The use of a cochlear implant (CI) in conjunction with a contralateral hearing instrument (HI) is termed **"bimodal hearing."** Several studies have reported on the benefits of bimodal hearing (CI+HI) over a cochlear implant alone, including improved speech intelligibility and sound localisation, as well as qualitative improvements in everyday environments.

Bimodal stimulation is the current recommendation for rehabilitation of individuals with unilateral cochlear implants. The following fitting guidelines provide a quick reference to an appropriate method of *fitting and optimising an HI* to complement a contralateral CI. Together with the bimodal streaming capability of the Phonak ComPilot accessory, these fitting guidelines represent a first step in a joint venture in bimodal hearing with AB and Phonak.

▶▶ STEP 1: Calibration

1. Prior to fitting the hearing instrument, confirm that the CI is operating at a comfortable and appropriate level for conversation. If not, the patient should be referred back to the cochlear implant team for reprogramming of the CI before optimising the hearing instrument for bimodal use.

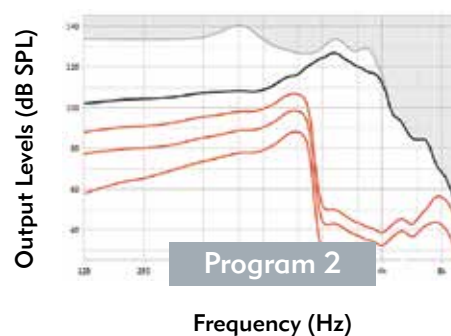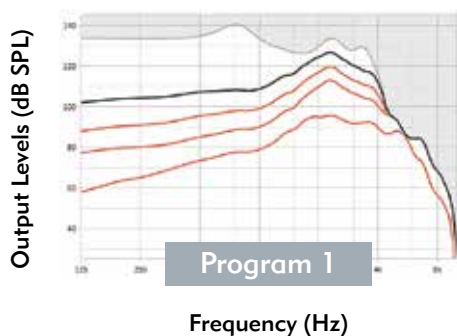2. **In the HI fitting software:**

   ☐ Verify or enter user's latest audiogram.

   ☐ Verify or enter user's latest Real Ear to Coupler Difference (RECD) values, if applicable.

   ☐ Verify or select hearing instrument.

   ☐ Verify acoustical parameters, including coupling method and vent size.

   - In order to maximise low-frequency audibility, fit the HI as closed as possible. Venting should only be considered for patients with good hearing below 500 Hz who report sound quality concerns resulting from occlusion of the ear canal.

   ☐ Run a feedback test.

▶▶ STEP 2: Program Fitting

1. Verify or select appropriate prescriptive fitting formula, such as DSL or Phonak Adaptive Digital.

2. **Create two programs:**

   ☐ **Program 1:** Broadband response, including prescribed gains at all frequencies.

   ☐ **Program 2:** Minimise gain for all frequencies at and above the lowest frequency where the hearing loss exceeds 80 dB HL. The example below indicates adjusted gains for a hearing loss which exceeds 80 dB HL at 2000 Hz.[1]

Program 1 — Output Levels (dB SPL) vs Frequency (Hz)

Program 2 — Output Levels (dB SPL) vs Frequency (Hz)

3. Verify audibility using real ear measurements.

1. Chalupper, J., Agrawal, S., Fredelake, S., & Spahr, T. (2013, July). Rationale and implementation of a bimodal fitting formula. Poster presented at the Conference on Implantable Auditory Prostheses, Lake Tahoe, California.

▶▶ STEP 3: Program Comparison

1. While listening to speech presented at conversational level (65 dB SPL) with the CI in the contralateral ear, ask the patient which of the two HI programs has the best sound quality.

☐ If the patient notes a clear preference, select that program for his/her default program.

☐ If the patient does not note a clear preference, or if additional verification measures are desired, measure performance outcomes.

- With CI alone, perform a sentence test in noise, adjusting the noise level to where the patient achieves 50% correct. Then, measure performance with the HI and CI together, first using Program 1 of the HI, and then using HI Program 2.

- If performance is better with one program compared to the other, select that program for his/her default program.

- If performance is similar with both programs, suggest a trial of 2-4 weeks with both programs.

