



## **Cinema screens acoustical performances**

Jean-Luc Ohl, Claude Prevost

### **Measurement setup**

Loudspeaker Meyer Acheron 80

Software : Acoustisoft R+D

Microphone : KT1, vertical, direct field calibrated

Distance : 1 m on axis of front of horn

Signal for SPL losses : pink noise at 95dB(c) at 1m on axis

Signal for frequency responses : sine sweep

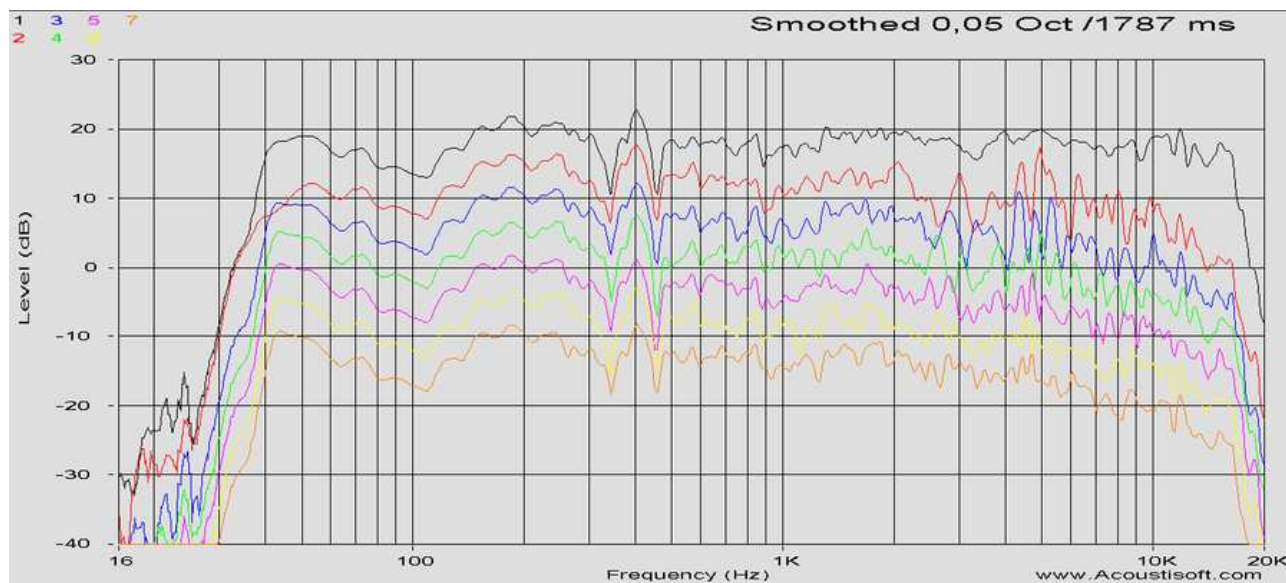
### **Tested conditions**

- various distances
- various angles
- without/with black backing
- without/with foam between loudspeaker and screen (PPU foam, 30ppi open-cell, 10cm)

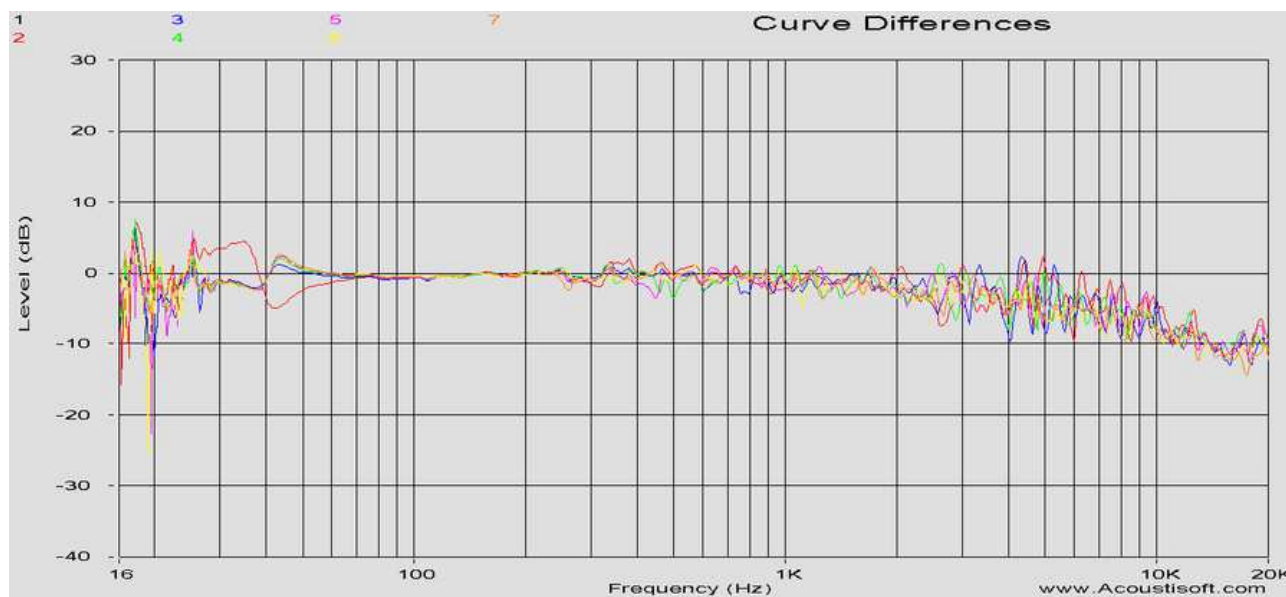
### **Tested screens**

- Harkness Matt Plus, vinyl standard perforated
- Harkness Matt PlusMP, vinyl miniperforated
- Harkness Matt PlusMPS, vinyl microperforated
- Screen Excellence Enlightor3, woven fabric
- Screen Excellence Enlightor4k, woven fabric

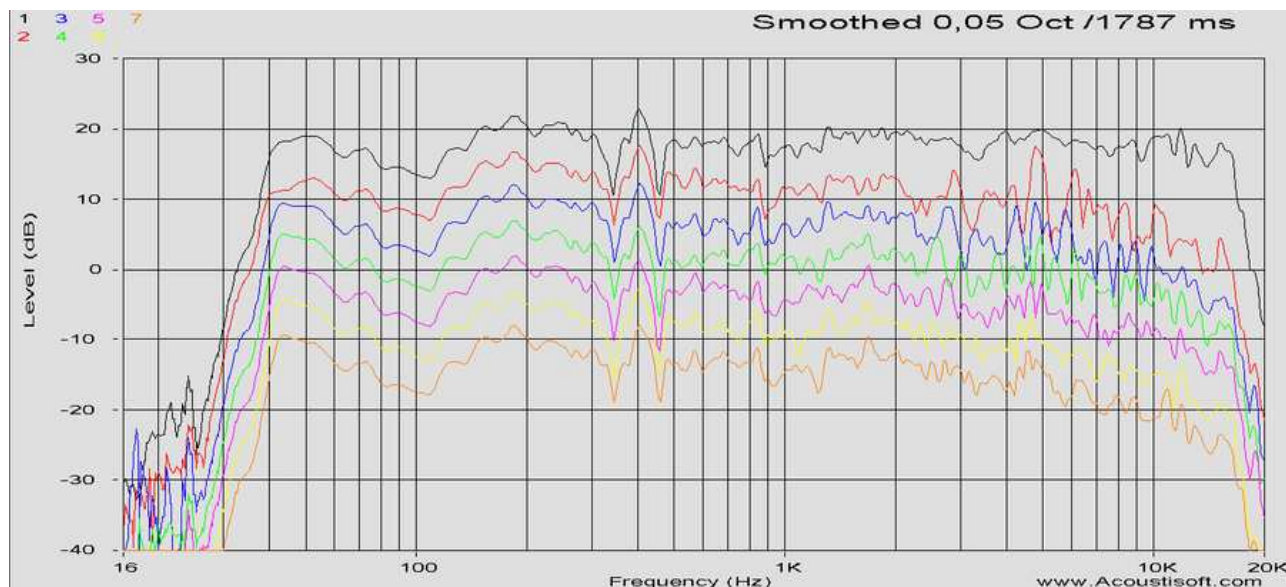
Screen Matt Plus : no screen, screen at 0, 10, 20, 30, 40, 50cm



