



MN54L-C15

Bluetooth® Low Energy Module

Datasheet Version A

Ordering Code

MN54L-C15 module for Box packaging: MN-L15Q1-01A-CB

BLE Solution: Nordic NRF54L15

RF IC	Crystal	Chip antenna
Nordic NRF54L15/V1	32MHz/20ppm/CL=8PF Embedded	Embedded

Overview and Benefits

Overview

The MN54L-C15 from **Aradconn** is a highly flexible, ultra-low power, Bluetooth Low Energy module based on the nRF54L15 SoC from Nordic Semiconductor. With an Arm® Cortex®-M33 with FPU 32-bit processor, embedded 2.4GHz transceiver, and integrated chip antenna. Providing full use of the nRF54L15's capabilities and peripherals, which include I2C, SPI, QSPI, UART, I2S, ADC, GPIO, and PWM interfaces.

Benefits

- **Bluetooth qualification and Regulatory certification reduce the burden to enter the market.**
- **Complete RF solution with no additional RF design, allowing faster time to launch a new product, and providing long working distance.**

MN54L-C: up to 500 meters in open space. @1 Mbps

- **Compact size: (L) 14.5 x (W) 9.3 x (H) 2.1mm.**
- **Provides flexibility in the OEM's application development choice with full support for using Nordic SDK and firmware tools.**

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1. Features

1.1 Features

• 2.4 GHz transceiver

- -96 dBm sensitivity in 1Mbps Bluetooth® low energy mode
- -104 dBm sensitivity in 125kbps Bluetooth® low energy mode(long range)
- -8 to +8dBm TX power, configurable in 1 dB steps
- Supported data rates:
 - Bluetooth® 5 – 2 Mbps, 1 Mbps, 500 kbps, and 125 kbp
 - IEEE 802.15.4-2020 – 250 kbps
 - Proprietary 2.4 GHz –4Mbps, 2 Mbps, 1 Mbps
- 9.1 mA/ @3V DC/DC peak current in TX (7 dBm)
- 2.1 mA/@3V DC/DC peak current in RX
- RSSI (1 dB resolution)

• Arm® Cortex®-M33 32-bit processor with TrustZone® technology, 128 MHz

- 500 EEMBC CoreMark® score running from non-volatile memory
- Single-precision floating-point unit (FPU)
- Memory protection unit (MPU)
- Digital signal processing (DSP) instructions
- Serial wire debug (SWD)

• Operating condition

- 1.7 V to 3.6 V supply and I/O voltage
- Single 32 MHz crystal operation
- Optional 32.768 kHz clock
- Operating temperature from -40°C to 85°C

• Memory

- 1.524MB NVM/256 kB RAM

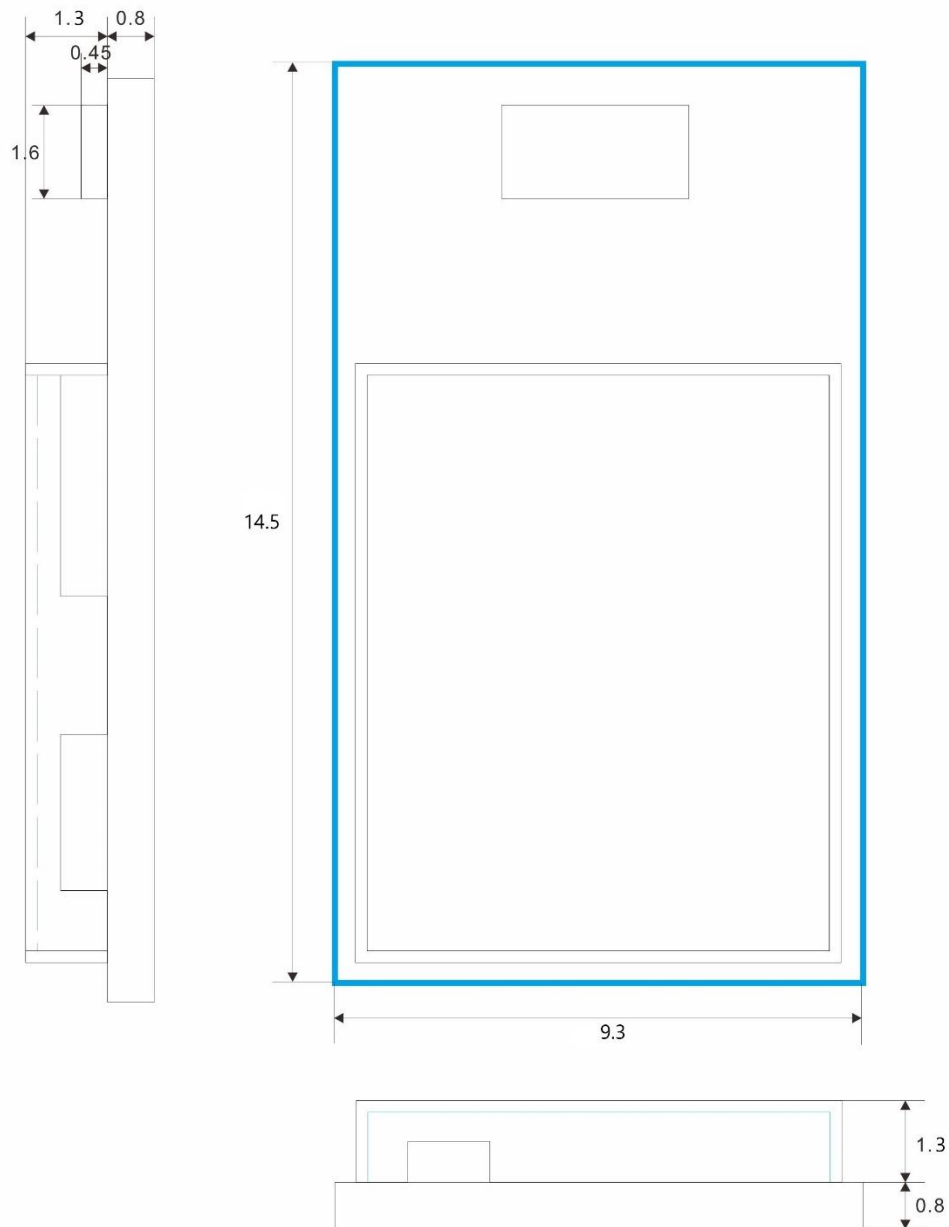
• Peripherals

- RISC-V 128MHZ Coprocessor
- 31 general purpose I/O pins
- Global RTC (GRTC) that can run in System OFF mode and implement a shared system timer
- Seven 32-bit timers with counter mode
- Up to five fully featured serial interfaces with EasyDMA,
supporting I2C, SPI controller/peripheral, and UART
 - One high-speed SPIM up to 32 MHz, four up to 8 MHz
 - I2C up to 400 kHz

- Three pulse width modulator (PWM) units with EasyDMA
- I2S two channel Inter-IC sound interface
- ADC with up to eight programmable gain channels.
14-bit at 31.25ksps, 12-bit at 250 ksps, and up to 10-bit at 2 Msps.
- Pulse density modulation (PDM) interface
- Up to two quadrature decoders (QDEC)
- Comparator and low-power comparator with wake-up from System OFF mode
- Temperature sensor

