



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

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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**

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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  $ES_{n,H}$ .