

Measurement Results from the revised ISO 16254 – application to safety regulations.

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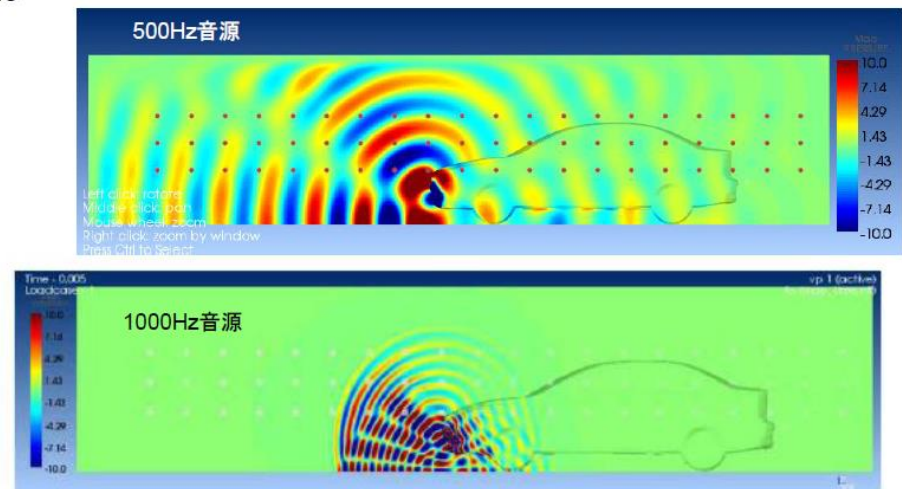
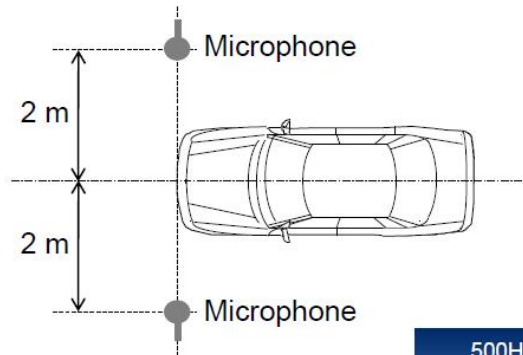
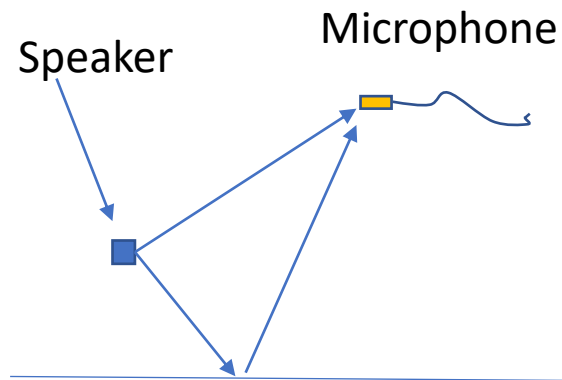
Convenor

