

Approval Sheet

(產品承認書)

產品名稱 (Product)	<u>Bluetooth USB-C Dongle (nRF52840)</u> <u>deployed MDBT50Q-P module</u>
產品型號 (Model No.)	<u>MDBT50Q-CX-40</u>
產品料號 (Part No.)	<u>MD – 240A7 – 001 (Raytac Logo)</u> <u>MD – 240A7 – 002 (No Logo)</u>

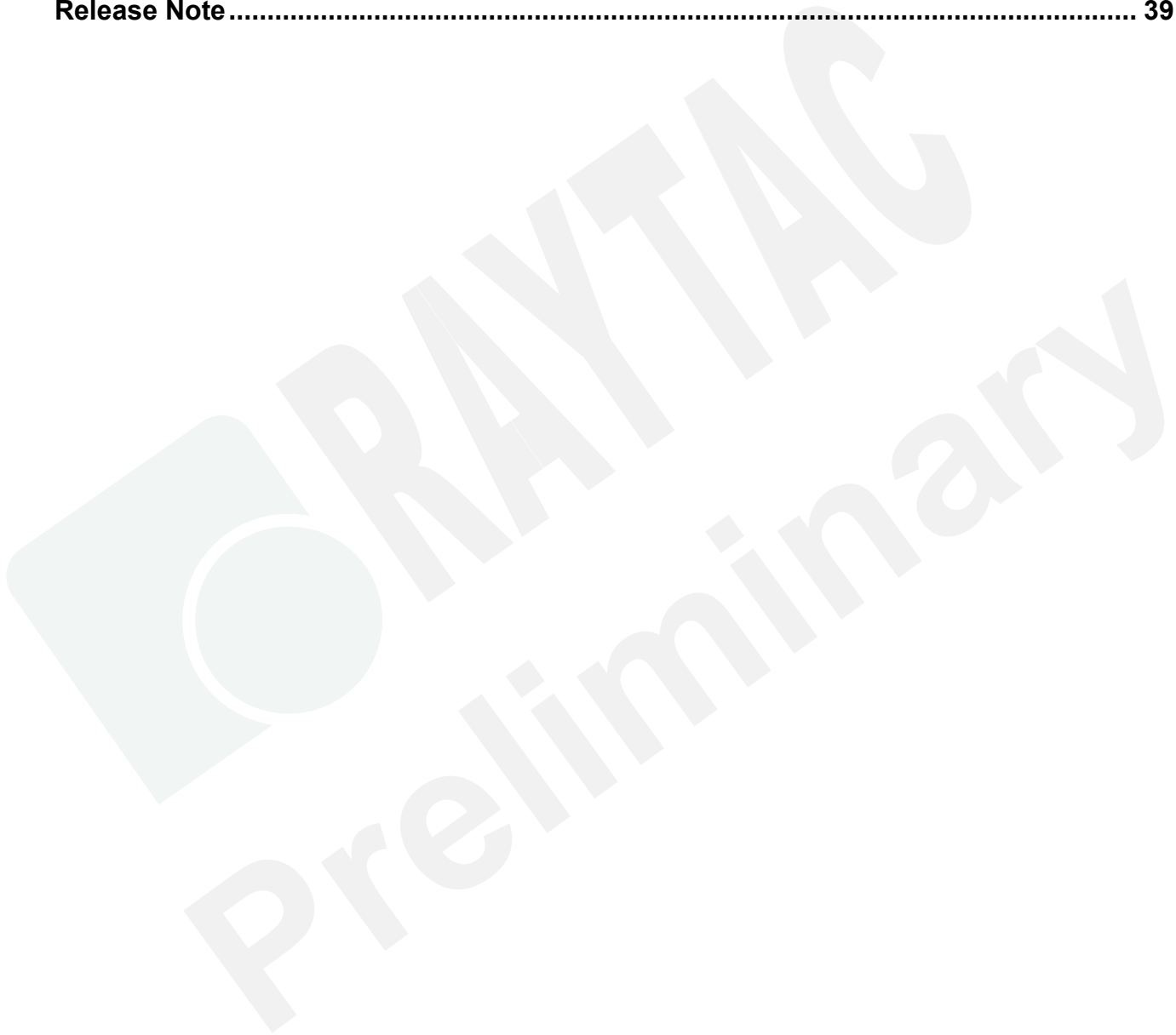
Working distance of MDBT50Q-CX-40

- **1Mbps:** up to 250 meters in open space.
- **2Mbps:** up to 120 meters in open space.

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1. Overall Introduction

Raytac's MDBT50Q-CX-40 is a BT 5.4 stack (Bluetooth low energy or BLE) USB-C dongle designed based on **Nordic nRF52840 SoC solution**, which incorporates: **GPIO**, **PWM** and **USB** interfaces for connecting peripherals and sensors.

Features:

1. Embedded 2.4GHz transceiver supports Bluetooth 5 ( **Bluetooth**®), IEEE 802.15.4 ( **THREAD** & Zigbee) & 2.4Ghz RF & ANT⁺ upon customer's preference.
2. Compact size with **(L) 26.2 x (W) 15.1 x (H) 6.8 mm**.(excluding Type C USB Connector)
3. Low power requirements, ultra-low peak, average and idle mode power consumption.
4. Be compatible with a large installed base of mobile phones, tablets and computers.
5. Fully coverage of BLE software stack.
6. BLE & RF transmission switching helps products fit all operation systems and most hardware.
7. This is a plug-in USB-C dongle without front side or back side ; Try to get better wireless distance by putting the QR Code side UP.

1.1. Applications

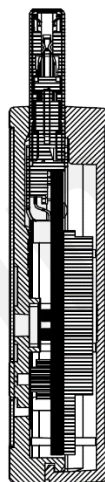
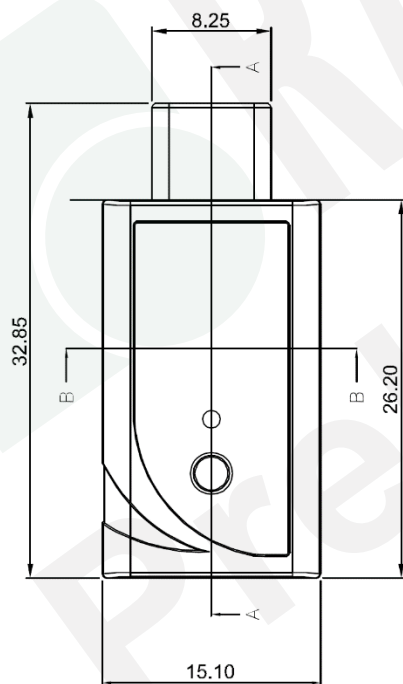
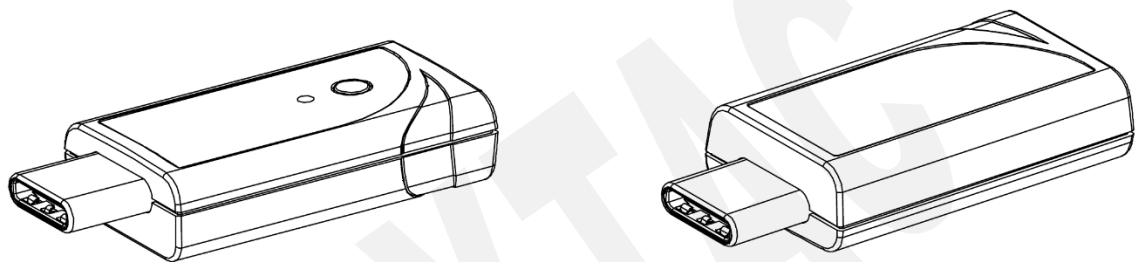
- IoT Networks
 - Smart home (such as door locks, lighting) sensors and controllers
 - Smart city sensor networks
 - Industrial IoT sensors and controllers
 - Connected white goods
- Personal Area Networks
 - Health / fitness sensor and monitor device
 - Medical device
- Advanced wearables
 - Gateway for smart watches or connected health
 - Advanced personal fitness devices
 - Virtual/Augmented Reality applications
- High performance HID Controllers
- Mesh Network

