

FCC TEST REPORT

Client Name : Saya Life Inc

Address : 525 S Hewitt Street, Los Angeles, California, 90013,
United States

Product Name : LoRa Gateway

Date : May 11, 2022

Shenzhen Anbotech Compliance Laboratory Limited



Contents

1. General Information	4
1.1. Client Information	4
1.2. Description of Device (EUT)	4
1.3. Auxiliary Equipment Used During Test	5
1.4. Description of Test Modes	5
1.5. List of Channels	5
1.6. Description of Test Setup	6
1.7. Test Equipment List	7
1.8. Measurement Uncertainty	8
1.9. Description of Test Facility	8
2. Summary of Test Results	9
3. Conducted Emission Test	10
3.1. Test Standard and Limit	10
3.2. Test Setup	10
3.3. Test Procedure	10
3.4. Test Data	11
4. Radiated Emission and Band Edge	13
4.1. Test Standard and Limit	13
4.2. Test Setup	14
4.3. Test Procedure	15
4.4. Test Data	15
5. 20dB Bandwidth Test	20
5.1. Test Standard and Limit	20
5.2. Test Setup	20
5.3. Test Procedure	20
5.4. Test Data	20
6. Antenna Requirement	22
6.1. Test Standard and Requirement	22
6.2. Antenna Connected Construction	22
APPENDIX I -- TEST SETUP PHOTOGRAPH	23
APPENDIX II -- EXTERNAL PHOTOGRAPH	25
APPENDIX III -- INTERNAL PHOTOGRAPH	28



TEST REPORT

Applicant : Saya Life Inc
Manufacturer : Tera Engineering
Product Name : LoRa Gateway
Model No. : SAYA-GW-LI915-C
Trade Mark : 
Rating(s) : Input: DC 5V, 2A

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 Anbotech Compliance Laboratory Limited 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 Anbotech Compliance Laboratory Limited 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 Anbotech Compliance Laboratory Limited.

Date of Receipt

Mar. 17, 2021

Date of Test

Mar. 17, 2021~Apr. 06, 2022

Prepared by

Nian xiu Chen

(Nianxiu Chen)

Approved & Authorized Signer

Kingkong Jin

(Kingkong Jin)

1. General Information

1.1. Client Information

Applicant	:	Saya Life Inc
Address	:	525 S Hewitt Street, Los Angeles, California, 90013, United States
Manufacturer	:	Tera Engineering
Address	:	758 N Batavia St i, Orange, CA 92868
Factory	:	Tera Engineering
Address	:	758 N Batavia St i, Orange, CA 92868

1.2. Description of Device (EUT)

Product Name	:	LoRa Gateway
Model No.	:	SAYA-GW-LI915-C
Trade Mark	:	
Test Power Supply	:	AC 120V, 60Hz for Adapter
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Product Description	Operation Frequency:	915MHZ
	Number of Channel:	1 Channel
	Antenna Type:	SMA Mount External Whip Antenna
	Modulation Type:	LoRa Chirp Spread Spectrum
	Antenna Gain(Peak):	3dBi (Provided by customer)
	Adapter:	N/A
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

Adapter	:	Model: XSG-0504000HUS Input: 100-240V~50/60Hz Output: DC 5V, 4A
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1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	CH01

For Conducted Emission	
Final Test Mode	Description
Mode 1	CH01

For Radiated Emission	
Final Test Mode	Description
Mode 1	CH01

Note:

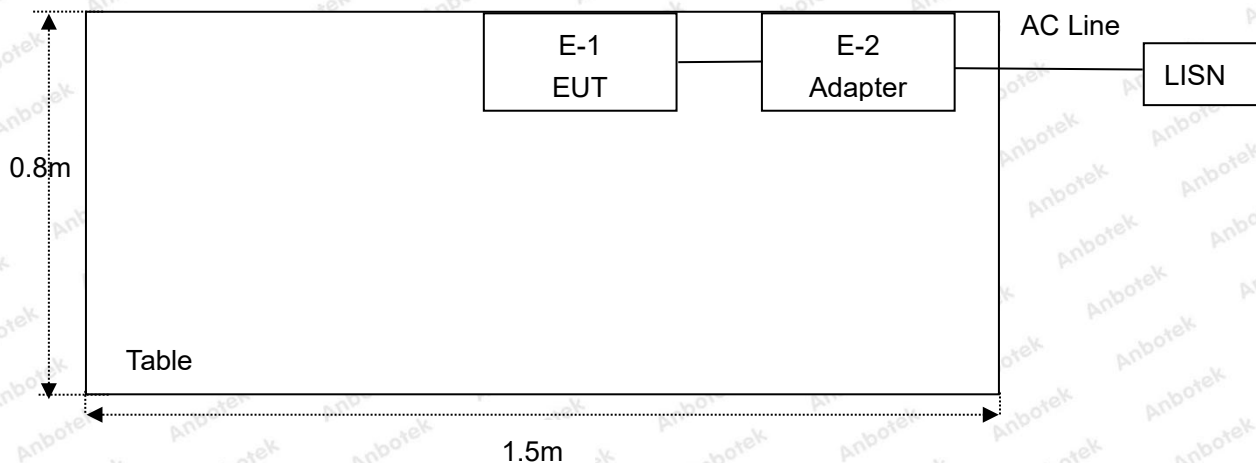
1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

1.5. List of Channels

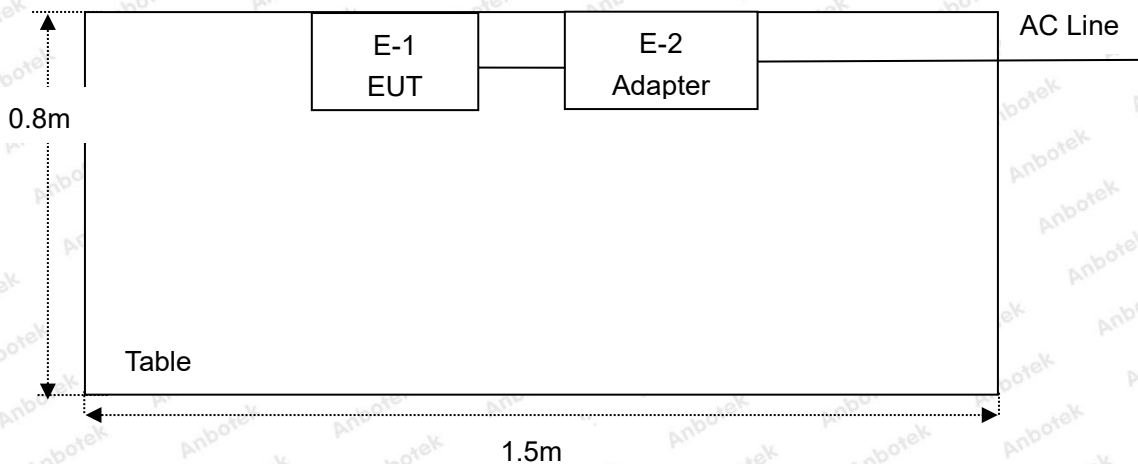
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	915	/	/	/	/	/	/
/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/

1.6. Description of Test Setup

CE



RE



1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul 05, 2021	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 22, 2021	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 22, 2021	1 Year
4.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 22, 2021	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 22, 2021	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Oct. 22, 2021	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Oct. 22, 2021	2 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Oct. 22, 2021	2 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 22, 2021	2 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Oct. 22, 2021	2 Year
11.	Pre-amplifier	SONOMA	310N	186860	Oct. 22, 2021	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	RF Test Control System	YIHENG	YH3000	2017430	Oct. 22, 2021	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Oct. 22, 2021	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Oct. 22, 2021	1 Year
16.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 22, 2021	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 22, 2021	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 22, 2021	1 Year
19.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2021	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Oct. 22, 2021	1 Year

1.8. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
	:	Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.9. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotech Compliance Laboratory Limited, 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. 184111.

ISED-Registration No.: 8058A

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotech Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China. 518102



2. Summary of Test Results

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



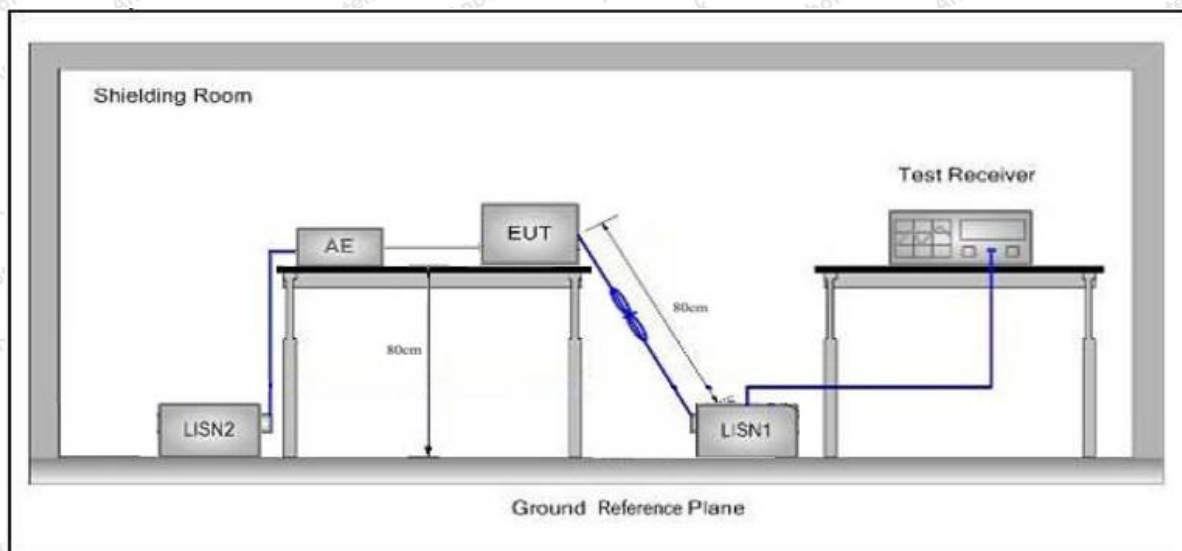
3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50

Remark: (1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequency.

3.2. Test Setup



3.3. Test Procedure

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 bandwidth of test receiver (ESCI) set at 9kHz.

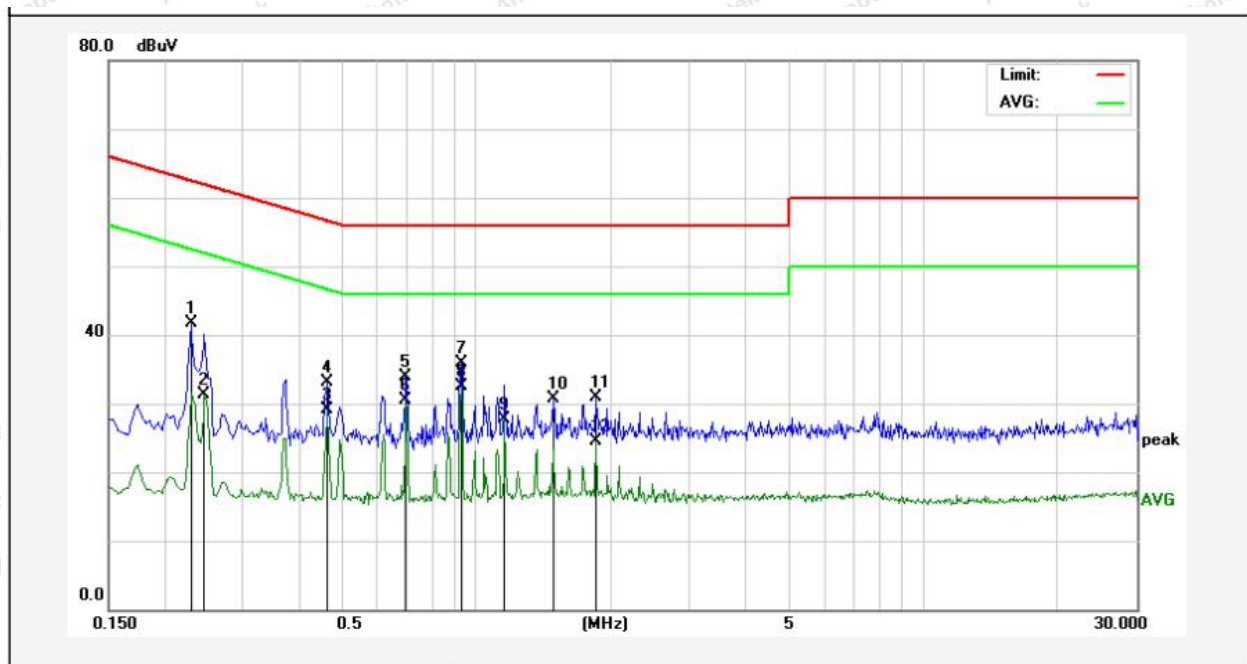
The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

