

FCC REPORT (BLE)

Applicant: Shenzhen RF-STAR Technology CO., LTD

Address of Applicant: 2F,BLDG.8,Zone A, BaoAn Internet Industry Base, BaoYuan Road, XiXiang, BaoAn DIST, Shenzhen, China

Equipment Under Test (EUT)

Product Name: Bluetooth 4.0 (BLE) Module

Model No.: RF-BM-S02, RF-BM-S02A

FCC ID: 2ABN2-RFBMS02

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: 08 May., 2014

Date of Test: 09 May., to 16 May., 2014

Date of report issued: 19 May., 2014

Test Result: PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	19 May., 2014	Original

Prepared by:

Shirley Li

Date:

19 May., 2014

Report Clerk

Reviewed by:

Wimmer Zhang

Date:

19 May., 2014

Project Engineer

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(3)	Pass
Emission Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Spurious Emission	15.205/15.209	Pass

Pass: The EUT complies with the essential requirements in the standard.

5 General Information

5.1 Client Information

Applicant:	Shenzhen RF-STAR Technology CO., LTD
Address of Applicant:	2F, BLDG.8, Zone A, Bao'an Internet Industry Base, Baoyuan Road, Xixiang, Bao'an DIST, Shenzhen, China
Manufacturer:	Shenzhen RF-STAR Technology CO., LTD
Address of Manufacturer:	2F, BLDG.8, Zone A, Bao'an Internet Industry Base, Baoyuan Road, Xixiang, Bao'an DIST, Shenzhen, China

5.2 General Description of E.U.T.

Product Name:	Bluetooth 4.0 (BLE) Module
Model No.:	RF-BM-S02, RF-BM-S02A
Operation Frequency:	2402-2480MHz
Channel numbers:	40
Channel separation:	2 MHz
Modulation technology:	GFSK
Data speed :	1Mbps
Antenna Type:	PCB Antenna
Antenna gain:	0dBi
Power supply:	DC5V
Remark:	The Model: RF-BM-S02, RF-BM-S02A were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name.

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz
2	2406MHz	12	2426MHz	22	2446MHz	32	2466MHz
3	2408MHz	13	2428MHz	23	2448MHz	33	2468MHz
4	2410MHz	14	2430MHz	24	2450MHz	34	2470MHz
5	2412MHz	15	2432MHz	25	2452MHz	35	2472MHz
6	2414MHz	16	2434MHz	26	2454MHz	36	2474MHz
7	2416MHz	17	2436MHz	27	2456MHz	37	2476MHz
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2442MHz
The Highest channel	2480MHz

5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Operation mode	Keep the EUT in continuous transmitting with modulation
The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. Duty cycle setting during the transmission is 100% with maximum power setting for all modulations.	

5.4 Description of Support Units

Manufacturer	Description	Model	Serial Number	FCC ID/DoC
Lenovo	Laptop	SL510	LR-7Y97D	DoC

5.5 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Registration No.: 817957**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 817957, February 27, 2012.

- **IC - Registration No.: 10106A-1**

The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L6048**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048.

5.6 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
Address: No.B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road,
Bao'an District, Shenzhen, Guangdong, China
Tel: +86-755-23118282
Fax: +86-755-23116366

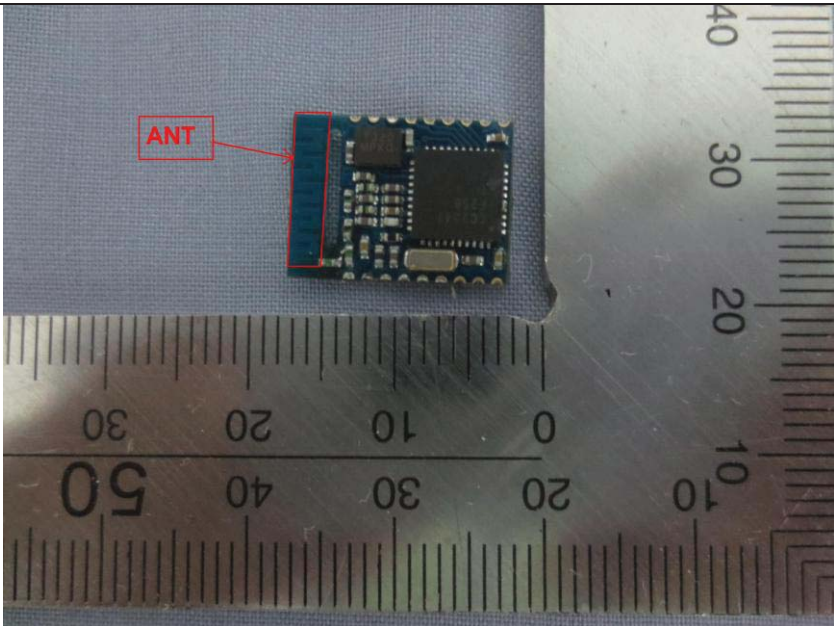
5.7 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	SAEMC	9(L)*6(W)* 6(H)	CCIS0001	June 09 2013	June 08 2014
2	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	CCIS0005	May 25 2013	May 24 2014
3	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	CCIS0006	May 25 2013	May 24 2014
4	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
5	Coaxial Cable	CCIS	N/A	CCIS0016	Apr. 01 2014	Mar. 31 2015
6	Coaxial Cable	CCIS	N/A	CCIS0017	Apr. 01 2014	Mar. 31 2015
7	Coaxial cable	CCIS	N/A	CCIS0018	Apr. 01 2014	Mar. 31 2015
8	Coaxial Cable	CCIS	N/A	CCIS0019	Apr. 01 2014	Mar. 31 2015
9	Coaxial Cable	CCIS	N/A	CCIS0087	Apr. 01 2014	Mar. 31 2015
10	Amplifier(10kHz-1.3GHz)	HP	8447D	CCIS0003	Apr. 01 2014	Mar. 31 2015
11	Amplifier(1GHz-18GHz)	Compliance Direction Systems Inc.	PAP-1G18	CCIS0011	June 09 2013	June 08 2014
12	Pre-amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	Apr. 01 2014	Mar. 31 2015
13	Horn Antenna	ETS-LINDGREN	3160	GTS217	Mar. 30 2014	Mar. 29 2015
14	Printer	HP	HP LaserJet P1007	N/A	N/A	N/A
15	Positioning Controller	UC	UC3000	CCIS0015	N/A	N/A
16	Spectrum analyzer 9k-30GHz	Rohde & Schwarz	FSP	CCIS0023	May. 25 2013	May. 24 2014
17	EMI Test Receiver	Rohde & Schwarz	ESPI	CCIS0022	Apr 01 2014	Mar. 31 2015
18	Loop antenna	Laplace instrument	RF300	EMC0701	Aug. 12 2013	Aug. 11 2014
19	Universal radio communication tester	Rhode & Schwarz	CMU200	CCIS0069	May. 25 2013	May. 24 2014
20	Signal Analyzer	Rohde & Schwarz	FSIQ3	CCIS0088	May. 25 2013	May. 24 2014

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
1	Shielding Room	ZhongShuo Electron	11.0(L)x4.0(W)x3.0(H)	CCIS0061	June 09 2013	June 08 2014
2	EMI Test Receiver	Rohde & Schwarz	ESCI	CCIS0002	May 25 2013	May 24 2014
3	LISN	CHASE	MN2050D	CCIS0074	Apr 01 2014	Mar. 31 2015
4	Coaxial Cable	CCIS	N/A	CCIS0086	Apr. 01 2014	Mar. 31 2015
5	EMI Test Software	AUDIX	E3	N/A	N/A	N/A

6 Test results and Measurement Data

6.1 Antenna requirement

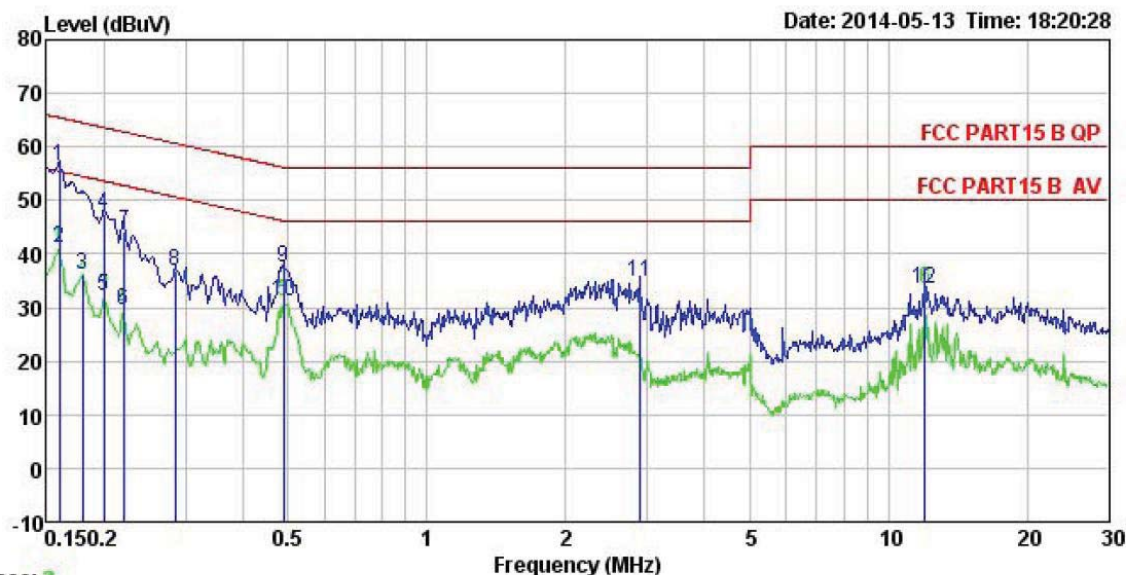
Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 requirement: <i>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</i> 15.247(c) (1)(i) requirement: <i>(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.</i>	
E.U.T Antenna:	
<i>The antenna is an internal antenna which cannot replace by end-user, the best case gain of the antenna is 0 dBi.</i>	
	