1.2. Features

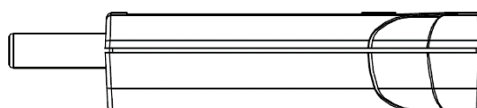
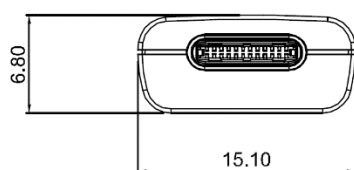
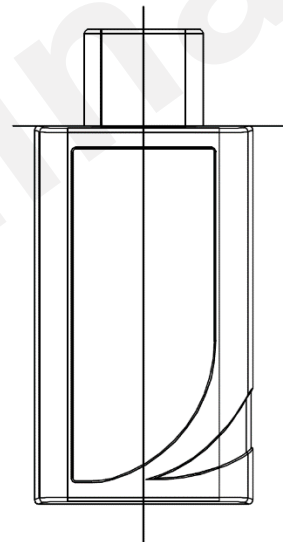
- Bluetooth 5, IEEE 802.15.4, 2.4 GHz transceiver
 - -95dBm sensitivity in 1Mbps Bluetooth low energy (BLE) mode
 - -103dBm sensitivity in 125Kbps BLE mode (long range)
 - +8 dBm TX power (down to -20 dBm in 4 dB steps)
 - On-air compatible with nRF52, nRF51, nRF24L and nRF24AP Series
 - Programmable output power from +8dBm to -20dB
 - RSSI (1dB resolution)
 - Supported data rates:
 - Bluetooth 5: 2 Mbps, 1 Mbps, 500 kbps, 125 kbps
 - IEEE 802.15.4-2006: 250 kbps
 - Proprietary 2.4 GHz: 2 Mbps, 1 Mbps
- ARM Cortex –M4 32-bit processor with FPU, 64 MHz
- Memory: 1MB flash / 256KB RAM
- HW accelerated security
 - ARM TrustZone Cryptocell 310 security subsystem
 - 128 bit AES / ECB / CCM / AAR co-processor (on-the-fly packet encryption)
- Interfaces on device
 - USB 2.0 full speed (12Mbps) controller
 - Programmable peripheral interconnect (PPI)
 - 1 x Switch and max. 2 x LED
 - EasyDMA automated data transfer between memory and peripherals.
- 4 x 4 channel pulse width modulator (PWM) units with EasyDMA
- 5 X 32-bit timers with counter mode
- 3 x 24-bit real-time counters (RTC)
- Flexible power management
 - On-chip DC/DC and LDO regulators with automated low current modes
 - Automated peripheral power management
 - Fast wake-up using 64MHz internal oscillator
 - 0.4uA at 3V in System OFF mode, no RAM retention
 - 1.5uA at 3V in System ON mode, no RAM retention, wake on RTC
- Nordic SoftDevice ready and with support for concurrent multi-protocol

2. Product Dimension

DONGLE SIZE: (L) 32.85 x (W) 15.10 x (H) 6.8 mm



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3. Main Chip Solution

RF IC	Module	Crystal Frequency
Nordic nRF52840	MDBT50Q-P (PCB/Printed Antenna)	32MHz

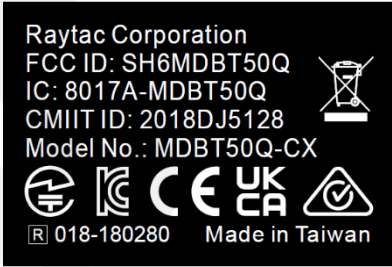
4. Shipment Packaging Information

Production Code	Logo on the casing
MD-240A7-001	Raytac Logo
	
MD-240A7-002	No Logo
	

- Unit Weight (with casing): 2.99 g ($\pm$ 0.2 g)
- Packaging Type: Anti-static Tray only
- Minimum Package Quantity (MPQ): 40 pcs per Tray
- Carton Contents: 600 pcs per carton (15 Full Trays + 1 Empty Tray Cover)
- Dimension of Carton: (L) 31 x (W) 25 x (H) 22 cm
- Gross Weight: approx. 3.094 kgs per full carton (contains 600 pcs)

4.1. Label

Labels presented on the front and backside of USB-C dongle. Surface protective Film applied, can be peeled off when use.

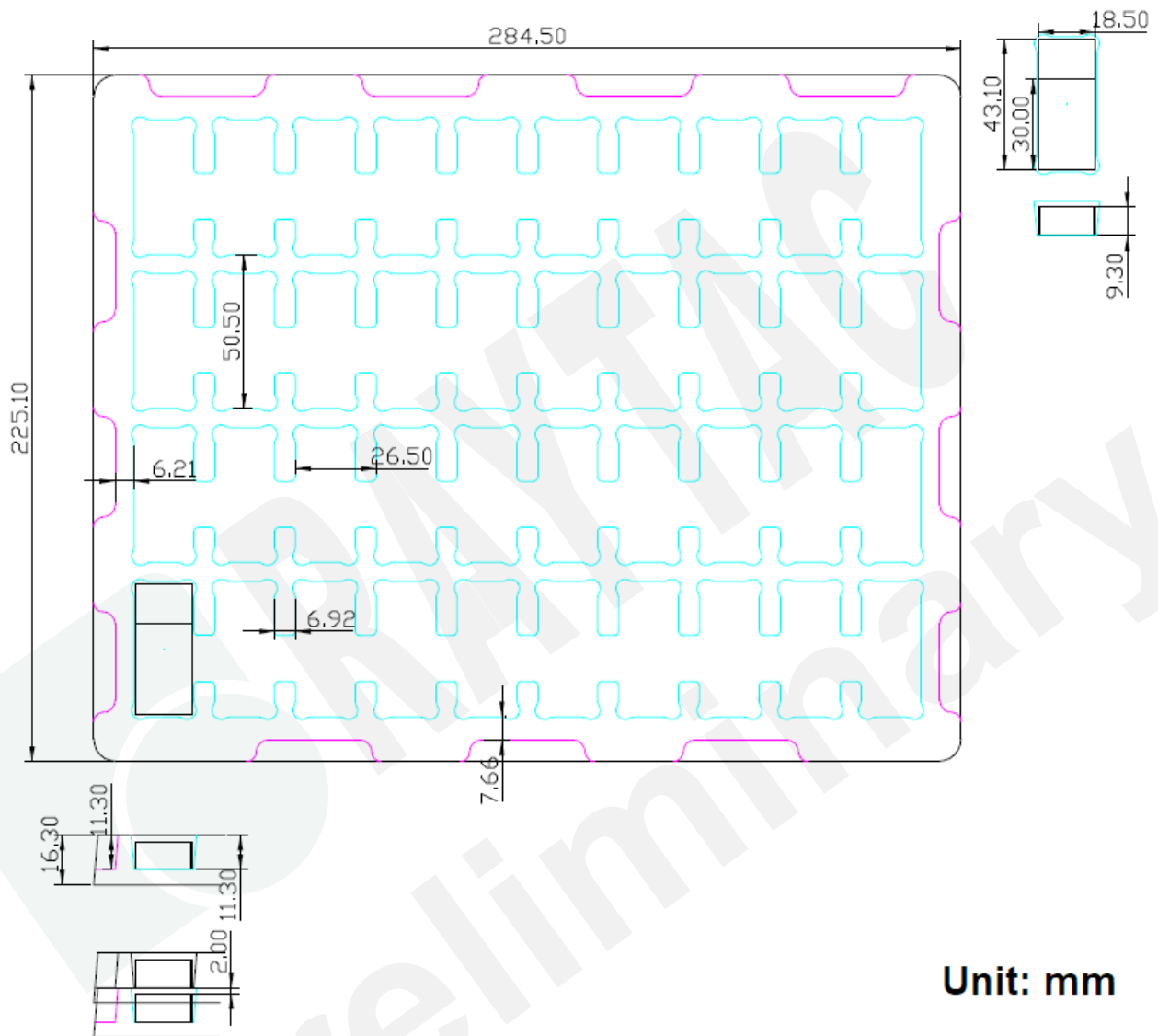
Label (Front)	QR Code (Back)	Certification Info (QR Code access)
 Surface protective Film applied, can be peeled off when use.		

Note: The test reports & certificate can be referred in [Chapter 10](#)

4.2. Tray Specifications

The USB-C Dongle will be packed in a tray (4x10=40pcs) for volume order.

Tray Specification is presented as follows:



5. Specification

5.1. Recommended operating conditions

Symbol	Parameter	Min.	Nom.	Max.	Units
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
TA	Operating emperature	-40	25	85	°C
T _J	Junction emperature			90	°C
t _{R_VDDH}	Supply rise time (0 V o 3.7 V)			100	ms

Important: The on-chip power-on reset circuitry may not function properly for rise times longer than the specified maximum.

