



# Hardware Description

For The Commsignia ITS-OB4-M

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# 1. Overview of the ITS-OB4-M

This is an introduction and a general overview of the ITS-OB4-M product, created by Commsignia.

The fourth generation vehicular connectivity system, designed by Commsignia, offers superior performance with a fully compatible Vehicle to Everything (V2X) software stack. The unit provides low-cost and simple OEM / after market integration, offering a built-in tamper-proof Hardware Security Module, CAN, high range V2X radio and easy HMI integration. By combining the benefits of automotive grade design, high performance application CPU and dual channel V2X radio performance, the ITS-OB4-M offers a professional, complete and future proof solution.

The platform features a powerful application processor, various communication subsystems (such as V2X, Cellular, CAN, Wi-Fi) and utilities for positioning, hardware security module, supervisor and many more. The product is built for automotive use with easy instalment into the vehicle and protection against physical and other challenges.

The ITS-OB4-M comes with an integrated Linux based operating system, complete V2X protocol Stack and a feature rich web based User Interface.

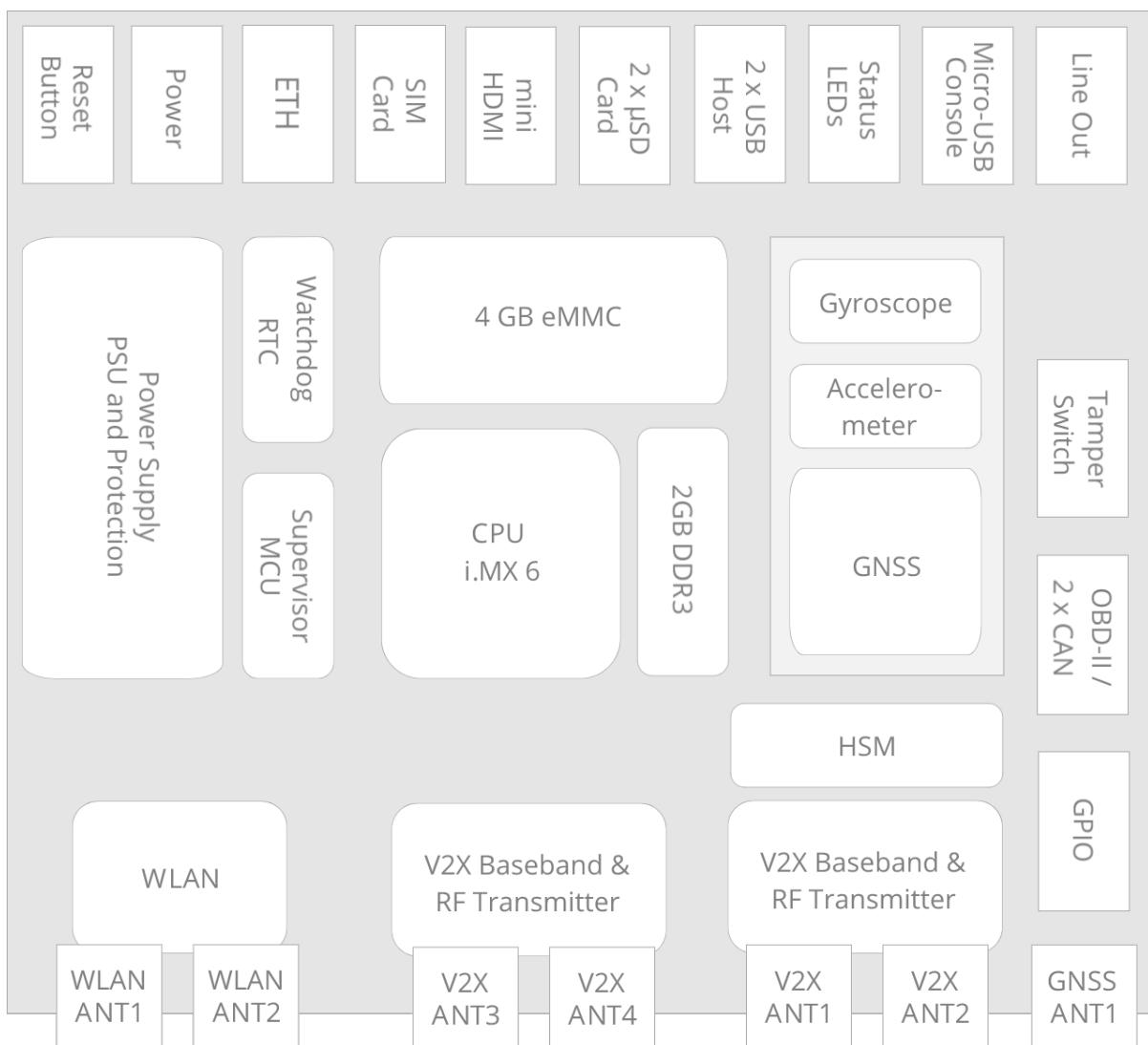
The main features of the ITS-OB4-M product line are:

- **High performance application processor:** The platform is based on an i.MX 6 CPU, which delivers performance to host the main operating system, all cooperative ITS services and any additional custom applications as well.
- **Easy control and management:** Unit functions and state can be easily used, monitored and configured using the advanced web-based HMI.
- **V2X Software Stack:** All variants are delivered with the pre-integrated V2X Software Stack, which complies with both EU (ETSI G5) and US (IEEE Wave 1609.x) standard protocols. This lets applications running on the device to receive, process, and transmit V2X standard compliant messages.
- **V2X Security Stack:** The system includes a multi-function Security Software Stack for V2X authentication, verification, and signing V2X messages - including support for Hardware Acceleration and key storage using a Hardware Security Module.
- **V2X radio support:** Units are equipped with V2X radios - Autotalks Sector (for DSRC) / WNC MV-9150M (for C-V2X)
- **IPv4/v6 Network Layer Security:** The platform supports standard Linux network security functions to enable secure connectivity towards external entities over any of the supported interfaces.
- **Tamper-proof HSM:** The unit features a Hardware Security Module (HSM) for secure key storage to meet all security and privacy requirements.
- **Hardware Accelerated V2X signature and verification:** The platform utilizes HW acceleration by dedicated System on Chips (SoCs) to deliver exceptional secure message processing time.
- **Positioning and dead reckoning:** The high precision positioning unit includes Dead Reckoning (DR) support and fast time to fix.
- **Smart time and clock management:** The device manages its clock input sources and internal signals to provide the most reliable system time facility.
- **Gigabit Ethernet:** The device is equipped with a Gb Ethernet interface for network connectivity.
- **Commercial Short range network access:** The device has Wi-Fi and Bluetooth connectivity for maintenance and configuration or for connecting to IoT devices and sensor networks.
- **Cellular:** Cellular connection is recommended for use cases where wireless access to Cloud services or the Road/Backbone Infrastructure network is required.
- **Power failure protected:** The unit is equipped with a dedicated power input protection circuitry making it resistant against power disturbances and short power outages. During long power failures, the device uses internal backup power to perform a store and shut down sequence.
- **Watchdog:** The system provides hardware based watchdog services essential for high reliability services and applications.

