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Approval Sheet

(產品承認書)

產品名稱	(Product)	BLE AT Command Dongle (nRF52840) deployed MDBT50Q-P module
產品型號	(Model No.)	**MDBT50Q – RX – ATM** in **Master / Central** role
產品料號	(Part No.)	**MD – 240A4 – 007** (Raytac Logo) **MD – 240A4 – 008** (No Logo)
韌體版本	(FW Rev.)	1.0

Working distance of MDBT50Q-RX-ATM

- ***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-RX-ATM is a BT 5.1 and BT 5.2 stack (Bluetooth low energy or BLE) dongle designed based on **Nordic nRF52840 SoC solution**, which incorporates: **USB** interface in only **master/central** role for data bridge. Size of dongle is **(L) 43.1 x (W) 18 x (H) 9.3 mm**.

2. AT Command

2.1. List of supported commands

- Setting of scanned device name
- Setting of scanned base UUID/service UUID/TX character/RX character
- Setting of scanned RSSI threshold
- Selective data rate of 1M bps, 2M bps or 125K bps on-air
- Set TX output power in 6 levels.
- Set scanning time
- Enable/disable scanning
- Set LED pattern indicating scanning or connecting status
- Auto UART baud rates
- Use external 32.768KHz oscillator
- Recover-to-default setting with software method
- System reset of software
- Set serial number and retrieve
- Retrieve MAC Address
- Support maximum MTU 247bytes / data payload up to maximum 244 bytes

2.2. AT Command Sets

2.2.1. “Write” Commands

No.	Command	Description
(1)	**AT+NAME**	Set scanned device name. Max. length of 20 characters e.g. AT+NAME123 (device name 123, 3 characters)
(2)	**AT+RESET**	Set to reset system
(3)	**AT+SCANOLDSTART**	Set to start scanning paired device
(4)	**AT+SCANNEWSTART**	Set to start scanning **ALL** devices
(5)	**AT+SCANSTOP**	Set to stop scanning
(6)	**AT+TXPOWER8DBM**	Set RF TX power at + 8dBm
(7)	**AT+TXPOWER4DBM**	Set RF TX power at + 4dBm
(8)	**AT+TXPOWER0DBM**	Set RF TX power at 0dBm
(9)	**AT+TXPOWER-4DBM**	Set RF TX power at - 4dBm
(10)	**AT+TXPOWER-8DBM**	Set RF TX power at - 8dBm
(11)	**AT+TXPOWER-20DBM**	Set RF TX power to - 20dBm
(12)	**AT+PHYMODE1MBPS**	Set PHY mode at 1Mbps
(13)	**AT+PHYMODE2MBPS**	Set PHY mode at 2Mbps
(14)	**AT+PHYMODE125KBPS**	Set PHY mode at 125Kbps
(15)	**AT+SCANOLDTIMEtttt**	Set time of scanning of paired device **(Hex)** e.g. 0x001E (min. 30secs), 0x0258 (Max. 600secs) 0x0000 (forever)
(16)	**AT+SCANNEWTIMEtttt**	Set time of scanning all devices **(Hex)** e.g. 0x001E (min. 30secs), 0x0258 (Max. 600secs) 0x0000 (forever)
(17)	**AT+CONNECTINTERVALMODE0**	Set connection interval mode for Peripheral 20ms/40ms usage (min. 20ms / Max. 75ms),
(18)	**AT+CONNECTINTERVALMODE1**	Set connection interval mode for Peripheral 8ms/8ms usage (min. 8ms / Max. 8ms)

No.	Command	Description
(19)	**AT+CONNECTINTERVALMODE2**	Set connection interval mode for Peripheral usage (programmable: min. / Max. range is 8 ms ~ 1,000 ms)
(20)	**AT+CONNECTINTERVALTIMEtttttttt**	Set LED connecting pattern **(Hex)**, <u>available when Activate "**AT+CONNECTINTERVALMODE2**"</u> e.g. 0x0008 (Min. 8ms) 0x03E8 (Max. 1,000ms), conditions to be met: "min. connection interval ≤ Max. connection interval"
(21)	**AT+CONNECTPATTERNnnnnffff**	Set LED connecting pattern **(Hex)**, where n = time when LED on, f = time when LED off e.g. 0x0064 (min. 100ms) 0x1388 (Max. 5,000ms) 0x00000000 (off) 0xFFFFFFFF (on)
(22)	**AT+SCANOLDPATTERNnnnnffff**	Set LED pattern for scanning paired device **(Hex)**, where n = time when LED on, f = time when LED off e.g. 0x0064 (min. 100ms) 0x1388 (Max. 5000ms) 0x00000000 (off) 0xFFFFFFFF (on)
(23)	**AT+SCANNEWPATTERNnnnnffff**	Set LED pattern for scanning all devise **(Hex)**, where n = time when LED on, f = time when LED off e.g. 0x0064 (min. 100ms) 0x1388 (Max. 5000ms) 0x00000000 (off) 0xFFFFFFFF (on)
(24)	**AT+SERIALNOnnnnnnnn**	Set serial number e.g. AB000001, fixed 8-character length
(25)	**AT+RESPONSEDIS**	Disable response when sending "write" command
(26)	**AT+RESPONSEEN**	Enable response when sending "write" command
(27)	**AT+DISCONNECT**	Terminate the connection
(28)	**AT+RSSITHRESHOLDnnn**	Set RSSI threshold for scanning all devices (Ascii), e.g. -90 (min.); -20 (Max.)

No.	Command	Description
(29)	**AT+TXCHARACTERUUIDuuuu**	Set TX character UUID for NUS **(Hex)**, e.g. 0x0003
(30)	**AT+RXCHARACTERUUIDuuuu**	Set RX character UUID for NUS **(Hex)**, e.g. 0x0002
(31)	**AT+SERVICEUUIDuuuu**	Set service UUID for NUS **(Hex)**, e.g. 0x0001
(32)	**AT+BASEUUID** **uuuuuuuuuuuuuuuu** **uuuuuuuuuuuuuuuu**	Set base UUID for NUS **(Hex)**, e.g. 9ECADC240EE5A9E093F3A3B5**0000**406E 13th & 14th byte is reserved for service / TX character RX character UUID, always be 0000.
(33)	**AT+DEFAULT**	Back to default

2.2.2. “Read” Commands

No.	Command	Description
(1)	**AT?NAME**	To retrieve scanned device name
(2)	**AT?VERSION**	To retrieve firmware version
(3)	**AT?MACADDR**	To retrieve IC MAC address
(4)	**AT?TXPOWER**	To retrieve RF TX power
(5)	**AT?PHYMODE**	To retrieve status of PHY mode
(6)	**AT?SCANOLDTIME**	To retrieve time of scanning paired device **(Hex)**
(7)	**AT?SCANNEWTIME**	To retrieve time of scanning all devices **(Hex)**
(8)	**AT?CONNECTINTERVALMODE**	To retrieve status of connection interval mode
(9)	**AT?CONNECTINTERVALTIME**	To retrieve value of connection interval time under Mode 2
(10)	**AT?CONNECTPATTERN**	To retrieve LED connecting pattern **(Hex)**
(11)	**AT?SCANOLDPATTERN**	To retrieve LED pattern when scanning paired device **(Hex)**
(12)	**AT?SCANNEWPATTERN**	To retrieve LED pattern when scanning all devices **(Hex)**
(13)	**AT?SERIALNO**	To retrieve serial number
(14)	**AT?RESPONSE**	To retrieve status of response
(15)	**AT?RSSITHRESHOLD**	To retrieve scanning new RSSI threshold value **(Ascii)**
(16)	**AT?CONNECTRSSI**	To retrieve RSSI value when in BLE connection **(Ascii)**
(17)	**AT?TXCHARACTERUUID**	To retrieve TX character UUID value **(Hex)**
(18)	**AT?RXCHARACTERUUID**	To retrieve RX character UUID value **(Hex)**
(19)	**AT?SERVICEUUID**	To retrieve service UUID value **(Hex)**
(20)	**AT?BASEUUID**	To retrieve base UUID value **(Hex)**
(21)	**AT?ALLPARAMETERS**	To retrieve value of all parameters

