



SURFACE VEHICLE INFORMATION REPORT

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LTE Vehicle-to-Everything (LTE-V2X)
Deployment Profiles and Radio Parameters
for PC5 Interface in 10 MHz Channel 180

RATIONALE

The LTE-V2X system provides a mechanism for information exchange between a host vehicle and other LTE-V2X-enabled devices which may be worn by or otherwise attached to a traveler to address safety, mobility, and communication system needs. An LTE-V2X reference system architecture and common design elements for the 20 MHz channel at 5905-5925 MHz (i.e., LTE band 47 using EARFCN 55140 with a 20 MHz channel width, aka Channel 183) is provided in SAE J3161. Additionally, the deployment profile and radio parameters for the 10 MHz channel (i.e., LTE band 47 using EARFCN 54990 with a 10 MHz channel width, also known as Channel 180) need to be defined in order to enable V2X applications. The audience for this document includes the developers of applications and application specifications, vehicle manufacturers, equipment manufacturers, roadside operators, and other deployment stakeholders. It is expected that the content of this information report will later become part of a standard.

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1. SCOPE

This SAE Information Report describes the deployment profile and radio parameters for a 10 MHz channel (i.e., LTE band 47 using EARFCN 54990 with a 10 MHz channel width, also known as Channel 180) based on LTE-V2X PC5 Sidelink (Mode 4) that can be used to support truck platooning applications. The content provided in this document is complementary to the content provided in SAE J3161 (which defines deployment profile and radio parameters for a 20 MHz channel).

1.1 Purpose

This SAE Information Report provides LTE-V2X radio parameters and deployment profile for a 10 MHz channel; addresses the on-board system needs for ensuring the V2V, V2I, and I2V communications; and provides parameters that can be used to achieve the desired interoperability and data integrity to support the V2X applications within a 10 MHz channel based on simulation and field test results.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J2735	V2X Communications Message Set Dictionary
SAE J2945/6	Performance Requirements for Cooperative Adaptive Cruise Control (CACC) and Platooning
SAE J3161	LTE Vehicle-to-Everything (LTE-V2X) Deployment Profiles and Radio Parameters for Single Radio Channel Multi-Service Coexistence
SAE J3161/1	On-Board System Requirements for LTE-V2X V2V Safety Communications
SAE J3268	Listing of Provider Service Identifiers and Associated Application Technical Reports

2.1.2 ETSI Publications

The references to ETSI documents in this section refer to ETSI transposition of specific 3GPP technical specification available from 3GPP Mobile Competence Centre, c/o ETSI, 650, route des Lucioles, 06921, Sophia Antipolis Cedex, France www.etsi.org. The equivalent 3GPP documents are listed in brackets below.

The following list of documents are from the ETSI Release 14 set of standards and are referred to in the body of this document by their 3GPP document number (e.g., ETSI TS 136 321, which is equivalent to 3GPP TS 36.321).

ETSI TS 136 213	Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures, V14.2.0 (Release 14) [3GPP TS 36.213]
ETSI TS 136 321	Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification, V14.2.1 (Release 14) [3GPP TS 36.321]
ETSI TS 136 322	Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Link Control (RLC) protocol specification, V14.1.0 (Release 14) [3GPP TS 36.322]
ETSI TS 136 331	Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 14) [3GPP TS 36.331]

These documents may reference other related ETSI documents.¹

2.1.3 IEEE Publications

Available from IEEE Operations Center, 445 and 501 Hoes Lane, Piscataway, NJ 08854-4141, Tel: 732-981-0060, www.ieee.org.

IEEE Std 1609.3 IEEE Standard for Wireless Access in Vehicular Environments (WAVE) - Networking Services

3. TERMS AND DEFINITIONS

For the purposes of this standard, the definitions, abbreviations, and acronyms found in SAE J2735 also apply. The following additional definitions, abbreviations, and acronyms supersede those found in SAE J2735 in the case of conflict.

3.1 CHANNEL

An LTE-V2X radio channel used in exchanging control information and information relevant for ITS applications.

3.2 CONNECTED VEHICLE

A vehicle equipped with devices enabling interoperable wireless communication. The devices can communicate with other equipped vehicles, infrastructure, and personal communications devices.

3.3 DEVICE

An ITS component (other than equipped vehicle and vulnerable road use) that is able to communicate through wireless or wireline interface.

3.4 GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)

A satellite system that is used to estimate the geographic location of a user's receiver antenna. Two examples include the United States' Global Positioning System (GPS) and the Russian Federation's Global Orbiting Navigation Satellite System (Globalnaya Navigazionnaya Sputnikovaya Sistema, or GLONASS).

¹ For example, ETSI TS 123 285 and ETSI TS 123 303.

3.5 HEAVY VEHICLE

Vehicles with an FHWA vehicle classification of 5 to 13.

3.6 HOST VEHICLE (HV)

The primary equipped vehicle of concern that is running a specific application about which a given use case may be constructed. The host vehicle (HV) can be a transmitting vehicle, a receiving vehicle, or both—this distinction is made clear in the use case description. There is typically only one host vehicle in any use case.

3.7 V2X INFRASTRUCTURE

Any LTE-V2X device that supports V2V/V2I/V2X communications flows (message exchanges), including—but not limited to—LTE-V2X RSU devices.

