User's Guide
SLOU257B–October 2009–Revised March 2015

AFE5801 8-Channel Variable Gain Amplifier (VGA) with Octal High-Speed ADC

The AFE5801EVM is an evaluation tool designed for the ultrasound analog front-end (AFE) device AFE5801. In order to deserialize the outputs of AFE5801, an ADSDeSer-50EVM or TSW1400EVM is needed during the evaluation.

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1 Introduction

AFE5801 includes an 8-channel voltage-Controlled-Amplifier (VCA) with digital control and an 8-channel 65MSPS analog-to-digital converter (ADC). The outputs of the ADC are 8-channel LVDS outputs which should be deserialized by the ADSDeSer-50EVM or TSW1400EVM. The AFE5801EVM provides an easy way to examine the performances and functionalities of AFE5801.

1.1 AFE5801EVM Kit Contents

The AFE5801EVM kit contains the following:

- AFE5801 EVM board
- USB cable

1.2 Features

- Characterize AFE5801
- Provide 8-channel LVDS outputs from the ADC
- Compatible to the standard TI LVDS deserializer ADSDeSer-50EVM or TSW1400EVM
- Communicate with PC through USB interface
- Power Management provides multiple power supplies for AFE5801 and other devices.

1.3 Power Supplies

The AFE5801EVM requires only +5V power supplies for operation.

1.4 Indicators

The AFE5801EVM has 4 LEDs on the board as shown in Figure 1. Their states demonstrate the normal operation of AFE5801EVM.

- **LED 1:** U1 status indicator. Its ON state indicates the clock management chip U1 works well if U1 is installed.
- **LED 3 and 2 (RED)**: 1.8VD and 1.8VA power supply indicators. ON state indicates that the AFE5801 is powered correctly.
- **LED 4 (GREEN):** +3.3V power supply indicator. ON state indicates that the AFE5801 is powered correctly.

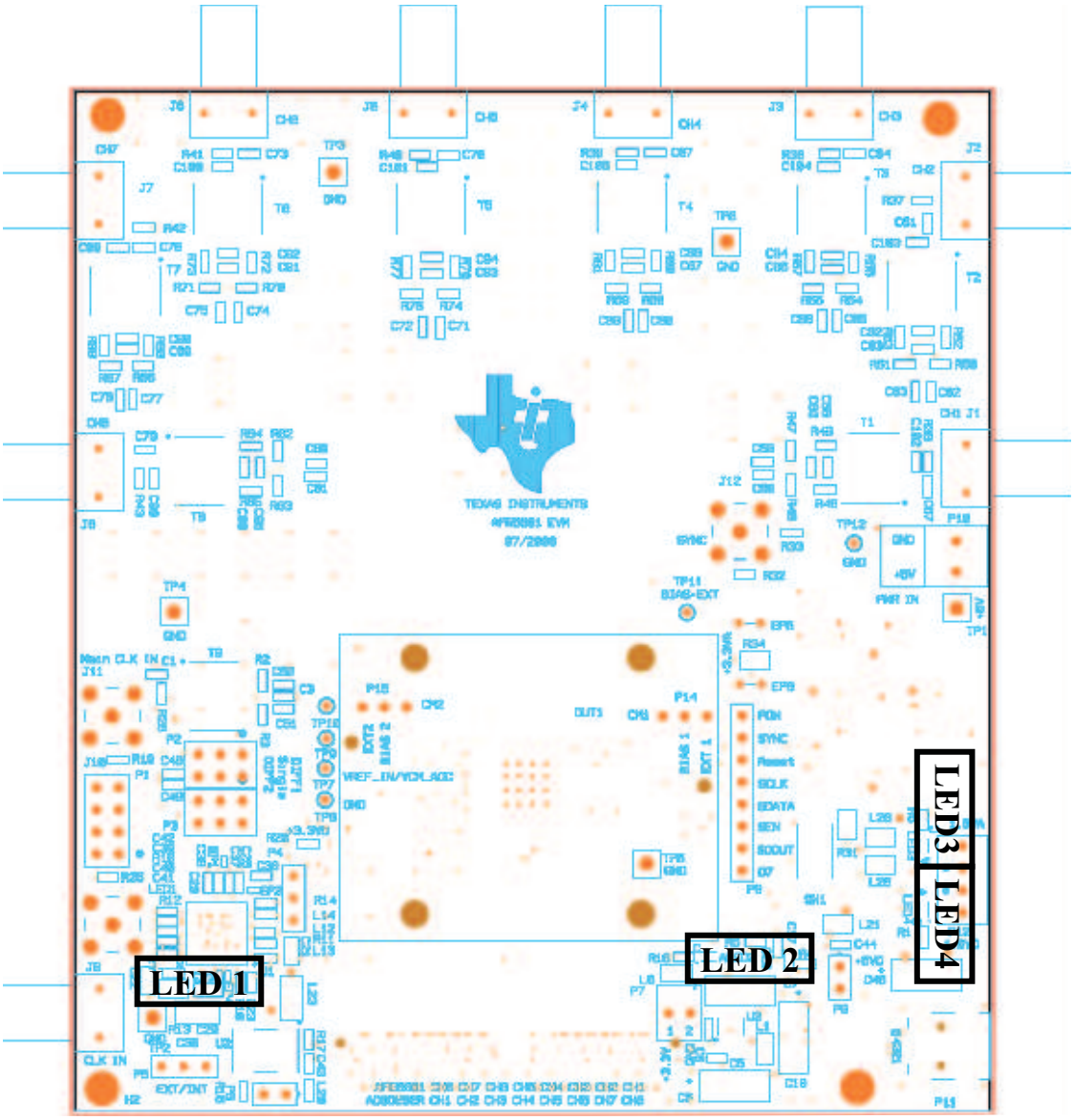


Figure 1. AFE5801EVM LED Locations

2 Board Configuration

This chapter describes the locations and functionalities of inputs, outputs, jumpers, test points of the AFE5801EVM in detail.

2.1 Board Connections Overview

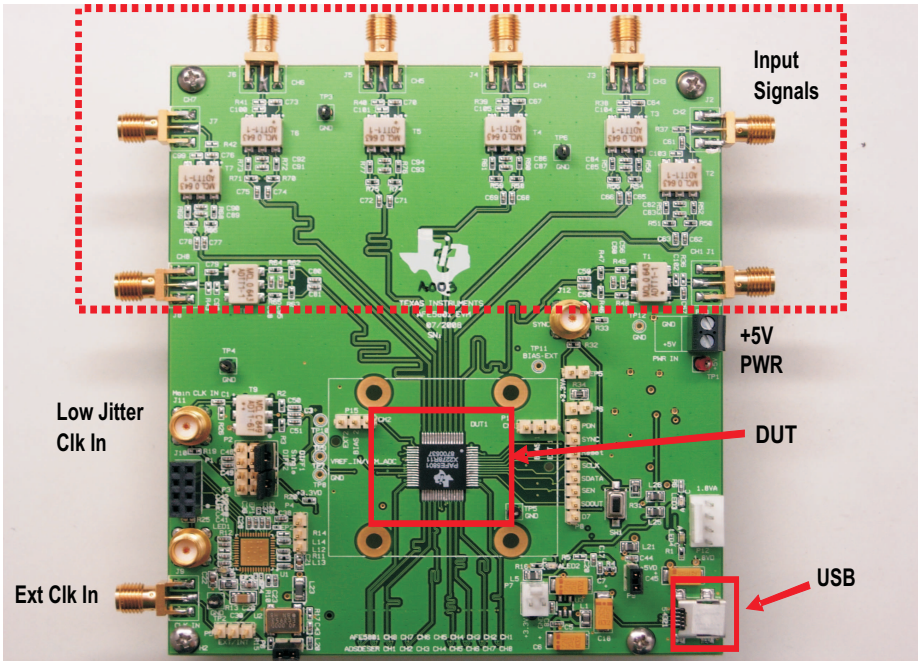


Figure 2. AFE5801EVM TOP View

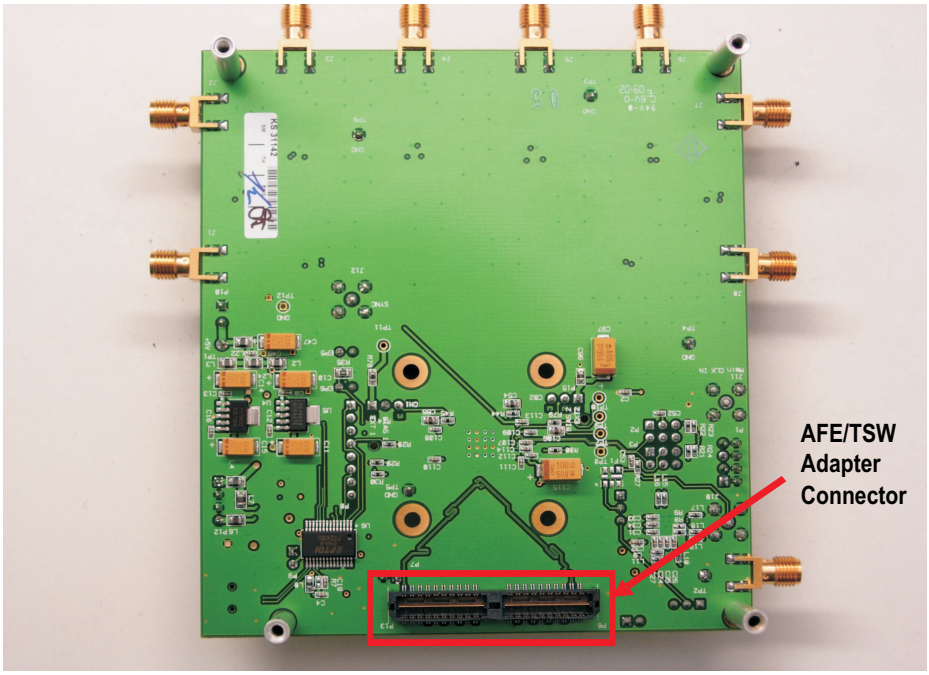


Figure 3. AFE5801EVM BOTTOM View

2.2 I/O and Power Connectors

The positions and functions of the AFE5801EVM connectors are discussed in this section.

- Analog Inputs Ch1~Ch8 (J1~J8): Single-end analog signal is converted to differential signals by transformer.
- Low Jitter CLK Source Input (J11): This input accepts clocks with low jitter noise, such as HP8644 output. 20~50MHz 50% duty cycle clock with 1~2Vrms amplitude can be used. When J11 is used, make sure shunts P4, P5, P6 are removed.
- CLK output (J10): The output of either the U1 output or the on-board 40MHz oscillator output depending on jumper P4's connection.
- External CLK Input (J9): ADC Clock input, such as FPGA outputs. FPGA outputs must be processed by U1. Otherwise, the ADC of AFE5801 will not achieve satisfactory performance.
- +5V PWR connector(P10): Power supply input
- USB input (P11): USB interface to control the AFE5801.
- LVDS Outputs Ch1~Ch8 (P13): Differential LVDS data outputs.

2.3 Jumpers and Setup

The board has been set to default mode. Detailed description can be found in Figure 4 and Figure 5.

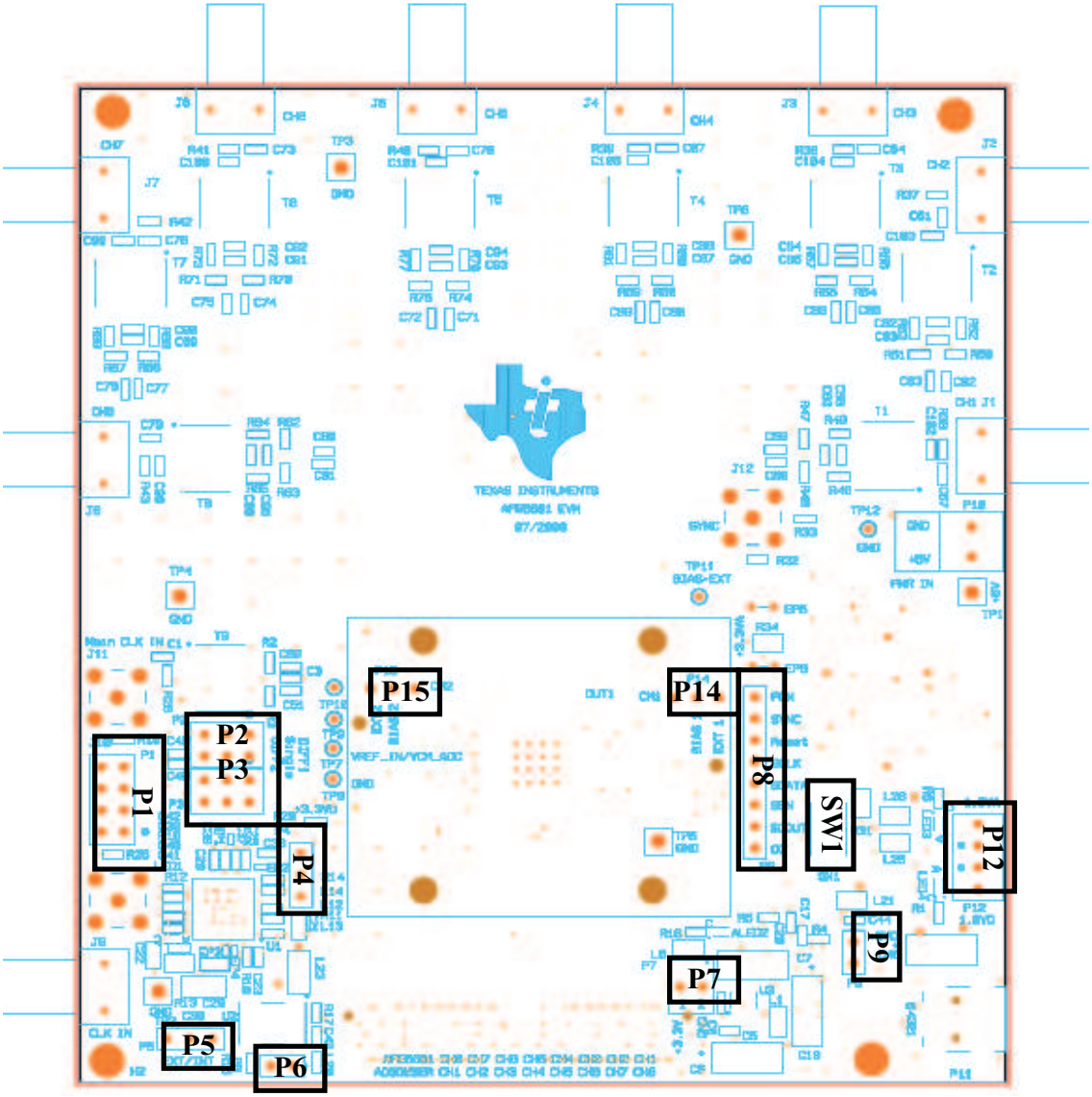


Figure 4. Locations of Jumpers, Headers and Switches on the AFE5801EVM

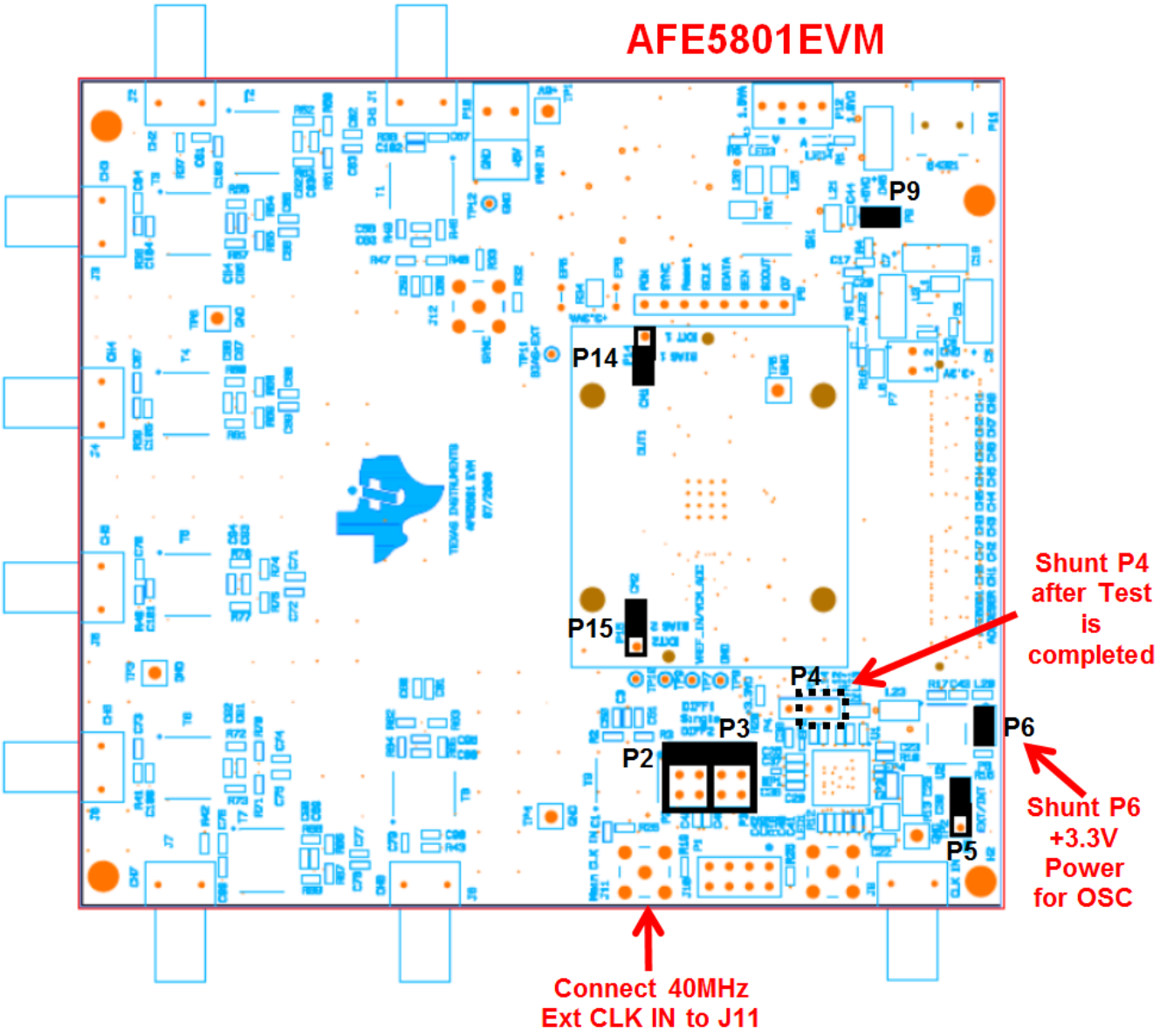


Figure 5. Default Setup for Jumpers

- P1: SPI interface for U1
- P2, P3: AFE5801 ADC clock input selection: transformer-based differential clock, single-ended LVCMOS clock, or future clock option (needs U1 to support). Default is to use transformer-based differential clock.
- P4: Select jitter-cleaned clock or non-jitter-cleaned clock. Default is to use non-jitter-cleaned clock (i.e., on-board 40MHz clock).
- P5: Use on-board 40MHz clock. Default is that the on-board clock is used.
- P6: Power on on-board 40MHz clock generator. Default is on.
- P8: Debug port for monitoring ADS SPI signals.
- P9: USB interface enable. Default is on.
- Regulated power supply outputs (P12, P7): 1.8VA, 1.8VD, and 3.3V. P12 and P7 can be configured as power supply input as well if users would like to skip the on-board regulators. Remove the ferrite beads L1, L2, L3, L7 and L24,

- SW1: Reset switch for AFE5801.

2.4 Test Points

- Multiple Test Points are provided on the EVM. Refer to the attached schematics for more information.

3 Board Operation

This chapter describes how to operate the AFE5801EVM for evaluation. Both software and hardware installation and operation are discussed.

3.1 Software Installation and Operation

The AFE5801EVM comes with a software install. To Dowload the software, visit the AFE5801 product folder in the *Tools & software* section. Once the zip folder is downloaded, run setup.exe to install the software. The software to use the TSW1400EVM is called HSDCPro (High Speed Data Converter Pro). For information on how to download this software, please see Appendix B.

USB Driver Installation

- Connect the USB port of EVM to your PC.
- If the driver has not been installed then the message “Windows Found New Hardware” will appear. The Wizard as the following picture will launch.
- Select "No, not this time" from the options. Press Next button

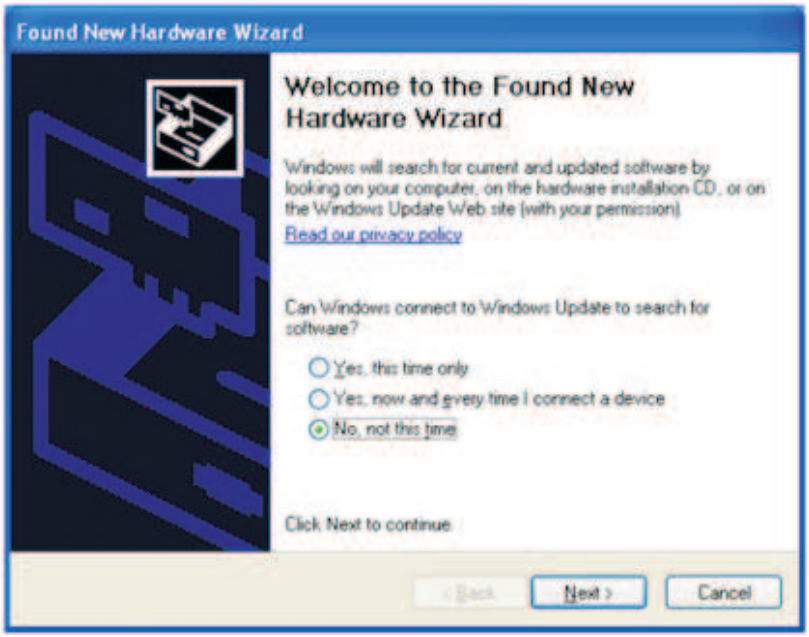


Figure 6. Found New Hardware Wizard Screen

- Select "Install from a list or specific location (Advanced)" as shown below and then click "Next".

