Tonochi's Audio Room – Supplemental Info

Review of KORG MR-2000S

2021/07/30

Review of Digital Audio Recorder, KORG MR-2000S

I usually use KORG MR-2000S to record analog discs. This time, I evaluate it as digital audio player (DAP). This document is purposefully written for comparison of MR-2000S with PC audio.

Contents

Summary

I bought MR-2000S in 2014. I've been using it to record analog discs in Hi-Res format since then.
I am satisfied with the sound quality, but I don't use it as a DAP because it isn't fully compatible with my preamplifier, PA-210 Simplicity.

This time, I evaluated the performance of MR-2000S as a DAP to compare it with other DAPs I have including PC audio.

I got very good results in both measurement and listening trials.

Measurement

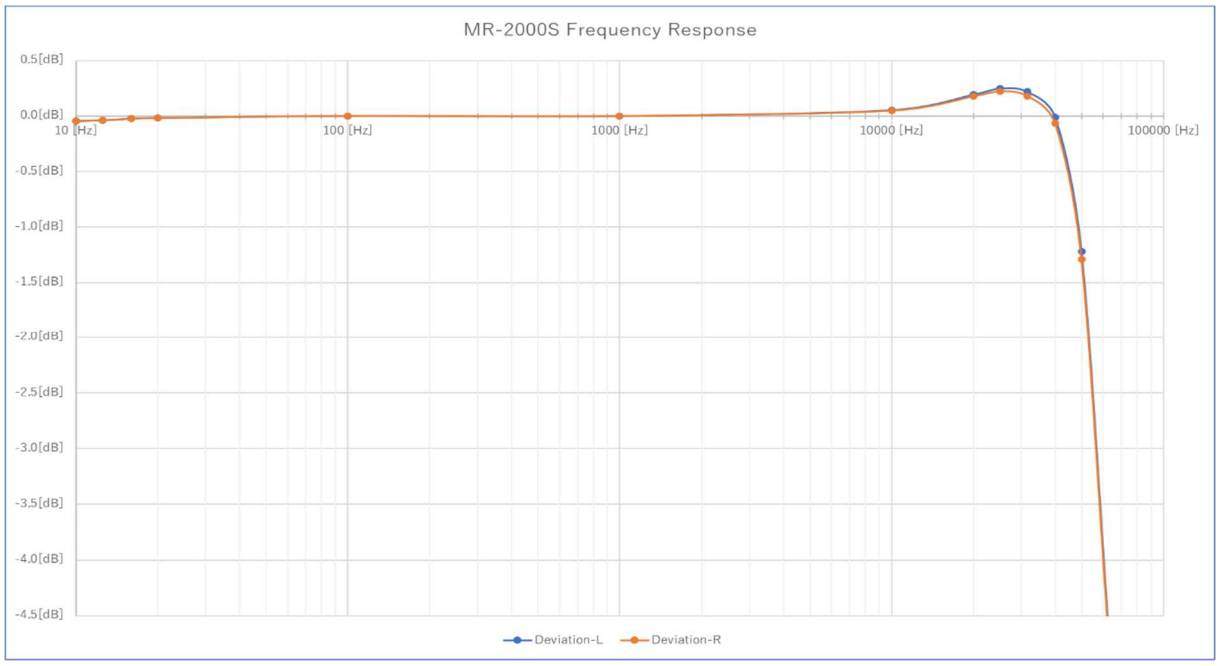
The test signals are saved in 192kHz/24bit WAV files and played by MR-2000S. The dummy load is 22 kohm.

Frequency Response

The chart below shows the frequency response of MR-2000S. The curves represent deviation from the output voltage at 1kHz, which is 0dB level.

The curves of the frequency response are not perfectly flat.
There is about +2.0dB peak at frequencies between 20kHz and 30kHz. Above the region, the response sharply goes down. The level is as low as -4.7dB at 63kHz.
I suppose the cutoff frequency of the anti-aliasing filter is that low.

