

# FCC Test Report

**Client Name** : Seeed Technology Co., Ltd.

**Client Address** : 9F, G3 Building, TCL International E City,  
Zhongshanyuan Road, Nanshan District,  
Shenzhen, 518055, China

**Product Name** : WM1302 LoRaWAN Gateway Module(SPI) –  
US915

**Report Date** : Sept. 09, 2022

**Shenzhen Anbotek Compliance Laboratory Limited**



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# TEST REPORT

Applicant : Seeed Technology Co., Ltd.  
Manufacturer : Seeed Technology Co., Ltd.  
Product Name : WM1302 LoRaWAN Gateway Module(SPI) – US915  
Model No. : WM1302-SPI-US915, WM1302-SPI-US915-J, WM1302-SPI-US915-M  
Trade Mark : Seeed Studio  
Rating(s) : Input: DC 3.3V/420mA

**Test Standard(s) : FCC Part15 Subpart C, Section 15.247**

**Test Method(s) : ANSI C63.10: 2020**

The device described above is tested by Shenzhen Anbotek 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 Anbotek 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 Anbotek Compliance Laboratory Limited.

Date of receipt

Jul. 28, 2022

Date of Test

Jul. 28~Aug. 12, 2022

Prepared by

Nian Xiu Chen

(Nianxiu Chen)

Approved & Authorized Signer

Kingkong Jin

(Kingkong Jin)





## Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Jul. 19, 2021
R01	Reference Note 1	Sept. 09, 2022

## Note 1:

This is a Class II application which was based on the original report 18220WC10157402. The difference between the original device and current one described as following:

1. Add ESD protection diode substitute of Antenna.
2. Add the PA substitute material.
3. Changing a few parts of Layout.
4. Add 3dbi sucker antenna.
5. Deleting components related to SX1262 on BOM which have not actived on function.
6. Changing the model to "WM1302-SPI-US915, WM1302-SPI-US915-J, WM1302-SPI-US915-M".
7. Update external photograph and internal photograph.

The changes are not related with the other RF parameters, only conducted emission and spurious emission were retested.



## 1. General Information

### 1.1. Client Information

Applicant	:	Seeed Technology Co., Ltd.
Address	:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, 518055, China
Manufacturer	:	Seeed Technology Co., Ltd.
Address	:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, 518055, China
Factory	:	Shenzhen Xinxian Technology Co; Limited
Address	:	F5, Building B17, Hengfeng Industrial City, No. 739 Zhoushi Rd, Baoan District, Shenzhen, Guangdong, P.R.C

### 1.2. Description of Device (EUT)

Product Name	:	WM1302 LoRaWAN Gateway Module(SPI) – US915
Model No.	:	WM1302-SPI-US915, WM1302-SPI-US915-J, WM1302-SPI-US915-M (For models differences: WM1302-SPI-US915, WM1302-SPI-US915-J with IC SX1262; WM1302-SPI-US915-M without IC SX1262, According to the difference between the models, so we prepare “WM1302-SPI-US915” for test only.)
Trade Mark	:	Seeed Studio
Test Power Supply	:	DC 3.3V by Debug board
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	N.A.
<b>RF Specification</b>		
Support Technology	:	<input checked="" type="checkbox"/> LoRa
Operation Mode	:	<input type="checkbox"/> DSSS <input checked="" type="checkbox"/> FHSS
Support Bandwidth	:	<input checked="" type="checkbox"/> 125KHz <input type="checkbox"/> 250KHz <input type="checkbox"/> 500KHz
Operation Frequency	:	902~928MHz
Number of Channel	:	64 Channels
Modulation Type	:	LoRa Chirp Spread Spectrum
Antenna Type	:	ANT 1: Cylindrical antenna ANT 2: Sucker antenna
Antenna Gain(Peak)	:	ANT 1: 2.6 dBi (Provided by customer) ANT 2: 3 dBi (Provided by customer)
<b>Remark:</b> 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)
Adapter	M/N: SAW12-050-2100UB Input: 100-240V~ 50/60Hz, 0.3A Output: DC 5V, 2100mA

### 1.4. Description of Test Modes

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.3	23	906.7	45	911.1
2	902.5	24	906.9	46	911.3
3	902.7	25	907.1	47	911.5
4	902.9	26	907.3	48	911.7
5	903.1	27	907.5	49	911.9
6	903.3	28	907.7	50	912.1
7	903.5	29	907.9	51	912.3
8	903.7	30	908.1	52	912.5
9	903.9	31	908.3	53	912.7
10	904.1	32	908.5	54	912.9
11	904.3	33	908.7	55	913.1
12	904.5	34	908.9	56	913.3
13	904.7	35	909.1	57	913.5
14	904.9	36	909.3	58	913.7
15	905.1	37	909.5	59	913.9
16	905.3	38	909.7	60	914.1
17	905.5	39	909.9	61	914.3
18	905.7	40	910.1	62	914.5
19	905.9	41	910.3	63	914.7
20	906.1	42	910.5	64	914.9
21	906.3	43	910.7	-	-
22	906.5	44	910.9	-	-

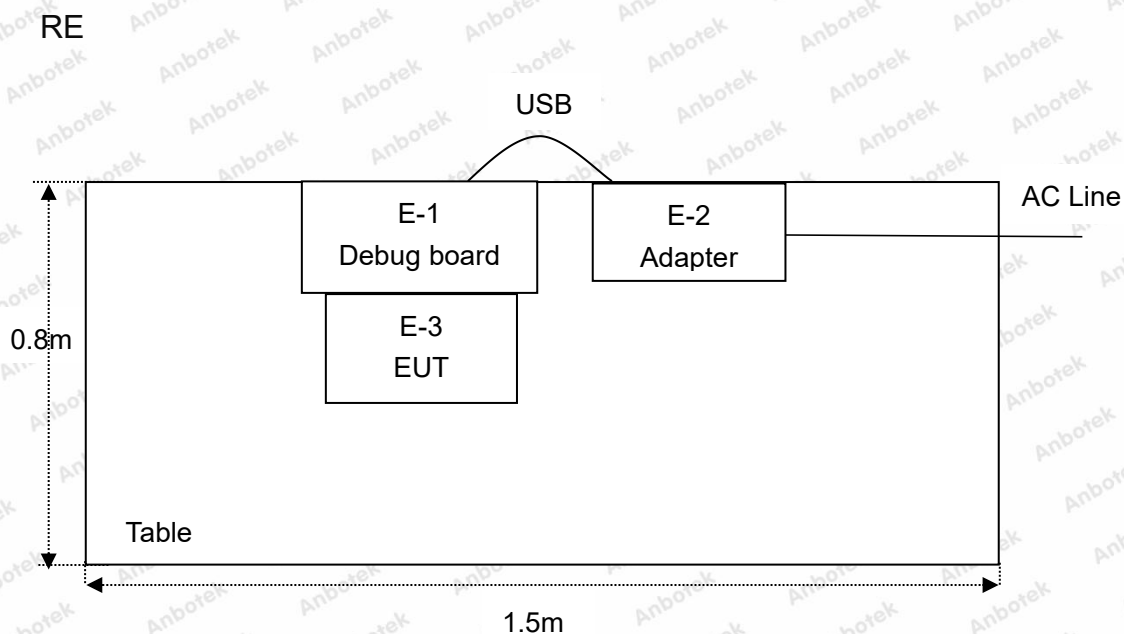
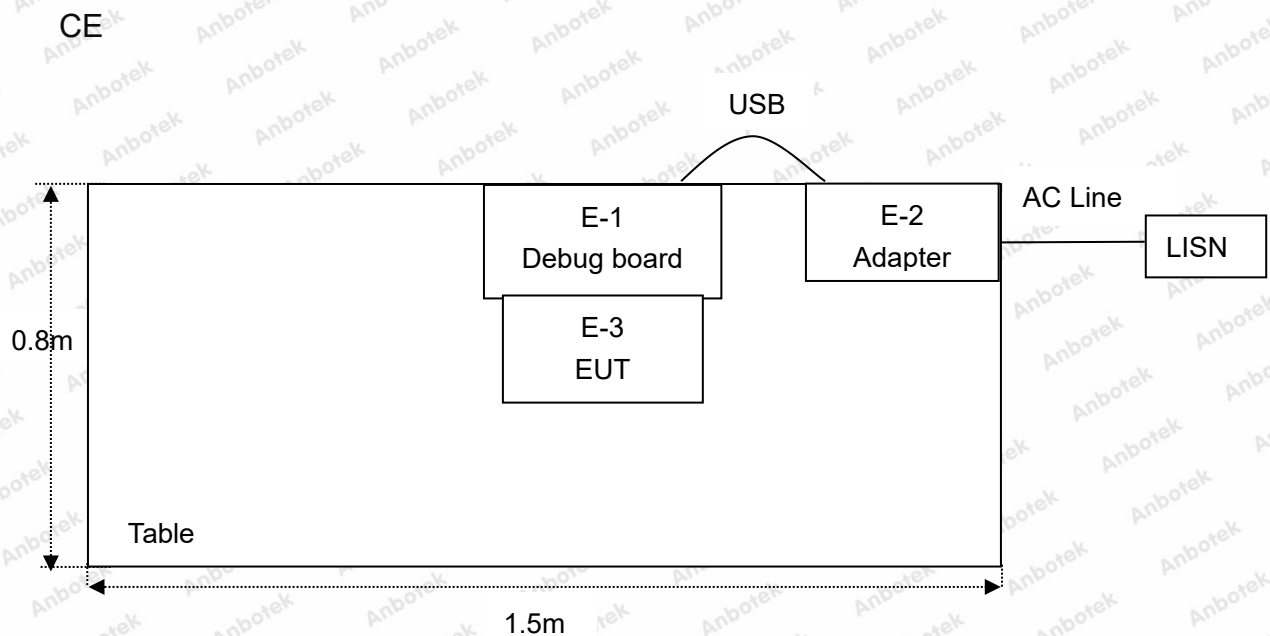
Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT was tested with Channel 1, 32 and 64.





### 1.5. Description Of Test Setup



## 1.6. 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, 2022	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





### 1.7. Measurement Uncertainty

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

### 1.8. Description of Test Facility

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

#### FCC-Registration No.: 184111

Shenzhen Anbotek 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 Anbotek 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 Anbotek 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
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
<b>Remark:</b> "N/A" is an abbreviation for Not Applicable.		

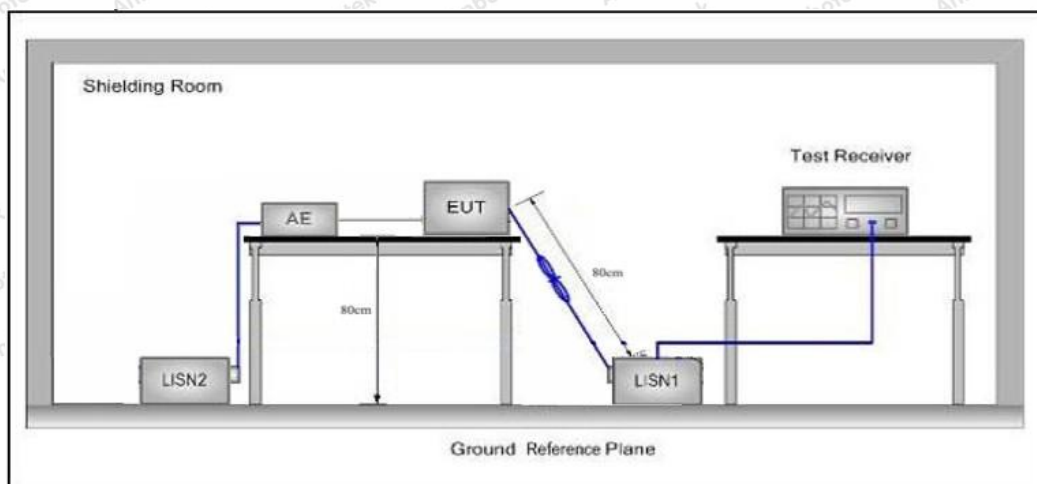


### 3. Conducted Emission Test

#### 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
<b>Remark:</b> (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

During the test, pre-scan all modes, only the worst case is recorded in the report.

Note: The EUT received input Voltage DC 3.3V from Debug board, and the Debug board received AC 120V/60Hz from Adapter.

