

FCC Report (Bluetooth)

Product Name : Bluetooth module
Trade mark : MCS LOGIC
Model No. : MB2000L
FCC ID : 2ATGFMB2000L
Report Number : BLA-EMC-201905-A33-02
Date of sample receipt : May 24, 2019
Date of Test : May 24, 2019–June 11, 2019
Date of Issue : June 13, 2019
Test standard : FCC CFR Title 47 Part 15 Subpart C Section 15.247
Test result : PASS

Prepared for:

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Prepared by:

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Date: June 13, 2019



2 Version

Version No.	Date	Description
00	June 13, 2019	Original

BlueAsia

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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 Output Power	15.247 (b)(3)	Pass
Channel 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.

Remark: Test according to ANSI C63.10:2013.

Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	$\pm 4.34\text{dB}$	(1)
Radiated Emission	30MHz ~ 1000MHz	$\pm 4.24\text{dB}$	(1)
Radiated Emission	1GHz ~ 26.5GHz	$\pm 4.68\text{dB}$	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	$\pm 3.45\text{dB}$	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Name:	Bluetooth module
Model No.:	MB2000L
Test Model No.:	MB2000L
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are model name for commercial purpose.	
Serial No.:	N/A
Sample(s) Status	Engineer sample
Hardware:	V1.02
Software:	V06
Operation Frequency:	2402MHz-2480MHz
Channel Numbers:	40
Channel Separation:	2MHz
Modulation Type:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	3.25dBi
Power Supply:	DC 3.3V

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	11	2422MHz	21	2442MHz	31	2462MHz
2	2404MHz	12	2424MHz	22	2444MHz	32	2464MHz
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
9	2418MHz	19	2438MHz	29	2458MHz	39	2478MHz
10	2420MHz	20	2440MHz	30	2460MHz	40	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

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
<i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

5.3 Description of Support Units

Manufacturer	Description	Model	Serial Number
Lenovo	Notebook computer	E470C	PF-10FB5C

5.4 Test Facility

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

● **FCC — Designation No.: CN1252**

Qianhai BlueAsia of Technical Services(Shenzhen) Co., Ltd 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 files. Designation CN1252.

● **ISED — CAB identifier No.: CN0028**

Qianhai BlueAsia of Technical Services(Shenzhen) Co., Ltd has been registered by Certification and Engineering Bureau of ISED for radio equipment testing with CAB identifier CN0028

5.5 Test Location

All tests were performed at:

All tests were performed at:

Qianhai BlueAsia of Technical Services(Shenzhen) Co., Ltd.

IOT Test Centre of BlueAsia

No. 448 Bulong Road, Bantian Street, Longgang District, Shenzhen, China

Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673

No tests were sub-contracted.

6 Test Instruments list

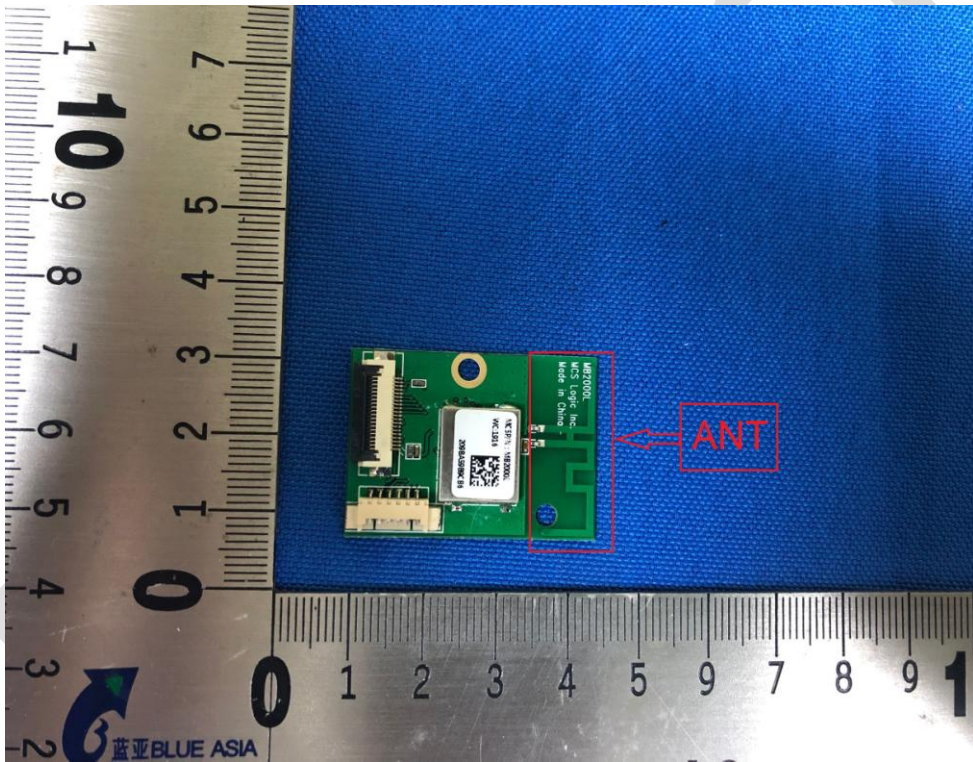
Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m SAC	SKET	9m*6 m*6m	966	06-10-2018	06-09-2023
2	Broadband Antenna	SCHWARZBECK	VULB9168	00836 P:00227	07-14-2018	07-13-2019
3	Horn Antenna	SCHWARZBECK	9120D	01892 P:00331	07-14-2018	07-13-2019
4	EMI Test Software	EZ	EZ	N/A	N/A	N/A
5	Pre-amplifier	SKET	N/A	N/A	07-19-2018	07-18-2019
6	Spectrum analyzer	Rohde & Schwarz	FSP40	100817	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020
7	EMI Test Receiver	Rohde & Schwarz	ESR7	101199	03-21-2019	03-20-2020
8	Controller	SKET	N/A	N/A	N/A	N/A
9	Vector Signal Generator	Agilent	E4438C	MY45092582	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020
10	Signal Generator	Agilent	E8257D	MY44320250	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020

Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	EMI Test Receiver	Rohde & Schwarz	ESPI3	101082	06-10-2019	06-09-2020
2	LISN	CHASE	MN2050D	1447	12-18-2018	12-17-2019
3	LISN	Rohde & Schwarz	ENV216	3560.6550.15	07-19-2018	07-18-2019
4	EMI Test Software	EZ	EZ	N/A	N/A	N/A
5	Temperature Humidity Chamber	Mingle	TH101B	N/A	07-19-2018	07-18-2019

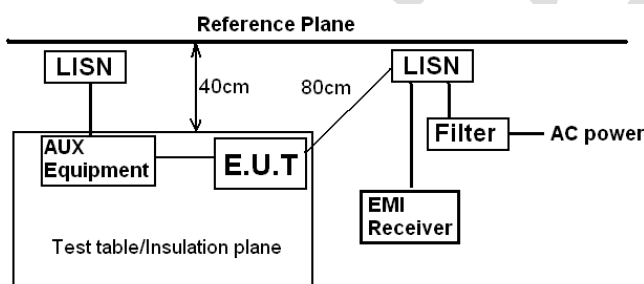
RF Conducted Test:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Spectrum Analyzer	Agilent	N9030A	MY50510123	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020
2	Spectrum analyzer	Rohde & Schwarz	FSP40	100817	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020
3	Vector Signal Generator	Agilent	E4438C	MY45092582	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020
4	Signal Generator	Agilent	E8257D	MY44320250	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020
5	Power Sensor	D.A.R.E	RPR3006W	17I00015SNO27	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020
6	Power Sensor	D.A.R.E	RPR3006W	17I00015SNO28	05-24-2018/ 05-24-2019	05-24-2019/ 05-24-2020
7	DC Power Supply	LODESTAR	LP305DE	N/A	07-19-2018	07-18-2019
8	Temperature Humidity Chamber	Mingle	TH101B	N/A	07-19-2018	07-18-2019

7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 requirement: 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. 15.247(c) (1)(i) requirement: (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.	
E.U.T Antenna: <i>The antenna is PCB antenna, the best case gain of the antenna is 3.25dBi</i>	
	

