' (-0.488 dBFS), 'Over-range Threshold T1' (-3.5 dBFS), and 'OVR Monitoring Period' (7, 1024 ADC Samples).
- Status:** Shows 'CAL\_GOOD', 'CAL\_STOPPED', and 'FG\_DONE' indicators, along with 'PD\_ACH' and 'PD\_BCH' buttons.
- Navigation:** Tabs include 'EVM', 'Control', 'JESD204B', 'NCO Configuration', 'Trim', 'LMK04828', 'LMX2582', and 'Low Level View'. A 'Reconnect?' button is also present.
- Footer:** Displays 'Idle', 'HARDWARE CONNECTED', and the 'TEXAS INSTRUMENTS' logo.

# ADC Configuration Tabs

## JMODES, INPUTS, JESD204B

The screenshot displays the ADC12DJxx00 GUI with the following configuration details:

- ADC12DJxx00 GUI** (Title Bar)
- File** **Debug** **Settings** **Help** (Menu Bar)
- ADC12DJxx00 GUI** (Main Title)
- EVM** **Control** **JESD204B** **NCO Configuration** **Trim** **LMK04828** **LMX2582** **Low Level View** (Navigation Tabs)
- USB Status** **Reconnect?** (Status Bar)
- DDC/Bypass Settings:**
  - JMODE: 0
  - Operating Mode: 12-bit, Single Channel, 8 lanes
  - DDC Gain Boost: Enabled
  - DB4 Mode Alias Protection: Enabled
  - DB2 Filter Mode: Low-pass Filter
  - DDC Real Output Spectrum Invert: Enabled
- JESD204B Block Control:**
  - JESD Block Enable: Enabled
  - Scrambler Enable: Enabled
  - Frames per Multiframe: K Value 4, K-1 Value 3
  - JSYNC\_N Sync Request: Disabled
  - SYNC Input Selection: SYNCSE Input
  - JESD Test Mode: Normal Operation
  - SFORMAT: Enabled
  - DID: Enabled
  - FCHAR: Enabled
- Input Mux Select:**
  - Single Input: Input Selection: INA is used
  - Dual Input: Channel Swap: ChA samples INA, ChB samples INB
- Serializer Control:**
  - Pre-emphasis Strength: 3
- Idle** (Bottom Left)
- HARDWARE CONNECTED** **TEXAS INSTRUMENTS** (Bottom Right)

# ADC Configuration Tabs

## NCO Settings

**ADC12DJxx00 GUI**

File Debug Settings Help

EVM Control JESD204B **NCO Configuration** Trim LMK04828 LMX2582 Low Level View USB Status Reconnect?

**NCO Configuration:**

CSELA/CSELB NCO Sel Mode  Enable Rational NCO Mode

Desired FSTEP: 10 kHz NCO\_RDIV: 0  NCO\_RDIV in range  NCO\_RDIV is Integer

Preset	Frequency (MHz)	Phase (radians)
Preset 0	3221225472 2025.000000000 MHz	0 0.000000000 radians
Preset 1	3221225472 2025.000000000 MHz	0 0.000000000 radians
Preset 2	3221225472 2025.000000000 MHz	0 0.000000000 radians
Preset 3	3221225472 2025.000000000 MHz	0 0.000000000 radians
Preset 4	3221225472 2025.000000000 MHz	0 0.000000000 radians
Preset 5	3221225472 2025.000000000 MHz	0 0.000000000 radians
Preset 6	3221225472 2025.000000000 MHz	0 0.000000000 radians
Preset 7	3221225472 2025.000000000 MHz	0 0.000000000 radians

This tab is used to program the NCO features of the ADC.

The NCO may be programmed to up to eight preset frequency /phase pairs. Changing this register after the JESD204B interface is running will result in non-deterministic NCO phase. If deterministic phase is required, the JESD204B interface should be re-initialized (assert and de-assert ~SYNC) after changing this register.

To program a preset pair, do the following:

1. Choose whether the NCO Preset Values shall be selected via the NCO\_SEL bits or input pins.
2. Choose which NCO Preset Value shall be configured (Preset 0 ... Preset 7).
3. Load/adjust the Preset Frequency register value. The NCO frequency (FNCO) is:  $FNCO = NCO\_FREQ * 2^{-32} * F_s$   
Fs is the sampling frequency of the ADC, and NCO\_FREQ is the integer value of this register. This register can be interpreted as signed or unsigned.
4. Select the Preset Phase. This value is left-justified into a 32-bit field and then added to the phase accumulator. The phase (radians) is:  
 $PHASE = NCO\_PHASE * 2^{-16} * 2 * \pi$   
This register may be interpreted as signed or unsigned.

