

Draft Communications Overview for the Task Force on Vehicular Communications (TF on VC)

This document explains vehicular communications for use by WP.29.

I. Vehicular communications – context

A. Ways of looking at vehicle communications

Vehicular communications are the exchange of information and data between vehicles as well as between vehicles and their surroundings. It involves the use of various wired or wireless communication technologies to enable communication and data sharing between vehicles, between vehicles and other road users and between vehicles and roadside units, traffic management systems, other infrastructure components and cloud-based remote data storage.

In general, vehicular communication includes Vehicle-to-Vehicle (V2V) communication, Vehicle-to-Motorcycle (V2M) communication, Vehicle-to-Infrastructure (V2I) communication, Vehicle-to-Grid (V2G) communication, Vehicle-to-Network (V2N) communication, Vehicle-to-Pedestrian (V2P) communication and Vehicle-to-Bicyclist (V2B) communication. Together, these can be called Vehicle-to-Everything (V2X).

B. Goals of vehicular communications

Goals of vehicular communications include improving road safety, transport efficiency, and the overall transport experience, as well as reducing negative environmental impacts. By facilitating interchange of information among vehicles, other road users and infrastructure, vehicular communications enable the exchange of data such as vehicle speed, position, acceleration, braking, signalling, road conditions, and traffic flow. This information can be used to support:

(a) *Safety and traffic related information sharing:* It allows the vehicle to issue warnings to its driver based on information transmitted by other vehicles or through cloud services and information sharing services.

(b) *Traffic management:* By collecting data from vehicles and infrastructure, vehicular communications can assist in optimizing traffic flow, reducing congestion, and improving overall transport efficiency.

(c) *Collision avoidance:* Vehicular communications can help vehicles detect and avoid potential collisions by sharing information about their positions, velocities, and intentions.

(d) *Protecting vulnerable road users:* Messages from devices in the possession of pedestrians, bicyclists and motorcyclists can alert vehicles to their presence.

(e) *Automated driving support:* There are various ways in which the deployment of automated driving systems (ADS) might be accelerated and/or their safety improved through V2I and V2V communications. E.g., Roadside infrastructure might be able to

provide information to assist ADS at complex junctions; and since merging is a difficult activity for ADS, they might need V2V to reliably do merge successfully 100% of the time.

(f) *Emergency services*: It enables faster response times for emergency services by providing real-time information about crashes, road hazards, and other incidents.

(g) *Cooperative driving*: Vehicular communications can support cooperative driving applications where vehicles collaborate to enhance safety and efficiency, such as platooning, and ADS for example by supporting intersection crossing.

(h) *Charging support*: Information from the grid can be used to control timing of charging and information can be provided to chargers about payment. Communication might also facility two-way energy flows, e.g. to allow electric vehicle batteries to be used to provide power to the grid or an owner's home.

(i) *Traffic signal interface*: Message can be sent by emergency vehicles and possibly transit vehicles to the traffic signal controller to change the signal to green and the traffic signal controller can send its signal phase and timing (SPAT) to vehicles so that they can adjust their speed to reduce energy use.

(j) *Infotainment and convenience*: Delivery of multimedia content, internet access, and personalized services to enhance the in-vehicle experience.

WP.29 has already developed regulatory requirements regarding emergency services (eCall / Accident Emergency Call Systems), OBD ports and Software Updates.

II. Types of Communications

Vehicular communications is information exchange between communications devices in vehicles and communications devices in something, including other vehicles. Vehicular communications includes messages sent from vehicles and messages sent to vehicles. For vehicles, communications can be separated into wired and wireless communications.

Wired communications in vehicles includes OBD and vehicle to charging point. Both OBD and vehicle to charging point might include wireless approaches in the future.

Wireless communications in vehicles includes:

- a. Proximity, such as key fobs.
- b. Close range, such as Bluetooth and Wi-Fi.
- c. Dedicated short range, such as toll transponders and what is commonly called V2X.
- d. Cellular, providing voice, text and mobile internet.
- e. Radio, including digital audio broadcasting (DAB), FM, AM and short wave.
- f. Satellite, including GNSS, satellite radio and satellite internet.
