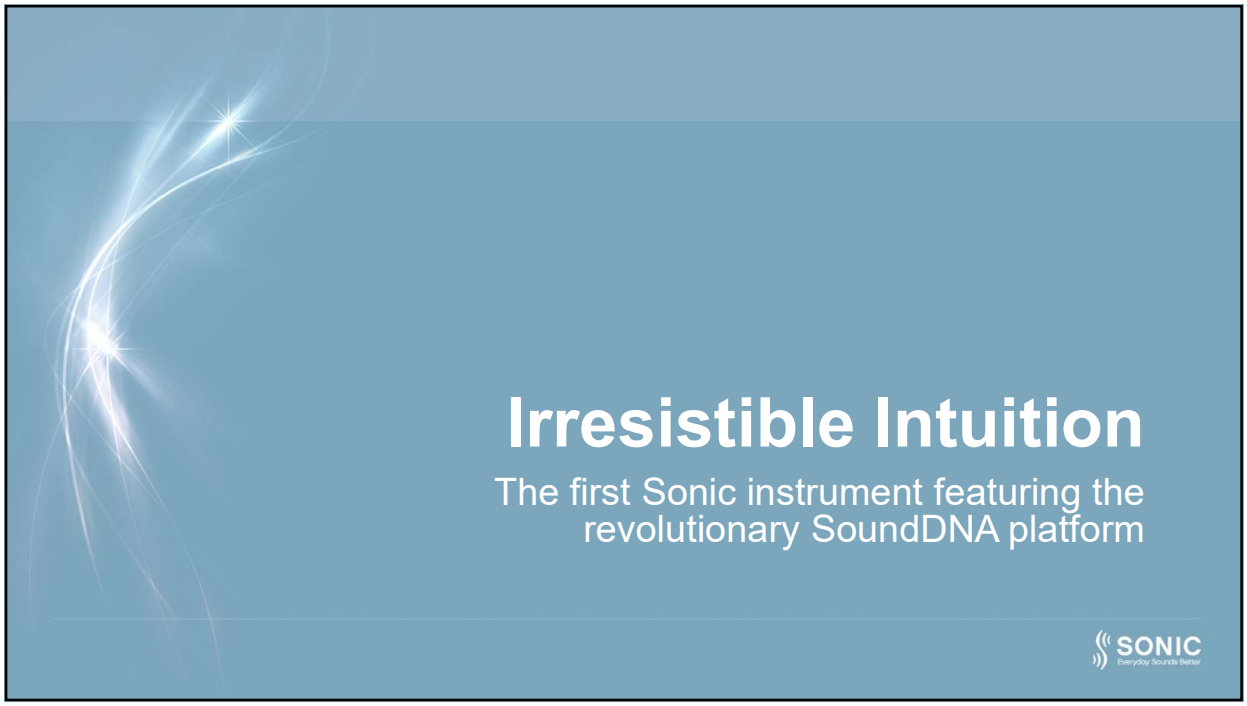
Learning Outcomes

- After this course learners will be able to describe how SmartCompress technology can control compression in speech-in-noise environments and control gain in non-speech environments.
  |
- After this course learners will be able to explain how the new SPiN Noise Management system in Enchant hearing aids coordinates noise reduction and directionality in one adaptive and flexible system.
- After this course learners will be able to list and describe all the features on the SoundDNA technology platform.


Irresistible Intuition
The first Sonic instrument featuring the revolutionary SoundDNA platform
SONIC
Everyday Sounds Better

It all starts with SoundDNA

Revolutionary new technology giving our most automatic, adaptive and flexible hearing technology to date

SONIC Everyday Sounds Better

SoundDNA Platform

- Commitment to 4S Foundation
  - **Sound** that is natural
  - **Speech** understanding in noise
  - **Simplicity** in all we do
  - **Style** that stands out

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Enchant

Capabilities that captivate

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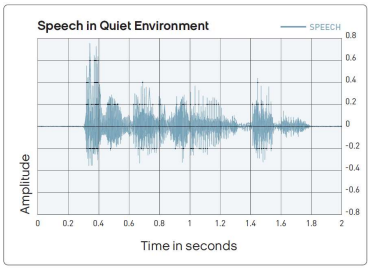
SmartCompress

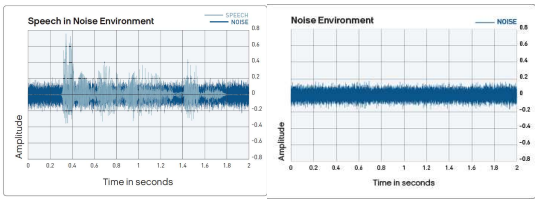
- Configurable adaptive compression system for intelligent amplification in noise
- Benefit
  Patients can enjoy the most natural and clear listening experience from one environment to the next

Principle Idea

- FACT: Hearing aids apply gain and compression based on the overall level, a manner that optimizes speech in quiet listening conditions

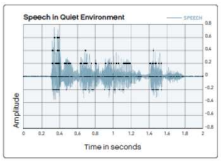


- Hearing aids should not apply the same gain prescription on the overall level in listening environments with noise

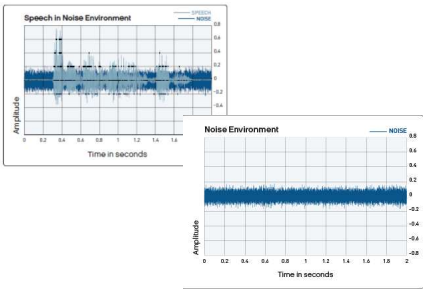


Sonic's Most Recent Solution

- **We have used Speech Variable Processing (SVP) to apply amplification in Speech in Quiet**
  - SVP measures and applies gain to the wideband acoustic signal
  - Does not break up incoming signal into separate frequency regions
  - Uses Phoneme Focus and Envelope Focus to address auditory resolution needs



- **We have used Environment Classification to assist SVP in identifying all other changing environments**



Limitation: Environment Classification

Environment Classification uses 'static' (non-adaptive) rules to classify environments

- In rapidly fluctuating environments, changes in performance are rigid and slow (300 msec delay)
- Imprecise hearing aid performance based on information from the past
- Requires manual adjustment (a speech-in-noise program, a noise-only program, a quiet program, etc.)

SVP with SmartCompress - Overview

SVP with SmartCompress

- Advances DSP technology beyond the limitation of a static environment classification system to a real-time adaptive compression system

- The technology is based on a real-time assessment of the environment using short- and long-term SNR analysis
- Results in accurate application of gain and compression in response to rapidly fluctuating environments
- Amplification is applied according to level and environment

SVP with SmartCompress - Overview

In other words…

- **SVP** is optimized for Speech in Quiet
- **SVP with SmartCompress** optimizes all other listening environments

- SmartCompress allows the system to intelligently overcome the challenges associated with rapidly changing listening environments for a natural, instinctive hearing experience
- No longer a need for Environment Classification with SmartCompress!

Solution: SmartCompress

SmartCompress delivers the solution ✓

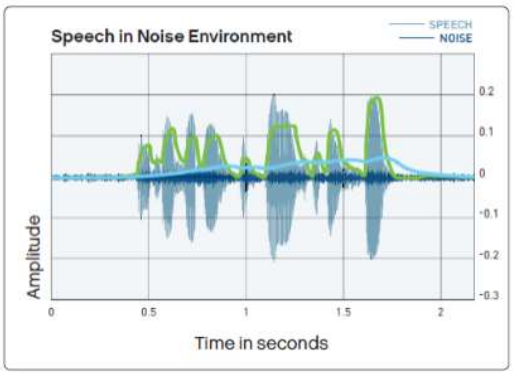
- It's effective
  - Specifically addresses the problem of applying compression in noise
- It's adaptive
  - An adaptive compression system overcomes limitations of fixed Environment Classification system
- Works well with others ☺
  - Complements SVP, directionality and noise reduction, and any fitting rationale of your choice

Solution: SmartCompress

- It's accurate:
  - Precisely measures sound changes in the environment
  - Detects short-term SNR of the signal at phonemic speed
  - Detects ongoing long-term SNR of the overall environment
- It discriminates
  - Knows what is speech and what is noise
- It's intelligent
  - Applies different amounts of gain and compression on speech vs. noise
- It's fast
  - Detects the SNR in real time
  - Addresses noise that occurs in between speech phonemes and speech pauses

SmartCompress - How does it do it?

- SmartCompress uses two SNR level estimators, compared to one in traditional systems
  - Green – fast phonemic estimator
  - Blue – slow, long-term estimator
- Provides accurate measurement of environmental changes in real time



SmartCompress

✓ Controls **compression** in **speech-in-noise** environments

- Adaptively varies the compression in speech-in-noise environments
- Determines how much the compression has to be decreased, or made more linear, for less noise in the output

✓ Controls **gain** in **non-speech** environments

- Adaptively limits gain when speech is not present
- Determines the occurrence of quiet and noise-only situations and applies less gain to the input

Summary: SmartCompress

- **Automatic**
  - Robust analysis of environmental changes
  - Reacts instantaneously, not based on rigid environment classification in rapidly fluctuating environments
- **Adaptive**
  - Tracks ongoing changes in signal-to-noise ratio (SNR)
  - Uses SNR information to guide adaptive compression system
  - Controls amplification based on the signal type
  - Intelligently adjusts the gain
- **Flexible**
  - Easily personalized for individual needs in fitting software

Options

Model Overview

Enchant Feature Overview*

	enchant 100	enchant 80	enchant 60	enchant 40	enchant 20
Sound Quality					
Signal Processing	« Speech Variable Processing »				
SmartCompress	10 Options	6 Options	2 Options	--	--

Enchant

Fascinating sound all around

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Importance of the SNR

What's the best thing we can do for our patients?

- Improve the SNR!
  - Hearing impaired persons need a significantly greater signal-to-noise ratio (SNR) advantage over persons with normal hearing in order to understand an equal amount of speech
- How? Noise Reduction Technologies
  - Directional Microphones
  - Digital Noise Reduction (DNR)

Put a Positive Spin on Speech-in-Noise

- Introducing a trio of new technologies designed to enhance speech, reduce noise and optimize the control of it all

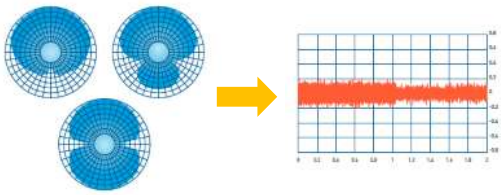
- SPiN Directionality
- SPiN Noise Reduction
- SPiN Engage

SPiN Management

SPiN Management - Overview

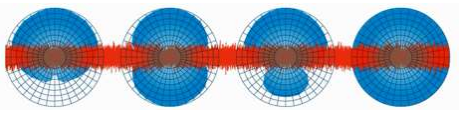
Previous Platform

- Directionality and Noise Reduction were uncoordinated before SVP amplified the signal:



Now on SoundDNA Platform

- With SPiN Management, Directionality and Noise Reduction are coordinated, to work better, together:



SPiN Directionality

- Enhances sensitivity to sound via automatic directional microphone system
- Benefit
  Patients can better enjoy conversations in noise with reduced distraction or discomfort

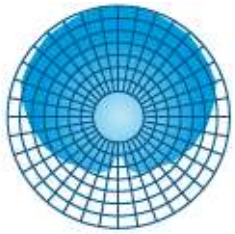
What We Know - Directionality

- DIR improves SNR over omnidirectional mics
  - Success is dependent on many things
    - *Spatial separation between signal and noise*
    - *Distance between the signal and the listener*
    - *Level of room reverberation, etc.*

- SPiN Directionality
  - Automatic
  - Adaptive
  - Multiband approach

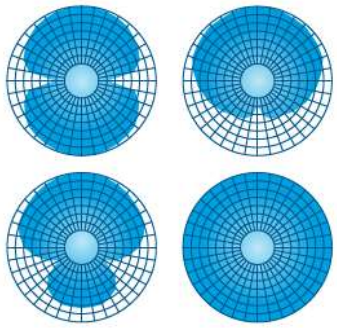
SPiN Directionality - Automatic

- Turns on the directional microphone only when needed
- From full omni to full directional
- Avoids limitations of directionality when not required



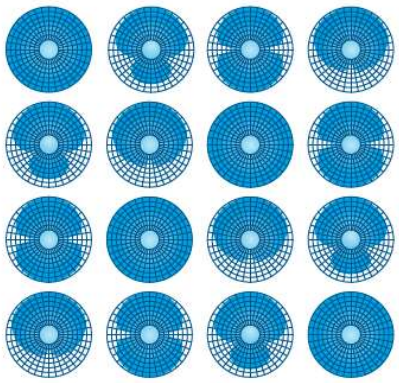
SPiN Directionality - Adaptive

- Polar patterns adaptively change in response to noise sources that are moving relative to the listener
- Continual changes in null-steering in each frequency band
- SNR driven



SPiN Directionality – Multiband

- 16 frequency bands
- Isolates and suppresses noise from different directions across the frequency spectrum with accuracy



SPiN Directionality - The Result

- Adaptively transitions to the optimal configuration
  - Selection based on best SNR
  - Analyzes between instruments (wirelessly)
  - This simultaneously occurs in 16 bands!
  - Continual, smooth null steering attenuating multiple noise sources

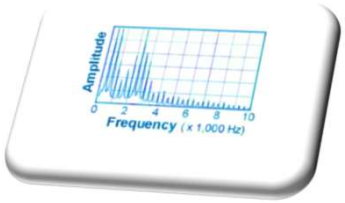
SPiN Noise Reduction

- Reduces background noise with special Speech in Noise focus
- Benefit
  Patients can better enjoy conversations in noise with reduced distraction or discomfort

Noise Reduction Review

- What is the goal of Digital Noise Reduction?
  - To reduce hearing aid output in the presence of noise
- How do modulation based DNR algorithms work?
  - Detect modulation rate of signal
    - High modulations = Speech
    - Low modulations = Noise

- DNR continuously determines the SNR by measuring the level of noise in frequency bands



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SPiN Noise Reduction – How?

