V2X On-Board-Unit, IEEE 1609.x protocol stacks

Model: OBU-201U Specification

The OBU-201U is a standalone V2X on-board-unit containing 3-CPU core processor, dual channel DSRC RF transceiver, GNSS receiver, and hardware security with embedded IEEE 1609.x protocol stacks running on ThreadX RTOS. Companies can directly deploy V2X application programs on OBU-201U internal system through SDK and protocol stack API.

DC 6-32V 4-pin power input supports separate Vbatt for GNSS RTC hot-start and ACC to whole system in automotive applications. Extensive I/O connectors provide flexible integration options. Automotive-grade design ensures vibrational and environmental reliability.

System integration of CRATON ECDSA verification engine and Infineon® SLE97 hardware security in V2X HSM firmware support ECDSA 256-bit signing and verification performance which exceeds the standards requirement. Private keys store securely in a tamper proof device.

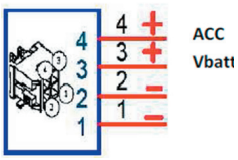
High-performance Telit® SL869 GNSS receiver supporting RTCM provides accurate positioning at 10Hz refresh rate.

Automotive-grade design ensures vibrational and environmental reliability. Interoperable and standard compliant IEEE 1609.x protocol stacks ensure the best performance and compatibility.

OBU-201U is a V2X-ready OBU solution for trials or retrofit deployments, also, can be used to painlessly enable V2X on existing Wi-Fi outdoor Access Point through Ethernet port connection and Unex's unique OSLink/SDK

Key Features:

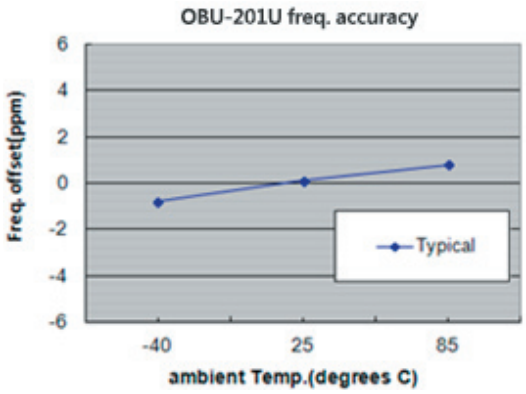
- V2X on-board unit contains Autotalks CRATON 3-CPU core communication processor, PLUTON RF transceiver, Telit® SL869 GNSS receiver, Infineon® SLE97 HSM, 128MB DDR3, and 32MB NOR flash memory with embedded firmware and IEEE 1609.x protocol stacks running on ThreadX RTOS for direct V2X application program deployment on internal system.
- Contains all V2X elements of RF (2*2), modem, security, positioning, and IEEE 1609.x V2X protocol stacks for OBU and RSU applications.
- AEC-Q100 qualified V2X chipsets, 4-corner UV cured resin for BGA chips, and automotive-grade components in pin header design ensure vibrational and environmental reliability.
- Complete IEEE 1609.x protocol stacks contains IEEE 1609.2, 1609.3, 1609.4 and SAE J2735 stacks.
- System integration of CRATON ECDSA verification engine and Infineon® SLE97 hardware security in V2X HSM firmware provide superior ECDSA 256-bit signing and verification performance which exceeds the standards requirement.
- Private keys store securely in a tamper proof device.
- Class C spectrum masks compliance with +20dBm RF power at DSRC antenna ports.
- Superior fading sensitivity in multipath scenarios increases wireless DSRC coverage.
- Dual PHY and MAC support con-concurrent dual channel operation or single channel with optimal DSRC Tx/Rx diversity.
- Internal 40MHz BW filter provides robust out-of-band DSRC radio interference immunity.
- High-performance Telit® SL869 GNSS receiver supporting RTCM provides accurate positioning at 10Hz refresh rate.
- Extensive connectivity provides the most flexible integration options: one 10/100Mbps Ethernet port, two CAN DB9 ports, one RS232 DB9 port for system debug, one audio jack, and one microSD socket for data logging.
- Dual DC 6-32V power inputs design: 4-pin automotive power connector or round jack provides application flexibility in the lab and vehicle.
- Separate ACC and Vbatt power input on 4-pin power connector for automotive application. ACC provides whole system power supply, and Vbatt provides power supply to GNSS module RTC for hot start.



