2.4G Proprietary/BLE Module

MPRFMODULE1
Manual

Revision history

Version	Date	Description
1.0	2022/5/22	First release
1.1	2022/8/22	RF warning message
1.2	2022/8/22	RF warning message update
1.3	2022/8/22	RF info update
1.4	2022/09/06	Add ch4 antenna instructions
1.5	2022/10/04	Add 5.2 – 5.4 for FCC/IC requirement

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1 Product Introduction

1.1 Introduction

MPRFMODULE1 is a BLE 5.2/ 2.4G proprietary module based on Nordic nRF52840 SoC with a 32-bit ARM® Cortex® M4 CPU, 1MB flash and 256kB RAM. The module comes with a coaxial connector for an external PIFA antenna.

1.2 Feather

- ARM® Cortex® M4 32bit processor with FPU, 64Mhz
- 1 MB flash and 256 kB RAM
- Bluetooth®5 & 2.4 GHz transceiver
- BLE 5 data rate: 1 Mbps
- 2.4G proprietary data rate: 2 Mbps
- Flexible power mangement:
    1.7V to 5.5V supply voltage range
    On-chip DC/DC and LDO regulators with automated low current modes
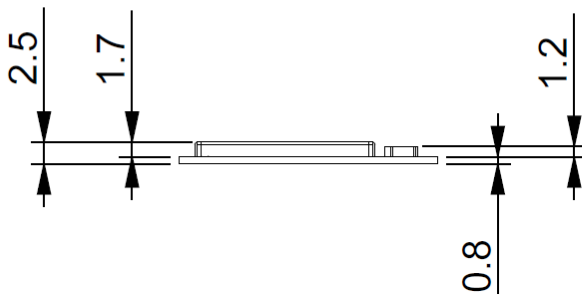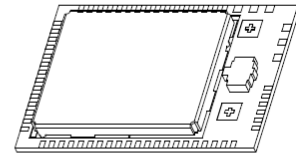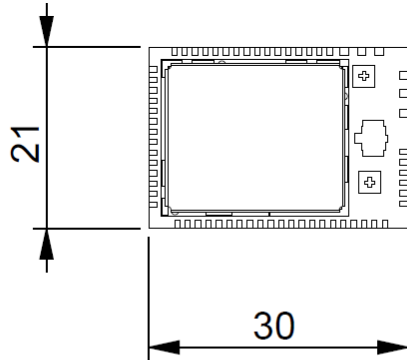   1.8V to 3.3V regulated supply for external components

1.3 Certification

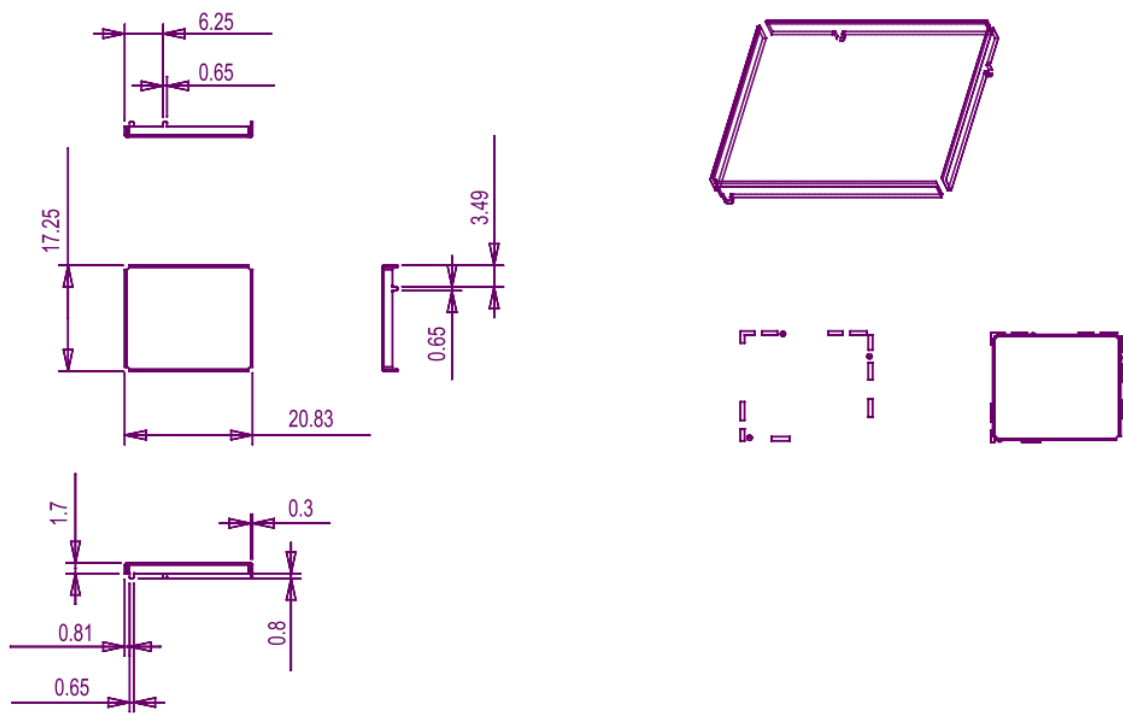- FCC ID:
- CE IDL:
- DID:

2 Product Descriptions

2.1 Dimension

- **PCB Size: 21 x 30 x 0.8mm**

Unit (mm)

- **Shielding Case**

Unit (mm)

2.2 Pin definition
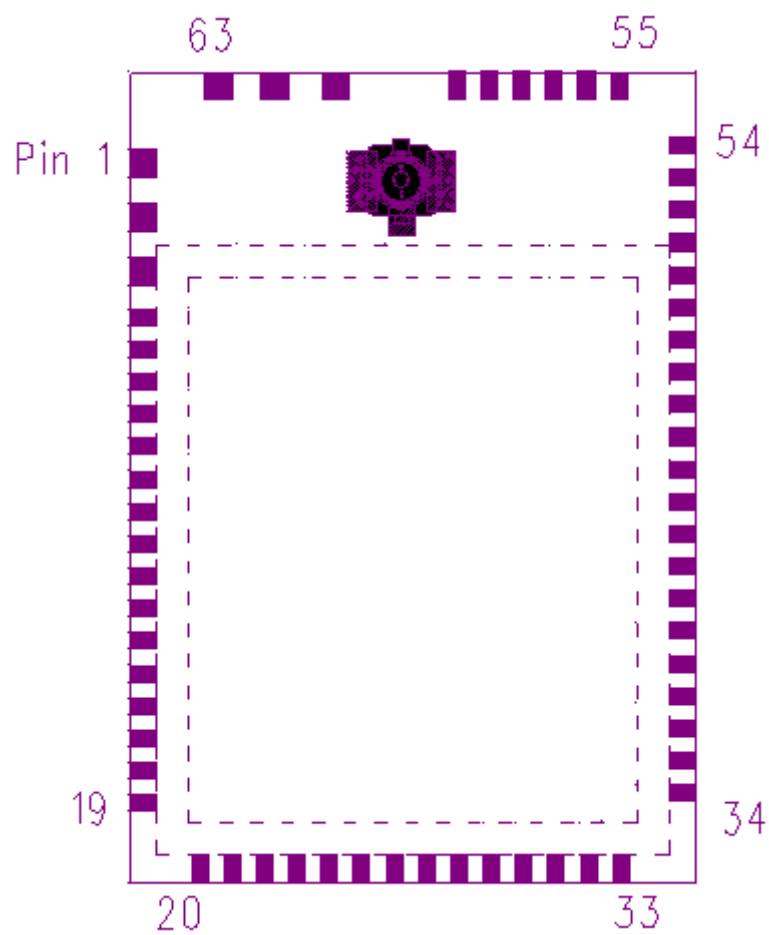
Pin No.	Name	Function	Description
1	GND	Power	ground
2	GND	Power	ground
3	GND	Power	ground
4	P1.11	Digital I/O	General purpose I/O (Standard drive)
5	P1.12	Digital I/O	General purpose I/O (Standard drive)
6	P1.14	Digital I/O	General purpose I/O (Standard drive)
7	P0.03	Digital I/O Analog input	General purpose I/O (Standard drive) Analog input
8	P0.28	Digital I/O Analog input	General purpose I/O (Standard drive) Analog input
9	P1.10	Digital I/O	General purpose I/O (Standard drive)
10	P1.13	Digital I/O	General purpose I/O (Standard drive)
11	P1.15	Digital I/O	General purpose I/O (Standard drive)
12	P0.02	Digital I/O Analog input	General purpose I/O (Standard drive) Analog input
13	P0.29	Digital I/O Analog input	General purpose I/O (Standard drive) Analog input
14	P0.31	Digital I/O Analog input	General purpose I/O (Standard drive) Analog input
15	P0.30	Digital I/O Analog input	General purpose I/O (Standard drive) Analog input
16	P0.27	Digital I/O	General purpose I/O
17	P0.05	Digital I/O Analog input	General purpose I/O Analog input
18	P0.07	Digital I/O	General purpose I/O
19	P1.08	Digital I/O	General purpose I/O
20	P0.11	Digital I/O	General purpose I/O
21	P0.00	Digital I/O Analog input	General purpose I/O Analog input
22	P0.01	Digital I/O Analog input	General purpose I/O Analog input
23	P0.26	Digital I/O	General purpose I/O
24	P0.04	Digital I/O Analog input	General purpose I/O Analog input
25	P0.06	Digital I/O	General purpose I/O
26	P0.08	Digital I/O	General purpose I/O
27	P1.09	Digital I/O	General purpose I/O
28	P0.12	Digital I/O	General purpose I/O
29	VDDH	Power	High voltage power supply
30	DCCH	Power	DC/DC converter output
31	VBUS	power	5 V input for USB 3.3 V regulator
32	VDD	power	Power supply
33	GND	power	ground
34	P0.14	Digital I/O	General purpose I/O
35	D-	USB	USB D-
36	D+	USB	SUB D+
37	P0.16	Digital I/O	General purpose I/O
38	P0.18	Digital I/O	General purpose I/O
39	P0.19	Digital I/O	General purpose I/O
40	P0.13	Digital I/O	General purpose I/O
41	P0.15	Digital I/O	General purpose I/O
42	P0.17	Digital I/O	General purpose I/O
43	P0.21	Digital I/O	General purpose I/O
44	P0.20	Digital I/O	General purpose I/O
45	P0.22	Digital I/O	General purpose I/O
46	P0.24	Digital I/O	General purpose I/O

