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Do-no-harm testing

Recommendation ITU-T G.161.1



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Recommendation ITU-T G.161.1

Do-no-harm testing

Summary

Recommendation ITU-T G.161.1 defines do-no-harm (DNH) tests for network-based and terminal-based voice quality enhancement (VQE) functions and non-VQE functions.

Conventionally, performance specifications are written for telecommunication equipment to specify their performance characteristics in their intended application. Do-no-harm testing is a concept that has been introduced to specify tests which may be carried out to evaluate situations where the equipment, although meeting its performance specifications in its intended application, may cause some other unexpected performance degradation. Specific DNH tests which relate to "fixed de-jitter buffer operation" and "long-term media path delay stability" are described in the annexes of this Recommendation. Where appropriate, these tests are backed up by case studies which are described in the appendices. It is anticipated that additional annexes covering other DNH scenarios will be added in the future.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Keywords

De-jitter buffer; delay stability; do no harm; media path delay; testing; voiceband data; 2100 Hz answering tone.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

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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.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation ITU-T G.161.1

Do-no-harm testing

1 Scope

This Recommendation defines do-no-harm (DNH) tests for network-based and terminal-based voice quality enhancement (VQE) functions and non-VQE functions. These tests are applicable to functions used in both fixed and mobile networks and are independent of transport technology (e.g., TDM, ATM and IP).

Where necessary, this Recommendation takes into account any similar tests that already exist in other Recommendations (e.g., [b-ITU-T G.160], [b-ITU-T G.168] and [b-ITU-T G.169]) and is applicable to both stand-alone VQE and non-VQE functions and VQE and non-VQE functions connected in tandem.

Where possible, the DNH tests defined in this Recommendation use standardized performance evaluation criteria (e.g., [ITU-T P.862] and [b-ITU-T P.863]) and cover all possible in-band audio signals including speech, voiceband data and network signalling tones. Each test has a well-defined test configuration and a set of requirements that allow repeatability and consistency of results between different test laboratories.

The following VQE and non-VQE functions are included in the scope for DNH:

- VQE functions:
 - Echo cancellers including comfort noise injection
 - Noise reduction/cancellation functions
 - Automatic gain/level control
- Non-VQE functions:
 - De-jitter buffers
 - Codecs
 - Voice activity detection
 - Silence suppression

Other functions which may be included are:

- Send or ingress (entering the network):
 - Microphone array processing (MAP)
 - High-frequency encoding (HFE)
 - Equalization (EQ)
 - Limiting (LM)
- Receive or egress (exiting the network):
 - Bandwidth extension (BWE)
 - Equalization (EQ)
 - Noise compensation (NC; also referred to as ALE)
 - Limiting (LM)

This Recommendation provides guidance on how to conduct DNH testing, including case studies, as specific examples.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T P.501] Recommendation ITU-T P.501 (2012), *Test signals for use in telephony*.
- [ITU-T P.862] Recommendation ITU-T P.862 (2001), *Perceptual evaluation of speech quality PESQ: An objective method for end-to-end speech quality assessment of narrow-band telephone networks and speech codecs*.
- [ITU-T V.8] Recommendation ITU-T V.8 (2000), *Procedures for starting sessions of data transmission over the public switched telephone network*.
- [ITU-T V.25] Recommendation ITU-T V.25 (1996), *Automatic answering equipment and general procedures for automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls*.
- [ETSI TS 102 929] ETSI TS 102 929 (V2.1.2) (2013-03), *Speech and multimedia Transmission Quality (STQ); Procedures for the identification and selection of common modes of de-jitter buffers and echo cancellers*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 answering tone [ITU-T V.25]: The tone transmitted from the called end.

NOTE 1 – The answering tone is an uninterrupted 2100 ± 15 Hz tone with a duration, except when truncated as described in clause 4.3 of [ITU-T V.25], of 3.3 ± 0.7 s.

NOTE 2 – Recommendation [ITU-T V.8] specifies, for the purpose of starting sessions of data transmission, an amplitude modulated answering tone, ANSam.

3.1.2 de-jitter buffer [b-ITU-T G.1020]: A buffer designed to remove the delay variation (i.e., jitter) in packet arrival times. Data is put into the de-jitter buffer at a variable rate (i.e., whenever they are received from the network) and taken out at a constant rate.

3.1.3 phase reversals [ITU-T V.25]: Reversals (180°) in the phase of the answering tone at intervals of 425 to 475 ms. The reversal in phase shall be accomplished such that the phase is within 180 ± 10 degrees in 1 ms, and that the amplitude of the answering tone is not more than 3 dB below its steady state value for more than 400 ms.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 do-no-harm (DNH): DNH is an attribute of a network-based or terminal-based function which states that if the function is included in the transmission path it does not degrade the performance of the media signal (e.g., speech or voiceband data) as measured using a stated metric. Note that depending on the metric, a tolerance may be necessary to allow some measureable degradation that is not significant for the user or application. For example, if the stated metric for voiceband data is the bit error rate (BER), then the requirement for DNH may be "zero increase in