

APPLICATION NOTE

Verification of Symmetrical Pinnae for HATS Type 4128-C

This Application Note verifies the new Symmetrical Pinnae for Head and Torso Simulator (HATS) Type 4128-C, by comparing measurements obtained using the original pinnae to those obtained using the new symmetrical pinnae.

For performance measurements of earphones and telephones, the Symmetrical Pinnae (hardness 35 on the Shore-00 scale) are available for Brüel & Kjær HATS.

The symmetrical pinna conforms to IEC and ITU-T recommendations and the pinna shape itself has been the preferred choice for more than two decades.

However, left and right pinnae have never been made symmetrical, because human pinnae are never 100% symmetrical! So this meant that measurements sometimes gave slightly different results depending on whether the device under test (DUT) was measured on a left or a right pinna (and depending on the application).

To overcome this obstacle, Brüel & Kjær have taken a digital mirror of the right ear and designed a set of symmetrical pinnae to be used with HATS.



Verification Measurements

To illustrate the differences that can be expected between asymmetrical and symmetrical pinnae, three sets of measurements were made on both types of pinnae:

1. Pressure measurements with two normal handsets (handset positioner/HATS) – new versus old pinnae
2. Free-field Response in an anechoic chamber – new versus old pinnae
3. Measurements on six headsets – new versus old pinnae

Pressure Measurements with Two Normal Handsets – New Versus Old Pinnae

Table 1 shows the pressure measurements obtained using a BeoCom 2100 handset fitted to the Handset Positioner Type 4606/HATS.

Table 1
Pressure
measurements with
BeoCom 2100
Handset

BeoCom 2100, Pressure in [N] at HATS/ERP		
Pinna	L	R
Old Asymmetrical DZ-9759/60	8.8	6.8
New Symmetrical sample 1 DZ-9769/70	7.5	6.8
New Symmetrical sample 2 DZ-9769/70	7.1	6.8

Table 2 shows the pressure measurements obtained using a Danmark 1 handset fitted to the Handset Positioner Type 4606/HATS.

Table 2
Pressure
measurements with
Danmark 1 Handset

Danmark 1, Pressure in [N] at HATS/ERP		
Pinna	L	R
Old Asymmetrical DZ-9759/60	12.0	9.2
New Symmetrical sample 1 DZ-9769/70	9.9	9.0
New Symmetrical sample 2 DZ-9769/70	9.8	9.0

The Handset Positioner is aligned/calibrated with the HATS, as close to the symmetrical centre of the two ears as possible.

The asymmetrical left ear requires 2–3 N more compression to achieve a measurement at the Ear Reference Point (ERP) than the asymmetrical right ear. The symmetrical left ear requires only 0.3–0.9 N more compression to achieve a measurement at the ERP than the symmetrical right ear.

This is an improvement, but there is still a difference. This difference cannot be related to the pinnae alone, however, but to the limitations in aligning/calibrating the Handset Positioner exactly at the HATS centre. Normally the positioner is calibrated to one side only (L or R) as default. This suggests there is an advantage in adjusting the positioner to pressure, rather than position, when making comparable symmetrical measurements with telephone handsets.

Free-field Response in an Anechoic Chamber – New Versus Old Pinnae

Fig. 1
Symmetrical L and R
soft ears (hardness 35
on the shore scale)
DZ-9769/70 – listener
free-field response at 0
degrees

