



CONNECTIVITY UNIT “CU02” USER MANUAL

Date 30/09/2025

Issue 0.2

Product	CU02			
Type	Connectivity Unit CU02, available in four different variants: - CU02 MINI (P/N 800-007-001) - CU02 MID (P/N 800-007-002) - CU02 MAXI (P/N 800-007-003) - CU02 MAXI EXT GPS (P/N 800-007-004)			
Brief description	This document summarizes all the main technical specifications of the CU02 device that are useful to the user and to the OEM operator, providing the summary of product interfaces and all the installation requirements.			
Remark				
Issue	Date	Authors	Approver	Note
0.1	22/01/2025	Matteo Pasquini	Diego Delvecchio	Document generated from "CU02_DataBrief_v1.2" (paragraphs from 1 to 4 and from 7 to 8)
0.2	30/09/2025	Matteo Pasquini	Diego Delvecchio	Updated §6.2 and §6.3 as requested for FCC certification

1 Index

2	Figures list	2
3	Tables list	3
4	Introduction	4
4.1	Purpose	4
4.2	Standards	4
4.3	Acronyms.....	6
5	ECU Manual - Technical specifications.....	7
5.1	External ECU dimensions	13
5.2	External Antenna	13
5.3	ECU pinout	14
6	ECU Manual – Installation and Safety Requirements	17
6.1	ECU installation guidelines	17
6.2	FCC radio installation notes.....	18
6.3	IC/ISED radio installation notes.....	19

2 Figures list

Figure 8	CU02 Technical drawing	13
Figure 9	CU02-MaxiEXTGPS external antenna drawing	13
Figure 10:	CU02 on-vehicle positioning with possible upper surfaces	17

3 Tables list

Table 1 Standards.....	5
Table 2 Acronyms	6
Table 6 CU02 Technical Features	12
Table 7 - ECU Mini connector A pinout.....	14
Table 8 - ECU Mid connector A pinout.....	15
Table 9 - ECU Mid connector B pinout.....	15
Table 10 - ECU Maxi connector A pinout.....	16
Table 11 - ECU Maxi connector C pinout.....	16

4 Introduction

4.1 Purpose

The CU02 is an e-Shock telematic control unit, specifically designed to offer remote connectivity, enhanced Bluetooth connectivity, capability in handling multimedia data stream and support for data exchange and notifications through the OEM's Cloud Data Storage.

The CU02 will target application in motorcycles, off-highway vehicles and automotive OEM.

This document summarizes all the main technical specifications of the CU02 device that are useful to the user and to the OEM operator, providing the summary of product interfaces and all the installation requirements.

4.2 Standards

ID	Code	Title
STD01	ISO 16750-3	Road Vehicles - Environmental conditions and testing for electronic equipment.
STD02	EN 60529	EN 60529 - Degrees of protection provided by enclosures.
STD03	ISO 7637-1	Road Vehicles - Electrical disturbance from conduction and coupling - Part 1: Definitions and general considerations.
STD04	ISO 7637-2	Road Vehicles - Electrical disturbance from conduction and coupling - Part 2: Electrical transient conduction along supply lines only on vehicles with nominal 12 V or 24 V supply voltage.
STD05	ISO 11452-1	Road Vehicles - Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 1: General principles and terminology.
STD06	ISO 11452-2	Road Vehicles - Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 2: Absorber-lined shielded enclosure.
STD07	ISO 11452-3	Road Vehicles - Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 3: Transverse electromagnetic mode (TEM) cell.

STD08	ISO 11452-4	Road Vehicles - Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 4: Bulk current injection (BCI).
STD09	ISO 10605	Road Vehicles - Test methods for electrical disturbances from electrostatic discharge
STD10	UNECE R-10	UN Regulations - Environmental compatibility: electromagnetic compatibility

Table 1 Standards

4.3 Acronyms

Acronym	Description
IDE	Integrated Development Environment
HW	Hardware
ECP	e-Shock Cloud Platform
ECU	Electronic Control Unit
N/A	Not Applicable
OEM	Original Equipment Manufacturer/Market
SW	Software
VCU	Vehicle Control Unit
ECP	e-Shock Cloud Platform
FOTA	Firmware Over the Air

Table 2 Acronyms

5 ECU Manual - Technical specifications

The main technical characteristics of the CU02 ECU, depending on product variants, are listed here:

Power	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Input Voltage range	8 - 28 V with overvoltage and reverse polarity inversion protection		
Internal Back-up Battery	500 mAh Li-Ion battery (2 Wh)		
CORE	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
MCU	Dual-core microprocessor: - ARM Coretx-A7 32-bit, running Yocto - ARM Cortex-M4 32-bit		
Flash Memory	8 GB eMMC		
CELLULAR	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Technology	LTE Cat 1 bis up to 10,3 Mbit/s DL, up to 5.2 Mbit/s UL GSM/GPRS fallback		
SIM	eSIM MFF2		
Data Support	SMS (text/data)		
GNSS	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Constellation GNSS	GPS, BeiDou, Galileo, GLONASS, SBAS and QZSS		
Position accuracy	1,5m CEP CEP, 50%, 24 hours static, -130 dBm, > 6 SVs for each GNSS system.		

	GPS in combination with SBAS and QZSS.		
Speed accuracy	0,05 m/s		
Update rate	>= 10 Hz (25 Hz available in high-performance mode)		
BLUETOOTH	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Standard	-	Bluetooth 5.2 BR / EDR / LE	
Wi-Fi	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Frequencies	-	2.4GHz	
Standard	-	Single-band IEEE 802.11b/g/n	
Network Topology	-	AP and STA dual mode	
RF POWER			
Wi-Fi		WiFi IEEE 802.11b: 19.6dBm EIRP max WiFi IEEE 802.11g: 15.6dBm EIRP max WiFi IEEE 802.11n: 14.6dBm EIRP max	
BT - BLE		BT: 14.6dBm EIRP max BLE: 10.6dBm EIRP max	
CELLULAR	2 W (33 dBm ± 2dB) – Class 4 @ GSM 900 1 W (30 dBm ± 2dB) – Class 1 @ DCS 1800 0.2 W (23 dBm ± 2,7 dB) – Class 3 @ E-UTRA LTE		
RF FREQUENCY BANDS			
Wi-Fi		2412 – 2472 MHz	
BT - BLE		2402 – 2480 MHz	
CELLULAR	GSM/GPRS: E-GSM 900, DCS 1800 E-UTRA LTE FDD: 2100 (B1) / 1800 (B3) / 2600 (B7) / 900 (B8) / 800 (B20) / 700 (B28)		

	E-UTRA LTE TDD: 2600 (B38) / 2300 (B40) / 2500 (B41)		
SENSORS	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
IMU	6 Axis inertial sensor		
Temperature	Temperature sensor embedded in the IMU		
DIAGNOSTIC PROTOCOL	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Data	CAN Bus Data (FD / STD)		
Data Reading	ISO 15765-4 CAN (11 bit ID) ISO 15765-4 CAN (29 bit ID) - [Ready but not implemented]		
INTERFACES	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Connector (TCU-Mini)	JST JWPF 6P-MALE	JST JWPF 6P-MALE + JST JWPF 4P-FEMALE	JST JWPF 6P-MALE + JST JWPF 8P-FEMALE
GNSS Antenna	Internal High Gain	Internal High Gain Gain	Internal High Gain (on CU02-Maxi) External High Gain ANTDOM-05-01-WPM with U.FL connector (on CU02-MaxiEXTGPS)
Cellular Antenna	Internal High Gain		
CAN BUS Lines	1 channel CAN	2 channels CAN	
CAN BUS Type	2.0 and FD, Standard and Extended supported		
Audio interface	-	-	Ready for External Microphone (1x analog input) and up-to-15W Mono Speaker (Mono - 8 to 20 Ohm)

PHYSICAL SPECIFICATION			
	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Dimensions	87 x 51 x 26 mm (L x W x H) 96 x 51 x 26 mm (L x W x H) (grommet included)		
Weight	< 150 g		
Housing	PA6 Glass Fiber 30% - UL94 V0 class		
OPERATING ENVIRONMENT			
	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS
Operating Temperature	-20 °C to +45 °C (with backup battery included)*		
Internal Battery Charge Temperature	10 °C to +45 °C		
Internal Battery Discharge Temperature	-20 °C to +60 °C		
Recommended Storage Temperature (for less than 1 month)	-20 °C to +45 °C (limits for preserving battery lifetime)		
Recommended Storage Temperature (for more than 3 months)	-10 °C to +45 °C (limits for preserving battery lifetime)		
Ingress Protection Rating	IP65		

