Test Report

Product Name : Wireless optical mouse

Model No. : F8E831-MSE, M304

FCC ID. : K7SF8E831-MSE

Applicant : Belkin Corporation

Address : 501 W. Walnut, Compton California 90220

Date of Receipt : Nov. 07, 2003

Date of Test : Nov. 11, 2002

Report No. : 03BL047FI

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

Test Report Certification

Test Date : Nov. 11, 2002
Report No. : 03BL047FI

QuieTek Corporation
Accredited by NIST (NVLAP)
NVLAP Lab Code: 200347-0

Product Name	:	Wireless optical mouse
Applicant	:	Belkin Corporation
Address	:	501 W. Walnut, Compton California 90220
Manufacturer	:	Darfon Electronics Corp.
Model No.	:	F8E831-MSE, M304
FCC ID.	:	K7SF8E831-MSE
Rated Voltage	:	DC 3V(Power by Battery)
Trade Name	:	Belkin, BenQ
Measurement Standard	:	FCC Part 15 Intentional Radiators for Subpart C Paragraph 15.227
Measurement Procedure	:	ANSI C63.4:1992
Test Result	:	Complied

NVLAP
NVLAP Lab Code : 200347-0

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Documented By : Miko Wu
(Miko Wu)

Tested By : Tom Hsieh
(Tom Hsieh)

Approved By : Gene Chang
(Gene Chang)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name : Wireless optical mouse
Trade Name : Belkin, BenQ
FCC ID. : K7SF8E831-MSE
Model No. : F8E831-MSE, M304
EUT Voltage : DC 3V(Power by Battery)
Frequency Range : 27.045MHz, 27.195MHz
Type of Modulation : FSK
Type of antenna : Loop antenna
Channel Number : 2
Channel Control : Manual

Frequency of Each Channel:

Channel	Frequency	Channel	Frequency
Channel 1:	27.045 MHz	Channel 2:	27.195 MHz

Note:

1. The EUT is a Wireless optical mouse intends to use in household and office PC system or related application.
2. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.227.
3. Regarding to the different construction of the EUT, the model number were shown in the table as following:

Model number	Different
F8E831-MSE	Belkin
M304	BenQ

1.2. Operation Description

The EUT is a 27MHz Wireless optical mouse intends to use in household and office PC system.
The device adapts FSK modulation. The antenna Loop antenna Provides diversity function to improve the transmitting function.
The super generation type receiver was used. An external excitation was used when the test of receiver was performed.

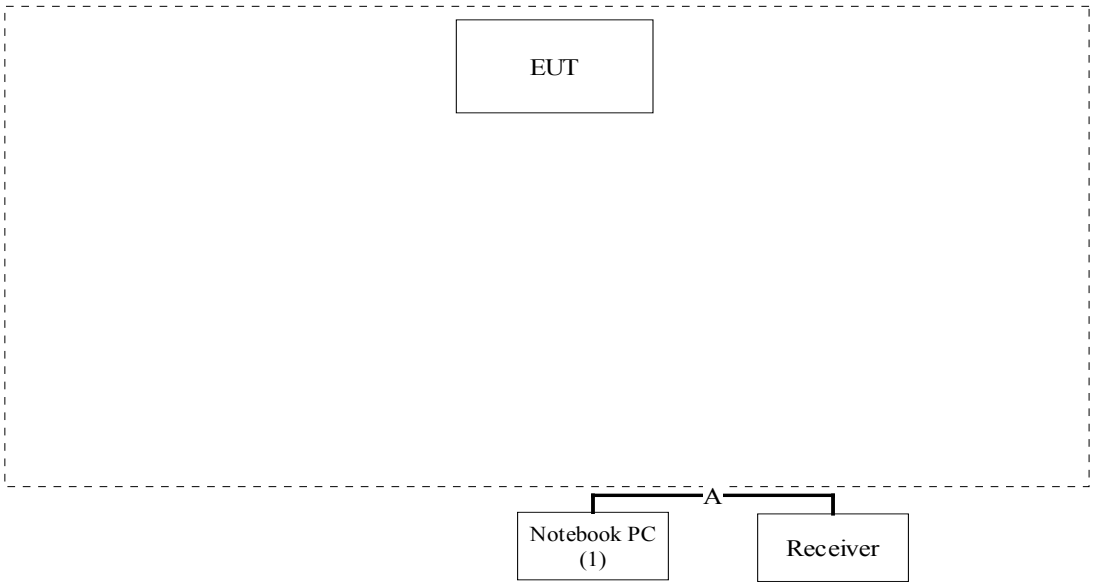
1.3. Tested System Details

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.	FCC ID	Power Cord
(1)	Notebook PC	DELL	PP01L	N/A	DoC	Non-Shielded, 1.8m

Signal Cable Type		Signal cable Description
A.	Receiver Cable	Shielded, 1.3m

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

April 18, 2001 Accreditation on Nemko
Certificate No.: ELA 165
Certificate No.: ELA 162
Certificate No.: ELA 191

Site Name: Quietek Corporation

Site Address: No.75-1, Wang-Yeh Valley, Yung-Hsing,
Chiung-Lin, Hsin-Chu County,
Taiwa, R.O.C.
TEL : 886-3-592-8858 / FAX : 886-3-592-8859
E-Mail : service@quietek.com

2. Conducted Emission

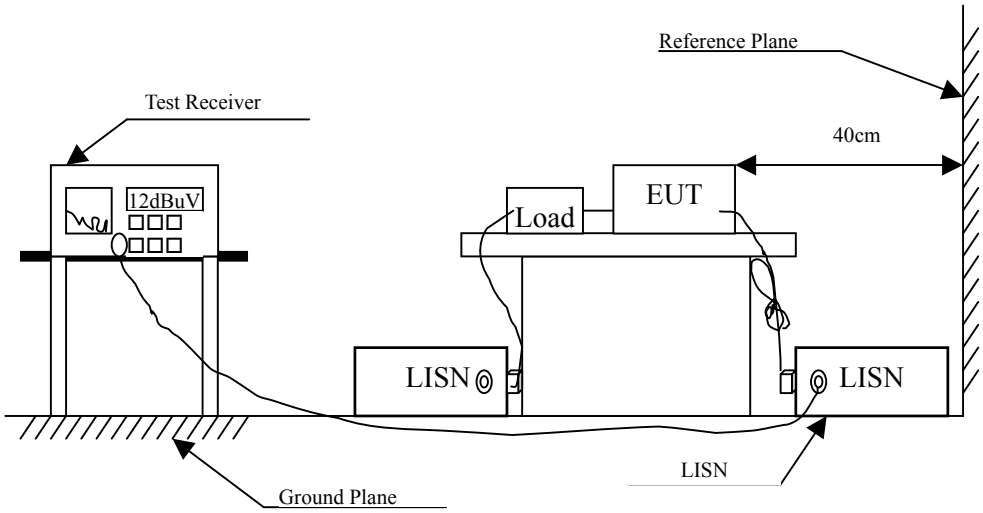
2.1. Test Equipment

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

Item	Instrument	Manufacturer	Type No./Serial No	Last Cal.	Remark
1	Test Receiver	R & S	ESCS 30/838251/0001	May, 2003	
2	L.I.S.N.	R & S	ESH3-Z5/836679/0023	May, 2003	EUT
3	L.I.S.N.	R & S	ENV 4200/833209/0023	May, 2003	Peripherals
4	Pulse Limiter	R & S	ESH3-Z2	May, 2003	
5	No.4 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 invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.5. Test Data of Conducted Emission

Owing to the DC operation of EUT, this test item is not performed.

3. Radiated Emission

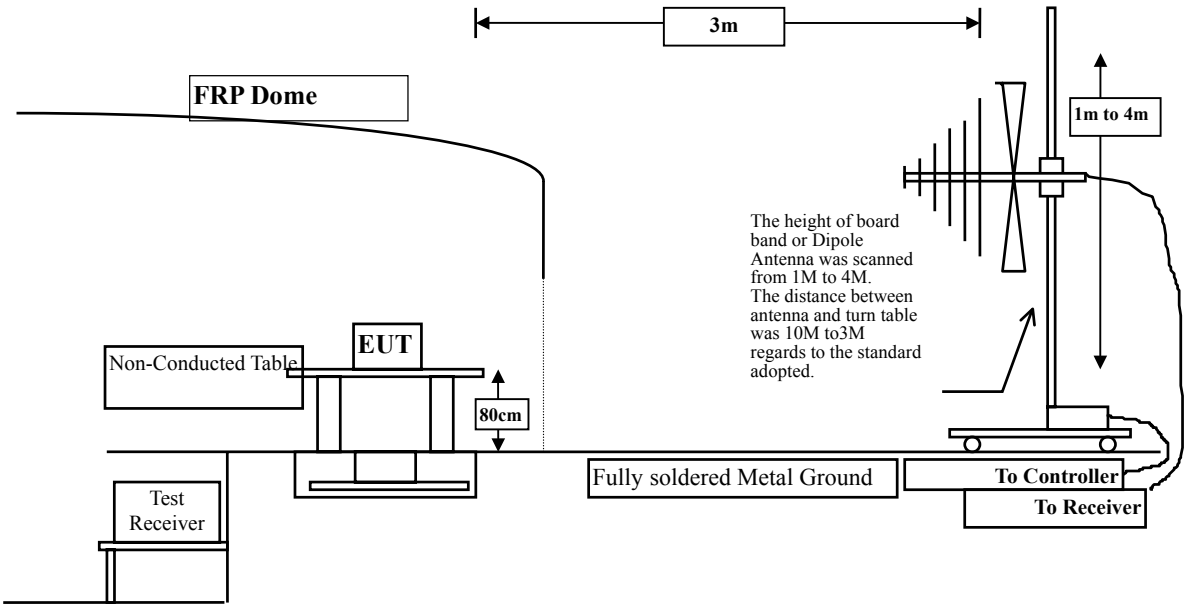
3.1. Test Equipment

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

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☐Site # 1	Test Receiver	R & S	ESVS 10 / 834468/003	July, 2003
	Spectrum Analyzer	Advantest	R3162/ 00803480	May, 2003
	Pre-Amplifier	Advantest	BB525C/ 3307A01812	May, 2003
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	Nov., 2003
☐Site # 2	Test Receiver	R & S	ESCS 30 / 836858 / 022	Nov., 2003
	Spectrum Analyzer	Advantest	R3162 / 100803466	May, 2003
	Pre-Amplifier	Advantest	BB525C/3307A01814	May, 2003
	Bilog Antenna	SCHAFFNER	CBL6112B / 2705	Oct., 2003
☒Site # 3	Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2003
	Spectrum Analyzer	Advantest	R3162 / 100803480	May, 2003
	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2003
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2003
	Horn Antenna	ETS	3115 / 0005-6160	July, 2003
	Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 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 invested over the frequency range from 30MHz to1GHz 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 harminics is checked.

3.5. Test Data of Radiated Emission

Product : Wireless optical mouse
Test Item : Fundamental Radiated Emission
Test Site : No.3 OATS
Test Voltage : DC 3V(Power by Battery)
Test Mode : Channel 1

Freq. MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal							
Peak Detector:							
27.200	0.17	-1.02	22.58	66.74	43.31	56.69	100.00
Vertical							
Peak Detector:							
27.200	0.17	3.98	22.58	63.73	45.30	54.70	100.00

Note:

1. All Readings are Peak value.
2. Emission Level = Reading Level + Probe Factor + Cable loss – PreAMP.
3. 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 optical mouse
Test Item : General Radiated Emission
Test Site : No.3 OATS
Test Voltage : DC 3V(Power by Battery)
Test Mode : Channel 1

	Frequency MHz	Cable Loss dB	Probe Factor dB/m	PreAMP dB	Reading Level dBuV	Emission Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal:								
	32.420	0.88	17.19	0.00	17.11	35.18	4.82	40.00
	49.400	0.97	7.96	0.00	24.05	32.98	7.02	40.00
	204.600	1.77	8.48	0.00	23.45	33.70	9.80	43.50
*	371.920	2.63	14.14	0.00	24.45	41.22	4.78	46.00
	384.060	2.69	14.01	0.00	11.94	28.64	17.36	46.00
	398.600	2.77	14.62	0.00	10.32	27.71	18.29	46.00
Vertical:								
	32.420	0.88	17.49	0.00	8.88	27.25	12.75	40.00
	180.350	1.64	8.41	0.00	18.44	28.50	15.00	43.50
*	209.450	1.79	8.75	0.00	20.69	31.23	12.27	43.50
	287.050	2.19	12.07	0.00	9.29	23.56	22.44	46.00
	774.470	4.70	20.04	0.00	5.19	29.93	16.07	46.00
	801.120	4.85	19.26	0.00	5.39	29.50	16.50	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.

