

Now Hear This

This independent (unsponsored), objective review of five hearing aids looks at price, quality, comfort, technology and features to help you hear better.

by Barry Nance

Executive Summary

The Siemens/Signia Silk Primax hearing aid easily won this competition. It uses advanced technology, sophisticated Digital Signal Processor (DSP) programming and a superior design to deliver clear, natural sounds.

The Signia Silk Primax device is

- Clear and natural-sounding
- Comfortable
- Highly configurable
- Packed with useful sound processing features
- Cost effective

Impressively, the Signia Silk Primax device outperformed the other hearing aids in every category.

Eh? What did you say?

If you think hearing aids are embarrassingly unsightly, far too expensive and awkwardly inconvenient, we have news for you.

“In-The-Ear” (ITE) hearing aids, which are suitable for many (but not all) people, are virtually invisible. Even your hair stylist/barber may not notice you have hearing aids. Internet hearing aid retailer discounts of 50 percent to 60 percent are easy to find. These discounts drop the price of a high-quality, full-featured pair of hearing aids to about a dollar a day. And wearing the devices becomes second-nature. You’ll often forget you’re wearing them.

Hearing aids (often referred to as “hearing devices” or “hearing instruments” by hearing aid manufacturers and hearing care professionals) are actually tiny computers that continuously process the sounds around you. The devices supply your ears with loudness-adjusted, clarified sounds. Using a computer-memory-stored configuration that’s personalized for a specific ear, a hearing aid increases (or decreases) loudness, filters out noise and distinguishes between voices, music, wind, echoes and other types of sounds.

The ideal hearing aid gives a person a perfectly natural hearing experience. From the lowest double bass violin note to the highest piccolo note, from the lowest male voice to the highest female voice, from the lowest peal of thunder to the highest chirp of a bird – a perfect hearing aid knows what sounds you have trouble hearing and compensates accordingly. The ideal hearing aid is so comfortable in your ear that you forget it's there. The hearing aid is not a factor when you brush your hair or someone ruffles your hair. It recognizes and enhances voices for the sake of clarity and understanding, while it filters and de-emphasizes sounds like wind noise and background clatter. The ideal hearing aid is durable and reliable. It can be configured and personalized to your exact hearing loss both now and in the future, as your hearing changes over time.

We decided to evaluate five hearing aids in our test lab. The five were

- Personal Sound Amplifying Products, or PSAPs (as a group)
- Audicus Uno
- iHear Medical HD
- Signia Silk Primax
- Phonak Virto B Titanium

The Signia Silk Primax device easily surpassed the competition in this review. It gave us the clearest, most natural sounds. Silk Primax was comfortable to wear, it was easy to configure (once we'd studied up on frequencies, amplitudes and compression) via Signia's Connexx Eight software and it was brimming with thoughtfully-designed, useful features. The Signia Silk Primax price of just \$1,100 per device (over the Internet, from www.BuyHear.com) was a nice bonus.

Why Review Only “In the Ear?”

Devices that sit completely inside the ear canal (“ITE”) rather than behind the ear (“BTE”) have several significant advantages.

They are of course invisible or nearly so.

You can prune shrubs and trees, brush your hair, let someone ruffle your hair, wear headphones, use earmuffs and walk (or run) under low-hanging trees without worrying about losing them.

You can insert them and forget them – ITE hearing devices are the ultimate in convenience.

... And What about Bluetooth? And TeleCoil?

Wireless hearing aid protocols are over-rated. People with normal hearing use telephones and attend public gatherings without special equipment. You want the same experience. Having to select a special program when the phone rings, trying to share the phone conversation content (when you'd otherwise just switch to speakerphone mode) or – especially – needing to give the phone call to another person are all problematic with BlueTooth.

Signia Silk Primax

Signia, a division of the Sivantos company, makes three levels (models) of Silk Primax devices – 3, 5 and 7. Because it's suitable for most people's degree of hearing loss, we primarily focused on level 5 in our testing (See the "How We Tested" section of this review).

The Silk Primax devices gave us the clearest, most natural sounds in every one of our tests. People's voices, including higher-pitched female voices, were perfectly understandable and intelligible. Music of all types was crisp and clear. Outdoor sounds such as bird songs, rustling leaves and arguing squirrels were pleasant and distinct. Sports events were enjoyable, and announcer's voices were sharp and clear. We could easily focus on and understand conversations in public places, from the workplace to restaurants and bars.

Impressively, all the testers agreed that the invisible, in-the-canal Silk Primax micro-miniaturized computers identified, enhanced and delivered pure, true sounds to our ears – sounds that would otherwise have been muffled, indistinct or even completely absent.

Technical Data: The Silk Primax 3 has 24 channels with 12 handles, the Primax 5 has 32 channels with 16 handles and the Primax 7 has 48 channels with 20 handles. Each channel or handle is a frequency range (such as 1,500 cycles to 1,750 cycles/sec, or 2,000 cycles/sec to 2,250 cycles/sec).

Configurable parameters for each frequency range tell the Silk Primax how to boost, compress or otherwise process sounds in that specific frequency range.

The high number of channels and handles is especially helpful for a person who hears normally across a range of frequencies but, beginning at a specific frequency, has more and more trouble hearing different sounds. An example: Fred hears well from 250 cycles/sec (a low musical note) to 1,000 cycles/sec (some male voices). He sometimes can't quite understand 1,250 cycles/sec male voices. 2,000 cycles/sec and higher female voices are a problem for Fred, and he

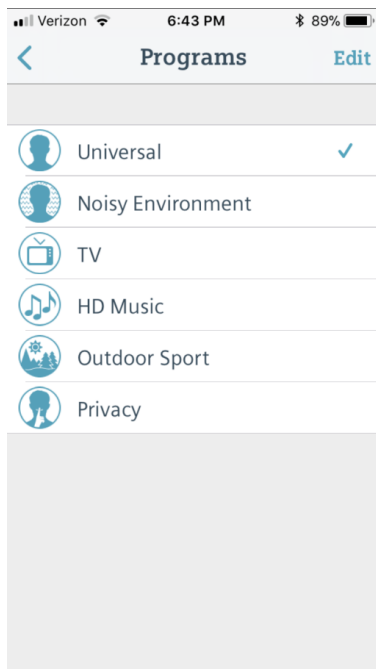
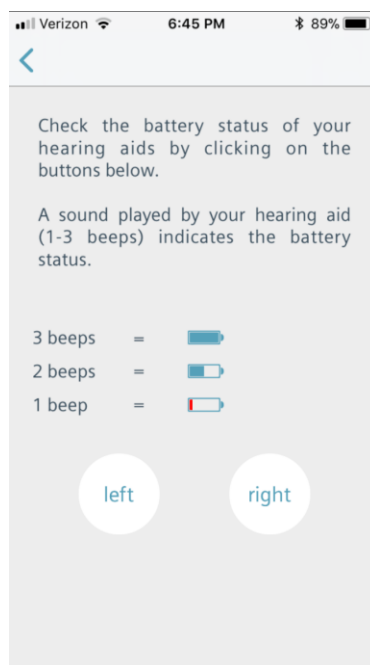
can't hear high musical notes and many bird chirps at all. Fred needs frequency-specific amplification beginning at 1,250 cycles/sec and increasing through higher frequencies.

In addition to compensating for frequency-specific hearing loss, a Silk Primax device can recognize and either emphasize or de-emphasize speech, music, feedback, wind noise and several other types of sounds. Moreover, for people suffering from Tinnitus, the person configuring a Silk Primax device can choose from multiple Tinnitus therapy signals, including Signia's own rather uniquely effective Notch Therapy.

You get six user-selectable programs in the Silk Primax:

- Universal
- Noisy Environment
- TV
- HD Music
- Outdoor Sport
- Privacy

You choose a specific program in the free Signia “Touch Control” smartphone app or by pressing a button on the optional “Mini-Pocket Remote.” Our testers greatly preferred using the smartphone app to select a program. As icing on the cake, the Signia “Touch Control” smartphone app additionally let us check battery status (i.e., charge level) whenever we wished.



Signia's smartphone app for program selection, battery charge information and other functions

The (default) Universal program supplies most hearing-challenged people with virtually normal hearing. While Universal is perfectly useful and effective in all listening situations, the other programs offer supplemental sound enhancements you might find helpful. Noisy Environment minimizes background noise and clatter in restaurants, bars and even bowling alleys. The TV program boosts voices and music when you're watching TV. HD Music enriches and heightens whatever music you listen to. Outdoor Sport is appropriate for stadiums and ballparks. And the Privacy program de-emphasizes sounds in your environment so that you can more easily concentrate on something without the distraction of background sounds.

We found the Silk Primax durable, sturdy and well-made. We expect the device will last many years. We appreciate the ability to reconfigure the device to accommodate ears whose hearing profile and acuity change over time.

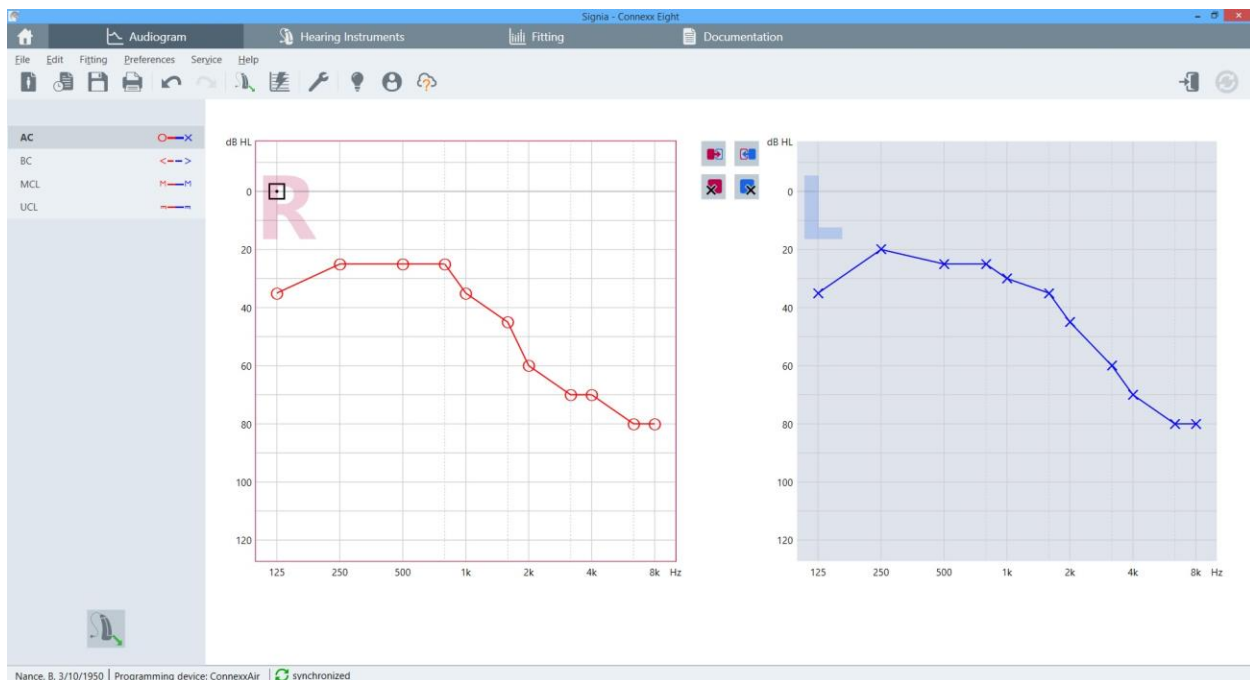
Wearing a Silk Primax is extraordinarily comfortable. The flexible silicone sleeves (large, medium or small, vented or non-vented) conform softly but securely to nearly any ear canal. Even forgetting to take them out at bedtime wasn't an issue (except for the extra battery usage). The Silk Primax's comfort is nearly as impressive as its digital intelligence.

Setting up a new, out-of-the-box Silk Primax device the first time consists simply of attaching a click sleeve, inserting the device into the ear and then configuring the device's amplifications for different frequencies as well as its several options.

Configuring the Silk Primax device (what audiologists inaccurately refer to as "programming") was a breeze with the Signia Connexx Eight software. We quickly set up a BlueTooth link between the computer and the ConnexxAir hardware, which in turn used ultrasonic signals (a protocol that Signia terms "e2e") to send configuration data to the Silk Primax devices.

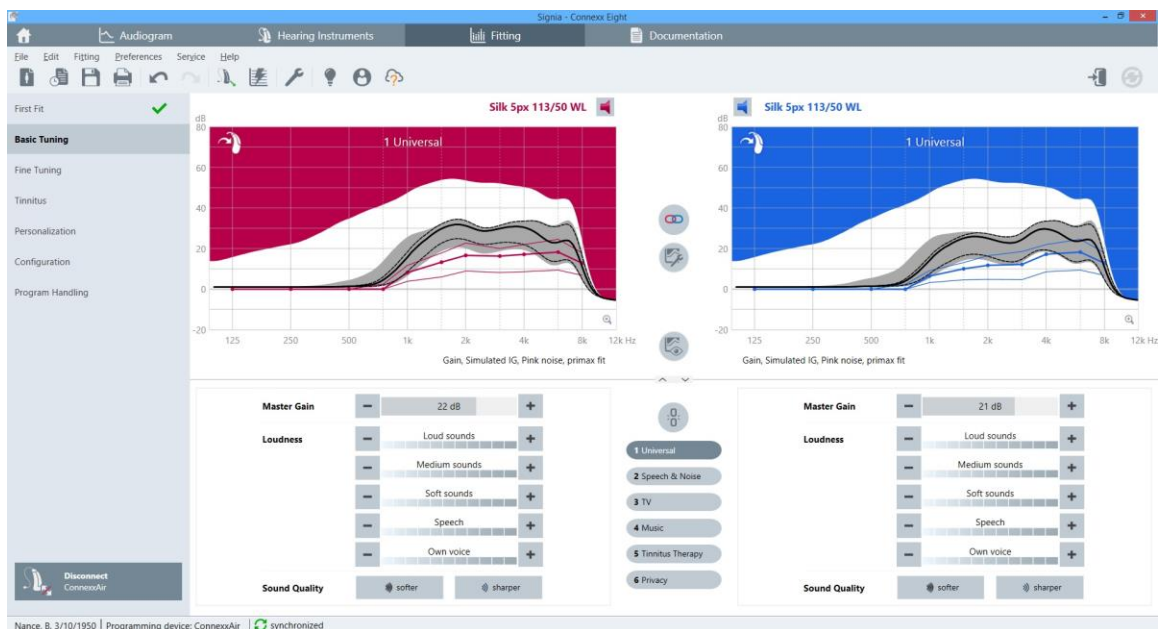
If you arm yourself with a good understanding of sound and hearing (frequencies, amplitudes and compression) and if you can operate a Windows application, we think you'll find using Signia's software a cost-saving alternative to having an audiologist configure your devices.

The Connexx Eight software, which runs on Windows, offers three increasingly fine ways to configure Silk Primax devices. At the first (most coarse) level, you point and click with a mouse to enter audiogram datapoints (e.g., 30 decibels of hearing loss at a frequency of 2,000 cycles).



Entering audiogram data via Signia's Connexx 8 software

You perform the optional second and third configuration steps if you want to make additional adjustments. At the second (somewhat finer) level, you use plus/minus buttons to adjust the loudness for loud sounds, medium sounds, soft sounds, speech and your own voice.



Adjusting sound levels in Connexx 8

At the third (finest) level, you use the mouse to move frequency-specific sliders (each slider is a channel/handle) up or down. You click a button on the screen to tell the Connexx Eight software your changes apply to both devices or just to one device (if you're configuring a device pair). With another button, you indicate whether the Connexx Eight software should apply your changes to all programs or just one.



