

Optimizing Omega AI for Music Listening: Every Note Matters

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Key Takeaways

Key Takeaway	Clinical Implication
Music and speech are acoustically distinct signals, differing in frequency range, intensity range, and temporal structure.	Fitting strategies optimized for speech will not adequately address music listening needs.
Omega AI applies additive compression, combining slow and fast compression differently for speech and music.	Speech Programs and Music Programs use distinct knee points, compression ratios, and adaptive features tailored to each signal type.
The dedicated Music Program removes expansion from the compression architecture and broadens the frequency response.	Patients gain a program specifically suited to acoustic music rather than streamed audio or speech.
e-STAT 2.0 and the Music Proprietary Fitting Formula provide music-specific gain prescriptions.	Clinicians can restore audibility for soft music and desired loudness for loud music using targeted fitting formulas.
Streaming sound quality can be customized through Pro Fit, the Audio Streaming screen, the Demo Stream feature, and the My Starkey App.	Clinicians and patients have multiple pathways available to fine-tune the streaming frequency response.
No two patients perceive music the same way.	Individualized programming, informed by direct patient feedback, is essential for musicians and music lovers alike.

Course Content

Learner Outcomes

- Participants will be able to describe the different frequency responses associated with common musical instruments
- Participants will be able to discuss how additive compression is being used by Starkey in our music processing
- Participants will be able to discuss how streaming can be controlled via the My Starkey app

The Building Blocks of Music

Music is composed of five core components that, layered together, build the overall musical experience:

- Rhythm
- Harmony
- Melody
- Timbre
- Form

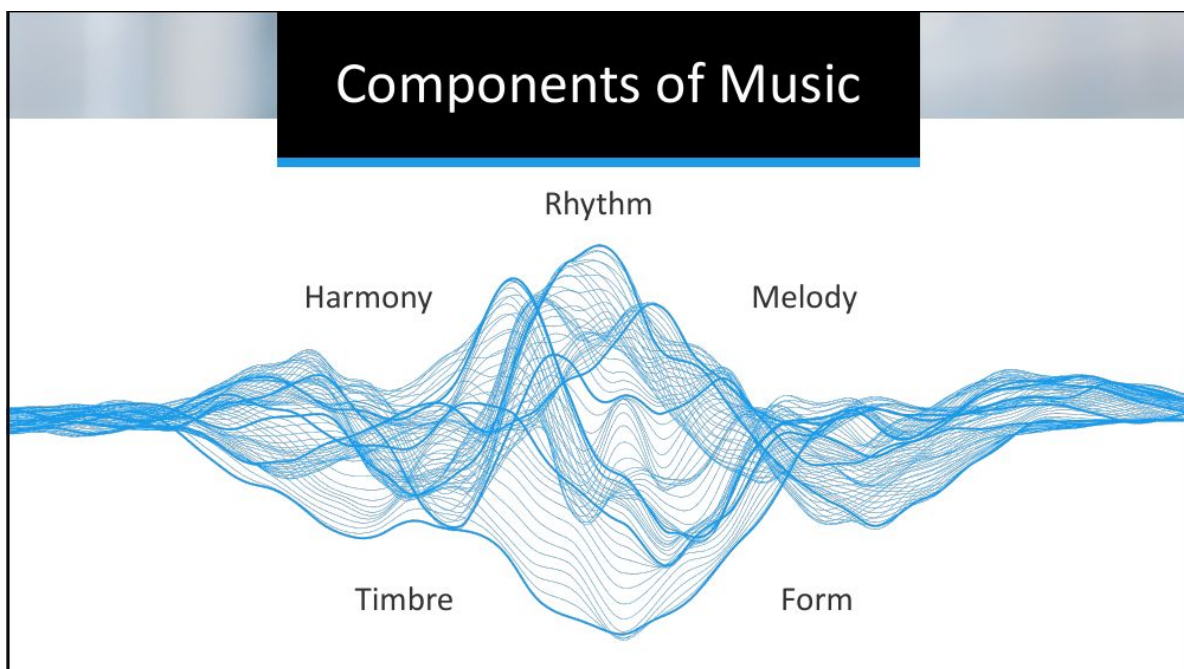


Figure 1. The five components of music—Rhythm, Harmony, Melody, Timbre, and Form—shown together as overlapping sound waveforms.

