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

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

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **22.847** | **CR** | **<CR#>** | **rev** | **<Rev#>** | **Current version:** | **18.0.0** |  |
|  | | | | | | | | |
| *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 | **X** | Core Network | **X** |

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|  | | | | | | | | | | |
| ***Title:*** | TACMM Consolidation of KPIs | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | China Mobile, Huawei, InterDigital, Futurewei, LG ?, Xiaomi ?… | | | | | | | | | |
| ***Source to TSG:*** | SA1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | FS\_TACMM | | | | |  | ***Date:*** | | | 2021-10-14 |
|  |  | | | |  | |  | | |  |
| ***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 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)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The existing TR is missing clause 6: Consolidation of KPIs | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Adding clause 6: Consolidation of KPIs | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The TR will be imcomplete. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2 (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:*** | |  | | | | | | | | |

6 Consolidated requirements

6.2 Consolidated potential KPIs

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

**Table 6.2-1:** **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 | typically  < 100 km2  (note 5) | Haptic feedback |
| 5 ms | < 1Mbit/s | [99.99%] | MTU | Stationary or Pedestrian | typically  < 100 km2  (note 5) | 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 | typically  < 100 km2  (note 5) | Video |
| 10 ms | 5-512 kbit/s | [99.9%] | 50 | Stationary or Pedestrian | typically  < 100 km2  (note 5) | 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 | typically  < 100 km2  (note 5) | 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 robotics  Controller 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 robotics  Controlee 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 [11] | 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 8  10 DoF: 20 to 80  100 DoF: 200 to 800 | Stationary or Pedestrian | ≤ 100 km2  NOTE 5 | Haptic feedback |
| <400 ms [11] | 1-100 Mbit/s | [99.999 %] | 1500 | Stationary/ or Pedestrian, | ≤ 100 km2  NOTE 5 | Video |
| <150 ms [11] | 5-512 kbit/s | [99.9 %] | 50 | Stationary or Pedestrian | ≤ 100 km2  NOTE 5 | Audio |
| <300 ms | 600 Mbit/s | [99.9 %] | MTU | Stationary or Pedestrian | ≤ 100 km2  NOTE 5 | VR |
| Local Site 🡪 Remote Site (UL) | <300 ms | 12 kbit/s [26] | [99.999 %] | 1500 | Stationary or Pedestrian | ≤ 100 km2  NOTE 5 | Biometric / Affective |
| <400 ms [11] | 1-100 Mbit/s | [99.999 %] | 1500 | Workers: Stationary/ or Pedestrian, UAV: [30-300mph] | ≤ 100 km2  NOTE 5 | Video |
| <150 ms [11] | 5-512 kbit/s | [99.9 %] | 50 | Stationary or Pedestrian | ≤ 100 km2  NOTE 5 | Audio |
| <300 ms | 600 Mbit/s | [99.9 %] | MTU | Stationary or Pedestrian | ≤ 100 km2  NOTE 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, synchronisation may be required between audio/visual and tactile components, in order to avoid having a negative impact on the user experience (i.e. detecting lack of synchronisation), for example [add ref/source of numbers]:

**Table 6.2-2: Examples of synchronization thresholds for immersive multi-modality VR applications**

|  |  |  |
| --- | --- | --- |
| **Media components** | **synchronisation threshold (Note 1)** | |
| **audio-tactile** | audio delay:  [50 ms] | tactile delay:  [25 ms] |
| **visual-tactile** | visual delay:  [15 ms] | tactile delay:  [50 ms] |
| Note 1: for each media component, “delay” refers to the case where that media component is delayed compared to the other. | | |