Idle **HARDWARE CONNECTED** TEXAS INSTRUMENTS

# GUI – Low Level View – Devices/Registers

The screenshot displays the ADC12DJxx00 GUI in the Low Level View. The interface includes a menu bar (File, Debug, Settings, Help), a title bar (ADC12DJxx00 GUI), and a toolbar with various icons. The main content area is divided into several sections:

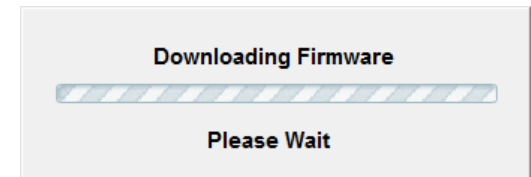
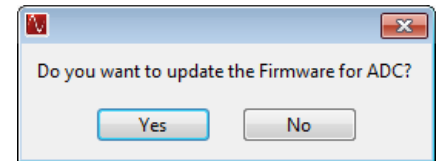
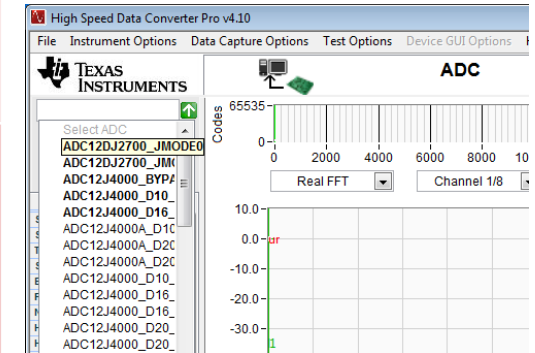
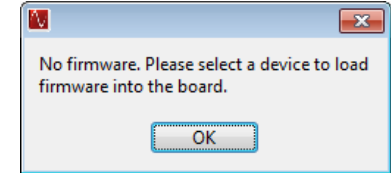
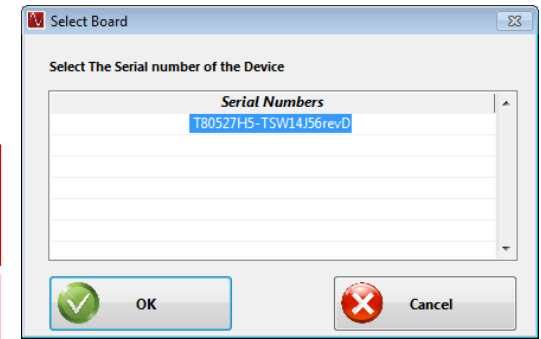
- Navigation and Settings:** Buttons for EVM, Control, JESD204B, NCO Configuration, Trim, LMK04828, and LMX2582. A 'Low Level View' icon is active. On the right, there is a 'USB Status' indicator (green light) and a 'Reconnect?' button.
- Register Map:** A table listing registers with columns for Register Name, Address, Default, Mode, Size, Value, and bit fields 15 through 8. The 'Update Mode' is set to 'Immediate'.
- Field View:** A grid for viewing individual bit fields, currently empty.
- Register Description:** A text area for describing the selected register.
- Control Panel:** Fields for 'Block', 'Address' (x 0), 'Write Data' (x 0), and 'Read Data\_Generic' (x 0). 'Write Register' and 'Read Register' buttons are present.
- Status Bar:** Shows 'Idle', 'HARDWARE CONNECTED', and the Texas Instruments logo.

Register Name	Address	Default	Mode	Size	Value	15	14	13	12	11	10	9	8
ADC12DJxx00	0x00	0x30	R/W	8	0x30								
CONFIG_A	0x00	0x30	R/W	8	0x30								
DEVICE_CONFIG	0x02	0x00	R/W	8	0x00								
CHIP_TYPE	0x03	0x03	R	8	0x03								
CHIP_ID_0	0x04	0x20	R	8	0x20								
CHIP_ID_1	0x05	0x00	R	8	0x00								
CHIP_VER	0x06	0x01	R	8	0x01								
VENDOR_ID_0	0x0C	0x51	R	8	0x51								
VENDOR_ID_1	0x0D	0x04	R	8	0x04								
USR0	0x10	0x00	R/W	8	0x00								
AC_CTRL1	0x23	0x00	R/W	8	0x00								
CLK_CTRL0	0x29	0x00	R/W	8	0x00								
CLK_CTRL1	0x2A	0x00	R/W	8	0x00								
SYSREF_POS_0	0x2C	0x00	R	8	0x00								
SYSREF_POS_1	0x2D	0x00	R	8	0x00								
SYSREF_POS_2	0x2E	0x00	R	8	0x00								
FS_RANGE_A_0	0x30	0xC4	R/W	8	0xC4								
FS_RANGE_A_1	0x31	0xA4	R/W	8	0xA4								
FS_RANGE_B_0	0x32	0xC4	R/W	8	0xC4								
FS_RANGE_B_1	0x33	0xA4	R/W	8	0xA4								

# Configure the TSW14J56 (1/2)

Step	How to	To do / observe
1. 'J56 is on from previous step 2.	ON/OFF power switch at ON position.	Multiple LEDs are lit
2. Open HSDC Pro	(Start → Programs → Texas Instruments ADCs → HSDC Pro)	Accept the board selection. If multiple TSW' boards are connected, select the appropriate model/serial number
3. Configure the Firmware for the desired operating mode corresponding to the current EVM configuration	Click the "Select ADC" pull-down Choose one of the following: <ul style="list-style-type: none"> <li>ADC12DJxx00_JMODE0</li> <li>ADC12DJxx00_JMODE2</li> <li>ADC12DJxx00_JMODE*</li> </ul> Select 'Yes' to download the Firmware for the ADC	Correct LED pattern after clicking Capture:  D1, D5 – N/A D4 = blinking D3, D6, D7 = OFF D8 = ON