PASS

Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: CH01
Test Specification: AC 120V, 60Hz for Adapter
Comment: Live Line
Tem.: 21.6°C Hum.: 50%

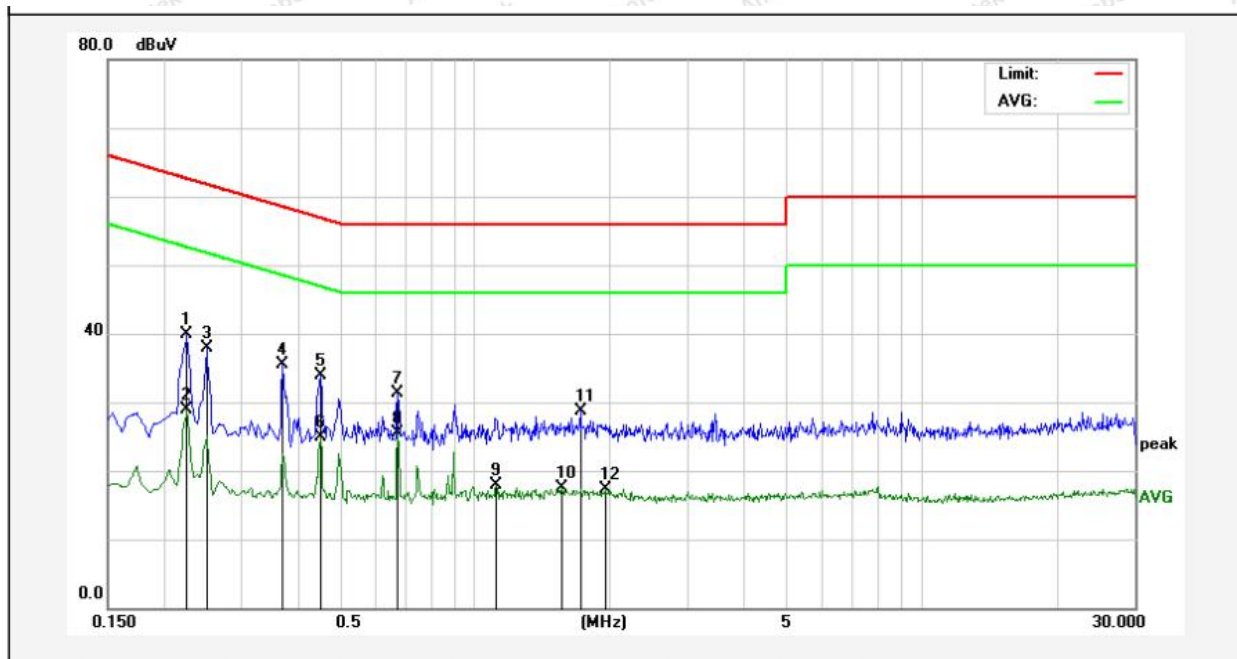


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.2300	21.90	19.89	41.79	62.45	-20.66	QP	
2	0.2460	11.49	19.89	31.38	51.89	-20.51	AVG	
3	0.4620	9.23	19.96	29.19	46.66	-17.47	AVG	
4	0.4660	13.15	19.96	33.11	56.58	-23.47	QP	
5	0.6940	13.92	20.04	33.96	56.00	-22.04	QP	
6	0.6940	10.44	20.04	30.48	46.00	-15.52	AVG	
7	0.9260	15.90	20.10	36.00	56.00	-20.00	QP	
8	0.9260	12.35	20.10	32.45	46.00	-13.55	AVG	
9	1.1580	7.57	20.12	27.69	46.00	-18.31	AVG	
10	1.4860	10.63	20.13	30.76	56.00	-25.24	QP	
11	1.8540	10.81	20.14	30.95	56.00	-25.05	QP	
12	1.8540	4.32	20.14	24.46	46.00	-21.54	AVG	



Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: CH01
Test Specification: AC 120V, 60Hz for Adapter
Comment: Neutral Line
Tem.: 21.6°C Hum.: 50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.2260	20.02	19.89	39.91	62.59	-22.68	QP	
2	0.2260	9.00	19.89	28.89	52.59	-23.70	AVG	
3	0.2500	17.96	19.89	37.85	61.75	-23.90	QP	
4	0.3700	15.55	19.92	35.47	58.50	-23.03	QP	
5	0.4500	13.94	19.96	33.90	56.87	-22.97	QP	
6	0.4500	4.91	19.96	24.87	46.87	-22.00	AVG	
7	0.6700	11.18	20.03	31.21	56.00	-24.79	QP	
8	0.6700	5.51	20.03	25.54	46.00	-20.46	AVG	
9	1.1140	-2.17	20.12	17.95	46.00	-28.05	AVG	
10	1.5620	-2.65	20.13	17.48	46.00	-28.52	AVG	
11	1.7220	8.61	20.13	28.74	56.00	-27.26	QP	
12	1.9580	-2.76	20.14	17.38	46.00	-28.62	AVG	



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)
	902~928	50	-	94.0	QP	3
	902~928	-	500	74.0	Peak	3
	902~928	-	500	54.0	Average	3
	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