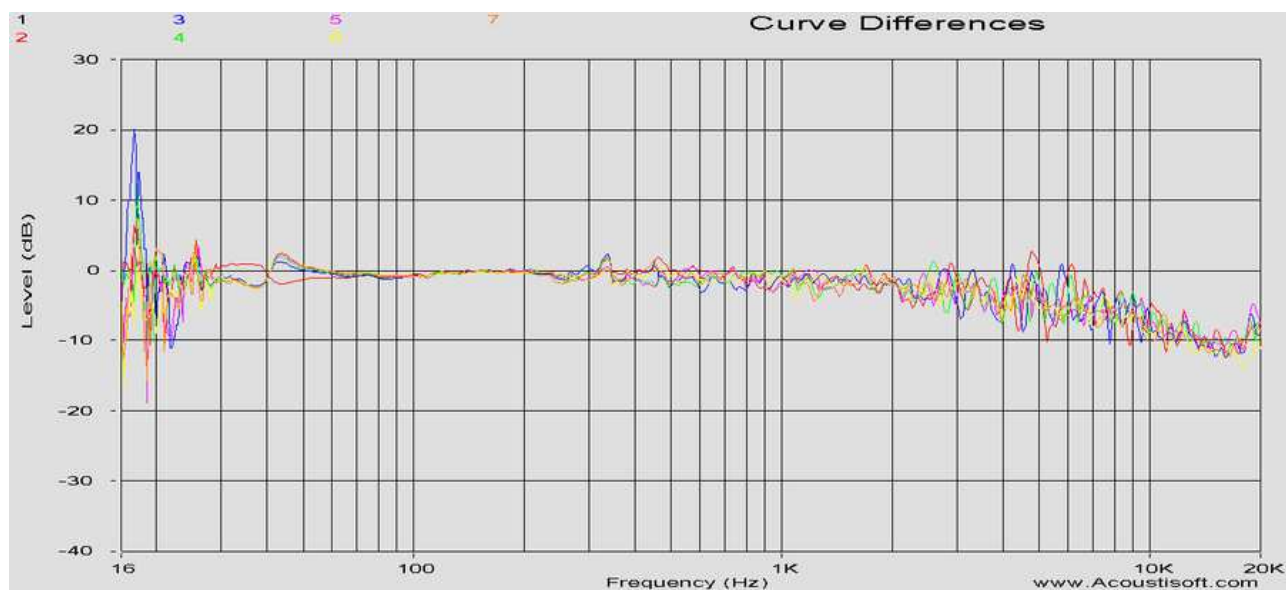
Screen Matt Plus : no screen, screen at 0, 10, 20, 30, 40, 50cm



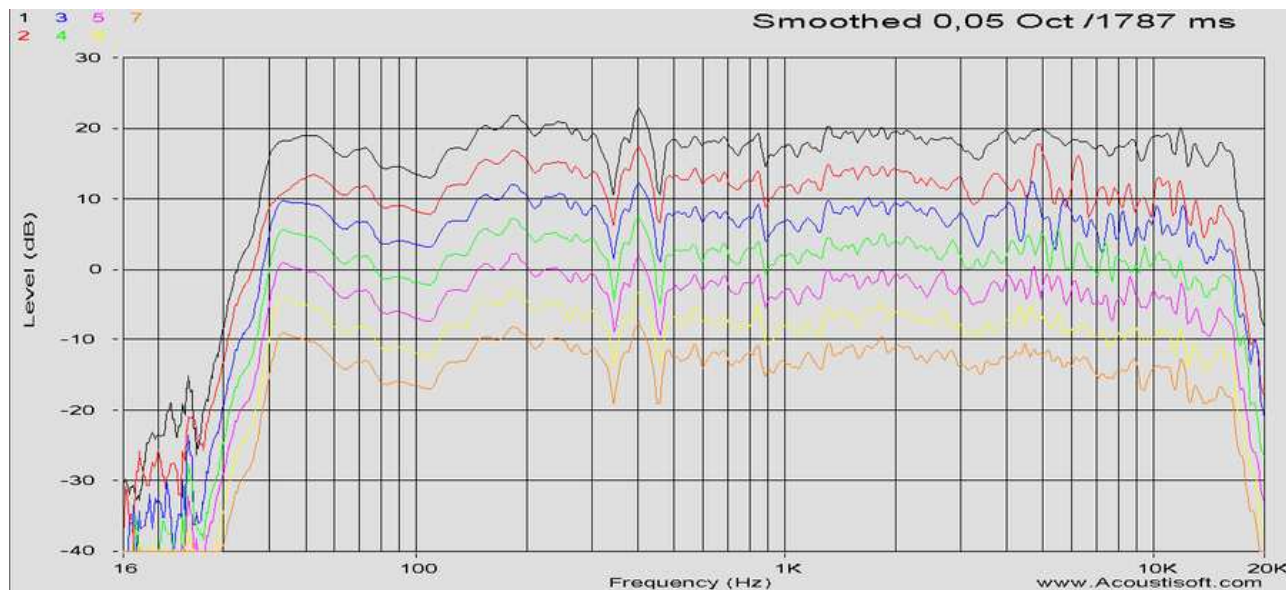
Screen Matt PlusMP : no screen, screen at 0, 10, 20, 30, 40, 50cm



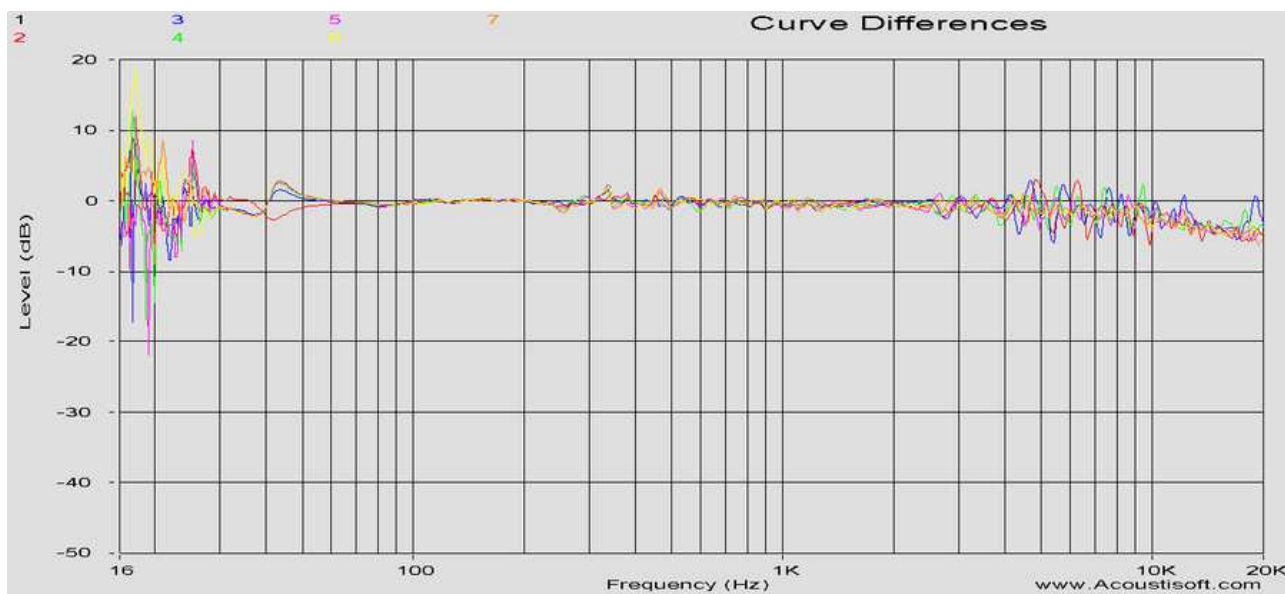
Screen Matt PlusMP : no screen, screen at 0, 10, 20, 30, 40, 50cm



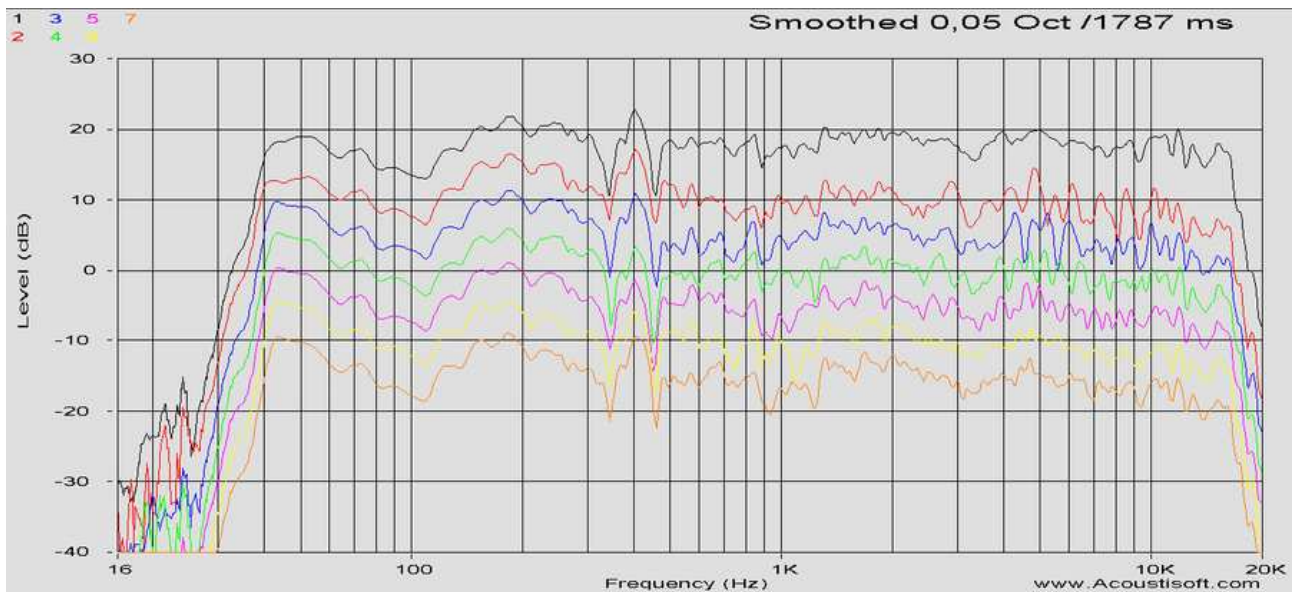
Screen Matt PlusMPS : no screen, screen at 0, 10, 20, 30, 40, 50cm



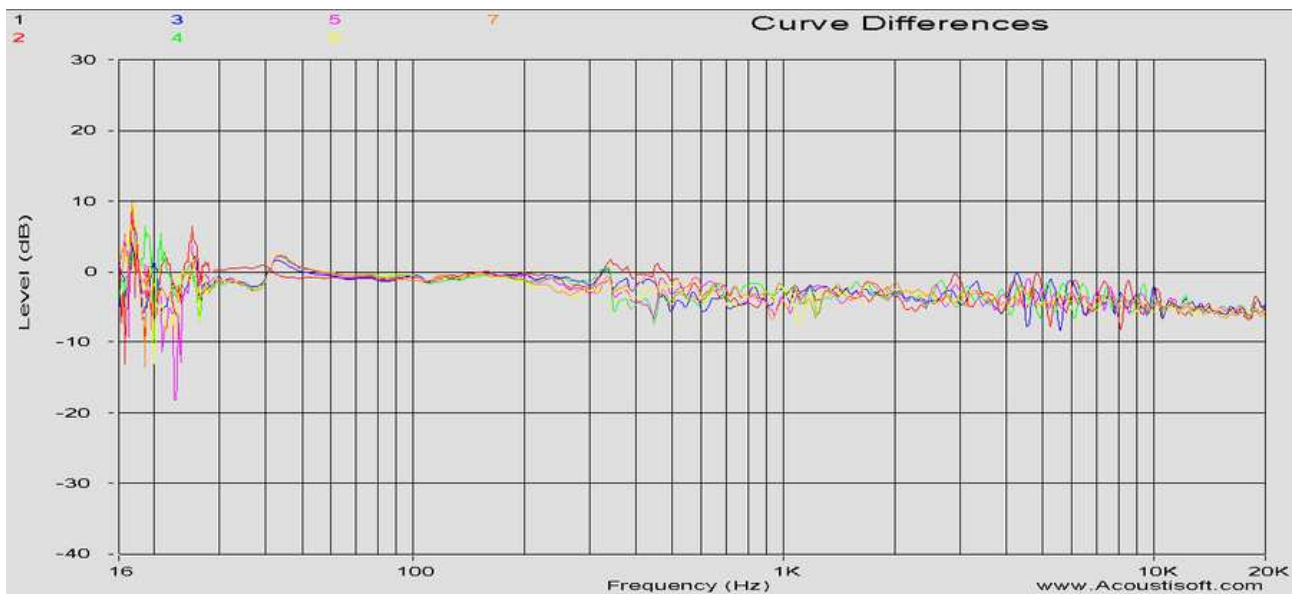
Screen Matt PlusMPS : no screen, screen at 0, 10, 20, 30, 40, 50cm



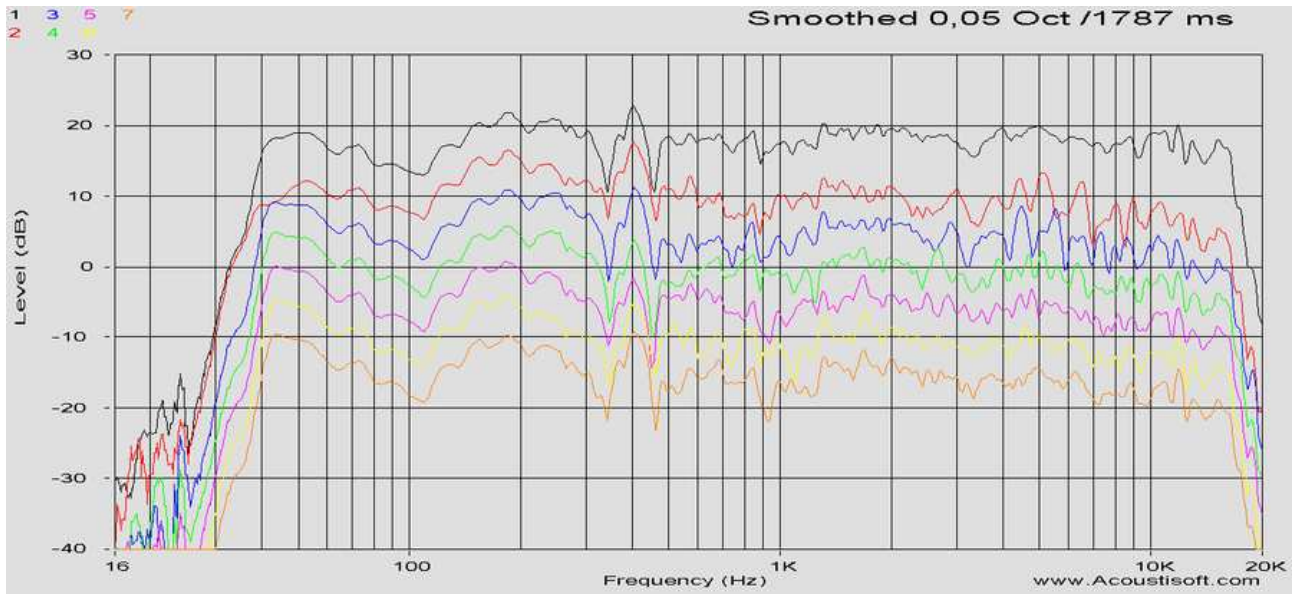
Screen Excellence Enlightor3 : no screen, screen at 0, 10, 20, 30, 40, 50cm



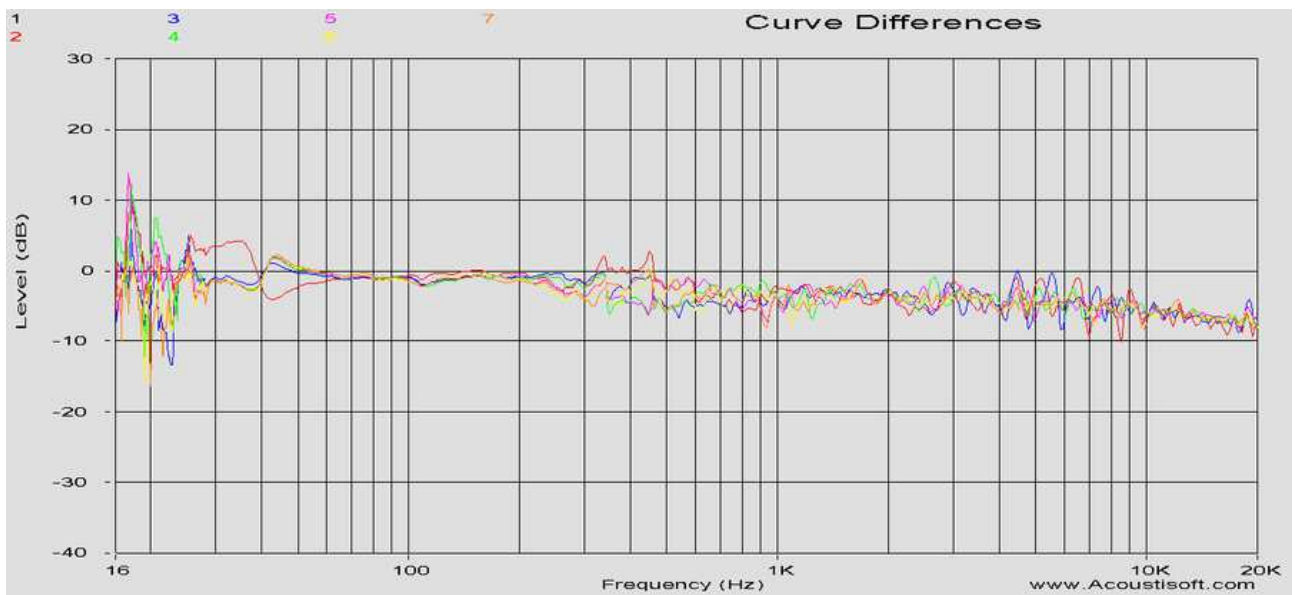
Screen Excellence Enlightor3 : no screen, screen at 0, 10, 20, 30, 40, 50cm



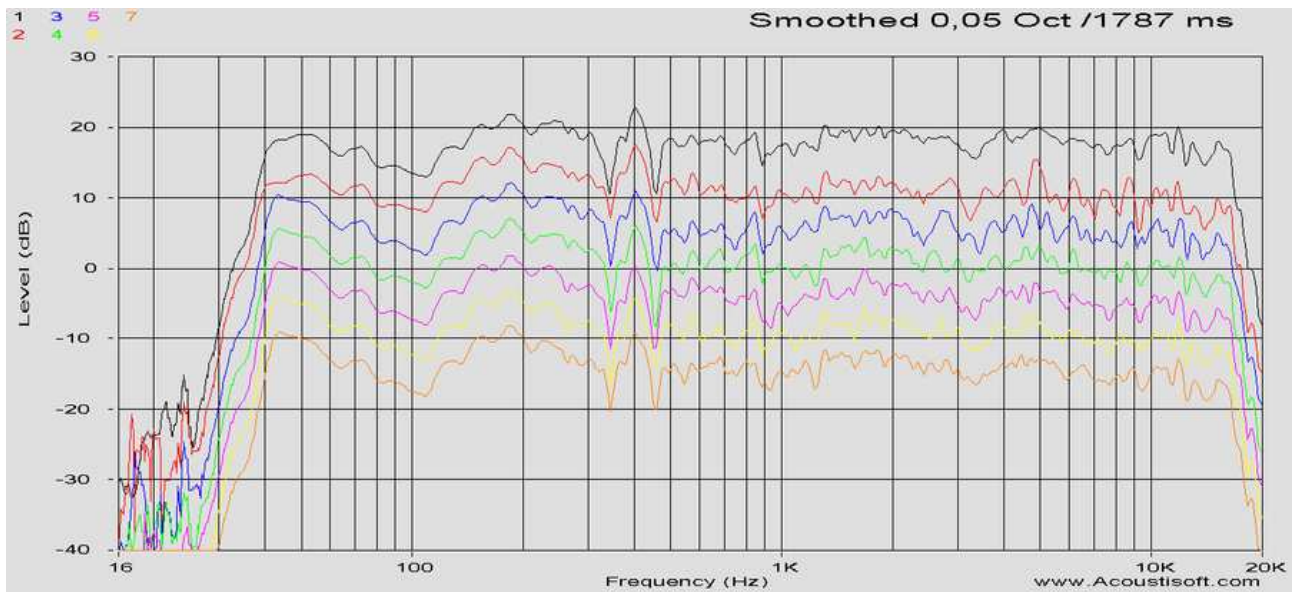
Screen Excellence Enlightor3 with black backing : no screen, screen at 0, 10, 20, 30, 40, 50cm



