

FCC PART 15.249
EMI MEASUREMENT AND TEST REPORT
 For
ATEK (CHINA) ELECTRONICS COMPANY LIMITED
 A2 BUILDING, LIANHE INDUSTRIAL PARK, FENGTANG ROAD, FUYONG TOWN,
 SHENZHEN, CHINA

FCC ID: RKRMX21

January 17, 2013

This Report Concerns: Original Report	Equipment Type: Wireless Mouse
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Test Engineer of performing the tests:	Hans Hu <i>Hans.Hu</i>
Report No.:	BST12121041Y-1ER-3
Receive EUT Date/Test Date:	December 24, 2012 / December 24, 2012- January 17, 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 BST approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that BST 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, BST 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 BST, unless the applicant has authorized BST in writing to do so.

Test Facility -

The test site used to collect the data is located on the address of
Global United Technology Service Co., Ltd
(FCC Registered Test Site Number: 600491) on
2nd Floor, Block No.2, Laodong Industrial Zone, Xixiang Road Baoan District,
Shenzhen, China 518102

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	$\pm 1.38\text{dB}$
2	RF power,conducted	$\pm 0.16\text{dB}$
3	Spurious emissions,conducted	$\pm 0.21\text{dB}$
4	All emissions,radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$

2. PRODUCT DESCRIPTION

2.1. EUT Description

Description	: Wireless Mouse
Applicant	: ATEK (CHINA) ELECTRONICS COMPANY LIMITED A2 BUILDING, LIANHE INDUSTRIAL PARK, FENGTANG ROAD, FUYONG TOWN, SHENZHEN, CHINA
Manufacturer	: ATEK (CHINA) ELECTRONICS COMPANY LIMITED A2 BUILDING, LIANHE INDUSTRIAL PARK, FENGTANG ROAD, FUYONG TOWN, SHENZHEN, CHINA
Model Number	: MX21, MX6600, MX6900, MX6800, MX22 , MX23 , MX24, MX25, MX26, MX8800, MX8600, MX12, MX7700, MX800, MX3500, MX3600, MX202, MX2500, MX2401, MX207, MX262, MX2520, MX1500, MX1200, MX1000, RX-211, RX212, MX8, MX6, MX5, MX2520, MX8900, MX9900, MX9930, MX9310, MX7800, MX7900, MX2800, MX3800, MX8200 , MX8100, MX9000, MX7000, LM-WM1, MX5200 , MX5000, MX6300, MX3200, MX2560, MX6601
Modulation type	: GFSK
Frequency	: 2402-2480MHz
Number of Channels	: 16 Channels
Power Supply	: DC 3V By battery

The series products, model name: MX21, MX6600, MX6900, MX6800, MX22 , MX23 , MX24, MX25, MX26, MX8800, MX8600, MX12, MX7700, MX800, MX3500, MX3600, MX202, MX2500, MX2401, MX207, MX262, MX2520, MX1500, MX1200, MX1000, RX-211, RX212, MX8, MX6, MX5, MX2520, MX8900, MX9900, MX9930, MX9310, MX7800, MX7900, MX2800, MX3800, MX8200 , MX8100, MX9000, MX7000, LM-WM1, MX5200 , MX5000, MX6300, MX3200, MX2560, MX6601 have the same circuit diagram, PCB layout, software, RF Module, Features and functionality. The differences are the model name, so, we select MX21 to test.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	5	2424	9	2444
2	2409	6	2428	10	2447
3	2416	7	2438	11	2455
4	2421	8	2441	12	2465
13	2461	14	2468	15	2475
16	2480				

2.2. Block Diagram of EUT Configuration



Figure 1 EUT Setup

2.3. Support Equipment List

Name	Model No	S/N	Manufacturer	Used "Yes/No"
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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

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

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	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	Mar. 30 2012	1 Year
Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	Jul. 04 2012	1 Year
BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRO NIK	VULB9163	GTS214	Feb. 25 2012	1 Year
Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRO NIK	9120D-829	GTS208	June 30 2012	1 Year
Horn Antenna	ETS-LINDGREN	3160	GTS217	Mar. 30 2012	1 Year
EMI Test Software	AUDIX	E3	N/A	N/A	N/A
Cable	Resenberger	N/A	NO.1	Apr. 6, 2012	1 Year
Cable	SCHWARZBECK	N/A	NO.2	Apr. 6, 2012	1 Year
Cable	SCHWARZBECK	N/A	NO.3	Apr. 6, 2012	1 Year
Amplifier(100kHz-3GHz)	HP	8347A	GTS204	Jul. 04 2012	1 Year
Amplifier(2GHz-20GHz)	HP	8349B	GTS206	Jul. 04 2012	1 Year
Amplifier (18-26GHz)	R&S	AFS33-1800 2 650-30-8P-4 4	GTS218	June 30 2012	1 Year
Band filter	Amindeon	82346	GTS219	Mar. 31 2012	1 Year
Active Loop Antenna	Beijing Daze	ZN30900A	GTS215	Mar. 31 2012	1 Year
Power Meter	R&S	NRVS	GTS216	Apr. 6, 2012	1 Year
Shielding Room	ZhongYu Electron	7.0(L)x3.0(W)x3.0(H)	GTS264	Sep. 08 2012	1 Year
EMI Test Receiver	R&S	ESCS30	GTS223	Jul. 04 2012	1 Year
10dB Pulse Limita	R&S	N/A	GTS224	Jul. 04 2012	1 Year
Coaxial Switch	ANRITSU CORP	MP59B	GTS225	Jul. 04 2012	1 Year
LISN	SCHWARZBECK MESS-ELEKTRO NIK	NSLK 8127	GTS226	Jul. 04 2012	1 Year
Coaxial Cable	SCHWARZBECK	N/A	NO.4	Apr. 6, 2012	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