6.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207		
Test Method:	ANSI C63.4:2003		
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases with the logarithm of the frequency.			
Test setup:	Reference Plane Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m		
Test procedure:	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2003 on conducted measurement.		
Test Instruments:	Refer to section 5.7 for details		
Test mode:	Bluetooth (Continuous transmitting) mode		
Test results:	Pass		

Measurement Data

Line:

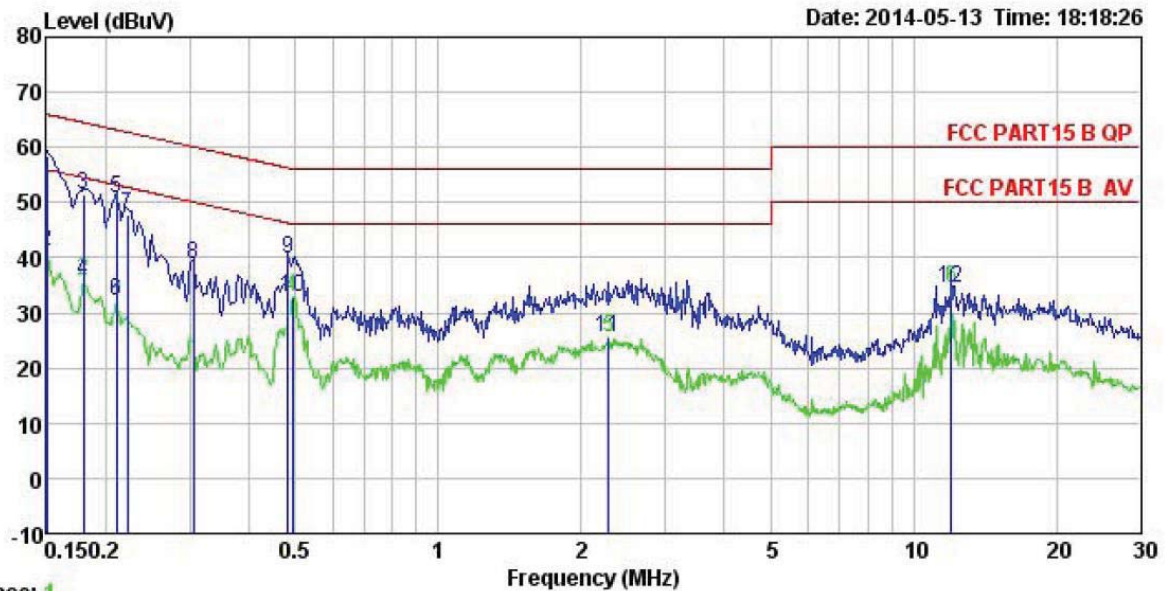


Trace: 3

Site : CCIS Shielding Room
 Condition : FCC PART15 B QP LISN LINE
 Pro : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test Mode : BLE mode
 Power Rating : DC5V
 Environment : Temp: 23 °C Humi:56% Atmos:101KPa
 Test Engineer: Carey
 Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.160	45.34	0.27	10.78	56.39	65.47	-9.08	QP
2	0.160	30.18	0.27	10.78	41.23	55.47	-14.24	Average
3	0.180	25.17	0.28	10.77	36.22	54.50	-18.28	Average
4	0.200	36.48	0.28	10.76	47.52	63.62	-16.10	QP
5	0.200	21.20	0.28	10.76	32.24	53.62	-21.38	Average
6	0.220	18.33	0.28	10.76	29.37	52.83	-23.46	Average
7	0.221	33.06	0.27	10.75	44.08	62.79	-18.71	QP
8	0.285	25.81	0.26	10.74	36.81	60.68	-23.87	QP
9	0.489	26.32	0.29	10.76	37.37	56.19	-18.82	QP
10	0.489	19.98	0.29	10.76	31.03	46.19	-15.16	Average
11	2.884	23.72	0.27	10.92	34.91	56.00	-21.09	QP
12	11.996	22.37	0.31	10.92	33.60	50.00	-16.40	Average

Neutral:

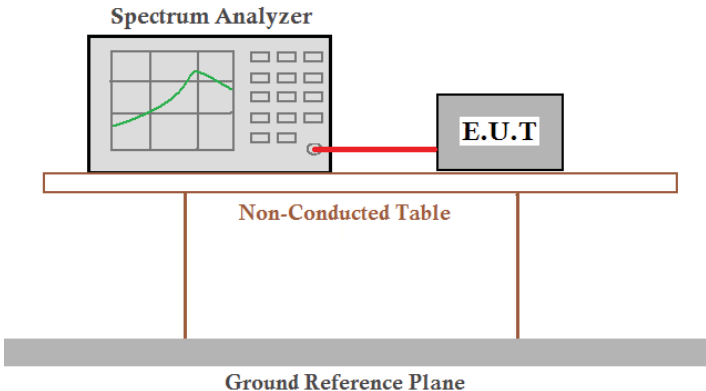


Trace: 1

Site : CCIS Shielding Room
 Condition : FCC PART15 B QP LISN NEUTRAL
 Pro : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test Mode : BLE mode
 Power Rating : DC5V
 Environment : Temp: 23 °C Humi:56% Atmos:101KPa
 Test Engineer: Carey
 Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	47.41	0.25	10.78	58.44	66.00	-7.56	QP
2	0.150	30.16	0.25	10.78	41.19	56.00	-14.81	Average
3	0.180	40.44	0.25	10.77	51.46	64.50	-13.04	QP
4	0.180	24.84	0.25	10.77	35.86	54.50	-18.64	Average
5	0.211	39.86	0.25	10.76	50.87	63.18	-12.31	QP
6	0.211	21.02	0.25	10.76	32.03	53.18	-21.15	Average
7	0.222	36.85	0.25	10.75	47.85	62.74	-14.89	QP
8	0.305	27.82	0.26	10.74	38.82	60.10	-21.28	QP
9	0.484	28.72	0.28	10.75	39.75	56.27	-16.52	QP
10	0.494	21.79	0.29	10.76	32.84	46.10	-13.26	Average
11	2.285	14.35	0.29	10.95	25.59	46.00	-20.41	Average
12	11.996	23.29	0.25	10.92	34.46	50.00	-15.54	Average

6.3 Conducted Output Power

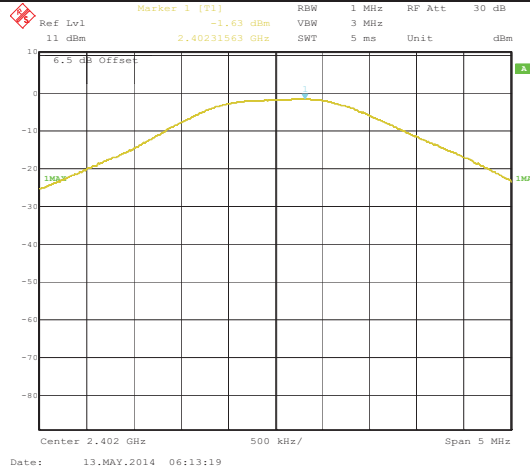
Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	30dBm
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs and sits on a Ground Reference Plane.
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	Test method refer to KDB558074 v03r01 (DTS Measure Guidance) section 9.2.2.2

Measurement Data

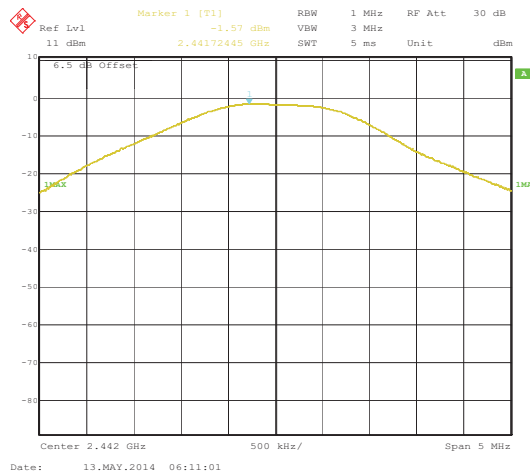
Test CH	Maximum Conducted Output Power (dBm)	Limit(dBm)	Result
Lowest	-1.63	30.00	Pass
Middle	-1.57		
Highest	-2.17		

Test plot as follows:

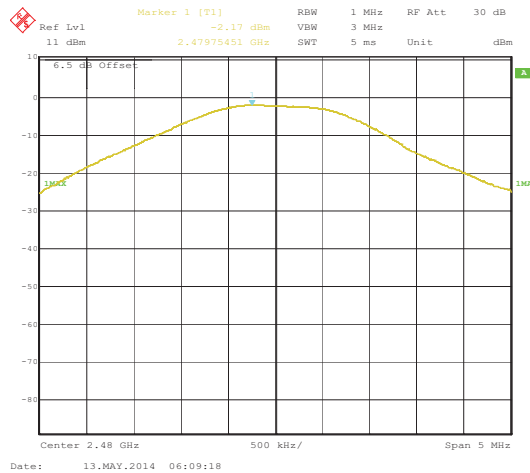
Test mode: GFSK



Lowest channel

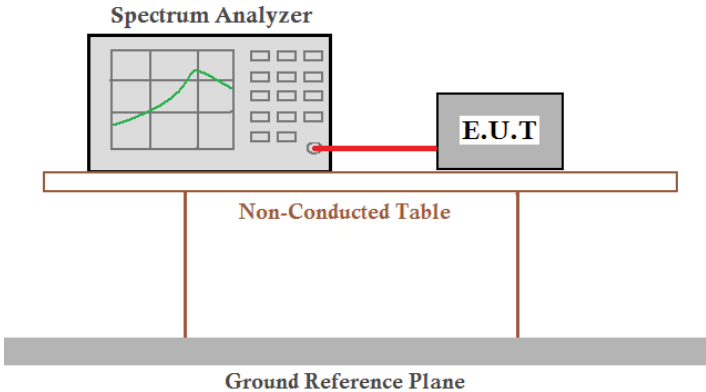


Middle channel



Highest channel

6.4 Occupy Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	>500kHz
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

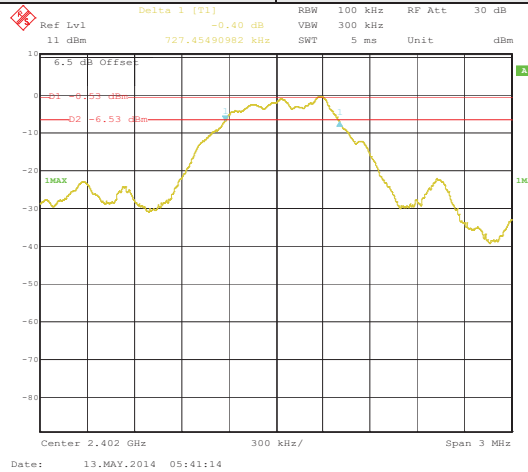
Test CH	6dB Emission Bandwidth (MHz)	Limit(kHz)	Result
Lowest	0.727	>500	Pass
Middle	0.739		
Highest	0.745		

Test CH	99% Occupy Bandwidth (MHz)	Limit(kHz)	Result
Lowest	1.178	N/A	N/A
Middle	1.148		
Highest	1.178		

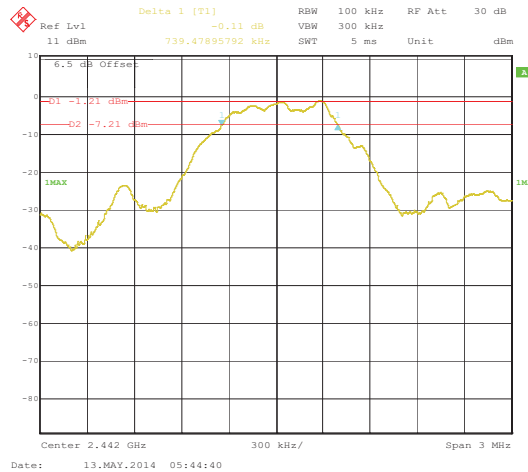
Test plot as follows:

Test mode:6dB EBW

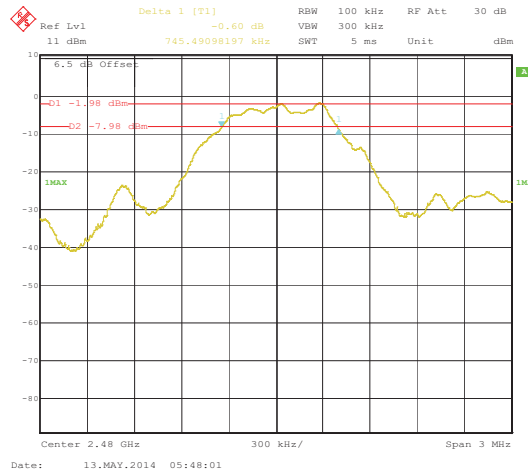
GFSK



Lowest channel

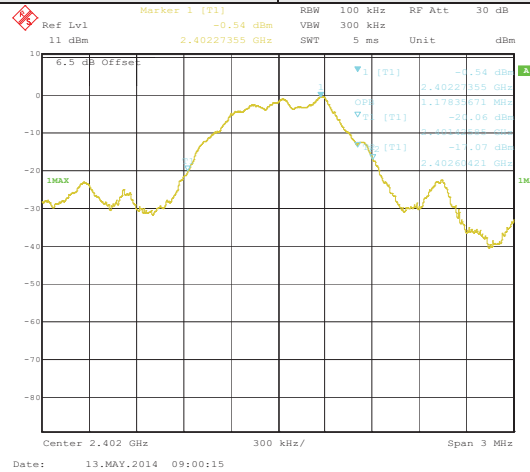


Middle channel

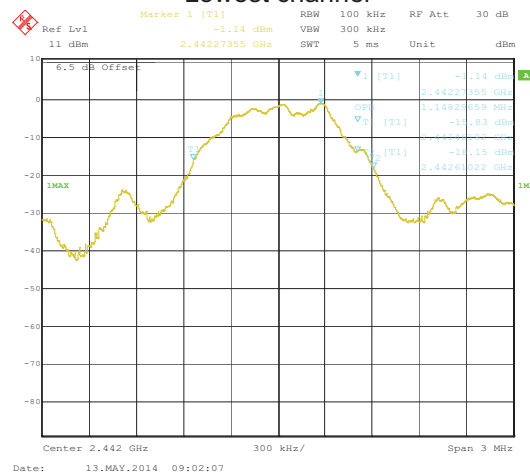


Highest channel

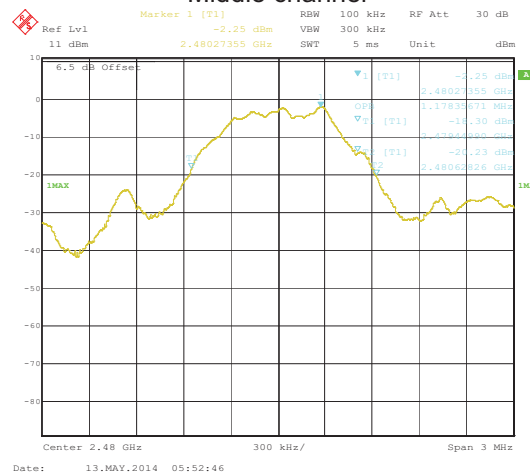
Test mode:99% OBW	GFSK
-------------------	------



Lowest channel

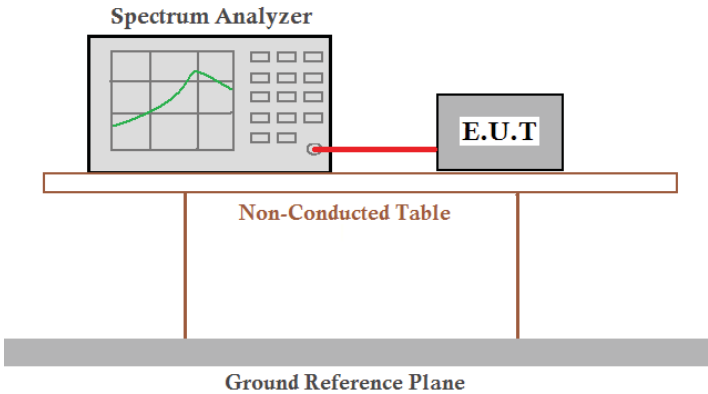


Middle channel



Highest channel

6.5 Power Spectral Density

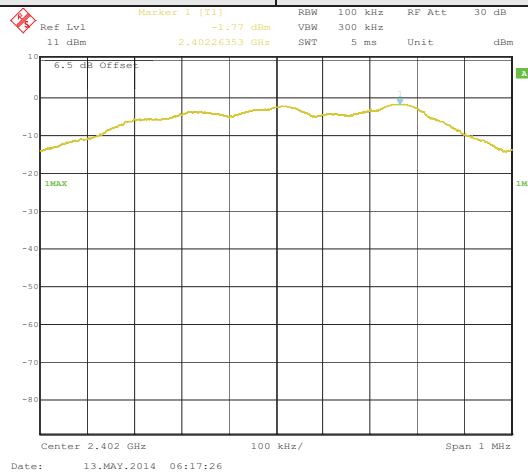
Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	8 dBm
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

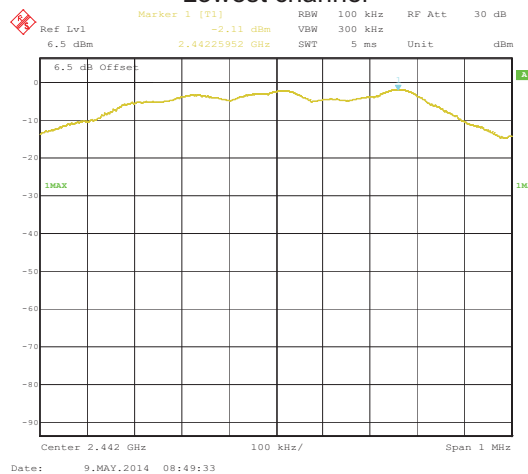
Test CH	Power Spectral Density (dBm)	Limit(dBm)	Result
Lowest	-1.77	8.00	Pass
Middle	-2.11		
Highest	-2.80		

Test plots as follow:

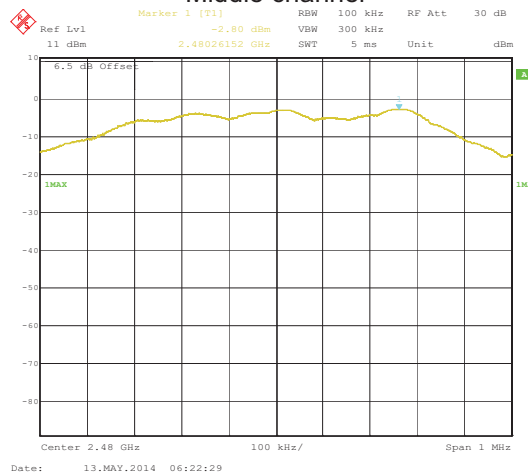
Test mode:



Lowest channel



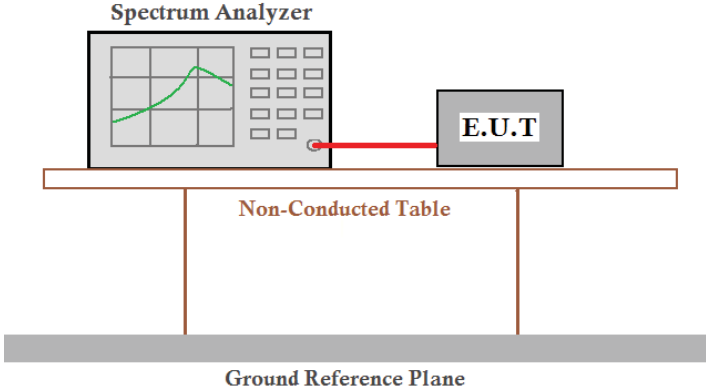
Middle channel



Highest channel

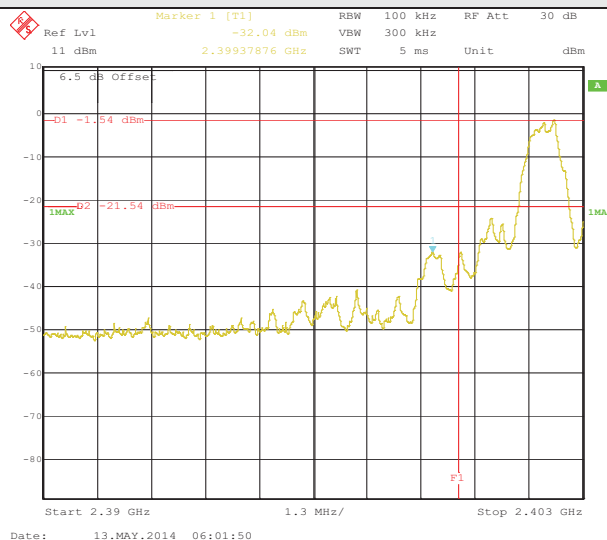
6.6 Band Edge

6.6.1 Conducted Emission Method

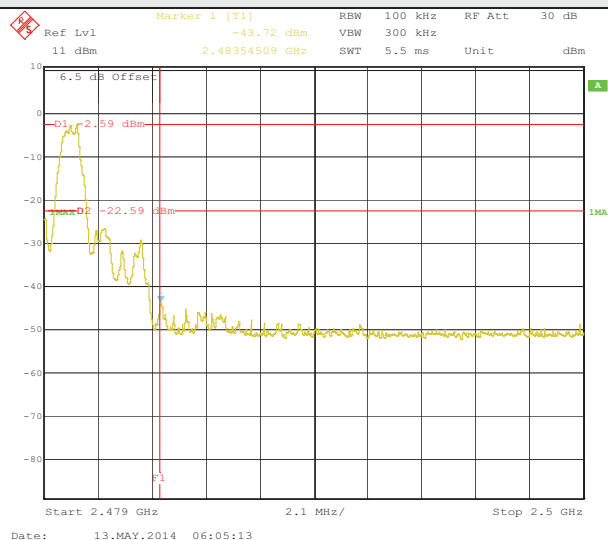
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plots as follow:

Test mode:



Lowest channel



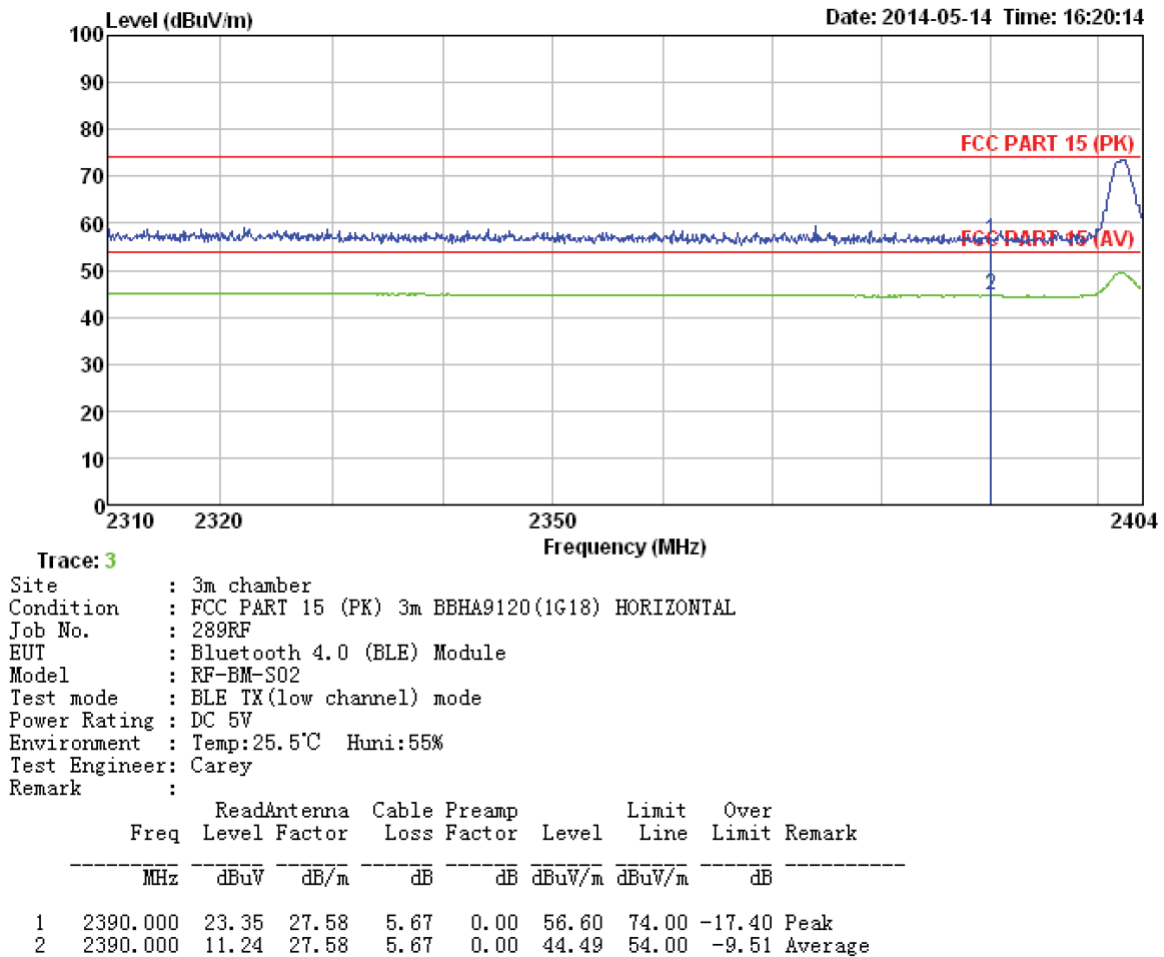
Highest channel

6.6.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205																		
Test Method:	ANSI C63.4: 2003																		
Test Frequency Range:	2.3GHz to 2.5GHz																		
Test site:	Measurement Distance: 3m																		
Receiver setup:	<table><tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr><tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr><tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr></table>					Frequency	Detector	RBW	VBW	Remark	Above 1GHz	Peak	1MHz	3MHz	Peak Value	Peak	1MHz	10Hz	Average Value
Frequency	Detector	RBW	VBW	Remark															
Above 1GHz	Peak	1MHz	3MHz	Peak Value															
	Peak	1MHz	10Hz	Average Value															
Limit:	<table><tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr><tr><td rowspan="2">Above 1GHz</td><td>54.00</td><td>Average Value</td></tr><tr><td>74.00</td><td>Peak Value</td></tr></table>					Frequency	Limit (dBuV/m @3m)	Remark	Above 1GHz	54.00	Average Value	74.00	Peak Value						
Frequency	Limit (dBuV/m @3m)	Remark																	
Above 1GHz	54.00	Average Value																	
	74.00	Peak Value																	
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.																		
Test setup:	The diagram illustrates the test setup. An Equipment Under Test (EUT) is placed on a Turn Table at a height of 0.8m. The Turn Table is positioned 3m away from an Antenna Tower. The Antenna Tower has a Horn Antenna at a height of 4m. A Spectrum Analyzer is connected to the Antenna Tower via an Amplifier. The distance from the ground to the Horn Antenna is 4m, and the distance from the ground to the Turn Table is 0.8m.																		
Test Instruments:	Refer to section 5.7 for details																		
Test mode:	Refer to section 5.3 for details																		
Test results:	Passed																		

Test channel: Lowest

Horizontal:



Test channel: Lowest

Vertical:



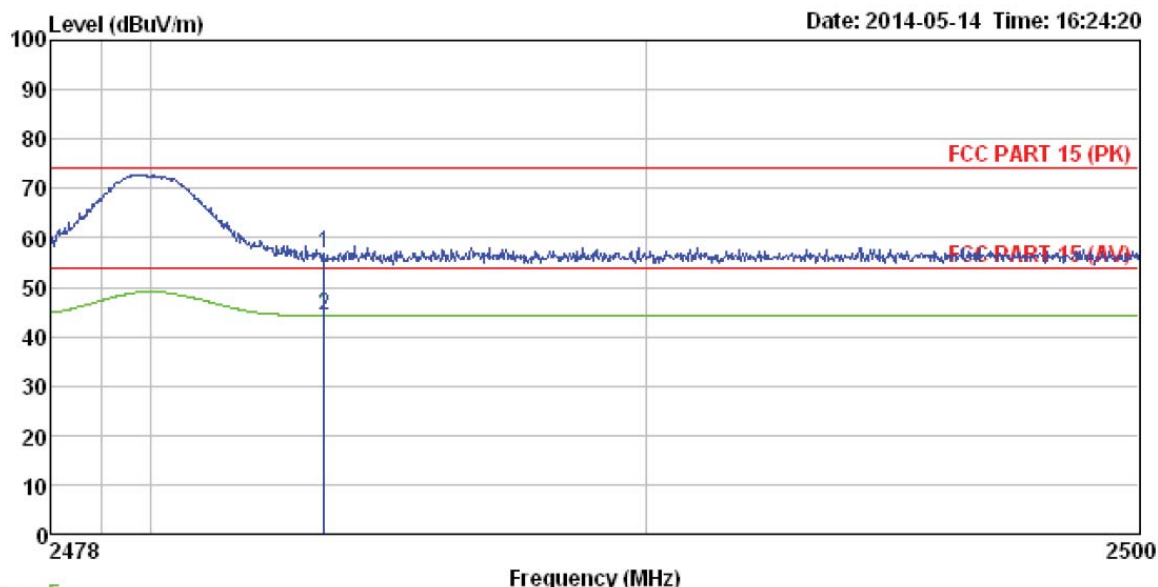
Trace: 1

Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE TX(low channel) mode
 Power Rating : DC 5V
 Environment : Temp:25.5'C Humi:55%
 Test Engineer: Carey
 Remark :

	Freq	Level	ReadAntenna Factor	Cable Loss Factor	Preamp Factor	Level	Limit	Over	
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	Remark
1	2390.000	24.17	27.58	5.67	0.00	57.42	74.00	-16.58	Peak
2	2390.000	11.28	27.58	5.67	0.00	44.53	54.00	-9.47	Average

Test channel: Highest

Horizontal:



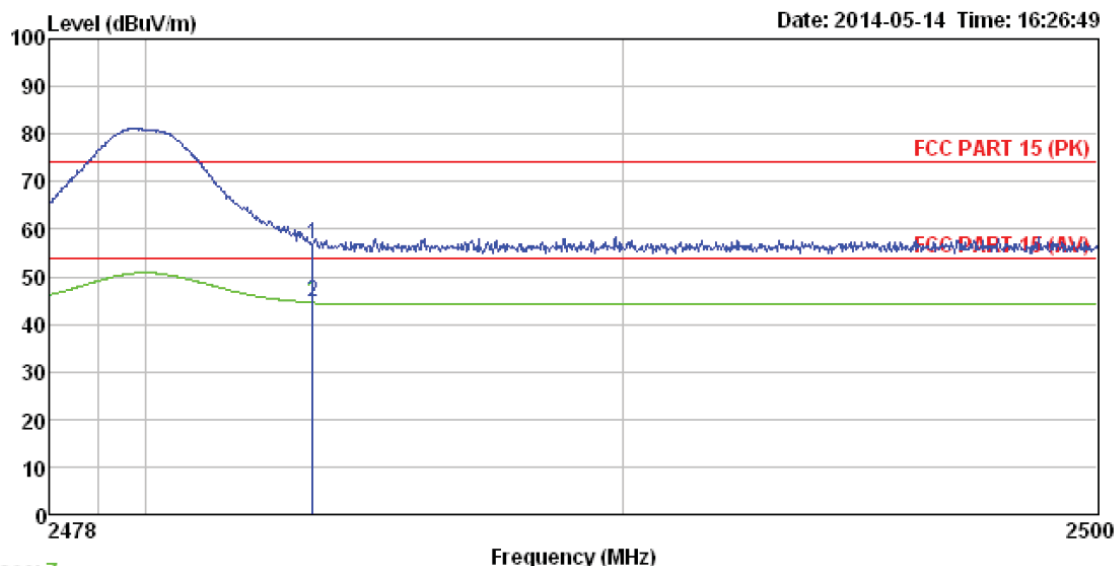
Trace: 5

Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE TX(high channel) mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

		ReadAntenna	Cable	Preamp		Limit	Over	
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	2483.500	23.44	27.52	5.70	0.00	56.66	74.00	-17.34 Peak
2	2483.500	10.94	27.52	5.70	0.00	44.16	54.00	-9.84 Average

Test channel: Highest

Vertical:



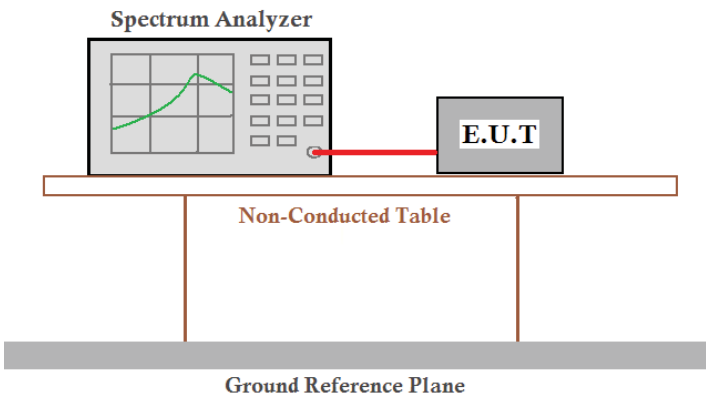
Trace: 7

Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE TX (high channel) mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

		ReadAntenna	Cable	Preamp		Limit	Over	
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	2483.500	23.62	27.52	5.70	0.00	56.84	74.00	-17.16 Peak
2	2483.500	11.27	27.52	5.70	0.00	44.49	54.00	-9.51 Average

6.7 Spurious Emission

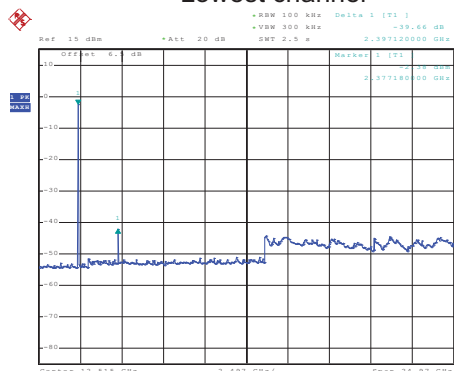
6.7.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.4:2003 and KDB558074
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plot as follows:

Test mode:

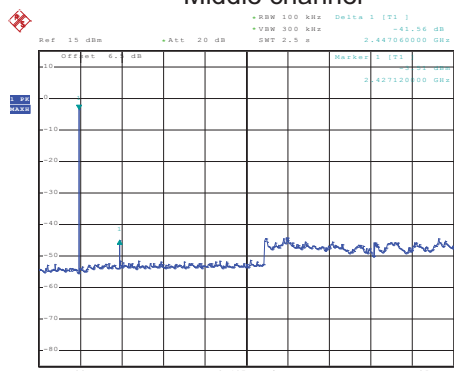
Lowest channel



Date: 9.MAY.2014 22:12:02

30MHz~25GHz

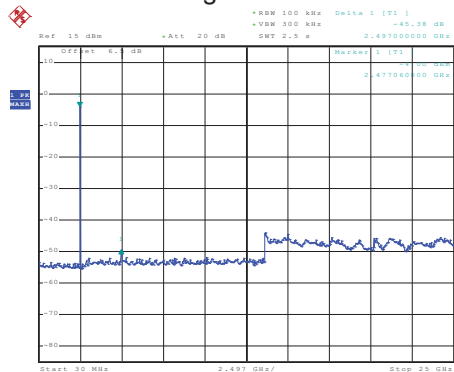
Middle channel



Date: 9.MAY.2014 22:15:26

30MHz~25GHz

Highest channel

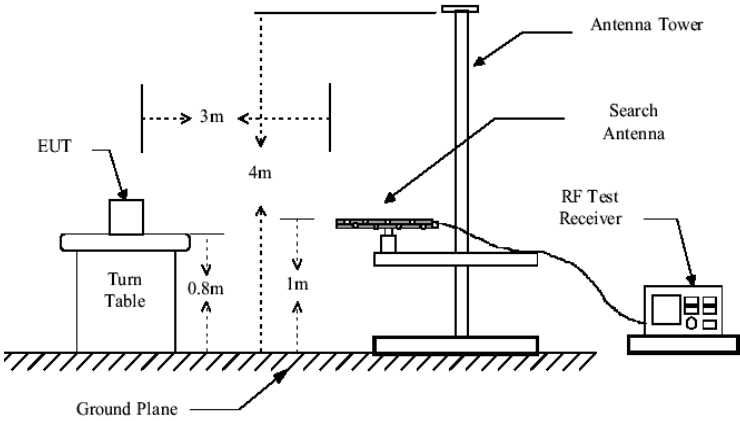
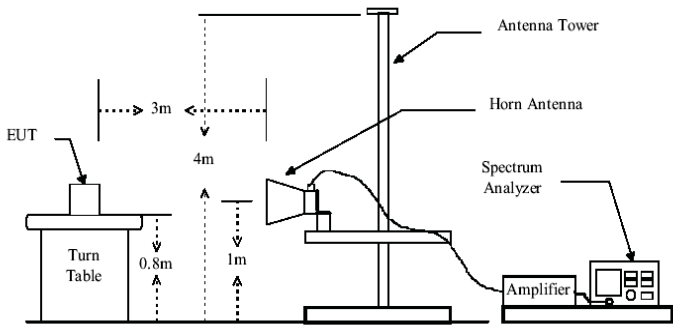


Date: 9.MAY.2014 22:17:26

30MHz~25GHz

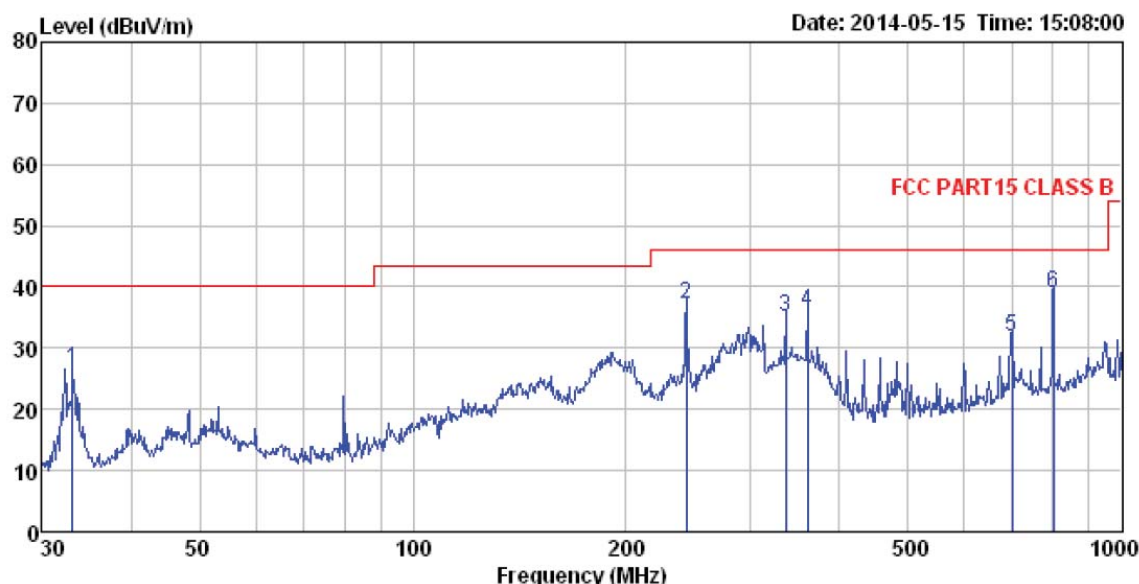
6.7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205																								
Test Method:	ANSI C63.4:2003																								
Test Frequency Range:	9KHz to 25GHz																								
Test site:	Measurement Distance: 3m																								
Receiver setup:	<table><tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr><tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr><tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr><tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr></table>					Frequency	Detector	RBW	VBW	Remark	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value	Above 1GHz	Peak	1MHz	3MHz	Peak Value	Peak	1MHz	10Hz	Average Value	
Frequency	Detector	RBW	VBW	Remark																					
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value																					
Above 1GHz	Peak	1MHz	3MHz	Peak Value																					
	Peak	1MHz	10Hz	Average Value																					
Limit:	<table><tr><td>Frequency</td><td>Limit (dBUV/m @3m)</td><td>Remark</td></tr><tr><td>30MHz-88MHz</td><td>40.0</td><td>Quasi-peak Value</td></tr><tr><td>88MHz-216MHz</td><td>43.5</td><td>Quasi-peak Value</td></tr><tr><td>216MHz-960MHz</td><td>46.0</td><td>Quasi-peak Value</td></tr><tr><td>960MHz-1GHz</td><td>54.0</td><td>Quasi-peak Value</td></tr><tr><td rowspan="2">Above 1GHz</td><td>54.0</td><td>Average Value</td></tr><tr><td>74.0</td><td>Peak Value</td></tr></table>					Frequency	Limit (dBUV/m @3m)	Remark	30MHz-88MHz	40.0	Quasi-peak Value	88MHz-216MHz	43.5	Quasi-peak Value	216MHz-960MHz	46.0	Quasi-peak Value	960MHz-1GHz	54.0	Quasi-peak Value	Above 1GHz	54.0	Average Value	74.0	Peak Value
Frequency	Limit (dBUV/m @3m)	Remark																							
30MHz-88MHz	40.0	Quasi-peak Value																							
88MHz-216MHz	43.5	Quasi-peak Value																							
216MHz-960MHz	46.0	Quasi-peak Value																							
960MHz-1GHz	54.0	Quasi-peak Value																							
Above 1GHz	54.0	Average Value																							
	74.0	Peak Value																							
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.																								

Test setup:	Below 1GHz  Above 1GHz 
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 2. 9 kHz to 30MHz is too low, so only shows the data of above 30MHz in this report.

Below 1GHz

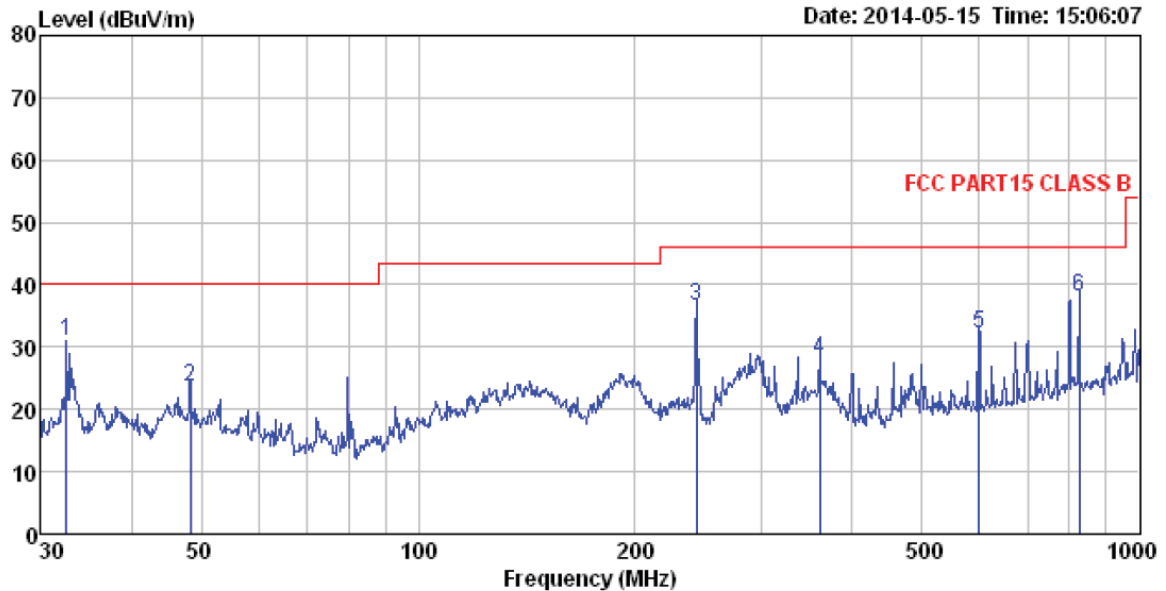
Horizontal:



Site : 3m chamber
 Condition : FCC PART15 CLASS B 3m VULB9163(30M1G) Horizontal
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