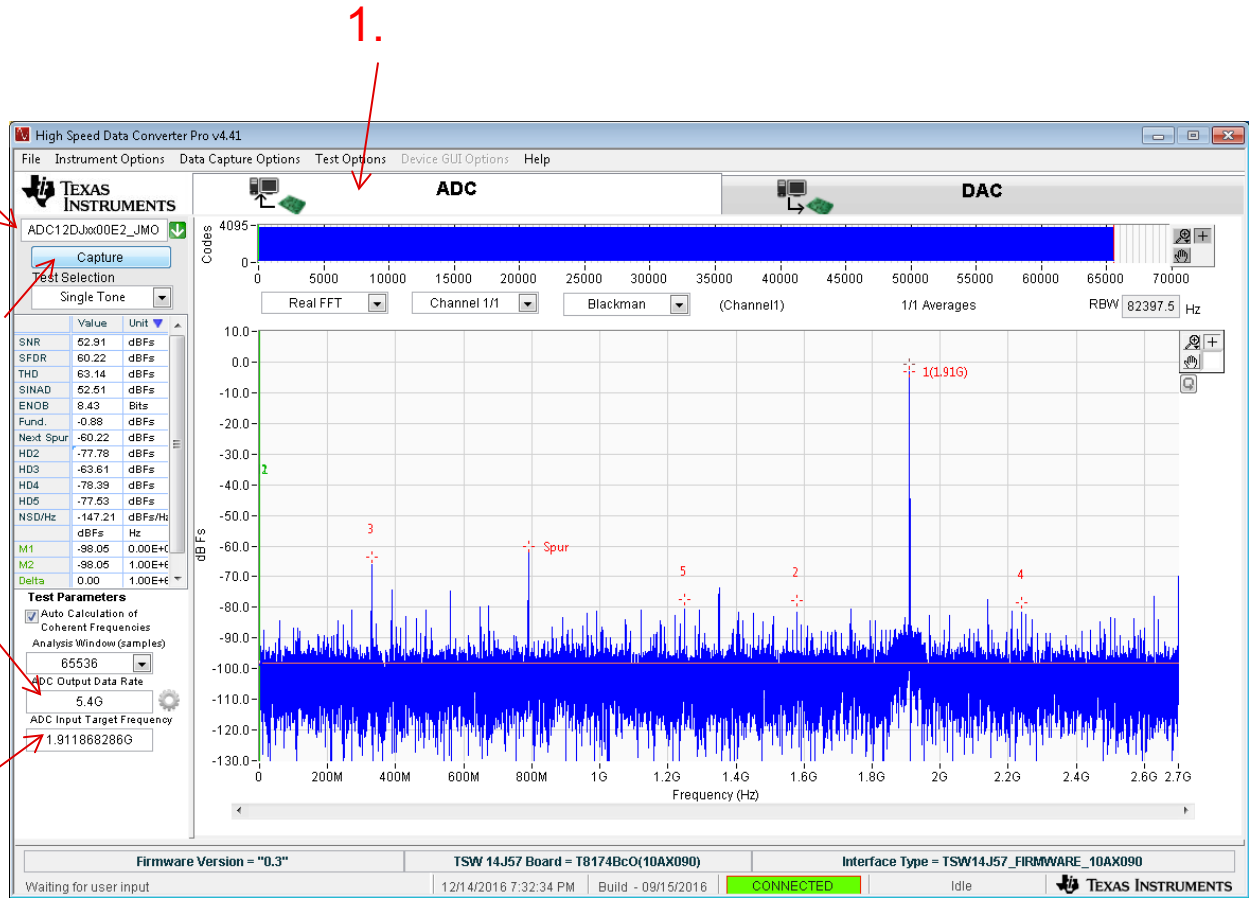
**Tip:** In case of incorrect LED pattern or capture problems, press "CPU Reset" button and/or click "Instrument Options>Reset Board" from HSDC Pro GUI.



