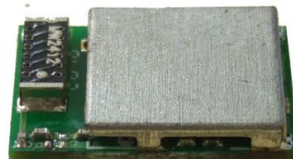


Embedded BLE Module for M2M and IOT



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Application

- Home and Building Automation
 - Connected Appliances
 - Lighting
 - Locks
 - Gateways
 - Security Systems
- Industrial
 - Logistics
 - Production and Manufacturing
 - Automation
 - Asset Tracking and Management
 - Remote Display
 - Cable Replacement
 - HMI
 - Access Control
- Retail
 - Beacons
 - Advertising
 - ESL / Price Tags
 - Point of Sales / Payment Systems
- Health and Medical
 - Thermometers
 - SpO2
 - Blood Glucose and Pressure Meters
 - Weight-scales
 - Vitals Monitoring
 - Hearing Aids
- Sports and Fitness
 - Activity Monitors and Fitness Trackers
 - Heart Rate Monitors
 - Running Sensors
 - Biking Sensors
 - Sports Watches
 - Gym Equipment
 - Team Sports Equipment
- HID
 - Remote Controls
 - Keyboards and Mice
 - Gaming
- Accessories
 - Toys
 - Trackers
 - Luggage-tags
 - Wearables

Electrical Specification

General Specification

Model Name	iBM40R2
Product Description	BLE module
Dimension	9 mm x 12.5 mm x 1.9mm ±0.5mm
Module Interface	UART/JTAG
Ambient temperature	-20°C to 70°C
Storage temperature	-40°C to 85°C
Humidity	Operating Humidity 10% to 95% Non-Condensing Storage Humidity 5% to 95% Non-Condensing

Absolute Maximum Ratings

		MIN	MAX	UNIT
Supply voltage, VDDS ⁽³⁾	VDDR supplied by internal DC/DC regulator or internal GLDO	-0.3	4.1	V
Supply voltage, VDDS ⁽³⁾ and VDDR	External regulator mode (VDDS and VDDR pins connected on PCB)	-0.3	2.25	V
Voltage on any digital pin ⁽⁴⁾		-0.3	VDDS+0.3, max 4.1	V
Voltage on crystal oscillator pins, X32K_Q1, X32K_Q2, X24M_N and X24M_P		-0.3	VDDR+0.3, max 2.25	V
Voltage on ADC input (V _{in})	Internal fixed or relative reference, voltage scaling enabled	-0.3	VDDS	V
	Internal fixed reference, voltage scaling disabled	-0.3	1.49	
	Internal relative reference, voltage scaling disabled	-0.3	VDDS / 2.9	
	External reference, voltage scaling enabled	-0.3	min (V _{ref} × 2.9, VDDS)	
	External reference, voltage scaling disabled	-0.3	V _{ref}	
Voltage on external ADC reference (V _{ref})		-0.3	1.6	V

Recommended Operating Ratings

		MIN	MAX	UNIT
Ambient temperature range		-40	85	°C
Operating supply voltage (VDDS and VDDR), external regulator mode	For operation in 1.8 V systems (VDDS and VDDR pins connected on PCB, internal DC/DC cannot be used)	1.7	1.95	V
Operating supply voltage (VDDS)	For operation in battery-powered and 3.3 V systems (internal DC/DC can be used to minimize power consumption)	1.8	3.8	V

