User's Guide
SLAU429–March 2012

TSW1265EVM Evaluation Module

The TSW1265EVM evaluation module is a wideband, dual-receiver reference design and evaluation platform. The signal chain allows conversion from RF to bits using a dual-channel downconversion mixer, the LMH6521 dual-channel, digitally controlled variable gain amplifier (DVGA), and the ADS4249 14-bit 250-MSPS analog-to-digital converter (ADC). The TSW1265EVM also includes the LMK04800 dual-PLL clock jitter cleaner and generator to provide an onboard low-noise clocking solution. A provided software GUI allows for configuration of the ADS4249 and LMK04800. Either the GUI or an FPGA using the high-speed connector can control the gain of the LMH6521 DVGA. The EVM mates with the TSW1400 pattern capture and generation card to capture data from the ADS4249. Then, the High Speed Data Converter Pro software tool can perform signal analysis. The TSW1265EVM product folder on the TI web site contains the EVM schematic, bill of materials, and layout files.

Contents

List of Figures

List of Tables

1 Introduction

1.1 Overview

The TSW1265EVM evaluation module is a wideband, dual-receiver reference design and evaluation platform. The signal chain allows conversion from RF to bits using a dual-channel downconversion mixer, the LMH6521 dual-channel DVGA, and the ADS4249 14-bit, 250-MSPS ADC. The TSW1265EVM also includes the LMK04800 dual-PLL clock jitter cleaner and generator to provide an onboard low-noise clocking solution.

The default configuration of the board allows for an RF frequency of 1700 MHz to 2200 MHz and an LO frequency of 1750 MHz to 2700 MHz. The IF portion of the board, starting at the output of the mixer to the ADC input, is set for a center frequency of 187.5 MHz and a 1-dB bandwidth of 75 MHz. Modification of both the RF and IF frequency ranges is possible and is discussed later.

A software GUI allows for configuring the ADS4249 and LMK04800. The GUI, or alternatively through the high-speed connector with an FPGA, can control the gain of the LMH6521 DVGA. The EVM mates with the TSW1400 pattern capture and generation board to capture data from the ADS4249. The High Speed Data Converter Pro software tool then can perform signal analysis. The TSW1400 and High Speed Data Converter Pro greatly simplify the evaluation process by providing the hardware and software necessary for pattern capture and analysis.

1.2 Block Diagram

Figure 1 shows the block diagram of the TSW1265EVM.

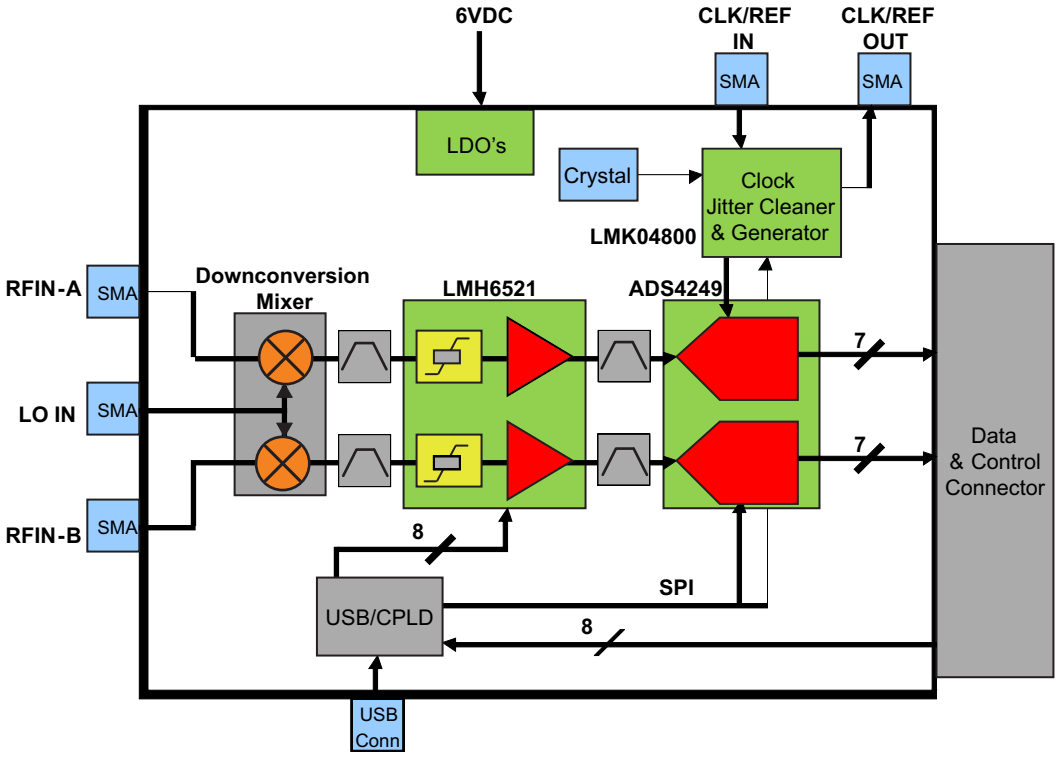

Figure 1. TSW1265EVM Block Diagram

2 Software Control

This section provides installation instructions and explanations of the TSW1265 GUI.