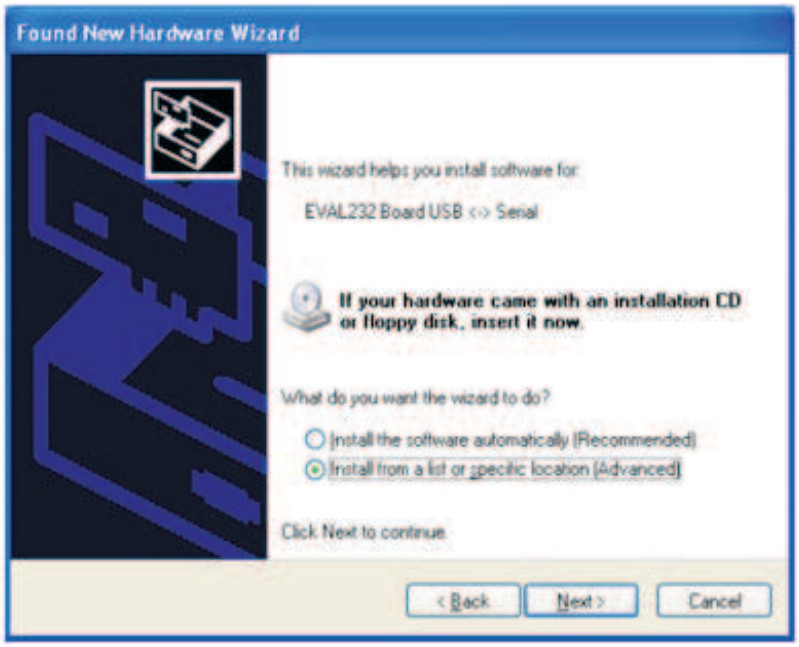


Figure 7. Found New Hardware Wizard (Next) Screen

- Select "Search for the best driver in these locations" and enter the file path for ("C:\Program Files\AFE5801\CDM 2.04.06 WHQL Certified ") in the combo-box or browse to it by clicking the browse button. Once the file path has been entered in the box, click next to proceed.
- If Microsoft® Windows® XP is configured to warn when unsigned (non-WHQL certified) drivers are about to be installed, the following screen will be displayed unless installing a Microsoft WHQL certified Driver. Click on "Continue Anyway" to continue with the installation. If Windows XP is configured to ignore file signature warnings, no message will appear.

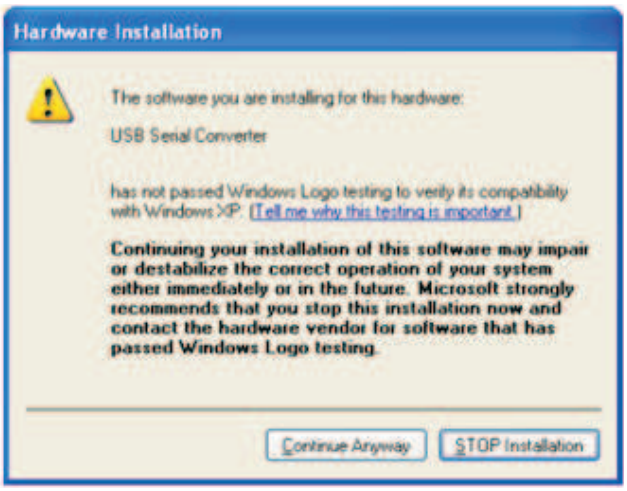


Figure 8.

GUI Startup

- Launch GUI from XP Window
- Start → All Programs\AFE5801EVM\AFE5801
- Several different screens appear displaying the different modes (Figure 9 through Figure 11)

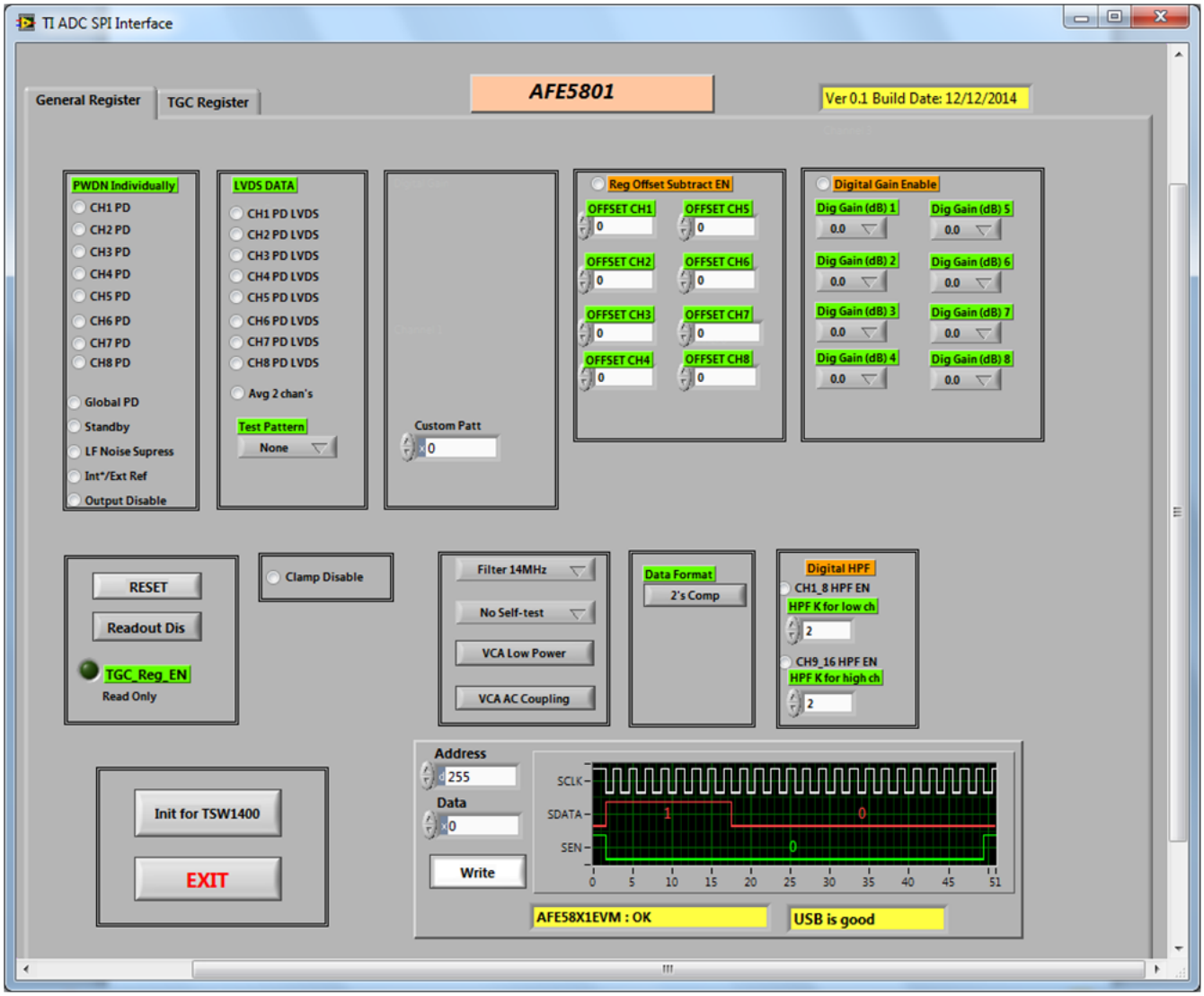


Figure 9. AFE5801EVM USB SPI Interface for General Registers.

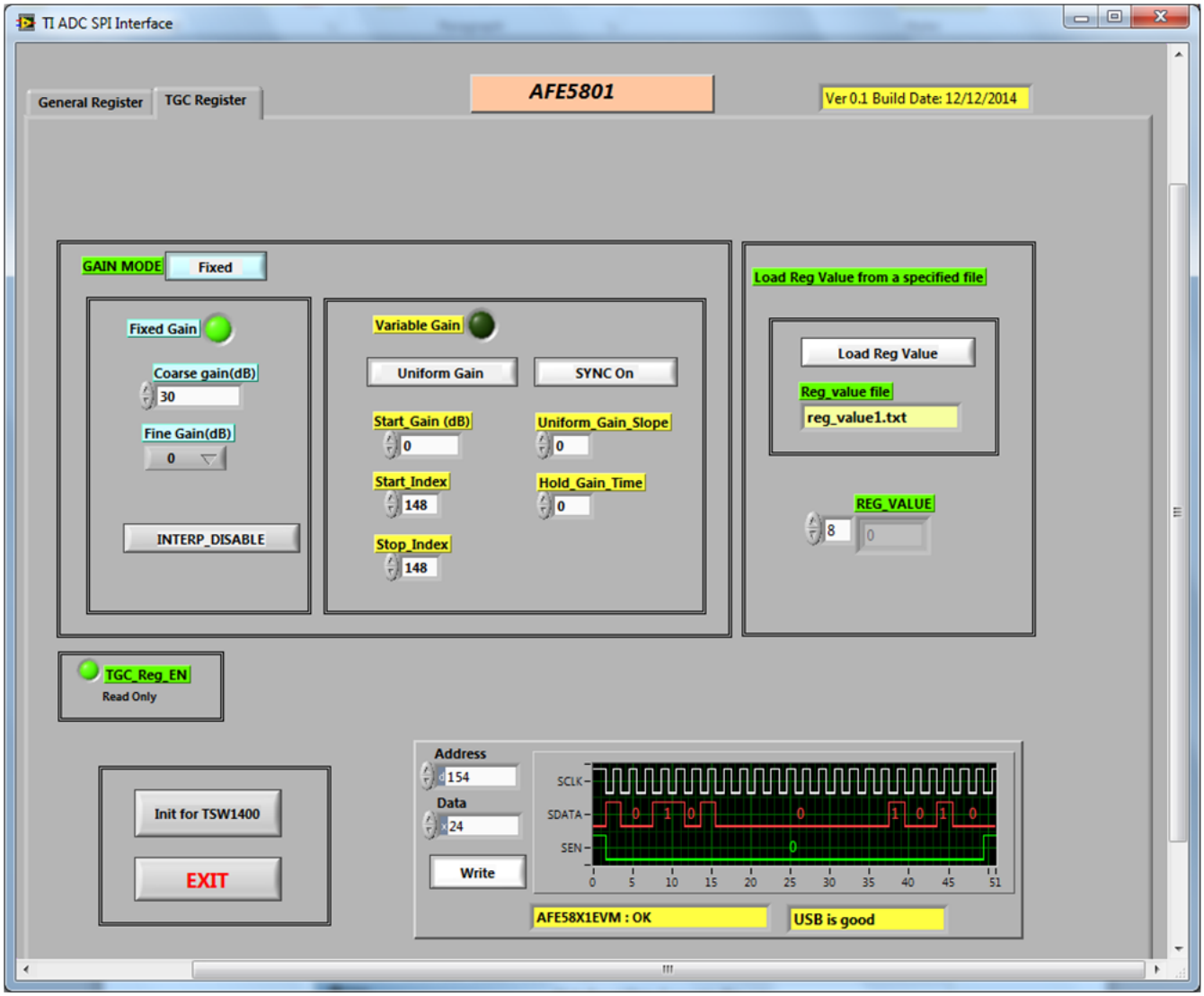


Figure 10. AFE5801EVM USB SPI Fixed Gain Mode

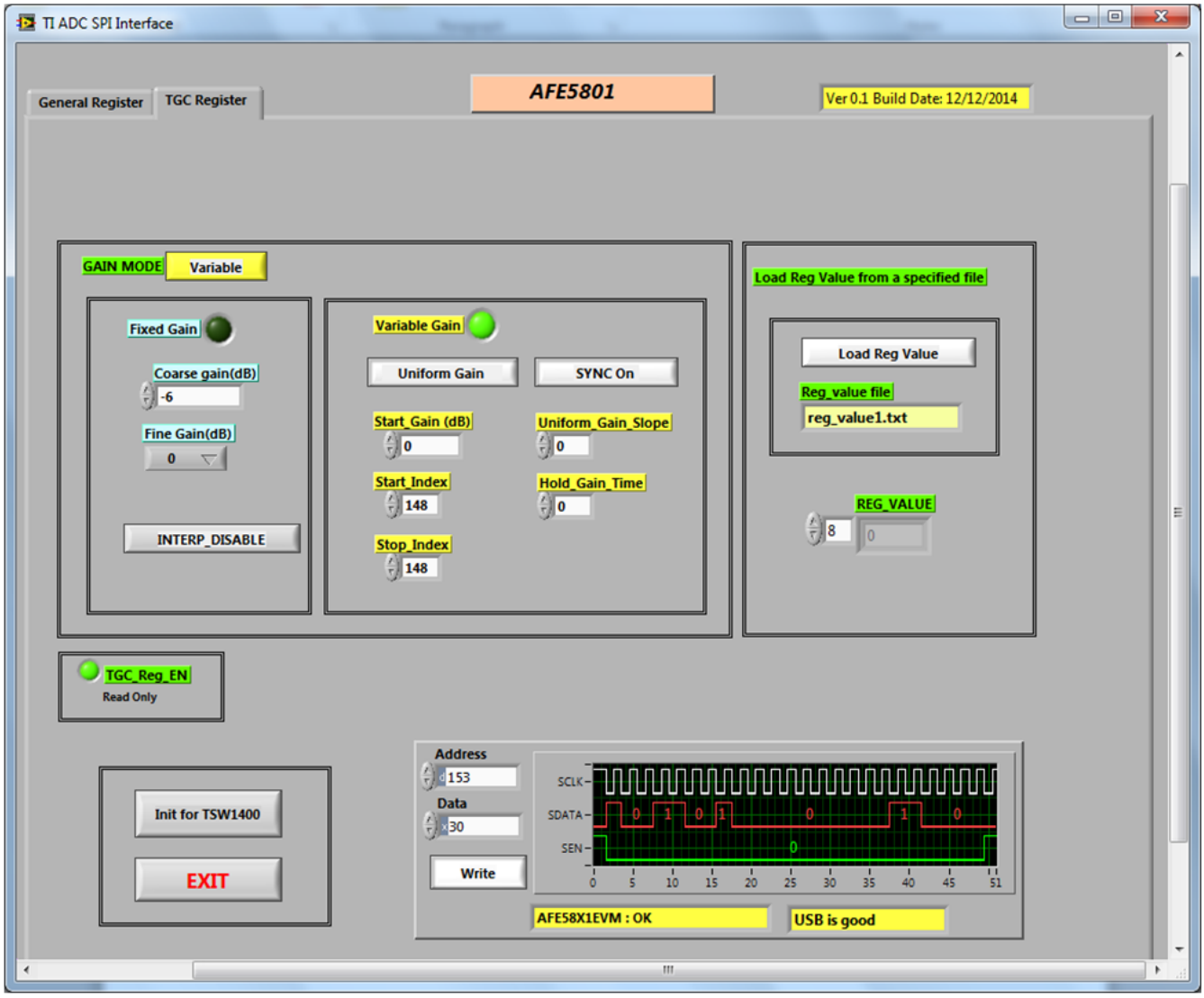


Figure 11. AFE5801EVM USB SPI Interface for Variable Gain Mode

When AFE5801EVM is powered on, all registers have been set to their default modes. Refer to the datasheet for all default settings. It is recommended to restart the SPI software when AFE5801 is powered on in order to synchronize the AFE5801 register settings to the software displays.

Users also can fill out Address Bytes and Data Bytes and press *ENTER* to configure each register.

Typical Configuration

- From Figure 9 press "Init for TSW1400" button
- Select TAB “TGC Register” - Figure 10 will appear
- From Figure 11, press “Variable” button to get into fixed gain mode
- From Figure 10 enter 30 in the “Coarse Gain(dB)” field then press “Write” button.

3.2 Hardware Setup

As mentioned before, Xilinx DeSerializer ADSDeSER-50EVM or TSW1400EVM is required. Please see details in the corresponding application notes on how to use the either of these EVMs. An example bench setup is shown in Figure 12. Band-pass filters are required for signal source in order to ensure the correct SNR measurements of the AFE5801.

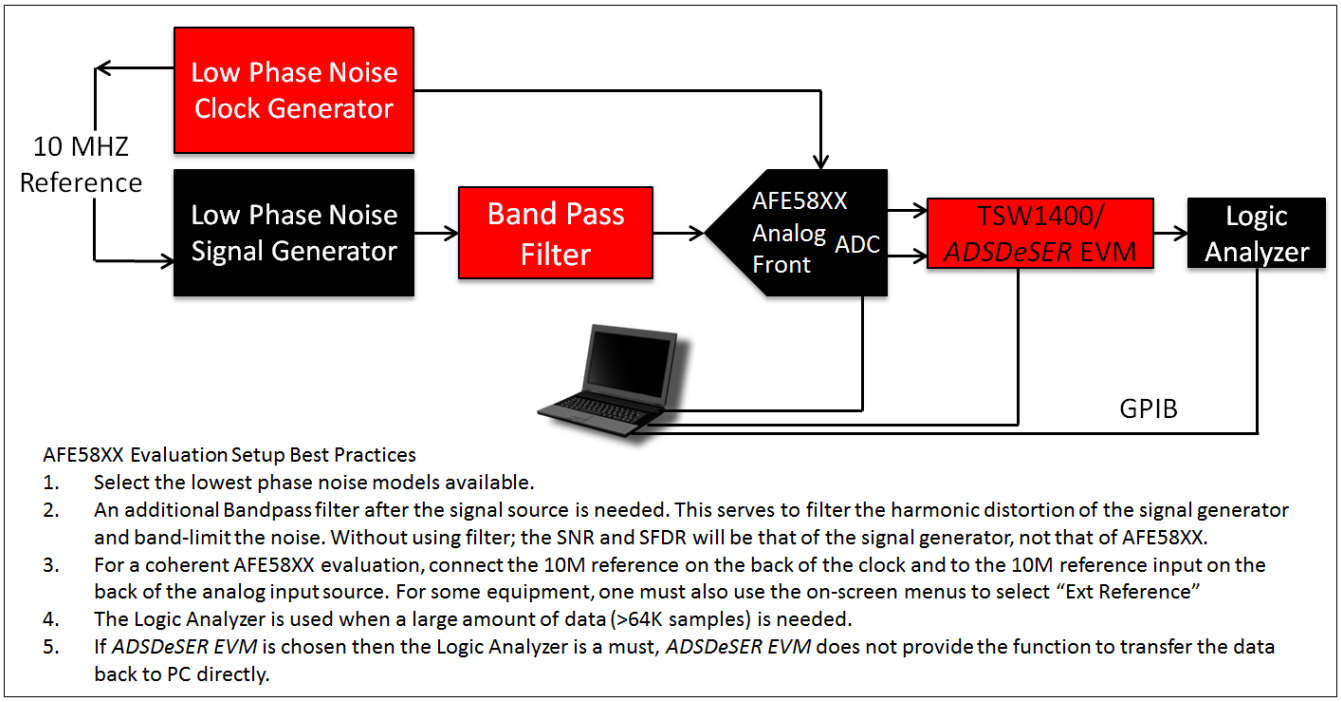


Figure 12. Typical AFE5801 Bench Setup:

The channel order of the AFE5801 outputs is not exactly the same as the one of ADS527x outputs. As a result, the channel number on the ADSDeSER-50EVM or AFE5801EVM might be misleading. Table 1 provides channel-to-channel sequence matching between the ADSDeSER-50EVM and AFE5801EVM.

Table 1. Channel-to-Channel Matching Between the AFE5801EVM and ADSDeSER-50EVM

AFE	FCLK	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	LCLK
Xilinx	FCLK	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	LCLK

For example, when an analog signal is input at CH1 on the AFE5801EVM, the corresponding 12-bit digital output will be seen at CH8 on the ADSDeSER-50EVM when the AFE5801 is configured as 8-channel mode.

3.3 Clock Selection

AFE5801 is typically clocked through a transformer-based circuit. Other options are also available if needed as shown in Figure 13.

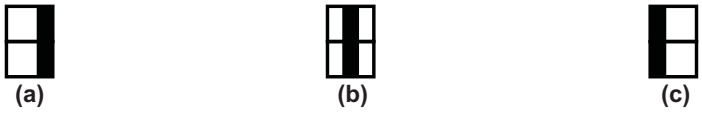


Figure 13. Clock Selection Jumper Configurations: (a) Transformer (default); (b) Single-ended Clock; (c) Future CLK Input Option Based on U1. Both (b) and (c) Configurations Need Some Modifications on the PCB.

The clock source of the EVM could be the on-board clock 40MHz, HP8644 low jitter clock source, or external clock source. The best performance of this EVM is achieved when low-jitter clock source HP8644 is used. The P4, P5, P6 should be removed in order to disable the on-board clock.

When HP8644 or similar clock sources are not available, the on-board 40MHz clock is also a desirable source. The jumpers P4, 5, 6 should be configured as Figure 13 shows (i.e., default setup for AFE5801EVM). In this mode, the transform-based differential clock is used.

3.4 Data Analysis

Based on the data file acquired by a logic analyzer, the performance of AFE5801 can be evaluated.

In Appendix A, we provide one solution (TI TSW1400 EVM) to analyze the data file using the PC. Appendix B provides step by step instructions on how to download the HSDCPro (Hish Speed Data Converter Pro) GUI, which accompanies the TSW1400EVM. Coherent sampling is recommended if the input and sampling clock are phase locked. Due to the frequency accuracy requirement of coherence sampling, two HP8644s for generating ADC clock and analog signal are required. For most users, this may not be feasible. Data analysis based on windowing is a more suitable approach.

4 Schematics, Layout, and, Bill of Materials

This chapter provides the schematics and layout of the AFE5801EVM as well as the bill of materials.