3.8 INTELLIGENT TRANSPORTATION SYSTEM (ITS)

A system that applies information technology to transportation challenges. ITS improves transportation safety and mobility and enhances productivity through the integration of advanced communications technologies into the transportation infrastructure and in vehicles. ITS encompasses a broad range of wireless and wireline communications-based information and electronics technologies. For more information, refer to <http://www.its.dot.gov/index.htm>.

3.9 LIGHT VEHICLE

A class 2 or class 3 vehicle as defined by FHWA (https://www.fhwa.dot.gov/policyinformation/tmguid/tmg_2013/vehicle-types.cfm) excluding ambulances, law enforcement vehicles, fire department vehicles, and construction vehicles.

3.10 LINK (RF)

A communications link being used in support of application data transfer needs.

3.11 MESSAGE

A set of data elements and data frames that can be sent between devices to convey some semantic meaning in the context of predefined applications.

3.12 MESSAGE SET

A collection of messages based on the functional area to which they pertain.

3.13 ON-BOARD UNIT (OBU)

A vehicle-mounted LTE-V2X device used to transmit and receive a variety of message traffic to and from other LTE-V2X devices (other OBUs and RSUs). Among the message types and applications supported by this process are vehicle safety messages used to exchange information on each vehicle's dynamic movements for coordination and safety.

3.14 PACKET DELAY BUDGET (PDB)

The maximum delay that a packet can tolerate before transmission once it is received by the modem from an application stack and is generally based on the priority of the packet generated.

3.15 ROADSIDE UNIT (RSU)

A device used to transmit to, and receive from, equipped vehicles (OBUs) and vulnerable road users (VRUs). The RSU transmits from a fixed position on the roadside (which may be either a permanent installation or “temporary” equipment brought on-site for a period of time associated with an incident, road construction, or other events). Some RSUs have the ability to transmit signals with greater power than OBUs and some may have connectivity to other nodes or the Internet. An RSU contains a UE.

3.16 SAFETY VEHICLE

A vehicle used for emergency or incident management.

3.17 STANDARDS DEVELOPING ORGANIZATION

An organization whose primary activities are developing, coordinating, promulgating, revising, amending, reissuing, interpreting, or otherwise producing technical standards that are intended to address the needs of some relatively wide base of affected adopters.

3.18 TRANSIT VEHICLE

A vehicle engaged in transit operations, e.g., a bus.

3.19 USER EQUIPMENT (UE)

UE is originally defined by ETSI as a device allowing a use to access network services. In this document, UE is any device used by an end user for sidelink communication with other devices. In this document, UE is capable of LTE-V2X sidelink communication.

4. ABBREVIATIONS AND ACRONYMS

The additional abbreviations and acronyms cited below are terms related to this standard (and of the other companion volumes and guides) unless specifically cited otherwise.

3GPP	Third Generation Partnership Project
BSM	Basic Safety Message
CAMP	Crash Avoidance Metrics Partnership
CBR	Channel Busy Ratio
CR	Channel Occupancy Ratio
DE	Data Element
DMRS	Demodulation Reference Signal
D2D	Device-to-Device
ECU	Electronic Control Unit
eNB	Evolved Node B
EARFCN	Evolved-UTRA Absolute Radio Frequency Channel Number
EVA	Emergency Vehicle Alert
ETSI	European Telecommunications Standards Institute
E-UTRA	Evolved Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access
FCC	Federal Communications Commission
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standards

GHz	Gigahertz
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HARQ	Hybrid Automatic Repeat Request
HV	Host Vehicle
Hz	Hertz
I2V	Infrastructure-to-Vehicle
ICT	Information and Communications Technology
ID	Identifier
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPG	Inter-Packet Gap
IPv6	Internet Protocol Version 6
km/h	Kilometers per Hour
LTE	Long Term Evolution
MAC	Medium Access Control
MAP	SAE J2735 Map Data Message
MCS	Modulation and Coding Scheme
MHz	Megahertz
MPDU	MAC Protocol Data Units
MSG	Message
NTCIP	National Transportation Communications for ITS Protocol
OBE	Onboard Equipment
OBU	Onboard Unit
OOBE	Out-of-Band Emission
PC5	ProSe Communications 5
PDB	Packet Delay Budget
PDM	Probe Data Message
PHY	Physical Layer

PPPP	ProSe per Packet Priority
ProSe	Proximity Services
PRB	Physical Resource Block
PRR	Packet Reception Ratio
PSCCH	Physical Sidelink Control Channel
PSSCH	Physical Sidelink Shared Channel
PSID	Provider Service ID
QPSK	Quadrature Phase Shift Keying
RB	Resource Block
RF	Radio Frequency
RP	Radiated Power
RLC	Radio Link Control
RSA	Roadside Alert
RSE	Roadside Equipment
RSM	Road Safety Message
RSU	Roadside Unit
RSRP	Reference Signal Receive Power
RTCM	Radio Technical Commission for Maritime Services
RWM	Road Weather Message
SCMS	Security Credential Management System
SC-FDMA	Single-Carrier Frequency-Division Multiple Access
SCI	Sidelink Control Information
SDO	Standards Developing Organizations or Standards Development Organization
SPaT	Signal Phase and Timing Message
SPS	Semi-Persistent Scheduling
SRS	Safety Restraint System or Supplemental Restraint System
SSP	Service Specific Permissions
Std	Standard
TIM	Traveler Information Message