Third-Generation Mbox
Technology Guide

Table of Contents

Design Philosophy Behind the Third-Generation Mbox Family

In designing the new Avid® Mbox® family of audio interfaces, our industry-leading engineering team set out to create best-in-class products that would surpass their previous efforts in this category—as well as those of other manufacturers. To meet this goal, we leveraged technology from our top-of-the-line Pro Tools|HD recording systems, and also drew from our extensive experience developing mobile recording solutions. In addition, we conducted numerous customer surveys and interviews, and incorporated a broad array of user requests into the new Mbox series—from higher audio quality and enhanced integration with Pro Tools® software, to a rock-solid new chassis and ergonomic front-panel design. Finally, we carefully optimized each member of the Mbox family for its specific function—from serious desktop production to mobile field work.

The Elements of a Great Audio Interface

It's important to understand the reasons why some interfaces sound better than others, even when recording at equal sample rates and bit depths. Much of the answer lies in the quality of the components.

Converters

Even if the performers, instruments, rooms, and microphones are excellent, a recording can suffer if the interface uses poor-quality converters to convert between the analog and digital domains. Low-quality converters create noise and distortion, which degrade the quality of the recording. Excellent converters deliver pure, powerful sound, even when the final playback medium is only 16 bits.

Preamps

It's important to use preamps that deliver high gain without introducing unwanted noise and hiss from their internal circuitry. This provides clean, natural-sounding audio regardless of how much gain is required. The signal-to-noise ratio* (expressed in negative values) is an important gauge of the quality of an interface's converters and preamps; lower (more negative) numbers indicate better performance.

Clocking

Audio interfaces must clock their converters at regular intervals in order to capture sound accurately. A poorly designed clock can breed jitter, causing the interface to sample audio irregularly. The irregularity results in audio distortion. An excellent clock has minimal jitter, ensuring that the digital audio converters stay rigidly time-locked and minimize related distortion.

Emissions Compliance

An excellent audio interface will be designed and manufactured to ensure that electronic emissions comply with the emission limits set by national and international standards agencies. It will also comply with the requirements to continue to properly operate with specified levels of emissions from nearby electrical and electronic equipment.

It's not enough to just use premium-quality components—it's absolutely critical to arrange and connect them with the utmost precision and expertise. This requires a deep level of experience and specialized training.

*Beware when comparing signal-to-noise specs from different manufacturers. Some companies only measure the noise introduced by the preamps and ignore the complete signal path; others state the theoretical specs of the converters and not the actual measured specs. This results in a signal-to-noise ratio that is misleading. Avid publishes only "real-world" specs, so users will know how the interface will truly perform before making a purchase.

The Keys to the Mbox Sound

Listening Tests

Before commencing work, our design team engaged in a series of listening tests. We sampled Avid interfaces as well as products from other manufacturers, then worked to develop the clearest, most transparent-sounding interfaces possible. With each subsequent revision of the electronics, our team reconvened for another set of exhaustive listening tests to ensure exceptional performance.

Premium Components and Efficient Layout

Our engineers started by selecting the best possible components. They sourced the finest D-A and A-D converters, as well as crystal-clear preamps for pure, pristine sound from start to finish. Then they worked to ensure the shortest possible path between components, resulting in superior audio quality. (See signal path diagrams in "Signal Path, Internal Layout, and Routing" section.)

World-Class Clocking and Jitter-Elimination Technology

The Mbox Pro interface features critically acclaimed JetPLL technology to provide extremely stable synchronization and eliminate jitter that can degrade audio quality. The Mbox and Mbox Mini interfaces also feature high-quality clocks to provide accurate, low-jitter audio sampling and exceptionally low resulting distortion.

Industrial and Electrical Design

Our engineering team worked hand in hand with our industrial designers to pair an aesthetically pleasing and ergonomic exterior with optimized internal electronics and connections. We carefully considered the position of every element. For example, we placed the preamp jacks on the same side of the interface as the gain pots and controls in order to ensure the shortest possible internal path—rather than routing them amongst other components that could introduce noise and interference. We fine-tuned every detail, down to the routing of every copper trace on the printed circuit boards. We spent months balancing the external design with the internal, in order to deliver an intuitive user experience as well as pristine sound.

Power

Since the Mbox Pro interface is intended for project studio use, it features an extremely efficient, low-noise power supply. In contrast, the Mbox and Mbox Mini each feature state-of-the-art bus power architecture in order to deliver high performance during mobile use, as well as in the studio.

Our engineering team paid exceptional attention to detail when considering the power requirements for each Mbox interface. All microphones draw different levels of power, so we started by sampling a wide variety of popular mics to understand the range of power needs. Then we designed the interfaces to provide adequate phantom power for all possible mics, with a slight bit of headroom. We carefully selected every single power-drawing component in the interfaces, continually minding the overall power budget. Then we pored over the schematics to analyze hot spots, and cut back wherever possible to ensure power efficiency—without ever compromising performance.

Hardware Build

In direct response to customer feedback, the third-generation Mbox interfaces are housed in professional-grade, rugged, metal chassis designed to withstand the rigors of heavy-duty mobile and studio use. All structural components are made of metal; a solid metal extrusion encases a secondary inner metal chassis, which ensures the precise alignment of all internal components. In addition, the metal enclosure—along with proper circuit design, filtering, and layout—provides immunity to emissions from nearby electronics equipment, keeping the sound quality pristine. A molded plastic faceplate and soft-touch knobs enhance the aesthetic and tactile appeal.

Expertise

Our engineering team relied on their personal experience as musicians and audiophiles to ensure that the Mbox interfaces would yield pleasing, musical results in even the most demanding circumstances. For example, if pushed to the point of distortion when capturing heavy vocals, the distortion sounds musical rather than harsh. These audible performance characteristics further separate Mbox from products by other manufacturers.

Like our engineering team, our testing department is full of working musicians, audio engineers, and audiophiles. These power-users rigorously tested the interfaces to make sure that they would perform optimally in a vast array of real-word scenarios—with a wide variety of computers, operating systems, microphones, and other gear. After standing up to their discerning ears and uncompromising scrutiny, we knew the Mbox interfaces would meet the sonic expectations of even the most demanding users.

Signal Path, Internal Layout, and Routing

In addition to selecting premium components and creating the shortest possible signal path between them, our engineers worked to optimize each model's signal chain for its intended use, as detailed below.

