TSW2110EVM Evaluation Module (EVM)

This user's guide describes the operation of the TSW2110 input signal generator evaluation module (EVM). The 10-MHz EVM is used to verify the functionality of various TI analog-to-digital converters (ADCs). The guide includes setup instructions for the hardware, expected results captured from a TSW1400EVM and an ADS4249EVM. The TSW2110EVM product folder on the TI web site contains the EVM schematic, bill of materials, and layout files.

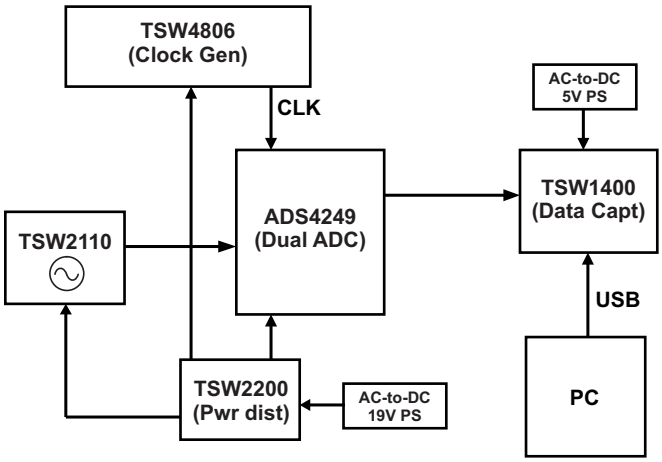

Figure 1. Block Diagram for Testing

1 Introduction

The TI TSW2110EVM (EVM) helps designers evaluate the functionality of their ADC devices. This product eliminates the expense of using a signal generator to create an input signal.

The board is powered off a bench power supply or the 5-V output which is found on the TSW2200EVM. A red and black banana jack to easy hook patch cable delivers the required voltage to the EVM. An external clock generator is required to provide a sampling clock for the ADC board to capture correctly. For the captures conducted in this document, a 245.76-MHz clocking signal from the TSW4806EVM was used.

The EVM has a default setup expecting an input voltage of 5 V. With this voltage applied, a temperature-controlled crystal oscillator (TCXO) generates a HCMOS waveform at 10 MHz. Using amplification, attenuation and filtering, a 10-MHz signal is generated with low harmonic distortion output. The output waveform is set to +10 dBm (2 Vpp), which is used as the input to an ADC board.

The TCXO is powered from the 3.3-V output of the low-dropout (LDO) regulator in its default mode. This applied voltage generates a 10-MHz, HCMOS signal with an amplitude of 10.6 dBm.

The output waveform of the TCXO is attenuated by a 15dB pad prior to going into the input of the amplifier. This amplifier requires an input signal with an amplitude of approximately –5 dBm. At this input level, a gain of 20 dB is achieved without creating additional harmonic distortion. The amplifier output waveform is +15 dBm and has significant harmonics. A crystal filter (part number, FTR-80307) is necessary to eliminate these harmonics. A 1db pad is installed after the amplifier to maintain 50-Ω termination and reduce the impact of impedance mismatches.

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On the 8-pole crystal filter, FTR-80307, matching is tuned for optimal performance. This matching is crucial for proper filter behavior and does not result in low output power. This filter attenuates the harmonics lower than –80 dBc resulting in a clean sine wave that is used as an input to the ADC board. Depending on which ADC is evaluated, the resulting carrier amplitude should be approximately –1 dBFS.

For information on the filter, contact PDI at www.pdixtal.com.

2 Evaluation with the TSW2110

This chapter details the evaluation process and features of the EVM. An external supply voltage must be connected to the voltage in and ground test points (TP1 and TP2, respectively). A blue LED turns on if the proper voltage is supplied. An SMA to SMA cable must be connected from the output SMA connector to the input channel of the unit under test.

The board accepts a supply voltage of 5 V (default) or 3.3 V. Different jumper configurations are necessary for these two options. If the board is supplied with 5 V, the charge pump is bypassed and the LDO 3.3-V regulator is implemented. If 3.3 V is supplied, the regulator is bypassed and the charge pump is used. The necessary configurations for each method are seen in Table 1. The board is clearly marked with these points so that the proper jumper configuration can be implemented. Improper jumpers will not damage the parts on the board; however, the system will not create the desired waveform for accurate testing.

Table 1. Jumper Configurations

Option	JP1	JP2, JP3	JP4, JP5
5 V (default)	Short 1-2	Opened	Shorted
3.3 V	Short 2-3	Shorted	Opened

3 Measurements

When the board is functioning properly, the output waveform measured on the SMA connector should have 10 dBm of amplitude. The best way to get an accurate reading is when measured on a signal analyzer with a 50-Ω load termination. The testing for this user's guide was done on a spectrum analyzer.

On many signal analyzers, the EVM output signal overdrives the machine in their default settings. RF attenuation must be set to account for this. The data taken in Figure 2 had the RF attenuation set to 25 dB and set to 5 dB in Figure 3.