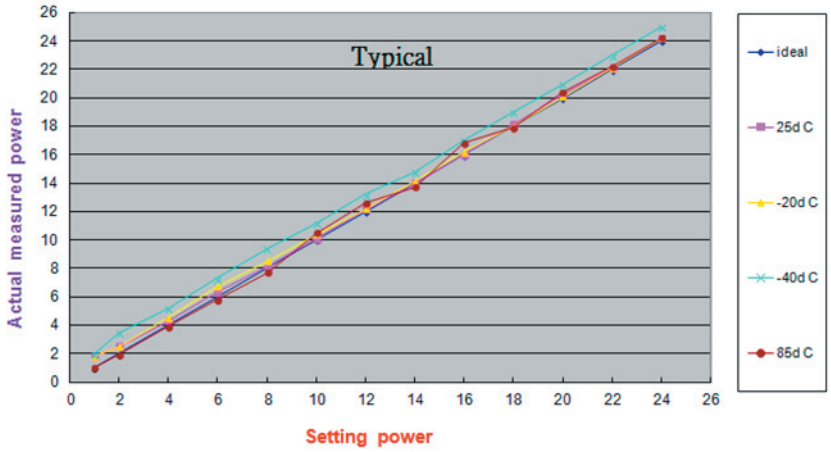
- Onboard programmable delay ON circuitry (default 200ms) supports cranking delay ON function.
- Power management: Idle, ON, and OFF state.
- 40V 3000W passive TVS, active IC LTC4365, and 80V dual MOS ensure robust UV/OV/RV protection on ACC trail.
- Circuitry of 40V 3000W passive TVS on Vbatt trial - LT3014 – GNSS' VRTC provides power trial protection for GNSS hot start.
- State-of-the-art TVS on DSRC/GNSS antenna ports and CAN ports provide robust ESD protection.
- Dedicated oscillator provide high frequency accuracy at ± 6.0ppm in –40°C ~ +85°C temperature range.
- Dynamic and accurate power control in wide 4.5dBm ~ 25dBm range provides superior performance stability.
- Two Fakra type Z DSRC detachable antennas support receiver diversity and enable robust assembly in automotive application.
- One Fakra type C active GNSS detachable antenna, cable length 5 meters.
- Automotive-grade -40°C ~ +85°C components (Infineon SLE97 supporting -20°C ~ +85°C now) ensure environmental reliability.
- RoHS compliance meets environment-friendly requirements.

Critical Facts of OBU-201U

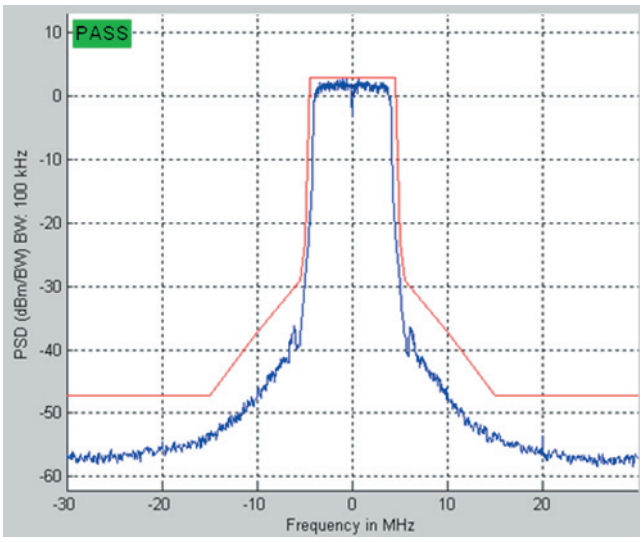
1. Frequency Accuracy:



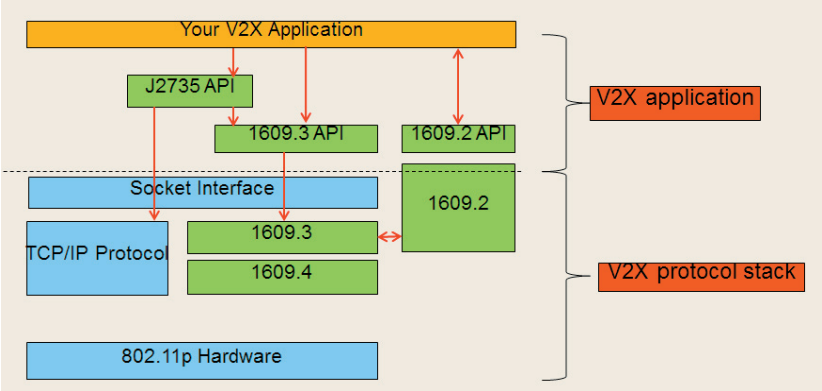
2. Power Control Accuracy:



3. Class C mask performance at +20dBm from -40°C ~ +85°C:

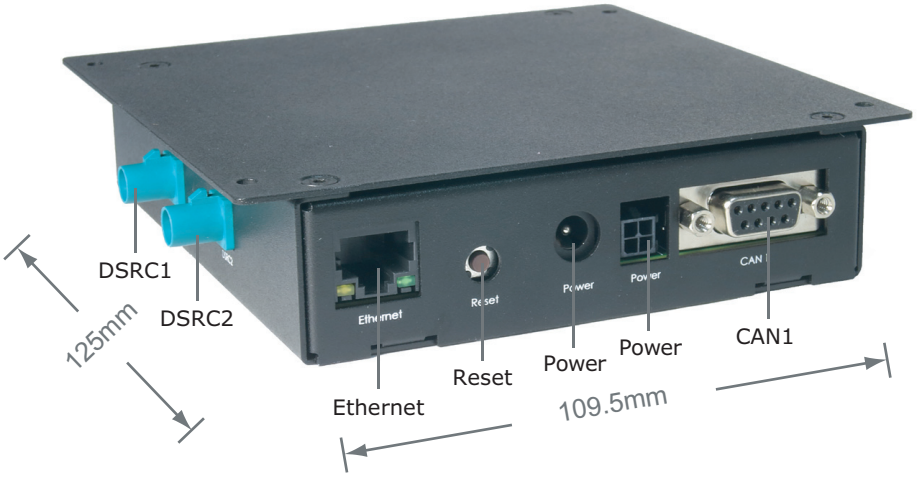


4. Complete and interoperable IEEE 1609.x protocol stacks with API:



Main Interfaces of OBU-201U

Dimension: 125mm (L) x 109.5mm(W) x 30mm (H)
Housing: zinc coating steel plate (1mm thickness) in black color



Software Specifications:

Operation System	ThreadX RTOS
Standard Compliance	IEEE 1609.2, 1609.3, 1609.4 and SAE J2735
Frequency Range	5.85 ~ 5.925 GHz (Remark: DSRC messages over 5.15 ~ 5.925 full band will be supported by project base.)
Firmware	Autotalks firmware
Protocol Stack	IEEE 1609.x stack including standard compliance: ▪ IEEE 1609.2 - 2013 ▪ IEEE 1609.3 – 2010 ▪ IEEE 1609.4 – 2010 ▪ IEEE 802.11p – 2010 ▪ SAE J2735: supports message formats of BSM, CSR, EVA, ICA, MAP, NMEA, PDM, PVD, RSA, RTCM, SPAT, RSM, SSM, TIM
Channel	172, 174, 176, 178, 180, 182, 184 (5.9GHz DSRC) (Remark: DSRC messages over 5.15 ~ 5.925 full band will be supported by project base.)
Security Firmware	dedicated HSM V2X firmware
Security Functions	▪ ECDSA Signing (<50ms) ▪ ECDSA 256-bit Verification
Development Tool	Unex's V2X SDK (including tool-chain, V2X protocol stack API)
System Service	RS232 console port (baud rate 115200 bps)

