Real Electronics Limited
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Measurement services

Real Electronics are pleased to announce the provision of a number of new services for Audiophiles and Pro audio customers:

Standard amplifier audio performance analysis

Pro amplifier audio performance analysis

Amplifier soak and stress test

All prices ex VAT and carriage charges.

About the tests

All tests will be carried out at Real Electronics' workshop in Sheffield by one of our trained engineers. Test results will be supplied in PDF format to a single email address. Onsite deliveries are welcome and courier delivery and despatch can be arranged if required. The details of all tests are explained in more detail below.

Standard amplifier audio performance analysis

The Standard amplifier audio performance analysis will cover the following tests:

- Maximum power output
- Frequency response plot

Pro amplifier test audio performance analysis

The Pro amplifier audio performance analysis will cover the following tests:

- Maximum power output
- Frequency response
- Level and Gain
- Harmonic distortion and noise
- CMRR
- Stepped level sweep
- THD+N – Total Harmonic Distortion + Noise
- One minute stress test with power and THD plots
- Cross talk plot

Amplifier soak and stress test

- As for Pro Amplifier after a soak and stress test as follows:
  - 30 minutes at 50% of max power output
  - 20 bursts of 10 seconds at max power output (class D 1 second bursts)

Maximum output

This next test explores the maximum power output of the amplifier whilst keeping the THD+N level lower than 0.5% or 2Vrms.

8Ohm Tests : Maximum Output	
Waveform:	Sine
Generator Level:	1.301 Vrms
DC Offset:	0.000 V
Frequency:	1.00000 kHz
Weighting Filter:	Signal Path
High-pass Filter:	20 Hz
Maximum Level:	2.000 Vrms
Measured Channel:	Ch2
Target THD+N:	0.500 %

RMS Level (24/08/2017 12:45:53.509)
Ch1 159.4 W
Ch2 171.5 W

8Ohm Tests : Clip Test	
Waveform:	Sine
Generator Level:	+1.000 dBrG (@1.271 Vrms)
DC Offset:	0.000 V
Frequency:	1.00000 kHz
Input:	Passed

RMS Level (24/08/2017 12:45:58.080)
Ch1 180.0 W
Ch2 196.1 W

The clip test measures the output power at which the signal starts to clip due to internal voltage rail limits.

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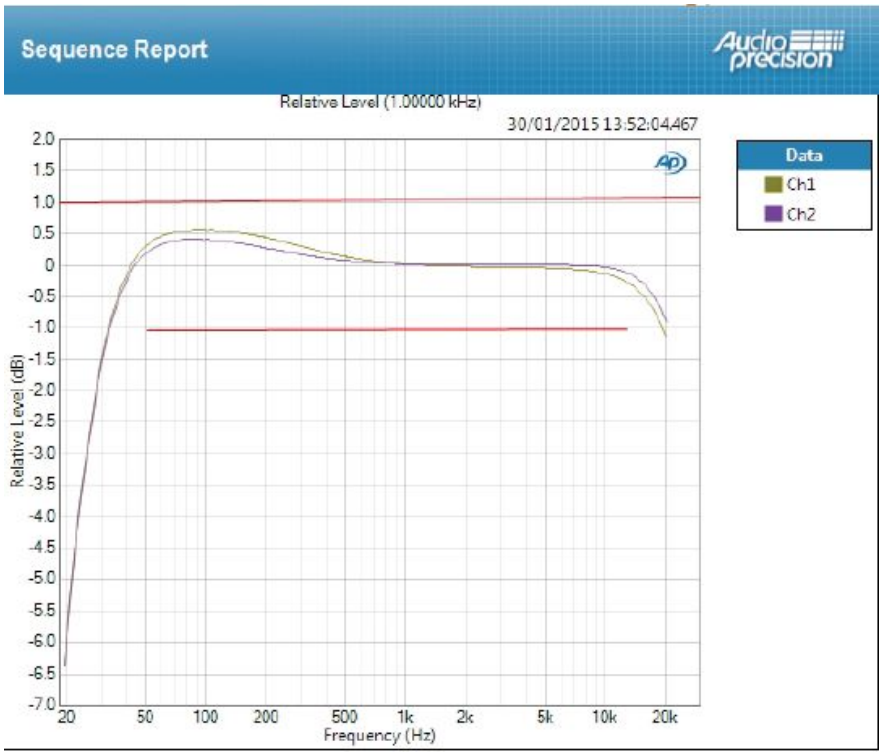
Frequency response

A frequency response measurement reports the output levels of an amplifier when stimulated with different frequencies of known level. The simplest of all frequency response measurements consists of only two or three tones, the first near the middle of a DUT's usable frequency range, and followed by a tone near the higher extreme of the range and sometimes a tone near the lower extreme. Assuming the tones are all generated at the same level, the DUT's output levels describe its response to these different frequencies. Full range frequency response measurements can be made by a number of different methods, the classic being a sweep of a sine wave from the lowest frequency in the range to the highest, the results plotted on a graph. A "flat" response de scribes the shape of a graph where the amplifier responds equally at all frequencies, producing a trace with a slope of 0 and with minimal variations. Ideally the plots should be within 0.5dB of each other.

Here is a plot of typical results:



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Level and gain

8Ohm Tests : Level and Gain	
Waveform:	Sine
Generator Level:	-5.000 dBrG (@1.271 Vrms)
DC Offset:	0.000 V
Frequency:	1.00000 kHz
RMS Level (24/08/2017 12:45:22.684)	
Ch1 19.74 Vrms	
Ch2 20.38 Vrms	
Gain (24/08/2017 12:45:22.684)	
Ch1 28.828 dB	
Ch2 29.105 dB	

This test establishes what the gain of the amplifier is.

The generator is set to -5dB from peak input. Peak input for amplifiers is generally around 2Vrms. This is ‘0dB’.

The read outs tells you the rms output level and the overall gain in dB with respect to the input.

We will not attempt to explain dB in this report – there are plenty of great resources on the web that will do that for you.

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Harmonic distortion and noise

8Ohm Tests : THD+N	
Waveform:	Sine
Generator Level:	-5.000 dBrG (@1.271 Vrms)
DC Offset:	0.000 V
Frequency:	1.00000 kHz
Low-pass Filter:	20 kHz
Weighting Filter:	Signal Path
High-pass Filter:	20 Hz
Notch Tuning Mode:	Measured Frequency

THD+N Ratio (24/08/2017 12:45:25.164)

Channel	Lower Limit	Value	Upper Limit	
Ch1	---- %	0.005363 %	0.050000 %	✓
Ch2	---- %	0.010608 %	0.050000 %	✓

Result: ✓ PASSED

THD+N Level (24/08/2017 12:45:25.164)

Ch1 1.058 mVrms
Ch2 2.161 mVrms

Distortion Product Ratio (24/08/2017 12:45:25.164)

Channel	1.000k	2.000k	3.000k	4.000k	5.000k	6.000k	7.000k	8.000k	9.000k	10.00k
Ch1	-0.00	-91.14	-98.22	-112.25	-105.51	-115.97	-106.35	-113.48	-109.63	-125.99
Ch2	-0.00	-102.31	-104.25	-121.91	-104.86	-124.29	-106.64	-115.97	-108.80	-119.99

Distortion Product Ratio Parameters

Frequency Unit:	Hz
Ratio Unit:	dB

THD+N stands for Total Harmonic Distortion plus Noise. Harmonic distortion is the unwanted addition of new tones to the audio signal. These tones are harmonically related tones to the original signal. When the signal is one sine wave of frequency f1, harmonic tones are f2, f3, etc., integral multiples of the original tone. Total harmonic distortion is the sum of all of the harmonics measured in the amplifier's bandwidth. Why THD+N? Why not just measure THD (the distortion) and N (the noise) individually? Well, at first glance it makes sense. However, in the pre- FFT days of audio measurement it was difficult to measure the THD by itself, without the noise, but it was relatively simple to measure the THD and the N together. So the accepted techniques handed down from years past specify THD+N, because that's what was practical. In addition, THD+N is a convenient and telling single -number mark of performance, widely understood and accepted.

In this test we again inject signal at -5dB and measure the distortion and noise at different frequencies. The readout in dB gives an indication of the quality of the amplifier.

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CMRR

8Ohm Tests : CMRR WIRED INPUT	
Waveform:	Sine
Generator Level:	-5.000 dBrG (@1.271 Vrms)
DC Offset:	0.000 V
Frequency:	1.00000 kHz
CMRR (24/08/2017 12:45:32.059)	
Ch1 74.275 dB	
Ch2 81.125 dB	

Common mode rejection ration shows the rejection in noise induces on both positive and negative inputs. It is only a valid reading for amplifiers with balanced inputs.

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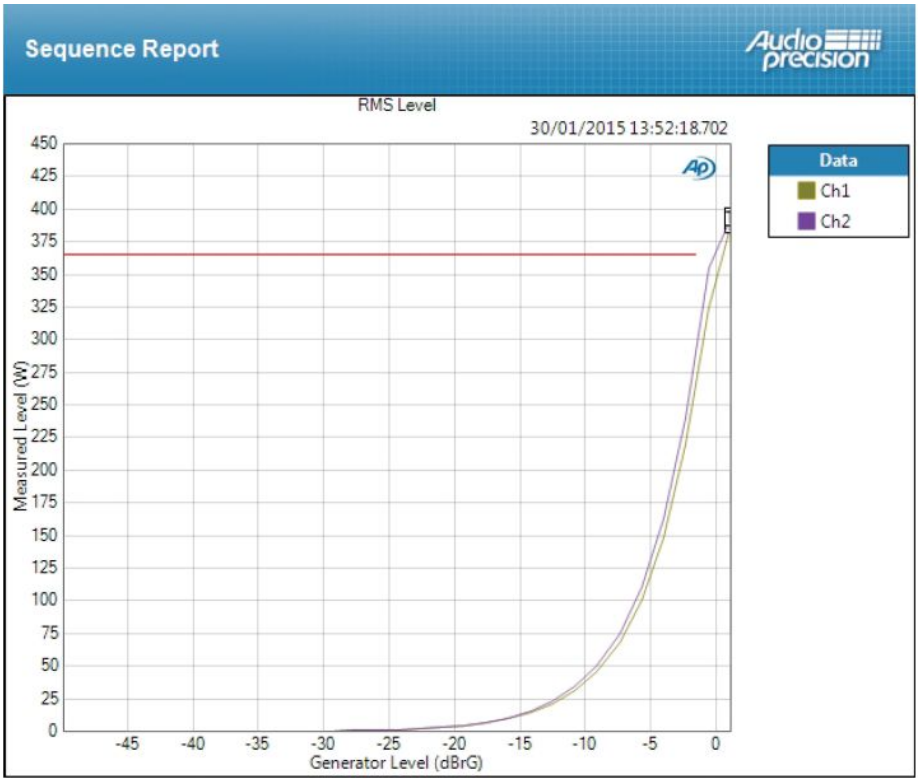
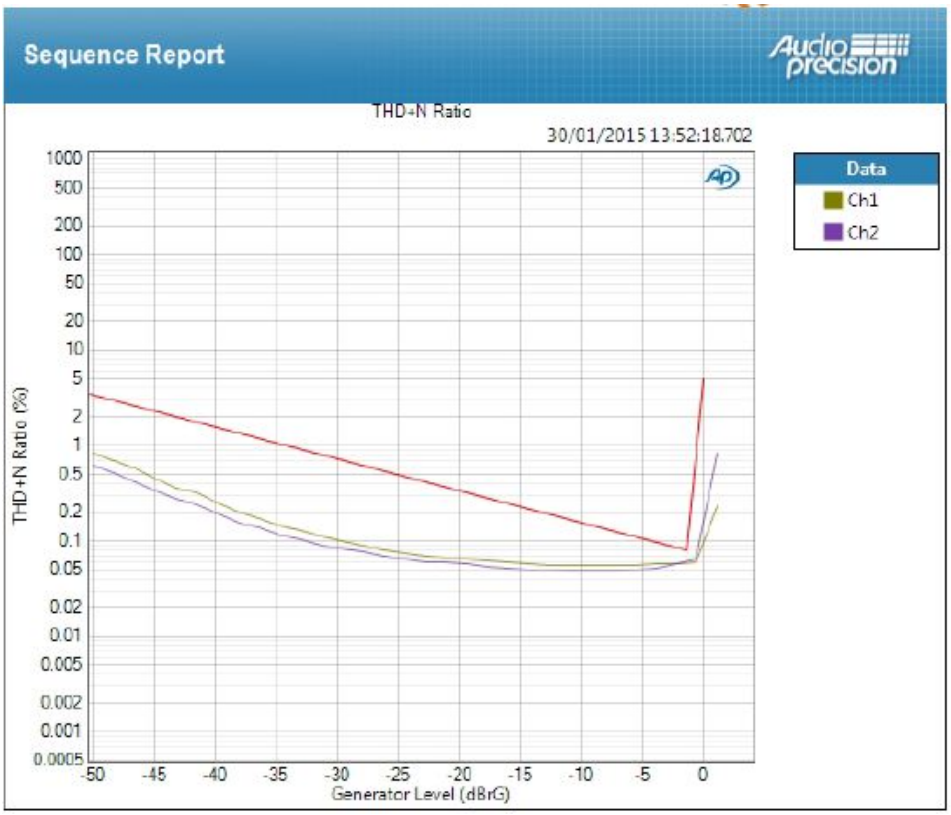
Stepped level sweep

