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| *Author(s) or Contact(s):* | Ye-Kui Wang 5775 Morehouse Drive San Diego, CA 92122, USA | Tel: Email: | +1-858-651-8345 [yekuiw@qti.qualcomm.com](mailto:yekuiw@qti.qualcomm.com) |
| *Source:* | Qualcomm Incorporated | | |

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| **Author** | [Ye-Kui Wang](mailto:yekuiw@qti.qualcomm.com) |

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# Abstract

This contribution, submitted as both JCTVC-AC0021 and m41441, provides a list of topics that the author thinks should be coordinated between OMAF and JCT-VC, targeting at aligned designs between OMAF version 1 and the omnidirectional video related SEI messages that covering the same functionalities. For each topic, a suggestion was made.

# List of topics and suggestions

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| **Index** | **Topic** | **Suggestion** |
| 1 | OMAF clause 5.1 includes a detailed description of the global and local coordinate axes as well as the rotations for conversion between the two, using two figures (Figures 5-1 and Figure 5-2) with some discrepancy between them.  In JCTVC-AB1005-v1, a simpler description without using a figure is included (in the semantics of both the equirectangular projection SEI message and the cubemap projection SEI message). | Due to that 1) there was some complaint about using a smiley face in standard specs being a bit creepy, and 2) there is some redundancy and discrepancy between the two figures in OMAF clause 5.1, it is suggested to remove the two figures from OMAF clause 5.1 and align the description therein with the description in JCTVC-AB1005-v1.  No specification text is provided for this suggestion. |
| 2 | The equirectangular projection SEI message includes the signalling of rotation information as part of the SEI message. However, the cubemap projection SEI message does not include the signalling of rotation information. In OMAF, the rotation information is signalled in file format level using a separate structure than that for the projection, and that rotation information signalling applies to any projection type. | It is suggested to use a separate SEI message for signalling of rotation parameters such that the same syntax could be used for any type of projection.  JCTVC-AC0022 contains a proposal that includes detailed specification text changes relative to JCTVC-AB1005-v1 for this suggestion.  No text changes to the OMAF draft specification is considered needed for this suggestion. |
| 3 | The equirectangular projection SEI message includes signalling of the sphere coverage information as part of the SEI message. However, the cubemap projection SEI message does not include signalling of the sphere coverage information. In OMAF, the sphere coverage information is signalled in file format level using a separate structure than that for the projection, and that sphere coverage signalling applies to any projection type. | It is suggested to use a separate SEI message for signalling of sphere coverage information such that the same syntax could be used for any type of projection.  See another aspect in item 4 below.  JCTVC-AC0024 contains a proposal with detailed specification text changes relative to JCTVC-AB1005-v1 for this suggestion.  No text changes to the OMAF draft specification is considered needed for this suggestion. |
| 4 | The equirectangular projection SEI message uses four parameters for signalling of the sphere coverage information: erp\_azimuth\_min, erp\_azimuth\_max, erp\_elevation\_min, and erp\_elevation\_max. To allow signalling of coverage sphere region that spans across the left and right boundaries of the projected picture, the values of erp\_aizmuth\_min and erp\_aizmuth\_max can be outside the range of −180 to 180 degrees, inclusive.  Allowing the azimuth range to be greater than 360 degrees enables support of ERP padding.  In multiple places in OMAF and in the omnidirectional viewport SEI message, a sphere region (including a sphere coverage region) is signalled by indicating its center position and the azimuth and elevation ranges. In addition, a sphere region may be a tilted sphere region indicated by the tilt angle, which is missing in the current sphere coverage signalling in JCTVC-AB1005-v1. | It is suggested to signal the sphere coverage information by specifying the center point of the coverage sphere region, the azimuth and elevation ranges, and the tilt angle of the sphere region.  This would make the signalling aligned with sphere region signalling in the omnidirectional viewport SEI message as well as sphere coverage signalling in OMAF.  JCTVC-AC0024 contains a proposal with detailed specification text changes relative to JCTVC-AB1005-v1 for this suggestion.  No text changes to the OMAF draft specification is considered needed for this suggestion. |
| 5 | The semantics of the equirectangular projection SEI message and the cubemap projection SEI message allow the use of omnidirectional projection with frame packing types 3, 4, and 5, while in OMAF omnidirectional projection can be used only with frame packing types 3 and 4. | Because only frame packing types 3 and 4 are widely used and supported for omnidirectional video, it is suggested to disallow the use of omnidirectional projection with frame packing type 5, for both the equirectangular projection and the cubemap projection.  No specification text is provided for this suggestion. |
