

# FCC Test Report

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

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

**Product Name** : WM1303 LoRaWAN Gateway Module(SPI) -  
US915

**Report Date** : Sept. 02, 2022

**Shenzhen Anbotek Compliance Laboratory Limited**



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# TEST REPORT

Applicant : Seeed Technology Co., Ltd.  
Manufacturer : Seeed Technology Co., Ltd.  
Product Name : WM1303 LoRaWAN Gateway Module(SPI) – US915  
Model No. : WM1303-SPI-US915, WM1303-SPI-US915-J, WM1303-SPI-US915-M  
Trade Mark : Seeed Studio  
Rating(s) : Input: DC 3.3V/420mA

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

**Test Method(s) : ANSI C63.10: 2020, KDB558074 D01 DTS Meas Guidance v05r02**

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. 22, 2021
R01	Reference Note 1	Sept. 02, 2022

### Note 1:

This is a Class II application which was based on the original report 18220WC10116101. 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. Add a model which deleting components related to SX1262 on BOM which have not actived on function.
6. Changing the model to "WM1303-SPI-US915, WM1303-SPI-US915-J, WM1303-SPI-US915-M".

The changes are not related with the other RF parameters, only spurious emission and RF Output Power 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	:	WM1303 LoRaWAN Gateway Module(SPI) - US915
Model No.	:	WM1303-SPI-US915, WM1303-SPI-US915-J, WM1303-SPI-US915-M (For models differences: WM1303-SPI-US915, WM1303-SPI-US915-J with IC SX1262; WM1303-SPI-US915-M without IC SX1262, According to the difference between the models, so we prepare "WM1303-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 checked="" type="checkbox"/> DSSS <input type="checkbox"/> FHSS
Support Bandwidth	:	<input type="checkbox"/> 125KHz <input type="checkbox"/> 250KHz <input checked="" type="checkbox"/> 500KHz
Operation Frequency	:	902~928MHz
Number of Channel	:	16 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 Configuration

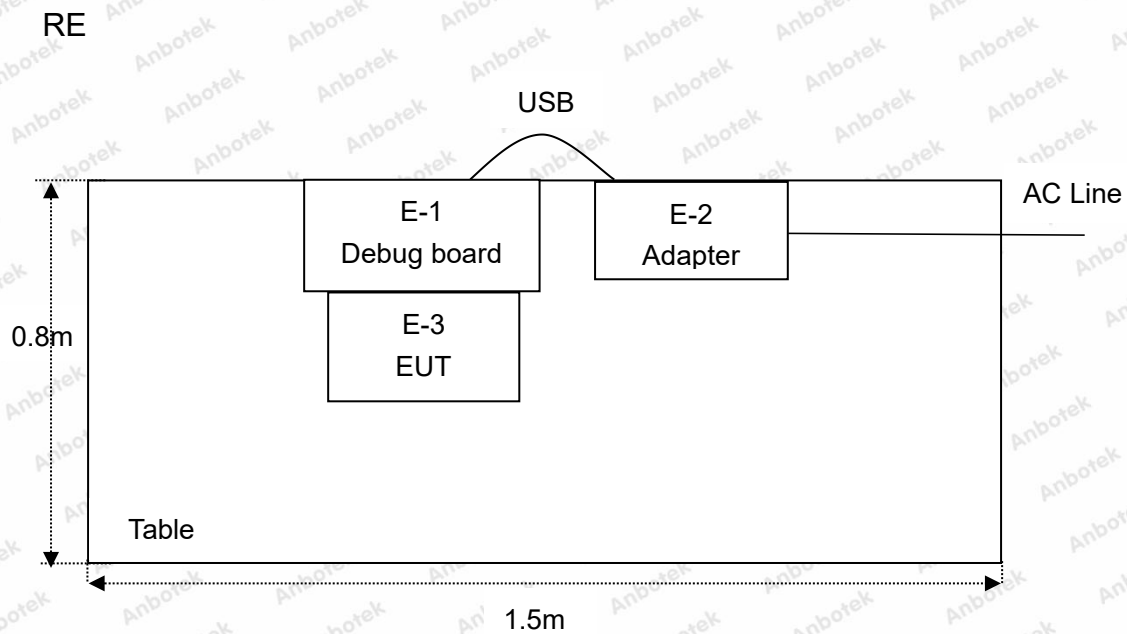
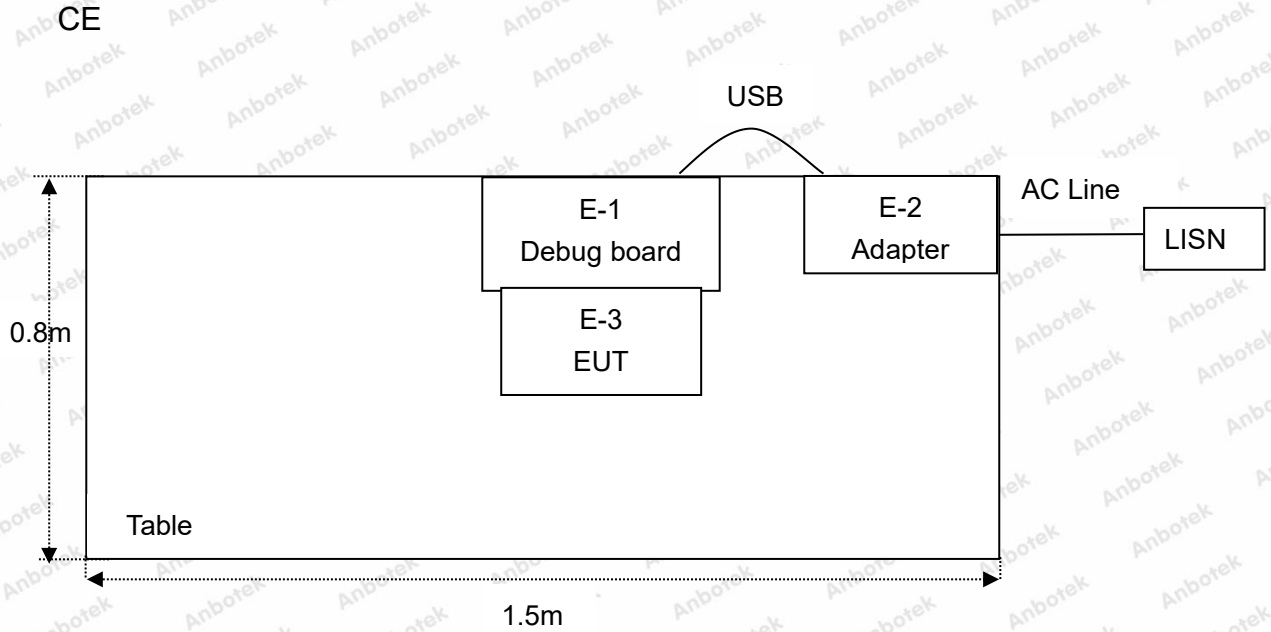
Channel	Frequency (MHz)	Channel	Frequency (MHz)
<b>01</b>	<b>903.0</b>	<b>09</b>	<b>923.3</b>
02	904.6	10	923.9
03	906.2	11	924.5
04	907.8	12	925.1
05	909.4	13	925.7
06	911.0	14	926.3
07	912.6	15	926.9
08	914.2	<b>16</b>	<b>927.5</b>

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, 9 and 16.



## 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
15.247(b)(3)	Conducted Peak Output Power	PASS
<b>Remark:</b> "N/A" is an abbreviation for Not Applicable.		



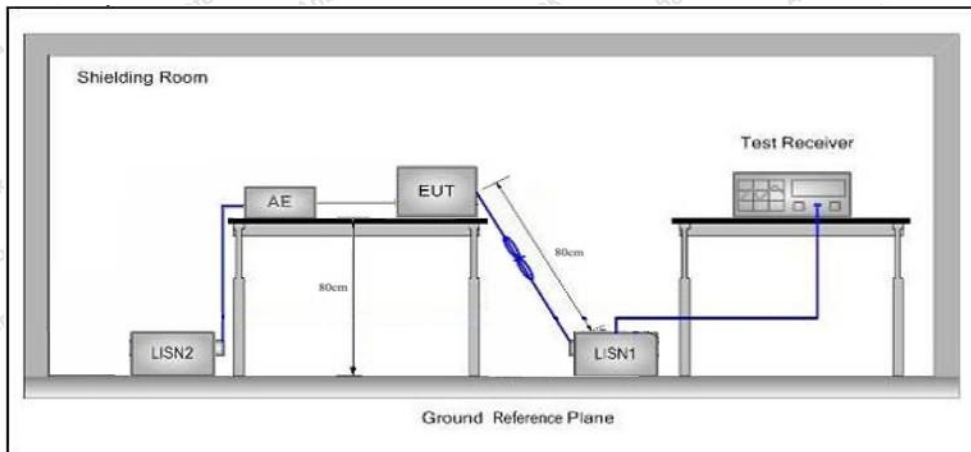
## 3. Conducted Emission Test

### 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

**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

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

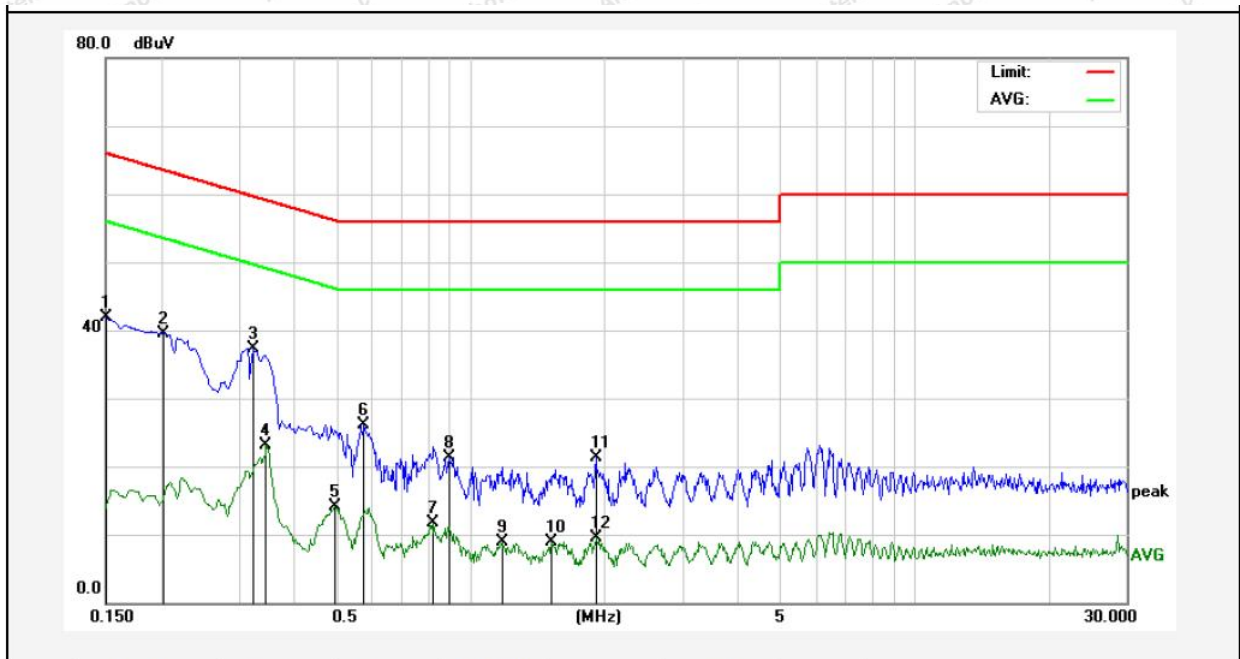
Note: The EUT received input Voltage DC 3.3V from Debug board, and the Debug board received AC 120V/60Hz from Adapter.

