

ESI U24XL Test Report using Multi-Instrument



Rev: 01
June 6, 2015

This report is valid only for the particular ESI U24XL unit we tested. The purpose of these tests was not only to evaluate the performance of ESI U24XL, but also to find the conditions under which the best performance of ESI U24XL can be obtained. The information obtained from these tests can be used as a reference for those who want to use ESI U24XL 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.

TABLE OF CONTENTS

1. TEST SETUP	3
2. LINE OUT -> LINE IN.....	4
2.1 NOISE LEVEL	4
2.2 THD, THD+N, SNR, SINAD, ENOB, NOISE LEVEL	5
2.3 IMD.....	6
2.4 BANDWIDTH	8
2.5 CROSSTALK	10
2.6 DYNAMIC RANGE	11
2.7 GAIN AND PHASE DIFFERENCE BETWEEN CHANNELS	12
2.8 THD+N, THD, SNR, MAGNITUDE RESPONSE VS FREQUENCY.....	14
2.9 CROSSTALK VS FREQUENCY	15

1. Test Setup

- (1) ESI U24XL 24-bit USB Audio Interface (www.esi-audio.com), Driver Version: 2.5.0.0.
- (2) Dell desktop with 2.70 GHz Intel Core i5-3330S CPU, 8GB RAM, 64-bit Windows 8.1 Professional.
- (3) Multi-Instrument 3.5 (Full version, Build 3.5.0.2). (21-day fully functional FREE trial available at: www.virtins.com/MIsetup.exe, or www.multi-instrument.com/MIsetup.exe)

Tips:

- *To reduce the CPU time consumption, in Multi-Instrument, you can set the Trigger Mode to “Auto” if necessary, use integer test frequency in the Signal Generator if possible, and if you are using ASIO driver, you can go to [Setting]>[Display]>and set “ASIO Buffer Size” to “Max” if necessary. If the audio interface comes with its own control panel, you may increase its buffer size there. These methods may help if you encounter erratic behavior caused by insufficient computing power of the computer.*
- *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 than the FFT size to avoid zero padding.*
- *If you want to use ASIO driver but the audio interface does not have one, you can download the generic ASIO driver from www.asio4all.com. You can also use ASIO4all if the native ASIO driver that comes with the audio interface shows discontinuity (clicks and pops) in the captured waveform when used with Multi-Instrument.*
- *The screenshots of this document are of high resolution. You can zoom in to see all the details.*

2. Line Out -> Line In

The following tests were carried out by looping back the Line Out to the Line In. This is an unbalanced connection.

2.1 Noise Level

Test Conditions

On ESI U24XL:

- [Output L] was connected to [Input L] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- [Output R] was connected to [Input R] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.
- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

In Multi-Instrument:

- ASIO Driver (ASIO4ALL)
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 48000
- FFT Size: 32768
- Window Function: Rectangle
- Test Tone: No signal
- Noise Measurement Range: 20~20 kHz
- Linear average: 10 frames

Test Results

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

Noise Level (no signal): -102 dBFS (represented by the dotted line in the following screen shot)



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

Test Conditions

On ESI U24XL:

- [Output L] was connected to [Input L] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- [Output R] was connected to [Input R] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.
- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

In Multi-Instrument:

- ASIO Driver (ASIO4ALL)
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A (mono)
- Record Length: 48000
- FFT Size: 32768

- Window Function: Kaiser 6
- Test Tone: Sine, 1000.4882812 Hz
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Linear average: 10 frames

Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at peak level: -6.8 dBFS.

THD (1kHz, -6.8dBFS): 0.0021% (-93.36 dB)

