

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

P.835

Amendment 1

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SERIES P: TELEPHONE TRANSMISSION QUALITY,
TELEPHONE INSTALLATIONS, LOCAL LINE
NETWORKS

Methods for objective and subjective assessment of
quality

Subjective test methodology for evaluating speech
communication systems that include noise
suppression algorithm

**Amendment 1: New Appendix III – Additional
provisions for nonstationary noise suppressors**

ITU-T Recommendation P.835 (2003) – Amendment 1

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ITU-T Recommendation P.835

Subjective test methodology for evaluating speech communication systems that include noise suppression algorithm

Amendment 1

New Appendix III – Additional provisions for nonstationary noise suppressors

Source

Amendment 1 to ITU-T Recommendation P.835 (2003) was agreed on 11 October 2007 by ITU-T Study Group 12 (2005-2008).

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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ITU-T Recommendation P.835

Subjective test methodology for evaluating speech communication systems that include noise suppression algorithm

Amendment 1

New Appendix III – Additional provisions for nonstationary noise suppressors

(This appendix does not form an integral part of this Recommendation)

III.1 General

The purpose of this appendix is to describe recommended test procedures for non-stationary acoustic noise suppressors.

The voice quality test is designed to evaluate the performance of the noise suppressor in nominal/optimal physical positions. The tests are conducted in physical positions corresponding to the usage mode: handset, far-talk, headset, speakerphone, and car handsfree mode. The recording environment uses a 4-speaker plus optional subwoofer configuration based on the [b-ETSI EG 202 396-1] project recommendation. Male and female voices are used for the speech sources, and a variety of stationary and non-stationary noise sources are used, including single voice, music, babble, street noise and car noise.

III.2 Usage mode

- **Handset mode:** In handset mode, the device is held on the head-and-torso simulator and oriented and positioned as described in [b-ITU-T P.64].
- **Far-talk mode:** In far-talk mode, the noise suppressor is held in front of the head-and-torso simulator's face and oriented and positioned as described in [b-3GPP TS 26.132].
- **Headset mode:** In headset mode, the device is placed on the ear of the head-and-torso simulator and oriented and positioned as described in [b-ITU-T P.380].
- **Speakerphone mode:** In speakerphone mode, the noise suppressor is placed on a table in front of the head-and-torso simulator and oriented and positioned as described in [b-ITU-T P.340].
- **Car handsfree mode:** In car handsfree mode, the device shall be positioned as described in [b-ITU-T P.581].

III.3 General recording properties

Source recordings of both speech and noise are to be made separately, and then played into the apparatus of the noise suppressor and re-recorded in multiple tracks.

- **Sample rate and bandwidth:** For narrow-band noise suppressors, the sample rate of the recordings shall be 8 kHz, and the bandwidth shall be 300-3400 Hz, according to ITU-T Rec. P.48 and [ITU-T P.830]. For wideband noise suppressors, the sample rate of the recordings shall be 16 kHz, and the bandwidth shall be 100-7000 Hz, according to [ITU-T P.830].
- **Duration:** The duration of each recording shall be at least 8 seconds (1 second background noise, 2 seconds of talking and noise, 2 seconds of noise, 2 seconds of talking and noise, 1 second background noise).

III.4 Speech source recordings

- **Head-and-torso simulator with mouth simulator to play speech recordings:** A head-and-torso simulator with mouth simulator shall be used to play the speech recordings into the noise suppressor, at a nominal/optimal controlled distance and orientation according to the desired usage mode, following [b-ITU-T P.51], [b-ITU-T P.57], [b-ITU-T P.58] and [b-ITU-T P.340].
- **Gender representation:** The speech files shall include recordings from at least two male talkers and two female talkers.

