**3GPP TSG-SA WG4 Meeting #126 S4-231822**

**Chicago, USA, 13 - 17 November 2023** *revision S4aV230082*

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| *CR-Form-v12.0* |
| **PSEUDO CHANGE REQUEST** |
|  |
|  | **26**.**966** | **CR** | **-** | **rev** | **1** | **Current version:** | **0.1.0** |  |
|  |
| *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]** **Providing scope and background** |
|  |  |
| ***Source to WG:*** | Apple |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | **FS\_HEVC\_Profiles** |  | ***Date:*** | 30/10/2023 |
|  |  |  |  |  |
| ***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)* |
|  |  |
| ***Reason for change:*** | The scope and background for the study are missing. |
|  |  |
| ***Summary of change:*** | The scope and background for the study are provided. |
|  |  |
| ***Consequences if not approved:*** | Scope and background for the study are missing. |
|  |  |
| ***Clauses affected:*** | 1, 2, 4 |
|  |  |
|  | **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:*** | * Updated language to remove SA4 procedural issues of study
* Clarified that mention of conclusions of TR 26.955 refer to the video services documented there.
* Removed reference to V3C.
* Rephrased the "renewed interest" bit.
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\* \* \* First Change \* \* \* \*

1 Scope

This Technical Report gathers the opportunities for improving HEVC-based services. This includes documentation of motivating use cases and scenarios. Specifically, potential of improving on the following use cases are identified: the compression performance for stereoscopic 3D content, the network performance related to exploding adaptive streaming traffic, and the demands for very high-quality image/video prosumer applications and gaming/screen content sharing. HEVC based solutions to address each opportunity are identified: HEVC Multiview profiles, HEVC Scalable profiles, and HEVC 4:4:4 (up to 10 bits) capable profiles. Methodologies to investigate and document the pros and cons of the proposed solutions for each use case are documented. Finally, conclusions are drawn on the relevancy of solutions and if any new normative specification work is to be done.

\* \* \* Next 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.

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

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

4 Background

The video codec characteristics for 5G services are documented in TR 26.955 [yy], and they demonstrate that the HEVC coding standard provides satisfactory performance to fulfil the needs of video service studied in the TR. It also recommended to consider upgrading specifications to support profiles, levels, and possibly features available in HEVC, including features that may include better support for screen content and computer-generated content, XR/AR type of services, as well as low and very low latency services. On the one hand, there is interest in the distribution, including streaming, of 3D movie content, and on the other hand, there are applications that could benefit from the distribution of 4:4:4 video, such as screen sharing, gaming, and even for new immersive applications. Finally, the use of scalability could further enhance multi-bitrate systems such as video conferencing, or adaptive streaming, but may also provide additional benefits to end user devices, such as power adaptation. HEVC may be suitable to cater and enable such applications. This specification outlines these emerging applications for video coding, gather evidence whether specific new tools can provide advantage for specific services and applications, and conclude if normative specification work is needed on these aspects.

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