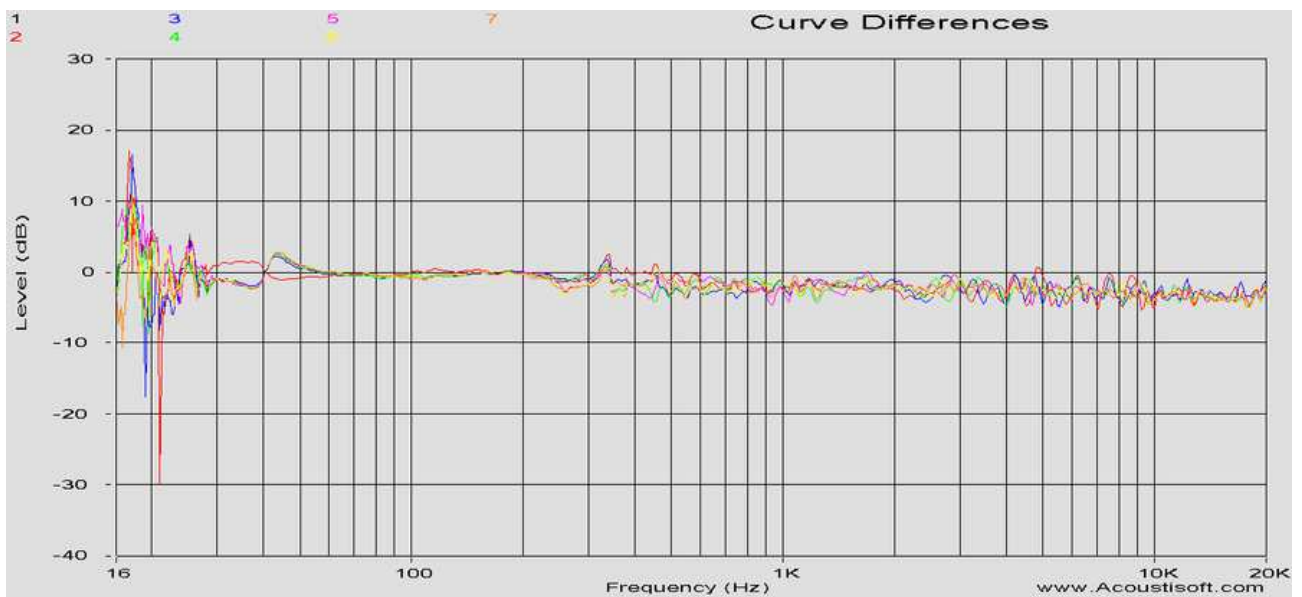
Screen Excellence Enlightor3 with black backing : no screen, screen at 0, 10, 20, 30, 40, 50cm



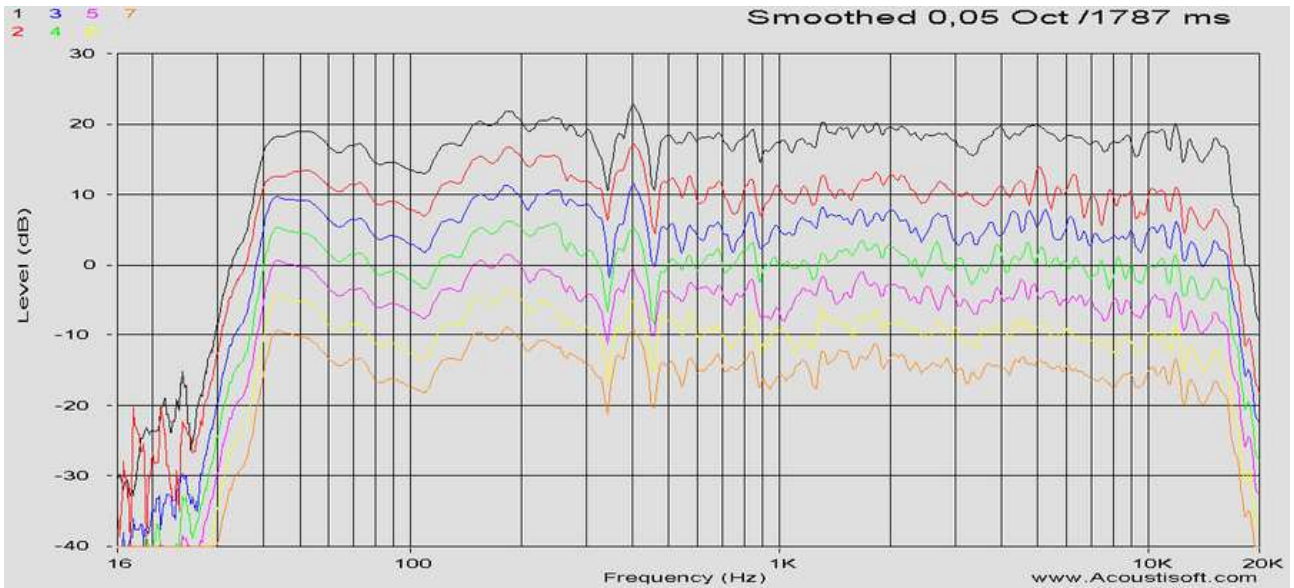
Screen Excellence Enlightor 4k : no screen, screen at 0, 10, 20, 30, 40, 50cm



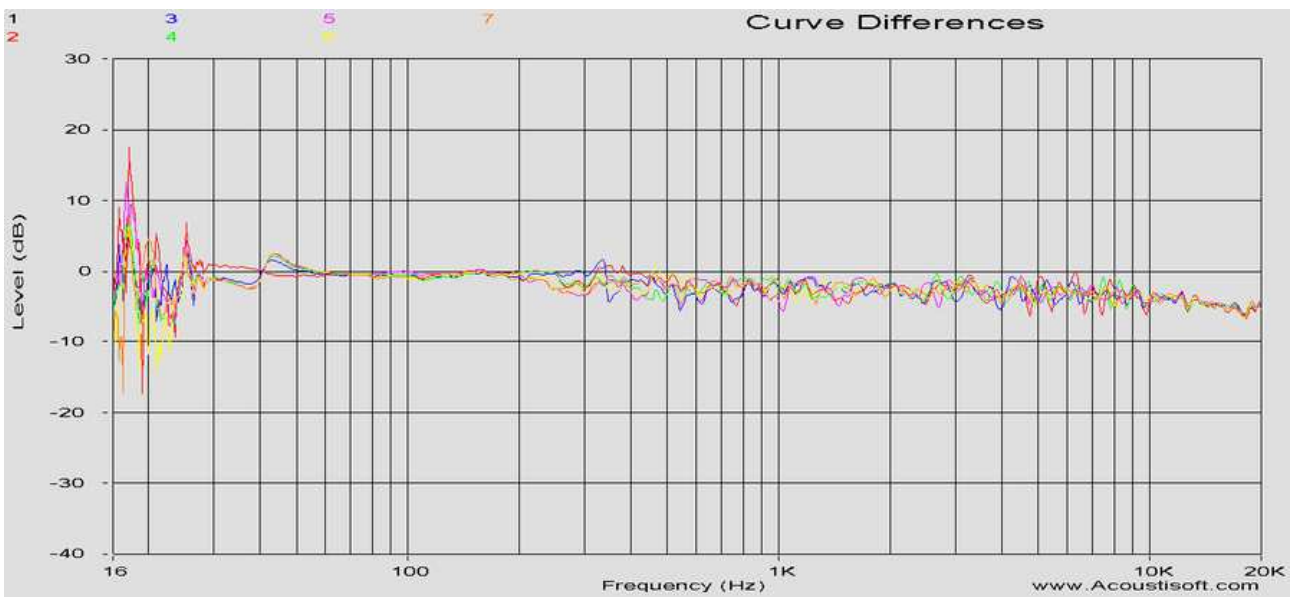
Screen Excellence Enlightor 4k : no screen, screen at 0, 10, 20, 30, 40, 50cm



Screen Excellence Enlightor 4k with black backing : no screen, screen at 0, 10, 20, 30, 40, 50cm

