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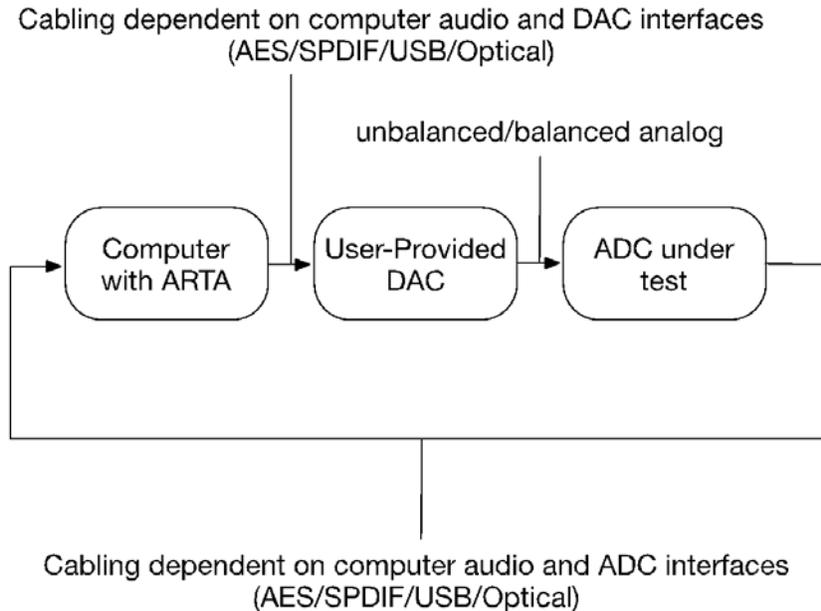
ADC Performance Testing:
Low Cost Performance Test Setup
User Guide

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Basic Setup

These instructions refer to a test setup encompassing a computer running the Windows operating system and ARTA software installed (http://artalabs.hr/), a user-provided DAC, and an ADC for testing. This setup is seen in the figure below.

Cabling dependent on computer audio and DAC interfaces (AES/SPDIF/USB/Optical)

unbalanced/balanced analog

Computer with ARTA — User-Provided DAC — ADC under test

Cabling dependent on computer audio and ADC interfaces (AES/SPDIF/USB/Optical)

User Instructions

The guideline and performance metrics are addressed in other documents within this deliverable. The text below serves as an aid to users in putting the test method to use and documenting the results.

General Setup

Initial Setup

● Open the test method document (*ADC_Low_Cost_performGuide_2016-09-01.pdf*). Follow the instructions within the document and use for each test a point of reference.

● For documenting and reporting, utilize the Excel spreadsheet named *Low_Cost_Test_Template.xlsx* and begin by filling out the information under the sections labeled "General Information", "Digital to Analog Converter" and "Equipment Under Test". Note that there are multiple tabs. When performing a test, navigate to the tab for the test being performed and populate the cells highlighted in green. These results will automatically populate the Summary tab.

● Ensure that your hardware and software are configured so that:

1) there is no overloading of the signal path imposed by improper configuration or settings
2) the DAC does not clip before the ADC clips

● Ensure that all of the OS settings for your audio devices are operating at the correct sample rate and bit depth.

● Set the ADC clock to internal and the correct sample rate

Open and Configure Steps
a. Open the Steps program that comes with ARTA

b. Within the *Setup -> Measurements* configure the following parameters:

Single Channel - Level
Response Channel: select the channel under test
Sampling Frequency: Set accordingly
Min Integration time: 8
Transient time: 4
I/O Delay: 0
Intra burst Pause: 4
Start Frequency: 20
Stop Frequency: 20000
Frequency: 1/12 octave
Generator Level: -0.5
Test Frequency: 1000
Mute Generator Switch-off Transients checked

Select "Generate" button and adjust the DAC gain until the meter reads -20

c. If Frequency Compensation is used within ARTA for the DAC being used be sure to document this in the notes section of the report.

d. Within *Setup -> Graph* configure the following parameters:
Magnitude Range
Graph Top: -18
Graph Range: 4

Frequency Range
High: 22000
Low: 10

Frequency Response
a. Within the main Steps window start the measurement by selecting the red triangle button.

b. Once complete, on the graph find and note the value at 1 kHz (note that the Steps scale is in dBV and not dBFS. This will not impact the test).

c. On the graph find and note the largest variance from 1 kHz between 20 Hz and 20 kHz.

d. Calculate and document the difference between the values in dB.

e. Within the *Overlay* menu select "Set as Overlay"

f. Run the test again for other channels being sure to select the appropriate channel under *Setup -> Measurement.*

g. Within the *Edit* menu select "Copy" and within the dialog window that appears select "Save to File" and save the graph to input into the results report.