47	P1.00	Digital I/O	General purpose I/O
48	SWDIO	Debug	Serial wire debug I/O for debug and programming
49	SWDCLK	Debug	Serial wire debug clock input for debug and programming
50	P1.02	Digital I/O	General purpose I/O (Standard drive)
51	P1.04	Digital I/O	General purpose I/O (Standard drive)
52	P1.06	Digital I/O	General purpose I/O (Standard drive)
53	P0.09	Digital I/O	General purpose I/O (Standard drive)
54	P0.10	Digital I/O	General purpose I/O (Standard drive)
55	P0.23	Digital I/O	General purpose I/O
56	P0.25	Digital I/O	General purpose I/O
57	P1.01	Digital I/O	General purpose I/O (Standard drive)
58	P1.03	Digital I/O	General purpose I/O (Standard drive)
59	P1.05	Digital I/O	General purpose I/O (Standard drive)
60	P1.07	Digital I/O	General purpose I/O (Standard drive)
61	GND	Power	ground
62	GND	Power	ground
63	GND	Power	ground

2.3 Footprint
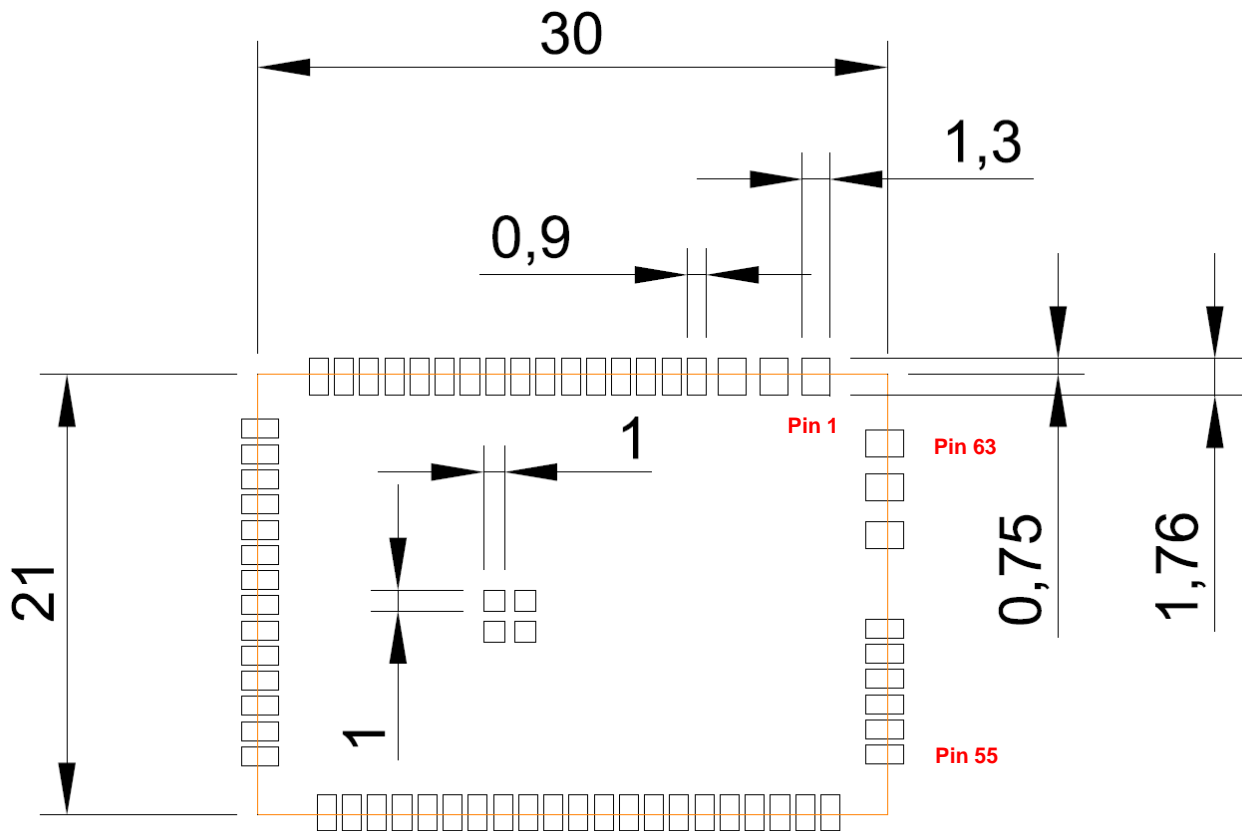
2.4 Block diagram
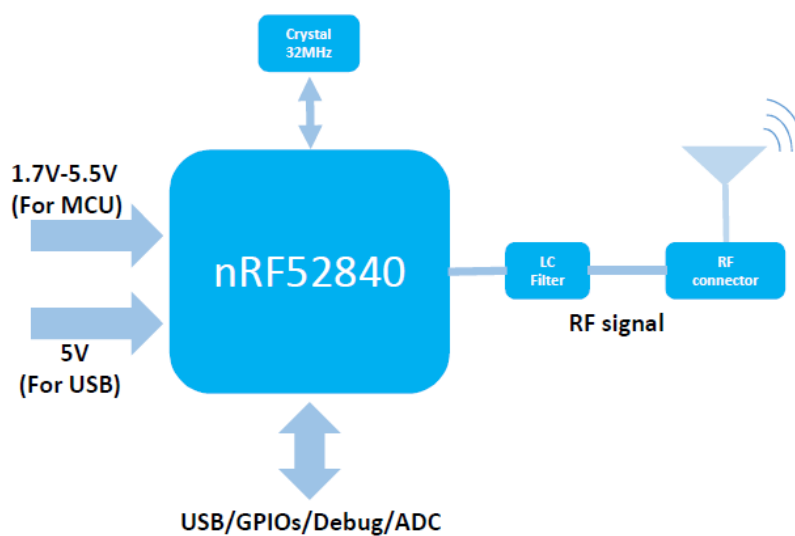
3 Electrical specification

3.1 Absolute maximum ratings

	Note	Min.	Max.	Unit
Supply voltages				
VDD		-0.3	+3.9	V
VDDH		-0.3	+5.8	V
VBUS		-0.3	+5.8	V
VSS			0	V
I/O pin voltage				
$V_{I/O}$, VDD ≤3.6 V		-0.3	VDD + 0.3	V
$V_{I/O}$, VDD >3.6 V		-0.3	3.9	V
Radio				
RF input level			10	dBm
Environmental aQFN™ 73 package				
Storage temperature		-40	+125	°C
MSL	Moisture Sensitivity Level		2	
ESD HBM	Human Body Model		2	kV
ESD HBM Class	Human Body Model Class		2	
ESD CDM	Charged Device Model		450	V