The stepped level sweep carries out various amplifier tests at different frequencies. The first test shown here indicates the output power level for a given input voltage level:



THD+N

This second plot shows the THD+N for different frequencies. The red line indicates the maximum acceptable level.



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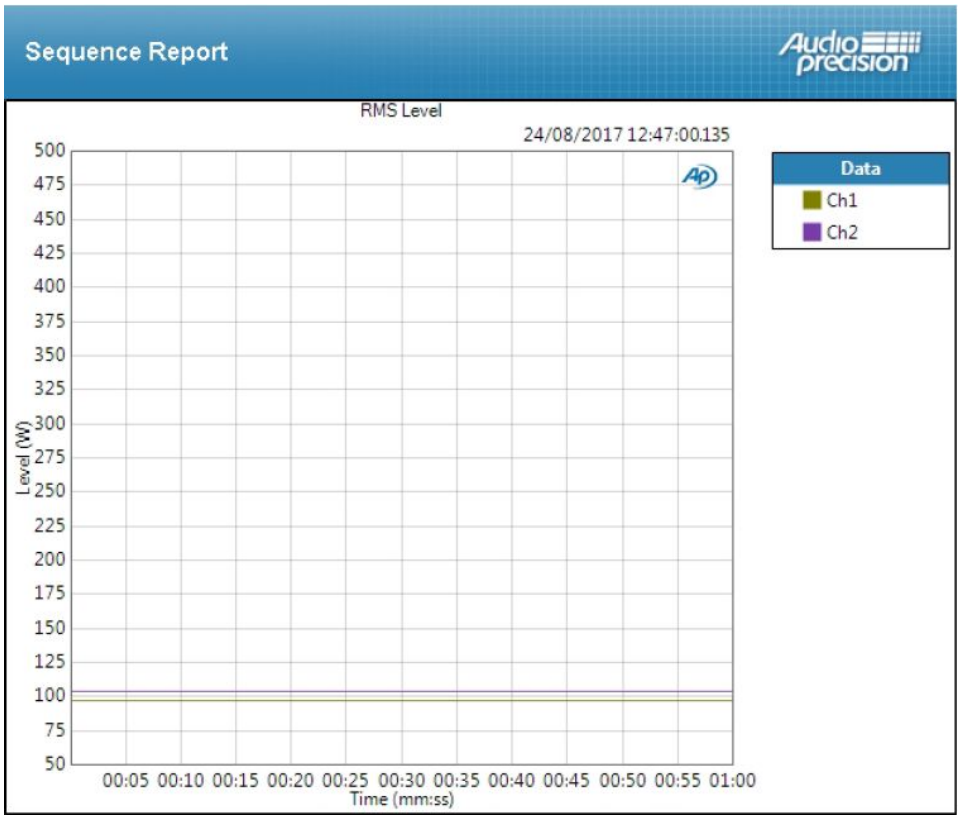
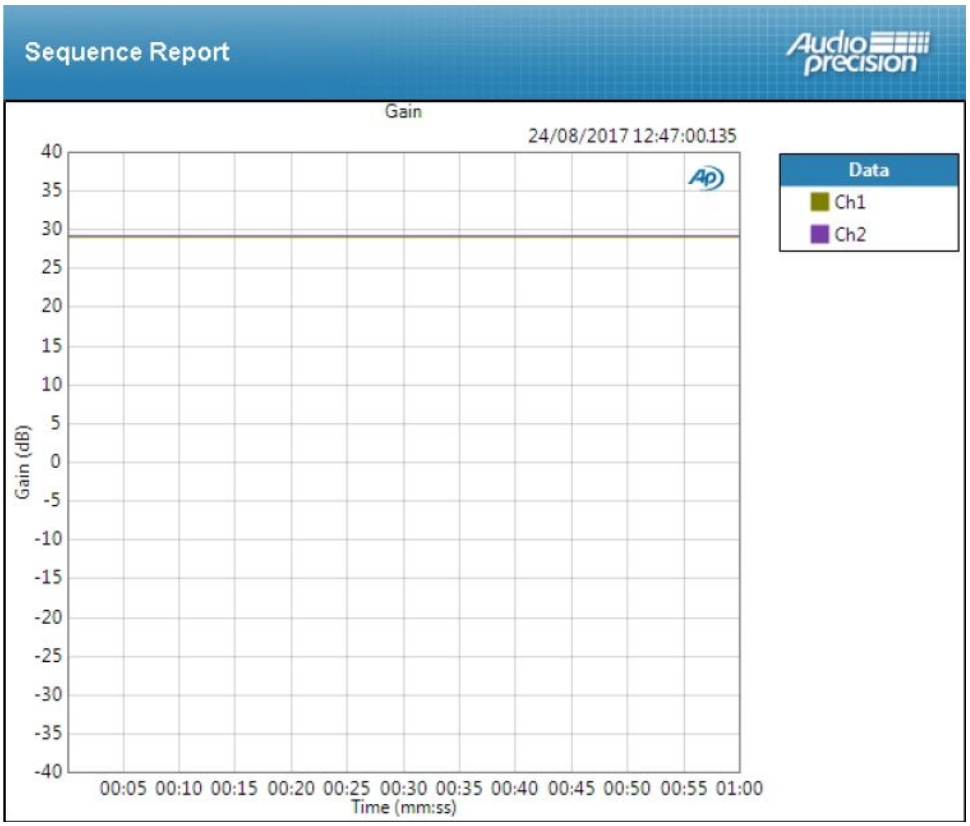
One minute stress test

In this test we inject -5dB and monitor the audio output for a minute. In the test we carry out a number of measurements including output power, phase and distortion as shown below.





