Knowles Balanced armature receivers 711 response and impedance

An App Note

Rev 1.2 28-09-2012
Morten Arnoldus

Revision history

Revision	Date	Comments
1.0	28-09-2012	Release
1.1	29-09-2012	Corrected y-axis range and labels
1.2	12-03-2013	Corrected graph for WBHC-23910-000. Was corrected to nominal drive of 0.0283V instead of 0.283V

Contents

Introduction

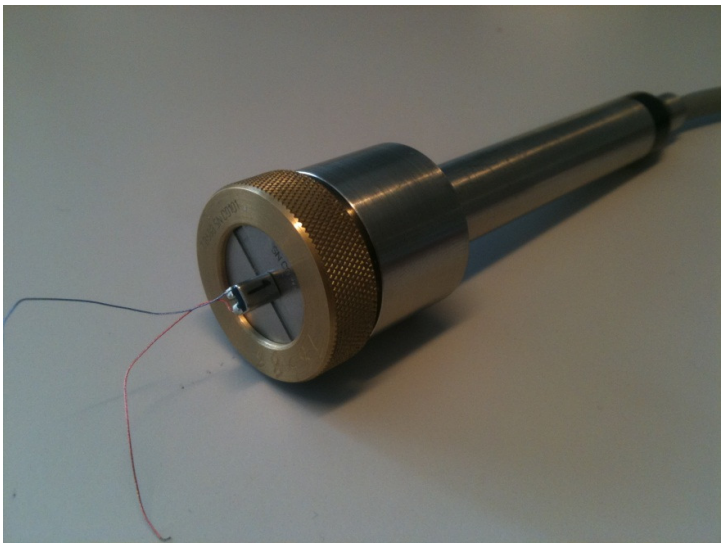
Knowles balanced armature (BA) receivers were originally developed for use in hearing aids in order to meet size and power consumption requirements. However, BA receivers are also used in high fidelity earphones for a number of reasons:

- Extended high frequency response
- Small physical form factor enabling small design
- Superior isolation of ambient noise
- Possible to combine tweeter, mid and bass units to design response

Coupler

In order to determine which receiver model to choose this app note provides measurement data of a range of Knowles receivers. The measurement is performed using the industry standard IEC 60318–4 coupler previously known as IEC60711 coupler or just commonly the "711" coupler.

The coupler to receiver interface is done using a T8688 fixture. Below is shown a photograph of the coupler-fixture-receiver setup:



The response data provided goes from 20-20kHz even though the 711 coupler is normally only specified to give reproducible results up to 10kHz. However, when using the same physical coupler unit comparison of the response of different receivers is possible.

Drive level

The drive voltage use is noted for the individual receivers. This is chosen so that the resulting output SPL is approximately 12dB lower than the output at which 10%THD occurs.

A note on amplifier output impedance

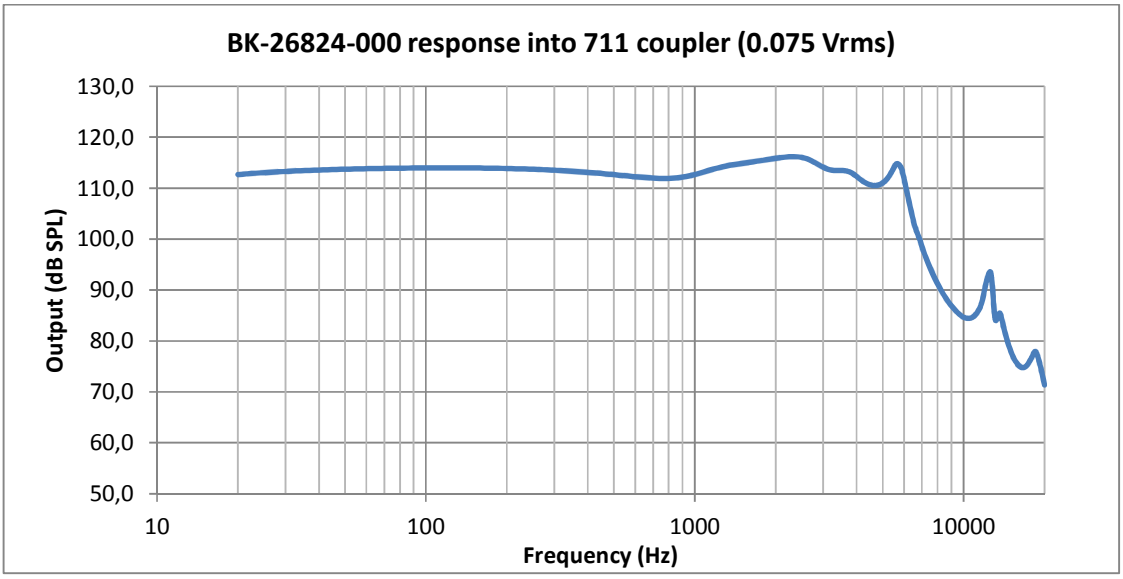
Response measurement data is obtained using an amplifier with output impedance lower than 0.1 Ohm. This is much lower than receiver impedance and results in a constant voltage drive. Some audio players will have output impedance that is on the order of the receiver impedance. This will typically result in an attenuation of the low frequency

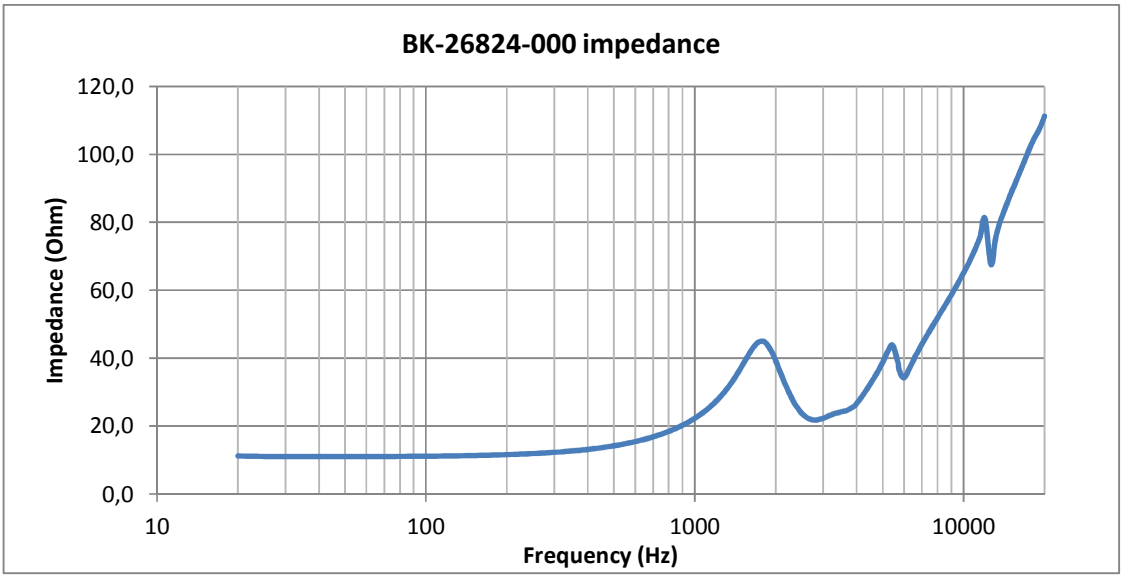
response – e.g. lower bass. At higher frequencies, receiver impedance rises and becomes high compared to the output impedance of a typical audio player.

Receiver impedance measurements

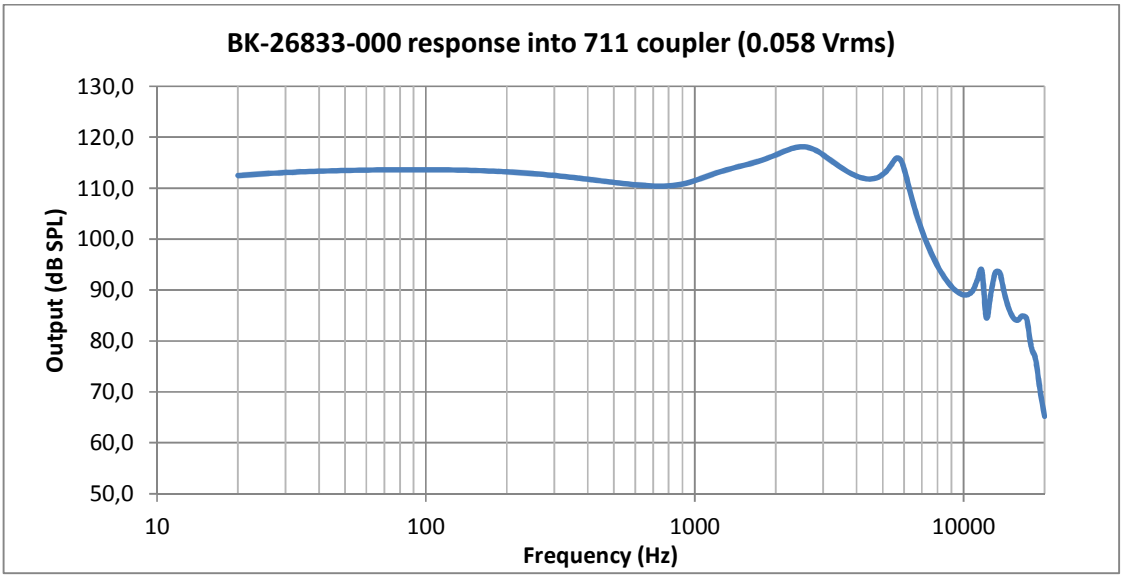
Furthermore, in order to better design cross-over circuits for multidriver designs measurement data of the receiver impedance is also given.