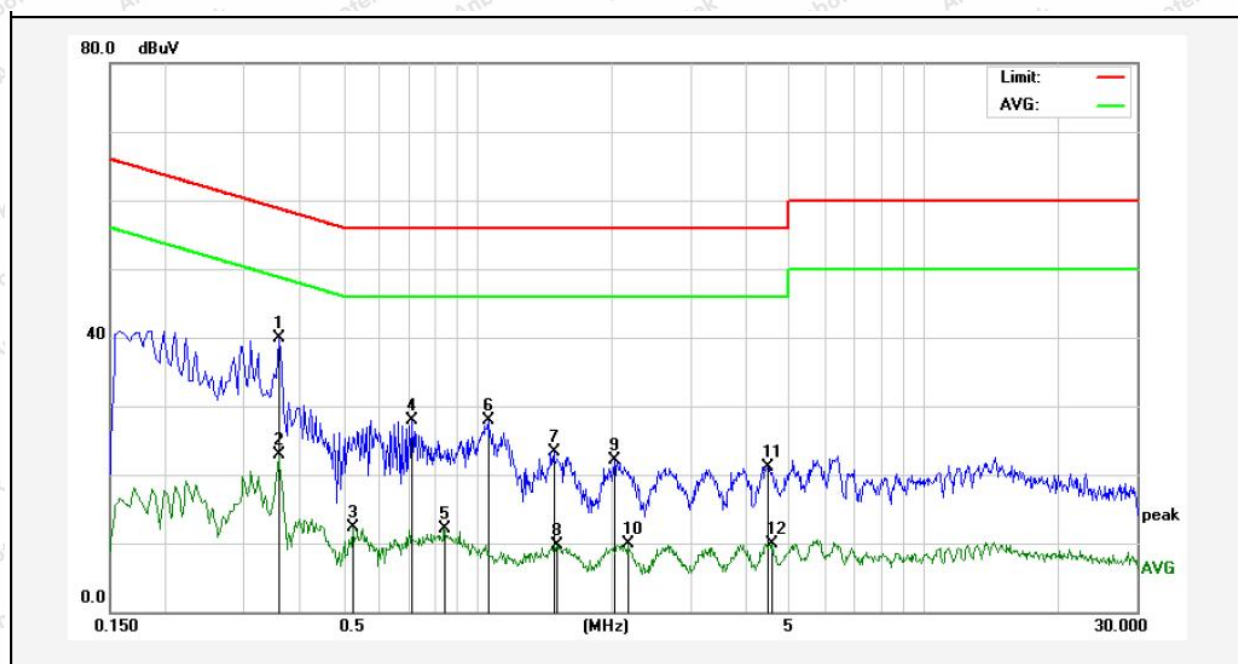
Please to see the following pages.





**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
Operating Condition: CH 01 with ANT1 (New PA)  
Test Specification: AC 120V, 60Hz  
Comment: Live Line  
Temp.(°C)/Hum.(%RH): 22.1°C/52%RH

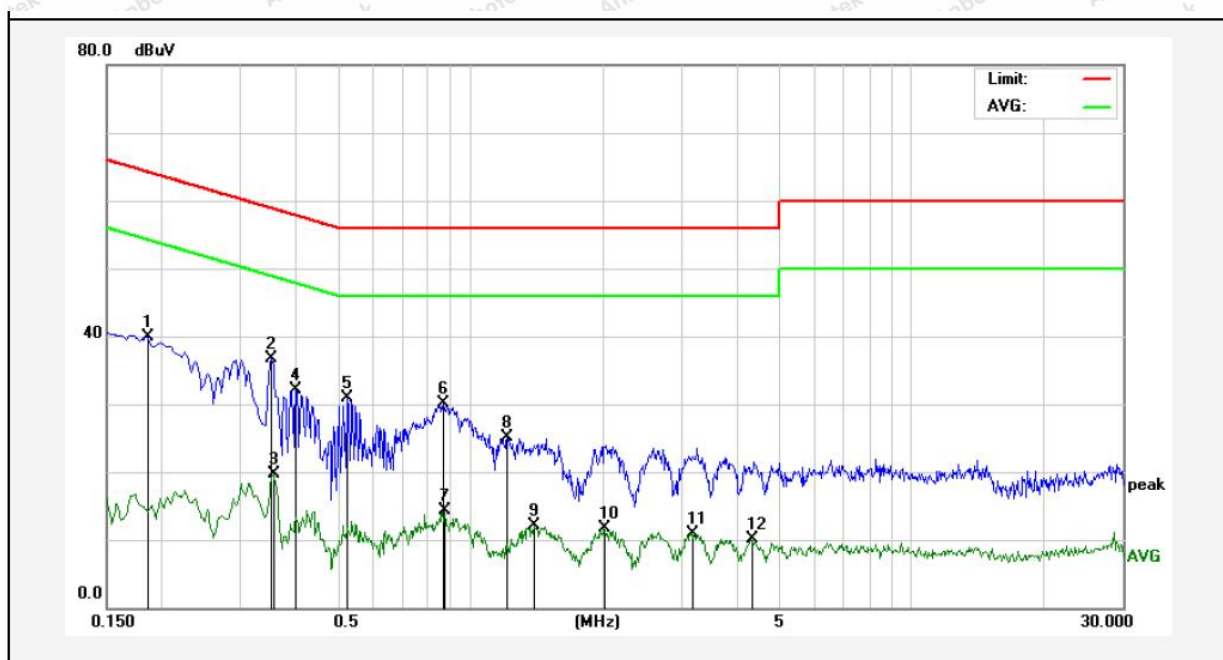


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3580	30.16	9.72	39.88	58.77	-18.89	QP	
2	0.3580	13.10	9.72	22.82	48.77	-25.95	AVG	
3	0.5260	2.46	9.76	12.22	46.00	-33.78	AVG	
4	0.7140	18.14	9.75	27.89	56.00	-28.11	QP	
5	0.8420	2.34	9.75	12.09	46.00	-33.91	AVG	
6	1.0580	18.21	9.74	27.95	56.00	-28.05	QP	
7	1.4819	13.60	9.73	23.33	56.00	-32.67	QP	
8	1.5100	-0.04	9.73	9.69	46.00	-36.31	AVG	
9	2.0300	12.46	9.72	22.18	56.00	-33.82	QP	
10	2.1780	0.12	9.72	9.84	46.00	-36.16	AVG	
11	4.4860	11.34	9.73	21.07	56.00	-34.93	QP	
12	4.5820	0.11	9.74	9.85	46.00	-36.15	AVG	



**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
Operating Condition: CH 01 with ANT1 (New PA)  
Test Specification: AC 120V, 60Hz  
Comment: Neutral Line  
Temp.(°C)/Hum.(%RH): 22.1°C/52%RH



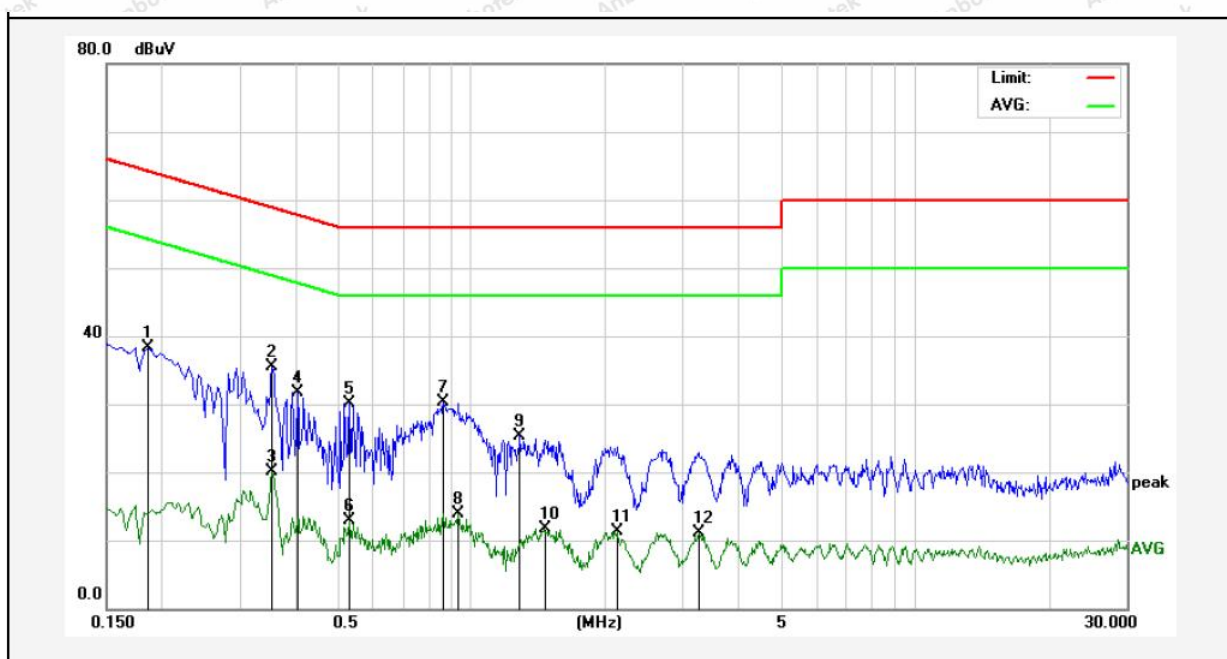
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1860	30.21	9.71	39.92	64.21	-24.29	QP	
2	0.3540	26.95	9.72	36.67	58.87	-22.20	QP	
3	0.3580	9.92	9.72	19.64	48.77	-29.13	AVG	
4	0.4020	22.45	9.71	32.16	57.81	-25.65	QP	
5	0.5260	21.14	9.76	30.90	56.00	-25.10	QP	
6	0.8700	20.39	9.75	30.14	56.00	-25.86	QP	
7	0.8780	4.51	9.74	14.25	46.00	-31.75	AVG	
8	1.2140	15.34	9.73	25.07	56.00	-30.93	QP	
9	1.3900	2.28	9.73	12.01	46.00	-33.99	AVG	
10	2.0020	1.90	9.72	11.62	46.00	-34.38	AVG	
11	3.1700	1.10	9.73	10.83	46.00	-35.17	AVG	
12	4.3260	0.32	9.73	10.05	46.00	-35.95	AVG	





**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
Operating Condition: CH 01 with ANT1 (Original PA)  
Test Specification: AC 120V, 60Hz  
Comment: Live Line  
Temp.(°C)/Hum.(%RH): 22.1°C/52%RH



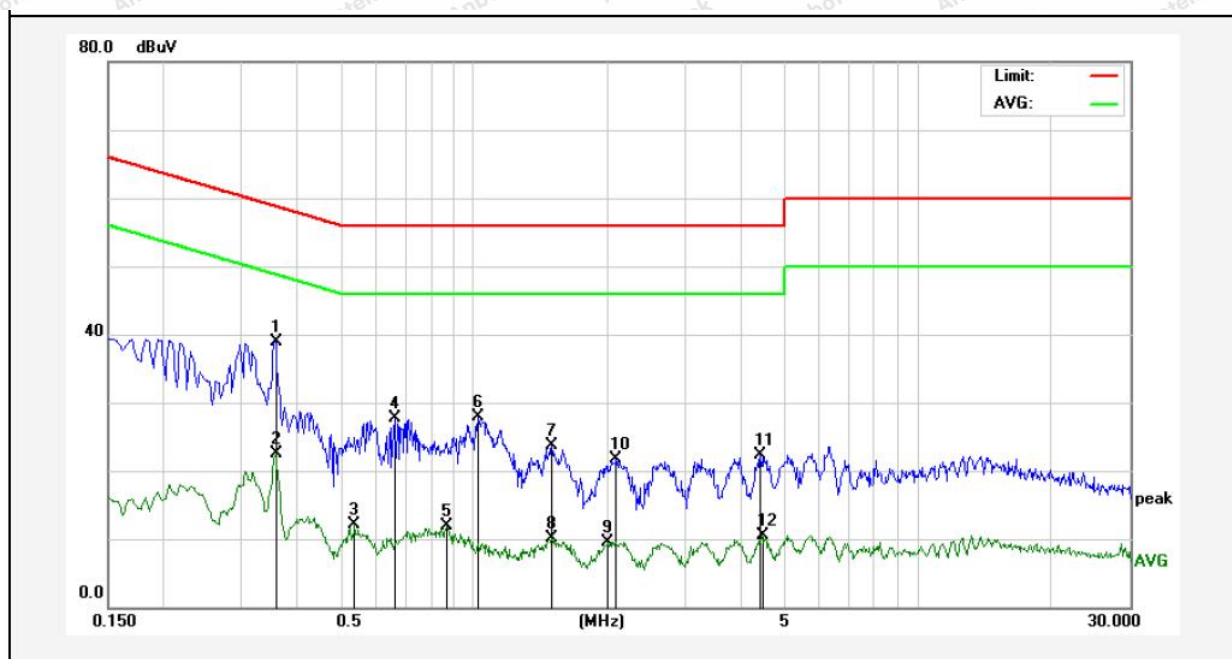
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1860	28.53	9.71	38.24	64.21	-25.97	QP	
2	0.3540	25.79	9.72	35.51	58.87	-23.36	QP	
3	0.3540	10.45	9.72	20.17	48.87	-28.70	AVG	
4	0.4060	22.00	9.71	31.71	57.73	-26.02	QP	
5	0.5299	20.32	9.76	30.08	56.00	-25.92	QP	
6	0.5299	3.12	9.76	12.88	46.00	-33.12	AVG	
7	0.8660	20.59	9.75	30.34	56.00	-25.66	QP	
8	0.9300	4.22	9.74	13.96	46.00	-32.04	AVG	
9	1.2860	15.66	9.73	25.39	56.00	-30.61	QP	
10	1.4580	1.96	9.73	11.69	46.00	-34.31	AVG	
11	2.1220	1.56	9.72	11.28	46.00	-34.72	AVG	
12	3.2500	1.34	9.73	11.07	46.00	-34.93	AVG	





