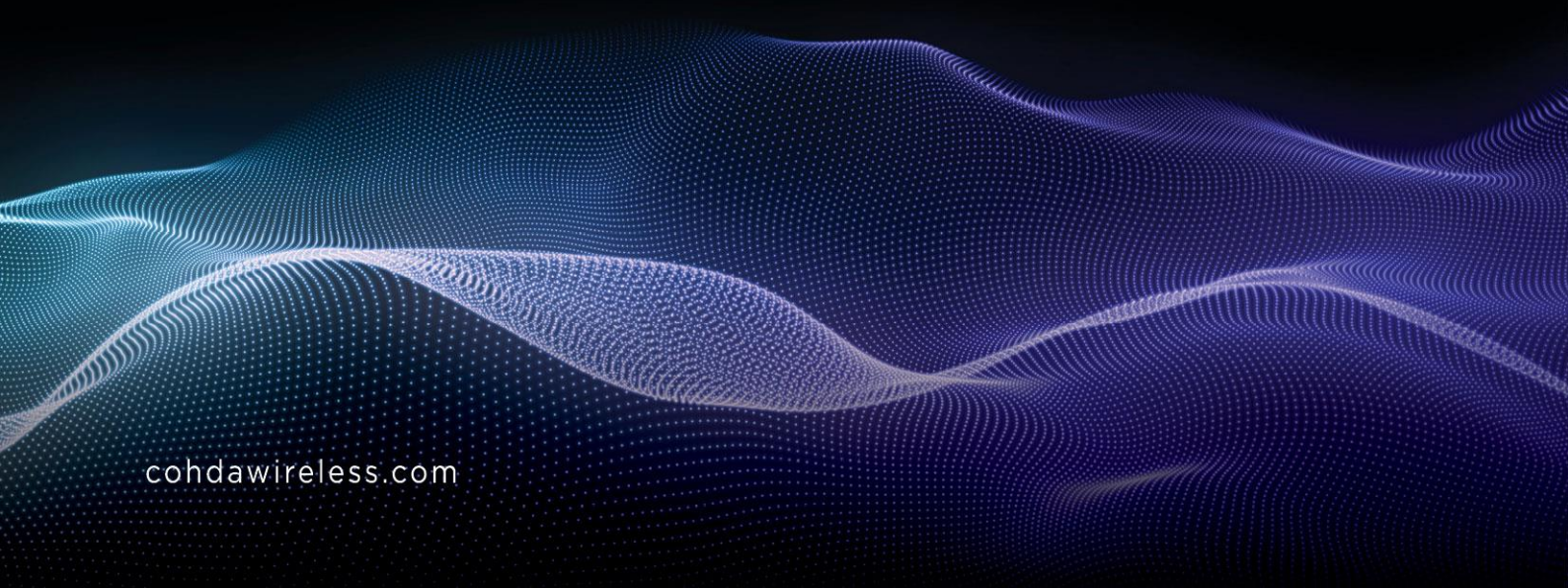
Cohda Wireless

Cohda XBU-V Specification



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Change Log

Version	Date	Comments
1	25/03/2019	Updated to new template from previous version and physical connector pinning.
1.1	06/05/2019	Minor cleanup
1.2	27/08/2019	Device Safety section added
1.3	29/08/2019	Canadian RF exposure statement added. Updated product label removed irrelevant certification info.
1.4	3/06/2020	Added FCC statement and updated product label