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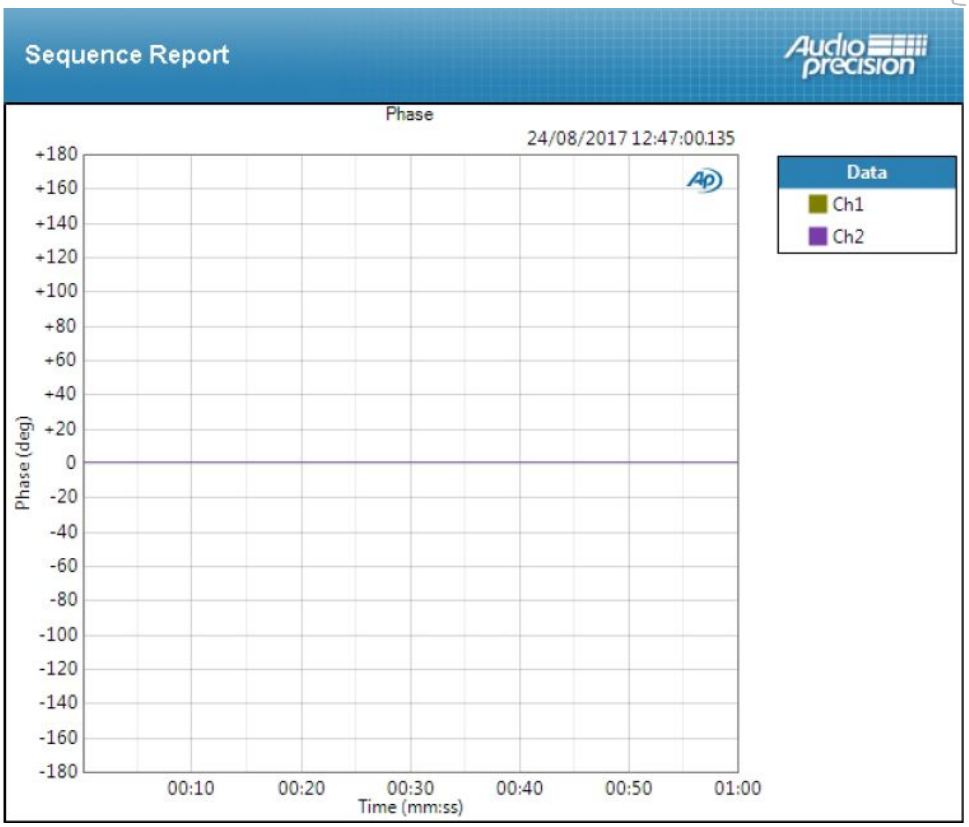

