

## 5GAA Roadmap towards C-V2X deployment in Europe

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# EU roadmap for Cooperative, connected and automated mobility (CCAM)



MOBILITY AND TRANSPORT

DG MOVE - Cooperative

2010 – Directive on Intelligent Transport Systems (C-ITS)

2016 – EU Strategy on Cooperative Intelligent Transport Systems (C-ITS)

2019 – Delegated Regulation on Cooperative Intelligent Transport Systems



#### **DG CONNECT - Connected**

2016 – 5G for Europe Action Plan 2018 – Roadmap for Data governance and Cybersecurity and Connectivity 2018 – 5G Corridors via Horizon2020 and CEF Digital Funding



#### **DG GROW - Automated**

High Level Group on Automotive Industry Gear 2030 – focusing on highly automated and connected vehicles General Safety/Pedestrian Safety Regulation (provisional political agreement in March 2019)



### **Connecting Europe Facility (CEF): 5G Infrastructure along Connected and Automated Mobility corridors**

- 2018-2020: Live Testing of CAM EU funding to support R&D trials/Technology and Business Model Analysis
- 2021-2025: Fast ramp-up of 5G network deployment Along main transport paths/private sector driven with support from CEF/Structural/InvestEU Funding





## EU 5G Strategy Transport - EU Cross-Border Corridors for CCAM

'At the Digital Day 2018 several Member States took important steps to extend the 5G European network by signing regional agreements on 5G corridors.

Following those new agreements and with previous agreements between many European countries, a pan-European network of 5G corridors is now emerging with hundreds of kilometers of motorways where tests will be conducted up to the stage where a car can operate itself with a driver present under certain conditions (third level of automation).'

- France, Germany and Luxembourg
- Norway, Finland and Sweden
- Netherlands and Belgium
- Spain and Portugal
- Bulgaria, Greece and Serbia
- Germany, Austria and Italy

**5G Cross-Border Corridors** 







## Delegated Regulation on C-ITS

## **C-ITS Delegated Regulation - Background**

- Subject matter:
  - Has the aim of establishing specifications necessary to ensure the compatibility, interoperability and continuity for the deployment and operational use of EU-wide C-ITS services based on trusted and secure communication within the EU;
  - Seeks to define how V2V and V2I/I2V are delivered by C-ITS stations, and how C-ITS stations are placed on the market and/or placed in service, to enable the provision of C-ITS services to end users.

#### • Scope:

- No obligation to deploy for OEMs or Member States: requirements only apply when and if deployed for both fixed & mobile C-ITS stations for a short-list of Day 1 Services.
- C-ITS definition inclusive only of short-range implementations enrolled in EU C-ITS Security Credential Management System: long-range is excluded
- Does not regulate or condition access to 5.9 GHz ITS band (Commission Decision 2008/671/EC, possibly amended following CEPT mandate to study the extension of the ITS safety-related band at 5.9 GHz)
- Status:
  - C-ITS Delegated Regulation is currently being reviewed by Council of European Union until mid-July.



## C-ITS Delegated Regulation – 5GAA position

#### In response to the public consultation 5GAA called upon the Commission to:

- Establish forward-looking regulatory framework for C-ITS, abiding wholly by the principle of technology neutrality, which endorses market-led solutions and supports technological evolution.
- Amend the current draft Delegated Regulation to include LTE-V2X for short-range and longrange communications within its scope on an equal footing with ITS-G5, via the related ETSI approved specifications and 5GAA delta profiles;
- **Define interoperability as a "mutual" requirement** among mature C-ITS technologies, namely ITS-G5 and LTE-V2X for short & long-range communications.



## LTE-V2X Standardisation and Specifications State of Play

# LTE-V2X Standards and Specifications for Reference by C-ITS Delegated Regulation

Standard	Version	Name	Tech neutral?	Equivalent standard for LTE-V2X
ETSI EN 302 636-4-1	V1.3.1 (2017-08)	Intelligent Transport Systems (ITS); Vehicular Communication; Geonetworking; Part 4 Geographical addressing and forwarding for point-to-point and point-to- multipoint communications; Sub-part 1: Media-Independent Functionality.	Partly	ETSI TS 102 636-7-1 (to be used in conjunction with ETSI EN 302 636-4-1 i.e., not a replacement)
ETSI TS 102 894-2	V1.3.1 (2018-08)	Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary	Yes	-
ISO/TS 19091	(2017-03)	Intelligent transport systems Cooperative ITS Using V2I and I2V communications for applications related to signalized intersections	Yes	-
ETSI EN 302 663	V1.2.1 (2013-07)	Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band	No	ETSI TS 103 613 pending EN 303 613 (in approval process)
ETSI EN 302 571	V2.1.1 (2017-02)	Intelligent Transport Systems (ITS), Radio Communications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU	Yes	-
ETSI TS 102 687	V1.2.1 (2018-04)	Intelligent Transport Systems (ITS); Decentralized Congestion Control Mechanisms for Intelligent Transport Systems operating in the 5 GHz range; Access layer part.	No	ETSI TS 103 574 v1.1.1
ETSI TS 102 792	V1.2.1 (2015-06)	Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range	Yes	-
ETSI EN 302 637-2	V1.4.1 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service	Yes	-
ETSI TS 102 724	V1.1.1 (2012-10)	Intelligent Transport Systems (ITS); Harmonized Channel Specifications for Intelligent Transport Systems operating in the 5 GHz frequency band	NA	Standard only applicable by design for ITS-G5 (not required for LTE-V2X) EN 302 571 or TS 103 613 offer generic alternatives



### LTE-V2X Standards and Specifications for Reference by C-ITS Delegated

#### Regulation

ETSI EN 302 636-5-1	V2.1.1 (2017-08)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol	No	Latest version of EN 302 636-5-1 adopted in Jan 2019 is tech neutral
ETSI TS 103 248	V1.2.1 (2018-08)	Intelligent Transport Systems (ITS); GeoNetworking; Port Numbers for the Basic Transport Protocol (BTP)	Yes	-
ETSI EN 302 931	V1.1.1 (2011-7)	Vehicular Communications; Geographical Area Definition	Yes	-
ETSI EN 302 637-3	V1.3.1 (2019-04)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service	Yes	-
ETSI TS 102 636-4-2	v.1.1.1 (2013-10)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to- point and point-to-multipoint communications; Sub-part 2: Media-dependent functionalities for ITS-G5	No	ETSI TS 103 613 pending EN 303 613 (in approval process)
SAE J2945/1	2016-03	On-board System Requirements for V2V Safety Communications	Yes	-
ETSI TS 103 097	v1.3.1 (2017-10)	Intelligent Transport Systems (ITS); Security; Security Header and Certificate Formats	Yes	-
ISO 8855	(2011-12)	Road vehicles - Vehicle dynamics and road-holding ability, - Vocabulary	Yes	-
ETSI TS 103 301	V1.2.1 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services	Yes	-
ETSI TS 103 175	V1.1.1 (2015-06)	Intelligent Transport Systems (ITS); Cross Layer DCC Management Entity for operation in the ITS G5A and ITS G5B medium	NA	Standard only applicable by design for ITS-G5 (not required for LTE-V2X)
ISO/TS 19321	(2015-04-15)	Intelligent transport systems - Cooperative ITS - Dictionary of in-vehicle information (IVI) data structures	Yes	-



## Commercial availability of LTE-V2X

## Commercial availability of LTE-V2X solutions

- LTE-V2X is ready for deployment with many hardware/sofware solutions now commercially available.
- On-board units (OBUs) or roadside units (RSUs) enable both C-V2X direct short-range and long-range:



## 5GAA LTE-V2X Interoperability Event 08-12 April 2019

### 5GAA IOT Event Schedule Overview

5GAA Interoperability Event #1 tested commercially available solutions across various vendors to verify:

- Interoperability on lower layers (3GPP PC5 direct-short range radio)
- Interoperability on higher layers (ITS protocols for C-V2X including IEEE, ETSI, SAE and ISO)

#### Direct short-range (PC5) Radio Test Cases Executed = 82

% Pass= 100 % % Fail= 0 %



Radio Protocols



#### Interoperability Test Cases Executed = 167

% Pass= 95 % % Fail= 5 %





## C-V2X Tests and Trials

#### Global Outlook on Tests, mais and Demonstrations involving Cellular-VZA and/or 5G Technology



#### North America

USDOT testing (Aberdeen, USA)

SANDAG Trial (San Diego, USA)

V2V C-V2X radio performance tests (Michigan, USA)

CDOT traffic management trial and early deployment (Colorado, USA)

Ford-Qualcomm V2X Technology Benchmark Testing (Ann Arbor/San Diego, USA)

Audi, Ford, Ducate, Qualcomm Joint C-V2X Intersection Demonstration (CES2019, Las Vegas, USA)

#### Europe

RACC Track (MWC2017, Barcelona, Spain) NordicWay Project 1 & 2 (Finland, Norway, Sweden and Denmark) ConVex (A9, Germany) Mobilfunk (A9, Germany) **Deutsche Telekom Trials (A9, Germany)** Car2X (A9, Germany) 5G-CM (A9, Germany) **MEC Pilot Project (A9, Germany) ICT4CART Project (Austria, Germany and Italy) CONCORDA (Germany, Spain, France, Belgium, Netherlands) Providentia (A9, Germany) SAFARI (Berlin, Germany) CAR2MEC (A9, Germany)** 5G CroCo, 5G Carmen, 5G Mobix

#### Asia-Pacific

C-V2X Performance Test (Shanghai International Automobile City, China)

Car2X (Wuzhen, China)

ICV Pilot Projects (Various Cities, China)

Wuxi City-Wide LTE-V2X Project (Wuxi, China)

Triple Level LTE-V@X IoT and Applications Demonstration (Shanghai Automotive Expo Park, China)

5G and cellular communication showcase trials (Korea)



### Tests and Trials in Europe involving Cellular-V2X and/or 5G Technology