	ReadAntenna	Cable Preamp	Limit	Over	
Freq	Level	Factor	Loss	Factor	Level
MHz	dBuV	dB/m	dB	dB	dBuV/m
1	33.095	43.78	12.31	0.46	29.96
2	243.377	52.22	12.08	1.59	28.58
3	336.035	47.90	13.99	1.89	28.53
4	360.448	48.22	14.43	1.98	28.61
5	699.305	38.79	18.80	2.91	28.67
6	801.786	43.86	20.06	3.17	28.19

Vertical:



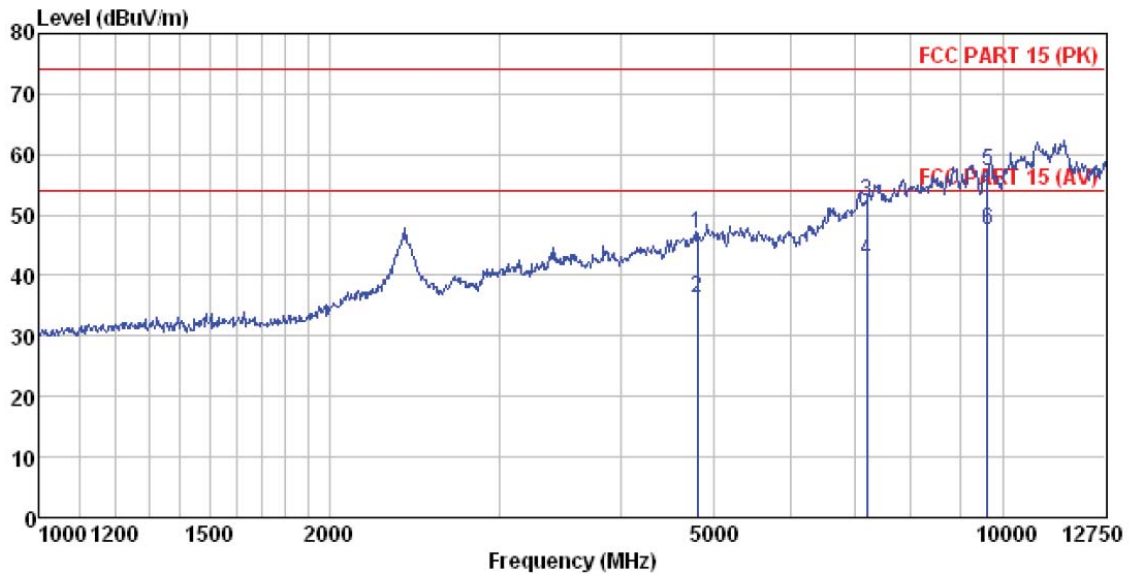
Site : 3m chamber
 Condition : FCC PART15 CLASS B 3m VULB9163(30M1G) VERTICAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	32.520	48.20	12.31	0.46	29.96	31.01	40.00	-8.99 QP
2	48.332	39.61	13.35	0.59	29.83	23.72	40.00	-16.28 QP
3	243.377	51.47	12.08	1.59	28.58	36.56	46.00	-9.44 QP
4	360.448	40.21	14.43	1.98	28.61	28.01	46.00	-17.99 QP
5	599.321	39.96	18.45	2.62	28.94	32.09	46.00	-13.91 QP
6	824.597	42.74	20.33	3.21	28.10	38.18	46.00	-7.82 QP

Above 1GHz

Lowest channel:

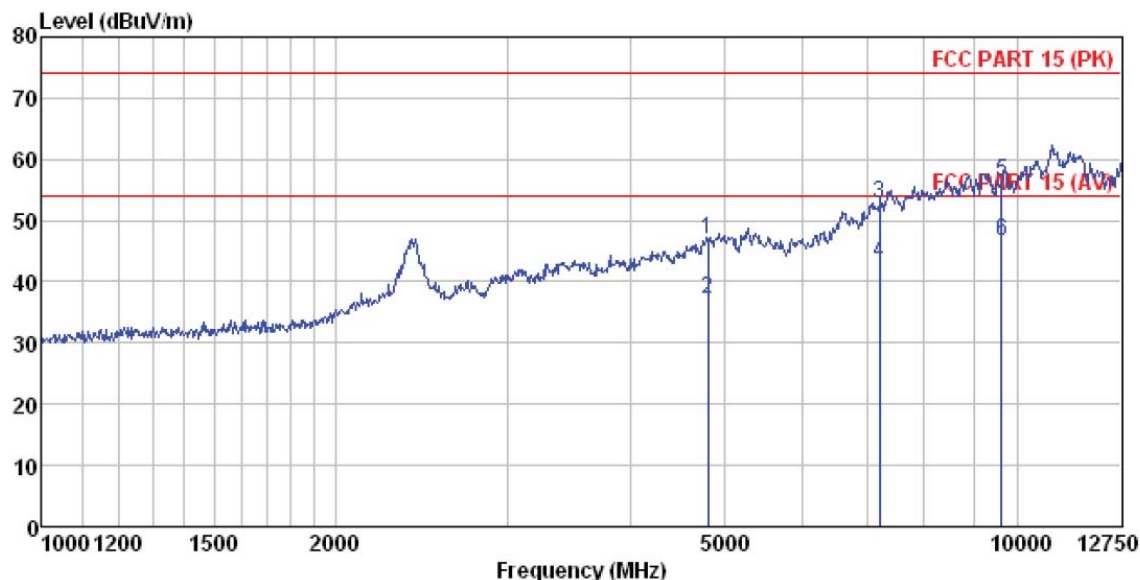
Vertical



Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE low mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier	Level	Limit	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4809.499	46.72	31.54	8.90	40.24	46.92	74.00	-27.08	Peak
2	4809.499	36.13	31.54	8.90	40.24	36.33	54.00	-17.67	Average
3	7209.015	46.44	36.47	10.59	41.24	52.26	74.00	-21.74	Peak
4	7209.015	36.57	36.47	10.59	41.24	42.39	54.00	-11.61	Average
5	9611.663	47.44	38.10	13.18	41.43	57.29	74.00	-16.71	Peak
6	9611.663	37.82	38.10	13.18	41.43	47.67	54.00	-6.33	Average

Horizontal

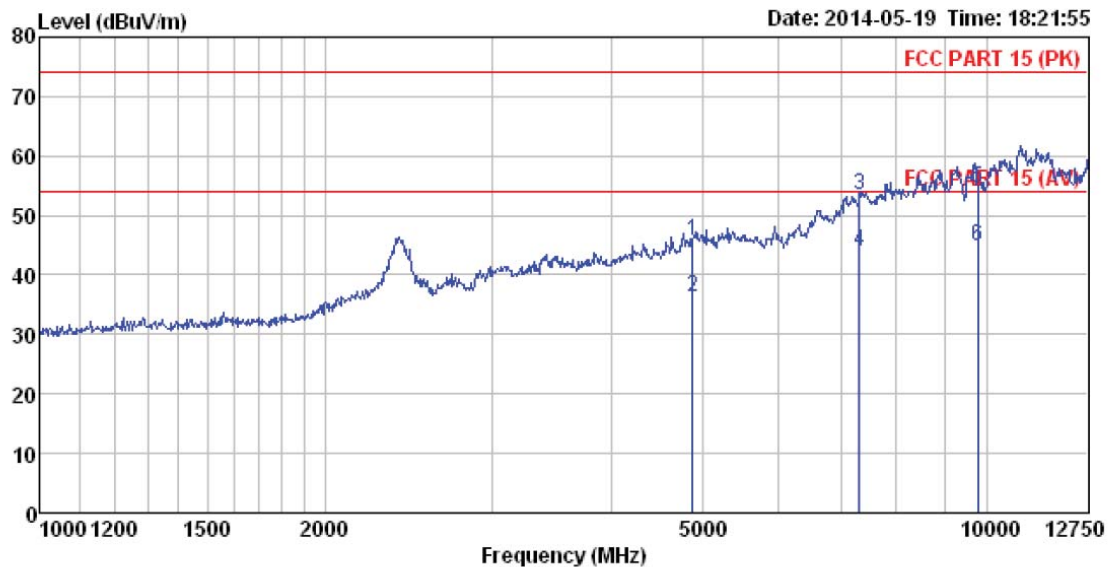


Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE low mode
 Power Rating : DC 5V
 Environment : Temp:25.5℃ Humi:55%
 Test Engineer: Carey
 Remark :

	Freq	ReadAntenna	Cable Preamp	Limit	Over	
		Level Factor	Loss Factor	Level	Line	Limit Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m
1	4809.499	46.63	31.54	8.90	40.24	46.83
2	4809.499	36.92	31.54	8.90	40.24	37.12
3	7209.015	47.04	36.47	10.59	41.24	52.86
4	7209.015	37.34	36.47	10.59	41.24	43.16
5	9611.663	46.55	38.10	13.18	41.43	56.40
6	9611.663	36.71	38.10	13.18	41.43	46.56

Middle channel:

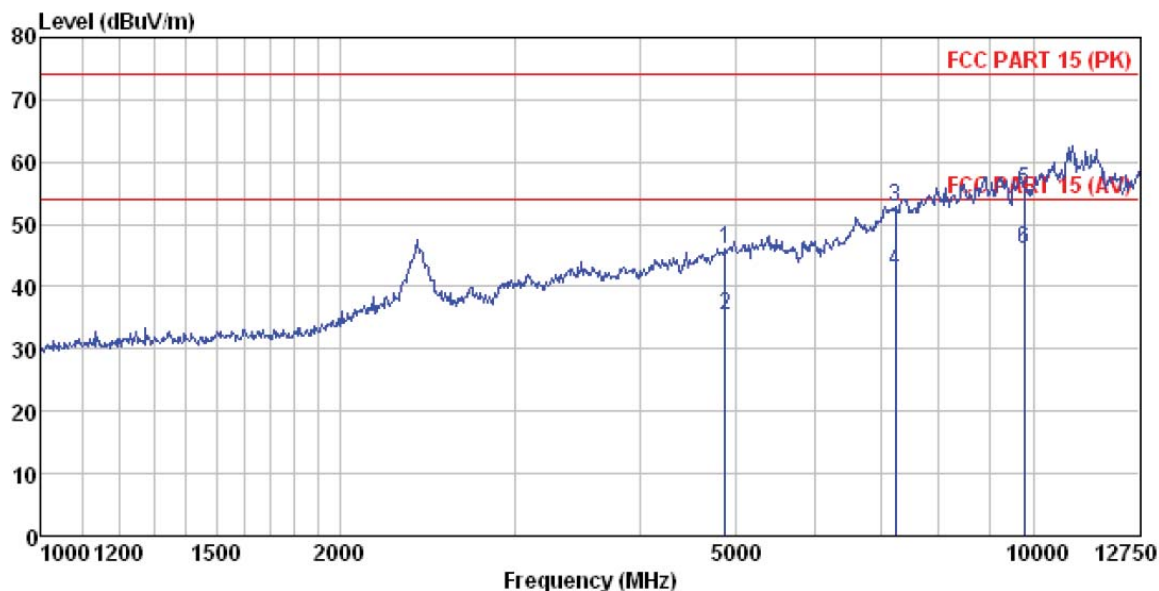
Vertical



Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE middle mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

	Freq	ReadAntenna	Cable Preamp	Limit	Over	
	Level	Factor	Loss Factor	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m
1	4883.519	45.23	31.58	8.98	40.15	45.64
2	4883.519	35.80	31.58	8.98	40.15	36.21
3	7319.964	47.29	36.48	10.69	41.15	53.31
4	7319.964	37.82	36.48	10.69	41.15	43.84
5	9759.591	44.41	38.45	13.35	41.68	54.53
6	9759.591	34.84	38.45	13.35	41.68	44.96

Horizontal

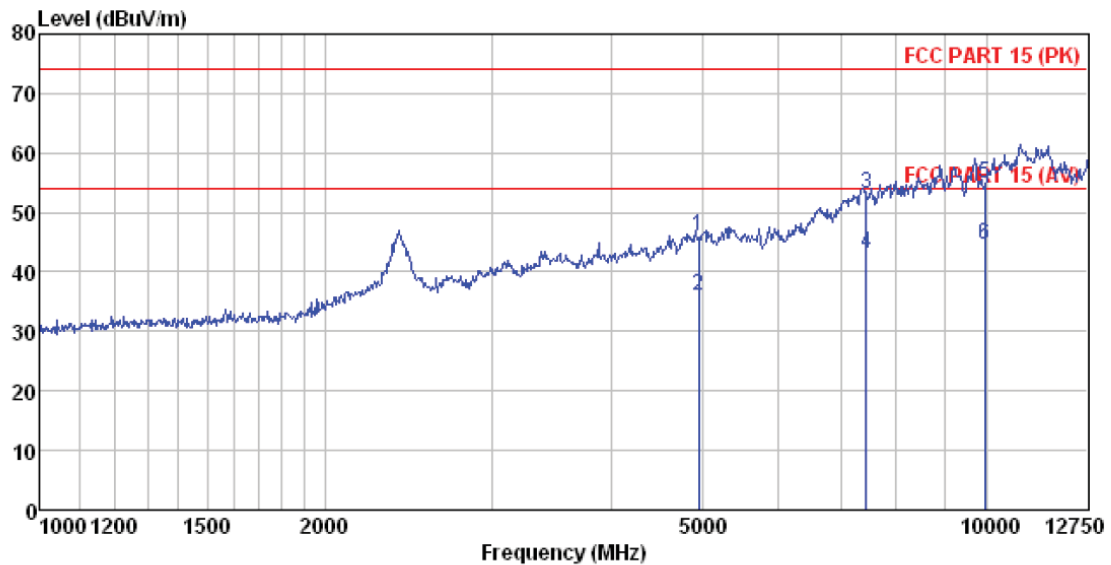


Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE middle mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

	Freq	Read	Antenna	Cable	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	dBuV/m	dBuV/m	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4883.519	45.52	31.58	8.98	40.15	45.93	74.00	-28.07	Peak
2	4883.519	35.13	31.58	8.98	40.15	35.54	54.00	-18.46	Average
3	7245.810	46.83	36.50	10.62	41.22	52.73	74.00	-21.27	Peak
4	7245.810	36.65	36.50	10.62	41.22	42.55	54.00	-11.45	Average
5	9759.591	45.37	38.45	13.35	41.68	55.49	74.00	-18.51	Peak
6	9759.591	35.91	38.45	13.35	41.68	46.03	54.00	-7.97	Average

Highest channel:

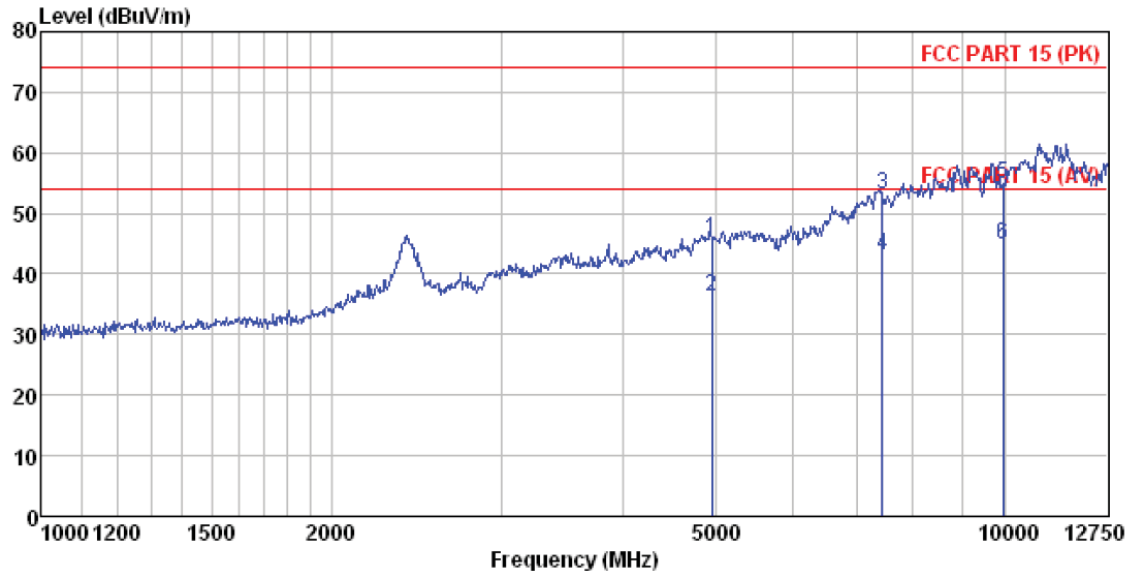
Vertical



Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE high mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

	Freq	ReadAntenna	Cable	Preamp		Limit	Over	
		Level	Factor	Loss	Factor	Level	Line	Limit
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	4958.678	45.37	31.69	9.08	40.03	46.11	74.00	-27.89 Peak
2	4958.678	35.35	31.69	9.08	40.03	36.09	54.00	-17.91 Average
3	7451.566	46.78	36.63	10.81	41.04	53.18	74.00	-20.82 Peak
4	7451.566	36.82	36.63	10.81	41.04	43.22	54.00	-10.78 Average
5	9935.053	44.73	38.64	13.57	42.02	54.92	74.00	-19.08 Peak
6	9935.053	34.45	38.64	13.57	42.02	44.64	54.00	-9.36 Average

Horizontal



Site : 3m chamber
 Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
 Job No. : 289RF
 EUT : Bluetooth 4.0 (BLE) Module
 Model : RF-BM-S02
 Test mode : BLE high mode
 Power Rating : DC 5V
 Environment : Temp:25.5°C Humi:55%
 Test Engineer: Carey
 Remark :

	Freq	ReadAntenna	Cable Preamp	Limit	Over				
	Level Factor	Loss Factor	Loss Factor	Level	Line	Limit Remark			
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	4958.678	45.03	31.69	9.08	40.03	45.77	74.00	-28.23	Peak
2	4958.678	35.60	31.69	9.08	40.03	36.34	54.00	-17.66	Average
3	7451.566	46.76	36.63	10.81	41.04	53.16	74.00	-20.84	Peak
4	7451.566	36.79	36.63	10.81	41.04	43.19	54.00	-10.81	Average
5	9935.053	44.75	38.64	13.57	42.02	54.94	74.00	-19.06	Peak
6	9935.053	34.82	38.64	13.57	42.02	45.01	54.00	-8.99	Average

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.