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Comparison of the experimental behaviour of Bassocontinuo racks versus a standard rack

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Summary

Present document resumes the results obtained during an experimental testing campaign performed by Vicoter on two racks manufactured by Bassocontinuo: Golia and Lyra. The behaviour of both racks when subjected to vibrations induced by playing music generated by a Hi-Fi audio system has been investigated. The behaviour is then compared with the one of a standard rack.

Index

1. *Introduction*

Vicoter measured the behaviour of the Golia and the Lyra racks manufactured by Bassocontinuo when subjected to vibrations induced into the structures by playing music with a Hi-Fi record player. Results have been compared to those measured on a standard audio rack.
All the racks have been mechanically loaded using the audio instrumentation necessary to operate the record player: an amplifier, a preamplifier, a phono preamplifier and the record player.
A picture of the used audio devices, provided by Bassocontinuo, is presented in Figure 1.

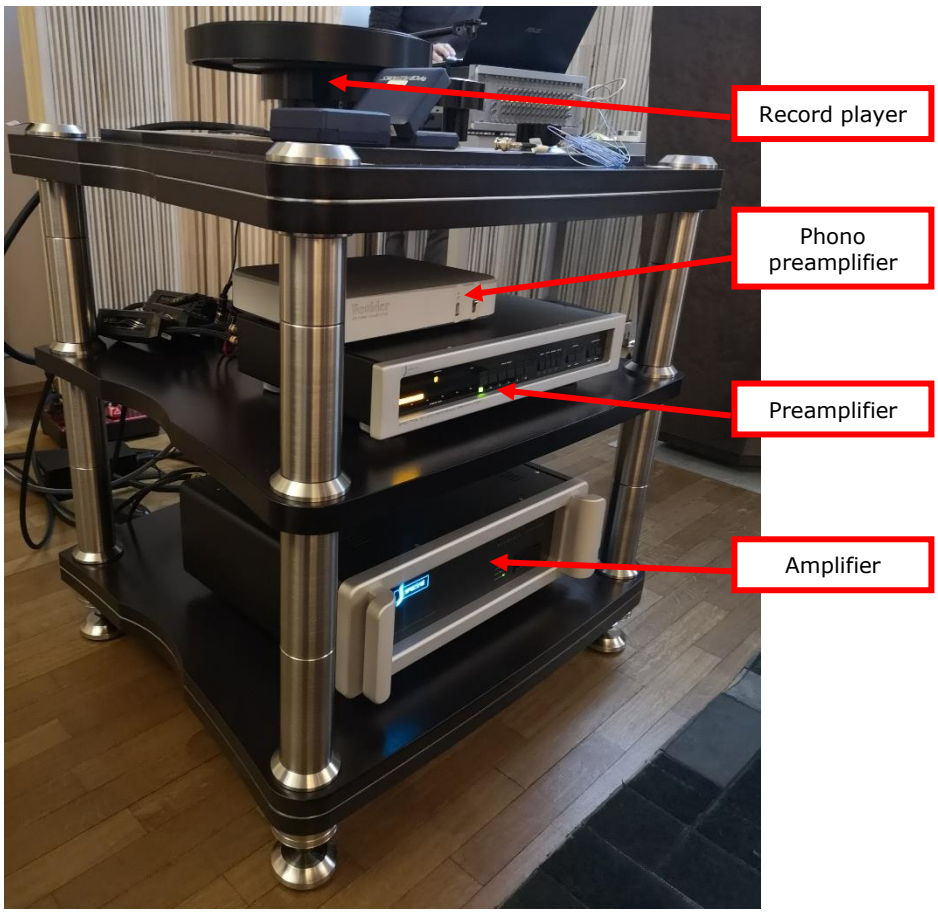

Figure 1. Audio devices setup during tests.

The three racks during the tests are presented in Figure 2.

		
Golia by Bassocontinuo	Lyra by Bassocontinuo	Standard audio rack

Figure 2. Tested racks during tests.

The racks were excited using the music generated by the Hi-Fi audio system. Two speakers were used. Tests were carried out in a typical house room, in order to reproduce the audio conditions experienced by a standard user, as shown in Figure 3.

Figure 3. Test room.

All racks were instrumented with 19 accelerometers: 4 at the corners of each rack floor; 1 at the centre of each rack floor; 1 on each audio device.
A microphone was used to record the excitation given to the structure and produced by the audio speakers.

Test purpose was to compare the response of the racks when subjected to two different levels of excitation.

2. *Test setup*

Following instrumentation was used to measure the vibrations and the audio excitation during tests:

- 1 Siemens LMS SCADAS 316 front-end for signal conditioning and acquisition.
- 12 PCB 333B32 uniaxial accelerometers, bandwidth from 0.5 Hz to 3 kHz and full-scale equal to 50 g.
- 6 PCB 356B08 triaxial accelerometers, bandwidth from 0.5 Hz to 5 kHz and full-scale equal to 50 g.
- 1 PCB 352A24 uniaxial micro-accelerometer, bandwidth from 0.1 Hz to 8 kHz and full-scale equal to 50 g.
- 1 ROGA MI-17 microphone, with frequency response: 30 Hz – 4 kHz, ± 0.5 dB; 4 kHz – 20 kHz, ± 1.5 dB, and maximum measurable peak SPL 130 dB (ref. 20 µ Pa).
- Software Siemens LMS-TestLab, release 17, for data-processing.