2. Mechanical specifications

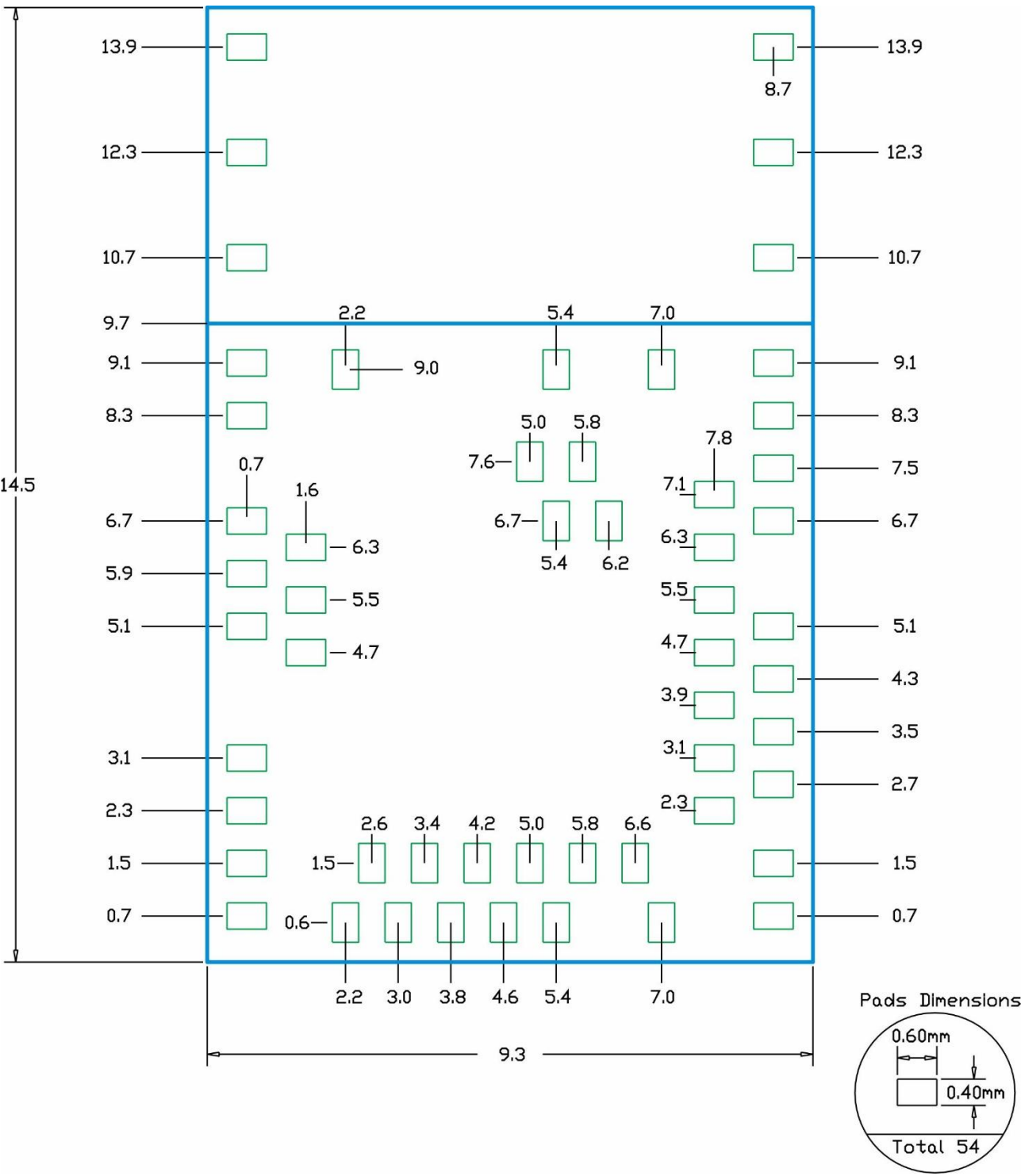
2.1 Dimensions



All dimensions are in millimeters.

Item	Dimension	Tolerance
Length	14.5mm	±0.30 mm
Width	9.3mm	±0.30mm
Height	2.1mm	±0.30mm

2.2 Footprint



All dimensions are in millimeters.

2.3 Module Marking

Aradconn MN:MN54L

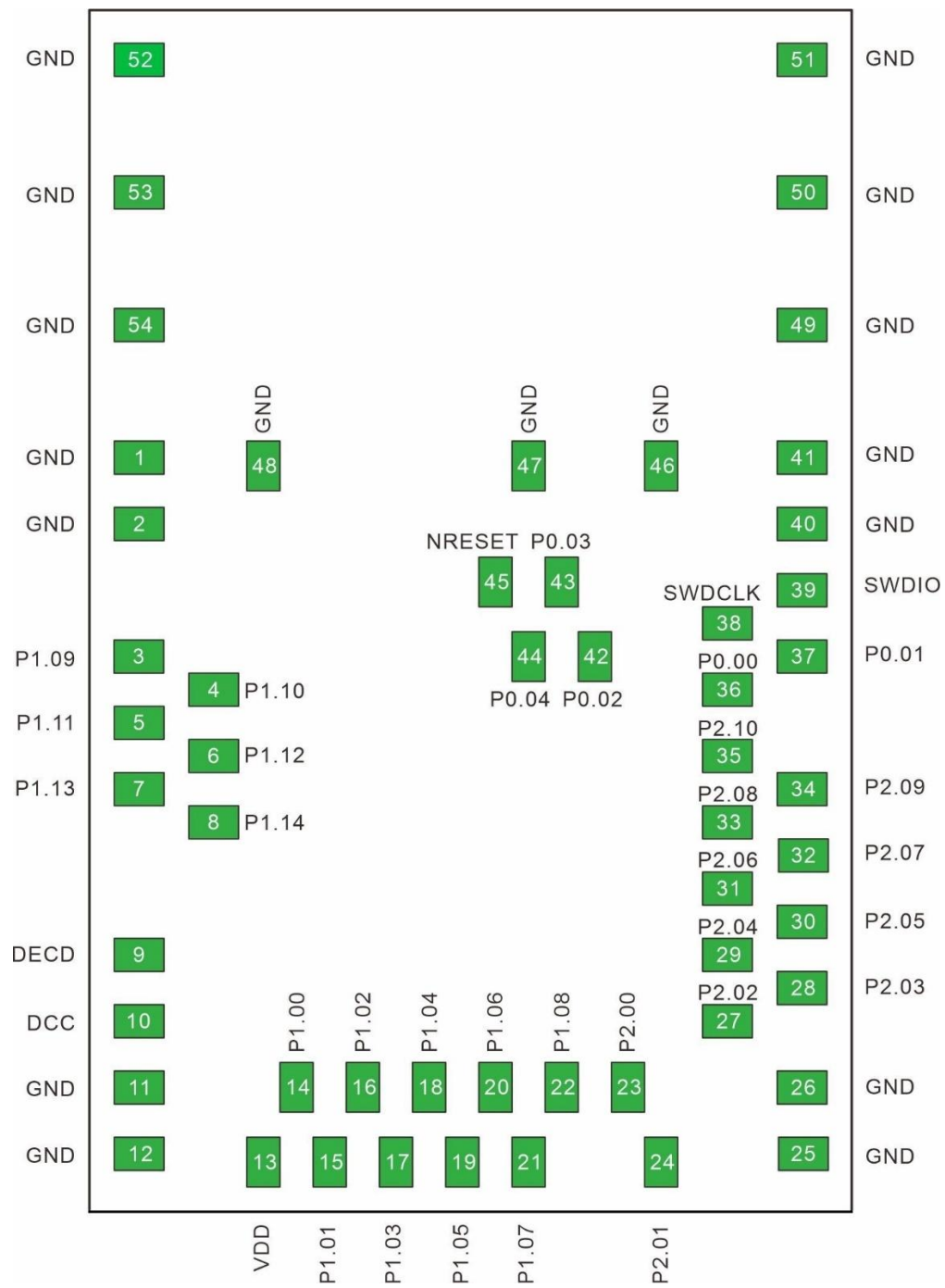
FCC ID: 2BLIDMN54L

IC: 33328 -MN54L

CMIIT ID:



3. Pin Assignment



Pin No.	Name	Pin function	Description
(1)	GND	Ground	The pad must be connected to a solid ground plane
(2)	GND	Ground	The pad must be connected to a solid ground plane
(3)	P1.09	Digital I/O	General-purpose I/O
	Radio 0	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
(4)	P1.10	Digital I/O	General-purpose I/O
	Radio 1	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
(5)	P1.11	Digital I/O	General-purpose I/O
	Radio 2	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN4	Analog input	Analog input
		Clock pin	Can be set as TWI
(6)	P1.12	Digital I/O	General-purpose I/O
	Radio 3	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN5	Analog input	Analog input
		Clock PIN	Can be set as TWI
(7)	P1.13	Digital I/O	General-purpose I/O
	Radio 4	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN6	Analog input	Analog input
(8)	P1.14	Digital I/O	General-purpose I/O
	Radio 5	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN7	Analog input	Analog input
(9)	DECD	Power	0.9 V regulator supply decoupling
(10)	DCC	Power	DC/DC regulator output
(11)	GND	Ground	The pad must be connected to a solid ground plane
(12)	GND	Ground	The pad must be connected to a solid ground plane
(13)	VDD	Power	Power supply
(14)	P1.00	Digital I/O	General-purpose I/O
	XL1	Analog input	Connection to 32.768kHz crystal (LFXO)
(15)	P1.01	Digital I/O	General-purpose I/O
	XL2	Analog input	Connection to 32.768kHz crystal (LFXO)
(16)	P1.02	Digital I/O	General-purpose I/O
(17)	P1.03	Digital I/O	General-purpose I/O
(18)	P1.04	Digital I/O	General-purpose I/O
	AIN0	Analog input	Analog input
(19)	P1.05	Digital I/O	General-purpose I/O
	Radio 6	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN1	Analog input	Analog input
(20)	P1.06	Digital I/O	General-purpose I/O
	AIN2	Analog input	Analog input
(21)	P1.07	Digital I/O	General-purpose I/O
	AIN3	Analog input	Analog input
Pin No.	Name	Pin function	Description
(22)	P1.08	Digital I/O	General-purpose I/O
	CLK16M	Clock PIN	GRTC HF clock output
	EXTREF	Analog input	External reference for SAADC

