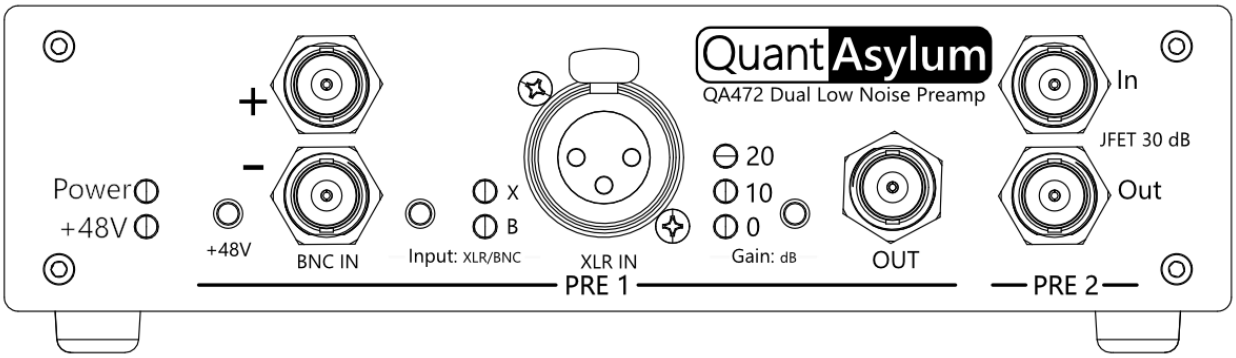
QuantAsylum

QA472 Dual PreAmp



Introduction

The QA472 features dual pre-amps. PRE1 includes both BNC and XLR inputs (switchable using a front-panel button), switchable 48V phantom power on the XLR input, and a selectable 0, 10 or 20 dB gain. This amp is primarily designed for amplifying balanced sources, including commercially available microphones. PRE1 is based on an INA849, due to its tight device-to-device matching that has been achieved via laser-trimming. The tight gain matching means that the QA472 unit-to-unit device gain-error matching is just ±0.05 dB. If you are used to mic preamps based on the SSM2019 or similar, you are also used to the associated ±0.5 dB gain error. The INA849 has made significant strides in this area. In a test bay, this means you can swap the QA472 without changing the calibration for that bay.

PRE2 is an ultra-low-noise 30 dB JFET amp based on the JFE150. FET amps are known for delivering exceptional noise performance even when source impedances are high. This amp is primarily designed for amplification of higher-impedance sources, or when noise levels are required that are beyond the levels possible with modern low-noise opamps.

The QA472 is USB powered, and the compact size of the QA472 (177W x 44H x 97D mm and 450g) means you can take it just about anywhere.

Note: While the QA472 is USB powered, it is not USB controlled. Settings are changed by pressing a momentary push-button on the front panel. The QA472 will remember your settings across power cycles.

Specifications

Figures below are subject to change without notice. See the description adjacent the spec to understand the operating conditions. Following the specifications, you will find measurement plots showing representative performance. There will be unit-to-unit variation on these graphs. Reasonable efforts have been made to ensure the accuracy of this document. However, QuantAsylum USA LLC assumes no liability for inaccuracies or omissions. QuantAsylum reserves the right to change the specs of the QA472 at any time.

General

USB Connector	USB Type B. Note the QA472 is USB powered, but settings cannot be controlled via USB.
USB Current	Approximately 100 mA.
Isolation	The QA472 was tested during design to offer >10Gohm of isolation between Audio Common (BNC Shell) and USB ground (USB shell) @ 1 kV test voltage. The isolation transformers are rated for 2.5 kV (1 minute). Isolation is not directly confirmed on each unit but can be verified using a DVM or Megger. Do not exceed ±50V in ground potentials between USB ground and Audio Common.
Operating Temperature	10°C to 35°C ambient, with 5-minute warmup. Operation outside those limits generally isn't a problem, but the accuracy may be degraded and/or the noise floor may increase.

Mechanical

Dimensions	177W x 44H x 97D
Weight	396 grams
Case Material	Powder-coated aluminum (2mm thick front panel, 1.6mm thick top/bottom)

Preamp #1 (See Attached Performance Plots)

Inputs	Balanced BNC or XLR (user selectable). Phantom voltage may be optionally applied to the XLR inputs.
Input Z	Phantom Off: 110kΩ Balanced 55kΩ Single-ended Phantom On: 13.6kΩ Balanced 6.8kΩ Single-ended
Input Coupling	AC, F_c < 1 Hz
Input Max DC	-1V, +50V (relative to BNC Shells), but current must be limited to <20 mA. Phantom Voltage will naturally limit current to far below this limit because it is delivered via 6.8k pull-up resistors. Voltages from -1 to 15V can be sustained indefinitely. For input voltages greater than 15V, the instantaneous current that will flow is expressed as follows: I = (Vin-15)/220, where I is the peak current, 15 is the internal supply rail, and 220 is the value of a current limiting series R. So, connecting the input to 19.4V will result in a 20 mA peak current flowing momentarily. Beyond 19.4V, use a series R to further limit the current. Contact support with any questions.
Noise (20-20 kHz)[1] [2]	0 dB Setting: -102.5 dBV RTO, -102.5 dBV RTI, -104.5 dBV RTI A-Weighted 10 dB Setting: -102.0 dBV RTO, -112.0 dBV RTI, -114.0 dBV RTI A-Weighted 20 dB Setting: -100.5 dBV RTO, -120.5 dBV RTI, -122.5 dBV RTI A-Weighted
Gain and Gain Accuracy	0 dB Setting: 0.00 dB gain nominal, ± 0.05 dB 10 dB Setting: 9.94 dB gain nominal, ± 0.05 dB 20 dB Setting: 20.01 dB gain nominal, ± 0.05 dB
THD (20 kHz)	Typically better than -110 dB @ 1 kHz. See plots.
THD+N (20-20 kHz)	Typically better than -95 dB @ 1 kHz. See plots.
Frequency Response	Typically 2.5 MHz (-3 dB) at 20 dB gain. See plots.
Phantom Voltage	46.75V ±1.25%
Output Z	100Ω

Preamp #2 (See Attached Performance Plots)

Input	BNC
Input Z	1MΩ
Input Coupling	AC, F_c < 1 Hz
Input Max DC	-1, +50V (relative to BNC shells), but current must be limited to <20mA (100mA surge for 50 mS). Voltages from -1 to 15V can be sustained indefinitely. For input voltages greater than 15V, the instantaneous current that will flow is expressed as follows: I = (Vin-15)/10, where I is the peak current, 15 is the internal supply rail, and 10 is the value of a current limiting series R. So, connecting the input to 16V will result in a 100 mA peak current flowing momentarily. Beyond 16V, use a series R to further limit the current. Contact support with any questions.
Noise (20-20 kHz)[3]	-102.0 dBV RTO, -132 dBV RTI, -134.2 dBV A-Weighted
Gain and Gain Accuracy	29.8 dB, ± 0.1 dB

[1] See Plots Section for Noise Density

[2] Noise is unchanged with Phantom Power on or off (XLR Input)

[3] See Plots Section for Noise Density

THD (20 kHz)	Typically better than -90 dB @ 1 kHz. See plots.
THD+N (20-20 kHz)	Typically better than -80 dB @ 1 kHz. See plots
Frequency Response	20 – 40 kHz, +0, -0.2 dB. See plots.
Output Z	100Ω

Other

Included Accessories	None
Box Size	The QA472 box is 180x130x21 mm. For bulk shipping, up to 6 QA472 can be shipped in a single carton.