Mbox Pro Signal Path
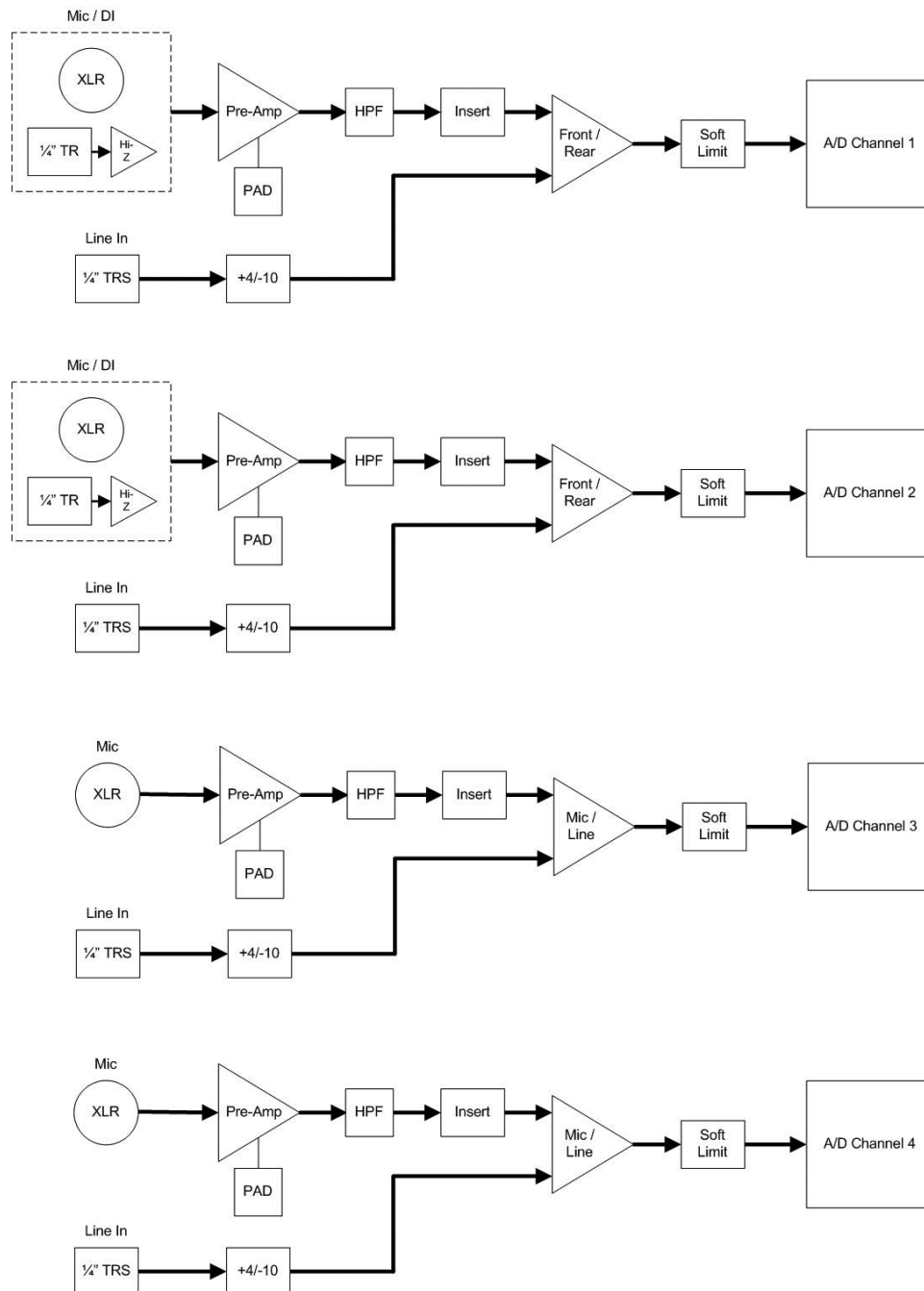
The Mbox Pro audio interface features 8 x 8 simultaneous channels of I/O. There are four microphone inputs with 48V phantom power (two XLR/DI combo, two XLR), plus four 1/4" TRS line inputs. The DSP and software-based mixer lie at the heart of the Mbox Pro interface, facilitating a huge variety of routing options. The mixer also provides access to a variety of hardware-based low-latency effects.

Microphone Input

The signal goes from the XLR input into a premium-quality preamp with a pad, which provides over 74 dB of gain range (including the 20 dB pad). From there, the signal goes to a high-pass filter, which is controlled by software via a high-quality relay. Then the signal passes to an insert jack on the back of the interface, so the user can send to external devices, and the return will come in through the same insert.

Line Input

The Mbox Pro interface is specifically optimized for desktop recording scenarios, where a user is likely to leave the line inputs plugged in at all times. A Front/Rear switch enables the user to choose between the preamp signals or line inputs on the back of the interface. The signal from the line input does not pass through the preamp; instead it connects directly to the converter, ensuring that the sound is not colored in any way. The line input features a +4/-10 switch so a user can switch between professional- and consumer-level signals.

Then, users have the option of passing the signal to the soft-clip limiter, which features the same technology as our top-of-the-line Pro Tools|HD 192 I/O audio interface, enabling users to track extremely hot signals without overloading the inputs and clipping. Finally, the signal feeds directly to the premium-quality A/D converter, which delivers world-class performance.

Instrument Input

The instrument input follows the same path as the microphone input, and thereby benefits from the same wide gain range and control via the gain knob. The instrument input is optimized to cover a wide range of signal strengths and output levels (passive and active guitars, etc.). The dynamic range and distortion specs are dramatically improved compared to the previous generation.

Mbox Signal Path
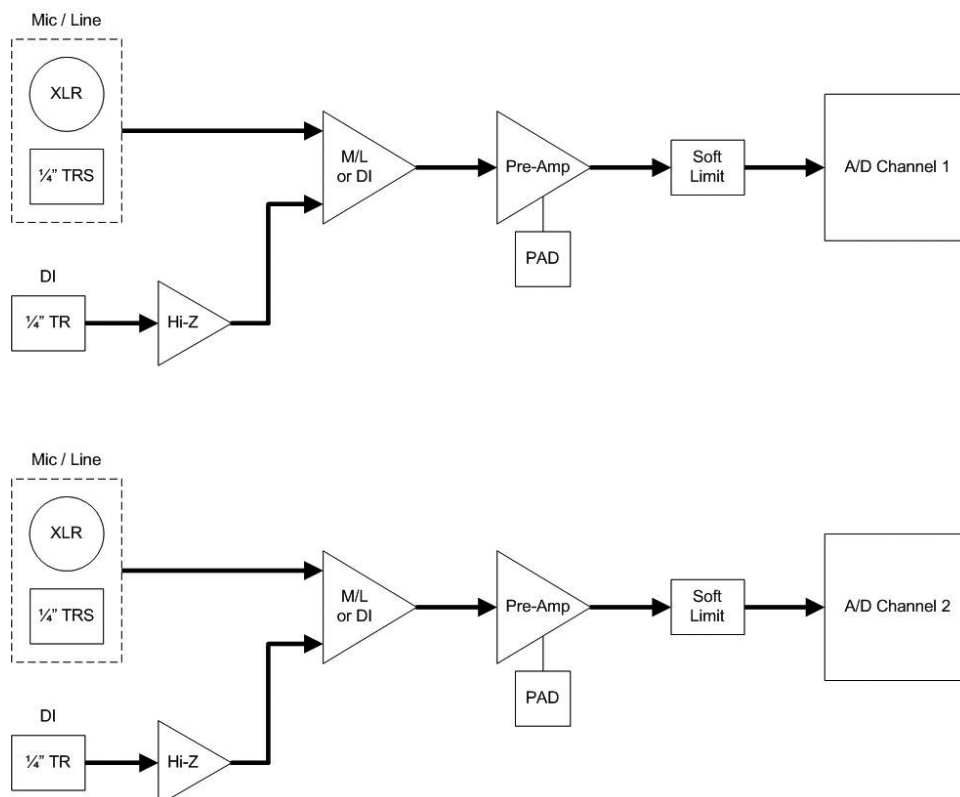
The Mbox interface provides 4 x 4 simultaneous channels of I/O—two XLR mic/line combo inputs with 48V phantom power, and two 1/4" DI inputs on the front panel for easy access. The Mbox signal path is designed to offer optimum flexibility for mobile scenarios and field use. The line inputs pass through the preamps, so users can plug in a variety of sources and just tweak the gain as needed. The high-quality preamp does not color the signal, and the placement of the mic and line inputs on the same circuit ensures that no additional noise is introduced. As a result, the Mbox delivers clear, pristine sound. The mixer also provides access to a variety of hardware-based low-latency effects.