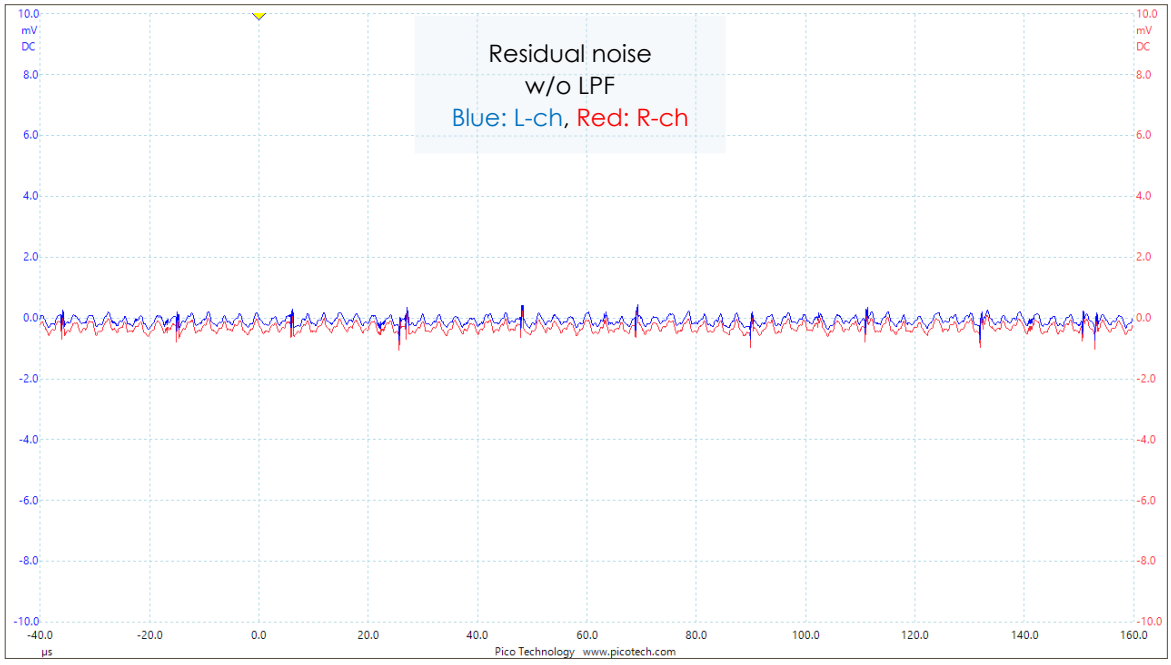
-0.3dB cutoff: ?kHz
-1dB cutoff: 47kHz



Residual Noise

No problem at all. RF noise is low enough.

Condition	Left channel		Right channel	
	AC (rms)	DC	AC (rms)	DC
Without filter	139 [uV]	−77 [uV]	151 [uV]	−304 [uV]
With 40kHz LPF	34 [uV]	−78 [uV]	32 [uV]	−306 [uV]

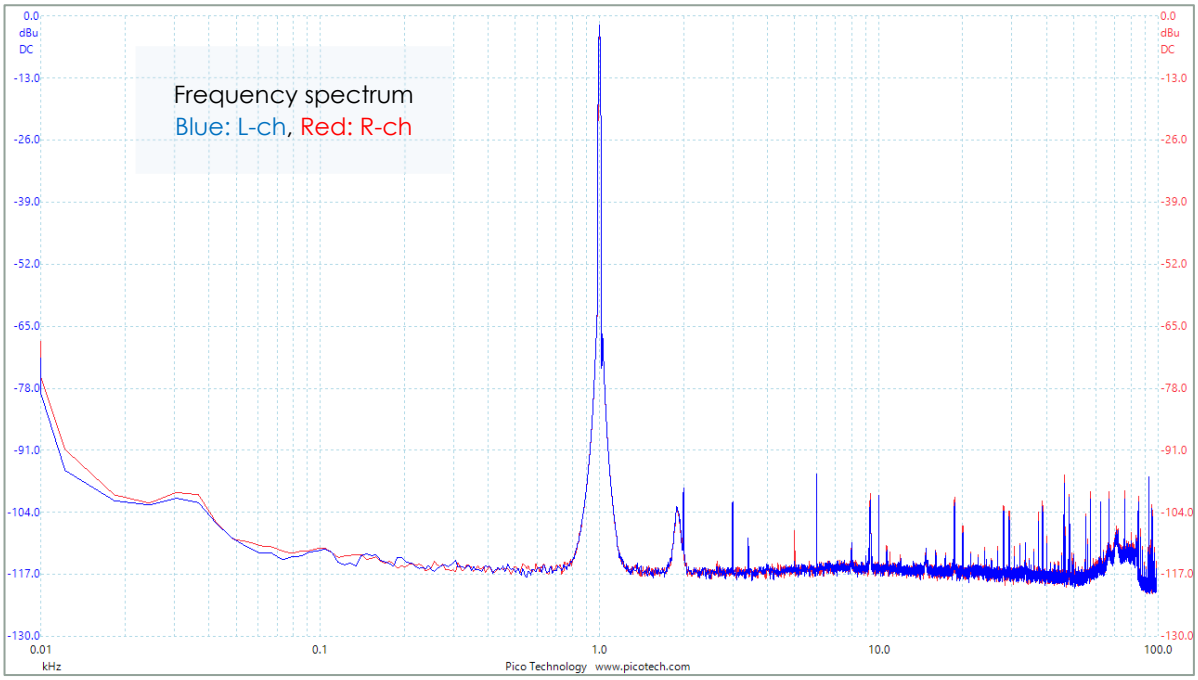


FFT Analysis

The result is very good.

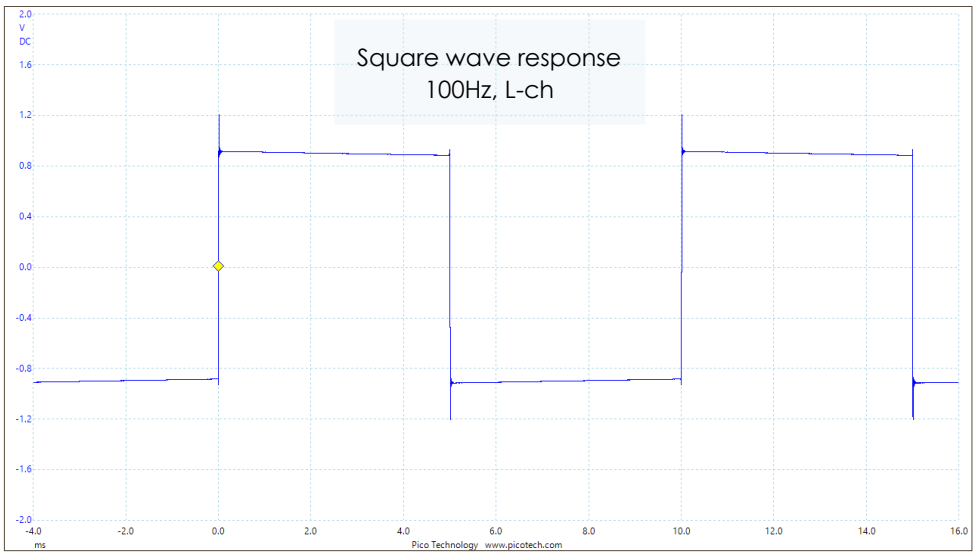
Some might think the SNR of 71.85 is too low, but it is the utmost value when it's measured with PicoScope. This value is the same as the SNR of the oscillator.

Index	Left channel	Right channel
THD	0.005%	0.005%
THD+N	-71.69[dBc]	-71.69[dBc]
SFDR	93.63[dBc]	93.63[dBc]
SNR	71.85[dBc]	71.85[dBc]
IMD	0.039%	0.039%

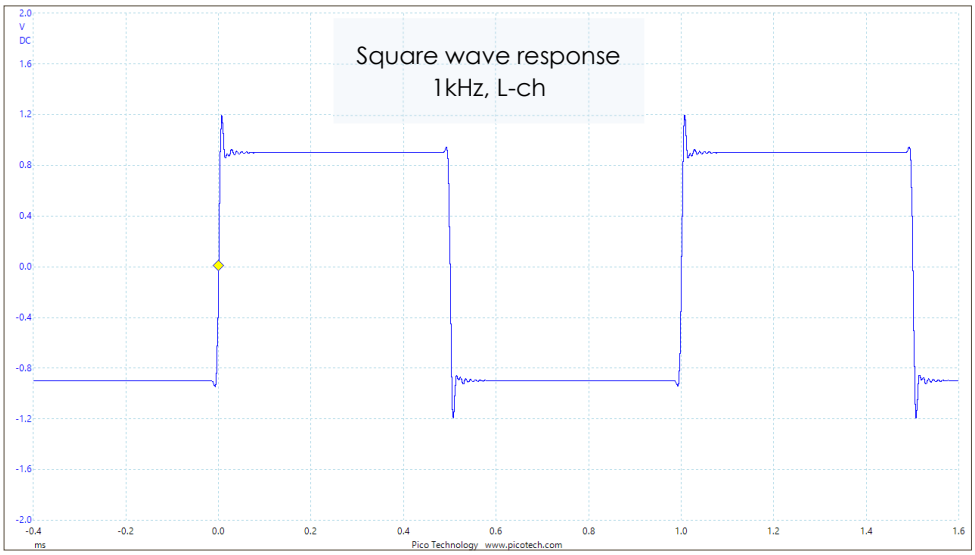


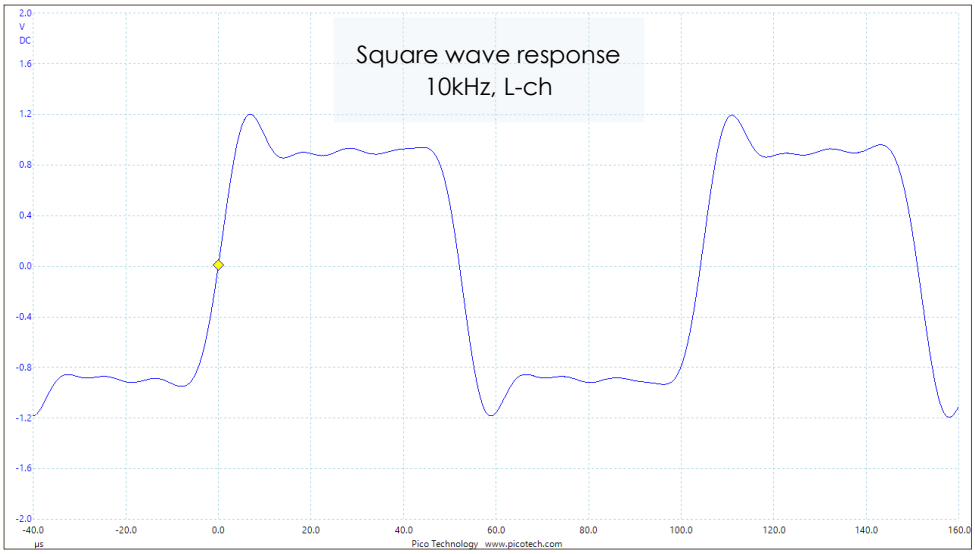
Square Wave Response

Square waves of 100Hz, 1kHz and 10kHz were used. The waveforms are exactly the same between the channels, so only the left channel's results are shown here.



The waveform is slightly slanting. That implies the response in very low frequency is low. MR-2000S probably has an output capacitor (AC coupling).



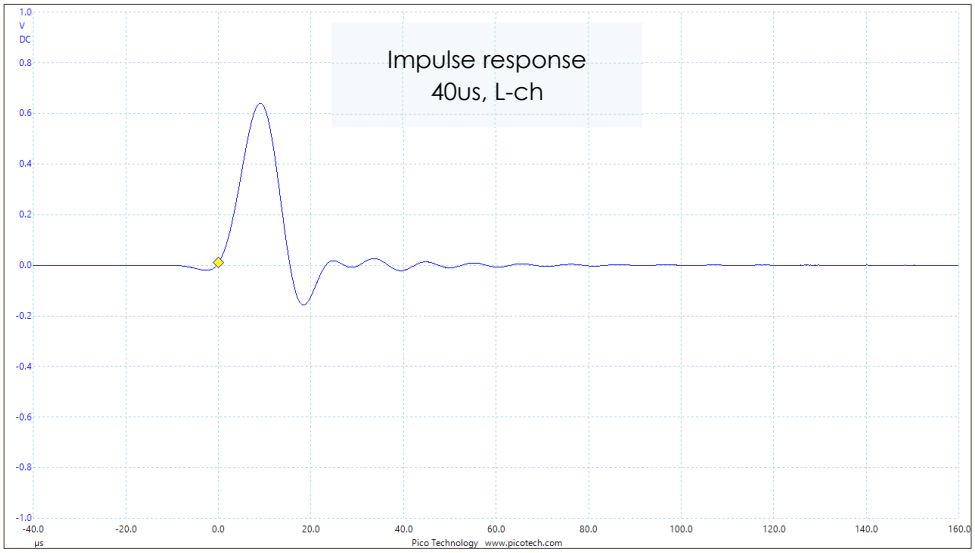


There seem to be overshoot and undershoot, but these peaks are caused by lack of very high frequencies. The ringing is so small. This well-shaped waveform explains high sound quality of MR-2000S.

Impulse Response

Impulse whose width is 40us was used. The signal's waveform is not exactly an impulse because it is converted into 192kHz/24bit format.

Ringing is so small like the square wave response. The waveforms are exactly the same between the channels, so only the left channel waveform is shown here.

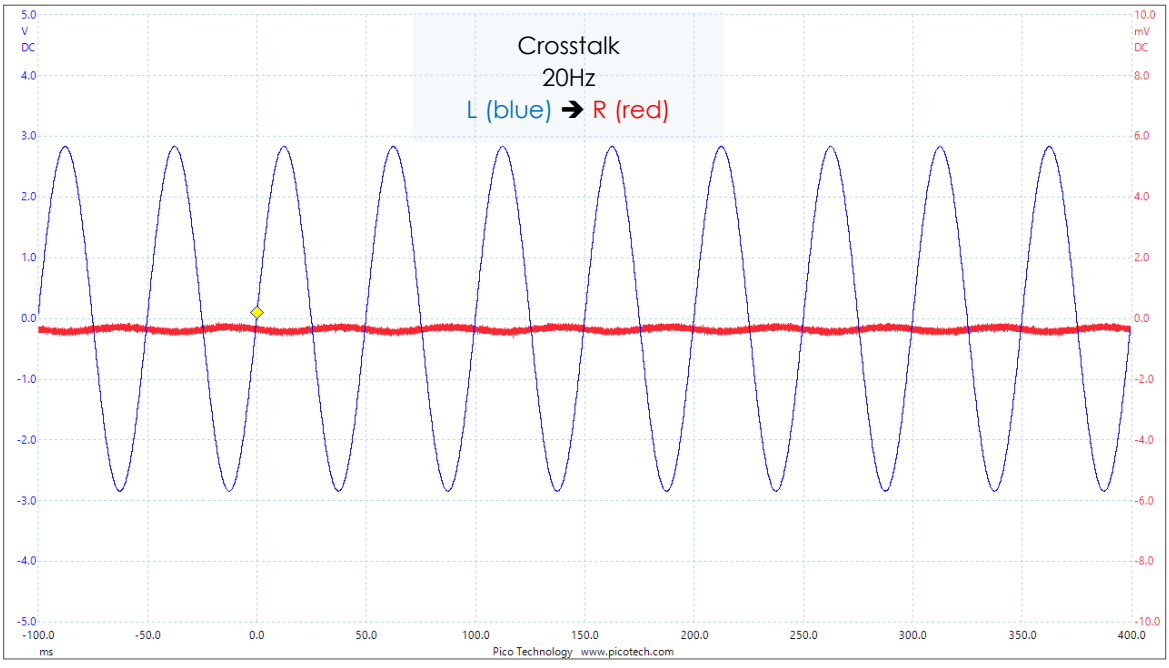


Channel Separation

Full-scale (0dBFS) sine wave is given to one channel, and the output of the other channel is measured.

At 20Hz, the separation is slightly under 90dB, but it's still so high. The separation at 20kHz is over 90dB. Excellent!

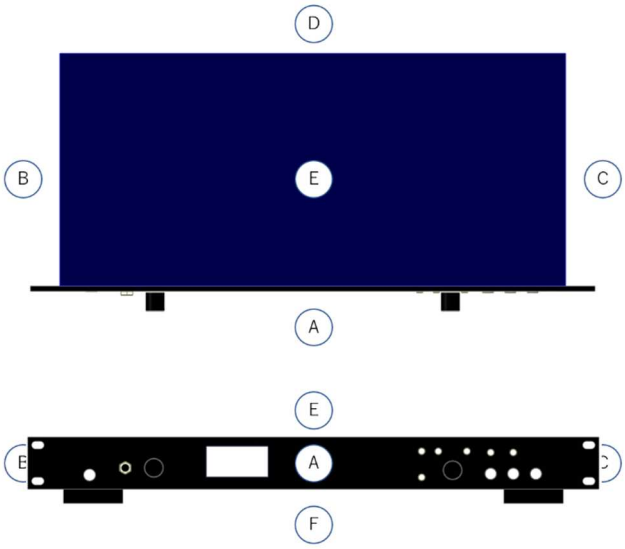
Frequency	Direction	Separation
20 [Hz]	L ➔ R	89.7 [dB]
	R ➔ L	89.5 [dB]
1 [kHz]	L ➔ R	92.8 [dB]
	R ➔ L	92.4 [dB]
20 [kHz]	L ➔ R	93.3 [dB]
	R ➔ L	92.2 [dB]



EMI (Radiated EMI)

Since I don't have an instrument for EMI (electromagnetic interference) measurement, I used a radio/recorder to measure radiated EMI.

I placed the radio/recorder 5cm away from each side of MR-2000S (the figure below illustrates the positions, A-F), and recorded the noise. The radio was tuned at 837kHz (AM). There isn't any broadcaster that uses this frequency in the region I live.



I replayed the recordings with an audio editor app, Audacity, and read the level of noise. The table below shows the result.
Note that these values are not exact because the recorder automatically adjust the recording level according to the level of the input.

Position	Power-off	Power-on	Playing music
A	-37[dB]	-27[dB]	-26[dB]
B	-28[dB]	-26[dB]	-26[dB]
C	-27[dB]	-29[dB]	-28[dB]
D	-36[dB]	-21[dB]	-22[dB]
E	-37[dB]	-29[dB]	-23[dB]
F	-37[dB]	-29[dB]	-29[dB]

These data shows that MR-2000S restrains noise radiation perfectly.
Though it has CPU, memory and HDD in it like PCs, its performance in EMI is far better than PCs.

You can hear a radio program without any noise, even when the radio is placed on MR-2000S.

Sound Quality

MR-2000S is a recorder, but sound quality in playing music files is very good too. Its sound quality is the best among my DAPs.
Its well-defined and stable stereo imaging is particularly attractive.

Wrap-up

The excellent sound quality of MR-2000S as a music player has been proved by the measurements.

However, the user interface of MR-2000S isn't good. Besides, the LEDs in the front panel are too bright. They look loud.
I'll continue to use it for recording only.

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