| 6 | On guard band signalling, OMAF relies on the signalling that is part of the region-wise packing syntax, while in JCTVC-AB1005-v1, the syntax of the region-wise packing SEI message does not include guard band signalling, and the cubemap projection SEI message includes a guard band syntax (although it is called padding) that is different than that in OMAF.  Also, it should be noted that there some are issues in JCTVC-AB1005-v1 regarding padding or guard band signalling for the cubemap projection, as described below.  The pictureWdith and pictureHeight (of the monoscopic projected luma picture) in the cubemap projection equations should not count any padded samples. Therefore, when the region-wise packing signalling is not present, in which case the size of the projected picture is not signalled, the size of the projected picture needs to be derived based on the cubemap projection SEI message syntax (the padding part). The width should be set equal to the width of the cropped output picture minus the total number of columns of padded samples, and the height should be set equal to the height of the cropped output picture minus the total number of row of padded samples, and there needs to be a constraint to require that all the remaining samples of the cropped output picture (i.e., excluding all the padded samples) shall exactly form a rectangle, which is the projected picture. When the region-wise packing signalling is present for CMP, there needs to be a constraint that no packed region shall contain any padded sample.  Specifications for the above derivation of the size of the projected picture and the constraints are currently missing.  In addition, the semantics of the CMP padding parameters are not clear, e.g., when cmp\_padding\_type is equal to 2 or 3, and the entire semantics of cmp\_padding\_chroma\_sample\_range\_minus1 (e.g., regarding the position of the padded samples). Also the naming of the syntax element cmp\_padding\_chroma\_sample\_range\_minus1 is a bit strange. Why chroma? So the padding here has nothing to do with luma?  The above issues can be resolved by adding guard band padding signalling into region-wise packing syntax, same as in OMAF, and relying on that for providing support of guard band padding, i.e., remove the padding signalling from the cubemap projection SEI message syntax. However, on the other hand, it is believed that it'd be beneficial to allow support of simple padding for CMP without the need of supporting the RWP signalling. | It is suggested to   * Add guard band padding signalling into the syntax of the region-wise packing SEI message, same as in OMAF. * Replace the current CMP padding with an optional CMP padding along the four picture boundaries and in the middle of the picture between the boundaries of the upper three cubemap faces and the lower three cubemap faces. When the optional CMP padding exists, the RWP signalling shall not be present. * Make text changes to the sample location remapping process for addressing the cases where the optional CMP padding exists.   For the above suggestion, JCTVC-AC0023 contains a proposal with detailed specification text changes relative to JCTVC-AB1005-v1.  The MPEG input document m41459 contains text changes to the latest OMAF draft specification in the MPEG output document N16950 for the suggestion. |
| 7 | In the semantics of the region-wise packing SEI message, currently (same as in the OMAF draft text before the Torino MPEG meeting in July 2017), the unit of the size of the projected picture and the size of projected and packed regions are either unspecified or specified as luma samples. In the latest OMAF draft text, these sizes are specified in relative units, to allow the use of the same region-wise packing syntax for multiple bitstreams representing the same source video content. For example, multiple bitstreams representing the same source video content may be generated for adaptive streaming purpose. | It is suggested to align the syntax and semantics of the region-wise packing SEI message with the region-wise packing syntax and semantics in the latest OMAF draft text, to signal packed picture sizes and the sizes of the projected and packed regions in relative units.  For the above suggestion, JCTVC-AC0023 contains a proposal with detailed specification text changes relative to JCTVC-AB1005-v1.  No text changes to the OMAF draft specification is considered needed for this suggestion. |
| 8 | In JCTVC-AB1005-v1, recommended viewports, generated per director's cut or viewing frequency, may be signalled using the viewport omnidirectional viewport SEI message.  In OMAF, the director's cut type of recommended viewport is supported, but not the type per viewing frequency. | It is suggested to align OMAF with the HEVC omnidirectional viewport SEI message by adding the recommended viewport type of most-viewed viewports by statistical measurements.  For the above suggestion, the MPEG input document m41462 contains a proposal with detailed specification text changes relative to the latest OMAF draft specification in the MPEG output document N16950.  No text changes to the OMAF-related SEI messages in JCTVC-AB1005-v1 is considered needed for this suggestion. |
