5G Automotive Association, **pioneering digital transformation** in the **automotive industry**

Learn more at WWW.5GAA.ORG

Driving Connected Mobility Forward

5GAA brings together the automotive and telecommunications industries to accelerate the global deployment of Cellular Vehicle-To-Everything (C-V2X) as a first step towards a fully integrated intelligent transport system with 5G

AUTOMOTIVE INDUSTRY

Vehicle Platform, Hardware and Software Solutions

TELECOMMUNICATIONS

Connectivity and Networking Systems, Devices and Technologies

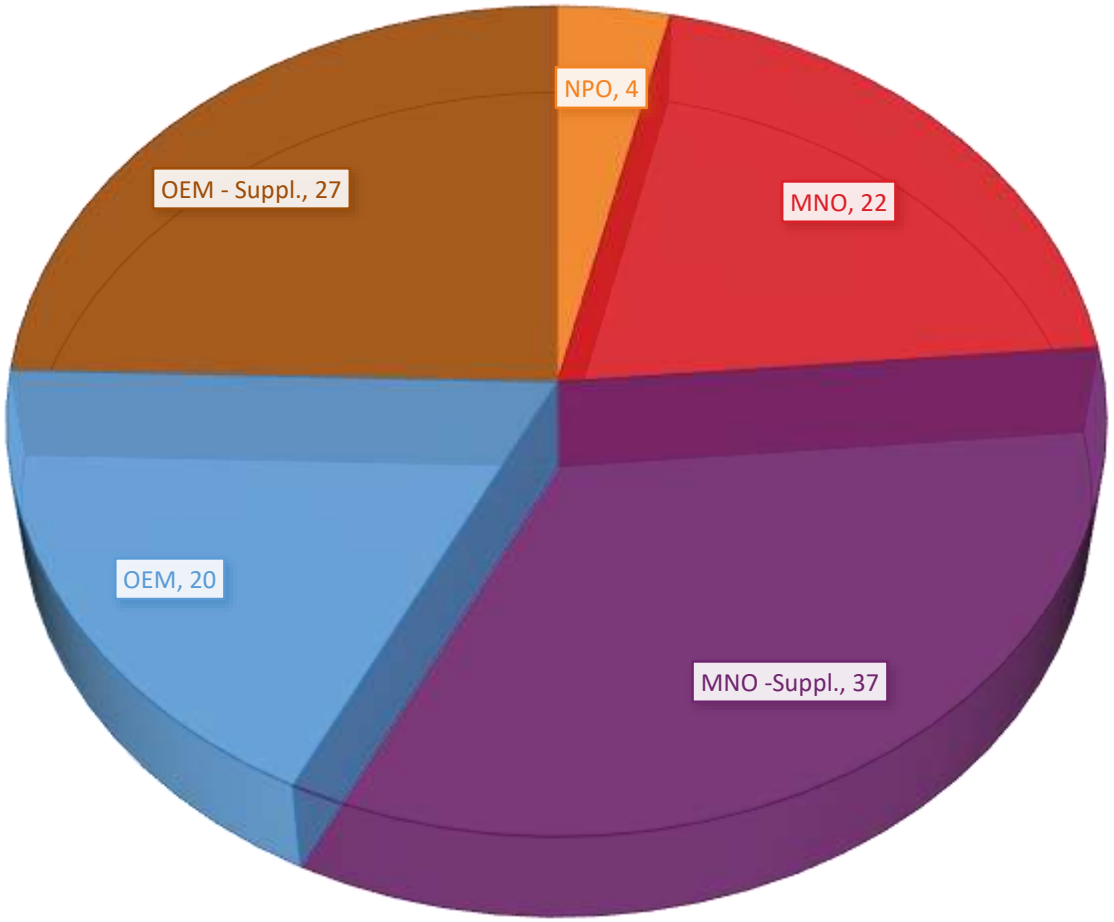
5GAA unites 110+ members* from around the world working together on all aspects of C-V2X including technology, standards, spectrum, policy, regulations, testing, business models and go-to-market