CERTIFICATIONS	CU02-Mini	CU02-Mid	CU02-Maxi / CU02-MaxiEXTGPS																																														
E-Mark	Yes																																																
Safety	According to EN 62368-1																																																
EMC	According to EN 301 489-1/-17/-19/-52																																																
EMF	According to EN 62311																																																
Radio Certifications	Wi-Fi 2.4GHz, BT, LTE & GNSS CE (RED Directive 2014/53/EU) UKCA, FCC and ISED																																																
Vibration resistance	According to ISO 16750-3 Par.4.1.2.4 and following table <table><tr><th>Axis</th><th>Frequency [Hz]</th><th>Power Spectral Density [((m/s^2)^2)/Hz]</th><th>Duration [h]</th></tr><tr><td rowspan="6">X-Axis</td><td>10</td><td>20</td><td rowspan="6">1</td></tr><tr><td>55</td><td>6.5</td></tr><tr><td>180</td><td>0.25</td></tr><tr><td>300</td><td>0.25</td></tr><tr><td>360</td><td>0.14</td></tr><tr><td>1000</td><td>0.14</td></tr><tr><td rowspan="6">Y-Axis</td><td>10</td><td>20</td><td rowspan="6">1</td></tr><tr><td>55</td><td>6.5</td></tr><tr><td>180</td><td>0.25</td></tr><tr><td>300</td><td>0.25</td></tr><tr><td>360</td><td>0.14</td></tr><tr><td>1000</td><td>0.14</td></tr><tr><td rowspan="6">Z-Axis</td><td>10</td><td>20</td><td rowspan="6">1</td></tr><tr><td>55</td><td>6.5</td></tr><tr><td>180</td><td>0.25</td></tr><tr><td>300</td><td>0.25</td></tr><tr><td>360</td><td>0.14</td></tr><tr><td>1000</td><td>0.14</td></tr></table>			Axis	Frequency [Hz]	Power Spectral Density [((m/s^2)^2)/Hz]	Duration [h]	X-Axis	10	20	1	55	6.5	180	0.25	300	0.25	360	0.14	1000	0.14	Y-Axis	10	20	1	55	6.5	180	0.25	300	0.25	360	0.14	1000	0.14	Z-Axis	10	20	1	55	6.5	180	0.25	300	0.25	360	0.14	1000	0.14
Axis	Frequency [Hz]	Power Spectral Density [((m/s^2)^2)/Hz]	Duration [h]																																														
X-Axis	10	20	1																																														
	55	6.5																																															
	180	0.25																																															
	300	0.25																																															
	360	0.14																																															
	1000	0.14																																															
Y-Axis	10	20	1																																														
	55	6.5																																															
	180	0.25																																															
	300	0.25																																															
	360	0.14																																															
	1000	0.14																																															
Z-Axis	10	20	1																																														
	55	6.5																																															
	180	0.25																																															
	300	0.25																																															
	360	0.14																																															
	1000	0.14																																															
Shock resistance	According to ISO 16750-3 Par.4.2.2 and following table																																																

	<table><tr><th>Axis</th><th>Acceleration [m/s^2]</th><th>Duration [ms]</th><th>Temperature [°C]</th><th>Pulse Shape</th><th>Number of Shocks</th></tr><tr><td>X- Axis</td><td>500</td><td>6</td><td>Room temperature</td><td>Half-sinusoidal</td><td>5 positive dir. 5 negative dir.</td></tr><tr><td>Y- Axis</td><td>500</td><td>6</td><td>Room temperature</td><td>Half-sinusoidal</td><td>5 positive dir. 5 negative dir.</td></tr><tr><td>Z- Axis</td><td>500</td><td>6</td><td>Room temperature</td><td>Half-sinusoidal</td><td>5 positive dir. 5 negative dir.</td></tr></table>	Axis	Acceleration [m/s^2]	Duration [ms]	Temperature [°C]	Pulse Shape	Number of Shocks	X- Axis	500	6	Room temperature	Half-sinusoidal	5 positive dir. 5 negative dir.	Y- Axis	500	6	Room temperature	Half-sinusoidal	5 positive dir. 5 negative dir.	Z- Axis	500	6	Room temperature	Half-sinusoidal	5 positive dir. 5 negative dir.
Axis	Acceleration [m/s^2]	Duration [ms]	Temperature [°C]	Pulse Shape	Number of Shocks																				
X- Axis	500	6	Room temperature	Half-sinusoidal	5 positive dir. 5 negative dir.																				
Y- Axis	500	6	Room temperature	Half-sinusoidal	5 positive dir. 5 negative dir.																				
Z- Axis	500	6	Room temperature	Half-sinusoidal	5 positive dir. 5 negative dir.																				
Humidity resistance	According to EN 60068-2-30 (2 cycles 12+12h)																								
Salt spray resistance	According to EN 60068-2-11 (168h)																								
IP rating	According to EN 62529 with IP65 rating																								