| 9 | The overall sample location mapping processes are aligned between JCTVC-AB1005-v1 and OMAF. However, there is one significant discrepancy in the mapping equations for the equirectangular projection. In JCTVC-AB1005-v1, the mapping equations for the equirectangular projection involve the sphere coverage parameters, while this is not the case in OMAF.  A basic assumption in OMAF of the overall sample location mapping processes, which involve RWP, is that the projected picture conceptually covers exactly the entire sphere. However, the current ERP equations in JCTVC-AB1005-v1 violates this assumption, but rather assumes that the projected picture covers exactly the indicated sphere coverage, which can be a subset of, the same as, or a subset of the entire sphere. When both the ERP SEI message the RWP SEI message are present, both of the two conflicting assumptions are in use in the sample location mapping processes, and the result would not be correct in this case. On the other hand, in OMAF, the RWP signalling needs to be present even when the true RWP functionality like region resizing, repositioning, rotation, mirroring as well as advanced guard band are not needed, e.g., for support of sub-sphere coverage and simple ERP padding. | It is suggested to align the ERP mapping equations between the two specifications as follows:   * For ERP, if an applicable region-wise packing (RWP) SEI message is not present, the projection equations that involve the sphere coverage parameters apply; otherwise, the projection equations that do not involve the sphere coverage parameters apply. * For both cases, the azimuth equation is changed a little bit such that the left side of a full coverage ERP picture corresponds to −180 degree instead of 180 degrees.   For the above suggestion, JCTVC-AC0024 contains a proposal with detailed specification text changes relative to JCTVC-AB1005-v1.  The MPEG input document m41459 contains a proposal with detailed specification text changes relative to the latest OMAF draft specification in the MPEG output document N16950 for the above suggestion. |
| 10 | Regarding the equations for the cubemap projection (in clause D.3.4.51.2 of JCTVC-AB1005-v1 and clause 5.2.2 of the OMAF SoDIS), there are the following discrepancies:   * In JCTVC-AB1005-v1 there is a constraint that requires that pictureWidth shall be a multiple of 3 and pictureHeight shall be a multiple of 2, but not in the OMAF SoDIS. * There were a few switches between '/' and '÷' at the beginning of the equations (rows 1, 2, 5, 6). | It is suggested to discuss these discrepancies and align them.  No specification text is provided for this suggestion in this contribution. Experts who are familiar with the CMP equations are encouraged to study the discrepancies and provide alignment suggestions. |
| 11 | In OMAF clauses 10.1.2.2, there is the following constraint:  When the video does not provide full 360 coverage, for each picture, there shall be a region-wise packing SEI messages present in the bitstream that applies to the picture.  However, this constraint wouldn't be needed when the sphere coverage information is present, since for the equirectangular projection the coverage in sphere domain is identical to the coverage in 2D picture domain, which the region-wise packing box provides in this scenario.  In the context of the OMAF-related SEI messages, there were also requests, e.g., from Minhua Zhou of Broadcom, to make the design of the OMAF-related SEI messages work for sub-360 coverage scenarios without mandating the presence of the region-wise packing SEI message when not necessary (i.e., when the projection type is the equirectangular projection and the sphere coverage information is present). | It is suggested to make aligned designs for OMAF and the OMAF-related SEI messages to address this issue.  Based on the suggestion for item#9 above, RWP is no longer needed for sub-360 coverage support for the viewport independent profiles. Therefore, it is suggested to require the absence of the RWP signalling altogether for the viewport independent profile.  The MPEG input document m41459 contains a proposal with detailed specification text changes relative to the latest OMAF draft specification in the MPEG output document N16950 for the above suggestion. |
| 12 | OMAF supports fisheye omnidirectional video. The fisheye video metadata is signalled in a file format box. However, there is no fisheye SEI message for support of fisheye omnidirectional video on elementary stream level.  The 3GPP SA4 standardization work on FLUS (Framework for Live Uplink Streaming) needs a fisheye SEI message. For the background of FLUS, you may take a look at the latest description of FLUS available in S4-AHM363 (<http://www.3gpp.org/FTP/tsg_sa/WG4_CODEC/Ad-hoc_MTSI/Docs/S4-AHM363zip>) plus recently agreed additions documented in S4-170843 (<ftp://ftp.3gpp.org/tsg_sa/WG4_CODEC/TSGS4_95/Docs/S4-170843.zip>). | It is suggested to specify a fisheye SEI message, and align the fisheye video metadata signalling between the SEI message and the OMAF file format level signalling. |
| 13 | There will most likely be OMAF and JCT-VC inputs to Macau that contain other topics than listed above for which coordination between OMAF and JCT-VC is necessary or desirable. | It is suggested to discuss as early as possible in OMAF meeting sessions (including Saturday and Sunday OMAF AHG meeting sessions) all OMAF inputs containing topics for which coordination between OMAF and JCT-VC is necessary or desirable, to allow joint discussions between OMAF and JCT-VC, knowing that JCT-VC will end by Tuesday.  These topics should be identified early and considered in preparing the meeting agendas of both OMAF and JCT-VC. |

# Patent rights declaration(s)

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