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Approval Sheet

(產品承認書)

產品名稱 (Product): BT 4.1 Module (Nordic nRF51822)

產品型號 (Model No.): **MDBT40** Series (Chip Antenna)

MDBT40-P Series (PCB Antenna)

Advantages of MDBT40 & MDBT40-P Series

1. *Long Working Distance*
   ***MDBT40** Series: Over 80 meters in open space*
   ***MDBT40-P** Series: Up to 60 meters in open space*

2. *Declaration ID already includes all Nordic applied profiles.*

3. *Granted major regional certificates, including FCC, CE (EU), TELEC (Japan), SRRC (China), IC (Canada), NCC (Taiwan), and KC (South Korea).*

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1. Overall Introduction

Raytac's MDBT40 is a BT 4.0 & BT 4.1 stack (Bluetooth low energy or BLE) module designed based on **Nordic nRF51822 SoC solution**, which incorporates: **GPIO**, **UART**, **I2C, SPI, PWM** and **ADC interfaces** for connecting peripherals and sensors.

The feature of the module:

1. Dual Transmission Mode of BLE & RF 2.4G upon customer preference.
2. Compact size with **(L) 18 x (W) 10 x (H) 3.2 or 2.7 mm**
3. Low power requirements, ultra-low peak, average and idle mode power consumption.
4. Compatible with a large installed base of mobile phones, tablets and computers.
5. Fully coverage of BLE software stack including:
   Proximity Profile; Heart Rate Profile; Health Thermometer Profile;
   Blood Pressure Profile; Running Speed & Cadence Profile;
   HID Over GATT Profile; Alert Notification Profile; Glucose Profile;
   Cycling Speed & Cadence Profile
6. BLE & RF transmission switching may help products to fit all operation system
7. BLE & RF transmission switching may help products fit all kinds of hardware.

1.1 Applications

. Computer peripherals and I/O devices
- . Mouse
- . Keyboard
- . Multi-touch track pad

. Interactive entertainment devices
- . Remote control
- . 3D Glasses
- . Gaming controller

. Personal Area Networks
- . Health/fitness sensor and monitor devices
- . Medical devices
- . Key-fobs + wrist watch
- . Remote control toys

1.2 Features

. 2.4GHZ transceiver

. -93dbm sensitivity in Bluetooth low energy mode

. TX Power -20 to +4dbm

. RSSI (1db resolution)

. ARM Cortex – M0 32 bit processor

. Serial Wire Debug (SWD)

. S100 series SoftDevice ready

. Memory

. 256kb or 128kb embedded flash programmed memory

. 16kb RAM or 32kb RAM

. Support for non-concurrent multiprotocol operation

. On-air compatibility with nRF24L series

. Flexible Power Management

. Supply voltage range 1.8V to 3.6V

. 2.5us wake-up using 16MHz RCOSC

. 0.6uA @ 3V mode

. 1.2uA @ 3V in OFF mode + 1 region RAM retention

. 2.6uA @ 3V ON mode, all blocks IDLE

. 8/9/10 bit ADC- 8 configurable channels

. 31 General Purpose I/O Pins

. One 32 bit and two 16 bit timers with counter mode

. SPI Master / Slave

. Two-wire Master (I2C compatible)

. UART (CTS/RTS)

. CPU independent Programmable Peripheral Interconnect (PPI)

. Quadrature Decoder (QDEC)

. AES HW encryption

. Real Timer Counter (RTC)

1.3 Profile & Service Information

Profile & Service below are supported by MDBT40 & MDBT40-P.

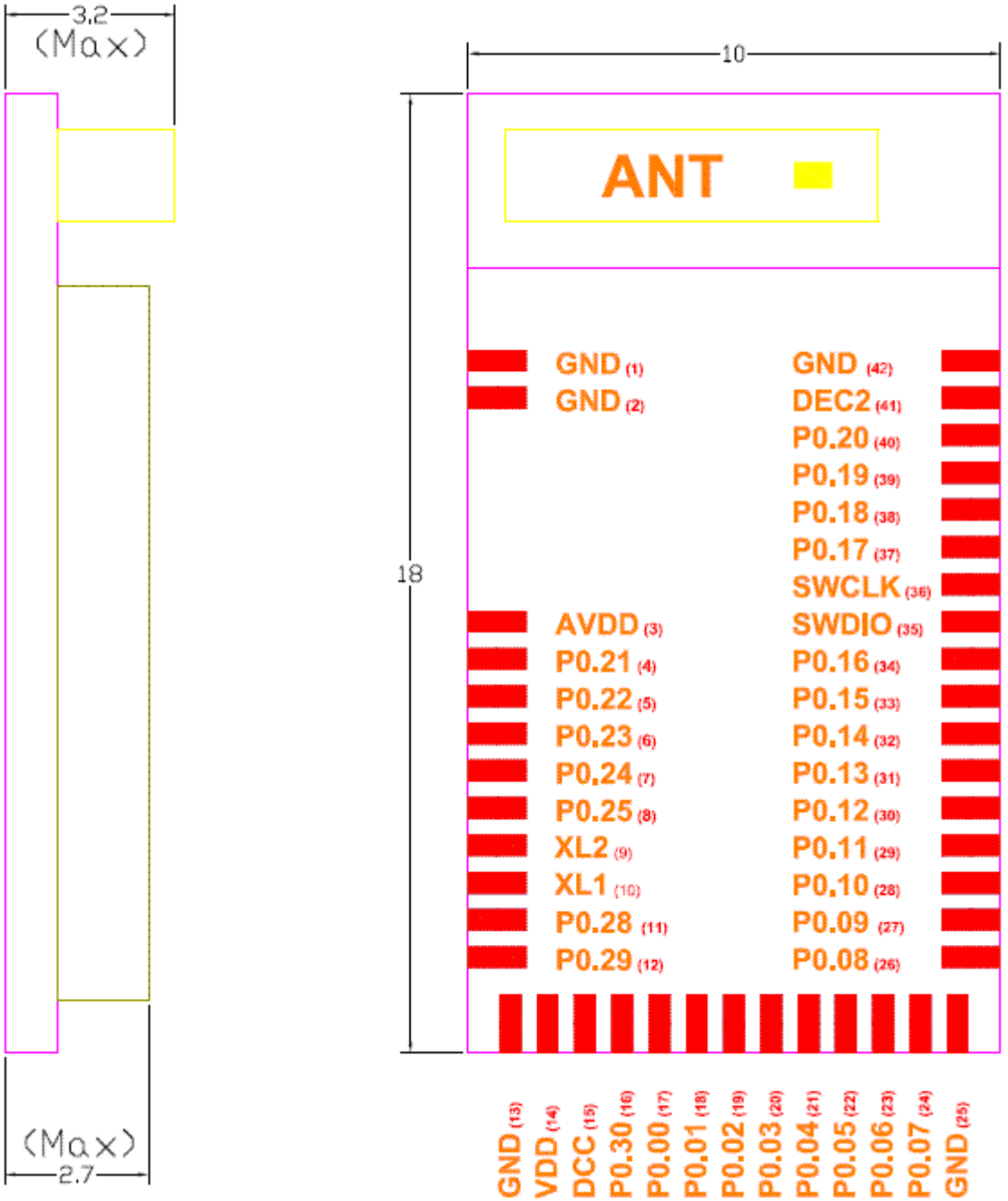
Profile Description	Service Description
Alert Notification Profile	Alert Notification Service
Blood Pressure Profile	Blood Pressure Service
	Device Information Service
Cycling Speed & Cadence Profile	Cycling Speed & Cadence Service
	Device Information Service
Glucose Profile	Glucose Service
	Device Information Service
Health Thermometer Profile	Health Thermometer Service
	Device Information Service
Heart Rate Profile	Heart Rate Service
	Device Information Service
HID over GATT Profile	HID Service
	Battery Service
Proximity Profile	Link Loss Service
	Immediate Alert Service
	TX Power Service
Running Speed & Cadence Profile	Running Speed & Cadence Service
	Device Information Service