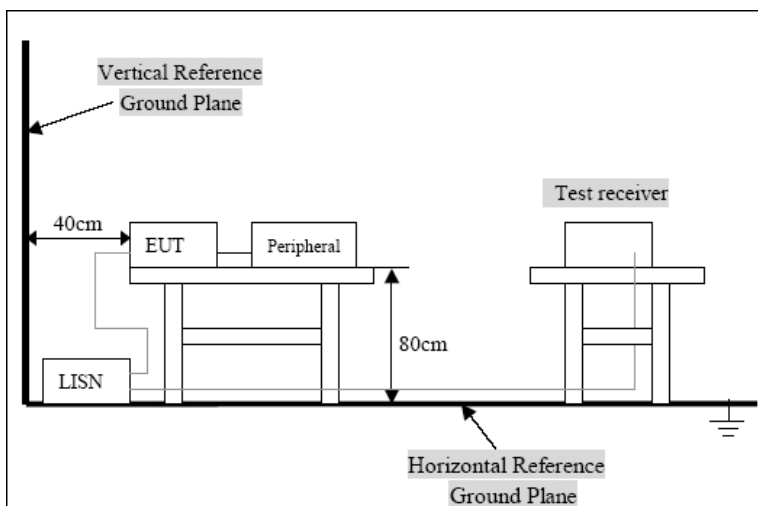
Please refer to section 4 this report.

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 impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uh coupling impedance with 50ohm termination.

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 ASIN C63.4:2003 on conducted measurement. Conducted emissions were measured 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

N/A.
the sample operating 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.

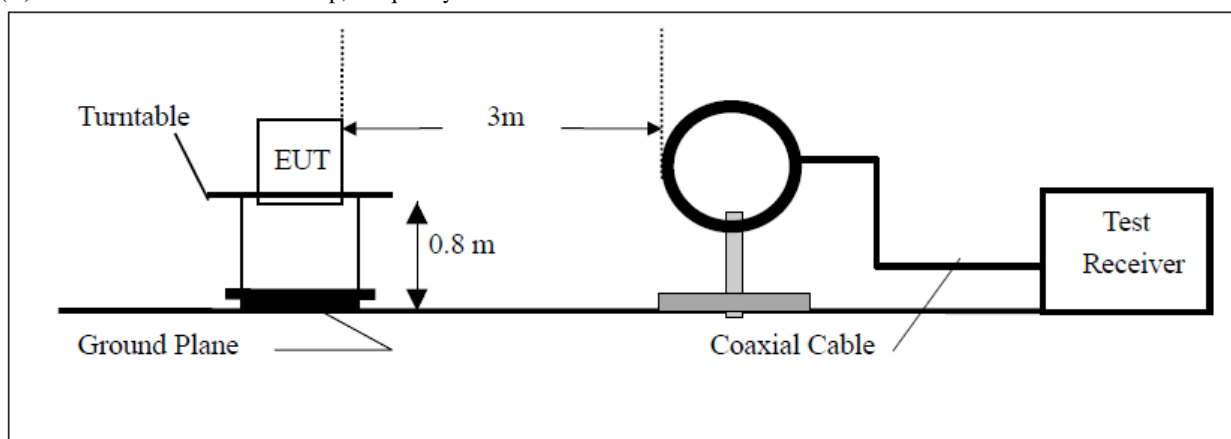
The frequency range from 9kHz to 25GHz is checked.

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.

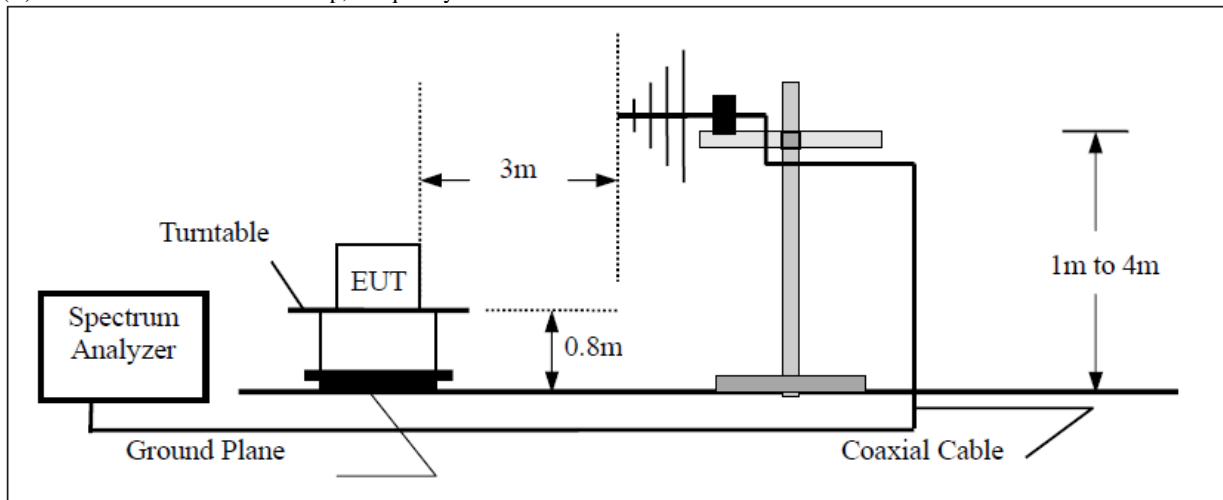
Through three orthogonal axes to determine which attitude and equipment arrangement produces the highest emission relative to the limit.

7.3. Radiated Test Setup

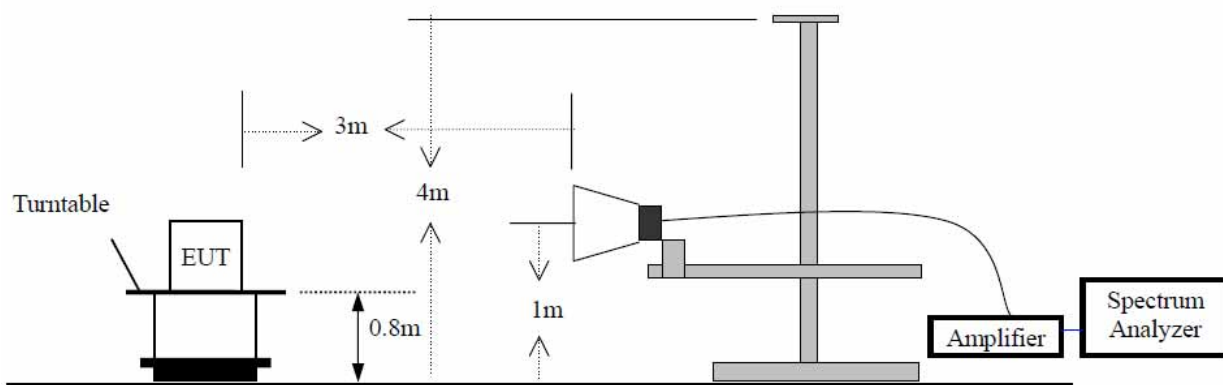
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(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 strength of Fundamental(3m)			Field as strength 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 is 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 (dB μ V/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) Distance 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)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
2402	54.14/88.58	VERT	94/114	-39.86/-25.42
2402	53.96/88.27	HORIZ	94/114	-40.04/-25.73

CH Middle

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
2441	56.02/88.68	VERT	94/114	-37.98/-25.32
2441	54.48/87.14	HORIZ	94/114	-39.52/-26.86

CH High

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
2480	54.76/90.32	VERT	94/114	-39.24/-23.68
2480	57.26/96.14	HORIZ	94/114	-36.74/-17.86

B. General Radiated Emissions Data

For below 9kHz-30MHz Spurious

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

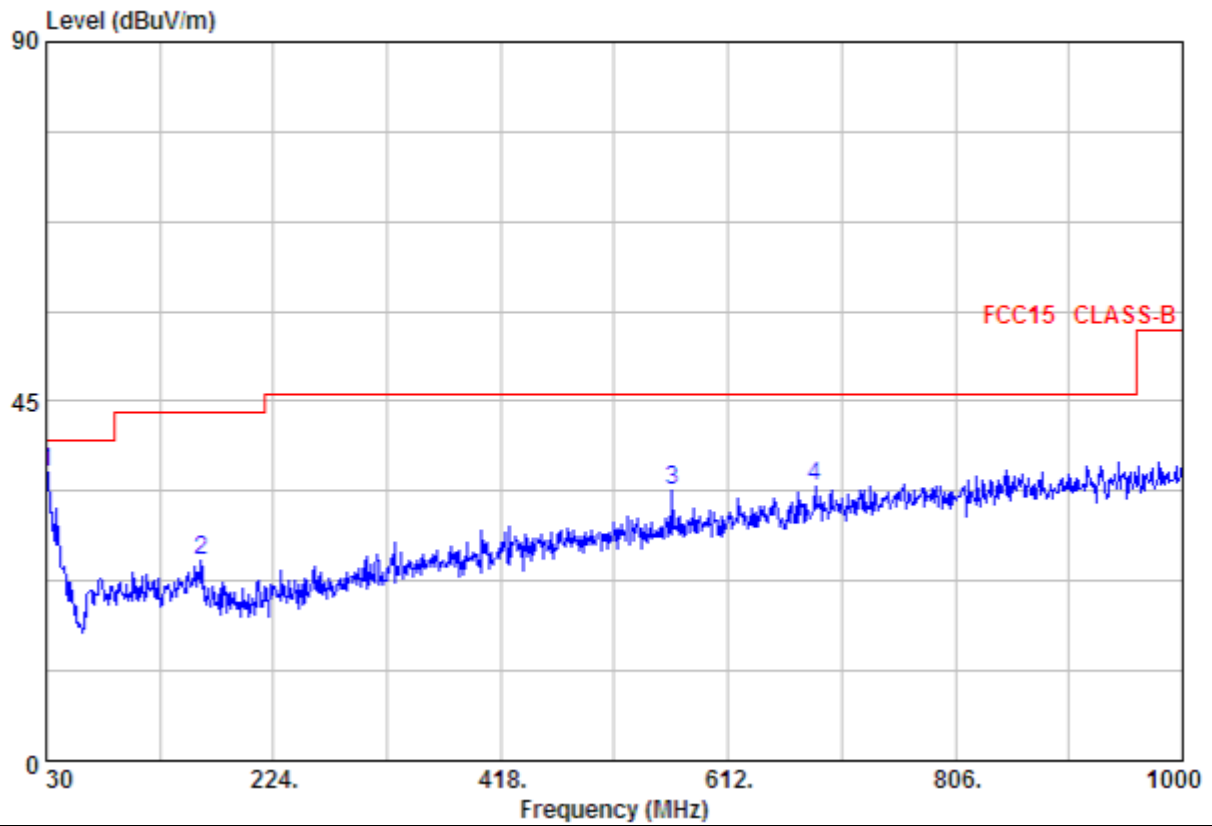
Note:

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

For 30M-1000MHz Spurious

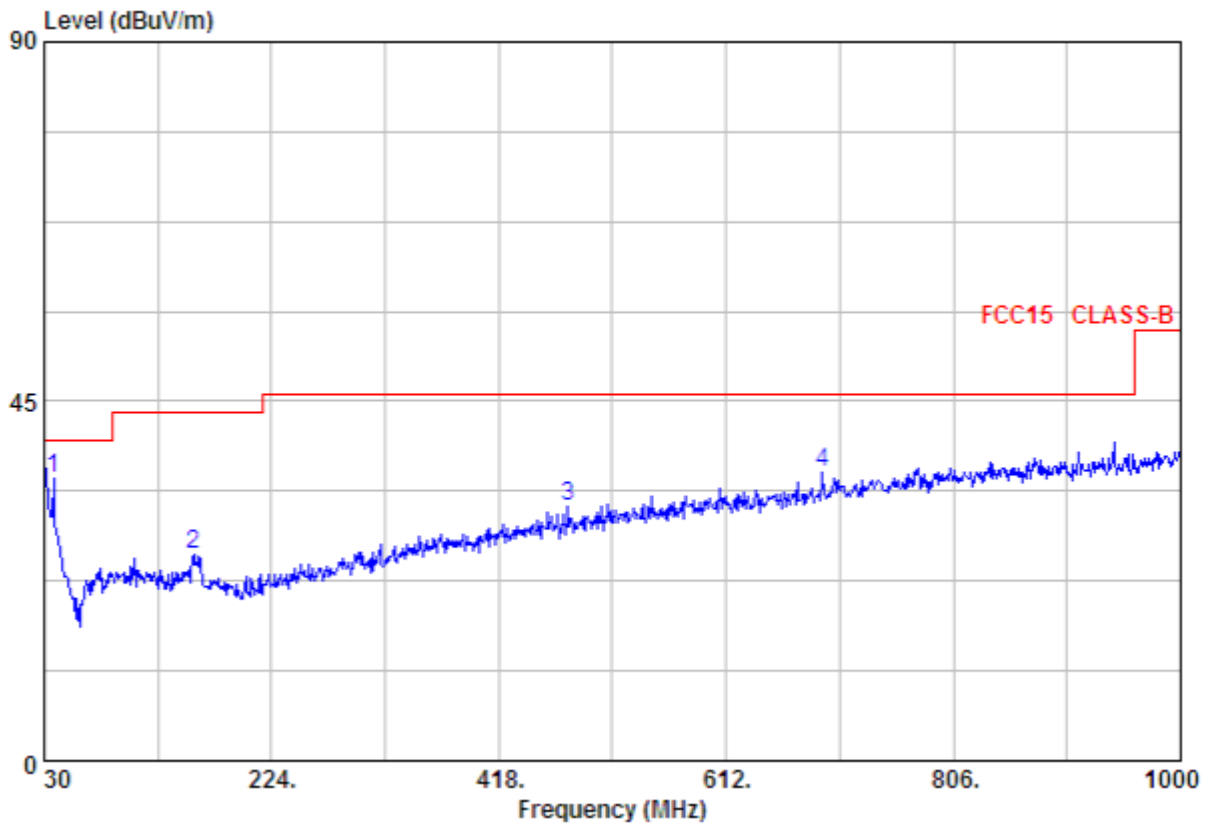
Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

Horizontal



Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limit (dBμV)	Margin (dB)	Detector
30.97	25.93	10.24	36.17	40.00	-3.83	QP
161.92	12.96	12.02	24.98	43.50	-18.52	QP
564.47	19.25	14.56	33.81	46.00	-12.19	QP
686.69	14.05	20.35	34.40	46.00	-11.6	QP

Vertical



Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limit (dBμV)	Margin (dB)	Detector
37.76	25.08	10.20	35.28	40.00	-4.72	QP
158.04	13.9	11.87	25.77	43.50	-17.73	QP
477.17	19.35	12.53	31.88	46.00	-14.12	QP
694.45	17.71	18.30	36.01	46.00	-9.99	QP

For above 1000MHz Spurious

CH Low

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4804.0	38.27/52.27	VERT	54.0/74.0	-15.73/-21.73
7206.0	40.92/53.59		54.0/74.0	-13.08/-20.41
9608.0	42.97/57.41		54.0/74.0	-11.03/-16.59
4804.0	35.84/49.84	HORIZ	54.0/74.0	-18.16/-24.16
7206.0	38.21/50.88		54.0/74.0	-15.79/-23.12
9608.0	39.98/54.42		54.0/74.0	-14.02/-19.58

CH Middle

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4882.0	40.11/51.82	VERT	54.0/74.0	-13.89/-22.18
7323.0	42.08/53.84		54.0/74.0	-11.92/-20.16
9764.0	44.42/56.39		54.0/74.0	-9.58/-17.61
4882.0	38.35/50.06	HORIZ	54.0/74.0	-15.65/-23.94
7323.0	40.10/51.86		54.0/74.0	-13.9/-22.14
9764.0	42.22/54.19		54.0/74.0	-11.78/-19.81

CH High

Freq. (MHz)	Emission(dBuV/m) AV/PK	HORIZ/ VERT	Limits(dBuV/m) AV/PK	Margin (dB)
4960.0	40.31/49.92	VERT	54.0/74.0	-13.69/-24.08
7440.0	41.64/56.85		54.0/74.0	-12.36/-17.15
9920.0	45.60/60.74		54.0/74.0	-8.4/-13.26
4960.0	37.94/45.74	HORIZ	54.0/74.0	-16.06/-28.26
7440.0	39.15/51.74		54.0/74.0	-14.85/-22.26
9920.0	42.99/54.70		54.0/74.0	-11.01/-19.3

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.

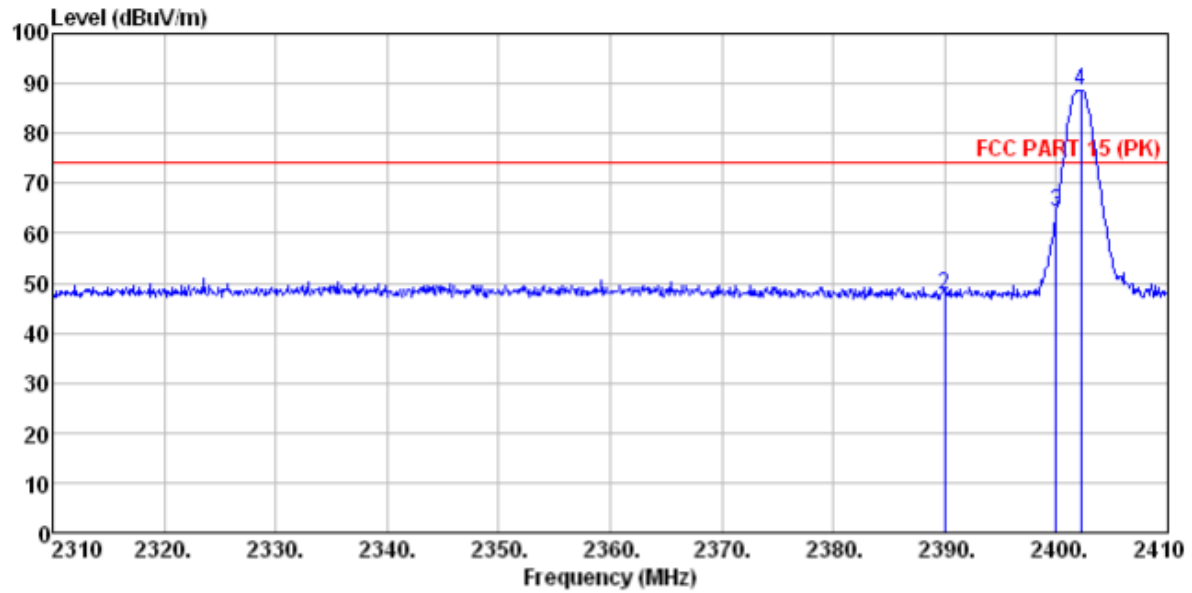
8.3. Band Edge FCC 15.249(d) Limit

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

Vertical (PK) TX 2402MHz

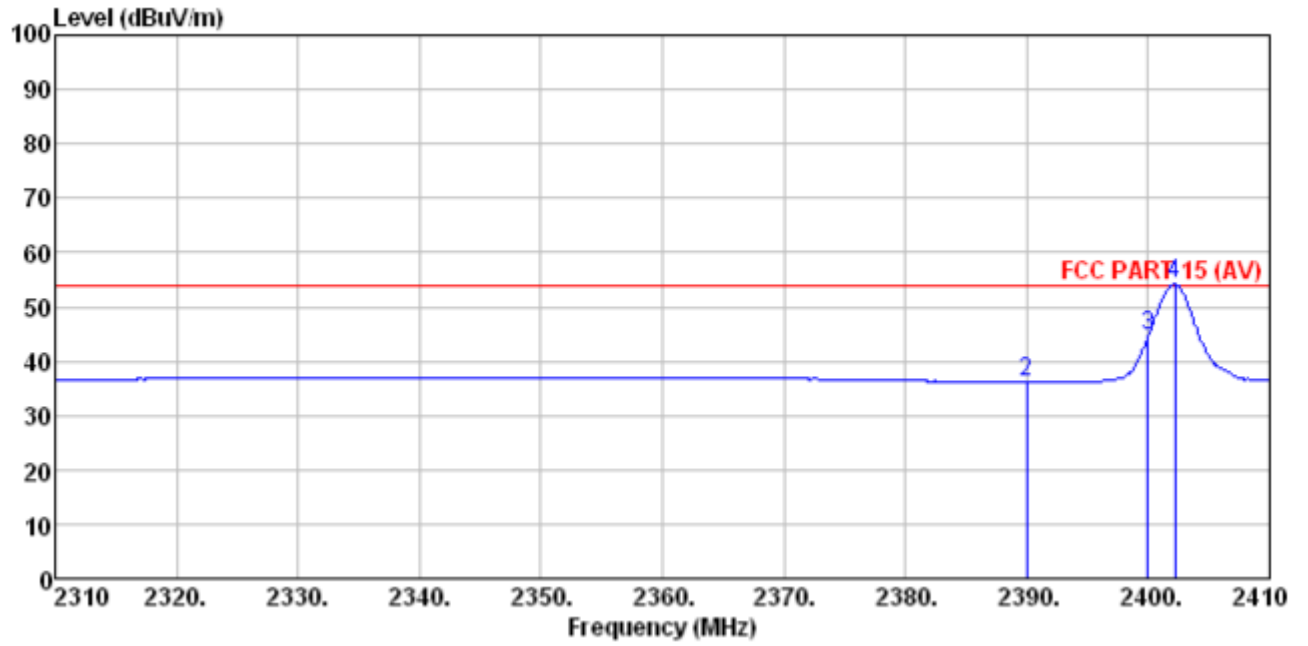


Frequency [MHz]	Read Level [dBuV]	Factor [dB]	Emission Level (dBμV/m)	Limits [dBμV/m]	Margin (dB)
2310	44.80	2.84	47.64	74.00	-26.36
2390	44.93	2.79	47.72	74.00	-26.28
2400	61.40	2.79	64.19	74.00	-9.81

Remark:

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

Vertical (AV) TX 2402MHz

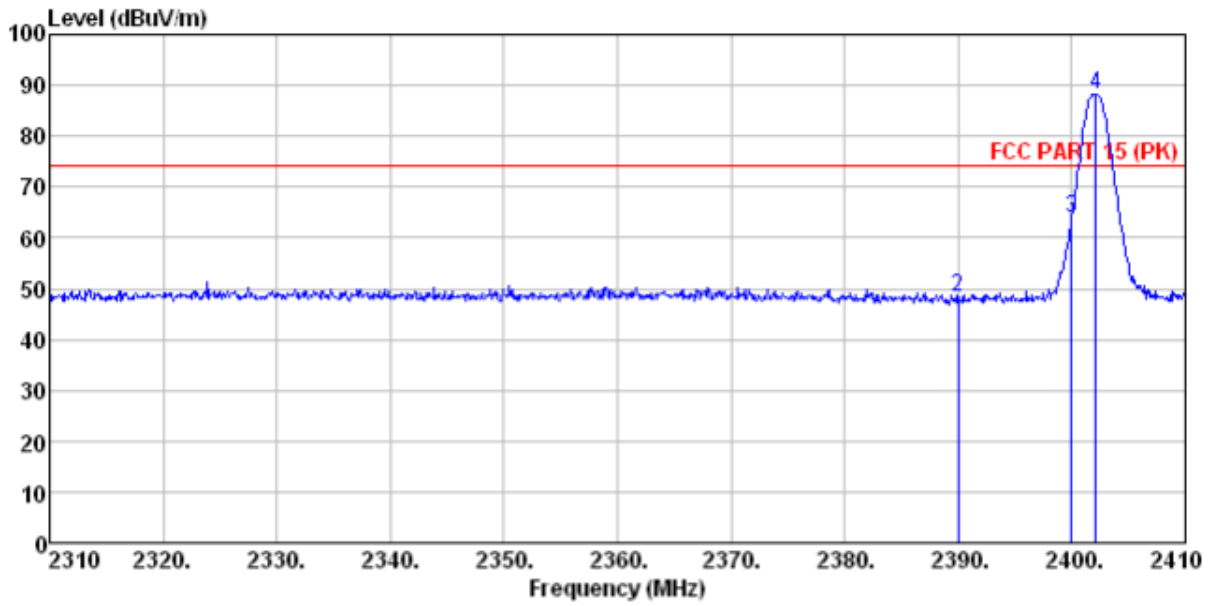


Frequency [MHz]	Read Level [dBuV]	Factor [dB]	Emission Level (dBμV/m)	Limits [dBμV/m]	Margin (dB)
2310	33.64	2.84	36.48	54.00	-17.52
2390	33.45	2.79	36.24	54.00	-17.76
2400	41.85	2.79	44.64	54.00	-9.36

Remark:

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

Horizontal (PK) TX 2402MHz

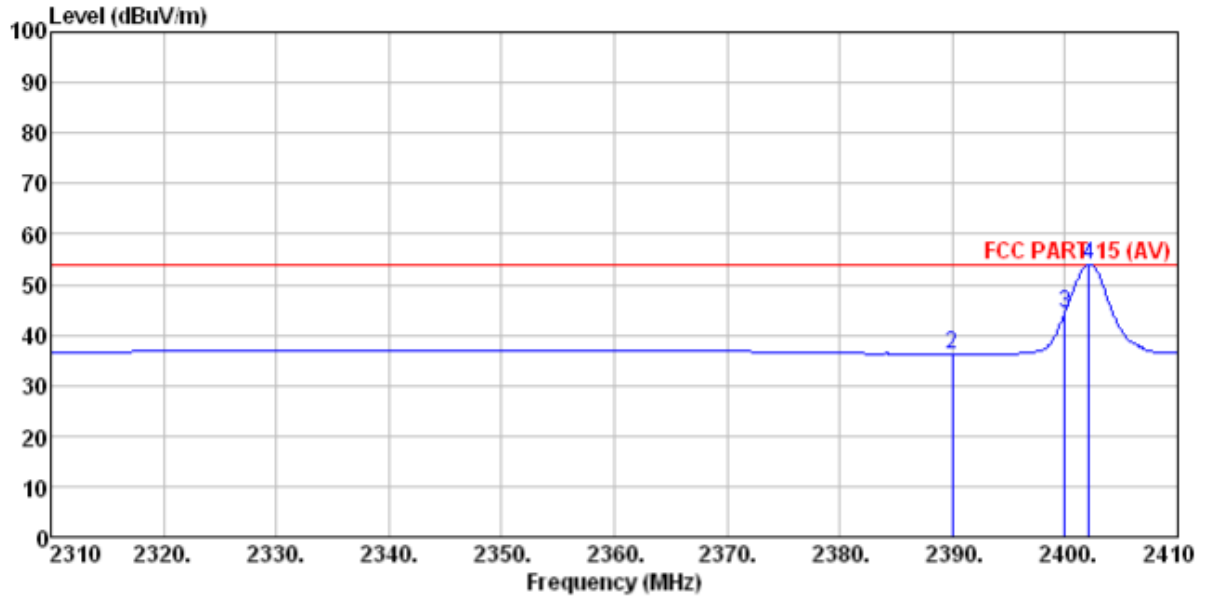


Frequency [MHz]	Read Level [dBuV]	Factor [dB]	Emission Level (dBμV/m)	Limits [dBμV/m]	Margin (dB)
2310	44.63	2.84	47.47	74.00	-26.53
2390	45.46	2.79	48.25	74.00	-25.75
2400	61.06	2.79	63.85	74.00	-10.15

Remark:

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

Horizontal (AV) TX 2402MHz

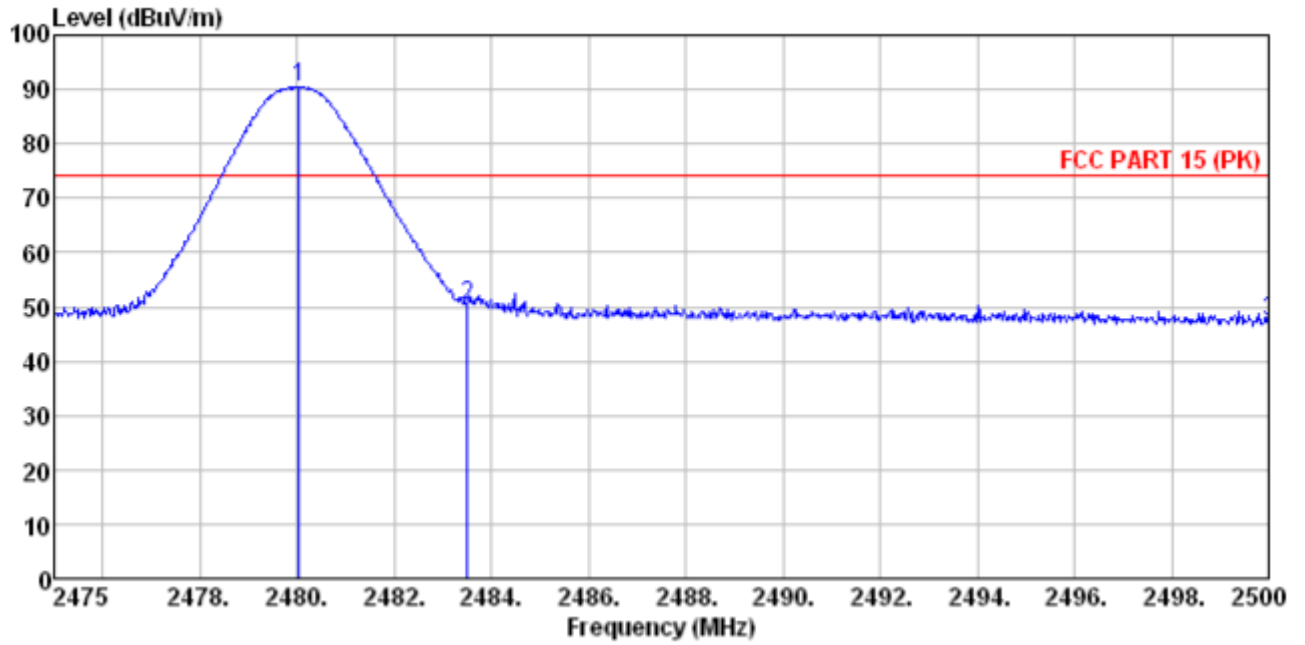


Frequency [MHz]	Read Level [dBuV]	Factor [dB]	Emission Level (dBμV/m)	Limits [dBμV/m]	Margin (dB)
2310	33.64	2.84	36.48	54.00	-17.52
2390	33.45	2.79	36.24	54.00	-17.76
2400	41.66	2.79	44.45	54.00	-9.55

Remark:

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

Vertical (PK) TX 2480MHz

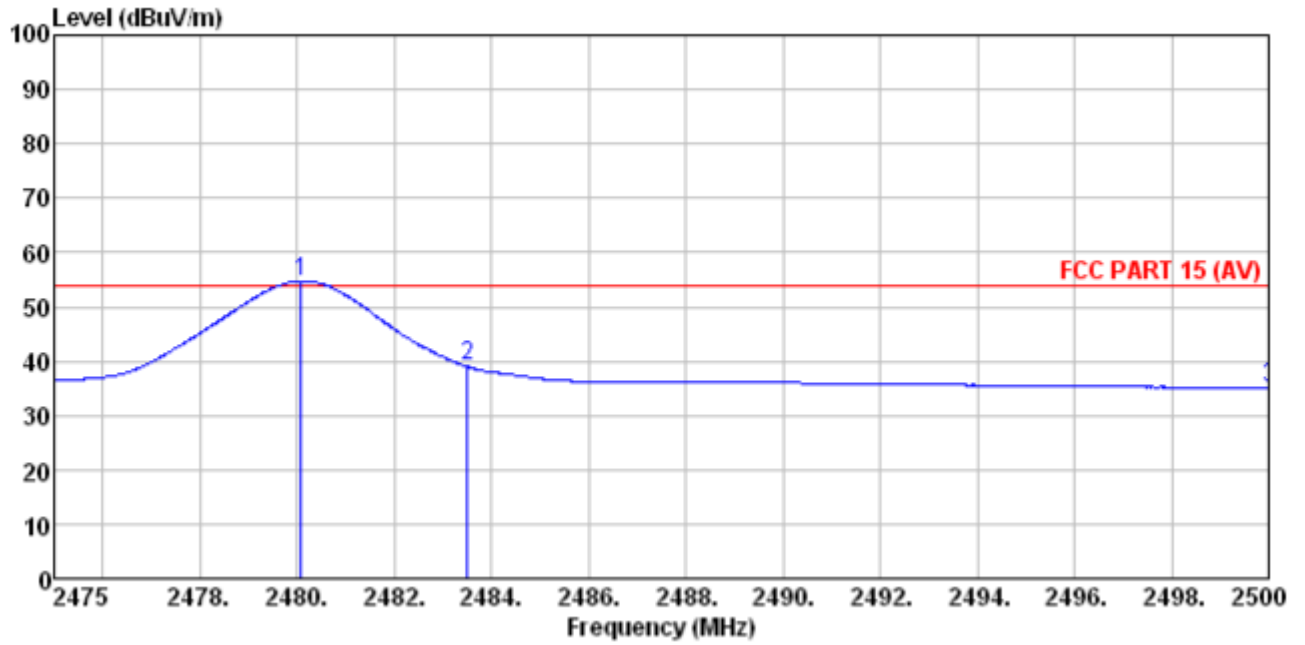


Frequency [MHz]	Read Level [dBuV]	Factor [dB]	Emission Level (dBμV/m)	Limits [dBμV/m]	Margin (dB)
2483.5	47.28	3.07	50.35	74.00	-23.65
2500	44.26	3.11	47.37	74.00	-26.63

Remark:

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

Vertical (AV) TX 2480MHz

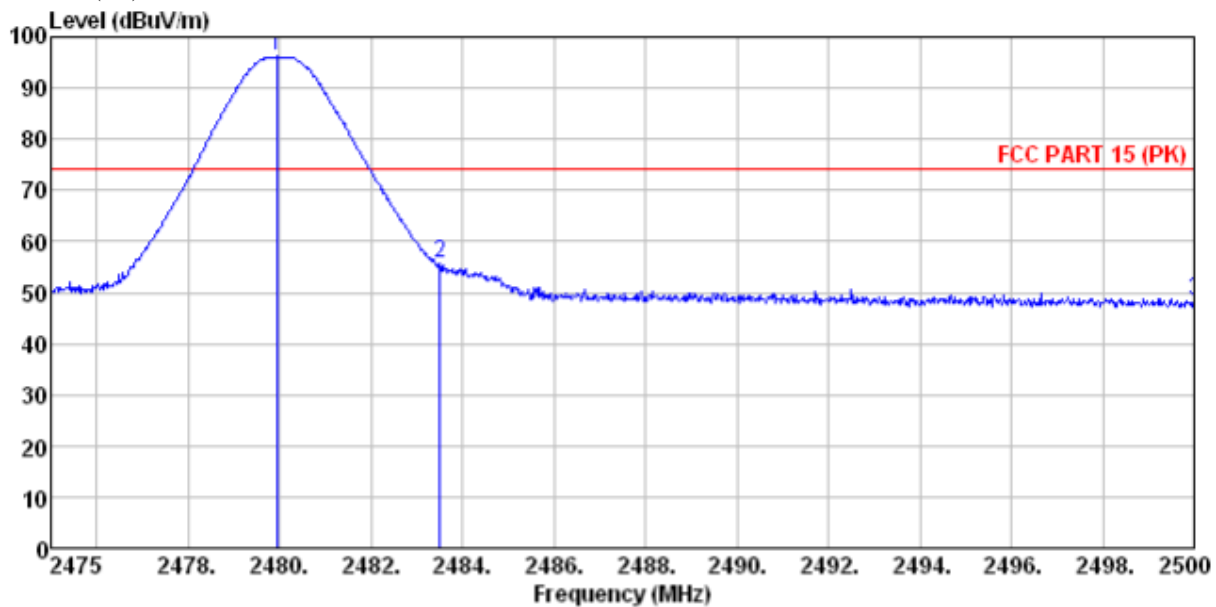


Frequency [MHz]	Read Level [dBuV]	Factor [dB]	Emission Level (dBμV/m)	Limits [dBμV/m]	Margin (dB)
2483.5	35.92	3.07	38.99	54.00	-15.01
2500	31.93	3.11	35.04	54.00	-18.96

Remark:

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

Horizontal (PK) TX 2480MHz

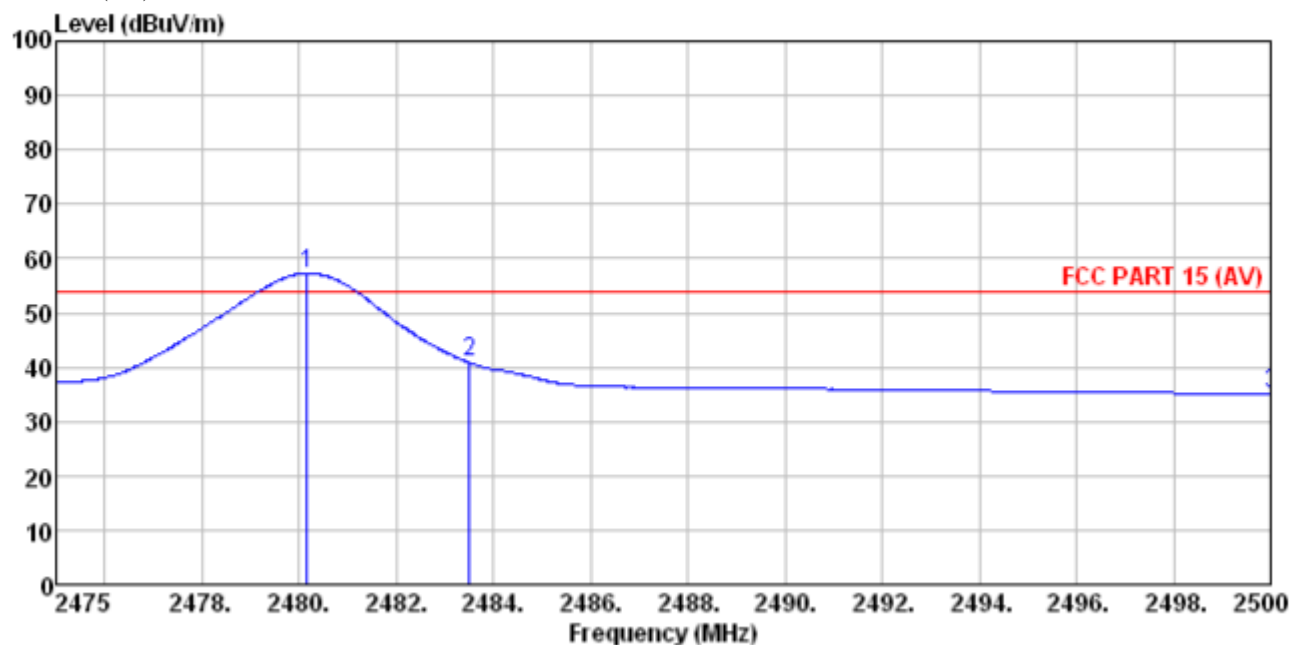


Frequency [MHz]	Read Level [dBuV]	Factor [dB]	Emission Level (dBμV/m)	Limits [dBμV/m]	Margin (dB)
2483.5	52.77	3.07	55.84	74.00	-18.16
2500	45.28	3.11	48.39	74.00	-25.61

Remark:

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

Horizontal (AV) TX 2480MHz



Frequency [MHz]	Read Level [dBuV]	Factor [dB]	Emission Level (dBμV/m)	Limits [dBμV/m]	Margin (dB)
2483.5	37.73	3.07	40.8	54.00	-13.2
2500	32.02	3.11	35.13	54.00	-18.87

Remark:

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