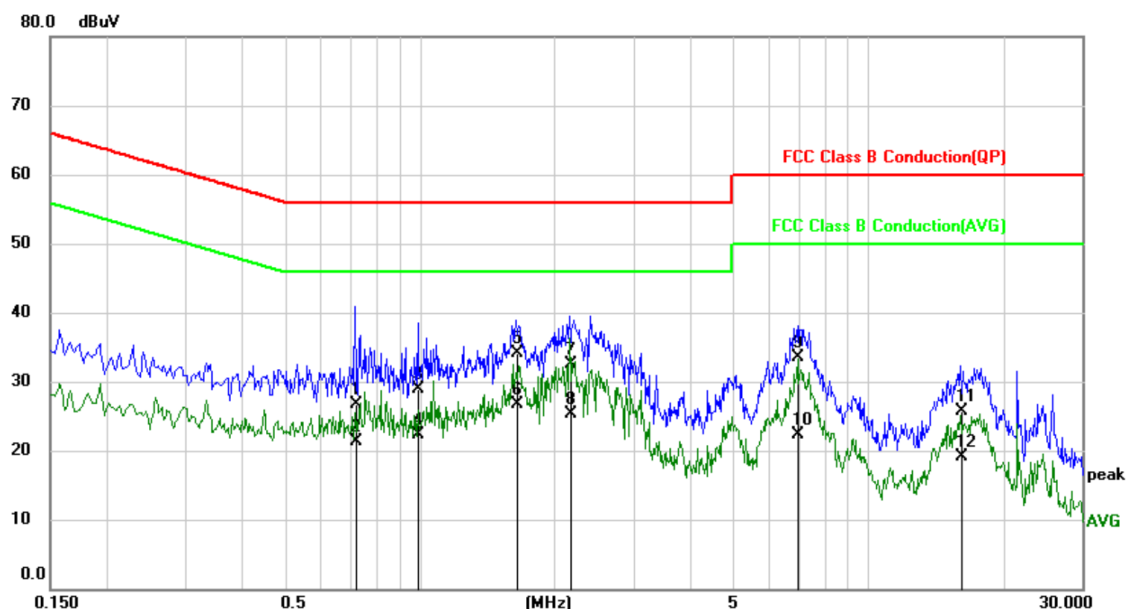
7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.10:2013														
Test Frequency Range:	150KHz to 30MHz														
Class / Severity:	Class B														
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto														
Limit:	<table><thead><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr></thead><tbody><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></tbody></table> * Decreases with the logarithm of the frequency.	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
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													
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 C63.10:2013 on conducted measurement.														
Test Instruments:	Refer to section 6.0 for details														
Test mode:	Refer to section 5.2 for details														
Test results:	Pass														

Measurement data

Line:

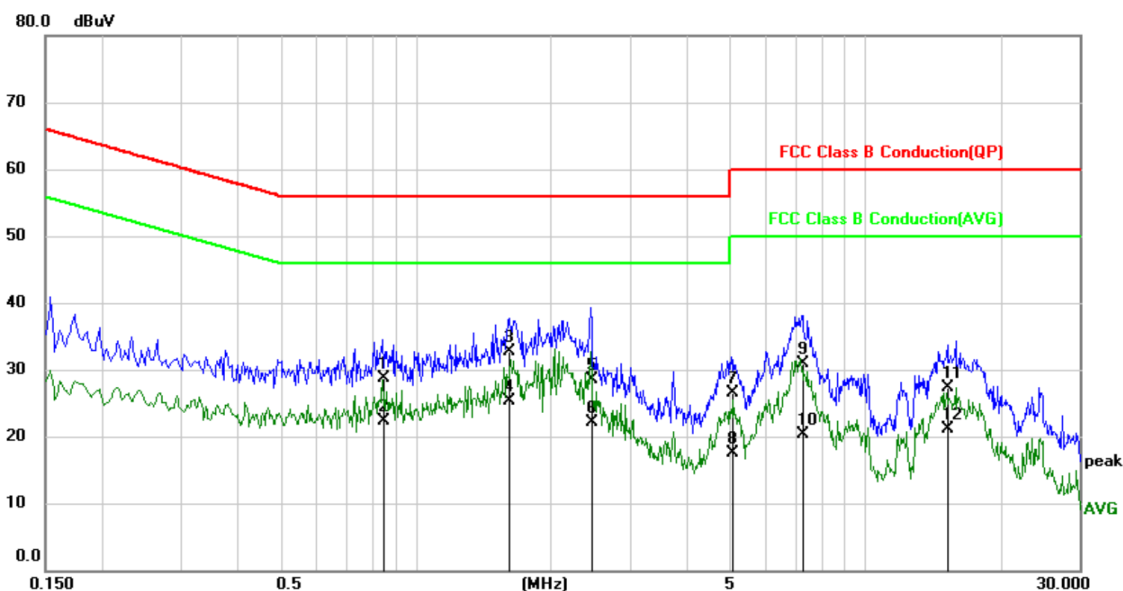
EUT:	Bluetooth module	Probe:	L1
Model:	MB2000L	Power Source:	AC120V/60Hz
Mode:	BLE mode	Test by:	Eason
Temp./Hum.(%H):	26°C/60%RH		



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.7180	17.08	9.68	26.76	56.00	-29.24	QP
2		0.7180	11.65	9.68	21.33	46.00	-24.67	AVG
3		0.9940	19.01	9.87	28.88	56.00	-27.12	QP
4		0.9940	12.46	9.87	22.33	46.00	-23.67	AVG
5		1.6380	24.20	9.83	34.03	56.00	-21.97	QP
6	*	1.6380	16.78	9.83	26.61	46.00	-19.39	AVG
7		2.1580	22.68	9.82	32.50	56.00	-23.50	QP
8		2.1580	15.49	9.82	25.31	46.00	-20.69	AVG
9		6.9620	23.72	9.86	33.58	60.00	-26.42	QP
10		6.9620	12.51	9.86	22.37	50.00	-27.63	AVG
11		16.0900	15.74	9.95	25.69	60.00	-34.31	QP
12		16.0900	9.19	9.95	19.14	50.00	-30.86	AVG

Neutral:

EUT:	Bluetooth module	Probe:	N
Model:	MB2000L	Power Source:	AC120V/60Hz
Mode:	BLE mode	Test by:	Eason
Temp./Hum.(%H):	26°C/60%RH		

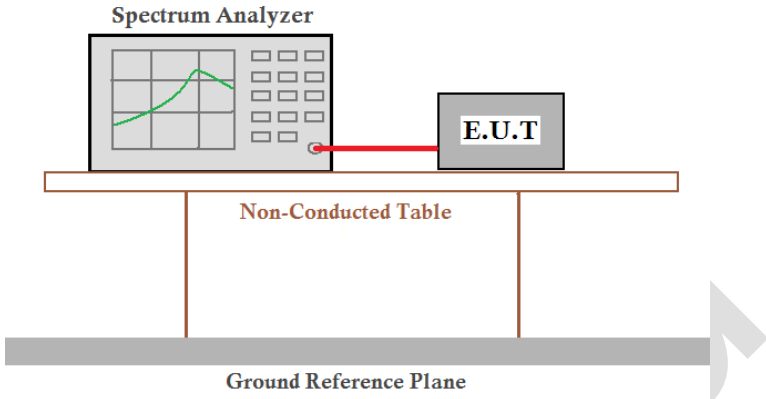


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.8460	19.05	9.75	28.80	56.00	-27.20	QP
2		0.8460	12.60	9.75	22.35	46.00	-23.65	AVG
3		1.6140	22.78	9.84	32.62	56.00	-23.38	QP
4	*	1.6140	15.42	9.84	25.26	46.00	-20.74	AVG
5		2.4500	18.62	9.86	28.48	56.00	-27.52	QP
6		2.4500	12.30	9.86	22.16	46.00	-23.84	AVG
7		5.0420	16.67	9.91	26.58	60.00	-33.42	QP
8		5.0420	7.61	9.91	17.52	50.00	-32.48	AVG
9		7.2620	21.00	9.85	30.85	60.00	-29.15	QP
10		7.2620	10.49	9.85	20.34	50.00	-29.66	AVG
11		15.2940	17.28	10.01	27.29	60.00	-32.71	QP
12		15.2940	11.12	10.01	21.13	50.00	-28.87	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. *Final Level = Receiver Read level + Correct factor*
4. *Correct factor = LISN Factor + Cable Loss*
5. *If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.*

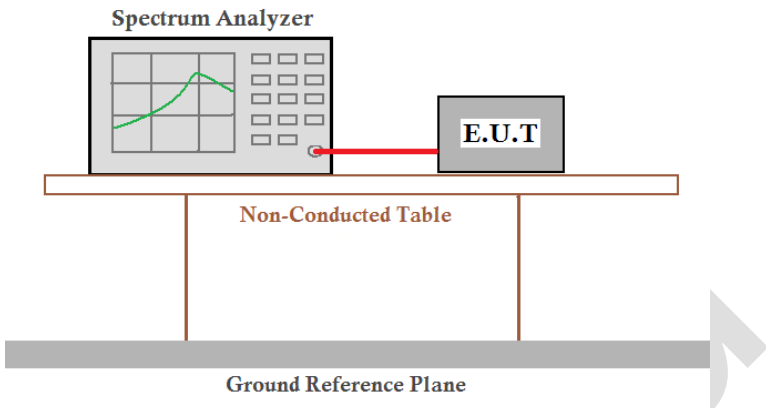
7.3 Conducted Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05
Limit:	30dBm
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

AppendixC: Maximum conducted output power

7.4 Channel Bandwidth

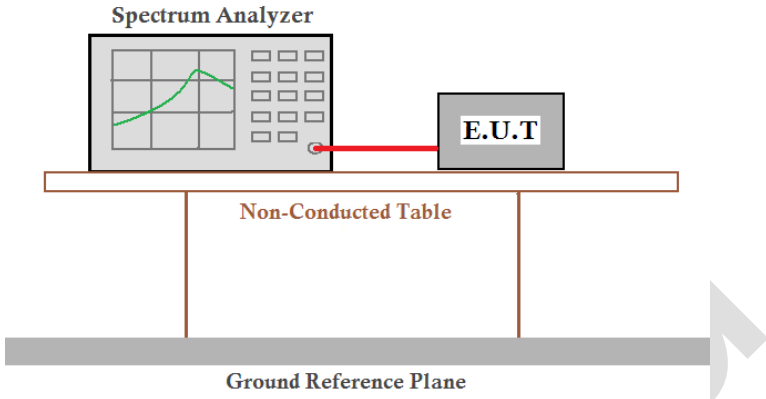
Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05
Limit:	>500KHz
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer 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 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

