**3GPP TSG SA WG4#117e S4-220212**

**E-meeting, 14th – 23rd February 2022**

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| *CR-Form-v12.1* | | | | | | | | |
| **PSEUDO CHANGE REQUEST** | | | | | | | | |
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|  | **26.998** | **CR** |  | **rev** |  | **Current version:** | **1.1.2** |  |
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| *For* [***HELP***](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 |  | Radio Access Network |  | Core Network |  |

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| ***Title:*** | Audio aspects of TR 26.998 | | | | | | | | | |
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| ***Source to WG:*** | EVS SWG | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | FS\_5GSTAR | | | | |  | ***Date:*** | | | 2022-02-18 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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 can be 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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | Audio aspects were so far not fully considered in the draft TR 26.998 and this needs to be clarified. | | | | | | | | |
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| ***Summary of change:*** | | Clarification of the main focus of the TR and the need to confirm audio aspects. Conclusion of further study for audio aspects with definition of some particular items that would require further considerations for audio. | | | | | | | | |
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| ***Consequences if not approved:*** | | Potentially misleading presentation of audio aspects, in particular lacking consideration of:  - the type of audio capture and playback and the related system integration  - suitable differentiation of functional structures for immersive media types  - suitable system architecture for split between codec and rendering | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | Introduction, 8.9 (new), 9 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

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# Introduction

Augmented Reality (AR) and Mixed Reality (MR) promise to provide as new experiences for immersive media services. The form factors of the devices for these services should typically not deviate significantly from those of typical glasses, resulting in less physical space for the various required components such as sensors, circuit boards, antennas, cameras, and batteries, when comparing with typical smartphones. Such physical limitations also reduce the media processing and communication capabilities that may be supported by AR/MR devices, in some cases requiring the devices to offload certain processing functions to a tethered device and/or a server.

This report addresses the integration of such new devices into 5G system networks and identifies potential needs for specifications to support AR glasses and AR/MR experiences in 5G.

thisdocument This report is not considered comprehensive for all AR/MR experiences and technologies, for example it may not be equally balanced or equally precise on all media types (e.g. on haptics, GPUs, audio). For example, extrapolations on architectural aspects derived for primarily visual media pipelines to audio pipelines may require confirmation based on further study.

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## 8.9 Audio Media Pipelines for AR Experiences

The current focus of this document is on general system aspects, especially targeting visual rendering on glasses. As such it may lack accuracy on audio media type. For example, extrapolations on architectural aspects derived for primarily visual media pipelines to for audio pipelines need confirmation and further considerations. In particular, the following aspects may require further study:

- In device functional architecture, the type of audio capture and playback and the related system integration need to be defined.

- In 5G AR device types, the functional structures identified in this TR may be differentiated for immersive media types, e.g. operating immersive audio standalone while immersive video functions are split, involving tethered and/or cloud/edge entities.

- In the 5G system architecture mapping, the split of codecs and rendering assumed for video may not be appropriate for audio.

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# 9 Conclusions

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Editor’s note: This needs to be further discussed and consolidated.

AR/MR experiences involve augmenting visual/auditory contents into the real world to improve the user’s experience with better immersiveness, unlike VR, which provides an entirely virtual world. To realize these experiences, glass-type AR/MR devices may be a good candidate device, easily combining the lights from the real world and those from the display without a need of holding a device in one’s hand.

In this study, the generic finding for eXtended Reality (XR) in TR 26.928 [2] have been further analysed with specific focus on Augmented Reality (AR) experiences and in particular also with a new device type, AR glasses. Different device centric functions of AR glasses are defined, and different device types are defined. Of particular relevance are 5G STandalone AR (STAR) UEs, i.e. devices that have sufficient capabilities to render rich AR experiences on the device as well as 5G EDGe-Dependent AR (EDGAR) UEs for which edge-based rendering support is a must to provide rich AR experiences. Three basic functions are introduced, the AR Runtime, the Scene Manager and the 5G Media Access Function. Basic AR processes are defined, and a comprehensive summary of AR related media formats is provided. The relevant work in external organizations is summarized.

Based on core use cases, different scenarios are mapped to the 5G System architecture, namely (i) Immersive media downlink streaming (ii) Interactive immersive services (iii) 5G cognitive/spatial computing immersive services as well (iv) AR conversational services. Potential normative work is identified and summarized in clause 8.

Based on the details in the report, the following next steps are proposed.

In the short-term:

- Document the relevant 5G Augmented Reality Experiences Architectures (5G-AREA) according to the considerations in clause 8.2. It may leverage the existing 5G System such as 5G media streaming or MTSI.

- Establish the concept of 5G Media Service Enablers as introduced in clause 8.3 and make use of the concept to define relevant AR media service enablers. It also includes identifying the relevant stage-2 and stage-3 works and providing a set of initially relevant functions of Media Service Enablers for normative works.

- Define a 5G Real-Time Communication (5G-RTC) Media Service Enabler to support different low-latency streaming and conversational AR related services based on the considerations in clause 8.4.

- Define Media Capabilities for Augmented Reality Glasses (MeCAR) in a service-independent manner based on the considerations in clause 8.5.

- Based on the work on 5G-AREA, 5G-MSE, 5G-RTC and MeCAR, define a Split Rendering Media Service Enabler for AR.

- Develop the extension of IMS-based AR conversational services, including an extended MTSI terminal architecture in consideration of the device types defined in clause 4.2, as well as session setup and control procedures for AR media and the transport of AR media/metadata via the IMS media path including Data Channel

- Complement this TR with the relevant audio aspects in a follow-up study based on the considerations in clause 8.9.

In the mid-term:

- Add issues around semantical perception and spatial mapping to an AI/ML study, taking into account also the findings in TR 22.874.

- Study options for Smartly Tethering AR Glasses (SmarTAR) based on the discussion in clause 8.7.

All work should be carried out in close coordination with other groups in 3GPP on 5G System and radio related matters, edge computing and rendering as well in communication with experts in MPEG on the MPEG-I project as well as with Khronos on their work on OpenXR, glTF and Vulkan/OpenGL. A follow-up workshop based on the information in clause 4.6.9 should be conducted in order to explore additional synergies and complementary work in different organizations in the XR/AR domain.

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