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Why should you think about modifying the power supply of your Bluesound Node?

This document was created to answer some frequently asked questions and dispel doubts about whether it is worth modifying the power supply.

Construction

Let's start with the fact that the device is equipped with a switching power supply as standard. Switching power supplies don't have to be bad at all ... but not in this case.

Main complaint are capacitors. The factory power supply uses KSC capacitors - "King-Sun Co Ltd". These are poor quality Chinese-made capacitors about which you can find a lot of bad information. They are a frequent cause of failure of consumer electronics in which they are used. In addition, the design of the power supply and their location causes much faster degradation. Some of them are located next to the heat sinks of switching transistors which are quite warm and they even touch them.

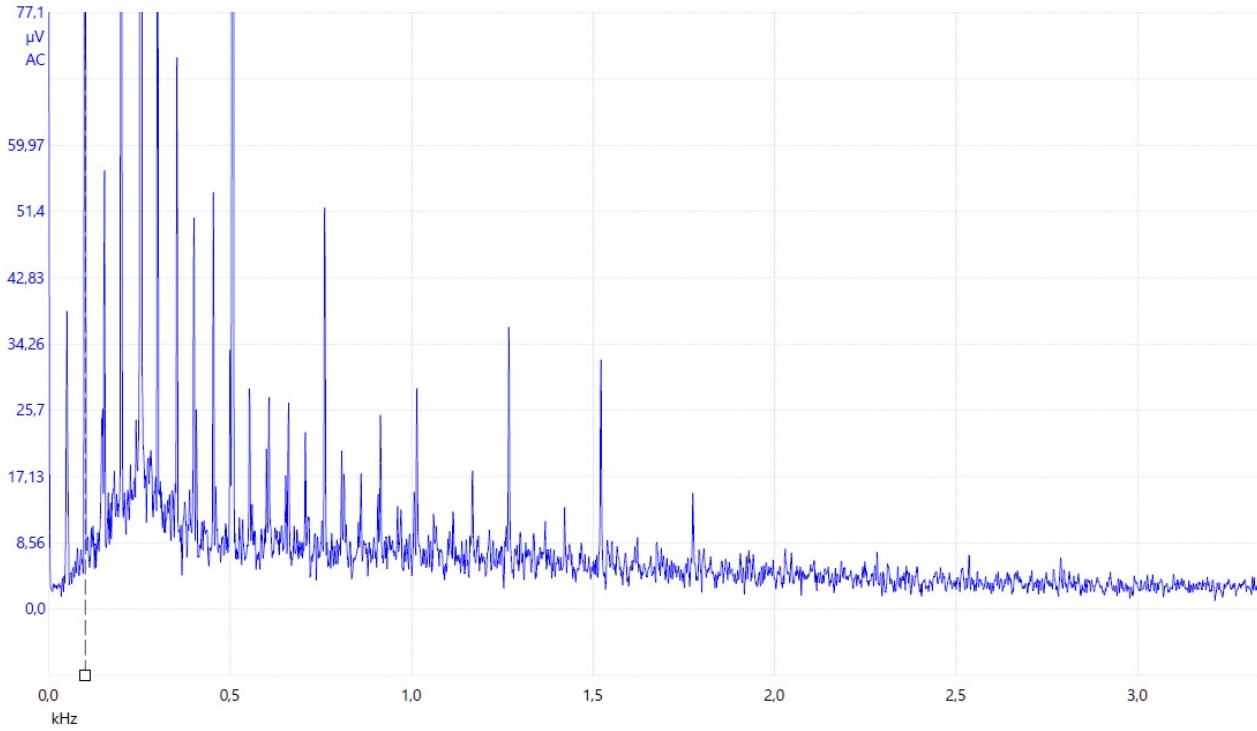
The real life of these capacitors is about 2 years, there are known cases of failure of the factory power supply after just 3 years.



The NAD logo should be a good source here, unfortunately these small savings are of great importance here.

Noise and ripple from the factory power supply. Let's measure them!