ISO TC43/SC1/WG42



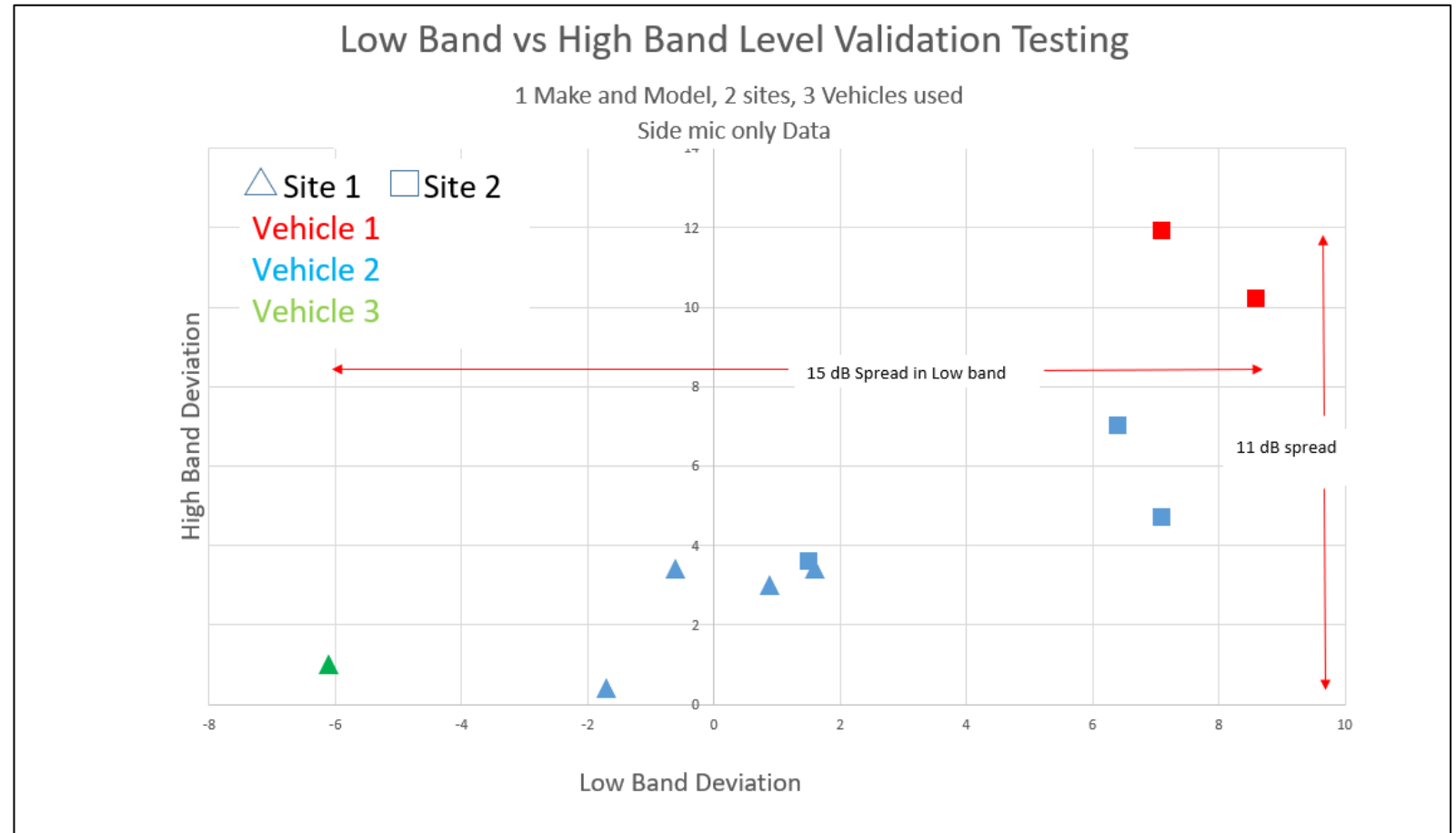
Background

- ISO 16254 has been updated to address the measurement uncertainty caused by nearfield spatial variation at a point source (the single microphone) which is most pronounced in the 1/3 octave results, especially for signals with tonal content.



Current variation experienced in the field

Message: Current 1/3 octave results experience results exceeding 10dB variation between identical vehicles tested when accounting for run-to-run and site-to-site variability



From a report to the ISO TC43/SC1/WG42 from experts from the United States in November of 2018 at the meeting in Matsue, Japan.

Assumptions in current method – which have proven incorrect.

- The reported SPL results, especially the 1/3 octave results, are representative of how humans experience the AVAS sounds.
 - Humans experience sounds in complex ways, but can be simplified to say humans have independent 1/3 octave detection filters coupled with the fact that humans are not a “point measurement”, meaning humans naturally detect sounds over a spatial range.
- Reporting the one-third octave results for the side with the lowest overall SPL will guarantee the louder side always will meet requirements.
- Reporting the 1/3 octave measurement results at the time of the maximum overall SPL will lead to reporting the corresponding maximum 1/3 octave results.
 - Measurements have consistently shown that different 1/3 octaves can have their peak levels at different times – not necessarily correlated to the maximum overall SPL.