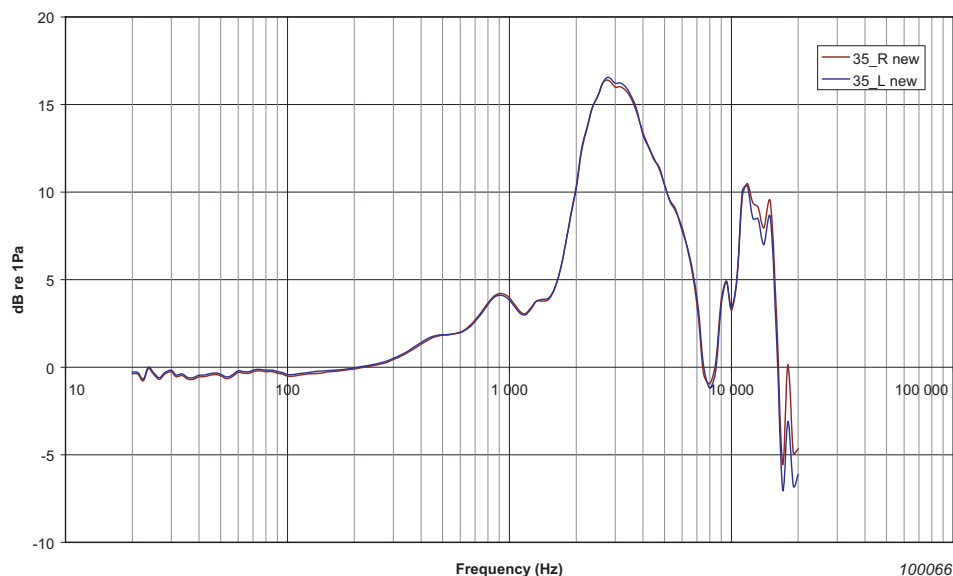


Fig. 2

Symmetrical L and R
soft ears (hardness 55
on the shore scale)
DZ-9771/72 – listener
free-field response at 0
degrees

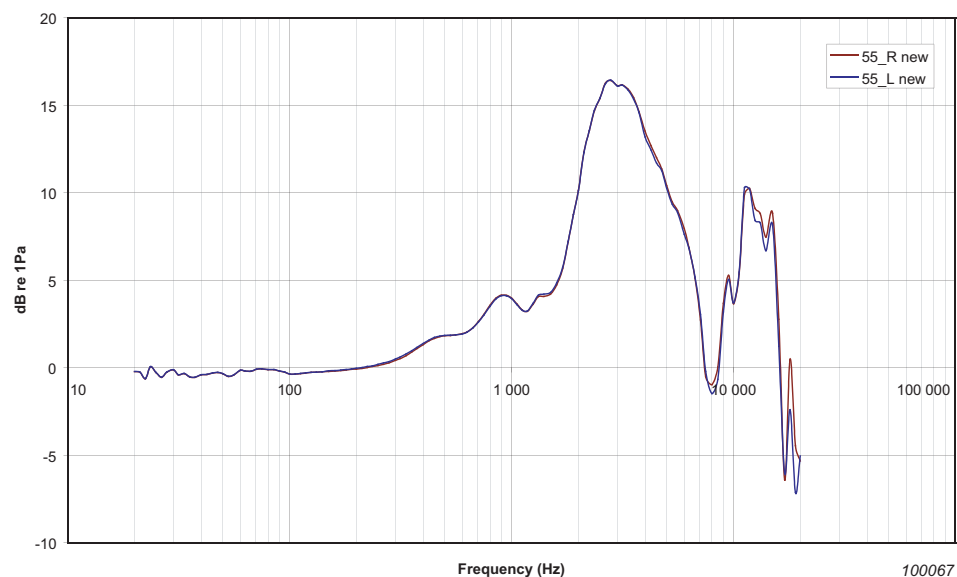


Fig. 3

Asymmetrical L and R
soft ears (hardness 35
on the shore scale)
DZ-9759/60 – listener
free-field response at 0
degrees