*as of Mar 2019

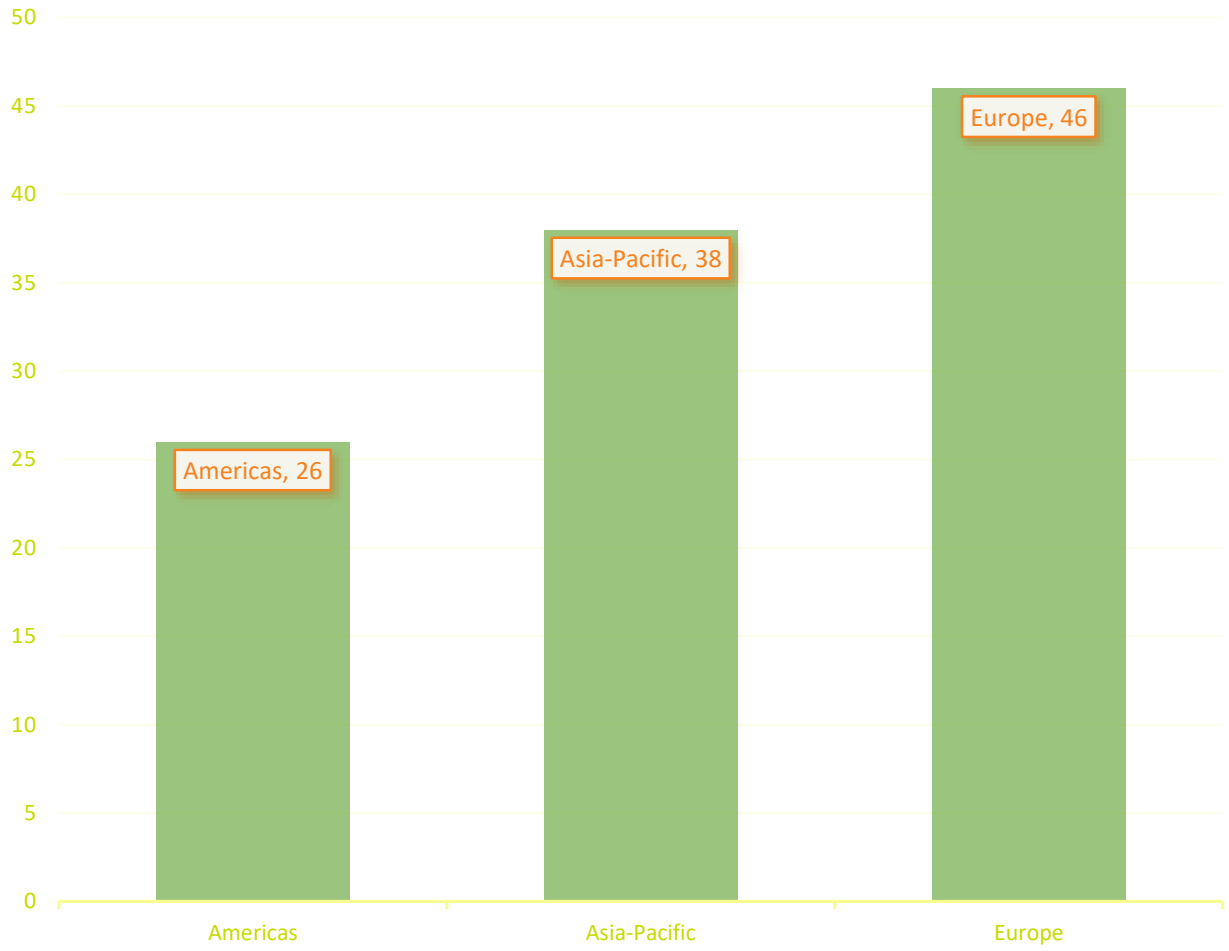
AIRBUS
Airgain
ALPINE
AMERICAN TOWER
ANALOG DEVICES
Anritsu envision : ensure
applied INFORMATION
AT&T
Audi
BAIC GROUP
Baidu 百度
宝能 BAONENG
Bell
BMW GROUP
BlackBerry
BOSCH
大唐电信科技产业集团
CETECOM
中国移动 China Mobile
千方科技 CHINA TRANSINFO
China unicom 中国联通
Cohda Wireless
commsignia
Continental The Future in Motion
DAIMLER
DANLAW AUTOMOTIVE MADE SMART
DEKRA
DENSO
Dt&C
EQUINIX
ERICSSON
Faraday Future
FAR EASTONE
FEV
Ford
Fraunhofer
GEELY
gemalto security to be free
GM
Gotell 果通科技
Hirschmann Car Communication
TE
HITACHI Inspire the Next
HONDA
HUAWEI
HYUNDAI MOTOR GROUP
HYUNDAI MOBIS
iDIRECT
Infineon
intel
INTERDIGITAL
JAGUAR
LAND ROVER
JUNIPER NETWORKS
KDDI
KEYSIGHT TECHNOLOGIES
kt
Laird
LEAR CORPORATION
LG
MITSUBISHI ELECTRIC Changes for the Better
MAGNETI MARELLI
lmt
muRata
NAVINFO
Neusoft 东软
NIO
NISSAN MOTOR CORPORATION
NOKIA
noris network
NTT docomo
OKI
orange
P3
Panasonic
proximus
PSA GROUPE
qorvo
QUALCOMM
QUECTEL Build a Smarter World
GROUPE RENAULT
ROHDE&SCHWARZ
ROHM SEMICONDUCTOR
SAIC 上汽集团 SAIC MOTOR
SAMSUNG
SAVARI
SGS
嘉亭·上海国际汽车城 Anting · Shanghai International Automobile City
SK telecom
SKYWORKS
SMART MOBILE LABS
SoftBank
SUMITOMO ELECTRIC
swift NAVIGATION
T
Telefónica
A1 Telekom Austria Group
TELUS
TERRANET
TÜVRheinland
Valeo
VENIAM
verizon
VIAVI
vodafone
Volkswagen
VOLVO
WNC Wistron NeWeb Corp.
ZF
ZTE

