

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 Anbotech 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, 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. 19, 2021
R01	Reference Note 1	Sept. 09, 2022

Note 1:

This is a Class II application which was based on the original report 18220WC10157401. 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.
RF Specification		
Support Technology	:	☒ LoRa
Operation Mode	:	☒ DSSS ☐ FHSS
Support Bandwidth	:	☐ 125KHz ☐ 250KHz ☒ 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)
Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.		



1.3. Auxiliary Equipment Used During Test

Description	Rating(s)
Adapter	M/N: SAW12-050-2100UB Input: 100-240V~ 50/60Hz, 0.3A Output: DC 5V, 2100mA

1.4. Description of Test Configuration

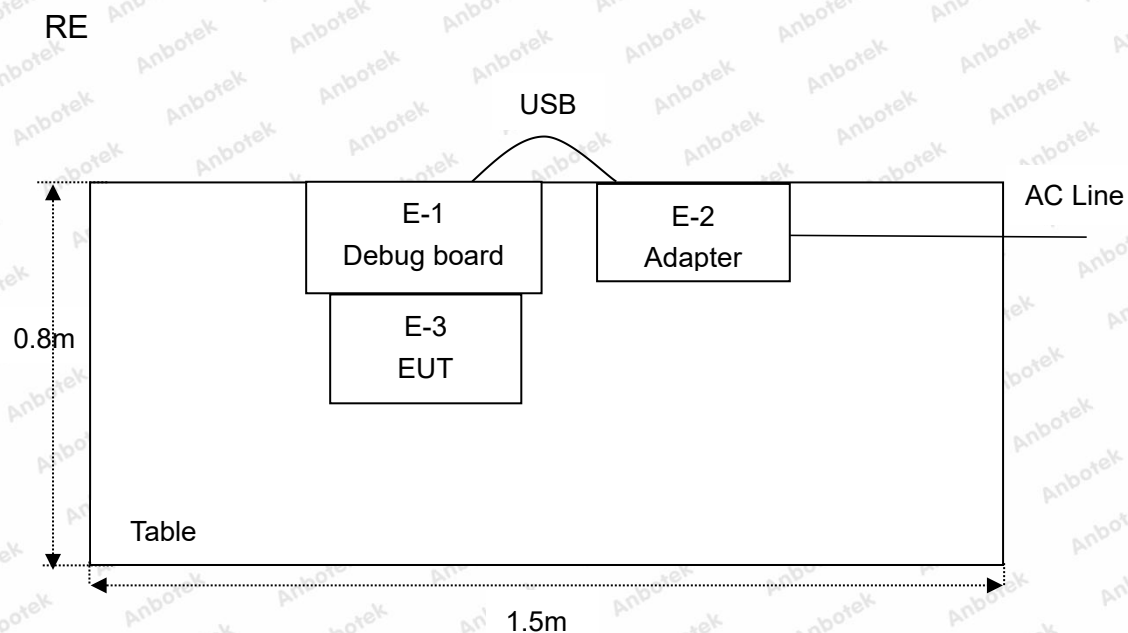
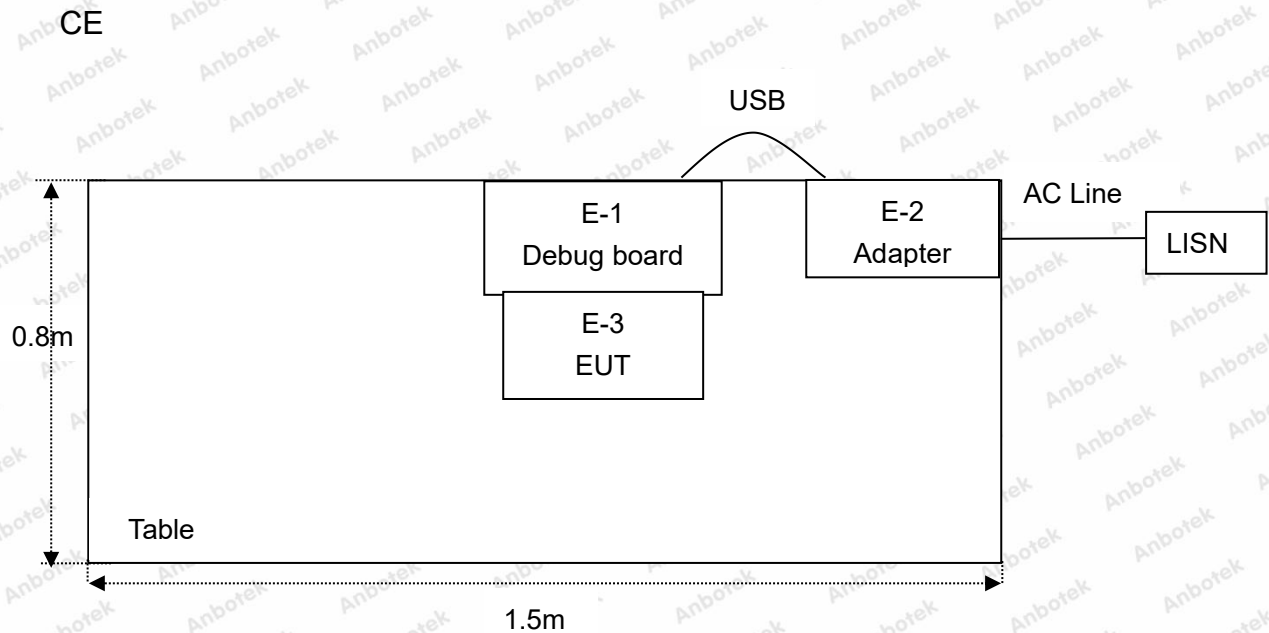
Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	903.0	09	923.3
02	904.6	10	923.9
03	906.2	11	924.5
04	907.8	12	925.1
05	909.4	13	925.7
06	911.0	14	926.3
07	912.6	15	926.9
08	914.2	16	927.5

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
Remark: "N/A" is an abbreviation for Not Applicable.		