2.1 Installation Instructions

1. The software can be downloaded from the TSW1265EVM production page on www.ti.com. Find the page by searching for *TSW1265EVM*. The software appears under the *Related Products* section on the *TI Software* tab.
2. Extract the files from the zip file named *TSW1265 GUI vXpY Installer.zip* where *XpY* represents the version number.
3. Run *setup.exe*, and follow the installation prompts.
4. Start the GUI by going to the Start Menu → All Programs → Texas Instruments ADCs → TSW1265 GUI.
5. When plugging the board into the computer for the first time through the USB cable, you are prompted to install the USB drivers.
   - Windows® XP: If Windows XP does not automatically install the drivers, follow the prompts on the screen to do so. Do not let Windows XP search Microsoft Update for the drivers, but do let Windows XP install the drivers automatically.
   - Windows 7: After installing the TSW1265 GUI, Windows 7 should automatically be able to install the drivers for the TSW1265EVM with no input from the user.

2.2 Software Operation

The TSW1265 GUI allows the user to program the ADS4249, LMH6521, and LMK04800 for proper operation. The controls for each device are split between different tabs for a simplified interface. Detailed descriptions for each tab are below.

2.2.1 ADS4249 Control Tab

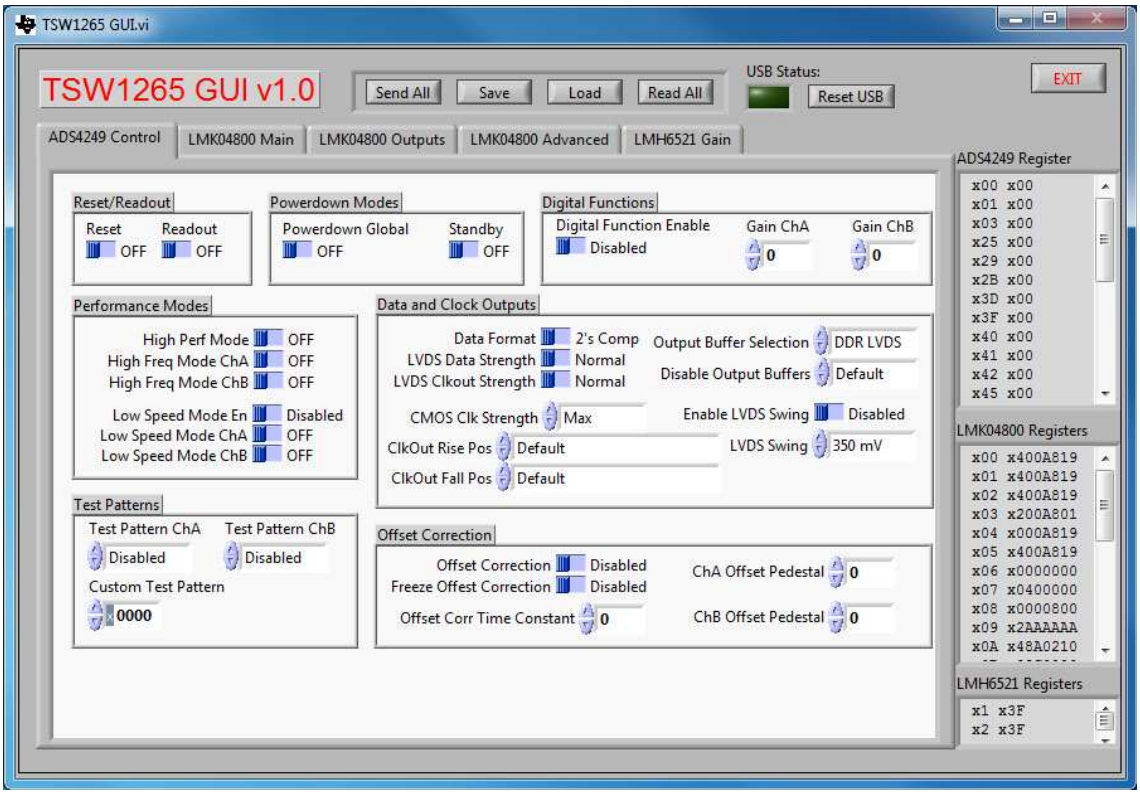

Figure 2. ADS4249 Control Tab

Table 1. ADS4249 Control Tab Section Descriptions

Section	Description
Reset/Readout	Controls the reset and readout functions. Note that readout is not currently functional.
Powerdown Modes	Put the device into either global or standby powerdown modes to lower power consumption.
Digital Functions	Enable or disable the digital gain functions and set the gain value. Also enables use of test patterns and offset correction.
Performance Modes	Set the various performance modes
Data and Clock Outputs	Change parameters of the digital and clock outputs such as levels, data format, and output buffer type.
Test Patterns	Set the test patterns of both channels for testing and troubleshooting of the digital interface.
Offset Correction	Enable and set parameters of the offset correction feature.

