

FCC EMC Test Report

Report No. : BTL-FCCE-1-1912T032
Equipment : Gaming Mouse
Model Name : Light² 200
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 : 2019/12/24
Date of Test : 2019/12/24 ~ 2020/1/2
Issued Date : 2020/1/8

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.

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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.

CONTENTS

CONTENTS	3
REPORT ISSUED HISTORY	4
1 SUMMARY OF TEST RESULTS	5
1.1 TEST FACILITY	6
1.2 MEASUREMENT UNCERTAINTY	6
1.3 TEST ENVIRONMENT CONDITIONS	6
2 GENERAL INFORMATION	7
2.1 EUT INFORMATION	7
2.2 TEST MODES	8
2.3 EUT OPERATING CONDITION	8
2.4 TESTED CONFIGURATION DIAGRAM	9
2.5 SUPPORT UNITS	9
3 EMC EMISSION TEST	10
3.1 CONDUCTED EMISSIONS TEST	10
3.1.1 LIMITS	10
3.1.2 MEASUREMENT INSTRUMENTS LIST	10
3.1.3 TEST PROCEDURE	11
3.1.4 DEVIATION FROM TEST STANDARD	11
3.1.5 TEST SETUP	11
3.1.6 TEST RESULT	12
3.2 RADIATED EMISSIONS BELOW 1 GHZ TEST	14
3.2.1 LIMITS	14
3.2.2 MEASUREMENT INSTRUMENTS LIST	15
3.2.3 TEST PROCEDURE	15
3.2.4 DEVIATION FROM TEST STANDARD	15
3.2.5 TEST SETUP	15
3.2.6 TEST RESULT	16
4 TEST PHOTOS	18
5 EUT PHOTOS	20

REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	2020/1/8

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	24°C, 60%	Melky Chen
Radiated emissions below 1 GHz	25°C, 57%	Ken.Wang

2 GENERAL INFORMATION

2.1 EUT INFORMATION

Equipment	Gaming Mouse
Model Name	Light ² 200
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 ² 200
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:16000)

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 1	USB (DPI:400)

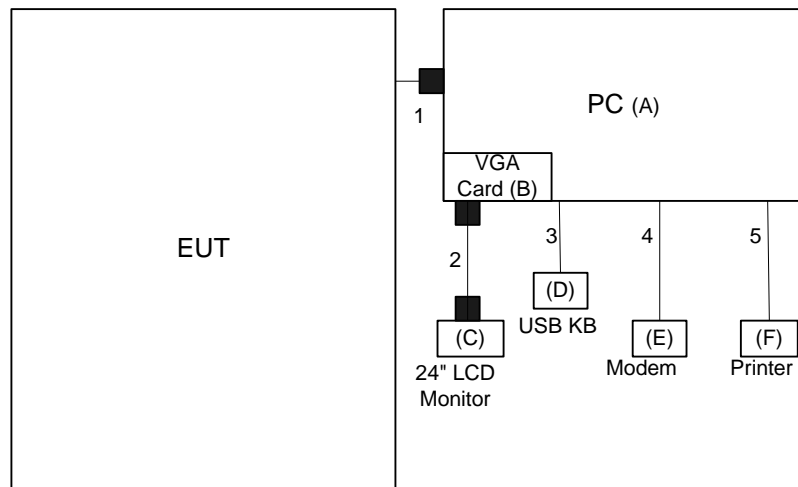
Radiated emissions below 1 GHz test	
Final Test Mode	Description
Mode 1	USB (DPI:400)

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	Supplied by test requester.
2	D-sub Cable	YES	YES	1.7m	Furnished by test lab.
3	USB Cable	YES	NO	1.7m	Furnished by test lab.
4	RS232 Cable	YES	NO	1.7m	Furnished by test lab.
5	USB Cable	YES	NO	1.7m	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	2019/12/24	2020/12/23
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.

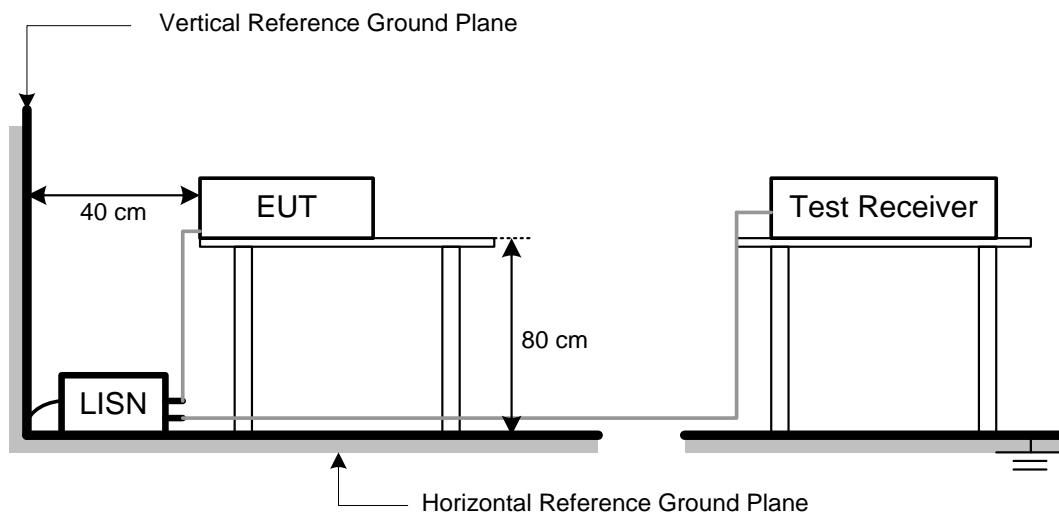
3.1.3 TEST PROCEDURE

- 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

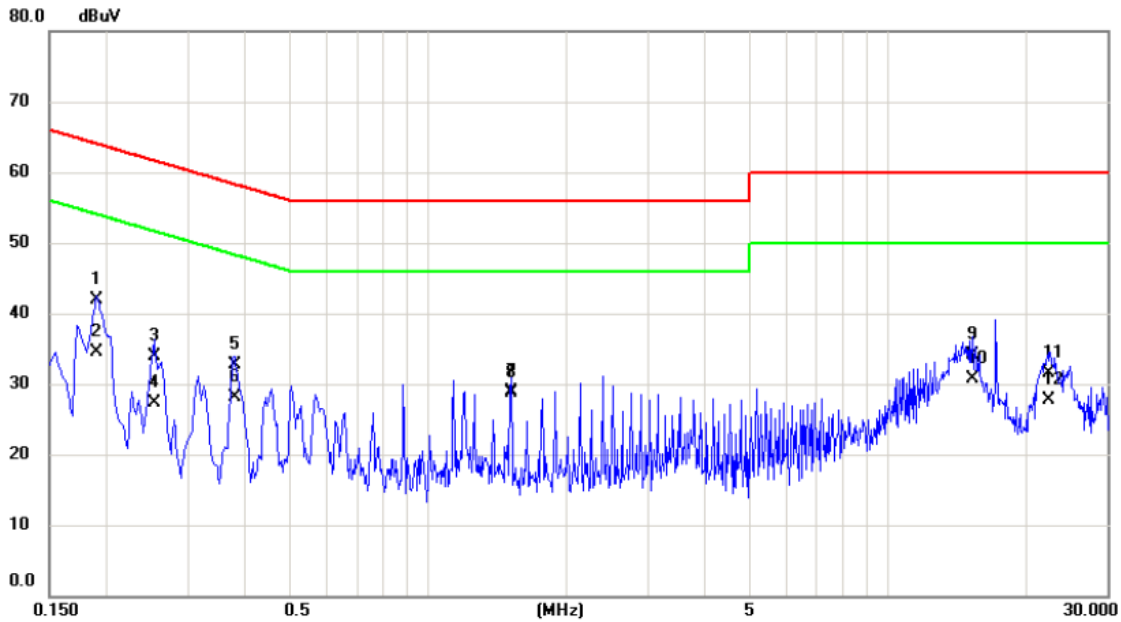
No deviation.

