Product Description

Radiocrafts Industrial IP Mesh (RIIM) is a wireless sensor network that is capable of sending and receiving data directly to and from the internet. This makes it easy to connect to cloud services and to other devices on the internet. IPv6 is used to reach each module from anywhere and vice versa.

The border router or edge router has the role of connecting the wireless RIIM network to the internet or local network. The **RIIM border router** is an off-the shelf device for routing packets between ethernet and RIIM.
Other border routers to connect to other mediums is also possible to make based on the RC1882CEF-IPM module.

The RIIM border router is plugged onto your local area network (LAN) through ethernet to internet

Applications

- Energy harvesting sensor application
- Coin cell battery systems
- IIOT applications
- Smart Sensor Technologies
- Energy Management and Sustainability
- Green House Monitoring
- Elderly Care
- Fire Detection
- Home Security

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- Home Security
- Indoor Air Quality Monitoring
- Industrial Temperature Control
- Medical Climate Control
- Predictive Maintenance
- Tank Level/Flow Monitoring
- Facilities and Infrastructure Management
- Radiation and Leak Detection

Features

- Internet interoperability via IPv6 addressing, UDP packet transmission, DTLS encryption and CoAP protocol.
- Multi-hop mesh technology.
- Self building and self healing network.
- Over The Air (OTA) updates
- Very high node count mesh
- Long RF range, several hundred meter LOS
- Pre-certified radio
- Based on open radio standards IEEE 802.15.4 g/e
- Frequency hopping via TSCH (6TiSCH) (not in RIIM-SDK 1.00)
- Automatic acknowledge and retransmission
- Ethernet transciever
- Antenna (add features)
- Power supply via USB-C

Quick Reference Data (typical at 3.6V, 868 MHz, 50 kb/s)

Parameter		Unit
Frequency band	862-930	MHz
Max output power	14	dBm
Sensitivity (BER 1%) @50kb/s	-110	dBm
Supply voltage (USB-C)	5	V
Current consumption, RX/TX	TBC	mA
Operating Temperature	-20 to +70	°C

RIIM overview

The RIIM network consists of these key elements

    The IPM module

- o The IPM module can be configured as root(border router), mesh router or leaf node.
    - ▪ As a root node it acts as the base of the mesh network. It can connect to an external network via ethernet or custom user application on other interfaces such as UART
    - ▪ As a router node, it will be able to transport packets in the RIIM mesh network
    - ▪ As a leaf node, it is not able to transport packets to other nodes except its parent. This mode uses the least amount of energy.
- o All modes supports customer ICI applications and external connections. Applications use the same RIIM Software Development Kit (SDK) for all node types.
- - The RIIM SDK
    - o Software development kit with application frameworks and tools for creating and uploading end network configuaration and customer applications to the RC1882CEF-IPM
- - The RIIM Border router, a complete router that is based on the RC1882CEF-IPM module that connects the RIIM network to the Internet.

