



Product Specifications

IEEE802. 11a/b/g/n/ac/ax/bt 2T2R 2.4G/5G Dual

with Integrated Bluetooth V5.2

Project Name	RTL8852BE Combo Module
Main Model	WD_RTL8852BEM2_V10 (Wi-Fi PCIE /BT:USB)
Version number	V10
Customer's Part NO	
Customer	

Approved	RD	quality	Drafted
David	Jin	Aaron	Abner

Customer	Customer signature	Approved Date

Shenzhen MiaoMing Intelligent Technology Co.,Ltd

Mobile: 13632661223 contacts: David-huang

Tell:0755-28197585

E-mail: david-huang @weidcn.com.

Floor 3, Factory Building 2, No. 1310, Kukeng Sightseeing Road, Kukeng Community, Guanlan Street,
Longhua District, Shenzhen, Guangdong.

Wb:www.szmiaoming.com



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一. Introduction

1.General Description

The Realtek RTL8852BE is a highly integrated single-chip that support 2-stream 802.11ax solutions with Multi-user MIMO (Multiple-Input, Multiple-Output) with Wireless LAN (WLAN) PCI Express network interface controller with integrated Bluetooth 5 USB interface controller. It combines a WLAN MAC, a 2T2R capable WLAN baseband, and RF in a single chip. The RTL8852BE provides a complete solution for a high-performance integrated wireless and Bluetooth device.

The RTL8852BE baseband implements Multi-user Multiple Input, Multiple Output (MU-MIMO) Orthogonal Frequency Division Multiplexing (OFDM) with two transmit and two receive paths (2T2R). Features include two spatial stream transmissions, short Guard Interval (GI), spatial spreading, and support for variant channel bandwidth. Moreover, RTL8852BE provides one spatial stream space-time block code (STBC), Transmit Beamforming (TxBF) and Low Density Parity Check (LDPC) to extend the range of transmission. At the receiver, extended range and good minimum sensitivity is achieved by having receiver diversity up to 2 antennas. As the recipient, the RTL8852BE also supports explicit sounding packet feedback that helps senders with beamforming capability.

For legacy compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCK) and OFDM baseband processing are included to support all IEEE 802.11b, 802.11g and 802.11a data rates. Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability are available, and CCK provides support for legacy data rates, with long or short preamble. The CCK processor can perform dual-receiver by providing diversity gain to extend range and improve the reception. The high speed FFT/IFFT paths, combined with BPSK, QPSK, 16QAM, 64QAM, 256QAM, and up to 1024QAM modulation of the individual subcarriers, and rate compatible coding rate of 1/2, 2/3, 3/4, and 5/6, provide up to 1201Mbps for IEEE 802.11ax MIMO OFDM.

For advanced 11ax spec, RTL8852BE can receive with OFDMA (OFDM Access) technology. The RU size can be supported form small unit, e.g., RU26, and RU52, 106, 242, 484, and finally up to RU996. The high-order modulation scheme, such as 1024-QAM, can also be handled very well. Meanwhile, diff number of total subcarrier in the HE-LTF, such as 1x, 2x and 4x is considered. More networking efficiency can be achieved by 1x, and better channel estimation performance provided by 4x.

The RTL8852BE builds in an enhanced signal detector, an adaptive frequency domain equalizer, and a soft-decision Viterbi decoder to alleviate severe multi-path effects and mutual interference in the reception of multiple streams. For better detection quality, receive diversity with Maximal-Ratio-Combine (MRC) applying up to two receive paths, and Maximum-Likelihood Detection (MLD) are implemented. Robust interference detection and suppression are provided to protect against Bluetooth, cordless phone, and microwave oven interference.



Receive vector diversity for multi-stream application is implemented for efficient utilization of the MIMO channel. Efficient IQ-imbalance, DC offset, phase noise, frequency offset, and timing offset compensations are provided for the radio frequency front-end.

The RTL8852BE supports fast receiver Automatic Gain Control (AGC) with synchronous and asynchronous control loops among antennas, antenna diversity functions, and adaptive transmit power control functions to obtain better performance in the analog portions of the transceiver.

