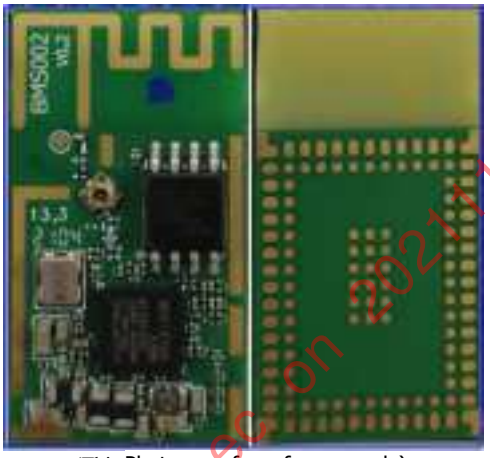
BMS002 BT5.2 LE Audio Module

Bluetooth Qualifie

MT2822A



(This Photos are for reference only)

Features

• Supports Bluetooth 5.2 dual-mode (BDR/EDR/ BLE) specifications
• Support Profile： A2DP1.3, AVRCP1.6,HFP1.8,HSP1.2 SPP1.2 ,DID1.3,
• ARM® Cortex®-M4 with Floating Point Unit (FPU) application processor
Maximum speed: 208MHz
• Cadence® HiFi Mini® Audio Engine DSP coprocessor
Maximum speed: 416MHz
• low latency 400kB system RAM (SYSRAM) with maximum speed 208MHz
• USB 2.0 device
• Support maximum three I2C Master mode 400kbps Up to 3.4Mbps
• Support maximum three UART interface Up to 3Mbps
• Support maximum three SPI master interface, Clock up to 52MHz
• EMMC/SDIO v2.0, up to 48MHz, 1-bit/4-bit mode eMMC4.41 ,
• Stand-alone module with on-board PWB antenna and Bluetooth stack
• Supports high resolution up to 24-bit, 192 kHz audio data format
• Supports maximum three I2S interface
• Supports to connect max three hosts with HFP/A2DP profiles simultaneously
• Supports smart phone applications by Bluetooth SPP or BLE link
• Supports firmware field upgrade by USB/OTA
• Supports five microphones
• Compact surface mount module:28.28 * 15.60 * 4.0 mm
• LGA package 122pin, Flatness is less than 0.05mm
• RoHS compliant
• Ideal for portable battery operated devices
• Internal battery regulator circuitry DSP Audio Processing
• Support for single SCO or Esco link with CVSD/mSBC coding.

Peripherals

• Built-in lithium-ion and lithium-polymer battery charger (up to 1A)
• Integrated 1.8V and 3V configurable switching regulator and low-dropout (LDO) regulator
• Built-in ADC for battery monitoring and voltage sense
• Built-in ADC for charger thermal protection
• Built-in under voltage protection (UVP)
• An AUX-In port for external audio input
• Multiple I/O pins for control and status

HCI Interface

• High-speed HCI-UART interface (supports up to 3M bps)

RF/Analog

• Frequency spectrum: 2.402 GHz to 2.480 GHz
• Receive sensitivity: -95 dBm (2 Mbps EDR)
• Crystal : 26MHZ ±20PPM@-20℃~+70℃
• Output Power： 8±2dBm (BDR) , 6±2dBm (EDR)
4±2dBm (BLE1M/2M)
• Antenna gain： 3.8dBi (peak)

Audio Codec

• SBC,AAC, LDAC
• 24-bit digital-to-analog converter (DAC) with 105dB SNR
• 24-bit analog-to-digital converter (ADC) with 95dB SNR
• Supports up to 24-bit, 192 kHz I2S digital audio

MAC/Baseband Processor

• Supports Bluetooth 5.2 dual-mode
• BDR/EDR transport for audio, voice, and SPP data exchange
• BLE transport for proprietary transparent service and Apple Notification Center Service (ANCS) data exchange

Operating Condition

• Operating voltage: 3.2V to 4.6V
• Operating temperature: -20°C to +70°C

Description

The BMS002 LE Audio module is made in China, a fully qualified Bluetooth 5.2 dual-mode (BDR/EDR/BLE) module for designers to add wireless audio and voice applications to their products. The BMS002 products is a Bluetooth module that provides a complete wireless solution with Bluetooth stack, integrated PWB antenna, and worldwide radio certifications in a compact surface-mount package.

Applications

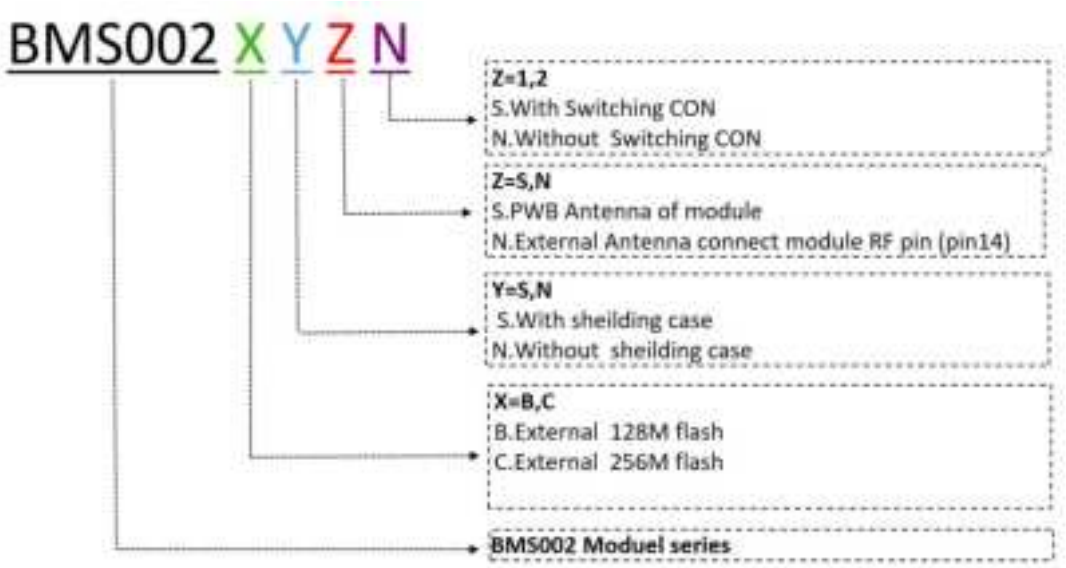
• Soundbar and Subwoofer (FW dependent)
• Bluetooth portable speaker phone
• Multi-speaker (FW dependent)

1. DEVICE OVERVIEW

The BMS002 LEAudio modules are built around AIROHA Technology MT2822A SoCs respectively. The MT2822A SoC integrates the Bluetooth 5.0 dual- mode radio transceiver, Power Management Unit (PMU), a crystal and DSP. Users can configure the BMS002 module by using the UI tool and DSP tool, a Windows-based utility.

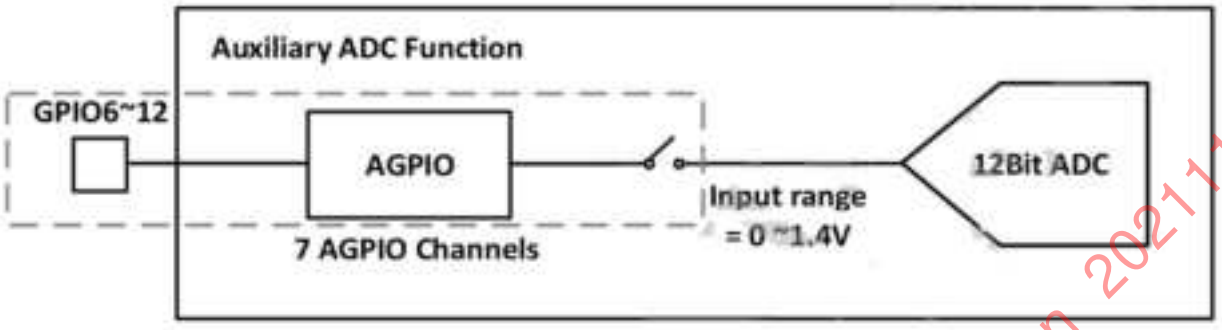
The BMS002 is a BT5.2 Bluetooth sub-system using MT2822A chipset from Bluetooth chipset supplier AIROHA. BMS002 interfaces up to 256Mbit extra serial flash, it provides a fully compliant Bluetooth system to v5.2 of the specification for data and voice communications, The module and device firmware is fully compliant with the Bluetooth specification V5.2. It's the master crystal frequency is 26MHz.

1.1 BMS002 Module series



2. AUDIO CODEC

2.1 Auxiliary ADC Block description



The auxiliary ADC includes the following functional blocks:

- Analog multiplexer- Selects signal from one of the eight auxiliary input pins. Real-world messages, such as temperature, are monitored and translated to the voltage domain.
- 12-bit A/D converter- Converts the multiplexed input signal to 12-bit digital data.

2.2 Audio uplink (Analog part)

The block diagram of audio uplink is illustrated below Figure 2.2-2. Audio uplink path is composed of PGA and audio ADC. The PGA gain range is the 0~30dB per 6dB step. There are six input pairs of the uplink path. The six input pairs also configuration as DMIC and AMIC. If no use the AMIC function, the six pairs input (VIN0 and VIN5) can be as one-wire DMIC function. Besides, the uplink front-end to PGA can be configured as ACC or DCC type. The necessary MIC bias voltages (MICBIAS0/1) are also provided by this completed audio codec. Relative Specification is as Table 2.2-2.

- Six channel PGA and ADC analog MIC input
- VIN0P/N and VIN5P/N can be configuration as DMIC in/out
- Analog Gain Range is 0dB to 30dB and gain step is 6dB.

