Approval Sheet

Bluetooth® Module

Customer MODEL	BnCOM MODEL
	BCM-SQ310-AS

History

VERSION	DATE	DESCRIPTION
0.1	2021.06.17	Initial Release

	Prepare	Review	Approval
CERAGEM			
BnCOM			

BCM-SQ310-AS
Specification

Revision 0.1 2021/06/17

CONFIDENTIAL INFORMATION

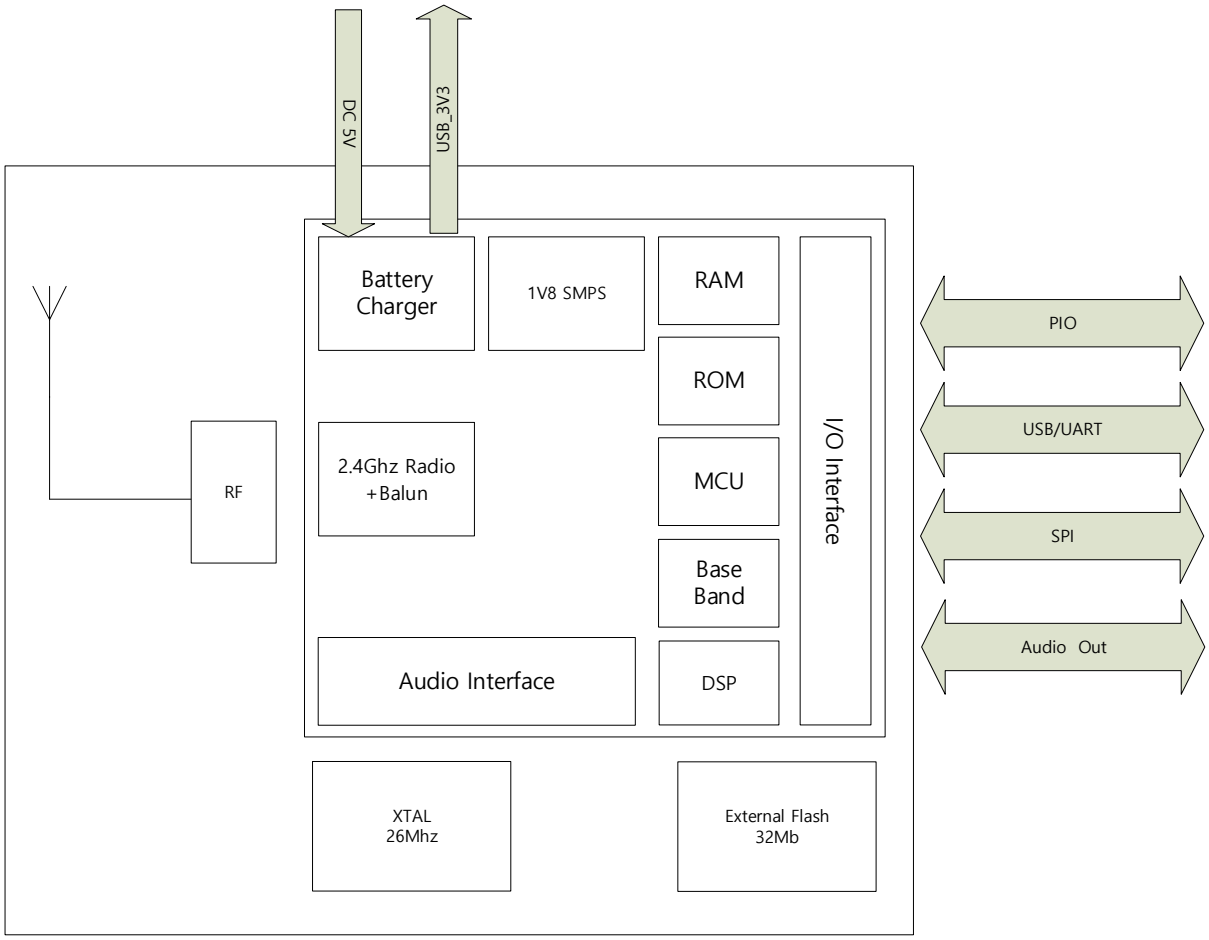
BnCOM Co.,Ltd.

List of Contents

1. General

1.1 Overview

This specification covers Bluetooth module which single IC Bluetooth solution; this module provides everything required to create a Bluetooth high quality audio product with RF, baseband, MCU, qualified Bluetooth v5.0 stack and customer application running.
BCM-SQ310-AS applies Qualcomm QCC3007
All detailed specification including pin outs and electrical specification may be changed without notice.