III.5 Noise source recordings

- **Quad speakers plus subwoofer to play noise recordings:** At least four loudspeakers plus subwoofer shall be used to play the noise recordings into the noise suppressor, at a distance of two metres from the noise suppressor, consistent with [b-ETSI EG 202 396-1] specification. Noise source files may be drawn from the [b-ETSI EG 202 396-1] corpus. It is also acceptable to use four loudspeakers without separate subwoofer provided that the low frequency content of the spectrum of the audio content is faithfully reproduced.
- **Noise source virtual motion:** The noise recordings shall include noise source virtual motion, that is, noise sources that are played from one speaker, then played from another speaker in quick succession.
- **Noise source multiple simultaneous sources:** The noise recordings shall also include multiple simultaneous noise sources played from multiple speakers.
- **Noise source types:** The noise recordings shall include the following noise source types:
 - **Pink noise:** Stationary noise recordings shall include pink noise files.
 - **Babble noise:** Babble recordings shall be used that include spoken voices of at least 4 people, with equal numbers of male and female talkers, talking simultaneously. In at least some of the tests, babble shall be created with each of 4 separate recordings played through its own speaker, to create the acoustic environment of 4 separate noise sources. The distribution of male and female talkers should be as spatially balanced as possible.
 - **Street noise:** Noise recordings shall include those made on a busy street.
 - **Car noise:** Noise recordings shall include those made in a moving automobile.
 - **Single voice:** Single-voice recordings shall be made with at least one male speaker and at least one female speaker.
 - **Music:** Music recordings shall be used that include drums.

III.6 Signal-to-noise ratios

Tests shall be performed using at least the following signal-to-noise ratios:

- 12 dB SNR
- 6 dB SNR
- 0 dB SNR

In addition, there shall be a test performed on clean speech (no added noise) to ensure no degradation by the noise suppressor (in the presence of a representative voice codec).

While not required, it is also recommended that informal tests be performed at low speech levels to ensure that speech is not clipped.

III.7 Post-processing by voice codec

Files shall be post-processed by a representative voice codec, suitable for the system in which the noise suppressor will be deployed (AMR, EVRC, etc.). If the codec contains a noise suppression algorithm (i.e., EVRC, SMV, EVRC-B), this noise suppression algorithm shall be disabled during the post-processing.

III.8 Initial convergence time

The initial convergence time of the device under test shall be discarded so as to ensure that the device has converged.

III.9 Test types

- **Overall quality on clean speech:** For a clean speech sample, the overall mean-opinion-score of the ITU-T P.835 procedures shall be measured with and without the noise suppressor.
- **Overall quality improvement in noise:** For the noisy speech samples, the overall mean-opinion-score of the ITU-T P.835 procedures shall be measured with and without the noise suppressor.

III.10 Example: acceptance test format Recommendations

This clause describes a recommended format for non-stationary noise suppressor acceptance tests. For each test, the ITU-T P.835 methodology is to be used. It is also possible to specify performance on the intermediate measures of voice quality and noise intrusiveness, or a combination of all the measures.

Test	Test Name	Noise Source	SNR	Position	Acceptance Criterion
Voice Quality Test	Overall Quality (Absolute MOS)	Pink	12 dB	Nominal	>X MOS
			6 dB		>X MOS
	0 dB		>X MOS		
	Overall MOS Improvement		12 dB		>X MOS
			6 dB		>X MOS
			0 dB		>X MOS
	Overall Quality (Absolute MOS)	Single-Voice	12 dB	Nominal	>X MOS
			6 dB		>X MOS
	0 dB		>X MOS		
	Overall MOS Improvement		12 dB		>X MOS
			6 dB		>X MOS
			0 dB		>X MOS
	Overall Quality (Absolute MOS)	Music	12 dB	Nominal	>X MOS
			6 dB		>X MOS
	0 dB		>X MOS		
	Overall MOS Improvement		12 dB		>X MOS
			6 dB		>X MOS
			0 dB		>X MOS
	Overall Quality (Absolute MOS)	Babble	12 dB	Nominal	>X MOS
			6 dB		>X MOS
	0 dB		>X MOS		
	Overall MOS Improvement		12 dB		>X MOS
			6 dB		>X MOS
			0 dB		>X MOS
Overall Quality (Absolute MOS)	Street	12 dB	Nominal	>X MOS	
		6 dB		>X MOS	
0 dB		>X MOS			
Overall MOS Improvement		12 dB		>X MOS	
		6 dB		>X MOS	
		0 dB		>X MOS	
Overall Quality (Absolute MOS)	Car	12 dB	Nominal	>X MOS	
		6 dB		>X MOS	
0 dB		>X MOS			
Overall MOS Improvement		12 dB		>X MOS	
		6 dB		>X MOS	
		0 dB		>X MOS	
Overall MOS Improvement	None	Infinity	Nominal	>X MOS	

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