OBU-301U
Information Sheet

V2X On-Board Unit,
DSRC stack, V2Xcast®

Overview:

OBU-301U is a comprehensive V2X (Vehicle to Everything) on-board unit featuring with automotive-grade hardware and IEEE 1609 WAVE stack. OBU-301U has complete V2X hardware and software to fit the various deployment needs of different OEMs and V2X system integrators. The model enables direct V2X application development to support innovative connected vehicles solutions. Featuring with intuitive V2Xcast® software that provides ready-to-use V2X communication services, OBU-301U supports highest application flexibility for connected vehicles ecosystem development.

Feature:

❖ Feature rich I/O ports provide the most flexible options to integrate with variable devices.

❖ Painlessly enable V2X on external Linux host device via USB or Ethernet connection and V2Xcast®.

❖ On-board mPCIe socket allows add-on module.

❖ Onboard RF compensators provide compensation against RF cable loss. (available in OBU-311 series)

❖ 5.9GHz and GPS antennas diagnostic detection in case of antenna open or cable pinch.

Specifications:

Chipset	- Autotalks® CRATON2 V2X communication processor - dual 600MHz ARM Cortex-A7 32-bit CPU cores 1140 DMIPS processing power each Cortex-A7 core - ARM Cortex M3 32-bit processor with memory protection unit (MPU) and ECC protected memory - Autotalks® PLUTON2 V2X RF Transceiver - Embedded Hardware Secure Module (eHSM) - Dedicated ARM Cortex-M0 CPU - Telit® SL869-V3 GNSS module (SL869-ADR optional)
Operation System	Linux Yocto
System Service	RS-232 console interface (baud rate 115200 bps)
System Memory	128MB NAND, 128MB DDR3
Preloaded Firmware	DSRC stack including IEEE 802.11p, IEEE 1609.2/3/4, and SCMS client* (*Est. in Q2 '21)
Development Tool	V2Xcast® SDK, including APIs and SAE J2735 facility layer messages
Hardware Security	- Dedicated ROM containing certified secure V2X signing firmware - Secure encrypted off-chip storage of private keys - Private material is inaccessible outside HSM - Capable of >110 signatures / second, with <9ms signing latency for ECDSA NIST P256 or ECDSA Brainpool P256R1 - Line-rate ECDSA verification engine (>2500 ECDSA NIST P256 verifications / second) - Embedded HSM supports less than 9ms latency on ECDSA NIST P256 signing, it's granted FIPS 140-2 Level 3 certification* - Tamper detection
DSRC	- Frequency band: 5.85 ~ 5.925 GHz - Radio mode: 802.11p - Channel: 172, 174, 176 , 178, 180, 182, 184 - Channel bandwidth: 10MHz (5MHz & 20MHz by project)

	❖ Data rate: 3, 4.5, 6, 9, 12, 18, 24, 27Mbps for 10MHz BW signal
	❖ RF transmit power: > +20dBm, Class C RF spectrum mask compliant with margins
	❖ RF receive power: < -92dBm, compliant with SAE J2945
GNSS	❖ Update rate: 10Hz
	❖ Sensitivity:
	◆ Acquisition: -146dBm
	◆ Navigation: -158dBm
	◆ Tracking: -162dBm
	❖ NMEA Standard: NMEA 0183
	❖ Accuracy: 1.5m (CEP50 with SBAS)
	❖ Telit® SL869-V3 GNSS receiver supports GPS/Glonass constellations. SBAS like EGNOS (EU), WAAS (US), and MSAS (JP) are also supported
External GNSS Support	NMEA input interface
External Connector	❖ One integrated 20-pin I/O interface
	◆ Power 6-48V DC
	◆ Reset
	◆ One RS-232 for Console (baud rate 115200 bps)
	◆ One RS-232 for external GNSS NMEA input
	◆ One 1PPS input
	◆ Two CAN
	◆ One USB with USB bus power
	◆ Two GPIOs
	❖ One Ethernet port with 802.3af PoE
	❖ One USB Mini-B port
	❖ Two FAKRA Z RF port for DSRC
	❖ One FAKRA C RF port for GNSS
On-Board Interface	❖ Two MMCX RF connector (DSRC with remote compensator power & control signal)
	❖ Two MHF RF connector (DSRC)
	❖ One MMCX RF connector (GNSS)
	❖ One Mini PCIe slot (for LTE module) *
	❖ One SIM slot*

- ❖ One PoE Module slot
- ❖ One Reset button
- ❖ LED headers
- ❖ Boot strapping DIP switch
- ❖ JTAG 7-pin header