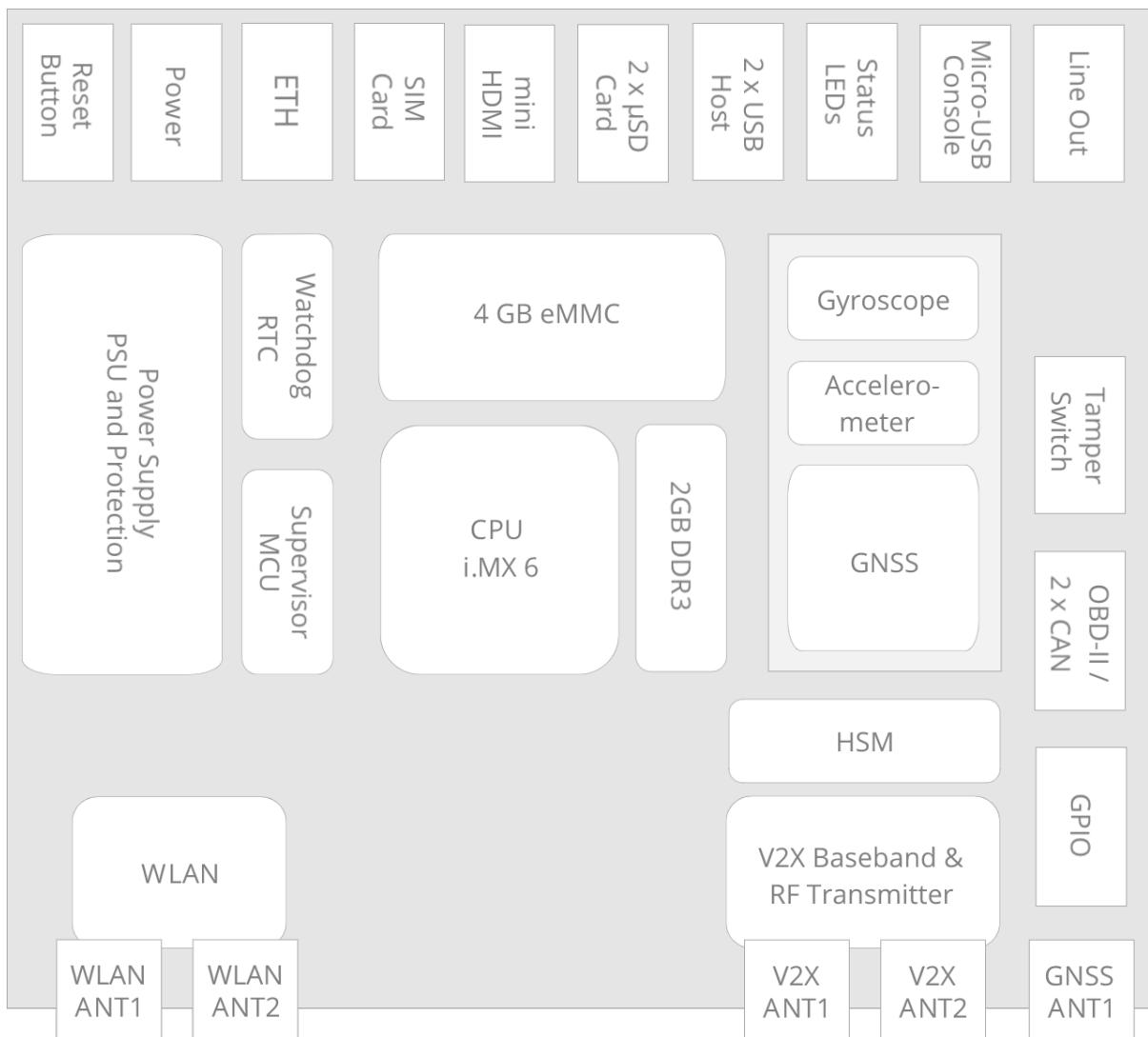
- **Smart upgrade package management:** The system firmware or modular updates are simple, convenient and fail-safe.
- **Infrastructure applications :** Various infrastructure applications and message sets are available to use services such as Green Light Optimal Speed Advisory (GLOSA), Road Works Warning (RWW), Traveler Information Message (TIM), Road Side Alert (RSA) and other Day 1 safety applications.
- **Environment resistant enclosures:** The devices are shipped in industrial grade, vibration resistant and easy to mount enclosures, compliant with the IP67 standard.
- **Camera, Radar, LiDAR support :** Connect all vehicle sensor feeds for Advanced Driver Assistance System (ADAS) sensor fusion.

## 2. Architecture of the ITS-OB4-M

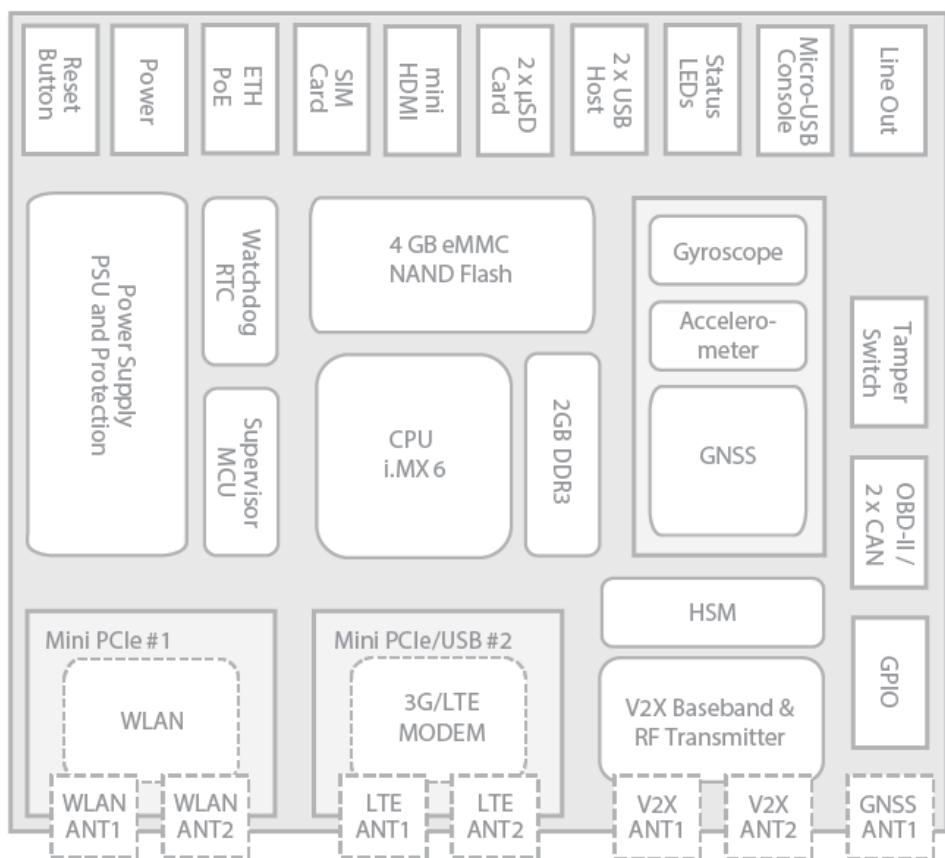
The following figure depicts the major internal components of the ITS-OB4-M productthe module inter-communication connections, as well as the internal/external interfaces.