Contents below are extracted from “[nRF52840 Product Specification v1.8](#)”,

Please refer to Nordic’s official release as the latest update.

5.2. Absolute Maximum Ratings

	Note	Min.	Max.	Unit
Supply voltages				
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
NFC antenna pin current				
I _{NFC1/2}			80	mA
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
Flash memory				
Endurance		10 000		write/erase cycles
Retention at 85 °C		10		years

5.3. Electrical Specifications

5.3.1. General Radio Characteristics

Symbol	Description	Min.	Typ.	Max.	Units
f_{OP}	Operating frequencies	2360		2500	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
$f_{DELTA,2M}$	Frequency deviation @ 2 Mbps		± 320		kHz
$f_{DELTA,BLE,2M}$	Frequency deviation @ BLE 2 Mbps		± 500		kHz
f_{skBPS}	On the air data rate	125		2000	kbps
$f_{chip, IEEE 802.15.4}$	Chip rate in IEEE 802.15.4 mode		2000		kchips

5.3.2. 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

Symbol	Description	Min.	Typ.	Max.	Units
$I_{TX,MINUS40dBm,DCDC}$	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

5.3.3. 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
$I_{RX,2M,DCDC}$	RX only run current (DC/DC, 3 V) 2 Mbps / 2 Mbps BLE	..	5.2	..	mA
$I_{RX,2M}$	RX only run current (LDO, 3 V) 2 Mbps / 2 Mbps BLE	..	11.1	..	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

5.3.4. Transmitter Specification

Symbol	Description	Min.	Typ.	Max.	Units
P_{RF}	Maximum output power	..	8.0	..	dBm
P_{RFC}	RF power control range		28.0		dB
P_{RFCR}	RF power accuracy			± 4	dB
$P_{RF1,1}$	1st Adjacent Channel Transmit Power 1 MHz (1 Mbps)	..	-24.8	..	dBc
$P_{RF2,1}$	2nd Adjacent Channel Transmit Power 2 MHz (1 Mbps)	..	-54.0	..	dBc
$P_{RF1,2}$	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
E_{vm}	Error vector magnitude IEEE 802.15.4	..	8	..	%rms
$P_{harm2nd, IEEE 802.15.4}$	2nd harmonics in IEEE 802.15.4 mode	..	-51.0	..	dBm
$P_{harm3rd, IEEE 802.15.4}$	3rd harmonics in IEEE 802.15.4		-48.0	..	dBm

5.3.5. 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

5.3.6. 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,2M}	Sensitivity, 2 Mbps nRF mode ideal transmitter ²		-89		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
P _{SENS,IT,SP,2M,BLE}	Sensitivity, 2 Mbps BLE ideal transmitter, packet length ≤ 37 bytes		-92		dBm
P _{SENS,IT,BLE LE125k}	Sensitivity, 125 kbps BLE mode		-103		dBm
P _{SENS,IT,BLE LE500k}	Sensitivity, 500 kbps BLE mode		-99		dBm
P _{SENS,IEEE 802.15.4}	Sensitivity in IEEE 802.15.4 mode		-100		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. Same as above.
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

5.3.7. RX Selectivity

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,±6MHz}	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
C/I _{2M,co-channel}	2 Mbps mode, Co-Channel interference		10		dB

Symbol	Description	Min.	Typ.	Max.	Units
C/I _{2M,-2MHz}	2 Mbps mode, Adjacent (-2 MHz) interference		6		dB
C/I _{2M,+2MHz}	2 Mbps mode, Adjacent (+2 MHz) interference		-19		dB
C/I _{2M,-4MHz}	2 Mbps mode, Adjacent (-4 MHz) interference		-20		dB
C/I _{2M,+4MHz}	2 Mbps mode, Adjacent (+4 MHz) interference		-44		dB
C/I _{2M,-6MHz}	2 Mbps mode, Adjacent (-6 MHz) interference		-42		dB
C/I _{2M,+6MHz}	2 Mbps mode, Adjacent (+6 MHz) interference		-42		dB
C/I _{2M,≥12MHz}	2 Mbps mode, Adjacent (≥12 MHz) interference		-52		dB
C/I _{2MBLE,co-channel}	2 Mbps BLE mode, Co-Channel interference		6.8		dB
C/I _{2MBLE,±2MHz}	2 Mbps BLE mode, Adjacent (±2 MHz) interference		-10		dB
C/I _{2MBLE,±4MHz}	2 Mbps BLE mode, Adjacent (±4 MHz) interference		-45		dB
C/I _{2MBLE,≥6MHz}	2 Mbps BLE mode, Adjacent (≥6 MHz) interference		-48		dB
C/I _{2MBLE,image}	Image frequency interference		-24		dB
C/I _{2MBLE,image, 2MHz}	Adjacent (2 MHz) interference to in-band image frequency		-35		dB
C/I _{125k BLE LR, co-channel}	125 kbps BLE LR mode, Co-Channel interference		4.4		dB
C/I _{125k BLE LR,-1MHz}	125 kbps BLE LR mode, Adjacent (-1 MHz) interference		-4.0		dB
C/I _{125k BLE LR,+1MHz}	125 kbps BLE LR mode, Adjacent (+1 MHz) interference		-12		dB
C/I _{125k BLE LR,-2MHz}	125 kbps BLE LR mode, Adjacent (-2 MHz) interference		-28		dB
C/I _{125k BLE LR,+2MHz}	125 kbps BLE LR mode, Adjacent (+2 MHz) interference		-50		dB
C/I _{125k BLE LR,>3MHz}	125 kbps BLE LR mode, Adjacent (≥3 MHz) interference		-55		dB
C/I _{125k BLE LR,image}	Image frequency interference		-29		dB

Remark: Wanted signal level at PIN = -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.

5.3.8. RX Intermodulation

Symbol	Description	Min.	Typ.	Max.	Units
P _{IMD,5TH,1M}	IMD performance, 1 Msps, 5th offset channel, Packet length ≤ 37 bytes		-33		dBm
P _{IMD,5TH,1M,BLE}	IMD performance, BLE 1 Msps, 5th offset channel, Packet length ≤ 37 bytes		-30		dBm
P _{IMD,5TH,2M}	IMD performance, 2 Msps, 5th offset channel, Packet length ≤ 37 bytes		-33		dBm
P _{IMD,5TH,2M,BLE}	IMD performance, BLE 2 Msps, 5th offset channel, Packet length ≤ 37 bytes		-31		dBm

Remark: Wanted signal level at PIN = -64dBm. 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 the interferers where the sensitivity equals BER = 0.1% is presented.

5.3.9. Radio Timing Parameters

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 μ s TIFS)	140		140	μ s
$t_{TXEN,FAST,BLE,1M}$	Time between TXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE with fast ramp-up and 150 μ s TIFS)	40		40	μ s
$t_{TXDIS,BLE,1M}$	When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit	6		6	μ s
$t_{RXEN,BLE,1M}$	Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE)	140		140	μ s
$t_{RXEN,FAST,BLE,1M}$	Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE with fast ramp-up)	40		40	μ s
$t_{RXDIS,BLE,1M}$	When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit	0		0	μ s
$t_{TXDIS,BLE,2M}$	When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_2Mbit and MODE = Ble_2Mbit	4		4	μ s
$t_{RXDIS,BLE,2M}$	When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_2Mbit and MODE = Ble_2Mbit	0		0	μ s
$t_{TXEN,IEEE\ 802.15.4}$	Time between TXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4)	130		130	μ s
$t_{TXEN,FAST,IEEE\ 802.15.4}$	Time between TXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4 with fast ramp-up)	40		40	μ s
$t_{TXDIS,IEEE\ 802.15.4}$	When in TX, delay between DISABLE task and DISABLED event (IEEE 802.15.4)	21		21	μ s
$t_{RXEN,IEEE\ 802.15.4}$	Time between the RXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4)	130		130	μ s
$t_{RXEN,FAST,IEEE\ 802.15.4}$	Time between the RXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4 with fast ramp-up)	40		40	μ s
$t_{RXDIS,IEEE\ 802.15.4}$	When in RX, delay between DISABLE task and DISABLED event (IEEE 802.15.4)	0.5		0.5	μ s
$t_{RX-to-TX\ turnaround}$	Maximum TX-to-RX or RX-to-TX turnaround time in IEEE 802.15.4 mode		40		μ s

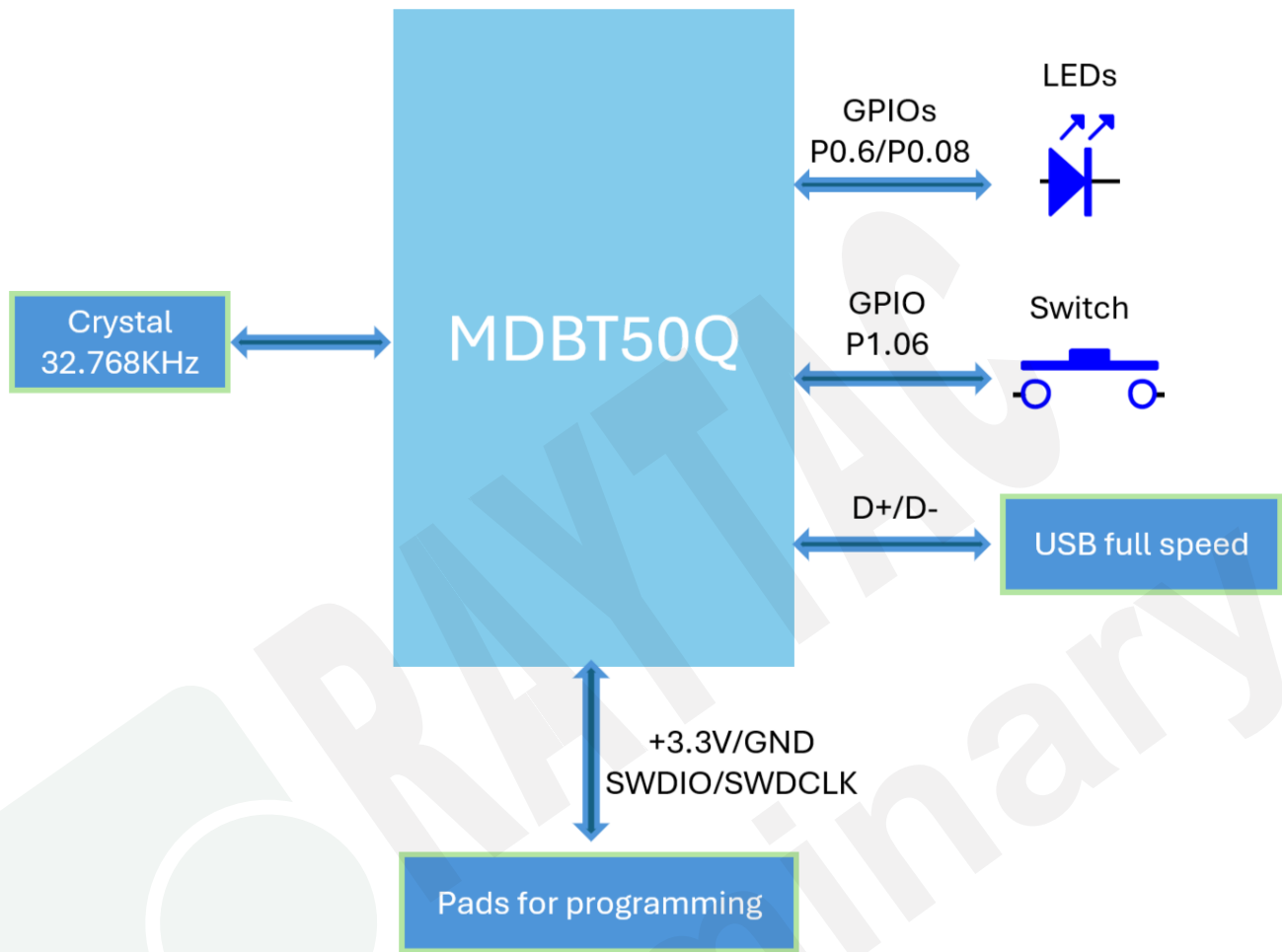
5.3.10. CPU Performance

Symbol	Description	Min.	Typ.	Max.	Units
W_{FLASH}	CPU wait states, running CoreMark from flash, cache disabled			2	
$W_{FLASHCACHE}$	CPU wait states, running CoreMark from flash, cache enabled			3	
W_{RAM}	CPU wait states, running CoreMark from RAM			0	
CM_{FLASH}	CoreMark, running CoreMark from flash, cache enabled		212		Core!
$CM_{FLASH/MHz}$	CoreMark per MHz, running CoreMark from flash, cache enabled		3.3		CoreMark/ MHz
$CM_{FLASH/mA}$	CoreMark per mA, running CoreMark from flash, cache enabled, DCDC 3V		64		Core! mA

5.3.11. Power Management

Symbol	Description	Min.	Typ.	Max.	Units
$I_{ON_RAMOFF_EVENT}$	System ON, no RAM retention, wake on any event		0.97		μA
$I_{ON_RAMON_EVENT}$	System ON, full 256 kB RAM retention, wake on any event		2.35		μA
$I_{ON_RAMON_POF}$	System ON, full 256 kB RAM retention, wake on any event, power-fail comparator enabled		2.35		μA
$I_{ON_RAMON_GPIOTE}$	System ON, full 256 kB RAM retention, wake on GPIOTE input (event mode)		17.37		μA
$I_{ON_RAMON_GPIOTEPORT}$	System ON, full 256 kB RAM retention, wake on GPIOTE PORT event		2.36		μA
$I_{ON_RAMOFF_RTC}$	System ON, no RAM retention, wake on RTC (running from LFRC clock)		1.5		μA
$I_{ON_RAMON_RTC}$	System ON, full 256 kB RAM retention, wake on RTC (running from LFRC clock)		3.16		μA
$I_{OFF_RAMOFF_RESET}$	System OFF, no RAM retention, wake on reset		0.40		μA
$I_{OFF_RAMOFF_LPCOMP}$	System OFF, no RAM retention, wake on LPCOMP		0.86		μA
$I_{OFF_RAMON_RESET}$	System OFF, full 256 kB RAM retention, wake on reset		1.86		μA
$I_{ON_RAMOFF_EVENT_5V}$	System ON, no RAM retention, wake on any event, 5 V supply on VDDH, REG0 output = 3.3 V		1.29		μA
$I_{OFF_RAMOFF_RESET_5V}$	System OFF, no RAM retention, wake on reset, 5 V supply on VDDH, REG0 output = 3.3 V		0.95		μA

6. Block Diagram



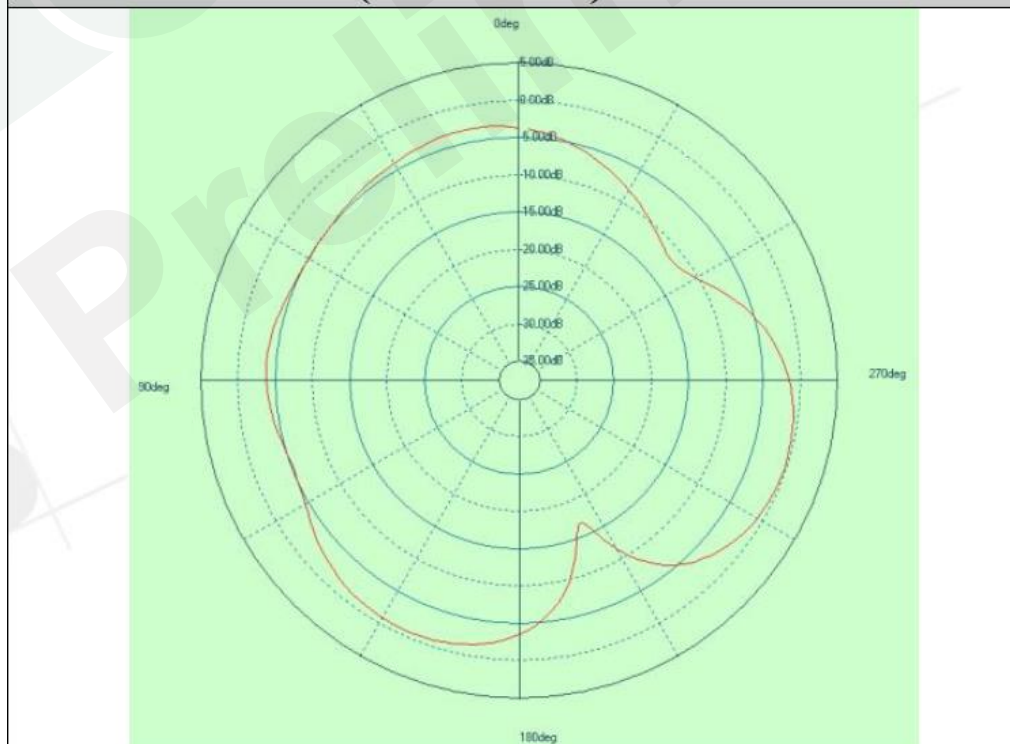
7. Antenna

7.1. MDBT50Q-P

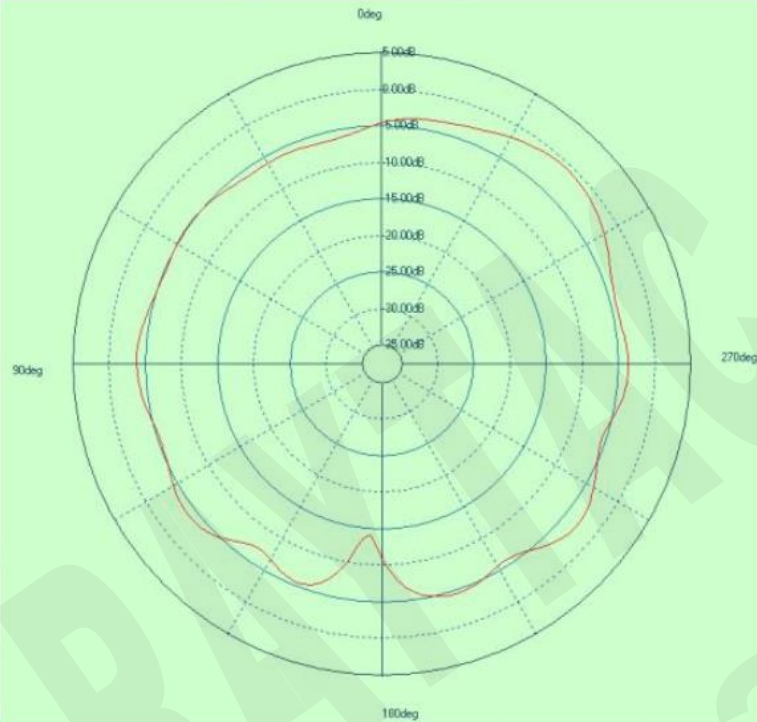
Antenna Gain and Efficiency

MDBT50Q (PCB antenna)			
Freq(MHz)	Peak. dBi	Efficiency	Average . dBi
2400.00	-0.72	29.40%	-5.32
2410.00	-0.62	31.02%	-5.08
2420.00	-0.44	32.89%	-4.83
2430.00	-0.44	35.00%	-4.56
2440.00	0.08	36.98%	-4.32
2450.00	0.05	37.76%	-4.23
2460.00	0.24	37.40%	-4.27
2470.00	0.26	37.43%	-4.27
2480.00	0.41	36.96%	-4.32
2490.00	0.37	35.03%	-4.56
2500.00	-0.15	31.71%	-4.99