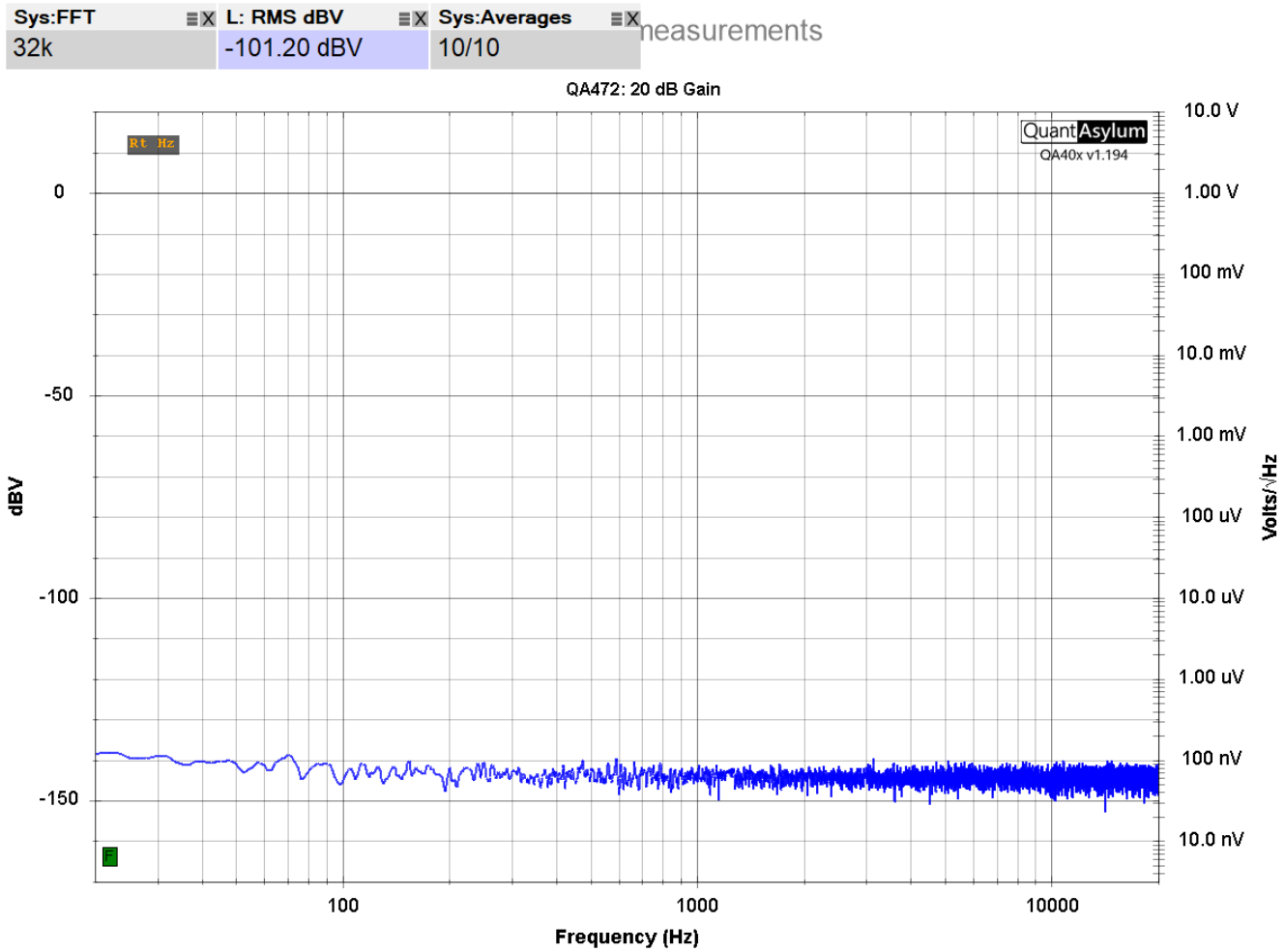
Representative Performance Plots

Notes for the following plots:

- The following graphs represent the typical performance of the QA472. Some units will perform slightly better, and some units will perform slightly worse.
- Some of plots shown on the following pages were made via automated sweeps. See the menu item labeled “Automated Tests” to replicate the plots on your QA40x.
- Where indicated, 0 ohm shorting blocks were used.
- Given the high input impedances and high gains, be aware that nearby cellphones and wifi activity may appear in the spectrum, as will certain USB peripherals such as mice and keyboards. If you see unexpected spectral components, take care to isolate any nearby unintentional transmitters.

PRE1: Noise Floor 20 dB Gain

The noise floor is shown below with inputs shorted, 20 dB gain selected on QA472. The RMS figure is a 20-20 kHz bandwidth.