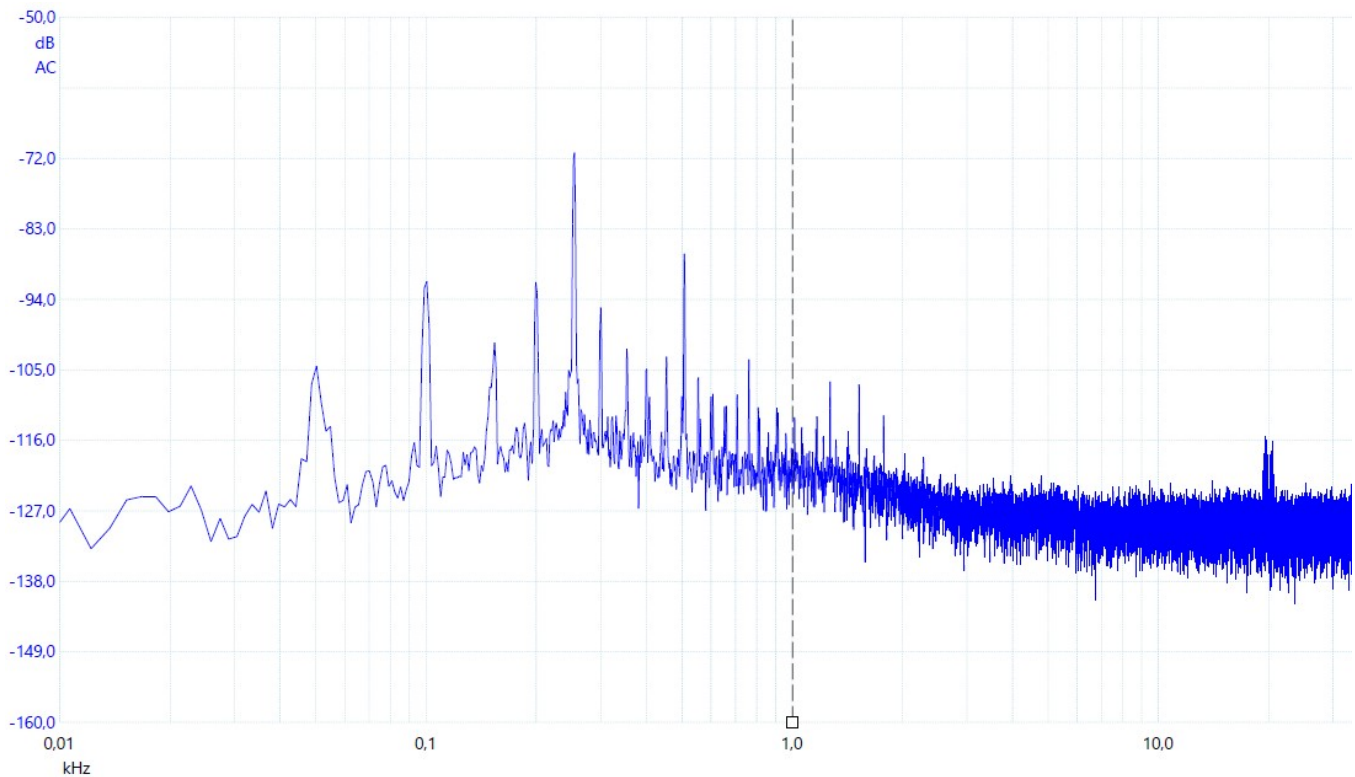
Low frequency noise and ripple of factory PSU.



The factory switched-mode power supply generates a huge amount of noise. The voltage is not constant and there is a large ripple. Some of them are off scale. The scale of this graph has been limited so that you can easily refer to the graphs of the low-noise power supply.

The highest ripple occurs at the frequency of 250Hz and reaches about 200uV (0.0002 V). There are a lot of harmonics. The lowest recorded noise is above 7uV (0.000007 V).

Noise level 0 to 100kHz.