2.2.3. Response (Default)

No.	Command	Response
(1)	**AT?NAME**	Raytac AT-UART (default)
(2)	**AT?VERSION**	e.g. version: 1.0
(3)	**AT?MACADDR**	e.g. D352BDE1E414
(4)	**AT?TXPOWER**	5 txpower 8dbm (default) (0 = 4dBm; 1 = 0dBm; 2 = -4dBm; 3 = -8dBm, 4 = -20dBm, 5 = 8dBm)
(5)	**AT?PHYMODE**	0 PHY mode 1Mbps (default) (0 = 1Mbps; 1 = 2Mbps; 2 = 125Kbps)
(6)	**AT?SCANOLDTIME**	0000 (default: **Hex**, forever scanning paired device with no timeout, tttt: 0x0000)
(7)	**AT?SCANNEWTIME**	0000 default: **Hex**, forever scanning ALL devices with no timeout, tttt: 0x0000)
(8)	**AT?CONNECTINTERVALMODE**	0 connect interval mode 0 (default) (0 = connection interval for Peripheral 20ms/40ms usage 1 = connection interval for Peripheral 8ms/8ms usage)
(9)	**AT?CONNECTINTERVALTIME**	01900190 (default: **Hex**, 400ms min. connection interval / 400ms Max. connection interval, tttttttt: 0x01900190)
(10)	**AT?CONNECTPATTERN**	00c80708 (default: Hex, 0.2sec on / 1.8sec off, nnnn: 0x00c8, ffff: 0x0708)
(11)	**AT?SCANOLDPATTERN**	03e803e8 (default: Hex, 1sec on / 1sec off, nnnn: 0x03e8, ffff: 0x03e8)
(12)	**AT?SCANNEWPATTERN**	00640064 (default: Hex, 0.1sec on / 0.1sec off, nnnn: 0x0064, ffff: 0x0064)
(13)	**AT?SERIALNO**	Display “ no data! ” string (default)
(14)	**AT?RESPONSE**	1 response en (default) (0 = disable response; 1 = enable response)
(15)	**AT?RSSITHRESHOLD**	-51 (default: Ascii, nnn: -51)

No.	Command	Response
(16)	**AT?TXCHARACTERUUID**	0003 (default: **Hex**, uuuu: 0x0003)
(17)	**AT?RXCHARACTERUUID**	0002 (default: **Hex**, uuuu: 0x0002)
(18)	**AT?SERVICEUUID**	0001 (default: **Hex**, uuuu: 0x0001)
(19)	**AT?BASEUUID**	9ECADC240EE5A9E093F3A3B50000406E (default: **Hex**, uuuuuuuuuuuuuuuuuuuuuuuuuuuuuuuu: 0x9ECADC240EE5A9E093F3A3B50000406E)
(20)	**AT?ALLPARAMETERS**	Display value of all parameters, separated by "0x0d0x0a"

2.3. Default Info

No.	Description	Default
(1)	**Scanned device name**	Raytac AT-UART
(2)	**Base UUID**	0x9E, 0xCA, 0xDC, 0x24, 0x0E, 0xE5, 0xA9, 0xE0, 0x93, 0xF3, 0xA3, 0xB5, 0x00, 0x00, 0x40, 0x6E
(3)	**Service UUID**	0x0001 TX characteristic: 0x0003; RX characteristic: 0x0002
(4)	**RF TX power**	+8dBm
(5)	**PHY mode**	1Mbps
(6)	**Time of scanning paired device**	Forever scanning for paired device with no timeout
(7)	**Time of scanning all devices**	Forever scanning for all devices with no timeout
(8)	**Connection interval mode**	Set at min. 20ms and Max. 75ms for Peripheral 20ms/40ms usage
(9)	**Connecting LED pattern**	0.2sec on / 1.8secs off
(10)	**LED pattern for scanning paired device**	1sec on / 1sec off
(11)	**LED pattern for scanning all devices**	0.1sec on / 0.1sec off
(12)	**Serial number**	Display “ no data! ” string
(13)	**State of response**	Enabled
(14)	**Scanning new RSSI threshold**	-51 **(Ascii)**.

3. How to Control USB Dongle

3.1. How to Send AT Commands

- **When BT is NOT connected, for ALL commands**

1. Plug the dongle into USB port on the computer and setup the communication software COM port to USB dongle.

2. Send any AT commands you want. Please wait for at least 250 ms before sending each command.

3. **Send command "AT+RESET" (not HW reset) to save all your settings.**

- **When BT is connected for following commands ONLY**
  Write: AT+DISCONNECT, AT+RESET, AT+SCANNEWSTART
  Read: AT?CONNECTRSSI, AT?PHYMODE

1. Just send "AT+DISCONNECT" or "AT+RESET" or "AT+SCANNEWSTART" or "AT?CONNECTRSSI" or "AT?PHYMODE" when BT is connected.

3.2. How to Return to Flashed Default Setting

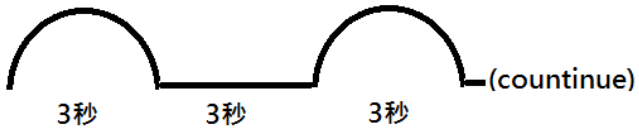
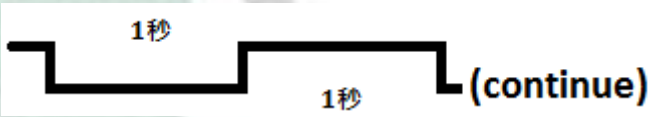
**** Only when BT is NOT connected ****

**** For other default, please check "2.3 Default Info"***

- ## Use Software method

  When BT is **NOT** connected and send command " AT+DEFAULT ", then system will return to default setting.

- ## Default Definition of LED (P1.13) Status

Mode	LED Status
Idle mode	 Breathing light
Connected	 0.2 sec ON / 1.8 secs OFF
Scan the paired device	 1 sec ON / 1 sec OFF
Scan all devices	 0.1 sec ON / 0.1 sec OFF

3.3. How to Start Scanning

This section describes how to start scanning using a physical button (hardware) or the AT Command (firmware) under various occasions. Before getting started, here are some notes applied to both methods.

- Each central device is only able to pair with 1 Peripheral.
- The device will be in idle directly when it is powered or not in BLE connection.
- A few criteria must be met in order to complete BLE connection:

	Under Paired Scanning	Under All-Devices Scanning
Base UUID	√	√
Service UUID	√	√
Device name	√	√
RSSI Threshold		√
Mac Address in Paired Record	√	
RF Data Rate	√	√

● Use Key/Button

START Scanning Paired Device --- (a)

- Press the button for less than 2 seconds and release it to start scanning paired device.

START Scanning All Devices --- (b)

- Press the button for 2 seconds or longer directly to start scanning all devices.

STOP Scanning Paired / All Device(s)

- Press the button for less than 2 seconds and release it to stop scanning. The device will to stop scanning and go to idle.

Disconnect BLE Connection

- When device is in BLE connection, press the button for less than 2 seconds and release it to disconnect the paired device.

	How to Start Scanning	
	Paired Device	All Devices
Device Status		
Idle	(a)[1]	(b)
BLE Connection	Not Available	(b)
Scanning Paired Device	Not Available	(b)
Scanning All Devices	(a)[1]	Not Available

Remark 1: The device stays in idle when there is no paired record.

Use AT Command

START Scanning Paired Device --- (a)

- Enter “AT+SCANOLDSTART” to start scanning paired device.

START Scanning All Devices --- (b)

- Enter “AT+SCANNEWSTART” to start scanning all devices.

STOP Scanning Paired / All Device(s)

- Enter “AT+SCANSTOP” to stop scanning. The device will be back to idle and go into deep sleep after a given timeout.

	How to Start Scanning	
	Paired Device	All Devices
Device Status		
Idle	(a)[1]	(b)
BLE Connection	Not Available	(b)
Scanning Paired Device	Not Available	(b)
Scanning All Devices	(a)[1]	Not Available

Remark 1: The device stays in idle when there is no paired record.

4. Report of Data Transmission

Abbreviation used in tables below: **D.L.** means "**Data Length**" and **D.I.** means "**Data Interval**"

- Peripheral (MDBT50Q) → Central (MDBT50Q-RX-ATM)→ PC Console

- **Under PHY mode at 2 Mbps:**

MDBT50Q-RX-ATM Connection Interval	MDBT50Q Connection Interval	USB Baud Rate	Peripheral D.L. (bytes)	MCU D.I. (ms)	Total D.L. (bytes)	Total Trans. Time (sec)	Data Rate (k-bytes/sec)
min = 20ms Max = 75ms	min = 8ms Max = 8ms	1000000	244	1	1049200	8	128.07
min = 20ms Max = 75ms	min = 50ms Max = 50ms	1000000	244	1	1049200	8	128.07
min = 20ms Max = 75ms	min = 400ms Max = 400ms	1000000	244	1	1049200	10	102.46
min = 8ms Max = 8ms	min = 8ms Max = 8ms	1000000	244	1	1049200	8	128.07
min = 8ms Max = 8ms	min = 50ms Max = 50ms	1000000	244	1	1049200	7	146.37
min = 8ms Max = 8ms	min = 400ms Max = 400ms	1000000	244	1	1049200	8	128.07
min = 400ms Max = 400ms	min = 8ms Max = 8ms	1000000	244	1	1049200	8	128.07

Continue to next page…

MDBT50Q-RX-ATM Connection Interval	MDBT50Q Connection Interval	USB Baud Rate	Peripheral D.L. (bytes)	MCU D.I. (ms)	Total D.L. (bytes)	Total Trans. Time (sec)	Data Rate (k-bytes/sec)
min = 400ms Max = 400ms	min = 50ms Max = 50ms	1000000	244	1	1049200	8	128.07
min = 400ms Max = 400ms	min = 400ms Max = 400ms	1000000	244	1	1049200	8	128.07