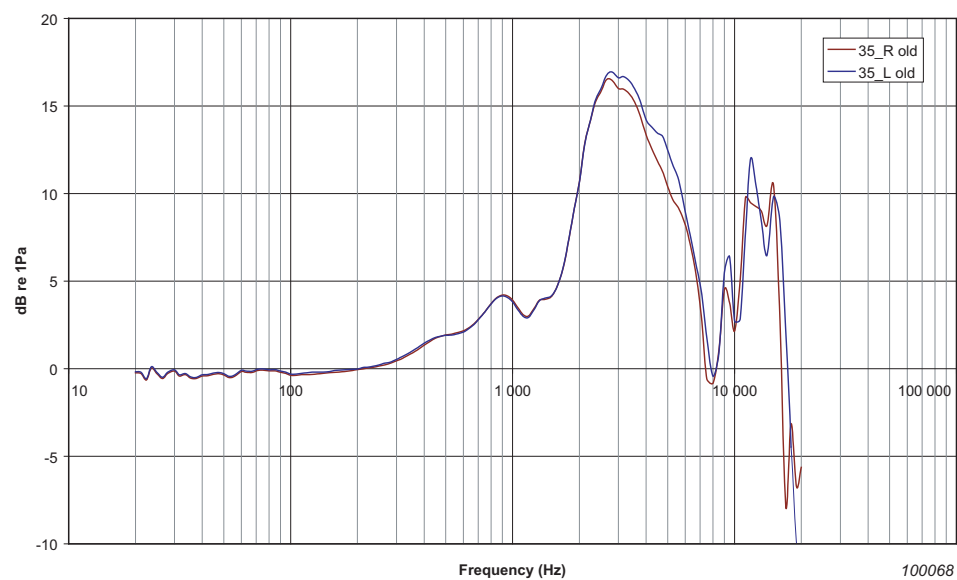


Fig. 4

Symmetrical versus
Asymmetrical R soft
ears (hardness 35 on
the shore scale) –
listener free-field
response at 0 degrees

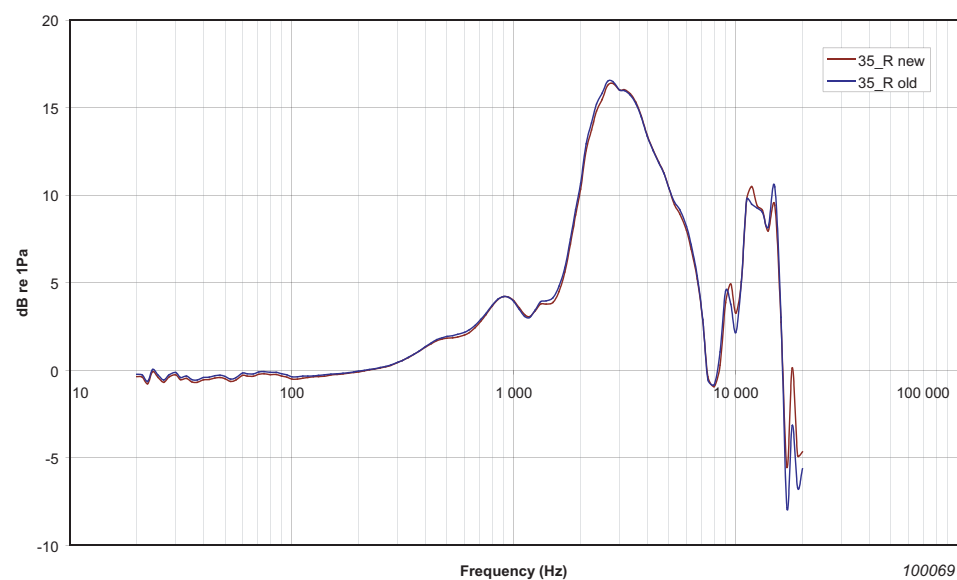
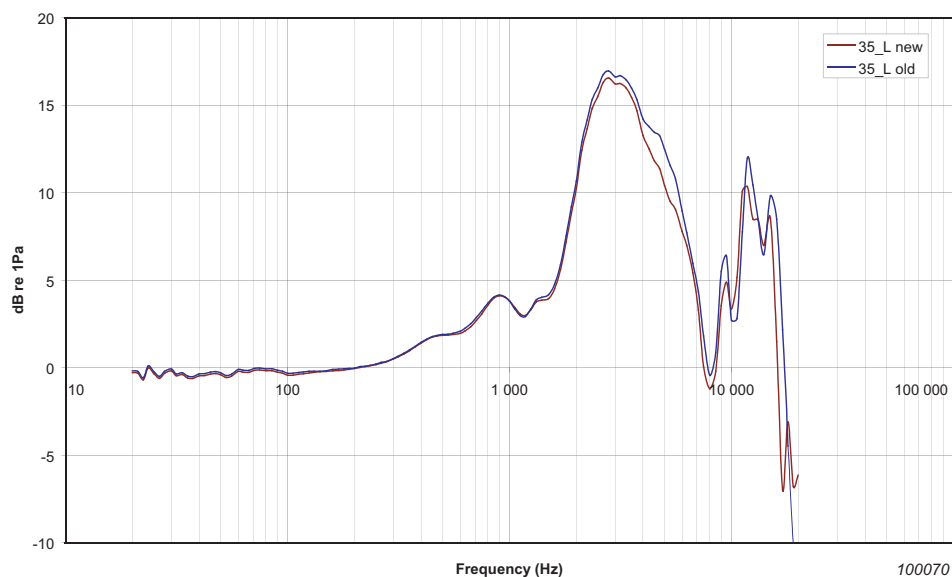


