



EMC TEST REPORT

Draft ETSI EN 301 489-1/-17

For

Applicant: SHENZHEN MARK TRADING CO., LTD.

**Address: 6th Floor, Building A, DongFangYaYuan, Chen Tian Communities, Xixiang
Bao'an District, Shenzhen, China**

Product Name: Wireless gaming mouse

Model Name: M720W, M*W, GM-***W, MO-***W(***stand for 0-9)**

Brand Name: MARVO,XTRIKE ME, @ONE

Report No.: MTWN19070328

Date of Issue: Jul.29, 2019

Issued by: Shenzhen Most Technology Service Co., Ltd.

**Address: No. 5, 2nd Langshan Road, North District, Hi-tech Industrial Park, Nanshan,
Shenzhen, Guangdong, China**

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1. TEST REPORT CERTIFICATION

Product Name:	Wireless gaming mouse
Brand Name:	MARVO,XTRIKE ME, @ONE
Model Name:	M720W
Series Model Name:	M***W, GM-***W, MO-***W(***stand for 0-9)
Difference description:	Only difference in model names
Applicant:	SHENZHEN MARK TRADING CO., LTD.
Applicant Address:	6th Floor, Building A, DongFangYaYuan, Chen Tian Communities, Xixiang Bao'an District, Shenzhen, China
Manufacturer:	SHENZHEN MARK TRADING CO., LTD.
Manufacturer Address:	6th Floor, Building A, DongFangYaYuan, Chen Tian Communities, Xixiang Bao'an District, Shenzhen, China
Test Standards:	Draft ETSI EN 301 489-1 V2.2.1 (2019-03) ; Draft ETSI EN 301 489-17 V3.2.0 (2017-03)
Test Result:	PASS

We, MOST, hereby certify that the submitted samples of the above item, as detailed in chapter 2.1 of this report, has been tested in our facility. The test record, data evaluation and test configuration represented herein are true and accurate accounts of measurements of the sample's EMC characteristics under the conditions herein specified.

Prepared by (+ signature):

Lili Lu

Lili Lu (Engineer)

Jul.24-26, 2019

Review by (+ signature):

Sunny

Sunny Deng (Engineer)



Jul.29, 2019

Approved by (+ signature):

Yvette Zhou

Yvette Zhou (Manager)

Jul.29, 2019

2. GENERAL INFORMATON

2.1 DESCRIPTION OF EUT

Product	Wireless gaming mouse
Trade Name	MARVO
Model Number	M720W
Power Supply	Transmitter: DC 1.5V by Battery Receiver: DC 5V by PC (AC 230V/50Hz for PC)
Frequency Range	2408MHz-2474 MHz
Modulation Type	GFSK for 2.4G
Channel Number	34
Temperature Range	-20°C ~ +55°C

NOTE:

1. For a more detailed features description about the EUT, please refer to User's Manual.

2.2 OBJECTIVE

Perform Electro Magnetic Interference (EMI) and Electro Magnetic Susceptibility (EMS) tests for CE Marking.

2.3 TEST STANDARDS AND RESULTS

The EUT has been tested according to Draft ETSI EN 301 489-1 V2.2.1 (2019-03), together with Draft ETSI EN 301 489-17 V3.2.0 (2017-03).

Draft ETSI EN 301 489-1 V2.2.1 (2019-03)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility
Draft ETSI EN 301 489-17 V3.2.0 (2017-03)	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 5: Specific conditions for Private Weather Station - WS3355 (PMR) and ancillary equipment (speech and non-speech)

Test items and the results are as bellow:

No	Basic Standard	Test Type	Result
EMISSION (EN 301 489-1 §7.1)			
1	EN 55032	Radiated emission	PASS
2	EN 55032	Conducted emission, DC ports	PASS
3	EN 55032	Conducted emission, AC ports	N/A
4	EN 55032	Conducted emission, Telecom ports	N/A
5	EN 61000-3-2	Harmonic current emissions	N/A
6	EN 61000-3-3	Voltage fluctuations & flicker	N/A
IMMUNITY (EN 301 489-1 §7.2)			
7	EN 61000-4-2	Electrostatic discharge immunity	PASS
8	EN 61000-4-3	Radiated RF electromagnetic field immunity (80MHz to 600MHz)	PASS
9	EN 61000-4-4	Electrical fast transient/burst immunity	PASS
10	EN 61000-4-5	Surge immunity, AC ports, Telecom ports	PASS
11	EN 61000-4-6	Immunity to conducted disturbances induced by RF fields	PASS
12	EN 61000-4-11	Voltage dips and short interruptions immunity	N/A

NOTE:

1. N/A- Not Applicable.
2. The latest versions of basic standards are applied.

2.4 IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION

Test Site:	Shenzhen Most Technology Service Co., Ltd.
Address:	No. 5, 2nd Langshan Road, North District, Hi-tech Industrial Park, Nanshan, Shenzhen, Guangdong, China
Description:	<p>There is one 3m semi-anechoic an area test sites and two line conducted labs for final test. The Open Area Test Sites and the Line Conducted labs are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4 and CISPR 16 requirements.</p> <p>The FCC Registration Number is 490827.</p> <p>The CNAS Registration Number is CNAS L3573.</p>

2.5 LIST OF EQUIPMENTS USED

No.	Equipment	Manufacturer	Model No.	S/N	Calculator date	Calculator Interval
1	Test Receiver	Rohde & Schwarz	ESCI	100492	2019/03/09	1 Year
2	L.I.S.N.	Rohde & Schwarz	ENV216	100093	2019/03/09	1 Year
3	Coaxial Switch	Anritsu Corp	MP59B	6200283933	2019/03/09	1 Year
4	Terminator	Hubersuhner	50Ω	No.1	2019/03/09	1 Year
5	RF Cable	SchwarzBeck	N/A	No.1	2019/03/09	1 Year
6	Test Receiver	Rohde & Schwarz	ESPI	101202	2019/03/09	1 Year
7	Bilog Antenna	Sunol	JB3	A121206	2019/03/09	1 Year
8	Cable	Resenberger	N/A	NO.1	2019/03/09	1 Year
9	Cable	SchwarzBeck	N/A	NO.2	2019/03/09	1 Year
10	Cable	SchwarzBeck	N/A	NO.3	2019/03/09	1 Year
11	DC Power Filter	DuoJi	DL2x30B	N/A	2019/03/09	1 Year
12	Single Phase Power Line Filter	DuoJi	FNF 202B30	N/A	2019/03/09	1 Year
13	3 Phase Power Line Filter	DuoJi	FNF 402B30	N/A	2019/03/09	1 Year
14	Test Receiver	Rohde & Schwarz	ESCI	100492	2019/03/09	1 Year
15	Absorbing Clamp	Luthi	MDS21	3635	2019/03/09	1 Year
16	Coaxial Switch	Anritsu Corp	MP59B	6200283933	2019/03/09	1 Year
17	AC Power Source	Kikusui	AC40MA	LM003232	2019/03/09	1 Year
18	Test Analyzer	Kikusui	KHA1000	LM003720	2019/03/09	1 Year
19	Line Impedence Network	Kikusui	LIN40MA-PCR-L	LM002352	2019/03/09	1 Year
20	ESD Tester	Kikusui	KES4021	LM003537	2019/03/09	1 Year
21	EMC PRO System	EM Test	UCS-500-M4	V0648102026	2019/03/09	1 Year
22	Signal Generator	IFR	2032	203002/100	2019/03/09	1 Year
23	Amplifier	A&R	150NETTAB MERCURY S (NT-3508M)0	301584	2019/03/09	1 Year
24	CDN	FCC	FCC-801-M2-25	47	2019/03/09	1 Year
25	CDN	FCC	FCC-801-M3-25	107	2019/03/09	1 Year
26	EM Injection Clamp	FCC	F-203I-23mm	403	2019/03/09	1 Year
27	Telecommunication Antenna	European Antennas	PSA 75301R/170	0304213	2019/03/09	1 Year
28	Audio Power Amplifier	B&K	2716-C-001	2610976	2019/03/09	1 Year
29	Mouth Simulator	B&K	4227	2630621	2019/03/09	1 Year
30	Sound Calibrator	B&K	4231	2637486	2019/03/09	1 Year
31	1/2" Pressure-field Microphone	B&K	4192	2641678	2019/03/09	1 Year
32	Ear Simulator for Telephonometry	B&K	4185	2553612	2019/03/09	1 Year
33	Telephone Test Head	B&K	4185	2631728	2019/03/09	1 Year
34	RF Cable	MIYAZAKI	N/A	No.1/No.2	2019/03/09	1 Year
35	Universal Radio Communication Tester	ROHDE&SCHWARZ	CMU200	0304789	2019/03/09	1 Year

NOTE: Equipments listed above have been calibrated and are in the period of validation.

2.6 ENVIRONMENTAL CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 15-35°C
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

2.7 MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

- Uncertainty of Conducted Emission, $U_c = \pm 1.8\text{dB}$
- Uncertainty of Radiated Emission, $U_c = \pm 3.2\text{dB}$

3. EMISSION TEST

3.1 EUT SETUP AND OPERATING CONDITIONS

Mode 1: GFSK data transmission Mode

The EUT configuration of the emission test was **mouse+batteries---USB dongle**.

Mode 2: Standby Mode

The EUT configuration of the emission test was **mouse+batteries---USB dongle**.