PRE1: Noise Floor 10 dB Gain

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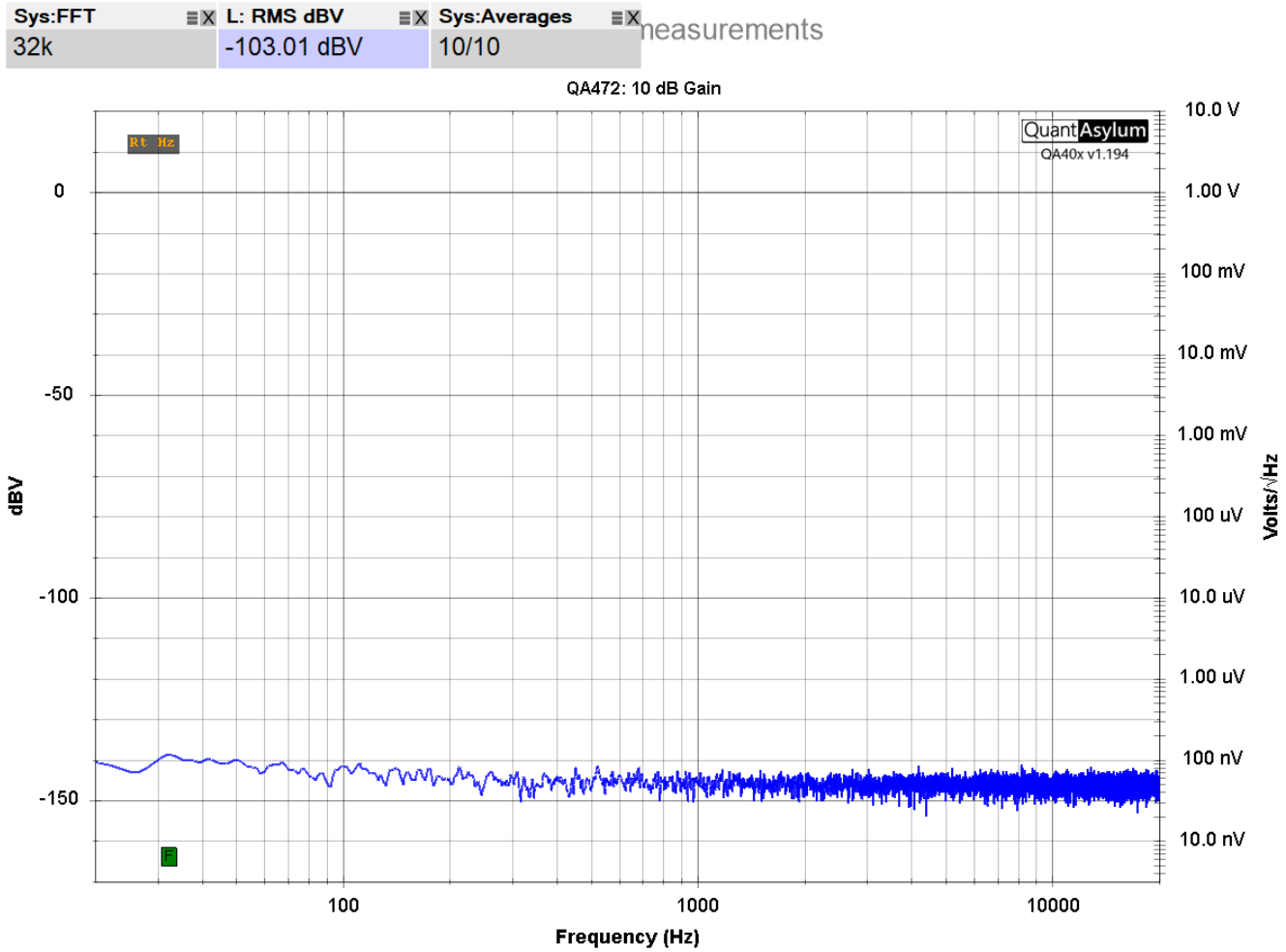
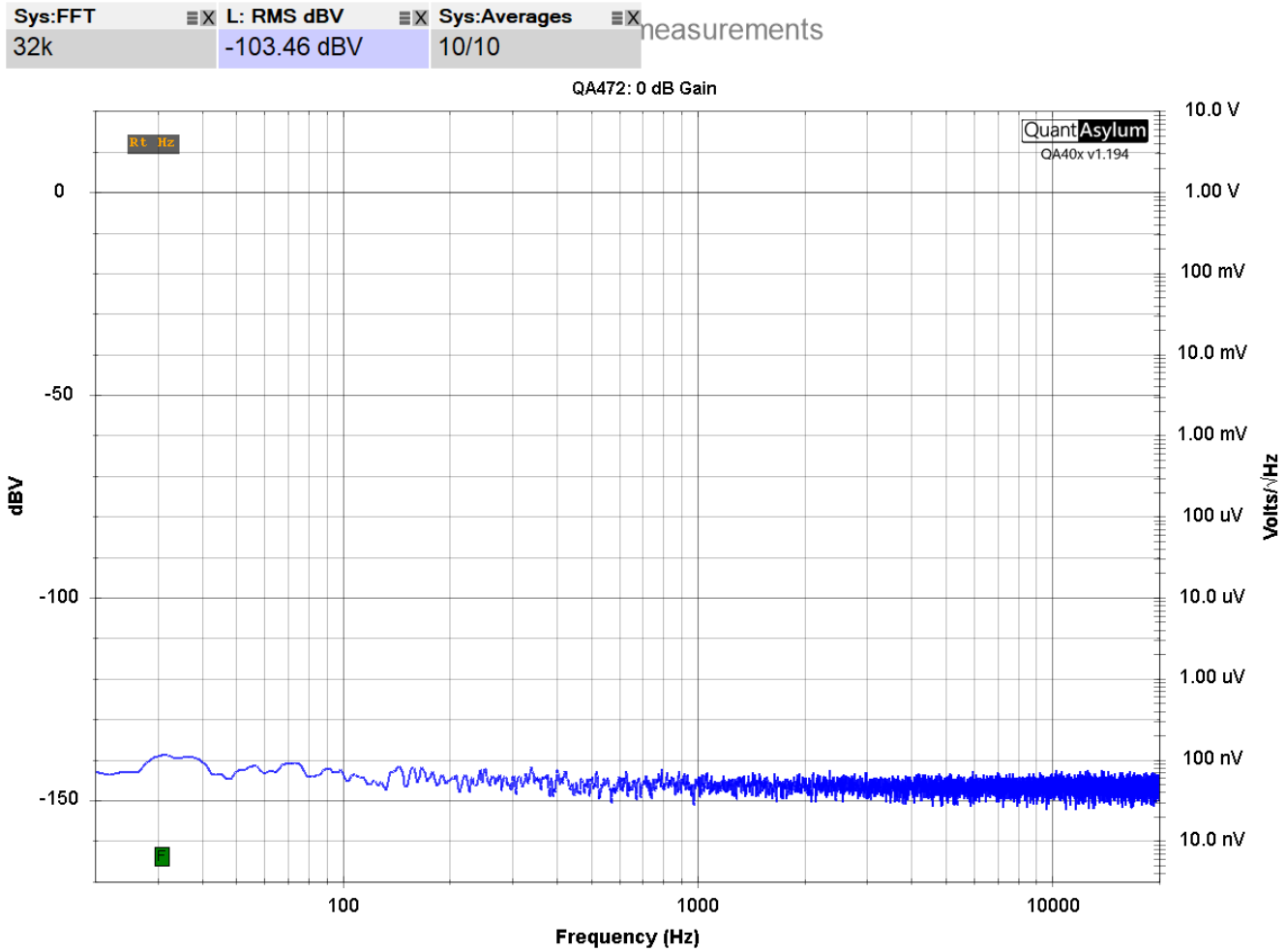


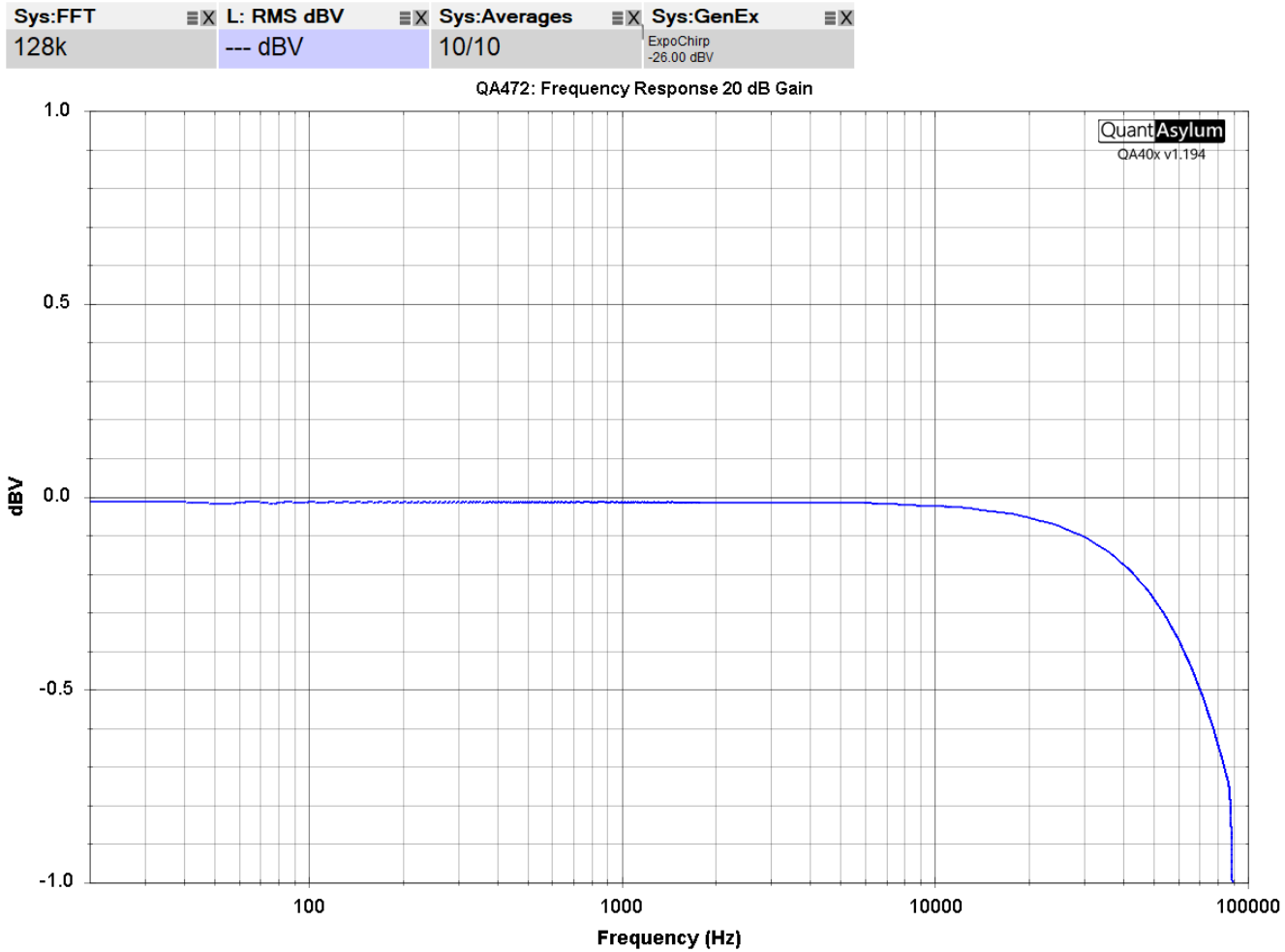
PRE1: Noise Floor 0 dB Gain

The noise floor is shown below with inputs shorted, 0 dB gain selected on QA472. The RMS figure is a 20-20 kHz bandwidth.