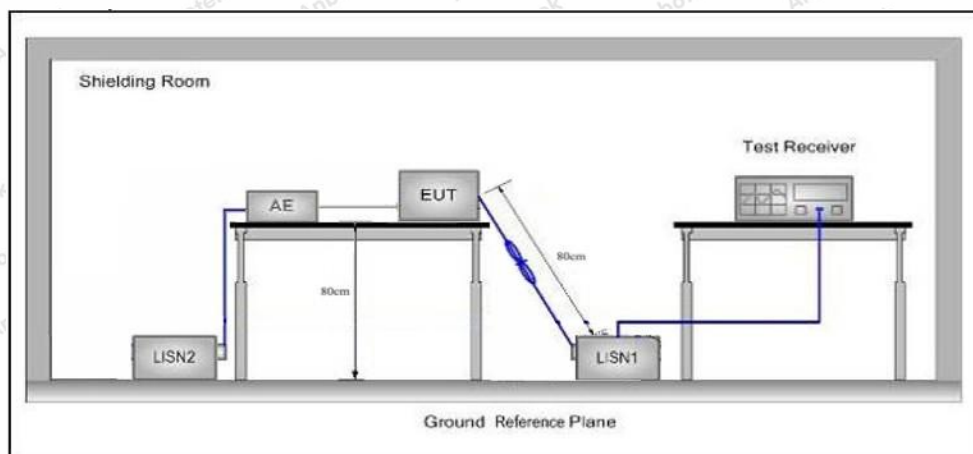


3. Conducted Emission Test

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

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

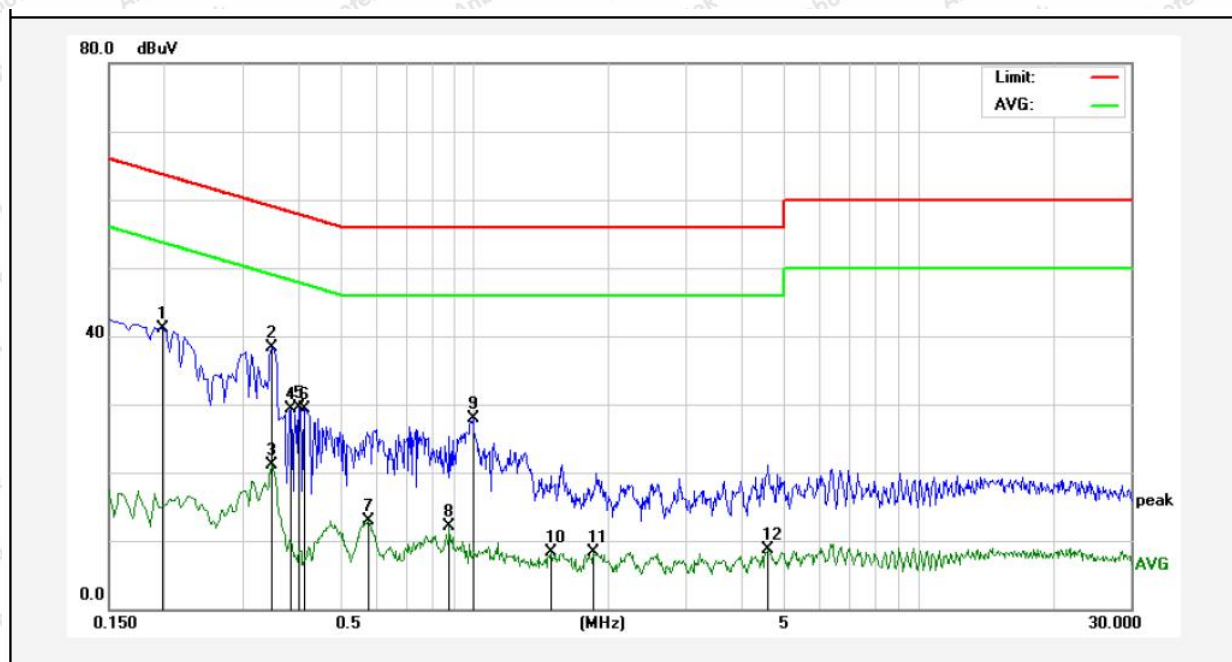
Note: The EUT received input Voltage DC 3.3V from Debug board, and the Debug board received AC 120V/60Hz from Adapter.

