FCC Report (Bluetooth)

Product Name	:	WIRELESS KEYBOARD
Trade mark	:	N/A
Model No.	:	KD9013
FCC ID	:	2AAVD-KD9013
Report Number	:	BLA-EMC-202001-A17-01
Date of sample receipt	:	January 13, 2020
Date of Test	:	January 13, 2020–March 09, 2020
Date of Issue	:	March 09, 2020
Test standard	:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Test result	:	PASS

Prepared for:

Shenzhen Loyal Electronics Co., Ltd
No.5 The First Industrial Area of Shanmen, Songgang, Baoan, Shenzhen, China

Prepared by:

BlueAsia of Technical Services(Shenzhen) Co., Ltd.
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Compiled by: Jozu

Review by: Sweet Liang

Approved by: Emen_li

Date: March 09, 2020

2 Version

Version No.	Date	Description
00	*March 09, 2020*	*Original*

3 Contents

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	N/A
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	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.45dB	(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:	WIRELESS KEYBOARD
Model No.:	KD9013
Test Model No.:	KD9013
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:	V04
Software:	43993707
Operation Frequency:	2402MHz-2480MHz
Channel Numbers:	40
Channel Separation:	2MHz
Modulation Type:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	2.34dBi
Power Supply:	DC 3V
Remark:The Antenna Gain is supplied by the customer.BlueAsia is not responsible for this data	

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 with modulation(new battery is used)

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**

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**

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:
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	07-14-2019	07-13-2020
3	Horn Antenna	SCHWARZBECK	9120D	01892 P:00331	07-14-2019	07-13-2020
4	EMI Test Software	EZ	EZ	N/A	N/A	N/A
5	Pre-amplifier	SKET	N/A	N/A	07-19-2019	07-18-2020
6	Spectrum analyzer	Rohde & Schwarz	FSP40	100817	05-24-2019	05-23-2020
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	05-24-2019	05-23-2020
10	Signal Generator	Agilent	E8257D	MY44320250	05-24-2019	05-23-2020

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	12-18-2019	12-17-2020
3	LISN	Rohde & Schwarz	ENV216	3560.6550.15	07-19-2019	07-18-2020
4	EMI Test Software	EZ	EZ	N/A	N/A	N/A
5	Temperature Humidity Chamber	Mingle	TH101B	N/A	07-19-2019	07-18-2020

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	05-24-2019	05-23-2020
2	Spectrum analyzer	Rohde & Schwarz	FSP40	100817	05-24-2019	05-23-2020
3	Vector Signal Generator	Agilent	E4438C	MY45092582	05-24-2019	05-23-2020
4	Signal Generator	Agilent	E8257D	MY44320250	05-24-2019	05-23-2020
5	Power Sensor	D.A.R.E	RPR3006W	17I00015SNO27	05-24-2019	05-23-2020
6	Power Sensor	D.A.R.E	RPR3006W	17I00015SNO28	05-24-2019	05-23-2020
7	DC Power Supply	LODESTAR	LP305DE	N/A	07-19-2019	07-18-2020
8	Temperature Humidity Chamber	Mingle	TH101B	N/A	07-19-2019	07-18-2020

7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)

15.203 requirement:

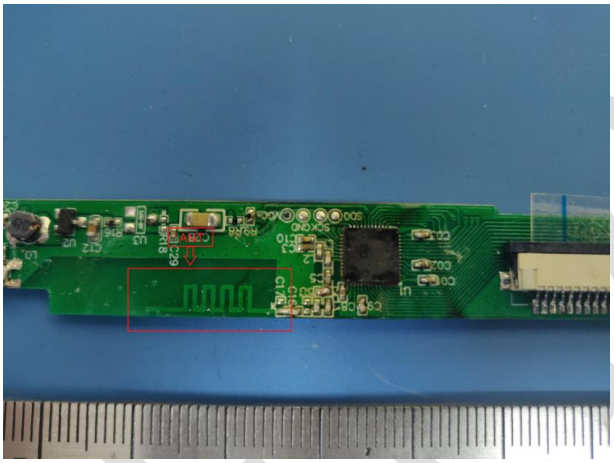
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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:

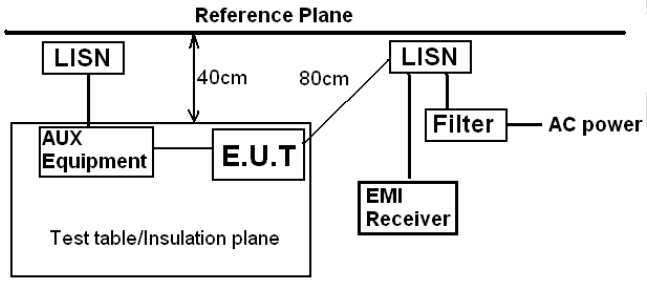
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

E.U.T Antenna:

The antenna is PCB antenna, the best case gain of the antenna is 2.34dBi

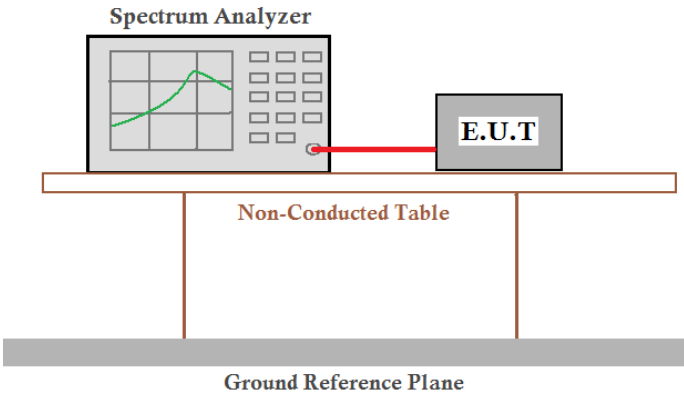


7.2 Conducted Emissions

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>150KHz to 30MHz</td></tr>
<tr><td>Class / Severity:</td><td>Class B</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9KHz, VBW=30KHz, Sweep time=auto</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<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>
</table>
* Decreases with the logarithm of the frequency.
</td></tr>
<tr><td>Test setup:</td><td>


Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m
</td></tr>
<tr><td>Test procedure:</td><td>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.</td></tr>
<tr><td>Test Instruments:</td><td>Refer to section 6.0 for details</td></tr>
<tr><td>Test mode:</td><td>Refer to section 5.2 for details</td></tr>
<tr><td>Test results:</td><td>N/A</td></tr>
</table>

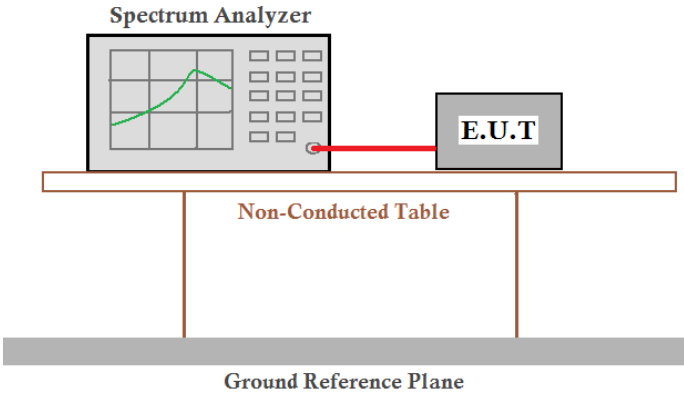
7.3 Conducted Output Power

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

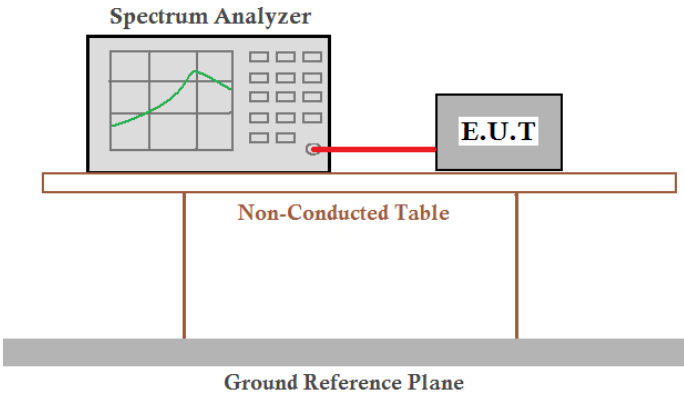
7.4 Channel Bandwidth

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:	
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

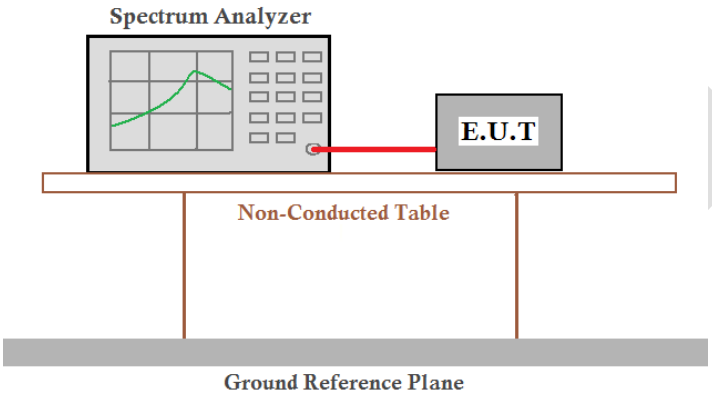
Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05
Limit:	8dBm/3kHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

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:	
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

