FCC PART 15.249

EMI MEASUREMENT AND TEST REPORT

For

SHENZHEN BLUE SOLIDS TECHNOLOGY CO.,LTD

3F, 30# RIFU LOAD BAISHIXIA EAST FUYONG TOWN BAOAN DISTRICT SHENZHEN,CHINA

FCC ID: 2ADGXBSTKB

October 29, 2014

This Report Concerns: Original Report	Equipment Type: Wireless Keyboard
Test Engineer:	Lisa Chen
Report No.:	BSL141029-2
Receive EUT Date/Test Date:	October 16, 2014 / October 16- October 29, 2014
Reviewed By:	Mike moo
Prepared By:	**BSL Testing Co.,LTD.** NO. 24, ZH Park, Nantou, Shenzhen, 518000 China Tel: 86- 755-26508703 Fax: 86- 755-26508703

Note: The test report is specially limited to the above company and this particular sample only. It may not be duplicated without prior written consent of BSL Testing Co.,LTD. This report must not be used by the client to claim product certification,approval,or endorsement by NVLAP, NIST or any agency of the US Government.

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1. GENERAL INFORMATION

1.1. Report information

1.1.1.This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that BSL approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that BSL in any way guarantees the later performance of the product/equipment.

1.1.2.The sample/s mentioned in this report is/are supplied by Applicant, BSL therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.

1.1.3.Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through BSL, unless the applicant has authorized BSL in writing to do so.

Test Facility -
The test site used to collect the radiated data is located on the address of
BSL Testing Co.,LTD.
(FCC Registered Test Site Number: 191509) on
NO. 24, ZH Park, Nantou, Shenzhen, 518000 China
The Test Site is constructed and calibrated to meet the FCC requirements.

1.2. Measurement Uncertainty

The reported uncertainty of measurement y ± U,where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2,providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Conducted Emission Test	+/-1.25dB
2	RF Power, Conducted	+/-0.20dB
3	Spurious emissions, conducted	+/-0.33dB
4	All emissions, radiated (<1G)	+/-3.47dB
5	All emissions, radiated (>1G)	+/-3.82dB
6	Temperature	+/-0.5°CdB
7	Humidity	+/-2%

2. PRODUCT DESCRIPTION

2.1. EUT Description

Description	:	Wireless Keyboard
Applicant	:	SHENZHEN BLUE SOLIDS TECHNOLOGY CO.,LTD 3F, 30# RIFU LOAD BAISHIXIA EAST FUYONG TOWN BAOAN DISTRICT SHENZHEN,CHINA
Manufacturer	:	Shenzhen Dinglongsheng Plastic Mould Co,.LTD 39# RIFU LOAD BAISHIXIA EAST FUYONG TOWN BAOAN DISTRICT SHENZHEN,CHINA
Model Number	:	BST-305,BST-302,BST-303M,BST-306,BST-221M,BST-226M, BST-229M,BST-125M,BST-136,BST-236
Modulation type	:	GFSK
Antenna gain	:	0dBi
Antenna type	:	PCB ANT
Frequency	:	2412-2475MHz
Number of Channels	:	64 Channels
Power Supply	:	DC 3V Battery

The series products, model name:
BST-305,BST-302,BST-303M,BST-306,BST-221M,BST-226M,BST-229M,BST-125M,BST-136, BST-236 have the same circuit diagram,PCB layout, software, RF Module, Features and functionality. The differences are the model name, so, we select BST-305 to test.

Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	28	2439	55	2466
2	2413	29	2440	56	2467
3	2414	30	2441	57	2468
4	2415	31	2442	58	2469
5	2416	32	2443	59	2470
6	2417	33	2444	60	2471
7	2418	34	2445	61	2472
8	2419	35	2446	62	2473
9	2420	36	2447	63	2474
10	2421	37	2448	64	2475
11	2422	38	2449		
12	2423	39	2450		
13	2424	40	2451		
14	2425	41	2452		
15	2426	42	2453		
16	2427	43	2454		
17	2428	44	2455		
18	2429	45	2456		
19	2430	46	2457		
20	2431	47	2458		
21	2432	48	2459		
22	2433	49	2460		
23	2434	50	2461		
24	2435	51	2462		
25	2436	52	2463		
26	2437	53	2464		
27	2438	54	2465		

2.2. Block Diagram of EUT Configuration

Figure 1 EUT Setup

2.3. Support Equipment List

Name	Model No	S/N	Manufacturer	Used (Y/N)

2.4. Test Conditions

Items	**Required (IEC 68-1)**	**Actual**
Temperature (℃)	15-35	20-25
Humidity (%RH)	25-75	50-63
Barometric pressure (mbar)	860-1060	950-1000

3. TEST RESULTS SUMMARY

FCC 15 Subpart C, Paragraph 15.249:2013

FCC Rules	Description of Test	Result
Section 15.207	Conducted Emission	N/A
Section 15.249(a)	The fundamental field strength and the harmonics	Compliant
Section 15.209 Section 15.249(d)	Radiated Emission	Compliant
Section 15.249(d)	Band Edge	Compliant
Section 15.203	Antenna Requirement	Compliant
Section 15.249	20dB Bandwidth	Compliant

Remark: “N/A” means “Not applicable”.

