alango

Front End DSP Audio Technologies for In-Car Applications
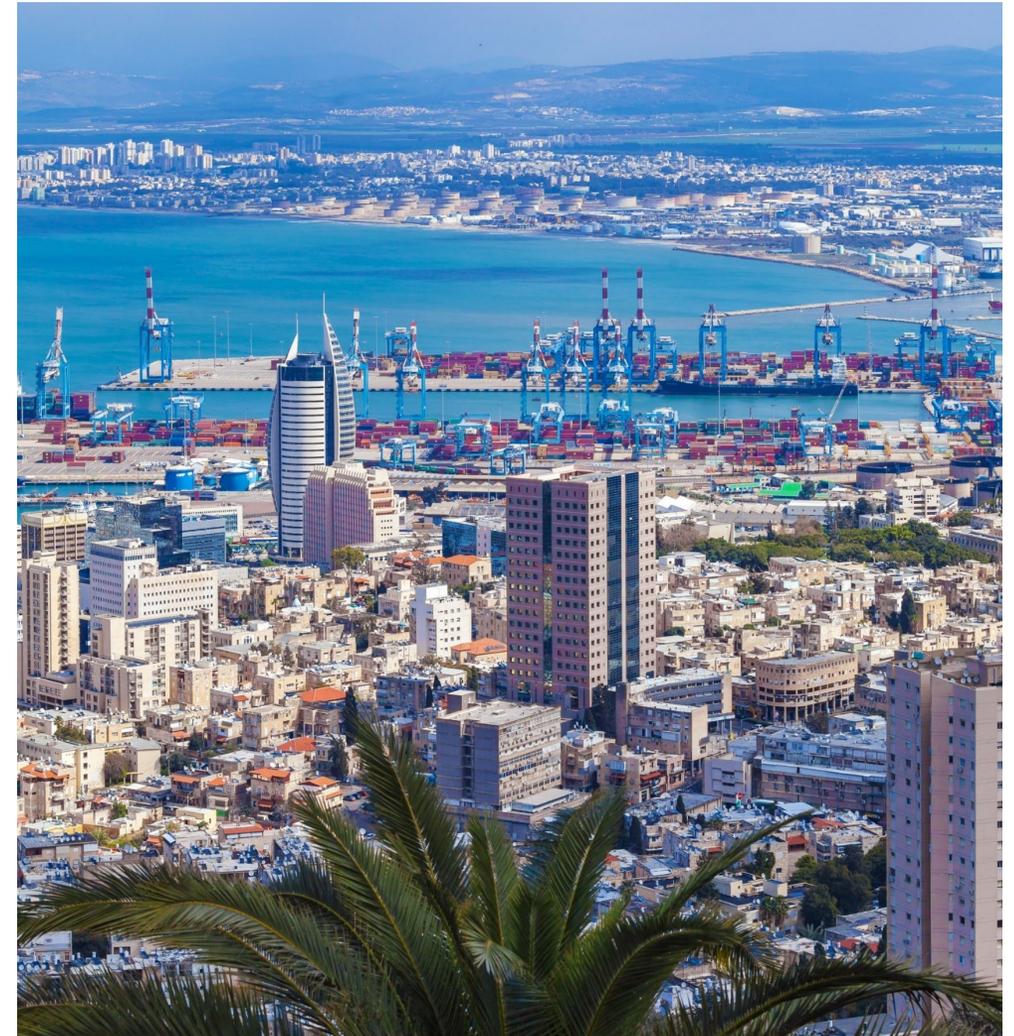
About Alango

SINCE 2002

- Embedded DSP Software for **digital sound enhancement**

- **Twenty years of practical experience** in algorithms, embedded DSP software and software licensing

- **27** Alango **employees**

- **Sales offices and reps** in China, Korea, Japan, Taiwan, Singapore

HQ, R&D:
Haifa, Israel

Alango Solutions

VOICE COMMUNICATION

Voice Communication Package (VCP)
Sound Reinforcement Package (SRP)

SOUND PERSONALIZATION

PersonaSound™

SPEECH RECOGNITION

Voice Enhancement Package (VEP)
Voice Activity Detector (VAD)

MUSIC ENHANCEMENT

Audio Enhancement Package (AEP)
Auto Volume & Frequency Equalization (EQ)
SonicVibrance™

SOUND ACQUISITION

SoundAround™
SoundDetector™

VCP – Voice Communication Package

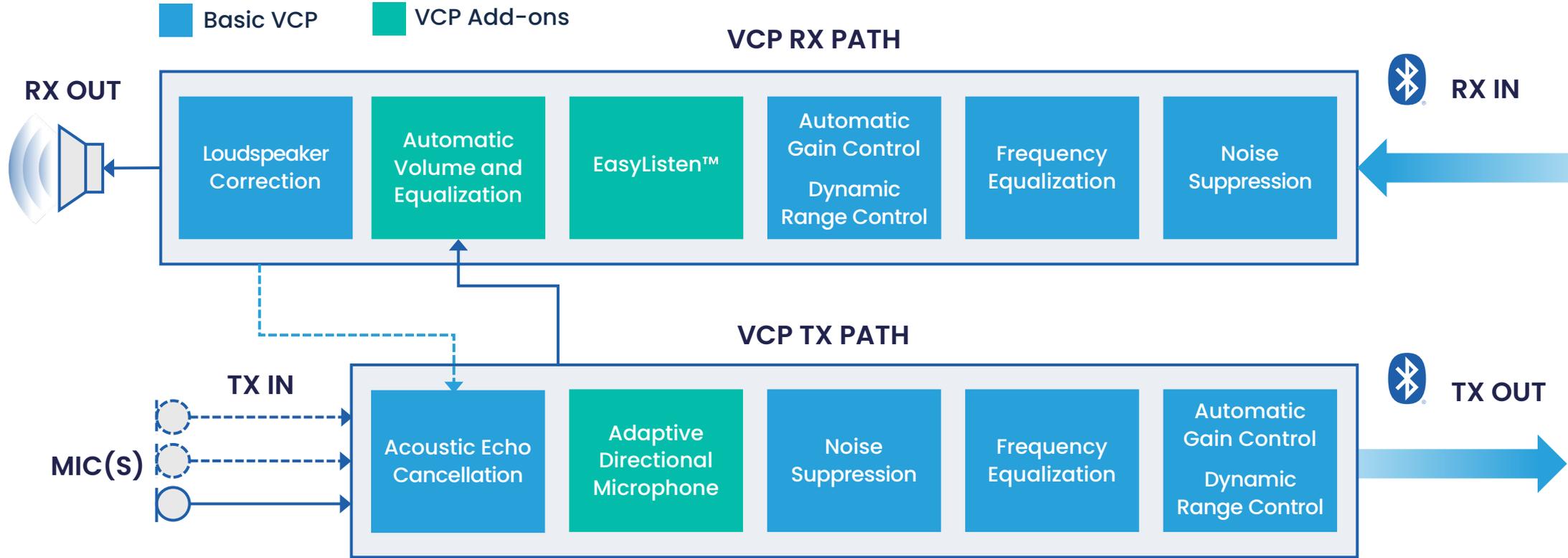**ESSENTIAL TECHNOLOGIES FOR AUTOMOTIVE HANDSFREE SYSTEMS**

- Enables crystal clear, full-duplex, noise-free voice calling in car

- Reduces different types of noises, cancels echoes, enhances speech

Voice Communication Package

OVER 20 MILLION CARS USE ALANGO VCP

(January 2019)

Legend: Basic VCP, VCP Add-ons

VCP RX PATH

RX OUT — Loudspeaker Correction — Automatic Volume and Equalization — EasyListen™ — Automatic Gain Control / Dynamic Range Control — Frequency Equalization — Noise Suppression — RX IN

VCP TX PATH

TX IN / MIC(S) — Acoustic Echo Cancellation — Adaptive Directional Microphone — Noise Suppression — Frequency Equalization — Automatic Gain Control / Dynamic Range Control — TX OUT

VCP Numbers

The numbers below are based on ARM Cortex A9 with Neon instructions and correspond to "typical" automotive acoustic settings with AEC echo tail of 100ms.

