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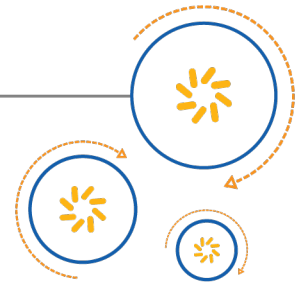
Qualcomm Technologies International, Ltd.

Qualcomm cVc Two Microphone Handsfree

Design Guidelines

80-CT411-1 Rev. AE

November 6, 2017

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Revision history

Revision	Date	Description
1	February 2014	Original publication of this document. Alternate number: CS-00225939-AN
2	May 2014	Editorial updates
3	May 2014	Editorial updates
4	September 2016	Updated to reflect QTIL rebranding
5	November 2017	Updated to reflect new document and revision numbering scheme

1   2 cVc 2-mic Handsfree system overview

The modules in the cVc algorithm that impact the functional quality of the 2-mic Handsfree system are:

■ Beamforming

■ ADF

■ OMS
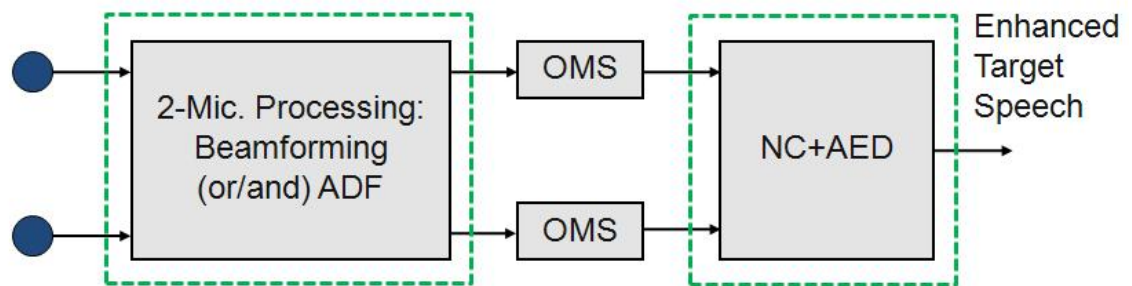
■ AED

Figure 1-1   2-mic Handsfree system

The cVc 2-mic Handsfree system enables you to select either omni-directional or uni-directional microphones.

Microphone types include:

■ Analog electrets

■ MEMS digital

■ MEMS silicon analog

cVc does not support a mix of microphone types. The processing does not support more than two microphones.

Figure 1-2   Typical In-car noise environment

Figure 1.3 shows array configurations and spacing for microphones with different directionality, and their corresponding beam patterns. Courtesy Light refers to the lamp assembly inside the car.
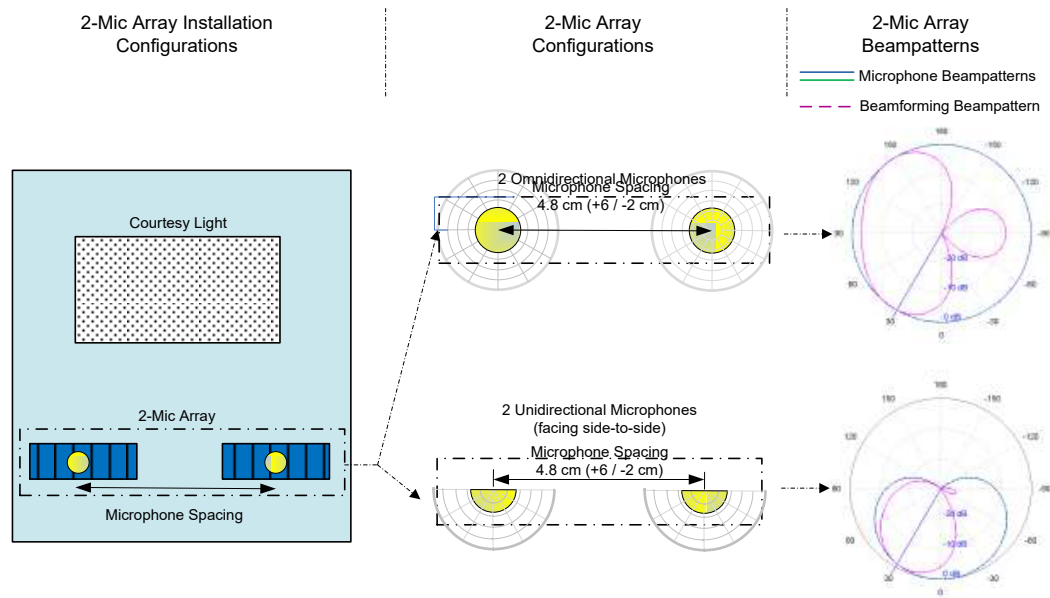
Figure 1-3   2-mic configurations overview

The cVc Handsfree system recommended microphone placement position is on the interior ceiling at the windshield, centered between the driver and passenger, either in:

■   The rear view mirror

■   The overhead lamp assembly

The microphones should be forward of the driver with a microphone-to-mouth distance of up to 60 cm. The cVc Handsfree system does not support microphone placement in the Vehicle A-pillars. For any position other than the recommended position, consult with QTIL for guidance.

1.1   Uni-directional microphones

This section describes QTIL's recommendations for uni-directional microphone placement.

1.2   Beamforming of directional microphones facing side-to-side

In this configuration, the cVc system contains:

■   Beamforming

■   AED

■   ADF

■   OMS

$\theta > 30^\circ$

Driver

Passenger

Back Passenger

Figure 1-4   Beamforming of directional microphones facing side-to-side

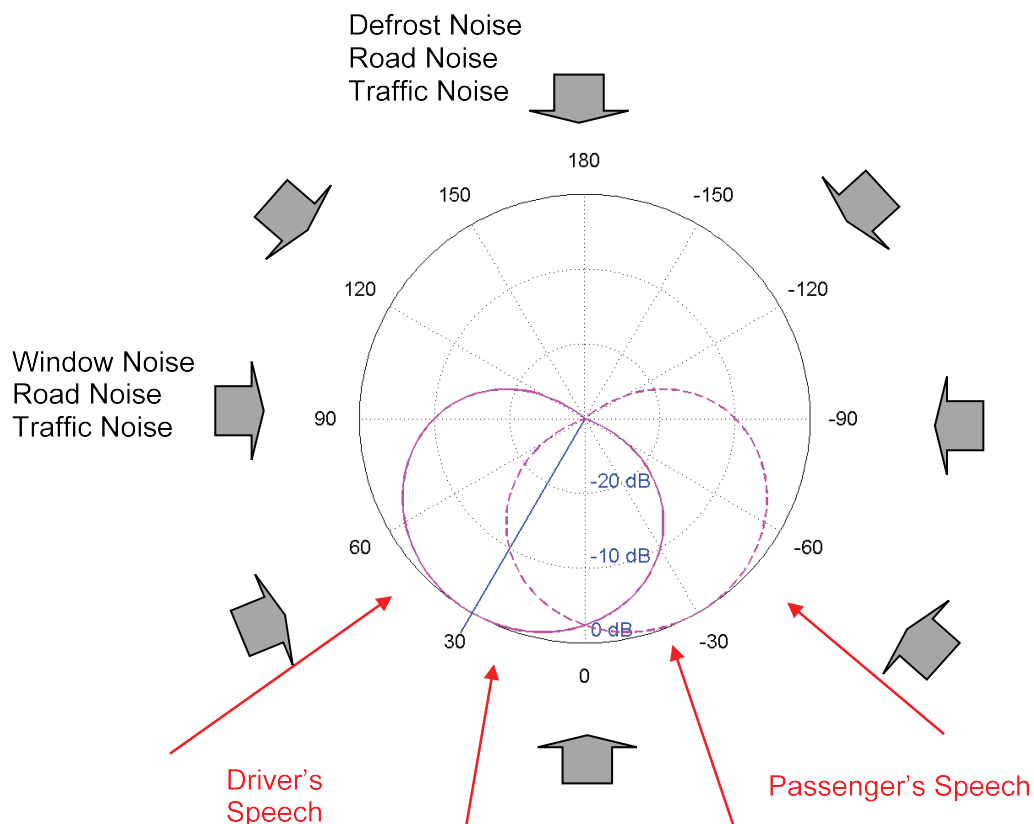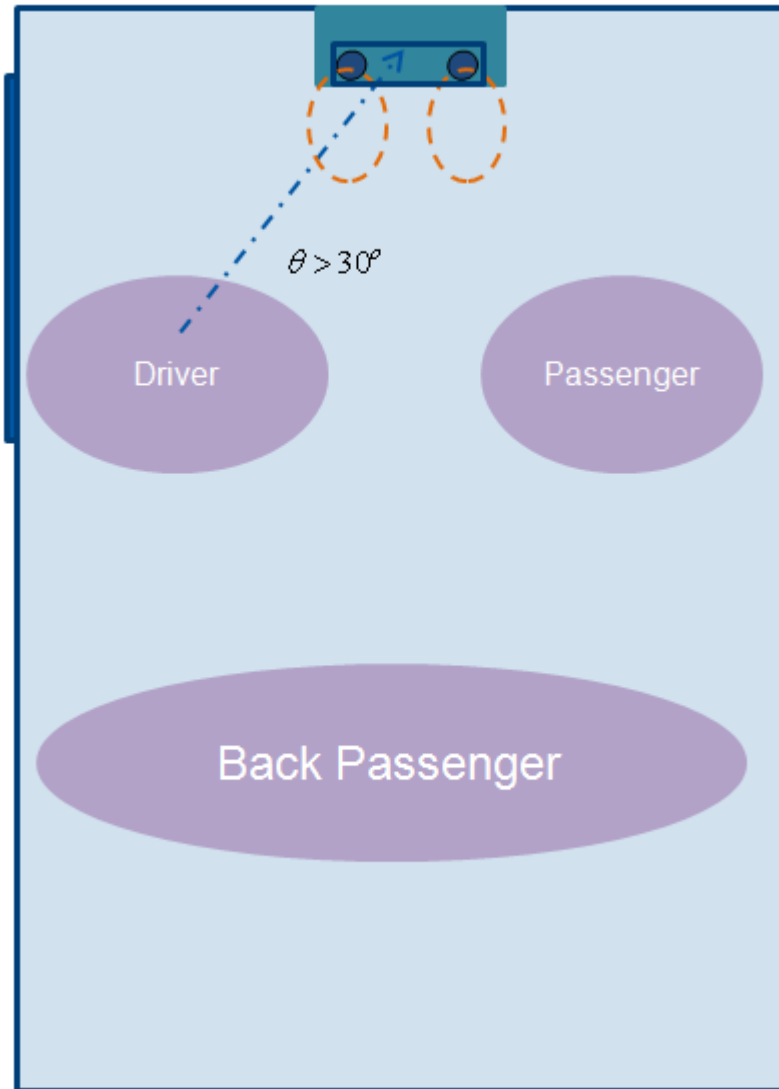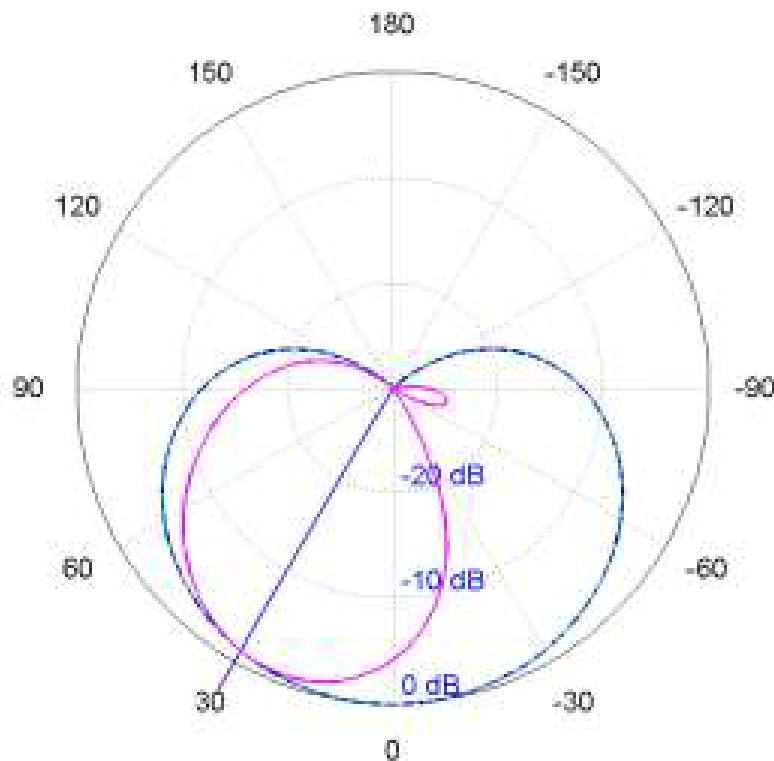**Figure 1-5   Beam pattern of directional microphones facing side-to-side**

