Focusrite Scarlett Solo Test Report using Multi-Instrument

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This report is valid only for the particular Focusrite Scarlett Solo unit we tested. The purpose of these tests was not only to evaluate the performance of Focusrite Scarlett Solo, but also to find the conditions under which the best performance of Focusrite Scarlett Solo can be obtained. The information obtained from these tests can be used as a reference for those who want to use Focusrite Scarlett Solo as a test and measurement instrument to measure other devices or signals.

Note: VIRTINS TECHNOLOGY reserves the right to make modifications to this document at any time without notice. This document may contain typographical errors.

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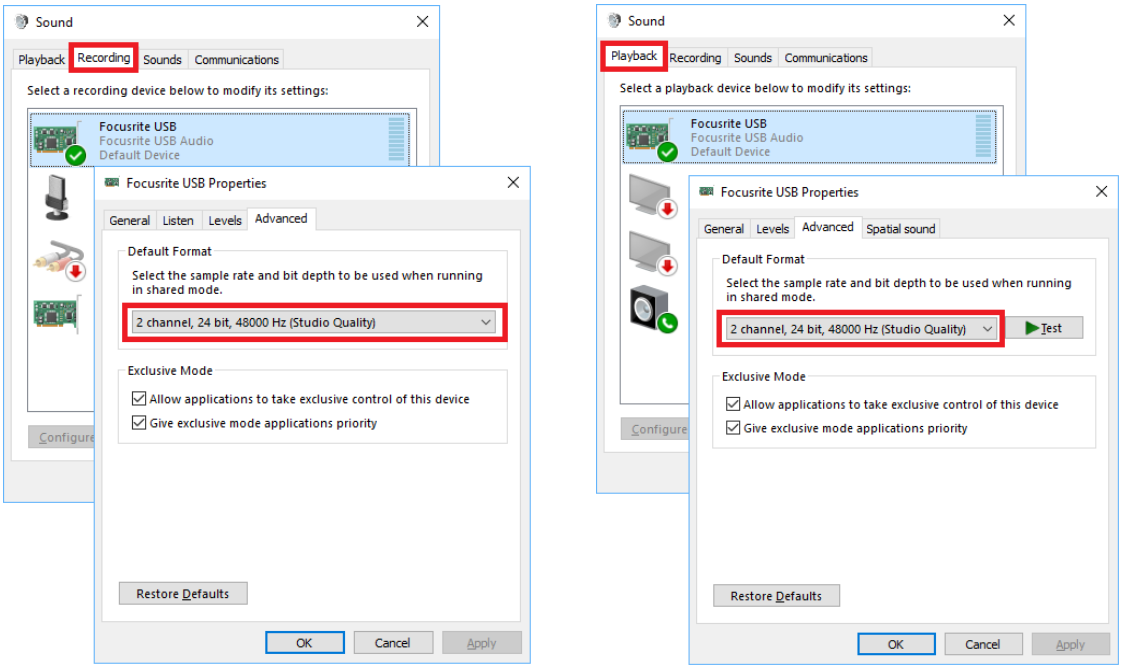
1. Test Setup

(1) Focusrite Scarlett Solo USB2.0 Audio Interface (www.focusrite.com), Driver Version: 2.1.
(2) Dell XPS 8900 Desktop, with 64-bit Windows 10 Professional, Intel Core i7-6700 CPU (3.40 GHz, 4 Cores), 8GB memory.
(3) Multi-Instrument 3.8 (Full version, Build 3.8.4.0). (21-day fully functional FREE trial available at: www.virtins.com/MIsetup.exe, or www.multi-instrument.com/MIsetup.exe)

Operational Note

- You should only use the sampling frequencies directly supported by Focusrite Scarlett Solo. Otherwise, with MME driver, Windows will perform a Sampling Rate Conversion (SRC) automatically which may deteriorate the quality of test signals and cause measurement inaccuracy. Under ASIO driver, the unsupported sampling frequencies will be rejected.

  When MME driver is used, to avoid the automatic Sampling Rate Conversion, you may need to make sure the sampling rates of recording and playback in shared mode (configured via Windows Control Panel) match those selected in Multi-Instrument.



- You should use either MME driver or ASIO driver for both ADC and DAC. Mixed use of MME and ASIO drivers should be avoided.

- The gain (level) settings of playback and recording under Windows Control Panel have no effect when ASIO driver is used.

Tips:

- *For THD measurement, use a test frequency with no spectral leakage. If you do not know what the "no spectral leakage" frequency is, just enter the test frequency you want in the Signal Generator and then tick the "no spectral leakage" option. The Signal Generator will then calculate the "no spectral leakage" frequency for you based on the current sampling frequency and FFT size. In most of cases, the "no spectral leakage" frequency is not an integer value. With a "no spectral leakage" test frequency, Rectangle window function should be used in the Spectrum Analyzer. Otherwise, Kaiser 6 window function is recommended. For both cases, the record length of the Oscilloscope should be set to a value equal or greater value than the FFT size to avoid zero padding.*

- *The screenshots of this document are of high resolution. You can zoom in to see all the details.*

2. Headphone Jack -> Line In

The following tests were carried out by looping back the output from the headphone jack (Direct Monitor: OFF, Unbalanced) to the Line In (Balanced). As this was an unbalanced-to-balanced connection, "–" of the balanced Line In was connected to the ground.

2.1 Noise Level

Test Conditions

On Focusrite Scarlett Solo:

- Both the headphone and line-in knobs were roughly at the "5 minutes" positon.

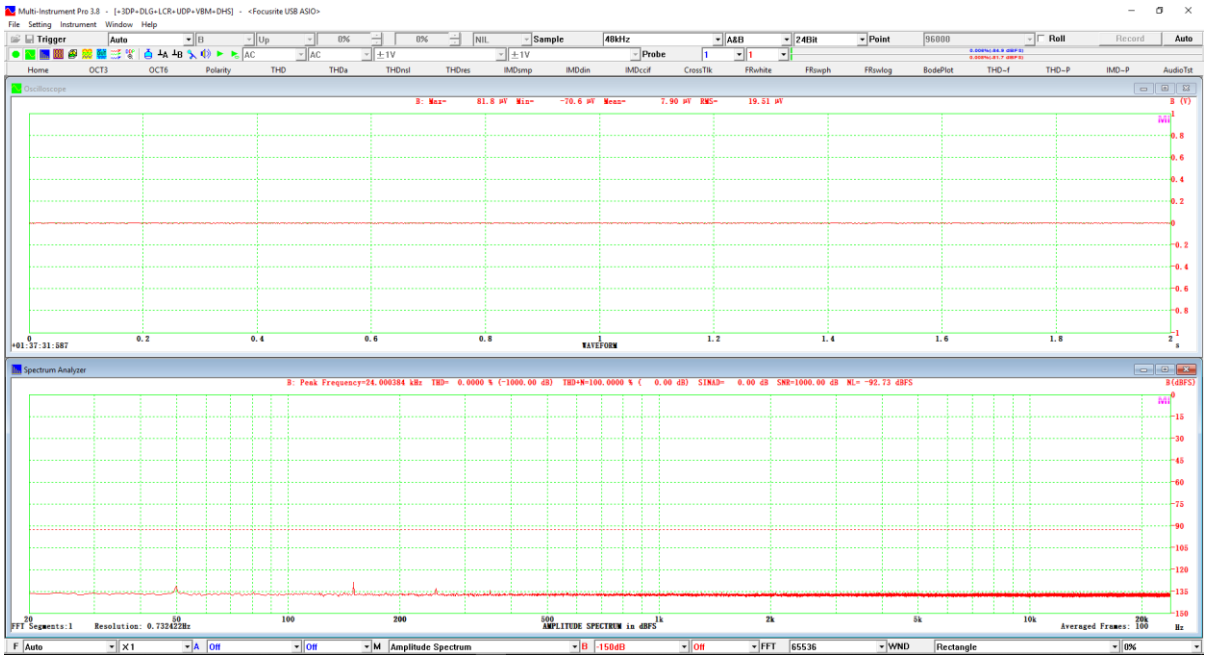
In Multi-Instrument:

- ASIO Driver
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 96000
- FFT Size: 65536
- Window Function: Rectangle
- Test Tone: No signal
- Noise Measurement Range: 20 Hz ~ 20 kHz
- Linear average: 100 frames

Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters.

Noise Level (no signal): -92.7 dBFS (represented by the dotted line in the following screen shot)



2.2 THD, THD+N, SNR, SINAD, ENOB, Noise Level

Test Conditions

On Focusrite Scarlett Solo:

- Both the headphone and line-in knobs were roughly at the “5 minutes” positon.

In Multi-Instrument:

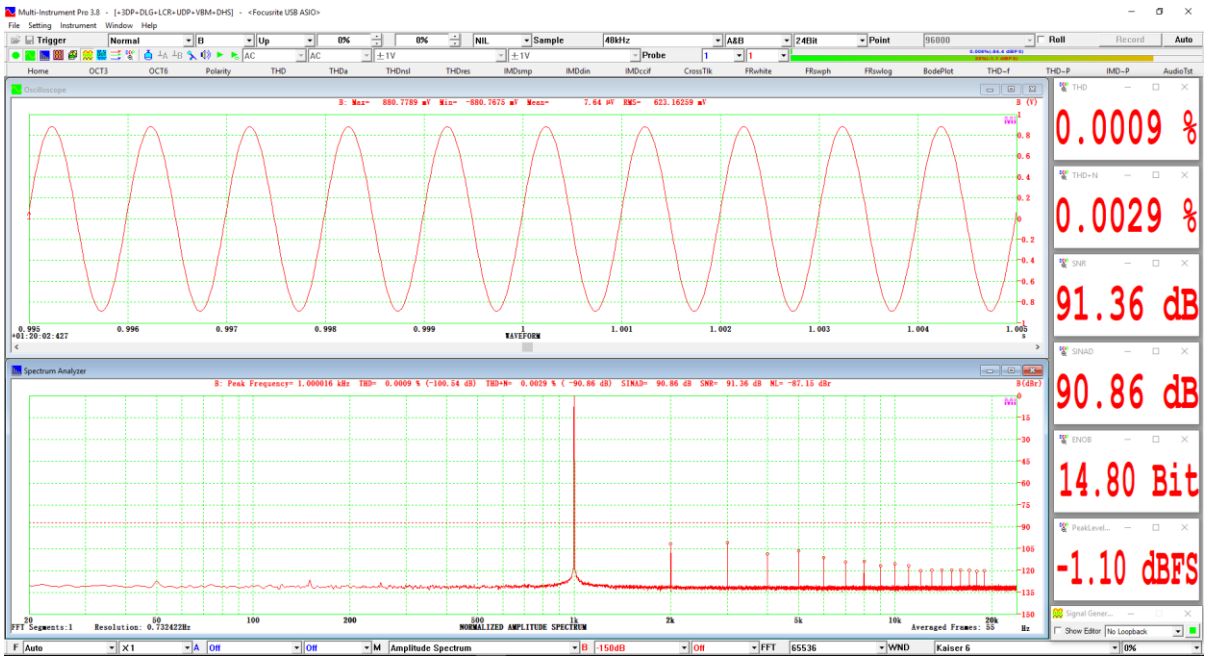
- ASIO Driver
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 96000
- FFT Size: 65536
- Window Function: Kaiser 6
- Test Tone: 1 kHz
- Harmonic Distortion and Noise Measurement Range: 20 Hz ~ 20 kHz
- Linear average: 55 frames

Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -1.1 dBFS.

THD (1kHz, -1.1dBFS): 0.0009% (-100.54 dB)
THD+N (1kHz, -1.1dBFS): 0.0029% (-90.86 dB)
SINAD (1kHz, -1.1dBFS): 90.86 dB
SNR (1kHz, -1.1dBFS): 91.36 dB

ENOB (1kHz, -1.1dBFS): 14.80 Bit
Noise Level (1kHz, -1.1dBFS): -87.15 dBFS (represented by the dotted line in the following screen shot)



Other Test Results:

It has been found through additional tests that:

- Changing the sampling frequency does not have discernible effect on the above results.
- Changing the sampling bit resolution to 16 will make the results a little bit worse.
- The combination of the input gain and output volume in the above test were optimized in order to obtain the best results. Other combination may make the above results worse.
- Applying A-weighting profile will make the THD, THD+N, SNR, SINAD, ENOB, Noise Level a little better.

2.3 IMD

Test Conditions

On Focusrite Scarlett Solo:

- Both the headphone and line-in knobs were roughly at the “5 minutes” positon.

In Multi-Instrument:

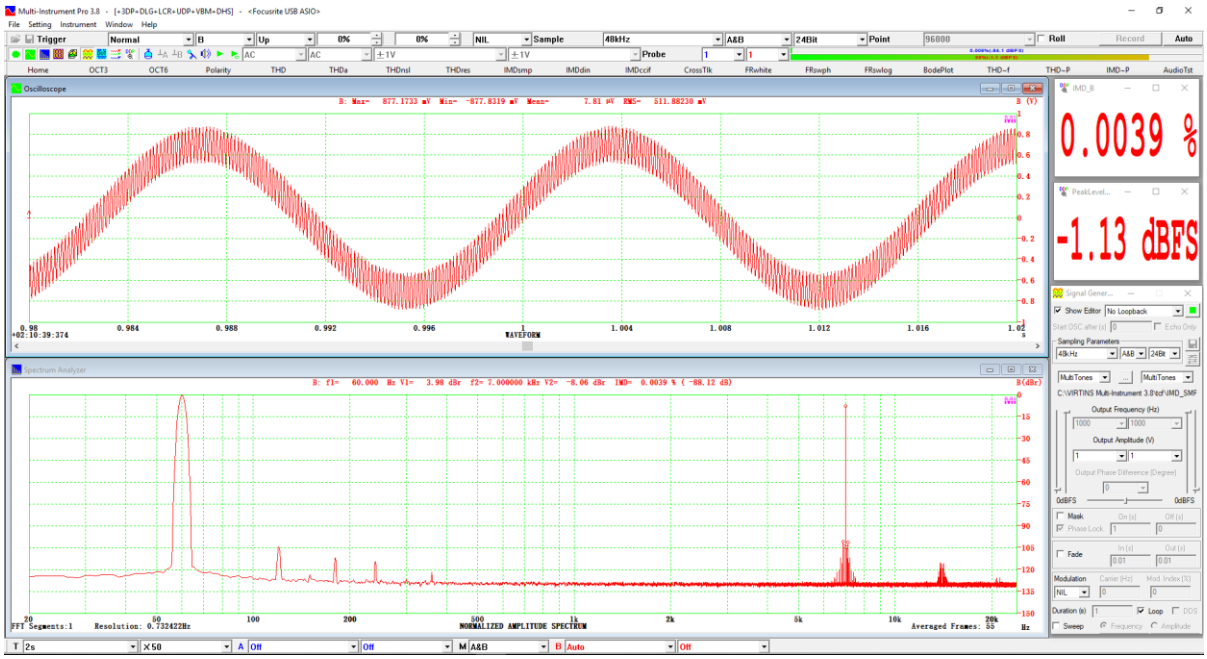
- ASIO Driver
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)

- Record Length: 96000
- FFT Size: 65536
- Window Function: Kaiser 6
- Test Tone: 1 kHz
- Linear average: 55 frames

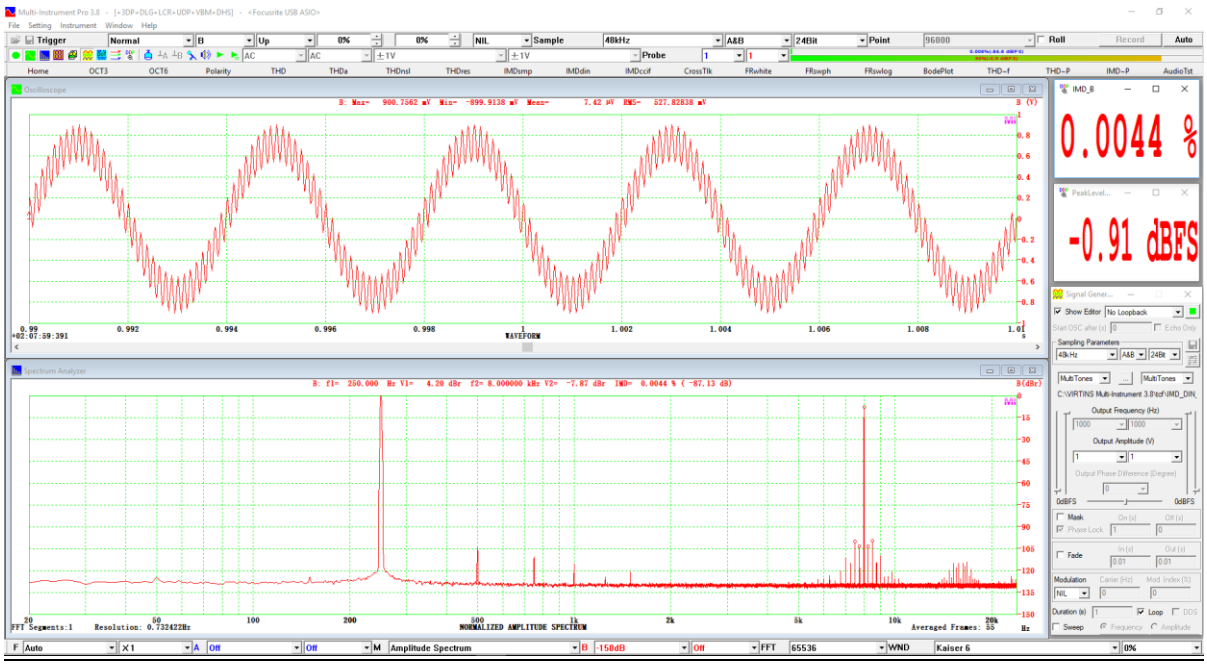
Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -1.13 dBFS, -0.91 dBFS and -0.86 dBFS, respectively.