Library type	Processing type	Program RAM, kB	Sampling rate, kHz	Data RAM, kB	MHz, average/ peak
VCP-F	With full RX processing	150 kB	16	95	75 / 85
VCP-F	Without RX processing	150 kB	16	80	65 / 75
VCP-L	With full RX processing	155 kB	16	80	60 / 70
VCP-L	Without RX processing	155 kB	16	55	35 / 40

Numbers may vary for different VCP versions, DSP/MCU/MPU types, levels of optimization

VCP-F – VCP full version, 32Hz frequency resolution

VCP-L – VCP lite version, 64Hz frequency resolution
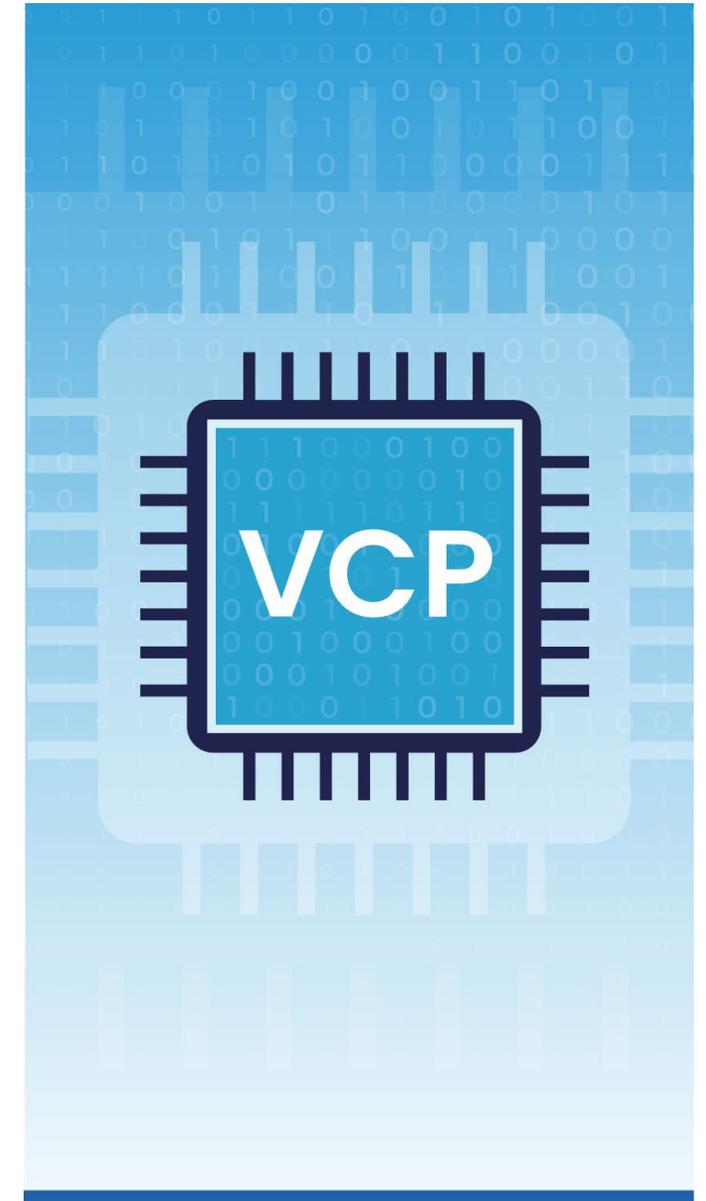
# Next Generation Hands-Free Voice Communication

DUAL-MICROPHONE VCP

Improved noise reduction:

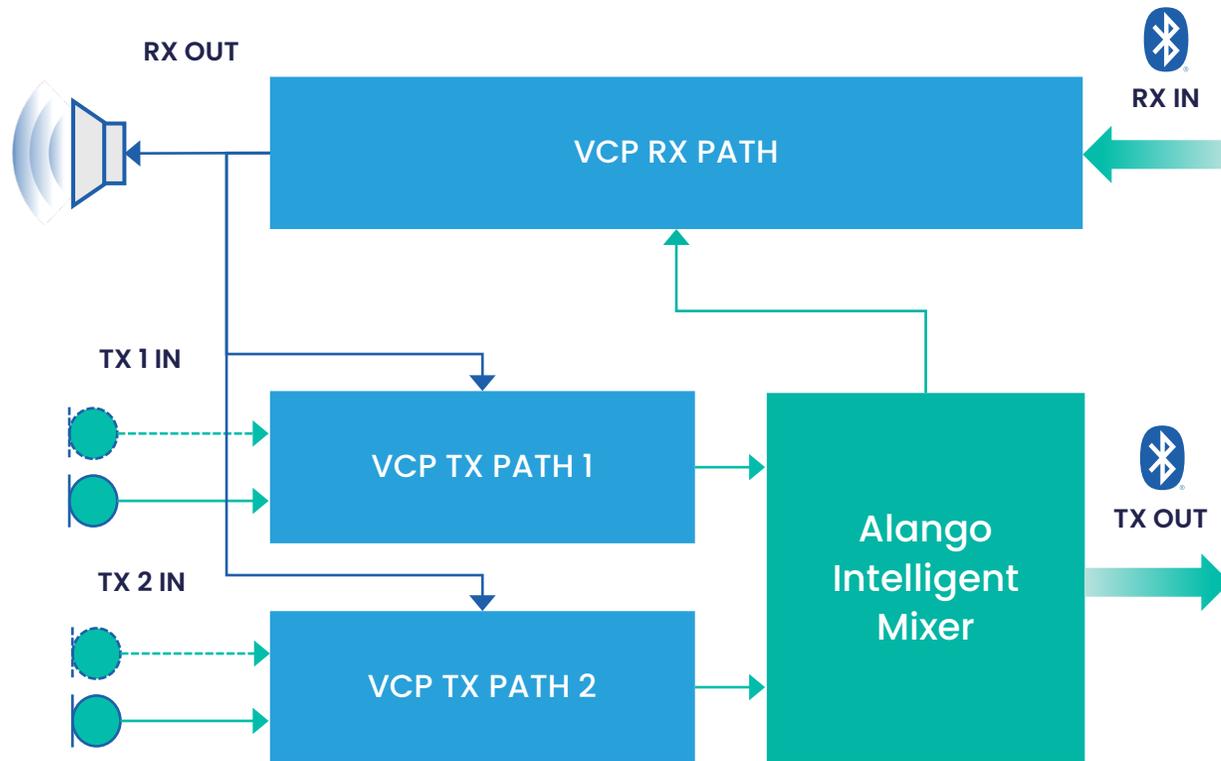- Road, engine, and wind noises

- Rear passenger voices

Driver-selectable mic zones:

- Driver's voice enhanced

- Passenger's voice enhanced

- Both voices enhanced

Support for mic beamforming arrays or driver/passenger mic mixer

DUAL MIC ARRAY

DRIVER MIC BEAM

PASSENGER MIC BEAM
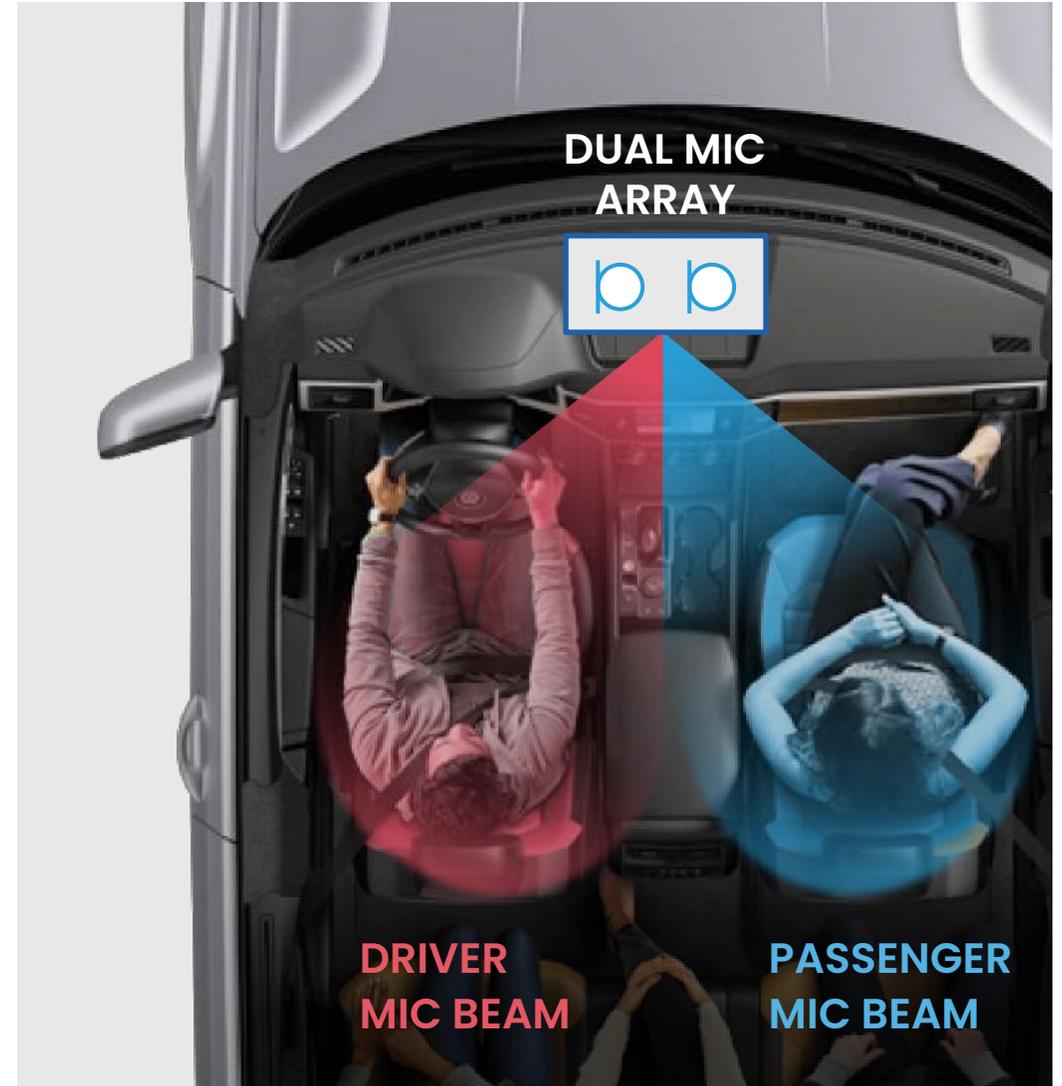
Extended VCP(eVCP) for Distributed MIC Zones

In INTELLIGENT MIXING MODE

both the driver's and passenger's voices are preserved, while ambient noise and echo are attenuated.

In PASSENGER REJECTION MODE

the driver's voice is preserved while the passenger's voice, ambient noise and echo are attenuated.

eVCP Numbers

eVCP footprint (MIPS and memory) depends on the number of zones and other acoustic settings. Single-zone footprint is identical for VCP8 footprint (refer to VCP8 data-sheet).

Dual-zone, single-microphone eVCP footprint based on ARM Cortex A9 with Neon instructions and correspond to "typical" automotive acoustic settings with AEC echo tail of 100ms.

Library type	Processing type	Program RAM, kB	Sampling rate, kHz	Data RAM, kB	MHz, average/ peak
eVCP (VCP Full-based)	With full RX processing	160 kB	16	175	130 / 150
eVCP (VCP Light-based)	With full RX processing	165 kB	16	130	90 / 100

Numbers may vary for different VCP versions, DSP/MCU/MPU types, levels of optimization

eVCP-F – VCP full version, 32Hz frequency resolution

eVCP-L – VCP lite version , 64Hz frequency resolution
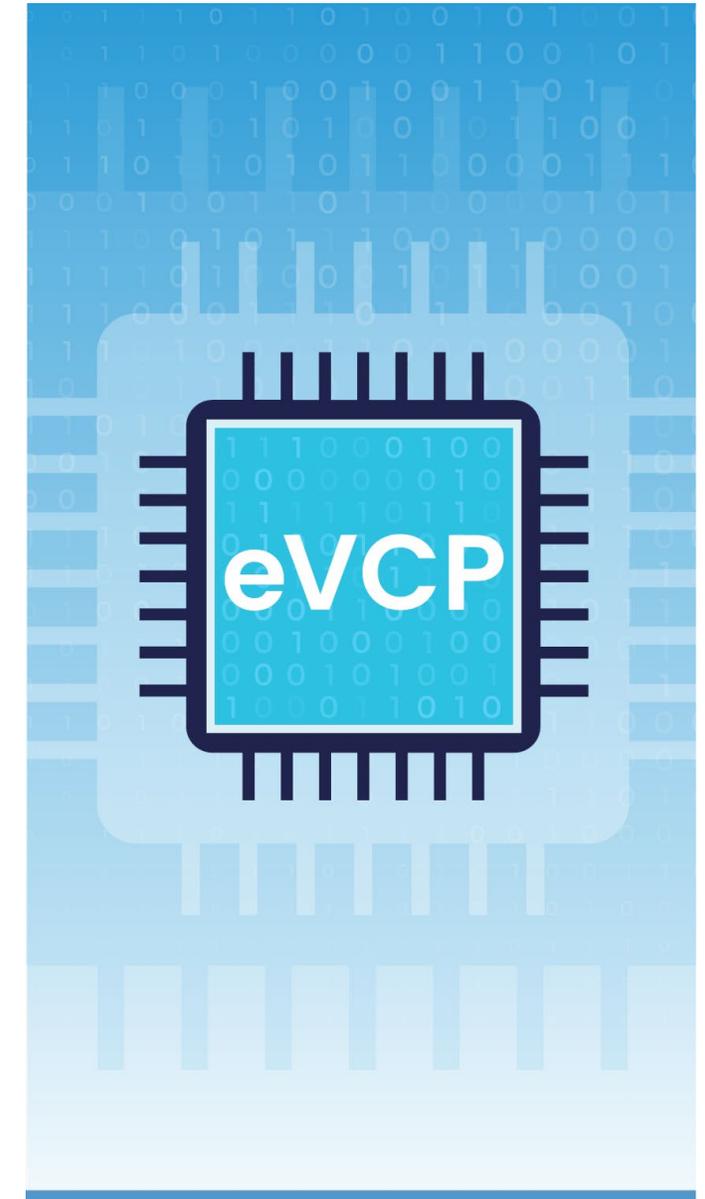
VCP Auto Industry Compliance

CLASS "TYPE 1":

Full Duplex Echo Cancellation

ITU-T
P.1100/P.1110 /P.1120
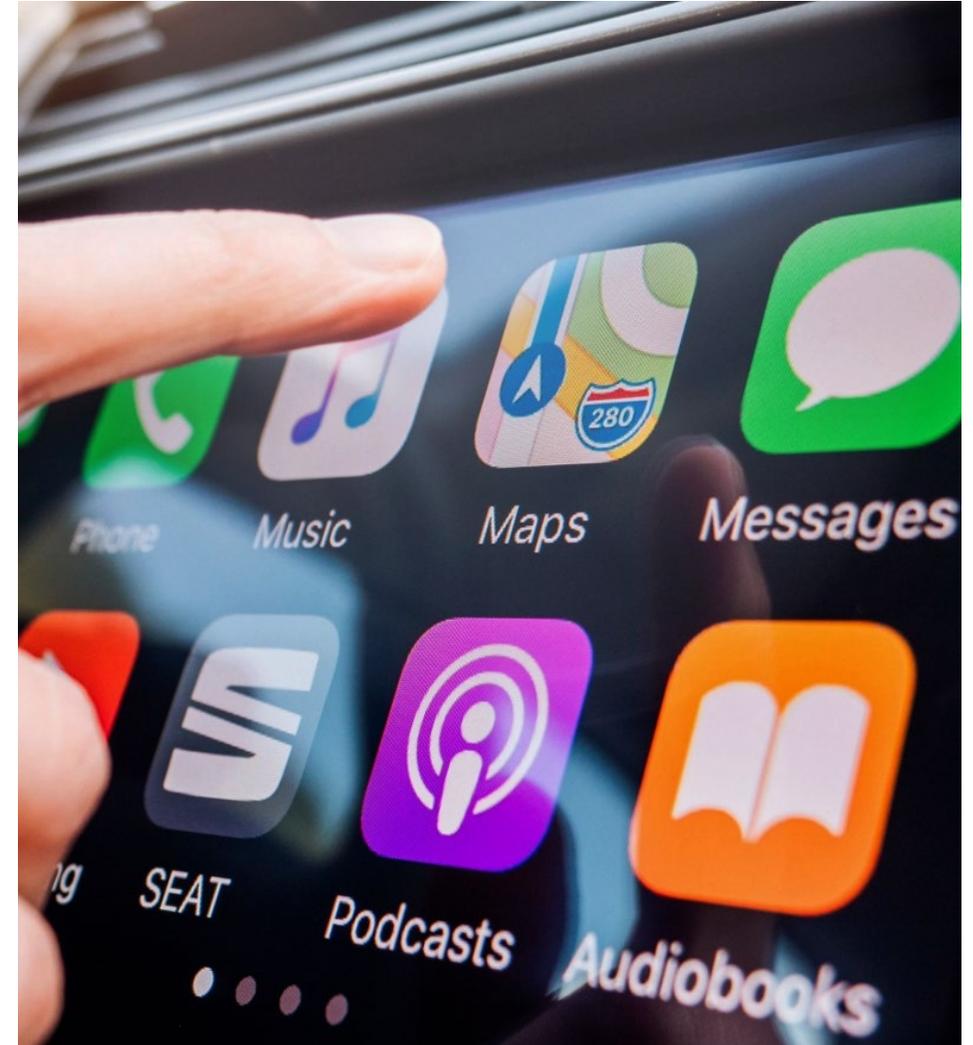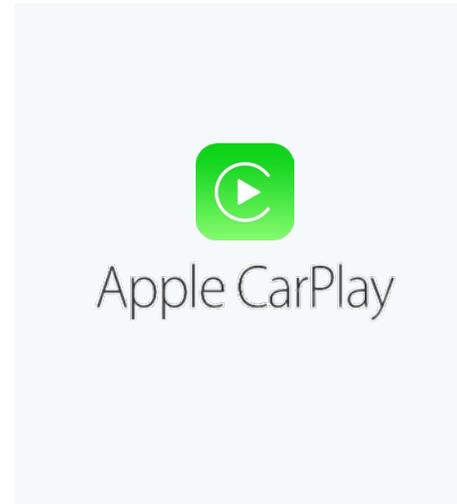
GOST R55531