2. Product Dimension

2.1 PCB Dimension & Pin Indication

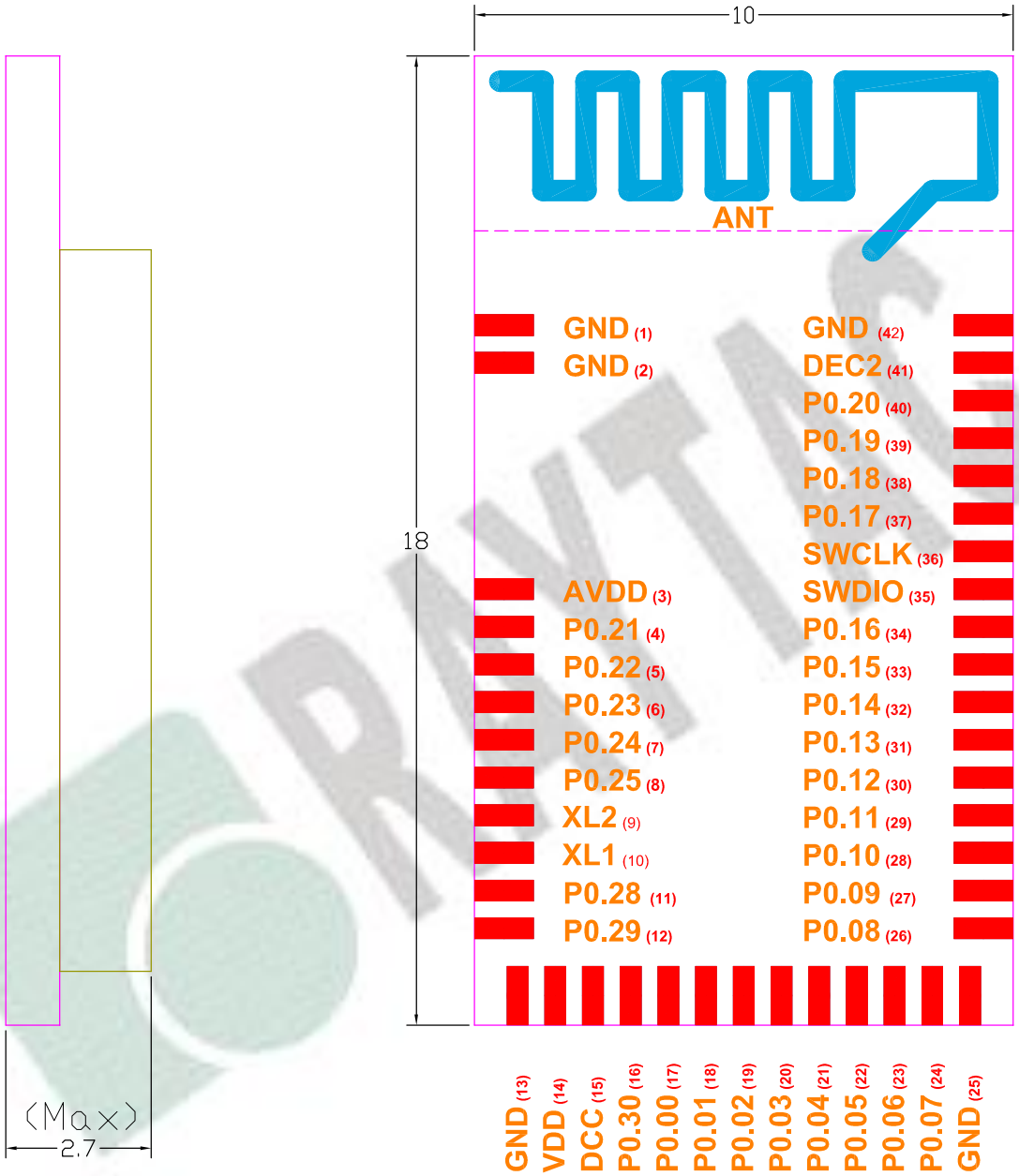
- **MDBT40** Series

PCB SIZE：(L) 18 x (W) 10 x (H) 3.2 mm



- **MDBT40-P** Series

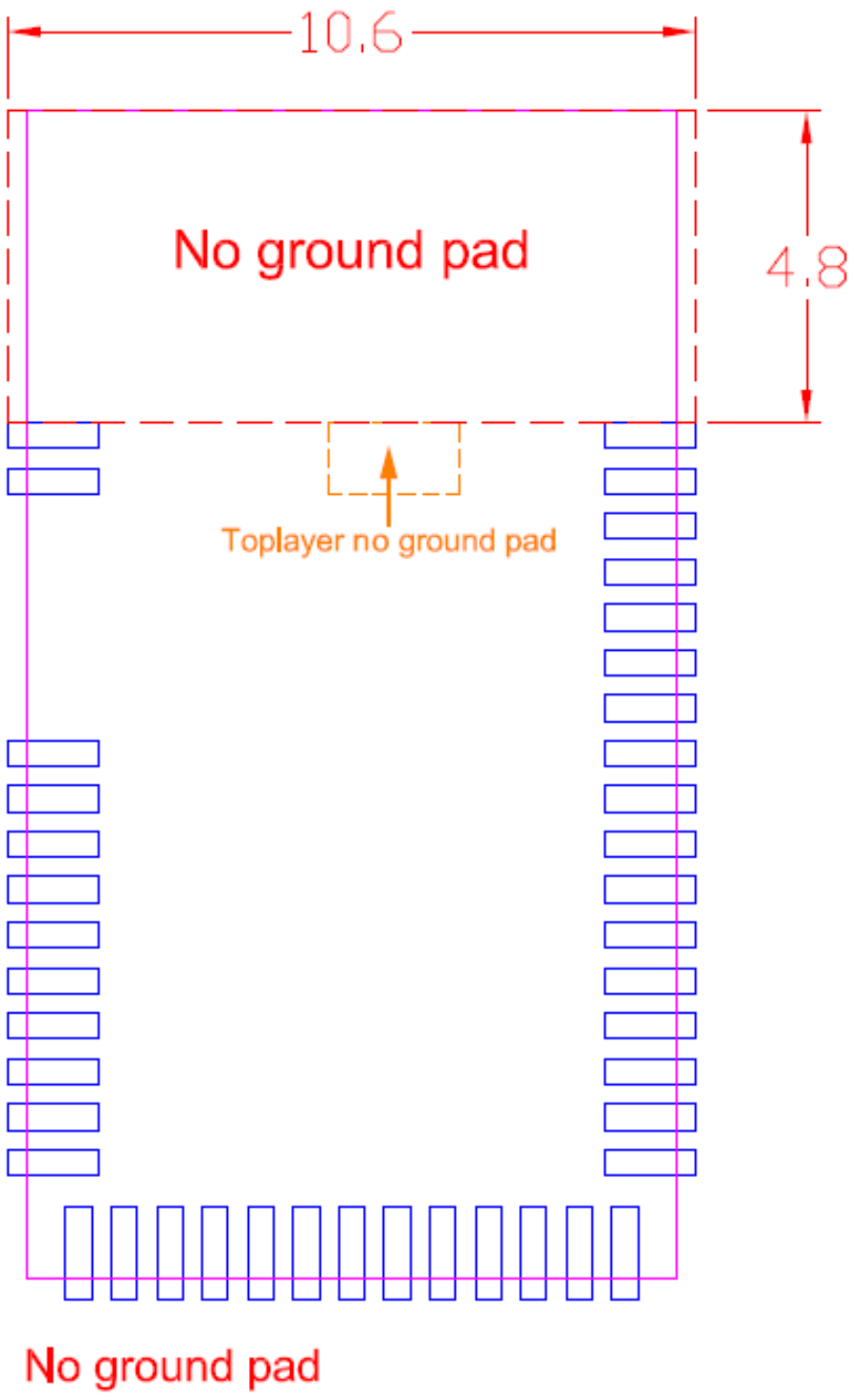
PCB SIZE：(L) 18 x (W) 10 x (H) 2.7 mm

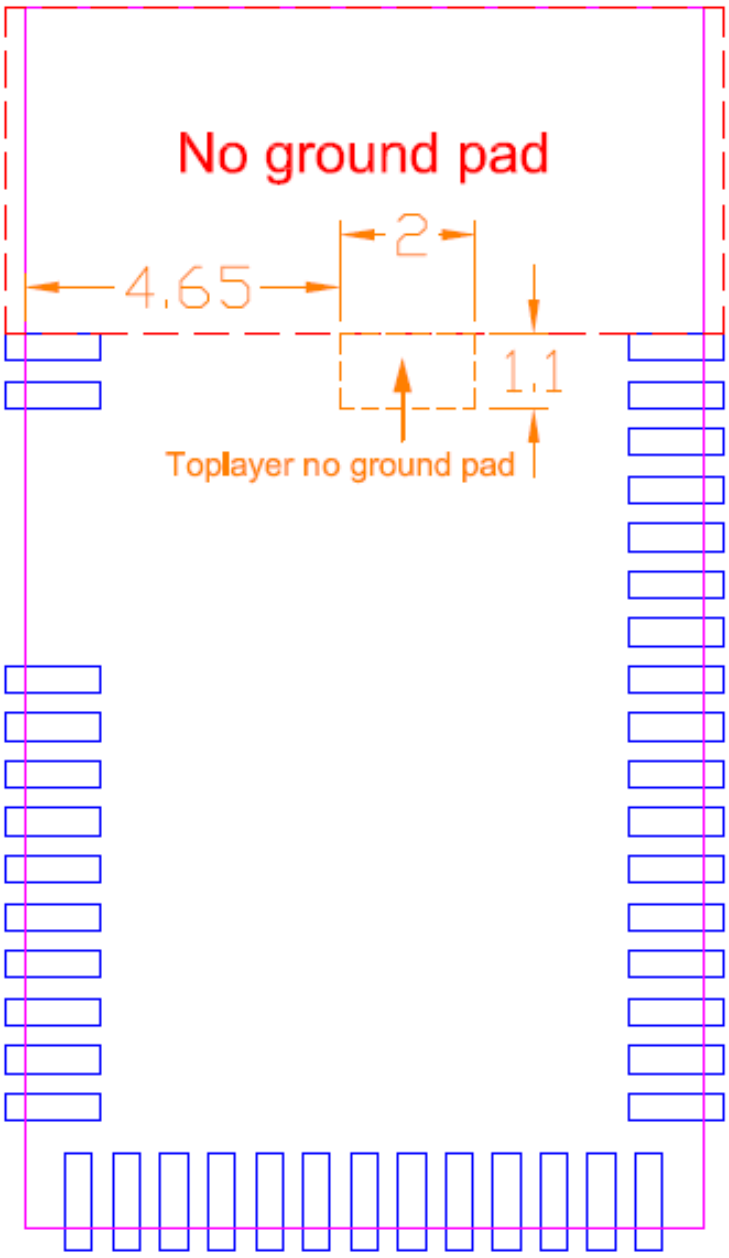


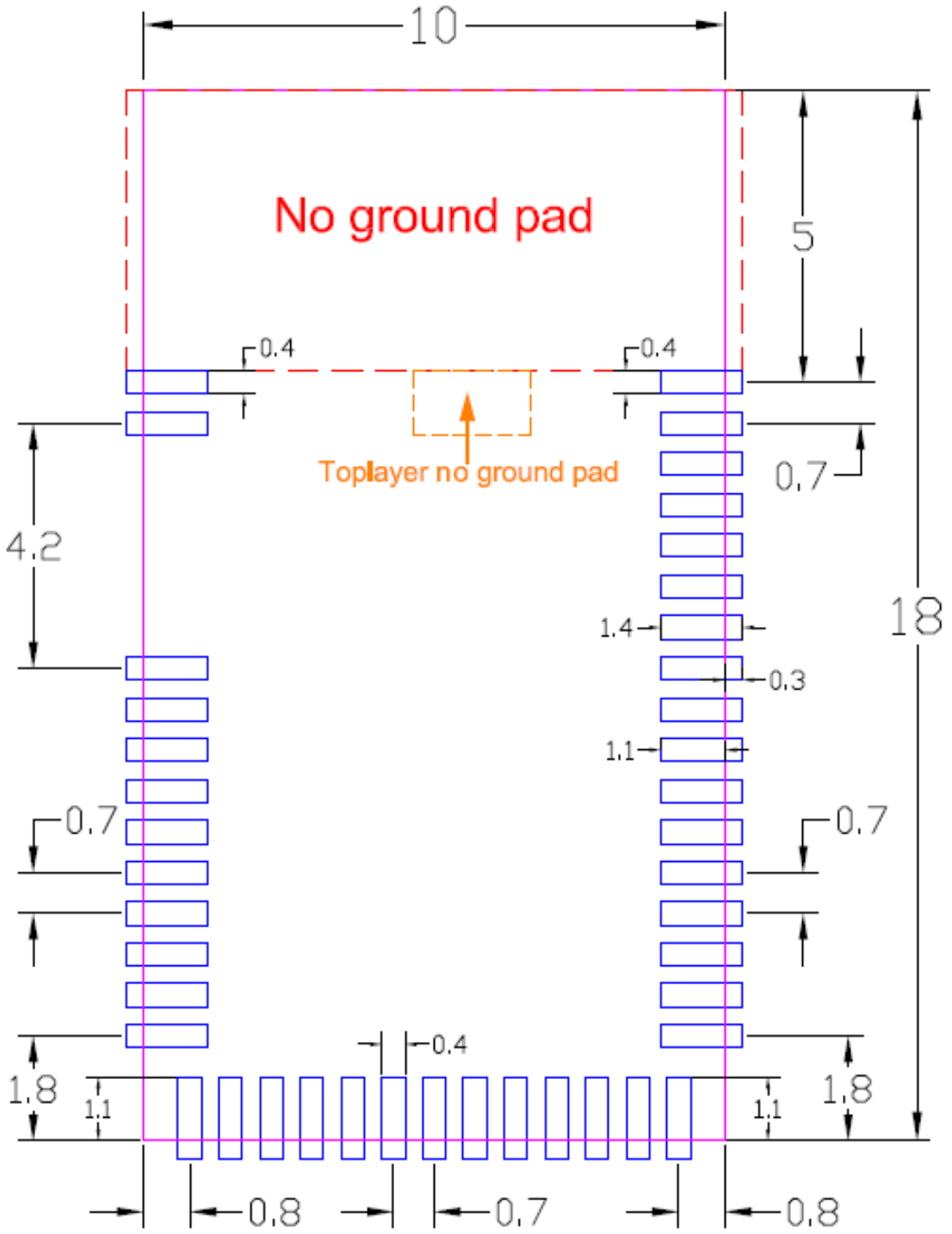
TOP 單位:(mm)

2.2 Recommended Layout of Solder Pad

Graphs are all in Top View, Units in mm.




No ground pad
2
4.65
1.1
Toplayer no ground pad
Toplayer no ground pad



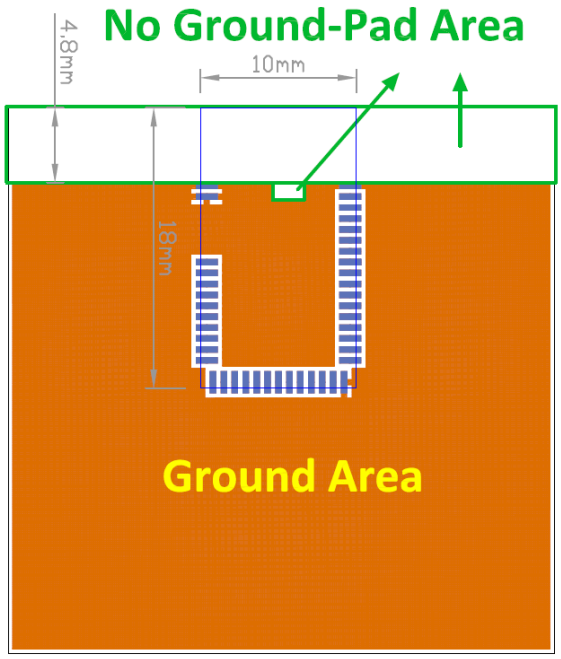
Top View（單位：mm）

recommended solder pad layout

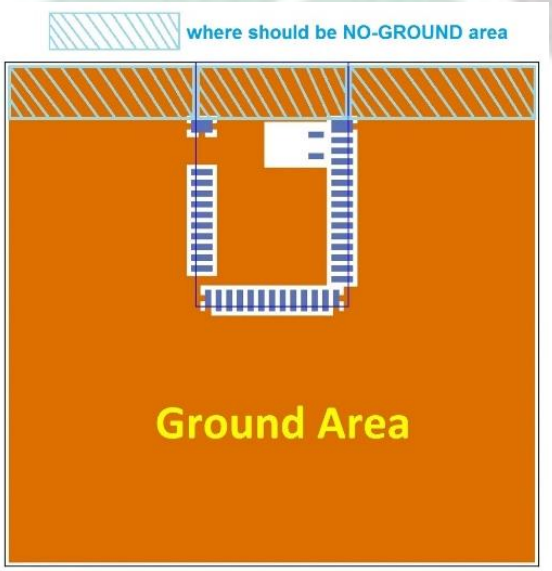
2.3 RF Layout Suggestion (aka Keep-Out Area)

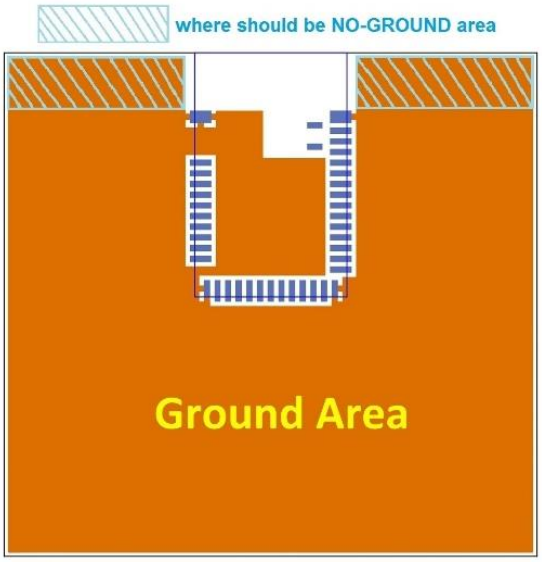
Please follow below instruction to have better wireless performance. Make sure to keep the "No-Ground-Pad" as wider as you can when there is no enough space in your design.

Welcome to send us your layout in PDF for review at service@raytac.com with title "Layout reviewing – MDBT40/MDBT40-P – YOUR company's name".



Examples of "**NOT RECOMMENDED**" layout





1. Carrier Board under the BLUE PART
   (antenna and test pin pad)
   Carrier Board is not allowed to have ground or circuit or components in any layer.

