



INTERNATIONAL STANDARD ISO/IEC 13818-1:2015
TECHNICAL CORRIGENDUM 2

Published 2017-05

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION
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Information technology — Generic coding of moving pictures and associated audio information: Part 1: Systems

TECHNICAL CORRIGENDUM 2: STD buffer sizes for HEVC and miscellaneous editorial issues

*Technologies de l'information — Codage générique des images animées et du son associé: Partie 1:
Systèmes*

RECTIFICATIF TECHNIQUE 2

Technical Corrigendum 2 to ISO/IEC 13818-1:2015 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information* in collaboration with ITU-T. The identical text is published as Rec. ITU-T H.222.0 (2014)/Cor.2 (03/2017).

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATIONInformation technology – Generic coding of moving pictures and associated audio
information: Systems

Technical Corrigendum 2

STD buffer sizes for HEVC and miscellaneous editorial issues

1) Clause 2.4.2.3, Extensions for single layer HEVC

In clause 2.4.2.3, replace:

NOTE 2 – In the following equations, unit conversion should be implicitly performed as appropriate.

With:

NOTE 2 – In the following equations, unit conversion should be implicitly performed as appropriate. Values expressed in bits are implicitly converted into values expressed in bytes by: $number_of_bytes = (number_of_bits + 7) / 8$.

2) Clause 2.17.2, Extensions for single layer HEVC

In clause 2.17.2, replace:

- There is exactly one multiplexing buffer MB_n for the HEVC video stream or HEVC temporal video sub-bitstream, where the size MBS_n of the multiplexing buffer MB is constrained as follows:

$$MBS_n = BS_{mux} + BS_{oh} + CpbBrNalFactor \times MaxCPB[tier, level] - cpb_size$$

where BS_{oh} , packet overhead buffering, is defined as:

$$BS_{oh} = (1/750) \text{ seconds} \times \max\{ CpbBrNalFactor \times MaxBR[tier, level], 2\,000\,000 \text{ bit/s} \}$$

and BS_{mux} , additional multiplex buffering, is defined as:

$$BS_{mux} = 0.004 \text{ seconds} \times \max\{ CpbBrNalFactor \times MaxBR[tier, level], 2\,000\,000 \text{ bit/s} \}$$

$MaxCPB[tier, level]$ and $MaxBR[tier, level]$ are taken from Annex A of Recommendation. ITU-T H.265 | ISO/IEC 23008-2 for the tier and level of the HEVC video stream or HEVC temporal video sub-bitstream. Cpb_size is taken from the HRD parameters, as specified in Annex E of Recommendation. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC video stream or HEVC temporal video sub-bitstream.

- There is exactly one elementary stream buffer EB_n for all the elementary streams in the set of received elementary streams associated by hierarchy descriptors, with a total size EBS_n

$$EBS_n = cpb_size \text{ (measured in bytes)}$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Recommendation. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC video stream or the HEVC temporal video sub-bitstream.

With:

- There is exactly one multiplexing buffer MB_n for the HEVC video stream or HEVC temporal video sub-bitstream, where the size MBS_n of the multiplexing buffer MB is constrained as follows:

$$MBS_n = BS_{mux} + BS_{oh} + CpbNalFactor \times MaxCPB[tier, level] - cpb_size$$

where BS_{oh} , packet overhead buffering, is defined as:

$$BS_{oh} = (1/750) \text{ seconds} \times \max\{ BrNalFactor \times MaxBR[tier, level], 2\,000\,000 \text{ bit/s} \}$$

and BS_{mux} , additional multiplex buffering, is defined as:

$$BS_{mux} = 0.004 \text{ seconds} \times \max\{ BrNalFactor \times MaxBR[tier, level], 2\,000\,000 \text{ bit/s} \}$$

$MaxCPB[tier, level]$ and $MaxBR[tier, level]$ are taken from Annex A of Rec. ITU-T H.265 | ISO/IEC 23008-2 for the tier and level of the HEVC video stream or HEVC temporal video sub-bitstream, where rates are expressed in bit/s. cpb_size is taken from the HRD parameters, as specified in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC video stream or HEVC temporal video sub-bitstream, where the size is expressed in bits. Implicit conversion is carried out according to Note 2 in 2.4.2.3.

- There is exactly one elementary stream buffer EB_n for all the elementary streams in the set of received elementary streams associated by hierarchy descriptors, with a total size EBS_n

$$EBS_n = cpb_size$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC video stream or the HEVC temporal video sub-bitstream, where the size is expressed in bits. Implicit conversion is carried out according to Note 2 in 2.4.2.3.

Further, replace:

When there is no data in TB_n then Rx_n is equal to zero. Otherwise:

$$Rx_n = bit_rate$$

where bit_rate is $CpbBrNalFactor/CpbBrVclFactor \times BitRate[SchedSelIdx]$ of data flow into the CPB for the byte stream format and $BitRate[SchedSelIdx]$ is as defined in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2 when $NAL_hrd_parameters()$ is present in the VUI parameters of the HEVC video stream.

With:

When there is no data in TB_n then Rx_n is equal to zero. Otherwise:

$$Rx_n = bit_rate$$

where bit_rate is $BrNalFactor/BrVclFactor \times BitRate[SchedSelIdx]$ of data flow into the CPB for the byte stream format and $BitRate[SchedSelIdx]$ is as defined in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2 when $NAL_hrd_parameters()$ is present in the VUI parameters of the HEVC video stream.

Further, replace:

Otherwise, the leak method shall be used to transfer data from MB_n to EB_n as follows:

$$Rbx_n = CpbBrNalFactor \times MaxBR[tier, level]$$

with:

Otherwise, the leak method shall be used to transfer data from MB_n to EB_n as follows:

$$Rbx_n = BrNalFactor \times MaxBR[tier, level]$$

3) Clause 2.17.3, Extensions for layered transport of HEVC temporal video subsets

In clause 2.17.3, replace:

- There is one multiplex buffer $MB_{n,k}$ for each received elementary stream $ES_{n,k}$, where the size $MBS_{n,k}$ of the multiplex buffer $MB_{n,k}$ is constrained as follows:

$$MBS_{n,k} = BS_{mux} + BS_{oh} + CpbBrNalFactor \times MaxCPB[tier, level] - cpb_size \text{ (measured in bytes)}$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Recommendation. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC highest temporal sub-layer representation associated with $ES_{n,H}$.

with

- There is one multiplex buffer $MB_{n,k}$ for each received elementary stream $ES_{n,k}$, where the size $MBS_{n,k}$ of the multiplex buffer $MB_{n,k}$ is constrained as follows:

$$MBS_{n,k} = BS_{mux} + BS_{oh} + CpbNalFactor \times MaxCPB[tier, level] - cpb_size$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC highest temporal sub-layer representation associated with $ES_{n,H}$. In the HRD parameters, cpb_size is expressed in bits, and its value is implicitly converted into a value expressed in bytes according to Note 2 in 2.4.2.3.

Further, replace

- There is exactly one elementary stream buffer EB_n for the $H + 1$ elementary streams in the set of received elementary streams $ES_{n,0}$ to $ES_{n,H}$, with a total size EBS_n

$$EBS_n = cpb_size \text{ (measured in bytes)}$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Recommendation. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC highest temporal sub-layer representation associated with $ES_{n,H}$.