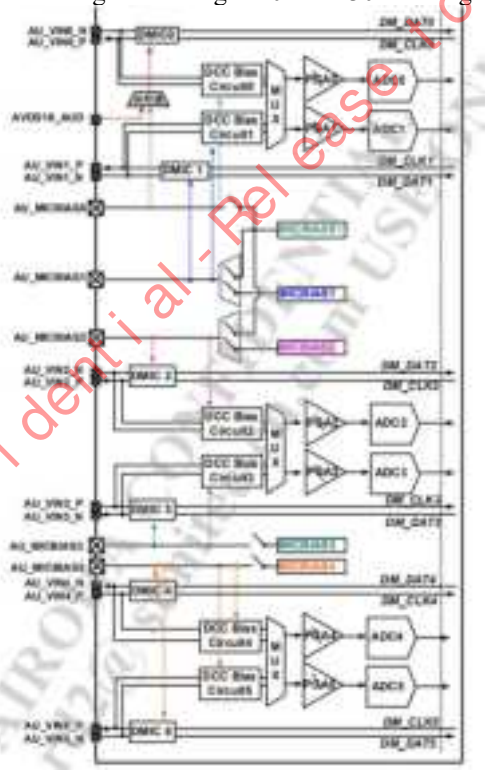


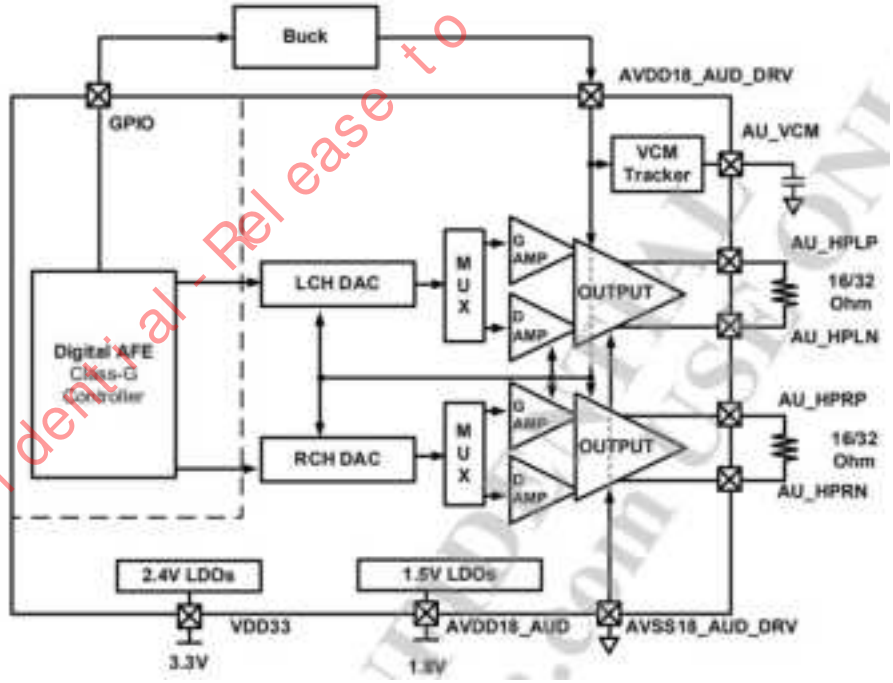
Table 2.2-2. MICBIAS specifications

Microphone Bias (MICBIAS) Temp = 25deg, 1µF capacitor on MICBIAS					
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{OUT}	Microphone bias voltage (LDO 3.3V)		1.8/1.85/1.9/2/2.1 /2.2/2.3/2.4/2.5		V
I_{OUT}	Maximum output current			12	mA
N_{OUT}	Output integrated noise (20~20kHz A-weighted) with 1µF cap. (Vout=1.85V)		4		µVrms
PSRR	Power rejection ratio(from AVDD to AU_MICBIAS*)	40			dB
Cload	Output capacitor load on MICBIAS	1		22	µF

2.3 Audio downlink (Analog part)

Low-power MT2822A audio downlink includes stereo DACs and audio Class-G/D amplifiers for audio playback is shown in Figure 2.3-1. The amplifiers is implemented with class-D and class-G mode. The digital Class-G controller preview the maximum signal level of input digital LCH and RCH signals, and then adjust the power level up or down in advance before the signal is played. The fully differential headphone amplifiers can deliver up to 38mW into 16Ohm load. The class-G gain range of amplifier is -22dB to +8dB, 1dB/step,The class-D gain range of amplifier is -6dB to +6dB, 3dB/step. The 1.5V and 2.4V Capless LDOs are embedded in the audio downlink to enhance the power supply rejection ratio (PSRR).

- 38mW Stereo HP driver diff. output into 16Ohm
- Low-power music playback with Class-G Operation
- Ultra Low-power music playback with Class-D Operation
- Click-and-pop noise suppression of Class-G amplifiers <-80dBVpp
- Click-and-pop noise suppression of Class-D amplifiers <-70dBVpp
- Low output DC offset < 300uV



The proposed downlink path supports the following features:

- The data precisions in the downlink path are 24-bit data width.
- The supported input sample rates for downlink:
- 8K/11.025K/12K/16K/22.05K/24K/32K/44.1K/48K/96K/192K

2.4 Digital controller for class-G amplifier

The Class-G amplifier is used for power saving of playback, and it can adjust the HP amplifier power rail according the audio content. The Class-G digital controller detects audio signal amplify and sends a control signal to buck converter through GPIO. When source swing goes high, the digital controller makes the Class-G amplifier change the DAC output from low-voltage to high-voltage state to avoid signal clipping. When source swing goes low, it has a configurable hold time control to prevent the Class-G amplifier from frequently adjusting the voltage. If the signal stays in a low state after a specific hold time, the digital controller sends a request to make the Class-G amplifier change the output from a high-voltage state to a low-voltage state. Otherwise, the output stays in a high-voltage state.

Figure 2.4-1 shows the block diagram of the Class-G digital controller. The audio digital Class-G path includes the following blocks: Preview FIFO, Frame Preview, EN-FSM, Hold Time control and DA signal generator. The EN-FSM module enables each voltage level in Class G. The Class-G input source is from the O_08 and O_09 (the same as downlink), which is defined in the audio interconnection. The output of DA Generator is sent to the analog DAC.

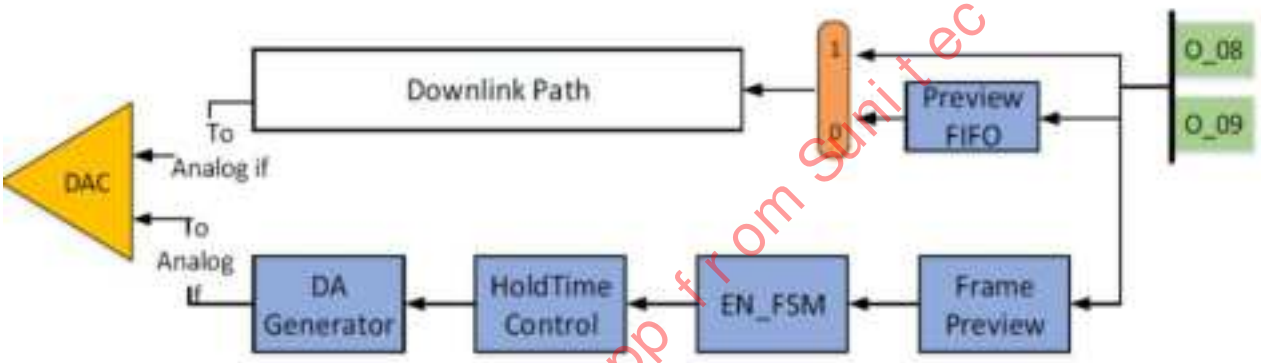


Figure 2.6-6. Class G Amplifier Digital Part Block Diagram

The Class-G digital controller supports the following features:

- Support for the independent selection for Class-G amplifier high-voltage and low-voltage levels.
- Support for programmable high-voltage and low-voltage thresholds in the digital controller.
- Support for a programmable hold time in the digital controller to prevent frequently voltage switching.
- Built-in signal generator hardware for the DA signal request to the Class-G amplifier.

3. Power-on/off sequence

PMIC manages the power-on and power-off of the handset. If the battery voltage is neither in the UVLO state nor in the thermal condition, there are three methods to power on the handset system.

3.1 Pulling PWRKEY low (User presses PWRKEY.)

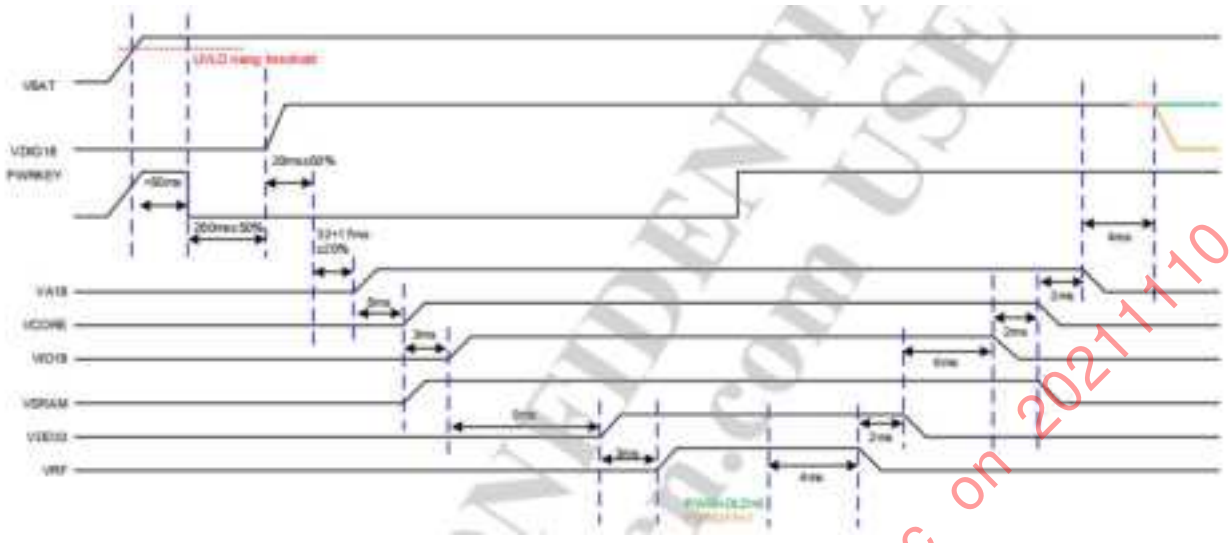
Pushing PWRKEY (pulling the PWRKEY pin to low level)

Pulling PWRKEY low is a typical method to turn on the handset. The system reset ends at the moment when all default-on regulators are sequentially turned on. After that, the MCU will send the PWRHOLD signal back to PMIC for acknowledgement. To successfully power on the handset, PWRKEY should be kept low until PMIC receives PWRHOLD from the MCU.**(shown in Figure 3.3-1)**

3.2 Valid charger plug-in

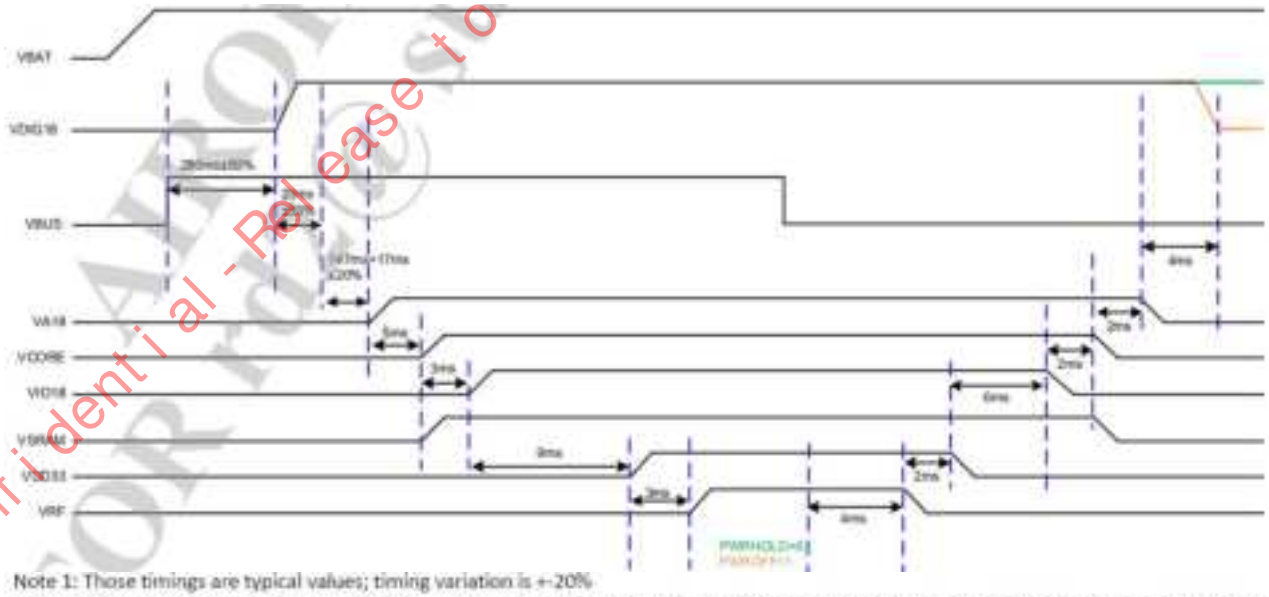
Valid charger plug-in (CHRIN voltage within valid range)

The charger plug-in will also turn on the handset if the charger is valid and VSYS > UVLO, the handset will also be powered on.**(shown in Figure 3.2-1)**



Note 1: Those timings are typical values; timing variation is +-20%
Note 2: When the system confirm received the power-on condition (after PWRKEY press 32ms + 20.3ms), it will check if VSYS is always > 2.9V UVLO rising threshold.
Note 3: VSYS voltage > 2.9v and keep maintain > 17ms
Note 4: The first 3ms is during power on sequence. After this 3ms, the regulators power-on sequence finished. (Also check the PGOOD is still ok.) The second 3ms, the original plan we need to check RESETB release (RESTEB pull high timing) by SOC.

Figure 3.1-1. Power-on/off control sequence by charger plug in or by pressing PWRKEY



Note 1: Those timings are typical values; timing variation is +-20%
Note 2: When the system confirm received the power-on condition (after Plug-In 147ms + 20.3ms), it will check if VSYS is always > 2.9V UVLO rising threshold.
Note 3: VSYS voltage > 2.9v and keep maintain > 17ms
Note 4: The first 3ms is during power on sequence. After this 3ms, the regulators power-on sequence finished. (Also check the PGOOD is still ok.) The second 3ms, the original plan we need to check RESETB release (RESTEB pull high timing) by SOC.

Figure 3.2-1. Power-on/off control sequence by charger plug in or by Charger plug-in

4. Battery charge specification revision 1.2 (BC1.2)

4.1 Feature and description

USB charging port detection:

MT2822A BC1.2 charger detector is used to distinguish the different types of charger. This BC1.2 detector provide a capable to determine several types of charging port which including Standard Downstream Ports (SDP), Charging Downstream Ports (CDP), Dedicated Charger Ports (DCP), Apple charger, non-standard charger. Typically, BC1.2 detection will execute right after the charger is plugged-in for charger input current limit configuration (The current limit setting please refer to the Charger's Datasheet).

4.2 Functional block

Figure 4.2-1 shows BC1.2 function block diagram.

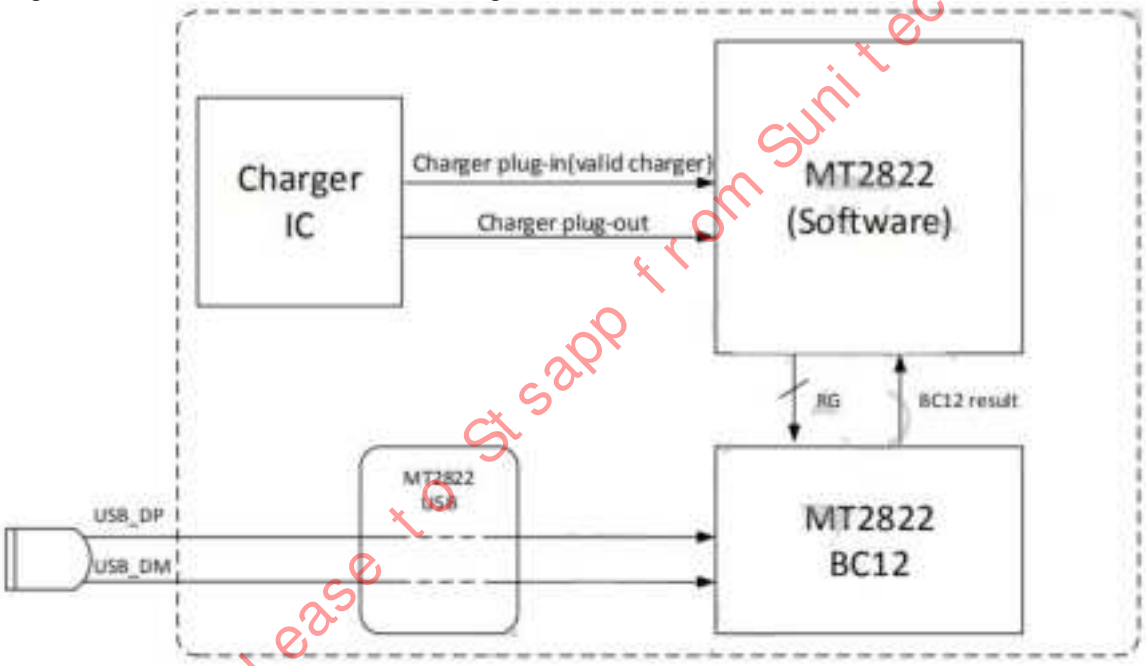


Figure 4.2-1. Block diagram

4.3 Linear Battery Charging

- Input current limit: 1.0A
- Power Path Management for Powering the System and Charging the Battery
- 24V Maximum Rating for VBUS Power
- JEITA Charge Protection
- NTC Thermistor Input
- Supports up to 0.5-A Charge Current with Current Monitoring Output (ISET)
- Programmable fast charging mode

5. Bluetooth RF Subsystem

5.1 Bluetooth description

The MT2822A series Bluetooth (BT) RF subsystem (as shown in Figure 5.1-1) consists of a highly integrated transceiver with tunable on-chip RF band pass filter (BPF) and BT TRX co-matching network.MT2822A series adopts a low intermediate frequency (LIF) receiver architecture. The receiver, including the on-chip RF BPF and TRX co-matching network, consists of a LNA and single balanced passive mixer, a complex BPF and a pair of 10-bit SAR ADCs. The MT2822A series BT receiver has best-in-class out-of-band blocking performance without the need of any external RF BPF.

The direct conversion transmitter consists of a pair of 9-bit current DACs and passive LPFs, an active IQ modulator (IQM) and a Class AB push-pull PA. This PA is capable of transmitting +5dBm power for enhanced data rate (EDR) and +8dBm for basic data rate (BDR). The Class AB push-pull PA, together with on-chip RF BPF and TRX co-matching network, minimizes TX harmonic distortion products significantly, eliminating the need for an external RF BPF.