Pictures of instrumented points are presented from Figure 4 to Figure 10. Measuring point were the same on the three racks.

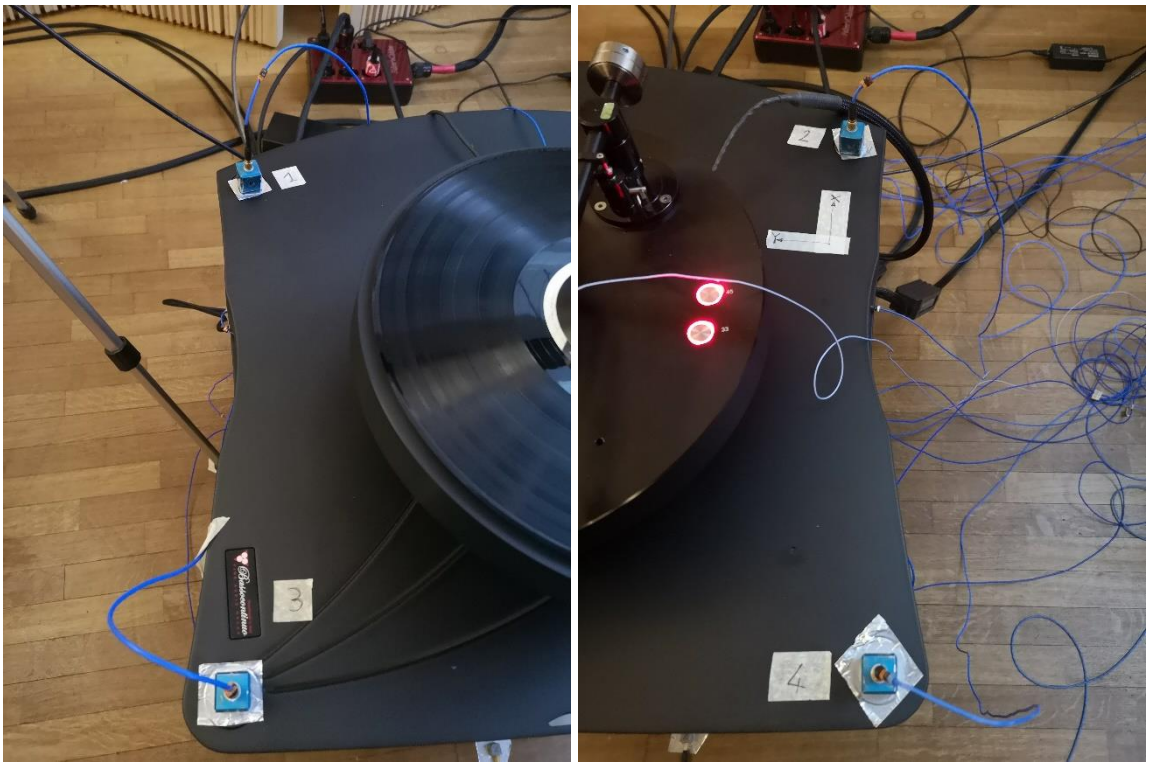

Figure 4. Measuring points 1 – 4.

Figure 5. Measuring point 5.