(23)	P2.00	Digital I/O	General-purpose I/O
		Digital I/O	SPIM DCX
		Digital I/O	UARTE RXD
		Digital I/O	QSPI D3
(24)	P2.01	Digital I/O	General-purpose I/O
		Clock PIN	SPIM SCK
		Clock PIN	SPIS SCK
		Clock PIN	QSPI SCK
(25)	GND	Ground	The pad must be connected to a solid ground plane
(26)	GND	Ground	The pad must be connected to a solid ground plane
(27)	P2.02	Digital I/O	General-purpose I/O
		Digital I/O	SPIM SDO
		Digital I/O	SPIS SDO
		Digital I/O	UARTE TXD
		Digital I/O	QSPI D0
(28)	P2.03	Digital I/O	General-purpose I/O
		Digital I/O	QSPI D2
(29)	P2.04	Digital I/O	General-purpose I/O
		Digital I/O	SPIM SDI
		Digital I/O	SPIS SDI
		Digital I/O	UARTE CTS
		Digital I/O	QSPI D1
(30)	P2.05	Digital I/O	General-purpose I/O
		Digital I/O	SPIM CS
		Digital I/O	UARTE RTS
		Digital I/O	QSPI CS
(31)	P2.06	Digital I/O	General-purpose I/O
		Clock PIN	SPIM SCK
		Clock PIN	SPIS SCK
(32)	P2.07	Digital I/O	General-purpose I/O
		Digital I/O	SPIM DCX
		Digital I/O	UART RXD
(33)	P2.08	Digital I/O	General-purpose I/O
		Digital I/O	SPIM SDO
		Digital I/O	SPIS SDO
		Digital I/O	UARTE TXD
(34)	P2.09	Digital I/O	General-purpose I/O
		Digital I/O	SPIM SDI
		Digital I/O	SPIS SDI
		Digital I/O	UART CTS
Pin No.	Name	Pin function	Description
(35)	P2.10	Digital I/O	General-purpose I/O
		Digital I/O	SPIM CS

		Digital I/O	UARTE RTS
(36)	P0.00	Digital I/O	General-purpose I/O
(37)	P0.01	Digital I/O	General-purpose I/O
(38)	SWDCLK	Debug	Serial wire clock. Input with onchip pull-up.
(39)	SWDIO	Debug	Serial wire data. Bidirectional with standard-drive and on-chip pull-down.
(40)	GND	Ground	The pad must be connected to a solid ground plane
(41)	GND	Ground	The pad must be connected to a solid ground plane
(42)	P0.02	Digital I/O	General-purpose I/O
(43)	P0.03	Digital I/O	General-purpose I/O
	GRTCPWM	Clock PIN	GRTC PWM output
(44)	P0.04	Digital I/O	General-purpose I/O
	GRTCLFCLKOUT	Clock PIN	GRTC LF clock output
(45)	nRESET	Reset	Pin reset with on-chip pull-up
(46)	GND	Ground	The pad must be connected to a solid ground plane
(47)	GND	Ground	The pad must be connected to a solid ground plane
(48)	GND	Ground	The pad must be connected to a solid ground plane
(49)	GND	Ground	The pad must be connected to a solid ground plane
(50)	GND	Ground	The pad must be connected to a solid ground plane
(51)	GND	Ground	The pad must be connected to a solid ground plane
(52)	GND	Ground	The pad must be connected to a solid ground plane
(53)	GND	Ground	The pad must be connected to a solid ground plane
(54)	GND	Ground	The pad must be connected to a solid ground plane

3.1 GPIO Recommended usage

Module PIN NO.	NRF54L15 GPIO	Recommended usage
QSPI		
23	P2.00	QSPI D3
24	P2.01	QSPI SCK
27	P2.02	QSPI D0
28	P2.03	QSPI D2
29	P2.04	QSPI D1
30	P2.05	QSPI CS
TWI (Note: TWIM and TWIS must use clock pins for both SDA and SCL)		
5	P1.11	TWI
6	P1.12	TWI
43	P0.03	Can be set as TWI when PWM output is unused
44	P0.04	Can be set as TWI when LF Clock output is unused
UARTE 00/20		
23	P2.00	RXD
27	P2.02	TXD
29	P2.04	CTS
30	P2.05	RTS
UARTE 00/21		
32	P2.07	RXD
33	P2.08	TXD
34	P2.09	CTS
35	P2.10	RTS
SPI 00/20		
23	P2.00	SPIM DCX
24	P2.01	SPIM/SPIS SCK
27	P2.02	SPIM/SPIS SDO
29	P2.04	SPIM/SPIS SDI
30	P2.05	SPIM CS
SPI 00/21		
31	P2.06	SPIM/SPIS SCK
32	P2.07	SPIM DCX
33	P2.08	SPIM/SPIS SDO
34	P2.09	SPIM/SPIS SDI
35	P2.10	SPIM CS
PWM		
43	P0.03	PWM

Clock Output		
22	P1.08	GRTC HF clock output(16MHZ)
44	P0.04	GRTC LF clock output (32.768KHZ)
Analog Input		
19	P1.05	AIN1
20	P1.06	AIN2
21	P1.07	AIN3
22	P1.08	External reference for SAADC
5	P1.11	AIN4
6	P1.12	AIN5
7	P1.13	AIN6
8	P1.14	AIN7
Radio (Direction Finding Antenna select GPIO)		
3	P1.09	Radio 0
4	P1.10	Radio 1
5	P1.11	Radio 2
6	P1.12	Radio 3
7	P1.13	Radio 4
8	P1.14	Radio 5

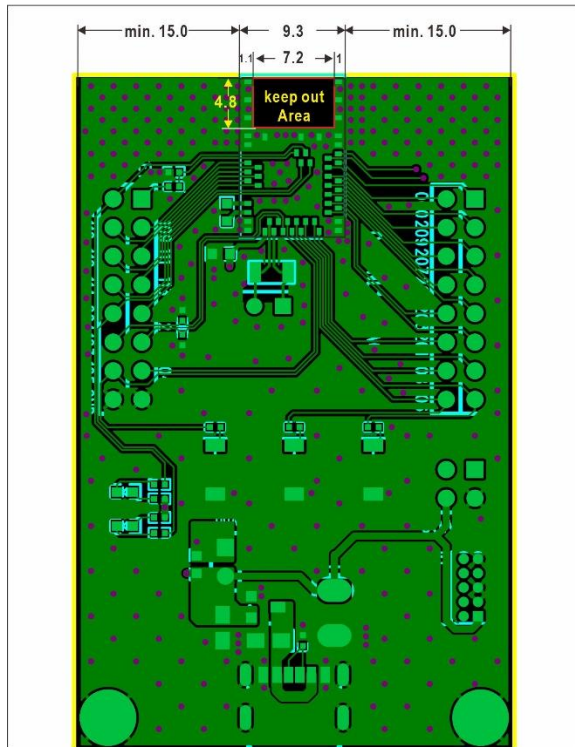
4 Layout design notes

4.1 Recommended RF layout and ground plane

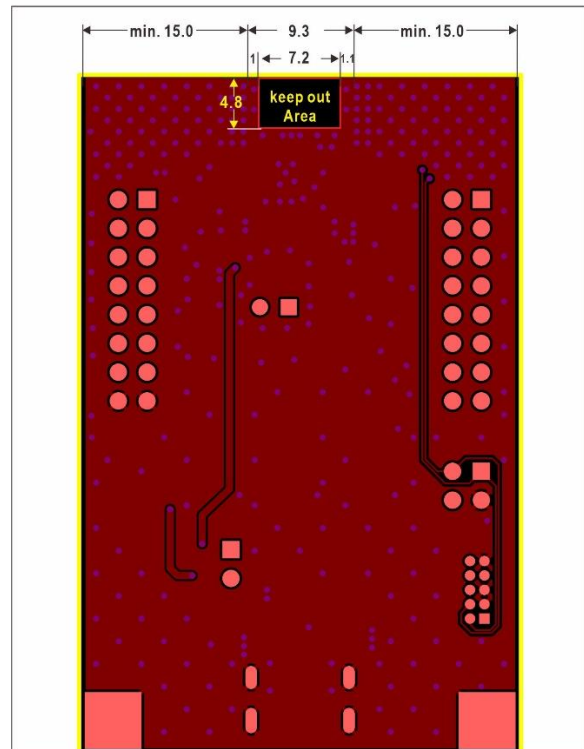
It is recommended to place the module:

- In the center (horizontal) of any mother PCB edge, with GND planes to the left and right
- Keep out Area should be included in the corresponding position of the antenna in each layer.
- Add via hole around GND pads on the mother PCB as many as you can, especially on the four corners and antenna area.

