



Test Report

Product Name: Wireless Keyboard

Model No.: LXH-LKY-RK51

FCC ID.: JNZ221729

Applicant : Logitech Far East Ltd.

Address : #2 Creation Rd., 4, Science-Based Ind. Park,
Hsinchu, Taiwan, R.O.C.

Date of Receipt : Sep 02, 2003

Date of Test : Sep 04, 2003

Report No. : 039H017FI

The Test Results relate only to the samples tested.

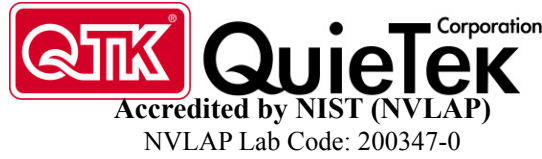
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This report must not be used to claim product endorsement by NVLAP any agency of the U.S. Government

Test Report Certification

Test Date : Sep 04, 2003

Report No. : 039H017FI



Product Name : Wireless Keyboard

Applicant : Logitech Far East Ltd.

Address : #2 Creation Rd., 4, Science-Based Ind. Park, Hsinchu,
Taiwan, R.O.C.

Manufacturer : Logitech Far East Ltd.

Model No. : LXH-LKY-RK51

FCC ID. : JNZ221729

Rated Voltage : DC 3V(Power by Battery)

Trade Name : Legend

Measurement Standard : FCC Part 15 Subpart C Paragraph 15.227

Measurement Procedure : ANSI C63.4: 1992

Test Result : Complied



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1. GENERAL INFORMATION

1.1. EUT Description

Product Name : Wireless Keyboard
Trade Name : Legend
FCC ID. : JNZ221729
Model No. : LXH-LKY-RK51
EUT Voltage : DC 3V(Power by Battery)
Frequency Range : 27.145MHz
Type of Modulation : FSK
Antenna Type : Soldered on PCB
Channel Number : 1
Channel Control : Non-Applied

Frequency of Each Channel:

Channel	Frequency
Channel 1:	27.145 MHz

Note:

1. The EUT is a Wireless Keyboard intends to use in household and office PC system or related application.
2. Regards to the frequency band operation; one frequency of channel were selected to perform the test, then shown on this report.
3. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.227.

1.2. Operation Description

The EUT is a 27.145MHz Wireless Keyboard intends to use in household and office PC system. The device adapts FSK modulation. The antenna Soldered on PCB Provides diversity function to improve the transmitting function.