(*. Support by project)

| LED	
	❖ STATUS (USDOT RSU 4.1) ◆ Start-up: Blinking Green ◆ Operational: Solid Green ◆ FW upgrade: Amber (R+G) ◆ Fault: Red ❖ PWR ❖ 1PPS ❖ EXT GNSS ❖ LTE WWAN ❖ LED0 ❖ LED1
Antenna	❖ Two detachable FAKRA type Z DSRC 5dBi Omni Dipole ❖ One detachable FAKRA type C active GNSS antenna, cable length: 3 meters
Operation Voltage	DC 6-48 V ± 5%
Operation Temperature Range	ambient: -40 ºC ~ +85 ºC
Operating Humidity	10% ~ 95%, non-condensing
Storage Humidity	max. 95%, non-condensing
Housing	aluminum plate, thickness: 1.0mm
Product Dimension	103mm (L) x 95mm(W) x 31mm (H)

Software:

1. Hostless Mode: OBU works as a standalone full-featured V2X unit
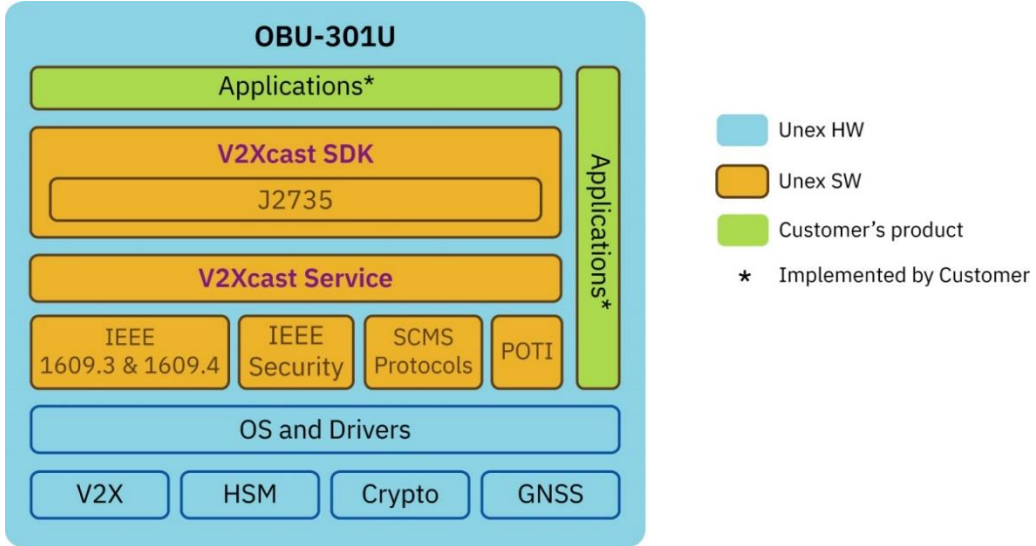
2. Hosted Mode: OBU works as a V2X communication unit to existing application host
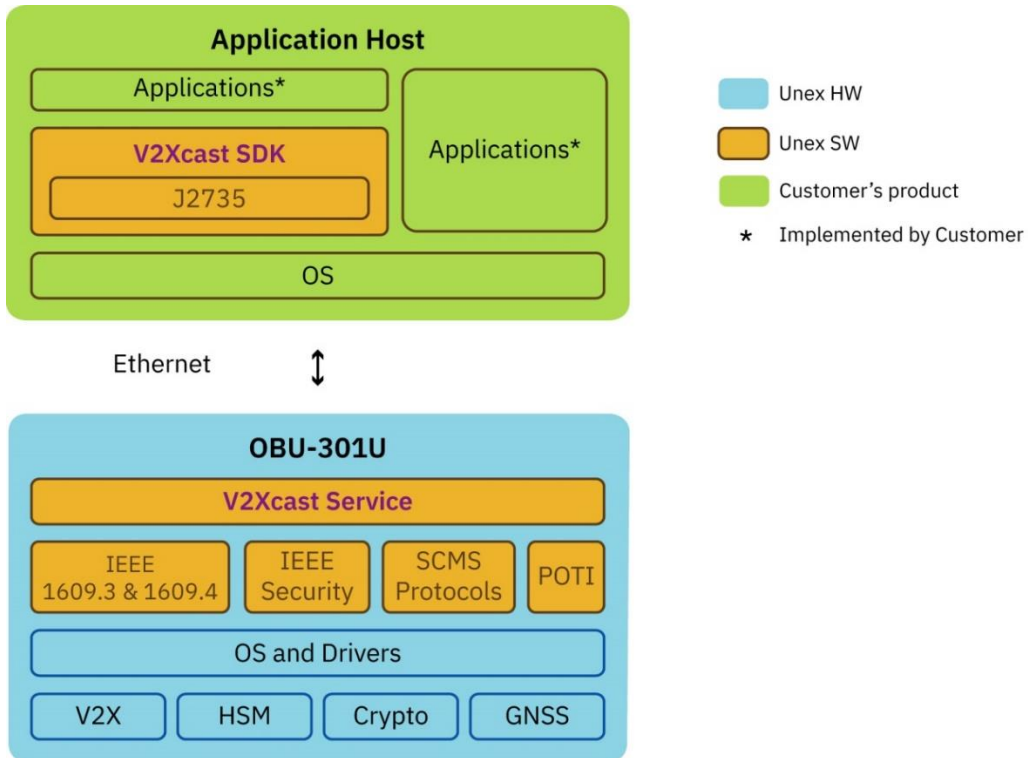
Unex OBU-301U enables ease of V2X software development through its V2Xcast® technology. Previously, V2X protocol software had to be built and verified complicated APIs, resulting in a duplicated effort, risk and cost. With Unex intuitive V2Xcast solution that provides ready-to-use V2X communication services for V2X applications, customers can significantly cut time-to-market with less development and testing cost.