The Δ-Σ fractional-N RF synthesizer is phase locked to 26MHz reference clock to generate the RF LO frequency. The BBPLL generates sampling clock for ADC and DAC as well as digital clock to BT modem.MT2822A series implements various automatic calibration schemes to minimize changes in RF performance from chip-to-chip and temperature variations. No additional RF factory calibration is necessary.

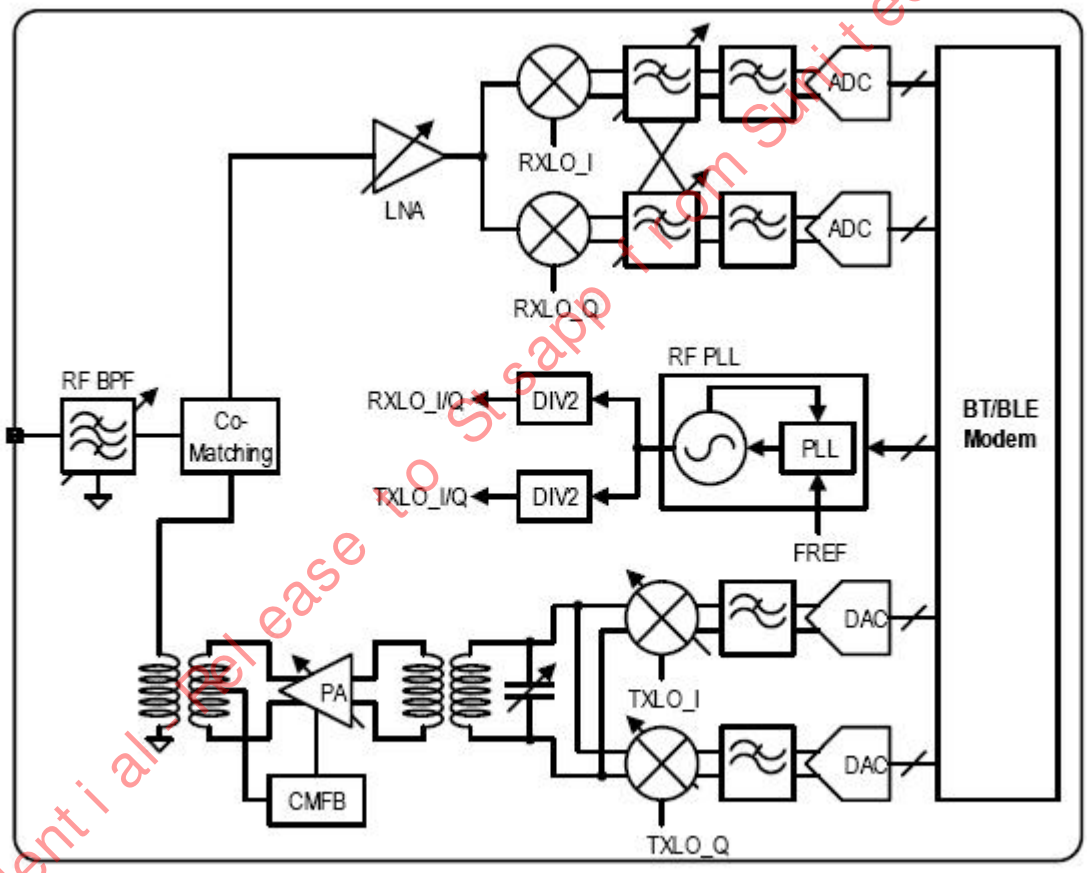


Figure 5.1-1. Bluetooth RF transceiver system

5.2 Functional specifications

Typical RF performances are specified for mid. channel, TA = +25°C, and under recommended operating conditions,unless stated otherwise.

Table 5.2. Recommended operating conditions

Description	Condition	Min	Typical	Max	Unit
VSYS Supply		3,0	3,7	4,8	V

5.3 Basic data rate – Receiver & Transmitter specifications

Items	Rate	Units	Min	Typ	Max
Frequency Range	--	MHZ	2402	--	2480
RF Maximum Output Power	DH5	dBm	6	8	10
RF Maximum Power Control gain step Range	DH5	dBm	2	4	8
RF Maximum Receiver Sensitivity@ BER＜0.1%	DH5	dBm	-96	-95	-70
Maximum detectable input power @ BER＜0.1%	DH5	dBm	-20	-5	-
Crystal Frequency Calibration	--	KHz	−5	0	5
Modulation Characteristics（Delta F1 Avg）	--	KHz	140	158	175
Carrier Frequency Drift	DH5	KHz	−40	0	40

5.4Enhanced data rate –Receiver & Transmitter specifications

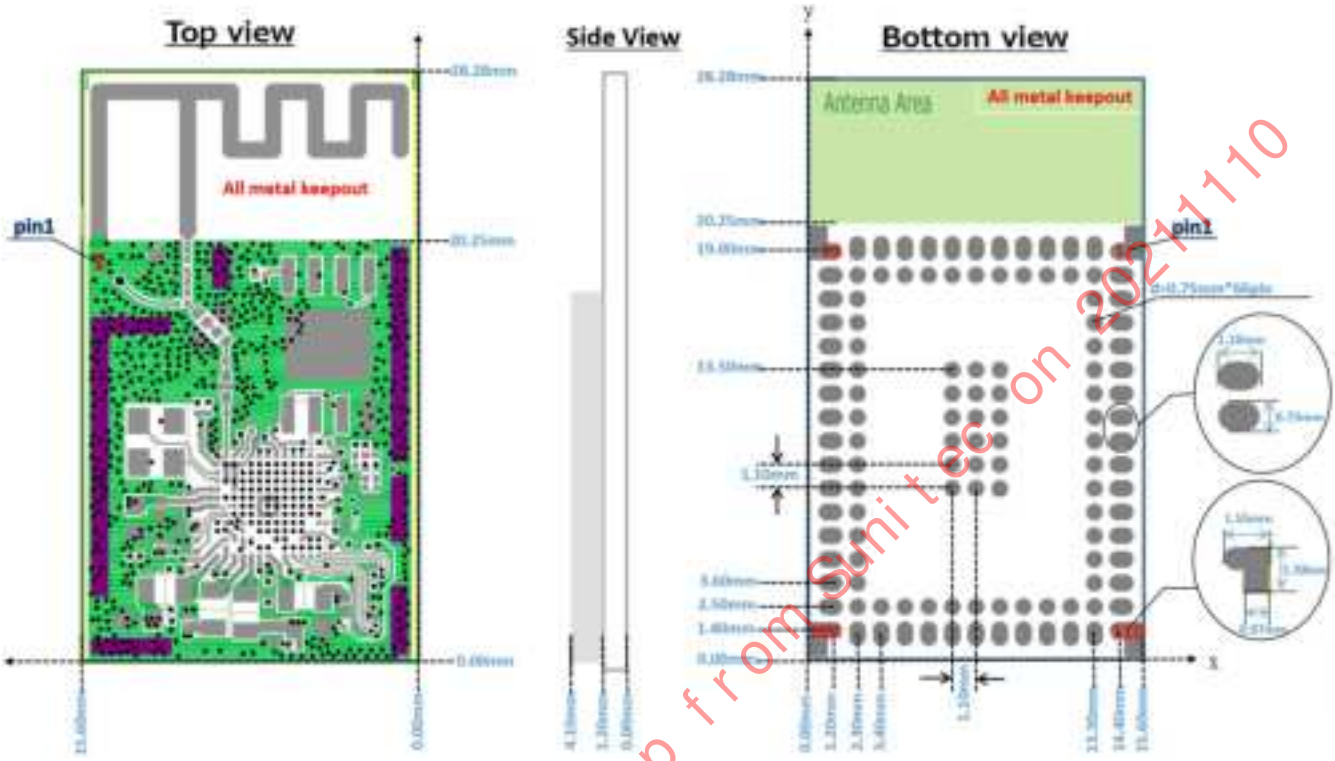
Items	Rate	Units	Min	Typ	Max
Frequency Range	--	MHZ	2402	--	2480
RF Maximum Output Power	2DH5	dBm	4	6	8
	3DH5	dBm	4	6	8
RF Maximum Power Control gain step Range	2DH5	dBm	2	4	8
	3DH5	dBm	2	4	8
RF Maximum Receiver Sensitivity@ BER＜0.01%	2DH5	dBm	-96	-95	-70
	3DH5	dBm	-91	-89	-70
Maximum detectable input power @ BER＜0.01%	2DH5	dBm	-20	-5	
	3DH5	dBm	-20	-5	
Crystal Frequency Calibration(Delta F1 Avg)	--	KHz	−5	0	5
Modulation Characteristics	--	KHz	140	158	175
Carrier Frequency Drift	--	KHz	140	158	175

5.5Bluetooth LE –Receiver & Transmitter specifications

Items	Rate	Units	Min	Typ	Max
Frequency Range	--	MHZ	2402	--	2480
Maximum Output Power	1M	dBm	2	4	6
	2M	dBm	2	4	6
Maximum Receiver Sensitivity@ BER＜30.8%	1M	dBm	-99	-98	-70
	2M	dBm	-96	-985	-70
Maximum detectable input power @ BER＜30.8%	1M	dBm	-10	-5	-
	2M	dBm	-10	-5	
Crystal Frequency Calibration	--	KHz	−5	0	5
Modulation Characteristics(Delta F1 Avg)	--	KHz	2135	250	265
Carrier Frequency Drift	--	KHz	−50	5	50