eCall

VCP For Smart Phone Enabled Display Audio

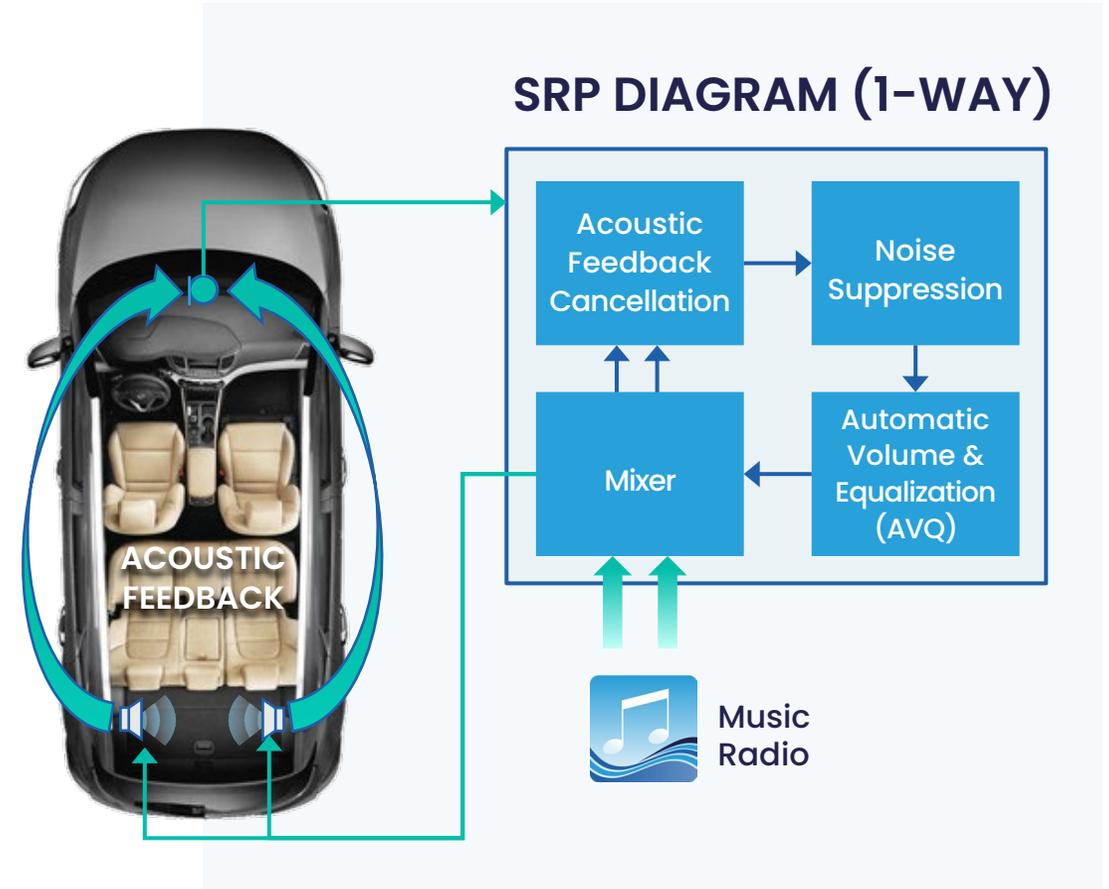**SUITABLE FOR AFTERMARKET PRODUCTS**

(single tuning for multiple cars)

VCP For Smart Phone Enabled Display Audio

SRP ENABLES COMFORTABLE, CONVENIENT VOICE COMMUNICATION BETWEEN DRIVER AND REAR SEAT PASSENGERS

- **Supports 1-way and 2-way ICC modes**; single-mic and multi-microphone configurations

- **Enables >12dB** of additional voice amplification before feedback

- **Adaptive noise suppression** provides up to 30dB noise reduction with low distortion

- **Stereo Echo Cancellation** allows for amplified voice communication with no need to pause the music

- When integrated into a low-latency audio framework, SRP's total delay of 8ms (6ms algorithm delay + 2ms audio buffer) is virtually imperceptible to the driver and passengers

- **Output volume and voice equalization are automatically adjusted based on cabin noise conditions** to ensure comfortable, intelligible voice output in varying driving scenarios

SRP DIAGRAM (1-WAY)

ACOUSTIC FEEDBACK

Acoustic Feedback Cancellation → Noise Suppression → Automatic Volume & Equalization (AVQ) → Mixer

Music Radio

Sound Reinforcement Package

SRP DEMO VIDEO

2-way SRP demonstrated on ADI SHARC + processor

[Watch video on youtube.com](#)

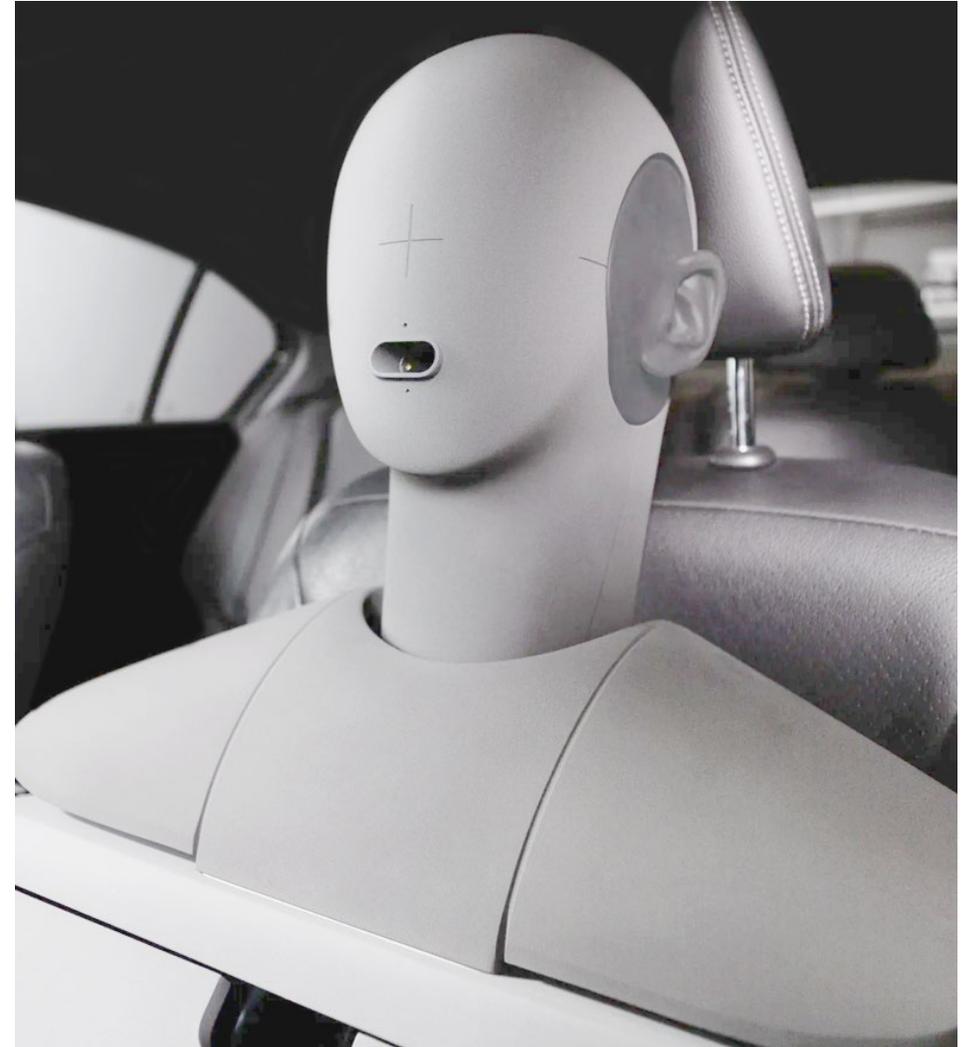[Watch video on alango.com](#)