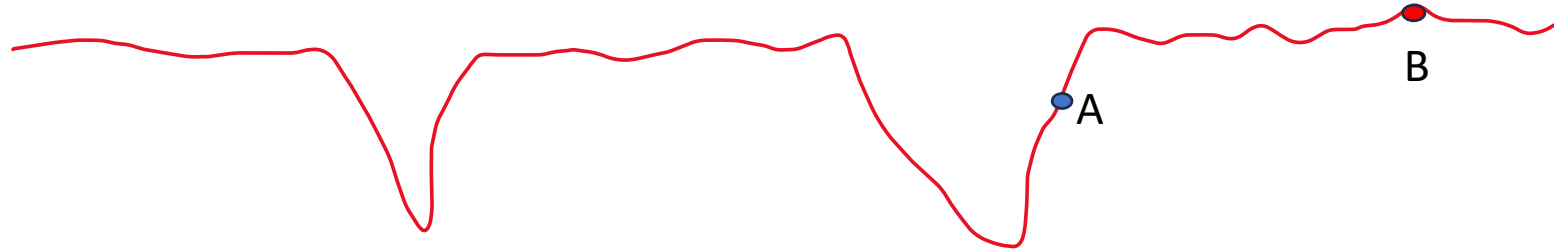
How does the revised ISO 16254 address the measurement issues?

- Incorporates a multi microphone array (5), to better capture the actual human experience. This idea is based on the principles of UN R28, where a microphone is traversed over a vertical range.
- Revised the signal processing to “Max Hold” in each 1/3 octave band, recognizing each band maximum may not occur at the same time.
- Reports 1/3 octave results from both sides of the vehicle.

What does this mean for UN R138 and safety?

- UN R138 has three independent safety requirements
 - Overall SPL
 - One-third octaves (at least two)
 - Frequency Shift
- The one-third octave regulatory requirements were set based on detection theories (Moore-Glasberg) and do not rely on the methods used in ISO 16254 for their validity.
 - These levels are the MINIMUM required for safety.
- The changes proposed in ISO 16254 are largely targeted to improve the representativeness and reduce the variation of the one-third octave results.

Perception and Safety



Take this as an example of a 1/3 octave vs. time. What do humans experience? We experience the peak levels, not the valleys. The 5-microphone array and max hold signal processing are designed to replicate this human perception. This is the same as how intermittent sounds are treated today (ISO, SAE, ECE, and FMVSS).

This perceived signal may be due to how the sound is designed, or how a human would experience a sound with spatial variation.

In both cases, the modulation improves the detectability of the sound over a steady-state sound.

We have the case today where the 1/3 octaves can be reported as point “A”, but the signal level representing perception is “B”.

Sounds, Measurement, and Safety

- Different sound types (tonal, broadband, modulated) have different potential variation in the current measurement procedure.
- The revised ISO 16254 will reduce the measurement variation.
- The revised ISO 16254 will better represent the actual human perception.

Consequences for measurement results

- The reported results will better correlate to actual human experience.
- The reported results will have less variation.
- With the changes proposed, it must be recognized that the reported results for the revised ISO 16254 and one-third octaves will always be equal or higher than for the current ISO 16254.
 - The amount of change is dependent on the type of sound.
 - However, 1/3 octave minimum levels are now guaranteed for BOTH sides of the vehicle, an improvement in the pedestrian safety.
 - Overall SPL is treated as the arithmetic average of the 5 microphones to keep the reported level as today.

ISO Recommendation

- The change to the technical measurement procedure does not, by itself, drive a change to the regulatory stringency levels.
- Different sound types are treated and reported with results better correlated to human perception.
- Any change to stringency levels need to be the result of studies of crash statistics.

Thank You

- Questions?