AppendixA: DTS Bandwidth

AppendixB: Occupied Channel Bandwidth

7.5 Power Spectral Density

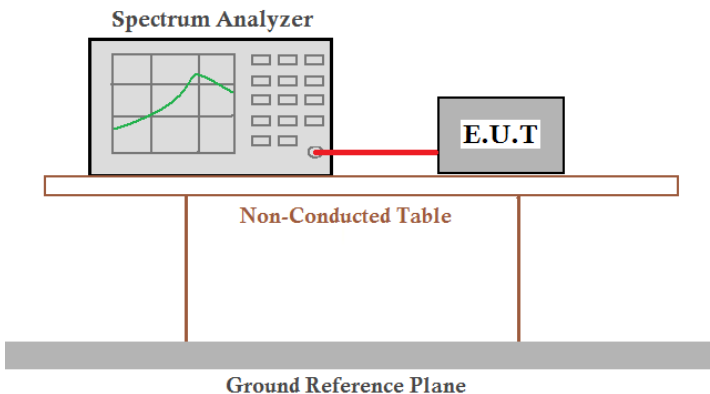
Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05
Limit:	8dBm/3kHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

AppendixD: Maximum power spectral density

7.6 Band edges

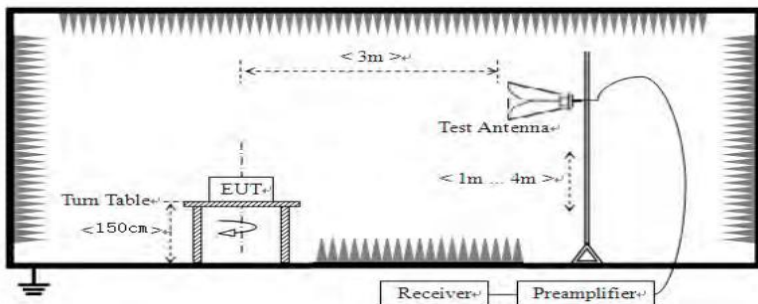
7.6.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05
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 for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

AppendixE:Band edge measurements

7.6.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2390MHz, 2483.5MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		RMS	1MHz	3MHz	Average
Limit:	Frequency		Limit (dBuV/m @3m)		Value
	Above 1GHz		54.00		Average
			74.00		Peak
Test setup:					
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 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 10dB 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 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 7. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.				
Test Instruments:	Refer to section 6.0 for details				
Test mode:	Refer to section 5.2 for details				
Test results:	Pass				

Measurement data:

Remark: The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.

Test channel:	Lowest
---------------	--------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	72.05	-14.56	57.49	74.00	-16.51	Horizontal
2390.00	82.93	-14.19	68.74	74.00	-5.26	Horizontal
2310.00	68.09	-14.85	53.24	74.00	-20.76	Vertical
2390.00	80.65	-14.52	66.13	74.00	-7.87	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	48.62	-14.56	34.06	54.00	-19.94	Horizontal
2390.00	61.60	-14.19	47.41	54.00	-6.59	Horizontal
2310.00	51.57	-14.85	36.72	54.00	-17.28	Vertical
2390.00	61.40	-14.52	46.88	54.00	-7.12	Vertical

Test channel:	Highest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	37.91	-13.66	69.72	74.00	-4.28	Horizontal
2500.00	28.40	-13.57	60.28	74.00	-13.72	Horizontal
2483.50	38.79	-14.05	70.21	74.00	-3.79	Vertical
2500.00	23.83	-13.97	55.31	74.00	-18.69	Vertical

Average value:

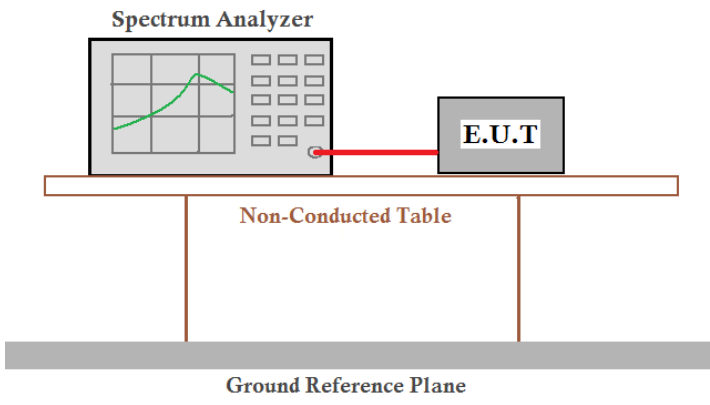
Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	17.42	-13.66	49.23	54.00	-4.77	Horizontal
2500.00	17.63	-13.57	49.51	54.00	-4.49	Horizontal
2483.50	17.39	-14.05	48.81	54.00	-5.19	Vertical
2500.00	13.77	-13.97	45.25	54.00	-8.75	Vertical

Remark:

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

7.7 Spurious Emission

7.7.1 Conducted Emission Method

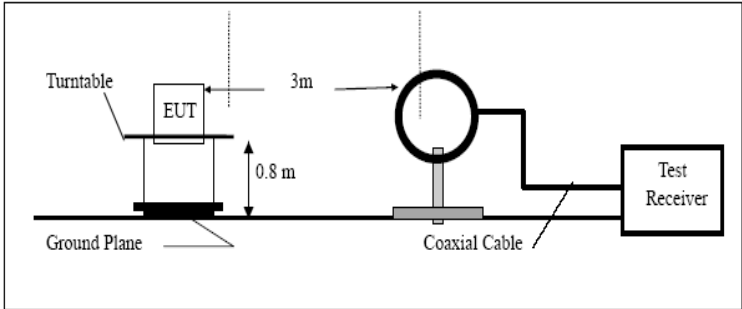
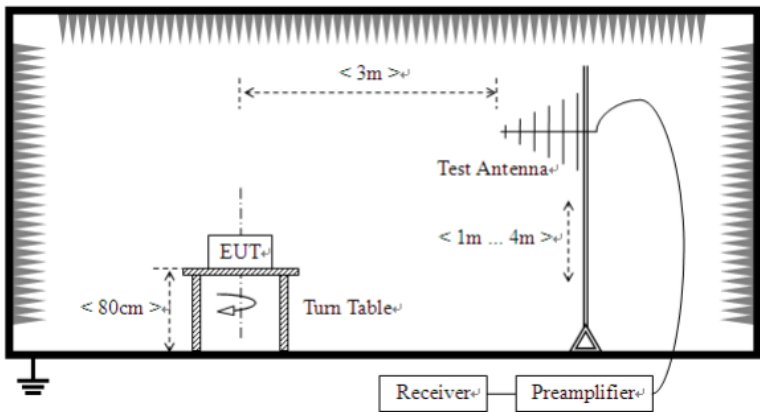
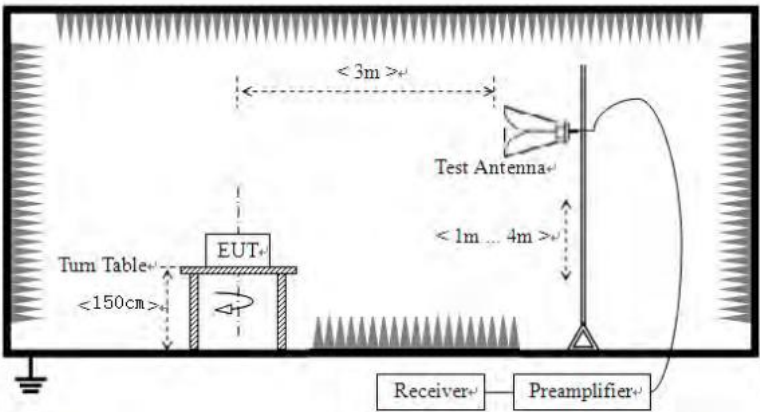
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional 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 two vertical legs and sits on a Ground Reference Plane, which is represented by a thick grey bar at the bottom.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

AppendixF:Conducted SpuriousEmission

7.7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit: (Spurious Emissions)	Frequency		Limit (uV/m)	Value	Measurement Distance
	0.009MHz-0.490MHz		2400/F(KHz)	QP	300m
	0.490MHz-1.705MHz		24000/F(KHz)	QP	30m
	1.705MHz-30MHz		30	QP	30m
	30MHz-88MHz		100	QP	3m
	88MHz-216MHz		150	QP	
	216MHz-960MHz		200	QP	
	960MHz-1GHz		500	QP	
	Above 1GHz		500	Average	
			5000	Peak	
Limit: (band edge)	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.				