4. Band Edge

4.1. Test Equipment

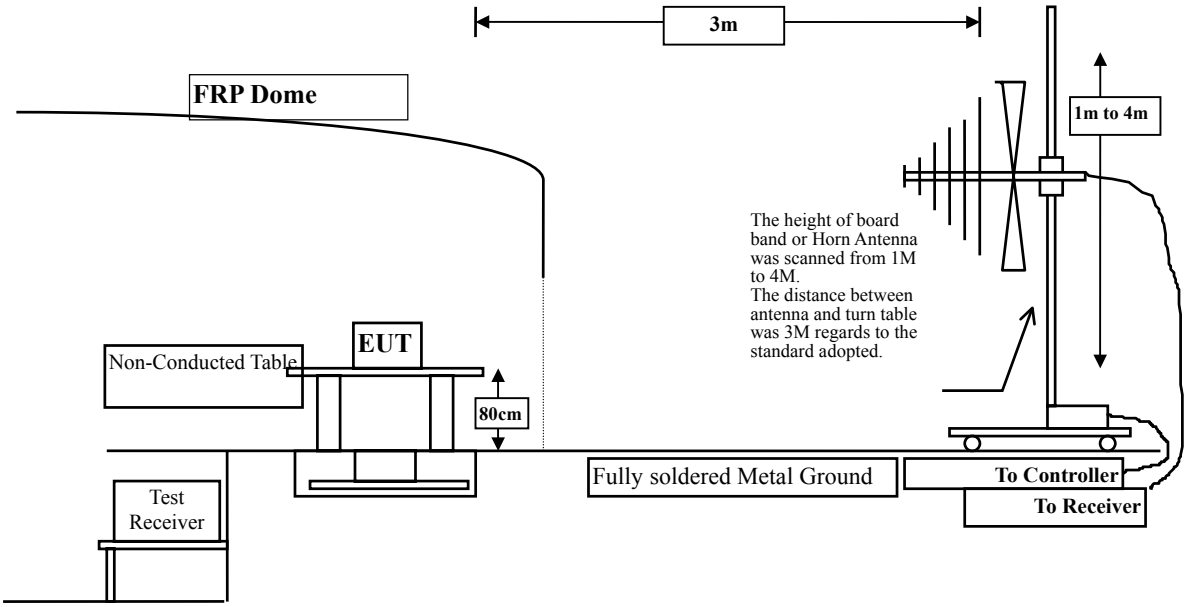
The following test equipment are used during the radiated emission test:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☐Site # 1	Test Receiver	R & S	ESVS 10 / 834468/003	July, 2003
	Spectrum Analyzer	Advantest	R3162/ 00803480	May, 2003
	Pre-Amplifier	Advantest	BB525C/ 3307A01812	May, 2003
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	Nov., 2003
☐Site # 2	Test Receiver	R & S	ESCS 30 / 836858 / 022	Nov., 2003
	Spectrum Analyzer	Advantest	R3162 / 100803466	May, 2003
	Pre-Amplifier	Advantest	BB525C/3307A01814	May, 2003
	Bilog Antenna	SCHAFFNER	CBL6112B / 2705	Oct., 2003
☒Site # 3	Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2003
	Spectrum Analyzer	Advantest	R3162 / 100803480	May, 2003
	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2003
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2003
	Horn Antenna	ETS	3115 / 0005-6160	July, 2003
	Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 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.

4.2. Test Setup

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 dtrength of harmonics measurement.
The bandwidth below 30MHz setting on the field strength meter is 10 kHz

4.5. Test Result of Band Edge

Product : Wireless optical mouse
Test Item : Band Edge
Test Site : No.1 OATS
Test Mode : Channel 1

RF Radiated Measurement: (Q-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)	25.08	32.34	-1.02	0.15	22.72	8.75	69.5	Pass
1 (Vertical)	23.43	34.42	3.98	0.14	22.77	15.78	69.5	Pass

Figure Channel 2: (Horizontal)

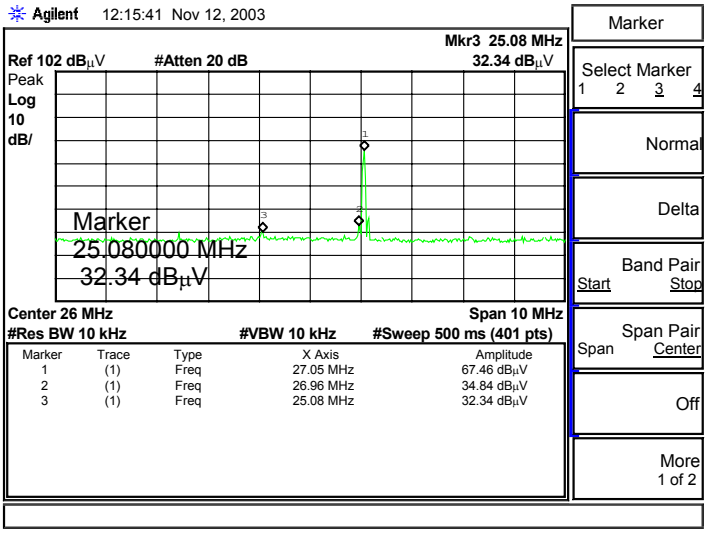
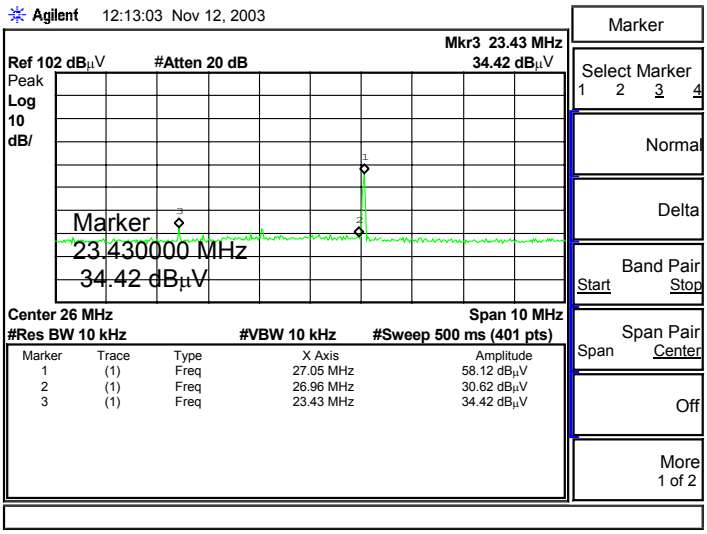


Figure Channel 2: (Vertical)



Note:

1. 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 optical mouse
Test Item : Band Edge Data
Test Site : No.1 OATS
Test Mode : Channel 1

RF Radiated Measurement: (Q-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)	27.30	40.73	-1.02	0.17	22.57	17.31	69.5	Pass
1 (Vertical)	27.60	30.22	3.98	0.17	22.55	11.82	69.5	Pass

Figure Channel 2: (Horizontal)

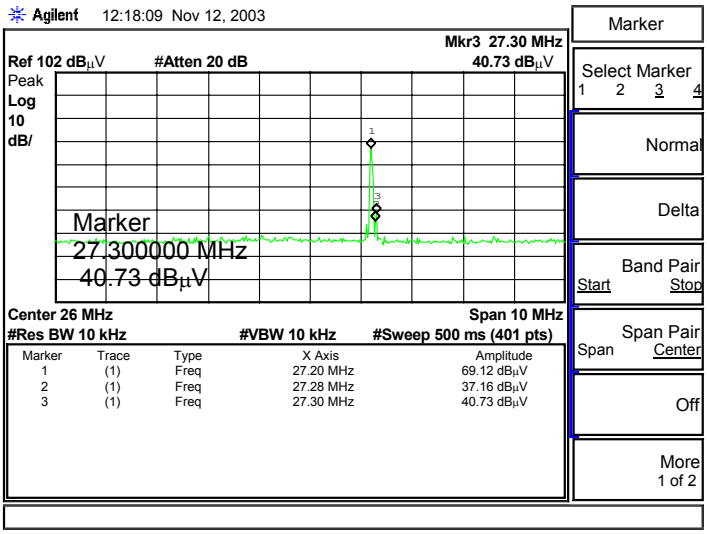
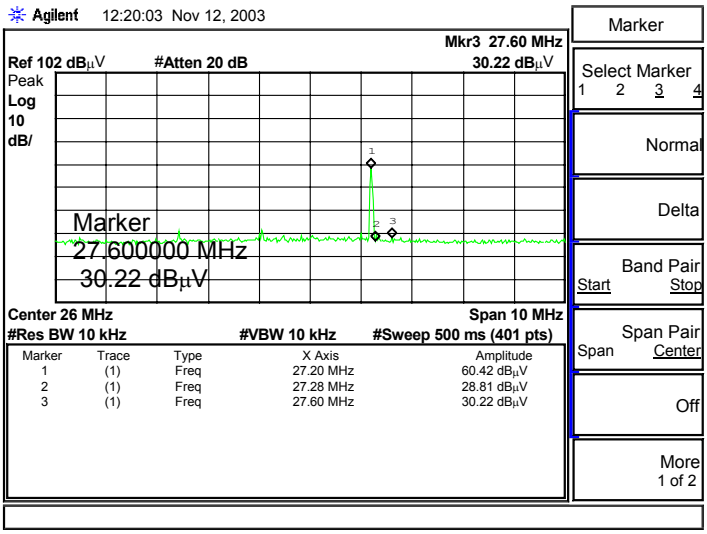


Figure Channel 2: (Vertical)



Note:

1. 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.

5. Occupied Bandwidth

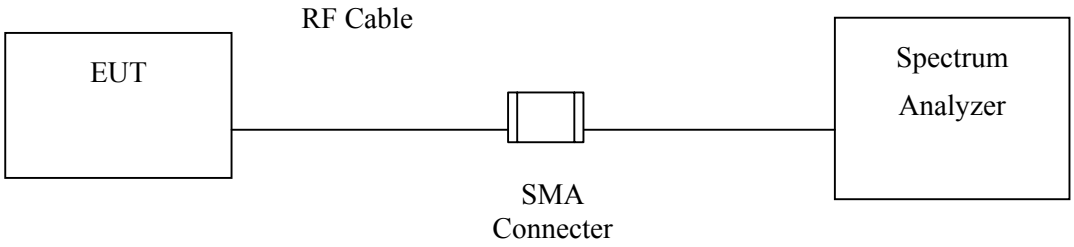
5.1. Test Equipment

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

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	HP	E4407B	May, 2003

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

5.2. Test Setup

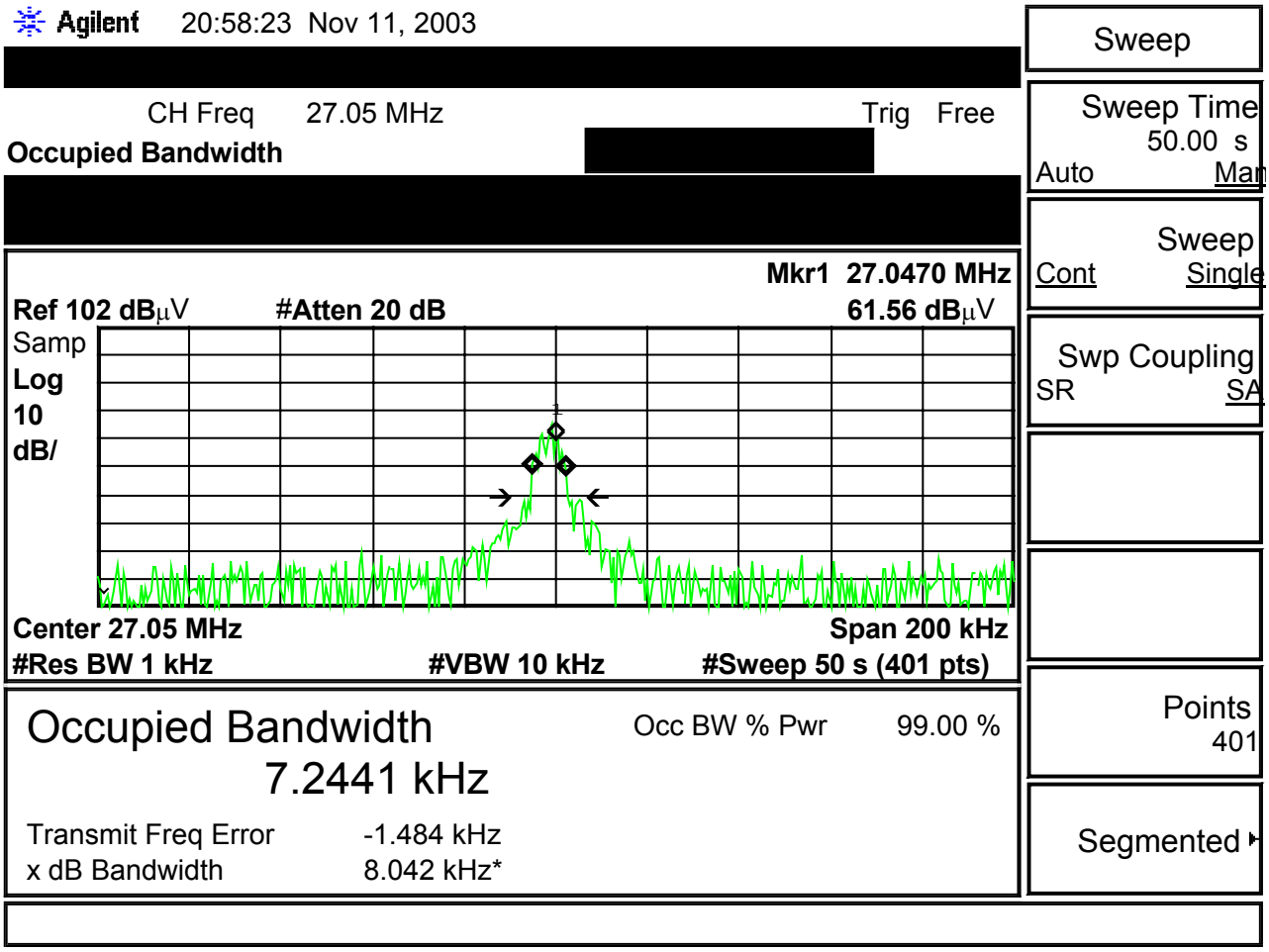


5.3. Test Result of Occupied Bandwidth

Product : Wireless optical mouse
Test Item : Occupied Bandwidth Data
Test Site : No.1 OATS
Test Mode : Channel 1

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
Ch01	27.045	7.2441	10	Pass

Figure Channel 1: 54Mbps



6. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 1: EUT Test Setup Photographs

Front View of Radiated Test

Back View of Radiated Test

Attachment 2: EUT Detailed Photographs

Attachment 2 : EUT Detailed Photographs

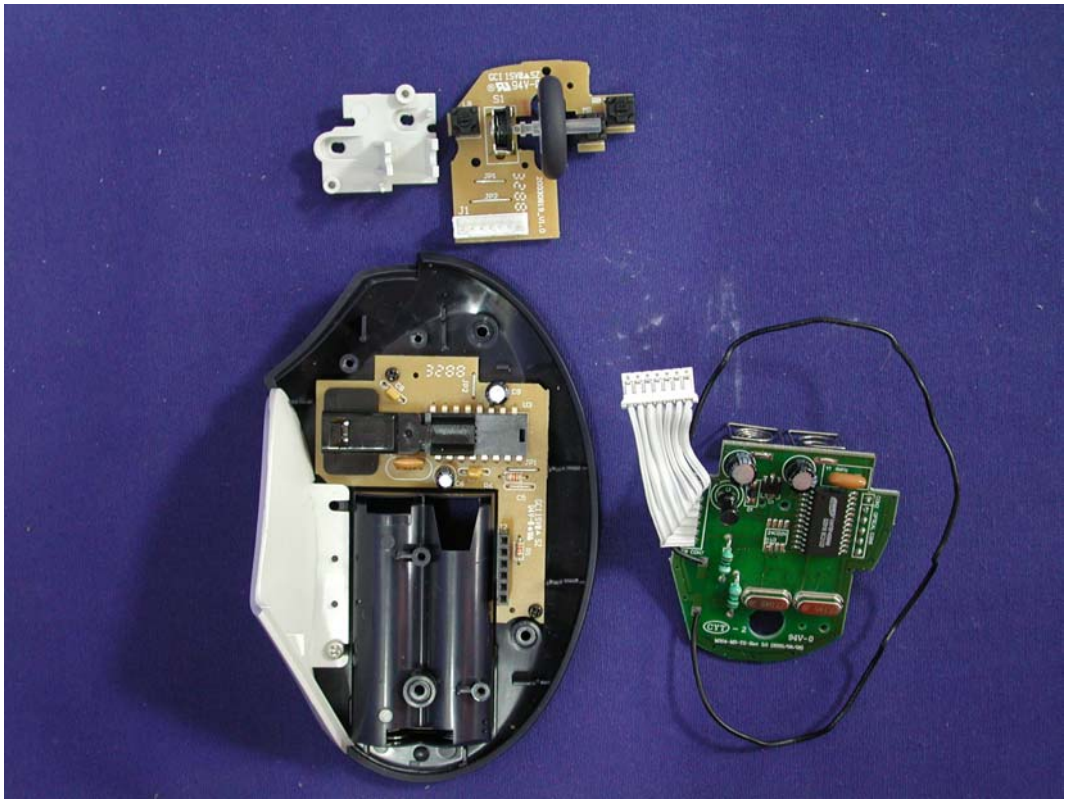
(1) EUT Photo

(2) EUT Photo

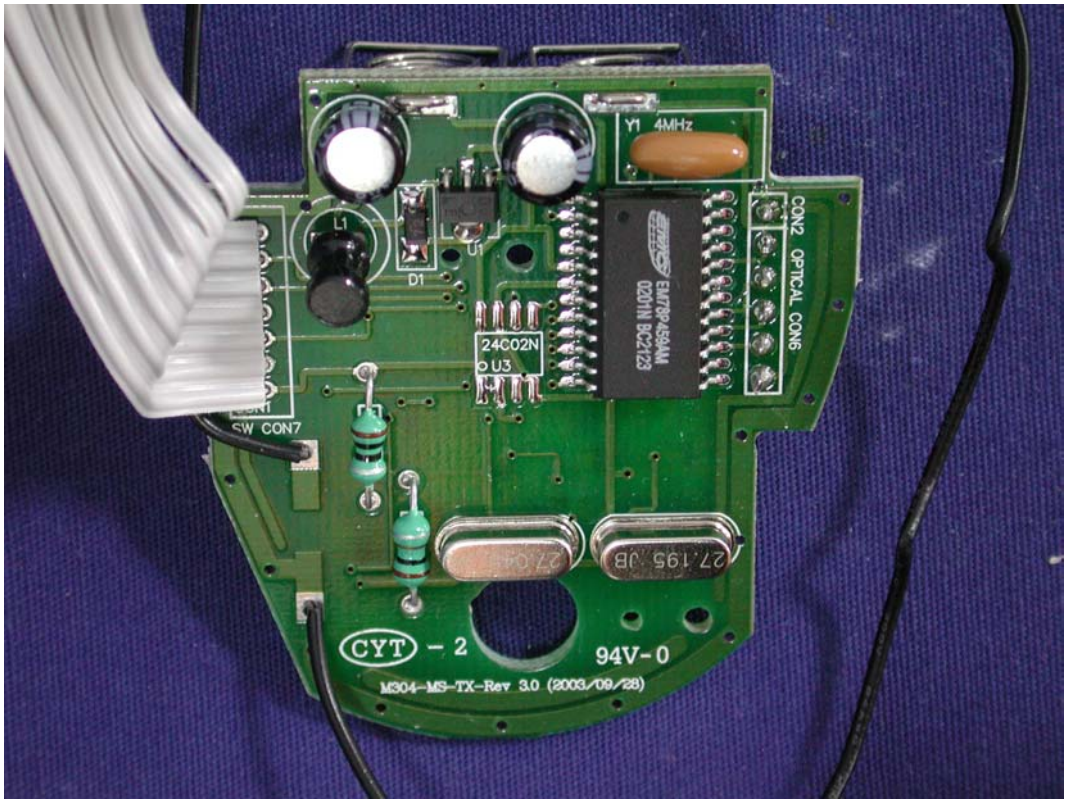
(3) EUT Photo

(4) EUT Photo

(5) EUT Photo



(6) EUT Photo



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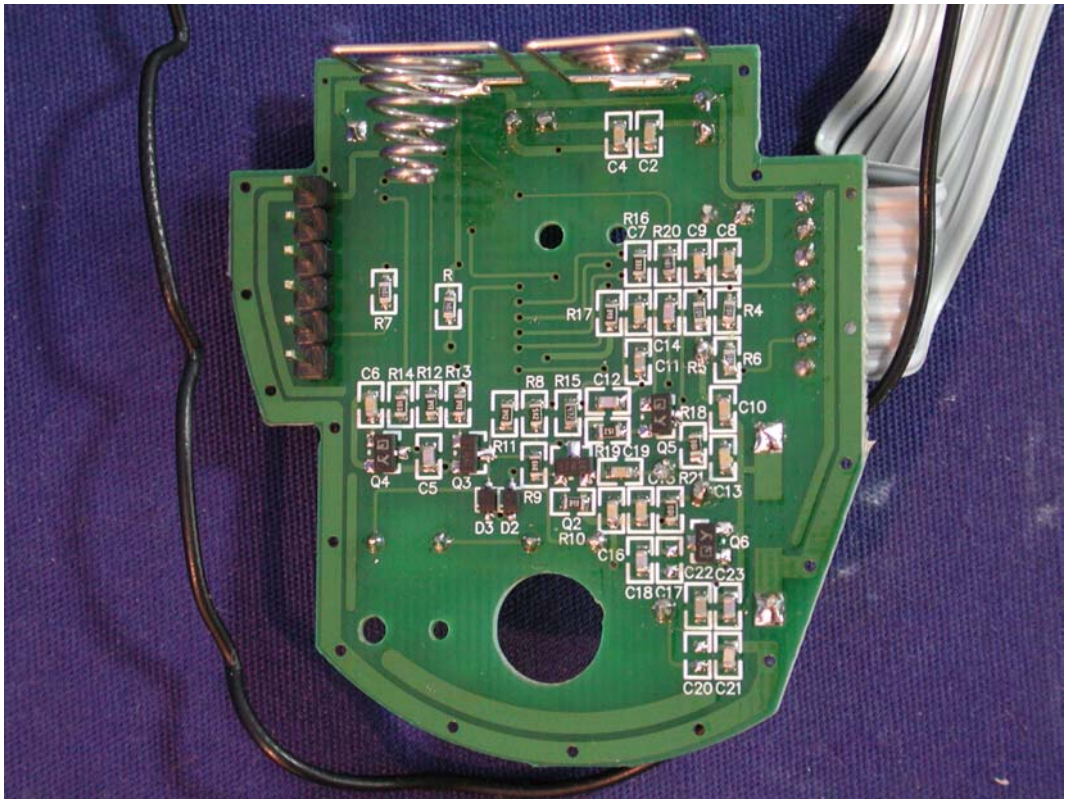
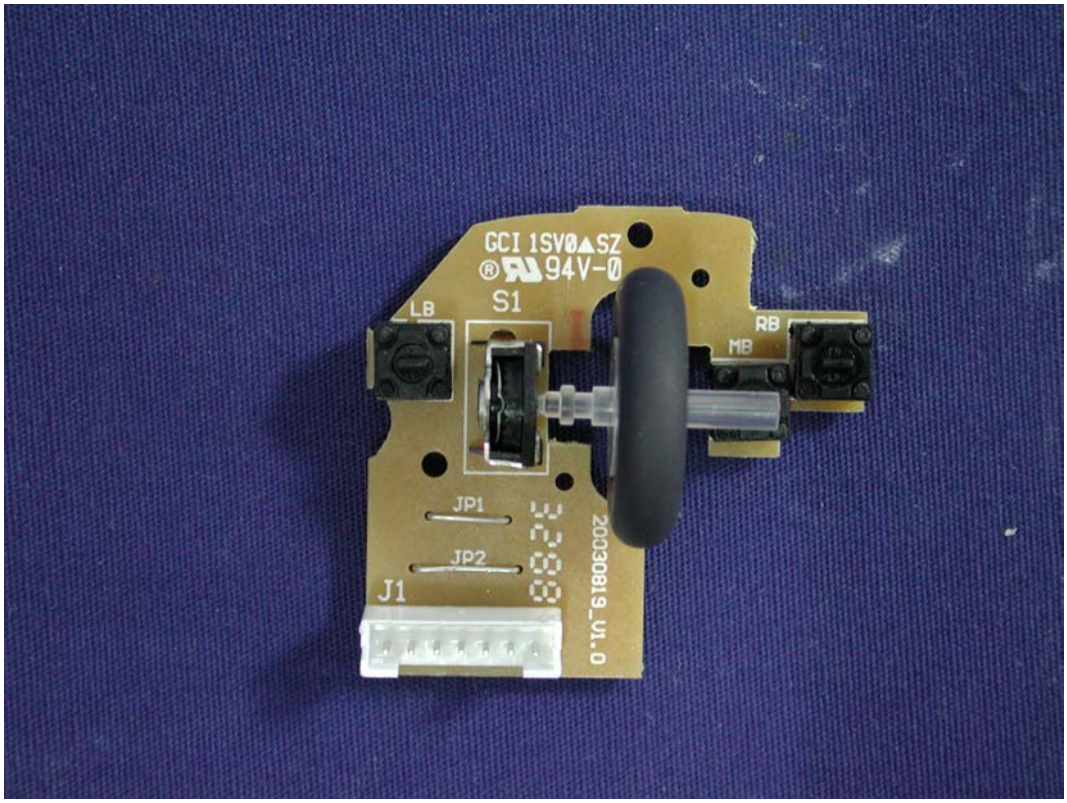
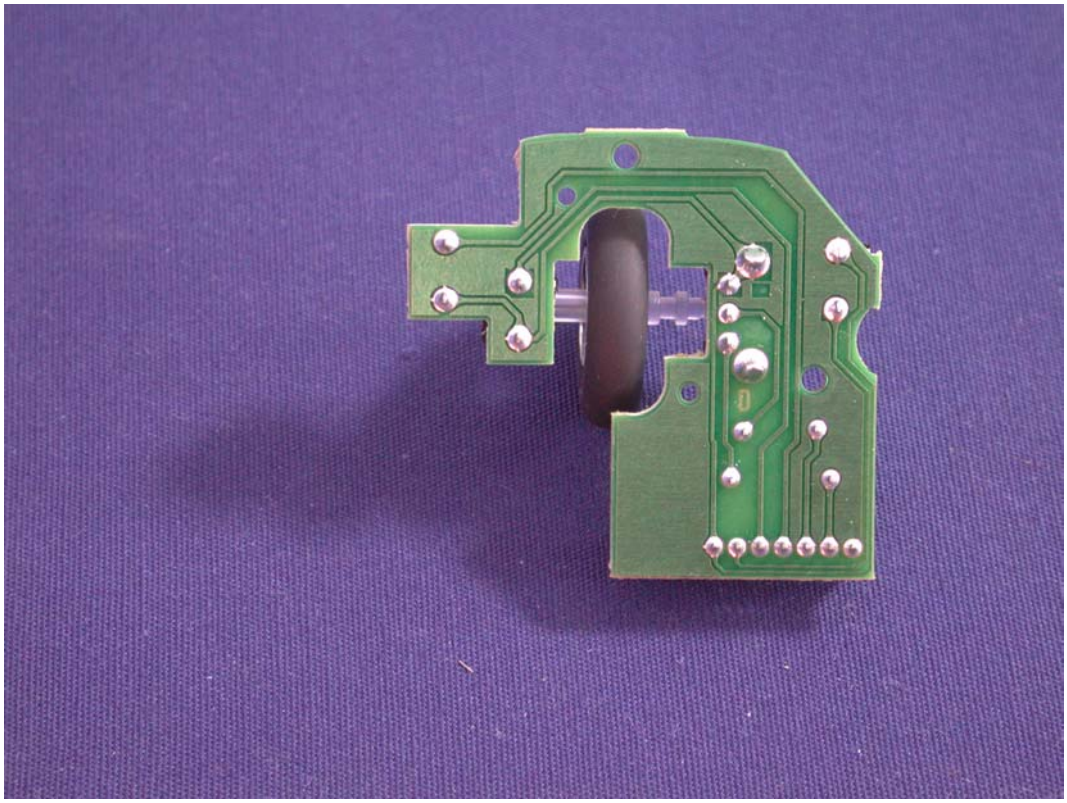


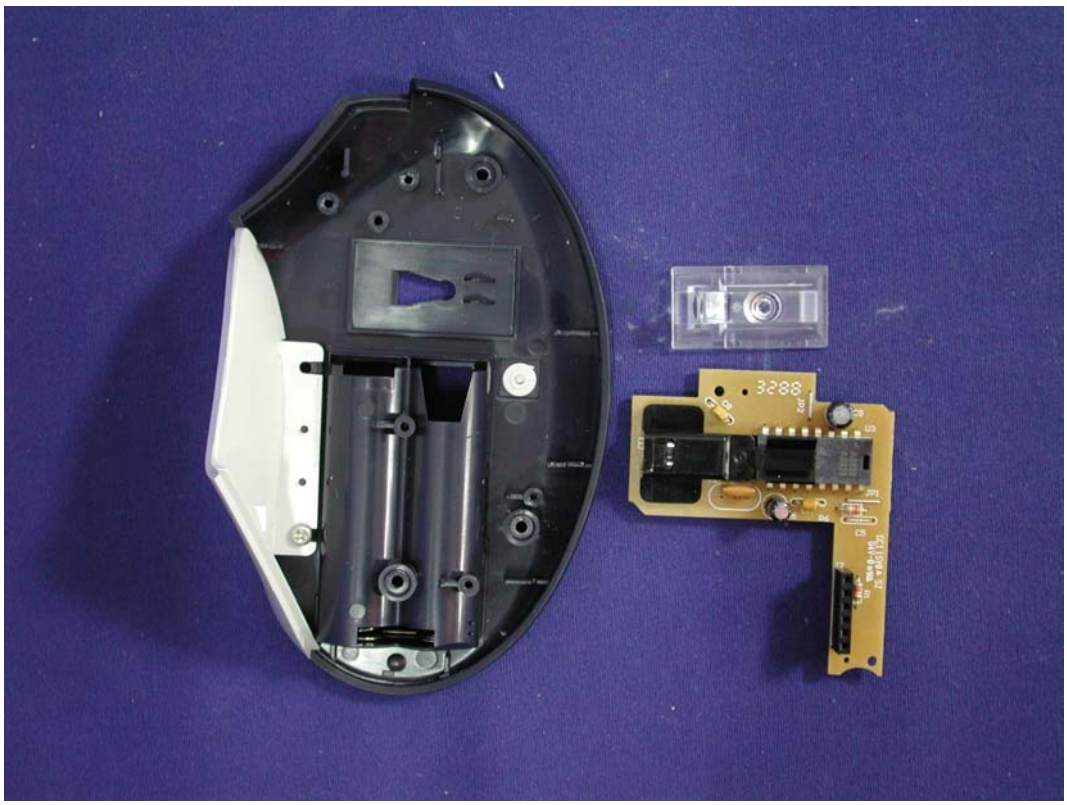
(8) EUT Photo



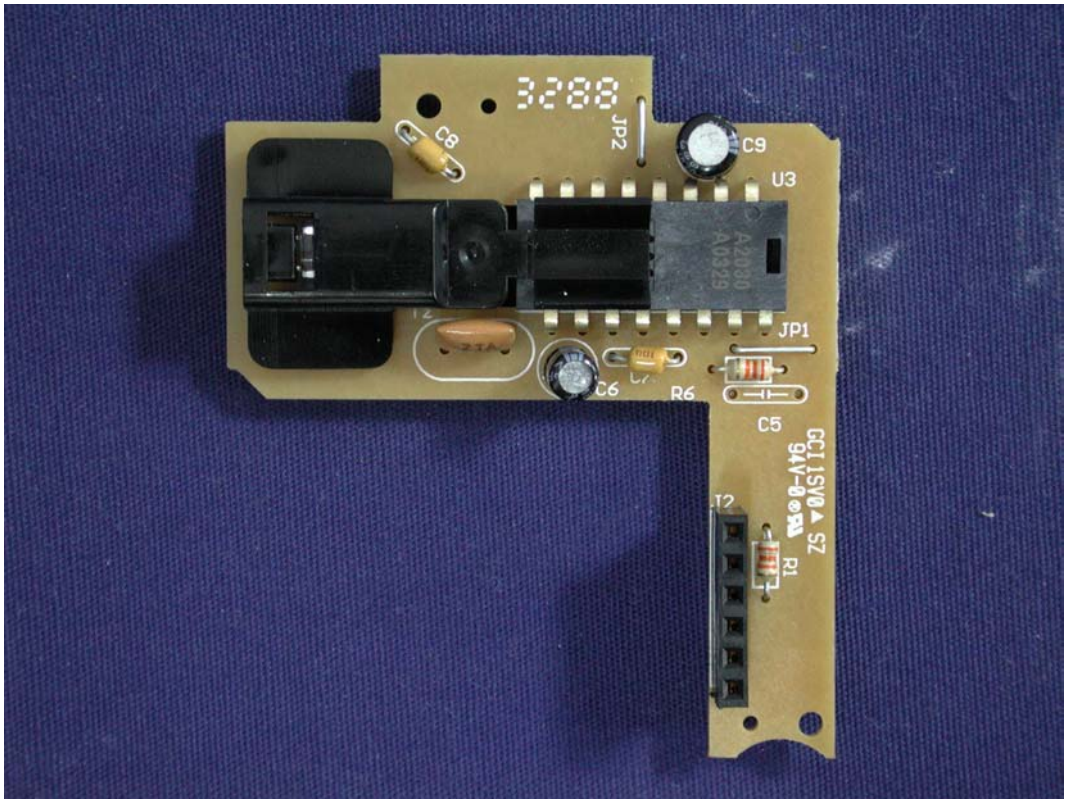
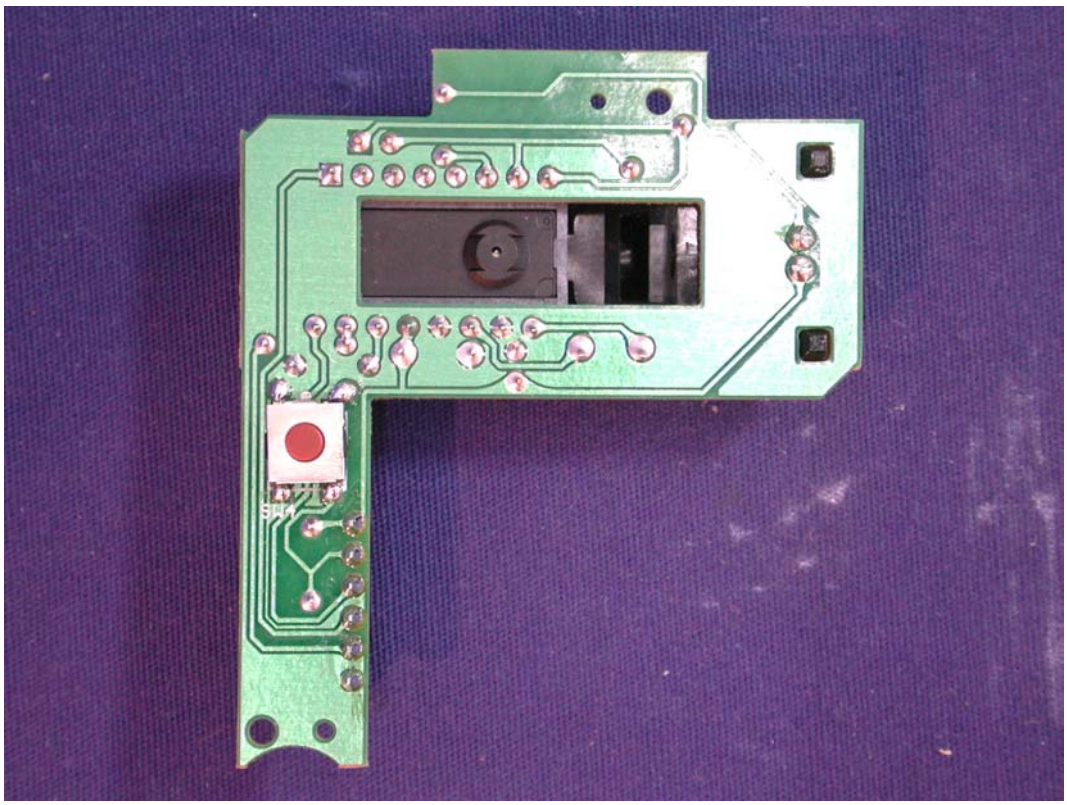
(9) EUT Photo



(10) EUT Photo



(11) EUT Photo



(12) EUT Photo