**3GPP TSG-SA1 Meeting #96e *S1-21ssss***

**Electronic Meeting, 8 – 18 November 2021** *(revision of S1-21xxxx)*

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  |  | **CR** | **0xxx** | **rev** | **-** | **Current version:** |  |  |
|  |
| *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 | **X** | Core Network | **X** |

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|   |
| ***Title:***  | Introduction of text for Tactile and multi-modal communication service |
|  |  |
| ***Source to WG:*** |  InterDigital |
| ***Source to TSG:*** |   |
|  |  |
| ***Work item code:*** | TACMM |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Normative requirements and KPIs for tactile and multi-modal communication service is missing. |
|  |  |
| ***Summary of change:*** | Normative requirements and KPIs for tactile and multi-modal communication service is added. |
|  |  |
| ***Consequences if not approved:*** | Service not available in Rel-18 |
|  |  |
| ***Clauses affected:*** | 6.43.1 (new), 6.43.2 (new), 7.10 (new) |
|  |  |
|  | **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 ==========**

## 6.43 Tactile and multi-modal communication service

### 6.43.1 Description

The tactile and multi-modal communication service combines input / output from multiple sources and enable multi-modal interactions, combining ultra-low latency with extremely high availability and reliability. The tactile and multi-modal communication service can be applied in multiple fields, e.g. industry, robotics and telepresence, virtual reality, augmented reality, healthcare, road traffic, serious gaming, education, culture and smart grid. The benefit of combining input from more than one source and/or output to more than one destination, is that the communication can be more accurate and faster and responses can be quicker. This provides a communication service that is smoother and more natural.

For a typical tactile and multi-modal communication service, there can be different modalities affecting the user experience, e.g.:

* Video/Audio media;
* Information perceived by sensors about the environment, e.g. brightness, temperature, humidity, etc.;
* Haptic data: can be feelings when touching a surface (e.g., pressure, texture, vibration, temperature), or kinaesthetic senses (e.g. gravity, pull forces, sense of position awareness).

The ambient information can be further processed to generate IoT control instructions as the feedback. The haptic data, according to the physiological perception, has specific characteristics, e.g. frequency and latency, and can require adequate periodic, deterministic and reliable communication path.

### Multiple modalities can be transmitted at the same time to multiple application servers for further processing in a coordinated manner, in terms of QoS coordination, traffic synchronization, power saving, etc. 6.43.2 Requirements

Editor’s Note: This clause will be updated to reflect the consolidated requirements from 3GPP TR 22.847.

The 5G system shall support a means for an authorized 3rd party to provide 5GS with a QoS policy to be used for coordination between flows of multiple UEs associated with an application. The policy may contain e.g. the set of UEs and data flows, the expected 5GS QoS handling(s) and the associated triggering events for multiple flows of different traffic types (e.g., haptic, audio and video).

The 5G system shall support a means for an authorized 3rd party to provide 5GS with synchronization threshold(s) between the multiple flows (e.g., haptic, audio and video) associated with a multi-modal communication session.

The 5G system shall support a means to assist a 3rd party application to coordinate the transmission of multiple flows (e.g., haptic, audio and video) of a multi-modal communication session to enable presenting the related tactile and multi-modal data to the user within a certain time.

The 5G system shall support a means to assist a 3rd party application to ensure users’ QoE of the multi-modal communication service involving one or multiple devices at either end of the communication. QoE refers to the difference of the physical interaction across the 5G network and the same manipulation carried out locally.

**========= Next Change ==========**

## 7.10 KPIs for tactile and multi-modal communication service

Editor’s Note: This clause will be updated to reflect the consolidated KPIs from 3GPP TR 22.847.

The 5G system shall support tactile and multi-modal communication services with the following KPIs.