Current Consumption

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
I _{core}	Core current consumption	Reset. RESET_N pin asserted		100		nA	
		Shutdown. No clocks running, no retention		150			
		Standby. With RTC, CPU, RAM and (partial) register retention. RCOSC_LF			1		μA
		Standby. With RTC, CPU, RAM and (partial) register retention. XOSC_LF			1.2		
		Standby. With Cache, RTC, CPU, RAM and (partial) register retention. RCOSC_LF			2.5		
		Standby. With Cache, RTC, CPU, RAM and (partial) register retention. XOSC_LF			2.7		
		Idle. Supply Systems and RAM powered.			550		
		Active. Core running CoreMark			1.45 mA + 31 μA/MHz		
		Radio RX ⁽¹⁾			5.9		mA
		Radio RX ⁽²⁾			6.1		
Radio TX, 0 dBm output power ⁽¹⁾			6.1				
I _{peri}	Peripheral Current Consumption (Adds to core current I _{core} for each peripheral unit activated) ⁽³⁾						
	Peripheral power domain	Delta current with domain enabled		20		μA	
	Serial power domain	Delta current with domain enabled		13		μA	
	RF Core	Delta current with power domain enabled, clock enabled, RF Core Idle		237		μA	
	μDMA	Delta current with clock enabled, module idle		130		μA	
	Timers	Delta current with clock enabled, module idle		113		μA	
	I ² C	Delta current with clock enabled, module idle		12		μA	
	I2S	Delta current with clock enabled, module idle		36		μA	
	SSI	Delta current with clock enabled, module idle		93		μA	
	UART	Delta current with clock enabled, module idle		164		μA	

Other Characteristic

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Wake-up and Timing					
Idle -> Active			14		μs
Standby -> Active			151		μs
Shutdown -> Active			1015		μs
Flash Memory					
Supported flash erase cycles before failure		100			k Cycles
Flash page/sector erase current	Average delta current		12.6		mA
Flash page/sector erase time ⁽¹⁾			8		ms
Flash page/sector size			4		KB
Flash write current	Average delta current, 4 bytes at a time		8.15		mA
Flash write time ⁽¹⁾	4 bytes at a time		8		μs

RF Specification

RX Sensitivity

1Mbps, GFSK, 250-KHz deviation, Bluetooth low energy mode and 1%BER

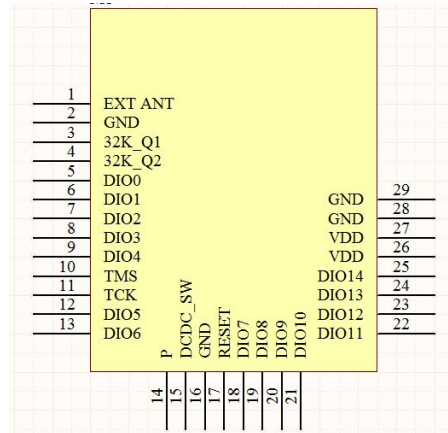
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Receiver sensitivity	Differential mode. Measured at the SMA		-97		dBm

TX Output Power

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output power, highest setting	Differential mode, delivered to a single-ended 50-Ω load through a balun		+15		dBm

Pin Assignments

PCB Pin Outline



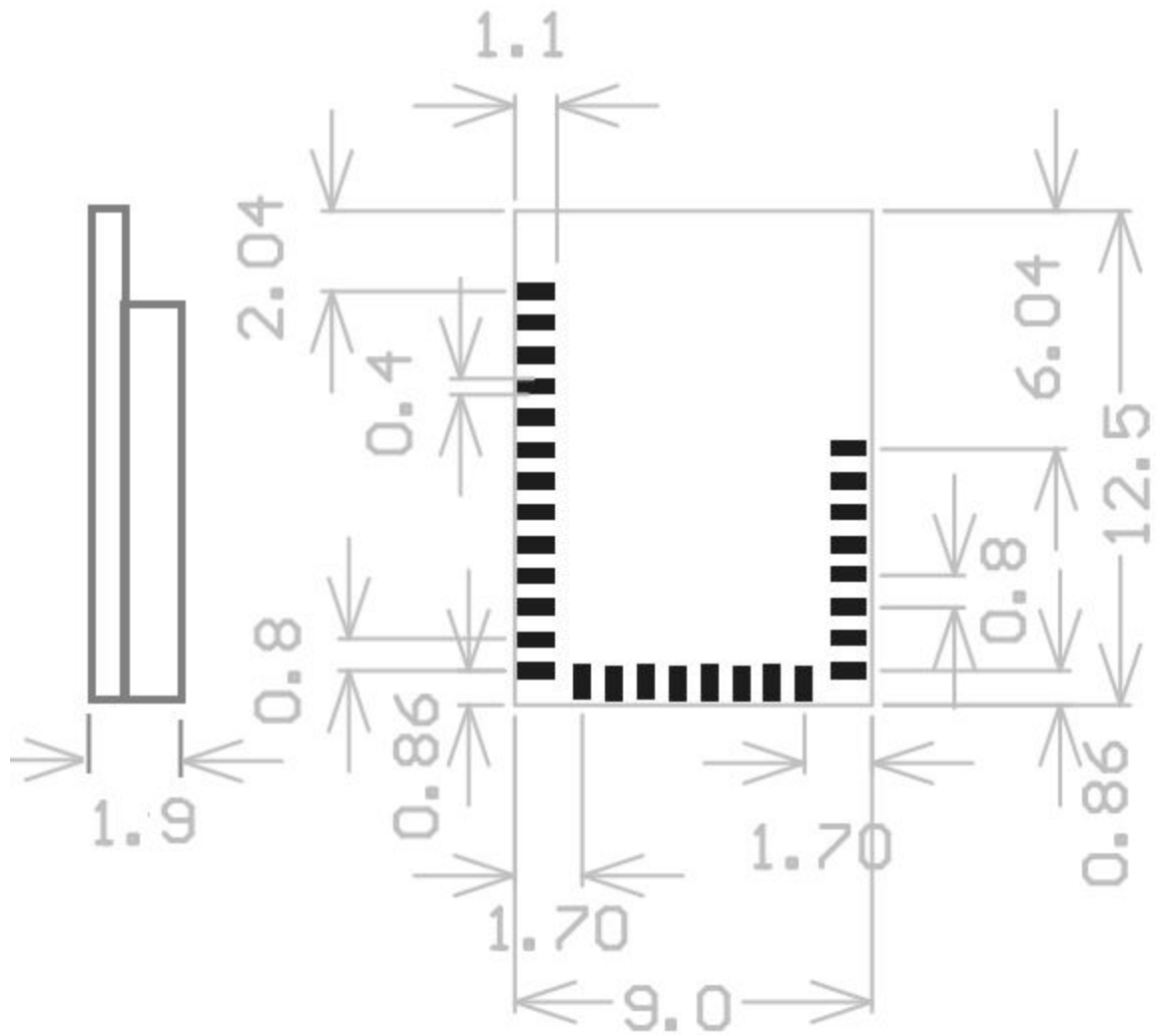
Pin Description

Pin#	Pin Define	Pin Type	Description
1	EXT ANT	Analog	External antenna / NC for internal antenna
2	GND	POWER	
3	32K_Q1	Analog	32.768Khz Crystal connecting
4	32K_Q2	Analog	32.768Khz Crystal connecting
5	DIO_0	Digital I/O	
6	DIO_1	Digital I/O	
7	DIO_2	Digital I/O	
8	DIO_3	Digital I/O	
9	DIO_4	Digital I/O	
10	TMS	Digital I/O	JTAG TMSC
11	TCK	Digital I/O	JTAG TCKC
12	DIO_5	Digital I/O	
13	DIO_6	Digital I/O	
14	P	POWER	Internal power switching
15	DCDC_SW	POWER	Internal power switching
16	GND	GND	
17	RESET	RESET	
18	DIO_7	Digital/Analog I/O	
19	DIO_8	Digital/Analog I/O	
20	DIO_9	Digital/Analog I/O	
21	DIO_10	Digital/Analog I/O	
22	DIO_11	Digital/Analog I/O	
23	DIO_12	Digital/Analog I/O	
24	DIO_13	Digital/Analog I/O	
25	DIO_14	Digital/Analog I/O	
26	VDD	POWER	POWER input(4.7uF and 0.1uF bypass capacitor needed and closed to this pin)
27	VDD	POWER	POWER input(4.7uF and 0.1uF bypass capacitor needed and closed to this pin)
28	GND	GND	
29	GND	GND	