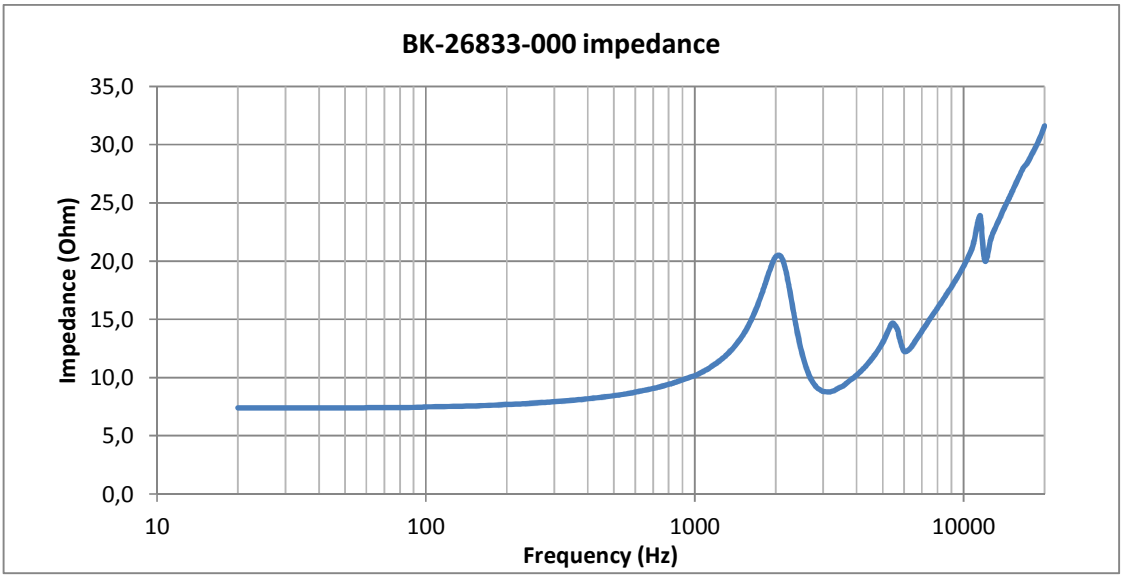
BK-26824-000


BK-26824-000 response into 711 coupler (0.075 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

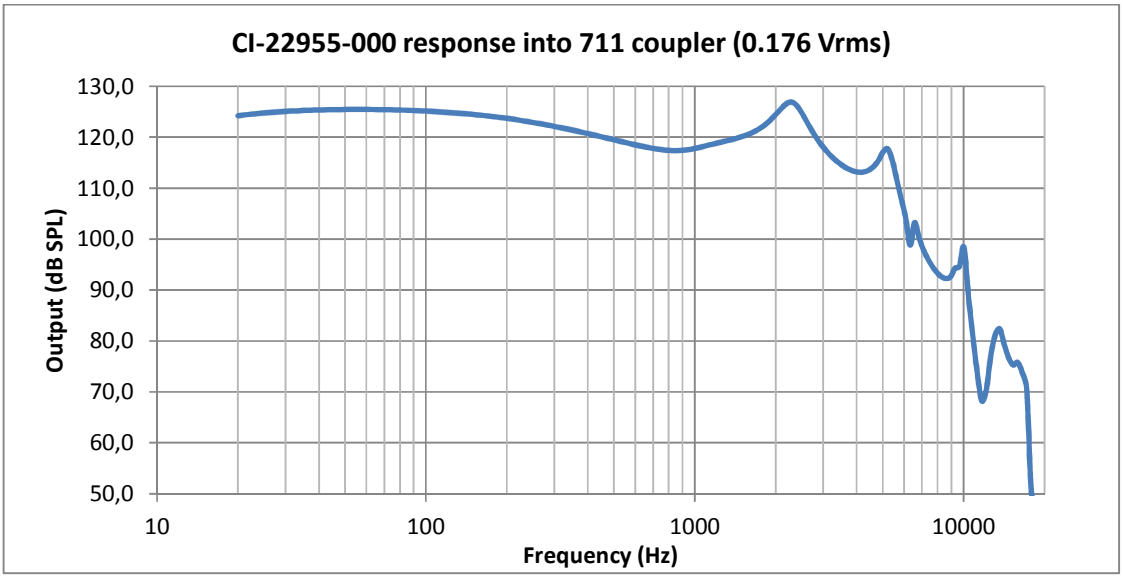

BK-26824-000 impedance
120,0
100,0
80,0
60,0
40,0
20,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

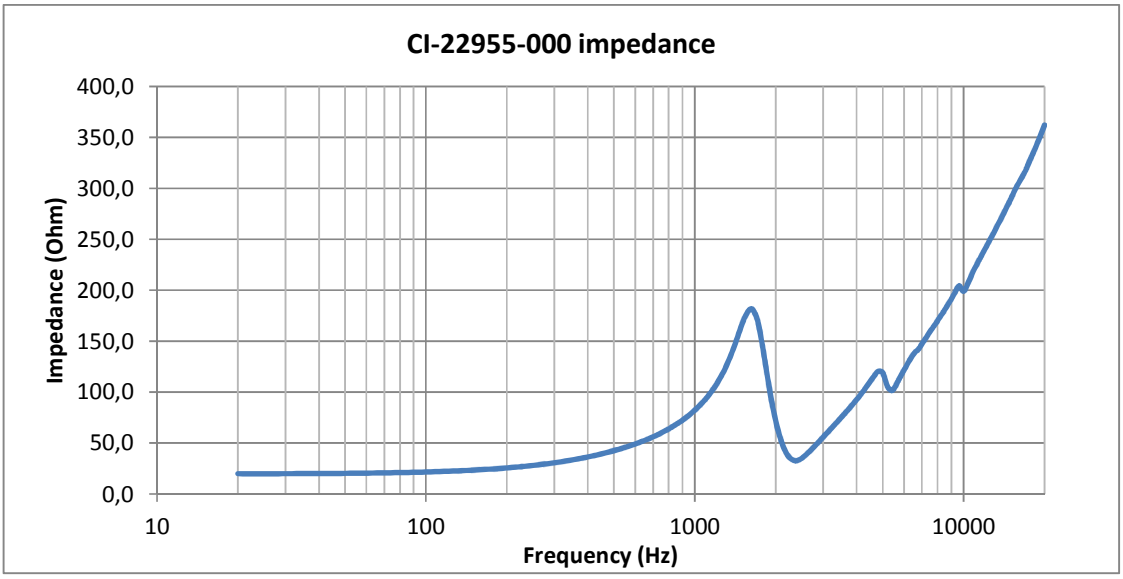
BK-26833-000


BK-26833-000 response into 711 coupler (0.058 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

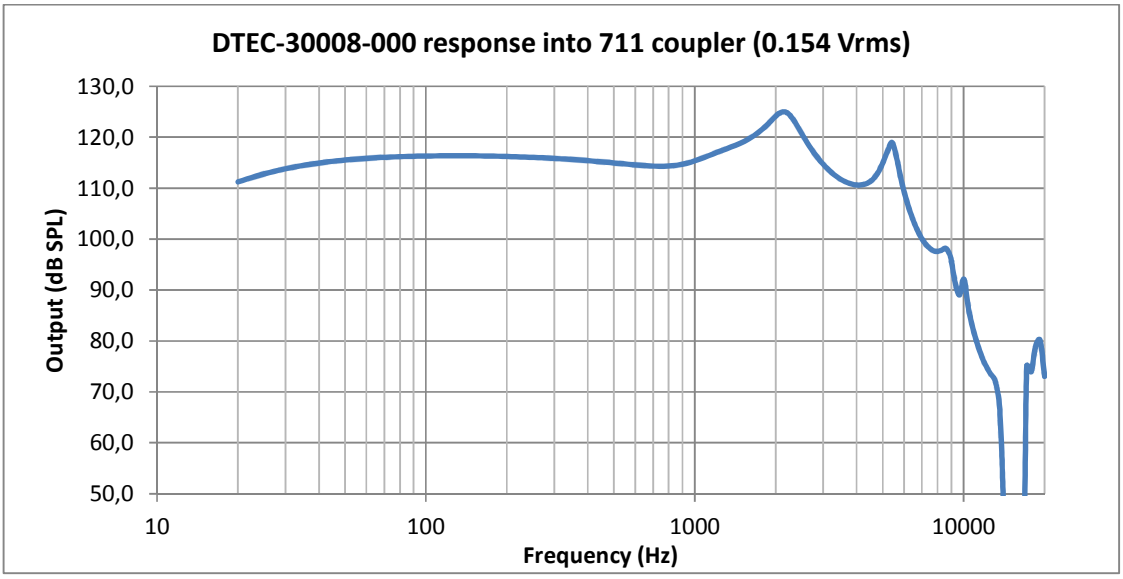

BK-26833-000 impedance
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

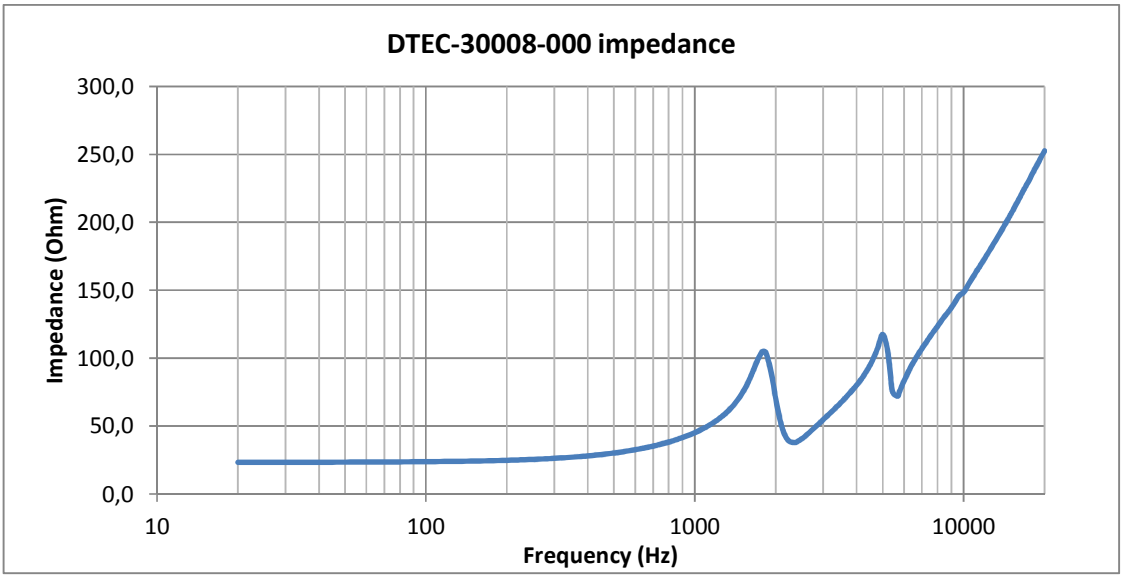
CI-22955-000


CI-22955-000 response into 711 coupler (0.176 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

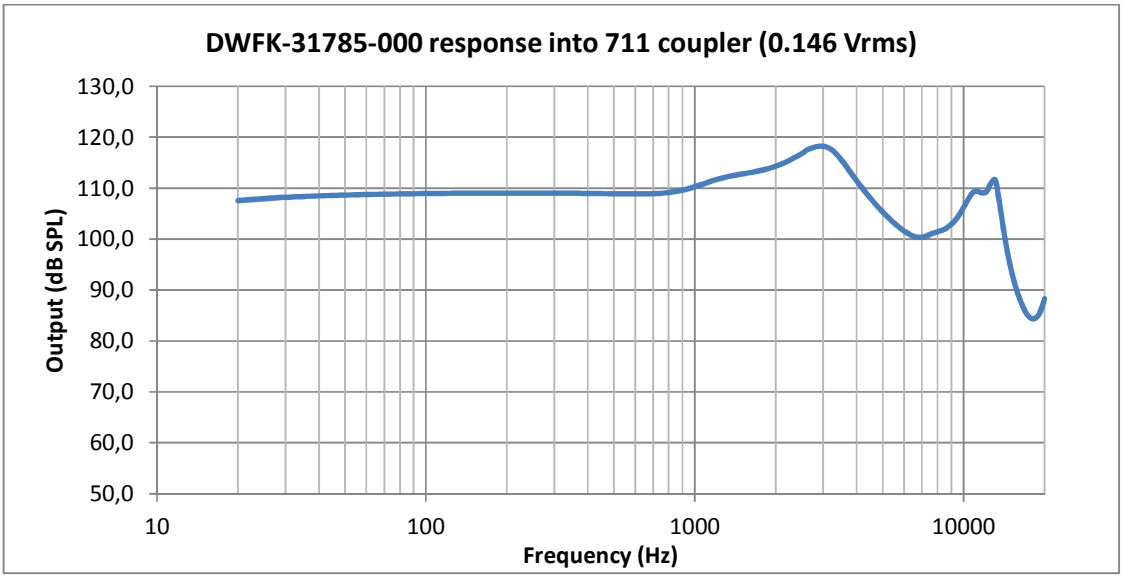

CI-22955-000 impedance
400,0
350,0
300,0
250,0
200,0
150,0
100,0
50,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

