**3GPP TSG SA WG 1 Meeting #104 S1-23xxxx**

**Chicago, USA, 13 - 17 November 2023** *(revision of S1-23xxxx)*

**Source: ZTE**

**pCR Title: Pseudo-CR on update of 6.2 KPI**

**Draft Spec: 3GPP TS 22.137**

**Agenda item: x.x**

**Document for: Approval**

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*Abstract: This document is to update the KPI values in TS 22.137.*

**1. Introduction**

This pCR is to update the KPI values of section 6.2 based on agreed KPI values in TR22.837.

**2. Reason for Change**

There has a great progress on the sensing KPI table during the SA103. But there has still some open issues need to be addressed. For example, the principle of the KPI valuses for one category is to choose the strictest requirements. But some of KPI values in one categoria are diversity, so it is suggested to separate them. The detail analysis is listed in the below table.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | Sensing service category | Sensing service area | Confidence level [%] | Accuracy of positioning estimate by sensing (for a target confidence level) | | Accuracy of velocity estimate by sensing (for a target confidence level) | | Sensing resolution | | Max sensing service latency  [ms] | Refreshing rate  [s] | Missed detection  [%] | False alarm  [%] | Example Services |
| Horizontal  [m] | Vertical  [m] | Horizontal  [m/s] | Vertical  [m/s] | Range resolution  [m] | Velocity resolution (horizontal/ vertical)  [m/s x m/s] |
| Object detection and tracking | 1 (use cases 5.1; 5.13 – level1) | 5.1 | 95 | ≤10 | ≤10 | N/A | N/A | N/A | N/A | <1000 | < 1 | < 5 | < 2 |  |
| 5.13 level1 | 95 | ≤10 | ≤10 | N/A | N/A | 10 | [5] | [≤1000] | [≤1] | ≤5 | ≤5 |  |
| Object to be detected indoor: Human, object to be detected outdoor: UAV | 95 | 10 | 10 | N/A | N/A | 10  NOTE 2 | 5  NOTE 3 | 1000 | 1 | 5 | 2 | intruder detection in smart home,  UAV intrusion detection |
| 2 (use cases 5.13 – level2, 5.6, 5.14) | 5.13 level2 | 95 | ≤5 | ≤5 | N/A | N/A | 10 | [5] | [≤1000] | [≤1] | ≤5 | ≤5 |  |
| 5.6 | 95 | ≤2 | N/A | N/A | N/A | N/A | N/A | ≤1000 | < 1 | < 0.1 | < 5 |  |
| 5.14 | 95 | [≤2] | N/A | [1] | N/A | [1] | [1] | [≤5000] | [≤0.2] | ≤5  NOTE 2 | ≤5  NOTE 2 |  |
| Object to be detected outdoor:  Human, UAV | 95 | 2 | 5 | 1 | N/A | 1  NOTE 2 | 1  NOTE 3 | Tourist spot monitoring : 5000; others 1000 | 0.2 | 0.1 | 5 | UAV flight route intrusion detection,  intruder detection in surroundings of smart home, tourist spot monitoring |
| 3 (use cases 5.2, 5.7, 5.10, 5.11, 5.12, 5.23) | 5.2 | 95 | ≤1 | N/A | N/A | N/A | N/A | N/A | ≤5000 | ≤ 0.1 | ≤5 | ≤5 |  |
| 5.7 | 95 | ≤1.5 | N/A | N/A | N/A | N/A | N/A | ˂1500 | ≤ 0.1 | 2 | 2 |  |
| 5.10 | N/A | 1-2 | 1-2 | 1-2 | 1-2 | 1m x 1m ~10m x 10m NOTE 2 | 1m/s x 1m/s ~ 10m/s x 10m/s NOTE 3 | 100~1000 NOTE 4 | 1Hz  NOTE 5 | 5 | 5 |  |
| 5.11 | 95 | ≤1 | N/A | N/A | N/A | N/A | N/A | ≤100  NOTE 2 | ≤ 0.1 | ≤5 | ≤5 |  |
| 5.12 | 95 | 1 | 1 | 1  NOTE 2 | 1 NOTE 2 | <1  NOTE 2 | 1 | 500 | 0.5 | N/A | N/A |  |
| 5.23 | 99 | ≤1 | N/A | 1 | N/A | 1 | 1.5 | ˂500 | 0.05 | N/A | 5 |  |
