

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

P.10/G.100

(11/2017)

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

Vocabulary and effects of transmission parameters on
customer opinion of transmission quality

**SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS**

International telephone connections and circuits –
Transmission planning and the E-model

**Vocabulary for performance, quality of service
and quality of experience**

Recommendation ITU-T P.10/G.100

ITU-T



Documents
International
Telecommunication
Union
Document Sharing Hub

ITU-T P-SERIES RECOMMENDATIONS

TELEPHONE TRANSMISSION QUALITY, TELEPHONE INSTALLATIONS, LOCAL LINE NETWORKS

Vocabulary and effects of transmission parameters on customer opinion of transmission quality	Series	P.10
Voice terminal characteristics	Series	P.30 P.300
Reference systems	Series	P.40
Objective measuring apparatus	Series	P.50 P.500
Objective electro-acoustical measurements	Series	P.60
Measurements related to speech loudness	Series	P.70
Methods for objective and subjective assessment of speech quality	Series	P.80
Methods for objective and subjective assessment of speech and video quality	Series	P.800
Audiovisual quality in multimedia services	Series	P.900
Transmission performance and QoS aspects of IP end-points	Series	P.1000
Communications involving vehicles	Series	P.1100
Models and tools for quality assessment of streamed media	Series	P.1200
Telemeeting assessment	Series	P.1300
Statistical analysis, evaluation and reporting guidelines of quality measurements	Series	P.1400
Methods for objective and subjective assessment of quality of services other than speech and video	Series	P.1500

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T P.10/G.100

Vocabulary for performance, quality of service and quality of experience

Summary

Recommendation ITU-T P.10/G.100 contains terms and definitions associated with network performance, quality of service and quality of experience.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T P.10	1980-11-21		11.1002/1000/7976
2.0	ITU-T P.10	1984-10-19		11.1002/1000/5883
3.0	ITU-T P.10	1988-11-25		11.1002/1000/1715
4.0	ITU-T P.10	1993-03-12	XII	11.1002/1000/1716
5.0	ITU-T P.10	1998-12-03	12	11.1002/1000/4535
5.1	ITU-T P.10 (1998) Amd. 1	2003-11-13	12	11.1002/1000/7039
6.0	ITU-T P.10/G.100	2006-07-14	12	11.1002/1000/8857
6.1	ITU-T P.10/G.100 (2006) Amd. 1	2007-01-25	12	11.1002/1000/9068
6.2	ITU-T P.10/G.100 (2006) Amd. 2	2008-07-14	12	11.1002/1000/9542
6.3	ITU-T P.10/G.100 (2006) Amd. 3	2011-12-14	12	11.1002/1000/11456
6.4	ITU-T P.10/G.100 (2006) Amd. 4	2015-06-29	12	11.1002/1000/12513
6.5	ITU-T P.10/G.100 (2006) Amd. 5	2016-07-29	12	11.1002/1000/12969
7.0	ITU-T P.10/G.100	2017-11-13	12	11.1002/1000/13408

Keywords

Definitions, quality of experience, quality of service, terms.

* 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

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). 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.

NOTE

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

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2017

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Table of Contents

	Page
1 Scope.....	1
2 References.....	1
3 Definitions	1
3.1 Terms defined elsewhere	1
3.2 Terms defined in this Recommendation.....	1
4 Abbreviations and acronyms	1
5 Conventions	3
6 Terms and definitions	3
Bibliography.....	40

Copyright International Telecommunication Union/ITU Telecommunication Sector
Provided by IHS Markit under license with ITU-T
No reproduction or networking permitted without license from IHS

Recommendation ITU-T P.10/G.100

Vocabulary for performance, quality of service and quality of experience

1 Scope

This Recommendation contains terms and definitions associated with network performance, quality of service and quality of experience.