V2Xcast is supported in OBU-301U to facilitate V2X application development. It includes two parts – V2Xcast Service and V2Xcast SDK.

V2Xcast SDK: Deploy V2Xcast SDK in either OBU-301U or external application host, it includes APIs to get the services from V2Xcast Service and the main functions of facility layer(J2735), such as message encoder/decoder and example code.

V2Xcast Service: V2Xcast Service image resides in OBU-301U, it combines IEEE 1609 WAVE protocol stack that includes IEEE 1609.2/3/4, SCMS protocol, and POTI. V2X communication protocols will be easily enabled via configuration input without any programming.

Security:
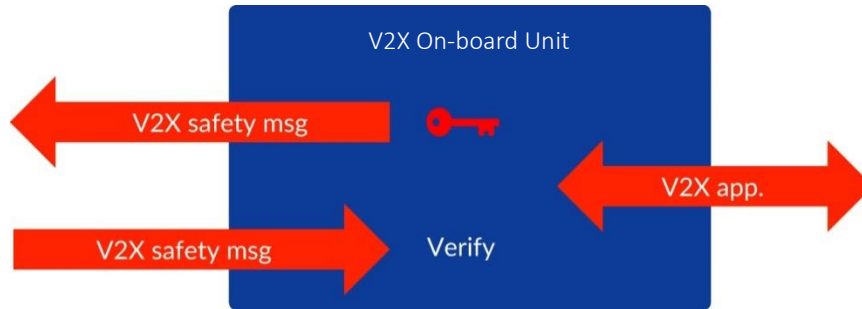
Security functions provided by V2Xcast® are designed based on a highly secure HSM (Hardware Security Module).

The highly secure HSM with FIPS 140-2 Level 3 certification is embedded in OBU-301U.

Cryptographic processor eliminates bottlenecks, maximizes application performance and offload CPU's computation. To protect your sensitive cryptographic keys in a high-assurance key vault, the design provides leverage a keys-in-hardware solution. With the keys-in-hardware solution, all the cryptographic operations are inside HSM and those keys never leave the HSM.
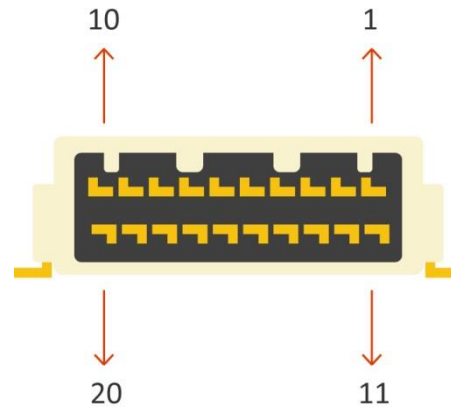
Input Output Interface:

20 pin Connector   Ethernet   USB Mini-B
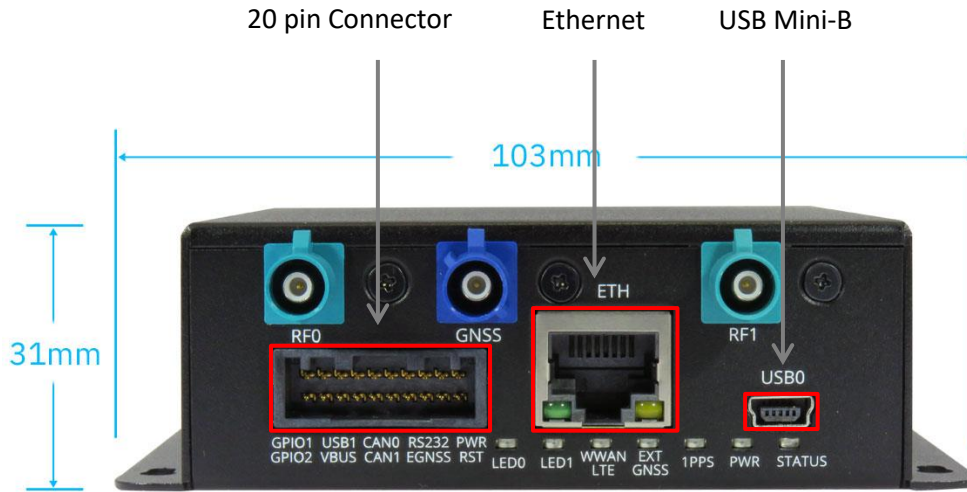
Function	Pin
Console (DCE)	TX(I)
	RX(O)
	GND
Ext GNSS (DTE)	Ext_GNSS_TX(O)
	Ext_GNSS_RX(I)
	Ext_1PPS(I)
	GND
CAN0	CAN0_H
	CAN0_L
CAN1	CAN1_H
	CAN1_L
USB	USB_DP
	USB_DN
	USB5V
	GND
GPIO	GPIO1
	GPIO2
PWR	POWER
	RESET
	GND

Pin Definition:

20 Pin Connector

Pin	Pin Name	Type	Description
1	POWER	I	6-48V System main power
2	RESET	I	Reboot the device with rising edge
3	TX	I	Serial data from DTE
4	RX	O	Serial data to DTE
5	GND	G	Ground
6	CAN0_H	I/O	CAN0 High
7	CAN1_H	I/O	CAN1 High
8	USB_DP	I/O	USB Data +
9	USB_5V	O	5V USB bus power
10	GPIO1	I/O	GPIO
11	GND	G	Ground
12	EXT_1PPS	I	External 1PPS signal
13	EXT_GNSS_RX	I	Serial data from external GNSS module
14	EXT_GNSS_TX	O	Serial data to external GNSS module
15	GND	G	Ground
16	CAN0_L	I/O	CAN0 Low
17	CAN1_L	I/O	CAN1 Low
18	USB_DN	I/O	USB Data -
19	GND	G	Ground
20	GPIO2	I/O	GPIO

RJ45

12345678
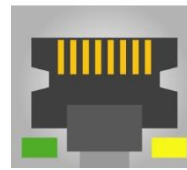
Pin	Pin Name	Type	Description
1	TX+ / BI_DA+	I/O	10/100Mbps: Transmit data + 1000Mbps: Bi-directional data +
2	TX- / BI_DA-	I/O	10/100Mbps: Transmit data - 1000Mbps: Bi-directional data -
3	RX+ / BI_DB+	I/O	10/100Mbps: Receive data + 1000Mbps: Bi-directional data +
4	BI_DC+	I/O	10/100Mbps: Not connected 1000Mbps: Bi-directional data +
5	BI_DC-	I/O	10/100Mbps: Not connected 1000Mbps: Bi-directional data -
6	RX- / BI_DB-	I/O	10/100Mbps: Receive data - 1000Mbps: Bi-directional data -
7	BI_DD+	I/O	10/100Mbps: Not connected 1000Mbps: Bi-directional data +
8	BI_DD-	I/O	10/100Mbps: Not connected 1000Mbps: Bi-directional data -