Contents

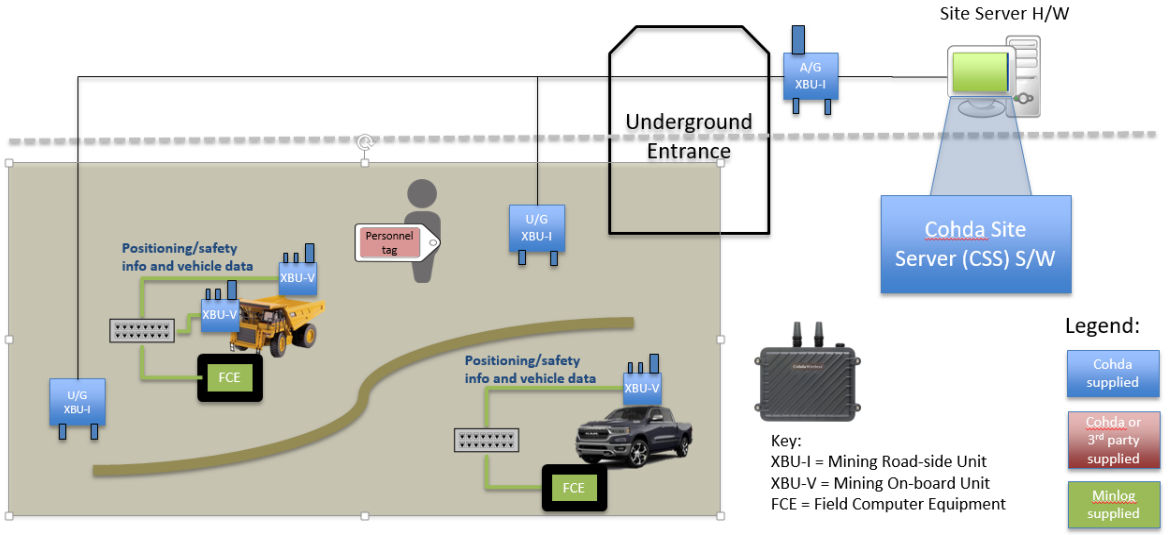
Introduction

This document presents the specification of the XBU optimized for underground/mining use.

The XBU-V kit comprises of the following:

- 2xDSRC antenna (top)
- Optional GNSS (top)
- 12V
- Ethernet for HMI
- Mounting kit
- M12 ETH connector
- M12 A-coded connector with cabling

The XBU-V is intended to be deployed within the Cohda Mining Solution offering which comprises of validated hardware components (including the Cohda XBU-I unit) and purpose built software targeting at realizing the vision of Productive Safety in the mine.



Cohda HW components	Description
XBU-I	RSU on infrastructure
XBU-V	OBU on vehicles
Antenna's	2 directional antenna's / XBU-V
Tag	Cohda TBD

Cohda's V2X-Locate engine powers the positioning aspect of the Cohda Mining Solution whilst delivering standardized V2X application concepts into the mine:

- Combines V2V collision avoidance, V2P proximity detection, and V2I asset tracking
- Cooperative positioning, works in tunnels and large cavities

Functional Specification

The current XBU-V is based on the Cohda MK5 platform and shares the functionality. The unit runs an Ubuntu 16.04 LTS, providing a flexible environment for running multiple applications. They will be briefly outlined here.

Processor

The MK5 Application Processor is an NXP i.MX6 Dual Lite processor, providing the processing power for the ITS applications. There is also a wide selection of services available to applications.

Communication Services

The MK5 system provides a range of communication services for ITS applications. All communication services are integrated within the Linux networking system. The following network protocols are provided by the MK5 platform:

- IPv6, IPv4 (Linux networking stack)
- IEEE1609.3 WSMP and WME management (Cohda WAVE networking services)
- ETSI TC-ITS G5, GN, GN6 & BTP (Cohda TC-ITS networking services)

These communication protocols are available to operate over the following communication interfaces available on the MK5 board:

- DSRC
- 10/100Mbps Ethernet
- USB 2.0

Ethernet

MK5 provides a 100Mbps Ethernet interface (10BASE-T/100BASE-TX) which can be used as part of an application or alternatively used for debugging purposes or remote status and control. The Ethernet interface is supported by Linux Ethernet device drivers, providing full IPv4/IPv6 over-Ethernet networking functionality.

Peripheral Interface Services

General purpose interface services are provided to allow interconnection with external peripheral devices and systems.

USB-OTG (optional)

A USB 2.0 on-the-go (OTG) port is optionally available as an upgrade and is supported by Linux USB host and peripheral device driver APIs.

Serial Console (optional)

The MK5 RSU provides an optional serial port upgrade via the expansion connector through which the primary operating system console is available. This port is used primarily for system development and debug operations, but may also be used by applications if required.

Timing and Positioning services

The MK5 XBU-V manages both timing and positioning services within the Cohda Mining Solution via our V2X-Locate Engine and PTP setup.