Mbox Mini Signal Path
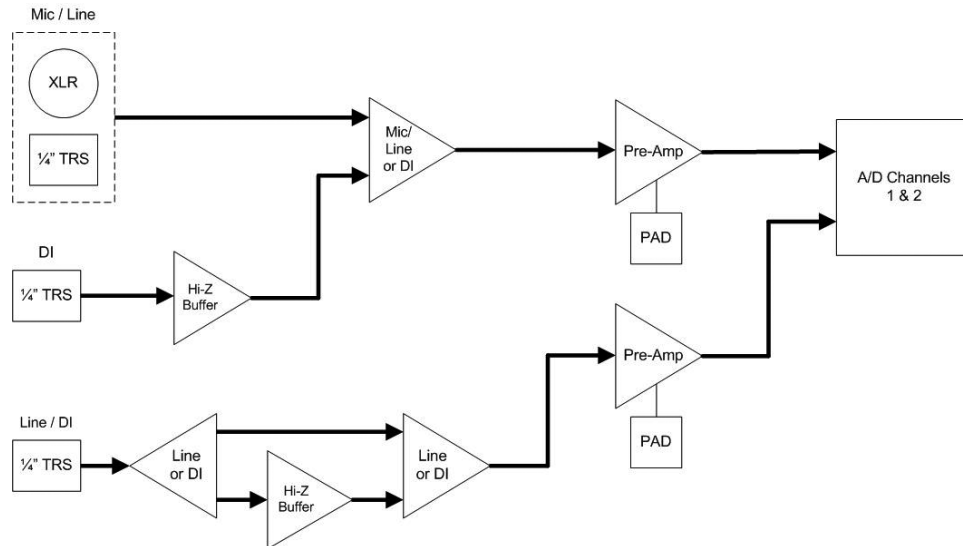
With 2 x 2 simultaneous channels of I/O, the Mbox Mini interface is designed to be a high-quality, personal, portable interface. It's built for simplicity, and optimized to deliver clean, clear performance. Its twin preamps accept a combination of mic, instrument, and line inputs, and provide exceptional quality like those found on the Mbox Pro and Mbox interfaces.

Additional Resources

From the powerhouse Mbox Pro to the ultra-compact Mbox Mini, the new family of Mbox interfaces delivers unparalleled sound quality and flexibility for today's recording enthusiasts. For more information about each model, visit www.avid.com/MboxFamily.

Appendix

As with all Avid product specifications, the published Mbox specs reflect actual performance measurements.

## Mbox Family Specification Comparison

	Mbox Pro	Mbox	Mbox Mini
Line Inputs (Balanced)			
Freq Response, 20 Hz - 20 kHz	+/-0.1 dB	+/-0.1 dB	+/-0.1 dB
Dynamic Range (A-wt)	112 dB	110 dB	106 dB
SNR (A-wt)	-112 dB	-110 dB	-106 dB
THD+N, 1 k, -1 dBFS	-100 dB	-100 dB	-94 dB
Crosstalk at 1 k	-120 dB	-120 dB	-116 dB
Maximum Input Level	+14 dBu / +6 dBV (switched)	+4.2 dBu	+0 dBu
Input Impedance	10 k (20 k)	10 k (20 k)	10 k (20 k)
Mic Inputs (Balanced)	**Min Gain, No Pad**	**Min Gain, No Pad**	**Min Gain, No Pad**
Freq Response, 20 Hz - 20 kHz	+/-0.1 dB	+/-0.1 dB	+/-0.1 dB
Dynamic Range (A-wt)	110 dB	110 dB	106 dB
SNR (A-wt)	-110 dB	-110 dB	-106 dB
THD+N, 1 k, -1 dBFS	-100 dB	-100 dB	-94 dB
EIN Unwtd, 54 dB gain, 150 R	-128 dB	-128 dB	-128 dB
Crosstalk at 1 k	-120 dB	-120 dB	-116 dB
Max Input Level (No Pad)	+0.5 dBu	+4.2 dBu	+0 dBu
Max Input Level (With Pad)	+20.5 dBu	+24.2 dBu	+20 dBu
Input Impedance	1.8 k (3.6 k)	2.2 k (4.4 k)	2.2 k (4.4 k)
Gain Range	54 dB (74 dB with Pad)	54 dB (74 dB with Pad)	54 dB (74 dB with Pad)
Pad in dB	-20 dB	-20 dB	-20 dB
Inst Inputs (Unbalanced)	**Min Gain, No Pad**	**Min Gain, No Pad**	**Min Gain, No Pad**
Freq Response, 20 Hz - 20 kHz	+/-0.1 dB	+/-0.1 dB	+/-0.1 dB
Dynamic Range (A-wt)	109 dB	109 dB	105 dB
SNR (A-wt)	-109 dB	-109 dB	-105 dB
THD+N, 1 k , -1 dBFS	-98 dB	-98 dB	-94 dB
Crosstalk at 1 k	-120 dB	-120 dB	-110 dB
Max Input Level	+16 dBV	+16 dBV	+16 dBV
Input Impedance	1 Mohm	1 Mohm	1 Mohm
Gain Range	54 dB (74 dB with Pad)	54 dB (74 dB with Pad)	54 dB (74 dB with Pad)
Pad in dB	-20 dB	-20 dB	-20 dB
Aux Inputs (Unbalanced)			
Freq Response, 20 Hz - 20 kHz	+/-0.1 dB	n/a	n/a
Dynamic Range (A-wt)	105 dB	n/a	n/a
SNR (A-wt)	-105 dB	n/a	n/a
THD+N, 1 k, -1 dBFS	-98 dB	n/a	n/a
Crosstalk at 1 k	-120 dB	n/a	n/a
Maximum Input Level	+2 dBV	n/a	n/a
Input Impedance	10 k	n/a	n/a
Line Outputs (Balanced)	**Max Level**	**Max Level**	**Max Level**
Freq Response, 20 Hz - 20 kHz	+/-0.1 dB	+/-0.1 dB	+/-0.1 dB
Dynamic Range (A-wt)	109 dB	109 dB	109 dB
SNR (A-wt)	-109 dB	-109 dB	-109 dB
THD+N, 1 k, -1 dBFS	-102 dB	-102 dB	-93 dB
Crosstalk at 1 k	-120 dB	-110 dB	-110 dB
Maximum Output Level	+14 dBu	+10.2 dBu	+10.2 dBu
Headphone Outputs	**Max Level, 32 R**	**Max Level, 32 R**	**Max Level, 32 R**
Freq Response, 20 Hz - 20 kHz	+/-0.2 dB	+/-1.0 dB	+/-0.2 dB
Power into Ohms	60 mW into 32 R	20 mW into 32 R	20 mW into 32 R

