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| **ITU – Telecommunications Standardization Sector**STUDY GROUP 21 Question 6**Video Coding Experts Group (VCEG)**77th Meeting: 26 June – 4 July 2025, Daejeon | Document VCEG-BY11-v1 |

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| Question: | 6/21 (VCEG) |
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| Title: | **Further Updates and Corrections to H.BWC High Level Syntax** |
| Purpose: | Proposal |

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# Abstract

This document contains proposed updates and corrections to the High Level Syntax (HLS) part of H.BWC. This is still a result of an ongoing effort to merge the proposals selected during the Call for Proposals (CfP).

# Introduction

As a result of the CfP evaluation for H.BWC conducted by VCEG in November 2024, it has been agreed that two systems will be merged. The syntax of one of the selected systems was based on NAL-units, and the syntax of the other system was based on msPackets. This resulted in the following mandates, see (Rapp, Q6/16, Nov 1-8, 2024):

* *Replace NAL-based HLS with msPacket-based HLS as described in VCEG-BW03-SyntaxDescription.docx), incorporating all systemic features as described in VCEG-BW03-SyntaxDescription.docx, clause 2.2.*
* *Modify HLS to accommodate for parameters included in “Waveform parameter set NAL units” as documented in 2.1 of VCEG-BW02-v1.docx for channel grouping.*

In this contribution, we propose further updates to HLS to meaningfully combine NAL-based and msPacket-based HLS. Previous efforts have been made at the April meeting, see (Dolby Laboratories, Mar 27-Apr 4, 2025) and further work is still required to ensure a proper integration of the two systems which may include additions, corrections and optimizations.

# Proposed Changes

Changes are mainly proposed to three RBSP syntax elements, i.e., Timestamp, Feature Set and Segment Metadata, of the current H.BWC specification. Minor editorial corrections are also proposed in other parts of the document. None of the proposed changes are affecting the core codec bitstream.

## Timestamp RBSP Syntax and Semantics

### Syntax Changes

The following changes have been introduced, and they are highlighted in the Table:

* Adding support for UNIX (**TIME\_UXT**) and UTC (**TIME\_UTC**) time, where the UTC time uses a string element instead of integer values as a result of counting seconds from an epoch.
* Adding support for timestamp use cases by introducing a syntax element **ts\_type**. In case the timestamp is used by the feature set RBSP (ts\_type == FEAT\_RBSP), a syntax element **ts\_time\_idx** is introduced to serve as an identifier.
* Replacing the “switch – case” statement by an “if – else” statement.
* Changing a few syntax element names and descriptors.

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| --- | --- |
| time\_stamp\_rbsp( ) { | Descriptor |
|  **ts\_channel\_group\_parameter\_set\_id** | u(8) |
|  if(NumChannelGroups > 1 ) |  |
|  **ts\_channel\_group\_id** | u(v) |
| **ts\_type** | u(3) |
| if (ts\_type == FEAT\_RBSP) |  |
| **ts\_time\_idx** | ue(v) |
|  **ts\_time\_type** | u(7) |
|  TimeType = ts\_time\_type |  |
|  **ts\_offset\_type\_flag** | u(1) |
|  if (TimeType == TIME\_LONG) { |  |
|  **ts\_time\_long** | se(v) |
|  **ts\_time\_offset** | se(v) |
|  } |  |
|  else if (TimeType == TIME\_SHORT) { |  |
|  **ts\_time\_short** | ev(4,8,8) |
|  **ts\_time\_offset** | ev(4,8,8) |
|  } |  |
|  else if (TimeType == TIME\_UXT) { |  |
|  **ts\_time\_uxt** | se(v) |
|  **ts\_time\_offset** | se(v) |
|  } |  |
|  else if (TimeType == TIME\_TAI) { /\* acc. ISO/IEC 23001-17 \*/ |  |
|  **ts\_time\_tai** | u(64) |
|  **ts\_status\_bits** | u(8) |
| } |  |
|  else if (TimeType == TIME\_UTC) { |  |
|  **ts\_time\_utc** | st(v) |
| } |  |
|  rbsp\_trailing\_bits( ) |  |
| } |  |

### Semantics Changes

In addition to providing the semantics for the proposed syntax changes, further text has also been added with the aim of providing a clearer understanding to the implementors. These changes are clearly marked in the attached document for review.

