



SiBEAM Snap™

**OEM Module Installation Guide for
MOD6212/13**

Introduction

The Lattice Semiconductor MOD6212/13 Wireless module provides a data interface compatible with USB device, which allows reception/transmission of various data rate from/to any USB compliant device. OEM can develop a system equipped with this module to wirelessly connect their high data sources to the target device.

The MOD6212/13 modules fit into a variety of industrial designs. No software needs to initialize and to control the module to achieve the wired connectivity offered. The MOD6212/13 module is a completely self-contained autonomous wireless sub-system that connects to a system board that provides the wired connectivity from a single port to a full featured multiport, multi-standard system. The advantage of this design is that the complexity of the wireless system, radio performance, regulatory requirements, and compliance to standards are all eliminated. This system interface carries data, power, and control signals. The module is pre-certified and is fully tested for fast time-to-market.

MOD6212/13 Diagram

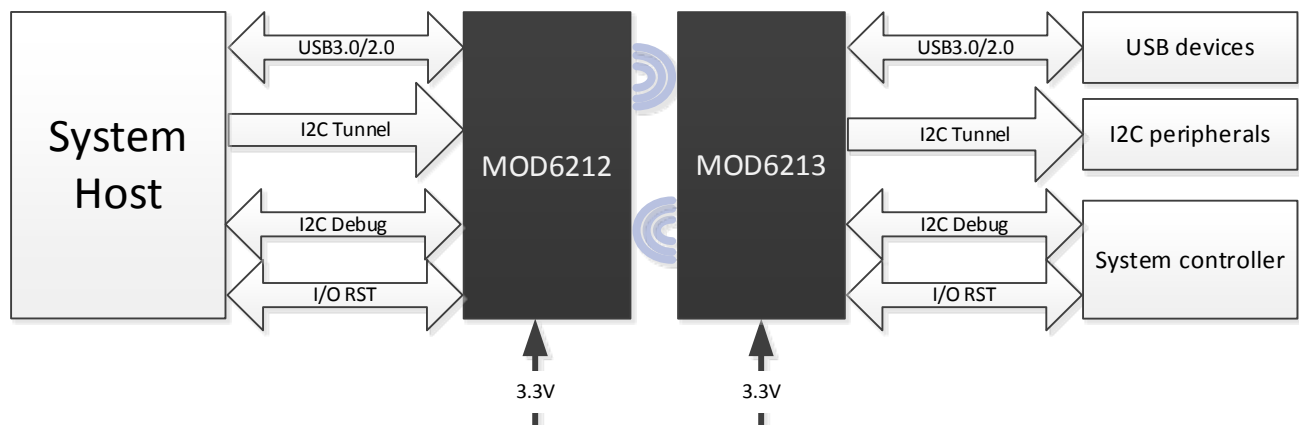


Figure 1. MOD6212/13 Transceiver Module Wireless connector principle

MOD6212/13 transceiver Features

- USB 3.0 and 2.0 connections: SS, HS, FS, LS.
- Up to 6Gbps full duplex data-rate
- I²C tunneling for remote I²C connections
- Fully automatic device detection and connection
- Close proximity operation
- Single chip IC, direct connector replacement
- Integrated antenna
- No software driver required