*Architecture of the ITS-OB4-M product variant F*



Architecture of the ITS-OB4-M product variant C



Architecture of the ITS-OB4-M product variant D

### 3. Technical specifications of the ITS-OB4-M product

**Table 1. Technical specifications of the ITS-OB4-M product**

Feature	Description	
CPU	NXP i.MX6 quadcore 792 MHz	
RAM	2 GB DDR3 SDRAM (minimum 2 GB of free storage is available)	
Flash	4 GB eMMC NAND Flash	
Storage interfaces	Dual micro SD Card slot	
Data interfaces	<ul style="list-style-type: none"> <li>• Gb Ethernet</li> <li>• Dual USB 2.0</li> <li>• 5 isolated inputs, 3 isolated MOSFET outputs</li> <li>• GPIO</li> <li>• CAN / OBD-II</li> </ul>	
Backup power	10s Store & Shutdown	
V2X interface	V2X transceiver	<ul style="list-style-type: none"> <li>• Dual-channel Autotalks Sector</li> </ul>
	Output power	<ul style="list-style-type: none"> <li>Default setting: 20 dBm</li> <li>Maximum setting: 28 dBm</li> <li>Maximum allowed by FCC 20 dBm</li> <li>(Class C RF spectrum mask)</li> </ul>
	Receiver sensitivity	< -90 dB
V2X Security	<ul style="list-style-type: none"> <li>• Hardware Security module (HSM) SLI97</li> <li>• Elliptic Curve Digital Signature Algorithm (ECDSA) verification (&gt; 2000 verifications), encryption (&lt; 50 microsecond signing delay)</li> <li>• Brainpool verification, encryption</li> <li>• Secure, tamper proof private key and certificate storage</li> <li>• EAL6+ certified with up to 1MB of secure SOLID FLASH</li> <li>• ARM TrustZone including the TZ architecture</li> </ul>	
GNSS	Supported technology	GPS, GLONASS, GALileo and QZSS
	Frequency bands	GPS (L1), GLONASS (L1, FDMA), GALILEO (E1)
	Sensitivity	<ul style="list-style-type: none"> <li>Acquisition: -146 dBm</li> <li>Navigation -158 dBm</li> <li>Tracking: -162 dBm</li> </ul>
	Time to First Fix (@ -130dBm)	<ul style="list-style-type: none"> <li>Hot Start 1 s</li> <li>Cold Start: &lt; 35 s</li> </ul>
Wi-Fi interface (Applicable only for product variants with the W extension)	Supported technology	IEEE 802.11 a/b/g/n, Wi-Fi compliant
	Receive Sensitivity (Wi-Fi)	<ul style="list-style-type: none"> <li>• 802.11a: 54M less than 68 dBm</li> <li>• 802.11b: 11M less than 78dBm</li> <li>• 802.11g: 54M less than 68 dBm</li> <li>• 802.11n 2.4G: HT20 MCS7 &lt;64 dBm, HT40 MCS7 &lt;61 dBm</li> <li>• 802.11n 5G: HT20 MCS7 &lt;64 dBm, HT40 MCS7 &lt;61 dBm</li> </ul>
	Receive Sensitivity (BT)	BER < 0.1% (Anritsu 8852B Tx -70Bm)
Cellular interface (Applicable only for product variants with the C495 extension)	Supported technology	GPRS/EDGE/WCDMA/HSPA+/LTE
	Frequency	850/900/1800/1900 MHz
	Data throughput	<ul style="list-style-type: none"> <li>• GPRS: DL 85.6 kbps/UL 85.6 kbps</li> <li>• EDGE: DL 236.8 kbps/UL 236.8 kbps</li> <li>• WCDMA CS: DL 64 kbps/UL 64 kbps</li> <li>• WCDMA PS: DL 384 kbps/UL 384 kbps</li> <li>• HSPA+: DL 21.6 Mbps/UL 5.76 Mbps</li> <li>• DC-HSPA+: DL 43.2 Mbps/UL 5.76 Mbps</li> <li>• LTE FDD: DL 150 Mbps/UL 50 Mbps @20M BW CAT4</li> </ul>

Feature	Description
IMU	<ul style="list-style-type: none"> <li>3 axis accelerometer + 3 axis gyroscope BOSCH BMI160</li> <li>3 axis magnetometer BMM150</li> </ul>
Power supply	8-32 VDC (surge and reverse polarity protected) Supercapacitor-powered backup power supply
Video & audio	HDMI 1.4a & 3.5 mm stereo jack line-out
Other	Reset button
Certifications	<ul style="list-style-type: none"> <li>FCC: certified (2AOZ5-CM-OB4)</li> <li>CE: in progress</li> <li>SW: OmniAir certified (DSRC-V2X 2018050801)</li> </ul>
Commsignia PN	F-W1-C495-S-S1 (with WiFi and LTE radios, including supercapacitor)