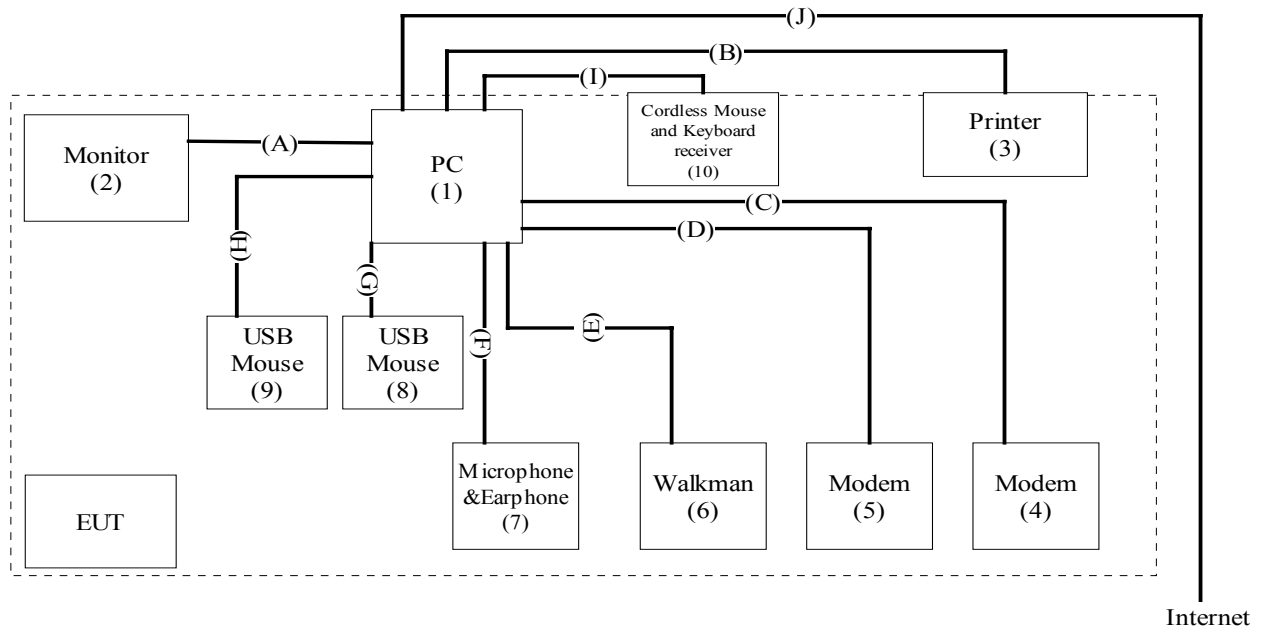
1.3. Tested System Details

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 Card
(1)	PC	HP	DTPC27	SG21200950	Non-shielded, 1.8m
(2)	Monitor	SAMPO	KM-511	829H0709	Non-shielded, 1.8m
(3)	Printer	HP	C2642A	TH86M1M34W	Non-shielded, 0.7m
(4)	Modem	ACEEX	DM-1414	0102027543	Non-shielded, 1.6m
(5)	Modem	ACEEX	DM-1414	980033034	Non-shielded, 1.6m
(6)	Walkman	AIWA	US-J202	HSA20201	--
(7)	Microphone & Earphone	TOKTO	SX-MI	N/A	--
(8)	USB Mouse	Logitech	M-UE55	N/A	--
(9)	USB Mouse	Logitech	M-BE58	LZE10152397	--
(10)	Cordless Mouse and Keyboard receiver	Logitech	C-BG17-DUAL	LZB23601973	--

	Signal Cable Type	Signal cable Description
A.	VGA Cable	Shielded, 1.6m, a ferrite core bonded.
B.	Printer Cable	Shielded, 1.2m
C.	Modem Cable	Shielded, 1.5m
D.	Modem Cable	Shielded, 1.5m
E.	Walkman Cable	Non-shielded, 1.6m
F.	Microphone & Earphone Cable	Non-shielded, 1.8m
G.	USB Mouse Cable	Shielded, 1.0m
H.	USB Mouse Cable	Shielded, 1.0m
I.	Cordless Mouse and Keyboard receiver Cable	Shielded, 1.5m, a ferrite core bonded
J.	LAN Cable	Non-shielded, 10m

1.4. Configuration of tested System



1.5. EUT Exercise Software

- (1) Setup the EUT and simulators as shown on 1.4.
- (2) Enable RF signal and confirm EUT active.
- (3) Modulate output capacity of EUT up to specification.

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

Site Description:

August 30, 2001 Accreditation on NVLAP
 NVLAP Lab Code: 200347-0



February 23, 1999 Accreditation on DNV
 Statement No. : 413-99-LAB11



January 04, 1999 Accreditation on TUV Rheinland
 Certificate No.: I9865712-9901



August 11, 2003 Accreditation on Nemko
 Certificate No.: ELA 165



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 Chiung-Lin, Hsin-Chu County,
 Taiwa, R.O.C.
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2. Conducted Emission

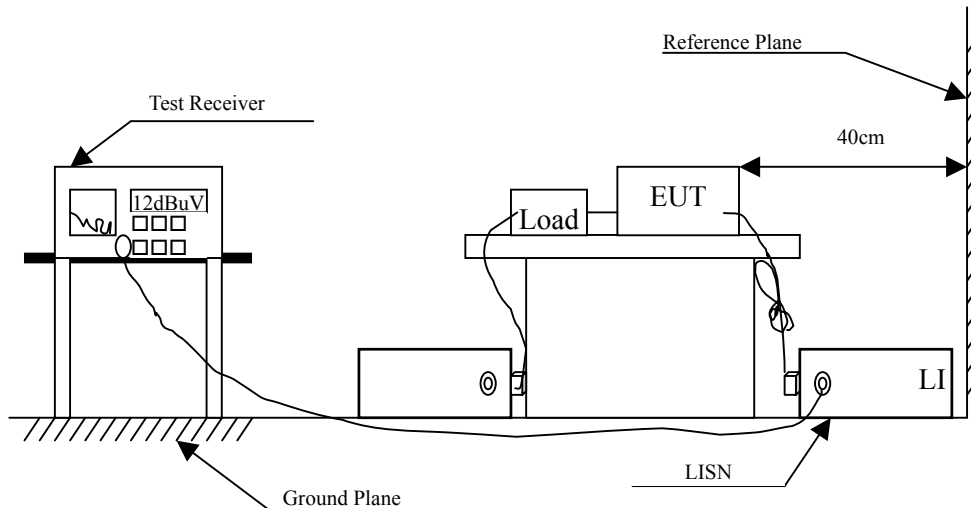
2.1. Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
1	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2002	
2	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2003	Peripherals
3	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2003	EUT
4	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2003	
5	No.2 Shielded Room			N/A	

Note: All equipment upon which need to calibrated are with calibration period of 1 year.