The XBU-V also employs a u-blox8 M8U GNSS receiver with concurrent support for GPS and Galileo or GLONASS constellations. The GPS receiver provides best in class tracking and navigation performance in difficult urban canyon environments. The MK5 provides position fixes at rates of up to 10 fixes/sec.

Data Storage services

MK5 provides 4GB non-volatile data storage services using on-board eMMC and standard Linux file systems.

Embedded File-System

The MK5 includes an embedded flash memory based file-system which is used for the storage of system firmware and small amounts of user application data.

General File-System

The MK5 system provides a general file-system in the form of a removable microSD card. This file-system can be used for any storage task an application may require, including the ability to log real-time data. The MK5 system includes device drivers for the microSD card.

Ancillary Services

The MK5 module software environment also provides access to System time (UTC).

The MK5 also provides power on self-test operations with the facility to log faults to the embedded file system and report faults via LEDs.

LED Indicators

The MK5 XBU-V variant has two external LED's, which are used to indicate the power and operational status:

- 1 LED to indicate the power status
    - Off - No Power
    - Solid Green - Powered On
- 1 LED to indicate the operational status
    - Off - No Power
    - Blinking Green - Start-Up
    - Solid Green - Operational
    - Amber - Firmware Update In Progress
    - Red - Fault

FIGURE 1 XBU-V FITTED WITH H+S ANTENNA

FIGURE 2: XBU-V BOTTOM CONNECTOR VIEW

Power and VIC connector

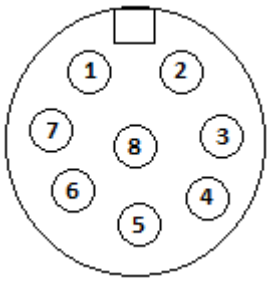
Circular Connector	Description	Drawing Female connector (Front View)
1	CAN1 N	
2	Serial RXD	
3	Serial TXD	
4	+VE	
5	GND	
6	+VE	
7	CAN1 P	
8	GND	

TABLE 1 POWER AND VIC CONNECTOR

The internal DC connector is a Molex Micro-fit 3.0 4 pin connector (43045-0400, with mating receptacle 043025-0400). It provides a 7VDC to 36VDC supply input.

The internal CAN0 interface in the XBU has no terminating resistors mounted. These must be provided externally if required (120Ω). The default speed for this interface is 500kbps.

The serial interface is provided for software functions if needed.

Ethernet Connector

The Ethernet Connector provides an RJ45 10BASE-T/100BASE Ethernet port.

Circular Connector	Description	Drawing Female connector (Front View)
1	White-Orange	
2	Orange	
3	White-Green	
4	Green	
5	White-Brown	
6	Brown	
7	White-Blue	
8	Blue	

TABLE 2 ETHERNET CONNECTOR

GPS Antenna Interface

PCB Ant3 is a 50 Ohm, Edge mount - male/plug, Key Code C FAKRA connector. This connector provides the GPS RF Antenna Input Interface. The Interface shall provide power to an Active GPS antenna, supplying a +4.7V, 50mA (max) supply.

Radio 5GHz Antenna Connectors

The internal Ant1 and Ant2 connectors provide connectivity to the two 5GHz band diversity antennas. Each connector is a 50 Ohm, Edge mount - male/plug, Key Code Z FAKRA (6GHz) connector.

IMPORTANT: Before applying power antennas (or terminators) must be connected to both 5GHz antenna connectors. Otherwise the internal PAs (Power Amplifiers) might be damaged.

Indicator LEDs

- Refer Section 0 LED Indicators

Internals

The MK5 Carrier Board is a rectangular card with dimensions 85 mm wide by 130 mm long. Figure 3 shows the physical dimensions, including the mounting hole locations (marked in blue).

Figure 4 presents the connector heights for the highest components on either side of the PCB.