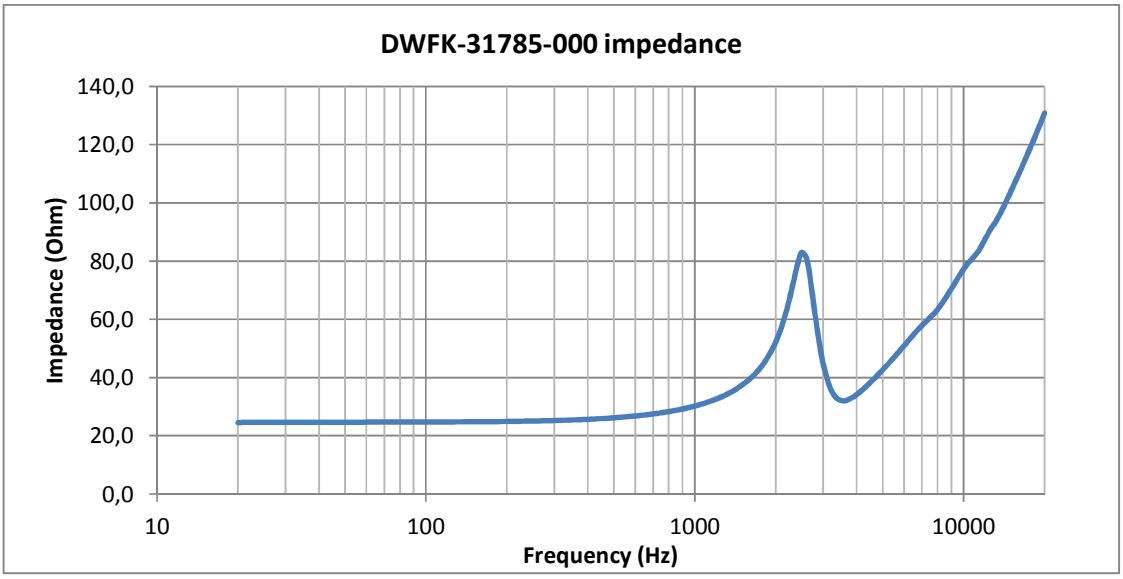
DTEC-30008-000



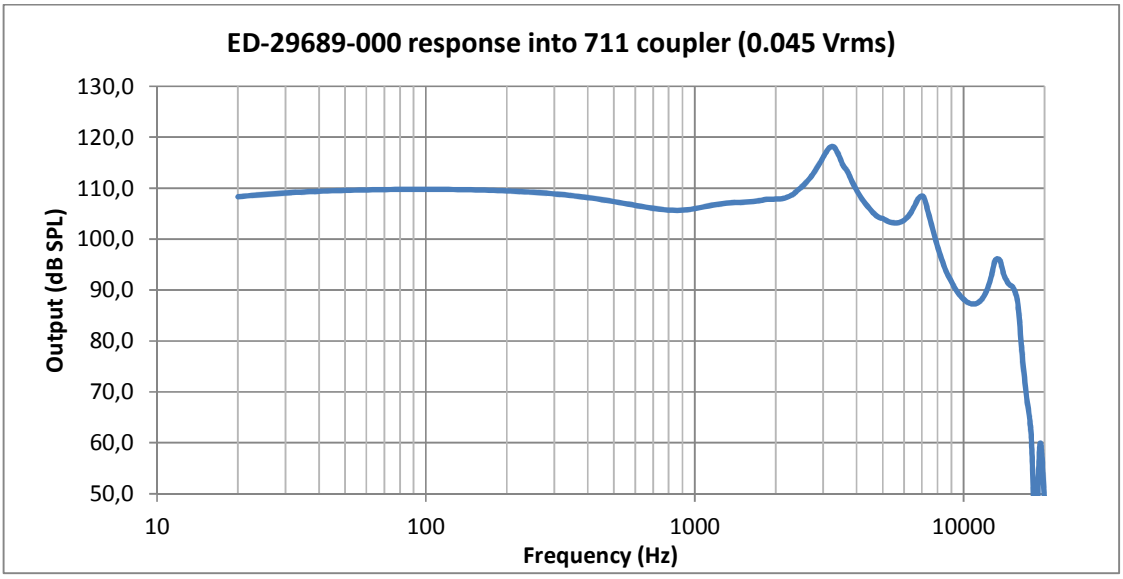


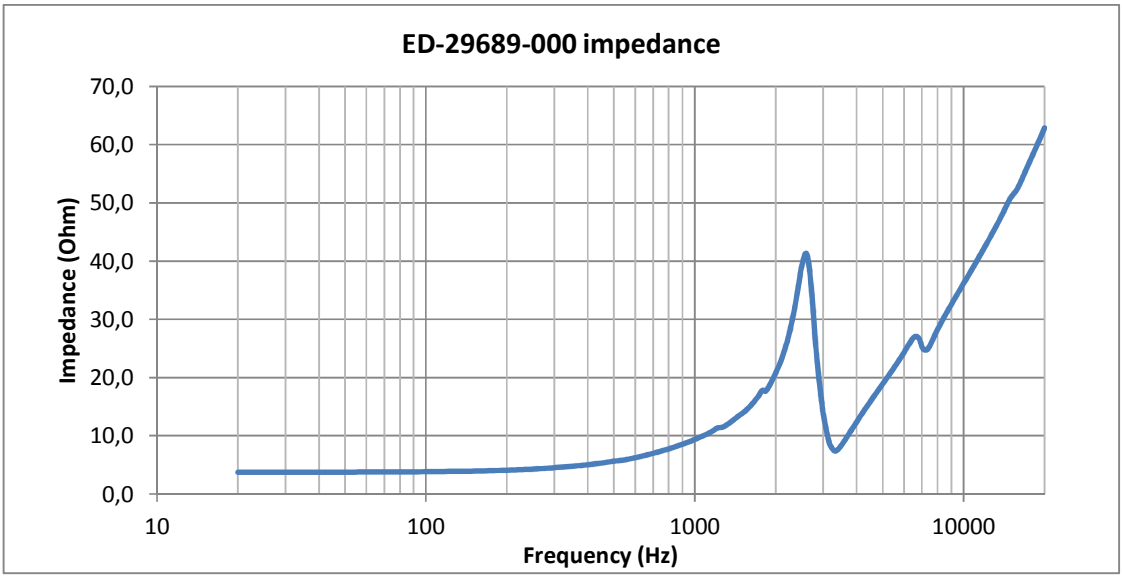
DWFK-31785-000



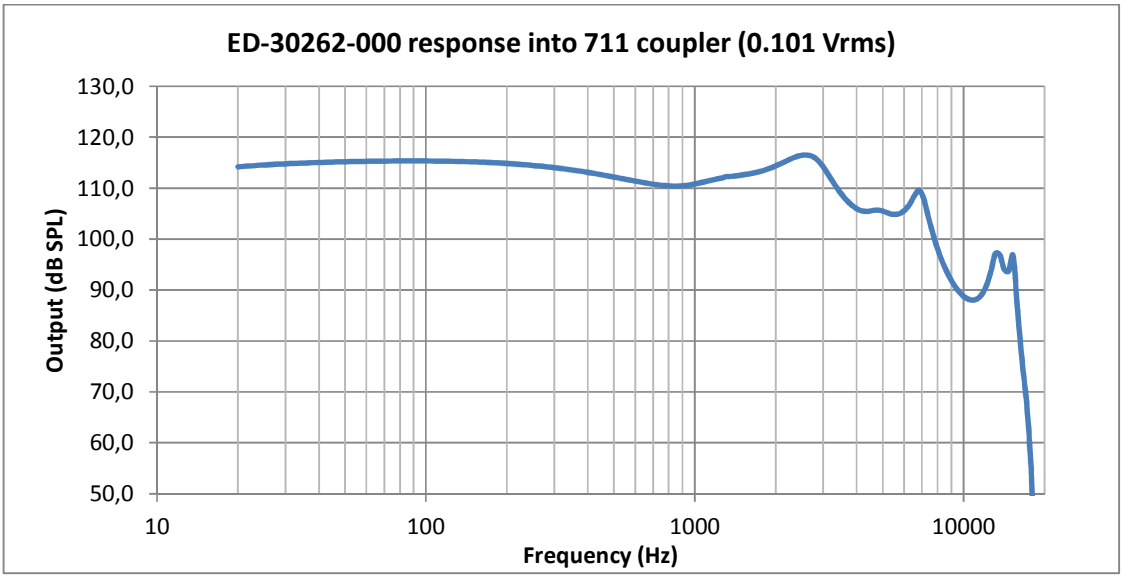


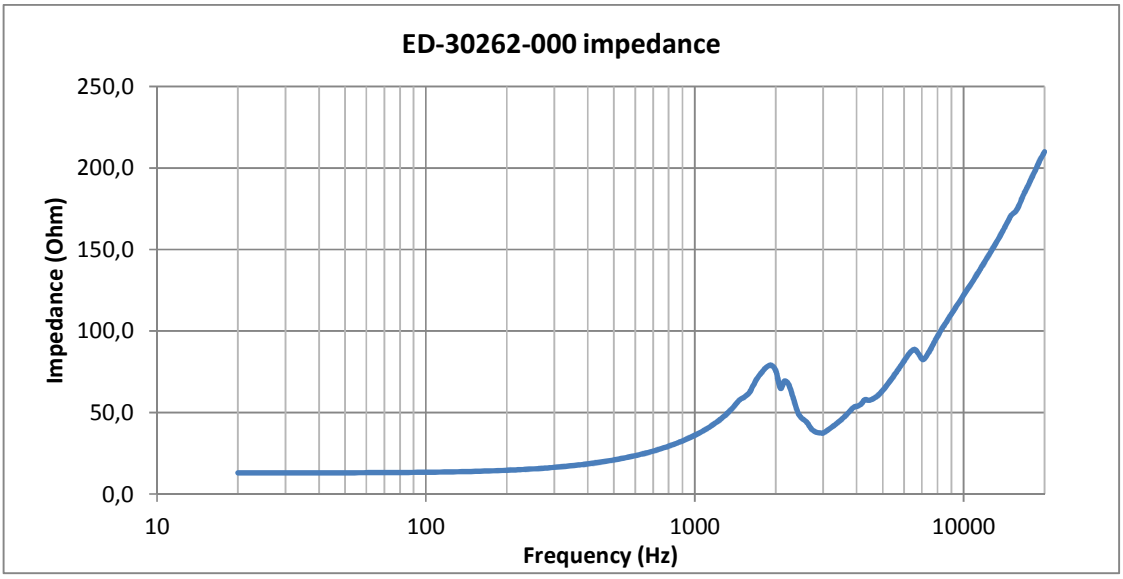
ED-29689-000


ED-29689-000 response into 711 coupler (0.045 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

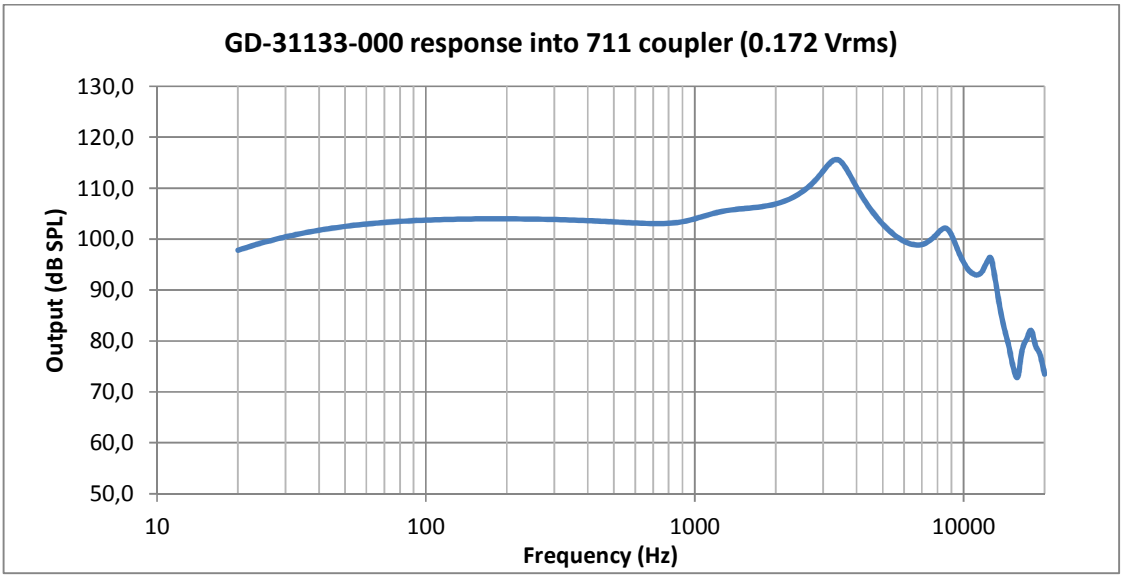

ED-29689-000 impedance
70,0
60,0
50,0
40,0
30,0
20,0
10,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

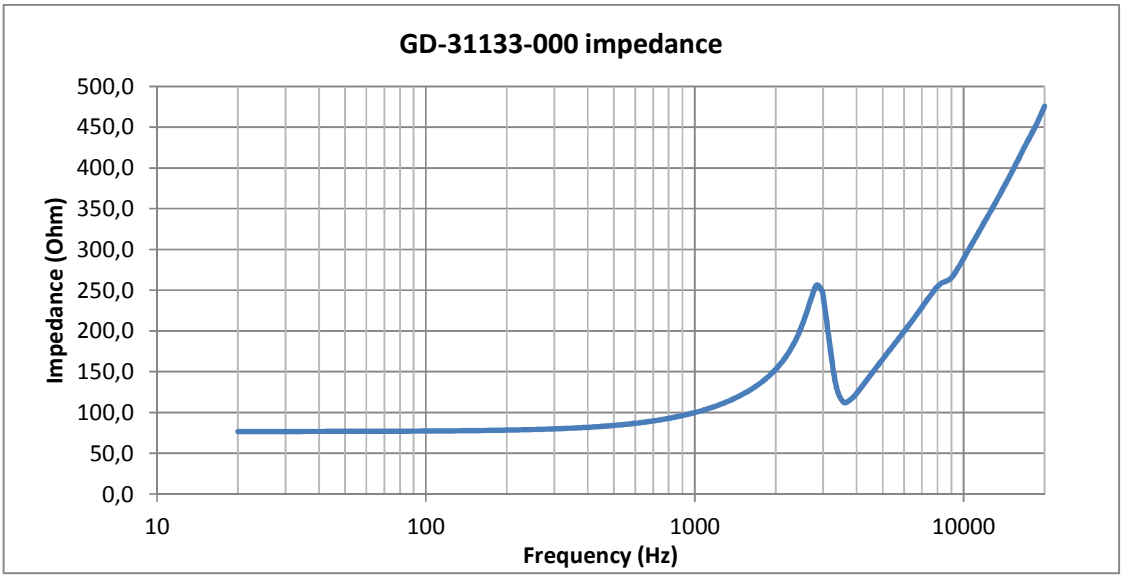
ED-30262-000


ED-30262-000 response into 711 coupler (0.101 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

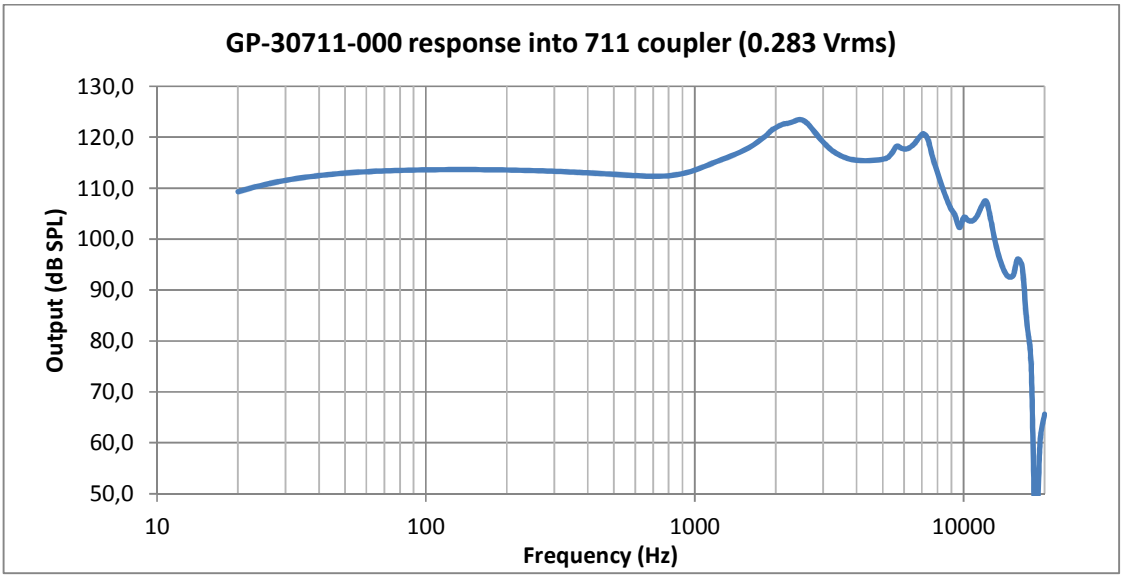

ED-30262-000 impedance
250,0
200,0
150,0
100,0
50,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

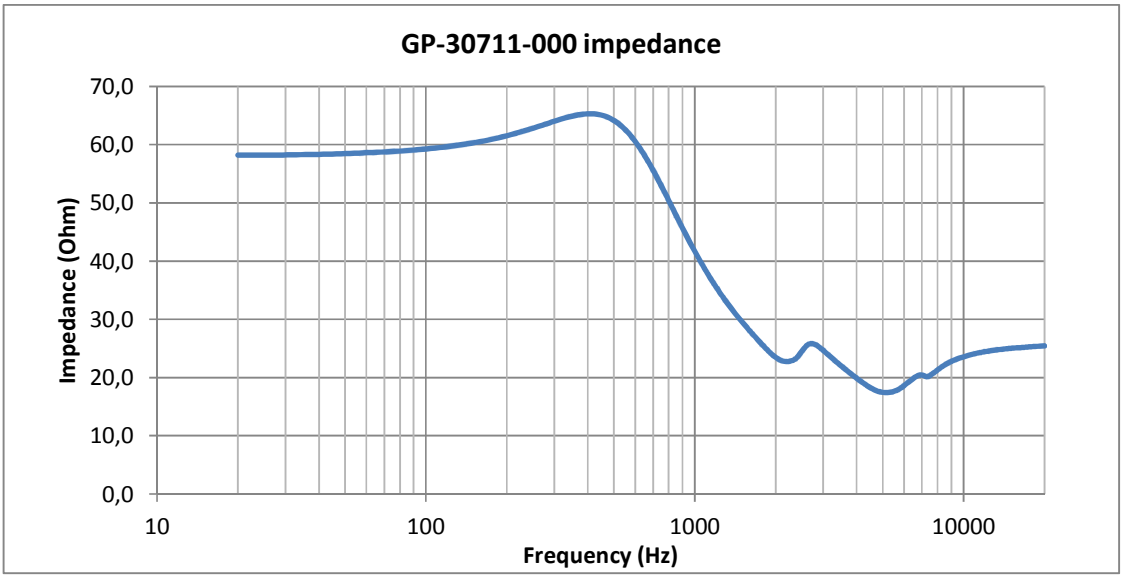
GD-31133-000


GD-31133-000 response into 711 coupler (0.172 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

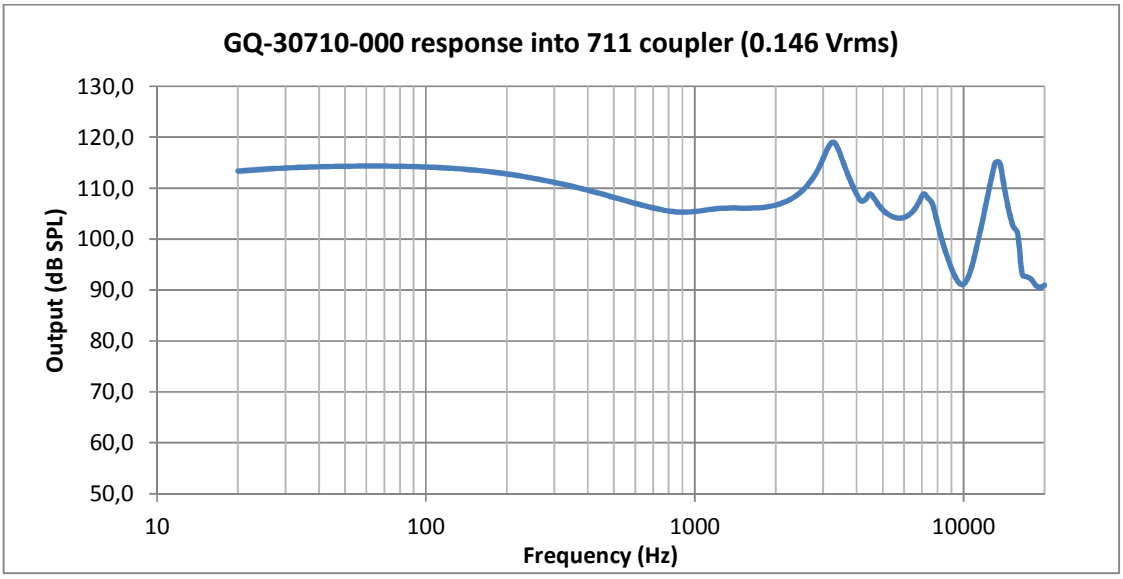

GD-31133-000 impedance
500,0
450,0
400,0
350,0
300,0
250,0
200,0
150,0
100,0
50,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

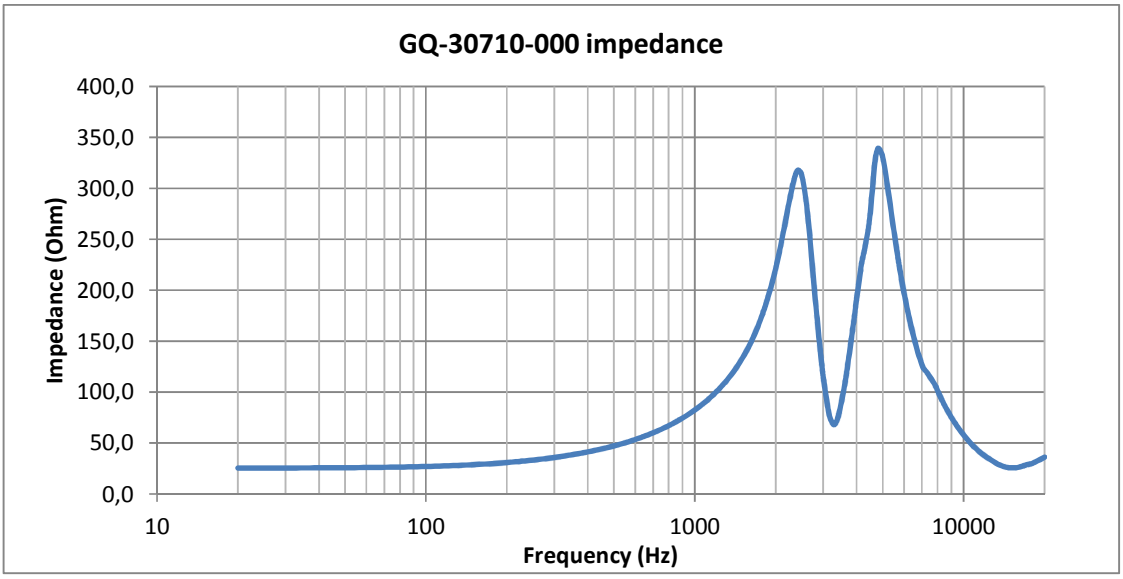
GP-30711-000


GP-30711-000 response into 711 coupler (0.283 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

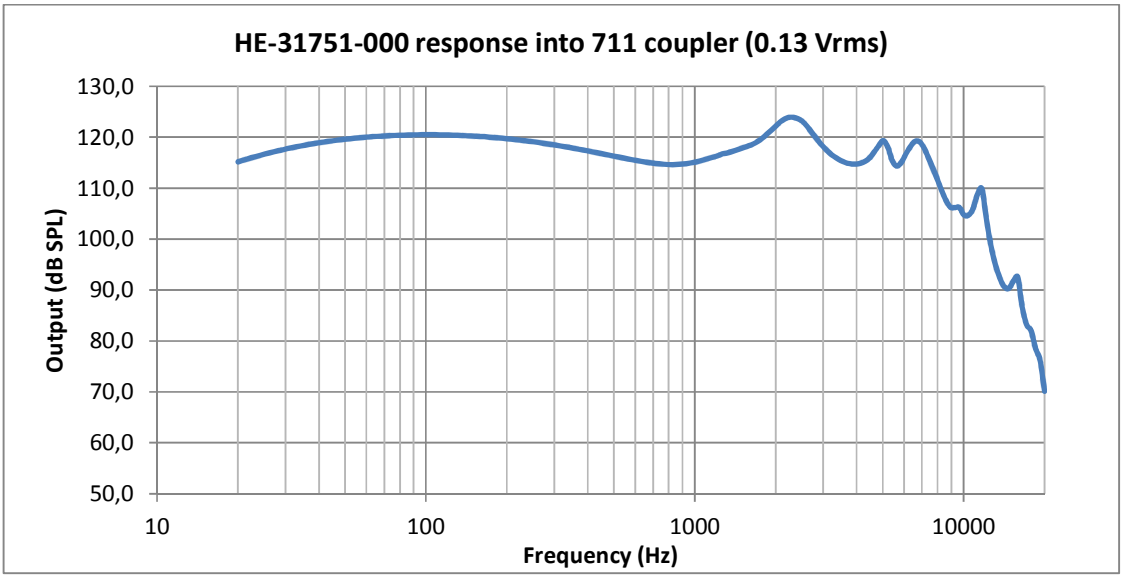

GP-30711-000 impedance
70,0
60,0
50,0
40,0
30,0
20,0
10,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

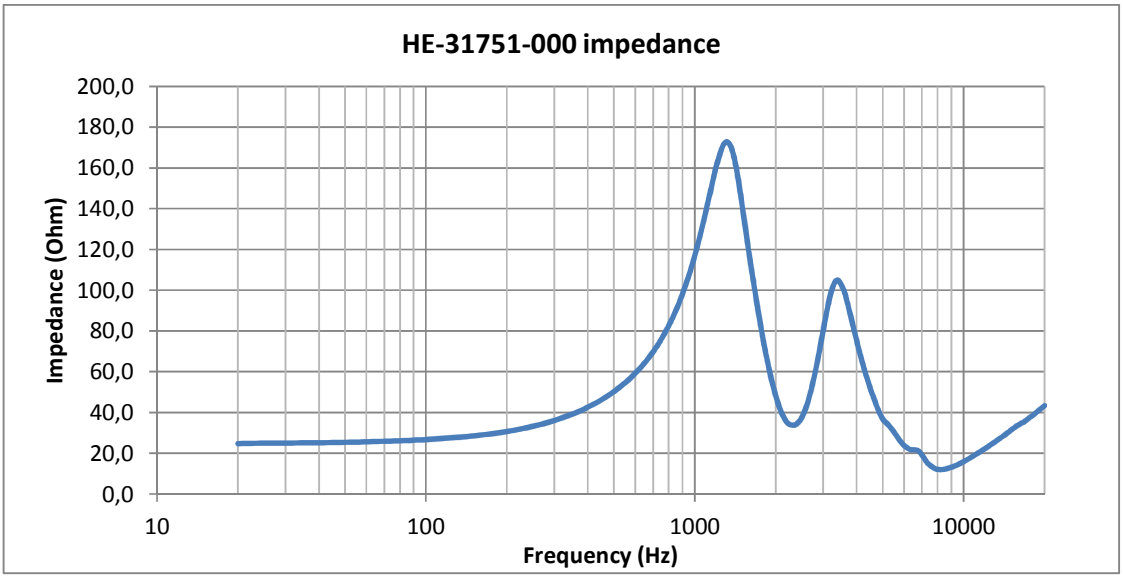
GQ-30710-000


GQ-30710-000 response into 711 coupler (0.146 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

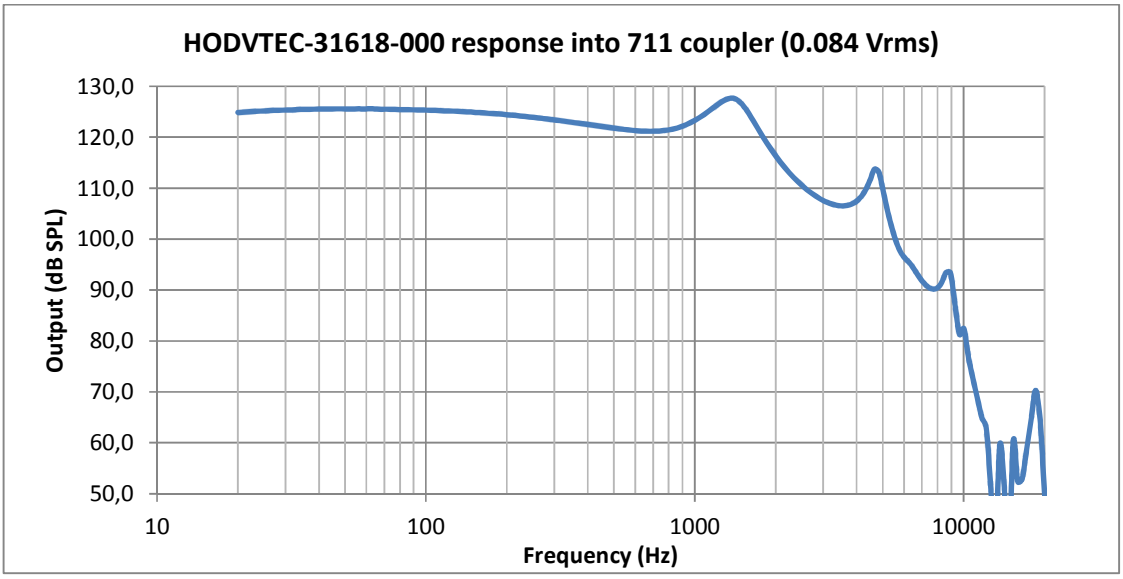

GQ-30710-000 impedance
400,0
350,0
300,0
250,0
200,0
150,0
100,0
50,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

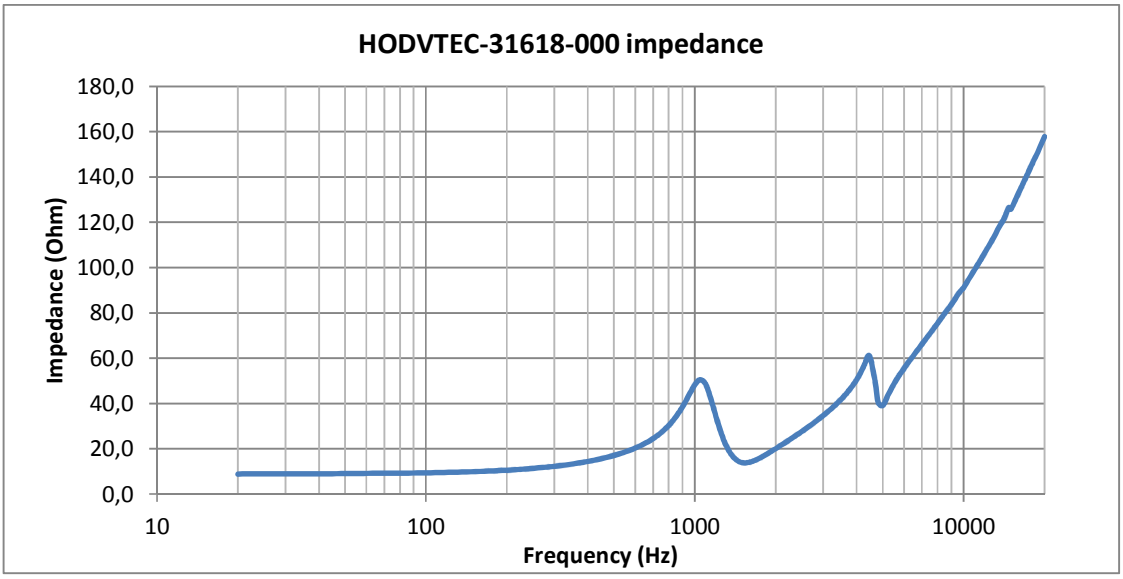
HE-31751-000


HE-31751-000 response into 711 coupler (0.13 Vrms)
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
Output (dB SPL)
10
100
1000
10000
Frequency (Hz)

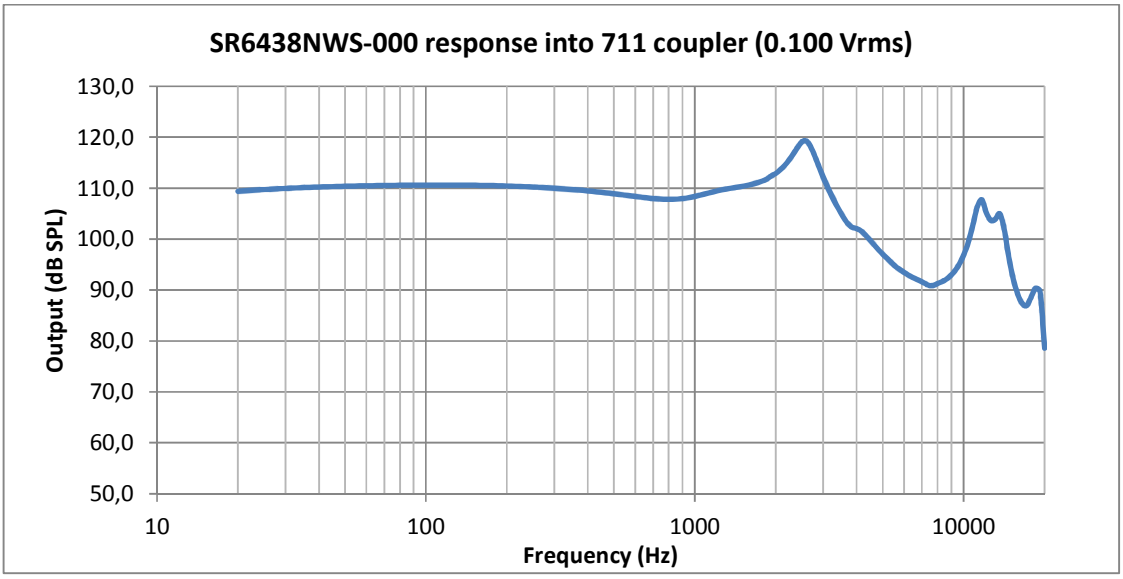

HE-31751-000 impedance
200,0
180,0
160,0
140,0
120,0
100,0
80,0
60,0
40,0
20,0
0,0
Impedance (Ohm)
10
100
1000
10000
Frequency (Hz)