Fig. 5
Symmetrical versus
Asymmetrical L soft
ears (hardness 35 on
the shore scale) –
listener free-field
response at 0 degrees



Measurements on Six Headsets – New Versus Old Pinnae

Fig. 6
Coby® headset –
asymmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator A

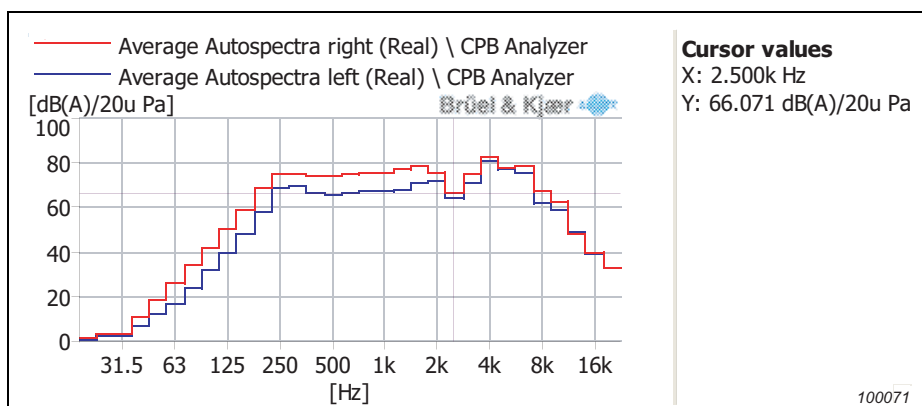


Fig. 7
Coby headset –
symmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator A

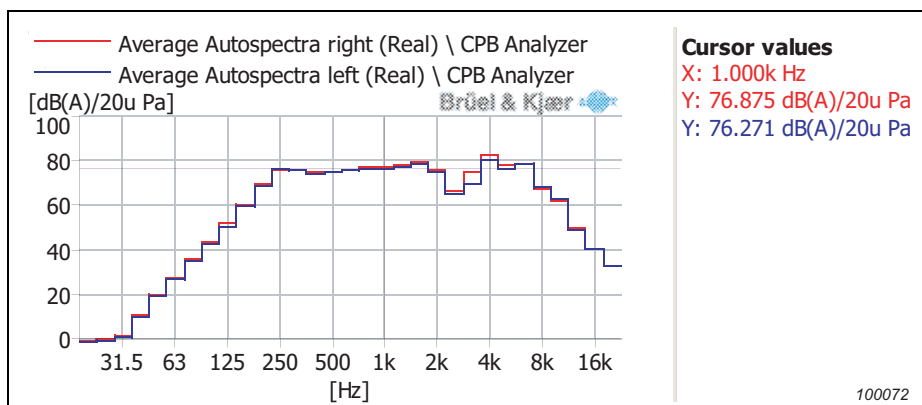


Fig. 8
iPod® headset –
asymmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator A

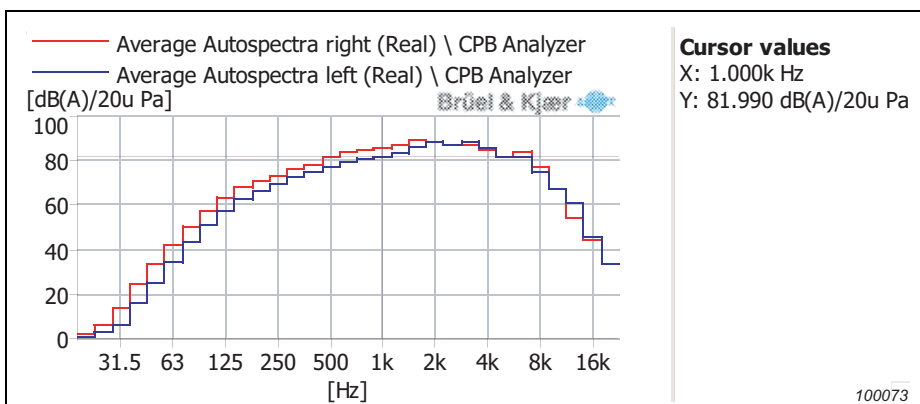


Fig. 9
iPod headset –
symmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator A

