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Qualcomm

Future Networked Car Symposium @ Geneva Auto Show 2018

Accelerating 5G for autonomous driving

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All major automakers use Qualcomm Technologies

- Acura • Audi • BMW • Buick • BYD
- Cadillac • Chevrolet • Dodge • FCA
- Ford • Geely • Honda • Hyundai • Infiniti
- Jaguar • Jeep • Kia • Land Rover
- Lexus • Lincoln • Mercedes • Mini
- Nissan • Opel • Porsche • PSA
- Renault • Rolls-Royce • Smart
- Subaru • Toyota • Tesla • Volvo • VW

25

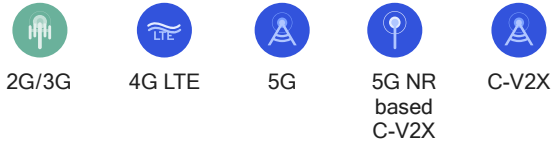
New Infotainment and Telematics design-wins in FY2017

$3B+

Design-win pipeline

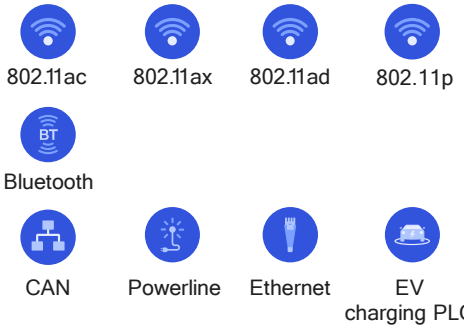
Qualcomm

Telematics / V2X



Location

Connectivity



Superior in-car Infotainment experience

12+ automakers

Have selected Snapdragon Automotive for infotainment

Billion-dollar+ design pipeline[1]

Focused on premium tier

Leading in premium

Next-gen premium infotainment design-wins[2]

1 2018-2027 period. Source: Company data 2 for production vehicles starting 2019-2020

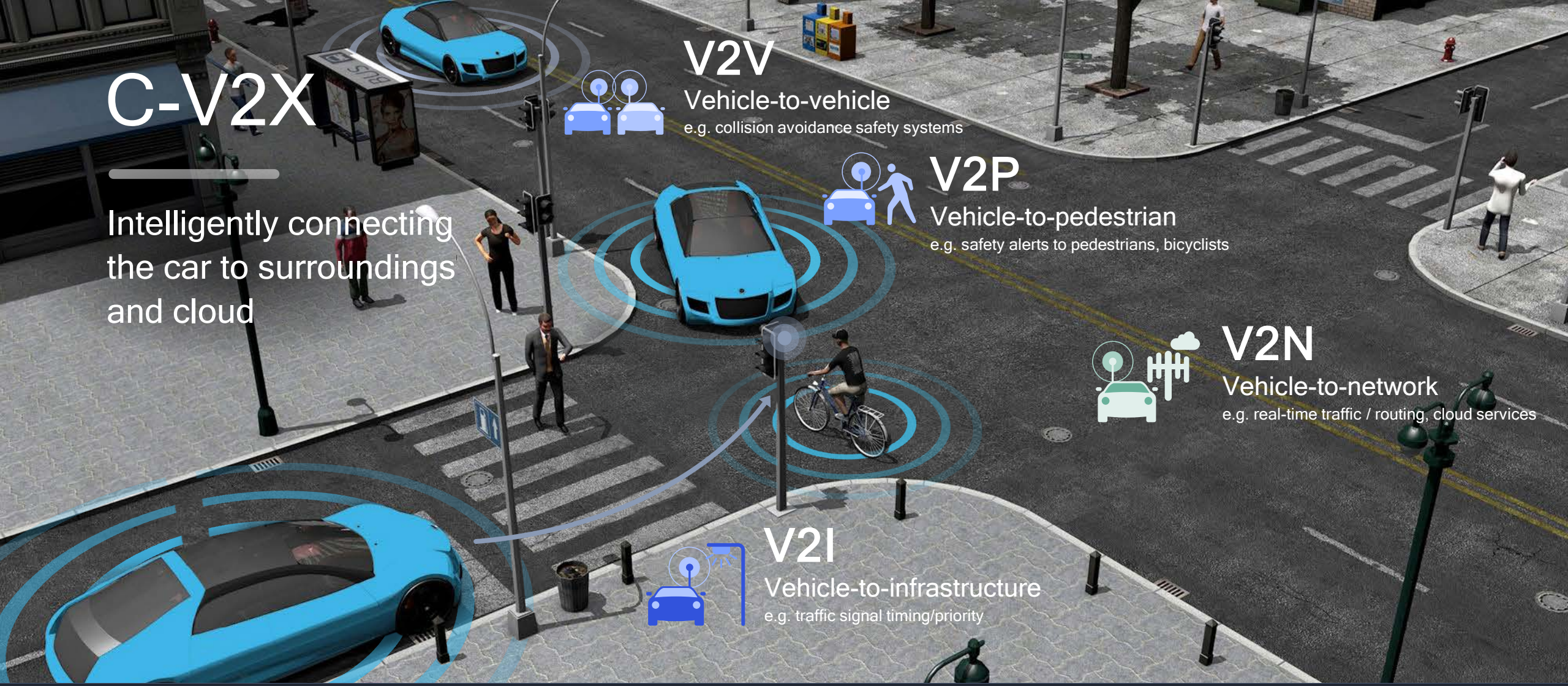
C-V2X complements other ADAS[1] sensor technologies