**Table 2. Technical specifications of the ITS-OB4-M product variant C**

Feature	Description	
CPU	NXP i.MX6 quadcore 792 MHz	
RAM	2 Gb DDR3 SDRAM (minimum 2 Gb of free storage is available)	
Flash	4 Gb eMMC NAND Flash	
Storage interfaces	Dual micro SD Card slot	
Data interfaces	<ul style="list-style-type: none"> <li>Gb Ethernet</li> <li>Dual USB 2.0</li> <li>5x isolated inputs, 3x isolated MOSFET outputs</li> <li>GPIO</li> <li>CAN / OBD-II</li> </ul>	
Backup power	10s Store & Shutdown	
V2X interface	V2X transceiver <ul style="list-style-type: none"> <li>Qualcomm 9150</li> </ul>	
	Output power	Default setting: 20 dBm Maximum setting: 21.5 dBm Maximum allowed by FCC 20 dBm
	Receiver sensitivity	< -103 dBm
V2X Security	<ul style="list-style-type: none"> <li>Hardware Security module (HSM) SLI97</li> <li>ECDSA verification (&gt; 2000 verifications), encryption (&lt; 50 microsecond signing delay)</li> <li>Brainpool verification, encryption</li> <li>Secure, tamper proof private key and certificate storage</li> <li>EAL6+ certified with up to 1MB of secure SOLID FLASH</li> <li>ARM TrustZone including the TZ architecture</li> </ul>	
GNSS	Supported technology	GPS, GLONASS, GALILEO and QZSS
	Frequency bands	GPS (L1), GLONASS (L1, FDMA), GALILEO (E1)
	Sensitivity	Acquisition: -146 dBm Navigation -158 dBm Tracking: 162 dBm
	Time to First Fix (@ -130dBm)	Hot Start 1 s Cold Start: < 35 s
	Supported technology	IEEE 802.11 a/b/g/n, Wi-Fi compliant
	Receive Sensitivity (Wi-Fi)	<ul style="list-style-type: none"> <li>802.11a: 54M less than 68 dBm</li> <li>802.11b: 11M less than 78dBm</li> <li>802.11g: 54M less than 68 dBm</li> <li>802.11n 2.4G: HT20 MCS7 &lt;64 dBm, HT40 MCS7 &lt;61 dBm</li> <li>802.11n 5G: HT20 MCS7 &lt;64 dBm, HT40 MCS7 &lt;61 dBm</li> </ul>
(Applicable only for product variants with the W extension)	Receive Sensitivity (BT)	BER < 0.1% (Anritsu 8852B Tx -70Bm)
	Supported technology	GPRS/EDGE/WCDMA/HSPA+/LTE
	Frequency	850/900/1800/1900 MHz

Feature	Description
Data throughput	<ul style="list-style-type: none"> <li>GPRS: DL 85.6 kbps/UL 85.6 kbps</li> <li>EDGE: DL 236.8 kbps/UL 236.8 kbps</li> <li>WCDMA CS: DL 64 kbps/UL 64 kbps</li> <li>WCDMA PS: DL 384 kbps/UL 384 kbps</li> <li>HSPA+: DL 21.6 Mbps/UL 5.76 Mbps</li> <li>DC-HSPA+: DL 43.2 Mbps/UL 5.76 Mbps</li> <li>LTE FDD: DL 150 Mbps/UL 50 Mbps @20M BW CAT4</li> </ul>
IMU	<ul style="list-style-type: none"> <li>3 axis accelerometer + 3 axis gyroscope BOSCH BMI160</li> <li>3 axis magnetometer BMM150</li> </ul>
Power supply	8-32 VDC (surge and reverse polarity protected) Supercapacitor-powered backup power supply
Video & audio	HDMI 1.4a & 3.5 mm stereo jack line-out
Other	Reset button
Certifications	<ul style="list-style-type: none"> <li>FCC: certified (2AOZ5-CM-OB4)</li> <li>CE: in progress</li> <li>SW: OmniAir certified (DSRC-V2X 2018050801)</li> </ul>
Commsignia PN	C-W-S-S1

**Table 3. Technical specifications of the ITS-OB4-M product variant D**

Feature	Description	
CPU	NXP i.MX6 quadcore 792 GHz	
RAM	2 Gb DDR3 SDRAM (minimum 2 Gb of free storage is available)	
Flash	4 Gb eMMC NAND Flash	
Storage interfaces	Dual micro SD Card slot	
Data interfaces	<ul style="list-style-type: none"> <li>Gb Ethernet</li> <li>Dual USB 2.0</li> <li>5x isolated inputs, 3x isolated MOSFET outputs</li> <li>GPIO</li> <li>CAN / OBD-II</li> </ul>	
Backup power	10s Store & Shutdown	
V2X interface	V2X transceiver #1 Output power Receiver sensitivity V2X transceiver #1 Output power Receiver sensitivity	Autotalks Secton
		Default setting: 20 dBm Maximum setting: 28 dBm
		< -90 dBm
		Qualcomm MDM 9150
		Default setting: 20 dBm Maximum setting: 23 dBm
		< -103 dBm
V2X Security	<ul style="list-style-type: none"> <li>Hardware Security module (HSM) SLI97</li> <li>ECDSA verification (&gt; 2000 verifications), encryption (&lt; 50 microsecond signing delay)</li> <li>Brainpool verification, encryption</li> <li>Secure, tamper proof private key and certificate storage</li> <li>EAL6+ certified with up to 1MB of secure SOLID FLASH</li> <li>ARM TrustZone including the TZ architecture</li> </ul>	
GNSS	Supported technology	GPS, GLONASS, GALileo and QZSS
	Frequency bands	GPS (L1), GLONASS (L1, FDMA), GALILEO (E1)
	Sensitivity	Acquisition: -146 dBm Navigation -158 dBm Tracking: 162 dBm
	Time to First Fix (@ -130dBm)	Hot Start 1 s Cold Start: < 35 s
Wi-Fi interface	Supported technology	IEEE 802.11 a/b/g/n, Wi-Fi compliant

Feature	Description
(Applicable only for product variants with the W extension)	<p>Receive Sensitivity (Wi-Fi)</p> <ul style="list-style-type: none"> <li>• 802.11a: 54M less than 68 dBm</li> <li>• 802.11b: 11M less than 78dBm</li> <li>• 802.11g: 54M less than 68 dBm</li> <li>• 802.11n 2.4G: HT20 MCS7 &lt;64 dBm, HT40 MCS7 &lt;61 dBm</li> <li>• 802.11n 5G: HT20 MCS7 &lt;64 dBm, HT40 MCS7 &lt;61 dBm</li> </ul>
Cellular interface	<p>Receive Sensitivity (BT)</p> <p>Supported technology</p> <p>Frequency</p> <p>Data throughput</p> <ul style="list-style-type: none"> <li>• GPRS: DL 85.6 kbps/UL 85.6 kbps</li> <li>• EDGE: DL 236.8 kbps/UL 236.8 kbps</li> <li>• WCDMA CS: DL 64 kbps/UL 64 kbps</li> <li>• WCDMA PS: DL 384 kbps/UL 384 kbps</li> <li>• HSPA+: DL 21.6 Mbps/UL 5.76 Mbps</li> <li>• DC-HSPA+: DL 43.2 Mbps/UL 5.76 Mbps</li> <li>• LTE FDD: DL 150 Mbps/UL 50 Mbps @20M BW CAT4</li> </ul>
IMU	<ul style="list-style-type: none"> <li>• 3 axis accelerometer + 3 axis gyroscope BOSCH BMI160</li> <li>• 3 axis magnetometer BMM150</li> </ul>
Power supply	PoE 8-32 V
Video & audio	HDMI 1.4a & 3.5 mm stereo jack line-out
Other	Reset button
Certifications	<ul style="list-style-type: none"> <li>• FCC: certified (2AOZ5-CM-OB4)</li> <li>• CE: in progress</li> <li>• SW: OmniAir certified (DSRC-V2X 2018050801)</li> </ul>
Commsignia PN	D-W1-C495-S-S1 (includes WiFi and LTE modules, and supercapacitor for the power supply)

## 4. Electrical specifications

This table contains the electrical specifications of the device.

**Table 4. Electrical specifications of the ITS-OB4-M**

Parameter	PIN	Connector	Min	Operation	Max	Units
Ignition Input Voltage	IGNITION+ IGNITION-	PWR	0	8-24	32	V
Maximum Ignition Current (continuous)	IGNITION+ IGNITION-	PWR			60	mA
Maximum Peak Power Consumption		PWR			25	W
Average Idle Consumption	IGNITION+ IGNITION-	PWR		7		W
Isolated inputs maximum continuous forward current	ISOLATED INxx	I/O			60	mA
Isolated inputs maximum peak forward current (100 us)	ISOLATED INxx	I/O			1	A
Isolated inputs maximum reverse voltage	ISOLATED INxx	I/O			6	V
Isolated inputs input forward voltage @ 1 mA	ISOLATED INxx	I/O	0	8-24	32	V
Switched outputs continuous load current	Switched OUTxx	I/O			700	mA (DC)
Switched outputs peak load current	Switched OUTxx	I/O			1	A
Switched outputs On-resistance	Switched OUTxx	I/O		0,35	0,55	Ohm
Storage temperature			-40	n/a	+85	C
Operating temperature			-40	n/a	+75	C
Operating humidity resistance			10	n/a	95	%
Storage humidity resistance				n/a	95	%

**Table 5.**

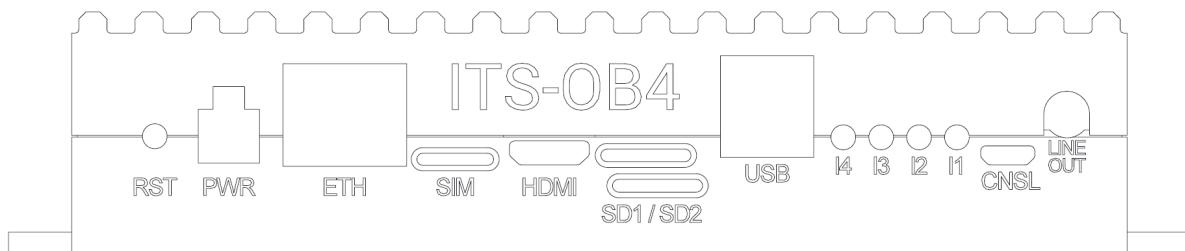
Parameter	Connector	Min	Operation	Max	Units
Power Supply Voltage	ETH	36	48	57	V
Maximum Peak Power Consumption	PWR			25	W
Storage temperature		-45 (-49)	n/a	+85 (+185)	C (F)
Operating temperature		-34 (-30)	n/a	+74 (+165)	C (F)
Operating humidity resistance		10	n/a	95	%
Storage humidity resistance			n/a	95	%

## 5. Enclosure

This chapter describes the front and back side connector layout and product dimension information. For the antenna connections and other details related to the external interfaces of the product, refer to the [External interfaces \(p. 14\)](#) chapter.

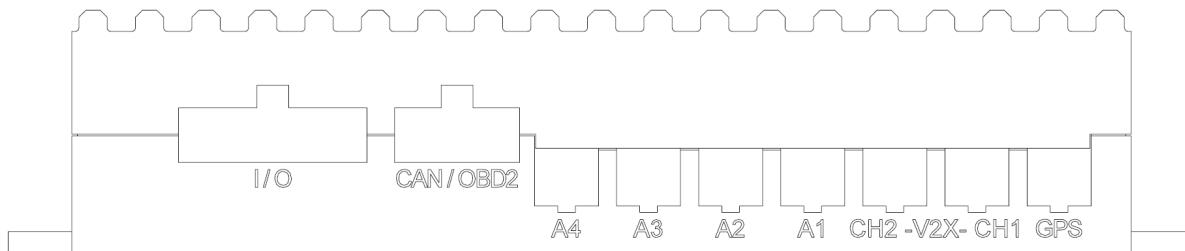
### 5.1. Enclosure specifications of the ITS-OB4-M product line

#### 5.1.1. Front layout



**Figure 1. Front layout of the ITS-OB4-M model variant in a small aluminium enclosure.**

#### 5.1.2. Back layout



**Figure 2. Back layout of the ITS-OB4-M model variant in a small aluminium enclosure.**

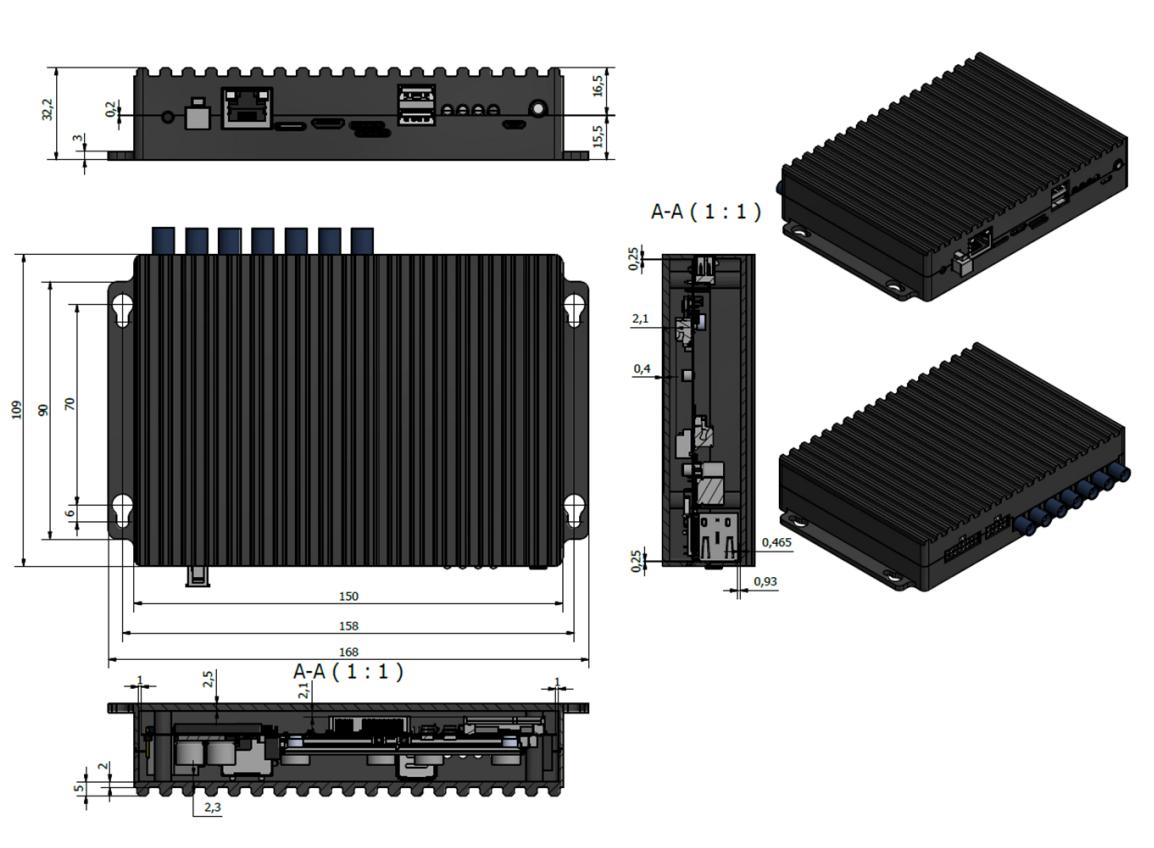
#### 5.1.3. Enclosure image

The following image shows the antenna connections of the small aluminium enclosure of the device.