- After the trial period, return to beginning of Step 3.
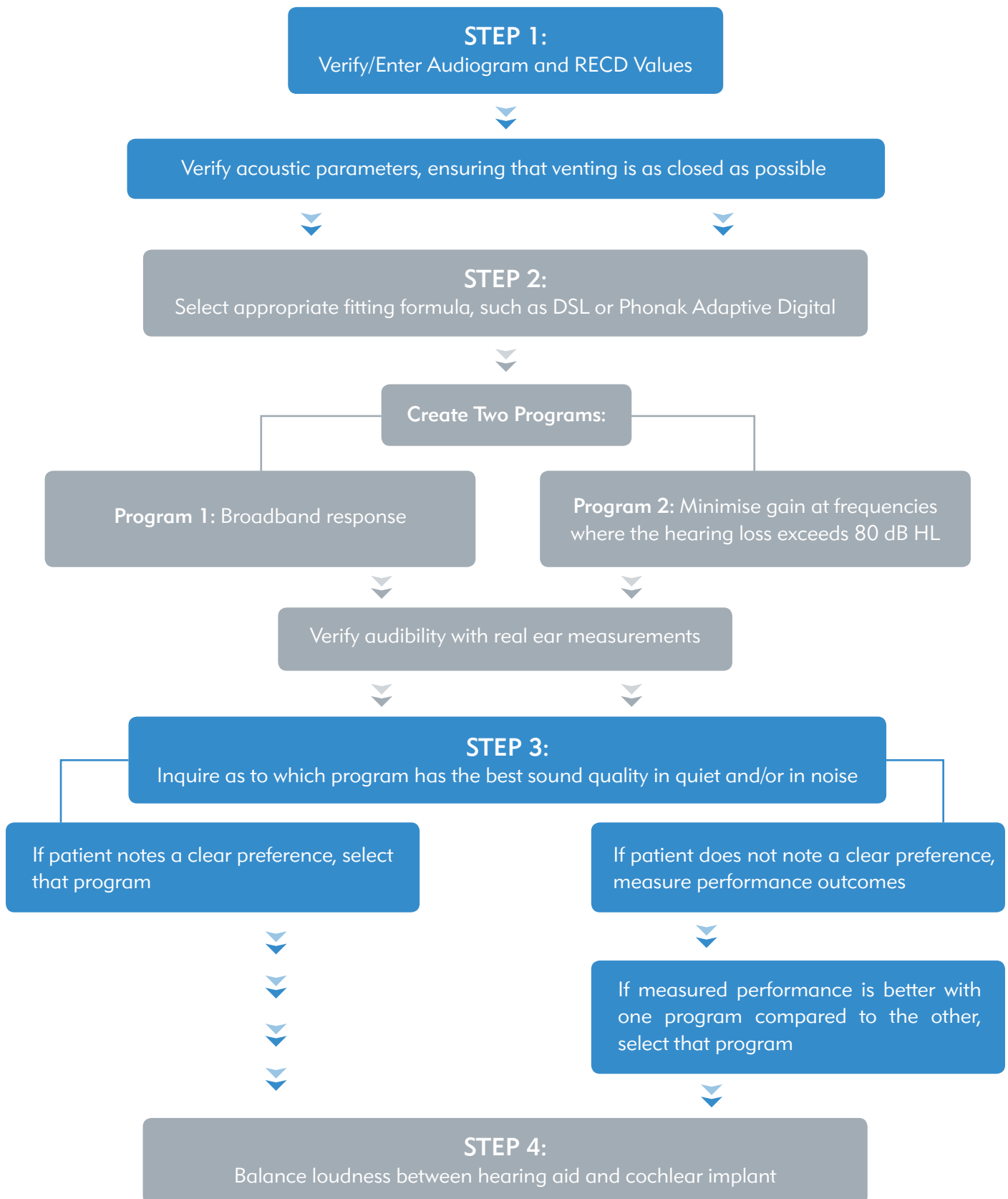
▶▶ STEP 4: Loudness Balancing

1. While listening with the HI + CI, using the preferred HI program (or both if no preference is reported):

☐ Adjust the overall gain of the HI using live speech at a conversational level (65 dB SPL) until the listener reports that the signals from the HI and CI sound balanced – *i.e., neither signal dominates perception.*

☐ If unbalanced for softer intensities, modify the HI gain for soft and medium sounds until balanced.

☐ If unbalanced at higher intensities, modify HI compression ratio, compression kneepoint or gain for loud sounds until balanced.

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Bimodal Fitting Flow Chart

STEP 1:
Verify/Enter Audiogram and RECD Values

Verify acoustic parameters, ensuring that venting is as closed as possible

STEP 2:
Select appropriate fitting formula, such as DSL or Phonak Adaptive Digital

Create Two Programs:

Program 1: Broadband response

Program 2: Minimise gain at frequencies where the hearing loss exceeds 80 dB HL

Verify audibility with real ear measurements

STEP 3:
Inquire as to which program has the best sound quality in quiet and/or in noise

If patient notes a clear preference, select that program

If patient does not note a clear preference, measure performance outcomes

If measured performance is better with one program compared to the other, select that program