Test setup:	Below 30MHz  Below 1GHz  Above 1GHz 
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) 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 10dB 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 10dB 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 Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Remark:

Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

Measurement Data

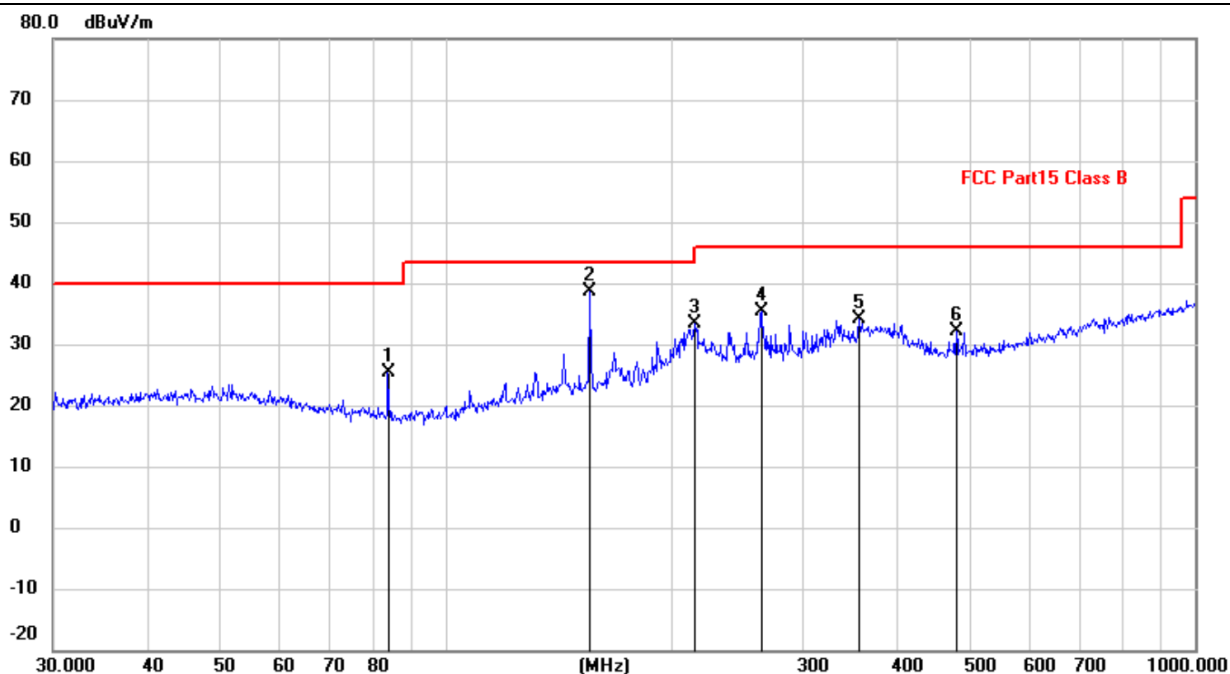
■ **9 kHz ~ 30 MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

■ Below 1GHz

Horizontal:

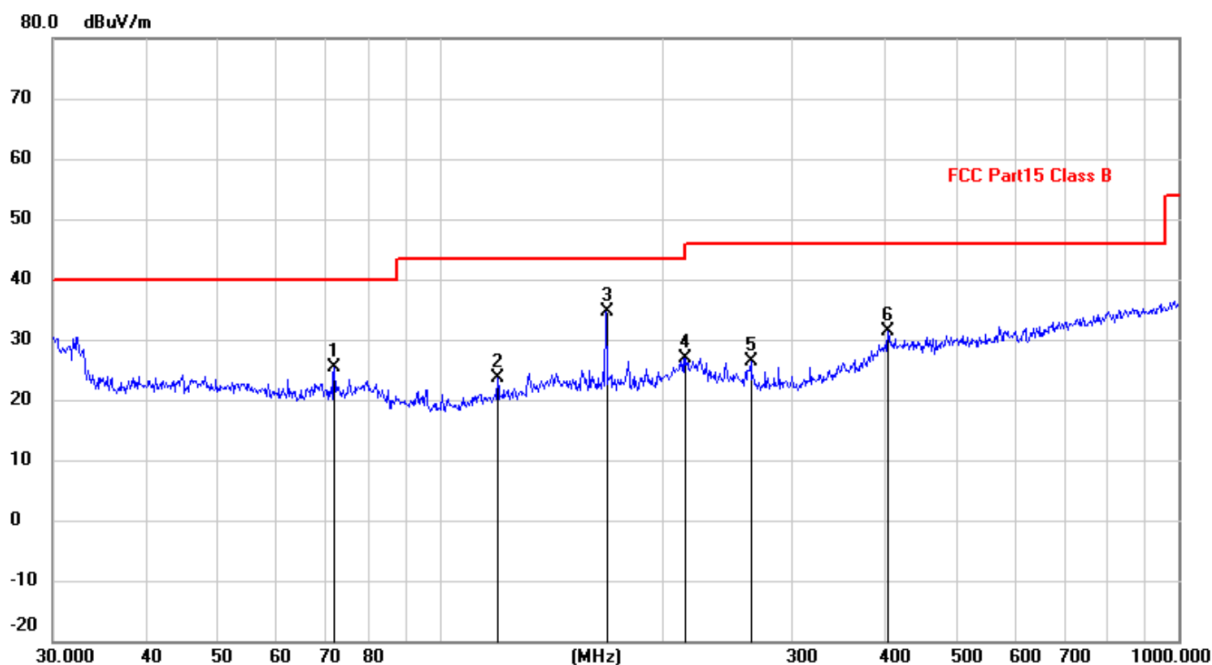
EUT:	Bluetooth module	Polarization:	Horizontal
Model:	MB2000L	Power Source:	AC120V/60Hz
Mode:	BLE mode	Test by:	Eason
Temp./Hum.(%RH):	26°C/60%RH		



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		83.8156	16.25	9.19	25.44	40.00	-14.56	QP
2	*	155.9101	25.54	13.03	38.57	43.50	-4.93	QP
3		215.2678	22.38	10.92	33.30	43.50	-10.20	QP
4		263.8190	22.60	12.73	35.33	46.00	-10.67	QP
5		356.6758	18.97	15.19	34.16	46.00	-11.84	QP
6		480.5276	13.75	18.41	32.16	46.00	-13.84	QP

Vertical:

EUT:	Bluetooth module	Polarization:	Vertical
Model:	MB2000L	Power Source:	AC120V/60Hz
Mode:	BLE mode	Test by:	Eason
Temp./Hum.(%H):	26℃/60%RH		



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		72.0843	15.04	10.45	25.49	40.00	-14.51	QP
2		119.8556	11.35	12.37	23.72	43.50	-19.78	QP
3	*	167.8243	22.55	12.18	34.73	43.50	-8.77	QP
4		215.2678	16.04	10.92	26.96	43.50	-16.54	QP
5		263.8190	13.63	12.73	26.36	46.00	-19.64	QP
6		404.6665	14.78	16.61	31.39	46.00	-14.61	QP

■ Above 1GHz

Test channel:	Lowest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	57.84	-7.43	50.41	74.00	-23.59	Vertical
7206.00	59.61	-2.42	57.19	74.00	-16.81	Vertical
9608.00	61.08	-2.38	58.70	74.00	-15.30	Vertical
12010.00	*			74.00		Vertical
14412.00	*			74.00		Vertical
4804.00	62.61	-7.43	55.18	74.00	-18.82	Horizontal
7206.00	64.32	-2.42	61.90	74.00	-12.10	Horizontal
9608.00	66.41	-2.38	54.03	74.00	-9.97	Horizontal
12010.00	*			74.00		Horizontal
14412.00	*			74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	45.81	-7.43	38.38	54.00	-15.62	Vertical
7206.00	47.53	-2.42	45.11	54.00	-8.89	Vertical
9608.00	49.88	-2.38	47.50	54.00	-6.50	Vertical
12010.00	*			54.00		Vertical
14412.00	*			54.00		Vertical
4804.00	50.26	-7.43	42.83	54.00	-11.17	Horizontal
7206.00	47.58	-2.42	45.16	54.00	-8.84	Horizontal
9608.00	48.03	-2.38	45.65	54.00	-8.35	Horizontal
12010.00	*			54.00		Horizontal
14412.00	*			54.00		Horizontal

Remark:

1. *Final Level = Receiver Read level + Correct factor*
2. *"*", means this data is the too weak instrument of signal is unable to test.*
3. *Correct factor = Antenna Factor + Cable Loss – Preamplifier Factor*

Test channel:	Middle
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4884.00	57.05	-7.49	49.56	74.00	-24.44	Vertical
7326.00	58.34	-2.40	55.94	74.00	-18.06	Vertical
9768.00	60.75	-2.38	58.37	74.00	-15.63	Vertical
12210.00	*			74.00		Vertical
14652.00	*			74.00		Vertical
4884.00	61.51	-7.49	54.02	74.00	-19.98	Horizontal
7326.00	60.28	-2.40	57.88	74.00	-16.12	Horizontal
9768.00	63.85	-2.38	61.47	74.00	-12.53	Horizontal
12210.00	*			74.00		Horizontal
14652.00	*			74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4884.00	44.86	-7.49	37.37	54.00	-16.63	Vertical
7326.00	45.26	-2.40	42.86	54.00	-11.14	Vertical
9768.00	47.14	-2.38	44.76	54.00	-9.24	Vertical
12210.00	*			54.00		Vertical
14652.00	*			54.00		Vertical
4884.00	49.33	-7.49	41.84	54.00	-12.16	Horizontal
7326.00	48.52	-2.40	46.12	54.00	-7.88	Horizontal
9768.00	51.69	-2.38	49.31	54.00	-4.69	Horizontal
12210.00	*			54.00		Horizontal
14652.00	*			54.00		Horizontal

Remark:

1. Final Level = Receiver Read level + Correct factor
2. “*”, means this data is the too weak instrument of signal is unable to test.
3. Correct factor = Antenna Factor + Cable Loss – Preamplifier Factor

Test channel:	Highest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	57.25	-7.47	49.78	74.00	-24.22	Vertical
7440.00	58.76	-2.45	56.31	74.00	-17.69	Vertical
9920.00	61.73	-2.37	59.36	74.00	-14.64	Vertical
12400.00	*			74.00		Vertical
14880.00	*			74.00		Vertical
4960.00	58.78	-7.47	51.31	74.00	-22.69	Horizontal
7440.00	60.05	-2.45	57.60	74.00	-16.40	Horizontal
9920.00	62.86	-2.37	60.49	74.00	-13.51	Horizontal
12400.00	*			74.00		Horizontal
14880.00	*			74.00		Horizontal

Average value:

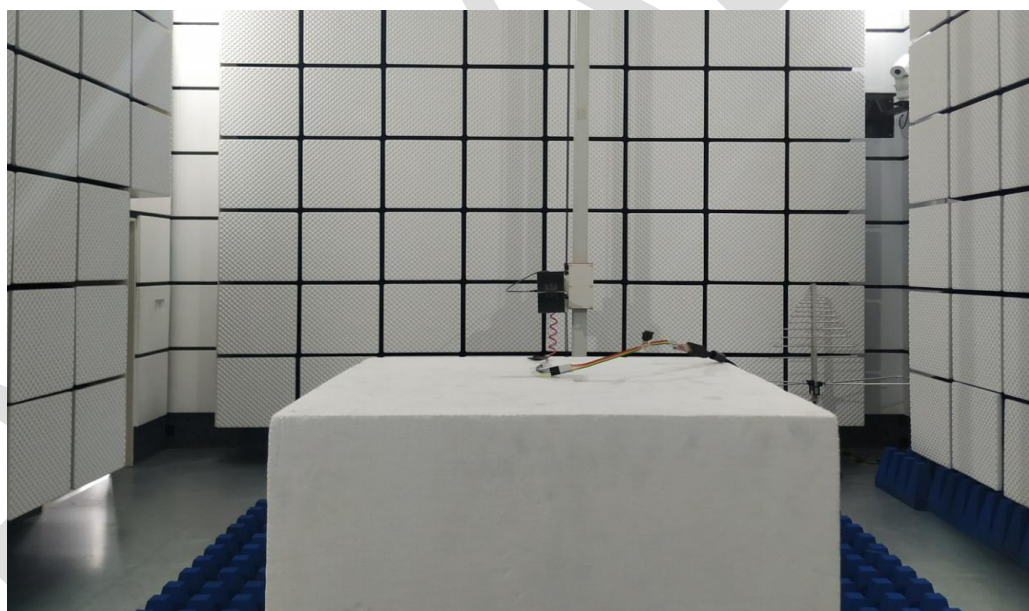
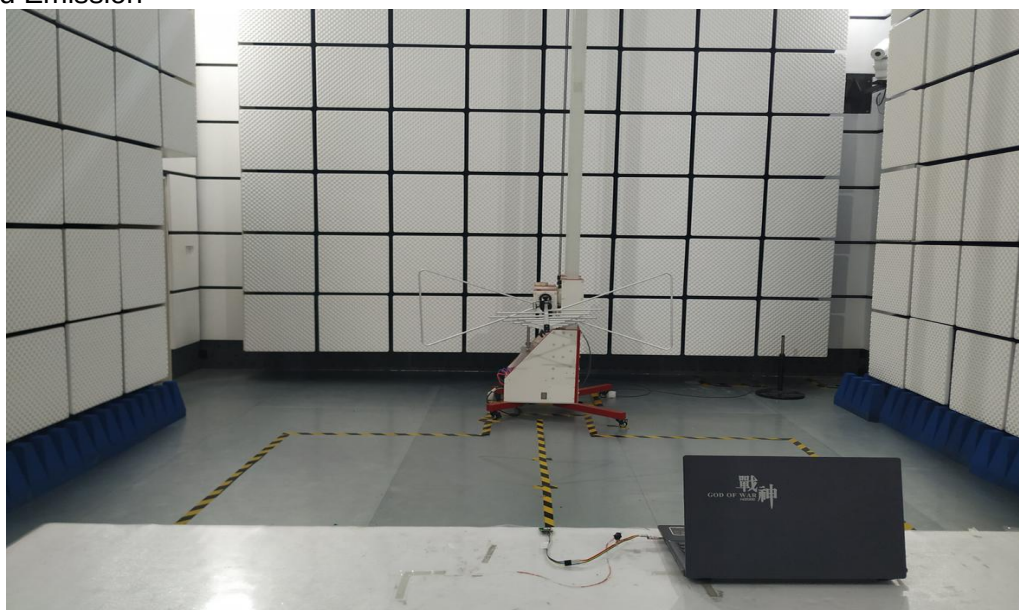
Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	45.11	-7.47	37.64	54.00	-16.36	Vertical
7440.00	46.23	-2.45	43.78	54.00	-10.22	Vertical
9920.00	47.62	-2.37	45.25	54.00	-8.75	Vertical
12400.00	*			54.00		Vertical
14880.00	*			54.00		Vertical
4960.00	46.83	-7.47	39.36	54.00	-14.64	Horizontal
7440.00	47.95	-2.45	45.50	54.00	-8.50	Horizontal
9920.00	49.06	-2.37	46.69	54.00	-7.31	Horizontal
12400.00	*			54.00		Horizontal
14880.00	*			54.00		Horizontal

Remark:

1. Final Level = Receiver Read level + Correct factor.
2. "*", means this data is the too weak instrument of signal is unable to test.
3. Correct factor = Antenna Factor + Cable Loss – Preamplifier Factor.

8 Test Setup Photo

Radiated Emission



Conducted Emission



9 EUT Constructional Details

Reference to the test report No. BLA-EMC-201905-A33-01

BlueAsia

10 Appendix

Refer to the following attachments.

*** End of Report ***

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of BlueAsia, this report can't be reproduced except in full.

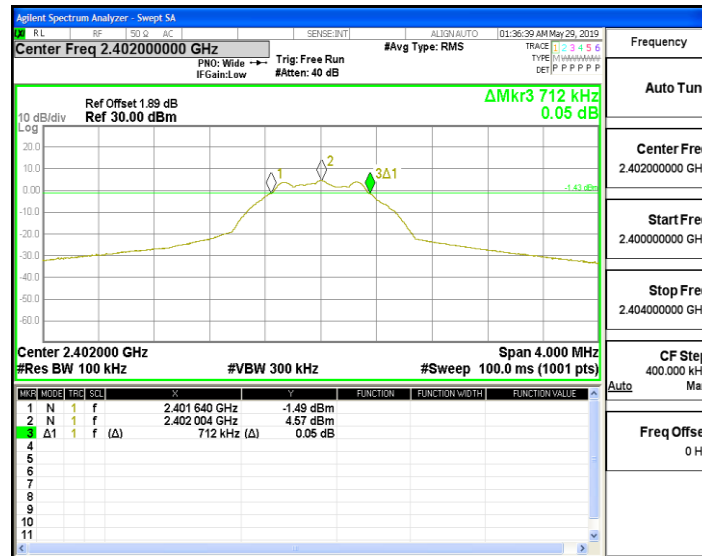
AppendixA: DTS Bandwidth

Test Result

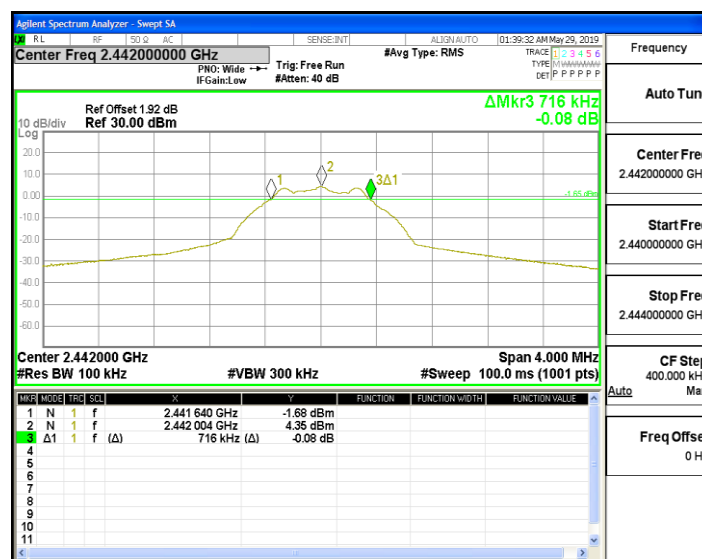
TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE	Ant1	2402	0.712	2401.640	2402.352	---	PASS
		2442	0.716	2441.640	2442.356	---	PASS
		2480	0.712	2479.640	2480.352	---	PASS

Test Graphs

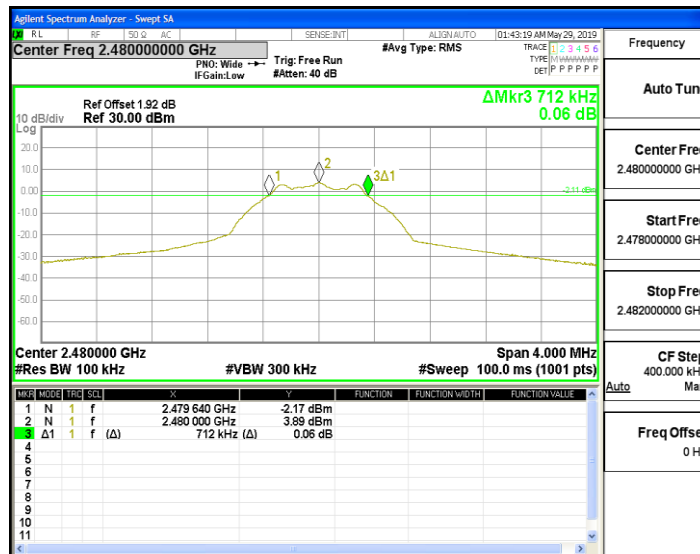
BLE_Ant1_2402



BLE_Ant1_2442



BLE_Ant1_2480



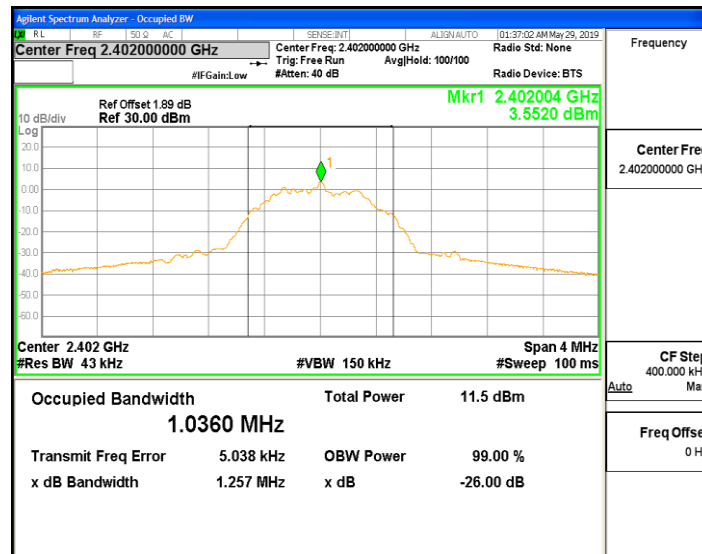
AppendixB: Occupied Channel Bandwidth

Test Result

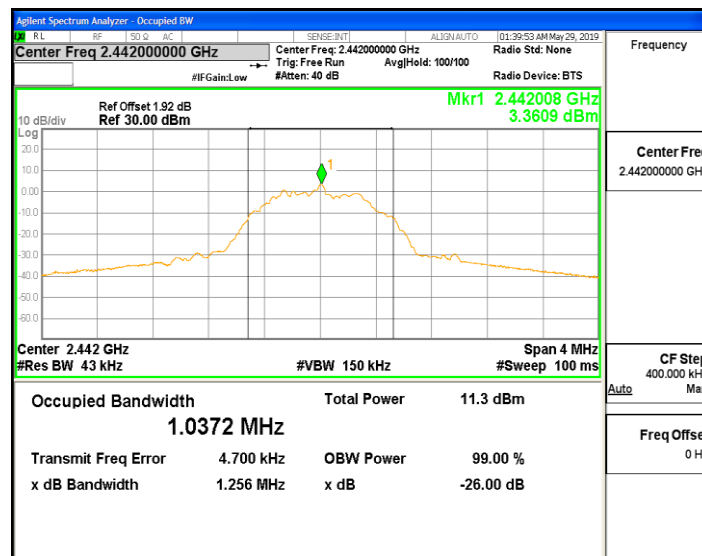
TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE	Ant1	2402	1.0360	2401.487	2402.523	---	PASS
		2442	1.0372	2441.486	2442.523	---	PASS
		2480	1.0380	2479.486	2480.524	---	PASS

Test Graphs

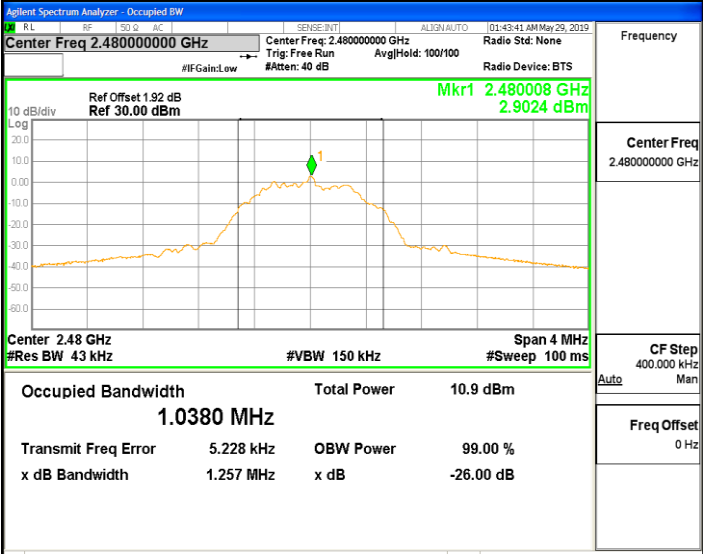
BLE_Ant1_2402



BLE_Ant1_2442



BLE_Ant1_2480



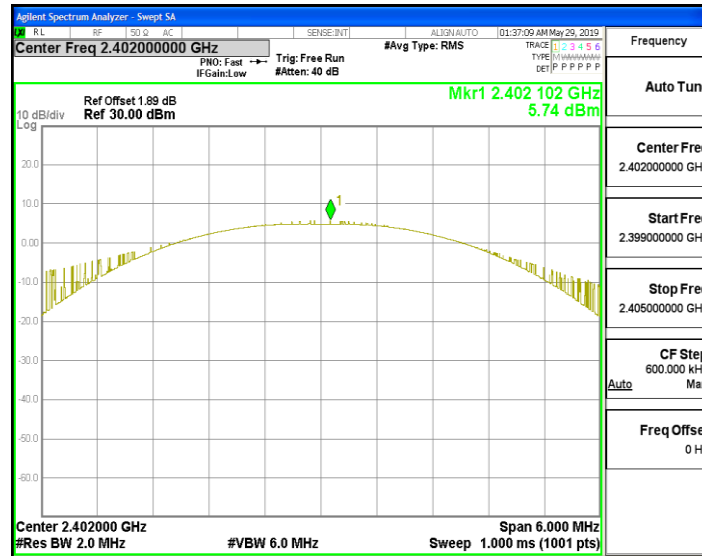
AppendixC: Maximum conducted output power

Test Result

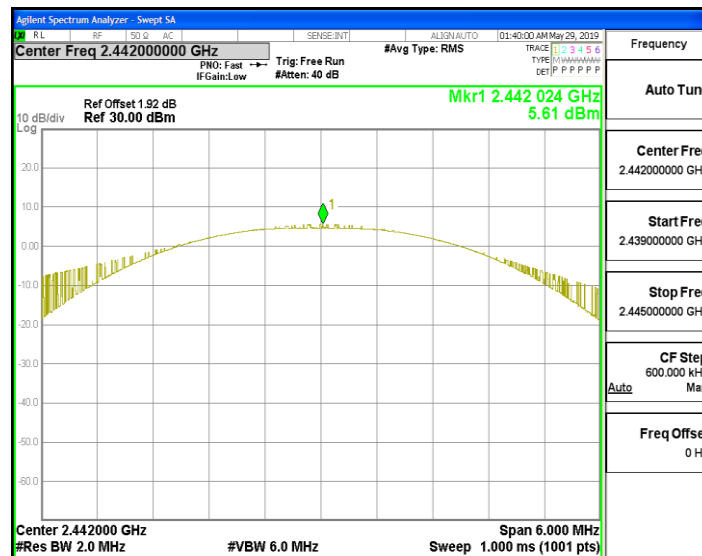
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	2402	5.74	<=30	PASS
		2442	5.61	<=30	PASS
		2480	5.15	<=30	PASS

Test Graphs

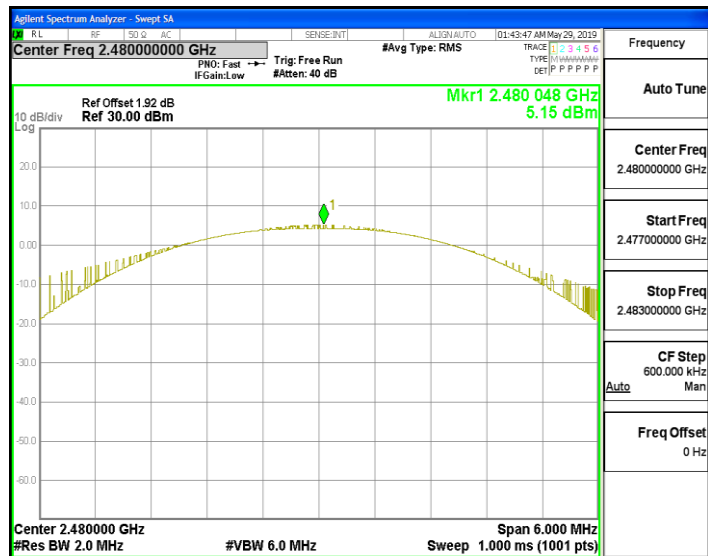
BLE_Ant1_2402



BLE_Ant1_2442



BLE_Ant1_2480



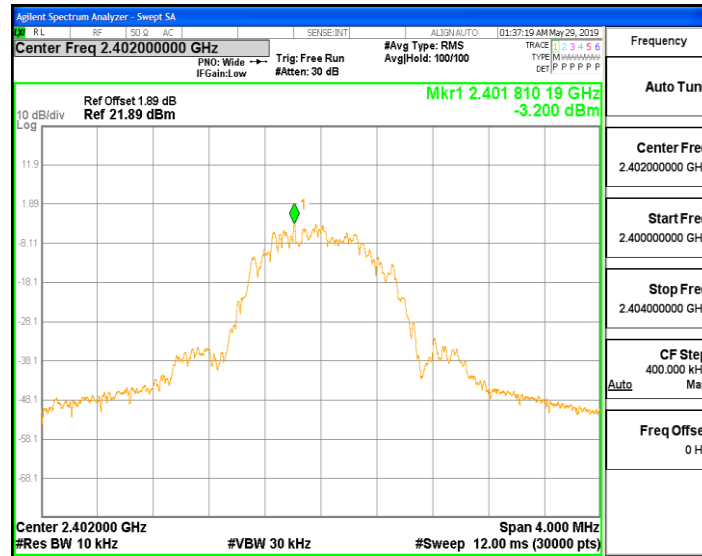
AppendixD: Maximum power spectral density

Test Result

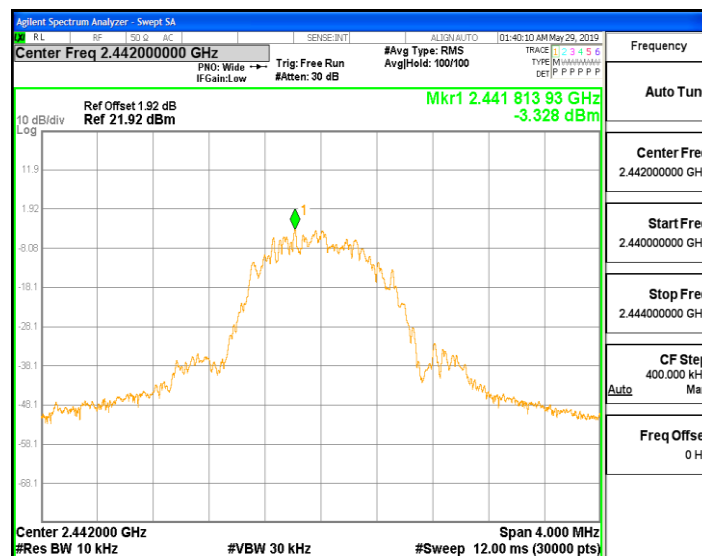
TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE	Ant1	2402	-3.2	<=8	PASS
		2442	-3.33	<=8	PASS
		2480	-3.9	<=8	PASS

Test Graphs

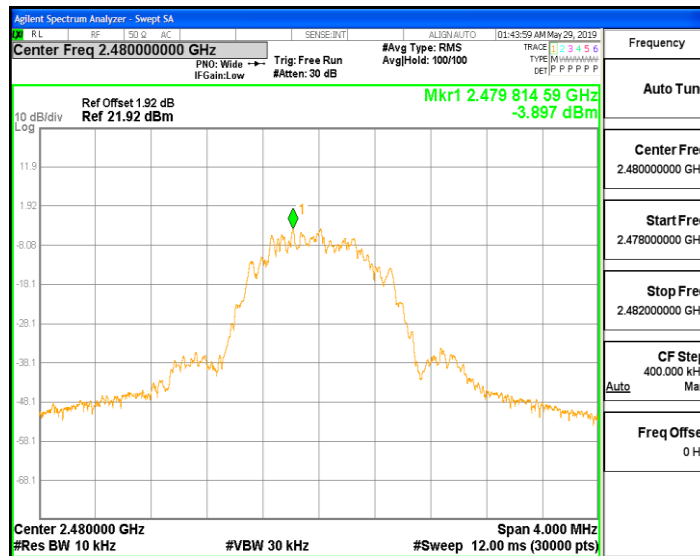
BLE_Ant1_2402



BLE_Ant1_2442



BLE_Ant1_2480



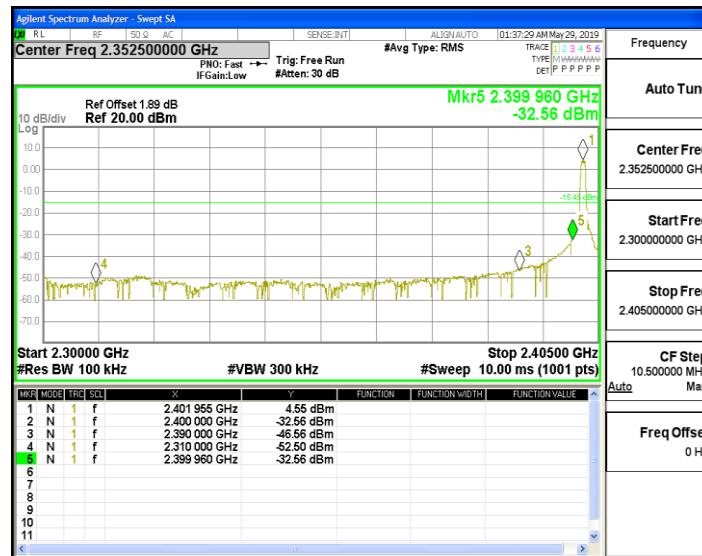
AppendixE:Band edge measurements

Test Result

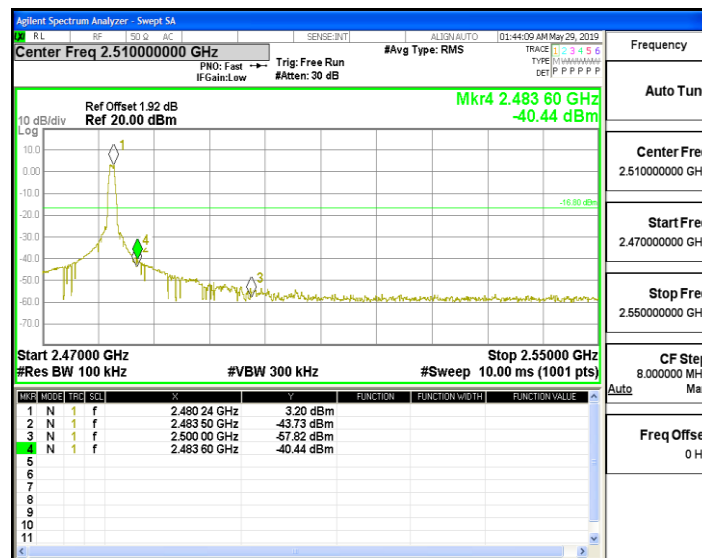
TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	Low	2402	4.55	-32.56	<=-15.45	PASS
		High	2480	3.20	-40.44	<=-16.8	PASS

Test Graphs

BLE_Ant1_Low_2402



BLE_Ant1_High_2480



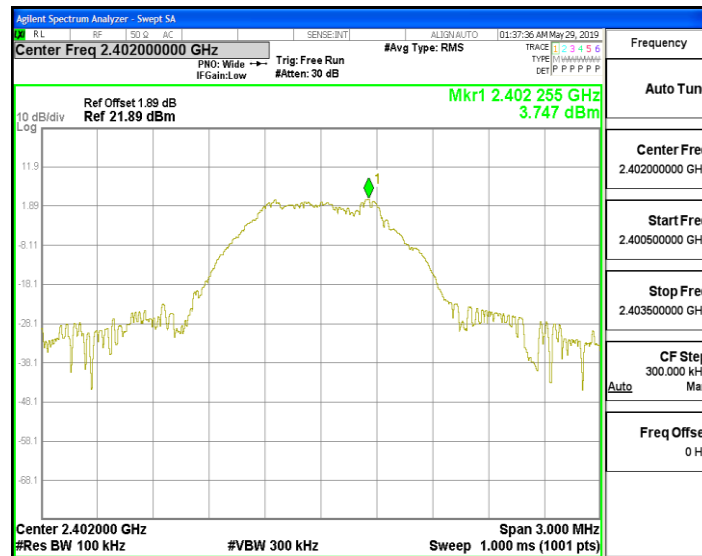
AppendixF:Conducted SpuriousEmission

Test Result

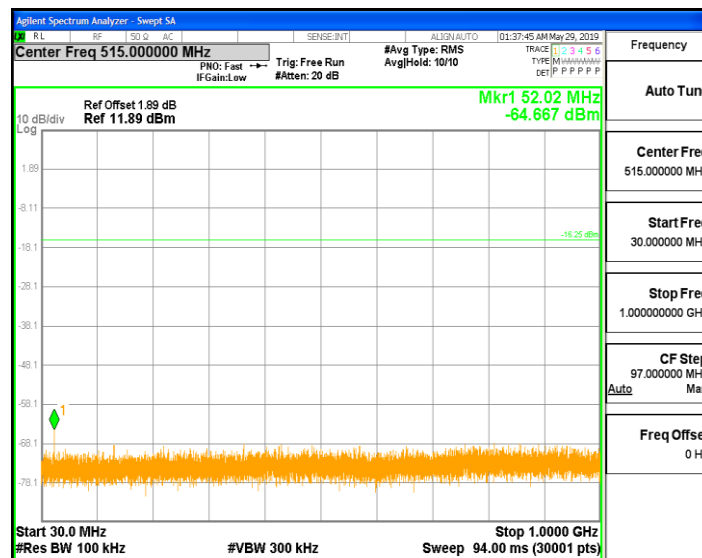
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	2402	Reference	3.75	3.75	---	PASS
			30~1000	30~1000	-64.667	<=-16.253	PASS
			1000~26500	1000~26500	-25.886	<=-16.253	PASS
		2442	Reference	4.30	4.30	---	PASS
			30~1000	30~1000	-65.388	<=-15.701	PASS
			1000~26500	1000~26500	-28.419	<=-15.701	PASS
		2480	Reference	3.85	3.85	---	PASS
			30~1000	30~1000	-64.743	<=-16.154	PASS
			1000~26500	1000~26500	-28.219	<=-16.154	PASS

