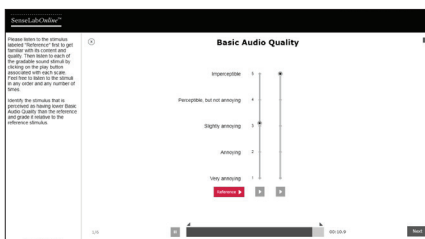


# ITU-R BS.1116-3

## Evaluation of high quality audio systems having small impairments

The ITU-R BS.1116-3 [1] is a very sensitive method intended for the assessment of systems, which introduce impairments as small as to be undetectable without rigorous control of the experimental conditions and appropriate statistical analysis.



The SenseLabOnline implementation of the ITU-R BS.1116-3 test. A system (technology under test) is being rated compared to a reference case.

### USE OF THE BS.1116-3

The ITU-R BS.1116-3 can be applied in a range of domains including (but not limited to):

- Audio codecs
- Watermarking technologies
- Speech codecs
- Various spatial sound technologies

SenseLab has experience in applying the method in any case where a technology is being benchmarked against a clear refer-

ence system, and where the difference between the reference system and the technology is (close to or actually) transparent.

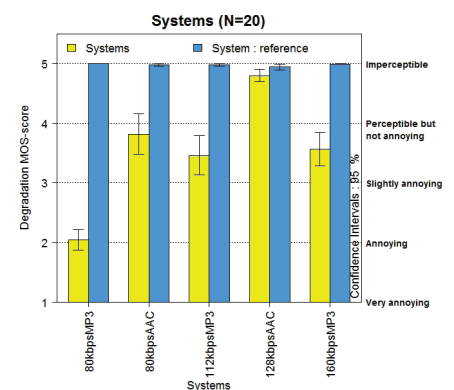
Results from the ITU-R BS.1116-3 test can be applied in both internal and external validations and benchmarking. The test can be used in both rapid product development cycles (R&D), as well as final product validation.

### RESULTS AND ANALYSIS

SenseLab has highly effective procedures for building tests, gathering data, and performing data analysis. This means that we can deliver test results from an ITU-T BS.1116-3 tests within 2-3 working days if needed.

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, plotting of means (incl. confidence intervals) for overall results, 2-way Analysis of Variance (ANOVA), plots showing interaction between independent variables, and assessor performance assurance [2].



Mean scores with confidence intervals from an ITU-R BS.1116-3 test including 5 systems (degradation compared to reference).

### THE TEST STEP-BY-STEP

The ITU-R BS.1116-3 test applies the continuous ITU-R five-grade impairment scale in one or more test questions.

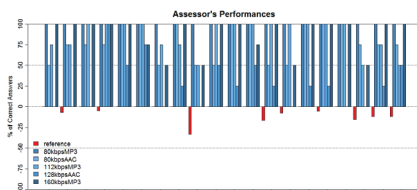
BASIC AUDIO QUALITY - is the single, global attribute, which is used in judging any and all detected differences between the reference and the object. Should always be included when testing.

In addition to basic audio quality other attributes may be included in the test. Example attributes for mono, stereo, multi-channel, and advanced audio systems can be found in the standard [1].

During the test the assessors can switch freely between the three stimuli. The known reference is always available at the "Reference"-button. The item (i.e. a given combination of a programme material and codec) and the hidden reference are randomly to the two play buttons below the sliders.

The assessors are asked to identify the reference and to assess the impairments of the item compared to the reference. Any perceived differences between the reference and the item must be interpreted as impairment.

Data from an ITU-R BS.1116-3 listening tests should come exclusively from assessors who have expertise in detecting the small impairments. The higher the quality reached by the systems to be tested, the more important it is to have expert/trained assessors.



Included in our analysis of the ITU-R BS.1116-3 is a thorough check of assessor performance and reliability.

SenseLab has developed its own internal procedure to fulfil the requirements in the standard regarding selecting appropriate assessors for this method [3].

A minimum of 20 assessors is recommended in the standard. SenseLab always applies an expert listening panel when performing an ITU-R BS.1116-3 test.

### ITU-R BS.1116-3

- Recommended for use in assessments of systems that introduce small impairment.
- Can be applied in both internal and external validation or benchmarking of R&D efforts.
- Performed by expert assessors for better data quality.
- Results can be delivered in 3 working days.

[1] ITU-R Recommendation BS.1116-3. Methods for the Subjective Assessment of small Impairments in Audio Systems including Multi channel Sound Systems, 2015. The ITU Radio communication Assembly (ITU-R)

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

[3] 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).

### CONTACT

SenseLab  
senselab@force.dk  
senselab.madebydelta.com  
+45 43 25 14 10

## SenseLab

FORCE Technology  
Venlighedsvej 4  
2970 Hørsholm  
Denmark

Tel.: +45 43 25 14 00  
senselab@force.dk  
senselab.madebydelta.com