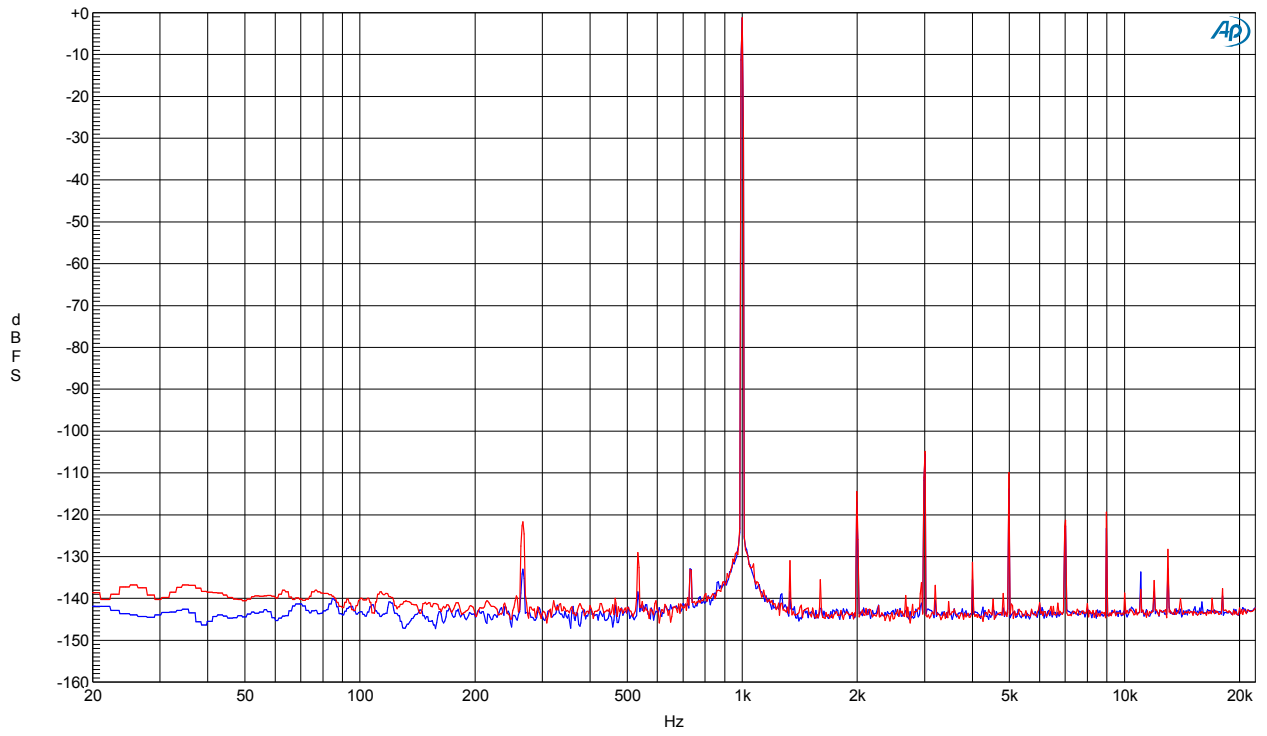# Frequency Response and Total Harmonic Distortion (THD)
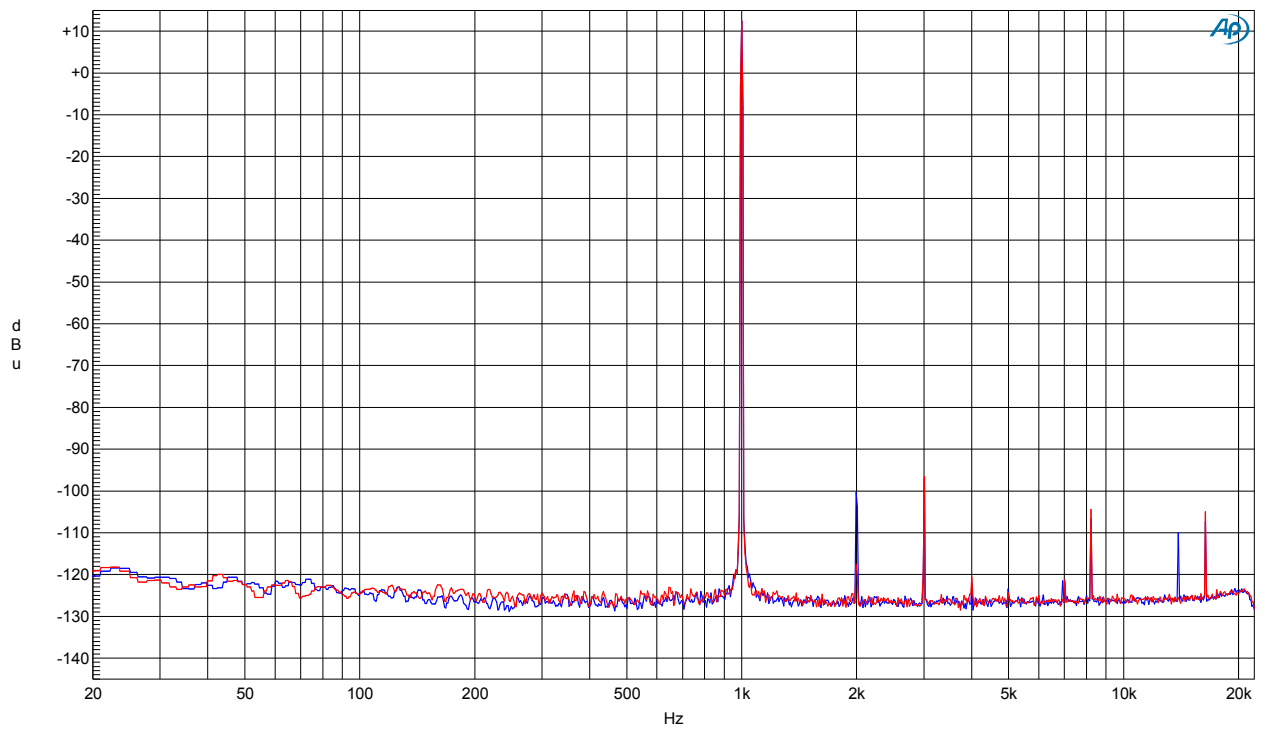
