Conventional ADC testing solution can be complex and expensive

The servo-loop based ADC testing method (Fig 1) is widely used to evaluate an ADC’s differential & integral non-linearity (DNL/INL). However, this technique has several issues:

■ **Issue 1:** This test method requires many different components, such as a voltage/current source, a digital multimeter (DVM), servo circuitry, etc. It also requires a complicated program to control and synchronize everything.

■ **Issue 2:** Conventional voltage/current sources used in the servo-loop test require significant averaging to eliminate noise as well as frequent PC communication, creating lots of test overhead time.

■ **Issue 3:** The histogram testing method is the most desirable technique due to its simplicity and efficiency; however, most conventional instrumentation does not have the required resolution, noise floor and linearity to test high bit ADCs.

B2961A/62A with LNF option streamlines 14-bit ADC testing

- **Solution 1:** The B2961A/62A with its low noise filter (LNF) has superior source resolution that does not require external monitoring by a DVM. This improves and simplifies ADC testing.

- **Solution 2:** The superior noise performance of the B2961A/62A with its LNF reduces averaging times. In addition, its external trigger input and 100k point waveform memory reduce PC communication frequency. All of these factors improve ADC testing efficiency.

- **Solution 3:** The B2961A/62A’s excellent arbitrary waveform generation function linearity supports ramp voltage histogram evaluation of 14bit ADC DNL/INL. Using the simple test setup shown in Fig. 2, two examples of DC performance testing for off-the-shelf ADCs will be shown on the next page.

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**Faster and easier 14-bit ADC evaluation**

**Agilent B2961A/B2962A 6.5 Digit Low Noise Power Source**

*The Agilent B2961A/62A’s 6.5 digit resolution, low noise performance and great linearity speed up and simplify ADC testing*

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**Fig.1 Block diagram of servo-loop test method**

**Fig.2 DC performance test with B2961A/62A with LNF**
Example 1: 12 bit ADC step voltage test using external trigger and waveform memory

**DUT:**
- *ATXMEGA256A3BU MCU built in 12bit SAR ADC
- Vref = 2.0 V

**Step voltage source:**
- B2961A with LNF
- 20 uV * 100 k steps, 0 V to 2.0 V
- *ATXMEGA256A3 is an Atmel product.

Fig.3 shows DNL error of 12bit ADC measured by B2961A with 0.04LSB size steps of voltage based on Fig. 2 test setup.

Unlike the servo-loop based method, the simpler B2961A/62A test setup eliminates the convergence loop and reduces PC communication frequency. The B2961A/62A’s 6.5 digit source resolution and better noise performance eliminate the need for DVM monitoring. In addition, the external trigger port and internal waveform memory improve ADC testing efficiency. As a result, the B2961A/62A with LNF allows you to implement simpler ADC testing methods and speed-up your testing.

Note: The B2961A/62A also provide an External Trigger output port.

Fig.3 DNL error of 12bit SAR ADC

Example 2: 14 bit ADC linear ramp voltage histogram test for DNL/INL measurement

**DUT:**
- ADS8324EVM 14bit SAR ADC evaluation board
- Vref = 1.6 V

**Ramp voltage source:**
- B2962A with LNF
- 30 sec ramp, -50 mV to 3.25 V
- Averaged 8 times
- *ADS8324EVM is a Texas Instruments product.

Fig.4 shows the INL error for a 14bit ADC measured by a B2962A using the ramp voltage histogram test for the test setup shown in Fig. 2.

An ADC’s DNL/INL performance can also be tested by applying a ramp voltage using the B2962A (histogram test). In this test method the ADC samples the ramp voltage at even intervals. This method requires a very linear voltage source, but the measurement time is shorter and the ADC controller can be simpler as compared to the step voltage method. The B2961A/arbitrary waveform generation function has the necessary linearity to permit evaluation of 14bit ADC DNL/INL using a ramp voltage.

Note: The B2961A/62A can also generate low distortion sinusoidal voltages.

Agilent B2961A/B2962A Low Noise Power Source Key Specifications and Characteristics

<table>
<thead>
<tr>
<th>Product Number</th>
<th>Option</th>
<th>Max DC output</th>
<th>Source Resolution</th>
<th>Output Noise 1 (10 to 20 MHz)</th>
<th>Source Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2961A</td>
<td></td>
<td>210 V/3.03A</td>
<td>6 ½ digit</td>
<td>3 mVRms</td>
<td>• Arbitrary waveform generation</td>
</tr>
<tr>
<td>B2962A</td>
<td>LN1</td>
<td>42 V/105 mA</td>
<td>6 ½ digit</td>
<td>10 μVRms</td>
<td>• Programmable output resistance</td>
</tr>
<tr>
<td></td>
<td>LN2</td>
<td>210 V/3.03 A</td>
<td>6 ½ digit</td>
<td>350 μVRms</td>
<td>• Time domain waveform viewer</td>
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1. Supplemental characteristics

**Related applications:**
- ADC evaluation with sinusoidal wave
- I/V source for handheld DMM calibration source
- Analog IC test and evaluation

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