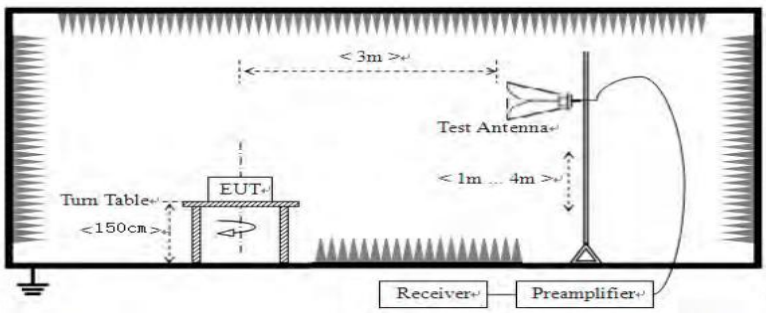
Receiver setup:

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	46.03	-4.20	41.83	74.00	-32.17	Horizontal
2390.00	45.25	-3.88	41.37	74.00	-32.63	Horizontal
2310.00	45.16	-4.49	40.67	74.00	-33.33	Vertical
2390.00	45.98	-4.21	41.77	74.00	-32.23	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	33.56	-4.20	29.36	54.00	-24.64	Horizontal
2390.00	32.78	-3.88	28.90	54.00	-25.10	Horizontal
2310.00	34.25	-4.49	29.76	54.00	-24.24	Vertical
2390.00	33.69	-4.21	29.48	54.00	-24.52	Vertical

Test channel:	Highest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	47.26	-3.38	43.88	74.00	-30.12	Horizontal
2500.00	46.33	-3.30	43.03	74.00	-30.97	Horizontal
2483.50	46.57	-3.77	42.80	74.00	-31.20	Vertical
2500.00	46.83	-3.70	43.13	74.00	-30.87	Vertical

Average value:

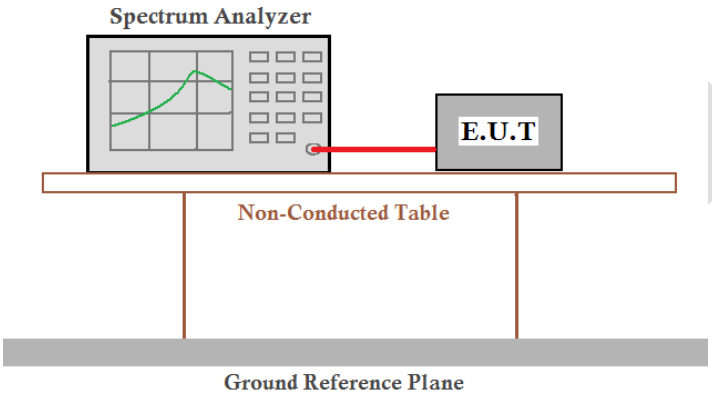
Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	33.69	-3.38	30.31	54.00	-23.69	Horizontal
2500.00	34.48	-3.30	31.18	54.00	-22.82	Horizontal
2483.50	34.07	-3.77	30.30	54.00	-23.70	Vertical
2500.00	34.86	-3.70	31.16	54.00	-22.84	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

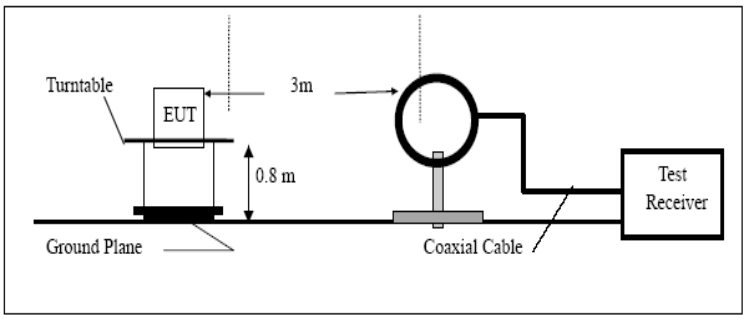
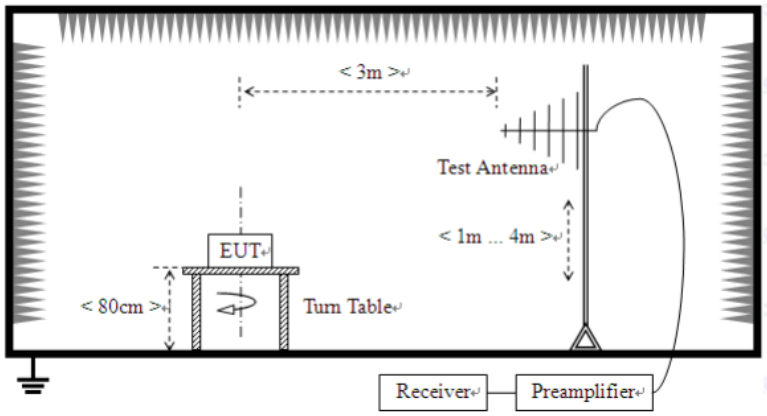
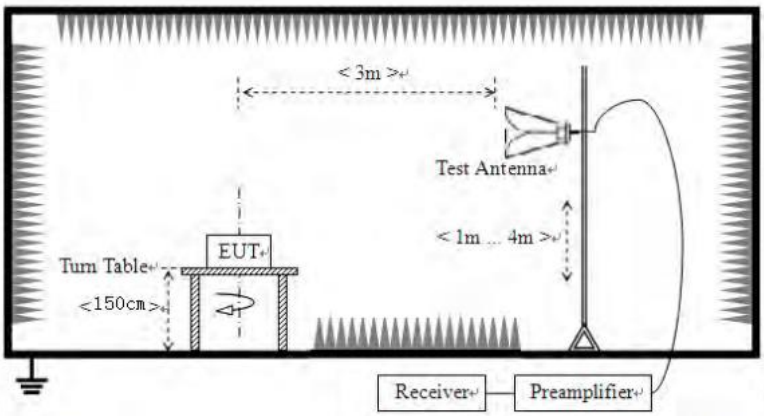
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional 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:	
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

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>9kHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Value</th></tr>
<tr><td>9KHz-150KHz</td><td>Quasi-peak</td><td>200Hz</td><td>600Hz</td><td>Quasi-peak</td></tr>
<tr><td>150KHz-30MHz</td><td>Quasi-peak</td><td>9KHz</td><td>30KHz</td><td>Quasi-peak</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:
(Spurious Emissions)</td><td>
<table>
<tr><th>Frequency</th><th>Limit (uV/m)</th><th>Value</th><th>Measurement Distance</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(KHz)</td><td>QP</td><td>30m</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>QP</td><td>30m</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>QP</td><td rowspan="7">3m</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>QP</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>QP</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>QP</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>Average</td></tr>
<tr><td>5000</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Limit:
(band edge)</td><td>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.</td></tr>
</table>

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

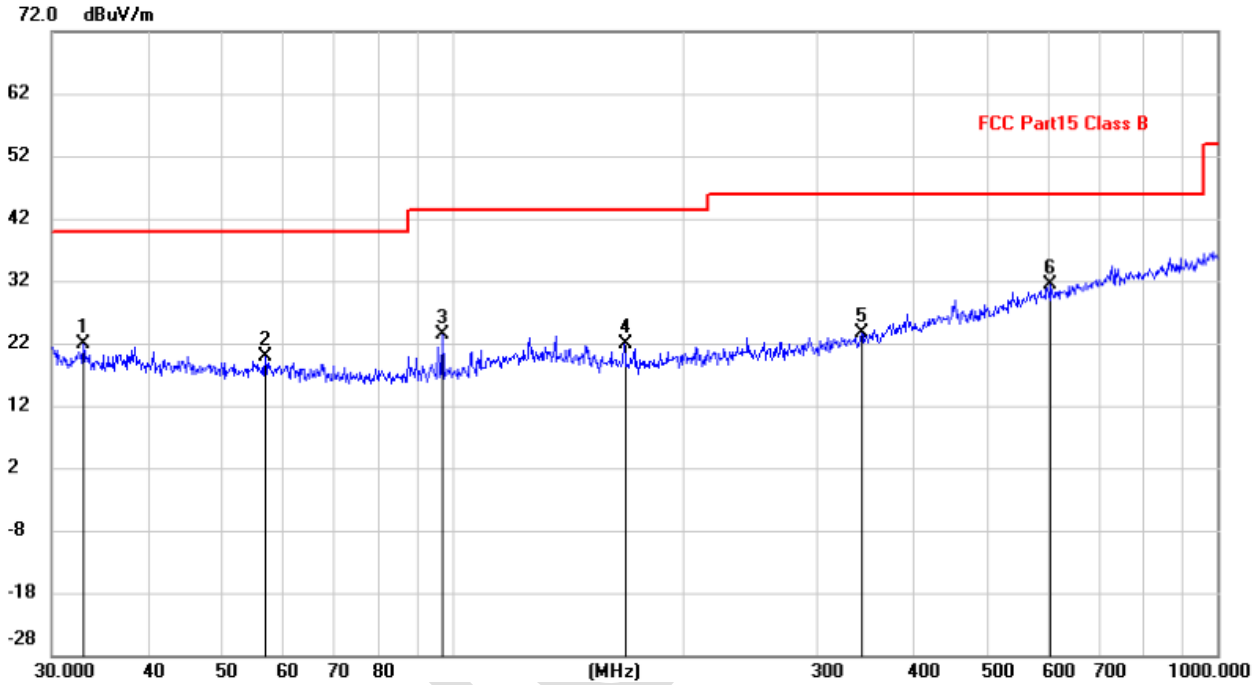
■ **9 kHz ~ 30 MHz**

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:

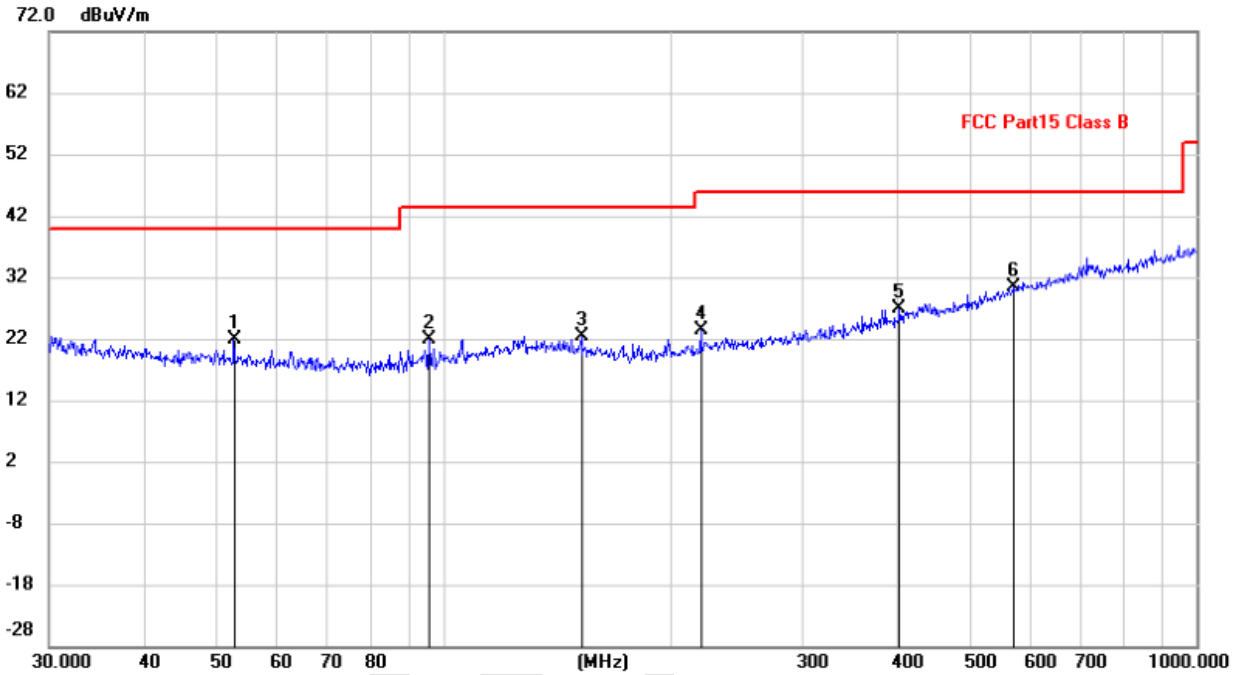
EUT:	WIRELESS KEYBOARD	**Polarziation:**	Horizontal
Model:	KD9013	**Power Source:**	DC3V
Mode:	BLE mode	**Test by:**	Jozu
Temp./Hum.(%H):	26℃/60%RH		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		32.9791	-0.97	22.91	21.94	40.00	-18.06	QP
2		56.9912	-3.89	23.71	19.82	40.00	-20.18	QP
3		97.1148	3.01	20.36	23.37	43.50	-20.13	QP
4		167.8243	-0.37	22.37	22.00	43.50	-21.50	QP
5		343.1800	-1.64	25.20	23.56	46.00	-22.44	QP
6	*	605.6592	0.01	31.29	31.30	46.00	-14.70	QP

Vertical：

EUT:	WIRELESS KEYBOARD	**Polarziation:**	Vertical
Model:	KD9013	**Power Source:**	DC3V
Mode:	BLE mode	**Test by:**	Jozu
Temp./Hum.(%H):	26℃/60%RH		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		52.7600	-2.35	24.19	21.84	40.00	-18.16	QP
2		95.7622	1.72	20.21	21.93	43.50	-21.57	QP
3		152.6640	-0.79	23.25	22.46	43.50	-21.04	QP
4		219.8448	1.70	21.56	23.26	46.00	-22.74	QP
5		403.2500	-0.11	27.07	26.96	46.00	-19.04	QP
6	*	570.6100	-0.13	30.57	30.44	46.00	-15.56	QP

■ **Above 1GHz**

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
4804.00	52.03	2.57	54.60	74.00	-19.40	Vertical
7206.00	47.74	7.58	55.32	74.00	-18.68	Vertical
9608.00	44.26	7.62	51.88	74.00	-22.12	Vertical
12010.00	*			74.00		Vertical
14412.00	*			74.00		Vertical
4804.00	50.15	2.57	52.72	74.00	-21.28	Horizontal
7206.00	45.59	7.58	53.17	74.00	-20.83	Horizontal
9608.00	43.67	7.62	51.29	74.00	-22.71	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	40.26	2.57	42.83	54.00	-11.17	Vertical
7206.00	35.51	7.58	43.09	54.00	-10.91	Vertical
9608.00	34.48	7.62	42.10	54.00	-11.90	Vertical
12010.00	*			54.00		Vertical
14412.00	*			54.00		Vertical
4804.00	38.56	2.57	41.13	54.00	-12.87	Horizontal
7206.00	34.26	7.58	41.84	54.00	-12.16	Horizontal
9608.00	34.00	7.62	41.62	54.00	-12.38	Horizontal
12010.00	*			54.00		Horizontal
14412.00	*			54.00		Horizontal

Test channel:	Middle

Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4884.00	54.26	0.10	54.36	74.00	-19.64	Vertical
7326.00	46.63	7.60	54.23	74.00	-19.77	Vertical
9768.00	44.48	7.62	52.10	74.00	-21.90	Vertical
12210.00	*			74.00		Vertical
14652.00	*			74.00		Vertical
4884.00	51.45	0.10	51.55	74.00	-22.45	Horizontal
7326.00	47.07	7.60	54.67	74.00	-19.33	Horizontal
9768.00	44.34	7.62	51.96	74.00	-22.04	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	37.58	0.10	37.68	54.00	-16.32	Vertical
7326.00	33.45	7.60	41.05	54.00	-12.95	Vertical
9768.00	34.63	7.62	42.25	54.00	-11.75	Vertical
12210.00	*			54.00		Vertical
14652.00	*			54.00		Vertical
4884.00	37.42	0.10	37.52	54.00	-16.48	Horizontal
7326.00	34.33	7.60	41.93	54.00	-12.07	Horizontal
9768.00	34.82	7.62	42.44	54.00	-11.56	Horizontal
12210.00	*			54.00		Horizontal
14652.00	*			54.00		Horizontal

Test channel:	Highest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	53.26	2.53	55.79	74.00	-18.21	Vertical
7440.00	47.25	7.55	54.80	74.00	-19.20	Vertical
9920.00	45.64	7.63	53.27	74.00	-20.73	Vertical
12400.00	*			74.00		Vertical
14880.00	*			74.00		Vertical
4960.00	50.17	2.53	52.70	74.00	-21.30	Horizontal
7440.00	46.66	7.55	54.21	74.00	-19.79	Horizontal
9920.00	44.09	7.63	51.72	74.00	-22.28	Horizontal
12400.00	*			74.00		Horizontal
14880.00	*			74.00		Horizontal

Average value:

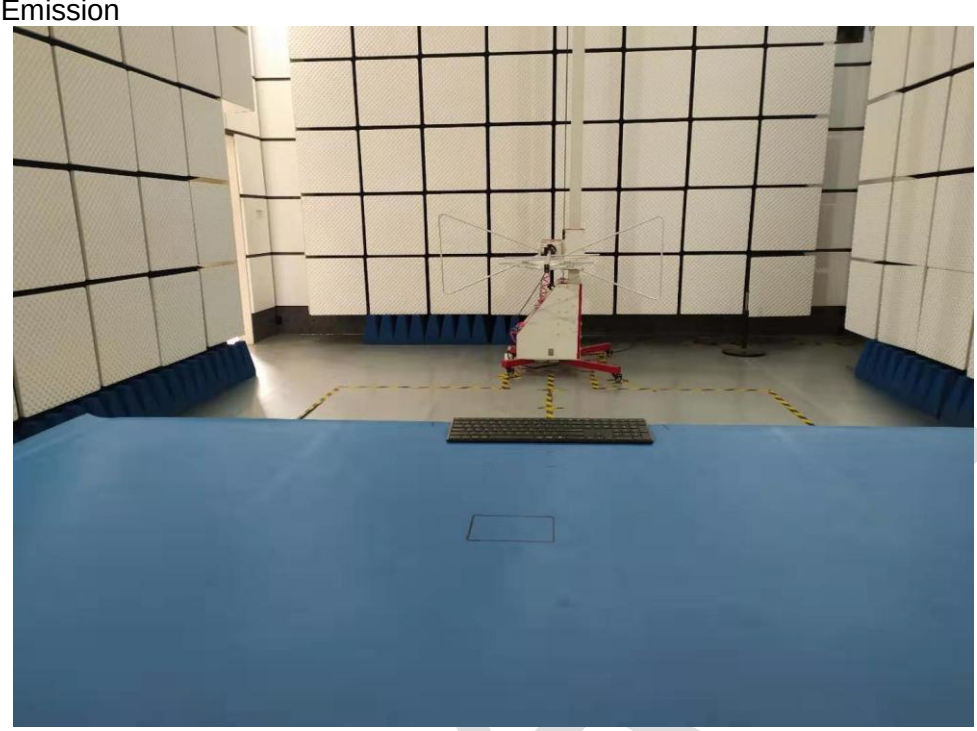
Frequency (MHz)	Read Level (dBuV)	Correct factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	38.03	2.53	40.56	54.00	-13.44	Vertical
7440.00	35.51	7.55	43.06	54.00	-10.94	Vertical
9920.00	34.07	7.63	41.70	54.00	-12.30	Vertical
12400.00	*			54.00		Vertical
14880.00	*			54.00		Vertical
4960.00	37.74	2.53	40.27	54.00	-13.73	Horizontal
7440.00	33.69	7.55	41.24	54.00	-12.76	Horizontal
9920.00	34.19	7.63	41.82	54.00	-12.18	Horizontal
12400.00	*			54.00		Horizontal
14880.00	*			54.00		Horizontal

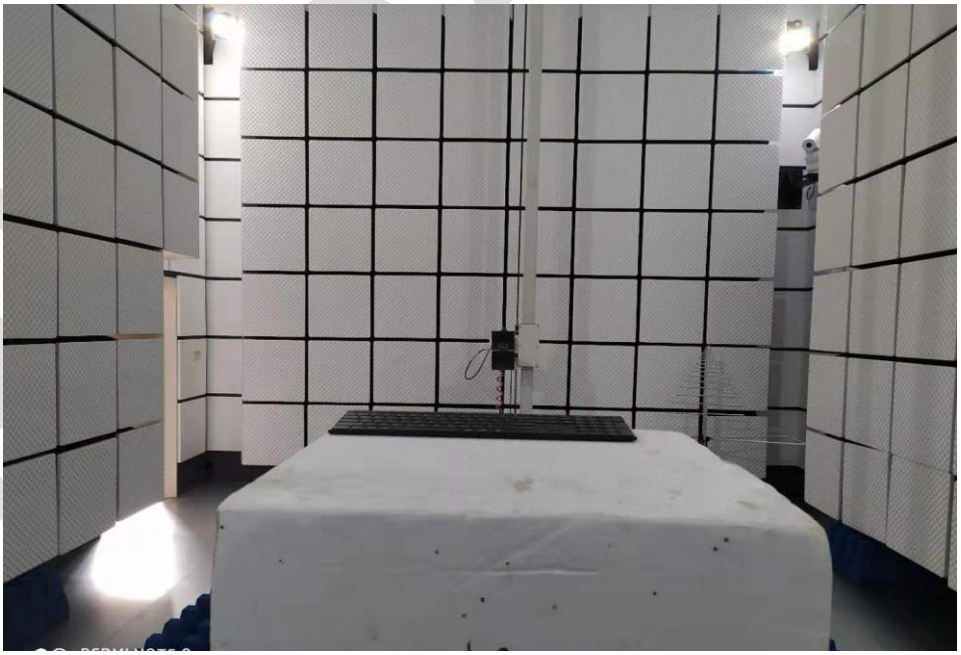
Remark:

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*
4. *As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.*

8 Test Setup Photo

Radiated Emission





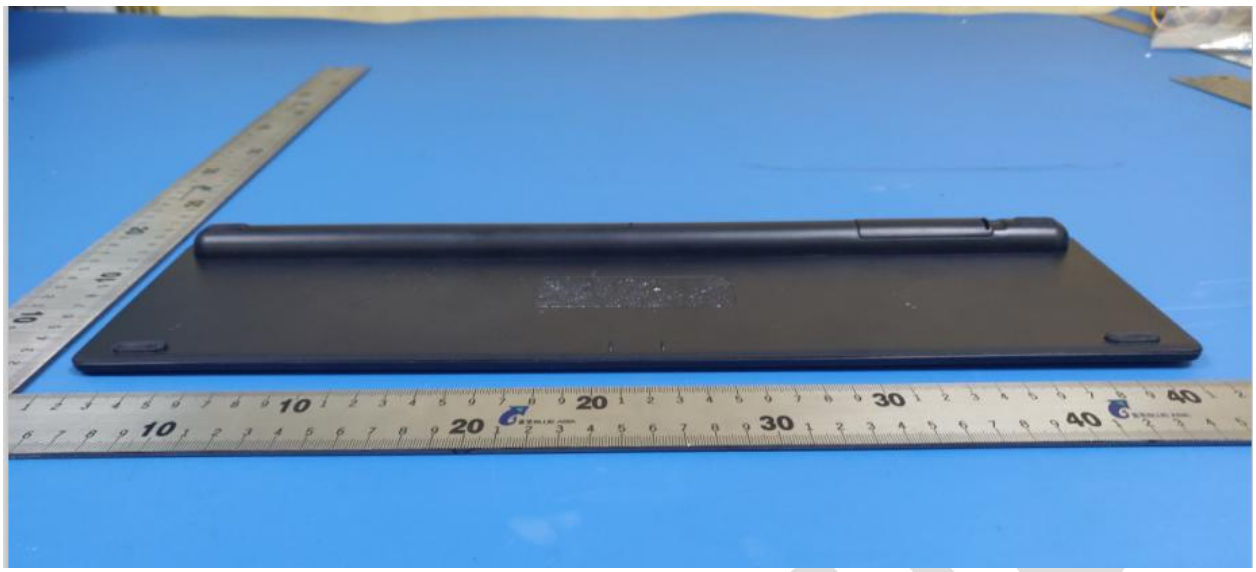
9 EUT Constructional Details

View of Product-1(mode : KD9013)

View of Product-2(mode : KD9013)

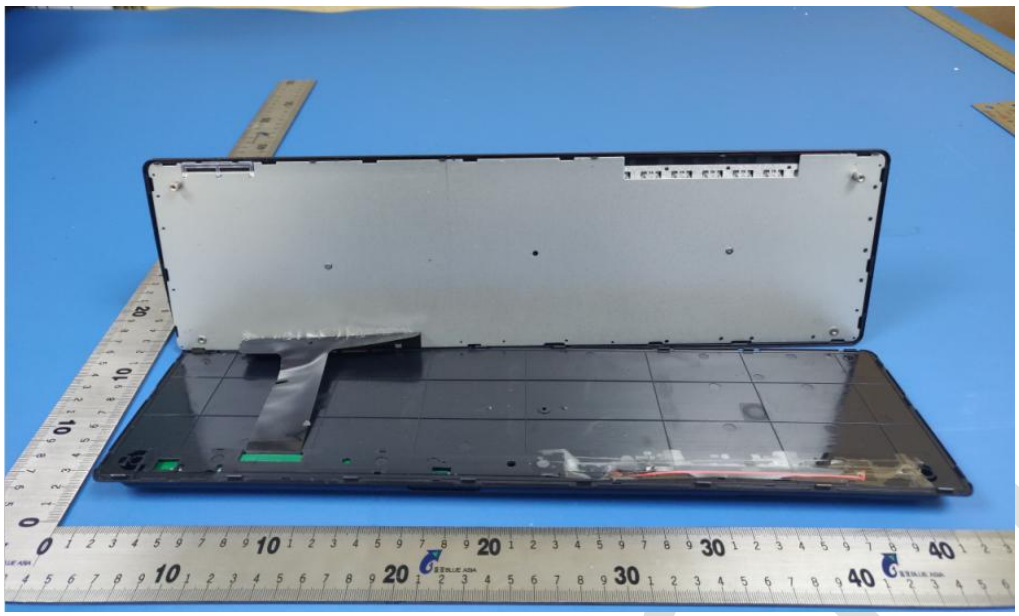
View of Product-3(mode : KD9013)

View of Product-4(mode : KD9013)

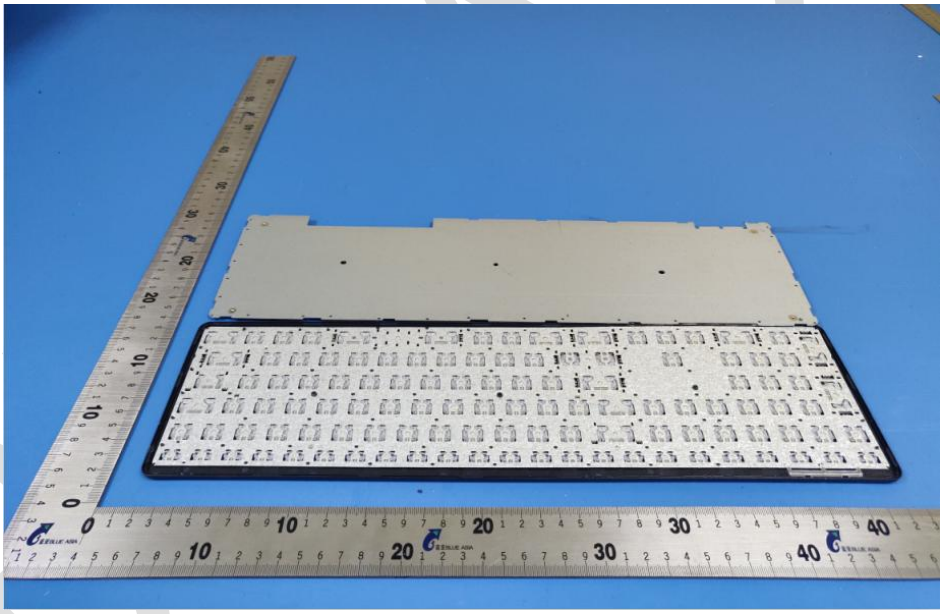


View of Product-5(mode : KD9013)

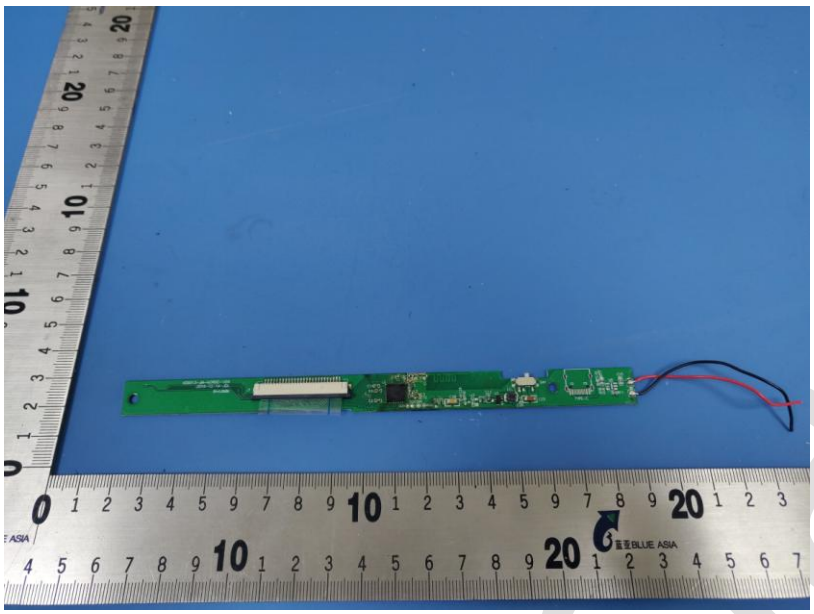
View of Product-6(mode : KD9013)



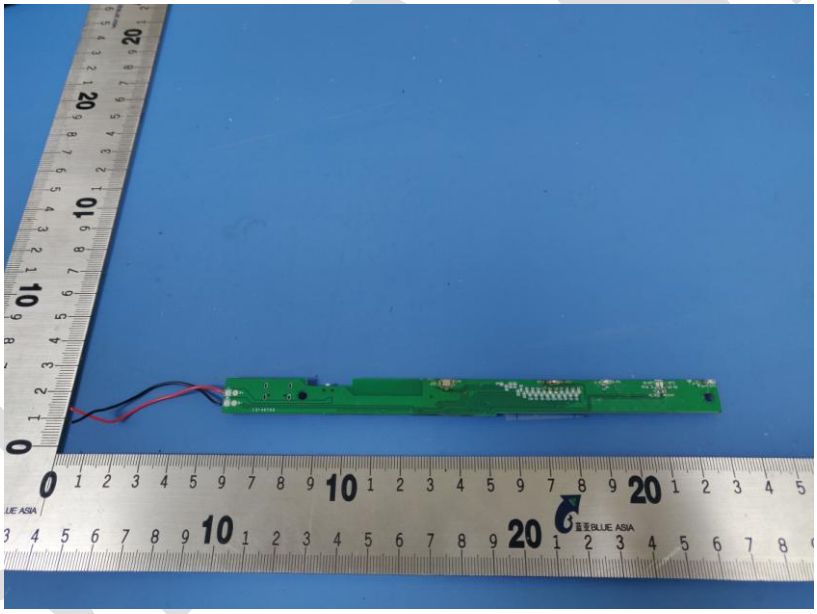
View of Product-7(mode : KD9013)



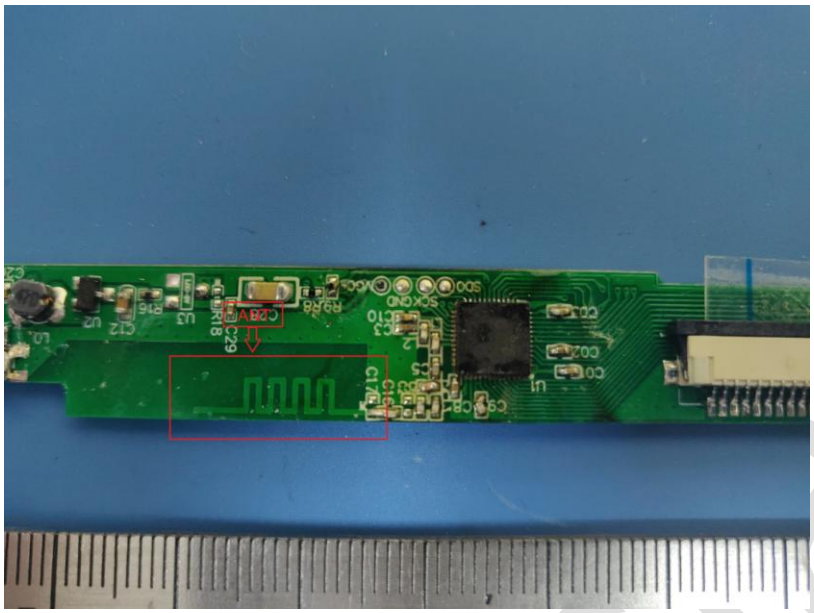
View of Product-8(mode : KD9013)



View of Product-9(mode : KD9013)



View of Product-10(mode : KD9013)



View of Product-11(mode : KD9013)

10 Appendix

Refer to the following attachments.

*** End of Report ***

AppendixA: DTS Bandwidth

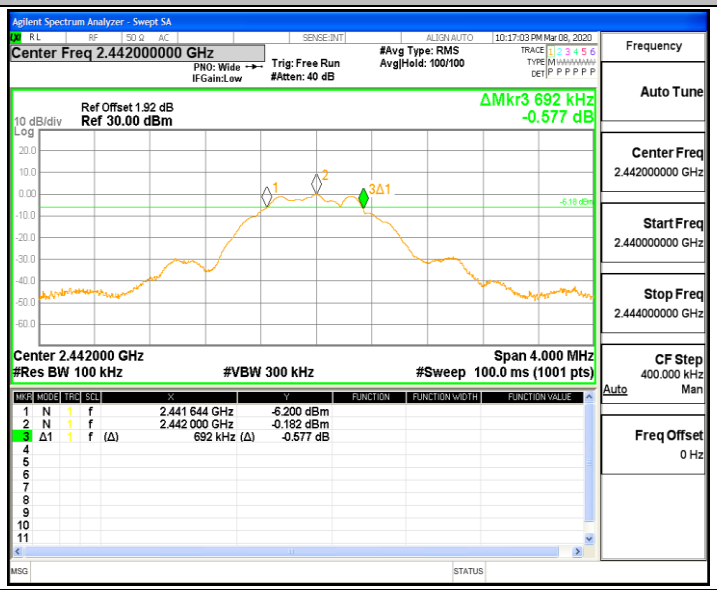
Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE	Ant1	2402	0.696	2401.640	2402.336	>=0.5	PASS
		2442	0.692	2441.644	2442.336	>=0.5	PASS
		2480	0.696	2479.640	2480.336	>=0.5	PASS

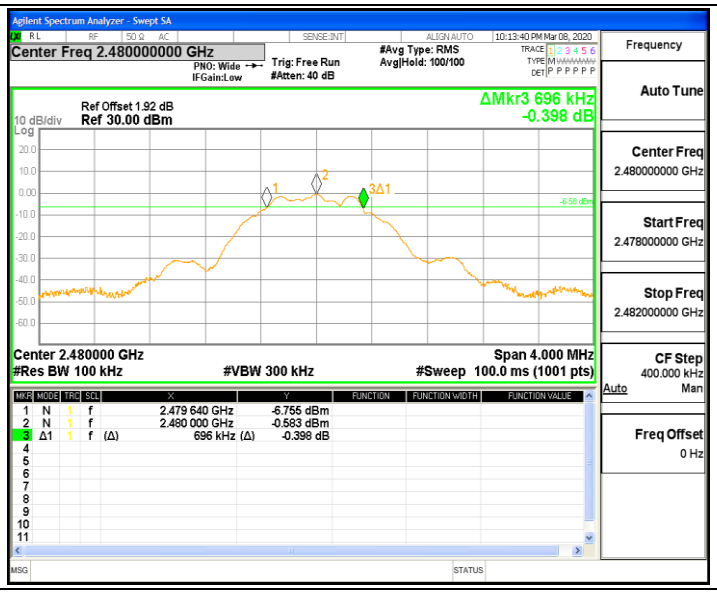
Test Graphs

BLE _Ant1_2402

BLE _Ant1_2442



BLE _Ant1_2480


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 100/100
10:13:40 PM Mar 08, 2020
Ref Offset 1.92 dB
10 dB/div
Log
Ref 30.00 dBm
ΔMkr3 696 kHz
-0.398 dB
-6.58 dBm
Center 2.480000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4.000 MHz
#Sweep 100.0 ms (1001 pts)
1 N 1 f 2.479 640 GHz -6.755 dBm
2 N 1 f 2.480 000 GHz -0.583 dBm
3 Δ1 1 f (Δ) 696 kHz (Δ) -0.398 dB
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.478000000 GHz
Stop Freq
2.482000000 GHz
CF Step
400.000 kHz
Auto
Man
Freq Offset
0 Hz