4.1 Schematics

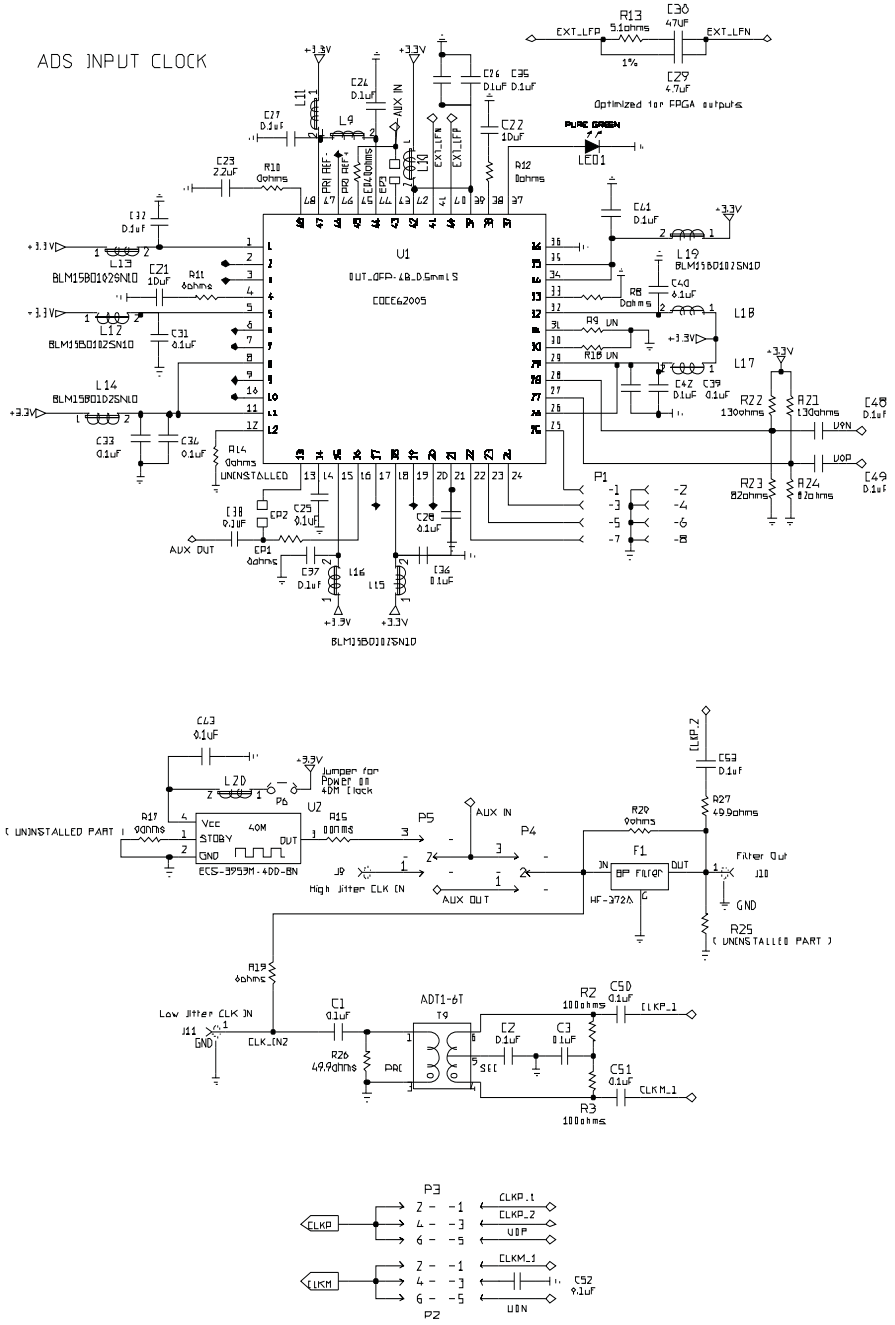


Figure 14. Schematic Page 1

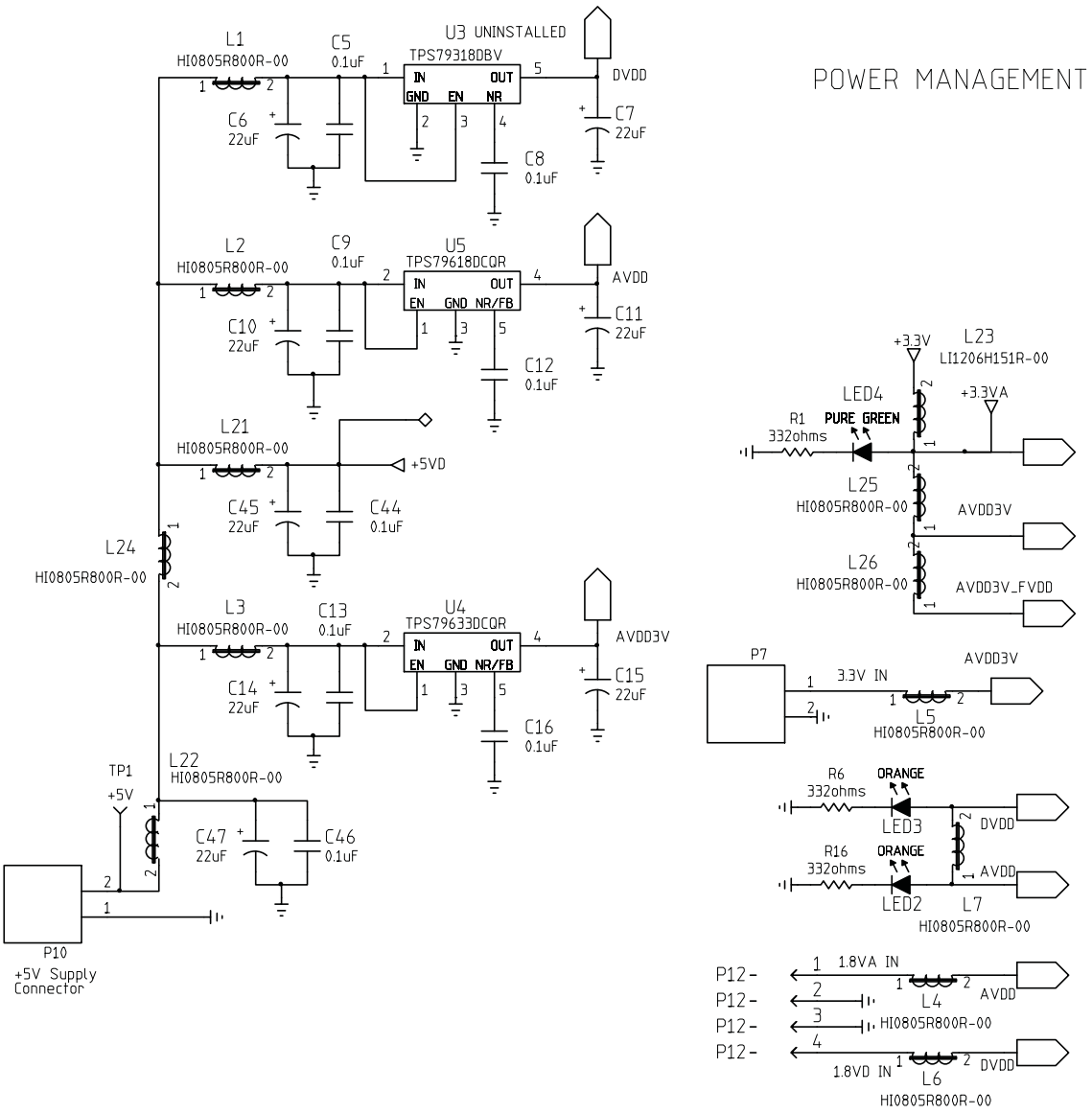


Figure 15. Schematic Page 2

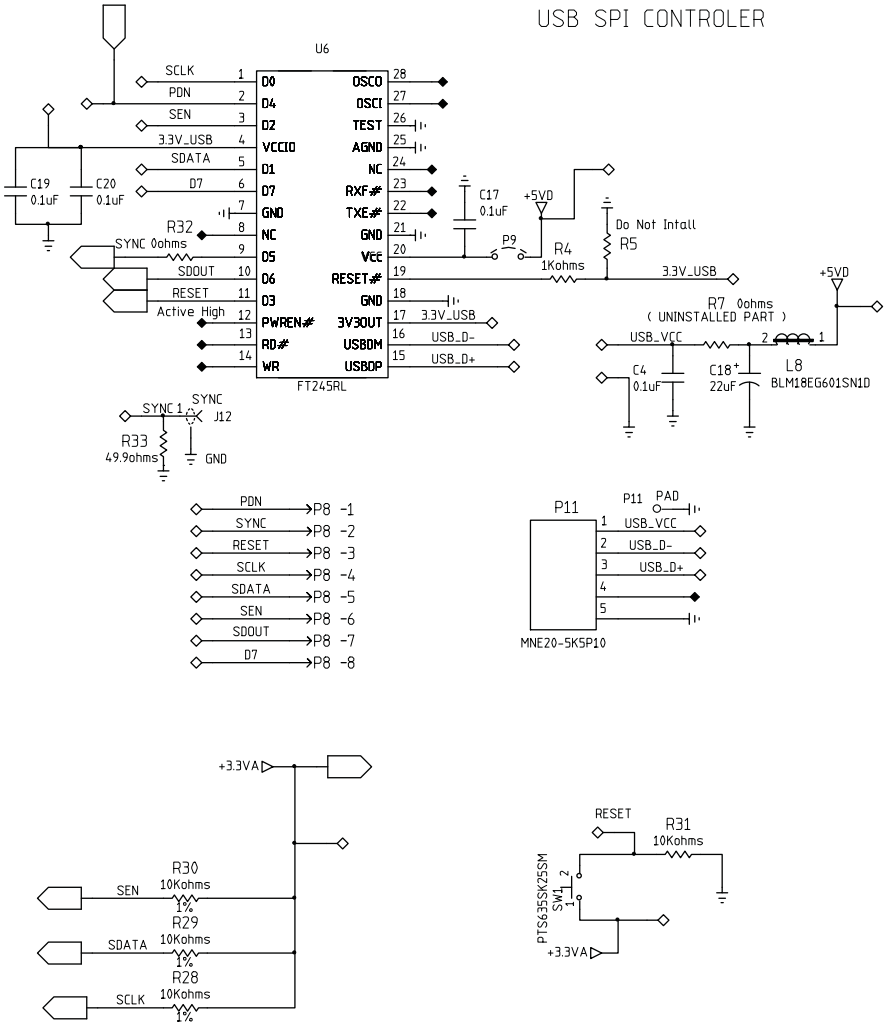


Figure 16. Schematic Page 3

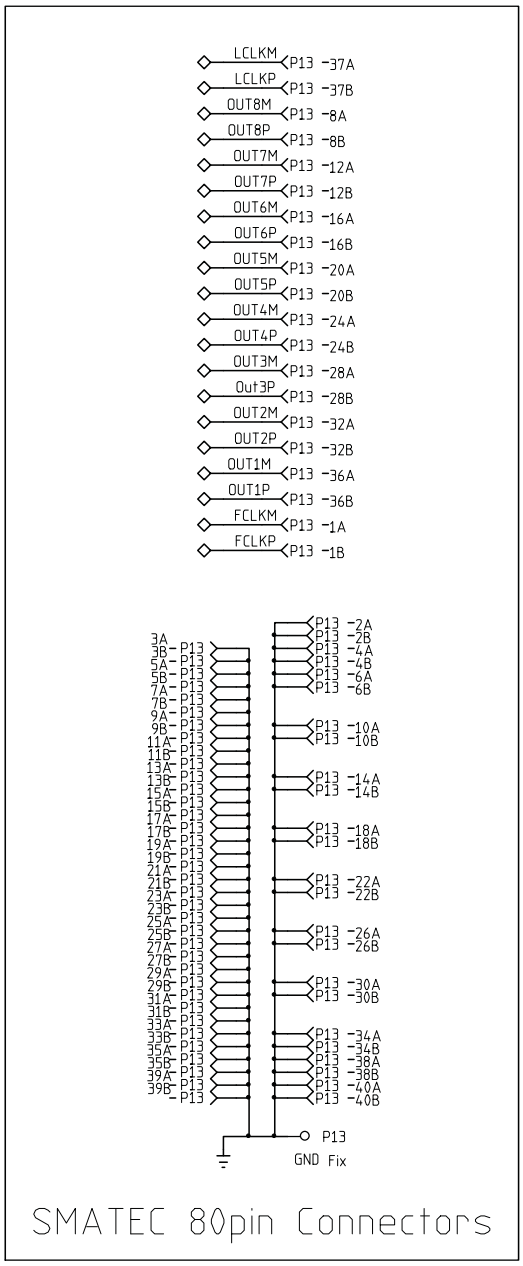


Figure 17. Schematic Page 4

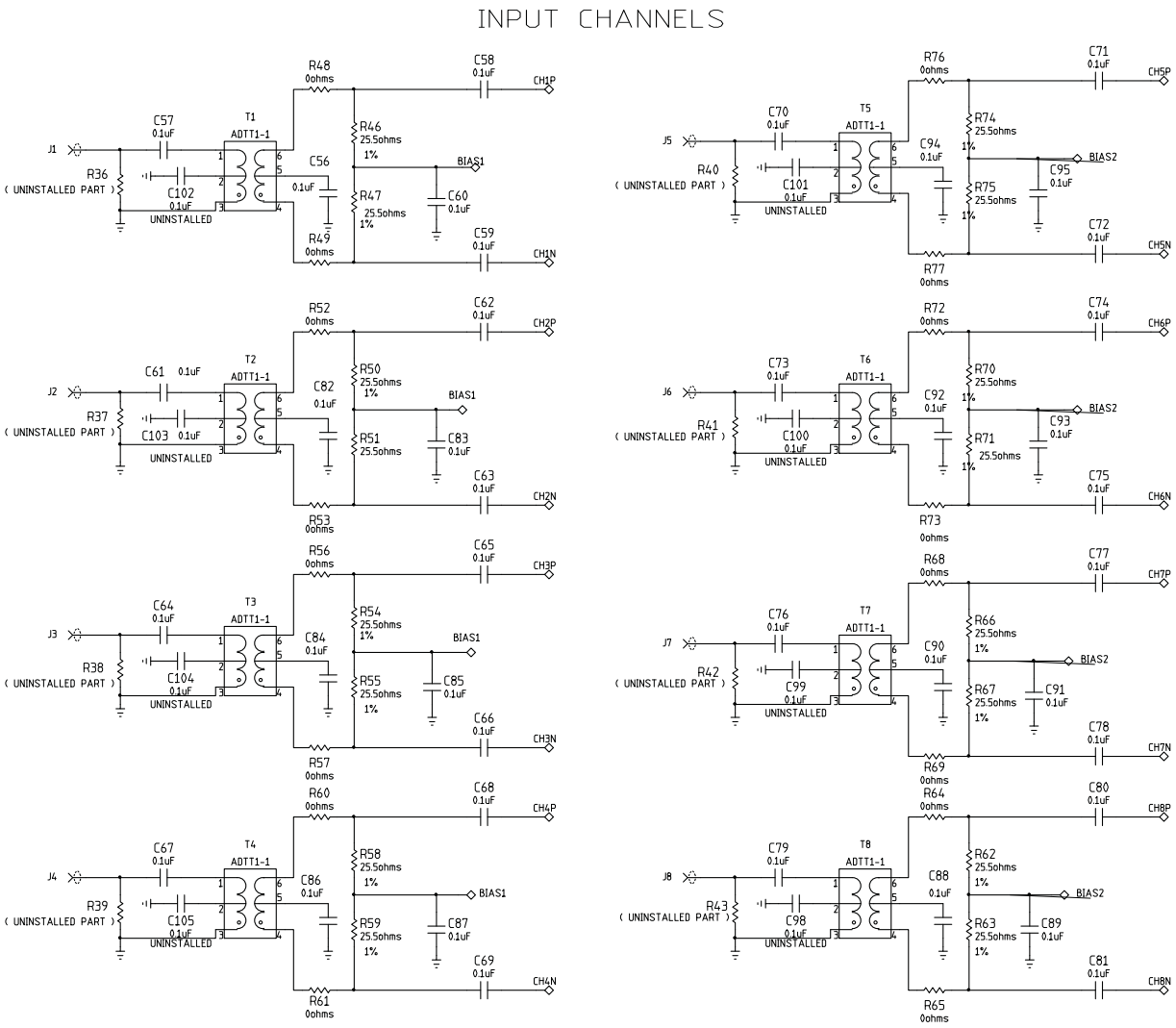


Figure 18. Schematic Page 5

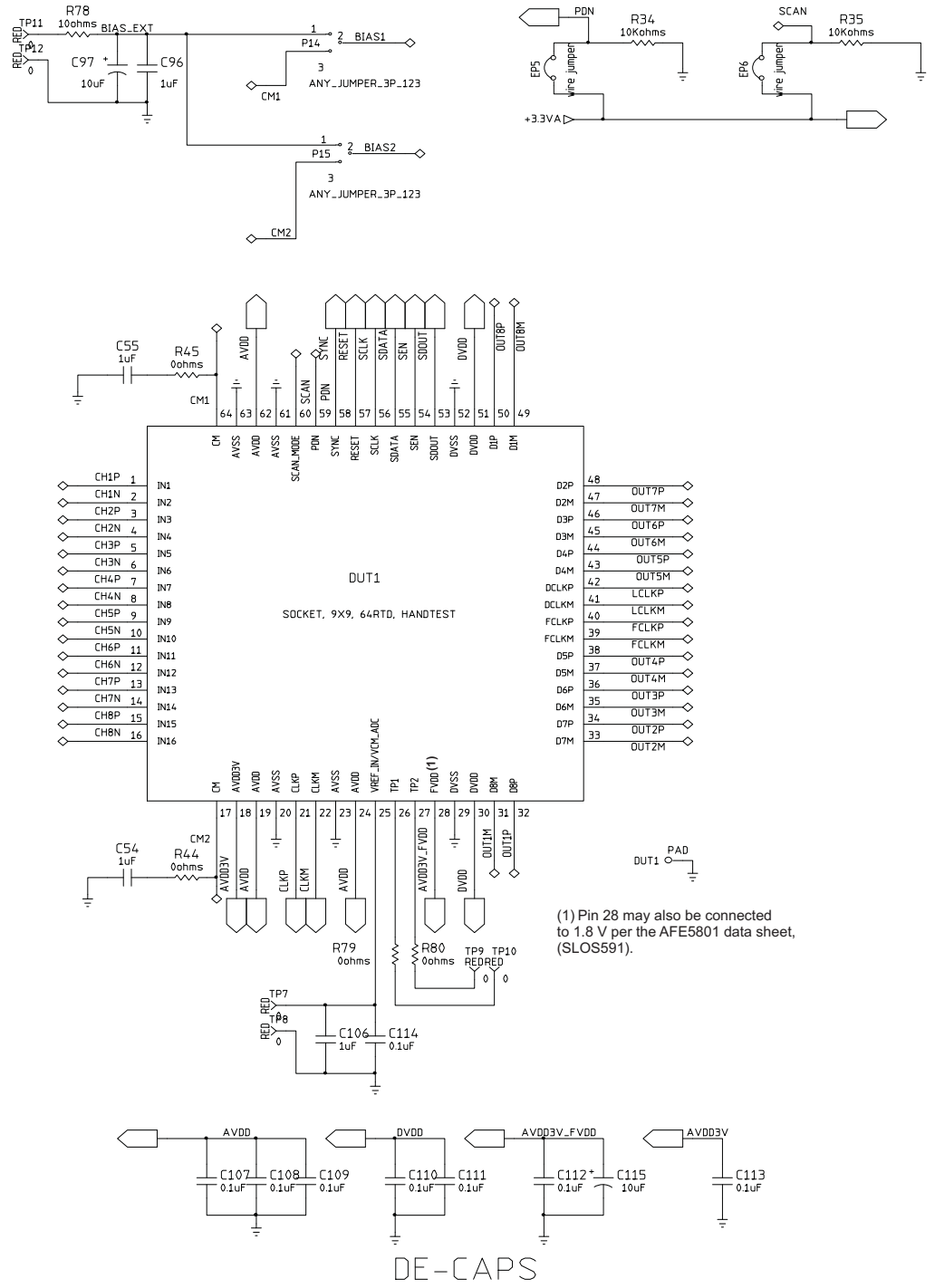


Figure 19. Schematic Page 6

4.2 PCB Layout

A six-layer printed-circuit board is used:

- Top Layer, signal
- Inner Layer 1, ground
- Inner Layer 2, signal
- Inner Layer 3, power
- Inner Layer 4, ground
- Bottom Layer, signal
- Top Silk Screen Layer
- Bottom Silk Screen Layer

