

ISO 16254 Measurement Variation – Field Experience

Relevant for GRBP IG on Reverse Alarm

Summary of ISO TC43/SC1
WG42 November 2018,
Matsue, Japan

Overview

- **Fundamental Issue:** Observed test variation is significantly greater than assumed and in excess of stated measurement uncertainty in ISO 16254.

Table 4 — Variability of measurement results for a coverage probability of 80 %

Measurement type	Run-to-run	Day-to-day	Site-to-site
A-weighted sound pressure level, in dB (indoor/outdoor)	0,3/0,5	0,5/0,9	1,4
A-weighted one-third-octave sound pressure level, in dB	1,5	2,5	3,5
Frequency shift, in Δf	1,0 %	1,0 %	10,0 %

NOTE 2 The measurement uncertainties listed here are the results after averaging the four individual measurement runs of this International Standard. The individual measurement runs will have variation in excess of these values.

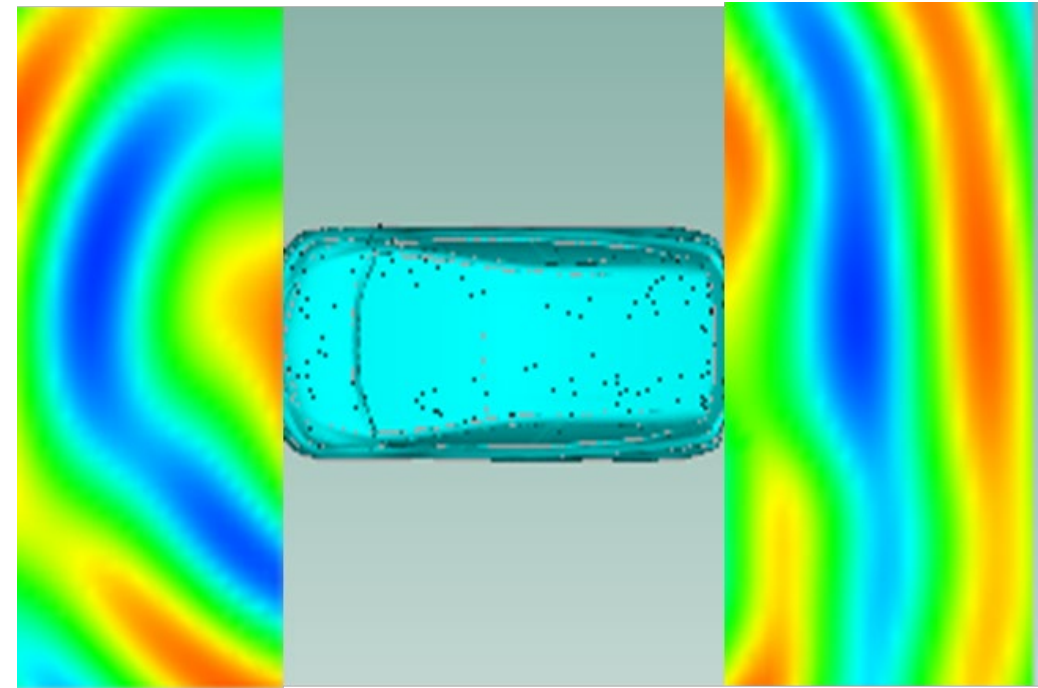
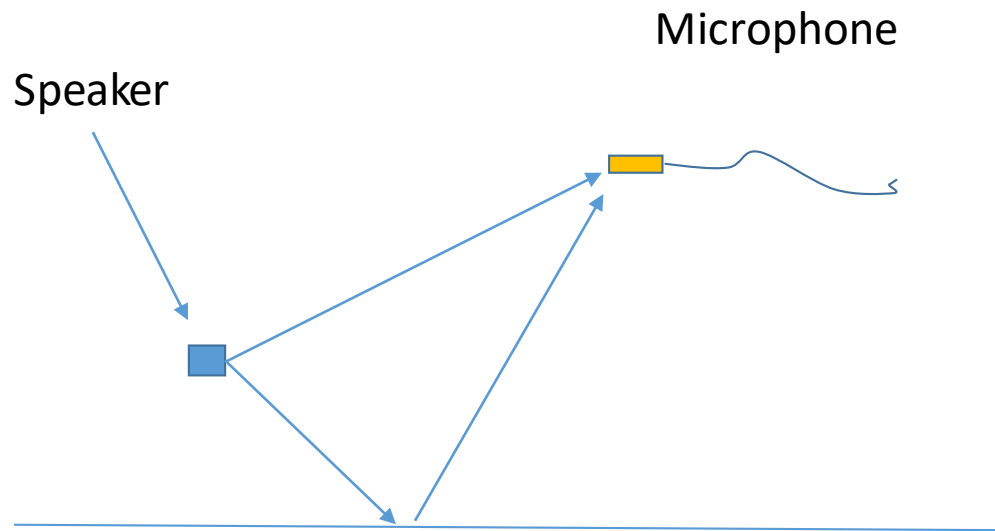
- Coverage probability at 95% is 1.58 times greater.
- Measurement variation observed in testing does not meet the principles of repeatability and reproducibility.