Dimensions

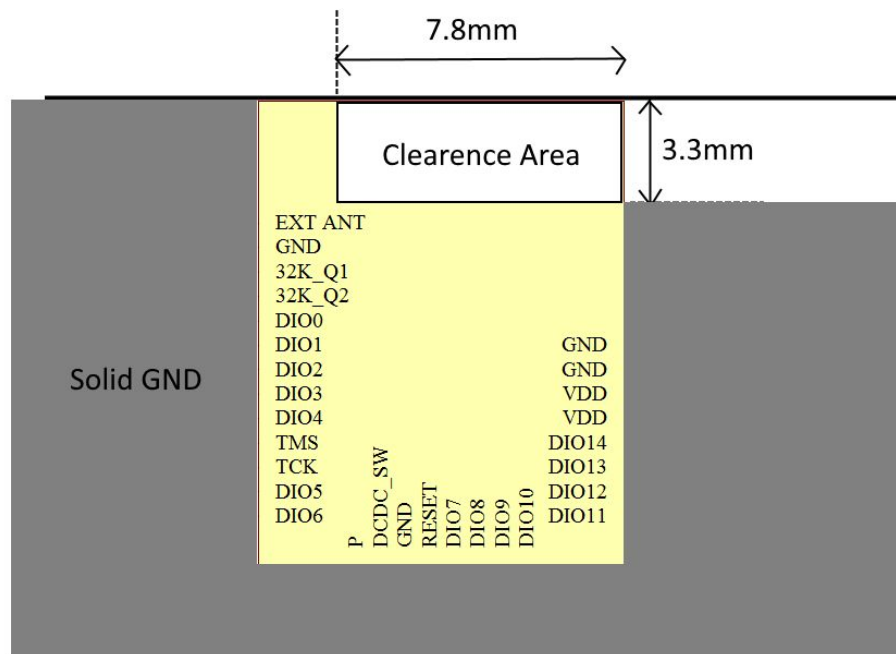
Physical Dimensions

(TOP View) Unit:mm

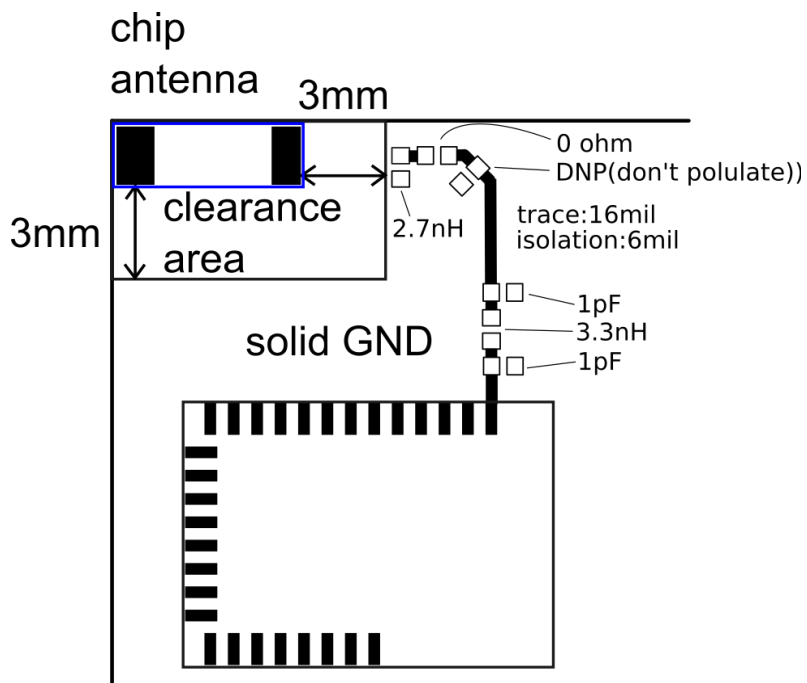


Layout Example

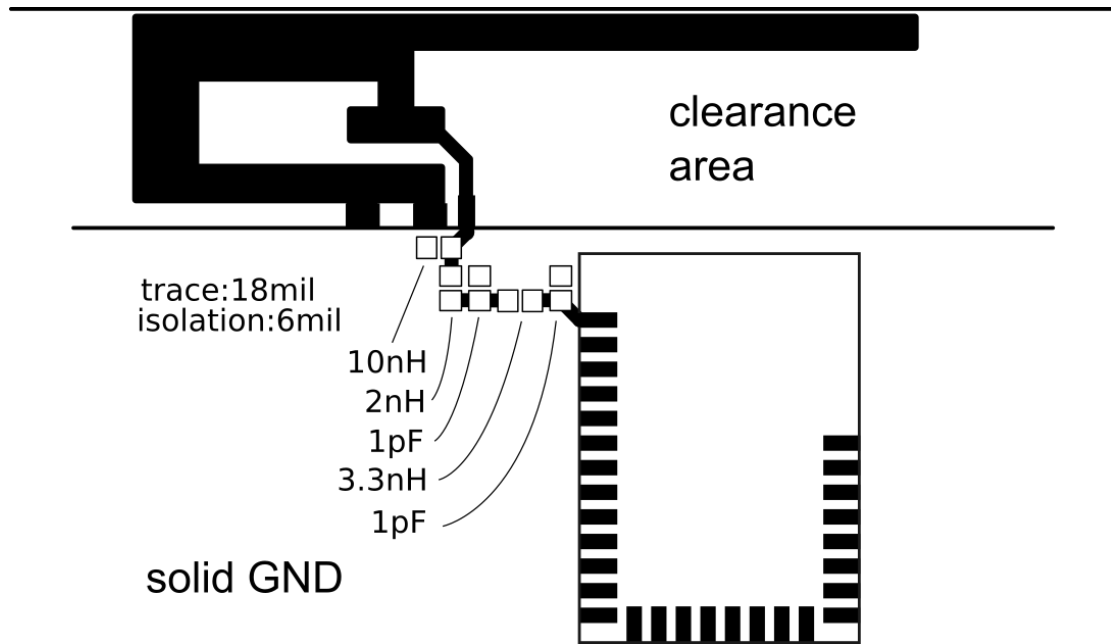
1. On Module Chip Antenna



2. External Chip Antenna



