# **E-MU Tracker Pre Test Report using Multi-Instrument**



#### Rev: 01 March 28, 2010

This report is valid only for the particular E-MU Tracker Pre unit we tested. The purpose of these tests was not only to evaluate the performance of E-MU Tracker Pre, but also to find the conditions under which the best performance of E-MU Tracker can be obtained. The information obtained from these tests can be used as a reference for those who want to use E-MU Tracker Pre 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) E-MU Tracker Pre USB2.0 Audio Interface (<u>www.emu.com</u>), Firmware Version: 8.04.
- (2) Dell Studio 15 laptop, with 64-bit Windows 7 Professional, Intel Core 2 Duo Processor P8700 (2.53GHz/1066FSB/3MB Cache), 4GB memory.
- (3) Multi-Instrument 3.2 (Full version, Build 3.2.0.2). (21-day fully functional FREE trial available at: <a href="https://www.virtins.com/MIsetup.exe">www.virtins.com/MIsetup.exe</a>, or <a href="https://www.multi-instrument.com/MIsetup.exe">www.multi-instrument.com/MIsetup.exe</a>)

# **Operational Note**

- A USB 2.0 port of the computer must be used in order to test the sampling frequencies higher than 48 kHz and the sampling bit resolution of 24. Some computers may have both USB 1.1 and USB 2.0 ports. The E-MU Tracker Pre Control Panel will show the type of the USB port connected. Sometimes you may need to plug out and plug in the USB plug a few times in order for the USB 2.0 to be detected correctly.
- With ASIO driver, E-MU Tracker Pre works for all its directly supported sampling frequencies stated in its manual under 32-bit and 64-bit Windows XP, Vista, 7. You do not need to use the E-MU Tracker Pre Control Panel to set the sampling frequency. It should be set from Multi-Instrument.
- With MME driver, E-MU Tracker Pre works for all its directly supported sampling frequencies stated in its manual under Windows XP. However, from our tests, it appears that it works only for the sampling frequency 44.1 kHz under Windows Vista and 7. Also, you must use the E-MU Tracker Pre Control Panel to set the sampling frequency to match what you are using with Multi-Instrument. Under Windows Vista or 7, you should set the sampling frequency to 44.1 kHz using the E-MU Tracker Pre Control Panel, otherwise some compatibility problem might occur.
- You should only use the sampling frequencies directly supported by E-MU Tracker Pre. 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.
- In Multi-Instrument, the sampling frequency and sampling bit resolution of the Oscilloscope and the Signal Generator must be set to the same values. You should use either MME driver or ASIO driver for both ADC and DAC. Mixed use of MME and ASIO drivers should be avoid.
- The speaker volume slider under Windows Control Panel works for both MME driver and ASIO driver. However, the microphone volume slider (shown under Windows 7 only) under Windows Control Panel works for MME driver only, and has no effect with ASIO driver. It was found that under Windows 7 with ASIO driver, the input gain is actually controlled by the speaker volume slider as well.

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. 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, 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.

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# 2. Headphone Jack -> Stereo Mic

The following tests were carried out by looping back the output from the headphone jack to the stereo mic input. This was an unbalanced connection.

# 2.1 Noise Level

## **Test Conditions**

On E-MU Tracker Pre:

- [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TRS (Tip, Ring, Sleeve) cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 80% percent. The knob for direct monitor was set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

In Multi-Instrument:

- ASIO Driver
- 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): -112.4 dBFS (represented by the dotted line in the following screen shot)

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

## **Test Conditions**

On E-MU Tracker Pre:

- [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 80% percent. The knob for direct monitor was set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

- **ASIO** Driver
- 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: Sine, 1000.4882812 Hz
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Linear average: 10 frames

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -9.4 dBFS.

THD (1kHz, -9.4dBFS): 0.000478% (-106.4 dB) THD+N (1kHz, -9.4dBFS): 0.001483% (-96.6 dB) SINAD (1kHz, -9.4dBFS): 96.6 dB SNR (1kHz, -9.4dBFS): 97.1 dB ENOB (1kHz, -9.4dBFS): 15.75 Bit Noise Level (1kHz, -9.4dBFS): -109.3 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 THD a little worse, and the rest results about 10dB worse.
- Changing the sampling channel to A (mono) will make the above results a little 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.
- Changing the laptop's power supply from the AC adapter to its internal battery does not have discernible effect on the above results.