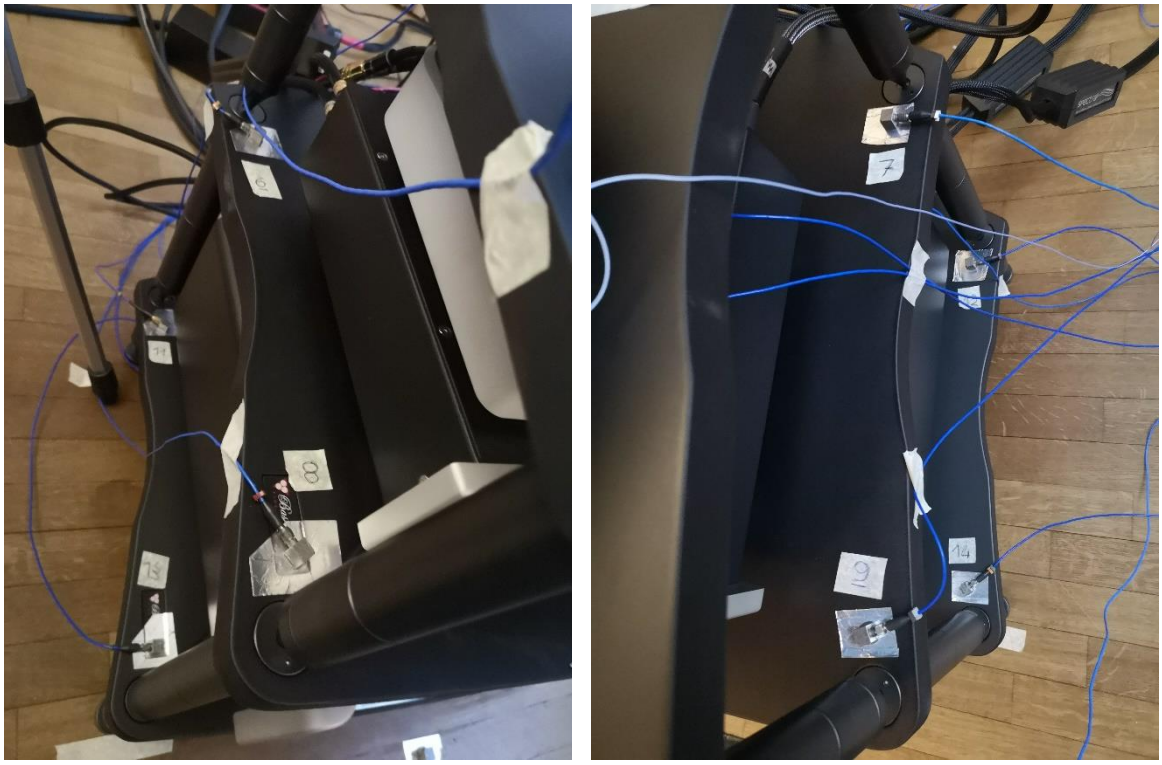

Figure 6. Measuring points 6 - 9, 11 - 14.

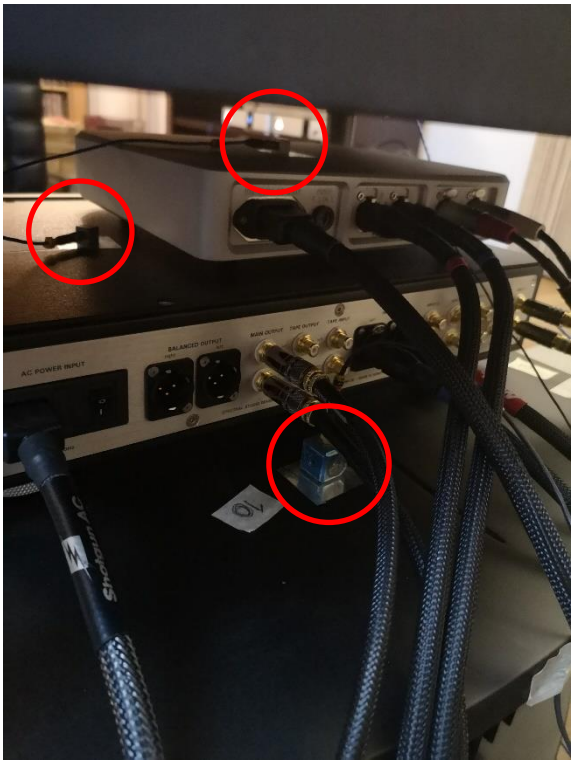

Figure 7. Measuring points 10, 16 and 17.

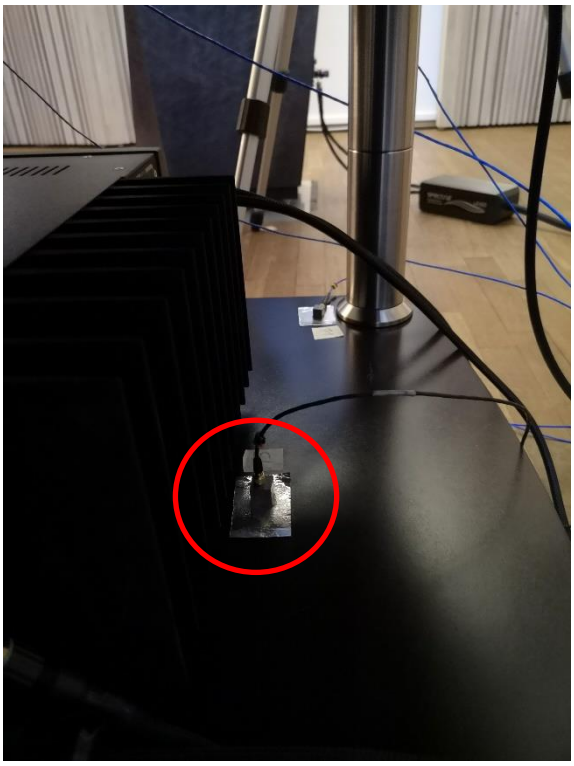

Figure 8. Measuring point 15.

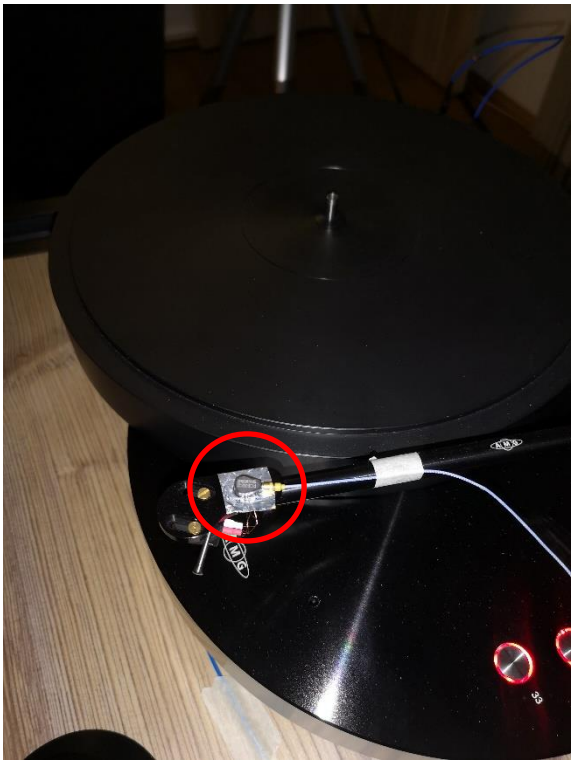

Figure 9. Measuring point 18.