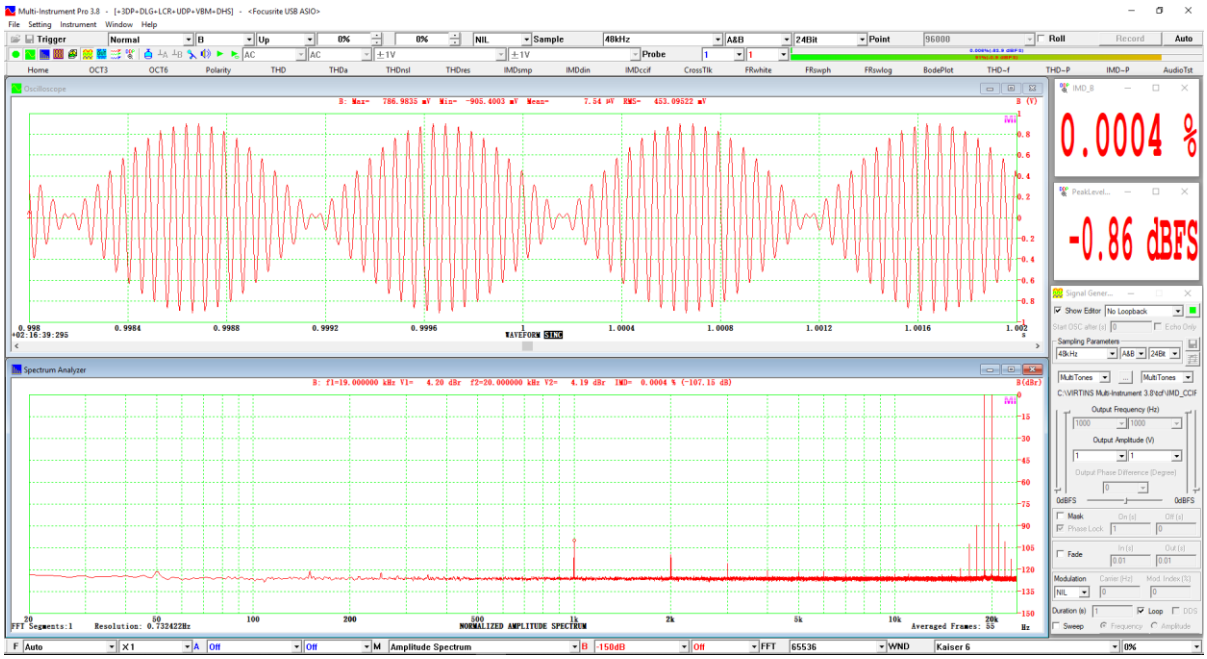
SMPTE IMD (-1.13 dBFS): 0.0039% (-88.1 dB)
DIN IMD (-0.91 dBFS): 0.0044% (-87.1 dB)
CCIF2 IMD (-0.86 dBFS): 0.0004% (-107.2 dB)



SMPTE IMD (Test Tone: 60Hz and 7kHz mixed at an amplitude ratio of 4:1)



DIN IMD (Test Tone: 250Hz and 8kHz mixed at an amplitude ratio of 4:1)



CCIF2 IMD (Test Tone: 19kHz and 20kHz mixed at an amplitude ratio of 1:1)

2.4 Bandwidth

Test Conditions

On Focusrite Scarlett Solo:

- Both the headphone and line-in knobs were roughly at the “5 minutes” positon.

In Multi-Instrument:

- ASIO Driver
- Sampling Rate: 48/96/192 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 1920000/3840000/ 3840000
- FFT Size: 4194304
- Window Function: Rectangle
- Test Tone: Frequency logarithmically swept sine: 1 Hz ~ 24/48/96 kHz, sweep duration 40/40/20 seconds
- Linear average: No

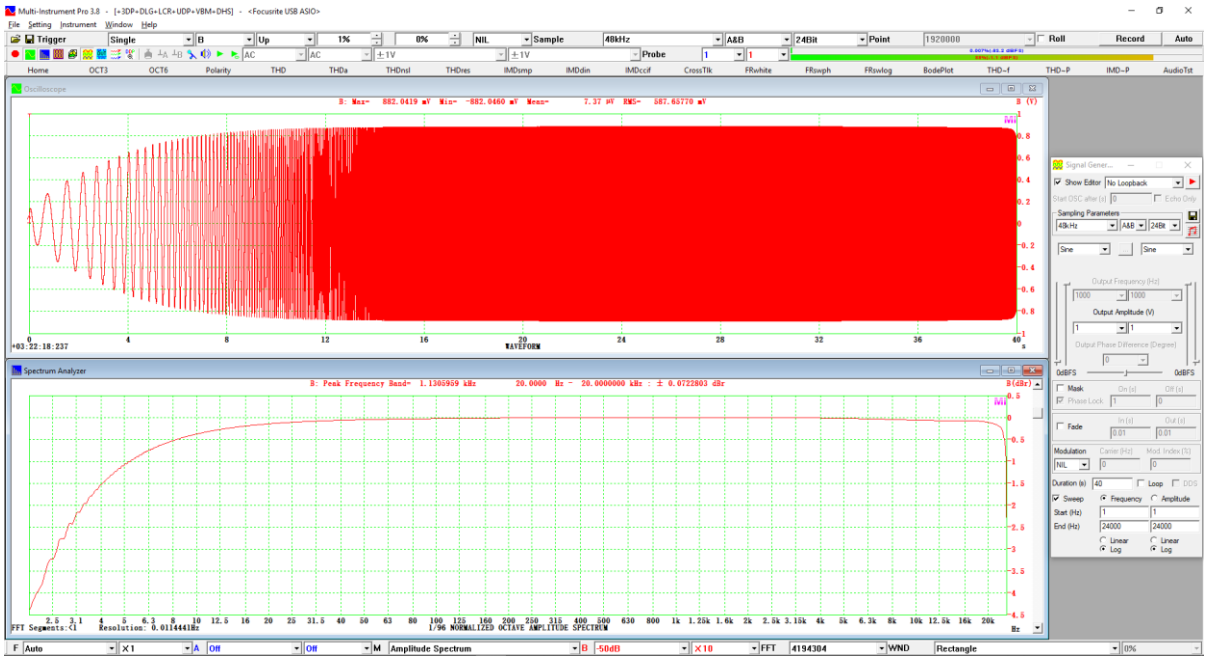
Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters.