2. Carrier Board under the GREEN PART
   a. Suggest equipping ground full green area in first layer
   b. If first layer equipped ground, 2nd and 3rd layer can have circuit in this area.
   c. If first layer equipped ground, 4th layer can have components in this area.

2.4 Footprint & Design Guide

Click to download from our official website.

2.5 Pin Assignment

Pin No.	Name	Pin function	Description
(1)(2)	GND	Ground	The pad must be connected to a solid ground plane
(3)	AVDD	Power	Analog power supply
(4)	P0.21	Digital I/O	General-purpose digital I/O
(5)	P0.22	Digital I/O	General-purpose digital I/O
(6)	P0.23	Digital I/O	General-purpose digital I/O
(7)	P0.24	Digital I/O	General-purpose digital I/O
(8)	P0.25	Digital I/O	General-purpose digital I/O
(9)	P0.26	Digital I/O	General-purpose digital I/O
	AIN0	Analog input	ADC input 0
	XL2	Analog output	Connector for 32.768KHz crystal
(10)	P0.27	Digital I/O	General-purpose digital I/O
	AIN1	Analog input	ADC input 1
	XL1	Analog input	Connector for 32.768KHz crystal or external 32.768KHz clock reference
(11)	P0.28	Digital I/O	General-purpose digital I/O
(12)	P0.29	Digital I/O	General-purpose digital I/O
(13)	GND	Ground	The pad must be connected to a solid ground plane
(14)	VDD	Power	Power supply
(15)	DCC	Power	DC/DC output voltage to external LC filter
(16)	P0.30	Digital I/O	General-purpose digital I/O
(17)	P0.00	Digital I/O	General-purpose digital I/O
	AREF0	Analog input	ADC Reference voltage
(18)	P0.01	Digital I/O	General-purpose digital I/O
	AIN2	Analog input	ADC input 2
(19)	P0.02	Digital I/O	General-purpose digital I/O
	AIN3	Analog input	ADC input 3
(20)	P0.03	Digital I/O	General-purpose digital I/O
	AIN4	Analog input	ADC input 4
(21)	P0.04	Digital I/O	General-purpose digital I/O
	AIN5	Analog input	ADC input 5
(22)	P0.05	Digital I/O	General-purpose digital I/O
	AIN6	Analog input	ADC input 6

Pin No.	Name	Pin function	Description
(23)	P0.06	Digital I/O	General-purpose digital I/O
	AIN7	Analog input	ADC input 7
	AREF1	Analog input	ADC Reference voltage
(24)	P0.07	Digital I/O	General-purpose digital I/O
(25)	GND	Ground	The pad must be connected to a solid ground plane
(26)	P0.08	Digital I/O	General-purpose digital I/O
(27)	P0.09	Digital I/O	General-purpose digital I/O
(28)	P0.10	Digital I/O	General-purpose digital I/O
(29)	P0.11	Digital I/O	General-purpose digital I/O
(30)	P0.12	Digital I/O	General-purpose digital I/O
(31)	P0.13	Digital I/O	General-purpose digital I/O
(32)	P0.14	Digital I/O	General-purpose digital I/O
(33)	P0.15	Digital I/O	General-purpose digital I/O
(34)	P0.16	Digital I/O	General-purpose digital I/O
(35)	SWDIO/RESET	Digital I/O	System reset(active low).Also HW debug and flash Programming
(36)	SWDCLK	Digital input	HW debug and flash programming.
(37)	P0.17	Digital I/O	General-purpose digital I/O
(38)	P0.18	Digital I/O	General-purpose digital I/O
(39)	P0.19	Digital I/O	General-purpose digital I/O
(40)	P0.20	Digital I/O	General-purpose digital I/O
(41)	DEC2	Power	Power supply decoupling. Low voltage mode VCC
(42)	GND	Ground	The pad must be connected to a solid ground plane

[1] **Digital I/O pad with 5mA source/sink capability.**

3. Main Chip Solution

RF IC	Crystal Frequency
Nordic NRF51822/QFN48	**16MHZ**

16MHz is already inside the module.

4. Shipment Packaging Information

Marking	Model	
Black	MDBT40-128V3	MDBT40-P128V3
		
Red	MDBT40-256V3	MDBT40-P256V3
		
Yellow	MDBT40-256RV3	MDBT40-P256RV3
		

- Unit Weight of Module:

  MDBT40 Series: 0.88g / pc (±0.02g) ; MDBT40-P Series: 0.78g / pc (±0.02g)

- Packaging Type: Tray only

- Minimum Package Quantity (MPQ): 88 pcs per Tray

- Carton Contents: 1760 pcs per Carton (20 Full Tray + 1 Empty Tray)

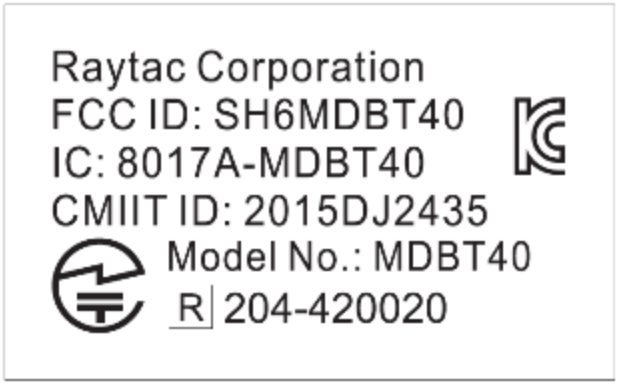
- Dimension of Carton: (L) 37 x (W) 21 x (H) 13 cm

- Gross Weight: approx. 3.2 kgs per full carton (contains 1760pcs)

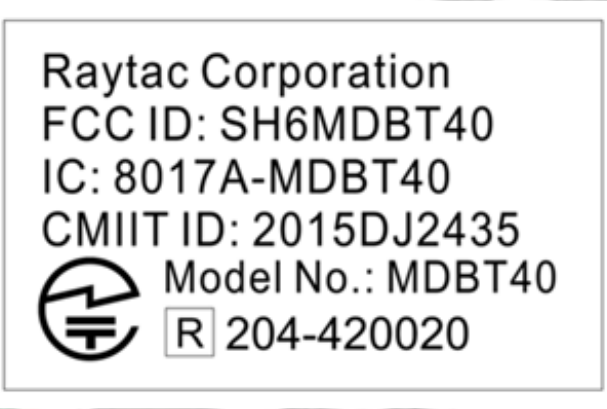
Remark: Packaging may be subject to change without further notice.

4.1 Marking on Metal Shielding

To obey the regulation that we have granted, the marking contains following contents.



Previous marking is as below which is applied to batch manufactured ***before*** 2017.



5. Specification

Any technical spec shall refer to Nordic's official documents as final reference.

5.1 Industrial Temperature Range

Industrial temperature range is applied in below IC chip.

nRF51822 variant	Build code
QFAA	Hx0[1]
CEAA	Ex0[1]

Raytac's corresponding model no. are MDBT40-256V3, MDBT40-P256V3 and **MDBT40-n256V3**.

Operating conditions are as below:

Symbol	Parameter	Notes	Min.	Typ.	Max.	Units
VDD	Supply voltage, internal LDO setup		**1.9**	3.0	3.6	V
VDD	Supply voltage, DC/DC converter setup		2.1	3.0	3.6	V
T_A	Operating temperature		**-40**	25	**105**	°C

Other changes are including:

(1) 2.4Ghz transceiver: Not supported 1Mbps data rates

(2) Not support 1.8V low voltage mode

For detail of changes, please refer to Nordic's document "nRF51822_PSA_EXTEMP_v1.0". Any updates shall refer to Nordic's release as final reference.

Except for MDBT40-256V3, MDBT40-P256V3 and MDBT40-n256V3, please check remaining section of Chapter 5 to know specification of other models.

5.2 Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit
Supply voltages				
VDD		-0.3	+3.9	V
DEC2			2	V
VSS			0	V
I/O pin voltage				
VIO		-0.3	VDD + 0.3	V
Environmental QFN48 package				
Storage temperature		-40	+125	°C
MSL	Moisture Sensitivity Level		2	
ESD HBM	Human Body Model		4	kV
ESD CDM	Charged Device Model		750	V
Environmental WLCSP package				
Storage temperature		-40	+125	°C
MSL	Moisture Sensitivity Level		1	
ESD HBM	Human Body Model		4	kV
ESD CDM	Charged Device Model		500	V
Flash memory				
Endurance		20 000[1]		write/erase cycles
Retention		10 years at 40 °C		
Number of times an address can be written between erase cycles			2	times

5.3 Operation Conditions

Symbol	Parameter	Notes	Min.	Typ.	Max.	Units
VDD	Supply voltage, internal LDO setup		1.8	3.0	3.6	V
VDD	Supply voltage, DC/DC converter setup		2.1	3.0	3.6	V
VDD	Supply voltage, low voltage mode setup	1	1.75	1.8	1.95	V
t_{R_VDD}	Supply rise time (0 V to VDD)	2			100	ms
T_A	Operating temperature		-25	25	75	°C

1. DEC2 shall be connected to VDD in this mode.
2. The on-chip power-on reset circuitry may not function properly for rise times outside the specified interval.

5.4 Electrical Specifications

5.4.1 Radio Transceiver

. General Radio Characteristics

Symbol	Description	Note	Min.	Typ.	Max.	Units	Test level
f_{OP}	Operating frequencies.	1 MHz channel spacing.	2400		2483	MHz	N/A
PLL_{res}	PLL programming resolution.			1		MHz	N/A
Δf250	Frequency deviation at 250 kbps.			±170		kHz	2
Δf_{1M}	Frequency deviation at 1 Mbps.			±170		kHz	2
Δf_{2M}	Frequency deviation at 2 Mbps.			±320		kHz	2
Δf_{BLE}	Frequency deviation at BLE.		±225	±250	±275	kHz	4
bps_{FSK}	On-air data rate.		250		2000	kbps	N/A

. Radio Current Consumption

Symbol	Description	Note	Min.	Typ.	Max.	Units	Test level
$I_{TX,+4dBm}$	TX only run current at P_{OUT} = +4 dBm.	1		16		mA	4
$I_{TX,0dBm}$	TX only run current at P_{OUT} = 0 dBm.	1		10.5		mA	4
$I_{TX,-4dBm}$	TX only run current at P_{OUT} = -4 dBm.	1		8		mA	2
$I_{TX,-8dBm}$	TX only run current at P_{OUT} = -8 dBm.	1		7		mA	2
$I_{TX,-12dBm}$	TX only run current at P_{OUT} = -12 dBm.	1		6.5		mA	2
$I_{TX,-16dBm}$	TX only run current at P_{OUT} = -16 dBm.	1		6		mA	2
$I_{TX,-20dBm}$	TX only run current at P_{OUT} = -20 dBm.	1		5.5		mA	2
$I_{TX,-30dBm}$	TX only run current at P_{OUT} = -30 dBm.	1		5.5		mA	2
$I_{START,TX}$	TX startup current.	2		7		mA	1
$I_{RX,250}$	RX only run current at 250 kbps.			12.6		mA	1
$I_{RX,1M}$	RX only run current at 1 Mbps.			13		mA	4
$I_{RX,2M}$	RX only run current at 2 Mbps.			13.4		mA	1
$I_{START,RX}$	RX startup current.	3		8.7		mA	1

1. Valid for data rates 250 kbps, 1 Mbps, and 2 Mbps.
2. Average current consumption (at 0 dBm TX output power) for TX startup (130 µs), and when changing mode from RX to TX (130 µs).
3. Average current consumption for RX startup (130 µs), and when changing mode from TX to RX (130 µs).