2.2.2 LMK04800 Main Tab

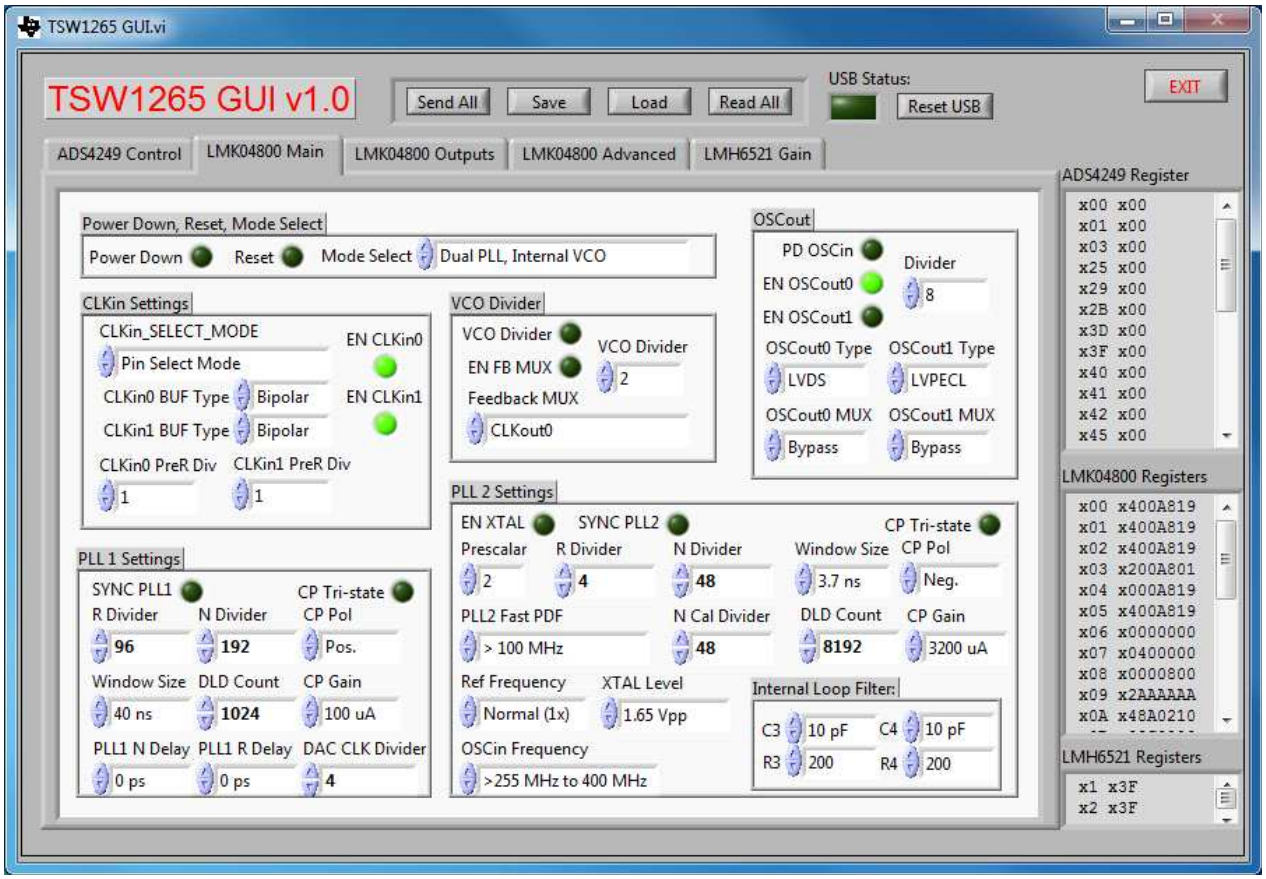

Figure 3. LMK04800 Main Tab

Table 2. LMK04800 Main Tab Section Descriptions

Section	Description
Power Down, Reset, Mode Select	Allows for powering down and resetting the part. Also controls the mode of the LMK04800.
CLKin Settings	Enabled and select the input clock source, input buffer types, and dividers.
VCO Divider	Set the VCO divider to reduce the frequency on the clock distribution path. It is recommended to use the VCO directly.
OSCout	Control power to the OSCin port. Also enable and change parameters of the OSCout pins.
PLL 1 Settings	Configure PLL 1 settings when using the dual PLL mode.
PLL 2 Settings	Configure PLL 2 settings for both dual and single PLL mode.