[Download video from alango.com (69mb)](#)

In Cabin Communication SRP
Auto Industry Compliance

ITU-T P.1150

CERTIFIED BY

Speech Recognition Improvement with VCP

Using the **same DSP processing blocks with alternate configurations**, VCP can be configured for both human-to-human voice communication and human-to-machine voice preprocessing.

VCP CONFIGURED FOR ASR

- Cleans and enhances the voice signal

- Leads to higher accuracy of speech recognition

- Works with any speech recognition engine

- Supports voice pickup during music playback

Stereo Music Reference

VCP (ASR CONFIGURATION)

MIC(S)

| Acoustic Echo Cancellation | Adaptive Directional Microphone | Noise Suppression | Frequency Equalization | Automatic Gain Control / Dynamic Range Control |

TO ASR/ KWR

Automatic Speech Recognition Enhancement Tests

TEST SCENARIO:

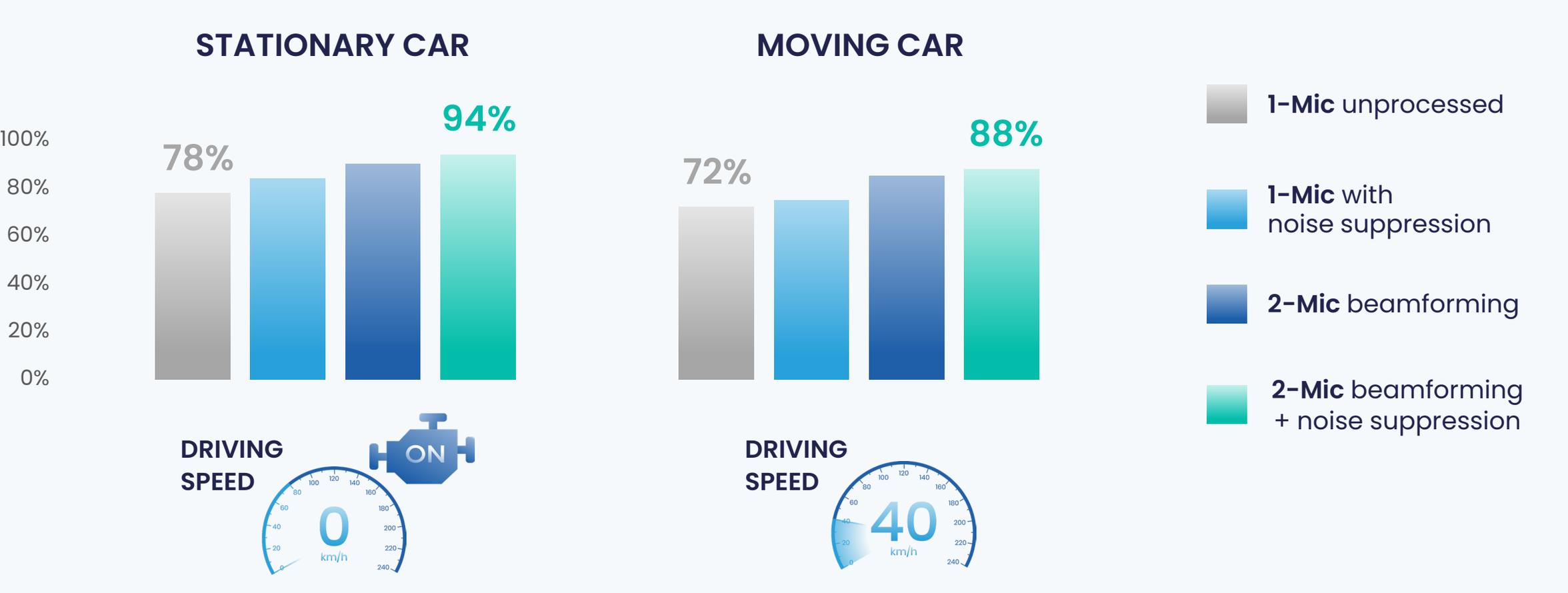By what measure is speech recognition rate in cars improved by Alango preprocessing technologies?

TEST STANDARD:

Using Google speech recognition, only phrases recognized exactly correctly are counted.

MICROPHONE ARRAY

MOUTH SIMULATOR
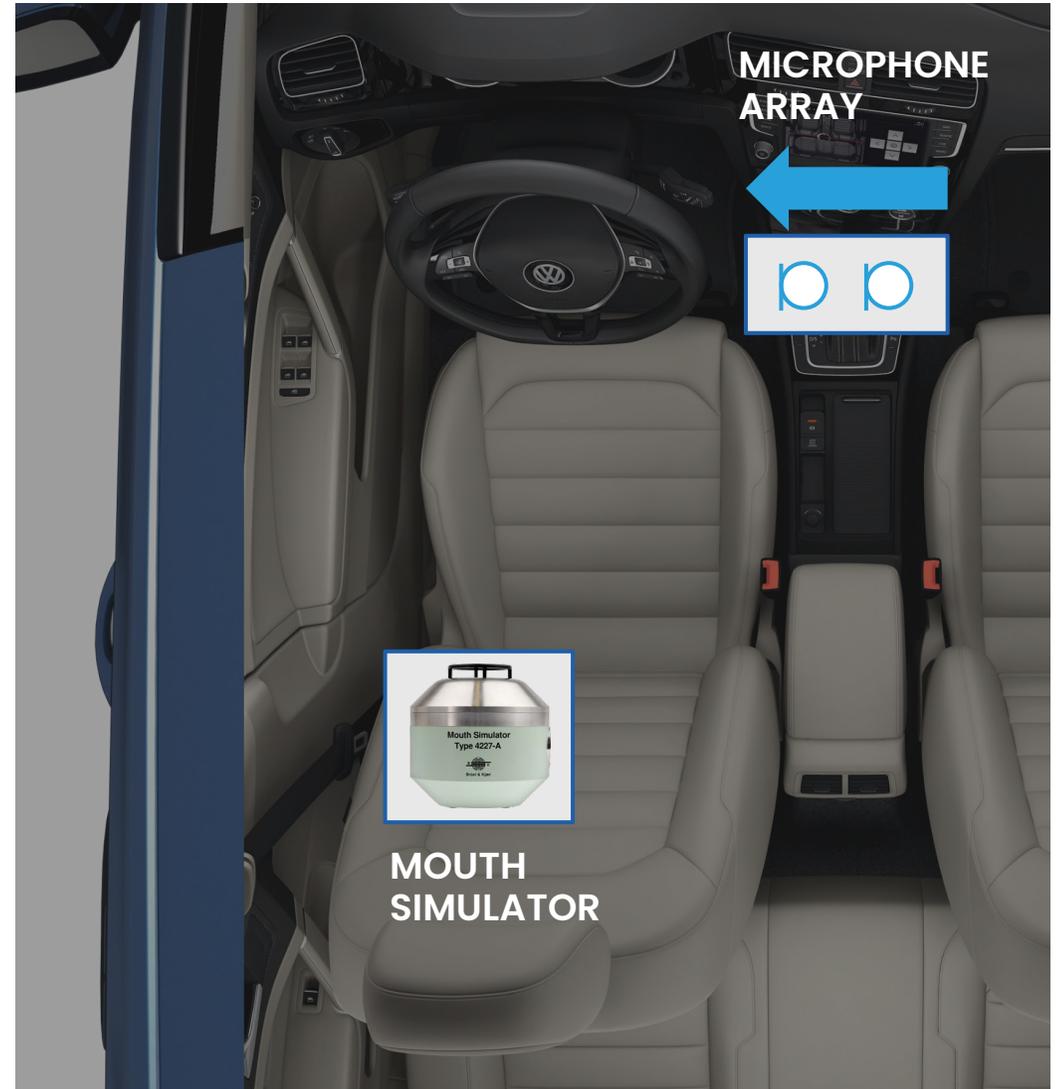
Speech Recognition Enhancement with VCP

