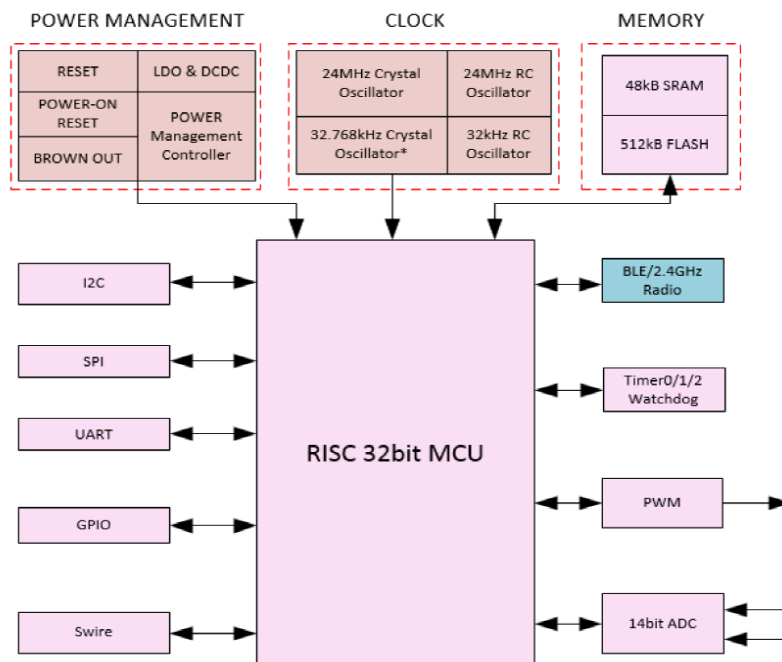# LK8628 Wireless Bluetooth Module Data Sheet

LK8628 is a module designed and built to meet the performance, security, and reliability of IoT products for Bluetooth networks

Based on the TLSR8250&TLSR8258 SoC, the LK8628 enables Bluetooth® Low Energy connectivity while delivering best-in-class RF range and performance, future-proof capability for feature and OTA firmware updates, enhanced security features, and low energy consumption.
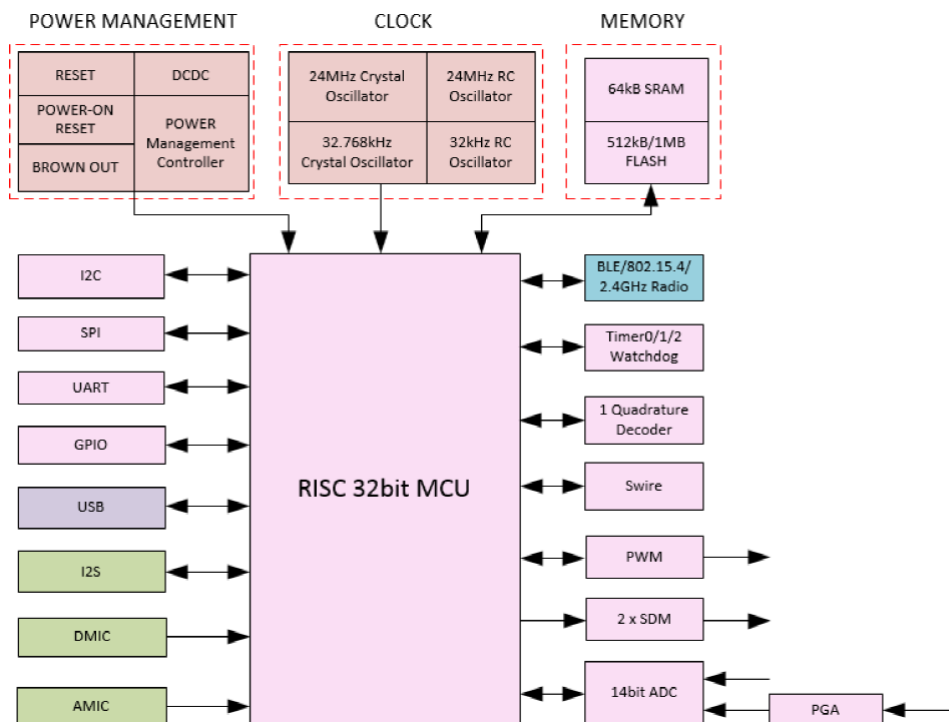
The LK8628 is targeted for a broad range of application, including:

*   Smart home
*   Connected lighting
*   Building automation and security
*   Factory automation

- Bluetooth 5.0 and Bluetooth MESH

- Built-in antenna

- Up to 10 dBm TX power

- -96dBm BLE RX sensitivity at 1 Mbps

- 32-bit core

- up to1024/64 kB of Flash/RAM memory

- Optimal selection of MCU peripherals

- 17 GPIO pins

- -40 to + 85

- 15.6 mm x 20.0 mm x 2.4 mm



TLSR8250 Block diagram

POWER MANAGEMENT

| RESET | DCDC |
|---|---|
| POWER-ON RESET | POWER Management Controller |
| BROWN OUT | |

CLOCK

| 24MHz Crystal Oscillator | 24MHz RC Oscillator |
|---|---|
| 32.768kHz Crystal Oscillator | 32kHz RC Oscillator |

MEMORY

| 64kB SRAM |
|---|
| 512kB/1MB FLASH |

I2C

SPI

UART

GPIO

USB

I2S

DMIC

AMIC

RISC 32bit MCU

BLE/802.15.4/ 2.4GHz Radio

Timer0/1/2 Watchdog

1 Quadrature Decoder

Swire

PWM

2 x SDM

14bit ADC

PGA

TLSR8258 Block diagram

Revised records

| edition | date changed | revise content | |
|---------|--------------|----------------|---|
| V 1.0 | 2021-4-20 | First release | dylan |
| | | | |
| | | | |
| | | | |
| | | | |
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## 1. Feature List

**LK8628 is a wireless module for Bluetooth 5.0 and MESH.**

- **Low-Power Wireless System-on-Chip**

- Embedded 32-bit microcontroller

- Up to 1024kB flash program memory

- 64 kB RAM data memory

- 2.4 GHz radio

- **Radio Performance**

- -96 dBm sensitivity @1 Mbps GFSK

- -93 dBm sensitivity @2 Mbps GFSK

- TX power up to 10 dBm

- **Low System Energy Consumption**

- 5.3 mA TX current at 0 dBm output power

- 4.8 mA RX current at 1 Mbps GFSK

- **Supported Modulation Format**

- GFSK

- **Protocol Support**

- Bluetooth Low power consumption (Bluetooth 5.0)

- **Wide selection of MCU peripherals**

- 14bit SAR (ADC)

- 17 I/O pins

- DMIC(Digital Mic)

- AMIC(Analog Mic)

- Stereo Audio output

- SPI

- I2C

- USB

- UART with hardware flow control and 7816 protocol support

- **working range**

  • 1.8 to 3.8 V

  • -40 to +85 °C

## 2. Ordering Information

| Model | Chip part number | Flash | Ram | Power | Attenna | GPIO | Temperature |
|---|---|---|---|---|---|---|---|
| LK8628A | TLSR8250F512ET32 | 512KB | 48KB | 7dBm | PCB | 17 | -40—85℃ |
| LK8628B | TLSR8258F512ET32 | 512KB | 64KB | 10dBm | PCB | 17 | -40—85℃ |
| LK8628C | TLSR8258F1KAT32 | 1024KB | 64KB | 10dBm | IPX | 17 | -40—105℃ |

# 3. System Overview

## 3.1 Block Diagram

 The LK8628 module is a highly-integrated, high-performance system, with all the hardware components needed to enable 2.4GHz wireless connectivity and supports Bluetooth Low Energy 5.0 protocol stack.

Built around the TLSR8250&TLSR8258 SoC, the LK8628 includes a built-in antenna and IPX versions, up to TX power of 10dBm, The temperature rating of LK8628C is-40-105℃, for operation in demanding environmental conditions.
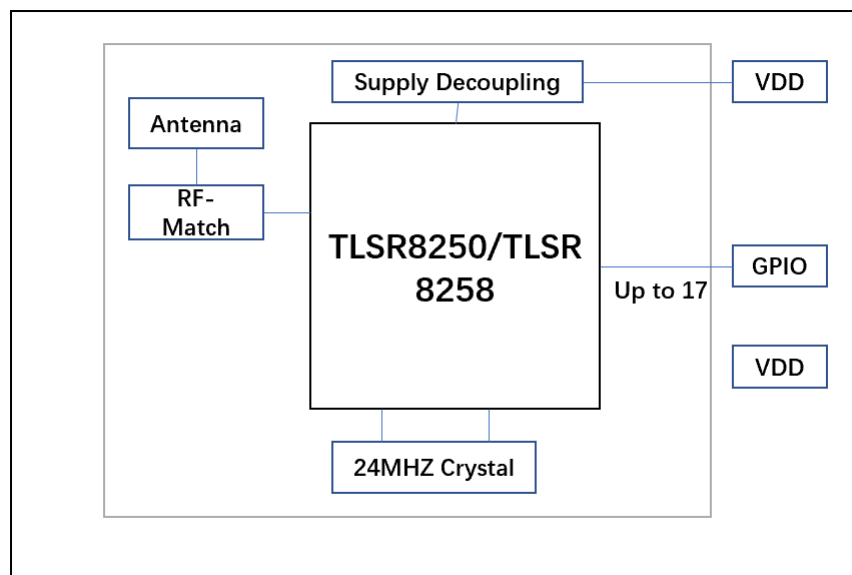
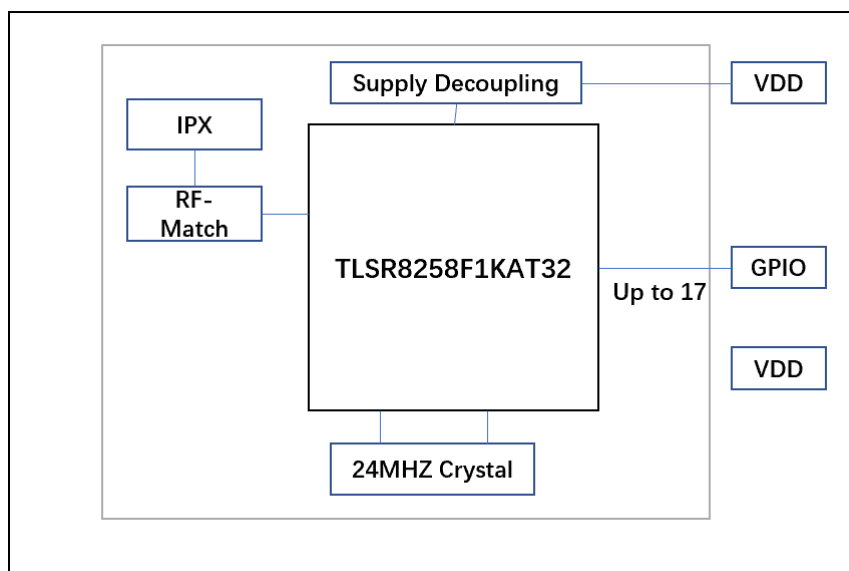**Figure 3.1.** LK8628A/B **Block diagram**

**Figure 3.2.** LK8628C **Block diagram**

### 3.2 TLSR8250&TLSR8258

The TLSR8250&TLSR8258 SoC features a 32-bit  core, a 2.4 GHz high-performance radio, 1024KB Flash memory, a rich set of MCU peripherals, For more chip information, please refer to:"TLSR8258 Specifications".

### 3.3 Antenna

The LK8628 module include a  built-in PCB antenna with the characteristics detailed in the table below.