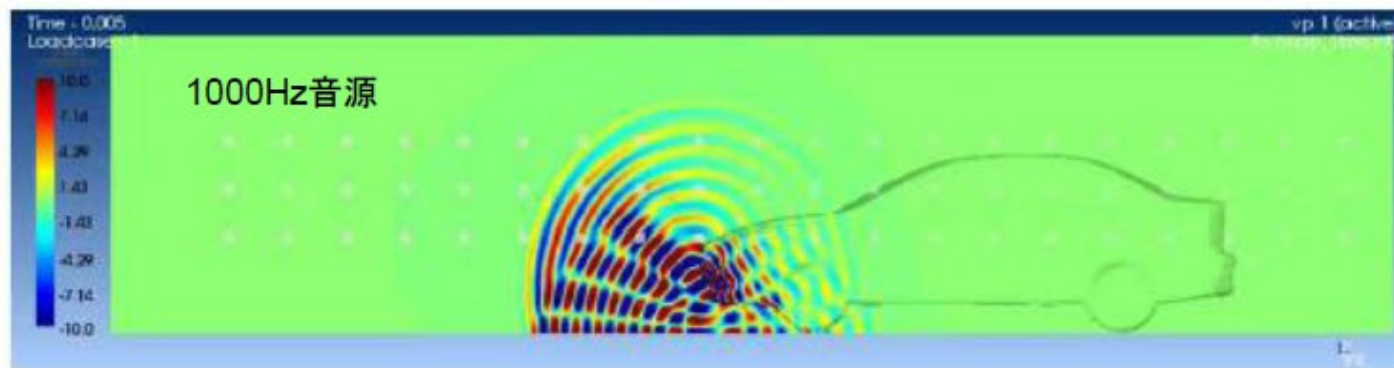
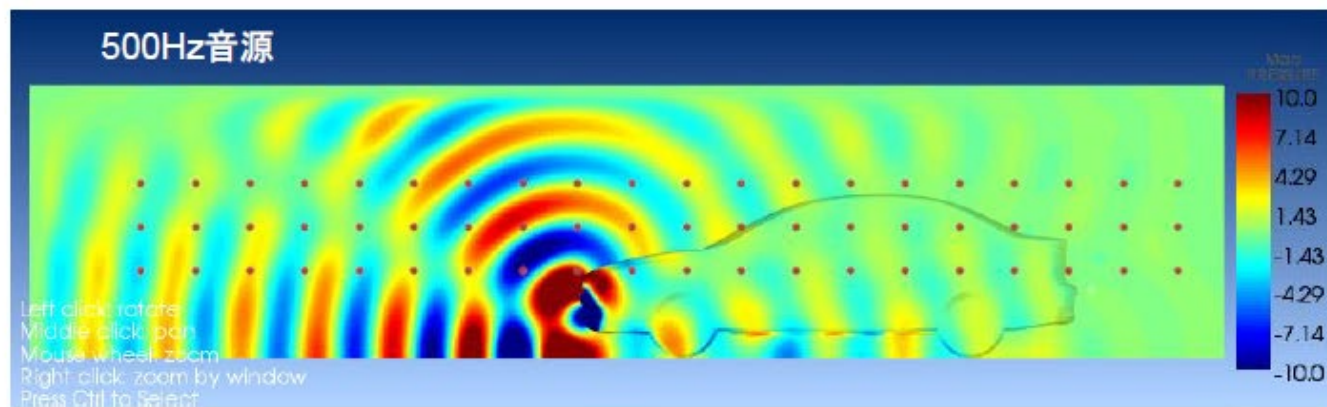
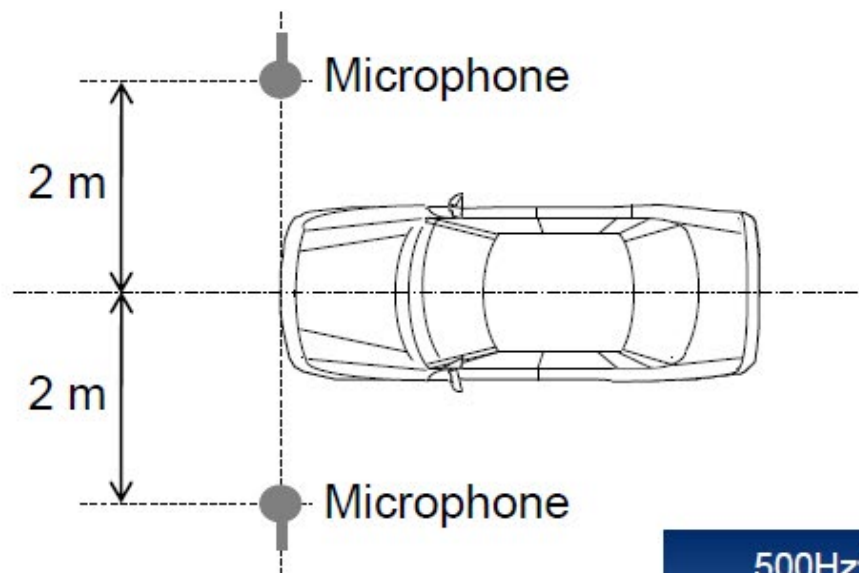
Investigation of reasons for variation