Statement: All testing was performed using the test procedures found in ANSI C63.4-2003.

Not: This EUT is powered by battery only, therefore this test item is not applicable.

Modifications

No modification was made.

4. TEST EQUIPMENT USED

EQUIPMENT/FACILITIES	MANUFACTURER	MODEL	SERIAL NO.	DATE OF CAL.	CAL. INTERVAL
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	Aug. 23 2014	1 Year
EMI Test Receiver	Rohde & Schwarz	ESCI3	BSL001	Sep. 28 2014	1 Year
BiConiLog Antenna	Rohde & Schwarz	HL562	BSL009	Sep. 28 2014	1 Year
Double -ridged waveguide horn	Rohde & Schwarz	9120D	BSL008	Aug. 27 2014	1 Year
Horn Antenna	ETS-LINDGREN	3160	BSL072	Dec. 28 2013	1 Year
Cable	Rohde & Schwarz	BSL045	BSL045	Aug. 27 2014	1 Year
Cable	Rohde & Schwarz	BSL046	BSL046	Aug. 27 2014	1 Year
Cable	Rohde & Schwarz	BSL047	BSL047	Aug. 27 2014	1 Year
Amplifier(100kHz-40GHz)	R&S	SMR40	BSL007	Sep. 28 2014	1 Year
Band filter	Amindeon	82346	BSL049	Aug. 27 2014	1 Year
Active Loop Antenna	EMTES	EM15	BSL011	Sep. 28 2014	1 Year
Coaxial Switch	YUANFANG	TA218B	BSL004	Aug. 27 2014	1 Year
Spectrum analyzer	Rohde & Schwarz	FSP40	BSL049	Sep. 28 2014	1 Year

5. ANTENNA REQUIREMENT

5.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, 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.

5.2. Antenna Connected Construction

According to § 15.203, 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 shall be considered sufficient to comply with the provisions of this section. 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.

The antenna used in this product is PCB ANT. The antenna is permanently attached. Refer to the product photo.

5.3. Result

Compliance

6. CONDUCTED POWER LINE TEST

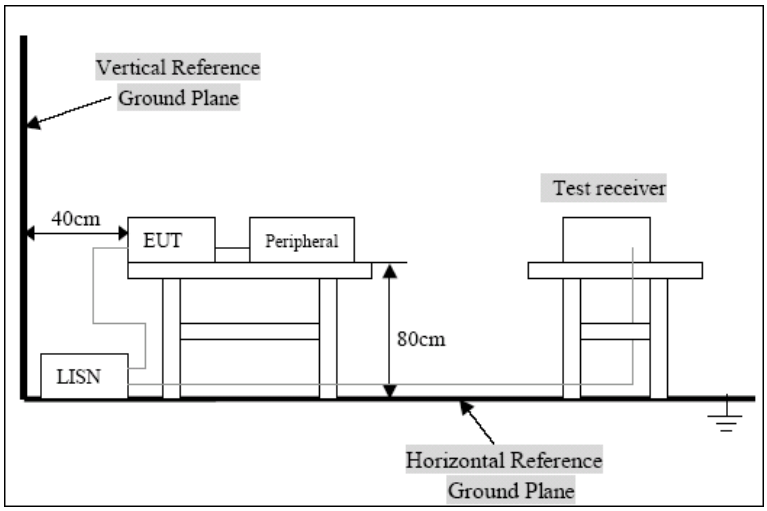
6.1. Test Equipment

Please refer to section 4 this report.

6.2. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.).This provides a 50ohm/50uh coupling inpedance for the measuring equipment.The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uh coupling inpedance with 50ohm termination.
Both sides of A.C. Line are check 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 ASIN C63.4:2003 on conducted measurement .Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

6.3. Test Setup



For the actual test configuration,Please refer to the related items-Photos of testing

6.4. Conducted Power line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuV)		
Frequency Range (MHZ)	Class A QP/AV	Class B QP/AV
0.15-0.5	79/66	65-56/56-46
0.5-5.0	73/60	56-46
5.0-3.0	73/60	60-50

Note: In the above table, the tighter limit applies at the band edges.

6.5. Conducted Power Line Test Result

Not: This EUT is powered by battery only, therefore this test item is not applicable.

7. RADIATED EMISSION TEST

7.1. Test Equipment

Please refer to section 4 this report.

7.2. Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level.

Calibrated Loop antenna is used as receiving antenna for frequencies below 30MHz, Calibrated Bilog antenna is used as receiving antenna for frequencies between 30 MHz and 1 GHz, Calibrated Horn antenna is used as receiving antenna for frequencies above 1000MHz. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.4: 2003 on radiated emission measurement.

The bandwidth of test receiver is set at 9kHz in below 30MHz. and set at 120kHz in 30-1000MHz, and 1MHz in above 1000MHz.