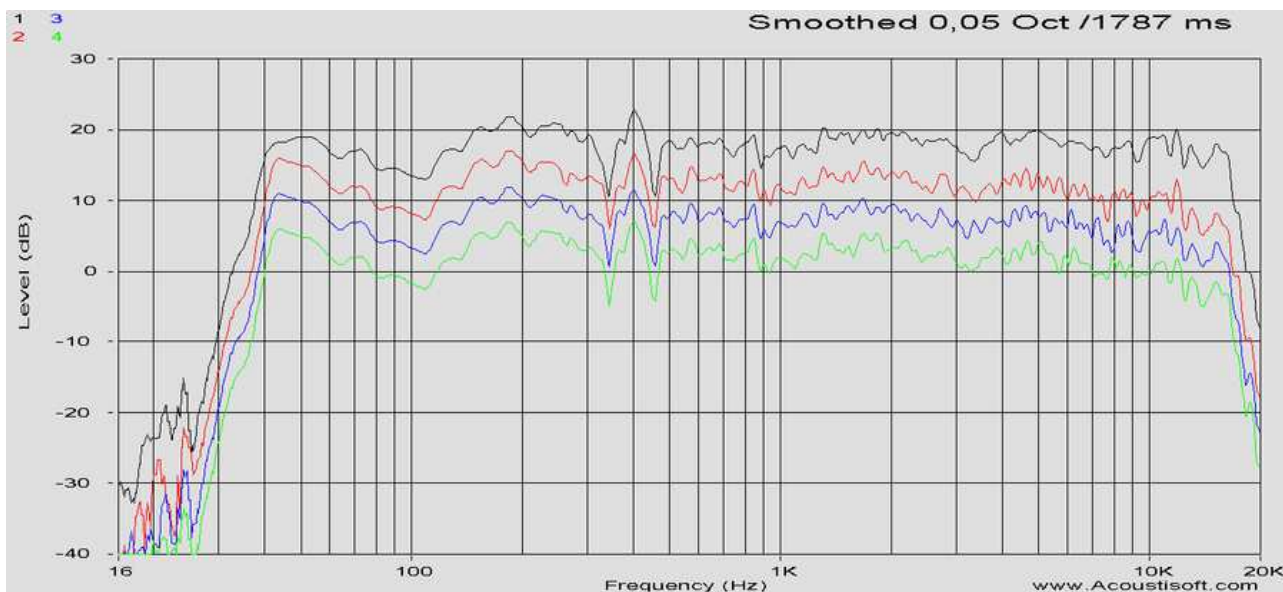


Screen Excellence Enlightor 4k with black backing : no screen, screen at 0, 10, 20, 30, 40, 50cm

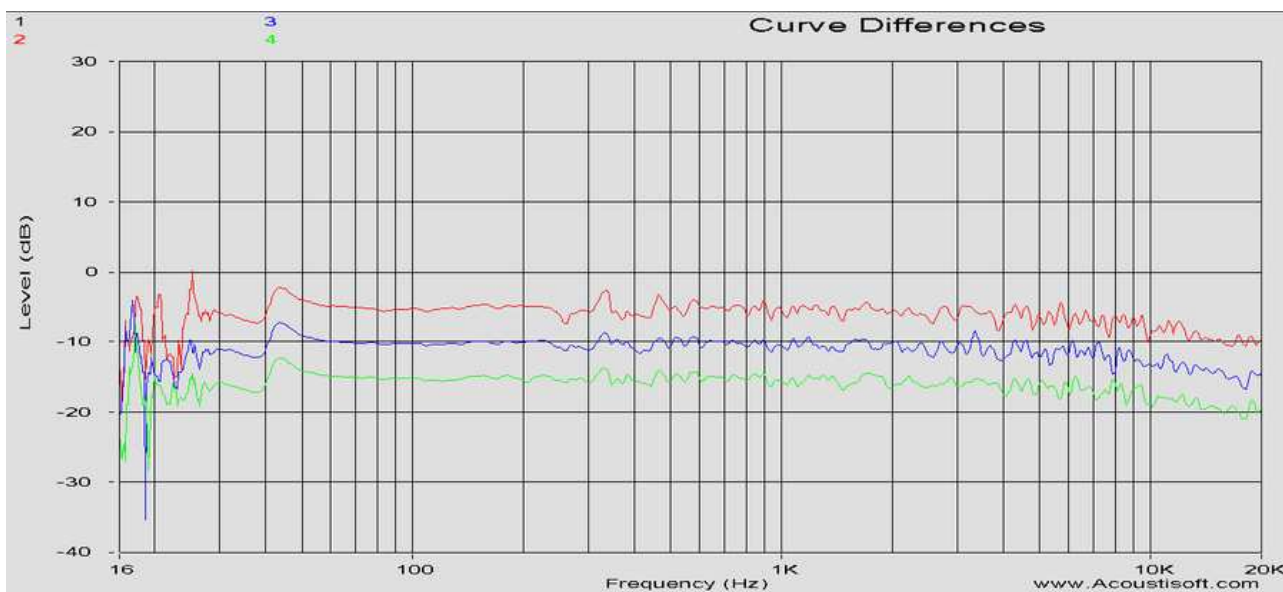




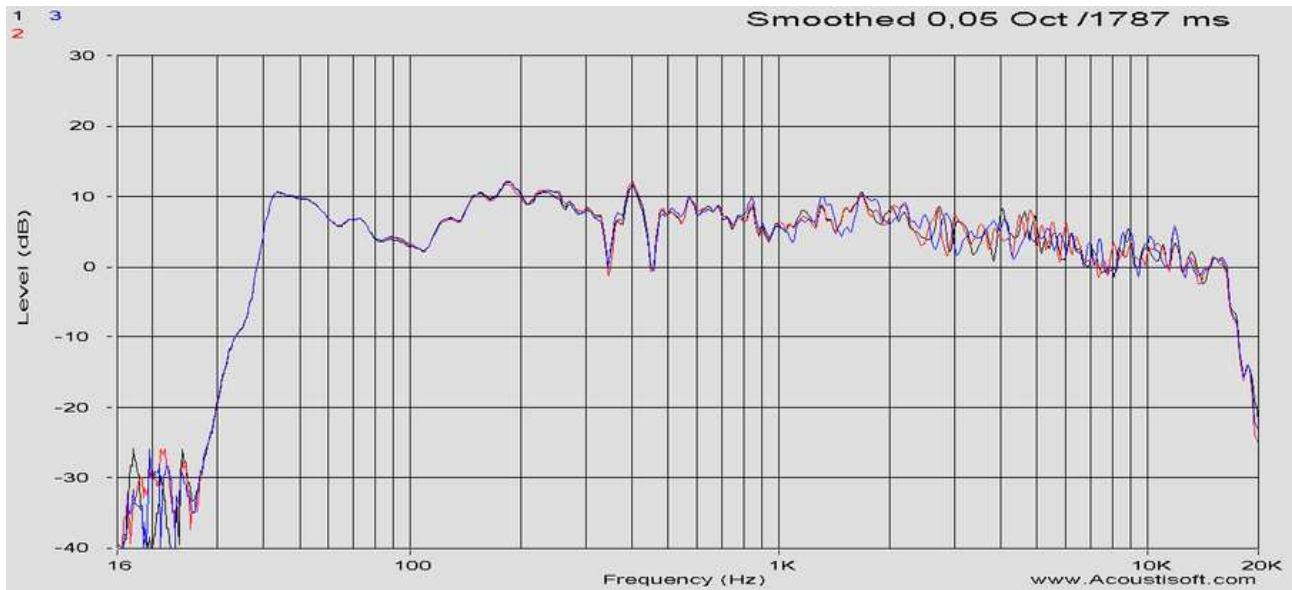
Screen Matt PlusMPS : distance 30cm, angle 0°, 10° and 20°



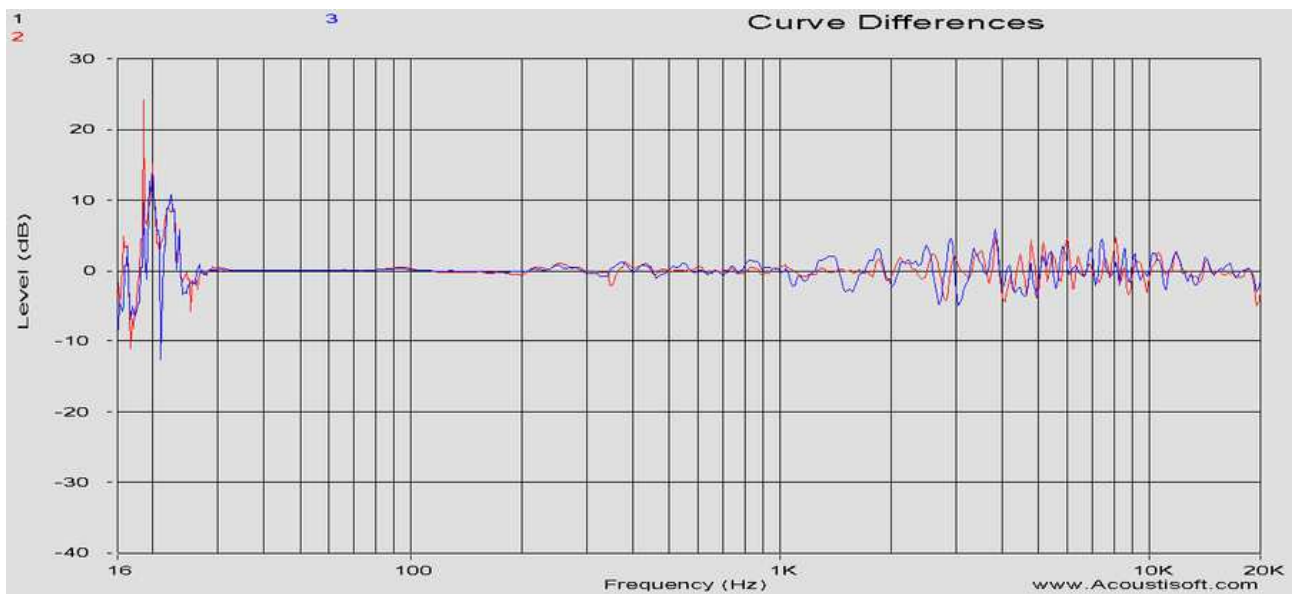
Screen Matt PlusMPS : distance 30cm, angle 0°, 10° and 20°



