V2X (Vehicle to Everything) and CVIS (Cooperative Vehicle Infrastructure System) Industry Report, 2019-2020

Mar.2020
STUDY GOAL AND OBJECTIVES
This report provides the industry executives with strategically significant competitor information, analysis, insight and projection on the competitive pattern and key companies in the industry, crucial to the development and implementation of effective business, marketing and R&D programs.

REPORT OBJECTIVES
◆ To establish a comprehensive, factual, annually updated and cost-effective information base on market size, competition patterns, market segments, goals and strategies of the leading players in the market, reviews and forecasts.
◆ To assist potential market entrants in evaluating prospective acquisition and joint venture candidates.
◆ To complement the organizations’ internal competitor information gathering efforts with strategic analysis, data interpretation and insight.
◆ To suggest for concerned investors in line with the current development of this industry as well as the development tendency.
◆ To help company to succeed in a competitive market, and

METHODOLOGY
Both primary and secondary research methodologies were used in preparing this study. Initially, a comprehensive and exhaustive search of the literature on this industry was conducted. These sources included related books and journals, trade literature, marketing literature, other product/promotional literature, annual reports, security analyst reports, and other publications. Subsequently, telephone interviews or email correspondence was conducted with marketing executives etc. Other sources included related magazines, academics, and consulting companies.

INFORMATION SOURCES
The primary information sources include Company Reports, and National Bureau of Statistics of China etc.
Abstract

5G+V2X CVIS will be a strong driver for highly automated driving.

The V2X industry is thriving with advances in automotive connectivity, to which great importance has been attached by car producing powers worldwide, and it is vigorously promoted and deployed about which the development plans, laws & regulations, technical criteria and pilot construction are in full swing in different countries.

Till 2025, the intelligent vehicles with conditional autonomy will be spawned in China, LTE-V2X and other networks will be regionally viable, 5G-V2X will be progressively available on expressways and in some cities, and the high-precision spatial-temporal datum service network will be fully covered, according to the Strategy for Innovative Development of Intelligent Vehicles circulated by National Development and Reform Commission (NDRC) in February 2020. An intelligent vehicle system with Chinese standards will be established between 2035 and 2050.

Two V2X technology roadmaps prevail worldwide, i.e., IEEE802.11p (DSRC) and C-V2X (Cellular-V2X). Application layer standards are drafted differently by countries.

C-V2X springs up and wins the hearts of industry insiders since it is far superior to DSRC. C-V2X, encompassing LTE-V2X and 5G-V2X, gets energetically promoted in China.

In December 2019, Federal Communications Commission (FCC) passed a resolution with one accord that most spectrums of 5.9GHz band will be reallocated and they will be dedicated for the unlicensed spectrum technology and the C-V2X technology. Over the past two decades, 75MHz in the 5.9GHz band was used for DSRC, but FCC seeking to revise the rules pointed it out that DSRC is at a standstill for many years, particularly in April 2019 when Toyota stopped using DSRC V2X technology.
5G NR based V2X will boost the development of fully automated vehicles.

C-V2X (incl. LTE-V2X, 5G-V2X) is based on 3GPP specifications. LTE-V2X evolves towards 5G-V2X.

3GPP R14 standards supporting LTE-V2X was issued in 2017; 3GPP R15 standards that support LTE-V2X enhanced (LTE-eV2X) were formally completed in June 2018; 3GPP R16+ standards supportive for 5G-V2X started to be studied in June 2018.
LTE-V2X is designed mainly to enable driver assistance, improve road safety, efficiency and comfort. NR-V2X, a fusion of communication technologies, big data, artificial intelligence, among others, suffice autonomous driving and other new features better. 5G NR V2X standards are rapidly under way and physical layer specifications plan to be nailed down in March 2020.

Among the 25 projects about Rel-17 that were established at the 3GPP RAN Meeting held in Spain in December 2019, a standardization project -- 5G new radio sidelink enhancement -- will be a souped-up version of Rel-16 NR-V2X sidelink. Also, the technology roadmap of 3GPP 5G 3rd edition (Rel-17) was made explicitly during the Meeting. Noticeably, Chinese operators initiated and joined many projects of criteria constitution about 3GPP RAN R17.

**Timeline for Commercial Deployment of 3GPP C-V2X (V2V/V2I)**

- **3GPP LTE Advanced Pro Release 14**
  - H1/2017
  - C-V2X (R14) chipsets from various vendors
- **3GPP 5G Release 15**
  - H1/2018
  - Inter-operability tests
- **3GPP 5G Release 15**
  - H2/2018
  - Commercial availability of Mode 4 chips
- **3GPP 5G Release 16**
  - 2019
  - Testing of traffic infrastructure (EU, China, US)
- **5.9 GHz Spectrum Target Availability**
  - EU spectrum, China (Test spectrum)
- **C-V2X (R14) chipsets from various vendors**
  - Integration, Validation and Testing with OEMS (EU, China, US)
- **5.9 GHz Spectrum Target Availability**
  - China (spectrum for deployment)
- **5.9 GHz Spectrum Target Availability**
  - US (spectrum for deployment)
- **2020**
  - Start of vehicle deployment
- **2021**
  - In-vehicle commercial deployment (i.e., type-approved vehicles) is foreseen at the latest by 2020 globally.

C-V2X has been codified in the released update to the cellular standard (3GPP Revision 14, June 2017). C-V2X is real and ready with commercial chipsets set for 2018.
Progress in C-V2X deployment

It is put forward in the Strategy for Innovative Development of Intelligent Vehicles to build a full-fledged intelligent vehicle infrastructure system, including (1) to build smart roads and next-generation national traffic control network, to expedite 5G construction and combination with telematics; (2) to study the licensing of special spectrums for automotive wireless communications, to hasten construction of wireless communication network for automotive use; (3) to accelerate construction of a unified national high-accuracy spatial temporal datum service capabilities by giving full play to the existing Beidou satellite positioning reference station network; (4) to develop the intelligent vehicle maps with unified standards, to build a perfect geographic information system containing road network information, to offer real-time kinematic (RTK) data services; (5) the existing facilities and data resources will be leveraged to build a national intelligent vehicle big data cloud-enabled platform.

5G+V2X, as a crucial infrastructure to autonomous driving, is booming with policy support. V2X started from 2019 to be piloted successively and will be more popular with 5G deployments in 2022. Meanwhile, 5G NR V2X is being tested and certified, setting the stage for large-scale application of intelligent vehicles with higher autonomy in 2025.

The traditional automotive terminals like T-Box are on the brink of a revolution. The automotive TCU (Telematics Control Unit) integrates 4G/5G module, C-V2X module, onboard navigation module and so forth, which means the opportunities and challenges to the providers of both cockpit electronics and conventional telematics.

Huawei Technologies rolled out the C-V2X T-Box compatible with both 4.5G and 5G; PATEO launched 4.5G C-V2X T-box; Neusoft released T-Box 3.0 combining C-V2X, 5G, Ethernet and other technologies; Samsung Harman announced the availability of TCU in-built with cellular NAD and Autotalks’ 2nd-Gen chipset, offering C-V2X capabilities.

Telematics evolves from initially TSP platform to intelligent connectivity platform and then to autonomous driving cloud-enabled platform (cooperative vehicle infrastructure system). 5G T-Box, a portal for big data of intelligent vehicles in future, will be the core product for smart hardware producers. Automakers also have collaborations with Tier 1 suppliers and plan to have the to-be-launched models configured with 5G+V2X successively.
C-V2X Deployments of Some Chinese Automakers

- 2018-19:
  - Forays in 5G+MEC (edge computing) technology: the roll-out of 5G Edge-Cloud intelligent driving solutions
- 2020:
  - To first have pilot run of 5G+L4 autonomous vehicle on open road in China
- 2021:
  - To produce 5G & C-V2X vehicle models and to spawn the crawler intelligent system combining vehicle intelligence with V2X CVIS
- 2022-23:
  - To realize V2X cooperative driving decisions
- 2024-25:
  - C-V2X Partners
  - 5G NR + edge computing cooperative urban cruise
  - To spawn 5G+LTE-V2X vehicle models in H2 2020
Perfection of C-V2X industry chain in China

C-V2X industry chain involves communication chip, communication module, terminals & equipment, vehicle manufacturing, test & certification, operation services, etc., where there are many players such as chip vendors, equipment manufacturers, OEMs, solution providers and telecom carriers. In October 2019, C-V2X ‘Four Crosses’ (cross-chip module, cross-terminal, cross-vehicle, cross-safety platform) connectivity demonstrations were successfully held, a full interpretation of C-V2X complete chain technology competences and facilitating further C-V2X deployments at home.

### C-V2X Industry Map

![C-V2X Industry Map](image)

Source: IMT-2020 (5G) Promotion Team
Huawei make great strides in C-V2X and has unveiled C-V2X chip, gateway, T-Box, RSU (Road Side Unit) to end-to-end solutions. In 2019, Huawei launched 5G in-car module MH5000 which is highly integrated with 5G and C-V2X technologies and is packed with 5G baseband chip Balong 5000 with such features as one-core multi-mode, high rates, downlink-uplink decoupling, support of SA (5G standalone) and NSA (5G non-standalone) dual-mode network, support of C-V2X, to name a few.
1 V2X Technologies and Development Trends

1.1 Tendencies of V2X Telematics
1.1.1 Definition of V2X Telematics and Market Size
1.1.2 Place of V2X in Intelligent Connected Vehicle (ICV) Industry Chain
1.1.3 Typical Applications of V2X
1.1.4 Typical Use of 5G NR-V2X in Autonomous Driving
1.1.5 Fusion of MEC and C-V2X
1.1.6 Policies on V2X Telematics Worldwide
1.1.7 Development Trend of Global V2X Telematics Industry
1.1.8 Development Trend of China’s V2X Telematics Industry

1.2 V2X Technology Roadmaps

1.3 C-V2X Evolution and Standardization

1.4 C-V2X Industrialization and Prospects
1.4.1 5GAA Alliance to Facilitate Global Deployments of C-V2X Technology
1.4.2 Timeline for Commercial Deployment of 3GPP C-V2X (V2V/V2I)
1.4.3 Timeline for V2X Promotion and Commercialization in China
1.4.4 C-V2X Progress in China
1.4.5 Path of C-V2X Implementation and Difficulties in China
1.4.6 Route for C-V2X Commercialization in China
1.4.7 Strategy for Promoting C-V2X Commercialization in China; Expressways and Urban Roads
1.4.8 C-V2X Industry Chain Involving Chip Vendors, Equipment Suppliers and Integrators
1.4.9 China C-V2X Industry Map and Members’ Shares
1.4.10 Timetable for C-V2X Industrialization

1.5 MEC and 5G Application
### 1.5.1 Multi-access Edge Computing (MEC)

- 1.5.2 ICT Companies’ Rush to MEC Technology
- 1.5.3 5G V2X as the Network Foundation for the Development of Autonomous Driving Technology
- 1.5.4 Use of 5G uRLLC in ICV
- 1.5.5 Edge Computing and Network Slicing
- 1.5.6 5G Network Makes Highly Automated Driving Possible
- 1.6 Trend of V2X Application and OEMs’ Plan of Deployments
- 1.6.1 Fusion of C-V2X and T-Box
- 1.6.2 V2X BOX
- 1.6.3 C-V2X Integration Strategy Roadmap
- 1.6.4 Parameters and Quotations of Latest C-V2X Modules at the End of 2019
- 1.6.5 Summary of Chinese Automakers’ C-V2X Deployment Plans
- 1.6.6 Summary of Foreign Automakers’ V2X Deployment Plans
- 1.7 V2X Market Size Estimation
- 1.7.1 Global Sales and Ownership Forecast of Connected Vehicles
- 1.7.2 Global and Chinese Telematics Market Size and Penetration Forecast

### 2 CVIS Technology and Development Trend

- 2.1 CVIS Policy Guidance and Path of Implementation
- 2.1.1 V2X CVIS Is Necessary for Autonomous Driving
- 2.1.2 CVIS Is the Foundation for Massive Use of Self-driving Cars
- 2.1.3 National CVIS Vehicle Side Strategy Guidance
- 2.1.4 V2X Pilots Promoted by MIIT and MOT
- 2.1.5 Six Orientations in National Traffic Control Network and Smart Road Pilots
2.1.6 CVIS Technology Roadmaps
2.2 CVIS Architecture and Applied Scenarios
2.3 CVIS Demonstrations
2.4 The Demand for Smart Road Construction and Market Size
   2.4.1 Levels of Intelligent Connected Road Systems and Interpretations
   2.4.2 Intelligent Connected Road and Autonomy Levels
   2.4.3 Intelligent Connected Road System Architecture
   2.4.5 Intelligent Expressways Market Forecast

3 V2X Terminals and System Solution Providers

3.1 Shenzhen Genvict Technologies
   3.1.1 Profile
   3.1.2 Operation Data
   3.1.3 Products
   3.1.4 Technology Roadmap
   3.1.5 C-V2X Solutions
   3.1.6 Clients and Partners
   3.1.7 V2X Demo Cases
3.2 Beijing Wanji Technology
   3.2.1 Profile
   3.2.2 Operation Data
   3.2.3 Products
   3.2.4 V2X Demo Cases
3.3 Ningbo Joyson Electronic
2.1.6 CVIS Technology Roadmaps
2.2 CVIS Architecture and Applied Scenarios
2.3 CVIS Demonstrations
2.4 The Demand for Smart Road Construction and Market Size
2.4.1 Levels of Intelligent Connected Road Systems and Interpretations
2.4.2 Intelligent Connected Road and Autonomy Levels
2.4.3 Intelligent Connected Road System Architecture
2.4.5 Intelligent Expressways Market Forecast

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3.1 Shenzhen Genvict Technologies
3.1.1 Profile
3.1.2 Operation Data
3.1.3 Products
3.1.4 Technology Roadmap
3.1.5 C-V2X Solutions
3.1.6 Clients and Partners
3.1.7 V2X Demo Cases
3.2 Beijing Wanji Technology
3.2.1 Profile
3.2.2 Operation Data
3.2.3 Products
3.2.4 V2X Demo Cases
3.3 Ningbo Joyson Electronic
<table>
<thead>
<tr>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.1 Profile</td>
</tr>
<tr>
<td>3.3.2 Operation Data</td>
</tr>
<tr>
<td>3.3.3 Development Strategy</td>
</tr>
<tr>
<td>3.3.4 Telematics Products</td>
</tr>
<tr>
<td>3.4 Neusoft Group</td>
</tr>
<tr>
<td>3.4.1 Profile</td>
</tr>
<tr>
<td>3.4.2 Operation Data</td>
</tr>
<tr>
<td>3.4.3 Automotive Operations</td>
</tr>
<tr>
<td>3.4.4 V2X Solutions</td>
</tr>
<tr>
<td>3.4.5 V2X Products</td>
</tr>
<tr>
<td>3.4.6 T-Box Technology Roadmap</td>
</tr>
<tr>
<td>3.4.7 T-Box Clients</td>
</tr>
<tr>
<td>3.5 China TransInfo Technology</td>
</tr>
<tr>
<td>3.5.1 Profile</td>
</tr>
<tr>
<td>3.5.2 Operation Data</td>
</tr>
<tr>
<td>3.5.3 R&amp;D System</td>
</tr>
<tr>
<td>3.5.4 Developments</td>
</tr>
<tr>
<td>3.5.5 V2X Demo Cases</td>
</tr>
<tr>
<td>3.6 Gosunecn Technology Group</td>
</tr>
<tr>
<td>3.6.1 Profile</td>
</tr>
<tr>
<td>3.6.2 Operation Data</td>
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<tr>
<td>3.6.3 Development Strategy</td>
</tr>
<tr>
<td>3.6.4 Products</td>
</tr>
<tr>
<td>3.6.5 V2X Demo Cases</td>
</tr>
<tr>
<td>3.6.6 Introduction to Gosunecn Welink</td>
</tr>
<tr>
<td>3.6.7 Development Plan of Gosunecn Welink</td>
</tr>
<tr>
<td>3.7 Nebula Link</td>
</tr>
<tr>
<td>3.7.1 Profile</td>
</tr>
<tr>
<td>3.7.2 Development History</td>
</tr>
<tr>
<td>3.7.3 Products</td>
</tr>
<tr>
<td>3.7.4 V2X Demo Cases</td>
</tr>
<tr>
<td>3.8 Huali SmartWays Technology</td>
</tr>
<tr>
<td>3.8.1 Profile</td>
</tr>
<tr>
<td>3.8.2 Development History</td>
</tr>
<tr>
<td>3.8.3 Products</td>
</tr>
<tr>
<td>3.8.4 Cooperation Cases</td>
</tr>
<tr>
<td>3.9 Changsha Intelligent Driving Institute (CIDI)</td>
</tr>
<tr>
<td>3.9.1 Profile</td>
</tr>
<tr>
<td>3.9.2 Product Solutions</td>
</tr>
<tr>
<td>3.9.3 V2X Cases</td>
</tr>
<tr>
<td>3.10 NavInfo</td>
</tr>
<tr>
<td>3.10.1 Profile</td>
</tr>
<tr>
<td>3.10.2 Development History</td>
</tr>
<tr>
<td>3.10.3 Business Layout</td>
</tr>
<tr>
<td>3.10.4 Development Strategy</td>
</tr>
<tr>
<td>3.10.5 V2X Demo Cases</td>
</tr>
<tr>
<td>3.11 Qianxun SI</td>
</tr>
<tr>
<td>3.11.1 Profile</td>
</tr>
<tr>
<td>3.11.2 Strategic Deployment</td>
</tr>
<tr>
<td>3.11.3 Business Range</td>
</tr>
</tbody>
</table>
# Table of contents

3.11.4 Products  
3.11.5 V2X Demo Cases  
3.12 Baidu  
3.12.1 Baidu Apollo Unveiled CVIS Open Source Scheme  
3.12.2 Baidu Apollo CVIS Open Source Technology Roadmap  
3.12.3 Product Technologies  
3.12.4 V2X Demo Cases  
3.13 Alibaba  
3.13.1 CVIS Autonomous Driving Solutions  
3.13.2 Development Strategy  
3.14 Cohda Wireless  
3.14.1 Profile  
3.14.2 Products  
3.15 Commsignia  
3.15.1 Profile  
3.15.2 Development Course  
3.15.3 Commsignia V2X Hardware  
3.15.4 Commsignia V2X Software  
3.15.5 Commsignia C-V2X Technology Evolution  
3.16 Bosch  
3.16.1 Overall Strategy for Autonomous Driving  
3.16.2 V2X Strategy  
3.16.3 V2X Products  
3.17 Savari  
3.17.1 Profile  
3.17.2 Technologies and Products  
3.17.3 Partners and Investors  
3.18 Harman  
3.18.1 Profile  
3.18.2 Products  
3.18.3 Future Plan of Harman TCU/T-Box  
3.19 LG Electronics  
3.19.1 Profile  
3.19.2 Products and Technologies  
3.20 Panasonic Ficosa  
3.20.1 Profile  
3.20.2 Products  
3.20.3 V2X Applied Cases  
3.21 Continental  
3.21.1 Profile  
3.21.2 Products and Technologies  

## 4 V2X Chip and Module Vendors

4.1 Huawei Technologies  
4.1.1 Overall Planning for Intelligent Connected Vehicle  
4.1.2 ICV Layout and Customers  
4.1.3 Deployment in C-V2X Telematics  
4.1.4 Product Technology  
4.1.5 Balong 765 Chip
4.1.6 Evolution of Huawei T-Box
4.1.7 Huawei’s Prediction of Global Intelligent Light Poles
4.1.8 Huawei CVIS Trend
4.2 Qualcomm
4.2.1 Composition of Qualcomm Autonomous Driving Platform
4.2.2 Product Technology
4.2.3 Use of Qualcomm C-V2X Chipset
4.3 Autotalks
4.3.1 Profile
4.3.2 Products
4.3.3 Product Application
4.4 NXP
4.4.1 Product Technology
4.4.2 In-car T-Box Solutions
4.4.3 Product Application
4.5 Datang GohighSec (CICT)
4.5.1 Profile of CICT
4.5.2 Industrial Layout of CICT
4.5.3 Development Course of V2X CVIS Products
4.5.4 Products and Technologies
4.5.5 Technology Roadmap and Planning
4.5.6 Collaborations
4.5.7 Applied Cases
4.6 Quectel Wireless Solutions
4.6.1 Profile
4.6.2 Development History
4.6.3 Operation Data
4.6.4 Product Technology
4.6.5 Superiority in Automotive-grade Module and Clients
4.6.6 Applied Cases
4.7 ZTE Corporation
4.7.1 Development Strategy
4.7.2 Product Technology
4.7.3 Partners
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