### Reference Software Changes

The corresponding changes in the reference software are available for review following the link below:

<https://vcgit.hhi.fraunhofer.de/vceg-sw/bwc/-/merge_requests/25>

## Feature Set RBSP Syntax and Semantics

### Syntax Changes

The following changes have been introduced, and they are highlighted in the Table:

* Adding support for the signal sampling frequency per channel group, **ft\_sampling\_frequency**
* Providing several methods to store the feature annotation/feature type values, i.e., embedding it within the feature set RBSP (**ft\_annotation\_str**), providing a pointer to an external file/storage (**ft\_annotation\_uri**), utilizing the annotation channel data RBSP (**ft\_annotation\_channel\_waveform\_parameter\_set\_id** and **ft\_annotation\_channel\_id**) and allowing the usage of pre-defined values (**ft\_feature\_type\_enum**)
* Changing a few syntax element descriptors.

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| --- | --- |
| feature\_set\_rbsp( ) { | Descriptor |
|  **ft\_channel\_group\_parameter\_set\_id** | u(8) |
| if(NumChannelGroups > 1 ) |  |
|  **ft\_channel\_group\_id** | u(v) |
|  **ft\_signal\_type** | ev(3,8,8) |
|  **ft\_sampling\_frequency** | u(16) |
|  **ft\_num\_features** | ev(3,8,8) |
| ~~j = 0~~ |  |
| for( i = 0; i < ft\_num\_features; i++ ) { |  |
|  **ft\_feature\_annotation\_type**[i] | u(2) |
| if( ft\_feature\_annotation\_type == 0 ) { |  |
|  **ft\_annotation\_str** | st(v) |
| } else if( ft\_feature\_annotation\_type == 1 ) { |  |
|  **ft\_annotation\_uri** | st(v) |
| } else if( ft\_feature\_annotation\_type == 2 ) { |  |
|  **ft\_annotation\_channel\_waveform\_parameter\_set\_id** | u(4) |
|  **ft\_annotation\_channel\_id** | ue(v) |
| } else { |  |
|  **ft\_feature\_type\_enum** | ev(3,8,8) |
| } |  |
| feature\_type[i] = feat\_extract() |  |
|  **ft\_feature\_marking\_present\_flag**[i] | u(1) |
| if( ft\_feature\_marking\_present\_flag ) { |  |
|  **ft\_feature\_start**[i] | ue(v) |
|  **ft\_feature\_length**[i] | ue(v) |
| ~~j++~~ |  |
|  } |  |
|  } |  |
|  byte\_alignment( ) |  |
| } |  |

### Semantics Changes

In addition to providing the semantics for the proposed syntax changes, further text has also been added with the aim of providing a clearer understanding to the implementors. These changes are clearly marked in the attached document for review.

### Reference Software Changes

The corresponding changes in the reference software are available for review following the link below:

<https://vcgit.hhi.fraunhofer.de/vceg-sw/bwc/-/merge_requests/26>

## Segment Metadata RBSP Syntax and Semantics

### Syntax Changes

The following changes have been introduced, and they are highlighted in the Table:

* Removing several syntax elements related to the feature set to avoid duplications (**sm\_feature\_in\_segment\_flag**, **sm\_nun\_features**, **sm\_feature\_type**, **sm\_feature\_block\_present\_flag**, **sm\_feature\_block\_start** and **sm\_feature\_block\_length**)
* Adding a flag (**sm\_segment\_stat\_flag**) to allow for an optional processing of block sizes in a segment metadata. Enclosed within sm\_segment\_stat\_flag, implementing the actual Golomb/Rice delta coding syntax as described in the semantics (**sm\_delta\_GR\_param**, **sm\_abs\_delta** and **sm\_sign\_delta**), reusing existing function calls in the software and existing description in the current H.BWC spec
* Providing support for allowing other types of distortion measure per channel to be carried in the bitstream (**sm\_num\_distortion\_measure** and **sm\_distortion\_measure\_type**)
* Changing a few syntax element names and descriptors.