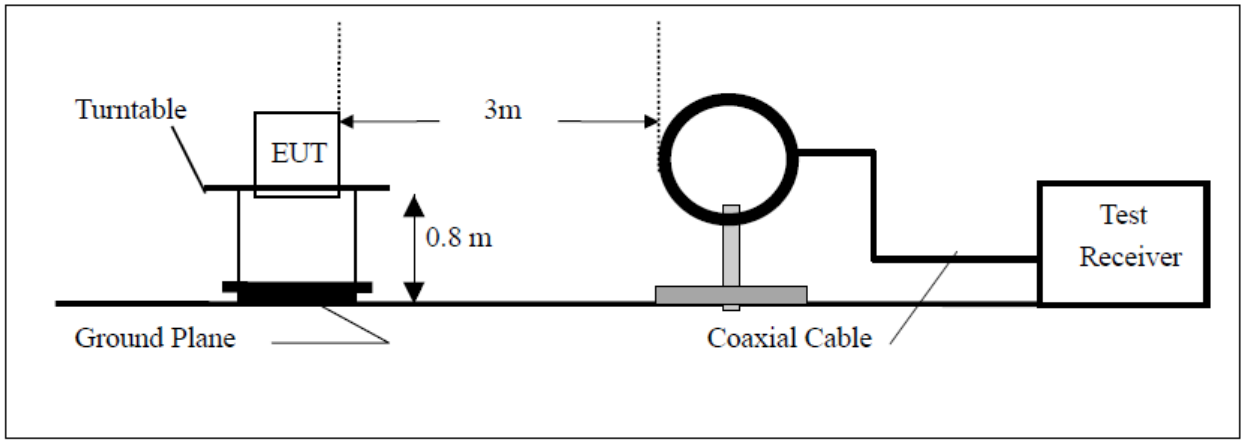
The frequency range from 9kHz to 25GHz is checked.

The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Peak detector and Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.

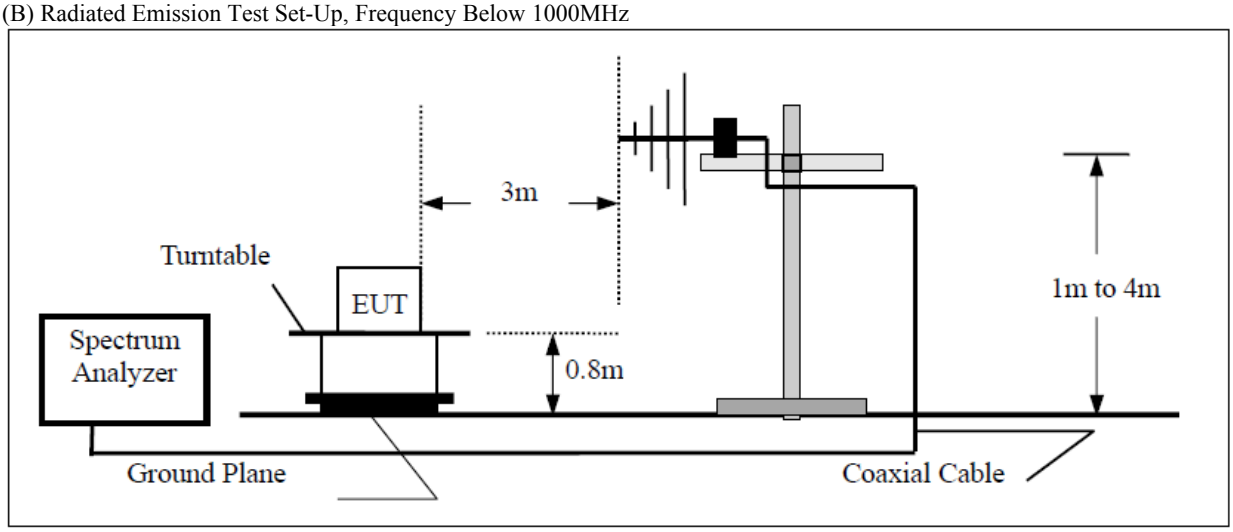
Through three orthogonal axes to determine which attitude and equipment arrangement produces the highest emission relative to the limit. And X direction is worst mode.

7.3. Radiated Test Setup

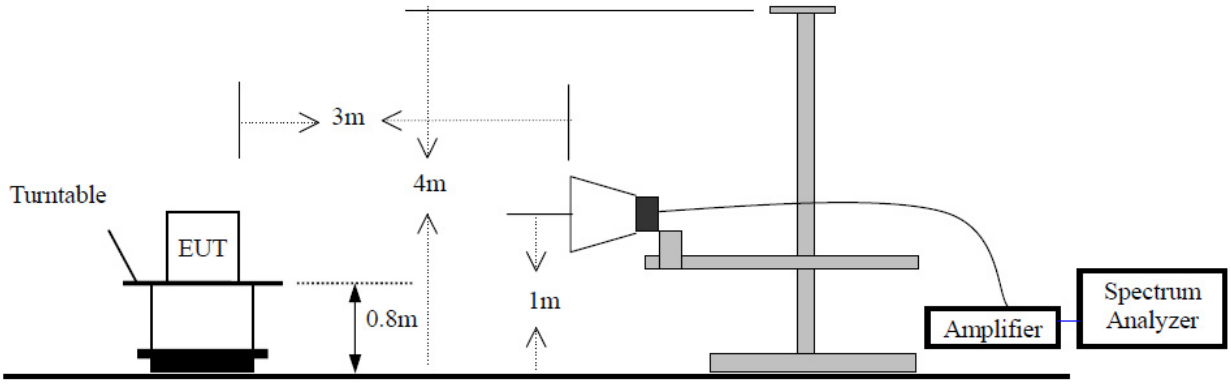
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



7.4. Radiated Emission Limit

All emission from a digital device,including any network of conductors and apparatus connected thereto,shall not exceed the level of field strength specified below :

A. Fundamental and Harmonics Radiated Emissions 15.249(a) Limit

Fundamental Frequency (MHZ)	Field as trength of Fundamental(3m)			Field as trength of Harmonics(3m)		
	mV/m	dBuV/m		uV/m	dBuV/m	
902-928	50	94(AV)	114(Peak)	500	54(AV)	74(Peak)
2400-2483.5	50	94(AV)	114(Peak)	500	54(AV)	74(Peak)

Note: (1) RF Voltage (dBuV)=20 log Voltage(uV)

(2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

(3) The emission limit in this paragraph os based on measurement instrumentation employing an average detector.Measurement using instrumentation with a peak detector function,corresponding to 20dB above the maximum permitted average limit.

B. Spurious Radiated Emissions.

Frequency (MHz)	Limit			
	Field Strength of Quasi-peak Value (microvolts/m)	Field Strength of Quasi-peak Value (dBμV/m)	Measurement distance (m)	The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.
0.009 - 0.490	2400/F(kHz)	/	300	
0.490 - 1.705	24000/F(kHz)	/	30	
1.705-30	30	29.5	30	
30 - 88	100	40	3	
88 - 216	150	43.5	3	
216 - 960	200	46	3	
Above 960	500	54	3	

Note: (1) RF Voltage (dBuV)=20 log Voltage(uV)

(2) In the Above Table,the tighter limit applies at the band edges.

(3) Distaqnce refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

7.5. Radiated Emission Test Result

Pass

A. Fundamental Radiated Emissions Data

CH Low

Freq. (MHz)	Read Level (dBuV) AV/PK	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission (dBuV/m) AV/PK	HORIZ/ VERT	Limits (dBuV/m) AV/PK	Margin (dB)
2412	78/87.73	27.47	5.42	30.17	80.72/90.45	VERT	94/114	-13.28/-23.55
2412	80.11/89.62	27.47	5.42	30.17	82.83/92.34	HORIZ	94/114	-11.17/-21.66

CH Middle

Freq. (MHz)	Read Level (dBuV) AV/PK	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission (dBuV/m) AV/PK	HORIZ/ VERT	Limits (dBuV/m) AV/PK	Margin (dB)
2443	79.16/88.23	27.40	5.40	30.15	81.81/90.88	VERT	94/114	-12.19/-23.12
2443	80.34/89.84	27.40	5.40	30.15	82.99/92.49	HORIZ	94/114	-11.01/-21.51

CH High

Freq. (MHz)	Read Level (dBuV) AV/PK	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission (dBuV/m) AV/PK	HORIZ/ VERT	Limits (dBuV/m) AV/PK	Margin (dB)
2475	77.86/86.96	27.50	5.46	29.98	80.84/89.94	VERT	94/114	-13.16/-24.06
2475	79.8/88.91	27.50	5.46	29.98	82.78/91.89	HORIZ	94/114	-11.22/-22.11

Remark:
Final Emission =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

B. General Radiated Emissions Data

For below 9kHz-30MHz Spurious

Freq. (MHz)	Emission(dBuV/m) PK / AV	Limits(dBuV/m) PK / AV	Margin (dB)
-	-	-	-
-	-	-	-

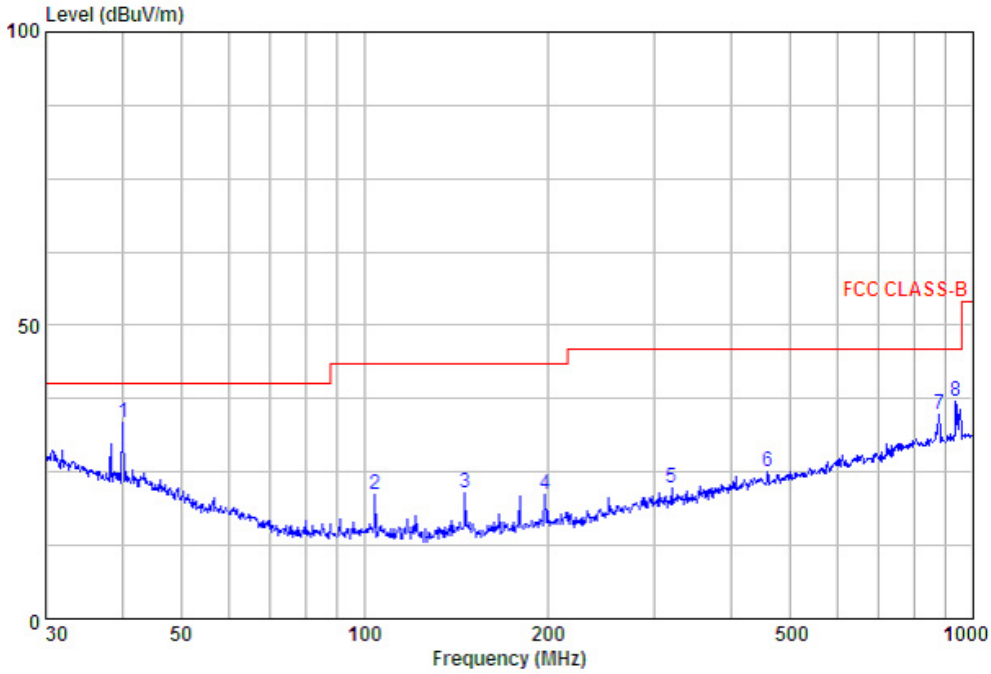
Note:

1. Emissions attenuated more than 20 dB below the permissible value are not reported.

For 30M-1000MHz Spurious

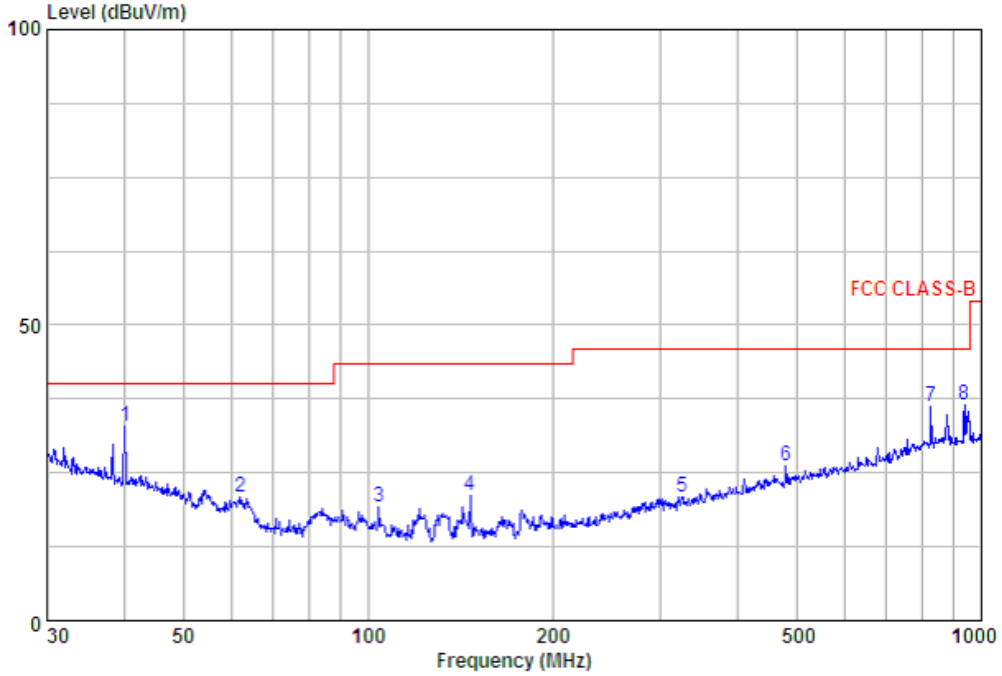
Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

2443M*Hz Transmitting(Worst case mode*)



Condition : FCC CLASS-B 3m HORIZONTAL
: RBW:120.000KHz VBW:300.000KHz SWT:Auto

	Freq	Limit Line	Level	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1 max	40.13	40.00	33.43	-6.57	QP	HORIZONTAL
2	104.17	43.50	21.28	-22.22	QP	HORIZONTAL
3	146.37	43.50	21.41	-22.09	QP	HORIZONTAL
4	197.89	43.50	21.22	-22.28	QP	HORIZONTAL
5	319.94	46.00	22.36	-23.64	QP	HORIZONTAL
6	459.11	46.00	25.05	-20.95	QP	HORIZONTAL
7	878.32	46.00	34.72	-11.28	QP	HORIZONTAL
8	935.55	46.00	37.01	-8.99	QP	HORIZONTAL



Condition : FCC CLASS-B 3m VERTICAL
: RBW:120.000KHz VBW:300.000KHz SWT:Auto

	Freq	Limit Line	Level	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1 max	40.13	40.00	32.93	-7.07	QP	VERTICAL
2	62.00	40.00	20.81	-19.19	QP	VERTICAL
3	104.17	43.50	19.30	-24.20	QP	VERTICAL
4	146.89	43.50	21.31	-22.19	QP	VERTICAL
5	325.60	46.00	20.99	-25.01	QP	VERTICAL
6	480.53	46.00	26.11	-19.89	QP	VERTICAL
7	827.49	46.00	36.09	-9.91	QP	VERTICAL
8	938.83	46.00	36.59	-9.41	QP	VERTICAL