3.1.5 TEST SETUP



3.1.6 TEST RESULT

Test Mode	Mode 1	Tested Date	2019/12/27
Test Voltage	AC 120V/60Hz	Phase	Line

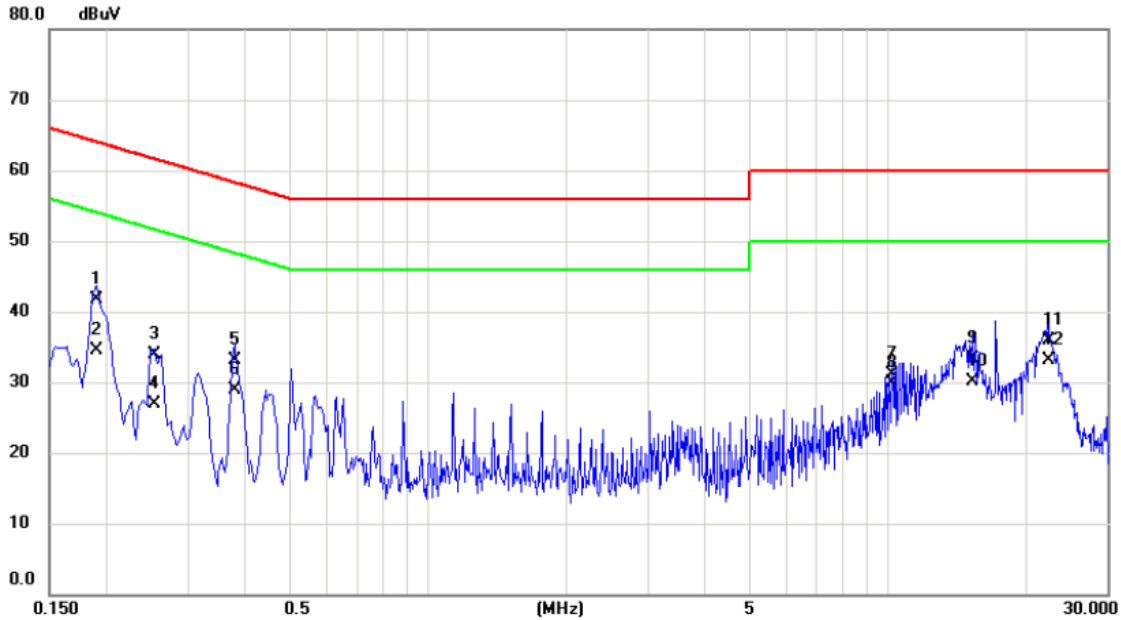


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1905	32.30	9.63	41.93	64.01	-22.08	QP	
2		0.1905	24.80	9.63	34.43	54.01	-19.58	AVG	
3		0.2535	24.30	9.64	33.94	61.64	-27.70	QP	
4		0.2535	17.70	9.64	27.34	51.64	-24.30	AVG	
5		0.3795	23.00	9.68	32.68	58.29	-25.61	QP	
6		0.3795	18.40	9.68	28.08	48.29	-20.21	AVG	
7		1.5135	19.30	9.65	28.95	56.00	-27.05	QP	
8	*	1.5135	19.00	9.65	28.65	46.00	-17.35	AVG	
9		15.2925	24.20	9.95	34.15	60.00	-25.85	QP	
10		15.2925	20.70	9.95	30.65	50.00	-19.35	AVG	
11		22.3125	21.50	9.98	31.48	60.00	-28.52	QP	
12		22.3125	17.80	9.98	27.78	50.00	-22.22	AVG	

REMARKS:

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

Test Mode	Mode 1	Tested Date	2019/12/27
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		0.1905	32.10	9.67	41.77	64.01	-22.24	QP	
2		0.1905	24.80	9.67	34.47	54.01	-19.54	AVG	
3		0.2535	24.30	9.66	33.96	61.64	-27.68	QP	
4		0.2535	17.20	9.66	26.86	51.64	-24.78	AVG	
5		0.3795	23.50	9.65	33.15	58.29	-25.14	QP	
6		0.3795	19.20	9.65	28.85	48.29	-19.44	AVG	
7		10.2120	21.20	9.90	31.10	60.00	-28.90	QP	
8		10.2120	20.10	9.90	30.00	50.00	-20.00	AVG	
9		15.2925	23.40	9.97	33.37	60.00	-26.63	QP	
10		15.2925	20.10	9.97	30.07	50.00	-19.93	AVG	
11		22.3170	25.80	10.01	35.81	60.00	-24.19	QP	
12	*	22.3170	23.00	10.01	33.01	50.00	-16.99	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	2019/9/26	2020/9/25
2	Pre-Amplifier	Anritsu	MH648A	M98457	2019/10/30	2020/10/29
3	Test Cable	TIMES	LMR-400	10M-OS01	2019/12/6	2020/12/5
4	Test Cable	EMCI	EMCCFD400-NM -NM-25000	171103	2019/12/6	2020/12/5
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.