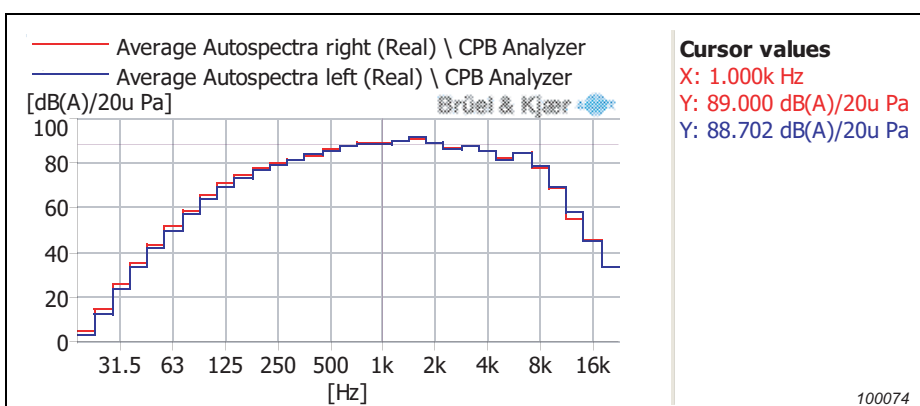


Fig. 10
NN headset –
asymmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator A

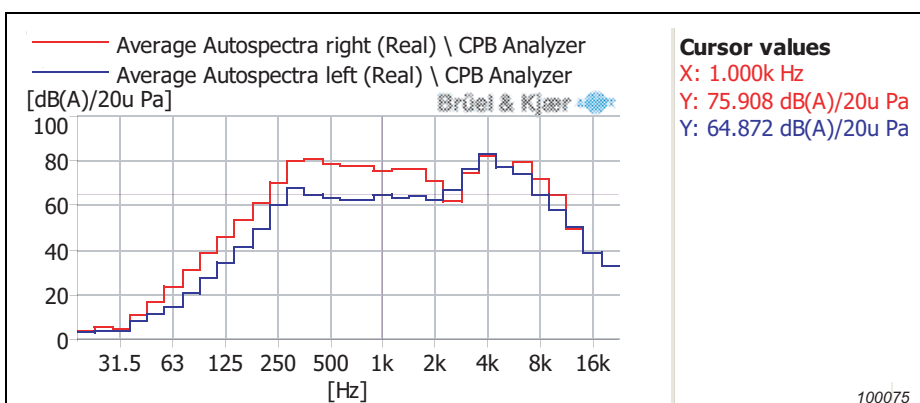


Fig. 11
NN headset –
symmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator A

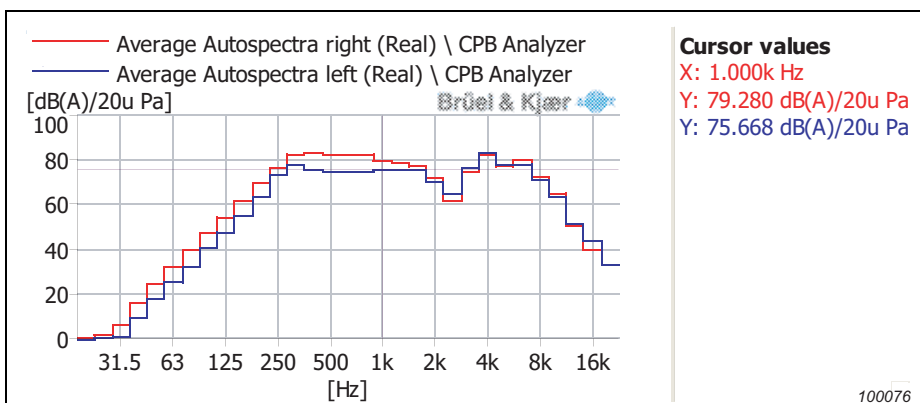


Fig. 12

Creative headset –
asymmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator B