- Under **PHY mode at 1 Mbps:**

MDBT50Q-RX-ATM Connection Interval	MDBT50Q Connection Interval	USB Baud Rate	Peripheral D.L. (bytes)	MCU D.I. (ms)	Total D.L. (bytes)	Total Trans. Time (sec)	Data Rate (k-bytes/sec)
min = 20ms Max = 75ms	min = 8ms Max = 8ms	1000000	244	1	1049200	31	33.05
min = 20ms Max = 75ms	min = 50ms Max = 50ms	1000000	244	1	1049200	24	42.69
min = 20ms Max = 75ms	min = 400ms Max = 400ms	1000000	244	1	1049200	29	35.33
min = 8ms Max = 8ms	min = 8ms Max = 8ms	1000000	244	1	1049200	31	33.05
min = 8ms Max = 8ms	min = 50ms Max = 50ms	1000000	244	1	1049200	24	42.69
min = 8ms Max = 8ms	min = 400ms Max = 400ms	1000000	244	1	1049200	30	34.15

Continue to next page…

MDBT50Q-RX-ATM Connection Interval	MDBT50Q Connection Interval	USB Baud Rate	Peripheral D.L. (bytes)	MCU D.I. (ms)	Total D.L. (bytes)	Total Trans. Time (sec)	Data Rate (k-bytes/sec)
min = 400ms Max = 400ms	min = 8ms Max = 8ms	1000000	244	1	1049200	33	31.04
min = 400ms Max = 400ms	min = 50ms Max = 50ms	1000000	244	1	1049200	31	33.05
min = 400ms Max = 400ms	min = 400ms Max = 400ms	1000000	244	1	1049200	13	78.81

- **Under PHY mode at 125 Kbps:**

MDBT50Q-RX-ATM Connection Interval	MDBT50Q Connection Interval	USB Baud Rate	Peripheral D.L. (bytes)	MCU D.I. (ms)	Total D.L. (bytes)	Total Trans. Time (sec)	Data Rate (k-bytes/sec)
min = 20ms Max = 75ms	min = 8ms Max = 8ms	1000000	244	1	1049200	324	3.16
min = 20ms Max = 75ms	min = 50ms Max = 50ms	1000000	244	1	1049200	321	3.19
min = 20ms Max = 75ms	min = 400ms Max = 400ms	1000000	244	1	1049200	319	3.12

Continue to next page…

MDBT50Q-RX-ATM Connection Interval	MDBT50Q Connection Interval	USB Baud Rate	Peripheral D.L. (bytes)	MCU D.I. (ms)	Total D.L. (bytes)	Total Trans. Time (sec)	Data Rate (k-bytes/sec)
min = 8ms Max = 8ms	min = 8ms Max = 8ms	1000000	244	1	1049200	325	3.15
min = 8ms Max = 8ms	min = 50ms Max = 50ms	1000000	244	1	1049200	319	3.21
min = 8ms Max = 8ms	min = 400ms Max = 400ms	1000000	244	1	1049200	323	3.17
min = 400ms Max = 400ms	min = 8ms Max = 8ms	1000000	244	1	1049200	326	3.14
min = 400ms Max = 400ms	min = 50ms Max = 50ms	1000000	244	1	1049200	324	3.16
min = 400ms Max = 400ms	min = 400ms Max = 400ms	1000000	244	1	1049200	301	3.40

- MCU (UART) → Peripheral (MDBT42V-AT) → Central (MDBT50Q-RX-ATM)→ PC Console

- **Under PHY mode at 2 Mbps:**

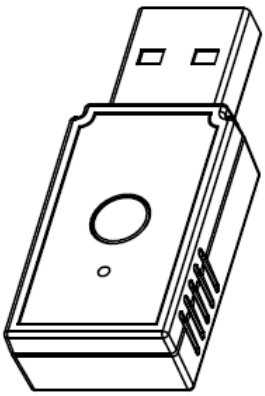
MDBT50Q-RX-ATM Connection Interval	MDBT42V-AT Connection Interval	UART Baud Rate	Flow Control	Peripheral D.L. (bytes)	MCU D.I. (ms)	Total D.L. (bytes)	Total Trans. Time (sec)	Data Rate (k-bytes/sec)
min = 20ms Max = 75ms	min =20ms Max = 40ms	460800	V	244	27	1049200	115	8.91
min = 20ms Max = 75ms	min = 8ms Max =8ms	460800	V	244	9	1049200	38	26.96
min = 8ms Max = 8ms	min =20ms Max = 40ms	460800	V	244	27	1049200	115	8.91
min = 8ms Max = 8ms	min = 8ms Max =8ms	460800	V	244	9	1049200	38	26.96
min = 400ms Max = 400ms	min =20ms Max = 40ms	460800	V	244	27	1049200	115	8.91
min = 400ms Max = 400ms	min = 8ms Max =8ms	460800	V	244	8	1049200	34	30.13

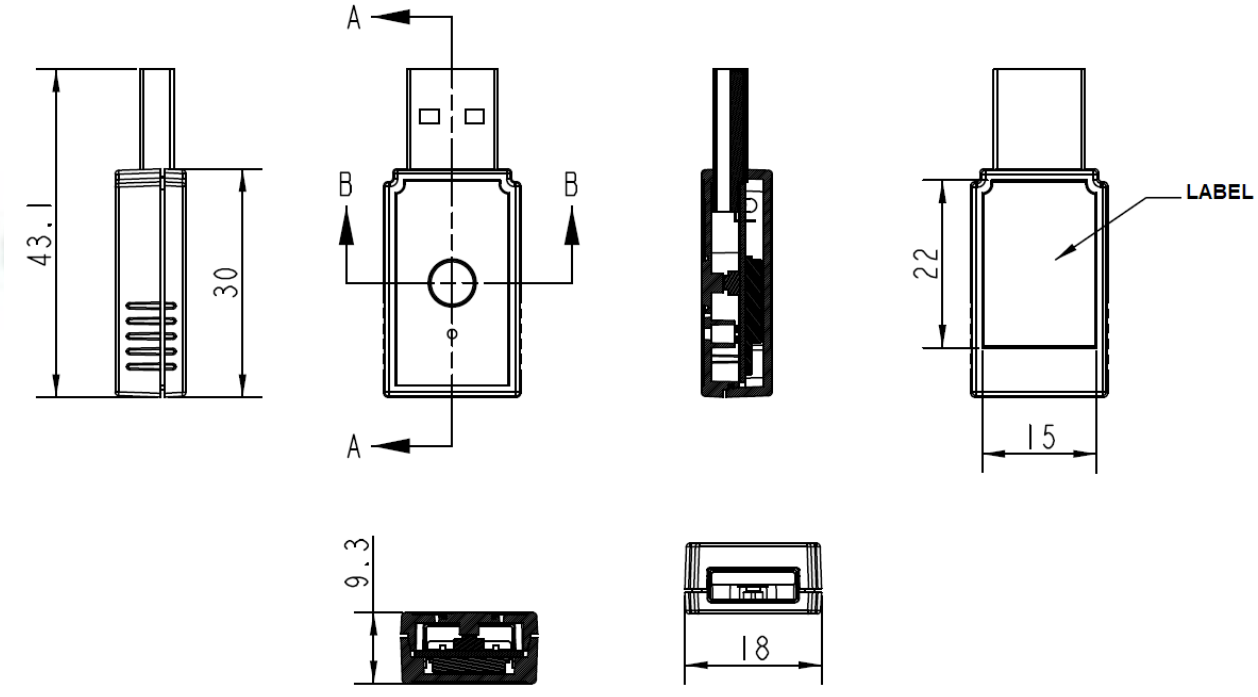
- **Under PHY mode at 1 Mbps:**

MDBT50Q-RX-ATM Connection Interval	MDBT42V-AT Connection Interval	UART Baud Rate	Flow Control	Peripheral D.L. (bytes)	MCU D.I. (ms)	Total D.L. (bytes)	Total Trans. Time (sec)	Data Rate (k-bytes/sec)
min = 20ms Max = 75ms	min =20ms Max = 40ms	460800	V	244	27	1049200	116	8.83
min = 20ms Max = 75ms	min = 8ms Max =8ms	460800	V	244	9	1049200	38	26.96
min = 8ms Max = 8ms	min =20ms Max = 40ms	460800	V	244	26	1049200	110	9.31
min = 8ms Max = 8ms	min = 8ms Max =8ms	460800	V	244	8	1049200	34	30.13
min = 400ms Max = 400ms	min =20ms Max = 40ms	460800	V	244	27	1049200	116	8.83
min = 400ms Max = 400ms	min = 8ms Max =8ms	460800	V	244	13	1049200	55	18.62

5. Product Dimension

DONGLE SIZE: (L) 43.1 x (W) 18 x (H) 9.3 mm





6. Main Chip Solution

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

7. Shipment Packaging Information

Order Code	Logo
MD-240A4-007	Raytac Logo
	
MD-240A4-008	No Logo
	

- Unit Weight (with casing): 5.8 g (± 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)