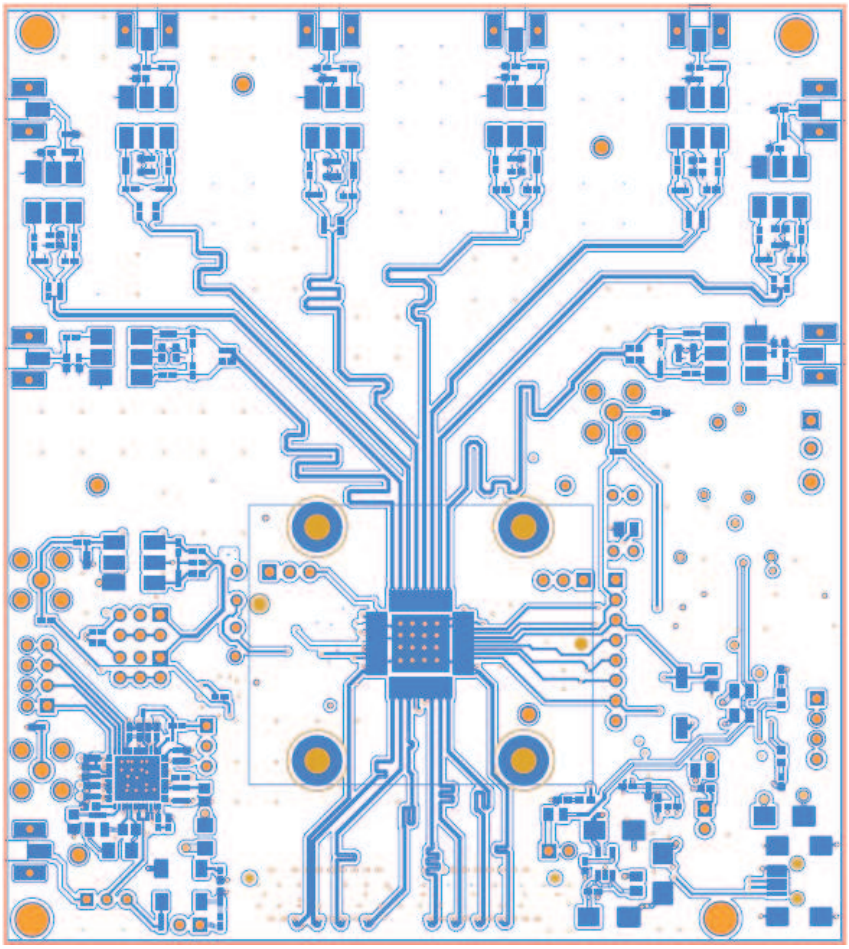


Figure 20. Top Layer Signal

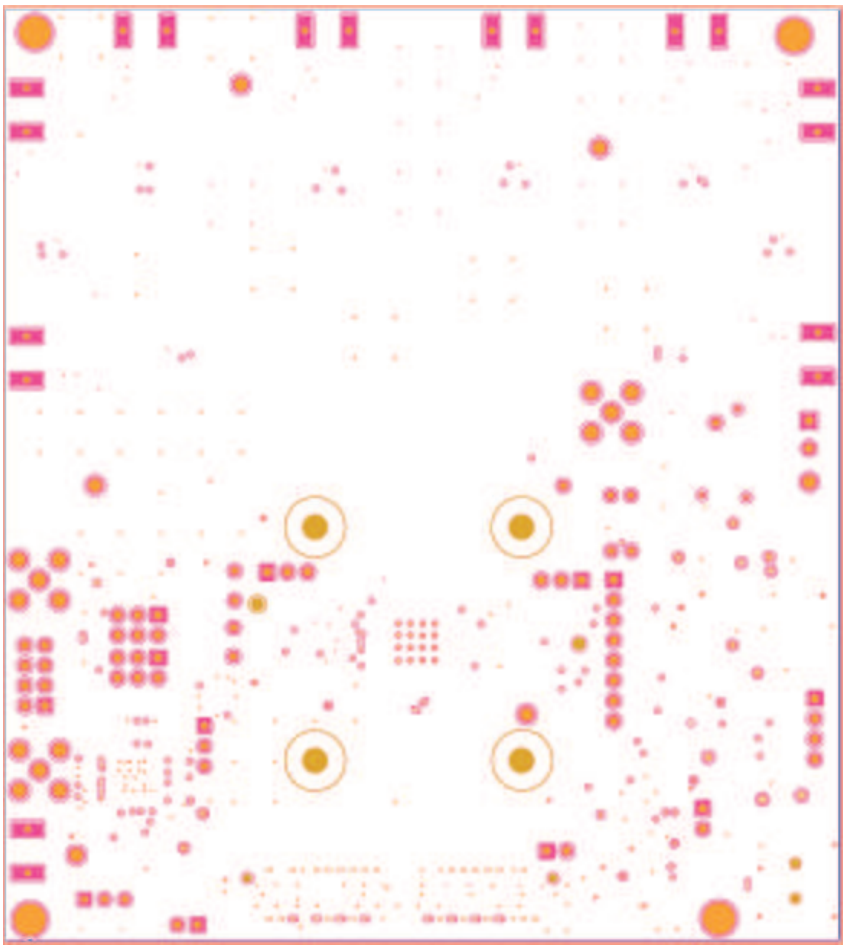


Figure 21. Inner Layer 1 Ground

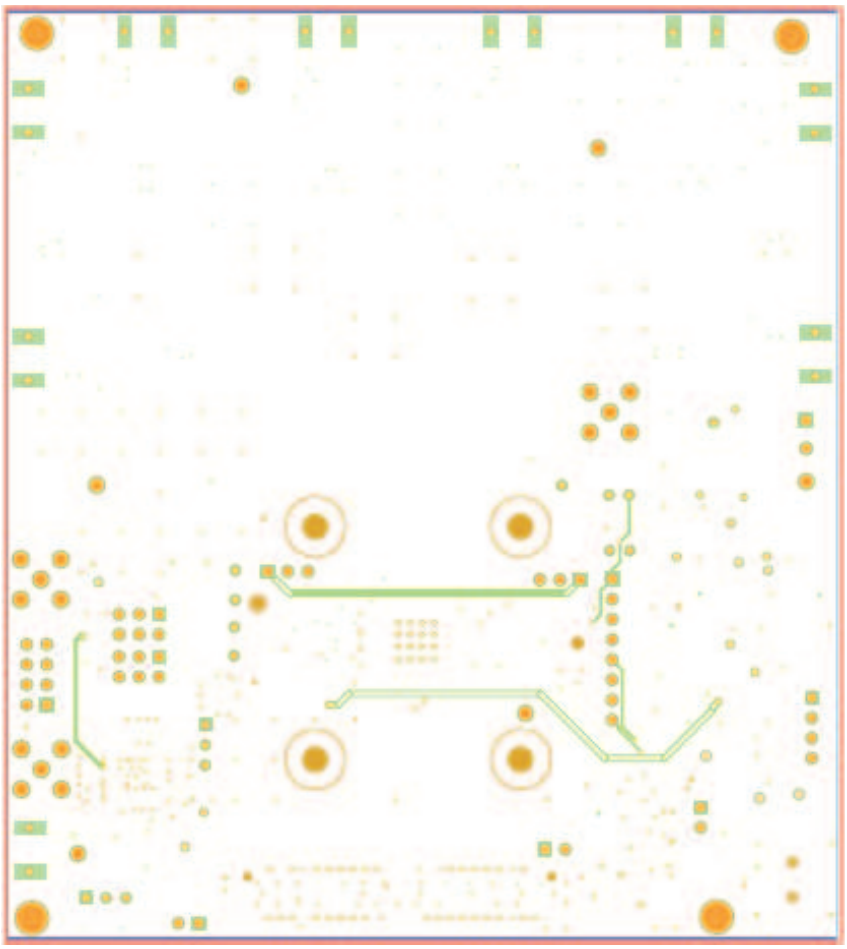


Figure 22. Inner Layer 2 Signal

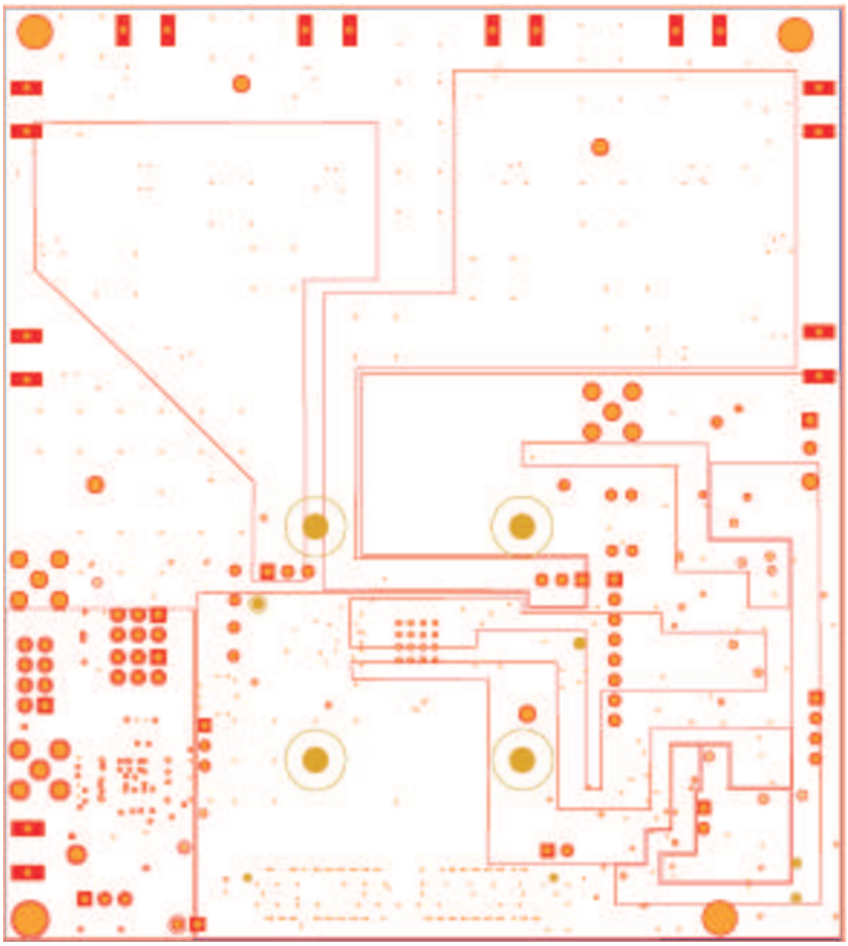


Figure 23. Inner Layer 3 Power

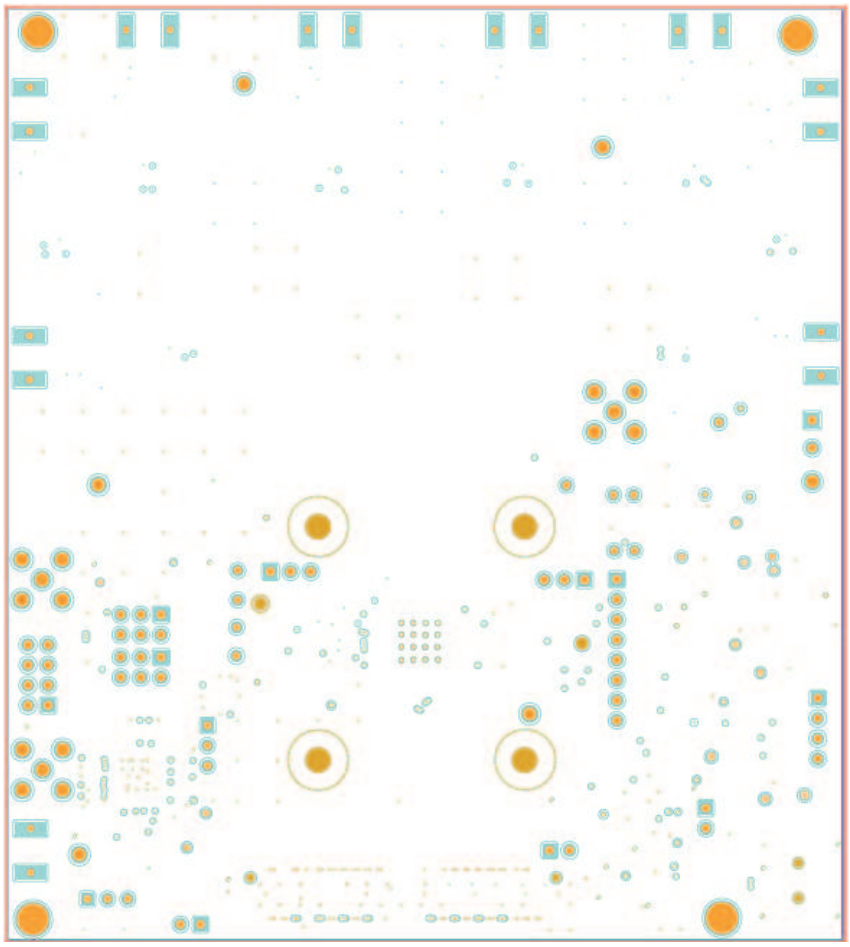


Figure 24. Inner Layer 4 Ground

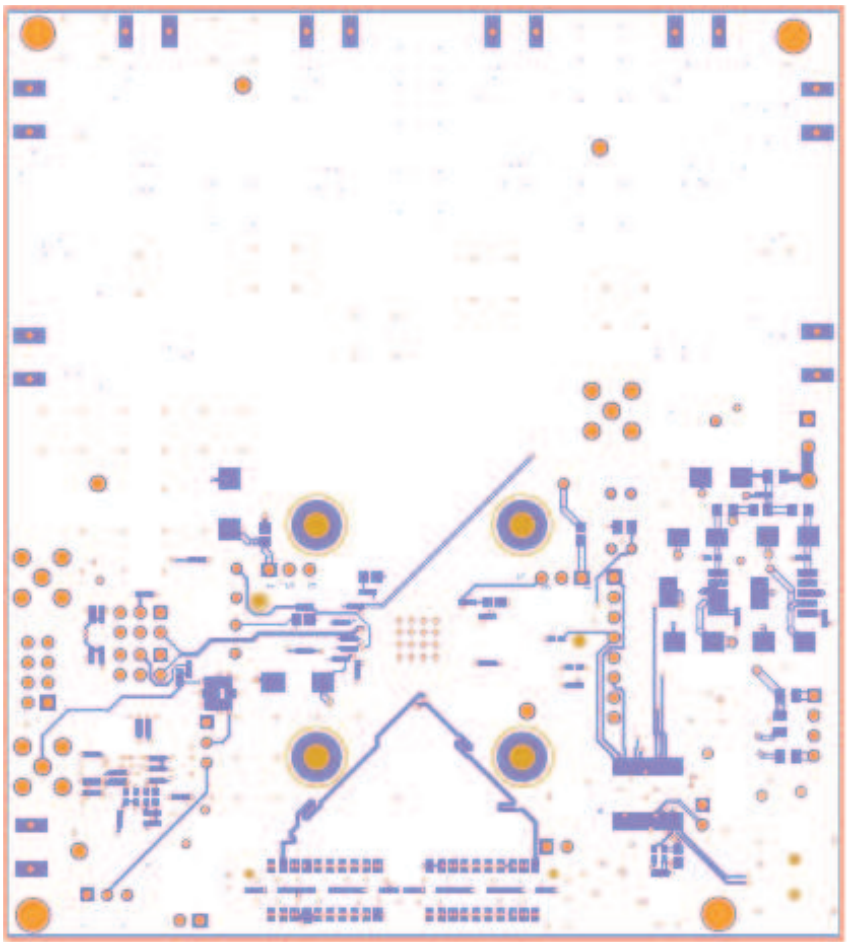


Figure 25. Bottom Layer Signal

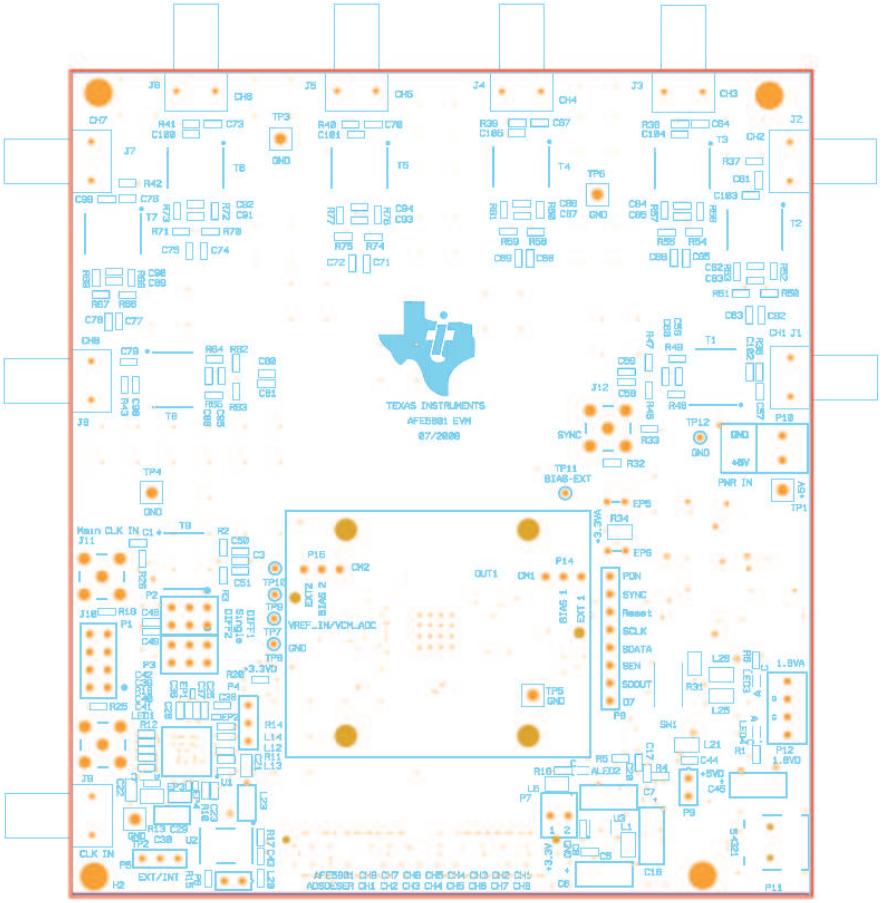


Figure 26. Top Silk Screen Layer

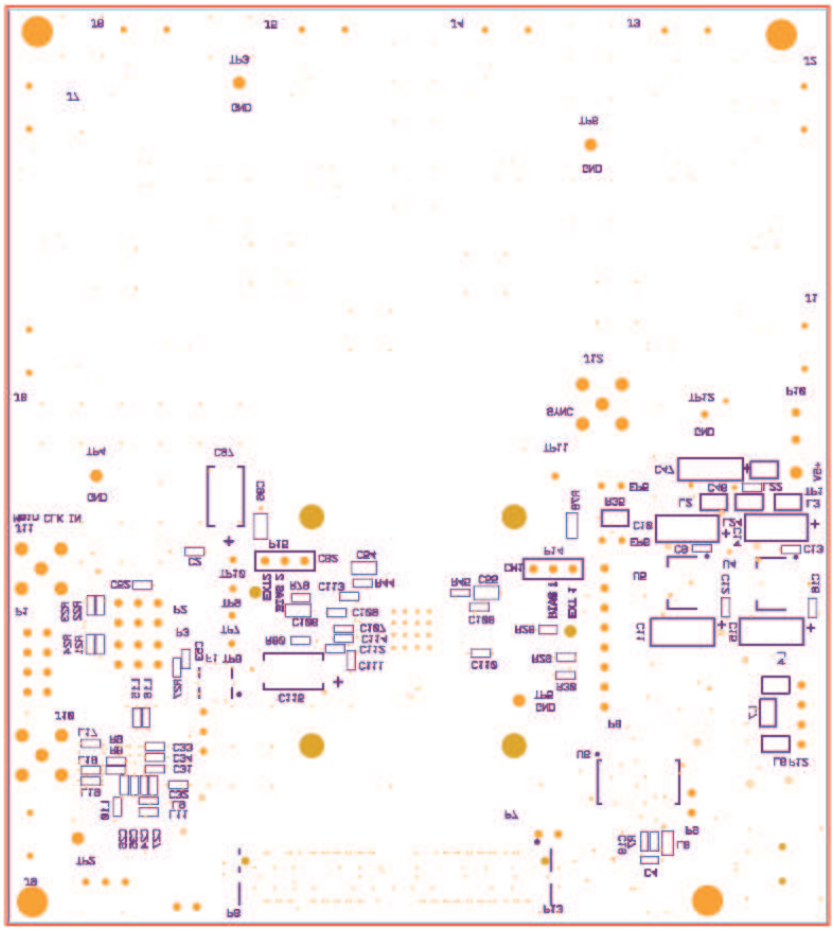


Figure 27. Bottom Silk Screen Layer

4.3 Bill of Materials

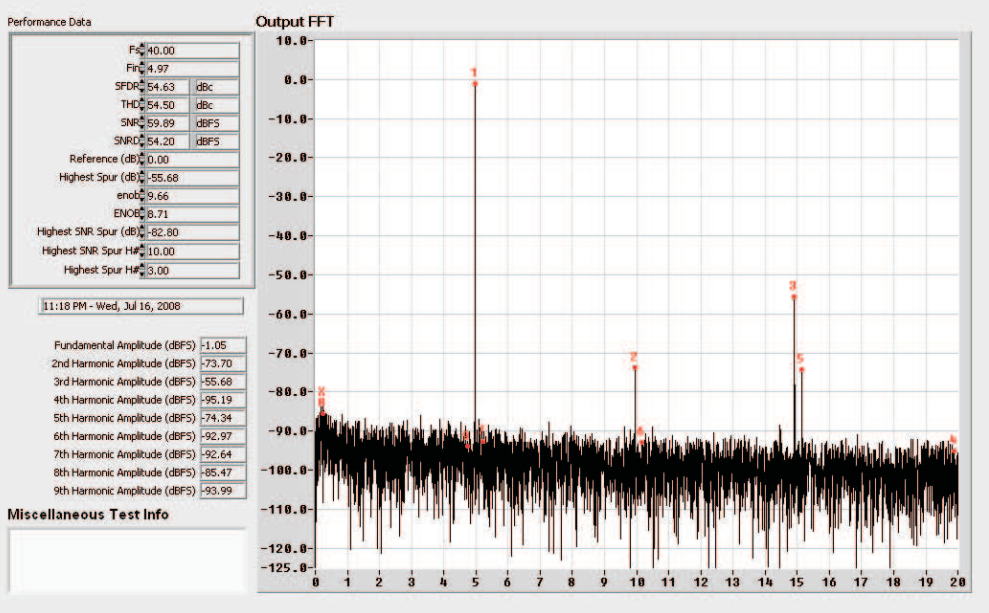
ITEM	MFG	MFG PART#	REF DES	VALUE or FUNCTION
1		UNINSTALLED	C98–C105	Capacitor, SMT, 0402 Uninstalled
2	Kemet	C0402C104K8PAC	C1–C5, C8, C9, C12, C13, C16, C17, C19, C20, C24–C28, C31–C44, C46, C48–C53, C56–C95, C107–C114	Capacitor, SMT, 0402, Ceramic, 0.1µF, 10V, 10%, X5R
3	Murata	GRM155R60J225ME15D	C23	Capacitor, SMT, 0402, Ceramic, 2.2 µF, 6.3V, 20%, X5R
4	Panasonic	ECJ-1VB0J475K	C29	Capacitor, SMT, 0603, Ceramic, 4.7 µF, 6.3V, 10%, X5R
5	Panasonic	ECJ-1VB1A105K	C54, C55, C96, C106	Capacitor, SMT, 0603, Ceramic, 1.0 µF, 10V, 10%, X5R
6	Taiyo Yuden	JMK107BJ106MA-T	C21, C22	Capacitor, SMT, 0603, Ceramic, 10 µF, 6.3V, 20%, X5R
7	Murata	GRM31CR60J476ME19B	C30	Capacitor, SMT, Ceramic, 1206, 47 µF, 6.3V, 20%, X5R
8	Vishay Sprage	293D106X5035D2T	C97, C115	Capacitor, TAN, SMT, 10uF, 35V, ±5%, –55~85C
9	AVX	TPSC226K016R0375	C6, C7, C10, C11, C14, C15, C18, C45, C47	10%, 16V, 22µF
10	Samtec	SMA-J-P-X-ST-EM1	J1–J9	SMA Jack, Edge mount, 062PCB, Brass/Gold, Straight, 50 Ω
11	Samtec	SMA-J-P-H-ST-TH1	J10–J12	SMA Coax straight PCB Jack, SMT, 175TL, 50 Ω, Gold
12	KYCON	KMBX-SMT-5S-S-3OTR	P11	USB Connectors MINI-USB B-Type SCKT
13	Samtec	QTH-040-01-L-D-DP-A	P13	Connector, SMT, 80P, 0,5mm, FEM, DIFF Pair, Receptacle, 168H
14	Epson Toyocom	HF-372A	F1	(Customer Supply) Crystal filter miniature radio Equipment/IF
15	TI	CDCE62005	U1	CDCE62005 UNINSTALLED. TI supply
16	Not Installed	PAD0201(UN)	EP2, EP3	(Uninstalled Part) Empty pad, SMT, 0201
17	Murata	BLM15BD102SN1D	L9–L20	Ferrite bead, SMT, 0402, 1kΩ, 200 mA
18	Murata	BLM18EG601SN1D	L8	Ferrite bead, SMT, 0603,600 Ω at 100 MHz, 25%, 800 mA
19	Steward	HI0805R800R-00	L1–L7, L21, L22, L24–L26	Ferrite, SMT, 0805, 80 Ω at 100 MHz, 5 A
20	Steward	LI1206H151R-00	L23	Ferrite, SMT, 1206, 150 Ω at 100 MHz, 0.8 A
21	Molex	39357-0002	P10	Header, THRU, Power, 2P, 3.5MM, Eurostyle
22	Samtec	SSQ-104-02-F-D	P1	Header, THU, 8P, 2X4, 100LS, FEM, VERT, 194TL
23	Samtec	TSW-103-08-G-D	P2, P3	Header, THU, 6P, 2X3, male, dual row, 100LS, 200TL
24	Tyco Electronics	103321-2	P6, P9	Header w/shunt, 2P, 100LS
25	Molex	22-23-2021-P	P7	MALE, 2PIN, 0.100CC w/ friction lock
26	Mill-Max	350-10-103-00-006	P4, P5	Header, THU, MAL, 0.1LS, 3P, 1X3, 284H, 110TL
27	Molex	22-23-2041	P12	4P, VERT, Friction lock
28	Samtec	TSW-108-05-G-S	P8	Header, THU, 8P, 1X8, male, single row, 100LS, 130TL
29	TI	TPS79618DCQR	U5	Ultralow-noise HI PSRR Fast RF 1-A LDO Linear regulator, 1.8V
30	TI	TPS79633DCQR	U4	Ultralow-noise HI PSRR Fast RF 1-A LDO Linear regulator, 3.3V
31	TI	TPS79318DBV	U3 (UNINSTALLED)	1.8V,Ultralow-noise HI PSRR Fast RF 200 mA LDO Linear regulator
32	Future Technology Device Int.	FT245RL	U6	USB FIFO IC Incorporate FTDICHIP-ID Security dongle
33	Any	JUMPER,2P 0.100cc	EP5, EP6	Installed any brand 2PIN THU Jumper
34	Any	JUMPER,3P 0.100cc 123	P14, P15	Installed jumper, THU, 3P 0.100cc, 123
35	Panasonic	LNJ308G8PRA	LED1, LED4	LED, SMT, 0603, pure green, 2.03V
36	Panasonic	LNJ808R8ERA	LED2, LED3	LED, SMT, 0603, orange, 1.8V