Industry Spread

Total number of members: 110



Regional Split



5GAA Organisational Structure and Working Groups

AT&T, Audi, BMW, 中国移动 China Mobile, DAIMLER, DENSO, ERICSSON, Ford, HUAWEI, intel, JAGUAR, LAND ROVER, NOKIA, QUALCOMM, SAIC 上汽集团 SAIC MOTOR, SAMSUNG, vodafone

BOARD

EXECUTIVE COMMITTEE

GENERAL ASSEMBLY

WG1 (Ford)	WG2 (ERICSSON)	WG3 (vodafone)	WG4 (intel)	WG5 (BMW)	TF	TF (Ford)
Use Cases and Technical Requirements	System Architecture and Solution Development	Evaluation, Testbeds and Pilots	Standards and Spectrum	Business Models and Go-To-Market Strategies	Public Affairs	Efficient Security Provisioning

CEPT TF

CEPT Mandate to study the extension of ITS safety-related band at 5.9 GHz

ETSI

3GPP A GLOBAL INITIATIVE

EATA

5G IA INFRASTRUCTURE ASSOCIATION

IMT-2020

CEPT ECC Electronic Communications Committee

GCF Global Certification Forum

ngmn the engine of broadband wireless innovation

5GAA Automotive Association

Ecosystem ***Cooperation***

5GMIF The Fifth Generation Mobile Communications Promotion Forum

GTI Global TD-LTE Initiative

ITS KOREA

VDT Alliance

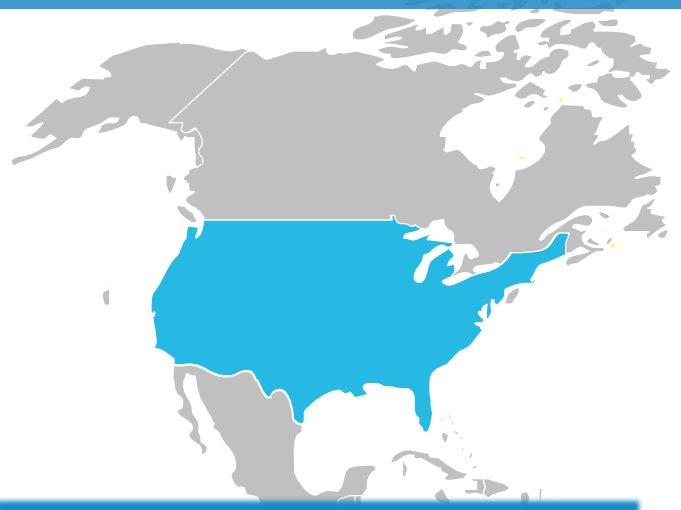
OMNIAIR CONSORTIUM

Connected Motorcycle Consortium

TiCAA

5G Forum

Global Outlook on Tests, Trials and Demonstrations involving Cellular-V2X and/or 5G Technology



North America

C-V2X Connected Car Technology Trials (San Diego, USA)

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

CDOT traffic management trial (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)

Build WI portofolio in line with 5GAA Priority Areas

Joint Ecosystem

Create a joint eco system **car – smartphone - home**

Vehicle to Smart Device

V2X-based vehicle interface for smartphone controlled functions

V2P

Push V2N

Intense functional rollout of **V2N based applications** in order to reach broad penetration fast

c2V2c

Edge Computing

Mobile Edge Computing as one of the **key elements of the connected future**

MEC4AUTO

New Radio

"Define the next step" - accelerate definition of **5G-V2X** based on 5G New Radio

NR-V2X

Security

Interoperability

Make sure that **cross OEM** cars and **cross operator** networks **can „speak" with each other**

IOP events

5GAA Automotive Association

Recent 5GAA publications

- White Paper on C-V2X Conclusions based on Evaluation of Available Architectural Options
- Updated white paper on C-V2X Deployment Timeline
- white paper on the benefits of using existing cellular networks for the delivery of C-ITS
- 5GAA position on European C-ITS Policy

Commercial availability of LTE-V2X

What is C-V2X (Vehicle to Everything)?

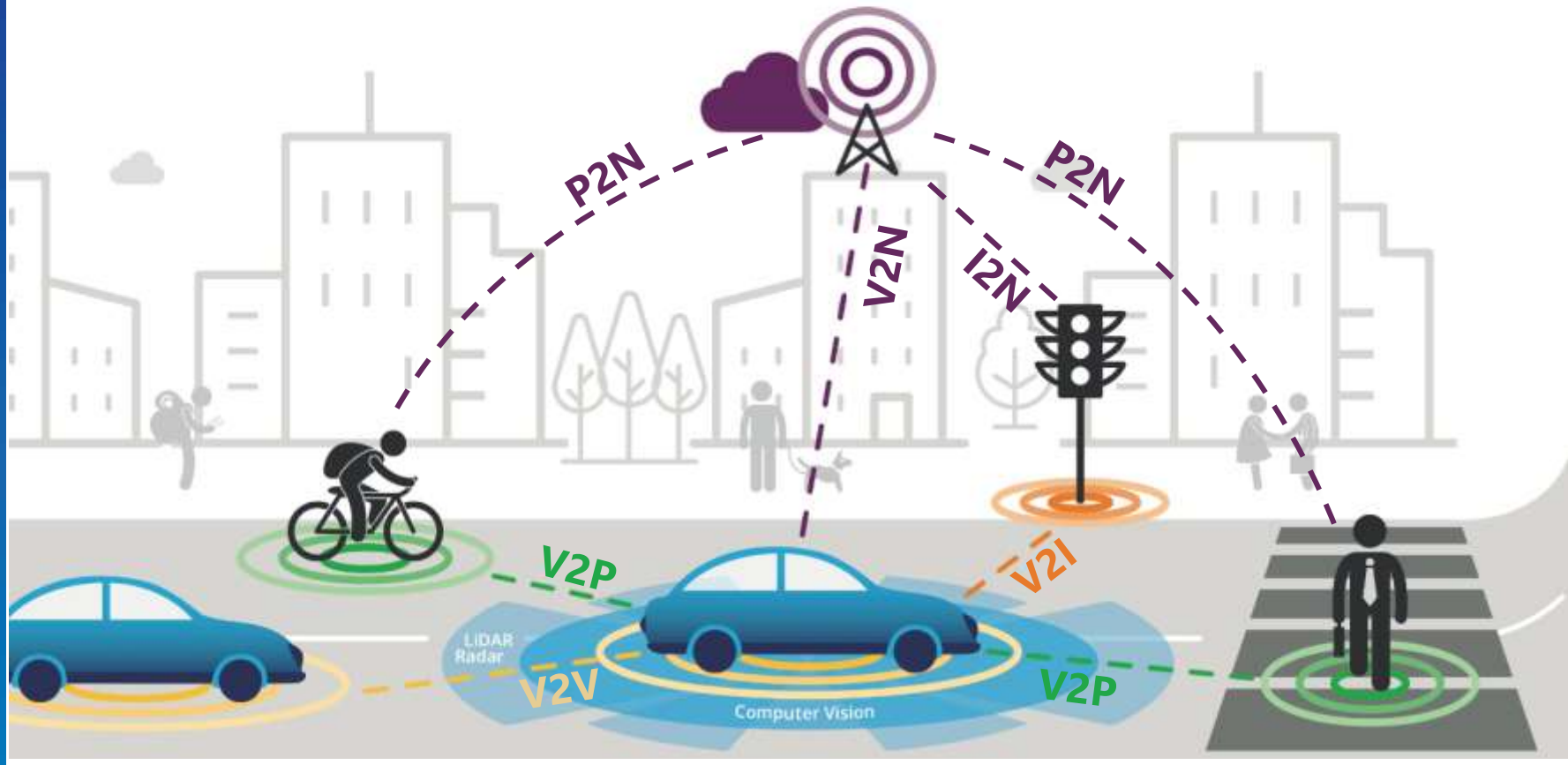
C-V2X is a comprehensive road safety and traffic efficiency solution that allows **vehicles** to communicate with

