



FCC Test Report

Applicant : Shenzhen Lingmo Vision Technology Co., Ltd.

Address : Room 408, Building A2, Taoyuan Plaza, Taoyuan
Street, Nanshan District, Shenzhen City.

Product Name : Car mood light

Report Date : 10. 18, 2023

Shenzhen Tian Hai Test Technology Co., Ltd.



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TEST REPORT

Applicant : Shenzhen Lingmo Vision Technology Co., Ltd.
Manufacturer : Shenzhen Lingmo Vision Technology Co., Ltd.
Product Name : Car mood light
Model No. : Xtra-pulse55/25
Trade Mark : /
Rating(s) : DC 9-16V

Test Standard(s) : FCC Part15 Subpart C, Paragraph 15.249
Test Method(s) : ANSI C63.10: 2020

The device described above is tested by Shenzhen Tian Hai Test Technology Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Tian Hai Test Technology Co., Ltd. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Tian Hai Test Technology Co., Ltd..

Date of Receipt : 10. 18, 2023
Date of Test : 09. 07~10. 18, 2023

Tested by

Sunny. Zhuo

(Sunny Zhuo)

Reviewed by

Blue Hu

(Blue Hu)

Approved & Authorized Signer

Binglee

(Binglee)



Revision History

Report Version	Description	Issued Date
R00	Original Issue.	08. 05, 2021



1. General Information

1.1. Client Information

Applicant	:	Shenzhen Lingmo Vision Technology Co., Ltd.
Address	:	Room 408, Building A2, Taoyuan Plaza, Taoyuan Street, Nanshan District, Shenzhen City.
Manufacturer	:	Shenzhen Lingmo Vision Technology Co., Ltd.
Address	:	Room 408, Building A2, Taoyuan Plaza, Taoyuan Street, Nanshan District, Shenzhen City.
Factory	:	Shenzhen Lingmo Vision Technology Co., Ltd.
Address	:	Room 408, Building A2, Taoyuan Plaza, Taoyuan Street, Nanshan District, Shenzhen City.

1.2. Description of Device (EUT)

Product Name	:	Car mood light
Model No.	:	Xtra-pulse55/25
Trade Mark	:	/
Test Power Supply	:	DC 9-16V
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	/

RF Specification

Operation Frequency	:	2402~2480MHz
Number of Channel	:	40 Channels
Modulation Type	:	GFSK
Antenna Type	:	PCB antenna
Antenna Gain(Peak)	:	-0.72 dBi (Provided by customer)

Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



1.3. Auxiliary Equipment Used During Test

Description	Rating(s)
/	/

1.4. Description of Test Configuration

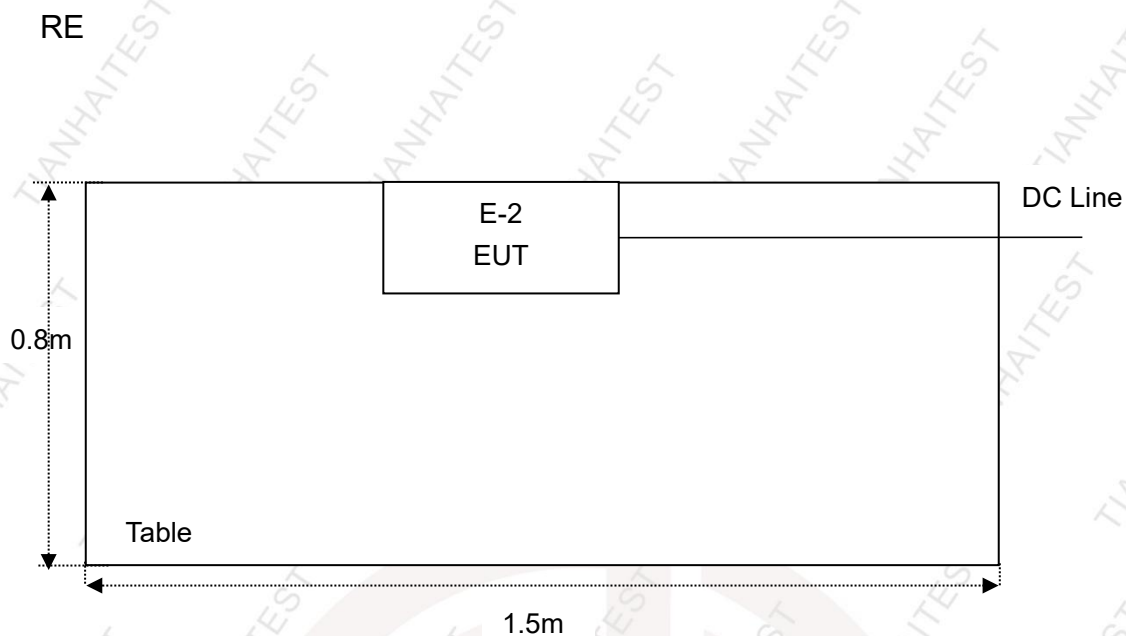
00	2402	09	2420	18	2438	27	2456	36	2474
01	2404	10	2422	19	2440	28	2458	37	2476
02	2406	11	2424	20	2442	29	2460	38	2478
03	2408	12	2426	21	2444	30	2462	39	2480
04	2410	13	2428	22	2446	31	2464		
05	2412	14	2430	23	2448	32	2466		
06	2414	15	2432	24	2450	33	2468		
07	2416	16	2434	25	2452	34	2470		
08	2418	17	2436	26	2454	35	2472		

Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT was tested with Channel 0, 19 and 39.



1.5. Description of Test Setup





1.6. Test Equipment List

Conducted Emission				
Kind of Equipment	Manufacturer	Type	S/N	Calibrate until
EMI Test Receiver	R&S	ESR7	102333	2023-11-13
L.I.S.N	Schwarzbeck	NNLK 8128	5089	2023-11-13
8-Wire ISN CAT6	Schwarzbeck	NTFM 8158	231	2023-11-13
Pulse Limiter	Schwarzbeck	VTSD 9561-F	847	2023-11-13
Test software	FALA	/	EMC-CON 3A1.1	/
Radiated Emission (3m)				
EMI Test Receiver	R&S	ESR7	102333	2023-11-13
MXA Signal Analyzer	Keysight	N9020A	MY51281805	2024-04-20
Bilog Antenna	Schwarzbeck	VULB 9168	01148	2023-11-20
Pre-Amplifier	Schwarzbeck	BBV 9718 B	00109	2023-11-13
Pre-Amplifier	Schwarzbeck	BBV 9743 B	00253	2023-11-13
Pre-Amplifier	GUANGGU ELECTRONIC	GLNA18-40GK-5 372	20210331001	2023-11-13
Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00148	2023-11-13
Horn Antenna	Schwarzbeck	BBHA 9120	02379	2023-11-20
Horn Antenna	A-INFO	LB-180400-KF	J258792	2023-11-20
Test software	FALA	/	FA-03A2 RE	/
RF Test System				
Wideband radio communication tester	R&S	CMW500	131134	2023-11-13
EXA Signal Analyzer	Keysight	N9010A	MY54488841	2024-04-20
MXG Vector Signal Generator	Agilent	N5182B	MY59100603	2024-04-20
Signal Generator	R&S	SMB100A	113650	2024-04-20
RF control unit	Tonscend	JS0806-2	21C8060397	/
DC Power supply	Agilent	E3632A	MY50120052	/
RF test system	Tonscend	/	V2.6.88.0346	/



1.7. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 6.3 dB
Conduction Uncertainty	:	Uc = 3.8 dB

(1) Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus.

(2) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

(3) The measurement uncertainty is not included in the test result.

