

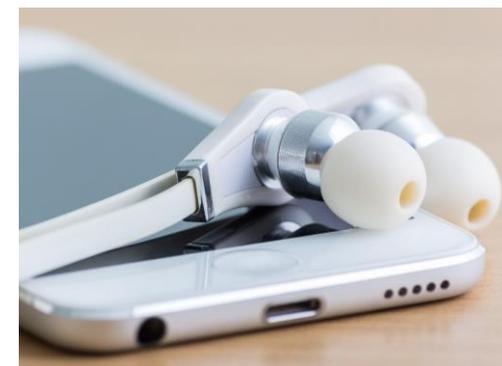


PersonaSound™

**HEARING, VOICE, AUDIO,
ENHANCEMENT TECHNOLOGIES**

for TWS earbuds, headsets, OTC
hearing aids & beyond

September 2022



SINCE 2002 – MAKING DIGITAL SOUND BETTER

- Embedded DSP Software for **digital sound enhancement**
- Twenty years of successful experience in algorithms, embedded DSP software and software licensing
- 40 Alango employees worldwide
- Sales offices and reps in China, Korea, Japan, Taiwan, Singapore



OVER 70 MILLION PRODUCT LICENSES SOLD

as of 2022



KEY FIELDS OF OPERATION



Automotive
hands-free calls
& audio



TWS earbuds,
headsets &
hearables



Audio/video
conferencing



Hearing aids and
assistive listening



SMART: speakers,
TV, appliances

ALANGO SOFTWARE MAKES SOUND BETTER FOR...



**VOICE
COMMUNICATIONS**



**AUDIO
PLAYBACK**



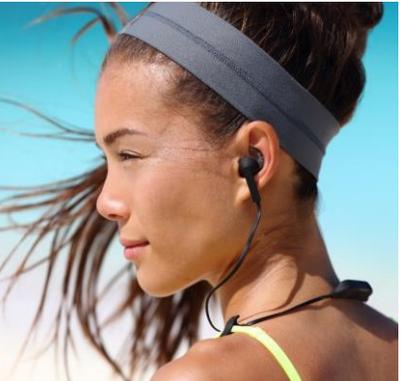
**AUGMENTED
HEARING**



**SPEECH
RECOGNITION**

ONE SOUND DOES NOT FIT ALL

We have distinct hearing profiles and listening preferences.
We need to make sound personal.



PersonaSound™ CONCEPT: MAKING SOUND PERSONAL

AUGMENTED LISTENING



Music and audio perception



Remote voice communications

AUGMENTED HEARING



Face-to-face voice communications



Live music



Sound of nature



Hearing protection

PersonaSound IS FOR HEARABLES



HEADPHONES



**NECK-HARNESS
HEADSETS**



**TRUE WIRELESS
EARBUDS**



**OVER THE COUNTER
HEARING AIDS**

PersonaSound IN ALANGO DSP SOFTWARE PACKAGES



HEARING CONTROL PACKAGE (HCP)

Hearing test
Loudness/tone control
HEP parameters calculator



HEARING ENHANCEMENT PACKAGE (HEP)

Adaptive Beamforming
Noise Reduction
Feedback cancellation
Personalized Amplification
Own-Voice Attenuation



AUDIO ENHANCEMENT PACKAGE (AEP)

Personalized Audio Enhancement
Ambient Noise Dependent Equalizer
Smart Transparency
Sound Effects Normalization



VOICE COMMUNICATION PACKAGE (VCP)

Incoming Voice Personalization
Incoming Noise Reduction
Ambient Noise Dependent Equalizer

HEARING SELF-TEST: ASSESSMENT



LAUNCHING HEARING TEST USER INTERFACE ON A SMARTPHONE

Alango to provide supporting examples.



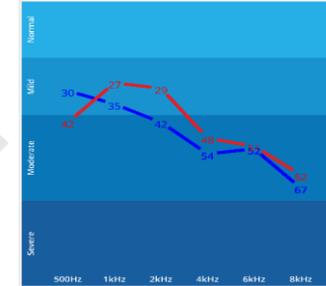
START THE HEARING TEST

User hears wobbling test tones of different frequencies, one tone one ear at a time.



FOR EACH TEST SOUND:

The user adjusts the volume until finding his/her hearing threshold (the level at which the tone is barely audible).