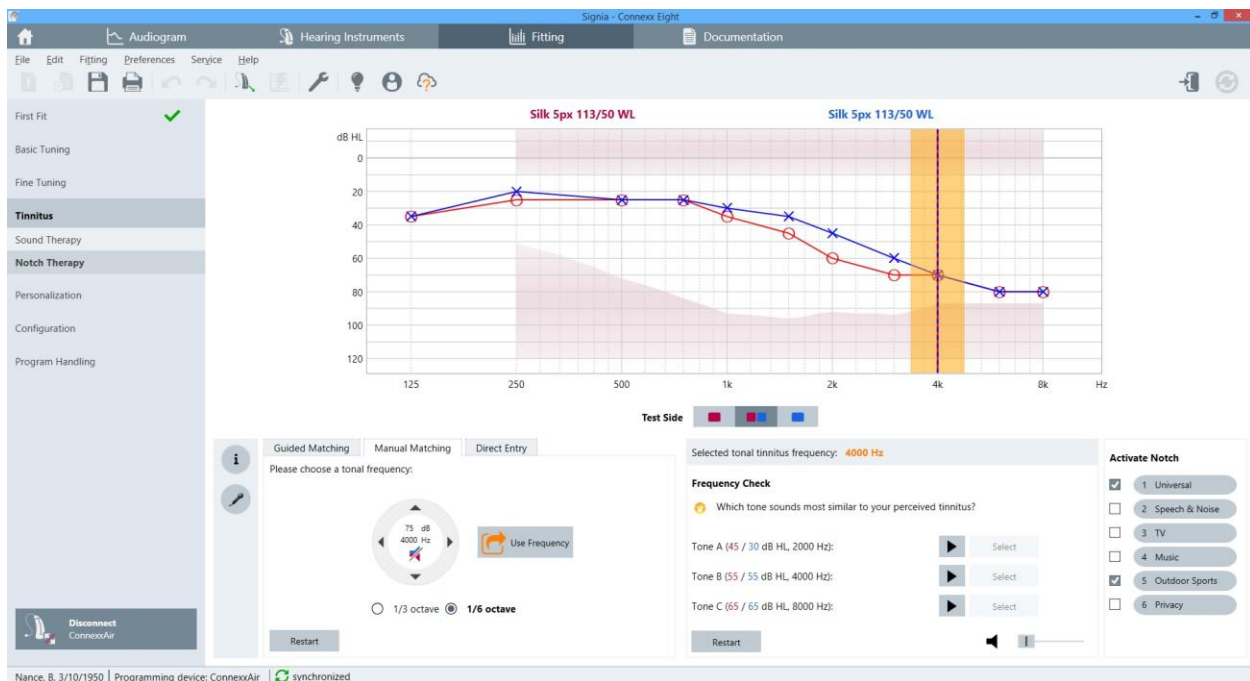
Frequency band fine tuning in Connexx 8

You use other configuration screens to adjust the Silk Primax devices' behaviors when they detect wind noise or mixtures of speech and noise.

Signia's Tinnitus Notch Therapy is a novel, advanced approach to the stubborn problem of tonal tinnitus. Other manufacturers' traditional tinnitus treatments typically require months of listening to recorded white noise or ocean waves for a few hours each day. In contrast, Notch Therapy integrates into one or more of your hearing devices' everyday programs. Basically, it works by avoiding the amplification of natural sounds that occur at or near the frequency of your tinnitus.

Notch Therapy uses the science of *cortical lateral inhibition*, a neural mechanism that reduces the activity in the over-stimulated region of the brain responsible for many types of tinnitus. The result is a continuous, daily tinnitus treatment that neither adds nor masks sounds to your listening experience.

The Silk Primax can be configured three ways: Notch Therapy at a specific frequency and amplitude, the classic noise-or-ocean-wave therapy or no tinnitus therapy at all.



Tinnitus therapy selection with Connexx 8

Silk Primax 5's suggested retail price is \$2,500 per device, but you can buy a pair on the Internet for typically \$1,100 each. The ConnexxAir hardware for configuring Silk Primax is \$250.00. With a lifespan of about six years, the Signia Silk Primax's daily cost is only about a dollar.

Audicus Uno

The Audicus Uno is actually manufactured by another company, Hansaton. Audicus private-labels the devices for sale on the Internet. The Uno is a no-frills, rather basic hearing aid that's one step above Personal Sound Amplifying Products (PSAPs). The Uno can selectively amplify sounds in a small number of frequency ranges, but it lacks features that would make those sounds seem as natural and genuine as people wished. We concluded that the Audicus Uno is best used as a back-up, or substitute, for those times your regular hearing devices are being repaired (if of course you can afford to buy a back-up pair).

Update

Just before we finished this review, Audicus posted "*Audicus is not currently offering the Uno, as of 2/1/2018*" on its Web site.

We don't know when Uno sales might resume. We'll leave the Uno in this review for when it or its similar replacement returns to the market.

Our testers reported that the Audicus Uno helped them hear and distinguish many sounds and several voice types. However, some musical instruments' notes were louder than they should have been, while others were fainter. Testers sometimes said their own voices were hollow-sounding. And two testers could not understand certain words spoken by high-pitched female voices.

The Audicus Uno worked well at sports events, but noisy public places were a challenge. Conversations in such environments were often unintelligible.

The consensus of our testers: Audicus Uno is a somewhat helpful device, but it has limited usefulness when you're trying to understand conversations in noisy environments or trying to enjoy music.

Technical Data: Audicus Uno has 8 channels, no user-selectable programs and no ability to provide any tinnitus therapy. The device incorporates a low-end, inexpensive computer chip (a Digital Signal Processor, or DSP). The Uno's DSP chip is much slower than that used in most hearing aids, and it doesn't respond quickly to sudden loud sounds or other sudden changes in the listening environment. The Uno's DSP chip is also less capable and offers very few configuration settings. To accommodate noisy environments and other listening situations, the Audicus (Hansaton) software running in the DSP samples incoming sounds, tries to identify them and dynamically changes the sounds before they reach your ears.

The Audicus Uno is a hard shell beige plastic hearing device. A detachable, replaceable soft plastic dome helps the Uno sit comfortably in the ear canal. Audicus ships the device with six such domes – small, medium and large in both “propeller” and “mushroom” shapes. We found that the domes lost their flexibility and resiliency within a week or two, which meant the domes needed replacing more often than we would've liked.

Audicus uses an audiogram that you send to the company to configure a new Audicus Uno for a particular ear's hearing loss. Thereafter, if you need any additional “fine tuning” of your new device, you must ship the Uno back to Audicus.

You cannot choose a program (listening mode) with the Audicus Uno. Instead, it automatically adjusts the sounds you hear based on its moment-by-moment analysis of your listening environment.

Audicus' price for each Uno is (was) \$499.

Phonak Virto B Titanium

Phonak, a division of the Sonova company, manufactures two models of Virto B Titanium devices – 70 and 90. We tested the model 70 device, which Phonak says is a sophisticated, computer-chip-based hearing aid that's custom-molded for each ear.

The Virto B70 Titanium hearing aid promised many features and capabilities at the beginning of our review. Unfortunately, the device didn't live up to its promises as we put it through daily use.

