



Neutron Engineering Inc.

Radio Test Report

FCC ID: H8GR8

This report concerns (check one) : ☒ Original Grant ☐ Class II Change

Issued Date : Jun. 25, 2013
Project No. : 1305197
Equipment : 2.4G RF Gaming Mouse
Model Name : R8; R8-1; R8a; R8ma

Applicant : A-FOUR TECH CO., LTD.
Address : 6F., No.108, Min-Chuan Rd., Xindian
Dist., New Taipei City, Taiwan R.O.C.

Tested by: Neutron Engineering Inc. EMC Laboratory
Date of Receipt: May 23, 2013
Date of Test: May 23, 2013 ~ May 30, 2013

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Declaration

Neutron represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **R.O.C.**, or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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REPORT ISSUED HISTORY

Revised Version No.	Description	Issued Date
-	Initial Issue.	Jun. 25, 2013



1 CERTIFICATION

Equipment : 2.4G RF Gaming Mouse

Brand Name : bloody;  ; A4TECH

Model Name : R8; R8-1; R8a; R8ma

Applicant : A-FOUR TECH CO., LTD.

Date of Test : May 23, 2013 ~ May 30, 2013

Standards : FCC Part 15, Subpart C: 2012
ANSI C63.4: 2009

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FCCP-1-1305197) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).



2. SUMMARY OF TEST RESULTS

Standard Clause	Test Item	Result
15.207	Conducted Emission	PASS
15.247 (c)	Antenna conducted Spurious Emission	PASS
15.247 (a)(2)	6dB Bandwidth	PASS
15.247 (b)	Maximum Peak Conducted Output Power	PASS
15.247 (c)	Radiated Spurious Emission	PASS
15.247 (d)(e)	Power Spectral Density	PASS
15.205	Restricted Bands	PASS
15.203	Antenna Requirement	PASS
1.1307 1.1310 2.1091 2.1093	RF Exposure Compliance	PASS

NOTE:

- (1) N/A: denotes test is not applicable in this Test Report
- (2) Portable device; SAR report is required.



2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

Conducted emission Test:

C01: (VCCI RN: C-2918; FCC RN: 95335; FCC DN: TW1010)

No.132-1, Ln. 329, Sec. 2, Balian Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

Radiated emission Test (Below 1 GHz):

CB08: (FCC RN: 614388; FCC DN: TW1054; IC Assigned Code: 4428C-1)

1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)

Radiated emission Test (Above 1 GHz):

CB08: (VCCI RN: G-91; FCC RN: 614388; FCC DN: TW1054; IC Assigned Code: 4428C-1)

1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)

2.2 MEASUREMENT UNCERTAINTY

The measurement uncertainty is not specified by FCC rules and for reference only.

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%.

The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

A. Conducted emission test:

Test Site	Measurement Frequency Range	U , (dB)	NOTE
C01	150 kHz ~ 30 MHz	1.94	

B. Radiated emission test:

Test Site	Item	Measurement Frequency Range	Uncertainty	NOTE
CB08	Radiated emission at 3m	Horizontal Polarization	30 - 200MHz	3.35 dB
			200 - 1000MHz	3.11 dB
			1 - 18GHz	3.97 dB
			18 - 40GHz	4.01 dB
	Vertical Polarization		30 - 200MHz	3.22 dB
			200 - 1000MHz	3.24 dB
			1 - 18GHz	4.05 dB
			18 - 40GHz	4.04 dB

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our U_{lab} values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called U_{CISPR} , as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz: 3.6 dB

Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz: 5.2 dB

It can be seen that our U_{lab} values are smaller than U_{CISPR} .

If U_{lab} is less than or equal to U_{CISPR} , then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{CISPR} , then:

- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{CISPR})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{CISPR})$, exceeds the disturbance limit.



3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	2.4G RF Gaming Mouse	
Brand Name	bloodY;  ; A4TECH	
Model Name	R8; R8-1; R8a; R8ma	
OEM Brand/Model Name	N/A	
Model Difference	Models' differences between each other only the changes of model name which do not affect the EMI performance. Model R8 was used for final testing and collecting test data included in this report.	
Product Description	The EUT is a 2.4G RF Gaming Mouse.	
	Operation Frequency	2407 MHz - 2473 MHz
	Modulation Type	GFSK
	Number Of Channel	Please refer to the Note 2.
	Antenna Designation	Please refer to the Note 3.
	Antenna Gain(Peak)	Please refer to the Note 3.
	Maximum Peak Conducted Output Power:	1.69 dBm
	More details of EUT technical specification, please refer to the User's Manual.	
Power Source	1. Supplied from USB DC Source. 2. Battery supplied.	
Power Rating	1. I/P: DC 5V 2. I/P: DC 3.7V 600mAh	
Connecting I/O Port(s)	Please refer to the User's Manual	
Products Covered	1 * Lithium Battery: TE-PL602030-2P, 3.7V 600mAh 1 * USB Cable	
EUT Modification(s)	N/A	



NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2407	24	2430	47	2453
02	2408	25	2431	48	2454
03	2409	26	2432	49	2455
04	2410	27	2433	50	2456
05	2411	28	2434	51	2457
06	2412	29	2435	52	2458
07	2413	30	2436	53	2459
08	2414	31	2437	54	2460
09	2415	32	2438	55	2461
10	2416	33	2439	56	2462
11	2417	34	2440	57	2463
12	2418	35	2441	58	2464
13	2419	36	2442	59	2465
14	2420	37	2443	60	2466
15	2421	38	2444	61	2467
16	2422	39	2445	62	2468
17	2423	40	2446	63	2469
18	2424	41	2447	64	2470
19	2425	42	2448	65	2471
20	2426	43	2449	66	2472
21	2427	44	2450	67	2473
22	2428	45	2451		
23	2429	46	2452		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Printed	N/A	-1.20



3.2 DESCRIPTION OF TEST MODES

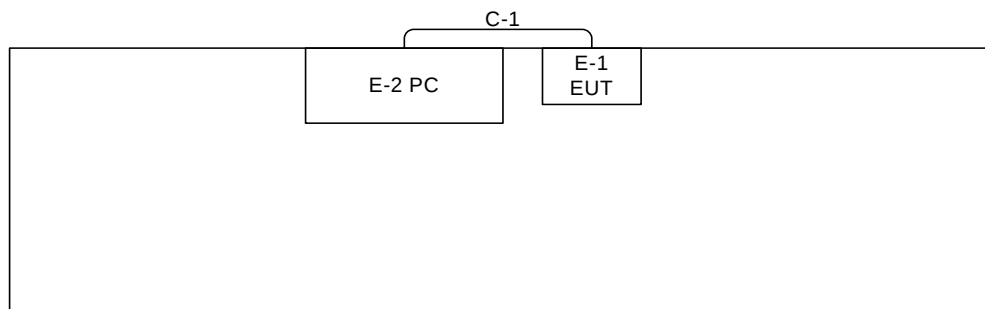
To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test Items	Mode	Data Rate	Channel	Note
Conducted Emission	GFSK	500 Kbps	2437 MHz	
Antenna conducted Spurious Emission	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
6 dB Bandwidth	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
Maximum Peak Conducted Output Power	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
Radiated Spurious Emission (30 MHz to 1 GHz)	GFSK	500 Kbps	2437 MHz	
Radiated Spurious Emission (above 1 GHz)	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
Restricted Bands	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
Antenna Requirement	-----	-----	-----	
RF Exposure Compliance	-----	-----	-----	

NOTE: The measurements are performed at the highest, middle, lowest available channels.



3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



C-1 USB Cable



3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	2.4G RF Gaming Mouse	bloodY;  ; A4TECH	R8	H8GR8	N/A	EUT
E-2	Notebook PC	DELL	D620	DOC	7T390 A03	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	YES	NO	1.2M	

NOTE: The support equipment was authorized by Declaration of Conformity (DOC).



4 CONDUCTED EMISSION

4.1 LIMIT

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 - 5.0	73.00	60.00	56.00	46.00
5.0 - 30.0	73.00	60.00	60.00	50.00

NOTE:

1. The tighter limit applies at the band edges.
2. The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
3. The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)
 Margin Level = Measurement Value – Limit Value

4.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	TWO-LINE V-NETWORK	R&S	ENV216	101050	Apr. 22, 2014
2	Test Cable	TIMES	LMR-400	C01	Aug. 16, 2013
3	EMI Test Receiver	R&S	ESCI	100082	Mar. 21, 2014
4	Measurement Software	EZ	EZ_EMG (Version NB-03A)	N/A	N/A

NOTE: **N/A:** denotes No Model Name, No Serial No. or No Calibration specified.

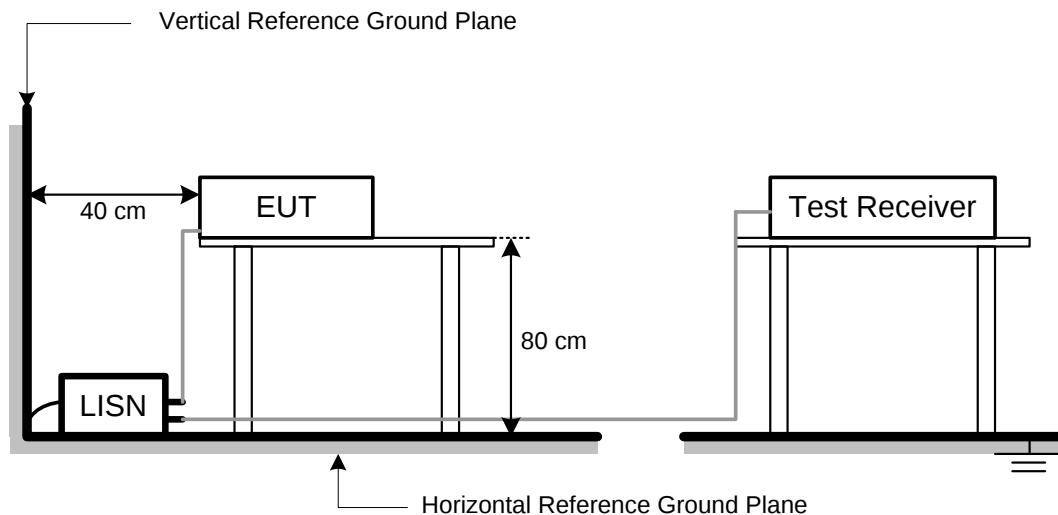
4.3 TEST PROCEDURES

- The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

NOTE:

- Reading in which marked as Peak, QP or AVG means measurements by using are Quasi-Peak or Average Mode with Detector BW=9 kHz (6 dB Bandwidth).
- All readings are Peak Mode value unless otherwise stated QP or AVG in column of Note. If the Peak or QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only Peak or QP Mode was measured, but AVG Mode didn't perform.

4.4 TEST SETUP LAYOUT



4.5 DEVIATION FROM TEST STANDARD

No deviation



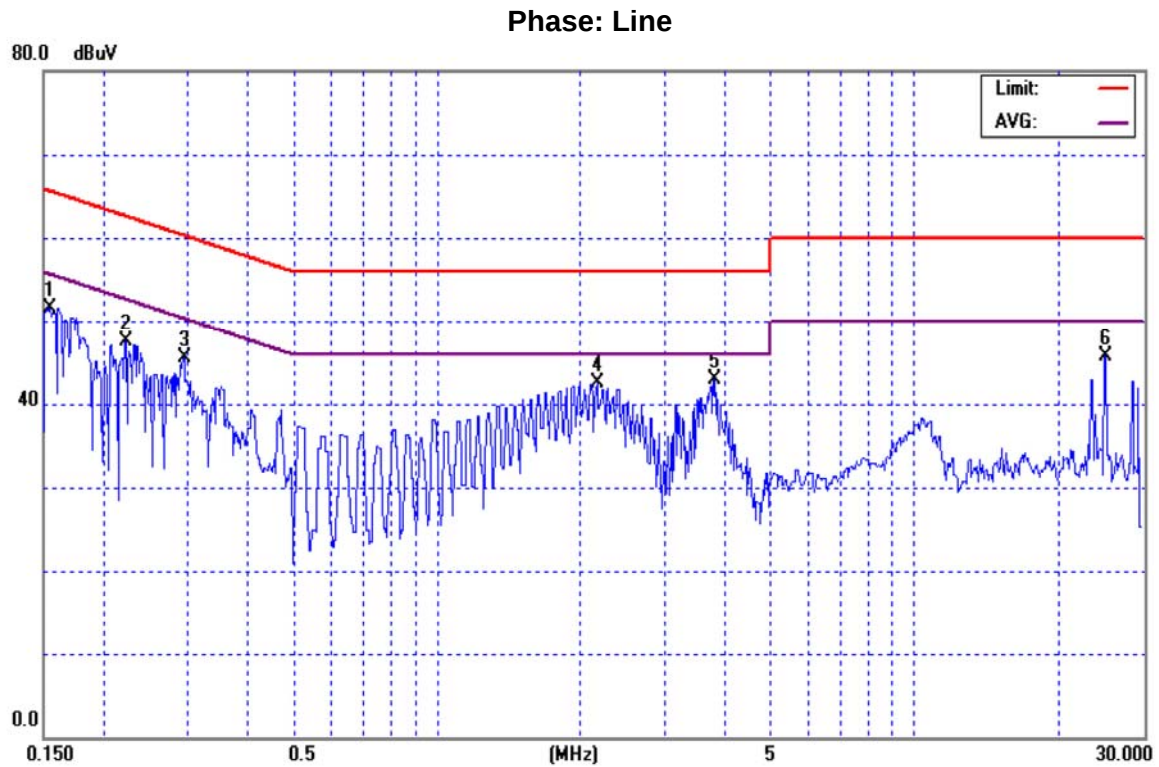
4.6 EUT OPERATING CONDITIONS

The EUT used during radiated and/or conducted emission measurement was designed to exercise in a manner similar to a typical use.