1.8. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 6827.01

Shenzhen Tian Hai Test Technology Co., Ltd, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 6827.01

Test Location

Shenzhen Tian Hai Test Technology Co., Ltd.

125-126, No.66, Zhangge Road, Zhangge Community, Fucheng Street, Longhua District, Shenzhen, Guangdong, China

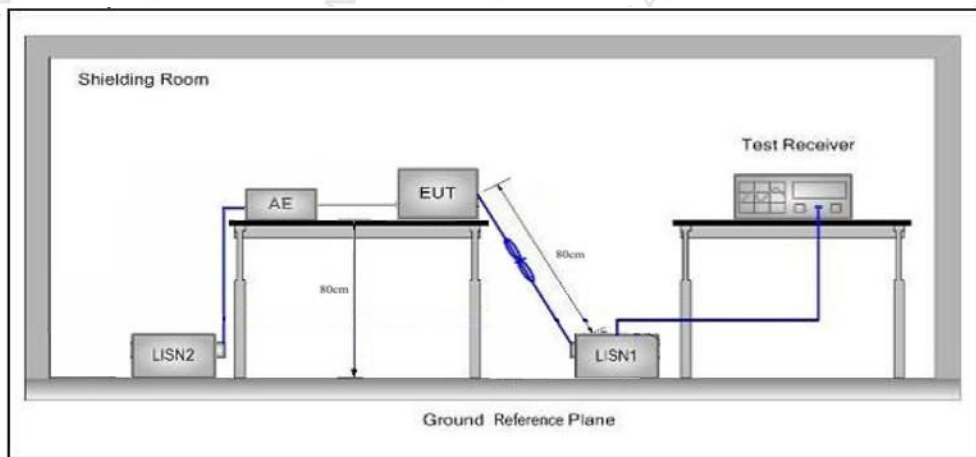


2. Summary of Test Results

Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.205/15.209/15.249	Radiated Emission	PASS
15.249(d)	Band Edge	PASS
15.215(c)	20dB Bandwidth	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

3.1. Test Standard and Limit

3.2. Test Setup



The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2020 on Conducted Emission Measurement.

The frequency range from 150kHz to 30MHz is checked.

The EUT is powered by batteries during actual use, and this project is not applicable



4. Radiated Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209 and 15.205				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Test Standard	FCC Part15 C Section 15.249					
Test Limit	Frequency (MHz)	Field Strength of fundamental ((millivolts /meter)	Field Strength of Harmonics (microvolts/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	2400~2483.5	50	-	114.0	Peak	3
	2400~2483.5	50	-	94.0	Average	3
	2400~2483.5	-	500	74.0	Peak	3
	2400~2483.5	-	500	54.0	Average	3

Remark:

(1) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.