2 References

None.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

The terms defined by this Recommendation are contained in clause 6.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACR	Absolute Category Rating
ARL	Acoustic Reference Level
ASR	Automatic Speech Recognition
CCR	Comparison Category Rating
CIF	Common Intermediate Format
CMOS	Comparison Mean Opinion Score
CLR	Circuit Loudness Rating
CQE	Communication Quality Estimated
CQO	Communication Quality Objective
CQS	Communication Quality Subjective
CSS	Composite Source Signal
DCME	Digital Circuit Multiplication Equipment
DCR	Degradation Category Rating
DL	Round-Trip Delay
DMOS	Degradation Mean Opinion Score
DMS	Digital Mobile System
DRP	Eardrum Reference Point
DRS	Digital Reference Sequence
ECRP	Ear Cap Reference Point



EEP	Ear Canal Entrance Point
ERP	Ear Reference Point
HATS	Head and Torso Simulator
HFRP	Hands-Free Reference Point
HRX	Hypothetical Reference Connection
I _e	Equipment Impairment Factor
INMD	In-service Non-intrusive Measurement Device
L _E	Earphone Coupling Loss
L _{ECHO}	Echo Loss
LELR	Listener Echo Loudness Rating
LQE	Listening-only Quality Estimated
LQS	Listening-only quality subjective
LR	Loudness Rating
LRP	Level Reference Point
LS	Local System
LSTR	Listener Sidetone Rating
MNRU	Modulated Noise Reference Unit
MOS	Mean Opinion Score
MPEG	Moving Picture Expert Group
MRP	Mouth Reference Point
MTF	Modulation Transfer Function
NCP	Network Connection Point
OLL	Open-Loop Loss
OLR	Overall Loudness Rating
PABX	Private Automatic Branch Exchange
PBN	Private Branch Network
PBX	Private Branch Exchange
PSTN	Public Switched Telephone Network
QDU	Quantizing Distortion Unit
QoE	Quality of Experience
QoS	Quality of Service
RLR	Receive Loudness Rating
RML	Ratio Medium/Low
SI	Spatial Perceptual Information
SIF	Source input format
SLR	Send Loudness Rating
SM	Singing Margin

Copyright International Telecommunication Union/ITU Telecommunication Sector

STI	Speech Transmission Index
STMR	Sidetone Masking Rating
TBRL	Test Balance Return Loss
TCL	Terminal Coupling Loss
TCL _w	Weighted Terminal Coupling Loss
TELR	Talker Echo Loudness Rating
TT	Transmission Time
TTT	Total Transmission Time
TI	Temporal Perceptual Information
TTS	Text-to-Speech Synthesis
TRP	Transmission Reference Point
XRLR	Crosstalk Receive Loudness Rating
VTC/VT	Video Teleconferencing/Video Telephony Service
VICP	Virtual International Connecting Point
VPN	Virtual Private Network

5 Conventions

None.

6 Terms and definitions

This Recommendation defines the following terms in alphabetic order:

6.1 3.1 kHz handset telephony

A real-time two-way speech communication within the frequency range from approximately 300 to 3400 Hz using one or more telecommunication networks with suitable terminal equipment connected to the network termination points, characterized by:

- presentation of an acoustical speech signal to the mouthpiece of a traditionally shaped handset:
 - either analogue transport of the said speech signal under real-time conditions through and by telecommunication networks: the said networks being intended for telephony applications between network termination points;
 - or filtering of the said speech signal to the frequency range from approximately 300 to 3 400 Hz; transformation of the said speech signal either by waveform or by non-waveform (speech analysis) encoder; transport and processing of the said speech signal under real-time conditions through and by telecommunication networks: the said networks being intended for telephony applications between network termination points; back transformation (speech synthesis) of the said speech signal by the respective decoder;
- acoustical presentation of the said speech signal in the frequency range from approximately 300 to 3 400 Hz by the earpiece of a traditionally shaped handset.



6.2 4-wire chain

The 4-wire chain denotes the whole unbroken chain of 4-wire national and international circuits in a complete telephone connection, including possible 4-wire circuits between the primary centre and the local exchange and on the subscriber line, e.g., ISDN access and 4-wire or digitally connected PBXs.

6.3 absolute category rating (ACR) (see [b-ITU-T P.800])

"Test method in which subjects are asked to express classification opinions by using absolute quality scales (excellent, good, ...) for their judgement."

6.4 acceptance scale (see [b-ITU-T P.85])

Opinion scale for measuring the overall quality of the message on a service point of view. Acceptance requires a Yes/No answer.

6.5 acceptance test

A contractual test to prove to the customer that the device meets certain conditions of its specification.

