SEE Testing of ADC and DAC

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Outline

1. Introduction
2. Component tested
3. SEE Test method investigated

Introduction

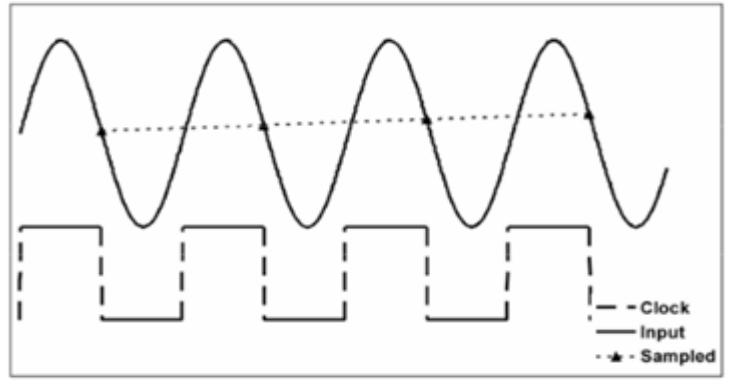
1. Different test methods can be used to perform a SEE test on ADC/DAC device
    a. Static test
    b. ADC/DAC
    c. Golden chip
    d. Compare DUT output to previous conversion cycles
        – Beat Frequency
        – 4 points
        – other

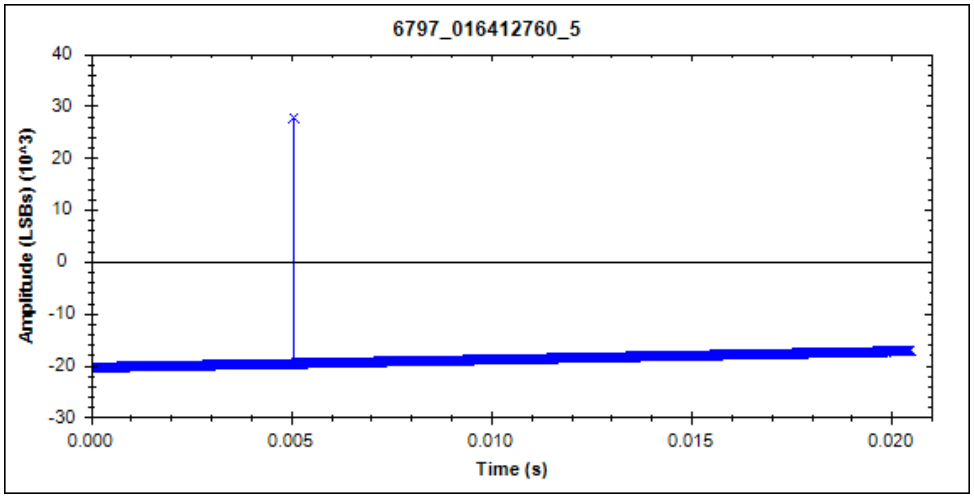
Types Tested

Type	Manufacturer	Function
AD976	Analog Devices	ADC 16 bits
RHF1401	ST Micro	ADC 14 bits
ADC128S102	TI	ADC 12 bits 8 channels
DAC5675	TI	DAC 14 bits

Beat Frequency Test Method

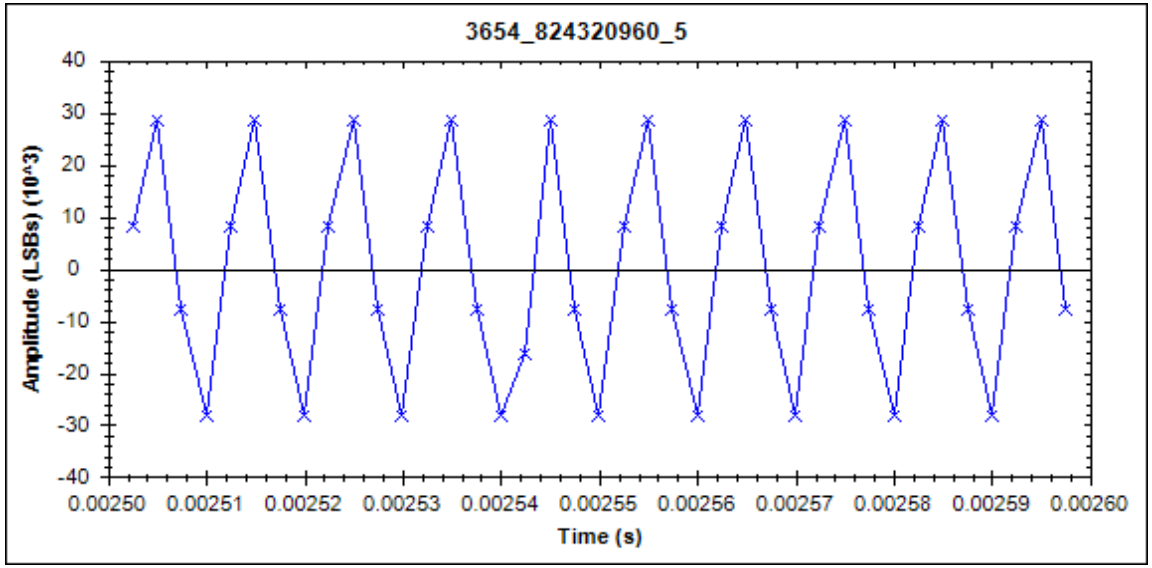
1. With the input frequency f_{in} set very close to the sampling frequency, the output code of the ADC is a slow moving sine wave, changing at a rate of 1 LSB per clock cycle.
    a. Input sine frequency f_{in} and sampling frequency f_s must repond to:
        – $f_{in}=f_s/(2^N*PI)$ with N=16
    b. SEE detection: compare DUT output with previous conversion cycle output