4.2. Test Setup

Figure 1. Below 30MHz

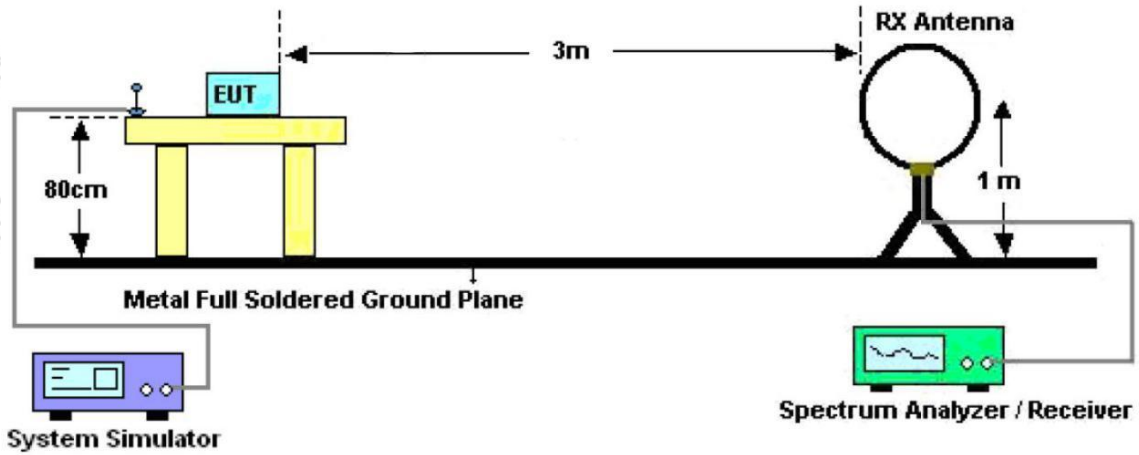


Figure 2. 30MHz to 1GHz

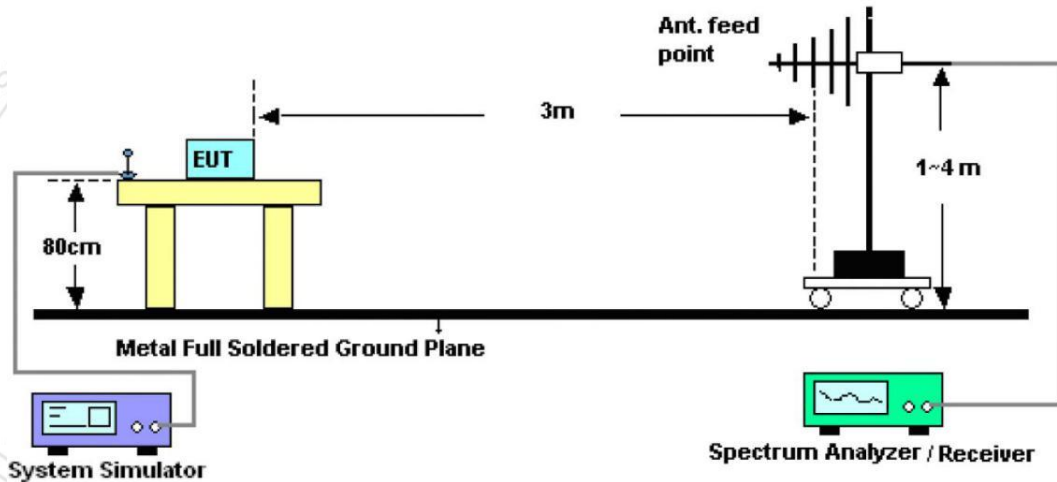
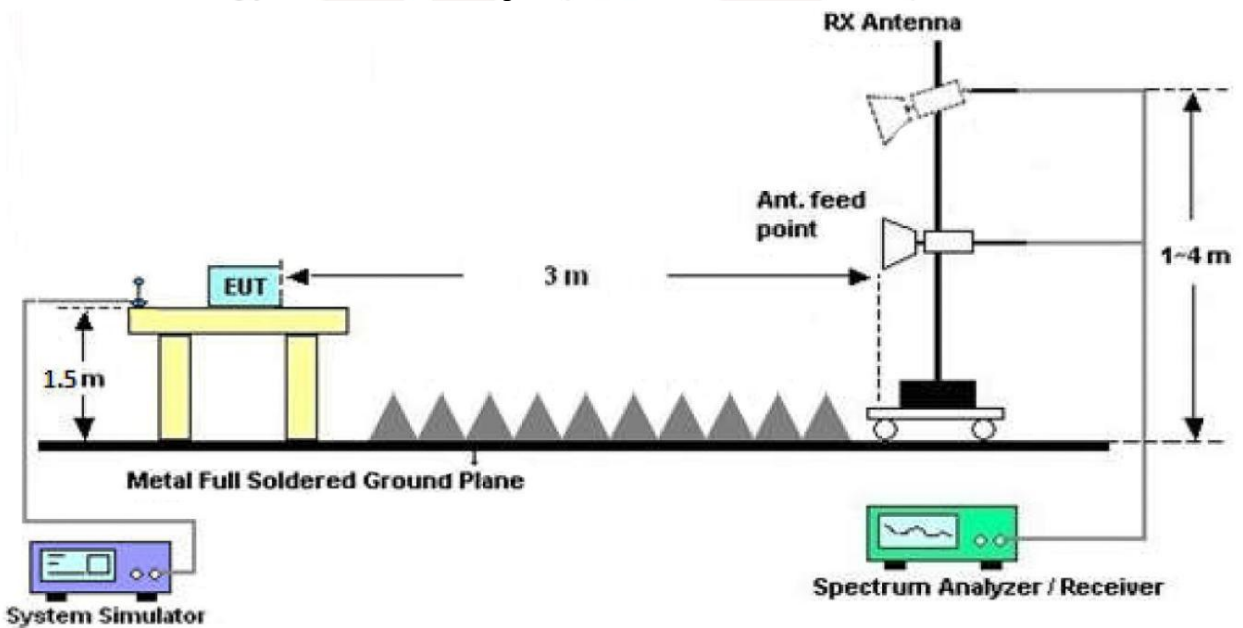


Figure 3. Above 1 GHz





4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW =300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz,Set the spectrum analyzer as:

RBW =1MHz, VBW =1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW =1MHz, VBW =10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, pre-scan all the modes, and found the Low CH (2402MHz) which is the worst case, only the worst case is recorded in the report.



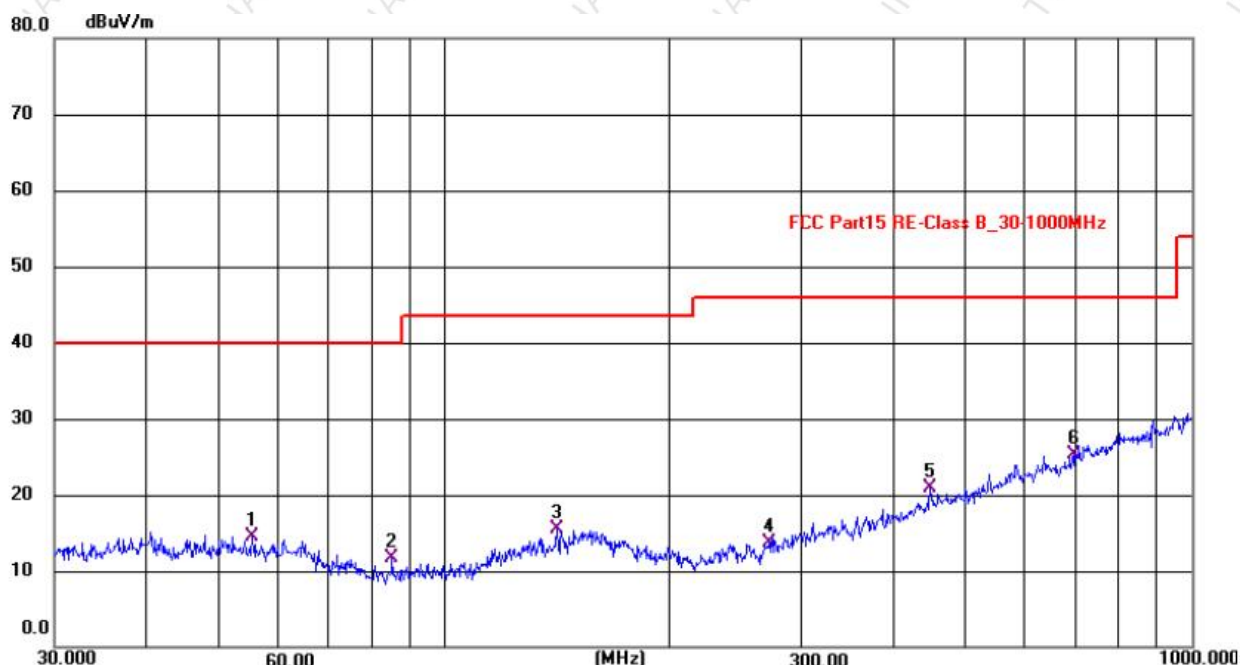
Test Results (30~1000MHz)

