**3GPP TSG-SA WG4 Meeting #127S4-240175**

**Sophia-Antipolis, France, 29 January - 2 February 2024**

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| *CR-Form-v12.0* |
| **PSEUDO CHANGE REQUEST** |
|  |
|  | **26**.**966** | **CR** | **-** | **rev** | **-** | **Current version:** | **1.0.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | **[FS\_HEVC\_Profiles] Updates to HEVC 4:4:4 solutions** |
|  |  |
| ***Source to WG:*** | Apple Inc. |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | **FS\_HEVC\_Profiles** |  | ***Date:*** | 2024-01-20 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | 18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | There are editor's notes for HEVC 4:4:4 scenario on evaluation e.g., impact of 4:4:4 up/down conversion on the evaluation. A new reference is added to address this. Till now no gains have been proposed to be documented for HEVC 4:2:2 scenario. |
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| ***Summary of change:*** | Addresses the editor's note on impact of 4:4:4 up/down conversion on the evaluation and notes that there is no available documentation for HEVC 4:2:2 scenario. |
|  |  |
| ***Consequences if not approved:*** | Editor's notes and the issues above will not be addressed. |
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| ***Clauses affected:*** | 2, 5.3.4, 6.4.3.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* First Change \* \* \* \*

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] ISO/IEC 14496-10:2022: "Information technology — Coding of audio-visual objects — Part 10: Advanced video coding"

[3] ISO/IEC 23008-2:2015: "Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 2: High efficiency video coding"

[3] 3GPP TR 26.905: "Mobile stereoscopic 3D video".

[4] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[5] 3GPP TS 26.244: "Transparent end-to-end packet switched streaming service (PSS); 3GPP file format (3GP)".

[6] 3GPP TS 26.214: "IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[7] 3GPP TS 26.218: "Virtual Reality (VR) profiles for streaming applications"

[8] 3GPP TS 26.347: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs"

[9] Vetro, Anthony. "Frame compatible formats for 3D video distribution." In 2010 IEEE International Conference on Image Processing, pp. 2405-2408. IEEE, 2010.

[10] Hannuksela, Miska M., Ye Yan, Xuehui Huang, and Houqiang Li. "Overview of the multiview high efficiency video coding (MV-HEVC) standard." In 2015 IEEE International Conference on Image Processing (ICIP), pp. 2154-2158. IEEE, 2015.

[11] ISO/IEC JTC1/SC29/WG11 MPEG2011 M22746, "AVC/MVC anchor coding for MFC", November 2011, Geneva, Switzerland.

[12] ISO/IEC JTC1/SC29/WG11 N16050, "MV-HEVC Verification Test Report", San Diego, US, Feb. 2016.

[13] ISO/IEC 14496-15:2022, "Information technology — Coding of audio-visual objects — Part 15: Carriage of network abstraction layer (NAL) unit structured video in the ISO base media file format"

[14] "HTTP Live Streaming (HLS) authoring specification for Apple devices," <https://developer.apple.com/documentation/http-live-streaming/hls-authoring-specification-for-apple-devices>

[15] "ISO Base Media File Format and Apple HEVC Stereo Video Format additions," Version 0.9 (Beta) June 21, 2023

[16] "Apple HEVC Stereo Video," Interoperability Profile Version 0.9 (Beta) June 21, 2023

[17] Delbracio, Mauricio, Damien Kelly, Michael S. Brown, and Peyman Milanfar. "Mobile computational photography: A tour." Annual Review of Vision Science 7 (2021): 571-604.

[18] Camera & Imaging Products Association (CIPA) "Production, Shipment of Digital Still Camera January, January-January in 2017," 2016

[19] "Smartphones vs Cameras: Closing the gap on image quality," <https://www.dxomark.com/smartphones-vs-cameras-closing-the-gap-on-image-quality/>

[20] Joint Video Team (JVT) of ISO/IEC MPEG & ITU-T VCEG JVT-I018, "Color format downconversion for test sequence generation," 2003.

[21] Joint Video Team (JVT) of ISO/IEC MPEG & ITU-T VCEG JVT-I019, "Color format upconversion for video display," 2003.

[22] ISO/IEC 23008-12:2022: "Information technology - MPEG systems technologies - Part 12: Image File Format".

[23] ISO/IEC 14496-12:2022: "Information technology — Coding of audio-visual objects — Part 12: ISO base media file format".

[24] "Using HEIF or HEVC media on Apple devices," https://support.apple.com/en-us/HT207022

[25] "HEIF Imaging," <https://source.android.com/docs/core/camera/heif>

[26] ITU-T Recommendation T.81: "Information technology; Digital compression and coding of continuous-tone still images: Requirements and guidelines".

[27] 3GPP TR 26.948: "Study on video enhancements in 3GPP multimedia services"

[28] HTTP Live Streaming (HLS) Authoring Specification for Apple Devices, <https://developer.apple.com/documentation/http_live_streaming/http_live_streaming_hls_authoring_specification_for_apple_devices>

[29] Samira Afzal, Vanessa Testoni, Christian Esteve Rothenberg, Prakash Kolan, Imed Bouazizi, “A holistic survey of multipath wireless video streaming”, Journal of Network and Computer Applications, 212: 103581 (2023)

[30] ISO/IEC JTC1/SC29/WG11 N16051, "SHVC verification test report", February 2016, San Diego, USA.

[31] ISO/IEC JTC1/SC29/WG11 N16268, "Supplemental SHVC verification test report", June 2016, Geneva, CH.

[32] 3GPP TR 26.955: "Video codec characteristics for 5G-based services and applications"

[33] ISO/IEC 23000-19:2020, "Information technology — Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media"

[34] ISO/IEC JTC1/SC29/WG03 N01026, "Preliminary WD of ISO/IEC 23000-19 AMD New Structural CMAF Brand Profile", October 2023, Hannover, Germany.

[35] ITU-R/Study Group 6/Document 6/33-E Draft New Recommendation ITU-R BT. "[EVP]: Subjective assessment of video quality using expert viewing protocol (EVP)", 4 February 2016, Geneva.

[36] ISO/IEC JTC1/SC29/WG03 N01033, "Technology under consideration on CMAF", October 2023, Hannover, Germany.

[37] Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11 Document JCTVC-AA0039, "Additional methods for Luma Adjustment," April 2017.

\* \* \* First Change \* \* \* \*

5.3.4 Evaluation methodology

\* \* \* Next Change \* \* \* \*

6.4.3.2 Codec performance evaluation

Assessment should be based on taking the same 4:4:4 still image content as in baseline solution 2.1. The material can be then downconverted to 4:2:2, while retaining the original bitdepth (i.e. 8 or 10 bits) using an agreed horizontal downsampling method (see JVT-I018[20]). Then such content can be coded with the appropriate HEVC 4:2:2 profile using the HEVC reference encoder (HM). As in the previous solution, and given the prevalence of the full range in still image content, full range signals should be generated across all conversion steps.

After decoding, the content will be upconverted to 4:4:4 using a well agreed methodology (see JVT-I019 [21]). Afterwards, metrics will be computed for the upconverted content such as PSNR for the three colour components, Y, Cb, Cr in the 4:4:4 domain using the original content. The bits needed for coding these representations would also be considered. Although distortion is introduced in this process because of downconversion from 4:4:4 to 4:2:2 and the subsequent upconversion back to 4:4:4, this is likely to be smaller than what is observed and documented for 4:4:4 to 4:2:0 conversion [37].

Currently, there are no documented performance enhancements achieved by this solution.

\* \* \* End of Changes \* \* \* \*