Table 3 CU02 Technical Features

* All components with the exception of battery are dimensioned for industrial range -40 °C to +85 °C

5.1 External ECU dimensions

The external dimension of the ECU for all variants are shown below:

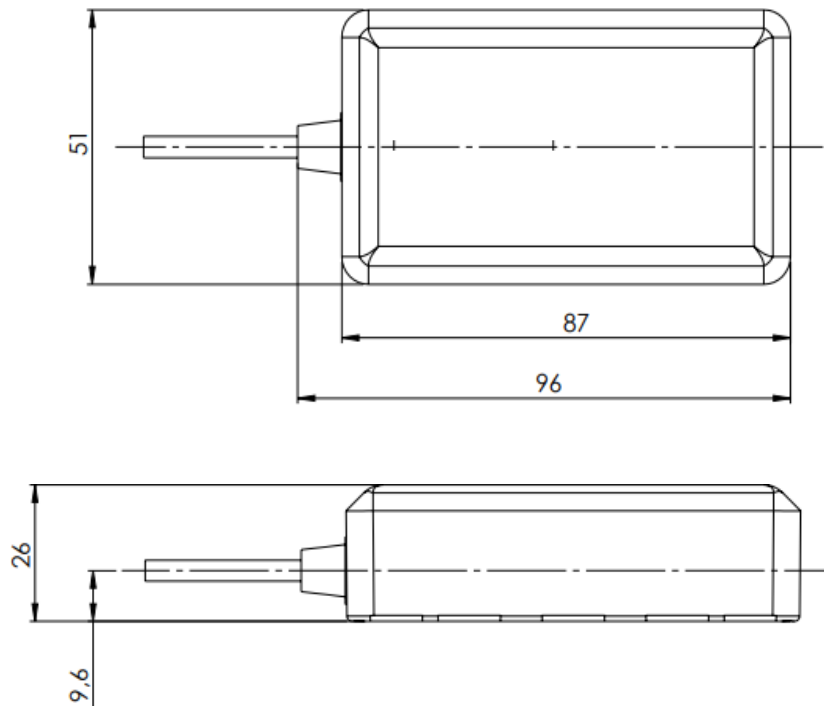


Figure 1 CU02 Technical drawing

5.2 External Antenna

The external antenna used and needed only for CU02-MaxiEXTGPS (p/n 800-007-004) is the p/n ANTDOM-05-01-WPM by Invented Systems. Its dimensions are as reported in the following picture:

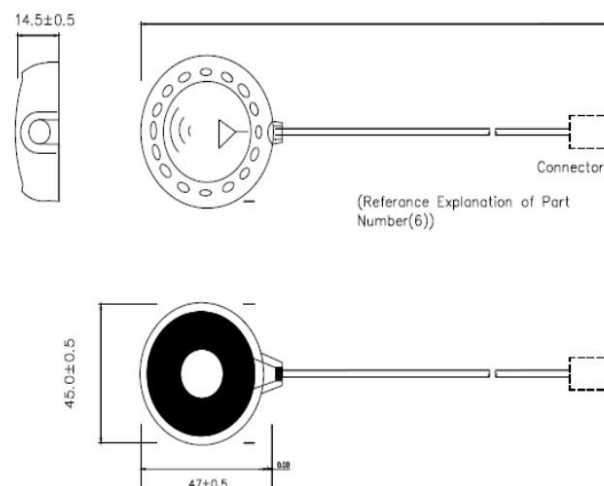


Figure 2 CU02-MaxiEXTGPS external antenna drawing

5.3 ECU pinout

For each variant, in the next sections you can find the connectors pinout and cables specification.

