

FCC EMC Test Report

Report No. : BTL-FCCE-1-2004T068
Equipment : Gaming Mouse
Model Name : Light² 100
Brand Name : Sharkoon
Applicant : Sharkoon Technologies GmbH
Address : Grüninger Weg 48, 35415 Pohlheim, Germany

FCC Rule Part(s) : FCC Part 15 Subpart B Class B
ISED Standard(s) : ICES-003 Issue 6:2016 (updated April 2019) Class B
Measurement Procedure(s) : ANSI C63.4-2014

Date of Receipt : 2020/4/16
Date of Test : 2020/4/16 ~ 2020/4/24
Issued Date : 2020/5/4

The above equipment has been tested and found in compliance with the requirement of the above standards by BTL Inc.

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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

The report must not be used by the client to claim product certification, approval, or endorsement by NIST, A2LA, or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	2020/5/4

1 SUMMARY OF TEST RESULTS

Emission			
Standard	Test Item	Limit	Judgment
FCC Part 15, Subpart B ICES-003 Issue 6:2016 (updated April 2019)	AC power line conducted emissions	Class B	PASS
	Radiated emissions below 1 GHz	Class B	PASS
	Radiated emissions above 1 GHz	-----	N/A

NOTE:

- (1) "N/A" denotes test is not applicable in this Test Report.
- (2) The report format version is TP.1.1.1.

1.1 TEST FACILITY

The test facilities used to collect the test data in this report:

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
 The test sites and facilities are covered under FCC RN: 355421 and DN: TW1099

C05 CB08 CB11 CB15 CB16

No.132-1, Ln. 329, Sec. 2, Balian Rd., Xizhi Dist., New Taipei City 221, Taiwan

OS02

No.18, Ln. 171, Sec. 2, Jiuzong Rd., Neihu Dist., Taipei City 114, Taiwan

C03 CB18 CB19

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of approximately **95 %**. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{CISPR} requirement.

A. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U (dB)
C03	CISPR	150 kHz ~ 30 MHz	2.30

B. Radiated emissions up to 1 GHz test:

Test Site	Method	Measurement Frequency Range	Ant. H / V	U (dB)
OS02 (10m)	CISPR	30 MHz ~ 200 MHz	V	3.84
		30 MHz ~ 200 MHz	H	3.34
		200 MHz ~ 1,000 MHz	V	3.74
		200 MHz ~ 1,000 MHz	H	3.06

NOTE:

Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Environment Condition	Tested by
Conducted emissions	23°C, 63%	Husbert Wang
Radiated emissions below 1 GHz	25°C, 57%	Gray.Wu

2 GENERAL INFORMATION

2.1 EUT INFORMATION

Equipment	Gaming Mouse
Model Name	Light ² 100
Brand Name	Sharkoon
Model Difference	N/A
Power Source	Supplied from USB port
Power Rating	I/P: DC 5V, 100mA
Products Covered	N/A
Test Model	Light ² 100
Highest Internal Frequency	24 MHz
EUT Modification(s)	N/A

NOTE:

- (1) For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2.2 TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation modes according to test plan.

Pretest Mode	Description
Mode 1	USB(DPI:400)
Mode 2	USB(DPI:2400)
Mode 3	USB(DPI:5000)

Following mode(s) as (were) found to be the worst case(s) and selected for the final test.

AC power line conducted emissions test	
Final Test Mode	Description
Mode 3	USB(DPI:5000)

