Reprogramming My Bernafon Juna 9 Aids for Music

By Paul Casper

Introduction: Some time back I purchased a pair of open dome Bernafon Juna 9 RITE aids from Costco, anticipating better performance with live and recorded music than with my 3 year old digital aids (Rexton Quintras). It didn't happen. I was very disappointed and on the verge of returning them. However, I happened to read several postings by Musician 72 and others on the DIY Hearing Aid Forum (now relocated to forums.hearingtracker.com "Hearing Aid Hacks (DIY)"), and I became convinced that if I could custom-program my aids I could possibly rectify the problem. This report documents the results I have been able to achieve so far.

Background: I am a retired electrical engineer and high tech business co-owner, and I have had a life-long love of well recorded and reproduced music. When I finally had to obtain hearing aids, that love became very frustrated by the disappointing performance of my digital aids on music, either live or recorded. After much research, I found that many musicians still preferred analog aids, in particular the ones with the K-Amp chip, originally designed by Mead Killian over 25 years ago [1]. It turns out that this chip is still sold by Walmart and Sam's Club as the "Simplicity Hi Fi" aid manufactured by Etymotic Research , and I immediately purchased a pair to test. As soon as I first put them on I started smiling, and haven't stopped. No, they are not perfect, but good enough that I again could enjoy the pleasure of good music with my hearing aids. My digital aids are still better on speech, so I had to get used to carrying around two sets of aids, which was inconvenient.

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K-Amp Features of Particular Interest: I was particularly interested in the K-Amp compression profile and the level-dependent frequency response. Figure 19 from [1] illustrates the compression profile:

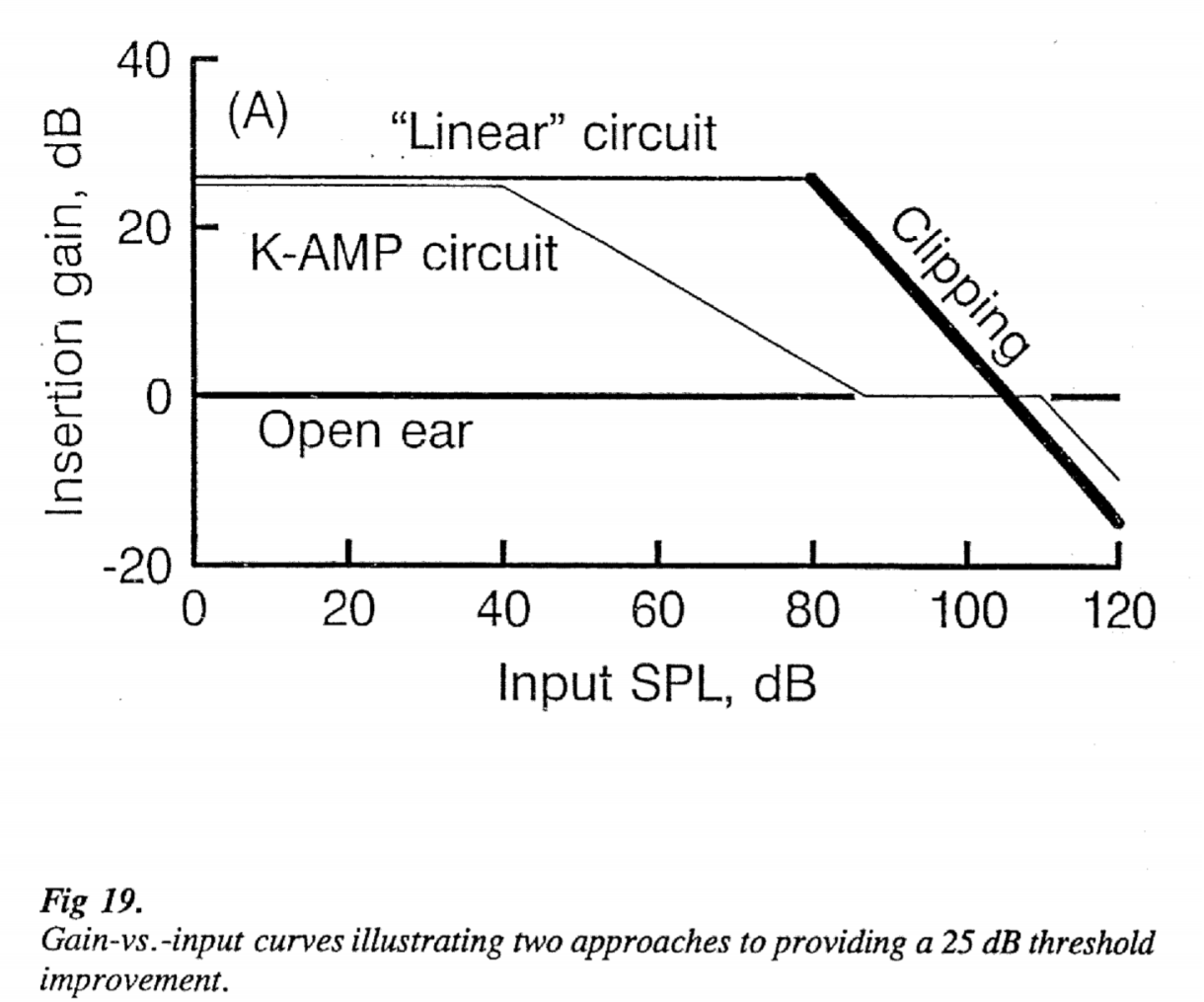

Fig 19.
Gain-vs.-input curves illustrating two approaches to providing a 25 dB threshold improvement.

It is evident that the chip begins to compress at 40 dB input SPL, where the gain is still 25 dB, and ends at a little over 80 dB SPL at unity gain (0dB). Thus, the compression ratio is somewhere between 1.5 and 2:1. We will see how this compares with the Bernafon compression profile later on in the report.

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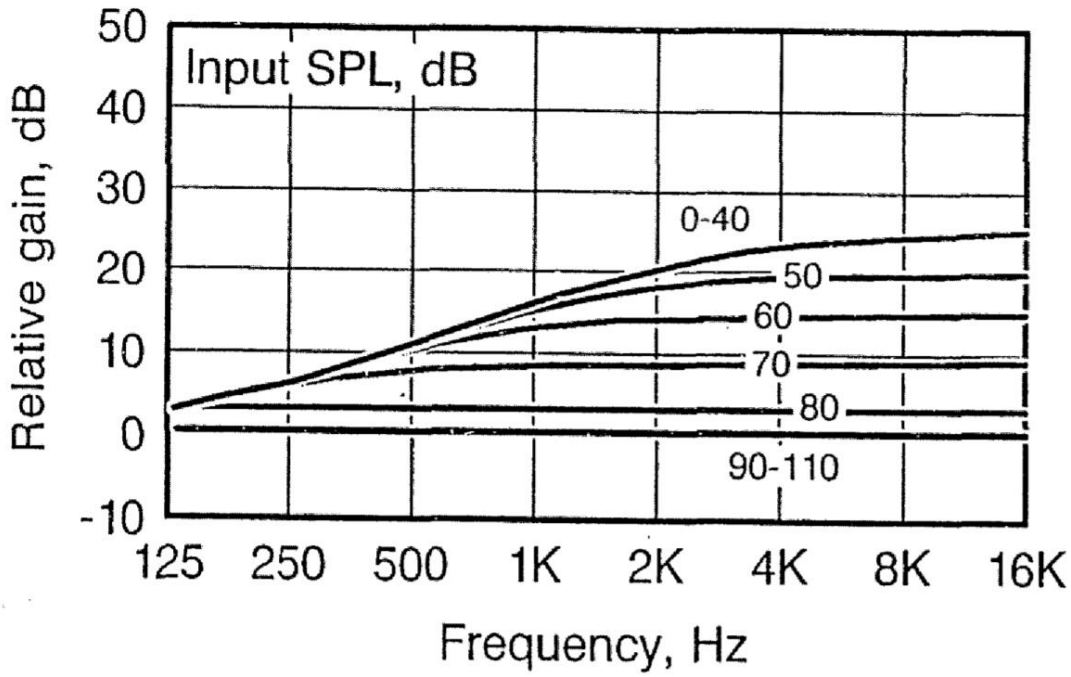

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Relative gain and frequency response of the K-AMP circuit for different input levels.

For weak input SPL (0 - 40 dB) the response rises near linearly from 2 dB at 125 Hz to 25 dB at 4 KHz, then flattens out all the way to 16 KHz. At high level input SPL (90-110 dB), the gain is flat at 0 dB throughout the whole spectrum. This accommodates the level-dependent high frequency response of the human ear (Fletcher-Munson effect), even when degraded by presbycusis or other causes.

With this information, I elected to ignore my audiogram and emulate figure 25 in the Bernafon Live Music program to the extent I could, and to adjust the gain for each ear to approximate figure 19 above.

Results: Figure A below below is reproduced from my Oasis frequency response programming screen, showing the Live Music program profiles as originally set automatically by the Oasis software based on my audiogram, including any tweaks by the audiologist. Figure B shows the profiles as modified to emulate the K-Amp

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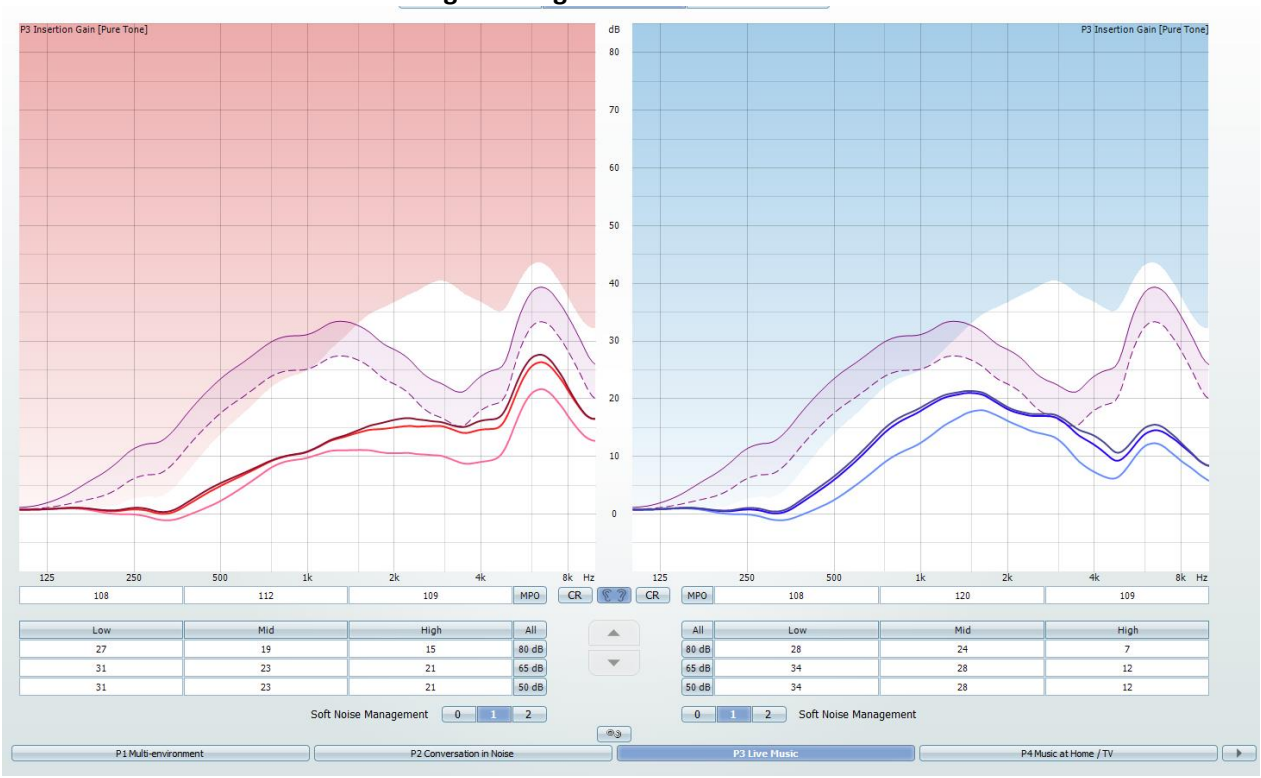

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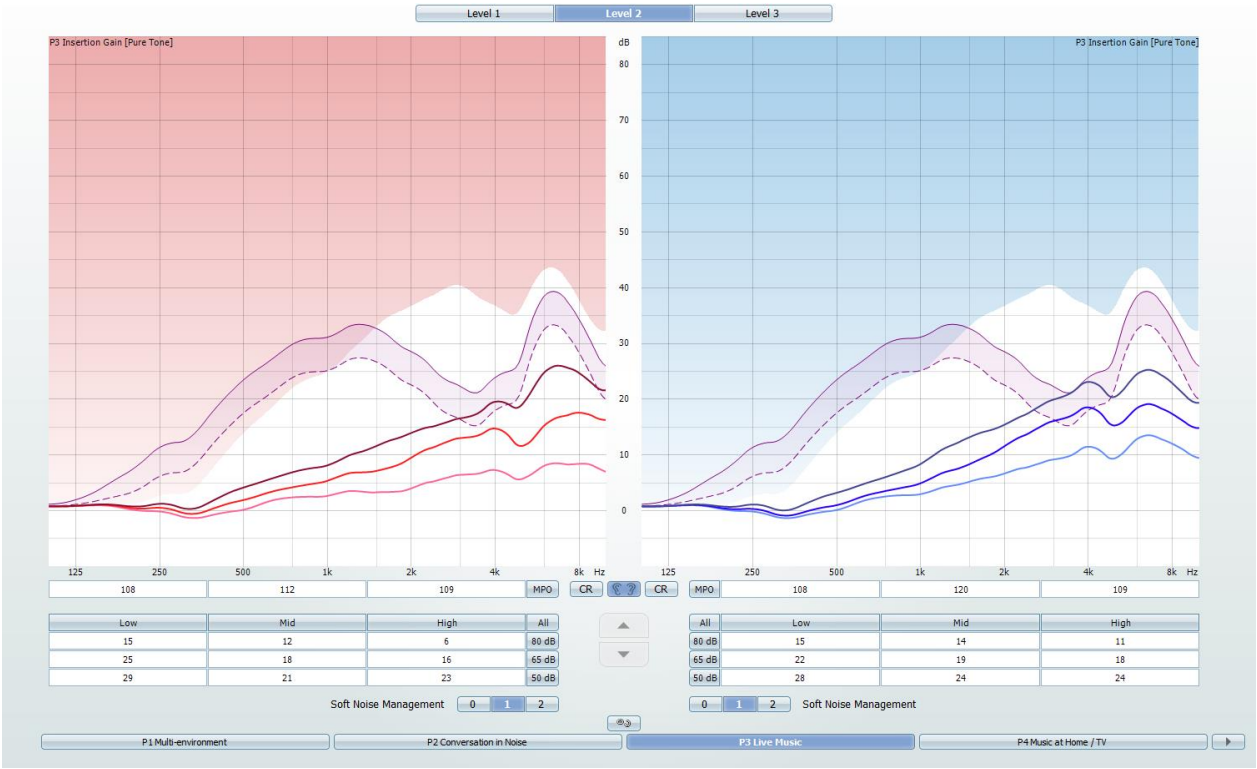

Programming Discussion: The Bernafon software accommodates different response profiles, dependent on input SPL, similar to Figure 25 from the Killion paper. Profiles for 50, 65 and 80 dB are definable. As is apparent, I defined relatively linear profiles for both ears from 250 Hz to 4 KHz at all three input levels. For the low level 50 dB input the gain at 4000Hz is 20 dB for the right ear, and 25 dB left ear. I did allow just a bit more peaking beyond 4KHz Hz, which I will probably remove. For the 80 dB high level input I reduced the gain at 4 KHz to about 7 dB for the right ear and 11 dB for the left ear. More than 0 dB gain for 80 dB input is in excess of the K-Amp case (figure 25) and my listening tests confirm that I need to bring it down closer to 0 dB. I do not have a curve equivalent to figure 19 from Killion, but the curves above indicate a 15 dB gain reduction at 4 KHz from 50 to 80 dB input SPL, which is consistent with Killion figure 25. I left programs 1, 2 and 4 as programmed by Oasis for my profile undisturbed.

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The Acid Test: Live and Recorded Music:

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Tuesday, August 29, 2017
11:50 AM

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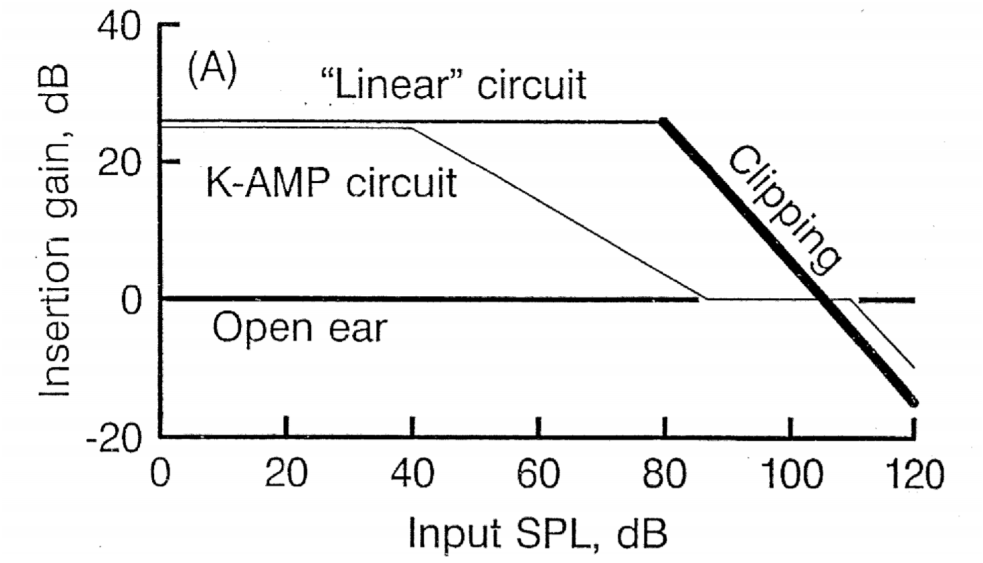

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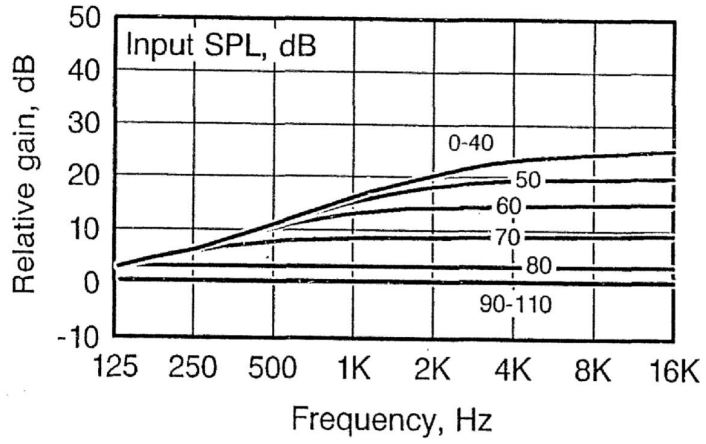

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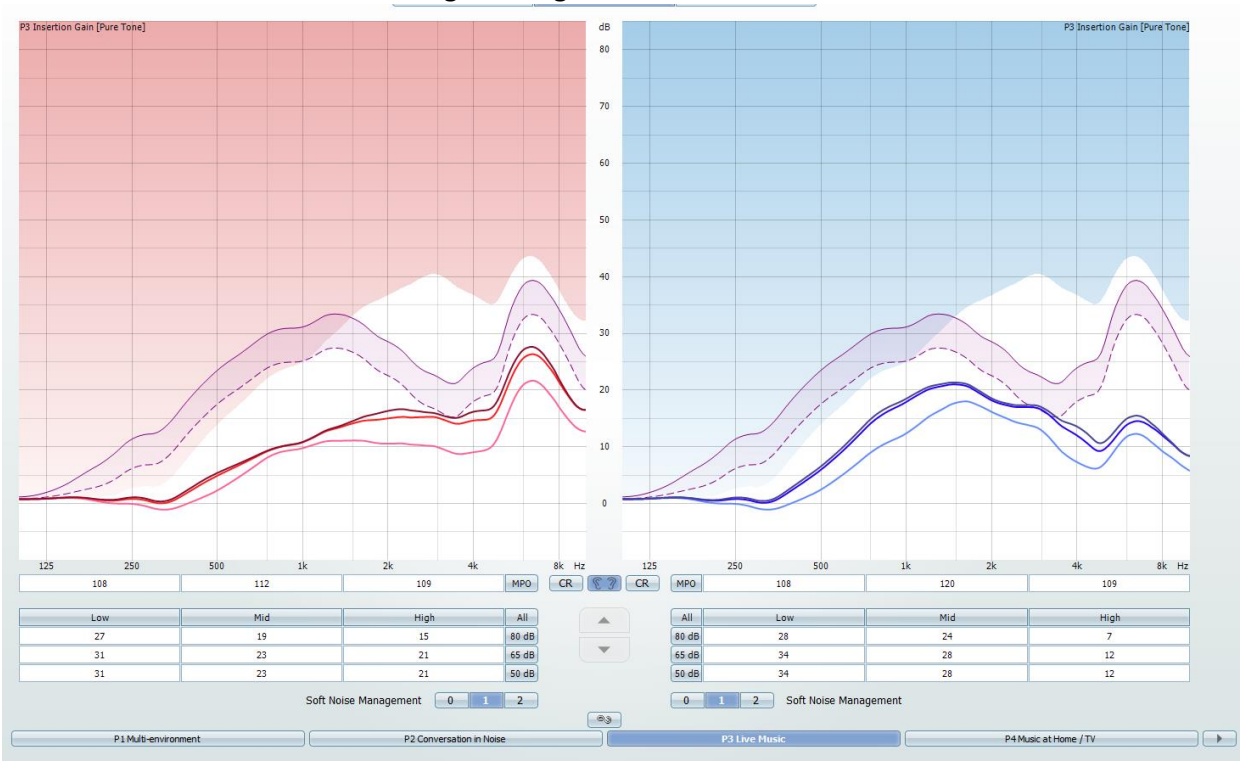

