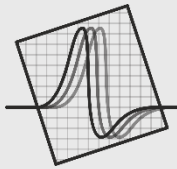
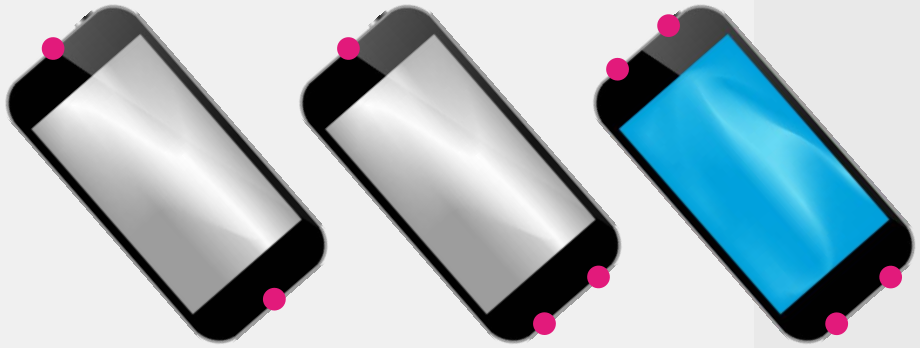
IMPROVEMENT OF VOICE TRIGGER RECOGNITION IN SMARTPHONES WITH MULTI-MIC VOICE ENHANCEMENT DSP TECHNOLOGY



ALANGO

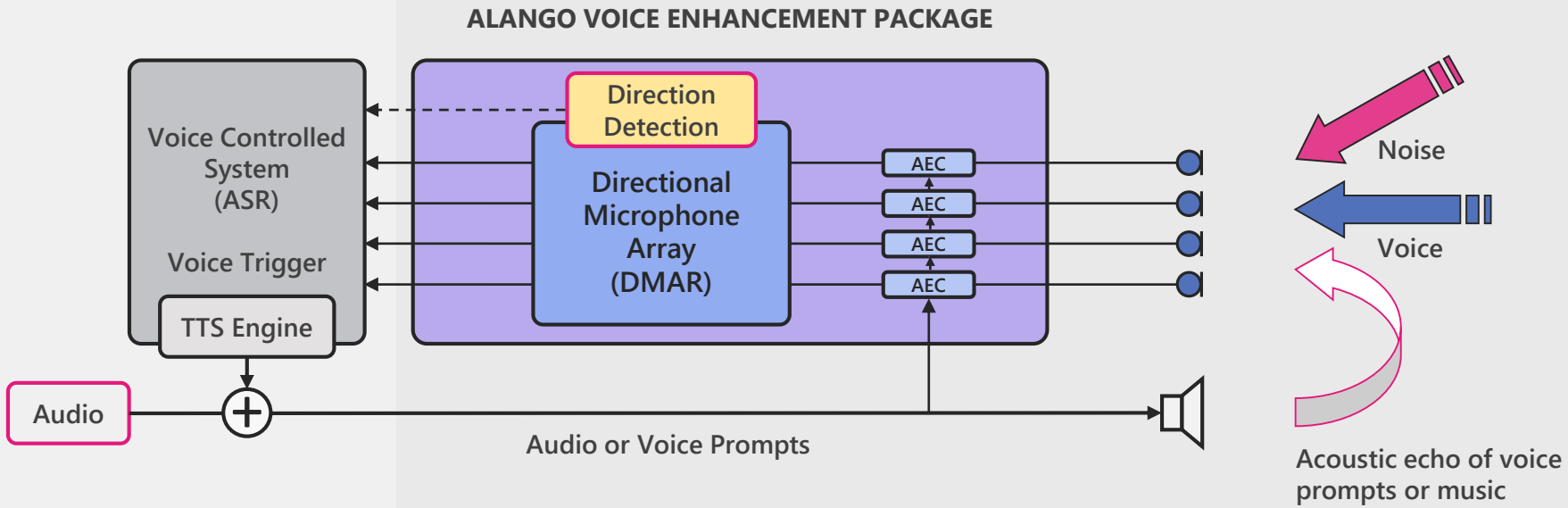
Technologies and solutions

ABOUT ALANGO VOICE ENHANCEMENT PACKAGE



Voice Enhancement Package (VEP) is a set of software technologies utilizing a number of microphones to enhance the voice signal before it is provided to the speech recognition engine