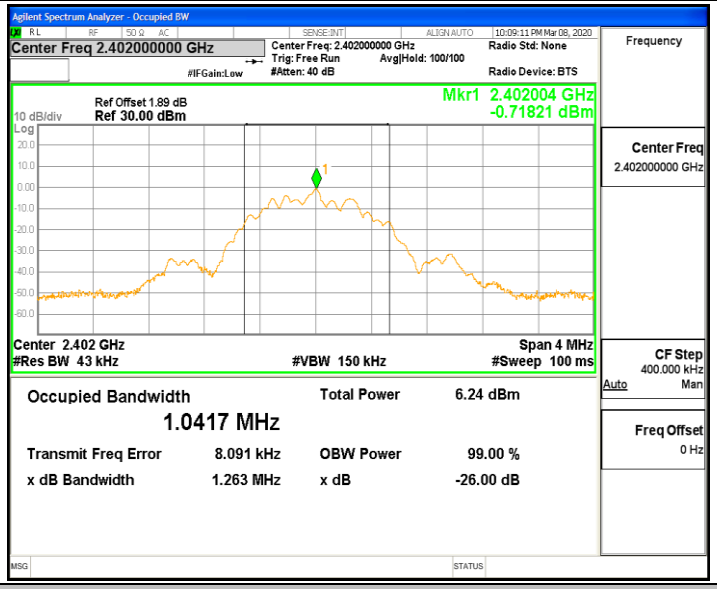
AppendixB: Occupied Channel Bandwidth

Test Result

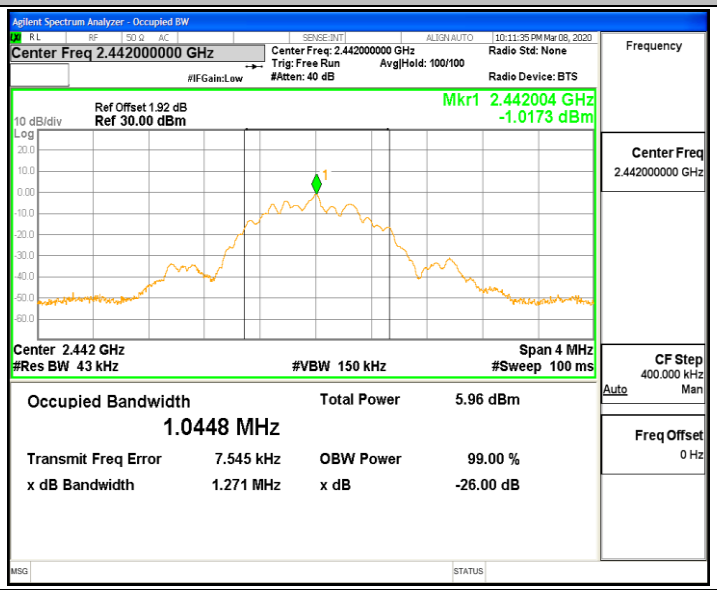
TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE	Ant1	2402	1.0417	2401.487	2402.529	---	PASS
		2442	1.0448	2441.485	2442.530	---	PASS
		2480	1.0465	2479.484	2480.531	---	PASS

Test Graphs

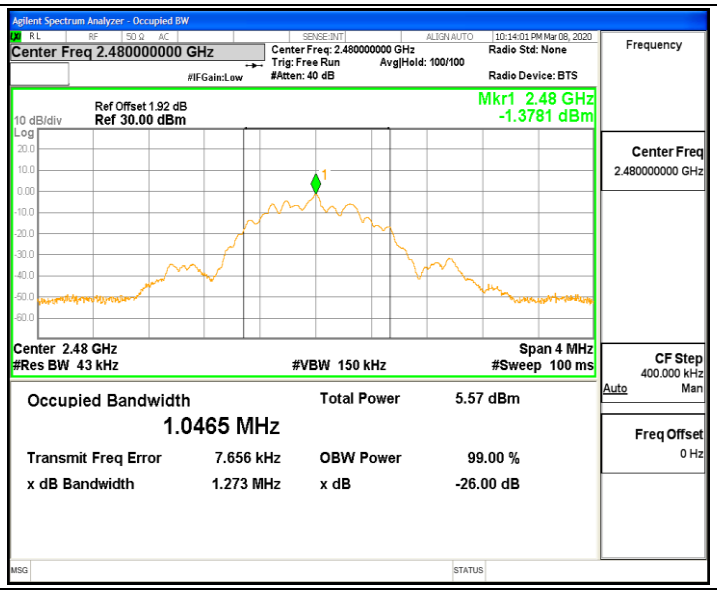
BLE _Ant1_2402



BLE _Ant1_2442



BLE _Ant1_2480


Agilent Spectrum Analyzer - Occupied BW
RL
RF
50 Ω
AC
SENSE:INT
ALIGN AUTO
10:14:01 PM Mar 08, 2020
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#IFGain:Low
#Atten: 40 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 1.92 dB
10 dB/div
Ref 30.00 dBm
Log
Mkr1 2.48 GHz
-1.3781 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 43 kHz
#VBW 150 kHz
Span 4 MHz
#Sweep 100 ms
CF Step
400.000 kHz
Auto
Man
Occupied Bandwidth
1.0465 MHz
Total Power
5.57 dBm
Freq Offset
0 Hz
Transmit Freq Error
7.656 kHz
OBW Power
99.00 %
x dB Bandwidth
1.273 MHz
x dB
-26.00 dB
MSG
STATUS

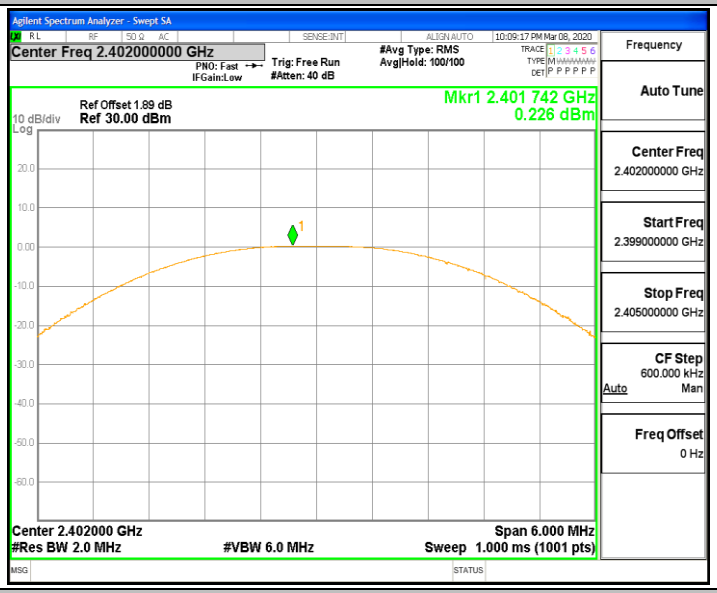
AppendixC: Maximum conducted output power

Test Result

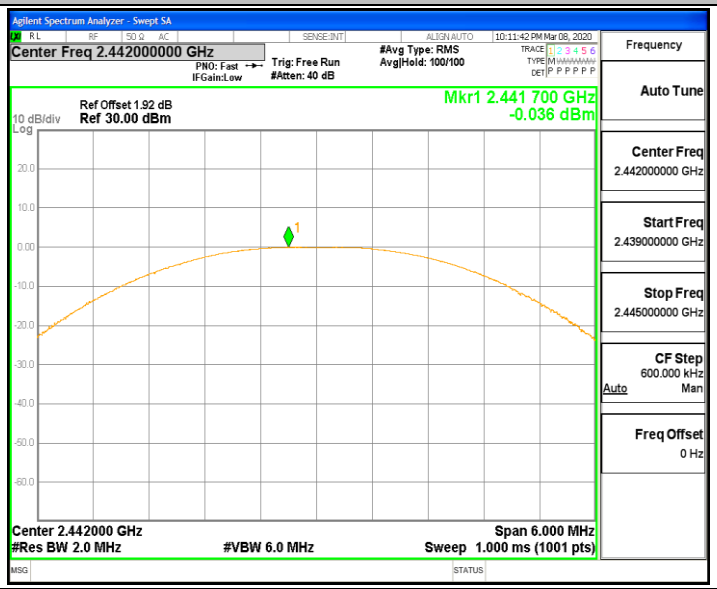
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	2402	0.23	<=30	PASS
		2442	-0.04	<=30	PASS
		2480	-0.41	<=30	PASS

Test Graphs

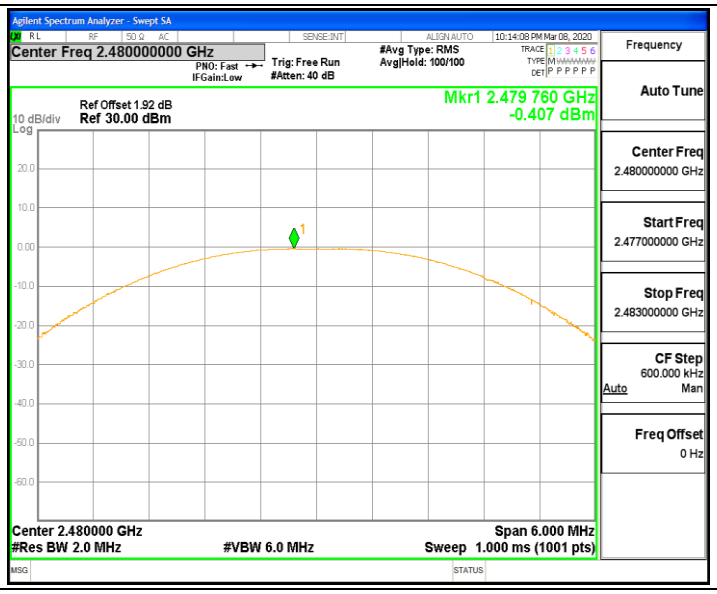
BLE _Ant1_2402



BLE _Ant1_2442



BLE _Ant1_2480

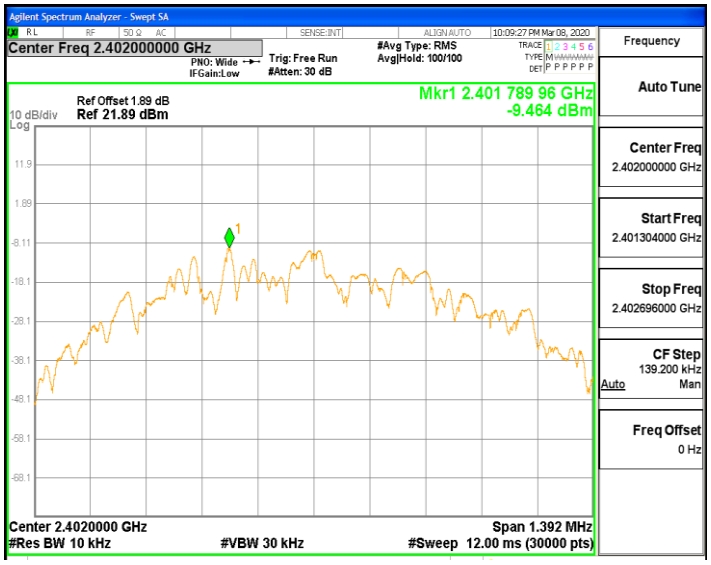
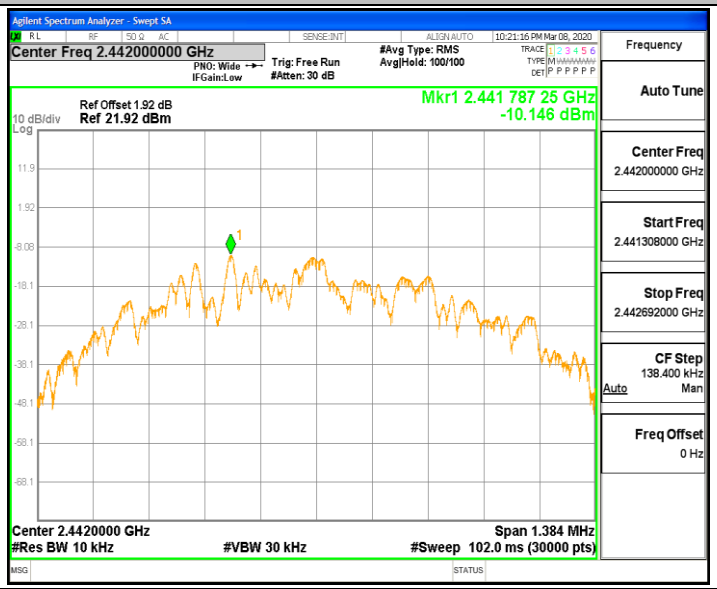

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 100/100
10:14:08 PM Mar 08, 2020
Ref Offset 1.92 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 2.479 760 GHz
-0.407 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Center 2.480000 GHz
#Res BW 2.0 MHz
#VBW 6.0 MHz
Span 6.000 MHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.477000000 GHz
Stop Freq
2.483000000 GHz
CF Step
600.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

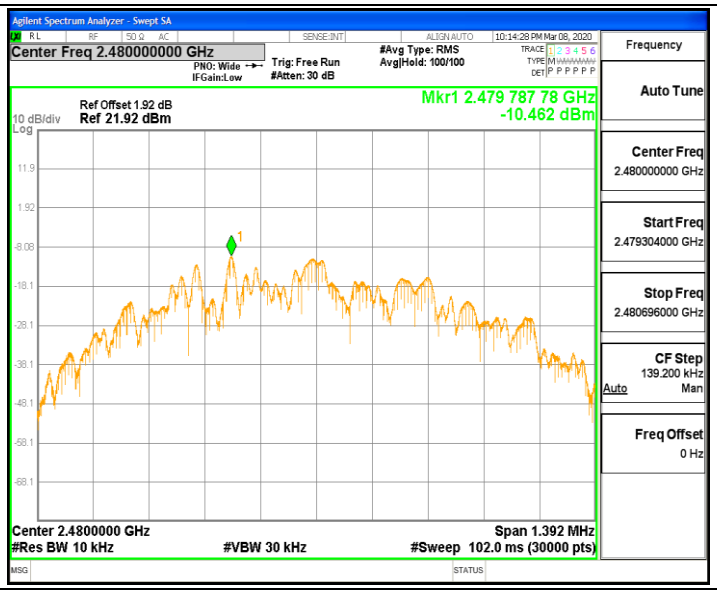
AppendixD: Maximum power spectral density

Test Result

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE	Ant1	2402	-9.46	<=8	PASS
		2442	-10.15	<=8	PASS
		2480	-10.46	<=8	PASS

Test Graphs

BLE _Ant1_2402

BLE _Ant1_2442

BLE _Ant1_2480

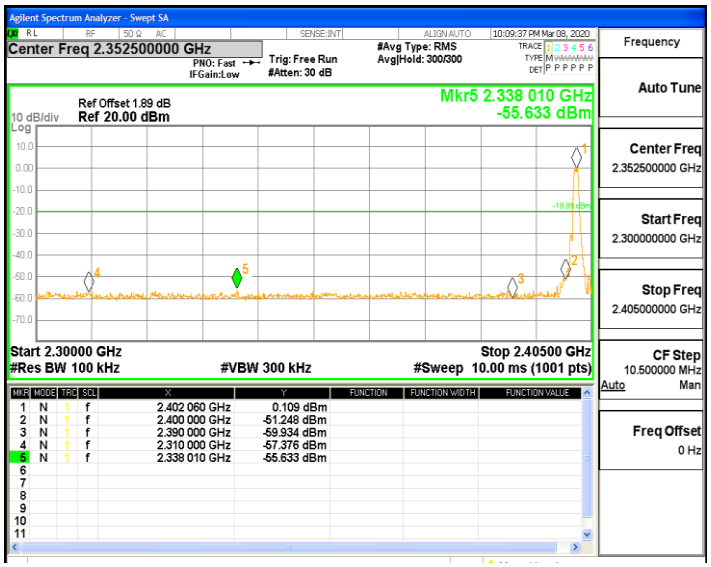

Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω
AC
SENSE:INT
ALIGN AUTO
10:14:28 PM Mar 08, 2020
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold: 100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P P P P P
Frequency
Auto Tune
Ref Offset 1.92 dB
10 dB/div
Ref 21.92 dBm
Log
Mkr1 2.479 787 78 GHz
-10.462 dBm
11.9
1.92
-8.08
-18.1
-28.1
-38.1
-48.1
-58.1
-68.1
Center Freq
2.480000000 GHz
Start Freq
2.479304000 GHz
Stop Freq
2.480696000 GHz
CF Step
139.200 kHz
Auto
Man
Freq Offset
0 Hz
Center 2.4800000 GHz
#Res BW 10 kHz
#VBW 30 kHz
Span 1.392 MHz
#Sweep 102.0 ms (30000 pts)
MSG
STATUS

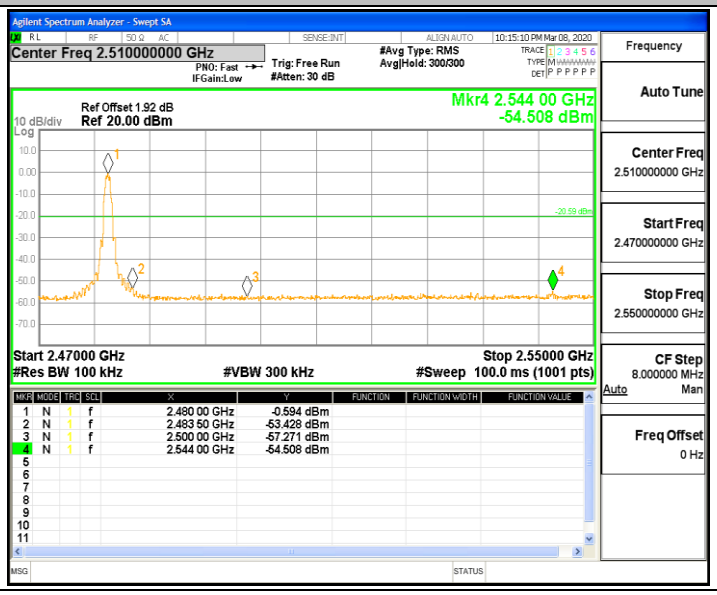
AppendixE:Band edge measurements

Test Result

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	Low	2402	0.11	-55.63	<=-19.89	PASS
		High	2480	-0.59	-54.51	<=-20.59	PASS

Test Graphs

BLE _Ant1_Low_2402


BLE _Ant1_High_2480


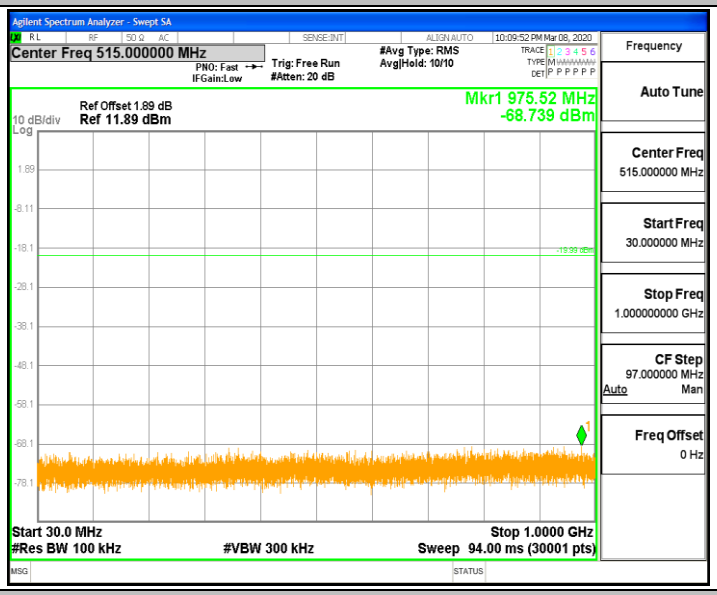
AppendixF:Conducted SpuriousEmission

Test Result

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE	Ant1	2402	Reference	0.01	0.01	---	PASS
			30~1000	30~1000	-68.739	<=-19.99	PASS
			1000~26500	1000~26500	-51.459	<=-19.99	PASS
		2442	Reference	-0.35	-0.35	---	PASS
			30~1000	30~1000	-67.58	<=-20.348	PASS
			1000~26500	1000~26500	-44.202	<=-20.348	PASS
		2480	Reference	-0.66	-0.66	---	PASS
			30~1000	30~1000	-67.683	<=-20.657	PASS
			1000~26500	1000~26500	-46.464	<=-20.657	PASS