MOD6212/13 Transceiver Module Dimensions

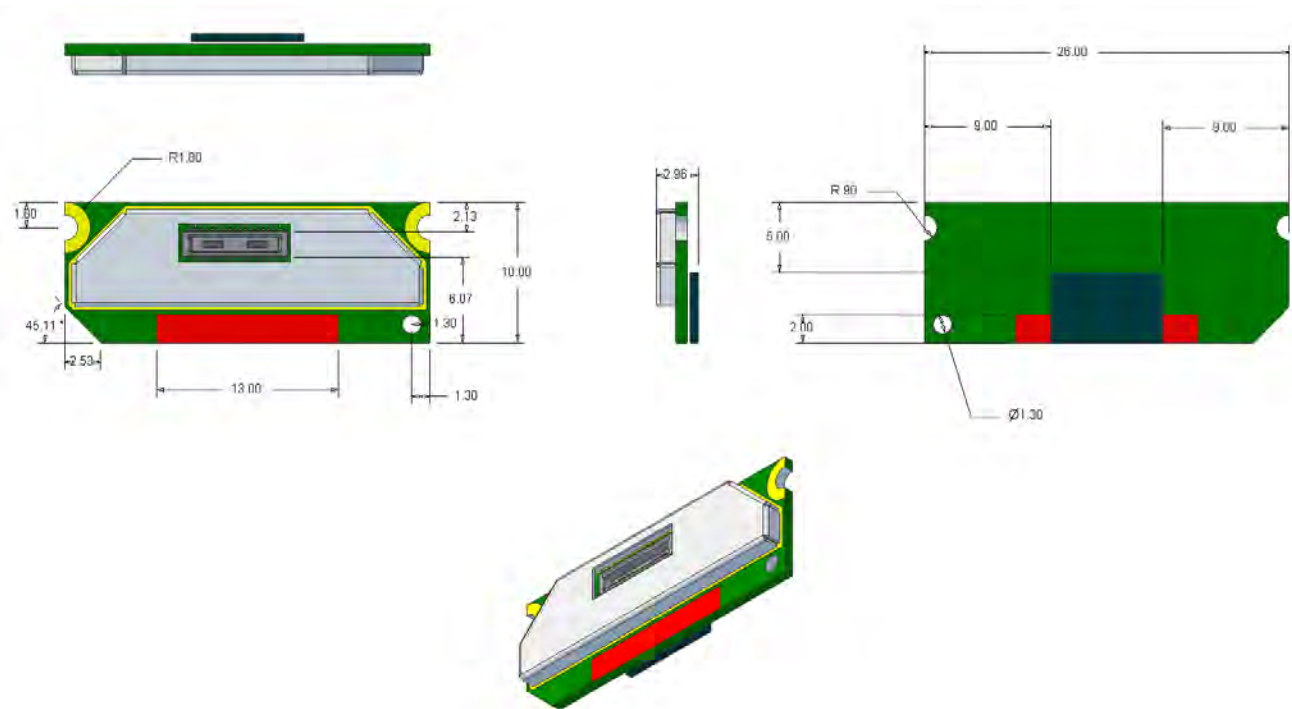


Figure 2. MOD6212/13 Transceiver Module Dimension (in mm)

MOD6212/13 Transceiver Module Pinout

Table 1. Signal pinout

Pin	Name	Type	Dir	Group	Description
1	3V3	Power	Input	Power	3.3V +/-5% power supply
2	SCL	Digital	In/Out O.D.	I ² C	I ² C Clock, Tunneling port. SB6210/SB6212 Connect to Master; SB6211/SB6213 Connect to Slave
3	3V3	Power	Input	Power	3.3V +/-5% power supply
4	SDA	Digital	In/Out O.D.	I ² C	I ² C Data, Tunneling port. SB6210/SB6212 Connect to Master; SB6211/SB6213 Connect to Slave
5	3V3	Power	Input	Power	3.3V +/-5% power supply
6	SCL_DBG	I ² C	Bi-Dir	USB	I ² C Data, Debug port. Connection to debug controller not required for normal operation.
7	GND	Power		Power	Ground
8	SDA_DBG	I ² C	In/Out O.D.	Debug	I ² C Data, Debug port. Connection to debug controller not required for normal operation.
9	GND	Power		Power	Ground
10	GPI	Digital	Input	GPIO	General purpose input. Status of this input is reflected on the GPO pin on the opposite side of an active wireless link.
11	WAKE_UP	Digital	Input	Control	Force the link to W0 State. This is useful to bypass USB states, when I ² C tunnel or GPI signal needs to be used, while the link is in low power states. Active High. Optional.
12	VBUS_SENSE	Digital	Input	USB	USB VBUS status input , 3V3
13	ATB_N	Analog	Output	Debug	Differential analog test bus - negative terminal
14	GND	Power		Power	Ground
15	ATB_P	Analog	Output	Debug	Differential analog test bus - positive terminal
16	SSRX-	Analog	Input	USB	USB Super speed Neg Input
17	RST	Digital	Input	Config	Reset Input, active HIGH
18	SSRX+	Analog	Input	USB	USB Super speed Pos Input
19	ID_IN	Digital	Input	USB	USB ID Input
20	GND	Power		Power	Ground
21	ID_VAL	Digital	Input	USB	USB ID Valid Input
22	SSTX+	Analog	Output	USB	USB Super speed Pos Output
23	ID_OUT	Digital	Output	USB	USB ID Output
24	SSTX-	Analog	Output	USB	USB Super speed Neg Output
25	VBUS_EN	Digital	Output	USB	USB VBUS status output, 3V3
26	GND	Power		Power	Ground
27	LEDO	Digital	Output	Config	LED output
28	D+	Analog	Bi-Dir	USB	USB High Speed/Full Speed/Low Speed Pos I/O
29	GPO/INT	Digital	Output	GPIO	General purpose output. When a wireless link is active, the status of this output reflects the GPI pin on the opposite side of the wireless link. Also used as I ² C tunnel interrupt
30	D-	Analog	Bi-Dir	USB	USB High Speed/Full Speed/Low Speed Neg I/O

