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Analysis of the behaviour of four damping blocks by Bassocontinuo

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Summary

Present document resumes the results obtained during an experimental testing campaign performed by Vicoter on four damping blocks by Bassocontinuo. The four dampers were designed to obtain the best performances in a range of loading values and are indicated as follows:

Damper ID	Damper design load (kg)
Level 2	0 – 2.5
Level 3	2.5 – 5
Level 4	5 – 10
Level 5	10 – 20

The behaviour of the dampers when subjected to acceleration has been investigated in the range 20 Hz – 6000 Hz.

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1. *Introduction*

Vicoter measured the behaviour of four damping block manufactured by Bassocontinuo when subjected to vibrations.
In particular, during tests, an electro-dynamic shaker (G&W V55) is used to introduce vibrations in dampers and two accelerometers (PCB 333B32) are used to measure the vibration reduction obtained by the damping block, which is loaded with a weight.
A picture illustrating the test setup is presented in Figure 1.

Figure 1. Test setup.

The shaker is connected to a power amplifier (GW SS300) and to cooling system (as presented in Figure 2). The amplifier is driven by a Siemens.LMS SCADAS 316 front-end, which is also used for signal conditioning and acquisition.

Figure 2. Testing systems.

Damper are excited using a random signal in the band from 20 Hz to 6 kHz; 100 averages are performed. Following reference weights are used on each damper type:

Damper type	Applied load (kg)
Level 2	1
Level 3	3.7
Level 4	7.4
Level 5	13

The damping capability of each damper is measured using the two accelerometers, as shown in Figure 3. In particular, the first (input) accelerometer, which is placed before the damper, is used to measure the vertical acceleration levels entering into the device, while the second (output) accelerometer, placed on the top of the loading weight, is used to acquire the vertical output levels.
The FRFs between the input accelerometer and the output one allow to measure the damping performance of the system: they represent the ratio between the output and the input levels, frequency by frequency.