While, in general, the number of microphones is unlimited, in smartphones the number of microphones cannot exceed 4 for cost, design and power consumption reasons



OBJECTIVES OF THE VOICE ENHANCEMENT TESTS

Determine objective improvement of Voice Triger recognition (hit rate) with Alango multi-directional beamforming in realistic conditions for different users, noise levels and distances

Test:

Compare voice trigger recognition rate in a controllable and reproducible acoustic environment (office meeting room), using:

- 1 microphone raw audio (without any additional processing)
- 2 microphones processed audio (2mic multidirectional voice enhancement)
- 3 microphones processed audio (3mic multidirectional voice enhancement)
- 4 microphones processed audio (4mic multidirectional voice enhancement)

Test setup and components:

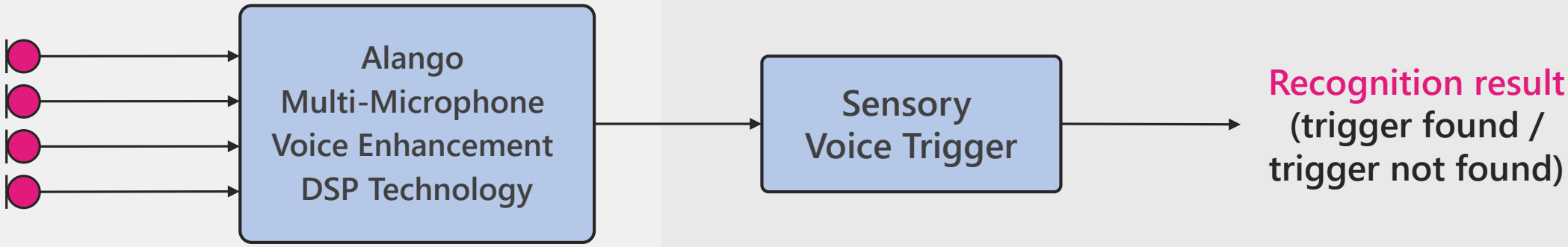
- Real meeting room
- A handset mockup integrating 4 microphones (DUT – Device Under Test)
- A mouth simulator generating the voice trigger “Hello blue genie” using different voices and voice levels:
- External speaker simulating ambient noise
- Signal processing chain: Alango n-mic DSP technology -> Sensory Voice Trigger “Truly Hands-free” technology

TEST DESCRIPTION & PREREQUISITES

Test flow:

- Make recordings of user's voice using mouth simulator reproducing the phrase "Hello blue genie":
  - ✓ at different distances from DUT: 0.5m, 1.0m, …, 4.5m
    and
  - ✓ at different SPL levels: 94, 88, 82, 76 dBSPL at Mouth Reference Point (3cm from mouth opening)
- Process recordings off-line using Alango n-mic voice enhancement DSP technology
- Pass the enhanced voice signals to Sensory Voice Trigger technology ("Truly Hands-free" SDK)
- Calculate recognition rate statistics ("hit-rate"), 448 triggers per test

Signal processing chart:



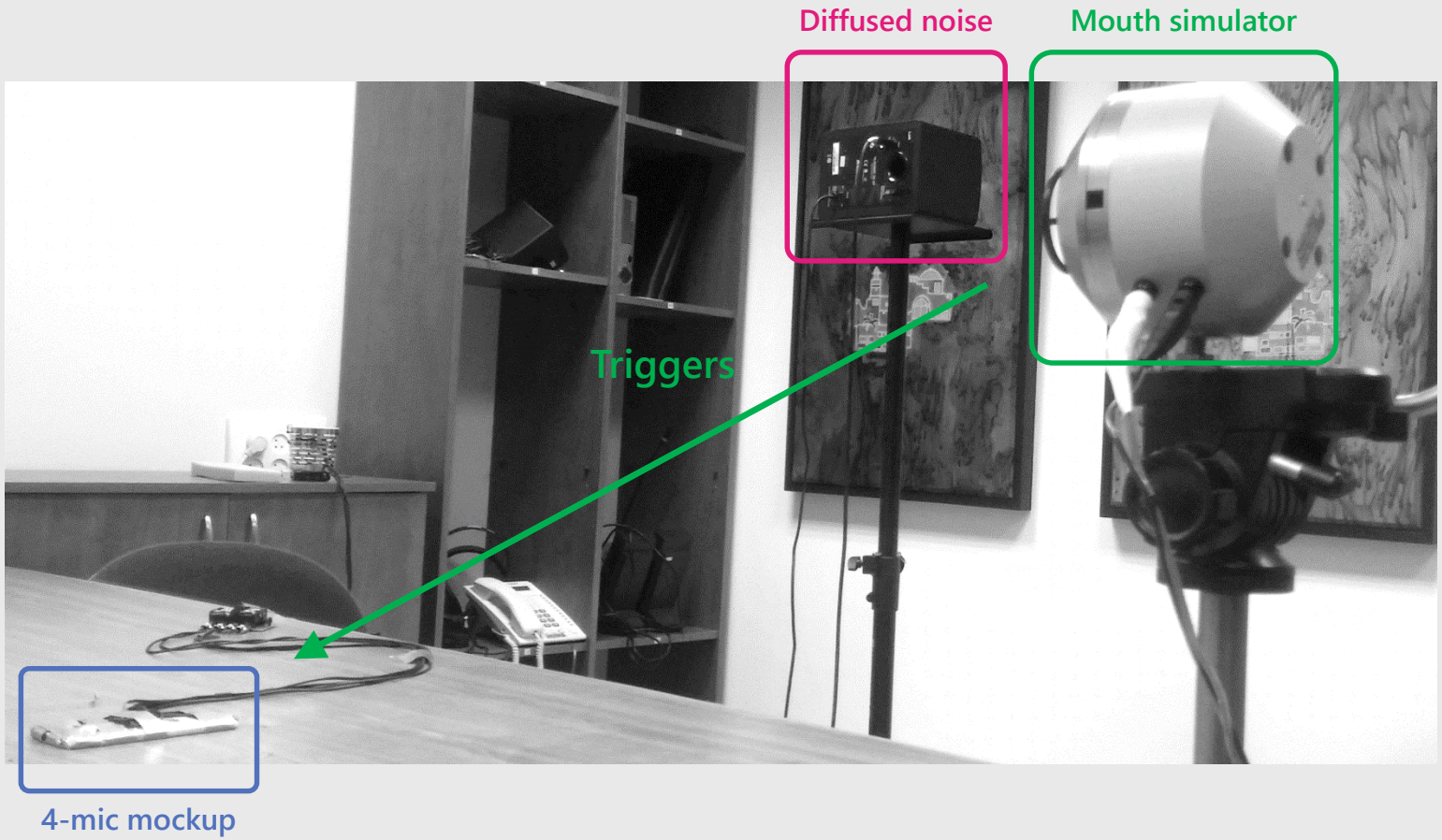
TEST DESCRIPTION & PREREQUISITES

Device under test (DUT):

A phone mockup integrating 4 microphones located on the top and bottom edges

Test setup (real photo):