- Hypothesis: Constructive / Destructive wave interference cause by multi-path sounds. Sound source with direct and reflected paths.
- Experiments:
 1. Place sound source on reflective floor, determine if change of source location distance follows distance law ($1/r^2$) or has other characteristics.
 2. Vary microphone position, determine if change of microphone location distance follows distance law ($1/r^2$) or has other characteristics.
 3. Conduct outdoor testing with array of microphone spaced over small distance, determine if change of microphone location distance follows distance law ($1/r^2$) or has other characteristics.

CAE investigations

- Evaluate magnitude of spatial variation
- Evaluate potential improvement with microphone array





Conclusions

- Field testing shows variation greater than expected uncertainty stated in ISO 16254. Current measurement process does not meet expected repeatability and reproducibility criteria.
- In lab testing shows Sound Pressure Level does not follow distance expectations.
- Testing with absorption on floor indicates reflective cancelation/amplification.
- CAE results show magnitude of possible error > 20dB.
- Use of measurement array can reduce theoretical error to 5 dB.
- Use of “Max Hold” 1/3 octave measurement can also reduced observed variation.

ISO 16254 Proposal

1. Replace single microphone with array microphone.
2. Report highest 1/3 octave band result within the array.
3. Use “Max Hold” as 1/3 octave reporting method.

Justification:

- Reduce variation and improve repeatability and reproducibility.
- Measurement results better correlated to human experience