**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
 Operating Condition: CH 01 with ANT1 (Original PA)  
 Test Specification: AC 120V, 60Hz  
 Comment: Neutral Line  
 Temp.(°C)/Hum.(%RH): 22.1°C/52%RH

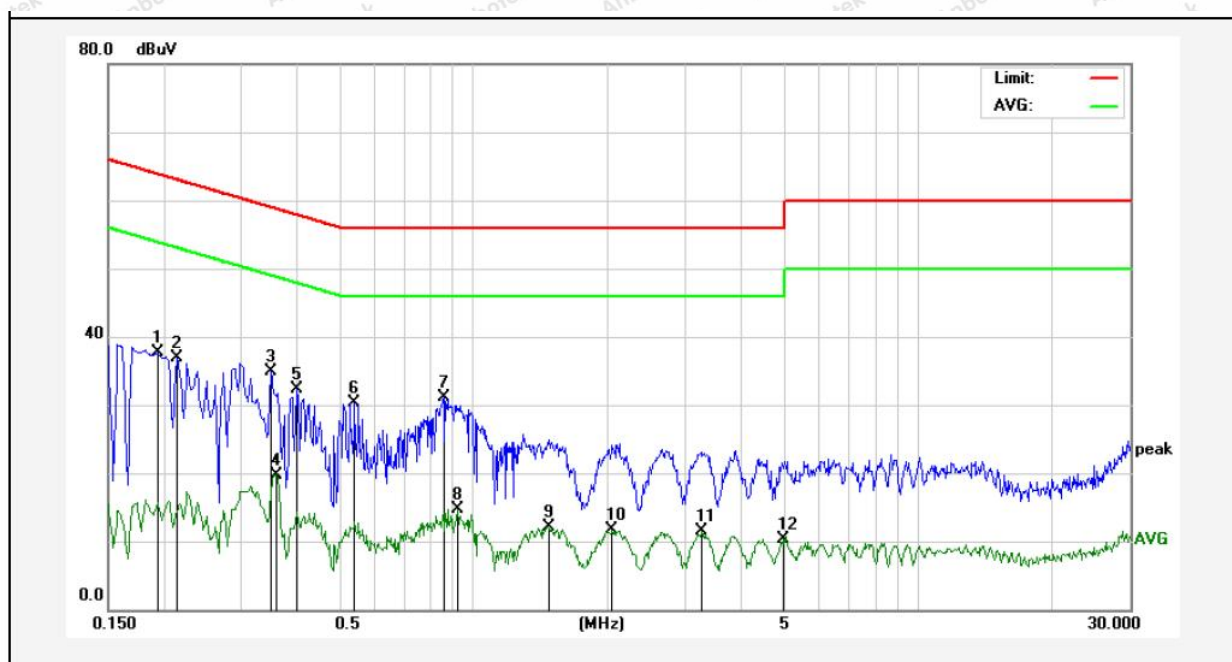


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3580	29.26	9.72	38.98	58.77	-19.79	QP	
2	0.3580	12.69	9.72	22.41	48.77	-26.36	AVG	
3	0.5380	2.40	9.76	12.16	46.00	-33.84	AVG	
4	0.6620	17.94	9.75	27.69	56.00	-28.31	QP	
5	0.8700	2.13	9.75	11.88	46.00	-34.12	AVG	
6	1.0260	18.16	9.74	27.90	56.00	-28.10	QP	
7	1.5020	13.92	9.72	23.64	56.00	-32.36	QP	
8	1.5020	0.45	9.72	10.17	46.00	-35.83	AVG	
9	2.0059	-0.15	9.72	9.57	46.00	-36.43	AVG	
10	2.0900	11.90	9.72	21.62	56.00	-34.38	QP	
11	4.4140	12.55	9.73	22.28	56.00	-33.72	QP	
12	4.4500	0.68	9.73	10.41	46.00	-35.59	AVG	



**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
Operating Condition: CH 01 with ANT2 (New PA)  
Test Specification: AC 120V, 60Hz  
Comment: Live Line  
Temp.(°C)/Hum.(%RH): 22.1°C/52%RH



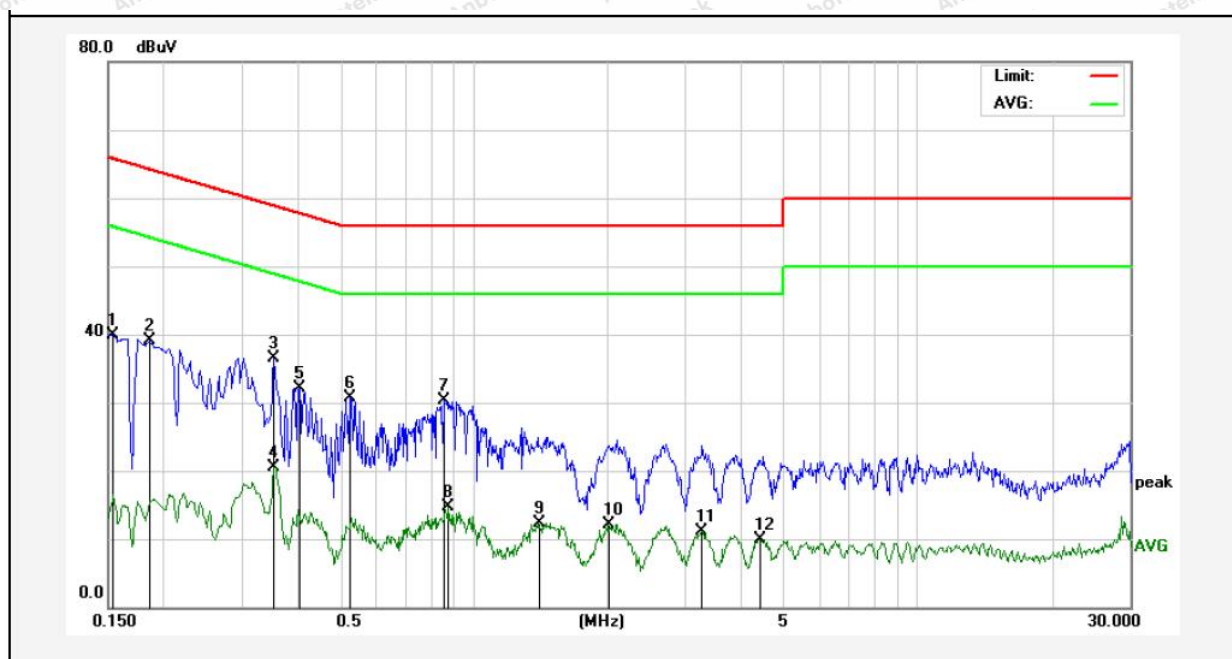
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1940	27.95	9.71	37.66	63.86	-26.20	QP	
2	0.2140	27.23	9.71	36.94	63.04	-26.10	QP	
3	0.3500	25.28	9.72	35.00	58.96	-23.96	QP	
4	0.3580	10.08	9.72	19.80	48.77	-28.97	AVG	
5	0.3980	22.50	9.71	32.21	57.89	-25.68	QP	
6	0.5380	20.56	9.76	30.32	56.00	-25.68	QP	
7	0.8540	21.30	9.75	31.05	56.00	-24.95	QP	
8	0.9220	4.92	9.74	14.66	46.00	-31.34	AVG	
9	1.4660	2.44	9.73	12.17	46.00	-33.83	AVG	
10	2.0500	2.01	9.72	11.73	46.00	-34.27	AVG	
11	3.2700	1.82	9.73	11.55	46.00	-34.45	AVG	
12	4.9740	0.62	9.74	10.36	46.00	-35.64	AVG	





**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
Operating Condition: CH 01 with ANT2 (New PA)  
Test Specification: AC 120V, 60Hz  
Comment: Neutral Line  
Temp.(°C)/Hum.(%RH): 22.1°C/52%RH



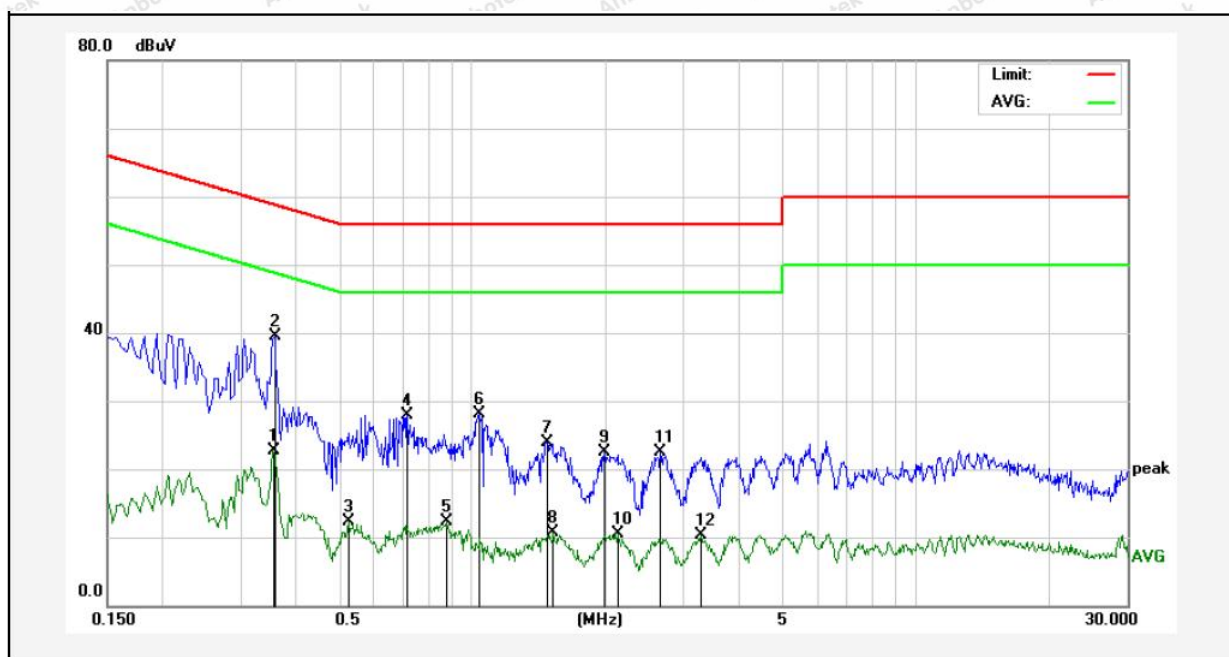
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1539	30.27	9.70	39.97	65.78	-25.81	QP	
2	0.1860	29.38	9.71	39.09	64.21	-25.12	QP	
3	0.3540	26.77	9.72	36.49	58.87	-22.38	QP	
4	0.3540	10.86	9.72	20.58	48.87	-28.29	AVG	
5	0.4060	22.46	9.71	32.17	57.73	-25.56	QP	
6	0.5260	20.85	9.76	30.61	56.00	-25.39	QP	
7	0.8540	20.52	9.75	30.27	56.00	-25.73	QP	
8	0.8780	5.04	9.74	14.78	46.00	-31.22	AVG	
9	1.4020	2.64	9.73	12.37	46.00	-33.63	AVG	
10	2.0100	2.47	9.72	12.19	46.00	-33.81	AVG	
11	3.2659	1.43	9.73	11.16	46.00	-34.84	AVG	
12	4.4300	0.25	9.73	9.98	46.00	-36.02	AVG	





**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
Operating Condition: CH 01 with ANT2 (Original PA)  
Test Specification: AC 120V, 60Hz  
Comment: Live Line  
Temp.(°C)/Hum.(%RH): 22.1°C/52%RH