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

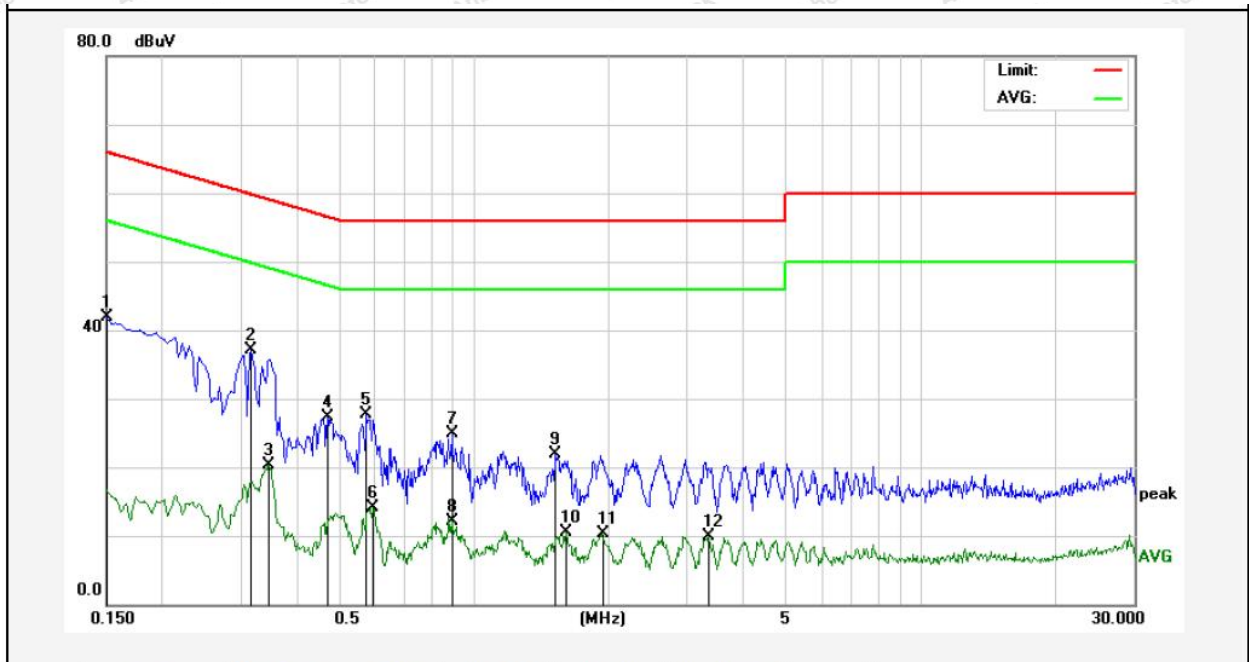


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	32.20	9.69	41.89	65.99	-24.10	QP	
2	0.2020	29.86	9.71	39.57	63.52	-23.95	QP	
3	0.3220	27.56	9.73	37.29	59.65	-22.36	QP	
4	0.3460	13.46	9.72	23.18	49.06	-25.88	AVG	
5	0.4940	4.33	9.76	14.09	46.10	-32.01	AVG	
6	0.5740	16.28	9.76	26.04	56.00	-29.96	QP	
7	0.8260	1.91	9.75	11.66	46.00	-34.34	AVG	
8	0.8940	11.52	9.74	21.26	56.00	-34.74	QP	
9	1.1740	-0.74	9.73	8.99	46.00	-37.01	AVG	
10	1.5180	-0.76	9.73	8.97	46.00	-37.03	AVG	
11	1.9100	11.68	9.72	21.40	56.00	-34.60	QP	
12	1.9100	-0.21	9.72	9.51	46.00	-36.49	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

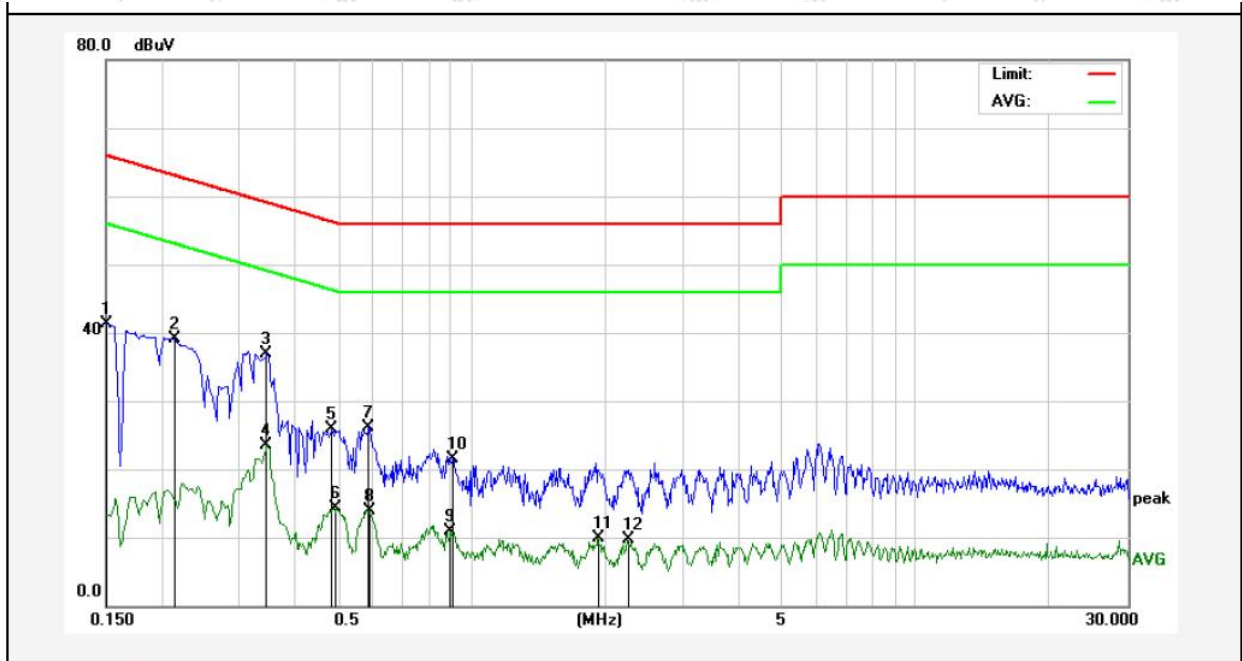


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	32.30	9.69	41.99	65.99	-24.00	QP	
2	0.3180	27.35	9.73	37.08	59.76	-22.68	QP	
3	0.3460	10.60	9.72	20.32	49.06	-28.74	AVG	
4	0.4700	17.63	9.75	27.38	56.51	-29.13	QP	
5	0.5740	17.88	9.76	27.64	56.00	-28.36	QP	
6	0.5940	4.25	9.76	14.01	46.00	-31.99	AVG	
7	0.8940	15.14	9.74	24.88	56.00	-31.12	QP	
8	0.8940	2.42	9.74	12.16	46.00	-33.84	AVG	
9	1.5260	12.12	9.73	21.85	56.00	-34.15	QP	
10	1.6060	0.71	9.73	10.44	46.00	-35.56	AVG	
11	1.9300	0.65	9.72	10.37	46.00	-35.63	AVG	
12	3.3460	0.18	9.73	9.91	46.00	-36.09	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

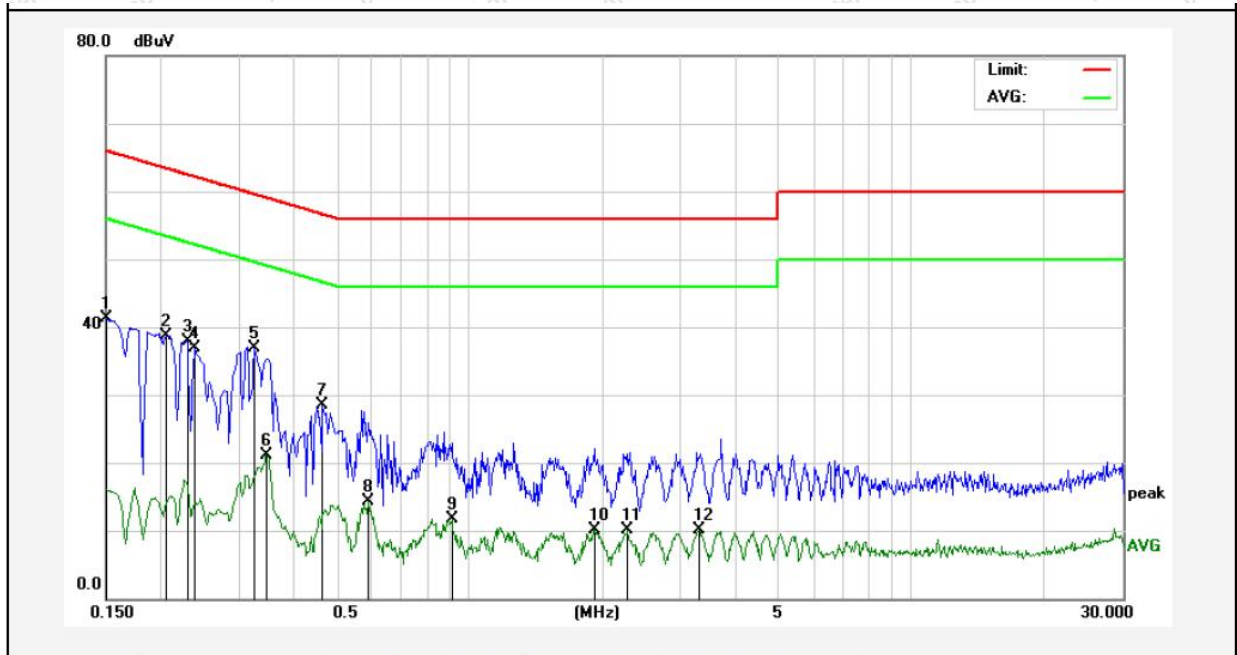


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	31.61	9.69	41.30	65.99	-24.69	QP	
2	0.2140	29.46	9.71	39.17	63.04	-23.87	QP	
3	0.3460	27.17	9.72	36.89	59.06	-22.17	QP	
4	0.3460	13.75	9.72	23.47	49.06	-25.59	AVG	
5	0.4860	16.25	9.75	26.00	56.24	-30.24	QP	
6	0.4900	4.55	9.76	14.31	46.17	-31.86	AVG	
7	0.5860	16.43	9.76	26.19	56.00	-29.81	QP	
8	0.5899	4.16	9.76	13.92	46.00	-32.08	AVG	
9	0.8980	1.25	9.74	10.99	46.00	-35.01	AVG	
10	0.9060	11.82	9.74	21.56	56.00	-34.44	QP	
11	1.9260	0.12	9.72	9.84	46.00	-36.16	AVG	
12	2.2380	-0.09	9.72	9.63	46.00	-36.37	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