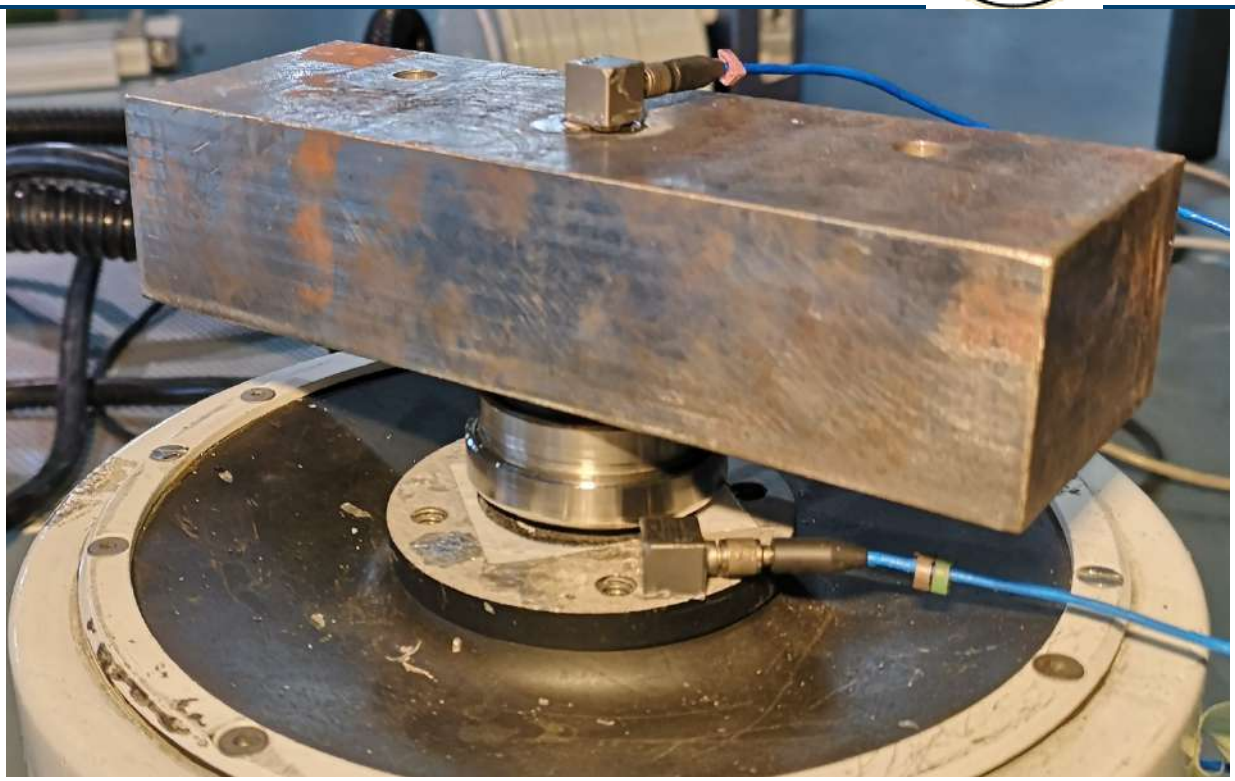

Figure 3. Test setup - Zoom.

2. *Results*

The comparison between the incoming and the outcoming accelerations on each damper in the tests at reference load are presented in figure from Figure 4 to Figure 7.

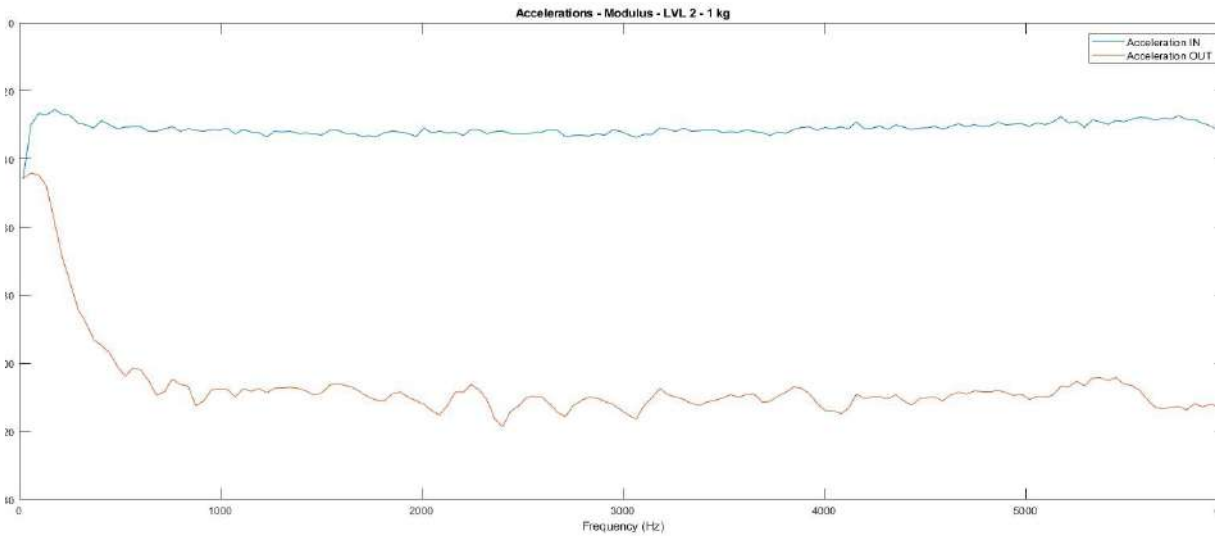

Figure 4. Incoming and outcoming accelerations on Level 2 damper loaded with 1 kg.