5.4.2 Transmitter Specifications

Symbol	Description	Min.	Typ.	Max.	Units	Test level
P_{RF}	Maximum output power.		4		dBm	4
P_{RFC}	RF power control range.	20	24		dB	2
PRFCR	RF power accuracy.			±4	dB	1
P_{WHISP}	RF power whisper mode.		-30		dBm	2
P_{BW2}	20 dB bandwidth for modulated carrier (2 Mbps).		1800	2000	kHz	2
P_{BW1}	20 dB bandwidth for modulated carrier (1 Mbps).		950	1100	kHz	2
P_{BW250}	20 dB bandwidth for modulated carrier (250 kbps).		700	800	kHz	2
$P_{RF1.2}$	1st Adjacent Channel Transmit Power. ±2 MHz (2 Mbps).			-20	dBc	2
$P_{RF2.2}$	2nd Adjacent Channel Transmit Power. ±4 MHz (2 Mbps).			-45	dBc	2
$P_{RF1.1}$	1st Adjacent Channel Transmit Power. ±1 MHz (1 Mbps).			-20	dBc	2
$P_{RF2.1}$	2nd Adjacent Channel Transmit Power. ±2 MHz (1 Mbps).			-40	dBc	2
$P_{RF1.250}$	1st Adjacent Channel Transmit Power. ±1 MHz (250 kbps).			-25	dBc	2
$P_{RF2.250}$	2nd Adjacent Channel Transmit Power. ±2 MHz (250 kbps).			-40	dBc	2
$t_{TX,30}$	Maximum consecutive transmission time, f_{TOL} < ±30 ppm.			16	ms	1
$t_{TX,60}$	Maximum consecutive transmission time, f_{TOL} < ±60 ppm.			4	ms	1

5.4.3 Receiver Specifications

Symbol	Description	Min.	Typ.	Max.	Units	Test level
Receiver operation						
PRX_{MAX}	Maximum received signal strength at < 0.1% PER.		0		dBm	1
$PRX_{SENS,2M}$	Sensitivity (0.1% BER) at 2 Mbps.		-85		dBm	2
$PRX_{SENS,1M}$	Sensitivity (0.1% BER) at 1 Mbps.		-90		dBm	2
$PRX_{SENS,250k}$	Sensitivity (0.1% BER) at 250 kbps.		-96		dBm	2
P_{SENS} IT 1 Mbps BLE	Receiver sensitivity: Ideal transmitter.		-93		dBm	2
P_{SENS} DT 1 Mbps BLE	Receiver sensitivity: Dirty transmitter.[1]		-91		dBm	2
RX selectivity - modulated interfering signal[2]						
	2 Mbps					
C/I_{CO}	C/I co-channel.		12		dB	2
C/I_{1ST}	1st ACS, C/I 2 MHz.		-4		dB	2
C/I_{2ND}	2nd ACS, C/I 4 MHz.		-24		dB	2
C/I_{3RD}	3rd ACS, C/I 6 MHz.		-28		dB	2
C/I_{6th}	6th ACS, C/I 12 MHz.		-44		dB	2
C/I_{Nth}	Nth ACS, C/I f_i > 25 MHz.		-50		dB	2
	1 Mbps					
C/I_{CO}	C/I co-channel (1 Mbps).		12		dB	2
C/I_{1ST}	1st ACS, C/I 1 MHz.		4		dB	2
C/I_{2ND}	2nd ACS, C/I 2 MHz.		-24		dB	2
C/I_{3RD}	3rd ACS, C/I 3 MHz.		-30		dB	2
C/I_{6th}	6th ACS, C/I 6 MHz.		-40		dB	2
C/I_{12th}	12th ACS, C/I 12 MHz.		-50		dB	2
C/I_{Nth}	Nth ACS, C/I f_i > 25 MHz.		-53		dB	2

Symbol	Description	Min.	Typ.	Max.	Units	Test level
	250 kbps					
C/I_{CO}	C/I co-channel.		4		dB	2
C/I_{1ST}	1st ACS, C/I 1 MHz.		-10		dB	2
C/I_{2ND}	2nd ACS, C/I 2 MHz.		-34		dB	2
C/I_{3RD}	3rd ACS, C/I 3 MHz.		-39		dB	2
C/I_{6th}	6th ACS, C/I f_i > 6 MHz.		-50		dB	2
C/I_{12th}	12th ACS, C/I 12 MHz.		-55		dB	2
C/I_{Nth}	Nth ACS, C/I f_i > 25 MHz.		-60		dB	2
	***Bluetooth* Low Energy RX selectivity**					
C/I_{CO}	C/I co-channel.		10		dB	2
C/I_{1ST}	1st ACS, C/I 1 MHz.		1		dB	2
C/I_{2ND}	2nd ACS, C/I 2 MHz.		-25		dB	2
C/I_{3+N}	ACS, C/I (3+n) MHz offset [n = 0, 1, 2, . . .].		-51		dB	2
C/I_{Image}	Image blocking level.		-30		dB	2
$C/I_{Image\pm1MHz}$	Adjacent channel to image blocking level (±1 MHz).		-31		dB	2
RX intermodulation[3]						
P_IMD_{2Mbps}	IMD performance, 2 Mbps, 3rd, 4th, and 5th offset channel.		-41		dBm	2
P_IMD_{1Mbps}	IMD performance, 1 Mbps, 3rd, 4th, and 5th offset channel.		-40		dBm	2
$P\_IMD_{250kbps}$	IMD performance, 250 kbps, 3rd, 4th, and 5th offset channel.		-36		dBm	2
P_IMD_{BLE}	IMD performance, 1 Mbps BLE, 3rd, 4th, and 5th offset channel.		-39		dBm	2

1. As defined in the *Bluetooth Core Specification* v4.0 Volume 6: Core System Package (Low Energy Controller Volume).
2. Wanted signal level at P_{IN} = -67 dBm. One interferer is used, having equal modulation as the wanted signal. The input power of the interferer where the sensitivity equals BER = 0.1% is presented.
3. Wanted signal level at P_{IN} = -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 wanted signal. The input power of interferers where the sensitivity equals BER = 0.1% is presented.

5.4.4 Radio Timing Parameters

Symbol	Description	250 k	1 M	2 M	BLE	Jitter	Units
t_{TXEN}	Time between TXEN task and READY event.	132	132	132	140	0	µs
$t_{TXDISABLE}$	Time between DISABLE task and DISABLED event when the radio was in TX.	10	4	3	4	1	µs
t_{RXEN}	Time between the RXEN task and READY event.	130	130	130	138	0	µs
$t_{RXDISABLE}$	Time between DISABLE task and DISABLED event when the radio was in RX.	0	0	0	0	1	µs
$t_{TXCHAIN}$	TX chain delay.	5	1	0.5	1	0	µs
$t_{RXCHAIN}$	RX chain delay.	12.5	3	2	3	0	µs

5.4.5 RSSI Specifications

Symbol	Description	Note	Min.	Typ.	Max.	Units	Test level
$RSSI_{ACC}$	RSSI accuracy.	Valid range -50 dBm to -80 dBm.			±6	dB	2
$RSSI_{RESOLUTION}$	RSSI resolution.			1		dB	1
$RSSI_{PERIOD}$	Sample period.		8.8			µs	1
$RSSI_{CURRENT}$	Current consumption in addition to I_{RX}.			250		µA	1

5.4.6 CPU

Symbol	Description	Min.	Typ.	Max.	Units	Test level
$I_{CPU, FLASH}$	Run current at 16 MHz (XOSC). Executing code from flash memory.		4.1[1]		mA	2
$I_{CPU, RAM}$	Run current at 16 MHz (XOSC). Executing code from RAM.		2.4[2]		mA	1
$I_{START, CPU}$	CPU startup current.		600		µA	1
$t_{START, CPU}$	IDLE to CPU execute.	0[3]			µs	1

1. Includes CPU, flash, 1V2, 1V7, RC16M.
2. Includes CPU, RAM, 1V2, RC16M.
3. t_{1V2} if 1V2 regulator is not running already.

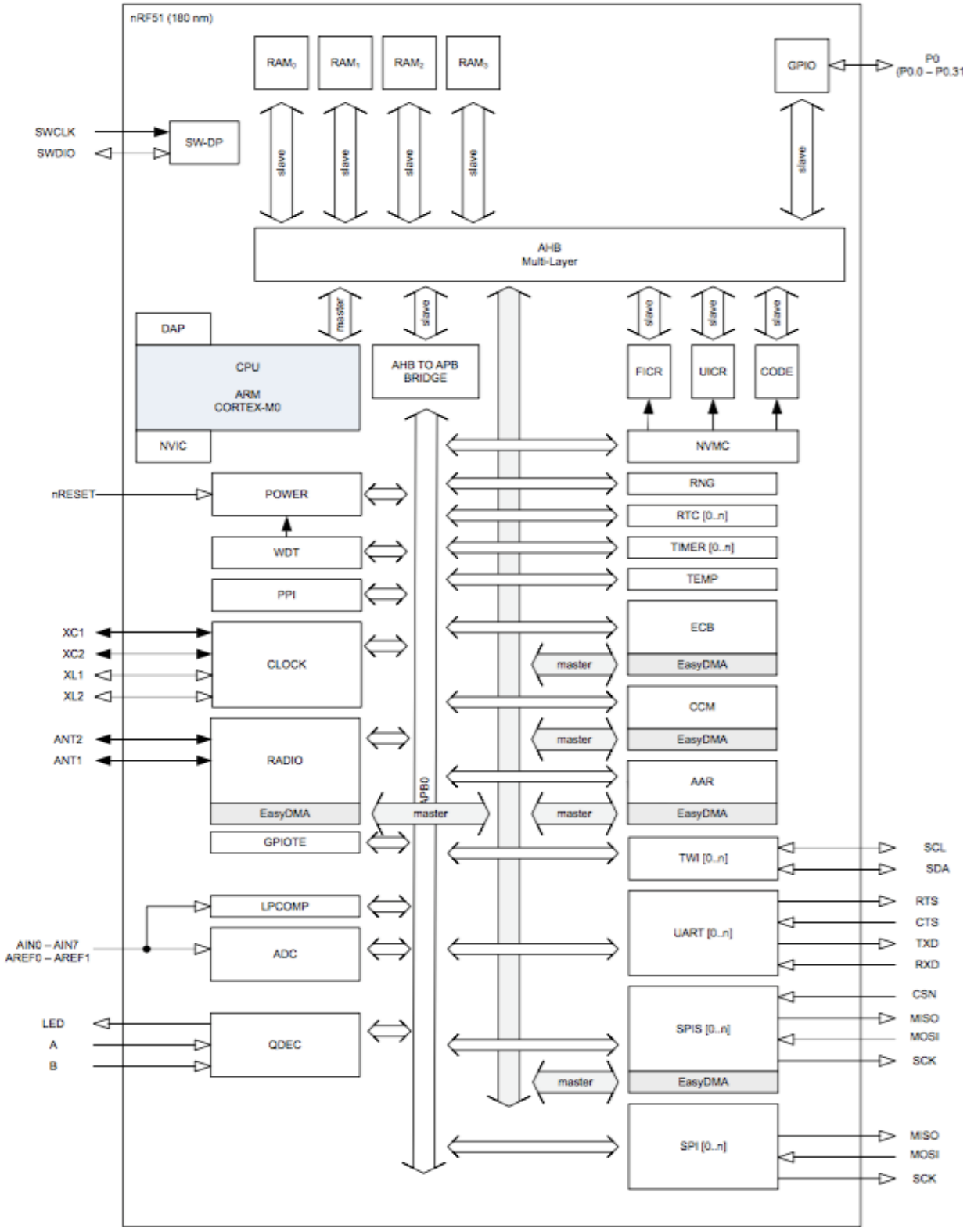
5.4.7 Power Management

Symbol	Description	Note	Min.	Typ.	Max.	Units	Test level
I_{OFF}	Current in SYSTEM OFF, no RAM retention.			0.6[1]		µA	2
$I_{OFF, RET, 8k}$	Additional current in SYSTEM OFF per retained RAM block (8 kB)			0.6[1]		µA	2
I_{OFF2ON}	OFF to CPU execute transition current.			400		µA	1
t_{OFF2ON}	OFF to CPU execute.			9.6	10.6	µs	1
$I_{ON,16k}$	SYSTEM-ON base current with 16 kB RAM enabled.			2.6[1]		µA	2
$I_{ON,32k}$	SYSTEM-ON base current with 32 kB RAM enabled.			3.8[1]		µA	2
t_{1V2}	Startup time for 1V2 regulator.			2.3		µs	1
$I_{1V2XO16}$	Current drawn by 1V2 regulator and 16 MHz XOSC when both are on at the same time.	See *Table 33* on page 48.		810[2]		µA	1
$I_{1V2XO32}$	Current drawn by 1V2 regulator and 32 MHz XOSC when both are on at the same time.	See *Table 33* on page 48.		840[2]		µA	1
$I_{1V2RC16}$	Current drawn by 1V2 regulator and 16 MHz RCOSC when both are on at the same time.	See *Table 33* on page 48.		880[2]		µA	1
$I_{1V2XO16,1M}$	For HFCLK in 1 MHz mode[3]. Current drawn by 1V2 regulator and 16 MHz XOSC when both are on at the same time.	See *Table 33* on page 48.		520[2]		µA	1
$I_{1V2XO32,1M}$	For HFCLK in 1 MHz mode[3]. Current drawn by 1V2 regulator and 32 MHz XOSC when both are on at the same time.	See *Table 33* on page 48.		560[2]		µA	1
$I_{1V2RC16,1M}$	For HFCLK in 1 MHz mode[3]. Current drawn by 1V2 regulator and 16 MHz RCOSC when both are on at the same time.	See *Table 33* on page 48.		630[2]		µA	1
t_{XO}	Startup time for the clock management system when the XTAL is in standby.			2.3	5.3	µs	1

Symbol	Description	Note	Min.	Typ.	Max.	Units	Test level
t_{1V7}	Startup time for 1V7 regulator			2	3.6	µs	1
I_{1V7}	Current drawn by 1V7 regulator			105		µA	2
F_{DCDC}	DC/DC converter current conversion factor.		0.65[4]		1.2[4]		1

1. Add 1 µA to the current value if the device is used in Low voltage mode.
2. This number includes the current used by the automated power and clock management system.
3. For details on 1 MHz mode, see *Section 4.2 "Timer/counters (TIMER)"* on page 32.
4. F_{DCDC} will vary depending on VDD and internal radio current consumption (I_{DD}). Please refer to the *nRF51 Series Reference Manual*, v3.0 or later, for a method to calculate $I_{DD,DCDC}$. See *Figure 11* on page 50 for a DC/DC conversion factor chart.

6. Block Diagram



nRF51822 block diagram

7. Antenna

7.1 **MDBT40** Series

ACX
Advanced Ceramic X

AT7020 Series
Multilayer Chip Antenna

Features

❖ Monolithic SMD with small, low-profile and light-weight type.

