

Data Sheet

(規格書)

產品名稱 (Product)	<u>Low-Power Wi-Fi Module</u>
解決方案 (Solution)	<u>Nordic nRF7002 QFN Package</u>
產品型號 (Model No.)	<u>AN7002Q – U (u.FL Antenna)</u>
產品料號 (Part No.)	<u>see 4.3 Order code</u>

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1. Overall introduction

Raytac's AN7002Q family consists of low-power Wi-Fi 6 modules based on Nordic's nRF7002 companion solution, supporting dual-band at 2.4 GHz and 5 GHz. The antenna port is single-ended 50 Ω, supporting 20 MHz channel bandwidth, 1x1 Single-Input Single-Output (SISO) operation, and a PHY data rate of 86 Mbps (MCS7).

The AN7002Q family is designed to interface with a System on Chip (SoC), Microprocessor Unit (MPU), or Microcontroller Unit (MCU). These modules are fully compatible with IEEE 802.11ax (Wi-Fi 6), as well as legacy standards including IEEE 802.11 a/b/g/n/ac.

Optimized for IoT applications, the AN7002Q modules are ideal for integrating modern Wi-Fi 6 functionality to platforms based on Bluetooth® Low Energy, Thread®, Zigbee®, or Matter, especially when used alongside Raytac's MDBT53 family modules. Communication with the host SoC or MCU is achieved via Serial Peripheral Interface (SPI) or Quad SPI (QSPI), with optional encryption.

The AN7002Q modules have a highly configurable coexistence hardware to help mitigate interference between WLAN and Bluetooth LE/IEEE 802.15.4 devices (Thread, Zigbee).

The coexistence hardware enables flexible output signals that support through a dedicated 3-wire or 4-wire coexistence interface. The modules support multiple operating modes, including Station and Wi-Fi Direct. They also support Software-Enabled Access Point (Soft AP) functionality (Wi-Fi 4 only), as well as concurrent Station + Soft AP or Wi-Fi Direct + Station operation.

1.1. Features

1. Wi-Fi® 6 companion IC with integrated RF.
2. Supports IEEE 802.11 ax and earlier standards (IEEE 802.11 a/b/g/n/ac).
3. Supports Target Wake Time (TWT), Orthogonal Frequency Division Multiple Access (OFDMA), Basic Service Set (BSS) Coloring.
4. Supports Wi-Fi CERTIFIED 6™, Wi-Fi CERTIFIED™, Wi-Fi Enhanced Open™.
5. Supports WPA3™, WPA2™, WPA™ (Personal and Enterprise), Protected Management Frames.
6. Supports WMM®, WMM - Power Save, Wi-Fi Agile Multiband™, Wi-Fi Direct®
7. Dual-band operation at 2.4 GHz and 5 GHz with 1x1 Single -Input-Sigle-Output (SISO).
8. 3-wire or 4-wire coexistence interface, compatible with Raytac MDBT53 series modules.

1.2. Application

- Internet of Things (IoT)
- Smart Home application
- Gateways and Border Routers
- Industrial IoT sensors and controllers
- Sports and Fitness sensor and monitor devices
- Wireless payment enabled devices
- Health monitor devices
- Wi-Fi positioning based on SSID scanning

1.3. General parameters

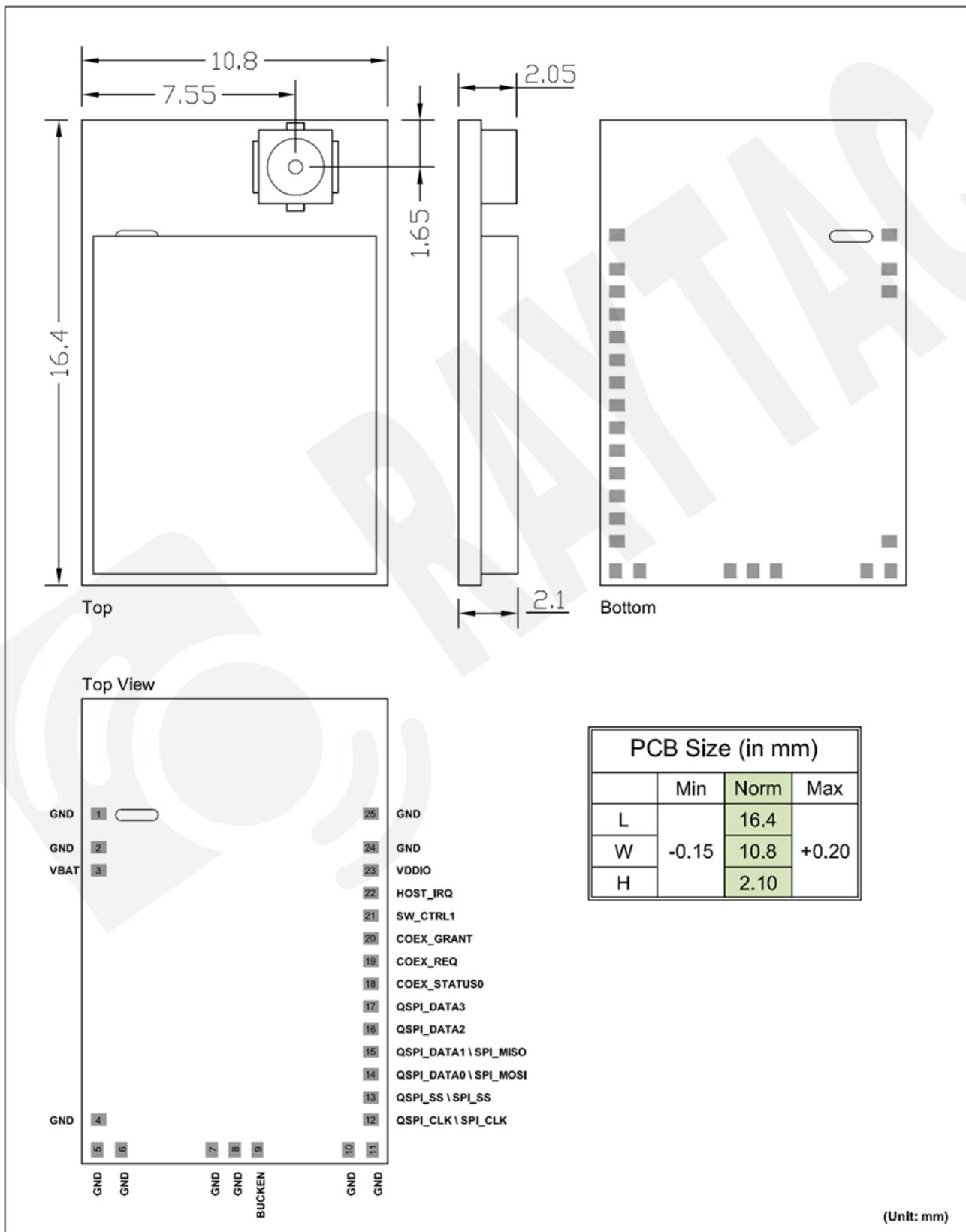
Model name	AN7002Q-P	AN7002Q	AN7002Q-U
Dimension (L x W x H)	17.1 x 10.8 x 2.1 mm	17.1 x 10.8 x 2.1mm	16.4 x 10.8 x 2.1mm
Weight (g)	0.78 (± 0.02 g)	0.79 (± 0.02 g)	0.85 (± 0.02 g)
Interface	SPI / QSPI		
Supply voltage	2.9V to 4.5V		
Operating temperature	-40 to +85°C		
Support antenna	1 x 1 (SISO)		
RF channels	2.4G	Ch1-Ch14*	
	5G	Ch36/40/44/48/52/56/60/64 Ch100/104/108/112/116/120/124/128/132/136/140/144 Ch149/153/157/161/165/169/173/177	
IEEE WLAN Standard	IEEE 802.11 a/b/g/n/ac/ax		

* **Channel 14 is only available for use in Japan, and it only supports the IEEE 802.11b standard (DSSS modulation).**

2. Product dimension

2.1. PCB dimensions & pin indication

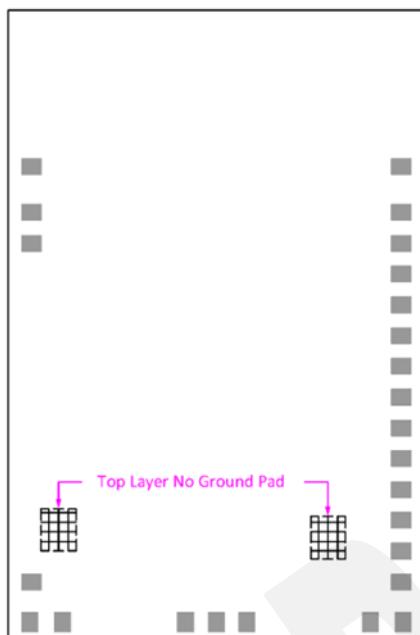
- **AN7002Q-U**



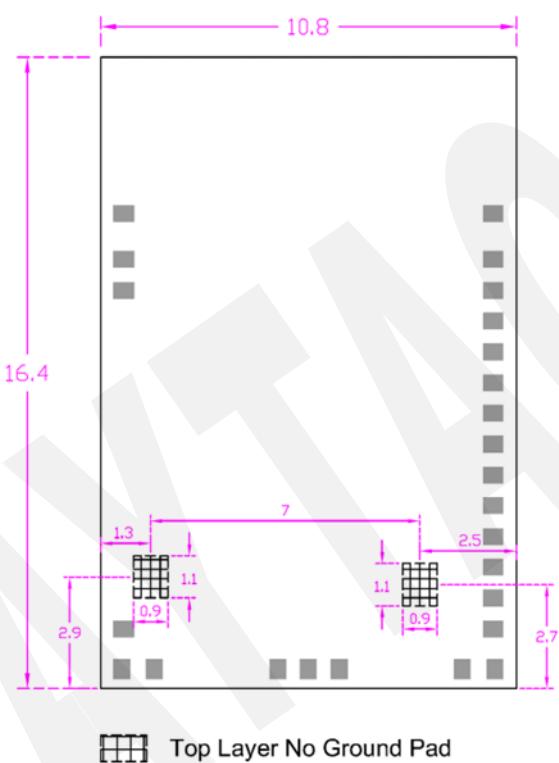
2.2. Recommended layout of solder pad

Graphs are all in Top View, Unit in mm.

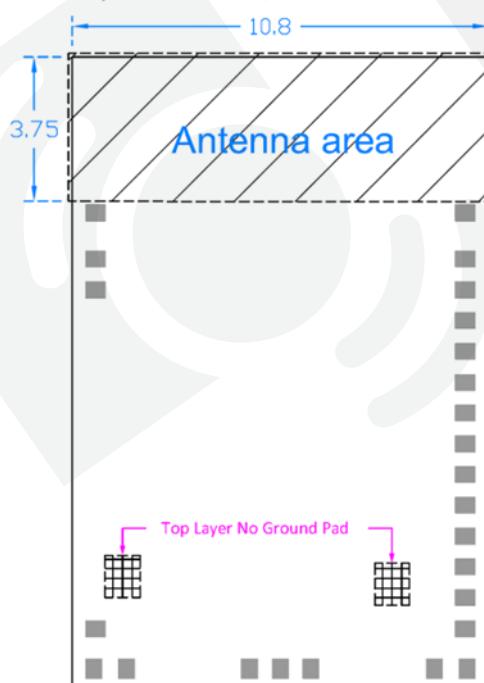
Top View



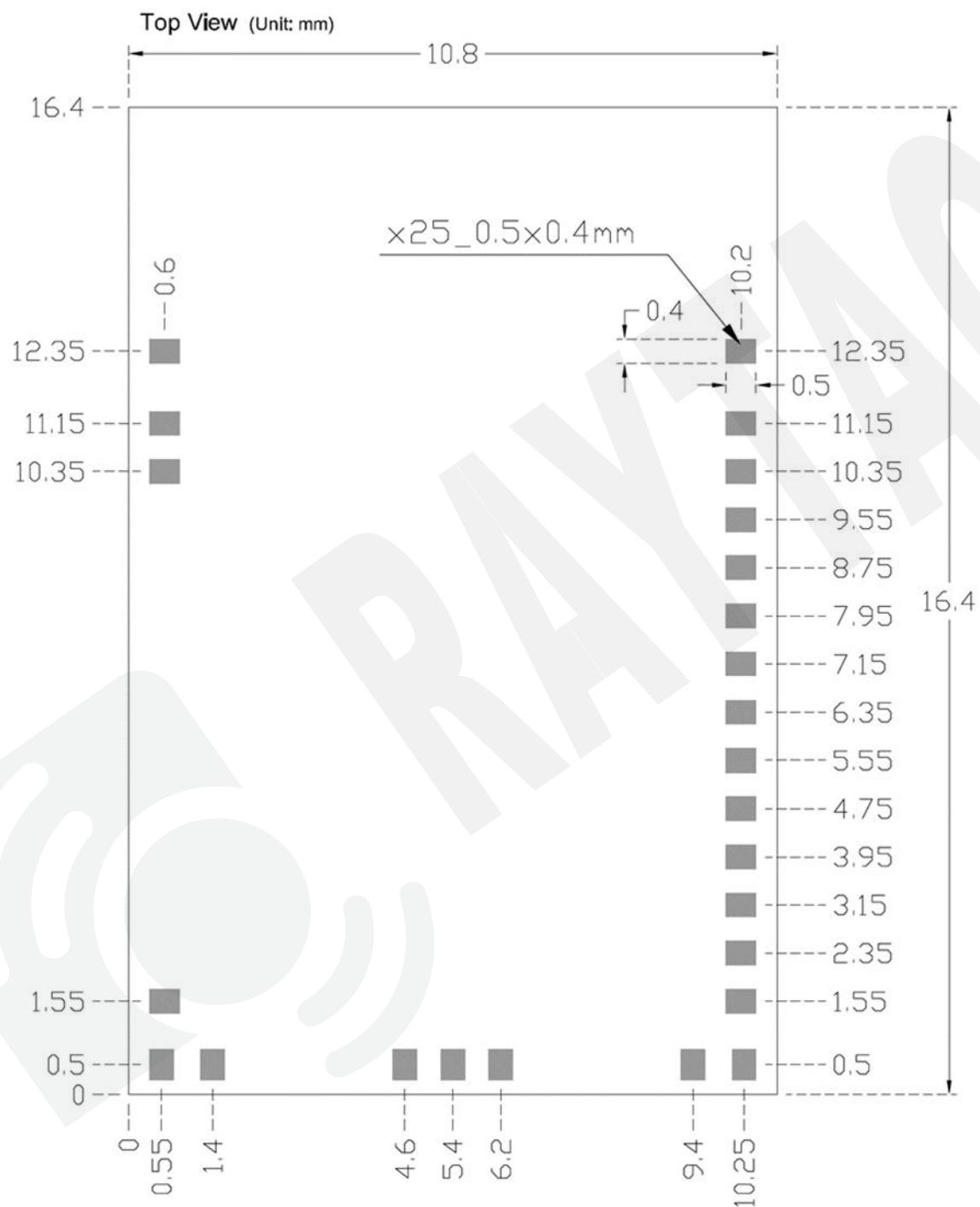
Top View (Unit: mm)



Top View (Unit: mm)



Antenna area



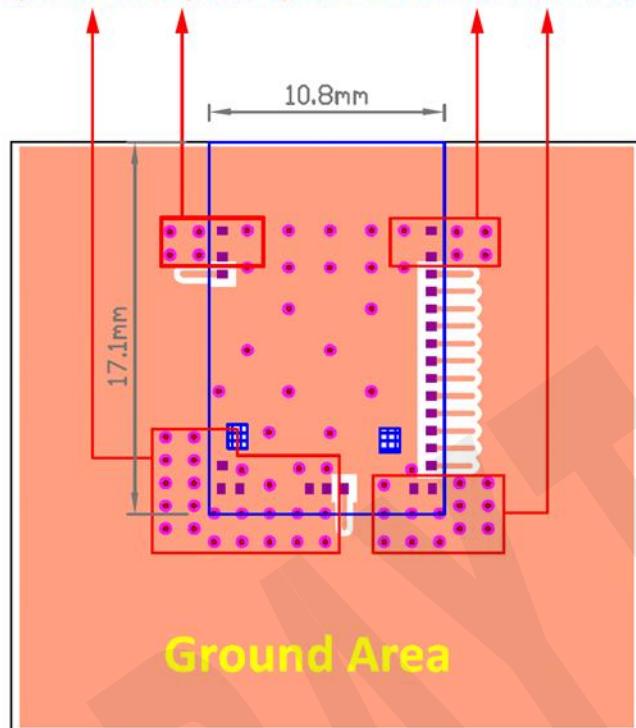
2.3. RF Layout Guidelines (Antenna Keep-Out Area)

Please ensure that no ground pad overlaps the “No Ground-Pad Area”, as shown in the images below. This is important to maintain antenna performance and to prevent potential short circuits within the module.

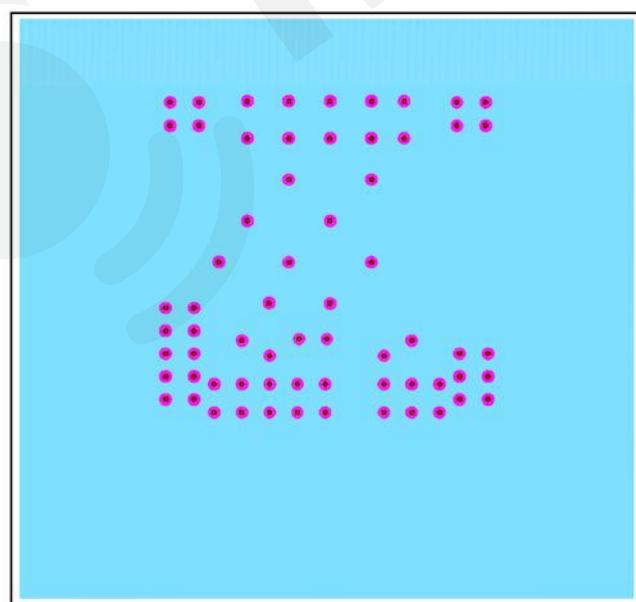
You are welcome to send us your design files for review at sales@raytac.com or to your Raytac contact with email subject titled: “Layout Review – Raytac Model No. – Your company name”.



Please add via holes in GROUND area as many as possible, especially around the four corners.



Top View

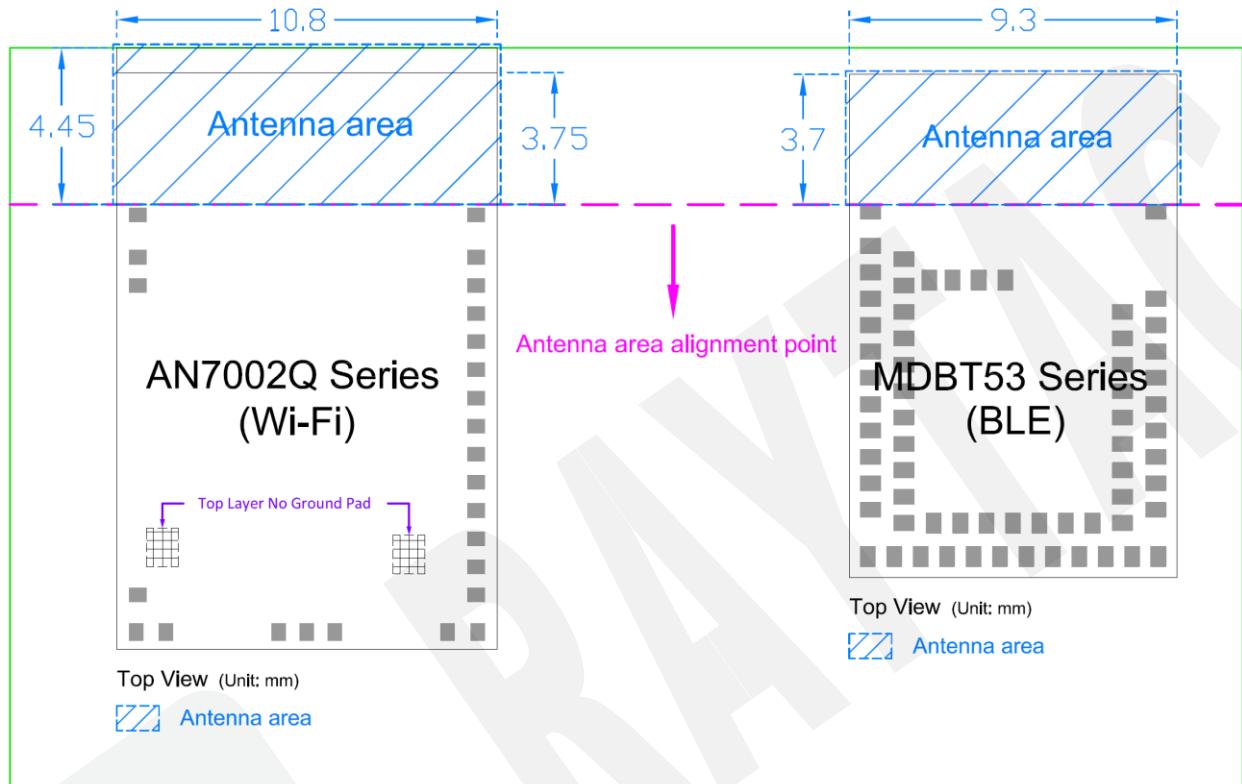


Perspective View

2.4. Module Placement Guideline

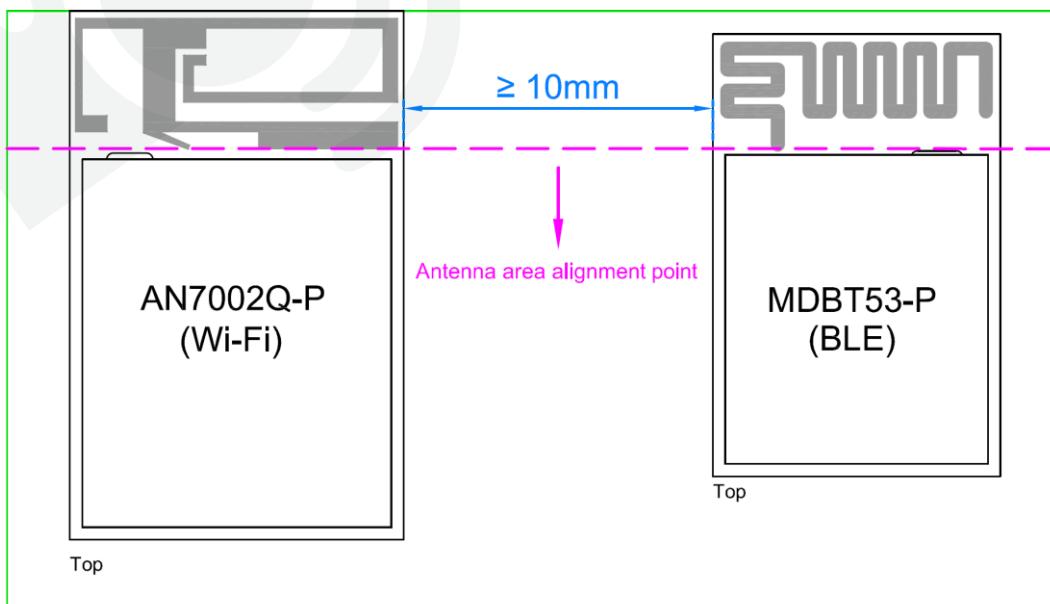
2.4.1. Module placement alignment point (Applicable to all modules)

Please align the antenna zones of both modules based on the Module Placement Alignment Point.



2.4.2. AN7002Q-P and MDBT53-P (Top view left side)

AN7002Q-P (Wi-Fi) and MDBT53-P (BLE) with antenna areas spaced ≥ 5 mm apart.



2.5. Footprint & Drawing

Please visit "[Support](#)" page of our website to download. The package includes footprint, 2D/3D drawing, and reflow graph/solder profile.

2.6. Pin assignment

Pin No.	Name	Pin Function	Description
(1) (2) (4) (5)			
(6) (7) (8) (10)	GND	Power	Ground
(11) (24) (25)			
(3)	VBAT	Power	
(9)	BUCKEN	Digital I/O	PWR IP enable pin
(12)	QSPI_CLK	Digital I/O	QSIP Clock
	SPI_CLK	Digital I/O	SIP Clock
(13)	QSPI_SS	Digital I/O	QSIP Slave select
	SPI_SS	Digital I/O	SIP Slave select
(14)	QSPI_DATD0	Digital I/O	QSIP data
	SPI_MOSI	Digital I/O	SIP data
(15)	QSPI_DATD1	Digital I/O	QSIP data
	SPI_MISO	Digital I/O	SIP data
(16)	QSPI_DATD2	Digital I/O	QSIP data
(17)	QSPI_DATD3	Debug	QSIP data
(18)	COEX_STATUS0	Digital I/O	Coex interface
(19)	COEX_REQ	Reset	Coex interface
(20)	COEX_GRANT	Digital I/O	Coex interface
(21)	SW_CTRL1	Digital I/O	External switch control (4 wire coex interface)
(22)	HOST_IRQ	Digital I/O	Host processor interrupt request
(23)	VDDIO	GND	I/O Power level

3. Main chip solution

RF IC	Crystal Frequency
Nordic NRF7002 / QFN	40MHz

The 40MHz crystal is already integrated into the module.



4. Shipment packaging information

Model	Antenna	Photo
AN7002Q-P	PCB antenna	
AN7002Q	Chip antenna	
AN7002Q-U	u.FL Connector	

- Unit weight of module:

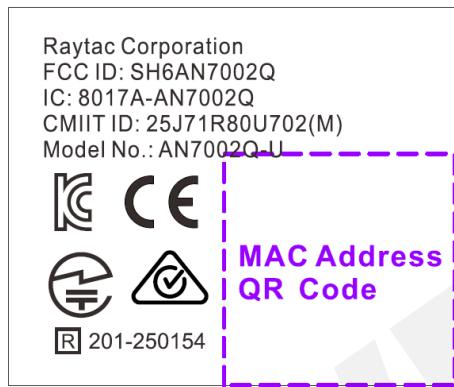
AN7002Q : 0.79 g (± 0.02 g) ; AN7002Q-P : 0.78 g (± 0.02 g) ; AN7002Q-U : 0.85 g (± 0.02 g) ;

- Packaging type: Anti-static Tray

Tray	
MPQ (Min. Package Q'ty)	88 pcs per tray
Carton Contents (per carton)	1,760 pcs
Carton Dimension (L) x (W) x (H) cm	37 x 21 x 13
Gross Weight	about 3.2 kgs

4.1. Marking on metal shield

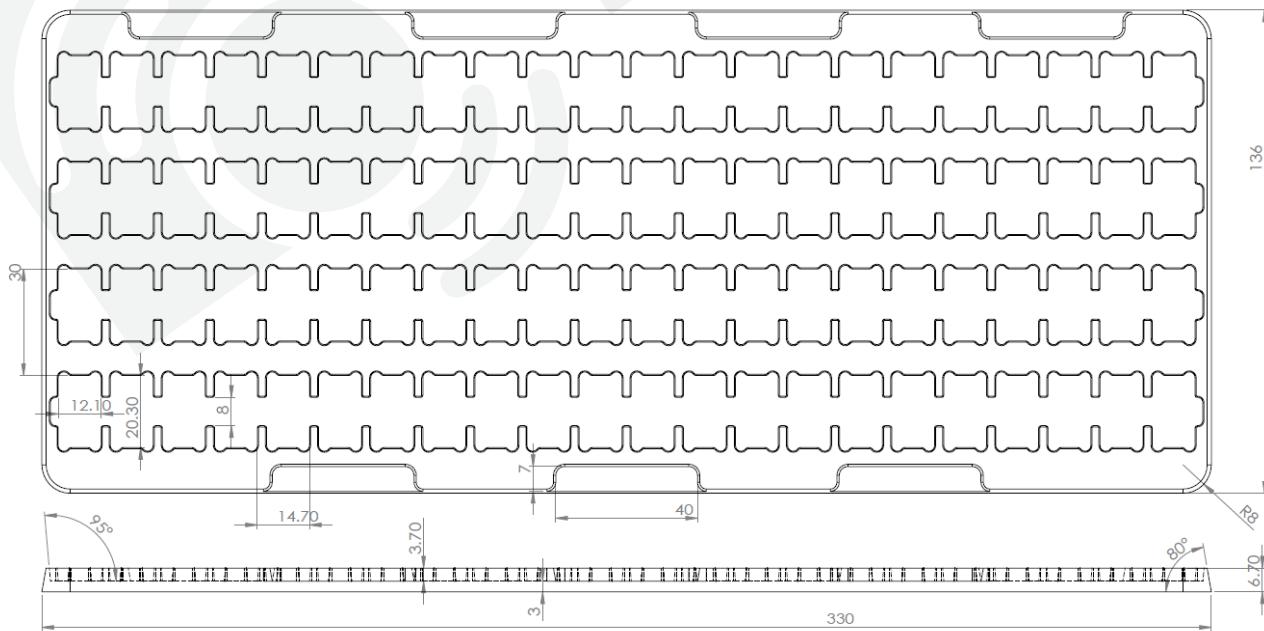
The purple area shown in the image below indicates the location where the Wi-Fi MAC address label will be applied, but only for modules programmed with the MAC address via Raytac's programming service. For modules not using this service, the area will remain blank.



4.2. Packaging Info

4.2.1. Tray Packaging

Anti-static tray is specifically designed for mass production. It can be used directly on SMT automatic machine.



4.3. Order code

Each model has two options for packaging. Please use the following part no. when placing orders with us.

Model	Tray
AN7002Q- P (without MAC pre-loaded)	WD-500A1-001
AN7002Q- P (with MAC pre-loaded)	WD-500A1-002
AN7002Q (without MAC pre-loaded)	WD-500A1-003
AN7002Q (with MAC pre-loaded)	WD-500A1-004
AN7002Q- U (without MAC pre-loaded)	WD-500A1-005
AN7002Q- U (with MAC pre-loaded)	WD-500A1-006

Tray packaging MPQ: 88 pcs.

5. Specification

Any technical spec shall refer to Nordic's official documents as final reference. Contents below are from "[nRF7002 Product Specification v1.2](#)", please click to download full spec.

5.1. Absolute maximum ratings

	Min.	Max.	Unit
Supply voltages			
VBAT	-0.3	4.5	V
IOVDD	-0.3	3.6	V
I/O pin voltage			
$V_{I/O}$, $IOVDD \leq 3.3$ V	-0.3	$IOVDD + 0.3$	V
$V_{I/O}$, $IOVDD > 3.3$ V	-0.3	3.6	V
BUCKEN	-0.3	$VBAT + 0.3$	V
Radio			
RF input level		-10	dBm
Environmental QFN package			
Storage temperature	-40	125	°C
Moisture Sensitivity Level (MSL)		2	
ESD Human Body Model (HBM)		750	V
ESD Charged Device Model (CDM)		1000	V

5.2. Recommended operating conditions

Symbol	Parameter	Min.	Nom.	Max.	Units
VBAT	VDD supply voltage	2.9	3.6	4.5	V
IOVDD	VDD supply voltage for IO pins	1.62	1.8	3.6	V
OTPVDD	VDD supply voltage for OTP memory (read mode)	1.62	1.8	1.98	V
OTPVDD	VDD supply voltage for OTP memory (write mode)	2.25	2.5	2.75	V
TA	Operating temperature	-40	25	85	°C

5.3. Electrical specifications

5.3.1. General characteristics

Symbol	Parameter	Min.	Nom.	Max.	Units	Note
$f_{OP,2.4GHz}$	Operating frequencies 2.4 GHz	2401	2495		MHz	
$f_{OP,5GHz}$	Operating frequencies 5 GHz	5170	5330		MHz	U-NII-1/U-NII-2A sub-bands
		5490	5730			U-NII-2C sub-band
		5735	5895			U-NII-3/U-NII-4 sub-bands
$f_{MOD,MIN}$	Minimum modulation rate		1DSSS 6 Mbps			2.4 GHz 5 GHz
$f_{MOD,MAX}$	Maximum modulation rate		MCS7			
f_{TOL}	Crystal frequency tolerance at 25°C ¹		20		ppm	
$f_{STA,TEMP}$	Crystal frequency stability over temperature and aging		13		ppm	
$C_{L,XO}$	XO load capacitance	8			pF	
ESR_{XO}	Equivalent Series Resistance		100		ohm	
$t_{SHUTDOWN \rightarrow ACTIVE}$	Startup time from shutdown state	400		ms		Depends on patch size and interface speed
$t_{SLEEP \rightarrow ACTIVE}$	Startup time from sleep state	6.7		ms		

5.3.2. Electric current consumption

Symbol	Parameter	Min.	Nom.	Max.	Units	Note
$I_{RX,2.4GHz}$	Receive current listen (2.4 GHz)	60			mA	
$I_{RX,5GHz}$	Receive current listen (5 GHz)	56			mA	
$I_{2.4GHz,DTIM1}$	Average current consumption (2.4GHz,DTIM=1, beacon duration 3.8 ms)	3.47			mA	
$I_{2.4GHz,DTIM3}$	Average current consumption (2.4GHz,DTIM=3, beacon duration 3.8 ms)	1.12			mA	
$I_{2.4GHz,DTIM10}$	Average current consumption (2.4GHz,DTIM=10, beacon duration 3.8 ms)	0.34			mA	
$I_{5GHz,DTIM1}$	Average current consumption (5GHz,DTIM=1, beacon duration 0.7 ms)	1.70			mA	
$I_{5GHz,DTIM3}$	Average current consumption (5GHz,DTIM=3, beacon duration 0.7 ms)	0.56			mA	
$I_{5GHz,DTIM10}$	Average current consumption (5GHz,DTIM=10, beacon duration 0.7 ms)	0.19			mA	
$I_{2.4GHz,TWT,1\ min}$	Average current consumption (2.4GHz, TWT, target wake interval 1 min) ²	29.5			uA	
$I_{2.4GHz,TWT,1\ hour}$	Average current consumption (2.4GHz, TWT, target wake interval 1 hour) ²	18.4			uA	
$I_{2.4GHz,TWT,1\ day}$	Average current consumption (2.4GHz, TWT, target wake interval 1 day) ²	18.2			uA	
$I_{5GHz,TWT,1\ min}$	Average current consumption (5GHz, TWT, target wake interval 1 min) ²	28.9			uA	
$I_{5GHz,TWT,1\ hour}$	Average current consumption (5GHz, TWT, target wake interval 1 hour) ²	18.2			uA	
$I_{5GHz,TWT,1\ day}$	Average current consumption (5GHz, TWT, target wake interval 1 day) ²	18.0			uA	
I_{OFF}	Shutdown current	1.7			μA	
I_{SLEEP}	Sleep current (with RTC)	15			μA	
I_{SCAN}	Average current consumption during scan operation	60			mA	The exact current depends on the number of APs detected during scan. The value quoted aligns with ~100 APs.

² Min wake duration 8.192 ms, transmit packet duration 100 μs.

5.3.3. Receiver characteristics

Symbol	Parameter	Min.	Nom.	Max.	Units	Note
$P_{SENS,2.4GHz,1DSSS}$	Sensitivity 2.4GHz (1 Mbps DSSS)	-98.6			dBm	
$P_{SENS,2.4GHz,11CCK}$	Sensitivity 2.4GHz (11 Mbps CCK)	-90.4			dBm	
$P_{SENS,2.4GHz,6MBPS}$	Sensitivity 2.4GHz (6 Mbps)	-91.6			dBm	
$P_{SENS,2.4GHz,54MBPS}$	Sensitivity 2.4GHz (54 Mbps)	-75.4			dBm	
$P_{SENS,2.4GHz,HT-MCS0}$	Sensitivity 2.4GHz (HT-MCS0)	-90.0			dBm	
$P_{SENS,2.4GHz,HT-MCS7}$	Sensitivity 2.4GHz (HT-MCS7)	-71.5			dBm	
$P_{SENS,5GHz,VHT-MCS0}$	Sensitivity 5.0GHz (VHT-MCS0)	-89.3			dBm	
$P_{SENS,5GHz,VHT-MCS7}$	Sensitivity 5.0GHz (VHT-MCS7)	-71.0			dBm	
$P_{SENS,5GHz,HE-MCS0}$	Sensitivity 5.0GHz (HE-MCS0)	-89.3			dBm	
$P_{SENS,5GHz,HE-MCS7}$	Sensitivity 5.0GHz (HE-MCS7)	-70.6			dBm	

5.3.4. Transmit current consumption

Symbol	Parameter	Min.	Nom.	Max.	Units	Note
$I_{TX,1DSSS,2.4GHz}$	Transmit current (2.4 GHz, 1DSSS, max output power)	252			mA	
$I_{TX,MCS0,2.4GHz}$	Transmit current (2.4 GHz, MCS0, max output power)	187			mA	
$I_{TX,MCS7,2.4GHz}$	Transmit current (2.4 GHz, MCS7, max output power)	191			mA	
$I_{TX,MCS0,5GHz}$	Transmit current (5 GHz, MCS0, max output power)	260			mA	
$I_{TX,MCS7,5GHz}$	Transmit current (5 GHz, MCS7, max output power)	260			mA	

5.3.5. Transmitter characteristics

Symbol	Parameter	Min.	Nom.	Max.	Units	Note
$P_{TXMAX,2.4GHz,DSSS//CCK}$	Maximum transmit power 2.4 GHz (DSSS/CCK)	20			dBm	
$P_{TXMAX,2.4GHz,MCS0}$	Maximum transmit power 2.4 GHz (6 Mbps/HT-MCS0/HE-MCS0)	15			dBm	
$P_{TXMAX,2.4GHz,MCS7}$	Maximum transmit power 2.4 GHz (54 Mbps/HT-MCS7/HE-MCS7)	15			dBm	
$P_{TXMAX,5GHz,MCS0}$	Maximum transmit power 5 GHz (6 Mbps/HT-MCS0/VHT-MCS0/HE-MCS0)	13			dBm	
$P_{TXMAX,5GHz,MCS7}$	Maximum transmit power 5 GHz (54 Mbps/HT-MCS7/VHT-MCS7/HE-MCS7)	13			dBm	

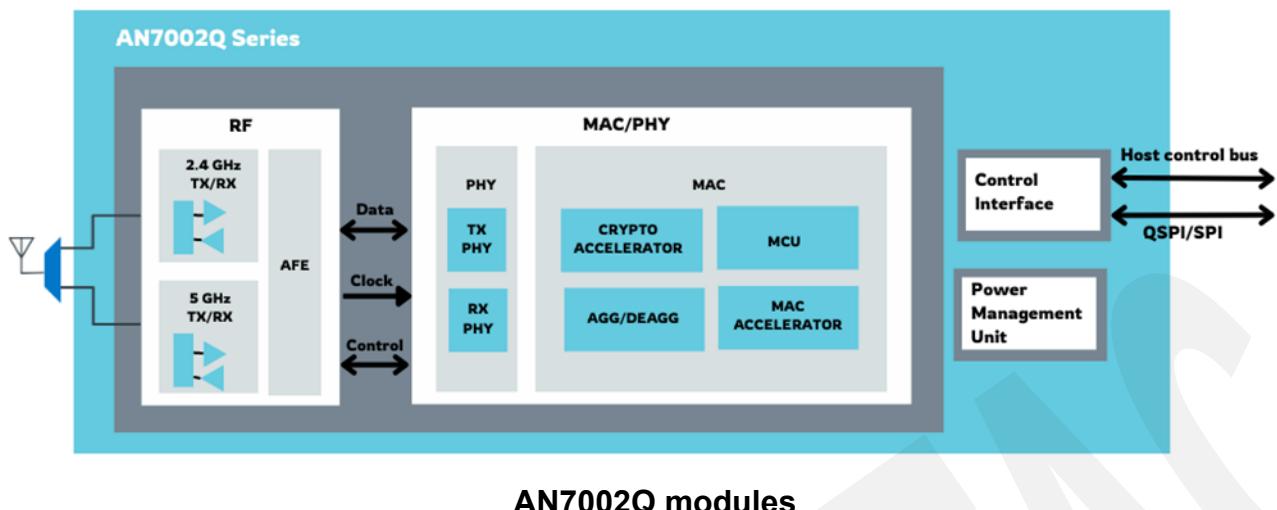
5.3.6. Transmitter power variation over temperature

Frequency band	-40C<TA<=-20C	-20C<TA<=0C	0C<TA<=60C	60C<TA<=85C
2.4GHz	0dB	0dB	0dB	-1dB
5GHz	-2dB	-1dB	0dB	-2dB

5.3.7. Transmitter power variation over supply voltage

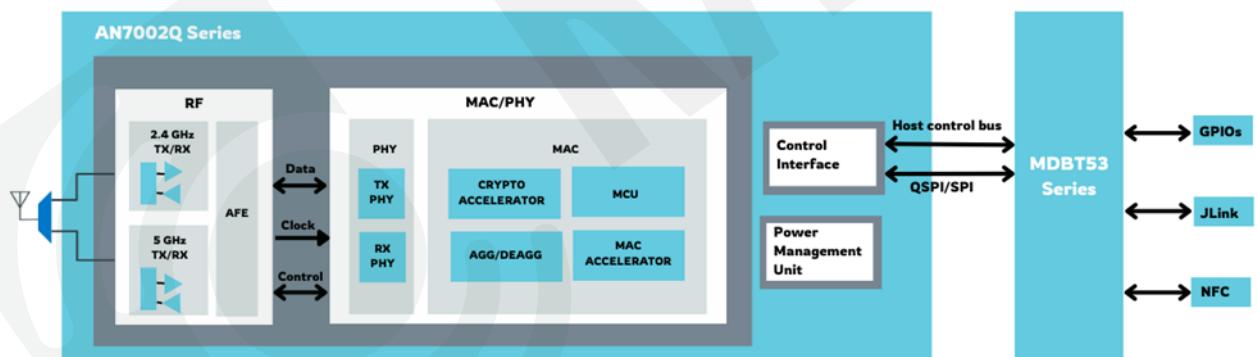
Frequency band	2.9V<VBAT<=3.1V	3.1V<VBAT<=3.4V	3.4V<VBAT<=4.5V
2.4GHz	-1dB	0dB	0dB
5GHz	-2dB	-1dB	0dB

6. Block diagram



AN7002Q modules

This is a block diagram using MDBT53 (nRF5340) module as host MCU paired with AN7002Q(Wi-Fi module).



AN7002Q family modules are companion alongside MDBT53 module

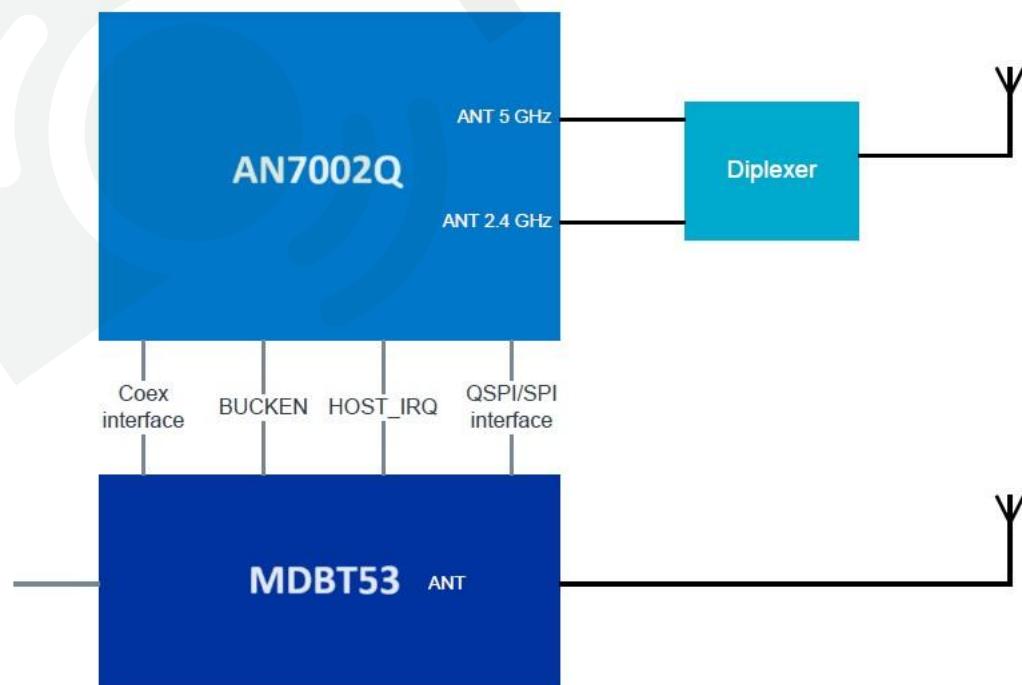
7. Host connection

AN7002Q is a wireless companion device that is connected to a host MCU or application processor. It is connected to the host through a QSPI (6-wire) or SPI (4-wire) for data and a 3-wire or 4-wire coexistence control interface for hosts that include a Bluetooth LE/IEEE 802.15.4 radio. In addition, two lines (HOST_IRQ and BUCKEN) are required. The user application executes on the host MCU.

The following figure shows a system with AN7002Q and a host MCU.



AN7002Q is designed to support radio coexistence and can be used together with another nRF Series device. The following figure shows AN7002Q together with Raytac MDBT53 series to achieve a combined Bluetooth LE and Wi-Fi solution. nRF5340 functions as a host and common interface to the wireless system.



8. Power and clock management

The power and clock management system in AN7002Q is optimized for ultra-low power applications to ensure maximum power efficiency.

8.1. Power states

AN7002Q series has three power states: Shutdown, Sleep, and Active.

- **Shutdown**

A fully inactive state where no state information is retained except for the contents of the *One Time Programmable (OTP) memory*. AN7002Q will only respond to a BUCKEN assertion (input to *Power Management Unit (PMU)*).

The following conditions occur during Shutdown state:

- PMU: Off
- Analog circuits: All circuits off
- Baseband logic and scratch RAMs: Off
- Retention RAMs: Off
- SPI/QSPI: Off

- **Sleep**

A low-power state where state information is retained and transitioning to Active state can occur rapidly. The device may be in the Sleep state during both pre-association (device idle waiting for host command) and post-association period as part of the Wi-Fi Power Save mode (that is, maintain association with an Access Point but without data traffic). In this state, the device is clocked through the internal 32KHz RC oscillator (Real-time Clock (RTC)), and can be awakened through the host interface or the internal sleep timer expiry.

The following conditions occur during Sleep state:

- PMU: Low-power mode (Pulse-Frequency Modulation (PFM))
- Analog circuits: RTC active, register state retained. All other circuits are powered down.
- Baseband logic and scratch RAMs: Off
- Retention RAMs: Off
- SPI/QSPI: On

- **Active**

In the Active state, the device will be in one of the Active sub-states: Transmit, Receive, or Idle. The high frequency crystal oscillator derived clocks are active and the appropriate RF section components are enabled as required. The Idle sub-state is a short-term transitory state used when Receive is not required, but Sleep cannot be exploited (for example, upon early termination of an RX packet).

The following conditions occur during Active state:

- PMU: High-power mode (*Pulse-Width Modulation (PWM)*)
- Analog circuits: All circuits powered (including crystal oscillator). The circuits are enabled according to Active sub-state (TX, RX, or IDLE)
- Baseband logic and scratch RAMs: On
- Retention RAMs: Active
- SPI/QSPI: On

8.2. Power state operation

Apart from transitions in or out of Shutdown state through the BUCKEN pin, all transitions between Sleep and Active states are automatic and do not rely on any control pin assertion or de-assertion.

Shutdown state is achieved by de-assertion on the BUCKEN pin. Asserting BUCKEN will result in the Active (IDLE sub-state) state being entered. The host will initiate the boot sequence through SPI/QSPI, culminating in the Sleep state being entered. This is the lowest power non-Shutdown state that can be achieved. Transitions from Active to Sleep are fully controlled by AN7002Q. Transitions from Sleep to Active are determined by both the host and AN7002Q. In a pre-association condition, Sleep is entered opportunistically whenever there is no activity initiated from the host (for example, a scan request). In a post-association condition, Sleep opportunities are determined by the negotiated Power Save mode of the Access Point. No host interactions are required to enter Sleep, while the host invokes a transition from Sleep to Active as part of any SPI/QSPI command transaction.

1. Switch the Power Management Unit (PMU) to high power mode (PWM).
2. Apply power to the digital logic, RAMs, and analog circuits.
3. Start the 40 MHz crystal oscillator and allow it to settle.
4. Start the baseband PLL and allow it to settle.

5. Boot all processor cores.
6. Execute baseband initializations.
7. Execute RF initializations and calibrations.

The initial steps consume equal duration whether originating in Shutdown or Sleep, while the baseband and RF initializations are dependent on the originating state. In particular: Full baseband initializations are required from Shutdown (including transferring the Factory Information Configuration Registers (FICR) information from OTP memory into retention RAM), while in Sleep some of the state is retained in retention RAMs.

- Full baseband initializations are required from Shutdown (including transferring the Factory Information Configuration Registers (FICR) information from OTP memory into retention RAM), while in Sleep some of the state is retained in retention RAMs.
- Complete RF calibrations are required from Shutdown, including across channels to support scanning. From Sleep, only minimal initialization or calibration on the operating channel is required.

See Electrical specification on page 34 for timing information.

8.3. Clock accuracy considerations

The crystal oscillator is active during normal operation, and is the clock reference for the RF synthesizer, the Analog-to-Digital Converter (ADC)/Digital-to-Analog Converter (DAC) sample clocks, and the baseband logic. The RTC is active during sleep state, and is used to run the wakeup timer used as part of Wi-Fi Power Save. The crystal oscillator is inactive during sleep.

The IEEE 802.11 specification defines the accuracy of the Wi-Fi carrier frequency to be within ± 20 ppm (in 5 GHz), which in turn defines the required accuracy of the external crystal. There is a provision to trim the crystal oscillator through a value programmed into the OTP memory on the AN7002Q device (or any other available non-volatile memory). This trimming will compensate for the combined frequency offset resulting from the crystal itself as well as any crystal oscillator variation at room temperature. The crystal and crystal oscillator will both exhibit frequency drift across temperature, and the crystal will also be subject to aging. The combination of these temperature and aging effects, along with the trimming accuracy, will consume the majority of the ± 20 ppm allowance, assuming a crystal with ± 10 ppm stability over temperature. The crystal tolerance (that is, accuracy at room temperature) is less important since this will be trimmed out by the crystal oscillator trim function (up to ± 20 ppm). The crystal oscillator/crystal is typically trimmed by transmitting Wi-Fi packets through the antenna connector and using a Vector Signal Analyzer (VSA) to

measure the frequency offset. Alternatively, a generic spectrum analyzer can be used to measure the frequency offset on a transmitted Carrier Wave (CW).

The RTC is automatically calibrated against the trimmed 40 MHz crystal oscillator reference at runtime, and as such nothing needs to be done on the production line. During sleep, the RTC clocked wakeup timer is used to time wakeup intervals (since the last Delivery Traffic Indication Message (DTIM) beacon in regular Wi-Fi Power Save), and as such any residual inaccuracy is not accumulated.

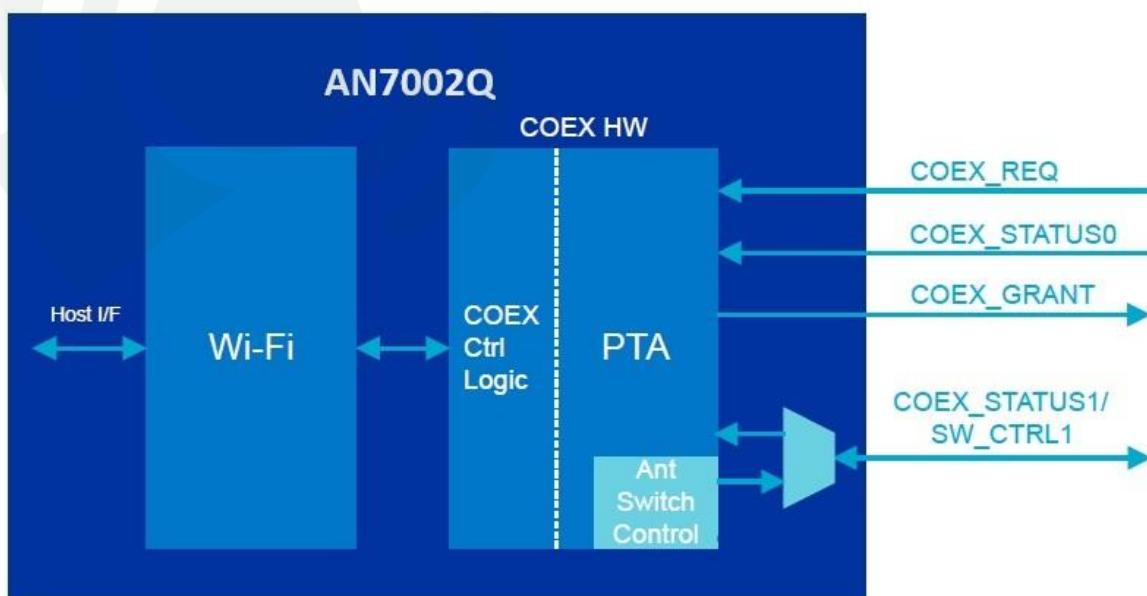
9. Coexistence

AN7002Q Series devices have a highly configurable coexistence hardware to help mitigate interference between WLAN and Bluetooth LE/IEEE 802.15.4 devices (Thread, Zigbee).

A Packet Traffic Arbitration (PTA) module, connected to the CH logic function, facilitates the mitigation of various interference scenarios through a highly-programmable fabric. The coexistence hardware enables the output signal that supports interface configurations 4-wire. The primary schemes supported are:

- Separate Antenna mode – The PTA makes priority decisions, granting TX/RX requests from Bluetooth LE/IEEE 802.15.4. Each interface is permanently connected to its own antenna.

The following figure shows the architecture of the coexistence hardware with details about the PTA control lines.



Signal name	I/O	Requirement	Bluetooth LE/ IEEE 802.15.4 signal (3-wire/4- wire)	Description
COEX_REQ	Input	Mandatory for 3-wire and 4-wire	SR_REQUEST	Bluetooth LE/IEEE 802.15.4 device requesting a TX/RX transaction
COEX_STATUS0	Input	Mandatory for 3-wire and 4-wire	SR_STATUS	Indicates if the Bluetooth LE/IEEE 802.15.4 transaction is TX or RX. If the device supports a Priority signal, Priority is muxed with TX/RX on this signal based on the timing diagrams.
COEX_GRANT	Output	Mandatory for 3-wire and 4-wire	SR_GRANT	Indicates that the Bluetooth LE/IEEE 802.15.4 device is granted access for this transaction.
COEX_STATUS1/ SW_CTRL1	Input/ Output	Optional for 3-wire	SR_PTI/ RF_SW_CTRL1	In 4-wire mode, this carries the Bluetooth LE/IEEE 802.15.4 1 bit priority signal. In 3-wire Shared Antenna mode, this can be optionally used as a second antenna switch control signal.

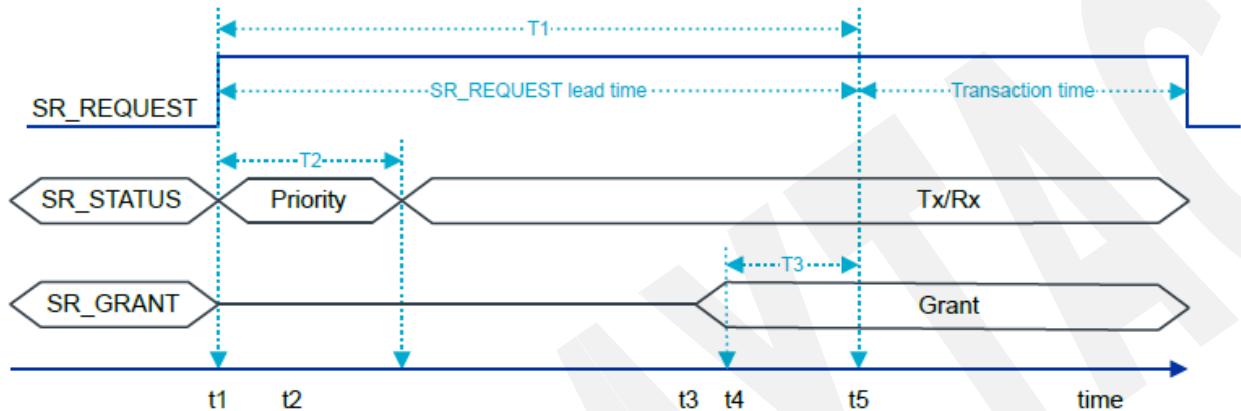
Note: Please consider the firmware set up details through [coexistence configuration](#) from Nordic Semiconductor.

9.1. Bluetooth LE/IEEE 802.15.4 timing

This section provides Bluetooth LE/IEEE 802.15.4 timing diagrams and parameters

3-wire with multiplexed priority

The following diagram shows external Bluetooth LE/IEEE 802.15.4 timing parameters when SR_STATUS carries both priority and TX/RX information in a time multiplexed manner.



Parameter	Description
T1: SR_REQUEST lead time period	The time SR_REQUEST is asserted before actual transactions.
T2: SR_STATUS	The time when SR_STATUS is sampled to get SR_PTI information.
T3: SR_GRANT	The time before PTA should post SR_GRANT so that it is stable to be considered by the Bluetooth LE/IEEE 802.15.4 device.

The Bluetooth LE/IEEE 802.15.4 timing parameters are used to derive PTA timing parameters. The following table describes the relationship between PTA timing parameters and Bluetooth LE/IEEE 802.15.4 timing parameters.

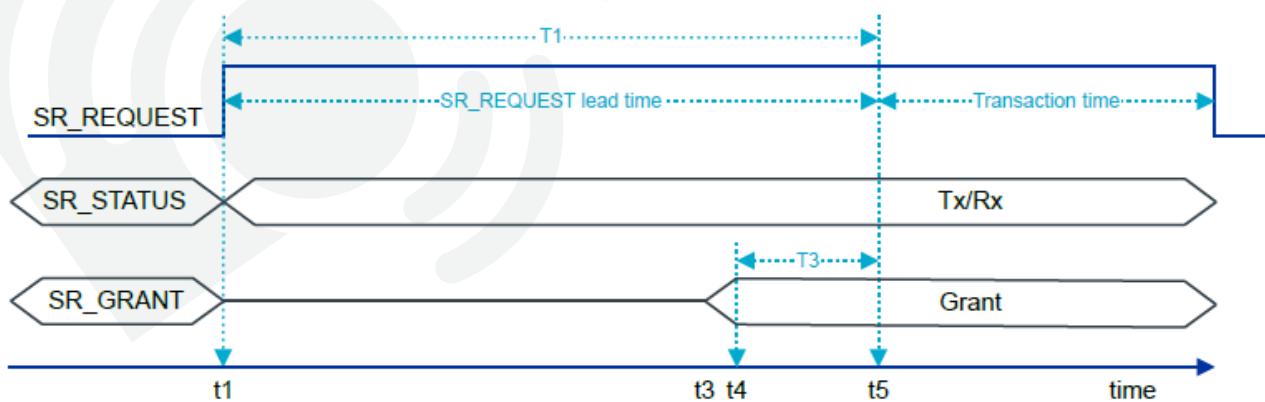
PTA timing parameter	Relation with Bluetooth LE/IEEE 802.15.4 timing parameter
Bluetooth LE/IEEE 802.15.4 device status priority sampling time (t2)	$t1 < t2 < (t1+T2)$
PTA arbitration decision time (t3)	$(t1+T2) < t3 < (T1-T3)$

Time instance	Description
t1	The time instance when SR_REQUEST is asserted.
t2	The time instance when SR_STATUS is sampled to get SR_PTI information. This can be any time during T2.
t3	The time instance when PTA takes an arbitration decision and posts SR_GRANT to the Bluetooth LE/IEEE 802.15.4 device. This is chosen a couple of microseconds before the start of the <i>SR grant lead time period</i> . This ensures that SR_GRANT is asserted as close to <i>SR grant lead time period</i> and is stable by the time the Bluetooth LE/IEEE 802.15.4 device uses this information to continue or abort the transaction.
t4	The time instance when the <i>SR grant lead time period</i> starts. This is the time when SR_GRANT must be stable to be considered by the Bluetooth LE/IEEE 802.15.4 device.
t5	The time instance when the actual transaction of the Bluetooth LE/IEEE 802.15.4 device starts. This is the time when the signaling period ends and the transaction period starts. Bluetooth LE/IEEE 802.15.4 Tx and Rx information is provided by changing the SR_STATUS signal level appropriately. PTA should track SR_STATUS if SR_REQUEST is high and update the information SR_TX_RX.

3-wire without multiplexed priority

If SR_STATUS carries only one parameter information (3-wire, no priority mode), then the default

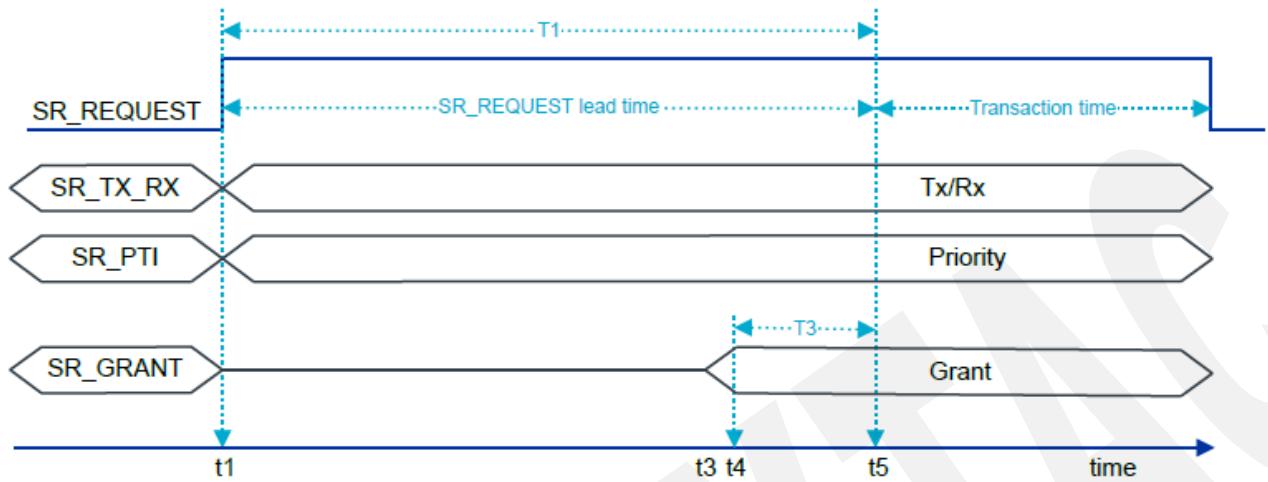
information that it carries is SR_TX_RX. In this case, SR_STATUS is set to TX or RX when SR_REQUEST is HIGH. The following diagram shows SR_STATUS only carrying TX/RX information. The signals are represented as a bus even though they are single bit ports to indicate transitions happening on the ports.



During the transaction, the Bluetooth LE/IEEE 802.15.4 device changes SR_STATUS appropriately to indicate TX and RX information. PTA continuously tracks SR_STATUS while SR_REQUEST is high and updates SR_TX_RX status internally for corresponding COEX behavior.

4-wire timing

In the following diagram, Bluetooth LE/IEEE 802.15.4 priority is explicitly signaled on the BT_COEX_STATUS1 pin.



10. OTP memory programming

AN7002Q includes a 128 x 32-bit OTP memory. This memory is partitioned into two regions, a factory programmed region, and a customer programmed region, each containing 64 x 32-bit locations.

The factory programmed region contains information related to production and trim values.

The customer programmed region contains:

- Encryption key used to protect the QSPI traffic (4 words)
- MAC addresses for VIF0 and VIF1 (4 words)
- Module level calibration coefficient (1 word)
- OTP memory protection control (4 words)
- Default register control (1 word)
- Reserved (24 words)
- User data region (26 words)

QSPI encryption is optional. This is enabled at runtime through a QSPI command. If this feature is not required, the OTP memory locations can remain unprogrammed. For security reasons, the encryption key cannot be read once programmed.

The MAC address fields in the OTP memory are accessed by firmware when powering up the device and presented to the host through an SPI/QSPI-based event as part of the boot phase. The host driver is responsible for configuring the MAC addresses as part of device configuration. As such, the MAC addresses stored in OTP memory can be overwritten by the host. Using this mechanism, the MAC addresses in the OTP memory can remain unprogrammed if an alternate host side storage is used.

The only module level calibration coefficient is the crystal oscillator trim. This is required to minimize the frequency offset resulting from the external 40 MHz crystal. See Device Commissioning and Characterization for information related to calibration.

Although the OTP memory is one time programmable, any bit still in a 1 state can be reprogrammed into a 0 state. To avoid deliberate or inadvertent modification of the OTP memory data, a protection mechanism is provided. The protection registers initially need to be programmed to 0x50FA50FA in order to activate programming of the remaining locations. Once OTP memory programming is complete, the protection registers should be programmed to 0x00000000, at which point the OTP memory can never be modified.

In addition to the logical protection mechanism described above, a programming voltage needs to be applied to the OTPVDD pin in order to enable programming. The programming voltage is 2.5 V, while for reads it is 1.8 V. To coordinate the OTPVDD supply voltage with read and write operations, it is recommended to drive this supply from the POWERIOVDD output pin on AN7002Q. This also ensures there will be no leakage associated with the OTP memory across sleep cycles, where the digital supply rail is removed.

The OTP memory is indirectly mapped, and as such read and writes are achieved using address, data, and mode registers. The OTP memory programming utility implements this programming, along with appropriate control of the OTPVDD supply through the POWERIOVDD output.

11. FICR - factory information configuration registers

The Factory Information Configuration Registers (FICR) are stored in the OTP memory.

FICR has two regions:

- A factory-programmed region that contains device information and has the INFO group registers.
- A customer-programmable region that contains empty registers for the customer to write data to. It has the QSPI, MAC, and CALIB group registers. Access to the customer-programmable region is controlled using the PROTECTION register. The PROTECTION scenarios are:
 - When PROTECTION is unprogrammed, neither read nor write is enabled.
 - When PROTECTION is programmed to 0x50FA50FA, full read and write access is enabled.
 - When PROTECTION is programmed to 0x00000000, access protection is applied and readout of QSPI.KEY is prevented.

The following table shows the access protection for the different register groups.

Register group	0xFFFFFFFF	0x50FA50FA	0x00000000
QSPI.KEY	-	R/W	-
MAC.ADDRESS	-	R/W	R
CALIB	-	R/W	R

You can download the complete specification via the “nRF7002 Product Specification” link in Chapter [5: Specification](#).

12. Antenna

Below chart shows a few options of external antenna which has been tested and approved to use with AN7002Q-U.

#	Photo	Model No.	Type	Supplier	Gain	Spec	Certification
1		SRE3W084-S9P	External	Antenova	3.1dBi @2.4G 5.2dBi @5G		FCC, ISED, CE, RCM, TELEC, KC, SRRC, NCC
2		ANTX100 ETHAB24553	External	Yageo	2.0dBi @2.4G 3.0dBi @5G		FCC, ISED, CE, RCM, TELEC, KC, SRRC, NCC
3		SRF2W012-100	PCB	Antenova	2.9dBi @2.4G 4.5dBi @5G		FCC, ISED, CE, RCM, TELEC, KC, SRRC, NCC
4		2344655-1	PCB	TE Connectivity	1.4dBi @2.4G 3.7dBi @5G		FCC, ISED, CE, RCM, TELEC, KC, SRRC, NCC

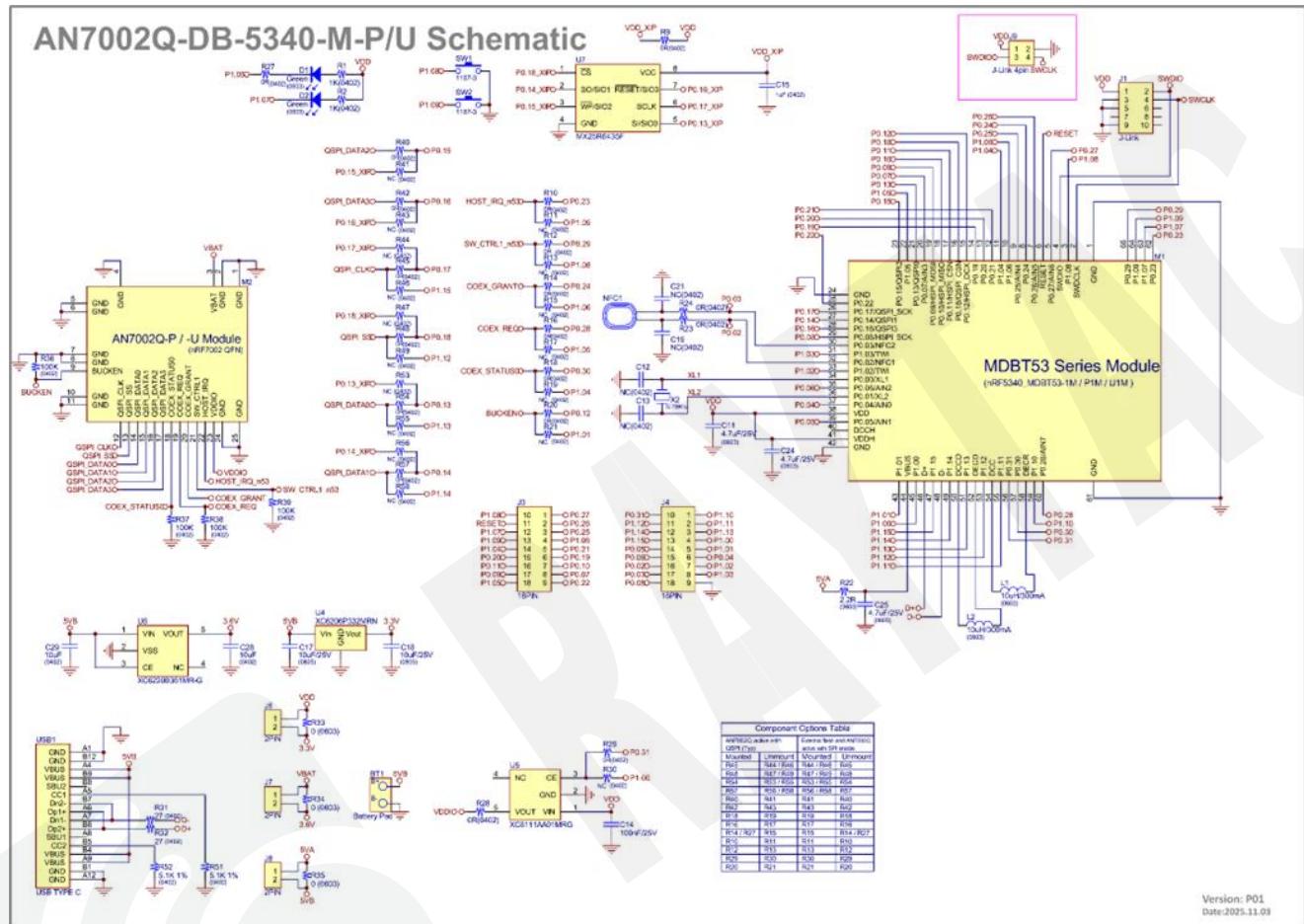
* End-product may need to perform further testing when applying CE, RCM and SRRC. Others are modular approval.

* Our certificate(s) might not be applicable when using antenna apart from above list.

13. Reference circuit

This circuit diagram is provided solely for GPIO pin testing. Customers requiring additional flash support may contact us. Contact sales@raytac.com or your Raytac representative, with the email subject line: “Flash Requirement – Raytac Model No. – Your Company Name”

AN7002Q-P / AN7002Q-U module compatible with MDBT53 Series module.



14. Certification

14.1. Wi-Fi alliance certification

 **Wi-Fi CERTIFIED™ Certificate** 

This certificate lists the features that have successfully completed Wi-Fi Alliance interoperability testing. Learn more: www.wi-fi.org/certification/programs

Certification ID: WFA131003

Product Info

Date of Certification	February 18, 2025
Company	Raytac Corporation
Product Name	AN7002Q
Product Model Variant	AN7002Q
Model Number	AN7002Q
Category	Other
Sub-category	Embedded Module

Summary of Certifications

CLASSIFICATION	CERTIFICATION
Network management	WMM® Wi-Fi Agile Multiband™
Security	Protected Management Frames WPA2™-Personal 2021-01 WPA3™-Personal 2024-10
Wi-Fi (MAC/PHY)	2.4 GHz Spectrum Capabilities 5 GHz Spectrum Capabilities Wi-Fi CERTIFIED 6® Release 2 Wi-Fi CERTIFIED™ a Wi-Fi CERTIFIED™ ac Wi-Fi CERTIFIED™ b Wi-Fi CERTIFIED™ g Wi-Fi CERTIFIED™ n

This certificate was downloaded on 2025-05-08 at 08:23:46 UTC

Wi-Fi®, Wi-Fi CERTIFIED®, Wi-Fi Alliance®, the Wi-Fi logo, the Wi-Fi CERTIFIED logo, and other marks are trademarks of Wi-Fi Alliance. Matter™ is a trademark of the Connectivity Standards Alliance.

14.2. FCC certificate (USA)

2.4G

kiwa



TCB

GRANT OF EQUIPMENT AUTHORIZATION

Certification

Issued Under the Authority of the
Federal Communications Commission
By:

Kiwa Nederland B.V.
Wilmersdorf 50
Apeldoorn, NL-7300 AC
Netherlands

Date of Grant: 04/25/2025

Application
Dated: 04/23/2025

Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist.,
New Taipei City, 235
Taiwan

Attention: Lyon Liu, President

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:

SH6AN7002Q

Name of Grantee:

Raytac Corp.

Equipment Class:

Digital Transmission System

Notes:

WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Modular Type:

Single Modular

Grant Notes

FCC Rule Parts

Frequency
Range (MHz)

Output
Watts

Frequency
Tolerance
Emission
Designator

CC

15C

2412.0 - 2462.0

0.17

Modular Approval. 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. The antenna's as listed in this application must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter procedures. 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. This device supports 20 MHz bandwidth modes. AN7002Q-U is for mobile condition. AN7002Q and AN7002Q-P are for portable condition. The highest reported SAR for stand-alone transmission exposure conditions is 0.93 W/kg, respectively.

CC: This device is certified pursuant to two different Part 15 rules sections.

Certificate No.:
252180651/AA/00

Ron Scheepers
Managing director



TCB

GRANT OF EQUIPMENT
AUTHORIZATION

Certification

Issued Under the Authority of the
Federal Communications Commission
By:

Kiwa Nederland B.V.
Wilmersdorf 50
Apeldoorn, NL-7300 AC
Netherlands

Date of Grant: 04/25/2025

Application
Dated: 04/23/2025

Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist.,
New Taipei City., 235
Taiwan

Attention: Lyon Liu , President

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:

SH6AN7002Q

Name of Grantee:

Raytac Corp.

Equipment Class:

Unlicensed National Information Infrastructure TX

Notes:

WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Modular Type:

Single Modular

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Emission Tolerance Designator
CC	15E	5180.0 - 5240.0	0.031	
CC ND	15E	5260.0 - 5320.0	0.031	
CC ND	15E	5500.0 - 5720.0	0.031	
CC	15E	5745.0 - 5825.0	0.031	
CC	15E	5845.0 - 5885.0	0.1	

Modular Approval. 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. The antenna's as listed in this application must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter procedures. 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. This device supports 20 MHz bandwidth modes. AN7002Q-U is for mobile condition. AN7002Q and AN7002Q-P are for portable condition. The highest reported SAR for stand-alone transmission exposure conditions is 0.73 W/kg, respectively.

CC: This device is certified pursuant to two different Part 15 rules sections.

ND: This UNII device complies with the Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS) requirements in Section 15.407(h).

Certificate No.: 252180653/AA/00	Ron Scheepers Managing director	
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RF Exposure report



Report No.: TESA2507000558ES

Page: 1 of 9

RF EXPOSURE REPORT



Applicant: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei
City, 235, Taiwan

Manufacturer: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei
City, 235, Taiwan

Product Name: WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Brand Name: Raytac

Model No.: AN7002Q-U

Family Model No. AN7002Q-P, AN7002Q

Model Difference: Refer to Section 1.2

FCC ID SH6AN7002Q

Date of EUT Received: Sep. 05, 2024

Issue Date: Aug. 11, 2025

Approved By _____

John Yeh
John Yeh

We hereby certify that:

The above equipment was evaluated by SGS Taiwan Ltd. The evaluation in this report is in compliance with FCC Rule Part §2.1091, KDB 447498 D01 v06.

The results of this report relate only to the sample identified in this report.

SAR report



Report No.: TESA2412000931ES

Page: 1 of 52

RF Exposure report



The following samples were submitted and identified on behalf of the client as:

Product Name	WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module
Brand Name	Raytac
Model No.	AN7002Q-U
Family Model No.	AN7002Q-P, AN7002Q
Applicant	Raytac Corp. 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Standards	IEEE/ANSI C95.1-1992, IEEE 1528-2013
FCC ID	SH6AN7002Q
Date of EUT Receipt	Jan. 09, 2025
Date of Test(s)	Feb. 23, 2025 ~ Feb. 28, 2025
Date of Issue	Apr. 09, 2025

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 Ltd. Central RF Lab or testing done by SGS Taiwan Ltd. Central RF Lab in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Ltd. Central RF Lab in writing.

Signed on behalf of SGS

Clerk / Cindy Chou	PM / Bond Tsai	Approved By / John Yeh
Cindy Chou	Bond Tsai	John Yeh

Date: Apr. 09, 2025

14.3. TELEC certificate (Japan)

2.4G & 5G

CERTIFICATE



**Certificate of
Radio Equipment in JAPAN
201-250154 / 00**

Issued 06 March 2025

Page 1 of 6
This certificate has THREE Annexes

Kiwa Nederland B.V., operating as Japan Conformity Assessment Body (CAB ID Number: 201), according procedure RD_740, declares that the listed product complies with the Technical Regulations Conformity Certification of Specified Radio equipment (ordinance of MPT N° 37,1981)

Product description: WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Trademark: Raytac

Type designation: AN7002Q-U

Hardware / Software: v0.9 / v2.5.2

Variants: See Annex 3

Manufacturer: Raytac Corp.

Address: 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist.,

City: 235 New Taipei City

Country: Taiwan

This certificate is granted to:

Name: Raytac Corp.

Address: 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist.,

City: 235 New Taipei City

Country: Taiwan


Ron Scheepers
Managing director

Kiwa Nederland B.V.
Wilmersdorf 50
Postbus 137
7300 AC Apeldoorn
The Netherlands

[https://www.kiwa.com/nl/en/markets/
radio-wireless-and-electrical-equipment/](https://www.kiwa.com/nl/en/markets/radio-wireless-and-electrical-equipment/)

Chamber of commerce
08090048



14.4. NCC certificate (Taiwan)

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	 Product Certification PC037
證照字號：型式字第 AM 號		
一、申請者：勁達國際電子股份有限公司		
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：勁達國際電子股份有限公司		
四、器材名稱：WIFI 模組		
五、廠牌：Raytac		
六、型號：AN7002Q-U		
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：114年05月02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)		
1. 應於本體明顯處標示審驗合格標籤或符合性聲明標籤及其型號，並於包裝盒標示主管機關標章。最終產品應於本體明顯處標示非隨插即用射頻模組(組件)之審驗合格標籤及最終產品型號，並於包裝盒標示主管機關標章，始得販賣。		
2. 依主管機關或相關技術規範規定於指定位置標示正體中文警語。		
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. 於網際網路販賣電信管制射頻器材者，應於該網際網路網頁標示其型號及審驗合格標籤或符合性聲明標籤資訊。但最終產品得僅標示其型號及其組裝之非隨插即用射頻模組(組件)之審驗合格標籤資訊。		
5. 使用手冊應標示下列資訊：		
(1) 取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。		
(2) 應避免影響附近雷達系統之操作。		
(3) 高增益指向性天線只得應用於固定式點對點系統。		
型式認證號碼：CCAM25Y10120T4	第 1 頁，共 3 頁	本證書與續頁分開使用無效

14.5. CE (EU) & RCM (Australia & New Zealand) test report

2.4G

	Report No.: TERF2409002664ER Page: 1 of 101
AS/NZS 4268:2017 ETSI EN 300 328 V2.2.2: 2019 TEST REPORT	
 	
Applicant:	Raytac Corp. 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Manufacturer:	Raytac Corp. 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Product Name:	WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module
Brand Name:	Raytac
Model No.:	AN7002Q-U
Family Model No.:	AN7002Q-P, AN7002Q
Model Difference:	Refer to section 1.2
Report Number:	TERF2409002664ER
Date of EUT Received:	September 05, 2024
Date of Test:	September 06, 2024 ~ February 12, 2025
Issue Date:	April 14, 2025

Jay Lin

Approved By _____

Jay Lin

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 2014/53/EU and Australian/New Zealand Standard AS/NZS 4268:2017, Row 59. 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.



**AS/NZS 4268:2017
ETSI EN 301 893 V2.1.1: 2017
TEST REPORT**

Report No.: TERF2409002665ER
Page: 1 of 85



Applicant: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan

Manufacturer: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan

Product Name: WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Brand Name: Raytac

Model No.: AN7002Q-U

Family Model No.: AN7002Q-P, AN7002Q

Model Difference: Refer to section 1.2

Report Number: TERF2409002665ER

Date of EUT Received: September 05, 2024

Date of Test: September 06, 2024 ~ February 12, 2025

Issue Date: April 14, 2025

Approved By _____

Jay Lin
Jay Lin

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 301 893 V2.1.1: 2017 under 2014/53/EU and Australian/New Zealand Standard AS/NZS 4268:2017, Row 61,62,63. 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.

5G for DFS-Slave



AS/NZS 4268:2017 ETSI EN 301 893 V2.1.1: 2017 DFS TEST REPORT

Report No.: TERF2409002667ER
Page: 1 of 18



Applicant: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan

Manufacturer: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan

Product Name: WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Brand Name: Raytac

Model No.: AN7002Q-U

Family Model No.: AN7002Q-P, AN7002Q

Model Difference: Refer to section 1.2

Report Number: TERF2409002667ER

Date of EUT Received: September 05, 2024

Date of Test: September 06, 2024 ~ February 05, 2025

Issue Date: April 14, 2025

Approved By


Jay Lin

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 301 893 V2.1.1: 2017 under 2014/53/EU and Australian/New Zealand Standard AS/NZS 4268:2017, Row 62,63.. 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.



**AS/NZS 4268:2017
ETSI EN 300 440 V2.2.1: 2018
TEST REPORT**

Report No.: TERF2409002666ER
Page: 1 of 73



Applicant: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan

Manufacturer: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan

Product Name: WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Brand Name: Raytac

Model No.: AN7002Q-U

Family Model No.: AN7002Q-P, AN7002Q

Model Difference: Refer to section 1.2

Report Number: TERF2409002666ER

Date of EUT Received: September 05, 2024

Date of Test: September 06, 2024 ~ February 12, 2025

Issue Date: April 14, 2025

Approved By _____

Jay Lin
Jay Lin

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 300 440 V2.2.1: 2018 under 2014/53/EU and Australian/New Zealand Standard AS/NZS 4268:2017, Row 60. 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.

RF Exposure report (CE)



Report No.: TESA2503000204ES
Page: 1 of 15

RF EXPOSURE REPORT



Applicant: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan

Manufacturer: Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan

Product Name: WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Brand Name: Raytac

Model No.: AN7002Q-U

Family Model No. AN7002Q-P, AN7002Q

Model Difference: Refer to Section 1.2

Date of EUT Received: Sep. 05, 2025

Issue Date: Apr. 09, 2025

Approved By _____

John Yeh

We hereby certify that:

The above equipment was evaluated by SGS Taiwan Ltd. for compliance with the requirements set forth in the European Standard EN 62311:2008 or EN IEC 62311:2020, EN 50665: 2017.

The results in this report apply to this specific product system.

SAR report (CE)



Report No.: TESA2412000933ES

Page: 1 of 38



RF Exposure report

The following samples were submitted and identified on behalf of the client as:

Product Name WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module
Brand Name Raytac
Model No. AN7002Q-U
Family Model No. AN7002Q-P, AN7002Q
Applicant Raytac Corp.
8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Standards EN 50566:2017/A1:2023 / EN 62209-2:2010+A1:2019
Date of EUT Receipt Jan. 09, 2025
Date of Test(s) Feb. 23, 2025 ~ Feb. 28, 2025
Date of Issue Apr. 09, 2025

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 Ltd. Central RF Lab or testing done by SGS Taiwan Ltd. Central RF Lab in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Ltd. Central RF Lab in writing.

Signed on behalf of SGS

Clerk / Cindy Chou	PM / Bond Tsai	Approved By / John Yeh
Cindy Chou	Bond Tsai	John Yeh

Date: Apr. 09, 2025



SGS Reference No. : VTMHY2412002493YEA/2025
Page: 1 of 1

VERIFICATION OF COMPLIANCE

Issue Date: Apr. 10, 2025
Applicant: Raytac Corp.
Address: 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Manufacturer: Raytac Corp.
Address: 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Product: WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module
Brand Name/Trade Mark: Raytac
Model/Type: AN7002Q-U
Added Model(s): AN7002Q-P, AN7002Q
Applicable Standards: EN 301 489 –1 v2.2.3 : 2019-11
EN 301 489 –17 v3.3.1 : 2024-09
EN 55032 : 2015+A11:2020
EN 61000-4-2 : 2009
EN IEC 61000-4-3 : 2020
EN 61000-4-4 : 2012
EN 61000-4-6 : 2014+AC:2015
Test Laboratory: SGS Taiwan Ltd.
Electromagnetic Compatibility Laboratory
No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan
Test Report No.: TMHY2412002493YE, dated on Apr. 10, 2025

Conclusion: Based upon a review of the Test Report(s), the tested sample of the product mentioned above is deemed to comply with the requirements of the above standards.

Note: This verification is only valid for the product and configuration described and in conjunction with the test report as detailed above.

Authorised Signatory:

SGS Taiwan Ltd.
Eddy Cheng
Asst. Supervisor

CE LVD Safety report

Test Report issued under the responsibility of:



TEST REPORT IEC/EN 62368-1	
Audio/video, information and communication technology equipment Part 1: Safety requirements	
Report Number	: TSSF2412000825L0
Date of issue	: 2025-04-29
Total number of pages	: 50
Name of Testing Laboratory preparing the Report	: SGS Taiwan Ltd. Safety Laboratory
Applicant's name	: Raytac Corp.
Address	: 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 235, Taiwan
Test specification:	
Standard	: IEC 62368-1:2018 and EN IEC 62368-1:2020+A11:2020
Test procedure	: Commission testing
Non-standard test method	: N/A
TRF template used	: IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No.	: IEC62368_1F modify by SGS TW (EN)
Test Report Form(s) Originator	: UL(US)
Master TRF	: Dated 2023-08-17
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This publication may be reproduced in whole or in part for non-commercial purposes as long as the IECEE is acknowledged as copyright owner and source of the material. IECEE takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.	
General disclaimer:	
The test results presented in this report relate only to the object tested.	
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.	

Supplier's declaration of conformity



This is the Australian Communications and Media Authority (ACMA) approved form for a declaration of conformity under the following legislative instruments:

- > Radiocommunications Equipment (General) Rules 2021
- > Radiocommunications Labelling (Electromagnetic Compatibility) Notice 2017.

This is a sample form for a declaration of conformity under the Telecommunications (Labelling Notice for Customer Equipment and Customer Cabling) Instrument 2025.

Instructions for completion

Do not return this form to the ACMA. This completed form must be retained by the supplier as part of the documentation required for the compliance records. However, it must be made available for inspection by the ACMA when requested.

Supplier's details (manufacturer, importer or authorised agent)

Company name (or individual)

N121 PTY LTD

ACN/ARBN

646 997 373

Street address (Australia or New Zealand)

UNIT 5, 25-31 ALEXANDRA STREET
DRUMMOYNE NSW 2047, AUSTRALIA

Product details and date of manufacture

Product description – brand name, type, current model, lot, batch or serial number (if available), software/firmware version (if applicable)

Equipment name: WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module

Model name: AN7002Q-U

Variant model name: AN7002Q-P, AN7002Q

Brand name: Raytac

Compliance – applicable standards and other supporting documents

Evidence of compliance with applicable standards may be demonstrated by test reports, endorsed/accredited test reports, certification/competent body statements.

Having had regard to these documents, I am satisfied the above-mentioned product complies with the requirements of the relevant ACMA standards made under the *Radiocommunications Act 1992* and/or the *Telecommunications Act 1997*.

List these documents including details of the standard title, number and, if applicable, number of the test report/endorsed test report or certification/competent body statement.

Standard	Report number
Radiocommunications Labelling (Electromagnetic Compatibility) Notice 2017 (AS/NZS CISPR 32:2015+A1:2020)	TMHY2412002494YE
Radiocommunications Equipment (General) Rules 2021	TERF2409002664ER TERF2409002665ER TERF2409002666ER TERF2409002667ER TESA2412000934ES TESA2503000205ES

Declaration

I hereby declare that:

1. I am authorised to make this declaration on behalf of the Company mentioned above
2. the contents of this form are true and correct
3. the product mentioned above complies with the applicable above mentioned standards and all products supplied under this declaration will be identical to the product identified above
4. I understand that giving false or misleading information is a serious offence.

Note: It is an offence to knowingly provide false or misleading information to a Commonwealth entity or a person who is exercising powers, performing functions under, or in connection with, a law of the Commonwealth. It is an offence to knowingly provide false or misleading information or documents in compliance or purported compliance with a law of the Commonwealth. (See sections 137.1 and 137.2 of the *Criminal Code Act 1995*.)

Penalty: 12 months imprisonment

Signature of Authorised Person

Date

Print Name

Position



May 13, 2025

Daniel

Managing Director

The *Privacy Act 1988* (Cth) (the Privacy Act) imposes obligations on the ACMA in relation to the collection, security, quality, access, use and disclosure of personal information. These obligations are detailed in the Australian Privacy Principles.

The ACMA may only collect personal information if it is reasonably necessary for, or directly related to, one or more of the ACMA's functions or activities.

The purpose of collecting the personal information in this form is to ensure the supplier is identified in the 'declaration of conformity'. If this declaration of conformity is not completed and the requested information is not provided, a compliance label cannot be applied.

Further information on the Privacy Act and the ACMA's privacy policy is available at www.acma.gov.au/privacypolicy. The privacy policy contains details about how you may access personal information about you that is held by the ACMA, and seek the correction of such information. It also explains how you may complain about a breach of the Privacy Act and how we will deal with such a complaint.

Should you have any questions in this regard, please contact the ACMA's privacy contact officer on telephone on 1800 226 667 or by email at privacy@acma.gov.au.

**RADIO SPECTRUM
MANAGEMENT****Supplier's Declaration of Conformity**

Section 134 (1) (g) of the New Zealand Radiocommunications Act 1989

Supplier's Details:**Name:** JNM NZ LIMITED**Supplier Number:** E9659**New Zealand Company Number:** 8308895**Address:** 1 Mariner Lane Beachlands 2018 New Zealand**Product Details:**

Brand name (Manufacture name)	Raytac		
Product name (Description)	WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module	Model name	AN7002Q-U, AN7002Q-P, AN7002Q
Frequency	2 412 MHz ~ 2 472 MHz 5 150 MHz ~ 5 350 MHz 5 470 MHz ~ 5 725 MHz 5 725 MHz ~ 5 8275 MHz	Radiated power e.i.r.p (dBm):	18.71dBm 20.82dBm 13.46dBm
Applicable Standards Title, Number and Edition	AS/NZS CISPR 32:2015+A1:2020 AS/NZS 4268:2017, EN 300 328 V2.2.2:2019 AS/NZS 4268:2017, EN 301 893 V2.1.1:2017 AS/NZS 4268:2017, EN 301 440 V2.2.1:2018 EN 62209-2:2010+A1:2019 AS/NZS 2772.2:2016		
Test Report Numbers	TMHY2412002494YE TERF2409002664ER TERF2409002665ER TERF2409002666ER TERF2409002667ER TESA2412000934ES TESA2503000205ES		

I hereby declare that the product to which this Declaration of conformity relates complies with the above-mentioned standard(s), and all products supplied under this Declaration will be identical to the sample identified in this Declaration.

Daniel
Director

14.6. IC certificate (Canada)

2.4G & 5.8G & DFS Slave

CERTIFICATE



CB Innovation, Science and Economic Development Canada Innovation, Sciences et Développement économique Canada

► Reg. No. NL0001

CERTIFICATION No. DE CERTIFICATION 8017A-AN7002Q

Issued 25 April 2025

Page 1 of 2
This certificate has ONE Annex

KIWA No. 252170219/AA/00
No. DE KIWA

TEST SITE No. 252170219/AA/00
No. DE LABORATOIRE

ISSUED TO Raytac Corp.
DÉLIVRÉ A 8F, No.788-1, Zhongzheng Rd., Zhonghe Dist. New Taipei City 235 Taiwan

TYPE OF EQUIPMENT Local Area Network (LAN) Device
GENRE DE MATÉRIEL Spread Spectrum or Digital Device (2400-2483.5 MHz)

TRADE NAME AND MODEL Raytac / AN7002Q-P
MARQUE ET MODELE Raytac / AN7002Q
Raytac / AN7002Q-U

CERTIFIED TO SPECIFICATION
CERTIFIÉ SELON LE CAHIER DES CHARGES RSS-102 ISSUE 6
RSS-247 EDITION 3

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 KIWA NEDERLAND B.V. (NL0001), RECOGNIZED CERTIFICATION BODY BY INNOVATION, SCIENCE AND ECONOMIC DEVELOPMENT CANADA, ACCORDING THE CANADIAN CERTIFICATION BODY SCHEME (CB-02).
DÉLIVRÉ PAR KIWA NEDERLAND B.V. (NL0001), ORGANISME DE CERTIFICATION RECONNUE PAR INNOVATION, SCIENCES ET DÉVELOPPEMENT ÉCONOMIQUE CANADA, SELON LE SYSTÈME D'ORGANISME DE CERTIFICATION DE CANADA (CB-02).

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.



Ron Scheepers
Managing director

Kiwa Nederland B.V.
Wilmersdorf 50
Postbus 137
7300 AC Apeldoorn
The Netherlands

<https://www.kiwa.com/nl/en/markets/radio-wireless-and-electrical-equipment/>

Chamber of commerce
08090048


PRODUCTS
RvA C 002

kiwa

14.7. SRRC certificate (China)



14.8. KC certificate (South Korea)

AE41-BA85-B6A5-C28D

방송통신기자재등의 적합등록 필증	
Registration of Broadcasting and Communication Equipments	
상호 또는 성명 Trade Name or Registrant	Raytac Corporation
기자재명칭(제품명칭) Equipment Name	WiFi Low Energy & IEEE 802.11 a/b/g/n/ac/ax Module
기기부호/추가 기기부호 Equipment code /Additional Equipment code	LARN5 / LARN8
기본모델명 Basic Model Number	AN7002Q-U
파생모델명 Series Model Number	AN7002Q, AN7002Q-P
등록번호 Registration No.	R-R-ryt-AN7002Q
제조자/제조국가 Manufacturer/Country of Origin	Raytac Corporation/대만
등록연월일 Date of Registration	2025-05-02
기타 Others	<small>기본모델명 : AN7002Q-U * External Antenna 1) SMA Plug Reverse Type - 제조사 : Antenova Limited - 모델명 : SRE3W084-S9 2) PCB Type - 제조사 : Pulse YAGBO company - 모델명 : ANTX100ETHSA24553 3) FPC Type - 제조사 : Antenova Limited - 모델명 : SRF2WW012 4) EMBEDDED Type - 제조사 : TB Connectivity - 모델명 : 2344655 파생모델명 : AN7002Q-P * Internal Antenna 1) PIFA Type - 제조사 : Raytac Corp. 파생모델명 : AN7002Q * Internal Antenna 1) Monopole Type - 제조사 : Raytac Corp.</small>
<p>위 기자재는 「전파법」 제58조의2 제3항에 따라 등록되었음을 증명합니다. It is verified that foregoing equipment has been registered under the Clause 3, Article 58-2 of Radio Waves Act.</p> <p style="text-align: right;">2025년(Year) 05월(Month) 08일(Day)</p> <p style="text-align: center;">  국립전파연구원 원장인 </p> <p style="text-align: center;">Director General of National Radio Research Agency</p> <p style="text-align: center; color: red;"> <small>※ 적합등록 방송통신기자재는 반드시 "적합성 평가표지"를 부착하여 유통하여야 합니다. 위반시 과태료 처분 및 등록이 취소될 수 있습니다.</small> </p>	

14.9. Cybersecurity report



Cybersecurity Test Report

Equipment	:	Low-Power Wi-Fi Module
Brand Name	:	Raytac
Model Name	:	AN7002Q, AN7002Q-P, AN7002Q-U
Applicant	:	Raytac Corporation
Manufacturer	:	Raytac Corporation
Standard	:	EN18031-1 2024
Test Date(s)	:	Aug. 20, 2025 ~ Oct. 13, 2025

We, SPORTON INTERNATIONAL INC. (SHENZHEN), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in EN18031:2024, parts 1 and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from SPORTON INTERNATIONAL INC. (SHENZHEN), the test report shall not be reproduced except in full.

Approved by: Joseph Chang



SPORTON INTERNATIONAL INC.(SHENZHEN)
1/F,2/F,Bldg 5,Shiling Industrial Zone,Xinwei Village,Xili,Nanshan Shenzhen, 518055
People's Republic of China

14.10. EU and UKCA Declarations of Conformity

The product complies with the applicable requirements of both the European Union and United Kingdom regulations, including the essential requirements of the following directives:

- **Radio Equipment Directive: 2014/53/EU**
- **RoHS Directive: 2011/65/EU and its amendment Directive (EU) 2015/863**

Conformity is demonstrated with reference to the following harmonized standards, based on test reports issued by SGS Taiwan Ltd.:

- **EN 300 328 V2.2.2:2019**
- **EN 301 893 V2.1.1:2017**
- **EN 300 400 V2.2.1:2018**
- **EN 301 489-1 V2.2.3:2019-11**
- **EN 301 489-17 V3.3.1:2024-09**
- **EN 55032:2015 + A11:2020**
- **EN 61000-4-2:2009**
- **EN 61000-4-3:2020**
- **EN 623113:2008**
- **EN 50566:2017 / A1:2023**
- **EN 62209-2:2010 + A1:2019**
- **IEC 62368-1:2018 + A11:2020**
- **EN 18031-1 2024**

RoHS compliance reports were issued by **TÜV Rheinland Hong Kong Ltd.**, covering Directive 2011/65/EU and its amendment Directive (EU) 2015/863.

14.11. RoHS & REACH report

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

14.12. End-Product label

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

14.12.1. FCC (USA)

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

“This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions. (1) This device may not cause harmful interference. (2) This device must accept any interference received, including interference that may cause undesired operation.”

The final end product must be labeled in a visible area with the following: “**Contain FCC ID: SH6AN7002Q**”.

14.12.2. TELEC (Japan)

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



14.12.3. NCC (Taiwan)

請依下列標籤式樣自製標籤，標貼或印鑄於器材本體明顯處，始得販賣或公開陳列。

Series	標籤樣式
AN7002Q Series	 CCAM25Y10122T8
AN7002Q-P Series	 CCAM25Y10121T6
AN7002Q-U Series	 CCAM25Y10120T4

以 AN7002Q 為例，平台廠商必須於平台上標示字樣「本產品內含射頻模組：ID 編號 CCAM25Y10122T8」。

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

14.12.4. IC (Canada)

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

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

The final end product must be labeled in a visible area with the following: **“Contain IC ID: 8017A-AN7002Q”**.

14.12.5. Wi-Fi

This product is certified by the Wi-Fi Alliance under **Certification ID (CID): WFA131003**.

The Wi-Fi logo may be printed on the product label, packaging, or user manual. When label space is not enough, the Certification ID (CID) is not required to be printed on the product body or label.

15. Certification Power table

15.1. FCC / IC / NCC

15.1.1. FCC – 2.4GHz band

Test Condition:

- Radio test mode: [Wi-Fi: Radio Test](#)
- Subcommand lists: [Radio Test Subcommands](#)
- Backoff subcommands:
 - Ch1 and Ch11 : `wifi_radio_test set_edge_bo 5`
 - Ch6 : `wifi_radio_test set_ant_gain 5`

See the link for detailed documentation on the examples and their functionality.

802.11b (FCC)

802.11b – WLAN 2.4GHz			
Channel No.	Frequency (MHz)	Data Rate	Power Setting
1	2412	1	18
6	2437	1	18
11	2462	1	18

802.11g (FCC)

802.11g – WLAN 2.4GHz			
Channel No.	Frequency (MHz)	Data Rate	Power Setting
1	2412	6	18
6	2437	6	18
11	2462	6	18

802.11n (FCC)

802.11n – WLAN 2.4GHz			
Channel No.	Frequency (MHz)	Data Rate	Power Setting
1	2412	MCS0	18
6	2437	MCS0	18
11	2462	MCS0	18

802.11ax HE (FCC)

802.11ax HE20 – WLAN 2.4GHz				
Channel No.	Frequency (MHz)	Data Rate	RU Config	Power Setting
1	2412	MCS0	full	18
			26/0	18
			52/37	18
			106/53	18
6	2437	MCS0	full	18
11	2462	MCS0	full	18
			26/8	18
			52/40	18
			106/54	18

15.1.2. FCC – 5GHz band

Test Condition:

- Radio test mode: [Wi-Fi: Radio Test](#)
- Subcommand lists: [Radio Test Subcommands](#)
- Backoff subcommands: **NA**

See the link for detailed documentation on the examples and their functionality.

802.11a (FCC)

802.11a – WLAN 5GHz				
Channel No.	Frequency (MHz)	Data Rate	Power Setting	
36	5180	6	15	
44	5220	6	15	
48	5240	6	15	
52	5260	6	15	
60	5300	6	15	
64	5320	6	15	
100	5500	6	15	
116	5580	6	15	
140	5700	6	15	

802.11a – WLAN 5GHz			
Channel No.	Channel No.	Channel No.	Channel No.
144	5720 (U-NII 2C)	6	15
144	5720 (U-NII 3)	6	15
149	5745	6	15
157	5785	6	15
165	5825	6	15
169	5845 (U-NII 3)	6	15
169	5845 (U-NII 4)	6	15
173	5865	6	15
177	5885	6	15

802.11n (FCC)

802.11n – WLAN 5GHz			
Channel No.	Frequency (MHz)	Data Rate	Power Setting
36	5180	MCS0	15
44	5220	MCS0	15
48	5240	MCS0	15
52	5260	MCS0	15
60	5300	MCS0	15
64	5320	MCS0	15
100	5500	MCS0	15
116	5580	MCS0	15
140	5700	MCS0	15
144	5720 (U-NII 2C)	MCS0	15
144	5720 (U-NII 3)	MCS0	15
149	5745	MCS0	15
157	5785	MCS0	15
165	5825	MCS0	15
169	5845 (U-NII 3)	MCS0	15
169	5845 (U-NII 4)	MCS0	15
173	5865	MCS0	15
177	5885	MCS0	15

802.11ac VHT (FCC)

802.11ac VHT20 – WLAN 5GHz			
Channel No.	Frequency (MHz)	Data Rate	Power Setting
36	5180	MCS0	15
44	5220	MCS0	15
48	5240	MCS0	15
52	5260	MCS0	15
60	5300	MCS0	15
64	5320	MCS0	15
100	5500	MCS0	15
116	5580	MCS0	15
140	5700	MCS0	15
144	5720 (U-NII 2C)	MCS0	15
144	5720 (U-NII 3)	MCS0	15
149	5745	MCS0	15
157	5785	MCS0	15
165	5825	MCS0	15
169	5845 (U-NII 3)	MCS0	15
169	5845 (U-NII 4)	MCS0	15
173	5865	MCS0	15
177	5885	MCS0	15

802.11ax HE (FCC)

802.11ax HE20 – WLAN 5GHz				
Channel No.	Frequency (MHz)	Data Rate	RU config.	Power Setting
36	5180	MCS0	full	15
		MCS0	26/0	8
		MCS0	53/37	10
		MCS0	106/53	12
44	5220	MCS0	full	15
48	5240	MCS0	full	15
52	5260	MCS0	full	15
60	5300	MCS0	full	15

802.11ax HE20 – WLAN 5GHz				
Channel No.	Channel No.	Channel No.	Channel No.	Channel No.
64	5320	MCS0	full	15
		MCS0	26/8	14
		MCS0	52/40	16
		MCS0	106/54	15
100	5500	MCS0	full	15
		MCS0	26/0	14
		MCS0	52/37	16
		MCS0	106/53	15
116	5580	MCS0	full	15
140	5700	MCS0	full	14
		MCS0	26/8	12
		MCS0	52/40	13
		MCS0	106/54	14
144	5720 (U-NII 2C)	MCS0	full	14
144	5720 (U-NII 3)	MCS0	full	14
149	5745	MCS0	full	15
		MCS0	26/0	16
		MCS0	52/37	16
		MCS0	106/53	15
157	5785	MCS0	full	15
165	5825	MCS0	full	15
		MCS0	26/8	16
		MCS0	52/40	16
		MCS0	106/54	15
169	5845 (U-NII 3)	MCS0	full	15
169	5845 (U-NII 4)	MCS0	full	15
173	5865	MCS0	full	15
		MCS0	26/0	16
		MCS0	52/37	16
		MCS0	106/53	15
177	5885	MCS0	full	15
		MCS0	26/8	16
		MCS0	52/40	16
		MCS0	106/54	15

15.2. CE (EU) and RCM

15.2.1. CE – 2.4GHz band

802.11b (CE)

802.11b – WLAN 2.4GHz		
Channel No.	Frequency (MHz)	Power Setting
1	2412	16
7	2442	16
13	2472	16

802.11g (CE)

802.11g – WLAN 2.4GHz		
Channel No.	Frequency (MHz)	Power Setting
1	2412	16
7	2442	16
13	2472	16

802.11n (CE)

802.11n – WLAN 2.4GHz		
Channel No.	Frequency (MHz)	Power Setting
1	2412	16
7	2442	16
13	2472	16

802.11ax HE (CE)

802.11ax HE20 – WLAN 2.4GHz			
Channel No.	Frequency (MHz)	RU config.	Power Setting
1	2412	full	16
		26/0	12
		52/37	14
		106/53	16
7	2442	full	16
13	2472	full	16
		26/8	12
		52/40	14
		106/54	16

15.2.2. CE – 5GHz band

802.11a (CE)

802.11a – WLAN 5GHz		
Channel No.	Frequency (MHz)	Power Setting
36	5180	15
64	5320	15
100	5500	15
140	5700	15

802.11n (CE)

802.11n – WLAN 5GHz		
Channel No.	Frequency (MHz)	Power Setting
36	5180	15
64	5320	15
100	5500	15
140	5700	15

802.11ac VHT (CE)

802.11ac VHT20 – WLAN 5GHz		
Channel No.	Frequency (MHz)	Power Setting
36	5180	15
64	5320	15
100	5500	15
140	5700	15

802.11ax HE (CE)

802.11ax HE20 – WLAN 5GHz			
Channel No.	Frequency (MHz)	RU config.	Power Setting
36	5180	full	15
		26/0	10
		52/37	12
		106/53	15
64	5320	full	15
		26/8	10
		52/40	12
		106/54	15
100	5500	full	15
		26/0	10
		52/37	12
		106/53	15
140	5700	full	15
		26/8	10
		52/40	12
		106/54	15

15.2.3. CE – 5.8GHz band

802.11a (CE)

802.11a – WLAN 5.8GHz		
Channel No.	Frequency (MHz)	Power Setting
149	5745	8
161	5805	8
173	5865	8

802.11n (CE)

802.11n – WLAN 5.8GHz		
Channel No.	Frequency (MHz)	Power Setting
149	5745	8
161	5805	8
173	5865	8

802.11ac VHT (CE)

802.11ac VHT20 – WLAN 5.8GHz		
Channel No.	Frequency (MHz)	Power Setting
149	5745	8
161	5805	8
173	5865	8

802.11ax HE (CE)

802.11ax HE20 – WLAN 5.8GHz			
Channel No.	Frequency (MHz)	RU config.	Power Setting
149	5745	full	8
		26/0	8
		52/37	8
		106/53	8
161	5805	full	8

802.11ax HE20 – WLAN 5.8GHz			
Channel No.	Channel No.	Channel No.	Channel No.
173	5865	full	8
		26/8	8
		52/40	8
		106/54	8

15.3. Japan

15.3.1. Japan – 2.4GHz band

802.11b (Japan)

802.11b – WLAN 2.4GHz		
Channel No.	Frequency (MHz)	Power Setting
1	2412	18
7	2442	18
13	2472	18
14	2484	18

802.11g/n (Japan)

802.11g/n – WLAN 2.4GHz		
Channel No.	Frequency (MHz)	Power Setting
1	2412	18
7	2442	18
13	2472	18

802.11ax HE (Japan)

802.11ax HE20 – WLAN 2.4GHz			
Channel No.	Frequency (MHz)	RU config.	Power Setting
1	2412	full	16
7	2442	full	16
13	2472	full	16

15.3.2. Japan – 5GHz band

802.11a/n/ac VHT/ax HE (Japan)

802.11a/n/ac VHT20/ax HE20 – WLAN 5GHz		
Channel No.	Frequency (MHz)	Power Setting
36	5180	13
44	5220	13
48	5240	13
52	5260	13
60	5300	13
64	5320	13
100	5500	13
116	5600	13
140	5700	13
144	5720	13

15.4. Korea (KC)

15.4.1. Korea – 2.4GHz band

802.11b/g/n (KC)

802.11b/g/n – WLAN 2.4GHz		
Channel No.	Frequency (MHz)	Power Setting
1	2412	17
7	2442	17
13	2472	17

802.11ax HE (KC)

802.11ax HE20 – WLAN 2.4GHz				
Channel No.	Frequency (MHz)	Tone	Data Rate	Power Setting
1	2412	26T	MCS0	7
		52T	MCS0	9
		106T	MCS0	12
		242T	MCS0	16
		SU	MCS0	16
7	2442	26T	MCS0	7
		52T	MCS0	9
		106T	MCS0	12
		242T	MCS0	16
		SU	MCS0	16
13	2472	26T	MCS0	7
		52T	MCS0	9
		106T	MCS0	12
		242T	MCS0	16
		SU	MCS0	16

15.4.2. Korea – 5GHz band

802.11a (KC)

802.11a – WLAN 5GHz			
Channel No.	Frequency (MHz)	Data Rate	Power Setting
36	5180	6 Mbps	15
48	5240	6 Mbps	15
52	5260	6 Mbps	15
64	5320	6 Mbps	15
100	5500	6 Mbps	15
132	5660	6 Mbps	15
165	5825	6 Mbps	15

802.11n/ac VHT (KC)

802.11 n/ac VHT20 – WLAN 5GHz			
Channel No.	Frequency (MHz)	Data Rata	Power Setting
36	5180	MCS0	15
48	5240	MCS0	15
52	5260	MCS0	15
64	5320	MCS0	15
100	5500	MCS0	15
132	5660	MCS0	15
165	5825	MCS0	15

802.11ax HE (KC)

802.11ax HE20 – WLAN 5GHz				
Channel No.	Frequency (MHz)	Tone	Data Rata	Power Setting
36	5180	26T	MCS0	6
		52T	MCS0	8
		106T	MCS0	11
		242T	MCS0	15
		SU	MCS0	15
48	5240	26T	MCS0	6
		52T	MCS0	8
		106T	MCS0	11
		242T	MCS0	15
		SU	MCS0	15
52	5260	26T	MCS0	6
		52T	MCS0	8
		106T	MCS0	11
		242T	MCS0	15
		SU	MCS0	15
64	5320	26T	MCS0	6
		52T	MCS0	8
		106T	MCS0	11
		242T	MCS0	15
		SU	MCS0	15

802.11ax HE20 – WLAN 5GHz				
Channel No.	Frequency (MHz)	Tone	Data Rata	Power Setting
100	5500	26T	MCS0	6
		52T	MCS0	8
		106T	MCS0	11
		242T	MCS0	15
		SU	MCS0	15
132	5660	26T	MCS0	6
		52T	MCS0	8
		106T	MCS0	11
		242T	MCS0	15
		SU	MCS0	15
165	5825	26T	MCS0	6
		52T	MCS0	8
		106T	MCS0	11
		242T	MCS0	15
		SU	MCS0	15

16. Module SAR

16.1. FCC Maximum SAR (1g) Values Summary

If your product requires SAR testing, the SAR certification of the end-product can leverage Raytac's module SAR report if the end-product designs comply with the module's test conditions, which are as follows:

- (a) The power settings comply with the AN7002Q power tables.
- (b) The shortest distance between the module antenna and the human body is >= 5mm.

The highest SAR 1g test results as the below tables.

Mode	AN7002Q (W/kg)	AN7002Q-P (W/kg)
2.4G WLAN	0.83	0.93
5G WLAN	0.67	0.73

Mode	AN7002Q-U	
Antenna	SRF2W012-100	2344655-1
2.4G WLAN	0.87	1.14
5G WLAN	1.18	1.18

16.2. CE Maximum SAR (10g) Values Summary

If your product requires SAR testing, the CE SAR certification must be conducted using the final product. Raytac provides the AN7002Q CE SAR reports for reference. The module's CE SAR test conditions are as follows:

- (a) The power settings comply with the AN7002Q power tables.
- (b) The shortest distance between the module antenna and the human body is >= 5mm.

The highest SAR 10g test results as the below tables.

Device	Antenna Type	Band	Measured SAR (W/kg)	Reported SAR (W/kg)	Channel	Position
AN7002Q	Chip Antenna	WLAN 802.11b	0.407	0.438	13	Back Surface
AN7002Q-P	PCB Antenna	WLAN 802.11b	0.371	0.399	13	Back Surface

17. Notes and Cautions

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

- A. Follow the guidelines of this document while designing circuit/end-product. Any discrepancy of core Wi-Fi technology and technical specification of IC should refer to definition of Wi-Fi Organization and Nordic Semiconductor as final reference.
- B. Do not supply voltage that is not within range of specification.
- C. Eliminate static electricity at any cost when working with the module as it may cause damage. It is highly recommended adding anti-ESD components to circuit design to prevent damage from real-life ESD events. Anti-ESD methods can be also applied in mechanical design.
- D. Do not expose modules under direct sunlight for long duration. Modules should be kept away from humid and salty air conditions, and any corrosive gasses or substances. Store it within -40°C to +125°C before and after installation.
- E. Avoid any physical shock, intense stress to the module or its surface.
- F. Do not wash the module. No-Clean Paste is used in production. Washing it will oxidize the metal shield and have chemistry reaction with No-Clean Paste. Functions of the module are not guaranteed if it has been washed.

The module is not suitable for life support device or system and not allowed to be used in destructive device or systems in any direct or indirect ways. The customer agrees to indemnify Raytac for any losses when applying modules in applications such as the ones described above.

18. Useful links

- Nordic infocenter: <https://docs.nordicsemi.com/>
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 developer. 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 nRF7002 : <https://www.nordicsemi.com/Products/nRF7002>
A brief introduction to nRF7002 and download links for Nordic's developing software and SoftDevices.

Full list of Raytac's Wi-Fi modules

- **AN7002Q series (QFN package IC)**

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	Size	Weight
AN7002Q	nRF7002	AN7002Q	1	Chip Antenna	17.1 x 10.8 x 2.1 mm	0.78 (±0.02g)
		AN7002Q-P	1	PCB Antenna	17.1 x 10.8 x 2.1 mm	0.79 (±0.02g)
		AN7002Q-U	1	u.FL Connector	16.4 x 10.8 x 2.1 mm	0.85 (±0.02g)

Full list of Raytac's Bluetooth modules

● AN54LQ series (QFN package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	NVM
AN54LQ	nRF54L15	AN54LQ-15	1	Chip Antenna	256 kB	1524 kB
	nRF54L10	AN54LQ-10	1		192 kB	1012 kB
	nRF54L05	AN54LQ-05	1		96 kB	500 kB
AN54LQ-P	nRF54L15	AN54LQ-P15	1	PCB Antenna	256 kB	1524 kB
	nRF54L10	AN54LQ-P10	1		192 kB	1012 kB
	nRF54L05	AN54LQ-P05	1		96 kB	500 kB
AN54LQ-U	nRF54L15	AN54LQ-U15	1	u.FL Connector	256 kB	1524 kB
	nRF54L10	AN54LQ-U10	1		192 kB	1012 kB
	nRF54L05	AN54LQ-U05	1		96 kB	500 kB

● AN54LV series (WLCSP package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	NVM
AN54LV	nRF54L15	AN54LV-15	1	Chip Antenna	256 kB	1524 kB
		AN54LV-P15	1	PCB Antenna		
AN54LV-U		AN54LV-U15	1	u.FL Connector		
AN54LV-K		AN54LV-K15	1	Pin Antenna		

● 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			
	nRF52833	MDBT50Q-512K	1			
MDBT50Q-P	nRF52840	MDBT50Q-P1MEN	3	PCB Antenna	256 kB	1 MB
	nRF52840	MDBT50Q-P1MV2	2			
	nRF52833	MDBT50Q-P512K	1			
MDBT50Q-U	nRF52840	MDBT50Q-U1MEN	3	u.FL Connector	256 kB	1 MB
	nRF52840	MDBT50Q-U1MV2	2			
	nRF52833	MDBT50Q-U512K	1			
Dongle	nRF52840	MDBT50Q-RX	1, 2	PCB Antenna	256 kB	1 MB
		MDBT50Q-CX-40	1			
	nRF52833	MDBT50Q-CX-33	1			

● MDBT42T series (WLCSP package IC)

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

● MDBT42TV series (WLCSP package IC)

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

● MDBT42 series (WLCSP package IC)

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

● MDBT42V series (WLCSP package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42V	nRF52832	MDBT42V-512KV2		Chip Antenna	64 kB	512 kB
MDBT42V-P		MDBT42V-P512KV2	2	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 kB
	nRF52832	MDBT42Q-512KV2	2			
	nRF52810	MDBT42Q-192KV2	2			
	nRF52811	MDBT42Q-192KL	1		24 kB	192 kB
MDBT42Q-P	nRF52832	MDBT42Q-P512KEN	3	PCB Antenna	64 kB	512 kB
	nRF52832	MDBT42Q-P512KV2	2			
	nRF52810	MDBT42Q-P192KV2	2			
	nRF52811	MDBT42Q-P192KL	1		24 kB	192 kB
MDBT42Q-U	nRF52832	MDBT42Q-U512KEN	3	u.FL Connector	64 kB	512 kB
	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 kB
		MDBT40-256RV3				
MDBT40-P	nRF51822	MDBT40-P256V3	3	PCB Antenna	16 kB	256 kB
		MDBT40-P256RV3				

Release Note

- 2025/12/10 Version 1.0: 1st release