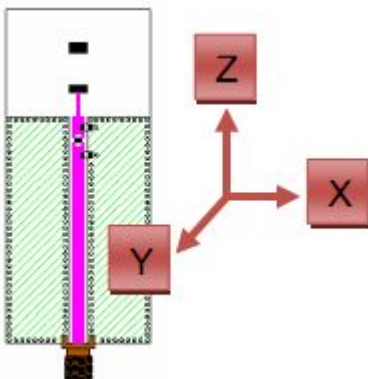
3. External Inverted F PCB Antenna

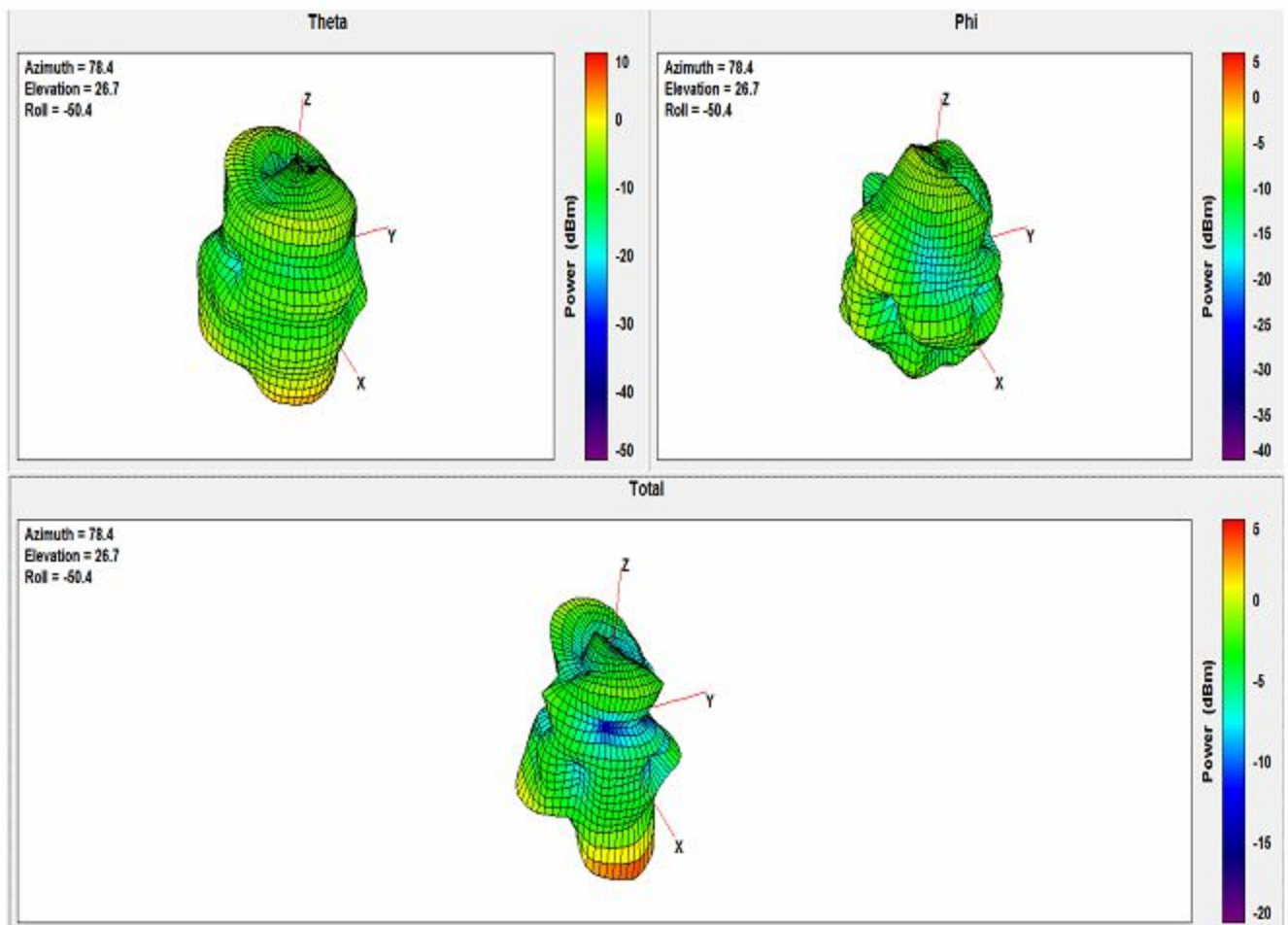


Antenna Pattern and Gain

Manufacturer	Model	Type	Antenna Gain	S/N	Impedance	Connector Type	Length of Antenna (mm)
TEXAS INSTRUMENTS	Inverted F-2.4G	FPCB Antenna	3.3 dBi	001	50Ω Typ.	Not applicable	25.58(L)*6.91(W)*1.0(H)
RIFO Technologies Corporation	MW2412(RA00L PFA00)	Chip Antenna	3.2 dBi	MA000	50Ω Typ.	Not applicable	5.0(L)*2.0(W)*1.0(H)