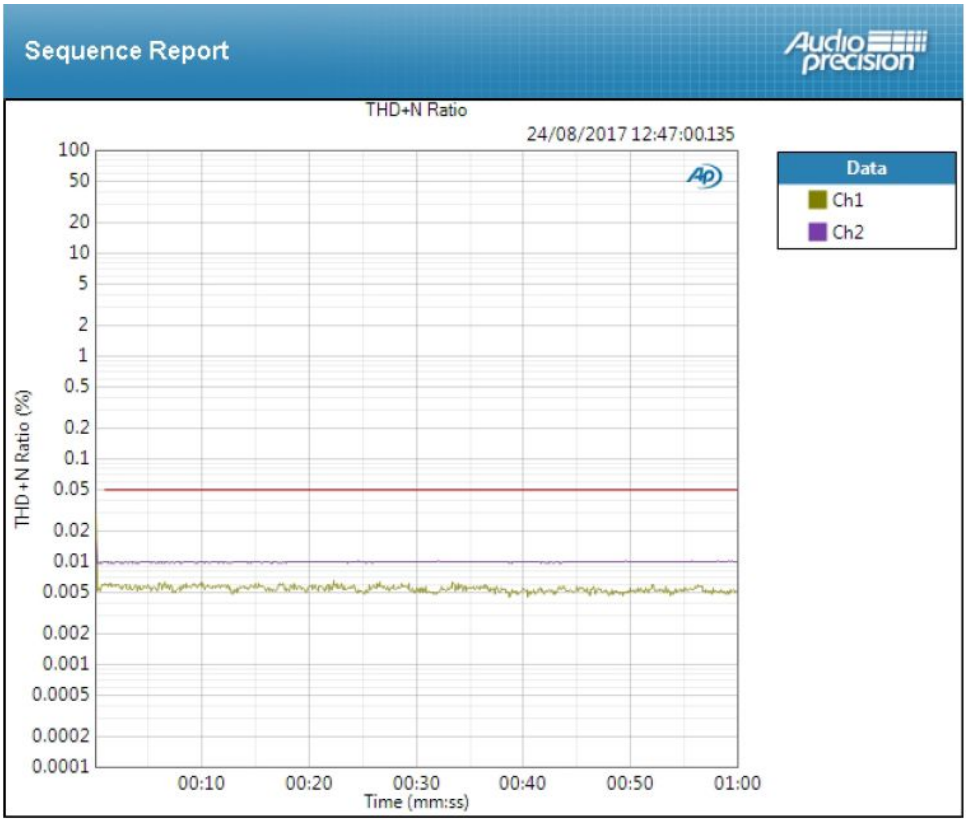

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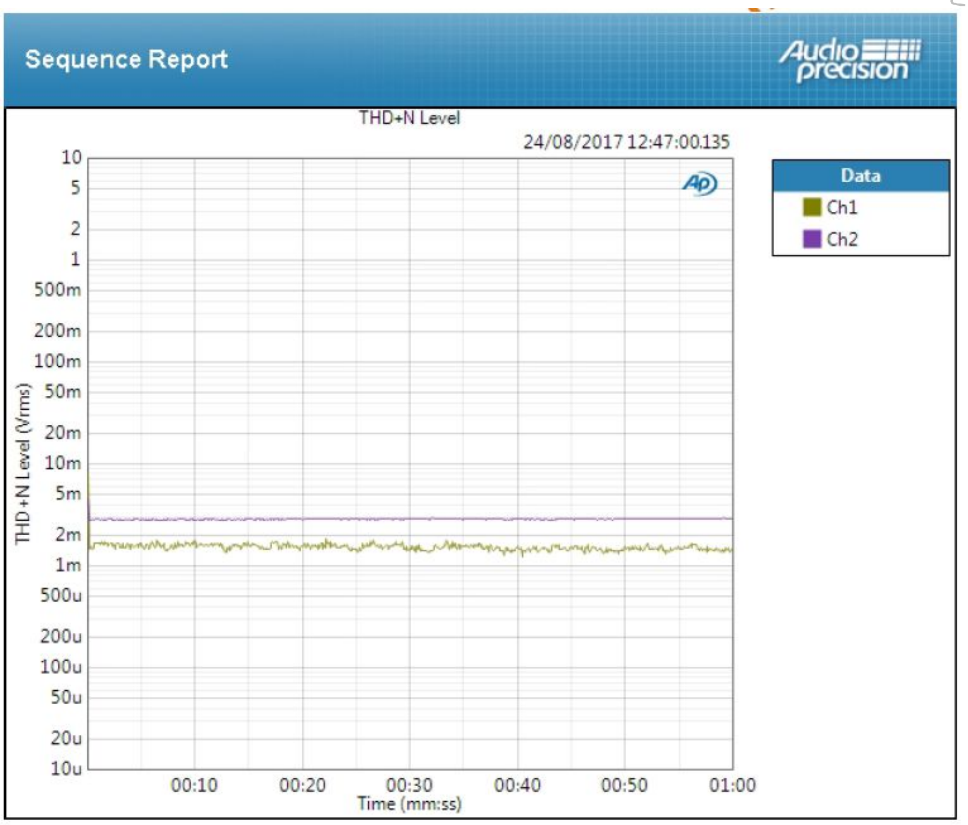

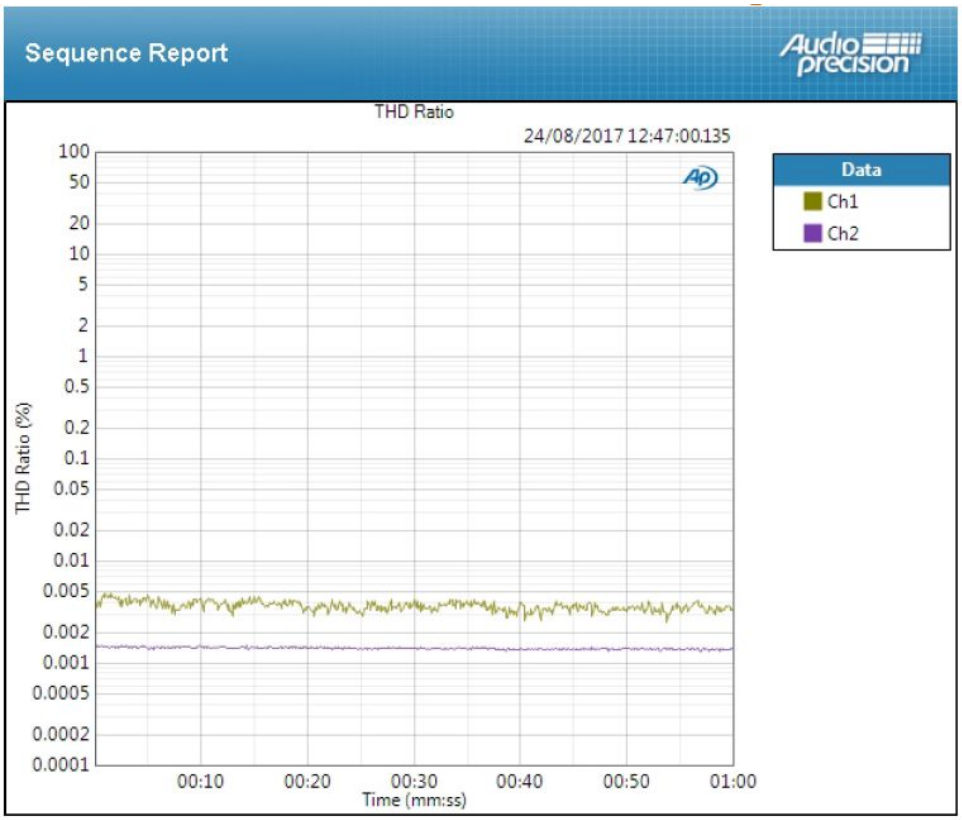

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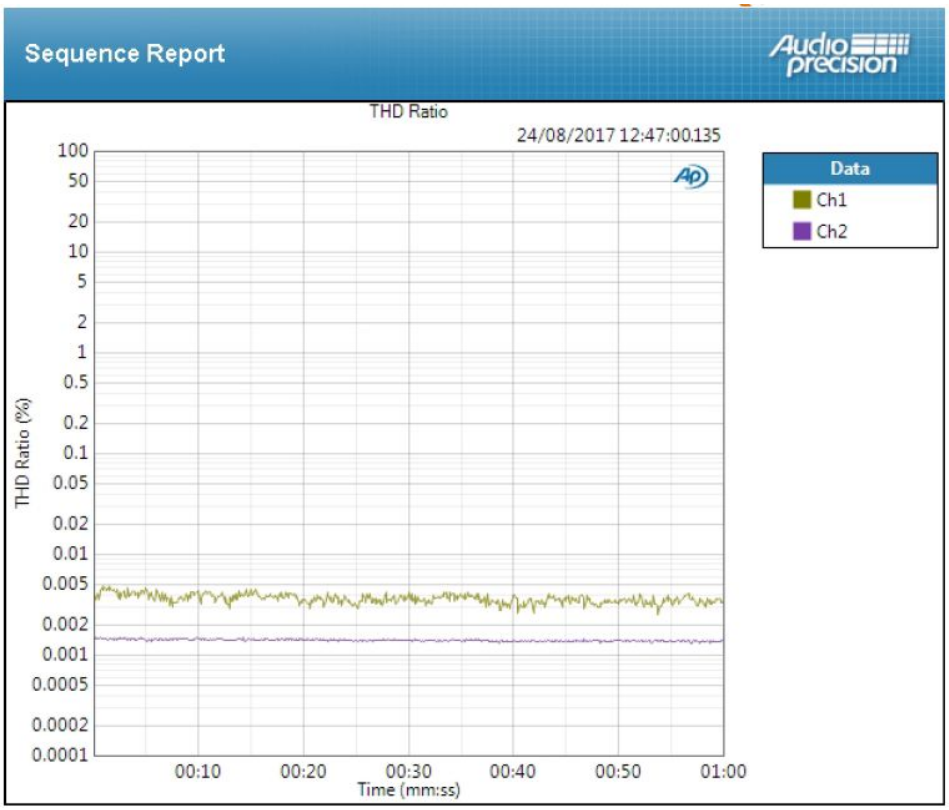

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Crosstalk

In audio systems of more than one channel, it is undesirable for the signal in one channel to appear at a reduced level in the output of another channel. This signal leakage across channels is called crosstalk, and in practical devices it is very difficult to eliminate. Crosstalk is expressed as the ratio of the undesired signal in the unstimulated channel to the signal in the stimulated channel. Crosstalk is largely the result of capacitive coupling between channel conductors in the device, and usually exhibits a rising characteristic with frequency.

Here is a typical crosstalk plot from a previous test. The red line indicates the maximum acceptable level.