



Test Report

Product Name	Wireless Keyboard
Model No	StarType ES500W
FCC ID.	I4LSTARTYPEES500W

Applicant	MICRO-STAR INT'L Co., LTD.
Address	No. 69, Li-De St., Jung-He City, Taipei Hsien, Taiwan, R.O.C.

Date of Receipt	Jul. 30, 2009
Issue Date	Oct. 01, 2009
Report No.	098086R-RFUSP42V01
Report Version	V1.0

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of Quietek Corporation.

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Test Report Certification

Issue Date: Oct. 01, 2009

Report No.: 098086R-RFUSP42V01



Accredited by NIST (NVLAP)
NVLAP Lab Code: 200533-0

Product Name	Wireless Keyboard
Applicant	MICRO-STAR INT'L Co., LTD.
Address	No. 69, Li-De St., Jung-He City, Taipei Hsien, Taiwan, R.O.C.
Manufacturer	MICRO-STAR INT'L Co., LTD.
Model No.	StarType ES500W
EUT Rated Voltage	DC 3V(Power by Battery)
EUT Test Voltage	DC 3V(Power by Battery)
Trade Name	MSI
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2008 ANSI C63.4: 2003
Test Result	Complied



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Tested By : NoNo Chang
(Engineer / NoNo Chang)



Testing Laboratory

0914

Approved By : Vincent Lin
(Manager / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Wireless Keyboard
Trade Name	MSI
Model No.	StarType ES500W
FCC ID.	I4LSTARTYPEES500W
Frequency Range	2404~2480MHz
Number of Channels	77
Type of Modulation	GFSK
Antenna Type	Printed on PCB
Antenna Gain	Refer to the table "Antenna List"
Channel Control	Auto

Antenna List

No.	Manufacturer	Part No.	Peak Gain
1	MSI	N/A	-1.32dBi for 2.4 GHz

Frequency of Each Channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 1:	2404 MHz	Channel 22:	2425 MHz	Channel 43:	2446 MHz	Channel 64:	2467 MHz
Channel 2:	2405 MHz	Channel 23:	2426 MHz	Channel 44:	2447 MHz	Channel 65:	2468 MHz
Channel 3:	2406 MHz	Channel 24:	2427 MHz	Channel 45:	2448 MHz	Channel 66:	2469 MHz
Channel 4:	2407 MHz	Channel 25:	2428 MHz	Channel 46:	2449 MHz	Channel 67:	2470 MHz
Channel 5:	2408 MHz	Channel 26:	2429 MHz	Channel 47:	2450 MHz	Channel 68:	2471 MHz
Channel 6:	2409 MHz	Channel 27:	2430 MHz	Channel 48:	2451 MHz	Channel 69:	2472 MHz
Channel 7:	2410 MHz	Channel 28:	2431 MHz	Channel 49:	2452 MHz	Channel 70:	2473 MHz
Channel 8:	2411 MHz	Channel 29:	2432 MHz	Channel 50:	2453 MHz	Channel 71:	2474 MHz
Channel 9:	2412 MHz	Channel 30:	2433 MHz	Channel 51:	2454 MHz	Channel 72:	2475 MHz
Channel 10:	2413 MHz	Channel 31:	2434 MHz	Channel 52:	2455 MHz	Channel 73:	2476 MHz
Channel 11:	2414 MHz	Channel 32:	2435 MHz	Channel 53:	2456 MHz	Channel 74:	2477 MHz
Channel 12:	2415 MHz	Channel 33:	2436 MHz	Channel 54:	2457 MHz	Channel 75:	2478 MHz
Channel 13:	2416 MHz	Channel 34:	2437 MHz	Channel 55:	2458 MHz	Channel 76:	2479 MHz
Channel 14:	2417 MHz	Channel 35:	2438 MHz	Channel 56:	2459 MHz	Channel 77:	2480 MHz
Channel 15:	2418 MHz	Channel 36:	2439 MHz	Channel 57:	2460 MHz		
Channel 16:	2419 MHz	Channel 37:	2440 MHz	Channel 58:	2461 MHz		
Channel 17:	2420 MHz	Channel 38:	2441 MHz	Channel 59:	2462 MHz		
Channel 18:	2421 MHz	Channel 39:	2442 MHz	Channel 60:	2463 MHz		
Channel 19:	2422 MHz	Channel 40:	2443 MHz	Channel 61:	2464 MHz		
Channel 20:	2423 MHz	Channel 41:	2444 MHz	Channel 62:	2465 MHz		
Channel 21:	2424 MHz	Channel 42:	2445 MHz	Channel 63:	2466 MHz		

Note:

1. The EUT is a Wireless Keyboard with a built-in 2.4GHz transceiver.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
3. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report.
4. These tests are conducted on a sample for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.247 of spread spectrum devices
5. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

1.2. Operational Description

The EUT is 2.4GHz Wireless Keyboard built-in 2.4GHz transceiver. The operation frequency is from 2404 MHz to 2480MHz with GFSK modulation. The signal will be transmitted through 2.4 GHz RF signal from the Printed antenna. DC 3V shall be provided for EUT operation.

Test Mode:	Mode 1: Transmitter
------------	---------------------

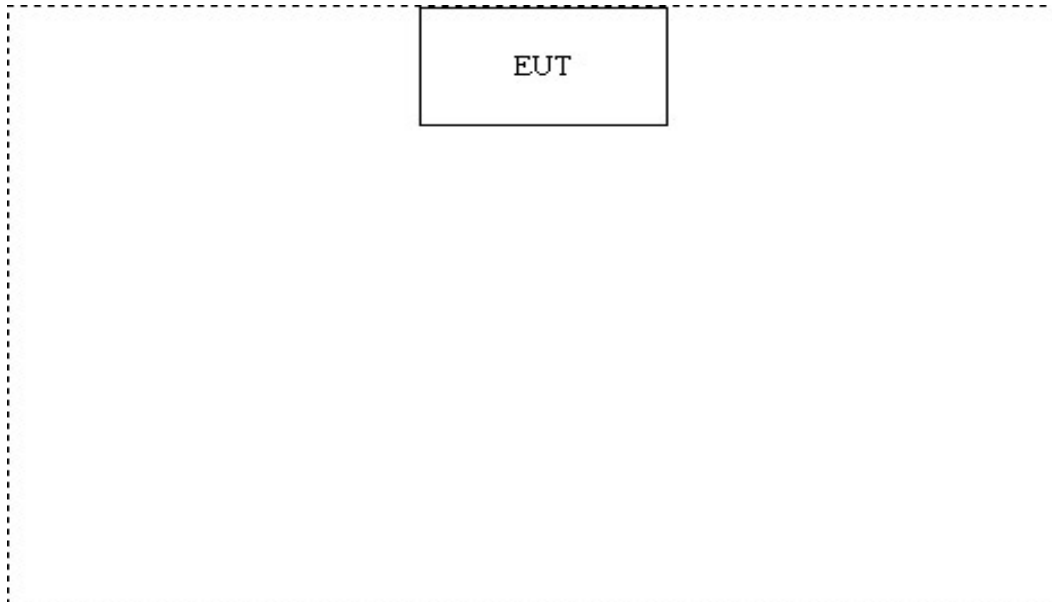
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1	N/A	N/A	N/A	N/A

Signal Cable Type	Signal cable Description
A	N/A

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1	Setup the EUT and display as shown on 1.4
2	Installs the battery.
3	The EUT will continuously transmit the radio signal.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation’s Web Site : <http://tw.quietek.com/modules/myalbum/>
 The address and introduction of Quietek Corporation’s laboratories can be founded in our Web site : <http://www.quietek.com/>

Site Description: File on
 Federal Communications Commission
 FCC Engineering Laboratory
 7435 Oakland Mills Road
 Columbia, MD 21046
 Registration Number: 92195



Accreditation on NVLAP
 NVLAP Lab Code: 200533-0



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FCC Accreditation Number: TW1014



2. Peak Power Output

2.1. Test Equipment

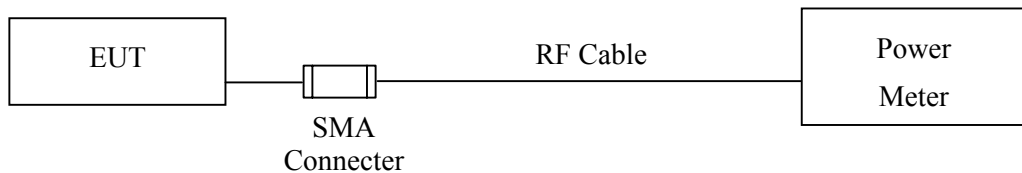
The following test equipments are used during the radiated emission tests:

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X Power Meter	Anritsu	ML2495A/6K00003357	May, 2009
X Power Sensor	Anritsu	MA2411B/0846193	May, 2009

Note: 1. All instruments are calibrated every one year.
 2. The test instruments marked by “X” are used to measure the final test results.

2.2. Test Setup

Conducted Measurement



2.3. Limits

The maximum peak power shall be less 1 Watt.

2.4. Test Procedure

The EUT was tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

2.5. Uncertainty

± 1.27 dB

2.6. Test Result of Peak Power Output

Product : Wireless Keyboard
Test Item : Peak Power Output Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmitter

Channel No.	Frequency(MHz)	Measurement	Required Limit	Result
01	2404.00	0.18 dBm	1 Watt= 30 dBm	Pass
39	2442.00	0.27 dBm	1 Watt= 30 dBm	Pass
77	2480.00	0.22 dBm	1 Watt= 30 dBm	Pass

Note: Peak Power Output Value =Reading value on peak power meter + cable loss

3. Radiated Emission

3.1. Test Equipment

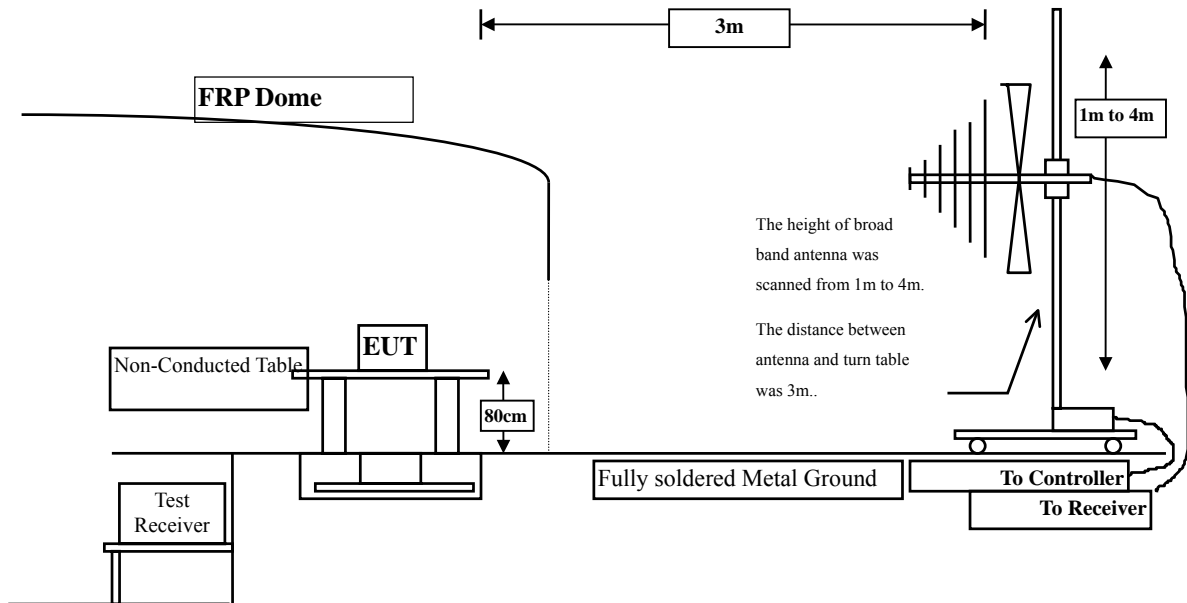
The following test equipment are used during the radiated emission test:

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2009
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2009
	X	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2009
	X	Pre-Amplifier	AGILENT	8447D/2944A09549	Sep., 2009
	X	Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2009
	X	Spectrum Analyzer	Advantest	R3162/91700283	Oct., 2009
	X	Coaxial Cable	Quietek	QTK-CABLE/ CAB5	Feb., 2009
	X	Controller	Quietek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

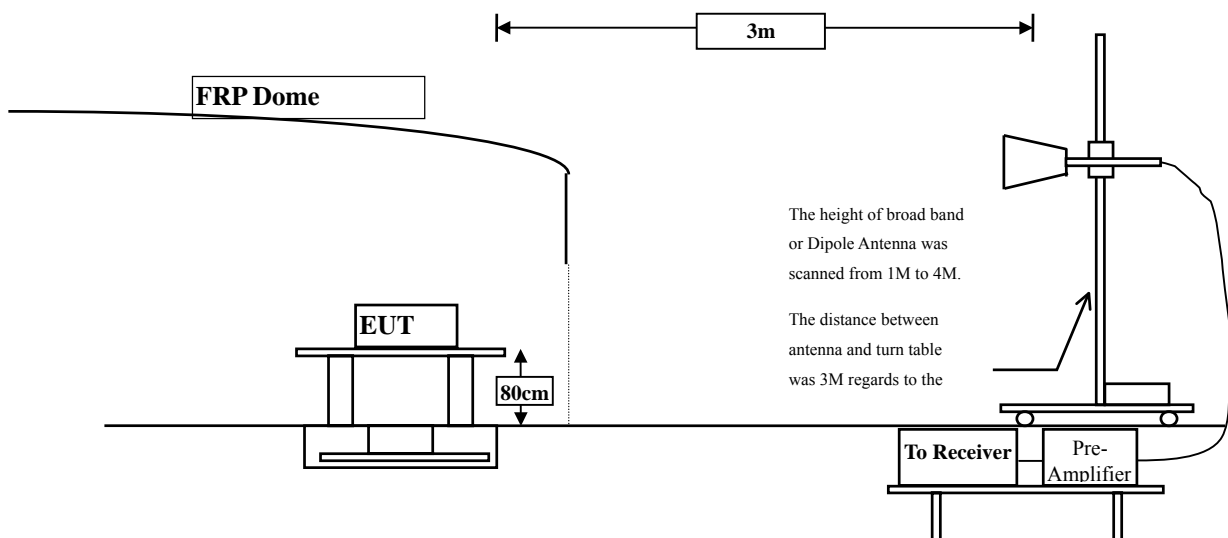
- Note:
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
 2. The test instruments marked with “X” are used to measure the final test results.

3.2. Test Setup

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



3.3. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits		
Frequency MHz	uV/m @3m	dBuV/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remarks: E field strength (dBuV/m) = 20 log E field strength (uV/m)

3.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2003 and tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 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 is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4:2003 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

Radiated emission measurements below 1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range from 30MHz - 10th Harmonic of fundamental was investigated.

3.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

3.6. Test Result of Radiated Emission

Product : Wireless Keyboard
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2404MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
4808.000	9.610	52.550	62.160	-11.840	74.000
7212.000	14.321	35.970	50.291	-23.709	74.000
9616.000	19.692	39.780	59.472	-14.528	74.000
--					
Vertical					
Peak Detector:					
4808.000	8.330	49.540	57.870	-16.130	74.000
7212.000	15.416	36.260	51.676	-22.324	74.000
9616.000	18.902	36.900	55.802	-18.198	74.000
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection.
6. The emission levels of other frequencies are very lower than the limit and not show in test report.

Frequency MHz	Peak Measurement dBuV/m	Duty Cycle Factor dB	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Average Detector:					
4808	62.16	-13.735	48.425	-5.575	54.000
7212	50.291	-13.735	36.556	-17.444	54.000
9616	59.472	-13.735	45.737	-8.263	54.000
Vertical					
Average Detector:					
4808	57.87	-13.735	44.135	-9.865	54.000
7212	51.676	-13.735	37.941	-16.059	54.000
9616	55.802	-13.735	42.067	-11.933	54.000

Note:

1. AVG Measurement=Peak Measurement + Duty Cycle
2. The Duty Cycle is refer to section 8.
3. If Duty Cycle is smaller than -20dB,based on FCC part15 the duty cycle correction factor is -20dB for calculating average emission.
4. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : Wireless Keyboard
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2442 MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
4884.000	9.496	51.650	61.146	-12.854	74.000
7236.000	14.401	35.270	49.671	-24.329	74.000
9768.000	20.061	38.350	58.411	-15.589	74.000
--					
Vertical					
Peak Detector:					
4884.000	9.006	49.290	58.296	-15.704	74.000
7326.000	15.264	35.140	50.404	-23.596	74.000
9768.000	19.261	36.430	55.691	-18.309	74.000
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection.
6. The emission levels of other frequencies are very lower than the limit and not show in test report.

Frequency MHz	Peak Measurement dBuV/m	Duty Cycle Factor dB	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Average Detector:					
4884	61.146	-13.735	47.411	-6.589	54.000
7236	49.671	-13.735	35.936	-18.064	54.000
9768	58.411	-13.735	44.676	-9.324	54.000
Vertical					
Average Detector:					
4884	58.296	-13.735	44.561	-9.439	54.000
7236	50.404	-13.735	36.669	-17.331	54.000
9768	55.691	-13.735	41.956	-12.044	54.000

Note:

1. AVG Measurement=Peak Measurement + Duty Cycle
2. The Duty Cycle is refer to section 8.
3. If Duty Cycle is smaller than -20dB,based on FCC part15 the duty cycle correction factor is -20dB for calculating average emission.
4. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : Wireless Keyboard
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2480 MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
4960.000	9.418	51.340	60.757	-13.243	74.000
7440.000	15.012	35.170	50.183	-23.817	74.000
9920.000	19.754	38.250	58.004	-15.996	74.000
--					
Vertical					
Peak Detector:					
4960.000	9.717	49.490	59.206	-14.794	74.000
7440.000	15.386	35.710	51.096	-22.904	74.000
9920.000	18.897	36.930	55.827	-18.173	74.000
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection.
6. The emission levels of other frequencies are very lower than the limit and not show in test report.

Frequency MHz	Peak Measurement dBuV/m	Duty Cycle Factor dB	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Average Detector:					
4960	60.757	-13.735	47.022	-6.978	54.000
7440	50.183	-13.735	36.448	-17.552	54.000
9920	58.004	-13.735	44.269	-9.731	54.000
Vertical					
Average Detector:					
4960	59.206	-13.735	45.471	-8.529	54.000
7440	51.096	-13.735	37.361	-16.639	54.000
9920	55.827	-13.735	42.092	-11.908	54.000

Note:

1. AVG Measurement=Peak Measurement + Duty Cycle
2. The Duty Cycle is refer to section 8.
3. If Duty Cycle is smaller than -20dB,based on FCC part15 the duty cycle correction factor is -20dB for calculating average emission.
4. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : Wireless Keyboard
 Test Item : General Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2442 MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
35.820	-4.537	35.103	30.566	-9.434	40.000
94.020	-8.453	30.082	21.628	-21.872	43.500
187.140	-11.912	32.590	20.678	-22.822	43.500
375.320	-1.779	27.108	25.329	-20.671	46.000
458.740	0.377	24.068	24.445	-21.555	46.000
544.100	2.992	25.619	28.611	-17.389	46.000
Vertical					
37.760	-4.281	32.514	28.234	-11.766	40.000
64.920	-12.760	43.014	30.254	-9.746	40.000
99.840	-7.789	33.993	26.204	-17.296	43.500
256.980	-5.478	27.144	21.666	-24.334	46.000
371.440	-1.634	26.691	25.056	-20.944	46.000
544.100	2.992	24.993	27.985	-18.015	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

4. RF antenna conducted test

4.1. Test Equipment

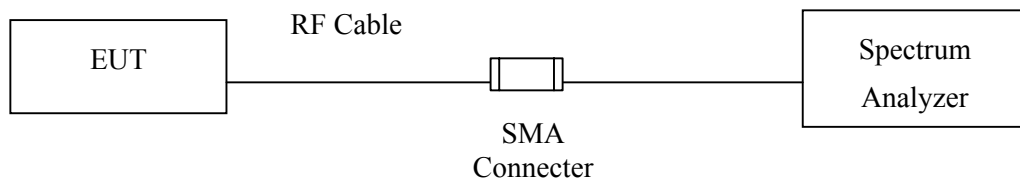
The following test equipments are used during the radiated emission tests:

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2008
Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2009
X Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2009

- Note:
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
 2. The test instruments marked with “X” are used to measure the final test results.

4.2. Test Setup

RF antenna Conducted Measurement:



4.3. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

4.4. Test Procedure

The EUT was tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW > RBW, scan up through 10th harmonic.

4.5. Uncertainty

The measurement uncertainty

Conducted is defined as $\pm 1.27\text{dB}$

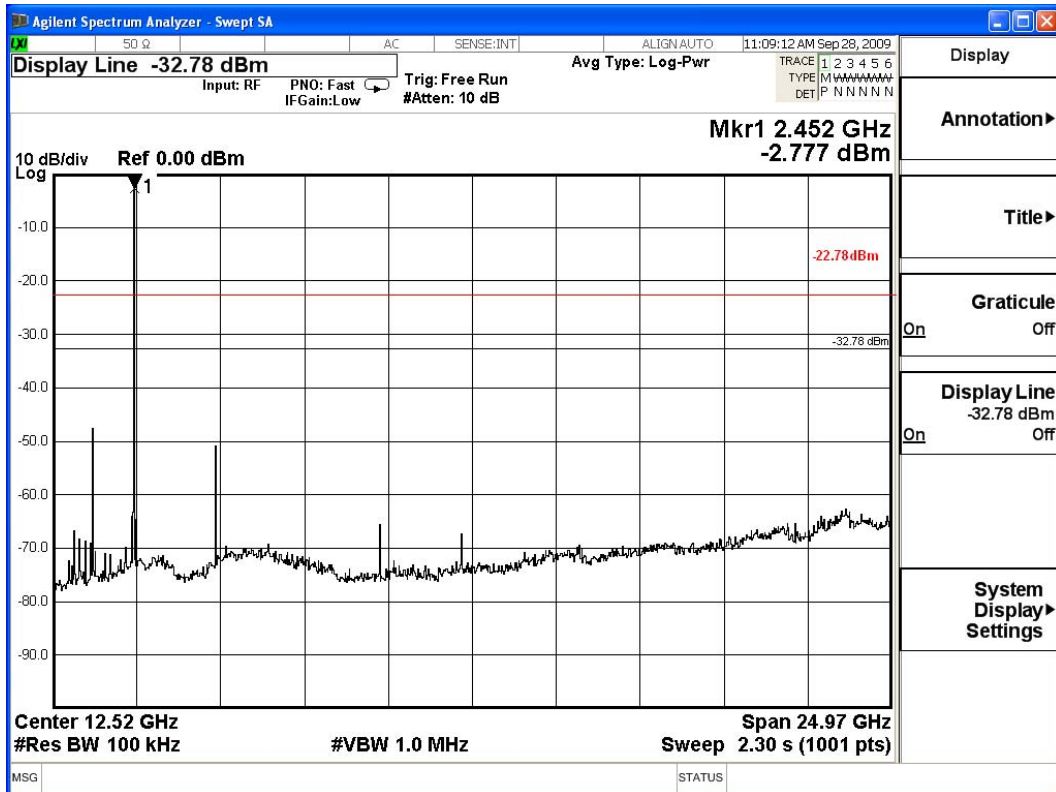
4.6. Test Result of RF antenna conducted test

Product : Wireless Keyboard
 Test Item : RF antenna conducted test
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter

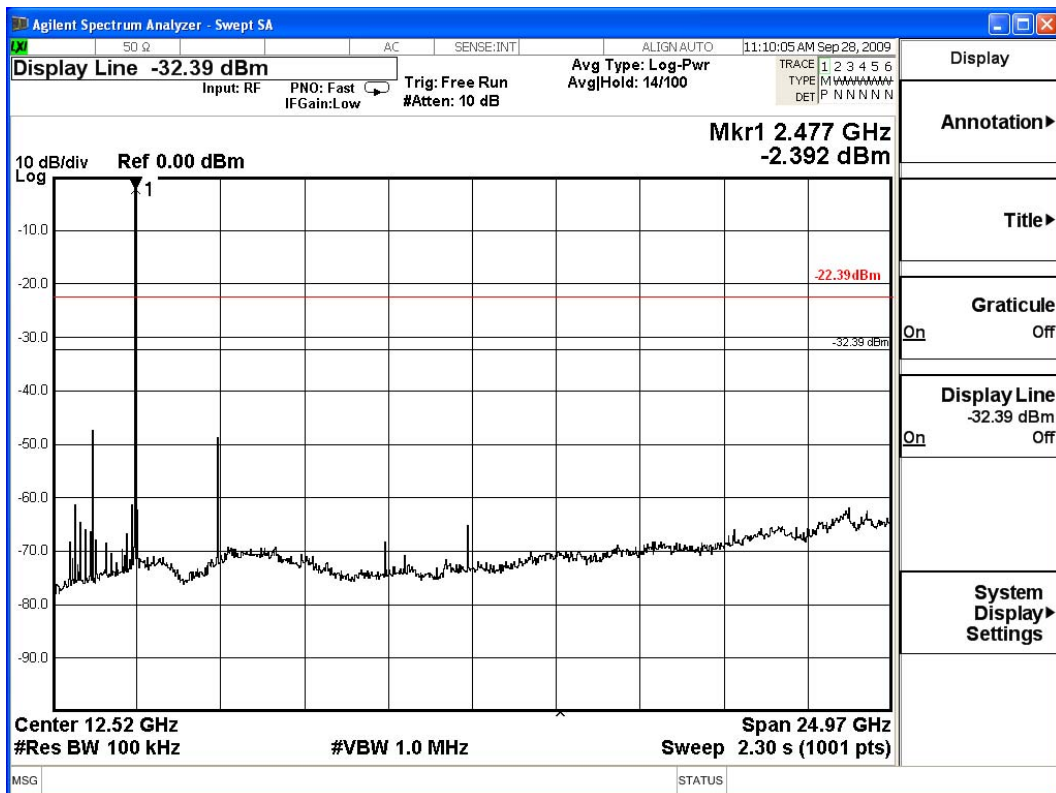
Channel 01 (2404MHz)



Channel 39 (2442MHz)



Channel 77 (2480MHz)



5. Band Edge

5.1. Test Equipment

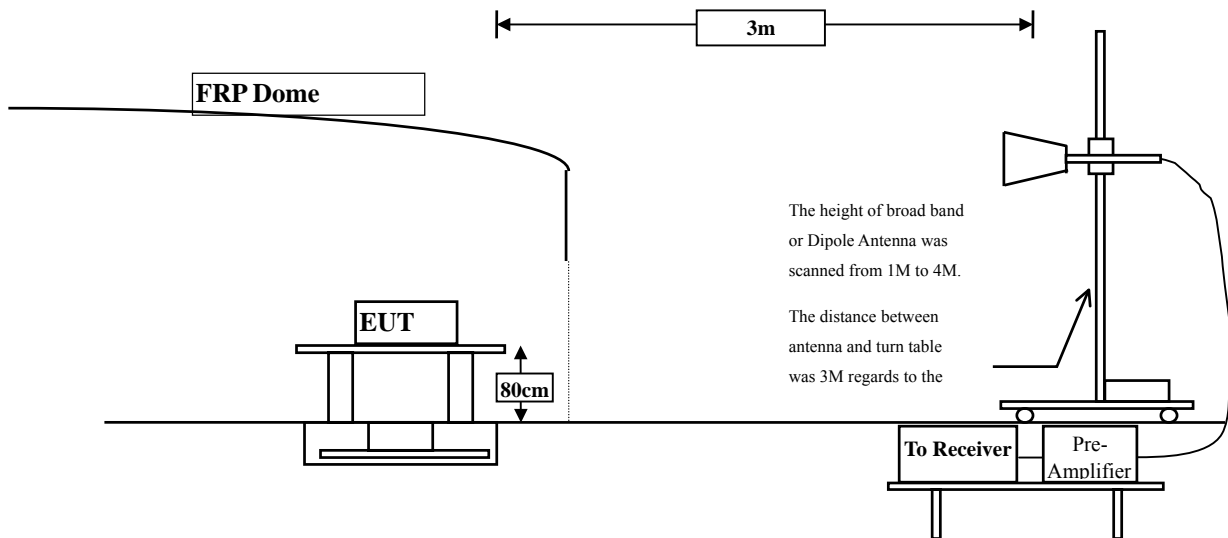
The following test equipments are used during the band edge tests:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2009
	X Pre-Amplifier	AGILENT	8447D/2944A09549	Sep., 2009
	X Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2009
	X Spectrum Analyzer	Advantest	R3162/91700283	Oct., 2009
	X Coaxial Cable	QuieTek	QTK-CABLE/ CAB5	Feb., 2009
	X Controller	QuieTek	QTK-CONTROLLER/ CTRL3	N/A
	X Coaxial Switch	Anritsu	MP59B/6200265729	N/A

- Note:
1. All instruments are calibrated every one year.
 2. The test instruments marked by "X" are used to measure the final test results.

5.2. Test Setup

RF Radiated Measurement:



5.3. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

5.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2003 and tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 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 is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4:2003 on radiated measurement.

5.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

5.6. Test Result of Band Edge

Product : Wireless Keyboard
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter

Fundamental Filed Strength

Antenna Pole	Frequency [MHz]	Reading Level [dBuV]	Correction Factor [dB/m]	Emission Level [dBuV/m]	Detector
Horizontal	2404	46.857	36.602	83.458	Peak
Vertical	2404	46.694	35.595	82.289	Peak

Note: 1:Spectrum Analyzer setting:

Peak detector: RBW=1MHz, VBW=1MHz

Band Edge Test Data

Antenna Pole	Test Frequency (MHz)	Fundamental (dBuV/m)	Δ (dB)	Band Edge Field Strength (dBuV/m)	Detector
Horizontal	2387.9	83.458	51.765	31.693	Peak
Horizontal	--	--	--	--	Average
Vertical	2387.9	82.289	51.765	30.524	Peak
Vertical	--	--	--	--	Average

Note:

The Band Edge Field Strength was calculated using the Fundamental and Conducted Band Edge measurements per the Marker-Delta Method with the following formula:

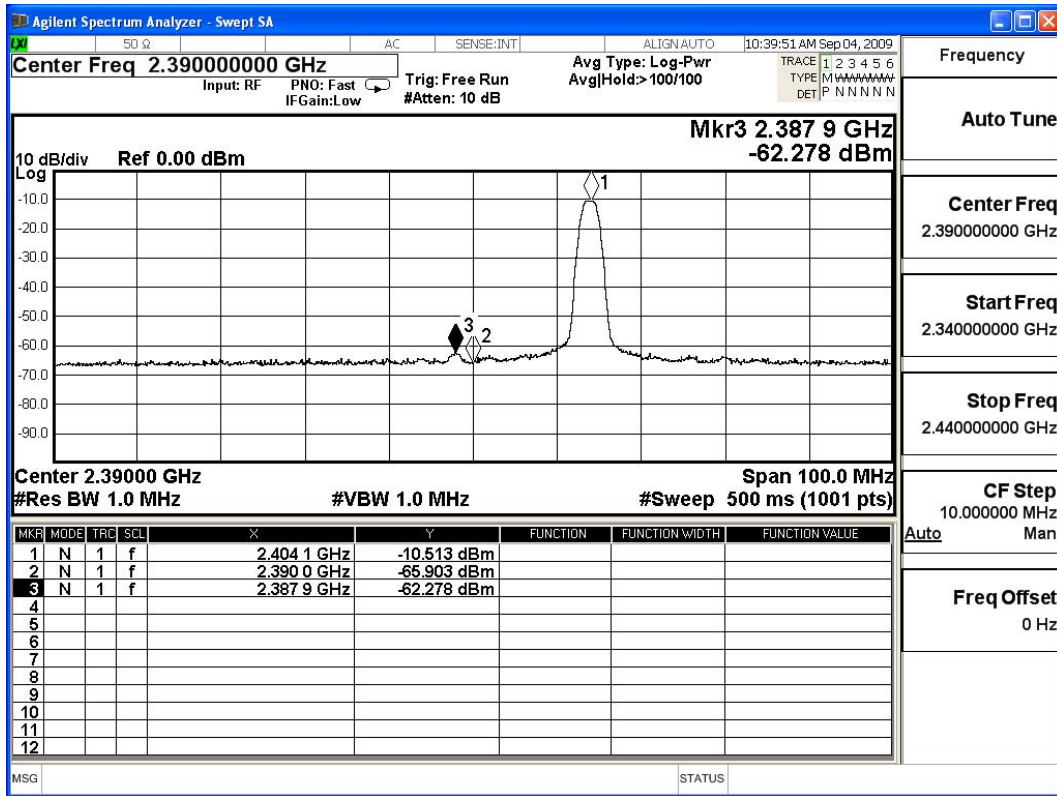
$$\text{Band Edge field Strength} = F - \Delta$$

F = Fundamental field Strength (Peak or Average)

Δ = Conducted Band Edge Delta (Peak or Average)

The Average Field Strength is Peak Field Strength + duty cycle

Peak Detector of conducted Band Edge Delta



Product : Wireless Keyboard
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter

Fundamental Filed Strength

Antenna Pole	Frequency [MHz]	Reading Level [dB(uV)]	Correction Factor [dB/m]	Emission Level [dB(uV/m)]	Detector
Horizontal	2480	45.828	36.706	82.534	Peak
Vertical	2480	46.069	36.162	82.230	Peak

Note: 1:Spectrum Analyzer setting:

Peak detector: RBW=1MHz, VBW=1MHz

Band Edge Test Data

Antenna Pole	Test Frequency (MHz)	Fundamental (dBuV/m)	Δ (dB)	Band Edge Field Strength (dBuV/m)	Detector
Horizontal	2483.5	82.534	51.202	31.341	Peak
Horizontal	--	--	--	--	Average
Vertical	2483.5	82.230	51.202	31.028	Peak
Vertical	--	--	--	--	Average

Note:

The Band Edge Field Strength was calculated using the Fundamental and Conducted Band Edge measurements per the Marker-Delta Method with the following formula:

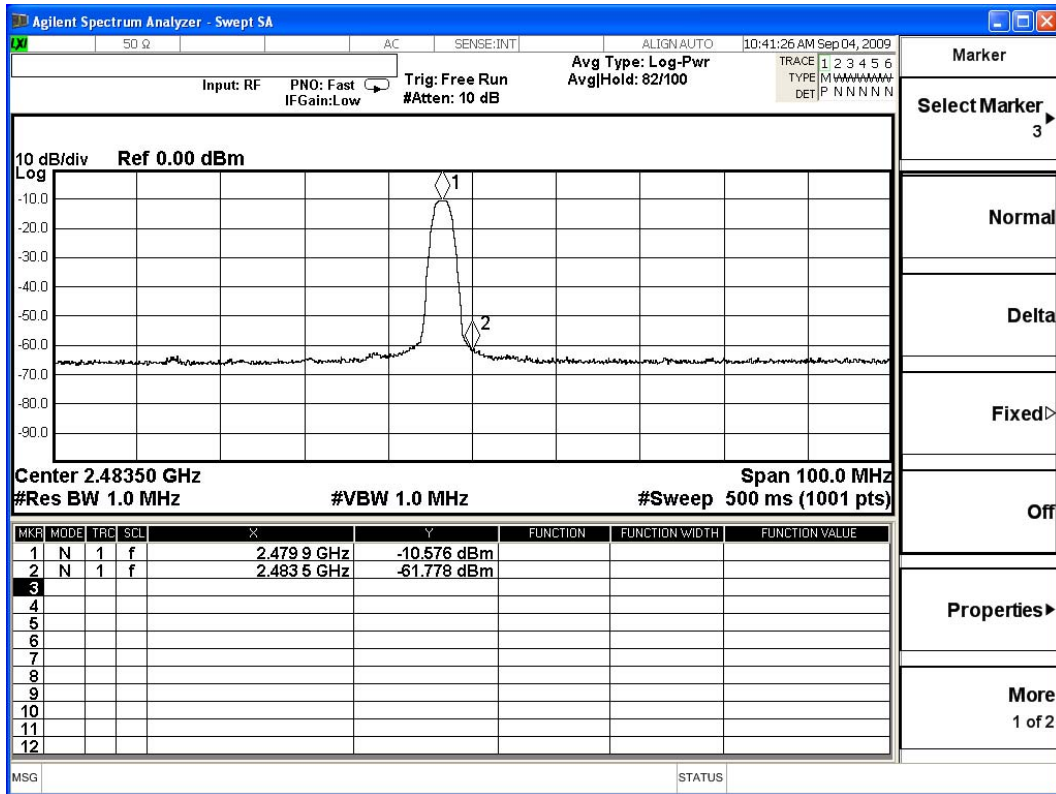
$$\text{Band Edge field Strength} = F - \Delta$$

F = Fundamental field Strength (Peak or Average)

Δ = Conducted Band Edge Delta (Peak or Average)

The Average Field Strength is Peak Field Strength + duty cycle

Peak Detector of conducted Band Edge Delta



6. Occupied Bandwidth

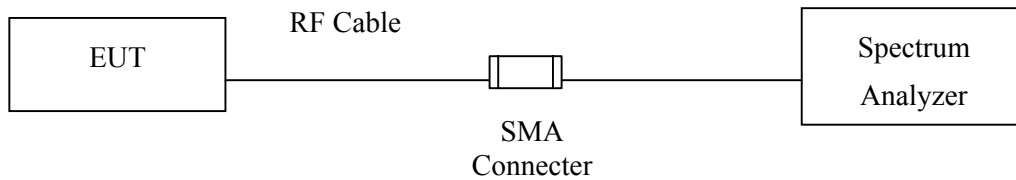
6.1. Test Equipment

The following test equipments are used during the radiated emission tests:

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2008
Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2009
X Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2009

Note: 1. All instruments are calibrated every one year.
 2. The test instruments marked by “X” are used to measure the final test results.

6.2. Test Setup



6.3. Limits

The minimum bandwidth shall be at least 500 kHz.

6.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2003; tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Span greater than RBW.

6.5. Uncertainty

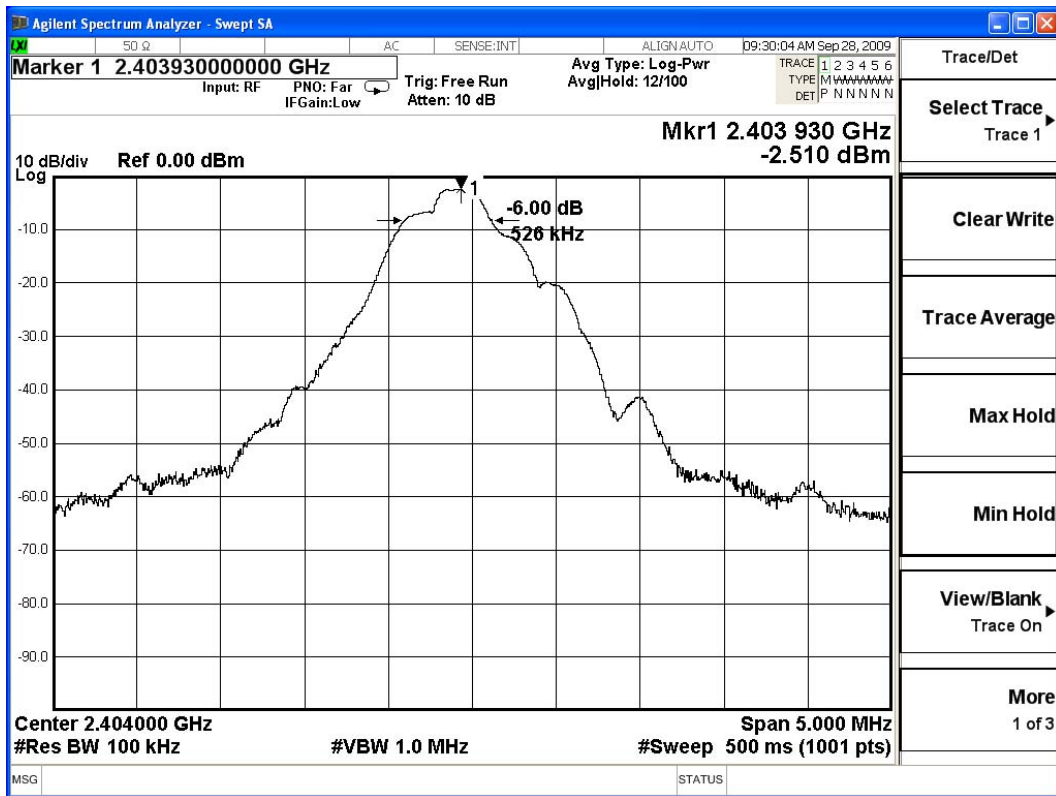
± 150Hz

6.6. Test Result of Occupied Bandwidth

Product : Wireless Keyboard
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2404MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
1	2404.00	526	>500	Pass

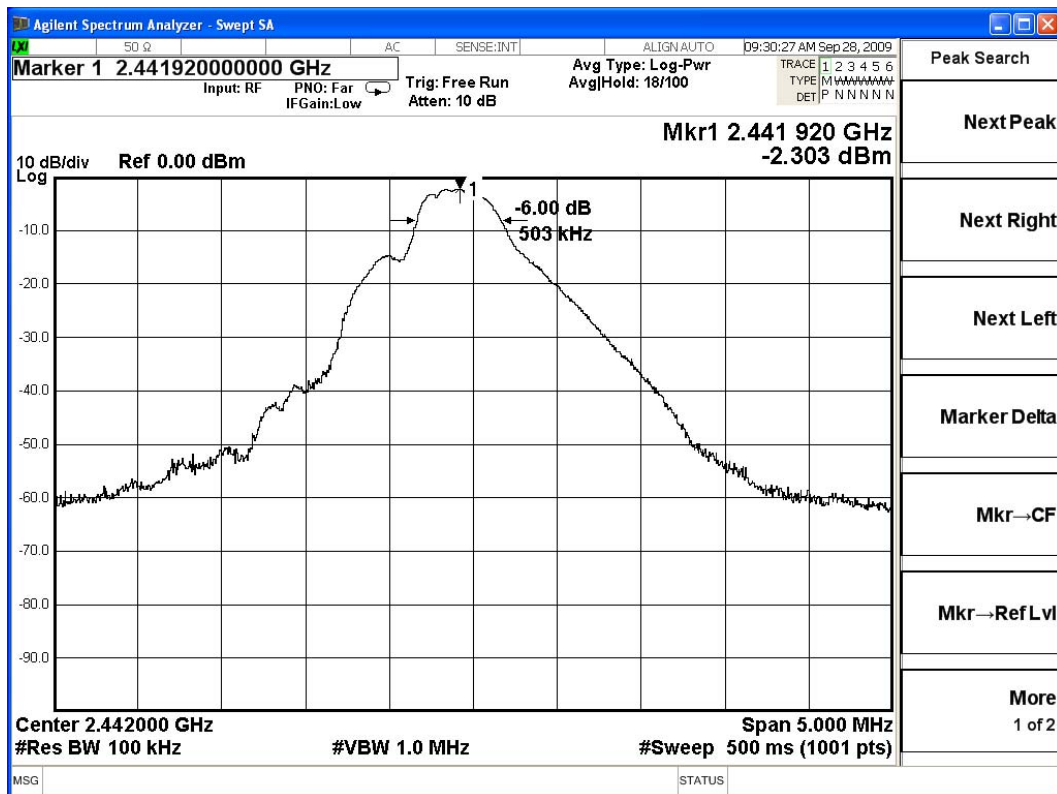
Figure Channel 1:



Product : Wireless Keyboard
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2442MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2442.00	503	>500	Pass

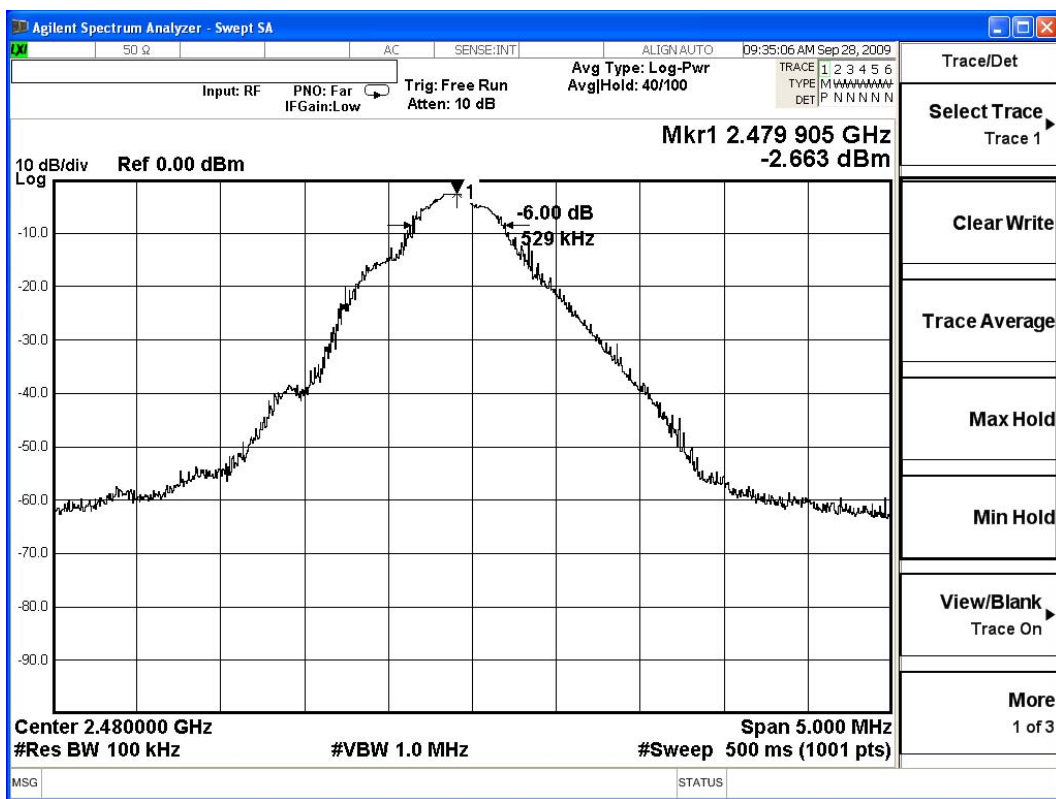
Figure Channel 39:



Product : Wireless Keyboard
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2480MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
77	2480.00	529	>500	Pass

Figure Channel 77:



7. Power Density

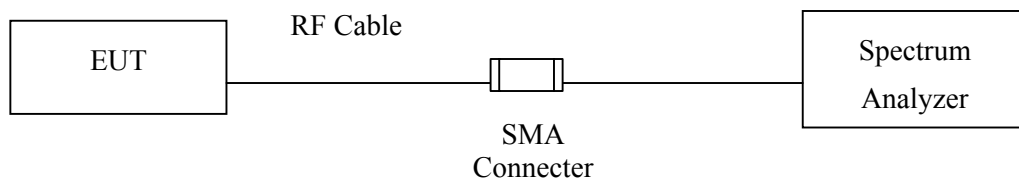
7.1. Test Equipment

The following test equipments are used during the radiated emission tests:

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2008
Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2009
X Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2009

Note: 1. All equipments are calibrated every one year.
 2. The test instruments marked by “X” are used to measure the final test results.

7.2. Test Setup



7.3. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

7.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2003; tested according to DTS test procedure of Mar. 2005 KDB558074 for compliance to FCC 47CFR 15.247 requirements.
 Set RBW= 3 kHz, VBW=10KHz, Sweep time=(SPAN/3KHz), detector=Peak detector

7.5. Uncertainty

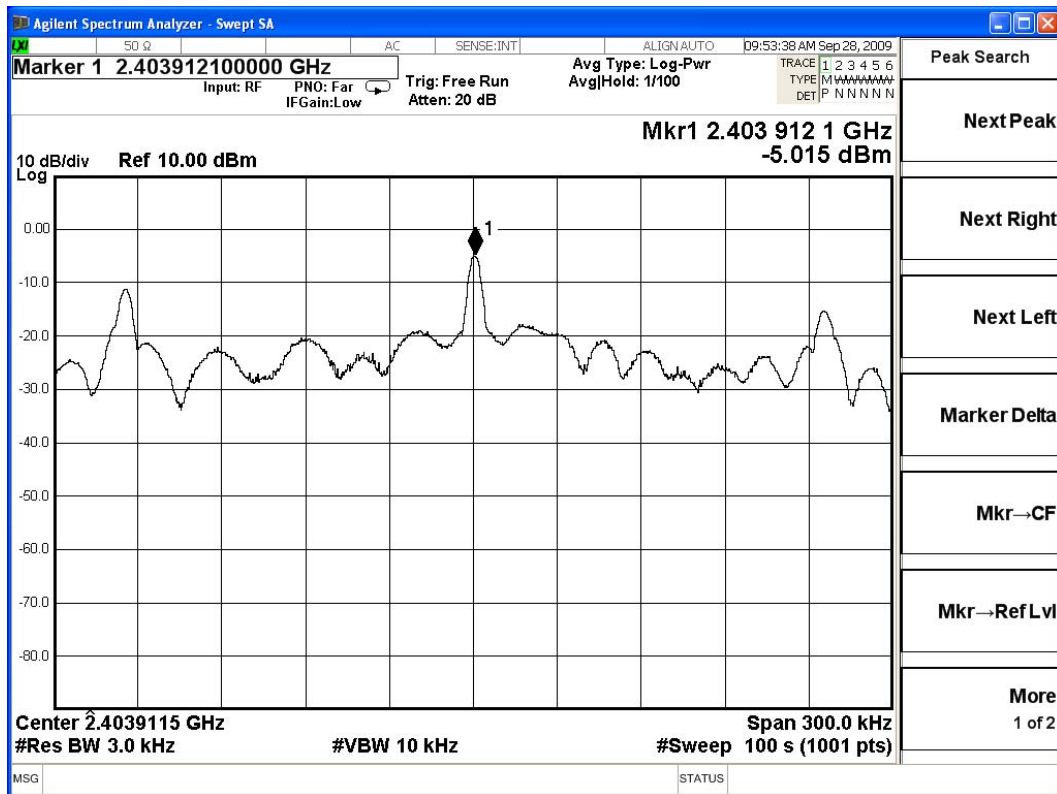
± 1.27 dB

7.6. Test Result of Power Density

Product : Wireless Keyboard
 Test Item : Power Density Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2404MHz)

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
1	2404.00	-5.015	< 8dBm	Pass

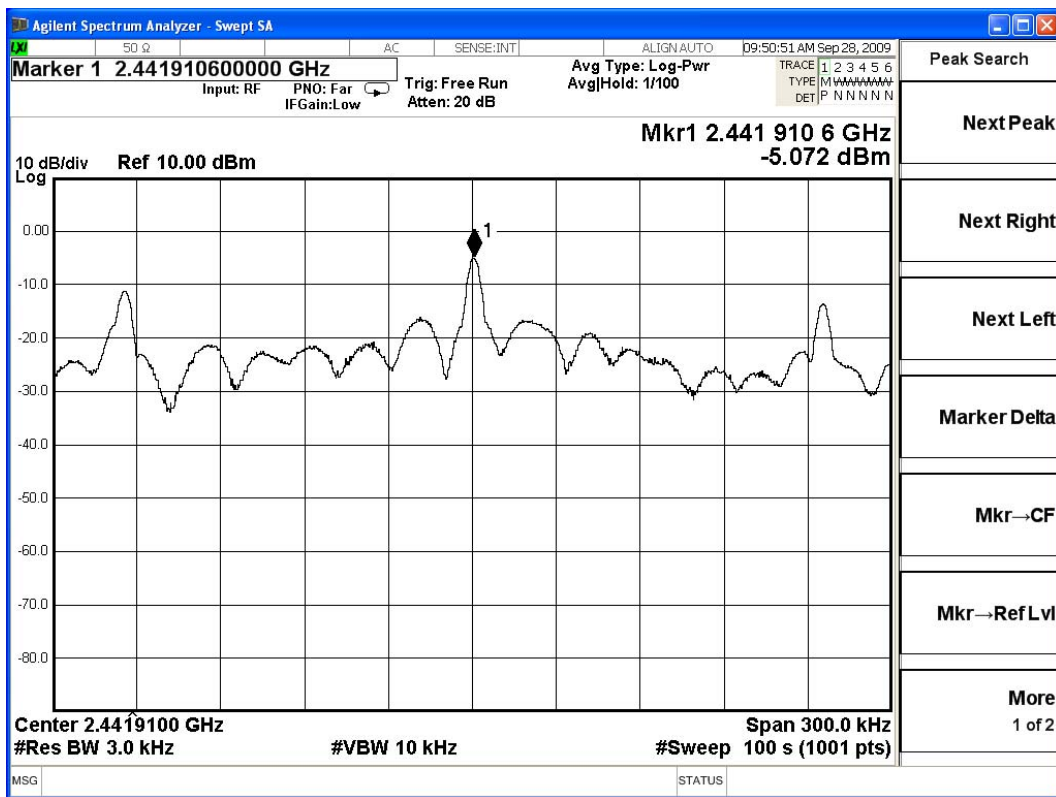
Figure Channel 1:



Product : Wireless Keyboard
 Test Item : Power Density Data
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmitter (2442MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
39	2442.000	-5.072	< 8dBm	Pass

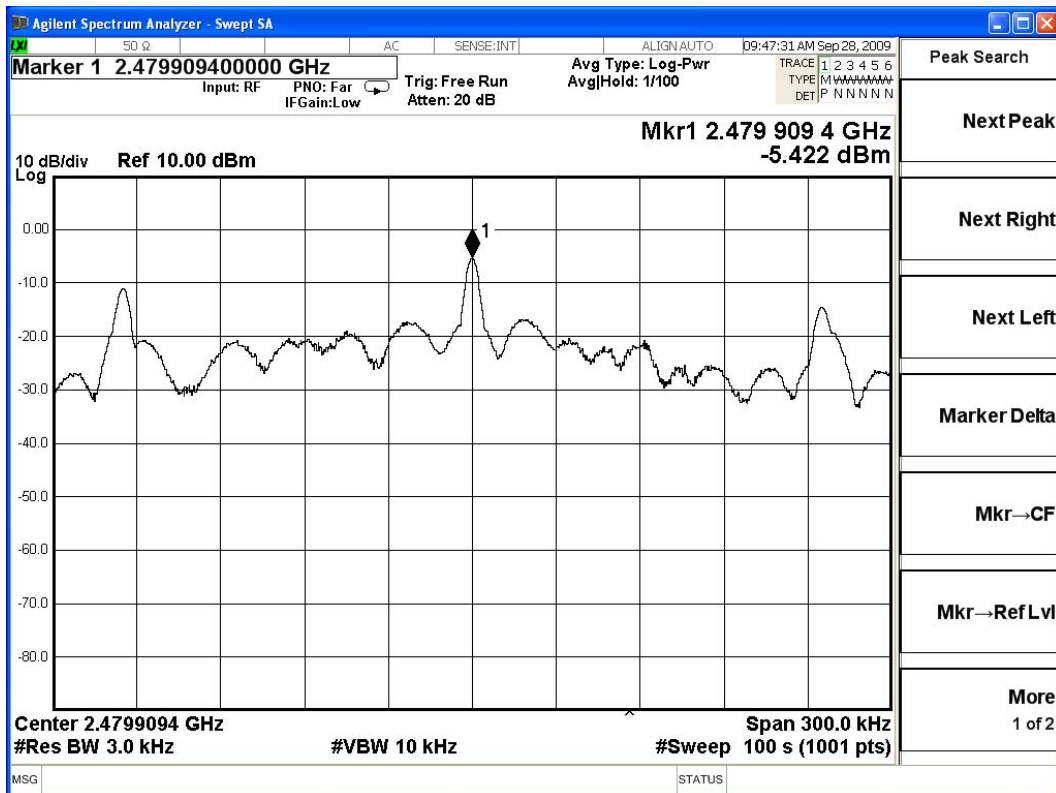
Figure Channel 39:



Product : Wireless Keyboard
 Test Item : Power Density Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2480MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
77	2480.00	-5.422	< 8dBm	Pass

Figure Channel 77:



8. Duty Cycle

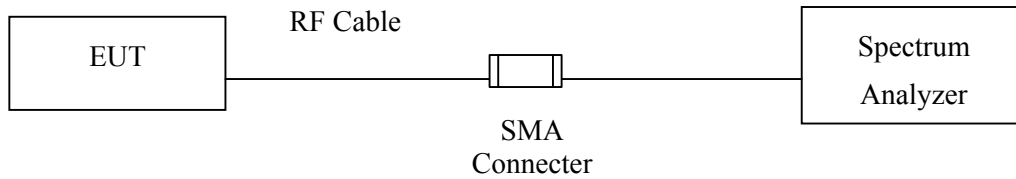
8.1. Test Equipment

The following test equipments are used during the band edge tests:

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr, 2009
X Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2008

- Note:
1. All equipments are calibrated every one year.
 2. The test equipments marked by "X" are used to measure the final test results.

8.2. Test Setup

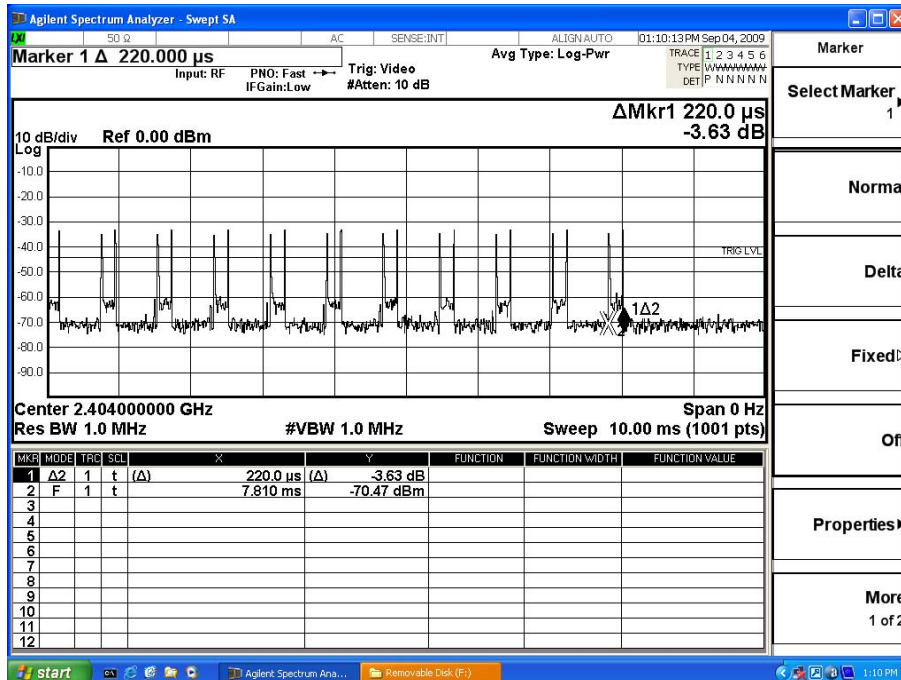
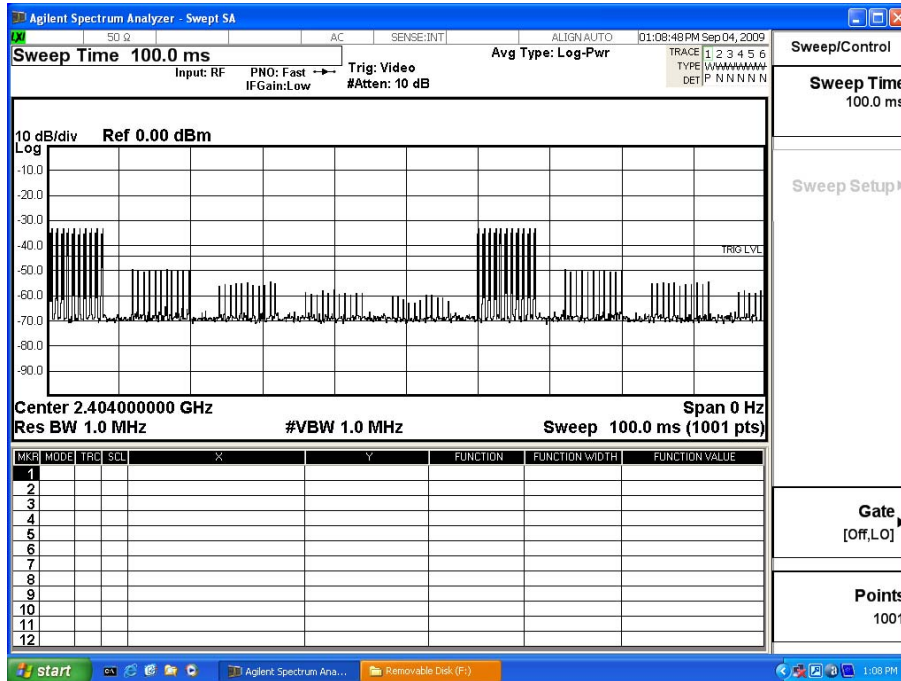


8.3. Uncertainty

$\pm 150\text{Hz}$

8.4. Test Result of Duty Cycle

Product : Wireless Keyboard
 Test Item : Duty Cycle Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter



$$T_{on} = (220\mu s * 11) * 8.5 = 20.57 \text{ ms}$$

$$\text{Duty Cycle} = 20.57 \text{ ms} / 100 \text{ ms} = 0.2057$$

$$\text{Duty Cycle correction factor} = 20 \text{ LOG } 0.2057 = -13.735 \text{ dB}$$

Duty Cycle correction factor	-13.735	dB
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Remark:

1. If Duty Cycle is smaller than -20dB, based on FCC part15 the duty cycle correction factor is -20dB for calculating average emission.

9. EMI Reduction Method During Compliance Testing

No modification was made during testing.