

EBU Technical Statement D89-2000

Quality and interoperability in a 625/50 digital television production environment using MPEG compression



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Aims

The EBU, as a user group, impartially evaluates alternative systems proposed for television programme production. Key factors in this process are the evaluation of signal quality, and the degree of interoperability achievable between system components.

ITU-R Recommendations 601 and 656 [1, 2] are benchmarks against which the quality and interoperability of television systems can be judged within a professional broadcast environment. These Recommendations:

- provide consistently high potential quality, even when performing pixel manipulations,
- have a defined interface performance,
- offer frame by frame editing,
- are implemented by a range of different manufacturers adhering to the same standard.

These features are targets for systems used in the production of all types of programmes. However users recognise that it may not be realistic to achieve all these objectives, when practical constraints are taken into account (e.g. cost, source quality and mobility requirements).

This statement addresses the factors that the EBU believes are the most important in making decisions about the best balance of features for production systems that use digital compression.

Operational Background

As well as the picture quality required, among many other operational factors, taken into account are: the need to work within an existing 601-based infrastructure, the demand for frame accurate editing, and the limited quality of some contributions.

With video compression, the different data rates used in operational situations will bring a range of trade-offs in terms of equipment and media cost, as well as in the bandwidth needed for transfer and storage.

The EBU has identified two application areas where different balances of features may be appropriate:

- programming with small numbers of generations (e.g. news),
- programming with significant manipulation of the picture content (e.g. for mainstream television).

Although the features above can distinguish operational situations, and this might lead to different quality levels, they are not separated in terms of the requirement to inter-operate. The separation into different quality levels is not the result of a user requirement, but is based on the experience gained with implementations which have appeared on the market, and which are designed with different balances of features.

Quality

The video quality from a system must be predictable. The EBU has spent significant effort on a range of subjective evaluations of the quality available from equipment that employed MPEG2 professional profile compression algorithms for video. These showed that, at 50Mb/s, the quality was sufficiently close to the Rec.601 quality target to be acceptable in a production environment that requires heavy processing (seven generations with four picture shifts: reference EBU/SMPTE Task Force 1998). [3]

The EBU is of the opinion that quality should be considered bearing in mind the need for the following:

- consistent output quality for the full range of practical pictures,
- the need for considerable manipulation in the production process,
- the requirements of all the media by which television programmes can be released, both today and in the future.

Interoperability

The EBU is of the opinion that interoperability is achieved if:

- the essence (audio, video) generated at the source passes through the production process without impairment,
- metadata passes through the system without error,
- the components used to build a system can be interconnected by a simple plugging operation,
- the interconnection of system components is independent of manufacturer,
- when required, real-time transfer which is faster than real-time can be achieved.

Operating Points within MPEG

In practice, interoperability is most easily achieved within a single family of standards.

Therefore, for complex television production, the EBU believes that an operating point of the MPEG-2 4:2:2P@ML is required, to achieve the above objectives. The parameters of this operating point are given in the Appendix. As also shown in the Appendix, the EBU believes that further elements are required to lead to a consistent output quality from practical systems

Bibliography

- [1] ITU-R Rec. BT.601-5: **Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios**
- [2] ITU-R Rec. BT.656-4: **Interfaces for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of Recommendation ITU-R BT.601 (Part A)**
- [3] EBU Review special supplement 1998: **Final Report and analyses of results: The Joint EBU SMPTE Task Force: Harmonised Standards for the Exchange of Television Programme Material as Bit Streams**

Appendix

Operating point of MPEG-2 4:2:2P@ML for complex television programme production

Coding parameters

1. Bit Rate: 50 Mbit/s
2. Group of Pictures: 1, (intra-frame encoded)
3. Number of bytes / frame: 250 000 +/- x bytes (x: to be decided) (note 1)
4. Decoders: Compliant with full range MPEG-2 422P@ML
5. Encoded TV raster: Active video exclusively, compliant with ITU-R BT.601 (Part A), unfiltered (note 2)

Note1: The maximum possible number of bytes / frame should be used for the encoding of the active picture content, in order to achieve the above quality requirements. Every effort should be made to ensure that all the bytes in each frame are used to code picture information.

Note2: The VBI should not be encoded as part of the picture, as this can lead to distortions in the picture itself. A standard is required to ensure that all common information carried in the VBI, and other metadata, may pass through any MPEG island within a Rec. 601 installation.

Encoders

For complex television production chains, the EBU expects that any encoder, based on a different implementation, should be able to replace any other encoder in the chain. This should have only positive effects on the average picture quality at the end of the chain.

Decoders

For complex television production chains, MPEG2 decoders with a baseband video output (either digital or analogue) for general stand-alone use should be able to decode all MPEG2 inputs, as required in the MPEG2 specification. This will allow users to develop their MPEG2 systems as other operating points come into use.