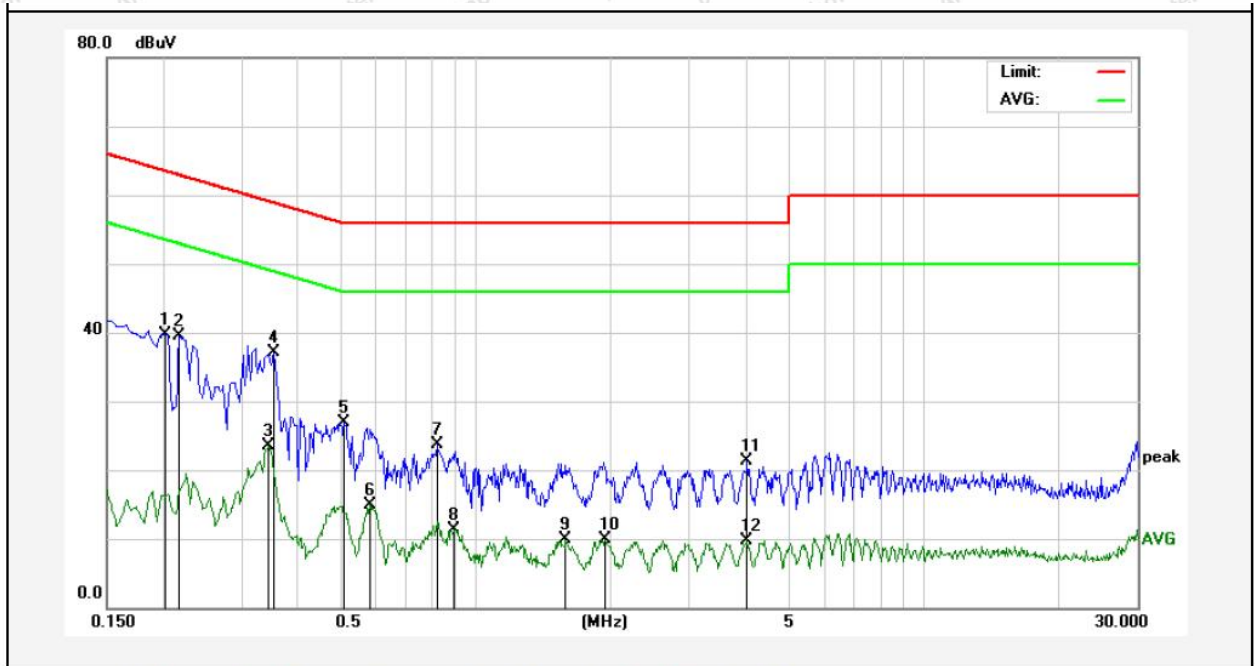


No.	Freq. (MHz)	Reading (dBUV)	Factor (dB)	Result (dBUV)	Limit (dBUV)	Over Limit (dB)	Detector	Remark
1	0.1500	31.66	9.69	41.35	65.99	-24.64	QP	
2	0.2060	29.04	9.71	38.75	63.36	-24.61	QP	
3	0.2300	28.21	9.71	37.92	62.45	-24.53	QP	
4	0.2380	27.13	9.71	36.84	62.16	-25.32	QP	
5	0.3260	27.11	9.72	36.83	59.55	-22.72	QP	
6	0.3460	11.36	9.72	21.08	49.06	-27.98	AVG	
7	0.4660	18.74	9.75	28.49	56.58	-28.09	QP	
8	0.5899	4.50	9.76	14.26	46.00	-31.74	AVG	
9	0.9100	2.05	9.74	11.79	46.00	-34.21	AVG	
10	1.9020	0.35	9.72	10.07	46.00	-35.93	AVG	
11	2.2780	0.37	9.72	10.09	46.00	-35.91	AVG	
12	3.3020	0.38	9.73	10.11	46.00	-35.89	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



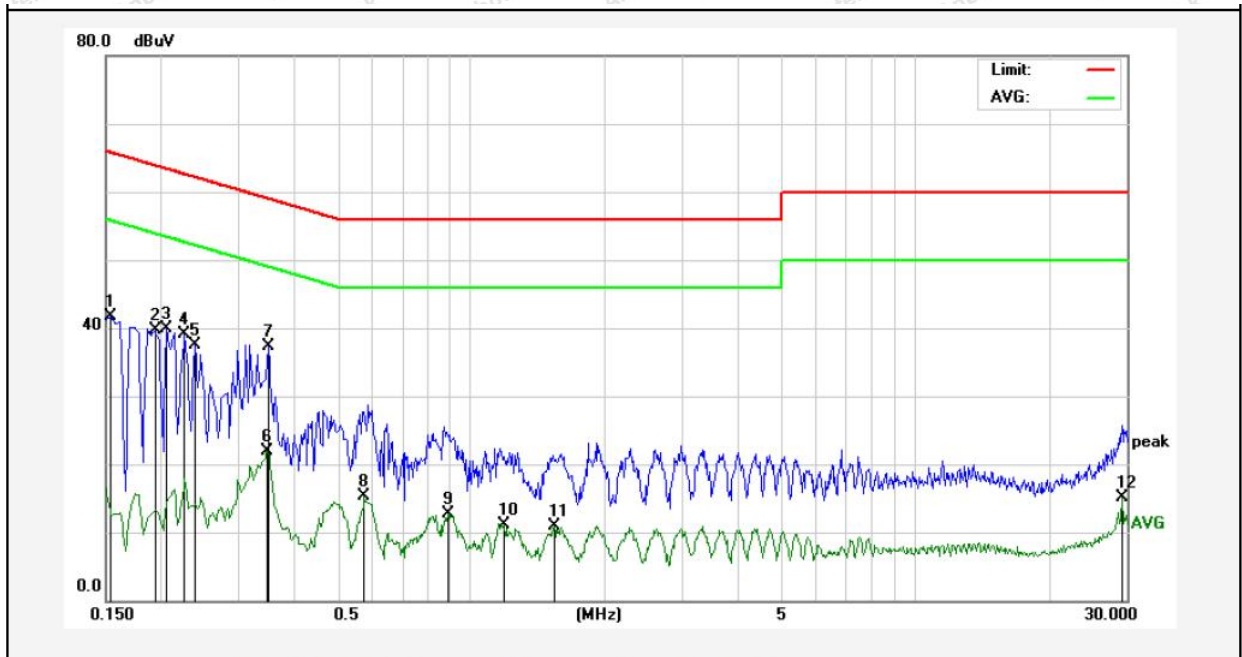
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.2020	30.05	9.71	39.76	63.52	-23.76	QP	
2	0.2180	29.71	9.71	39.42	62.89	-23.47	QP	
3	0.3460	13.74	9.72	23.46	49.06	-25.60	AVG	
4	0.3540	27.38	9.72	37.10	58.87	-21.77	QP	
5	0.5100	17.14	9.76	26.90	56.00	-29.10	QP	
6	0.5820	5.06	9.76	14.82	46.00	-31.18	AVG	
7	0.8180	14.00	9.75	23.75	56.00	-32.25	QP	
8	0.8980	1.64	9.74	11.38	46.00	-34.62	AVG	
9	1.5859	0.15	9.73	9.88	46.00	-36.12	AVG	
10	1.9460	0.23	9.72	9.95	46.00	-36.05	AVG	
11	4.0300	11.51	9.73	21.24	56.00	-34.76	QP	
12	4.0300	0.07	9.73	9.80	46.00	-36.20	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

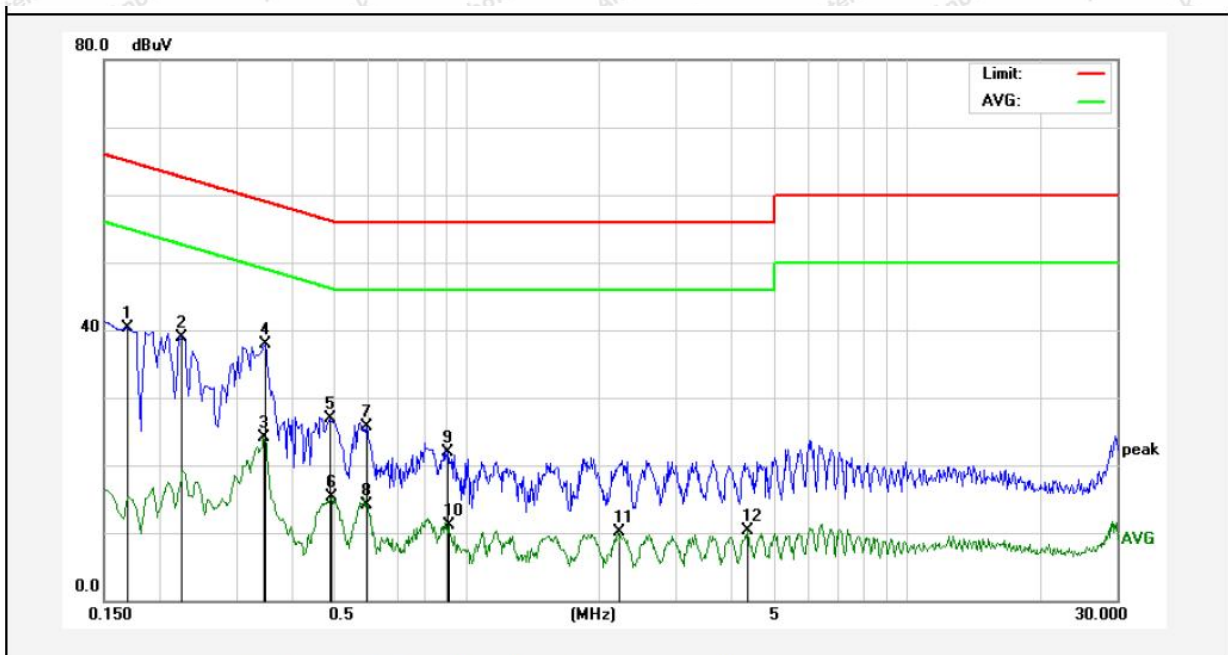


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1539	31.95	9.70	41.65	65.78	-24.13	QP	
2	0.1940	29.99	9.71	39.70	63.86	-24.16	QP	
3	0.2060	30.11	9.71	39.82	63.36	-23.54	QP	
4	0.2260	29.41	9.71	39.12	62.59	-23.47	QP	
5	0.2380	27.82	9.71	37.53	62.16	-24.63	QP	
6	0.3460	12.21	9.72	21.93	49.06	-27.13	AVG	
7	0.3500	27.61	9.72	37.33	58.96	-21.63	QP	
8	0.5740	5.53	9.76	15.29	46.00	-30.71	AVG	
9	0.8860	3.05	9.74	12.79	46.00	-33.21	AVG	
10	1.1860	1.28	9.73	11.01	46.00	-34.99	AVG	
11	1.5380	1.26	9.73	10.99	46.00	-35.01	AVG	
12	29.2380	4.85	10.28	15.13	50.00	-34.87	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