Test Graphs

BLE _Ant1_2402_0~Reference

BLE _Ant1_2402_30~1000

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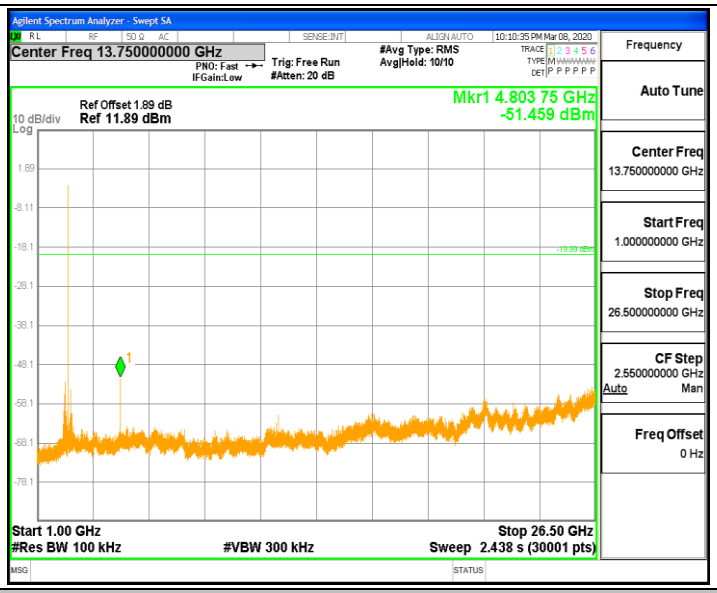

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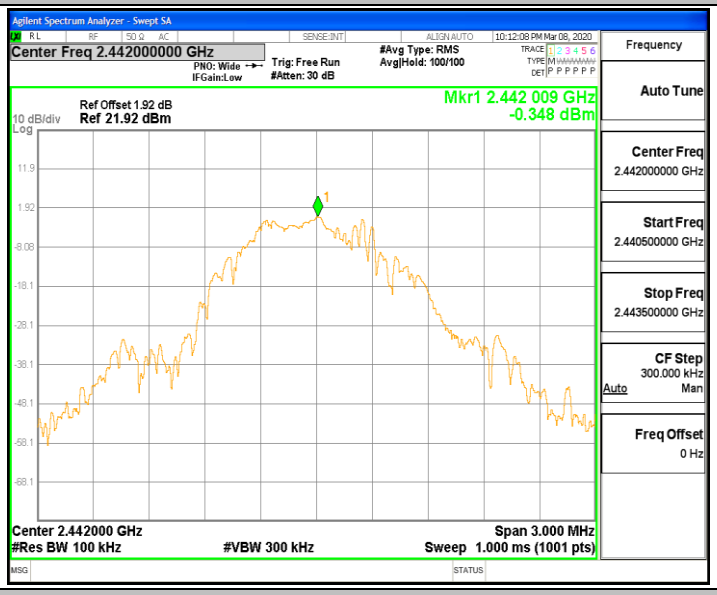

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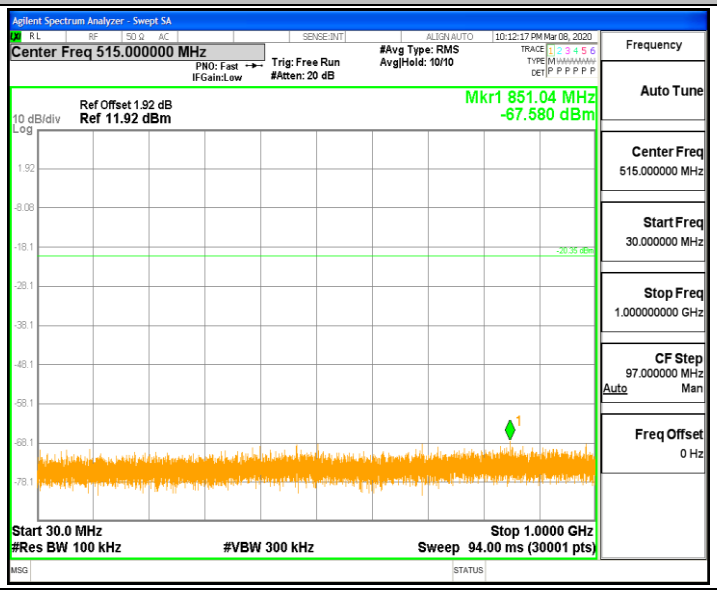

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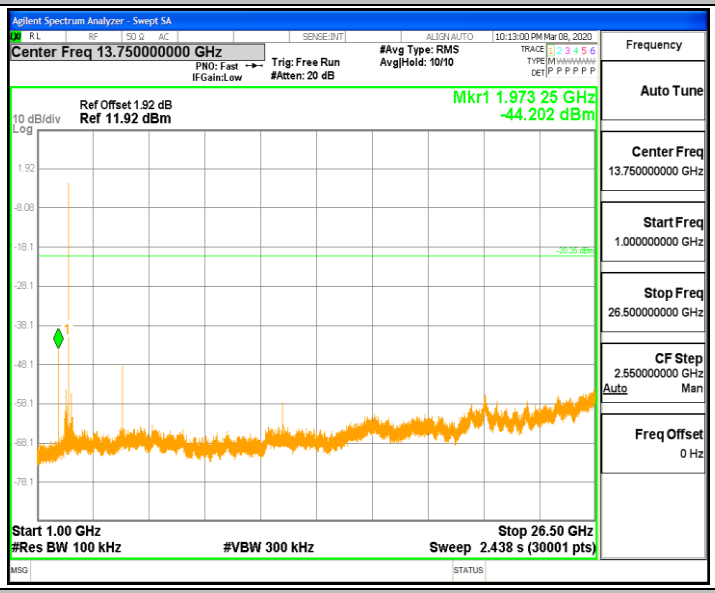
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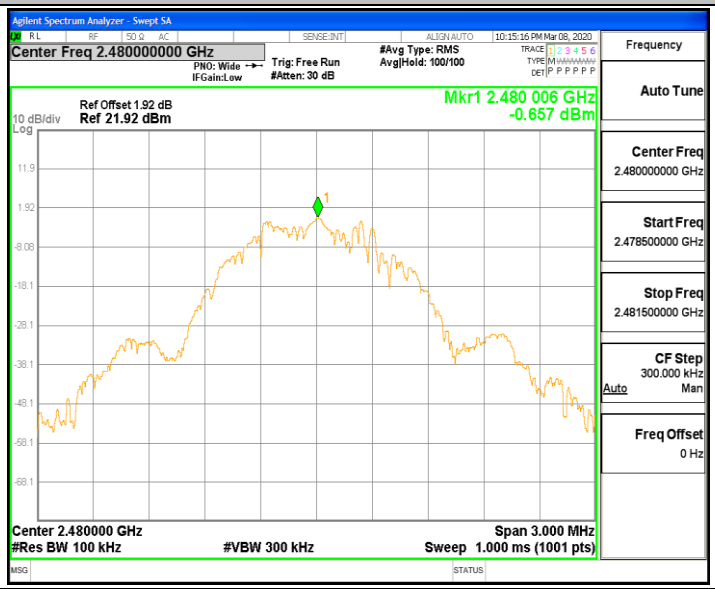
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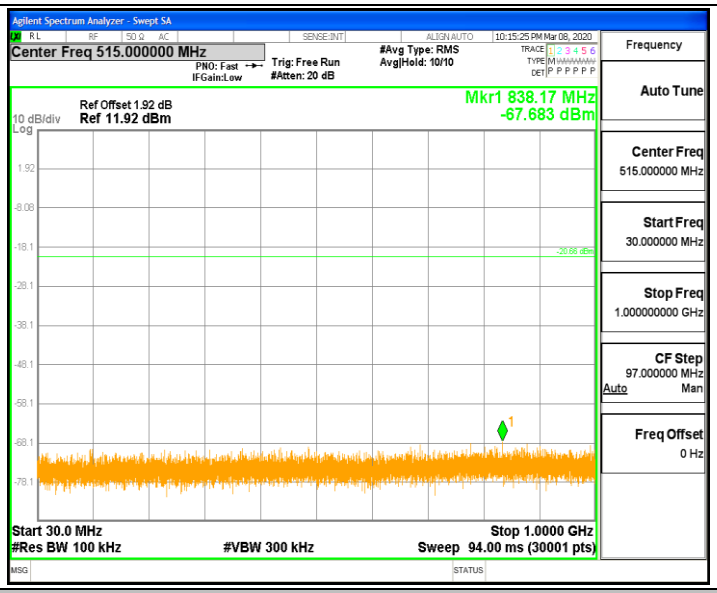

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