3.2 Recommended operating conditions

Symbol	Parameter	Min.	Nom.	Max.	Units
VDD	VDD supply voltage, independent of DCDC enable	1.7	3.0	3.6	V
VDD_{POR}	VDD supply voltage needed during power-on reset	1.75			V
VDDH	VDDH supply voltage, independent of DCDC enable	2.5	3.7	5.5	V
VBUS	VBUS USB supply voltage	4.35	5.0	5.5	V
t_{R_VDD}	Supply rise time (0 V to 1.7 V)			60	ms
t_{R_VDDH}	Supply rise time (0 V to 3.7 V)			100	ms
TA	Operating temperature	-40	25	85	°C
T_J	Junction temperature			90	°C

3.3 General radio characteristics

Symbol	Description	Min.	Typ.	Max.	Units
f_{OP}	Operating frequencies	2402		2480	MHz
$f_{PLL,CH,SP}$	PLL channel spacing		1		MHz
$f_{DELTA,1M}$	Frequency deviation @ 1 Mbps		±170		kHz
$f_{DELTA,BLE,1M}$	Frequency deviation @ BLE 1 Mbps		±250		kHz
fsk_{BPS}	On-the-air data rate	125		2000	kbps

3.4 Radio current consumption (transmitter)

Symbol	Description	Min.	Typ.	Max.	Units
$I_{TX,PLUS8dBM,DCDC}$	TX only run current (DC/DC, 3 V) P_{RF} = +8 dBm		14.8		mA
$I_{TX,PLUS8dBM}$	TX only run current P_{RF} = +8 dBm		32.7		mA
$I_{TX,PLUS4dBM,DCDC}$	TX only run current (DC/DC, 3 V) P_{RF} = +4 dBm		9.6		mA
$I_{TX,PLUS4dBM}$	TX only run current P_{RF} = +4 dBm		21.4		mA
$I_{TX,0dBM,DCDC,5V,REG0HIGH}$	TX only run current (DC/DC, 5 V, REG0 out = 3.3 V) P_{RF} = 0 dBm		3.0		mA
$I_{TX,0dBM,DCDC,5V,REG0L}$	TX only run current (DC/DC, 5 V, REG0 out = 1.8 V) P_{RF} = 0 dBm		3.0		mA
$I_{TX,0dBM,DCDC}$	TX only run current (DC/DC, 3 V) P_{RF} = 0 dBm		4.8		mA
$I_{TX,0dBM}$	TX only run current P_{RF} = 0 dBm		10.6		mA
$I_{TX,MINUS4dBM,DCDC}$	TX only run current DC/DC, 3 V P_{RF} = -4 dBm		3.1		mA
$I_{TX,MINUS4dBM}$	TX only run current P_{RF} = -4 dBm		8.1		mA
$I_{TX,MINUS8dBM,DCDC}$	TX only run current DC/DC, 3 V P_{RF} = -8 dBm		3.3		mA
$I_{TX,MINUS8dBM}$	TX only run current P_{RF} = -8 dBm		7.2		mA
$I_{TX,MINUS12dBM,DCDC}$	TX only run current DC/DC, 3 V P_{RF} = -12 dBm		3.0		mA
$I_{TX,MINUS12dBM}$	TX only run current P_{RF} = -12 dBm		6.4		mA
$I_{TX,MINUS16dBM,DCDC}$	TX only run current DC/DC, 3 V P_{RF} = -16 dBm		2.8		mA
$I_{TX,MINUS16dBM}$	TX only run current P_{RF} = -16 dBm		6.0		mA
$I_{TX,MINUS20dBM,DCDC}$	TX only run current DC/DC, 3 V P_{RF} = -20 dBm		2.7		mA
$I_{TX,MINUS20dBM}$	TX only run current P_{RF} = -20 dBm		5.6		mA
$I_{TX,MINUS40dBM,DCDC}$	TX only run current DC/DC, 3 V P_{RF} = -40 dBm		2.3		mA
$I_{TX,MINUS40dBM}$	TX only run current P_{RF} = -40 dBm		4.6		mA
$I_{START,TX,DCDC}$	TX start-up current DC/DC, 3 V, P_{RF} = 4 dBm		5.2		mA
$I_{START,TX}$	TX start-up current, P_{RF} = 4 dBm		11.0		mA