The RTL8852BE MAC supports 802.11e for multimedia applications, 802.11i and WAPI (Wireless Authentication Privacy Infrastructure) for security, and 802.11n/802.11ac/802.11ax for enhanced MAC protocol efficiency. Using packet aggregation techniques such as A-MPDU with BA and A-MSDU, protocol efficiency is significantly improved. Power saving mechanisms such as Legacy Power Save, UAPSD, and MIMO power saving reduce the power wasted during idle time, and compensate for the extra power required to transmit MIMO OFDM. The RTL8852BE provides simple legacy, 20MHz/40MHz/80MHz co-existence mechanisms to ensure backward and network compatibility.

2. Features

General

- 76-pin QFN
- CMOS MAC, Baseband PHY and RF in a single chip for IEEE 802.11a/b/g/n/ac/ax compatible WLAN
- Support 802.11ac 2x2, Wave-2 compliant with RX MU-MIMO
- Support 802.11ax 2x2, with OFDMA and MU-MIMO, by 4 types PPDU format, such as HE-SU-PPDU, HE-ER-SU-PPDU, HEMU-PPDU, and HE-TB-PPDU
- Maximum PHY data rate up to 286.8 Mbps using 20MHz bandwidth, 573.5Mbps using 40MHz bandwidth, and 1201Mbps using 80MHz bandwidth
- Backward compatible with 802.11a/b/g devices while operating at 802.11n data rates
- Backward compatible with 802.11a/n/ac devices while operating at 802.11ax data rates

Host Interface

- Complies with PCI Express Base Specification Revision 1.1
- PCIe LTR/L1.Off state supported.
- Complies with USB2.0 FS-mode Specification for Bluetooth.