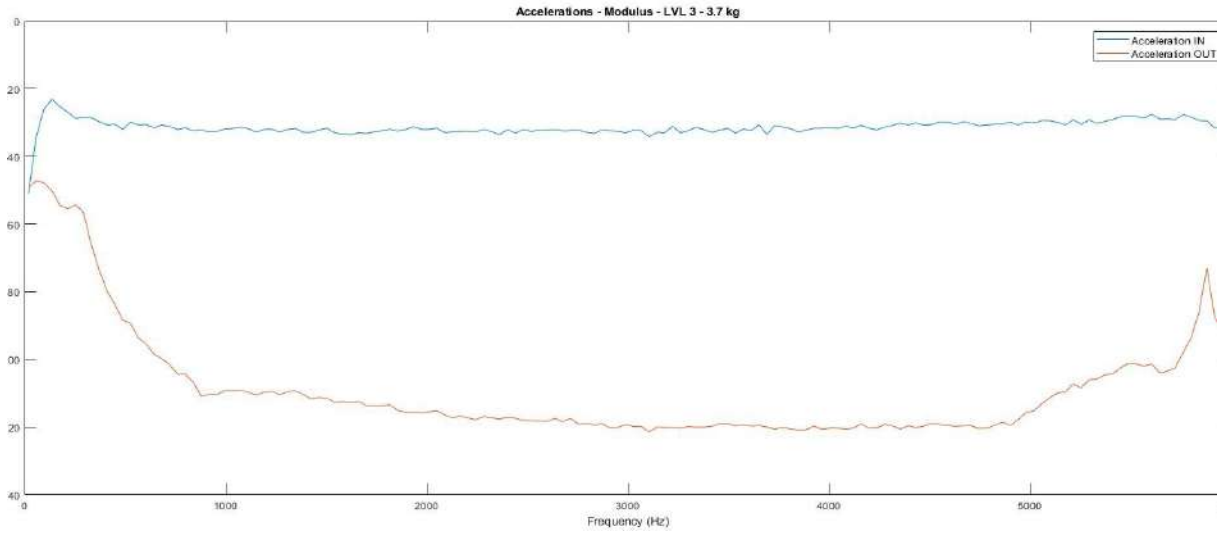

Figure 5. Incoming and outcoming accelerations on Level 3 damper loaded with 3.7 kg.

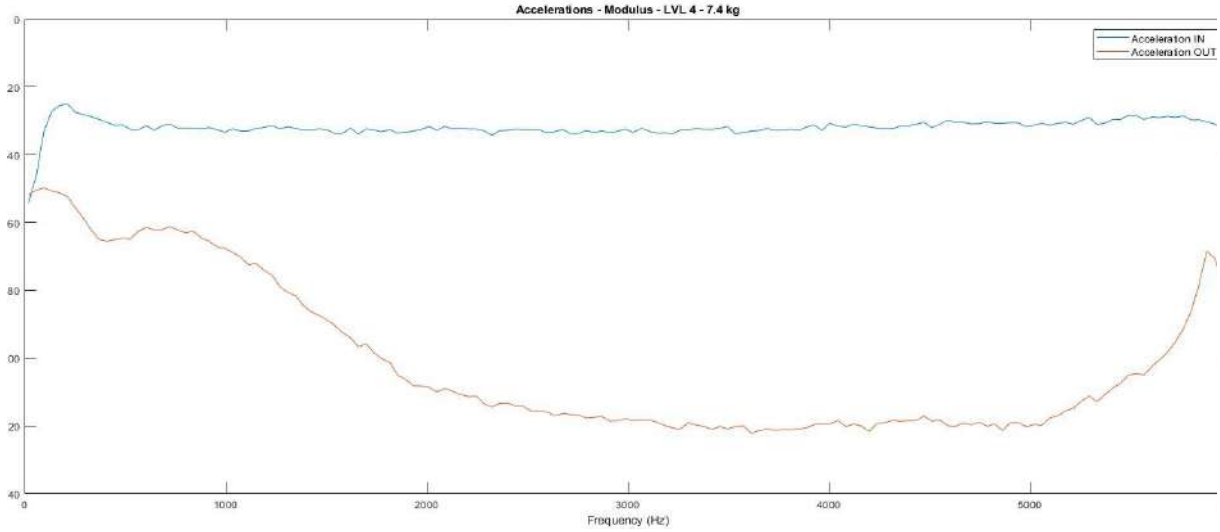

Figure 6. Incoming and outcoming accelerations on Level 4 damper loaded with 7.4 kg.