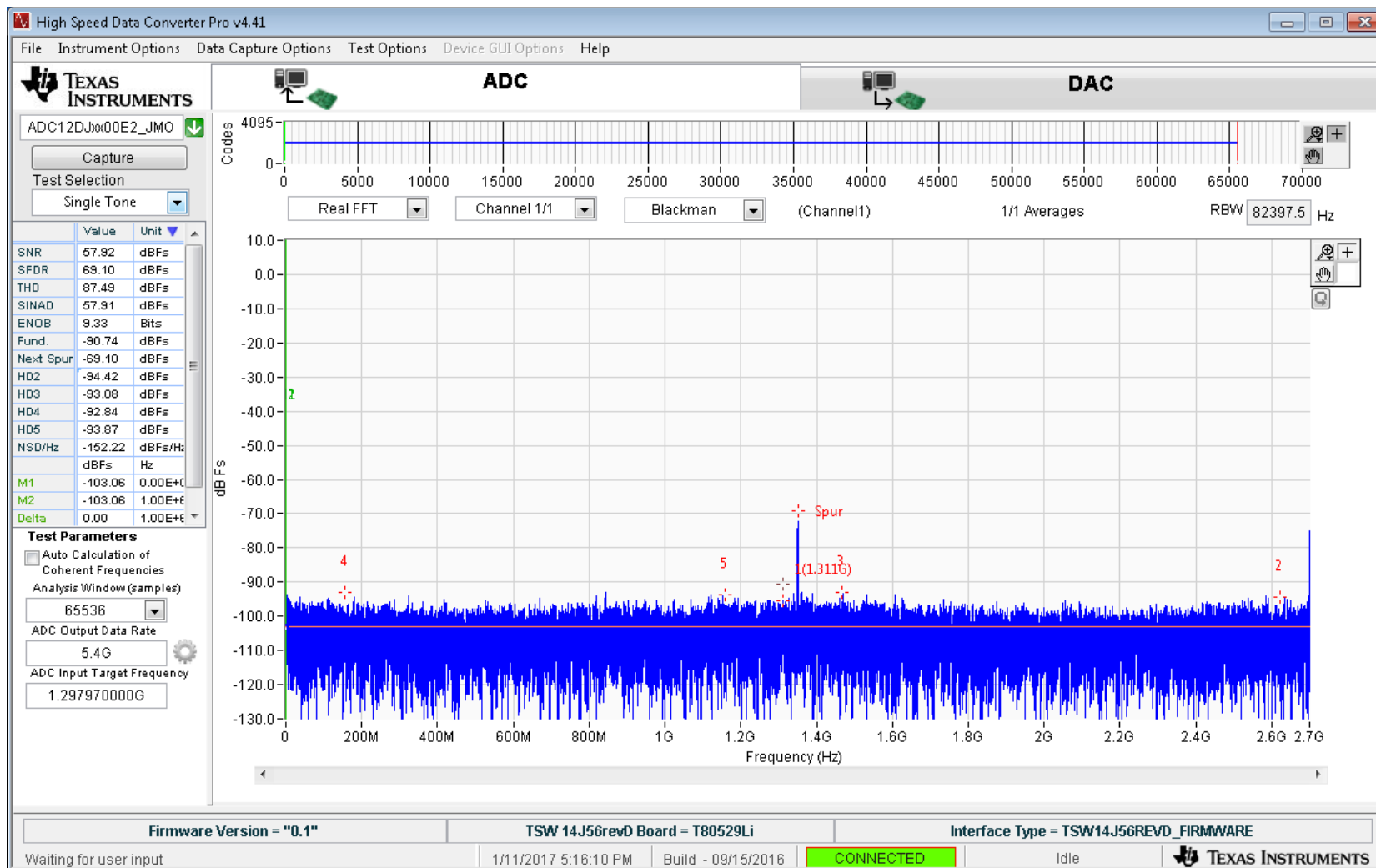


# Configure the TSW14J56 (2/2)

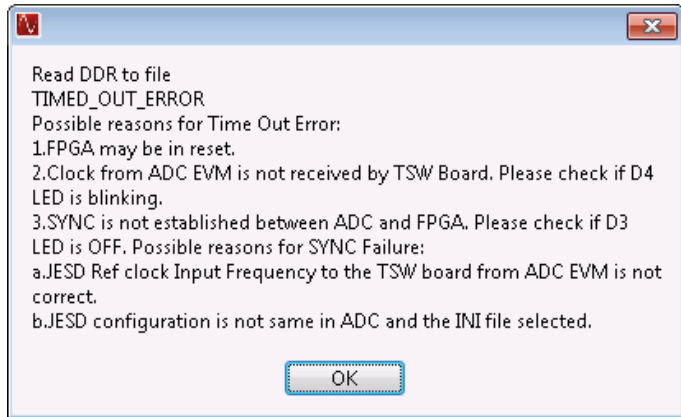
1. Select the leftmost “ADC” tab
  2. Select the “ADC12DJxx00\_JMODE0”
  3. Enter the ADC Output Data Rate = 5.4G
  4. Enter the ADC Input Target Frequency. For this example,  $F_{in} = 1.91\text{GHz}$
  5. Click the Capture button to collect data
- Note: Refer to the user manual for High Speed Data Converter Pro software for more details and options.



# Captured Data Results – Signal Off



# In Case of Data Capture Timeout



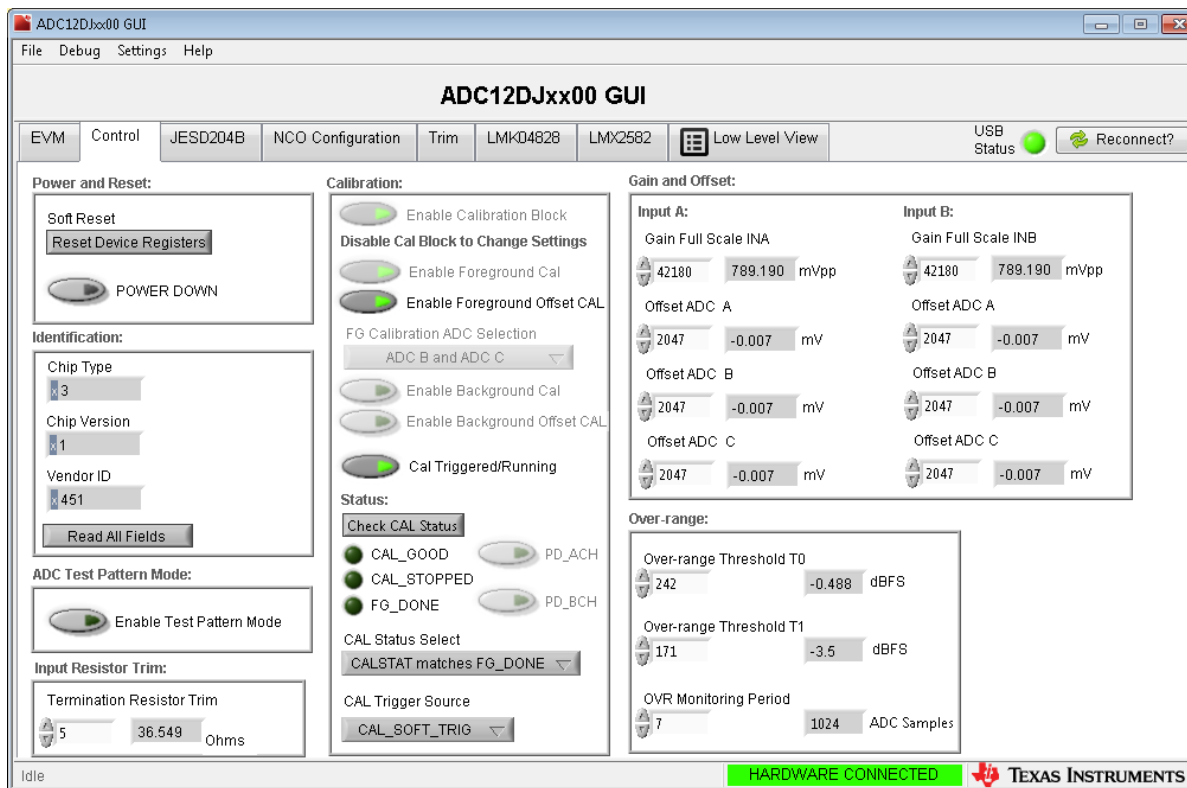
- If capture fails an error message will appear
- Possible Causes
  - Incompatible settings between ADC EVM and HSDC Pro
    - Double check EVM configuration modes set and HSDC Pro device selection and ADC Output Data Rate field. Ensure upper case G and M are used.
  - Capture firmware has lost sync with ADC EVM.
    - Select “Instrument Options>Reset Board” and try to capture again.