MOD6212/13 Transceiver Module Connector

The module is designed to be connected to the system board through a single board to board connector:

On the module side:

The connector type is DF40 from Hirose

Part number: DF40C-30DP-0.4V (51)

Description: Dual row Board to Board Receptacle (Plug), 0.4 pitch, 50 pins

A=7.52mm, B=5.6mm, C=1.5mm

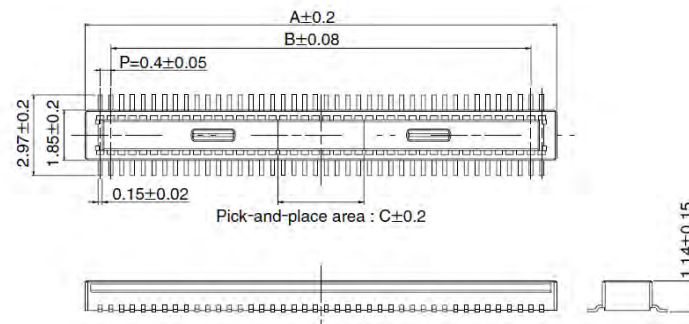


Figure 3. Module side connector.

MOD6212/13 Transceiver Module Functional description

USB 3.0 Interface

The MOD6212/13 Transceiver Module interfaces directly with a USB 3.0 port without requiring any additional control or interface logic. “ID_IN” and “ID_VAL” strapping pins on the Transceiver Module are used along with wireless communication to establish the USB port personality as either upstream facing or downstream facing. The ID_OUT signal from each transceiver to the attached USB port indicates upstream or downstream facing transceiver operation.

Table 2. Transceiver Personality Based on Pair Configuration

Pair Configuration				Transceiver Personality						Application Example
MOD6212		MOD6213		MOD6212	MOD6213	MOD6212	MOD6213	MOD6212	MOD6213	
ID_IN	ID_VAL	ID_IN	ID_VAL	ID_OUT	ID_OUT	Facing	Facing	VBUS_En	VBUS_En	
1	1	0	1	0	Z	US	DS	0	1	2 in 1 Laptop
0	1	1	1	Z	0	DS	US	1	0	Sport Camera/ Storage
X	0	1	1	Z	0	DS	US	1	0	Mobile Phone (as Device)
X	0	0	1	0	Z	US	DS	0	1	Mobile Phone (as Host)

The “VBUS” supply from the upstream USB port is used as a VBUS_SENSE input to the transceiver. Note that a resistor divider or equivalent circuit should be used to reduce the +5V VBUS voltage level to a +3.3V voltage level that is compatible with the VBUS_SENSE input. The VBUS status is sent to the downstream facing transceiver, where the “VBUS_EN” signal is used to control the local VBUS status at the downstream USB connection.

When MOD6212 based Module transceiver is located in close proximity to another MOD6213 based Module transceiver, the two transceivers automatically establish a wireless connection, enabling high speed communication with the devices on the other side of the link. Establishing a wireless link is analogous to plugging in a USB cable. Once “connected”, this link will act and behave just like a wired USB 3.0 interface. The “ID_OUT” signal emulates the proper grounding of the ID pin that would be seen when attaching a USB 3.0 cable between devices. The “VBUS_EN” signal can be used to either drive a VBUS logic input, or an external FET transistor to actually switch the VBUS power to the downstream facing USB interface.

I2C Tunneling

I2C tunneling is a key feature of the MOD6212/13 Transceiver Module. It simply allows an I2C master on the MOD6212 to communicate with I2C devices connected to the MOD6213.