- Same framework/structure as SPiN Directionality

- Three components to SPiN NR:
  - Automatic activation in noise
  - Adaptive control in noise
  - Multiband design

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SPiN Noise Reduction - Automatic

- Detects the modulation rate of incoming sound
  - Signals with a high modulation rate are desirable (e.g. speech)
  - Signals with a low rate are undesirable (e.g. steady-state noise)
- Analyzes the modulation depth of incoming sound
  - Continuously monitors peaks and troughs of the signal
  - Large peak-to-trough value signifies a high SNR
  - Small peak-to-trough value signifies a low SNR

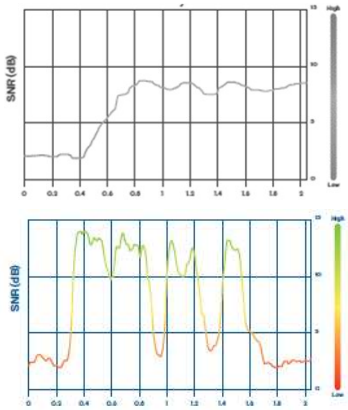
This process estimates the SNR

- Helps to provide an accurate representation of speech versus noise

SPiN Noise Reduction - Adaptive

Uses extremely fast adaptation speed

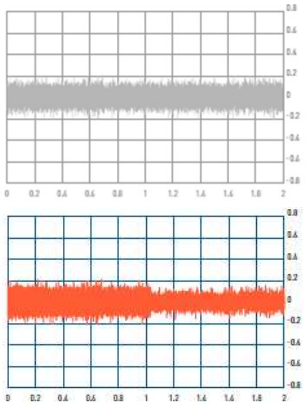
- Fast time constants provides greater accuracy in estimating speech vs. noise
- Reduces gain only as much as needed
- Efficiently responds to rapid fluctuations in noise, to attenuate noise even between the smallest speech pauses and preserve speech down to the phonemic level



SPiN Noise Reduction – 16 Bands

Operates in 16 frequency bands

- High-resolution framework
- Identifies noise of varying spectral content
- Reduces gain in the narrow bands where noise is detected
- With SPiN Directionality, the two systems manage speech and noise across the frequency spectrum



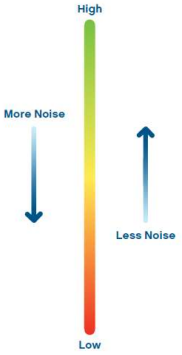
SPiN Engage

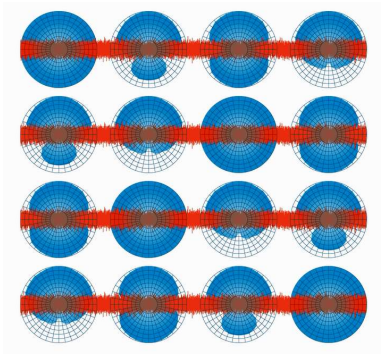
- Optimizes the onset of directional and noise reduction technologies
- Benefit
  Patients can better enjoy conversations in noise with reduced distraction or discomfort

SPiN Engage

3rd component of SPiN Management

- This feature determines at which signal-to-noise ratio SPiN Directionality and SPiN Noise Reduction will adjust to the environment
- Works within the same multiband design
- Coordinates the onset of directionality and noise reduction as the SNR fluctuates in 16 independent frequency bands





SPiN Engage – Why?

Hearing aid users have varying tolerance limits regarding how much noise they are willing to accept

- SPiN Engage allows customization based on individual needs and preferences
- It offers up to three settings that correspond to the level of help your patient needs—or prefers—in changing listening environments
- It is beneficial to determine the extent that background noise bothers your patient in daily listening activities

SPiN Engage – Patient Profiles

Patient distracted or disturbed by speech in noise

Set SPiN Engage to quickly put an emphasis on the speech signal

- High setting

Patient accepts more noise & prefers auditory awareness

Set SPiN Engage with a more gradual onset

- Medium setting
- Low setting

Options

Model Overview

Enchant Feature Overview*

	enchant 100	enchant 80	enchant 60	enchant 40	enchant 20
Noise Management					
SPiN Noise Reduction	4 Options	4 Options	3 Options	2 Options	2 Options
SPiN Engage	3 Options	3 Options	2 Options		
Directionality					
SPiN Directionality	2 Options: Hi/Med	1 Option: Med	1 Option: Med	1 Option: Low	1 Option: Low

Enchant

Distractions seem to disappear

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Binaural Noise Management

- Balances hearing in noise wirelessly from side to side
- Benefit
  Balanced listening in noise provides more comfortable listening

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Binaural Noise Management

Activates when the SNR becomes significantly different between ears

- Shifts the hearing aid response into a mode where the better ear is emphasized via optimal directionality to maintain full audibility on the ear with better SNR
- Reduces gain and fully activates the NR system on the opposite side

Binaural Noise Management - Benefits

These actions concentrate the response of the binaural system towards the better side