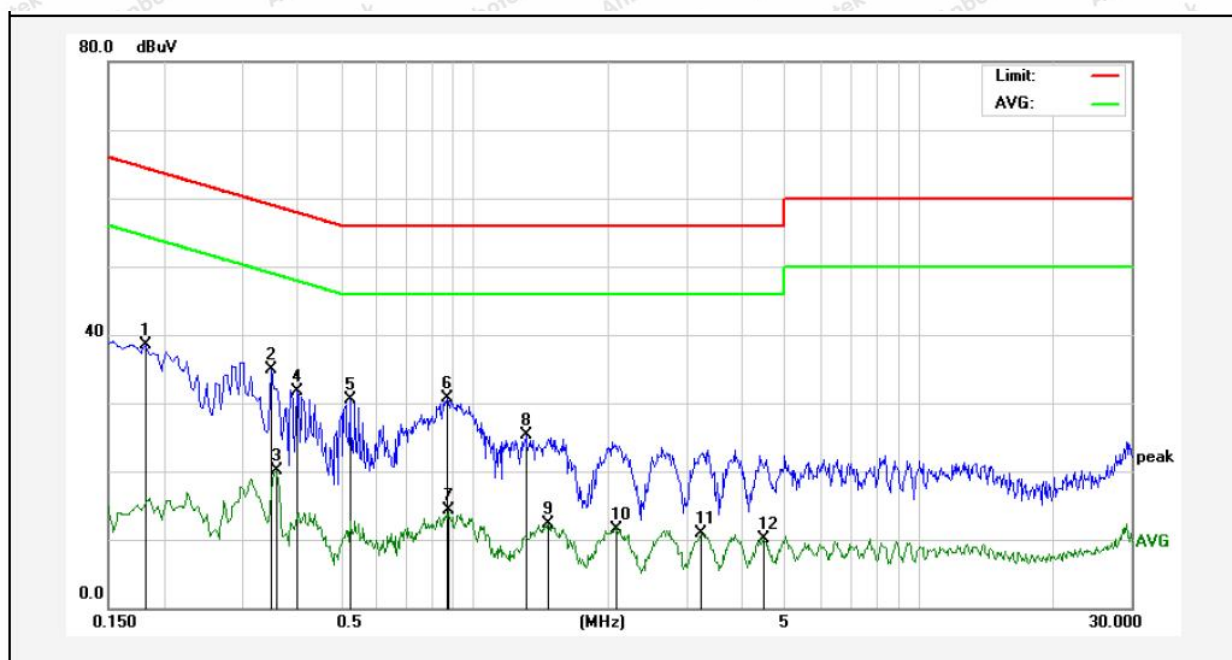


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3540	12.89	9.72	22.61	48.87	-26.26	AVG	
2	0.3580	29.78	9.72	39.50	58.77	-19.27	QP	
3	0.5260	2.56	9.76	12.32	46.00	-33.68	AVG	
4	0.7140	18.20	9.75	27.95	56.00	-28.05	QP	
5	0.8740	2.57	9.74	12.31	46.00	-33.69	AVG	
6	1.0339	18.29	9.74	28.03	56.00	-27.97	QP	
7	1.4780	14.22	9.73	23.95	56.00	-32.05	QP	
8	1.5260	1.02	9.73	10.75	46.00	-35.25	AVG	
9	1.9900	12.73	9.72	22.45	56.00	-33.55	QP	
10	2.1260	0.79	9.72	10.51	46.00	-35.49	AVG	
11	2.6580	12.84	9.73	22.57	56.00	-33.43	QP	
12	3.2820	0.55	9.73	10.28	46.00	-35.72	AVG	



**Conducted Emission Test Data**

Test Site: 1# Shielded Room  
 Operating Condition: CH 01 with ANT2 (Original PA)  
 Test Specification: AC 120V, 60Hz  
 Comment: Neutral Line  
 Temp.(°C)/Hum.(%RH): 22.1°C/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1819	28.81	9.71	38.52	64.39	-25.87	QP	
2	0.3500	25.21	9.72	34.93	58.96	-24.03	QP	
3	0.3580	10.30	9.72	20.02	48.77	-28.75	AVG	
4	0.3980	21.92	9.71	31.63	57.89	-26.26	QP	
5	0.5260	20.82	9.76	30.58	56.00	-25.42	QP	
6	0.8700	21.02	9.75	30.77	56.00	-25.23	QP	
7	0.8740	4.51	9.74	14.25	46.00	-31.75	AVG	
8	1.3060	15.48	9.73	25.21	56.00	-30.79	QP	
9	1.4660	2.48	9.73	12.21	46.00	-33.79	AVG	
10	2.0940	1.88	9.72	11.60	46.00	-34.40	AVG	
11	3.2380	1.24	9.73	10.97	46.00	-35.03	AVG	
12	4.4620	0.40	9.73	10.13	46.00	-35.87	AVG	





## 4. Radiation Spurious 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.





There are restrictions placed on radiated field strength emission limits that fall within what are referred to as Restricted Bands in Part 15.205 and tabulated below in Table 2: Part 15.205 Restricted Frequency Bands shall not exceed the radiated emission limits of Part 15.209, as listed in

Table 3: Part 15.209 Radiated Emission Limits for Frequencies above 30MHz .Only spurious emissions are permitted within the restricted frequency bands.

Table 2: Part 15.205 Restricted Frequency Bands

Frequency			
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	* 4.5-5.15 (5)
0.495-0.505	16.69475-16.69525	608-614	* 5.35-5.46 (6)
2.1735-2.1905	16.80425-16.80475	960-1240	* 7.25-7.75 (8)
4.125-4.128	25.5-25.67	1300-1427	* 8.025-8.5 (9)
4.17725-4.17775	37.5-38.25	1435-1626.5	* 9.0-9.2 (10)
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	* 2690-2900 (3)	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
2.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	* 3600-4400 (4)	Above 38.6
13.36-13.41			

\* Harmonic (n) of emission between 902 – 928MHz may fall within a restricted band of operation

\*E[dBV/m] = EIRP[dBm] + 95.2, for d = 3 m

\*Limit=E-20dBc

## 4.2. Test Setup

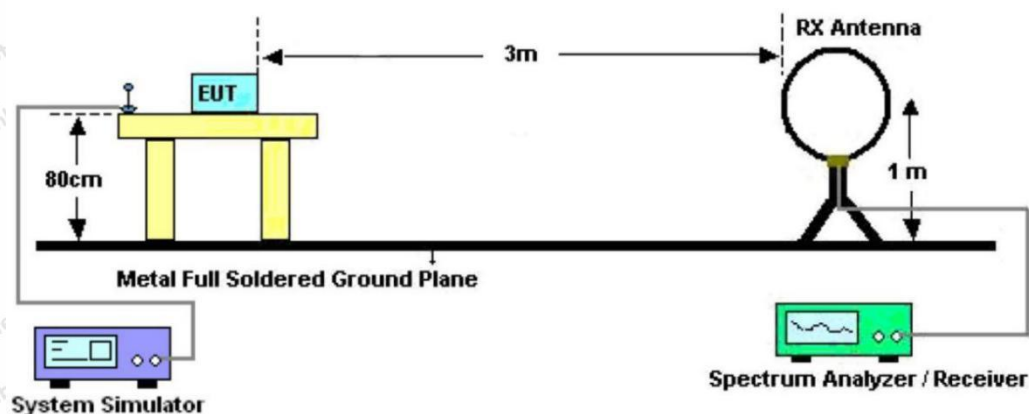


Figure 1. Below 30MHz

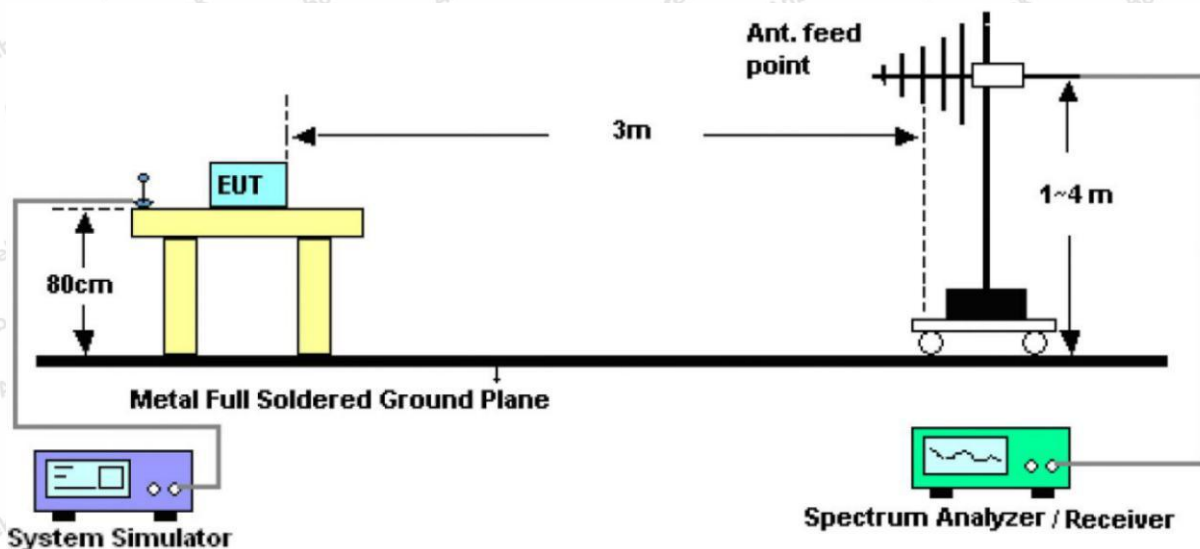


Figure 2. 30MHz to 1GHz

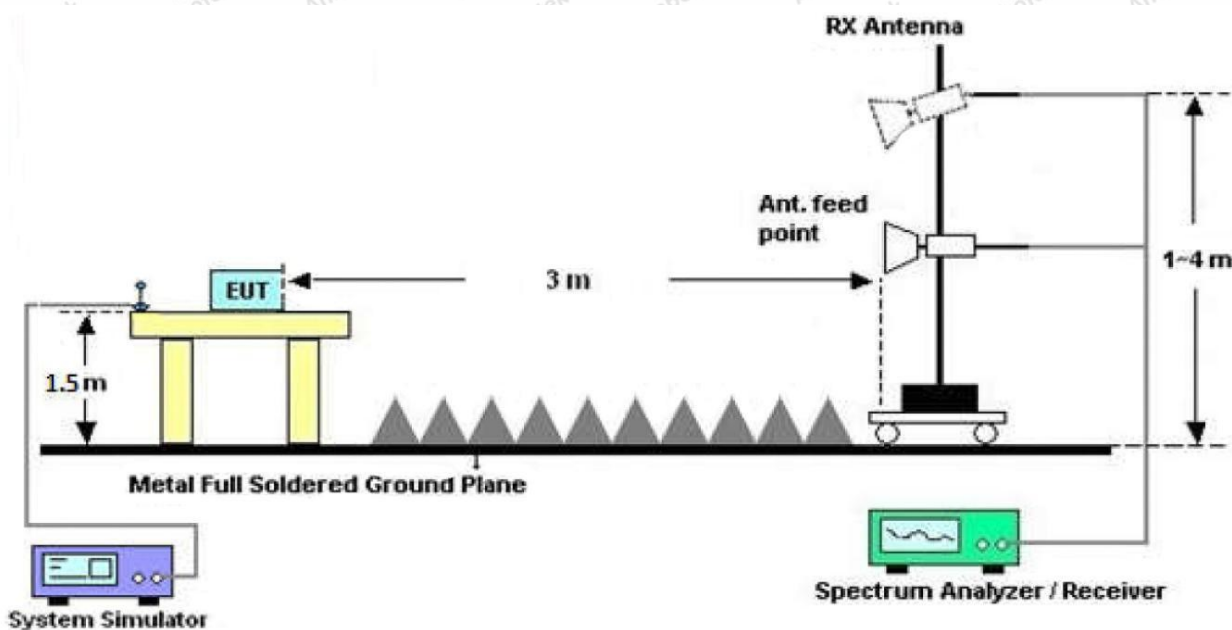


Figure 3. Above 1 GHz

### 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 modes, only the worst case is recorded in the report.

Note: The EUT received input Voltage DC 3.3V from Debug board, and the Debug board received AC 120V/60Hz from Adapter.





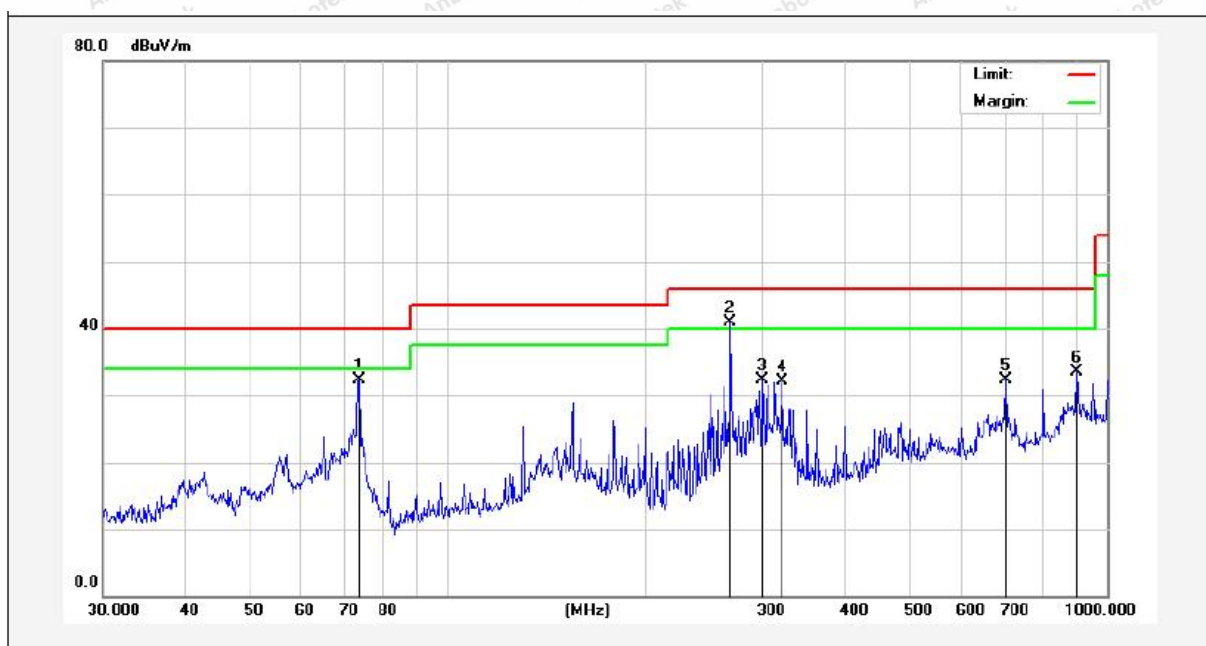
## Test Results (30~1000MHz)

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°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	73.3593	54.39	-22.08	32.31	40.00	-7.69	QP			
2	268.4853	60.79	-19.89	40.90	46.00	-5.10	QP			
3	300.3672	49.41	-17.15	32.26	46.00	-13.74	QP			
4	322.1886	48.72	-16.64	32.08	46.00	-13.92	QP			
5	701.7610	42.25	-9.89	32.36	46.00	-13.64	QP			
6	900.1474	39.82	-6.22	33.60	46.00	-12.40	QP			



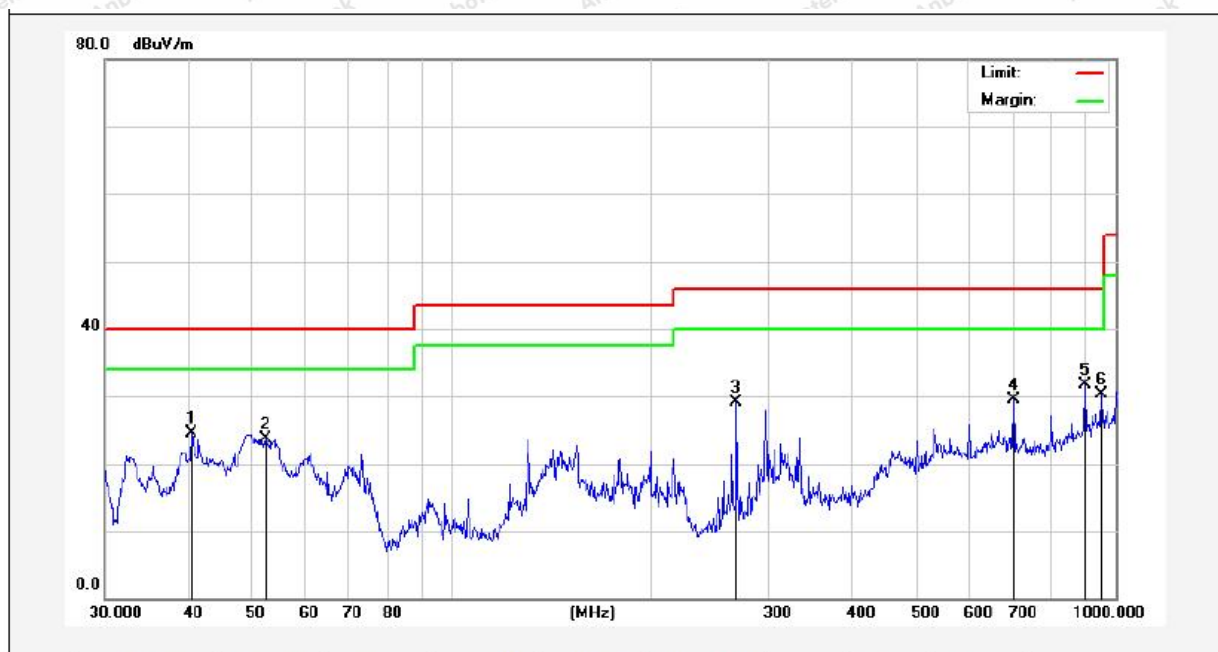
**Test Results (30~1000MHz)**

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°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	40.5591	39.19	-14.62	24.57	40.00	-15.43	QP			
2	52.3912	40.32	-16.66	23.66	40.00	-16.34	QP			
3	268.4853	46.44	-17.32	29.12	46.00	-16.88	QP			
4	701.7610	39.48	-9.89	29.59	46.00	-16.41	QP			
5	900.1474	37.99	-6.22	31.77	46.00	-14.23	QP			
6	952.0937	35.98	-5.61	30.37	46.00	-15.63	QP			





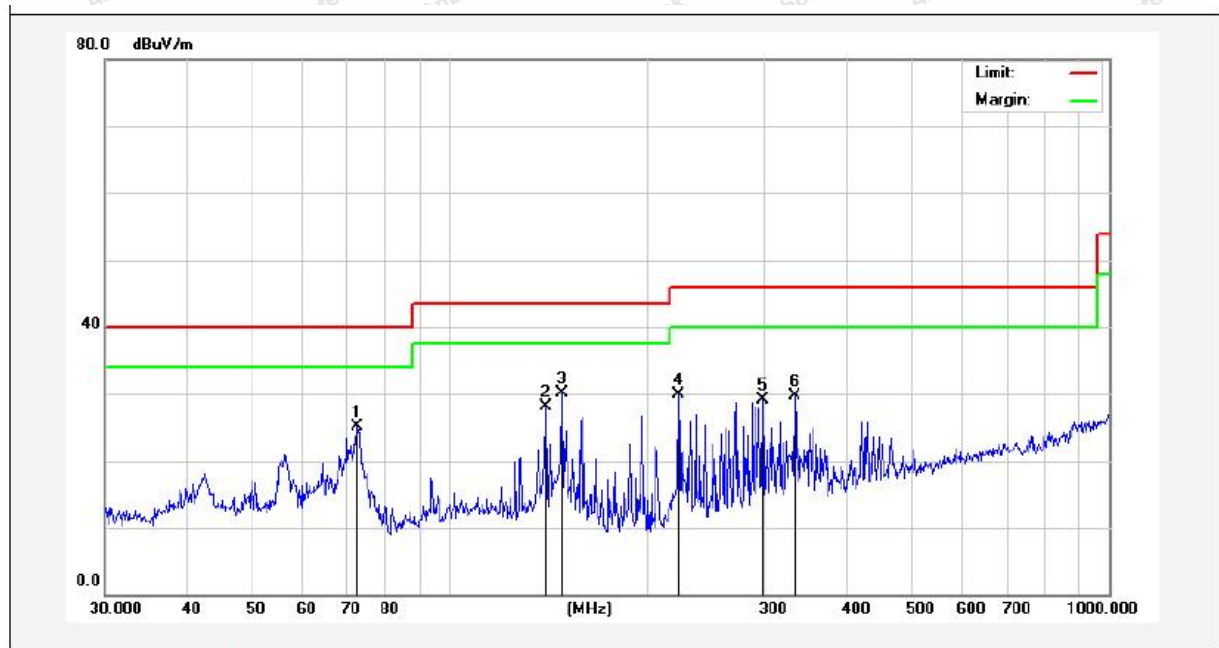
**Test Results (30~1000MHz)**

Test Mode: CH 01 with ANT1 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°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	72.3376	47.15	-22.13	25.02	40.00	-14.98	QP			
2	139.8508	51.10	-23.06	28.04	43.50	-15.46	QP			
3	147.9214	52.97	-22.89	30.08	43.50	-13.42	QP			
4	222.1698	51.82	-21.96	29.86	46.00	-16.14	QP			
5	298.2681	46.45	-17.31	29.14	46.00	-16.86	QP			
6	333.6867	46.07	-16.38	29.69	46.00	-16.31	QP			



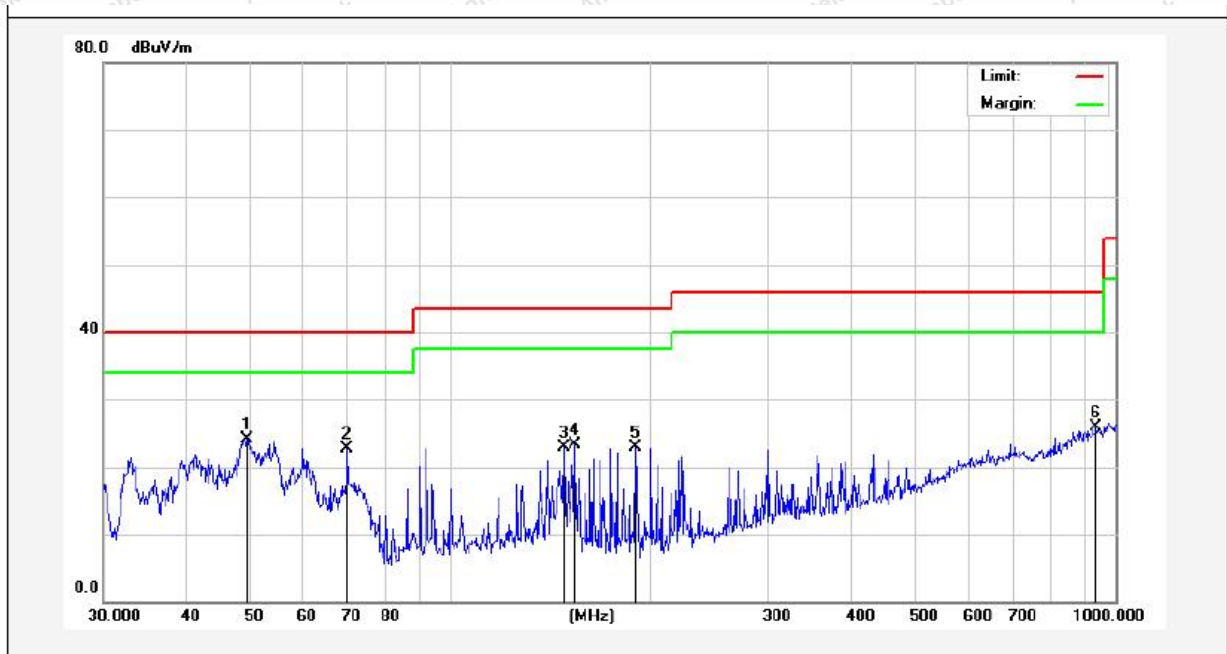
**Test Results (30~1000MHz)**

Test Mode: CH 01 with ANT1 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°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	49.3594	39.85	-15.68	24.17	40.00	-15.83	QP			
2	69.8450	42.72	-19.94	22.78	40.00	-17.22	QP			
3	147.9214	44.95	-22.10	22.85	43.50	-20.65	QP			
4	153.7385	45.33	-21.93	23.40	43.50	-20.10	QP			
5	189.7385	43.03	-20.15	22.88	43.50	-20.62	QP			
6	935.5463	31.79	-5.81	25.98	46.00	-20.02	QP			





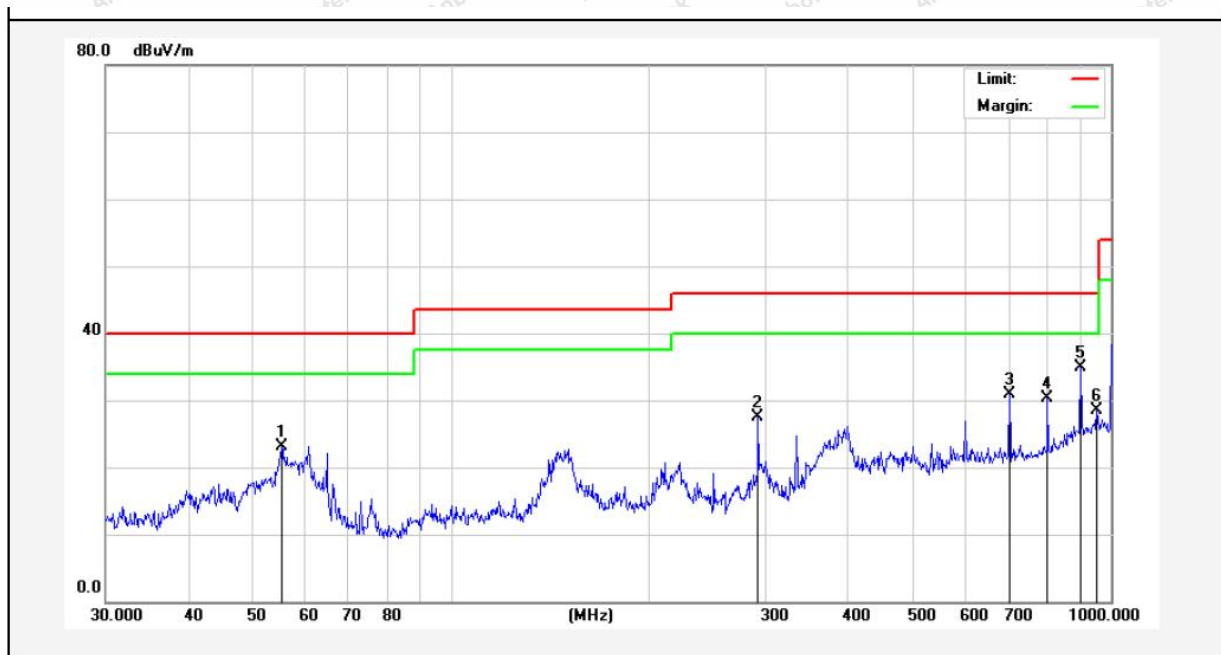
**Test Results (30~1000MHz)**

Test Mode: CH 01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°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	55.4147	40.74	-17.62	23.12	40.00	-16.88	QP			
2	292.0583	45.29	-17.85	27.44	46.00	-18.56	QP			
3	701.7610	40.74	-9.89	30.85	46.00	-15.15	QP			
4	801.7863	38.54	-8.24	30.30	46.00	-15.70	QP			
5	900.1474	41.22	-6.22	35.00	46.00	-11.00	QP			
6	952.0937	34.12	-5.61	28.51	46.00	-17.49	QP			



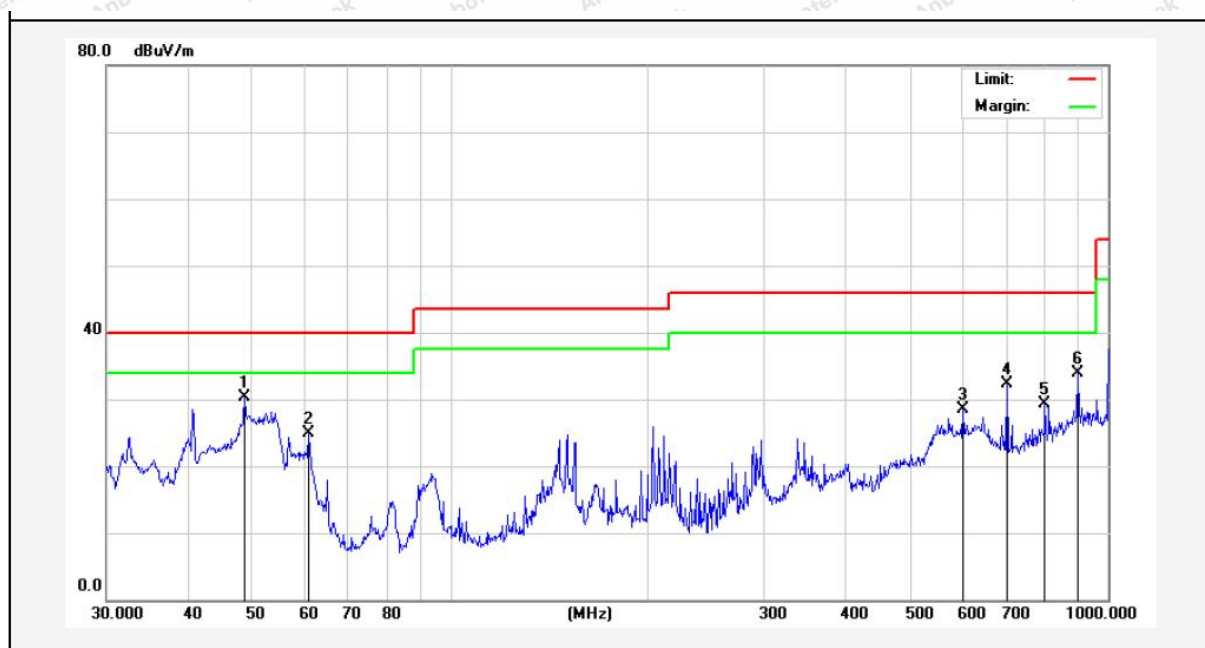
## Test Results (30~1000MHz)

Test Mode: CH 01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°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	48.6719	45.97	-15.58	30.39	40.00	-9.61	QP			
2	60.9176	42.66	-17.82	24.84	40.00	-15.16	QP			
3	601.4265	39.05	-10.53	28.52	46.00	-17.48	QP			
4	701.7610	42.23	-9.89	32.34	46.00	-13.66	QP			
5	801.7863	37.59	-8.24	29.35	46.00	-16.65	QP			
6	900.1474	40.09	-6.22	33.87	46.00	-12.13	QP			





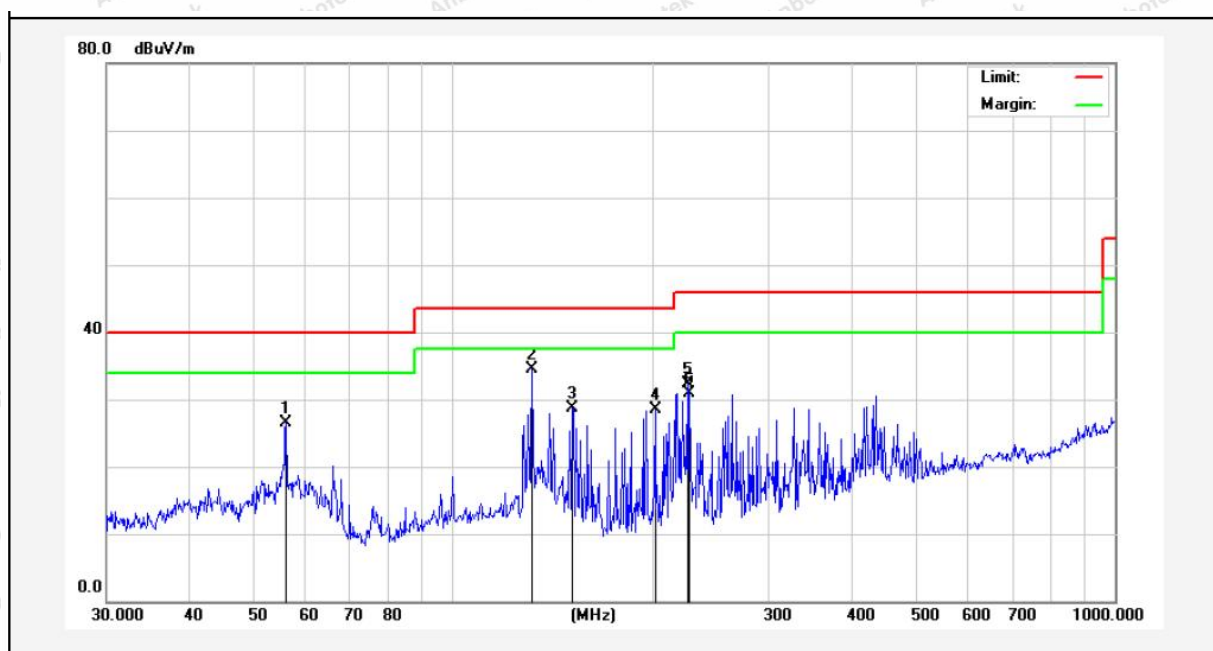
**Test Results (30~1000MHz)**

Test Mode: CH 01 with ANT2 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°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	56.0007	44.17	-17.60	26.57	40.00	-13.43	QP			
2	131.7577	57.17	-22.60	34.57	43.50	-8.93	QP			
3	151.5972	51.73	-23.04	28.69	43.50	-14.81	QP			
4	202.1005	50.79	-22.29	28.50	43.50	-15.00	QP			
5	226.0994	54.17	-21.90	32.27	46.00	-13.73	QP			
6	227.6906	52.84	-21.87	30.97	46.00	-15.03	QP			



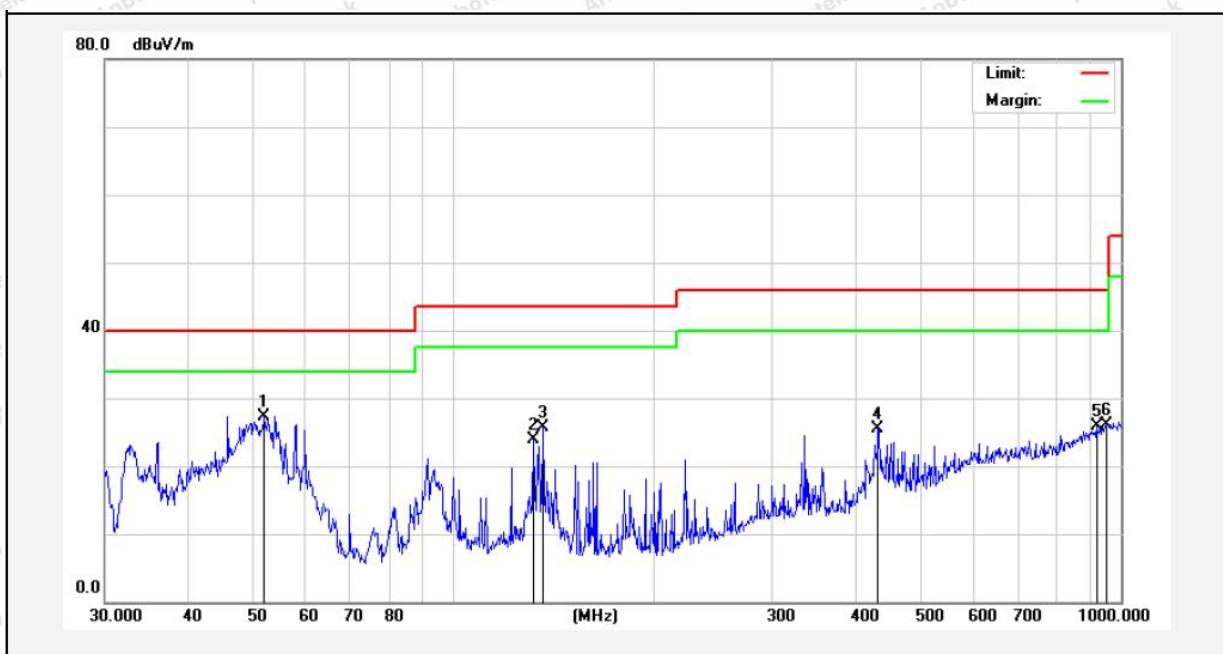
**Test Results (30~1000MHz)**

Test Mode: CH 01 with ANT2 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°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	52.0251	43.92	-16.52	27.40	40.00	-12.60	QP			
2	131.7577	45.58	-21.59	23.99	43.50	-19.51	QP			
3	135.9822	47.66	-21.89	25.77	43.50	-17.73	QP			
4	432.5457	39.52	-13.95	25.57	46.00	-20.43	QP			
5	919.2866	31.95	-5.99	25.96	46.00	-20.04	QP			
6	952.0937	31.73	-5.61	26.12	46.00	-19.88	QP			





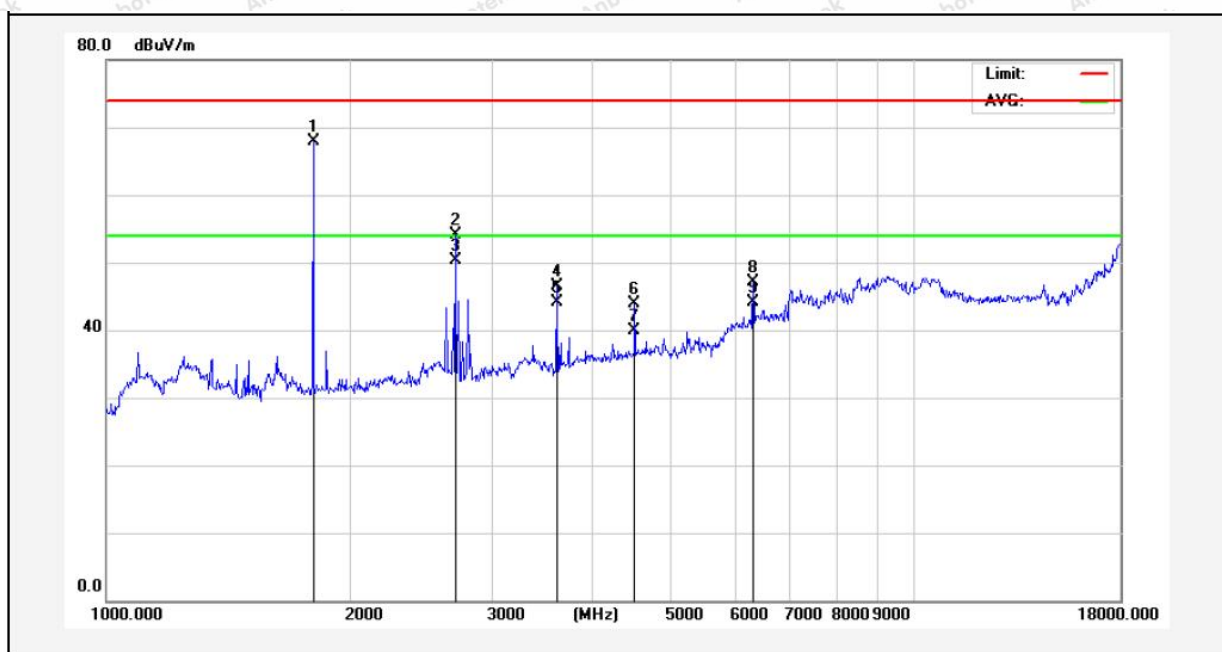
**Test Results (1GHz~18GHz)**

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°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	* 1803.332	94.20	-26.32	67.88	104.32	-36.44	peak			
2	2702.799	77.85	-23.70	54.15	74.00	-19.85	peak			
3	2702.799	73.99	-23.70	50.29	54.00	-3.71	AVG			
4	3608.619	68.17	-21.65	46.52	74.00	-27.48	peak			
5	3608.619	65.76	-21.65	44.11	54.00	-9.89	AVG			
6	4508.136	62.33	-18.33	44.00	74.00	-30.00	peak			
7	4508.136	58.22	-18.33	39.89	54.00	-14.11	AVG			
8	6322.136	59.22	-12.13	47.09	74.00	-26.91	peak			
9	6322.136	56.20	-12.13	44.07	54.00	-9.93	AVG			

\*) -20 dBc



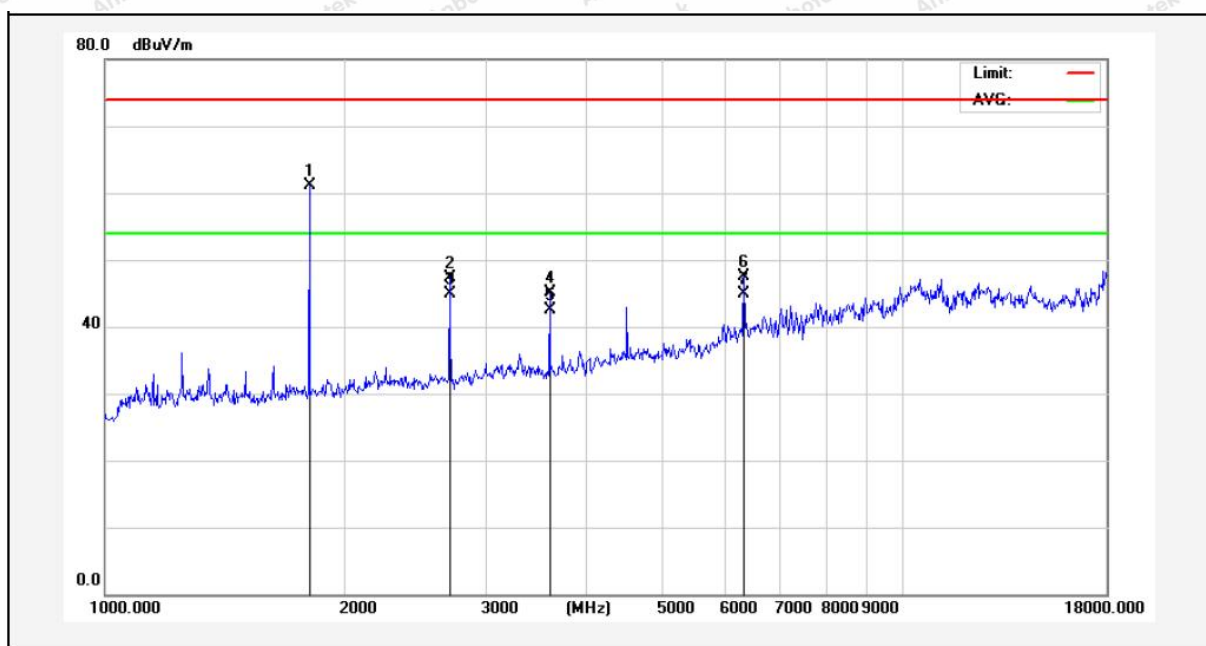
**Test Results (1GHz~18GHz)**

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°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	* 1803.332	87.49	-26.32	61.17	104.32	-43.15	peak			
2	2702.799	70.96	-23.70	47.26	74.00	-26.74	peak			
3	2702.799	68.66	-23.70	44.96	54.00	-9.04	AVG			
4	3608.619	66.74	-21.65	45.09	74.00	-28.91	peak			
5	3608.619	64.22	-21.65	42.57	54.00	-11.43	AVG			
6	6322.136	59.66	-12.13	47.53	74.00	-26.47	peak			
7	6322.136	57.09	-12.13	44.96	54.00	-9.04	AVG			

\*) -20 dBc





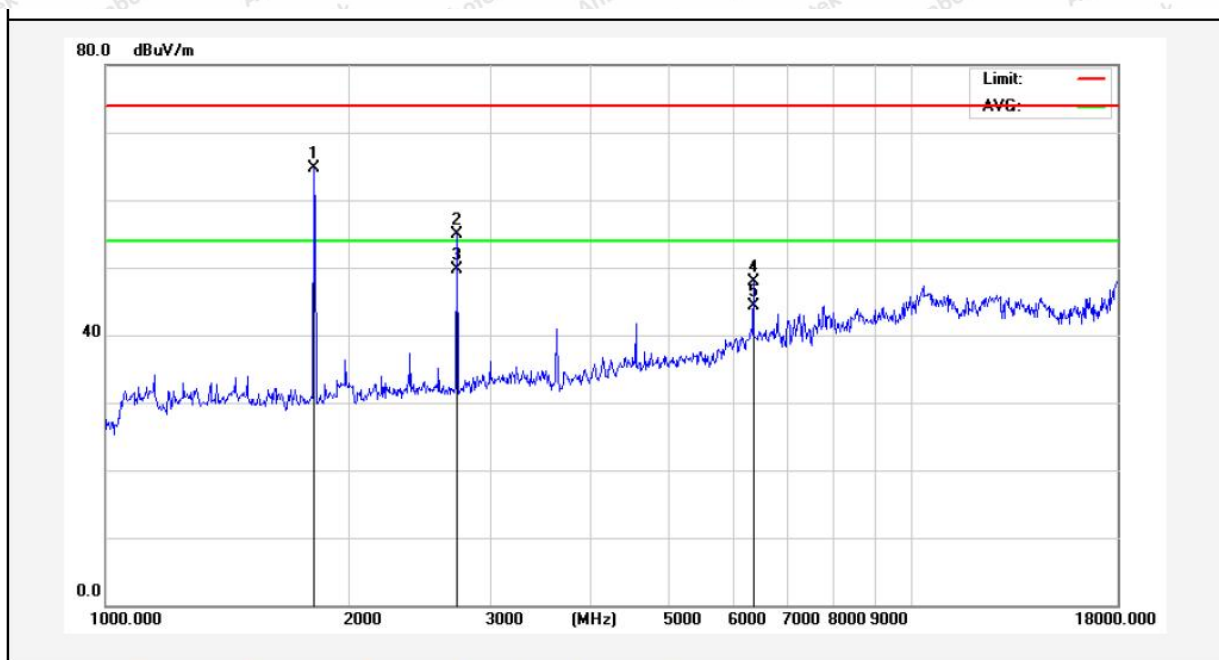
**Test Results (1GHz~18GHz)**

Test Mode: CH 09 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°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	* 1813.786	90.93	-26.25	64.68	103.83	-39.15	peak			
2	2726.337	78.60	-23.65	54.95	74.00	-19.05	peak			
3	2726.337	73.39	-23.65	49.74	54.00	-4.26	AVG			
4	6358.789	59.88	-11.97	47.91	74.00	-26.09	peak			
5	6358.789	56.20	-11.97	44.23	54.00	-9.77	AVG			

\*) -20 dBc



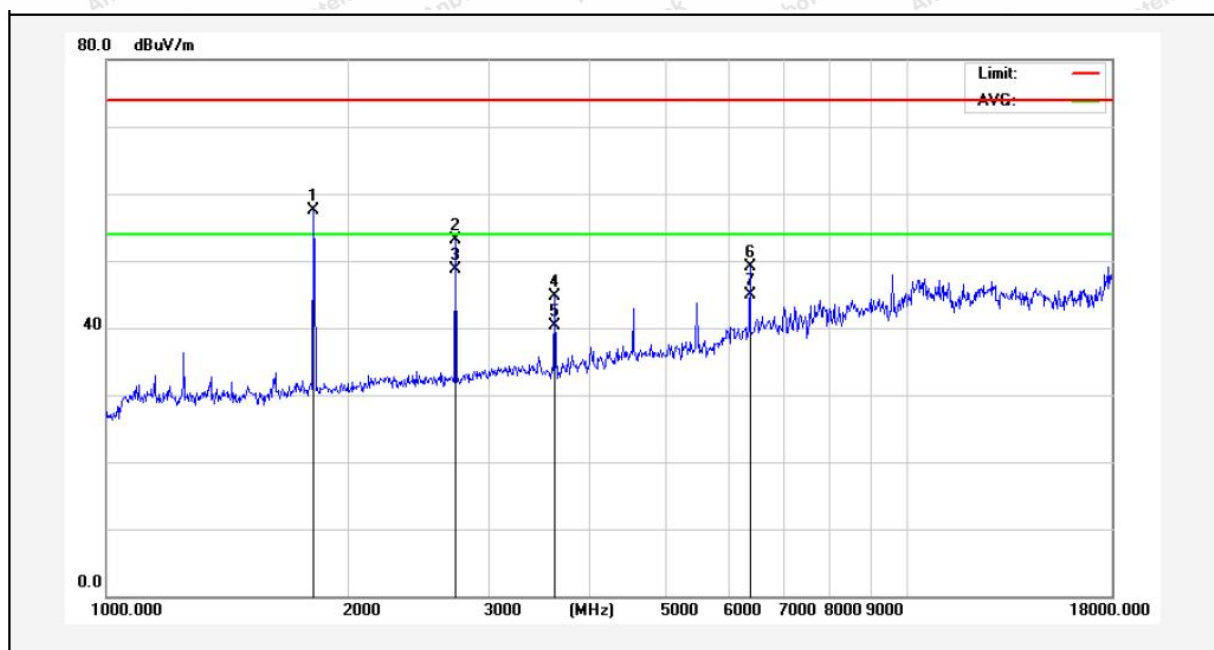
## Test Results (1GHz~18GHz)

Test Mode: CH 09 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°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	* 1813.786	83.71	-26.25	57.46	103.83	-46.37	peak			
2	2726.337	76.84	-23.65	53.19	74.00	-20.81	peak			
3	2726.337	72.44	-23.65	48.79	54.00	-5.21	AVG			
4	3629.540	66.17	-21.51	44.66	74.00	-29.34	peak			
5	3629.540	61.86	-21.51	40.35	54.00	-13.65	AVG			
6	6358.789	61.07	-11.97	49.10	74.00	-24.90	peak			
7	6358.789	56.95	-11.97	44.98	54.00	-9.02	AVG			

\*) -20 dBc





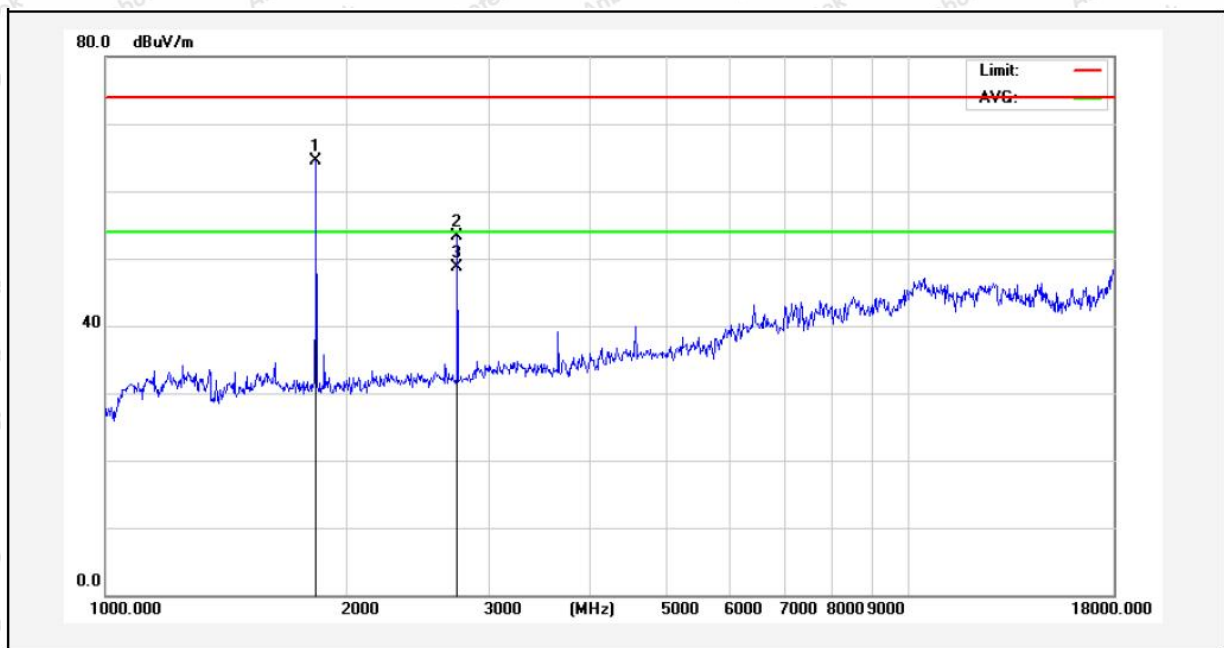
**Test Results (1GHz~18GHz)**

Test Mode: CH 16 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°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	* 1829.582	90.69	-26.12	64.57	102.45	-37.88	peak			
2	2742.143	76.88	-23.61	53.27	74.00	-20.73	peak			
3	2742.143	72.38	-23.61	48.77	54.00	-5.23	AVG			

\*) -20 dBc



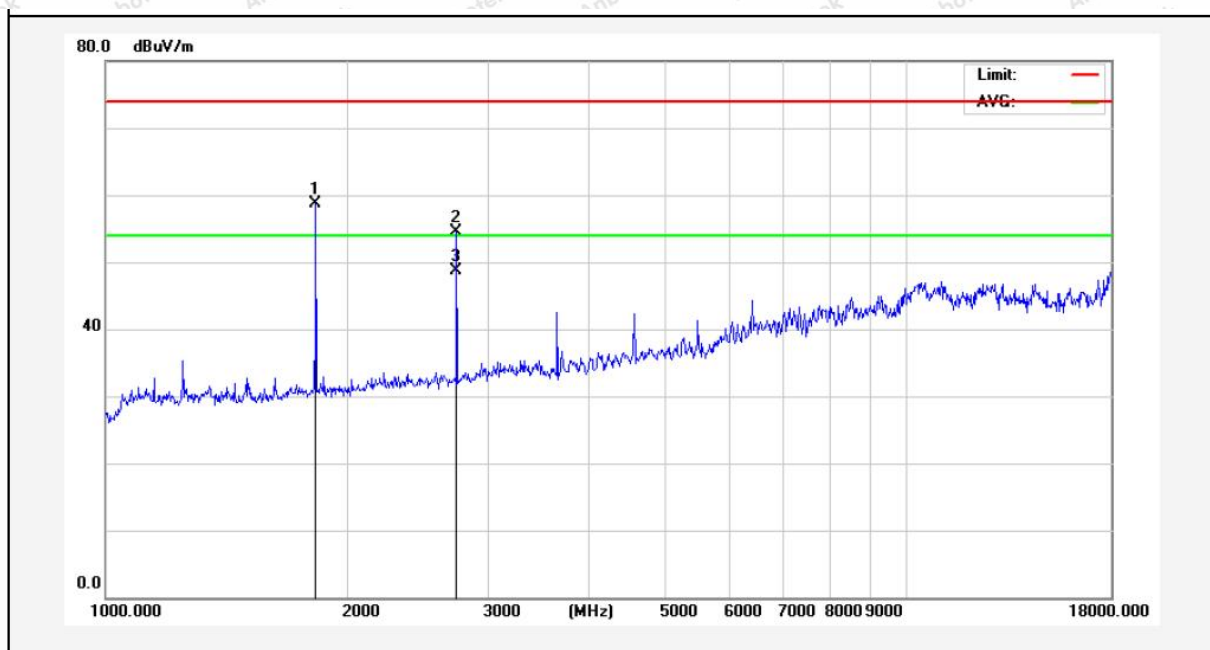
**Test Results (1GHz~18GHz)**

Test Mode: CH 16 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°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	* 1829.582	84.85	-26.12	58.73	102.45	-43.72	peak			
2	2742.143	78.08	-23.61	54.47	74.00	-19.53	peak			
3	2742.143	72.39	-23.61	48.78	54.00	-5.22	AVG			

\*) -20 dBc





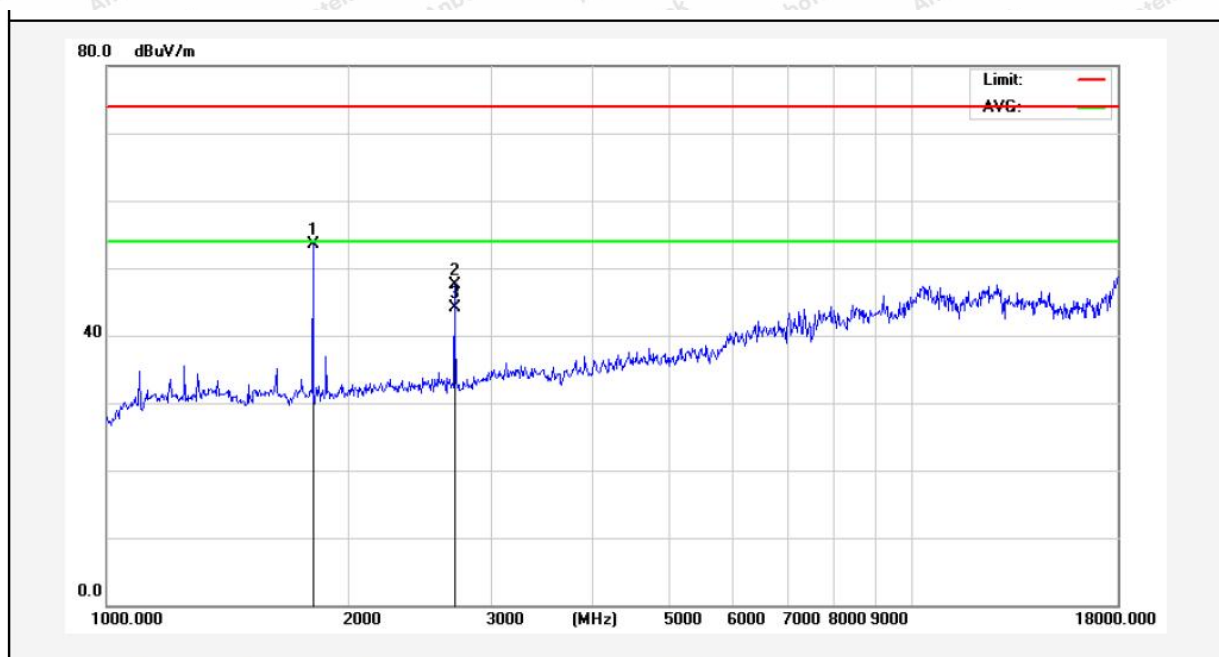
**Test Results (1GHz~18GHz)**

Test Mode: CH01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°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	* 1803.332	79.92	-26.32	53.60	104.72	-51.12	peak			
2	2702.799	71.12	-23.70	47.42	74.00	-26.58	peak			
3	2702.799	67.88	-23.70	44.18	54.00	-9.82	AVG			

\*) -20 dBc



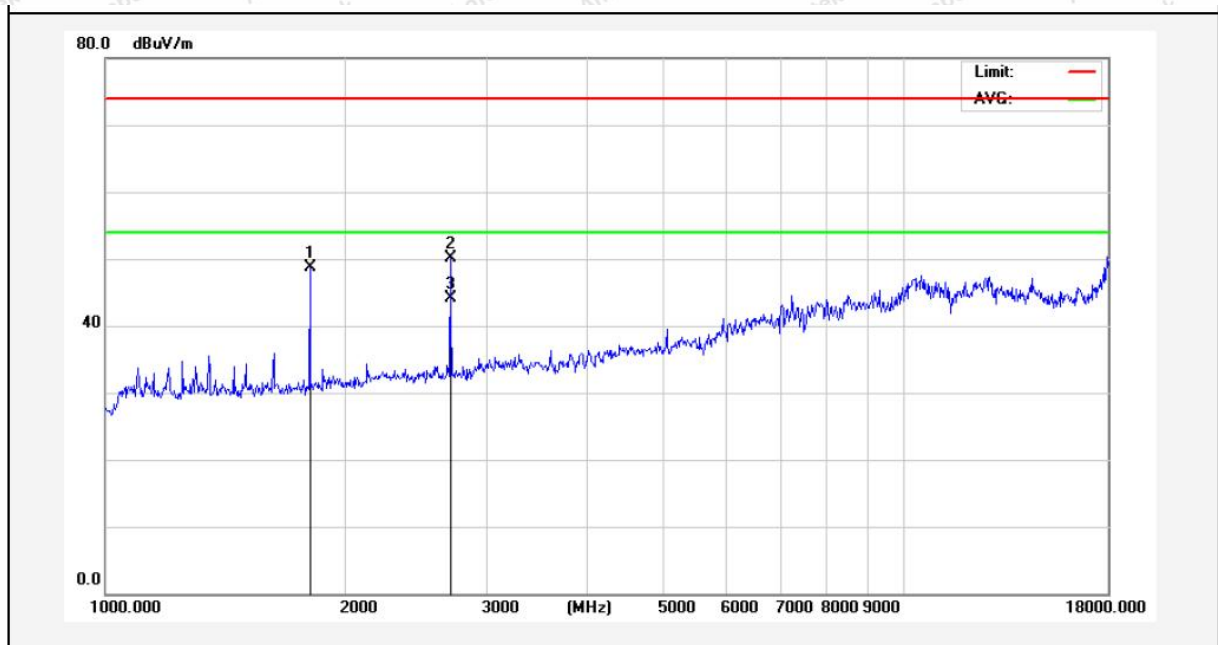
**Test Results (1GHz~18GHz)**

Test Mode: CH01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 22.5°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	1803.332	75.02	-26.32	48.70	104.72	-56.02	peak			
2	2702.799	73.89	-23.70	50.19	74.00	-23.81	peak			
3	2702.799	67.87	-23.70	44.17	54.00	-9.83	AVG			

\*) -20 dBc





## 5. Antenna Requirement

### 5.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /247(c)
Requirement	<p>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.</p> <p>2) 15.247(c) (1)(i) requirement: Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.</p>

### 5.2. Antenna Connected Construction

The antenna is ANT 1: Cylindrical antenna; ANT 2: Sucker antenna which permanently attached, and the best case gain of the antenna is ANT 1: 2.6 dBi; ANT 2: 3 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 -----