Only phrases recognized exactly are counted as success!

STATIONARY CAR

94%
78%

100%
80%
60%
40%
20%
0%

DRIVING SPEED

ON

0 km/h

MOVING CAR

88%
72%

DRIVING SPEED

40 km/h

1-Mic unprocessed

1-Mic with noise suppression

2-Mic beamforming

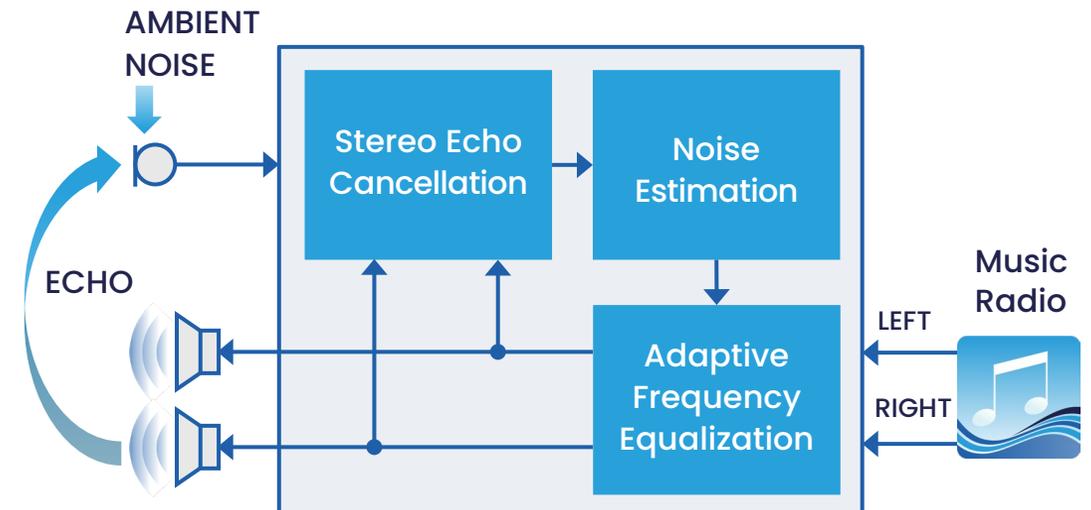2-Mic beamforming + noise suppression

Automatic Volume & eQualization (AVQ) Explained

AVQ DYNAMICALLY AMPLIFIES AND EQUALIZES MUSIC CONTENT TO COMPENSATE FOR VARIATIONS OF IN-CABIN NOISE LEVEL AND SPECTRUM

- Utilizes the existing handsfree microphone to monitor the in-cabin audio environment

- Directly measures cabin noise level and spectrum as experienced inside the car, providing real-time data (not relying on RPM-based noise estimation)

- Employs Automatic Volume & Equalization (AVQ) technology for continuous, automatic sound enhancement based on ambient noise conditions
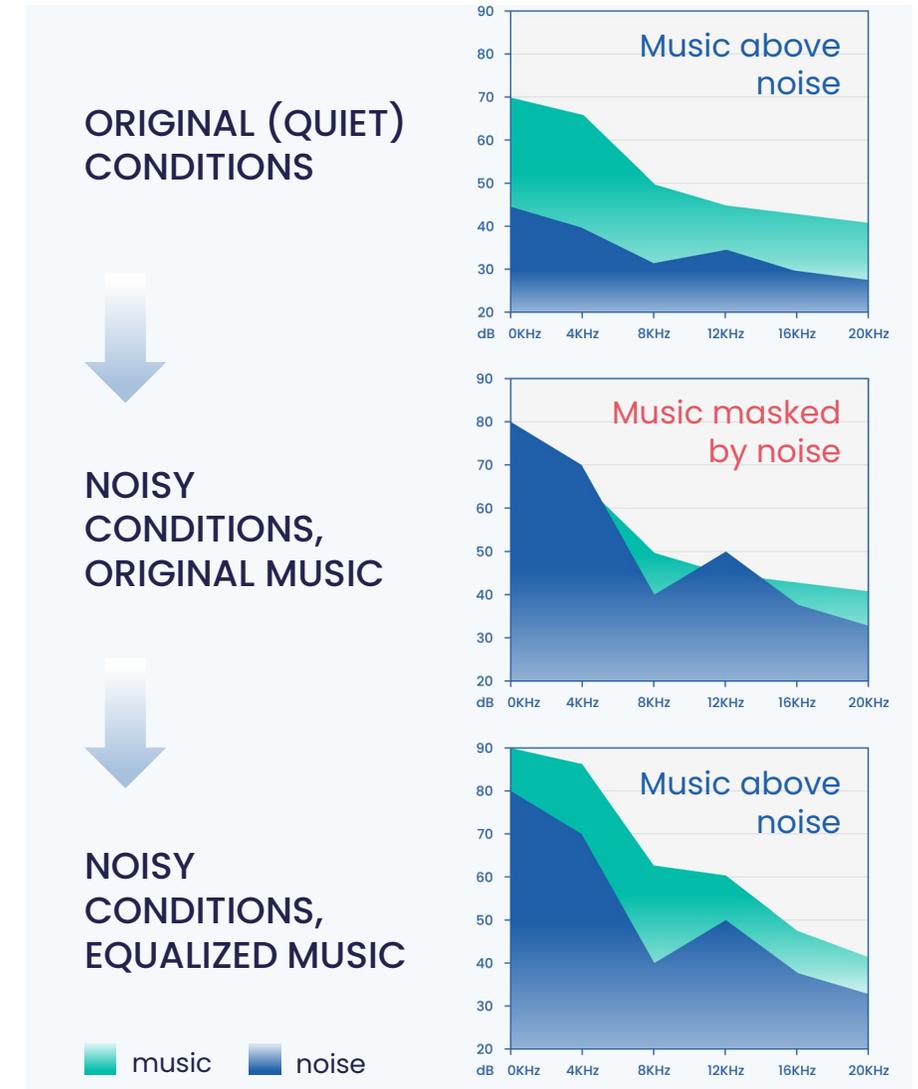

AUTOMATIC VOLUME & EQUALIZATION
ALANGO TECHNOLOGIES
INFO@ALANGO.COM

[Click to watch video](#)

AMBIENT NOISE

ECHO

Stereo Echo Cancellation

Noise Estimation

Adaptive Frequency Equalization

LEFT

RIGHT

Music Radio

Automatic Volume & eQualization (AVQ) Explained

ESSENTIAL TECHNOLOGIES FOR AUTOMOTIVE HANDSFREE SYSTEMS

- Dynamically adjusts volume and equalization to raise speech or music above changing background noise

- Amplifies specific parts of the audio spectrum that are masked by noise, ensuring consistent intelligibility and listening comfort

- Improves clarity of navigation prompts, voice calls, and music, adapting to variable driving conditions without manual intervention

ORIGINAL (QUIET) CONDITIONS

Music above noise

NOISY CONDITIONS, ORIGINAL MUSIC

Music masked by noise

NOISY CONDITIONS, EQUALIZED MUSIC

Music above noise

■ music   ■ noise

SonicVibrance™

PURPOSE

SonicVibrance™ makes in-car music more enjoyable by **brightening vocals, enhancing bass, and widening the stereo field**.