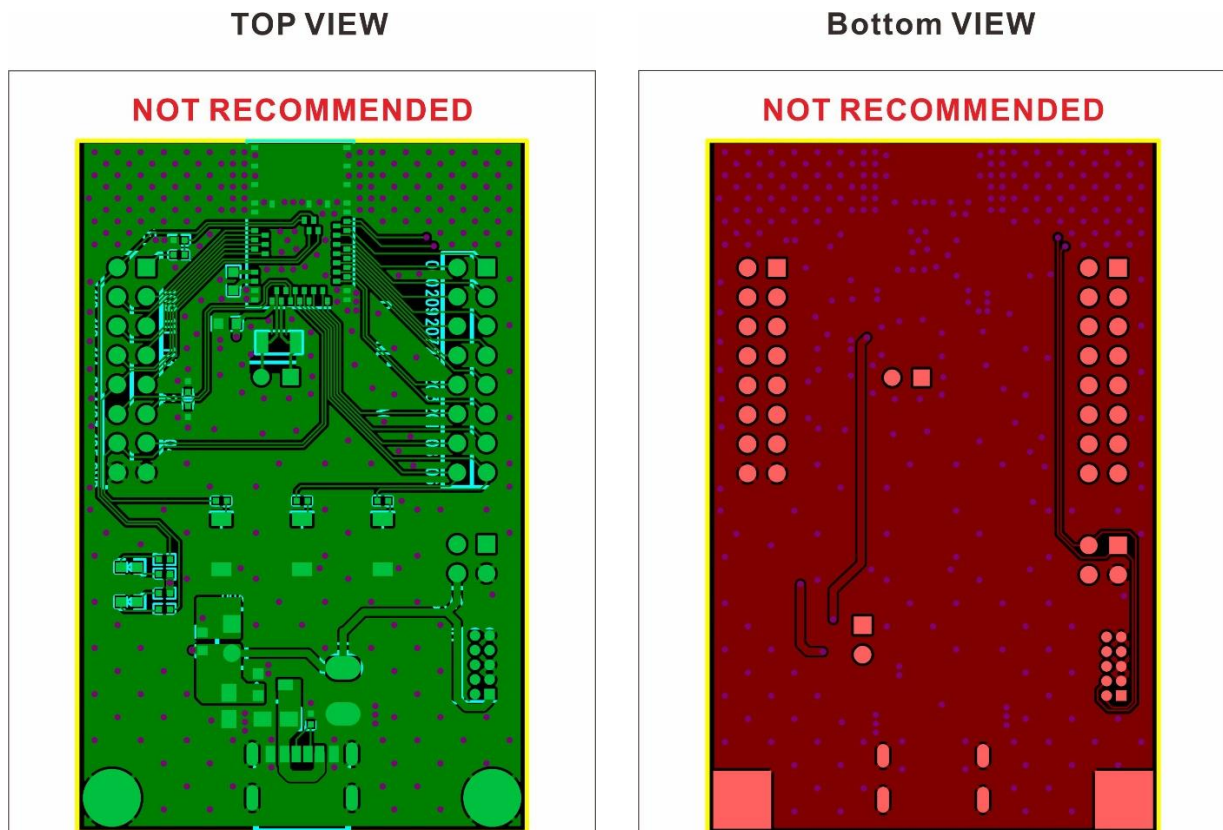
TOP VIEW



Bottom VIEW



4.2 Not Recommended RF layout and ground plane



4.3 Antenna keep out when proximity to Metal

- The minimum safe distance for metals without seriously compromising the antenna tuning is 4cm (bottom, top, left, right).
- Metal close to the antenna (bottom, top, left, right) will degrade RF performance. Any metal closer than 2 cm will significantly degrade RF performance.

5. Electrical Specification

5.1 Absolute Maximum Ratings

Maximum ratings are the extreme limits to which the chip can be exposed for a limited amount of time without causing permanent damage. Prolonged exposure to absolute maximum ratings may affect the device's reliability.

Parameter	Min.	Max.	Unit
Supply voltage			
VDD	-0.3	+3.6	V
VSS		0	V
I/O pin voltage			
VI/o, VDD ≤3.5 V	-0.3	VDD+0.3	V
VI/o, VDD >3.5 V		3.6	V
Environmental			
Storage temperature	-40	+105	°C
MSL (moisture sensitivity level)		2	
ESD HBM (human body model)		1	KV
ESD CDM (charged device model)		500	V
Flash memory			
Endurance		10000	Write/erase cycles
Retention		10 years at 85°C	

5.2 Operation Conditions

Parameter	Min.	Nom.	Max.	Units
VDD (independent of DCDC)	1.7		3.5	V
VDD during power on reset	1.75			V
Operating temperature	-40	25	85	°C

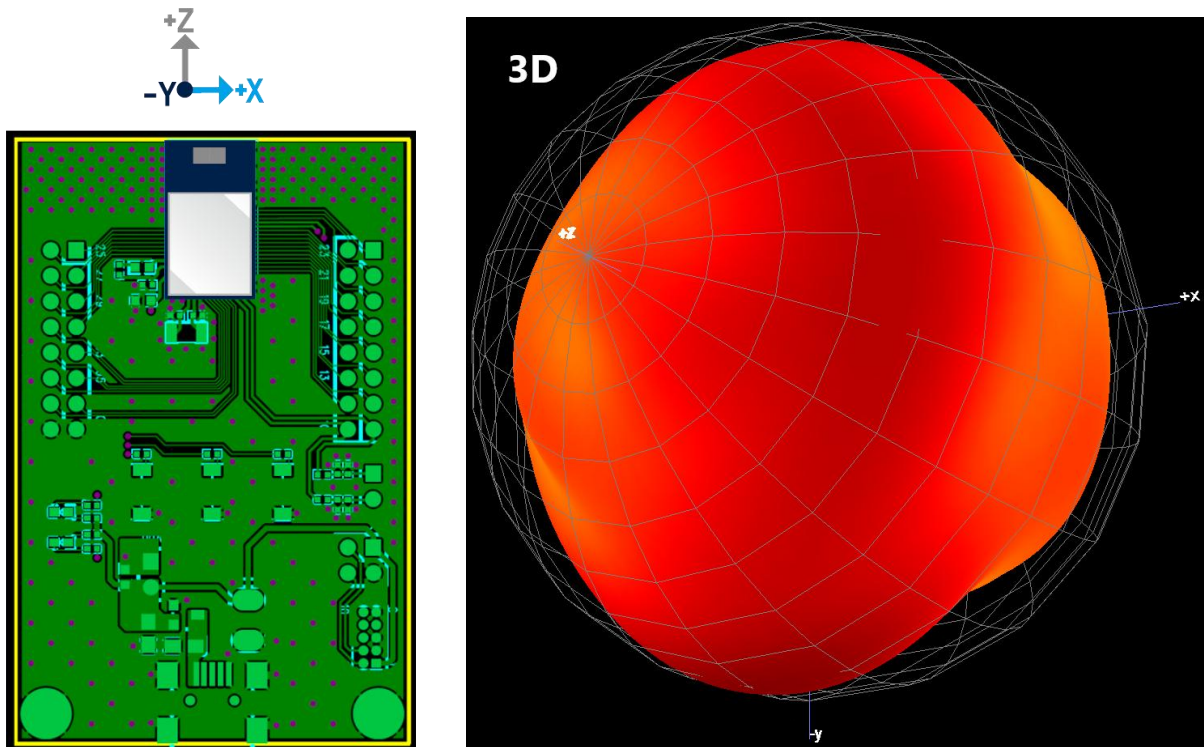
5.3 Radio Specifications

Parameter	Description	Min.	Typ.	Max.	Unit
Operating frequencies	BLE	2402		2480	MHz
Channel spacing	BLE		2		MHz
Frequency deviation	BLE 1Mbps		±250		kHz
	BLE 2Mbps		±500		kHz
On-the-air data rate		125		4000	kHz
Transmitter					
TX power	Setting at +7dBm		+7		dBm
RF power control range	-8 ~+8dBm, in 1db step	-16		+7	dBm
TX current (TX only)	DCDC@3V/+7 dBm		9.1		mA
Receiver					
Receive Sensitivity	1Msps BLE ideal transmitter Packet <=37bytes BRE=0.1%		-96		dBm
	2Msps BLE ideal transmitter Packet <=37bytes BRE=0.1%		-94		dBm
	125ksps BLE ideal transmitter Packet <=37bytes BRE=0.1%		-104		dBm
RX current (RX only)	DCDC@3V/1Msps BLE		2.1		mA
	DCDC@3V/2Msps BLE		2.2		mA
RSSI	RSSI Accuracy Valid range	-90		-30	dBm
	RSSI resolution		1		dB
	Sample period		0.25		us
Antenna gain			1.05		dBi