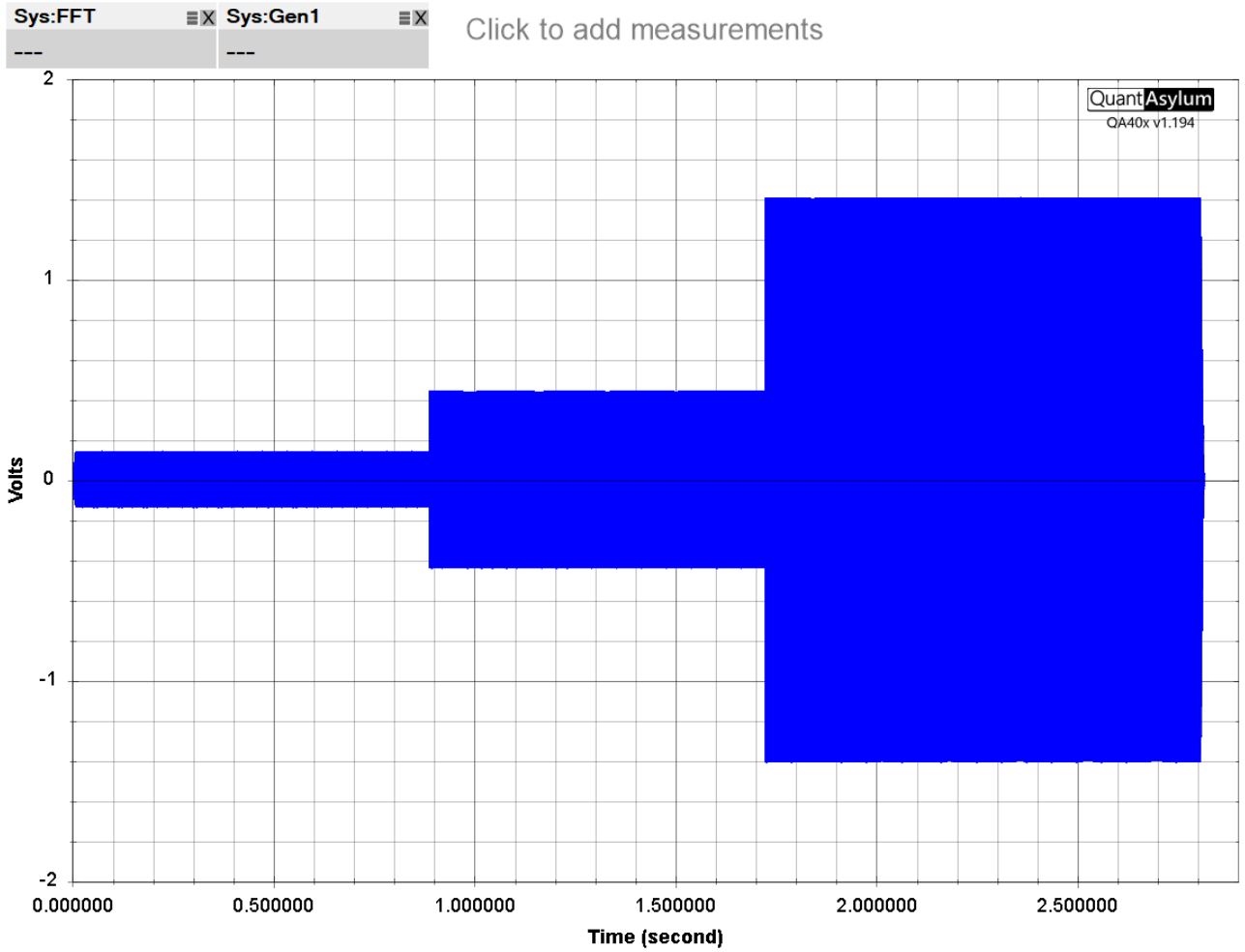
PRE1: Frequency Response

The plot below shows the frequency response of the QA472 with -20 dBV balanced input and 20 dB gain. The QA403 audio analyzer is the limiting factor here. Measured with an external signal generator and an oscilloscope, the bandwidth with 20 dB of gain is 2.5 MHz.