• Applying A-weighting profile will make the THD+N, SNR, SINAD, ENOB, Noise Level a little better.

# 2.3 IMD

# **Test Conditions**

On E-MU Tracker Pre:

- [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 80% percent. The knob for direct monitor was set to minimum.
- Direct Monitor: Off

On Laptop:

Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

In Multi-Instrument:

- ASIO Driver
- Sampling Rate: 48 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- 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 a peak level of -9.4 dBFS.

SMPTE IMD (-9.4dBFS): 0.002248% (-93.0 dB) DIN IMD (-9.4dBFS): 0.001805% (-94.9 dB) CCIF2 IMD (-9.4dBFS): 0.000096% (-120.4 dB)

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Multi-Instrument Pro 3.2 - [+3DP+DLG+LCR+UDP] - <ASIO E-MU Tracker Pre | USB> - 0 **- X**  
Image: Set of the set of t - Roll A&B
V24Bit
Probe
1
1
FRswp
FRswp ÷ 0% ÷ Sample 48kHz ▲ A&B ▲ 24Bit ▲ Point 48000 Record Auto mp IMDdin IMD IMDccif BodePlot THD~f IMD~P AudioTst THD~F Oscill A: Max:: 0.3512 -0.2 02 0.3 04 0.6 07 0.8 0.5 WAVEFORM \_ O X 😵 IMD (Ch. A) -In Spectrum Analyz A: 61-250 0 H+ \/1-0 2 0.001805 % 53 👷 Signal Generator-AS... 📼 Show Editor No Loopback • 16.8 21.6 Averaged Frames: 10 2.4 ts:1 Resolution: 1.46484Hz 12 AMPLITUDE SPECTRUM in dBES ▼ B Off F Auto ▼ ×1 ▼A -200dB ▼ Off ▼ M Amplitude Spectrum ▼ Off ▼ FFT 32768 • WND Kaiser 6 • 0% DIN IMD (Test Tone: 250Hz and 8kHz mixed at an amplitude ratio of 4:1)





# 2.4 Bandwidth

## **Test Conditions**

On E-MU Tracker Pre:

- [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 80% percent. The knob for direct monitor was set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

- ASIO Driver
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- 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: 1.5Hz ~23581Hz Bandwidth (-3dB) at the sampling rate of 96kHz: 2.9Hz ~464431Hz Bandwidth (-3dB) at the sampling rate of 192kHz: 5.9Hz ~89702Hz





# **2.5 Crosstalk**

## **Test Conditions**

On E-MU Tracker Pre:

- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 80% percent. The knob for direct monitor was set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

- **ASIO** Driver
- 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

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -9.4 dBFS.

(1) Crosstalk (1kHz, -9.4dBFS): -81.0 dB, [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TRS cable. This meant that the crosstalk measured was contributed by the output channels, the loopback cable, and the input channels.



(2) Crosstalk (1kHz, -9.4dBFS): -112.8 dB, [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TS (Tip, Sleeve) cable. This meant that the crosstalk measured was contributed by the input channels, and the input of the second input channel was grounded.

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# 2.6 Dynamic Range

# **Test Conditions**

On E-MU Tracker Pre:

- [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 25% percent. The knob for direct monitor was set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

- **ASIO Driver**
- 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: Sine, 1000.4882812 Hz
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Linear average: 10 frames

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

SNR (-60dBFS, 1kHz): 52.0 dB Dynamic Range: 52.0+60=112.0 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 (Device Under Test) using the dual-FFT method.

## **Test Conditions**

On E-MU Tracker Pre:

- [Headphone Jack] was connected to [Stereo Mic Input] via a modified 1/4" male to 1/8" male TRS cable. <u>The cable was modified such that the output Channel A was connected to both the input Channels A and B. The output Channel B was not connected.</u>
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 80% percent. The knob for direct monitor was set to minimum.

• Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

In Multi-Instrument:

- ASIO Driver
- 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. As the gain and phase difference between the two channels were very small and was not discernible from the screenshot, the following values were obtained by examining the measured gain and phase difference data.