5.4 Antenna information

The antenna test report is based on the BN54L-C15 with a ground plane size of 60 mm x 40 mm.

5.4.1 The orientation of Antenna

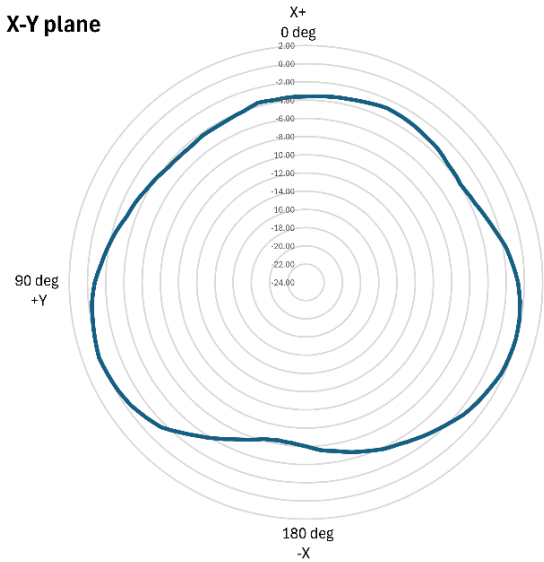


5.4.2 Antenna Gain and Efficiency

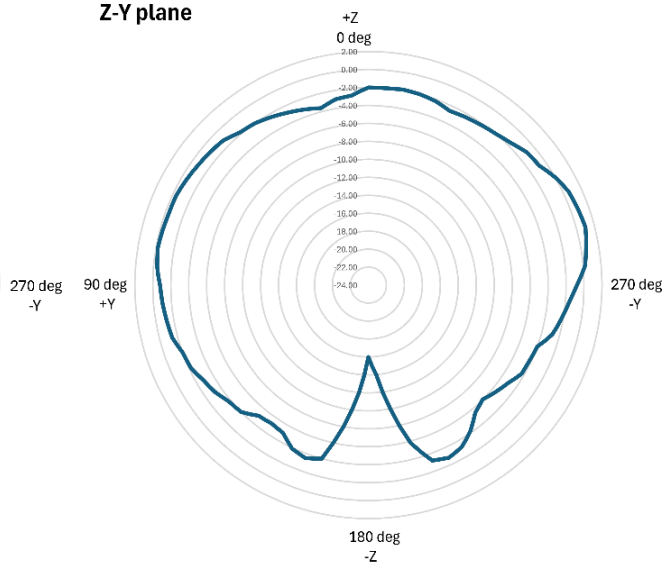
Frequency	Gain(dBi)	Efficiency
2400MHZ	-0.21	42
2410MHZ	0.22	45
2420MHZ	0.52	47
2430MHZ	0.92	50
2440MHZ	1.05	51
2450MHZ	0.87	50
2460MHZ	0.62	48
2470MHZ	0.43	44
2480MHZ	0.19	40
2490MHZ	-0.27	35

5.4.3 Antenna Pattern 2D

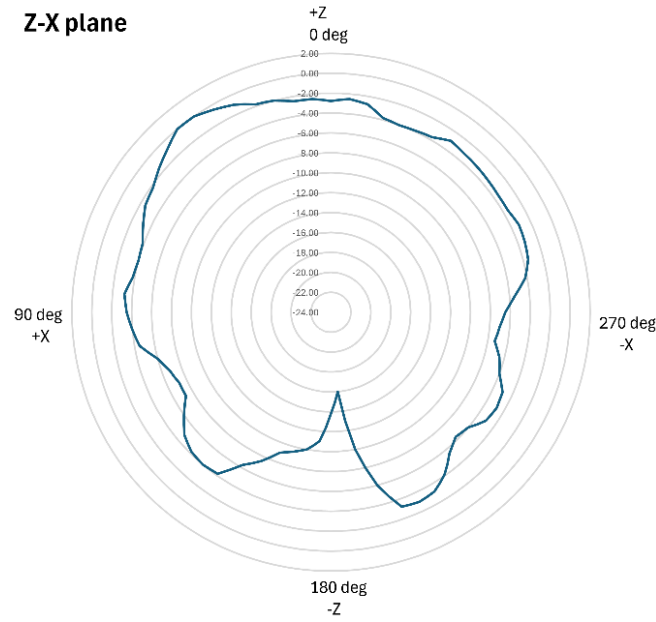
X-Y plane



Z-Y plane



Z-X plane



5.5 CPU Specifications

The ARM® Cortex®-M33 processor with floating-point unit (FPU) has a 32-bit instruction set.

128 MHz RISC-V coprocessor : VPR RISC-V is a small, efficient CPU developed by Nordic Semiconductor.

Memory	NVM	RAM			
	1524KB	256KB			
Parameter	Description	Min.	Typ.	Max.	Unit
CoreMark	running from flash, cache enabled		500		CoreMark
CoreMark /MHz	running from flash, cache enabled		3.9		CoreMark/ MHz
CPU current	Running Coremark@128MHz from NVM, cache enabled		2.6		mA
	running Coremark@128MHz from RAM, cache disabled		2.9		mA

5.6 Power Management

Parameter	Description	Min.	Typ.	Max.	Unit
System OFF	No RAM retention, Wake on pin		0.6		uA
	No RAM retention, Wake on pin +GRTC ,LFXO		0.8		uA
System ON	No RAM retention, Wake on pin		0.7		uA
	Full RAM retention, Wake on pin		3.0		uA
	Full RAM retention, Wake on pin + GRTC ,LFXO		3.1		uA
	Full RAM retention, Wake on pin + GRTC ,LFRC		3.7		uA

5.7 System Clock

The MN54L series requires two clocks, a high frequency clock and a low frequency clock.

- The high frequency clock (HFCLK)

HFCLK is provided on-module by a high-accuracy 32 MHz/±20 ppm/CL=8PF crystal for radio and CPU operation.

- The low frequency clock (LFCLK)

LFCLK can be provided internally by an RC oscillator (±250 ppm) with calibration, or externally by a 32.768 kHz crystal.