Table 3.1 Antenna Efficiency and Peak Gain

| Parameter | With optimal layout | Antenna efficiency, gain and radiation pattern are highly dependent on the application PCB layout and mechanical design. Refer to the Design Guidelines for recommendations to achieve optimal antenna performance. |
|---|---|---|
| Efficiency | -6.57 到-6.05dB | |
| Peak gain | 0.54dBi | |

## 4. Electrical Characteristics

### 4.1 Absolute Maximum Ratings

| Parameter | Symbol | Test condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Storage temperature range | $T_{stg}$ | | -40 | — | +125 | ℃ |
| Voltage on any supply pin | V ccmax | | -0.3 | — | 3.6 | V |
| DC voltage on any GPIO pin | $V_{DIGPIN}$ | | -0.3 | — | $V_{IOVDD}+0.3$ | V |

### 4.2 Normal operating parameters

**LK8628A/B**

| Parameter | Symbol | Test condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Operating ambient temperature range | $T_A$ | -I temperature grade | -40 | — | +85 | ℃ |
| VCC Supply voltage | Vcc | | 1.8 | 3 | 3.6 | V |
| IOVDD opetating supply voltage(All IOVDD pins) | $V_{IOVDD}$ | | 1.8 | 3 | 3.6 | V |

**LK8628C**

| Parameter | Symbol | Test condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Operating ambient temperature range | $T_A$ | -I temperature grade | -40 | — | +105 | ℃ |
| VCC Supply voltage | Vcc | | 1.8 | 3 | 3.6 | V |
| IOVDD opetating supply voltage(All IOVDD pins) | $V_{IOVDD}$ | | 1.8 | 3 | 3.6 | V |

### 4.3 Radio Current Consumption @ 3V

RF current consumption measured all MCU peripheral disabled. $T_A$: 25 ℃.

| Parameter | Symbol | Test condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Current consumption in receive mode, | $I_{RX\_ACTIVE}$ | Whole Chip | – | 5.3 | – | m A |
| Current consumption in transmit mode | $I_{TX}$ | Whole chip @0dBm with DCDC | – | 4.8 | – | m A |

## 4.4 RF  General Characteristics

Conditions: $T_A$=25 ℃, VCC=3.0V. Measured with RF center frequency of 2.45G.

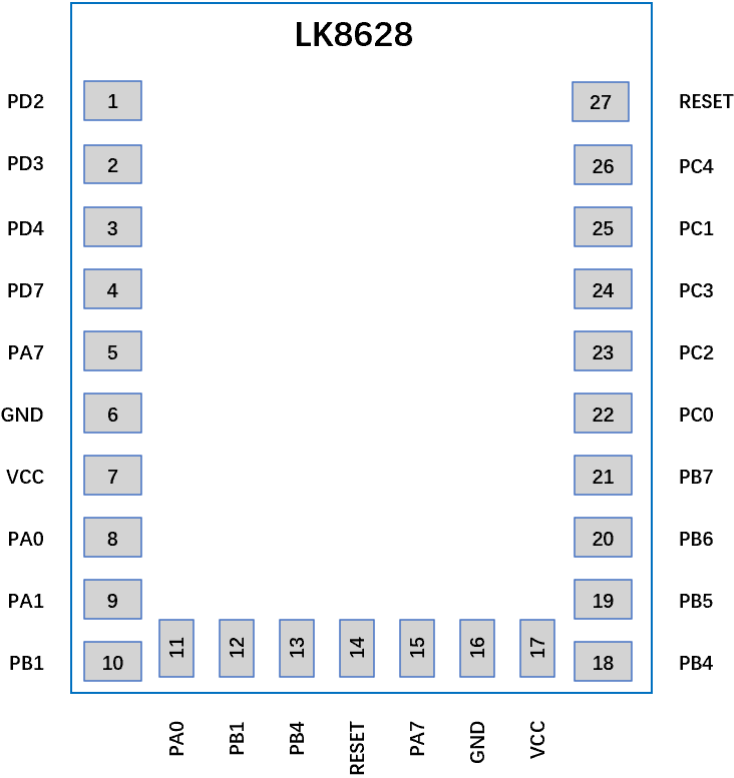| Parameter | Symbol | Test condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| RF tuning frequency range | $F_{range}$ | | 2400 | _ | 2483.5 | M HZ |
| Maximum TX output power | $POUT_{MAX}$ | LK8628A Module, VCC = 3.3 V | _ | 7 | _ | d Bm |
| | | LK8628B/C Module, VCC = 3.3 V | _ | 10 | _ | d Bm |
| Sensitivity | SENS | 1Mbps,VCC=3.3V | _ | -96 | _ | dBm |
| | | 2Mbps,VCC=3.3V | _ | -93 | _ | dBm |
| | | 500Kbps,VDD=3.3V | _ | -99 | _ | dBm |
| | | 125Kbps,VDD=3.3V | _ | -101 | _ | dBm |