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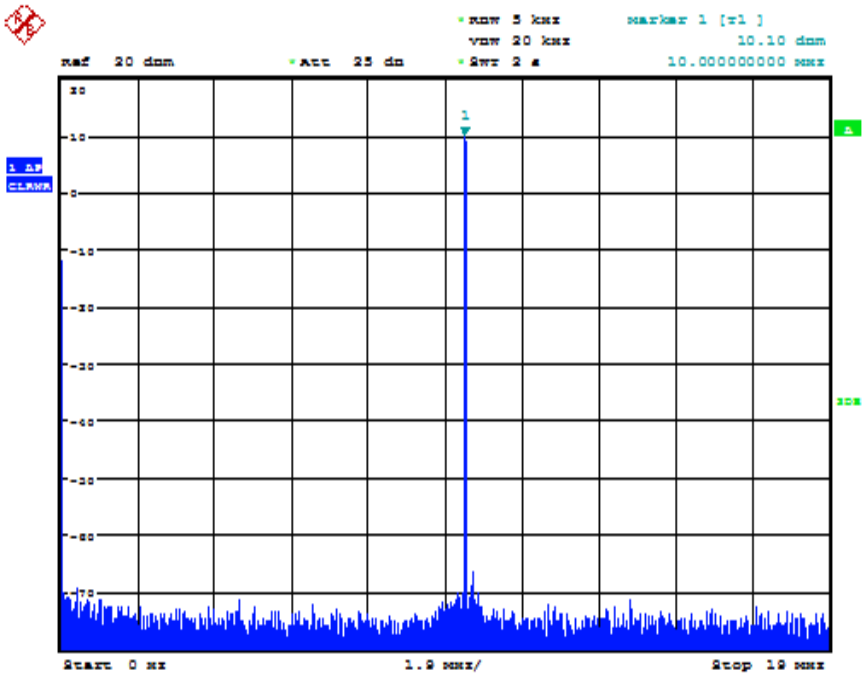

Figure 2. Output Waveform At 10 MHz, Signal At 10.1 dBm

The output is filtered with a 10-MHz rejection filter to keep from distorting the analyzer. Figure 3 shows the performance of the EVM at the second through fifth harmonics. The highest is the second harmonic at 74.2 dBm.

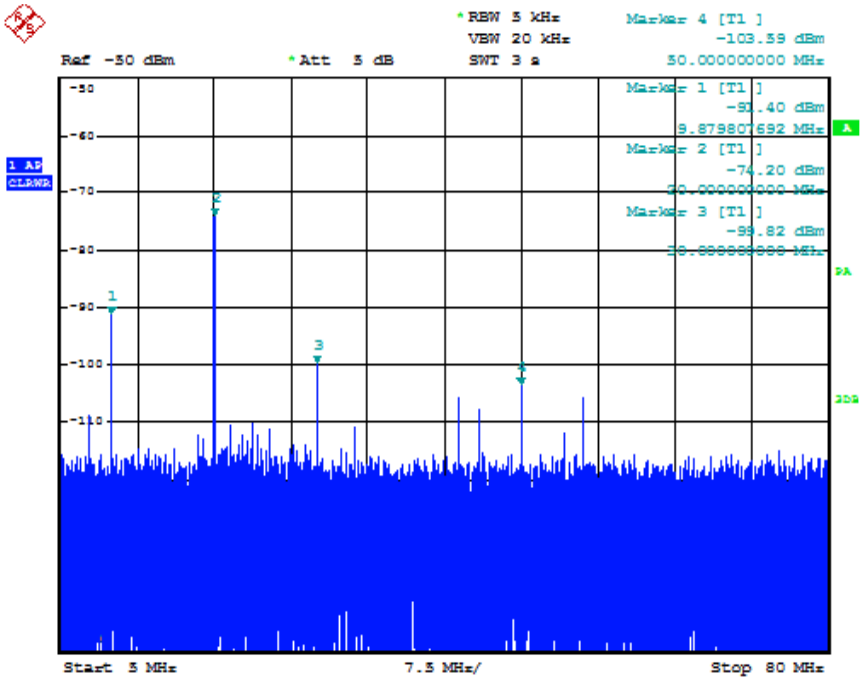

Figure 3. Waveform Harmonics At 91.4, 74.2, 99.82, and 103.59 dBm

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3.1 Expected Values

Table 2 and Table 3 outline the expected values for certain test points on the board to monitor the functionality of the TSW2110. Depending on the input voltage configuration on the board, some of the expected values are different. The charge pump draws more current in the 3.3-V input configuration than the LDO regulator does with the 5-V input.