Internal 32.768 kHz RC oscillator (LFRC)

Description	Min.	Typ.	Max.	Unit
Nominal frequency		32.768		kHz
Frequency tolerance for LFRC after calibration (calibration performed at least every 8 seconds)			±500	ppm
Run current for 32.768 kHz RC oscillator		0.7		uA
Startup time for 32.768 kHz RC oscillator		1000		us

External 32.768 kHz crystal oscillator (LFXO)

Parameter	Description	Min.	Typ.	Max.	Unit
	Crystal frequency		32.768		kHz
	Frequency tolerance requirement for BLE stack			±500	ppm
	Frequency tolerance requirement for ANT stack			±50	ppm
	Run current for 32.768 kHz crystal oscillator		0.23		uA
CL	Load capacitance	6		9	pF

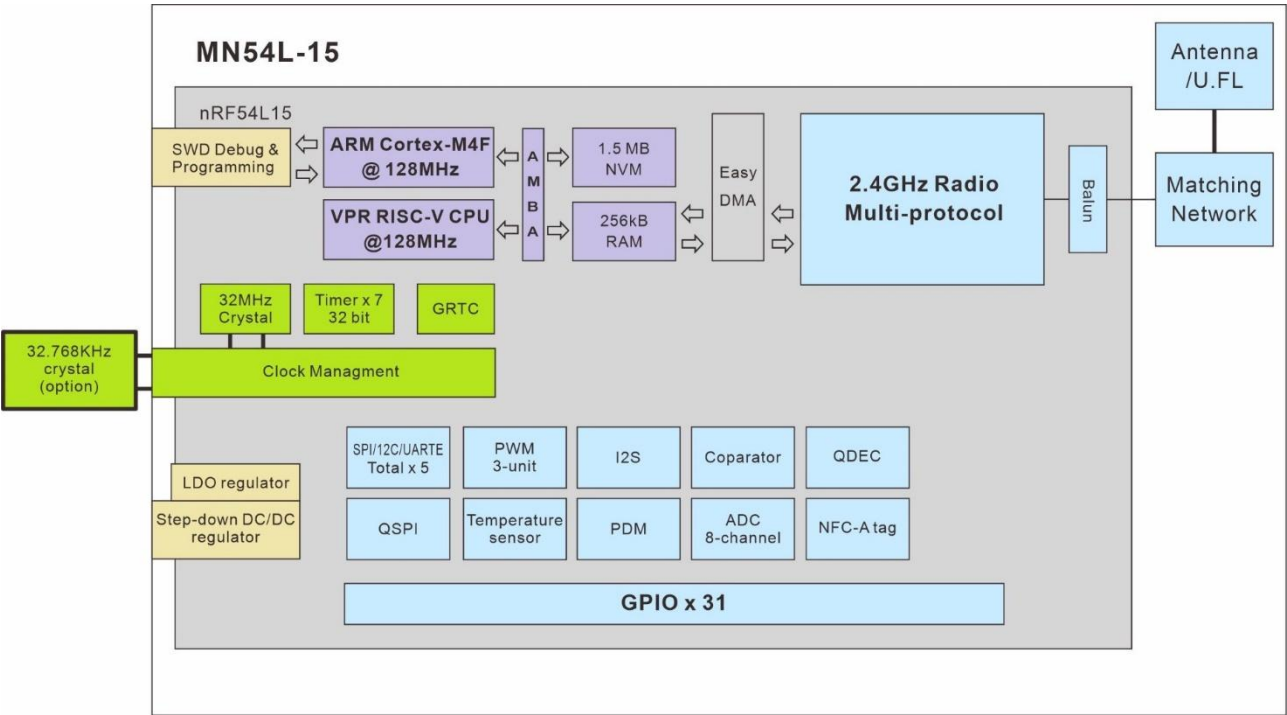
An external crystal provides the lowest power consumption and greatest accuracy.

Using the internal RC oscillator with calibration provides acceptable performance for BLE stack at a reduced cost and slight increase in power consumption.

Important:

- The ANT protocol requires the use of an external crystal for high accuracy.
- Nordic SDK example program P1.00/P1.01 as external LFXO, you need an external crystal to work.
- Nordic SDK example program P1.00/P1.01 as external LFXO, if you would like to reduce material cost, save layout space or requires 2 more GPIO for application. you need program P1.00/P1.01 as internal LFRC.

5.8 Block Diagram



6. BN54L-C15 evaluation board

6.1 BN54L-C15 component placement

BN54L-C15 is a full-featured evaluation board for **MN54L-C15** that supports:

M1:MN54L-C15 module

J6: A power over Type C USB

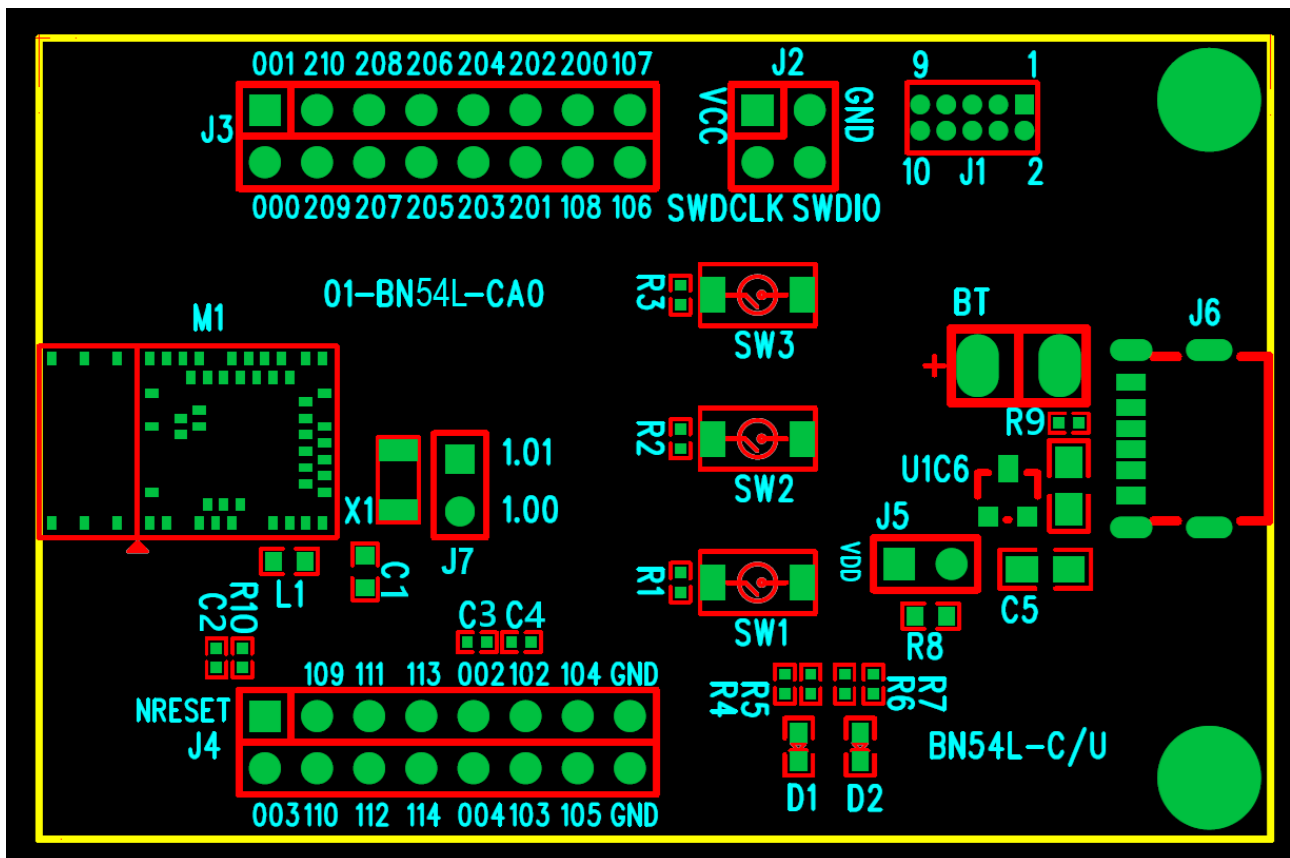
J3/J4: Complete I/O pinout to headers

J1/J2: On-board programming and debugging interface

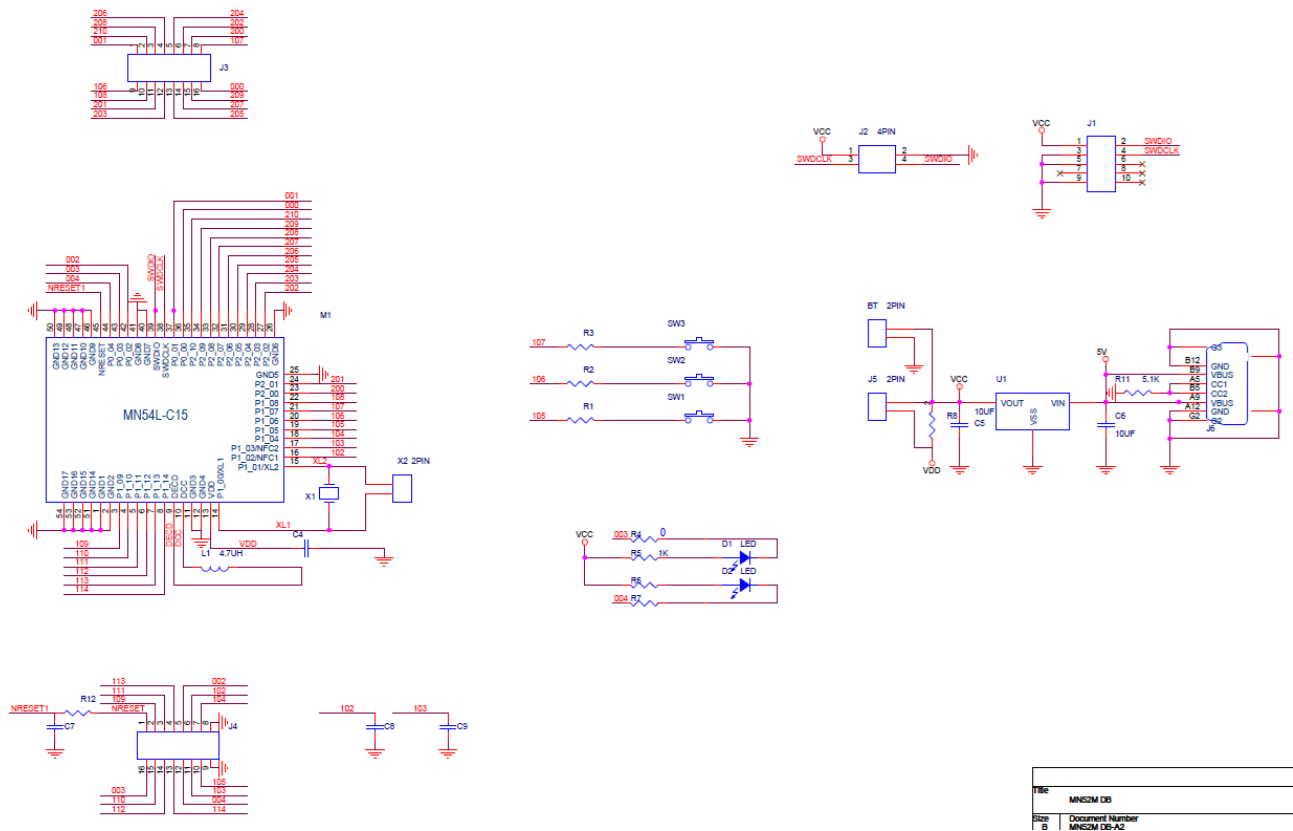
X1:32.768 kHz crystal

D1: One user LED

SW1/SW2/SW3: Three user buttons



6.2 BN54L-C15 schematic



REMARK:

- When using internal 32.768kHz RC oscillator, please remove X1 and calibration performed at least every 8 seconds.

7. Product Information

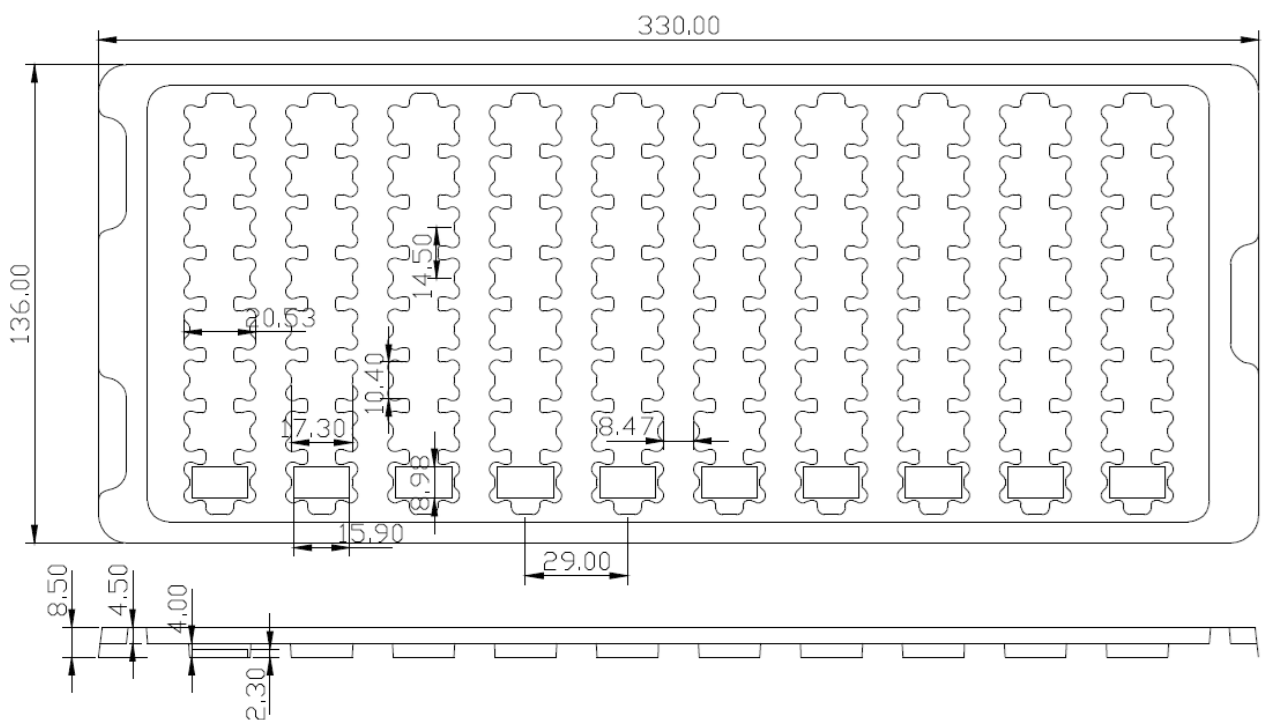
7.1 Mass production information

7.1.1 Tray Packaging:

Material: anti-static PET

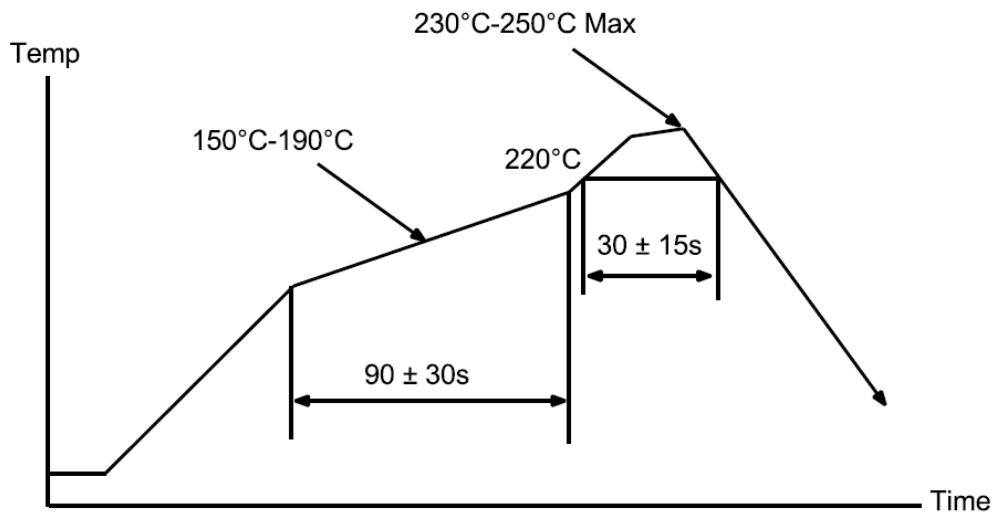
PET thickness: 0.8mm

Dimension: 322mm x 136mm x 8.5mm



The tray is designed for direct use on a SMT automatic machine.

7.1.2 Reflow Parameters



7.2 Packing information

Type	Quantity	Dimension (L)x(W)x(H)	Gross Weight
Tray	80 pcs per tray	322x136x8.5mm	
Carton	1040 pcs(13 trays)	36x20x12cm	3.0Kg

7.3 Ordering Code

Model	Ordering code	Photo
MN54L-C15	MN-L15Q1-01A-CB	

Ordering code: MN-L15Q1-01A-CB

MN: Module/Nordic

L15Q1: NRF54L15/QFN/V1

01A: Aradconn standard module without customer code

CB: Chip antenna/Box packing

MN54L Series

Model	IC/Version	Antenna	Ordering code	Quantity
MN54L-C15	NRF54L15/V1	Chip	MN-L15Q1-01A-CB	1040
MN54L-C10	NRF54L10/V1		MN-L10Q1-01A-CB	1040
MN54L-C05	NRF54L05/V1		MN-L05Q1-01A-CB	1040
MN54L-P15	NRF54L15/V1	PCB	MN-L15Q1-01A-PB	1040
MN54L-P10	NRF54L10/V1		MN-L10Q1-01A-PB	1040
MN54L-P05	NRF54L05/V1		MN-L05Q1-01A-PB	1040
MN54L-U15	NRF54L15/V1	U.FL Connector	MN-L15Q1-01A-UB	1040

8. Bluetooth qualification& Regulatory certification

8.1 Bluetooth qualification

The MN54L-C15 Bluetooth Low Energy module is based on Nordic Semiconductor's NRF54 series SOC and listed on the Bluetooth SIG website as a qualified End Product.