2.2. Test Setup



2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

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

2.4. 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 50 ohm /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. (Please refers to the block diagram of the test setup and photographs.)

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 ANSI C63.4: 1992 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.5. Test Data of Conducted Emission

Product : Wireless Keyboard
 Test Item : Conducted Emission
 Power Line : Line 1
 Test Mode : Normal Operation

Frequency MHz	Cable Loss dB	Probe Factor dB	Reading Level dBuV	Emission Level dBuV	Limits dBuV
Quasi-Peak					
* 0.199	0.05	0.13	50.03	50.21	63.64
0.301	0.00	0.17	41.55	41.72	60.22
0.504	0.02	0.21	38.53	38.76	56.00
0.605	0.02	0.23	39.65	39.90	56.00
1.010	0.07	0.28	37.13	37.48	56.00
27.146	0.39	0.59	42.83	43.81	60.00
Average					
0.199	0.05	0.13	49.00	49.18	53.65
0.301	0.00	0.17	40.70	40.87	50.22
0.504	0.02	0.21	38.10	38.33	46.00
0.605	0.02	0.23	39.00	39.25	46.00
1.010	0.07	0.28	36.50	36.85	46.00
27.146	0.39	0.59	42.50	43.48	50.00

Note:

1. All Reading Levels are Quasi-Peak and Average value.
2. “ * ”, means this data is the worst emission level.
3. Emission Level = Reading Level + LISN Factor + Cable Loss.

Product : Wireless Keyboard
 Test Item : Conducted Emission
 Power Line : Line 2
 Test Mode : Normal Operation

Frequency	Cable	Probe	Reading	Emission	Limits
MHz	Loss	Factor	Level	Level	
	dB	dB	dBuV	dBuV	dBuV
Quasi-Peak					
* 0.199	0.05	0.13	49.83	50.01	63.64
0.304	0.00	0.17	41.65	41.82	60.12
0.506	0.02	0.21	36.83	37.06	56.00
0.603	0.02	0.23	37.35	37.60	56.00
1.009	0.07	0.28	37.19	37.54	56.00
27.147	0.39	0.59	42.93	43.91	60.00
Average					
0.199	0.05	0.13	49.30	49.48	53.65
0.304	0.00	0.17	41.00	41.17	50.13
0.506	0.02	0.21	36.20	36.43	46.00
0.603	0.02	0.23	36.80	37.05	46.00
1.009	0.07	0.28	36.30	36.65	46.00
27.147	0.39	0.59	42.30	43.28	50.00

Note:

1. All Reading Levels are Quasi-Peak and Average value.
2. “ * ”, means this data is the worst emission level.
3. Emission Level = Reading Level + LISN Factor + Cable Loss.

3. Radiated Emission

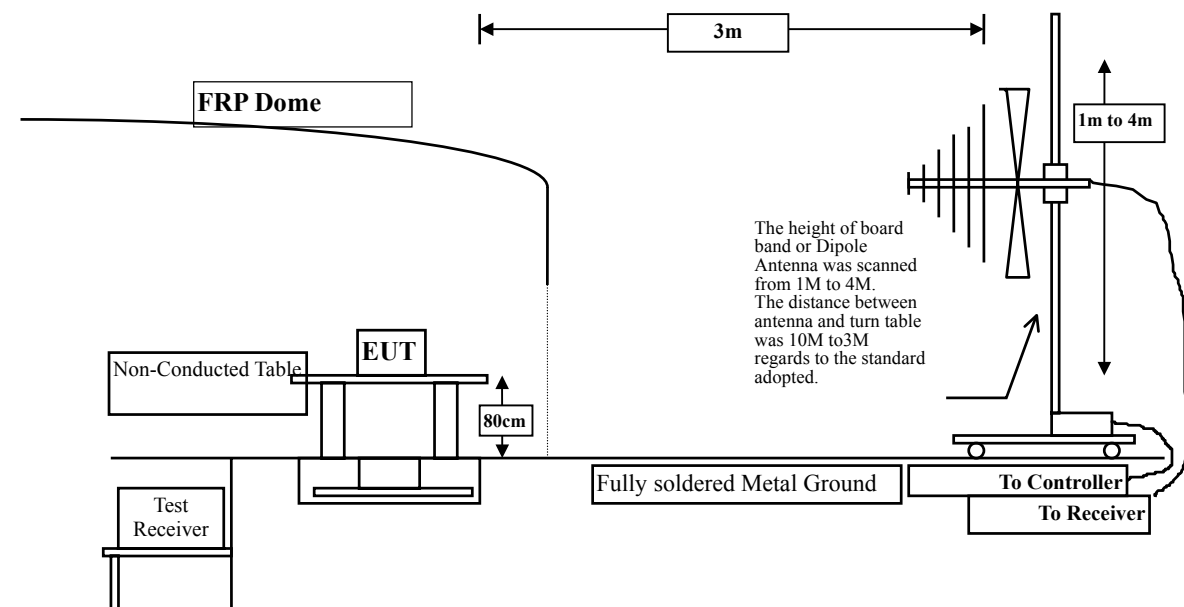
3.1. Test Equipment

The following test equipment are used during the test:

Test Site	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.
OATS # 1	X Test Receiver	R & S	ESCS 30 / 825442/017	Jan., 2003
	X Spectrum Analyzer	Advantest	R3261C / 81720266	N/A
	X Pre-Amplifier	HP	8447D / 2944A09276	N/A
	X BiconiLog Antenna	Schwarzbeck	VULB 9166 / 1061	Sep., 2003
OATS # 2	Test Receiver	R & S	ESCS 30 / 836858/023	Jan., 2003
	Spectrum Analyzer	Advantest	R3261C / 81720471	N/A
	Pre-Amplifier	Quietek	QTK-AMP / AMP1	N/A
	Bilog Antenna	Chase	CBL6112B / 2708	Sep., 2003
OATS # 3	Test Receiver	R & S	ESCS 30 / 825442/014	Jun., 2003
	Spectrum Analyzer	Advantest	R3162 / 91700283	N/A
	Pre-Amplifier	Advantest	BB525C / N/A	N/A
	Bilog Antenna	Schaffner	CBL6112B / 2673	Sep., 2003

- Note: 1. All equipments that need to calibrate are with calibration period of 1 year.
 2. Mark "X" test instruments are used to measure the final test results.

3.2. Test Setup



3.3. Limits

➤ FCC Part 15 Subpart C Paragraph 15.227 Limit

FCC Part 15 Subpart C Paragraph 15.227 Limits		
Fundamental Frequency MHz	Field strength of fundamental	
	uV/m	dBuV/m
26.96-27.28	10000	80.0

Remarks :

1. RF Voltage (dBuV) = 20 log RF 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.

➤ Frequencies in restricted band are complied to limits on Paragraph 15.209.

FCC Part 15 Subpart C Paragraph 15.209 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 :
1. RF Voltage (dBuV/m) = 20 log RF Voltage (uV/m)
 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.

3.4. 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 C63.4:1992 on radiated measurement.

Radiated emissions were investigated over the frequency range from 30MHz to 1GHz using a receiver bandwidth of 120kHz. Radiated was performed at an antenna to EUT distance of 3 meters.

The frequency range from 30MHz to 10th harmonics is checked.

3.5. Test Data of Radiated Emission

Product : Wireless Keyboard
 Test Item : Fundamental Radiated Emission
 Test Site : No.1 OATS
 Test Voltage : DC 3V(Power by Battery)
 Test Mode : Normal Operation

Freq.	Cable	Probe	PreAMP	Reading	Emission	Margin	Limit
MHz	Loss	Factor		Level	Level		
	dB	dB/m	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal

Peak Detector:

27.144	1.00	18.36	0.00	46.97	66.33	33.67	100.00
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Vertical

Peak Detector:

27.144	1.00	18.36	0.00	34.05	53.41	46.59	100.00
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Note:

1. All Readings Levels are performed with peak and/or average measurements as necessary.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz ◦
3. Emission Level = Reading Level + Probe Factor + Cable Loss.
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
 Test Site : No.1 OATS
 Test Voltage : DC 3V(Power by Battery)
 Test Mode : Normal Operation

Frequency	Cable	Probe	PreAMP	Reading	Emission	Margin	Limit
MHz	Loss	Factor		Level	Level		
	dB	dB/m	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal:

82.380	1.23	4.88	22.60	45.60	29.12	10.88	40.00
189.080	1.67	9.31	22.60	37.60	25.98	17.52	43.50
229.820	1.84	7.91	22.60	42.20	29.35	16.65	46.00
271.530	2.01	12.11	22.60	45.00	36.52	9.48	46.00
568.350	3.23	21.85	22.60	35.60	38.08	7.92	46.00
* 580.960	3.28	21.71	22.60	38.60	40.99	5.01	46.00

Vertical:

* 83.350	1.24	11.43	22.60	38.60	28.67	11.33	40.00
163.860	1.57	20.80	22.60	31.20	30.96	12.54	43.50
324.880	2.23	16.17	22.60	34.80	30.60	15.40	46.00
487.840	2.90	15.47	22.60	32.20	27.96	18.04	46.00
567.380	3.22	19.75	22.60	31.00	31.37	14.63	46.00
580.960	3.28	18.45	22.60	32.40	31.53	14.47	46.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. “ * ”, means this data is the worst emission level.
3. Emission Level = Reading Level + Probe Factor + Cable Loss-PreAMP.

4. Band Edge

4.1. Test Equipment

The following test equipment are used during the test:

RF Conducted Measurement:

Item	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
1	Spectrum Analyzer	R & S	FSP / 100561	Mar., 2003	
2	No.1 OATS			Sep., 2002	

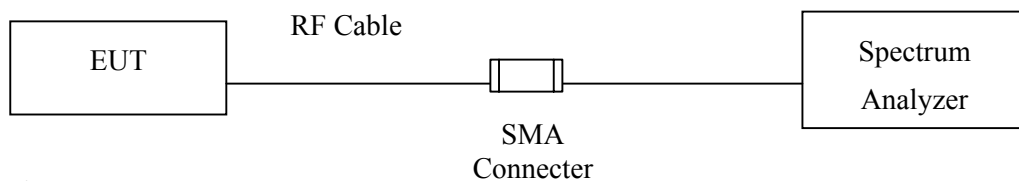
RF Radiated Measurement:

Item		Equipment	Manufacturer	Model No. / Serial No.	Last Cal.
1	X	Spectrum Analyzer	R & S	FSP40 / 100005	Aug., 2003
2	X	Pre-Amplifier	HP	8449B / 3008A01123	Feb., 2003
3		Loop Antenna	R & S	HFH2-Z2 / 833799/004	Sep., 2003
4	X	BiconiLog Antenna	Schwarzbeck	VULB 9166 / 1061	Sep., 2003
5		Bilog Antenna	Chase	CBL6112B / 2455	Sep., 2003
6		Horn Antenna	Schwarzbeck	BBHA 9120D / BBHA9120D312	Jul., 2003
7		No.1 OATS			Sep., 2002

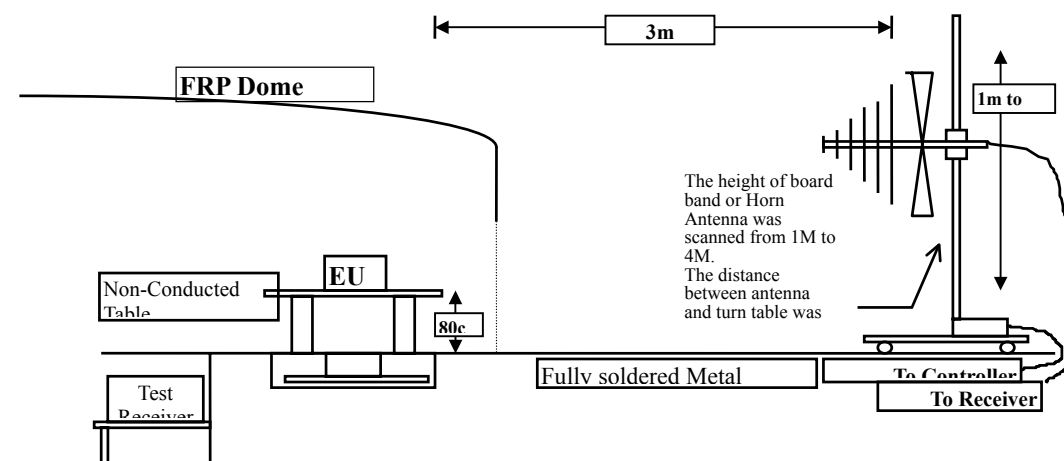
- Note:
1. All equipments that need to calibrate are with calibration period of 1 year.
 2. Mark "X" test instruments are used to measure the final test results.

4.2. Test Setup

RF Conducted Measurement:



RF Radiated Measurement:



4.3. Limit

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 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 C63.4:1992 on radiated measurement.

The additional latch filter below 1GHz was used to measure the level of harmonics radiated emission during field strength of harmonics measurement.

The bandwidth below 30MHz setting on the field strength meter is 10 kHz, above 1GHz are 1 MHz.

4.5. Test Result of Band Edge

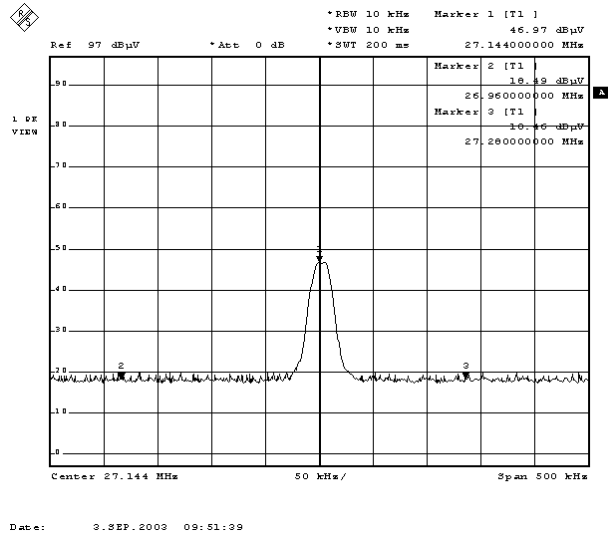
Product : Wireless Keyboard
 Test Item : Band Edge
 Test Site : No.1 OATS
 Test Mode : Normal Operation

RF Radiated Measurement: (Quasi-Peak Detector)

Channel No.	Frequency (MHz)	Reading Level (dBuV)	Probe Factor (dB/m)	Cable Loss (dB)	PreAMP (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Result
1 (Horizontal)	26.960	18.49	18.36	1.00	0.00	37.85	49.50	Pass
1 (Horizontal)	27.280	18.46	18.36	1.00	0.00	37.82	49.50	Pass

Figure:

(Horizontal)

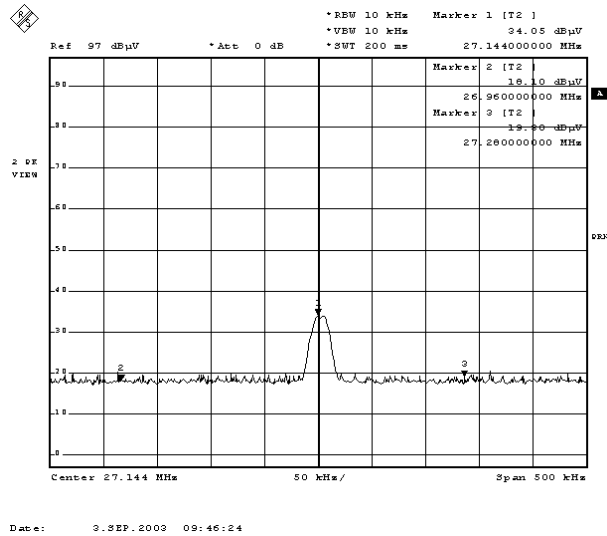


Product : Wireless Keyboard
 Test Item : Band Edge Data
 Test Site : No.1 OATS
 Test Mode : Normal Operation

RF Radiated Measurement: (Quasi-Peak Detector)

Channel No.	Frequency (MHz)	Reading Level (dBuV)	Probe Factor (dB/m)	Cable Loss (dB)	PreAMP (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Result
1 (Vertical)	26.960	18.10	18.36	1.00	0.00	37.46	49.50	Pass
1 (Vertical)	27.280	19.80	18.36	1.00	0.00	39.16	49.50	Pass

Figure: (Vertical)



5. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs