R&TTE (Radio) TEST REPORT
for
Wintop Electronics Co., Limited

2.4GHz Wireless Optical Mouse
Model No.: WM-697

Prepared for	:	Wintop Electronics Co., Limited
Address	:	Unit 04 7/F, Bright Way Tower 33, Mong Kok RD KL, HONGKONG

Prepared By	:	Shenzhen Anbotek Compliance Laboratory Limited
Address	:	1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China Tel: (86) 755-26066544 Fax: (86) 755-26014772

Report Number	:	R011408088T
Date of Test	:	Aug. 06~ 13, 2014
Date of Report	:	Aug. 14, 2014

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Test Report

TEST REPORT

Applicant	:	Wintop Electronics Co., Limited
Manufacturer	:	Shenzhen Wintop Electronics Co., Limited
EUT	:	2.4GHz Wireless Optical Mouse
Model No.	:	WM-697
Serial No.	:	N.A.
Trade Mark	:	N.A.
Rating	:	DC 3.0V, 8mA

Measurement Procedure Used:

ETSI EN 300 440-1 V1.6.1 (2010-08)
ETSI EN 300 440-2 V1.4.1 (2010-08)

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the EN 300 440-1 & EN 300 440-2 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited

Date of Test : Aug. 06~ 13, 2014

Prepared by : Rock Zeng
(Tested Engineer / Rock Zeng)

Reviewer : Amy Ding
(Project Manager / Amy Ding)

Approved & Authorized Signer : Tom Chen
(Manager / Tom Chen)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	2.4GHz Wireless Optical Mouse
Model Number	:	WM-697
Test Voltage	:	DC 3V Via Battery
Frequency	:	2405~2472MHz
Channel	:	68 Channels, 1MHz Spacing
Antenna Gain	:	-2dBi (The device uses an integral PCB antenna which is not intended and easy to modify.)
Applicant	:	Wintop Electronics Co., Limited
Address	:	Unit 04 7/F, Bright Way Tower 33, Mong Kok RD KL, HONGKONG
Manufacturer	:	Shenzhen Wintop Electronics Co., Limited
Address	:	Huaguan Industrial Park, Xinhe Road, Baolai Industrial District, Shangmugu, Pinghu Town, Longgang District, Shenzhen City, 518000, China
Factory	:	Shenzhen Wintop Electronics Co., Limited
Address	:	Huaguan Industrial Park, Xinhe Road, Baolai Industrial District, Shangmugu, Pinghu Town, Longgang District, Shenzhen City, 518000, China
Date of receipt	:	Aug. 06, 2014
Date of Test	:	Aug. 06~ 13, 2014

1.2. Receiver categories

Receiver category	Relevant receiver clauses	Risk assessment of receiver performance
1	8.1, 8.2 and 8.3	Highly reliable SRD communication media; e.g. serving human life inherent systems (may result in a physical risk to a person).
2	8.2 and 8.3	Medium reliable SRD communication media e.g. causing inconvenience to persons, which cannot simply be overcome by other means.
3	8.3	Standard reliable SRD communication media e.g. Inconvenience to persons, which can simply be overcome by other means (e.g. manual).

* This receiver is ranged into **Category 3** Equipment

1.3. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:
CNAS - LAB Code: L3503
Shenzhen Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

FCC-Registration No.: 752021
Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 752021, July 10, 2013.

IC-Registration No.: 8058A-1
Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A-1, February 22, 2013.

Test Location
All Emissions tests were performed at
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

1.4. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 4.3dB
Conduction Uncertainty	:	Uc = 3.4dB

1.5. Test Standards

ETSI EN 300 440-1 V1.6.1 (2010-08) Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 1: Technical characteristics and test methods **ETSI EN 300 440-2 V1.4.1 (2010-08)** Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

Note: All radiated measurements were made in all three orthogonal. The values reported are the maximum values.

1.6. Auxiliary Equipment Used during Test

N/A

2. MEASURING DEVICE AND TEST EQUIPMENT

Equipment	Manufacturer	Model #	Serial #	Date of Cal.	Cal. Interval
EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2014	1 Year
Spectrum Analyzer	Agilent	E4407B	US39390582	Aug. 09, 2014	1 Year
Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	May 14, 2013	3 Year
Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2014	1 Year
Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2014	1 Year
AC Power Source	Sepcial power system	YF650	N/A	N/A	N/A
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	N/A	N/A	N/A
EMI Test Software EZ-EMC	SHURPLE	EZ-EMC	N/A	N/A	N/A
Coaxial Cable	N/A	N/A	N/A	N/A	N/A
Coaxial Cable	N/A	N/A	N/A	N/A	N/A
Coaxial Cable	N/A	N/A	N/A	N/A	N/A
3m Semi-Anechoic Chamber	Zhong Yu Electronic	N/A	N/A	N/A	N/A

3. Technical Test

3.1. Summary of Test Results

No Deviations from the technical specification(s) were ascertained in the course of the tests Performed	
Final Verdict: (only “Passed” if all single measurements are “Passed”)	Passed

3.2. Test Report

Test Report Reference

ETSI EN 300 440-2 V1.6.1 (2010-08)		
Description of Test	Rule	Result
Transmitter requirements	Section 4.2.1	
Equivalent isotropically radiated power	Section 4.2.1.1	Complies
Permitted range of operating frequencies	Section 4.2.1.2	Complies
Unwanted emissions in the spurious domain	Section 4.2.1.3	Complies
Duty cycle	Section 4.2.1.4	N/A note(1)
Receiver requirements	Section 4.2.2	
Adjacent channel selectivity	Section 4.2.2.1	N/A note(2)
Blocking or desensitization	Section 4.2.2.2	N/A note(3)
Spurious radiations	Section 4.2.2.3	Complies

Note (1): Not applicable , This requirement applies to RFID transmitters operating in 2 446 MHz to 2 454 MHz only.
Note (2): Not applicable, since the test applies to class 1 receivers only
Note (3): Not applicable, since the test applies to class 1 and class 2 receivers only

3.3. Description of Test Modes

The EUT has been tested under operating condition.
Manual control the EUT for staying in continuous transmitting mode.
Channel 1(2405MHz), Channel 34(2438MHz) and Channel 68(2472MHz) are chosen for the final testing.

3.4. Technical Requirements

3.4.1. Equivalent isotropically radiated power

3.4.1.1. Standard Applicable

According to ETSI EN 300 440-2 V1.4.1, The equivalent isotropically radiated power, as defined in EN 300 440-1 [1], clause 7.1.1, shall not exceed the limits in EN 300 440-1 [1], clause 7.1.3, table 4.

This requirement applies to transmitters with an integral or dedicated antenna.

Table 4: Maximum radiated peak power (e.i.r.p.)

Frequency Bands	Power	Application	Notes
2 400 MHz to 2 483,5 MHz	10 mW e.i.r.p.	Generic use	
2 400 MHz to 2 483,5 MHz	25 mW e.i.r.p.	Detection, movement and alert applications	
(a) 2 446 MHz to 2 454 MHz	500 mW e.i.r.p.	RFID	See also table 6 and annex C
(b) 2 446 MHz to 2 454 MHz	4 W e.i.r.p.	RFID	See also table 6 and annex C
5 725 MHz to 5 875 MHz	25 mW e.i.r.p.	Generic use	
9 200 MHz to 9 500 MHz	25 mW e.i.r.p.	Radiodetermination: radar, detection, movement and alert applications	
9 500 MHz to 9 975 MHz	25 mW e.i.r.p.	Radiodetermination: Radar, detection, movement and alert applications	
10,5 GHz to 10,6 GHz	500 mW e.i.r.p.	Radiodetermination: Radar, detection, movement and alert applications	
13,4 GHz to 14,0 GHz	25 mW e.i.r.p.	Radiodetermination: Radar, detection, movement and alert applications	
17,1 GHz to 17,3 GHz	400 mW e.i.r.p.	Radiodetermination: GBSAR detection, movement and alert applications	See annex E
24,00 GHz to 24,25 GHz	100 mW e.i.r.p.	Generic use and Radiodetermination: radar, detection, movement and alert applications	

3.4.1.2.Test Procedure

The measurement arrangement see following figure:

Equipment measured as constant envelope modulation equipment

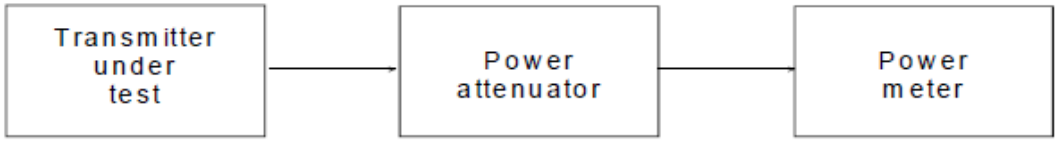


Figure 6: Measurement arrangement

1. The transmitter output was connected to the spectrum analyzer through an attenuator.

2. The transmitter output was connected to the spectrum analyzer via a cable and cable loss is used as the offset of the spectrum analyzer.

3. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100MHz bandwidth from lower band edge. Then detector set to peak and max hold this trace.

4. For peak power measurements, a spectrum analyser or frequency-selective voltmeter shall be used and tuned to the transmitter carrier at which the highest level is detected.

5. The equivalent isotropically radiated power is then calculated from the measured value, the known antenna gain, relative to an isotropic antenna.
6. The transmitter shall be tested under normal and extreme test conditions

3.4.1.3. Test Result

Temperature (℃)	22~23
Humidity (%RH)	40~42
Barometric Pressure (mbar)	950~1000
EUT	2.4GHz Wireless Optical Mouse
M/N	WM-697
Operating Mode	Continuous Transmitting

TEST CONDITION:	Frequency (MHz)	Power (dBm)	Factor (dB)	*Corrected Power* (dBm)	Limit (dBm)	Margin *(dBm)*	Result
Normal	2405	-5.14	1.5	-3.64	10	-13.64	PASS
	2438	-5.24	1.5	-3.74	10	-13.74	PASS
	2472	-5.36	1.5	-3.86	10	-13.86	PASS
Extreme	2405	-5.73	1.5	-4.23	10	-14.23	PASS
	2438	-5.82	1.5	-4.32	10	-14.32	PASS
	2472	-6.03	1.5	-4.53	10	-14.53	PASS

3.4.2. Permitted range of operating frequencies

3.4.2.1. Standard Application

The permitted range of operating frequencies includes all frequencies on which the equipment may operate within an assigned frequency band. The operating frequency range shall be declared by the manufacturer.

The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope.

F_H is the highest frequency of the power envelope, it is the frequency furthest above the frequency of maximum power where the output power drops below the level of –80dBm/Hz spectral power density (-30dBm if measured in a 100kHz bandwidth) eirp.

F_L is the lowest frequency of the power envelope; it is the frequency furthest below the frequency of maximum power where the output power drops below the level of –80dBm/Hz spectral lower density (-30dBm if measured in a 100kHz bandwidth) eirp.

3.4.2.2. Test Procedure

Put the spectrum analyzer in video averaging mode with a minimum of 50 sweeps selected;

Select the lowest operating frequency of the equipment under test and activate the transmitter with modulation applied. The RF emission of the equipment shall be displayed on the spectrum analyzer.

Using the marker of the spectrum analyzer, find lowest frequency below the operating frequency at which spectral power density drops below the required value.

Select the highest operating frequency of the equipment under test and find the highest frequency at which the spectral power density drop below the required value.

The difference between the frequencies measured in step 3 and step 4 is the operating frequency range.

3.4.2.3. Test Result

Temperature (℃)	22~23
Humidity (%RH)	40~42
Barometric Pressure (mbar)	950~1000
EUT	2.4GHz Wireless Optical Mouse
M/N	WM-697
Operating Mode	Continuous Transmitting

Test Condition			Test Result	
	Voltage (V)	Temperature (℃)	F_L(MHz)	F_H(MHz)
Normal Condition	DC 3V	24	2402.29	2474.51
Extreme Condition	DC 2.7V	-10	2402.74	2474.82
		+55	2402.35	2474.79
	DC 3.3V	-10	2402.84	2474.62
		+55	2402.97	2474.96
Limit			F_L > 2400MHz	F_H<2483.5MHz
Conclusion			PASS	PASS

3.4.3. Unwanted emissions in the spurious domain

3.4.3.1. Standard Application

According to ETSI EN 300 440-2 V1.4.1, Unwanted emissions in the spurious domain (spurious emissions) are those at frequencies beyond the limit of 250 % of the necessary bandwidth above and below the centre frequency of the emission.

The level of spurious emissions shall be measured as either:
a)
i) their power level in a specified load (conducted emission); and
ii) their effective radiated power when radiated by the cabinet and structure of the equipment (cabinet
radiation); or
b) their effective radiated power when radiated by the cabinet and the integral or dedicated antenna, in the case of equipment fitted with such an antenna and no permanent RF connector.

For measurements above 1 000 MHz the peak value shall be measured using a spectrum analyser. The "max hold" function of a spectrum analyser shall be used. For measurements up to 1 000 MHz the quasi-peak detector set in accordance with the specification of CISPR 16 [1] shall be used.

The power of any spurious emission shall not exceed the following values given in table 5.

Table 5: Spurious emissions

Frequency ranges / State	47 MHz to 74 MHz 87,5 MHz to 108 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1 000 MHz	Frequencies > 1 000 MHz
Operating	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

Frequency ranges / State	47MHz to 74MHz 87.5MHz to 108MHz 174MHz to 230MHz 470MHz to 862MHz	Other frequencies ≦1000MHz	Frequencies >1000MHz
Operating	41.25 dBuV/m	59.20 dBuV/m	65.23 dBuV/m
Standby	38.22 dBuV/m	38.22 dBuV/m	48.24 dBuV/m

3.4.3.2. Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is +4.0 dB.

3.4.3.3. Test Procedure

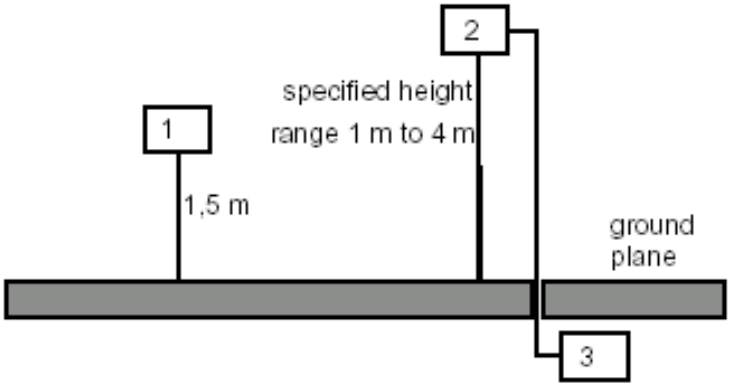
Radiated measurements were performed with the aid of a test antenna and measurement instruments. The test antenna and measurement instrument shall be calibrated according to the procedure defined in this annex. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level. This position was recorded in the measurement report. The frequency range was measured in this position.

Preferably, radiated measurements were performed in an anechoic chamber. For other test sites corrections may be needed. The following test procedure applies:

a) a test site which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna were oriented initially for vertical polarization unless otherwise stated and the transmitter under test shall be placed on the support in its standard position and switched on;

b) for average power measurements a non-selective voltmeter or wide band spectrum analyzer were used. For other measurements a spectrum analyzer or selective voltmeter shall be used and tuned to the measurement frequency.

In either case a) or b), the test antenna shall be raised or lowered, if necessary, through the specified height range until the maximum signal level is detected on the spectrum analyzer or selective voltmeter.



1) equipment under test.
2) test antenna.
3) spectrum analyser or measuring receiver.

Figure C.1: Measurement arrangement No.1

c) the transmitter shall be rotated through 360° about a vertical axis until a higher maximum signal is received;

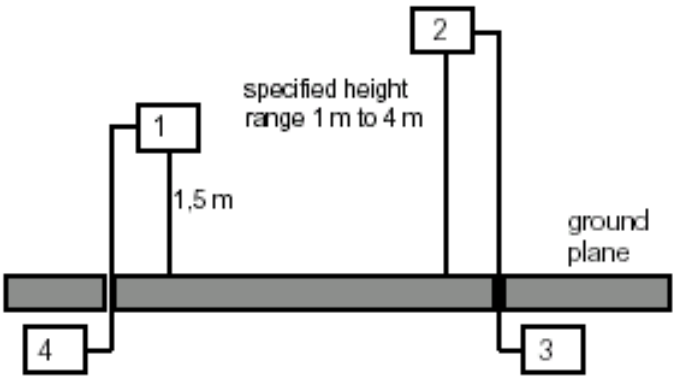
d) the test antenna shall be raised or lowered again, if necessary, through the specified height range until a maximum is obtained. This level shall be recorded.

NOTE: This maximum may be a lower value than the value obtainable at heights outside the specified limits.

The test antenna need not be raised or lowered if the measurement is carried out on a test site according to clause b.1.2. This measurement shall be repeated for horizontal polarization.

The actual signal generated by the measured equipment may be determined by means of a substitution measurement in which a known signal source replaces the device to be measured, see figure C.2.

Preferably, this method of measurement shall be used in an anechoic chamber. For other test sites corrections may be needed.



1) substitution antenna.
2) test antenna.
3) spectrum analyser or selective voltmeter.
4) signal generator.

Figure C.2: Measurement arrangement No.2

a) using measurement arrangement NO.2, the substitution antenna shall replace the transmitter antenna in the same position and in vertical polarization. The frequency of the signal generator shall be adjusted to the measurement frequency. The test antenna shall be raised or lowered, if necessary, to ensure that the maximum signal is still received. The input signal to the substitution antenna shall be adjusted in level until an equal or a known related level to that detected from the transmitter is obtained in the transmitter is obtained in the test receiver;

- the radiated power is equal to the power supplied by the signal generator, increased by the known relationship if necessary and after corrections due to the gain of the substitution antenna and the cable loss between the signal generator and the substitution antenna;

b) this measurement shall be repeated with horizontal and vertical polarization.

3.4.3.4. Test Result

Temperature (℃)	22~23
Humidity (%RH)	40~42
Barometric Pressure (mbar)	950~1000
EUT	2.4GHz Wireless Optical Mouse
M/N	WM-697
Operating Mode	Continuous Transmitting

Tx mode

Frequency MHz	Antenna Polar (H/V)	Read Level (dBuV)	Correct Factor (dB)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2147.52	H	45.78	-8.73	37.05	65.23	-28.18
2713.25	H	46.33	-8.16	38.17	65.23	-27.06
3174.71	H	45.49	-7.42	38.07	65.23	-27.16
3904.42	H	46.45	-6.54	39.91	65.23	-25.32
4468.06	H	47.95	-4.97	42.98	65.23	-22.25
5817.47	H	46.87	-3.17	43.70	65.23	-21.53
1857.39	V	47.53	-11.76	35.77	65.23	-29.46
2425.69	V	59.88	-8.66	51.22	65.23	-14.01
3123.33	V	49.77	-7.53	42.24	65.23	-22.99
3574.08	V	45.02	-7.03	37.99	65.23	-27.24
4463.20	V	50.39	-4.90	45.49	65.23	-19.74
5259.83	V	49.04	-4.06	44.98	65.23	-20.25

Standby mode

Frequency MHz	Antenna Polar (H/V)	Read Level (dBm)	Correct Factor (dB)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.27	V	6.79	13.24	20.03	38.22	-18.19
391.46	V	5.56	16.85	22.41	38.22	-15.81
464.03	V	5.41	18.41	23.82	38.22	-14.40
577.82	V	2.86	20.25	23.11	38.22	-15.11
727.47	V	4.24	23.66	27.90	38.22	-10.32
175.40	H	6.41	9.10	15.51	38.22	-22.71
391.36	H	8.03	16.85	24.88	38.22	-13.34
462.37	H	2.74	18.20	20.94	38.22	-17.28

3.4.4. Receiver requirements-Spurious radiations

3.4.4.1. Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is +4.0 dB.

3.4.4.2. Limit of Spurious Emissions

Frequency Range	≤ 1000MHz	> 1000MHz
Power Limit	2nW(38.22 dBuV/m)	20nW(48.24 dBuV/m)

3.4.4.3. Test Procedure

Rx was placed on a nonmetal table which is 1.5 meter above the grounded reference plane and set to work in normal operation mode. Details refer to ETSI EN 300 220-1 V1.3.1 subclause 9.4.3.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dBμV of specification limitation), and are distinguished with a "QP" in the data table.

The EUT was operating at normal to represent worst case during final qualification test.

3.4.4.4. Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. –Limit

3.4.4.5. Measurement Result

Temperature (℃)	22~23
Humidity (%RH)	40~42
Barometric Pressure (mbar)	950~1000
EUT	2.4GHz Wireless Optical Mouse
M/N	WM-697
Operating Mode	Continuous Transmitting

Frequency MHz	Antenna Polar (H/V)	Read Level (dBuV)	Correct Factor (dB)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1203.25	H	42.35	-7.6	34.75	48.24	-13.49
1342.13	H	40.87	-8.4	32.47	48.24	-15.77
1687.14	H	35.13	-7.3	27.83	48.24	-20.41
2454.69	H	35.62	-7.2	28.42	48.24	-19.82
2689.30	H	50.47	-7.6	42.87	48.24	-5.37
2815.48	H	46.02	-7.6	38.42	48.24	-9.82
1103.26	V	35.67	-7.1	28.57	48.24	-19.67
1366.29	V	40.89	-7.3	33.59	48.24	-14.65
1848.52	V	47.04	-8.0	39.04	48.24	-9.20
2210.03	V	45.23	-7.1	38.13	48.24	-10.11
2531.36	V	48.01	-7.2	40.81	48.24	-7.43
2667.00	V	34.71	-7.6	27.11	48.24	-21.13

APPENDIX I (TEST PHOTOGRAPHS)

1. Photo of Emission Test