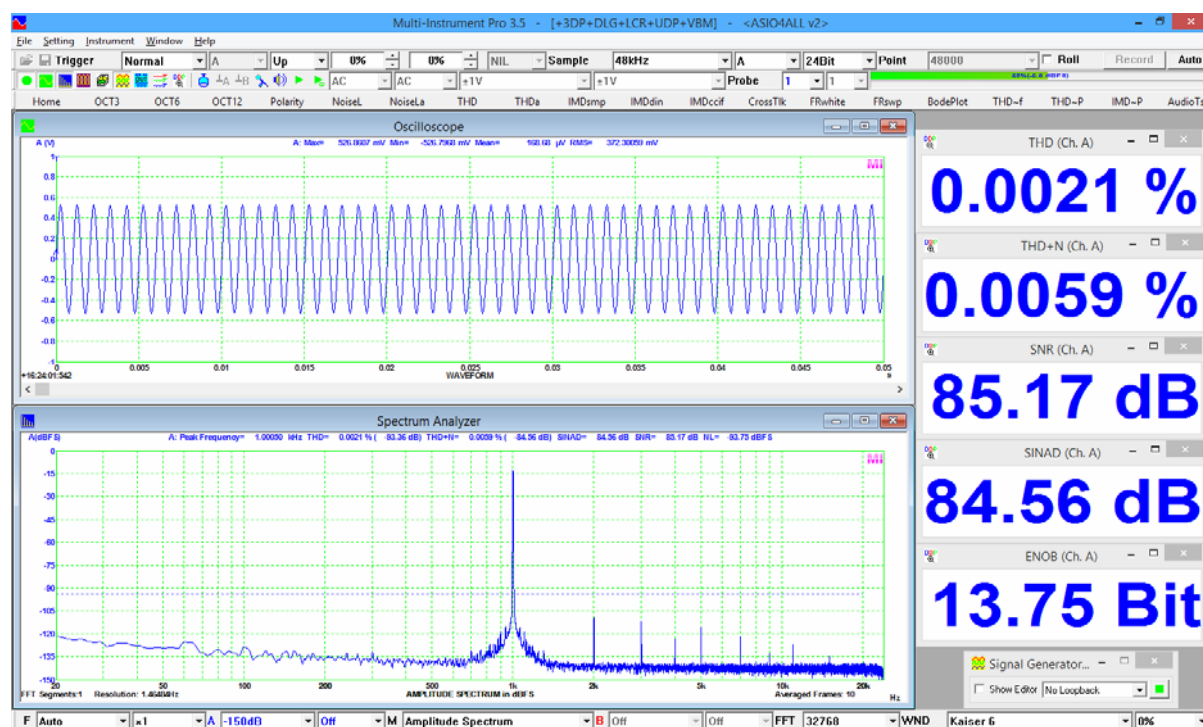
THD+N (1kHz, -6.8dBFS): 0.0059% (-84.56 dB)

SINAD (1kHz, -6.8dBFS): 84.56 dB

SNR (1kHz, -6.8dBFS): 85.17 dB

ENOB (1kHz, -6.8dBFS): 13.75 Bit

Noise Level (1kHz, -6.8dBFS): -93.75 dBFS (represented by the dotted line in the following screen shot)



2.3 IMD

Test Conditions

On ESI U24XL:

- [Output L] was connected to [Input L] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- [Output R] was connected to [Input R] via a ¼" male to ¼" male TS cable. This connection is unbalanced.

- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.
- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

In Multi-Instrument:

- ASIO Driver (ASIO4ALL)
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A (mono)
- Record Length: 48000
- FFT Size: 32768
- Window Function: Kaiser 6
- Linear average: 10 frames

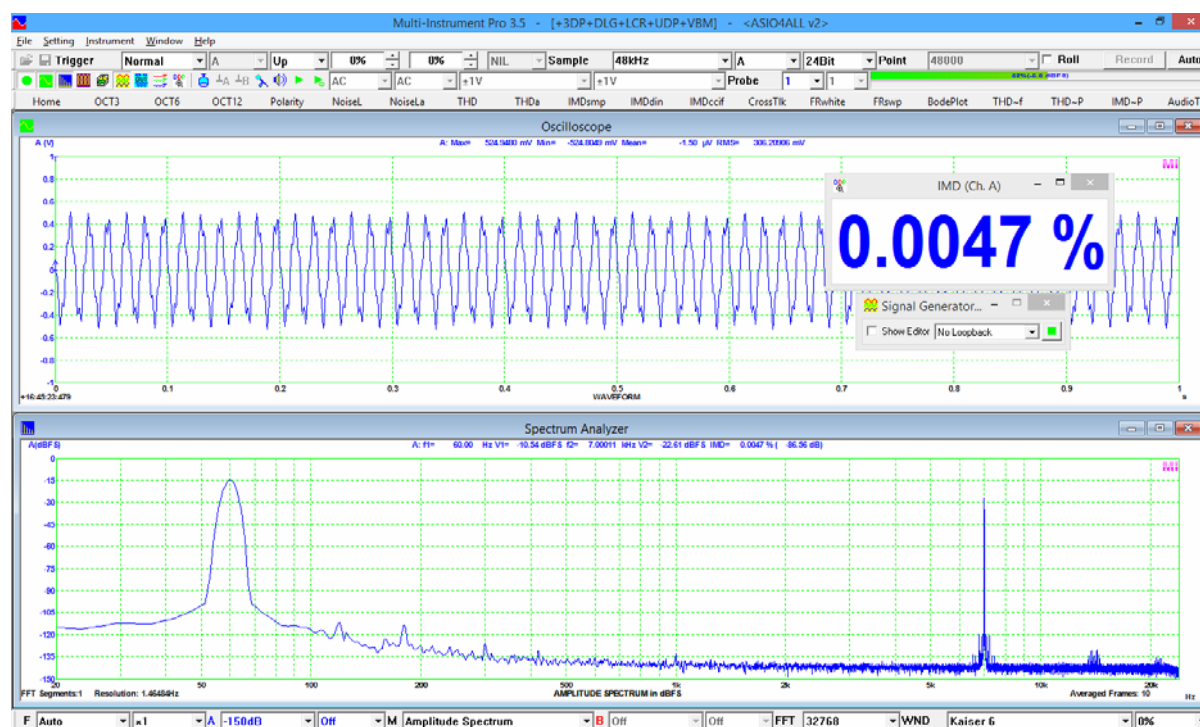
Test Results

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at peak level: -6.8 dBFS.

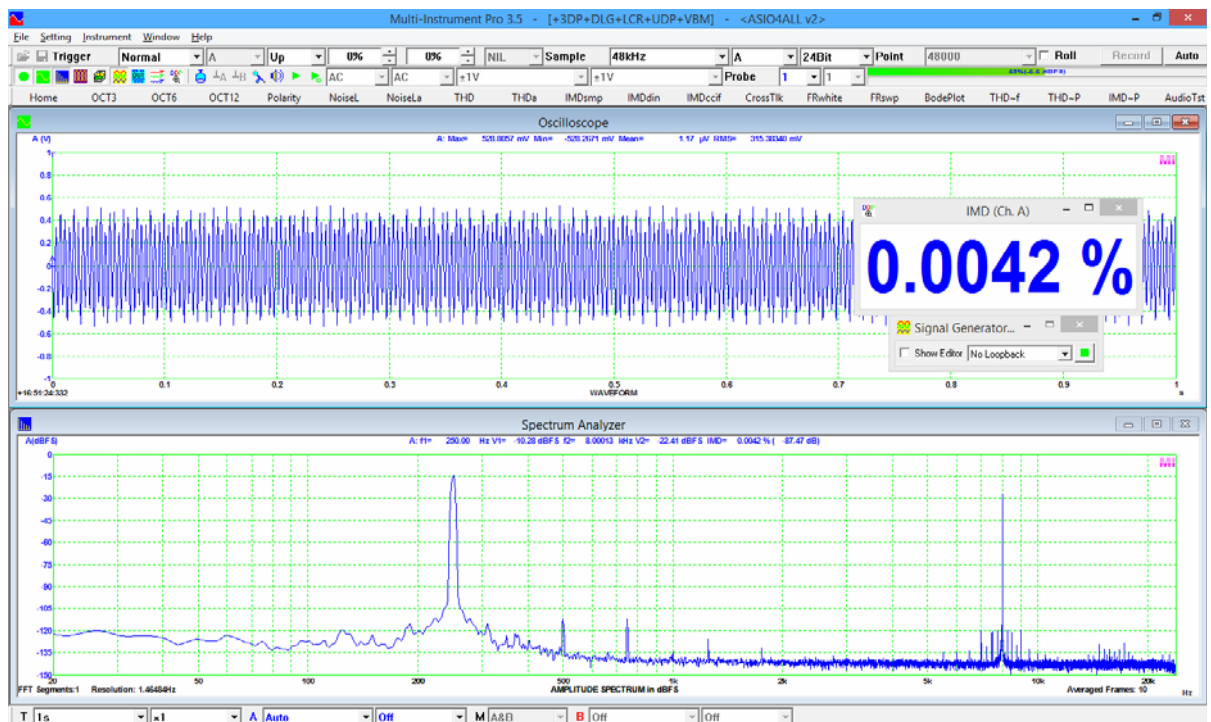
SMPTE IMD (-6.8dBFS) : 0.0047% (-86.56 dB)