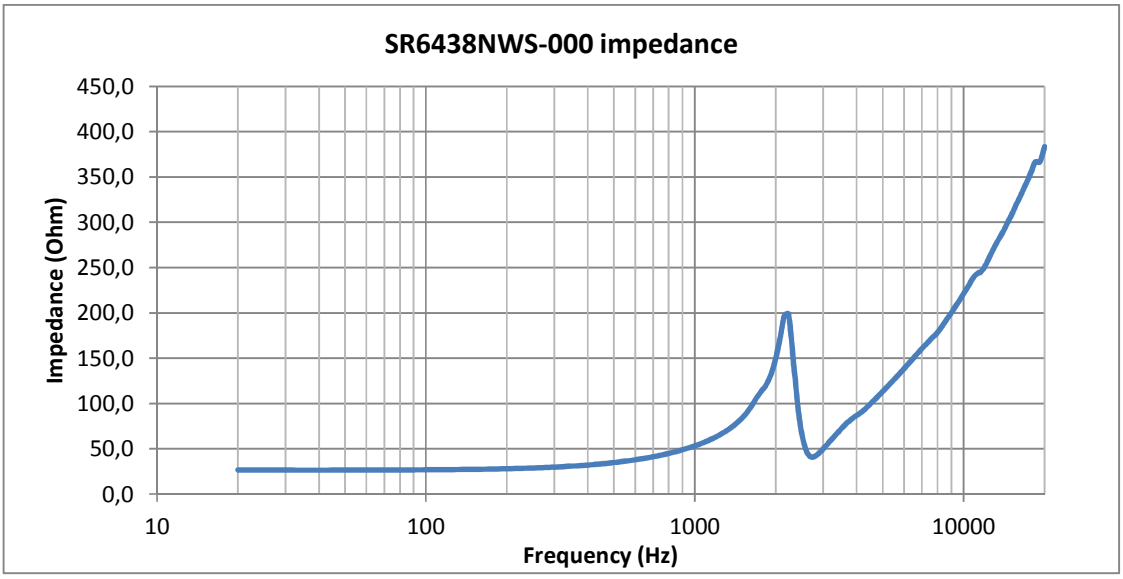
HODVTEC-31618-000



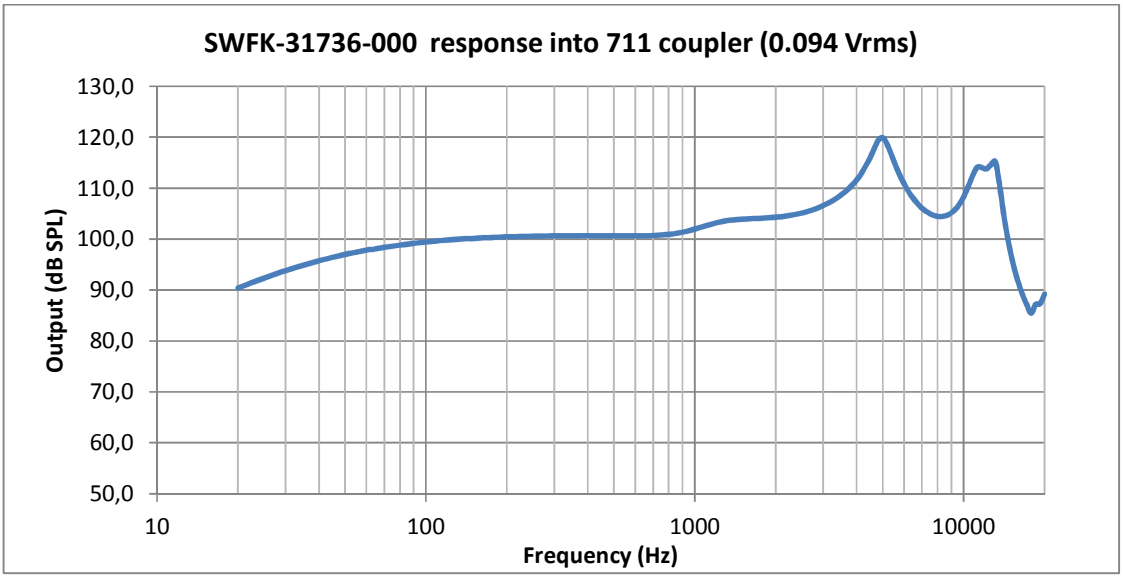


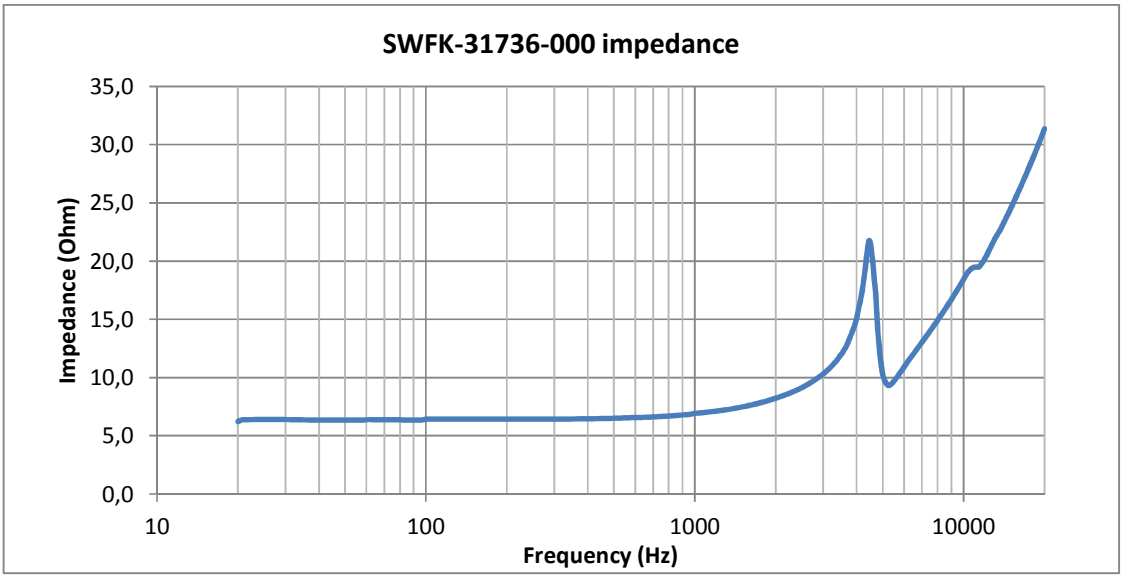
SR6438NWS-000



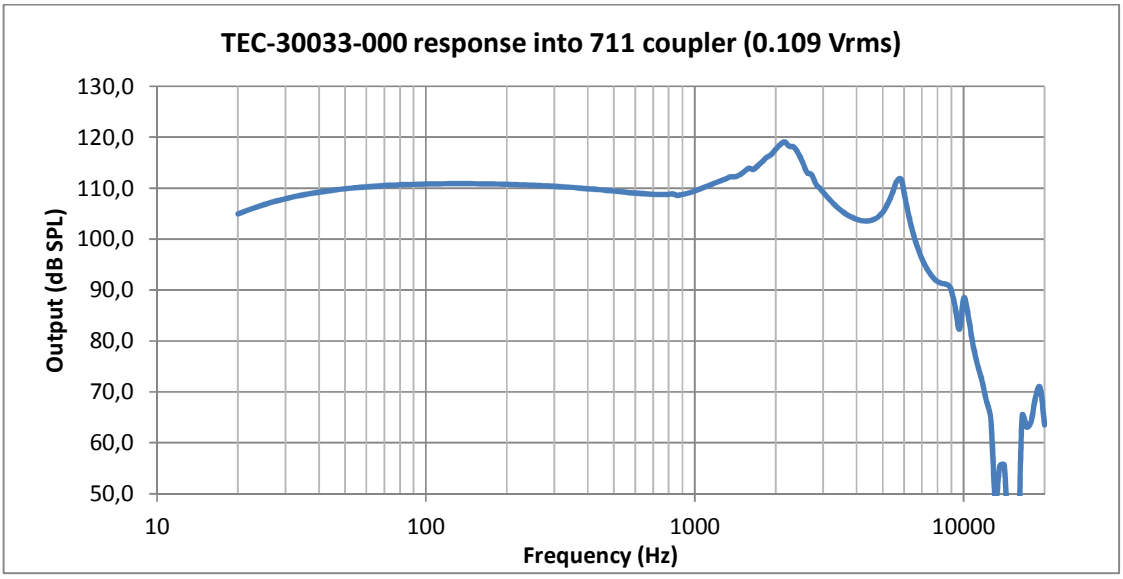


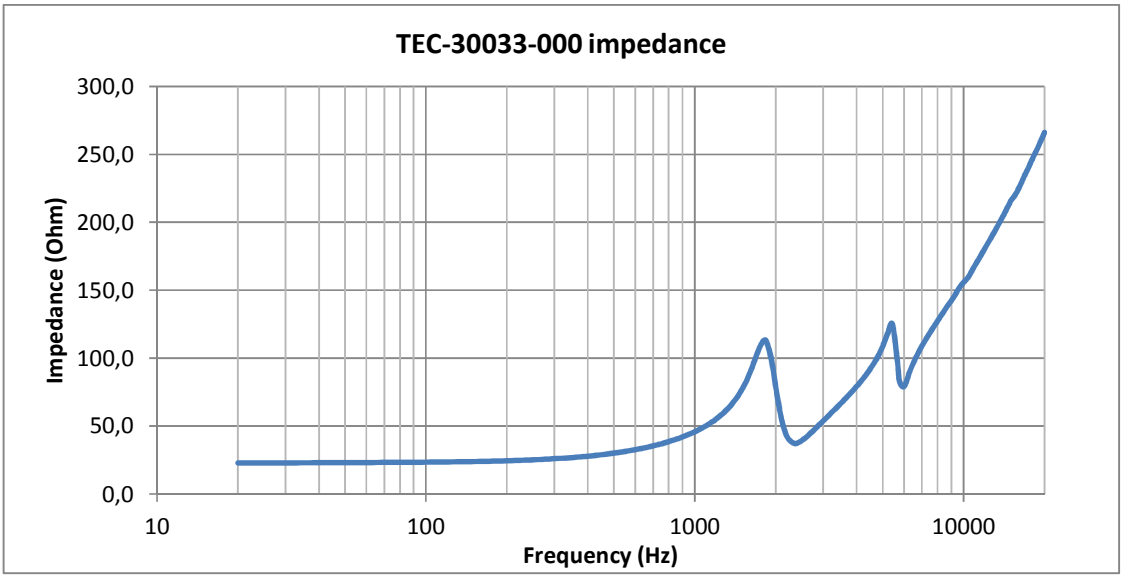