3.2 MAINS TERMINAL DISTURBANCE VOLTAGE MEASUREMENT

3.2.1 LIMITS OF MAINS TERMINAL DISTURBANCE VOLTAGE

Frequency range (MHz)	Limits (dB μ V), Class B ITE	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

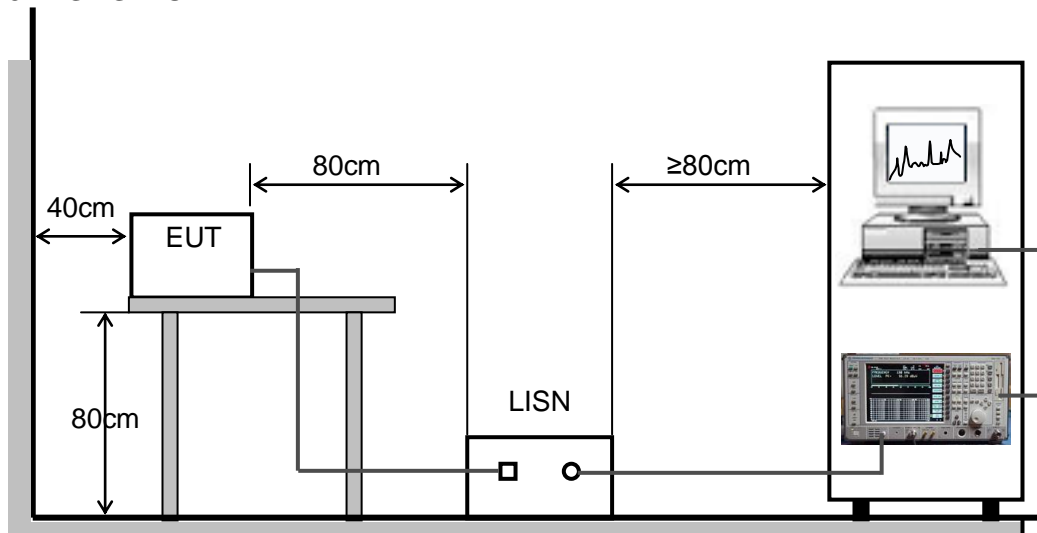
NOTE:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.

3.2.2 TEST PROCEDURE

1. The EUT was placed 0.4 meters from the conducting wall of shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provide 50 Ω /50 μ H of coupling impedance for the measuring instrument.
2. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
3. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 20dB under the prescribed limits are not reported.

3.2.3 TEST SETUP

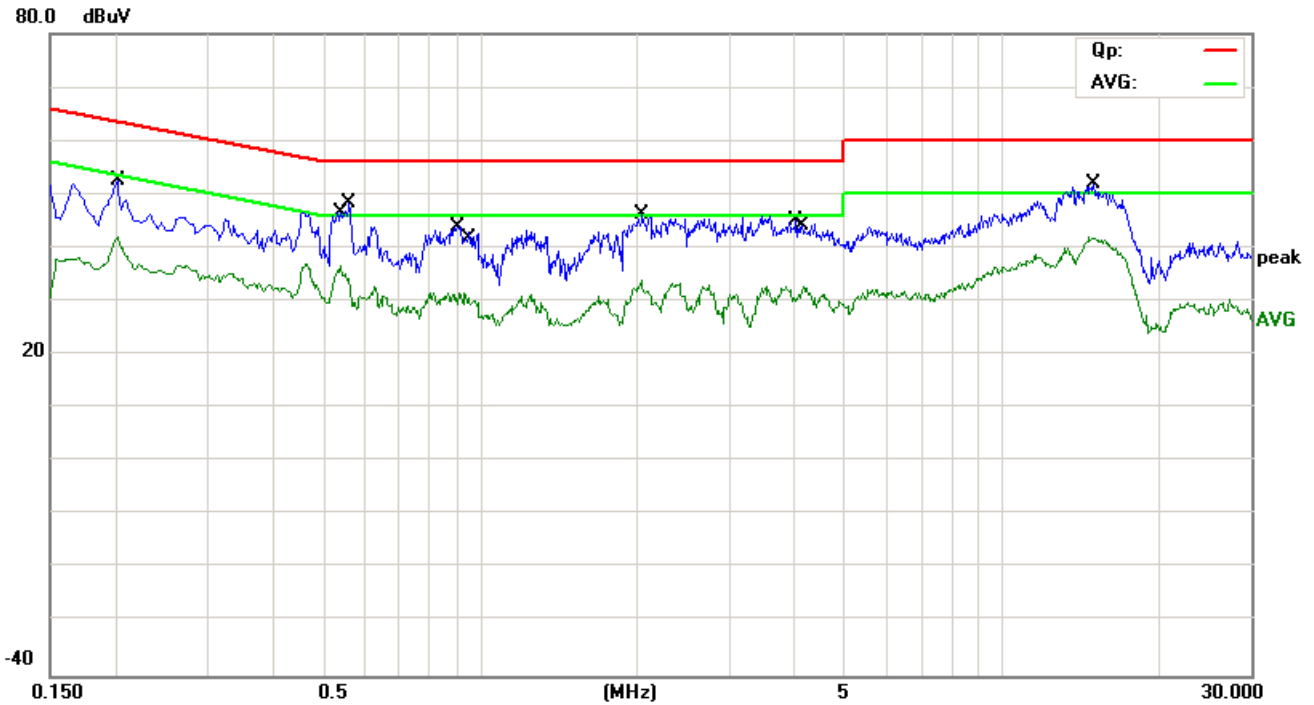


For the actual test configuration, please refer to the related item - Photographs of the Test Configuration.

3.2.4 TEST RESULT

During the test, pre-scan the USB-powered mode and the battery-powered mode. we found the USB-powered mode is worse case:

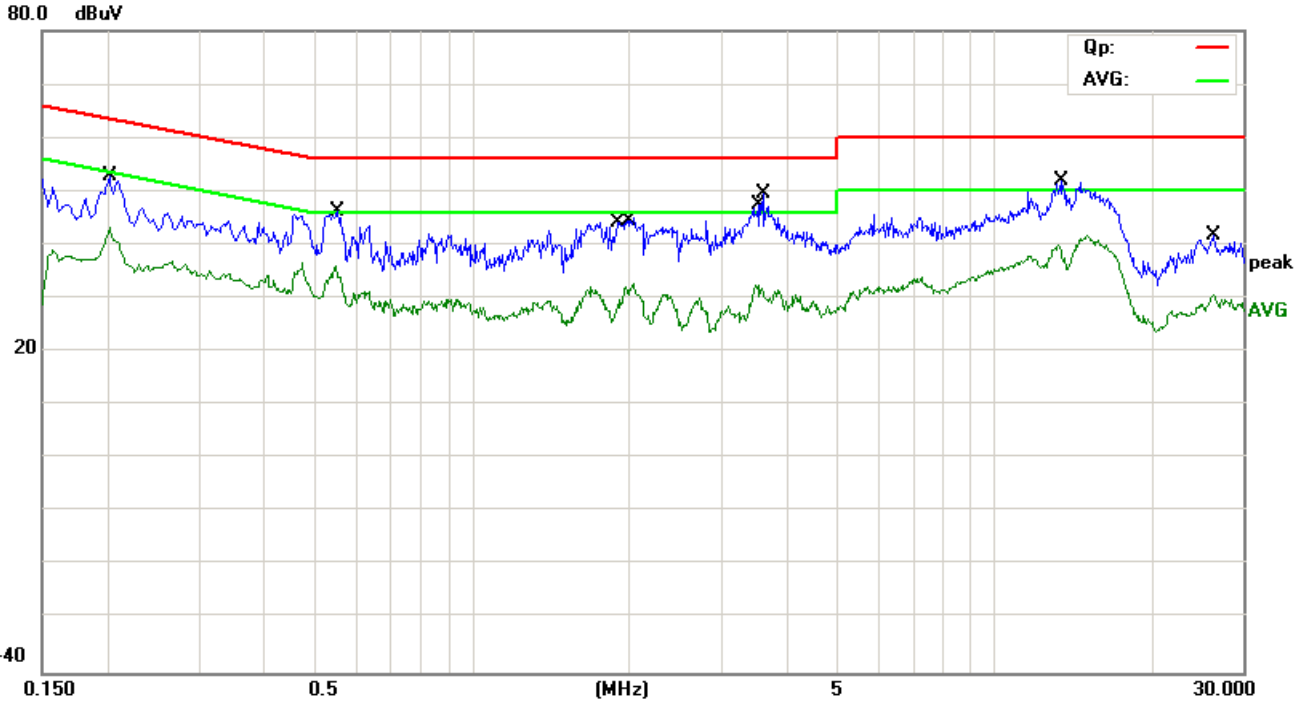
EUT:	Wireless mouse	M/N:	M720W
Mode:	GFSK Mode	Phase:	L1
Test by:	Leo	Power:	DC 5V by PC (AC 230V/50Hz for PC)
Temperature: / Humidity	31.0°C / 52.0%	Test date:	2019-07-24



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2020	42.70	9.60	52.30	63.53	-11.23	QP	
2		0.2020	32.60	9.60	42.20	53.53	-11.33	AVG	
3		0.5420	27.03	9.59	36.62	46.00	-9.38	AVG	
4	*	0.5620	38.50	9.59	48.09	56.00	-7.91	QP	
5		0.9060	34.00	9.60	43.60	56.00	-12.40	QP	
6		0.9380	21.96	9.60	31.56	46.00	-14.44	AVG	
7		2.0380	24.32	9.60	33.92	46.00	-12.08	AVG	
8		2.0460	36.40	9.60	46.00	56.00	-10.00	QP	
9		4.0300	35.20	9.62	44.82	56.00	-11.18	QP	
10		4.1780	23.14	9.62	32.76	46.00	-13.24	AVG	
11		14.6820	32.35	9.70	42.05	50.00	-7.95	AVG	
12		15.0500	41.10	9.70	50.80	60.00	-9.20	QP	