Gain Difference  $(0 \sim 24 \text{ kHz})$ :  $< \pm 0.012 \text{ dB}$ (Note: the average gain difference of -0.033 dB could be further removed by fine tuning the gain knobs for individual channels)

Phase Difference (0 ~ 24 kHz):  $< \pm 0.09$  degree





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

## **Test Conditions**

On E-MU Tracker Pre:

- [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 80% percent. The knob for direct monitor was set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

- ASIO Driver
- Sampling Rate: 192 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)
- Record Length: 192000
- FFT Size: 131072

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

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -9.4 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): -0.19/-0.05 dB (obtained by examining the data)



# **2.9 Crosstalk vs Frequency**

## **Test Conditions**

On E-MU Tracker Pre:

- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2R Mic/Line/HiZ] were at the 5<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum). The knob for the headphone was at roughly 80% percent. The knob for direct monitor was set to minimum.
- Direct Monitor: Off

## On Laptop:

Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 71%

In Multi-Instrument:

- ASIO Driver
- 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: 100-point Logarithmically Stepped Sine in the range of 20Hz~20kHz (No Spectral Leakage)
- 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 -9.4 dBFS.

(1) [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TRS cable. This meant that the crosstalk measured was contributed by the output channels, the loopback cable, and the input channels.



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(2) [Headphone Jack] was connected to [Stereo Mic Input] via a 1/4" male to 1/8" male TS cable. This meant that the crosstalk measured was contributed by the input channels, and the input of the second input channel was grounded.



# 3. Line Out -> Line In

# 3.1 Noise Level

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

- ASIO Driver
- 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): -113.8 dBFS (represented by the dotted line in the following screen shot)



# 3.2 THD, THD+N, SNR, SINAD, ENOB, Noise Level

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a 1/4" male to 1/4" male balanced TRS cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a 1/4" male to 1/4" male balanced TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

- ASIO Driver
- 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: Sine, 1000.4882812 Hz
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Linear average: 10 frames

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at peak level: -9.6 dBFS.

THD (1kHz, -9.6dBFS): 0.000622% (-104.1 dB) THD+N (1kHz, -9.6dBFS): 0.001379% (-97.2 dB) SINAD (1kHz, -9.6dBFS): 97.2 dB SNR (1kHz, -9.6dBFS): 98.2 dB ENOB (1kHz, -9.6dBFS): 15.86 Bit Noise Level (1kHz, -9.6dBFS): -110.7 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 THD a little worse, and the rest results about 10dB worse.
- Changing the sampling channel to A (mono) will make the above results a little worse.

- Connecting using <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male unbalanced TS cables instead does not have discernible effect on the above results.
- 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.
- Changing the laptop's power supply from the AC adapter to its internal battery does not have discernible effect on the above results.
- Applying A-weighting profile will make the THD+N, SNR, SINAD, ENOB, Noise Level a little better.

# 3.3 IMD

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

## In Multi-Instrument:

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

## **Test Results**

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Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at peak level: -9.6 dBFS.

SMPTE IMD (-9.6dBFS) : 0.004156% (-87.6 dB) DIN IMD (-9.6dBFS): 0.004873% (-86.2 dB) CCIF2 IMD (-9.6dBFS): 0.000119% (-118.5 dB)





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# 3.4 Bandwidth

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/4" male to <sup>1</sup>/4" male balanced TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

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

- Window Function: Rectangle
- Test Tone: White Noise
- Linear average: 200 frames

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

Bandwidth (-3dB) at the sampling rate of 48kHz: 1.5Hz ~23567Hz Bandwidth (-3dB) at the sampling rate of 96kHz: 2.9Hz ~46474Hz Bandwidth (-3dB) at the sampling rate of 192kHz: 5.9Hz ~90228Hz



Bandwidth (-3dB) (Sampling Rate = 48kHz, Record Length = 48000, FFT Size=32768)

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# 3.5 Crosstalk

## **Test Conditions**

On E-MU Tracker Pre:

• [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable

- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

- ASIO Driver
- 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 -9.4 dBFS.