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

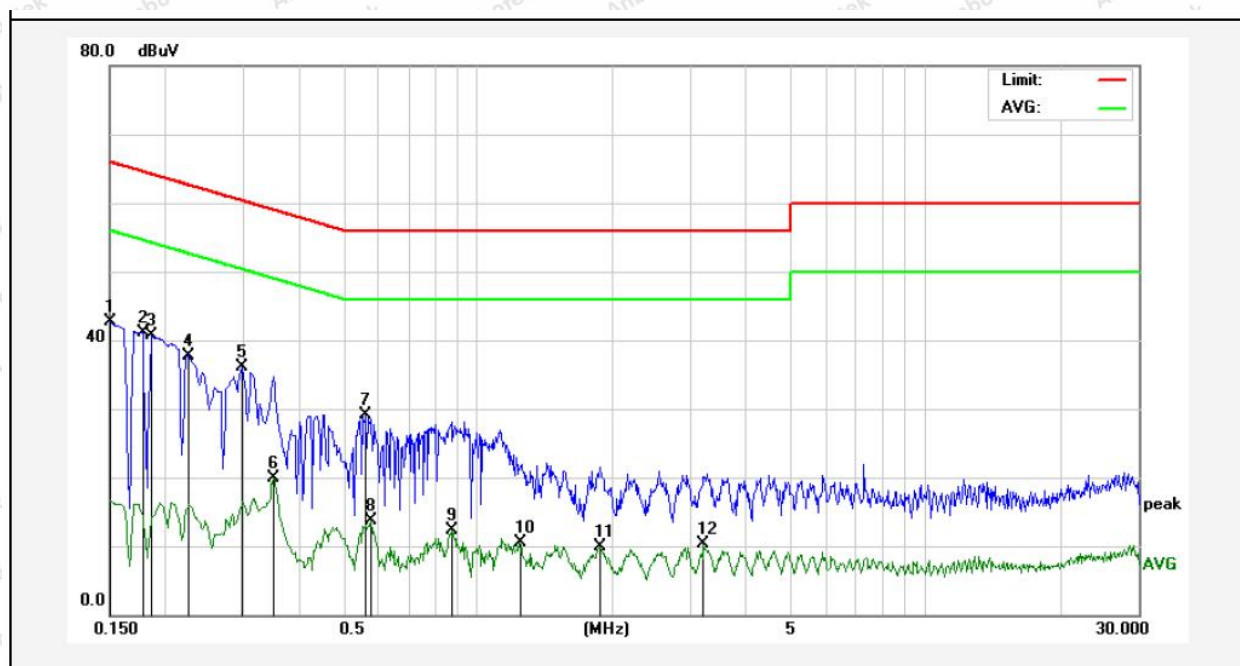


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1980	31.42	9.71	41.13	63.69	-22.56	QP	
2	0.3500	28.62	9.72	38.34	58.96	-20.62	QP	
3	0.3500	11.30	9.72	21.02	48.96	-27.94	AVG	
4	0.3860	19.62	9.71	29.33	58.15	-28.82	QP	
5	0.4020	19.87	9.71	29.58	57.81	-28.23	QP	
6	0.4140	19.63	9.72	29.35	57.57	-28.22	QP	
7	0.5780	3.18	9.76	12.94	46.00	-33.06	AVG	
8	0.8780	2.27	9.74	12.01	46.00	-33.99	AVG	
9	0.9900	18.19	9.74	27.93	56.00	-28.07	QP	
10	1.4819	-1.40	9.73	8.33	46.00	-37.67	AVG	
11	1.8540	-1.33	9.72	8.39	46.00	-37.61	AVG	
12	4.5860	-1.07	9.74	8.67	46.00	-37.33	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

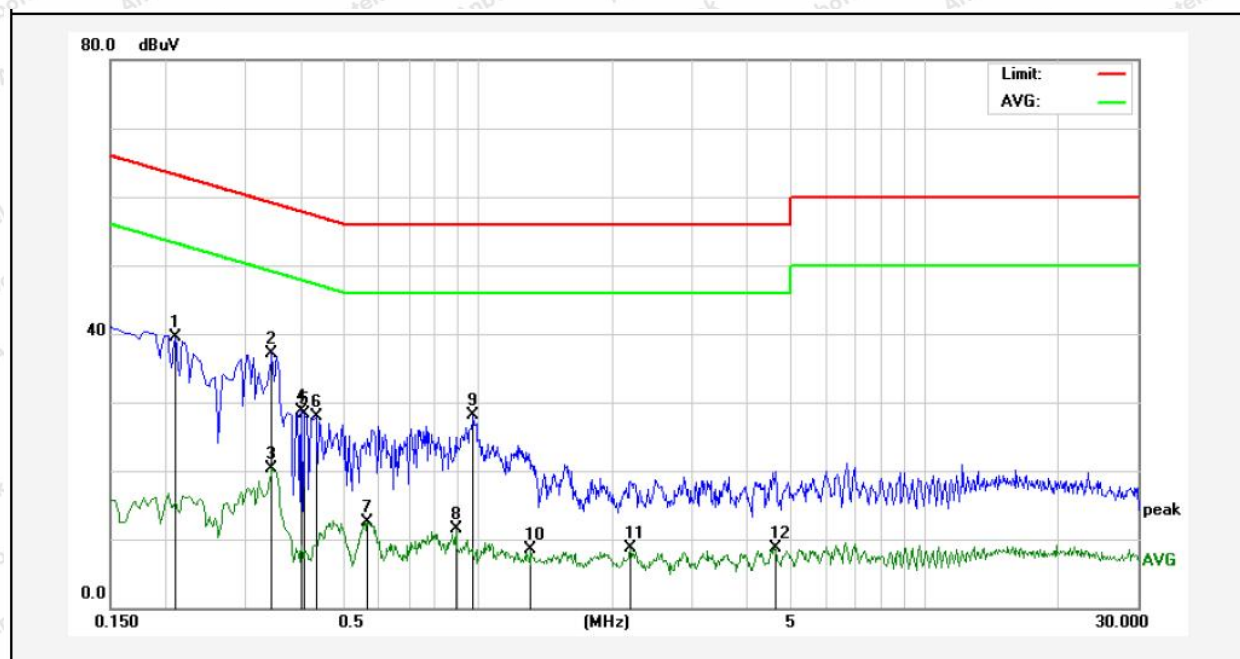


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	33.11	9.69	42.80	65.99	-23.19	QP	
2	0.1780	31.41	9.71	41.12	64.57	-23.45	QP	
3	0.1860	31.03	9.71	40.74	64.21	-23.47	QP	
4	0.2260	28.05	9.71	37.76	62.59	-24.83	QP	
5	0.2980	26.40	9.72	36.12	60.30	-24.18	QP	
6	0.3500	10.14	9.72	19.86	48.96	-29.10	AVG	
7	0.5620	19.40	9.76	29.16	56.00	-26.84	QP	
8	0.5780	3.90	9.76	13.66	46.00	-32.34	AVG	
9	0.8780	2.52	9.74	12.26	46.00	-33.74	AVG	
10	1.2420	0.71	9.73	10.44	46.00	-35.56	AVG	
11	1.8860	0.19	9.72	9.91	46.00	-36.09	AVG	
12	3.2020	0.58	9.73	10.31	46.00	-35.69	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