6.6 acoustic artificial voice

Acoustic signal at the mouth reference point (MRP) of the artificial mouth. It complies with the same time and spectral specifications as the electrical artificial voice.

6.7 acoustic coupler (in telephonometry)

A cavity of defined shape and volume used for the testing of telephone earphones or telephone transmitters in conjunction with a calibrated microphone adapted to measure the pressure developed within the cavity.

6.8 acoustic hood

A hood lined with sound-absorbing material to facilitate the use of a telephone station by reducing the ambient noise level.

6.9 acoustic reference level (ARL) (see [b-ITU-T P.310], [b-ITU-T P.311], [b-ITU-T P.341] and [b-ITU-T P.342])

The acoustic level at MRP which results in a -10 dBm0 output at the digital interface.

6.10 acoustic shock suppressor (in telephony)

A device associated with a telephone station and intended to prevent acoustic shocks, by setting an upper limit to the absolute values of the instantaneous electrical voltage that can be applied to the telephone earphone.

6.11 Acoustic startle

A psychological effect caused by acoustic stimulation that may cause disturbance to some users.

6.12 acoustical telephony gain (telephonic transfer function) (see [b-ITU-T P.58])

Ratio of the pressure at the ear reference point of a listener to the pressure at the mouth reference point of a talker connected by a telephone channel.

6.13 acoustically closed earphones (nominally sealed) (see [b-ITU-T P.57])

Earphones which are intended to prevent any acoustic coupling between the external environment and the ear canal.

6.14 acoustically open earphones (nominally unsealed) (see [b-ITU-T P.57])

Earphones which intentionally provide an acoustic path between the external environment and the ear canal.

6.15 active speech level (see [b-ITU-T P.56])

A quantity, expressed in decibels relative to a stated reference, e.g., volts or pascals, formed by averaging the speech-signal's power over the active time, according to [b-ITU-T P.56], method B.

6.16 active testing

Refers to the method in which data is acquired for the measurement, i.e., that the test makes use of a dedicated channel for the measurement, or by dialling a number and making a call, or by setting-up a channel for the measurement, or by transmitting packets or frames whose purpose is dedicated to measurement.

6.17 active time

Aggregate of all intervals of time when speech is deemed to be present according to the criterion adopted by ITU-T (see [b-ITU-T P.56]) for the purpose of measurement.

6.18 activity factor

Ratio of the active time to total time elapsed during a measurement, usually expressed as a percentage.

6.19 advantage factor

A scalar number (normally positive) representing the advantage of access that certain systems (e.g., mobile) have over wire bound handset telephony. Expressed in units of the transmission rating factor R.

6.20 analogue network

A network in which the access interface and all network elements are considered analogue.

6.21 articulation index

(Definition generally used in psychoacoustics)

A measure of the intelligibility of voice signals, expressed as a percentage of speech units that are understood by the listener when heard out of context. The articulation index is based on partially empirical, partially theoretical principles to predict the speech intelligibility under known signal-to-noise conditions.

6.22 articulation scale (see [b-ITU-T P.85])

Opinion scale for measuring the impression of clarity felt by a listener. How distinguishable are the words composing the message?

6.23 artificial conversational speech (see [b-ITU-T P.59])

A signal which reproduces the on-off characteristics of human conversational speech, especially useful for characterizing speech processing systems which have speech detectors, such as speakerphones, echo control devices and digital circuit multiplication equipment (DCME).

6.24 artificial ear

A device for the calibration of earphones incorporating an acoustic coupler and a calibrated microphone for the measurement of sound pressure and having an overall acoustic impedance similar to that of the average human ear over a given frequency band.

6.25 artificial mouth

A device consisting of a loudspeaker mounted in an enclosure and having a directivity and radiation pattern similar to those of the average human mouth.

6.26 artificial mouth excitation signal

A signal applied to the artificial mouth in order to produce the acoustic artificial voice. It is obtained by equalizing the electrical artificial voice for compensating the sensitivity/frequency characteristic of the mouth.

6.27 artificial voice

A mathematically defined signal which reproduces human speech characteristics, relevant to the characterization of linear and non-linear telecommunication systems. It is intended to give a satisfactory correlation between objective measurements and tests with real speech.

6.28 automatic speech recognition (ASR)

A process or a technology which accepts a natural speech signal as an input and provides, at the output, a coded version of what has been said (word, command, expression, sentence, etc.).

6.29 automatic speech recognition (ASR) system

An implementation in hardware or software that accepts a natural speech signal as an input and provides, at the output, a coded version of what has been said (word, command, expression, sentence, etc.).

6.30 balance return loss

At a 4-wire terminating set ("hybrid"), that portion of the semi-loop loss which is attributable to the degree of match between the impedance, Z_2 , connected to the 2-wire line terminals, and the balance impedance, Z_B . It is given approximately by the expression:

$$L_{BR} = 20 \log_{10} \left| \frac{Z_2 + Z_B}{Z_2 - Z_B} \right| \text{ dB}$$

NOTE – Under most circumstances the expression given is sufficiently accurate. However, for some worst case evaluations, the exact expression must be used. The exact expression is:

$$L_{BR} = 20 \log_{10} \left| \frac{Z_0 + Z_B}{2Z_0} - \frac{Z_2 + Z_0}{Z_2 - Z_B} \right| \text{ dB}$$

where Z_0 is the 2-wire input impedance. (If $Z_0 = Z_B$, the two expressions become identical.)

6.31 band sensation level

The difference, expressed in decibels, between the sound integrated over a frequency band and the sound pressure level in that band at the threshold of audibility, there being no other disturbing sound.

6.32 block

A group of pixel. For example, a block of 8×8 pixel is the smallest coding block used in MPEG-1 algorithms. There are 1320 blocks in a SIF image, 44 in the horizontal direction (352 pixel/8) and 30 in the vertical direction (240 lines/8).

6.33 block distortion

Distortion of the image characterized by the appearance of an underlying block encoding structure. Also called tiling.

6.34 blurring

A global distortion over the entire image, characterized by reduced sharpness of edges and spatial detail.

6.35 call

The establishment and use of a complete connection following a call attempt.

6.36 call attempt (by a user)

A sequence of operations made by a user of a telecommunication network trying to connect to the desired user or service.

Associated term: to call.

6.37 circuit access point

The circuit access points have been defined as "4-wire access points so located that as much as possible of the international circuit is included between corresponding pairs of these access points at the two centres concerned" (see [b-ITU-T M.565]). These points, and their relative level (with reference to the transmission reference point), are determined in each case by the administration concerned. They are taken as the basic reference points of known relative level to which other transmission measurements will be related. In other words, for measurement and lining-up purposes, the relative level at the appropriate circuit access point is the relative level with respect to which other levels are adjusted.

6.38 circuit loudness rating (CLR) (see [b-ITU-T G.111])

The loudness loss between two electrical interfaces in a connection or circuit, each interface is terminated by its nominal impedance which may be complex.

6.39 circuit, telecommunication circuit

A combination of two transmission channels permitting bidirectional transmission of signals between two points, to support a single communication.

NOTE 1 – If the telecommunication is by nature unidirectional (for example: long distance television transmission), the term "circuit" is sometimes used to designate the single channel providing the facility.

NOTE 2 – In a telecommunication network, the use of the term "circuit" is generally limited to a telecommunication circuit directly connecting two switching devices or exchanges, together with associated terminating equipment.

NOTE 3 – A telecommunication circuit may permit transmission in both directions simultaneously (duplex), or not simultaneously (simplex).

NOTE 4 – A telecommunication circuit that is used for transmission in one direction only is sometimes referred to as a unidirectional telecommunication circuit. A telecommunication circuit that is used for transmission in both directions (whether simultaneously or not) is sometimes referred to as a bidirectional telecommunication circuit.

NOTE 5 – The term circuit may be preceded by qualifiers other than telecommunication, e.g., telephone, digital, leased, etc., each defining a different application and having a different meaning.

6.40 circum-aural earphones (see [b-ITU-T P.57])

Earphones which enclose the pinna and rests on the surrounding surface of the head. Contact to the head is normally maintained by compliant cushions. Circum-aural earphones may touch, but not significantly compress the pinna.

6.41 colour errors

Distortion of all or a portion of the final image characterized by the appearance of unnatural or unexpected hues or saturation levels. These hues or saturation levels were not present in the original image.

6.42 commissioning objective

(Defined in [b-ITU-T G.102])

6.43 common intermediate format (CIF)

Common intermediate format used by [b-ITU-T H.261] coders, 352 luminance pixel $\times$ 288 lines.

6.44 communication-quality component

Communication-quality component refers to how users perceive that the system is facilitating the communication. More specifically, it refers to those quality features related with communication aspects. Examples of such aspects are conversation flow, communication effort, cognitive load and task performance.

6.45 comparison category rating (CCR) (see [b-ITU-T P.800])

Test method in which subjects are asked to express opinion judgements using comparison category scale (much better, better, slightly better, ...).

6.46 comparison mean opinion score (CMOS) (see [b-ITU-T P.800])

The mean of opinion scores as defined in clause 6.184, when the CCR method is used to evaluate the performance of a telephone transmission system.

6.47 (complete) connection

A connection between users' terminals.

6.48 complexity for an ASR system

A measure of the mean length of the sentences which are accepted by the system.

6.49 composite loss

The composite loss of a quadrupole inserted between two impedances Z_E (of the generator) and Z_R (of the load) is the expression in transmission units of the ratio P_E/P_R , where:

P_E is the apparent power that the generator Z_E would furnish to a load of impedance Z_E .

P_R is the apparent power that the same generator furnishes via the said quadrupole to the load Z_R .

If the number thus obtained is negative, then there is a composite gain.

6.50 composite source signal (CSS)

A signal composed in time by various signal elements.

6.51 connected-word mode

A string of words spoken carefully, but with no explicit pauses between them.

6.52 connection

A temporary association of transmission channels or telecommunication circuits, switching and other functional units set up to provide the means of a transfer of information between two or more points in a telecommunication network.

6.53 continuous speech understanding system

A system that can recognize continuous speech, often having phoneme-sized references, using lexical, syntactic, semantic, and pragmatic knowledge, and reacts appropriately (therefore, having interpreted the message and found the corresponding action to be taken). This term describes the final objective of an ASR research.

6.54 continuous-speech mode

A string of words spoken fluently and rapidly as in conversational speech.

6.55 conversational quality

The quality of a bi- or multidirectional conversation as perceived by a communication partner.

6.56 conversational speech quality

The speech quality as experienced in a bi- or multidirectional conversation.

6.57 crest factor

Peak-to-RMS ratio of a signal.

6.58 crosstalk receive loudness rating (XRLR)

The loudness loss from a disturbing electric interface to the disturbed subscriber's ear via the crosstalk path.

6.59 daily noise exposure

Daily noise exposure is a time-weighted-average of A-weighted noise exposure for a conventional 8-hour workday.

6.60 dB-related units

dBW: absolute power level with respect to 1 watt, expressed in decibels;

dBm: absolute power level with respect to 1 milliwatt, expressed in decibels;

dBov relative power level expressed in decibels, referred to the overload point of the digital system;

dBfs relative power level expressed in decibels, referred to the maximum possible digital level (full scale);

dBu: absolute voltage level with respect to 0.775 V, expressed in decibels;

dBrS: relative power level expressed in decibels, referred to another point in sound-programme transmission;

dBV: absolute power level with respect to 1 V, expressed in decibels;

dBm0: at the reference frequency (1020 Hz), L dBm0 represents an absolute power level of L dBm measured at the transmission reference point (0 dBr point), and a level of L + x dBm measured at a point having a relative level of x dBr.

The voltage of a 0 dBm0 tone at any voice band frequency at a point of x dBr is given by the expression:

$$V = \sqrt{\frac{x}{10^{10}} \times (1 \times 10^{-3}) \text{ watt} \times |Z_{1020}|} \text{ volts}$$

where $|Z_{1020}|$ is the modulus of the nominal impedance, Z, at the point at the reference frequency 1020 Hz. Z may be resistive or complex.

NOTE – A discussion of the applications of other dB-related terms is given in Appendix I of [b-ITU-T G.100.1].

6.61 degradation category rating (DCR) (see [b-ITU-T P.800])

A modification of the ACR test method where subjects compare the system under test with a reference system and express their opinion using a degradation scale (degradation inaudible, audible but not annoying, slightly annoying, ...).

6.62 degradation mean opinion score (DMOS) (see [b-ITU-T P.800])

The mean of opinion scores as defined in clause 6.184, when the DCR method is used to evaluate the performance of a telephone transmission system.