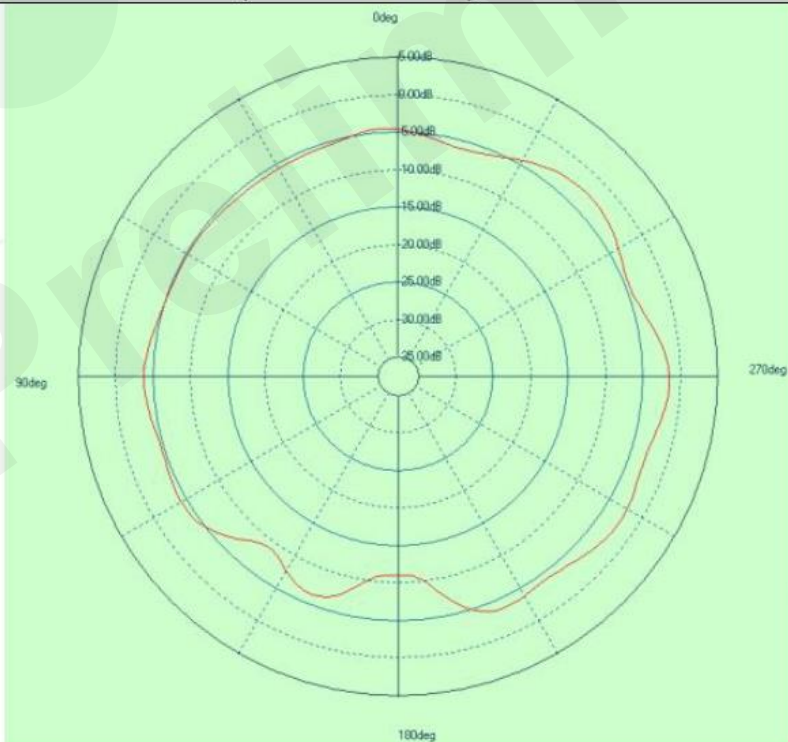
Free Space EIRP (2450 MHz) – XY cut



Free Space EIRP (2450 MHz) – XZ cut



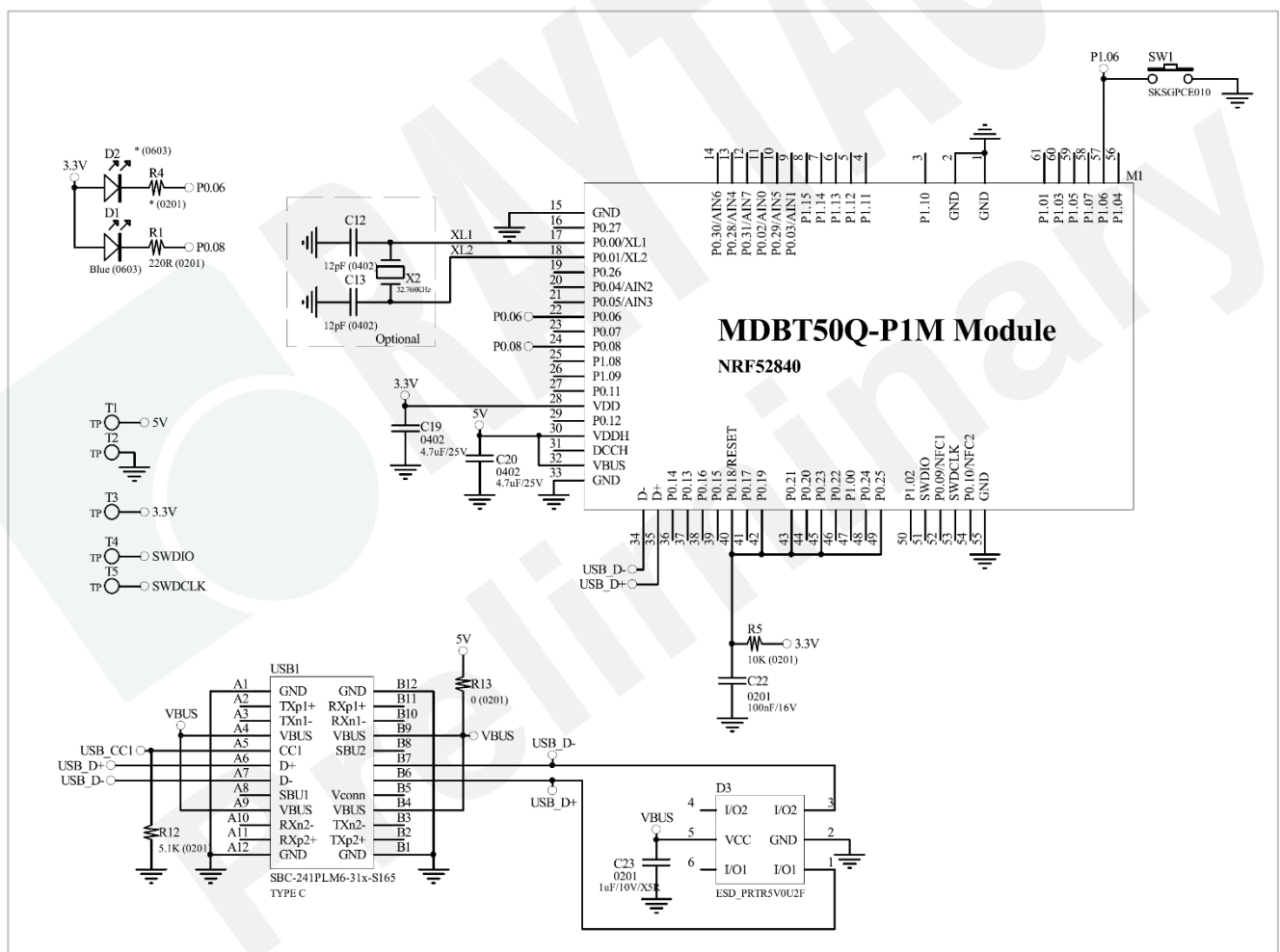
Free Space EIRP (2450 MHz) – YZ cut

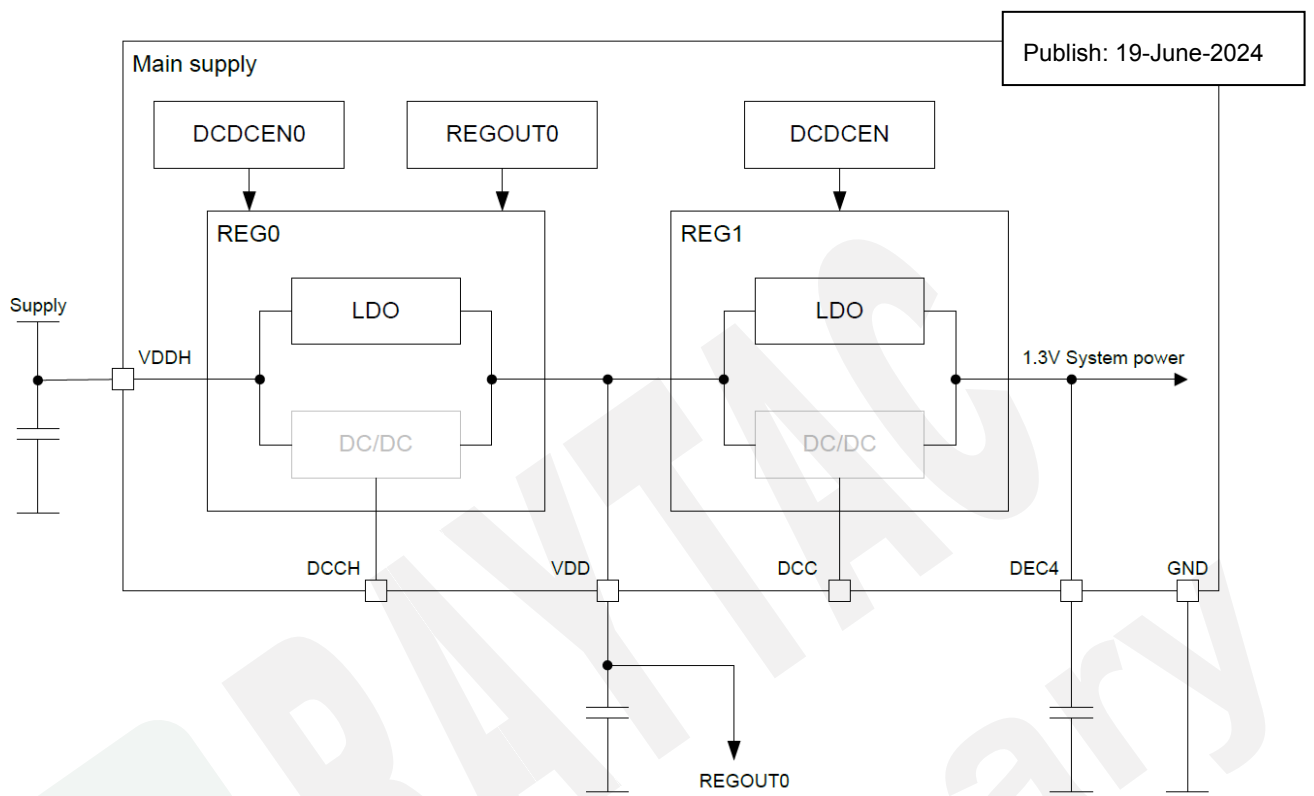


8. Reference Circuit

System is working on high voltage mode, LDO only. VDD default supplies 3.0V.

- External 32.768kHz is equipped on the USB-C dongle board.
- Raytac Standard USB-C dongle has one LED (D1) mounted.
2 LEDs (D1+D2) is feasible for production (With prior discussion)
Please come to Raytac service center (sales team) for more details if you need 2 LEDs.





9. Programming Pin

Here's the drawing indicates the programming pin (SWDIO, SWCLK) for jump wire programming or for debug mode.

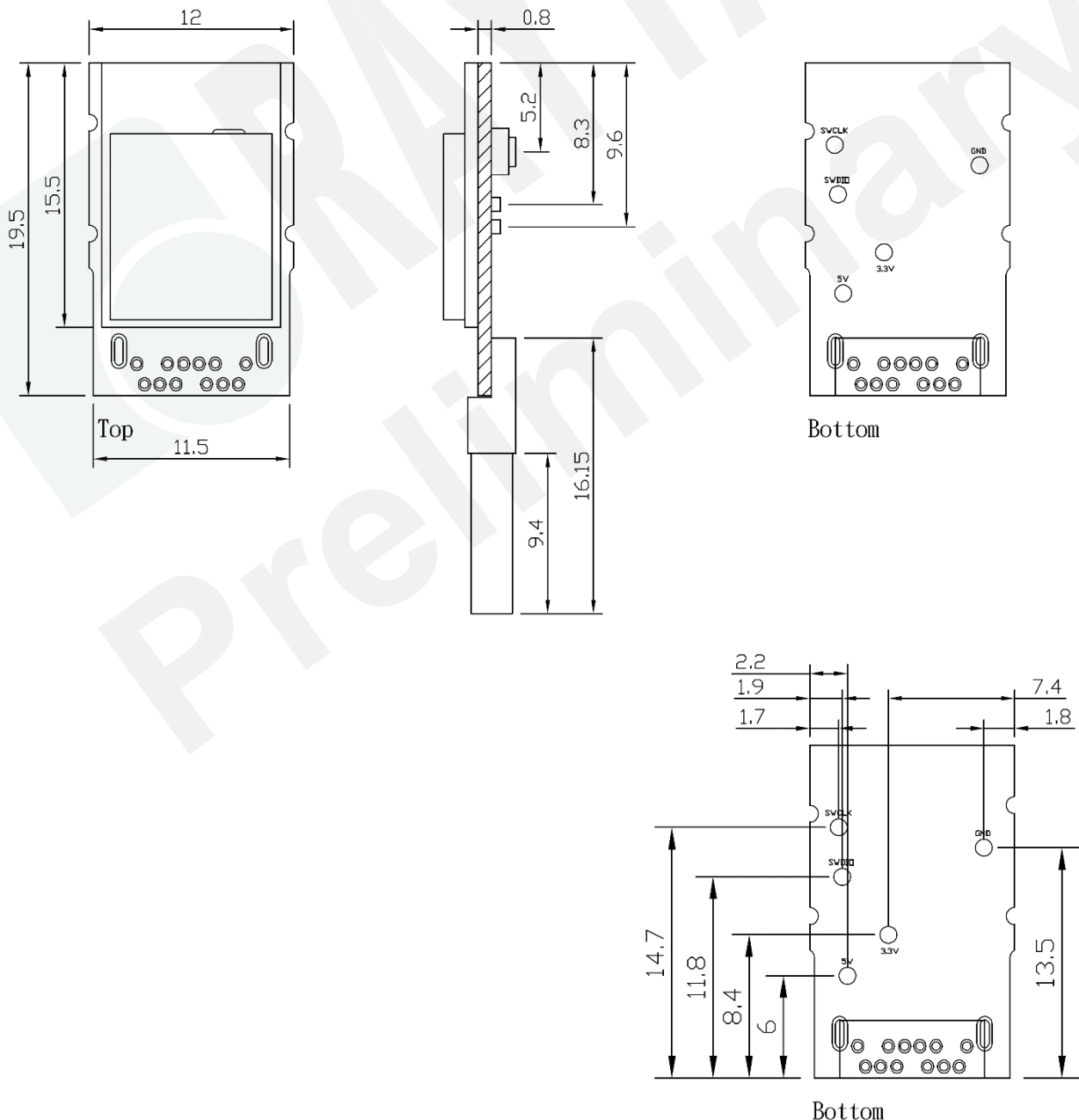
This USB-C Dongle is pre-programmed with Raytac production test code as well as built in bootloader.