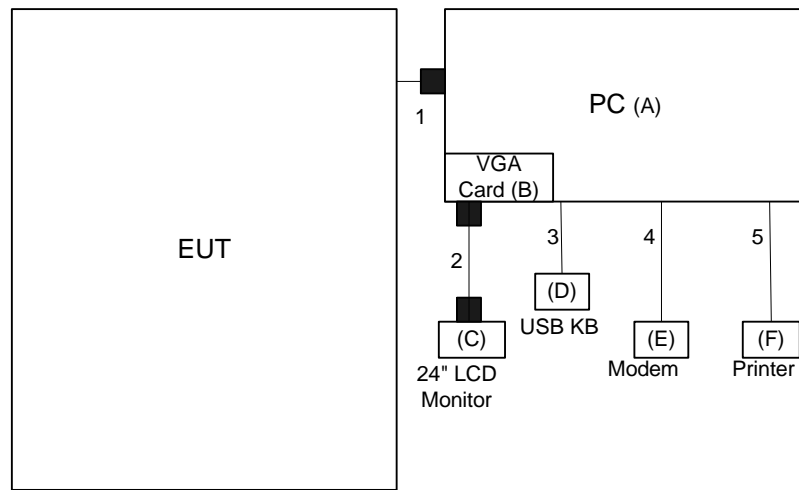
Radiated emissions below 1 GHz test	
Final Test Mode	Description
Mode 3	USB(DPI:5000)

2.3 EUT OPERATING CONDITION

The EUT exercise program (BurninTEST V8.1) used during radiated and/or conducted emissions measurement was designed to exercise the various system components in a manner similar to a typical use.

2.4 TESTED CONFIGURATION DIAGRAM

Equipment letters and Cable numbers refer to item numbers described in the tables of clause 2.5.



2.5 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	PC	DELL	OptiPlex 790 MT	64NJVBX	Furnished by test lab.
B	VGA Card	Gigabyte	GTX 550 Ti	122951008613	Furnished by test lab.
C	24" LCD Monitor	DELL	U2410f	CN-OJ257M-728 72-09J-067L	Furnished by test lab.
D	USB K/B	DELL	KB216t	CN-0W33XP-L03 00-797-05TY-A03	Furnished by test lab.
E	Modem	ACEEX	DM-1414V	8041708	Furnished by test lab.
F	Printer	HP	SNPRH-1504	N/A	Furnished by test lab.

Item	Cable Type	Shielded	Ferrite Core	Length	Remarks
1	USB Cable	YES	YES	1.8m	Type: USB 2.0 Supplied by test requester.
2	D-sub Cable	YES	YES	1.8m	Furnished by test lab.
3	USB Cable	YES	NO	1.7m	Type: USB 2.0 Furnished by test lab.
4	RS232 Cable	YES	NO	1.7m	Furnished by test lab.
5	USB Cable	YES	NO	1.7m	Type: USB 2.0 Furnished by test lab.

3 EMC EMISSION TEST

3.1 CONDUCTED EMISSIONS TEST

3.1.1 LIMITS

Frequency (MHz)	Class A (dB μ V)		Class B (dB μ V)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56 *	56 - 46 *
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

NOTE:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
- (3) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor (if use)
 Margin Level = Measurement Value – Limit Value

Calculation example:

Reading Level		Correct Factor		Measurement Value
38.22	+	3.45	=	41.67

Measurement Value		Limit Value		Margin Level
41.67	-	60	=	-18.33

3.1.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	TWO-LINE V-NETWORK	R&S	ENV216	101051	2019/6/21	2020/6/20
2	Test Cable	EMCI	EMCCFD300-BM -BMR-6000	170714	2019/6/3	2020/6/2
3	EMI Test Receiver	R&S	ESR	101854	2020/1/6	2021/1/5
4	Measurement Software	Farad	EZ EMC (Ver. NB-03A1-01)	N/A	N/A	N/A

REMARK:

- (1) "N/A" denotes no model name, no serial no. or no calibration specified.
- (2) All calibration period of equipment list is one year.