# Apply Test Signal and Capture

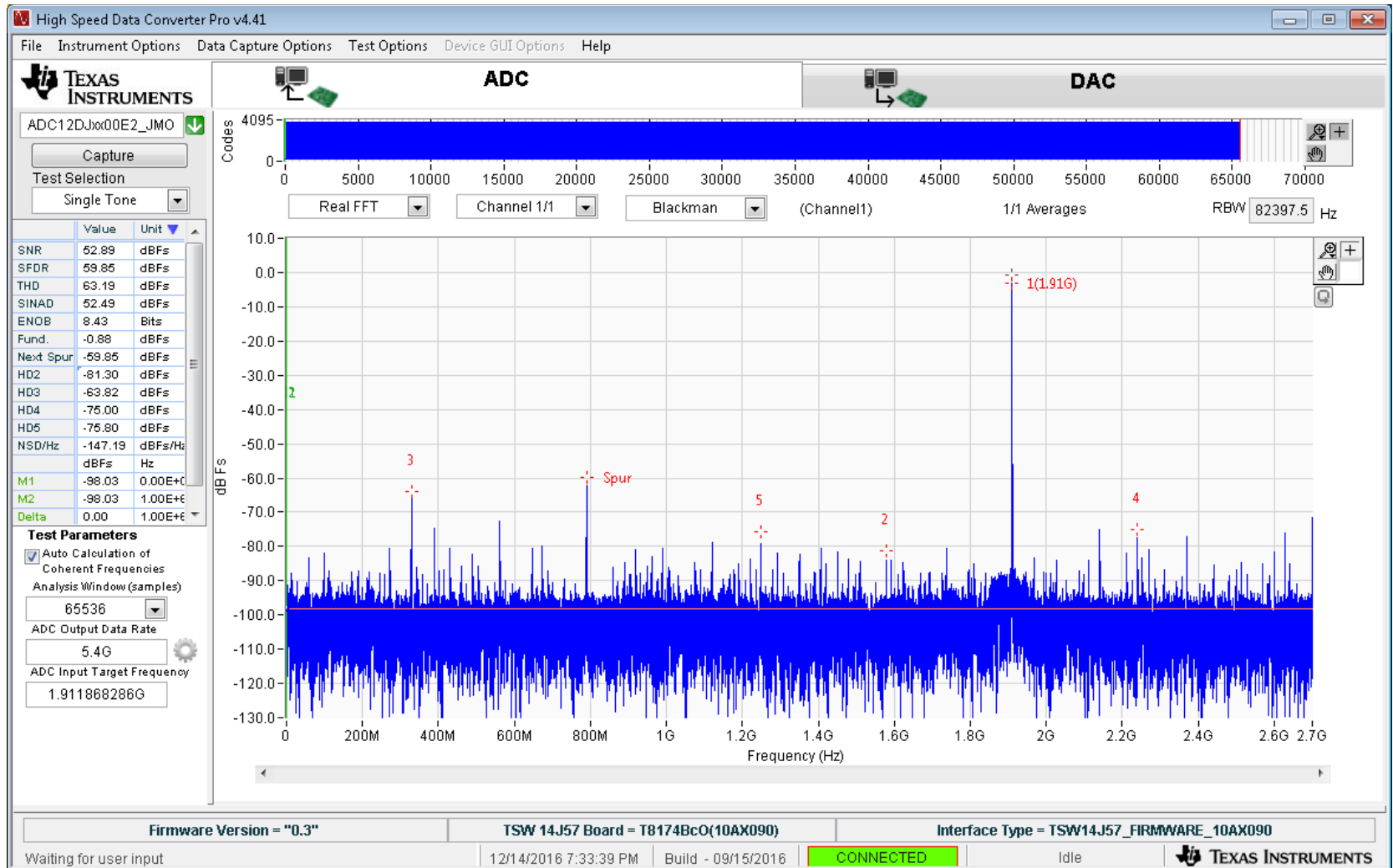
- Once a successful capture has been done the test signal can be applied and evaluation done.
- It is important that the ADC calibration is properly done before evaluation.
- Foreground Calibration
  - Once device temperature is stable re-calibrate by following the procedure on the following slide.
- Background Calibration
  - If the device is in background calibration mode, it continuously self-calibrates and no additional steps need to be taken.

