

# **Rosemount RM2642 Bluetooth Low Energy Module Integration Guidance**

Revision A5

23 July 2025

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# 1 Purpose

This document serves as a guide for integrating the RM2642 BLE module into approved Rosemount products for a complete Bluetooth solution.

## 2 General Information

### 2.1 Product Description

The BLE module has been designed to be fully compliant with Bluetooth Low Energy Core Specification 5.2. It operates in the 2.4GHz ISM frequency band and is expected to operate to a minimum distance of 50ft line of sight.

## 3 Specifications

### 3.1 Normal Operating Conditions

	Min	Typ	Max	Units	Comments
Operating supply voltage	1.7	3.3	5.5	VDC	
Operating temperature range	-60		85	°C	
Peak supply current		7		mA	25C, 3VDC, Advertising mode
		10.7		mA	25C, 3VDC, 2M constant TX
		19.3		mA	85C, 1.85VDC, 2M constant TX

### 3.2 Electrical Specifications

Parameter	Test Conditions	Min	Typ	Max	Units
VIH	T <sub>A</sub> = 25C, V <sub>DD5</sub> = 3.8V	0.8*V <sub>DD5</sub>			V
VIL	T <sub>A</sub> = 25C, V <sub>DD5</sub> = 3.8V	0.2*V <sub>DD5</sub>			V
SPI freq to main MCU		3.75			MHz
SPI freq to external flash		12			MHz

### 3.3 Radio Specifications

	Min	Typ	Max	Units	Comments
Operating frequency	2402		2480	MHz	Channel center 2442MHz
Number of channels		40			
Channel separation		2		MHz	
Occupied channel bandwidth		1.1		MHz	99% at 1Mbps
Modulation		GFSK			IEEE 802.15.1
Raw data rate	1		2	Mbps	
Output power setting		5		dBm	Output power rating: 2.2 dBm

## 4 Antenna Specifications

The RM2642 module uses an on-board PCB trace antenna with a measured antenna gain as shown in EMPM0206 OTA report of -0.60 dBi. The antenna is permanently connected to the radio on the module. No other antennas are approved for use with this module.

## 5 Installation Guidelines

The RM2642 radio module is only available for use in Emerson products. Host integrators must consult with the manufacturer for specific pinout assignments for data and power. Host integrators must perform required testing to ensure compliance with host product regulations. This section describes the test modes needed for spectrum approvals. To access these test modes, special host test firmware must be loaded.

### 5.1 Spectrum Approval Test Modes

Spectrum approval test modes are accessed via serial commands using TI's BTool software. Btool version 1.42.19 must be used.

UART connections are available on pins 5 and 6 of the module. USB to UART serial converters from FTDI are recommended (TTL-232RG). Be sure to choose the correct voltage cable that matches with your supply voltage to the BLE module.

These test modes are not accessible by the general public.

#### 5.1.1 Bluetooth Tests

Radio testing for Bluetooth is performed as both radiated and/or conducted testing. The conducted tests require a Murata RF probe be connected to the BLE module (P/N MXHQ87WA3000) and routed to the labs test equipment.

Transmit tests require the following BTool commands and runs at 100% duty cycle:

- `HCIEExt_SetTxPowerCmd` – Set transmit power to +5dBm
- `HCIEExt_EnhancedModemTestTxCmd` – Set PHY mode (1M or 2M) and RF channel to be tested.
- `HCIEExt_EndModemTestCmd` – Select this to change RF channels, PHY modes, or when the test is complete.

Receive tests require the following BTool command:

- `HCExtModemTestRxCmd` – Place the module into receive mode for Receiver Spurious Emissions. Select channel to be tested (usually channels 0 and 39).

## 6 Regulatory and Standards Compliance

The RM2642 allows modular host product integration in the United States, Canada, and European Union. The following guidance must be reviewed to ensure final compliance to regulatory standards.

Host integrators must perform their own system level spectrum approval testing to ensure compliance with world area regulations.

### 6.1 FCC Compliance Testing

The RM2642 radio module has demonstrated compliance to FCC 15.247.

In order to fulfill FCC certification requirements, products incorporating the RM2642 must comply with the following:

1. An external label must be provided on the outside of the final product enclosure specifying the FCC identifier as described in below.
  - a. Alternatively, if the device is always shipping with a graphical display, the business unit may incorporate an electronic label that incorporates the FCC identifier (according to e-labeling guidance per FCC KDB 784748 D02).
2. The system level device integrating the RM2642 must demonstrate compliance to FCC 15.247 requirements.
  - a. The device integrating the RM2642 may not cause harmful interference, and must accept any interference received, including interference that may cause undesired operation.
3. An unintentional radiator scan must be performed on the device integrating the RM2642, per FCC rules and regulations, CFR Title 47, Part 15, Subpart B. See FCC rules for specifics on requirements for declaration of conformity.
4. A class II permissive change is required to add additional hosts.
5. See section 8 for unshielded limited module test plan per Appendix C of KDB 996369 D01

Reference KDB 996369 D04 Module Integration Guide v02 for detailed integration and testing guidance.