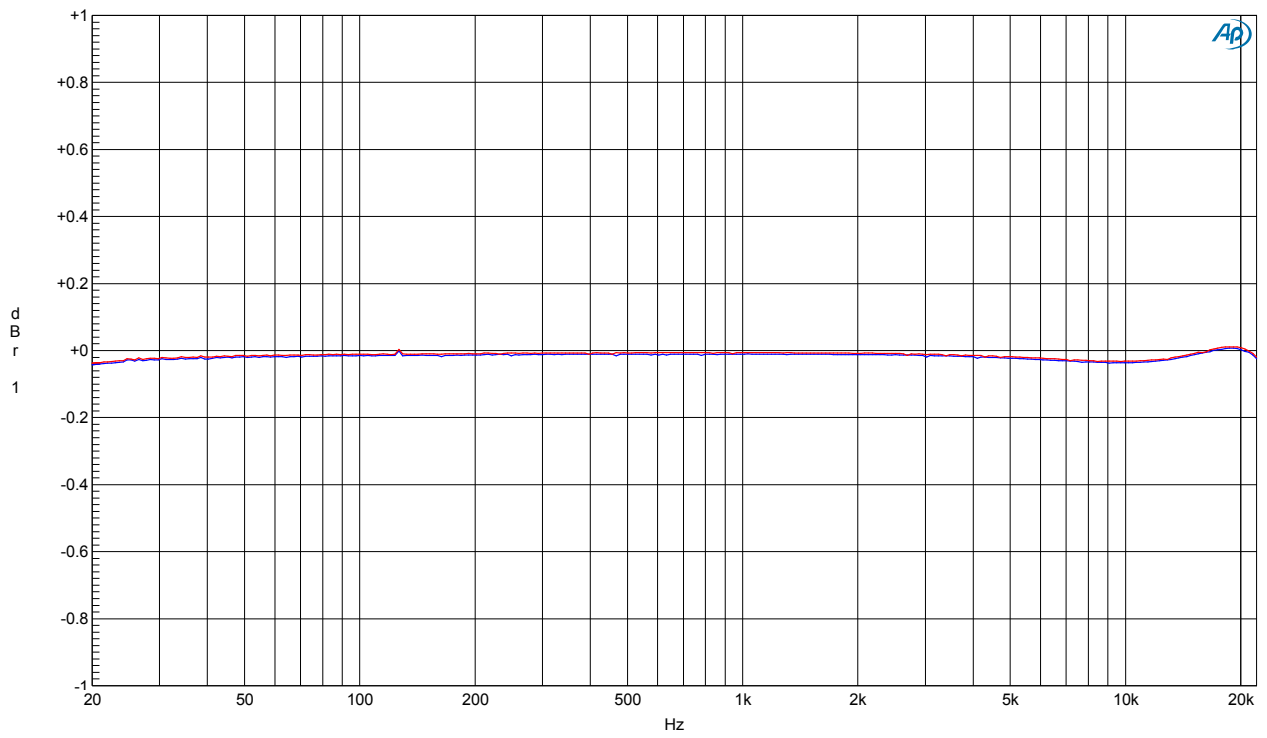## *Mbox Pro Input Frequency Response*
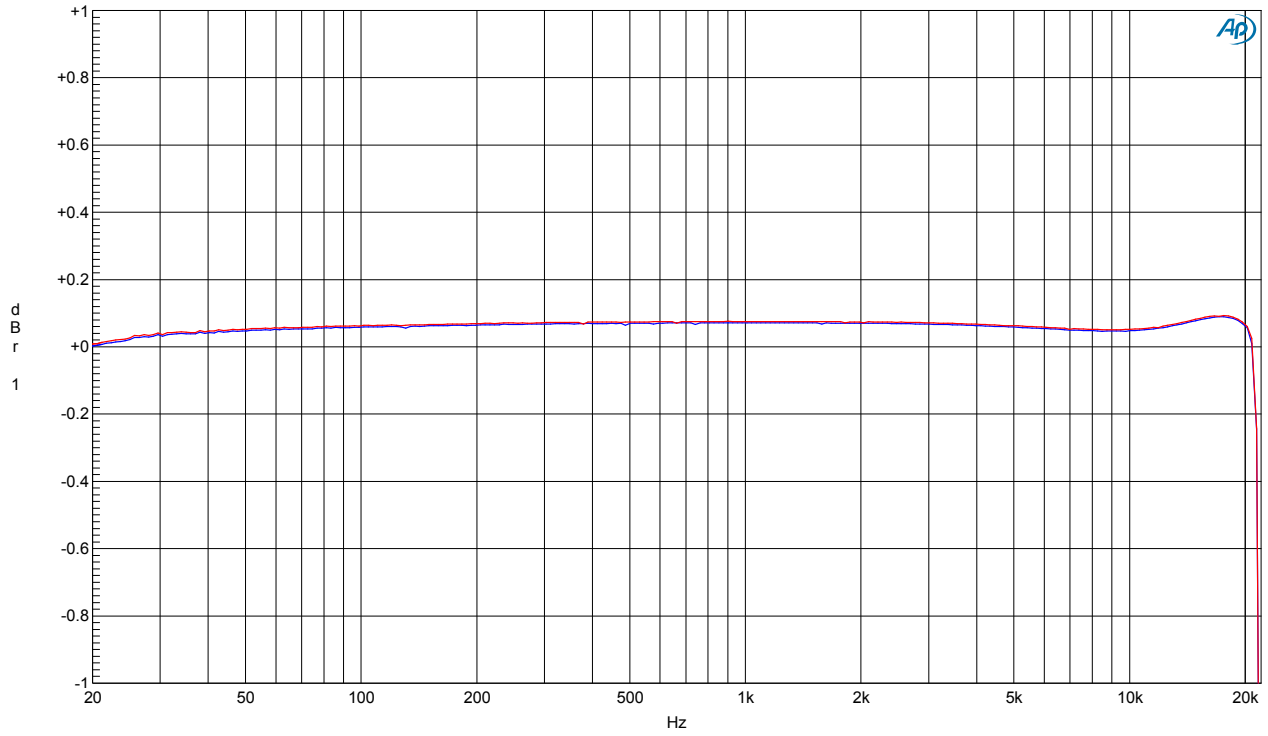