You can execute USB DFU(Device Firmware Update) to flash your own firmware to USB-C dongle without hardware wiring.

User Guidance can be found and referred at :

[User Manual of MDBT50Q-CX \(nRF52840 USB-C Dongle\)](#)

Here is [Gerber file](#) to make programming jig for mass programming.



10. Certification

10.1. Declaration ID for Bluetooth

BT 5.4

Declaration ID	QDID(s)	Company	Specification Name
D066910	232392 - End Product > 228005 - Component (Tested)	Raytac Corporation	5.4

BT 5.2

Declaration ID	QDID(s)	Company	Specification Name
D053149	159932 - End Product	Raytac Corporation	5.2

BT 5.1

Declaration ID	QDID(s)	Company	Specification Name
D047708	139361 - End Product	Raytac Corporation	5.1

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
Time Profile	Time Profile Service
Glucose Profile (Central)	
Mesh Profile	Mesh Provisioning Service
	Mesh Proxy Service

10.2. FCC Certificate (USA)



TCB

**GRANT OF EQUIPMENT
AUTHORIZATION**
Certification
Issued Under the Authority of the
Federal Communications Commission
By:

TCB

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

Attention: Venson Liao , R&D Manager

Telefication B.V.
Edisonstraat 12a
Zevenaar, NL-6902 PK
Netherlands

Date of Grant: 07/26/2018

Application
Dated: 07/25/2018

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:

Name of Grantee:

Equipment Class:

Notes:

Modular Type:

SH6MDBT50Q

Raytac Corp.

Digital Transmission System

Bluetooth Low Energy & IEEE 802.15.4 Combo Module

Single Modular

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Emission Tolerance Designator
	15C	2402.0 - 2480.0	0.0066	
	15C	2405.0 - 2480.0	0.0066	

Modular Approval. This is a portable device. Power Output is conducted. This grant is valid only when the module is sold to OEM integrators and must be installed by the OEM or OEM integrators. End-users may not be provided with the module installation instructions. OEM integrators and end-users must be provided with transmitter operating conditions for satisfying RF exposure compliance.

Certificate No.:
182180940/AA/00

Ramy Nabod
Product Assessor



10.3. TELEC Certificate (Japan)

	<i>Certificate Technical Support Center Co., Ltd.</i> <i>RAB ID No. 018</i>
Construction Type Certification	
Registration No.	CSRT180280
Certificate Holder	Raytac Corporation 5F, No.3, Jiankang Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Product Category	Article 2, Paragraph 1, Item 19
Model Type or Name	MDBT50Q, MDBT50Q-1M, MDBT50Q-P1M, MDBT50Q-U1M
Type of Emission, Frequency and Antenna Power	F1D 2402MHz - 2480MHz (2MHz separation, 40 channels) 5.9704mW, 5.0816mW
Manufacturer	Raytac Corporation 5F, No.3, Jiankang Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Factory	Tech-Lin's Electronics Corp. 5F/11F, No. 778, Zhongzheng Rd., Zhonghe Dist., New Taipei City 23586, Taiwan R.O.C
Remarks	The scope of evaluation relates to the submitted documents and product only. It is only valid in conjunction with the Annex.
When the product is placed on the Japanese market, the Specified Radio Equipment marking as shown on the right must be attached on visible part of the product.	 R 018-180280
Witnesses that the certification is on Construction Type Certification under Article 38-24 of the Radio Law.	
Date of Certificate 2018/7/30	 Certification Examiner : Takuji Nakano  Certificate Technical Support Center Co., Ltd.
	
Address: Shinyokohama First Bldg B1, 1-2-1 Shinyokohama, Kohoku-ku, Yokohama-City, 222-0033 Japan Tel.: +81 45 478 3365 • Fax: +81 45 478 3382 • E-mail: cert@cns-web.co.jp	

10.4. NCC Certificate (Taiwan)

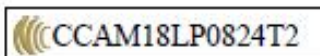
MDBT50Q-P



台灣檢驗科技股份有限公司 電信管制射頻器材型式認證證明

- 一、申請者：勁達國際電子有限公司
二、地址：臺北市大安區和平東路1段145號5樓之1
三、製造廠商：勁達國際電子有限公司
四、器材名稱：低功耗藍牙及 IEEE 802.15.4 整合模組
五、廠牌：Raytac
六、型號：MDBT50Q-P
七、發射功率(電場強度)：詳細射頻規格如備註欄
八、工作頻率：詳細射頻規格如備註欄
九、審驗日期：108年10月24日

- 十、審驗合格標籤式樣：



- 十一、警語或標示要求：(器材本體、使用手冊、外包裝盒等應遵守下列標示要求)

- 應依審驗合格標籤或符合性聲明標籤式樣自製標籤黏貼或印鑄於電信管制射頻器材本體明顯處，並於包裝盒標示本會標章，始得開陳列或販賣。
- 電信管制射頻器材應依本會或相關技術規範規定於指定位置標示中文警語。
- 經授權使用射頻模組(組件)之審驗合格標籤者，應於最終產品說明書及包裝盒提供充分與正確之資訊。
- 於網際網路販賣取得審驗證明之電信管制射頻器材者，應於該網際網路網頁提供審驗合格標籤或符合性聲明標籤資訊。
- 使用手冊應標示下列資訊：
(1)經型式認證合格之低功率射頻電機，非經許可，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。低功率射頻電機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。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機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。
- 本器材之審驗範圍僅限無線射頻硬體功能，不及於器材之資通安全檢測。

10.5. IC Certificate (Canada)

telefication bv The Netherlands Chamber of Commerce 51565536 www.telefication.com		 telefication	
TECHNICAL ACCEPTANCE CERTIFICATE		CERTIFICAT D'ACCEPTABILITÉ TECHNIQUE	
CERTIFICATION No. No. DE CERTIFICATION	8017A-MDBT50Q		
TELEFICATION No. No. DE TELEFICATION	182170262/AA/00		
TEST SITE No. No. DE LABORATOIRE	4620A-5		
ISSUED TO DÉLIVRÉ À	Raytac Corporation		
TYPE OF EQUIPMENT GENRE DE MATÉRIEL	Bluetooth device Spread Spectrum/Digital Device (2400-2483.5 MHz)		
TRADE NAME AND MODEL MARQUE ET MODÈLE	Raytac / MDBT50Q Raytac / MDBT50Q-1M Raytac / MDBT50Q-P1M		
CERTIFIED TO CERTIFIÉ SELON LE	SPECIFICATION CAHIER DES CHARGES	RSS-102 RSS-247	ISSUE ÉDITION 5 2
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 ISDE 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 ISDE. 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 ISDE.		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'ISDE 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'ISDE. 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 ISDE.	
ISSUED BY TELEFICATION BV (NL0001), RECOGNIZED CERTIFICATION BODY BY INNOVATION, SCIENCE AND ECONOMIC DEVELOPMENT CANADA DÉLIVRÉ PAR TELEFICATION BV (NL0001), ORGANISME DE CERTIFICATION RECONNU PAR INNOVATION, SCIENCES ET DÉVELOPPEMENT ÉCONOMIQUE CANADA			
<i>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</i>			
DATE 30 Jul 2018 BY	Ramy Nabod Product Assessor	 	
This certificate has one annex.			

10.6. 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: 2021DJ1849 to the provisions with its CMIIT ID:	
有效期： Validity	五年  (发证机关) Sealed by issuing authority 2021 年 03 月 01 日 Year Month Date

10.7. KC Certificate (South Korea)

2CC6-E6D4-B6AA-9E64

방송통신기자재등의 적합인증서 <i>Certificate of Broadcasting and Communication Equipments</i>	
상호 또는 성명 <i>Trade Name or Applicant</i>	Raytac Corporation
기자재명칭(명칭) <i>Equipment Name</i>	특정소출력 무선기기(무선데이터통신시스템용 무선기기)
기본모델명 <i>Basic Model Number</i>	MDBT50Q-U
파생모델명 <i>Series Model Number</i>	MDBT50Q, MDBT50Q-P
인증번호 <i>Certification No.</i>	R-C-ryt-MDBT50Q
제조사/제조국가 <i>Manufacturer/ Country of Origin</i>	Raytac Corporation / 대만
인증연월일 <i>Date of Certification</i>	2018-08-17
기타 <i>Others</i>	
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. 2018년(Year) 08월(Month) 17일(Day) 국립전파연구원장  <i>Director General of National Radio Research Agency</i> ※ 인증 받은 방송통신기자재는 반드시 "적합성평가표시" 를 부착하여 유통하여야 합니다. 위반시 과태료 처분 및 인증이 취소될 수 있습니다.	