**Table 7.10-1: Tactile and multi-modal communication service performance requirements**

| **Use Cases** | **Characteristic parameter (KPI)** | **Influence quantity** | **Remarks** |
| --- | --- | --- | --- |
| **Max allowed end-to-end latency** | **Service bit rate: user-experienced data rate** | **Reliability** | **Message size (byte)** | **UE Speed** | **Service Area** |  |
| Immersive multi-modal VR (UL: device 🡪 application sever) | 5 ms(note 2) | 16 kbit/s -2 Mbit/s(without haptic compression encoding);0.8 - 200 kbit/s (with haptic compression encoding) | [99.9%] (without haptic compression encoding)[99.999%] (with haptic compression encoding) | 1 DoF: 2-8 3 DoFs: 6-24 6 DoFs: 12-48 More DoFs may supported by the haptic device | Stationary or Pedestrian | several km2(note 3) | Haptic feedback |
| 5 ms | < 1Mbit/s | [99.99%] | MTU | Stationary or Pedestrian | several km2(note 3) | Sensing information e.g. user poisoning and view |
| Immersive multi-modal VR (DL: application sever 🡪 device) | 10 ms(note1) | 1-100 Mbit/s | [99.9%] | 1500 | Stationary or Pedestrian | several km2(note 3) | Video |
| 10 ms | 5-512 kbit/s | [99.9%] | 50 | Stationary or Pedestrian | several km2(note 3) | Audio |
| 5 ms(note 2) | 16 kbit/s -2 Mbit/s(without haptic compression encoding);0.8 - 200 kbit/s (with haptic compression encoding) | [99.9%] (without haptic compression encoding)[99.999%] (with haptic compression encoding) | 1 DoF: 2-8 3 DoFs: 6-24 6 DoFs: 12-48 | Stationary or Pedestrian | several km2(note 3) | Haptic feedback |
| Remote control robot | [1-20ms] | 16 kbit/s -2 Mbit/s(without haptic compression encoding);0.8 - 200 kbit/s (with haptic compression encoding) | [99.99%] | 2-8 (1 DoF) | high-dynamic | ≤ 1 km2 | Haptic feedback |
| [20-100ms] | 16 kbit/s -2 Mbit/s(without haptic compression encoding);0.8 - 200 kbit/s (with haptic compression encoding) | [99.99%] | 2-8 (1 DoF) | Stationary or Pedestrian | ≤ 1 km2 | Haptic feedback |
| 5 ms | 1-100 Mbit/s | [99.9%] | 1500 | Stationary or Pedestrian | ≤ 1 km2 | Video |
| 5 ms | 5-512 kbit/s | [99.9%] | [50-100] | Stationary or Pedestrian | ≤ 1 km2 | Audio |
| 5 ms | < 1Mbit/s | [99.999%] | - | Stationary or Pedestrian | ≤ 1 km2 | Sensing information |
| Skillset sharing low- dynamic robotics(including teleoperation) Controller to controlee | [5-10ms] | 0.8 - 200 kbit/s (with compression) | [99,999%] | 1 DoF: 2-8 3 DoFs: 6-24 6 DoFs: 12-48 | Stationary or Pedestrian | TBD | Haptic (position, velocity) |
| Skillset sharing low- dynamic robotics(including teleoperation)Controlee to controller | [5-10ms] | 0.8 - 200 kbit/s (with compression) | [99,999%] | 1 DoF: 2-8 10 DoFs: 20-80 100 DoFs: 200-800 | Stationary or Pedestrian | TBD | Haptic feedback |
| 10ms | 1-100 Mbit/s | [99,999%] | 1500 | Stationary or Pedestrian | TBD | Video |
|  10ms | 5-512 kbit/s | [99,9%] | 50 | Stationary or Pedestrian | TBD | Audio |
| Highly dynamic/ mobile roboticsController to controlee  | [1-5ms] | 16 kbit/s -2 Mbit/s(without haptic compression encoding);0.8 - 200 kbit/s (with haptic compression encoding) | [99,999%] (with compression)[99,9%] (w/o compression) | 1 DoF: 2-8 3 DoFs: 6-24 6 DoFs: 12-48 | high-dynamic | TBD | Haptic (position, velocity) |
| Highly dynamic/ mobile roboticsControlee to controller | [1-5ms] | 0.8 - 200 kbit/s  | [99,999%] (with compression)[99,9%] (w/o compression) | 1 DoF: 2-8 10 DoFs: 20-80 100 DoFs: 200-800 | high-dynamic | TBD | Haptic feedback |
| [1-10ms] | 1-10 Mbit/s | [99,999%] | [2-4] | high-dynamic | TBD | Video |
| [1-10ms] | 100-500 kbit/s | [99,9%] | 100 | high-dynamic | TBD | Audio |
| Immersive multi-modal navigation applications Remote Site 🡪 Local Site (DL) | 50 ms | 16 kbit/s -2 Mbit/s (without haptic compression encoding)0.8 - 200 kbit/s (with haptic compression encoding) | [99.999 %] | 1 DoF: 2 to 810 DoF: 20 to 80100 DoF: 200 to 800 | Stationary or Pedestrian | ≤ 100 km2NOTE 5 | Haptic feedback  |
| <400 ms | 1-100 Mbit/s | [99.999 %] | 1500 | Stationary/ or Pedestrian,  | ≤ 100 km2NOTE 5 | Video |
| <150 ms | 5-512 kbit/s | [99.9 %] | 50 | Stationary or Pedestrian | ≤ 100 km2NOTE 5 | Audio |
| <300 ms | 600 Mbit/s | [99.9 %] | MTU | Stationary or Pedestrian | ≤ 100 km2NOTE 5 | VR |
| Local Site 🡪 Remote Site (UL) | <300 ms | 12 kbit/s [26] | [99.999 %] | 1500 | Stationary or Pedestrian | ≤ 100 km2NOTE 5 | Biometric / Affective  |
| <400 ms | 1-100 Mbit/s | [99.999 %] | 1500 | Workers: Stationary/ or Pedestrian, UAV: [30-300mph] | ≤ 100 km2NOTE 5 | Video |
| <150 ms | 5-512 kbit/s | [99.9 %] | 50 | Stationary or Pedestrian | ≤ 100 km2NOTE 5 | Audio |
| <300 ms | 600 Mbit/s | [99.9 %] | MTU | Stationary or Pedestrian | ≤ 100 km2NOTE 5 | VR |
| NOTE 1: Motion-to-photon delay (the time difference between the user’s motion and corresponding change of the video image on display) should be less than 20ms, the communication latency for transfer the packets of one audio-visual media is less than 10ms, e.g. the packets corresponding to one video/audio frame are transferred to the devices within 10ms.NOTE 2: Refer to IEEE 1918.1 [3] as for haptic feedback, the latency should be less than 25ms for accurately completing haptic operations. As rendering and hardware introduce some delay, the communication delay for haptic modality should be reasonably less than 5ms, i.e. the packets related to one haptic feedback are transferred to the devices within 10ms.NOTE 3: Haptic feedback is typically haptic signal, such as force level, torque level, vibration and texture. NOTE 4: The latency requirements are expected to be satisfied even when multimodal communication for skillset sharing is via indirect network connection (i.e., relayed by one UE to network relay). NOTE 5: In practice, the service area depends on the actual deployment and is the same for uplink and downlink traffic. In some cases a local approach (e.g. the application servers are hosted at the network edge) is preferred in order to satisfy the requirements of low latency and high reliability. |

To support immersive multi-modal VR applications, the 5G system shall support the following synchronisation thresholds in order to avoid having a negative impact on the user experience (i.e. viewers detecting lack of synchronisation).

**Table 7.10-2: Key performance requirements for synchronization thresholds for immersive multi-modality VR applications**

|  |  |
| --- | --- |
|  | **synchronisation threshold** |
| **audio-tactile** | audio delay:[50 ms] | tactile delay:[25 ms] |
| **visual-tactile** | visual delay:[15 ms] | tactile delay:[50 ms] |

**========= End of Changes ==========**