For the sake of strength and durability, the Phonak Virto B Titanium incorporates a 3-D-printed titanium shell rather than an acrylic (plastic) shell. The titanium shell is supposed to fit securely within the ear canal. To customize the shape of the titanium shell for a particular person, an audiologist squirts silicone gel into the ear, lets it harden, removes the resulting ear canal mold and sends the mold's shape and size data to the manufacturer. Phonak uses the mold dimension data and a 3-D printing process to encase the hearing aid electronics and circuits inside a shell of thin titanium.

Titanium 3-D Printing

3-D printing, also known as "Additive Manufacturing" (AM), incrementally melts and then deposits extremely thin layers of powdered material, such as titanium, on an object. The result can be a unique metallic shape fabricated to close tolerances.

However, because of the granular nature of the surface of an AM part, such objects can exhibit weaker fatigue and static strengths than conventionally-milled components. This is one reason for the cautious adoption of 3-D printing.

To our disappointment, the titanium shell didn't retain its shape as it should have. Micrometer measurements of the device after the initial fitting and then after testing revealed slight deformations in the thin titanium in only a few months of use. Also, one of the devices failed during testing when the wax guard holder fell out (with the wax guard still inserted).

Moreover, both occlusion (hearing one's own voice as a hollow, abnormal sound) and feedback/whistling were frequent problems with the Virto B Titanium devices.

Technical Data: The Virto B70 Titanium device has 16 channels and the B90 model has 20 channels. The AutoSense feature is designed to detect and accommodate these listening environments: Calm Situation, Speech in Noise, Comfort in Noise and Music. A magnet, in the form of a manufacturer-supplied mini-remote “MiniControl” hand-held unit, can manually select one of the listening modes or Acoustic Phone. Other features are designed to block whistling, feedback and wind noises.

The Virto B Titanium devices’ tinnitus therapy consists simply of generated noise (i.e., white noise or pink noise) at a pre-configured loudness and frequency. The generated noise can be set to appear in all listening mode programs or in a separate custom program.

The Virto B Titanium hearing aids have the following programs that are selectable with a magnet (the accompanying handheld mini-remote “MiniControl” unit):

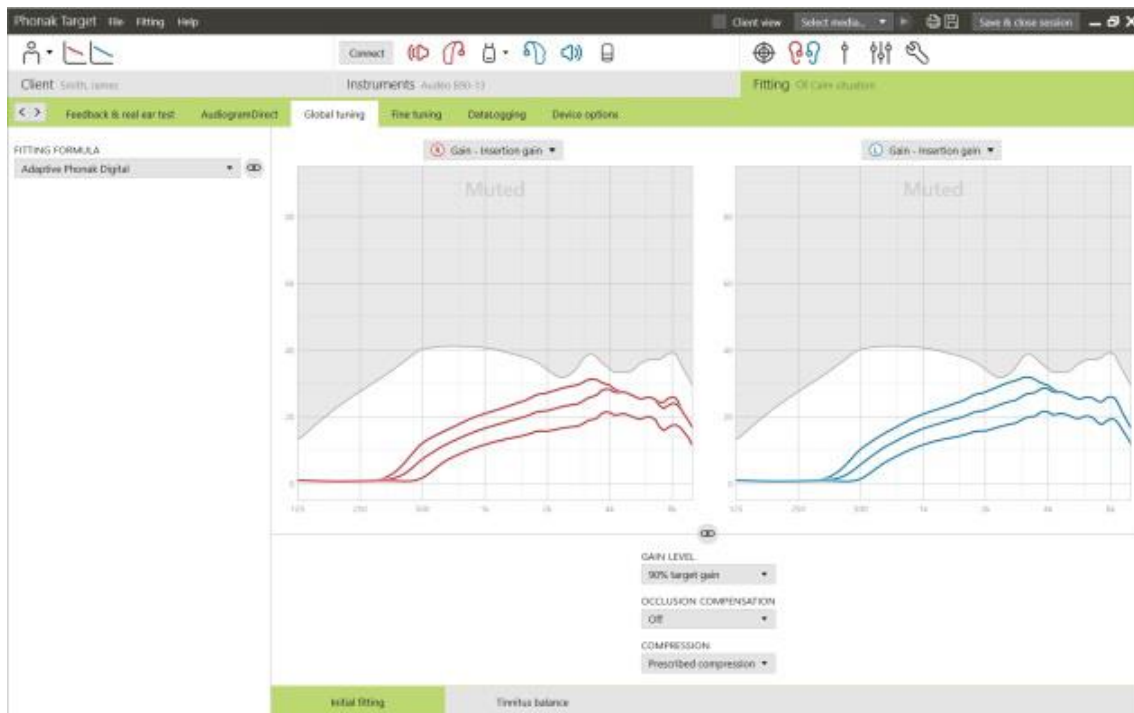
- Comfort in Echo (only on the model B90)
- Calm Situation
- Comfort in Noise
- Music
- Acoustic phone

The MiniControl is a keychain holder containing a magnet that you can extract from the keychain holder. To switch programs, you unscrew the magnet from the keychain holder and insert the magnet into your ear close to the Virto B Titanium hearing device. You then promptly remove the magnet from your ear when the Virto B Titanium hearing instrument aurally signals that it’s using the program you want.

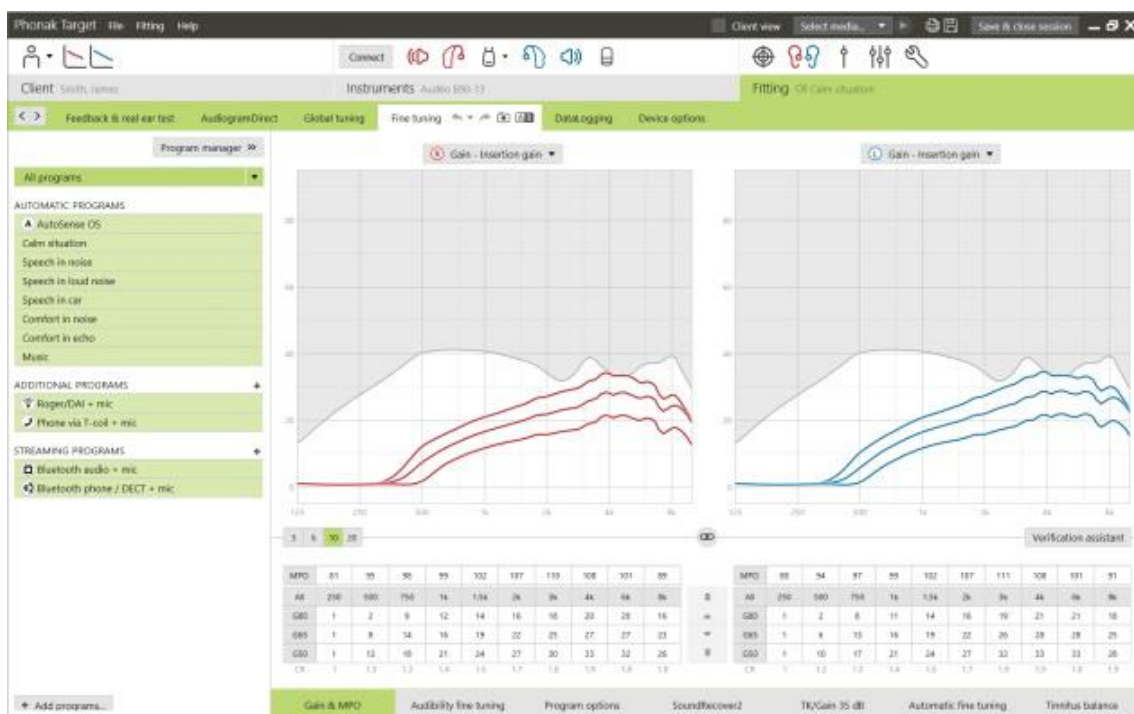
The mini-remote “MiniControl” magnet does not help you know how much battery life is left. Phonak does not offer a smartphone app for selecting Virto B Titanium programs.

The customized shape of the Virto B Titanium device, based on the audiologist making a mold of the ear canal, made the insertion and removal of the hearing aid a simple process. However, a tester reported the metal shell was often uncomfortably cold during the first minute after insertion.

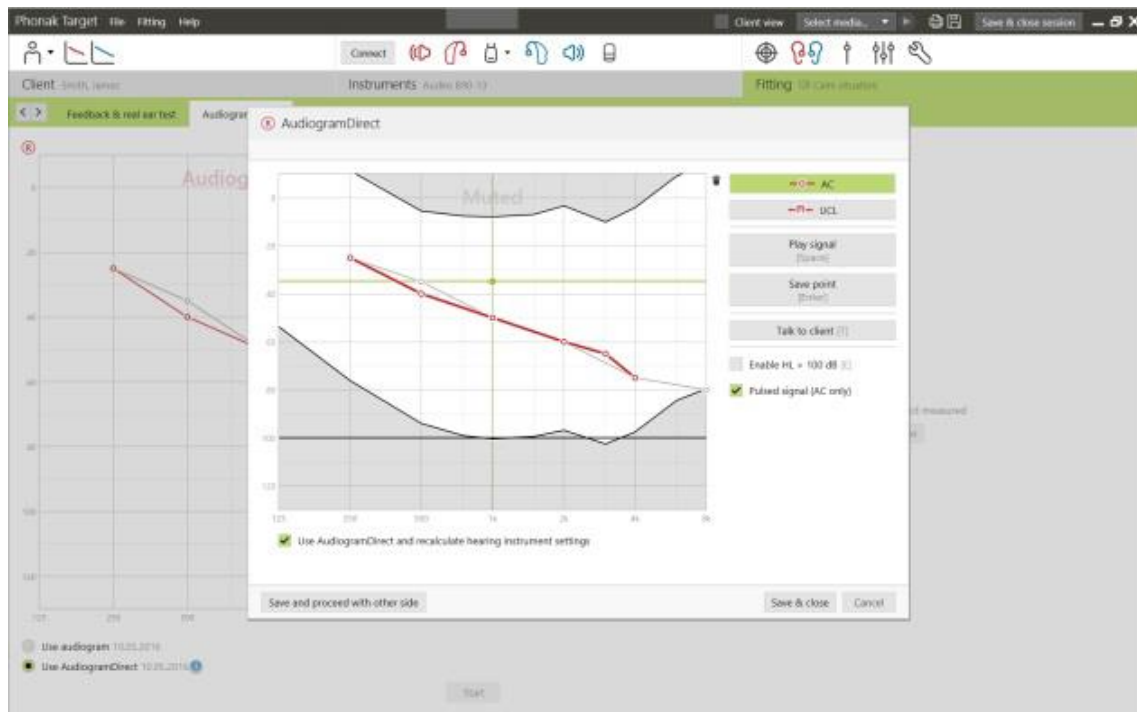
Once you obtain and then connect a “Hi-Pro 2” hardware device to both your computer and your Virto B Titanium hearing aids via a special cable, configuring the Virto B units is fairly straightforward. Just as with the combination of Signia Silk Primax devices and Signia Connexx 8 software, you can enter audiogram data and perform fine tuning steps with the Virto B Titanium devices and Phonak Target software.



Audiogram data in Phonak's Target software



Phonak's Target software – frequency range adjustments



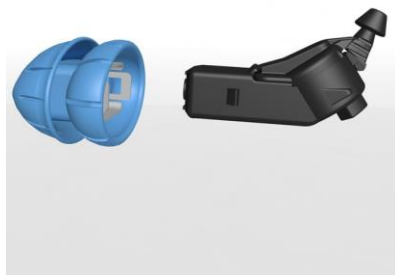
Phonak's Target software – frequency fine tuning

The MSRP for each Phonak Virto B70 is \$3,100, although you can buy one on the Internet (online) for as low as \$1,800 (\$3,600 per pair). However, if you're contemplating an online purchase, keep in mind that you'll still need to see an audiologist to have him or her make the silicone gel mold of your ear.