Hardware Specifications:

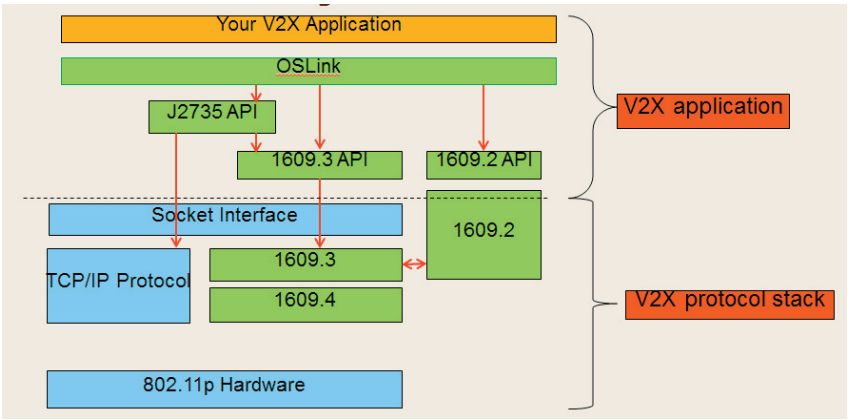
Main Chipset	▪ Autotalks CRATON (ATK4100) V2X communication processor, three 240MHz CPU cores. ▪ Autotalks PLUTON (ATK3100) V2X RF Transceiver ▪ Telit SL869 GNSS module ▪ Infineon SLE97 Hardware Security Module (HSM)
Memory	32MB NOR system memory and 128MB DDR3 storage memory
DSRC Frequency Band	5.85 ~ 5.925 GHz (5.15 ~ 5.925GHz full band by project)
DSRC Radio Mode	802.11p
DSRC Channels	172, 174, 176, 178, 180, 182, 184
DSRC Channel Bandwidth	10MHz (5MHz & 20MHz by project)
DSRC Data Rate	3, 4.5, 6, 9, 12, 18, 24, 27Mbps for 10MHz BW signal
DSRC Frequency Accuracy	± 6.0ppm
DSRC Transmit Power	Class C spectrum mask compliance with +20dBm RF power
DSRC Static Sensitivity (Typical)	Conditions / -40°C / +25°C / +85°C 3Mbps / -97dBm / -93dBm / -92dBm 4.5Mbps / -97dBm / -93dBm / -92dBm 6Mbps / -95dBm / -91dBm / -91dBm 9Mbps / -93dBm / -89dBm / -89dBm 12Mbps / -90dBm / -86dBm / -85dBm 18Mbps / -86dBm / -83dBm / -83dBm 24Mbps / -80dBm / -75dBm / -75dBm 27Mbps / -78dBm / -74dBm / -73dBm
DSRC Fading Sensitivity	Power @ 10% PER sensitivity (6Mbps, 1000B packet), fading channels as 5 typical C2C multipath scenarios defined by ETSI: ± 2dBm ▪ Rural LOS: -92.5dBm ▪ Highway LOS: -91.5dBm ▪ Urban Approaching LOS: -91.5dBm ▪ Crossing NLOS: -89.5dBm ▪ Highway NLOS: -88.5dBm
DSRC Antenna	two Fakra type Z 5.9 GHz /5dBi Omni Dipole detachable antennas
GNSS Radio	Telit SL869 integrated GPS and Gloness receiver

