

EMC TEST REPORT

For

Shenzhen Free&Easy Technology Co., Limited

Vertical Wireless Mouse

Test Model No.: RF-439

Prepared for : Shenzhen Free&Easy Technology Co., Limited
Address : No.8 Xingong 1st Road, Hongxing Village, Gongming
Town, Guangming New Area, SZ, China

Prepared by : Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample : November 02, 2016
Number of tested samples : 1
Serial number : Prototype
Date of Test : November 02, 2016~November 08, 2016
Date of Report : November 08, 2016



EMC TEST REPORT **ETSI EN 301 489-17 V2.2.1(2012-09)**

Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services

Report Reference No. : LCS1611020170E

Date Of Issue : November 08, 2016

Testing Laboratory Name..... : Shenzhen LCS Compliance Testing Laboratory Ltd.

Address : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,
Bao'an District, Shenzhen, Guangdong, China

Testing Location/ Procedure..... : Full application of Harmonised standards ☒
 Partial application of Harmonised standards ☐
 Other standard testing method ☐

Applicant's Name..... : Shenzhen Free&Easy Technology Co., Limited

Address : No.8 Xinggong 1st Road, Hongxing Village, Gongming Town,
Guangming New Area, SZ, China

Test Specification

Standard : ETSI EN 301 489-1 V1.9.2 (2011-09)
 ETSI EN 301 489-17 V2.2.1 (2012-09)

Test Report Form No. : LCSEMC-1.0

TRF Originator : Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF..... : Dated 2011-03

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Test Item Description. : Vertical Wireless Mouse

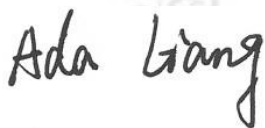
Trade Mark : N/A

Model/ Type Reference : RF-439

Ratings..... : Transmitter: DC 3.7V by battery (500mAh)
 Recharge Voltage: 5V $\overline{\text{---}}$, 500mA
 Receiver: DC 5V

Result : Positive

Compiled by:



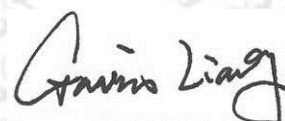
Ada Liang/ File administrators

Supervised by:



Glin Lu/ Technique principal

Approved by:



Gavin Liang/ Manager

EMC -- TEST REPORT**Test Report No. : LCS1611020170E**November 08, 2016

Date of issue

Type / Model.....	: RF-439
EUT.....	: Vertical Wireless Mouse
Applicant.....	: Shenzhen Free&Easy Technology Co., Limited
Address.....	: No.8 Xinggong 1st Road, Hongxing Village, Gongming Town, Guangming New Area, SZ, China
Telephone.....	: /
Fax.....	: /
Manufacturer.....	: Shenzhen Free&Easy Technology Co., Limited
Address.....	: No.8 Xinggong 1st Road, Hongxing Village, Gongming Town, Guangming New Area, SZ, China
Telephone.....	: /
Fax.....	: /
Factory.....	: Shenzhen Free&Easy Technology Co., Limited
Address.....	: No.8 Xinggong 1st Road, Hongxing Village, Gongming Town, Guangming New Area, SZ, China
Telephone.....	: /
Fax.....	: /

Test Result**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
00	2016-11-08	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1. Product Description for Equipment Under Test (EUT)

EUT	: Vertical Wireless Mouse
Test Model No.	: RF-439
Power Supply	: Transmitter: DC 3.7V by battery (500mAh) Recharge Voltage: 5V $\overline{\text{---}}$, 500mA Receiver: DC 5V
Hardware Version	: /
Software Version	: /
Frequency Range	: 2402-2480MHz (Channel Frequency List is 2402, 2407, 2414, 2419, 2422, 2426, 2436, 2439, 2441, 2445, 2453, 2459, 2463, 2466, 2473, 2480; (Unit: MHz))
Channel Number	: 16
Modulation Type	: GFSK
Antenna Description	: Internal Antenna, -1.0dBi(Max.)