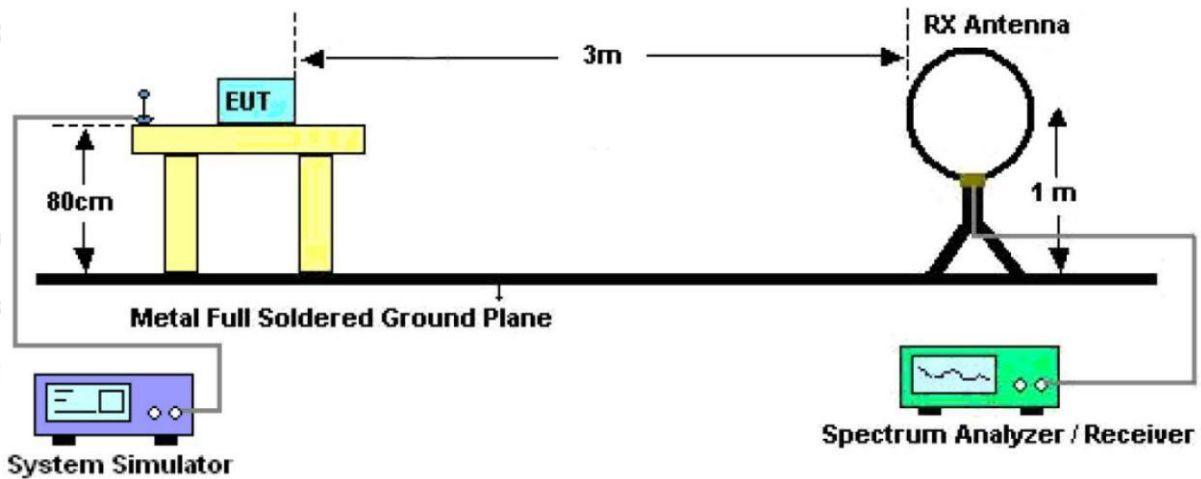


Figure 2. 30MHz to 1GHz

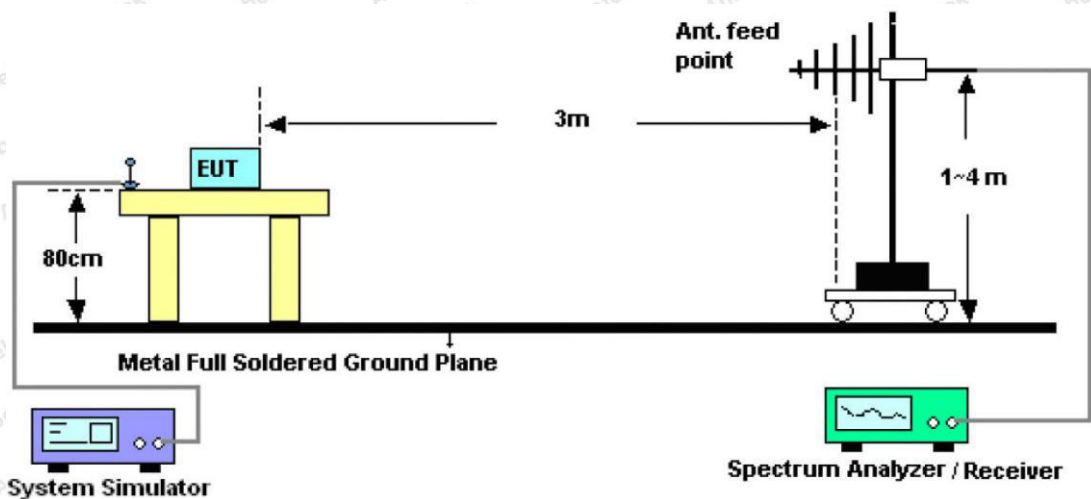
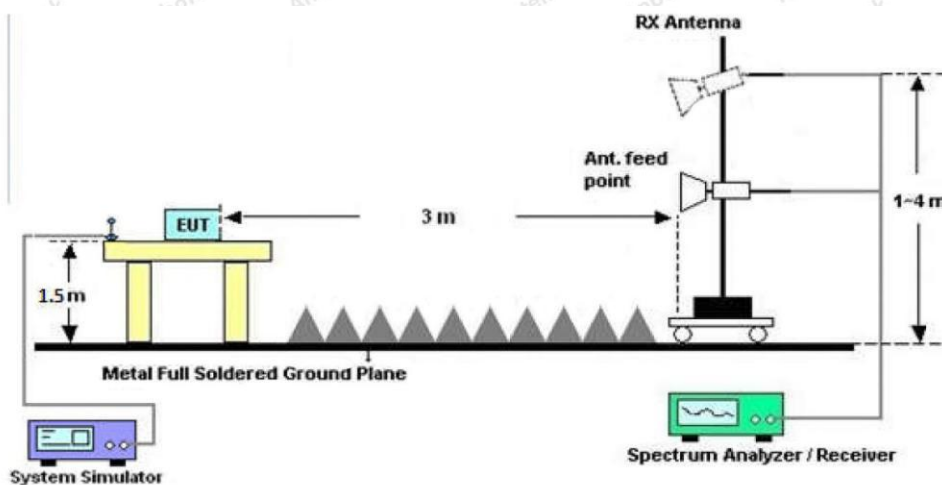


Figure 3. Above 1 GHz



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

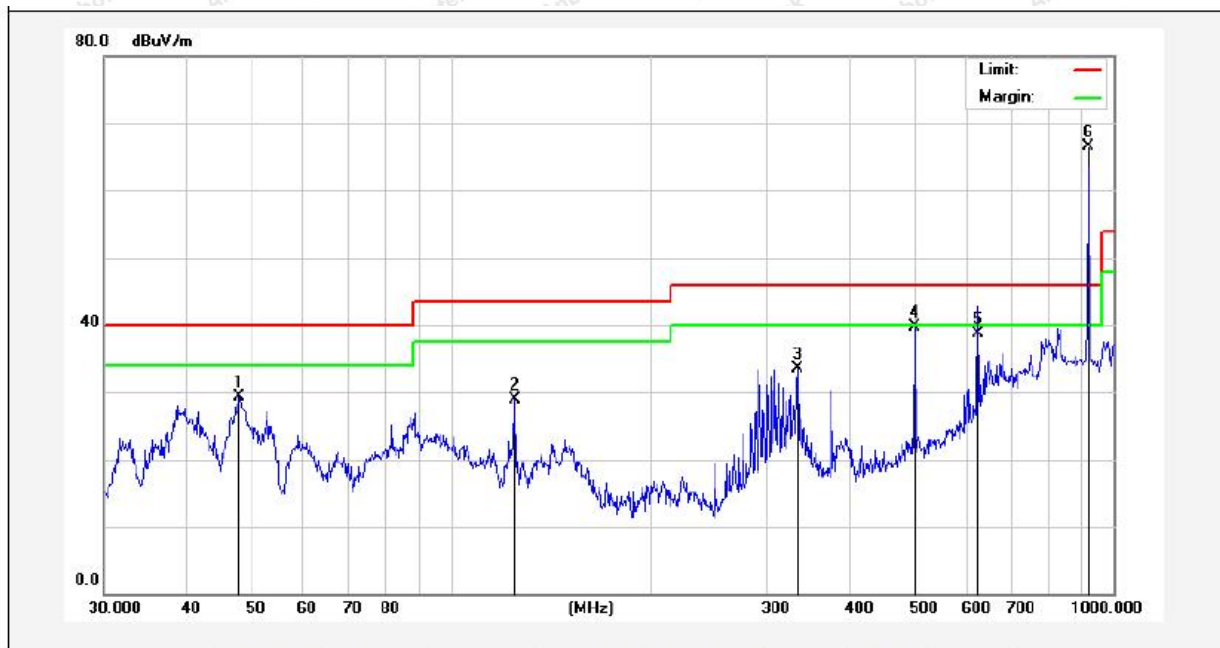
During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