Mbox Pro Output Frequency Response
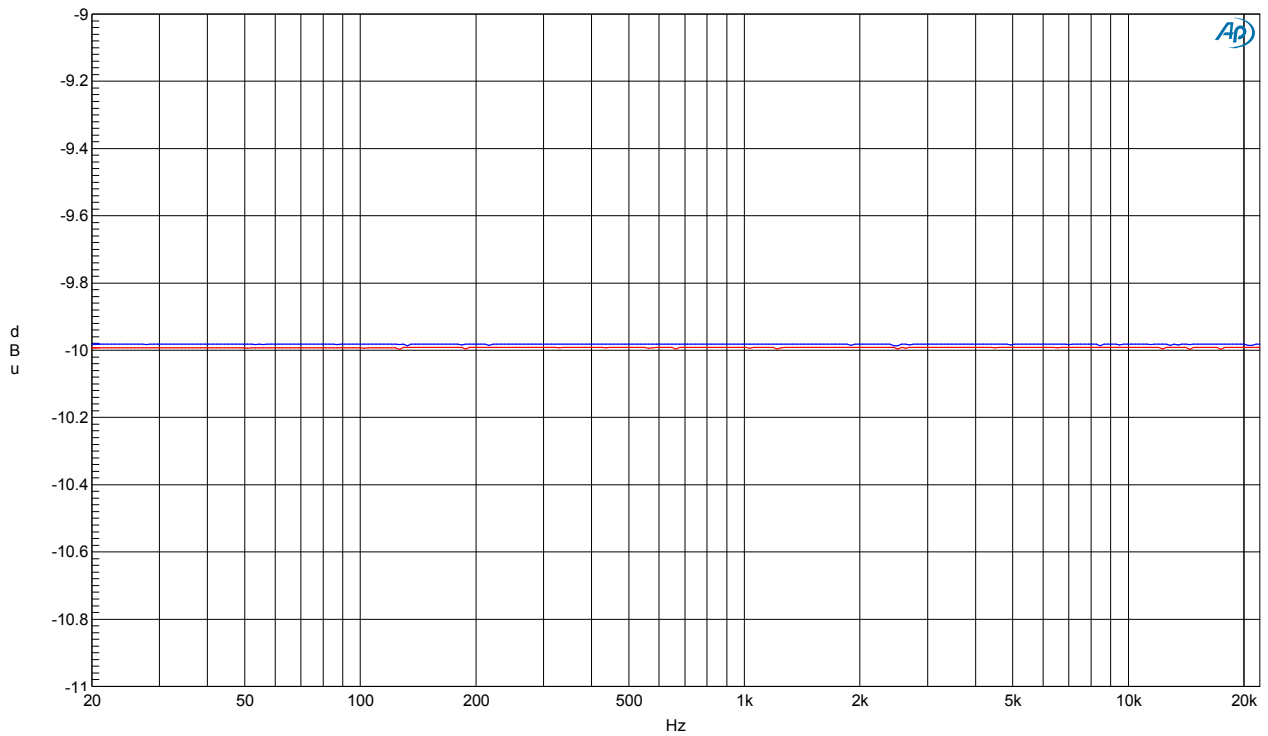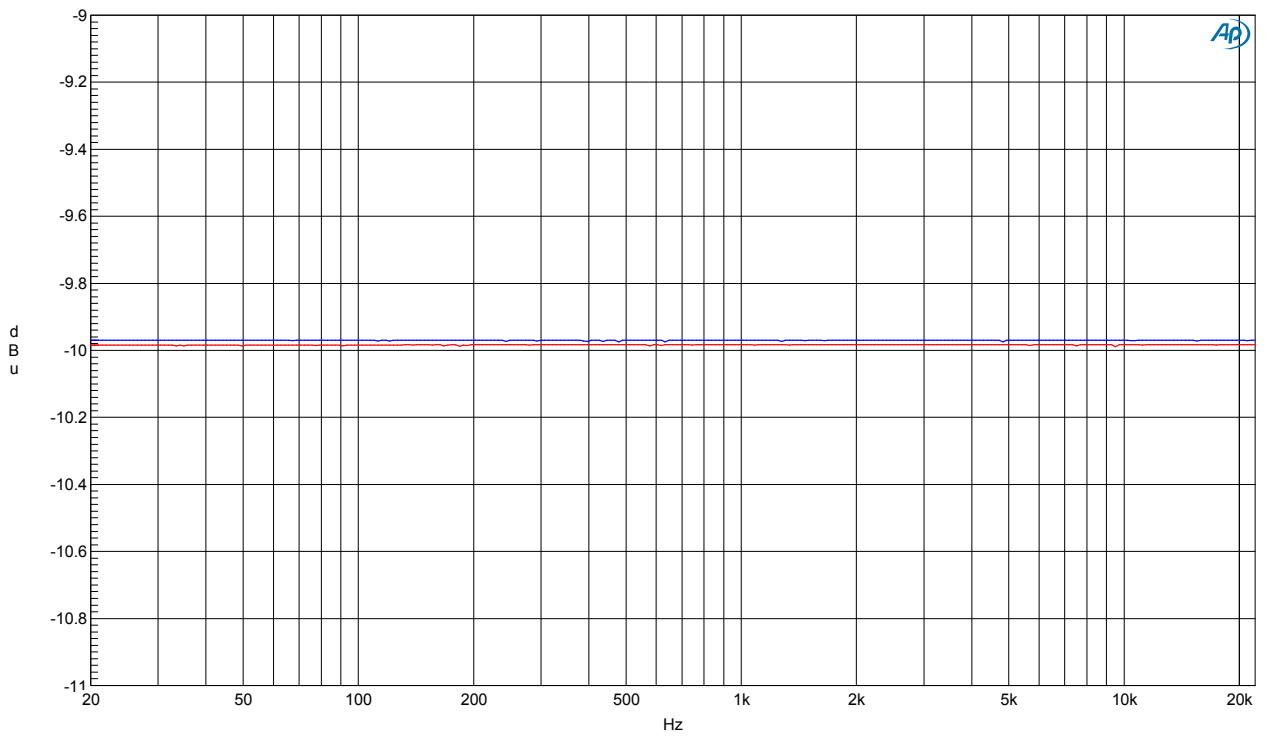
