



# FRONT END DSP AUDIO TECHNOLOGIES FOR IN-CAR APPLICATIONS

Revision 5.3  
December 2023



# ABOUT ALANGO

SINCE 2002

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



# ALANGO SOLUTIONS PORTFOLIO



## VOICE COMMUNICATION

Voice Communication Package (VCP)

Sound Reinforcement Package (SRP)



## SPEECH RECOGNITION

Voice Enhancement Package (VEP)

Voice Activity Detector (VAD)



## MUSIC ENHANCEMENT

Audio Enhancement Package (AEP)

Auto Volume & Frequency Equalization (EQ)

SonicVibrance™



## SOUND PERSONALIZATION

PersonaSound™

# 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

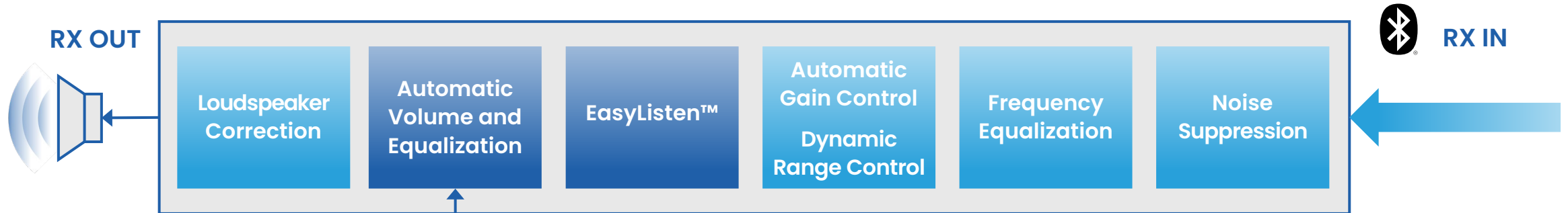


# VOICE COMMUNICATION PACKAGE

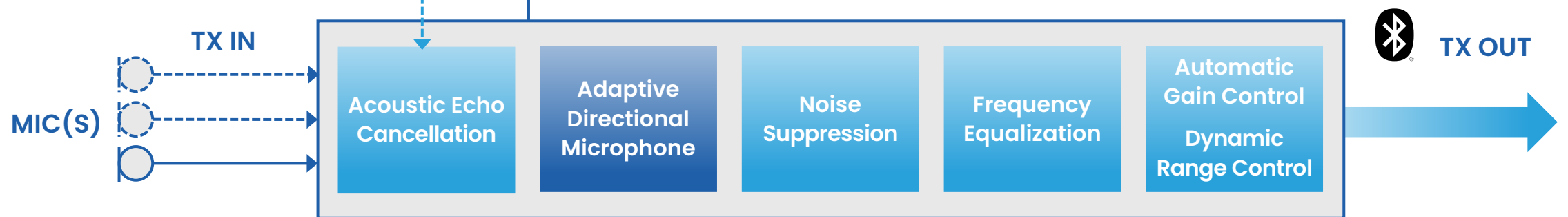
OVER 20 MILLION CARS USE ALANGO VCP  
(Jan. 2019)