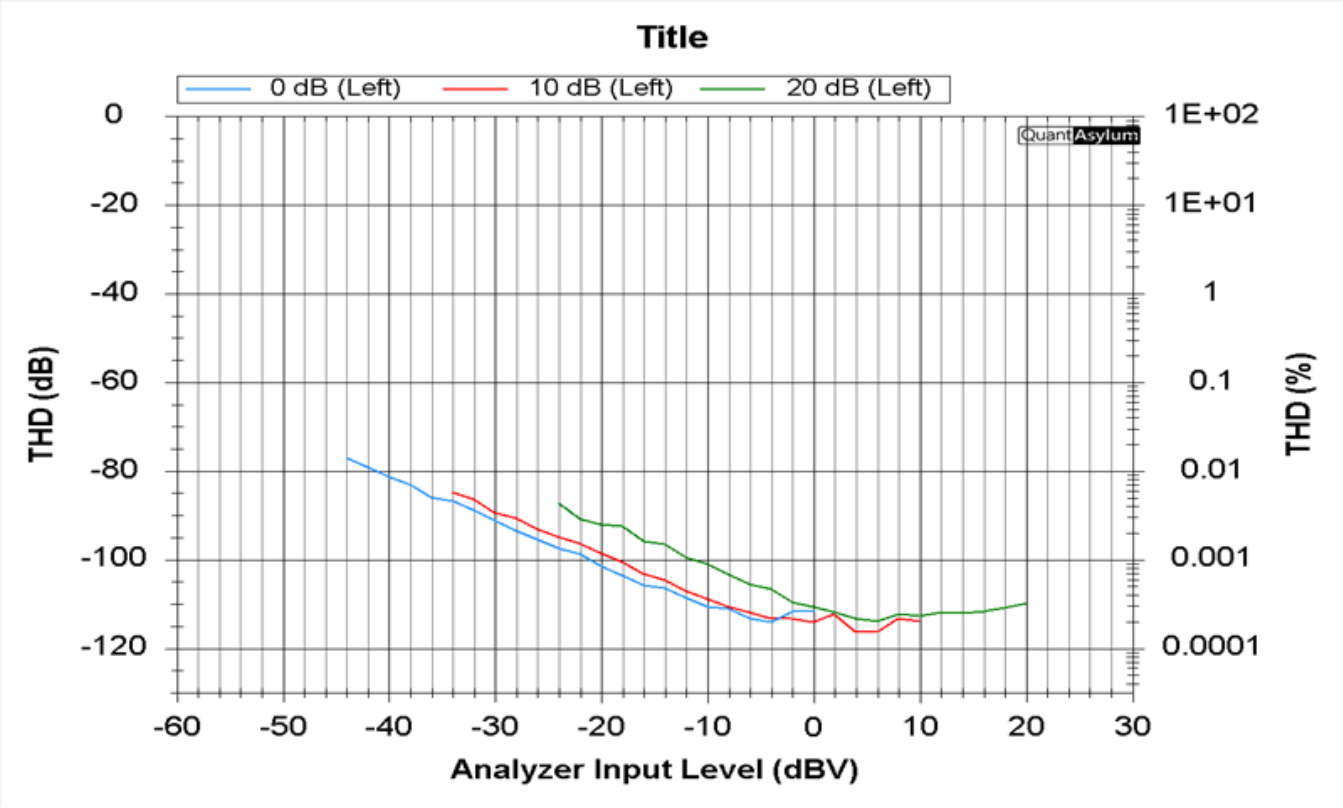
PRE1: Gain Switch Glitching

The time domain plot below shows the gain changes cycling from 0 dB to 10 dB to 20 dB during an acquisition. There is no glitching in gain while cycling. The gain levels are electronically switched using solid state relays.



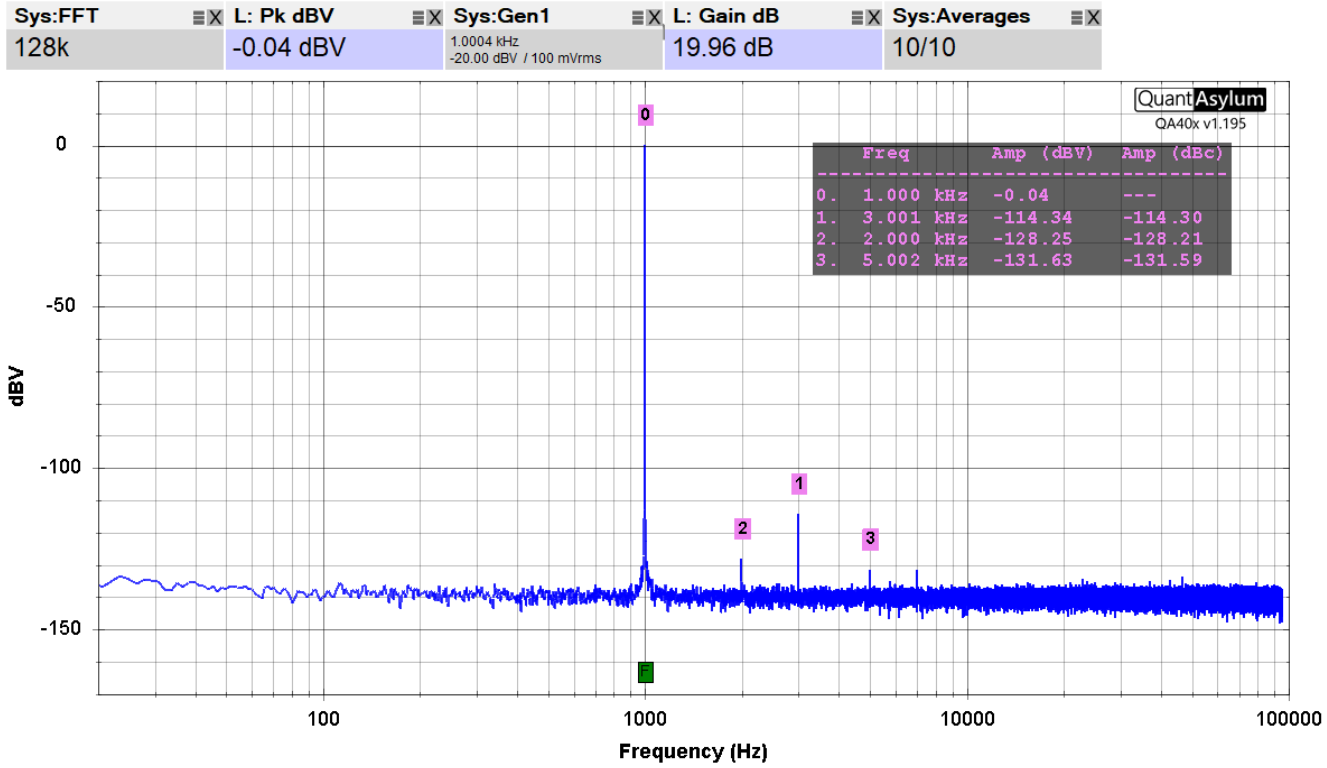
PRE1: THD versus Output Level

The plot below shows the THD level versus the QA403 Analyzer Input (or QA472 Output) level. Tone is 1 kHz. Harmonics up to 20 kHz are considered.



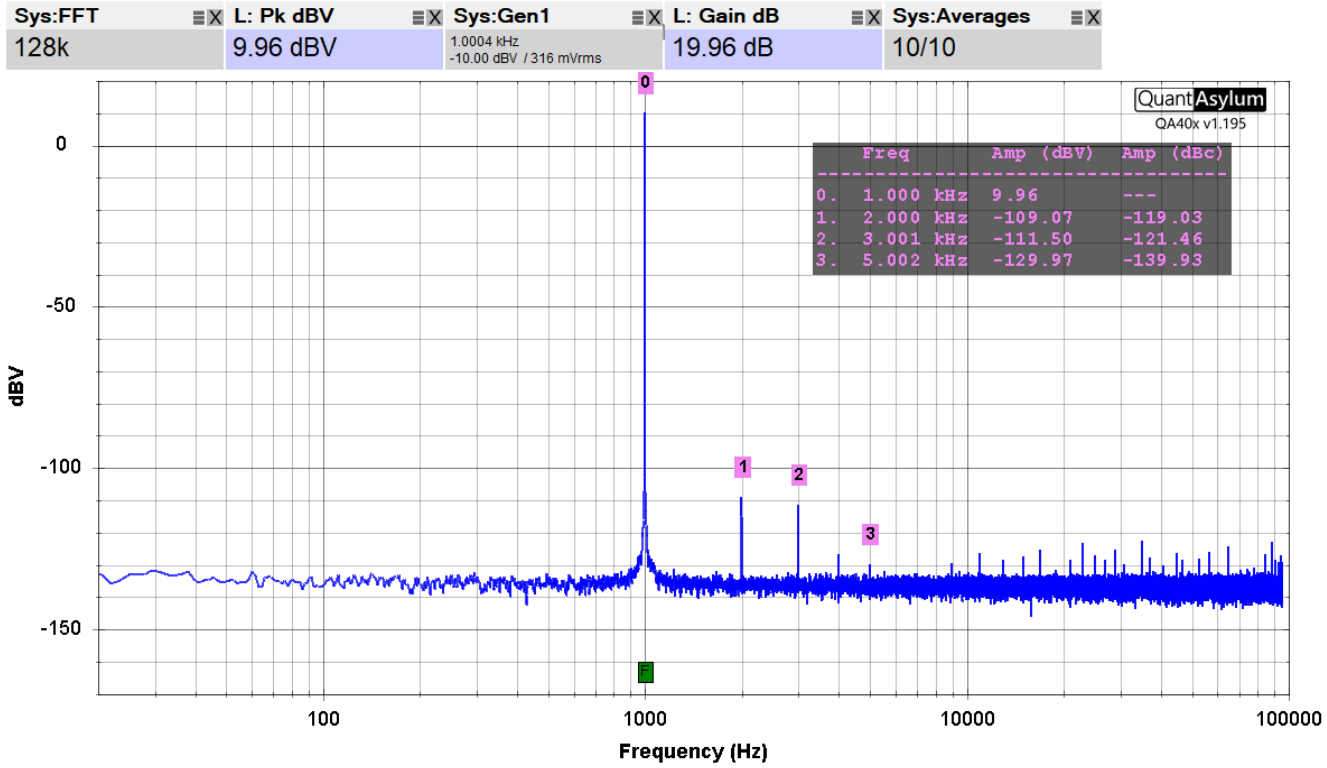
PRE1: THD versus Output Level Spectrum at -20 dBV Input with 20 dB Gain