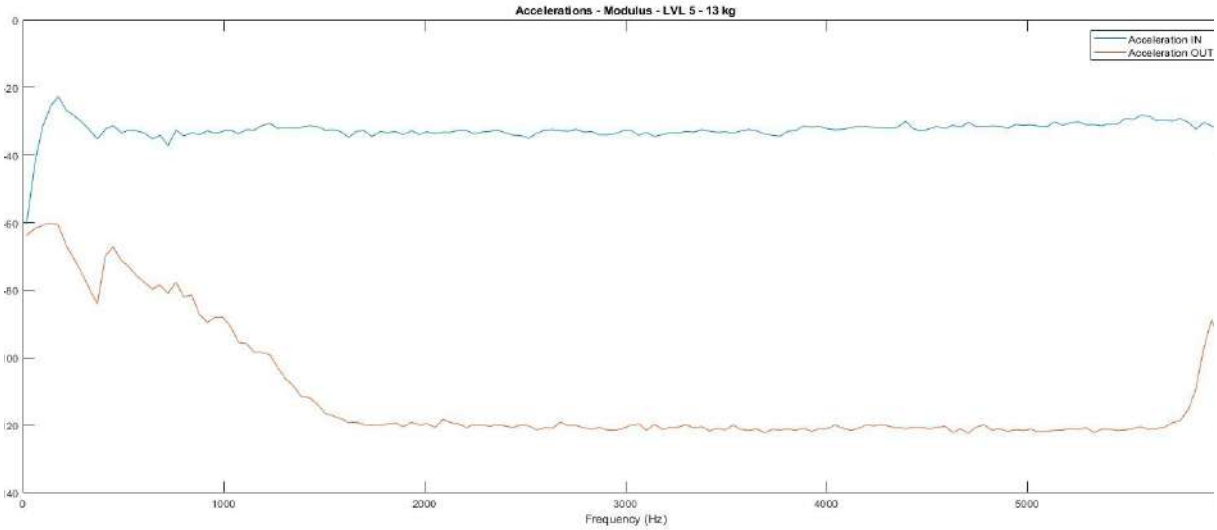

Figure 7. Incoming and outcoming accelerations on Level 5 damper loaded with 13 kg.

Corresponding FRFs are presented in figures from Figure 8 to Figure 11.