2.2.3 LMK04800 Outputs Tab

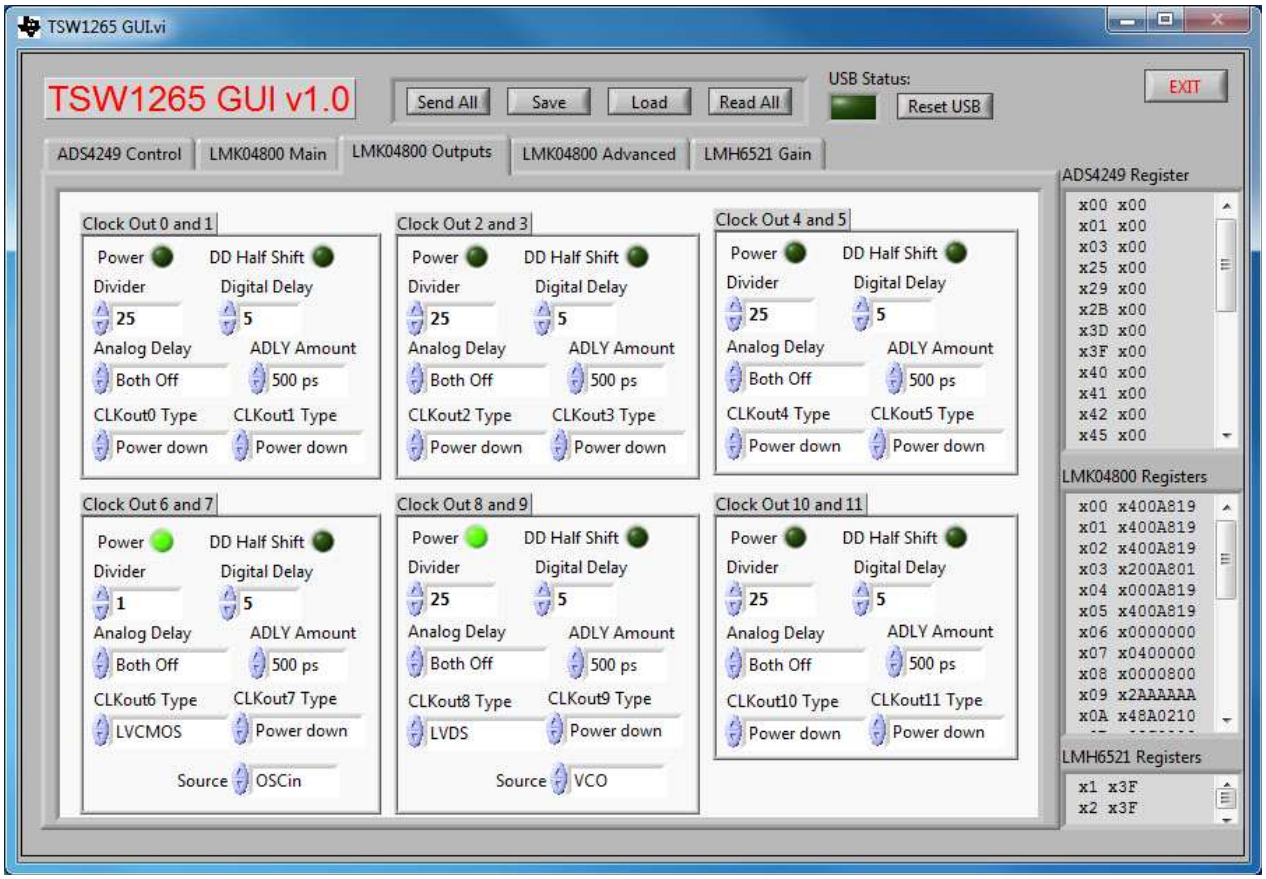

Figure 4. LMK04800 Outputs Tab

Table 3. LMK04800 Outputs Tab Section Descriptions

Section	Description
Clock Out 0 and 1	Configure Clock Out 0 and 1 outputs. Enable the outputs and set the divider, delay, and output buffer.
Clock Out 2 and 3	Configure Clock Out 2 and 3 outputs. Enable the outputs and set the divider, delay, and output buffer.
Clock Out 4 and 5	Configure Clock Out 4 and 5 outputs. Enable the outputs and set the divider, delay, and output buffer.
Clock Out 6 and 7	Configure Clock Out 6 and 7 outputs. Enable the outputs and set the divider, delay, and output buffer. Also select the source for the output.
Clock Out 8 and 9	Configure Clock Out 8 and 9 outputs. Enable the outputs and set the divider, delay, and output buffer. Also select the source for the output.
Clock Out 10 and 11	Configure Clock Out 10 and 11 outputs. Enable the outputs and set the divider, delay, and output buffer.