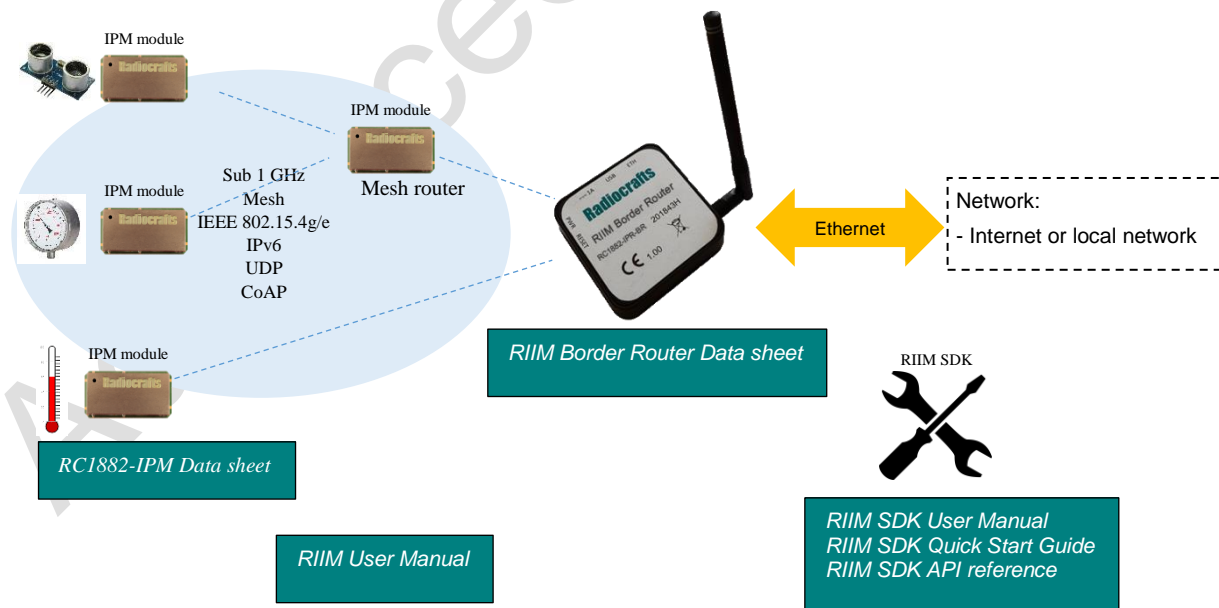   Below is an illustration of the different elements and the documentation available

Figure 1. RIIM network – system and documentation overview

Ethernet Interface

The network connection is a 10BASE-T Ethernet connection following IEEE802.3 standard. On network layer both IPv4 and ICMP, **OR** IPv6 and ICMPv6 can be used.

The border router support DHCP.

The application packets used in RIIM are CoAP on UDP port 5683 or CoAPs(including DTLS) on UPD port 5684.

For more details on the CoAP application resource and how to communicate with them, please see details in RIIM User Manual.

Power

The RIIM border router is powered through a USB-C type connector. The power supply is dimensioned to 1 A, while the actual current drawn is much less. A green power LED indicated that device is power on.

Channel

The border router follows the channel mapping of IEEE802.15.4g

Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency MHz]
1	863.125	11	865.125	21	867.125	31	869.125
2	863.325	12	865.325	22	867.325	32	869.325
3	863.525	13	865.525	23	867.525	33	869.525
4	863.725	14	865.725	24	867.725	34	869.725
5	863.925	15	865.925	25	867.925		
6	864.125	16	866.125	26	868.125		
7	864.325	17	866.325	27	868.325		
8	864.525	18	866.525	28	868.525		
9	864.725	19	866.725	29	868.725		
10	864.925	20	866.925	30	868.925		

Figure 2 Channels for RIIM Border Router Europe(RC1882CEF-IPM-BR-BOX)

Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency MHz]
1	902.2	34	908.8	67	915.4	100	922
2	902.4	35	909	68	915.6	101	922.2
3	902.6	36	909.2	69	915.8	102	922.4
4	902.8	37	909.4	70	916	103	922.6
5	903	38	909.6	71	916.2	104	922.8
6	903.2	39	909.8	72	916.4	105	923
7	903.4	40	910	73	916.6	106	923.2
8	903.6	41	910.2	74	916.8	107	923.4
9	903.8	42	910.4	75	917	108	923.6
10	904	43	910.6	76	917.2	109	923.8
11	904.2	44	910.8	77	917.4	110	924
12	904.4	45	911	78	917.6	111	924.2
13	904.6	46	911.2	79	917.8	112	924.4