**Figure 3. Image of the enclosure**

#### 5.1.4. Schematics



**Figure 4. Schematics overview of the enclosure with dimensions in mm**

### 5.1.5. Enclosure Dimensions

Height 32.2 mm / 1.26 inches  
Width 168 mm / 6.61 inches  
Depth 109 mm / 4.29 inches

### 5.1.6. Package Dimensions

Height 35 mm / 1.38 inches  
Width 175 mm / 6.90 inches  
Depth 125 mm / 4.92 inches

## 6. External interfaces for the ITS-OB4-M

For the architecture diagram of the product, refer to the [Architecture \(p. 3\)](#) chapter. For more information about the enclosure and the interface connection layout, see the [Enclosure specification \(p. 11\)](#) chapter.

**Table 6. ITS-OB4-M product variant F external interfaces**

Name	Type	Description
Power	3.0mm pitch Micro-Fit (2x2)	DC input voltage 10-32 V with max current 1.3 A @12V (~16W). The additional two pins are ignition line connectors for intelligent power control.
SIM card slot	nano-SIM (4FF) socket Push-Push	Supports standard mini-SIM cards for the cellular modem.
SD card slot 1/2	Push-Pull type micro SD card slot	micro SD Card slot for the main CPU (i.MX6) See below figure for card alignment.
General Purpose I/O	3.0mm Micro-Fit (2x8) Receptacle	Grouped isolated input and switched DC output ports.
CAN/OBD-II	3.0mm Micro-Fit (2x5) Receptacle	Automotive standard wired connectivity (CAN2.0B + OBD-II)
Dual USB host port 1 & 2	Double Type A USB Receptacle	2 x USB 2.0 Hi-Speed port connected to the Main CPU (i.MX6).
Serial console port	Micro USB B type	This interface establishes a connection to the available serial consoles of the platform. By default, the following connections exist:  Serial 0: V2X MCU Console Serial  Serial 1: Main CPU (i.MX6) Console.  Connecting a computer to this USB port will add two separate COM ports. Additional driver installation may be required before you can connect to these COM ports.  The following configuration must be used for a serial connection: 115200, 8 bit, 1 stop, no parity  Carefully connect the micro USB cable to the port to avoid damaging it!
Reset	Pushbutton switch (3mm diameter)	Applies full system reset
Stat. LED 1	RG LED	Status LED 1 for Supervisor
Stat. LED 2	RG LED	Status LED 2 for V2X subsystem
Stat. LED 3	RG LED	Status LED 3 for Main CPU (i.MX6)
Stat. LED 4	RG LED	Status LED 4 for Main CPU (i.MX6)
A1	male FAKRA connector	LTE main (Applicable only for product variants with the C495 extension)
A2	male FAKRA connector	LTE diversity (Applicable only for product variants with the C495 extension)
A3	male FAKRA connector	Wi-Fi main
A4	male FAKRA connector	Wi-Fi diversity
V2X-CH1	male FAKRA connector	DSRC Channel 1 for external antenna
V2X-CH2	male FAKRA connector	DSRC Channel 2 for external antenna
GPS	male FAKRA connector	GNSS Channel for external antenna

**Table 7. ITS-OB4-M product variant C external interfaces**

Name	Type	Description
Power	3.0mm pitch Micro-Fit (2x2)	DC input voltage 10-32 V with max current 1.3 A @12V (~16W). The additional two pins are ignition line connectors for intelligent power control.
SIM card slot	nano-SIM (4FF) socket Push-Push	Supports standard mini-SIM cards for the cellular modem.
SD card slot 1/2	Push-Pull type micro SD card slot	micro SD Card slot for the main CPU (i.MX6) See below figure for card alignment.

Name	Type	Description
General Purpose I/O	3.0mm Micro-Fit (2x8) Receptacle	Grouped isolated input and switched DC output ports.
CAN/OBD-II	3.0mm Micro-Fit (2x5) Receptacle	Automotive standard wired connectivity (CAN2.0B + OBD-II)
Dual USB host port 1 & 2	Double Type A USB Receptacle	2 x USB 2.0 Hi-Speed port connected to the Main CPU (i.MX6).
Serial console port	Micro USB B type	<p>This interface establishes a connection to the available serial consoles of the platform. By default, the following connections exist: Serial 0: V2X MCU Console Serial 1: Main CPU (i.MX6) Console. Connecting a computer to this USB port will add two separate COM ports. Additional driver installation may be required before you can connect to these COM ports.</p> <p>The following configuration must be used for a serial connection: 115200, 8 bit, 1 stop, no parity</p> <p>Be careful when connecting a micro USB cable not to damage the physical port!</p>
Reset	Pushbutton switch (3mm diameter)	Applies full system reset
Stat. LED 1	RG LED	Status LED 1 for Supervisor
Stat. LED 2	RG LED	Status LED 2 for V2X subsystem
Stat. LED 3	RG LED	Status LED 3 for Main CPU (i.MX6)
Stat. LED 4	RG LED	Status LED 4 for Main CPU (i.MX6)
A1	male FAKRA connector	C-V2X CH1
A2	male FAKRA connector	C-V2X CH2
A3	male FAKRA connector	Wi-Fi main
A4	male FAKRA connector	Wi-Fi diversity
V2X-CH1	male FAKRA connector	DSRC CH1 - not connected
V2X-CH2	male FAKRA connector	DSRC CH2 - not connected
GPS	male FAKRA connector	GNSS

**Table 8. ITS-OB4-M product variant D external interfaces**

Name	Type	Description
SIM card slot	mini-SIM (2FF) Push-Push socket	Supports standard mini-SIM cards for the cellular modem.
SD card slot 1/2	Push-Pull type micro SD card slot	micro SD Card slot for the main CPU (i.MX6) See below figure for card alignment.
General Purpose I/O	3.0mm Micro-Fit (2x8) Receptacle	Grouped isolated input and switched DC output ports.
CAN/OBD-II	3.0mm Micro-Fit (2x5) Receptacle	Automotive standard wired connectivity (CAN2.0B + OBD-II)
Dual USB host port 1 & 2	Double Type A USB Receptacle	2 x USB 2.0 Hi-Speed port connected to the Main CPU (i.MX6).
Serial console port	Micro USB B type	<p>This interface establishes a connection to the available serial consoles of the platform. By default, the following connections exist: Serial 0: V2X MCU Console Serial 1: Main CPU (i.MX6) Console. Connecting a computer to this USB port will add two separate COM ports. Additional driver installation may be required before you can connect to these COM ports.</p> <p>The following configuration must be used for a serial connection: 115200, 8 bit, 1 stop, no parity</p> <p>Be careful when connecting a micro USB cable not to damage the physical port!</p>
Reset	Pushbutton switch (3mm diameter)	Applies full system reset
Stat. LED 1	RG LED	Status LED 1 for Supervisor
Stat. LED 2	RG LED	Status LED 2 for V2X subsystem
Stat. LED 3	RG LED	Status LED 3 for Main CPU (i.MX6)