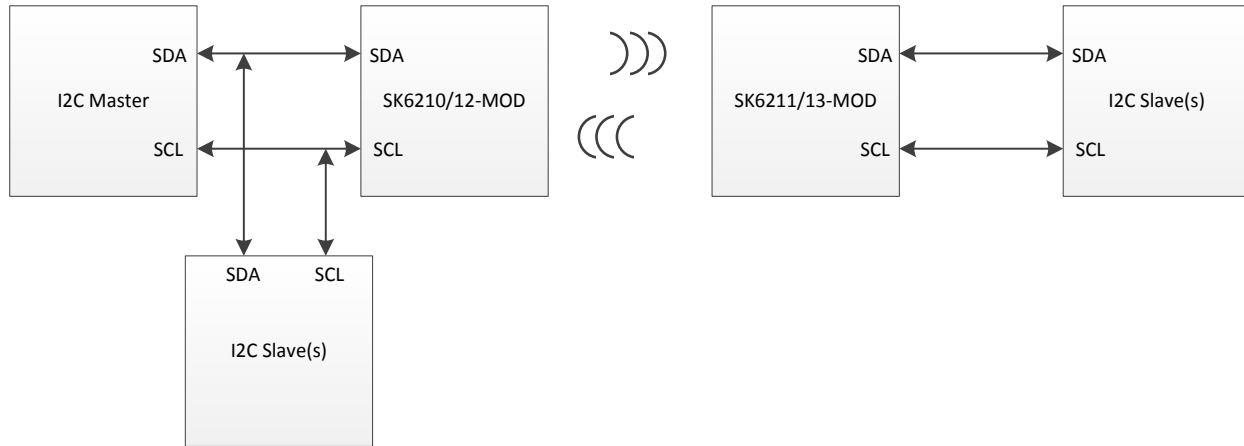


Figure 5. MOD6212/13 Transceiver Module I2C tunnel principle

GPI, GPO, and LEDO

The MOD6212/13 Transceiver Module contains a general purpose input (GPI) and a general purpose output (GPO) as well as a dedicated led output (LEDO) pin. At system level those can be routed to a Host MCU or directly to LED devices.

The LEDO indicates the state of the wireless link. A persistent low (off state) indicates that the module transceiver is powered down or being held in reset. A periodic high (blink) indicates that the device is scanning for a connection. A high (on state) indicates that RF link is established.

Without a link present, GPO will be low (off state). When a link is established, and the transfer is in the Full speed mode (W0 state), the GPO will reflect the state of the GPI pin on the opposite side of the link. If the GPI pin on the opposite side of the link keeps high, the GPO output can be used to indicate a high speed data transfer. If the device goes into a “Detached State”, (link established but no data being transferred) the GPO signal will periodically go high (blink).

Each GPI pin can be used to control the state of the GPO pin on the opposite side of the link, but only when the link is in a Full Speed mode (W0 state).

GPI on MOD6212 to GPO on MOD6213 can also be used as interrupt function along with the WAKE_UP pin to wake up the wireless link and I2C host for service. Asserting WAKE_UP will force the wireless link to W0 state or stop the link from entering low power modes (W2, W3, IDLE). This combination of WAKE_UP pin and GPO/INT works together with the I2C Tunnel function to prevent the need for polling on the I2C tunnel from the master side.

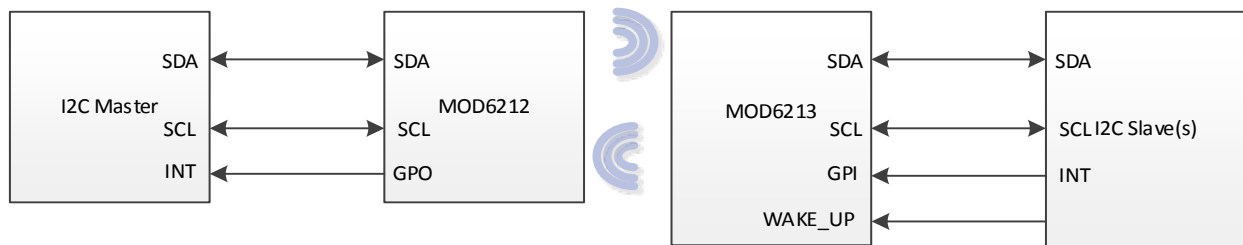


Figure 6. MOD6212/13 Transceiver Module interrupt based I2C tunnel

Reset

The MOD6212/13 Transceiver module has an RST input pin that keeps the device in standby. The reset circuit is designed such that if an RST signal is not available. The part will generate an internal RST signal as the device is powered on.

