

WiFi module
Integrated Bluetooth V2.1/3.0/4.2/5.3

Model Number: WXT0HR1101
(REALTEK : RTL8851BU)

(MAC address from GSD)

Customer Approval Section		
Customer Name		
Department		
Approval		Date:

拟制 DESIGN	审核 CHECK	批准 APPROVAL
徐欢	侯德伟	高照
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惠州高盛达科技股份有限公司
HUIZHOU GAOSHENGDA TECHNOLOGY CO.,LTD

中国惠州惠澳大道惠南高新科技产业园金达路 2 号
NO.2,JINDA ROAD, HUINAN SCIENCE AND TECHNOLOGY PARK, HUIZHOU, CHINA
TEL: (0752) 2096985

E-mail: xuh@gaosd.com



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1. General Description

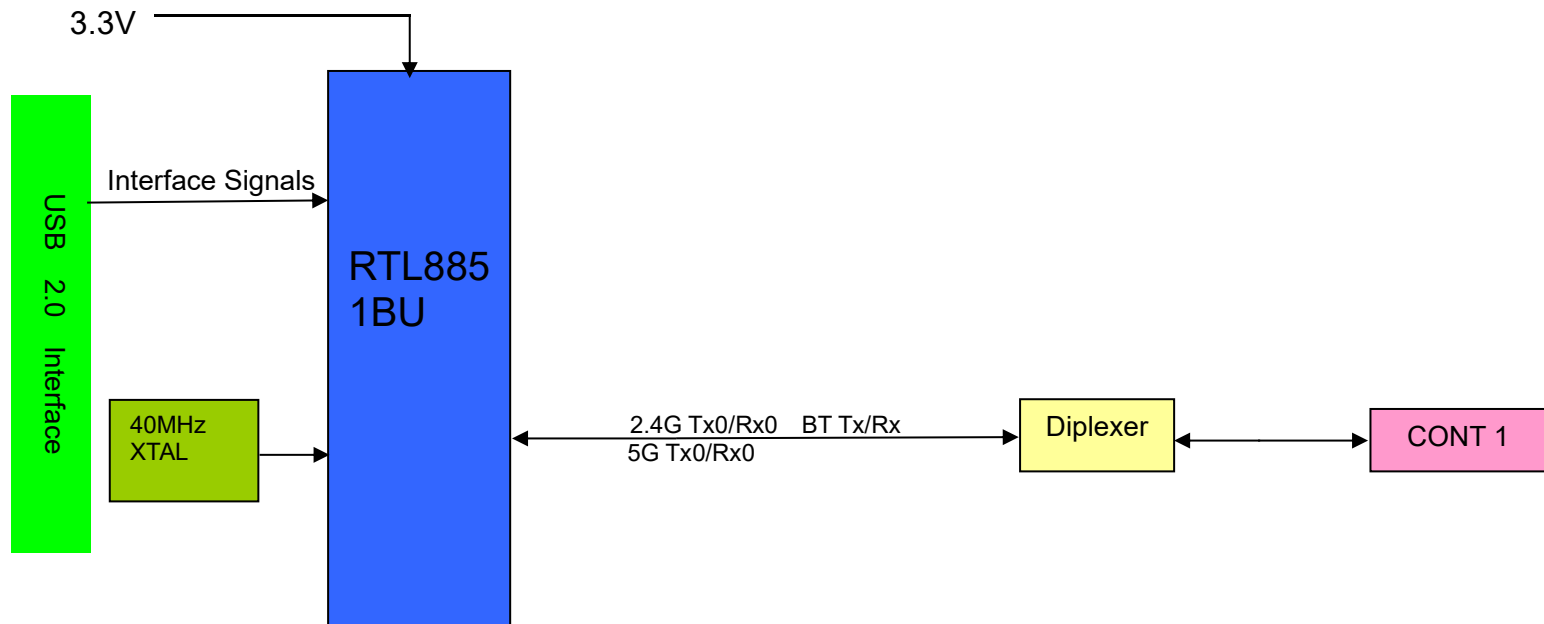
The Realtek RTL8851BU is a highly integrated single-chip that support 1-stream 802.11ax solutions with Wireless LAN (WLAN) USB interface controller. It combines a WLAN MAC, a 1T1R capable WLAN baseband, and RF in a single chip. The RTL8851BU provides a complete solution for a high-performance integrated wireless and Bluetooth device.