Model	Bluetooth Version	DID	QDID	Company
MN54L	6.0		(Nordic) (Nordic)	Arad Connectivity

8.2 USA (FCC Certificate)

8.2.1 FCC ID and Labeling requirements

The MN54L series hold full modular certification, are assigned the

FCC ID number: 2BLIDMN54L

If the FCC ID is not visible when the module is installed inside OEM device, then the outside of the finished product must also display a label referring to the enclosed module. The end product must in any case be labelled on the exterior with:

Contains FCC ID: 2BLIDMN54L

8.2.2 FCC Notice:

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.

8.2.3 CAUTION:

The OEM should have their device which incorporates the MN54L series tested by a qualified test Lab to verify compliance with FCC Part 15 Subpart B limits for unintentional radiators.

8.2.4 RF Exposure Statement:

This module is approved for installation into mobile and/or portable host platforms.

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

(1) The transmitter module may not be co-located with any other transmitter or antenna.

(If the condition above is met, further transmitter test will not be required.)

(2) The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for satisfying RF Exposure compliance when this module installed.

8.3 Canada (IC Certificate)

8.3.1 IC ID and Labeling requirements

The MN54L series hold full modular certification, are assigned the

IC ID number: 33328-MN54L

If the IC ID is not visible when the module is installed inside OEM device, then the outside of the finished product must also display a label referring to the enclosed module. The end product must in any case be labelled on the exterior with:

Contains IC ID: 33328-MN54L

8.3.2 IC Notice:

This device complies with Industry Canada license-exempt RSSs. 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.

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;
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.**

8.3.3 RF Exposure Statement:

This module is approved for installation into mobile and/or portable host platforms.

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

(1) The transmitter module may not be co-located with any other transmitter or antenna.

(If the condition above is met, further transmitter test will not be required.)

(2) The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for satisfying RF Exposure compliance when this module installed.

8.4 European Union (CE)

8.4.1 Labeling requirements

The label on the final products which contain the MN54L series module must follow CE marking requirements, should be labelled as follows:



The OEM should consult with a qualified test Lab before entering their device into an EU member country to make sure all regulatory requirements have been met for their complete device.

8.4.2 Radio Equipment Directive (RED)

The MN54L series module complies with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2019/07

8.5 Australia / New Zealand (RCM)

The MN54L series has been tested to comply with the AS/NZS 62368.1:2022



8.6 NCC Certificate (Taiwan)

8.6.1 NCC ID and Labeling requirements

MN54L 系列依天線不同,可分為 3 種型式, 認證為 3 個不同的 NCC ID

MN54L-C NCC ID number:

MN54L-P NCC ID number:

MN54L-U NCC ID number:

請依下列標籤式樣自製標籤，標貼或印鑄於器材(產品)本體明顯處，始得販賣或公開陳列。

NCC logo and NCC ID

MN54L-C:

MN54L-P:

MN54L-U:

NCC 平台政策下的完全模組: 須符合平台政策才能適用完全模組

「平台」定義如下：若器材無安裝型式認證之模組仍具備其它複合性功能，該器材得視為平台，若無其它複合性功能，則不能視為平台。

NCC 警語:

「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。」

9. RoHS & REACH Report

MN54L series modules comply with EU RoHS Directive 2011/65/EU, 2015/863/EU and do not contain or over the threshold value of SVHC (Substance of Very High Concern), as defined by Directive EC/1907/2006 Article according to REACH Annex XVII.

10. Life support warning

This module is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety.

Revision history

Version	Date	Notes	Name
0.8	2025/05/01	Initial Release	

15.19 Labeling requirements.

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.

15.21 Changes or modification warning.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.105 Information to the user.

Note: 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 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

RF warning for Mobile device:

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 module is intended for OEM integrators only. Per FCC KDB 996369 D03 OEM Manual v01 guidance, the following conditions must be strictly followed when using this certified module:

KDB 996369 D03 OEM Manual v01 rule sections:**2.2 List of applicable FCC rules**

This module has been tested for compliance to FCC Part 15

2.3 Summarize the specific operational use conditions

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) or being used in a portable condition will need a separate reassessment through a class II permissive change application or new certification.

2.4 Limited module procedures

Not application

2.5 Trace antenna designs

Not application

2.6 RF exposure considerations

This equipment complies with FCC mobile radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. If the module is installed in a portable host, a separate SAR evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

2.7 Antennas

The following antennas have been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

Antenna Type	BT 2.20 dBi;
Antenna Type	BT 3.30 dBi;
Antenna Type	BT 2.29 dBi;
Antenna Type	BT 0.80 dBi;
Antenna Type	BT 1.05 dBi;

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following: “Contains FCC ID: 2BLIDMN54L”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

2.9 Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) or portable use will require a separate class II permissive change re-evaluation or new certification.

2.10 Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

As long as all 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 additional compliance 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.

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. The end user manual shall include all required regulatory information/warning as show in this manual

OEM/Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment

Industry Canada statement

This device complies with ISSED's licence-exempt RSSs. 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.

Le présent appareil est conforme aux CNR d' ISSED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

5G WIFI statement

The device is restricted to indoor use when operated in 5150MHz~5350MHz to reduce the potential for interference

Radiation Exposure Statement:

This equipment complies with ISSED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with greater than 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISSED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à plus de 20 cm entre le radiateur et votre corps.

IC statement

The final end product must be labeled in a visible area with the following "Contains IC: 33328-MN54L"

The Host Marketing Name (HMN) must be indicated at any location on the exterior of the host product or product packaging or product literature, which shall be available with the host product or online.

This radio transmitter [IC: 33328-MN54L] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with

this device.

Frequency range	Manufacturer	Peak gain	Impedance	Antenna type
2400-2483.5Mhz	Pluse Electronics	2.20 dBi	50ohm	PCB
2400-2483.5Mhz	Pluse Electronics	3.30 dBi	50ohm	PCB
2400-2483.5Mhz	Pluse Electronics	2.29 dBi	50ohm	Dipole
2400-2483.5Mhz	Arad Connectivity Co., Ltd.	0.80 dBi	50ohm	PCB
2400-2483.5Mhz	Arad Connectivity Co., Ltd.	1.05 dBi	50ohm	Ceramics

1.The OEM integrator must be aware not to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product. The user manual which is provided by OEM integrators for end users must include the following information in a prominent location.

L'intégrateur OEM doit être conscient de ne pas fournir d'informations à l'utilisateur final sur la manière d'installer ou de retirer ce module RF dans le manuel d'utilisation du produit final. Le manuel d'utilisation fourni par les intégrateurs OEM pour les utilisateurs finaux doit inclure les informations suivantes dans un emplacement visible.

2.To comply with IC RF exposure compliance requirements, the antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with IC multi-transmitter product procedures. Pour se conformer aux exigences de conformité de l'exposition RF IC, l'antenne utilisée pour cet émetteur ne doit pas être co-localisée ou fonctionner en conjonction avec une autre antenne ou un autre émetteur, sauf conformément aux procédures du produit multi-émetteur IC.

3.The final system integrator must ensure there is no instruction provided in the user manual or customer documentation indicating how to install or remove the transmitter module except such device has implemented two-ways authentication between module and the host system. L'intégrateur système final doit s'assurer qu'aucune instruction n'est fournie dans le manuel de l'utilisateur ou dans la documentation du client indiquant comment installer ou retirer le module transmetteur, sauf qu'un tel dispositif a mis en place une authentification bidirectionnelle entre le module et le système hôte.

4. The host device shall be properly labelled to identify the module within the host device. The end product must be labeled in a visible area with the following: "Contains IC:23860-SRM955 " Any similar wording that expresses the same meaning may be used.

Le périphérique hôte doit être correctement étiqueté pour identifier le module dans le périphérique hôte. Le produit final doit être étiqueté dans une zone visible avec: "Contains IC: 23860-SRM955 " Toute formulation similaire exprimant la même signification peut être utilisée. The IC Statement below should also be included on the label. When not possible, the IC Statement should be included in the User Manual of the host device. "This device complies with Industry Canada license-exempt RSS standard(s). 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.

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