ITEM	MFG	MFG PART#	REF DES	VALUE or FUNCTION
37	ECS	ECS-3953M-400-BN	U2	OSC, SMT, 3.3V, 50ppm, -40~85C, 5nS, 40.000 MHz
38	Vishay	CRCW04021002F100	R28, R29, R30	Resistor, SMT, 0402, 10K, 1/16W, 1%, 100ppm
39	Panasonic	ERJ-2GE0R00X	R8, R10–R12, R15, R19, R20, R32, R44, R45, R48, R49, R52, R53, R56, R57, R60, R61, R64, R65, R68, R69, R72, R73, R76, R77, R79, R80	Resistor/jumper,SMT, 0402, 0 Ω, 5%, 1/16W
40	Panasonic	ERJ-2GEJ0000(UN)	R5, R7, R9, R14, R17, R18	(UNINSTALLED PART)
41	Panasonic	ERJ-2GEJ131	R21, R22	Resistor, SMT, 0402, thick film, 5%, 1/16W, 130
42	Panasonic	ERJ-2GEJ49R9(UN)	R25, R36–R43	(UNINSTALLED PART)
43	Panasonic	ERJ-2GEJ820	R23, R24	Resistor, SMT, 0402, thick film, 5%, 1/16W, 82
44	Panasonic	ERJ-2RKF1000X	R2, R3	Resistor, SMT, 0402, 100 Ω, 1%, 1/16W
45	Panasonic	ERJ-2RKF1001X	R4	Resistor, SMT, 0402, 1.00K, 1%, 1/16W
46	Panasonic	ERJ-2RKF25R5X	R46, R47, R50, R51, R54, R55, R58, R59, R62, R63, R66, R67, R70, R71, R74, R75	Resistor, SMT, 0402, 25.5 Ω, 1%, 1/16W
47	Panasonic	ERJ-2RKF3320X	R1, R6, R16	Resistor, SMT, 0402 332 Ω, 1%, 1/16W
48	Panasonic	ERJ-2RKF49R9X	R26, R27, R33	Resistor, SMT, 0402, 49.9 Ω, 1%, 1/16W
49	Panasonic	ERJ-3GSYJ100	R78	Resistor, SMT, 0603, 5%, 1/10W, 10
50	Vishay	CRCW08051002F	R31, R34, R35	Resistor, SMT, 0805, thick film, 1%, 1/8W, 10.0K
51	Panasonic	ERJ-6RQF5R1V	R13	Resistor, SMT, 0805, 1%, 1/8W, 5.1 Ω
52	Panasonic	ERJ-1GE0R00C	EP1, EP4	Resistor, SMT, 0201, thick film, 0 Ω, 5%,0 Ω Jumper, 1/20W
53	AFE5801	AFE5801	DUT1	AFE5801 Analog Front End. TI supplied.
54	ITT Industries	PTS635SK25SM	SW1	Switch, SMT, 2P, SPST-NO, 2.5mm Height, MOM, rectangular, 0.05A, 12V
55	Keystone Electronics	5005	TP1	Testpoint, THU, compact, 0.125LS, 130TL, red
56	Keystone Electronics	5006	TP2–TP6	Testpoint, THU, compact, 0.125LS, 130TL, black
57	Mini-Circuits	ADTT1-1	T1–T8	RF Transformer 0.03–300 MHz
58	Mini-Circuits	ADT1-6T	T9	RF Transformer wideband, 0.03–125 MHz
59	PEM	KFS2-M2.5	PEM NUTS	UNINSTALLED
60	AMP	531220-2	P6, P9	SHUNT JUMPER 2POS

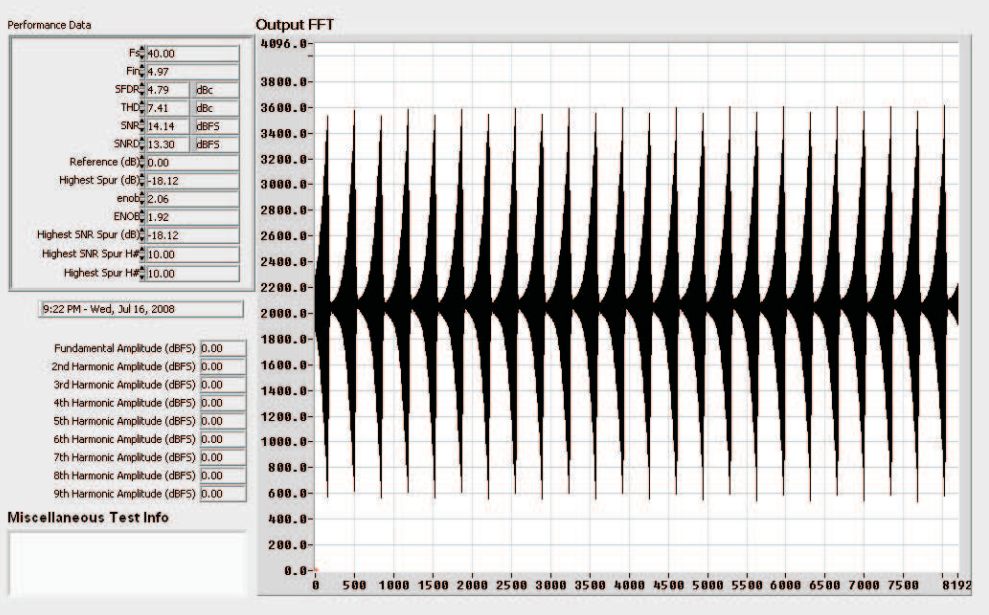
5 Typical Performance

This chapter provides some typical performance of the AFE5801EVM to assist users to verify their setup.

A typical performance plot of the AFE5801 is shown in Figure 28 with 30dB digital gain setting.



(a)



(b)

Figure 28. Typical Performance of AFE5801. (a) Fixed Gain Mode; (b) Variable Gain Mode

TSW1400 for Evaluating AFE5801

A.1 Introduction

This application report goes through the steps of evaluating the AFE501 using the TSW1400EVM.

A.2 Hardware Setup

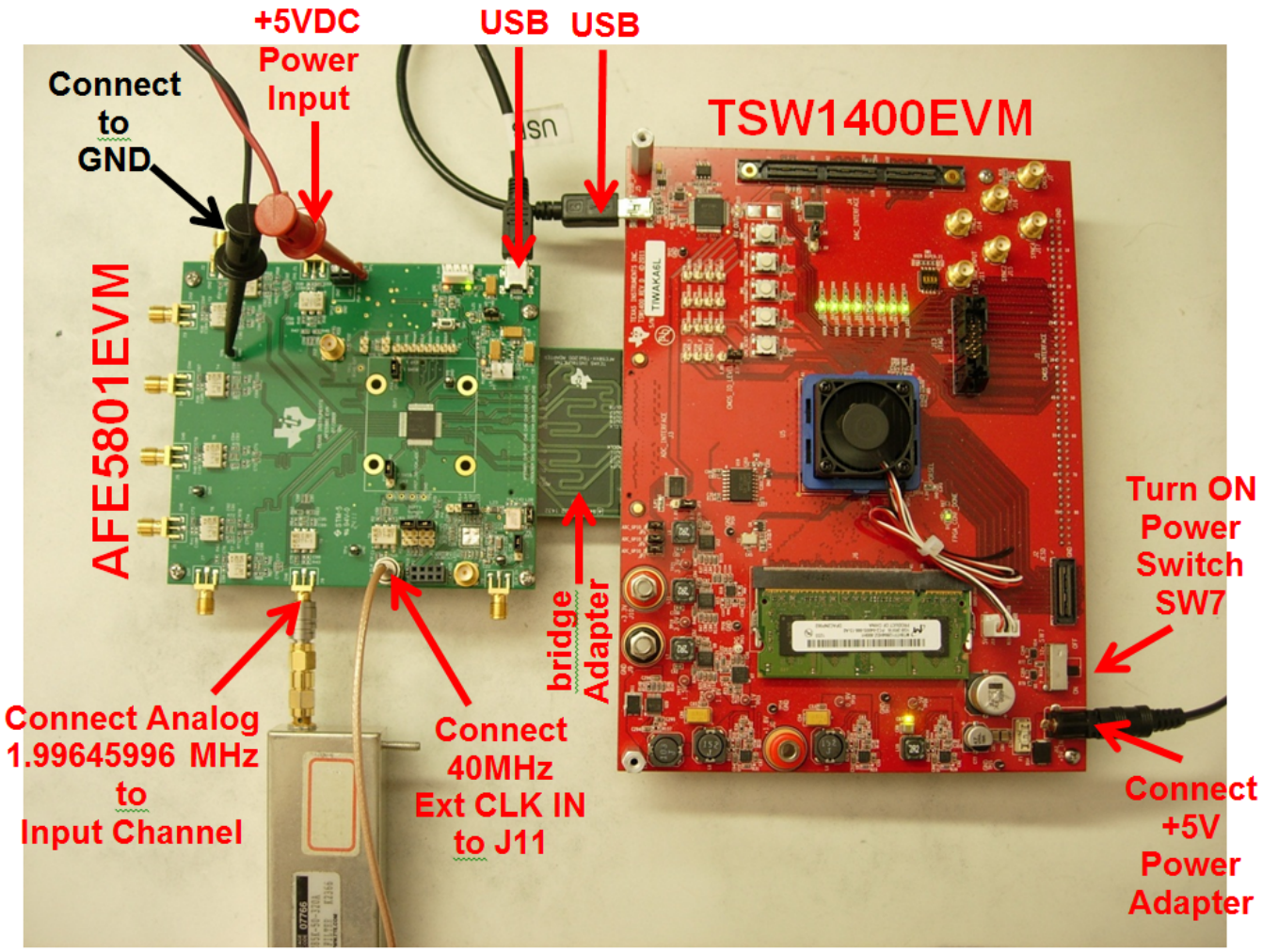


Figure 29. Connection Between TSW1400EVM and AFE5801

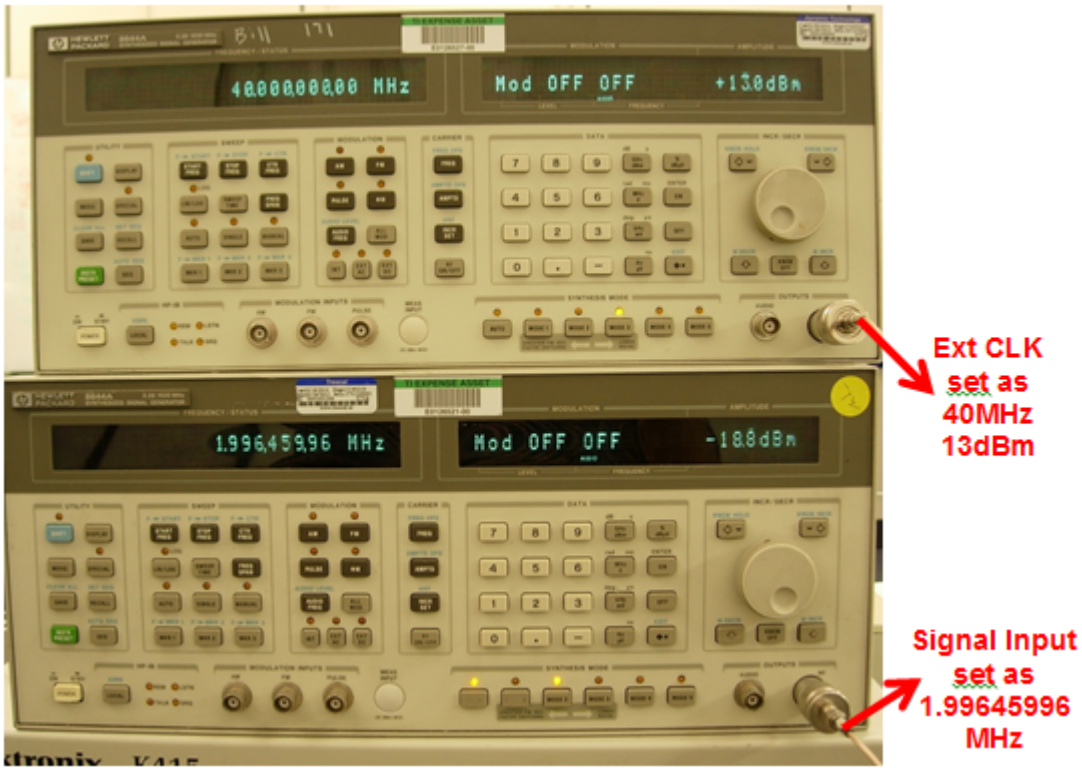


Figure 30. Connection of the Instruments

Launch AFE5801 GUI

From PC click Start Menu→All Programs→Texas Instruments→AFE5801EVM USB SPI→AFE5801EVM USB SPI

The GUI may be running if the following screen appears:

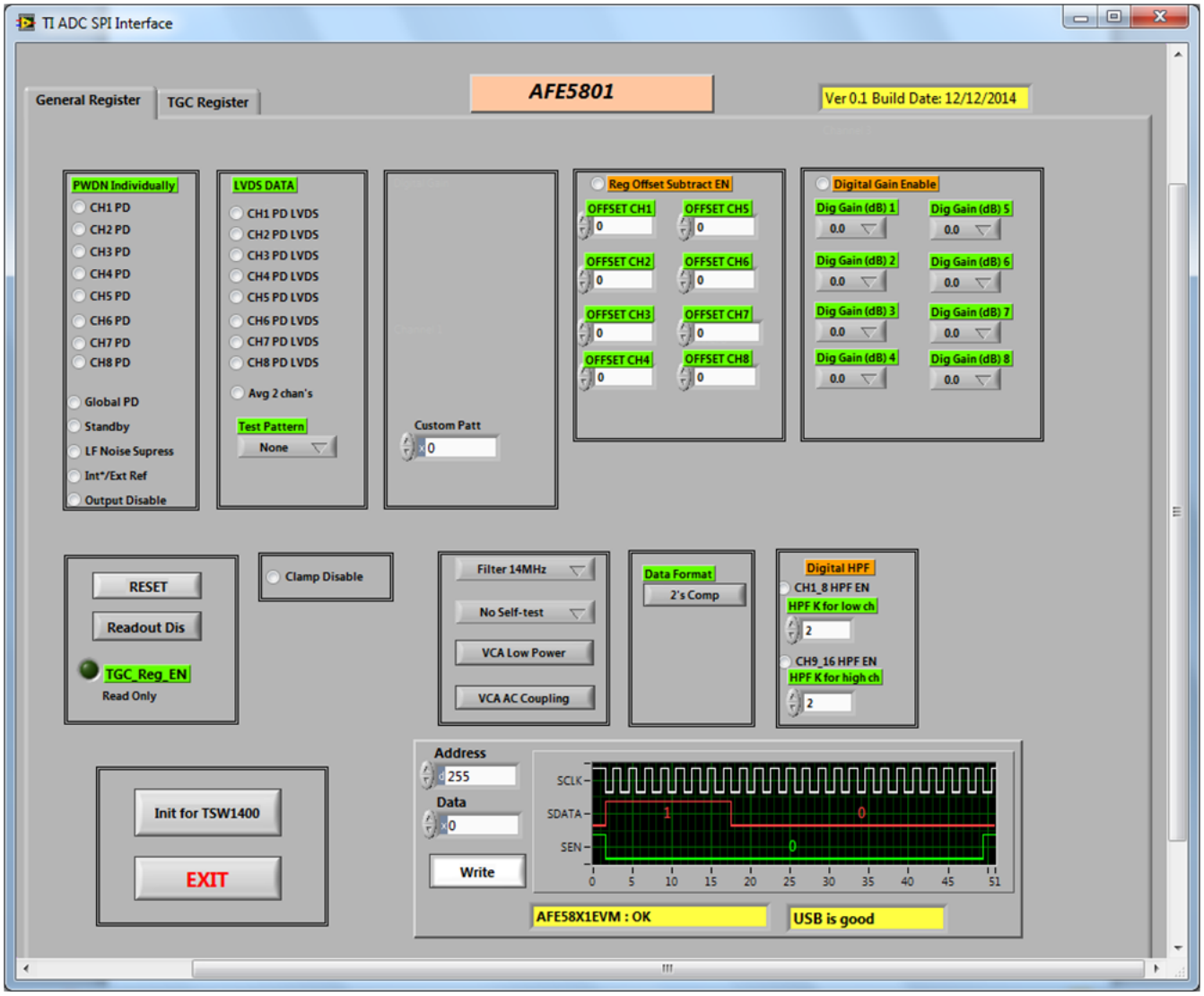


Figure 31. AFE5801EVM GUI - RUN Mode

In case the GUI is not running, then press the START button of the GUI to run it.

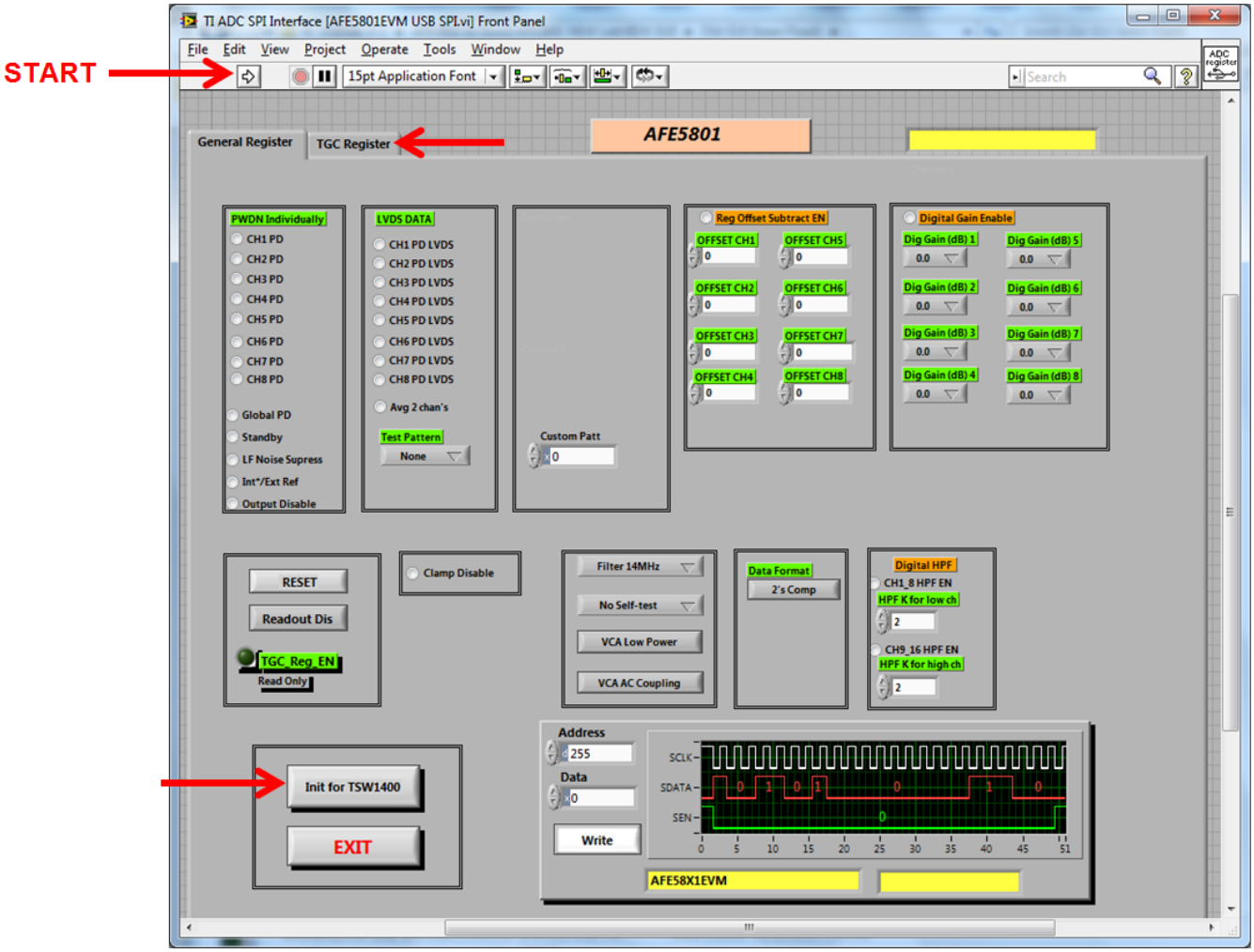


Figure 32. AFE5801 EVM GUI - START Button

- **Commands to the AFE5801 GUI:**

1. Click Init for TSW1400 to set the proper condition to work with TSW1400EVM.
2. Go to "TGC Register " Tab.
3. Press Variable button to change the mode to Fixed.

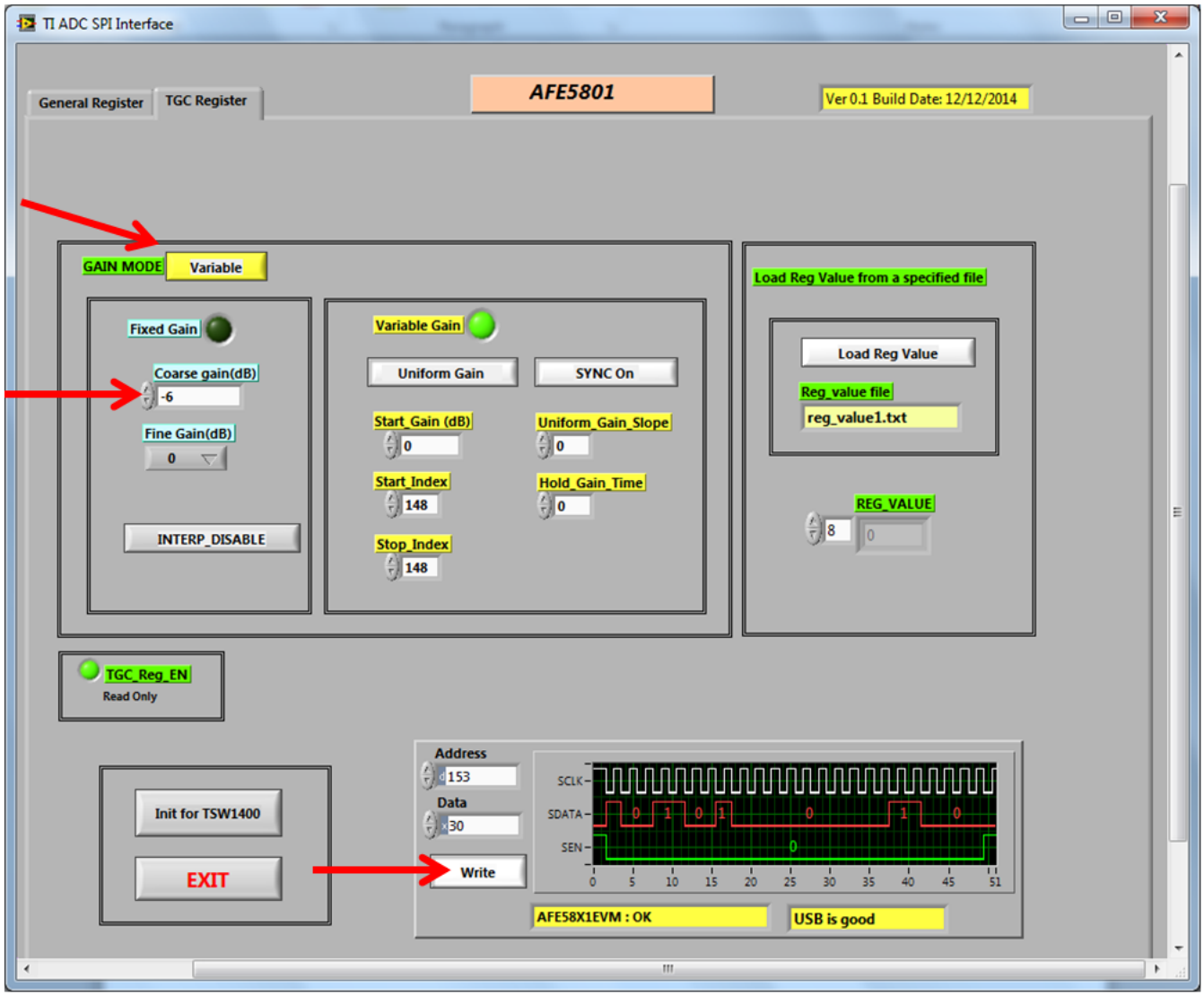


Figure 33. AFE5801EVM GUI - Variable Gain

4. Type 30 and press Write button.

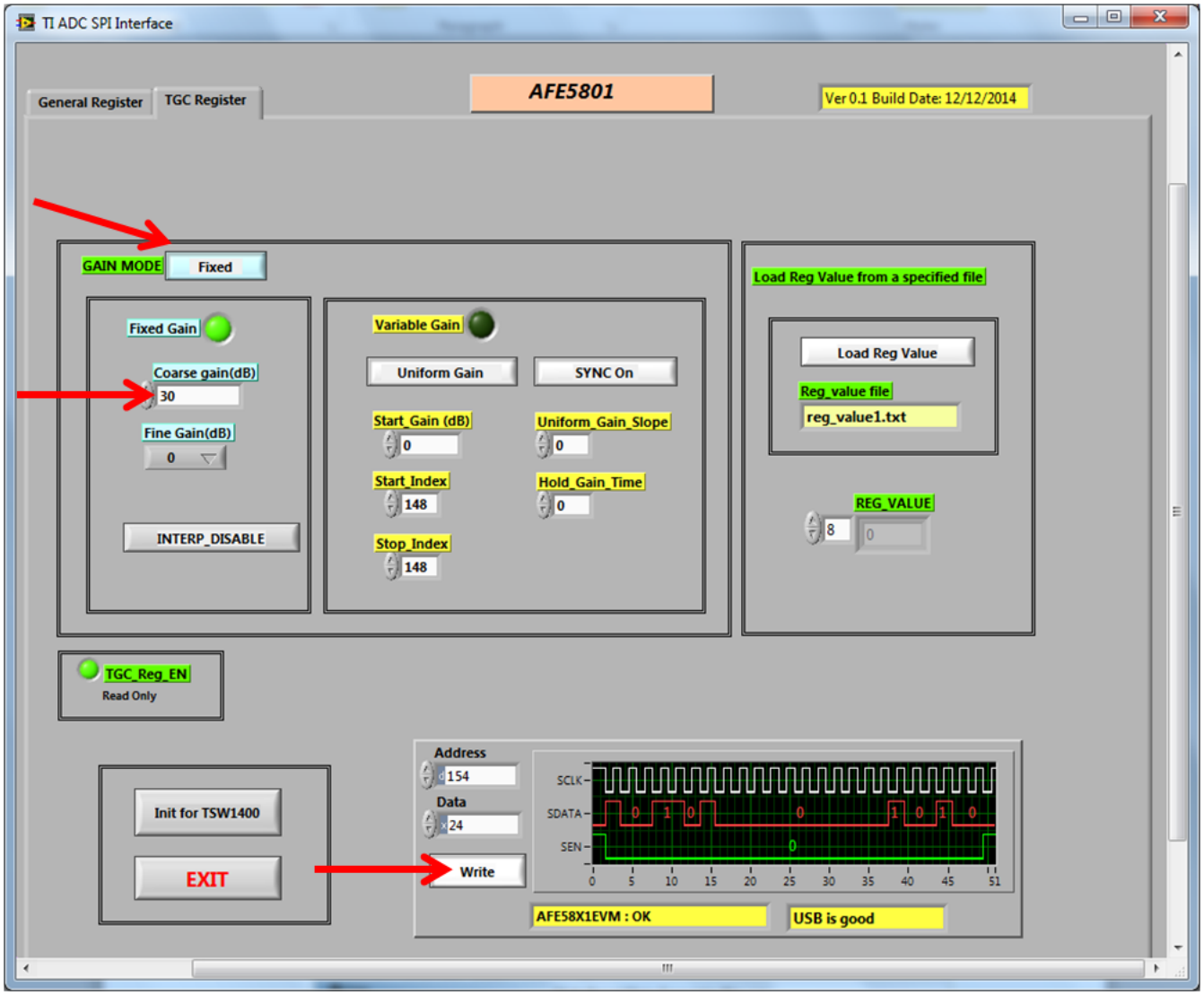


Figure 34. AFE5801EVM GUI - Setting Fixed Gain

At this stage the AFE5801 is ready.

Launch TSW1400 GUI

- **Graphics User Interface (GUI)**

  TSW1400 provides a GUI for users to evaluate the performance of the device. When GUI is started, the screen of the following figure appears.

For details, see the TSW1400 User's Guide.

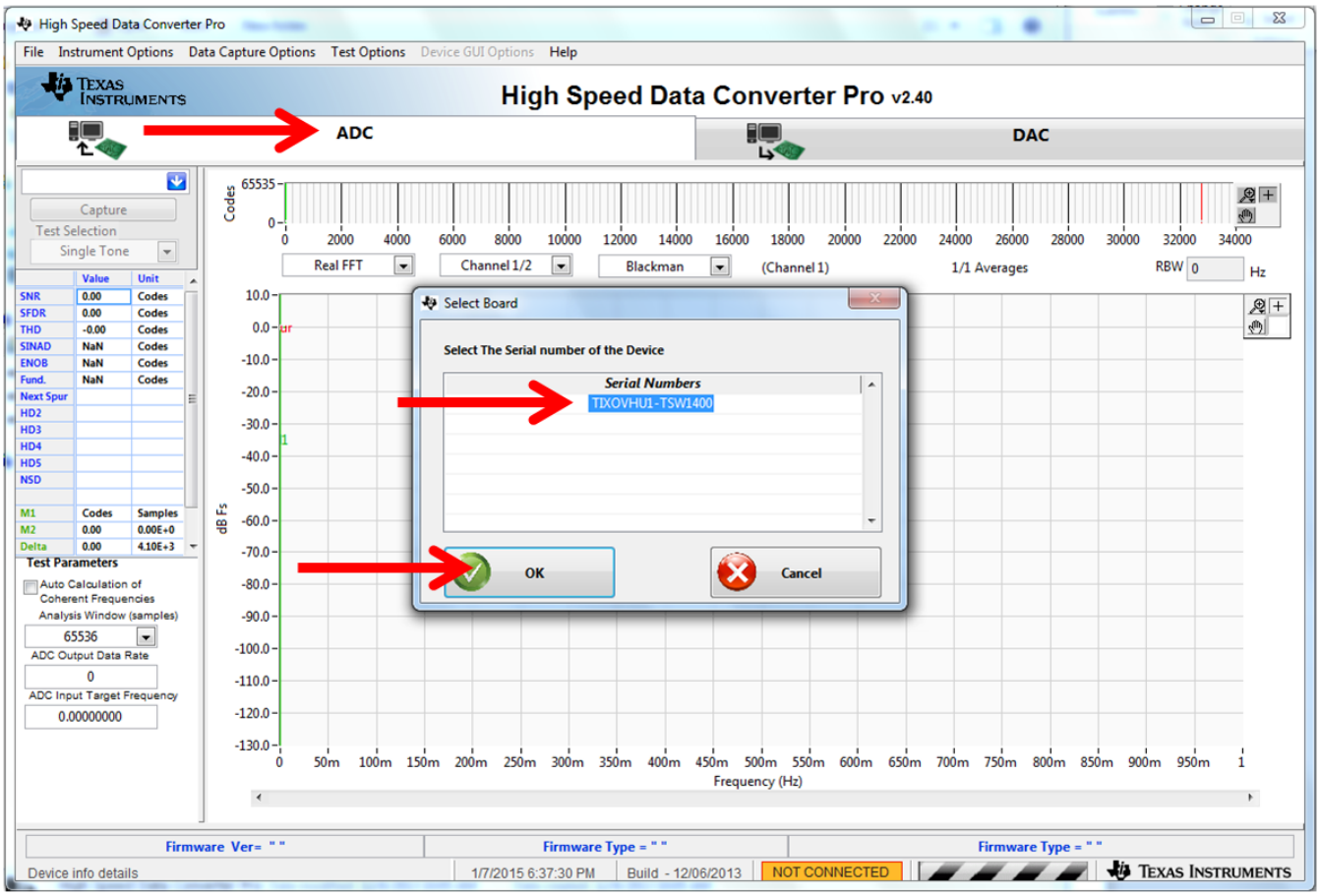


Figure 35. User Interface: Initial Setup Screen

- **Test Condition**

Perform the steps in the order indicated in the following figure to set the test conditions:

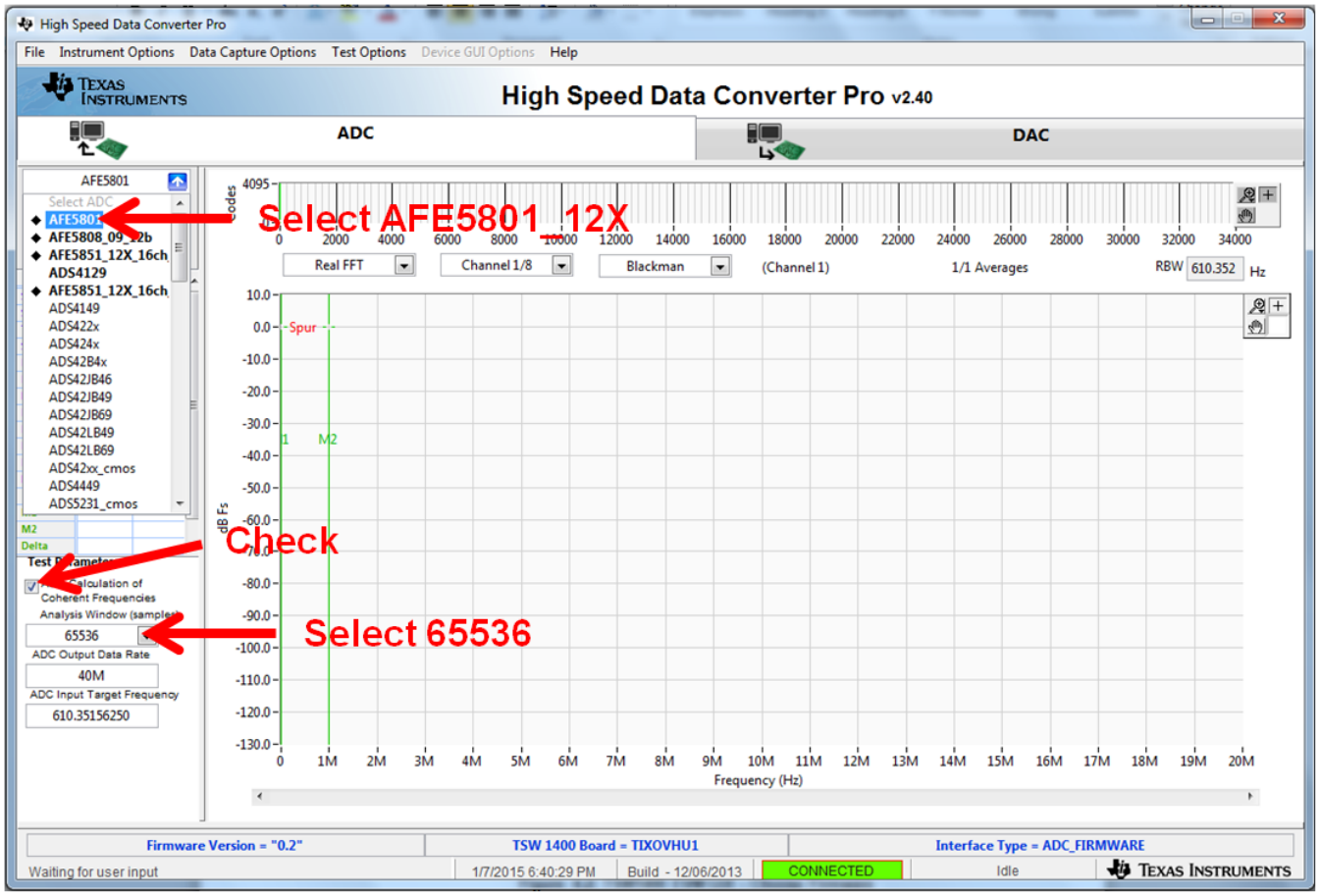


Figure 36. User Interface: Step-by-Step Setup

After completing the steps indicated, the following figure appears:

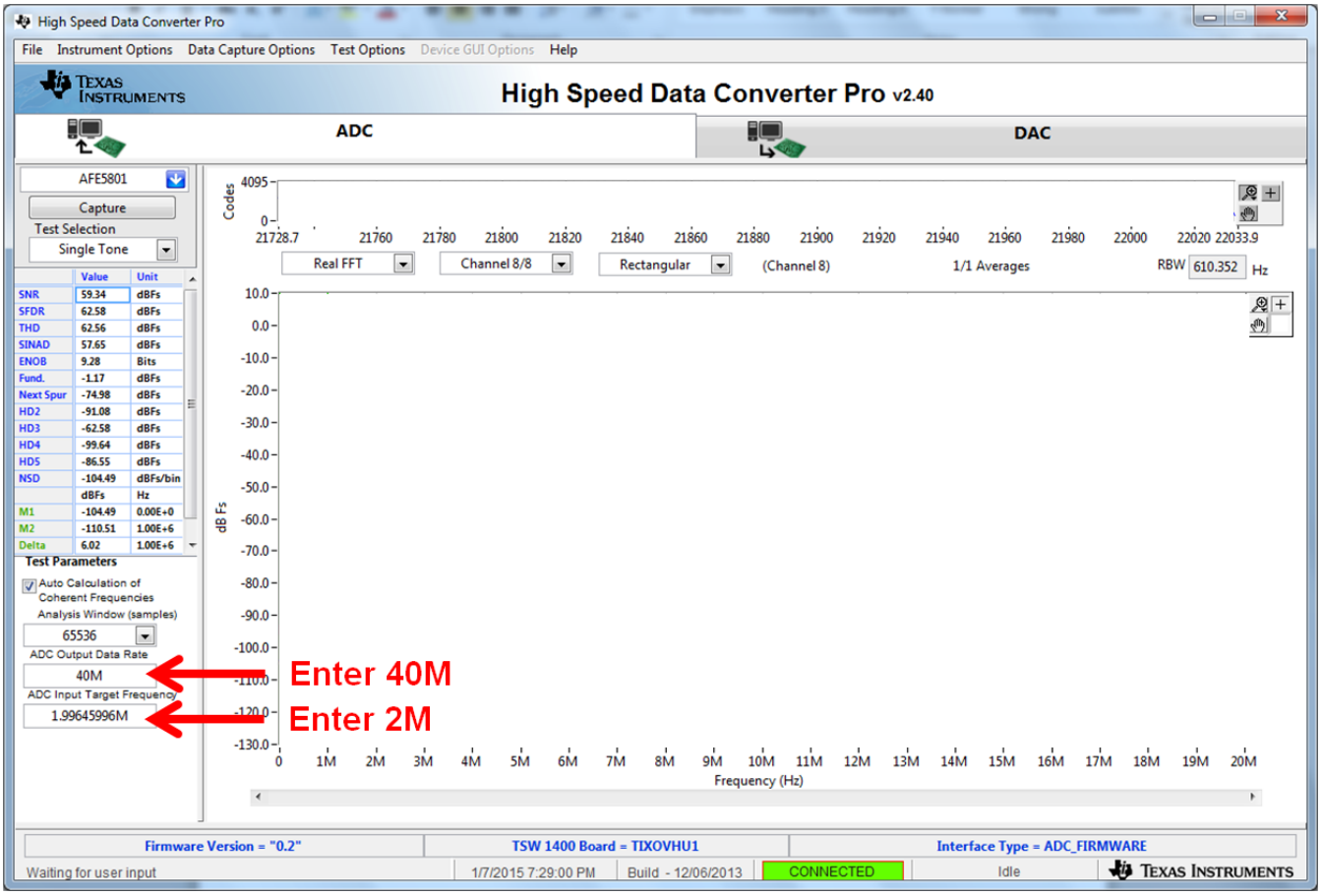


Figure 37. User Interface: Frequency Load Value to Signal Generator

Take the ADC Input frequency, and set the frequency of the signal generator to the noted ADC Input frequency.

Set the Amplitude of the signal generator to -18 to -20 dBm (input amplitude should be between -1dBFS to -3dbFS)

Set the Frequency of the Clock Generator to 40 MHz.

Set the Amplitude of the Clock Generator to 13 dBm.

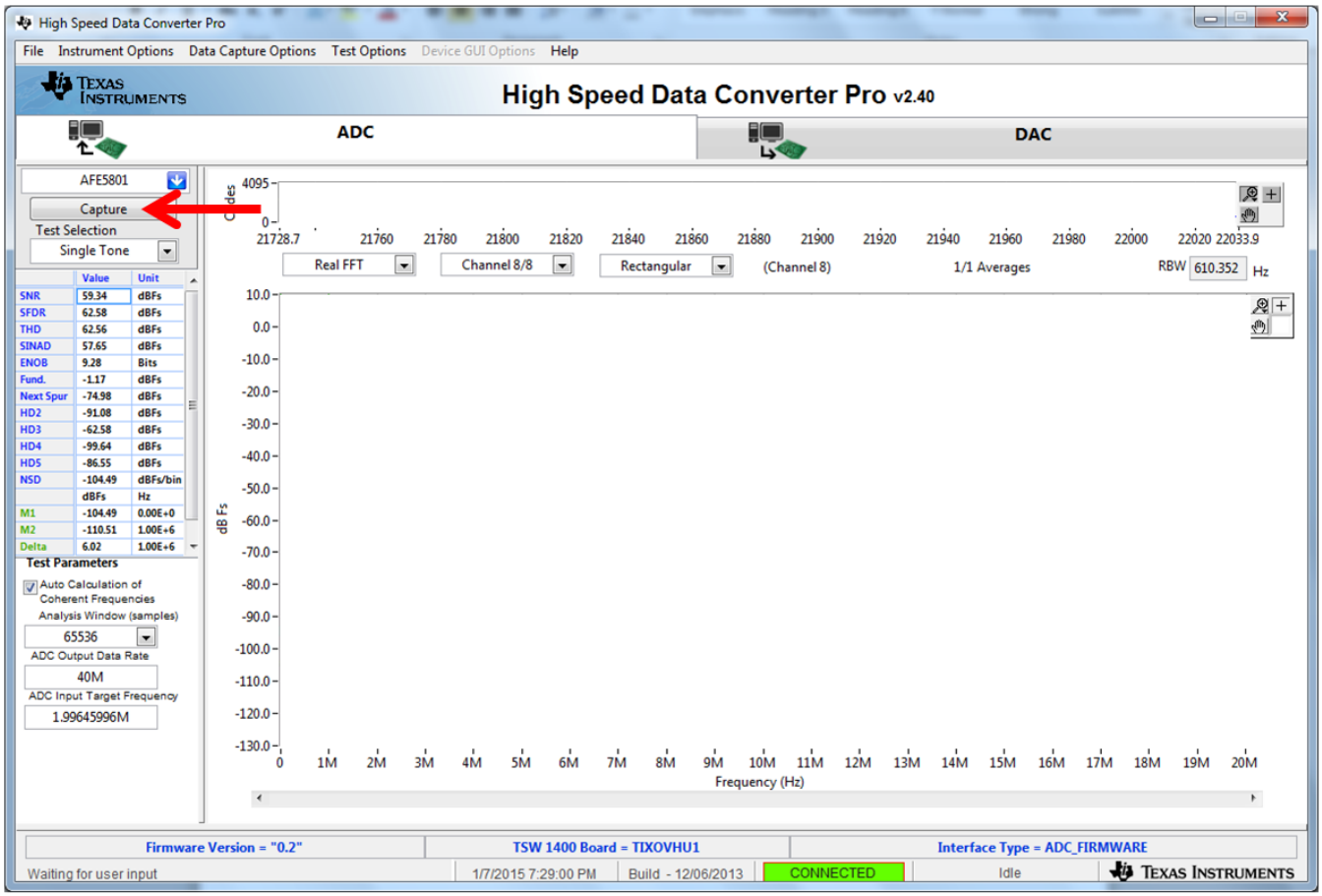


Figure 38. User Interface: Final Setup Screen

Now the user can select the test channel, select the test type by choosing the Single Tone Tab, or Time Domain Tab, and begin testing.

