Tonochi's Audio Room – Supplemental Info

Review of Oliospec canariono Fils9

2021/08/25

Review of silent PC Oliospec canarino Fils9

My expectations for the PC for audio, Oliospec canarino Fils9, was shattered when I bought it and began using it. I repeatedly modified and evaluated it for three months. However, I am still not satisfied. This document describes the issues concerning canarino Fils9 and my review of it.

Contents:

Summary

I decided to use a PC as a DAP (digital audio player) in the system design of Gaudi II. I searched for PCs for audio on Internet, but couldn't find a good one but Oliospec canarino series. I couldn't decide soon, but I finally bought canarino Fils9 (called Fils9, hereafter).

At first, I expected I could build a good DAP only by connecting a good DAC to Fils9, because Fils9 was labeled as "PC for audio." But my expectations were shattered soon. Many troubles occurred. I struggled to make it run stably.
Besides, I realized Fils9 wasn't good enough in performance for Hi-Fi audio.
Finally, I found a way to improve Fils9 so that it can be used in Gaudi II system.

About Oliospec canarino Fils9

About Oliospec

Oliospec is a PC shop at Akihabara district in Tokyo. They develop their unique merchandises too. Especially, silent PCs are their specialty.
Oliospec is a limited private company, and may have a small number of employees.

They have their e-commerce website, where they sell their BTO PCs and peripherals.
https://www.oliospec.com

About canarino Fils9

Fils9 has no cooling fans. The heat from CPU gets through the heat pipe that connects CPU and the heatsink fixed on the side of the enclosure. Fils9 has a special USB hub in it which has a noise filter in the bus power.
All the parts of the enclosure are made of aluminum. The enclosure looks like an audio device.

Fils9 is a high-performance PC consisting of high-performance parts like CPU of the latest Intel Core i series and memory of DDR4 2933.

Some optional pre-installed apps for audio are available.

I ordered Fils9 of the following spec:

Enclosure	Silver, w/o optical drive slot
CPU	Intel Core i3 10300T (Comet Lake)
Memory	DDR4 2933 16GB (8GB x2)
Storage	SSD 500GB (SATA)
Power supply	150W (12V, 12.5A)*
OS	Windows 10 Home 64 ビット
Pre-installed app	dBpoweramp foobar2000

*: I ordered power supply of 108W (12V, 9A), but the one I received is 150W type.

The specification of hardware is the basic one. I selected Core i3 CPU, though Core i5 or i7 CPU is available too, because I judged i3 has enough performance for music player.

I ordered it Feb. 6, 2021, and received it Feb 28. The price was 203,556 JPY, including the price of dBpoweramp, 7,106 JPY. dBpoweramp is ripping app.
I also ordered pre-installed foobar2000 (called FB2K, hereafter), a music player app. It was free of charge.

Troubleshooting

It took me about three months to make Fils9 run stably. I almost abandoned it in trouble after trouble.
Though most of the troubles were not caused by Fils9, I found one shortcoming of Fils9 that couldn't be ignored.

Quality Assurance

When I received Fils9, I was thrilled because I found a sticker on the package which said "audio equipment." I mistook Fils9 wasn't PC but audio equipment.

However, I realized my misunderstanding next day when I unpacked Fils9.
I had unwatchfully believed that Oliospec was a PC manufacturer. I didn't read the homepage of Oliospec carefully. I realized Oliospec is a PC shop then.
It is obvious Oliospec doesn't have a quality assurance department, and doesn't conduct any strict investigation and inspection concerning quality.

No user manual nor warranty card was included in the package. Instead, the manuals of the mother board and the enclosure were included. It is totally the world of DIY PC!

I found some words like "one-year warranty" and "customers first" on the homepage of Oliospec, but I don't know how they can keep their words.

Configuration

To use Fils9 as a DAP, the peripherals shown in the table below were added.

Peripheral	Manufacturer	Model #	Note
Display	SHARP Century	AQUOS 4T-C43AM1 LCD-10000UT	43" LCD TV 10.1" display w/ touch panel, USB3.0
Keyboard/mouse	Logicool	MK240	Wireless keyboard/mouse combo
Wi-Fi adapter	Buffalo	WI-U3-866DS	11ac, USB3.0
BD drive	Pioneer	BDR-XU03J	Portable BD drive, USB3.0
USB audio I/F	KORG	DS-DAC-10R	DSD5.6M, 192kHz/24bit ADC/DAC

Troubles

The following troubles took place:

1. Backup data couldn't be recovered
2. Touch panel of the touch display malfunctioned
3. Operation of wireless keyboard/mouse was unstable
4. BD drive didn't work
5. Communication via Wi-Fi was often interrupted

The cause of the trouble #1 is the matter of specification of Windows PE, which is the OS of the recovery disc; the trouble #2 is resulted from my ignorance; the #4 is the defect of the BD drive.

The troubles #3, 5 were caused by a shortcoming of Fils9.

Facing these troubles, I suspected my Fils9 was defective, and almost regretted having bought it.

Trouble with Keyboard/Mouse

I noticed the move of the mouse pointer wasn't smooth when I began using Fils9. As peripherals were added, this trouble got worse, and sometimes the data from keyboard weren't received.

The cause was common with the Wi-Fi trouble.

Wi-Fi Trouble

I could hardly find the cause of the Wi-Fi trouble. I supposed some causes like bad settings of the driver, a defect of the Wi-Fi adaptor, shortage of USB bus power, etc. I devised tests to prove each supposition and the carried them out.
All the tests resulted in OK. I wondered what is the casue.

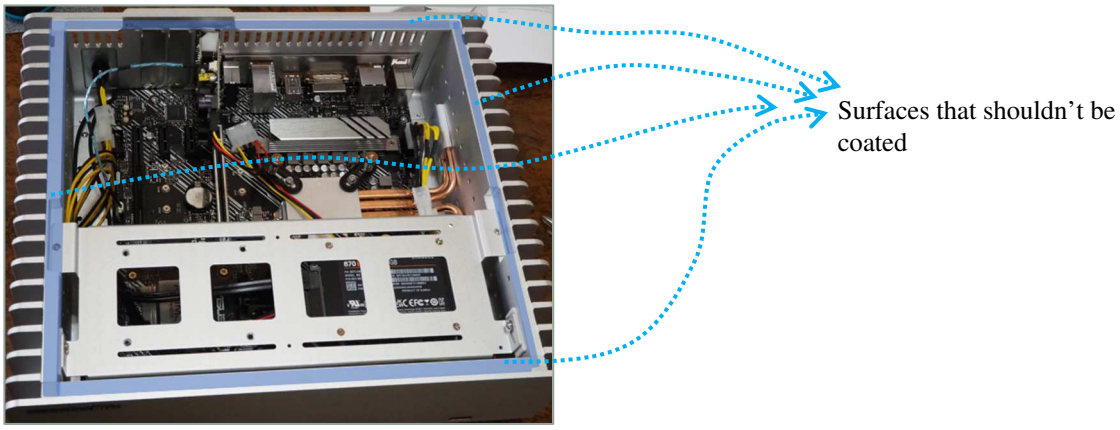
I suddenly realized after my three-week struggle that the trouble was common in the wireless devices.
I assumed that the radiated EMI (electromagnetic interference) from Fils9 interfered communication between the wireless devices and Fils9.

Investigation

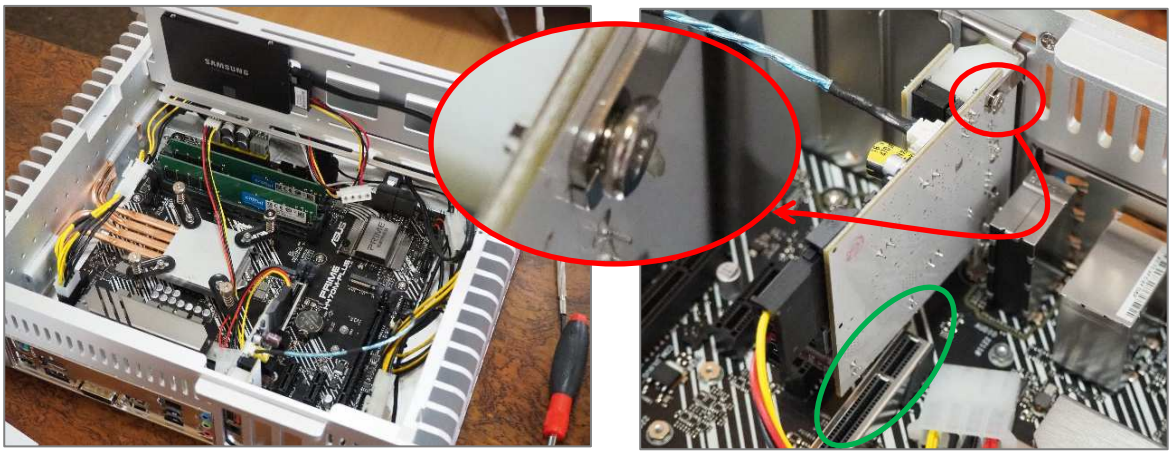
I started with checking hardware.
The enclosure is composed of aluminum parts; bottom panel, left and right heatsinks, front panel, rear panel and top panel. The enclosure is assembled by fixing these parts with screws. The top panel is 2.5mm sick. The others are 4mm thick.
This enclosure is well-designed. Especially, the heatsinks are desirable, whose fins are thick enough to prevent resonance.

I found one thing that may be problematic. The electric resistance between the parts seems significantly high. This weakens shield (screening) effect.
There is no part that reduces electric resistance between the parts like 'shield finger' in the enclosure.

The photo below shows the enclosure of Fils9 without the top panel. The surfaces made out in light blue are contacted to the top panel and shouldn't be coated. But they are coated. All the surfaces of the top panel are coated too. The top panel is not electrically contacted to the enclosure.

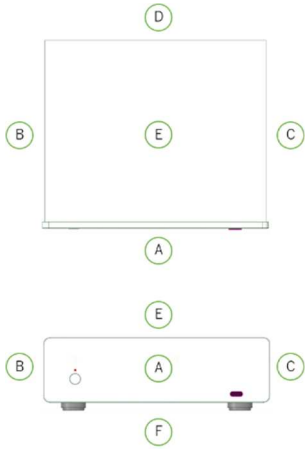


I found one more thing, though it has nothing to do with the instability. The USB hub for audio, SOtM tx-USBhubIn, which is a special feature of Oliospec, is not well-designed.
This USB hub is in the form of expansion card. Generally, an expansion card is inserted into the expansion slot of the motherboard. However, the USB hub doesn't have a card edge connector that plugs in the slot, and is fixed to the enclosure with a single screw. Therefore, it is not fixed firmly. It must have the card edge connector (indicated by the green circle in the photo below).
Moreover, the screw that fixes the card to the bracket wasn't tightened. The USB hub wasn't fixed tightly (indicated by the red circle in the photo below).



The radiated EMI can't be measured without dedicated measurement instruments. Besides, a special facility called 'electromagnetic anechoic chamber' is necessary for accurate measurement. It's impossible for amateurs to measure EMI.

However, you can consider a solution without accurate measurements only by knowing the direction of electromagnetic noise.
I hit upon with an idea that a radio/recorder can be used for this purpose.
As illustrated in the figure on the right, the radio/recorder is placed 5cm away from each side of the enclosure and records the noise. The radio is set out of tune. The Wi-Fi adaptor, the receiver of the keyboard/mouse and the DAC are connected to PC as in the real use.
The recorded data is played by an audio editing app to show the level of the noise and its waveform.



The radio/recorder I used has an automatic gain control for recording. That is, the gain isn't fixed. So, the data isn't accurate. But it's better than nothing!

The result of this simple measurement tells that the level of the radiated noise is the most intense at the positions C and D, and rather weak at the positions A and B.
This result implies that the intense noise from CPU is conveyed through the heat pipe to the right heatsink. The left heatsink isn't connected to CPU.

Solution

I had a strong suspicion that the electromagnetic noise emitted from Fils9 interfered the wireless communication. So, I carried out the following solution.

An extension USB cable is used for the receiver of the keyboard/mouse and the receiver is placed near the front panel of Fils9.
The Wi-Fi adaptor is also connected to Fils9 via the extension USB cable that came with the adaptor.

This solution really solved the problem I had suffered for nearly six weeks.

Still, Fils9 isn't so reliable, but I decided to employ it for DAP in Gaudi II system after improving it by myself, since I had planned to build the PC for audio myself in the first place.

Support by Oliospec

I didn't feel like consulting Oliospec, but did it at last, because Fils9 was unstable for the long time.

Advices from Olipspec, like "checking Device Manager's status," "changing USB ports," were not useful. They were all I had already done.
I tell them the model numbers of all the devices I used, and asked a question about compatibility. But I got no answer.

I couldn't rely on Oliospec. As described above, I conducted troubleshooting by myself.
I informed them of how I tested Fils9 and the results of the tests one by one.

Oliospec excused themselves by saying “We haven’t got such a complaint before. We don’t know how to cope with it.” (Am I the only person who feels such an excuse, “no support because of no precedent,” is heard more and more often lately?)

When I realized Fils9 didn’t comply with EMI restriction, I said to Oliospec that PCs for audio/visual use must comply with FCC class-B. They answered they didn’t have any experience about EMI and could not do anything about it.
It is natural because Oliospec isn’t a manufacturer but a shop. But, even so, I’d like them to grantee EMI performance at any rate (for example, subcontracting it to another company), because they call Fils9 ‘PC for audio’.
PCs manufactured by PC manufacturers are all compatible with FCC class-B even if the PC is not for audio. And, the ‘class-B’ is the restriction for all IT devices used for household. The devices used for Hi-Fi audio should emit less noise than class-B.
This because I don’t call Fils9 ‘PC for Audio’ but ‘silent PC’.

At the time when the trouble continued one month, Olipspec told me I could return Fils9 and get refund. It was an offer with sincerity.

However, I was a little frustrated by the fact that they didn’t answer when I notified I wouldn’t return Fils9. I think it’s natural that they express gratitude for my informing them of the details of my troubleshooting and solution.

Evaluation of Fils9 as an Audio Equipment

Measurements

I regarded Fils9 with the peripherals shown in the table below as a DAP, and made measurement. The major target of the measurement was more of the DAC and driver and the player app than Fils9.

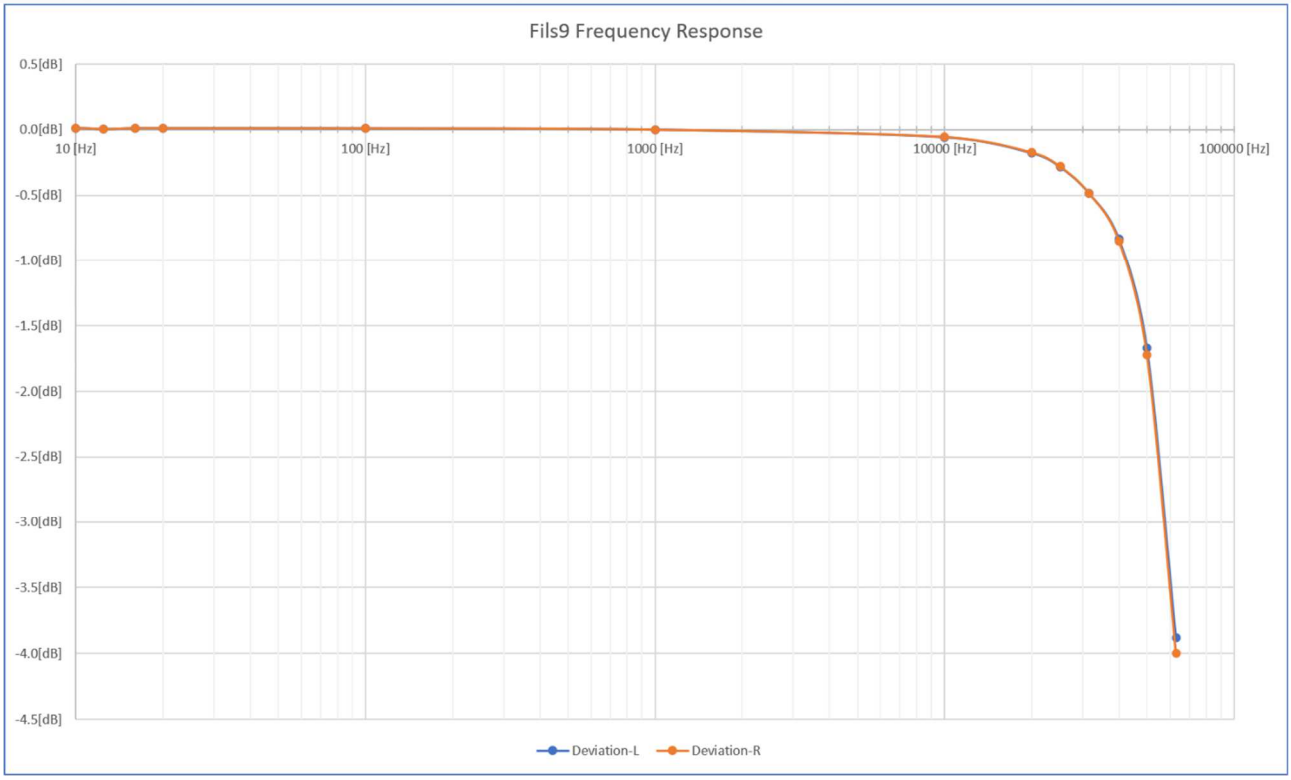
Peripheral	Manufacturer	Model number	Note
Display	Century	LCD-10000UT	10.1” display w/ touch panel, USB3.0
Keyboard/mouse	Logicool	MK240	Wireless keyboard/mouse combo
Wi-Fi adaptor	Buffalo	WI-U3-866DS	11ac, USB3.0
External BD drive	Pioneer	BDR-XU03J	Portable BD drive, USB3.0
USB audio I/F (DAC)	KORG	DS-DAC-10R	DSD5.6M, 192kHz/24bit ADC/DAC
Player app		foobar2000	w/ ASIO driver

The test signals are saved in WAV files in 192kHz/24bit resolution. They are played by Fils9. The voltage across the dummy load (22k ohm), which is connected to the output, is measured.

Frequency Response

See the chart below. The output voltage at 1kHz is the reference voltage (0dB), and the deviation from the reference voltage is plotted.