DIN IMD (-6.8dBFS): 0.0042% (-87.47 dB)

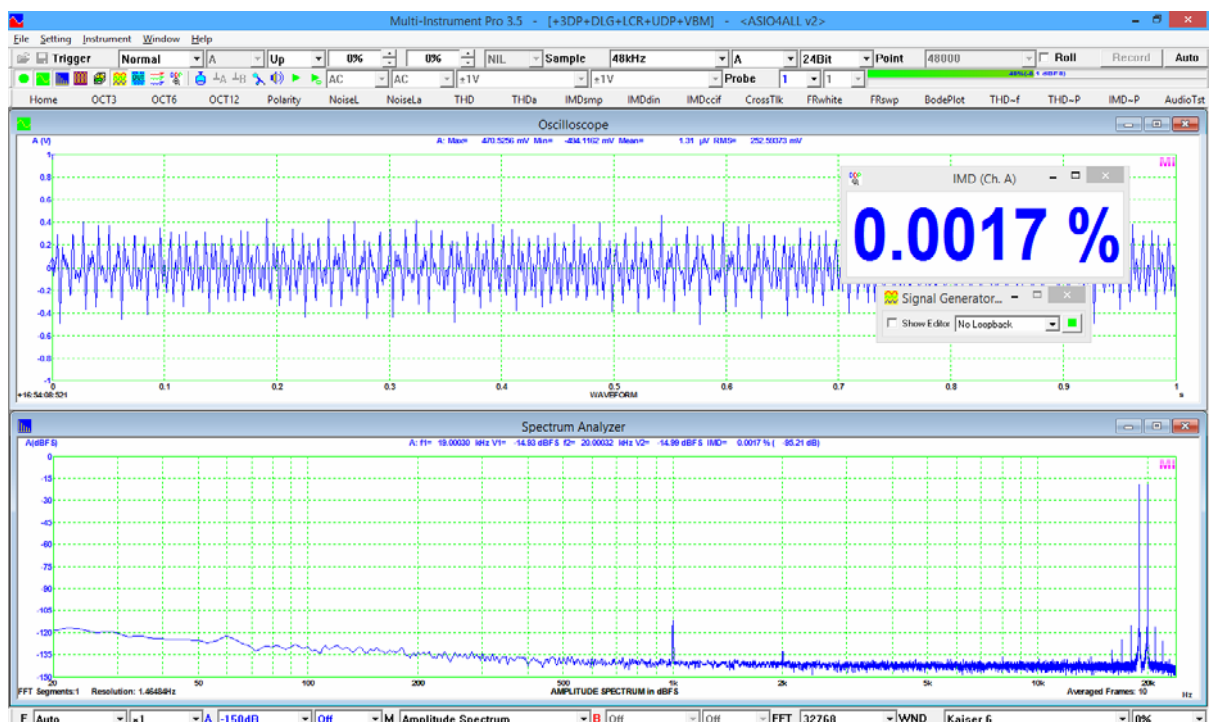
CCIF2 IMD (-6.8dBFS): 0.0017% (-95.21 dB)



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 ESI U24XL:

- [Output L] was connected to [Input L] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- [Output R] was connected to [Input R] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.
- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