- **Other vehicles (V2V),**
- **Pedestrians and Cyclists via smartphones (V2P),**
- **Road Infrastructure (V2I),**

supported by the

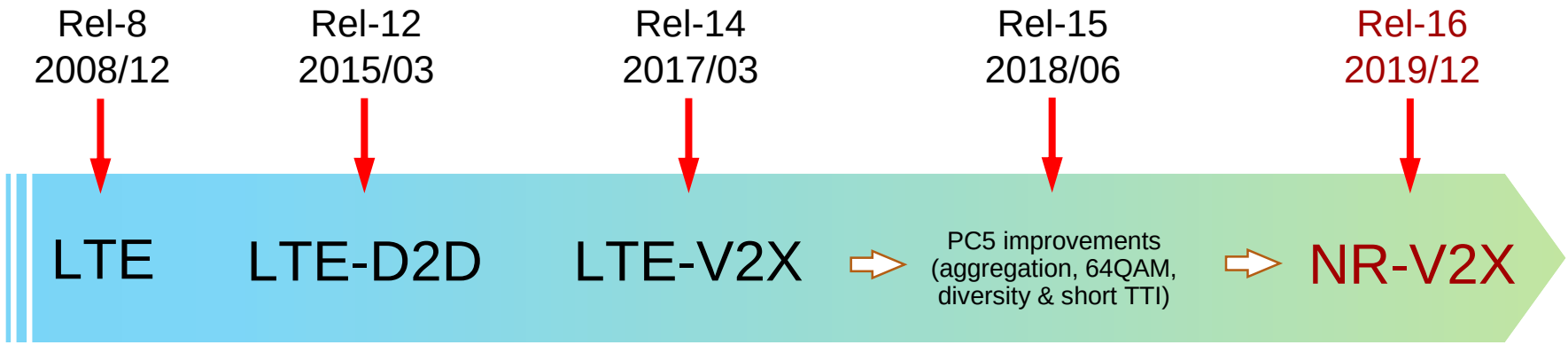
- **Mobile network (V2N, P2N, I2N)**

to guarantee **full coverage** and **continuity of services**.



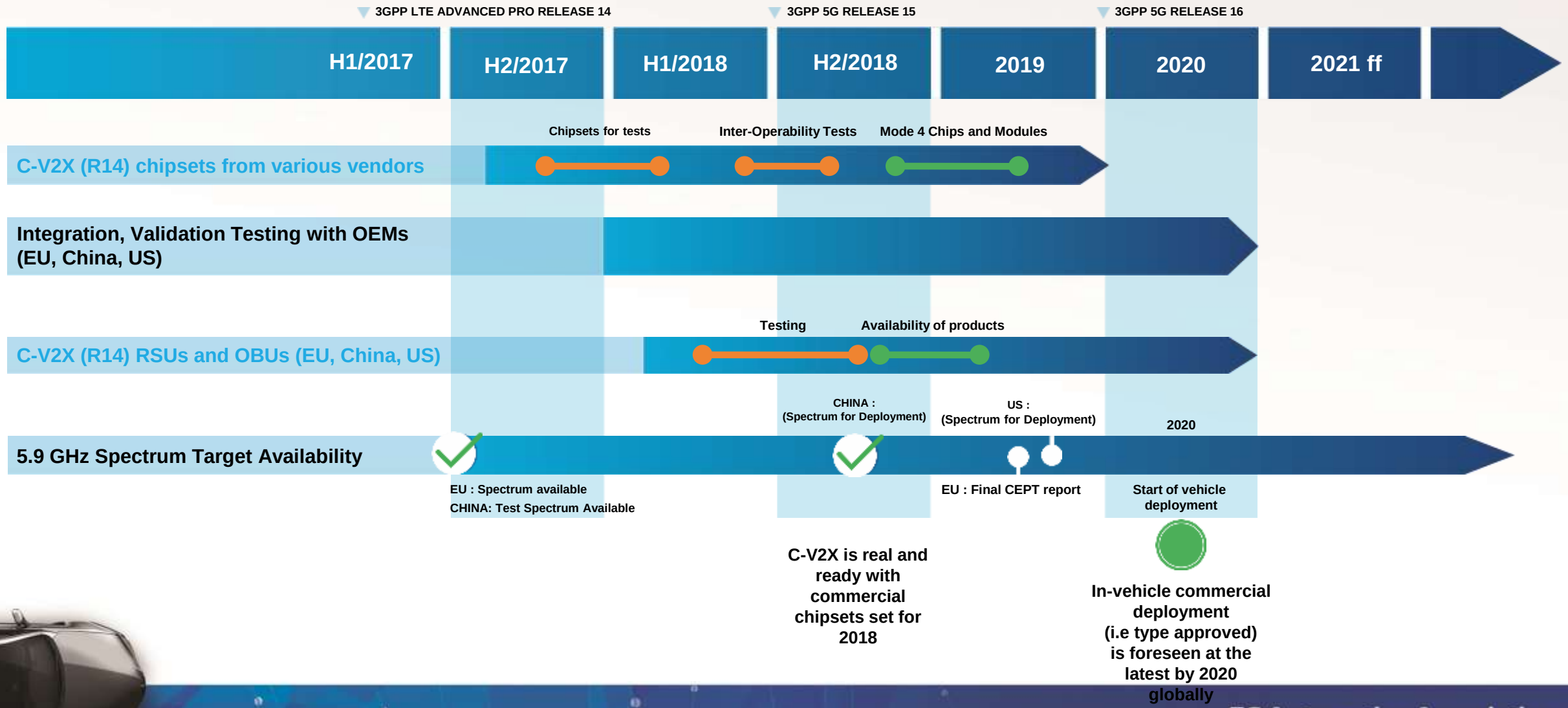
3GPP time plan: from LTE-V2X to 5G NR-V2X

- Current version of C-V2X is called LTE-V2X as part of 3GPP Rel-14 & 15.
- NR-V2X as part of Rel-16 comes as an improvement to support automated driving.
- NR-V2X will complement, co-exist and support interworking with LTE-V2X i.e. operation of NR-V2X alone is not considered.