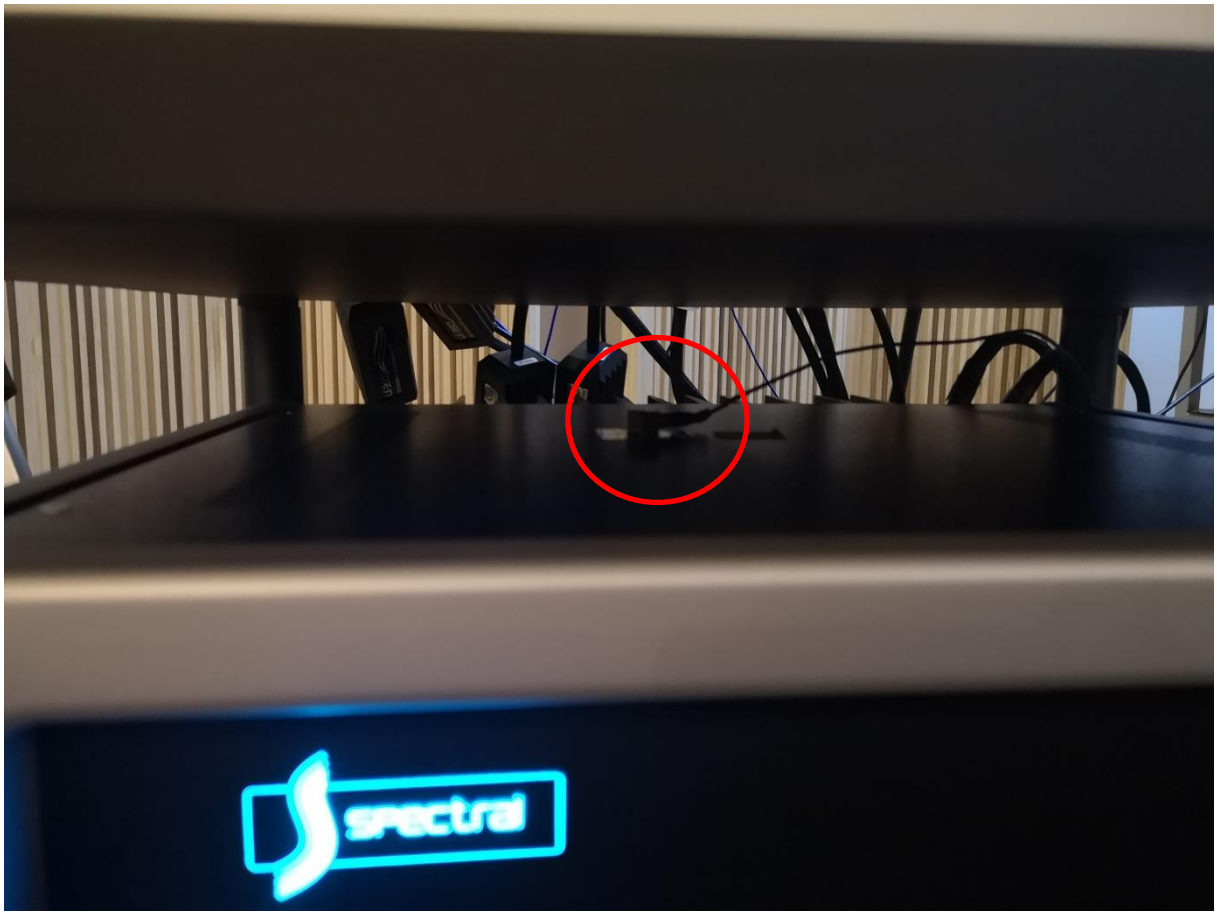

Figure 10. Measuring point 19.

The microphone position is shown in Figure 11, as well as, adopted reference system.