Provides 360º NLOS[2] sensing for higher levels of predictability and autonomy

Brain of the car to help automate the driving process by using:

Sensor fusion | Machine learning

1 Advanced Driver Assistance Systems; 2 Non-line of Sight

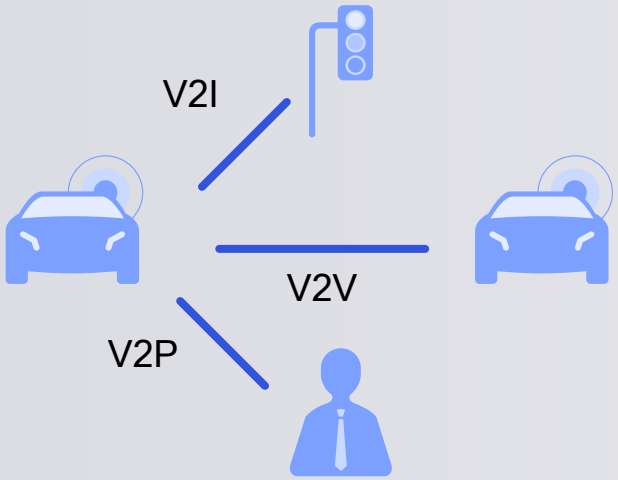


Commercial vehicle deployments coming soon...

C-V2X defines two complementary transmission modes

Direct communications (PC5)

V2V, V2I, and V2P operating in harmonized 5.9 GHz ITS bands independent of cellular network or cellular subscription

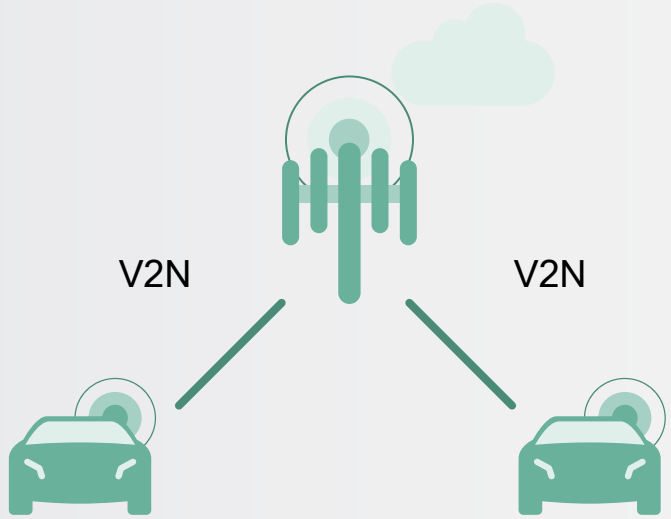


Active safety

Latency-sensitive use cases, e.g. collision avoidance

Network communications (Uu)

V2N operating in traditional mobile broadband licensed spectrum



Informational safety

More latency tolerant use cases, e.g. *accident 2 kilometers ahead*

C-V2X direct communications offers key advantages

Enhanced range and reliability

More cost efficient than other technologies

Up to 500km/h relative speed support

5G NR

Forward compatible evolution path to 5G

Synergistic with cellular modem already being embedded

Leverages cellular ecosystem

Reuse of SAE / ETSI upper layers

Qualcomm

9150
C-V2X
Chipset

Qualcomm® 9150 C-V2X Chipset

The Qualcomm® 9150 C-V2X chipset with integrated GNSS will be featured as a part of the Qualcomm® C-V2X Reference Design to deliver a complete solution for trials and commercial development

Anticipated Commercial Availability: 2H18

Driving C-V2X towards commercialization

Qualcomm Technologies, Inc.'s (QTI) first-announced C-V2X solution supports C-V2X PC5 Direct Communications (V2V, V2I and V2P) based on 3GPP Release-14

C-V2X direct communications is being validated globally

Many trials started in 2017, based upon 3GPP R14

C-V2X specifications completed in 2017

Example of global trials

ConVeX trial in Germany
Qualcomm, Audi, Ericsson, SWARCO, U. of Kaiserslautern

Towards 5G trial in France
Qualcomm, PSA Group, Orange, Ericsson

Ford trials in US
Qualcomm, AT&T, Ford, Nokia and McCain with SANDAG, Caltrans and the City of Chula Vista

Nissan trials in Japan
Qualcomm, Continental, Ericsson, Nissan, NTT DOCOMO, INC., OKI

Other trials announced, and some still unannounced in China, Korea, elsewhere

Ecosystem preparing for commercialization[1] of 9150 C-V2X chipset

Tier-1 suppliers

Continental
LG
FICOSA
LEAR CORPORATION
Panasonic AUTOMOTIVE
Valeo

Cellular module manufacturers

gemalto security to be free
LG Innotek
Quectel
SIERRA WIRELESS
Telit
WNC Wistron NeWeb Corp.
ZTE

ITS software solution providers

Cohda Wireless
commsignia
MARBEN
SAVARI

System integrators & test

ROHDE&SCHWARZ
SASKEN
ThunderSoft

[1] - February 22, 2018 Qualcomm Press Release: https://www.prnewswire.com/news-releases/qualcomm-and-leading-automotive-companies-across-the-globe-drive-the-commercialization-of-c-v2x-300602527.html

Some Supporting Automakers

BMW
Ford
Nissan
PSA GROUPE
SAIC 上汽集团 SAIC MOTOR

C-V2X has a strong evolution path towards 5G NR

While maintaining backward compatibility

Evolution to 5G NR, while being backward compatible
C-V2X R14/R15 is necessary and operates with R16

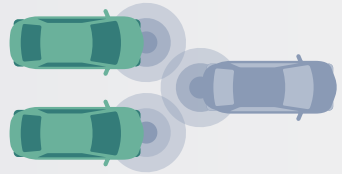
Basic safety
IEEE 802.11p

Basic and enhanced safety
C-V2X R14/R15 with enhanced range and reliability

Autonomous driving use cases
5G NR based C-V2X R16

Backward compatible with R14/R15 enabled vehicles

- Higher throughput
- Wideband ranging/positioning
- Higher reliability
- Lower latency



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Thank you!

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