- Dimension of Carton: (L) 31 x (W) 25 x (H) 22 cm

- Gross Weight: approx. 4.70 kgs per full carton (contains 600 pcs)

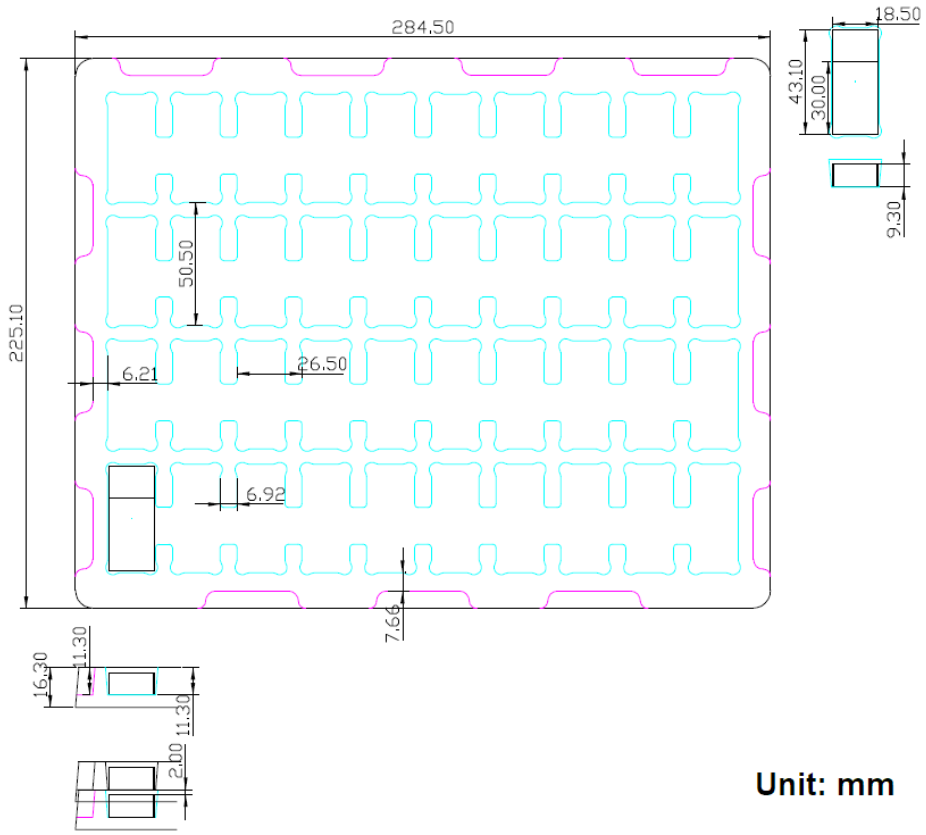
7.1. Label

A label is attached to the bottom cover of the dongle.

Period	Label
Shipments made ***before*** September, 2021	
after September, 2021	

7.2. Tray Specifications

Dongles are packed in trays for volume order. Specifications are as follows:



Unit: mm

8. Specification

8.1. Operating Conditions

Symbol	Parameter	Min.	Nom.	Max.	Units
VDD	VDD supply voltage, independent of DCDC enable		3.3		V
VDD_{POR}	VDD supply voltage needed during power-on reset	1.75			V
VDDH	VDDH supply voltage, independent of DCDC enable		3.3		V
VBUS	VBUS USB supply voltage	4.35	5	5.5	V
t_{R_VDD}	Supply rise time (0 V to 1.7 V)			60	ms
t_{R_VDDH}	Supply rise time (0 V to 3.7 V)			100	ms
TA	Operating temperature	-40	25	75	°C

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

Contents below are from "nRF52840 Product Specification v1.2", please refer to Nordic's release as final reference.

8.2. Absolute Maximum Ratings

	Note	Min.	Max.	Unit
Radio				
RF input level			10	dBm
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
Environmental aQFN™ package				
ESD CDM	Charged Device Model		750	V
MSL	Moisture Sensitivity Level		2	
ESD HBM	Human Body Model		2	kV
ESD HBM Class	Human Body Model Class		2	
Flash memory				
Endurance		10 000		Write/erase cycles
Retention		10 years at 40°C		

8.3. Electrical Specifications

8.3.1. 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
fsk_{BPS}	On the air data rate	125		2000	kbps
$f_{chip,\ IEEE\ 802.15.4}$	Chip rate in IEEE 802.15.4 mode		2000		kchips

8.3.2. 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

8.3.3. 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

8.3.4. 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

8.3.5. 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

8.3.6. 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

8.3.7. RX Selectivity

Symbol	Description	Min.	Typ.	Max.	Units
$C/I_{1M,co\text{-}channel}$	1Mbps mode, Co-Channel interference		9		dB
$C/I_{1M,-1MHz}$	1 Mbps mode, Adjacent (-1 MHz) interference		-2		dB
$C/I_{1M,+1MHz}$	1 Mbps mode, Adjacent (+1 MHz) interference		-10		dB
$C/I_{1M,-2MHz}$	1 Mbps mode, Adjacent (-2 MHz) interference		-19		dB
$C/I_{1M,+2MHz}$	1 Mbps mode, Adjacent (+2 MHz) interference		-42		dB
$C/I_{1M,-3MHz}$	1 Mbps mode, Adjacent (-3 MHz) interference		-38		dB
$C/I_{1M,+3MHz}$	1 Mbps mode, Adjacent (+3 MHz) interference		-48		dB
$C/I_{1M,\pm6MHz}$	1 Mbps mode, Adjacent (≥6 MHz) interference		-50		dB
$C/I_{1MBLE,co\text{-}channel}$	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
$C/I_{2M,co\text{-}channel}$	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
$C/I_{2M,\geq12MHz}$	2 Mbps mode, Adjacent (≥12 MHz) interference		-52		dB
$C/I_{2MBLE,co\text{-}channel}$	2 Mbps BLE mode, Co-Channel interference		6.8		dB
$C/I_{2MBLE,\pm2MHz}$	2 Mbps BLE mode, Adjacent (±2 MHz) interference		-10		dB
$C/I_{2MBLE,\pm4MHz}$	2 Mbps BLE mode, Adjacent (±4 MHz) interference		-45		dB
$C/I_{2MBLE,\geq6MHz}$	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
$C/I_{125k\ BLE\ LR,\ co\text{-}channel}$	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.

8.3.8. 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 closet 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.