ECU MINI

Connector A:



- JST 06T-JWPF-VSLE-D

# PIN	KL CODE	DESCRIPTION
1	CAN1_H	CAN1_H
2	CAN1_L	CAN1_L
3	KL15	IGNITION
4	KL30	VBATT
5	NC	NOT CONNECTED
6	KL31	GND

Table 4 - ECU Mini connector A pinout

Cable:

- 5 channels AWG 24
- -40°C ~ 105°C
- UL Style 20387
- External diameter 5,59 mm
- Length: 15 cm

ECU MID

Connector A:



- JST 06T-JWPF-VSLE-D

# PIN	KL CODE	DESCRIPTION
1	CAN1_H	CAN1_H
2	CAN1_L	CAN1_L
3	KL15	IGNITION
4	KL30	VBATT
5	NC	NOT CONNECTED
6	KL31	GND

Table 5 - ECU Mid connector A pinout

Connector B:



- JST JWPF 4P-FEMALE

# PIN	DESCRIPTION
1	CAN2_H
2	CAN2_L
3	GND
4	DIGITAL_OUT

Table 6 - ECU Mid connector B pinout

Cable:

- 9 channels AWG 26
- -50°C ~ 90°C
- UL Style 21959
- External diameter 5,87mm
- Length: 15cm

ECU MAXI

Connector A:



- JST 06T-JWPF-VSLE-D

# PIN	KL CODE	DESCRIPTION
1	CAN1_H	CAN1_H
2	CAN1_L	CAN1_L
3	KL15	IGNITION
4	KL30	VBATT
5	NC	NOT CONNECTED
6	KL31	GND

Table 7 - ECU Maxi connector A pinout

Connector C:



- JST JWPF 8P-FEMALE

# PIN	DESCRIPTION
1	CAN2_H
2	CAN2_L
3	GND
4	SPEAKER_OUT
5	5V
6	SWITCH_IN
7	MIC_IN-
8	MIC_IN+

Table 8 - ECU Maxi connector C pinout

Cable:

- 15 channels AWG 26
- -35°C ~ 105°C
- UL style 2464
- External diameter: 6,3mm
- Length: 15cm

6 ECU Manual – Installation and Safety Requirements

6.1 ECU installation guidelines

To grant the correct behaviour of the connectivity unit CU02 and to respect technical and safety requirements, CU02 shall be installed on vehicle following the indications below:

1. Distance from other ECUs:

- The device **must be installed at a minimum distance of 20cm** from any other ECU equipped with **radio communication** (i.e. Bluetooth modules, Wi-Fi, or other transmitting devices).
- It is recommended, even if not strictly mandatory/necessary, to grant a minimum distance of 20cm also from **non-radio** ECUs which could potentially disturb the correct CU02 functioning (i.e. control units for electronic actuation or powertrain management).

2. Positioning with respect to metallic surfaces or shielding materials:

- The device's **upper surface** (surface marked with 1 or 2 in below picture depending on how the device is installed on vehicle) **must be free of shielding surfaces** such as metal or carbon, to grant a good **sky view** to optimize GPS performances and radio communication.

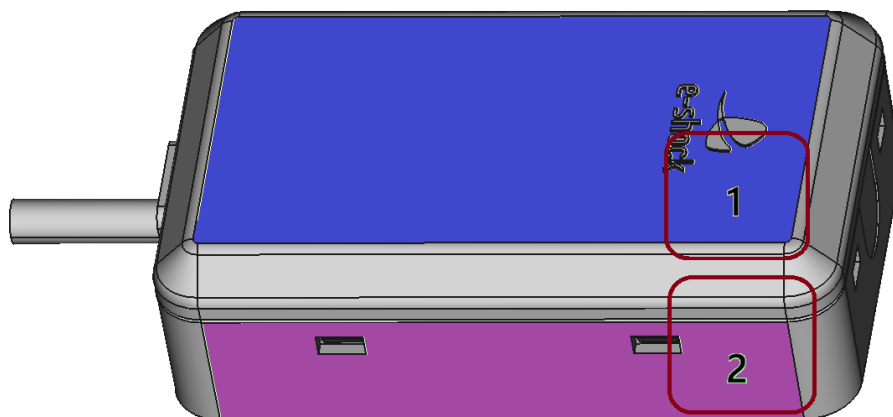


Figure 3: CU02 on-vehicle positioning with possible upper surfaces

- The device's **lower surface** (so the opposite surface of 1 or 2 depending on device installation) can be installed upon metal or conductive parts. This could benefit the CU02 both in terms of **heating dissipation and GPS performances**, assuming that the upper surface is exposed to open sky like stated before.