# Trigger Calibration via High Level Control

- Trigger a Foreground Calibration
  - Click on Cal Triggered/Running button on Control tab twice

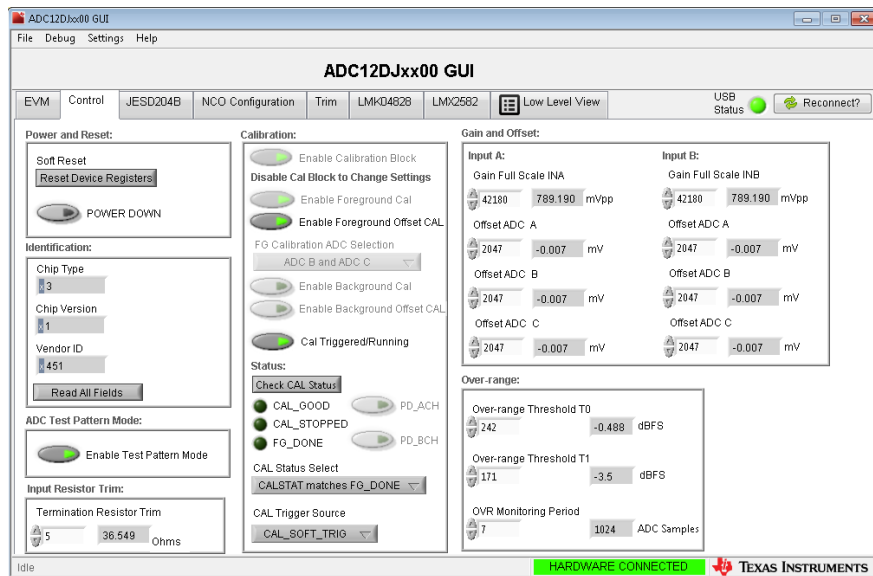


# Captured Data Results – Signal On

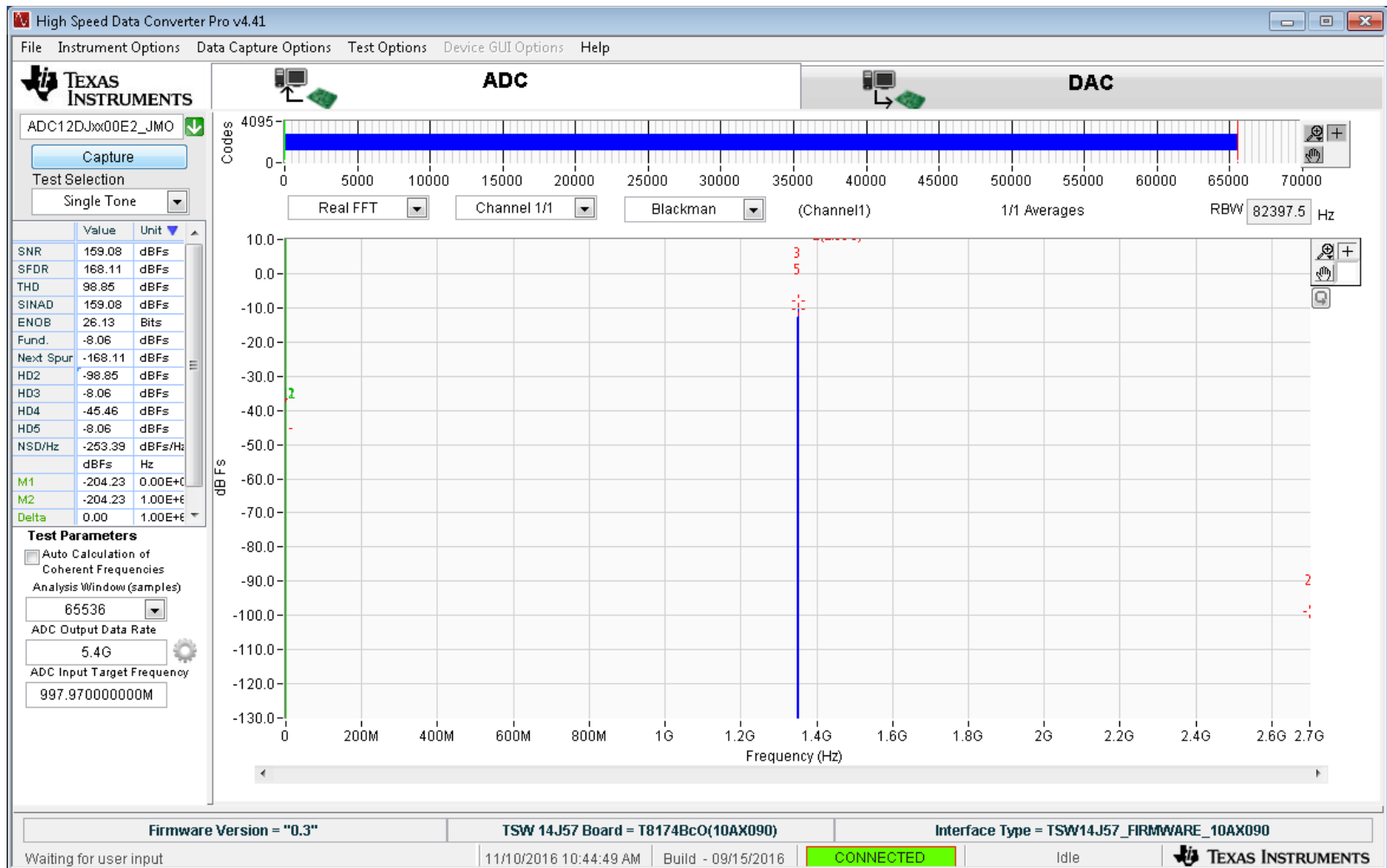


# Enable ADC Test Pattern Output

- Click on Enable Test Pattern Mode button in lower left of Control tab
- Click again to Disable

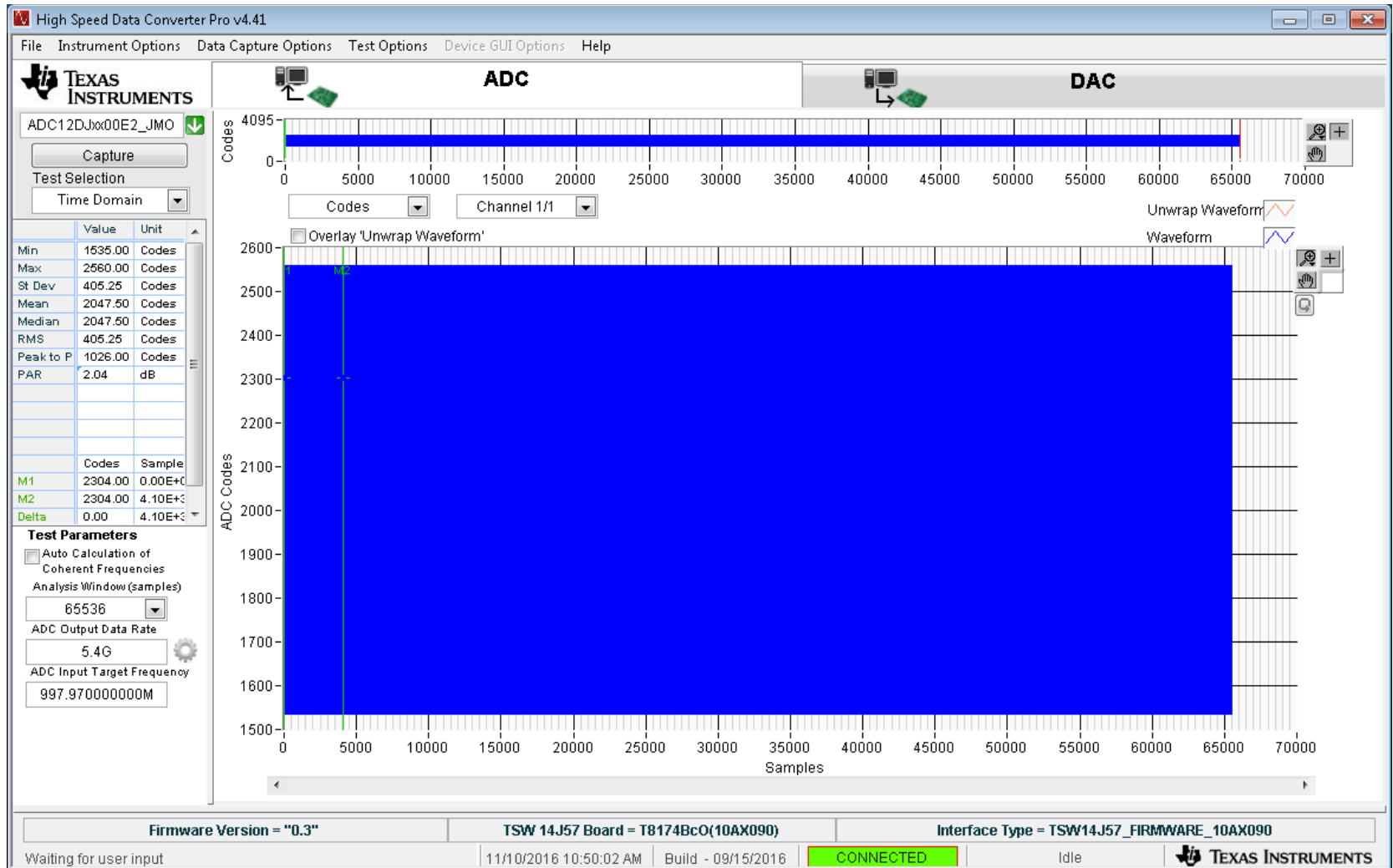


# ADC TPM Capture Results





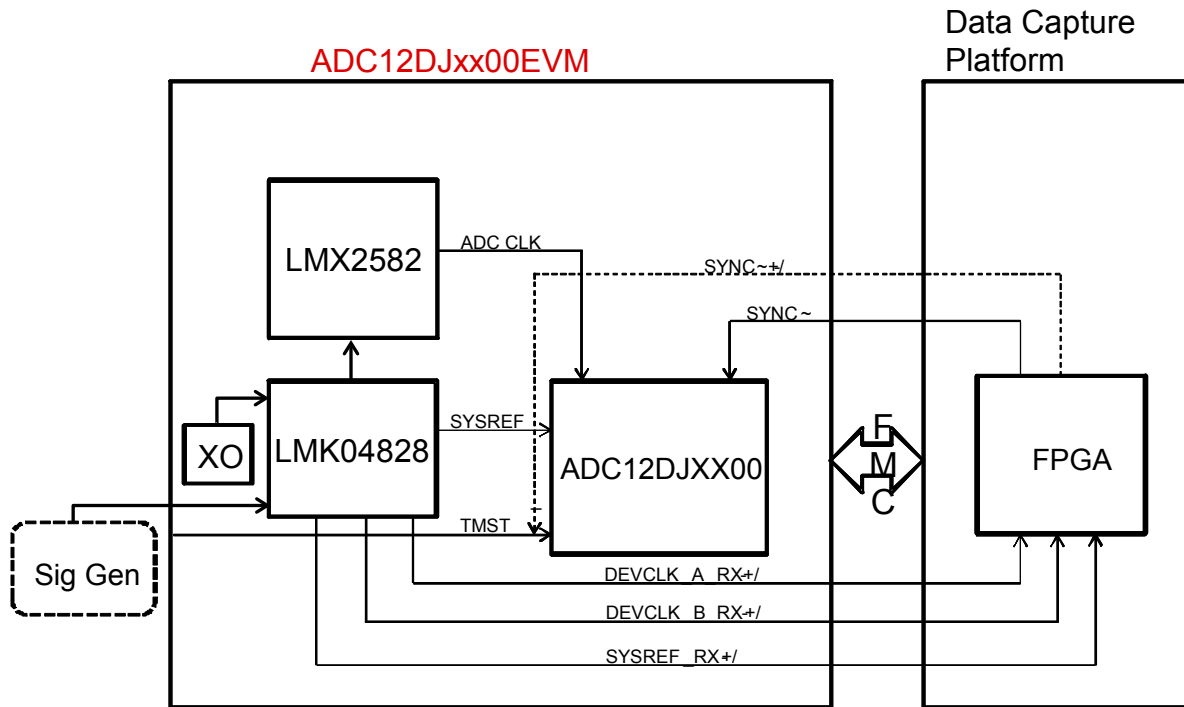
# ADC TPM Capture Results – Time Domain



# ADC TPM Capture Results – Zoomed In



# EVM Clocking Block Diagram



## On-board solution: {0.5-3.2GHz}

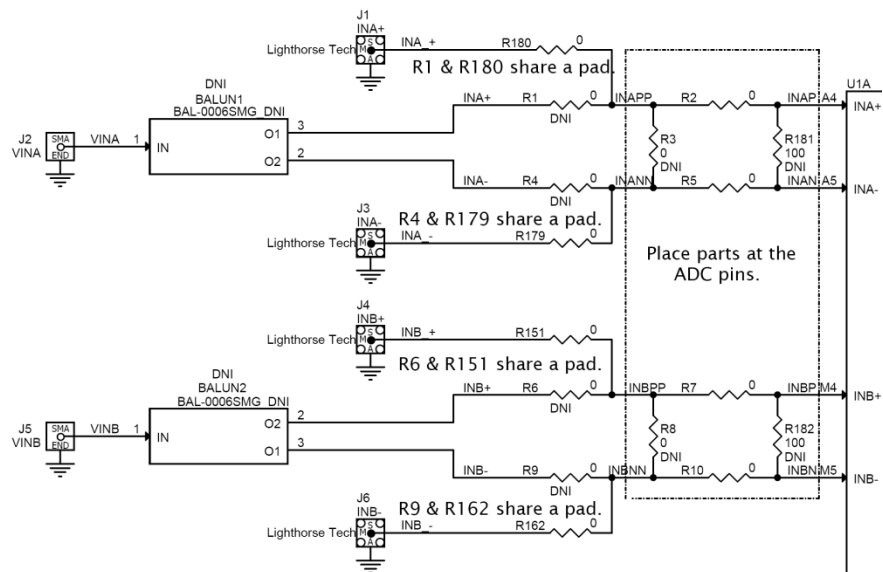
- LMK04828 provides reference for LMX2582
- LMX2582 sends CLK to ADC and LMKo4828
- LMK04828 generates JESD204B SYSREF
- LMX2582 provides ADC CLK based on reference from LMK04828

## External solution: {0.5-3.2GHz}

- In development

# Analog Inputs

- The EVM may be configured for several different analog input options.



Coupling	Input	SMA to Use	R1, R4, R6, R9	R151, R162, R179, R180
AC (default)	S/E Balun {500kHz, 5GHz}	VINA, VINB	0Ω	DNI
DC	Differential	INA+ / INA- INB+ / INB-	DNI	0Ω
AC	Differential	INA+ / INA- INB+ / INB-	DNI	0.1uF

# Limitations and Errata

1. The board is configured for AC-coupled Single Ended input via a balun. If a differential input is needed the board must be reconfigured.
2. Read-back from the LMX2582 does not function because the dual/use readback pin is being used for a PLL Lock Detect function.

# Revision History

- Rev B (December 2016) – Updated for latest EVM GUI
- Rev C (January 2017) – Updated Captured Data Results – Signal Off plot, corrected details for TSW14J56EVM status LEDs

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    - 3.1.1 *Notice applicable to EVMs not FCC-Approved:*

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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.

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- 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

#### Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). 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.

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[http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page)

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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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