SWFK-31736-000



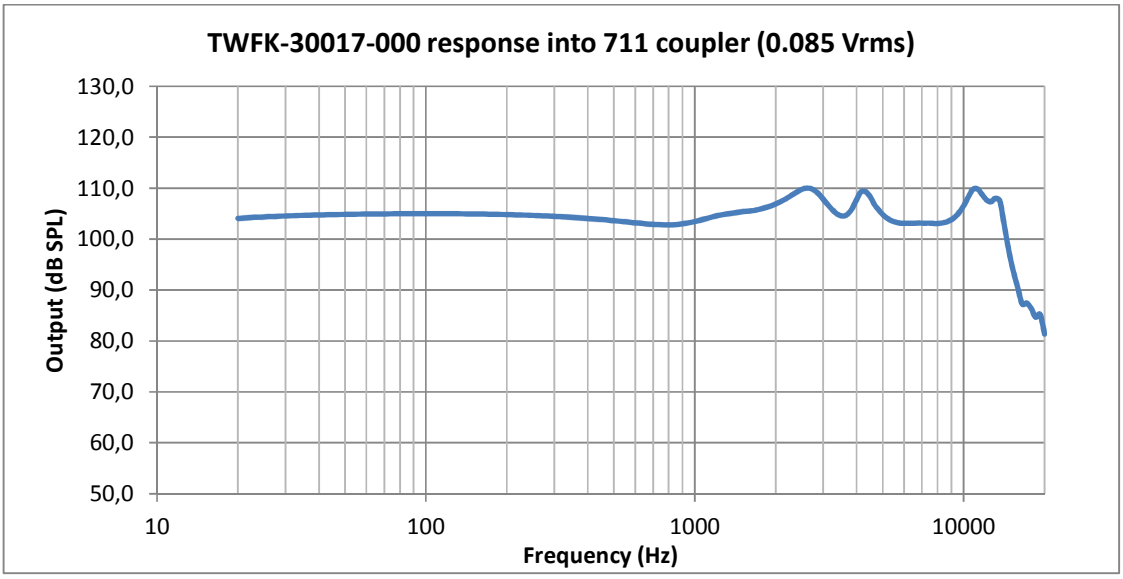


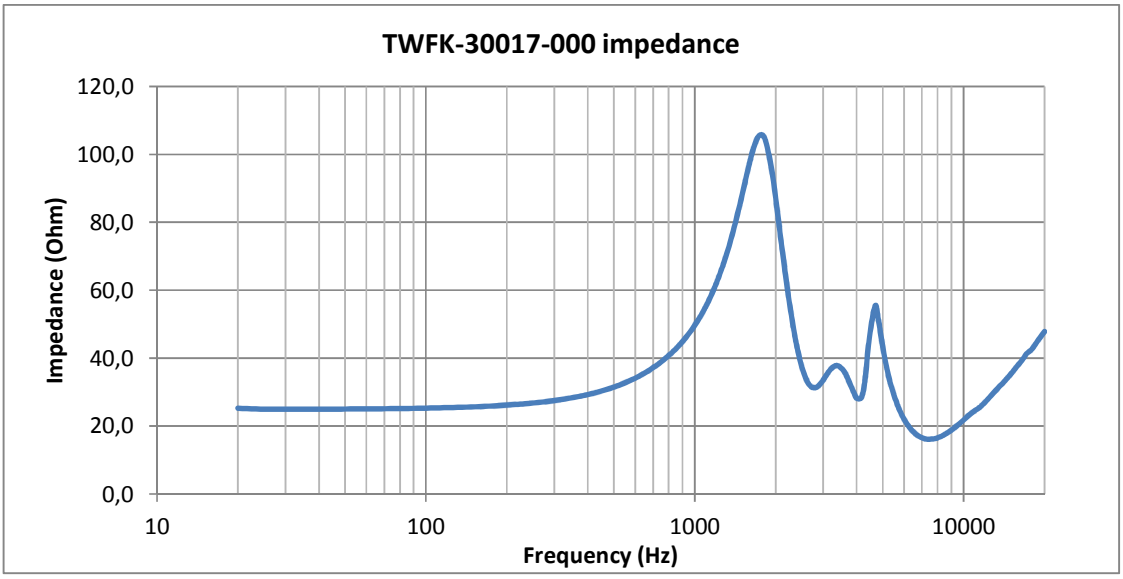
TEC-30033-000



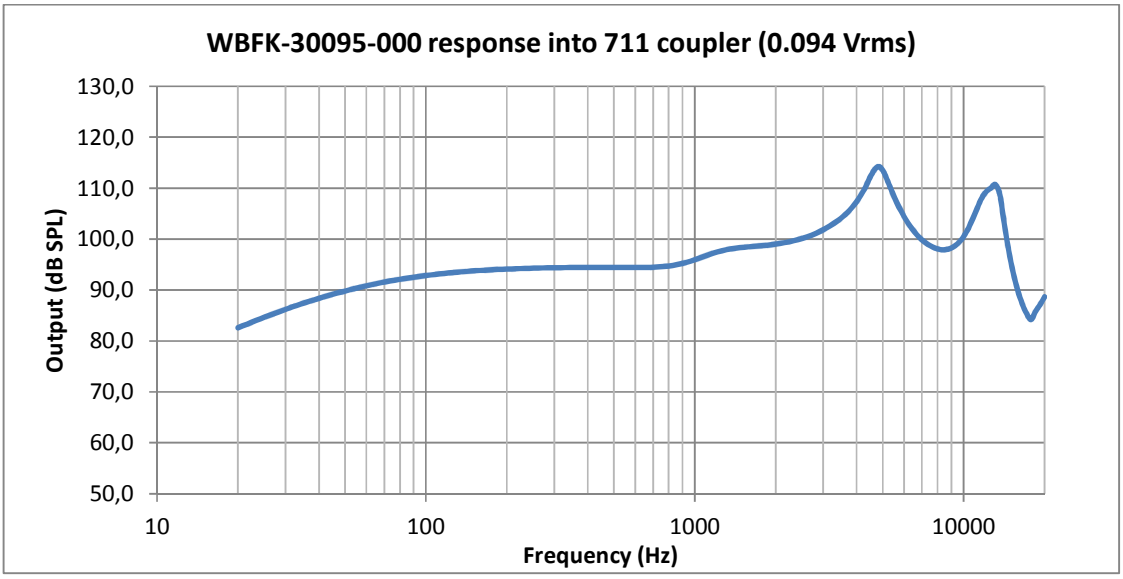


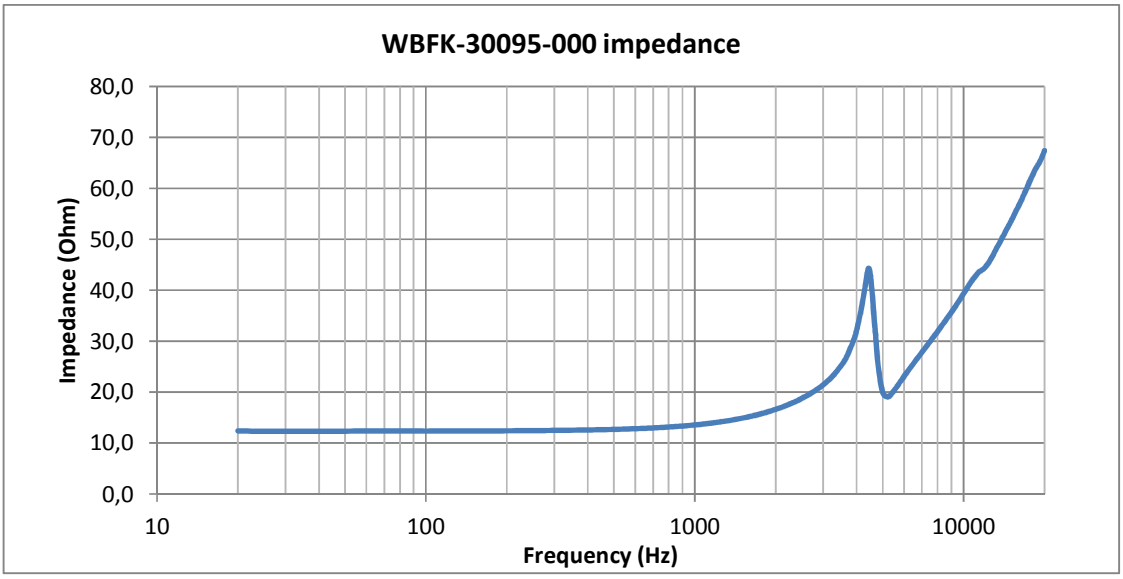
TWFK-30017-000





WBFK-30095-000





WBHC-23910-000