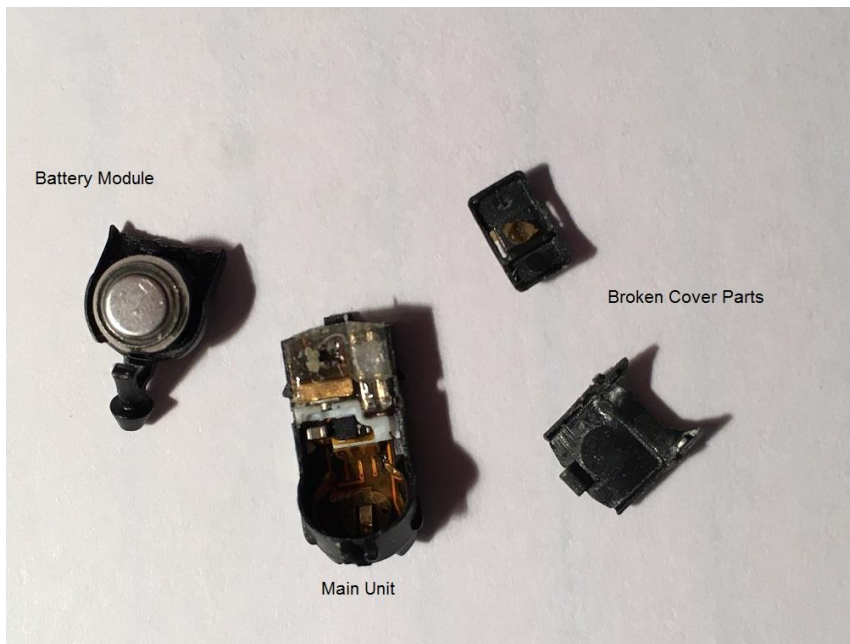
iHear Medical HD

iHear Medical both designs and manufactures its hearing aids. The company calls its in-the-ear device the "HD." It has just four frequency ranges (channels) and four programs. Just as with the Phonak Virto B devices, a magnet held close to the ear changes the program. The HD hearing aid is a rectangular, hard black plastic unit that uses proprietary (available only from iHear Medical) batteries.

Unfortunately, we found the HD to be badly designed and poorly made.



To our huge disappointment, as we tested a pair of HD devices, the one for the right ear failed. It randomly changed programs, causing us to have to reset it on a frequent basis. Just as its replacement arrived from the iHear Medical company, the left ear device fell apart – literally.



iHear Medical's HD device broke during normal use

To compound the problem, iHear Medical used a slow ground shipping service for both the returned right ear device and the replacement device, leaving us without a working hearing aid for nearly two weeks.

Even when the devices were working, we found them problematic. The four frequency ranges did not coincide closely enough with any of our tester's hearing losses. As a result, many sounds were louder than they should've been, while others were too quiet. Whistling and feedback occurred often.

Technical Data: The iHear Medical HD device has just four channels. These rather broad frequency ranges were (1) zero to 875 cycles/sec, (2) 875 to 1,625 cycles/sec, (3) 1,625 to 3,625 cycles/sec and (4) anything greater than 3,625 cycles/sec. Range 1 represents a male voice, range 2 is a low female voice, range 3 is a high female voice and range 4 represents bird chirps.

The HD's Digital Signal Processor (DSP) is a rudimentary, not-very-capable and very inexpensive chip (ON Semiconductor's Rhythm SB3229).

The iHear Medical HD comes with a magnet that changes the HD's program (listening mode). These programs are Main Profile, Volume Cut, Speech Enhancement and Volume Boost. Volume Cut decreases all frequency range amplifications by 6 db. Speech Enhancement decreases range 1 amplification by

12 db and range 2 amplification by 6 db. Volume Boost increases all frequency range amplifications by 4 db.

The HD relies on a person's own natural accommodation for wind noise, and the device has no tinnitus therapy.

An HD wearer positions the supplied magnet close to each ear's HD device, one at a time, to cause the HD to jump to the next program. For example, changing from Main Profile to Speech Enhancement requires two magnet touches in each ear. Changing back to Main Profile requires two magnet touches in each ear.

iHear Medical does not offer a smartphone app for choosing a program or for knowing how much battery life is left in each device.

To configure the HD devices at home, you purchase the manufacturer's Tuning Kit. Confusingly, our Tuning Kit arrived in a box labeled "Hearing Test." To use the configuration software, you remove the proprietary batteries from each device, connect the HD devices to your computer via cables and re-insert the devices in your ears. You then respond to a series of sounds and simple questions to indicate how much amplification (or compression) each frequency range should have. The test sounds include male voices, female voices and bird chirps.

ih iH TUNER Version A.5.5.4

File Help

ihTUNER™

John Doe

Signout

ih TUNER

My iHEAR HD Devices

Support

ih TUNER: Right Device

Loud Male Voice

Loud Female Voice

Soft Male Voice

Soft Female Voice

Bird Chirp

Limit Loud Sounds

Final Loudness & Balance

LEFT

1L

2L

3L

4L

5L

6L

RIGHT

1R

2R

3R

4R

5R

6R

B

Loud Female Voice

Adjust Volume to a slightly loud but comfortable level. Then adjust Clarity for clear speech but not too sharp or tinny. Note: Chose lower settings if unsure to prevent possible feedback (whistling) later. When finished click "Save & Continue."