❖ Wide bandwidth

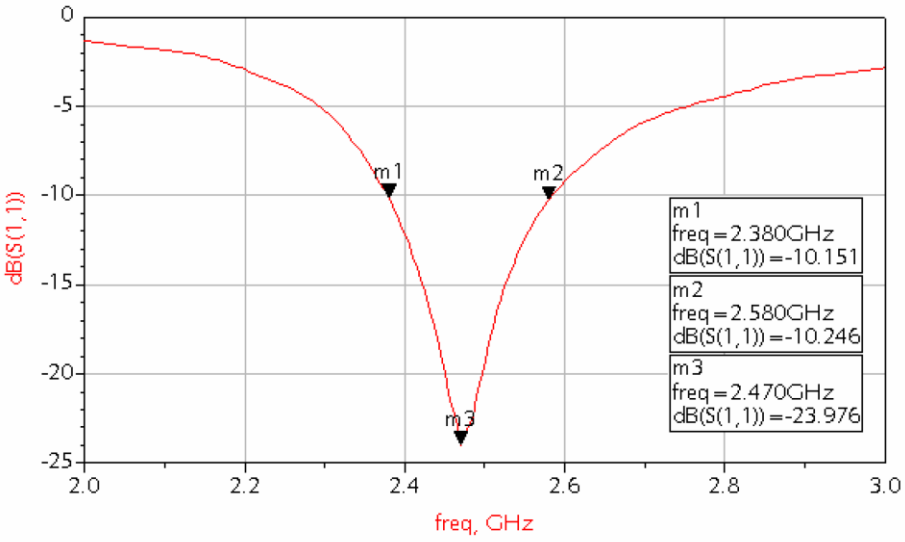
Applications

❖2.4GHz WLAN, Home RF, Bluetooth Modules, etc.

Specifications

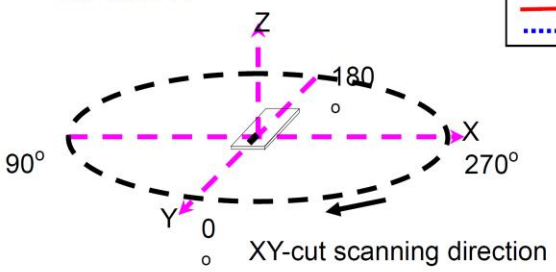
Part Number	Frequency Range (MHz)	Peak Gain (dBi typ.)	Average Gain (dBi typ.)	VSWR	Impedance
AT7020 -E3R0HBA_	2400~2500	1.3dBi (XZ-V)	-0.5dBi (XZ-V)	2 max.	50 Ω

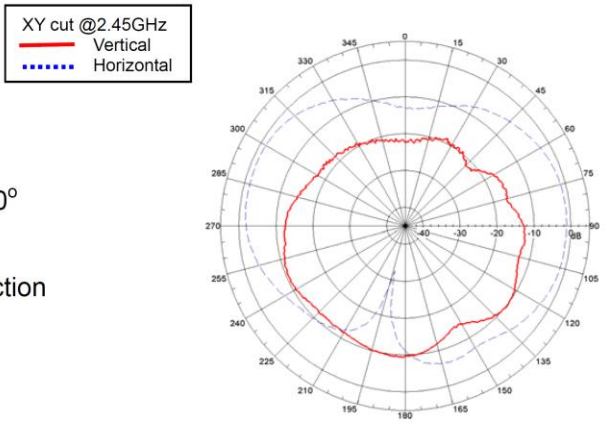
❖ Return Loss/With Matching Circuits



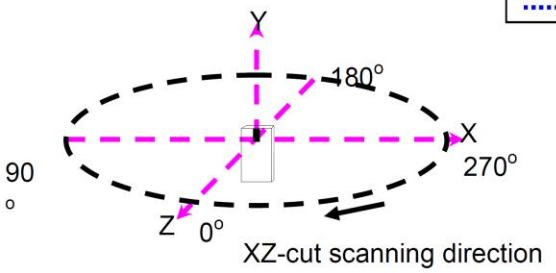
❖ Radiation Patterns

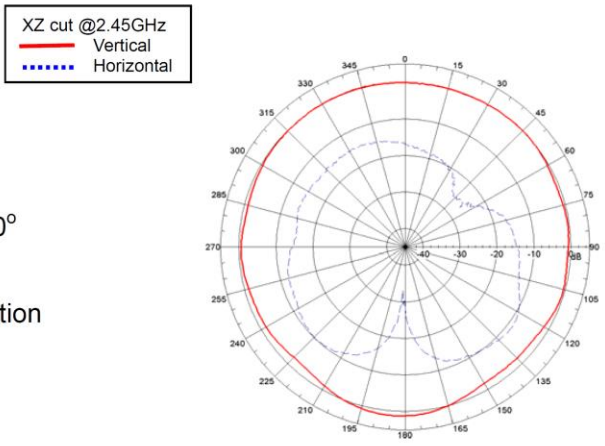
XY-V/XY-H



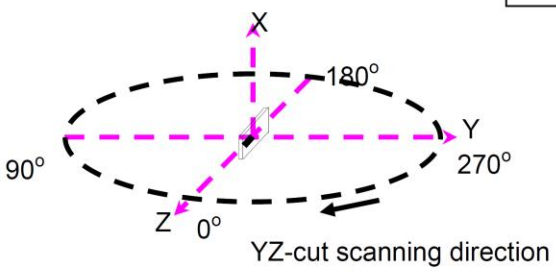


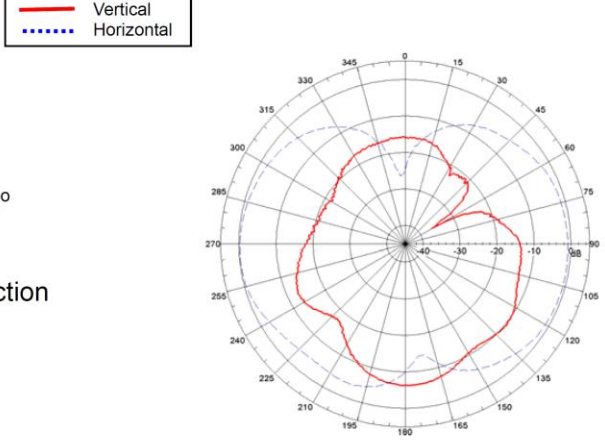
XZ-V/XZ-H





YZ-V/YZ-H

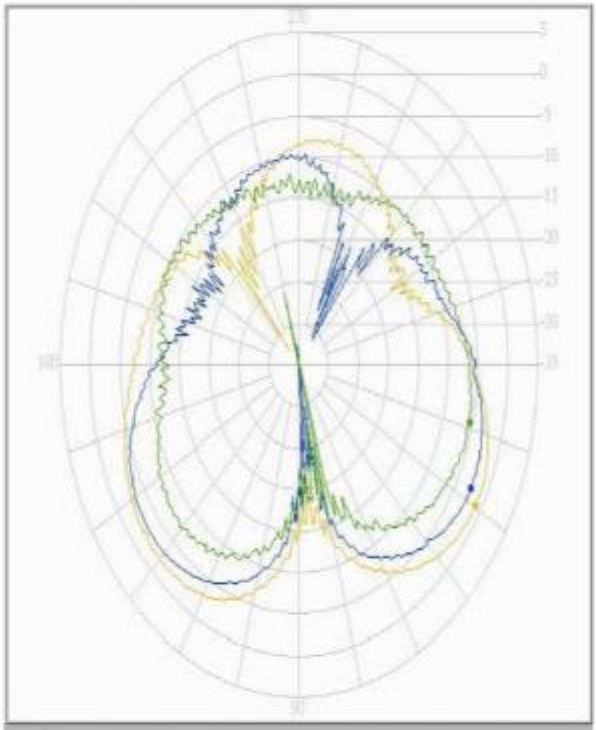




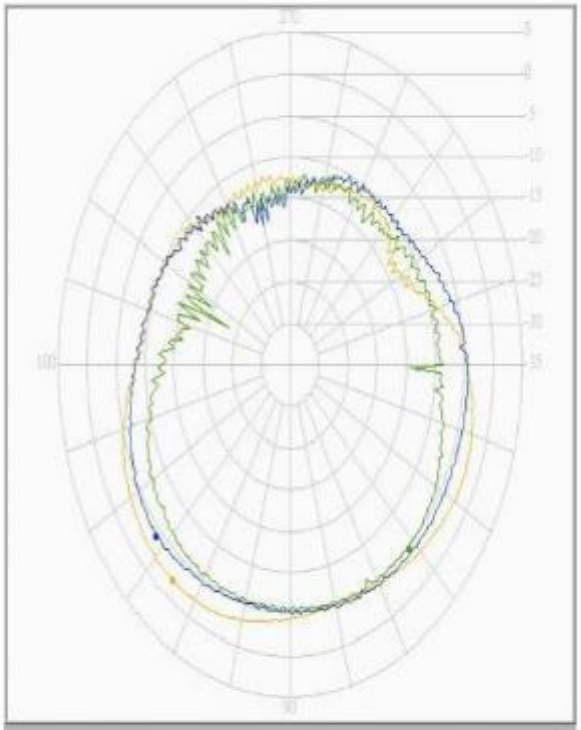
7.2 **MDBT40-P** Series

Antenna Manufacturer : Raytac Corporation.
MODEL:Printed Trace Antenna

C. X-Z polarization scan



Model No.	Ant. Polarization	Freq(MHz)	Peak angle	Value	Average
XZ 2400 H	Horizontal	2400.0	330.3	-0.9	-6.1
XZ 2450 H	Horizontal	2450.0	332.8	-2.5	-7.6
XZ 2500 H	Horizontal	2500.0	346.0	-5.5	-9.8

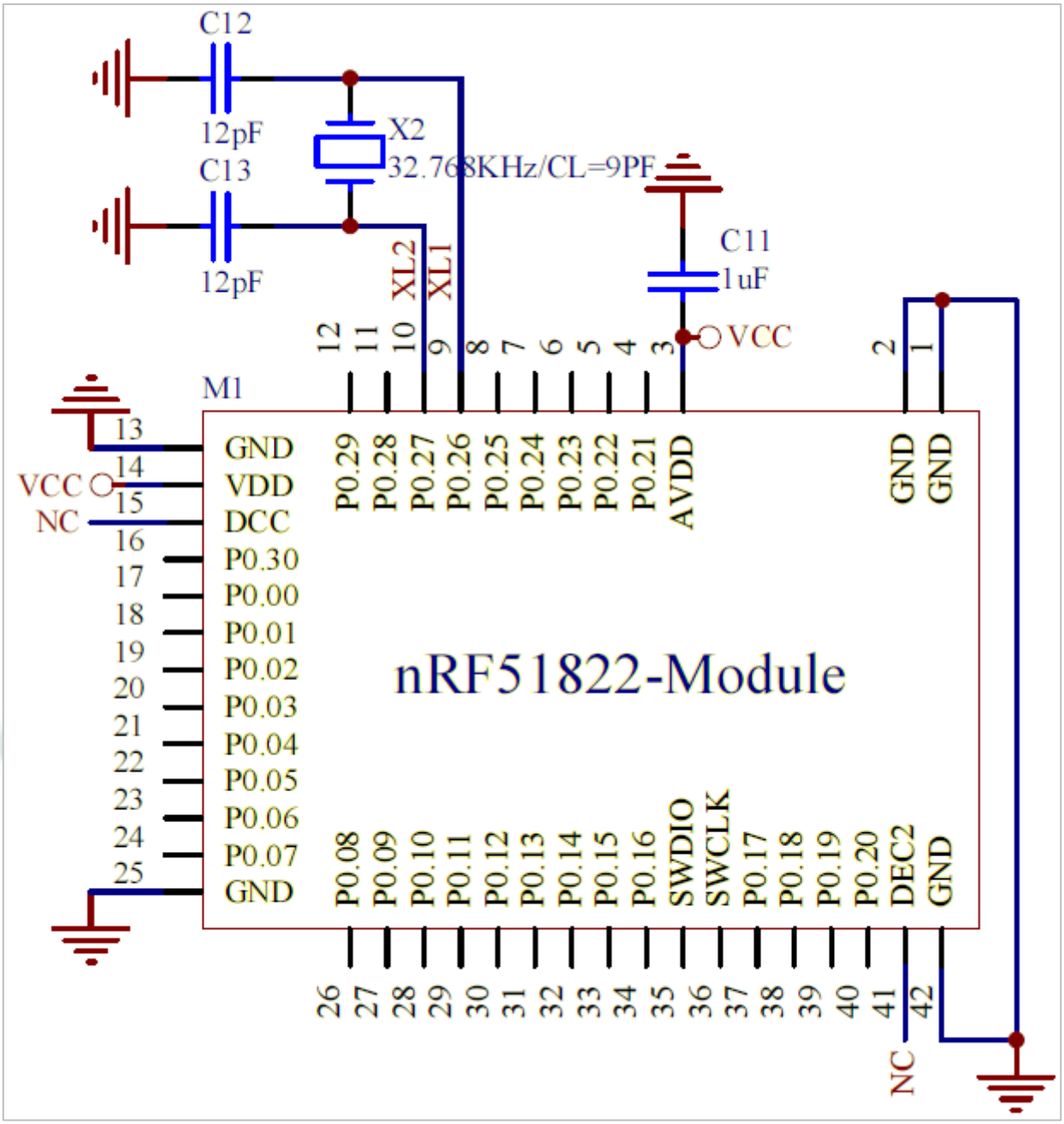


Model No.	Ant. Polarization	Freq(MHz)	Peak angle	Value	Average
XZ 2400 V	Vertical	2400.0	232.1	-2.0	-5.7
XZ 2450 V	Vertical	2450.0	221.8	-4.1	-6.6
XZ 2500 V	Vertical	2500.0	312.7	-4.8	-8.5

