

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

J.342

(04/2011)

SERIES J: CABLE NETWORKS AND TRANSMISSION
OF TELEVISION, SOUND PROGRAMME AND OTHER
MULTIMEDIA SIGNALS

Measurement of the quality of service

**Objective multimedia video quality
measurement of HDTV for digital cable
television in the presence of a reduced
reference signal**

Recommendation ITU-T J.342



International
Telecommunication
Union
Documents

Document Sharing Hub

Document ID: 123456789

Recommendation ITU-T J.342

Objective multimedia video quality measurement of HDTV for digital cable television in the presence of a reduced reference signal

Summary

Recommendation ITU-T J.342 provides an objective video quality measurement method for high definition television (HDTV) when a reduced reference signal is available. The following list shows example applications that can use this Recommendation:

- 1) Interlaced video television streams over cable networks including those transmitted over the Internet using Internet Protocol.
- 2) Video quality monitoring at the receiver when side-channels are available.
- 3) Video quality monitoring at measurement nodes located between point of transmission and point of reception.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T J.342	2011-04-29	9

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 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 2012

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
	1.1 Applications.....	2
	1.2 Limitations.....	2
2	References.....	2
3	Definitions	3
	3.1 Terms defined elsewhere	3
	3.2 Terms defined in this Recommendation.....	3
4	Abbreviations and acronyms	3
5	Conventions	4
6	Description of the reduced reference measurement methods	4
	6.1 Introduction	4
	6.2 EPSNR reduced-reference model.....	5
	Appendix I – Findings of the Video Quality Experts Group (VQEG)	17
	Bibliography.....	19

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
 Full document details: ITU-T J.342 2011

Recommendation ITU-T J.342

Objective multimedia video quality measurement of HDTV for digital cable television in the presence of a reduced reference signal

1 Scope

This Recommendation provides a video quality measurement method for use in high definition television (HDTV) non-interactive applications when the reduced reference (RR) measurement method can be used. The model was compared to subjective quality scores obtained using [b-ITU-T P.910]. Analyses showed that the accuracy of this model was equivalent to that of peak signal-to-noise ratio (PSNR).

For the RR model to operate correctly, the unimpaired source video should be available for the model to extract parameters. These extracted parameters as well as the degraded video sequence are the inputs to the RR model. The estimation method performs both calibration (i.e., gain/offset and spatial/temporal registration) and objective video quality estimation.

The validation test material contained both ITU-T H.264 and MPEG-2 coding degradations and various transmission error conditions (e.g., bit errors, dropped packets). The model proposed in this Recommendation may be used to monitor the quality of deployed networks to ensure their operational readiness. The visual effects of the degradations may include spatial as well as temporal degradations. The model in this Recommendation can also be used for lab testing of video systems. When used to compare different video systems, it is advisable to use a quantitative method (such as that in [b-ITU-T J.149]) to determine the model's accuracy for that particular context.

This Recommendation is deemed appropriate for telecommunication services delivered between 1 Mbit/s and 30 Mbit/s. The following resolutions and frame rates were considered in the validation test:

- 1080i 60 Hz (29.97 fps);
- 1080p (25 fps);
- 1080i 50 Hz (25 fps);
- 1080p (29.97 fps).

The following conditions were allowed in the validation test for each resolution:

Test factors
Video resolution: 1920 × 1080 interlaced and progressive
Video frame rates 29.97 and 25 frames per second
Video bitrates: 1 to 30 Mbit/s
Temporal frame freezing (pausing with skipping) of maximum 2 seconds
Transmission errors with packet loss
Conversion of the SRC from 1080 to 720p, compression, transmission, decompression, and then conversion back to 1080
Coding technologies
ITU-T H.264/AVC (MPEG-4 Part 10)
MPEG-2

Note that 720p was considered in the validation test plan as part of the test condition of the hypothetical reference circuit (HRC). Because currently 720p is commonly upscaled as part of the display, it was felt that 720p HRCs would more appropriately address this format.

1.1 Applications

The applications for the estimation models described in this Recommendation include but are not limited to:

- 1) Interlaced video television streams over cable networks including those transmitted over the Internet using Internet Protocol.
- 2) Video quality monitoring at the receiver when side-channels are available.
- 3) Video quality monitoring at measurement nodes located between point of transmission and point of reception.

The model described in this Recommendation provides a statistically similar performance to PSNR; yet it can be used for video quality assessment when the reference signal is not available at the point of measurement.

1.2 Limitations

The video quality estimation model described in this Recommendation cannot be used to replace subjective testing. Correlation values between two carefully designed and executed subjective tests (i.e., in two different laboratories) normally fall within the range 0.95 to 0.98. This Recommendation cannot be used to make video system comparisons (e.g., comparing two codecs, comparing two different implementations of the same compression algorithm). The performance of the video quality estimation model described in this Recommendation is not statistically better than PSNR.

When frame freezing was present, the test conditions typically had frame freezing durations for less than 2 seconds. The model in this Recommendation was not validated for measuring video quality in a re-buffering condition (i.e., video that has a steadily increasing delay or freezing without skipping). The model was not tested on other frame rates than those used in TV systems (i.e., 29.97 frames per second and 25 frames per second, in interlaced or progressive mode).

It should be noted that in case of new coding and transmission technologies producing artifacts which were not included in this evaluation, the objective model may produce erroneous results. Here, a subjective evaluation is required.

Note that the model in this Recommendation was not evaluated on talking-head content typical of video-conferencing scenarios.

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 J.144] Recommendation ITU-T J.144 (2004), *Objective perceptual video quality measurement techniques for digital cable television in the presence of a full reference*.

[ITU-T J.244] Recommendation ITU-T J.244 (2008), *Full reference and reduced reference calibration methods for video transmission systems with constant misalignment of spatial and temporal domains with constant gain and offset.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 objective perceptual measurement (picture) [ITU-T J.144]: The measurement of the performance of a programme chain by the use of programme-like pictures and objective (instrumental) measurement methods to obtain an indication that approximates the rating that would be obtained from a subjective assessment test.

3.1.2 proponent [ITU-T J.144]: An organization or company that proposes a video quality model for validation testing and possible inclusion in an ITU Recommendation.

3.1.3 subjective assessment (picture) [ITU-T J.144]: The determination of the quality or impairment of programme-like pictures presented to a panel of human assessors in viewing sessions.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 frame rate: The number of unique frames (i.e., total frames – repeated frames) per second.

3.2.2 simulated transmission errors: Errors imposed upon the digital video bit stream in a highly controlled environment. Examples include simulated packet loss rates and simulated bit errors. Parameters used to control simulated transmission errors are well defined.

3.2.3 transmission errors: Any error imposed on the video transmission. Example types of errors include simulated transmission errors and live network conditions.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACR	Absolute Category Rating (see [b-ITU-T P.910])
ACR-HR	Absolute Category Rating with Hidden Reference (see [b-ITU-T P.910])
AVI	Audio Video Interleave
DMOS	Difference Mean Opinion Score
FR	Full Reference
FRTV	Full Reference Television
HRC	Hypothetical Reference Circuit
ILG	VQEG's Independent Laboratory Group
MOS	Mean Opinion Score
MOSp	Mean Opinion Score, predicted
NR	No (or zero) Reference
PSNR	Peak Signal-to-Noise Ratio
PVS	Processed Video Sequence