Open and configure ARTA
a. Open ARTA and select SPA

b. Within *Setup -> Measurement* configure the following parameters

> Averaging: Linear
> Max Averages: 4096
> FFT Size: 32768
> Window: Kaiser7
> Sampling Rate: set accordingly

c. Within *Setup -> Spectrum Scaling* configure the following parameters
> Scaling: dBFS
> Voltage units: dBu
> Pressure: dB re 20 uPa
> Distortion
>> check the following:
>>> THD
>>> THD+N
>>> IMD
>>> Multitone TD+N
> Normalize with full power: unchecked
> Low cut-off: 20
> 2nd and 3rd Order IMD: checked
> Frequency weighting: unchecked

THD+N
a. Within *Generator-> Configure*, under the Sine/square generator section

> Set the frequency to the specified frequency

b. Adjust the DAC gain until ARTA shows the specified level at the ADC output

c. In the main ARTA window run the test for each channel at each frequency and level combination

d. Document the THD+N results displayed in ARTA

e. Repeat the test and document the results for each channel being sure to select the appropriate channel under *Setup -> Measurement*

Dynamic Range

a. Generating 997 Hz at -40 dBFS (the last tone and level generated in the THD+N test), document both the THD and THD+N values.

b. Repeat for each channel being sure to select the appropriate channel under *Setup -> Measurement*

Crosstalk

a. Within *Generator-> Configure* , under the Sine/square generator section

    Set the frequency to the specified frequency

b. Adjust the the DAC gain until ARTA shows -1 dBFS at the ADC output

c. Place a shorting plug into the channel under test (the not the channel being driven with the signal generator)

d. Measure the value at the specified frequency on the channel under test (the shorted channel) by placing the cursor at the frequency, adding 1dB and documenting the value.

e. Repeat and report for each frequency on each channel being sure to select the appropriate channel under *Setup -> Measurement*

IMD LF

a. No gain adjustments will be made for this test following the Crosstalk test

b. Within *Generator -> Configure*

    Under the Two sine generator section

        Select "User" and populate Freq1 with 41, Freq2 with 7993 and Magn with 4

c. Select "Two sine" in the *Gen* pull-down menu in the Spectrum Analyzer window

d. Run the test by selecting the red triangle button

e. Document the SMPTE IMD measurement reported by ARTA

f. Repeat the test for each channel being sure to select the appropriate channel under *Setup -> Measurement*

IMD HF

a. No gain adjustments will be made for this test following the IMD LF test

b. Maintain "Two sine" in the *Gen* pull-down menu

c. Within *Generator -> Configure*, under the Two sine generator, User section

populate Freq1 with 18000, Freq2 with 20000 and Magn with 1

d. Run the test by selecting the red triangle button

e. Document the DFD2 and DFD3 measurements reported by ARTA

f. Repeat the test for each channel being sure to select the appropriate channel under *Setup -> Measurement*

Spurious Inharmonic

a. No gain adjustment is needed following IMD HF

b. Select "Sine" in the *Gen* dropdown menu of the main ARTA window

c. Within *Generator -> Configure*

Set Frequency to 997 Hz

d. Within *Setup -> Measurement* set the following parameters
Type: Linear
Max averages: 32

e. Within the main ARTA window select the red triangle button to run the test. After 32 averages the test will stop.

f. Cursor along the graph finding the most significant inharmonic (not a multiple of the stimulus) spurious component outside of the stimulus skirt (the immediate area surrounding the stimulus).

g. Document the RMS level reported by ARTA

h. Within the *Overlay* menu select "Set as Overlay"

i. Repeat for each channel being sure to select the appropriate channel under *Setup -> Measurement*

j. Within the *Edit* menu select "Copy" and within the dialog window that appears select "Save to File" and save the graph to input into the results report.