## 5. Pin Definitions

### 5.1 Module Pinout



**Figure 5.1 LK8628 Module Pinout**

**Table 6.1 LK8628 Pin Definitions**

| Module Pin | Pin Description | Chip Pin | | Module Pin | Pin Description | Chip Pin |
|---|---|---|---|---|---|---|
| 1 | GPIO | PD<2> | | 15 | GPIO | PA<7> |
| 2 | GPIO | PD<3> | | 16 | Ground | GND |
| 3 | GPIO | PD<4> | | 17 | VCC | VCC |
| 4 | GPIO | PD<7> | | 18 | GPIO | PB<4> |
| 5 | GPIO | PA<7> | | 19 | GPIO | SPB<5> |
| 6 | Ground | GND | | 20 | GPIO | PB<6> |
| 7 | VCC | VCC | | 21 | GPIO | SPB<7> |
| 8 | GPIO | PA<0> | | 22 | GPIO | PC<0> |
| 9 | GPIO | PA<1> | | 23 | GPIO | PC<2> |
| 10 | GPIO | PB<1> | | 24 | GPIO | PC<3> |
| 11 | GPIO | PA<0> | | 25 | GPIO | PC<1> |
| 12 | GPIO | PB<1> | | 26 | GPIO | PC<4> |
| 13 | GPIO | PB<4> | | 27 | RESET | RESETB |
| 14 | RESET | RESETB | | | | |