| Factory (100m2), crossroad, highway, railway [air]  NOTE 4  Object to be detected: Animal, Human, UAV, Vehicle | 95 | 1 | 1 | 1  NOTE 5 | 1 | 1  NOTE 5  NOTE 8 | 1 x 1 NOTE 9 | 100  NOTE 6  1000  NOTE 10  Intrution detection in highway: 5000 | 0.05  NOTE 11 | 2 | 2 | pedestrian/animal intrusion detection on a highway/railway,  sensing at crossroads with/without obstacle,  UAV flight trajectory tracing  UAV collision avoidance,  AMR collision avoidance in smart factories |
| 4 (use cases 5.20, 5.22, 5.25, 5.32，5.27) | 5.20 | 95 | 0.5 | 0.5 | 0.1 | N/A | 2.5m perpendicular to the parking space  5m parallel to the parking space | N/A | 1000 | 1 | 1 | 5 |  |
| 5.22 | 95 | ≤0.7 | N/A | UAV: ≤25  Pedestrian: ≤1.5  Vehicle: ≤15 | N/A | N/A | N/A | ≤5s | ≥10Hz | [≤5] | [≤5] |  |
| 5.25 | 95 | 0.5 | 0.5 | 0.1 | N/A | 0.5 | N/A | 250  (granularity of field is 1.5m x 1.5m) | 0.25 | 5 | 5 |  |
| 5.32 | 99 | [≤0.5] | N/A | 0.5 | N/A | [0.5] | [0.5] | ≤100 | 0.1 | N/A | N/A |  |
| 5.27 | 99 | ≤ 0.5 | ≤ 1.0 | Pedestrian: ≤1.5 | Pedestrian: ≤1.5 | 3 | Horiz: 5  Vert: 5 | ≤1s | ≥10Hz | [≤3] | [≤3] |  |
| Factory and public safety  Object to be detected: Animal, Human, UAV, AGV/AMR, Vehicle, | 95, for public safety it is 99 | 0.5 | 0.5 | 0.1  Vehicle: 15;  Pedestrian: ≤1.5 | N/A,  Pedestrian: ≤1.5 | 0.5m | factories: 0.5 x 0.5 | Detection near smart grid is 5000;  Public safety: 1000  Factory: 100 | 0.1 | 1 | 3 | Parking Space Determination,  UAVs/vehicles/pedestrians detection near Smart Grid equipment (NOTE 7),  immersive experience based on sensing,  integrated sensing and positioning in factory hall, public safety |
| 5 (use cases ~~5.27~~, 5.28) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5.28 | [95] | Long range radar:[≤1.3]  NOTE 2  Short range radar:[≤2.6] | ≤0.5 | [≤ 0.12]  NOTE 4 | N/A | [0.4]  NOTE 5 | [≤ 0.6]  NOTE 4 | Long range radar: [50]  Short range radar:20 | Long range radar: [≤ 0.2];  Short range radar: [≤ 0.05] | [≤ 10] | [<1] |  |
| ADAS  Object to be detected: Vehicle, | 95 | short-range radar:2.6;  long range radar:1.3 | 0.5 | 0.12 | N/A | 0.4 | 0.6 | Long range radar: [50]  Short range radar:20 | Long range radar: [≤ 0.2];  Short range radar: [≤ 0.05] | 10 | 1 | ADAS |
| Environment monitoring | 6 (use cases 5.3 and 5.5.) | 5.3 | 95 | N/A | N/A | N/A | N/A | N/A | N/A | 1 min | 10min, application configurable | 5 | 5 |  |
| 5.5 | 95 | ≤10 | [≤0.2]  NOTE 2 | N/A | N/A | N/A | N/A | ≤ 1min  NOTE 3 | < 1min  NOTE 3 | < 0.1 | < 3 |  |
| Rainfall monitoring and flooding  NOTE 14  Object to be detected: Rain | 95 | 10 | 0.2  NOTE 15 | N/A | N/A | N/A | N/A | 60000 | 1 | 0.1 | 3 | rainfall monitoring,  flooding monitoring |
| Motion monitoring | 7 (use cases 5.15, 5.24) | 5.15 | 95 | N/A | N/A | N/A | N/A | N/A | N/A | 60s | 60 | 5 NOTE 3 | 5  NOTE 3 |  |
| 5.24 | 95 | N/A | N/A | N/A | N/A | N/A | N/A | 60s | 1min | N/A | N/A |  |
| Indoor human motion -sleep monitoring NOTE 12, sports monitoring NOTE 13, | 95 | N/A | N/A | N/A | N/A | N/A | N/A | 60000 | 60 | 5 | 5 | sleep monitoring,  sports monitoring |
| 8 (use case 5.29) | 5.29 | 95 | 0.2  NOTES 4 and 5 | 0.2  NOTES 4 and 5 | 0.1 | 0.1 | 0.375  NOTES 1 and ,2 and 5 | 0.3 | 5 – 50  NOTE 3 | ≤0.1 | ≤5 | ≤5 |  |
| Hand gesture recognition | 95 | 0.2 | 0.2 | 0.1 | 0.1 | 0.375 | 0.3 | 5 | 0.1 | 5 | 5 | Hand gesture recognition |

**3. Proposal**

It is proposed to considering above light green result in the KPI table and agree the following changes to 3GPP TS 22.137.

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

## 6.2 Requirements

The 5G system shall be able to provide sensing results with the performance requirements in Table 6.2-1.

Table 6.2-1: Performance requirements for 5G Wireless sensing

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scenario | Sensing service category | Confidence level [%] | Accuracy of positioning estimate by sensing (for a target confidence level) | | Accuracy of velocity estimate by sensing (for a target confidence level) | | Sensing resolution | | Max sensing service latency  [ms] | Refreshing rate  [s] | Missed detection  [%] | False alarm  [%] | Sensing service description in a target sensing service area |
| Horizontal  [m] | Vertical  [m] | Horizontal  [m/s] | Vertical  [m/s] | Range resolution  [m] | Velocity resolution (horizontal/ vertical)  [m/s x m/s] |
| Object detection and tracking | 1 | 95 | 10 | 10 | N/A | N/A | 10 | 5 | 1000 | 1 | 5 | 2 | Indoor/outdoor (e.g., detection of human, UAV) |
| 2 | 95 | 2 | 5 | 1 | N/A | 1 | 1 | Tourist spot monitoring : 5000;  others 1000 | 0.2 | 0.1 | 5 | Outdoor (e.g., detection of human, UAV) requiring higher performance than category 1 |
| 3 | 95 | 1 | 1 | 1 | 1 | 1 | 1 x 1 | 100 (NOTE 2), or 1000 (NOTE 3)  detection in highway: 5000 | 0.05 | 2 | 2 | Indoor/outdoor (e.g., detection tracking of human, animal, UAV) |
| 4 | 99 for public safety, otherwise, 95 | 0.5 | 0.5 | 1.5 for pedestrian,  15 for vehicle, otherwise, 0.1 | 1.5 for Pedestrian; | 0.5 | factories 0.5 x 0.5 | Detection for smart grid: 5000;  Public safety: 1000;  Factory:100 | 0.1 | 1 | 3 | Indoor/outdoor (e.g., detection tracking of human, animal, UAV, AGV, vehicle) requiring higher performance than category 3 |
| 5 | 95 | short range radar: 2.6;  Long range radar:1.3; | 0.5 | 0.12 | N/A | 0.4 | 0.6 | Short range radar:20;  Long range radar: 50; | Short range radar: 0.05;  Long range radar:0.2 | 10 | 1 | ADAS |
| Environment monitoring | 6 | 95 | 10 | 0.2 | N/A | N/A | N/A | N/A | 60000 | 60 | 0.1 | 3 | Nature of environments monitored by sensing. |
| Motion monitoring | 7 | 95 | N/A | N/A | N/A | N/A | N/A | N/A | 60000 | 60 | 5 | 5 | Human motions and activities obtained by sensing (NOTE 4). |
| 8 | 95 | 0.2 | 0.2 | 0.1 | 0.1 | 0.375 | 0.3 | 5 | 0.1 | 5 | 5 | Human hand gestures obtained by sensing |
| NOTE 1: The additional information on some of the performance requirements can be found in [2].  NOTE 2: The value 100 ms is sourced from [3] and is valid for sensing at crossroads.  NOTE 3: To realize 1m granularity tracking, when the velocity resolution is 1 m/s, the maximum corresponding sensing service latency is 1 s.  NOTE 4: Additional KPI on human motion rate accuracy is defined for contactless sleep/sports monitoring [2]. | | | | | | | | | | | | | |

\* \* \* End of Change \* \* \* \*