12345
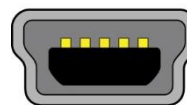
Mini-B

USB Mini-B

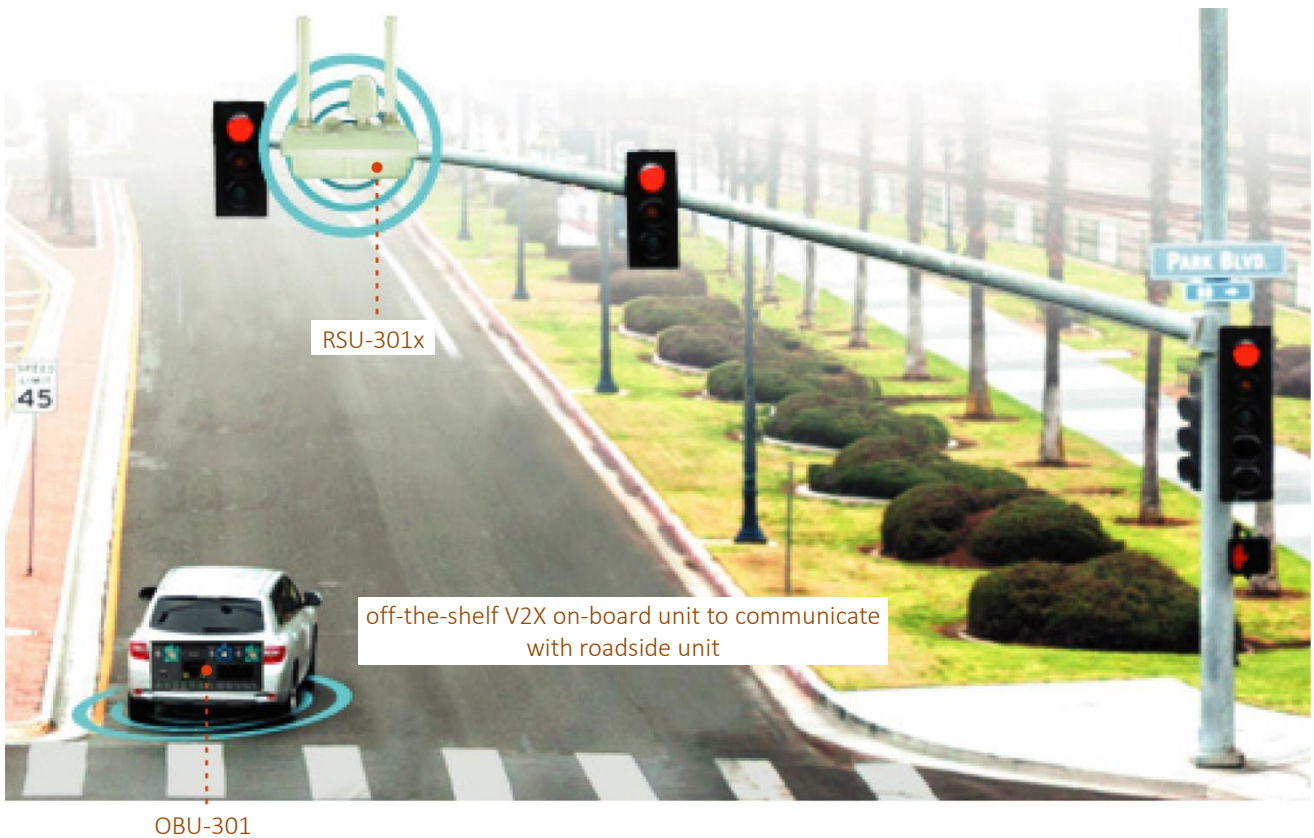| Pin	Pin Name	Type	Description
1	VBUS	O	+5V USB bus power
2	D-	I/O	Data -
3	D+	I/O	Data +
4	ID	-	Not connected
5	GND	G	Ground

Typical Using Case:

1. Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) applications in standard compliance IEEE 1609.x protocol stack and J2735 messages:

V2V

OBU-301U   OBU-301U

off-the-shelf V2X on-board unit with standard compliance
V2X stack to deploy V2X applications

V2I

RSU-301x

off-the-shelf V2X on-board unit to communicate
with roadside unit

OBU-301

2. Enables V2X on external host device with no impact on existing system architecture:

   Simply connect external host device to OBU-301U with preloaded V2Xcast Service, and deploy V2Xcast SDK in the external host device which allows it to send and receive J2735 compliant messages.

OBU-301U

OBU

WSM

IP

Vehicle equipped with OBU-301 or standard V2X OBU

External host device (PC, T-box, NAD...) with Linux OS

J2735 applications (BSM, SPaT, MAP, ...)

Package contents:

1. One OBU-301U

2. Two DSRC omni dipole detachable antennas, 5.9GHz FAKRA type Z

3. One GPS active detachable antenna, FAKRA type C, cable length 3 meters

4. One power supply unit

5. Hardware Guide, software development kit available on Unex server

Ordering Information and Options:

OBU-301U	V2X On-Board Unit, DSRC stack, V2Xcast®
EX-46	20-pin cable assembly
EX-47	I/O conversion board

Other Recommended Model:

OBU-301E	V2X On-Board Unit, ITS-G5 stack, V2Xcast®
OBU-311U (offer by project)	V2X On-Board Unit, RF Compensator, DSRC stack, V2Xcast®
OBU-311E (offer by project)	V2X On-Board Unit, RF Compensator, ITS-G5 stack, V2Xcast®
RFC-311 (offer by project)	V2X RF Compensator

EX-46:

20-pin cable assembly

EX-47:

I/O conversion board