Crosstalk (1kHz): -97.9 dB



# **3.6 Dynamic Range**

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a 1/4" male to 1/4" male balanced TRS cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a 1/4" male to 1/4" male balanced TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

- ASIO Driver
- 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: Sine, 1000.4882812 Hz
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Output Amplitude of the Signal Generator: 0.187% of the full scale
- Linear average: 10 frames

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

SNR (-60dBFS, 1kHz): 50.2 dB Dynamic Range: 50.2+60=110.2 dB



# **3.7 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 E-MU Tracker Pre:

- [Output 1L] was connected to both [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] via an in-house made <sup>1</sup>/<sub>4</sub>" male to 2× <sup>1</sup>/<sub>4</sub>" male balanced TRS cables
- [Output 2L] was not connected.
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.

• Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

- ASIO Driver
- 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. As the gain and phase difference between the two channels were very small and was not discernible from the screenshot, the following values were obtained by examining the measured gain and phase difference data.

Gain Difference  $(0 \sim 24 \text{ kHz})$ :  $< \pm 0.005 \text{ dB}$ (Note: the average gain difference of -0.024 dB could be further removed by fine tuning the gain knobs for individual channels)

Phase Difference (0 ~ 24 kHz):  $< \pm 0.09$  degree





# 3.8 THD+N, THD, SNR, Magnitude Response vs Frequency

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/4" male to <sup>1</sup>/4" male balanced TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

- ASIO Driver
- Sampling Rate: 192 kHz
- Sampling Bit Resolution: 24 Bit
- Sampling Channels: A&B (stereo)

- Record Length: 192000
- FFT Size: 131072
- Window Function: Rectangle
- Test Tone: 100-point Logarithmically 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

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -9.4 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): -0.20/-0.03 dB (obtained by examining the data)



## **Discussion**

In the above THD+N vs Frequency plot (upper left), a sharp dip of THD+N between 6 kHz and 7 kHz was observed. The individual THD+N spectrum at 6 kHz and 7 kHz were then analyzed (see figures below) to find out the reason. As we know, THD+N consists of harmonic distortion and noise. In the above test, the Harmonic Distortion and Noise Measurement Range was set to 20~20 kHz. This implies that, for a 6 kHz test tone, THD+N consists of 2<sup>nd</sup> and 3<sup>rd</sup> order harmonic distortion and noise. If the 3<sup>rd</sup> order harmonic distortion and noise, while for a 7 kHz test tone, THD+N consists of only 2<sup>nd</sup> order harmonic distortion and noise. If the 3<sup>rd</sup> order harmonic distortion were small compared with the 2<sup>nd</sup> harmonic distortion and noise, then the above dip would not be so discernible. However, the following two figures show that the 3<sup>rd</sup> order harmonic distortion was actually the biggest among them. This explains the sharp dip of

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THD+N between 6 kHz and 7 kHz in the above figure. Note the dotted line in the following figures represents the total noise level, and its horizontal coverage represents the frequency band from which the noise level and distortion is calculated.

With the harmonic distortion and noise measurement range set to 20~20 kHz, actually a sampling frequency of 44.1kHz is enough for this test.





# **3.9** Crosstalk vs Frequency

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" male to <sup>1</sup>/<sub>4</sub>" male balanced TRS cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

- ASIO Driver
- 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: 100-point Logarithmically 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 -9.4 dBFS.



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# 4. Line Out -> XLR Mic

# 4.1 Noise Level

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop:

Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

- ASIO Driver
- 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): -113.8 dBFS (represented by the dotted line in the following screen shot)



# 4.2 THD, THD+N, SNR, SINAD, ENOB, Noise Level

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a 1/4" TRS male to XLR male balanced cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a 1/4" TRS male to XLR male balanced cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

- ASIO Driver
- 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: Sine, 1000.4882812 Hz
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Linear average: 10 frames

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at a peak level of -9.6 dBFS.

THD (1kHz, -9.6dBFS): 0.000351% (-109.1 dB) THD+N (1kHz, -9.6dBFS): 0.001424% (-96.9 dB) SINAD (1kHz, -9.6dBFS): 96.9 dB SNR (1kHz, -9.6dBFS): 97.2 dB ENOB (1kHz, -9.6dBFS): 15.81 Bit Noise Level (1kHz, -9.6dBFS): -109.7 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 THD a little worse, and the rest results about 10dB worse.

- Changing the sampling channel to A (mono) will make the above results a little 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.
- Changing the laptop's power supply from the AC adapter to its internal battery does not have discernible effect on the above results.
- Applying A-weighting profile will make the THD+N, SNR, SINAD, ENOB, Noise Level a little better.