Name	Type	Description
Stat. LED 4	RG LED	Status LED 4 for Main CPU (i.MX6)
A1	male FAKRA connector	C-V2X CH 1 for external antenna
A2	male FAKRA connector	C-V2X CH 2 for external antenna
A3	male FAKRA connector	Wi-Fi main
A4	male FAKRA connector	Wi-Fi diversity
V2X-CH1	male FAKRA connector	DSRC CH 1 for external antenna
V2X-CH2	male FAKRA connector	DSRC CH 2 for external antenna
GPS	male FAKRA connector	GNSS antenna

## 6.1. LED statuses

This chapter explains the different statuses of the LEDs on the device.

**Table 9. LED 1 Power**

Status	Color	Frequency	Duty cycle	Description
Normal	Green	1 Hz	50%	The device is powered on.
No ignition	Green	1 Hz	10%	The device is in low power mode. Battery voltage is present, but ignition voltage is low.
Shutdown in progress	Orange	1 Hz	50%	The device is entering low power mode.
Hardware failure	Red	1 Hz	50%	Internal power failure.

**Table 10. LED 2 Status**

Status	Color	Frequency	Duty cycle	Description
Off	N/A	N/A	N/A	No power
Device start-up	Green	1 Hz	50%	The device is starting up. The system is booting or ITS binary/tools are starting up.
Device operational	Green	1 Hz	100%	Normal operation.
Firmware update	Amber	1 Hz	100%	Firmware update is in progress.
C-V2X modem firmware update	Amber	1 Hz	Variable	C-V2X modem firmware upgrade is in progress.
				 <b>NOTE</b> Turning off the device in this state can render the C-V2X modem unusable.
Fault	Red	1 Hz	100%	System failure. ITS binary/tools cannot run.

**Table 11. LED 3 Internal load / Firmware upgrade status**

Status	Color	Frequency	Duty cycle	Description
Heartbeat	Green	1 Hz	Variable	The light blinks in a varied cycle, based on the internal load. Blinking also indicates that the device is operational.
Firmware upgrade started	Red	0.6 Hz	70%	The device is checking the firmware from the upgrade source. If it is validated the firmware upgrade process will start.
Firmware upgrade is in progress	Red	0.6 Hz	50%	Firmware upgrade is in progress.
Firmware verification is in progress	Red	1.6 Hz	50%	Verification after firmware upgrade is in progress.

Status	Color	Frequency	Duty cycle	Description
Firmware completed upgrade	Red	1 Hz	90%	The firmware upgrade is successfully completed. The device is waiting for reboot / ignition cycle.

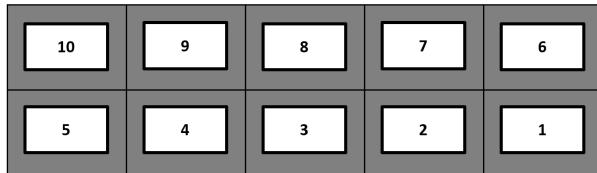
**Table 12. LED 4 GPS PPS**

Status	Color	Frequency	Duty cycle	Description
GPS PPS	Red	1 Hz	10%	Shows the current state of the GPS PSS line of the GPS module. Slow blinking indicates that the device has acquired a GPS position successfully.

## 6.2. CAN bus

Information about the Controller Area Network (CAN bus) vehicle bus connector.

### 6.2.1. CAN connector pin layout

**Figure 5. CAN connector pin layout (rear view)****Table 13. CAN connector pins and their details**

Pin	Function
1	CAN1_H
2	CAN0_H
3	GND
4	ISO_K
5	J1850+
6	CAN1_L
7	CAN0_L
8	GND
9	ISO_L
10	J1850-

Micro-Fit 3.0 Receptacle Housing, Dual Row, 10 Circuits, UL 94V-0, Low-Halogen, Black, that can be used with a wire size AWG 24 or equivalent. Part number 43025-1000.

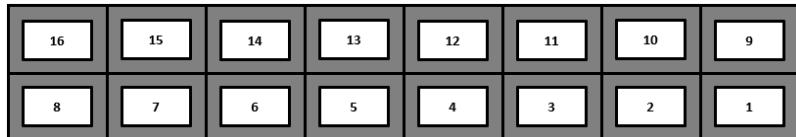


**Figure 6. CAN connector location on the device**

### 6.3. General purpose I/O interfaces

This chapter provides details about the General purpose I/O (GPIO) pin layout and functions.

#### 6.3.1. GPIO Pin layout



**Figure 7. GPIO pin layout (rear view)**

**Table 14. GPIO pins and their details**

Pin	Function
1	OUT0+
2	OUT1+
3	OUT2+
4	IN1+
5	IN2+
6	IN3+
7	IN4+
8	IN5+
9	OUT0-
10	OUT1-
11	OUT2-
12	IN1-
13	IN2-

Pin	Function
14	IN3-
15	IN4-
16	IN5-

The device has a connector for General Purpose I/O interfaces (GPIOs). It is a Molex Micro-Fit 3.0 connector (Part no. 43025-1600) and it can be used with wire size AWG 24 or equivalent.

## 7. Supported radio bands and antenna specifications

The device operates according to the regional technical standards regarding radio bands, antenna gain, and frequency.

### 7.1. ITS-OB4-M Antenna Overview

The antenna features four elements in one IP67 UV resistant radome casing. The Cellular element (on Cable 1) is wideband and covers LTE at 700 MHz as well as the established 850/1900 GSM/CDMA bands, 1.7/2.1 AWS bands and WiMAX 2.5 all on a single board. The antenna also covers 2.4GHz / 5GHz dual-band WiFi on Cables 2 & 3. The antennas can also be configured for combined GPS & GLONASS use.