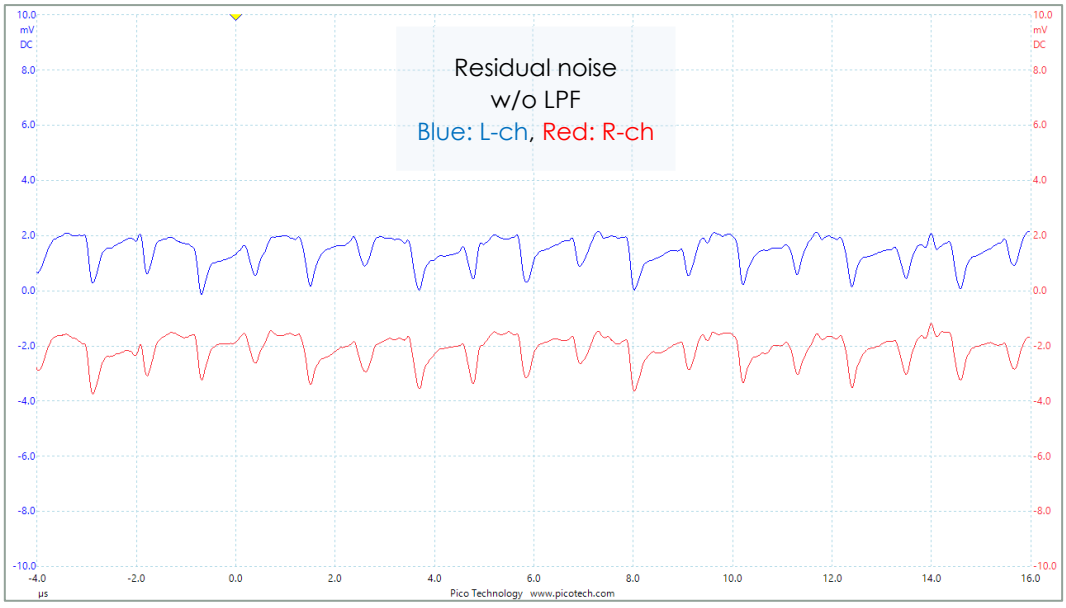
The result is not as good as I expected. The response at high frequencies isn’t good.
-0.3dB cutoff: 25kHz
-1dB cutoff: 42kHz
It seems that phase shift occurs at 3kHz or above.
The error between channels is zero.



Residual Noise

The result is not as good as I expected. RF noise and DC offset are large.
The RF noise level was so high I made another measurement with 40kHz LPF. I found noise in the audible band is small.

Condition	Left channel		Right channel	
	AC (rms)	DC	AC (rms)	DC
w/o filter	507 [uV]	1435 [uV]	506 [uV]	−2117 [uV]
w/ 40kHz LPF	20 [uV]	1374 [uV]	19 [uV]	−2143 [uV]



I suppose this noise comes from the clock oscillator of DS-DAC-10R. The frequency is approximately 920kHz.

In the industrial standard measurement, the RF noise is ignored. So, if the residual noise were printed in the catalog of DS-DAC-10R, it would be less than 20uV (because a sharper filter than 40kHz LPF is used).
The catalog says the SNR is 105dB. It is also the value that doesn't include the RF noise. According to Tonochi Method, the SNR is less than 60dB, because the residual noise is more than 0.5mV.

SNR = 20 x log (0.5[V] / 0.5[mV]) = 60[dB]

Where 0.5V is the voltage of the reference stipulated by JEITA

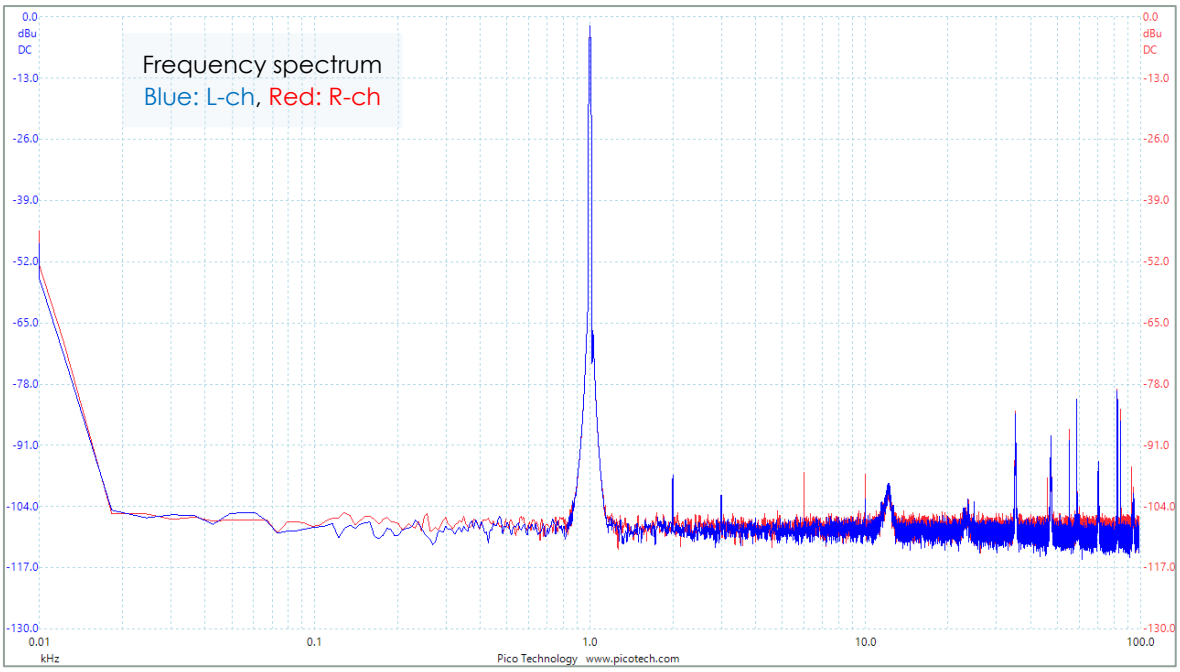
RF noises are not ignorable. Both transistor and op amp has very high gain at 1MHz. The RF noises possibly affect the distortion ratio of amplifier (especially power amp).

Though the DC offset of 1mV isn't rare, I hope it is less than 1mV for Hi-Fi audio components.

FFT Analysis

The test signal is 1kHz sine wave.
Harmonics are slightly less in the left channel than in the right channel.

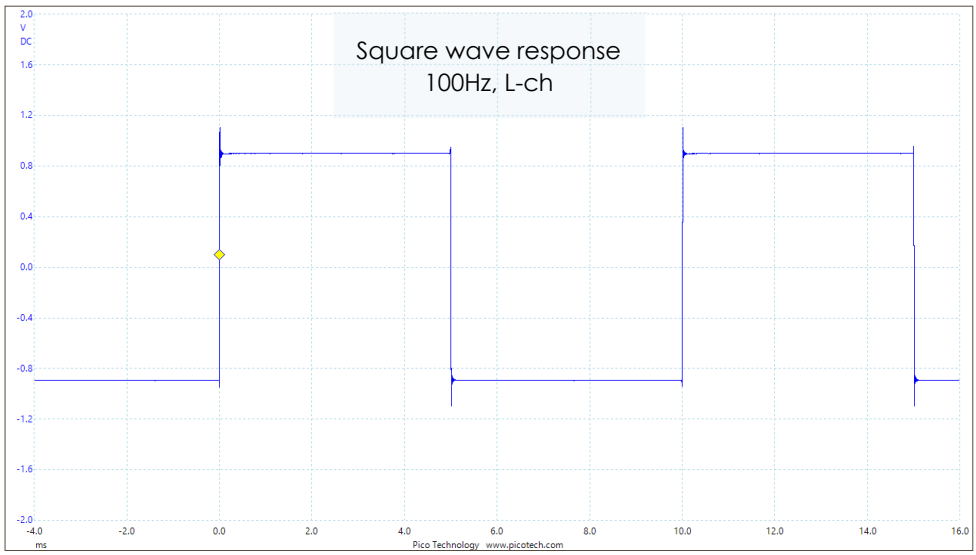
Index	Left channel	Right channel
THD	0.007%	0.008%
THD+N	-61.76[dBc]	-61.29[dBc]
SFDR	75.66[dBc]	75.39[dBc]
SNR	61.79[dBc]	61.32[dBc]
IMD	0.04%	0.04%