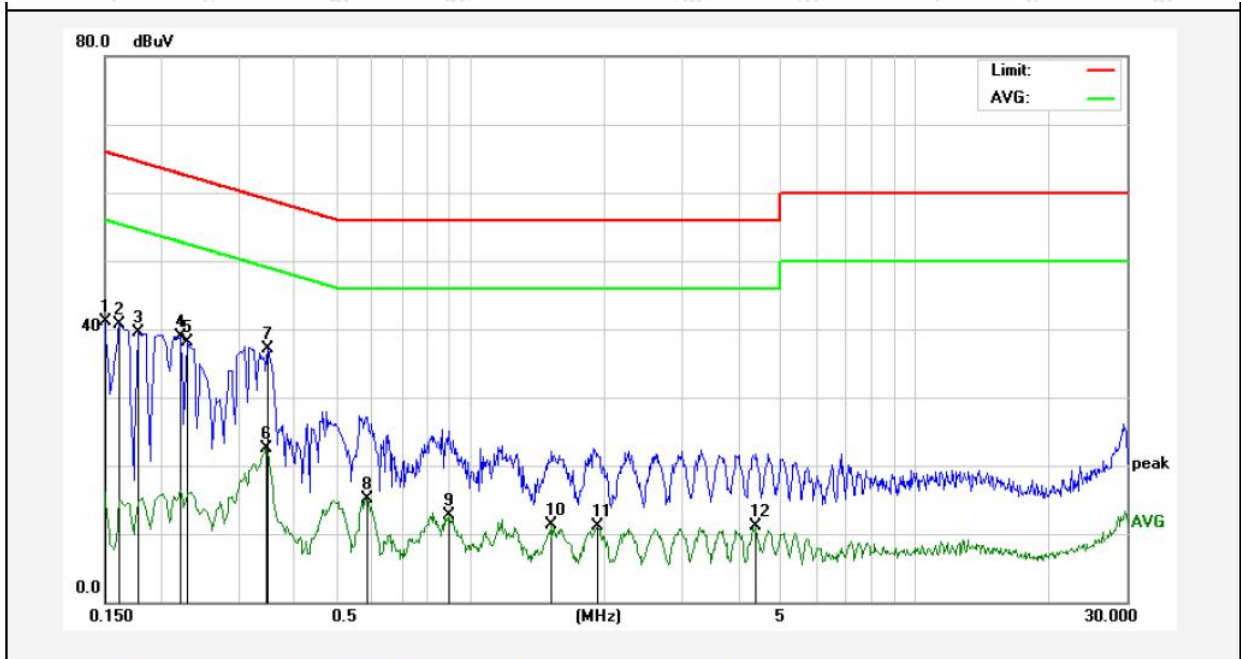


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1700	30.66	9.71	40.37	64.96	-24.59	QP	
2	0.2260	29.25	9.71	38.96	62.59	-23.63	QP	
3	0.3460	14.36	9.72	24.08	49.06	-24.98	AVG	
4	0.3500	28.28	9.72	38.00	58.96	-20.96	QP	
5	0.4900	17.10	9.76	26.86	56.17	-29.31	QP	
6	0.4940	5.60	9.76	15.36	46.10	-30.74	AVG	
7	0.5940	15.94	9.76	25.70	56.00	-30.30	QP	
8	0.5940	4.42	9.76	14.18	46.00	-31.82	AVG	
9	0.9060	12.11	9.74	21.85	56.00	-34.15	QP	
10	0.9100	1.27	9.74	11.01	46.00	-34.99	AVG	
11	2.2020	0.37	9.72	10.09	46.00	-35.91	AVG	
12	4.3500	0.48	9.73	10.21	46.00	-35.79	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	0.1500	31.36	9.69	41.05	65.99	-24.94	QP	
2	0.1620	31.05	9.70	40.75	65.36	-24.61	QP	
3	0.1780	29.73	9.71	39.44	64.57	-25.13	QP	
4	0.2220	29.10	9.71	38.81	62.74	-23.93	QP	
5	0.2300	28.38	9.71	38.09	62.45	-24.36	QP	
6	0.3460	12.86	9.72	22.58	49.06	-26.48	AVG	
7	0.3500	27.36	9.72	37.08	58.96	-21.88	QP	
8	0.5820	5.31	9.76	15.07	46.00	-30.93	AVG	
9	0.8940	3.06	9.74	12.80	46.00	-33.20	AVG	
10	1.5260	1.48	9.73	11.21	46.00	-34.79	AVG	
11	1.9300	1.37	9.72	11.09	46.00	-34.91	AVG	
12	4.3940	1.28	9.73	11.01	46.00	-34.99	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				
	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
Test Limit	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

**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

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

$$* \text{Limit} = E - 20 \text{ dBc}$$

## 4.2. Test Setup

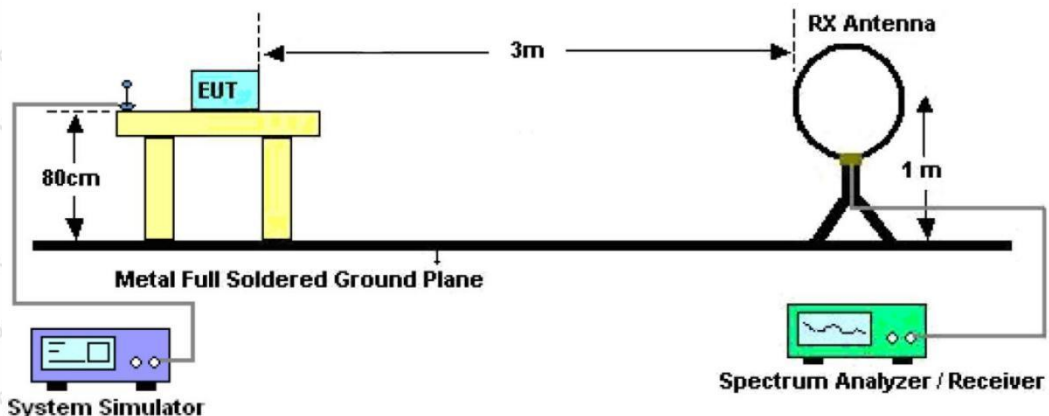


Figure 1. Below 30MHz

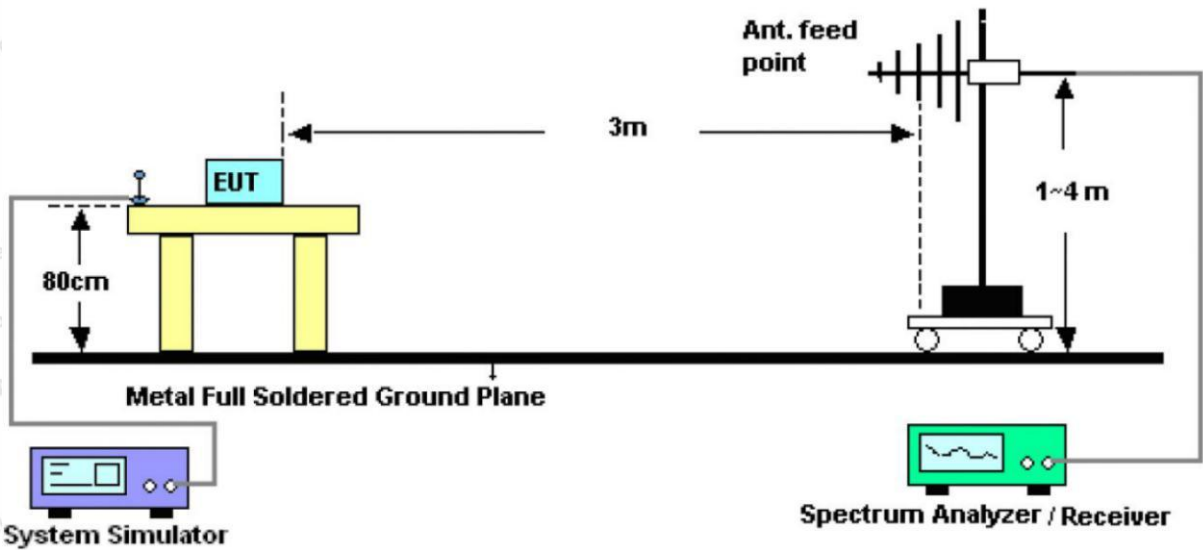


Figure 2. 30MHz to 1GHz

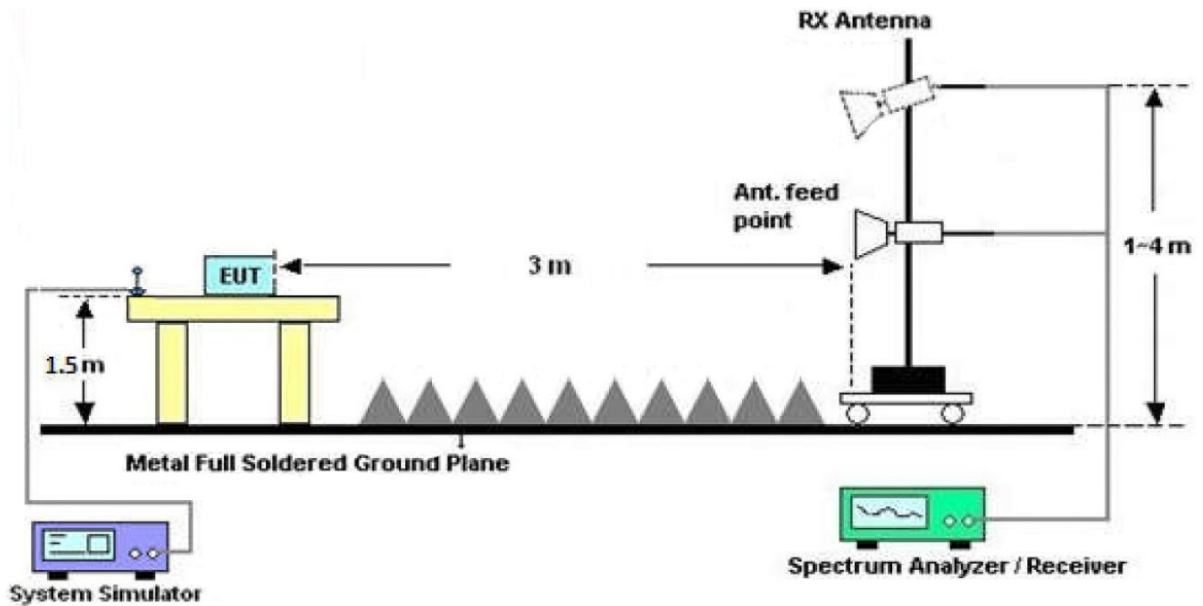


Figure 3. Above 1 GHz

### 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, 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.



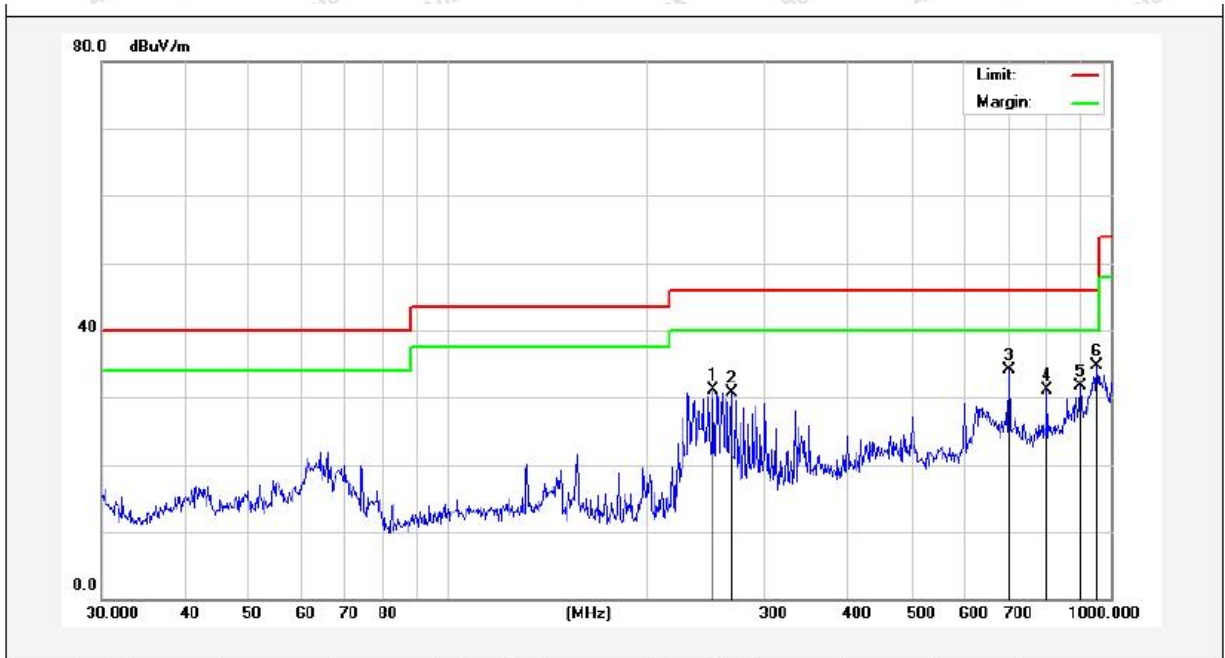
### Test Results (30~1000MHz)