For 1000MHz-25000MHz Spurious

CH Low

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4824	35.95/45.88	VERT	54.0/74.0	-18.05/-28.12
7236	39.91/49.88		54.0/74.0	-14.09/-24.12
9648	37.9/47.9		54.0/74.0	-16.1/-26.1
4824	34.82/46.49	HORIZ	54.0/74.0	-19.18/-27.51
7236	42.36/52.36		54.0/74.0	-11.64/-21.64
9648	43.85/53.85		54.0/74.0	-10.15/-20.15

CH Middle

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4886	30.85/40.93	VERT	54.0/74.0	-23.15/-33.07
7329	36.74/46.69		54.0/74.0	-17.26/-27.31
9772	35.67/45.7		54.0/74.0	-18.33/-28.3
4886	30.93/40.96	HORIZ	54.0/74.0	-23.07/-33.04
7329	39/49		54.0/74.0	-15/-25
9772	43.74/53.73		54.0/74.0	-10.26/-20.27

CH High

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4950	33.95/43.99	VERT	54.0/74.0	-20.05/-30.01
7425	37.82/47.82		54.0/74.0	-16.18/-26.18
9900	38.86/48.95		54.0/74.0	-15.14/-25.05
4950	33.22/43.22	HORIZ	54.0/74.0	-20.78/-30.78
7425	37.91/47.92		54.0/74.0	-16.09/-26.08
9900	39.91/50		54.0/74.0	-14.09/-24

Note:

1. The average measurement was not performed when the peak measured data under the limit of average detection.
2. Emissions attenuated more than 20 dB below the permissible value are not reported.

8. BAND EDGE

8.1. Test Equipment

Please refer to Section 4 this report.

8.2. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4: 2003 on radiated measurement. The bandwidth setting below 1GHz and above 1GHz on the field strength meter is 120 kHz and 1MHz respectively.

8.3. Band Edge FCC 15.249(d) Limit

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.

8.4. Band Edge Test Result

Pass

ALL of the restriction bands were tested,and only the data of worst case was exhibited.

CH Low

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
2390	34.57/42.36	VERT	54.0/74.0	-19.43/-31.64
2400	39.84/49.26		54.0/74.0	-14.16/-24.74
2390	35.3/44.37	HORIZ	54.0/74.0	-18.7/-29.63
2400	37.53/50.48		54.0/74.0	-16.47/-23.52

CH High

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
2483.5	34.3/45.63	VERT	54.0/74.0	-19.7/-28.37
2500.00	31.33/41.22		54.0/74.0	-22.67/-32.78
2483.5	35.66/46.22	HORIZ	54.0/74.0	-18.34/-27.78
2500.00	32.22/40.37		54.0/74.0	-21.78/-33.63

Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.

9. 20-DB BANDWIDTH

9.1. Test Equipment

Please refer to Section 4 this report.