2. Features

- Compatible with IEEE 802.11a standard, providing wireless data rate up to 54Mbps.
- Compatible with IEEE 802.11b standard, providing wireless data rate up to 11Mbps.
- Compatible with IEEE 802.11g standard, providing wireless data rate up to 54Mbps.
- Compatible with IEEE 802.11n standard, providing wireless data rate up to 150Mbps.
- Compatible with IEEE 802.11ac standard, providing wireless data rate up to 433.3Mbps.
- Compatible with IEEE 802.11ax standard to provide wireless 286Mbps data rate in 2.4GHz band.
- Compatible with IEEE 802.11ax standard to provide wireless 600Mbps data rate in 5GHz band.
- Support 20MHz, 40MHz bandwidth in 2.4GHz band.
- Support 20MHz, 40MHz, 80Mhz bandwidth in 5GHz band.
- Support STBC, LDPC
- support QoS Enhancement (WMM)
- Security support for WPA/WPA2/WPA3
- Operation at 2.4~2.5GHz and 5.15~5.825GHz frequency band to meet worldwide regulations
- Bluetooth specification 2.1/3.0/4.2
- Bluetooth 5.3
- High speed USB 2.0 interface
- HSF compliant

3. Application Diagrams

3.1 Functional Block Diagram



3.2 General Requirements

3.2.1 IEEE 802.11b Section

	Feature	Detailed Description
3.2.1.1	Standard	<ul style="list-style-type: none">IEEE 802.11b
3.2.1.2	Radio and Modulation Schemes	<ul style="list-style-type: none">DQPSK , DBPSK and CCK with DSSS
3.2.1.3	Operating Frequency	<ul style="list-style-type: none">2400 ~ 2483.5MHz ISM band
3.2.1.4	Channel Numbers	<ul style="list-style-type: none">11 channels for Worldwide
3.2.1.5	Data Rate	<ul style="list-style-type: none">at most 11Mbps
3.2.1.6	Media Access Protocol	<ul style="list-style-type: none">CSMA/CA with ACK

3.2.2 IEEE 802.11g Section

	Feature	Detailed Description
3.2.2.1	Standard	<ul style="list-style-type: none">IEEE 802.11g
3.2.2.2	Radio and Modulation Type	<ul style="list-style-type: none">QPSK , BPSK , 16QAM ,64QAM with OFDM
3.2.2.3	Operating Frequency	<ul style="list-style-type: none">2400 ~ 2483.5MHz ISM band
3.2.2.4	Channel Numbers	<ul style="list-style-type: none">11 channels for Worldwide
3.2.2.5	Data Rate	<ul style="list-style-type: none">at most 54Mbps
3.2.2.6	Media Access Protocol	<ul style="list-style-type: none">CSMA/CA with ACK

3.2.3 IEEE 802.11a Section

	Feature	Detailed Description
3.2.3.1	Standard	<ul style="list-style-type: none"> IEEE 802.11a
3.2.3.2	Radio and Modulation Type	<ul style="list-style-type: none"> QPSK , BPSK , 16QAM ,64QAM with OFDM
3.2.3.3	Operating Frequency	<ul style="list-style-type: none"> 5.15~5.25GHz 5.25~5.35GHz 5.47~5.725GHz 5.725~5.85GHz
3.2.3.4	Data Rate	<ul style="list-style-type: none"> at most 54Mbps
3.2.3.5	Media Access Protocol	<ul style="list-style-type: none"> CSMA/CA with ACK

3.2.4 IEEE 802.11n Section

	Feature	Detailed Description
3.2.4.1	Standard	<ul style="list-style-type: none"> IEEE 802.11n
3.2.4.2	Radio and Modulation Type	<ul style="list-style-type: none"> BPSK , QPSK , 16QAM ,64QAM with OFDM
3.2.4.3	Operating Frequency	<ul style="list-style-type: none"> 2.4GHz :2400 ~ 2483.5MHz for ISM band 5GHz : 5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.725GHz; 5.725~5.85GHz;
3.2.4.4	Data Rate	at most 150 Mbps
3.2.4.5	Media Access Protocol	<ul style="list-style-type: none"> CSMA/CA with ACK

3.2.5 IEEE 802.11ac Section

	Feature	Detailed Description
3.2.5.1	Standard	<ul style="list-style-type: none">IEEE 802.11ac
3.2.5.2	Radio and Modulation Type	<ul style="list-style-type: none">QPSK , BPSK , 16QAM ,64QAM,256QAM with OFDM
3.2.5.3	Operating Frequency	<ul style="list-style-type: none">5GHz : 5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.725GHz; 5.725~5.85GHz;
3.2.5.4	Data Rate	<ul style="list-style-type: none">at most 433.3Mbps
3.2.5.5	Media Access Protocol	<ul style="list-style-type: none">CSMA/CA with ACK

3.2.6 IEEE 802.11ax Section

	Feature	Detailed Description
3.2.6.1	Standard	<ul style="list-style-type: none">IEEE 802.11ax
3.2.6.2	Radio and Modulation Type	<ul style="list-style-type: none">QPSK , BPSK , 16QAM ,64QAM,256QAM, 1024QAM with OFDMA
3.2.6.3	Operating Frequency	<ul style="list-style-type: none">2G: 2400 ~ 2483.5MHz ISM band5GHz : 5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.725GHz; 5.725~5.85GHz;
3.2.6.4	Data Rate	<ul style="list-style-type: none">2G: at most 286Mbps5G: at most 600Mbps
3.2.6.5	Media Access Protocol	<ul style="list-style-type: none">CSMA/CA with ACK

3.2.7 Bluetooth Section

Feather		Description	
General specification			
Bluetooth standard	Bluetooth V2.1/3.0/4.2/5.3		
Frequency band	2402MHz-2480MHz		
Channel Numbers	79 channels for BDR+EDR 40 channels for BLE		
Modulation	GFSK, $\pi/4$ -DQPSK and 8DPSK		
RF specification			
	Min（dBm）	Type（dBm）	Max（dBm）
BDR Output Power			
BLE Output Power			
Sensitive @BER=0.1% FOR GFSK(1Mbps)		-86	
Sensitive @BER=0.01% FOR $\pi/4$ -DQPSK(2Mbps)		-86	
Sensitive @BER=0.01% FOR 8DPSK(3Mbps)		-80	
Maximum input level	GFSK(1Mbps) -20dBm		
	$\pi/4$ -DQPSK(2Mbps) -20dBm		
	8DQPSK(3Mbps) -20dBm		
Sensitive @PER=30.8% FOR BLE		-90	

4. Electrical and Thermal Characteristics

4.1 Temperature Limit Ratings

Parameter	Minimum	Maximum	Units
Storage Temperature	-40	+80	°C
Ambient Operating Temperature	0	70	°C
Junction Temperature	0	125	°C

4.2 General Section

	Feature	Detailed Description
4.2.1	Antenna Type	• WIFI&BT :IPEX&PIFA Antenna
4.2.2	Operating Voltage	• 3.3V±0.3V
4.2.3	Current Consumption	• <2A
4.2.4	Form Factor and Interface	• High Speed USB2.0 Interface



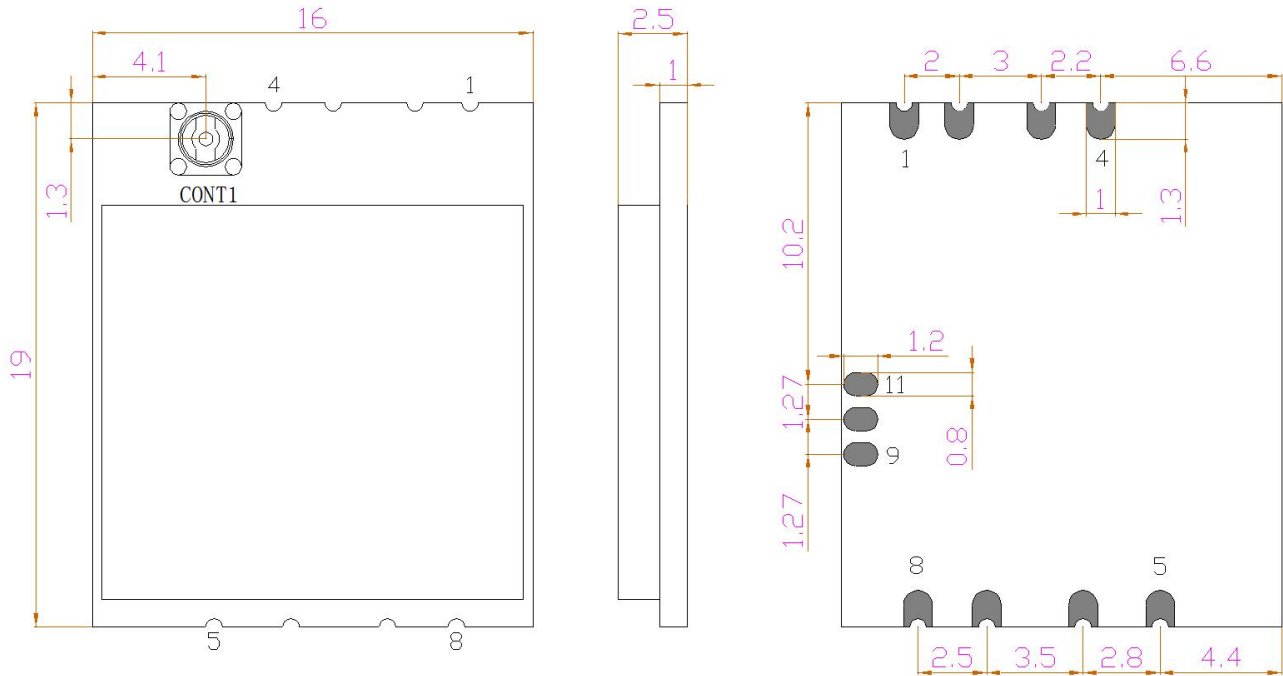
4.3 Software

Driver	Windows, Android, Linux
Security	WPA,WPA2,WPA3

4.4 Mechanical Dimensions

Feature	Detailed Description
Length	<ul style="list-style-type: none">• 16mm
Width	<ul style="list-style-type: none">• 19mm
Height	<ul style="list-style-type: none">• PCB1.0mm

5.Mechanical Dimensions



CONT1: WIFI/BT

Tolerance:

Length(mm)	Tolerance(mm)
0-5	±0.15
5-10	±0.20
10-50	±0.30
>50	±0.40



6. Connector Definition

Pin	Definition	Remark	I/O
1	GND	GND	
2	NC	NC	
3	NC	NC	
4	GND	GND	
5	VDD3.3	3.3V	
6	DM	USB D-	
7	DP	USB D+	
8	GND	GND	
9	Reset	RESERT	I
10	WL FW log	WL FW log	
11	WL_WAKE_HOST	WIFI Wake Host	O
	CONT1	WIFI/BT	

Note: WIFI and BT share the same address segment, but there will be no situation where they share the same address.

The Pin 9. RESET module has been internally pulled up to 3.3V, and the port status should be configured to be valid at a low level

Pin 10.WL FW log: NC of the entire machine is fine

Pin 11.WL_WAKE_HOST: The module has been internally pulled up to 3.3V, and the port status should be configured to be valid at a low level

7. Interface Timing Specification

USB Bus during Power On Sequence

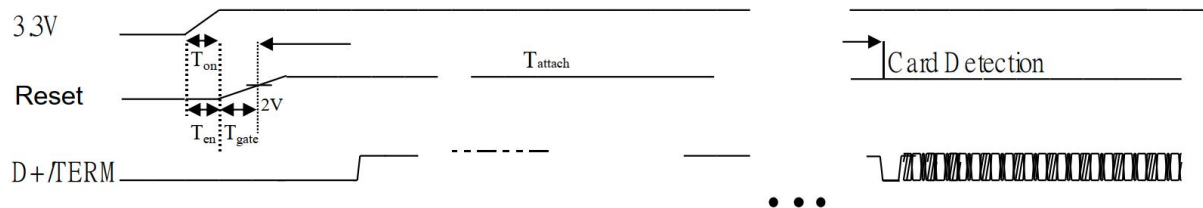


Figure 3 RTL8851BU-CG USB Bus Power On Sequence

T_{on}: The main power ramp up duration

T_{en}: Interval between the rising point of 3.3V and chip_en

T_{gate}: Interval of 3.3V to be gated when chip_en voltage level < 2V

T_{attach}: USB attach state. The duration from resistor attached to USB host starting card detection procedure

Table 15. Typical Timing Range

	Unit	Min.	Typical	Max.
T _{on}	ms	-	1.5	5
T _{en}	ms	0	0	5
T _{gate}	ms	0	1.5	8
T _{attach}	ms	100	250	-

RTL8851BU-CG Power off Sequence

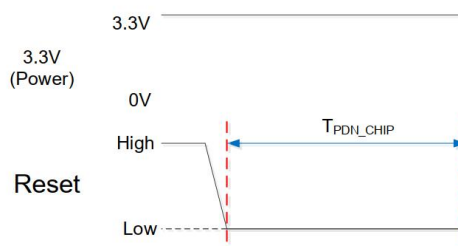


Figure 4 RTL8851BU-CG Power Off Sequence

Table 16 RTL8851BU-CG Power Off Timing Parameters

	Min.	Typical	Max.	Unit	Description
T _{PDN_CHIP}	10	100	X	ms	CHIP_EN keep low duration

Reset can externally shutdown the RTL8851BU-CG when Reset is pulled low. The keeping low duration must be more than T_{PDN_CHIP}

FCC WARNING

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labelled in a visible area with the following:

“Contains Transmitter Module FCC ID:2BN5S-2503D

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of FCC part 15C(15.247).FCC Part 15.407

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain.

Explanation: The EUT contains four different FPC antennas. Yes, this module includes a permanent additional antenna with a maximum antenna gain of 4.22dBi for 2.4G and 5.47dBi for 5G. The prototype is used under mobile conditions.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited

module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is a single module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: No, The module has no tracking antenna design, is FPC antenna.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement,
FCC ID: 2BN5S-2503D

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT contains four different FPC antennas. Yes, this module includes a permanent additional antenna with a maximum antenna gain of 4.22dBi for 2.4G and 5.47dBi for 5G. The prototype is used under mobile conditions.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This

includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2BN5S-2503D

2.9 Information on test modes and additional testing requirements

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

Explanation: Any company of the host device which install this modular with limit modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C: 15.247 and 15.209 & 15.207, 15B Class B requirement, Only if the test result comply with FCC part 15C: 15.247 and 15.209 & 15.207, 15B Class B requirement, then the host can be sold legally. The module is installed in the host and can be transmitted independently.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules

that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15

Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The host should be evaluated by the FCC Subpart B.

This product adopts FPC antennas. The maximum antenna gain is 4.22dBi for the 2.4G antenna and 5.47dBi for the 5G antenna B.

IC statement

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.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

The term "IC: " before the certification/registration number only signifies that the Industry Canada

technical specifications were met.

This product meets the applicable Industry Canada technical specifications.

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS)

d'Innovation, Sciences et Développement économique Canada. 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.

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;

2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Please notice that if the ISED certification number is not visible when the module is installed inside

another device, then the outside of the device into which the module is installed should display a label referring to the enclosed module. This exterior label can use wording such as the following:

"Contains IC: 33667-2503D" any similar wording that expresses the same meaning may be used.

L'appareil hôte doit porter une étiquette donnant le numéro de certification du module d'Industrie

Canada, précédé des mots «Contient un module d'émission », du mot « IC: 33667-2503D » ou d'une formulation similaire exprimant le même sens, comme suit

The device meets the exemption from the routine evaluation limits in section 6.6 of RSS 102 and compliance with RSS-102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

Le dispositif rencontre l'exemption des limites courantes d'évaluation dans la section 6.6 de RSS

102 et la conformité

à l'exposition de RSS-102 rf, utilisateurs peut obtenir l'information canadienne sur l'exposition et la

conformité de rf.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Cet émetteur ne doit pas être Co-placé ou ne fonctionnant en même temps qu'aucune autre antenne ou émetteur. Cet équipement devrait être installé et actionné avec une distance minimum

de 20 centimètres entre le radiateur et votre corps.

Operation of this device is restricted to indoor use only. (5150-5250MHz)

Le fonctionnement de cet appareil est limité à une utilisation en intérieur uniquement.

(5150-5250MHz)

Cet émetteur radio IC : 33667-2503D a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous, avec le gain maximal admissible indiqué. Les types d'antenne non inclus dans cette liste qui ont un gain supérieur au gain maximum indiqué pour tout type répertorié sont strictement interdits pour une utilisation avec cet appareil.

The radio transmitter IC: 33667-2503D has been approved by The Ministry of Innovation, Science and Economic Development of Canada to use the following antenna types with the specified maximum allowed gain. Antenna types not included in this list, whose gain is higher than the maximum gain of any type listed, are strictly prohibited from use with this device.

ANT1

Type of antenna:	FPC antenna
Antenna Gain:	2.4G :2400-2500(4.09dBi) 5G :5150-5850MHz(4.08dBi)
Impedance:	50hm
Manufacture:	SHENZHEN LINRONG TECHNOLOGY CO.,LTD
Model:	54.07.001.0144

ANT2

Type of antenna:	FPC antenna
Antenna Gain:	2.4G :2400-2500(4.22dBi) 5G :5150-5850MHz(5.47dBi)
Impedance:	50hm
Manufacture:	Shenzhen Be-Comfortable Technology Co. Ltd
Model:	54.07.001.0144

ANT3

Type of antenna:	FPC antenna
Antenna Gain:	2.4G :2400-2500(2.6dBi) 5G :5150-5850MHz(4.2dBi)
Impedance:	50hm
Manufacture:	SHENZHEN LINRONG TECHNOLOGY CO.,LTD
Model:	54.07.001.0156

ANT4

Type of antenna:	FPC antenna
Antenna Gain:	2.4G :2400-2500(3.95dBi) 5G :5150-5850MHz(4.75dBi)

Impedance:	50hm
Manufacture:	SHENZHEN LINRONG TECHNOLOGY CO.,LTD
Model:	54.07.001.0158