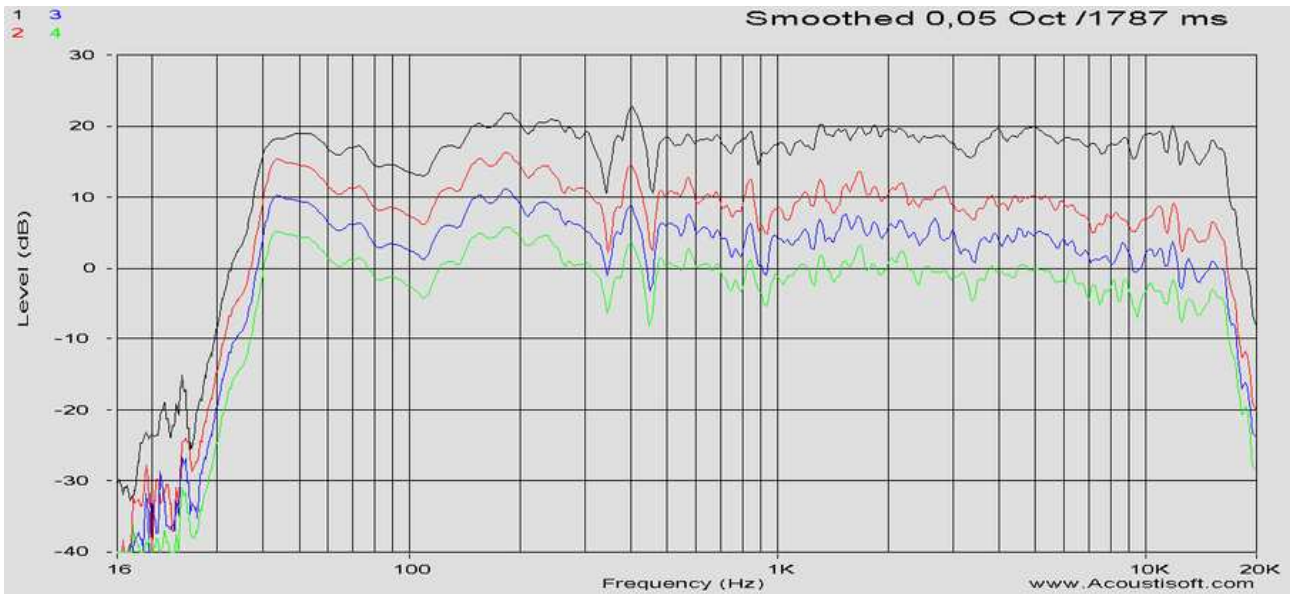
Screen Matt Plus : distance 30cm, angle 0°, 10° and 20°



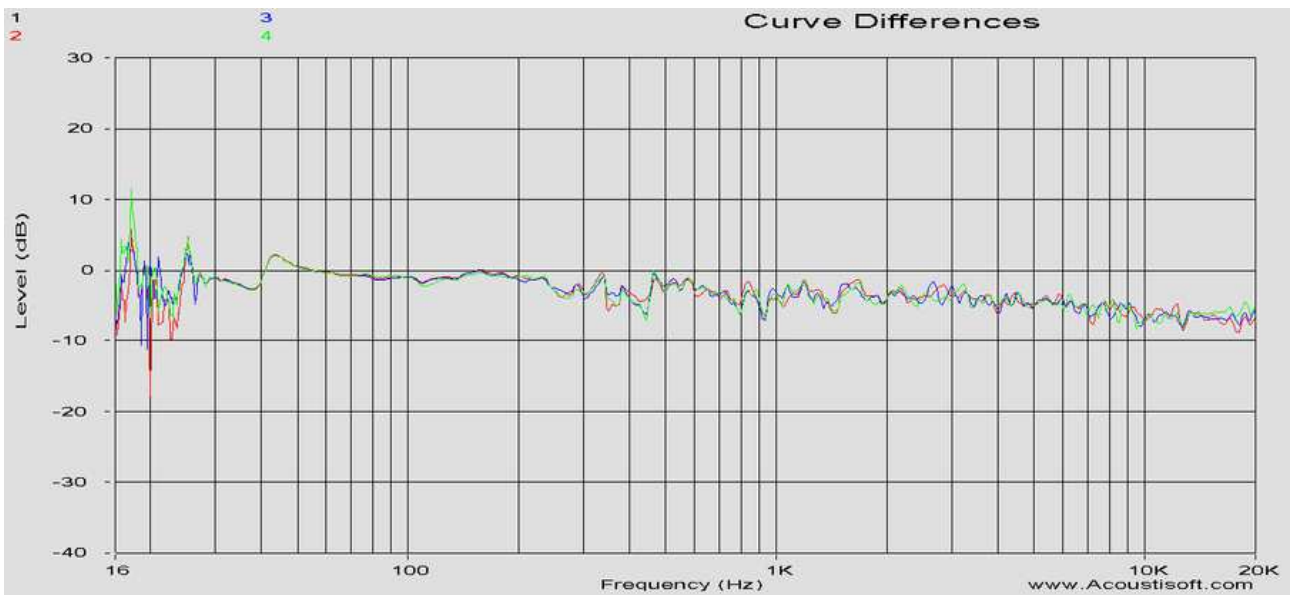
Screen Matt Plus : distance 30cm, angle 0°, 10° and 20°



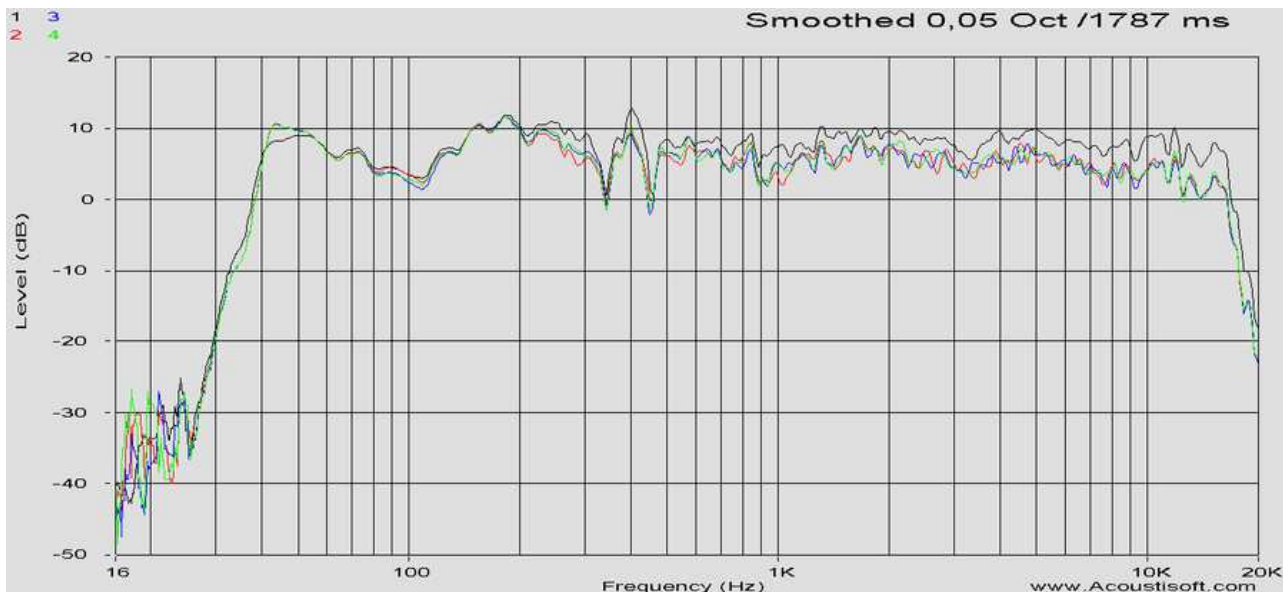
Screen Excellence Enlightor3 with black backing : distance 30cm, no screen, angle 0°, 10° and 20°