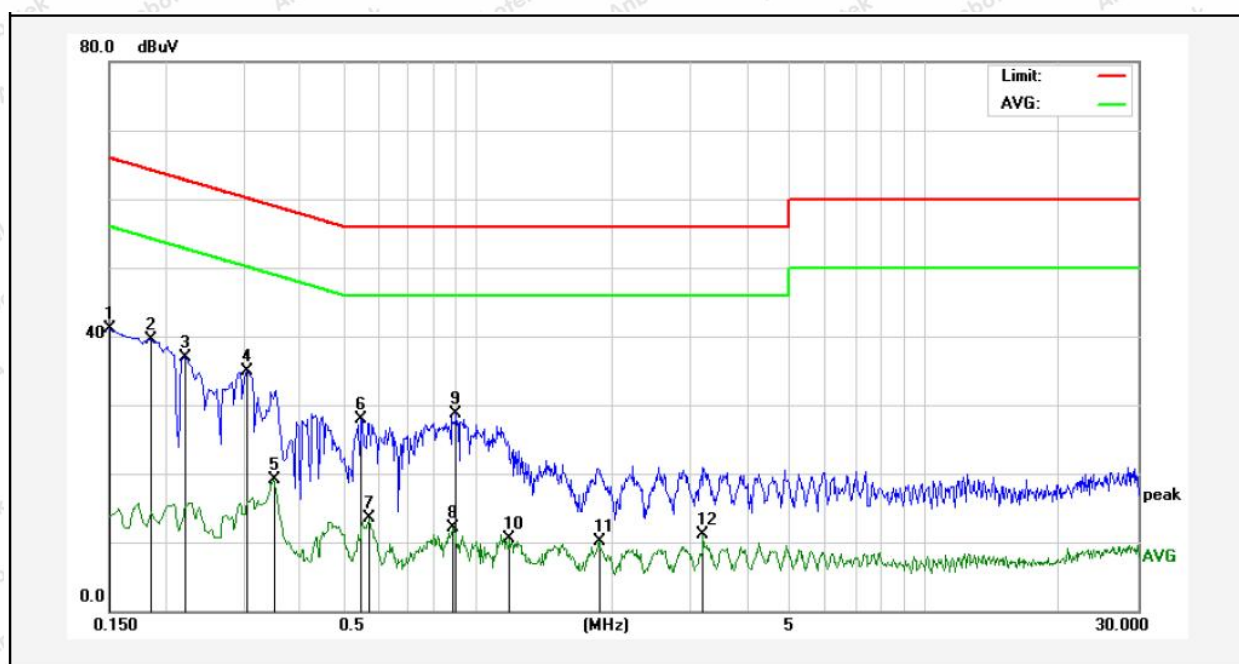


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.2100	29.86	9.71	39.57	63.20	-23.63	QP	
2	0.3460	27.40	9.72	37.12	59.06	-21.94	QP	
3	0.3460	10.64	9.72	20.36	49.06	-28.70	AVG	
4	0.4020	18.98	9.71	28.69	57.81	-29.12	QP	
5	0.4100	18.63	9.71	28.34	57.65	-29.31	QP	
6	0.4340	18.17	9.72	27.89	57.18	-29.29	QP	
7	0.5660	2.71	9.76	12.47	46.00	-33.53	AVG	
8	0.8900	1.67	9.74	11.41	46.00	-34.59	AVG	
9	0.9740	18.41	9.74	28.15	56.00	-27.85	QP	
10	1.3140	-1.24	9.73	8.49	46.00	-37.51	AVG	
11	2.1900	-1.08	9.72	8.64	46.00	-37.36	AVG	
12	4.6100	-0.99	9.74	8.75	46.00	-37.25	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

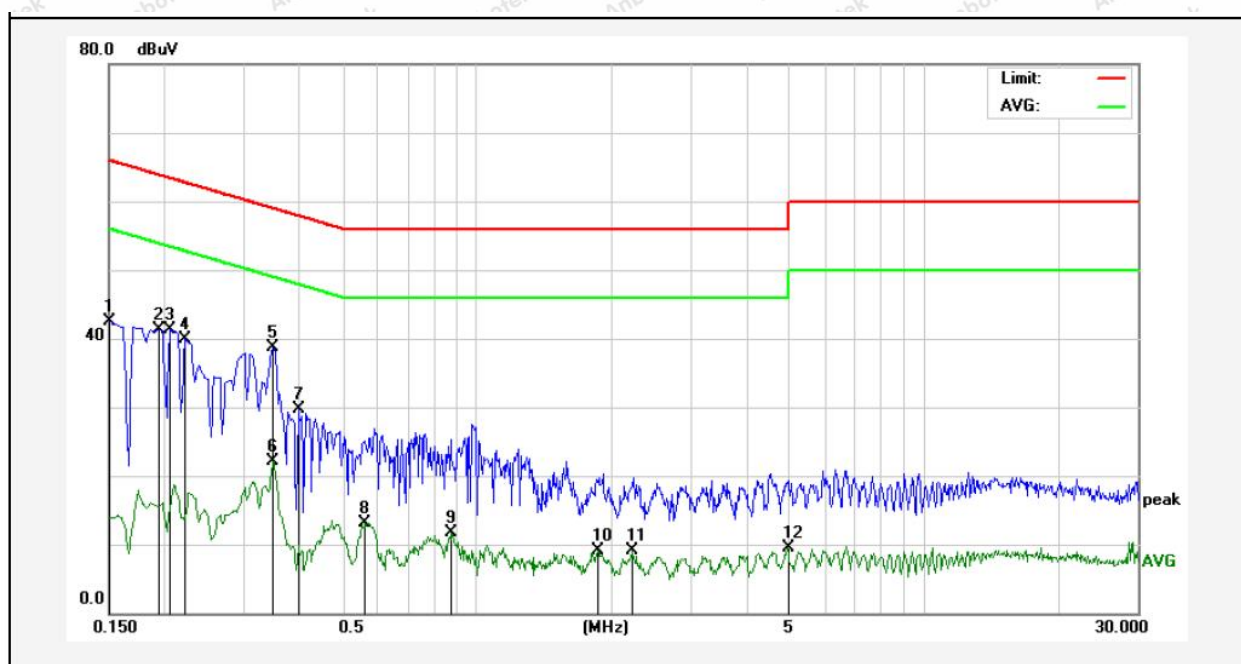


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	31.40	9.69	41.09	65.99	-24.90	QP	
2	0.1860	29.88	9.71	39.59	64.21	-24.62	QP	
3	0.2220	27.18	9.71	36.89	62.74	-25.85	QP	
4	0.3060	25.13	9.73	34.86	60.08	-25.22	QP	
5	0.3500	9.34	9.72	19.06	48.96	-29.90	AVG	
6	0.5500	18.05	9.76	27.81	56.00	-28.19	QP	
7	0.5740	3.69	9.76	13.45	46.00	-32.55	AVG	
8	0.8820	2.41	9.74	12.15	46.00	-33.85	AVG	
9	0.8980	18.90	9.74	28.64	56.00	-27.36	QP	
10	1.1820	0.80	9.73	10.53	46.00	-35.47	AVG	
11	1.8700	0.43	9.72	10.15	46.00	-35.85	AVG	
12	3.2020	1.35	9.73	11.08	46.00	-34.92	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

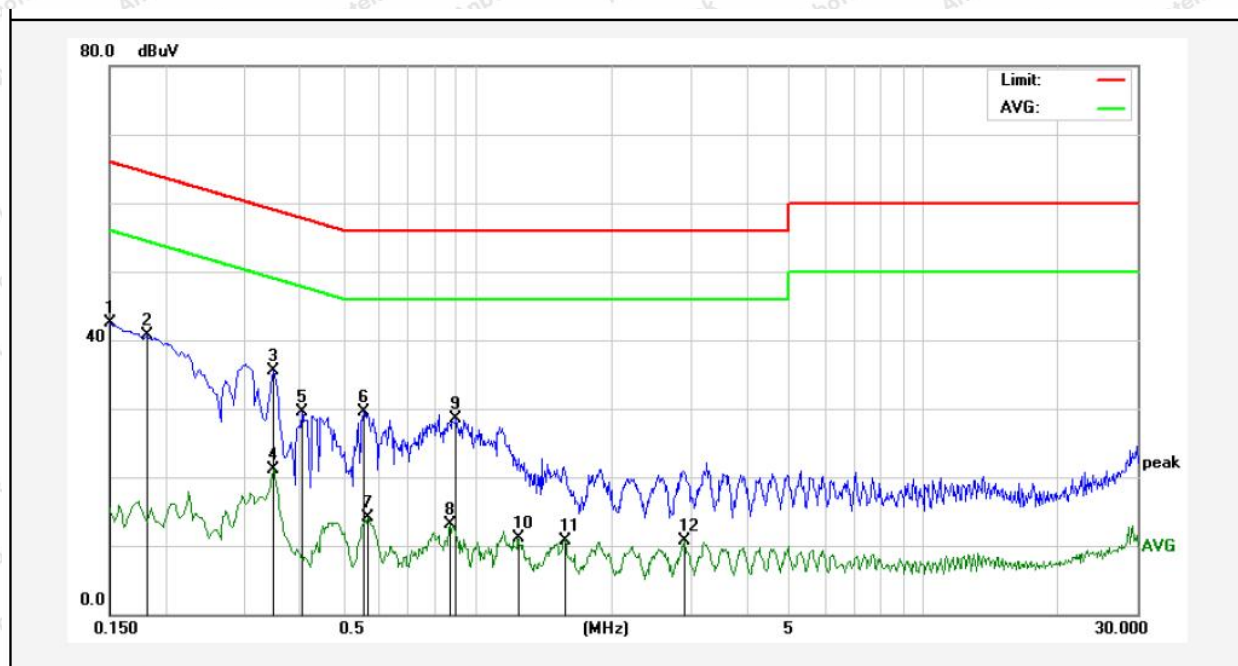


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	32.84	9.69	42.53	65.99	-23.46	QP	
2	0.1940	31.67	9.71	41.38	63.86	-22.48	QP	
3	0.2060	31.52	9.71	41.23	63.36	-22.13	QP	
4	0.2220	30.23	9.71	39.94	62.74	-22.80	QP	
5	0.3500	28.92	9.72	38.64	58.96	-20.32	QP	
6	0.3500	12.42	9.72	22.14	48.96	-26.82	AVG	
7	0.3980	19.92	9.71	29.63	57.89	-28.26	QP	
8	0.5620	3.29	9.76	13.05	46.00	-32.95	AVG	
9	0.8780	1.93	9.74	11.67	46.00	-34.33	AVG	
10	1.8620	-0.54	9.72	9.18	46.00	-36.82	AVG	
11	2.2220	-0.53	9.72	9.19	46.00	-36.81	AVG	
12	4.9260	-0.24	9.74	9.50	46.00	-36.50	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