8. Reference Circuit

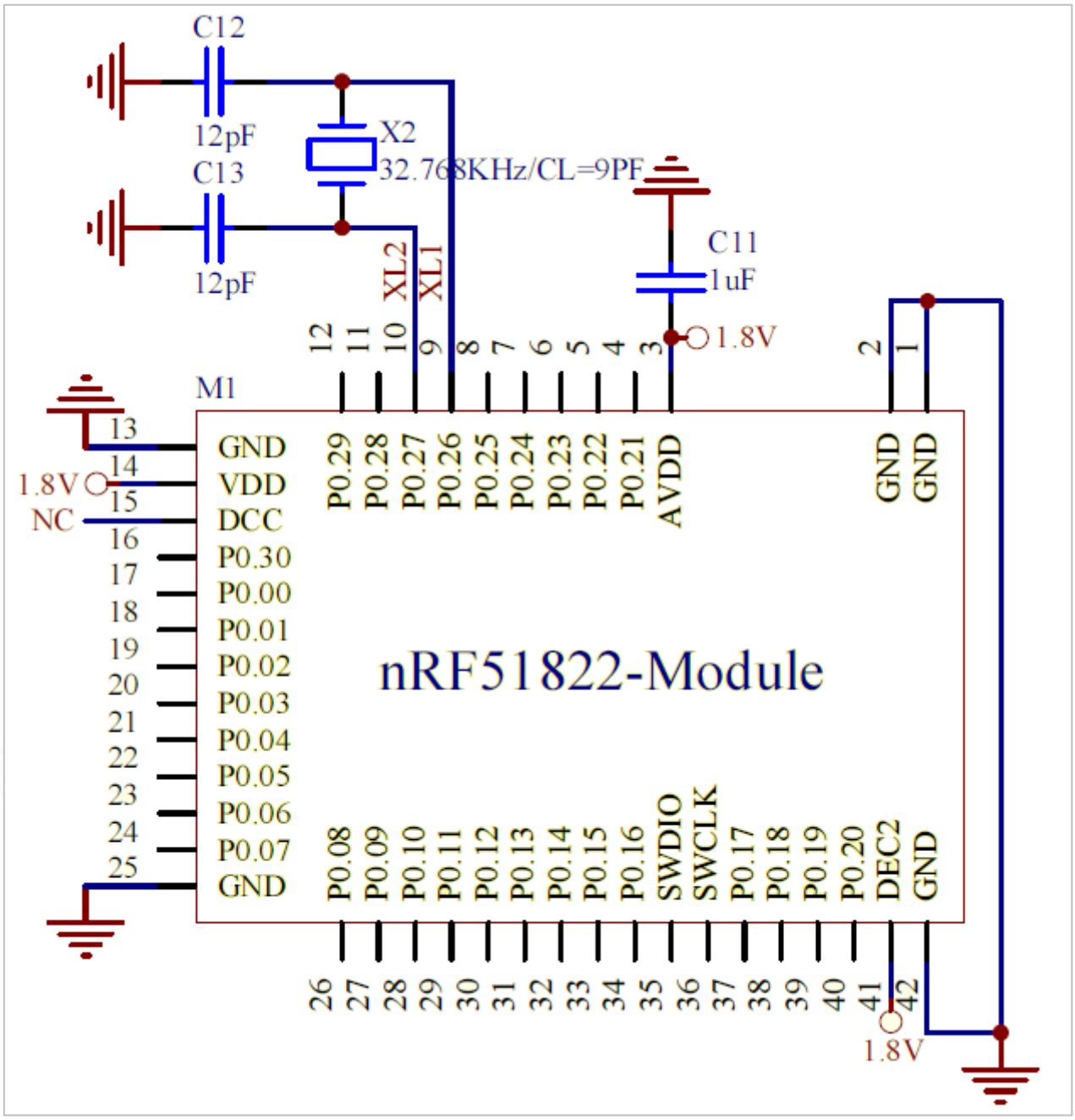
8.1 nRF51822 Schematic with Internal LDO **(Module's Default)**

Default is using external 32.768khz crystal. Please make sure it is connected to make module work.



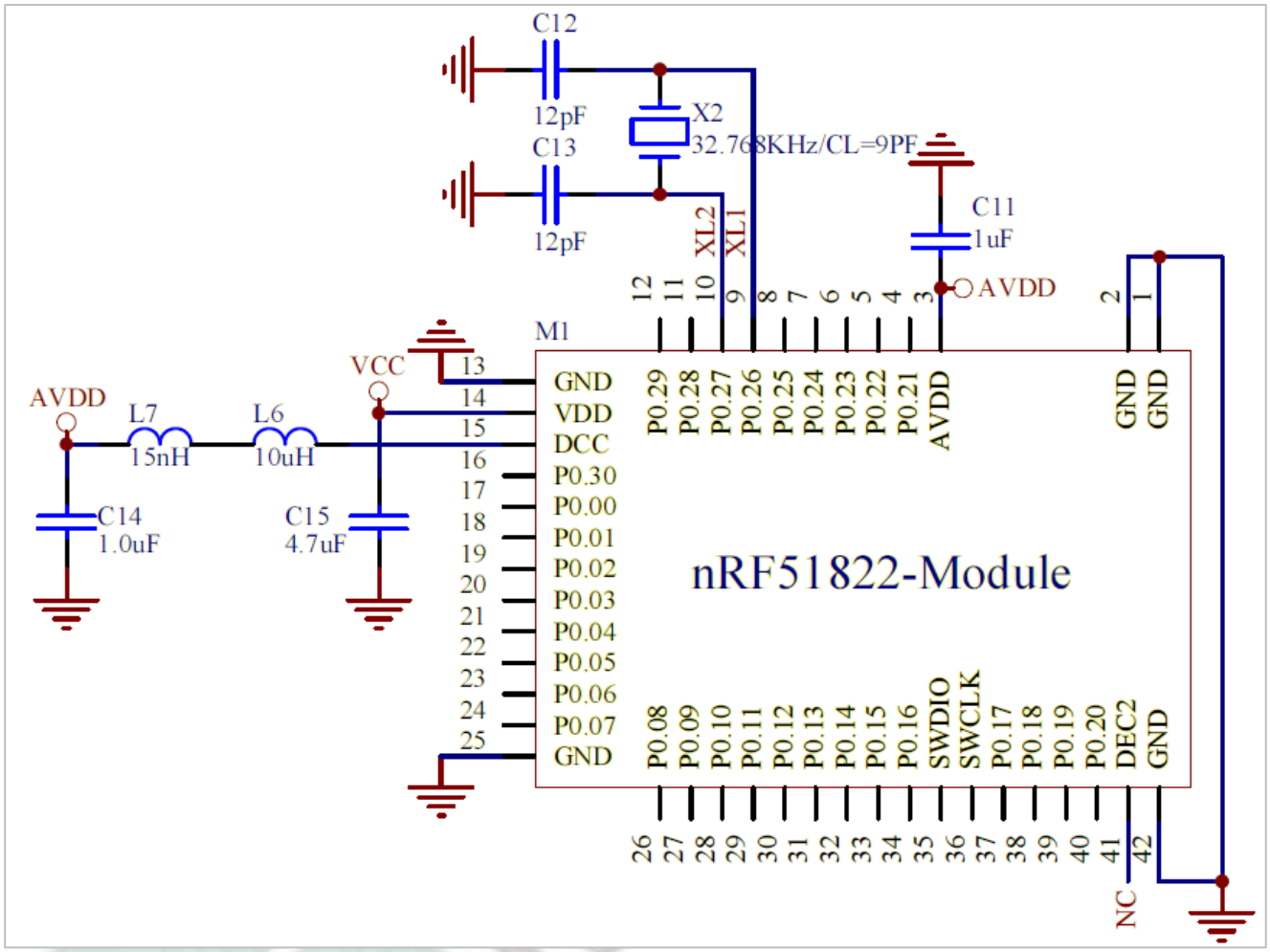
8.2 nRF51822 Schematic with 1.8V Low Voltage Mode

1. When operating temperature is from -40℃ to 105℃, it is not supported 1.8V low voltage mode.
2. External 32.768khz is optional.



8.3 nRF51822 Schematic with Internal DC/DC Converter

External 32.768khz is optional.



9. Certification

9.1 Declaration ID Certification

QDL Bluetooth® Qualified Design Listing

The Bluetooth SIG Hereby Recognizes

Ginstar Corporation
Member Company

nRF51xxx Bluetooth 4.1 Module
Qualified Design Name

Declaration ID: D023258
Qualified Design ID: 60912
Specification Name: 4.1
Product Type: End Product
Model Number: MDBT40 / MDBT40-P
Listing Date: 02 September 2014
Assessment Date: 02 September 2014
Hardware Version Number: 1
Software Version Number: 1

This certificate acknowledges the *Bluetooth*® Specifications declared by the member were achieved in accordance with the *Bluetooth* Qualification Process as specified within the *Bluetooth* Specifications and as required within the current PRD

QDID Property owned by Raytac Corporation

Bluetooth SPECIAL INTEREST GROUP

Remark: Ginstar Corporation is one of subsidiaries of Raytac Corporation.

9.2 FCC Certification (USA)

TCB

GRANT OF EQUIPMENT AUTHORIZATION

TCB

Certification
Issued Under the Authority of the
Federal Communications Commission
By:

PHOENIX TESTLAB GmbH
Koenigswinkel 10
32825 Blomberg,
Germany

Date of Grant: 03/24/2015

Application Dated: 03/24/2015

Raytac Corp.
5F., No.3, Jiankang Rd., Zhonghe Dist.,
New Taipei City,, 23586
Taiwan

Attention: Venson Liao , R&D Manager

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: SH6MDBT40
Name of Grantee: Raytac Corp.
Equipment Class: Digital Transmission System
Notes: BT 4.0 Module
Modular Type: Single Modular

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	15C	2402.0 - 2480.0	0.0027		
	15C	2405.0 - 2480.0	0.0028		

Output power listed is peak conducted. This OEM module is approved for use in products operating as portable transmitting device. End users may not be provided with the module installation instructions.

This Class II Permissive Change covers the performed modifications as documented in the filing.

CERTIFICATE OF COMPLIANCE

International Certification Corp

Certificate Number: INF412101

This is to certify that the following products have been tested by us with the listed standards and found in conformity with the procedures given in ANSI C63.4-2009 and all tests are performed according to FCC Part 15 and Canada Standard ICES-003 Issue 5 Rules.

This Certificate applies to the tested sample below mentioned only and shall not imply an assessment of the whole production. It is only valid in connection with the test report number: FD412101.

Applicant	:	Raytac Corporation
Product Name	:	BT4.0 module
Model No.	:	MDBT40
Brand Name	:	Raytac
Applied Standards	:	FCC Part 15, Subpart B, Class B ICES-003 Issue 5 ANSI C63.4:2009

Kent Chen / Assistant Manager

February 12, 2014

International Certification Corp.
Address: No. 3-1, Lane 6, Wen San 3rd St.,Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C.
Tel: 886-3-271-8666, Fax: 886-3-318-0155

Rev. 01

9.3 TELEC Certification (Japan)

Annex 1 to
Certificate No 14-110771
of Technical Regulations Conformity
for Specified Radio Equipment in Japan

PHOENIX TESTLAB

- The validity of this certificate is limited to products, which are equal to the one examined in the type-examination.
- When the holder of this certificate is placing the product on the Japanese market, the product must be affixed with the following Specified Radio Equipment marking:

R 204-420020

Remarks and observations:

The following conditions are applicable:

- Chip Antenna, MDBT40, with a maximum gain of 1.3 dBi for the 2.4 GHz band

Documentation lodged for the type examination:

Testreports:

- International Certification Corp.: JR412101AC, Feb.12, 2014
- International Certification Corp.: JR412101AE, Feb.12, 2014

Product documentation:

- Block Diagram
- Bill of Materials
- Photos
- User Manual
- Circuit Diagram
- Placement Drawings
- Antenna Specifications

Technical standards and specifications

The product complies with:

Ordinance Regulating Radio Equipment
- Chapter I, General Provisions
- Chapter II, Transmitting Equipment
- Chapter III, Receiving Equipment
- Chapter IV, Article 49.20

9.4 NCC Certificate (Taiwan)

MDBT40 Series

耕興股份有限公司

低功率射頻電機型式認證證明

(1) 申　請　者	：	勁達國際電子有限公司 (臺北市大安區和平東路 1 段 145 號 5 樓之 1)
(2) 製 造 廠 商	：	Ginstar Corporation
(3) 器 材 名 稱	：	BT4.0 module
(4) 廠 牌 / 型 號	：	Raytac / MDBT40
(5) 發射功率（電場強度）	：	2.402-2.480 GHz: 4.38dBm
(6) 工 作 頻 率	：	2.402-2.480 GHz (GFSK 40CH,ChS-2MHz)
(7) 審 驗 日 期	：	104 年 02 月 04 日
(8) 審驗合格標籤式樣	：	