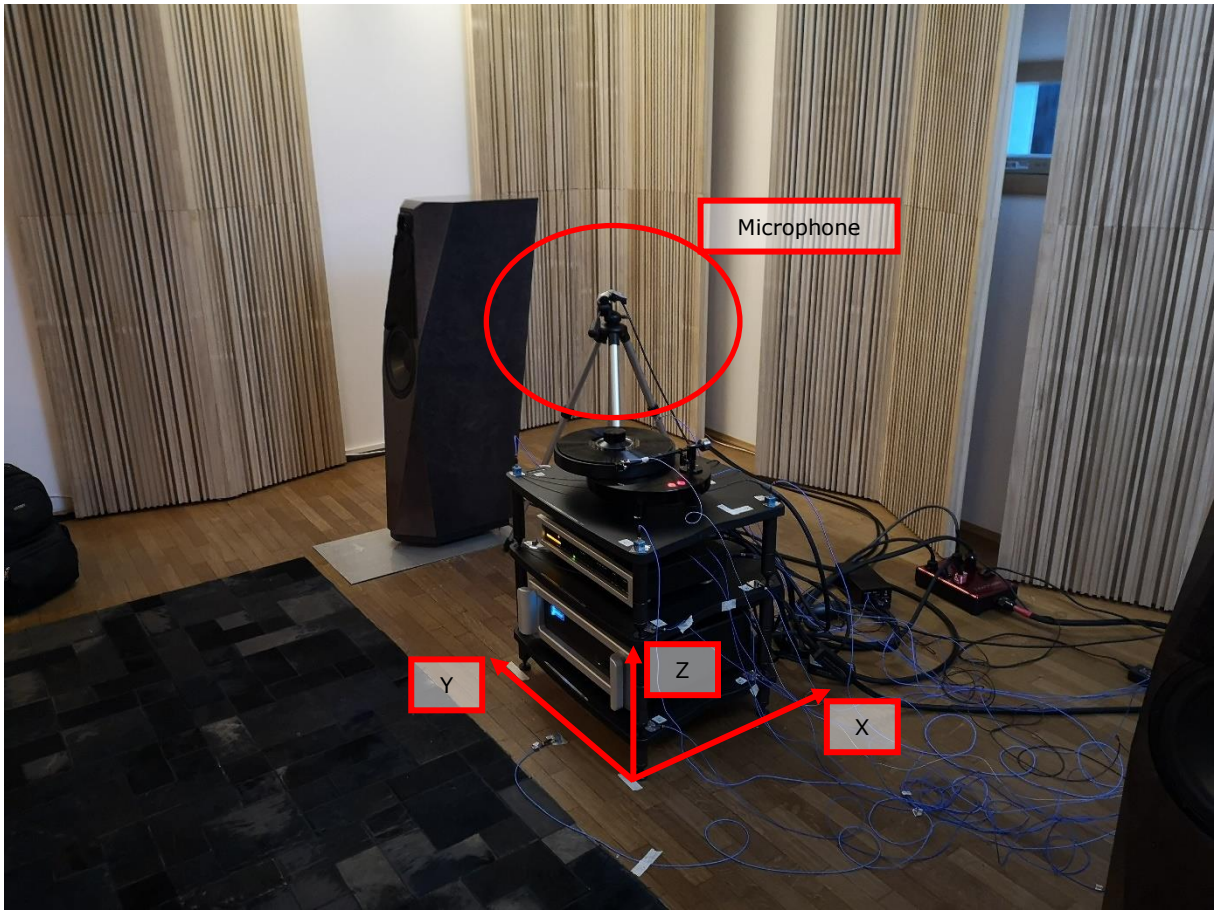

Figure 11. Microphone position during tests.

Racks were excited playing the song "The Wall", by Pink Floyd, at two different levels of the amplifier:

- Level 1 = 60% of the maximum amplifier power.
- Level 2 = 80% of the maximum amplifier power.

3. *Results*

The main amplitudes of acceleration were acquired in vertical (z) direction in every point. Other directions present accelerations much lower than the z ones.
Figure 12 and Figure 13 present two comparisons of the accelerations versus time measured on homologous points on the three racks.

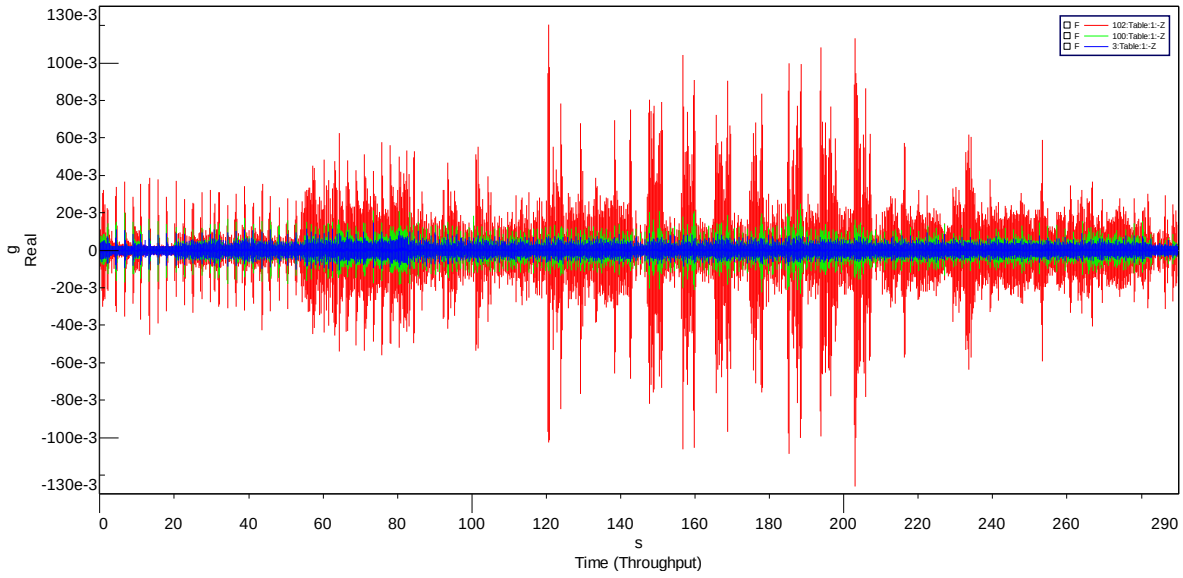

Figure 12. Point 1 (upper floor, corner), direction z. Standard rack (red), Lyra rack (green), Golia rack (blue).