9.2. Test Procedure

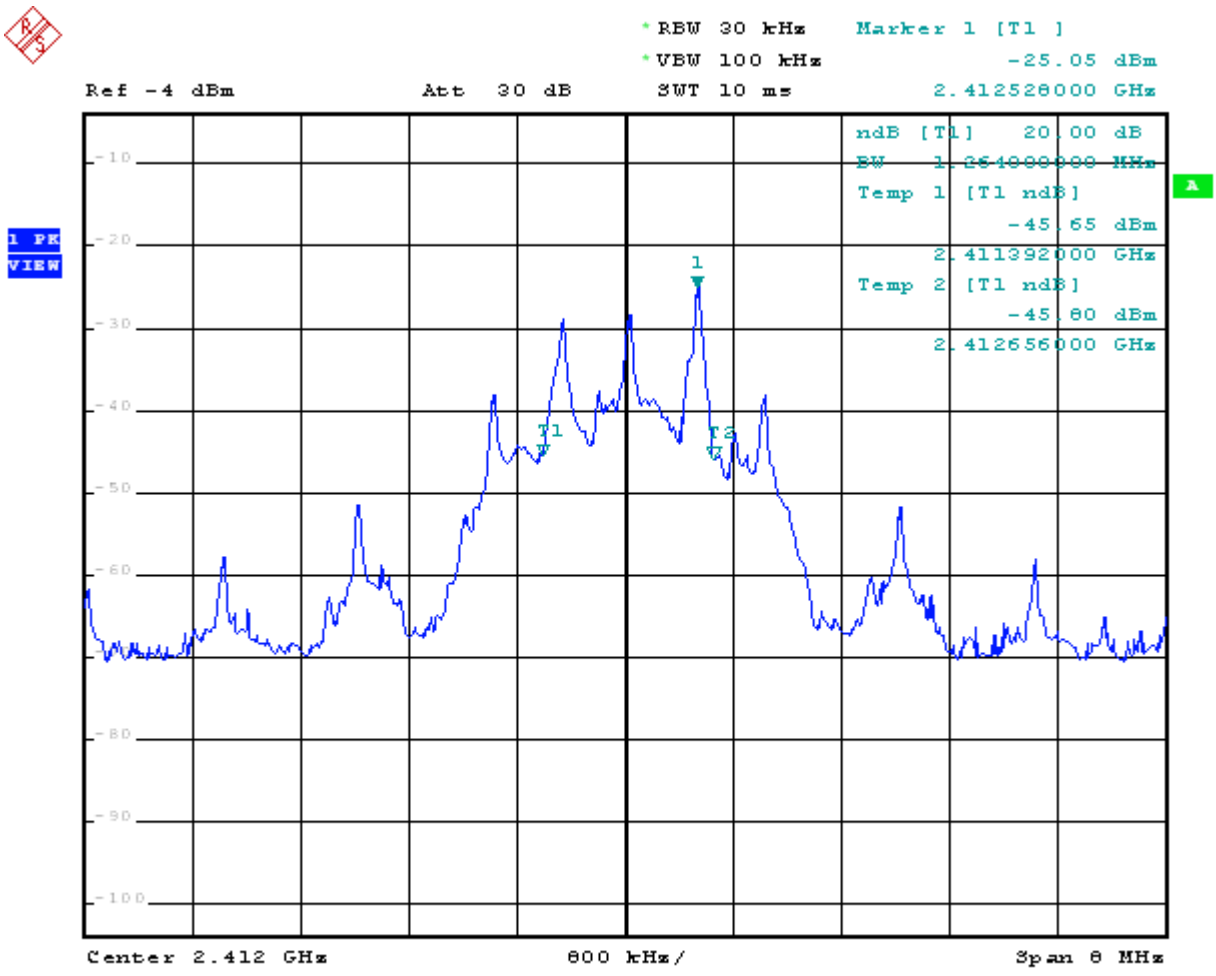
1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. The spectrum analyzer as RBW=30 KHz, VBW=100 KHz, Sweep=auto
4. Mark the peak frequency and –20dB (upper and lower) frequency.

9.3. Limit

Please refer section15.249

9.4. Test Result /Plots

Limit	Channel Frequency (MHz)	20dB Bandwidth (MHz)
/	2412	1.264
/	2443	1.28
/	2475	1.28



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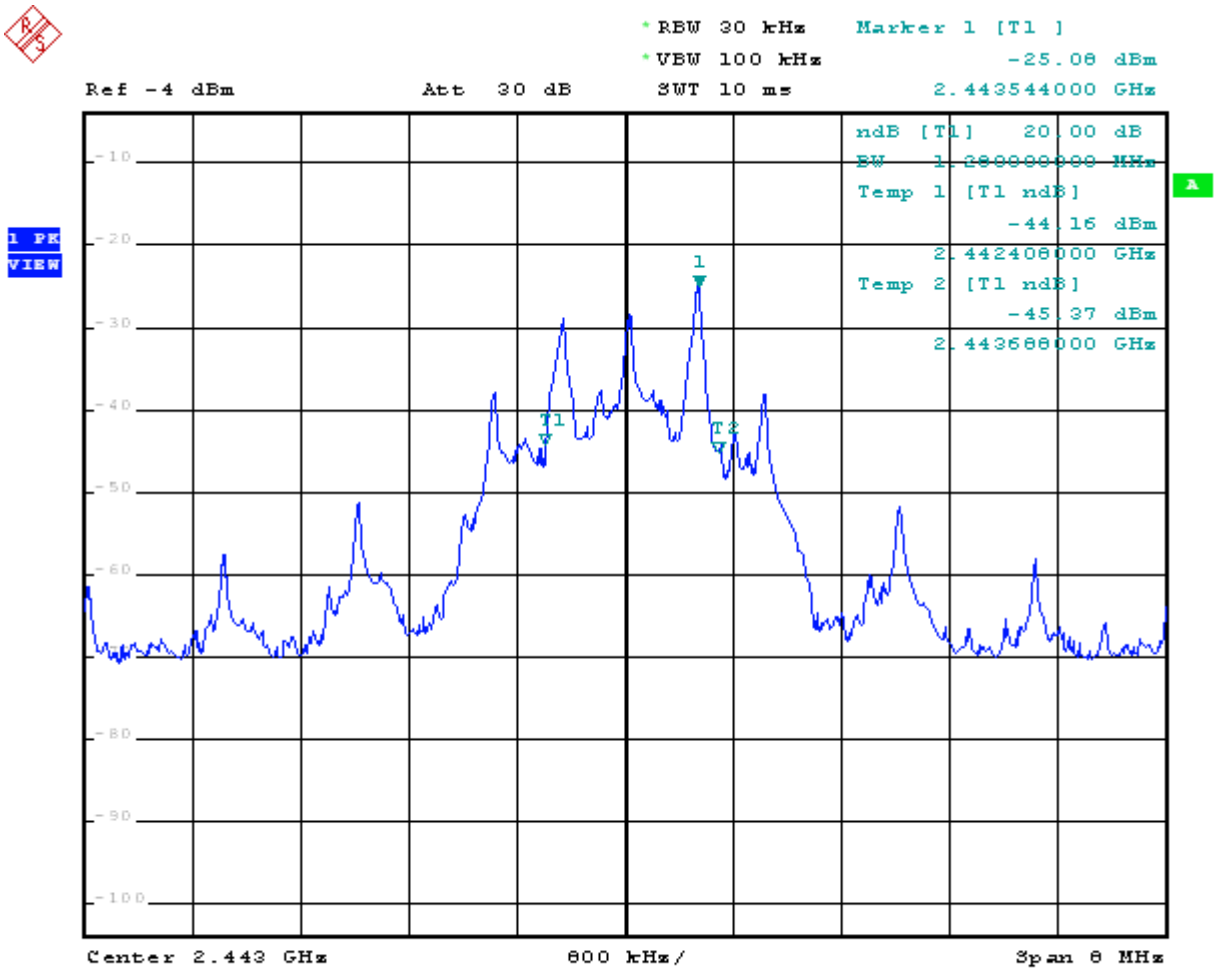