Additional models No.				
RF-498	RF-129	RF-3512	RF-464	RF-468
RF-465	RF-467	RF-442	--	--
Remark: no additional models were tested.				

1.2. Objective

ETSI EN 301 489-1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
ETSI EN 301 489-17	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment Part 17: Specific conditions for Broadband Data Transmission Systems

The objective is to determine compliance with ETSI EN 301 489-1 V1.9.2 (2011-09) and ETSI EN 301 489-17 V2.2.1 (2012-09).

1.3. Related Submittal(s)/Grant(s)

No Related Submittals.

1.4. Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 489-1 V1.9.2 (2012-09) and ETSI EN 301 489-17 V2.2.1 (2012-09).

1.5. Description of Test Facility

CNAS Registration Number. is L4595.
 FCC Registration Number. is 899208.
 Industry Canada Registration Number. is 9642A-1.
 VCCI Registration Number. is C-4260 and R-3804.
 ESMD Registration Number. is ARCB0108.
 UL Registration Number. is 100571-492.
 TUV SUD Registration Number. is SCN1081.
 TUV RH Registration Number. is UA 50296516-001

1.6. Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
--	--	--	--	--

1.7. External I/O

I/O Port Description	Quantity	Cable
Charge Interface	1	0.5m

1.8. Measurement Uncertainty

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.42dB	
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.54dB	Polarize: V
	4.1dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	2.08dB	Polarize: H
	2.56dB	Polarize: V
Uncertainty for radio frequency	0.01ppm	
Uncertainty for conducted RF Power	0.65dB	
Uncertainty for temperature	0.2°C	
Uncertainty for humidity	1%	
Uncertainty for DC and low frequency voltages	0.06%	

1.9. Description Of Test Modes

TM1: Operating (Transmit-receive).
 TM2: Idle

***Note:

All test modes were tested, but we only recorded the worst case in this report.

2. SUMMARY OF TEST RESULTS

Rule	Description of Test Items	Result
§7.1	Reference to clauses EN 301 489-1 §8.4 AC mains power input/output ports	Compliant
§7.1	Reference to clauses EN 301 489-1 §8.3 DC power input/output ports	N/A*
§7.1	Reference to clauses EN 301 489-1 §8.2 Enclosure of ancillary equipment measured on a stand alone basis	Compliant
§7.1	Reference to clauses EN 301 489-1 §8.5 Harmonic current emissions (AC mains input port)	N/A
§7.1	Reference to clauses EN 301 489-1 §8.6 Voltage fluctuations and flicker (AC mains input port)	N/A
§7.1	Reference to clauses EN 301 489-1 §8.7 Telecommunication ports	N/A*
§7.2	Reference to clauses EN 301 489-1 §9.3 Electrostatic discharge (EN 61000-4-2)	Compliant
§7.2	Reference to clauses EN 301 489-1 §9.2 Radio frequency electromagnetic field (80 MHz to 1 000 MHz and 1 400 MHz to 2 000 MHz)(EN 61000-4-3)	Compliant
§7.2	Reference to clauses EN 301 489-1 §9.4 Fast transients, common mode (EN 61000-4-4)	N/A
§7.2	Reference to clauses EN 301 489-1 §9.8 Surges (EN 61000-4-5)	N/A
§7.2	Reference to clauses EN 301 489-1 §9.5 Radio frequency, common mode (EN 61000-4-6)	N/A
§7.2	Reference to clauses EN 301 489-1 §9.6 Transients and surges in the vehicular environment (ISO 7637-2)	N/A*
§7.2	Reference to clauses EN 301 489-1 §9.7 Voltage dips and interruptions (EN 61000-4-11)	N/A

3. RADIATED DISTURBANCE

3.1. Radiated Emission Limit

ETSI 301 489-1 V1.9.2 (2011-09)/EN 55022 Class B

Limits for radiated disturbance Blow 1GHz

FREQUENCY (MHz)	DISTANCE (Meters)	FIELD STRENGTHS LIMIT (dB μ V/m)
30 ~ 230	3	40
230 ~ 1000	3	47

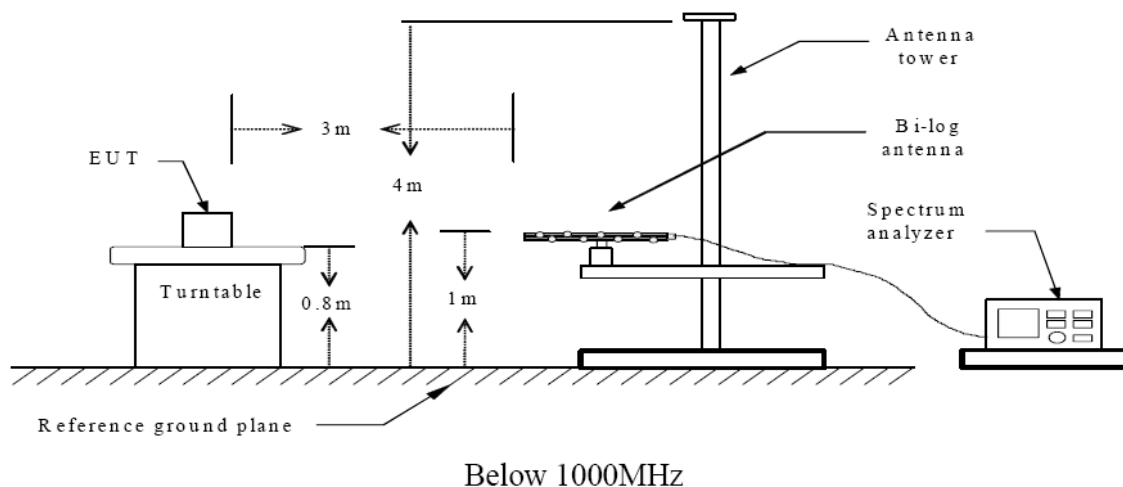
Note: (1) The smaller limit shall apply at the combination point between two frequency bands. (2) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the EUT.

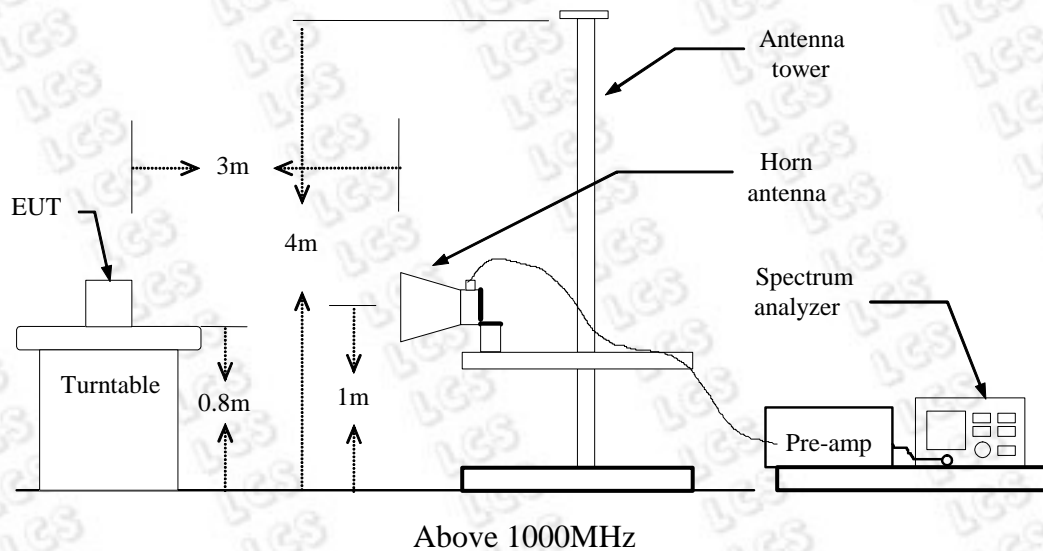
Limits for radiated disturbance Above 1GHz

FREQUENCY (MHz)	DISTANCE (Meters)	Average Limit (dB μ V/m)	Peak Limit (dB μ V/m)
1000-3000	3	50	70
3000-6000	3	54	74

Note: The lower limit applies at the transition frequency.

3.2. Test Configuration



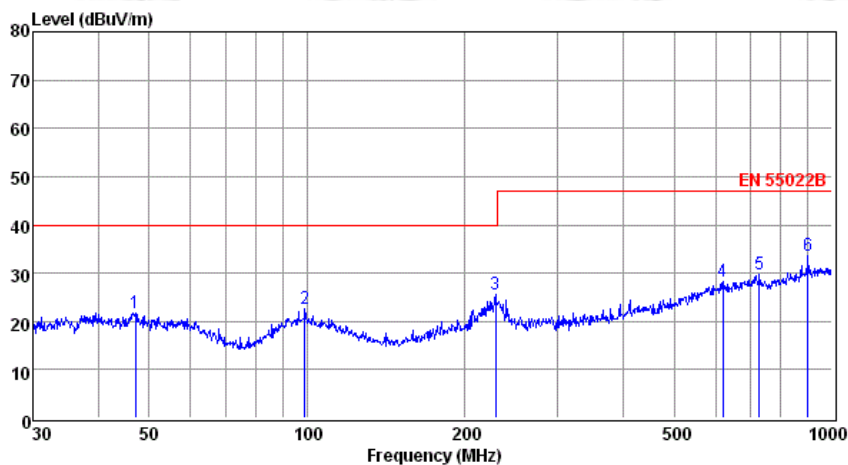


3.3. Test Procedure

Please refer to ETSI EN 301 489-1 Clause 8.2.3 and EN 55022 Clause 6 for the measurement methods.

3.4. Test Data

The worst test mode of the EUT was TM1, and its test data was showed as the follow:



Env./Ins: 24°C/56%

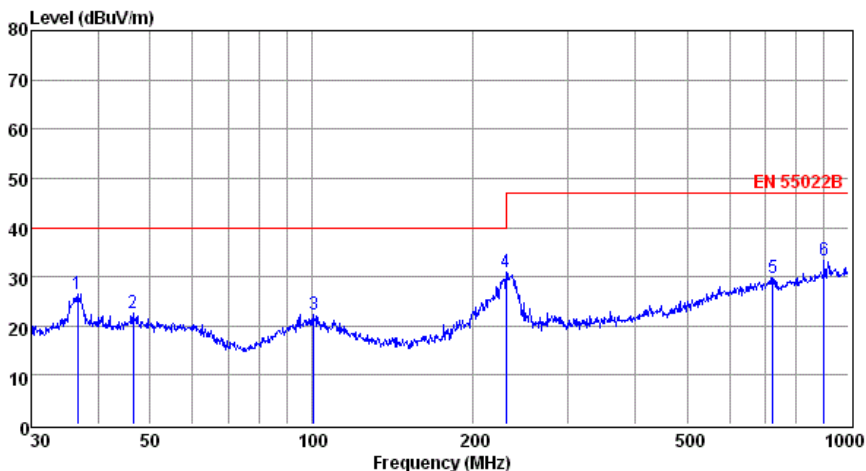
pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	46.99	7.93	0.35	13.43	21.71	40.00	-18.29	QP
2	98.83	8.85	0.61	13.09	22.55	40.00	-17.45	QP
3	228.49	13.20	0.93	11.58	25.71	40.00	-14.29	QP
4	620.71	8.05	1.62	18.52	28.19	47.00	-18.81	QP
5	726.81	8.95	1.70	19.15	29.80	47.00	-17.20	QP
6	900.15	10.56	1.88	21.09	33.53	47.00	-13.47	QP

Note: 1. All readings are Quasi-peak values.

2. Measured= Reading + Antenna Factor + Cable Loss

3. The emission that are 20dB below the official limit are not reported



Env./Ins: 24°C/56%

pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	36.64	13.35	0.41	12.72	26.48	40.00	-13.52	QP
2	46.50	8.67	0.35	13.46	22.48	40.00	-17.52	QP
3	100.93	8.54	0.60	13.08	22.22	40.00	-17.78	QP
4	230.10	18.27	0.93	11.65	30.85	47.00	-16.15	QP
5	721.73	9.05	1.63	19.08	29.76	47.00	-17.24	QP
6	900.15	10.21	1.88	21.09	33.18	47.00	-13.82	QP

Note: 1. All readings are Quasi-peak values.

2. Measured= Reading + Antenna Factor + Cable Loss

3. The emission that are 20dB below the official limit are not reported

Test Mode: TM1(above 1GHz)	Tested by: Jayden Zhuo
Test voltage: DC 3.7V	Test Distance: 3m
Detector Function: Peak+AV	Test Results: Passed

Polarization	Frequency MHz	Emission Level dB μ V/m		Limits dB μ V/m		Margin dB μ V/m	
Horizontal	1402.56	51.89	34.03	70	50	-18.11	-15.97
	1857.64	56.43	37.74	70	50	-13.57	-12.26
	3224.94	53.62	39.46	74	54	-20.38	-14.54
	3972.69	64.22	40.87	74	54	-9.78	-13.13
	4459.31	65.85	39.13	74	54	-8.15	-14.87
	4866.52	61.49	44.06	74	54	-12.51	-9.94
Vertical	1388.26	51.91	31.16	70	50	-18.09	-18.84
	1889.41	54.52	37.92	70	50	-15.48	-12.08
	3244.12	56.48	42.12	74	54	-17.52	-11.88
	3740.81	64.42	36.45	74	54	-9.58	-17.55
	4459.27	66.88	44.18	74	54	-7.12	-9.82
	4862.85	64.10	52.76	74	54	-9.90	-1.24
1. Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB. 2. Measurements above show only up to 6 maximum emissions noted. 3. Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.							

4. GENERAL PERFORMANCE CRITERIA FOR IMMUNITY TEST

4.1. Performance criteria for Continuous phenomena applied to Transmitter (CT)

For equipment of type II or type III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence.

Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that any unintentional transmission does not occur.

4.2. Performance criteria for Transient phenomena applied to Transmitter (TT)

For equipment of type II or type III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence. Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that any unintentional transmission does not occur.

4.3. Performance criteria for Continuous phenomena applied to Receiver (CR)

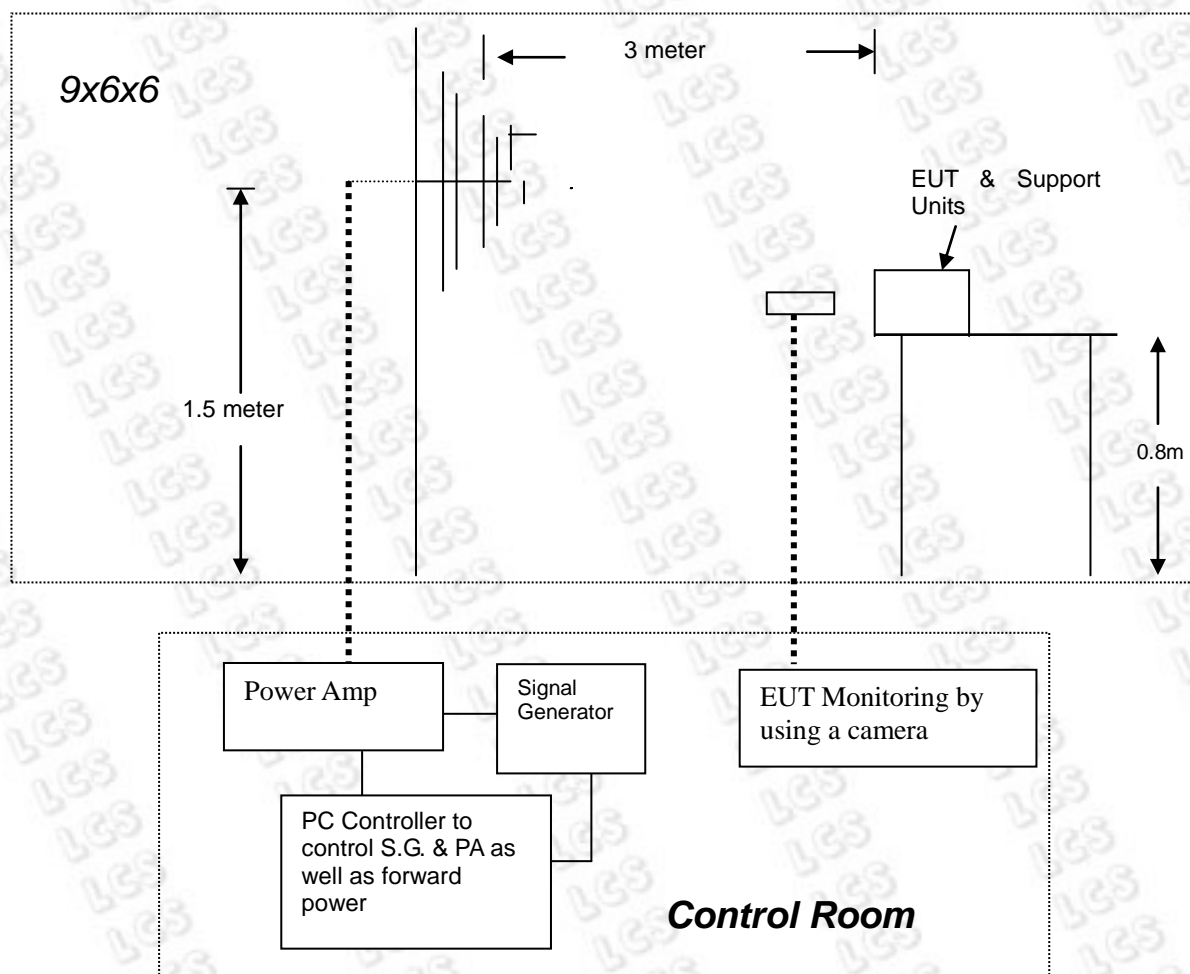
For equipment of type II or III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence. Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

4.4. Performance criteria for Transient phenomena applied to Receiver (TR)

For equipment of type II or type III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence. Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

5. RF ELECTROMAGNETIC FIELD (80 MHZ -1000 MHZ AND 1400 MHZ –2700 MHZ)

5.1. Test Configuration



5.2. Test Standard

ETSI 301 489-1, EN 301 489-17(EN 61000-4-3: 2006+A1: 2008+A2: 2010)

Test level 2 at 3V / m.

5.3. Severity Level

Level	Field Strength V/m
1.	1
2.	3
3.	10
X	Special

Performance criterion: A

5.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. EUT is set 3 meter away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarization of the antenna are set on test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually. In order to judge the EUT performance, a CCD camera is used to monitor EUT screen. All the scanning conditions are as follows:

Condition of Test	Remarks
1. Fielded Strength	3 V/m (Severity Level 2)
2. Radiated Signal	Unmodulated
3. Scanning Frequency	80 - 1000MHz & 1400 - 2700 MHz
4. Dwell time of radiated	0.0015 decade/s
5. Waiting Time	3 Sec.

5.5. Test Result

2.4G Operating Test Result:

EUT Working Mode	Antenna Polarity	Frequency (MHz)	Field Strength (V/m)	Observation	Position	Conclusion
Operating Mode	Vertical	80-1000, 1400-2700	3	CT,CR	Front, Right, Left, Back	Pass
	Horizontal	80-1000, 1400-2700	3	CT,CR	Front, Right, Left, Back	Pass
Idle	Vertical	80-1000, 1400-2700	3	See Note	Front, Right, Left, Back	Pass
	Horizontal	80-1000, 1400-2700	3	See Note	Front, Right, Left, Back	Pass

TM2 Test Result:

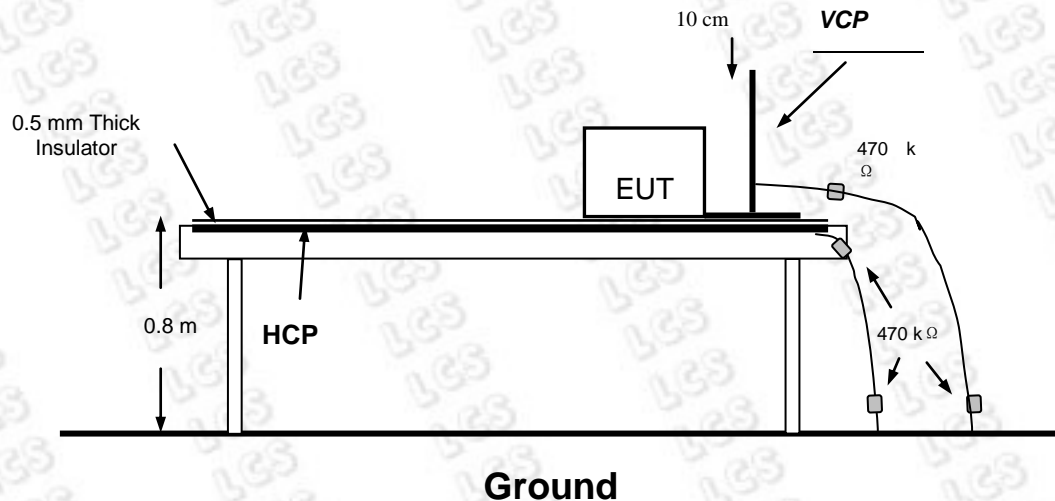
EUT Working Mode	Antenna Polarity	Frequency (MHz)	Field Strength (V/m)	Observation	Position	Conclusion
Operating Mode	Vertical	80-1000, 1400-2700	3	See Note	Front, Right, Left, Back	Pass
	Horizontal	80-1000, 1400-2700	3	See Note	Front, Right, Left, Back	Pass
Idle	Vertical	80-1000, 1400-2700	3	See Note	Front, Right, Left, Back	Pass
	Horizontal	80-1000, 1400-2700	3	See Note	Front, Right, Left, Back	Pass

***Note: Unintentional transmission is not founded from the EUT.

6. ELECTROSTATIC DISCHARGE

Please refer to ETSI EN 301 489-1 and EN 61000-4-2.

6.1. Test Configuration



EN 61000-4-2 specifies that a tabletop EUT shall be placed on a non-conducting table which is 80 centimeters above a ground reference plane and that floor mounted equipment shall be placed on a insulating support approximately 10 centimeters above a ground plane. During the tests, the EUT is positioned over a ground reference plane in conformance with this requirement.

For tabletop equipment, a 1.5 by 1.0-meter metal sheet (HCP) is placed on the table and connected to the ground plane via a metal strap with two 470 k Ohms resistors in series. The EUT and attached cables are isolated from this metal sheet by 0.5-millimeter thick insulating material. A Vertical Coupling Plane (VCP) grounded on the ground plane through the same configuration as in the HCP is used.

6.2. Test Procedure

ETSI 301 489-1 V1.9.2 (2011-09)/ EN 61000-4-2: 2009

Test level 3 for Air Discharge at ± 8 kV

Test level 2 for Contact Discharge at ± 4 kV

6.2.1. Air Discharge

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

6.2.2. Contact Discharge

All the procedure shall be same as Section 6.2.1. except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

6.2.3. Indirect Discharge For Horizontal Coupling Plane

At least 10 single discharges (in the most sensitive polarity) shall be applied at the front edge of each HCP opposite the center point of each unit (if applicable) of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.

