

ARTA calibrations for 2 channel acoustic measurements

Saturday, April 01, 2017 2:56 PM

Step 1

Use the "Generate sinus" function in ARTA and measure the output level with Oscilloscope or multimeter (make sure the multimeter is use can measure 400Hz accurately)

Enter the voltage in mV to step 3 of output calibration -> click Accept.

This will also pre-fill the step 2 in input calibration with this new measured value



Step 2

Wire loopback cables from both outputs to both inputs.
The input gains are 0dB for both inputs at this point.

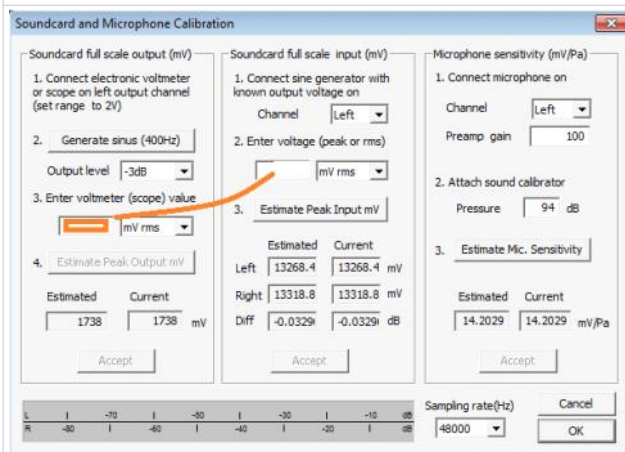
Channel = Left

Click the "Estimate Peak Input mV" -> This will generate the 400Hz from soundcard out and feed it to both inputs.

Click "Accept" once this is done

Now change Channel = Right

Repeat the "Estimate Peak Input mV" -> click Accept



Step 3.

Connect the mic (or a mic preamp output) to the Left input instead of the loopback cable.

In case of RME soundcard the MIC preamp is built in -> so I change the input gain from 0 to +40dB

Calculate the absolute gain with formula

ARTA gain = $10^{(dB\ gain/20)}$

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For the +40dB gain this means 100

Connect the pistonphone calibrator and run the

"Estimate Mic. Sensitivity"

Once done click -> Accept

Microphone sensitivity (mV/Pa)

1. Connect microphone on

Channel:

Preamp gain:

2. Attach sound calibrator

Pressure: dB

3. Estimate Mic. Sensitivity

Estimated: Current: mV/Pa

Accept

Sampling rate(Hz): Cancel OK

$$\text{ARTA gain} = 10^{\frac{\text{dB gain}}{20}}$$



Step 4.

Adjusting the power amp to give 2.83V output.

I'm using the ARTA-s Spectrum analysis mode for that and set the generator to produce 400Hz @ -3dBFS

Connect the output of soundcard to the amplifier.

Measure the output of amplifier and adjust the volume until amplifier output 2.83V RMS

Generator Setup for Continuous Signals

Sine / square generator

Frequency (Hz):

Level (dB FS):

RMS Voltage: 0.871395 V

Dither Level:

Multitone and noise generator

PN Pink cut off:

Level (dB FS):

Multitone:

Two sine generator

	Freq1	Freq2	Magn
Def1	13 kHz	14 kHz	1 : 1
Def2	250 Hz	8 kHz	4 : 1
User	19000	20000	1 : 1

Default Cancel OK

Note that the Impulse response measurement generator is slightly different

A 0dB output level in impulse response measurements equals the -3dBFS signal level in Spectrum analyzer

So to get the measurements at a level of 2.83V RMS one needs to use a Output volume (dB) = 0

Impulse response measurement / Signal recording

Periodic Noise Sweep MLS External excitation

Sweep generator

Sequence length:

Sampling rate (Hz):

Time constant: 2730.67 ms

Output volume (dB):

Log frequency sweep: ☒

Generate voice activation: ☐

Recorder

Preferred input channel:

Dual channel measurement mode: ☒

Invert phase of input channel: ☐

Number of averages:

Filter dual channel impulse response: ☒

Record

Center peak of impulse response: ☒ Close after recording: ☒

Default

OK Cancel

Now the calibrations are done, but for 2 channel acoustic measurements there are still few settings to adjust

- Mic preamp gain to be set
- As I use an attenuator of 8,2kohm/1kohm and the input impedance of RME UCX soundcard is 8kohm I've calculated the compensation gain for Right ch input
- I've adjusted the power amp to give 2.83V rms with 0dB signal - the gain needed in power amp to achieve that is 9.6dB

To find the power amp gain in dB after this one can either measure it with ARTA or measure the voltage in the input of amplifier and output of amplifier with multimeter or oscilloscope and calculate the gain as shown on right.

Note that foreentering all these gains one needs to use the absolute gain formula again.

<http://www.sengpielaudio.com/calculator-gainloss.htm>

• Voltage and Gain •

Enter any two values - the third will be calculated.

Reference voltage V_0	<input type="text" value="0.94"/>	<input type="text" value="V"/>	<input type="button" value="reset"/>
Measured voltage V	<input type="text" value="2.83"/>	<input type="text" value="V"/>	<input type="button" value="reset"/>
Gain G or L_y	<input type="text" value="9.57318305892037"/>	<input type="text" value="dB"/>	<input type="button" value="reset"/>
<input type="button" value="calculate"/>			<input type="button" value="all reset"/>

Audio Devices Setup

Soundcard

Soundcard driver: ASIO Fireface USB Control Panel

Input channels: Not detected

Output channels: Not detected Wave Format: 16-bit

I/O Amplifier Interface

LineIn Sensitivity (mVpeak - left ch): 13268.4 LineOut Sensitivity (mVpeak - left ch): 1738

Ext. left preamp gain: 100 L/R channel diff. (dB): -0.032902

Ext. right preamp gain: 0.09823 Power amplifier gain: 3.019

Microphone

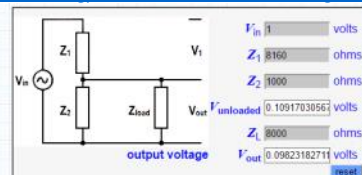
☒ Microphone Used On Left Ch Sensitivity (mV/Pa): 14.2029

Save setup Load setup Cancel OK

ARTA gain = $10^{\frac{dB \text{ gain}}{20}}$

A	B	C	D
Left ch	Gain in dB	ARTA gain	
mic preamp	40.00	100.0000	
Right ch	Gain in dB	ARTA gain	
attenuator	-20.15	0.0982	
Power amp	Gain in dB	ARTA gain	
	9.60	3.0193	

<http://www.sengpielaudio.com/calculator-voltagedivider.htm>



$V_{out_unloaded}$ means V_{out} without Z_L . If wanted, Z_{source} of the generator can be added to Z_1 .

Voltage damping $D = 20 \times \log_{10} \left(\frac{V_{out}}{V_{in}} \right)$

V_{out} : 0.09823182711 V_{in} : 1

D : -20.154959 dB

Audio Devices Setup

Soundcard

Soundcard driver: ASIO Fireface USB Control Panel

Input channels: 1 / 2

Output channels: 3 / 4 Wave Format: 16-bit

I/O Amplifier Interface

LineIn Sensitivity (mVpeak - left ch): 13285.2 LineOut Sensitivity (mVpeak - left ch): 1738

Ext. left preamp gain: 100 L/R channel diff. (dB): -0.035888

Ext. right preamp gain: 0.1059 Power amplifier gain: 3.019

Microphone

☒ Microphone Used On Left Ch Sensitivity (mV/Pa): 14.2303

Save setup Load setup Cancel OK