3.5 Radio current consumption (Receiver)

Symbol	Description	Min.	Typ.	Max.	Units
$I_{RX,1M,DCDC}$	RX only run current (DC/DC, 3 V) 1 Mbps/1 Mbps BLE		4.6		mA
$I_{RX,1M}$	RX only run current (LDO, 3 V) 1 Mbps/1 Mbps BLE		9.9		mA
$I_{START,RX,1M,DCDC}$	RX start-up current (DC/DC, 3 V) 1 Mbps/1 Mbps BLE		3.7		mA
$I_{START,RX,1M}$	RX start-up current 1 Mbps/1 Mbps BLE		6.7		mA

3.6 Transmitter specification

Symbol	Description	Min.	Typ.	Max.	Units
P_{RF}	Maximum output power		6.0		dBm
P_{RFC}	RF power control range		28.0		dB
P_{RFCR}	RF power accuracy (NT)			±2	dB
$P_{RF1,2}$	1st Adjacent Channel Transmit Power 2 MHz (2 Mbps)		-25		dBc
$P_{RF2,2}$	2nd Adjacent Channel Transmit Power 4 MHz (2 Mbps)		-54.0		dBc

3.7 Receiver operation

Symbol	Description	Min.	Typ.	Max.	Units
$P_{RX,MAX}$	Maximum received signal strength at < 0.1% PER		0		dBm
$P_{SENS,IT,1M}$	Sensitivity, 1 Mbps nRF mode ideal transmitter[1]		-93		dBm
$P_{SENS,IT,SP,1M,BLE}$	Sensitivity, 1 Mbps BLE ideal transmitter, packet length ≤ 37 bytes BER=1E-3[3]		-95		dBm
$P_{SENS,IT,LP,1M,BLE}$	Sensitivity, 1 Mbps BLE ideal transmitter, packet length ≥ 128 bytes BER=1E-4[4]		-94		dBm

[1] Typical sensitivity applies when ADDR0 is used for receiver address correlation. When ADDR[1...7] are used for receiver address correlation, the typical sensitivity for this mode is degraded by 3 dB.

[2] Typical sensitivity applies when ADDR0 is used for receiver address correlation. When ADDR[1..7] are used for receiver address correlation, the typical sensitivity for this mode is degraded by 3 dB.

[3] As defined in the *Bluetooth Core Specification v4.0 Volume 6: Core System Package (Low Energy Controller Volume)*

[4] Equivalent BER limit < 10E-04

3.8 RX selectivity [5]

Symbol	Description	Min.	Typ.	Max.	Units
$C/I_{1M,co-channel}$	1Mbps mode, Co-Channel interference		9		dB
$C/I_{1M,-1MHz}$	1 Mbps mode, Adjacent (-1 MHz) interference		-2		dB
$C/I_{1M,+1MHz}$	1 Mbps mode, Adjacent (+1 MHz) interference		-10		dB
$C/I_{1M,-2MHz}$	1 Mbps mode, Adjacent (-2 MHz) interference		-19		dB
$C/I_{1M,+2MHz}$	1 Mbps mode, Adjacent (+2 MHz) interference		-42		dB
$C/I_{1M,-3MHz}$	1 Mbps mode, Adjacent (-3 MHz) interference		-38		dB
$C/I_{1M,+3MHz}$	1 Mbps mode, Adjacent (+3 MHz) interference		-48		dB
$C/I_{1M,\pm6MHz}$	1 Mbps mode, Adjacent (≥6 MHz) interference		-50		dB
$C/I_{1MBLE,co-channel}$	1 Mbps BLE mode, Co-Channel interference		6		dB
$C/I_{1MBLE,-1MHz}$	1 Mbps BLE mode, Adjacent (-1 MHz) interference		-2		dB
$C/I_{1MBLE,+1MHz}$	1 Mbps BLE mode, Adjacent (+1 MHz) interference		-9		dB
$C/I_{1MBLE,-2MHz}$	1 Mbps BLE mode, Adjacent (-2 MHz) interference		-22		dB
$C/I_{1MBLE,+2MHz}$	1 Mbps BLE mode, Adjacent (+2 MHz) interference		-46		dB
$C/I_{1MBLE,>3MHz}$	1 Mbps BLE mode, Adjacent (≥3 MHz) interference		-50		dB
$C/I_{1MBLE,image}$	Image frequency interference		-22		dB
$C/I_{1MBLE,image,1MHz}$	Adjacent (1 MHz) interference to in-band image frequency		-35		dB