1. Chip Antenna

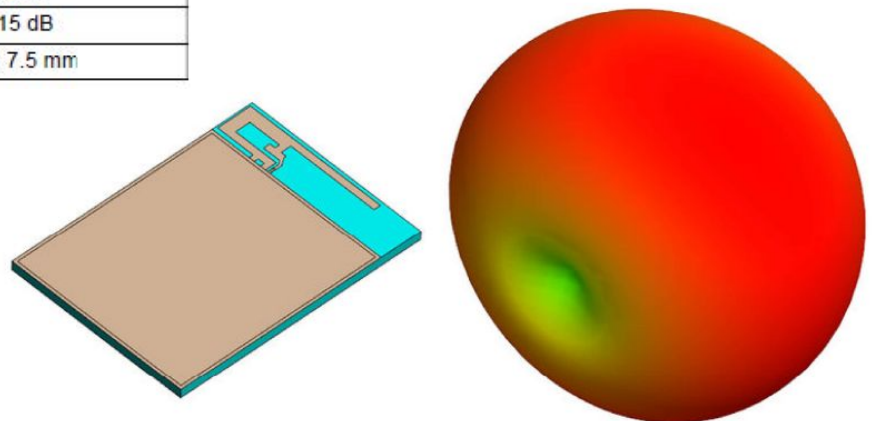




2. Inverted F PCB antenna

Summary of IFA Properties

Gain in XY plane	1.1 dBi
Gain in XZ plane	3.3 dBi
Gain in YZ plane	1.6 dBi
Reflection	< -15 dB
Antenna size	25.7 × 7.5 mm



Revision History

Date	Revision	Changes
Jan. 2019	1	Initial release

Integration Instructions

This instruction is to meet the requirement of FCC KDB 996369 D03 OEM Manual v01.

List of applicable FCC rules

As listed in the Statement section.

The specific operational use conditions

This module is approved by using three kinds of antenna arrangement which is listed in Layout Example section. Other antenna arrangement is not covered by this certification.

Trace antenna designs

In the Layout Example section, item2 and 3, a PCB trace leads to the antenna is used. To use these two kinds of antenna arrangement, please follow the layout example. Also follow the provided BOM, schematic, and antenna specification for choosing the component. Below is the details for these trace lead to the antenna.

Item 2. External Chip Antenna

Trace width: 16 mil

Trace impedance: 50 ohm

Trace isolation(distance to shielding ground): 6 mil

Trace thickness: 1 OZ

Item 3. External Inverted F PCB Antenna

Trace width: 18 mil

Trace impedance: 50 ohm

Trace isolation(distance to shielding ground): 6 mil

Trace thickness: 1 OZ

To verify the design by using this module, one can refer to the RF test report of this module to check if any violation would happened. If happened, please inform us to help to check your design. For production by using this module on the product, RF gain and emission has to be confirmed.

Any deviation from above design, require a Class II permissive change application.

RF exposure considerations

As listed in the Statement section.

Antennas

Two antennas are used for the certification, please check the specification for the details.

1. 2.4G Chip Antenna: RA00LPFA00MA000(MW2412)
2. 2.4G Inverted F PCB antenna

Label and compliance information

As stated in Certification section

Information on test modes and additional testing requirements

The module is based on TI's CC2640R2F chip. For testing the module on your product, please refer to TI SmartRF Studio <http://www.ti.com/tool/SMARTRFM-STUDIO> on how to configure and evaluate the module.

Additional testing, Part 15 Subpart B disclaimer

Although the module is Part 15 Subpart B compliant, the final product still requires Part 15 Subpart B compliance testing with the modular transmitter installed. Final product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

Certification

FCC ID label on the final system must be labeled with "Contains FCC ID: 2AH2IIBM40R2.

IC label on the final system must be labeled with "Contains IC: 21379-IBM40R2"

L'étiquette IC sur le système final doit porter la mention "Contient IC: 21379-IBM40R2".

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.

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:

To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. (Example - use only shielded interface cables when connecting to computer or peripheral devices).

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. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. If the device built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by § 2.1093.

Industry Canada Statement

This device complies with Industry Canada licence-exempt RSS standard. Operation 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.

Déclaration d'Industrie Canada

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.

IC Radiation Exposure Statement

This equipment complies with IC RSS-102 radiation exposure limit set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. If the device built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by RSS-102 § 2.5.1

Déclaration d'exposition aux radiations IC

Cet équipement est conforme à la limite d'exposition au rayonnement IC RSS-102 définie pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à une distance minimale de 20 cm entre le radiateur et votre corps. Si le dispositif est intégré à un hôte en tant qu'utilisation portable, l'évaluation supplémentaire de l'exposition aux RF peut être requise, comme indiqué au paragraphe RSS-102 § 2.5.1