11. Notes and Cautions

Dongle is not designed to last for a lifetime. Like most electronic products, it is expected to be worn out after continuous usage over several years. To assure that the product will perform better and last longer, please make sure you:

- Follow the guidelines of this document while working with the product. Any discrepancy of core Bluetooth technology and technical specification of IC should refer to the definition of Bluetooth Organization and Nordic Semiconductor as final reference.
- Do not supply voltage that is not within range of specification.
- Eliminate static electricity at any cost when working with the dongle without casing as it may cause damage to the PCBA. It is highly recommended using anti-ESD measurements when working with the dongle without casing or during assembly to prevent damage from real-life ESD events.
- Do not expose modules under direct sunlight for longer periods of time. Dongles should be kept away from humid and salty air conditions, and any corrosive gasses or substances. Store it within -40°C to $+75^{\circ}\text{C}$ before and after installation.
- Avoid any physical shock or intense stress to the dongle or its surface.
- Do not wash the dongle. No-Clean Paste is used in production. Washing it will oxidize the metal shield on the module and have chemistry reaction with No-Clean Paste. Functions of the dongle are not guaranteed if it has been washed.

The dongle is not suitable for life support devices or systems and is not allowed to be used in destructive devices or systems in any direct or indirect ways. The customer agrees to indemnify Raytac for any losses when using dongle(s) in applications such as the ones described above.

- The USB-C dongle may not function properly with those type-C hubs/device which is lack of type-C certification.

12. Basic Facts for nRF52 Chip

Below chart shows basic spec for Nordic nRF52 family, which is helpful to understand the differences between each SoC. Any discrepancy shall refer to Nordic's technical document as final reference.

See [錯誤! 找不到參照來源。](#) for complete model no. of each item.

Nordic Solution	nRF52840	nRF52833	nRF52820	nRF52832	nRF52810	nRF52811	nRF52805
RAYTAC Model No. (MDBTXX)	50Q series	50Q series 50 series	50 series	42Q series 42 series 42V series	42Q series	42Q Series	42T series 42TV series
Bluetooth Direction Finding		V	V			V	
Bluetooth 5 Long Range (125kbps)	V	V	V			V	
Bluetooth 5 High Speed	V	V	V	V	V	V	V
Bluetooth 5 Ad. Extention (x8)	V	V	V	V	V	V	V
Flash (kBytes)	1024	512	256	512	192	192	192
RAM (kBytes)	256	128	32	64	24	24	24
ANT Plus	V	V	V	V	V	V	
IEEE 802.15.4	V	V	V			V	
ARM® TrustZone® Cryptocell	V						
USB	V	V	V				
QSPI	V						
NFC	V	V		V			
I2S	V	V		V			
SPI, TWI, UART, PWM	V	V	V	V	V	V	without PWM
PDM	V	V		V	V	V	
ADC, Comparators	V	V	without ADC	V	V	V	without comparators
Supply Range (V)	1.7 to 5.5	1.7 to 5.5	1.7 to 5.5	1.7 to 3.6	1.7 to 3.6	1.7 to 3.6	1.7 to 3.6

13. Useful Links

- **Nordic Infocenter:** <https://infocenter.nordicsemi.com/index.jsp>
All the necessary technical files and software development kits of Nordic's chip are on this website.
- **Nordic DevZone:** <https://devzone.nordicsemi.com/questions/>
A highly recommended website for firmware developers. Interact, discuss and consult with other fellow developers and Nordic's employees to get answers to your questions. The site also includes tutorials in detail to help you get started.
- **Official Page of nRF52840 :** <https://www.nordicsemi.com/eng/Products/nRF52840>
A brief introduction to nRF52840 and download links for Nordic's developing software and SoftDevices.

14. USB Driver for Windows

Please check "[Support](#)" page of our website to download.

Full List of Raytac's WiFi Modules

● AN7002Q Series (QFN Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna
AN7002Q	nRF7002	AN7002Q	1	Chip Antenna
		AN7002Q-P	1	PCB Antenna
		AN7002Q-U	1	u.FL Connector

Full List of Raytac's Bluetooth Modules

- **AN54L15 Series (QFN Package IC) ~ Coming soon**

- **AN54H20 Series ~ Coming soon**

- **AS1262 Series (QFN Package IC) ~ Coming soon**

- **MDBT53 Series (WLCSP Package IC)**

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT53	nRF5340	MDBT53-1M	1	Chip Antenna	512 kb	1 MB
MDBT53-P	nRF5340	MDBT53-P1M	1	PCB Antenna	512 kb	1 MB
MDBT53-U	nRF5340	MDBT53-U1M	1	u.FL Connector	512 kb	1 MB

- **MDBT53V Series (WLCSP Package IC)**

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT53V	nRF5340	MDBT53V-1M	1	Chip Antenna	512 kb	1 MB
MDBT53V-P	nRF5340	MDBT53V-P1M	1	PCB Antenna	512 kb	1 MB

● MDBT50 Series (QFN Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT50	nRF52820	MDBT50-256R	1	Chip Antenna	32 kb	256 kb
	nRF52833	MDBT50-512K	1		128 kb	512 kb
MDBT50-P	nRF52820	MDBT50-P256R	1	PCB Antenna	32 kb	256 kb
	nRF52833	MDBT50-P512K	1		128 kb	512 kb

● MDBT50Q Series (aQFN Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT50Q	nRF52840	MDBT50Q-1MEN	3	Chip Antenna	256 kb	1 MB
	nRF52840	MDBT50Q-1MV2	2		128 kb	512 kb
	nRF52833	MDBT50Q-512K	1		128 kb	512 kb
MDBT50Q-P	nRF52840	MDBT50Q-P1MEN	3	PCB Antenna	256 kb	1 MB
	nRF52840	MDBT50Q-P1MV2	2		128 kb	512 kb
	nRF52833	MDBT50Q-P512K	1		128 kb	512 kb
MDBT50Q-U	nRF52840	MDBT50Q-U1MEN	3	u.FL Connector	256 kb	1 MB
	nRF52840	MDBT50Q-U1MV2	2		128 kb	512 kb
	nRF52833	MDBT50Q-U512K	1		128 kb	512 kb
Dongle	nRF52840	MDBT50Q-RX	1, 2	PCB Antenna	256 kb	1 MB
		MDBT50Q-CX-40	1		128 kb	512 kb
	nRF52833	MDBT50Q-CX-33	1		128 kb	512 kb

● MDBT42T Series (WLCSP Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42T	nRF52805	MDBT42T-192K	1	Chip Antenna	24 kb	192 K
MDBT42T-P		MDBT42T-P192K		PCB Antenna		

● MDBT42TV Series (WLCSP Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42TV	nRF52805	MDBT42TV-192K	1	Chip Antenna	24 kb	192 K
MDBT42TV-P		MDBT42TV-P192K		PCB Antenna		

● MDBT42 Series (WLCSP Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42	nRF52832	MDBT42-512KV2	2	Chip Antenna	64 kb	512 K
MDBT42-P		MDBT42-P512KV2		PCB Antenna		

● MDBT42V Series (WLCSP Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42V	nRF52832	MDBT42V-512KV2	2	Chip Antenna	64 kb	512 K
MDBT42V-P		MDBT42V-P512KV2		PCB Antenna		

● MDBT42Q Series (QFN Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42Q	nRF52832	MDBT42Q-512KEN	3	Chip Antenna	64 kb	512 K
	nRF52832	MDBT42Q-512KV2	2			
	nRF52810	MDBT42Q-192KV2	2		24 kb	192 K
	nRF52811	MDBT42Q-192KL	1			
MDBT42Q-P	nRF52832	MDBT42Q-P512KEN	3	PCB Antenna	64 kb	512 K
	nRF52832	MDBT42Q-P512KV2	2			
	nRF52810	MDBT42Q-P192KV2	2		24 kb	192 K
	nRF52811	MDBT42Q-P192KL	1			
MDBT42Q-U	nRF52832	MDBT42Q-U512KEN	3	u.FL Connector	64 kb	512 K
	nRF52832	MDBT42Q-U512KV2	2			

● MDBT40 Series

Series	Nordic Solution	Raytac No.	IC Ver.	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

Release Note

- 2024/07/26: Version 0.1: Preliminary.