AUDIOGRAM & HEARING PROFILE

Upon completion, the thresholds are presented as an audiogram and saved as a hearing profile.



UPLOAD AND APPLY

The hearing profile is uploaded to the device and the user enjoys personalized sound in all device modes (hearing, music, phone calls).

PersonaSound IS MUCH DIFFERENT THAN FREQUENCY EQUALIZATION

TYPICAL HEARING LOSS

- Different for different frequencies, high frequency loss being the most common.
- Not a simple attenuation of sounds. Quiet sounds are attenuated more than loud sounds.

LINEAR AMPLIFICATION & FREQUENCY EQUALIZATION DOESN'T WORK WELL

- Additional amplification of loud sounds can become overbearing and even harmful.

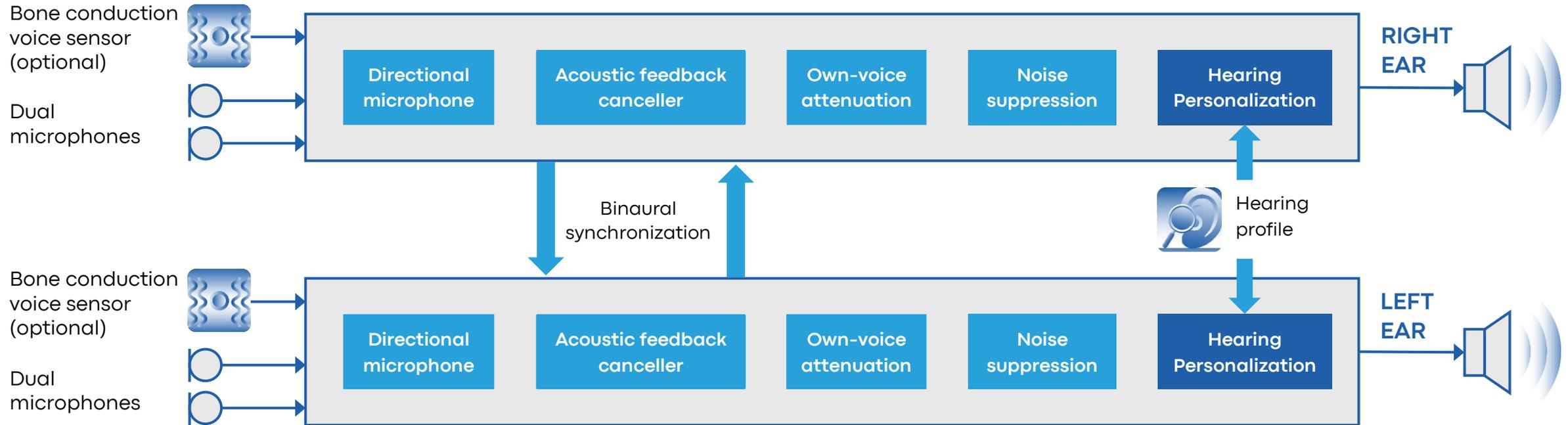
TRUE HEARING LOSS COMPENSATION

- PersonaSound is based on Wide-band Dynamic Range Compression (WDRC) principals. Sounds are amplified depending on their frequency and level and according to the measured hearing loss.



**Parameters
of Wide-band
Dynamic Range
Compressor**

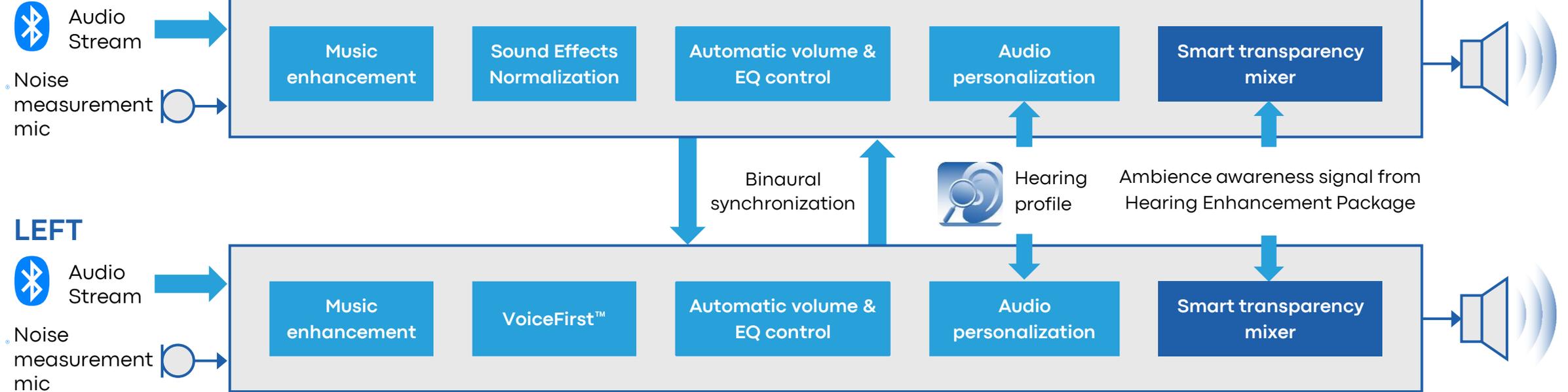
HEARING ENHANCEMENT PACKAGE (HEP)



- Hearing Personalization by Wide-band Dynamic Range Compression
- Binaural Directivity for conversation focus using 2 synchronized beamforming mic-pairs
- Own (user's) voice detection and attenuation using bone conduction voice sensor

AUDIO ENHANCEMENT PACKAGE (AEP)

RIGHT

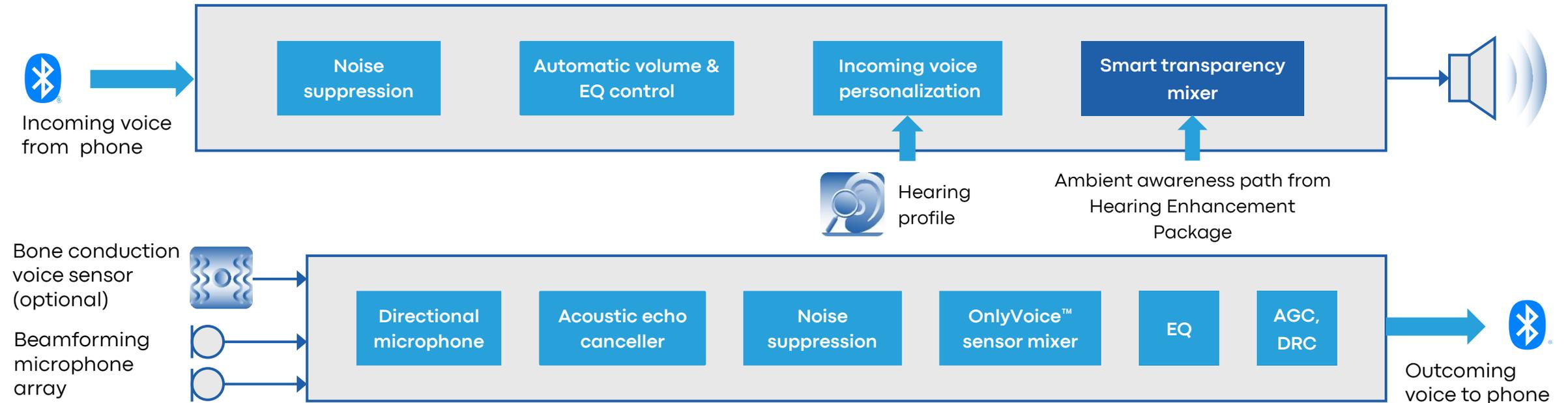


LEFT



- Audio-Personalization Wide-band Dynamic Range Compression.
- Music Enhancement for normalizing stereo effect, enhancing weak spectral components and emphasizing bass.
- VoiceFirst™ reduces overbearing sound effects and boosts speech intelligibility of streamed AV content.
- Automatic Volume and EQ for adjusting sound according to ambient noise amplitude and spectrum.
- Intelligent transparency mixer “unmasks” important ambient sounds masked by loud music for better awareness.