The plot below was taken at 192Ksps. The with -20 dBV in and 20 dB of gain, the output is 0 dBV



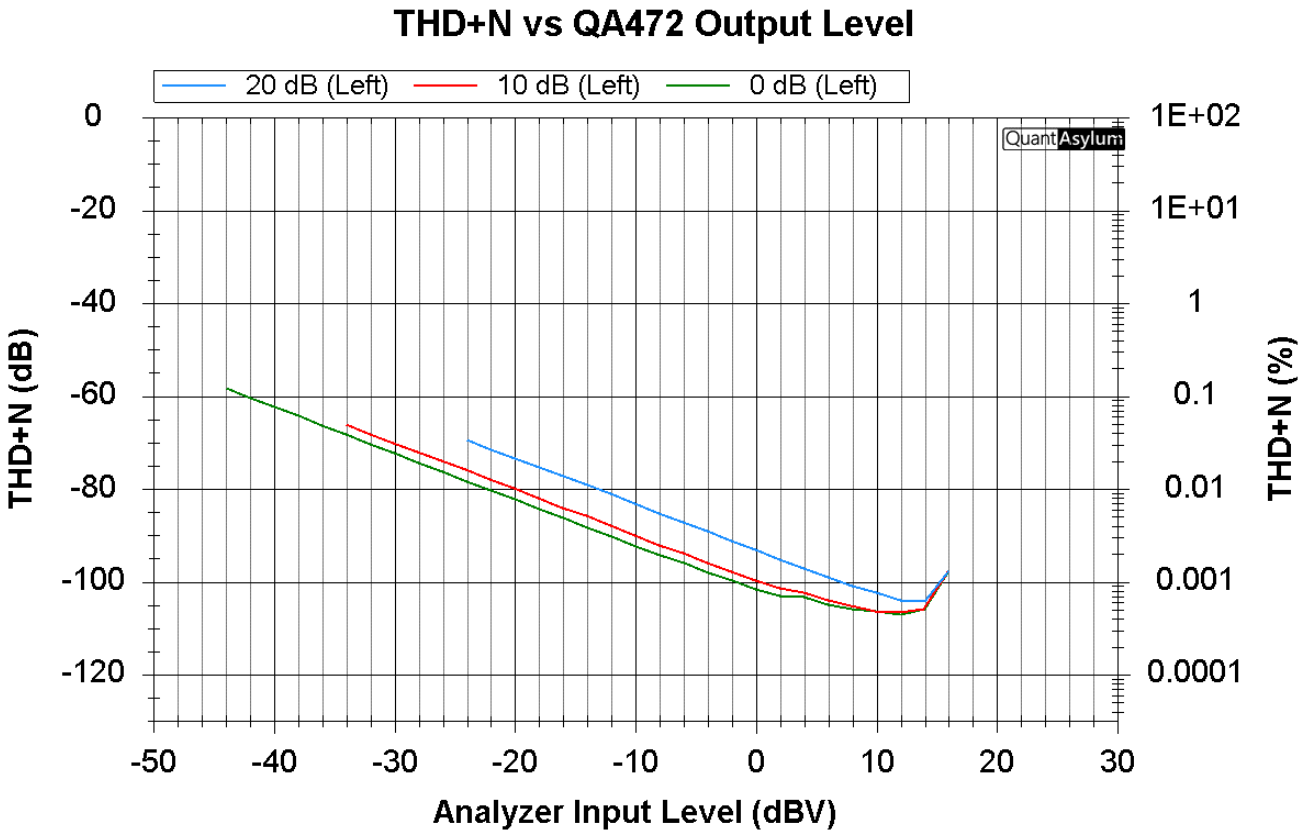
PRE1: THD versus Output Level Spectrum at -10 dBV Input with 20 dB Gain

The plot below shows even at -10 dBV single-ended input and 10 dBV output levels the distortion remains -120 dBc or better.



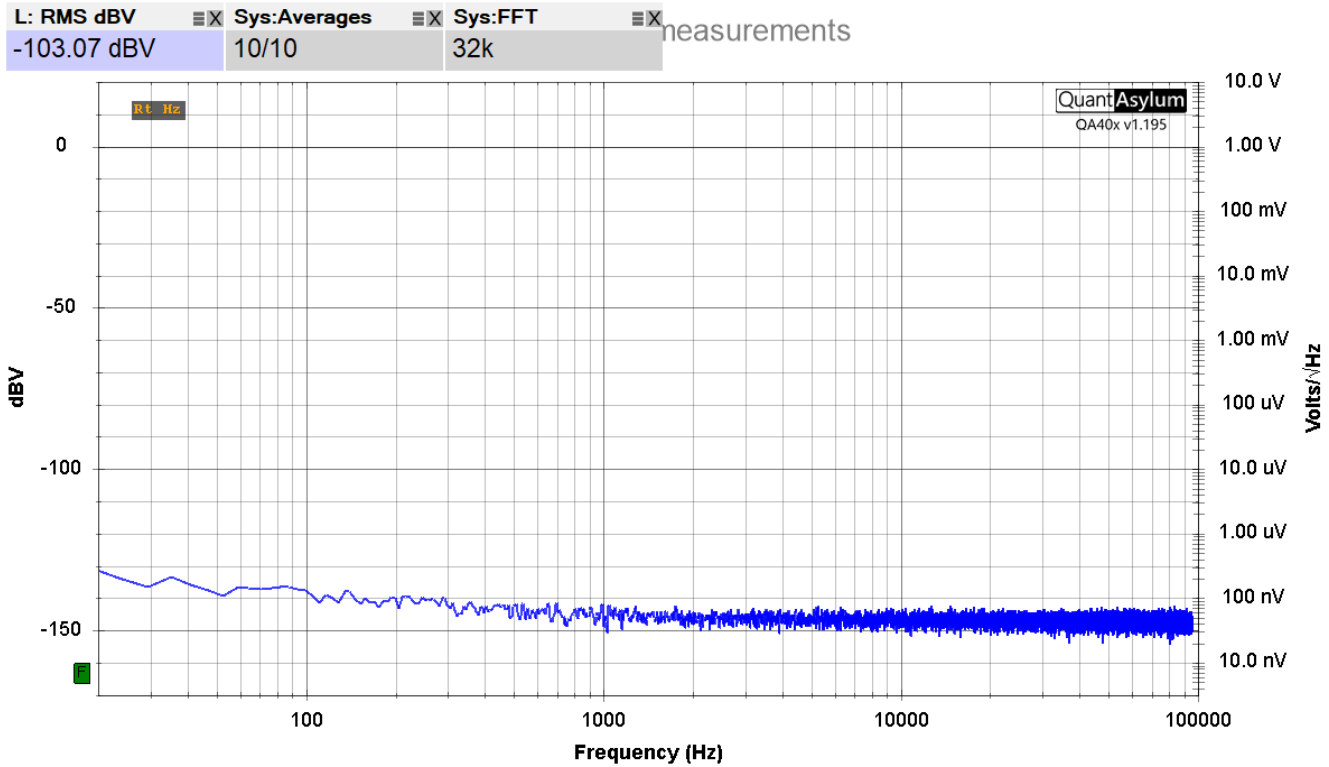
PRE1: THD+N vs QA472 Output Level

THD+N is noise-limited through -14 dBV, becoming harmonic-limited beyond 14 dBV (output level). The rise in distortion beyond +14 dBV = 5Vrms is due to the onset of supply rail clipping. Tone is 1 kHz and measurement bandwidth is 20 to 20 kHz.