Mbox Pro Input THD
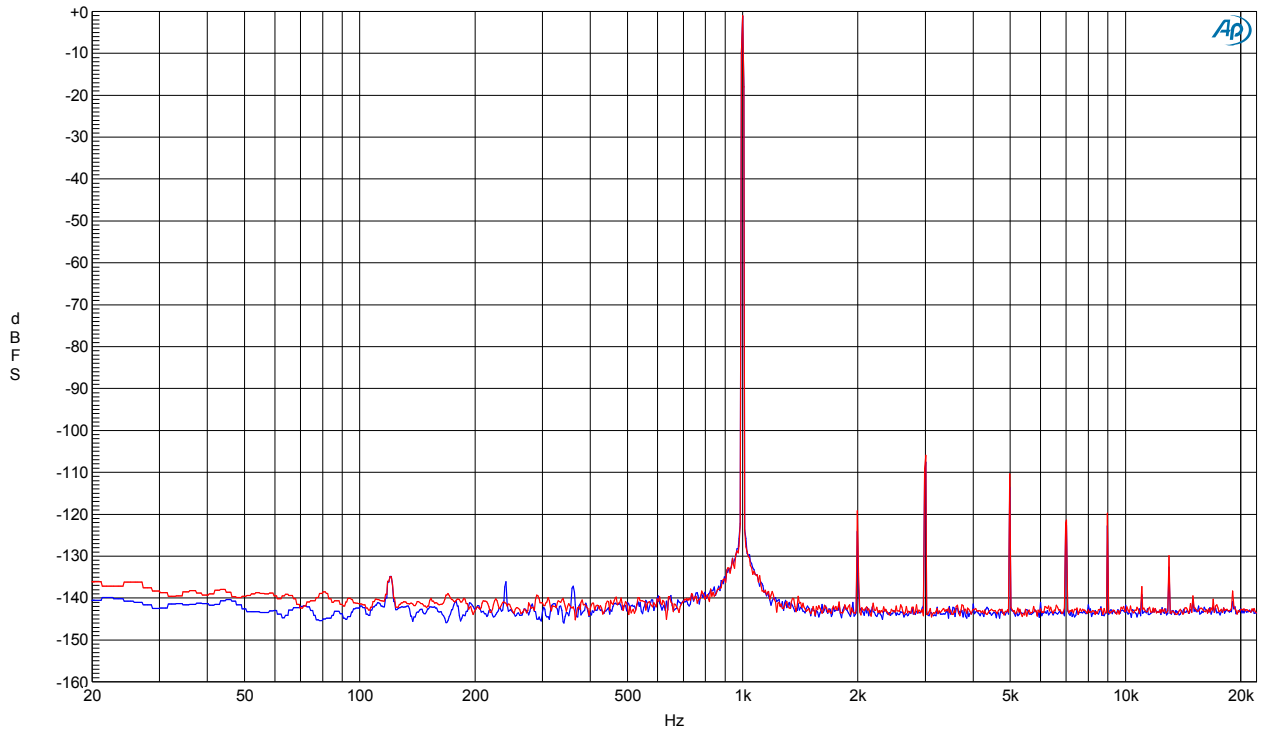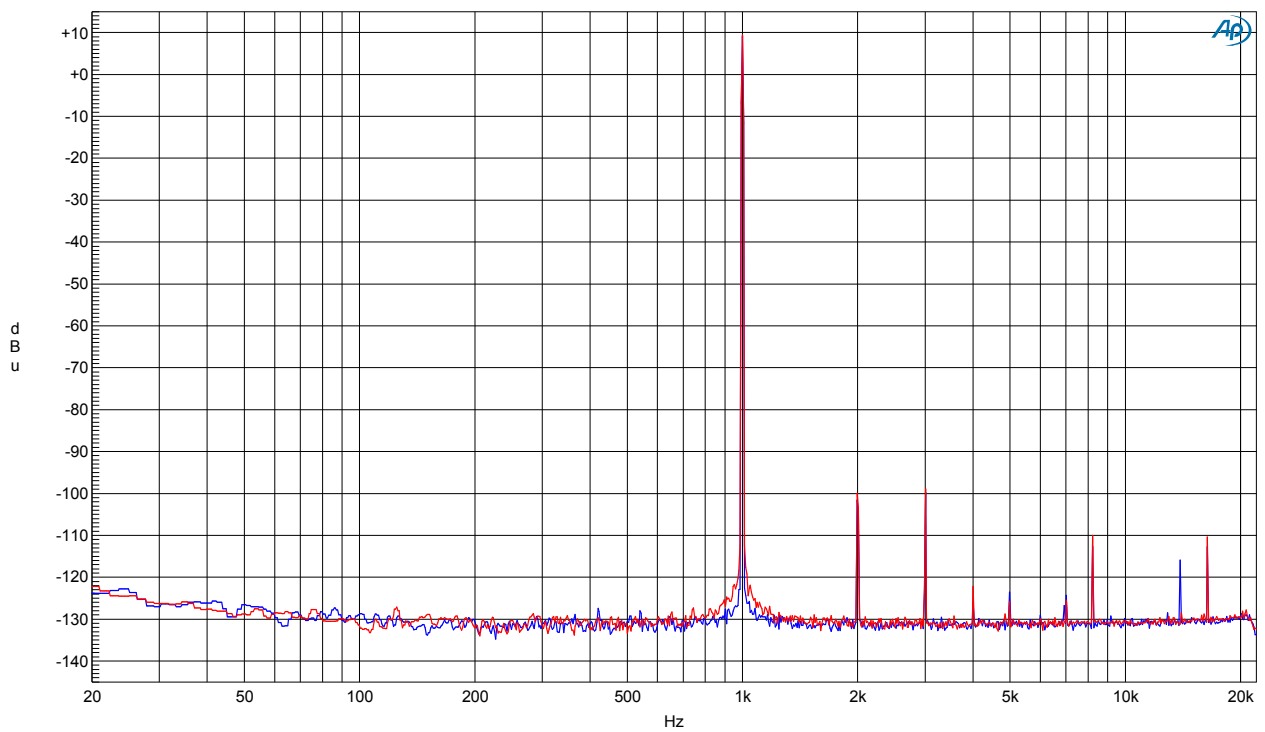

