EBU – Recommendation R 124

Choice of HDTV Compression Algorithm and Bitrate for Acquisition, Production & Distribution

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Choice of HDTV Compression Algorithm and Bitrate for Acquisition, Production & Distribution

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Foreword

This document is intended for technical managers of the EBU members.

The recommendations given in this document are based on the tests of production HDTV studio compression codecs and HDTV broadcast encoders performed by the EBU during the second half of 2007[1].

It should be noted that all the encoders tested are in a state of evolution and therefore this document is something of a snapshot of the situation in 2007/2008. Further enhancements in hardware and software can be expected.

IMPORTANT NOTE:

Readers of this recommendation and EBU members with access to the BPN reports have to be aware that the EBU has **not** performed comparative tests of different vendors' products, thus no document has been issued favouring any technology over the others. The information in the BPN reports is intended to assist technical managers and experts in EBU members in drawing their own conclusions.

This document relates to "mainstream" HDTV production and not "high-end" HDTV production.

Recommendations

It may generally be observed that:

- The tests have revealed that a progressive HD picture format performs better than an interlaced HD picture format as far as picture quality is concerned, and that this is particularly evident for transmission.
- The most significant factor in the preservation of picture quality in production and emission is the chosen bitrate.
- The multi-generation process within a HDTV studio environment requires particular attention.

[1] EBU members (only) may obtain the detailed results of the tests on HDTV studio compression codecs in EBU BPN 76, 77, 78 and 79 and those of the broadcast encoder tests in BPN 87, 88 and 89.

For <u>acquisition</u> of mainstream HD material, **it is recommended that**

- The acquisition format should use 4:2:2 sampling
- No further horizontal or vertical sub-sampling should be applied.
- 8-bit bit-depth is sufficient for mainstream programme (10-bit bit-depth is preferred for high-end acquisition).

For <u>production</u> of mainstream HD**,** the EBU has found no reason to relax the requirement placed on SDTV studio codecs that 'Quasi-transparent quality' must be maintained after 7 cycles of encoding and recoding with horizontal and vertical pixel-shifts applied.

It is recommended that:

- If the production/archiving format is to be based on I-frames only, the bitrate should not be less than 100 Mbit/s.
- If the production/archiving format is to be based on long-GOP MPEG-2, the bitrate should not be less than 50 Mbit/s.

Users should be aware that maintaining the above criteria would ensure quasi-transparent quality up to at least 4 to 5 multi-generations.

Expert viewing tests have further revealed that:

- A 10-bit bit-depth in production is only significant for post-production with graphics, and after transmission encoding and decoding at the consumer if the content, e.g. graphics or animation, has been generated using advanced colour grading, etc.
- For normal moving pictures, an 8-bit bit-depth in production will not significantly degrade the HD picture quality at the consumer's premises.

For <u>distribution</u>, the EBU has already stated[1] that the HD picture format for HD distribution should be 720p/50 with H.264/AVC encoding. Recent EBU tests[2] have confirmed this recommendation.

It was found that:

- H.264/AVC requires up to 50% less bitrate than MPEG-2 (content dependent).
- Interlaced image format (1080i/25) requires about 20% more bit-rate than the progressive image format (720p/50) to obtain the same subjective image quality.
- Statistical multiplexing between HD and/or SD data streams for video is recommended.

Impact of the production codec on distribution quality

Provided the production quality headroom is maintained according to the above recommendation (and even after multi-generation and independent of the type of production encoder used) it was found that *<u>the dominant image quality impairments are determined by the distribution codec</u>*.

When designing a production system, it is strongly recommended that broadcasters evaluate the final image quality, including the distribution chain.

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[1] EBU Recommendation R112-2004 and EBU Document Tech 3312-2005

[2] EBU group D/HDC performed a series of tests on distribution encoders between Autumn 2007 and Spring 2008.