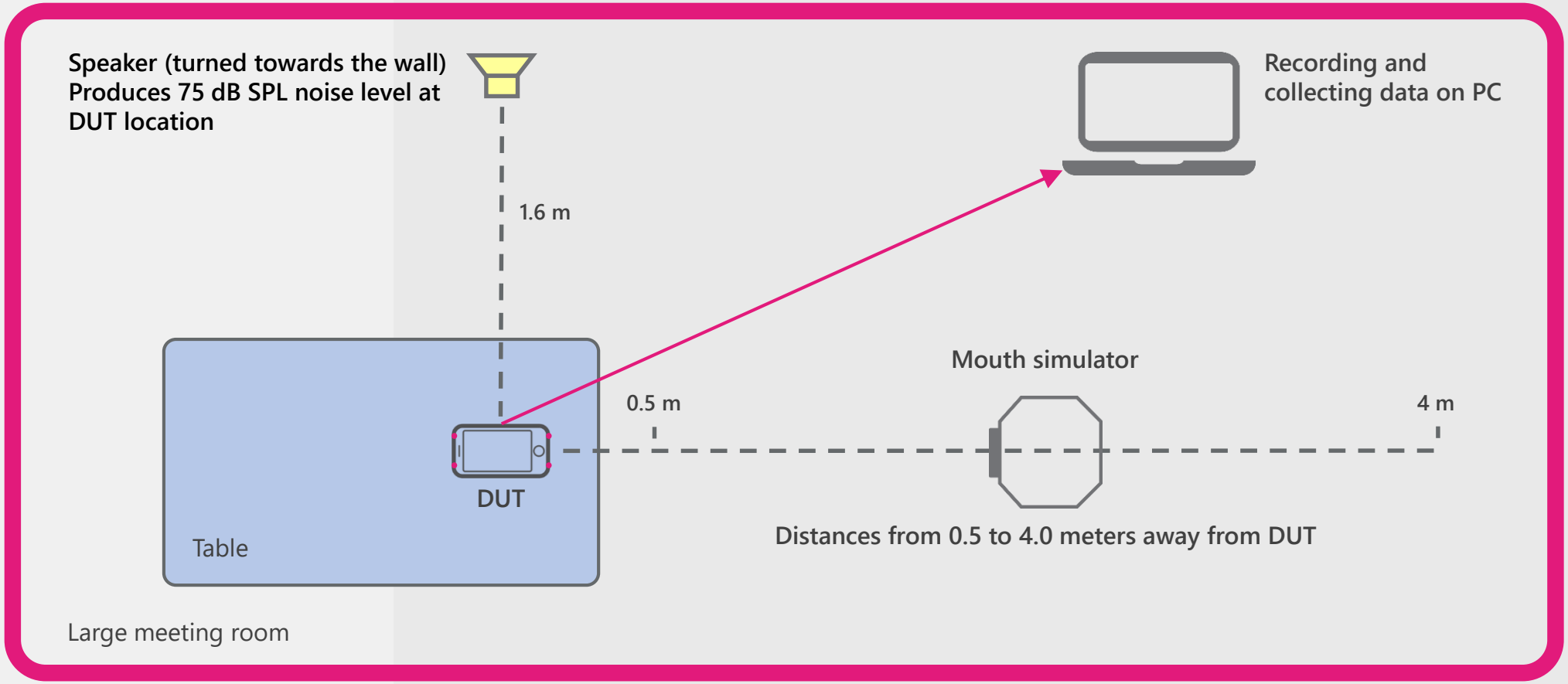
1. Mouth simulator connected to the computer plays prerecorded voice triggers of different strength with different voices and from different distances
2. A large loudspeaker directed towards the wall produces different types of diffused noise from different directions
3. 4-mic phone (DUT) lying on a table. Signals from 4 microphones are recorded and processed by the computer



TEST A

- Voice Trigger direction – phone back
- Noise direction – phone side

Test setup configuration (top view)



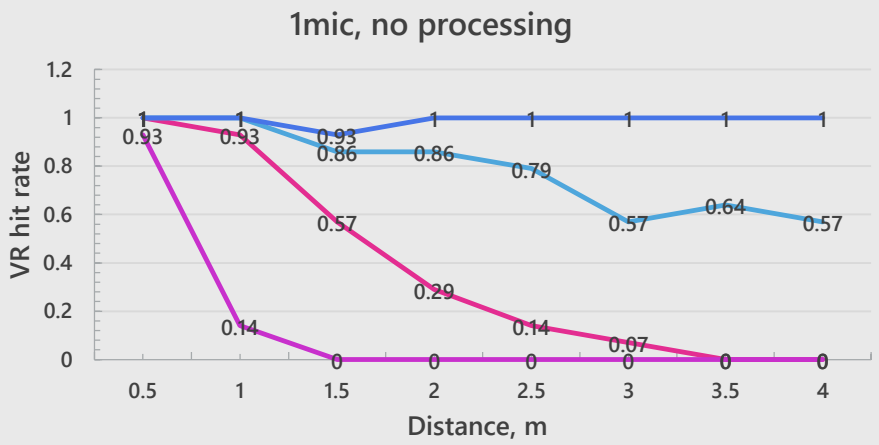
TEST A RESULTS

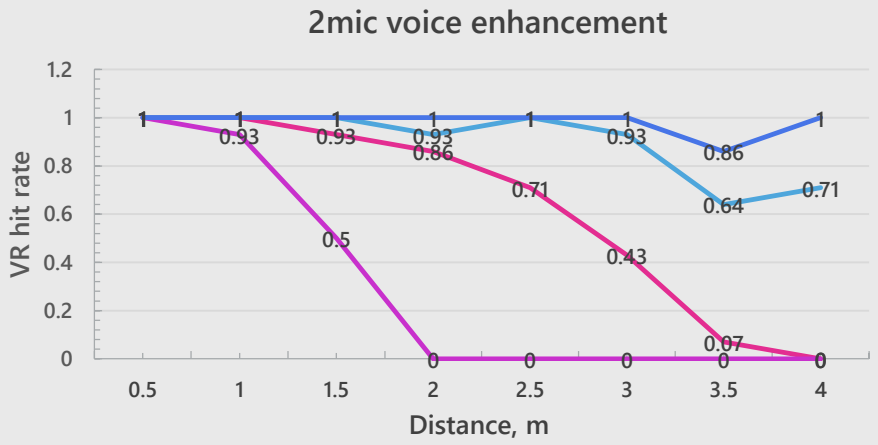
- Voice Trigger direction – phone back
- Noise direction – phone side

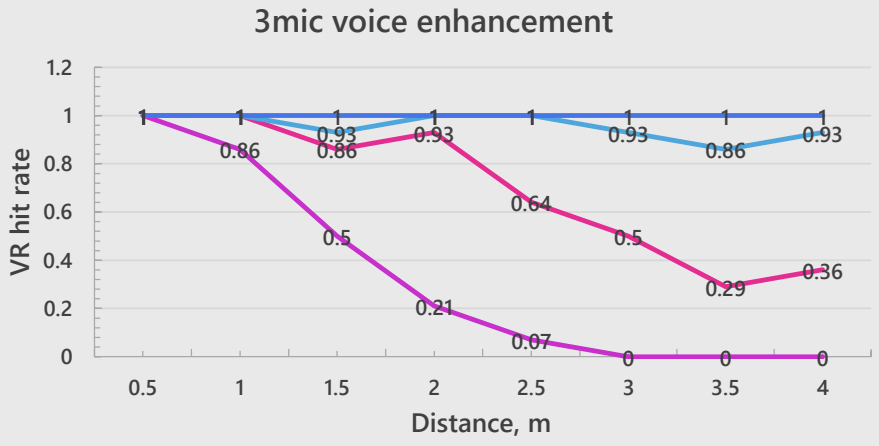
Voice Sound Pressure Level
at the Mouth Reference Point
(3cm from the mouth opening)

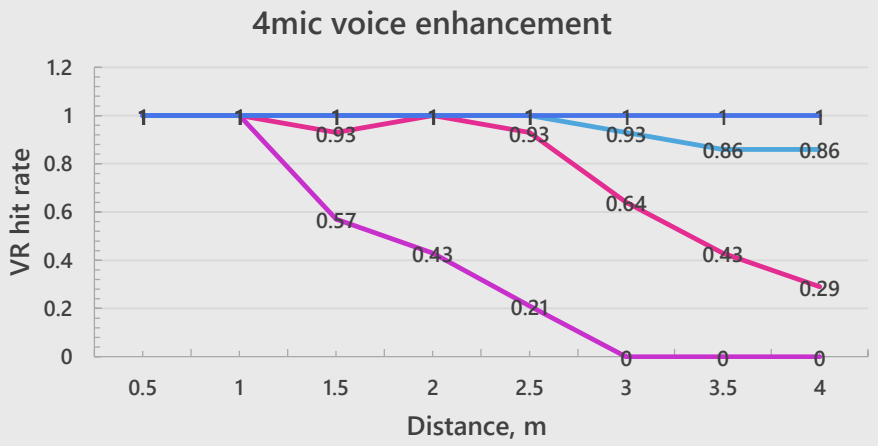
- 94 - very loud voice
- 88 - loud voice
- 82 - normal voice
- 76 - quiet voice

Each chart is a result of statistics collected over 448 voice trigger stimulus tests