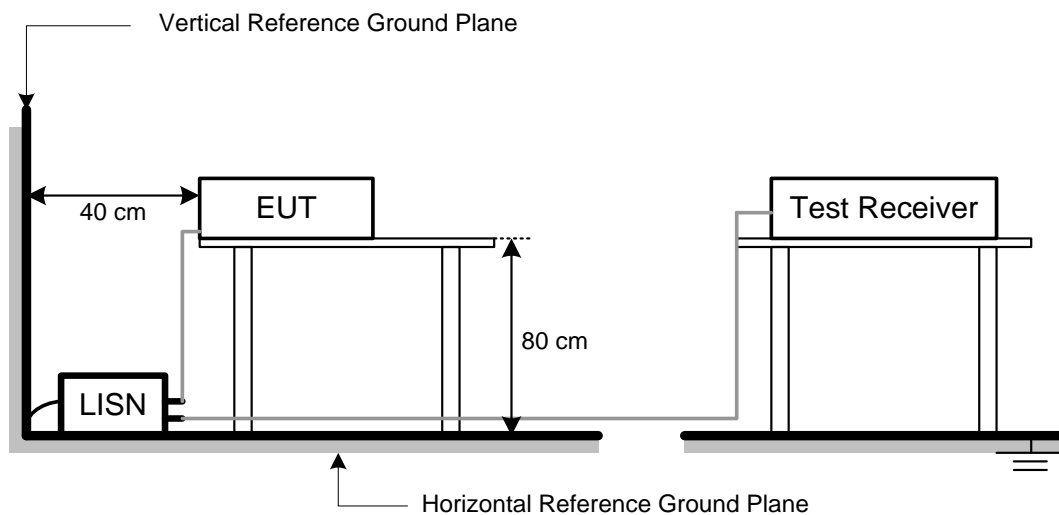
3.1.3 TEST PROCEDURE

- a. The EUT was placed 0.8 m above the horizontal ground plane with the EUT being connected to the power mains through a line impedance stabilization network (LISN).
All other support equipment were powered from an additional LISN(s).
The LISN provides 50 Ohm/50uH of impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle to keep the cable above 40 cm.
- c. Excess I/O cables that are not connected to a peripheral shall be bundled in the center.
The end of the cable will be terminated, using the correct terminating impedance.
The overall length shall not exceed 1 m.
- d. The LISN is spaced at least 80 cm from the nearest part of the EUT chassis.
- e. For the actual test configuration, please refer to the related Item - TEST PHOTOS.

3.1.4 DEVIATION FROM TEST STANDARD

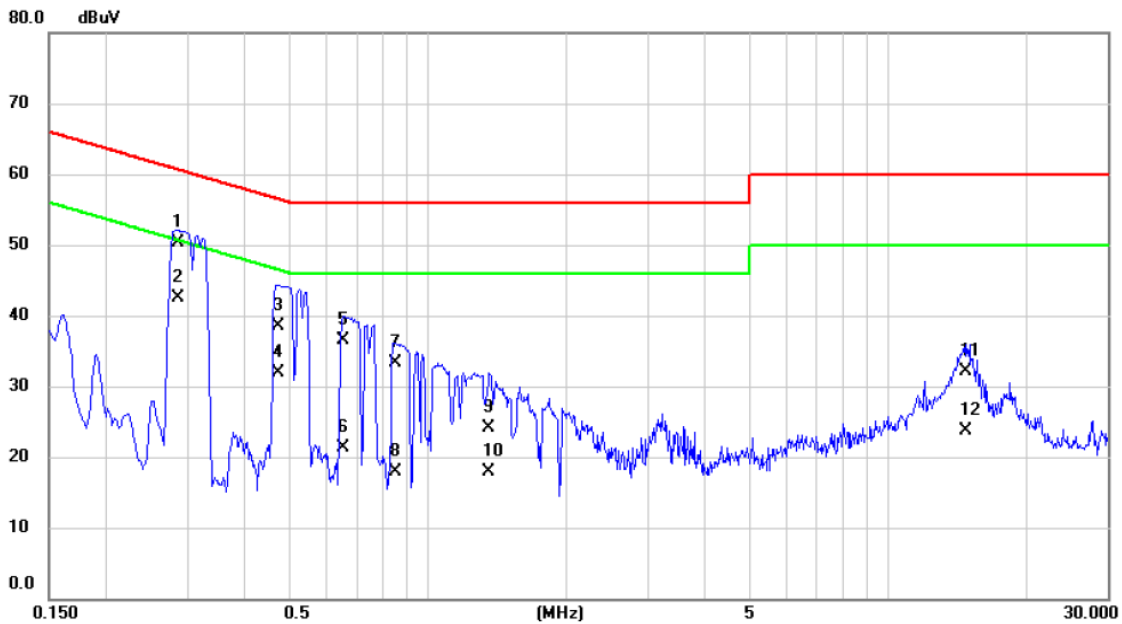
No deviation.

3.1.5 TEST SETUP



3.1.6 TEST RESULT

Test Mode	Mode 1	Tested Date	2020/4/21
Test Voltage	AC 120V/60Hz	Phase	Line

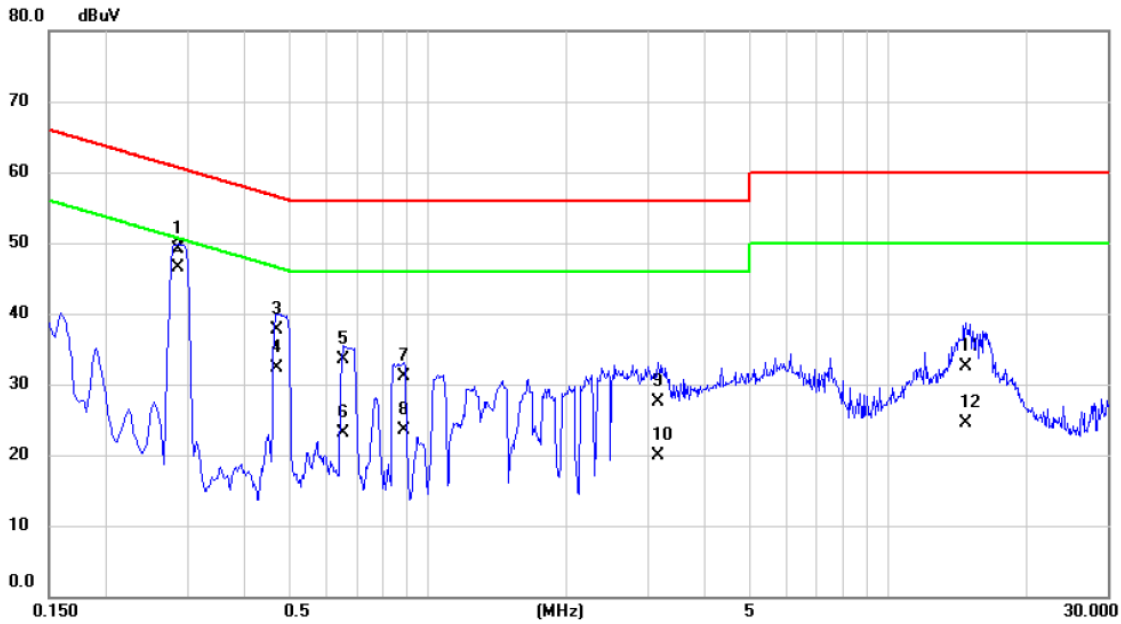


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.2872	40.60	9.68	50.28	60.60	-10.32	QP	
2	*	0.2872	32.90	9.68	42.58	50.60	-8.02	AVG	
3		0.4740	28.90	9.67	38.57	56.44	-17.87	QP	
4		0.4740	22.20	9.67	31.87	46.44	-14.57	AVG	
5		0.6540	26.80	9.67	36.47	56.00	-19.53	QP	
6		0.6540	11.60	9.67	21.27	46.00	-24.73	AVG	
7		0.8520	23.60	9.68	33.28	56.00	-22.72	QP	
8		0.8520	8.30	9.68	17.98	46.00	-28.02	AVG	
9		1.3583	14.30	9.71	24.01	56.00	-31.99	QP	
10		1.3583	8.20	9.71	17.91	46.00	-28.09	AVG	
11		14.7975	22.10	9.92	32.02	60.00	-27.98	QP	
12		14.7975	13.80	9.92	23.72	50.00	-26.28	AVG	

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

Test Mode	Mode 1	Tested Date	2020/4/21
Test Voltage	AC 120V/60Hz	Phase	Neutral



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.2872	39.50	9.67	49.17	60.60	-11.43	QP	
2	*	0.2872	36.90	9.67	46.57	50.60	-4.03	AVG	
3		0.4695	28.00	9.67	37.67	56.52	-18.85	QP	
4		0.4695	22.70	9.67	32.37	46.52	-14.15	AVG	
5		0.6561	23.80	9.67	33.47	56.00	-22.53	QP	
6		0.6561	13.50	9.67	23.17	46.00	-22.83	AVG	
7		0.8857	21.50	9.68	31.18	56.00	-24.82	QP	
8		0.8857	13.80	9.68	23.48	46.00	-22.52	AVG	
9		3.1538	17.80	9.78	27.58	56.00	-28.42	QP	
10		3.1538	10.20	9.78	19.98	46.00	-26.02	AVG	
11		14.7953	22.50	9.97	32.47	60.00	-27.53	QP	
12		14.7953	14.60	9.97	24.57	50.00	-25.43	AVG	

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

3.2 RADIATED EMISSIONS BELOW 1 GHZ TEST

3.2.1 LIMITS

FCC Part 15, Subpart B:

Frequency (MHz)	Class A (at 10 m)		Class B (at 3 m)	
	(uV/m) Field strength	(dBuV/m) Field strength	(uV/m) Field strength	(dBuV/m) Field strength
30 - 88	90	39	100	40
88 - 216	150	43.5	150	43.5
216 - 960	210	46.4	200	46
Above 960	300	49.5	500	54

CISPR 22 or CAN/CSA-CISPR 22-10:

Frequency (MHz)	Class A (at 10 m)		Class B (at 10 m)	
	dBuV/m		dBuV/m	
30 - 230	40		30	
230 - 1000	47		37	

FCC Part 15, Subpart B, section 15.109(g) provides, as an alternative, compliance to the CISPR 22 (Third Edition) radiated emission limits in the 30 MHz to 1000 MHz range.

Frequency range of radiated measurements (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

NOTE:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBuV/m) = 20log Emission level (uV/m).
3 m Emission level = 10 m Emission level + 20log(10 m/3 m).
- (3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain (if use)
Margin Level = Measurement Value - Limit Value
Calculation example:

Reading Level		Correct Factor		Measurement Value
19.11	+	2.11	=	21.22

Measurement Value		Limit Value		Margin Level
21.22	-	40	=	-18.78

3.2.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Log-Bicon Antenna	Schwarzbeck	VULB 9160	3176	2019/7/31	2020/7/30
2	Pre-Amplifier	Anritsu	MH648A	M98457	2019/10/22	2020/10/21
3	Test Cable	TIMES	LMR-400	10M-OS01	2019/10/22	2020/10/21
4	Test Cable	EMCI	EMCCFD400-NM -NM-25000	171103	2019/10/22	2020/10/21
5	EMI Test Receiver	R&S	ESCI	100080	2019/6/14	2020/6/13
6	Measurement Software	Farad	EZ EMC (Ver. NB-03A1-01)	N/A	N/A	N/A

REMARK:

- (1) "N/A" denotes no model name, no serial no. or no calibration specified.
- (2) All calibration period of equipment list is one year.