Moreover since the device has an embedded Lithium Battery

These requirements are mandatory to grant an optimal behaviour of the CU02 device and to grant conformity to radio standards and operational needs.

It is highly recommended to execute performance tests before freezing the device installation position on vehicle.

6.2 FCC radio installation notes

- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. 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.
- The device model CU02-Mini (p/n 800-007-001) contains:
FCC ID: XPYUBX22EL01 IC:8595A-UBX22EL01
- The device models CU02-Mid, CU02-Maxi and CU02-MaxiEXTGPS (p/n 800-007-002, 800-007-003 and 800-007-004) contain:
FCC ID: 2BOUM-CU02 FCC ID: XPYUBX22EL01 IC: 33848-CU02 IC:8595A-UBX22EL01
- Responsible party's contact located in the United States:
Company Name: +1 Compliance LLC
Physical U.S. Company Address: 2113 Huron Circle, Denton, Texas 76210 USA
FRN: 0033497389
Agent name: Benjamin W. Tidwell
Agent Email Address: contact@1compliant.com
- 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 into 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.
- This product complies with FCC and ISED radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.
- This radio transmitter has been approved to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated, are strictly prohibited for use with this device.

Quectel type YFCA002AA:

Frequency (MHz)	700	960	1710	1990	2170	2300	2400	2500	2680
Gain (dBi)	-1.15	0.97	0.7	2.17	1.57	3.42	4.01	3.88	2.51

Murata type 1DX: 0.6 dBi (max)

6.3 IC/ISED radio installation notes

- Responsible party's contact located in the Canada:
 Company Name: Canadian Certification Consulting Inc.
 Company Number1: 10842A
 Company Address: 2210 Horizon Drive, Suite 17, West Kelowna BC, V1Z 3L4, Canada
 Contact Name: Jon Hughes
 Phone Number: 1-250-575-1719
 Email: info@can-cert.com
- This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
 1. This device may not cause interference.
 2. This device must accept any interference, including interference that may cause undesired operation of the device.
- L'émetteur/recepteur exempt de licence contenu dans le present appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
 1. L'appareil ne doit pas produire de brouillage.
 2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement du dispositif.
- ICES-003 Class B Notice - Avis NMB-003 Classe B: This Class B digital device complies with Canadian ICES-003. Cet appareil numérique classe B est conforme à la norme NMB-003 du Canada. CAN ICES-3 (B) / NMB-3 (B)
- This radio transmitter has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed in ISED filing, with the maximum permissible gain indicated. Antenna types not included in that list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

List of approved antennas:

Quectel type YFCA002AA:

Frequency (MHz)	700	960	1710	1990	2170	2300	2400	2500	2680
Gain (dBi)	-1.15	0.97	0.7	2.17	1.57	3.42	4.01	3.88	2.51

Murata type 1DX: 0.6 dBi (max)

- Le présent émetteur radio a été validé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés dans ISED dépôt avec indication du gain maximum autorisé. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour fonctionner avec cet appareil.
- This product complies with ISED radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with ISED multi-transmitter product procedures.

- Cet appareil est conforme aux limites d'exposition aux rayonnements de l'ISED pour un environnement non contrôlé. L'antenne doit être installée de façon à garder une distance minimale de 20 centimètres entre la source de rayonnements et votre corps.

Cet appareil et son (ses) antenne(s) ne doivent pas être co-localisés ou utilisés en conjonction avec une autre antenne ou un autre émetteur, sauf en conformité avec les procédures du produit multi-émetteur de la ISED. This device complies with Health Canada's Safety Code. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement. Cet appareil est conforme avec Santé Canada Code de sécurité 6. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada.