5G-ACIA to 3GPP TSG SA
5G-ACIA-LS-2022-006

Title:	**Use Cases and requirements for industrial factory applications**
Source:	**5G Alliance for Connected Industries and Automation (5G-ACIA)**
To:	**3GPP TSG SA, 3GPP TSG RAN**
CC:	
Date:	**09 Dec, 2022**
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1. Overall Description

5G-ACIA is discussing the following use cases for connected industries and automation which have also been captured as stage 1 requirements in 3GPP TS 22.104. 5G-ACIA would like to be informed about the status of the specification work for these use cases.

Cooperative Carrying Robots Use Case: This use case investigates using sidelink connectivity between a group of mobile robots/AGVs. The mobile robots/AGVs are part of a 5G non-public network, either stand-alone (SNPN) or Public Network, integrated (PNI-NPN). The collaborating mobile robots/AGVs carrying the large or heavy work piece are communicating with direct 5G communication between each other (sidelink). The mobile robots/AGVs contain a 5G UE for the 5G communication with each other. The automation application on the UEs of the collaborating mobile robots/AGVs will initiate the sidelink communication. These mobile robots/AGVs belong to the same working clock domain (cf. TS 22.104, annex D.1) to achieve the necessary time synchronization between each other for the periodic deterministic communication requiring high communication service availability and ultra-low latency using multicast & unicast for their cyber-physical control application (cf. TS 22.104, section A.2.2.5). The exchange of control commands and control feedback is done with periodic deterministic communication and using time-sensitive networking. The localization information which might be absolute or relative can be exchanged along with the communication data. The KPIs for the cooperative carrying robot use case are listed in Table 5.2-1of 3GPP TS 22.104.

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Relative Positioning Use Case: Positioning is a capability with high value in connected industries and automation. It can be used for tracking mobile assets in the factory, as e.g., described in 3GPP TS 22.104 clause 5.7.1 and clause A.7. In addition to absolute positioning, also relative positioning of a device with respect to other devices can be used. In this case relative positioning/ranging of the UE with regard to another UE can be provided. A corresponding requirement for relative positioning of a UE is defined in 3GPP TS 22.104, clause 5.7.1.

The industrial use cases and the resulting requirements on sidelink are described in 3GPP TS 22.104 as listed below:

- Supporting direct device to device communication via sidelink according to the requirements on latency, reliability, and availability as described in 3GPP TS 22.104 Table 5.2-1 related to cooperative carrying
- Clock synchronization to a common working clock (cf. 3GPP TS 22.104, clause D.1) for a group of UEs via the 5G network or via the direct device connection over sidelink with a time synchronicity budget of the 5GS that does not exceed 900ns, as described in 3GPP TS 22.104 clause 5.7.1 and Table 5.2.3.2-1,
- Supporting positioning information for a UE that is out of coverage of the network, with accuracy of < [1 m] relative to other UEs that are in proximity and in coverage of the network and corresponding requirement for relative positioning of a UE is defined in 3GPP TS 22.104, Table 5.7.1-1 in clause 5.7.1.

The usage of sidelink as described above is relevant for UEs supporting factory applications that belong to a non-public network (NPN), either a standalone NPN or a public-network integrated NPN.

2. Actions to 3GPP TSG SA and 3GPP TSG RAN:

5G-ACIA would like to be informed if and how these requirements have been addressed by stages 2 and 3 and if not, whether there are any ongoing or planned activities to address them.

3. Date of Next 5G-ACIA Plenary Meetings

- February 2023, Plenary Meeting is online

4. References

[1] 3GPP TS 22.104, v18.3.0, Service Requirements for Cyber Physical Control Communications, 2021.
[2] 3GPP TS 22.261, v18.6.1 Service Requirements for 5G System, 2022