Q1

Quiz Hint: Rhythm is the component of music that measures movement and pattern — it is one of the five core elements shown alongside Harmony, Melody, Timbre, and Form.

Music vs. Speech: Acoustic Differences

Speech and music differ substantially in their acoustic characteristics:

	Speech	Music
Average level	65 dB SPL on average, with peaks and valleys about +/- 12-15 dB	Can range from 20 dB SPL up to 120 dB SPL
Typical ceiling	Often not greater than 90 dB	Can hit a player's ear between 85-100 dB SPL

Compared across frequency and intensity, music occupies a much broader range than speech:

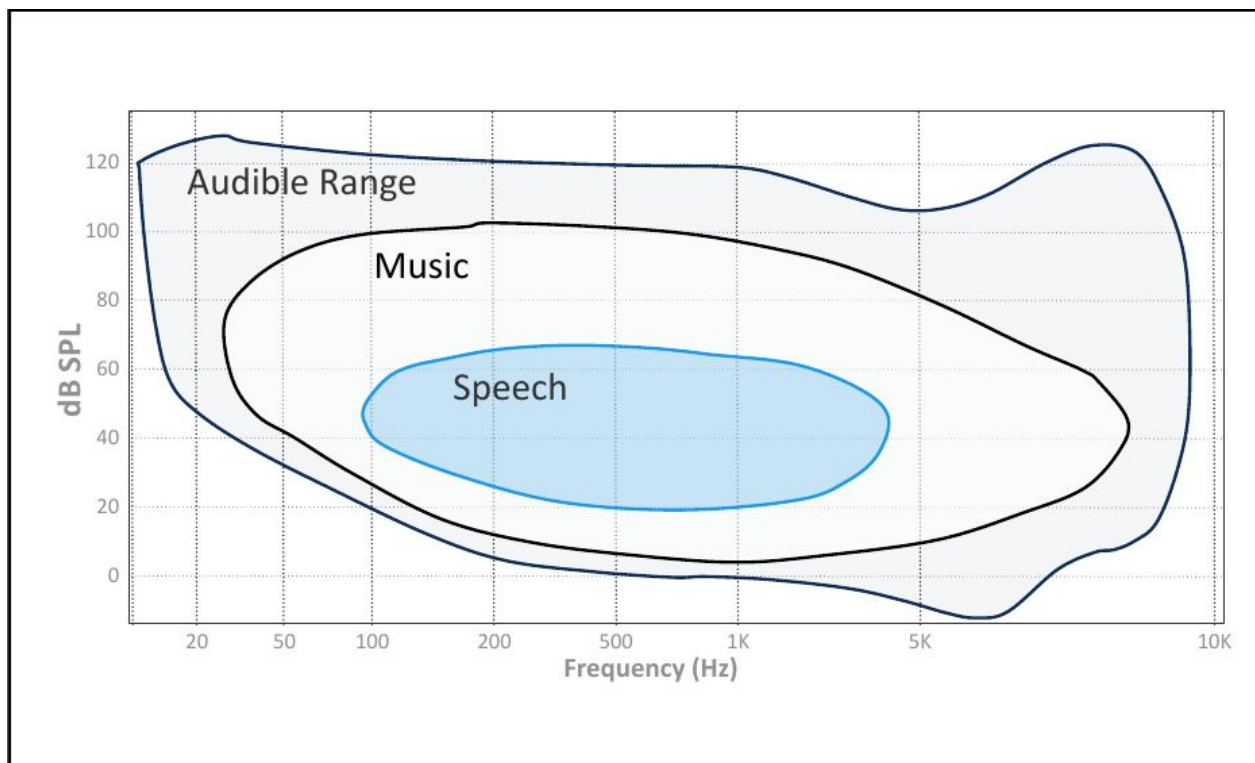


Figure 2. Comparison of the Audible Range, Music, and Speech signals across frequency and sound pressure level.

Signal classification for music and speech relies on identifying distinguishing acoustic features:

- Envelope Modulation
- Spectral Changes
- Spectral Distribution
- Periodicity Strength
- Temporal Envelope Peakiness
- Rate of Temporal Changes
- Temporal Fine Structures
- Envelope Characteristics

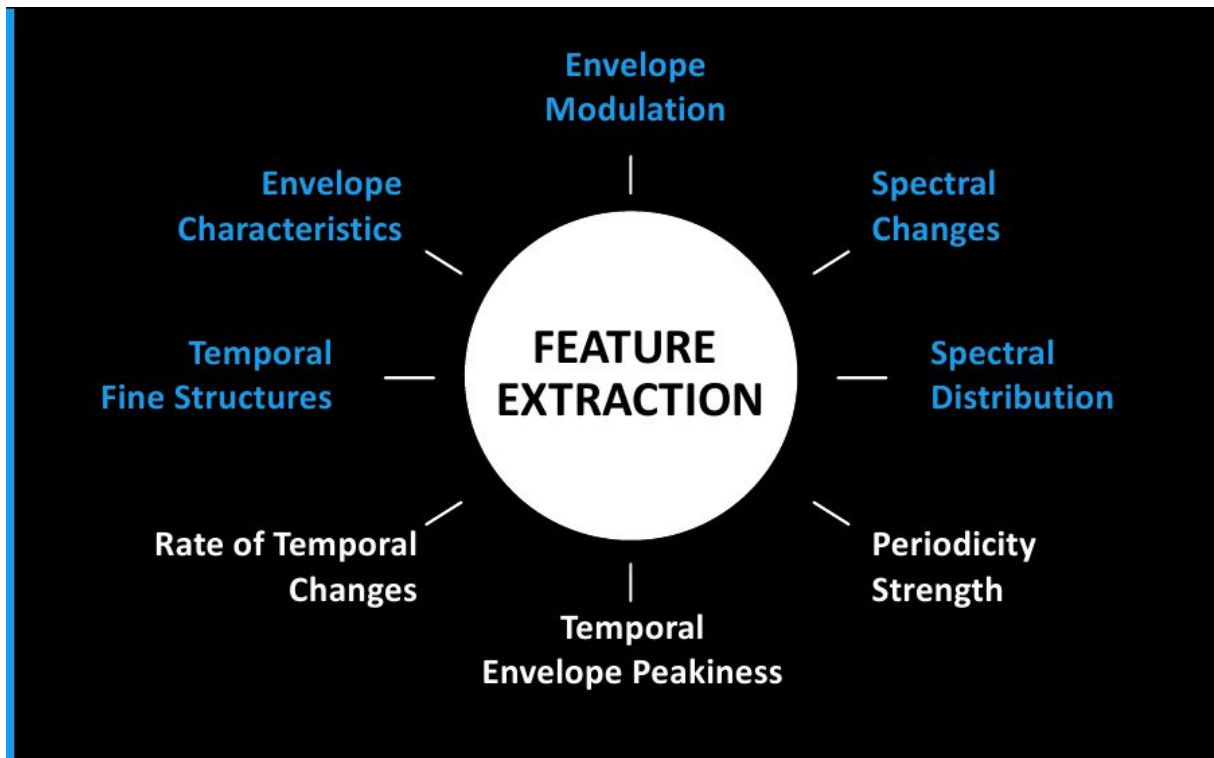


Figure 3. Eight categories of acoustic feature extraction used to classify a sound signal.

Signal Classification and Additive Compression

Classification accuracy follows a chain from sound input to patient outcome:

- Sound Classification
- Signal Adaptation
- Sound Quality
- Patient Satisfaction

Additive Compression combines slow compression (more gain for softer sounds, less gain for louder sounds) with fast compression (responding to consonants and vowels) to adapt to the input signal.

Speech Programs	Music Program	Both Speech & Music
Dedicated knee points and compression ratios for speech	Dedicated knee points and compression ratios for music	Expansion has been removed from compression architecture
Fast and slow compression running in conjunction	Fast compressor disabled	Broader Hz response
Adaptive features based off speech characteristics	Adaptive features based off music characteristics	

Music Terminology

Term	Definition
Tone	A steady periodic sound
Interval	The distance of two single tones
Octave	When the interval between the frequencies of two tones is 1:2
Bass	Sounds that are lower in frequency
Tenor	Range of notes between the alto and bass
Alto	The second highest part in a 4-part voice; higher than the tenor

Instrument Frequency Ranges

Different instrument families occupy distinct fundamental frequency and harmonic ranges, from Keys and Strings through Woodwinds, Brass, Percussion, and Voice:

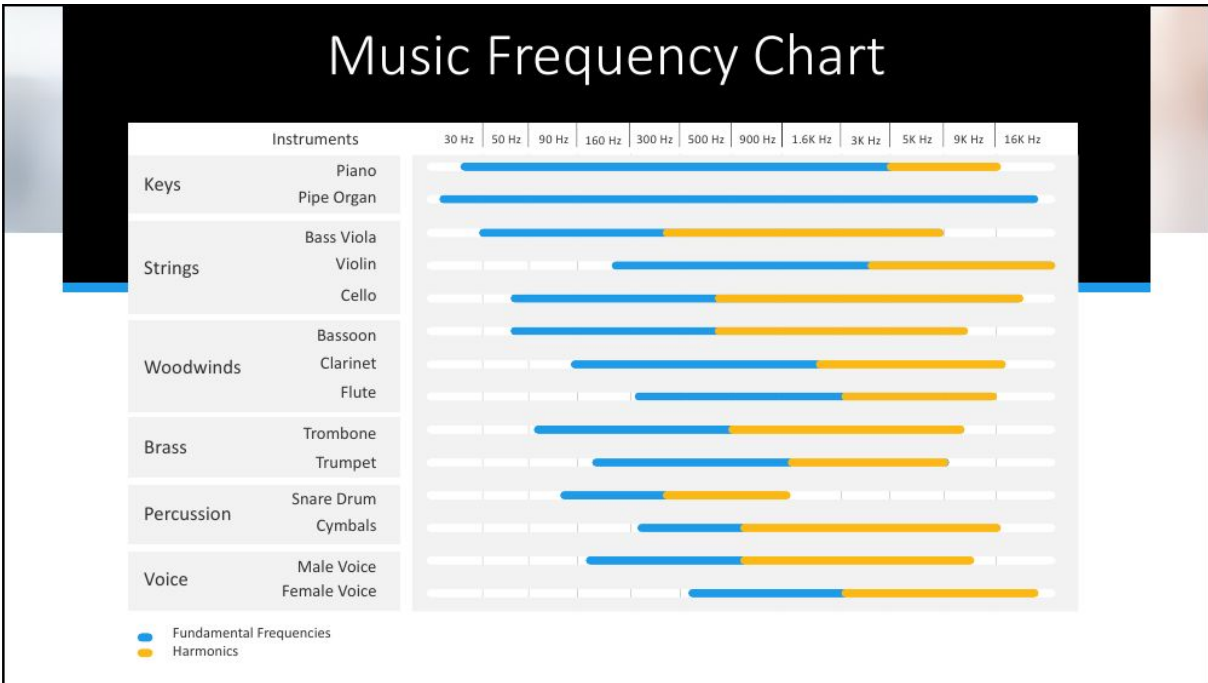


Figure 4. Fundamental frequency and harmonic ranges for common musical instruments by category.

Fitting Formulas for Music

The e-STAT 2.0 Proprietary Fitting Formula is designed to complement the Omega AI compression architecture and provides:

- ~4-6 dB more gain for soft sounds (varies with the audiogram and acoustic stimuli)
- Improved vent modeling
- More gain at higher frequencies above 3 kHz (varies with audiogram and with frequency)

The Dedicated Music Program is a selectable program environment that bundles a package of functionality:

- A fitting rationale optimized for music
- Compression optimized for music
- Controls in Pro Fit optimized for music adjustment

The Music Proprietary Fitting Formula is designed to complement a music fitting rationale, offering:

- A unique music-centric fitting prescription
- Shaped gain according to hearing loss for quiet music
- Flat, linear insertion gain for loud music

Music Program Fitting Rationale Goals are focused on music audibility, desired loudness, and sound quality:

- Make soft music audible while achieving transparency
- Restore desired loudness at high input levels

Prescriptive Fitting for Music is an evidence-based prescription optimized for music, restoring overall loudness of loud music with flat gain and restoring audibility of soft music with shaped, compressive gain, using unique compression thresholds (TKs) and compression ratios (CRs):

Prescriptive Fitting for Music

Evidence-based prescription optimized for music

Restores audibility for soft music

Restores desired loudness for loud music

Unique compression TKs and CRs

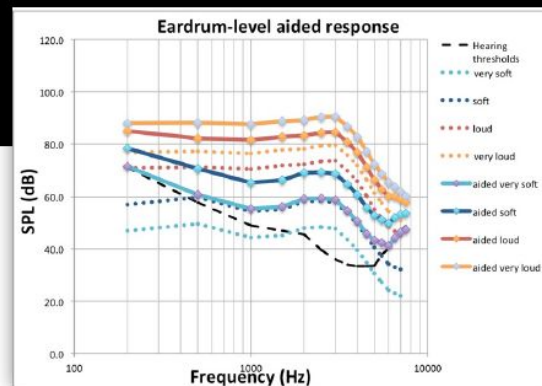


Figure 5. Eardrum-level aided response curves illustrating the prescriptive fitting formula's goals for soft and loud music.