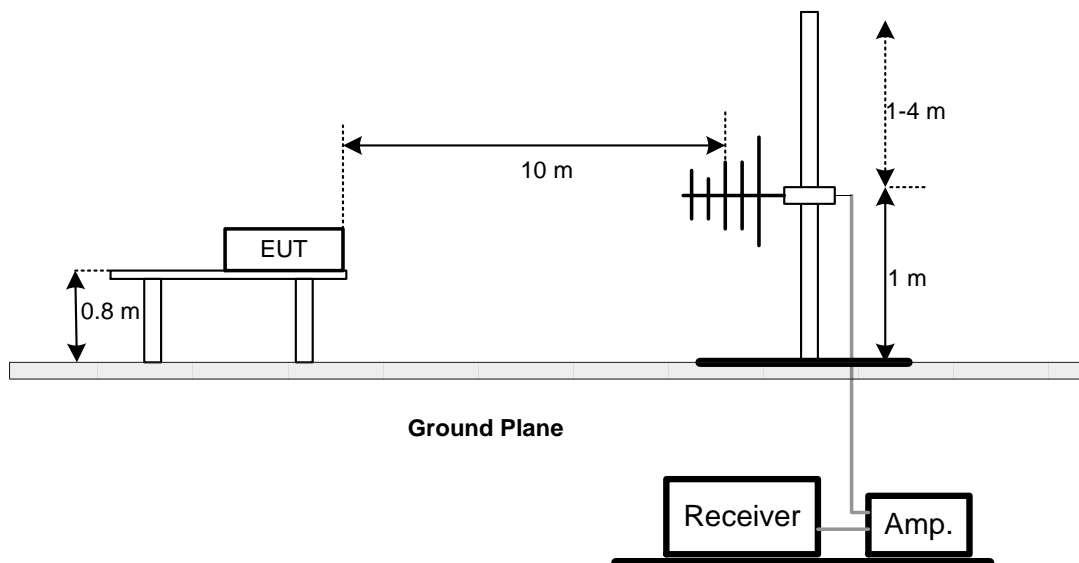
3.2.3 TEST PROCEDURE

- 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

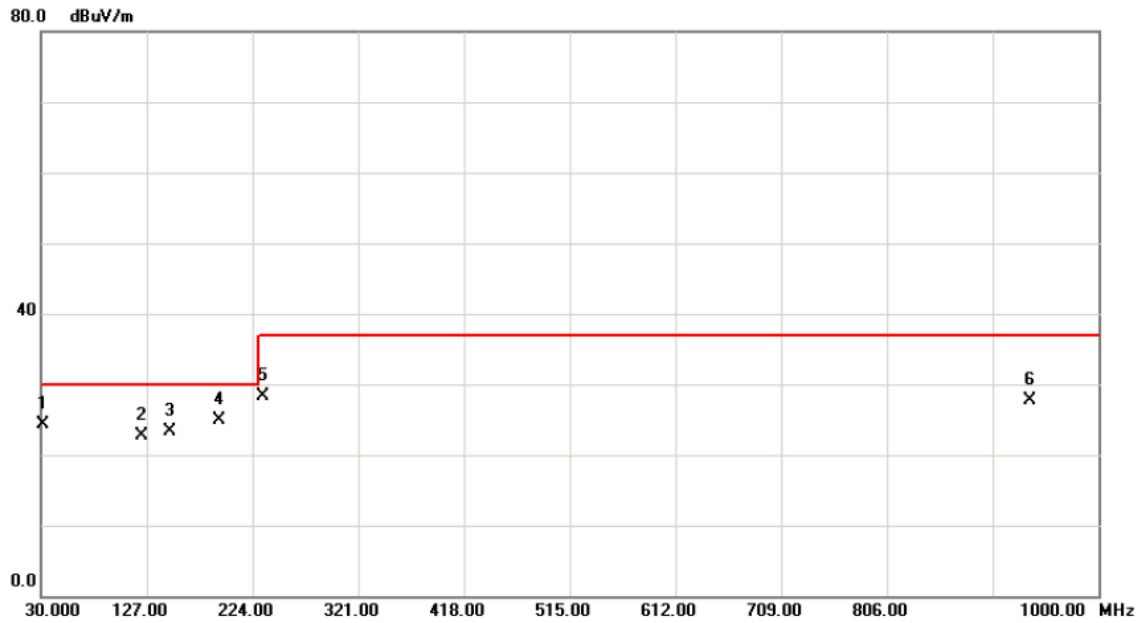
No deviation.

3.2.5 TEST SETUP



3.2.6 TEST RESULT

Test Mode	Mode 1	Tested Date	2019/12/27
Test Voltage	AC 120V/60Hz	Polarization	Vertical