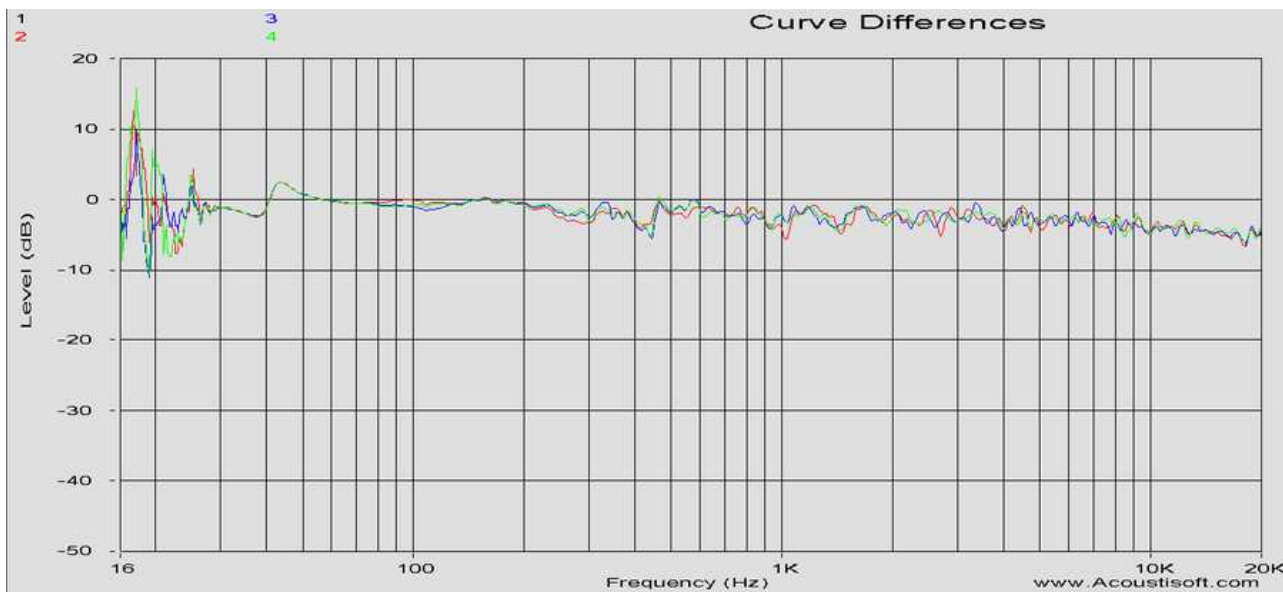
Screen Excellence Enlightor3 with black backing : distance 30cm, no screen, angle 0°, 10° and 20°



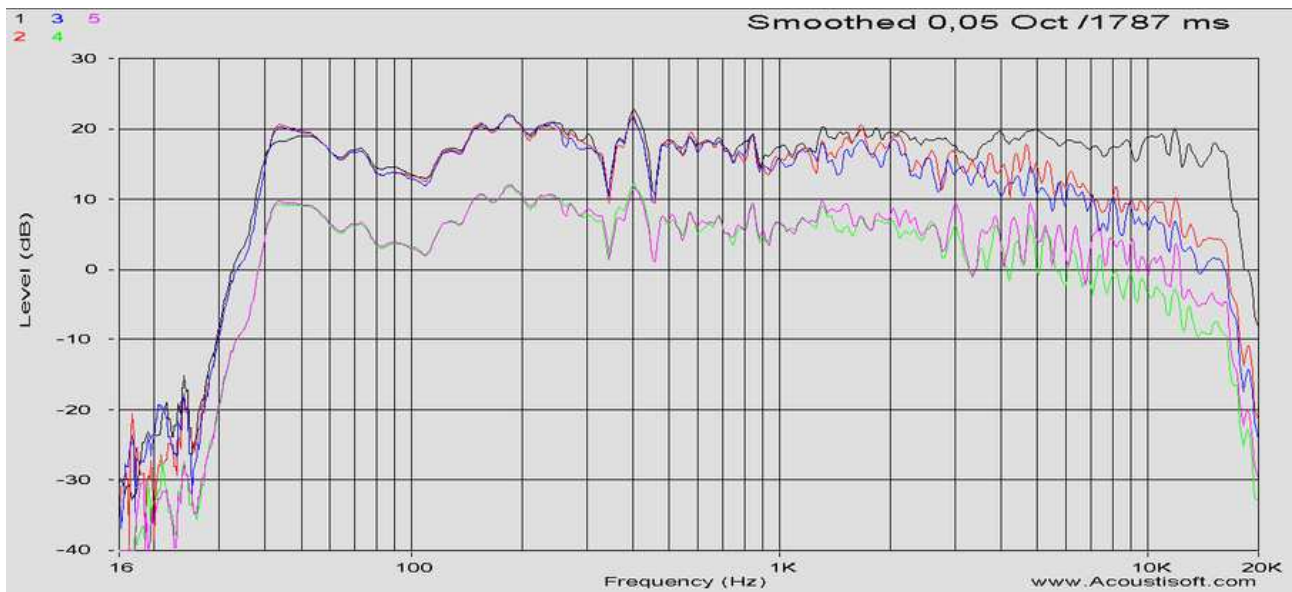
Screen Excellence Enlightor4k with black backing : distance 30cm, no screen, angle 0°, 10° and 20°



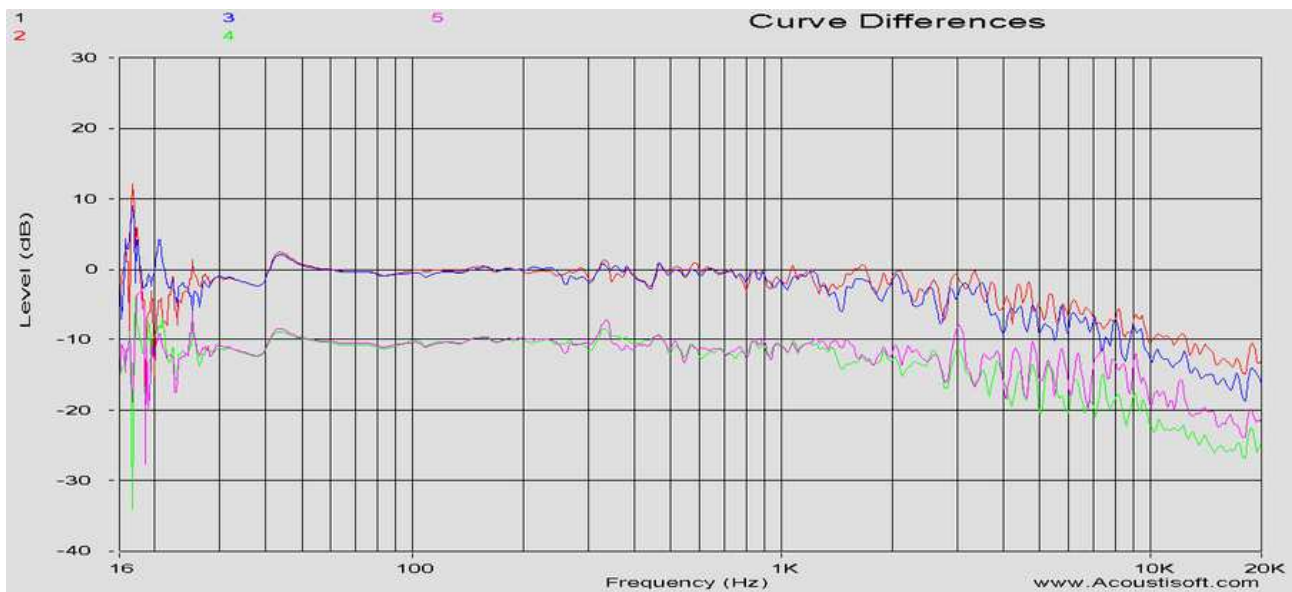
Screen Excellence Enlightor4k with black backing : distance 30cm, angle 0°, 10° and 20°



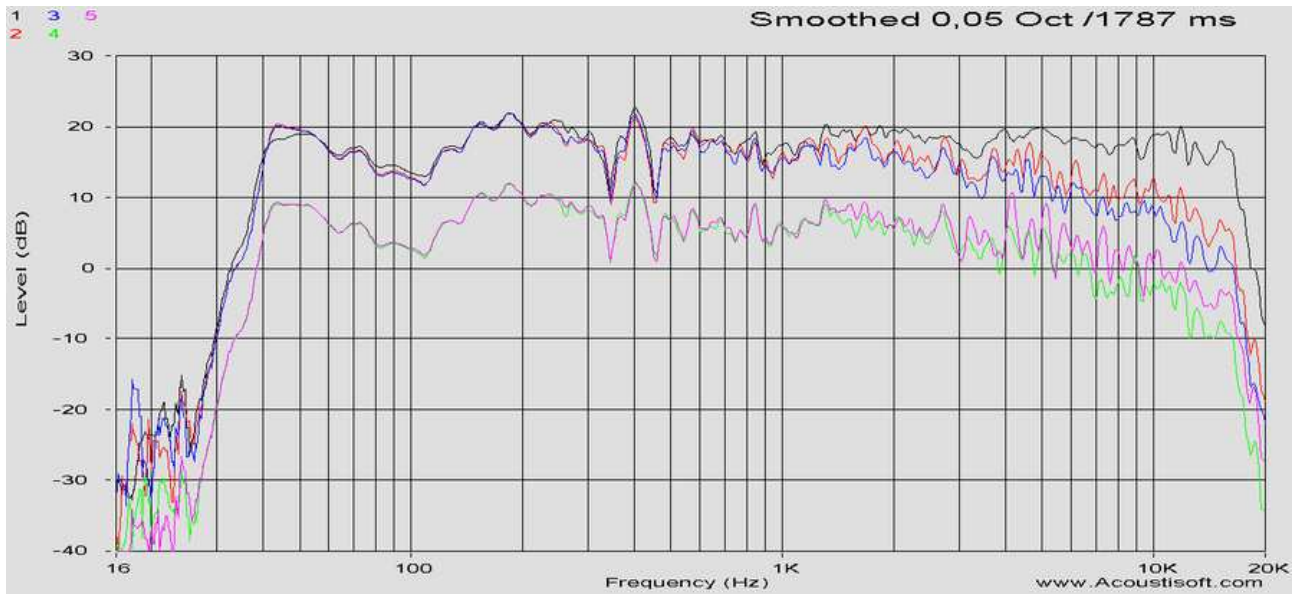
Screen Matt Plus : distance 10cm without/with foam, 30cm without/with foam (-10dB shift)



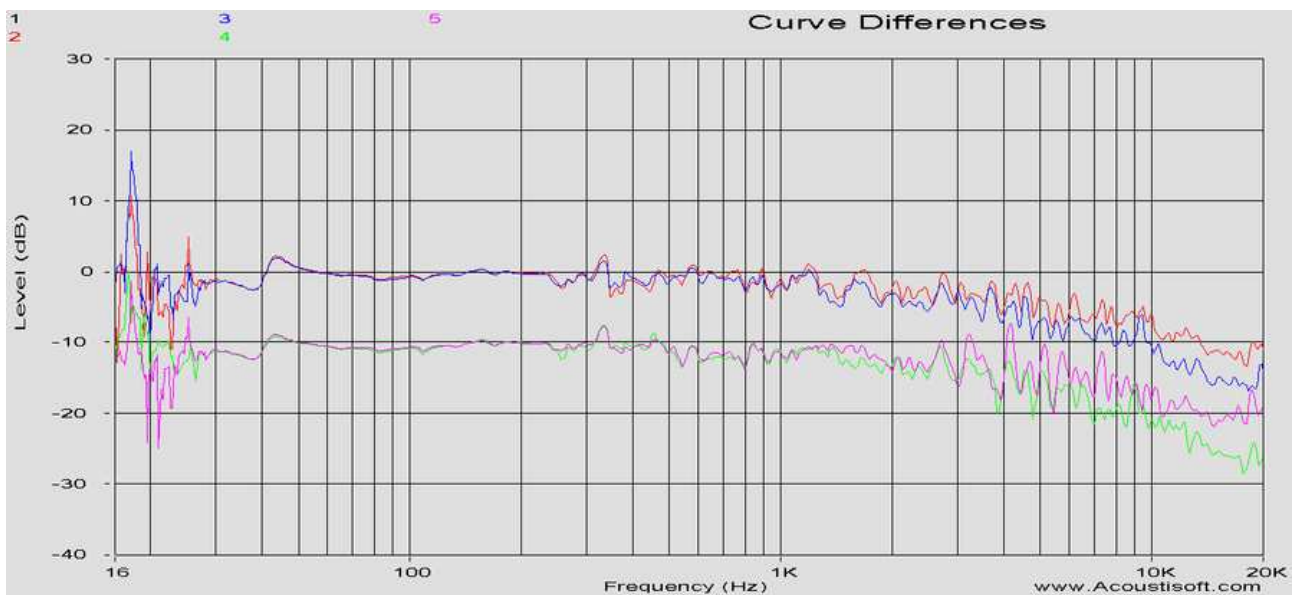
Screen Matt Plus : distance 10cm without/with foam, 30cm without/with foam (-10dB shift)



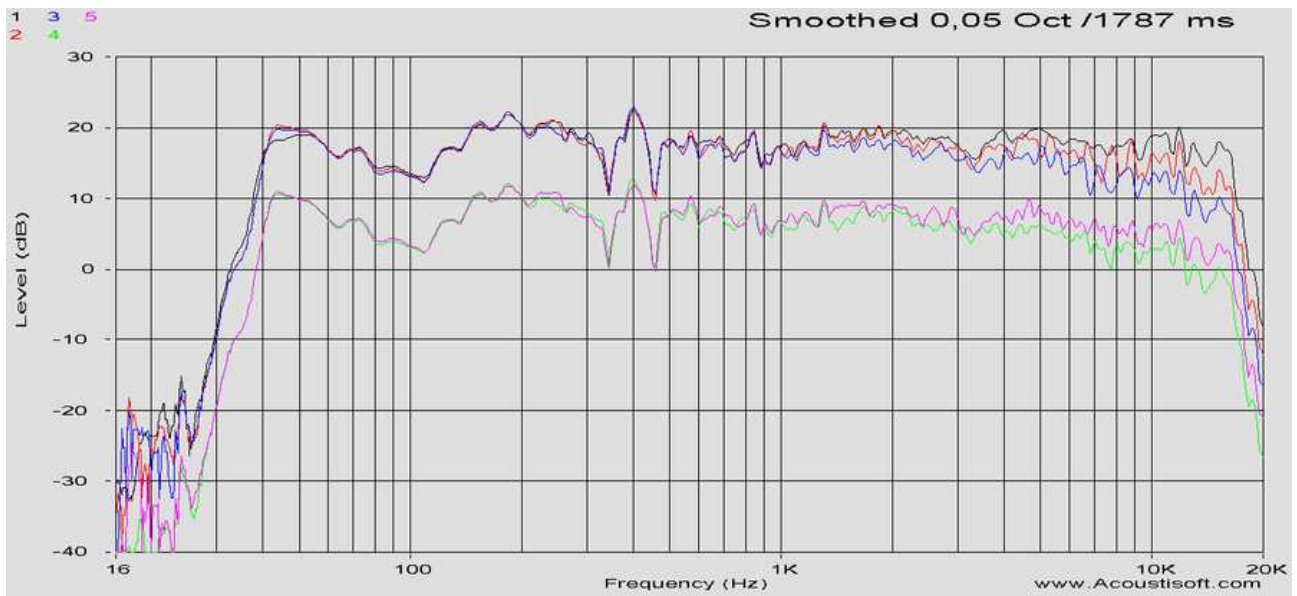
Screen Matt PlusMP : distance 10cm without/with foam, 30cm without/with foam (-10dB shift)



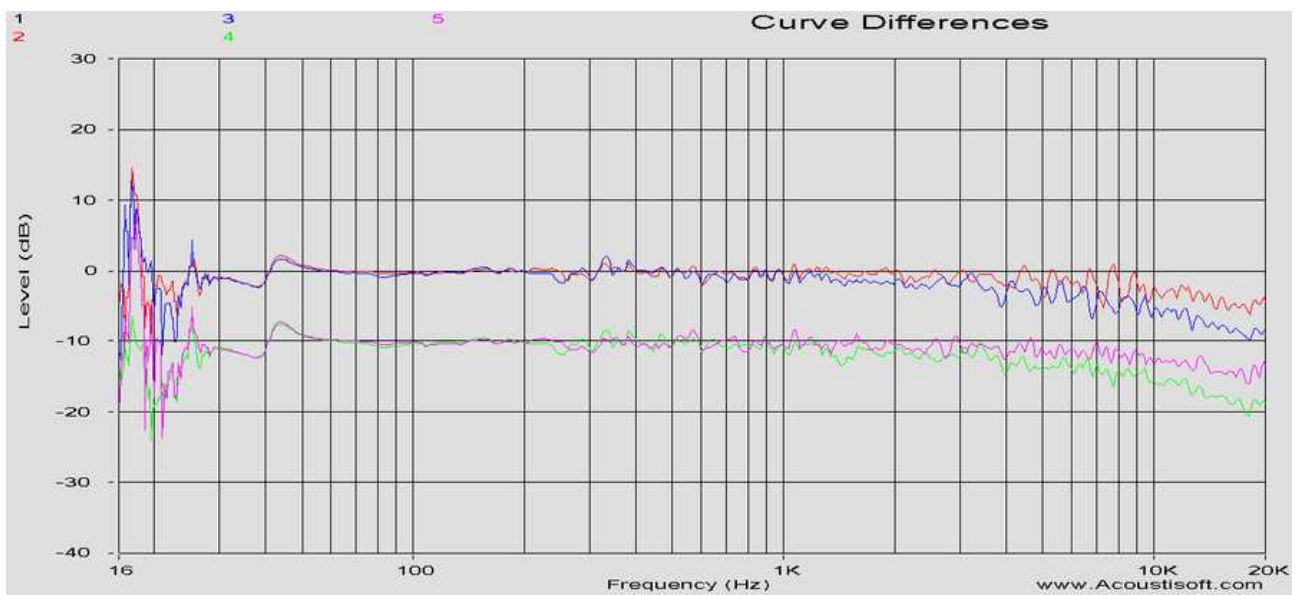
Screen Matt PlusMP : distance 10cm without/with foam, 30cm without/with foam (-10dB shift)



Screen Matt PlusMPS : distance 10cm without/with foam, 30cm without/with foam



Screen Matt PlusMPS : distance 10cm without/with foam, 30cm without/with foam



## Results

<i>values in dB</i>	Matt Plus	PlusMP	PlusMPS	E3	E3+bb	E4k	E4k+bb
perforation	standard	mini	micro		black backing		black backing
SPL(c) attenuation	-1	-1.3	-0.3	-1.8	-2	-1.2	-1.4
2kHz attenuation	-2	-2	-0.5	-3	-4	-2	-2.5
10kHz attenuation	-8	-8	-3	-5	-6	-3	-4
response ripples	11	11	9	7	7	4	5

## Conclusions

### SPL

- SPL losses have to be taken into account, especially with woven fabric, when designing the room and speaker setup

### Frequency response

- all screens produce attenuation at high frequencies and response ripples
- woven screens show less ripples than vinyl
- Matt PlusMPS is much better than Matt Plus and Matt PlusMP, and not so far from woven

### Distance between screen and horn

- more than 30cm is recommended in all cases
- a very short distance (<10cm) shows a strange behaviour at low frequencies, a loss of up to 6dB at 40Hz, because it more or less obturates the ports. So avoid very short distances between screen and horn !

### Angle between screen and horn

- for all screens, an angle >10° smoothes slightly the frequency response

### Foam between screen and horn

- foam can slightly reduce reflections and ripples but it also shows an attenuation of about 0.7dB SPL(c) and nearly 2dB at 10kHz.