Mbox Pro Output THD

Mbox Input Frequency Response

Mbox Output Frequency Response
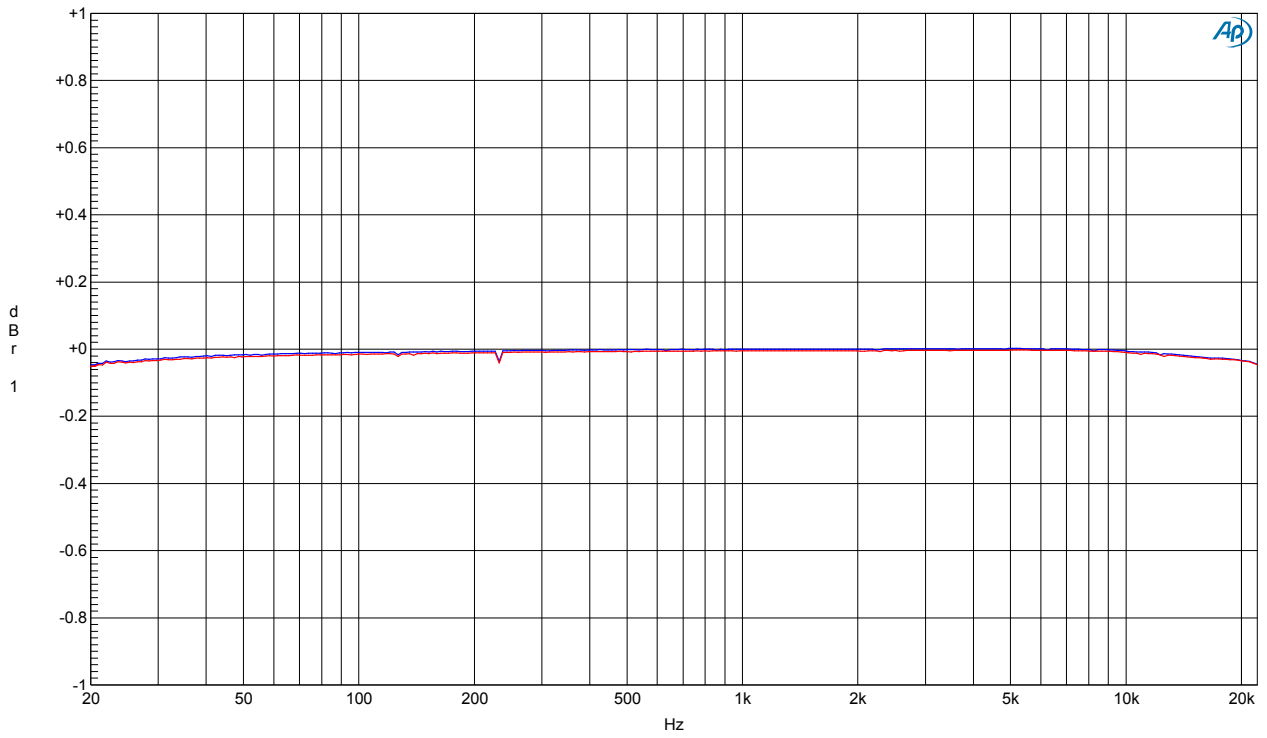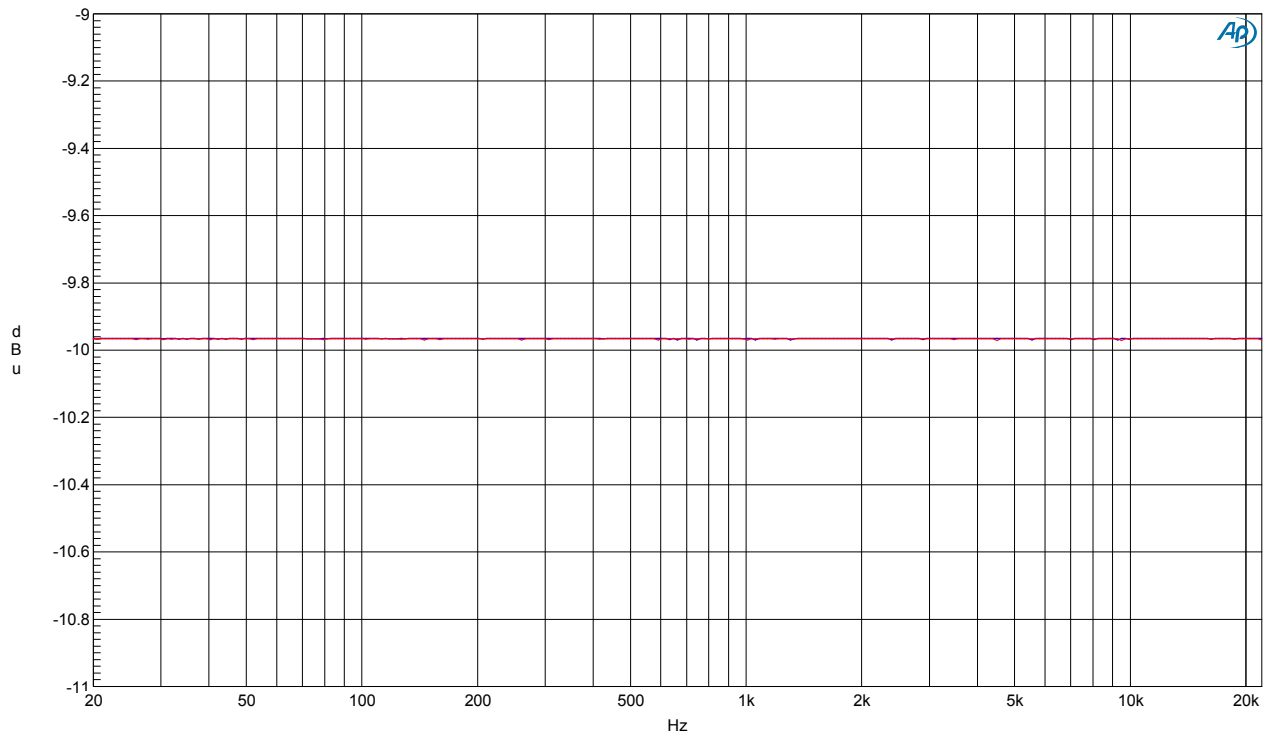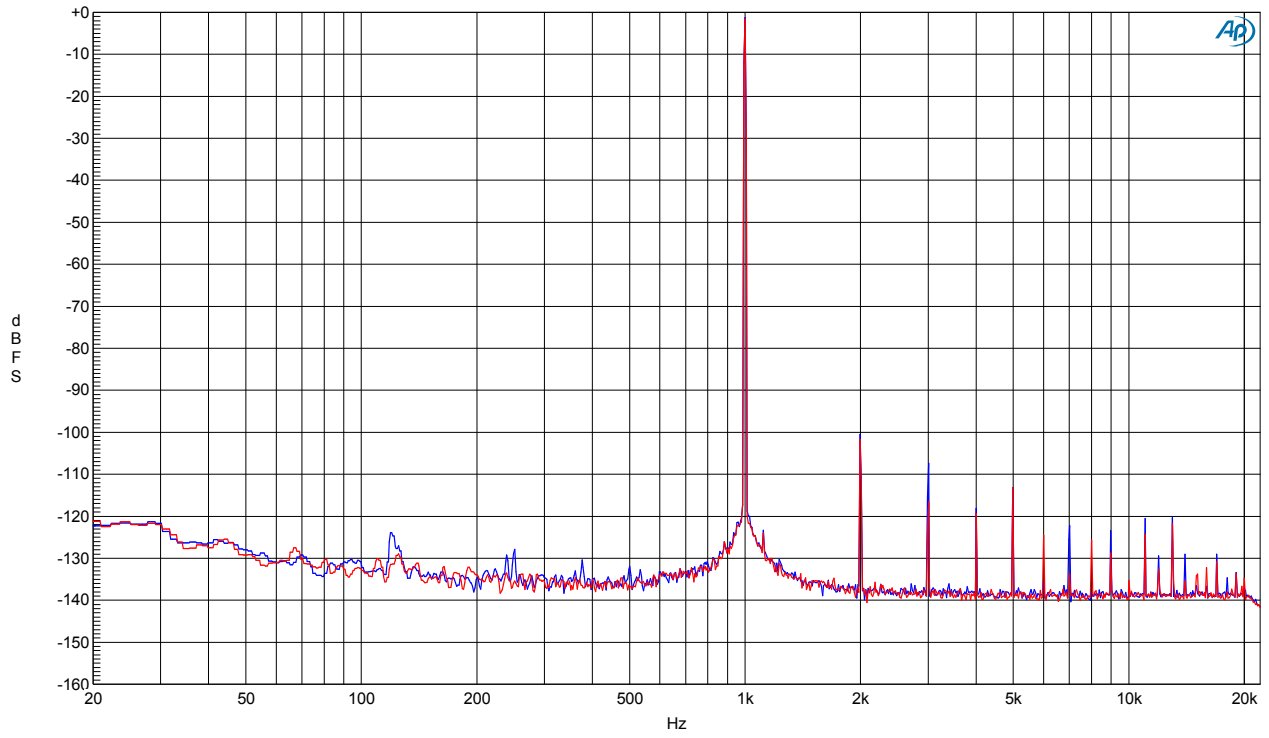
Mbox Input THD

Mbox Output THD

13

Mbox Mini Input Frequency Response

Mbox Mini Output Frequency Response

14

Mbox Mini Input THD

Mbox Mini Output THD