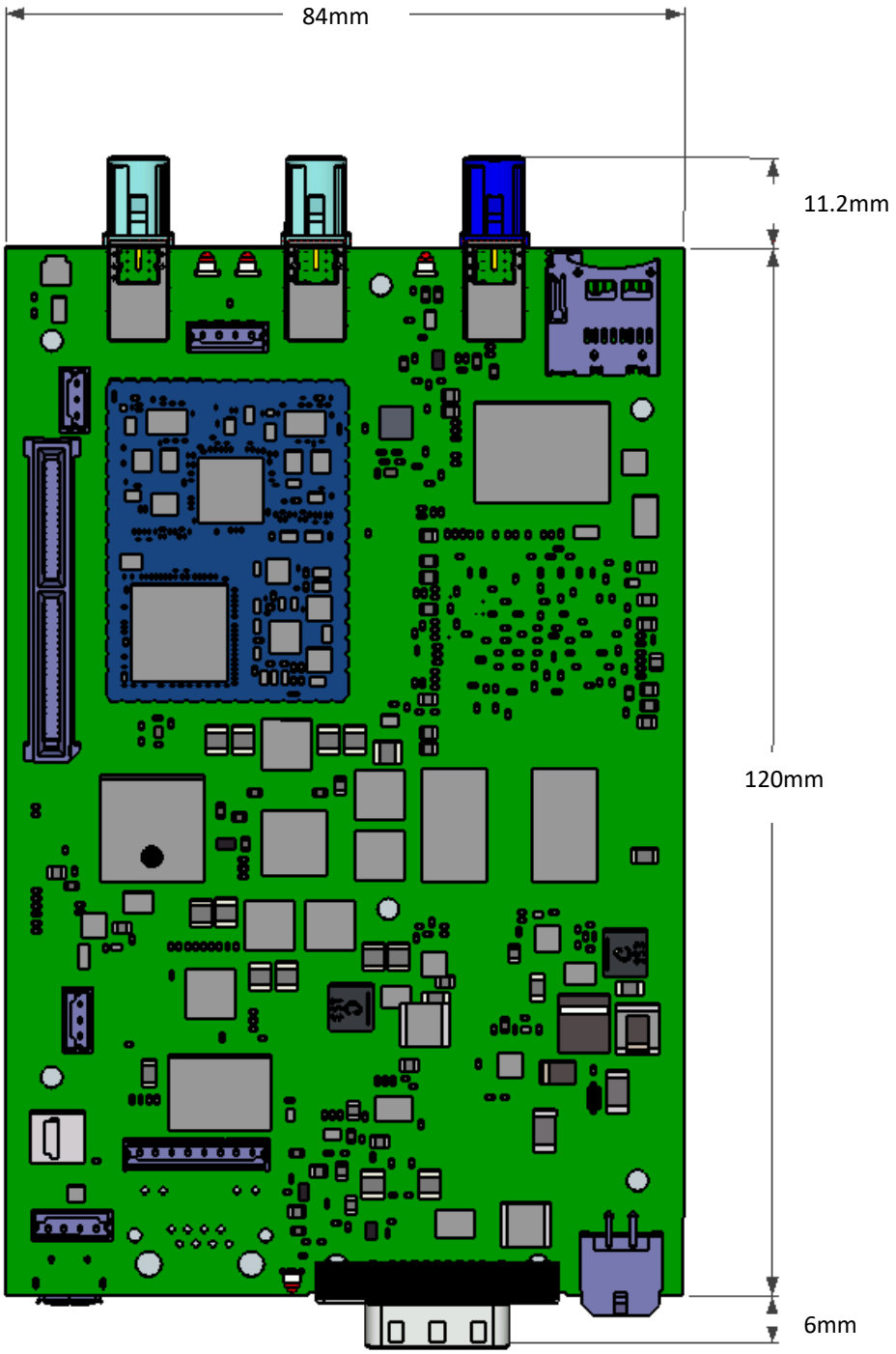


FIGURE 3 - PCB DIMENSIONS WITH MOUNTING HOLE LOCATIONS

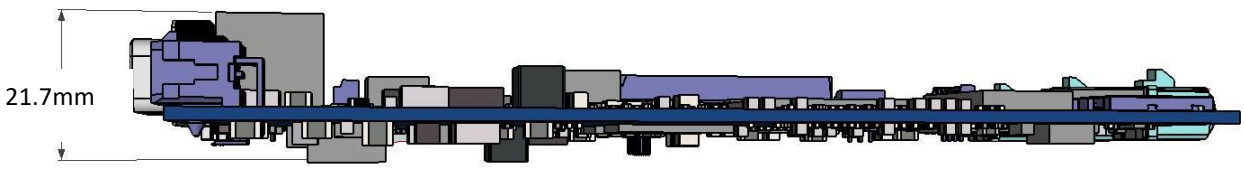


FIGURE 4 - SIDE VIEW WITH MAXIMUM CONNECTOR HEIGHTS

The height requirement is distributed with the board requiring 10 mm clearance below and 20mm clearance above. The board is designed to dissipate heat from underneath and thus should be coupled to a box or a base-plate via thermal pad material. The MK5 is mounted in a NEMA4 Compliant enclosure.

USB-OTG Connector

The USB-OTG Connector is a micro-AB USB connector, providing a USB 2.0 On-The-Go (OTG) interface (up to 480Mbps operation). Being an OTG interface, either a peripheral or host USB device can be connected to this interface. When operating as a host this port provides the USB +5V Vbus supply with 500mA current limiting.

microSD Card Socket

The microSD card socket accepts microSD flash cards to provide an external flash-based file system for the MK5. The interface supports either 1 bit or 4 bit transfers. The RSU has an 8GB microSD card installed.