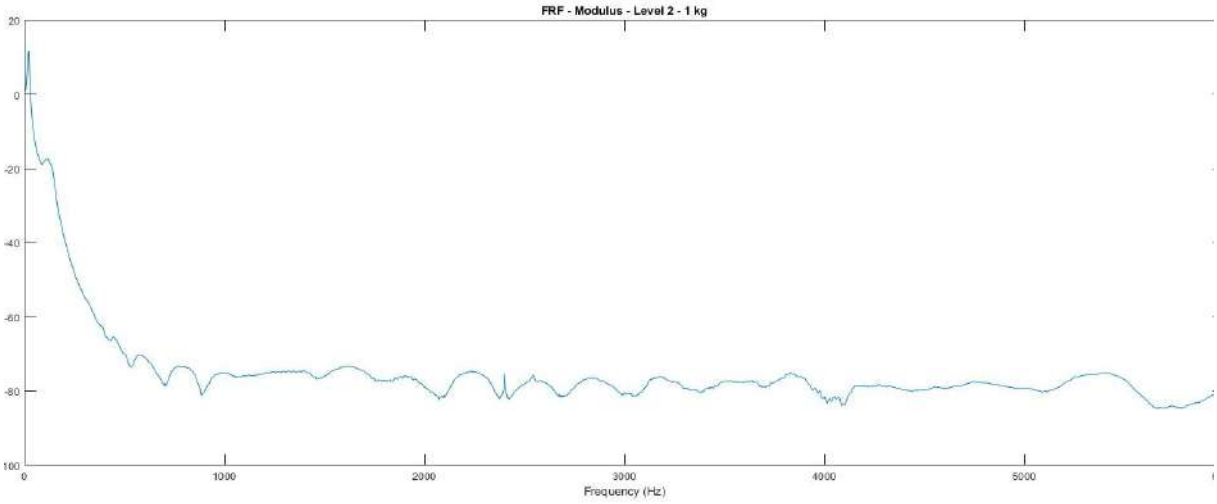

Figure 8. FRF on Level 2 damper loaded with 1 kg.

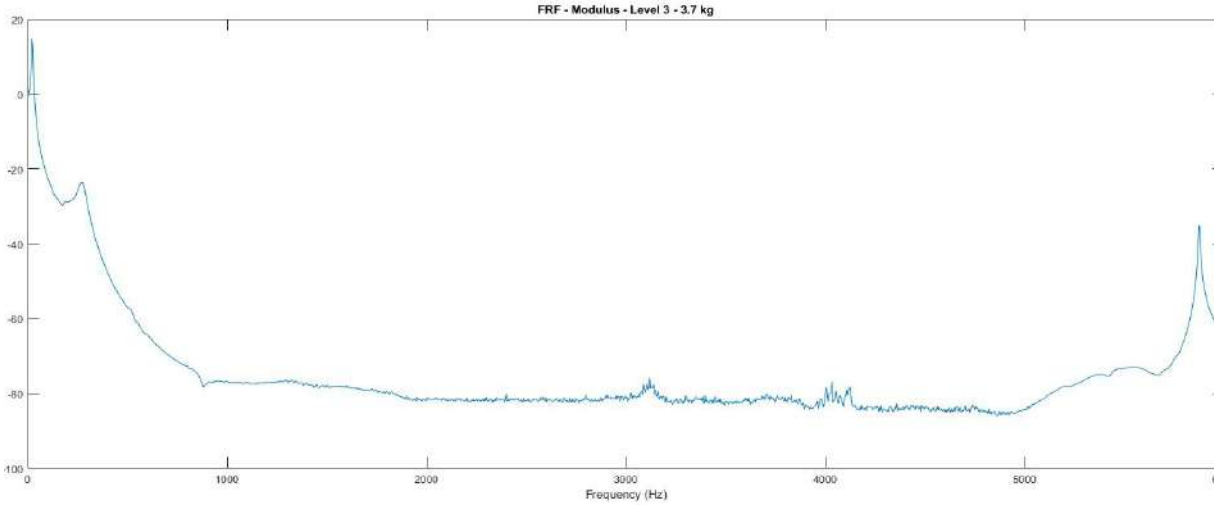

Figure 9. FRF on Level 3 damper loaded with 3.7 kg.