**Figure 8. OBU Antenna**

### 7.2. Specifications

**Table 15. Antenna specifications**

Frequency and Gain Cable 1	694-894 MHz, 3 dBi & 1.7-2.7 GHz, 5 dBi
Frequency and Gain Cable 2	2.4-2.5 & 4.9-6.0 GHz, 5 dBi
Frequency and Gain Cable 3	2.1-2.5 & 4.4-6.0 GHz, 5 dBi
Frequency and Gain Cable 4	1575.42 +/- 2 MHz, LNA: 26dB 5 dBi nominal RHCP
Maximum Power	10 W
Nominal Impedance	50 ohms
GPS Amplifier Bias	2.7 to 5 VDC
GPS Noise Figure	20 dB max, 1.7 dB typical
GPS Current	20 mA max, 10 mA typical
GPS & GLONASS Option	1575 MHz & 1612 MHz
Cable Connector	FAKRA Plug (Female)
Case	UV resistant ASA material, Dimensions: 107 mm x 81 mm (4.2"D x 3.2"H)
Mounting	Magnetic mount
Operating Temperature	-40 to +80 Celsius / -40 to 176 Fahrenheit

Shock and Vibration Resistance	IEEE1478, EN 61373, MIL-810G TIA 329.2-C
Dust and Water Resistance	IP67

### 7.3. Supported radio bands

- WLAN 2.4 GHz
- WLAN 5 GHz
- 4G / LTE / UMTS
- C-V2X / DSRC / ITS-G5 (depending on availability)



#### NOTE

Replacing the antennas of the device is not recommended! If the antennas are replaced then the following maximum gains of the antennas must not be exceeded.

**Table 16. Maximum antenna gains**

Antenna	Maximum gain
C-V2X / DSRC / ITS-G5 (depending on availability)	7.6 dBi
LTE	3.5 dBi
WLAN 2.4 / 5 GHz	3.4 dBi / 5.1 dBi

### 7.4. Tx Frequency usage

**Table 17. Tx Frequency usage**

Band	Frequency range	max. EIRP
C-V2X (ITS-G5B, ITS-G5A, ITS-G5D) (depending on availability)	5855-5925 MHz	33 dBm
WLAN 2.4	2412-2472 MHz	20 dBm
WLAN 5	5470-5725 MHz (except 5130- 5350 MHz)	23 dBm
WLAN 5	5725-5875 MHz	14 dBm
LTE-FDD(B1)	1920-1980 MHz	23 dBm
LTE-FDD(B2) – non EU	1850-1910MHz	23 dBm
LTE-FDD(B3)	1710-1785 MHz	23 dBm
LTE-FDD(B4) – non EU	1710-1755 MHz	23 dBm
LTE-FDD(B5) – non EU	824-849 MHz	23 dBm
LTE-FDD(B7)	2500-2570 MHz	23 dBm
LTE-FDD(B8)	880-915 MHz	23 dBm
LTE-FDD(B12) – non EU	699-716 MHz	23 dBm
LTE-FDD(B13) – non EU	777-787 MHz	23 dBm
LTE-FDD(B18) – non EU	815-830 MHz	23 dBm
LTE-FDD(B19) – non EU	830-845 MHz	23 dBm
LTE-FDD(B20)	832-862 MHz	23 dBm
LTE-FDD(B25) – non EU	1850-1915 MHz	23 dBm
LTE-FDD(B28) – non EU	703-748 MHz	23 dBm
LTE-FDD(B28)	703-748 MHz	23 dBm
LTE-TDD(B38)	2570-2620 MHz	23 dBm
LTE-TDD(B39) – non EU	1880-1920 MHz	23 dBm
LTE-TDD(B40)	2300-2400 MHz	23 dBm

Band	Frequency range	max. EIRP
LTE-TDD(B41) – non EU	2496-2690 MHz	23 dBm
WCDMA(B1)	1920-1980 MHz	24 dBm
WCDMA(B2) – non EU	1850-1910 MHz	24 dBm
WCDMA(B4) – non EU	1710-1755 MHz	24 dBm
WCDMA(B5) – non EU	824-849 MHz	24 dBm
WCDMA(B6) – non EU	830-840 MHz	24 dBm
WCDMA(B8)	880-915 MHz	24 dBm
WCDMA(B19) – non EU	830-845 MHz	24 dBm
GSM850	824-849 MHz	33 dBm
GSM900	880-915 MHz	33 dBm
GSM1800	1710-1785 MHz	30 dBm
GSM1900	1850-1910 MHz	30 dBm

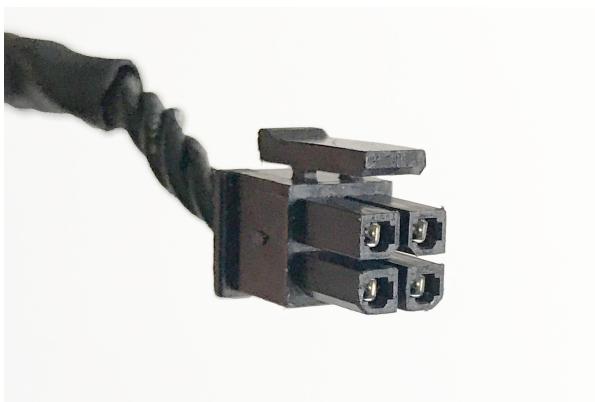
## 8. Mounting and device startup

### *Tune-up procedure for the ITS-OB4*

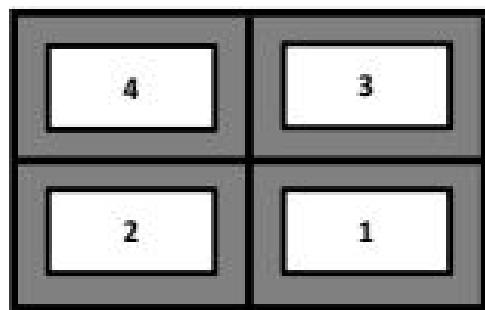
In a regular device deployment scenario the device is connected to a power supply. In advanced configuration scenarios the device needs to be connected to a computer through a serial connection port or through an Ethernet cable.

The device does not have a dedicated power switch, it will start operation immediately after it is connected to power. Make sure that all antennas are connected before powering up the device.

1. Make sure that all antennas are connected, then connect the power cable to power on the device.



**Figure 9. Power cable with Molex Micro-Fit connector**



Pin	Function
1	GND
2	IGNITION- (GND)
3	VBATT (+12V)
4	IGNITION+



**Figure 10. Power connector pinout**

2. In case an antenna(s) and/or antenna cable(s) are connected, the Tx power and EIRP need to be adjusted in accordance with the IEEE 802.11-2012 standard; considering the connector and cable losses plus calculating the gain of the antenna.

3. The Tx Power can be adjusted between 10dBm and 23dBm to operate the radio in the normal operational range.
4. Advanced configuration options can be accessed using the graphical user interface where operation frequency, bandwidth, datarate and further values can be changed on the device. The device can be identified by its IP address. Before changing any of the above listed settings, ensure that IEEE 802.11-2012 and local regulations are followed by the intended changes.

The device is powered on and ready to use.

## 9. Labeling

General information about the labeling of the product.

The product is delivered labeled with the product type (marked in the green field) and the following information.



*Example product label*