[5] Desired signal level at PIN = -67 dBm. One interferer is used, having equal modulation as the desired signal. The input power of the interferer where the sensitivity equals BER = 0.1% is presented

3.9 RX intermodulation [6]

Symbol	Description	Min.	Typ.	Max.	Units
$P_{IMD,5TH,1M}$	IMD performance, 1 Mbps, 5th offset channel, packet length ≤ 37 bytes		-33		dBm
$P_{IMD,5TH,1M,BLE}$	IMD performance, BLE 1 Mbps, 5th offset channel, packet length ≤ 37 bytes		-30		dBm

[6] Desired signal level at PIN = -64 dBm. Two interferers with equal input power are used. The interferer closest in frequency is not modulated, the other interferer is modulated equal with the desired signal. The input power of the interferers where the sensitivity equals BER = 0.1% is presented.

3.10 Radio timing

Symbol	Description	Min.	Typ.	Max.	Units
$t_{TXEN,BLE,1M}$	Time between TXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE and 150 µs TIFS)	140		140	µs
$t_{TXEN,FAST,BLE,1M}$	Time between TXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE with fast ramp-up and 150 µs TIFS)	40		40	µs
$t_{TXDIS,BLE,1M}$	When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit	6		6	µs
$t_{RXEN,BLE,1M}$	Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE)	140		140	µs
$t_{RXEN,FAST,BLE,1M}$	Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE with fast ramp-up)	40		40	µs
$t_{RXDIS,BLE,1M}$	When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit	0		0	µs

3.11 Received signal strength indicator (RSSI) specifications

Symbol	Description	Min.	Typ.	Max.	Units
RSSI$_{ACC}$	RSSI accuracy valid range -90 to -20 dBm		±2		dB
RSSI$_{RESOLUTION}$	RSSI resolution		1		dB
RSSI$_{PERIOD}$	RSSI sampling time from RSSI_START task		0.25		μs
RSSI$_{SETTLE}$	RSSI settling time after signal level change		15		μs

4 Antenna

4.1 Antenna Type and Gains

Only antennas of the same type and with equal or less gains as 3.96 dBi for the 2.4GHz band shall be used with the MPRFMODULE1. Other types of antennas and/or higher gain antennas may require additional authorization for operation. For testing purposes the following dual band antenna that approximates closely the above limits was used:

Antenna Type	Part No.	Peak Gain	Length
PIFA	20LT0-000LJ000	3.96 dBi for 2.4GHz	150mm
Note : The antenna gain include cable loss.			

4.2 Antenna Placement Within the Host Platform

To ensure RF exposure compliance the antenna used with the ASUS wireless module must be installed in host platforms to provide a minimum separation distance from all persons, in all operating modes and orientations of the host platform, with strict adherence to the table below. The antenna separation distance applies to both horizontal and vertical orientation of the antenna when installed in the host system.

ASUS Wireless Module	Minimum required antenna-to-user separation distance
MPRFMODULE1	0 mm

4.3 Recommended Method For Retention Of Cable

It is recommended to restrain the antenna cables of products of cable length leaving the RF connectors on the module.
It is recommended to use a robust tape or adhesive to secure the cables so they do not move or pull on the connector during shock and vibration of the system.

5 RF warning message

5.1 RF Exposure Information (SAR)

This device meets the government's requirements for exposure to radio waves. This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the U.S. Government.

The exposure standard employs a unit of measurement known as the Specific Absorption Rate, or SAR. The SAR limit set by the FCC is 1.6 W/kg. Tests for SAR are conducted using standard operating positions accepted by the FCC with the EUT transmitting at the specified power level in different channels.

The FCC has granted an Equipment Authorization for this device with all reported SAR levels evaluated as in compliance with the FCC RF exposure guidelines. SAR information on this device is on file with the FCC and can be found under the Display Grant section of www.fcc.gov/eot/ea/fccid after searching on FCC ID: MSQMPRFMODULE1

5.2 Class B Device Interference Statement

This wireless module 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 wireless module generates, uses, and can radiate radio frequency energy. If the wireless module is not installed and used in accordance with the instructions, the wireless module may cause harmful interference to radio communications. There is no guarantee, however,

that such interference will not occur in a particular installation. If this wireless module 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 taking one or more of the following measures:

·   Reorient or relocate the receiving antenna of the equipment experiencing the interference.

·   Increase the distance between the wireless module and the equipment experiencing the interference.