#### 6.1.1 FCC Labeling Requirements

The outside of the final product enclosure must have a label with the following (or similar) text specifying the FCC identifier. The FCC ID must be in Latin letters and Arabic numbers, 4pt or larger, and visible without magnification.

Contains transmitter module FCC ID: LW2-  
RM2642 Or Contains FCC ID: LW2-RM2642

### 6.1.2 FCC Documentation Requirements

User documentation must contain the following statements:

- 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.
- This device must be installed to ensure a minimum antenna separation distance of 20 cm from all persons.
- Changes or modification to the equipment not expressly approved by Emerson could void the user's authority to operate the equipment.

## 6.2 ISED Compliance Testing

The RM2642 radio module has demonstrated compliance to ISED RSS-247. The system level device integrating the RM2642 must demonstrate compliance to RSS-247 requirements and must meet all applicable requirements in RSS-Gen, including the radio frequency exposure compliance requirements in RSS-102.

### 6.2.1 ISED Labeling Requirements

The host product manufacturer must ensure that IC labeling requirements are met. The outside of the final product enclosure must have a label with the following (or similar) text specifying the IC identifier. Alternatively, if the device is always shipping with a graphical display, the business unit may incorporate an electronic label that incorporates the IC identifier (according to e-labeling guidance in RSS-GEN, Annex B).

The IC ID and certification code must be in Latin letters and Arabic numbers, 4pt or larger, and visible without magnification.

Contains IC: 2731A-RM2642

### 6.2.2 ISED Documentation Requirements

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/récepteur exempt de licence contenu dans le présent 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.

### 6.3 EU Compliance

The RM2642 radio module has demonstrated compliance as a module to the following standards:

EN 300 328 V2.2.2

EN 301 489-1 V2.2.2

EN 301 489-17 V3.2.4

EN 62311:2020

Host products are required to demonstrate compliance to the EU Radio Equipment Directive (RED) 2014/53/EU and follow all documentation and labeling requirements.

## 7 RF Exposure Considerations

The RM2642 module has demonstrated compliance to RF exposure limitations for FCC, ISED, and EU. The RM2642 must be installed to ensure a minimum antenna separation distance of 20 cm from all persons.

The RM2642 must be installed in accordance with manufacturers specifications. To be used in any other way than granted, requires additional evaluation and testing.

## 8 Detailed Limited Modular Approval Test Plan

The RM2642 is an unshielded, limited module and requires testing and a class II permissive change to integrate into a new host. For any EIRP or output power changes, see 996369 D01 Module Certification Guide and use engineering judgment to determine a path forward. To integrate the RM2642 into a new host, the following must all be complete.

- Confirm and document the continued compliance for the fundamentals for each band under each specific rule part granted for the module.
- The test shall demonstrate each band's worst-case modulation mode(s). Worst case can be chosen by completing pre-scans as outlined in the table below. If a worst-case is not chosen, full compliance testing will be required.
- Test band edge compliance for the widest and narrowest bandwidths per modulation type. The widest bandwidth, highest aggregate power, and highest power spectral density should be tested.

-Include radiated spurious emissions with the antenna connected. Testing shall be performed for each supported modulation testing 15.31(m). In all cases, a test of each modulation is required for channels over the frequency range defined in 15.33(a) for unlicensed transmitters and 2.1057(a) for licensed transmitters.

-Confirm and demonstrate with the radiated test that no additional parasitic, non-compliant emissions exist due to ingress (parasitic oscillations, radiation of stray signals within a host, etc.) are present.

Below is the required test and method of 15.247 to test to when integrating the RM2642 into a new host.

Part 15	Method Clause	Test	Comment
107/207	6.2	Powerline Conducted Emissions	If line over 3M or connected to AC mains
247 (b)(3)	11.9.1.1	Output Power	Evaluate via conducted cable to the board between filter and antenna. Limit: 1.739 dBm
247 (b)(3)	11.9.1.1	Equivalent Isotropic Radiated Power	Evaluate via conducted cable to the board between filter and antenna. Limit: 5.959 dBm
247 (d)	11.11	Band Edge	Do pre scan of the host 1-18 Ghz for high (2480Mhz) and low (2402Mhz) channel in 3 orientations at both data rates to determine worst case orientation.
247 (d)	11.12.1, 11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Do pre scan of the host 30Mhz-18 Ghz for high (2480 Mhz) mid (2440Mhz) and low channel (2402 Mhz) in 3 orientations at both data rates to determine worst case orientation. Do full scan of worst case.

Table 1: Test plan for module integration

Frequency of emission (MHz)	Conducted Limit	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency

Table 2: Power line Conducted Emissions limit