

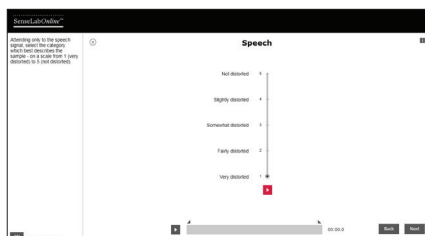


ITU-T P.835

Methodology for evaluating Speech Communication Systems that include noise suppression

The ITU-T P.835 methodology [1] is typically applied in evaluating systems that include noise suppression technologies. It is commonly used in the telecommunication industry for evaluating both uplink and downlink performance.

It has shown to produce very reliable and useful results for R&D because it includes information about performance on two very important factors – quality of speech signal as well as level of background noise.



The SenseLabOnline implementation of the ITU-T P.835. A system (technology under test) is being rated on the quality of the speech signal.

ATTRIBUTE DEVELOPMENT

The ITU-T P.835 methodology is mainly applicable in cases where a system is either encoding or reproducing a speech signal in a noisy environment. This includes:

- Handsets
- Various hands free solutions
- Headsets
- Hearing aids

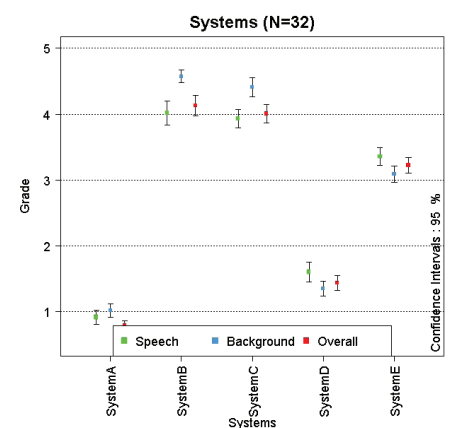
Results from the ITU-T P.835 test can be applied in both internal and external validations and benchmarking. The test can be used in rapid product development cycles (R&D), as well as final product validation.

RESULTS AND ANALYSIS

SenseLab has highly effective procedures for building tests, gathering data, and performing data analysis. We are able to deliver test results from an ITU-T P.835 test within 5 working days if needed.

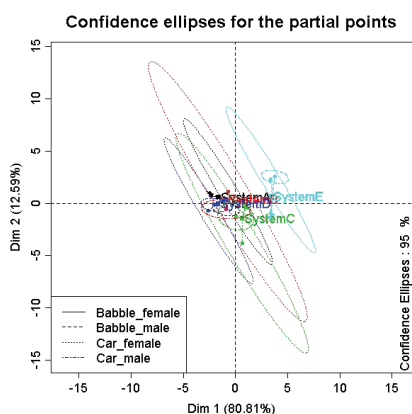
SenseLabOnline's statistical analysis includes all procedures necessary to ensure reliability of the obtained results, using graphs for easy overview of the results.

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) and plots showing interaction between independent variables [2].



Mean scores with confidence intervals from an ITU-T P.835 test including 5 systems. The graph shows the performance of each system on all three test questions.

Due to the multidimensionality of the ITU-T P.835 test, it is possible to apply multivariate analysis methods. This type of analysis provides an easy overview of how the independent variables influence and interact with system performance. This extra level of information is valuable when applying findings directly into R&D efforts.



The multivariate statistical analysis from an ITU-T P.835 test provides in-depth knowledge of interaction between e.g. background noise conditions and system performance.

THE TEST STEP-BY-STEP

The ITU-T P.835 includes three separate test questions that are all an inherent part of the test:

- **QUALITY OF SPEECH** - evaluates distortion of speech.
- **LEVEL OF BACKGROUND NOISE** - evaluates the intrusiveness of background noise.
- **OVERALL QUALITY** - assesses the overall perceived quality of the stimuli being presented.

The assessors judge the performance of one sound file on one test question at a time. The test questions are presented in fixed order throughout the test and completed for one sound file before proceeding to the next.

Data from an ITU-T P. 835 listening test should, according to the recommendation, come exclusively from naïve assessors.

ITU-T P.835

- Recommended for use in assessments of systems that include noise suppression and encode or reproduce speech signals in noisy environments.
- Can be applied in both internal and external validation or benchmarking of R&D efforts.
- Performed by naïve assessors (n=32).
- Include up to 9 systems (products under test) and 9 samples (test material) in a SenseLabOnline test.
- Results can be delivered within 5 working days.

[1] ITU-T Recommendation P.835.

Subjective test methodology for evaluating speech communication systems that include noise suppression algorithm, 2003. Telecommunication standardization sector of ITU (ITU-T).

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

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