No device driver needed

MOD6212/13 Transceiver module is software free product. Module does not need to install and to initialize the device driver to control the module to achieve the wired connectivity offered. As soon as the MOD6212/13 module detects each other through proximity detection and establishes the RF link within second, user could start the USB data transfer now.

Modular approval for Lattice MOD6212/13 transmitter

MOD6212/MOD6213 radio is a low power 60GHz full duplex radio operating under §15.255 that provides very short range (<15mm) contactless bidirectional USB data transfer between two hosts. Spatial separation between receive and transmit antennas is used to allow simultaneous operation of two radio links on the same frequency to provide bidirectional data transfer.

Lattice is a module supplier and does not manufacture host systems.

Modular transmitter should meet all the applicable requirements.

1. The final host system shall be subject to unwanted radiated emission testing up to 40GHz with transmitter active and a test report shall be provided to the grantee. The grantee shall review that report and acknowledge to the host manufacturer that it demonstrates compliance.
2. Host manufacturer module placement shall comply with the following requirements:
 - a) The shielded side of the module shall face inwards to the host;
 - b) The open side of the module shall be immediately adjacent to the enclosure with no intermediate conducting material;
 - c) The spacing between unshielded side of module and enclosure shall be 3mm or less and must be free of any conducting material within a defined exclusion region (Figure 7).
 - d) The enclosure shall be constructed from non-conducting material adjacent to that exclusion region.

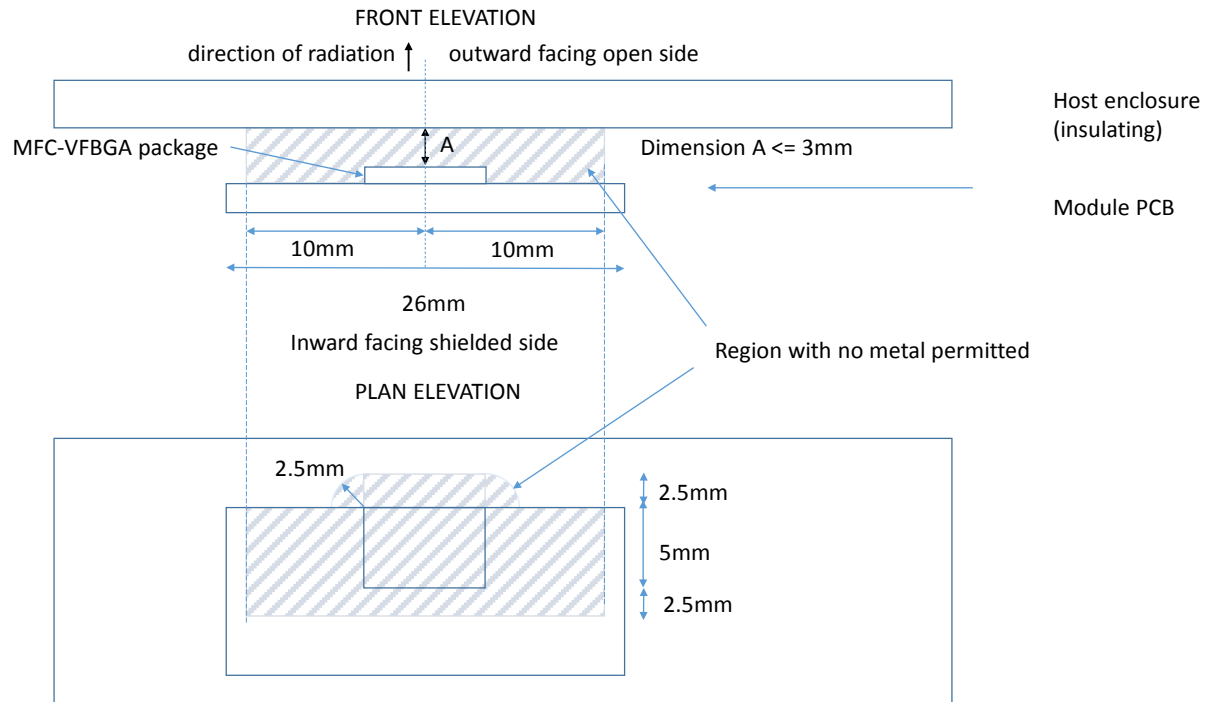
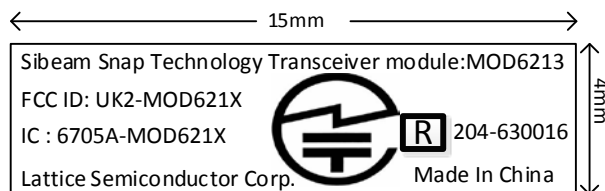
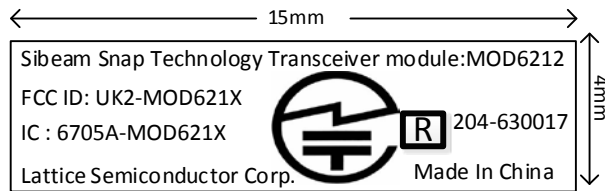
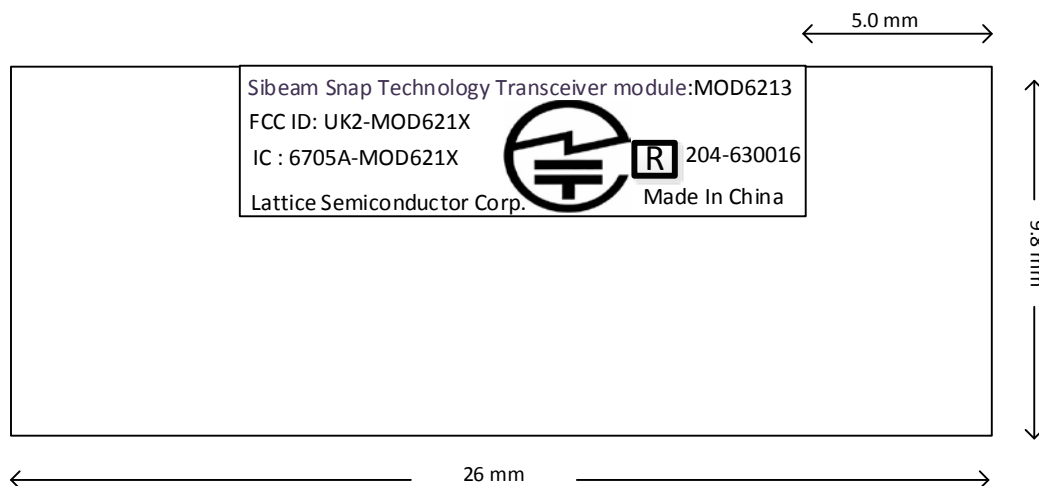