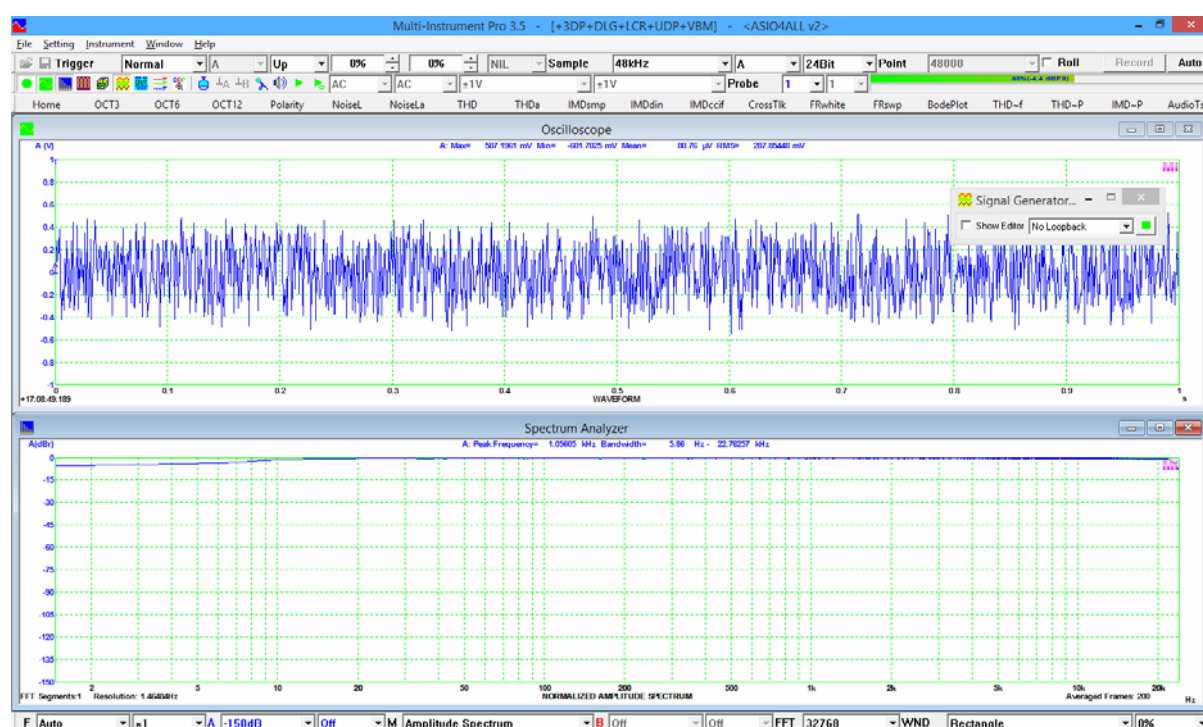
In Multi-Instrument:

- ASIO Driver (ASIO4ALL)
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A (mono)
- Window Function: Rectangle
- Test Tone: White Noise
- Linear average: 200 frames

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: 5.86Hz ~22763Hz



2.5 Crosstalk

Test Conditions

On ESI U24XL:

- [Output L] was connected to [Input L] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- [Output R] was connected to [Input R] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.
- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

In Multi-Instrument:

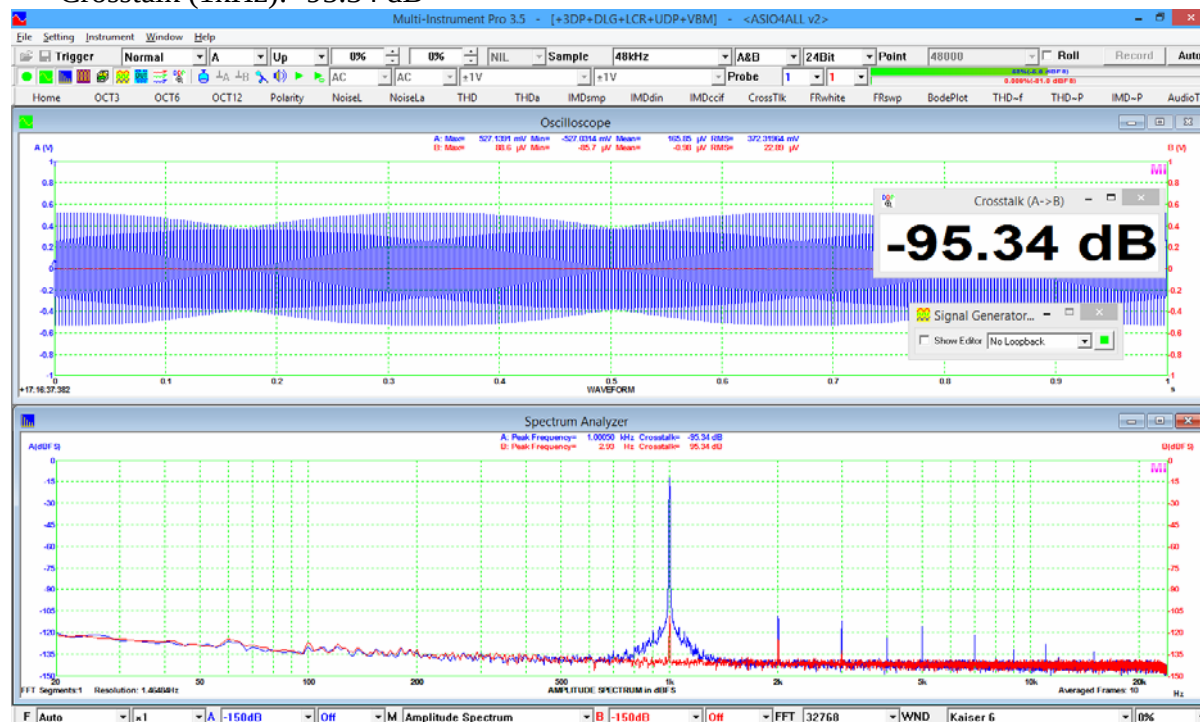
- ASIO Driver (ASIO4ALL)
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 48000
- FFT Size: 32768
- Window Function: Rectangle

- Test Tone: Channel A: Sine, 1000.4882812 Hz Channel B: No signal
- Linear average: 10 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 -6.8 dBFS.

Crosstalk (1kHz): -95.34 dB



2.6 Dynamic Range

Test Conditions

On ESI U24XL:

- [Output L] was connected to [Input L] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- [Output R] was connected to [Input R] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.

- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

In Multi-Instrument:

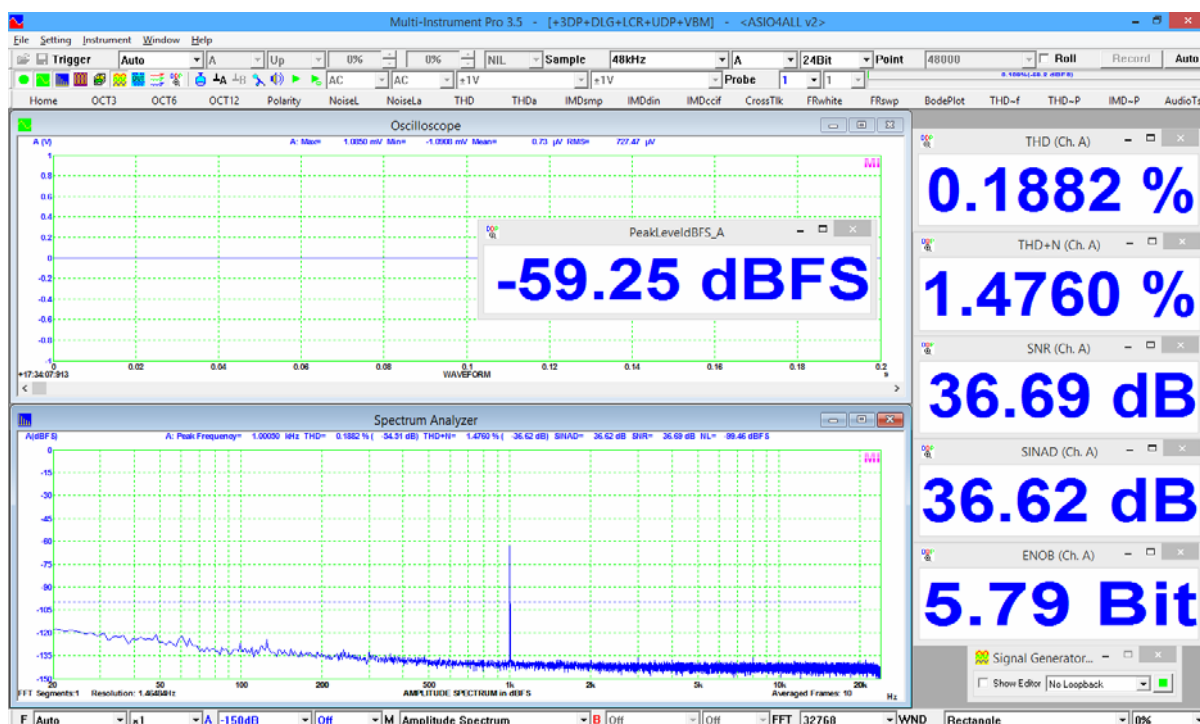
- ASIO Driver (ASIO4ALL)
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A (mono)
- Record Length: 48000
- FFT Size: 32768
- Window Function: Rectangle
- Test Tone: Sine, 1000.4882812 Hz
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Linear average: 10 frames

Test Results

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

SNR (-59.25dBFS, 1kHz): 36.69 dB

Dynamic Range: 36.69+59.25=95.94 dB



2.7 Gain and Phase Difference between Channels

This test is important if you want to measure the transfer function (Bode plot, or frequency response) of a DUT using the dual-FFT method.

Test Conditions

On ESI U24XL:

- [Output L] was connected to [Input L] and [Input R] via an in-house made ¼" male to 2 × ¼" male TS cable. This connection is unbalanced.
- [Output R] was not connected.
- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.
- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

In Multi-Instrument:

- ASIO Driver (ASIO4ALL)
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 48000
- FFT Size: 1024
- Window Function: Rectangle
- Test Tone: White Noise
- Measurement Range: 0~24 kHz
- Linear average: 50 frames

Test Results

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

Gain Difference (0 ~ 24 kHz): < ±0.015 dB

(Note: the average gain difference of -0.06 dB could be further removed by fine tuning the gain knobs for individual channels in the software panel)

Phase Difference (0 ~ 24 kHz): < 1.25 degree



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

Test Conditions

On ESI U24XL:

- [Output L] was connected to [Input L] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- [Output R] was connected to [Input R] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.
- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

In Multi-Instrument:

- ASIO Driver (ASIO4ALL)
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 16 Bit
- Sampling Channels: A (mono)
- Record Length: 48000

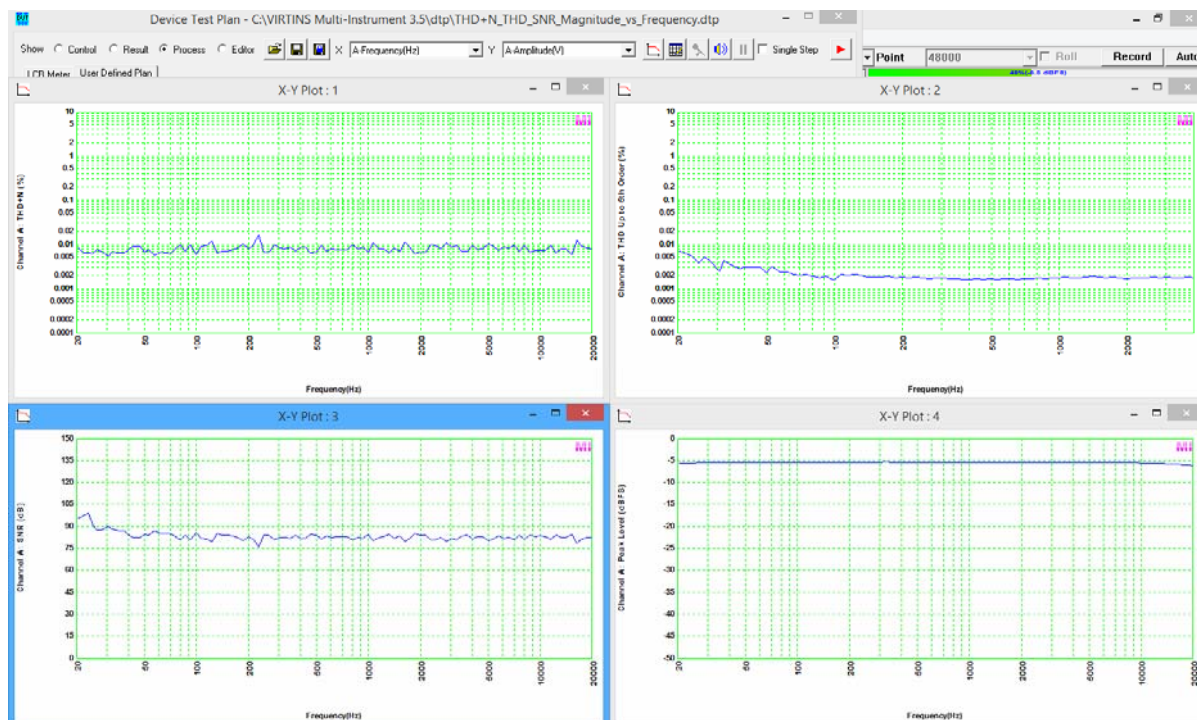
- FFT Size: 32768
- Window Function: Rectangle
- Test Tone: 100-point Logarithmically Frequency Stepped Sine in the range of 20Hz~20kHz (No Spectral Leakage).
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Device Test Plan is used

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 -6.8 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.

Frequency Response (20Hz~20kHz): -0.2/-0.6 dB (obtained by examining the data)



2.9 Crosstalk vs Frequency

Test Conditions

On ESI U24XL:

- [Output L] was connected to [Input L] via a ¼" male to ¼" male TS cable. This connection is unbalanced.

- [Output R] was connected to [Input R] via a ¼" male to ¼" male TS cable. This connection is unbalanced.
- Factory Default except its buffer number set to the maximum: 9 (via its software control panel)

On PC:

USB bus powered.

On Windows Control Panel:

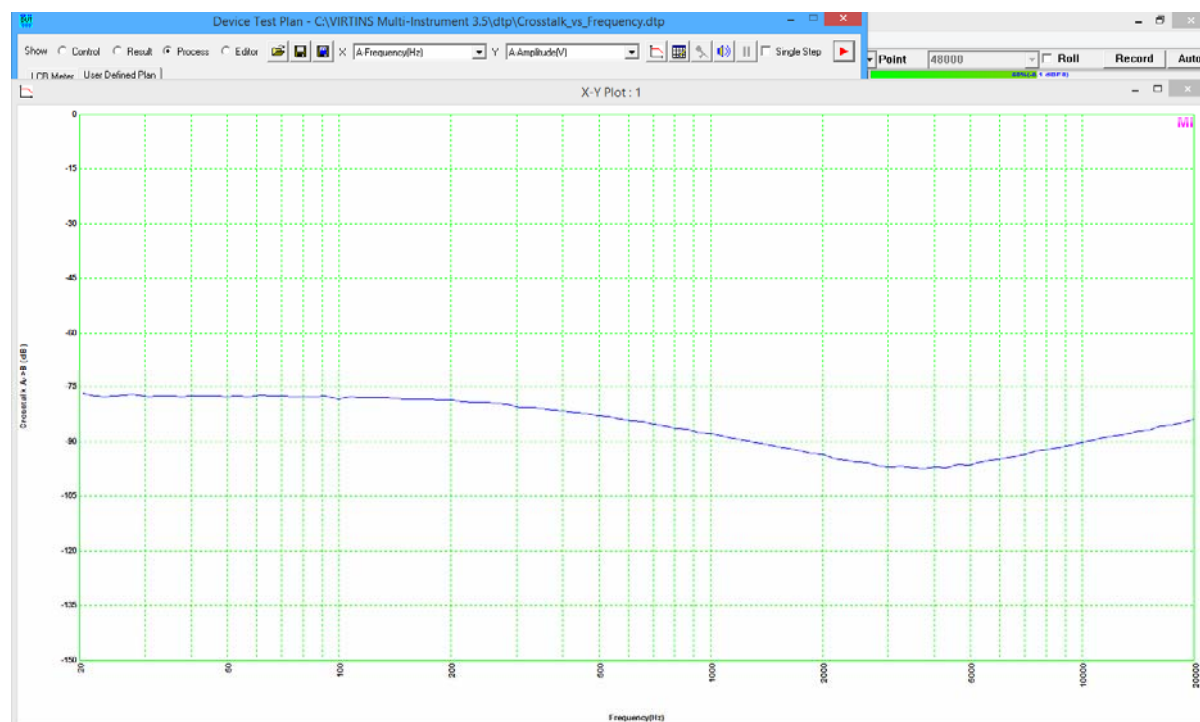
- [Sounds and Audio Devices]>[Sound Recording]>[U24XL Audio Driver]: No effect.
- [Sounds and Audio Devices]>[Sound Playback]>[U24XL Audio Driver]: No effect.

In Multi-Instrument:

- ASIO Driver (ASIO4ALL)
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 16 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 48000
- FFT Size: 32768
- Window Function: Rectangle
- Test Tone: Channel A: 100-point Logarithmically Frequency Stepped Sine in the range of 20Hz~20kHz (No Spectral Leakage), Channel B: No signal.
- 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 -6.8 dBFS.



3. Conclusion

Driven by the ASIO driver, U24XL has very good performances in THD, SNR, IMD, Noise Level, Dynamic Range and Crosstalk within audio frequency range. Its bandwidth is from a few Hz to about 23 kHz. The gain and phase differences between the two Line In/Out channels are very small and thus it is suitable for being used as a tool for transfer function measurement. It can measure an input voltage in the range of $\pm 5V$ without clipping, and can output a voltage in the range of $\pm 1.7V$. One advantage of using U24XL for absolute voltage measurement is that its input and output gain can only be adjusted from its software control panel, no hardware gain knobs are provided. Therefore, its input and output calibration in Multi-Instrument cannot be invalidated by casual touch on the external hardware knobs, unlike many other audio interfaces.