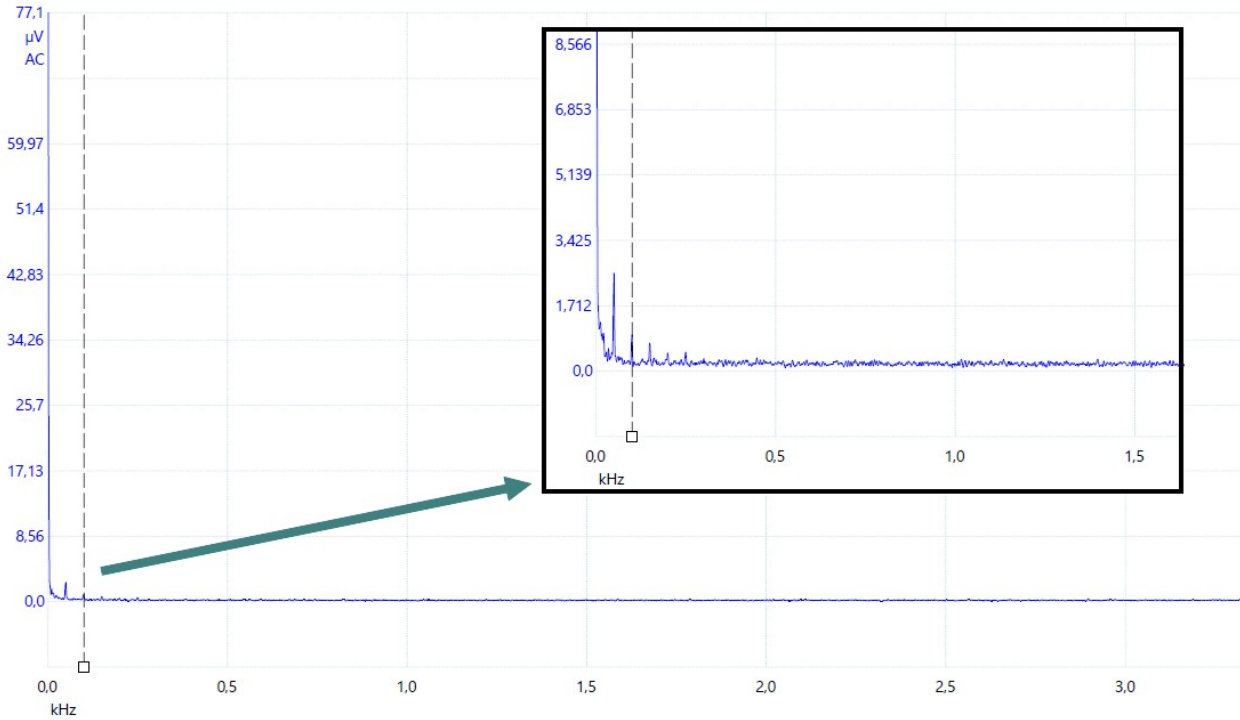


There is nothing to say. We have set two marker points: first at 1kHz, and second at 100kHz. The lowest possible noise floor level registered at these points is -118dB and -116dB, respectively. The lowest in the whole range is -123dB. Highest possible noise floor is -114dB at 250Hz frequency, also there are a lot of distortions and harmonics even up to -70dB.

AC RMS noise for 0 to 100kHz frequency band, of factory PSU is about 2000uV (0.002 V)!!

Solution! Get rid of this and change it to low noise PSU.