2.2.4 LMK04800 Advanced Tab

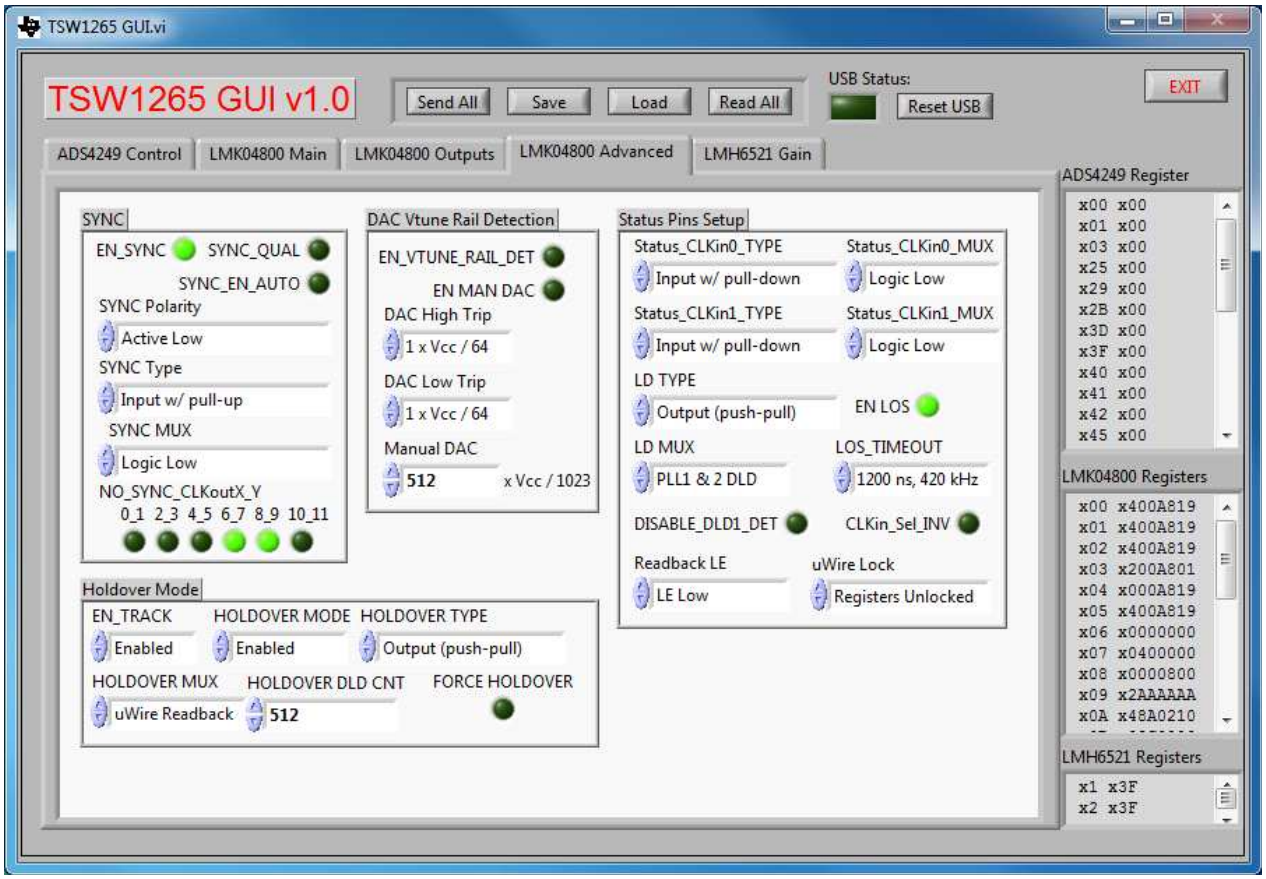

Figure 5. LMK04800 Advanced Tab

Table 4. LMK04800 Advanced Tab Section Descriptions

Section	Description
SYNC	Enable and configure the sync functionality.
DAC Vtune Rail Detection	Enable and control the internal DAC settings.
Status Pins Setup	Setup the status pins for various outputs as well as control some miscellaneous functions.
Holdover Mode	Enable and configure holdover mode.

2.2.5 LMH6521 Gain Tab

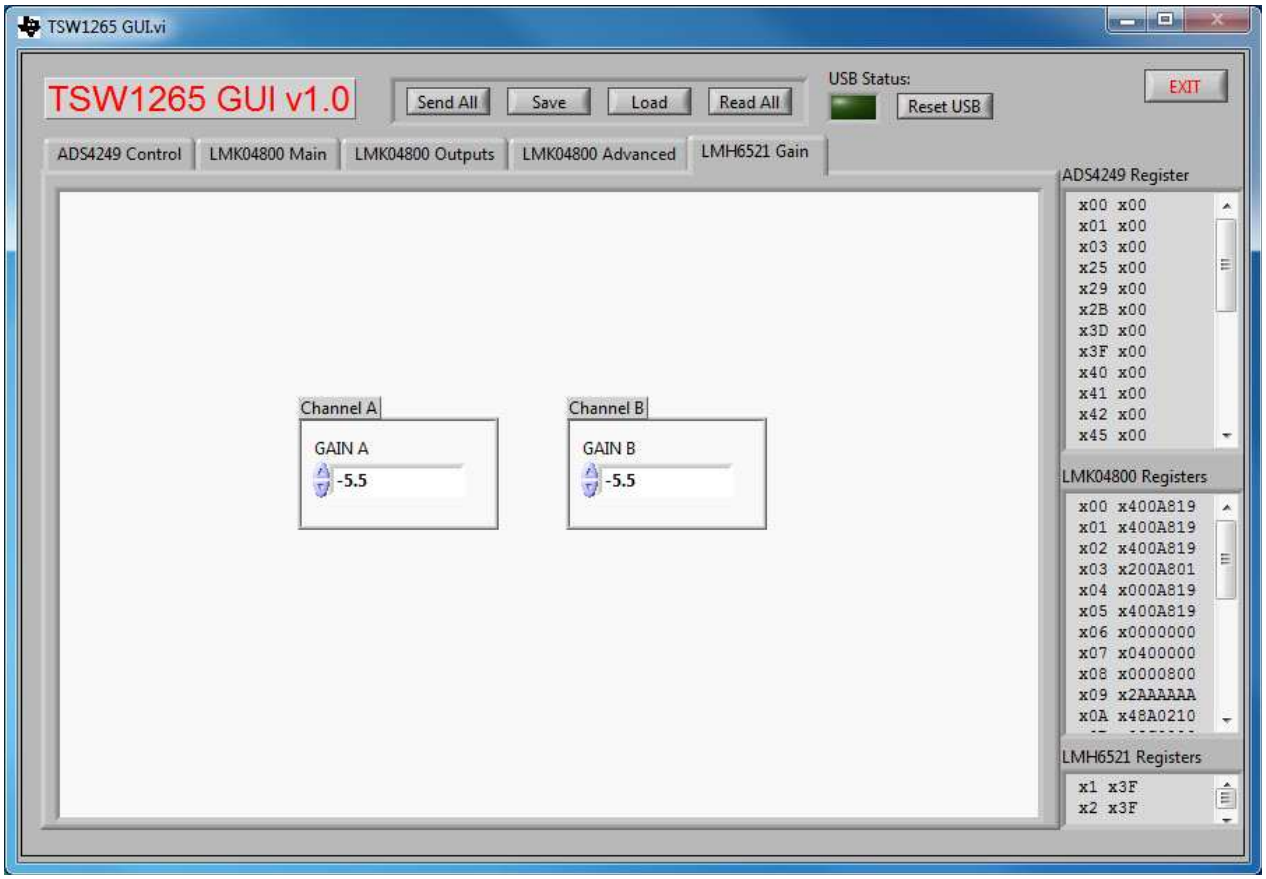

Figure 6. LMH6521 Gain Tab

Table 5. LMH6521 Gain Tab Section Descriptions

Section	Description
Channel A	Set the gain for channel A of the LMH6521.
Channel B	Set the gain for channel B of the LMH6521.

2.2.6 Send All, Save, Load, Read All

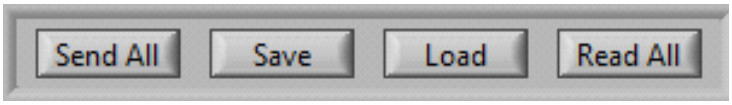

Figure 7. Send All, Save, Load, and Read All

Table 6. Send All, Save, Load, and Read All Descriptions

Section	Description
Send All	Click to send all the registers for all devices. Press a few times if the board does not seem to be responding correctly.
Save	Save the register settings in a text file. Can be reloaded later to set the GUI and devices to a known state.
Load	Load a saved configuration.
Read All	This function is not currently enabled on the TSW1265 GUI.