Music Program Controls and Considerations

Fitting and evaluation of the Music Program is inherently subjective:

- Individual variability of desired sound is likely much higher than for speech
- No objective measures exist for evaluating a hearing device fitting for music
- Adjustments will need to be made based on patient feedback regarding music sound quality

The Dedicated Music Program can be programmed in multiple program banks of the hearing aid, with music-centric controls that facilitate communication between patient and professional for addressing subjective music listening reports.

Music Programming Basics distinguish Quick Fit (adjusts larger frequency bands) from Fine Tuning (targeted and specific frequency adjustments), with all adjustments made in 2 dB steps across three bands:

Music Programming Basics

Quick Fit
Adjusts larger
frequency bands

Fine Tuning
Targeted and specific
frequency adjustments

All adjustments
are in 2 dB steps

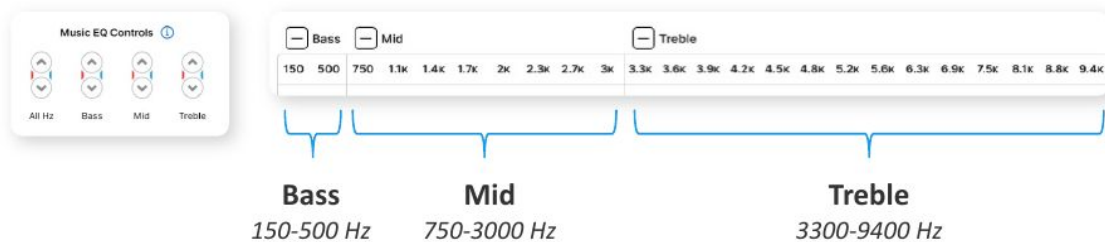


Figure 6. Bass, Mid, and Treble frequency bands used in Quick Fit and Fine Tuning music programming controls.

Q4

Quiz Hint: In the Music Programming Basics controls, Bass, Mid, and Treble bands span from 150 Hz up through 9,400 Hz — fine-tuning gain is adjustable across roughly a 10,000 Hz bandwidth in the dedicated Music program.

Unique Adjustments for Music in the dedicated Music Program include:

- Omni Mic
- No Noise Reduction
- Feedback Sensitivity Reduced

Streaming for Music

Best-in-class streaming provides a streaming configuration for all streamed inputs. Customization of the streaming frequency response is available through several pathways:

- Pro Fit
- Audio Streaming screen
- Demo Stream feature
- My Starkey App

Q2

Quiz Hint: Streaming sound quality can be customized through both the Accessories Screen and Audio Streaming screen in Pro Fit, as well as through the Demo Stream feature and the My Starkey App.

Audio Streaming Configuration is accessed via the Fly Out Menu or the Accessories Screen, and includes Quick Fit and Fine Tuning Controls plus a Stream Target Match feature, which matches the target to the audio streaming configuration.

Omega AI Streaming automatically switches to a streaming response when streaming, and allows access to Adjust Sound, My Hearing, and hearing aid volume.

Q3

Quiz Hint: When streaming engages, Omega AI automatically switches to the streaming response for whichever program the hearing aid is in at the time, the streaming signal can be customized within My Starkey, and streaming engagement will also engage contextual volume controls — all of these are true at once.

The streaming EQ offers three adjustable boost options for customizing sound while streaming:

- Bass Boost
- Overall Boost
- Treble Boost

Q5

Quiz Hint: The streaming mode options within Pro Fit and My Starkey include Bass Boost, Treble Boost, and Overall Boost.

Who Are We Programming For?

Music listeners fall along a spectrum of engagement with music:

- Casual Listeners
- Constant Streamers
- Music Lovers
- Casual Musicians
- Professional Musicians

Music characteristics differ meaningfully by genre, including frequency ranges and the intensity of the instruments involved. Professional musicians face particular occupational risk: hearing loss is very common amongst professional musicians, with a higher occurrence of hearing loss in rock musicians versus classical musicians, and classical musicians tending to have more asymmetric hearing loss configurations than their rock musician counterparts. Average exposure has been reported at 103 dB for rock and 94 dB in classical music (Di Stadio et al., 2018).

Research on the importance of music to seniors found that a large proportion of both younger-old (69-77 years) and older-old (78-100 years) adults judged music as highly important to them (Cohen et al., 2002). Separately, in a study of elderly hearing-impaired listeners, 50% reported listening to music daily and 30% reported that hearing loss impacts their enjoyment of music, with commonly cited difficulties including sounds being too loud or soft, melody recognition, understanding lyrics, and volume changes (Leek et al., 2008).

The more severe the hearing loss, the worse the music appreciation scores tend to be, though there are few differences between mild and moderate hearing loss in terms of music appreciation. More severe hearing loss is also associated with a greater preference for lower-pitched instruments (Looi et al., 2019).

Taken together, the research indicates: music is important to many people, hearing loss impacts enjoyment of music, music and speech signals are different, and traditional (speech-focused) fittings haven't been satisfactory for music.

Music in Action: Case Examples

Susan M., 54, Pianist — teaches piano for a living and enjoys going to the local jazz bar to listen to live music. Reporting: the upper keys on the piano are coming in a little tinny or crispy, and mid keys seem a little flat. Adjustment options considered: drop upper key frequencies, raise mid frequencies, and try to bring some balance between the frequencies overall.

Chandler B., 36, Data Specialist — works in an office setting and streams frequently during work hours to reduce office background noise. Reporting: difficulty hearing recorded samples via streaming from his students, and concerns about the sound quality of streamed music. Adjustment options considered: the Demo Stream feature within Pro Fit, and adjustments in the My Starkey App.

Bryan S., 42, Vocalist — performs in the St. Olaf Choir and sings for fun at local events. Reporting: struggles to hear other singers around him, and feels like the overall robustness of music is lower than he would like. Adjustment options considered: increase low frequencies, increase baritone frequencies, and increase all frequencies.

Office Optimization for Music Programming

Optimizing the office for music programming can include:

- External speakers for playing sound sources
- A CD player or the ability to play MP3 sound sources so patients' specific music of choice can be used
- Digital music streaming services such as YouTube, Spotify, and Pandora
- A media player built into the fitting software
- Bringing the patient's instrument into the office for programming

Clinical Considerations for Different Instruments: many string instruments, like the violin, are played by holding the instrument up to the shoulder on one side. Disabling the Ear-to-Ear Volume Control — or using individual ear volume control within My Starkey — allows the patient to adjust the volume independently to keep things balanced.

Conclusion

- Dedicated Music Program is for acoustic music and not speech
- No two patients will perceive music the same way
- Individualization of programming is key for musicians and music lovers

Interactive Worksheet

Complete this worksheet as you review the course content. Every response area below is a fillable field — click in to type.

Learning Objectives

- Participants will be able to describe the different frequency responses associated with common musical instruments
- Participants will be able to discuss how additive compression is being used by Starkey in our music processing
- Participants will be able to discuss how streaming can be controlled via the My Starkey app

Module 1: Music vs. Speech & Signal Classification

Key Terms — in your own words:

Key Term	In Your Own Words
Tone	Click here to enter text.
Interval	Click here to enter text.
Octave	Click here to enter text.

The five components of music are:

Click here to enter text.

Explain how the Speech Program differs from the Music Program in Omega AI's compression architecture:

Click here to enter text.

Pause & Apply (If-Then): If a patient reports that streamed or acoustic music sounds unclear or distorted, then I will...

Click here to enter text.

Module 2: Fitting Formulas & Programming for Music

Key Terms — in your own words:

Key Term	In Your Own Words
e-STAT 2.0	Click here to enter text.
Dedicated Music Program	Click here to enter text.
Prescriptive Fitting for Music	Click here to enter text.

List the three streaming mode boost options available within Pro Fit and My Starkey:

Click here to enter text.

Describe how the Bass, Mid, and Treble bands are divided in Music Programming Basics, and how Quick Fit differs from Fine Tuning:

Click here to enter text.

Pause & Apply (If-Then): If a musician patient reports that the upper register of their instrument sounds tinny or crispy, then I will...

Click here to enter text.

Quick Check: True or False

Mark each statement True or False.

The dedicated Music Program disables the fast compressor.

☐ True ☐ False

Once streaming engages, the streaming frequency response can no longer be customized.

☐ True ☐ False

The dedicated Music Program broadens the frequency response and removes expansion from the compression architecture.

☐ True ☐ False

Case in Practice: Susan M., 54, Pianist

Susan teaches piano for a living and enjoys going to the local jazz bar to listen to live music.

Part 1 — Introduction: Susan reports that the upper keys on the piano are coming in a little tinny or crispy, and that the mid keys seem a little flat. What clinical data would you want to gather first, and what would you listen for during a demo?

Click here to enter text.

Part 2 — Assessment Data: Susan's fine-tuning record shows loud and soft gain reduced across the 3k–4.2k band and increased across the 1.4k–2.7k band. What does this pattern suggest about the adjustments being made, and why?

Click here to enter text.

Part 3 — Considering the Whole Picture: Susan's complaints span both the upper keys (tinny/crispy) and the mid keys (flat). How does addressing both ends of the spectrum change your approach compared to adjusting a single frequency region alone?

Click here to enter text.

Part 4 — Application: What follow-up would you plan with Susan to confirm the adjustments met her needs, and what would you ask her to listen for in the meantime?

Click here to enter text.

Post-Course Reflection

What was the most significant thing you learned today that surprised you or challenged your existing practice?

Click here to enter text.

What knowledge gaps did this course reveal in your own skills or knowledge around fitting for music?

Click here to enter text.

Describe a specific patient or client from your own practice where you would apply something from this course:

Click here to enter text.

Action Plan

Identify at least 2 specific, measurable changes you plan to make to your clinical practice as a direct result of this course.

My Action Plan Goal	Target Date	How I Will Measure Success
Click here to enter text.	Click here to enter text.	Click here to enter text.

My Action Plan Goal	Target Date	How I Will Measure Success
Click here to enter text.	Click here to enter text.	Click here to enter text.

Quiz Summary

The following quiz hints appeared throughout the course content. Use this section as a quick study reference.

Q1

Quiz Hint: Rhythm is the component of music that measures movement and pattern — it is one of the five core elements shown alongside Harmony, Melody, Timbre, and Form.

Q2

Quiz Hint: Streaming sound quality can be customized through both the Accessories Screen and Audio Streaming screen in Pro Fit, as well as through the Demo Stream feature and the My Starkey App.

Q3

Quiz Hint: When streaming engages, Omega AI automatically switches to the streaming response for whichever program the hearing aid is in at the time, the streaming signal can be customized within My Starkey, and streaming engagement will also engage contextual volume controls — all of these are true at once.

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Quiz Hint: In the Music Programming Basics controls, Bass, Mid, and Treble bands span from 150 Hz up through 9,400 Hz — fine-tuning gain is adjustable across roughly a 10,000 Hz bandwidth in the dedicated Music program.

Q5

Quiz Hint: The streaming mode options within Pro Fit and My Starkey include Bass Boost, Treble Boost, and Overall Boost.

References

- Cohen, A., Bailey, B. A., & Nilsson, T. (2002). The importance of music to seniors. *Psychomusicology: A Journal of Research in Music Cognition*, 18(1-2), 89–102. <https://doi.org/10.1037/h0094049>
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Additional Information

Presenter Bio

Keeley Layfield, Au.D., joined the education and training division of Starkey in early 2022. She received her Au.D. from Louisiana Tech University and has practiced audiology in a variety of ear, nose, and throat offices before joining Starkey in 2019 as part of the sales team. Layfield's current responsibilities include assisting in the development of educational materials, leading training classes, and assisting with course offerings through AudiologyOnline.

Presenter Disclosure

Financial: Keeley Layfield is an employee of Starkey Hearing.

Non-financial: Keeley Layfield has no relevant non-financial relationships to disclose.

Additional Information (continued)

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- Healthcare providers should apply cultural competence and sensitivity to ensure effective and respectful care based on their patients' diverse needs.
- Providers should always evaluate the limitations of diagnostic and screening tools, considering their potential for false results as well as any ethical implications.
- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.

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