4.7 TEST RESULTS

E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	61%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

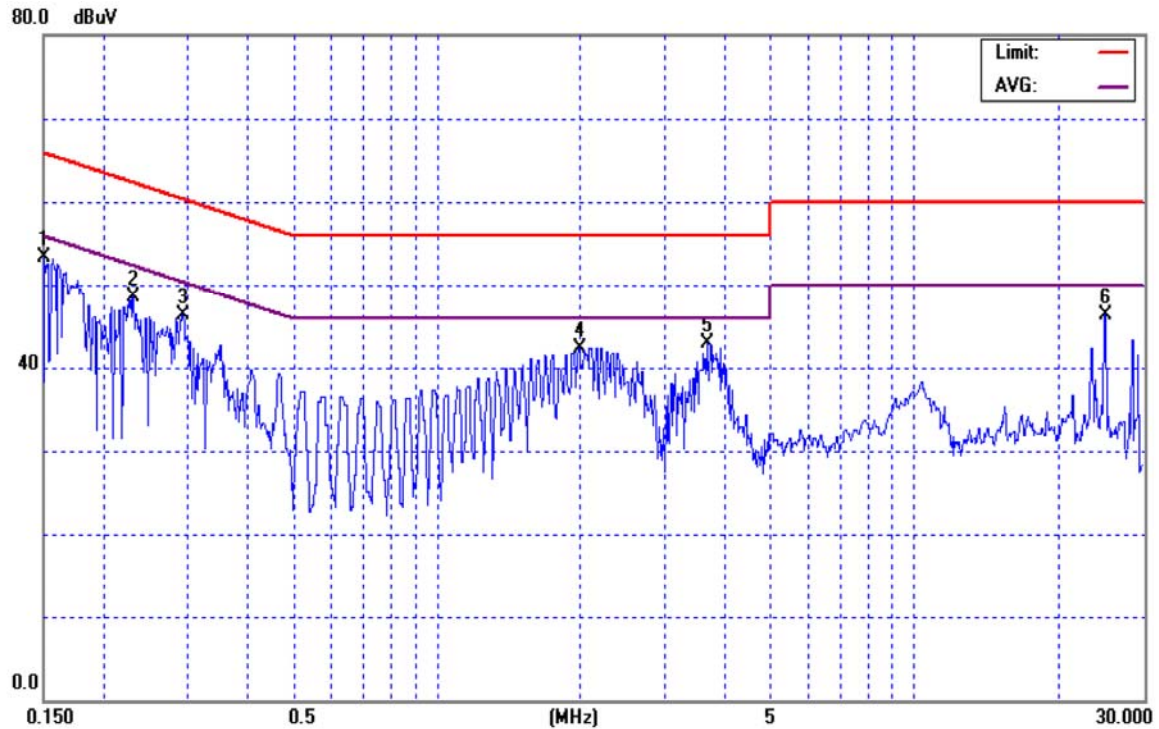


No. Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.1542	41.84	9.65	51.49	65.77	-14.28	peak	
2	0.2221	37.77	9.69	47.46	62.74	-15.28	peak	
3	0.2942	35.75	9.67	45.42	60.40	-14.98	peak	
4	2.1650	32.64	9.77	42.41	56.00	-13.59	peak	
5 *	3.8030	33.05	9.82	42.87	56.00	-13.13	peak	
6	25.1000	35.14	10.49	45.63	60.00	-14.37	peak	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	61%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Phase: Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1507	43.69	9.67	53.36	65.96	-12.60	peak	
2		0.2305	38.79	9.71	48.50	62.43	-13.93	peak	
3		0.2928	36.56	9.69	46.25	60.44	-14.19	peak	
4		1.9850	32.61	9.79	42.40	56.00	-13.60	peak	
5		3.6770	33.15	9.83	42.98	56.00	-13.02	peak	
6		25.1000	35.63	10.59	46.22	60.00	-13.78	peak	



5 ANTENNA CONDUCTED SPURIOUS EMISSION

5.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Antenna conducted Spurious Emission	30-25000	20 dB less than the peak value of fundamental frequency

5.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

5.3 TEST PROCEDURES

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.

5.4 TEST SETUP LAYOUT



5.5 DEVIATION FROM TEST STANDARD

No deviation

5.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.



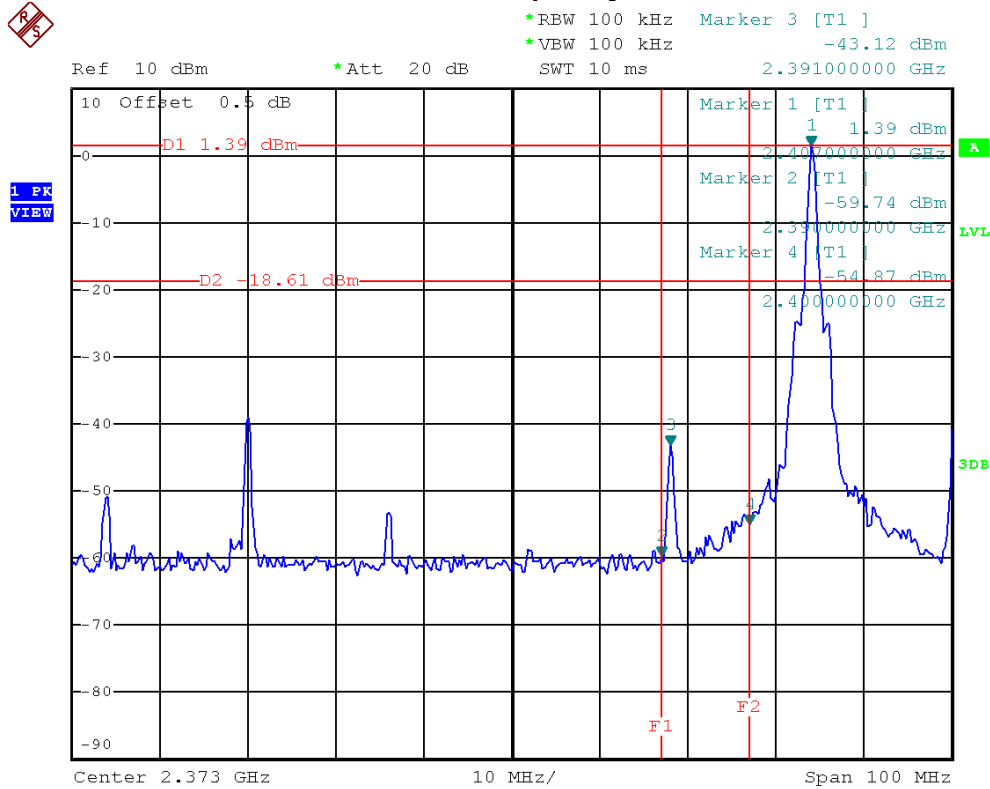
5.7 TEST RESULTS

E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz/2473 MHz		

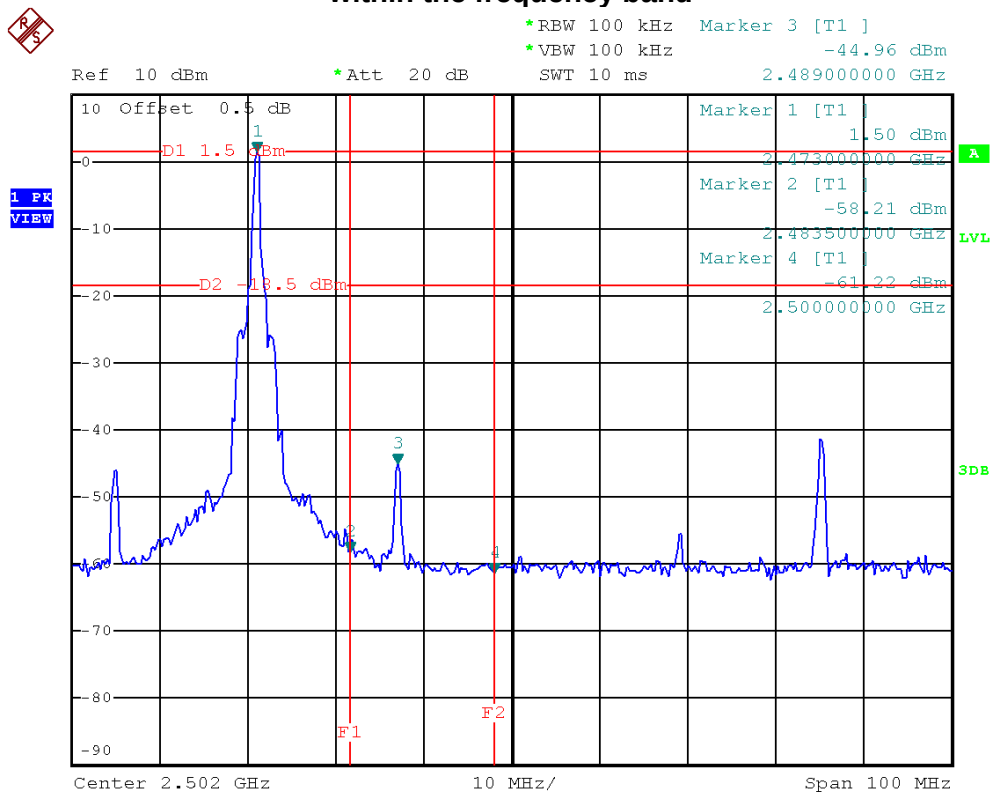
Channel of Worst Data			
The max. radio frequency power in any 100kHz bandwidth outside the frequency band		The max. radio frequency power in any 100 kHz bandwidth within the frequency band.	
FREQUENCY(MHz)	POWER(dBm)	FREQUENCY(MHz)	POWER(dBm)
2391.00	-43.12	2489.00	-44.96
Result			
In any 100kHz bandwidth outside the frequency band, the radio frequency power is at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.			



The max. radio frequency power in any 100kHz bandwidth
outside the frequency band

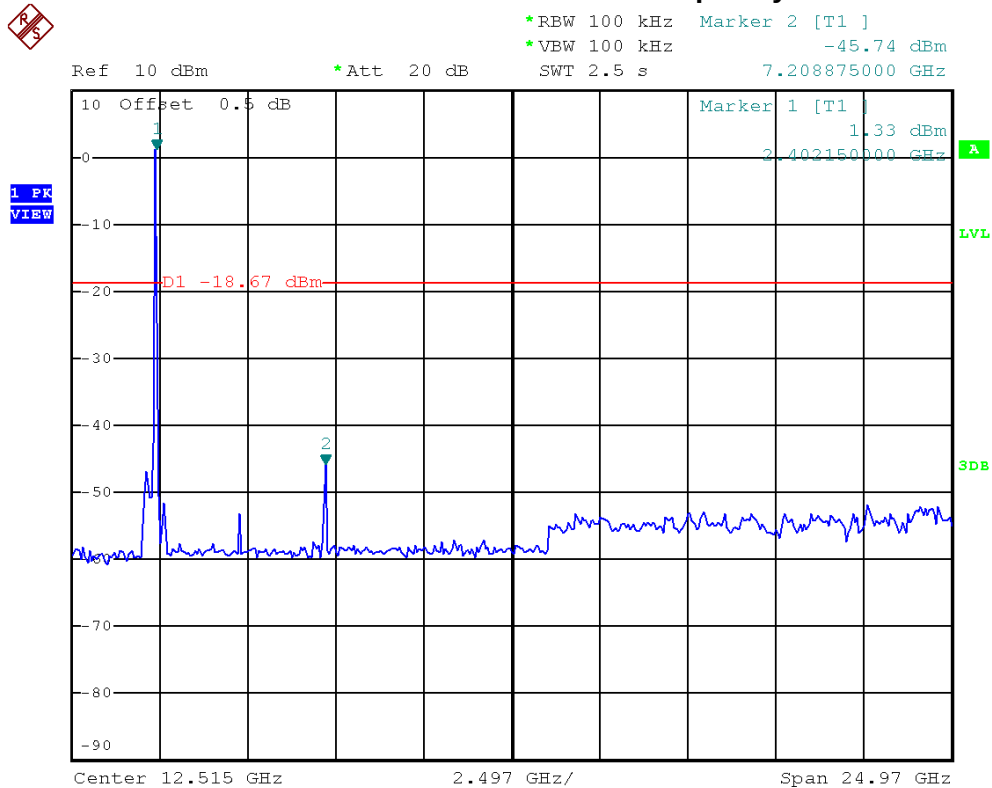


The max. radio frequency power in any 100 kHz bandwidth
within the frequency band

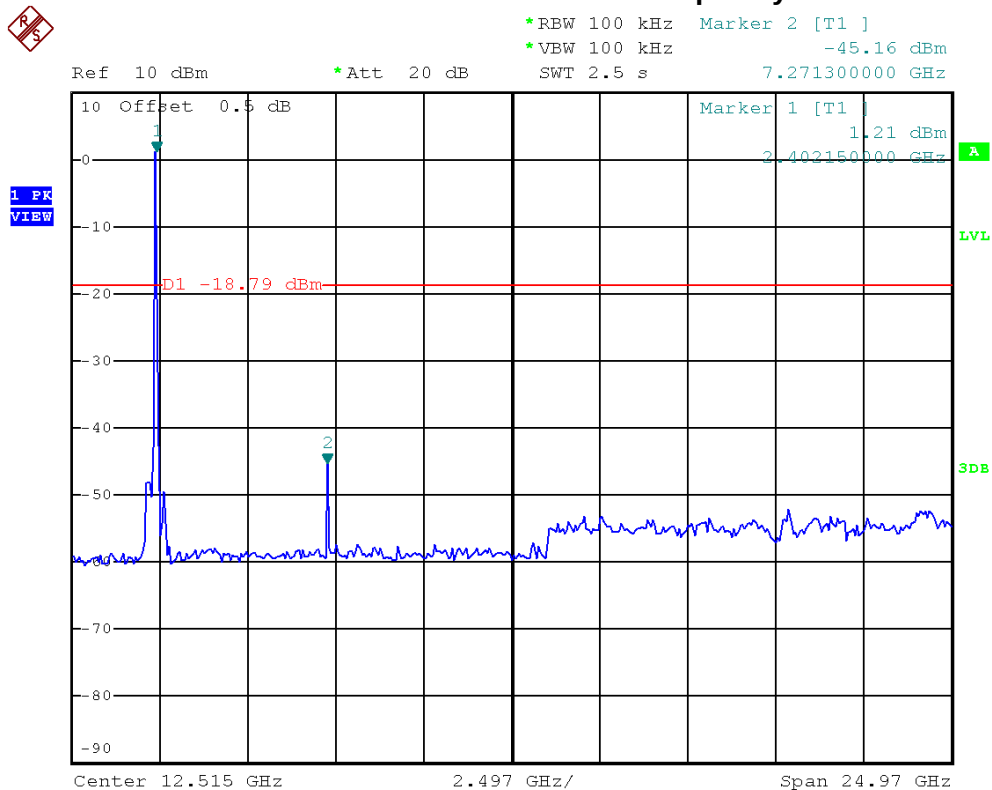




2407 MHz/10 Harmonic of the frequency

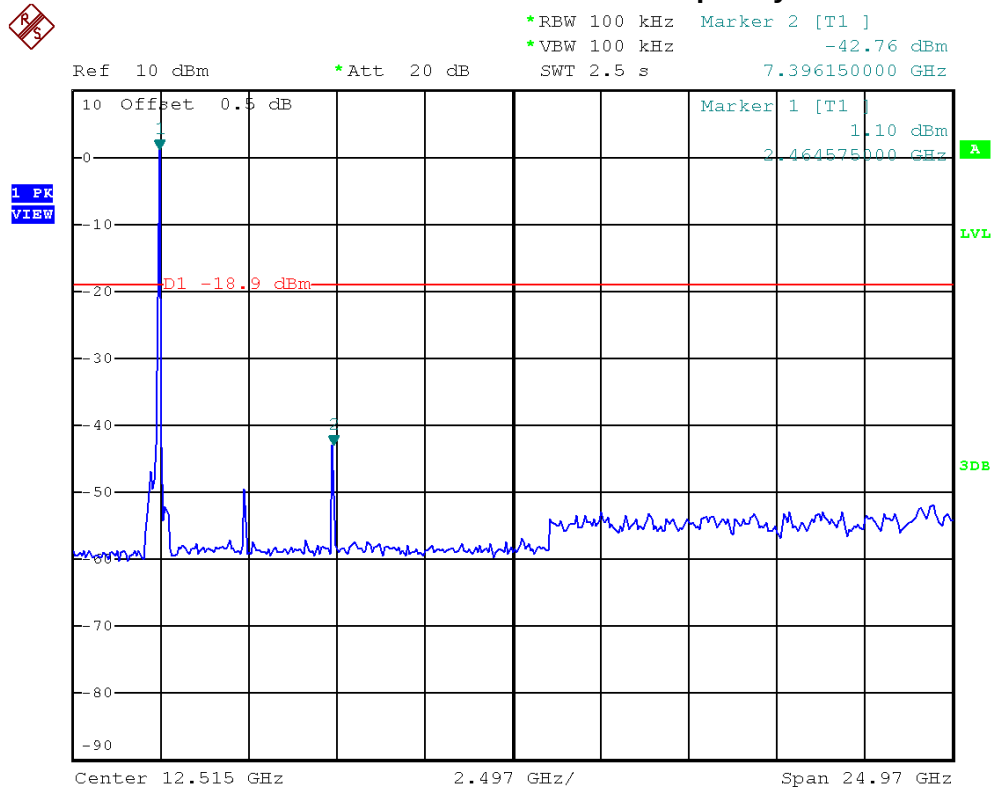


2437 MHz/10 Harmonic of the frequency





2473 MHz/10 Harmonic of the frequency





6 6 DB BANDWIDTH

6.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Bandwidth	2400-2483.5	$\geq 500\text{KHz}$ (6 dB bandwidth)

6.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

6.3 TEST PROCEDURES

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.

6.4 TEST SETUP LAYOUT



6.5 DEVIATION FROM TEST STANDARD

No deviation

6.6 EUT OPERATING CONDITIONS

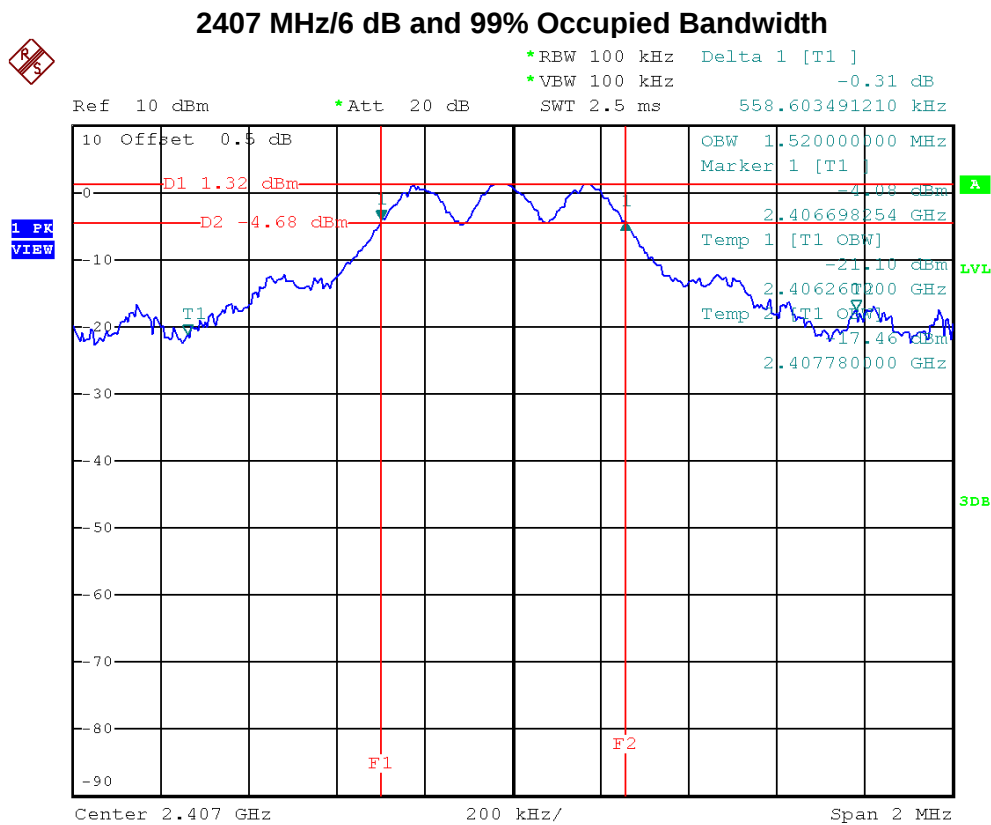
The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.



6.7 TEST RESULTS

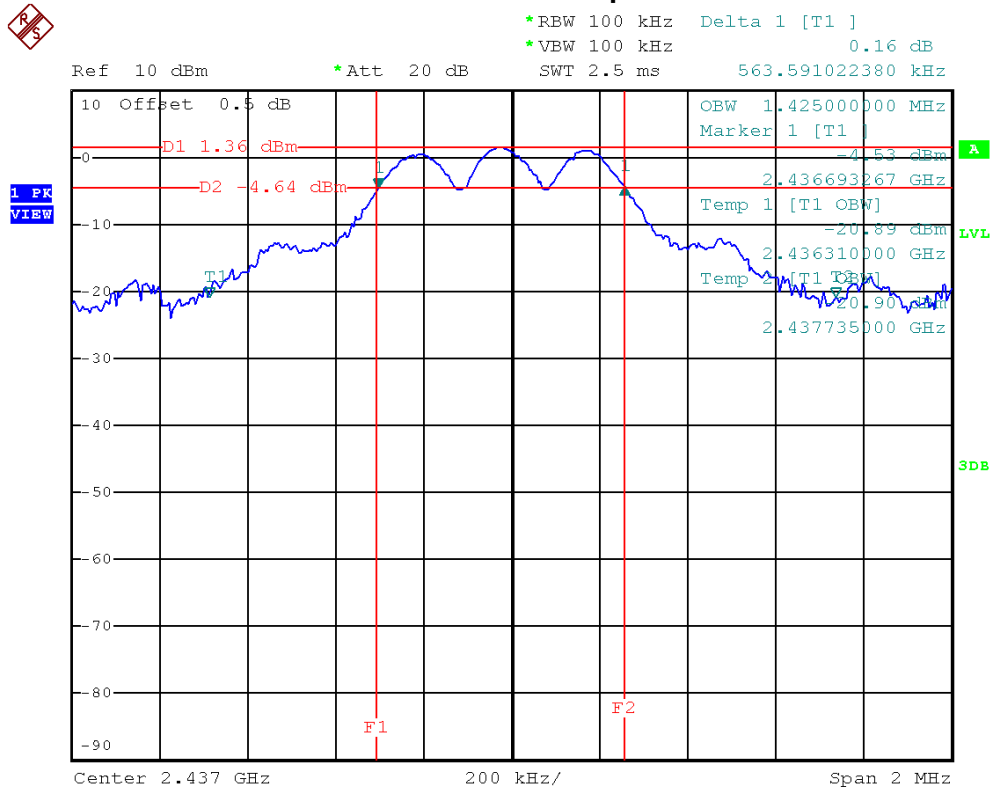
E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

Frequency	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit	Result
2407 MHz	0.56	1.52	≥ 500 kHz	PASS
2437 MHz	0.56	1.43	≥ 500 kHz	PASS
2473 MHz	0.57	1.31	≥ 500 kHz	PASS

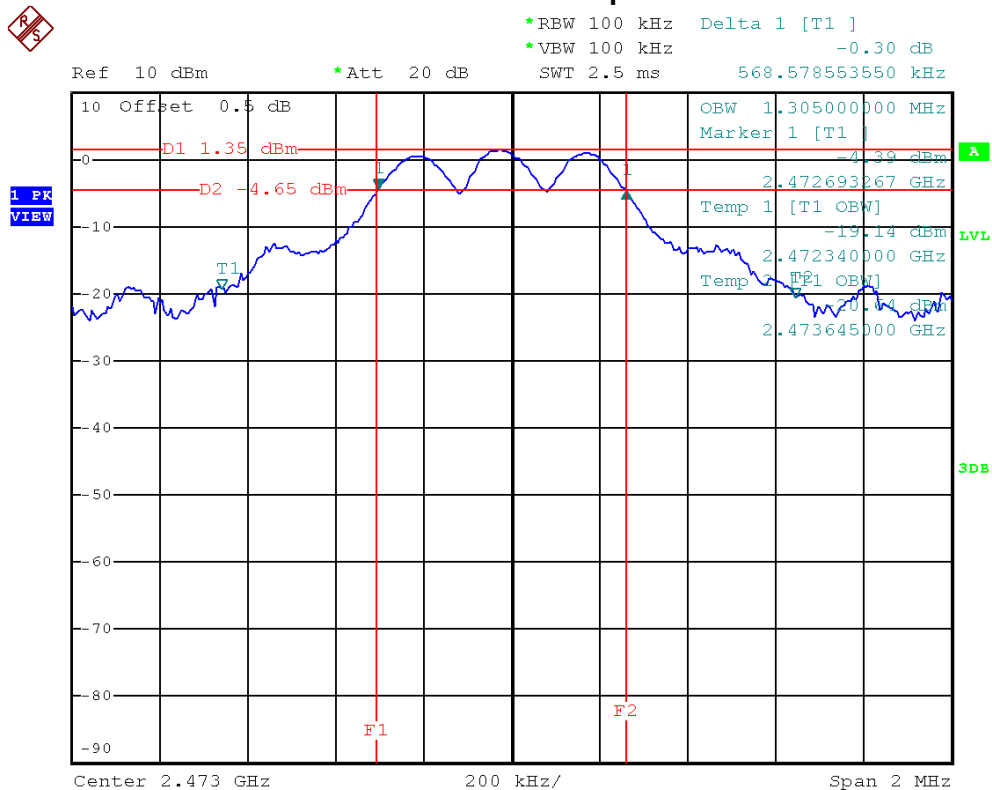




2437 MHz/6 dB and 99% Occupied Bandwidth



2473 MHz/6 dB and 99% Occupied Bandwidth





7 MAXIMUM PEAK CONDUCTED OUTPUT POWER

7.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Maximum Peak Conducted Output Power	2400-2483.5	1 watt or 30 dBm

7.2 MEASUREMENT INSTRUMENTS LIST

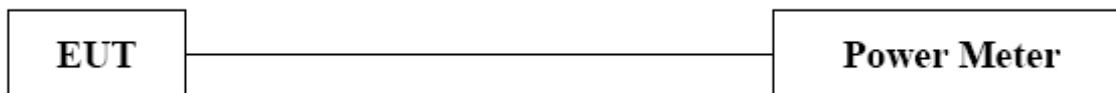
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	Anritsu	ML2495A	1128008	Feb,26,2014
2	Power Meter Sensor	Anritsu	MA2411B	1126001	Feb,26,2014

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

7.3 TEST PROCEDURES

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

7.4 TEST SETUP LAYOUT



7.5 DEVIATION FROM TEST STANDARD

No deviation

7.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.



7.7 TEST RESULTS

E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

Frequency	Peak Output Power (dBm)	LIMIT (dBm)	Result
2407 MHz	1.66	30	PASS
2437 MHz	1.69	30	PASS
2473 MHz	1.65	30	PASS



8 RADIATED SPURIOUS EMISSION (9 KHZ TO 1 GHZ)

8.1 LIMIT

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency Range: 9 kHz to 1 GHz		
FREQUENCY (MHz)	Field Strength (micровolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Frequency Range: above 1 GHz				
FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
above 1 GHz	80	60	74	54

NOTE:

1. The limit for radiated test was performed according to FCC PART 15B.
2. The tighter limit applies at the band edges.
3. Emission level (dBuV/m)=20log Emission level (uV/m).
4. The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)
 Margin Level = Measurement Value – Limit Value



8.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013
2	Horn Antenna	Schwarzbeck	BBHA 9120	D-325	Apr. 15, 2014
3	Microwave Pre-amplifier	Agilent	8449B	3008A01714	Apr. 16, 2014
4	Microflex Cable	N/A	27478LL142	1m	May. 14, 2014
5	Microflex Cable	AISI	S104-SMAP-1	8m	May. 14, 2014
6	Microflex Cable	N/A	27478LL142	3m	May. 14, 2014
7	Test Cable	N/A	LMR-400	966_12m	May. 14, 2014
8	Test Cable	N/A	LMR-400	966_3m	May. 14, 2014
9	Pre-Amplifier	EMC	EMC-330	980001	Jul. 07, 2013
10	Log-Bicon Antenna	Schwarzbeck	VULB9168-352	9168-352	Jun. 12, 2013

Remark: "N/A" denotes No Model Name, No Serial No. or No Calibration specified.

8.3 MEASURING INSTRUMENTS SETTING

EMI Test Receiver	Parameter Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP



8.4 TEST PROCEDURES

- The measuring distance of at 3 m shall be used for measurements at frequency up to 1 GHz. For frequencies above 1 GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m Semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.
- The testing follows the guidelines in ANSI C63.4 and FCC Public Notice DA 00-705 Measurement Guidelines. In case the emission is fail due to the used RBW/VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

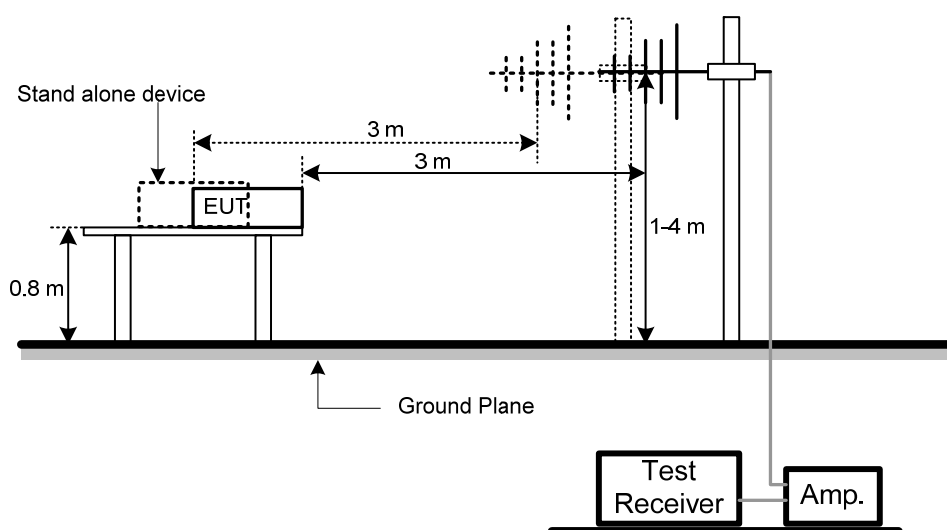
NOTE:

- Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode with Detector BW=120 kHz; SPA setting in RBW=100 kHz, VBW =100 kHz, Swp. Time = 0.3 sec./ MHz.
- All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.

8.5 DEVIATION FROM TEST STANDARD

No deviation

8.6 TEST SETUP LAYOUT





8.7 EUT OPERATING CONDITIONS

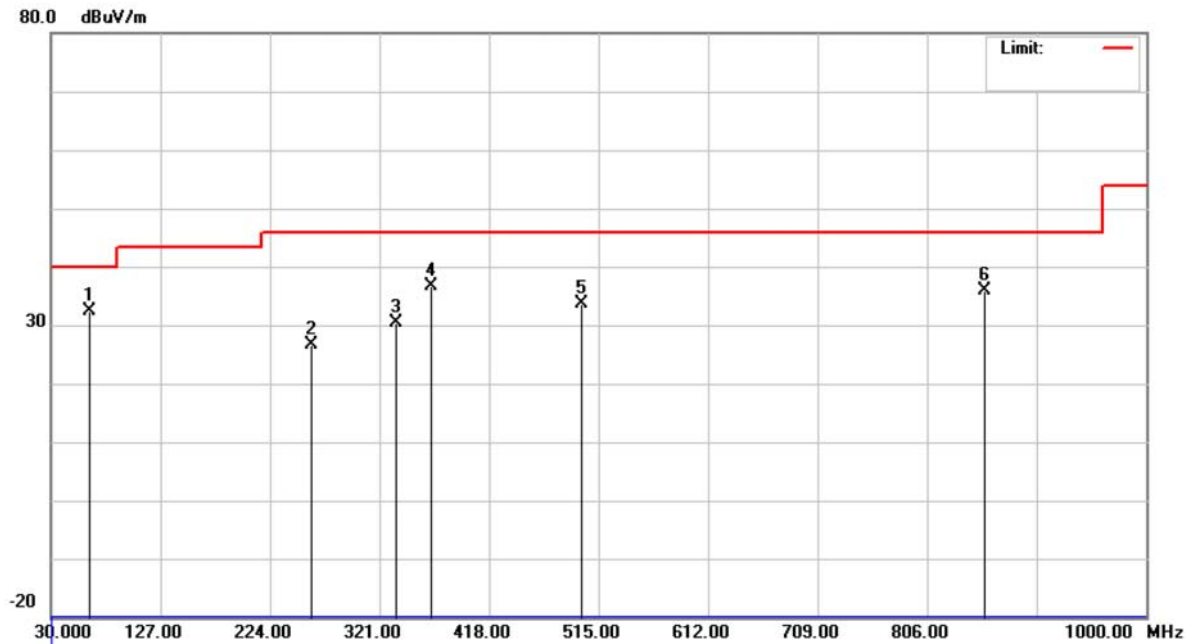
The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.



8.8 TEST RESULTS

E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Vertical

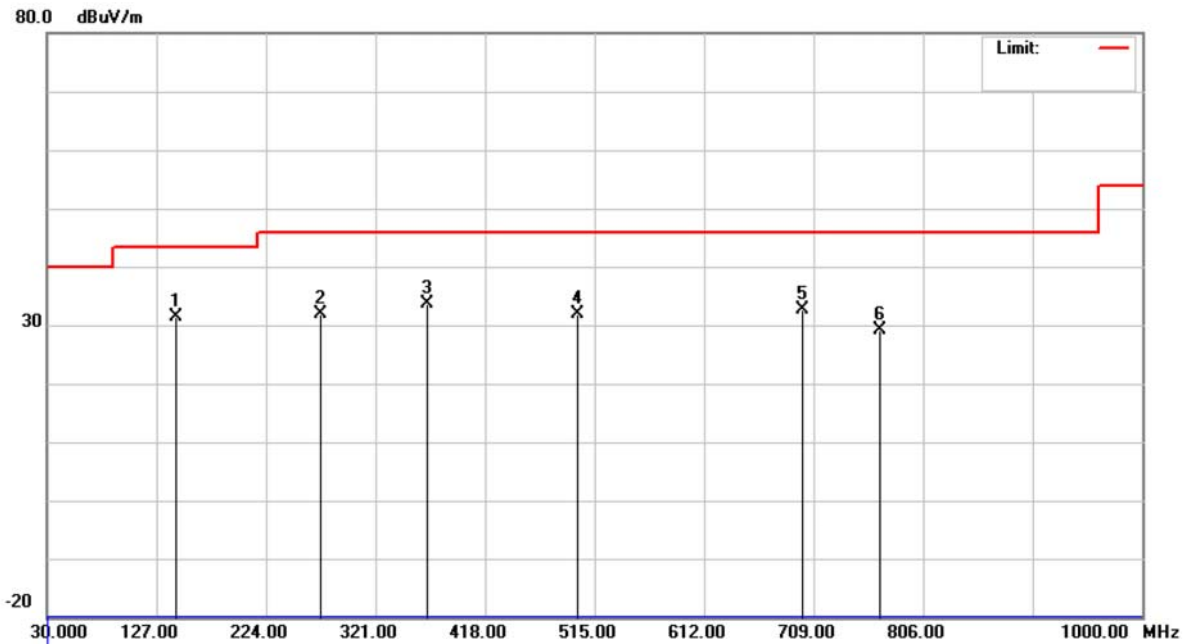


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	63.9500	52.47	-20.16	32.31	40.00	-7.69	peak	
2		260.3750	46.45	-19.72	26.73	46.00	-19.27	peak	
3		335.5499	47.81	-17.45	30.36	46.00	-15.64	peak	
4		367.0750	53.22	-16.68	36.54	46.00	-9.46	peak	
5		500.4500	47.47	-13.95	33.52	46.00	-12.48	peak	
6		856.9249	43.65	-7.70	35.95	46.00	-10.05	peak	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	143.9750	50.81	-19.50	31.31	43.50	-12.19	peak	
2		272.5000	50.93	-19.09	31.84	46.00	-14.16	peak	
3		367.0750	50.33	-16.68	33.65	46.00	-12.35	peak	
4		500.4500	45.86	-13.95	31.91	46.00	-14.09	peak	
5		699.2999	42.99	-10.27	32.72	46.00	-13.28	peak	
6		767.2000	38.01	-8.93	29.08	46.00	-16.92	peak	



9 RADIATED SPURIOUS EMISSION (ABOVE 1 GHz)

9.1 LIMIT

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency Range: 9 kHz to 1 GHz		
FREQUENCY (MHz)	Field Strength (micровolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Frequency Range: above 1 GHz				
FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
above 1 GHz	80	60	74	54

NOTE:

- (1) The limit for radiated test was performed according to FCC PART 15B.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)
 Margin Level = Measurement Value – Limit Value



9.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013
2	Horn Antenna	Schwarzbeck	BBHA 9120	D-325	Apr. 15, 2014
3	Microwave Pre_amplifier	Agilent	8449B	3008A01714	Apr. 16, 2014
4	Microflex Cable	N/A	27478LL142	1m	May. 14, 2014
5	Microflex Cable	AISI	S104-SMAP-1	8m	May. 14, 2014
6	Microflex Cable	N/A	27478LL142	3m	May. 14, 2014
7	Test Cable	N/A	LMR-400	966_12m	May. 14, 2014
8	Test Cable	N/A	LMR-400	966_3m	May. 14, 2014
9	Pre-Amplifier	EMC	EMC-330	980001	Jul. 07, 2013
10	Log-Bicon Antenna	Schwarzbeck	VULB9168-352	9168-352	Jun. 12, 2013

Remark: "N/A" denotes No Model Name, No Serial No. or No Calibration specified.

9.3 MEASURING INSTRUMENTS SETTING

Spectrum Analyzer	Parameter Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (other emission)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average



9.4 TEST PROCEDURES

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m Semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.
- The testing follows the guidelines in ANSI C63.4 and FCC Public Notice DA 00-705 Measurement Guidelines. In case the emission is fail due to the used RBW/VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

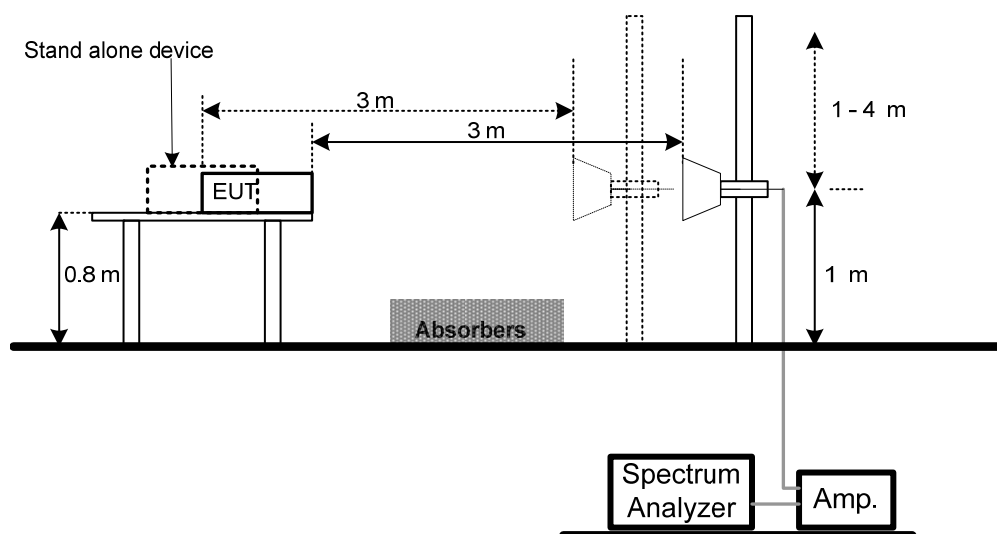
NOTE:

- Reading in which marked as Peak means measurements by using are Peak Mode with instrument setting in RBW= 1 MHz, VBW= 1 MHz, Swp. Time = Auto.
Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW= 1 MHz, VBW= 10 Hz, Swp. Time = Auto.
- All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform.

9.5 DEVIATION FROM TEST STANDARD

No deviation

9.6 TEST SETUP LAYOUT





9.7 EUT OPERATING CONDITIONS

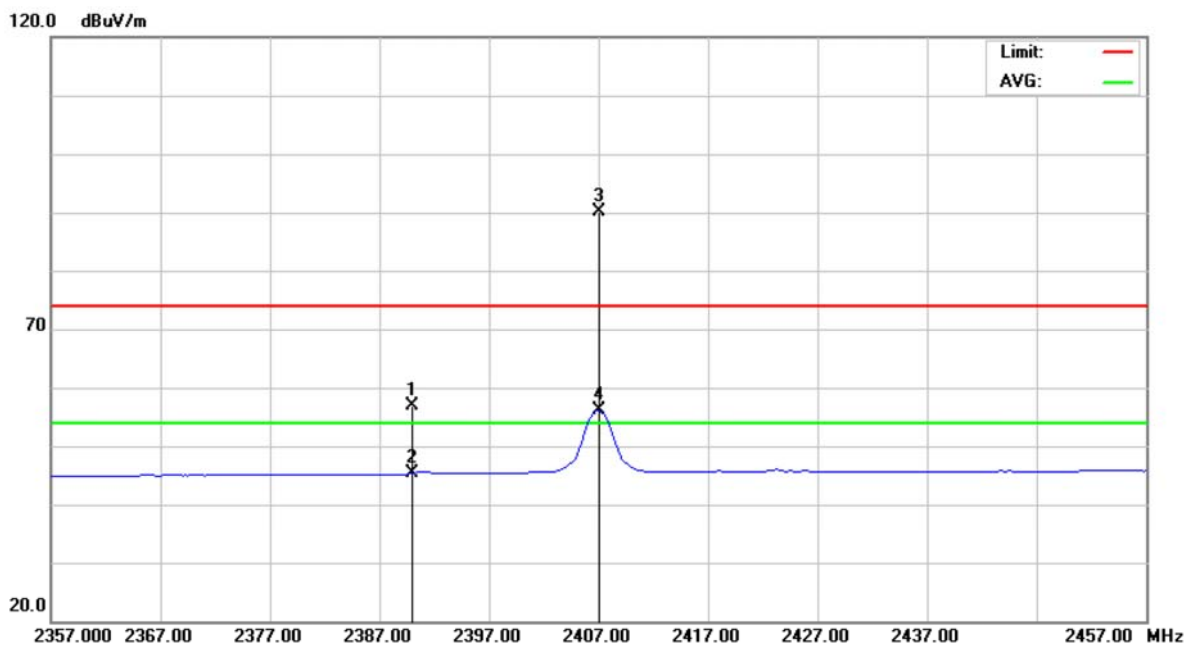
The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.



9.8 TEST RESULTS

E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		

Polarization: Vertical

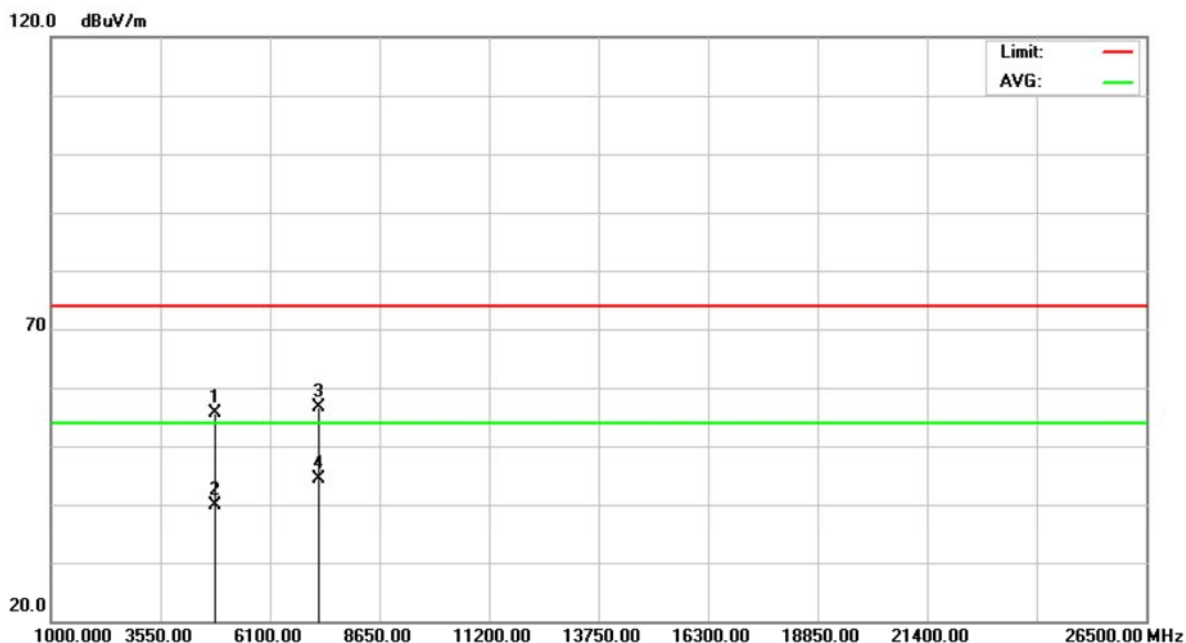


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	25.14	31.67	56.81	74.00	-17.19	peak	
2		2390.000	13.69	31.67	45.36	54.00	-8.64	AVG	
3	*	2407.000	58.38	31.74	90.12	74.00	16.12	peak	
4	X	2407.000	24.40	31.74	56.14	54.00	2.14	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		

Polarization: Vertical

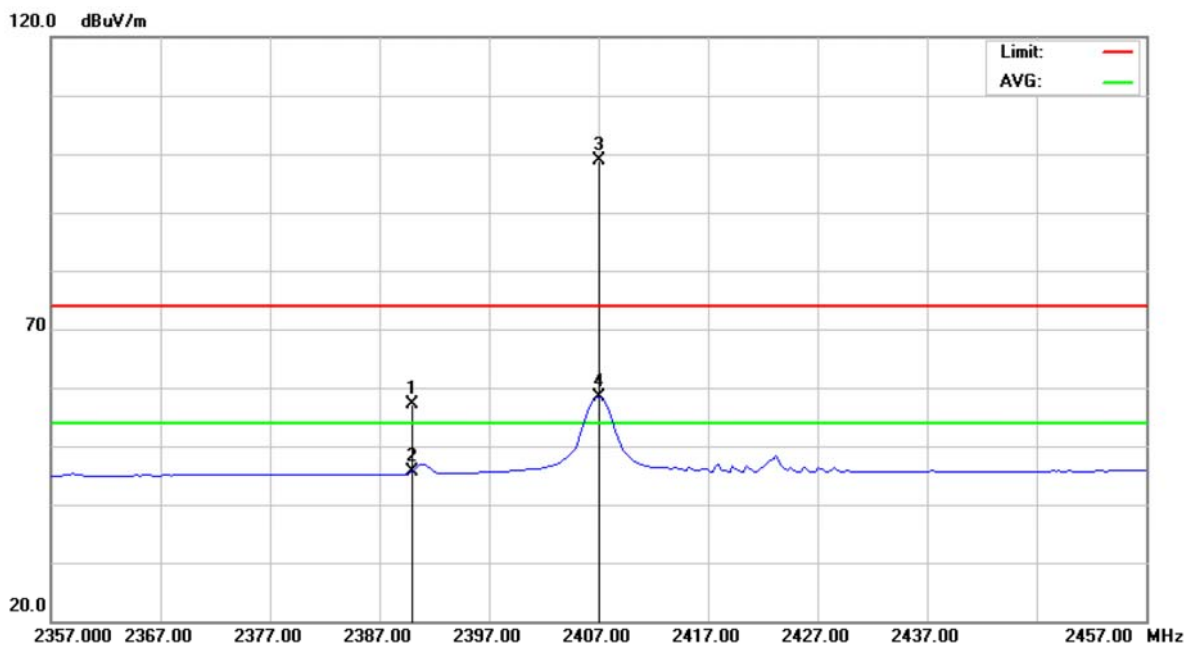


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4813.900	49.94	5.70	55.64	74.00	-18.36	peak	
2		4813.900	34.08	5.70	39.78	54.00	-14.22	AVG	
3		7221.075	44.46	12.23	56.69	74.00	-17.31	peak	
4	*	7221.075	32.13	12.23	44.36	54.00	-9.64	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		

Polarization: Horizontal

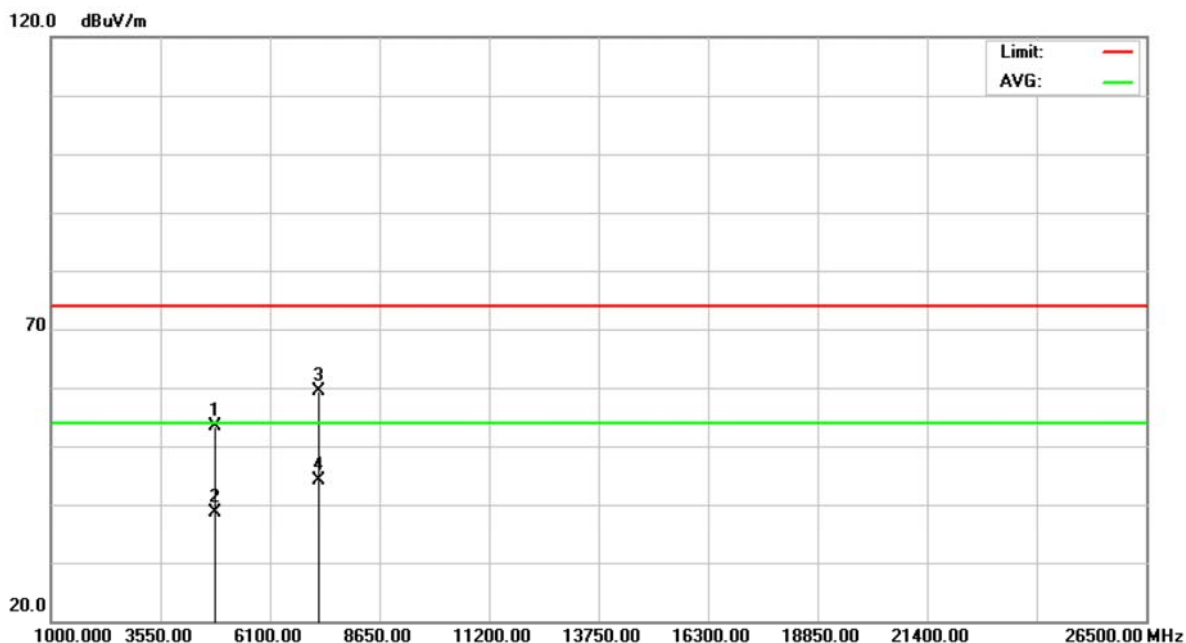


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	25.36	31.67	57.03	74.00	-16.97	peak	
2		2390.000	14.03	31.67	45.70	54.00	-8.30	AVG	
3	*	2407.000	67.05	31.74	98.79	74.00	24.79	peak	
4	X	2407.000	26.66	31.74	58.40	54.00	4.40	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		

Polarization: Horizontal

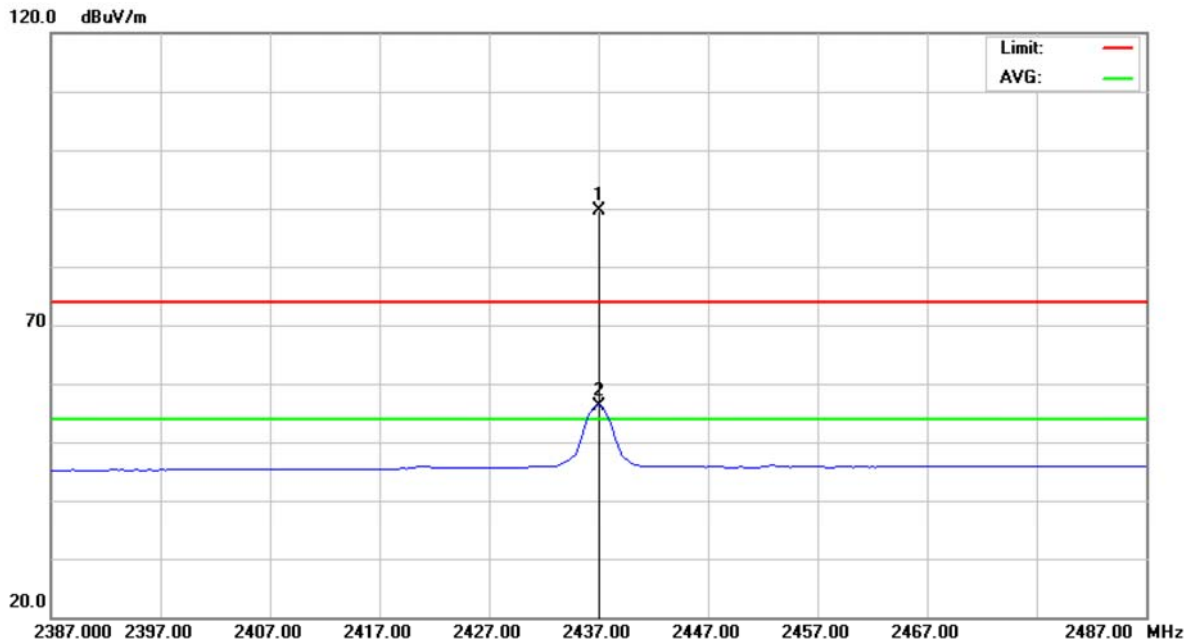


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4813.938	47.71	5.70	53.41	74.00	-20.59	peak	
2		4813.938	32.82	5.70	38.52	54.00	-15.48	AVG	
3		7220.737	47.09	12.23	59.32	74.00	-14.68	peak	
4	*	7220.737	31.82	12.23	44.05	54.00	-9.95	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Vertical

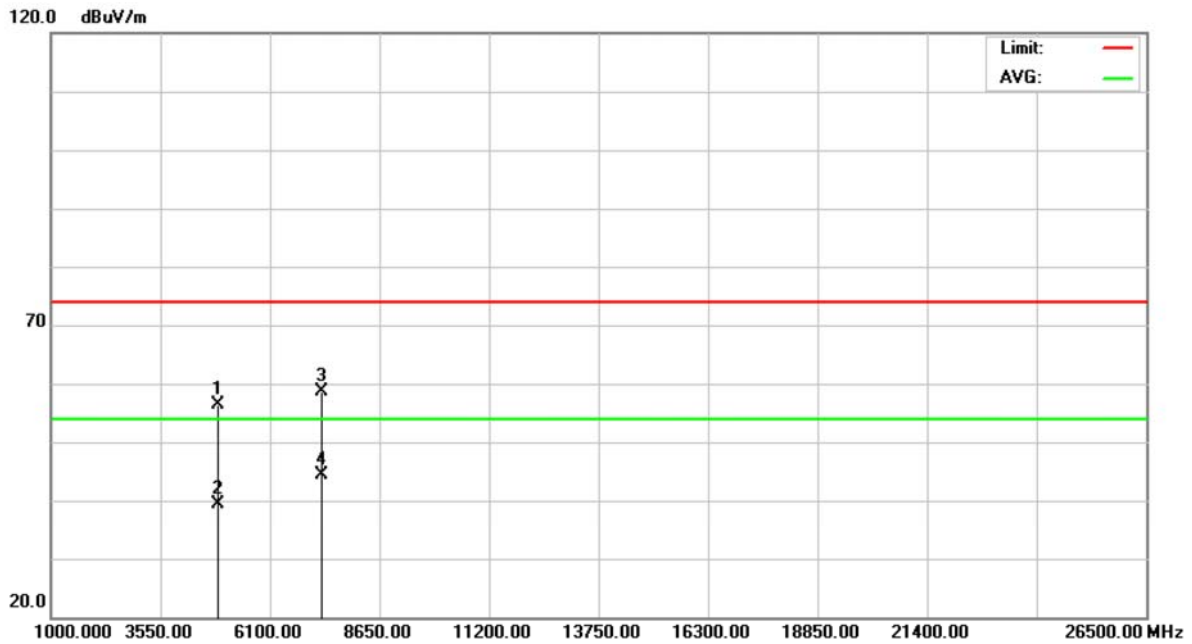


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2437.000	57.87	31.88	89.75	74.00	15.75	peak	
2	X	2437.000	24.37	31.88	56.25	54.00	2.25	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Vertical

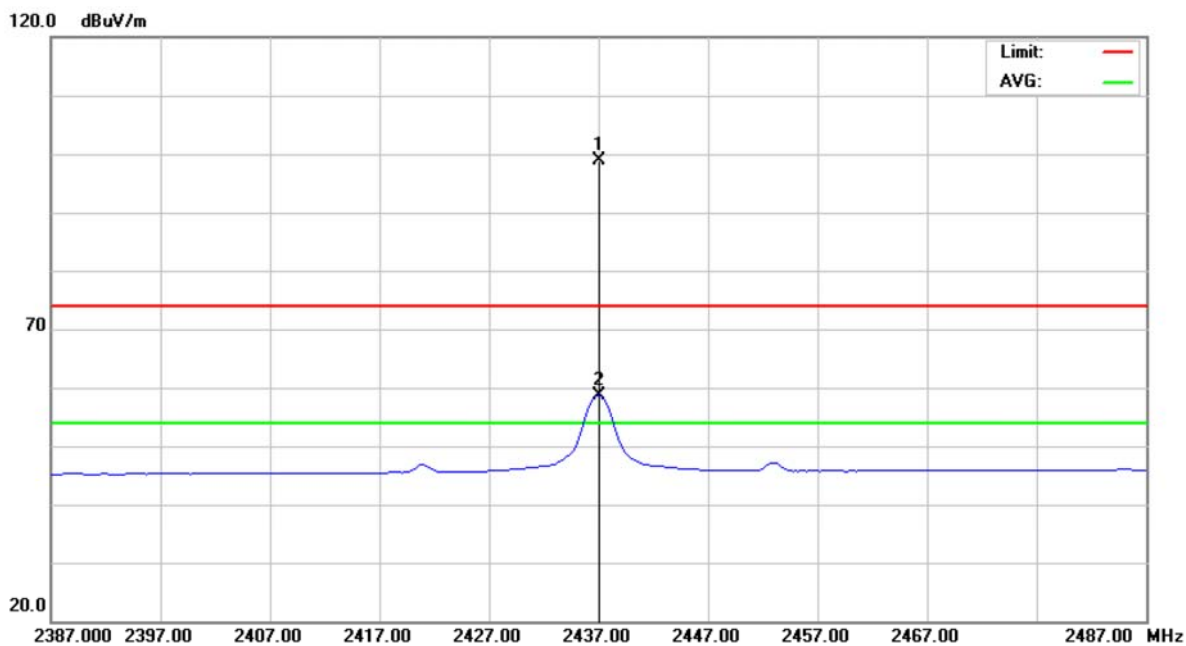


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4873.925	50.68	5.78	56.46	74.00	-17.54	peak	
2		4873.925	33.53	5.78	39.31	54.00	-14.69	AVG	
3		7310.975	45.94	12.57	58.51	74.00	-15.49	peak	
4	*	7310.975	31.84	12.57	44.41	54.00	-9.59	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Horizontal

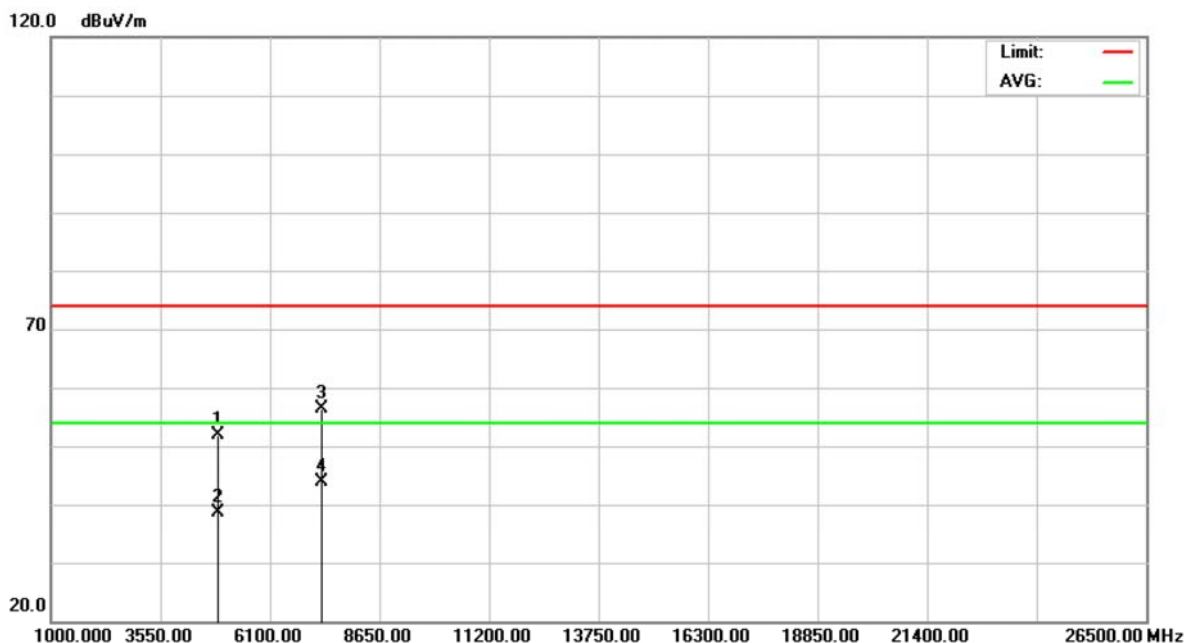


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2437.000	67.12	31.88	99.00	74.00	25.00	peak	
2	X	2437.000	26.82	31.88	58.70	54.00	4.70	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Horizontal

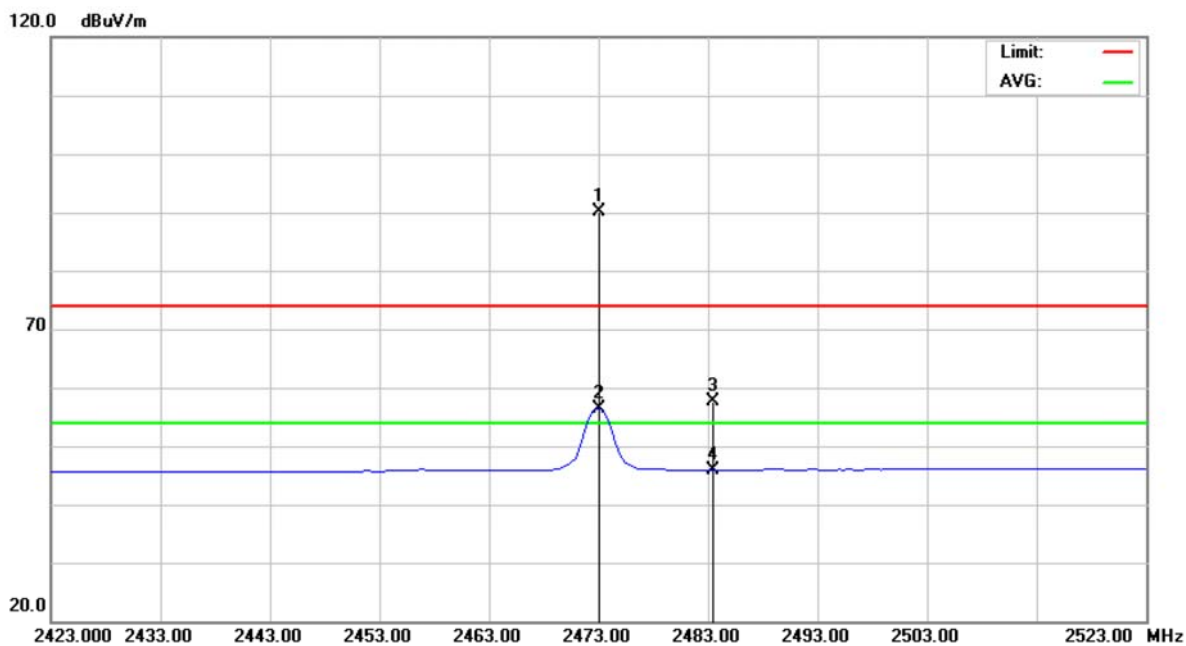


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4873.913	46.22	5.78	52.00	74.00	-22.00	peak	
2		4873.913	32.90	5.78	38.68	54.00	-15.32	AVG	
3		7310.925	43.90	12.57	56.47	74.00	-17.53	peak	
4	*	7310.925	31.36	12.57	43.93	54.00	-10.07	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		

Polarization: Vertical

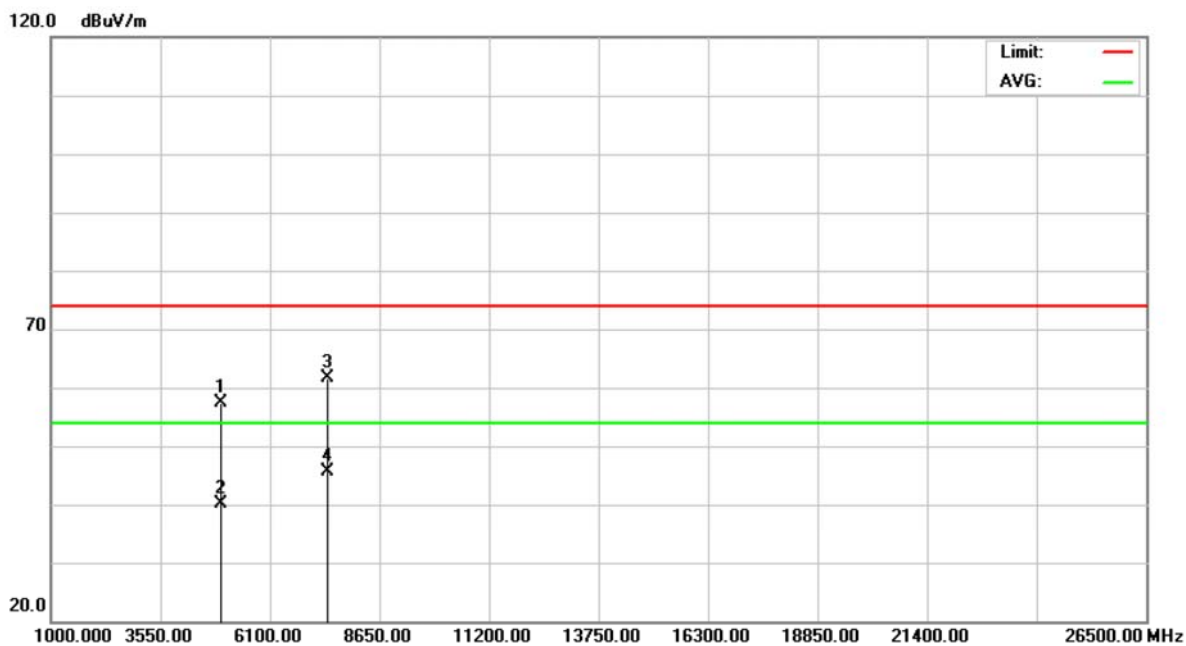


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2473.000	58.01	32.04	90.05	74.00	16.05	peak	
2	X	2473.000	24.45	32.04	56.49	54.00	2.49	AVG	
3		2483.500	25.60	32.09	57.69	74.00	-16.31	peak	
4		2483.500	13.81	32.09	45.90	54.00	-8.10	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		

Polarization: Vertical

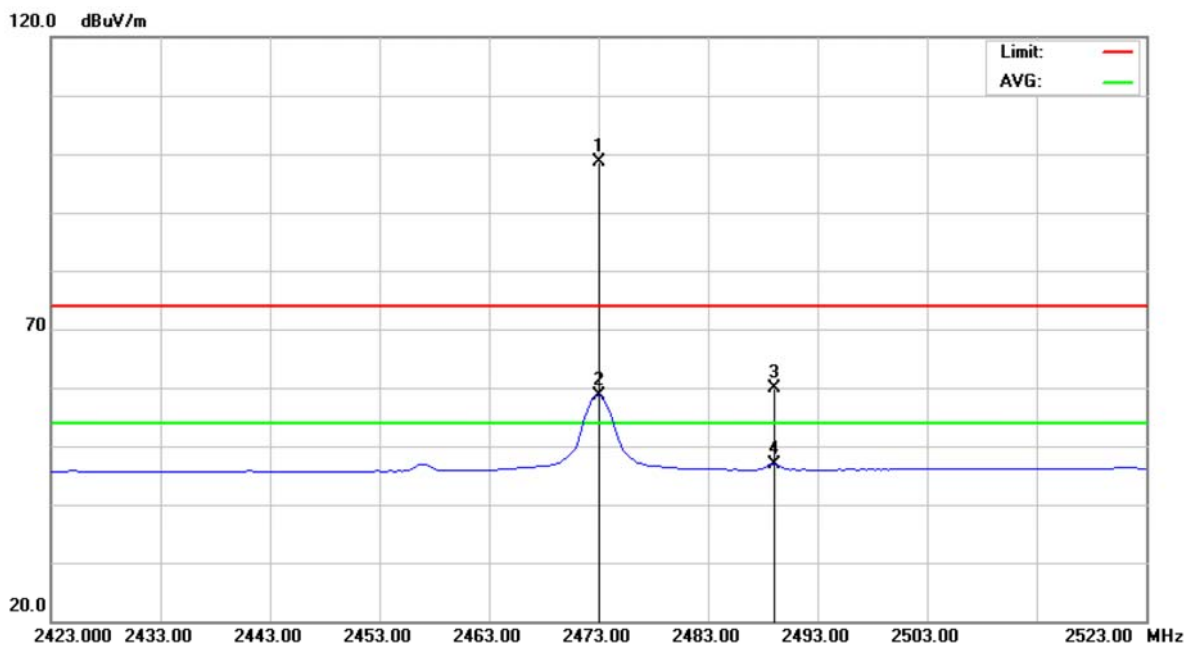


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4946.000	51.41	5.87	57.28	74.00	-16.72	peak	
2		4946.000	34.34	5.87	40.21	54.00	-13.79	AVG	
3		7418.875	48.71	12.97	61.68	74.00	-12.32	peak	
4	*	7418.875	32.72	12.97	45.69	54.00	-8.31	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		

Polarization: Horizontal

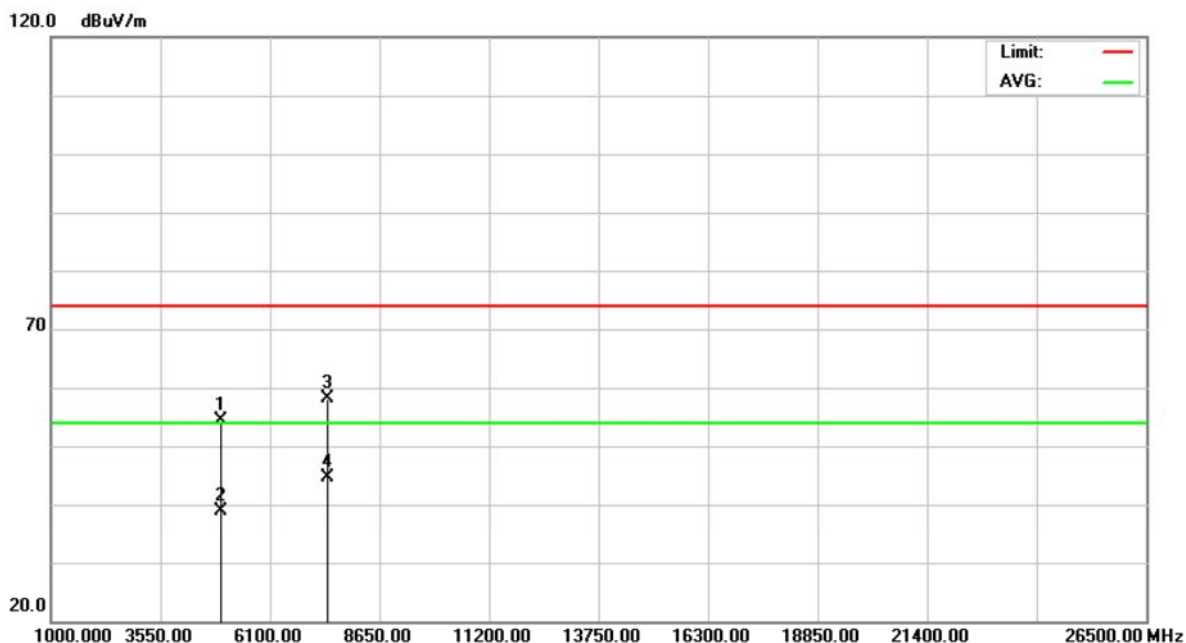


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2473.000	66.70	32.04	98.74	74.00	24.74	peak	
2	X	2473.000	26.67	32.04	58.71	54.00	4.71	AVG	
3		2489.000	27.69	32.11	59.80	74.00	-14.20	peak	
4		2489.000	14.89	32.11	47.00	54.00	-7.00	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		

Polarization: Horizontal



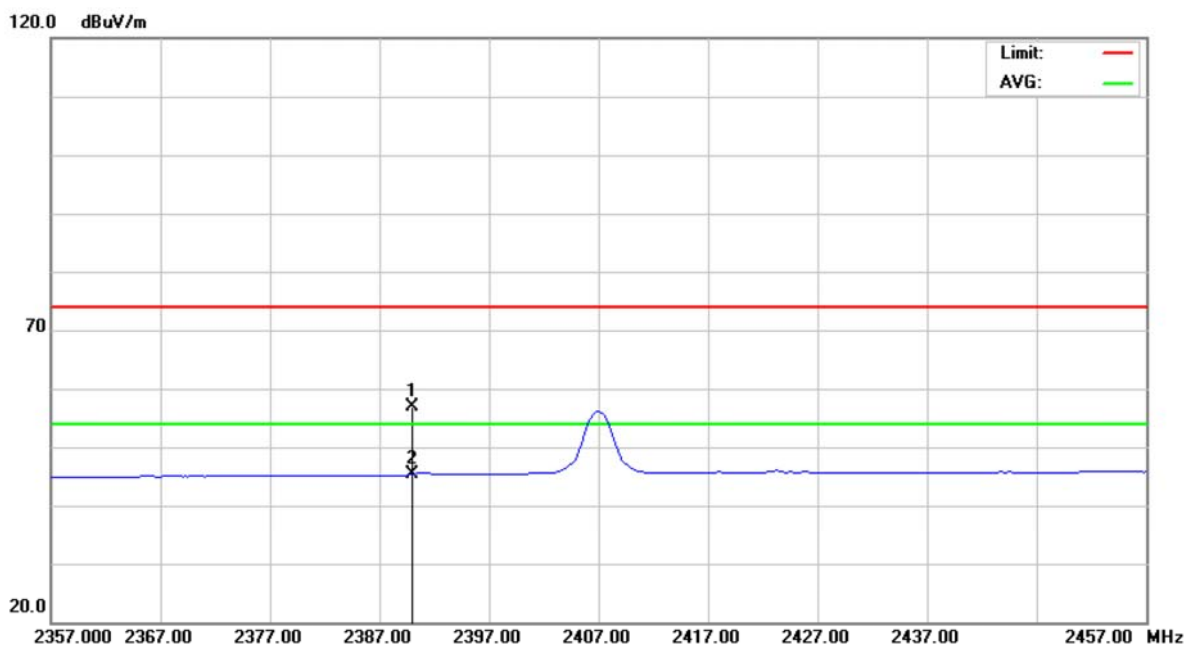
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4945.950	48.52	5.87	54.39	74.00	-19.61	peak	
2		4945.950	32.95	5.87	38.82	54.00	-15.18	AVG	
3		7419.075	45.08	12.97	58.05	74.00	-15.95	peak	
4	*	7419.075	31.71	12.97	44.68	54.00	-9.32	AVG	



9.9 TEST RESULTS (RESTRICTED BANDS)

E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		
NOTE	The transmitter was setup to transmit at the lowest channel and the field strength was measured at 2310-2390 MHz.		

Polarization: Vertical

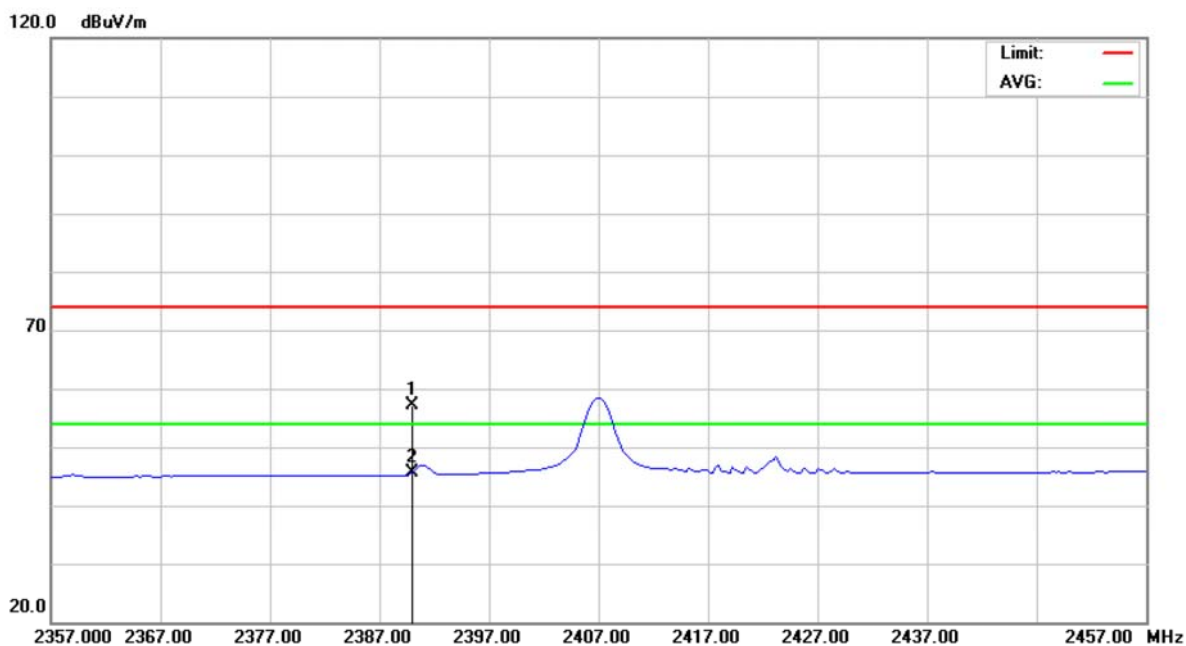


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	25.14	31.67	56.81	74.00	-17.19	peak	
2	*	2390.000	13.69	31.67	45.36	54.00	-8.64	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		
NOTE	The transmitter was setup to transmit at the lowest channel and the field strength was measured at 2310-2390 MHz.		

Polarization: Horizontal

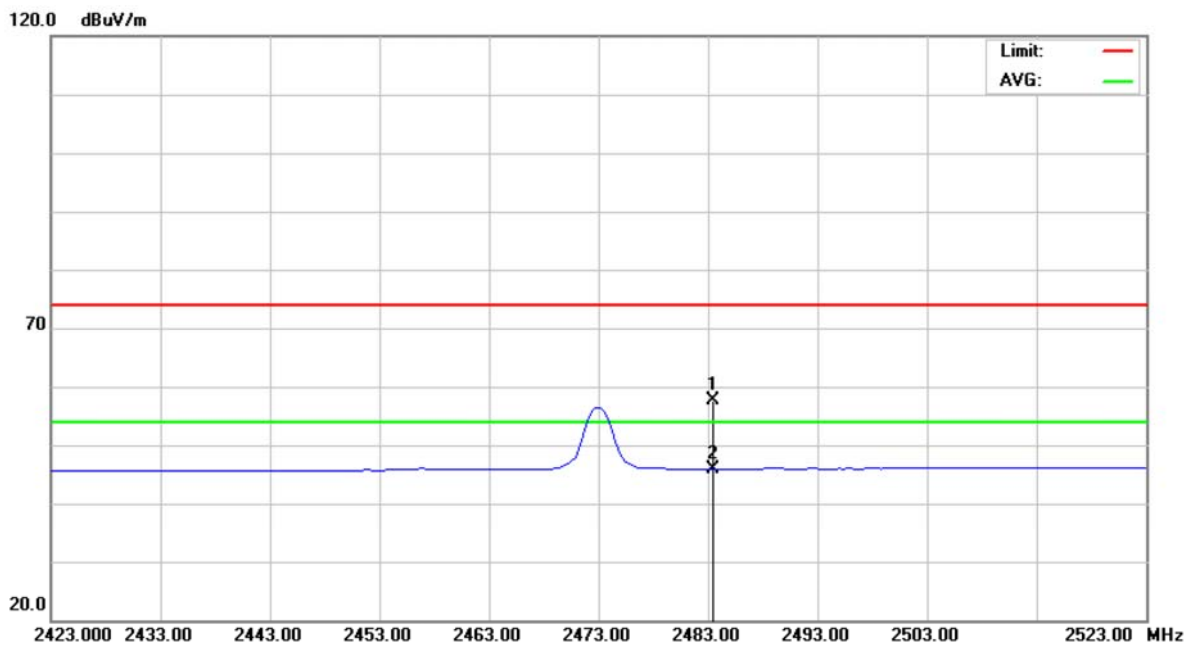


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	25.36	31.67	57.03	74.00	-16.97	peak	
2	*	2390.000	14.03	31.67	45.70	54.00	-8.30	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		
NOTE	The transmitter was setup to transmit at the highest channel and the field strength was measured at 2483.5-2500 MHz.		

Polarization: Vertical

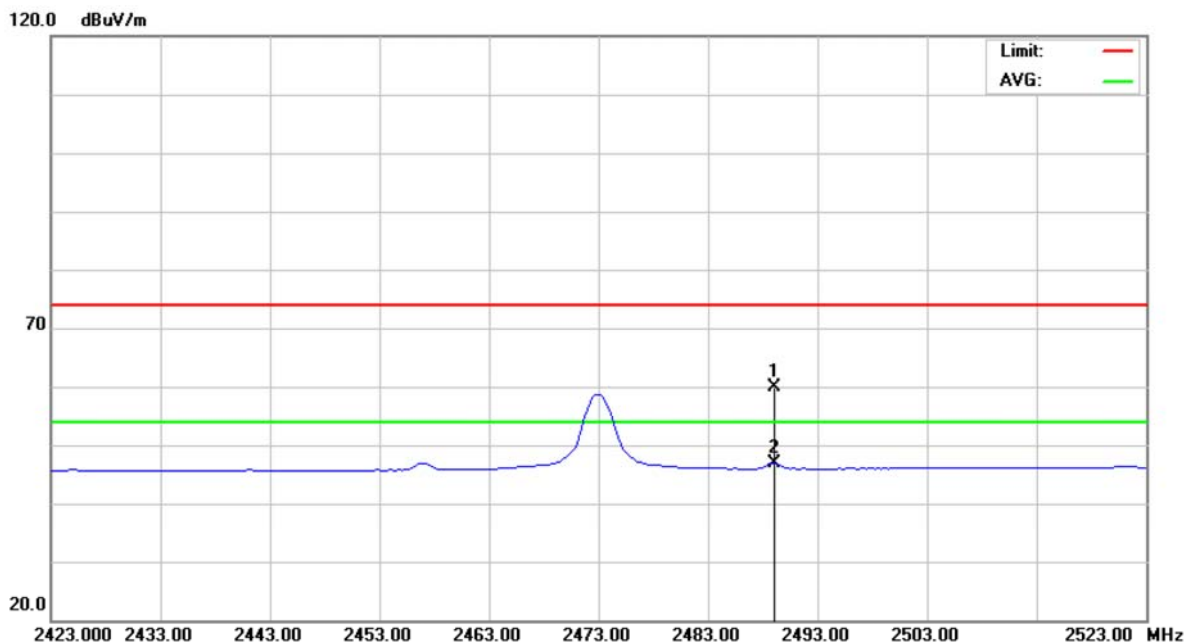


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2483.500	25.60	32.09	57.69	74.00	-16.31	peak	
2	*	2483.500	13.81	32.09	45.90	54.00	-8.10	AVG	



E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		
NOTE	The transmitter was setup to transmit at the highest channel and the field strength was measured at 2483.5-2500 MHz.		

Polarization: Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2489.000	27.69	32.11	59.80	74.00	-14.20	peak	
2	*	2489.000	14.89	32.11	47.00	54.00	-7.00	AVG	



10 POWER SPECTRAL DENSITY

10.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Power Spectral Density	2400-2483.5	8 dBm (in any 3 kHz)

10.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

10.3 TEST PROCEDURES

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW=3 kHz, VBW=30 kHz, Sweep time = 500s.

10.4 TEST SETUP LAYOUT



10.5 DEVIATION FROM TEST STANDARD

No deviation

10.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.

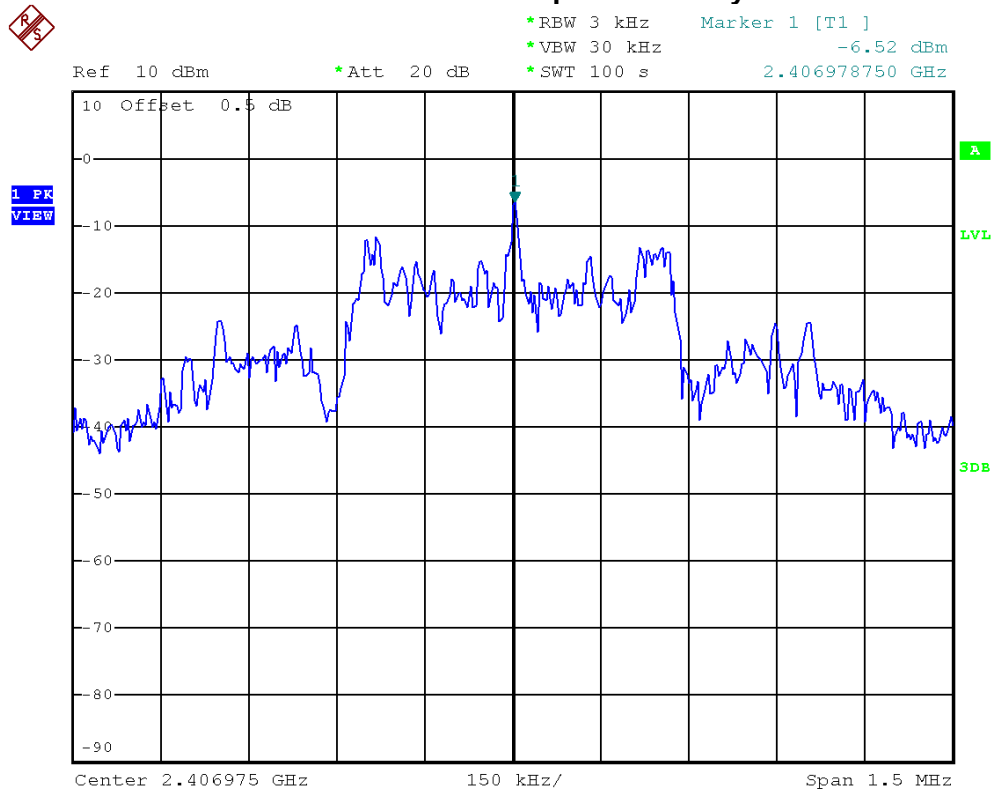


10.7 TEST RESULTS

E.U.T	2.4G RF Gaming Mouse	Model Name	R8
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

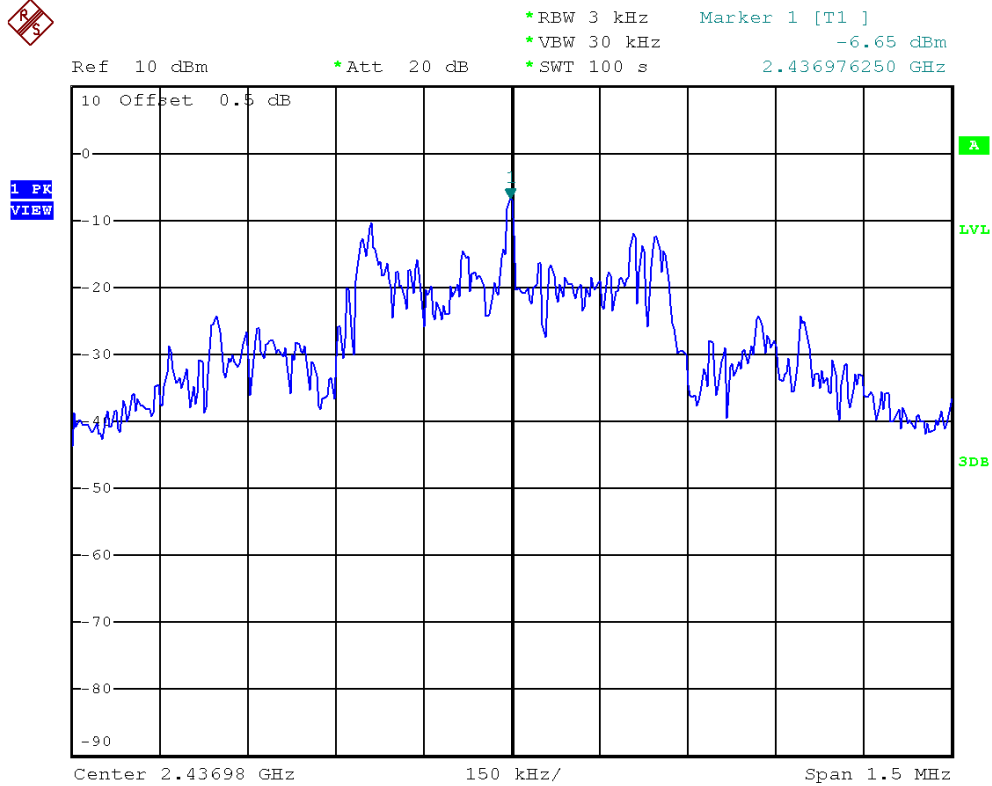
Frequency	Power Density (dBm)	Limit (dBm)	Result
2407 MHz	-6.52	8	PASS
2437 MHz	-6.65	8	PASS
2473 MHz	-6.65	8	PASS

2407 MHz/Power Sepctral Density

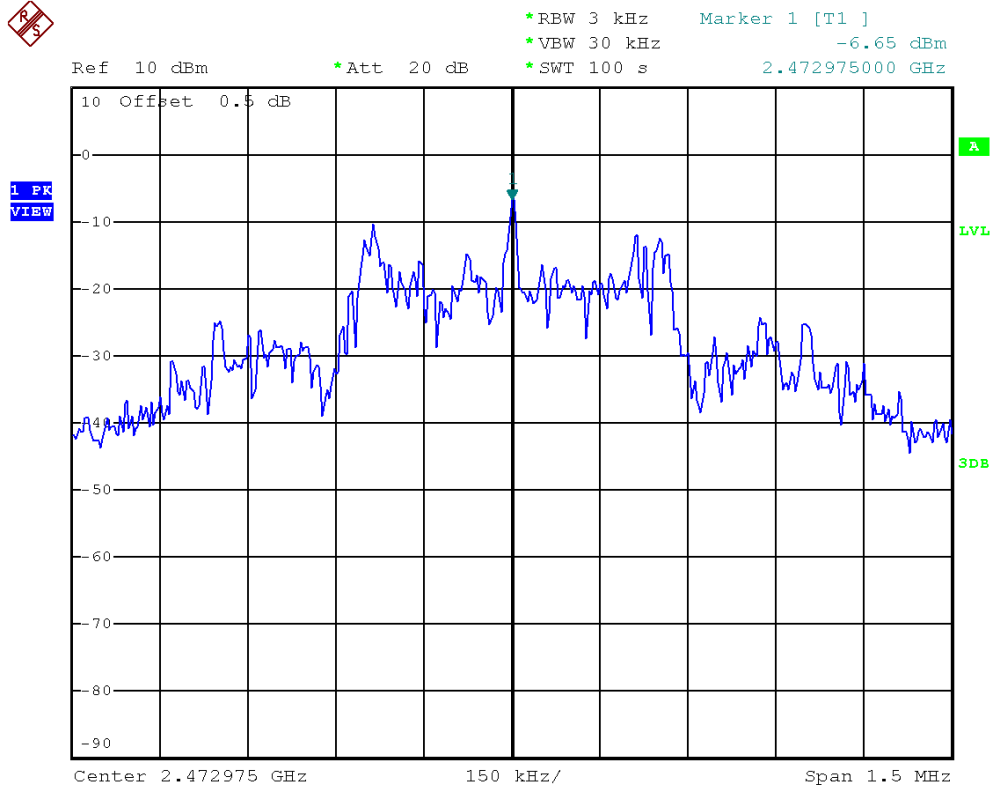




2437 MHz/Power Sepctral Density



2473 MHz/Power Sepctral Density





11 RF EXPOSURE COMPLIANCE

11.1 LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

NOTE: f = frequency in MHz ; *Plane-wave equivalent power density.

11.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	Anritsu	ML2495A	1128008	Feb,20,2013
2	Power Meter Sensor	Anritsu	MA2411B	1126001	Feb,20,2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

11.3 MPE CALCULATION METHOD

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

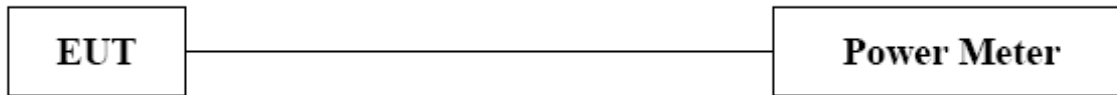
The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained



11.4 TEST SETUP LAYOUT



11.5 DEVIATION FROM TEST STANDARD

No deviation

11.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.

11.7 TEST RESULTS

The power is too low, so no RF calculations are needed.