Music
Radio

| Stereo Normalizer | Spectral Compander | Bass Enhancer |

More information about the technology, sound examples and **demonstration software download** is here
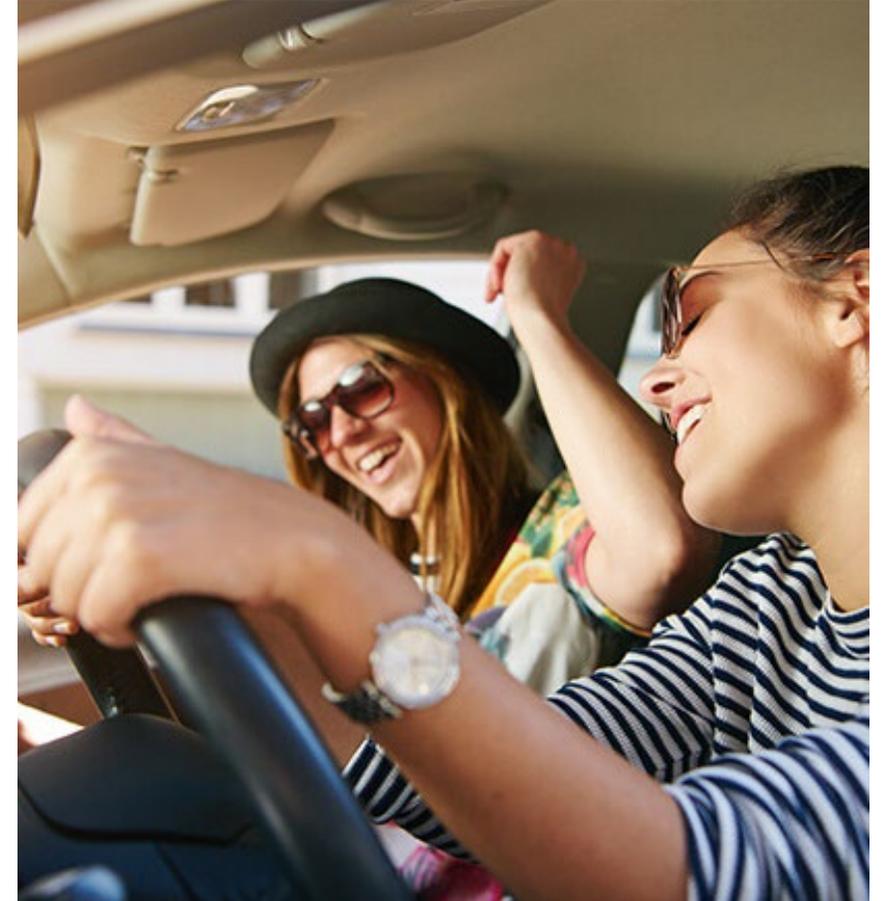
# Sound Personalization: Music, Calls, Podcasts, Navigation

PURPOSE

Adapts the sound to match each user's unique ear sensitivities and hearing preferences.

BENEFITS TO YOUR CUSTOMERS

Delivers a personalized listening experience, tailoring sound to individual hearing profiles. Restores natural detail and richness of music, improves speech intelligibility.

HOW WE MAKE IT HAPPEN

1. According to the age group (average)
2. Best Sound Point (patent pending)
3. Hearing Self-test with real time adjustment (pictured here)
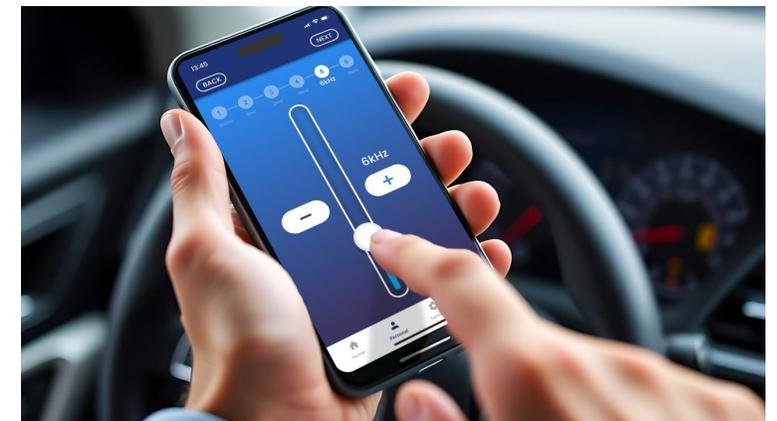
Hearing Threshold Test conducted on either the cockpit display or smartphone application
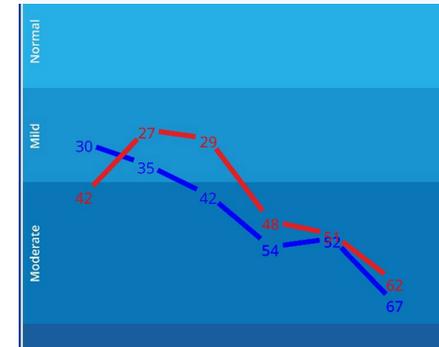
Personalization after Hearing Self-test

PURPOSE

Tone-audiology based hearing self test.

PROCEDURE

- Complete a hearing self-test.

- The app plays warbling tones at different frequencies, one at a time.

- Users adjust each tone to the lowest audible level to determine hearing thresholds.

- The device automatically calculates personalized amplification and wide dynamic range compression settings based on the thresholds.

- These settings are uploaded and applied to the head-unit for all sounds (voice, music, navigation prompts).

SELF TEST

RESULTANT AUDIOGRAM

ALL SOUNDS BECOME PERSONALIZED

# Best Sound Point - Personalization at Your Fingertips

PURPOSE

Provide a procedure of sound self-personalization without performing an explicit hearing test.

WHY

1. Some people are reluctant to take a hearing test that may indicate hearing loss.

2. Some people have normal hearing thresholds but still struggle with speech intelligibility and high dynamic range music.

PROCEDURE

1. Users activate the Best Sound Point tuning procedure on head-unit touch screen or smartphone. Each square represents processing parameters corresponding to a specific type and level of hearing loss.

2. While listening to music, podcasts, or prerecorded or live sound, users find the point on the screen where the sound is best for them.

3. The Best Sount Point parameters are set as standard and applied to all sounds.
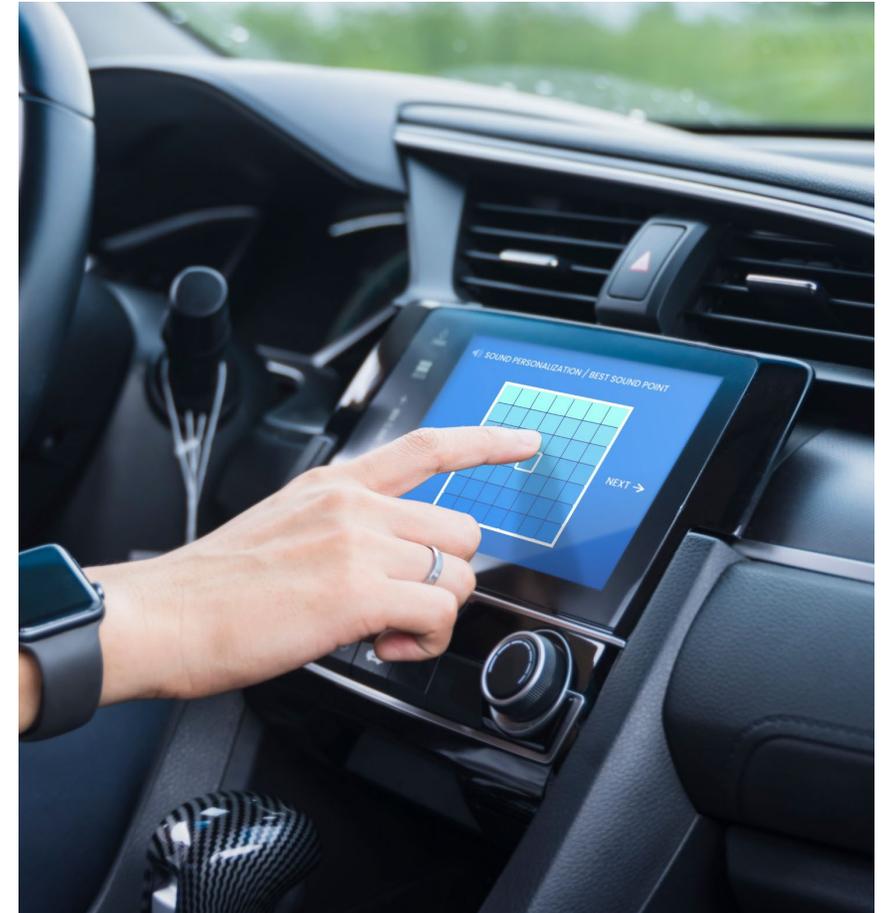
BSP - Best Sound Point the USER finds it!