Figure 7: Module placement restrictions

Proposed label



Proposed Module Location



Federal Communication Commission 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 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.

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.

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.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance **20cm** between the radiator & your body.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated.

Additional testing and certification may be necessary when multiple modules are used.

USERS MANUAL OF THE END PRODUCT:

In the user's manual of the end product, the end user has to be informed to keep at least **20cm** separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

If the labelling area is small than the palm of the hand, then additional FCC part 15.19 statement is required to be available in the user's manual: This device complies with Part 15 of 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following "**Contains FCC ID: UK2-MOD621X.**"

If the labelling area is larger than the palm of the hand, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

This Module may not be integrated into host devices that are addressed for operation inside airplanes/satellites.

Industry Canada Interference Statement

This device complies with Industry Canada License-exempt RSS standard(s). Opération is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This radio transmitter (**MOD6212/MOD6213**) has been approved by Industry Canada 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 for that type, are strictly prohibited for use with this device.

*Le présent émetteur radio (**MOD6212/MOD6213**) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.*

List of antenna for each module :

Brand	Model Name	Antenna Type	Gain (dBi)
Sibeam	SB6212	Chip	0
Sibeam	SB6213	Chip	2

IMPORTANT NOTE:

IC Radiation Exposure Statement:

*This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance **20cm** between the radiator & your body.*

*Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de **20 cm** de distance entre la source de rayonnement et votre corps.*

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated.

Additional testing and certification may be necessary when multiple modules are used.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the user's manual of the end product, the end user has to be informed to keep at least **20cm** separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following "**Contains IC: 6705A-MOD621X**". The Host Model Number (HMN) must be indicated at any location on the exterior of the end product or product packaging or product literature which shall be available with the end product or online.