

## 26-E25 AcuPass™

## Introduction

The 26-E25WT module consist of a 2600 woofer and an E25 tweeter combined on a plastic joiner frame with one combined sound outlet. The 2600 family is well known for the superb sound quality in small size. In the module the 2600 covers frequencies up to 7 kHz. The E25 tweeter contributes above 7 kHz to provide a crispy sound with extended high frequencies up to 18 kHz. The modules are preliminary intended for high-end earphone applications providing a turn-key use solution to obtain great sound quality.

### Basic Features

- Plug and play 2-way module in small size
- Patent pending Joiner concept with combined spout with diameter equal to SSD damper
- Tuned vent woofer option for improved bass
- New designed E25 super tweeter with extended high frequency bandwidth
- Acoustic AcuPass™ low pass on the woofer to provide smooth response and reduce receiver interaction
- Electric High-pass on tweeter by capacitor
- Options for adapting to typical universal fit or custom fit application acoustics.
- Options to be used as stand alone or in combination with a (sub) woofer in a 3 way system.

The sound signature can be modified by the earphone designer by the applied acoustics. Choice of damper, dimensions of the tubing/nozzle will have direct influence on the end result.

This application note provides some background information and guidelines for implementation.

## Designs Basics

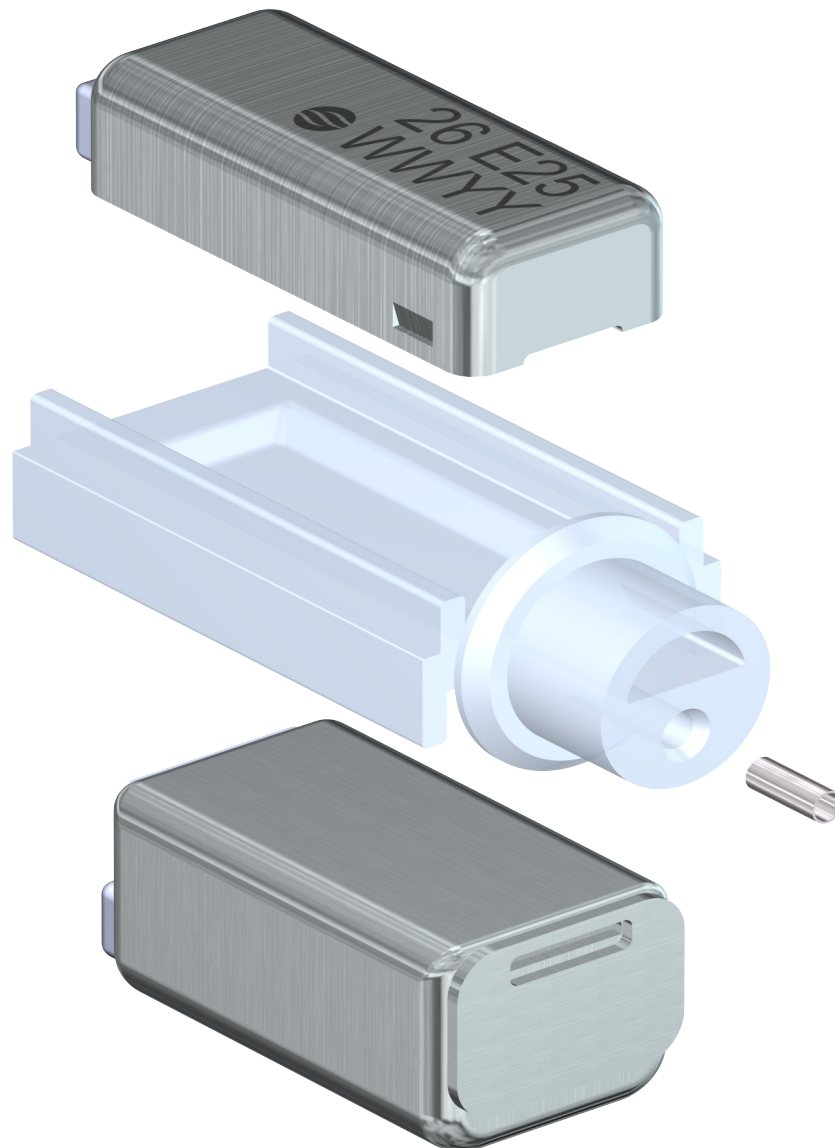
### AcuPass™ and joiner

The 26-E25WT module is based on 2 patent pending concepts:

- Both receivers are mounted on a frame called “joiner”. The joiner concept has the advantage to build receiver modules out of any relevant combination of Sonion receiver families with a short time-to-market, also on customer specification.
- The 2-way system performance is based on AcuPass™ technology which provides an acoustic low pass filter at the woofer part of the module. Due to this acoustic filter the interference of woofer and tweeter is minimized, resulting in a better bandwidth and smooth response. In figure 1 the construction of the module is shown.

**Figure 1**

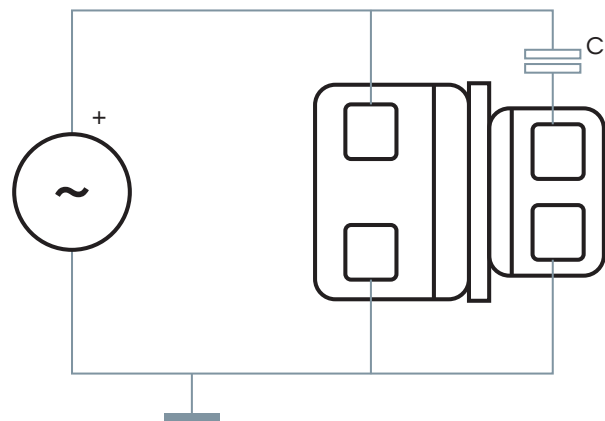
**Construction of a 26-E25WT module**



## Connections and Electrical Crossover

The module is provided with a ceramic crossover cap for the tweeter. The capacitor is placed on the tweeter PCB. The module has been prepped according the circuit description shown in figure 2. The earphone cable or better litzwires for the electrical connection can be soldered to the pads of the woofer. Soldering the cables should be done with great care, short time and preferably no additional flux

**Figure 2**  
**Electric Circuit**

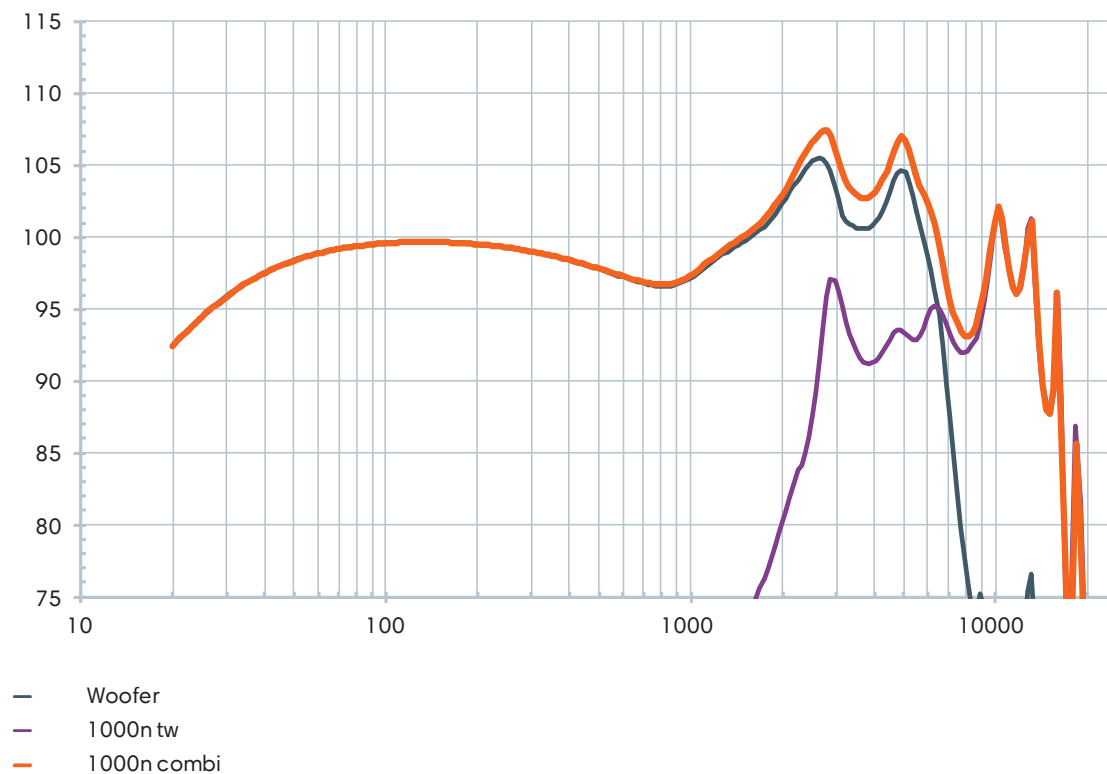


## Woofertweeter Response

The crossover point is set at 7 kHz by both AcuPass™ and the crossover cap, the contribution of woofer and tweeter is shown in figure 3. The available headroom is determined by the 2600 receiver which is sufficient for consumer applications. The E25 tweeter does not contribute at lower frequencies which keeps the overall distortion low.

**Figure 3**

**Overall and individual woofer / tweeter response for 26-E25WT02/9 on IEC 711 + PA tubing, 100 mV drive**



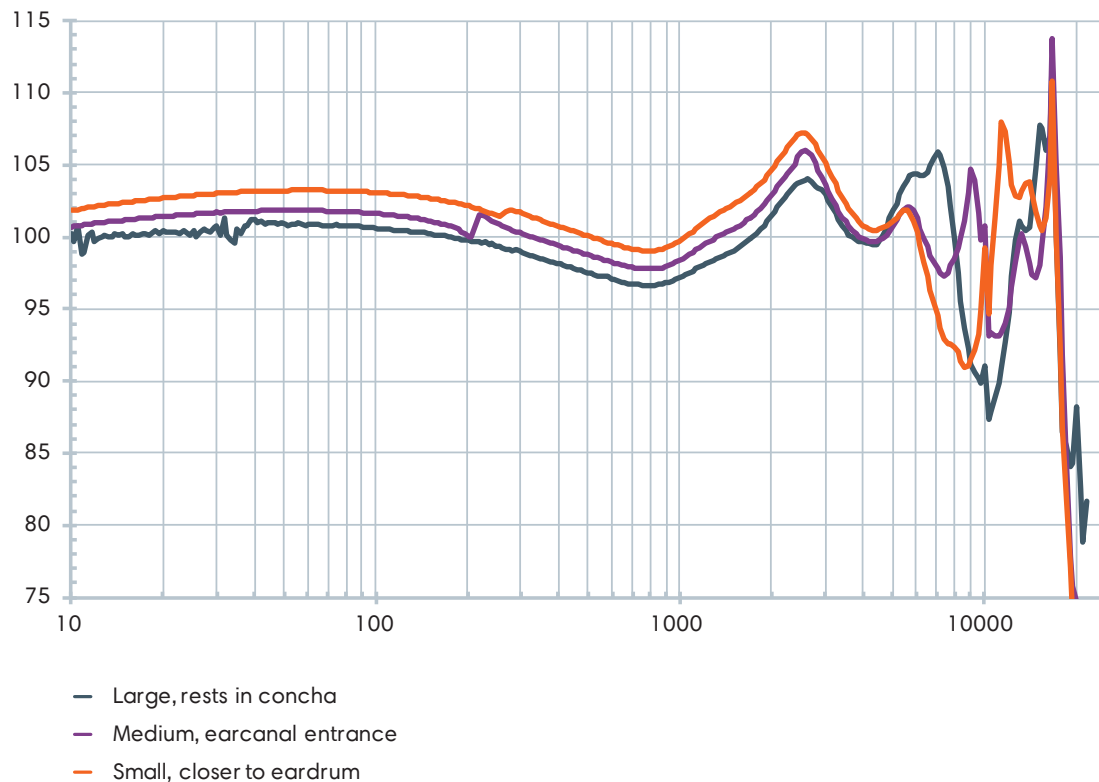
## Implementation guidelines

The response of the earphone will depend on the module, length and diameter of the tube, acoustic damping, insertion depth of the earphone and the cross-over filter. In this guideline the effects of changing these parameters are shown.

## Universal fit, custom, deepfit: consequences of fit position

The basic choice of earphone style will have major influence on the choice of the module and adjustment of the acoustics. Deeper fit applications will require stronger tweeter performance in the 5-10 kHz range. An optimization for universal fit consumer product will sound dull in a custom application. Also the other way around: an optimization for custom application with deeper fit will sound over-bright and harsh in a universal fit earphone. The effect is illustrated in figure 5.

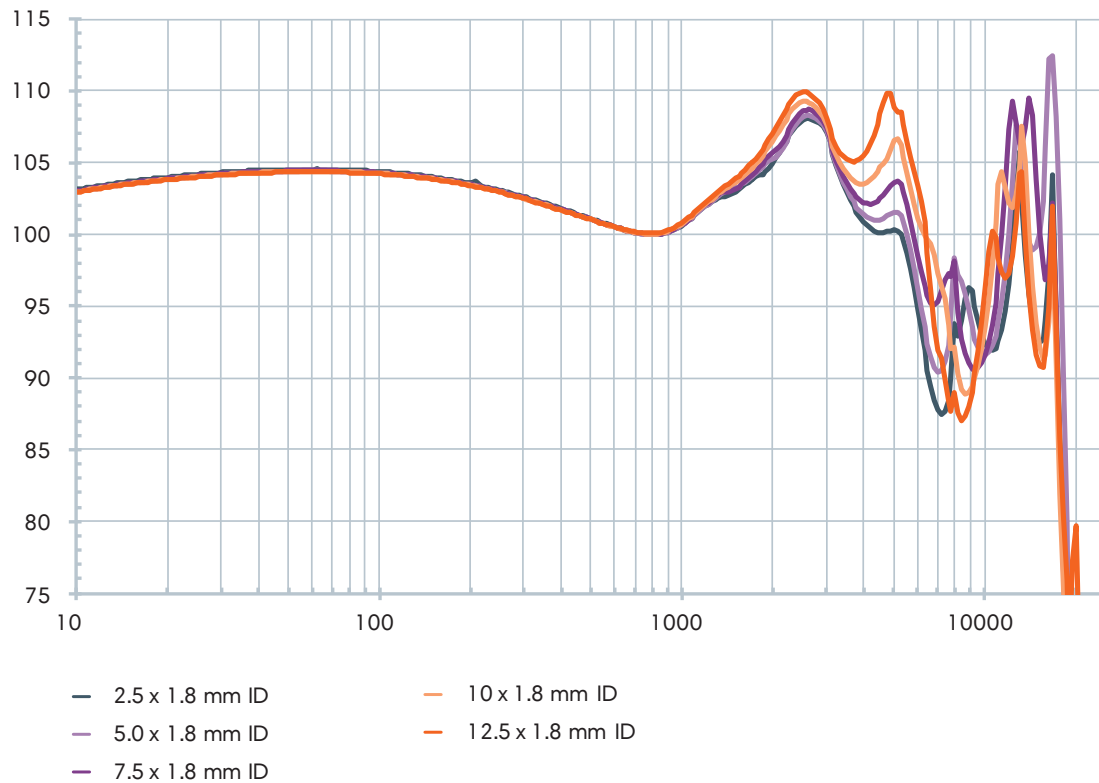
**Figure 5**  
Effect of position of eartip in earcanal



## Adjusting Tubing Length

The length of the tubing affects amplitude of the second peak of the module. Around 10mm length is advised as a starting point. The large valley between 6-10 kHz depends on the fact the tube is directly coupled to the ear-simulator and will disappear when a universal fit ear-tip is used. Furthermore the depth of the valley can be adjusted with the cross-over cap. Figure 6 shows the effect of changing the length of a 1.8 mm ID un-damped tube, directly coupled to the 711 coupler.

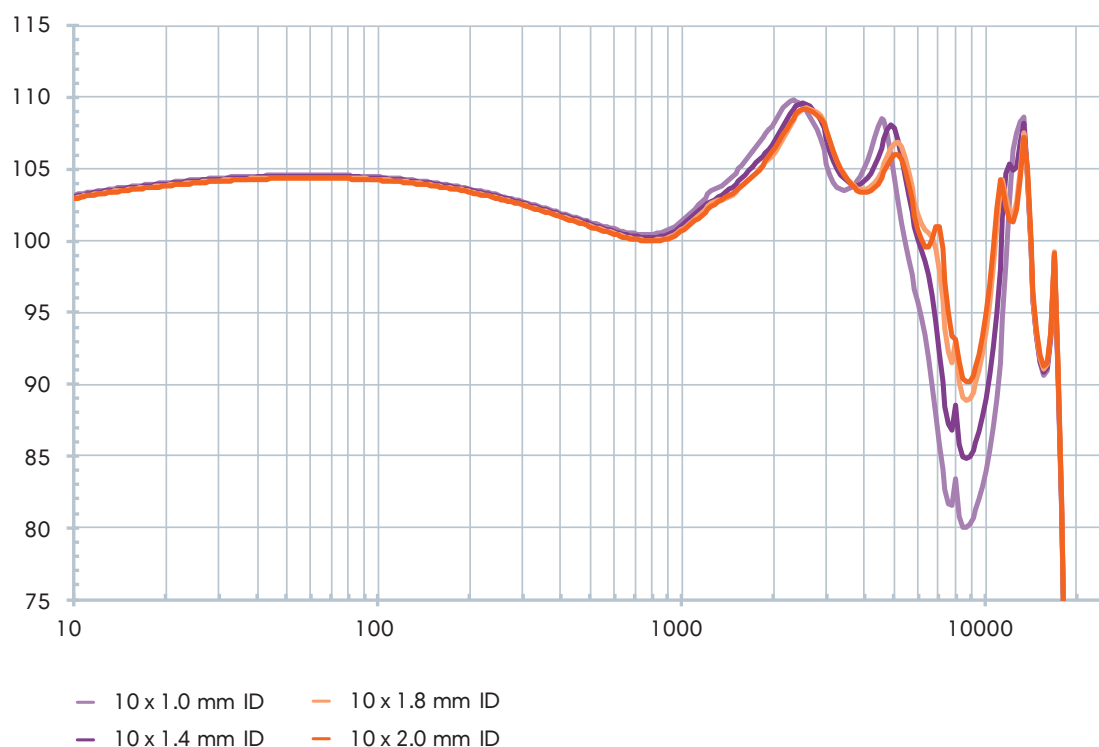
**Figure 6**  
Response adjustments setting the length of the tubing



## Adjusting Tubing diameter

The diameter of the tube has direct effect on the depth of the valley between 6 and 10 kHz. Other parameters that influence the same frequency range are the value of cross over cap and the fact the tube is directly coupled to the ear-simulator as previously explained. In general diameters below 1.4 mm should be avoided. The effect of a range of diameters is shown in figure 7. Length is kept constant at 10 mm, no damping and directly coupled to the 711 ear simulator.

**Figure 7**  
Effects of tubing diameter

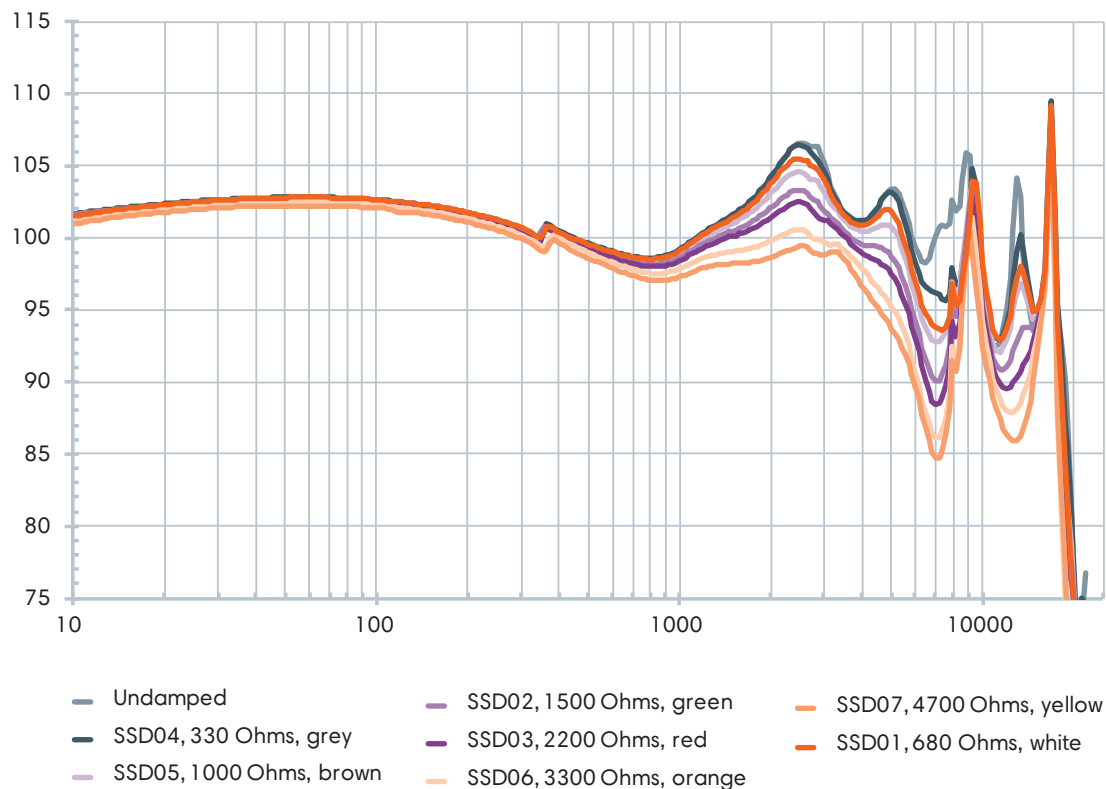




## Adjusting Damper values

Sonion provides acoustic dampers in the range of 320 to 4700 Ohms. For application to smooth the response of the 26-E25WT models SSD01 to SSD05 are appropriate. With the adjustment of the damping the presence of the soundsignature can be set. Default will be SSD02, 680 Ohms. Using less damping such as SSD04, 320 Ohms the sound signature will be brighter revealing more musical details. Using higher values of damping instead such as SSD03, 2200 Ohms the signature will be less explicit. Figure 8 show some test results with various dampers in a universal fit application with medium size eartip.

**Figure 8**  
Effects of nozzle damping



## The crossover capacitor

The 26-E25WT02/9 is preliminary designed and optimized for use in universal fit applications. The value of the default capacitor is chosen such that in combination with typical universal fit acoustics a smooth overall response curve is obtained.