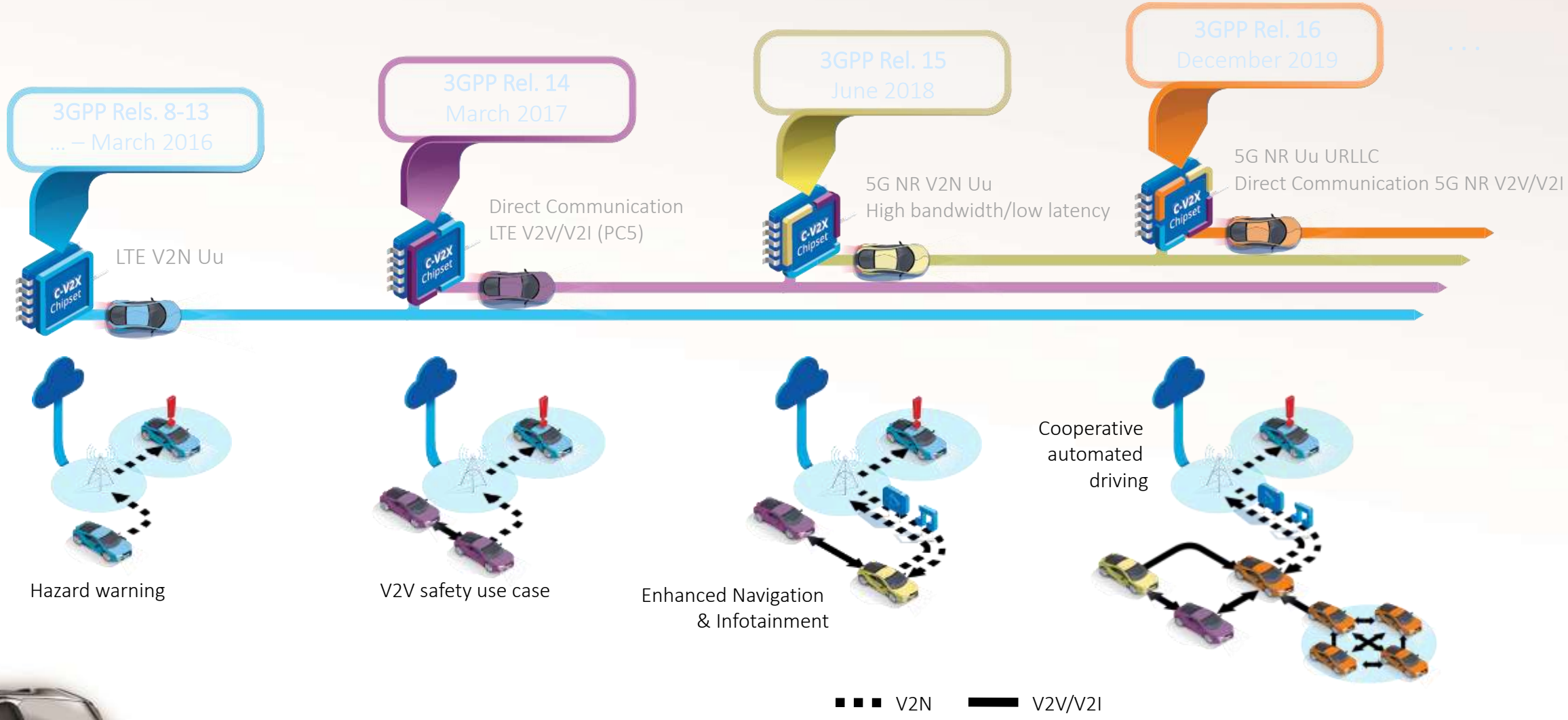


- NR-V2X study item finalized in March 2019.
- NR-V2X work item started in March 2019 and due December 2019.

Timeline for deployment of C-V2X (V2V/V2I)



C-V2X: Evolution to 5G maintains backward compatibility



Robust Global C-V2X Ecosystem is Ready

9150 Modules

- WNC
- Quectel
- ZTE
- LG
- LG Innotek
- Telit
- SIMCom

Commercial ready module in 2018

RSU vendors

- **US**: Savari, Kapsch Commsignia, McCain
- **EU**: Swarco, Lacroix, Aximum, Marben
- **China**: Nebulalink, Genevict, Neusoft
- **RoW**: Cohda, Cybercom, Oki

16+ RSU products in the pipeline. Commercial ready in Q1 2019

Tier1s/OBU vendors

- Bosch
- Ficosa
- Cohda
- Valeo
- Savari
- Marben
- Continental
- LG Electronics
- Nebula
- Commsignia
- Genevict

10+ OBU suppliers the pipeline. Commercial ready in Q1 2019

System Integrators

- **Sasken**
  - Integration & support
- **Thundersoft** (China)
  - Integration & support

Global foot print to support system Integration

C-V2X is ready for deployment now!

Source: Qualcomm

Partner	Commercially available product
WNC	CV2X module & mPCIe card EVK – RR3 C-V2X platform
Quectel	AG15 : C-V2X Module
ZTE	ZM8350 : C-V2X Module
SIMCOM	SIM8100 : C-V2X Module
LG Innotek	LAM-V500 : C-V2X Module
Kapsch	RIS 9260 : C-V2X Roadside Unit
Commsignia	C-V2X Roadside Unit C-V2X On Board Unit Software stack
Nebulalink	V-Box : C-V2X Roadside Unit (C-SAE)
Genvict	LB-RD10 : C-V2X Roadside Unit LB-LD10 : C-V2X On Board Unit
Savari	StreetWAVE 2000 RSU MobiWAVE C-V2X software stack
Neusoft	V2X Roadside Unit V2X On Board Unit Ve Talk C-V2X software stack
Cohda Wireless	C-V2X Software development kit
Danlaw	C-V2X Aftermarket OBU
Sasken	C-V2X system integration
Ficosa	Carcom – FITAX OBU
Telit	VE915C1 C-V2X Module

