**3GPP TSG SA WG4#133-e Tdoc S4-251322**

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**Source: China Mobile Com. Corporation**

**Title: [FS\_Beyond2D] Conclusions and Proposed Next Steps**

**Agenda item: 9.6**

**Document for: Agreement**

**1. Introduction**

This proposal provides draft conclusions and potential next steps for FS\_Beyond2D.

**2. Proposal**

It is proposed to agree the following changes to the 3GPP draft TR 26.956 V1.0.0

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

# 11 Conclusions and Proposed Next Steps

This Technical Report provides an evaluation and characterization framework of Beyond 2D Video Formats and Codecs, which includes the following aspects:

- An overview of existing and emerging Beyond-2D video representation formats is provided in clause 4. For each format, it defines its production and capturing systems, rendering and display systems, known compression technologies, typical quality criteria, and its benefits and limitations.

- The overall evaluation and characterization framework defined in clause 6.

- A comprehensive set of end-to-end Beyond-2D video reference scenarios and corresponding workflows is described in clause 7. For each scenario, it provides details on capturing, encoding, packaging, delivery, decoding, and rendering, along with general constraints on latency and the complexity required for 3GPP network delivery and device support.

- The detailed evaluation framework for each scenario, including test conditions and parameters, KPIs, metrics, test sequences, and agreed reference signals is provided in clause 9. The corresponding reference sequences for each scenario are identified, with further details provided in Annex C.

The limitation of this study includes; (1) Currently, no common anchor is available across the different Beyond-2D video formats, making direct comparisons between formats challenging; (2) The encoders used in the evaluation are at varying levels of maturity; (3) Due to time constraints and the absence of standardized codecs, some emerging formats, such as dynamic mesh, NeRF, and 3D Gaussian Splatting were not included in the evaluation; (4) The results presented in this document should be interpreted with caution, as no verification or cross-checking has been performed; (5) The framework focuses primarily on objective evaluations and provision of videos enabling subjective testing, but no formal subjective test was organized by 3GPP. External objective and subjective test reports are referenced when available. .

The outcome of this TR is providing a comprehensive evaluation of emerging beyond 2D formats, including stereoscopic video, and multi-view. However, immediate standardization is not required at this time. Emerging formats such as 3DGS demonstrate promising capabilities to overcome the limitations of current representation methods. However, these technologies are still in their infancy and require further industry stabilization before reaching well-defined maturity.

#### **Recommendations for 3GPP:**

Short-Term Focus:

* The study proposes to enhance support for stereoscopic video formats to enable more immersive Beyond 2D experiences. This aspect has been addressed in TS 26.265 [26265] and its potential next phase,
* We recommend to evaluate the dynamic mesh representation format with V-DMC and HEVC as underlying video codec with objective results and delivery of videos as it has been done for dynamic point clouds with V-PCC
* Further we recommend to evaluate network related aspects when delivering content represented as dynamic mesh over 3GPP networks
* Address dynamic mesh content generation for offline productions in prosumer case (e.g. social media) and for realtime applications.

Mid-Term Focus:

- We recommend that 3GPP actively monitor advancements in dynamic mesh and 3DGS and consider integrating them into standardization frameworks once the ecosystem matures.

- In addition, immersive services are a cornerstone of 6G-enabled applications, yet the lack of unified standards for Beyond 2D representation formats remains a critical barrier to adoption. Identify potential formats and implementation strategies for Beyond 2D video in 6G scenarios is recommended to be addressed in the subsequent study.

- B2D video involves processing, transmitting, and storing massive amounts of data over 3GPP networks, posing significant challenges to both network bandwidth and end-user device (UE) computational capabilities. Thus, exploring efficient network solutions and bandwidth optimization is crucial to enable real-time B2D video delivery across a wide viewing range without compromising perceptual immersion.

- B2D-related features, such as multi-viewpoint generation and real-time 2D-to-3D conversion, demand substantial computing power, which may exceed UE capabilities. To address this, it is essential to investigate the feasibility of implementing these features (fully or partially) at the network level, reducing computing latency and improving energy efficiency.

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