14	904.8	47	911.4	80	918	113	924.6
15	905	48	911.6	81	918.2	114	924.8
16	905.2	49	911.8	82	918.4	115	925
17	905.4	50	912	83	918.6	116	925.2
18	905.6	51	912.2	84	918.8	117	925.4
19	905.8	52	912.4	85	919	118	925.6
20	906	53	912.6	86	919.2	119	925.8
21	906.2	54	912.8	87	919.4	120	926
22	906.4	55	913	88	919.6	121	926.2
23	906.6	56	913.2	89	919.8	122	926.4
24	906.8	57	913.4	90	920	123	926.6
25	907	58	913.6	91	920.2	124	926.8
26	907.2	59	913.8	92	920.4	125	927
27	907.4	60	914	93	920.6	126	927.2
28	907.6	61	914.2	94	920.8	127	927.4
29	907.8	62	914.4	95	921	128	927.6
30	908	63	914.6	96	921.2	129	927.8
31	908.2	64	914.8	97	921.4		
32	908.4	65	915	98	921.6		
33	908.6	66	915.2	99	921.8		

Figure 3 Channels for RIIM Border Router US(RC1882CEF-IPM-BR-BOX-FCC)

Local USB interface

The RIIM border router also have local USB interface through USB-C connector. This allow debugging and trace for the application running inside the border router.

The serial UART baud rate is 115.200 baud.

The serial port via USB is handled through FTDI chip FX232. Drivers are widely distributed in both linux and windows. Drivers can also be downloaded from www.ftdi.com

Firmware and firmware upgrade

The border router supports FW upgrade both through local USB interface and via COAP/UDP/IP over Ethernet.

The border router is delivered with a standard (default) firmware, but customization can be done by user.

Typical feature the customer would like to setup:
    PAN ID (RF network)
    Channel (RF network)
    Link encryption key (RF network)

    IP address
        Fixed prefix IPv6
        DHCP
        IPv5 ND
    IPv4 vs IPv6 on ethernet

Setup at mesh router

By programming a mesh router functionallity to the product, the product can act as an mesh router – routing from one wireless device to the next. In this case the Etherner connector will not be used.

LED for radio traffic

The border router has 2 LED indication for indicating radio traffic.
The blue led indicate radio transmission and the yellow led indicated radio reception.
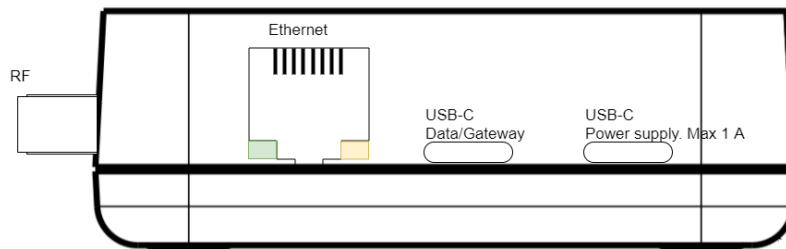
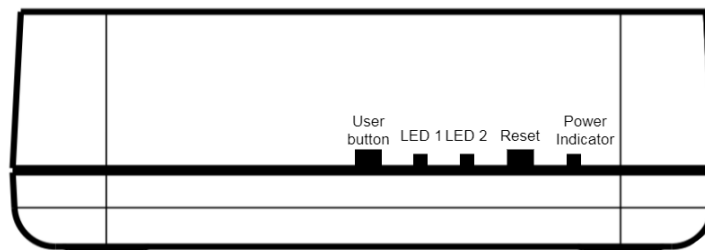## Connectors, LEDs and button
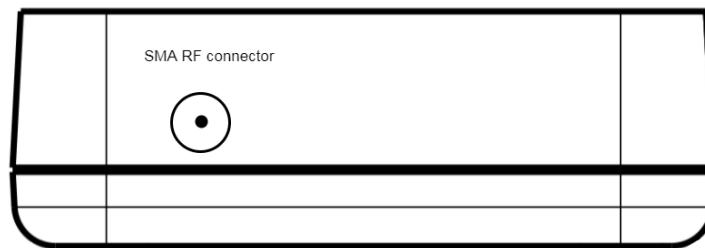

Figure 4. Connector side view.