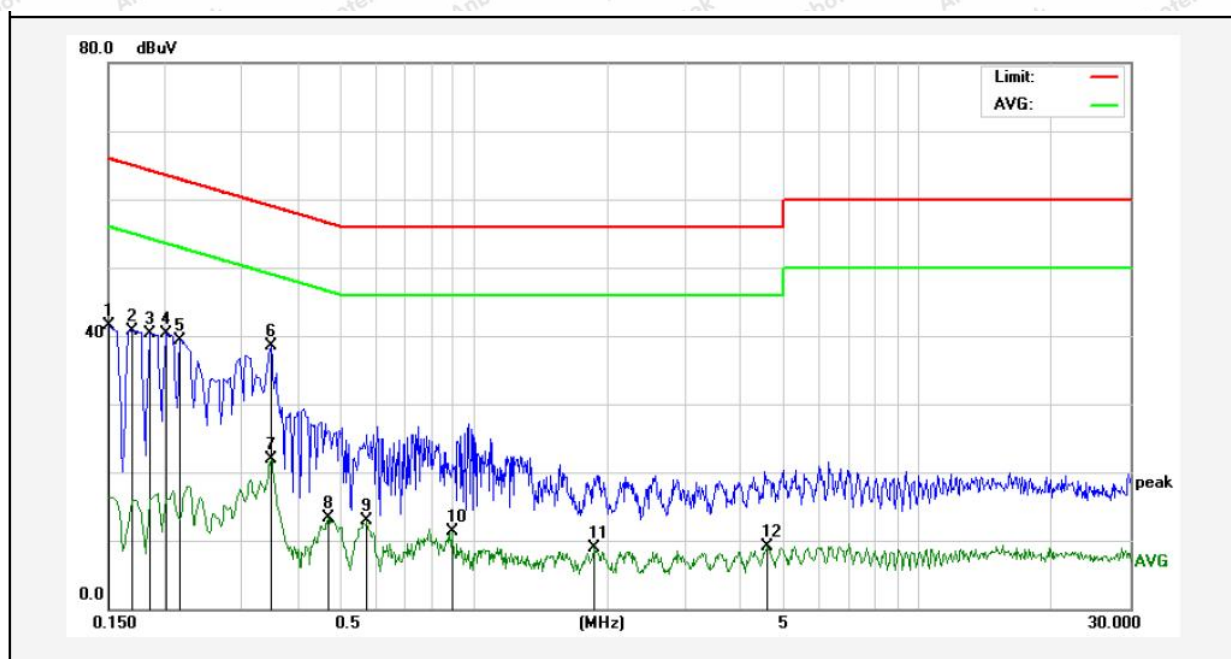


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	32.76	9.69	42.45	65.99	-23.54	QP	
2	0.1819	31.00	9.71	40.71	64.39	-23.68	QP	
3	0.3500	25.85	9.72	35.57	58.96	-23.39	QP	
4	0.3500	11.40	9.72	21.12	48.96	-27.84	AVG	
5	0.4060	19.77	9.71	29.48	57.73	-28.25	QP	
6	0.5580	19.70	9.76	29.46	56.00	-26.54	QP	
7	0.5700	4.37	9.76	14.13	46.00	-31.87	AVG	
8	0.8700	3.45	9.75	13.20	46.00	-32.80	AVG	
9	0.8980	18.69	9.74	28.43	56.00	-27.57	QP	
10	1.2300	1.31	9.73	11.04	46.00	-34.96	AVG	
11	1.5740	1.07	9.73	10.80	46.00	-35.20	AVG	
12	2.9060	1.05	9.73	10.78	46.00	-35.22	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

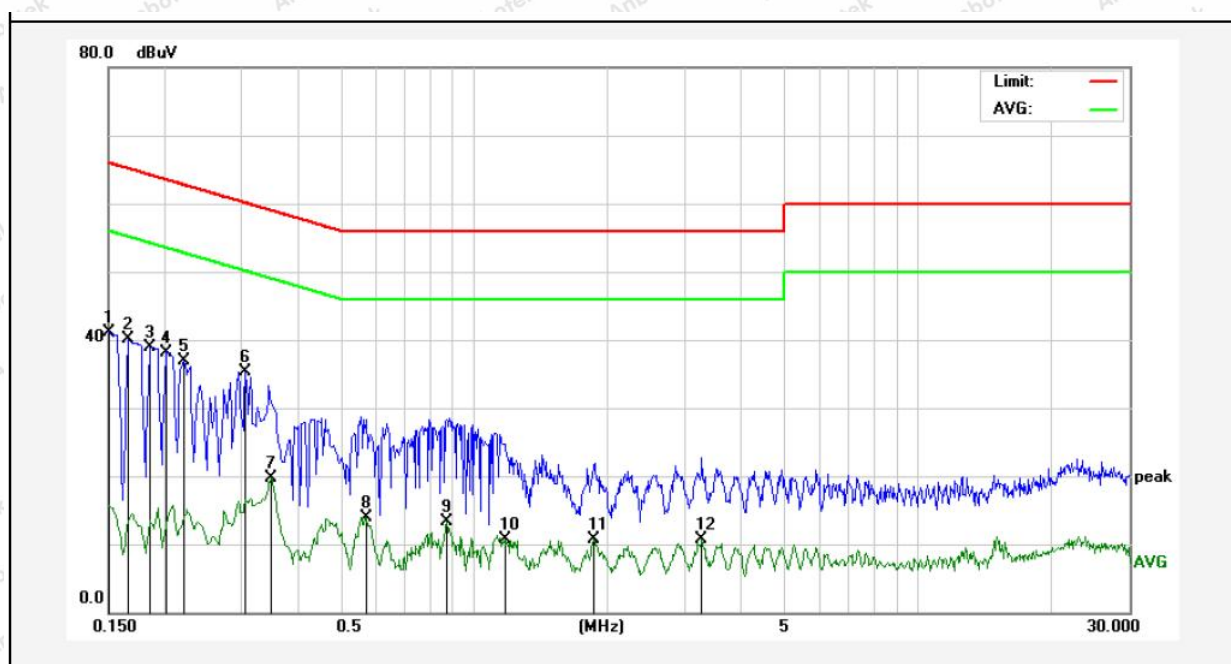


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	31.76	9.69	41.45	65.99	-24.54	QP	
2	0.1700	30.97	9.71	40.68	64.96	-24.28	QP	
3	0.1860	30.66	9.71	40.37	64.21	-23.84	QP	
4	0.2020	30.55	9.71	40.26	63.52	-23.26	QP	
5	0.2180	29.64	9.71	39.35	62.89	-23.54	QP	
6	0.3500	28.75	9.72	38.47	58.96	-20.49	QP	
7	0.3500	12.15	9.72	21.87	48.96	-27.09	AVG	
8	0.4700	3.53	9.75	13.28	46.51	-33.23	AVG	
9	0.5740	3.18	9.76	12.94	46.00	-33.06	AVG	
10	0.8900	1.55	9.74	11.29	46.00	-34.71	AVG	
11	1.8660	-0.87	9.72	8.85	46.00	-37.15	AVG	
12	4.5500	-0.69	9.74	9.05	46.00	-36.95	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	31.51	9.69	41.20	65.99	-24.79	QP	
2	0.1660	30.40	9.70	40.10	65.15	-25.05	QP	
3	0.1860	29.19	9.71	38.90	64.21	-25.31	QP	
4	0.2020	28.49	9.71	38.20	63.52	-25.32	QP	
5	0.2220	27.29	9.71	37.00	62.74	-25.74	QP	
6	0.3060	25.58	9.73	35.31	60.08	-24.77	QP	
7	0.3500	9.97	9.72	19.69	48.96	-29.27	AVG	
8	0.5700	4.24	9.76	14.00	46.00	-32.00	AVG	
9	0.8700	3.47	9.75	13.22	46.00	-32.78	AVG	
10	1.1780	0.91	9.73	10.64	46.00	-35.36	AVG	
11	1.8660	0.94	9.72	10.66	46.00	-35.34	AVG	
12	3.2620	1.06	9.73	10.79	46.00	-35.21	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.



here 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

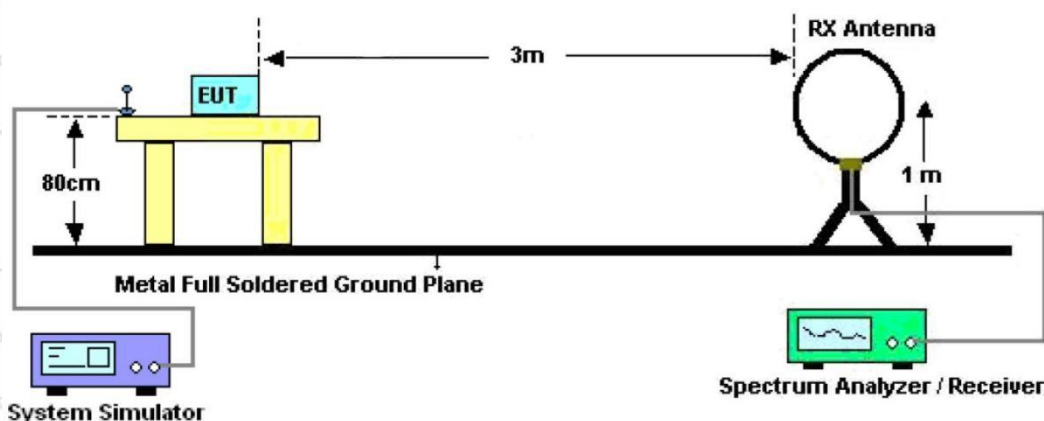


Figure 1. Below 30MHz

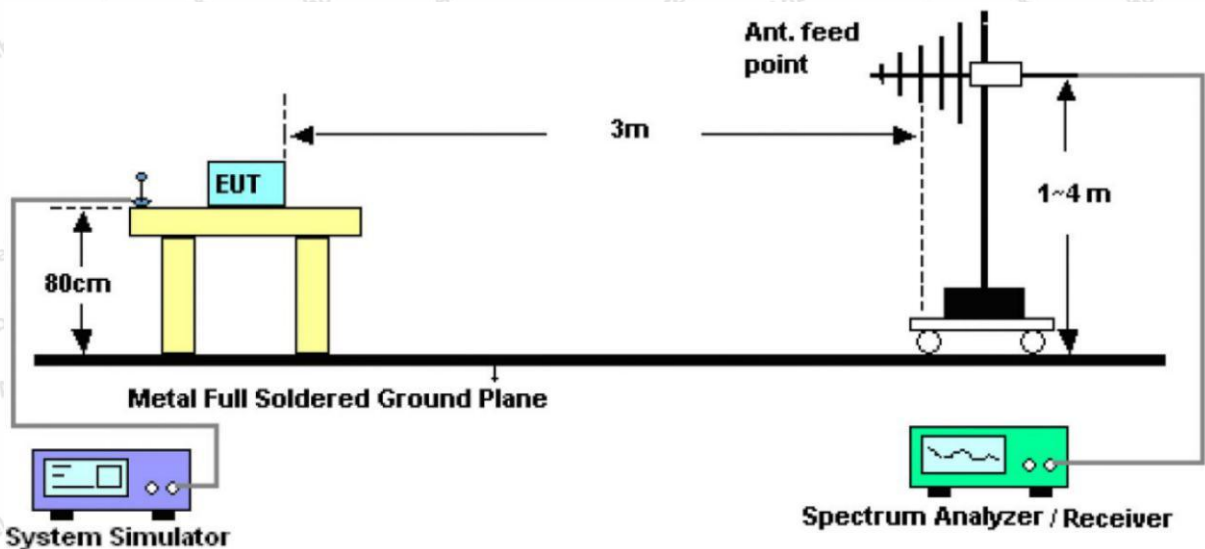


Figure 2. 30MHz to 1GHz

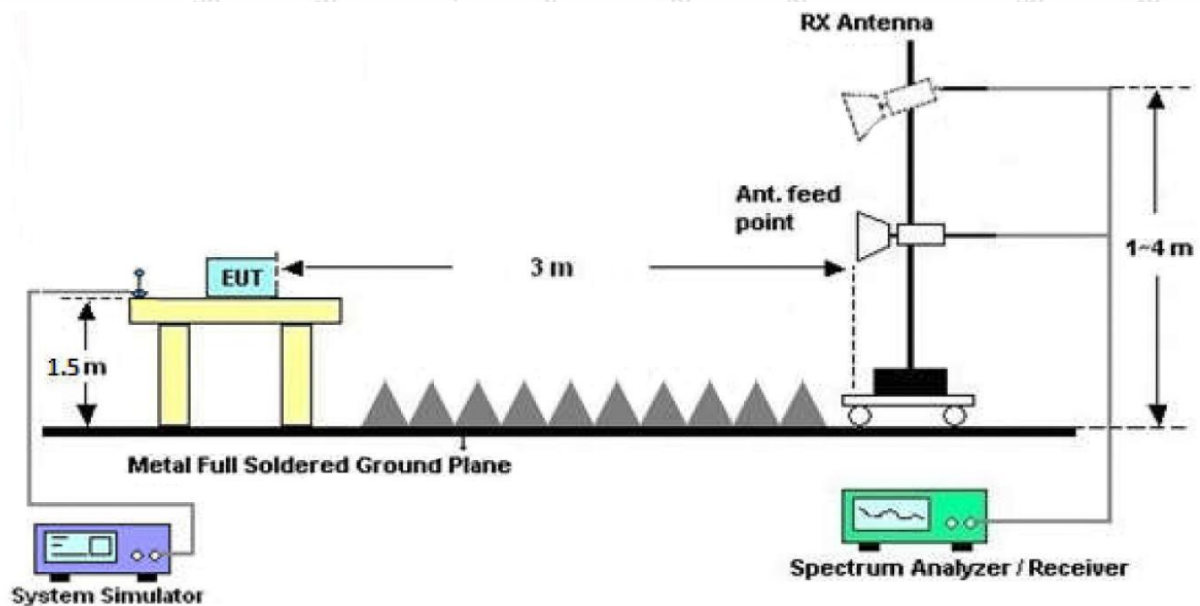


Figure 3. Above 1 GHz

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 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.