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

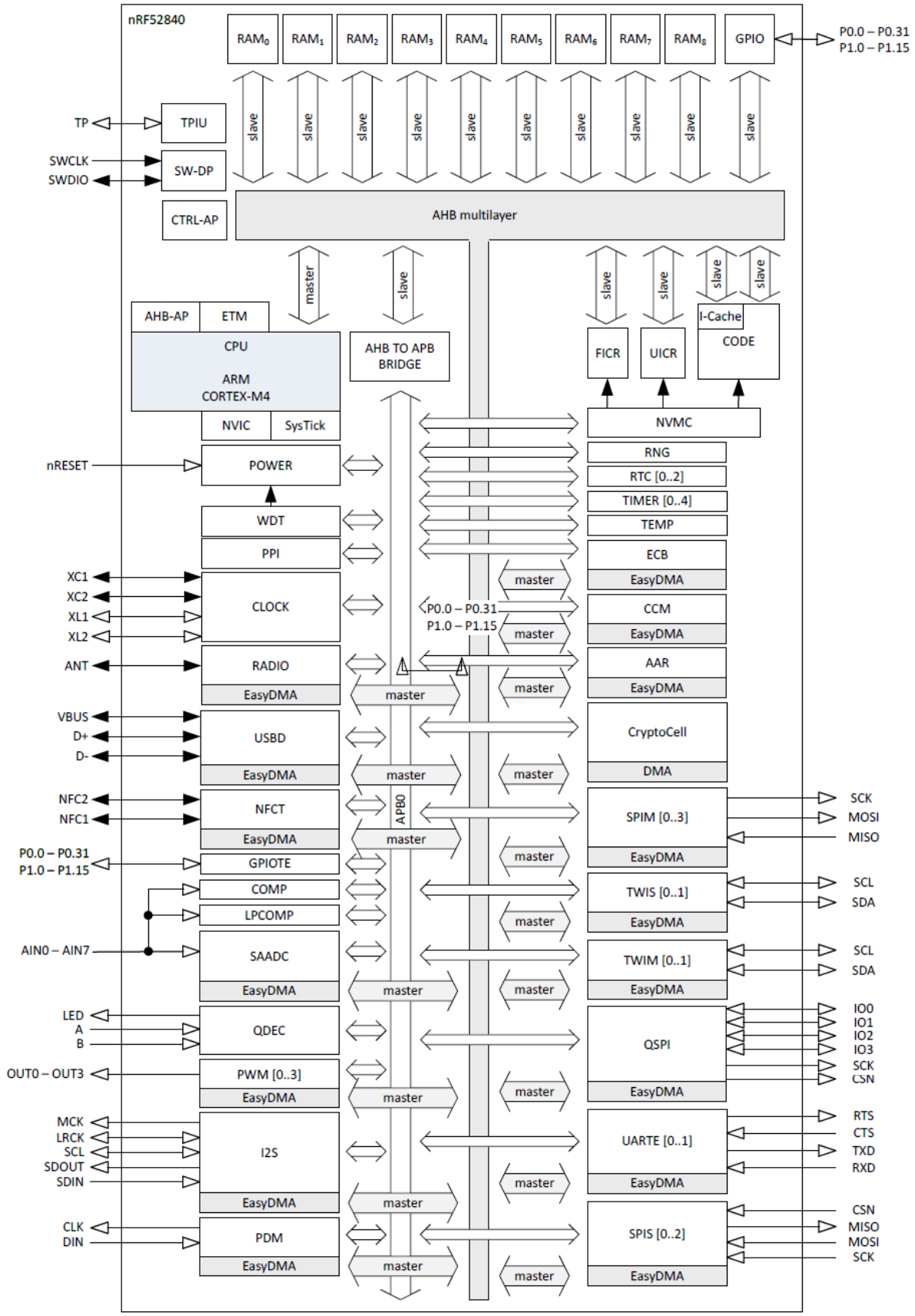
8.3.10. CPU

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		CoreM
$CM_{FLASH/MHz}$	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		CoreM mA