Reset switch

The MK5CB provides a push-button reset switch on units configured with this which provides a full system-reset of the unit. This switch is not externally accessible.

XBU-V Enclosure

The enclosure is designed to comply with the following NEMA4 requirements:

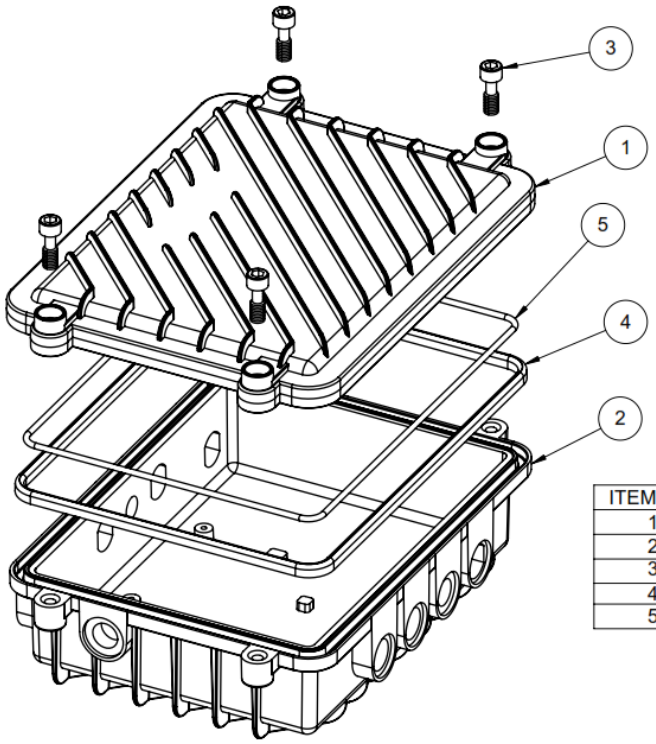
- Indoor / Outdoor use, providing a degree of protection to personnel against access to hazardous parts
- Provide protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and windblown dust)
- Provide protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure.

The inside of the enclosure is arranged such that there is increased thermal coupling between the warm components on the PCB and the metal enclosure by way of customised heat spreaders embedded in the aluminium cast.

The enclosure provides:

- NEMA4/IP67 compliance
- Die-cast Aluminium with a grey Powder-Coat finish
- Complete set of mounting holes for PCB

The outline of the NEMA4 enclosure (SEI-004) is presented in Figure 5 and Figure 6.