- Helps focus attention to the signal that should provide the best chance for speech understanding
- Fast wireless transmissions support the way in which we naturally switch our attention between binaural listening and better ear listening as dictated by the environment
- Focusing on the ear with the best SNR helps the wearer in following the target speech over time

Binaural Noise Management - Summary

Binaural Noise Management uses wireless technology to offset unpredictable noises that affect one side more than another

- BNM analyzes the SNR from each hearing aid and automatically applies the optimum noise reduction setting to improve the binaural SNR
- Wireless communication between devices is automatic for an immediate response

Options

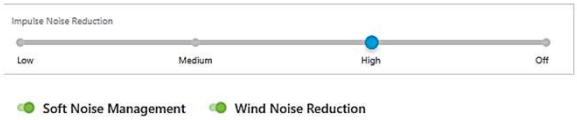
Model Overview

Enchant Feature Overview*

	enchant 100	enchant 80	enchant 60	enchant 40	enchant 20
Binaural Coordination					
Binaural Noise Management	■	■			

More Noise Reduction Technologies

- Impulse Noise Reduction
  - Identifies and suppresses unexpected sounds without modifying the speech input
  - New in 2018! Greater attenuation of impulse noise in all three settings



- Wind Noise Reduction
  - Quickly sets the lowest frequencies to an optimal directional response and applies attenuation across all frequencies upon detecting wind
- Soft Noise Reduction
  - Reduces soft background noise without changing the amplification of speech

Enchant

Delight in bits of brilliance

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Tinnitus SoundSupport

- Customizable sound and amplification therapy
- Benefit
  Alleviate the negative effects of tinnitus

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Tinnitus SoundSupport

Offers the following tinnitus relief sound options:

- 4 broadband sounds

White Noise | Pink Noise | Red Noise | Shaped to audiogram

- 3 nature-like sounds

Ocean 1 | Ocean 2 | Ocean 3

Why Use Broadband Sounds?

Most commonly used in tinnitus therapy

- Have stable and neutral characteristics
- Do not attract major attention
- Are not annoying
- Do not provoke a negative reaction

Why Use Ocean Sounds?

Nature sounds like water can have a positive emotional effect[1]

- Provide a rhythmic and soothing sound
- Patients may feel less stressed and more relaxed

[1]Jastreboff and Hazell (2004)

Synchronization of Sounds

All relief sounds are synchronized

- Patient has a balanced perception of sound
- Especially important when relief sounds are modulated
- Can be deactivated if required

Control Tinnitus Sounds - App

Sonic SoundLink 2 App

- Adjust Tinnitus volume or mute
- Modify Tinnitus sound by changing its modulation rate or frequency response

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Wireless Streaming

Sonic does not provide a proprietary tinnitus app for streaming sounds

- Various tinnitus apps are available for download
- Direct-to-ear 2.4 GHz streaming is possible with iPhone only or with SoundClip-A for Android

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Options

Model Overview

Enchant Feature Overview*

	enchant 100	enchant 80	enchant 60	enchant 40	enchant 20
Sound Quality					
Tinnitus SoundSupport	■	■	■	■	■

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Frequency Transfer

- Goal is to improve speech understanding for severe to profound high frequency losses
- Benefit
  Helps to access high frequency speech cues for those with high frequency losses

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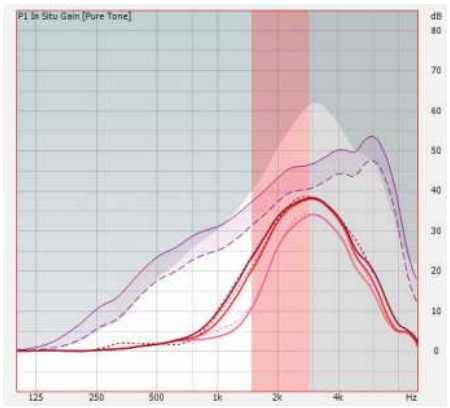
Frequency Transfer



- Frequency Transfer with 3 controls:
  - 10 destination regions
  - 7 intensity settings
  - High Frequency Attenuation
    - Turns gain in the high-frequency bands above the destination on or off.
    - It is on by default

Adaptive Feedback Canceller

- Exceptionally fast adaptive filter to identify feedback
  - Memory aspect
- Benefit
  Comfort with reduced hassle of feedback

Impressive IP Ratings

- IP 68 protection from dust and water
  - miniRITE
  - miniRITE T
  - BTE 105
  - All Customs
- Benefit
  Low repair rates means happy customers…and happy patients ☺

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Surrounded by something special

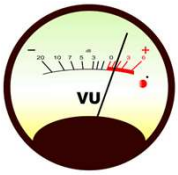
SONIC Everyday Sounds Better

Extended Dynamic Range

- For clarity of loud speech
- Benefit
  Improved fidelity with higher input levels

Extended Dynamic Range

- Listening environments with speech can get **LOUD**
  - Can quickly change in intensity
  - Presence of loud speech signals can have peaks that exceed > 95 dB A



- Digital hearing instruments limit inputs at 95 dB SPL
  - Creates distortion for higher input levels due to compression

Extended Dynamic Range – What?