Table 2. Expected Values With a 5-V Input

System Current	115 mA
Input Voltage	5 V
Amplifier Voltage	4.98 V

Table 3. Expected Values With a 3.3-V Input

System Current	190 mA
Input Voltage	3.3 V
Amplifier Voltage	5.01 V

3.2 Output Waveform

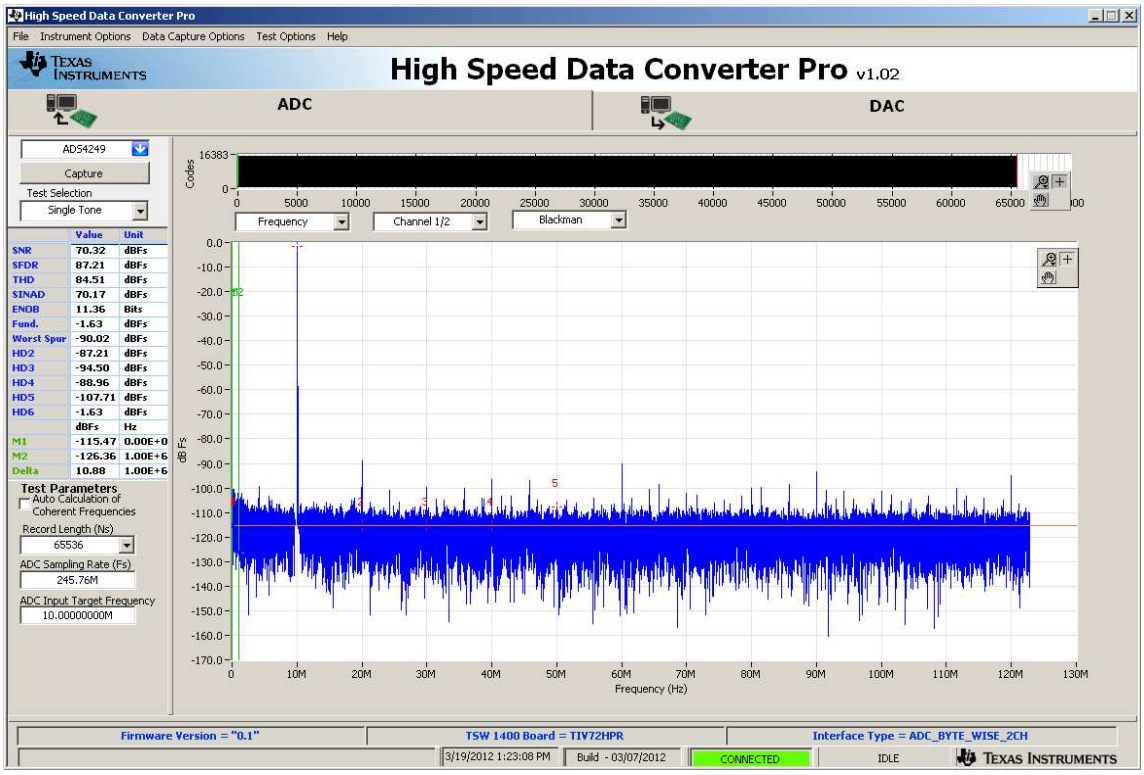

Figure 4. Capture on TSW1400 of the ADS4249EVM, Input Signal Source Is TSW2110

The data captured meets datasheet-type performance for the ADS4249EVM.

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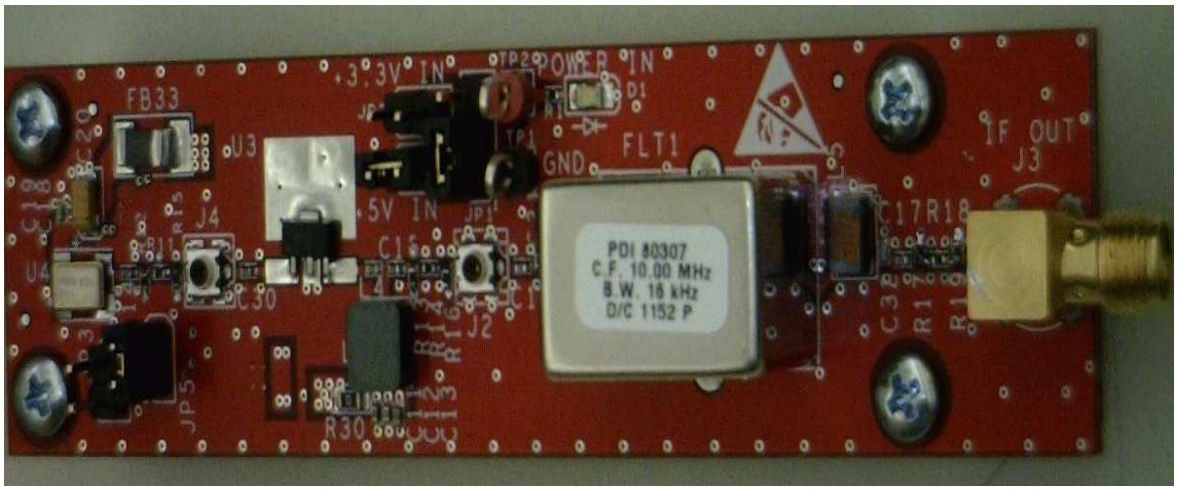

Figure 5. TSW2110EVM Board

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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.

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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.

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