6. Module Description

6.1 BMS002 module structure



Tolerances:
PWB Thickness: ±0.16mm
Note: PWB Dimensions: X: 15.6mm, Y: 28.28mm and tolerances:±0.5mm

6.2 BMS002 module pin assignment and pin description

Pin NO.	13	12	11	10	9	8	7	6	5	4	3	2	1
Pin Name	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND	GND
Pin NO.	26	25	24	23	22	21	20	19	18	17	16	15	14
Pin Name	GP1030	GP1029	GP1014	GP102	GND	GND	GND	GND	GND	GND	GND	GND	RF
Pin NO.	30	29										28	27
Pin Name	GP1024	GP1025										GND	GND
Pin NO.	34	33										32	31
Pin Name	AU_HPLP	GP1026										GP103	GP1019
Pin NO.	38	37										36	35
Pin Name	AU_HPLN	GP1027										GP106	GP1018
Pin NO.	45	44										40	39
Pin Name	AU_HPRN	GP1023										GP107	GP1017
Pin NO.	52	51										47	46
Pin Name	AU_HPRP	GP1028										GP104	GP1016
Pin NO.	59	58										54	53
Pin Name	AU_VIN1P	GP1020										GP105	GP1022
Pin NO.	66	65										61	60
Pin Name	AU_VIN1N	GP1031										GP1021	GP106
Pin NO.	73	72										68	67
Pin Name	AU_VINOP	GP1032										GP1010	GP101
Pin NO.	80	79										75	74
Pin Name	AU_VINON	GP1033										GP1011	GP1012
Pin NO.	84	83										82	81
Pin Name	AU_VIN2P	GP1034										GP108	GP109
Pin NO.	88	87										86	85
Pin Name	AU_VIN2N	MODBAS1										PWRKEY	GP1037
Pin NO.	92	91										90	89
Pin Name	AU_VIN3N	MODBAS4										RTC_GP102	GP1030
Pin NO.	96	95										94	93
Pin Name	AU_VIN3P	MODBAS3										CHR_THM	GP1027
Pin NO.	109	108	107	106	105	104	103	102	101	100	99	98	97
Pin Name	AU_VINSN	MODBAS0	MODBAS2	VIO18	VDD33	NC	DVDD_101	DVDD_100	VSYS	BAT_SENSE	RTC_GP101	RTC_GP100	GP1026
Pin NO.	122	121	120	119	118	117	116	115	114	113	112	111	110
Pin Name	AU_VINSP	AU_VIN4N	AU_VIN4P	GP1013	USB_DM	USB_DP	VBUS	SYSMODE	LED0	LED1	VBAT	GP1011	GP1029

Pin NO.	43	42	41
Pin Name	GND	GND	GND
Pin NO.	50	49	48
Pin Name	GND	GND	GND
Pin NO.	57	56	55
Pin Name	GND	GND	GND
Pin NO.	64	63	62
Pin Name	GND	GND	GND
Pin NO.	71	70	69
Pin Name	GND	GND	GND
Pin NO.	78	77	76
Pin Name	GND	GND	GND

Table 6.1-1

Pin No.	Pin Type	Pull-Type	Power domain	Pin Name	Description
1	P	-	-	GND	Ground reference
2	P	-	-	GND	Ground reference
3	P	-	-	GND	Ground reference
4	P	-	-	GND	Ground reference
5	P	-	-	GND	Ground reference
6	P	-	-	GND	Ground reference
7	P	-	-	GND	Ground reference
8	P	-	-	GND	Ground reference
9	P	-	-	GND	Ground reference
10	P	-	-	GND	Ground reference
11	P	-	-	GND	Ground reference
12	P	-	-	GND	Ground reference
13	P	-	-	GND	Ground reference
15	P	-	-	GND	Ground reference
16	P	-	-	GND	Ground reference
17	P	-	-	GND	Ground reference
18	P	-	-	GND	Ground reference
19	P	-	-	GND	Ground reference
20	P	-	-	GND	Ground reference
21	P	-	-	GND	Ground reference
22	P	-	-	GND	Ground reference
27	P	-		GND	Ground reference
28	P	-		GND	Ground reference
41	P	-	-	GND	Ground reference
42	P	-	-	GND	Ground reference
43	P	-	-	GND	Ground reference
48	P	-	-	GND	Ground reference
49	P	-	-	GND	Ground reference
50	P	-	-	GND	Ground reference
55	P	-	-	GND	Ground reference
56	P	-	-	GND	Ground reference
57	P	-	-	GND	Ground reference
62	P	-	-	GND	Ground reference
63	P	-	-	GND	Ground reference
64	P	-	-	GND	Ground reference
69	P	-	-	GND	Ground reference
70	P	-		GND	Ground reference
71	P	-	-	GND	Ground reference
76	P	-	-	GND	Ground reference
77	P	-	-	GND	Ground reference
78	P	-	-	GND	Ground reference
14	AI	-	-	BT_RFIN	Bluetooth 50 ohm transmitter output and receiver input
36	DIO	PD	DVDD_IO_0	GPIO0	General purpose input/output, Pin 0 Alternate Pin Functions: ■ UART (0) ■ Audio_EXT_SYNC_
40	DIO	PD	DVDD_IO_0	GPIO1	General purpose input/output, Pin 1 Alternate Pin Functions: ■ UART (0) ■ SRCLKENAI_FREF
23	DIO	PD	DVDD_IO_0	GPIO2	General purpose input/output, Pin 2 Alternate Pin Functions: ■ DMIC (0) ■ RESETB_OUT
32	DIO	PD	DVDD_IO_0	GPIO3	General purpose input/output, Pin 3 Alternate Pin Functions: ■ UART (0) ■ DMIC(0) ■ UART(2) ■ SPI Master(2)
47	DIO	PD	DVDD_IO_0	GPIO4	General purpose input/output, Pin 4

					Alternate Pin Functions: ■ I2C (1) ■ UART(1) ■ DMIC(1) ■ PWM(3)
54	DIO	PD	DVDD_IO_0	GPIO5	General purpose input/output, Pin 5 Alternate Pin Functions: ■ I2C (1) ■ DMIC(1) ■ PWM(4) ■ CLKO3
60	DIO	PD	DVDD_IO_0	GPIO6	General purpose input/output, Pin 6 Alternate Pin Functions: ■ UART(1) ■ I2C(2) ■ I2S Master(0) ■ PWM(0) ■ SPI Master(1) ■ SPI Slave(0) ■ AUXADC
67	DIO	PD	DVDD_IO_0	GPIO7	General purpose input/output, Pin 7 Alternate Pin Functions: ■ UART(2) ■ I2C(2) ■ I2S Master(1) ■ SPI Master(1) ■ SPI Slave(0) ■ AUXADC
82	DIO	PD	DVDD_IO_0	GPIO8	General purpose input/output, Pin 8 Alternate Pin Functions: ■ I2C(0) ■ I2S Master(0) ■ I2S Slave(0) ■ CLKO0 ■ SPI Master(1) ■ SPI Slave(0) ■ AUXADC
81	DIO	PD	DVDD_IO_0	GPIO9	General purpose input/output, Pin 9 Alternate Pin Functions: ■ I2C(0) ■ I2S Master(0) ■ I2S Slave(0) ■ UART(0) ■ SPI Master(1) ■ SPI Slave(0) ■ AUXADC
68	DIO	PD	DVDD_IO_0	GPIO10	General purpose input/output, Pin 10 Alternate Pin Functions: ■ I2C(1) ■ I2S Master(0) ■ I2S Slave(0) ■ UART(0) ■ SPI Master(1) ■ SPI Slave(0) ■ AUXADC
75	DIO	PD	DVDD_IO_0	GPIO11	General purpose input/output, Pin 11 Alternate Pin Functions: ■ I2C(1) ■ I2S Master(0) ■ I2S Slave(0) ■ UART(1) ■ SPI Master(1) ■ SPI Slave(0) ■ AUXADC
74	DIO	PD	DVDD_IO_0	GPIO12	General purpose input/output, Pin 12 Alternate Pin Functions: ■ I2C(1) ■ I2S Master(0)

					■ I2S Slave(0) ■ UART(1) ■ UART(2) ■ AUXADC
111	DIO	Hi-Z	DVDD_IO_1	GPIO13	General purpose input/output, Pin 13 Alternate Pin Functions: ■ PWM(2) ■ I2S Master(1) ■ I2S Slave(1) ■ MSDC(0) ■ DMIC(0)
24	DIO	PD	DVDD_IO_1	GPIO14	General purpose input/output, Pin 14 Alternate Pin Functions: ■ PWM(1) ■ I2S Master(1) ■ I2S Slave(1) ■ MSDC(0) ■ DMIC(0) ■ UART(0)
119	DIO	PD	DVDD_IO_1	GPIO15	General purpose input/output, Pin 15 Alternate Pin Functions: ■ I2S Master(2) ■ I2S Master(1) ■ I2S Slave(1) ■ MSDC(0) ■ DMIC(1) ■ SPI Master(0) ■ UART(2)
46	DIO	PD	DVDD_IO_1	GPIO16	General purpose input/output, Pin 16 Alternate Pin Functions: ■ I2C(0) ■ I2S Master(2) ■ I2S Slave(2) ■ MSDC(0) ■ DMIC(1) ■ SPI Master(0) ■ UART(1)
39	DIO	PD	DVDD_IO_1	GPIO17	General purpose input/output, Pin 17 Alternate Pin Functions: ■ I2C(0) ■ I2S Master(2) ■ I2S Slave(2) ■ MSDC(0) ■ SPI Master(0) ■ UART(1)
35	DIO	PD	DVDD_IO_1	GPIO18	General purpose input/output, Pin 18 Alternate Pin Functions: ■ I2S Master(1) ■ I2S Master(2) ■ I2S Slave(2) ■ MSDC(0) ■ SPI Master(0) ■ UART(2)
31	DIO	HIGH	DVDD_IO_1	GPIO19	General purpose input/output, Pin 19 Alternate Pin Functions: ■ I2S Master(0) ■ I2S Master(2) ■ I2S Slave(2) ■ MSDC(0) ■ SPI Master(0) ■ UART(2)
53	DIO	PD	DVDD_IO_0	GPIO20	General purpose input/output, Pin 20 Alternate Pin Functions: ■ I2C(0) ■ I2C(1) ■ I2S Master(2) ■ SPI Master(0) ■ UART(1)

61	DIO	PD	DVDD_IO_0	GPIO21	General purpose input/output, Pin 21 Alternate Pin Functions: ■ I2C(0) ■ I2C(1) ■ I2S Master(1) ■ I2S Slave(1) ■ SPI Master(2) ■ UART(1)
37	DIO	PD	DVDD_IO_0	GPIO22	General purpose input/output, Pin 22 Alternate Pin Functions: ■ I2S Master(1) ■ I2S Slave(1) ■ DMIC(1) ■ SPI Master(2) ■ UART(1)
44	DIO	PD	DVDD_IO_0	GPIO23	General purpose input/output, Pin 23 Alternate Pin Functions: ■ I2S Master(2) ■ I2S Slave(2) ■ DMIC(1) ■ SPI Master(2) ■ UART(1)
30	DIO	PD	DVDD_IO_0	GPIO24	General purpose input/output, Pin 24 Alternate Pin Functions: ■ I2S Master(2) ■ I2S Slave(2) ■ DMIC(0) ■ SPI Master(0) ■ UART(1)
51	DIO	PD	DVDD_IO_0	GPIO25	General purpose input/output, Pin 25 Alternate Pin Functions: ■ I2C(2) ■ I2S Master(2) ■ I2S Slave(2) ■ DMIC(0) ■ SPI Master(2) ■ SPI Master(0)
58	DIO	PD	DVDD_IO_0	GPIO26	General purpose input/output, Pin 26 Alternate Pin Functions: ■ I2C(2) ■ I2S Master(2) ■ I2S Slave(2) ■ SPI Master(2) ■ SPI Master(0) ■ PWM(2)
93	DIO	PD	DVDD_IO_0	GPIO27	General purpose input/output, Pin 27 Alternate Pin Functions: ■ I2C(1) ■ I2C(0) ■ I2S Master(0) ■ I2S Slave(0) ■ DMIC(0)
97	DIO	PD	DVDD_MC0	GPIO28	General purpose input/output, Pin 28 Alternate Pin Functions: ■ I2C(1) ■ I2C(0) ■ I2S Master(0) ■ I2S Slave(0) ■ DMIC(0) ■ SPI Master(0) ■ SPI Master(1) ■ UART(0)
110	DIO	PD	DVDD_IO_1	GPIO29	General purpose input/output, Pin 29 Alternate Pin Functions: ■ I2C(2) ■ CLKO0 ■ I2S Master(0) ■ I2S Slave(0)

					■ SPI Master(0) ■ SPI Master(1) ■ UART(0)
89	DIO	PD	DVDD_IO_0	GPIO30	General purpose input/output, Pin 30 Alternate Pin Functions: ■ I2C(2) ■ I2S Master(0) ■ I2S Slave(0) ■ DMIC(1) ■ SPI Master(0) ■ SPI Master(1) ■ UART(0)
65	DIO	PD	DVDD_IO_0	GPIO31	General purpose input/output, Pin 31 Alternate Pin Functions: ■ I2C(0) ■ I2S Master(2) ■ I2S Slave(2) ■ DMIC(1) ■ SPI Master(2) ■ UART(0)
72	DIO	PD	DVDD_IO_0	GPIO32	General purpose input/output, Pin 32 Alternate Pin Functions: ■ I2C(0) ■ I2S Master(2) ■ I2S Slave(2) ■ SPI Master(2)
79	DIO	PD	DVDD_MC0	GPIO33	General purpose input/output, Pin 33 Alternate Pin Functions: ■ I2S Master(2) ■ I2S Slave(2) ■ SPI Master(2) ■ UART(1)
83	DIO	PD	DVDD_IO_0	GPIO34	General purpose input/output, Pin 34 Alternate Pin Functions: ■ I2S Master(2) ■ I2S Slave(2) ■ SPI Master(2) ■ SPI Slave(0) ■ UART(1)
33	DIO	PD	DVDD_IO_0	GPIO35	General purpose input/output, Pin 35 Alternate Pin Functions: ■ I2S Master(1) ■ I2S Slave(1) ■ PWM(0) ■ SPI Slave(0) ■ UART(1) ■ UART(2)
29	DIO	PD	DVDD_IO_0	GPIO36	General purpose input/output, Pin 36 Alternate Pin Functions: ■ I2S Master(1) ■ I2S Slave(1) ■ PWM(1) ■ SPI Slave(0) ■ UART(1) ■ UART(2)
25	DIO	PD	DVDD_IO_0	GPIO37	General purpose input/output, Pin 37 Alternate Pin Functions: ■ I2C(0) ■ I2S Master(1) ■ I2S Slave(1) ■ SPI Slave(0) ■ MSDC(0) ■ UART(2)
26	DIO	PD	DVDD_IO_0	GPIO38	General purpose input/output, Pin 38 Alternate Pin Functions: ■ I2C(0) ■ I2S Master(1) ■ I2S Slave(1)

					■ SPI Slave(0) ■ MSDC(0) ■ UART(2)
85	DIO	PD	DVDD_IO_0	GPIO39	General purpose input/output, Pin 39 Alternate Pin Functions: ■ I2S Master(0) ■ I2S Master(1) ■ I2S Master(2) ■ SPI Master（2） ■ SPI Slave(0) ■ PWM(4) ■ CLKO2
98	DIO	Hi-Z	VDIG18	RTC_GPIO0	RTC GPIO 0
99	DIO	Hi-Z	VDIG18	RTC_GPIO1	RTC GPIO 1
90	DIO	Hi-Z	VDIG18	RTC_GPIO2	RTC GPIO 2
86	AI	-	VSYS	PWRKEY	PWRKEY Button
115	DI	-	VIO18	SYSRSTB	SYSRSTB Button
113	AO	-	AVDD18_AUD_DRV	LED1	Headphone L-ch P-side
114	P	-	-	LED0	Battery connection. Connect VBAT to the positive terminal of battery.
34	AO	-	AVDD18_AUD_DRV	AU_HPLP	Headphone L-ch P-side
38	AO	-	AVDD18_AUD_DRV	AU_HPLN	Headphone L-ch N-side
45	AO	-	AVDD18_AUD_DRV	AU_HPRN	Headphone R-ch N-side
52	AO	-	AVDD18_AUD_DRV	AU_HPRP	Headphone R-ch P-side
73	AI	-	-	AU_VIN0_P	Audio input CH0 P-side
80	AI	-	-	AU_VIN0_N	Audio input CH0 N-side
59	AI	-	-	AU_VIN1_P	Audio input CH1 P-side
66	AI	-	-	AU_VIN1_N	Audio input CH1 N-side
84	AI	-	-	AU_VIN2_P	Audio input CH2 P-side
88	AI	-	-	AU_VIN2_N	Audio input CH2 N-side
92	AI	-	-	AU_VIN3_N	Audio input CH3 N-side
96	AI	-	-	AU_VIN3_P	Audio input CH3 P-side
120	AI	-	-	AU_VIN4_P	Audio input CH4 P-side
121	AI	-	-	AU_VIN4_N	Audio input CH4 N-side
122	AI	-	-	AU_VIN5_P	Audio input CH5 P-side
109	AI	-	-	AU_VIN5_N	Audio input CH5 N-side
108	AO	-	AVDD33_MB	AU_MICBIAS0	Analog mic phone bias0
87	AO	-	AVDD33_MB	AU_MICBIAS1	Analog mic phone bias1
107	AO	-	AVDD33_MB	AU_MICBIAS2	Analog mic phone bias2
95	AO	-	AVDD33_MB	AU_MICBIAS3	Analog mic phone bias3
91	AO	-	AVDD33_MB	AU_MICBIAS4	Analog mic phone bias4
112	P	-	-	VBAT	Battery connection. Connect VBAT to the positive terminal of battery.
100	I	-	BAT	BATSNS	Negative terminal for battery's charging current sensing resistor
94	AI	-	VSYS	CHR_THM	Thermistor (BATON) for battery temperature.
101	P	-	-	VSYS	System load connection. Connect VSYS to system load.
102	P	-	-	DVDD_IO_0	Power input of GPIO group 0
103	P	-	-	DVDD_IO_1	Power input of GPIO group 1
105	AO	-	VSYS	VDD33	VLDO33 output voltage
106	P	-	-	VIO18	Buck VIO18, 1V8 power output, max200mA.
116	P	-	-	VBUS	Charger power input.
117	AIO	-	VDD33	USB_DP	USB signal DP
118	AIO	-	VDD33	USB_DM	USB signal DN
104	NC	-	-	NC	NC

7. Antenna of BMS002

7.1 Recommended for PWB Antenna design

Around of the PWB Antenna should keep out of metal over 15mm, So that RF have a good performance ,

See Figure 7.2-1

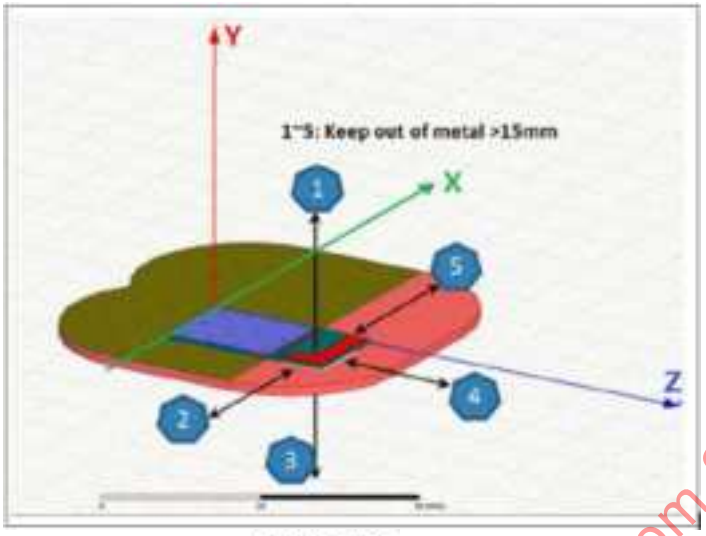


Figure 7.2-1

7.2 Module Placement Guidelines

For a Bluetooth-enabled product, the antenna placement affects the overall performance of the system. The antenna requires free space to radiate RF signals and it must not be surrounded by the ground plane. Recommend that the areas underneath the antenna on the host PWB must not contain copper on top, inner, or bottom layers, as illustrated in Figure 7.2-1.