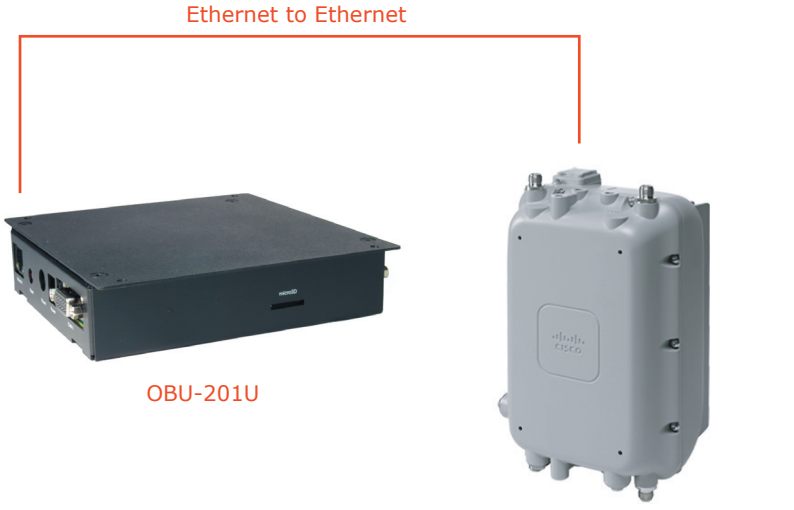
GNSS Refresh Rate	10Hz
GNSS sensitivity	-135dBm
GNSS NMEA Standard	NMEA 0183
GNSS Channel	32-channel multi-constellation
DGPS support	RTCM SC-104 message 1 and 9
GNSS accuracy	typical 1.5 meters
GPS Antenna	one active Fakra type C attachable antenna, cable length: 5 meters
Security	▪ ECDSA Signing (<50ms) ▪ ECDSA 256-bit Verification ▪ Secure storage of private keys in HSM
Interface	▪ two DB-9 female CAN ports ▪ one 10/100Mbps Ethernet port ▪ one DB-9 female RS232 for system debug (baud rate 115200 bps) ▪ one audio jack ▪ one reset button ▪ one microSD socket for flash memory
Power Supply	dual DC 6-32V power inputs: ▪ one 4-pin connector supporting Vbatt. and ACC; ▪ one DC round jack connector
Operation Voltage	DC 6-32 V ± 5%
Power Consumption	12V power input Condition / -40°C / +25°C / +85°C Tx @20~8dBm (RF duty cycle=7%) / 0.3A / 0.3A / 0.315A Idle / 0.29A / 0.29A / 0.3A
Power Management	three states of Idle, ON. and OFF
Operation Temperature Range	ambient: -40°C~ +85°C (Infineon SLE97 Hardware Security Module supports -20°C ~ +85°C)
Operating Humidity	10% ~ 95%, non-condensing
Storage Humidity	max. 95%, non-condensing
Environment-Friendly Compliance	RoHS
Housing	zinc coating steel plate, thickness: 1.0mm
Product Dimension	125mm (L) x 109.5mm(W) x 30mm (H)
Packing Box Size	305mm (L) x212mm (W) x 68mm (H)
Carton Packing	4 boxes in one carton

OBU-201U Application Scenarios

1. Directly deploy ThreadX V2X application programs on OBU-201U:

2. Painless enable V2X on existing outdoor Wi-Fi AP: Directly connect OBU-201U to existing Wi-Fi AP through Ethernet port. Deploy V2X application software on Linux through OSLink and TCP/IP.





Package contents:

1. OBU-201U x 1
2. One GPS active detachable antenna, Fakra type C, cable length 5 meters
3. Two DSRC omni dipole detachable antennas, 5.9GHz Fakra type Z
4. One 4-pin power cable
5. One 12V/1A 110~240V round-jack power adaptor
6. One DB9 male to female connector
7. Quick-start Guide and User's manual in CD-ROM

Ordering Information:	
OBU-201U	V2X On-Board-Unit, 1609.x protocol stacks
OBU-201E	V2X On-Board-Unit, ETSI TC-ITS protocol stacks
OBU-201	V2X On-Board-Unit, Autotalks SDK for V2X protocol stacks porting.
EX-20	USB (A-male) to RS-232 (DB-9 male) cable, Prolific PL2303 chipset, cable length 1.8 meters