# BIAP Recommendation 06/16 - 07/7 Annex 2:

# Verification of Hearing Assistive Technology: Electroacoustic measurements

## Introduction

In the same way as with hearing aids, HAT (FM – frequency modulation / RF – radio modulation / DFM – digital frequency modulation) devices should be evaluated in order to guarantee that the system will not interfere with the hearing aids already in use (transparency), will provide supplement gain (gain advantage) and also will not malfunction. Any of these situations would compromise the main purpose of FM/RF use: to offer a better hearing condition to the user in the presence of noise, reverberation and distance. This would promote less hearing effort and consequent easier comunication.

With constant technology growth, we may also find a subcategory of hearing assistance technologies, i.e. remote microphone hearing assistance technologies (RF and Bluetooth). These are specifically designed for use in improving the signal-to-noise ratio (SNR) for a variety of listening situations. These systems may be verified in relation to transparency, but not with gain advantage. The gain advantage (± 10dB is possible with the FM and DFM devices, as they provide separate settings (receiver and transmitter) connected to the hearing aids or cochlear Implants.

Before starting any verification, it is advisable to check the quality of the sound by using a headphone or stethoclip with and without the HAT-system.

## Recommendation

In the following items, each step of the verification procedures will be described, considering the updated devices and equipments used in daily practice.

### 1. The HAT System device

HAT transmitters are found in many configurations to accommodate various remote microphone applications in different environments. The manufacturers also provide wireless remote microphone options, either as dedicated accessory devices or as an operational option for other wireless devices such as a remote control. Receivers can come in external boot configurations or can be integrated into the actual case and circuitry of a hearing aid. In these configurations, the receiver communicates directly with the hearing aid amplifier. Additionally,the signals transmitted can be sent to the hearing aids through their telecoil, either through a neck loop, or through a looped room. FM/DFM receivers can be also coupled to the external devices of cochlear implants.

### 2. Verification priorities

Considering the FM/DFM gain advantage properties designed into today's transmitters, it is expected that the system should increase the level of speech reaching the listener's ear on average by 10 dB relative to the hearing aid-only signal. This is something you cannot test directly at the clinical level, but something the FM/DFM system is designed to maintain. The advantage of 10 dB was considered from the evidence of research on the preference of SNR of listeners in different noise conditions in several communication settings.

The electroacoustic measurements should be conducted with the same speech signal for both the FM/DFM and HA test. If an MPO assessment is made, it should be done with just the hearing aid microphone. The input signal recommended for these tests is 65 dB SPL speech, a level which is below the offset kneepoint of the transmitter.

3. Terminology

- E= Electroacoustic measurement
- R = Real ear measurement
- B = Behavioural measurement
- HA = Hearing aid only
- F(D)M/DFM = FM/DFM only
- F(D)M/HA = FM evaluated in the FM+HA setting
- HA/F(D)M = HA evaluated in the FM+HA setting
- dBSPL or dBHL = level of input specified for each test

4. In order to conduct the FM/DFM verification procedures, it is considered that the Audiologist has already performed all the tests included in the hearing aids process for real ear measurements. As the FM transparency verification is done in the test box, the SPL mapping screen is used to set up the result curves.

STEPS FOR THE TRANSPARENCY VERIFICATION

1. Evaluate EHA 65-SPL without the receiver attached (electroacoustic test with the hearing aid only, with 65-SPL speech input). Place the already programmed hearing aids in the test box and record the test results for this input level without any RF hardware attached or involved.

2. Evaluate EHA 65-SPL with receiver attached and transmitter on but muted, outside the testbox and in verification mode. The hearing aids are at the same position, but with the receivers on.

3. Evaluate EHA 65-SPL with the transmitter on and in the box and the coupler/HA outside the testbox.

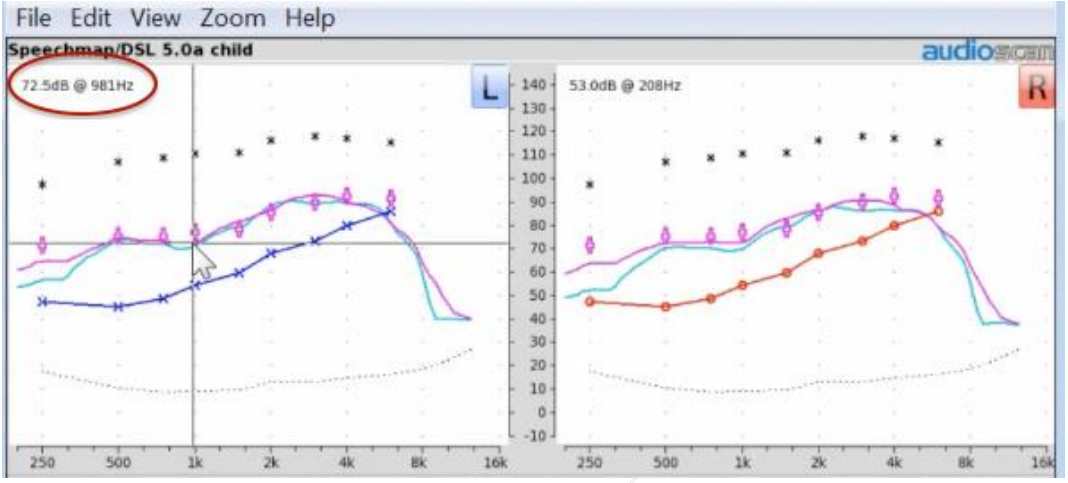
At this point, an electroacoustic test of the signal with the hearing aid in HAT+HA mode is performed with a 65 dB SPL speech input stimulus. This allows measurement of the output of the hearing aids while the speech signal is sent to the HAT transmitter microphone located in the test box.

Consider the different positions of the transmitter microphone inside the test box according to the manufacturer specifications.

This procedure measures the long-term average of the speech spectrum (LTASS) as it is being presented to the HAT microphone, transmitted to the hearing aids, and produced as output in the couplers.

In order to verify the transparency, once Test 3 is completed, the professional may compare the LTASS of Test 3 with the LTASS of Test 2 to see if the responses are close enough to justify transparency.

The differences are compared showing if transparency is achieved.




To prove the system is transparent, the comparison has to focus on the frequencies 750 Hz, 1000 Hz and 2000 Hz. If the average difference is between ± 2 dB transparency is achieved. If the average is more or less than ± 2 dB the gain at the receiver must be adjusted accordingly.

The same procedures may be performed with the Cochlear Implants, taking into account the specificity of each instrument.

5. Evaluate EHA 90-SPL with the transmitter on and in the box and the coupler/HA outside the testbox to ensure the response does not exceed the MPO targets.

An interesting guideline can also be found on the website from **EUHA**:

http://www.euha.org/assets/Uploads/Leitlinien/Expertenkreis-04-Hoerakustik/EUHA-Guideline-04-06-en.pdf

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**This recommendation was created and approved in multidisciplinary cooperation between professionals of all audiophonological disciplines, which are medicine, pedagogy, speech therapy, psychology and hearing instrument audiology.**

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