1.3 Applications

- NOTE-BOOK
- TV
- Tablet PC
- Set-Top box

二. GENERAL SPECIFICATION

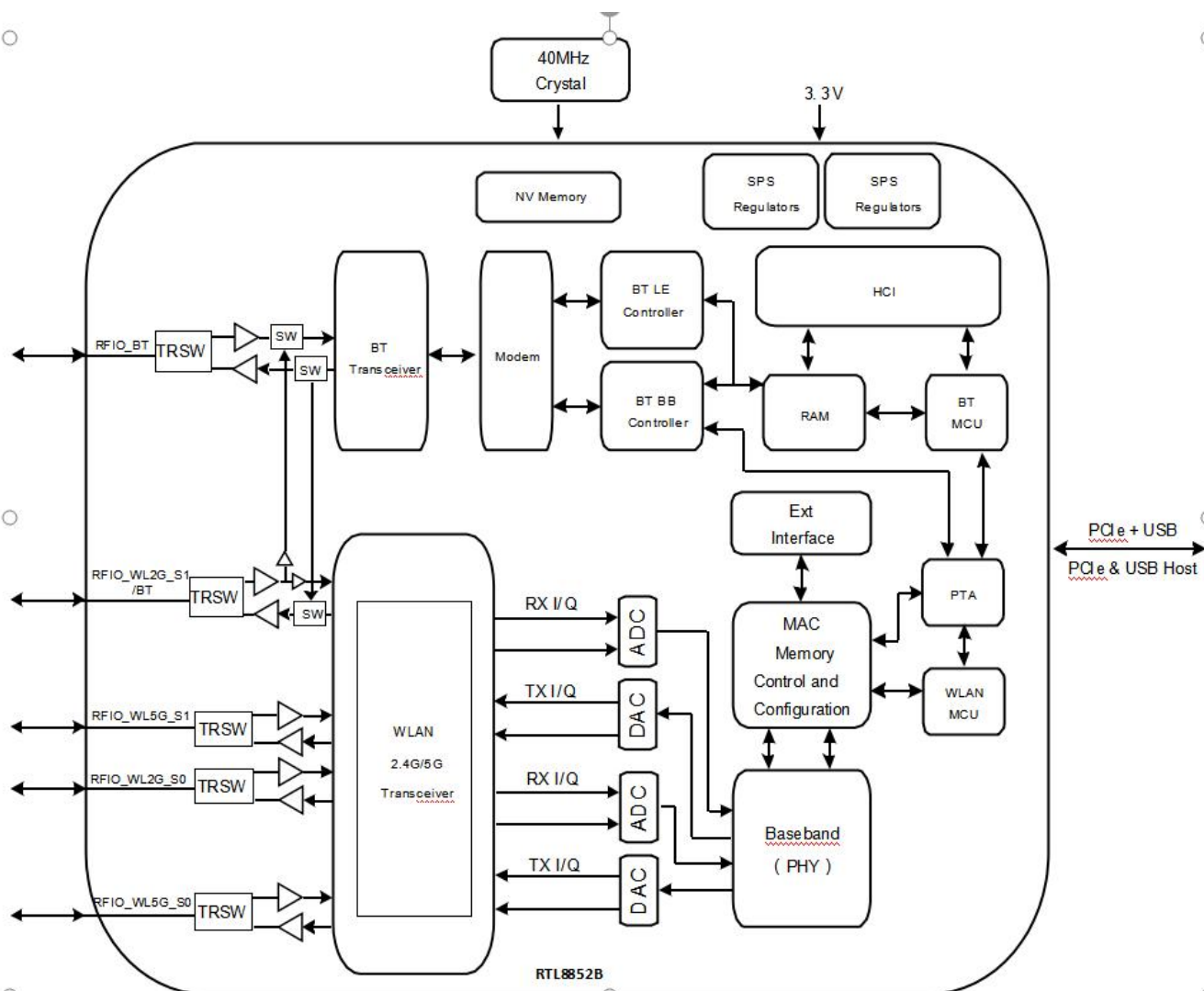


Figure 1. Dual-Band MIMO 2x2 Solution(11ax 2x2 MAC/BB/RF + PA) and Integrated Bluetooth Controller Solution --- RTL8852BE



2.1 WiFi RF Specifications

Features	Descriptions
Main Chipset	RTL8852BE-CG
Frequency Range	BT: 2402-2480MHz; 2.4G WIFI: 2412-2462MHz; 5G WIFI: 5180-5240MHz & 5745-5825MHz
Host Interface	WiFi: PCI Express BT: USB
Standards	WiFi: IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, IEEE 802.11n, IEEE 802.11ac, 802.11ax
Modulation	WiFi: 802.11b: DSS/CCK 802.11 a/g/n/ac: OFDM
PHY Data rates	WiFi: 802.11a: 54,48,36,24,18,12,9,6 Mbps 802.11b: 11,5.5,2,1 Mbps 802.11g: 54,48,36,24,18,12,9,6 Mbps 802.11n: up to 300Mbps 802.11ac: up to 867Mbps 802.11ax: up to 1021Mbps



Receiver Sensitivity 2.4G	802.11b@8% PER Receive maximum level ≥ -10 11Mbps ≤ -82 dBm
	802.11g@10% PER Receive maximum level ≥ -20 54Mbps ≤ -72 dBm
	802.11n@10% PER Receive maximum level ≥ -20 MCS 7_HT20 ≤ -70 dBm MCS 7_HT40 ≤ -66 dBm
Receiver Sensitivity 5G	802.11a@10% PER Receive maximum level ≥ -30 54Mbps ≤ -70 dBm
	802.11n/ac@10% PER Receive maximum level ≥ -30 MCS 7_HT20 ≤ -67 dBm MCS 7_HT40 ≤ -65 dBm MCS 9 ≤ -59 dBm (HT 80) MCS 11 ≤ -51 dBm (HT 80)
Operating Channel	WiFi 2.4GHz: 11: (Ch. 1-11) – United States(North America) 13: (Ch. 1-13) – Europe 14: (Ch. 1-14) – Japan
Operating Channel	WiFi 5.8GHz:



2.2 Bluetooth Specification

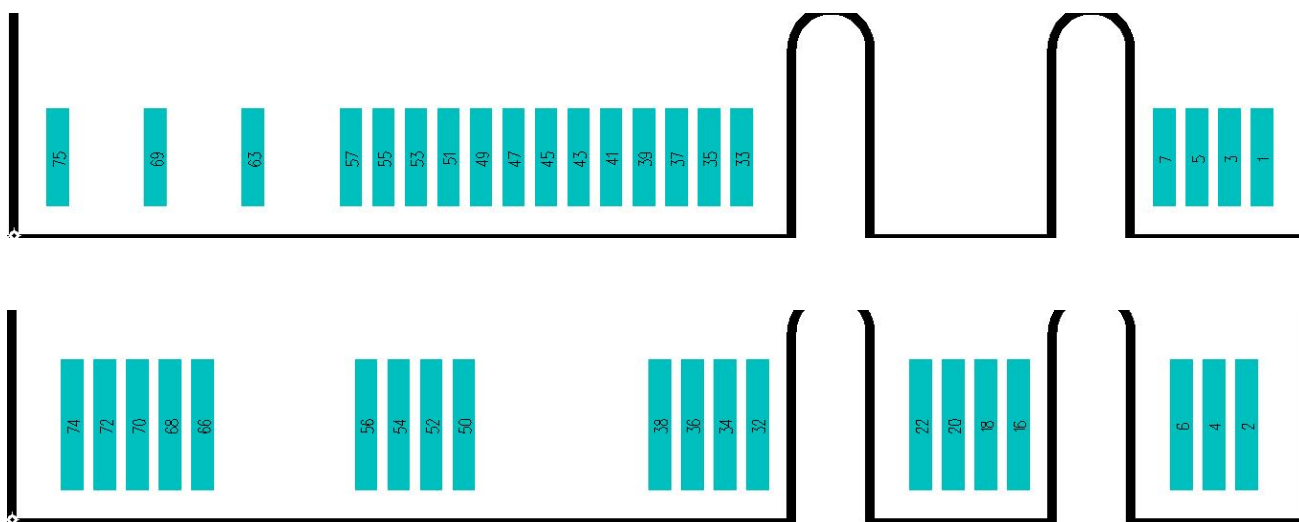
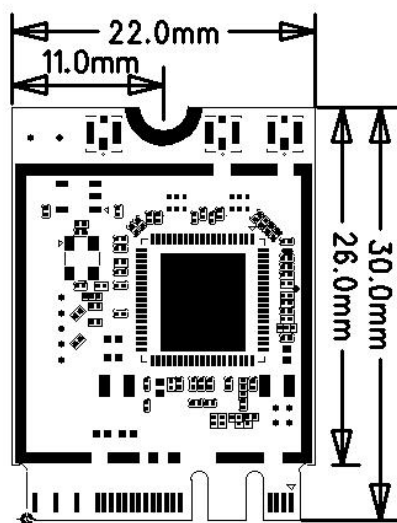
Feature	Description																							
General Specification																								
Bluetooth Standard	Bluetooth V5.2 of 1, 2 and 3 Mbps.																							
Host Interface	USB																							
Antenna Reference	Small antennas with 0~2 dBi peak gain																							
Frequency Band	2.400 GHz ~ 2483.5 GHz																							
Number of Channels	79 channels																							
Modulation	FHSS, GFSK, DPSK, DQPSK																							
RF Specification																								
	<table><tr><th>Min</th><th>Typical</th><th>Max</th></tr><tr><td>Output Power (Class 1.5)</td><td>-6</td><td>8</td><td>10</td></tr><tr><td>Output Power (Class 2)</td><td></td><td>2</td><td></td></tr><tr><td>Sensitivity @ BER=0.1% for GFSK (1Mbps)</td><td></td><td>-89</td><td></td></tr><tr><td>Sensitivity @ BER=0.01% for $\pi/4$-DQPSK (2Mbps)</td><td></td><td>-85</td><td></td></tr><tr><td>Sensitivity @ BER=0.01% for 8DPSK (3Mbps)</td><td></td><td>-83</td><td></td></tr></table>	Min	Typical	Max	Output Power (Class 1.5)	-6	8	10	Output Power (Class 2)		2		Sensitivity @ BER=0.1% for GFSK (1Mbps)		-89		Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)		-85		Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-83	
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2.3 Operating Conditions

Parameter	Min.	Typ.	Max.	Unit
Operating Temperature	-10	-	+70	°C
Operating Humidity	10	-	85	%
VCC33	3.15	3.3	3.45	V
VDDIO	1.7	1.8 or 3.3	3.45	V
External power supply current design	≥ 1200mA			

三. MECHANICAL SPECIFICATION



3.1. Pin Definition

Pin	Definition	Description
1	Gnd	Ground
2	VDD33	3.3V
4	VDD33	3.3V
3	HSDP	USB2.0_DP



	5	HSDM	USB2.0_DM
	6	LED_WL	GPIO8
	7	GND	Ground
	8-15	NC	NC
	16	LED_BT	BT_LED
	17.19.21.23	NC	NC
	18	GND	Ground
	20	BT_WAKE_HOST	GPIO14
	22	UART_TX	NC
	24~31	NC	NC
	32	UART_RX	NC
	33	GND	Ground
	34	UART_RTS	NC
	35	HSIP	PCI Express Receive Differential Pair
	36	UART_CTS	NC
	37	HSIN	PCI Express Receive Differential Pair
	38	HOST_WAKE_BT	HOST_WAKE
	39	GND	Ground
	40.42	NC	NC
	41	HSOP	PCI Express Transmit Differential Pair



43	HS0N	PCI Express Transmit Differential Pair
44	nc	nc
45	GND	Ground
46	nc	nc
47	REFCLK+	REFCLK_P
48	nc	nc
49	REFCLK-	REFCLK_N
50	SUSCLK	EECS
51	GND	Ground
52	PERSTN	PERSTN
53	CLKREQN	CLKREQN
54	BT_DIS_N	GPIO11
55	WAKEN	WAKEN
56	WL_DIS_N	GPIO9
57	GND	Ground
58-62	NC	NC
63	GND	Ground
64-65	NC	NC
66	PCM_IN	GPIO0
67	NC	NC
68	PCM_OUT	GPIO1
69	GND	Ground
70	PCM_SYNC	GPIO2
71	NC	NC
72-74	VDD33	3.3V
73	NC	NC
75	GND	Ground

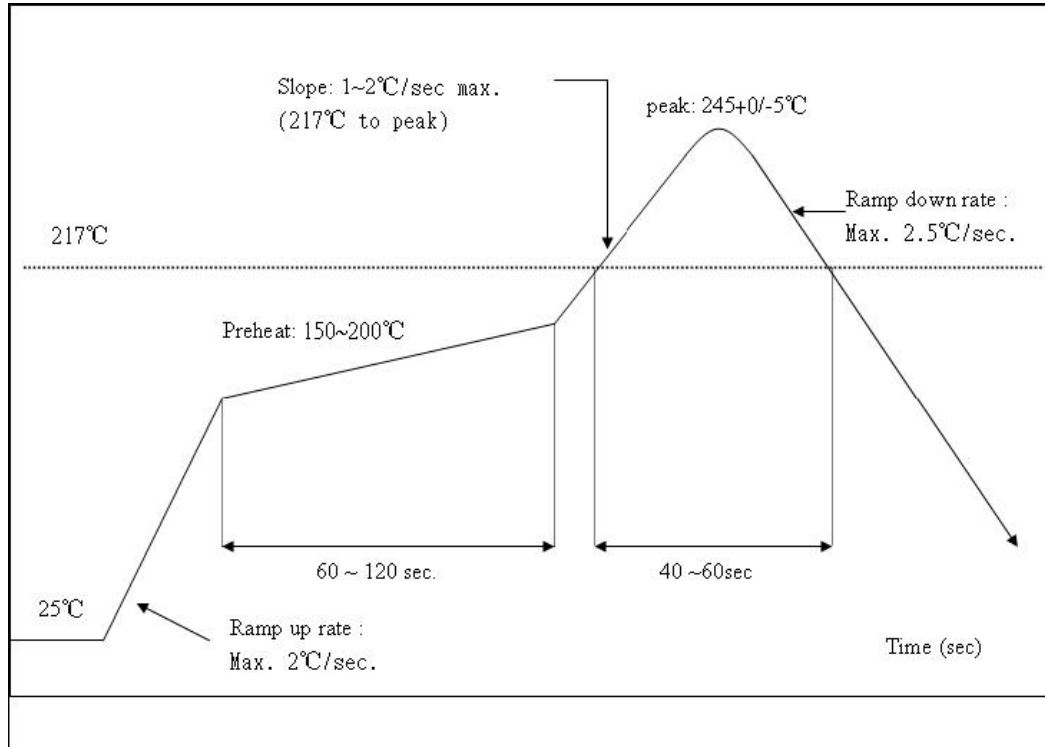


四. ENVIRONMENTAL REQUIREMENTS

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times



ENVIRONMENTAL

Operating

Operating Temperature: -10°C to +70 °C

Relative Humidity: 5-90% (non-condensing)

Storage

Temperature: -55°C to +125°C (non-operating)

Relevant Humidity: 5-95% (non-condensing)

Patch WIFI modules installed before the notice:

WIFI module installed note:

1. Please press 1 : 1 and then expand outward proportion to 0.7 mm, 0.12 mm thickness

When open a stencil

2. Take and use the WIFI module, please insure the electrostatic protective measures.

3. Reflow soldering temperature should be according to the customer the main size of the products, such as the temperature set at 250 + 5 °C for the MID motherboard.

About the module packaging, storage and use of matters needing attention are as follows:

1. The module of the reel and storage life of vacuum packing: 1). Shelf life: 8 months, storage environment conditions: temperature in: < 40 °C, relative humidity: < 90% r.h.

2. The module vacuum packing once opened, time limit of the assembly:



Card: 1) check the humidity display value should be less than 30% (in blue), such as: 30% ~ 40% (pink), or greater than 40% (red) the module have been moisture absorption.

2.) factory environmental temperature humidity control: $\leq 30^{\circ}\text{C}$, $\leq 60\%$ r.h..

3). Once opened, the workshop the preservation of life for 168 hours.

3. Once opened, such as when not used up within 168 hours:

1). The module must be again to remove the module moisture absorption.

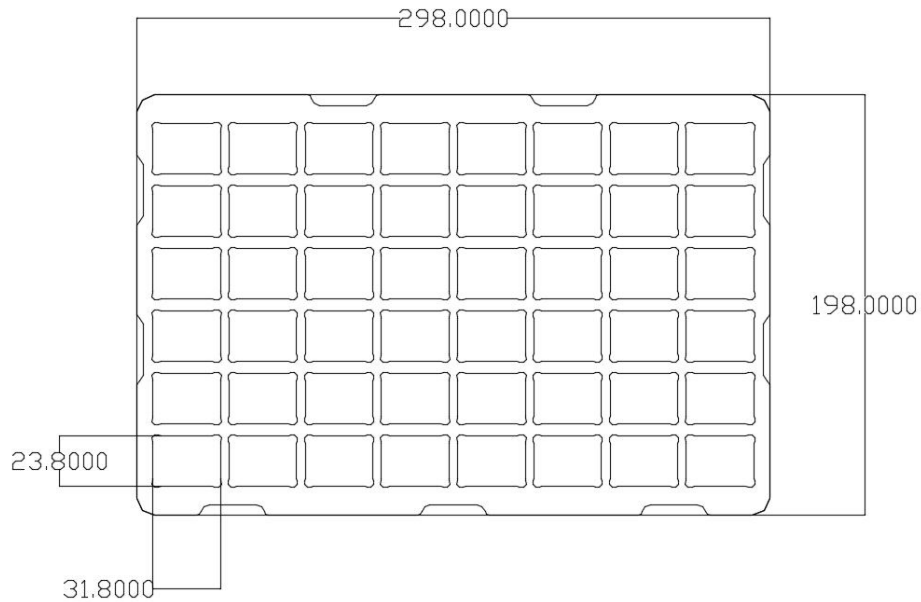
2). The baking temperature: 125°C , 8 hours.

3.) After baking, put the right amount of desiccant to seal packages.

六. PACKING INFORMATION



The following figure shows the dimensions of the blister disk



This product is packed in a blister tray, 48 pieces in a tray, 10 pieces in a bag with a lid, 4 bags in a box, 1920PCS in a box. The following figure shows the packaging of this product.





Note: Shenzhen MiaoMing may make improvements and/or changes in this document or in the product described in this document at any time. This document could include technical inaccuracies or typographical errors.

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Federal Communication Commission Statement (FCC, U.S.)

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 important announcement

Important Note:

Radiation Exposure Statement

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

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

Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, a
2. The transmitter module may not be co-located with any other transmitter or antenna
2. For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change. (if modular only test Channel 1-11)

As long as the three conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following"
Contains FCC ID: 2AXHE-RTL8852BEM2"

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.
The end user manual shall include all required regulatory information/warning as show in this manual.

Integration instructions for host product manufactures according to KDB 996369 D03 OEM Manual v01**2.2 List of applicable FCC rules**

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable.

2.5 Trace antenna designs

Not applicable.

2.6 RF exposure considerations**FCC Radiation Exposure Statement**

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

2.7 Antennas

This radio transmitter FCC ID: 2AXHE-RTL8852BEM2 been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna Model No.	Antenna Gain (dBi)			Antenna Tyoe	Antenna Manufacturer
	Bluetooth (BDR+EDR+BLE)	2.4G WiFi	5G WiFi		
SLK-MX-2516HV2CM B03U	ANT 1: 1.98 dBi	ANT 1& ANT 2: 1.98 dBi	ANT 1&2: U-NII-1: 1.74 dBi U-NII-3: 1.89 dBi	FPC Antenna	Shenzhen Yishengbang Technology Co., Ltd

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following "Contains TX FCC ID:2AXHE-RTL8852BEM2". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label:

This device complies with Part 15 of 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.

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Note EMI Considerations

Host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, that a host manufacture only needs to do an evaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device (including unintentional radiators) as a composite. The host manufacturer must fix any failure.