Volume:

4

Clarity:

4

BACK

PAUSE

SAVE & CONTINUE

COMPLETE

iHear Medical’s Tuning Kit questions

ih iH TUNER Version A.9.0.3

File Help

ihTUNER™

Barry Nance

Sign Out

ih TUNER

My Hearing Devices

Support

My Hearing Devices:

Devices	Loud Male Voice	Loud Female Voice	Soft Male Voice	Soft Female Voice	Bird Chirp	Limit Loud Sounds	Final Loudness & Balance
	Volume	Volume	Clarity	Volume	Volume	Clarity	Volume
Left iHEAR HD SN: L17000423	2	2	4	1	3	1	3
Right iHEAR HD SN: R17000628	2	3	4	1	3	1	3
Right iHEAR HD SN: R17000468	2	3	4	1	3	1	3

BACK

RESTORE DEFAULT FACTORY SETTINGS

RESTORE LAST iH TUNER SETTINGS

CHAT

iHear Medical’s Tuning Kit summary screen

The iHear Medical HD hearing aids are fairly comfortable once they're inserted in the ear canals, but they were not so comfortable that we could forget that we were wearing them. We found handling them for insertion and extraction somewhat difficult. The HD's rectangular, sharp-edge surface definitely makes manipulating them with the fingertips a challenge.

iHear Medical sells the HD devices on the company's Web site for \$399 each. The at-home programming kit is \$150.

PSAPs

Be aware (beware?) that Personal Sound Amplification Products (PSAPs) indiscriminately amplify all sounds, both high and low. Do you have trouble understanding soft voices in a noisy place? A PSAP will amplify both the voices and the noise. A PSAP does not distinguish tubas from flutes, low male voices from high-pitched female voices or growling dogs from bird songs. A PSAP amplifies them all equally.

Most PSAPs do not even compress loud sounds. A sudden, very loud sound – that you would've heard perfectly well without the PSAP – can be painful, possibly damaging, when amplified by a PSAP.

Here are just a couple of random examples of in-the-ear PSAPs available (February – March 2018) on Amazon. You'll find dozens if not hundreds for sale on the Internet.



NewEAR Hearing Amplifier Ear ITC (Pair) "Extra Small" Second Generation
Amazon price: \$37.43 & FREE Shipping



Easyuslife Extra Small In-The-Canal (ITC) New Digital Hearing Amplifiers
Amazon price: \$99.00 (\$49.50 / Item) & FREE Shipping.

Deciding to buy a PSAP might seem economical and budget-wise, but you're unlikely to be happy with the result. In addition to the blanket amplification of all low-pitched sounds, all high-pitched sounds and sounds that are already very loud, a PSAP lacks listening modes (programs), recognition and abatement of various kinds of noise as well as configurability.

Our testing of several PSAPs showed that many under-amplified high frequencies and over-amplified low frequencies. Since most people have difficulty hearing high frequencies, a PSAP would not help most people hear better. A cheap PSAP might even make your hearing worse.

You may find that replacement domes and even batteries are difficult to obtain. The PSAP may not be durable and well-made. And it may not be quite as comfortable in your ear as you'd like.

Finally, according to the FDA, "PSAPs are intended to amplify environmental sound for non-hearing impaired consumers. They are intended to accentuate sounds in specific listening environments, rather than for everyday use in multiple listening situations."

PSAPs can range in price from \$10 to \$500. At any price, however, we urge you to exercise great caution if you're thinking of buying a PSAP.

Conclusion

The Signia Silk Primax hearing aids easily emerged the winner in this competition. They are feature-rich, comfortable, digitally sophisticated, durable, and – for the technically-minded – a breeze to configure. The \$1,100 price for each one, spread across five or six years of expected use, makes them cost-effective. We highly recommend the Signia Silk Primax.

Report Card

	Signia Silk Primax	Audicus Uno	Phonak Virto B Titanium	iHear Medical HD	PSAPs
Hearing	A	B	C	C	D
Comfort	A	B +	A –	C	C
Durability	A	A	C	F	?
Ease of configuring	A	D	B	B	F
Price	A	A	C	B	B
Average	A	B	C	C	D

How We Tested

This review is perfectly independent. We received no sponsorship, no compensation of any sort and no free devices from any manufacturer.

We evaluated these hearing aids primarily for their ability to compensate for hearing loss. We looked at how comfortable each device was in daily use and how easy (or difficult) insertion and extraction was. We assessed each device's design and manufacturing quality. We tested the ease with which we could configure the device's sound processing parameters and options. We also judged the device's cost in relation to its breadth of features and its expected lifespan.

Our test environment consisted of six people with varying degrees of hearing loss.

We used notebook computers running Windows 8.2 and Windows 10 to run each manufacturer's configuration software. Our smartphone platforms were an iPhone 6s and an iPhone X.

About the Lab and the Author

Established in 1989, Network Testing Labs performs independent technology research and product reviews. Its network laboratory connects myriads of types of computers and virtually every kind of network device in an ever-changing variety of ways. Its authors are networking experts who write clearly and plainly about complex technologies and products.

Network Testing Labs' experts have written hardware and software product reviews, state-of-the-art analyses, feature articles, in-depth technology workshops, cover stories, buyer's guides and in-depth technology outlooks. Our experts have created industry standard network benchmark software, database benchmark software and network diagnostic utilities.

Barry Nance is a networking expert, magazine columnist, book author and application architect. He has more than 35 years of experience with IT technologies, methodologies and products. Since 1989, working on behalf of Network Testing Labs, he has evaluated thousands of hardware and software products for ComputerWorld, BYTE Magazine, Government Computer News, PC Magazine, Network Computing, Network World and many other publications. He's authored thousands of magazine articles as well as popular books such as Introduction to Networking (4th Edition), Network Programming in C and Client/Server LAN Programming.

He's also designed successful e-commerce Web-based applications, created database and network benchmark tools, written a variety of network diagnostic software utilities and developed a number of special-purpose networking protocols.

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