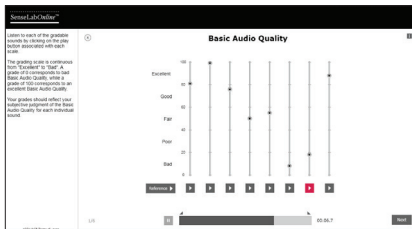




# ITU-R BS.1534-2 – MUSHRA

## Assessment of sound quality for multiple systems

The ITU-R BS.1534-2 Multi Stimulus test with Hidden Reference and Anchor (MUSHRA) [1] test is intended for the assessment of intermediate audio quality. Further, the method has shown to provide a reliable and repeatable measure of the audio quality of systems in a variety of technology domains.



The SenseLabOnline implementation of the MUSHRA test facilitates easy gathering of data.

### Use of the MUSHRA test

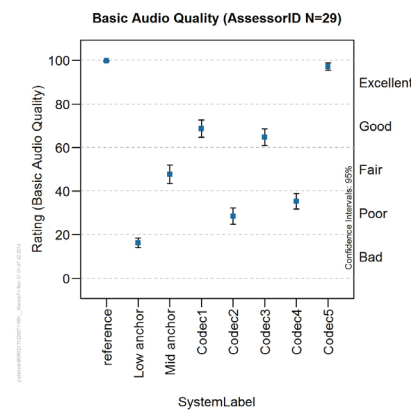
SenseLab has successfully used the method in the following technology domains:

- Audio codec
- Multi-channel codec
- Speech codec for telecommunication
- Headsets
- Headphones
- Small speakers
- Hearing aids [2]
- Active Noise Control headphones

The results from the MUSHRA test can be applied in both internal and external validations and benchmarking. The test can be used in both rapid product development cycles (R&D), as well as final product validation.

### Results and analysis

With highly effective procedures for building tests, gathering data, and performing data analysis SenseLab can deliver test results from MUSHRA tests within 2-3 working days.



Mean scores with confidence intervals (95%) from a MUSHRA test including 5 systems (+reference, mid anchor, and low anchor).

SenseLabOnline’s statistical analysis includes all procedures necessary to ensure reliability of the obtained results, using graphs for easy overview of the results.

Our standard analysis includes; checking basic assumptions and data quality, box-plots, plotting of means (incl. confidence intervals) for overall results, 2-way Analysis of Variance (ANOVA), plots showing interaction between independent variables, and eGauge (screening experienced assessors) [3] [4] [5].

### The test step-by-step

The MUSHRA test applies the Continuous Quality Scale with one or more attributes.

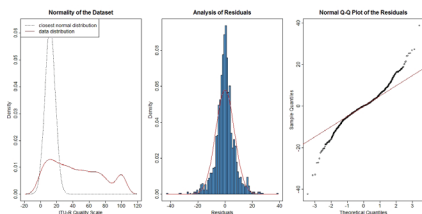
BASIC AUDIO QUALITY – is the single, global attribute, which is used to judge any and all, detected differences between the reference and the object. It is recommended that this attribute is always included in a test. Additional attributes may be added if relevant to the test (for e.g. stereophonic or multi channel systems).

In each trial the assessor is presented with sound samples from the reference system

and from the systems under test (e.g. different audio codecs), plus one hidden reference, and two hidden anchors. The assessor is allowed to switch between the reference signal and any of the systems under test. This is done real-time in SenseLabOnline.

The lengths of the samples should be ~10 sec. in order to increase robustness and stability of assessor ratings, reduce fatigue and the total duration of the listening test.

SenseLab has trained and developed its own panel for the purpose as it is recommended to use experienced assessors in the MUSHRA test [5].



*In SenseLabOnline we carefully check the reliability of the data before providing you with the results.*

### ITU-R BS.1534-2

- Recommended for use in assessments of intermediate audio quality.
- Can be applied in both internal and external validation or benchmarking of R&D efforts.
- Performed by experienced assessors for better data quality.
- Results can be delivered in 3 working days.

[1] ITU-R Recommendation BS.1534-2. Method for the subjective assessment of intermediate quality level of audio systems (06/2014). The ITU Radio communication Assembly.

[2] Simonsen, C. S., Legarth, S. V. (2010). A Procedure for Sound Quality Evaluation of Hearing Aids. Hearing Review, Dec. 2010.

[3] Le Ray, G. (2009). Development of a statistical routine with R in the field of audio engineering. (MSc Thesis). AGRO CAMPUS OUEST, France.

[4] Lorho, G., Le Ray, G., Zacharov, N. (2010). eGauge – A Measure of Assessor Expertise in Audio Quality Evaluations. AES 38th (Piteå, Sweden).

[5] Report ITU-R BS.2300-0. Methods for Assessor Screening (04/2014). The ITU Radio communication Assembly.

[6] Legarth, S. V., & Zacharov, N. V. (2009). Assessor selection process for multisensory applications. Proceedings of the 126th Convention of the Audio Engineering Society (Munich, Germany).

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