2.2.7 USB Status

The indicator shows the status of the USB connection. The indicator is lit when the USB connection is valid. If the computer is not connected to the board, click the *Reset USB* button.

2.2.8 Exit

Click to exit the GUI. Note that the *X* in the upper right corner of the window has been disabled to ensure that the USB connection is closed properly.

3 Basic Test Procedure

3.1 TSW1400 Setup

See the TSW1400 User's Guide (SLWU079) for a more detailed explanation of the TSW1400 setup and its features. This document assumes that the High Speed Data Converter Pro software and the TSW1400 pattern capture and generation board are both installed and functioning properly. This information can be found at http://www.ti.com/tool/tsw1400evm.

3.2 Test Setup Block Diagram

Below is a block diagram of the test setup.

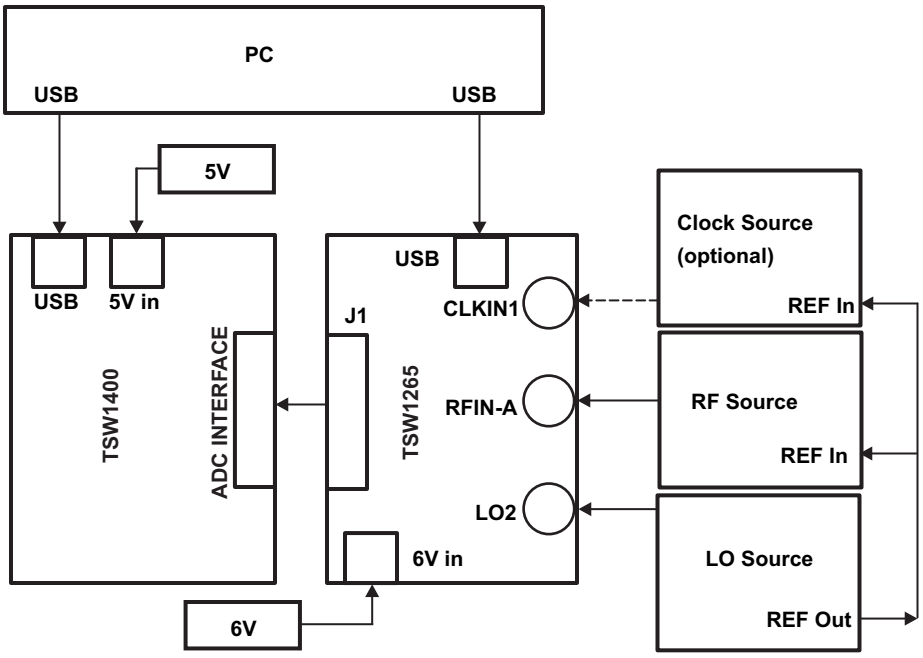

Figure 8. Test Setup Block Diagram

3.3 Quick-Start Procedure

3.3.1 TSW1400 Data Capture Card

1. Connect a 5-V power supply to connector J12 of the TSW1400. Flip switch SW7 to the "ON" position.
2. Insert a USB cable into the USB port on the TSW1400. Connect the other end to the PC.

3.3.2 TSW1265EVM

1. Connect a 6-V power supply to either the banana jacks or the barrel connector. If using the banana jacks, connect the positive end to J17 and the negative end to J16.
2. Connect a USB cable between the TSW1265 board and the PC.
3. Connect an LO source to the SMA connector labeled *LO2*. Set the LO source to 1960 MHz and 0 dBm.
4. Connect an RF source to the SMA connector labeled *RFIN-B*. Because the DVGA may come up with an unknown gain, set the amplitude of the RF input to -30 dBm to prevent overdriving the ADC on start-up. Set the frequency to 1780 MHz.
5. Connect the TSW1265 to the TSW1400 by connecting J1 on the TSW1265 to the ADC Interface connector on the bottom of the TSW1400.

3.3.3 TSW1265 GUI

1. Start the TSW1265 GUI by going to Start Menu → All Programs → Texas Instruments ADCs → TSW1265 GUI.
2. Make sure the green indicator is lit up indicating that the TSW1265 board has been successfully connected to the PC. If not, click the "Reset USB" button. If it still is not lit up, check the USB connection. If the USB connection is correct, unplug the USB cable, wait five seconds and then plug it back in. Repeat these steps if necessary.
3. Click the "Load" button and select the file named "250MHz_onboard_clock.txt". Click "Ok". The file is

located in the TSW1265 GUI installation directory in the folder named "Configuration Files".

4. Click "Send All". At this point, the LED labeled "D1" on the TSW1265 should be lit indicating a PLL lock. If it is not lit, click "Send All" again.

3.3.4 High Speed Data Converter Pro

1. Start the High Speed Data Convert Pro software tool by going to Start Menu → All Programs → Texas Instruments ADCs → High Speed Data Converter Pro.
2. When it prompts for the serial number of the board, select the serial number that represents the TSW1400 that has been connected to the TSW1265. This number should be on a sticker on the TSW1400.
3. In the "Select ADC" drop-down box select "ADS4249". If it asks to download the firmware select "Yes". Multiple LEDs will light up on the TSW1400 once the firmware has finished downloading.
4. Select *Single Tone* from the *Test Selection* drop-down menu.
5. At the bottom left corner, enter *250M* into the ADC Sampling Rate (Fs) box. Enter *180M* into the *ADC Input Target Frequency* box. Press the *Enter* key.
6. Select *Blackman* from the drop-down box originally labeled "Rectangular". This applies a Blackman windowing function because the clock source is not synchronized to the LO and RF sources and therefore the captured data will not be coherent.
7. All boards and software are now set up. Click the *Capture* button. Once the capture is complete, adjust the input source amplitude and LMH6521 gain as needed to achieve approximately -1 dBFS. The LMH6521 gain can be changed on the *LMH6521* Gain tab of the TSW1265 GUI. An example of a -1-dBFS plot is shown in the figure below.