8.3.11. 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

9. Block Diagram



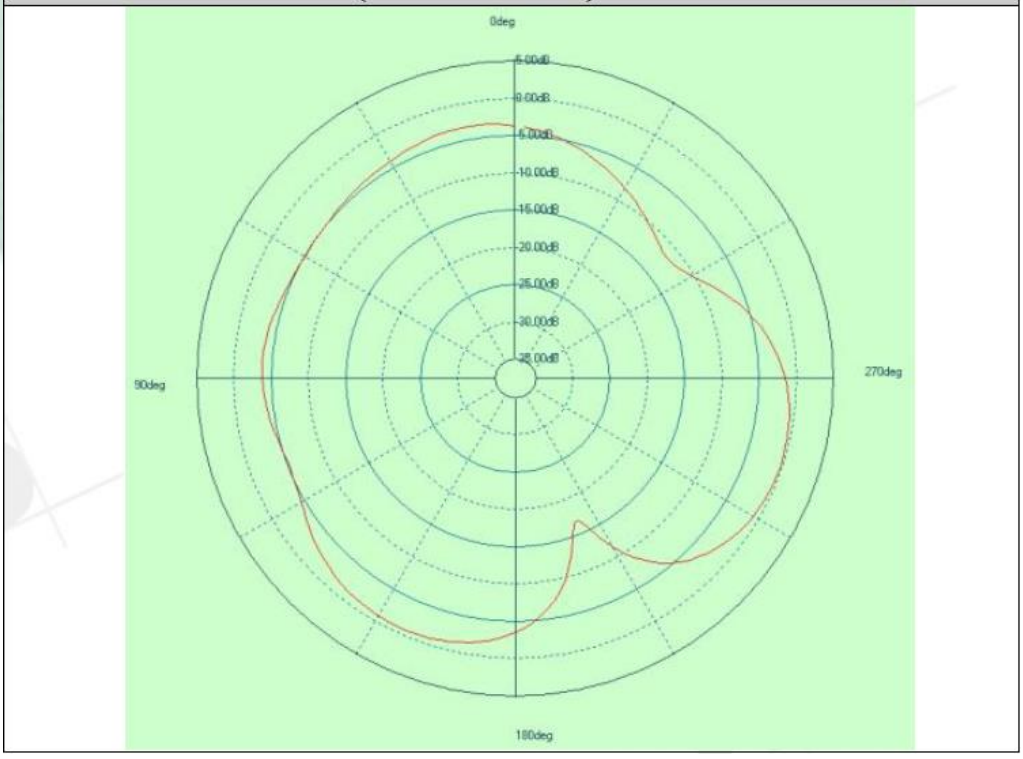
10. Antenna

10.1. MDBT50Q-P

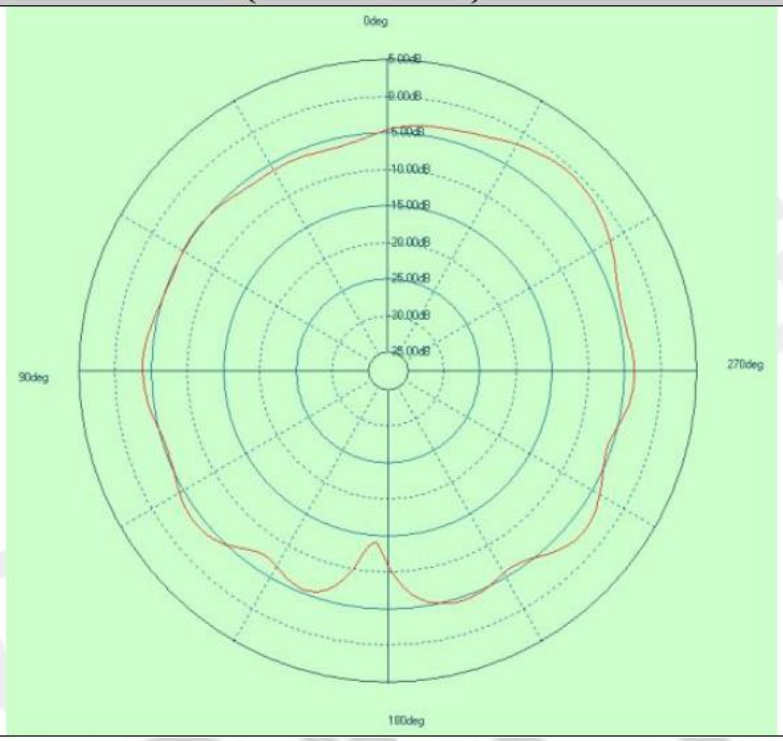
Antenna Gain and Efficiency

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

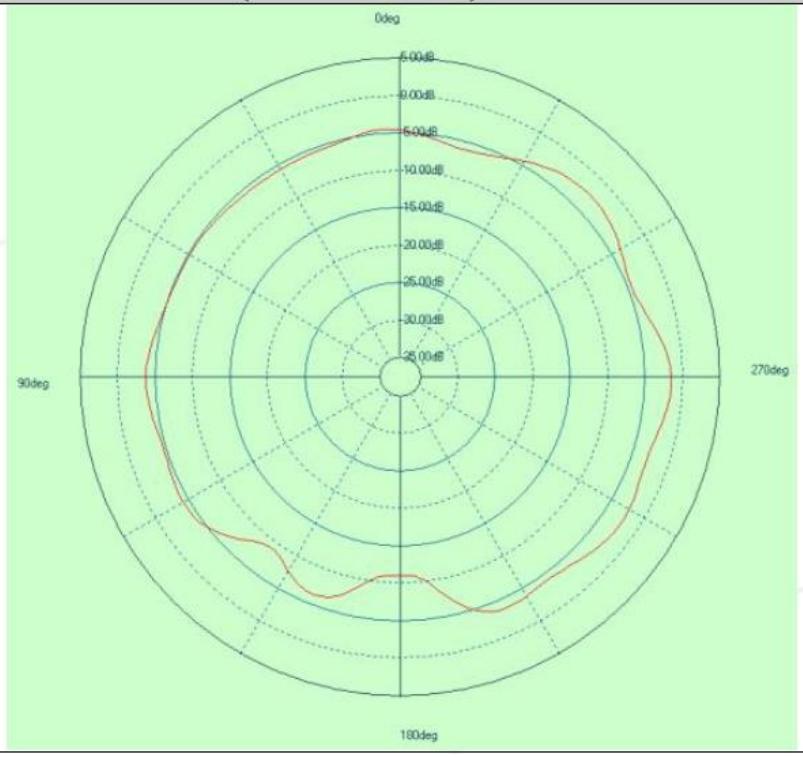
Free Space
EIRP (2450 MHz) – XY cut



Free Space
EIRP (2450 MHz) – XZ cut



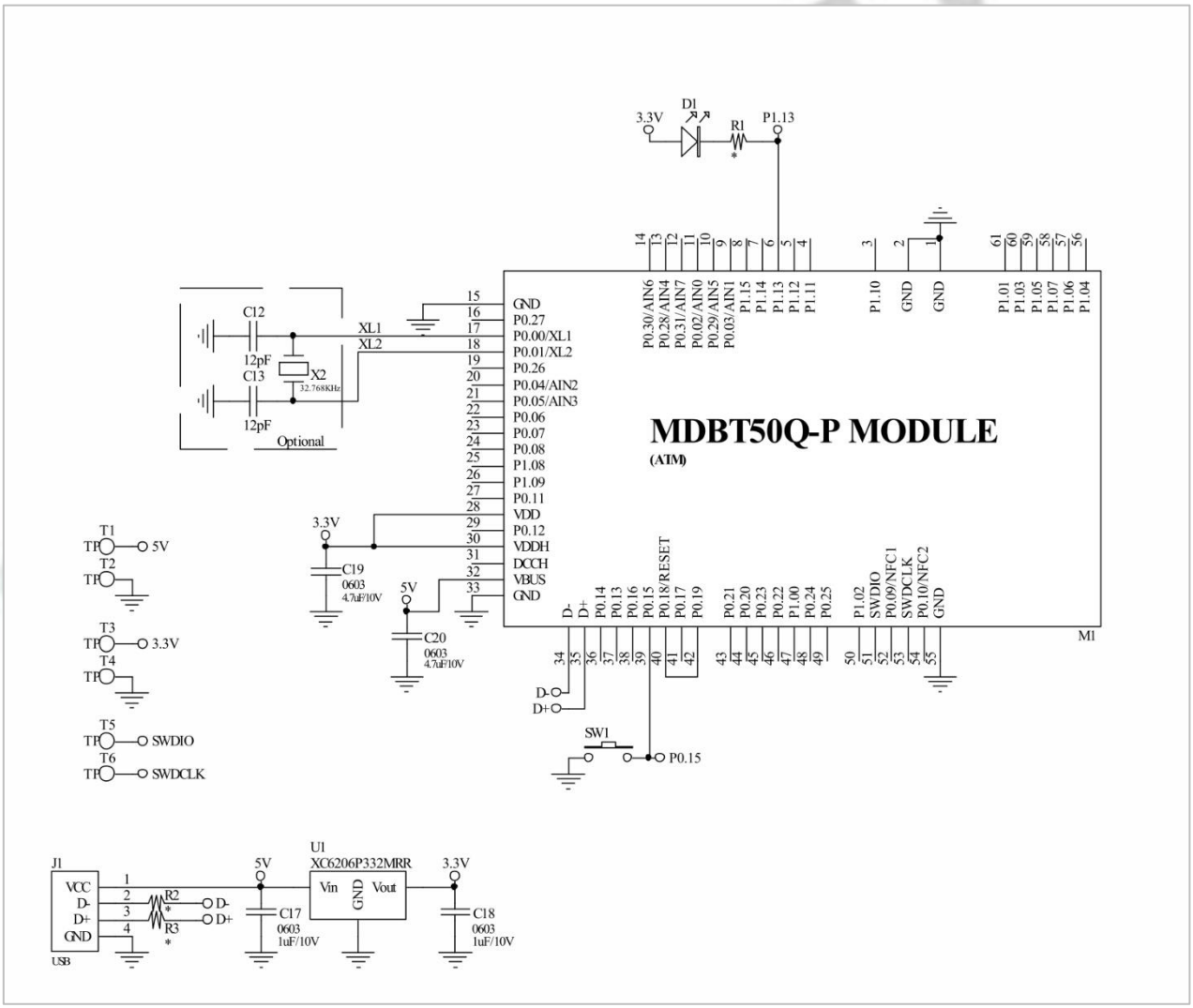
Free Space
EIRP (2450 MHz) – YZ cut

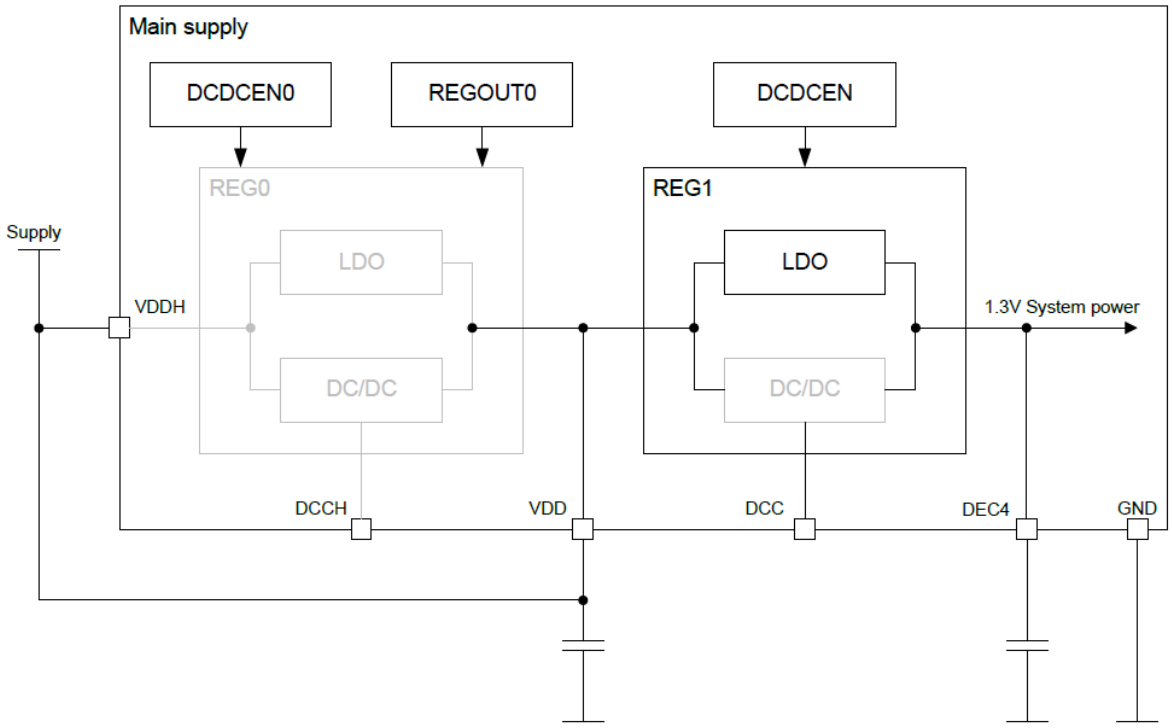


11. Reference Circuit

Module is pre-programmed with Raytac's AT command firmware. Default is using "LDO mode" and is using external 32.768khz crystal.

- External 32.768khz is already inside the dongle.




Main supply
DCDCEN0
REGOUT0
DCDCEN
REG0
REG1
Supply
LDO
LDO
VDDH
1.3V System power
DC/DC
DC/DC
DCCH
VDD
DCC
DEC4
GND

12. Certification

12.1. Declaration ID

BT 5.1

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

BT 5.2

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

12.2. FCC Certificate (USA)

telefication

TCB

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

TCB

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

Date of Grant: 07/26/2018

Application
Dated: 07/25/2018

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:	SH6MDBT50Q
Name of Grantee:	Raytac Corp.
Equipment Class:	**Digital Transmission System**
Notes:	**Bluetooth Low Energy & IEEE 802.15.4 Combo Module**
Modular Type:	**Single Modular**

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

No. 134, Wu Kung Road,
New Taipei Industrial Park,
Wuku District, New Taipei City,
Taiwan 24803
Tel: +886-2-2299-3279
Fax: +886-2-2298-2698

No: MH/2018/C0096C

FCC SDoC REPORT

This certifies that the following designated product

Product Name: Bluetooth Low Energy & IEEE 802.15.4 Combo Dongle
Brand Name: Raytac
Model No. : MDBT50Q-RX
Added Model(s): N/A

(Product Identification)

It is herewith confirmed and found to comply with the requirements set up by ANSI C63.4:2014 & 47 CFR Part 15, Subpart B, Class B regulations for the evaluation of electromagnetic compatibility.
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.

(Identification of regulations / standards)

This declaration is the responsibility of the manufacturer / importer

Applicant : Raytac Corporation
Address : 5F., No.3, Jiankang Road, Zhonghe District, New Taipei City 23586, Taiwan
Manufacturer : Raytac Corporation
Address : 5F., No.3, Jiankang Road, Zhonghe District, New Taipei City 23586, Taiwan

This is the result of test, **Based on SGS EMC Test Report Number(s) : MH/2018/C0096**, that was carried out from the submitted type-samples of a product in conformity with the specification of the respective standards. The certificate holder has the right to fix the FCC-mark for EMI on the product complying with the inspection sample.

Eddy Cheng

(Mr. Eddy Cheng)

..... Dec. 28, 2018.....
(Date)

Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.