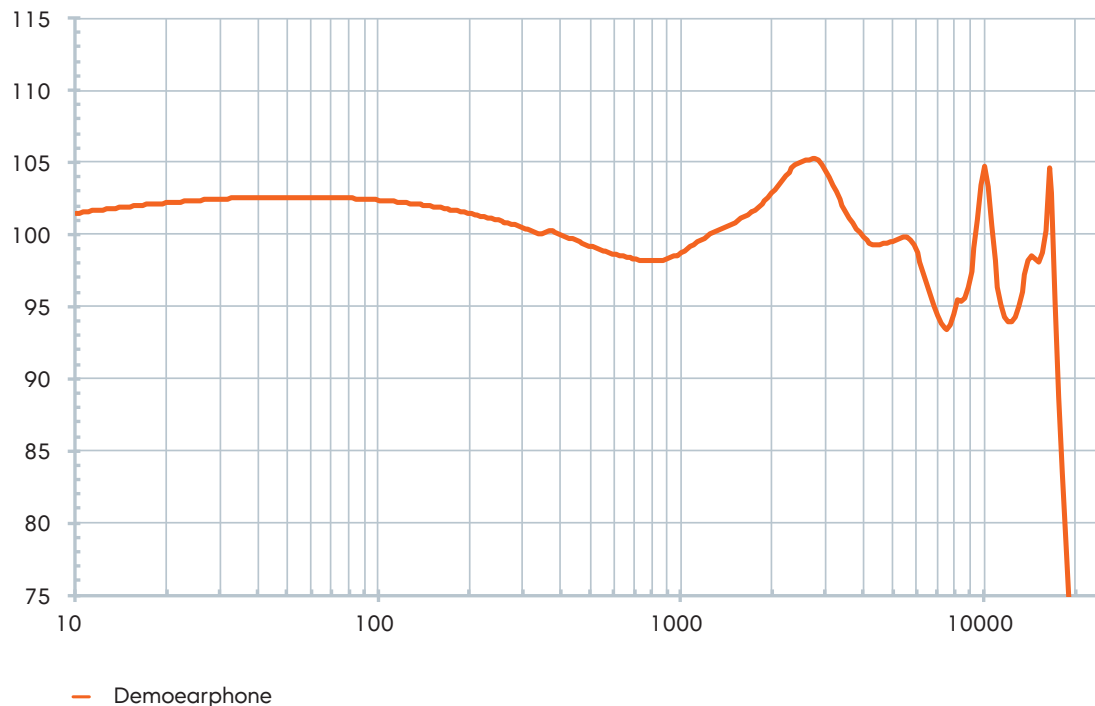
The 100 nF capacitor is a ceramic type with 10% tolerance and X5R temperature coefficient.

## Universal fit design example.

Figure 9 shows the example of the Sonion universal fit demonstrator Earphone using 26-E25WT02/9 module. The overall length of acoustic channel including eartip is 10 mm. It contains a section of 2.1 mm ID x 6 mm to fit receiver spout on one side and containing a SSD01 damper at the other, and a section of 3 mm ID x 3 mm at the ear tip.

**Figure 9**

**Response of universal fit demo earphone with 26-E25WT02/9 module**



## Handling notes

- For this product please follow general Sonion Handling Instructions (see [www.sonion.com/Products/Application Notes](http://www.sonion.com/Products/Application Notes))
- For 26-E25WT02/9:  
Please make sure the vent tube located in the middle of the PCB of the woofer is not clogged or damaged by pollution, flux during processing the module
- For soldering, please follow general Sonion Soldering Instructions (see [www.sonion.com/Products/Application Notes](http://www.sonion.com/Products/Application Notes)).
- The cable should be connected to the woofer. Soldering on the tweeter is not necessary and should be prevented to avoid damage of the x-over cap.
- Soldering the cables should be done with great care, short time and preferably no additional flux.
- Mechanical force by heavy or stiff cable on the solderpads should be prevented.