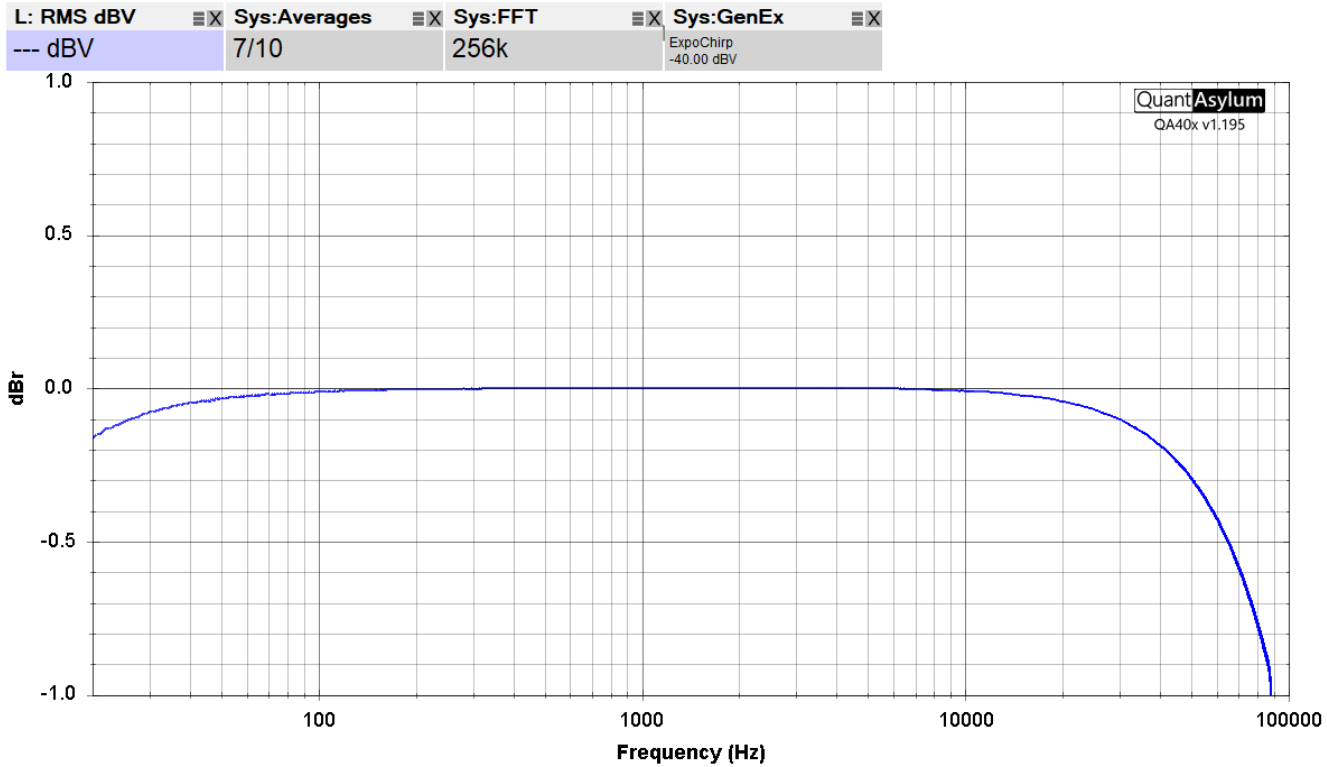
PRE2: Noise Floor

Noise floor below is shown with 192K sample rate, and a 20-20 kHz measurement bandwidth, no weighting.



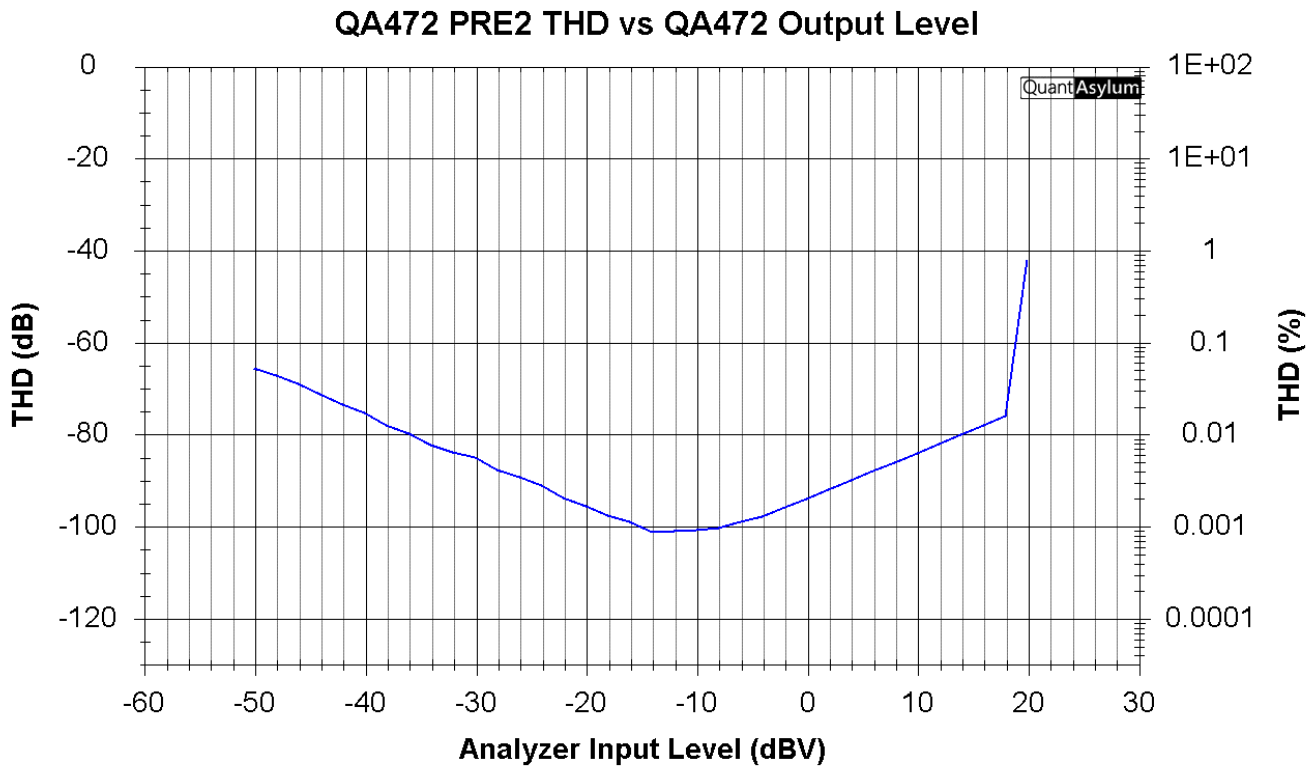
PRE2: Frequency Response

The frequency response below is primarily limited by the QA403 analyzer. Using a signal generator and scope, the frequency response (3 dB) extends to about 250 kHz. However, for larger signals you will see slew rate limiting at higher frequencies.