- Designed specifically for signals with high intensity levels
  - Adaptive Technology
  - Expands the dynamic range of sound up to 113 dB SPL
  - As sounds grow in intensity, EDR ensures superior clarity

- Especially helpful at movie theaters, performances, auditoriums, and other places where sudden dramatic sounds really makes the moment

Extended Dynamic Range - Summary

Adaptively extends dynamic input range

- Expands to growing sound levels only as needed
  - Upper limit depends on input level of speech signal (from 95-113 dB SPL)

- Allows loud peaks to be amplified without distortion
- For everyday sounds
- Available in premium products only

Options

Model Overview

Enchant Feature Overview*

	enchant 100	enchant 80	enchant 60	enchant 40	enchant 20
Sound Quality					
Extended Dynamic Range	■				

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SmartMusic

- Greater enjoyment of live music
- Benefit
  Music enthusiasts and musicians alike can enjoy undistorted music again

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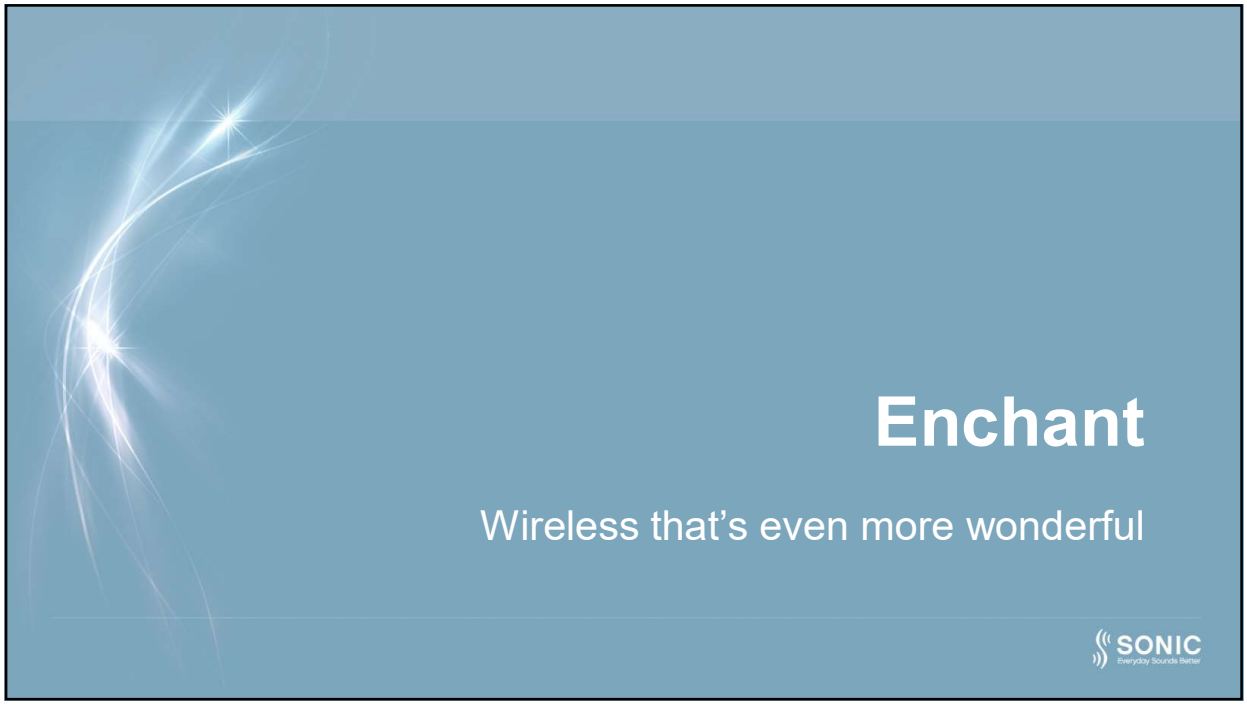
4 Important Components to SmartMusic

- Fixed Extended Dynamic Range
  - Increases limit at the input to a fixed 113 dB SPL
- Speech Variable Processing
  - Maintains balance between harmonics
- Wideband Frequency Response
  - Important for perceived naturalness of music
- Controls
  - Fixed Hypercardioid polar setting
  - Position of null does not change
  - Eliminates noises from behind
  - Concentrate on what's on stage

Two Ears Working as One

- Binaural Coordination
  - Automatically shares information between right and left devices
- Binaural Synchronization
  - Simultaneous adjustments for volume and program change between the ears
- Non-Telephone Ear Control
  - Keep distractions at bay by reducing gain or muting the ear opposite of the phone