Material Specification

Aluminum Alloy 413

Finish Specification

Option 1: Powder Coated

Option 2: Baked Enamel

Option 3: Bead Blast

Option 4: Sand Blast

Weight

Base: 530 Grams

Lid: 295 Grams

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	MA-401	SEI-004 LID	1
2	MA-402	SEI-004 BASE	1
3	MA-403	M6-1x18 Cap Screw	4
4	MA-404	Rubber Gasket	1
5	MA-405	EMI Gasket	1

FIGURE 5 - 3D OUTLINE OF THE XBU ENCLOSURE

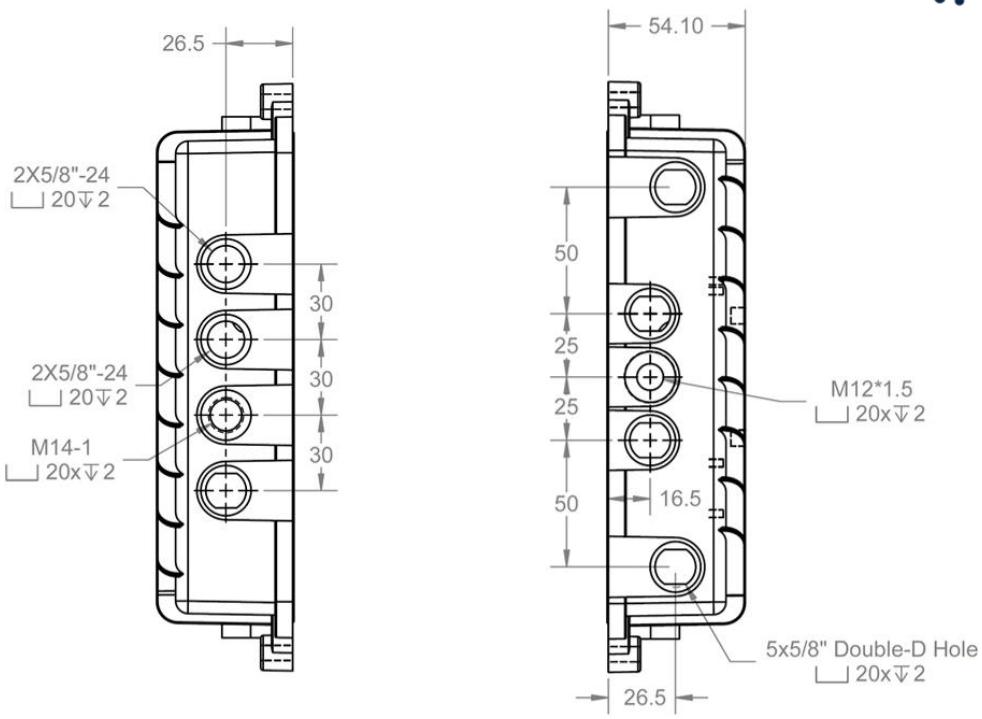


FIGURE 6 - 2D OUTLINE OF THE XBU ENCLOSURE

The connector openings are designed to support the following waterproof interface:

- LED
- Ethernet
- N-Type Connectors
- Serial/CAN
- All unused openings are sealed (2mm wall thickness) during enclosure fabrication.

The side of the enclosure shall have provision for the Cohda Wireless logo and a 30mm x 40mm cleared area for regulatory (FCC, IC, UL) and Cohda's Serial Number markings. Location of the product label is presented in Figure 7.

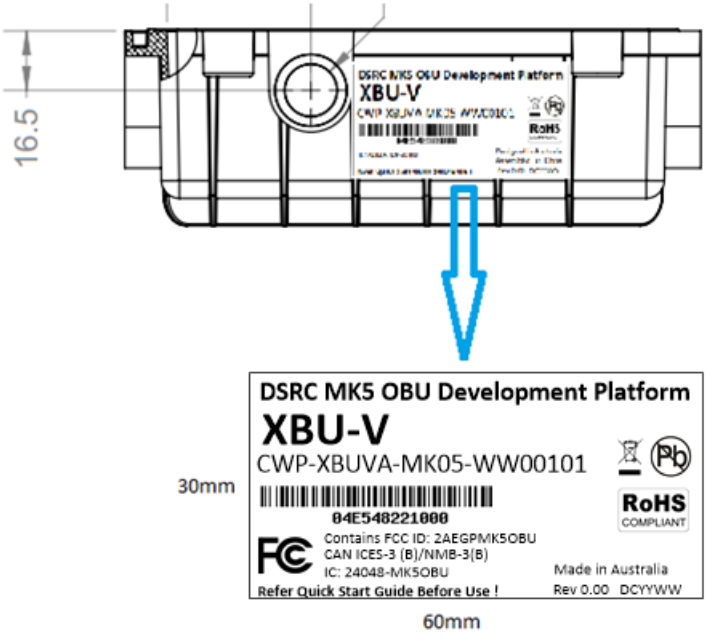


FIGURE 7 - LOCATION OF PRODUCT AND REGULATORY LABEL

XBU Mounting Kit

The XBU has a flat surface, four mounting holes and is capable of accepting a mounting bracket. Size and location of these mounting holes are illustrated in Figure 8 below.

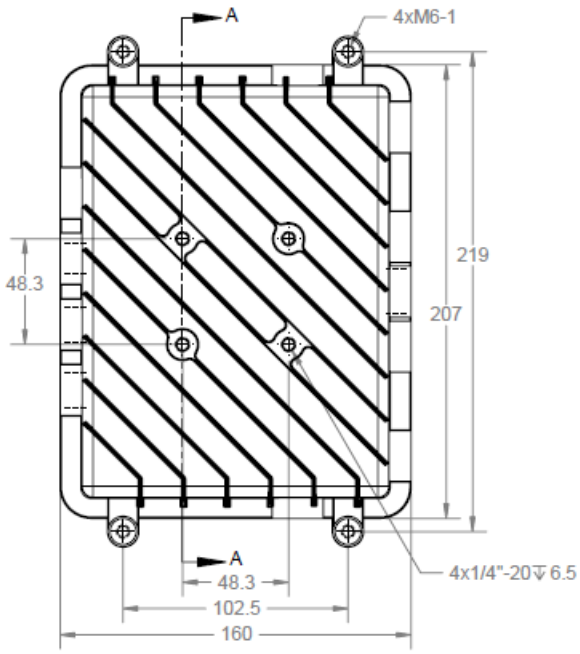


FIGURE 8 - XBU ENCLOSURE MOUNTING HOLE

An example of the light weight magnet mounting kit is presented in Figure 9 and Figure 10. A stainless steel pole mount kit is also available as optional item.

- Pole Mount Kit
    - SEI P/N: BKT-002

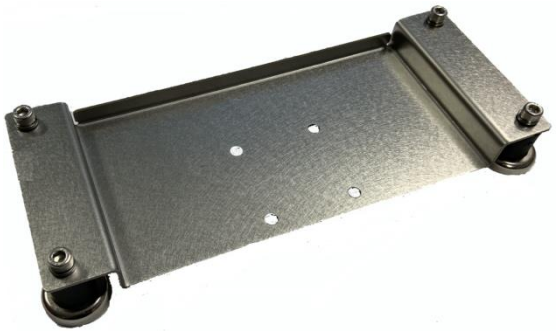


FIGURE 9 - POLE MOUNT KIT (ADAPTOR PLATE)

FIGURE 10 –MAGNETIC MOUNT

Weight

The XBU-V, including GNSS and DSRC antennas, weighs approximately 3kg.

Device Safety

The device must be installed in such a way that a separation of at least 20cm or more between the device antennas and the closest unintentional human proximity is guaranteed. Otherwise compliance with radiated emission minimum human exposure regulations will become invalid.

Approval and Compliance

This equipment complies with Canada radiation RF exposure limits set forth in Industry Canada RSS-102 for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and the body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le produit a ete teste pour le marche Canadien RSS-102 et suit les limites de radio puissance emises pour l utilisation a ciel ouvert. Le produit ne peut pas etre installe et utilise a une distance de moins de 20cm de tout corps humain. Le produit ne doit pas etre place au meme endroit qu un autre produit emettant des ondes radios.

Federal Communications Commission (FCC) Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Federal Communications Commission (FCC) Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

Others

The MK5 RSU is RoHS and Lead-Free compliant. It complies with the "Directive 2011/65/EU of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

References

[1] Cohda MK5 RSU specifications. CWD-P0052-RSU-SPEC-WW01-187-MK5_RSU_Specification.docx, 31 Oct 2017

Appendix