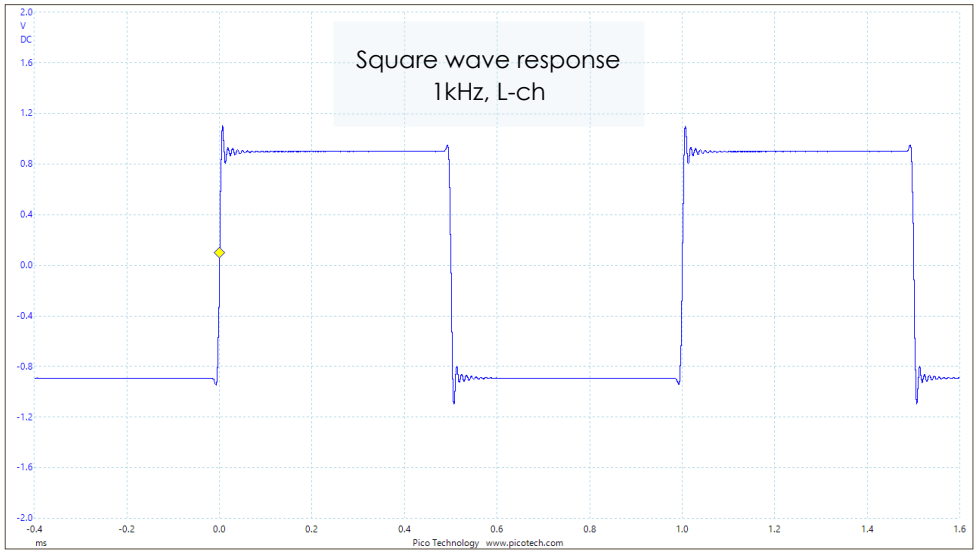


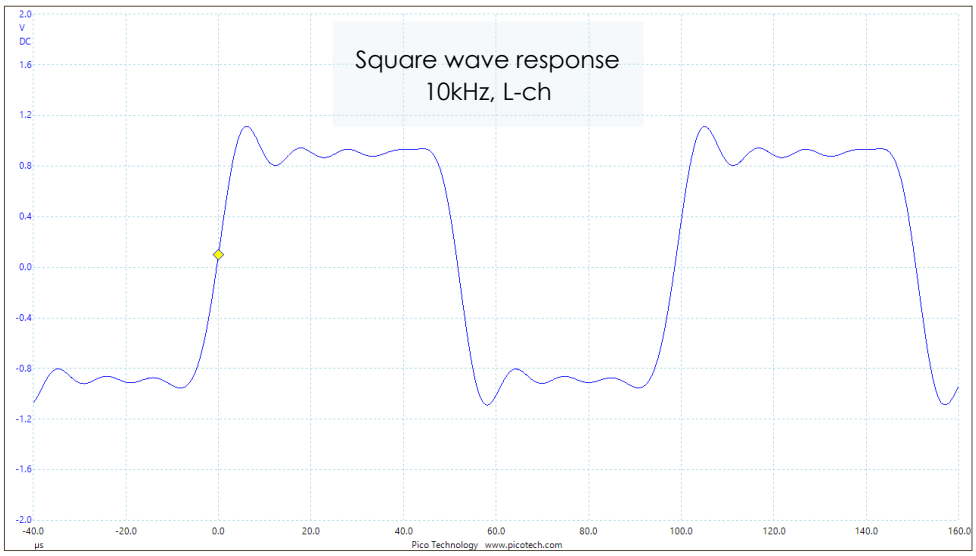
Square Wave Response

The test signals are 100Hz, 1kHz and 10kHz square waves. The waveforms are exactly the same between the channels. Only the waveforms of the left channel are shown here.

Note that the test signals are converted in to 192kHz/24bit and the waveforms are slightly distorted in the conversion.



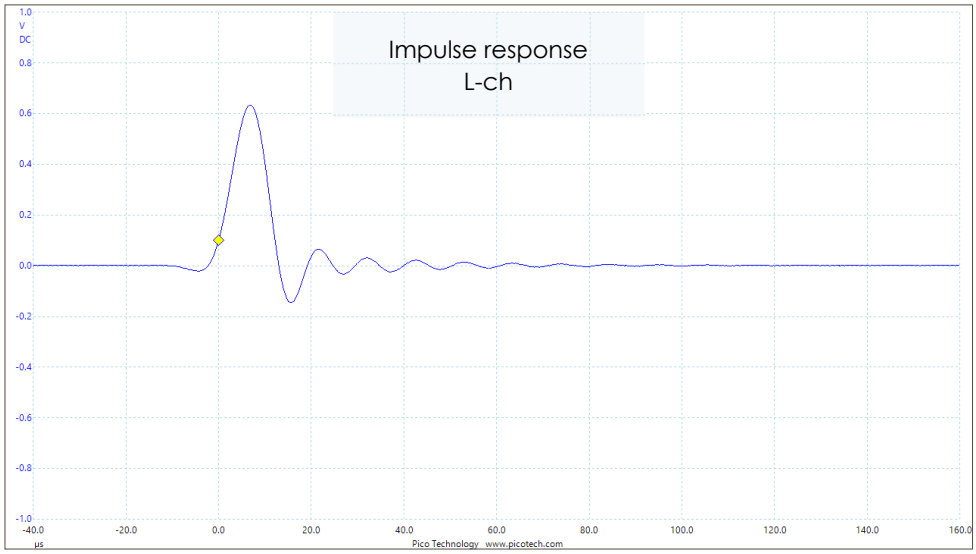




Ringing occurs. It is a bit problematic. While THD doesn't affect sound quality (SQ) much (0.1% is the same as 0.001% for human being), this ringing could affect SQ more or less.

Impulse Response

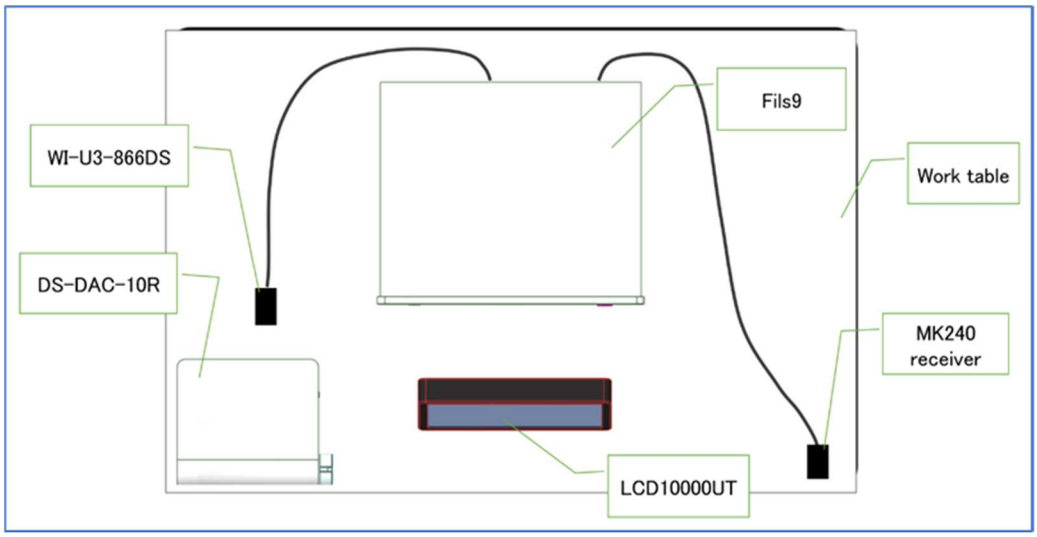
The test signal isn't impulse to be exact, but the waveform is nearly impulse.
The waveforms are exactly the same between channels. The chart below shows the left channel waveform only.



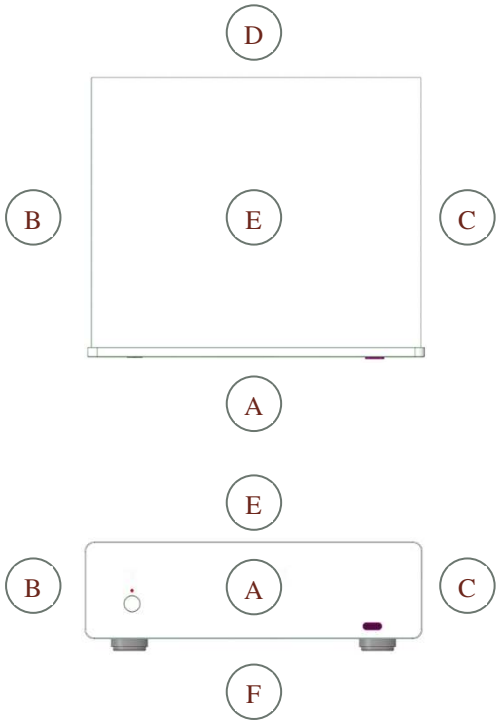
EMI (Radiated EMI)

As mentioned above, I don't have a measurement instrument for EMI, and I utilized my radio/recorder for the simple measurement.

The devices are placed on work table as illustrated in the figure below.
For the stable operation of Fils9, the Wi-Fi adaptor (WI-U3-866DS) and the receiver and the keyboard/mouse (MK240) are connected to Fils9 via the extension USB cable. The Wi-Fi adaptor is located near the DS-DAC-10R, though, I confirmed this layout doesn't affect DS-DAC-10R (as mentioned below, Wi-Fi communication could be interrupted).



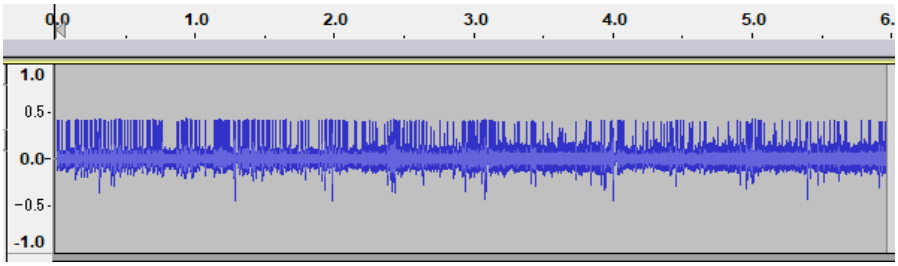
As illustrated in the figure below, the radio/recorder is placed 5cm away from each side of Fils9 and records the noise.
The radio is set to 837kHz (AM). In the region I live, this frequency isn't used by any broadcaster.



The recorded data is played by an audio editing app, Audacity, to read the level of the noise.
Note that the radio/recorder I used has an automatic gain control for recording. That is, the gain isn't fixed. So, the data isn't so accurate.

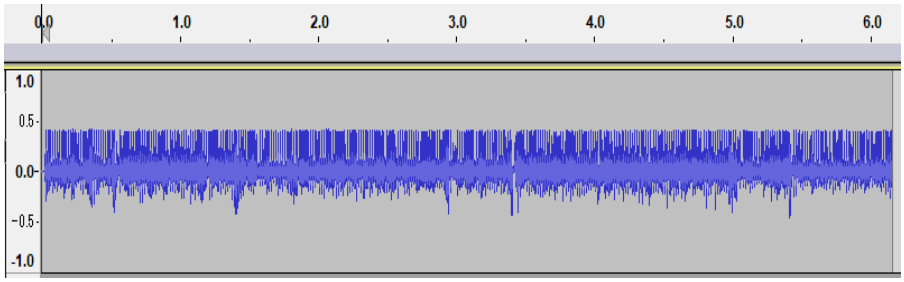
Position	Power off	Power on	Music playing
A	-30[dB]	-9[dB]	-8[dB]
B	-24[dB]	-9[dB]	-8[dB]
C	-24[dB]	-9[dB]	-8[dB]
D	-28[dB]	-10[dB]	-9[dB]
E	-28[dB]	-9[dB]	-9[dB]
F	-22[dB]	-9[dB]	-8[dB]

Interestingly, the noise increases during a music file is being played. I felt like I could have recognized which tune is played when I listened to the recording.
The noise is most intense at the position-C. The figure below shows the waveform of the noise at the position-C when Fils9 is turned on but a music file is not played.



Waveform at Pos-C:
Power on

The figure below shows the waveform when a music file is being played. It is apparently different from the waveform above. The waveforms tell the difference more clearly than the values.



Waveform at Pos-C:
Music playing

I found that the noise radiated from the rear panel (position-D) is not as intense as the first measurement. When I measured EMI for the first time, Fils9 was located in front of TV. That may have affected the measurement.

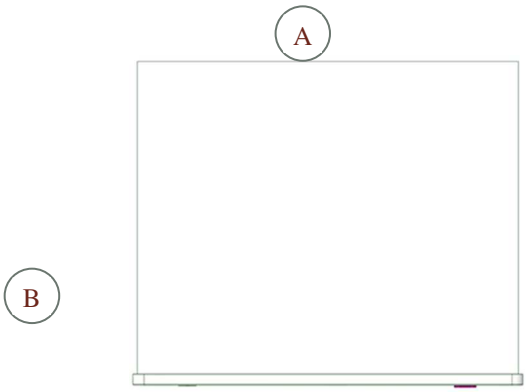
Wi-Fi Signal Quality

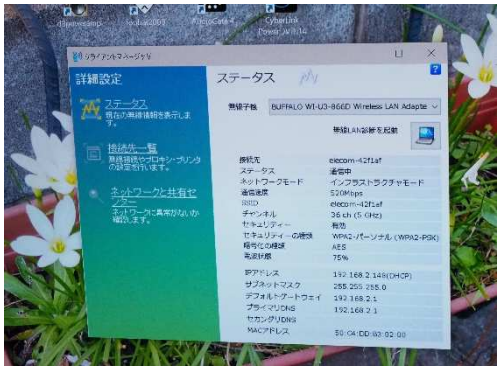
I checked the signal quality of Wi-Fi by using a monitor app, Baffalo Client Manager V.

The measurement was made in my study/lab like other measurements. The distance between Fils9 and the Wi-Fi router is longer than the original layout where Fils9 is placed in the living room.

The settings of Wi-Fi is default.
The positions of the Wi-Fi adaptor, Buffalo WI-U3-866DS, are:

A: Wi-Fi adaptor is inserted into the USB3.2 port in the rear panel of Fils9
B: Wi-Fi adaptor is connected to the USB3.2 port via extension USB cable, and placed near the front panel





Client Manager V

The table below shows the result.

Position	Signal quality	Transfer rate
A	55%	260Mpbs
B	57%	292.5Mbps

The result shows the location of the Wi-Fi adaptor does not affect the signal quality as much as I expected.

I noticed during the measrement that the signal quality got as bad as the communication was interrupted when the Wi-Fi adaptor was near the DAC or the BD drive.
Especially, the interference got more severe when the BD drive was electrically floating (when it wasn't connected to Fils9).

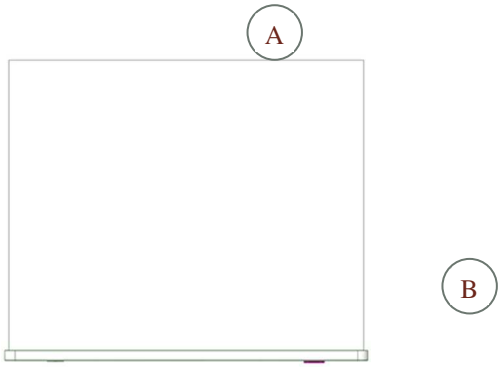
The parts of the enclosure of Fils9 except the bottom panel are somewhat electrically floating, because there is some electric resistance between them and FG. There is a possibility the enclosure interferes radio wave by reflection, absorption and diffraction (it is only my supposition). That is, there is a possibility that EMI isn't the cause of the interference in Wi-Fi communication.

Wireless Keyboard/Mouse Stability

I checked the operation stability of the wireless keyboard/mouse (Logicool MK240) at two positions of the receiver.

A: Direct connection to the USB2.0 port in the rear panel

B: Connection via extension USB cable, and the receiver positioned near the front panel.



The result is:

Receiver position	Distance *
A	< 1.5m
B	< 6.5m

* The distance between the keyboard or mouse and the receiver for stable operation

The position of the receiver is more crucial for the keyboard/mouse than Wi-Fi.

Power Dissipation

I measured power dissipation with a simple power meter (ELPA ECOkeeper EC-05EB).

Condition	Dissipation
Stand-by	1-2W
System startup	55W
Idle state	20-25W
Music being played	35W

Sound Quality

I auditioned Fils9 with Gaudi II and Kinglet.

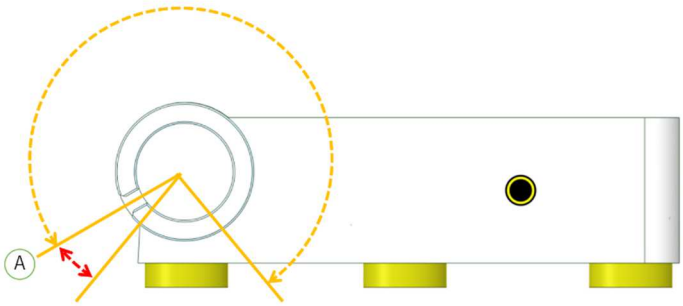
With Gaudi II, I feel the SQ of Fils9 is only marginally acceptable.
In comparison with SONY HAP-Z1ES (HAP), I think HAP is slightly better. HAP sounds naturally especially in reproduction of vocal.

With Kinglet, I feel the same thing.
I'm not perfectly satisfied with Fils9, compared with my familiar Kinglet sound.

I evaluated SQ of the headphone amplifier too, though I didn't spend much time for this because I wouldn't listen to music with headphones.
I used AKG K245 and audio-technica ATH-PRO700.

SQ was good for both the headphones. But I found a problem.
When the volume is turned down, the volume suddenly becomes zero at the position A indicated in the figure below. Because volume is zero at the angles indicated by the red arrow, the user can't set the volume to very low level. You can't listen to music with headphones at very low volume in a sleepless night.

I haven't made it clear whether it is the specification of DS-DAC-10R or a mere defect.



Improvement

According to the supposition that the radiated EMI is the cause of the trouble, I devised and carried out an improvement.

The motherboard and PSU of Fils9 comply with FCC Class-B. So, EMI can be suppressed by improving the shield effect of the enclosure.

Method

The best method is to disassemble the enclosure, remove the coating film off the surfaces of the parts that contact with another, and re-assemble the enclosure. The coating film is electrical insulation. The contact resistance should be reduced by removing it.

This method is so troublesome I compromised. I removed the coating film off only the positions where the screws contact.
I didn't disassemble the enclosure. I removed one screw, removed the coating film, and drove the screw back. Then I removed another screw, did the same thing, and so on.

This compromised method reduces only slight contact resistance. I didn't expect much, but thought it's better than nothing.

Work

I worked on each screw that fixes the parts of the enclosure as I described above.

I attached a grind stone for a handy router to a tapping tool, and removed the coating film with it.

The screw holes for the top panel are too small the grind stone couldn't be applied. I tried to insert serrated washers, instead of removing the coating film, but the screw hole is too small for the washer too.

Measurement

I made measurement just the same way as I did before the improvement.

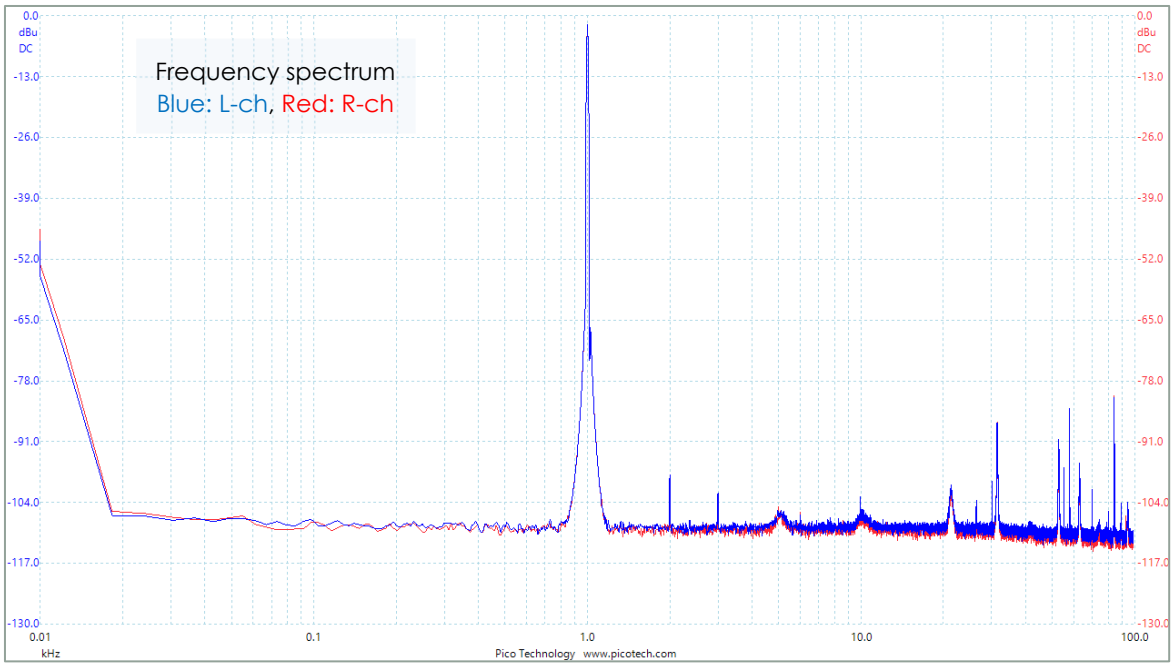
There is no difference in frequency response, residual noise, impulse response and square wave response.

The result of the FFT analysis is a bit better than before.
EMI is not improved.

FFT Analysis after Improvement

A bit better than before. The right channel is more improved than the left.

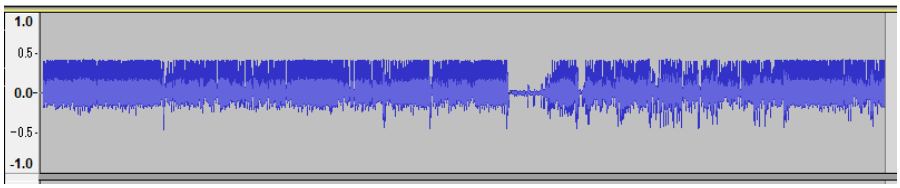
Index	Left channel		Right channel	
	Figure after improvement	Difference	Figure after improvement	Difference
THD	0.007%	+/−0	0.006%	−0.002
THD+N	−62.20 [dBc]	−0.44	−62.49 [dBc]	−0.76
SFDR	77.17 [dBc]	+1.51	76.98 [dBc]	+1.59
SNR	62.23 [dBc]	+0.44	62.52 [dBc]	+1.20
IMD	0.04%	+/−0	0.04%	+/−0



EMI after Improvement

Slightly worse than before, but this measurement is not accurate in the first place. It's better to say there's no difference.

Position	Power off		Power on		Music being played	
	Figure after improvement	Difference	Figure after improvement	Difference	Figure after improvement	Difference
A	-34[dB]	-4	-8[dB]	+1	-8[dB]	+/-0
B	-23[dB]	-1	-8[dB]	+1	-8[dB]	+/-0
C	-25[dB]	-1	-8[dB]	+1	-8[dB]	+/-0
D	-32[dB]	-4	-9[dB]	+1	-9[dB]	+/-0
E	-34[dB]	-6	-9[dB]	+/-0	-8[dB]	+1
F	-28[dB]	-6	-9[dB]	+/-0	-8[dB]	+/-0



Waveform at Pos-C:
Music playing

Channel Separation

I forgot to measure channel separation before improvement. So, the data below can't be compared.

The test signal is full-scale ($0dB_{FS}$) sine waves. A low-pass filter (LPF) of cutoff frequency of 40kHz is used to eliminate RF noise.

Frequency	Direction	Separation
20 [Hz]	L ➔ R	99.0 [dB]
	R ➔ L	99.2 [dB]
1 [kHz]	L ➔ R	99.4 [dB]
	R ➔ L	99.8 [dB]
20 [kHz]	L ➔ R	97.8 [dB]
	R ➔ L	97.9 [dB]

Good result. It is desirable that the separation is high even at 20kHz.

Evaluation of the Improvement

SQ hasn't been improved.
The result of FFT analysis has been slightly improved, but it is an inaudible improvement.

By the way, I found out the real cause of the instability of Wi-Fi. It was a bug in the Wi-Fi adaptor or its driver.
In the default setting, WI-U3-866DS automatically selects the format among 11a, 11n and 11ac, according to the signal quality. When it switches the format, communication interrupts and it takes some time to resume. Streaming of movie or music is interrupted.

To prevent it, the driver's setting should be changed so that it always selects 11ac. Then, Wi-Fi communication becomes stable.

Comparison with Other Combinations

I checked out combinations of Fils9 and another DAC or another player app.

The table below summarizes the results. 'A' represents the best, and 'E' the worst.

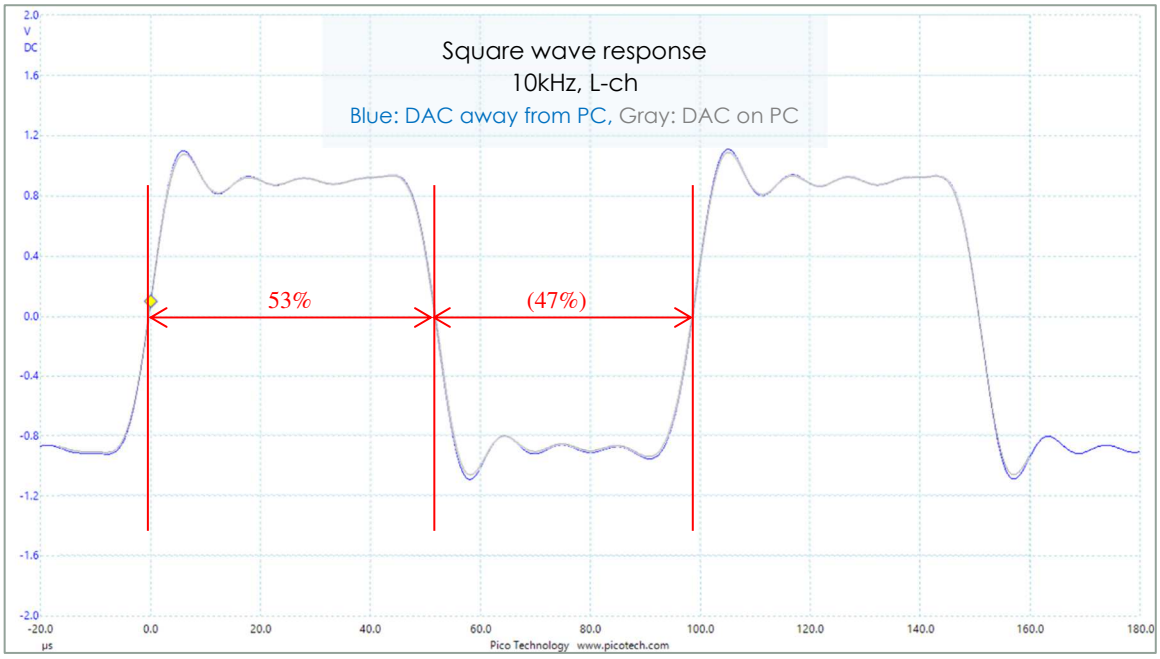
Combination	Measurements	SQ	Note
DS-DAC-10R on top of Fils9	C	C	Measurements are same as the original configuration
DAC: DS-DAC-10	B	B	Lower residual noise, clearer sound
Player app: AudioGate 4	C	B	Slightly bigger IMD, 50% duty ratio in 10kHz square wave response
On-board sound system	E	E	High end: 20kHz, high noise, rough sound
Original configuration	C	C	High RF noise, less clear sound

DS-DAC-10R on the Top of Fils9

When the DAC is on Fils9, I feel SQ is a bit worse. But the measurements are all the same.

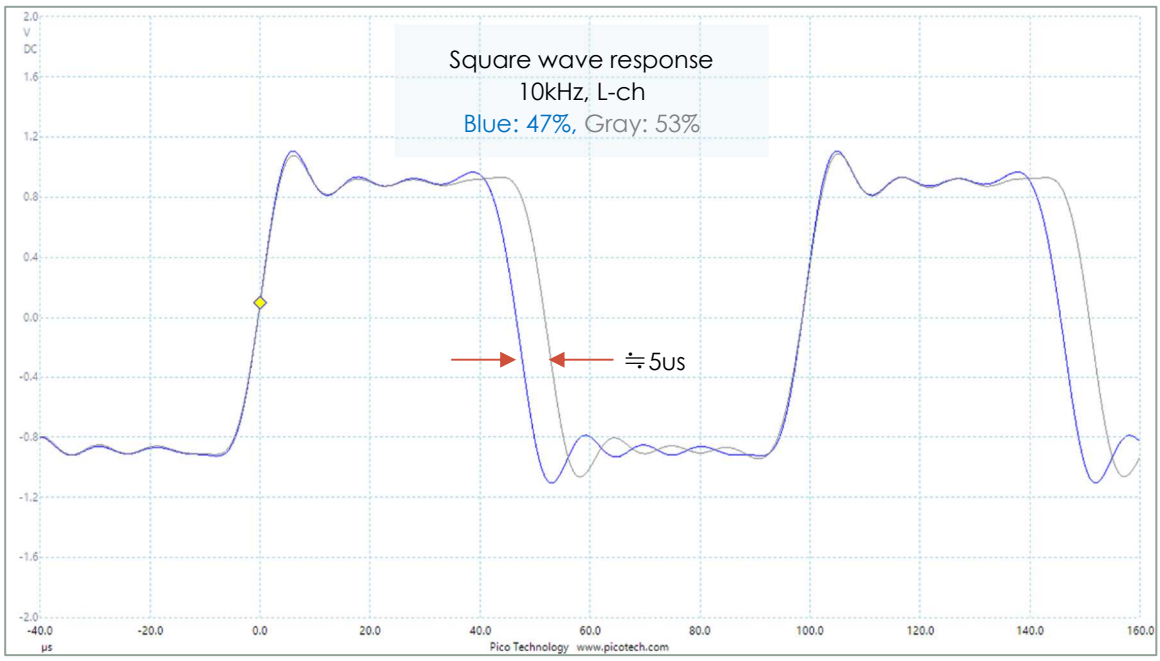
By the way, I realized an important fact I had overlooked, when I was scrutinized the waveforms in square wave response.

The figure below shows the waveform of the response to 10kHz square wave. You can see the duty ratio is 53% (more than 50%) at a close look. It means the period of the high level is longer than that of the low level.



At some trigger timing, the duty ratio becomes 47%.

The next figure shows the waveform of 47% superimposed on the 53%.



The timing of the falling edge of the 47% duty is earlier than the 53% duty by about 5us. This approx. 5us equals to one cycle of the sampling clock (192Hz). If the timing of the falling edge is the halfway between the two waveforms, the duty ratio is 50%. That means the both falling edges are shifting by +/-2.5ns.

If the sampling frequency were much higher, this problem wouldn't take place. As long as the sampling frequency is 192kHz or lower, this problem is inevitable.
Later, I tried out the player app, AudioGate 4 (AG4, hereafter). The duty ratio was exactly 50% when the same test signal was played. I don't know the mechanism of AG4…

The fluctuation of the duty ratio could impair SQ. This could be the reason why SQ of Fils9 is slightly worse than HAP-Z1ES.

DS-DAC-10 vs DS-DAC-10R

I compared DS-DAC-10, the predecessor of DS-DAC-10R, with DS-DAC-10R.
To my ears, DS-DAC-10 is better than DS-DAC-10R in SQ.

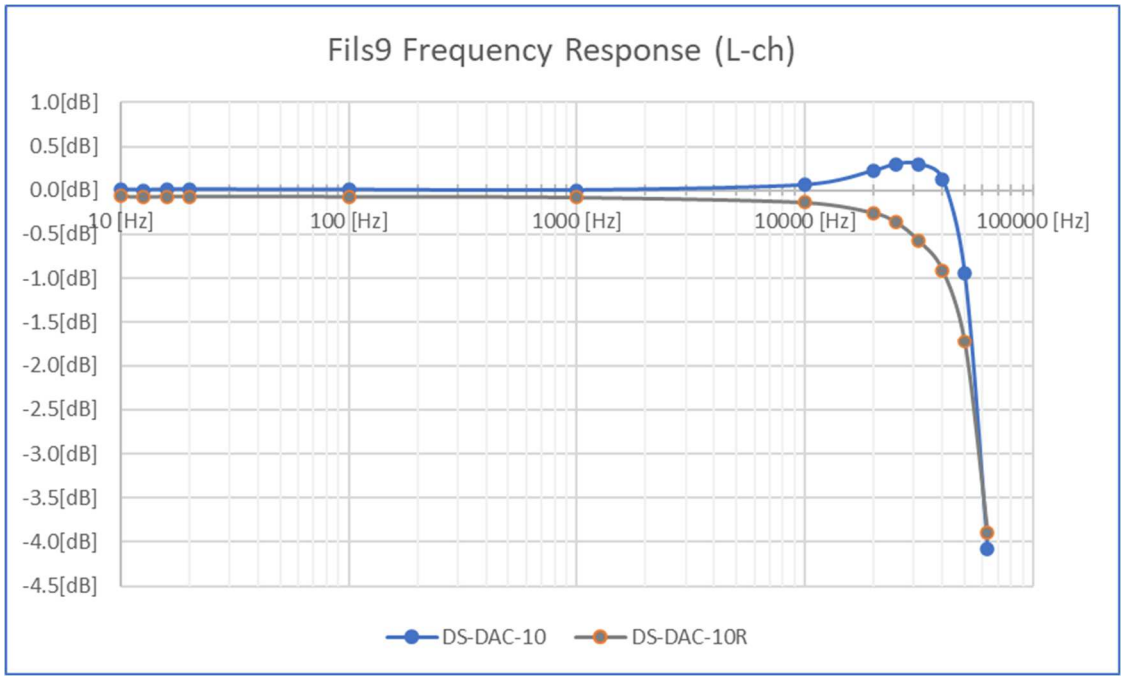
Here are the measurements that are different between the DACs.

Frequency Response

The measurements differ in the band higher than 20kHz.

The response of DS-DAC-10R gently reduces at the high frequencies, while that of DS-DAC-10 increases in the region between 25kHz and 31.5kHz by about 0.3dB.

The figure below shows the responses of DS-DAC-10 (blue curve) and DS-DAC-10R (gray curve). They are both the data of the left channel.



Residual Noise

This measurement shows the bigger difference than the others.
DS-DAC-10 generates less noise than DS-DAC-10R. The major component is 920kHz. It is probably the clock of the DAC as in DS-DAC-10R.

DAC	Left channel		Right channel	
	AC (rms)	DC	AC (rms)	DC
DS-DAC-10	356uV	2.481mV	290uV	-1.602mV
DS-DAC-10R	506uV	1.413mV	490uV	2.155mV

The AC components of the both DACs are about 20uV when 40kHz LPF is used to eliminate RF noise. They both don't generate noise in the audible band.

Square Wave Response

The waveforms are exactly the same as DS-DAC-10R. The duty ratio is the same: 53/47%.

FFT Analysis

DS-DAC-10 is better.

In the table below, 'difference' means difference between DS-DAC-10 and DS-DAC-10R.

Index	Left channel		Right channel	
	DS-DAC-10	Difference	DS-DAC-10	Difference
THD	0.006[%]	-0.001	0.005[%]	-0.001
THD+N	-65.94[dBc]	-3.74	-67.98[dBc]	-5.49
SFDR	81.43[dBc]	+4.26	82.00[dBc]	+5.02
SNR	66.00[dBc]	+3.77	68.05[dBc]	+5.53
IMD	0.039%	-0.001	0.039%	-0.001

Channel Separation

Almost the same, but DS-DAC-10 is a bit worse at 20kHz.

DS-DAC-10: 95dB (@20kHz)

DS-DAC-10R: 98dB (@20kHz)

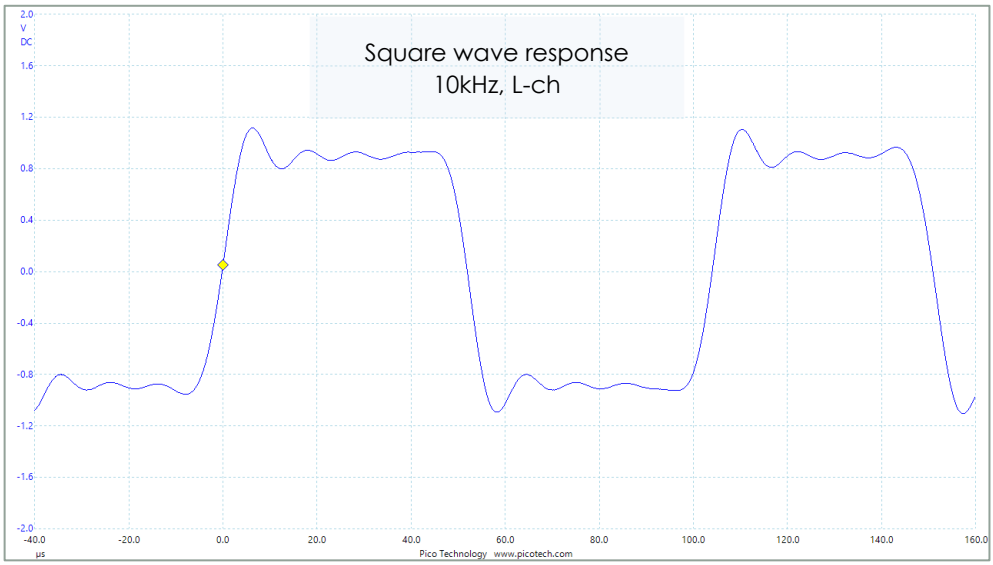
Sound Quality

DS-DAC-10 sounds clearer and more transparent than DS-DAC-10R.
In my experience, I've found the higher RF noise level makes the sound less transparent and blurry. The result of the comparison of DS-DAC-10 and DS-DAC-10R backs up my theory.

I had expected DS-DAC-10R is better than DS-DAC-10 in SQ, since it is a new model, but it doesn't live up to my expectation.

AudioGate 4 vs foobar2000

There is no difference between AG4 and FB2K in all the measurements but the 10kHz square wave response.
The duty ratio is 50%, when AG4 is used.

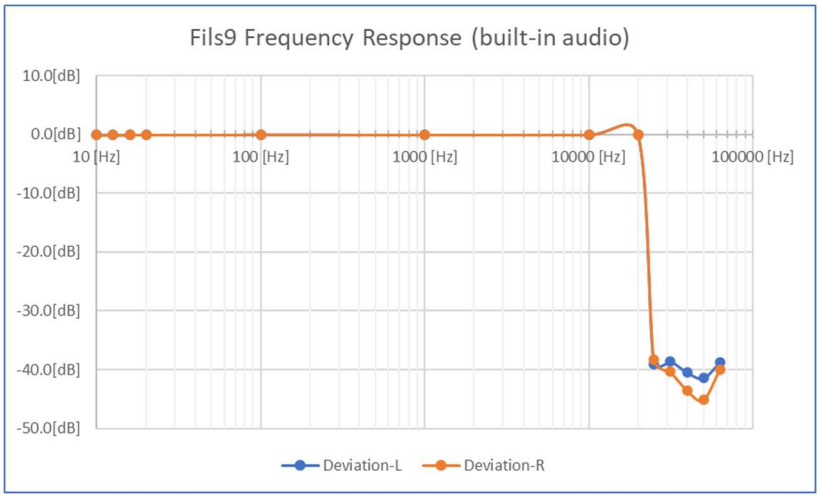


AG4 sounds slightly better than FB2K.
You should select AG4 if you stick to SQ, though FB2K is better for functionality and user-friendliness.

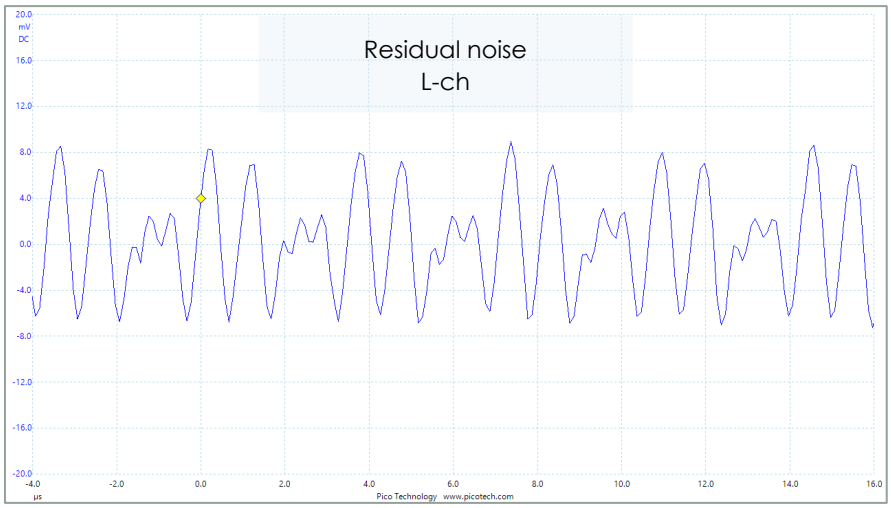
Built-in Sound System

The result is too bad in both the measurements and SQ. It can't be used in a Hi-Fi system.

In the **frequency response**, the frequencies higher than 20kHz are filtered by a sharp-cutoff filter. Hi-Res sources are meaningless with this sound system.



The level of the **residual noise** is high. Not only the RF component but audible white noise is so high.



Due to the high-level noise, the results of **FFT analysis** are so bad (THD=0.123%, SNR=41dB, etc).

As for **SQ**, it sounds rough. It's not comparable with DS-DAC-10R.

The catalog of the motherboard (ASUS PRIME H470M-PLUS) appeals its excellent SQ under the catch letters 'Transcendent Audio'. I think the assessment criterion in the world of IT is totally different from the world of Hi-Fi audio.

DS-DAC-10R Connected to On-board USB Port

Connecting DS-DAC-10R to the on-board USB2.0 port makes no difference in comparison with using SOtM tx-USBhubIn in both measurements and SQ.

I experienced a similar thing before.
I once used a self-powered USB hub, Aurorasound BusPower-Pro, for DS-DAC-10, intending to improve SQ. But I soon discarded it because it wasn't helpful (for details, see the article below).
https://nobody-audio.com/English/posts/topics_en4.html

Unless your PC is a cheap one, the USB bus power it provides is well-regulated and low-noise. Besides, DACs have a high-performance DC/DC converter in it. There is little need for an extra power supply.

Without the USB hub, Fils9 is less expensive by 38,665 JPY (as of August 2021). I recommend it.

Wrap-up

EMI Issue

Due to the instability of Wi-Fi and the wireless keyboard/mouse, I took me as long as six weeks to make Fils9 operate stably.
I suspected Fils9's EMI interfered the wireless communication, because Oliospec didn't guarantee low electromagnetic emission. I used the extension USB cables to avoid EMI, and this remedy was successful.
However, I still wonder if EMI is the true cause. One more possibility is that the enclosure may reflect or absorb radio waves. To ascertain which is true, I need a measurement instrument for this purpose.

It is certain that the level of noise radiated by Fils9 is much higher than that of audio equipment.
I still wonder if this noise adversely affects SQ. When DS-DAC-10R was placed on Fils9, I felt SQ was impaired. But the measurements didn't change. The deterioration of SQ could be my imagination. Or, the measurement method should be improved.

Issue of DS-DAC-10R

The more serious problem is that the output of DS-DAC-10R contains the high-level RF noise. The noise possibly makes the sound less transparent and somewhat misty.
This deterioration of SQ is caused in the amplifier (esp. power amp) rather than in the DAC. The RF noise modulates signals in the audible band in the amp.

To my ears, the combination of Fils9 and DS-DAC-10R sounds a bit worse than audio equipment like HAP-Z1ES and MR-2000S.

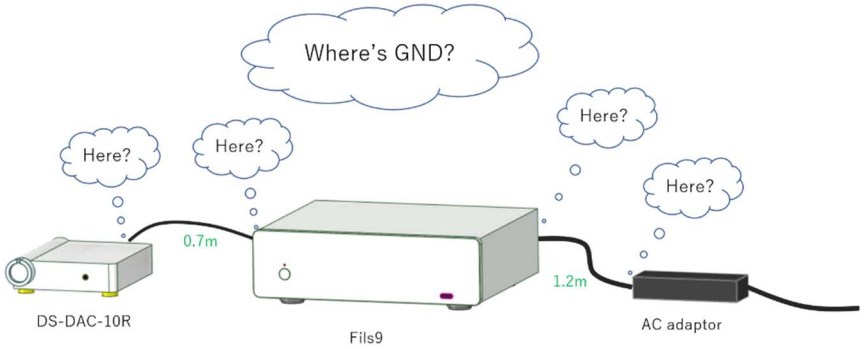
Conclusion

I've decided not to use DS-DAC-10R.
There's one solution to avoid the RF noise. An LPF built in the amplifier can reduce the noise. But I don't like the fact that DS-DAC-10R requires such a solution. And, I don't like DS-DAC-10R because it is inferior to the old DS-DAC-10 in both the measurements and SQ.

I've decided to buy another DAC.
I focus on the following two conditions:

1. Low clock jitter
2. AC-powered (not using USB bus power)

I made the condition-2 because I doubt the USB bus power is powerful enough for the DAC. The power consumption of USB2.0 device must be 2.5W or lower. For the DAC with a headphone amp in it, the limit of 2.5W should be a tough criterion. I'm suspecting that the design of DS-DAC-10R focuses more on low power consumption than high SQ.
In addition, the length of the ground line in the USB-powered system may be an issue. I wonder where the true ground is. The long ground line could lead to high-level noise.
By the way, the PSU (AC adaptor) of Fils9 isolates the secondary (DC side) from the primary (AC side), so its ground is floating from the Earth.



I expect Fils9 can be a high-performance DAP that meets the requirement of Gaudi II by combining it with better DAC.

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