# 4.3 IMD

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

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

## **Test Results**

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Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at peak level: -9.6 dBFS.

SMPTE IMD: 0.002035% (-93.8 dB) DIN IMD: 0.002340% (-92.6 dB) CCIF2 IMD: 0.000099% (-120.1 dB)





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# 4.4 Bandwidth

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" TRS male to XLR male balanced cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

- ASIO Driver
- Sampling Bit Resolution: 24 Bit

- Sampling Channels: A&B (stereo)
- Window Function: Rectangle
- Test Tone: White Noise
- Linear average: 200 frames

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

Bandwidth (-3dB) at the sampling rate of 48kHz: 1.5Hz ~23562Hz Bandwidth (-3dB) at the sampling rate of 96kHz: 4.4Hz ~46535Hz Bandwidth (-3dB) at the sampling rate of 192kHz: 5.9Hz ~90657Hz



Bandwidth (-3dB) (Sampling Rate = 48kHz, Record Length = 48000, FFT Size=32768)

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# 4.5 Crosstalk

## **Test Conditions**

On E-MU Tracker Pre:

• [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/<sub>4</sub>" TRS male to XLR male balanced cable

- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

- ASIO Driver
- 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 -9.6 dBFS.

Crosstalk (1kHz): -102.1 dB



# 4.6 Dynamic Range

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a 1/4" TRS male to XLR male balanced cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a 1/4" TRS male to XLR male balanced cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

- ASIO Driver
- 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: Sine, 1000.4882812 Hz
- Harmonic Distortion and Noise Measurement Range: 20~20 kHz
- Output Amplitude of the Signal Generator: 0.228% of the full scale
- Linear average: 10 frames

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

SNR (-60dBFS, 1kHz): 50.6 dB Dynamic Range: 50.6+60=110.6 dB



# 4.7 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 dual-FFT method.

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to both [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] via an in-house made <sup>1</sup>/<sub>4</sub>" male to 2 × XLR male balanced TRS cables
- [Output 2L] was not connected.

- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

- ASIO Driver
- 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. As the gain and phase difference between the two channels were very small and was not discernible from the screenshot, the following values were obtained by examining the measured gain and phase difference data.

Gain Difference (0 ~ 24 kHz):  $< \pm 0.008$  dB

(Note: the average gain difference of -0.023 dB could be further removed by fine tuning the gain knob for individual channel)

Phase Difference (0 ~ 24 kHz):  $< \pm 0.10$  degree





# 4.8 THD+N, THD, SNR, Magnitude Response vs Frequency

## **Test Conditions**

On E-MU Tracker Pre:

- [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

- ASIO Driver
- Sampling Rate: 192 kHz
- Sampling Bit Resolution: 24 Bit

- Sampling Channels: A&B (stereo)
- Record Length: 192000
- FFT Size: 131072
- Window Function: Rectangle
- Test Tone: 100-point Logarithmically 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

Please refer to the Multi-Instrument manual for a clear definition of the following parameters. They were measured at peak level: -9.4 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): -0.23/-0.05 dB (obtained by examining the data)



# **4.9** Crosstalk vs Frequency

## **Test Conditions**

On E-MU Tracker Pre:

• [Output 1L] was connected to [Input 1L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable

- [Output 2L] was connected to [Input 2L Mic/Line/HiZ] via a <sup>1</sup>/4" TRS male to XLR male balanced cable
- The knobs for [Input 1L Mic/Line/HiZ] and [Input 2L Mic/Line/HiZ] were at the 4<sup>th</sup> mark roughly (1<sup>st</sup>: minimum, 11<sup>th</sup>: maximum), the rest of the knobs on the panel were set to minimum.
- Direct Monitor: Off
- Phantom Power Off

On Laptop: Powered by its AC adapter.

On Windows Control Panel:

- [Sound]>[Recording]>[E-MU Tracker Pre Microphone]>[Levels]>[Main Volume]: No effect
- [Sound]>[Playback]>[E-MU Tracker Pre Speakers]>[Levels]>[Main Volume]: 68%

In Multi-Instrument:

- ASIO Driver
- 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: 100-point Logarithmically 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 peak level: -9.6 dBFS.



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