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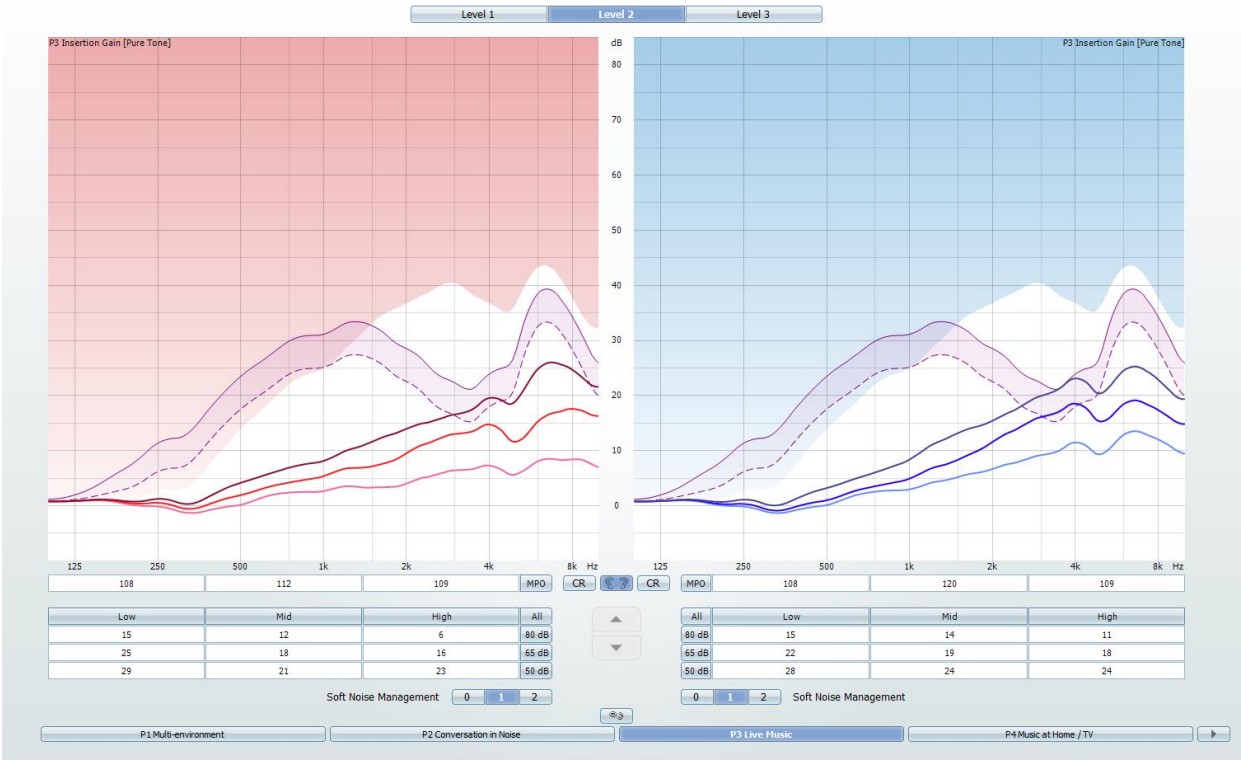

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