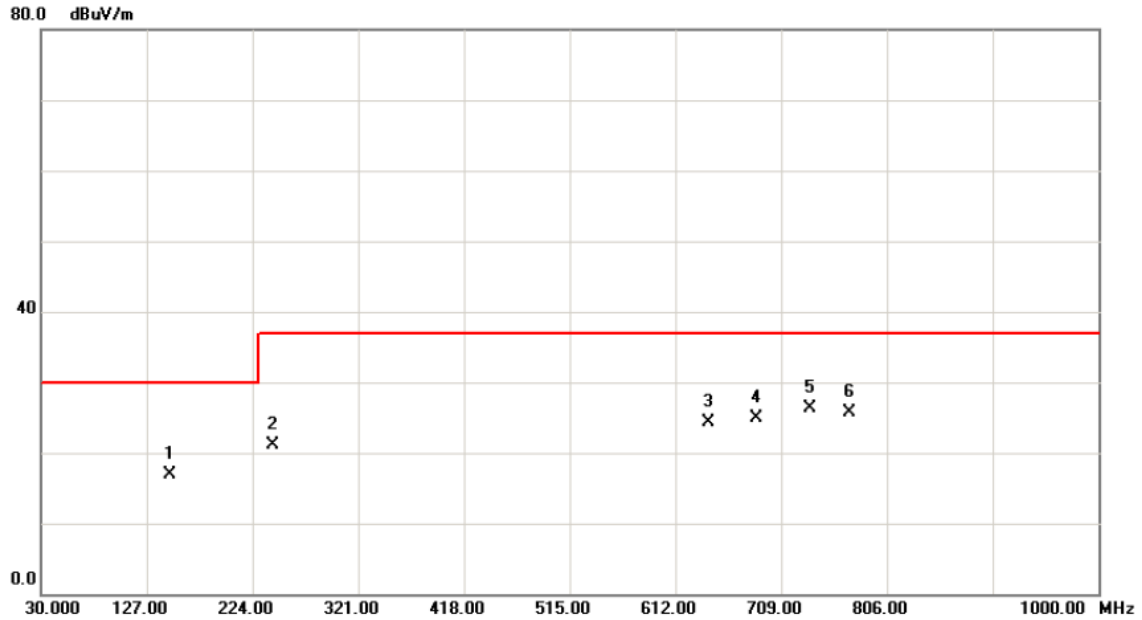


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Antenna Height cm	Table Degree	Comment
1		31.2500	30.02	-5.71	24.31	30.00	-5.69	QP	100	259	
2		122.0900	27.11	-4.38	22.73	30.00	-7.27	QP	100	308	
3		147.6500	26.54	-3.20	23.34	30.00	-6.66	QP	100	121	
4	*	192.3800	30.21	-5.39	24.82	30.00	-5.18	QP	100	332	
5		233.0100	33.00	-4.63	28.37	37.00	-8.63	QP	100	157	
6		936.5800	19.12	8.52	27.64	37.00	-9.36	QP	100	56	

REMARKS:

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

Test Mode	Mode 1	Tested Date	2019/12/27
Test Voltage	AC 120V/60Hz	Polarization	Horizontal



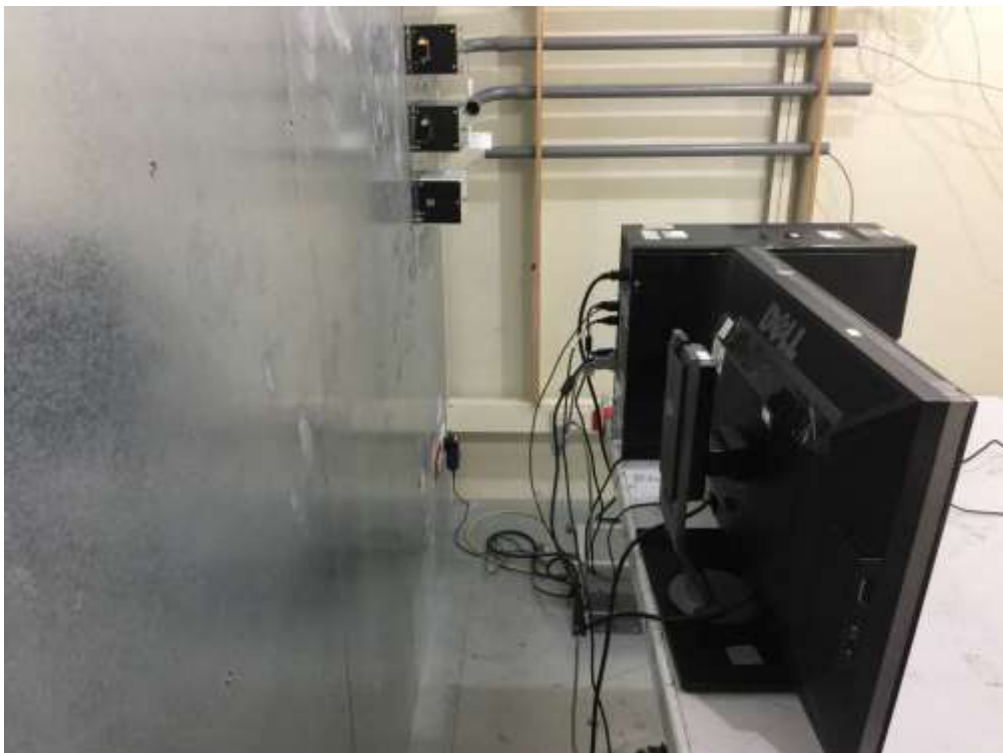
No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV/m	Limit dBuV/m	Margin dB	Antenna Height cm	Table Degree	Comment
1	147.7100	20.12	-3.20	16.92	30.00	-13.08	QP 400	288	
2	241.5200	25.16	-4.02	21.14	37.00	-15.86	QP 400	301	
3	641.1300	20.11	4.10	24.21	37.00	-12.79	QP 400	129	
4	685.2000	20.04	4.89	24.93	37.00	-12.07	QP 400	117	
5 *	735.1200	20.55	5.79	26.34	37.00	-10.66	QP 153	254	
6	771.2400	19.17	6.45	25.62	37.00	-11.38	QP 155	66	

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-1912T032-1 (APPENDIX-EUT PHOTOS).

End of Test Report