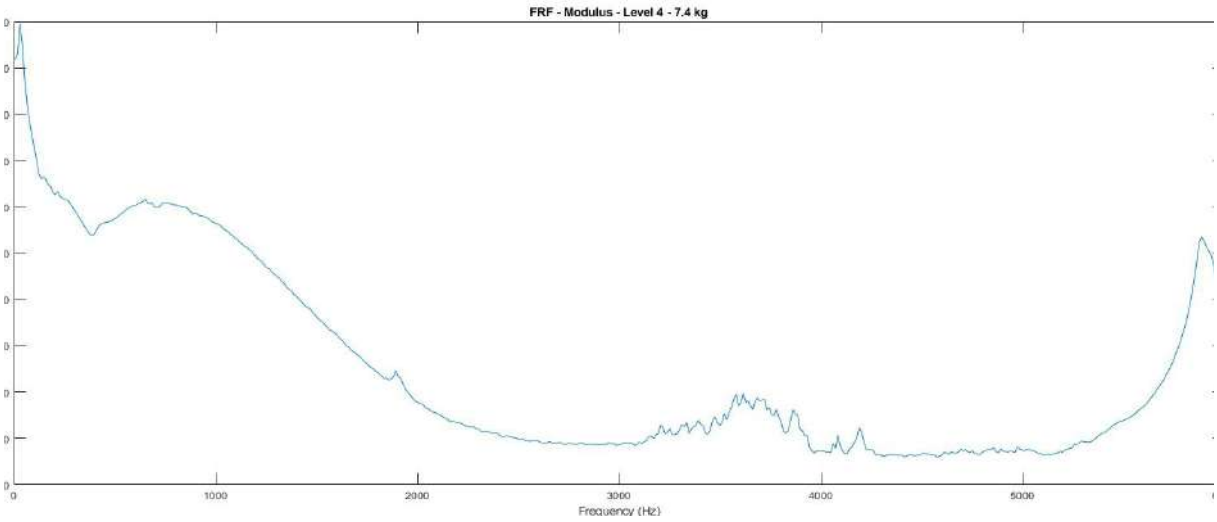

Figure 10. FRF on Level 4 damper loaded with 7.4 kg.

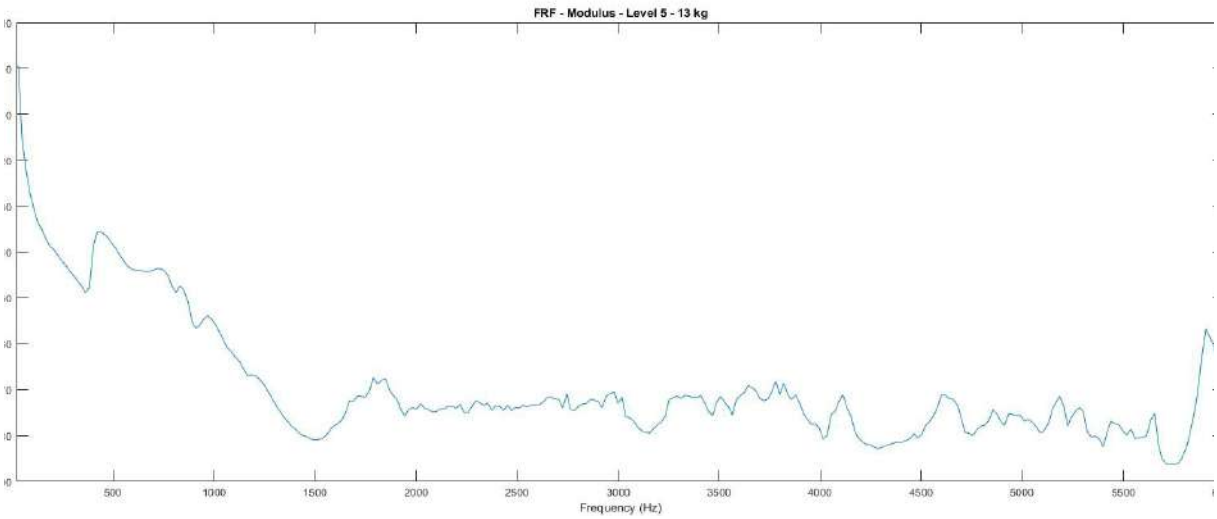

Figure 11. FRF on Level 5 damper loaded with 13 kg.

Present test campaign is performed with the purpose to demonstrate that each damper maximizes its performances when loaded in its designed load range.
This scope is obtained by loading with the same load each damper and comparing measured FRFs. Obviously, no damper is loaded over its designed maximum load, in order to avoid damages in the devices.
Table 1 resumes the performed tests.