A low-impedance ground plane will ensure the best radio performance (best range, lowest noise). The ground plane can be extended beyond the minimum recommendation, as required for the main PWB EMC noise reduction. For the best range performance, keep all external metal at least 15 mm away from the on-board PWB trace antenna.

Figure 7.3-1 and Figure 7.3-2 and Figure 7.3-3 illustrate examples of good and poor placement of the BMS002 module on a host board with GND plane.

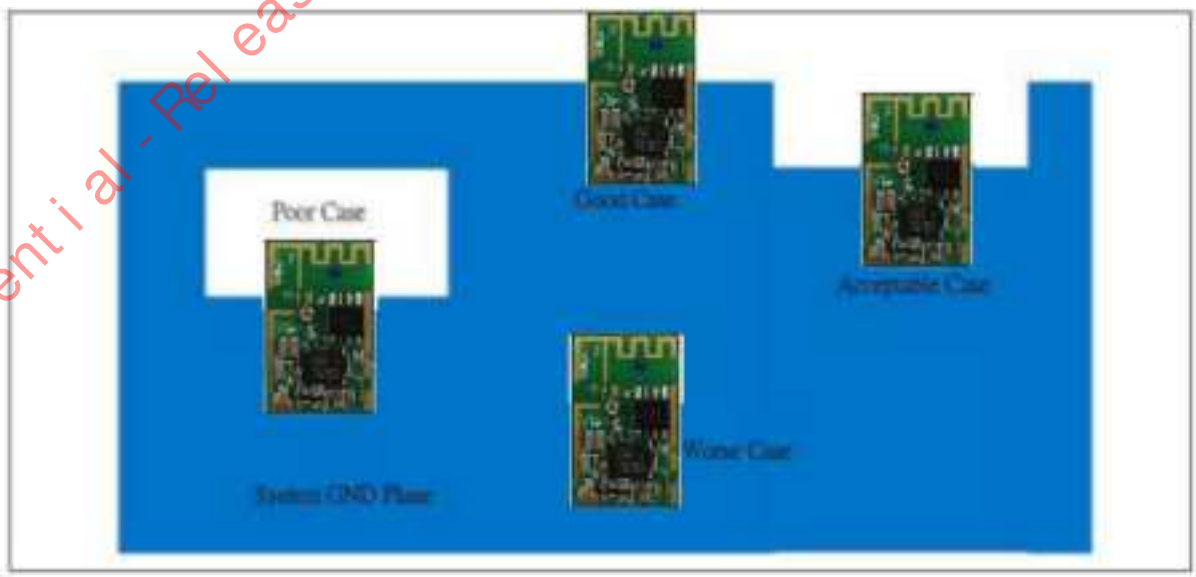


Figure 7.3-1 Module Placement Guidelines

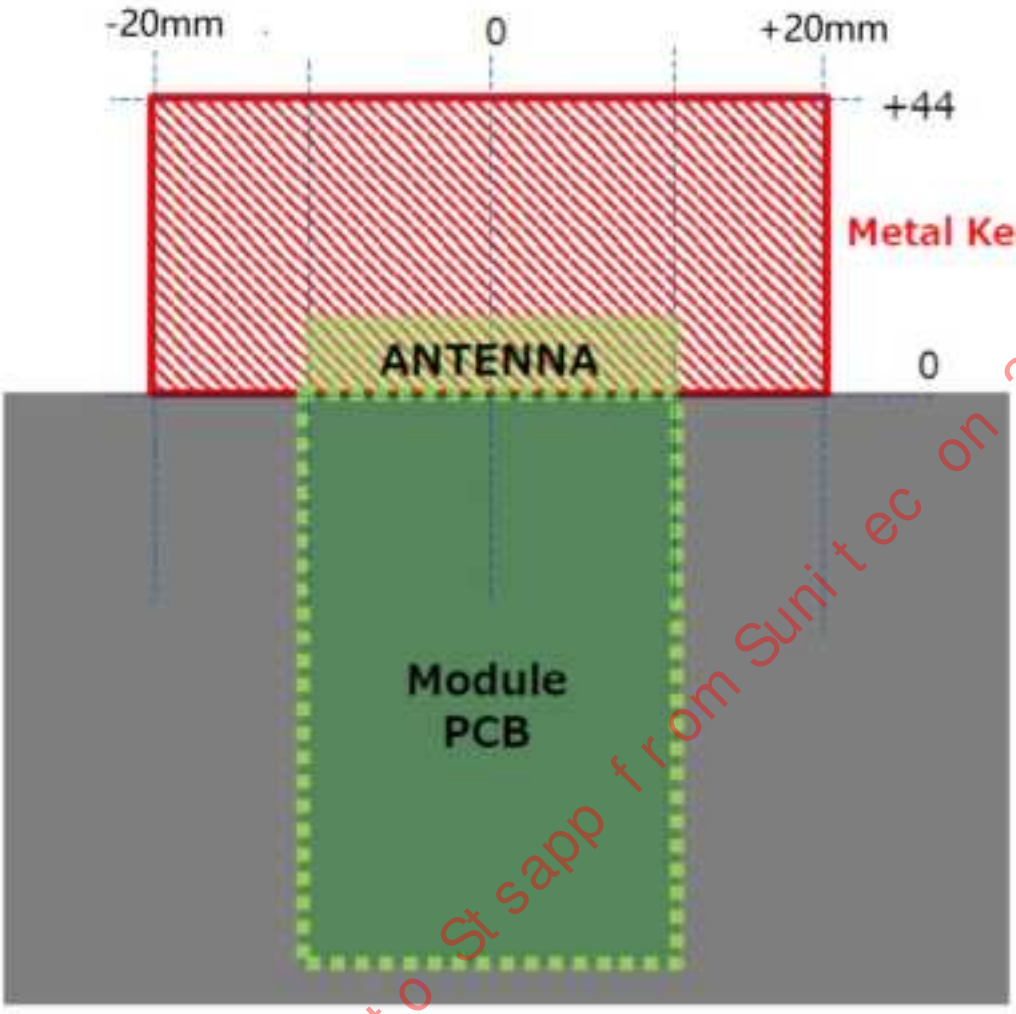


Figure 7.3-3 **Recommended PWB footprint of the BMS002 module**

8. Electrical Characteristics

This section provides an overview of the BMS002 LEAudio module electrical characteristics. Additional information will be provided in future revisions of this document as it becomes available.
Absolute maximum ratings for the BMS002 module are listed below. Exposure to these maximum rating conditions for extended periods may affect device reliability. Functional operation of the device at these or any other conditions, above the parameters indicated in the operation listings of this specification is not implied.

8.1 Module Power Consumption (Vcore =0.7-1.1V)

✓ **TABLE 8-1**

Module base on Sunitec BMS002 EVB		
Condition：TA = +25℃ , Vcore=0.7 – 1.1V (not fixed)		
Mode	Power Consumption (mA)	
BT Pairing mode	Max.	3.57
	Avg.	1.37
	Min.	0.84
Connected mode	Max.	7.29
	Avg.	3.25
	Min.	0.75
Sleep mode （Send power OFF command）	Max.	1.35
	Avg.	0.54
	Min.	0.38
BT SBC streaming mode （Play silence tone）	Max.	5.64
	Avg.	4.97
	Min.	4.70
AUX in mode	Max.	5.25
	Avg.	5.18
	Min.	4.68
Call active	Max.	7.34
	Avg.	6.91
	Min.	6.71
Disconnect mode	Max.	3.66
	Avg.	3.34
	Min.	0.40
Reconnecting mode	Max.	8.66
	Avg.	3.26
	Min.	0.75

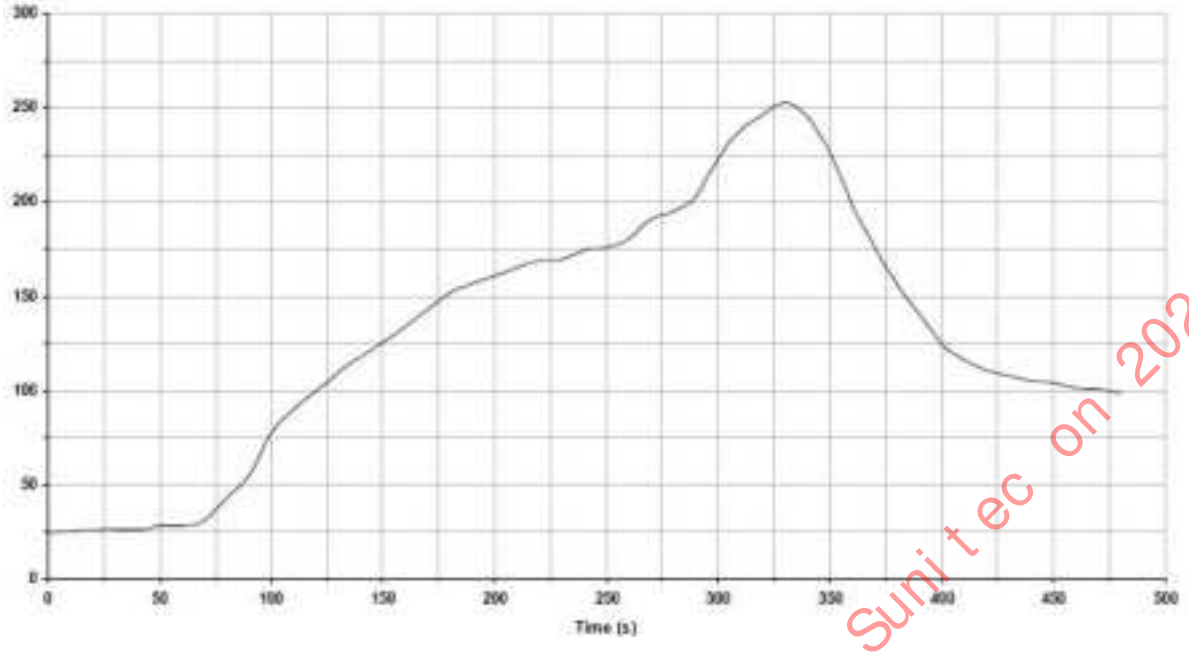
Note:
1. BT Firmware : FW_MT2822A_ER3_ADC_OUT_MAX_0Db
2. BT Codec： SBC
3. The current consumption values are measured with the BMS002 EVB as test platform, with BAT_IN = 3.89V. The Distance between the smartphone and BMS002 EVB is 30cm, and the speaker is without loading.

8.2 Module Power Supply

✓ **TABLE 8-3-1**

Recommended Operating Conditions	Min	Max
Operating Temperature Range	-20°C	+70°C
Supply Voltage, (VBAT)	3.0V	+5.5V
VSYS Voltage (VSYS)	3.0V	+5.5V
Supply Voltage,(VIO)	+1.62V	+3.63V
Supply Voltage,(DVDD_IO_0-2)	+1.62V	+3.63V
Supply Voltage, (VBUS)	4.1V	+23V
Power key	0.7 * VBAT	--
	--	0.3 * VBAT
SYRSTB	0.7 * VIO	--
	--	0.3 * VIO

9. Recommended Reflow Temperature Profile:



Key features of the profile:
-Initial Ramp=1-2.5℃/sec to 175℃ equilibrium
-Equilibrium time=60 to 90 seconds
-Ramp to Maximum temperature (250℃)=3℃/sec Max
-Time above liquidus temperature (217℃): 70 - 90 seconds
-Device absolute maximum reflow temperature: 250℃
-TAMURA solder paster

10.QR code label information:

Label

(These Photos are for reference only)

MAC ID: XXXXXX (last 6 digits)
FW Ver: Vxx.xx (V17.03)
Customer part NO: 07GBTMS00-1BXBH4-N
07GBTMS00-1BXBM4-N
07GBTMS00-1BXBL4-N

11.Certification

11.1 BQB Certification QDID

TBD

11.2 EMC Certification

The BMS002 module has received the regulatory approval for following countries:

No	Country	Certification	STANDARD	Certification ID/No.
1	United States			
2	Canada			
3	Europe			
4	Argentina			
5	Japan			
6	Malaysia			
7	UAE			
8	Mexico			
9	Peru			

The component does not contain any prohibited substance specified in “SS-00259”.
If using recycled plastic or sheathed wire as customer-classified, it shall be procured from a Sony green partner.

12.Standard Packing Information

Module packing Box (Max 2100pcs module per box)

35pcs per tray, 10trays per ESD bag, vacuum packing sealed in ESD PE bag.

Maximum modules per ESD bag is 350pcs

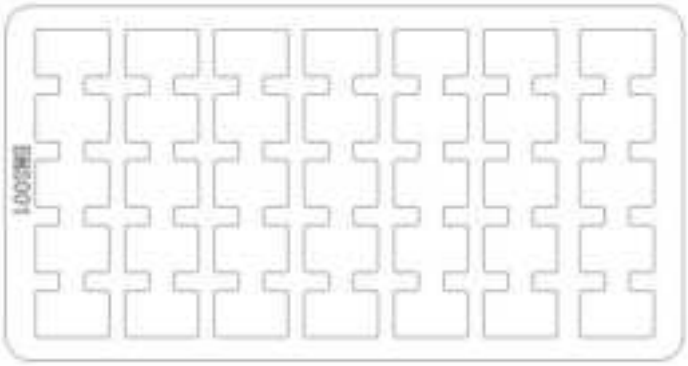
Module packing bag dimension: 290*160*6.5mm

Delivering carton box

To hold of module carton box for shipment, 6bags per box (Max 2100pcs modules per box)

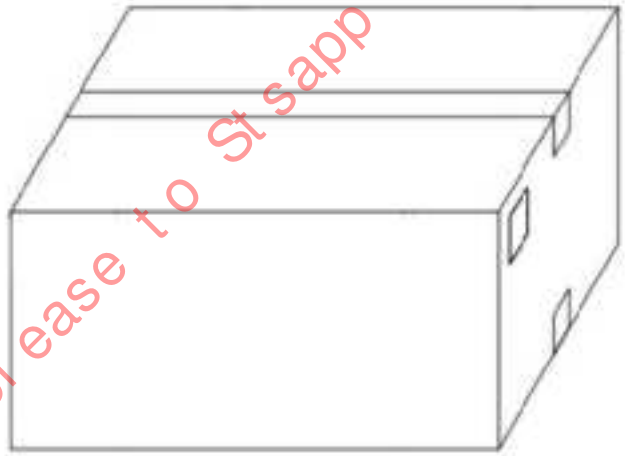
Delivery Carton Box dimension: 310.0mm x 340.0mm x 340.0mm (W x D x H)

ESD tray dimension: 290*160*6.5mm



（plastic tray size :290mm*160mm*6.5mm， qty :35 pcs/ tray）

（10 trays / package bag）



（carton size： 310mm*340mm*340mm， 6 bags / carton , total :2100pcs/carton ）

The actual photo

（plastic tray photo :35 pcs/ tray）

（ESD PE bag dimension）

（Vacuum packing： 10trays per ESD bag)

Carton box (6bags in per carton box)

13.Document History

Revision	Date	History
V1.0	2021-02-18	First release
V1.1	2021-02-25	Updated pin description
V1.2	2021-03-02	Updated BMS002 module structure/packaging
V1.3	2021-03-25	Add profile information and add in module RF performance data
V1.4	2021-08-05	Add power consumption data and updated RF Antenna Design Guidelines
V1.5	2021-09-08	Updated to Crystal : 26MHZ ±20PPM@-20℃~+70℃
V1.6	2021-10-08	Removed 64Mbit flash party number
V1.7	2021-10-18	BLE 1M/2M RF output power change to 4dBm from 6dBm for CE certification

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China Factory:
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Fax: 86-755-28016097
E-mail: sales16@sunitec-cn.com or manager@sunitec-cn.com
Http://www.sunitec-cn.com

IC Warning This device complies with Industry Canada licence-exempt RSS standard(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.
The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

For a host manufacture's using a certified modular, if (1) the module's IC number is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the IC number of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module IC: 23011-BMS002" or "Contains IC: 23011-BMS002" must be used.

Le présent appareil est conforme aux CNR d'Industrie 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 Le modular peut être installé ou intégré dans un mobile ou réparer une seule chose Installation dans n’importe quell appareil portable.

Pour un hôte, on utilise un modular, si (1) le numéro de module est non visible Quand on est installé dans le serveur, or (2) si le propriétaire est commercialisé Straightforward commonly used for the access to remove travail so that the number IC en vue Le module est visible;Ensuite, le label permanent a été attribué au module: "Contient le Module IC: 23011-BMS002" " ou "contenu IC: 23011-BMS002" doit be used.

Radiation Exposure Statement
This modular complies with RF 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 except in accordance with multi-transmitter product procedures. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

Déclaration d'exposition aux rayonnements
Ce module est conforme aux limites d'exposition aux rayonnements RF définies pour un environnement non contrôlé. Cet émetteur ne doit pas être co-localisé ou fonctionner en conjonction avec une autre antenne ou émetteur, sauf conformément aux procédures du produit multi-émetteur. Ce modulaire doit être installé et exploité avec une distance minimale de 20 cm entre le radiateur et le corps de l'utilisateur.

FCC Statement

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.

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

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2AMX3BMS002” Or “Contains FCC ID: 2AMX3BMS002”

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.

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

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with Limited Single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C : 15.247 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement，then the host can be sold legally.

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 15.247.

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, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a PCB Antenna, and the antenna use a permanently attached antenna which is not replaceable.

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 limited module, limited used in speaker.

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: Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design, antenna, connectors, and isolation requirements.

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 is: 2AMX3BMS002.

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 has a PCB Antenna, and the antenna use a permanently attached antenna which is unique.

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: 2AMX3BMS002, Contains IC: 23011-BMS002 ”

2.9 Information on test modes and additional testing requirements5

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: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

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 circuity), 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 module without unintentional-radiator digital circuity, so the module does not require an evaluation by FCC Part 15 Subpart B. The host shoule be evaluated by the FCC Subpart B.