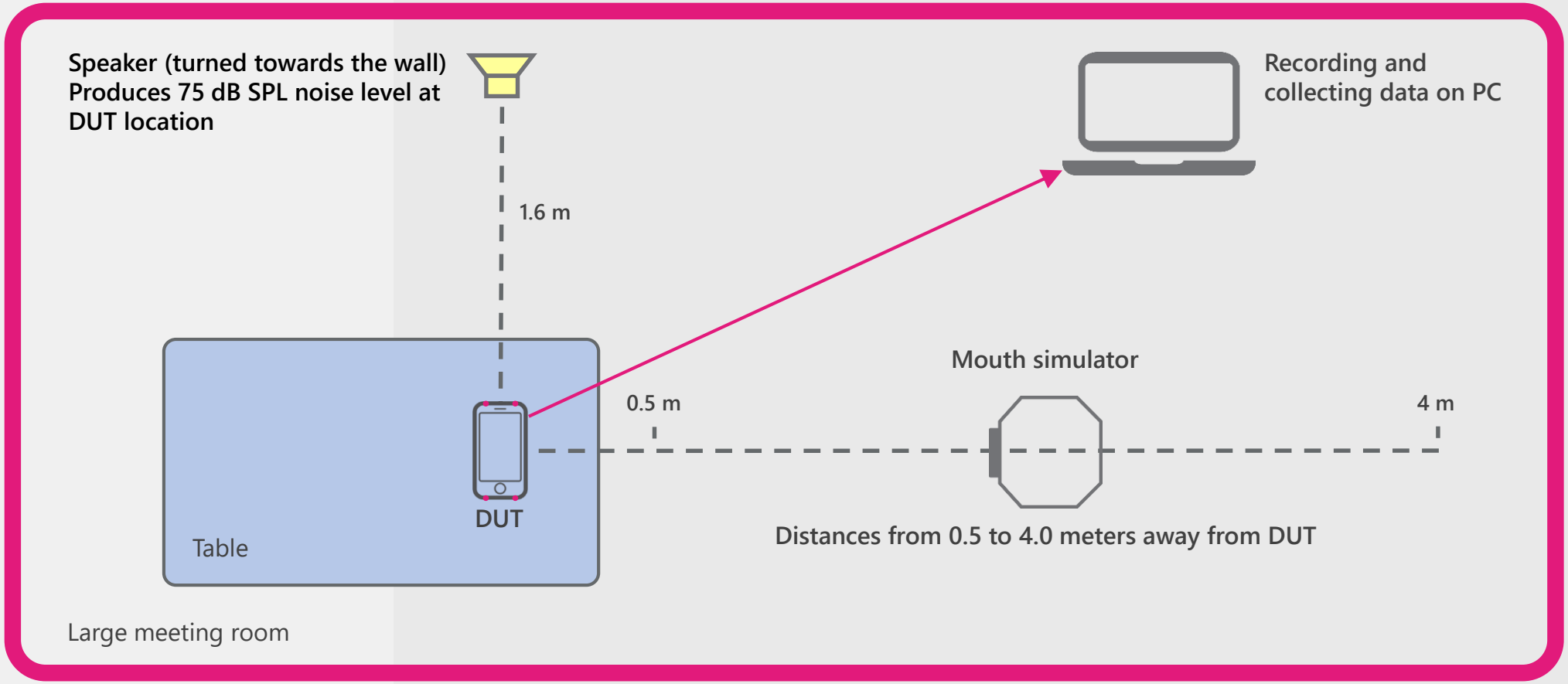




TEST B

- Voice Trigger direction – phone side
- Noise direction – phone back

Test setup configuration (top view)



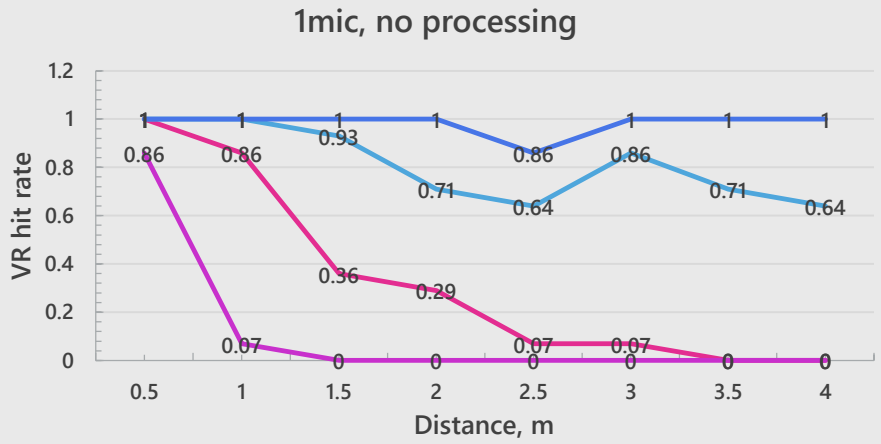
TEST B RESULTS

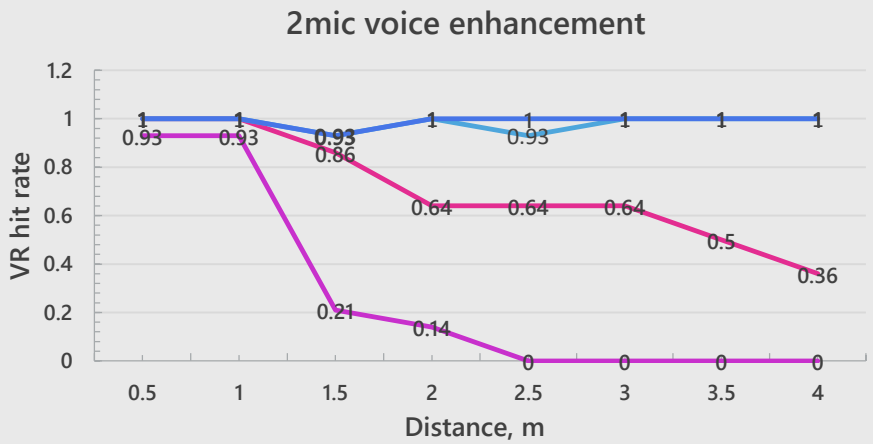
- Voice Trigger direction – phone back
- Noise direction – phone side

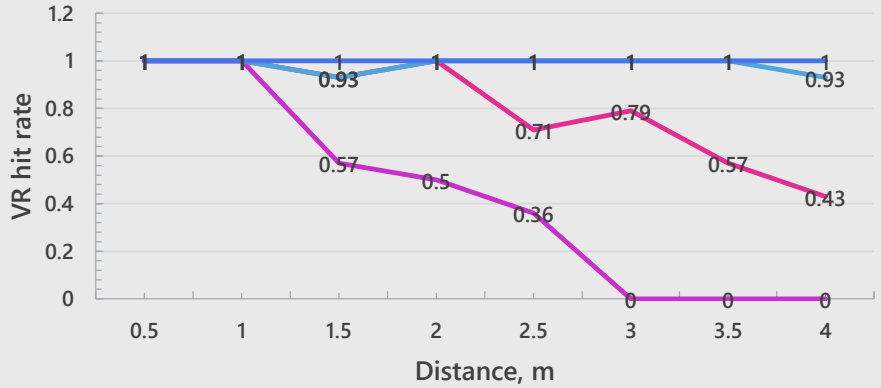
Voice Sound Pressure Level
at the Mouth Reference Point
(3cm from the mouth opening)

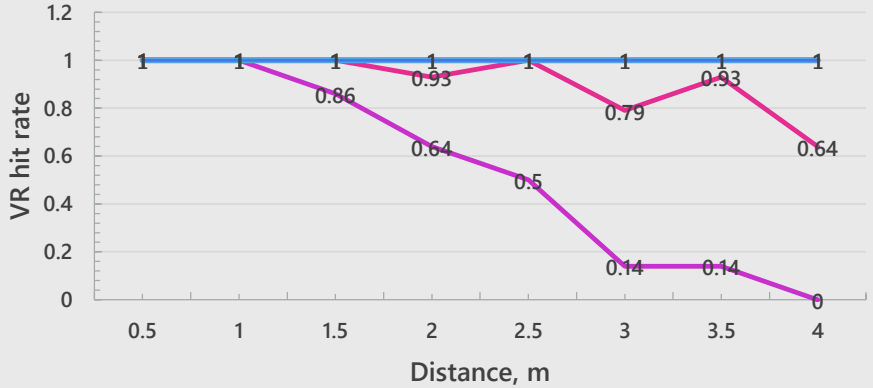
- 94 - very loud voice
- 88 - loud voice
- 82 - normal voice
- 76 - quiet voice

Each chart is a result of statistics collected over 448 voice trigger stimulus tests







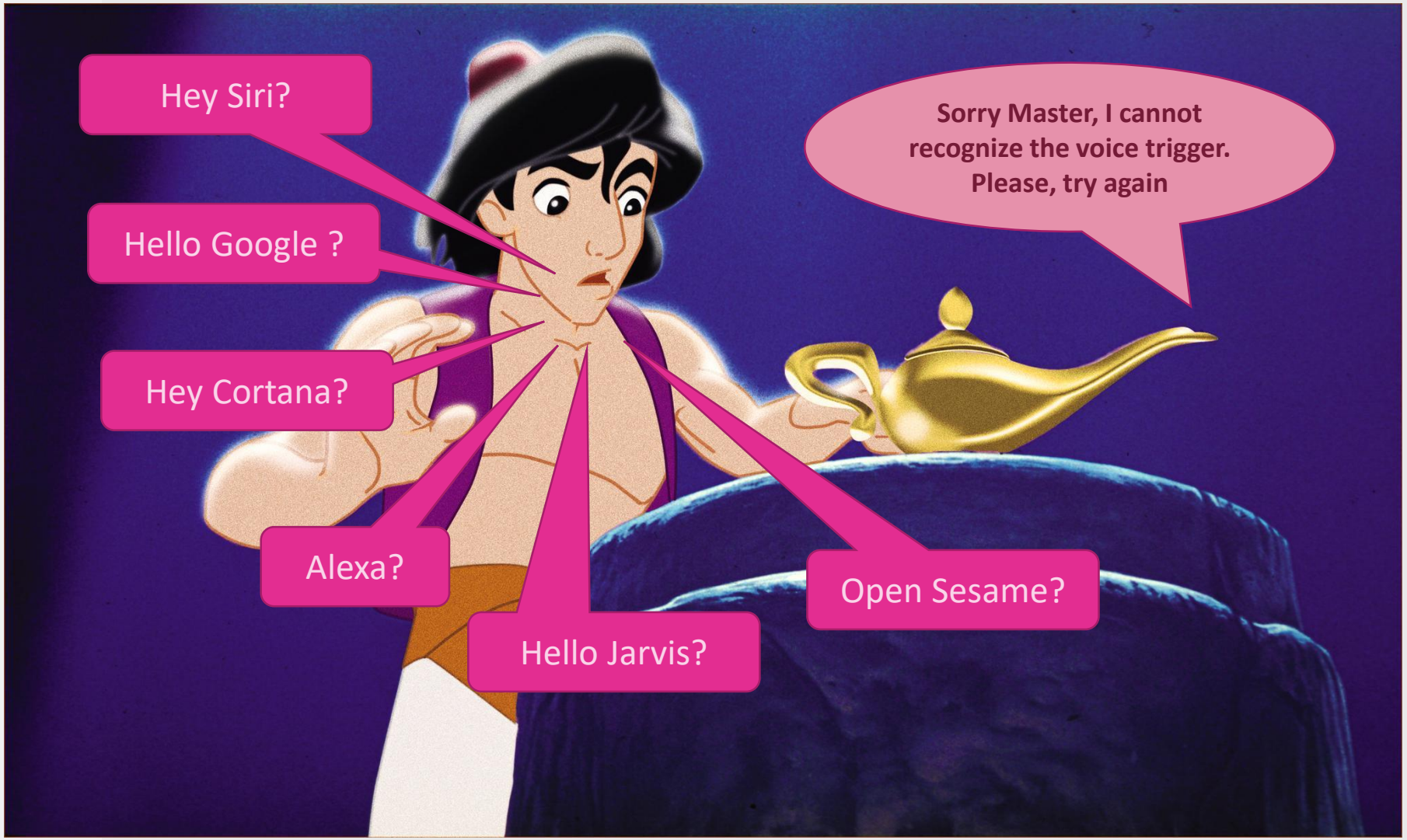


AUDIO EXAMPLES

- Distance to DUT – 2m
- User's speech level – 82 dBSPL@MRP

Trigger direction – phone back Noise direction – phone side		Trigger direction – phone side Noise direction – phone back	
1mic (no processing)	Play	1mic (no processing)	Play
2mic voice enhancement	Play	2mic voice enhancement	Play
3mic voice enhancement	Play	3mic voice enhancement	Play
4mic voice enhancement	Play	4mic voice enhancement	Play

THANK YOU FOR YOUR INTEREST!



CONTACT INFORMATION

Don’t hesitate to contact us if you need more information about Alango voice enhancement or other technologies.
Let us know what you think!
We are looking forward to hearing from you!

Please, send your questions, comments, thoughts, proposals to info-il@alango.com or specifically

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