**3GPP TSG-SA WG4 Meeting #132 S4-250882**

**Fukuoka, JP, 19 – 23 May 2025**

**Source: China Mobile Com. Corporation**

**Title: [FS\_Beyond2D] Scenario 1: External Performance data and Additional Information**

**Agenda item: 9.7**

**Document for: Agreement**

**1. Introduction**

This proposal provides external performance data and additional information for Scenario 1: UE-to-UE Stereoscopic Video Live Streaming.

**2. Proposal**

It is proposed to agree the following changes to the 3GPP draft TR 26.956 V0.4.0

\* \* \* 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*.

[LS-15] V. Baroncini, K. Müller, and S. Shinya (editors), "MV-HEVC verification test report", JCT3V-N1001, May 2016.

[LS-16] VQEG 3DTV Group, Test Plan for Evaluation of Video Quality Models for Use with Stereoscopic Three-Dimensional Television Content, 2012

[LS-17] Recommendation ITU-R P.914, “Display requirements for 3D video quality assessment ”, 2016.

[LS-18] Recommendation ITU-R P.915, “Subjective assessment methods for 3D video quality”, 2016.

[LS-19] Recommendation ITU-R P.916, “Information and guidelines for assessing and minimizing visual discomfort and visual fatigue from 3D video”, 2016.

[LS-20] Guodong Chen, Sizhe Wang, Jacob Chakareski, Dimitrios Koutsonikolas, and Mallesham Dasari. 2025. Spatial Video Streaming on Apple Vision Pro XR Headset. In Proceedings of the 26th International Workshop on Mobile Computing Systems and Applications (HotMobile '25). Association for Computing Machinery, New York, NY, USA, 115–120. https://doi.org/10.1145/3708468.3711878

[LS-21] Sizhe Wang, Mingkun Liu, Mallesham Dasari, and Dimitrios Koutsonikolas. 2024. A First Look at Apple’s Stereoscopic Video and its Potential in Live Video Streaming for XR Headsets. In Proceedings of the 30th Annual International Conference on Mobile Computing and Networking (ACM MobiCom '24). Association for Computing Machinery, New York, NY, USA, 1617–1619. https://doi.org/10.1145/3636534.3697437

\* \* \* Second Change (All New)\* \* \*

### 7.2.9 External Performance data

The verification test report for MV-HEVC can be downloaded from the JCT-3V website [LS-15]

The VQEG 3DTV Group conducted an evaluation of video quality models for stereoscopic 3D television content. In collaboration with the DVB, they further assessed the visual impact of Side-by-Side, Top-Bottom, and Tile formats on Quality of Experience (QoE) for Full-HD television transmissions across varying bitrates [LS-16]. The findings from this evaluation played a key role in the development of ITU-T Recommendations P.914 [LS-17], P.915 [LS-18], and P.916 [LS-19].

Two recent research papers [LS-20][LS-21] evaluated end-to-end stereoscopic 3D live streaming using the iPhone 15TM and the Apple Vision ProTM XR headset, the key observations are summarized below:

- **Bandwidth Requirements**

- Apple TV+TM’s immersive 180° stereoscopic video demands ~99.81 Mbps at peak quality (4320×4320, 90fps), challenging LTE/5G uplink.

- Vision ProTM’s spatial video requires 31 Mbps, while iPhone 15 ProTM uses 16.89 Mbps, comparable to YouTubeTM’s 4K (35-45 Mbps) and 2K (16 Mbps) streams.

- iPhone 15 ProTM’s spatial videos consume about twice the bitrate of conventional iPhone 11 ProTM videos.

**- Impact of network artifacts on depth perception:**

- According to [LS-20], lower bitrates degrade disparity map quality, with a 3.5 dB PSNR drop when reducing bitrates from 300 Mbps to 1 Mbps, along with noticeable object dislocation in the scene, creating unnatural depth conflicts under poor network conditions.

**- Content-Related Impacts on User Experience**

- Stereoscopic videos generally provided a better viewing experience than monoscopic videos at the same bitrate. However, some exceptions occurred: close-up scenes sometimes caused visual discomfort, and high-motion scenes were rated lower across both formats due to motion sickness. Scenes with strong depth cues and occlusions were particularly well-suited to stereoscopic presentation, receiving higher user ratings.

### 7.2.10 Additional information

The industry has increasingly embraced stereoscopic 3D video, as demonstrated by recent advancements in application support:

- Dolby VisionTM Profile 20 extends Dolby Vision’s quality enhancements to MV-HEVC and immersive content: https://professionalsupport.dolby.com/s/article/Dolby-Vision-Profile-20-FAQ?language=en\_US

- Apple Vision ProTM Spatial Video Formats (a stereo MV-HEVC video track, plus spatial metadata): https://developer.apple.com/av-foundation/HEVC-Stereo-Video-Profile.pdf

- NVIDIATM’s Video Codec SDK 13.0 introduces an MV-HEVC encoder, further supporting stereoscopic 3D video: https://developer.nvidia.com/blog/enabling-stereoscopic-and-3d-views-using-mv-hevc-in-nvidia-video-codec-sdk-13-0/

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