

WG2 conclusions/recommendations on Connectivity for automation:

I. Conclusions

- 1. Connectivity can enhance the effectiveness of automated systems to improve road safety and traffic efficiency by allowing better perception (tactic and strategic decisions) and communication with the environment. For perception, automated systems to be launched until 2020 will rely mostly on on-board sensors. From a pure technical point of view, connectivity is therefore not a strict prerequisite for automation for 2020 systems except for platooning.**

Although automated driving will initially rely on car sensor information, without cooperation amongst road users, vehicle-to-everything (V2X) connectivity can enhance autonomous driving by providing more sensory resources and a complete different level of redundancy, thus enabling collective perception and prediction with non-line of sight sensing and coordinated resolution of complex decisions¹. Indeed, V2X contributes to many operational use cases in addition to vehicle sensors, thus eliminating common causes of failure for safety critical needs such as ‘seeing through’ big vehicles and non-line-of-sight objects. It also enables better situation assessment by using information on road and traffic conditions. This level of redundancy will further benefit from high penetration of V2X technology in both vehicles and infrastructure which will require time and investments.

- 2. The type of connectivity technology needed (e.g. short range, mobile network, satellites) and the related performances (e.g. spectrum, latency, bandwidth, coverage) depend on the automation use case (e.g. V2V for platooning).**

The type of V2X connectivity needed can be grouped under two distinct families – each of which has different characteristics and can respond, alone or in combination, to different use cases:

- a) Vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-pedestrian or other vulnerable road users (V2P) connectivity, which relies on short-range, ad-hoc connectivity for time-critical safety applications (e.g. autonomous emergency braking in low visibility conditions). This type of connectivity is based on standardised protocols and data sets in a licence-exempt regulatory framework (currently using in the 5875-5905 MHz (ITS) band²) and does not require any mobile network or subscription. Technologies enabling this mode of communication are expected to be available for deployment from 2019 onwards for Day-1 services as highlighted by the

¹ The European Commission considers in its Communication on C-ITS, that communication between vehicles, infrastructure and with other road users is crucial also to increase the safety of automated vehicles and ensure their full integration into the overall transport system.

² In the EU this "5.9GHz Safety Related ITS band" (5875-5905 MHz) is harmonised by Commission Decision 2008/671/EC. At CEPT level, the frequency band 5855-5875 MHz has been made available for ITS (non-safety applications) by ECC Recommendation (08)01. Furthermore (CEPT) ECC Decision (08)01 as amended on 3 July 2015 states in "Decides n.4" that "*CEPT administrations shall consider within a future review of this Decision the designation of the frequency sub-band 5905-5925 MHz for an extension of ITS spectrum noting that protection of ITS cannot be ensured in this band*". Adoption of CEPT rules in each of its 48 Member States is on a voluntary basis.

European Commission for in the C-ITS Communication³. The key technologies are the currently available ITS-G5 and the upcoming C-V2X (LTE-V2X and 5G).

- b) Vehicle-to-network (V2N) connectivity, is delivered over commercial mobile networks (satellites, 3G, 4G, LTE or 5G) and bands. V2N would comprise commercial services requiring a subscription with a mobile network operator. 5G is not fully standardised yet but its key specifications and technological building blocks are already being developed and tested. The Commission stated that it will work with Member States and industry stakeholders to align roadmaps and priorities for a coordinated 5G deployment across all EU, targeting early network introduction by 2018, and moving towards commercial large scale introduction by the end of 2020 at the latest and all major transport paths in 2025 (see 5G Action Plan⁴).

C-V2X has the potential to use existing 4G infrastructure.

II. Recommendations

The deployment of both short range and mobile broadband services would be beneficial for deployment of automated and connected vehicles.

³ A European strategy on Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility, COM(2016) 766 final, 30 Nov. 2016.

⁴ Communication from the EC, 5G for Europe Action Plan, COM(2016) 588 final, 14 Sept. 2016.