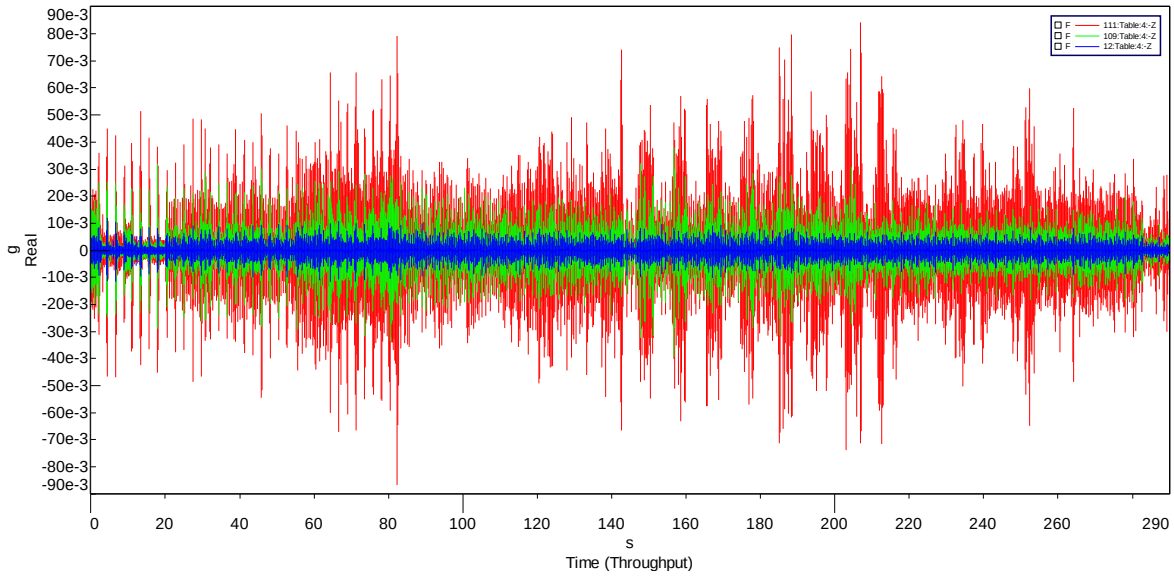

Figure 13. Point 4 (upper floor, corner), direction z. Standard rack (red), Lyra rack (green), Golia rack (blue).

Both previous figures clearly show that Golia rack presents vibrations on the upper floor lower than the Lyra, which in turn shows vibrations lower than the standard rack, for the same acoustic input.
The same consideration can be done comparing points on the other floors of the racks. As examples, Figure 14 and Figure 15 respectively compare the measurements carried out at point 10 in the z direction (centre of the middle floor), and at point 15 in the z direction (centre of the lower floor).

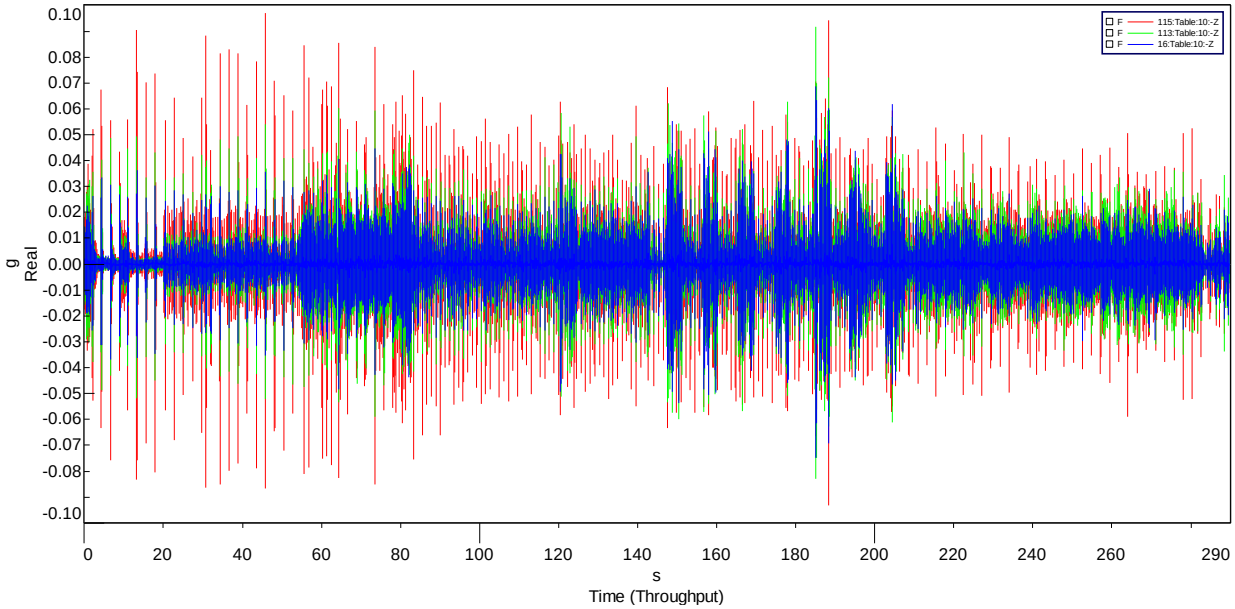

Figure 14. Point 10 (middle floor, centre), direction z. Standard rack (red), Lyra rack (green), Golia rack (blue).