CCAF15LP0280T1

說明：

1. 請依上列標籤式樣自製標籤，標貼或印鑄於器材本體明顯處，始得販賣或公開陳列。
2. 經型式認證合格之低功率射頻電機，其廠牌、型號、設計、射頻性能如有變更，應重新申請型式認證。
3. 違反低功率電波輻射性電機管理辦法之規定，擅自使用或變更無線電頻率、電功率者，除依電信法規定處罰外，驗證機關(構)並得廢止其型式認證證明或型式認證標籤。
4. 送審廠商應保留送審樣品供日後核對。
5. 本型式認證證明及其合格標籤使用權專屬取得本證明者。依電信管制射頻器材審驗辦法第 15 條規定，持有人得經由網際網路申請同意他人於同廠牌同型號之電信管制射頻器材使用型式認證標籤，並於次日起 30 天內，應檢具「電信管制射頻器材審驗合格標籤或符合性聲明標籤同意使用備查表」送國家通訊傳播委員會備查。

備註：

1. 本器材符合低功率射頻電機技術規範(第 3.10.1 章節)之規定。
2. 本器材使用 Chip 天線，天線增益 1.3dBi。
3. 本公司係經國家通訊傳播委員會委託之驗證機構(電信管制射頻器材驗證機構認證證書號碼：NCC-RCB-05/電信終端設備驗證機構認證證書號碼：NCC-RCB-05)，核發本型式認證證明。
4. 依「商品標示法」及「資訊、通信及消費性電子商品標示基準」規定，標示事項貼於商品或內外包裝上，以免違法而受處分。
5. 本案審驗模組為完全模組，適用於任何平台。「平台」定義如下：若器材不組裝本案審驗模組，消費者仍能正常使用該器材主要功能，該器材得視為平台。若器材不組裝本案審驗模組，消費者不能正常使用該器材主要功能，則該器材不能視為平台，該類不同廠牌型號器材組裝本案審驗模組後，須分別申請型式認證。

SGS 台灣檢驗科技股份有限公司

低功率射頻電機型式認證證明

一、申　請　者：勁達國際電子有限公司
　　地　　址：106 臺北市大安區和平東路 1 段 145 號 5 樓之 1
二、製 造 廠 商：Ginstar Corporation (中國廣東省中山市坦州鎮前進三路)
三、器 材 名 稱：BT BLE Module
四、廠　　牌：Raytac
五、型　　號：MDBT40
六、發 射 功 率：BT V4.0 Single Mode: 4.18dBm (Peak)
七、工 作 頻 率：2402MHz – 2480MHz
八、審 驗 日 期：104 年 04 月 02 日
九、審驗合格標籤式樣：CCAM15LP0230T1

台灣檢驗科技股份有限公司電信設備審驗印章

說明：
1. 請依上列標籤式樣自製標籤，標貼或印鑄於器材本體明顯處，始得販賣或公開陳列。
2. 經型式認證合格之低功率射頻電機，其廠牌、型號、設計、射頻性能如有變更，應重新申請型式認證。
3. 違反低功率電波輻射性電機管理辦法之規定，擅自使用或變更無線電頻率、電功率者，除依電信法規定處罰外，驗證機關(構)並得廢止其型式認證證明或型式認證標籤。
4. 送審廠商應保留送審樣品供日後核對。
5. 本型式認證證明及其合格標籤使用權專屬取得本證明者。依電信管制射頻器材審驗辦法第15條規定，持有人得經由網際網路申請同意他人於同廠牌同型號之電信管制射頻器材使用型式認證標籤，並於次日起30天內，應檢具「電信管制射頻器材審驗合格標籤，或符合性聲明標籤同意使用備查表」送國家通訊傳播委員會備查。

備註：
1. 本器材符合低功率射頻電機技術規範(3.10.1)之規定。
2. 本公司僅對無線射頻特性技術規範辦理型式認證，其他仍須依本國相關法規辦理。
3. 本器材使用天線型態: Printed Trace Antenna，廠牌: Raytac Corporation，型號: Printed Trace Antenna，增益: -0.8dBi。
4. 本案審驗模組為完全模組，適用於任何平台。【平台】定義如下:若器材不組裝本案審驗模組，消費者仍能正常使用該器材主要功能，該器材得視為平台。若器材不組裝本案審驗模組，消費者不能正常使用該器材主要功能，該器材不能視為平台，該類不同廠牌型號器材組裝本案審驗模組後，須分別申請型式認證。
5. 本公司係經國家通訊傳播委員會委託之驗證機構，核發本型式認證證明。

9.5 CE Test Report (EU)

SGS Reference No: E1/2017/40113C

VERIFICATION OF EMC COMPLIANCE

Verification No.	:	E1/2017/40113C
Representative Model No.	:	MDBT40
Added Model(s)	:	MDBT40-P
Product Name	:	BT 4.1 Module
Brand Name	:	Raytac
Applicant	:	Raytac Corporation
Address of Applicant	:	5F., No.3, Jiankang Road, Zhonghe District 23586, Taiwan
Test Report Number	:	E1/2017/40113
Date of Issue	:	May 19, 2017
Applicable Standards	:	EN 301 489–$1_{v2.1.1}$: 2017-02, EN 301 489–$17_{v3.1.1}$: 2017-02 EN 55032 : 2015+AC:2016-07 EN 61000-4-2 : 2009, EN 61000-4-3 : 2006+A1:2008+A2:2010

Conclusion

The apparatus meets the requirements of the above standards and hence compliance the essential requirements under article 3.1b of the RED (2014/53/EU) Directive.

*This verification is only valid for the equipment and configuration described, and in conjunction with the test report as detailed above.

CE

Authorized Signatory:

Wisely Huang

SGS TAIWAN LTD.
Wisely Huang
Technical Asst. Manager

9.6 IC Certificate (Canada)

telefication bv
The Netherlands
Chamber of Commerce
51565536
www.telefication.com

telefication

CB Industry Canada Industrie Canada

► Reg. No. NL0001

TECHNICAL ACCEPTANCE CERTIFICATE / CERTIFICAT D'ACCEPTABILITÉ TECHNIQUE

CERTIFICATION No. / No. DE CERTIFICATION	► 8017A-MDBT40
TELEFICATION No. / No. DE TELEFICATION	► 152170125/AA/00
TEST SITE No. / No. DE LABORATOIRE	► 4620A-5
ISSUED TO / DÉLIVRÉ A	► Raytac Corporation
TYPE OF EQUIPMENT / GENRE DE MATÉRIEL	► Bluetooth Device Modular Approval
TRADE NAME AND MODEL / MARQUE ET MODELE	► Raytac MDBT40
CERTIFIED TO / CERTIFIÉ SELON LE	► SPECIFICATION / CAHIER DES CHARGES RSS-247 ISSUE / EDITION Issue 1

Certification of equipment means only that the equipment has met the requirements of the above-noted specification. Licence applications, where applicable to use certified equipment, are acted on accordingly by the Industry Canada issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements and procedures issued by Industry Canada. The equipment for which this certificate is issued shall not be manufactured, imported, distributed, leased, offered for sale or sold unless the equipment complies with the applicable technical specifications and procedures issued by Industry Canada.

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance d'Industrie Canada et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation. Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'Industrie Canada. Le matériel à l'égard duquel le présent certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins d'être conforme aux procédures et aux spécifications techniques applicables publiées par Industrie Canada.

ISSUED BY TELEFICATION BV, RECOGNIZED CERTIFICATION BODY BY INDUSTRY CANADA
DÉLIVRÉ PAR TELEFICATION BV, ORGANISME DE CERTIFICATION RECONNU PAR INDUSTRIE CANADA

I hereby attest that the subject equipment was tested and found in compliance with the above-noted specification.
J'atteste, par la présente, que le matériel a fait l'objet d'essai et a été jugé conforme à la spécification ci-dessus.

DATE 15 June 2015 BY

W.J.M. Jong
Manager Product Certification
i.o.

This certificate has one annex.

RvA PRODUCTS RvA C 224

9.7 SRRC Certificate (China)

无线电发射设备
Radio Transmission Equipment
型号核准证
Type Approval Certificate

劲达国际电子有限公司（台湾）：

根据《中华人民共和国无线电管理
In accordance with the provisions on the Radio

条例》，经审查，下列无线电发射设备
Regulations of the People's Republic of China , the following

符合中华人民共和国无线电管理规定和
radio transmission equipment , after examination , conforms

技术标准，其核准代码为：CMIIT ID: 2015DJ2435
to the provisions with its CMIIT ID:

中华人民共和国工业和信息化部
（发证机关）
Sealed by issuing authority

有效期：五年
Validity

2015 年 6 月 2 日
Year Month Date

9.8 KC Certificate (South Korea)

0D0F-48CC-97AD-AA45

방송통신기자재등의 적합인증서

Certificate of Broadcasting and Communication Equipments

상호 또는 성명 *Trade Name or Applicant*	Raytac Corporation
기자재 명칭 *Equipment Name*	특정소출력 무선기기(무선데이터통신시스템용 무선기기)
기본모델명 *Basic Model Number*	MDBT40
파생모델명 *Series Model Number*	MDBT40-P
인증번호 *Certification No.*	MSIP-CRM-ryt-MDBT40
제조자/제조국가 *Manufacturer/ Country of Origin*	Raytac Corporation / 대만
인증연월일 *Date of Certification*	2016-11-29
기타 *Others*	

위 기자재는 「전파법」 제58조의2 제2항에 따라 인증되었음을 증명합니다.

It is verified that foregoing equipment has been certificated under the Clause 2, Article 58-2 of Radio Waves Act.

2016년(Year) 11월(Month) 29일(Date)

국립전파연구원장 국립전파연구원장인

Director General of National Radio Research Agency

※ 인증 받은 방송통신기자재는 반드시 "**적합성평가표시**"를 부착하여 유통하여야 합니다.
위반시 과태료 처분 및 인증이 취소될 수 있습니다.

9.9 RoHS & RoHS Report

Please click link below to download full report.

- RoHS Report for MDBT40 & MDBT40-P

- REACH Report for MDBT40 & MDBT40-P

9.10 Reliability Test

Below are the extracted events from reliability test. Please contact us for full report.

- Tested Item: MDBT40 / MDBT40-P
- Testing Method:

  Conducted continuously BLE transmitting and receiving function checking during requested duration.
- Testing Result: No fault or package loss during testing.
- Testing Events:

  1. Operating under Low Temperature Test

Test Method/ Specification:	
Test method:	Refer to JASO D001-94, Clause 5.13
Sample condition:	Operating
Temperature:	-30℃
Duration:	72 Hours

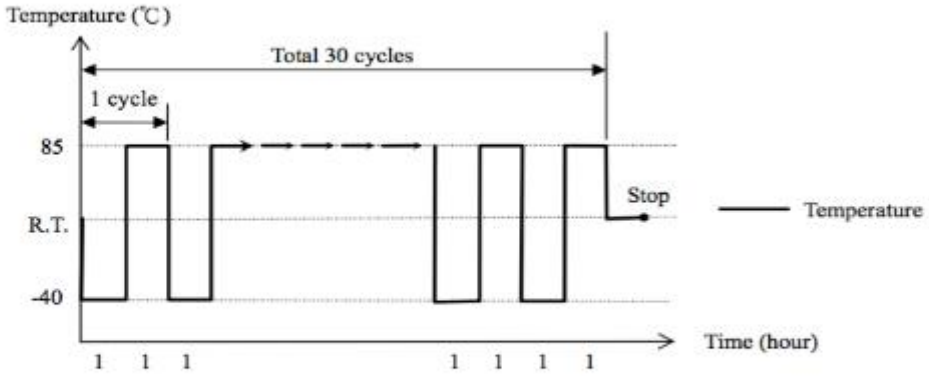
  2. Operating under High Temperature Test

Test Method/ Specification:	
Test method:	Refer to JASO D001-94, Clause 5.15
Sample condition:	Operating
Temperature:	85℃
Duration:	120 Hours

  3. Thermal Shock Test

Test Method/ Specification:

Test method: Refer to JASO D001-94, Clause 5.17



- Sample Condition: Operating
- The temperature transition time shall be within 1 minute.
- Examine the appearance of specimen(s) by visual check and perform functional check after this test.
- Functional check: Connect the specimen(s) with notebook and rated power ($2V_{DC}$) then examine whether the signal transmission could be work normally or not.

4. Temperature Cycling Test

1. Temperature Cycling Test:

Test Equipment:

Name	Brand	Model	Serial No.
Programmable Temperature & Humidity Chamber	KSON	THS-D4T-150-LN2	D129
Programmable DC Power Supply	GW	PSM-2010	PH220347

Lab Environmental Conditions:

Ambient Temperature: (25 ± 3) ℃

Ambient humidity: (55 ± 20) % RH

Test Method/ Specification:

Condition I:

Test method: Refer to JASO D001-94, Clause 5.18

Step	Temperature (℃)	Humidity (%RH)	Time (hours)	Sample Condition
1	23	60	4	Operating
2	23→55	60→95	0.5	Operating
3	55	95	10	Operating
4	55→-40	95→0	2.5	Non-Operating
5	-40	0	2	Non-Operating
6	-40→85	0	1.5	Non-Operating
7	85	0	2	Operating
8	85→23	0	1.5	Operating
Test cycle: Total 10 cycles.				

- Examine the appearance of specimen(s) by visual check and perform functional check after this test.
- Functional check: Connect the specimen(s) with notebook and rated power ($2V_{DC}$) then examine whether the signal transmission could be work normally or not.

