



Recommendation ITU-R BT.1866
(03/2010)

**Objective perpetual video quality
measurement techniques for broadcasting
applications using low definition television
in the presence of a full reference signal**

BT Series
Broadcasting service
(television)



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Foreword

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Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
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M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BT.1866

**Objective perceptual video quality measurement techniques
for broadcasting applications using low definition television*
in the presence of a full reference signal**

(2010)

Scope

This Recommendation specifies methods for estimating the perceived video quality of broadcasting applications using low definition television (LDTV) when a full reference signal is available.

The ITU Radiocommunication Assembly,

considering

- a) that the ability to automatically measure the quality of broadcast video has long been recognized as a valuable asset to the industry;
- b) that Recommendation ITU-R BT.1683 describes objective methods for measuring the perceived video quality of standard definition digital broadcast television in the presence of a full reference;
- c) that Recommendation ITU-R BT.1833 describes multimedia systems for the broadcasting of multimedia and data applications for mobile reception by handheld receivers;
- d) that low definition television (LDTV) is becoming widely used in the broadcasting of multimedia and data applications for mobile reception;
- e) that ITU-T Recommendation J.247¹ specifies objective measurement techniques of perceptual video quality applicable to LDTV applications in the presence of a full reference;
- f) that objective measurement of the perceived video quality of LDTV may complement subjective assessment methods,

recognizing

- a) that use of LDTV is mainly intended for viewing on small screens such as those available on handheld and mobile receivers,

recommends

- 1 that the guidelines, scope, and limitations given in Annex 1 should be used in the application of the objective video quality measurement models identified in *recommends* 2;
- 2 that the objective perceptual video quality measurement models given in ITU-T Recommendation J.247 should be used for broadcasting applications using LDTV when a full reference signal is available.

NOTE 1 – Summaries of the measurement models are given in Annexes 2 to 5 for information. For more detail see ITU-T Recommendation J.247.

* Low definition television (LDTV) refers to video resolutions having lesser number of pixels than the ones defined in Recommendation ITU-R BT.601. A pertinent ITU-R Recommendation on LDTV is under consideration.

¹ ITU-T Recommendation J.247 is available at <http://www.itu.int/rec/T-REC-J.247-200808_P/en>

Annex 1

1 Introduction

This Recommendation specifies methods for estimating the perceived video quality of broadcasting applications using LDTV when a full reference signal is available.

The estimation methods in this Recommendation are applicable to:

- codec evaluation, specification, and acceptance testing;
- potentially real-time, in-service quality monitoring at the source;
- remote destination quality monitoring when a copy of the source is available;
- quality measurement for monitoring of a storage or transmission system that uses either a single pass or concatenation of video compression and decompression techniques;
- lab testing of video systems.

The full reference measurement method can be used when the unimpaired reference video signal is readily available at the measurement point, as may be the case of measurements on individual equipment or a chain of processes in a laboratory or in a closed environment. The estimation methods are based on processing low definition video in VGA, CIF, and QCIF resolution.

The validation test material contained both multiple coding degradations and various transmission error conditions (e.g. bit errors and dropped packets).

In a case where coding distortions are considered in the video signals, the encoder can use various compression methods (e.g. MPEG-2, H.264, etc.). The models described 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 (e.g. frame repeats, frame skips, and frame rate reduction). The models in this Recommendation can also be used for lab testing of video systems.

This Recommendation is deemed appropriate for services delivered at 4 Mbit/s or less presented on mobile receivers. The following conditions were used in the validation test for each resolution and found to be suitable:

- QCIF (quarter common intermediate format (176×144 pixels)): 16 to 320 kbit/s.
- CIF (common intermediate format (352×288 pixels)): 64 kbit/s to 2 Mbit/s.
- VGA (video graphics array (640×480 pixels)): 128 kbit/s to 4 Mbit/s.

TABLE 1
Factors used in evaluation of models

Test factors
Transmission errors with packet loss
Video resolution QCIF, CIF and VGA
Video bitrates QCIF: 16 to 320 kbit/s CIF: 64 kbit/s to 2 Mbit/s VGA: 128 kbit/s to 4 Mbit/s
Temporal errors (pausing with skipping) of maximum 2 s
Video frame rates from 5 to 30 fps

TABLE 1 (*end*)

Coding schemes
H.264/AVC (MPEG-4 Part 10), MPEG-4 Part 2, and three other proprietary coding schemes. (See Note 1 below.)

NOTE 1 – The validation testing of models included video sequences encoded using 15 different video codecs. The five codecs listed in Table 1 were most commonly applied to encode test sequences, and any recommended models may be considered appropriate for evaluating these codecs. In addition to these five codecs, a smaller proportion of test sequences were created using the following codecs: H.261, H.263, H.263+², JPEG-2000, MPEG-1, MPEG-2, H.264 SVC, and other proprietary systems. Note that some of these codecs were used only for CIF and QCIF resolutions because they are expected to be used in the field mostly for these resolutions. Before applying a model to sequences encoded using one of these codecs, the user should carefully examine its predictive performance to determine whether the model reaches acceptable predictive performance.

2 Application

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

- 1 codec evaluation, specification, and acceptance testing;
- 2 potentially real-time, in-service quality monitoring at the source;
- 3 remote destination quality monitoring when a copy of the source is available;
- 4 quality measurement for monitoring of a storage or transmission system that uses either a single pass or concatenation of video compression and decompression techniques; and
- 5 lab testing of video systems.

3 Model usage

This Recommendation includes the objective computational models shown in Table 2. An overview of the model performance is shown in Table 3. Further information is given in Appendix 1.

TABLE 2
Objective computational models

Model id	Proponent	Country	Annex
A	NTT	Japan	2
B	OPTICOM	Germany	3
C	Psytechnics	United Kingdom	4
D	Yonsei University	Korea (Rep. of)	5

All four models significantly outperform the peak signal to noise ratio (PSNR).

² H.263+ is a particular configuration of H.263 (1998).