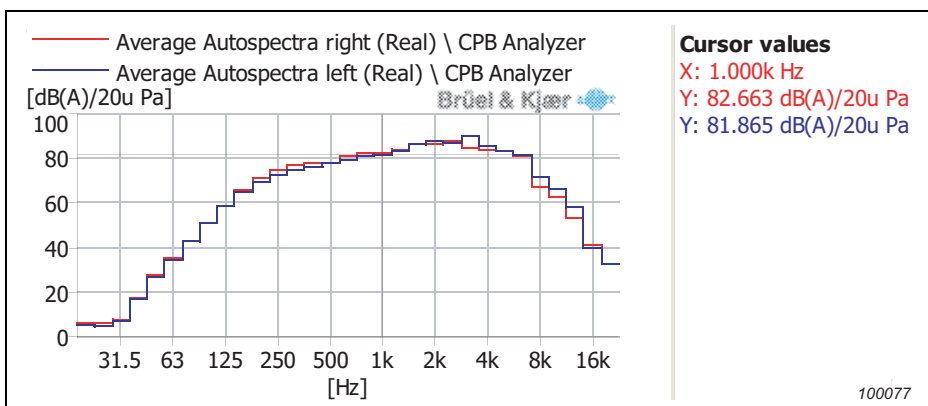


Fig. 13

Creative headset –
symmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator B

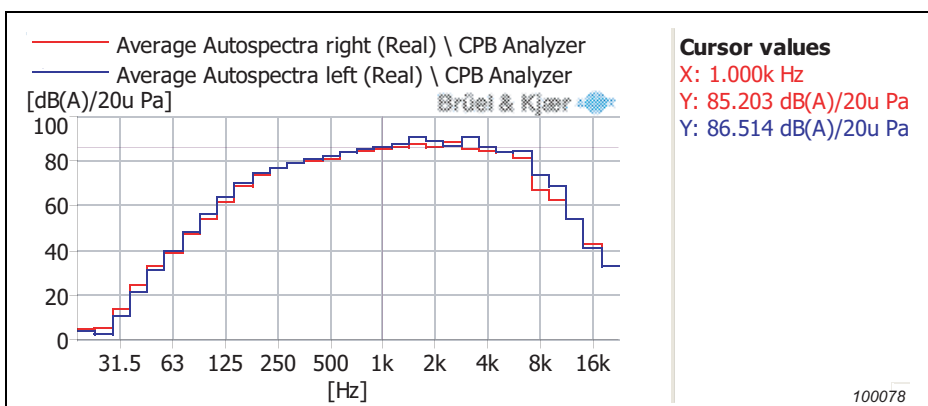


Fig. 14

MM headset –
asymmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator B

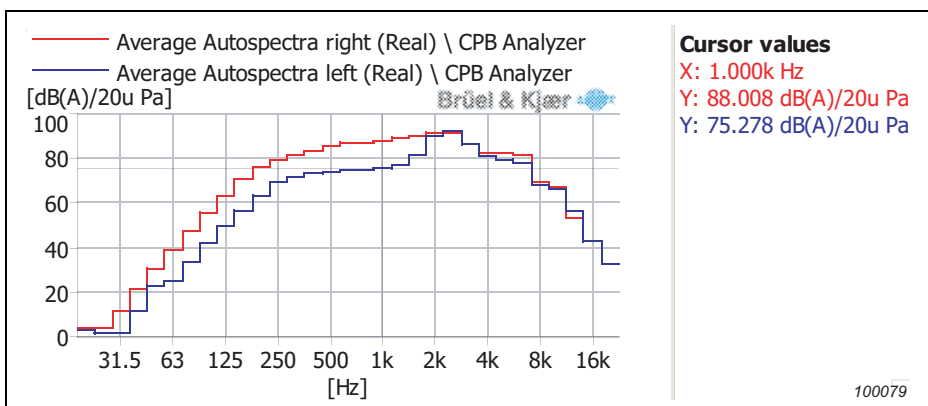


Fig. 15

MM headset –
symmetrical pinnae
(hardness 35 on the
shore scale) – red is
right, blue is left,
operator B