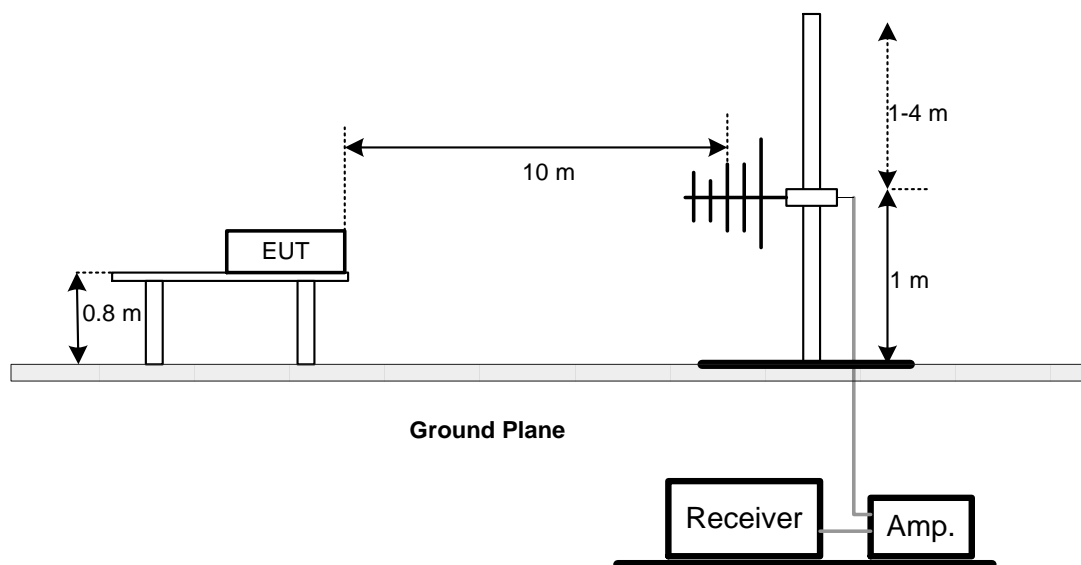
3.2.3 TEST PROCEDURE

- a. The separation distance of 10 m was used for measurements below 1 GHz. The EUT was placed on the top of a rotating table 0.8 m above the ground in a 10 m open area test site.
- b. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the receive antenna was varied between 1 m and 4 m. Both horizontal and vertical polarizations of the antenna were checked.
- d. For each suspected emission, the EUT was arranged at its worst case and then the antenna was scanned in height to find the maximum. The tower Bore sight function was used.
- e. The receiver was set to quasi-peak detect function and specified bandwidth with maximum hold mode.
- f. For the actual test configuration, please refer to the related Item - TEST PHOTOS.

3.2.4 DEVIATION FROM TEST STANDARD

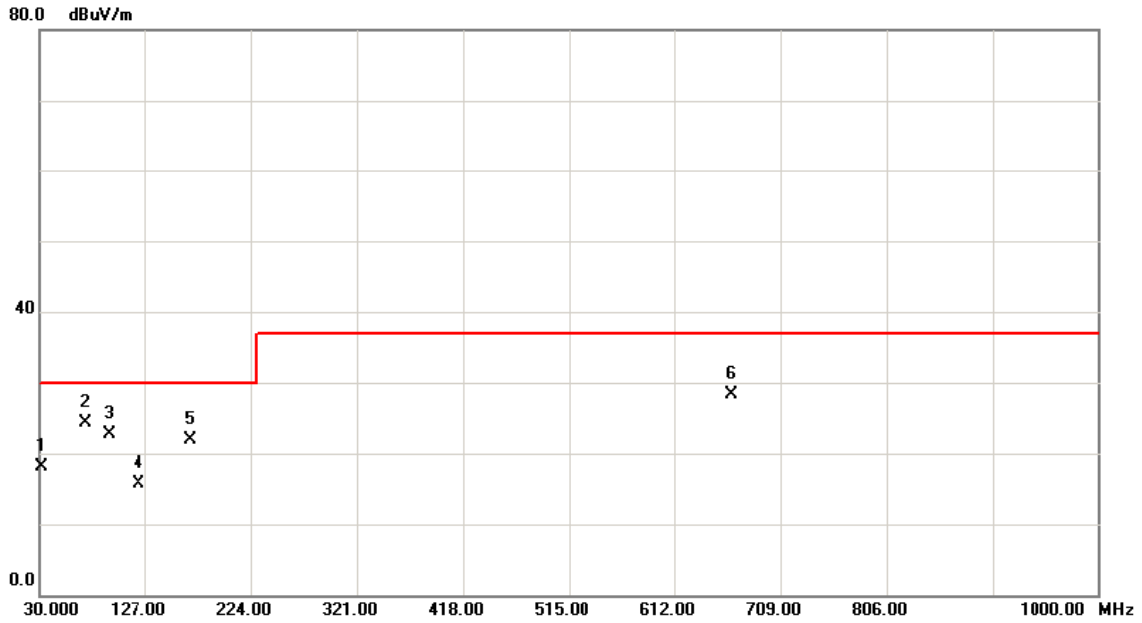
No deviation.