Test Graphs

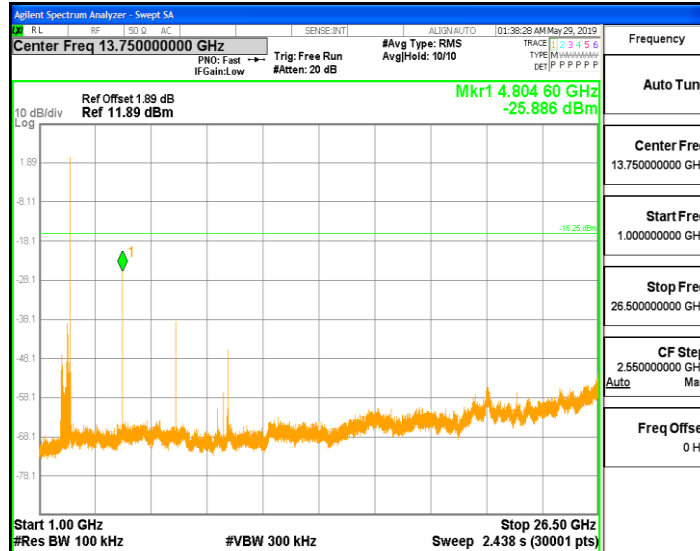
BLE_Ant1_2402_0~Reference



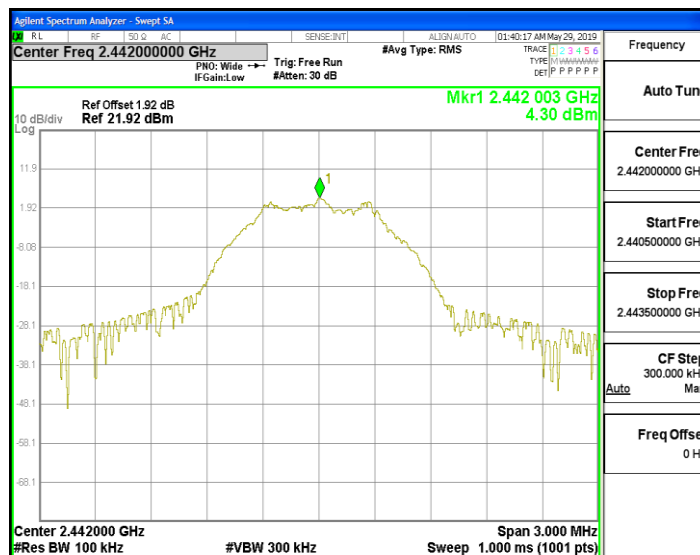
BLE_Ant1_2402_30~1000



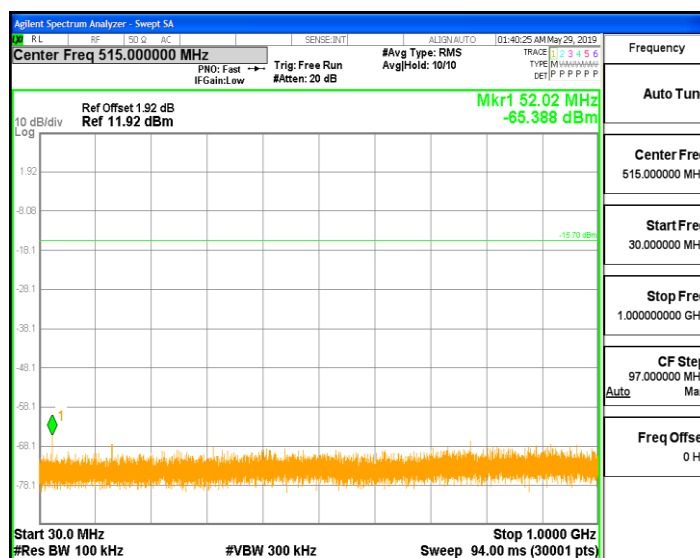
BLE_Ant1_2402_1000~26500



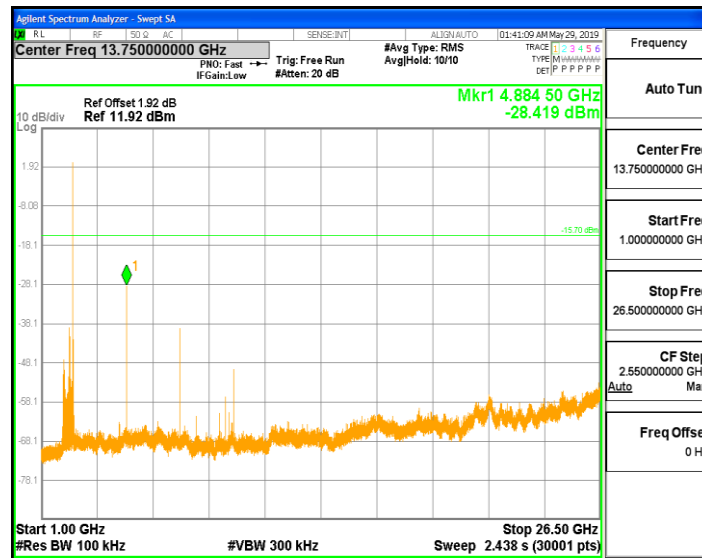
BLE_Ant1_2442_0~Reference



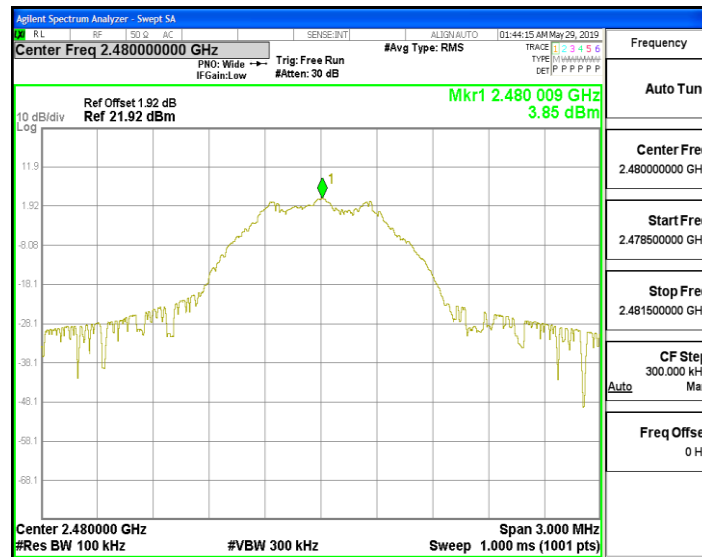
BLE_Ant1_2442_30~1000



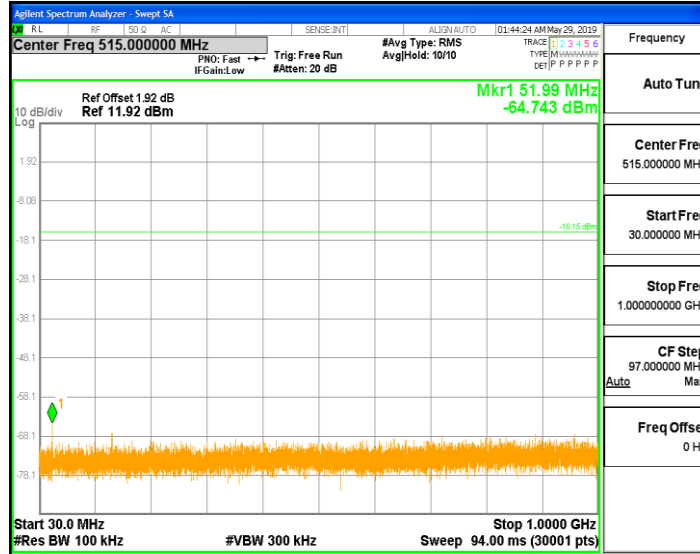
BLE_Ant1_2442_1000~26500



BLE_Ant1_2480_0~Reference



BLE_Ant1_2480_30~1000



BLE_Ant1_2480_1000~26500