*:Maximum data x:Over limit !:over margin

EUT:	Wireless mouse	M/N:	M720W
Mode:	GFSK Mode	Phase:	N
Test by:	Leo	Power:	DC 5V by PC (AC 230V/50Hz for PC)
Temperature: / Humidity	31.0°C / 52.0%	Test date:	2019-07-24



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2020	43.00	9.60	52.60	63.53	-10.93	QP	
2		0.2020	33.66	9.60	43.26	53.53	-10.27	AVG	
3		0.5500	26.38	9.59	35.97	46.00	-10.03	AVG	
4		0.5540	36.20	9.59	45.79	56.00	-10.21	QP	
5		1.9060	34.50	9.60	44.10	56.00	-11.90	QP	
6		1.9780	22.64	9.60	32.24	46.00	-13.76	AVG	
7		3.5380	22.81	9.62	32.43	46.00	-13.57	AVG	
8	*	3.6100	39.60	9.62	49.22	56.00	-6.78	QP	
9		13.2940	30.19	9.70	39.89	50.00	-10.11	AVG	
10		13.4340	42.10	9.70	51.80	60.00	-8.20	QP	
11		26.2980	31.80	9.76	41.56	60.00	-18.44	QP	
12		26.2980	20.75	9.76	30.51	50.00	-19.49	AVG	

*:Maximum data x:Over limit !:over margin

3.3 RADIATED DISTURBANCE MEASUREMENT

3.3.1 LIMITS OF RADIATED DISTURBANCE

Frequency range (MHz)	Quasi peak limits(dBuV/m), for Class B ITE, at 3m measurement distance
30 - 230	40
230 - 1000	47

Above 1000 MHz

Frequency range (MHz)	Peak limits(dB μ V/m), for Class B ITE, at 3m measurement distance	Average limits(dB μ V/m), for Class B ITE, at 3m measurement distance
1000 – 3000	70	50
3000 - 6000	74	54

Notes:

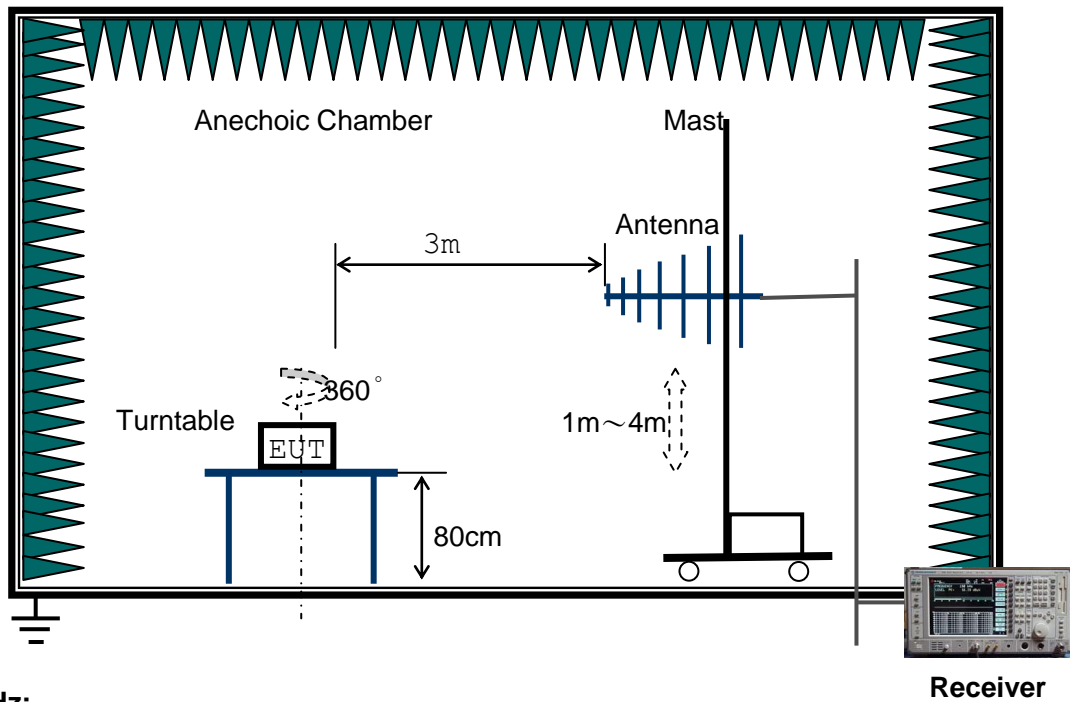
1. The lower limit shall apply at the transition frequency.
2. Additional provisions may be required for cases where interference occurs.

3.3.2 TEST PROCEDURE

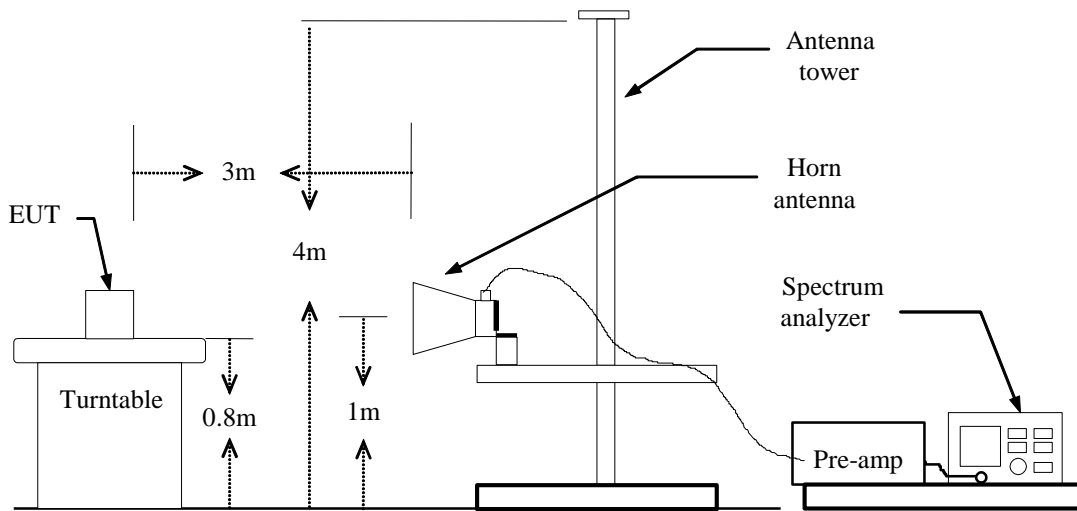
1. The EUT was placed on the top of an insulating table 0.8 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna is a broadband antenna, and its height is varied from 1 to 4 meter above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the heights from 1 to 4 meters and the ratable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The Analyzer/Receiver scanned from 30MHz to 6000MHz and set to Peak Detector Function and Specified Bandwidth with Maximum Hold Mode. If the emission level of the EUT in peak mode was 20dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emission that did not have 20dB margin would be retested one by one using the quasi-peak method.

3.3.3 TEST SETUP

Below 1GHz:



Above 1GHz:



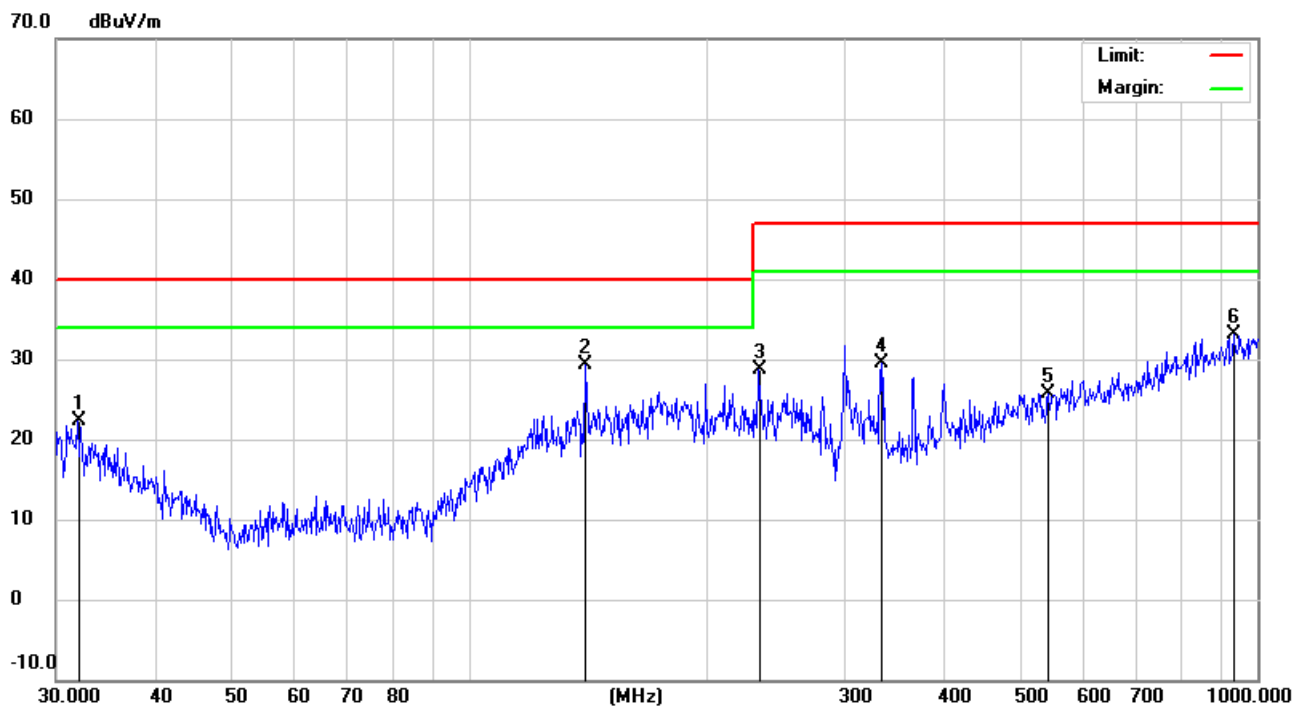
For the actual test configuration, please refer to the related item-Photographs of the Test Configuration.