3.2.5 TEST SETUP



3.2.6 TEST RESULT

Test Mode	Mode 1	Tested Date	2020/4/21
Test Voltage	AC 120V/60Hz	Polarization	Vertical

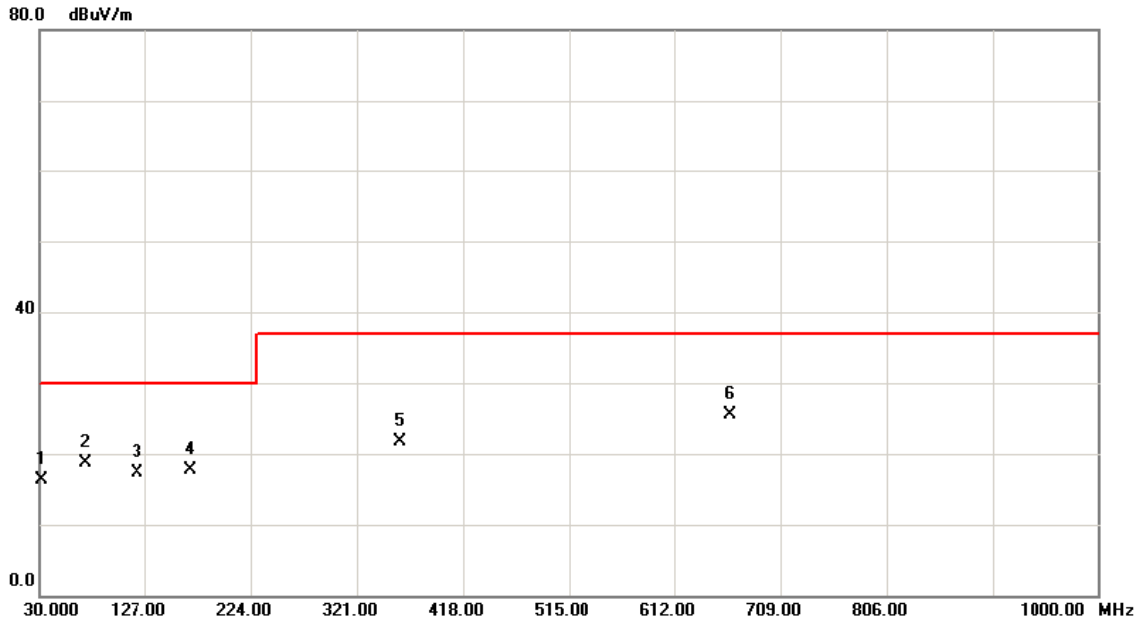


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Antenna Height cm	Table Degree	Comment
1		30.0000	24.73	-6.70	18.03	30.00	-11.97	QP	100	344
2	*	71.1200	32.77	-8.39	24.38	30.00	-5.62	QP	100	0
3		93.5800	32.82	-10.09	22.73	30.00	-7.27	QP	100	13
4		120.3800	21.79	-6.11	15.68	30.00	-14.32	QP	100	176
5		168.1400	25.77	-3.93	21.84	30.00	-8.16	QP	100	183
6		663.5900	24.56	3.65	28.21	37.00	-8.79	QP	100	172

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

Test Mode	Mode 1	Tested Date	2020/4/21
Test Voltage	AC 120V/60Hz	Polarization	Horizontal



No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV/m	Limit dBuV/m	Margin dB	Detector	Antenna Height cm	Table Degree	Comment
1	30.8100	23.18	-6.80	16.38	30.00	-13.62	QP	300	148	
2 *	71.0800	27.04	-8.38	18.66	30.00	-11.34	QP	300	265	
3	119.6400	23.52	-6.17	17.35	30.00	-12.65	QP	200	102	
4	168.4300	21.66	-3.93	17.73	30.00	-12.27	QP	200	166	
5	360.2800	24.75	-2.96	21.79	37.00	-15.21	QP	200	224	
6	661.7900	21.89	3.64	25.53	37.00	-11.47	QP	100	12	

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

4 TEST PHOTOS

AC power line conducted emissions test photos



Radiated emissions below 1 GHz test photos

5 EUT PHOTOS

Please refer to document Appendix No.: EP-2004T068-1 (APPENDIX-EUT PHOTOS).

End of Test Report