- **Single Tone FFT**

  The Single Tone FFT test is shown in Figure 39. The larger central pane displays the FFT power spectrum, whereas the calculated statistics are grouped into categories on the right of the screen. Settings and inputs relevant to the test are entered in drop-down menus or text input boxes on the left portion of the window.

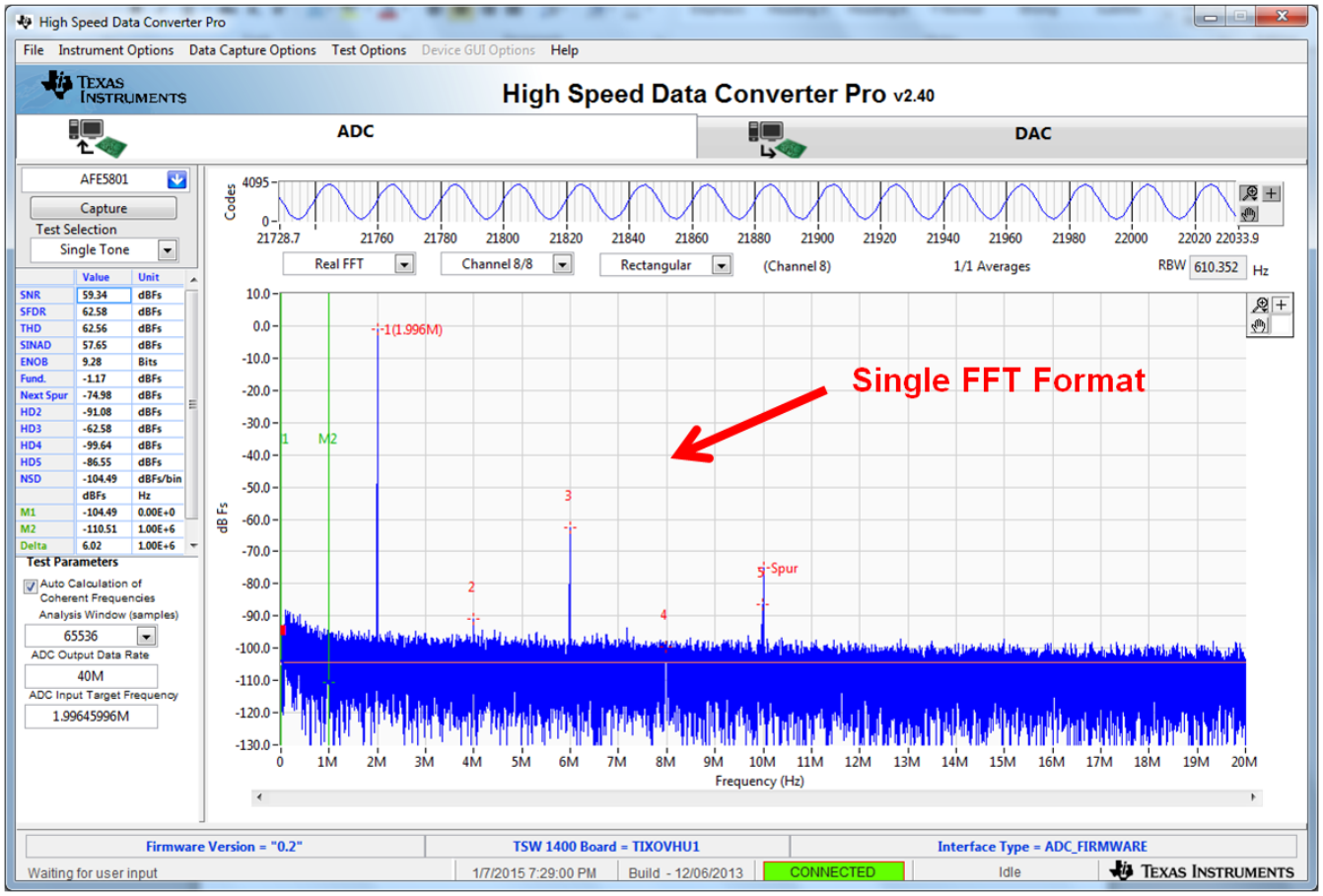


Figure 39. User Interface: Single FFT Format

- **Time Domain**

The Time Domain test is shown in Figure 40. The larger central pane displays the raw sampled data whereas the calculated statistics are grouped into categories on the right of the screen. Settings and inputs relevant to the test are entered in drop-down menus or text input boxes on the left portion of the window.

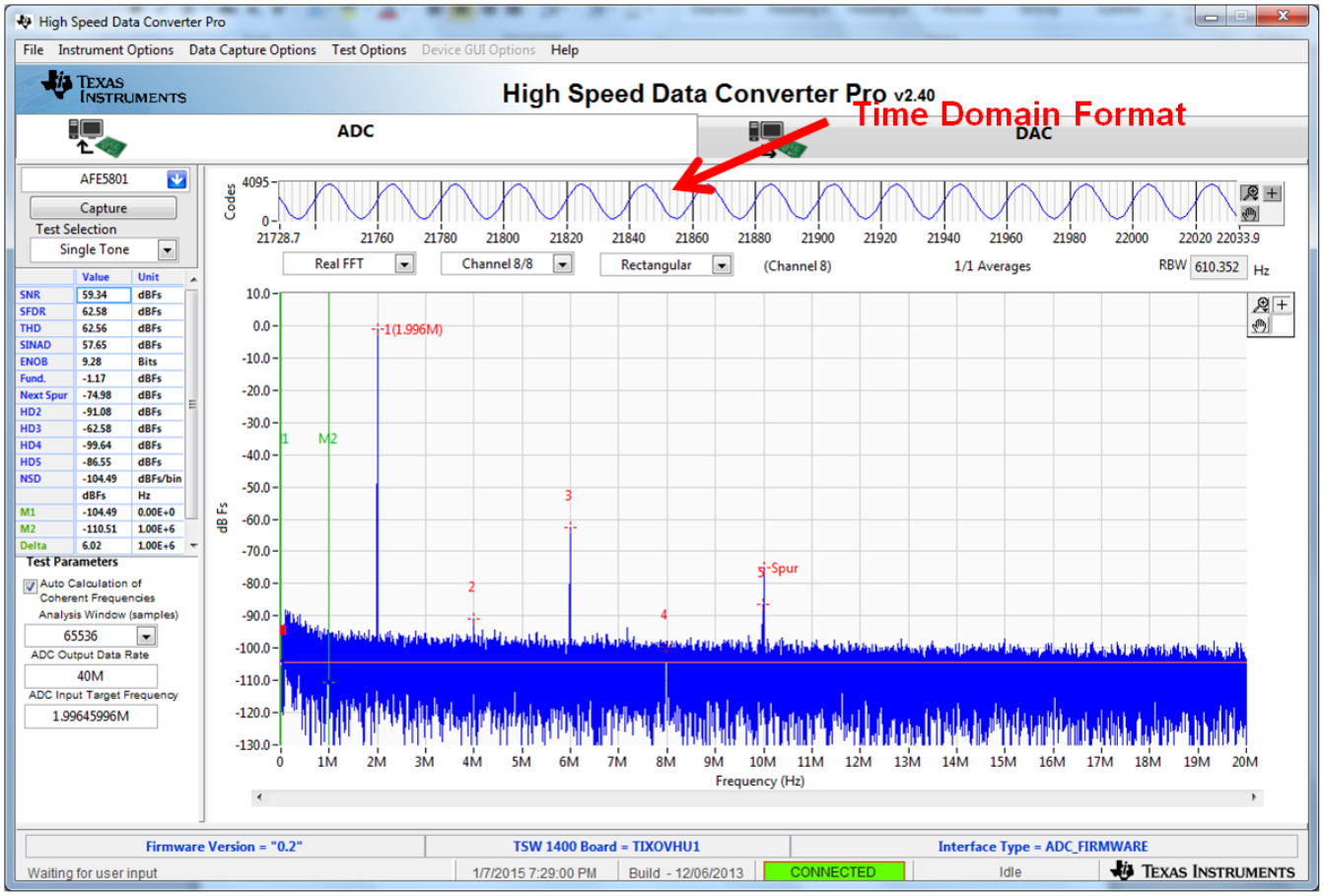


Figure 40. User Interface: Time Domain Format

- **EXCEL**

The raw test sampled data can be saved to a file and processed by EXCEL or some other software.

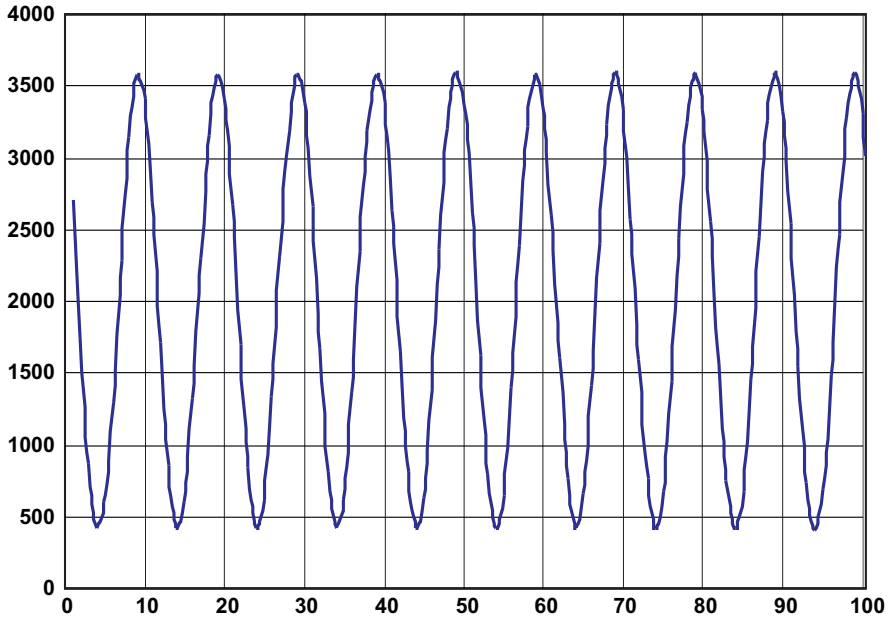


Figure 41. Plot of Saved Sample Data

High Speed Data Converter Pro (HSDCPro) GUI Installation

Download the HSDCPro GUI Installer using this link: HSDCPro GUI

- Unzip the saved folder and run the installer executable to obtain the pop-up shown in Figure 42.
- Click the *Install* button.

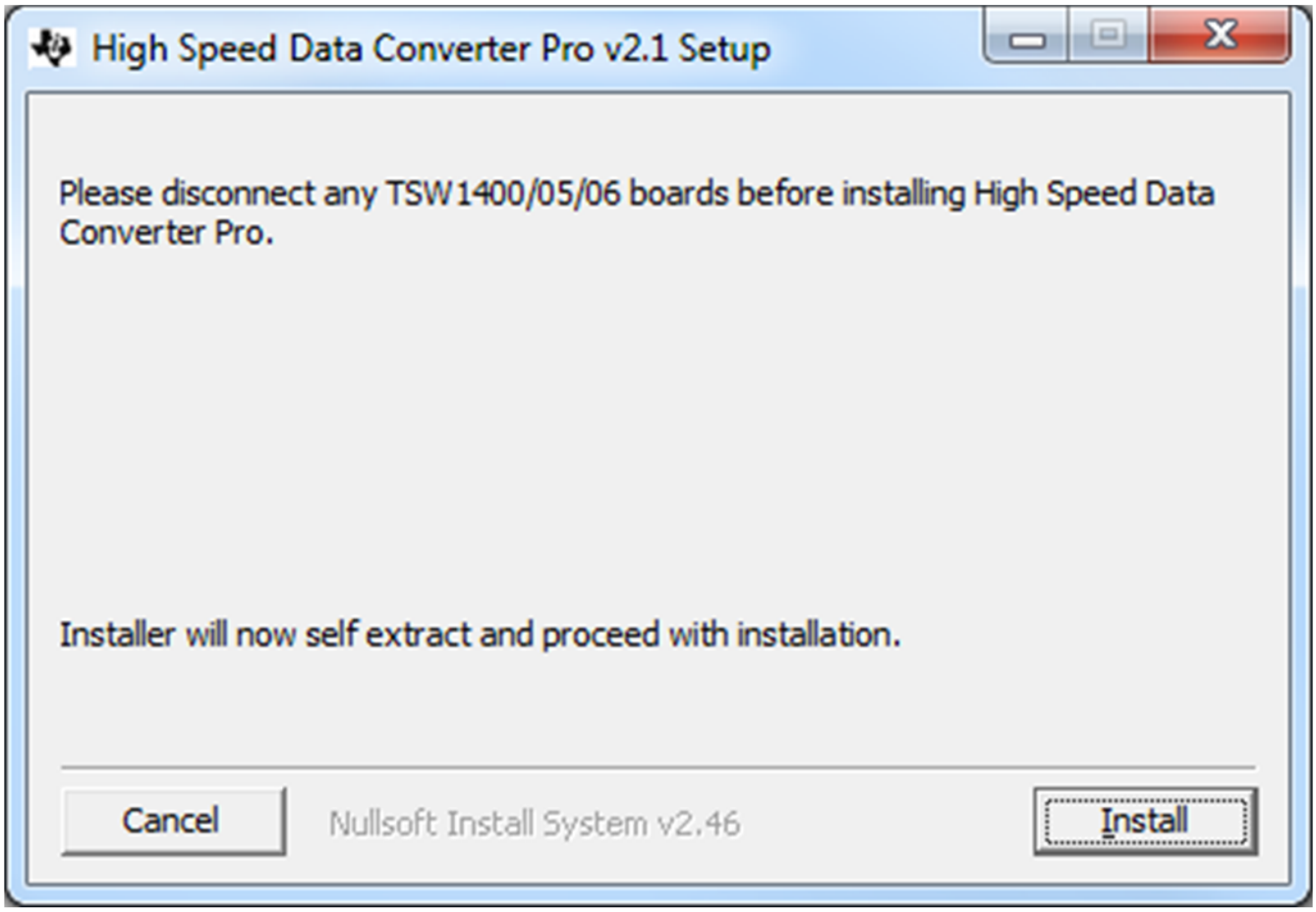


Figure 42. HSDCPro Install (Begin)

- Leave the destination directories as the default location, for the TSW1400GUI installation and press the NEXT button as shown in Figure 43.

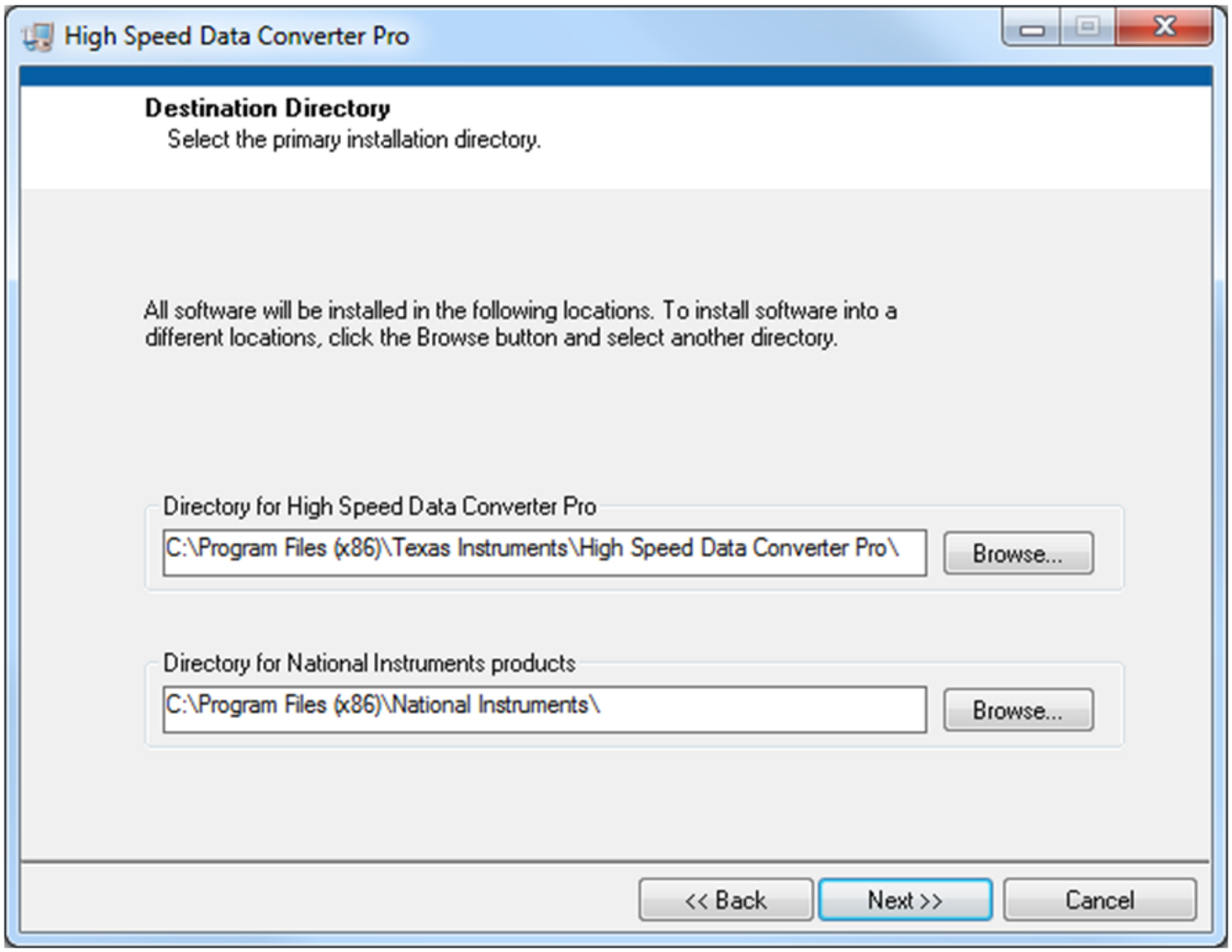


Figure 43. HSDCPro Install (Install Directory)

- Read the License Agreement from Texas Instruments and select *I accept the License Agreement* and press the *Next* button as shown in Figure 44.

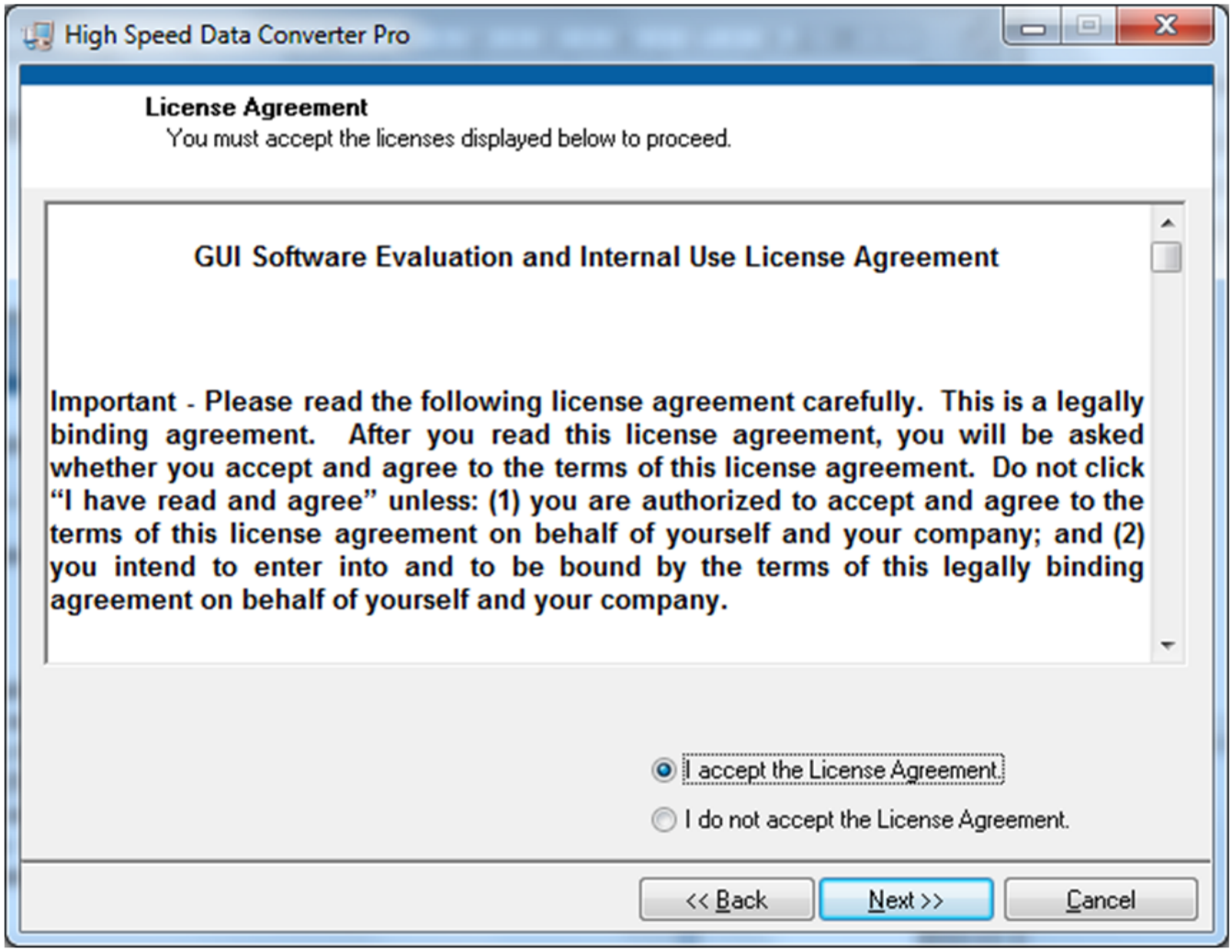


Figure 44. HSDCPro Install (TI License Agreement)

- Read the License Agreement from National Instruments and select *I accept the License Agreement* and press the *Next* button as shown in Figure 45.