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



Test Results (30~1000MHz)

Test Mode: CH01
Power Source: AC 120V, 60Hz for Adapter
Polarization: Vertical
Temp.(°C)/Hum.(%RH): 23.1°C/50%RH

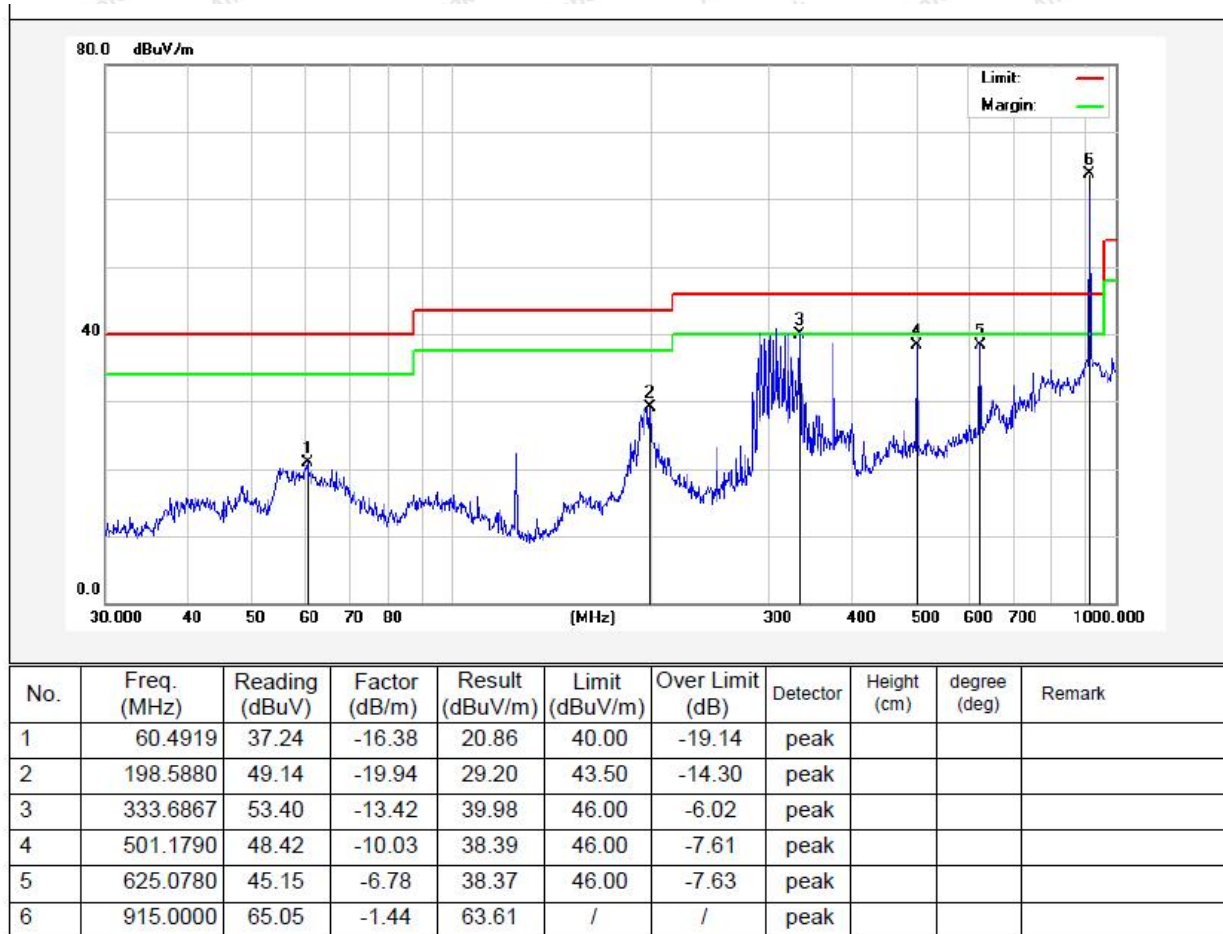


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	47.9940	43.84	-14.55	29.29	40.00	-10.71	peak			
2	125.0066	47.48	-18.66	28.82	43.50	-14.68	peak			
3	333.6867	45.88	-12.46	33.42	46.00	-12.58	peak			
4	501.1790	48.30	-8.53	39.77	46.00	-6.23	peak			
5	625.0780	45.45	-6.78	38.67	46.00	-7.33	QP	100	360	
6	915.0000	67.86	-1.44	66.42	/	/	peak			



Test Results (30~1000MHz)

Test Mode: CH01
Power Source: AC 120V, 60Hz for Adapter
Polarization: Horizontal
Temp.(°C)/Hum.(%RH): 23.1°C/50%RH



Fundamental

Frequency (MHz)	Antenna Pol.	Reading (dBuV/m)	Factor (dB)	Results (dBuV/m)	Limits (dBuV/m)	Det. Mode
915	H	73.89	-3.71	70.18	94	QP
915	V	76.78	-3.71	73.07	94	QP

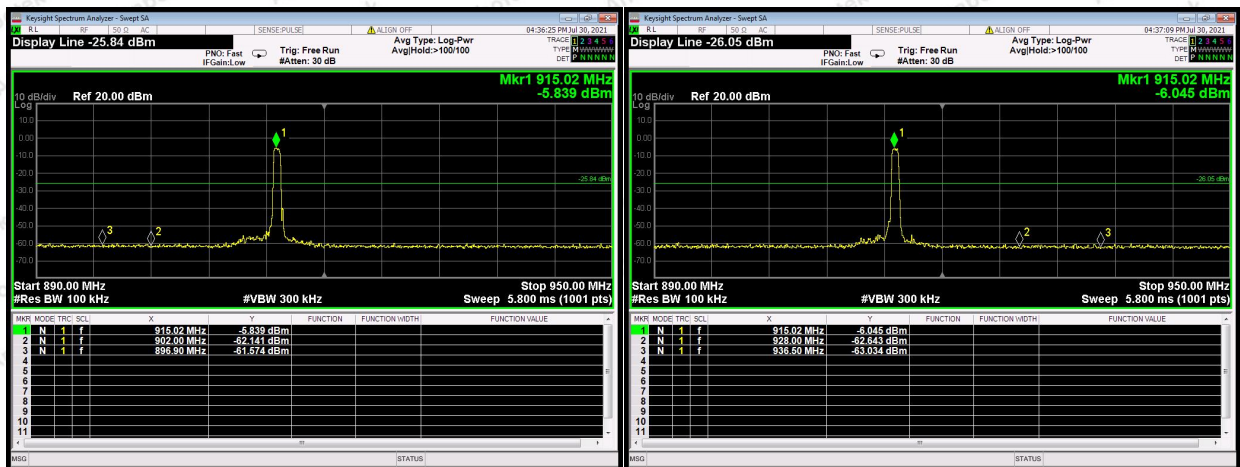
Test Results (1GHz-25GHz)

Test Mode: 915MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Detector
1830.0000	50.43	7.39	28.73	26.31	60.24	74	-13.76	H	Peak
1830.0000	39.52	7.39	28.73	26.31	49.33	54	-4.67	H	AVG
2745.0000	47.84	8.10	29.71	27.01	58.64	74	-15.36	H	Peak
2745.0000	37.61	8.10	29.71	27.01	48.41	54	-5.59	H	AVG
3660.0000	--	--	--	--	--	--	--	H	Peak
3660.0000	--	--	--	--	--	--	--	H	AVG
1830.0000	44.88	7.39	28.73	26.31	54.69	74	-19.31	V	Peak
1830.0000	37.71	7.39	28.73	26.31	47.52	54	-6.48	V	AVG
2745.0000	45.93	8.10	29.71	27.01	56.73	74	-17.27	V	Peak
2745.0000	37.99	8.10	29.71	27.01	48.79	54	-5.21	V	AVG
3660.0000	--	--	--	--	--	--	--	V	Peak
3660.0000	--	--	--	--	--	--	--	V	AVG

Note:

1. Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier 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:

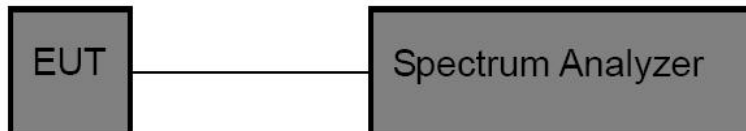


5. 20dB Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.249
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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 = 30kHz, VBW $\geq$ 3*RBW =100kHz,
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. Test Data

Test Item : 20dB Bandwidth

Test Voltage : AC 120V, 60Hz for Adapter

Test Result : PASS

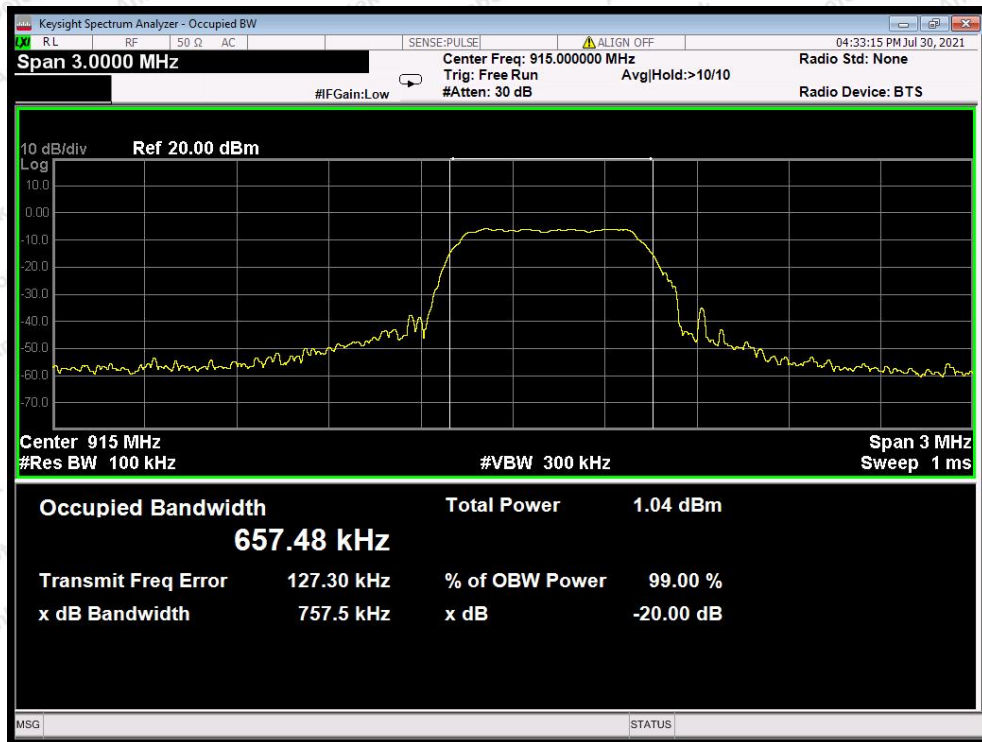
Test Mode : Mode 1

Temperature : 22.4℃

Humidity : 55%RH

Frequency (MHz)	Bandwidth (kHz)	Result
915	757.5	PASS





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 SMA Mount External Whip Antenna which permanently attached, and the best case gain of the antenna is 3 dBi. It complies with the standard requirement.



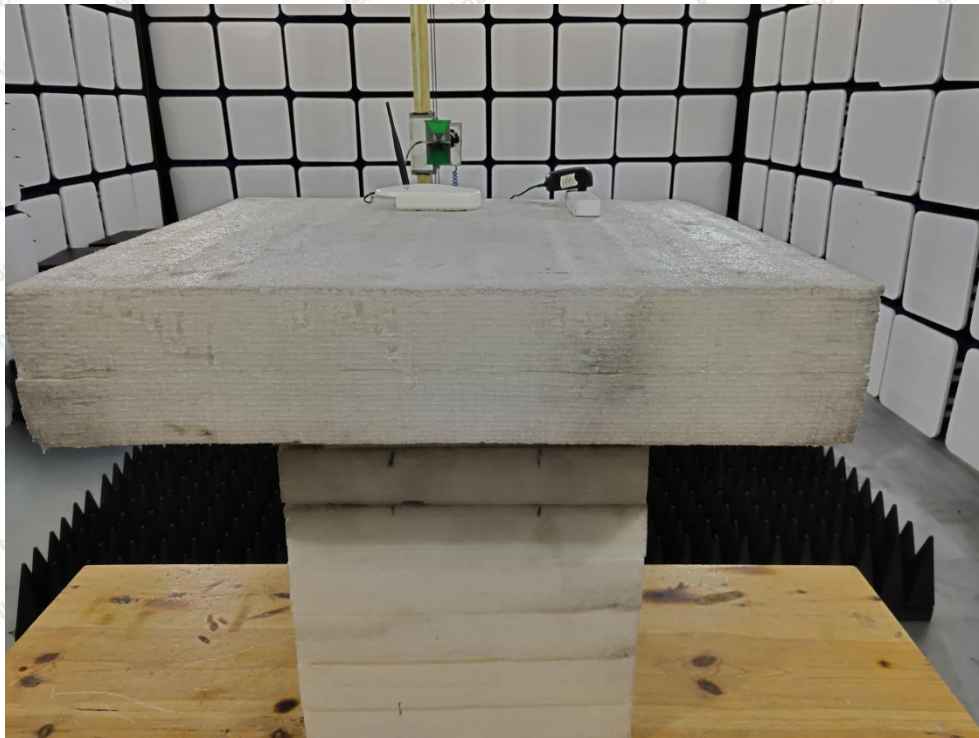
APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Power Line Conducted Emission Test



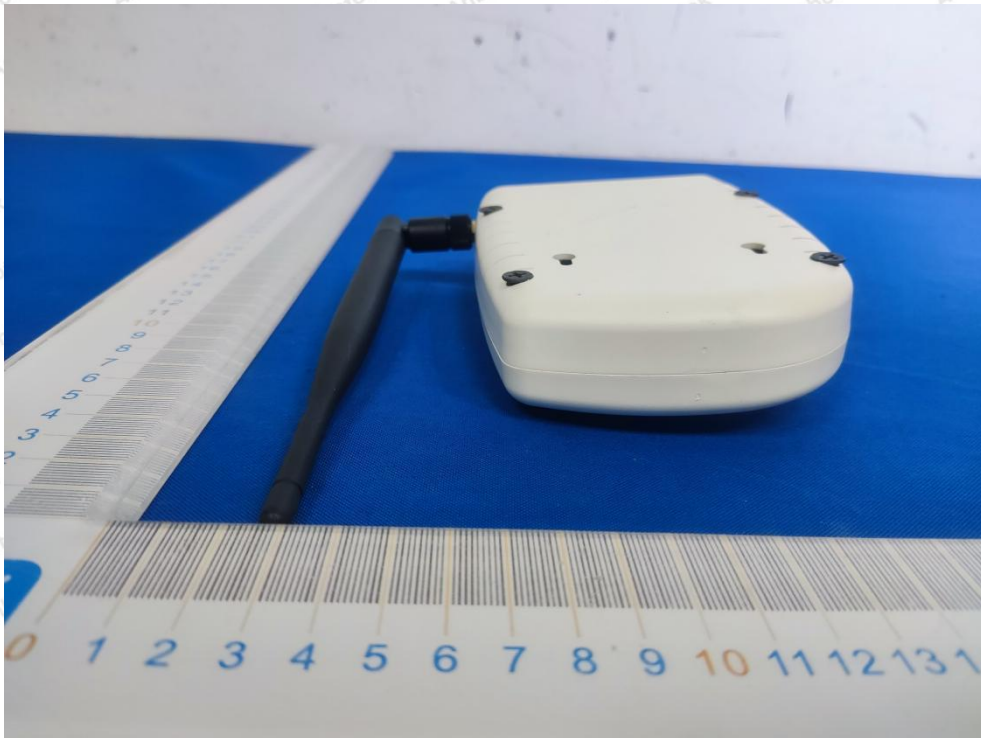
Photo of Radiation Emission Test





APPENDIX II -- EXTERNAL PHOTOGRAPH

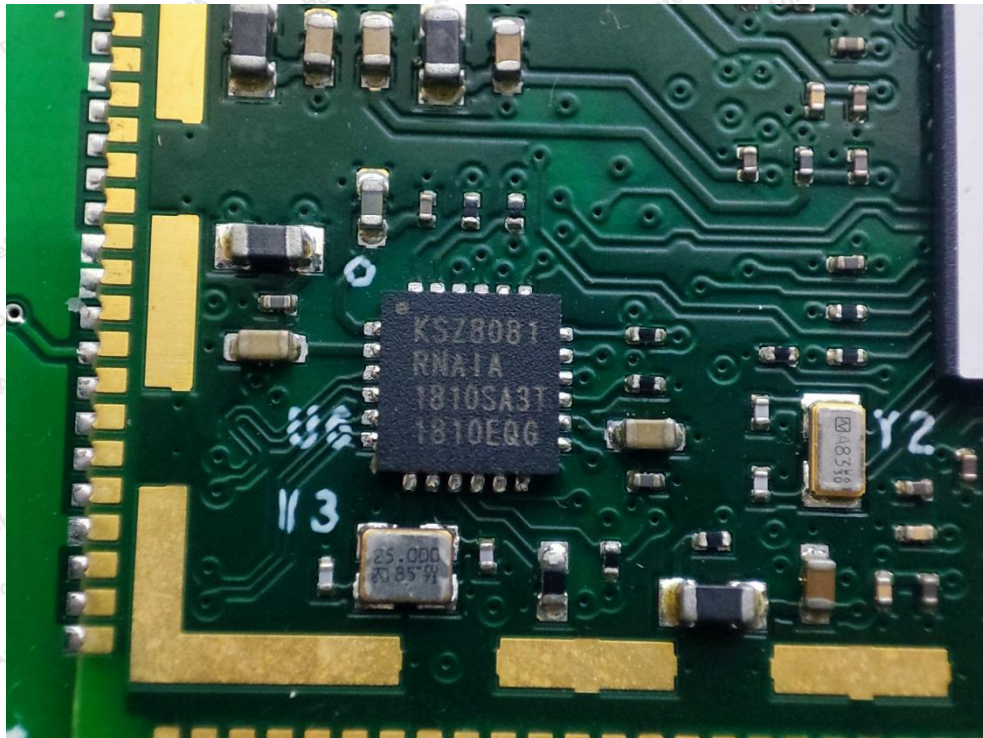
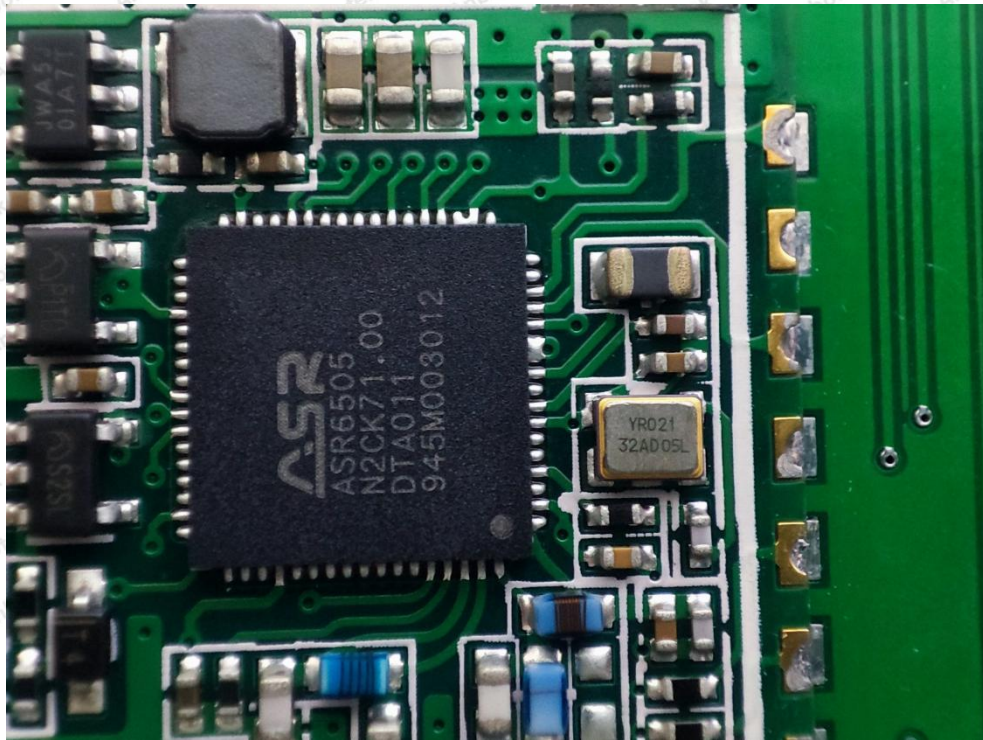


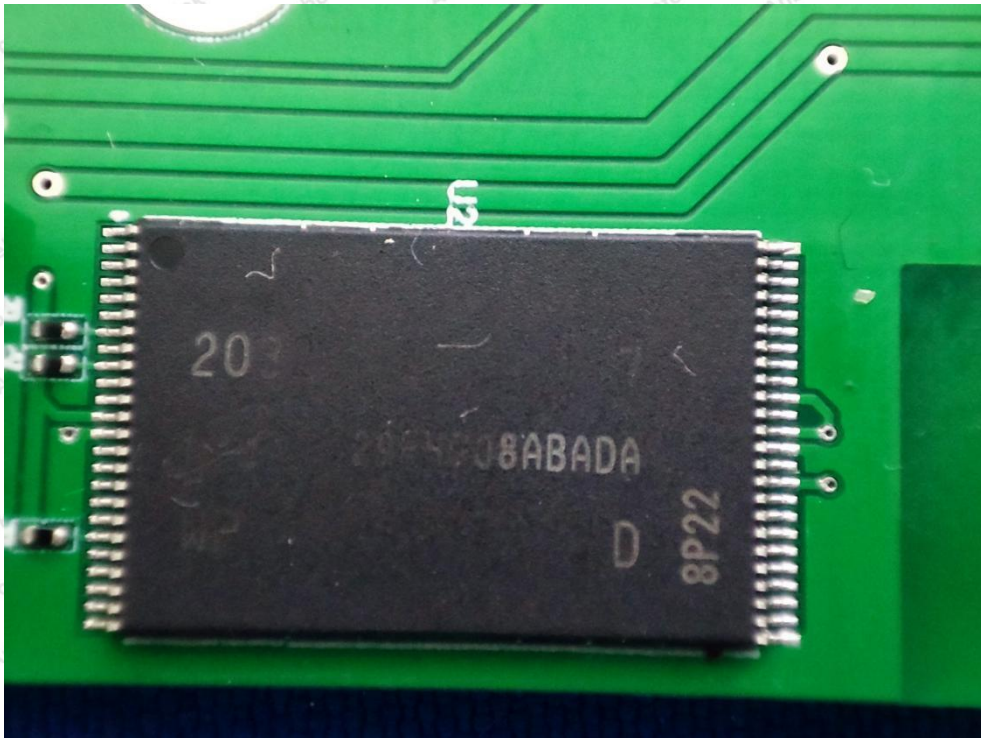
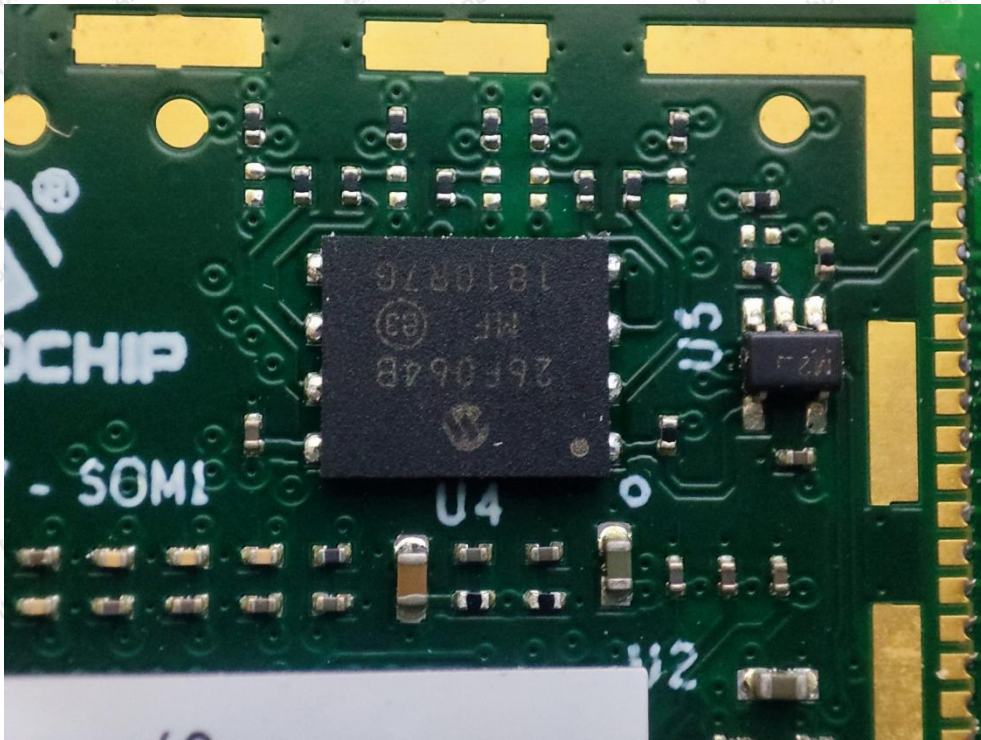


APPENDIX III -- INTERNAL PHOTOGRAPH









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

