

FCC PART 15.249
EMI MEASUREMENT AND TEST REPORT

For

Shenzhen Suoai Electronics & Technology Co.,Ltd
No.213 Fuyuan Road, No.1 Fenghuang Industry Area, Baoan District, Shenzhen, China

FCC ID: 2ABLISI928

December 19, 2013

This Report Concerns: Original Report	Equipment Type: wireless mouse
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Report No.:	BSL13071015Y-1ER-58
Receive EUT Date/Test Date:	December 01 , 2013/ December 01 - December 19, 2013
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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 $y \pm U$, where expanded 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 mouse
Applicant	:	Shenzhen Suoai Electronics & Technology Co.,Ltd No.213 Fuyuan Road, No.1 Fenghuang Industry Area, Baoan District, Shenzhen, China
Manufacturer	:	Shenzhen Suoai Electronics & Technology Co.,Ltd No.213 Fuyuan Road, No.1 Fenghuang Industry Area, Baoan District, Shenzhen, China
Model Number	:	SI928,SI960,SI980,SI989,SI983,SI916,SI959,SI963,SI966,SI956
Modulation type	:	GFSK
Antenna gain	:	0dBi
Frequency	:	2403-2479MHz
Number of Channels	:	39 Channels
data rate	:	1Mbps
Power Supply	:	Transmitting:DC 1.5V By battery (The new battery is used during the measurement)

The series products, model name: SI928,SI960,SI980,SI989,SI983,SI916,SI959,SI963,SI966,SI956 have the same circuit diagram,PCB layout, software, RF Module, Features and functionality. The differences are the model name, so, we select wireless mouse SI928 to test.

1CH	2403 GHZ	14CH	2429 GHZ	27CH	2455 GHZ
2CH	2405 GHZ	15CH	2431 GHZ	28CH	2457 GHZ
3CH	2407 GHZ	16CH	2433 GHZ	29CH	2459 GHZ
4CH	2409 GHZ	17CH	2435 GHZ	30CH	2461 GHZ
5CH	2411 GHZ	18CH	2437 GHZ	31CH	2463 GHZ
6CH	2413 GHZ	19CH	2439 GHZ	32CH	2465 GHZ
7CH	2415 GHZ	20CH	2441 GHZ	33CH	2467 GHZ
8CH	2417 GHZ	21CH	2443 GHZ	34CH	2469 GHZ
9CH	2419 GHZ	22CH	2445 GHZ	35CH	2471 GHZ
10CH	2421 GHZ	23CH	2447 GHZ	36CH	2473 GHZ
11CH	2423 GHZ	24CH	2449 GHZ	37CH	2475 GHZ
12CH	2425 GHZ	25CH	2451 GHZ	38CH	2477 GHZ
13CH	2427 GHZ	26CH	2453 GHZ	39CH	2479 GHZ

2.2. Block Diagram of EUT Configuration

Radiated emissions test



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 (°C)	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 15.249:2012

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.

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 2013	1 Year
EMI Test Receiver	Rohde & Schwarz	ESCI3	BSL001	Sep. 28 2013	1 Year
BiConiLog Antenna	Rohde & Schwarz	HL562	BSL009	Sep. 28 2013	1 Year
Double -ridged waveguide horn	Rohde & Schwarz	9120D	BSL008	Aug. 27 2013	1 Year
Horn Antenna	ETS-LINDGREN	3160	BSL072	Dec. 28 2012	1 Year
Cable	Rohde & Schwarz	N/A	BSL045	Aug. 27 2013	1 Year
Cable	Rohde & Schwarz	N/A	BSL046	Aug. 27 2013	1 Year
Cable	Rohde & Schwarz	N/A	BSL047	Aug. 27 2013	1 Year
Amplifier(100kHz-40G Hz)	R&S	SMR40	BSL007	Sep. 28 2013	1 Year
Band filter	Amindeon	82346	BSL049	Aug. 27 2013	1 Year
Active Loop Antenna	EMTES	EM15	BSL011	Sep. 28 2013	1 Year
Coaxial Switch	YUANFANG	TA218B	BSL004	Aug. 27 2013	1 Year
Spectrum analyzer	Rohde & Schwarz	FSP40	BSL049	Sep. 28 2013	1 Year
EMI TEST SOFTWARE	AUDIX	E3	N/A	N/A	N/A

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 antenna. The antenna is permanently attached. Refer to the product photo.

5.3. Result

Compliance

6. CONDUCTED POWER LINE TEST

6.1. Test Equipment

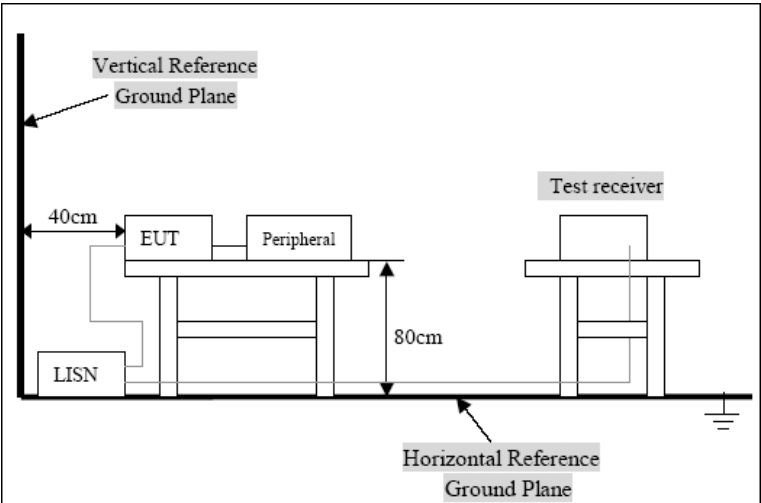
Please refer to section 4 this report.

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 applicable

Power Supply:DC 1.5V By battery

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.

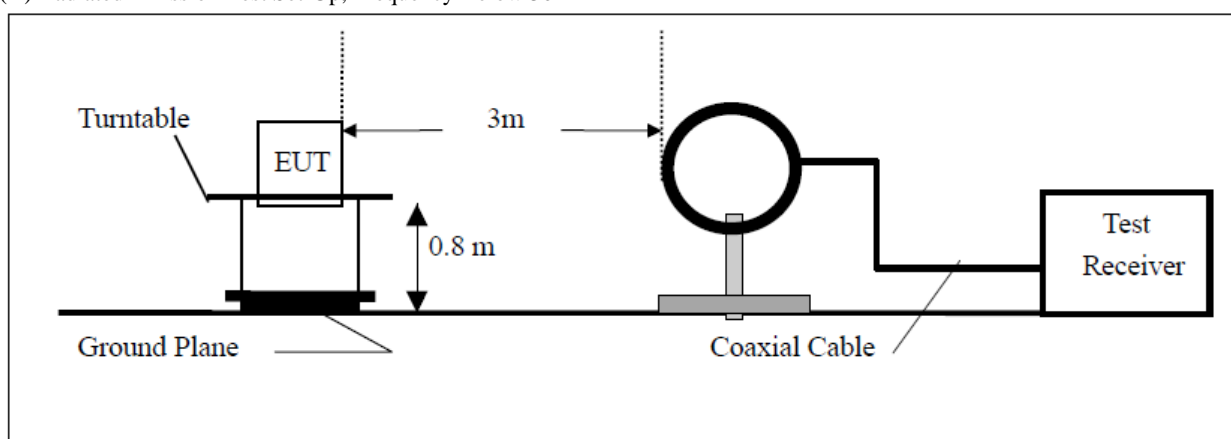
The frequency range from 9kHz to 25GHz is checked.

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.

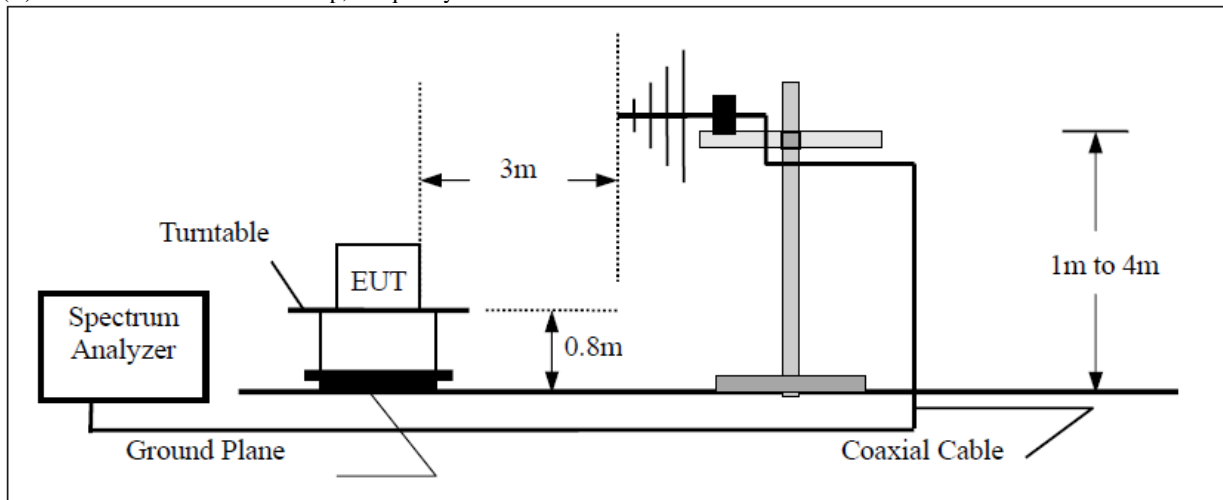
Through three orthogonal axes to determine which attitude and equipment arrangement produces the highest emission relative to the limit. And X direction is worst mode

7.3. Radiated Test Setup

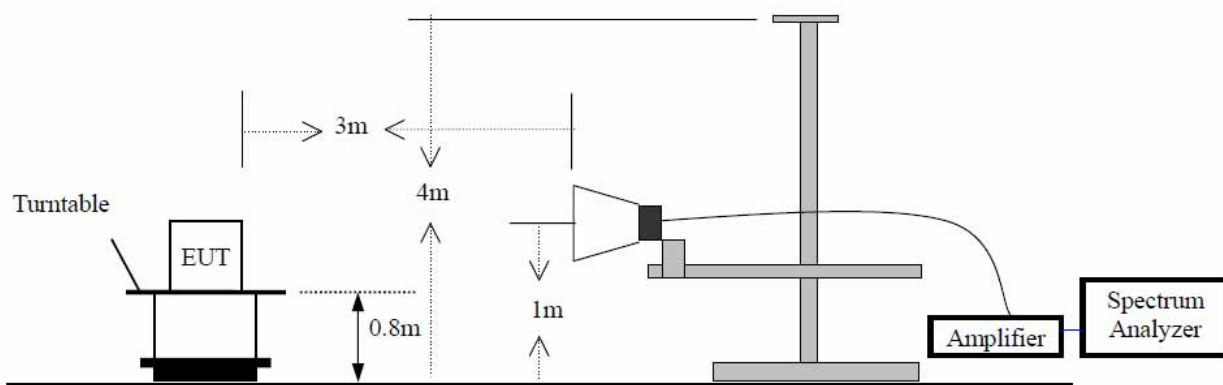
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(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			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.
	Field Strength of Quasi-peak Value (microvolts/m)	Field Strength of Quasi-peak Value (dBμV/m)	Measurement distance (m)	
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)
2403	62.63/86.07	27.47	5.42	30.17	65.35/88.79	VERT	94/114	-28.65/-25.21
2403	68.78/91.55	27.47	5.42	30.17	71.5/94.27	HORIZ	94/114	-22.5/-19.73

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)
2441	62.53/86.27	27.40	5.40	30.15	65.18/88.92	VERT	94/114	-28.82/-25.08
2441	69.36/92.58	27.40	5.40	30.15	72.01/95.23	HORIZ	94/114	-21.99/-18.77

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)
2479	61.22/85.99	27.50	5.46	29.98	64.2/88.97	VERT	94/114	-29.8/-25.03
2479	69.37/92.8	27.50	5.46	29.98	72.35/95.78	HORIZ	94/114	-21.65/-18.22

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)
-	-	-	-
-	-	-	-

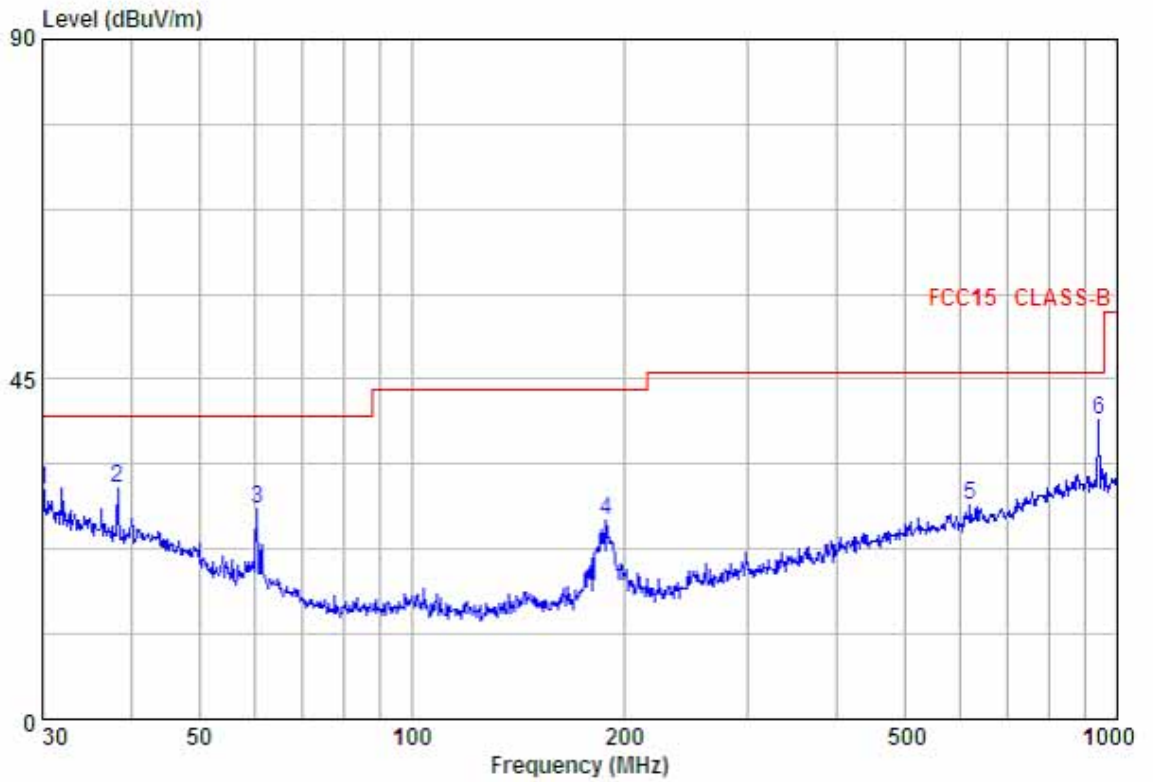
Note:

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

For 30M-1000MHz Spurious

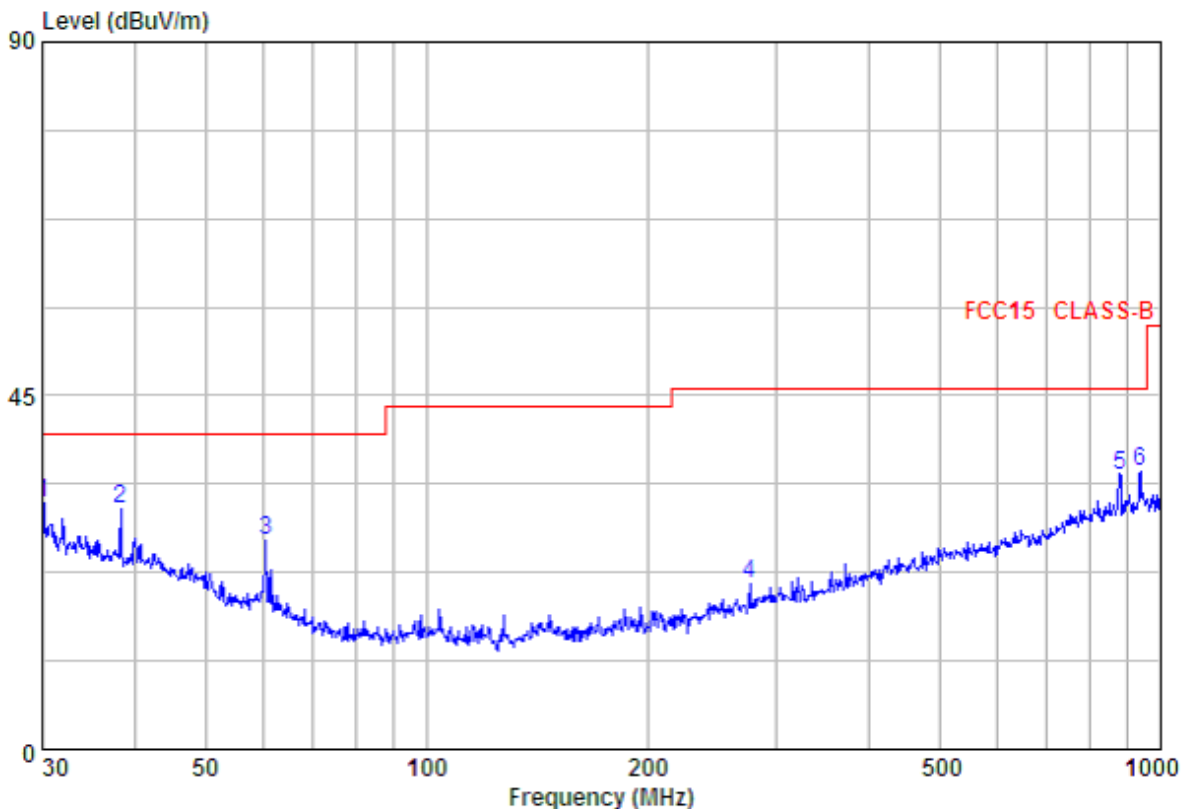
$$\text{Corrected Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

Transmitting



Condition : FCC15 CLASS-B 3m VERTICAL
 : RBW:120.000KHz VBW:300.000KHz SWT:Auto

	Freq	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1	30.11	30.42	40.00	-9.58	QP	VERTICAL
2	38.35	30.59	40.00	-9.41	QP	VERTICAL
3	60.49	27.85	40.00	-12.15	QP	VERTICAL
4	188.41	26.38	43.50	-17.12	QP	VERTICAL
5	618.54	28.27	46.00	-17.73	QP	VERTICAL
6 max	942.13	39.56	46.00	-6.44	QP	VERTICAL



Condition : FCC15 CLASS-B 3m HORIZONTAL
 : RBW:120.000KHz VBW:300.000KHz SWT:Auto

	Freq	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1 max	30.11	31.34	40.00	-8.66	QP	HORIZONTAL
2	38.35	30.59	40.00	-9.41	QP	HORIZONTAL
3	60.49	26.47	40.00	-13.53	QP	HORIZONTAL
4	276.12	21.10	46.00	-24.90	QP	HORIZONTAL
5	881.41	34.95	46.00	-11.05	QP	HORIZONTAL
6	938.83	35.44	46.00	-10.56	QP	HORIZONTAL

For 1000MHz-25000MHz Spurious

CH Low

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4806	41.51/57.23	VERT	54.0/74.0	-12.49/-16.77
7209	41.8/55.77		54.0/74.0	-12.2/-18.23
9612	40.96/55.24		54.0/74.0	-13.04/-18.76
4806	42.9/58.29	HORIZ	54.0/74.0	-11.1/-15.71
7209	42.06/57.34		54.0/74.0	-11.94/-16.66
9612	41.93/57.19		54.0/74.0	-12.07/-16.81

CH Middle

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4882	43.91/56.34	VERT	54.0/74.0	-10.09/-17.66
7323	42.4/56.18		54.0/74.0	-11.6/-17.82
9764	42.8/57.21		54.0/74.0	-11.2/-16.79
4882	44.21/58.4	HORIZ	54.0/74.0	-9.79/-15.6
7323	43.53/57.27		54.0/74.0	-10.47/-16.73
9764	42.91/56.85		54.0/74.0	-11.09/-17.15

CH High

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4958	42.41/58.07	VERT	54.0/74.0	-11.59/-15.93
7437	41.96/57.41		54.0/74.0	-12.04/-16.59
9916	42.24/56.76		54.0/74.0	-11.76/-17.24
4958	45.42/58.55	HORIZ	54.0/74.0	-8.58/-15.45
7437	44.23/57.87		54.0/74.0	-9.77/-16.13
9916	43.57/57.18		54.0/74.0	-10.43/-16.82

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	35.39/45.11	VERT	54.0/74.0	-18.61/-28.89
2400	45.68/61.65		54.0/74.0	-8.32/-12.35
2390	33.78/42.17	HORIZ	54.0/74.0	-20.22/-31.83
2400	44.94/61.22		54.0/74.0	-9.06/-12.78

CH High

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
2483.5	41.29/49.95	VERT	54.0/74.0	-12.71/-24.05
2500.00	36.84/49.29		54.0/74.0	-17.16/-24.71
2483.5	40.3/49.43	HORIZ	54.0/74.0	-13.7/-24.57
2500.00	36.11/47.75		54.0/74.0	-17.89/-26.25

Remark:

- 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 section 15.249

9.4. Test Result /Plots

Limit	Channel Frequency (MHz)	20dB Bandwidth (MHz)
/	2403	0.990
/	2441	1.010
/	2479	0.980

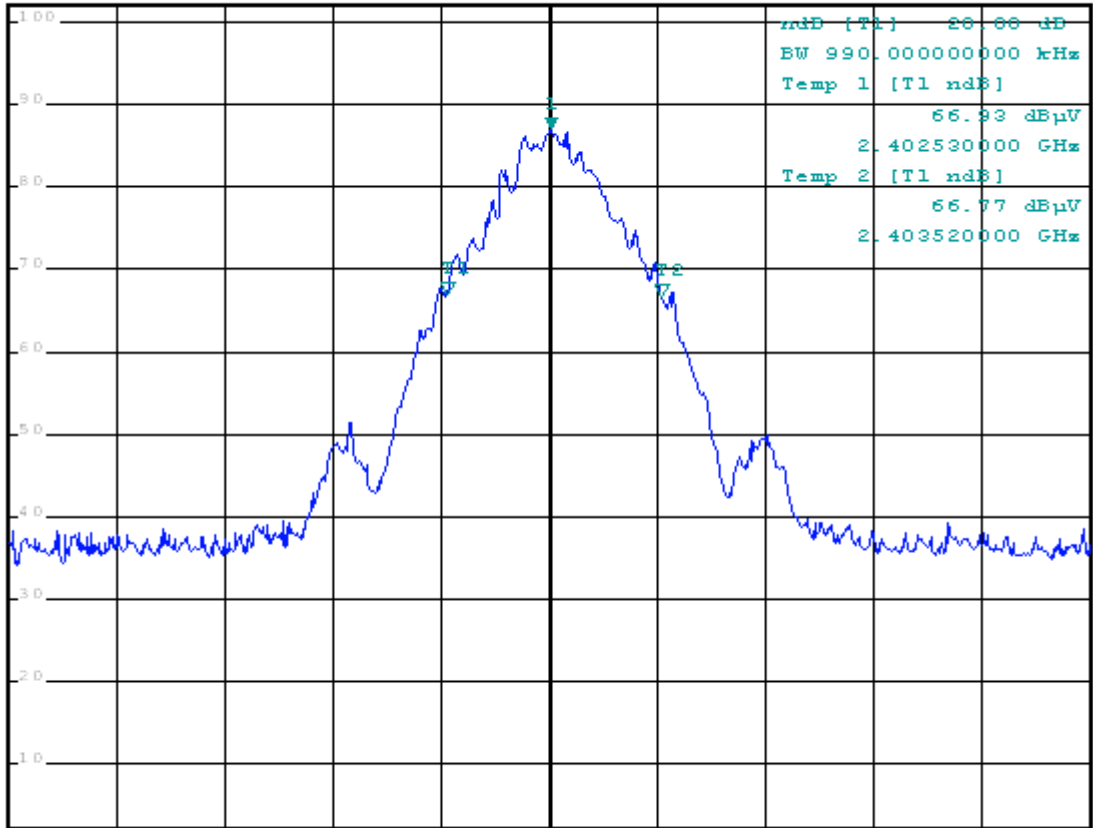


*RBW 30 kHz Marker 1 [T1]
 *VBW 100 kHz 66.85 dBμV
 *SWT 10 ms 2.403010000 GHz

Ref 102 dBμV

Att 30 dB

1 PR
VIEW



Center 2.403 GHz

500 kHz/

Span 5 MHz

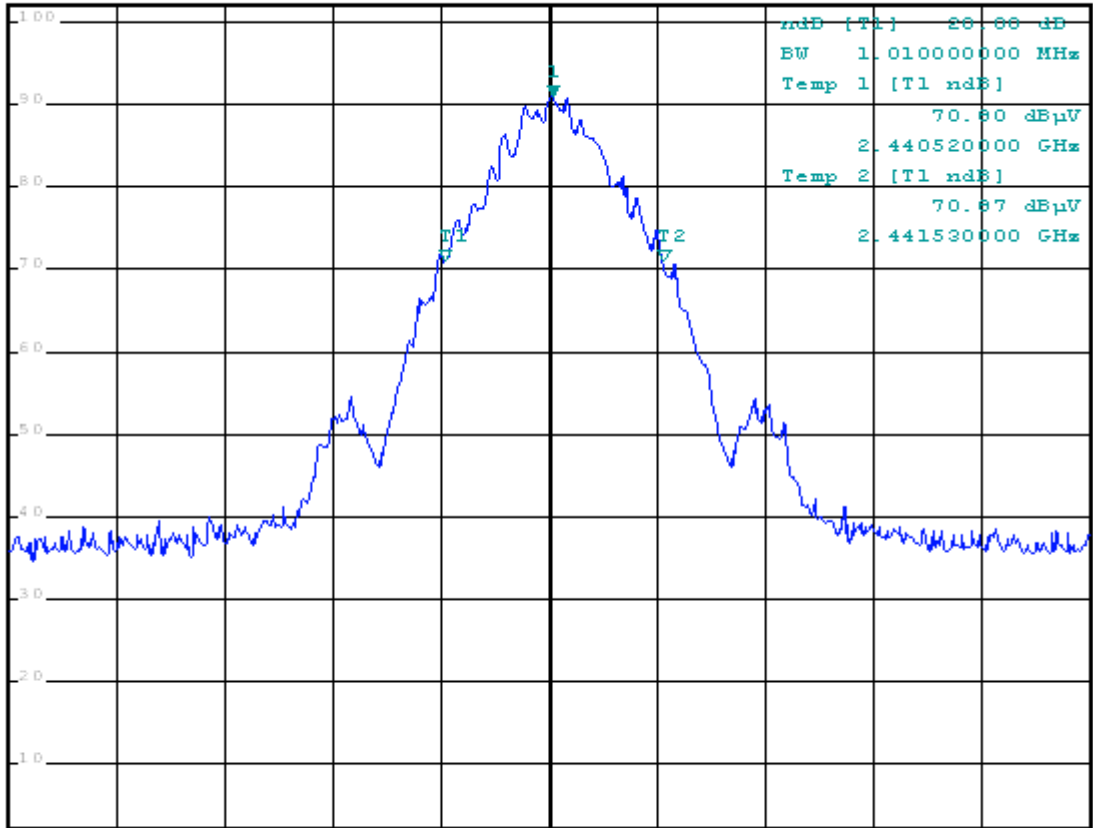


*RBW 30 kHz Marker 1 [T1]
*VBW 100 kHz 90.89 dBμV
*SWT 10 ms 2.441020000 GHz

Ref 102 dBμV

Att 30 dB

1 PR
VIEW



Center 2.441 GHz

500 kHz/

Span 5 MHz

A

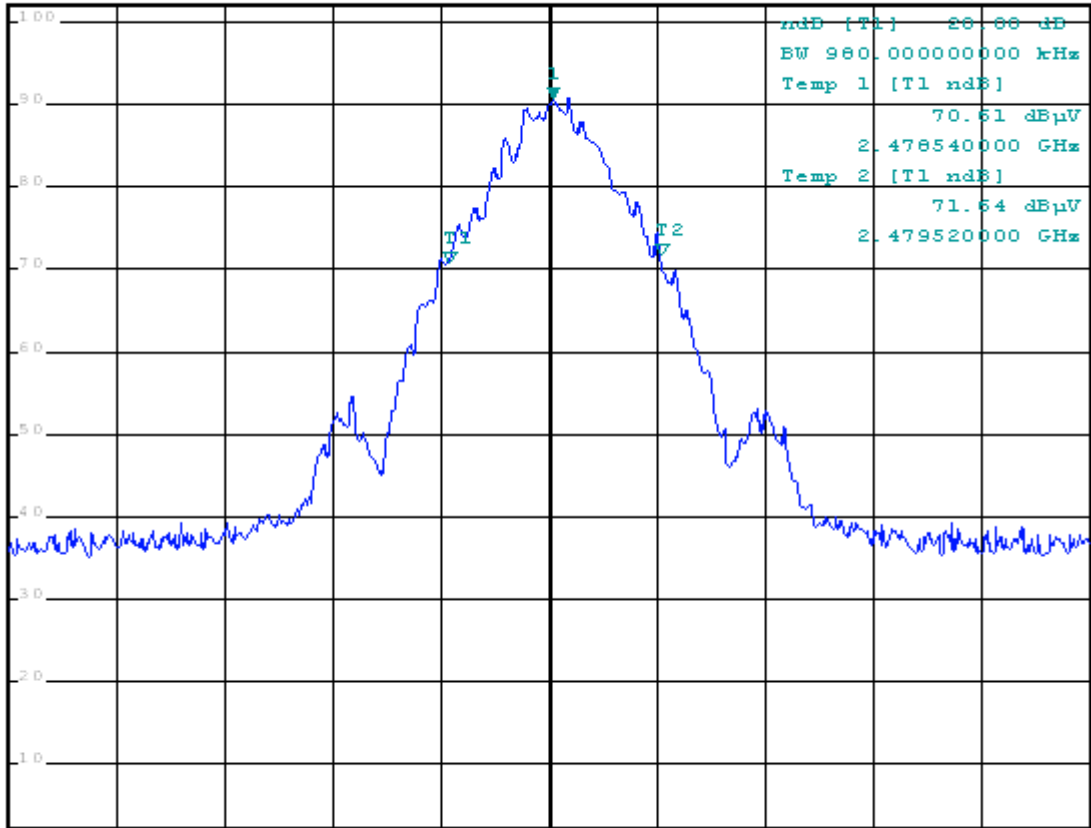


*RBW 30 kHz Marker 1 [T1]
 *VBW 100 kHz 90.62 dBμV
 *SWT 10 ms 2.479020000 GHz

Ref 102 dBμV

Att 30 dB

1 PR
 VIEW



ndB [T1] 20.00 dB
 BW 980.000000000 kHz
 Temp 1 [T1 ndB] 70.61 dBμV
 2.478540000 GHz
 Temp 2 [T1 ndB] 71.64 dBμV
 2.479520000 GHz

Center 2.479 GHz

500 kHz/

Span 5 MHz

End Of The Report