Basic VCP   
VCP Add-ons 

## VCP RX PATH



## VCP TX PATH





## 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

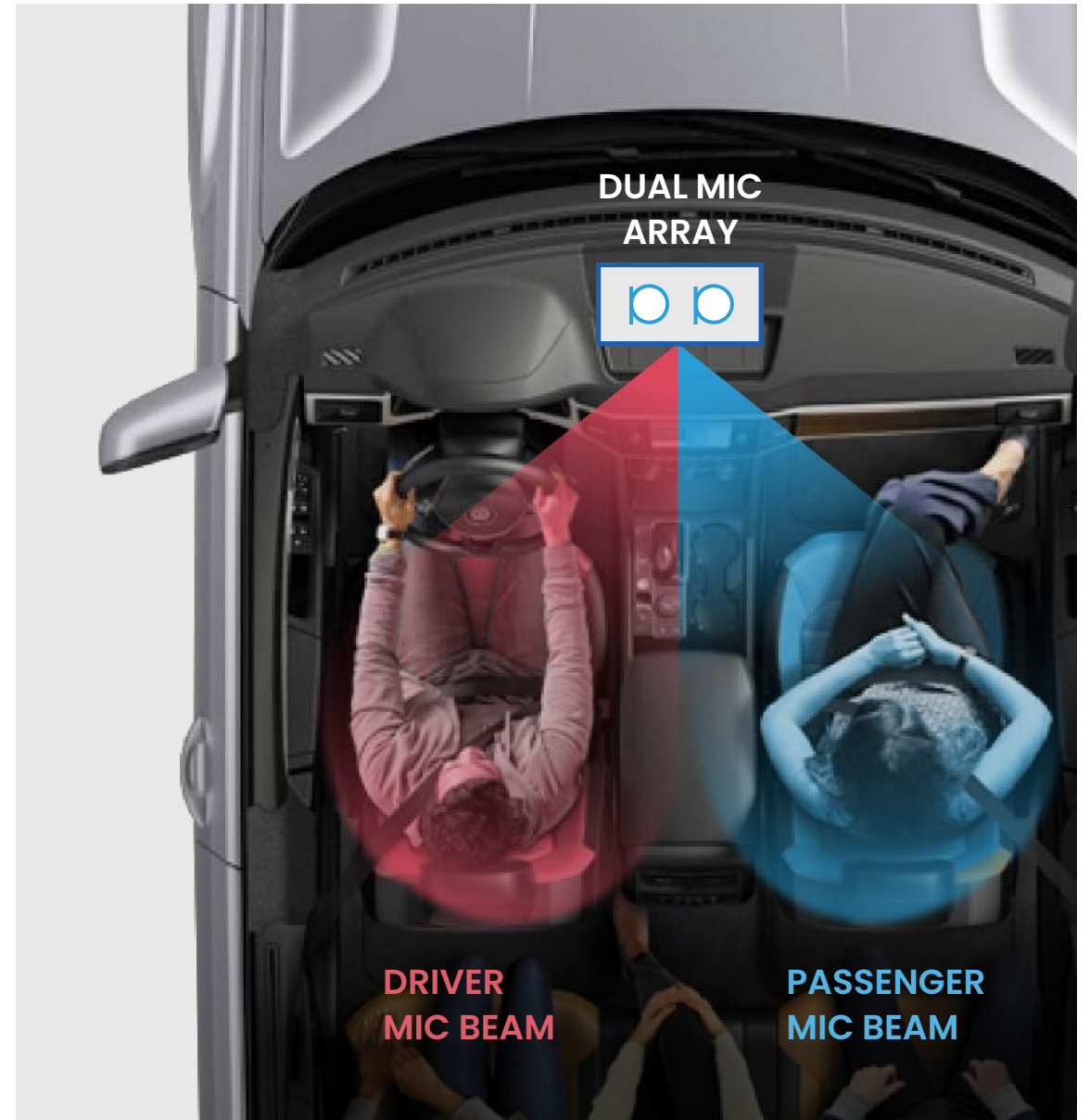
### Improved noise reduction:

- Road, engine, and wind noises
- Rear passenger voices

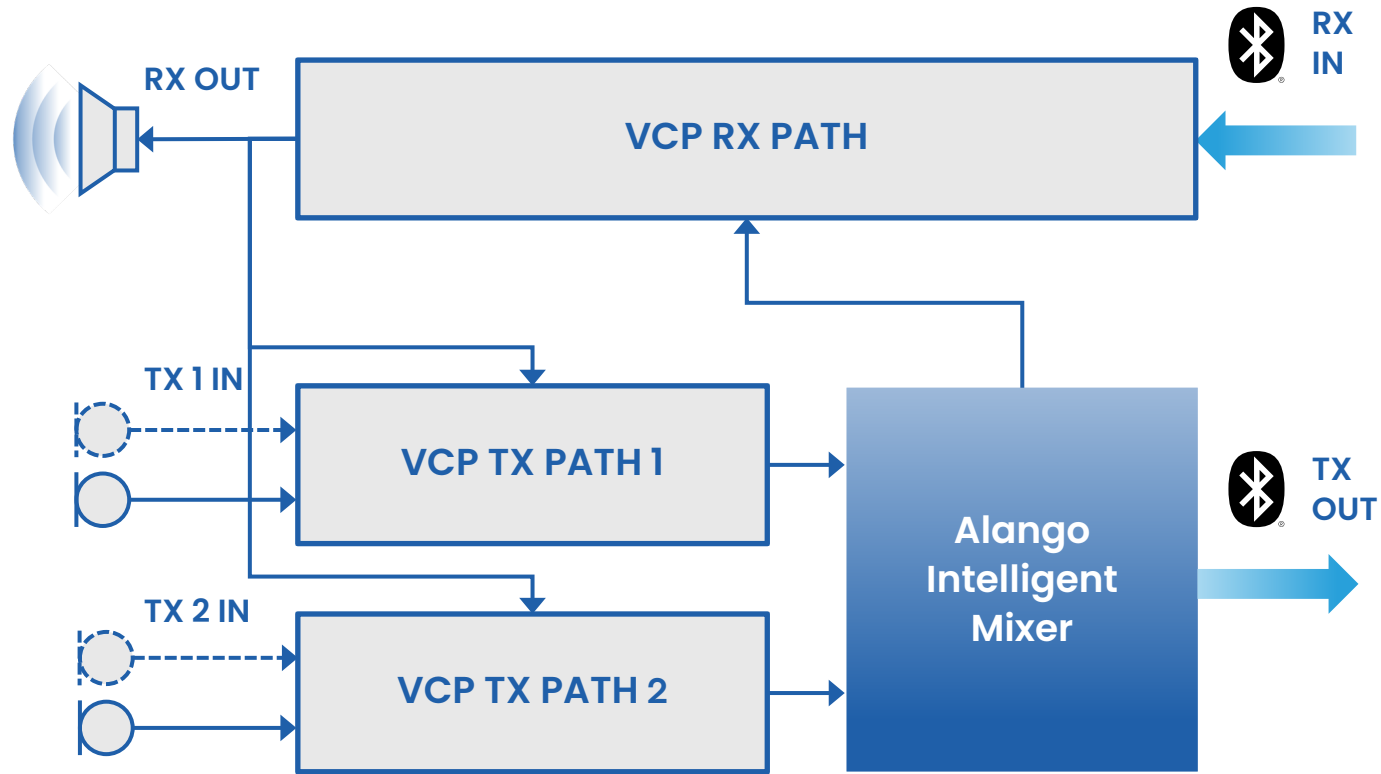
### Driver-selectable mic zones:

- Driver's voice enhanced
- Passenger's voice enhanced
- Both voices enhanced

Support for mic beamforming arrays or driver/passenger mic mixer



# 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 eVCP versions, DSP/MCU/MPU types, levels of optimization*

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

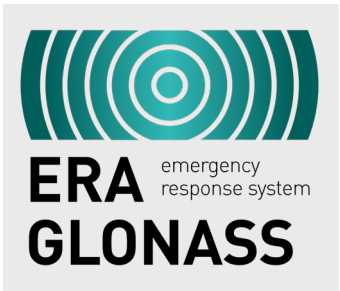
eVCP-L – VCP lite version, 64Hz frequency resolution

# VCP AUTO INDUSTRY COMPLIANCE

CLASS "TYPE 1":  
FULL DUPLEX ECHO CANCELLATION



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



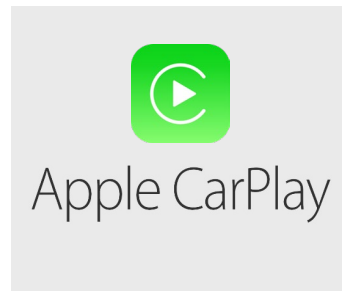
GOST R55531



eCALL



# VCP FOR SMART PHONE ENABLED DISPLAY AUDIO

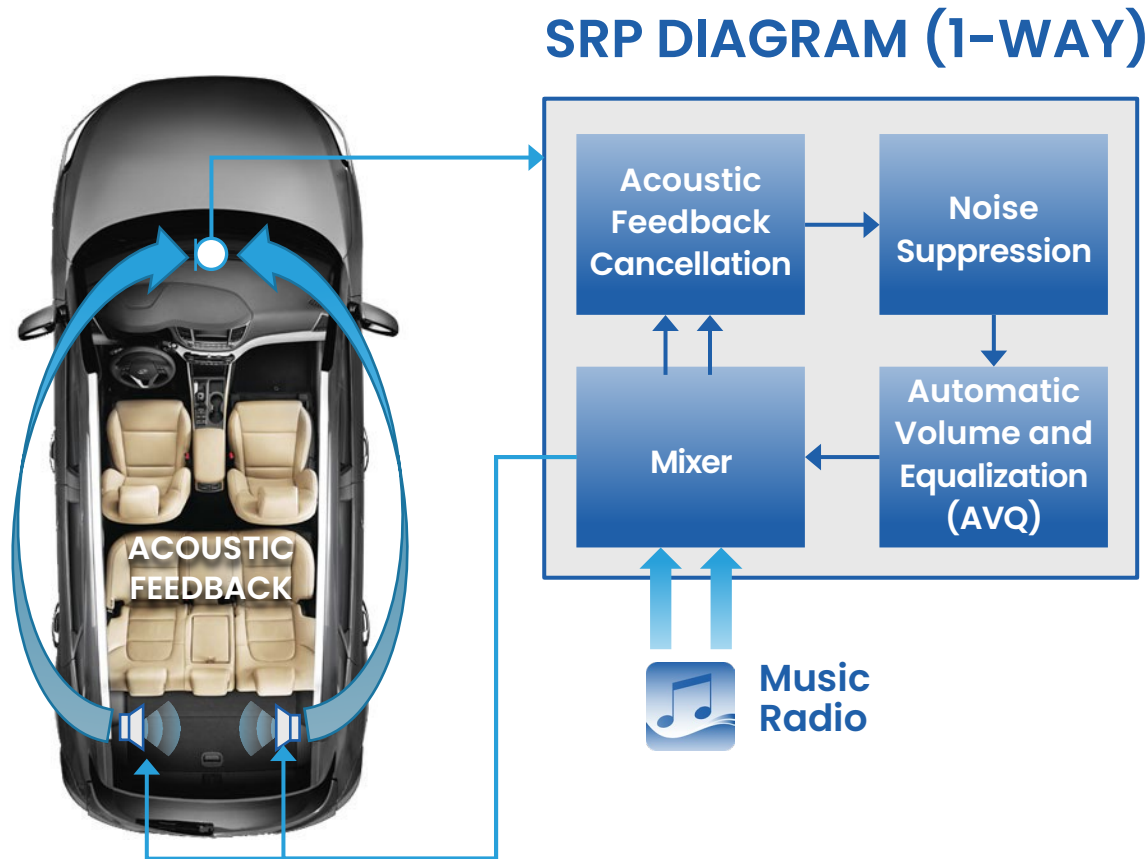


**SUITABLE FOR AFTERMARKET  
PRODUCTS**  
(single tuning for multiple cars)



# SOUND REINFORCEMENT PACKAGE (SRP) FOR ICC

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

# SOUND REINFORCEMENT PACKAGE



## SRP DEMO VIDEO

2-way SRP demonstrated on ADI SHARC+ processor



[Watch video on youtube](#)



[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



# AUTOMATIC SPEECH RECOGNITION ENHANCEMENT TESTS

## TEST SCENARIO:

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

## TEST STANDARD:

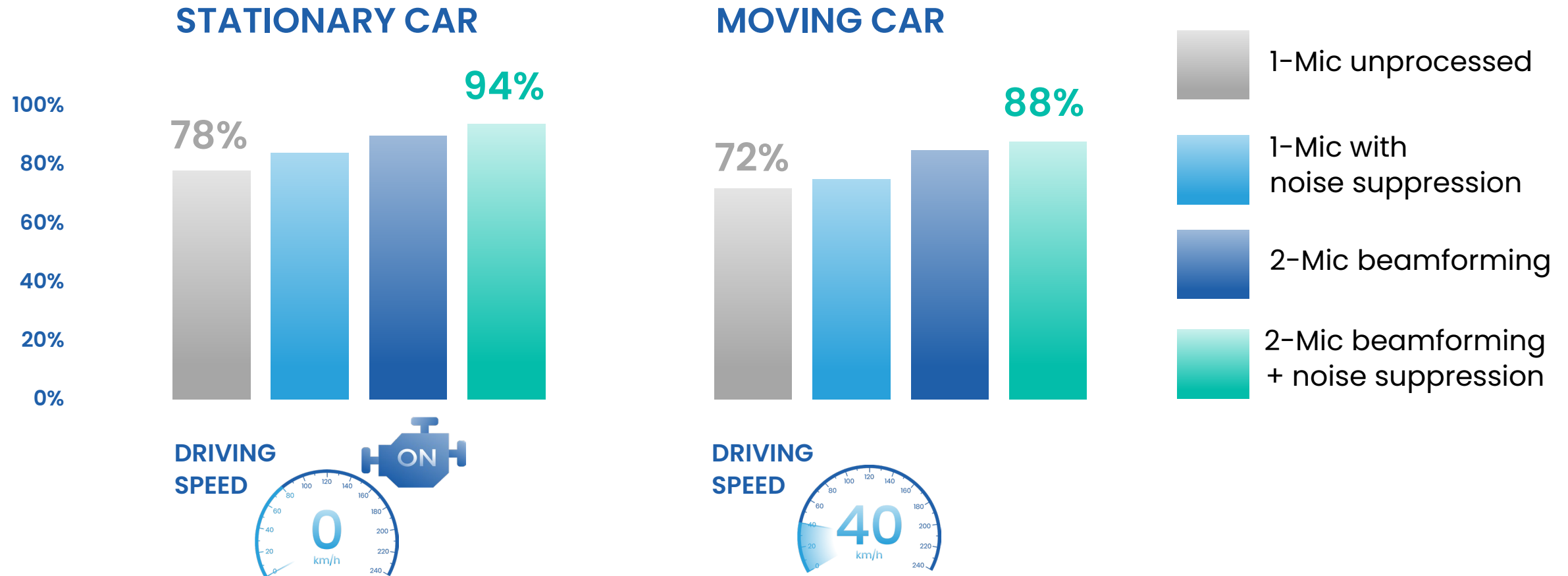
Using Google speech recognition, only phrases recognized exactly correctly are counted





# SPEECH RECOGNITION ENHANCEMENT WITH VCP

Only phrases recognized **exactly** are counted as success



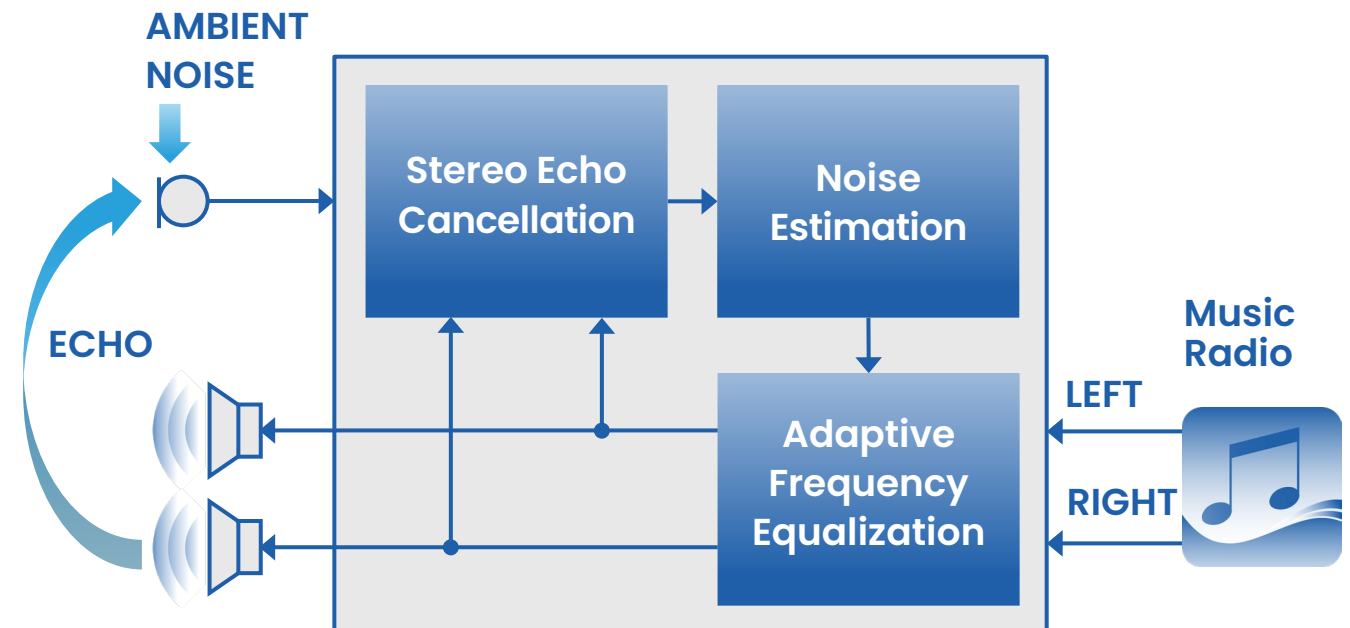
# AUTOMATIC VOLUME AND eQUALIZATION (AVQ)

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

- Uses existing handsfree mic
- Directly measures cabin noise level and spectrum as heard inside the car, rather than RPM-based noise estimation
- Provides equal perceptual loudness and sound coloration of music in different driving conditions
- Improves intelligibility of speech, such as navigation prompts and voice calls

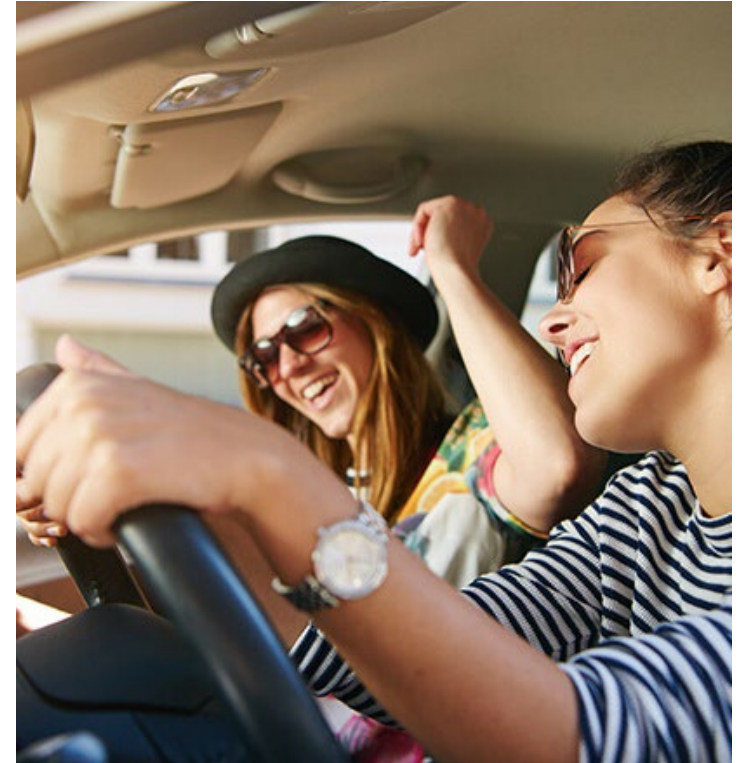


[Watch video on YouTube](#)



# SonicVibrance™

**SONICVIBRANCE MAKES IN-CAR MUSIC MORE ENJOYABLE BY BRIGHTENING VOCALS, ENHANCING BASS, AND WIDENING THE STEREO FIELD.**



More information about the technology, sound examples and demonstration software download is [here](#)

# AUTOMOTIVE PersonaSound™

Without **sound personalization**, hearing impaired drivers do not enjoy the car infotainment system in full. With PersonaSound, all sounds are automatically tuned to match the driver's hearing profile.