STEP 4:
Balance loudness between hearing aid and cochlear implant
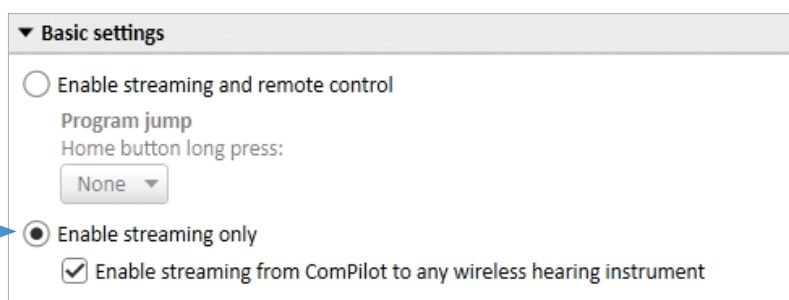
ComPilot

The Phonak ComPilot accessory allows for wireless streaming of Bluetooth, direct audio, or Roger/FM input to compatible Phonak hearing instruments and Advanced Bionics sound processors simultaneously. In addition, bimodal recipients may use the Phonak RemoteMic and TVLink S accessories with the ComPilot.

The ComPilot is bimodally compatible directly out of the box. As long as ComPilot streaming is enabled on both the HI and the sound processor, the signal and voice notifications (in English) will be streamed to both the CI and HI.

To configure and enable ComPilot streaming:

In Phonak Target™:

1. Select "ComPilot" in the "Accessories" section of the Instruments tab.
2. Click on the Options link to open the "Device options" screen.
3. Select "Enable streaming only" and ensure that "Enable streaming from ComPilot to any wireless hearing instrument" is checked.

4. In the ComPilot streaming program (Bluetooth audio + mic and/or Mobile phone + mic), select the "Program options" tab, and set the microphone attenuation to "0."

In Advanced Bionics SoundWave™ Professional Suite:

1. With the patient file **closed**: To configure the ComPilot for bimodal streaming, click the ComPilot icon in the ribbon bar.
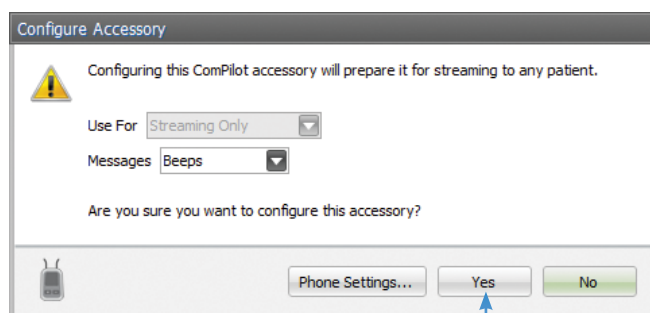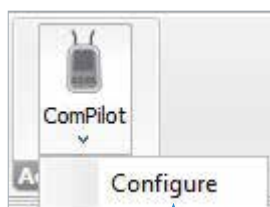
2. With the patient file **open**: In order to enable ComPilot streaming within the sound processor, click the ComPilot icon for the preferred program slot(s) in the processor pane prior to download. When the icon is illuminated orange, ComPilot is enabled.

The default ComPilot mix is 50%. To change the ComPilot mix, select the appropriate option (25%, 50%, 75% or 100%) in the slot drop-down for each program in which ComPilot is enabled.

*Note: Always ensure that the ComPilot is not set to act as a remote control for either the HI or the sound processor, as this will disable streaming to the other device.

Roger/FM

Three options exist for patients wishing to receive Roger/FM signal bimodally.

1. **Via design-integrated Roger receiver:** A Roger signal can be transmitted via design-integrated receiver to both Advanced Bionics Naída CI sound processors (using Roger 17) and Phonak HIs (using Roger 10, 11, 13, 15, or 16).

   • To enable Roger 17 access in the CI sound processor, make sure to create at least one program access to Auxiliary ("Aux") input.
   • To enable integrated Roger access in the HI, simply create an FM program, such as "Roger/FM ± mic," as desired. Additionally, select the "Program options" tab and ensure that the microphone attenuation is set to "0."

2. **Via ComPilot:** As mentioned above, Roger/FM system may be used with the Phonak ComPilot. Simply plug any europort compatible Roger/FM receiver (such as the Phonak Roger X) into the ComPilot and ensure that streaming is enabled for both devices.

3. **Via Telecoil:** Roger/FM signals can be transmitted via telecoil using an inductive neckloop, such as the Phonak Roger MyLink. Simply ensure that telecoil is enabled in at least one program on both the HI and sound processor. Additionally, within the "Program option" tab of the HI telecoil program, ensure that the microphone attenuation is set to "0."

   *Note: For additional details on fitting Roger and cochlear implants, please reference Phonak's *Roger and Cochlear Implants Fitting Guide.*

Telecoil

Integrated T-coils on both the CI sound processor and the HI allow for easy access to the telephone, FM systems, and looped environments. As mentioned above, simply ensure that T-coil is enabled in at least one program on both devices and that the microphone attenuation is set to "0" for the HI telecoil program.