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Spatial sound

EDITORS OF ISSUE

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ABSTRACT

Binaural hearing (hearing with both ears) is essential for the ability to understand speech against background noise and locate different sounds. The ability to precisely determine where sounds are coming from can be crucial in everyday life. Locating a person talking to you or determining the direction of a car coming towards you can be very important when it comes to getting the full experience of life around you. In both situations, your spatial hearing helps you take appropriate action, by either moving to safety or turning your head to optimise hearing conditions.

Supporting the natural function of the ear

Differences in sound at the two ears help to create the auditory world around us. Sound between the ears can differ with respect to level and timing. These interaural level differences (ILD) work primarily at high frequencies (1500 Hz and above) while the interaural timing differences (ITD) work primarily at low frequencies (below 1000 Hz). Based on such basic information, the brain creates our "perceptual world". To make the most of the spatial hearing ability, a hearing instrument needs to leave many situations as natural as possible and only in some situations the hearing instrument may need to offer additional help or support to overcome a very difficult listening environment. Different listeners need different degrees of help, which is why the system also needs to be personalised to the individual.

Oticon Spatial Sound

With the target of maintaining and preserving as many of the authentic sound details in sound scenes as possible, Spatial Sound makes the organisation of the sound scenes easier for the user. In other words, it is easier for the user to localise the origin of the sound sources. Taking advantage of the binaural fitting, Spatial Sound is a combination of a number of device characteristics and technologies that can be used to preserve spatial cues. In the Alta and Nera products, Spatial Sound is available at two different performance and price levels, called Premium and Advanced, allowing Spatial Sound to work for a wider range of listeners than ever before.

Binaural compression, enabled by binaural processing, is important for ensuring that interaural level differences

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(ILDs) are preserved to the highest degree possible using compression, which amplifies soft sounds more than loud sounds. If compression is unlinked and works are independently optimised, the levels at the eardrums can end up being roughly the same (see Figure 1), eliminating important localisation cues, i.e. the ILDs.

Figure 1 illustrates the Binaural Processing, which is part of Spatial Sound Premium and Spatial Sound Advanced. The Binaural Processing constantly exchanges data about the sound level in each ear and thereby maintains the difference in input between the two ears. This enables the hearing instrument user to localise sounds in the environment better. [1)]

As localisation cues are embedded at higher frequencies, it is crucial that the bandwidth of the hearing instrument supports this with a broad frequency response. The more HF response the better it supports the residual hearing while simultaneously preserving the localisation cues.

Figure 2a and 2b show the frequency response of an Oticon Alta RITE85 and a competitor standard product and a competitor power product. The RITE 85 provides high output and extended bandwidth without sacrificing one to get the other. The figures also show how more localisation cues (ILDs) are supported and conveyed through Oticon broadband instruments, and also better preserved thanks to the more smoother response curve.

Spatial Sound uses binaural processing and the broad frequency response of the two binaurally fitted instruments to get a better sense of the surrounding world.

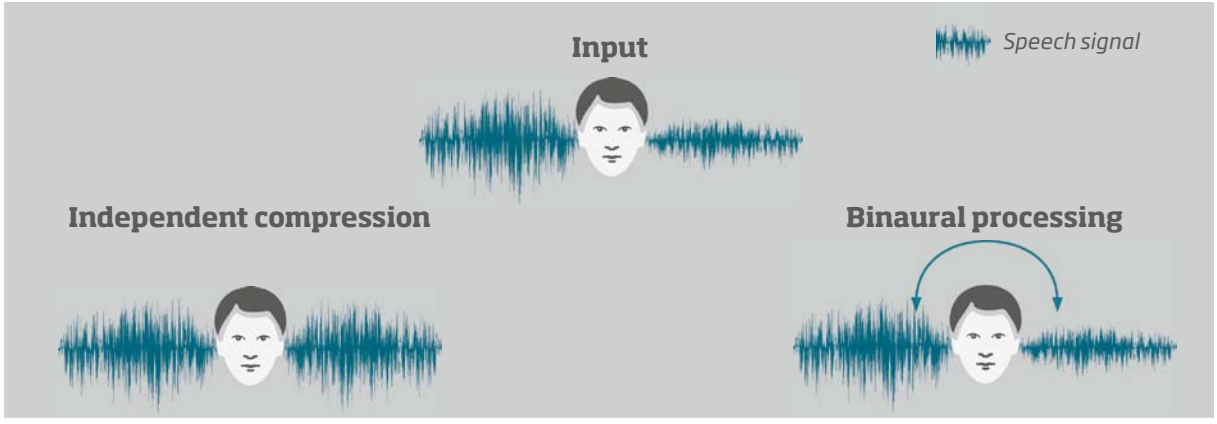

***Figure 1** illustrates the Binaural Processing which is part of Spatial Sound Premium and Spatial Sound Advanced. The Binaural Processing maintains the difference in input between the two ears enabling better localisation of sound in the environment.*

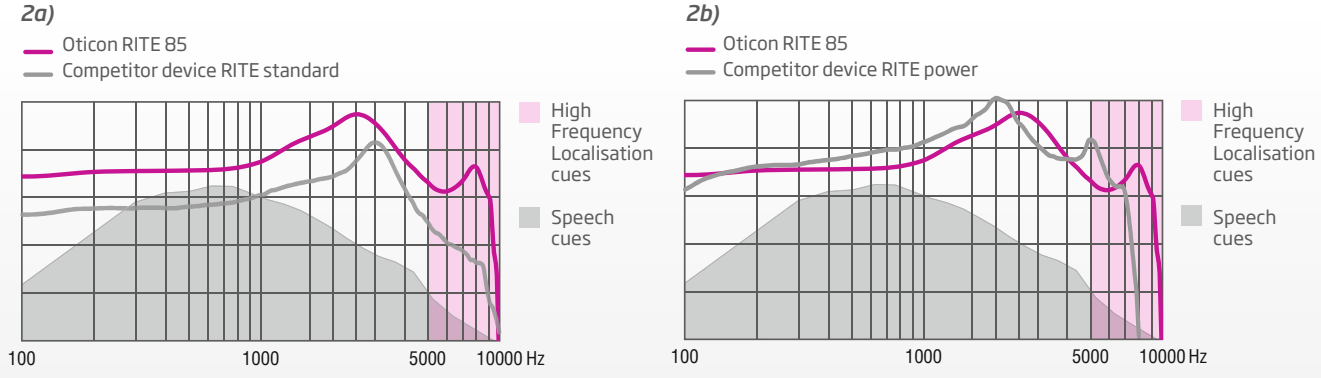

***Figure 2a** and **2b** show the frequency response of an Oticon Alta RITE85 and a competitor standard product and a competitor power product. The RITE 85 provides high output and extended bandwidth without sacrificing one to get the other. The figures also show how more localisation cues (ILDs) are supported and conveyed through Oticon broadband instruments, and also better preserved thanks to the smoother response curve.*

1) Ibrahim, I., Parsa, V., Macpherson, E., & Cheesman, M., Evaluation of speech intelligibility and sound localisation abilities with hearing aids using binaural wireless technology. Audiology Research, 2013. 3e1: p. 1-9

Spatial Sound Premium

Oticon Alta features Spatial Sound Premium, which includes all relevant features at their highest performance.

Spatial Sound Premium in Oticon Alta instruments encompasses several features;

- Binaural processing where information about the surroundings is communicated between the ears and compression characteristics are adapted accordingly to maintain the naturally occurring difference in loudness.
- An extended, wide bandwidth increasing the range of ILDs made audible.
- Spatial Noise Management to provide extra help in noisy, challenging (asymmetrical) situations.

Spatial Noise Management looks at asymmetrical, noisy situations and, when beneficial, overrides the standard binaural compression. When there are large differences in the signal-to-noise ratio between ears, the Spatial Noise Management will emphasise the ear with a better signal-to-noise ratio. The extent to which the better ear is emphasised is based on the personal profile, so this processing is used more frequently for individuals who appreciate more processing to reduce noise.

Figure 3 shows how the noise is attenuated in the ear with the poorer signal-to-noise ratio in noisy, asymmetrical situations

Spatial Sound Advanced

Oticon Nera features Spatial Sound Advanced, which builds on fundamental binaural processing with an up to 8 kHz response. Compared to Spatial Sound Premium, the 8 kHz version reduces the amount of ILDs supported.

Spatial Sound Advanced in Oticon Nera instruments combines the following features;

- Binaural processing where information about the surroundings is communicated between the ears and compression characteristics are adapted accordingly to maintain the naturally occurring difference in loudness.
- A bandwidth of up to 8 kHz to make a wide range of ILDs audible.

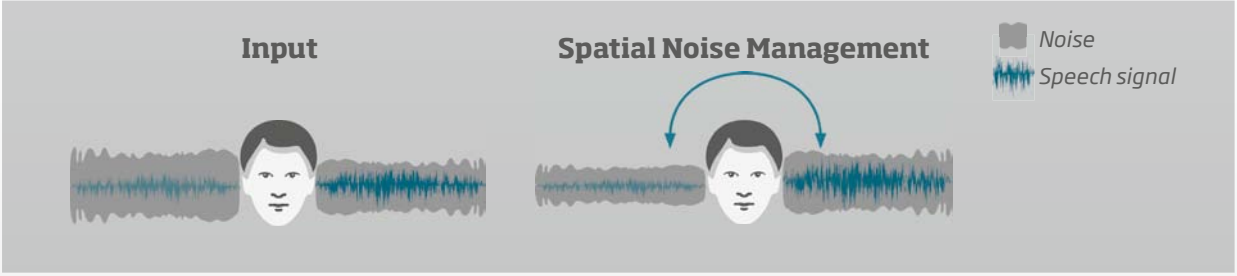

***Figure 3** shows how the noise is attenuated on the ear with the poorer signal-to-noise ratio in noisy, asymmetrical situations*

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People First is our promise
to empower people
to communicate freely,
interact naturally and
participate actively

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