## USE THE APP TO MAKE THE CAR SOUND PERSONAL



**TEST HEARING PREFERENCE**



**OBTAIN HEARING RESULTS**



**UPLOAD HEARING PROFILE TO CAR**

# SoundAround™

## ACQUIZITION OF EXTERNAL SOUNDS WITHOUT EXTERNAL MICROPHONES

### BACKGROUND

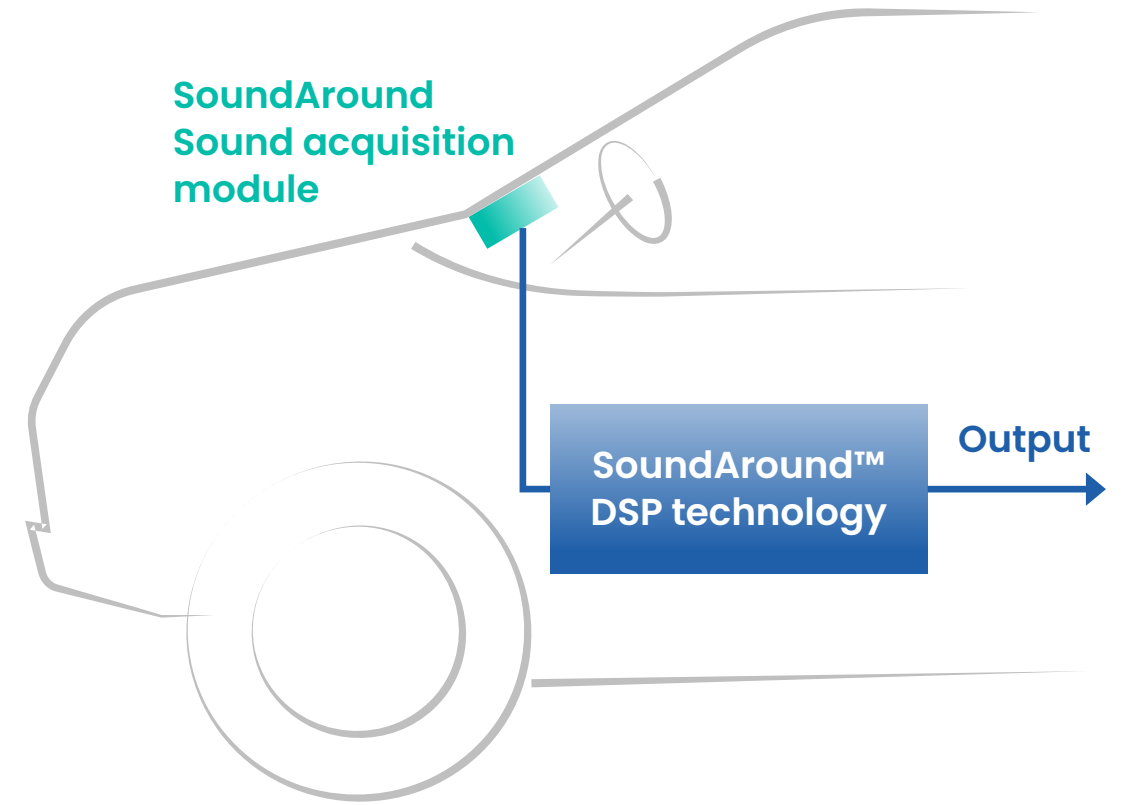
- Combines an interior window-mounted sound pickup module and DSP software to acquire outside sounds while ignoring sounds inside a car

### 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



# 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



**arm**

**cādence®**

**CEVA®**

**SYNOPSYS®**

**Qualcomm**

# SELECTED CUSTOMERS

**SONY**

*Pioneer*

**JVC**

HYUNDAI  
**MOBIS**



**MOVON**

**GARMIN®**

**HSAE**

**HUMAX**

**DESAYSV**

 **LG Innotek**

  
**SIERRA  
WIRELESS®**



# 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  
Series



Kia Forte



Roewe RX5  
Plus



Isuzu Elf



MAN TGS35.500

# INTERESTED? WE ARE LOOKING FORWARD TO HEARING FROM YOU

Thank you for your time reading this presentation. Please, contact us.

If something is missing or you have any questions or comments, don't hesitate to contact us.

We will appreciate your feedback if you give a hint how we can make this presentation better.



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