Figure 5. User interface side view

Figure 6. RF connector side view

Regulatory Compliance Information

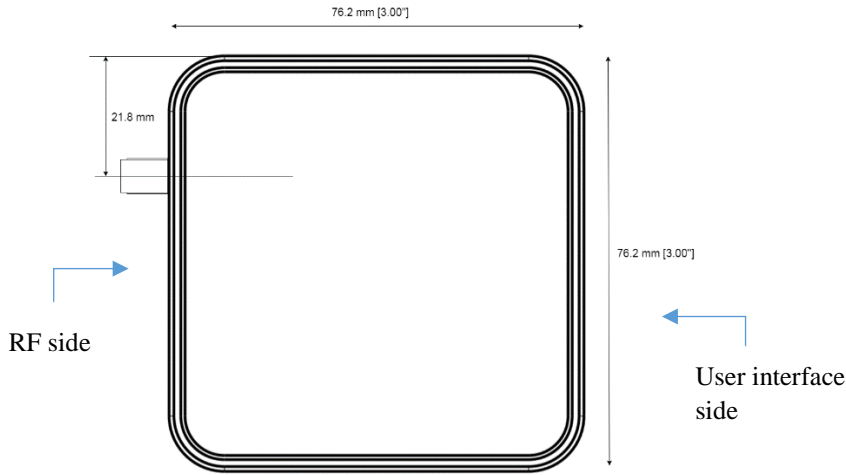Regulatory compliance testing is still to be done.

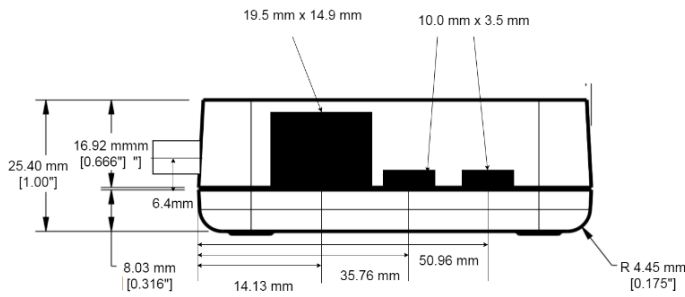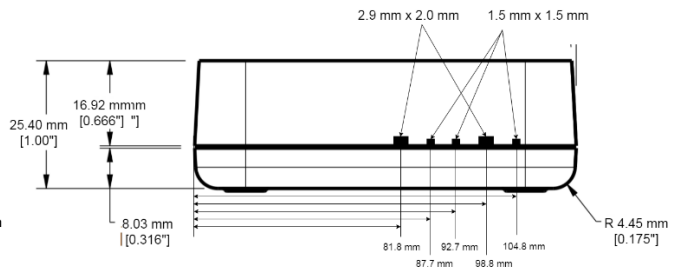## Mechanical Drawing

Figure 7. Top view

RF side

User interface side

Figure 8. Side view

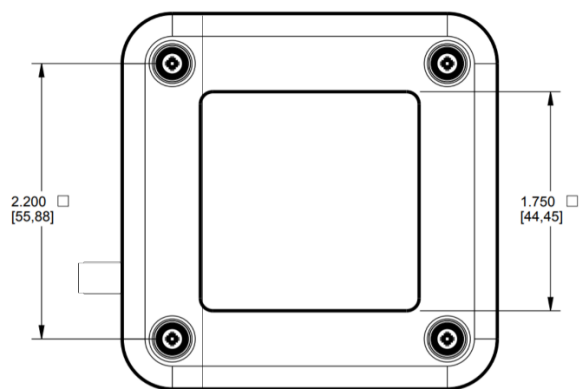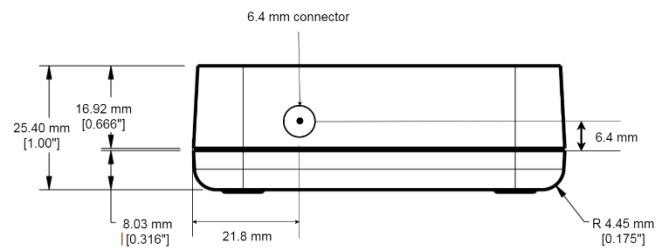**User interface side view**