SoundAround™ – Acquisition of external sounds without microphones

BACKGROUND

Combines an interior window-mounted sound pickup module and DSP software to acquire outside sounds while ignoring sounds inside a car.
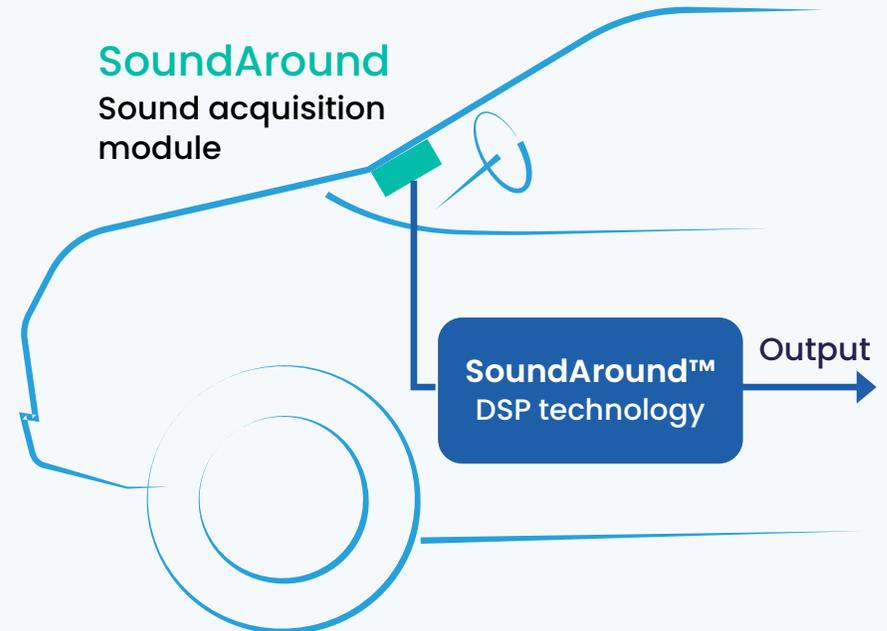
APPLICATIONS

- Autonomous and assisted driving

- Dashcam

- Blackbox

BENEFITS

- Reliable siren and acoustic events detection

- Outside sounds recording for all incidents

- Driver's alert to critical events around the vehicle

- Liability determination through preceding and collision sounds

Acquisition of external sounds **without external microphones**

SoundAround
Sound acquisition module

SoundAround™
DSP technology

Output

SirenDetector™ – Identification of police, ambulance, & fire trucks

BACKGROUND

Siren detection enhances safety and response times by effectively recognizing the presence of emergency sirens.
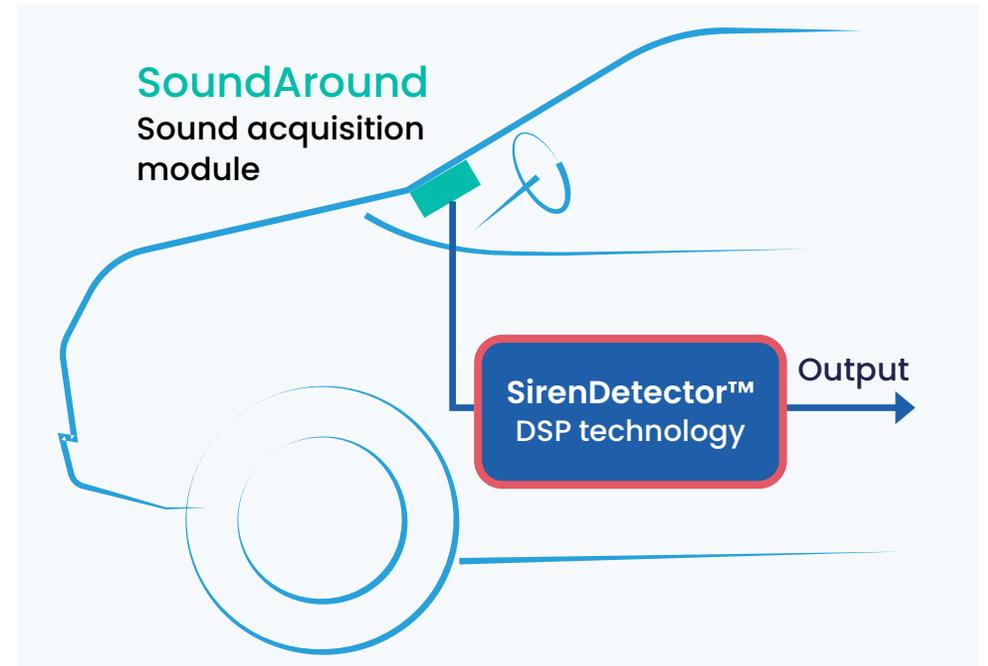
APPLICATIONS

- Autonomous and assisted driving
- Dashcam
- Blackbox

BENEFITS

- Alerts drivers to take precautions
- Adjusts behavior of autonomous vehicles

Siren acquisition ensures the signal is heard, while **siren detection** ensures the signal is acted upon.

SoundAround
Sound acquisition module

SirenDetector™
DSP technology

Output

Why Work with Alango?

OUR TECHNOLOGIES ARE FIELD PROVEN

30 million cars and aftermarket products use Alango technologies

OUR SOFTWARE IS EASY TO IMPLEMENT

extensive development tools and documentation available to ease tuning and integration

OUR SOFTWARE IS EFFICIENT

low computational footprint; wide range of supported DSP/MCU platforms

IP Partners

Selected Customers

OEMs Using Alango Technologies

Alango Inside

Citroen C4 Aircross	Chevrolet Aveo	Chevrolet Captiva	Chevrolet New Cruze	Chevrolet Spark	Chevrolet New Spark	Honda CR-Z	Honda N-Box
Hyundai Accent	Hyundai New Avante	Hyundai Equus	Hyundai New Genesis	Hyundai Grandeur HG	Hyundai i30	Hyundai i40	Hyundai IONYQ
Hyundai ix25	Hyundai ix35	Hyundai Santa Fe	Hyundai Sonata	Hyundai Sonata LF	Hyundai Sonata YF	Hyundai iMax/iLoad	Hyundai Veracruz
Kia Carens	Kia Carnival	Kia K3	Kia K5	Kia K7	Kia K9	Kia Mohave	Kia Niro Hybrid
Kia Ray	Kia Sedona	Kia Sorento	Kia Soul	Kia New Soul	Kia New Soul EV	Kia Sportage R	New Kia Sportage

Alango Inside

GM Alpheon

Hyundai Tucson

Hyundai Venue

MG 6

MG ZS

MG HS

Mitsubishi Lancer

Mitsubishi Outlander

Nissan Kicks

Nissan Leaf

Opel Adam

Opel Astra

Opel Junior

Opel Meriva

Opel Zafira

Qoros 5 SUV

Renault Samsung Motors SM5

Renault Samsung Motors QM3

Renault Samsung Motors QM5

Renault Samsung Motors SM3

Roewe i5

Roewe Marvel X

Roewe RX8

Ssangyong Chairman

Ford Maverick

Ssangyong Korando

Ssangyong Rexton

Ssangyong Tivoli

Suzuki S-Cross

Volkswagen Amarok

Volkswagen Passat

Maxus G50

Baijun RS-5

Toyota Rav4

Daedong NX Series

Kia K5 Fastback

Kia Forte

Roewe RX5 Plus

Isuzu Elf

MAN TGS35.500

Interested?
We are looking forward to hearing from you

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

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