3.3.4 TEST RESULT

The test modes were carried out for all operation modes of 3.1, and its worse test data was showed as the follow:

Below 1GHz:

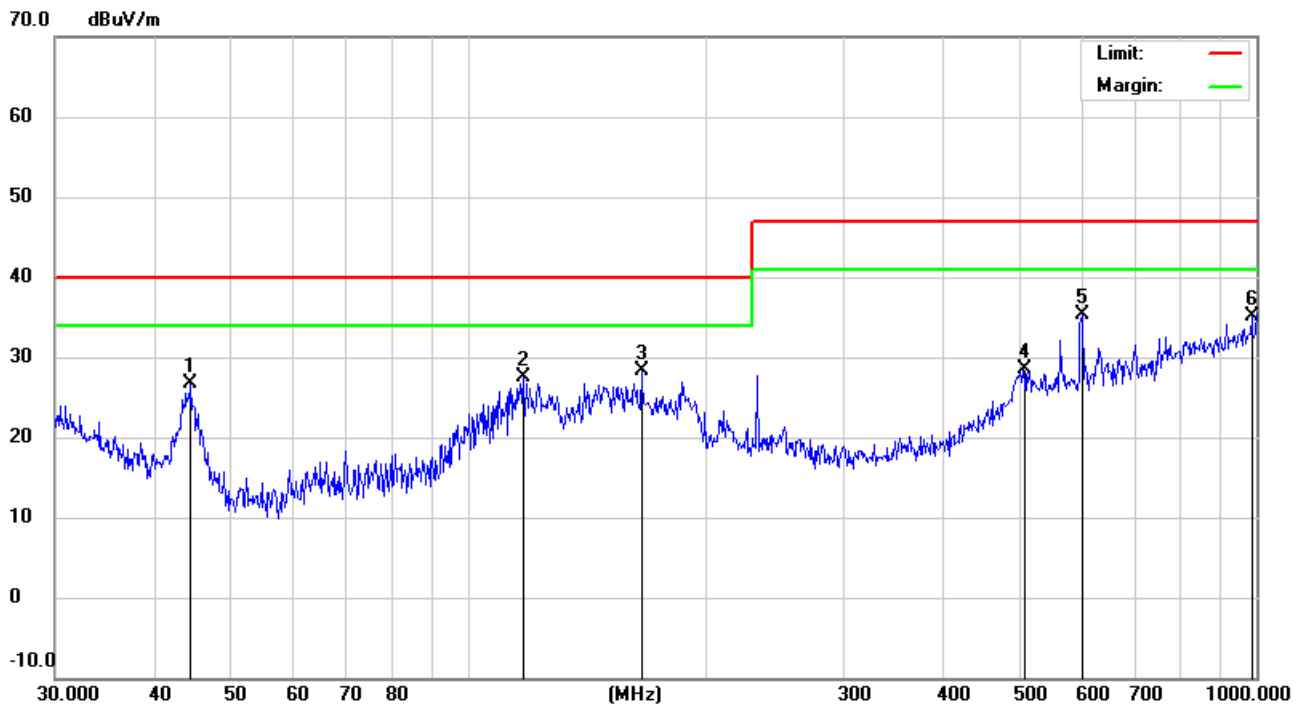
EUT:	Wireless gaming mouse	M/N:	M720W
Mode:	GFSK Mode	Polarization:	Horizontal
Test by:	Jaya	Power:	Transmitter: DC 1.5V by Battery Receiver: DC 5V by PC (AC 230V/50Hz for PC)
Temperature: / Humidity	29.0°C / 60.0%	Test date:	2019-07-24



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		31.9546	2.69	19.57	22.26	40.00	-17.74	QP		
2	*	140.3421	12.77	16.44	29.21	40.00	-10.79	QP		
3		233.3487	14.35	14.27	28.62	47.00	-18.38	QP		
4		333.6867	13.34	16.14	29.48	47.00	-17.52	QP		
5		543.2742	2.61	23.18	25.79	47.00	-21.21	QP		
6		932.2715	3.72	29.32	33.04	47.00	-13.96	QP		

*:Maximum data x:Over limit !:over margin

EUT:	Wireless gaming mouse	M/N:	M720W
Mode:	GFSK Mode	Polarization:	Vertical
Test by:	Jaya	Power:	Transmitter: DC 1.5V by Battery Receiver: DC 5V by PC (AC 230V/50Hz for PC)
Temperature: / Humidity	29.0°C / 60.0%	Test date:	2019-07-24

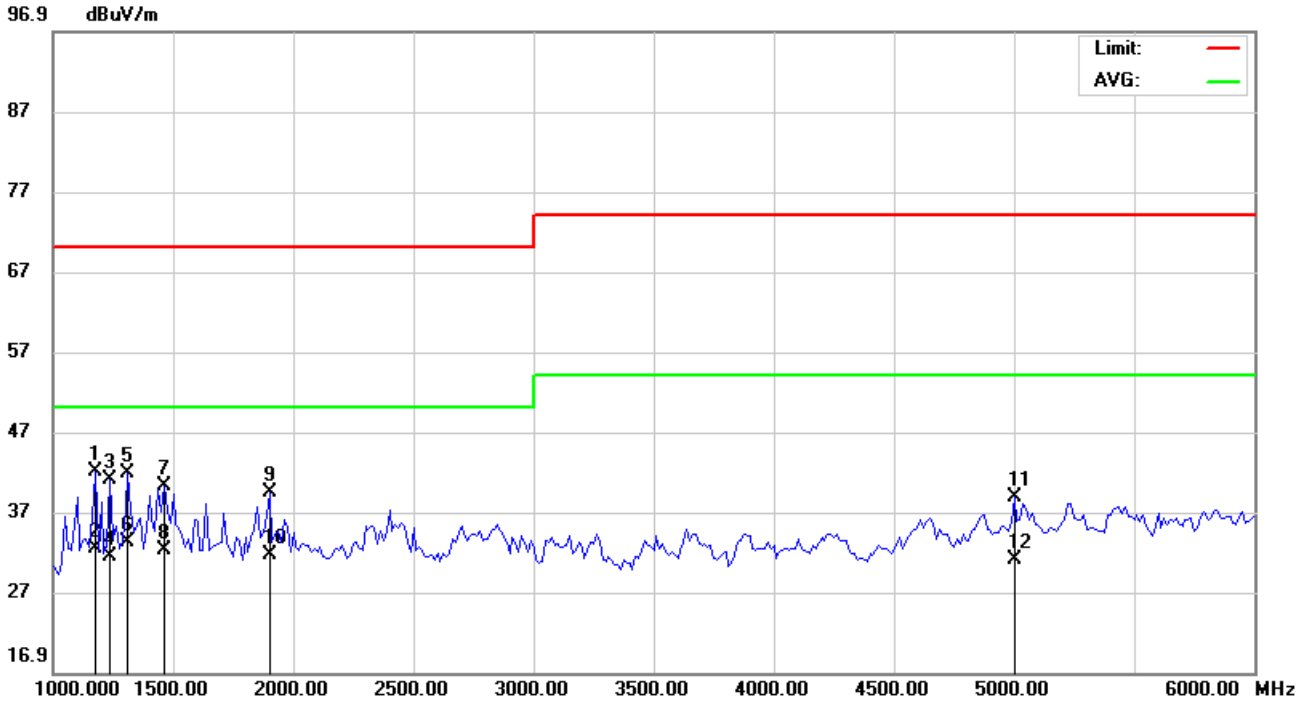


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		44.5868	16.01	10.77	26.78	40.00	-13.22	QP		
2		117.7725	11.87	15.55	27.42	40.00	-12.58	QP		
3		166.0680	11.17	17.10	28.27	40.00	-11.73	QP		
4		506.4791	5.74	22.77	28.51	47.00	-18.49	QP		
5	*	601.4265	11.45	23.82	35.27	47.00	-11.73	QP		
6		986.0717	5.17	29.86	35.03	47.00	-11.97	QP		

*:Maximum data x:Over limit !:over margin

Above 1GHz:

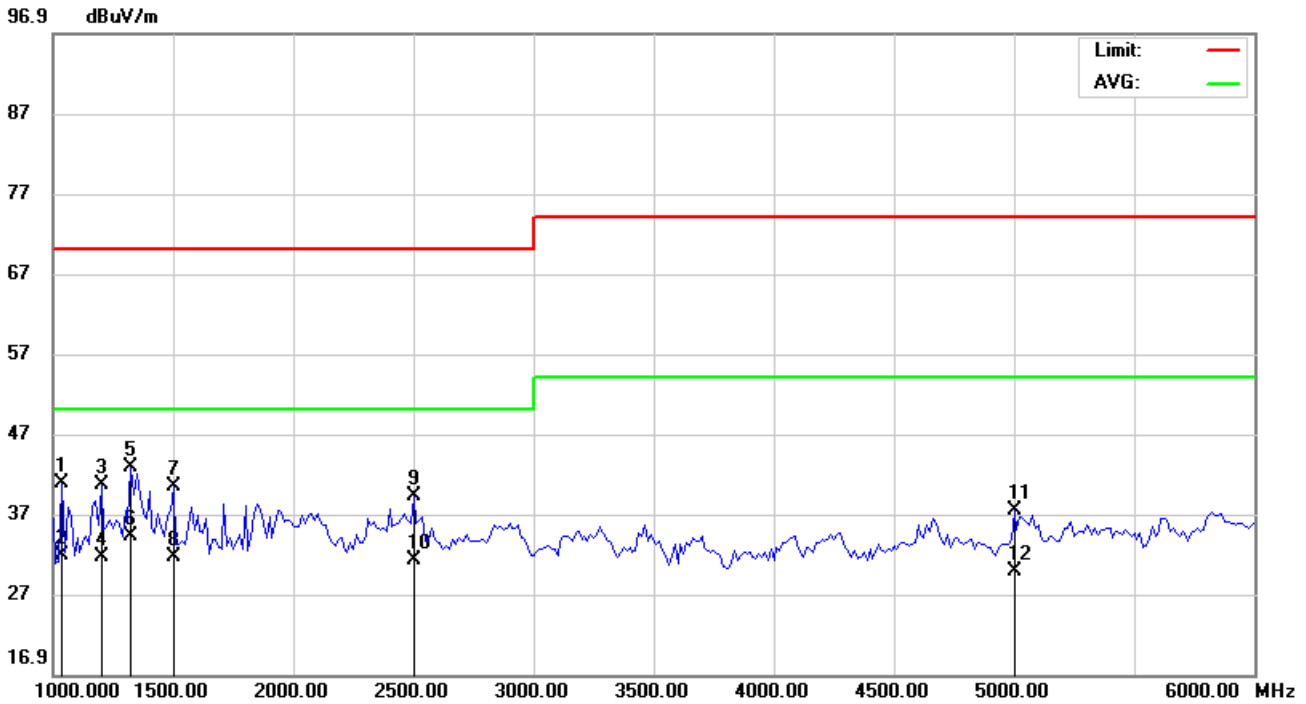
EUT:	Wireless gaming mouse	M/N:	M720W
Mode:	GFSK Mode	Polarization:	Horizontal
Test by:	Jaya	Power:	Transmitter: DC 1.5V by Battery Receiver: DC 5V by PC (AC 230V/50Hz for PC)
Temperature: / Humidity	29.0°C / 60.0%	Test date:	2019-07-24



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		1175.000	50.90	-8.81	42.09	70.00	-27.91			peak
2		1175.000	41.23	-8.81	32.42	50.00	-17.58			AVG
3		1237.500	49.66	-8.73	40.93	70.00	-29.07			peak
4		1237.500	40.10	-8.73	31.37	50.00	-18.63			AVG
5		1312.500	50.56	-8.78	41.78	70.00	-28.22			peak
6	*	1312.500	42.01	-8.78	33.23	50.00	-16.77			AVG
7		1462.500	48.82	-8.60	40.22	70.00	-29.78			peak
8		1462.500	40.71	-8.60	32.11	50.00	-17.89			AVG
9		1900.000	46.19	-6.85	39.34	70.00	-30.66			peak
10		1900.000	38.52	-6.85	31.67	50.00	-18.33			AVG
11		5000.000	42.62	-3.79	38.83	74.00	-35.17			peak
12		5000.000	34.70	-3.79	30.91	54.00	-23.09			AVG

*:Maximum data x:Over limit !:over margin

EUT:	Wireless gaming mouse	M/N:	M720W
Mode:	GFSK Mode	Polarization:	Vertical
Test by:	Jaya	Power:	Transmitter: DC 1.5V by Battery Receiver: DC 5V by PC (AC 230V/50Hz for PC)
Temperature: / Humidity	29.0°C / 60.0%	Test date:	2019-07-24



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		1037.500	50.21	-9.41	40.80	70.00	-29.20			peak
2		1037.500	41.25	-9.41	31.84	50.00	-18.16			AVG
3		1200.000	49.28	-8.70	40.58	70.00	-29.42			peak
4		1200.000	40.23	-8.70	31.53	50.00	-18.47			AVG
5		1325.000	51.54	-8.79	42.75	70.00	-27.25			peak
6	*	1325.000	43.00	-8.79	34.21	50.00	-15.79			AVG
7		1500.000	48.87	-8.46	40.41	70.00	-29.59			peak
8		1500.000	40.14	-8.46	31.68	50.00	-18.32			AVG
9		2500.000	47.51	-8.26	39.25	70.00	-30.75			peak
10		2500.000	39.41	-8.26	31.15	50.00	-18.85			AVG
11		5000.000	41.25	-3.79	37.46	74.00	-36.54			peak
12		5000.000	33.66	-3.79	29.87	54.00	-24.13			AVG

*:Maximum data x:Over limit !:over margin

Notes:

1. Measuring frequencies from 1 GHz to 6GHz.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
3. The frequency that above 3GHz is mainly from the environment noise.

3.4 HARMONIC CURRENT MEASUREMENT

3.4.1 LIMITS OF HARMONIC CURRENT

Limits for Class A Equipment	
Harmonics Order n	Max. permissible harmonic current (A)
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \leq n \leq 39$	$0.15 \times 15/n$
Even harmonics	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	$0.23 \times 8/n$

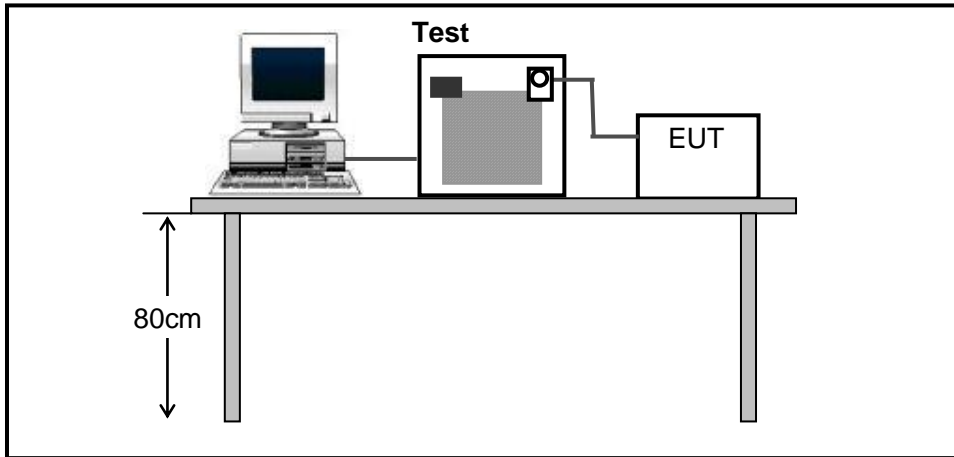
NOTE:

1. According to section 5 of EN61000-3-2: 2006, the EUT is Class A equipment.
2. The above limits are for all applications having an active input power **>75W**. No limits apply for equipment with an active input power up to and including 75W.

3.4.2 TEST PROCEDURE

1. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.
2. The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the necessary for the EUT to be exercised.

3.4.3 TEST SETUP



For the actual test configuration, please refer to Appendix I : Photographs of the Test Configuration.

3.4.4 TEST RESULT:

Not applicable to device with an active input power less than or equal to 75W.

3.5 VOLTAGE FLUCTUATIONS AND FLICK MEASUREMENT

3.5.1 LIMITS OF VOLTAGE FLUCTUATIONS AND FLICK

Test Item	Limit	Note
P_{st}	1.00	P_{st} means Short-term flicker indicator
P_{lt}	0.65	P_{lt} means long-term flicker indicator
T_{dt}	0.50	T_{dt} means maximum time that d_t exceeds 3.3%
$d_{max}(\%)$	4.0%	d_{max} means maximum relative voltage change.
$d_c(\%)$	3.3%	d_c means relative steady-state voltage change.

3.5.2 TEST PROCEDURE

1. The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal conditions
2. During the flick measurement, the measure time shall include that part of whole operation changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

3.5.3 TEST SETUP

Same as 3.4.3

3.5.4 TEST RESULT:

N/A

4. IMMUNITY TEST

4.1 EUT SETUP AND OPERATING CONDITIONS

Mode 1: GFSK data transmission Mode

The EUT configuration of the emission test was **mouse+batteries---USB dongle**.

Mode 2: Standby Mode

The EUT configuration of the emission test was **mouse+batteries---USB dongle**.

4.2 PERFORMANCE CRITERIA

4.2.1 GENERAL PERFORMANCE CRITERIA TO BT/WIFI

Criteria	During the test	After the test
A	Shall operate as intended May show degradation of performance (see note 1) Shall be no loss of function Shall be no unintentional transmissions	Shall operate as intended Shall be no degradation of performance (see note 2) Shall be no loss of function Shall be no loss of stored data or user programmable functions
B	May show loss of function (one or more) May show degradation of performance (see note 1) No unintentional transmissions	Functions shall be self-recoverable Shall operate as intended after recovering Shall be no degradation of performance (see note 2) Shall be no loss of stored data or user programmable functions
C	May be loss of function (one or more)	Functions shall be recoverable by the operator Shall operate as intended after recovering Shall be no degradation of performance (see note 2)

NOTE 1: Degradation of performance during the test is understood as degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 2: no degradation of performance after the test is understood as any degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

4.2.2 PERFORMANCE CRITERIA FOR CT AND CR FOR BT/WIFI

PERFORMANCE FOR CT TO BT/WIFI

The performance criteria A shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an Acknowledgement (ACK) or Not Acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

PERFORMANCE FOR CR TO BT/WIFI

The performance criteria A shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized

that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

4.2.3 PERFORMANCE CRITERIA FOR TT AND TR TO BT/WIFI

PERFORMANCE FOR TT TO BT/WIFI

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

PERFORMANCE FOR TR TO BT/WIFI

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

4.3 ELECTROSTATIC DISCHARGE IMMUNITY TEST

4.3.1 TEST SPECIFICATION

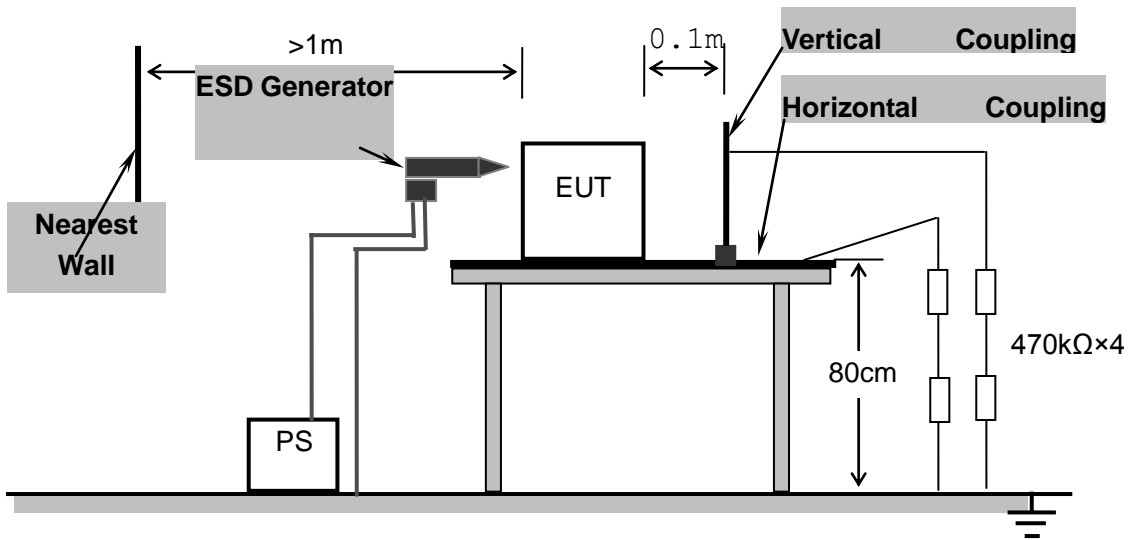
Basic Standard:	EN 61000-4-2
Discharge Impedance	330Ω / 150 pF
Discharge Voltage:	Air Discharge – +/- 8 kV Contact Discharge – +/- 4 kV
Polarity:	Positive / Negative
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single discharge
Discharge Period:	1-second minimum

4.3.2 TEST PROCEDURE

The test procedure was in accordance with EN 61000-4-2:

1. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
2. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
3. The time interval between two successive single discharges was at least 1 second.
4. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.
5. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
6. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were completed.
7. At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator was positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.
8. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5m×0.5m) was placed vertically to and 0.1 meters from the EUT.

4.3.3 TEST SETUP



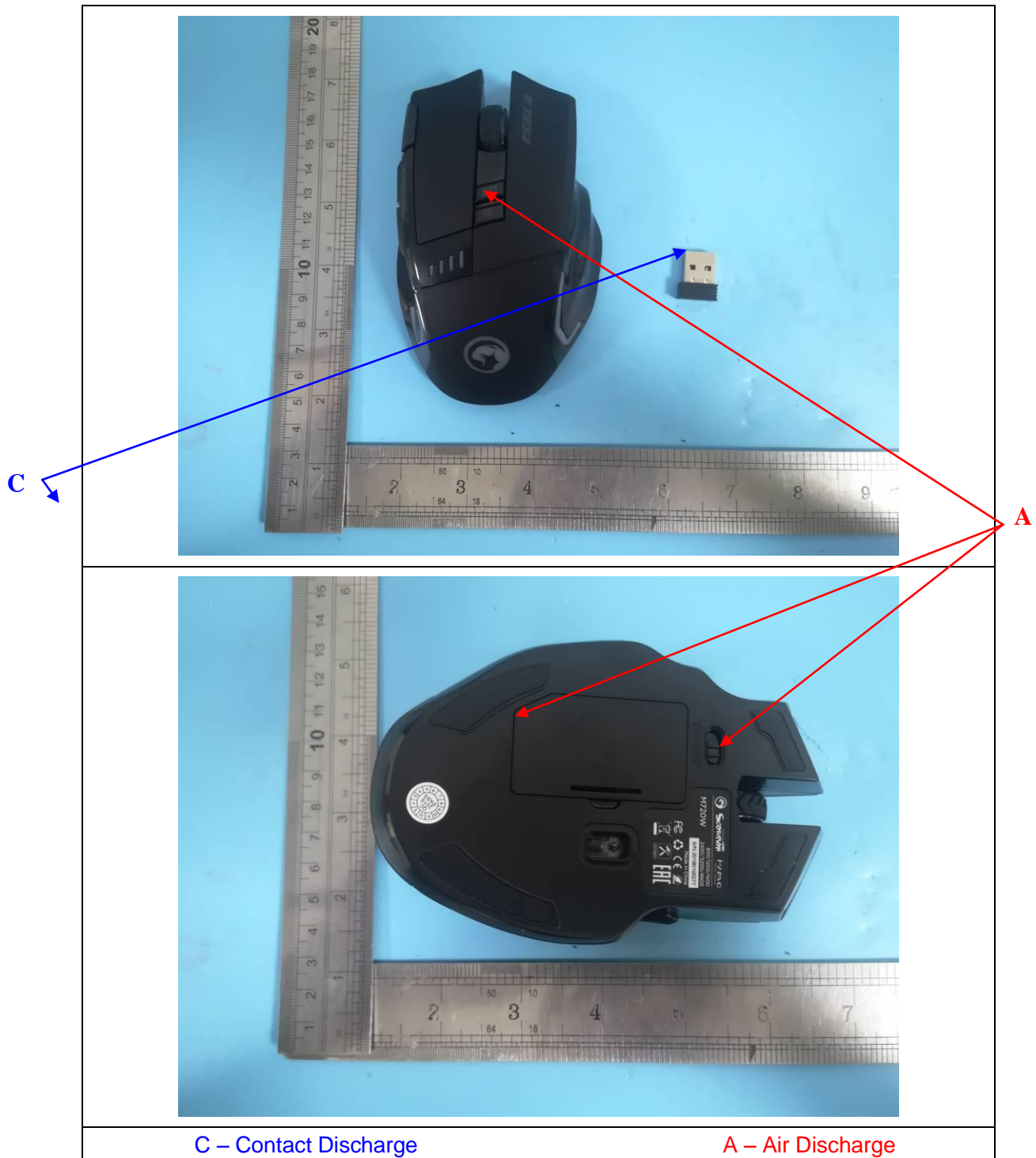
For the actual test configuration, please refer to Appendix I : Photographs of the Test Configuration.

4.3.4 TEST RESULT

Test Points	Discharge Level (kV)	Discharge Mode	Observation	Conclusion
HCP	±2, ±4	Contact	Note(1)	Pass
VCP	±2, ±4	Contact	Note(1)	Pass
Gaps	±2, ±4, ±8	Air	Note(1)	Pass
Port	±2, ±4	Contact	Note(1)	Pass
Switch	±2, ±4, ±8	Air	Note(1)	Pass
Key	±2, ±4, ±8	Air	Note(1)	Pass

NOTE: (1) All test mode of section 4.1 were tested and the EUT performance complied with the performance criteria for TT and TR. And the test result criterion is A.

4.3.5 TEST POINT:



4.4 RADIATED, RADIO FREQUENCY ELECTROMAGNETIC FIELD IMMUNITY TEST

4.4.1 TEST SPECIFICATION

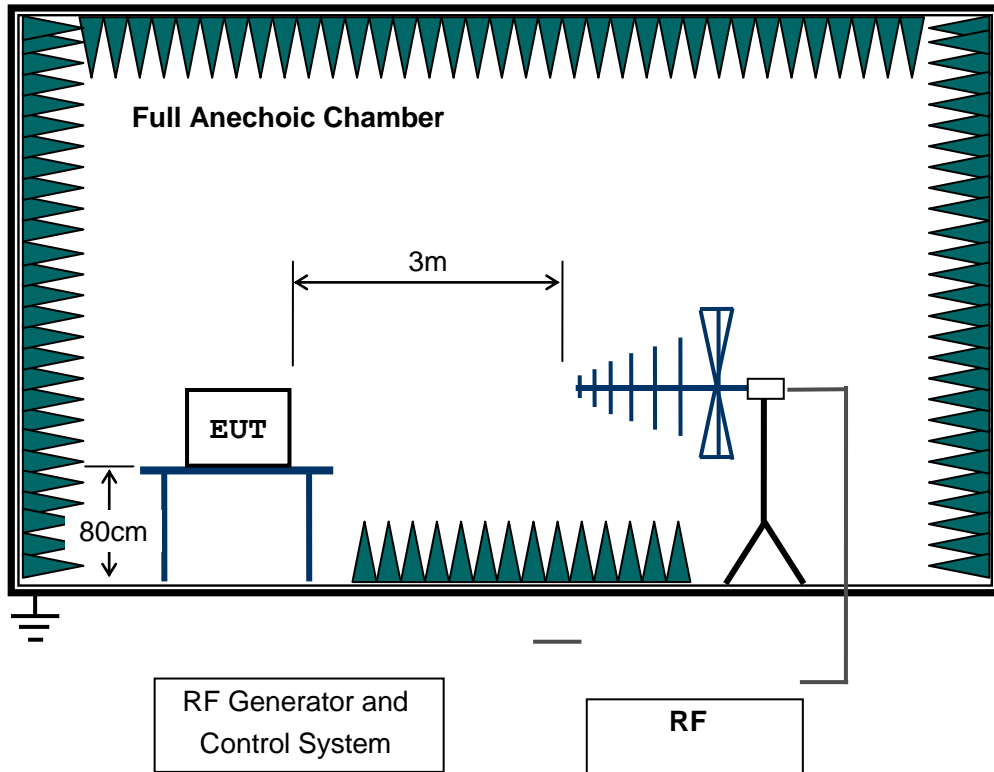
Basic Standard:	EN 61000-4-3
Frequency Range:	80 MHz – 1000MHz, 1400MHz-2700MHz
Field Strength:	3V/m
Modulation:	1 kHz sine wave, 80%, AM modulation
Frequency Step:	1% of fundamental
Polarity of Antenna	Horizontal and Vertical
Test Distance:	3m
Antenna Height:	1.5m
Dwell Time:	3 seconds

4.4.2 TEST PROCEDURE

The test procedure was in accordance with EN 61000-4-3.

1. The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
2. The test signal was 80% amplitude modulated with a 1 kHz sine wave.
3. The frequency range was swept from 80 MHz to 1000MHz and 1400MHz to 2700MHz with the exception of the exclusion band for operating transmitter mode, but the test shall be repeated with the equipment in the idle mode of the operation and the exclusion band shall not be used during the test. The rate of sweep did not exceed 1.5×10^{-3} decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
4. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
5. The field strength level was 3V/m.
6. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

4.4.3 TEST SETUP



For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

4.4.4 TEST RESULT

EUT Operating Mode	Antenna Polarity	Frequency (MHz)	Field Strength (V/m)	Observation	Conclusion
GFSK Mode	Vertical	80-6000	3	Note(1)	Pass
	Horizontal	80-6000	3	Note(1)	Pass
Standby Mode	Vertical	80-6000	3	Note(1)	Pass
	Horizontal	80-6000	3	Note(1)	Pass

NOTE: (1) All test mode of section 4.1 were tested and the EUT performance complied with the performance criteria for CT and CR. And the test result criterion is A.

4.5 ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST

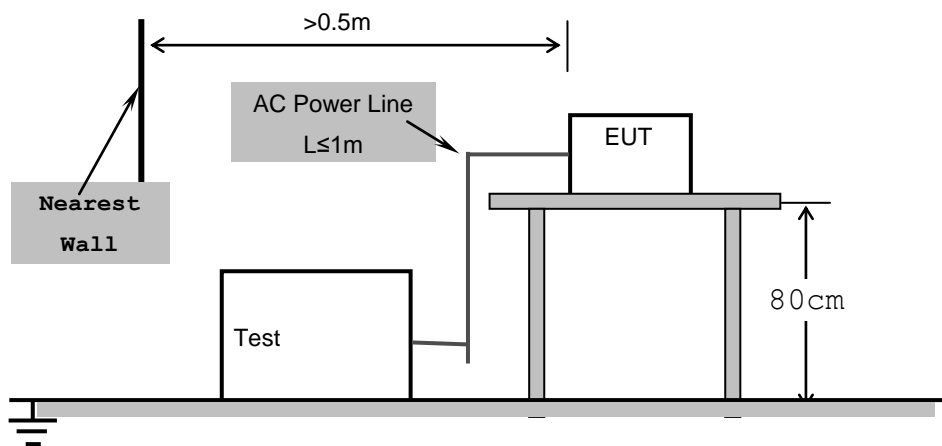
4.5.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-4
Test Voltage:	a.c. power port – 1 kV
Polarity:	Positive/Negative
Impulse Frequency:	5kHz
Impulse wave shape:	5/50ns
Burst Duration:	15ms
Burst Period:	300ms
Test Duration:	Not less than 1 min.

4.5.2 TEST PROCEDURE

1. The EUT was tested with 1000 volt discharges to the AC power input leads.
2. Both positive and negative polarity discharges were applied.
3. The length of the “hot wire” from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 meter.
4. The duration time of each test sequential was 1 minute.
5. The transient/burst waveform was in accordance with EN 61000-4-4, 5/50ns.

4.5.3 TEST SETUP



For the actual test configuration, please refer to Appendix I : Photographs of the Test Configuration.

4.5.4 TEST RESULT

Test Point	Polarity	Test Level (kV)	Observation	Conclusion
a.c. port, L	+/-	1	Note (1)	Pass
a.c. port, N	+/-	1	Note (1)	Pass
a.c. port, L-N	+/-	1	Note (1)	Pass

NOTE: (1) All test mode of section 4.1 were tested and the EUT performance complied with the performance criteria for TT and TR. And the test result criterion is A.

4.6 SURGE IMMUNITY TEST

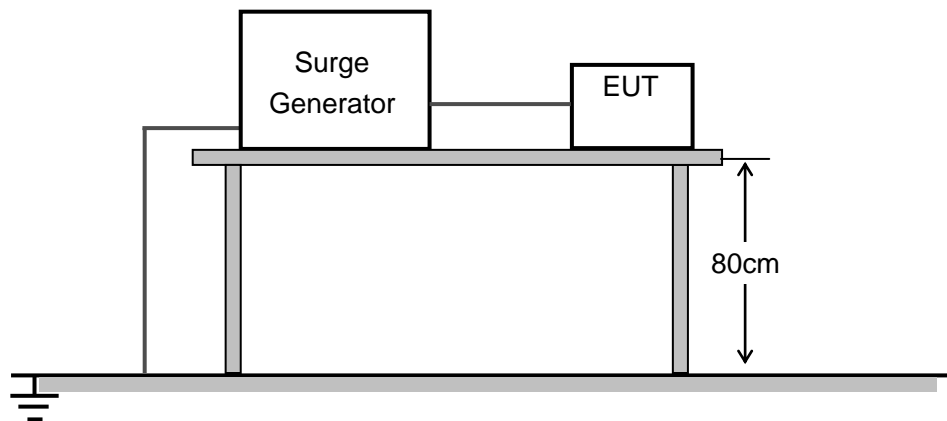
4.6.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-5
Waveform:	Voltage 1.2/50 μ s; Current 8/20 μ s
Test Voltage:	a.c. power port, line to ground 2 kV, line to line 1kV
Polarity:	Positive/Negative
Phase Angle:	0°, 90°, 180°, 270°
Repetition Rate:	60sec
Times:	5 time/each condition.

4.6.2 TEST PROCEDURE

1. The EUT and the auxiliary equipment were placed on a table of 0.8m heights above a metal ground reference plane. The size of ground plane is greater than 1m \times 1m and project beyond the EUT by at least 0.1m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT was less than 2 meters (provided by the manufacturer).
2. The EUT was connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise was applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).
3. The surges were applied line to line and line(s) to earth. When testing line to earth the test voltage was applied successively between each of the lines and earth. Steps up to the test level specified increased the test voltage. All lower levels including the selected test level were tested. The polarity of each surge level included positive and negative test pulses.

4.6.3 TEST SETUP



For the actual test configuration, please refer to Appendix I : Photographs of the Test Configuration.

4.6.4 TEST RESULT

Coupling Line	Polarity	Voltage (kV)	Observation	Conclusion
a.c. power, L-N	+/-	1	Note (1)	Pass

NOTE: (1) All test mode of section 4.1 were tested and the EUT performance complied with the performance criteria for TT and TR. And the test result criterion is A

4.7 IMMUNITY TO CONDUCTED DISTURBANCES INDUCED BY RF FIELDS

4.7.1 TEST SPECIFICATION

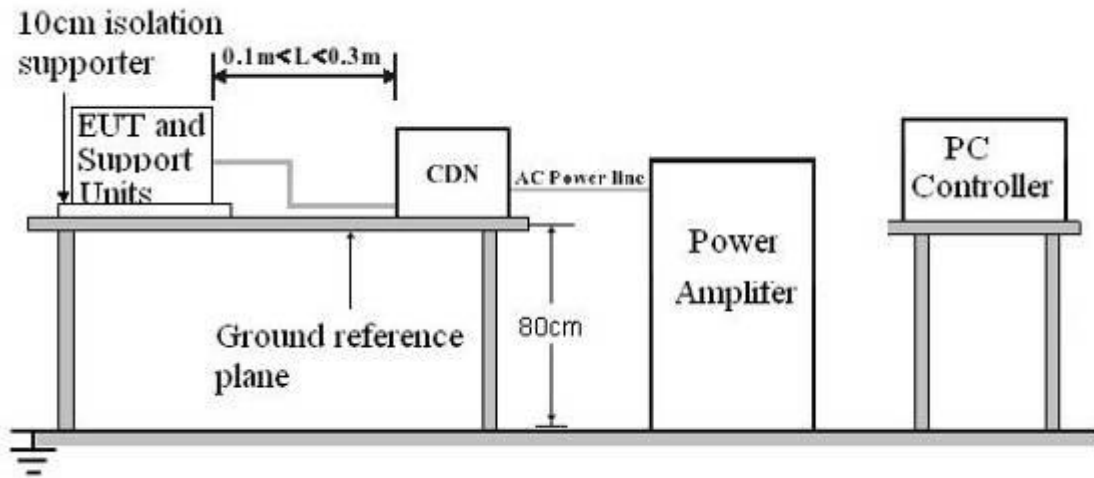
Basic Standard:	EN 61000-4-6
Frequency Range:	0.15 MHz – 80 MHz
Field Strength:	3Vrms
Modulation:	1 kHz Sine Wave, 80% AM
Frequency Step:	1% of fundamental
Coupled Cable:	a.c. power line
Coupling Device:	CDN-M2

4.7.2 TEST PROCEDURE

The test procedure was in accordance with EN 61000-4-6.

1. The EUT shall be tested within its intended operating and climatic conditions.
2. The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.
3. The test signal was 80% amplitude modulated with a 1 kHz sine wave
4. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80% amplitude. The sweep rate shall not exceed 1.5×10^{-3} decades/s. The step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value where the frequency is swept incrementally.
5. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequencies and harmonics or frequencies of dominant interest, shall be analyzed separately.
6. Attempts should be made to fully exercise the EUT during test, and to fully interrogate all exercise modes selected for susceptibility.

4.7.3 TEST SETUP



For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

4.7.4 TEST RESULT

EUT Operating Mode	Test Point	Frequency (MHz)	Field Strength (Vrms)	Observation	Conclusion
GFSK Mode	a.c. port	0.15 – 80	3	Note(1)	Pass
Standby Mode	a.c. port	0.15 – 80	3	Note(1)	Pass

NOTE: (1) All test mode of section 4.1 were tested and the EUT performance complied with the performance criteria for CT and CR. And the test result criterion is A.

4.8 VOLTAGE DIPS AND SHORT INTERRUPTIONS IMMUNITY TEST

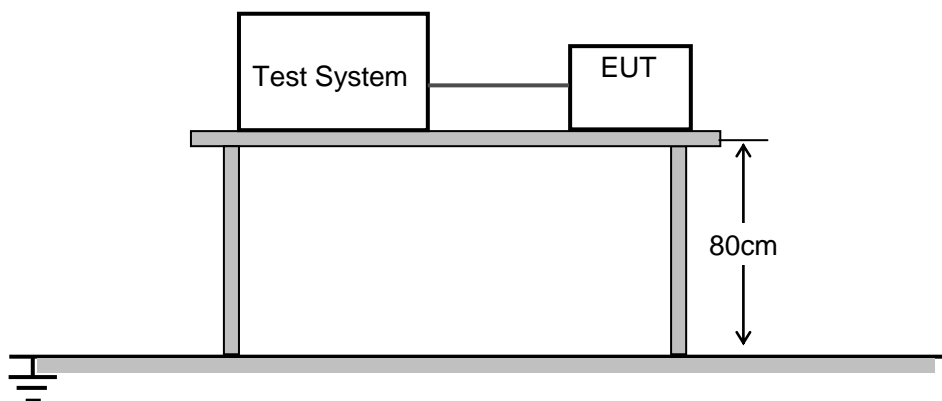
4.8.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-11
Voltage Dips:	0% residual voltage for 0.5 cycle 0% residual voltage for 1 cycle 70% residual voltage for 25 cycles (at 50Hz)
Voltage Interruptions:	0% residual voltage for 250 cycles (at 50Hz)
Voltage Phase Angle:	0°

4.8.2 TEST PROCEDURE

1. The power cord was used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.
2. The EUT was tested for (I) 0% residual voltage dip of supplied voltage with duration of 0.5 cycle, (II) 0% residual voltage dip of supplied voltage and duration 1 cycle and (III) 70% residual voltage dip of supplied voltage and duration 25 cycles (at 50Hz). Both of the dip tests were carried out for a sequence of three voltage dips with intervals of 10 seconds (at 50Hz).
3. 0% residual voltage interruption of supplied voltage with duration of 250 cycles (at 50Hz) was followed, which was a sequence of three voltage interruptions with intervals of 10 seconds.
4. Voltage reductions occur at 0 degree crossover point of the voltage waveform. The performance of the EUT was checked after the voltage dip or interruption.

4.8.3 TEST SETUP



For the actual test configuration, please refer to Appendix I : Photographs of the Test Configuration.

4.8.4 TEST RESULT

N/A

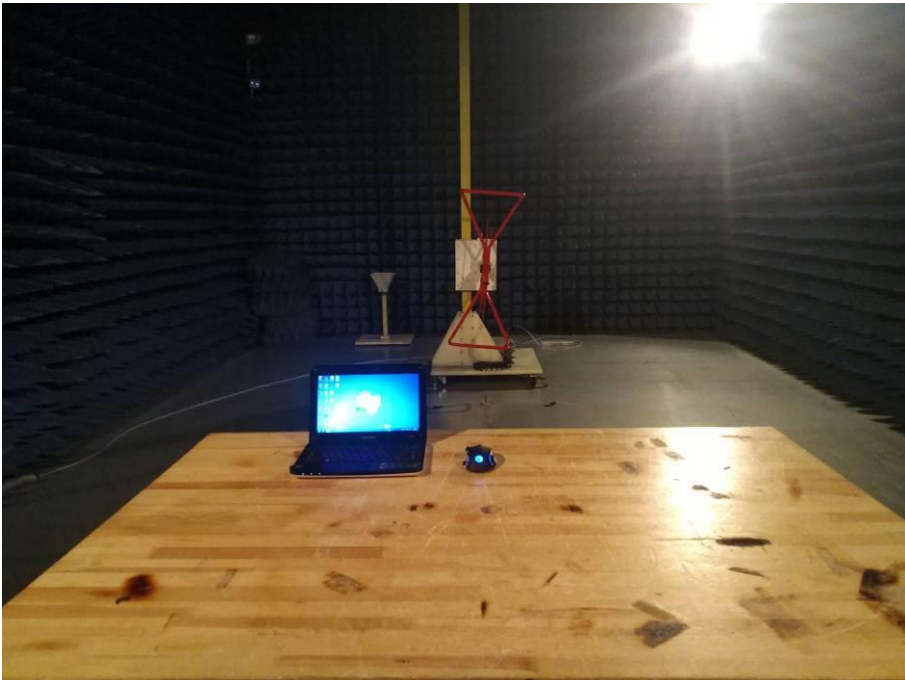
APPENDIX I

PHOTOGRAPHS OF THE TEST SETUP

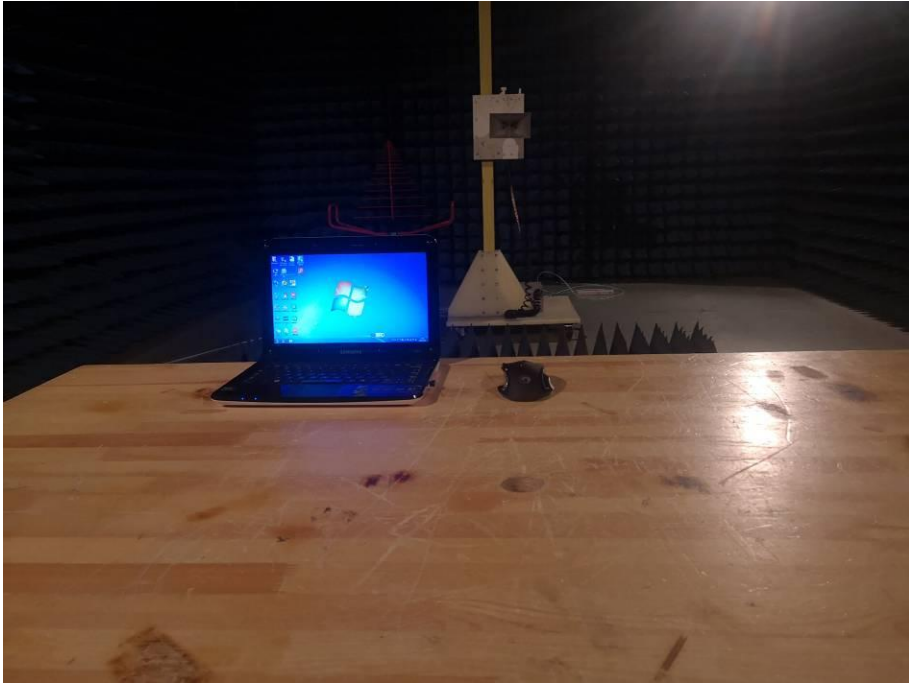
CE TEST



RE TEST



RE TEST



ESD TEST



DIPS/ EFT/SURGE TEST



RS TEST



----END OF REPORT----

RS TEST



----END OF REPORT----