VOICE COMMUNICATION PACKAGE (VCP)



- Incoming voice personalization by Wide-band Dynamic Range Compression
- Automatic Volume and EQ of incoming voice according to ambient noise amplitude and spectrum for true hands-free operation
- Sub-band dual microphone array for exceptional speech transmit quality from noisy environments
- OnlyVoice™ technology utilizing a bone conduction voice sensor for ultimate speech quality in extreme noise environments

FIELD-PROVEN TECHNOLOGIES REPRESENTED IN ALANGO BeHear®

- Self-fit, advanced, personalized listening & hearing amplification
- Full Bluetooth stereo headset functionality optimized for user's specific hearing loss
- Assistive listening capabilities
- Built-in hearing test (controlled by BeHear smartphone app)



BeHear SMARTO



BeHear ACCESS



BeHear PROXY

ALANGO BeHear ACCESS COMPARED TO ADVANCED HEARING AIDS

Speech Intelligibility Index (SSI) demonstrates which percentage of speech is intelligible to the user. More information on SSI:

<https://blog.ansi.org/2016/06/speech-intelligibility-index>

BeHear ACCESS SSI is higher compared to Advanced HA in all three tests at 55dB, 65dB, 75dB.*



BeHear ACCESS

LEGEND, RIGHT		
1	SII: [46%]	NAL NL2 – 55 (84) dB – ISTS Si...
2	SII: [63%]	NAL NL2 – 65 (90) dB – ISTS Si...
3	SII: [71%]	NAL NL2 – 75 (93) dB – ISTS Si...

Advanced Hearing Aids (a top model from one of big 5)

LEGEND, RIGHT		
1	SII: [42%]	NAL NL2 – 55 (82) dB – ISTS Si...
2	SII: [54%]	NAL NL2 – 65 (86) dB – ISTS Si...
3	SII: [63%]	NAL NL2 – 75 (89) dB – ISTS Si...

* Full report available upon request

ALANGO'S COMPETITIVE ADVANTAGES

Alango Technologies is the only company having:

- Comprehensive portfolio of proven technologies (hearing, voice, audio)
- Established relevant customer base of major OEMs
- Established partnership networks with major chipset providers and ODM manufacturers
- Line of BeHear concept products that users love
<https://alango-behear.com>
- 20 years of successful experience in DSP software licensing



PersonaSound

BEYOND HEARABLES

We can help making all this devices to sound personal:



TV, SOUNDBAR



CAR



PC



STEREO

THANK YOU!

**DON'T HESITATE TO CONTACT US.
WE ARE ALWAYS LOOKING FORWARD
TO HEARING FROM YOU!**

Email us your questions, comments,
thoughts, or proposals.



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Sales enquiries - sales@alango.com

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APPENDIX

VOICE TECHNOLOGIES

EasyListen™

OnlyVoice™

Dynamic Noise Suppression

Wind Noise Reduction

Acoustic Echo Cancellation

Acoustic Feedback Reduction

Adaptive Dual Microphone

Multi-Microphone Arrays

Automatic Volume and eQualization Control

Automatic Gain Control

Multiband Dynamic Range Processing

Voice Activity Detection

AUDIO ENHANCEMENT TECHNOLOGIES

ListenThrough™

SonicVibrance™

Automatic Volume and eQualization Control

Loudspeaker Frequency Response Correction

Multiband Dynamic Range Processing

VoiceFirst™

ALANGO VOICES TECHNOLOGIES

EasyListen™: REAL-TIME SPEECH TEMPO MODIFICATION

Real-time audio processing technology that slows incoming speech, making it more intelligible.

Works by dynamically stretching (slowing) certain parts of speech while adding no noticeable overall delay.

ALANGO VOICES TECHNOLOGIES

OnlyVoice™:

ULTIMATE VOICE QUALITY FROM EVERYWHERE

Enables robust voice acquisition in True Wireless earbuds from extreme noise conditions.

Works by intelligently mixing the output of adaptive dual microphone beamforming with bone conduction voice sensor.

Can work with in-ear feedback microphone instead of the sensor.

ALANGO VOICES TECHNOLOGIES

DYNAMIC NOISE SUPPRESSION

Reduces stationary and dynamic noises (e.g. approaching car) in single-channel speech signals without noticeable artefacts.

Dynamic Noise Suppression increases the signal-to-noise ratio and improves speech intelligibility thus reducing listening fatigue.

ALANGO VOICES TECHNOLOGIES

WIND NOISE REDUCTION (WNR)

Automatically detects and attenuates wind noise while preserving clear speech.

WNR uses sub-band processing to filter out wind noise in affected frequency regions leaving “good” frequency regions untouched.

ALANGO VOICES TECHNOLOGIES

ACOUSTIC ECHO CANCELLATION (AEC)

Eliminates acoustic coupling between speaker and microphone, allowing high-quality, full-duplex voice communication without echo.

Alango AEC technology supports mono and stereo echo cancellation with very fast adaptation times.

Alango AEC includes highly efficient, sub-band Acoustic Echo Suppressor.

ALANGO VOICES TECHNOLOGIES

ACOUSTIC FEEDBACK REDUCTION

Alleviates acoustic feedback by using sub-band adaptive filtering, noise and howling suppression, and quasi-proportional frequency shifting.

ALANGO VOICES TECHNOLOGIES

ADAPTIVE DUAL MICROPHONE

Creates a directional or noise-canceling microphone using just two omnidirectional microphones.

Adaptively changes mic directionality to achieve best possible noise reduction.

Includes adaptive wind noise suppression.

Allows optional microphone calibration during the production.

ALANGO VOICES TECHNOLOGIES

MULTI-MICROPHONE ARRAYS

Multi-microphone adaptive beamforming with 2 or more microphones.

Allows multi-beam configurations and sound of arrival detection.

Robust to wind noises.

ALANGO VOICES TECHNOLOGIES

AUTOMATIC VOLUME AND EQUALIZATION CONTROL

Improves perceptual loudness and intelligibility of voice in dynamic environment with changing noises.

Works by automatically amplifying and equalizing sounds in response to ambient noise characteristics.

ALANGO VOICES TECHNOLOGIES

AUTOMATIC GAIN CONTROL

Used in conjunction with Dynamic Range Processing to amplify a weak voice signal.

To reduce noise pickup, gain is applied only when user voice activity is detected.

ALANGO VOICES TECHNOLOGIES

MULTIBAND DYNAMIC RANGE PROCESSING

Adjusts the dynamic range of an audio signal by

- splitting into frequency sub-bands,
- processing each band according to specified characteristics, and
- synthesizing the resultant signal.

ALANGO VOICES TECHNOLOGIES

VOICE ACTIVITY DETECTION

Differentiates between voice and ambient noises in an acoustic signal, enabling low-power operation of always-on devices.

The VAD block acts as a low-power “watchdog,” alerting the system to use heavier processing blocks only when the user’s voice is detected.

ALANGO AUDIO ENHANCEMENT TECHNOLOGIES

ListenThrough™: ENVIRONMENTAL AUDIO AWARENESS

Improves situational awareness for stereo headset users.

Important external sounds are emphasized to avoid masking by music, while ambient noise is filtered out.

ALANGO AUDIO ENHANCEMENT TECHNOLOGIES

SonicVibrance™: MUSIC ENHANCEMENT

An integrated set of DSP technologies to enhance the audio experience in music and entertainment applications, including:

- stereo expansion (normalization)
- spectral enhancement,
- bass correction and amplification

ALANGO AUDIO ENHANCEMENT TECHNOLOGIES

AUTOMATIC VOLUME AND EQUALIZATION CONTROL

Increases the perceived loudness and clarity of music being played in noisy environments.

Works by adaptively amplifying and equalizing the music in response to changing ambient noise characteristics.

ALANGO AUDIO ENHANCEMENT TECHNOLOGIES

LOUDSPEAKER FREQUENCY RESPONSE CORRECTION

Corrects loudspeaker amplitude and phase responses for reproducing natural sound.

ALANGO AUDIO ENHANCEMENT TECHNOLOGIES

MULTIBAND DYNAMIC RANGE PROCESSING

Improves the listening experience by adjusting the dynamic range of an audio signal.

Applies dynamic range processing to frequency sub-bands of the audio signal, recombines the sub-bands after processing, and optimizes the gain of the resultant signal.

MDRP is fully configurable to whatever number of channels and attack/release points.

ALANGO AUDIO ENHANCEMENT TECHNOLOGIES

VoiceFirst™

Improves listening experience by enhancing speech intelligibility of TV, movies, and sports broadcasts.

Works by detecting and attenuating background sounds while preserving speech and dialogue.