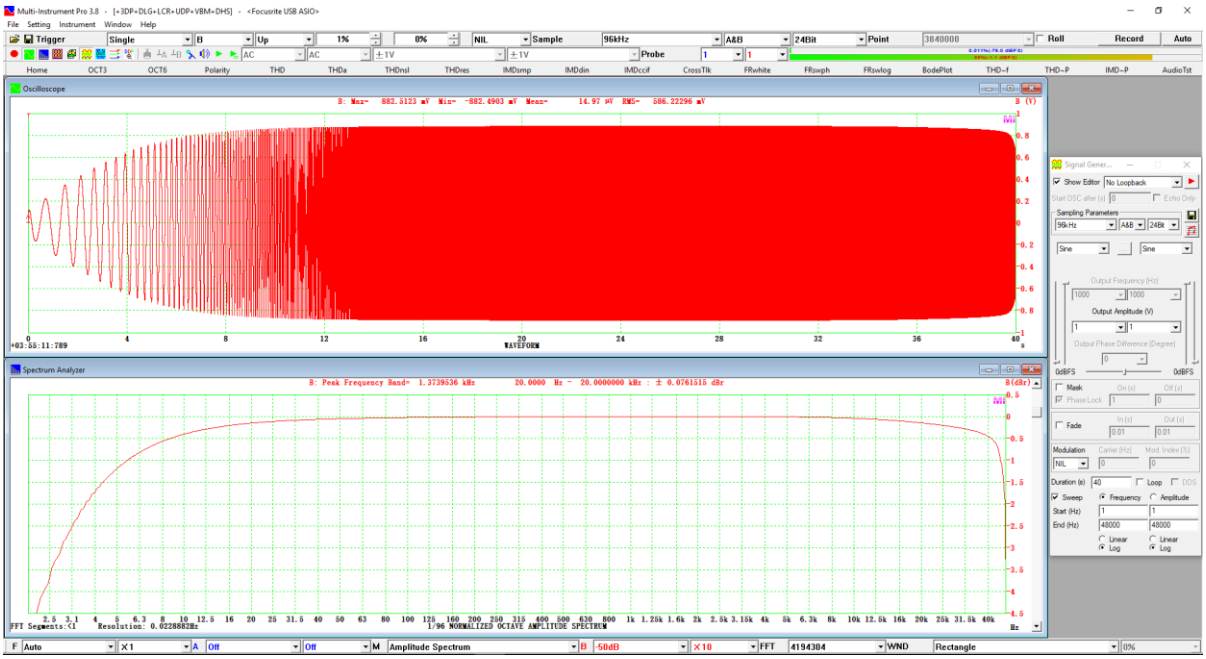
Bandwidth (-3dB) at the sampling rate of 48kHz: 2.6 Hz ~ 24 kHz,
Flatness within 20 Hz ~ 20 kHz: ±0.072 dB

Bandwidth (-3dB) at the sampling rate of 96kHz: 2.8 Hz ~ 48 kHz
Flatness within 20 Hz ~ 20 kHz: ±0.076 dB