Enchant Program Options	Enchant^{100}	Enchant^{80}	Enchant^{60}	Enchant^{40}	Enchant^{20}
Universal – Everyday	✓	✓	✓	✓	✓
Speech in Noise	✓	✓	✓	✓	✓
SmartMusic	✓	✓	✓		
Noise	✓	✓	✓	✓	✓
Music	✓	✓	✓	✓	✓
Telephone (M|T|MT)	✓	✓	✓	✓	✓
Entertainment	✓	✓	✓		
Automobile	✓	✓	✓		
Classroom (M|T|MT)	✓	✓	✓	✓	✓
Airplane	✓				



Dual-Radio System

- Fast and direct wireless transmissions with optimized battery life
- Benefit
  Patients stay connected to their SMART world

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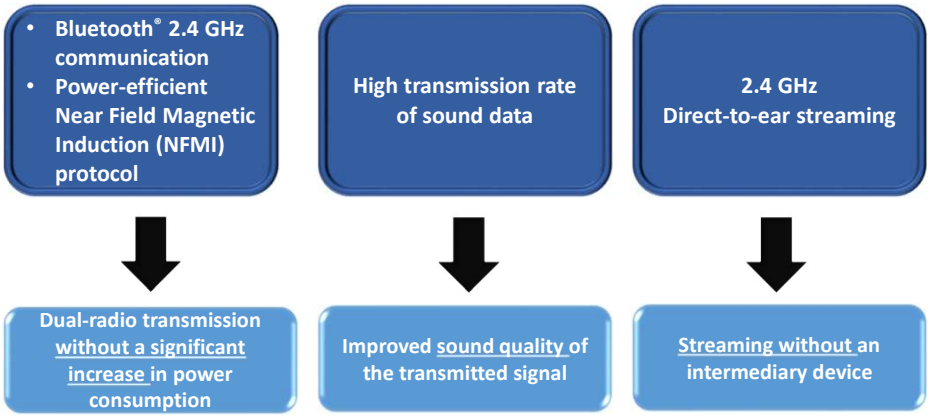
Benefits of New Chip in SoundDNA



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Enchant Connectivity Portfolio

Enchant

Splendidly sophisticated

SONIC
Everyday Sounds Better

Style – Introducing Customs

- Embrace exceptional versatility to truly give your patients a personalized experience
- Models that make sense

Options include →

Battery size

Fitting level

Omni | Directional

NFMI | 2.4 GHz Wireless

Push button | Volume wheel

Telecoil | Autophone

Enchanting Custom Features*

Focus on Size

- Renewed commitment to first-rate fit
- Using a variety of venting, amplifier and battery configurations
- Goal → Our smallest possible instruments to satisfy individual preferences

Focus on Features

- Packed with features on the SoundDNA platform
- Offering up to 4 receiver sizes, advanced wireless communication and several dexterity enhancements
- Goal → Feature rich offering in 5 technology levels

*Not all features are available on all models – and restricted to size limitations and space requirements.

*Not all features are available on all models – and restricted to size limitations and space requirements.

IP68 IS **STANDARD** ON ALL ENCHANT ITE DEVICES

1. **Dual Covered Microphones**
   - Allow for sophisticated directional features to enhance performance in noise
   - Keeps unwanted debris and moisture from entering the device
2. **Push Button**
   - Provides easy access for up to four listening memories
   - Optional volume control feature on wireless models
3. **Venting Styles**
   - Free Vents
   - Oval Vents
   - Collection Vents
   - Round Vents
4. **ProWax System**
   - Protects receiver from moisture and cerumen
   - Easily replaceable by the patient
5. **Optional Telecoil and Auto Telephone**
   - Telecoil provides crystal-clear telephone reception
   - Auto Telephone provides hands-free switching to a fully-configurable, dedicated telephone listening program
6. **Fitting Levels**
   - Receiver Sizes 75, 85, 90, 100 (ITC, ITE)
   - Receiver Sizes 75, 85 (IIC, CIC)
7. **Wireless Connectivity**
   - NFMI - Enables binaural communication between devices
   - 2.4 GHz - Provides connectivity to external audio sources (mobile phone, television, computer, etc.)
8. **Optional Volume Control Wheel (not pictured)**
   - Programmable range
   - Configurable alerting tones provide audible cue as the volume is changed
9. **Ingress Protection Rating**
   - Hydrophobic coating and overall design protects against dust and continuous immersion in three feet of water or more
   - IP68
10. **Dexterity Features**
    - Removal notches
    - Removal filament
    - Removal post
    - Raised volume control
    - Raised Push Button
    - Color dots
    - Attachment hook
    - Canal lock, Helix lock

Enchanting Style

Available in styles popular with patients and effective for a variety of hearing needs

Enchant miniRITE

- New, modern design
- Single push-button volume and program control
- Size 312 battery

Enchant miniRITE T

- Dual push-button volume and program control
- Size 312 battery
- Equipped with telecoil

Enchant BTE 105

- Earhook or thin tube options for robust power
- Size 13 battery
- Equipped with telecoil

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Enchanting Colors

beige taupe brown grey dark grey black* gold**

*Black color available in Enchant[100|80|40] only.
**Gold color available in the Enchant[100] miniRITE only.

black* beige light brown medium brown dark brown

*Black color available in IIC only.

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SONIC Everyday Sounds Better

Enchant

Stunningly Simple

SONIC Everyday Sounds Better

EXPRESS*fit*® PRO

- Continues easy-to-use, robust fitting system
- Real Ear Fit
- Sound Studio

Streamlined design and fitting flow

More fitting bands and graph views options

Audible indicator tones for easier sound recognition

Firmware Updater*

Software Updater*

*Requires Internet Connection

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Adaptation Manager

- Gradually increases gain settings over time
- Benefit
  Gradual adaptation of gain over time results in higher acceptance of amplification

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Acclimatization to amplification

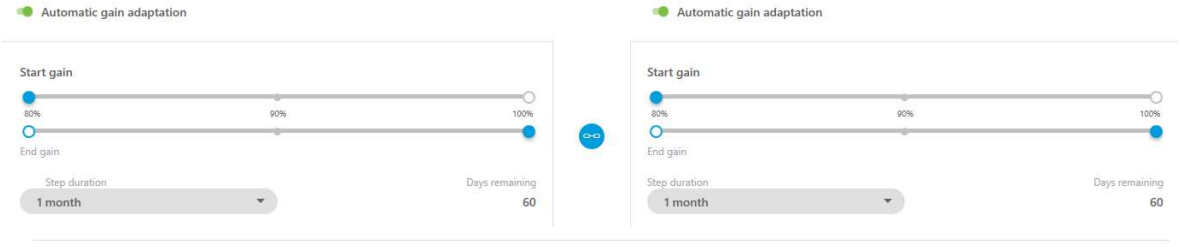
- If you just say 'you'll get used to it'… What can happen?

- The wearer adapts to it ☺
- The wearer gets enough benefit from it to put up with it without really liking it ☹
- The wearer is annoyed enough to become a semi-unhappy part-time wearer ☹
- The wearer rejects amplification entirely ☹☹

Ref: Mueller H, Powers T. Consideration of auditory acclimatization in the prescriptive fitting of hearing aids. *Sem Hear.* 2001;2:103-124

Adaptation At its Best

- Exclusively in EXPRESS*fit*® Pro
- The three-step Adaptation process can help the patient gradually adjust to the full response of an instrument
  - **80% → 90% → 100% of Target Gain**
  - **Automatic and Manual Options**



Real Ear Fit

- Achieve accurate fittings and improve patient satisfaction by simplifying the real ear verification process
- Compatible with
  - MedRx Avant Speech, Avant Speech+, Avant REMsp, Interacoustics Affinity & Callisto, and Otometrics Otosuite
  - New! supports an interface for Audioscan systems

REAL EAR FIT
SIMPLE, ACCURATE FITTINGS

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SONIC Everyday Sounds Better

SoundStudio

- Put Enchant to the test
  - Demonstrate real-life sounds through your PC speakers
  - Sample dozens of audio clips or import your own!
  - Create new scenes with Scene Editor

SoundStudio
Real life sound simulation

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SONIC Everyday Sounds Better

FittingLINK 3.0

- New firmware in wireless fitting dongle
- No intermediate neckloop device
- Direct two-way transmission to and from the hearing instruments
- 2.4 GHz Bluetooth® Low Energy (BLE) technology

Desk stand

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SONIC Everyday Sounds Better

Enchant

Adaptive, all day long

SONIC Everyday Sounds Better

ZPower with Enchant miniRITE

- Simple and convenient
  - Hold 40% more charge than other rechargeable microbatteries
  - Can interchange with disposable batteries if needed
  - Last approximately 1 year – buy them once annually

Estimated battery life with ZPower*

	Listening Activities	Duration Per Charge
Normal Use plus	No streaming	18 – 19.5 hours
	90 minutes of iPhone® streaming	16 – 17 hours
	4 hours of TV + 1 hour of iPhone streaming	15 – 16 hours

*Estimated battery life may vary depending on the use of the hearing aid, the degree of hearing loss, amplification and listening activities.

ZPower®

ZPower - New in 2018!

- Charger Station firmware update
  - Improved charging process ensuring a 100% charge, even when contact with battery door and battery is weak
  - Improved battery detection
- Charger firmware updater tool
  - Available on the ZPower website:

  https://zpowerhearing.com/fwupdates

ZPower®

In Summary

Thank you!

- We appreciate your time joining us for today's course!
- Should you have any questions, please contact Audiology Support @ Sonic
  - 888.423.7834
  - www.sonici.com

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Instinctively Smart.

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