Test Mode: Low CH (2402MHz)

Power Source: DC 12V

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°C/50%RH



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	55.3176	29.88	-15.29	14.59	40.00	-25.41	QP
2	85.2980	31.31	-19.66	11.65	40.00	-28.35	QP
3	141.3298	31.24	-15.68	15.56	43.50	-27.94	QP
4	272.7553	29.79	-16.03	13.76	46.00	-32.24	QP
5	447.9822	32.03	-11.12	20.91	46.00	-25.09	QP
6 *	696.8567	31.83	-6.46	25.37	46.00	-20.63	QP

Remark:

Margin = Limit – Level, Correct Factor = Cable lose + LISN insertion loss, Level= Reading + Correct factor



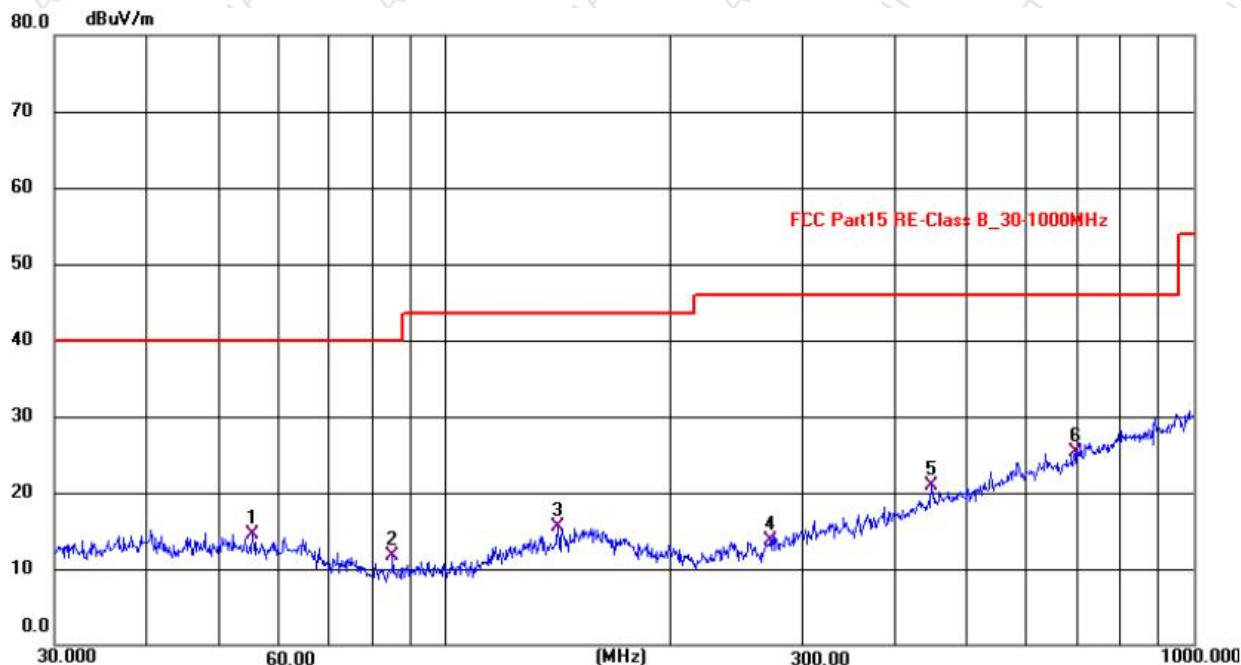
Test Results (30~1000MHz)

Test Mode: Low CH (2402MHz)