6.2.4. Indirect Discharge For Vertical Coupling Plane

At least 10 single discharges (in the most sensitive polarity) shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

6.3. Test Data

PASS.

Electrostatic Discharge Test Results

Standard	<input type="checkbox"/> IEC 61000-4-2 <input checked="" type="checkbox"/> EN 61000-4-2		
Applicant	Shenzhen Free&Easy Technology Co., Limited		
EUT	Vertical Wireless Mouse	Temperature	24℃
M/N	RF-439	Humidity	53%
Criterion	B	Pressure	1021mbar
Test Mode	TM1-TM2	Test Date	November 05, 2016
Test Engineer	Jayden Zhuo		

TEST RESULT OF 2.4G

Test Voltage	Coupling	Observation	Result (Pass/Fail)
±2KV, ±4kV	Contact Discharge	TT, TR	Pass
±2KV, ±4kV, ±8kV	Air Discharge	TT, TR	Pass
±2KV, ±4kV	Indirect Discharge HCP	TT, TR	Pass
±2KV, ±4kV	Indirect Discharge VCP	TT, TR	Pass

TEST RESULT OF TM2

Test Voltage	Coupling	Result (Pass/Fail)
±2KV, ±4kV	Contact Discharge	Pass
±2KV, ±4kV, ±8kV	Air Discharge	Pass
±2KV, ±4kV	Indirect Discharge HCP	Pass
±2KV, ±4kV	Indirect Discharge VCP	Pass

Note: The EUT performance complied with performance criteria for CT&CR to MS Function and there is no any degradation of performance and function.

7. LIST OF MEASURING EQUIPMENT

Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101142	2016-06-18
10dB Attenuator	SCHWARZBECK	OSPA236	9729	2016-06-18
Artificial Mains	ROHDE & SCHWARZ	ENV216	101288	2016-06-18
EMI Test Software	AUDIX	E3	N/A	2016-06-18
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101142	2016-06-18
Absorbing clamp	ROHDE & SCHWARZ	MDS 21	4033	2016-06-18
EMI Test Software	AUDIX	E3	N/A	2016-06-18
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101142	2016-06-18
Triple-loop Antenna	EVERFINE	LLA-2	11050003	2016-06-18
EMI Test Receiver	ROHDE & SCHWARZ	ESPI	101840	2016-06-18
EMI Test Software	AUDIX	E3	N/A	2016-06-18
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2016-06-18
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101142	2016-06-18
Log per Antenna	SCHWARZBECK	VULB9163	9163-470	2016-04-18
EMI Test Software	AUDIX	E3	N/A	2016-06-18
Positioning Controller	MF	MF-7082	/	2016-06-18
Power Analyzer Test System	Voltech	PM6000	20000670053	2016-06-18
ESD Simulator	KIKUSUI	KC001311	KES4021	2016-09-03
SIGNAL GENERATOR	R&S	SMB100A	105942	2016-09-14
RF Power Amplifier	BONN Elektronik	BLWA0830-160/100/40D	128740	2016-09-14
Log-periodic Antenna	SCHWARZBECK	STLP9128D	043	2016-09-14
Power Meter	R&S	102031	16829	2016-09-14
Electrical fast transient(EFT)generator	3CTEST	EFT-4021	EC0461044	2016-06-18
Coupling Clamp	3CTEST	EFTC	EC0441098	2016-06-18
Surge test system	3CTEST	SG5006G	EC5581070	2016-06-18
Coupling/decoupling network	3CTEST	SGN-5010G	CS5591033	2016-06-18
Simulator	FRANKONIA	CIT-10	A126A1195	2016-06-18
CDN	FRANKONIA	CDN-M2	5100100100	2016-06-18
CDN	FRANKONIA	CDN-M3	0900-11	2016-06-18
Attenuator	FRANKONIA	ATT6	0010222A	2016-06-18
Voltage dips and up generator	3CTEST	VDG-1105G	EC0171014	2016-06-18

-----THE END OF REPORT-----