

Recommendation ITU-R BT.1868-0
(03/2010)

**User requirements for codecs for
transmission of television signals
through contribution, primary
distribution, and SNG networks**

BT Series
Broadcasting service
(television)

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)
F	Fixed service
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.1868-0*

User requirements for codecs for transmission of television signals through contribution, primary distribution, and SNG networks

(2010)

Scope

This Recommendation describes user requirements for the specifications, design, and testing of systems for the transmission of television signals through contribution, primary distribution and SNG networks.

The ITU Radiocommunication Assembly,

considering

- a) that contribution, primary distribution, and satellite news gathering (SNG) networks are essential for broadcasting operations and provide a valuable method of transmission for rapidly acquiring and broadcasting events;
- b) that Report ITU-R BT.2069 – Spectrum usage and operational characteristics of terrestrial electronic news gathering (ENG), television outside broadcast (TVOB) and electronic field production (EFP) systems, provides specifications for broadcast auxiliary services (BAS);
- c) that the use of SNG and the technical and operational characteristics for SNG are defined in Recommendations ITU-R SNG.770, ITU-R SNG.771 and ITU-R SNG.1007;
- d) that the system characteristics of TVOB, ENG and EFP in fixed services and mobile services are specified in Recommendations ITU-R F.1777 and ITU-R M.1824;
- e) that user requirements for video bit-rate reduction coding of digital TV signals for an end-to-end television system, with respect to picture formats, coding schemes, and picture quality have been specified in Recommendation ITU-R BT.1203;
- f) that coding algorithms using bit-rate reduction techniques for television signals have been devised to enable such transmission to be effective, with the aim of maximizing efficiency and resources;
- g) that television signals should be transmitted with minimum impairments;
- h) that general advice on methods of assessment and subjective evaluation are defined in ITU-R Recommendations;
- j) that such assessment will need to take into account the basic picture and sound quality, failure characteristics when there are errors in the transmission link, and the quality achieved after downstream processing;
- k) that both the design of codecs and their assessment will need to take into account user requirements;
- l) that to be complete, the user requirements should specify the test procedures and test material that should be used to check whether the requirements are being met,

* Radiocommunication Study Group 6 made editorial amendments to this Recommendation in February 2020 in accordance with Resolution ITU-R 1.

recommends

1 that the following user requirements should be applied for the specifications, design, and testing of systems for the transmission of television signals through contribution, primary distribution and SNG networks as part of the broadcasting chain.

TABLE 1

Type of transmission network	Contribution	Primary distribution	SNG/ENG
Input video signal format	Sampling: 4:2:2 (Y, C_B, C_R) 8 or 10 bits per sample for each component		
Input audio signal format	Sampling: 48 kHz 20 bits or more	Sampling: 48 kHz 18 bits or more	Sampling: 48 kHz 16 bits or more
Sound channel	Eight channels (typical)	Six channels (typical)	Two channels (minimum)
Ancillary data	Bit rate: around 100 kbit/s		
Maximum relative sound/vision delay	± 2 ms per codec ⁽¹⁾		
Basic picture quality (for the given number of codecs in tandem in error-free condition) ⁽²⁾	Three codecs in tandem	Two codecs in tandem	Single codec
	Quality difference: $\leq 12\%$ with DSCQS method using at least four sequences taken from Recommendation ITU-R BT.1210, at least half of which should be high-activity sequences. The given quality grade should be met using at least 75% of the sequences chosen; the rest must achieve $\leq 20\%$		
Optional requirement for picture quality (for the given number of codecs in tandem in error-free condition) ⁽²⁾	N/A	N/A	Two codecs in tandem
			Quality difference $\leq 18\%$ of the DSCQS or at least four sequences chosen from Recommendation ITU-R BT.1210, at least half of which should be high activity sequences. The given grade should be met using at least 75% of the sequences chosen, the rest should achieve $\leq 36\%$
Picture quality after colour matte, after modification to picture geometry, or after slow motion ⁽²⁾	Quality difference: $\leq 18\%$ with DSCQS method using two foreground sequences and appropriate background material taken from Recommendation ITU-R BT.1210, between two codecs	N/A	N/A
Basic sound quality	See Recommendation ITU-R BS.1548, Annex 1		
Failure characteristic/error performance ⁽⁵⁾	Quasi-error-free at decoder input for normal condition ^{(3), (4)} Error-concealment functionality should be required for decoders. A signalling function for errors should be provided		
Vision/audio failure characteristics	Vision failure first		

TABLE 1 (*end*)

Type of transmission network	Contribution	Primary distribution	SNG/ENG
Recovery time ^{(5), (7)}	≤ 500 ms after a break of 50 ms ⁽⁶⁾		< 1 s after a break of 50 ms ⁽⁶⁾
Change in overall delay after signal interruption/ major disturbance ⁽⁵⁾	Less than 20 μ s		

DSCQS: double stimulus continuous quality scale.

DSIS: double stimulus impairment scale.

N/A: not applicable.

- (1) The figure of ± 2 ms per codec was chosen in the light of the maximum discrepancy of 20 ms (sound advanced) or 40 ms (sound delayed) specified in ITU-T Recommendation J.100 for the whole signal chain, taking into account the likelihood that:
 - a number of codecs will be connected in tandem; and
 - a major part of the overall discrepancy will occur elsewhere in the signal chain.
- (2) Subjective assessment of picture quality should be carried out in accordance with Recommendation ITU-R BT.500.
- (3) Different transmission (modulation) schemes could result in different failure conditions.
- (4) The failure characteristics of digital transmission systems are generally abrupt. It is therefore desirable to provide a means of switching the form of the transmitted signal to a more robust one in SNG applications and under conditions likely to jeopardize normal reception. There would therefore be two operation modes. Optimum methods of doing this need to be investigated. It is anticipated, however, that some reduction in video signal quality will be incurred when the switch is made; the figure given here indicates what would probably be a reasonable compromise.
- (5) Further information relating to failure characteristics and recovery time is given in Appendix 1.
- (6) The decoder should maintain a still frame output or a frame of black during resynchronization.
- (7) The recovery time can be measured as the number of fields of delay that is required between the connection of the signal to the decoder, and switching picture monitor input from a gray-level signal (or a suitably delayed non-processed signal) to the decoder output signal such that no disruption to picture quality can be observed. A similar procedure should be adopted to assess the recovery time associated with bit slips, which might occur following a non-sync cut, for example.

Appendix 1

Further information relating to failure characteristics and recovery time

- Interruptions in any part of the multiplexing lasting several seconds or more are intolerable and protection modes would be required.
- With regard to the response to burst errors of short duration, the synchronizing system should have adequate protection so that the effect of the errors on the video, audio or data would not be extended due to the need for resynchronization. By maintaining synchronization through interruptions, the error-management systems for video, audio and data could be independent.

- It is likely that it will not be possible to protect against interruptions of the order of 50 ms. After such events, the decoder circuits would have to relock in a manner similar to that of the initial switch-on. This suggests that the relocking sequence should be completed within 160 ms.
 - It is important for the overall signal delay through the codec to not change markedly when influenced by transmission errors or interruptions. The degree to which delays should be permitted to change has been suggested by ITU-T Recommendation J.81 where $\pm 20 \mu\text{s}$ would be a reasonable maximum.
 - Note that very short duration defects are less tolerable in sound than in the picture.
 - The degree of protection required for data is heavily dependent on the application. For example, if the data is being used for system control, this could be very critical and require powerful protection.
 - Under normal operating conditions there should be no perceptible effect from channel errors in video, sound or data.
 - Switching to the protected link should not cause disruptions in the video, sound, or data signal and this should be considered in designing systems to protect the performance of a link in use when it deteriorates.
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