QTIL recommends these guidelines for the omni-direction microphones:

■   Direction of arrival: ~30°

■   Distance between two microphones: 5 cm (range between 5 to 6 cm)

■   Well-matched 2-mic frequency response and beam pattern <3 dB of mismatch is allowed

■   Must be the same microphone model in each position

1.3   Omni-directional microphones

In this configuration, the cVc system contains

■   Beamforming

■   ADF

■   OMS

■   AED

Figure 1-6   Beamforming of omni-directional microphones

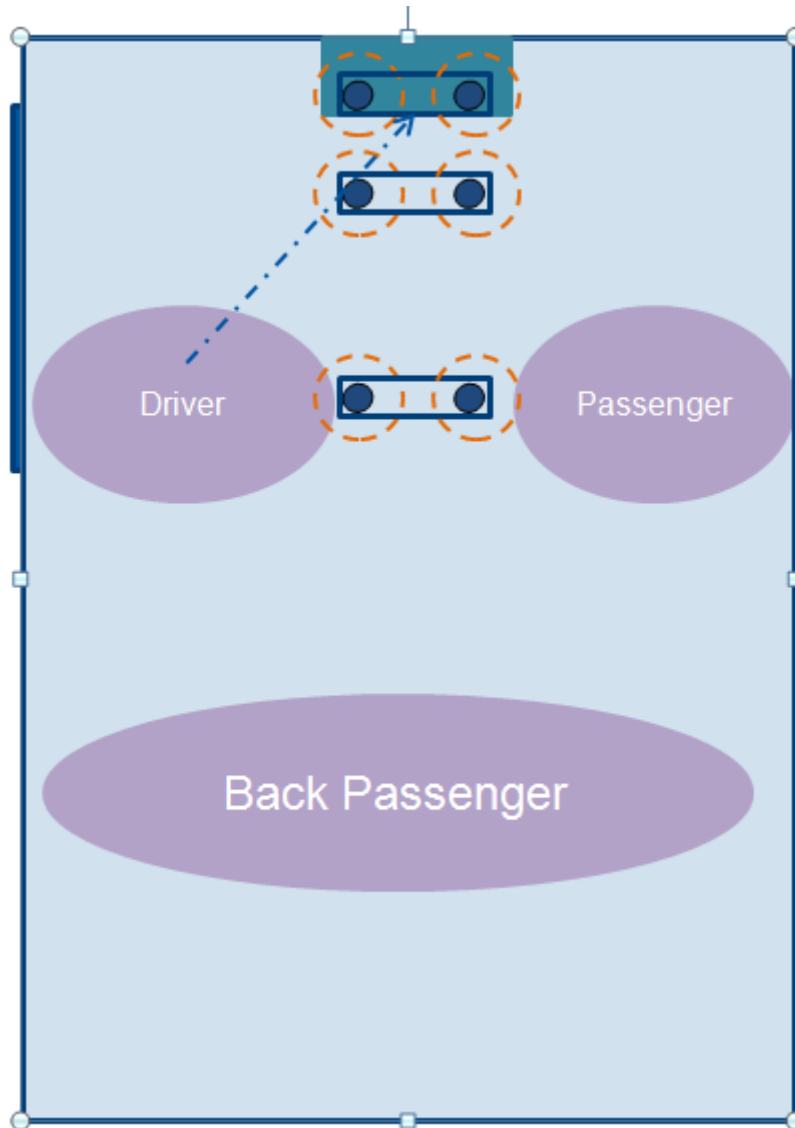**Figure 1-7   Beam pattern of omni-directional microphones**

QTIL recommends these guidelines for the omni-direction microphones:

■   Direction of arrival: ~30°

■   Distance between two microphones: 5 cm (range between 5 to 6 cm)

■   Well-matched 2-mic frequency response and beam pattern <3 dB of mismatch is allowed

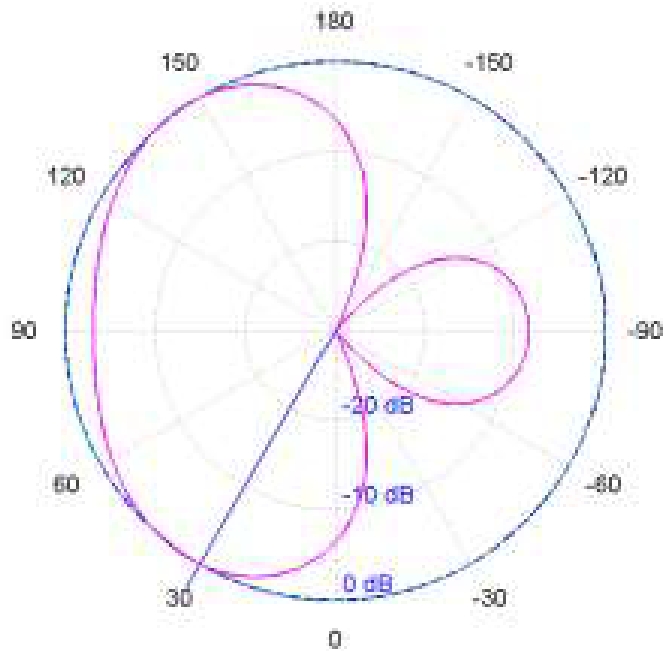■   Must be the same microphone model in each position

2   2 cVc 2-mic Handsfree system design example

This section describes an example design and does not represent a specific QTIL recommendation.

Table 2-1   Example microphone specification

Type	Analog MEMS
Grade	Automotive
Directionality	Uni-directional or omni-directional
Frequency range	70 to 12000 Hz @ -10 dB
Sensitivity	-40 ± 0.5 dB part to part variance
Distortion	<3% THD @ 115 dB SPL @1 kHz
SNR	> 55 dB 1 kHz, A weighted
Operating and storage temperature	-40 to 100° C
Tolerance	± 3 dB

Table 2-2   Example microphone positioning

Placement	Rear-view mirror
Microphone spacing	4.8 cm
Microphone orientation	Facing side-to-side
Direction of arrival	30°
Microphone to mouth distance	40 cm

Table 2-3   cVc details

Version	BCSW-CVC-HF-5-0-x
Blocks used	■ Beamforming ■ ADF ■ OMS ■ AED
Target speech	Driver of the vehicle
Hardware	CSR8670, DaleAuto2 A08 ROM running QTIL Software

Document references

Document	Reference
BCSW-CVC-HF-5-0-3 2M-HF Parameter Manager User Guide	80-CT413-1/CS-00309823-UG
BCSW-CVC-HF-5-0-3 2M-HF Tuning Guide	80-CT412-1 /CS-00309822-UG

Terms and definitions

ADF	Adaptive Decorrelation Filter
AED	Acoustic Events Detection
BCSW	BlueCore Software
BlueCore®	Group term for QTIL's range of Bluetooth wireless technology chips.
Bluetooth®	Set of technologies providing audio and data transfer over short-range radio connections.
cVc®	Clear Voice Capture DSP audio processing software
HF	Handsfree
HFK	Headset Mode
HS	Headset
MEMS	Micro-electro-mechanical systems
OMS	One Microphone solution
PRD	Product Requirements Document
QTIL	Qualcomm Technologies International, Ltd.
SDK	Software Development Kit
SNR	Signal to Noise Ratio
SPL	Sound Pressure Level
THD	Total Harmonic Distortion