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°C/50%RH



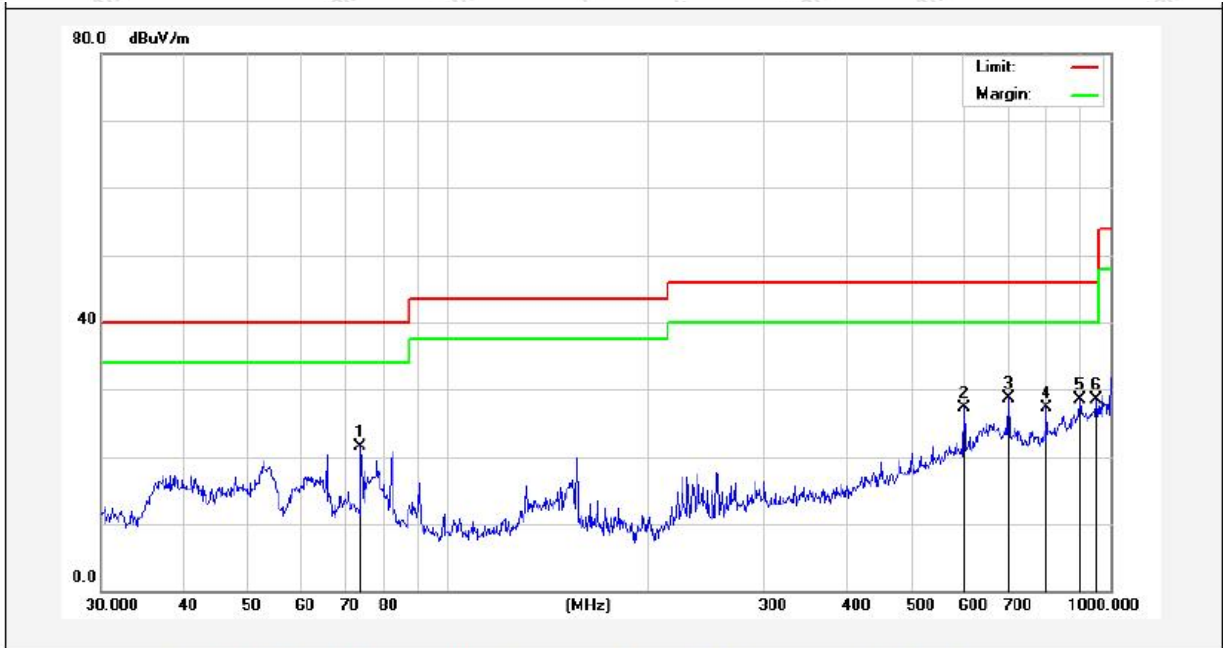
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	251.1804	52.50	-21.39	31.11	46.00	-14.89	QP			
2	267.5455	50.65	-19.97	30.68	46.00	-15.32	QP			
3	701.7610	44.05	-9.89	34.16	46.00	-11.84	QP			
4	801.7863	39.32	-8.24	31.08	46.00	-14.92	QP			
5	900.1474	37.93	-6.22	31.71	46.00	-14.29	QP			
6	952.0937	40.40	-5.61	34.79	46.00	-11.21	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

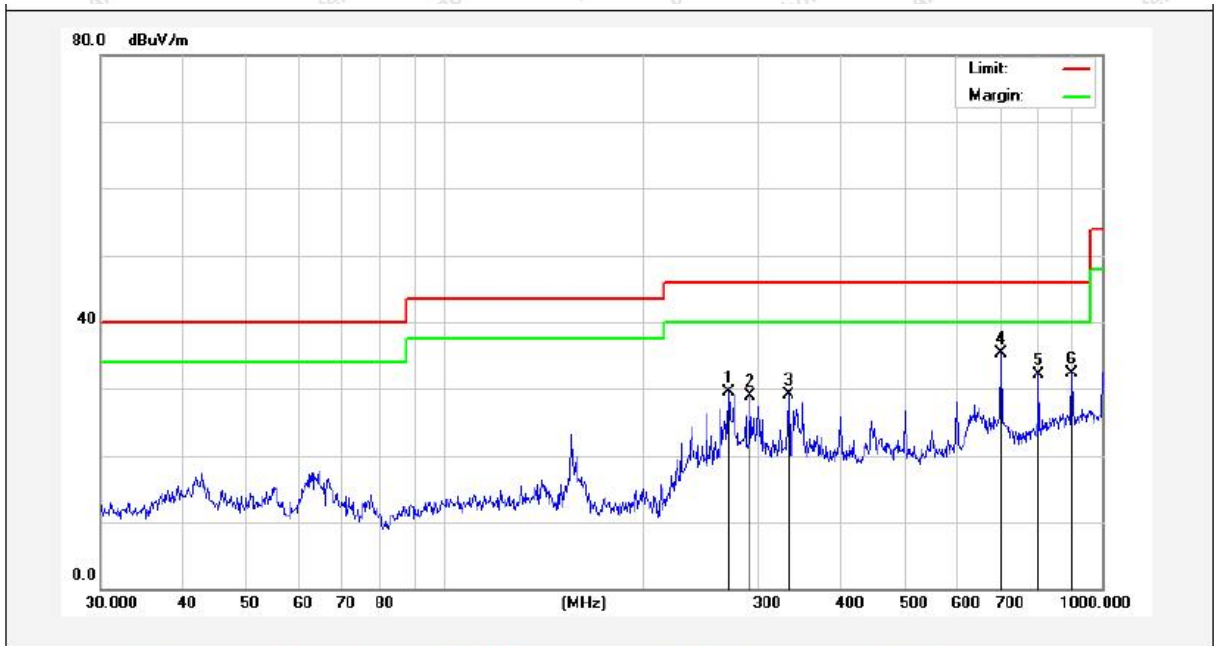


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	73.8756	41.41	-19.90	21.51	40.00	-18.49	QP			
2	601.4265	37.83	-10.53	27.30	46.00	-18.70	QP			
3	701.7610	38.69	-9.89	28.80	46.00	-17.20	QP			
4	801.7863	35.50	-8.24	27.26	46.00	-18.74	QP			
5	900.1474	34.76	-6.22	28.54	46.00	-17.46	QP			
6	952.0937	34.20	-5.61	28.59	46.00	-17.41	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

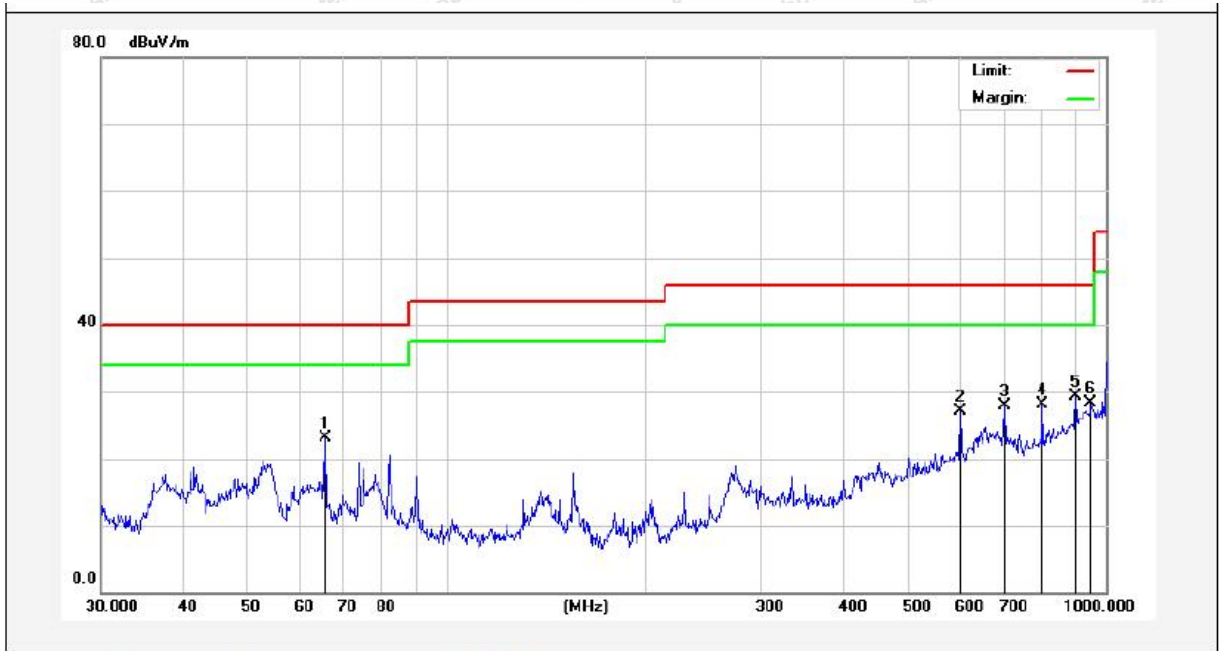


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	270.3748	49.18	-19.72	29.46	46.00	-16.54	QP			
2	292.0583	46.69	-17.85	28.84	46.00	-17.16	QP			
3	333.6867	45.44	-16.38	29.06	46.00	-16.94	QP			
4	701.7610	45.23	-9.89	35.34	46.00	-10.66	QP			
5	801.7863	40.37	-8.24	32.13	46.00	-13.87	QP			
6	900.1474	38.59	-6.22	32.37	46.00	-13.63	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	65.5727	42.59	-19.40	23.19	40.00	-16.81	QP			
2	601.4265	37.71	-10.53	27.18	46.00	-18.82	QP			
3	701.7610	37.78	-9.89	27.89	46.00	-18.11	QP			
4	801.7863	36.39	-8.24	28.15	46.00	-17.85	QP			
5	900.1474	35.47	-6.22	29.25	46.00	-16.75	QP			
6	948.7610	33.97	-5.65	28.32	46.00	-17.68	QP			



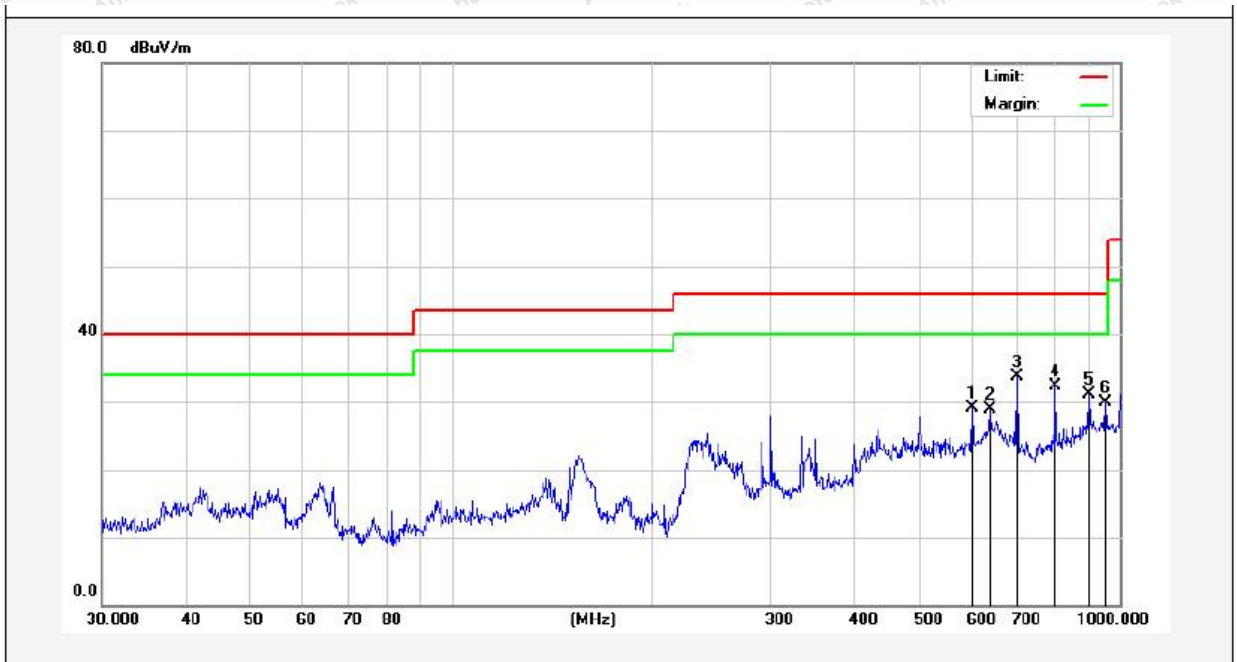
### Test Results (30~1000MHz)

Test Mode: CH 01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°C/50%RH

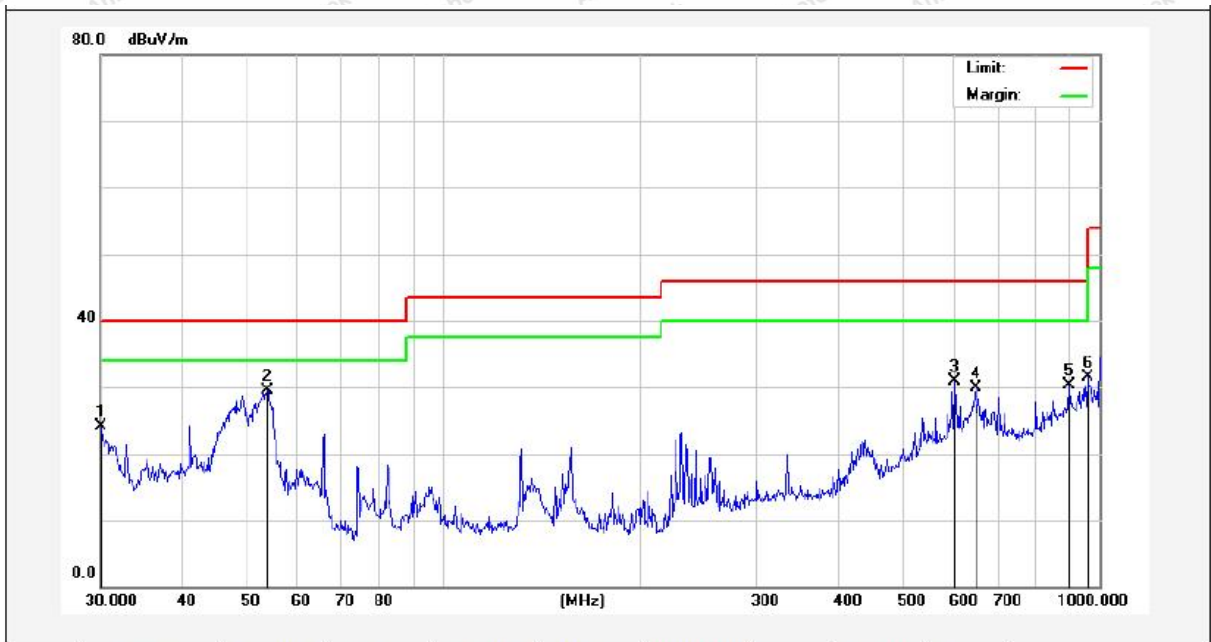


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	601.4265	39.62	-10.53	29.09	46.00	-16.91	QP			
2	638.3686	39.60	-10.63	28.97	46.00	-17.03	QP			
3	701.7610	43.61	-9.89	33.72	46.00	-12.28	QP			
4	801.7863	40.48	-8.24	32.24	46.00	-13.76	QP			
5	900.1474	37.38	-6.22	31.16	46.00	-14.84	QP			
6	952.0937	35.53	-5.61	29.92	46.00	-16.08	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	30.1054	42.03	-17.95	24.08	40.00	-15.92	QP			
2	53.8818	46.74	-17.21	29.53	40.00	-10.47	QP			
3	601.4265	41.42	-10.53	30.89	46.00	-15.11	QP			
4	647.3856	40.54	-10.66	29.88	46.00	-16.12	QP			
5	900.1474	36.48	-6.22	30.26	46.00	-15.74	QP			
6	958.7943	36.97	-5.49	31.48	46.00	-14.52	QP			



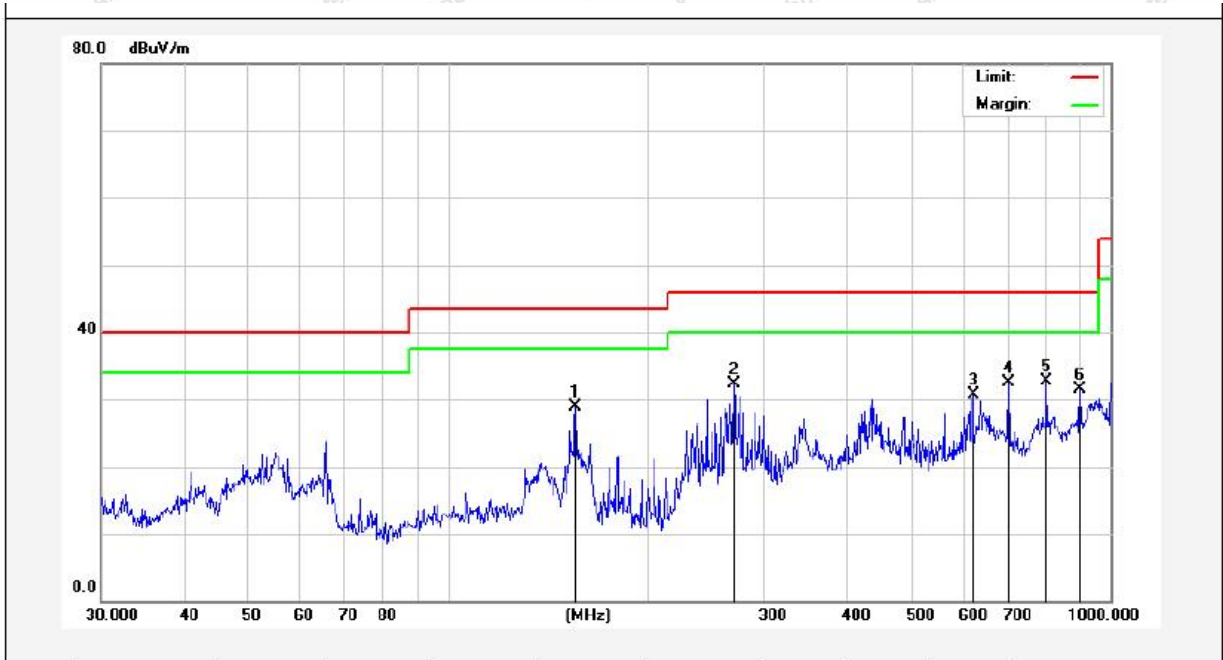
### Test Results (30~1000MHz)

Test Mode: CH 01 with ANT2 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 22.5°C/50%RH

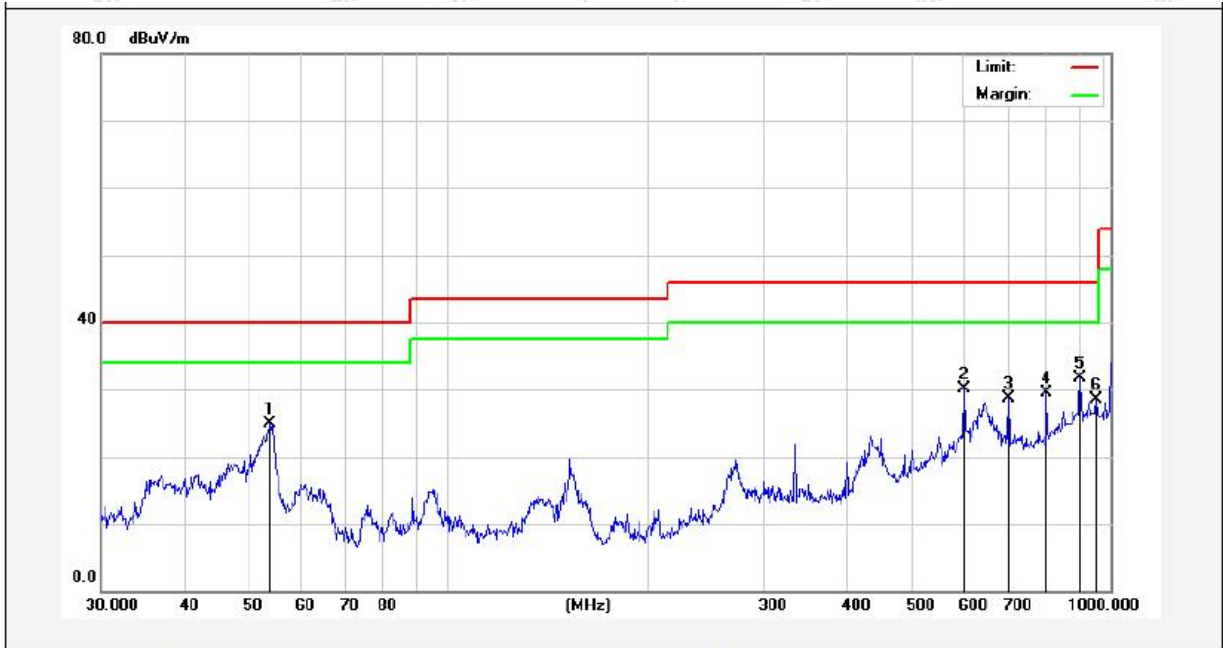


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	155.9101	52.42	-23.54	28.88	43.50	-14.62	QP			
2	270.3748	52.04	-19.72	32.32	46.00	-13.68	QP			
3	620.7096	41.21	-10.57	30.64	46.00	-15.36	QP			
4	701.7610	42.36	-9.89	32.47	46.00	-13.53	QP			
5	801.7863	40.91	-8.24	32.67	46.00	-13.33	QP			
6	900.1474	37.70	-6.22	31.48	46.00	-14.52	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

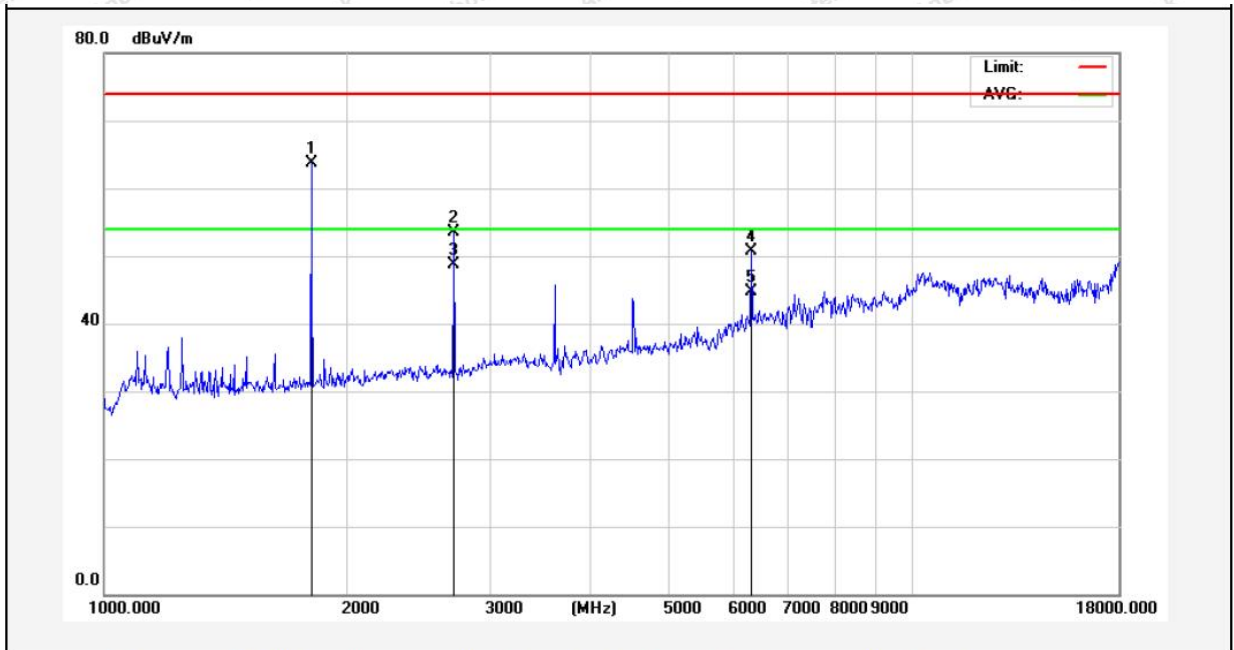


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	53.8818	42.08	-17.21	24.87	40.00	-15.13	peak			
2	601.4265	40.71	-10.53	30.18	46.00	-15.82	peak			
3	701.7610	38.66	-9.89	28.77	46.00	-17.23	peak			
4	801.7863	37.83	-8.24	29.59	46.00	-16.41	peak			
5	900.1474	37.98	-6.22	31.76	46.00	-14.24	peak			
6	952.0937	34.16	-5.61	28.55	46.00	-17.45	peak			



### 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	90.05	-26.32	63.73	104.02	-40.29	peak			
2	2710.622	77.24	-23.69	53.55	74.00	-20.45	peak			
3	2710.622	72.34	-23.69	48.65	74.00	-25.35	peak			
4	6322.136	62.84	-12.13	50.71	74.00	-23.29	peak			
5	6322.136	56.90	-12.13	44.77	54.00	-9.23	AVG			

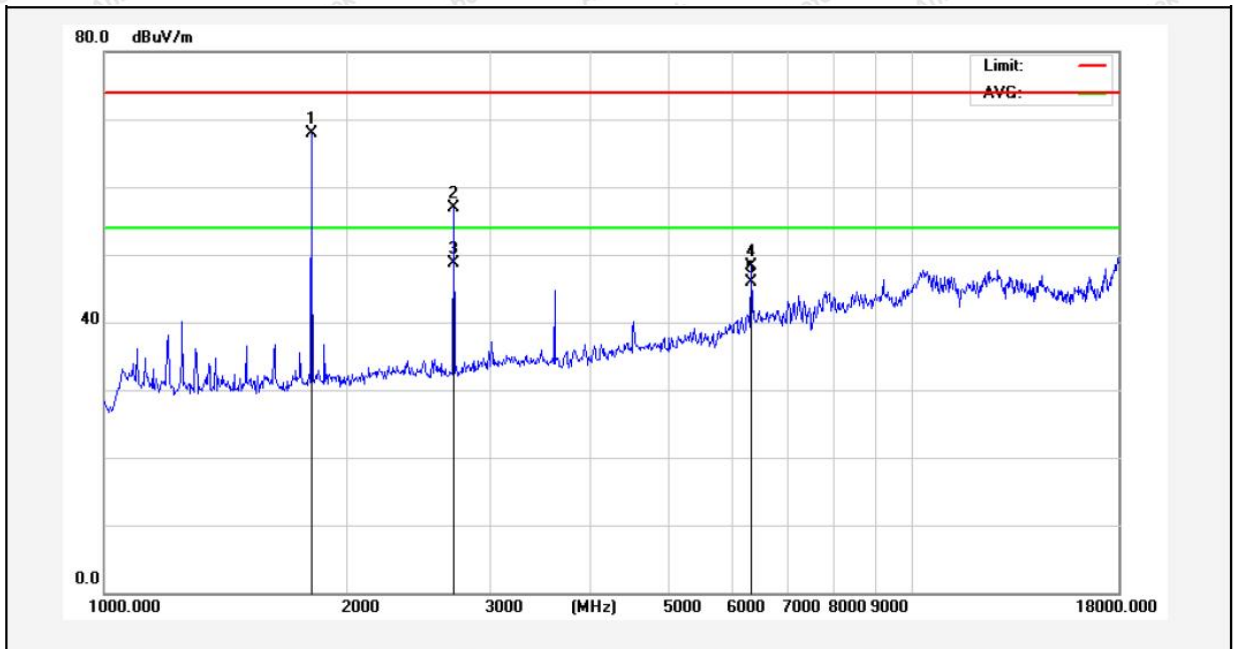
\*) -20 dBc





### 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



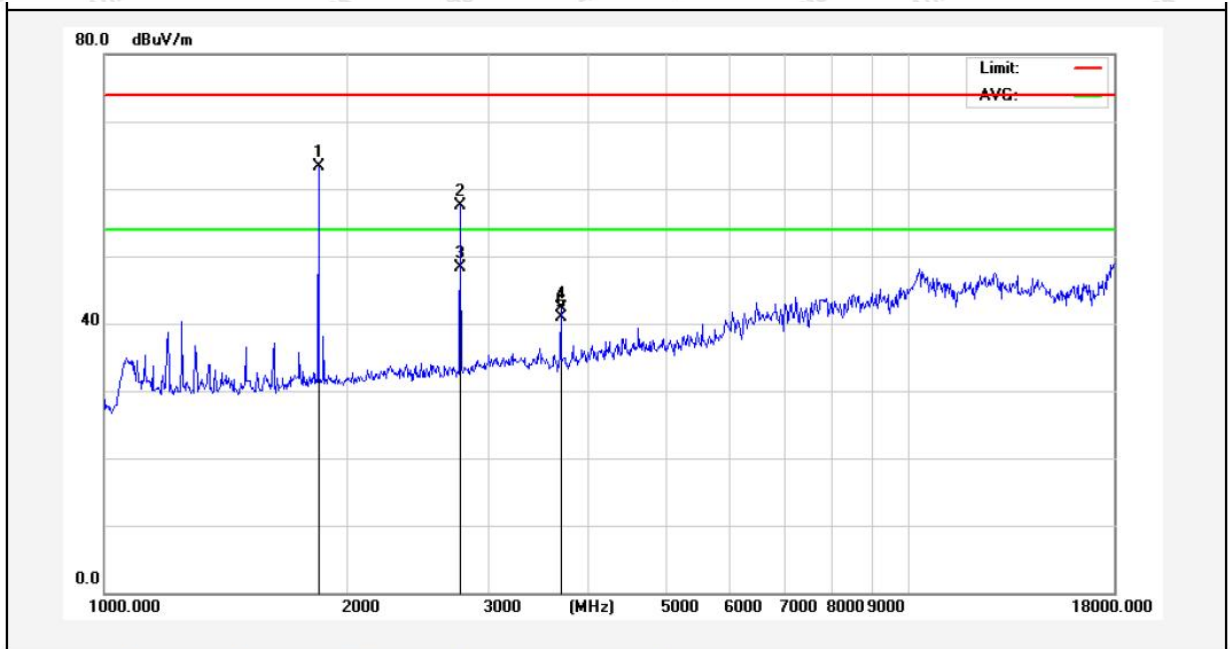
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	* 1803.332	94.19	-26.32	67.87	104.02	-36.15	peak			
2	2710.622	80.62	-23.69	56.93	74.00	-17.07	peak			
3	2710.622	72.46	-23.69	48.77	54.00	-5.23	AVG			
4	6322.136	60.43	-12.13	48.30	74.00	-25.70	peak			
5	6322.136	58.10	-12.13	45.97	54.00	-8.03	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



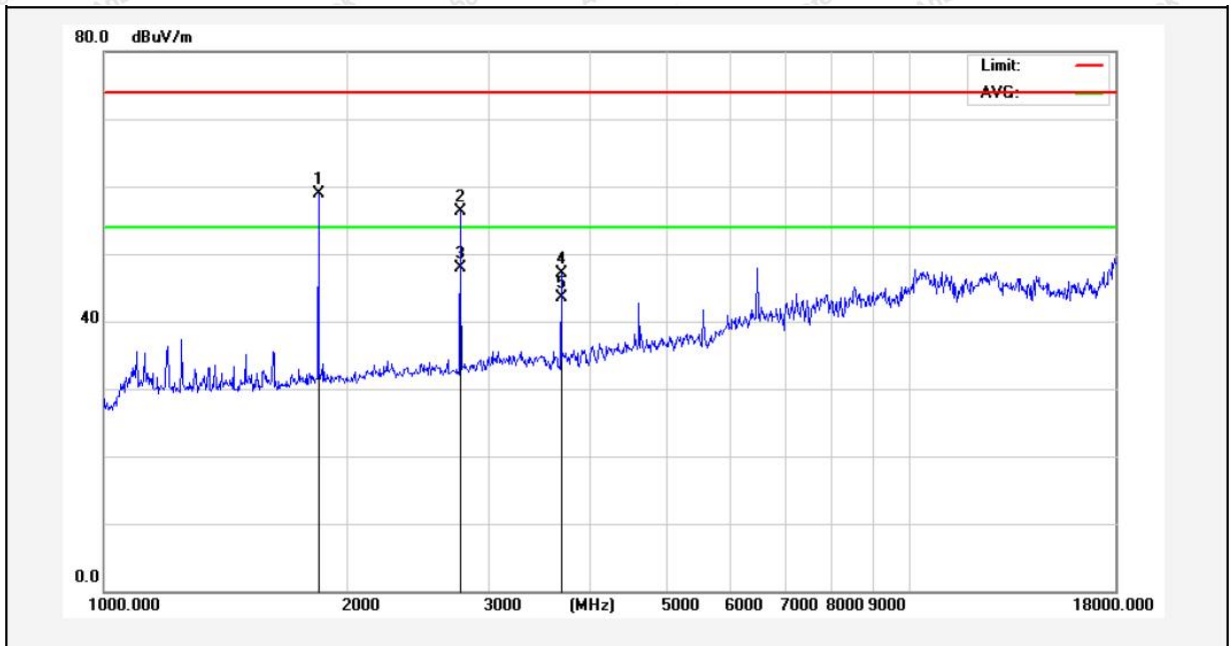
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	* 1845.516	89.37	-26.00	63.37	103.65	-40.28	peak			
2	2766.024	81.04	-23.55	57.49	74.00	-16.51	peak			
3	2766.024	71.76	-23.55	48.21	54.00	-5.79	AVG			
4	3693.033	63.37	-21.09	42.28	74.00	-31.72	peak			
5	3693.033	62.08	-21.09	40.99	54.00	-13.01	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



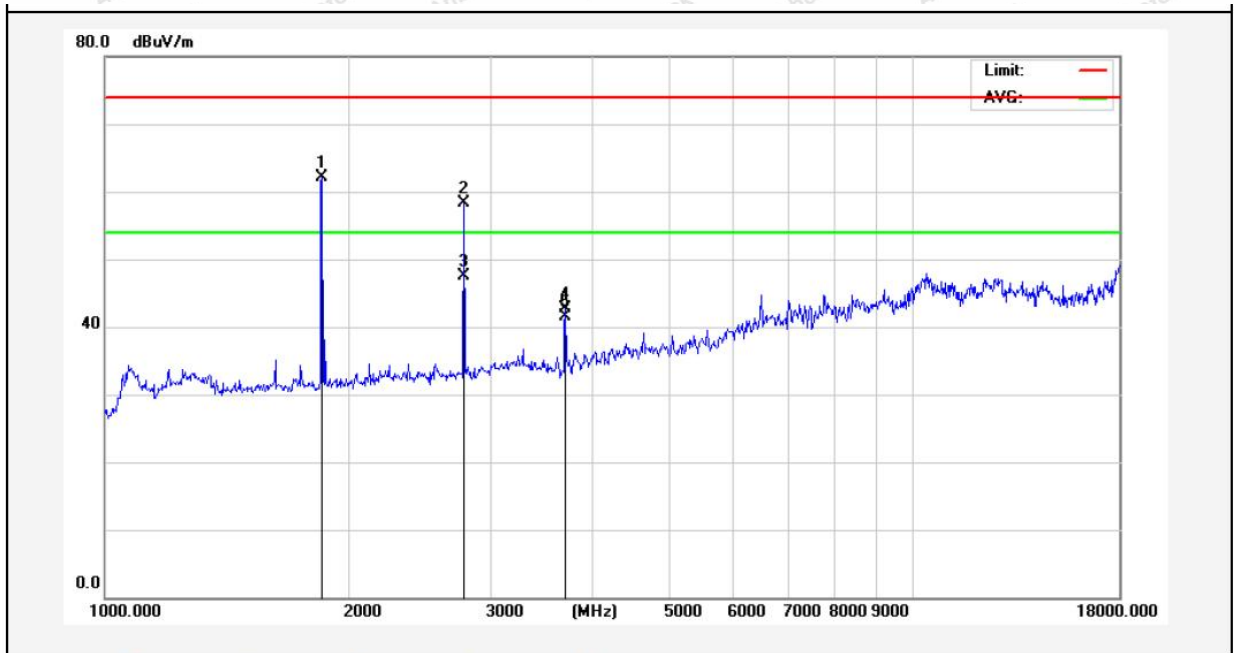
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	* 1845.516	84.88	-26.00	58.88	103.65	-44.77	peak			
2	2766.024	79.92	-23.55	56.37	74.00	-17.63	peak			
3	2766.024	71.53	-23.55	47.98	54.00	-6.02	AVG			
4	3693.033	68.28	-21.09	47.19	74.00	-26.81	peak			
5	3693.033	64.63	-21.09	43.54	54.00	-10.46	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



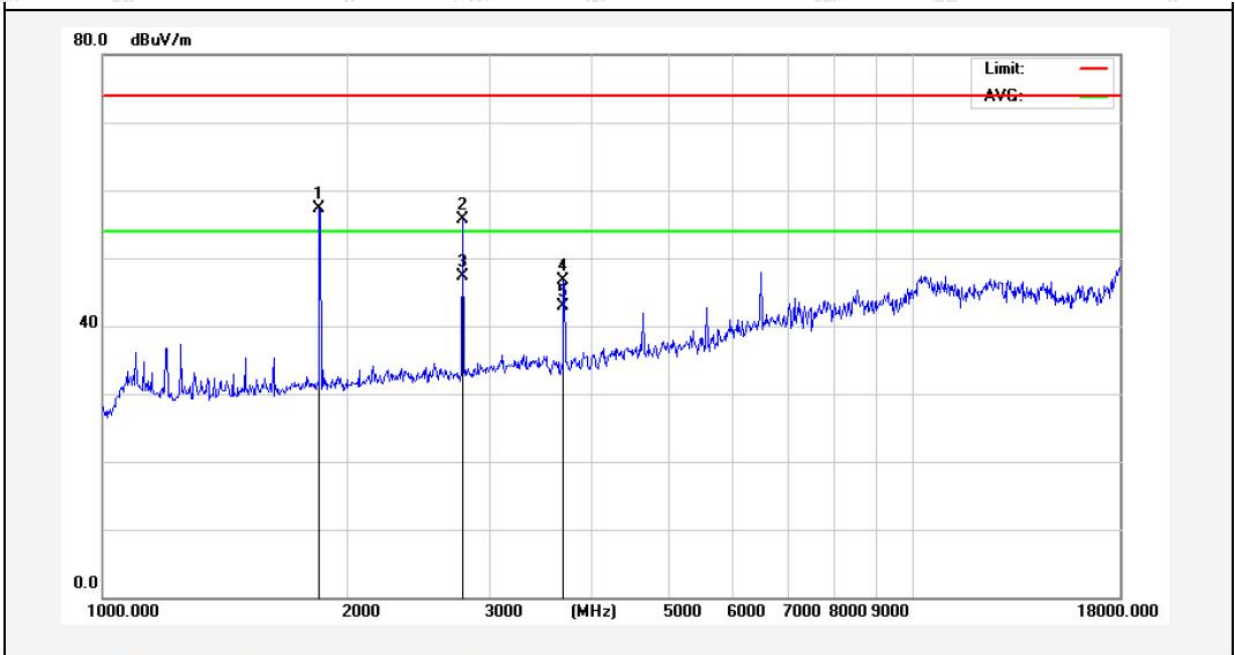
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	* 1856.215	88.05	-25.92	62.13	103.59	-41.46	peak			
2	2782.060	81.80	-23.52	58.28	74.00	-15.72	peak			
3	2782.060	71.03	-23.52	47.51	54.00	-6.49	AVG			
4	3714.443	63.60	-20.95	42.65	74.00	-31.35	peak			
5	3714.443	62.36	-20.95	41.41	54.00	-12.59	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



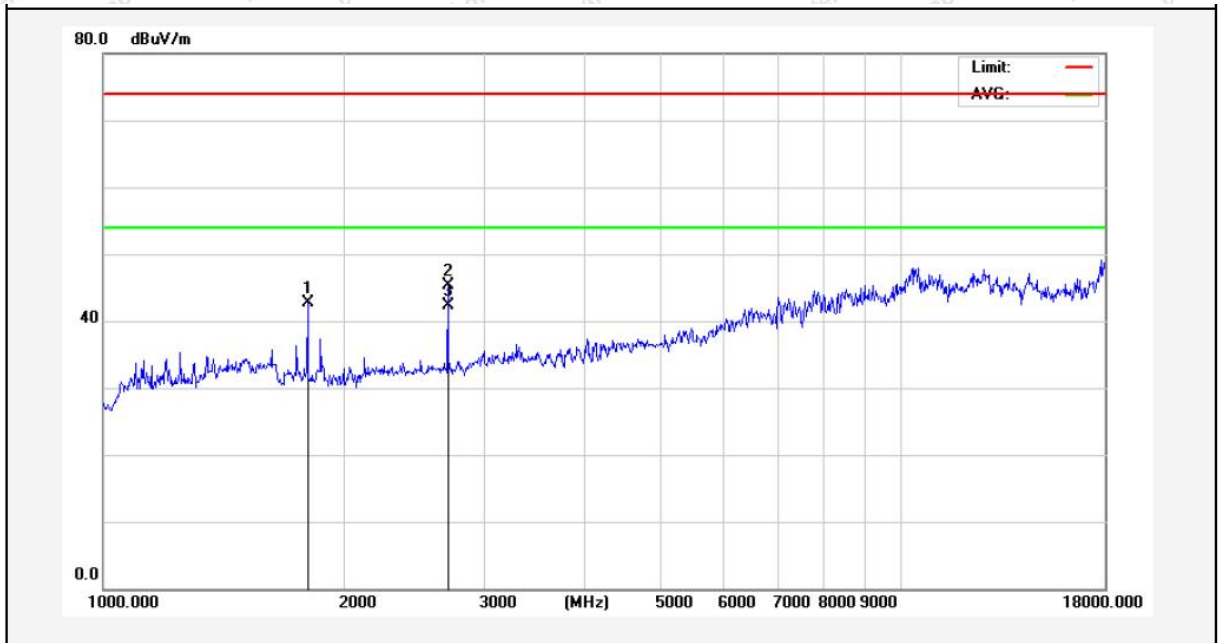
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	* 1850.858	83.26	-25.96	57.30	103.59	-46.29	peak			
2	2782.060	79.18	-23.52	55.66	74.00	-18.34	peak			
3	2782.060	70.78	-23.52	47.26	54.00	-6.74	AVG			
4	3703.722	67.66	-21.02	46.64	74.00	-27.36	peak			
5	3703.722	63.98	-21.02	42.96	54.00	-11.04	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



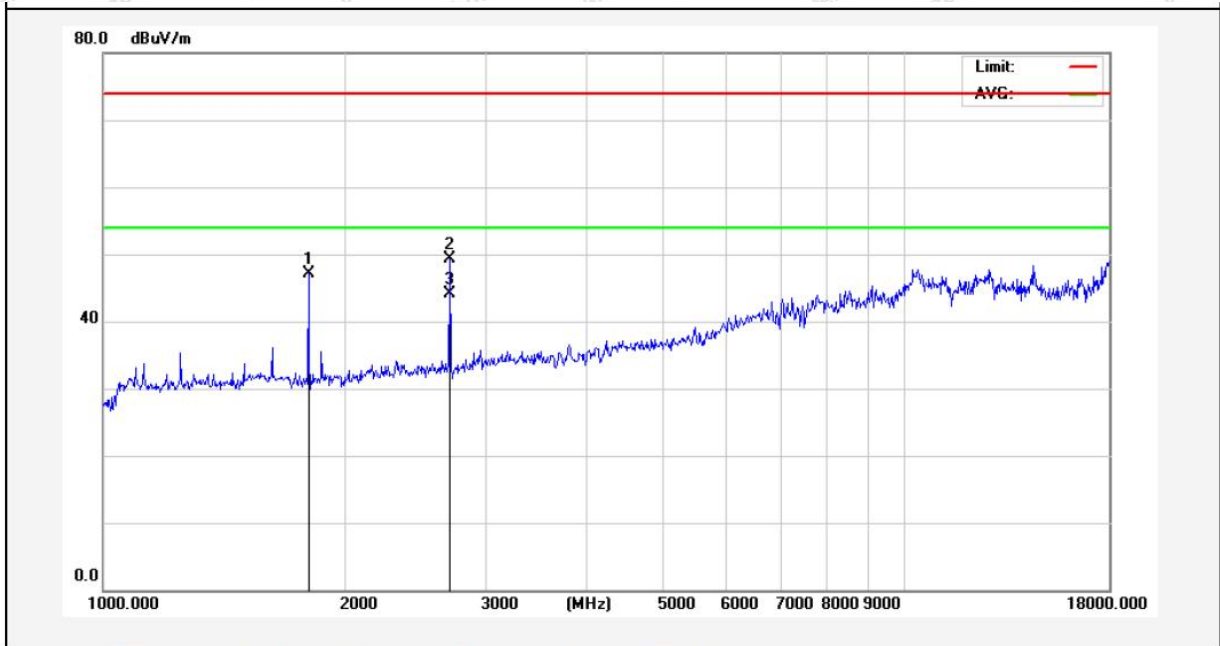
No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	* 1803.332	69.05	-26.32	42.73	104.42	-61.69	peak			
2	2702.799	68.99	-23.70	45.29	74.00	-28.71	peak			
3	2702.799	66.06	-23.70	42.36	54.00	-11.64	AVG			

\*) -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	73.43	-26.32	47.11	104.42	-57.31	peak			
2	2710.622	73.05	-23.69	49.36	74.00	-24.64	peak			
3	2710.622	67.81	-23.69	44.12	54.00	-9.88	AVG			

\*) -20 dBc

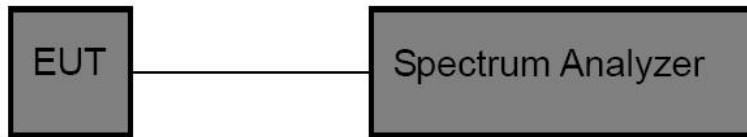


## 5. Maximum Peak Output Power Test

### 5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(3)
Test Limit	1W (30dBm)

### 5.2. Test Setup



### 5.3. Test Procedure

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

1. Set the RBW  $\geq$  DTS bandwidth.
2. Set the VBW  $\geq 3 \times$  RBW.
3. Set the span  $\geq 3 \times$  RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.

### 5.4. Test Data

Test Item	:	Max. peak output power	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 3.3V	Temperature	:	23.6°C
Test Result	:	PASS	Humidity	:	53 %

#### For New PA:

Test Channel	Peak Power output (dBm)	Limit (dBm)	Results
Low	26.224	30	PASS
Middle	25.859	30	PASS
High	25.792	30	PASS





**For Original PA:**

Test Channel	Peak Power output (dBm)	Limit (dBm)	Results
Low	25.423	30	PASS
Middle	24.812	30	PASS
High	25.341	30	PASS



## 6. Antenna Requirement

### 6.1. 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>

### 6.2. Antenna Connected Construction

The antenna is a 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 -----