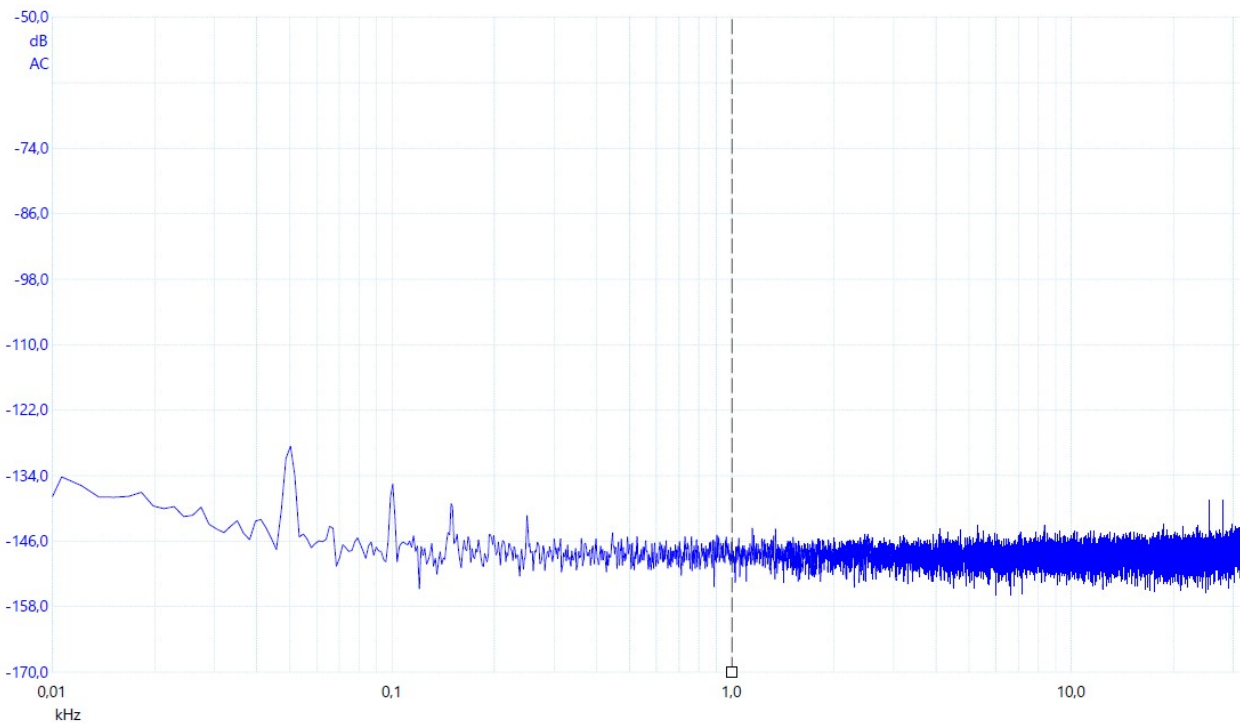
Low frequency noise and ripple of PCB interface + low noise PSU.



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We used the same scale as on the factory power supply graph ... but we had to zoom in to show the real difference. The ripple level is below 1µV (0.000001 V). The highest ripple recorded occurs at 50Hz - this is the so-called component of the main grid network - and amounts to 2.5µV (0.0000025 V).

Noise level 0 to 100kHz of PCB interface + low noise PSU.



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Once again there is nothing to say. We have set two marker points: first at 1kHz, and second at 100kHz. The lowest possible noise floor level registered at these points is -144dB. The lowest in the whole range is -147dB. Highest possible noise floor is -136dB at 10Hz frequency.

Again, we can observe the component of the main grid network - 50Hz - in this case it is -128dB.

AC RMS noise for 0 to 100kHz frequency band of PCB interface and low noise PSU is only 40uV (0.00004 V).

Summary.

All measurements were made with a current load of 1A under normal use conditions.

Measurements were made with a tip and barrel probe plugged directly to PSU mainboard plug. Hardware used for measurements is 16-bit depth PicoScope 5242D oscilloscope, with PicoScope 6 Version 6.14.23.5207 software.

Comparison table (lower are better).

Parameters	Factory SMPSU	PCB interface + Low noise PSU
AC RMS noise (0-100kHz)	2000uV	40uV
Average noise density uV/Hz	from 50uV to 8uV	from 1.2uV to 0.4uV
Maximum voltage ripple	200uV at 250Hz	2.5uV at 50Hz
Noise floor range	from -114dB to -123dB	from -136dB to -147dB
Noise peak	-70dB	-128dB

Thank you for reading.

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