·   Connect the computer with the wireless adapter to an outlet on a circuit different from that to which the equipment experiencing the interference is connected.

·   Consult the dealer or an experienced radio/TV technician for help.
         NOTE: The adapter must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product. Any other installation or use will violate FCC Part 15 regulations.

5.3 Information for OEMs and Host Integrators

The guidelines described within this document are provided to OEM integrators installing ASUS wireless module in keyboard and mouse devices. Adherence to these requirements is necessary to meet the conditions of compliance with FCC rules, including RF exposure. When all antenna type and placement guidelines described herein are fulfilled the ASUS wireless module may be incorporated into keyboard and mouse devices with no further restrictions. If any of the guidelines described herein are not satisfied it may be necessary for the OEM or integrator to perform additional testing and/or obtain additional approval. The OEM or integrator is responsible to determine the required host regulatory testing and/or obtaining the required host approvals for compliance.

·   ASUS wireless module are intended for OEMs and host integrators only.

·   The ASUS wireless module FCC Grant of Authorization describes any limited conditions of modular approval.

·   The ASUS wireless module must be operated with an access point that has been approved for the country of operation.

·   Changes or modification to ASUS wireless module by OEMs, integrators or other third parties is not permitted. Any changes or modification to ASUS wireless module by OEMs, integrators or other third parties will void authorization to operate the adapter.

5.4 Simultaneous Transmission of ASUS Wireless Module with Other Integrated or Plug-In Transmitters

Based upon FCC Knowledge Database publication number 616217, when there are multiple transmitting devices installed in a host device, an RF exposure transmitting assessment shall be performed to determine the necessary application and test requirements. OEM integrators must identify all possible combinations of simultaneous transmission configurations for all transmitters and antennas installed in the host system. This includes transmitters installed in the host as mobile devices (>20 cm separation from user) and portable devices (<20 cm separation from user). OEM integrators should consult the actual FCC KDB 616217 document for all details in making this assessment to determine if any additional requirements for testing or FCC approval is necessary.

Canada, Innovation, Science and Economic Development Canada (ISED) Notices

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.

Avis du Canada, Innovation, Sciences et Développement économique Canada (ISED)

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.

Radio Frequency (RF) Exposure Information

The radiated output power of the Wireless Device is below the Innovation, Science and Economic Development Canada (ISED) radio frequency exposure limits. The Wireless Device should be used in such a manner such that the potential for human contact during normal operation is minimized.

This device has been evaluated for and shown compliant with the ISED Specific Absorption Rate ("SAR") limits when operated in portable exposure conditions.

Informations concernant l'exposition aux fréquences radio (RF)

La puissance de sortie rayonnée du dispositif sans fil est inférieure aux limites d'exposition aux radiofréquences d'Innovation, Sciences et Développement économique Canada (ISED). Le dispositif sans fil doit être utilisé de manière à minimiser le potentiel de contact humain pendant le fonctionnement normal.

Cet appareil a été évalué et montré conforme aux limites de DAS (Débit d'Absorption Spécifique) de l'ISED lorsqu'il est utilisé dans des conditions d'exposition portables.

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	ASUS	20LT0-000LJ000 (Main)	PIFA	3.96 dBi for 2.4 GHz

NCC: Taiwan Wireless Statement

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

本模組於取得認證後將依規定於模組本體標示審驗合格標籤，並要求最終產品平台廠商(OEM Integrator)於最終產品平台(End Product)上標示: ((·
" 本產品內含射頻模組，其 NCC 型式認證號碼為： CCXXxxYYyyyZzW "

CE RED RF Output table (Directive 2014/53/EU)

Function	FREQUENCY	Maximum Output Power(EIRP)
WiFi	2402-2480 MHz	10 dBm
Bluetooth	2402-2480 MHz	10 dBm

UKCA RF Output table (The Radio Equipment Regulations 2017)

Function	FREQUENCY	Maximum Output Power(EIRP)
WiFi	2402-2480 MHz	10 dBm
Bluetooth	2402-2480 MHz	10 dBm

KC RF Output Table

Function	Frequency	Power
2.4GHz wireless	2402-2480MHz-Module 특정소출력 무선기기(무선데이터통신시스템용 무선기기)	4mW
BLE	2402-2480MHz-Module 특정소출력 무선기기(무선데이터통신시스템용 무선기기)	4mW

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