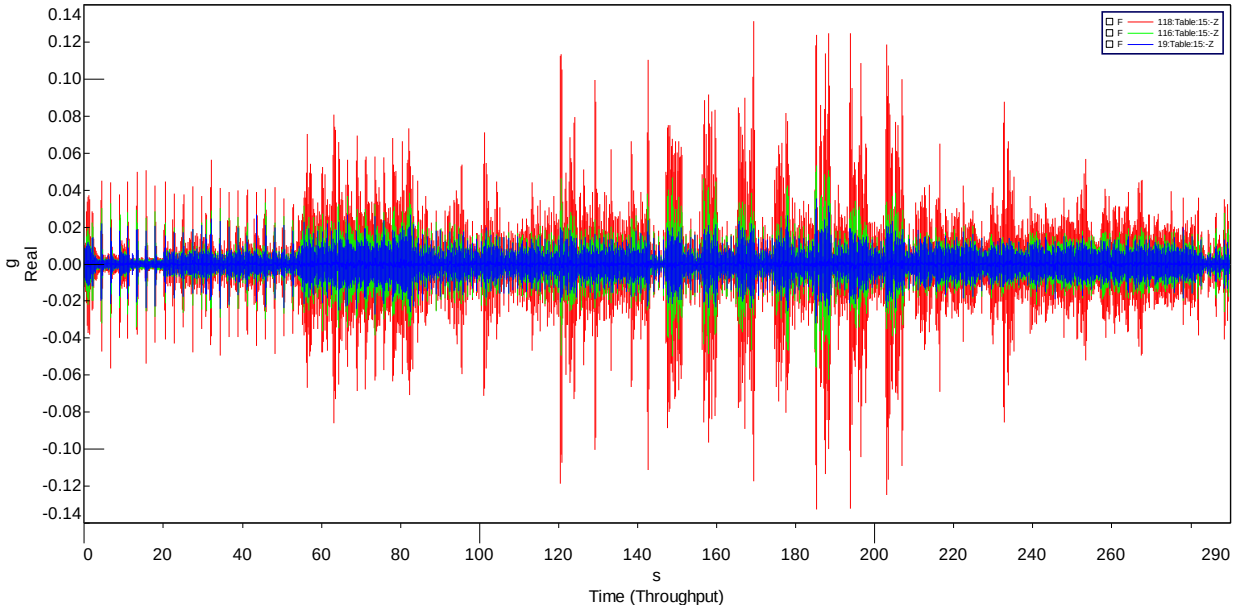

Figure 15. Point 15 (lower floor, centre), direction z. Standard rack (red), Lyra rack (green), Golia rack (blue).

A frequency analyses of measured signals shows that the spectrum of vibrations of the three racks is very different.
In particular, looking at Figure 16, it is possible to notice that the commercial rack (lower part of the figure) has a response larger in band than the Lyra (centre part of the figure), which in turn has a larger response than the Golia (high part of the figure).
Note that, the larger the excitation in the band spectrum is, the larger the undesired effects on the sound due to the rack are.