Damper type	**Applied loads**		
	Comparison 1	Comparison 2	Comparison 3
Level 2	1 kg	/	/
Level 3	1 kg	3.7 kg	/
Level 4	1 kg	3.7 kg	7.4 kg
Level 5	1 kg	3.7 kg	7.4 kg

Table 1. Comparison tests.

Figure 12 presents Comparison 1 graph, in the range 0 Hz to 1000 Hz.

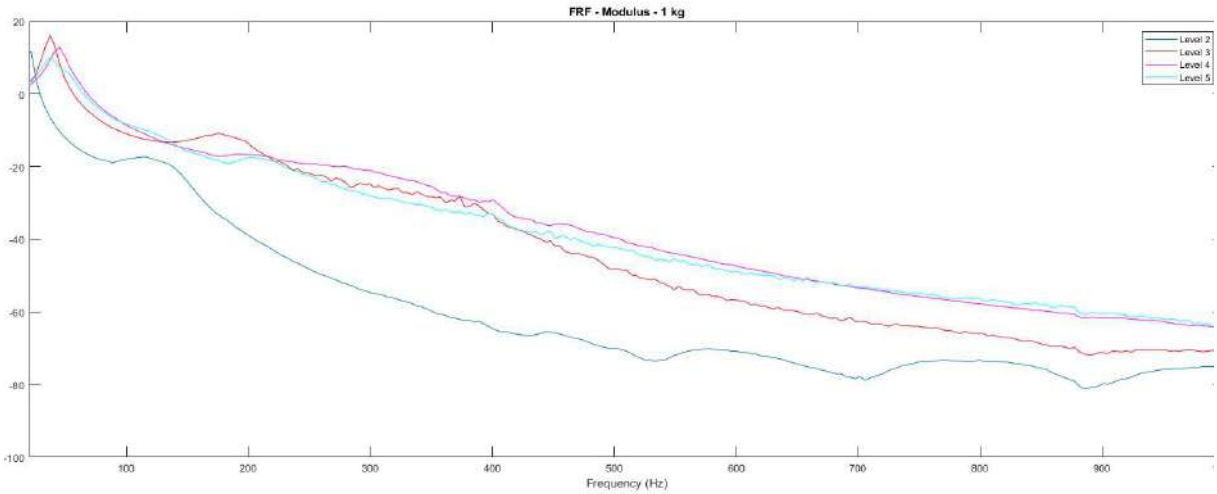

Figure 12. Comparison 1.

It's possible to observe that, when loading dampers with 1 kg, Level 2 damper offers the best performances, because its FRF presents an acceleration reduction which is much higher than the reduction of all the other dampers in all the investigated frequency band.
Figure 13 presents Comparison 2 graph, in the range 0 Hz to 1000 Hz.