Power Source: DC 12V

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°C/50%RH



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	55.3176	29.88	-15.29	14.59	40.00	-25.41	QP
2	85.2980	31.31	-19.66	11.65	40.00	-28.35	QP
3	141.3298	31.24	-15.68	15.56	43.50	-27.94	QP
4	272.7553	29.79	-16.03	13.76	46.00	-32.24	QP
5	447.9822	32.03	-11.12	20.91	46.00	-25.09	QP
6 *	696.8567	31.83	-6.46	25.37	46.00	-20.63	QP

Remark:

Margin = Limit – Level, Correct Factor = Cable lose + LISN insertion loss, Level= Reading + Correct factor



Test Results (1GHz-25GHz)

Test channel: Lowest

Peak value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
2402.00	76.32	25.84	102.16	114.00	-11.84	Vertical
4804.00	44.11	14.69	58.80	74.00	-15.20	Vertical
7206.00	46.58	15.41	61.99	74.00	-12.01	Vertical
9608.00	43.28	15.29	58.57	74.00	-15.43	Vertical
12010.00	*			74.00		Vertical
14412.00	*			74.00		Vertical
2402.00	77.10	25.84	102.94	114.00	-11.06	Horizontal
4804.00	43.01	14.69	57.70	74.00	-16.30	Horizontal
7206.00	45.27	15.41	60.68	74.00	-13.32	Horizontal
9608.00	42.18	15.29	57.47	74.00	-16.53	Horizontal
12010.00	*			74.00		Horizontal
14412.00	*			74.00		Horizontal

Average value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
2402.00	62.31	23.94	86.25	94.00	-7.75	Vertical
4804.00	38.61	7.88	46.49	54.00	-7.51	Vertical
7206.00	35.14	8.15	43.29	54.00	-10.71	Vertical
9608.00	36.22	7.31	43.53	54.00	-10.47	Vertical
12010.00	*			54.00		Vertical
14412.00	*			54.00		Vertical
2402.00	59.33	23.94	83.27	94.00	-10.73	Horizontal
4804.00	36.99	7.88	44.87	54.00	-9.13	Horizontal
7206.00	36.21	8.15	44.36	54.00	-9.64	Horizontal
9608.00	35.27	7.31	42.58	54.00	-11.42	Horizontal
12010.00	*			54.00		Horizontal
14412.00	*			54.00		Horizontal

Remark:

1.Result =Reading + Factor

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.



Test Results (1GHz-25GHz)

Test channel: Middle

Peak value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
2440.00	76.51	25.84	102.35	114.00	-11.65	Vertical
4880.00	44.11	14.69	58.80	74.00	-15.20	Vertical
7320.00	40.32	15.41	55.73	74.00	-18.27	Vertical
9760.00	41.19	15.29	56.48	74.00	-17.52	Vertical
12200.00	*			74.00		Vertical
14640.00	*			74.00		Vertical
2440.00	75.32	25.84	101.16	114.00	-12.84	Horizontal
4880.00	43.21	14.69	57.90	74.00	-16.10	Horizontal
7320.00	42.15	15.41	57.56	74.00	-16.44	Horizontal
9760.00	42.36	15.29	57.65	74.00	-16.35	Horizontal
12200.00	*			74.00		Horizontal
14640.00	*			74.00		Horizontal

Average value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
2440.00	60.12	23.94	84.06	94.00	-9.94	Vertical
4880.00	36.87	7.88	44.75	54.00	-9.25	Vertical
7320.00	37.19	8.15	45.34	54.00	-8.66	Vertical
9760.00	36.14	7.31	43.45	54.00	-10.55	Vertical
12200.00	*			54.00		Vertical
14640.00	*			54.00		Vertical
2440.00	60.39	23.94	84.33	94.00	-9.67	Horizontal
4880.00	36.14	7.88	44.02	54.00	-9.98	Horizontal
7320.00	34.58	8.15	42.73	54.00	-11.27	Horizontal
9760.00	36.20	7.31	43.51	54.00	-10.49	Horizontal
12200.00	*			54.00		Horizontal
14640.00	*			54.00		Horizontal

Remark:

1.Result =Reading + Factor

2. “*” means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.