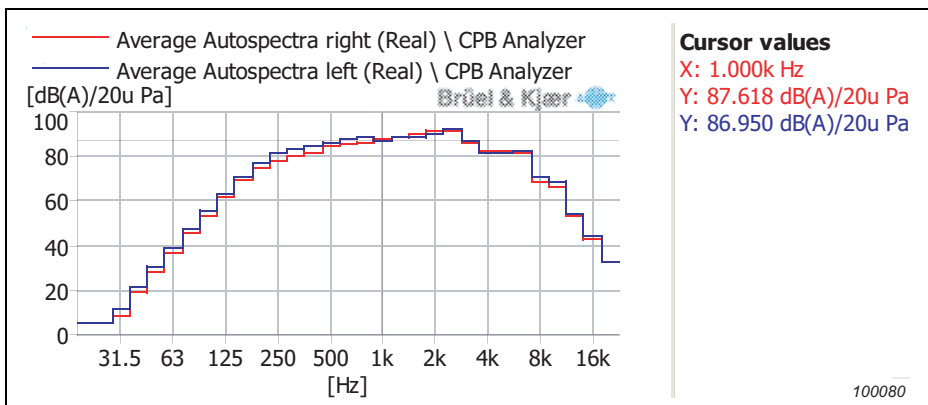


Fig. 16

Logitech® headset – asymmetrical pinnae (hardness 35 on the shore scale) – red is right, blue is left, operator C

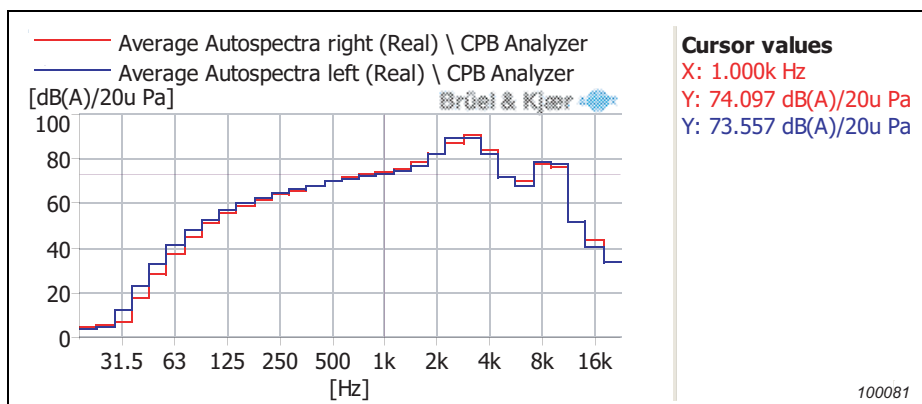
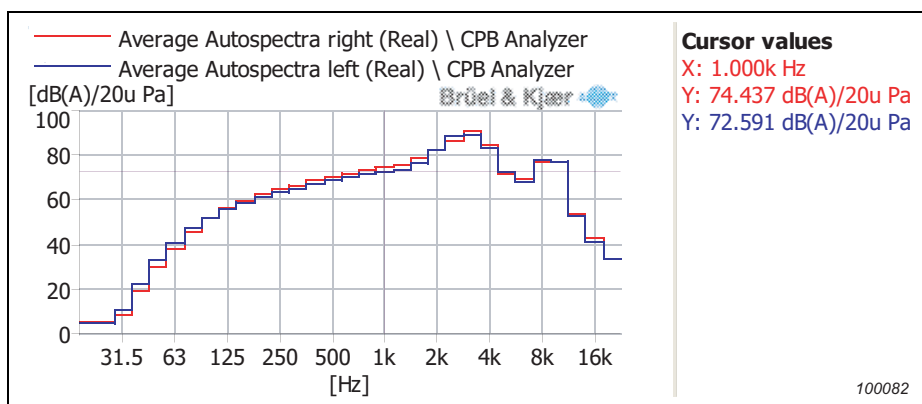


Fig. 17

Logitech headset – symmetrical pinnae (hardness 35 on the shore scale) – red is right, blue is left, operator C



Conclusion

The conclusion is that measurements performed with symmetrical pinnae provide a better benchmark for measuring headsets and telephones than measurements with asymmetrical pinnae.

However, care needs to be taken when actually installing the Device Under Test and it is recommended that the final measurement should be based on an average of five consecutive measurements, to ensure a valid and confident result.

Ordering Information

DZ-9769 Right Pinna – soft (Shore OO 35°)
DZ-9770 Left Pinna – soft (Shore OO 35°)

DZ-9771 Right Pinna – hard (Shore OO 55°)
DZ-9772 Left Pinna – hard (Shore OO 55°)

TRADEMARKS

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