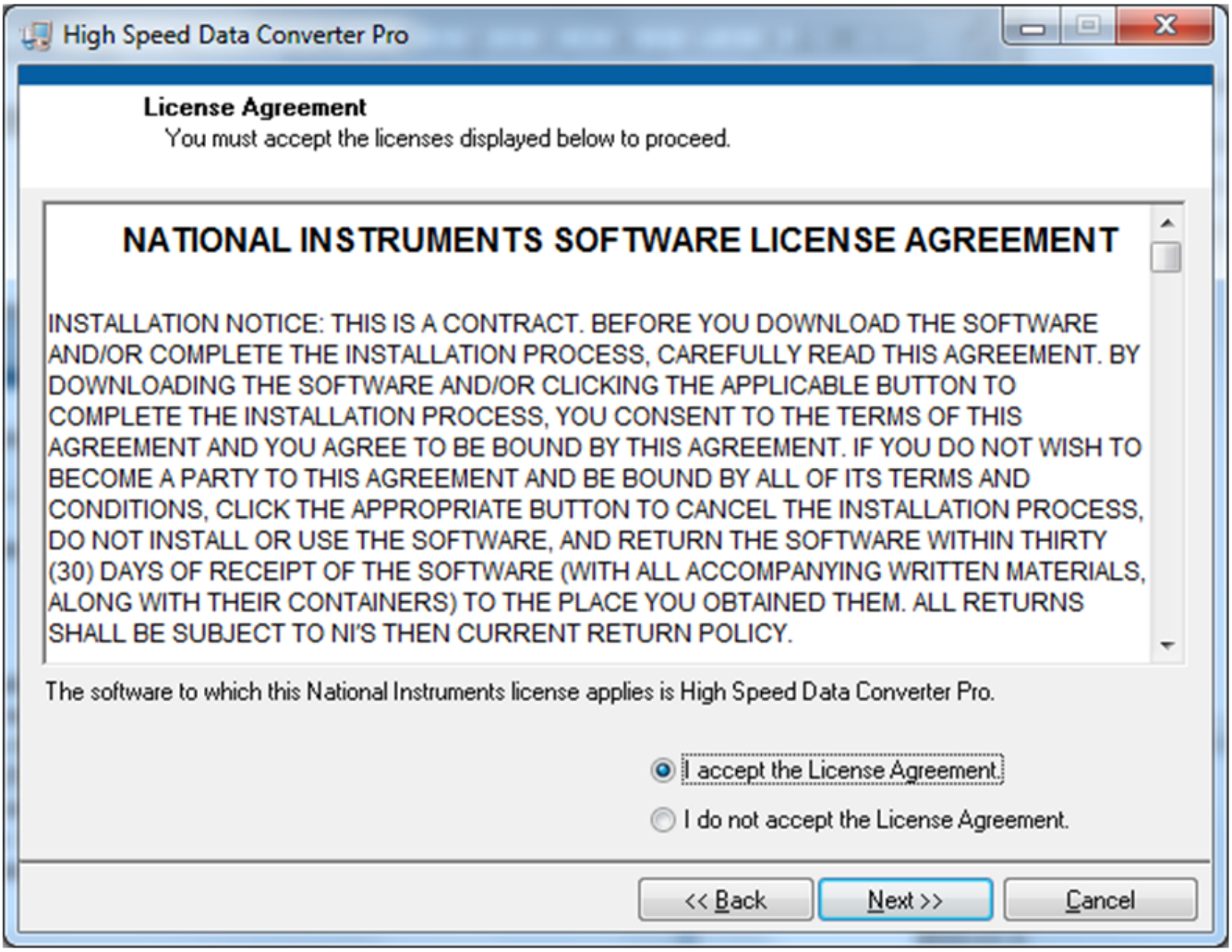


Figure 45. HSDCPro Install (NI License Agreement)

- Press the *Next* button as shown in Figure 46.

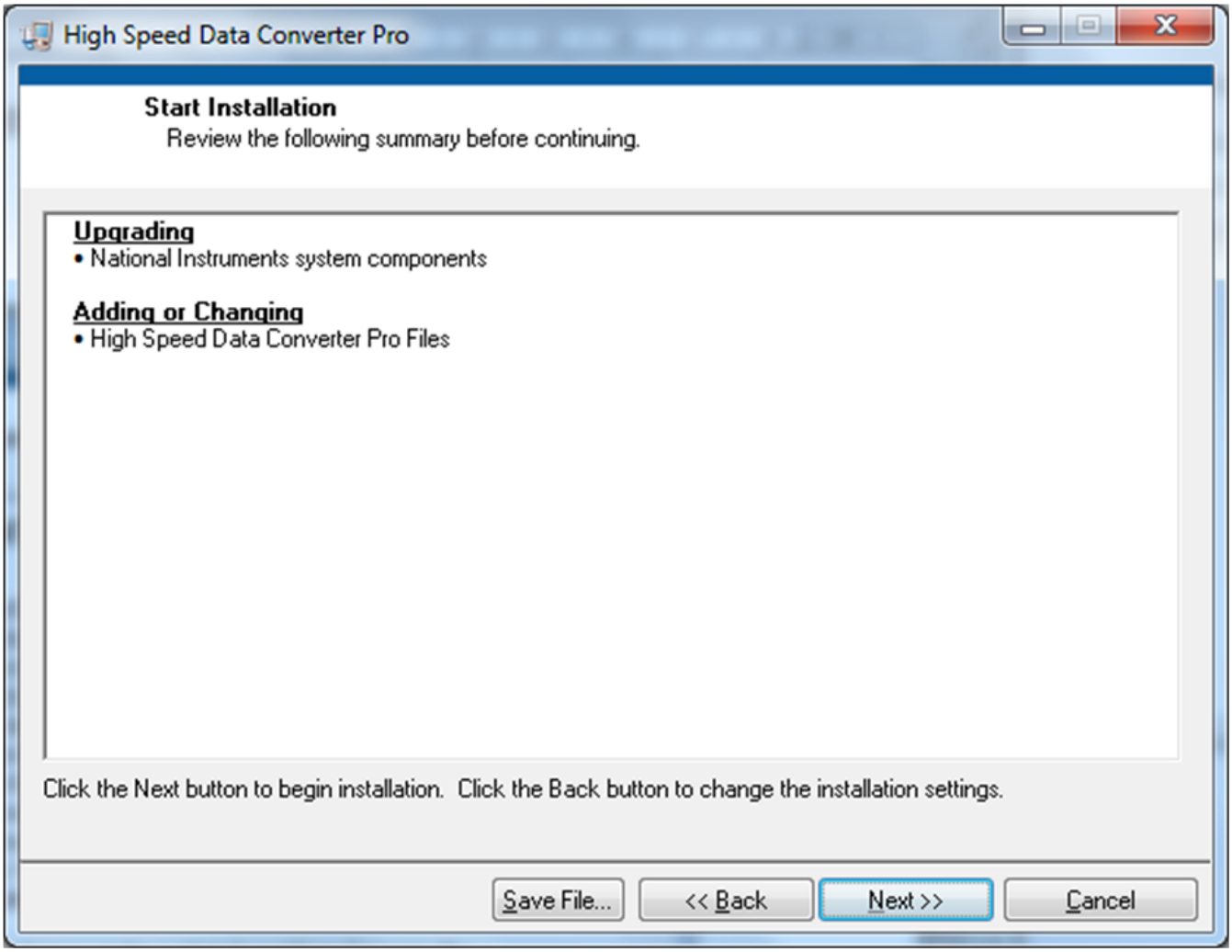


Figure 46. HSDCPro Install (Start Installation)

- The window shown in Figure 47 should appear indicating that the installation is in progress.

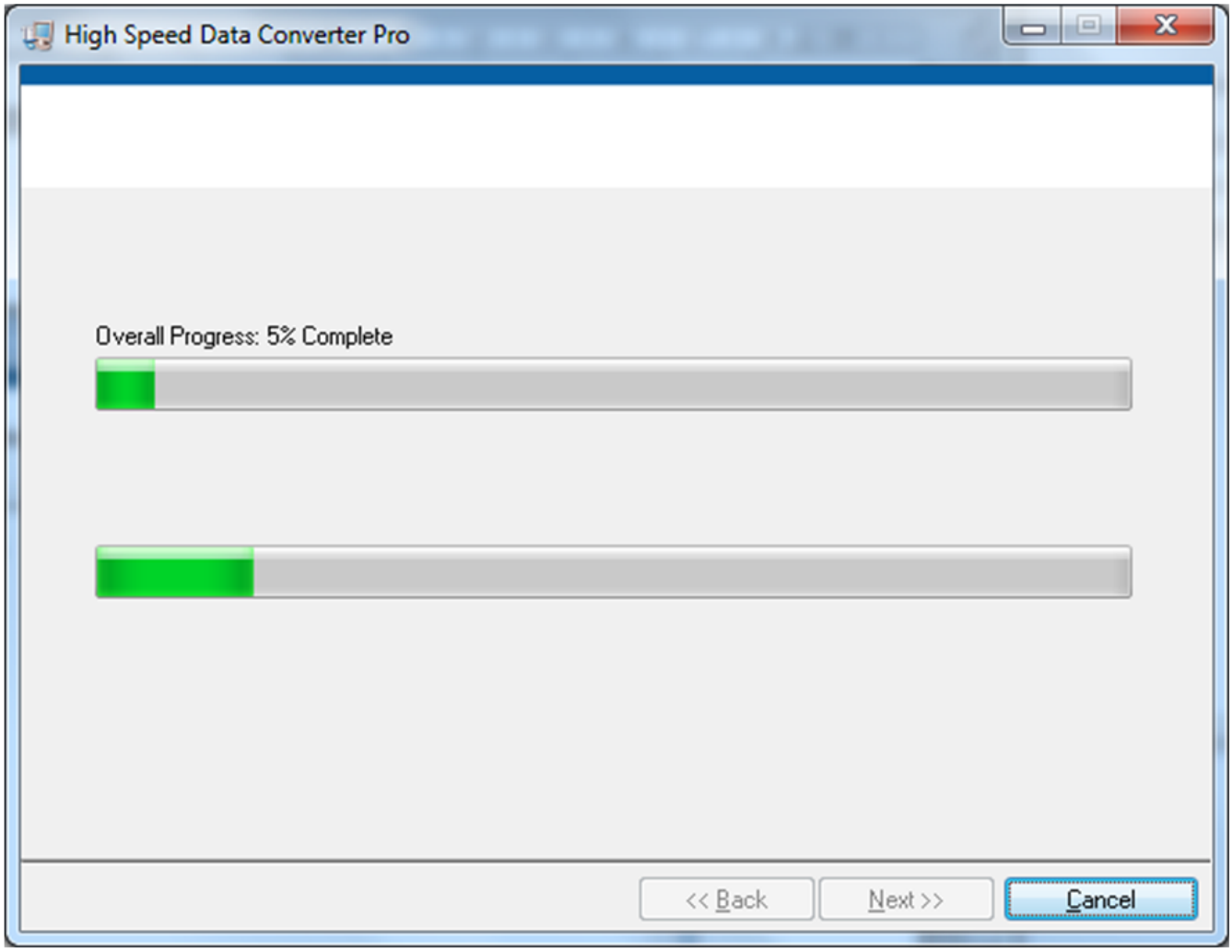


Figure 47. HSDCPro Install (Installation Progress)

- The window shown in Figure 48 appears indicating *Installation Complete*. Press the *Next* button.

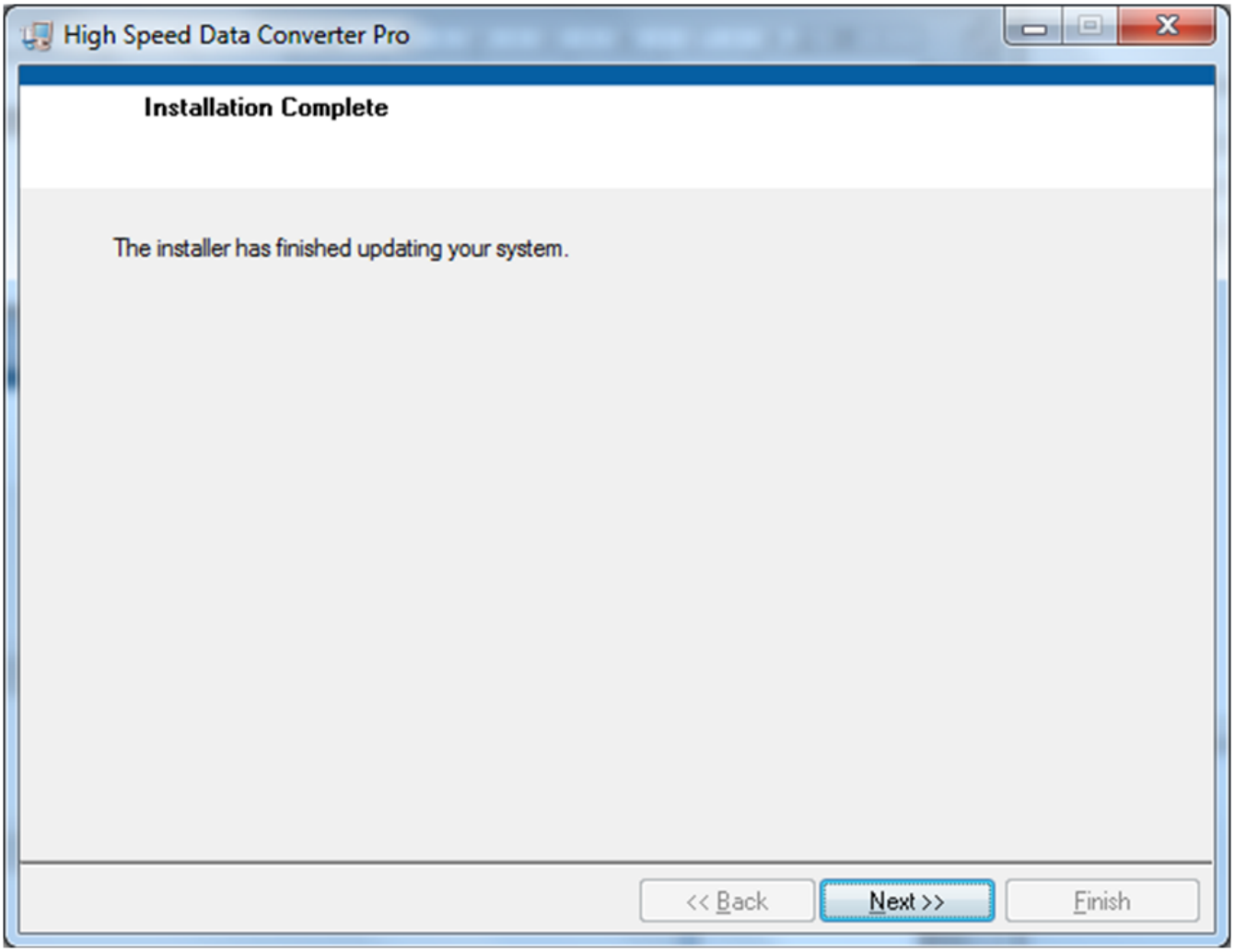


Figure 48. HSDCPro Install (Installation Complete)

- The window shown in Figure 49 appears briefly to complete the process.

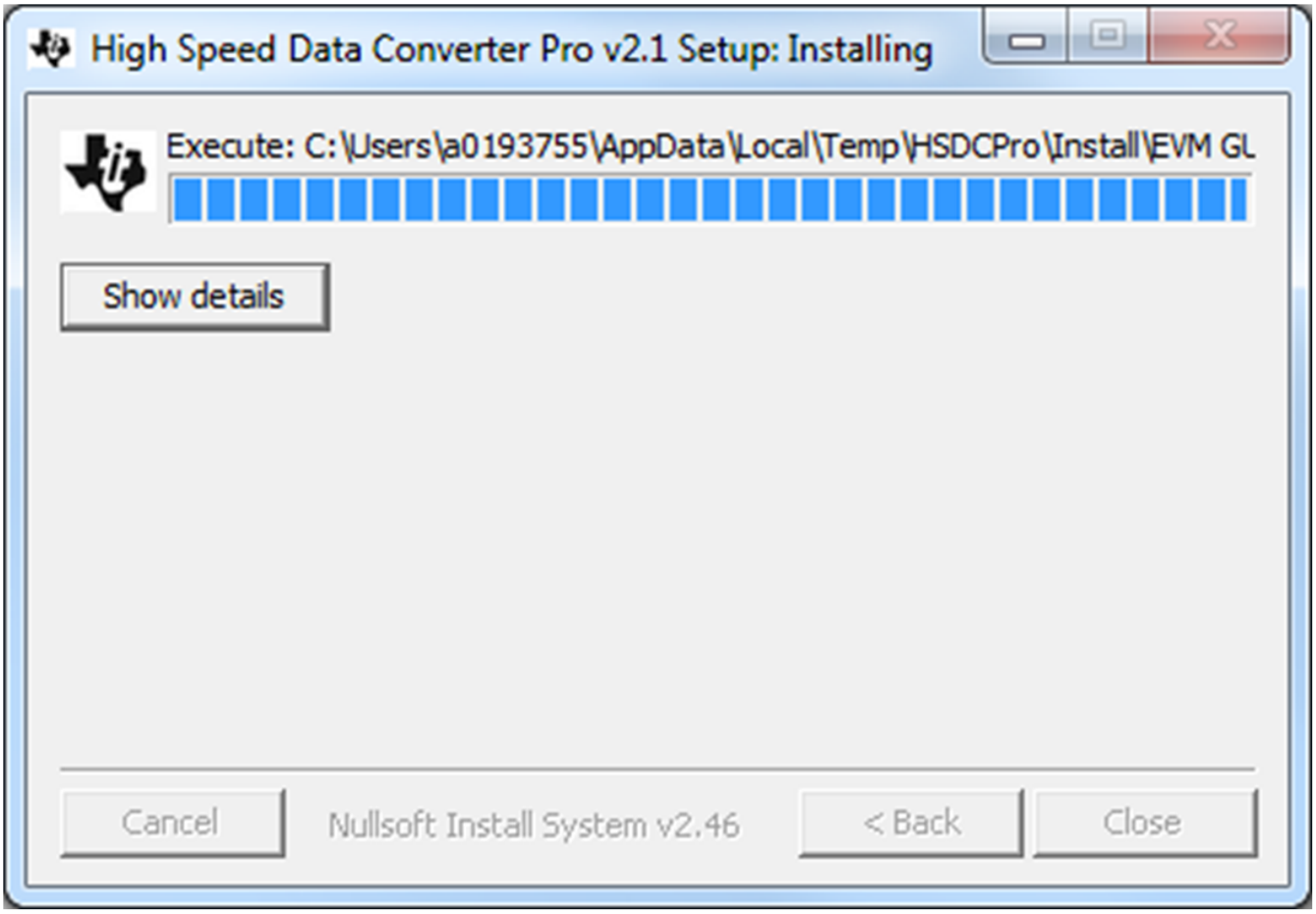


Figure 49. HSDCPro Install (h)

- As shown in Figure 50 a restart might be requested depending on whether or not the PC already had the National Instruments MCR Installer. If requested, hit the *Restart* button to complete the installation.

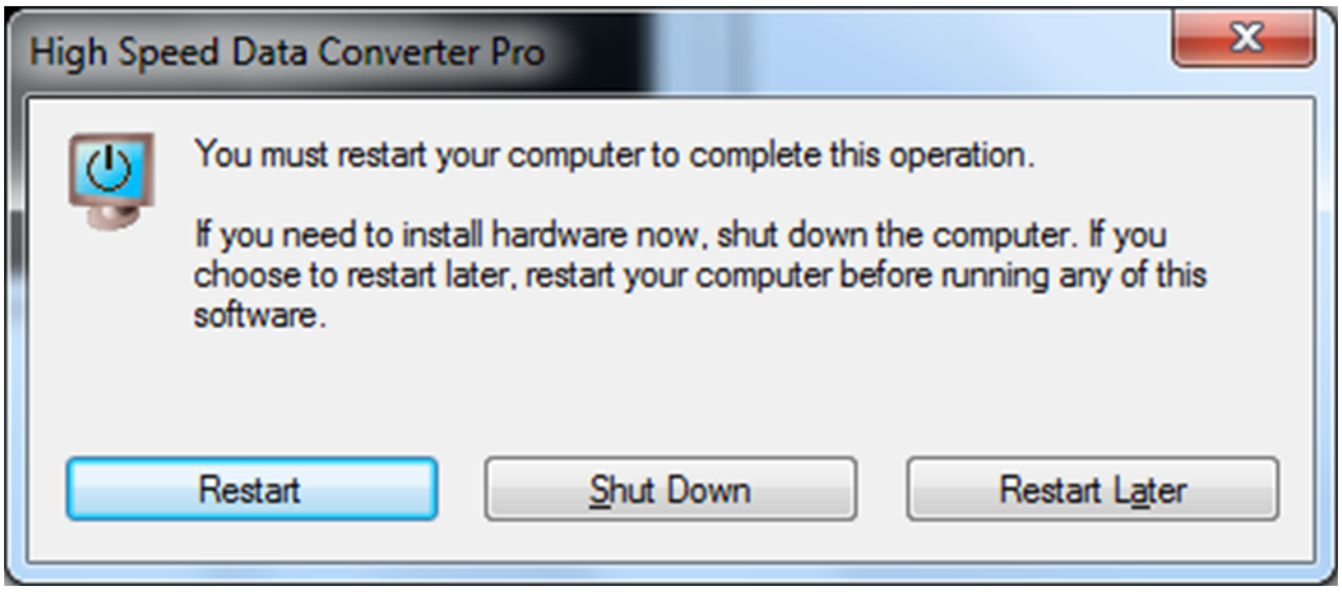


Figure 50. HSDCPro Install

Revision History

Changes from A Revision (August 2011) to B Revision	Page
• Added Appendix B: High Speed Data Converter Pro (HSDCPro) GUI Installation.	45

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

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software

   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 and conditions 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 any defects that are 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. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, 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.

3 *Regulatory Notices:*

   3.1 *United States*

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

      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*

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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/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。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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

If User uses EVMs in Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】

本開発キットは技術基準適合証明を受けておりません。

本製品のご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

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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.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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