12.3. TELEC Certificate (Japan)

Certificate Technical Support Center Co.,Ltd:
RAB ID No. 018

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

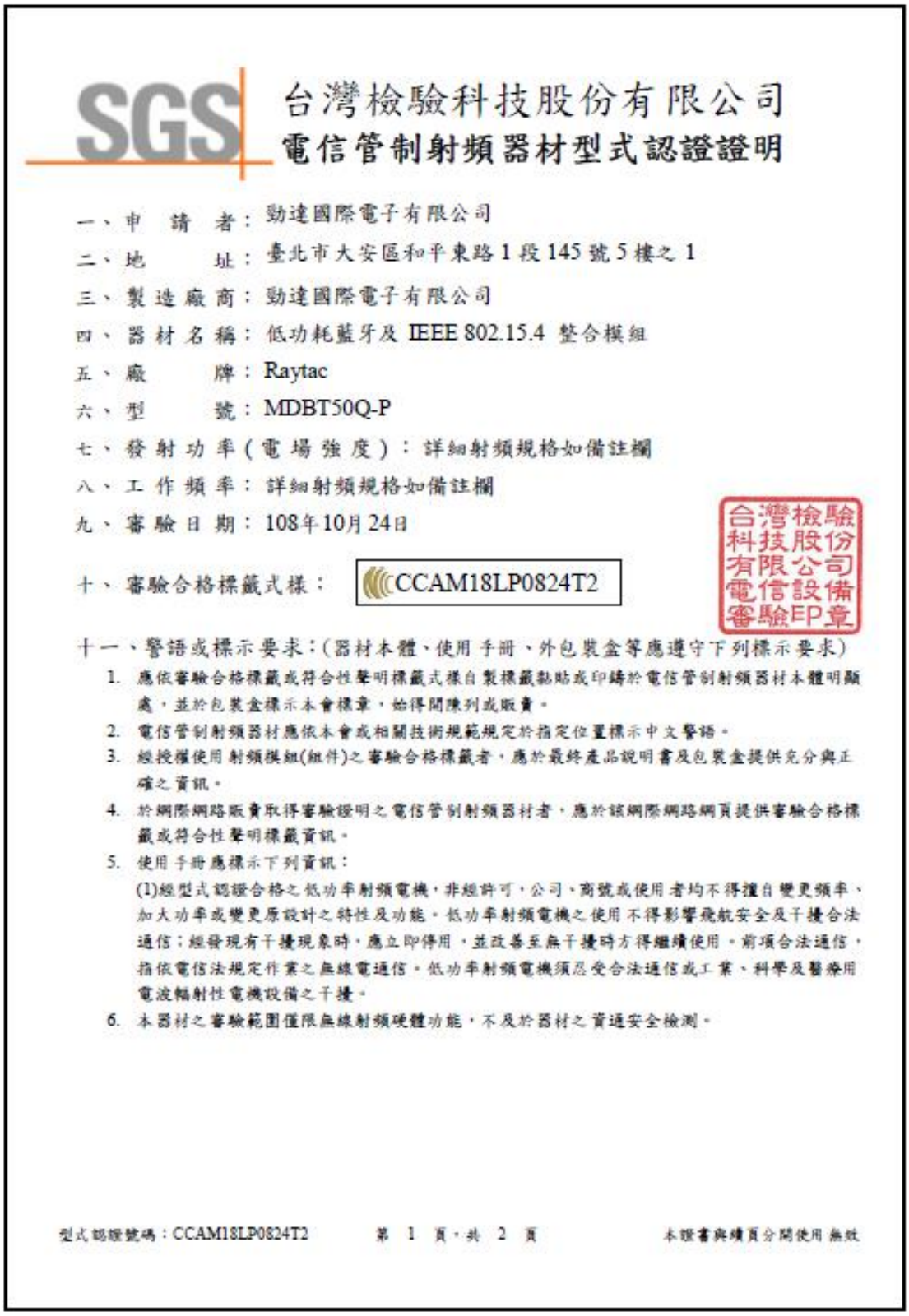
Takuji Nakano

Certification Examiner : Takuji Nakano
C&S /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

12.4. NCC Certificate (Taiwan)

MDBT50Q-P



SGS 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：CCAM18LP0824T2

台灣檢驗科技股份有限公司電信設備審驗印章

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)

1. 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，始得陳列或販賣。
2. 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。
3. 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。
4. 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。
5. 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。
6. 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。

型式認證號碼：CCAM18LP0824T2　　第 1 頁，共 2 頁　　本證書與續頁分開使用無效

12.5. CE (EU) Test Report

Report No.: E2/2018/C0012-01
Page: 1 of 40

CE

RED (2014/53/EU)
ETSI EN 300 328 V2.2.2 : 2019
TEST REPORT

FOR

Applicant:	Raytac Corporation 5F., No.3, Jiankang Road, Zhonghe District, New Taipei City 23586, Taiwan
Product Name:	Bluetooth Low Energy & IEEE 802.15.4 Combo Dongle
Brand Name:	Raytac
Model No.:	MDBT50Q-RX
Model Difference:	N/A
Report Number:	E2/2018/C0012-01
Issue Date:	Jun. 15, 2020
Date of Test:	Dec. 21, 2018 ~ Dec. 27, 2018
Date of EUT Received:	Dec. 17, 2018

We hereby certify that:
The above equipment was tested by SGS Taiwan Ltd., Central RF Lab for compliance with the requirements set forth in the European Standard ETSI EN 300 328 V2.2.2: 2019 under RED 2014/53/EU. The results of testing in this report apply to the product system that was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved By: Jay. Lin
Jay Lin / Asst. Supervisor

ilac-MRA TAF Testing Laboratory 3702

SGS Reference No: MH/2018/C0095C

VERIFICATION OF EMC COMPLIANCE

Verification No.	:	MH/2018/C0095C
Representative Model No.	:	MDBT50Q-RX
Added Model(s)	:	N/A
Product Name	:	Bluetooth Low Energy & IEEE 802.15.4 Combo Dongle
Brand Name	:	Raytac
Applicant	:	Raytac Corporation
Address of Applicant	:	5F., No.3, Jiankang Road, Zhonghe District, New Taipei City 23586, Taiwan
Test Report Number	:	MH/2018/C0095
Date of Issue	:	Dec. 28, 2018
Applicable Standards	:	EN 301 489 –1 $_{v2.2.0}$: 2017-03 (Draft) EN 301 489 –17 $_{v3.2.0}$: 2017-03 (Draft) 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.

Authorized Signatory:

Eddy Cheng

SGS TAIWAN LTD.
Eddy Cheng
Technical Asst. Supervisor

12.6. RCM (Australia & New Zealand) Test Report

Australian/New Zealand Standard
AS/NZS 4268:2017
TEST REPORT

FOR

Applicant:	Raytac Corporation 5F., No.3, Jiankang Road, Zhonghe District, New Taipei City 23586, Taiwan
Product Name:	Bluetooth Low Energy & IEEE 802.15.4 Combo Dongle
Brand Name:	Raytac
Model No.:	MDBT50Q-RX
Model Difference:	N/A
Report Number:	E2/2019/20021
Issue Date:	Feb. 20, 2018
Date of Test:	Dec. 21, 2018 ~ Dec. 27, 2018
Date of EUT Received:	Dec. 17, 2018

We hereby certify that:
The above equipment was tested by SGS Taiwan Ltd., Electronics & Communication Laboratory for compliance with the requirements set forth in the Australian/New Zealand Standard AS/NZS 4268:2017. Test report to determine compliance with AS/NZS 4268 requirements. The results of testing in this report apply to the product system that was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By: Vito Pei
Vito Pei / Sr. Engineer

Approved By: CHUN-CHIEH, CHEN
Chun Chieh Chen / Asst. Supervisor

Testing Laboratory
0513

EMC TEST REPORT

Based on SGS EMC Test Report No.: MH/2018/C0095

Applicant	:	**Raytac Corporation**
Address	:	**5F., No.3, Jiankang Road, Zhonghe District, New Taipei City 23586, Taiwan**
Manufacturer	:	**Raytac Corporation**
Address	:	**5F., No.3, Jiankang Road, Zhonghe District, New Taipei City 23586, Taiwan**

Equipment Under Test (EUT) :

Name	:	**Bluetooth Low Energy & IEEE 802.15.4 Combo Dongle**
Brand Name	:	**Raytac**
Model No.	:	**MDBT50Q-RX**
Added Model(s)	:	**N/A**

Standard : AS/NZS CISPR 32 : 2015

Date of Receipt : **Feb. 15, 2019**
Date of Test : **Dec. 17 ~ 26, 2018**
Date of Issue : **Feb. 19, 2019**

Test Result :	**PASS**

In the configuration tested, the EUT complied with the standards specified above.

Remarks :

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS Taiwan Electronics & Communication Laboratory or testing done by SGS Taiwan Electronics & Communication Laboratory in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Electronics & Communication Laboratory in writing.

Tested By: Lowka Chen ***Date*** **Feb. 19, 2019**

Lowca Chen (Engineer)

Approved By Eddy Cheng ***Date*** **Feb. 19, 2019**

Eddy Cheng (Asst.Supervisor)

12.7. 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 A	Raytac Corporation
TYPE OF EQUIPMENT GENRE DE MATÉRIEL	Bluetooth device Spread Spectrum/Digital Device (2400-2483.5 MHz)
TRADE NAME AND MODEL MARQUE ET MODELE	Raytac / MDBT50Q Raytac / MDBT50Q-1M Raytac / MDBT50Q-P1M
CERTIFIED TO CERTIFIÉ SELON LE	SPECIFICATION CAHIER DES CHARGES

RSS-102 RSS-247	ISSUE EDITION	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 ISED 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 ISED. 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 ISED.

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 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 30 Jul 2018 BY

Ramy Nabod
Product Assessor

This certificate has one annex.

RvA PRODUCTS RvA C 224

12.8. 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：五年
Validity

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

2021 年 03 月 01 日
Year Month Date

12.9. KC Certificate (South Korea)

2CC6-E6D4-B6AA-9E64

방송통신기자재등의 적합인증서

Certificate of Broadcasting and Communication Equipments

상호 또는 성명 *Trade Name or Applicant*	Raytac Corporation
기자재명칭(명칭) *Equipment Name*	특정소출력 무선기기(무선데이터통신시스템용 무선기기)
기본모델명 *Basic Model Number*	MDBT50Q-U
파생모델명 *Series Model Number*	MDBT50Q, MDBT50Q-P
인증번호 *Certification No.*	R-C-ryt-MDBT50Q
제조자/제조국가 *Manufacturer/ Country of Origin*	Raytac Corporation / 대만
인증연월일 *Date of Certification*	2018-08-17
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.

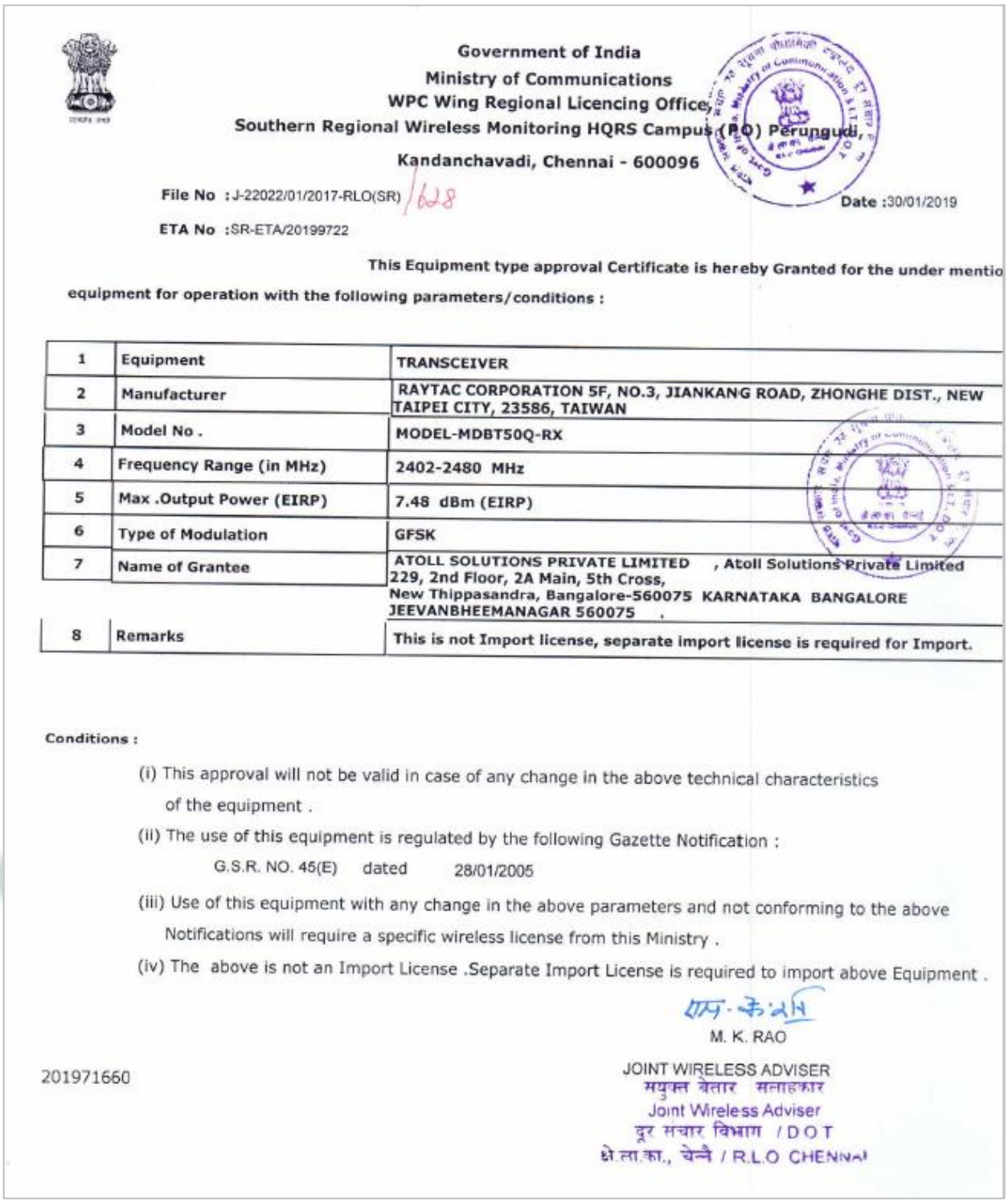
2018년(Year) 08월(Month) 17일(Day)

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.

12.10. WPC (India) Certificate



Government of India
Ministry of Communications
WPC Wing Regional Licencing Office,
Southern Regional Wireless Monitoring HQRS Campus (PO) Perungudi,
Kandanchavadi, Chennai - 600096

File No : J-22022/01/2017-RLO(SR) /628 Date : 30/01/2019

ETA No : SR-ETA/20199722

This Equipment type approval Certificate is hereby Granted for the under mentio equipment for operation with the following parameters/conditions :

1	Equipment	TRANSCEIVER
2	Manufacturer	RAYTAC CORPORATION 5F, NO.3, JIANKANG ROAD, ZHONGHE DIST., NEW TAIPEI CITY, 23586, TAIWAN
3	Model No .	MODEL-MDBT50Q-RX
4	Frequency Range (in MHz)	2402-2480 MHz
5	Max .Output Power (EIRP)	7.48 dBm (EIRP)
6	Type of Modulation	GFSK
7	Name of Grantee	ATOLL SOLUTIONS PRIVATE LIMITED , Atoll Solutions Private Limited 229, 2nd Floor, 2A Main, 5th Cross, New Thippasandra, Bangalore-560075 KARNATAKA BANGALORE JEEVANBHEEMANAGAR 560075 .
8	Remarks	This is not Import license, separate import license is required for Import.

Conditions :

(i) This approval will not be valid in case of any change in the above technical characteristics of the equipment .

(ii) The use of this equipment is regulated by the following Gazette Notification :

G.S.R. NO. 45(E) dated 28/01/2005

(iii) Use of this equipment with any change in the above parameters and not conforming to the above Notifications will require a specific wireless license from this Ministry .

(iv) The above is not an Import License .Separate Import License is required to import above Equipment .

M. K. RAO

JOINT WIRELESS ADVISER
संयुक्त बेतार सलाहकार
Joint Wireless Adviser
दूर संचार विभाग / D O T
क्षे.ला.का., चेन्नै / R.L.O CHENNAI

201971660

12.11. RoHS & REACH Report

Please visit "Support" page of our website to download.

13. Notes and Cautions

Dongle is not designed to last for a lifetime. Like general 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℃ to +75℃ 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.

14. 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 *Full List of Raytac's BLE Modules* 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

15. 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.

16. USB Driver for Windows

Please check "Support" page of our website to download.

History of Firmware Revision

FW Ver.	Compatible HW Build	Release Date	Description of Revision	Note
1.0		2019/03/22	1st release.	99-52840-05A

Full List of Raytac's BLE Modules

● 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

● MDBT42Q Series (QFN Package IC)

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

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		

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		

MDBT50Q Series (aQFN Package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT50Q	nRF52840	MDBT50Q-1MV2	2	Chip Antenna	256 kb	1 MB
	nRF52833	MDBT50Q-512K	1		128 kb	512 kb
MDBT50Q-P	nRF52840	MDBT50Q-P1MV2	2	PCB Antenna	256 kb	1 MB
	nRF52833	MDBT50Q-P512K	1		128 kb	512 kb
MDBT50Q-U	nRF52840	MDBT50Q-U1MV2	2	u.FL Connector	256 kb	1 MB
	nRF52833	MDBT50Q-U512K	1		128 kb	512 kb

MDBT50 Series (QFN Package IC)

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

Release Note

- 2019/03/22: 1ST release.

- 2020/06/22: Version B

  (1) Refined description in Chapter 3: How to Control USB Dongle.

  (2) Updated CE reports to EN300.328 V2.2.2 & EN62368-1 in Chapter 12: Certification.

  (3) Updated information in Chapter 14: Basic Facts for nRF52 Chips and Full List of Raytac's BLE Modules.

- 2021/08/04 Version C

  (1) Refined description in section 1 of Chapter 3: How to Send AT Commands.

  (2) Updated Chapter 5: Specification corresponding to Nordic's new nRF52840 Product Specification V1.2

  (3) Added new label info with UKCA info in Chapter 7: Shipment Packaging Information.

  (4) Added BT 5.2 SIG approval and updated NCC, SRRC certificate in Chapter 12: Certification.

  (5) Updated table in Chapter 14: Basic Facts for nRF52 Family.

  (6) Updated Full List of Raytac's BLE Modules.