## 6. 6. Package Outline
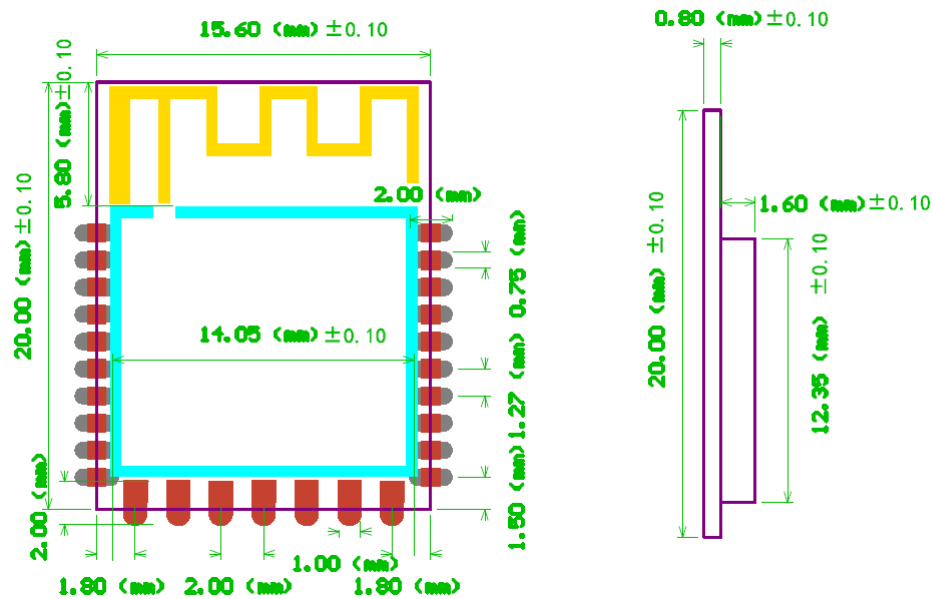


**Figure 6.1  Top and Side Views**
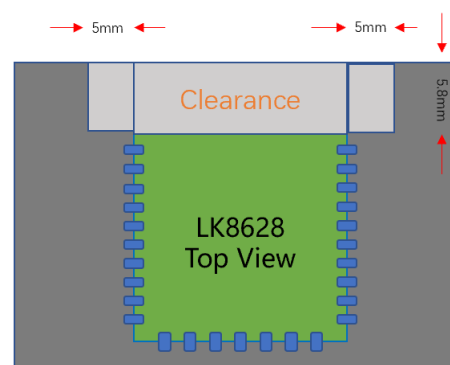
## 7. Design Guidelines

(1) It is recommended not to install in a metal housing.

(2) PCB layout: The antenna of the Bluetooth module (the left and right side and front end of the antenna) is strictly prohibited under the floor and trace, if it can be hollowed out better.

### 7.1 recommended layout scheme:
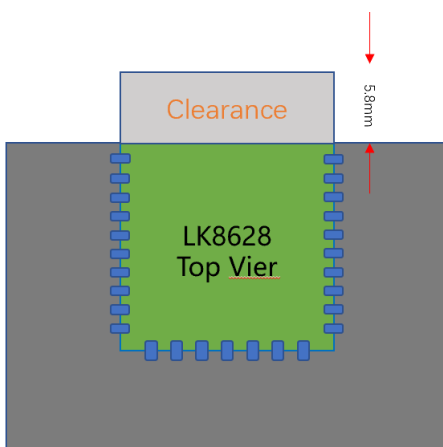


**Solution 1:Aantenna outside the PCB;**



**Soution2: Antenna aligned to the edge PCB, carved / withour copper below**

## 8. Module production process precautions:

1. Check the materials before production, if there is moisture, the plated materials are baked in an incubator at 120 °C±5 °C/4H, and the coiled materials are baked around the conditions of 60 °C ± 5 °C/8 hours in a constant temperature box to remove dampness.

2. Steel mesh engraving requirements, internal cutting and external expansion: In principle, the effective welding surface of the module is in the bottom area and the side, the inner cut is to prevent the bottom tin is generally cut inside 0.2MM, the outer expansion is to strengthen the welding strength of the side generally requires the three-side expansion range between 0.3mm-0.8mm according to the size of the pad, it is recommended to expand 0.3mm on both sides and 0.8mm on the outside.

3. Printing requirements, solder paste storage temperature/expiration date: 2-8°C/6 months, thawing time: 4 hours, stirring time: 5 minutes, usable time: 4-6 hours. Use solder paste with good activity, such as: senju solder paste or 3-4 grams of silver 1 kilogram solder paste.

4. Reflow soldering requirements, RoHS process furnace temperature setting Normal peak temp242-245°C time 10 seconds, Between: 160-217°C time 80-95 seconds, Over: 220°C, time 50-65 seconds Upward: 1-3°C/sec.

**Federal Communication Commission Interference 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.

This device 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.

**FCC Caution:**

➢ Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
➢ The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
➢ The country code selection is for non-US model only and is not available to all US model.

## ▶ RF Exposure Information (SAR)

This device is intended only for OEM integrators under the following conditions;

1）     The antenna must be installed such that 20 cm is maintained between the antenna and users, and the maximum antenna gain allowed for use with this device is 3dBi,

As long as 1 conditions above are met, further transmitter test will not be required. However,the OEM integrator is still responsible for testing their end-product for any additionalcompliance requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling：The final end product must be labeled in a visible area with the following:

Contains FCC ID: 2A8JX-LK8628C

Manual Information to the End User：The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.