Test Results (1GHz-25GHz)

Test channel: Highest

Peak value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
2480.00	77.89	25.84	103.73	114.00	-10.27	Vertical
4960.00	44.11	14.69	58.80	74.00	-15.20	Vertical
7440.00	42.56	15.41	57.97	74.00	-16.03	Vertical
9920.00	43.31	15.29	58.60	74.00	-15.40	Vertical
12400.00	*			74.00		Vertical
14880.00	*			74.00		Vertical
2480.00	76.66	25.84	102.50	114.00	-11.50	Horizontal
4960.00	43.23	14.69	57.92	74.00	-16.08	Horizontal
7440.00	44.11	15.41	59.52	74.00	-14.48	Horizontal
9920.00	46.32	15.29	61.61	74.00	-12.39	Horizontal
12400.00	*			74.00		Horizontal
14880.00	*			74.00		Horizontal

Average value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
2480.00	60.32	23.94	84.26	94.00	-9.74	Vertical
4960.00	38.14	7.88	46.02	54.00	-7.98	Vertical
7440.00	35.11	8.15	43.26	54.00	-10.74	Vertical
9920.00	32.19	7.31	39.50	54.00	-14.50	Vertical
12400.00	*			54.00		Vertical
14880.00	*			54.00		Vertical
2480.00	62.13	23.94	86.07	94.00	-7.93	Horizontal
4960.00	37.15	7.88	45.03	54.00	-8.97	Horizontal
7440.00	36.24	8.15	44.39	54.00	-9.61	Horizontal
9920.00	30.25	7.31	37.56	54.00	-16.44	Horizontal
12400.00	*			54.00		Horizontal
14880.00	*			54.00		Horizontal

Remark:

1.Result =Reading + Factor

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.



Radiated Band Edge:

Test channel: Lowest							
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Antenna Pol.	Detector
2390.00	50.33	10.38	60.71	74.00	-13.29	H	Peak
2400.00	50.13	10.41	60.54	74.00	-13.46	V	Peak
2390.00	32.15	6.98	39.13	54.00	-14.87	H	AVG
2400.00	33.25	7.59	40.84	54.00	-13.16	V	AVG
Test channel: Highest							
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Antenna Pol.	Detector
2483.50	49.74	10.2	59.94	74.00	-14.06	H	Peak
2500.00	51.23	11.05	62.28	74.00	-11.72	V	Peak
2483.50	34.26	7.45	41.71	54.00	-12.29	H	AVG
2500.00	36.21	7.71	43.92	54.00	-10.08	V	AVG

Remark:

1. Level =Reading+ Factor

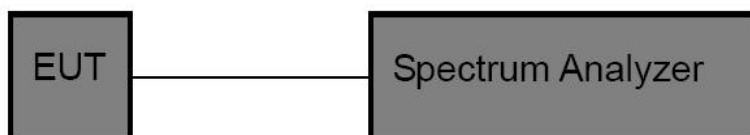


5. 20dB Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.215(c)
Test Limit	N/A

5.2. Test Setup



5.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
RBW = 43kHz, VBW $\geq$ 3*RBW =130kHz,
Detector= Average
Trace mode= Max hold.
Sweep- auto couple.
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

5.4. 5.4. Test Data

Test Item	: 20dB Bandwidth	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 12V	Temperature	: 24.2℃
Test Result	: PASS	Humidity	: 39%RH

Channel	Bandwidth (MHz)	Result
Low	1.093	PASS
Middle	1.095	PASS
High	1.094	PASS



Low Channel



Mid Channel



High Channel



6. Antenna Requirement

6.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
Requirement	1) 15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

6.2. Antenna Connected Construction

The antenna is a PCB Antenna which permanently attached, and the best case gain of the antenna is -0.72 dBi. It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

----- End of Report -----