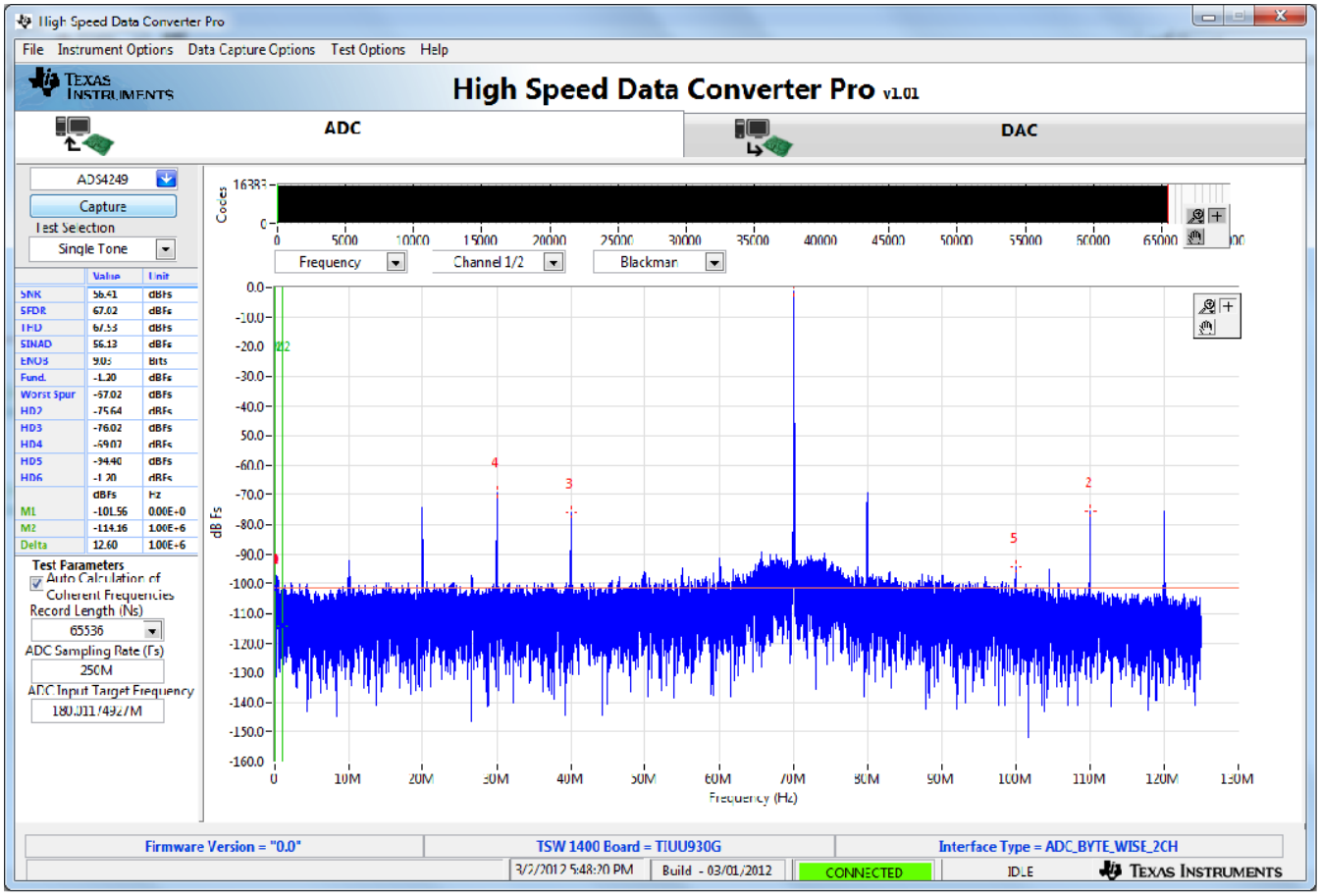

Figure 9. TSW1265 Sample Capture using the TSW1400

3.4 Optional Features and Configurations

3.4.1 Clocking

The TSW1265EVM allows for multiple clocking configurations by using the LMK04800 clock jitter cleaner and generation chip. The board comes preinstalled with a 20-MHz crystal which can be used to generate the sampling clock. The default for the board is a 250-MHz sampling clock.

Since the board is initially setup for a 250-MHz sampling clock, an LC resonant tank filter centered at 250 MHz has been placed on the clock lines to provide filtering of wideband noise. The filter has a wide enough bandwidth to allow the use of an external 245.76-MHz clock as well. If another clocking frequency is needed, the LC resonant tank will need to be changed. It can also be removed altogether, but at the cost of some added clock jitter. Use Equation 1 below to calculate the inductor and capacitor values for the desired clock frequency. F_c is the center frequency of the filter and Q can be chosen to be an arbitrary value of 25. Assume R is equal to 100 Ω. Note that the traces from the LMK04800 to the ADC add approximately 50 pF of capacitance which has already been considered in Equation 1.

$$L = \frac{1}{2\pi f \frac{Q}{R}}$$

$$C = L\left(\frac{Q}{R}\right)^2 - 50pF \quad (1)$$

The TSW1265 board comes preinstalled with the LMK04803 which has an internal VCO frequency range of 1840 MHz to 2030 MHz. If the desired clock cannot be derived from this frequency range using integer dividers, then this device can be swapped out for another LMK04800 with a different VCO range. Consult the LMK04800 datasheet (SNAS489H) to determine which LMK04800 will provide the correct VCO range for the needed clocking frequency.

The LMK04800 can be setup in clock distribution mode or as a clock generator using single or dual PLL mode. The different modes of operation are discussed below.

- **External Clock Mode:** The LMK04800 can be setup in clock distribution mode to allow the use of an external clock source. This can be used for coherent sampling by provided a clock that is synchronized to the RF and LO signal sources. The TSW1265 GUI includes a configuration file for the external clock mode. This file is located in the TSW1265 GUI installation directory in the folder "Configuration Files" and is named "external_clock.txt". The file can be loaded by clicking the "Load" button, navigating to the correct folder, selecting the file, and clicking "Ok". Click "Send All" a few times to make sure the board is configured properly. The user provides an external clock through the "CLKIN1" SMA connector on the TSW1265 board.
- **Onboard Clock using Single PLL Mode:** This is the default mode of operation for the TSW1265. In this mode, the 20-MHz crystal is used to generate other frequencies by using the single PLL mode of the LMK04800. The 20-MHz crystal acts as the reference for the PLL and the divided down internal VCO acts as the clock source. There is an included configuration file that will setup the LMK04800 in single PLL mode and generate a 250-MHz sampling clock for the ADS4249. This file is located in the TSW1265 GUI installation directory in the folder "Configuration Files" and is named *250MHz_onboard_clock.txt*. The file can be loaded by clicking the *Load* button, navigating to the correct folder, selecting the file, and clicking *Ok*. Click *Send All* a few times to make sure the board is configured properly. The LED labeled *D1* on the board will light up indicating that the PLL is locked.
- **Onboard Clock using Dual PLL Mode:** This mode of operation allows the user to provide a low frequency reference through the CLKIN1 connector to generate a synchronized, higher frequency sampling clock. The reference can come from any source, such as a 10-MHz reference from a piece of test equipment. This allows for synchronization between all signal sources and for coherent sampling. In order to use this mode, a VCXO needs to be installed at Y2 or Y4. Additionally, R69, R66, C168, C167 should be removed and install 50 Ω for R97, 0.1 uF for C73, and 0.1 uF for C167. The user must update the loop filters if a change in the reference or VCXO occurs. Use the Clock Design Tool (http://www.ti.com/tool/clockdesigntool) to design the loop filters and PLL settings based on the reference, VCXO, and output frequencies.

3.4.2 Changing the RF and LO Frequencies

The default RF frequency range is 1700 MHz to 2200 MHz. The default LO frequency range is 1750 MHz to 2700 MHz. These ranges are set by the MAX19995A downconversion mixer. The board was designed to work with most of the Maxim and Skyworks downconversion mixers, therefore the mixer can be replaced with a different one that has different frequency ranges. The passive components will also need to be changed based on the data sheet of the part.

3.4.3 Changing the IF Frequency

The IF frequency of the TSW1265 is fixed due to the LC filters on the board. There is a filter between the mixer and the LMH6521 and a filter between the LMH6521 and the ADS4249. These filters provide an overall 1-dB bandwidth of 75 MHz centered at 187.5 MHz. The filter between the mixer and the LMH6521 is a second-order LC filter with a 1-dB bandwidth of approximately 140 MHz. The filter between the LMH6521 and the ADS4249 is a fourth order with a bandwidth of 75 MHz.

To change the IF frequency of the TSW1265, the user needs to change the filters that are implemented on the board. There are many tools available for download online that will calculate a filter design based on frequency and ripple requirements. Use these tools to get a starting point for the filter design. Due to parasitic capacitance and inductance on the board, the user must interactively tune the filter to achieve the desired response. Once the filter has been designed for one channel, it can be implemented on the other channel as well. Note that the transformer following the IF filter is in place to correct for any imbalances between the two legs of the differential signal. For more detailed information about how to design the IF filters see the application note titled "Band-Pass Filter Design Techniques for High-Speed ADCs" (SBAA195).

3.4.4 Using the High-Speed Connector to Set the DVGA Gain

The high-speed connector (J1) on the TSW1265 board has connections that allow a user to change the gain of the LMH6521 quickly. Pins 105, 107, 109, 111, 113, 115, 117, and 119 on the connector can be used to pass the gain and latch signals from an FPGA to the DVGA. To use this feature, the jumper JP9 needs to be moved between pins 2 and 3. This configures the CPLD to route the gain from the connector rather than from the USB connection.

EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used. TI currently deals with a variety of customers for products, and therefore our arrangement with the user is not exclusive. TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.

REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

Texas Instruments Japan Limited
(address) 24-1, Nishi-Shinjuku 6 chome, Shinjuku-ku, Tokyo, Japan

http://www.tij.co.jp

【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。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

日本テキサス・インスツルメンツ株式会社
東京都新宿区西新宿６丁目２４番１号
西新宿三井ビル
http://www.tij.co.jp

EVALUATION BOARD/KIT/MODULE (EVM)
WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. Since the EVM is not a completed product, it may not meet all applicable regulatory and safety compliance standards (such as UL, CSA, VDE, CE, RoHS and WEEE) which may normally be associated with similar items. You assume full responsibility to determine and/or assure compliance with any such standards and related certifications as may be applicable. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM’s electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI’s recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to 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 use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265