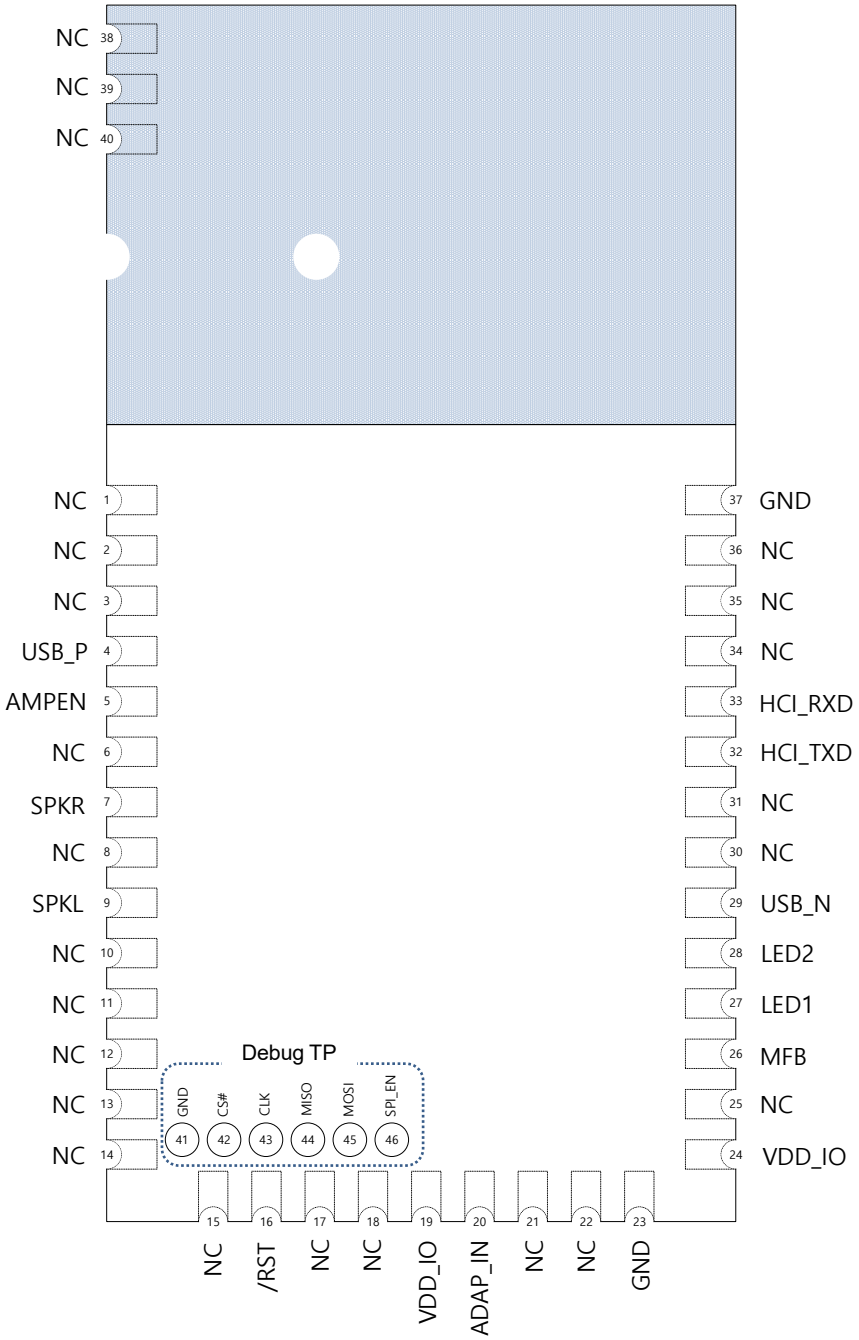
1.2 Features

- Bluetooth® v5.0 specification compliant (with Low Energy)
- Radio includes integrated balun and BPF with RF performance of 7dBm(TYP)
- Receiver sensitivity: -90dBm (basic rate) and -82dBm(EDR)
- 80MHz RISC CPU and 80MHz Qualcomm Kalimba DSP
- Stereo audio DAC
- USB 2.0 interface (full-speed)
- 1 UART interface
- SPI debug and programming interface with read access disable locking
- 2 general purpose PIOs and unused digital interfaces are available as PIOs
- 2 LED drivers (includes RGB) with PWM flasher on sleep clock
- Power-on-reset detects low supply voltage
- Integrated 3.3V LDO
- Audio features : SBC, AAC audio codec and TWS.
- Competitive Size : 15mm x 29mm x 2.4mm : 40Pin
- Operating temperature range (MAX -20℃ ~ 70℃)

1.3 Application

- Mobile Phone Accessories
- Stereo Wireless Headsets
- Portable stereo speakers.

1.4 Pin Configuration



- The SPI Debug TP are not pads, Do not make PCB lands.

Pin Configuration (TOP VIEW)

1.5 Device Terminal Functions

1.5.1 Pin Discription

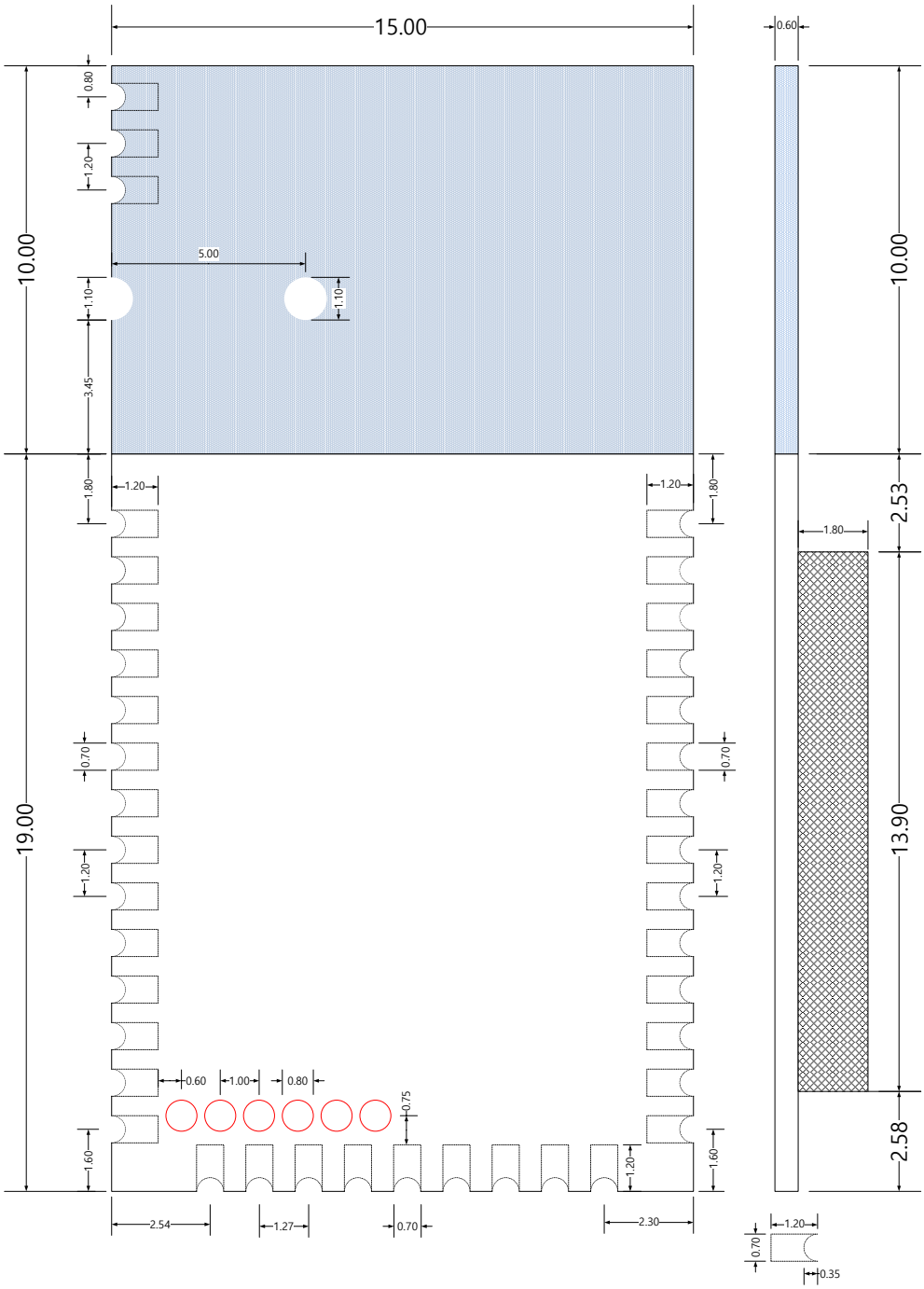
Block	Function	Pin No.	Pad Type	Description
SPEAKER	SPKR	7	Analog out	Speaker output right
	SPKL	9	Analog out	Speaker output left
UART	HCI_TXD	32	Bidirectional with strong pull-up	UART_TX: UART data output
	HCI_RXD	33	Bidirectional with strong pull-up	UART_RX: UART data input
LED	LED1	27	Bidirectional	Open-drain output
	LED2	28	Bidirectional	Open-drain output
USB	USP_P	4	Bidirectional	USB data plus with selectable internal 1.5 k pull-up resistor
	USB_N	29	Bidirectional	USB data minus
PIO	AMPEN	5	Bidirectional with strong pull-up	
	MFB	26	Bidirectional with weak pull-down	
OTHER PIN	ADAP_IN	20	5V Input	Main power input
	VDD_IO	19, 24	3.3V output	3.3 V bypass linear regulator output.
	GND	23, 37	Ground	Ground connections.
	NC	1,2,3,6,8, 9,10,11,12,13, 14,15,17,18,21, 22,25,30,31,34, 35,36,38,39,40		Not Connect

1.5.2 Debug TP (Test Point)

Block	Function	Pin No.	Pad Type	Description
SPI	GND	41	Ground	Ground connection
	CS#	42	Bidirectional with weak pull-down	chip select for Debug SPI, active low
	CLK	43	Bidirectional with weak pull-down	Debug SPI clock
	MISO	44	Bidirectional with weak pull-down	Debug SPI data output
	MOSI	45	Bidirectional with weak pull-down	Debug SPI data input
	SPI_EN	46	Input with weak pulldown	SPI select input (Active High)

1.6 Package Dimensions & Land Pattern

- **unit = mm**
- **Outline Tolerances = ±0.2mm**



BCM-SQ310-AS Package Dimensions

2. Characteristics

2.1 Electrical Characteristics

■ Absolute Maximum Ratings

Rating	Min	Max	Unit
Storage Temperature range	-40	85	°C
ADAP_IN	-0.4	6.50	V
Other terminal voltages	VSS-0.4	≤ 3.60	V

■ Recommended Operating Conditions

Operating Condition		Min	TYP	Max	Unit
Operating Temperature range		-20		70	°C
ADAP_IN		4.75	5.0	6.5	V
LEDs	LED[2:1]	1.10	3.7	4.3	V

■ USB

USB	Min	TYP	Max	Unit
VDD_IO (Internal Bypass LDO regulator output)	3.10	3.30	3.60	V
V_{IL} input logic level low	-	-	0.3 X VDD_IO	V
V_{IH} input logic level high	0.7 X VDD_IO	-	-	V
V_{OL} output logic level low	0	-	0.2	V
V_{OH} output logic level high	2.80	-	VDD_IO	V

■ Digital to Analogue Converter

Parameter	Conditions			Min	TYP	Max	Unit
Resolution	-			-	-	16	Bits
output Sample Rate, F_{sample}	-			8	-	48	KHz
SNR	f_{in} = 1kHz B/W=20Hz→20kHz 0dB FS input	F_{sample}	Load				
		48KHz	100KΩ	-	95.4	-	dB
		48KHz	32Ω	-	96.5	-	dB
		48KHz	16Ω	-	95.8	-	dB
THD+N		F_{sample}	Load				
		48KHz	100KΩ	-	0.0021	-	%
		48KHz	32Ω	-	0.0031	-	%
		48KHz	16Ω	-	0.0034	-	%
		48KHz	100KΩ	-	0.0037	-	%
		48KHz	32Ω	-	0.0029	-	%
		48KHz	16Ω	-	0.0042	-	%
Digital gain	Digital gain resolution = 1/32			-24.00	-	21.50	dB
Analogue gain	Analogue Gain Resolution = 3dB			-21.00	-	0.00	dB
Output voltage	Full-scale swing (differential)			-	-	778.00	mV rms
Stereo separation (crosstalk)					-90.5		dB

■ Digital Terminals

Input Voltage Levels	Min	TYP	Max	Unit
V_{IL} input logic level low	-0.4	-	0.4	V
V_{IH} input logic level high	2.5	-	3.6	V
T_r/T_f	-	-	25	ns

Output Voltage Levels	Min	TYP	Max	Unit
V_{OL} output logic level low, I_{OL} = 4.0mA	-	-	0.4	V
V_{OH} output logic level high, I_{OH} = -4.0mA	2	-	-	V
T_r/T_f	-	-	5	ns

Input and Tristate Currents	Min	TYP	Max	Unit
Strong pull-up	-150	-40	-10	µA
Strong pull-down	10	40	150	µA
Weak pull-up	-5	-1.0	-0.33	µA
Weak pull-down	0.33	1.0	5.0	µA
C_I Input Capacitance	1.0	-	5.0	pF

■ LED Driver Pads

LED Driver Pads		Min	TYP	Max	Unit
Current, IPAD	High impedance state	-	-	5	µA
	Current sink state	-	-	10	mA
LED pad voltage, VPAD	I_{PAD}= 10mA	-	-	0.55	V
LED pad resistance	V_{PAD}< 0.5V	-	-	40	Ω

2.2 RF Characteristics

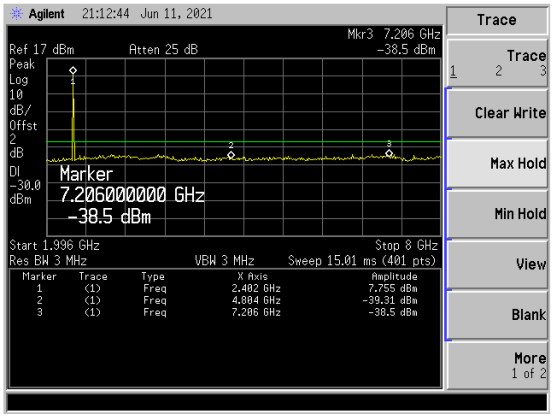
2.2.1 Transmitter

RF Characteristics		NOTE	MIN	TYP	MAX	Bluetooth Specification	UNIT
Maximum RF transmit power		a b c	-	-	8	-6 to 20	dBm
RF power variation over temperature range		d					
20dB bandwidth for modulated carrier			-	925	1000	≤ 1000	kHz
ACP	F =F0 ± 2MHz	e f g	-	-23	-20	≤ -20	dBm
	F =F0 ± 3MHz	e f g	-	-32	-28	≤ -40	dBm
	F =F0 ± > 3MHz	e f g	-	-65	-40	≤ -40	dBm
Δf1avgmaximum modulation			140	165	175	140 < f1avg < 175	kHz
Δf2avgmaximum modulation			115	137		≥ 115	kHz
Δ2avg/Δf1avg			0.8	0.9		≥ 0.80	
ICFT		h	-75	15	75	± 75	kHz
Drift rate			-	7	20	≤ 20	KHz/50 μs
Drift(single slot packet)			-	15	25	≤ 25	kHz
Drift(five slot packet)			-	15	40	≤ 40	kHz
2nd harmonic content		i	-	-40	-	≤ -30	dBm
3nd harmonic content		i	-	-55	-	≤ -30	dBm

a The firmware maintains the transmit power within Bluetooth v5.0 specification limits.
b Measurement made using appropriate PS Key settings.
c Class 1 RF transmit power range, Bluetooth v5.0 specification.
d Parameters depend on matching circuit used and behavior over temperature. These parameters may be beyond QTIL's direct control.
e Resolution guaranteed over the range -5 dB to -25 dB relative to maximum power for TX Level -20 dBm.
f Measured at F0 = 2441 MHz.
g BCM-SQ310-AS guaranteed to meet ACP performance in Bluetooth v5.0 specification.
h Ignores any frequency error in the reference.
I Filter will attenuate the harmonics.

2.2.2 Harmonic Content

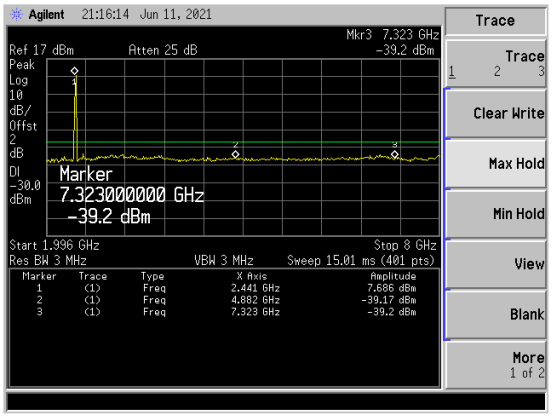
2402Mhz



2nd harmonic = 4804MHz , -39.31dBm

3RD harmonic = 7206MHz , - 39.2dBm

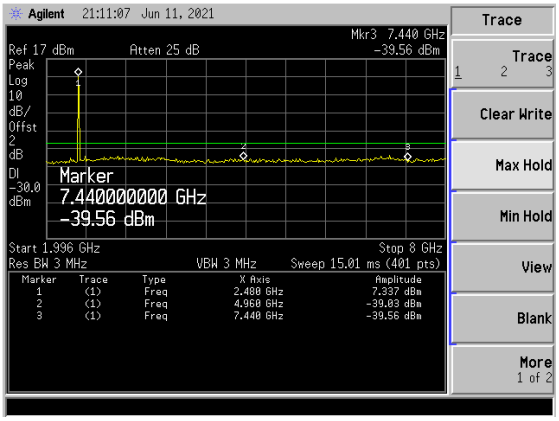
2441Mhz



2nd harmonic = 4882MHz , -39.17dBm

3RD harmonic = 7206MHz , - 38.5dBm

2480Mhz



2nd harmonic = 4960MHz , -39.03dBm

3RD harmonic = 7440MHz , - 39.56dBm

2.2.3 Receiver

RF Characteristics	Frequency (GHz)	Notes	Min	Typ	Max	Bluetooth Specification	Unit
Sensitivity at 0.1% BER for all basic rate packet types	2.402	-	-	-87.9	-	≤-70	dBm
	2.441	-	-	-88.6	-		
	2.480	-	-	-87.5	-		
Maximum received signal at 0.1% BER		-	-20	>-10	-	≥-20	dBm
Continuous power required to block Bluetooth reception (for input power of -67 dBm with 0.1% BER) measured at the output of BCM-SQ310-AS	0.030 - 2.000	-	-10	>1	-	-10	dBm
	2.000 - 2.400	-	-27	-7	-	-27	
	2.500 - 3.000	-	-27	-6	-	-27	
	3.000 - 12.75	-	-10	>3	-	-10	
C/I co-channel		a b c	-	5	11	≤11	dB
Adjacent channel selectivity C/I	F = F0 + 1MHz	a b c	-	-5	0	≤0	dB
	F = F0 - 1MHz	a b c	-	-3	0	≤0	dB
	F = F0 + 2MHz	a b c	-	-40	-30	≤-30	dB
	F = F0 - 2MHz	a b c	-	-32	-20	≤-20	dB
	F = F0 - 3MHz	a b c	-	-48	-40	≤-40	dB
	F = F0 - 5MHz	a b c	-	-49	-40	≤-40	dB
	F = F_{Image}	a b c	-39	-32	-9	≤-9	dB
Maximum level of intermodulation interferers		d	-	-15	-	≥-39	dBm
Spurious output level		e		-155	-		dBm/Hz

Note:

a BCM-SQ310-AS is guaranteed to meet the C/I performance as specified by the Bluetooth v5.0 specification.

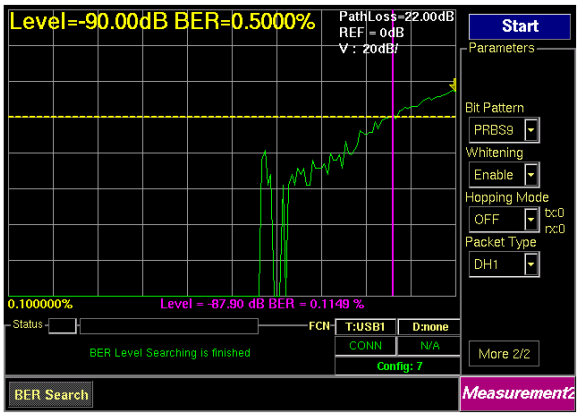
b Measured at F0 = 2441 MHz.

c F_{Image} = F0 + 3 MHz. However, depending on crystal frequency and channel number, the image may switch to the opposite side of the carrier. When this occurs, F_{Image} = F0 - 3 MHz and the offsets in the table equations associated with C/I are also reversed.

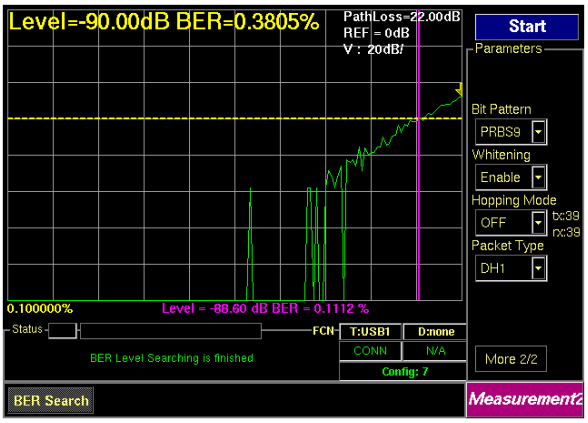
d Measured at f1 - f2 = 5 MHz. Measurement is performed in accordance with Bluetooth RF test RCV/CA/05/c, i.e. wanted signal at -64 dBm.

e Measured at single-ended RF port of BCM-SQ310-AS. Integrated in 100 kHz bandwidth and normalized to 1 Hz. Actual figure is typically -155 dBm/Hz except for peaks of -75 dBm at 1600 MHz, -80 dBm in-band at 2.4 GHz and -75 dBm in-band at 3.2 GHz.

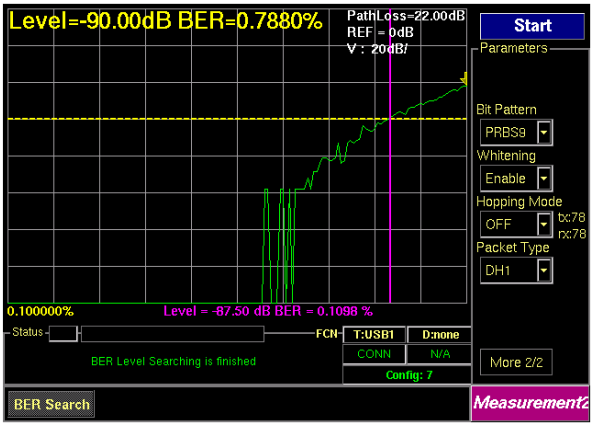
2.2.4 Sensitivity Level & BER



CH 0 : Level = -87.9dB, BER=0.1149%



CH 39 : Level = -88.6dB, BER=0.1112%



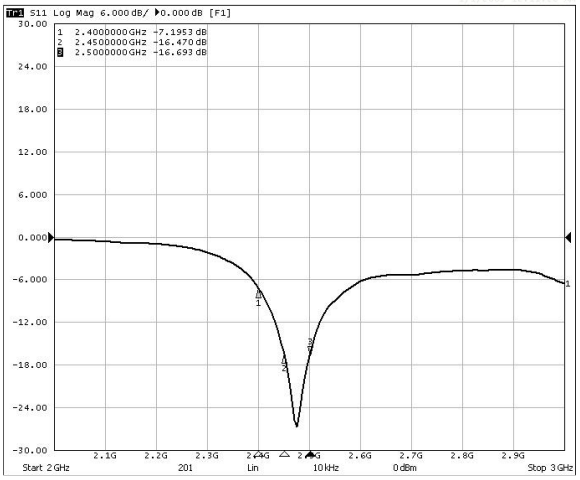
CH 78 : Level = -87.5dB, BER=0.1098%

2.3 Antenna Characteristics

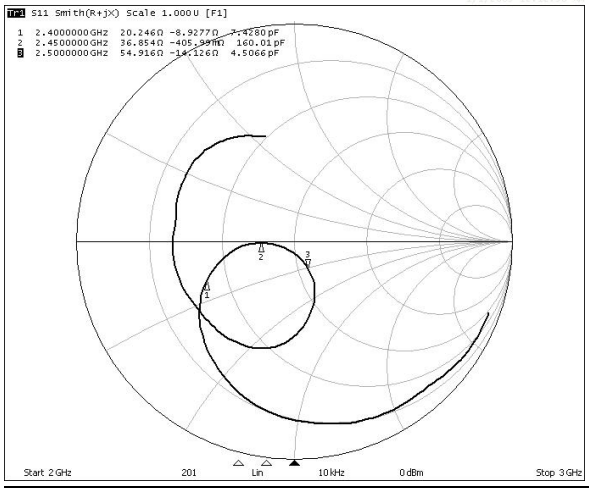
The antenna is Gradiant type of PCB antenna. The antenna impedance matching is optimized for 1 mm ~ 2 mm mother board PCB thickness. The radiation pattern is impacted by the layout of the mother board.
Typically the highest gain is towards GND plane and weakest gain away from the GND plane.

2.3.1 Antenna Passive Data

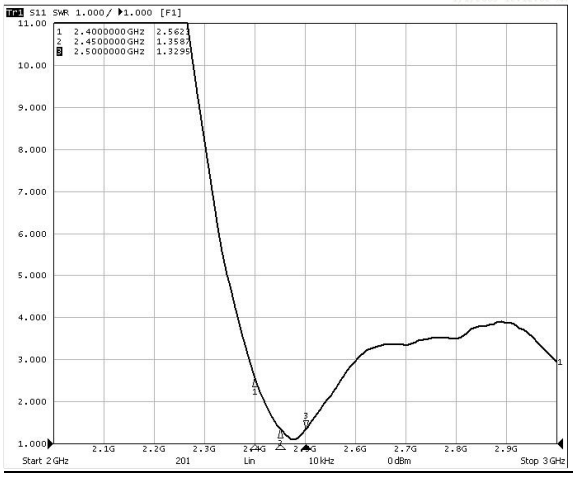
S11



SC

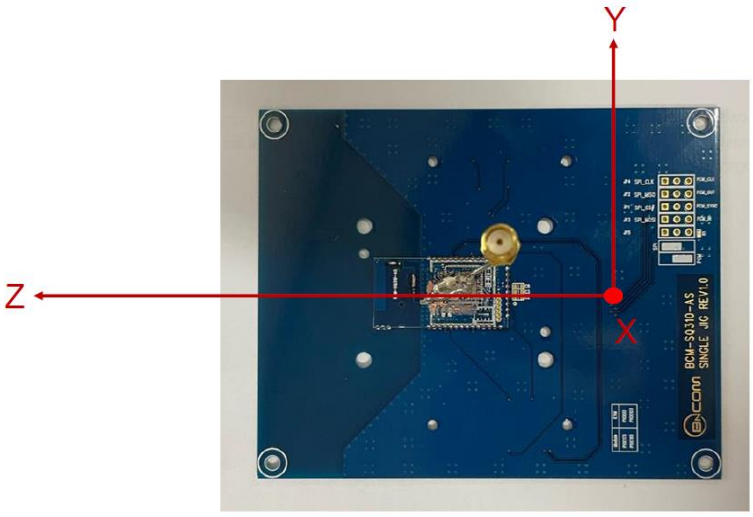


SWR

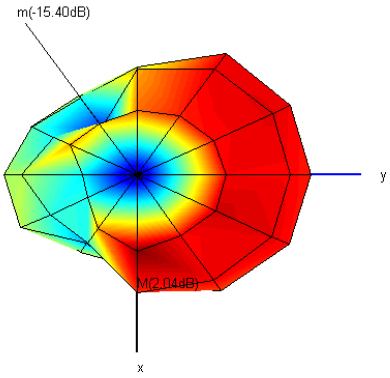


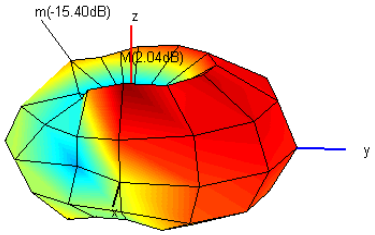
Aerage Efficiency	-2.41dBi	57.45%
Peak Gain	2.25dBi	

2.3.2 3D Plot

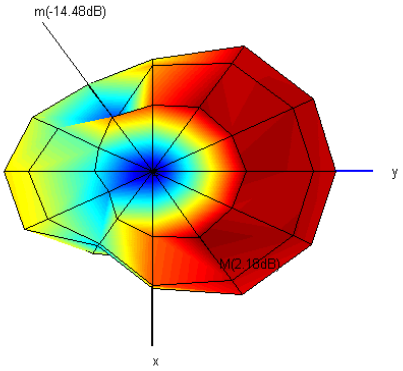


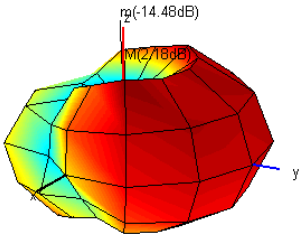
2400MHz



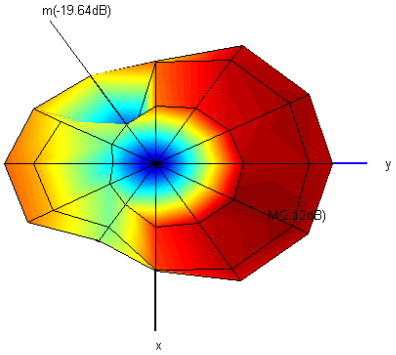


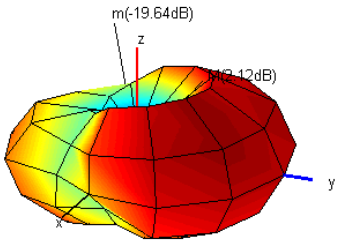
2445MHz





2445MHz





9. Package Information

9.1. Reel Pocket Information

TBD

9.2 Reel Information

TBD

9.3 Out Box Information

TBD

FCC MODULAR APPROVAL INFORMATION EXAMPLES for Manual
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.

CAUTION: 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.

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.

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

The module must be installed in the host equipment such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the internal on-board antenna that has been originally tested and certified with this module. External antennas are not supported. As long as these 3 conditions above are met, further transmitter test 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 (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve a FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:
In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module 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. In such cases, please involve a FCC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:
The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC for this module, in order to prevent compliance issues.

End product labeling:
This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID: 2A3VY-SQ310”.

Information that must be placed in the end user manual:

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.

FCC MODULAR APPROVAL INFORMATION EXAMPLES for Manual
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(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation.

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- 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.

WARNING
Changes or modifications not expressly approved by the manufacturer could void the user’s authority to operate the equipment.

“CAUTION : Exposure to Radio Frequency Radiation.
Antenna shall be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna should not be contacted during operation to avoid the possibility of exceeding the FCC radio frequency exposure limit.