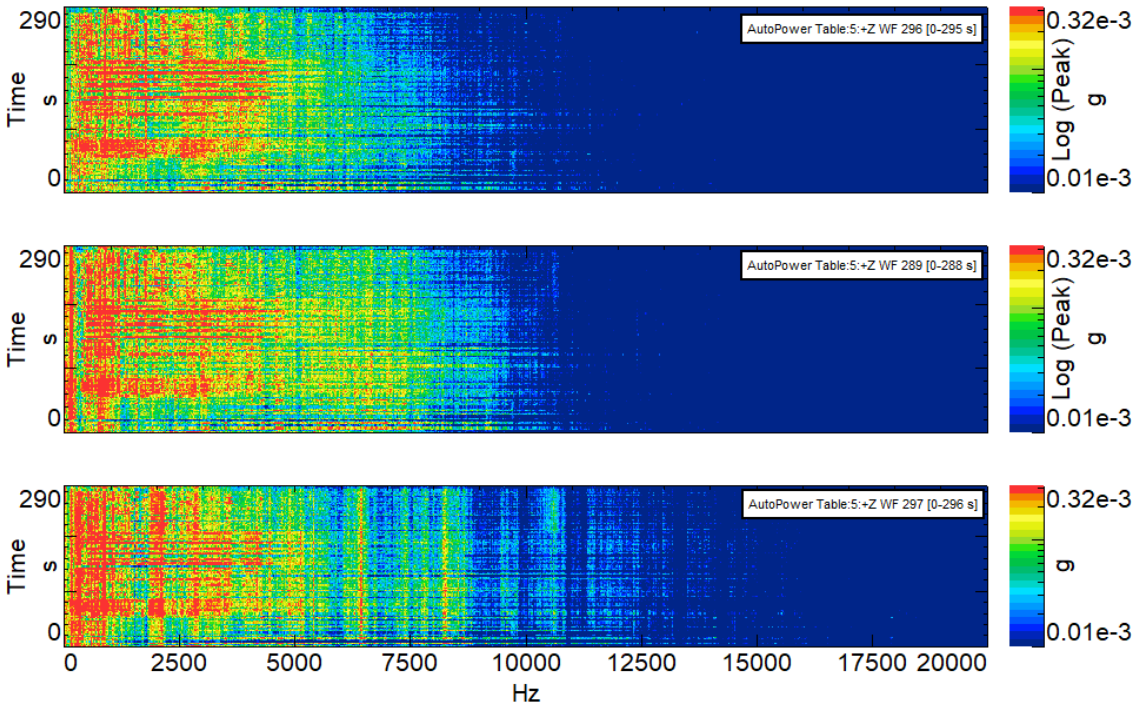

Figure 16. Comparison of vibration spectrum among Golia rack (up), Lyra rack (middle) and standard rack (down) – Amplifier level 1.

The same effect of incidence on a larger frequency band is visible even at higher level of excitation input, as shown in Figure 17.

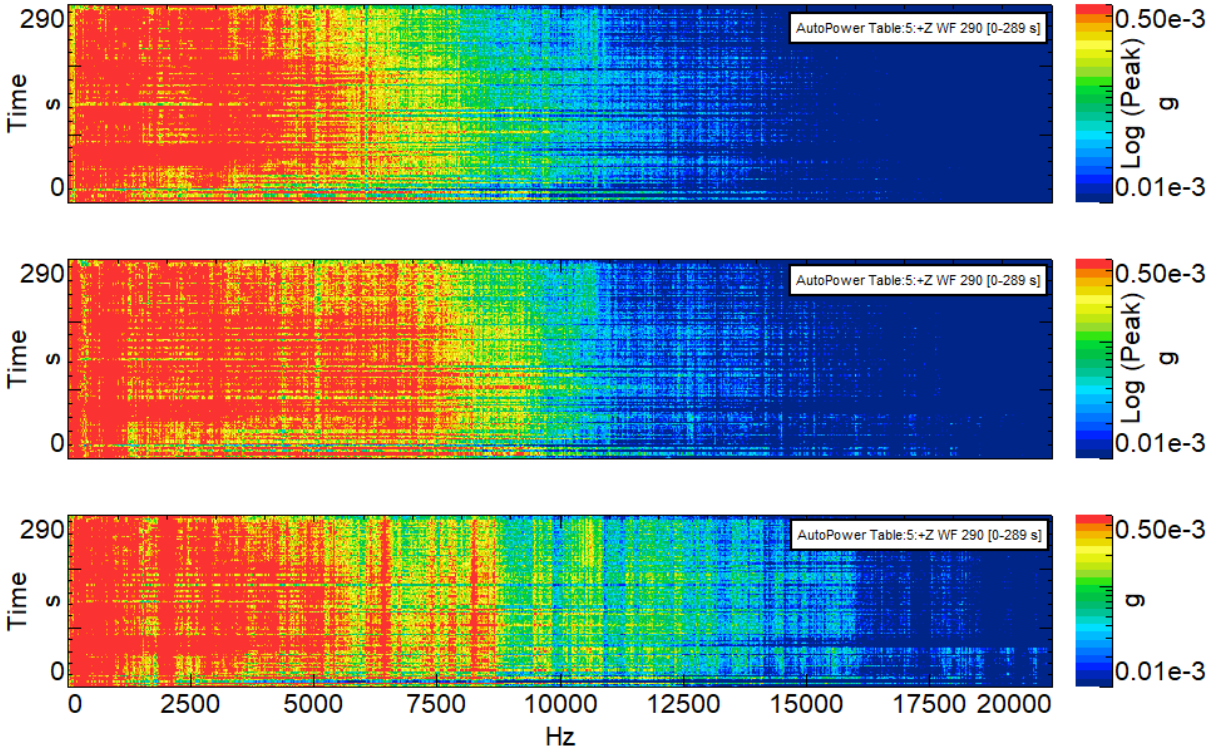

Figure 17. Comparison of vibration spectrum among Golia (up), Lyra (middle) and standard rack (down) – Amplifier level 2.

4. *Conclusions*

Vicoter measured the vibrational behaviour of three racks subjected to vibrations generated by playing music with a Hi-Fi record player in a typical house room: the Golia and the Lyra racks manufactured by Bassocontinuo and a standard audio rack.
Results have been compared both in the time domain and in the frequency domain.
They demonstrate that:

1. The behaviour of the Golia rack is better than the one of the Lyra rack, which is better than the one of the standard rack. Indeed, the vibrations of the structure induced by the music are lower in the Golia, than in the Lyra, which in turn has lower vibration levels than a standard audio rack.
2. The frequency response of the Golia rack is better than the one of the Lyra rack, which is better than the one of the standard rack. Indeed, the response band of the Golia is lower than Lyra one, which in turn is lower than the standard rack one.