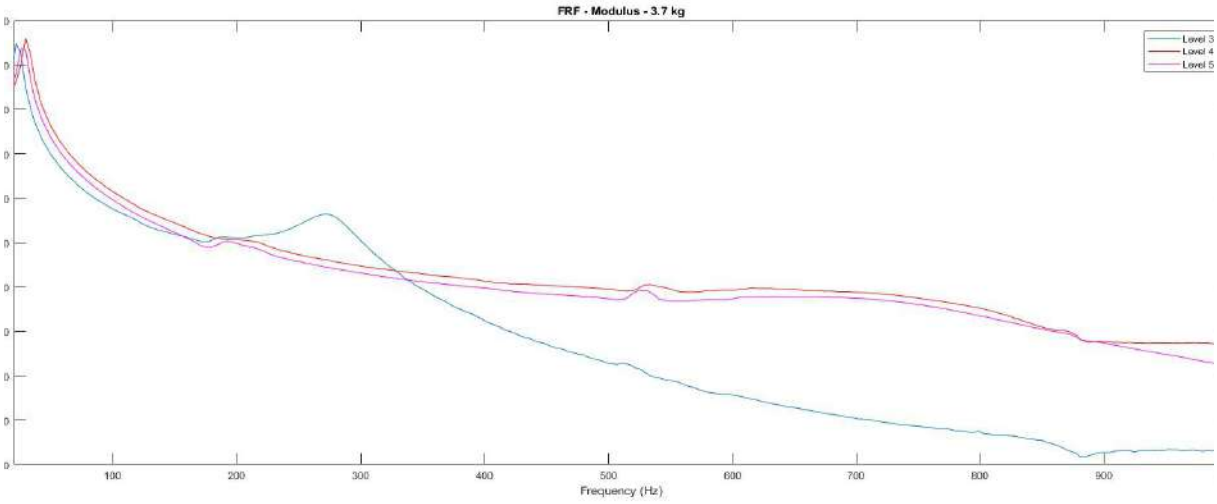

Figure 13. Comparison 2.

It's possible to observe that, when loading dampers with 3.7 kg, Level 3 damper offers the best performances, because its FRF presents an acceleration reduction which is much higher than the reduction of all the other dampers in all the investigated frequency band, but the range 200 Hz – 300 Hz.
Figure 14 presents Comparison 3 graph, in the range 0 Hz to 1000 Hz.

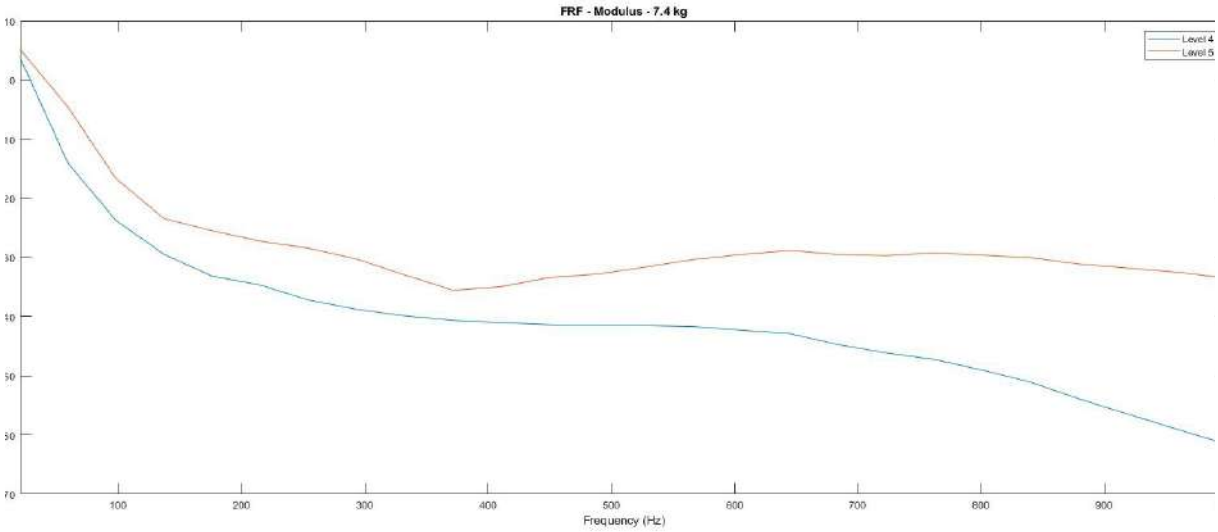

Figure 14. Comparison 3.

It's possible to observe that, when loading dampers with 7.4 kg, Level 4 damper offers the best performances, because its FRF presents an acceleration reduction which is much higher than the reduction of Level 5 damper in all the investigated frequency band.

3. *Conclusions*

Vicoter measured the damping properties of four damper types manufactured by Bassocontinuo.
Results demonstrate that, when loaded in their respective design ranges, each damper offers the best performances respect to the other ones.