Condition II:

Test method: Refer to JASO D001-94, Clause 5.18

Step	Temperature (℃)	Humidity (%RH)	Time (hours)	Sample Condition
1	23	60	4	Operating
2	23→55	60→95	0.5	Operating
3	55	95	10	Operating
4	55→-40	95→0	2.5	Operating
5	-40	0	2	Operating
6	-40→85	0	1.5	Operating
7	85	0	2	Operating
8	85→23	0	1.5	Operating
Test cycle: Total 1 cycle. Note: Condition II is start after Condition I complete				

- Examine the appearance of specimen(s) by visual check and perform functional check after this test.
- Functional check: Connect the specimen(s) with notebook and rated power ($2V_{DC}$) then examine whether the signal transmission could be work normally or not.

9.11 End-Product Label

It is suggested using following content adding to package or user manual or label to obey the regulation. Any rules of end-product label shall refer to each certification for final reference

9.11.1 FCC (USA)

The FCC statement should be included in the user manual when there is no enough space on label. Otherwise, it should be included on the label.

“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. (2) This device must accept any interference received, including interference that may cause undesired operation.”

The final end product must be labeled in a visible area with the following: “Contain FCC ID: SH6MDBT40”.

9.11.2 TELEC (Japan)

When manufacturer is placing the product on the Japanese market, the product must be affixed with the following Specified Radio Equipment marking:

9.11.3 NCC (Taiwan)

請依下列標籤式樣自製標籤，標貼或印鑄於器材本體明顯處，始得販賣或公開陳列。

MDBT40 Series

MDBT40-P Series

平台廠商必須於平台上標示字樣「本產品內含射頻模組：ID 編號 CCAF15LP0280T1」或「本產品內含射頻模組：ID 編號 CCAM15LP0230T1」。

「平台」定義如下：若器材組裝本案模組，消費者仍能正常使用該器材主要功能，該器材得視為平台。若器材不組裝本案模組，消費者不能正常使用該器材主要功能，該器材不能視為平台。該類不同廠牌型號器材組裝本案審驗模組後，須分別申請型式認證。

9.11.4 IC (Canada)

The IC statement should be included in the user manual when there is no enough space on label. Otherwise, it should be included on the label.

“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 harmful interference. (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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.”

The final end product must be labeled in a visible area with the following: “Contain IC ID: 8017A-MDBT40.

10. Current Consumption Reference Data (BT 3.0 VS BT 4.1)

Mouse Power Consumption			
	BT4.0 (Based on nRF51822)		**BT3.0**
	BT4.0 Mode	RF2.4GHz	
2 x AAA	9.5 Months	10 Months	2.9 Months
2 x AA	21 Months	22 Months	6.2 Months
Including Sensor	**BT4.0 (Based on nRF51822)**		**BT3.0 @3V**
	BT4.0 Mode @ 1.5V	RF2.4GHz @1.5V	
Active-Mouse moving (4.3%) (7.5ms report rate)	5.4 mA 8.1 mW	5.8 mA 8.7 mW	8.7 mA 26.1 mW
Rest 1>1s (4.1%) Link maintained Sensor latency: 20ms	900 uA 1.35 mW	350 uA No link 1.05 mW	1.24 mA 3.72 mW
Rest 2>10 sec (4.9%) Link maintained Sensor latency: 100ms	680 uA 1.02 mW	120 uA 198 uW	900 uA 2.7 mW
Rest 2d>60 sec Link maintained Sensor latency: 100ms	120 uA 180 uW	120 uA 198 uW	900 uA 2.7 mW
Rest 3>600s (86.3) Link disconnected Sensor latency: 500ms	90 uA 135 uW	90 uA 135 uW	797 uA 2.3 mW

Keyboard Power Consumption			
	BT4.0 (Based on nRF51822)		**BT3.0 @3V**
	BT4.0 Mode @3V	RF2.4GHz @3V	
Active 6 letters/s	200 uA	5.8 mA 8.7 mW	8.7 mA 26.1 mW
Rest 1 Maintain link	20 - 40 uA	NA	20 - 40 uA
Rest 2 after>1min, disconnected	0.8 uA	0.8 uA	2 uA Only when PC is off

11. BT 4.1 Product Certification Cost Comparison Chart

(First Certification Application)			
	Chip-on-board Built Up Product	Apply Raytac Module MDBT40 to Build Product	Raytac Module Saving
Declaration ID	US$8,000	US$8,000	Every Single Customer & Every Single Product Certificaiton Cost Saving
BQB Test	US$7,000	US$2,000 (*Note 1)	
USA FCC Test for BT4.0	US$3,600	US$0	
Japan Telec Test for BT4.0	US$5,500	US$0	
CE RF Certification	US$4,500	US$0	
IC (Canada) Certificate	US$3,600	US$0	
SRRC (China) Certificate	US$8,500	US$0	
Taiwan NCC	US$3,600	US$0	
CE & FCC Part 15B EMC Testing	US$1,800	US$1,800	
Total	US$46,100	US$11,800	US$34,300

(2nd and Later Series Product Certification Application)			
	Chip-on-board Built Up Product	Apply Raytac Module MDBT40 to Build Product	Raytac Module Saving
Declaration ID	US$8,000	US$0	Every Single Customer & Every Single Product Certificaiton Cost Saving
BQB Test	US$7,000	US$0	
USA FCC Test for BT4.0	US$3,600	US$0	
Japan Telec Test for BT4.0	US$5,500	US$0	
CE RF Certification	US$4,500	US$0	
IC (Canada) Certificate	US$3,600	US$0	
SRRC (China) Certificate	US$8,500	US$0	
Taiwan NCC	US$3,600	US$0	
CE & FCC Part 15B EMC Testing	US$1,800	US$1,800	
Total	US$46,100	US$1,800	US$44,300
Note:	1. BQB test based on single profile 2. Declaration ID cost based on Adopter Membership	1. FCC & Telec applicant is Raytac (For the case of copy report to change the applicant, the cost is about US$1800 for FCC & US$2,800 for Telec)	

Above cost provided for reference, it may be varied according to different testing lab.

12. nRF51 IC Compatibility with SDK & SoftDevice

Below table is from Nordic's website. Any discrepancy shall refer to Nordic's official release as final reference.

Link of complete document: https://infocenter.nordicsemi.com/index.jsp

nRF51 IC rev.	nRF51 SDK[1]	S110 SD[2]	S110 SDS[3]	S120 SD[2]	S120 SDS[3]	S130 SD[2]	S130 SDS[3]	S210 SD[2][4]	S210 SDS[3]	S310 SD[2][5]	S310 SDS[3]
1	4.4.2	5.2.1[6]	1.1	-	-	-	-	2.0.0[7]	1.0	-	-
2	4.4.2	5.2.1	1.1	-	-	-	-	3.0.0	1.2	-	-
	5.2.0	6.0.0 6.2.1	1.2					3.0.0	1.2	1.0.0	1.0
	6.1.0	7.x.x	1.3	1.0.1	1.1			3.0.0	1.2	1.0.0	1.0
	-	8.0.0	2.0	2.x	2.1			4.0.1	2.0	2.0.1	2.0
3	-	5.2.1	1.1	-	-	-	-	-	-	-	-
	-	6.2.1	1.2	-	-	-	-	-	-	-	-
	6.1.0	7.x.x	1.3	1.0.1	1.1	-	-	3.0.0	1.2	1.0.0	1.0
	7.0.1					0.5.0-1.alpha	0.5	4.0.1	2.0	-	-
	7.1.0									2.0.1	2.0
	7.2.0										
	8.0.0	8.0.0	2.0	2.x	2.1	0.9.0-1.alpha	0.5	4.0.1	2.0	-	-
	8.1.0					1.0.0	1.0				
	9.0.0							5.0.0	3.0	3.0.0	3.0
	10.0.0										
	11.0.0	-	-	-	-	2.0.x	2.0	-	-	-	-
	12.0.0										
	12.1.0										
	12.2.0										

1) At v11, the SDK has been renamed into nRF5 SDK, and it includes support for both nRF51 and nRF52.

2) SD = SoftDevice

3) SDS = SoftDevice Specification

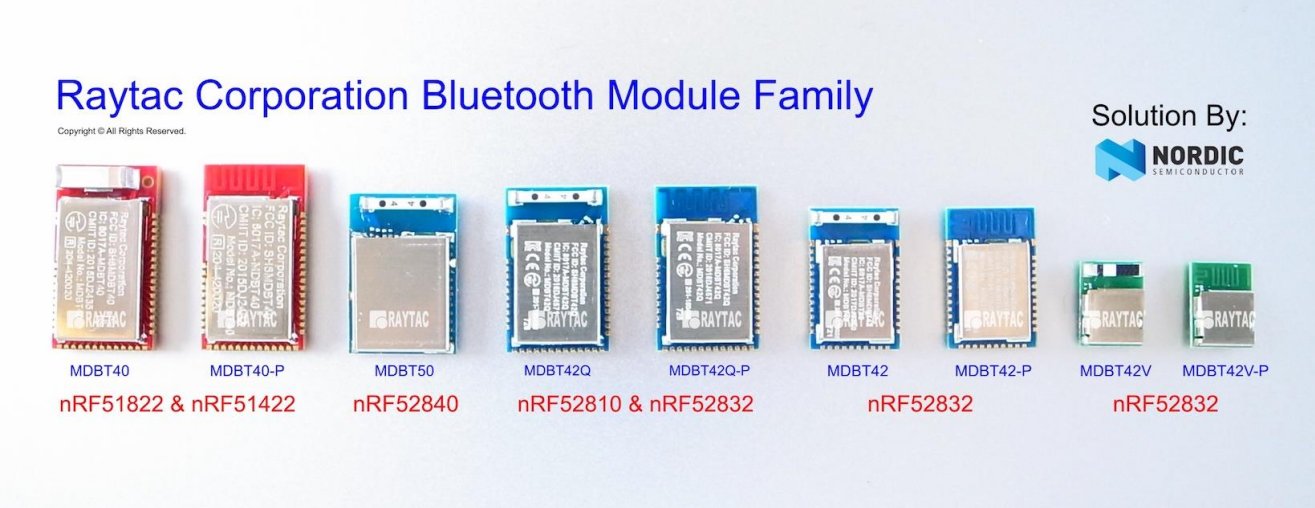
4) ANT only SoftDevice. Only compatible with nRF51422 IC.

5) ANT and BLE combined SoftDevice. Only compatible with nRF51422 IC.

6) Valid for nRF51822 only.

7) Preprogrammed in factory.

Full List of Raytac's BLE Modules



MDBT40 & MDBT40-P Series

Series	Nordic Solution	Raytac No.	IC Version	Antenna	RAM	Flash Memory
MDBT40	nRF51822	MDBT40-256V3	3	Chip Antenna	16 kb	256 K
		MDBT40-256RV3			32 kb	256 K
MDBT40-P	nRF51822	MDBT40-P256V3	3	PCB Antenna	16 kb	256 K
		MDBT40-P256RV3			32 kb	256 K
MDBT40 - ANT	nRF51422	MDBT40-ANT -256V3	3	Chip Antenna	16 kb	256 K
		MDBT40-ANT -256RV3			32 kb	
MDBT40 - ANT-P	nRF51422	MDBT40-ANT -P256V3	3	PCB Antenna	16 kb	256 K
		MDBT40-ANT -P256RV3			32 kb	
MDBT40 Nano	nRF51822	MDBT40-n256V3	3	N/A	16 kb	256 K
MDBT40 - ANT-Nano	nRF51422	MDBT40-ANT -n256V3	3	N/A	16 kb	256 K

MDBT42 Series

QFN Package IC

Series	Nordic Solution	Raytac No.	IC Version	Antenna	RAM	Flash Memory
MDBT42Q	nRF52832	MDBT42Q-512K	1	Chip Antenna	64 kb	512 K
	nRF52810	MDBT42Q-192K			24 kb	192 K

MDBT42Q-P	nRF52832	MDBT42Q-P512K	1	PCB Antenna	64 kb	512 K
	nRF52810	MDBT42Q-P192K			24 kb	192 K

WLCSP Package IC

Series	Nordic Solution	Raytac No.	IC Version	Antenna	RAM	Flash Memory
MDBT42	nRF52832	MDBT42-512K	1	Chip Antenna	64 kb	512 K
MDBT42-P		MDBT42-P512K	1	PCB Antenna		

Series	Nordic Solution	Raytac No.	IC Version	Antenna	RAM	Flash Memory
MDBT42V	nRF52832	MDBT42V-512K	1	Chip Antenna	64 kb	512 K
MDBT42V-P		MDBT42V-P512K	1	PCB Antenna		

Release Note

- 2015/02/13 Version A1: NCC certificate in Chapter 10 added.
- 2015/04/29 Version A2:

  (1) Added MDBT40-P Spec, RoHS Report, List of Raytac's Model No.

  (2) Updated Chapter 8, 9, and 12, 13.
- 2015/07/01 Version A3: Adding IC & SRRC certificates.
- 2015/11/03 Version A4:

  (1) Revised layout guide for MDBT40 series in Chapter 2.

  (2) Updated Chapter 5.

  (3) Updated List of Raytac's Model No.

  (4) Removed info of V2 module from Chapter 4.

  (5) Added Reliability Test in Chapter 10.
- 2017/01/16 Version A5:

  (1) Updated List of Raytac no., Chapter 2, 4, and 12.

  (2) Added KC certificate, RoHS & REACH reports and updated others in Chapter 9.
- 2017/05/19 Version A6:

  (1) Updated List of Raytac's Model No., link for footprint & design guide in Chapter 4.

  (2) Updated CE reports to new RED directives.
- 2017/07/19 Version A7

  (1) Updated chapter 2.3 &2.4, and full list of Raytac's BLE modules.