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| --- | --- |
| segment\_metadata\_rbsp( ) { | Descriptor |
|  **sm\_channel\_group\_parameter\_set\_id** | u(8) |
| if(NumChannelGroups > 1 ) |  |
|  **sm\_channel\_group\_id** | u(v) |
|  **sm\_signal\_type** | ev(3,8,8) |
| **sm\_segment\_stat\_flag** | u(1) |
| if (sm\_segment\_stat\_flag) { |  |
|  **sm\_num\_blocks\_per\_segment** | ue(v) |
| **sm\_block\_size**[0] | ue(v) |
| if (sm\_num\_blocks\_per\_segment > 1) { |  |
| **sm\_delta\_GR\_param** | ae(v) |
|  for( n = 1; n < sm\_num\_blocks\_per\_segment; n++ ) { |  |
|  **sm\_abs\_delta** | ae(v) |
| **sm\_sign\_delta** | ae(v) |
| delta = (sm\_sign\_delta == 1) ? -sm\_abs\_delta : sm\_abs\_delta |  |
| sm\_block\_size[n] = sm\_block\_size[n-1] + delta |  |
| } |  |
| } |  |
| } |  |
|  **sm\_distortion\_measure\_flag** | u(1) |
| if(sm\_distortion\_measure\_flag) { |  |
|  **sm\_num\_distortion\_measures** | ev(3,8,8) |
| for( ch = 0; ch < NumChannels[ sm\_channel\_group\_id ]; ch++ ) { |  |
|  **sm\_variance**[ch] | u(8) |
|  **sm\_squared\_error**[ch] | u(8) |
| for( i = 0; i < sm\_num\_distortion\_measures; i++ ) { |  |
| **sm\_distortion\_measure\_type**[ch][i] | st(v) |
| **sm\_distortion\_measure**[ch][i] | se(v) |
| } |  |
| } |  |
| } |  |
|  **~~sm\_feature\_in\_segment\_flag~~** | ~~u(1)~~ |
| ~~if(sm\_feature\_in\_segment\_flag) {~~ |  |
|  **~~sm\_num\_features~~** | ~~ev(3,8,8)~~ |
| ~~j = 0~~ |  |
| ~~for( i = 0; i < sm\_num\_features; i++ ) {~~ |  |
|  **~~sm\_feature\_type~~**~~[i]~~ | ~~ev(3,8,8)~~ |
|  **~~sm\_feature\_block\_present\_flag~~**~~[i]~~ | ~~u(1)~~ |
| ~~if( sm\_feature\_block\_present\_flag ) {~~ |  |
|  **~~sm\_feature\_block\_start~~**~~[j]~~ | ~~u(16)~~ |
|  **~~sm\_feature\_block\_length~~**~~[j]~~ | ~~u(16)~~ |
| ~~j++~~ |  |
|  ~~}~~ |  |
|  ~~}~~ |  |
|  byte\_alignment( ) |  |
| } |  |

### Semantics Changes

In addition to providing the semantics for the proposed syntax changes, further text has also been added with the aim of providing a clearer understanding to the implementors. These changes are clearly marked in the attached document for review.

### Reference Software Changes

The corresponding changes in the reference software are available for review following the link below:

<https://vcgit.hhi.fraunhofer.de/vceg-sw/bwc/-/merge_requests/24>

# Conclusion

We propose adopting the changes outlined in this contribution into the next draft version of H.BWC. For completeness, all proposed editorial changes to the current H.BWC draft are provided in the document attached to this contribution.

# Patent rights declaration(s)

**Dolby Laboratories may have current or pending patent rights relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**

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# References

Dolby Laboratories. (Mar 27-Apr 4, 2025). *Updates and Corrections to H.BWC High Level Syntax, doc VCEG-BX07-v1.* Online: ITU-T Q.6/21 (VCEG).

Rapp, Q6/16. (Nov 1-8, 2024). *Report of the Q6/16 Rapp & JVET meeting, doc. TD\_JVET-AJ1000\_d4.* Kemer, Turkey: ITU-T Q.6/21 (VCEG).