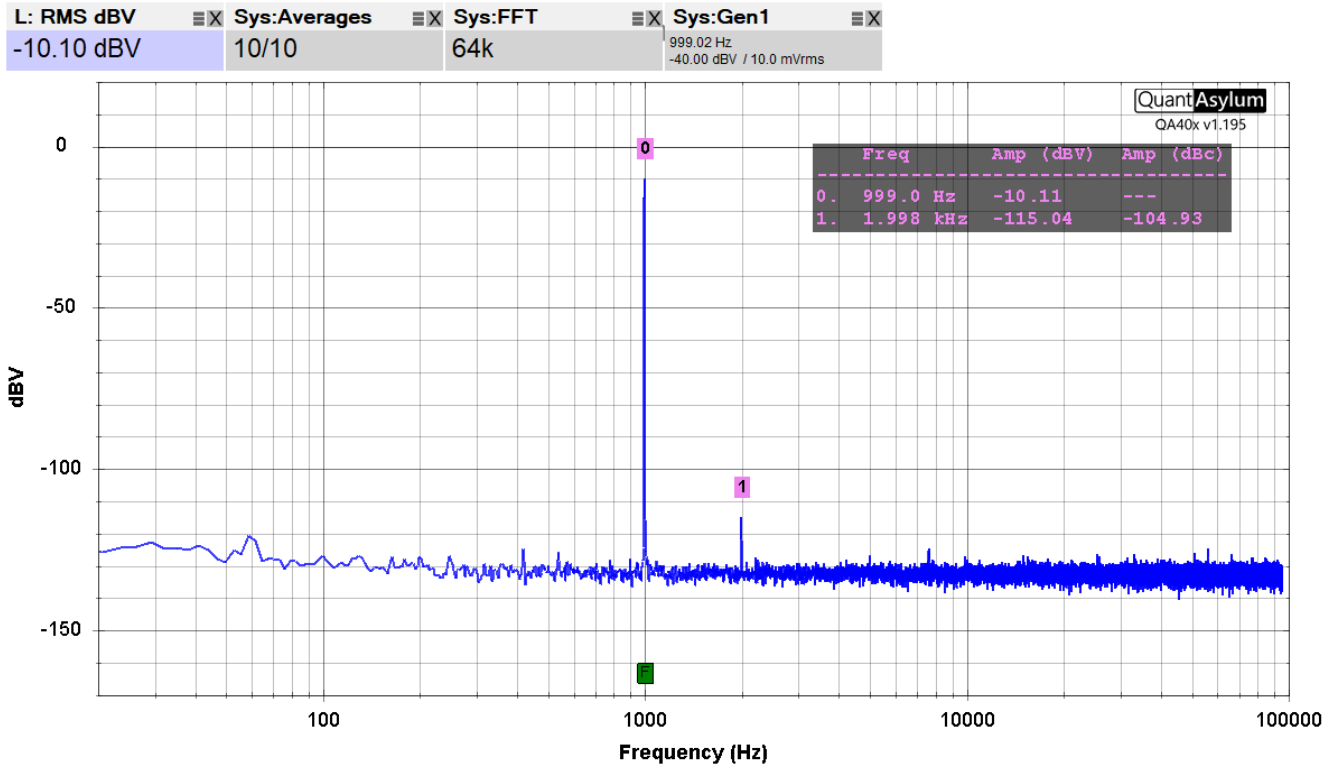
PRE2: THD versus PRE2 Output Level

The plot below shows the PRE2 output THD for a 1 kHz tone, with harmonics up to 20 kHz considered. The sharp knee beyond the +18 dBV output l output is due to supply clipping.



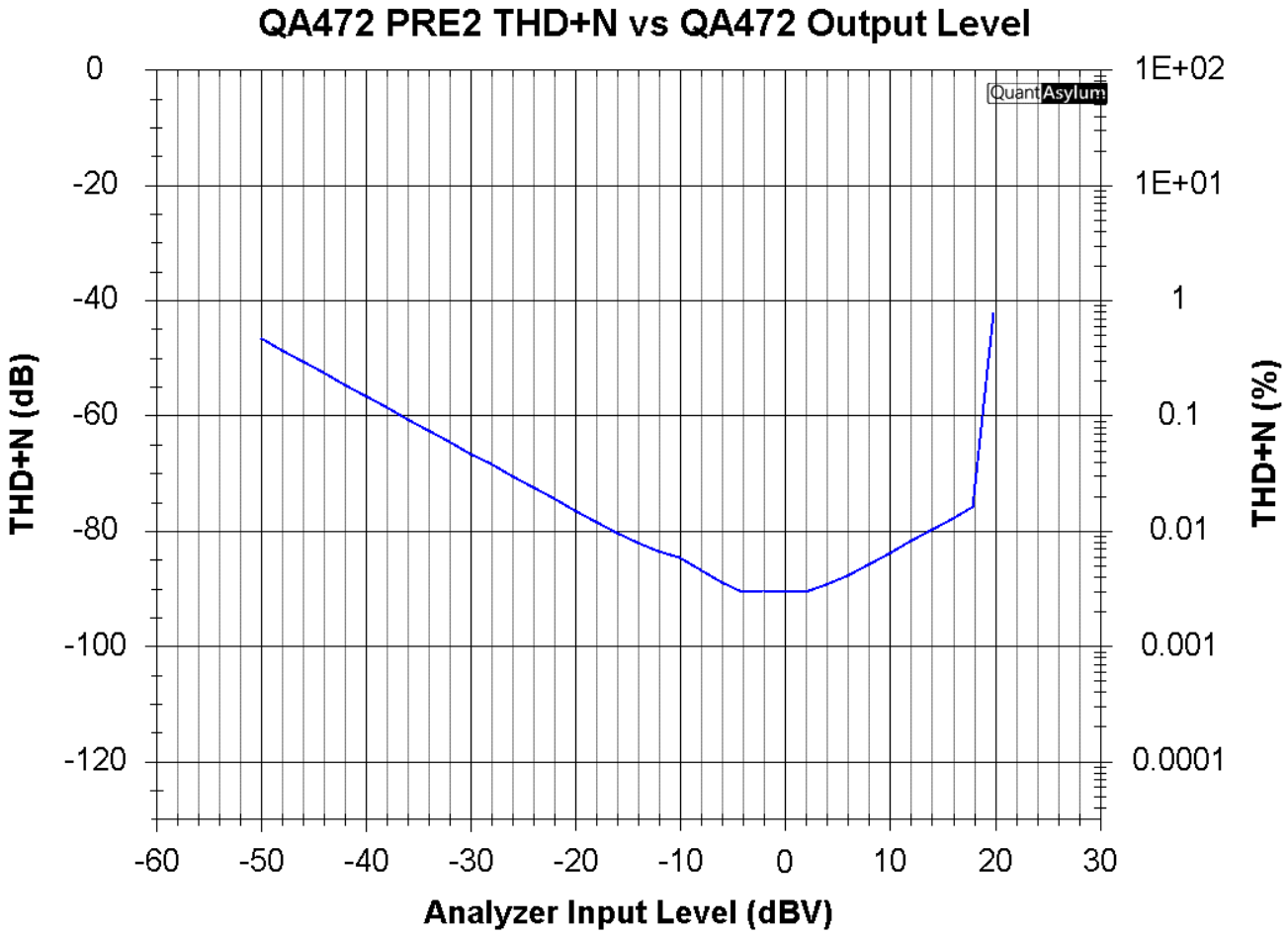
PRE2: THD Plot

PRE2 output at 192Ksps with a -40 dBV input.



PRE2: THD+N versus Output Level

THD+N



PRE2: Slew-Induced Distortion

Simulations of the JFET circuit show slew rate limits around 380mV/uS. Because the circuit gain is so high, these limits probably won't usually be encountered during normal use. But they are present, so be aware. The plot below shows where slew-induced distortion starts to be becomes a factor. From the plot, we can see at -40 dBV input and nearly 20 kHz the distortion has risen to just over -80 dB.