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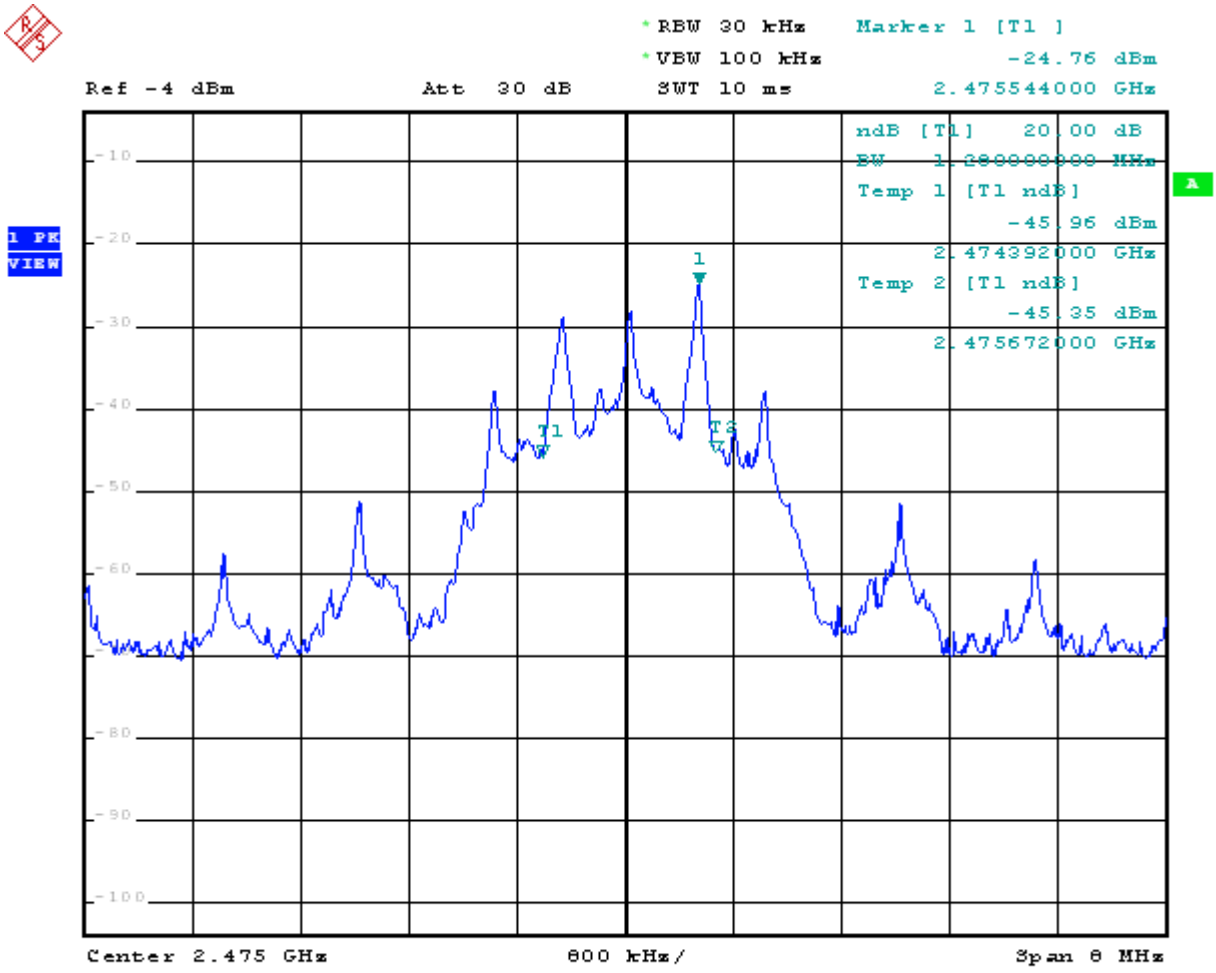

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