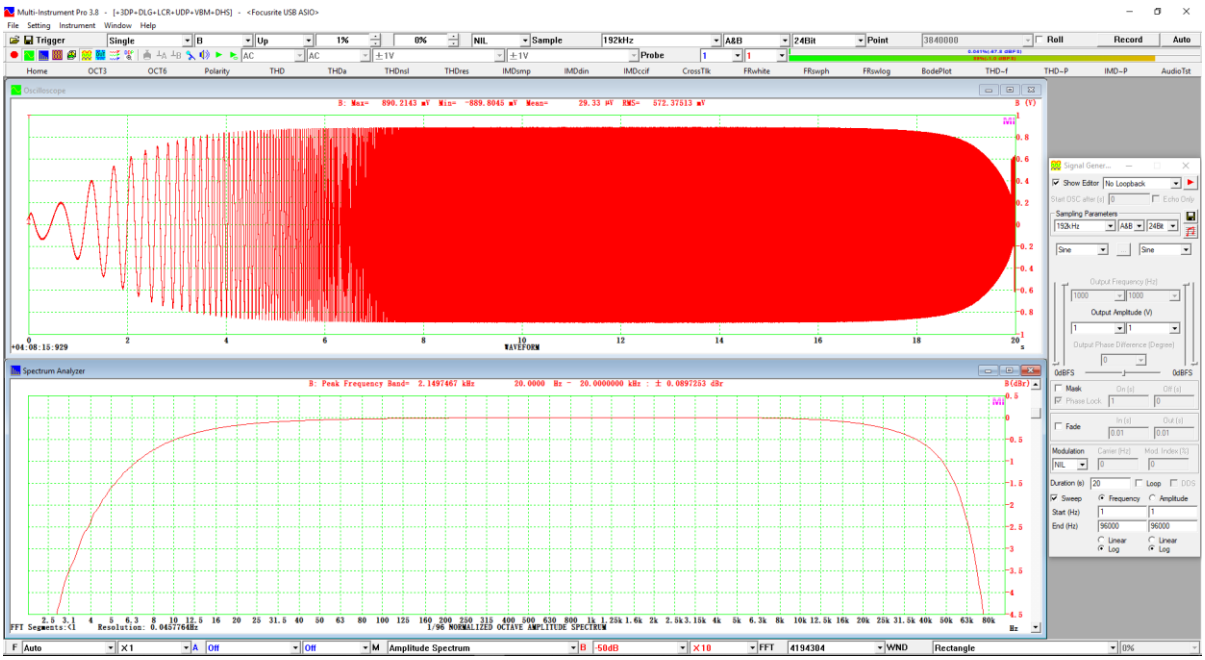
Bandwidth (-3dB) at the sampling rate of 192kHz: 3.5Hz ~ 67.3 kHz,
Flatness within 20 Hz ~ 20 kHz: ±0.090 dB



Bandwidth (-3dB) (Sampling Rate = 48kHz, Record Length =1920000, FFT Size=4194304)



Bandwidth (-3dB) (Sampling Rate = 96kHz, Record Length =3840000, FFT Size=4194304)



Bandwidth (-3dB) (Sampling Rate = 192kHz, Record Length =3840000, FFT Size=4194304)

It was found that Focusrite Scarlett Solo produced some high spikes intermittently when the test frequency is in the range of about 90 kHz ~ 96 kHz (see rightmost part of the waveform displayed in the oscilloscope in the above figure). This strange behaviour was further confirmed using a single test frequency.

2.5 Crosstalk

Test Conditions

On Focusrite Scarlett Solo:

- Both the headphone and line-in knobs were roughly at the “5 minutes” positon.
- The microphone input was not connected and the microphone knob was set to the minimum gain. So the crosstalk was caused internally only.

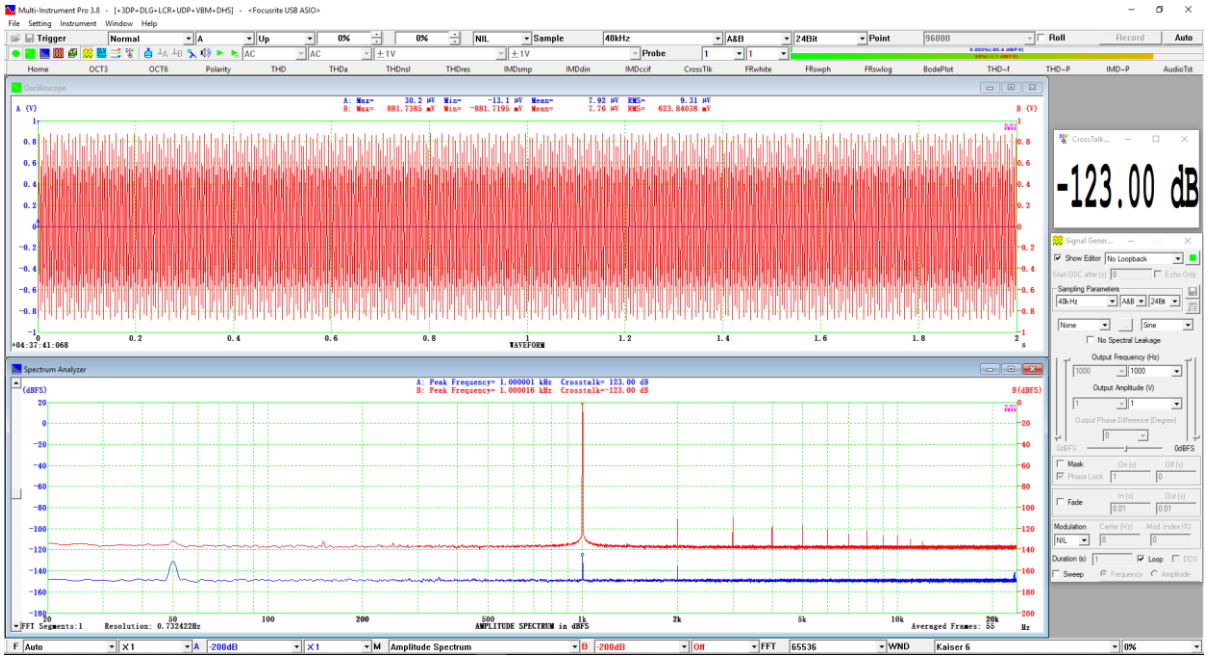
In Multi-Instrument:

- ASIO Driver
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 96000
- FFT Size: 65536
- Window Function: Kaiser 6
- Test Tone: 1 kHz
- Linear average: 55 frames

Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -1.1 dBFS.

(1) Crosstalk (1kHz, -1.1dBFS): -123.0 dB.



2.6 Dynamic Range

Test Conditions

On Focusrite Scarlett Solo:

- Both the headphone and line-in knobs were roughly at the “5 minutes” positon.

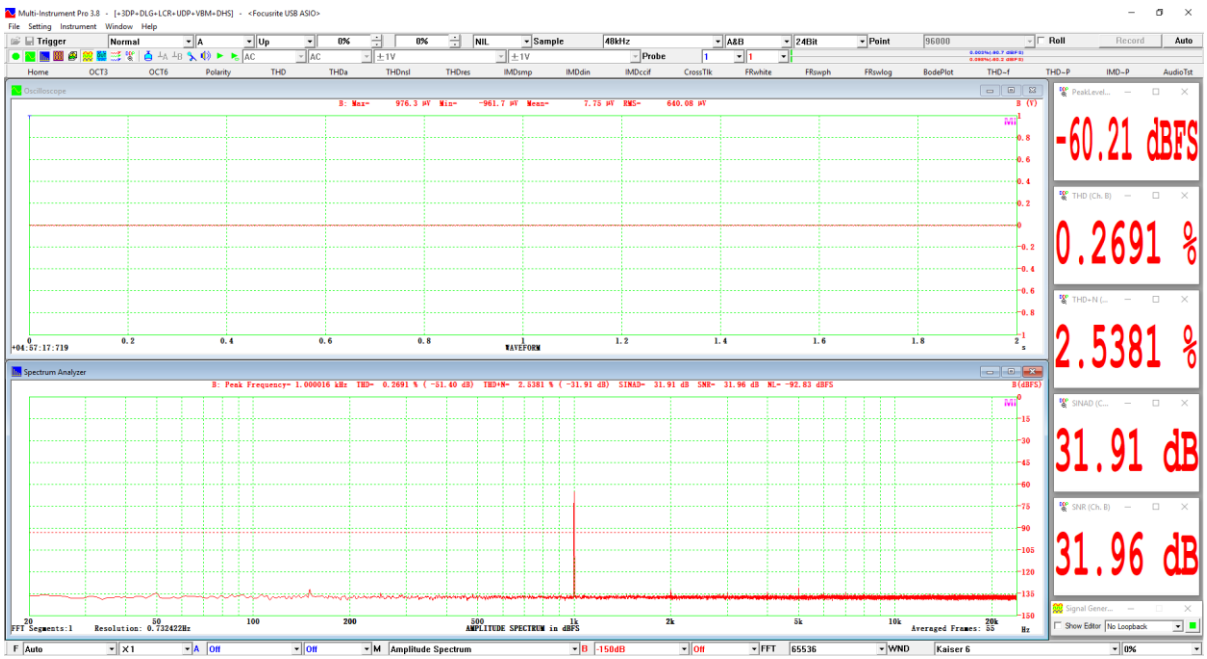
In Multi-Instrument:

- ASIO Driver
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 96000
- FFT Size: 65536
- Window Function: Kaiser 6
- Test Tone: 1 kHz
- Harmonic Distortion and Noise Measurement Range: 20 Hz ~ 20 kHz
- Linear average: 55 frames

Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -60 dBFS.

SNR (-60dBFS, 1kHz): 32.0 dB
Dynamic Range: 32.0+60=92.0 dB



2.7 THD+N, THD, SNR, Magnitude Response vs Frequency

Test Conditions

On Focusrite Scarlett Solo:

- Both the headphone and line-in knobs were roughly at the “5 minutes” positon.

In Multi-Instrument:

- ASIO Driver
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 48000
- FFT Size: 3276
- Window Function: Kaiser 6
- Test Tone: 100-point Logarithmically Stepped Sine in the range of 20 Hz ~ 20 kHz (No Spectral Leakage).
- Harmonic Distortion and Noise Measurement Range: 20 Hz ~ 20 kHz
- Device Test Plan is used

Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -1.1 dBFS.

(1) Upper left graph: THD+N vs Frequency
(2) Upper right graph: THD (up to 3rd order) vs Frequency
(3) Lower left graph: SNR vs Frequency
(4) Lower right graph: Peak Level vs Frequency.