Figure 9. Bottom view

RF side view

Mechanical Dimensions

The module size is 76.2 x 76.2 x 25.4 mm. (excluding SMA connector)

Product Ordering Number

RC1882CEF-IPM-BR-BOX	Q3 2019
RC1882CEF-IPM-BR-FCC-BOX	*Future release*

Cables and power supply not included

     Data sheet RIIM Border Router (rev. 1.00)

Absolute Maximum Ratings

Parameter	Min	Max	Unit
Supply voltage, VCC	-0.3	4.1	V
Voltage on any pin	-0.3	VCC + 0.3 (max 4.1)	V
Input RF level		10	dBm
Storage temperature	-40	150	°C
Operating temperature	-40	85	°C

Caution ! ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.

Under no circumstances the absolute maximum ratings given above should be violated. Stress exceeding one or more of the limiting values may cause permanent damage to the device.

Electrical Specifications

T=25°C, VCC = 3.3V, 868 MHz, 50 ohm if nothing else stated.

Parameter	Min	Typ.	Max	Unit	Condition / Note
Operating frequency	862		930	MHz	
Input/output impedance		50		Ohm	
Data rate		50		kbit/s	
Frequency stability			+/- 10	ppm	Initially
			+/-15	ppm	Temperature drift -30°-85°
			+20/-26	ppm	Temperature drift -40°-85°
					Other stability option available on request
Transmit power	-10		14	dBm	Programmable from firmware
Harmonics					@ max output power
2nd harmonic		-44		dBm	
3rd harmonic		-43		dBm	
Spurious emission, TX, 868 MHz					
30 – 1000 MHz			-54	dBm	EN 300 220 restricted band
30 – 1000 MHz			-36	dBm	EN 300 220 un-restricted band
1-12.75 GHz			-30	dBm	
Sensitivity		- 110		dBm	BER = 1%, 50 kbps 2 FSK, IEEE 802.15.4g mandatory settings
Saturation		10		dBm	
Spurious emission, RX					Complies with EN 300 220
1-12.75 GHz		-59		dBm	CRF47 Part 15 and ARIB STD-T66
Supply voltage					
Recommended operating voltage	1.8		3.8	V	
Current consumption, RX(radio only)		6.0		mA	VCC = 3.6V
Current consumption, TX (radio only)		25		mA	Output power 14 dBm, VCC = 3.6V
		18			Output power 12 dBm.
RAM memory		88		kB	
SoC internal Flash memory		354		kB	
SPI Flash memory		1024		kB	Optional
I2C EEPROM		4		kB	Optional
MCU clock frequency		48		MHz	
MCU low frequency crystal		32.768		kHz	Optional
Antenna VSWR		<2:1	3:1		

Product Status and Definitions

Current Status	Data Sheet Identification	Product Status	Definition
X	Advance Information	Planned or under development	This data sheet contains the design specifications for product development. Specifications may change in any manner without notice.
	Preliminary	Engineering Samples and First Production	This data sheet contains preliminary data, and supplementary data will be published at a later date. Radiocrafts reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
	No Identification Noted	Full Production	This data sheet contains final specifications. Radiocrafts reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
	Not recommended for new designs	Last time buy available	Product close to end of lifetime
	Obsolete	Not in Production Optionally accepting order with Minimum Order Quantity	This data sheet contains specifications on a product that has been discontinued by Radiocrafts. The data sheet is printed for reference information only.

Changes

1.0   2019-03-28   First release

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