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dustry

European policy
C-ITS Delegated Act

C-ITS Delegated Regulation - Background

- **“Delegated Regulation” under ITS Directive 2010/40/EC:**
  - Specific procedure giving more powers to European Commission as regards the text drafting
  - Less involvement of the European Parliament & Council of Ministers – only scrutiny power on the final text
- **Subject matter:**
  - 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;
  - Defines 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 & mobiles 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)

C-ITS Delegated Regulation – 5GAA position

5GAA called upon the Commission to:

1. 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.
2. Amend the current draft Delegated Regulation to **include LTE-V2X for short-range and long-range communications within its scope** on **an equal footing with ITS-G5,** via the related ETSI approved specifications and 5GAA delta profiles**;**
3. **Define interoperability as a "mutual" requirement** among mature C-ITS technologies, namely ITS-G5 and LTE-V2X for short & long-range communications;
4. **Avoid legal uncertainty** on the "fast-track" update process by**:**
   - Introducing a 6-month deadline for the Commission to make its decision publicly known as regards the initiation of an amendment procedure to include new technologies (e.g., 5G-V2X) or new C-ITS services;
   - Specifying clearly the terms, conditions and processes for the inclusion of other technologies (e.g. 5G-V2X) or C-ITS services in the Delegated Regulation, including unambiguous definitions of terms such as "existing", "maturity" or "migration path", etc.;
   - Include as an Annex to the Delegated Regulation a template for the "technical file" to be submitted.
5. **Open up participation in the future C-ITS Expert Group** to representatives of technology segments that are not within the scope of the draft Delegated Act Regulation today.

C-ITS Delegated Regulation – Outcome & next steps

Key points:

- 3G/4G, LTE-V2X and 5G not included in the scope but recognised as "*prime candidates*" for future amendments (Recital 30)
  - Full review: 3 years after entry into force
  - Fast-track procedure: one or more amendments "at any time after entry into force" i.e. as early as 20 days after OJEU publication
- '*Open and future approach in standards and legislation in line with the principles of openness, consensus & transpar*ency' guaranteed (Article 33)
- "*Stakeholders that have put C-ITS stations in service should cooperate in good faith, in line with EU and national law, to ensure level playing field between technologies without hindering development of new ones" and […] should also prepare their products for the integration of future technologies*." (Recital 30)

Fast-track amendment procedure:

1. Submission of file containing tech specifications and information
2. Commission to analyse the file with undue delay and start discussing with Expert Group (public and private stakeholders – C- ITS station manufacturers and C-ITS network operators) within 2 months
3. The Expert Group should assess need for common specs integrating new C-ITS solution and provide an opinion within 6 months at the latest. JRC shall support with an independent technical assessment. Consultation to be held in an open and transparent manner.
4. **Degree of maturity:**
   - All required profiles/technical specifications for LTE-V2X have been adopted; ✓
   - Multiple vendors have already commercialized LTE-V2X short-range hardware and software solutions in Q1 2019 (and more are announced for Q2 2019); ✓
   - LTE-V2X long-range solutions are readily available and have been commercially deployed for many years. ✓
5. **Compatibility & interoperability with existing C-ITS stations in service or suitable migration path**
   - Text does not specify how this will work in practice, who/how solutions are to be identified but level-playing field between technologies must be ensured in defining such solutions (as per Recital 30)

What is next with NR V2X (in Rel16 – Dec 2019)

5G NR C-V2X

Communication augments autonomous driving

Perception

Sharing of high throughput sensor data and real world model

Path planning

Intention and trajectory sharing for faster, yet safe maneuvers

Real-time local updates

Real-time sharing of local data with infrastructure and other vehicles (e.g. 3D HD maps)

Coordinated driving

Exchanging intention and sensor data for more predictable, coordinated autonomous driving

Source: Qualcomm

Corporative Driving Demo at CES and the new 5G NR WI

https://www.nbcbayarea.com/on-air/as-seen-on/5G-Cellular-Could-Change-How-You-Drive_Bay-Area-504246962.html

demonstration by Audi, Ducati, Ford and Qualcomm

1. showcase potential of advanced C-V2X communications
2. develop basic understanding of protocol requirements to enable interactions between vehicles engaged in cooperative maneuvers
3. Build up hands-on knowledge for 5GAA work items

5GAA Automotive Association

For more information please contact:

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or visit:

www.5GAA.org