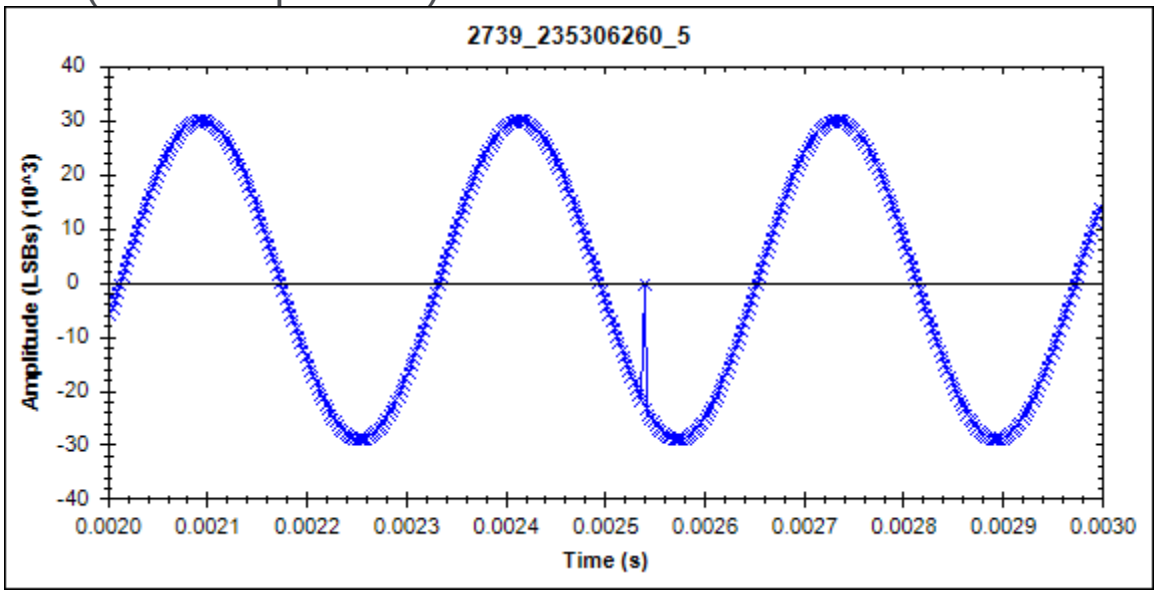
4-point method

1. DUT sampling frequency being fixed, the selected frequency of the sinewave input is such that only 4 points of the sine output are converted continuously.
    a. Input sinewave frequency f_{in} and sampling frequency f_s must repond to:
        – $f_{in}=f_s/4$
    b. SEE detection: compare DUT output with output of 4 clock cycles before (or a multiple of 4)



HIREX “classic” method

1. DUT sampling frequency being fixed, input frequency is set to a much lower value than f_s and $f_{s\ is?}$ a multiple of $f_{in,}$ leading to a significant number of points converted by sinewave input period.
    a. Input sinewave frequency f_{in} and sampling frequency f_s must repond to:
        – $f_{in}=f_s/m$ with m integer (m=128)
    b. SEE detection: compare DUT output with previous output m clock time (or a multiple of m) before



SEE detection

1. A conversion is considered in error when the output comparison with the reference exhibits a difference greater than a set threshold
    1. Threshold set is the minimum error value for which no detection occurs in the absence of beam
        1. Typically 4LSBs for 14 and 16 bits (1 LSB ~ 100 uV)
2. 2048 conversions values before the detection trigger and 2048 after are recorded
    1. allows for checking the occurrence of successive conversions in error if any.

DUT Clock and Input Generation

- Excellent accuracy
- Control of phase shift