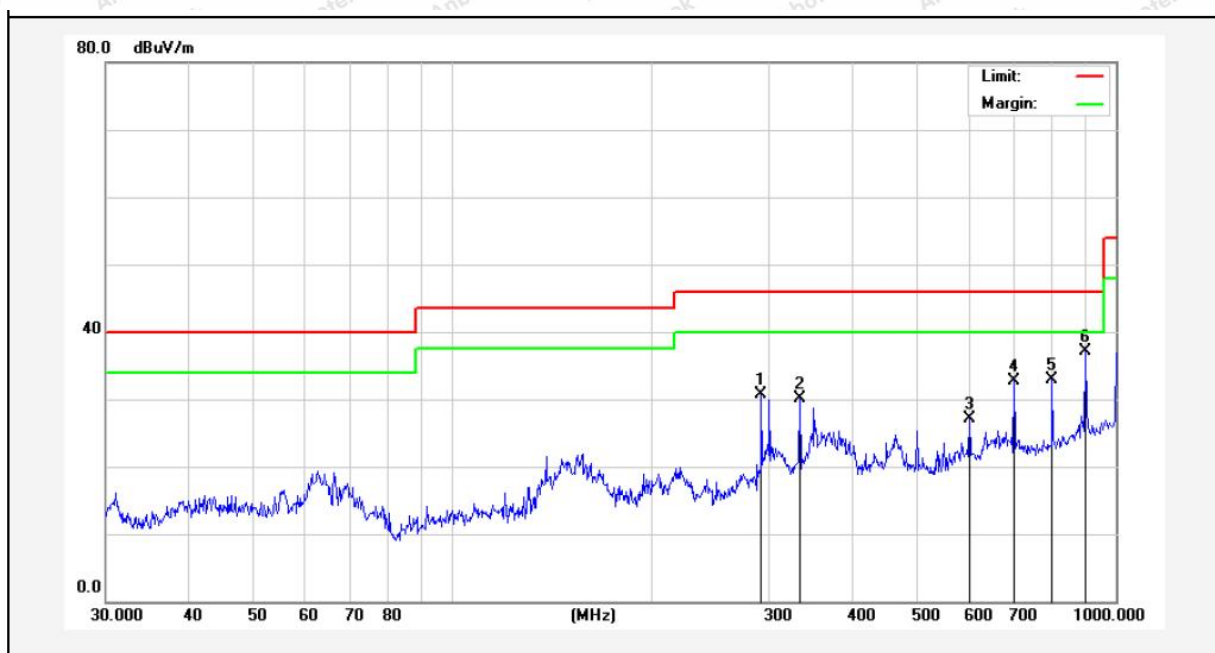
Test Results (30~1000MHz)

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	292.0583	48.57	-17.85	30.72	46.00	-15.28	QP			
2	333.6867	46.40	-16.38	30.02	46.00	-15.98	QP			
3	601.4265	37.70	-10.53	27.17	46.00	-18.83	QP			
4	701.7610	42.69	-9.89	32.80	46.00	-13.20	QP			
5	801.7863	41.16	-8.24	32.92	46.00	-13.08	QP			
6	900.1474	43.39	-6.22	37.17	46.00	-8.83	QP			



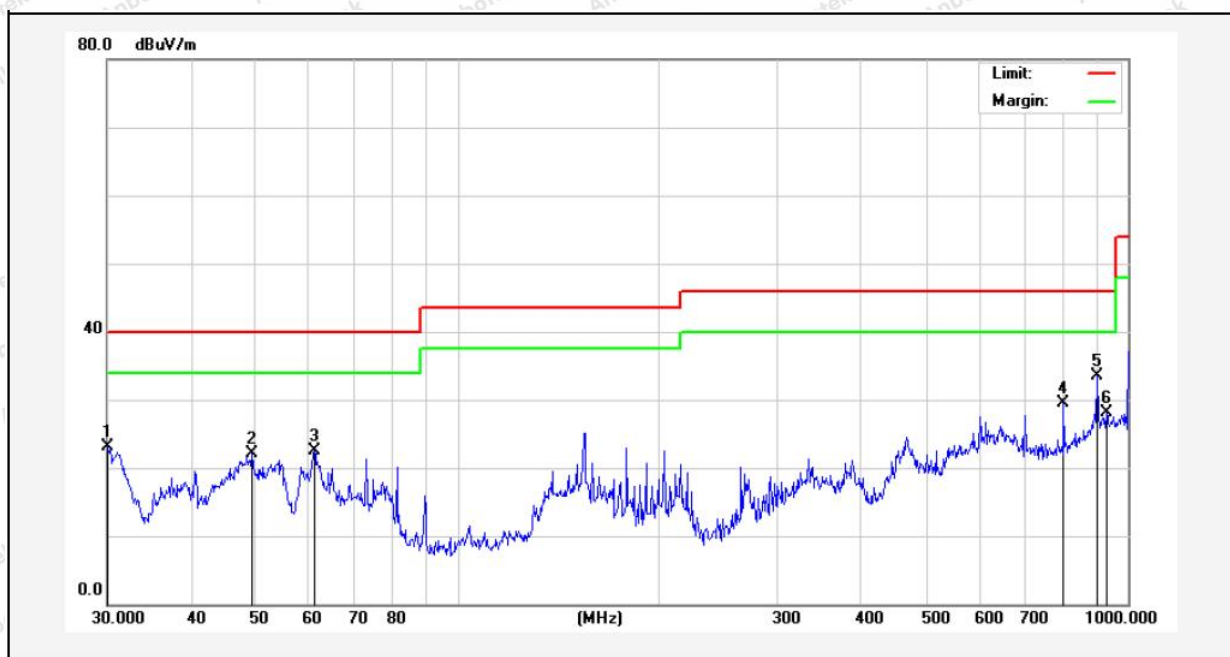
Test Results (30~1000MHz)

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	30.0000	41.10	-17.96	23.14	40.00	-16.86	QP			
2	49.3594	37.80	-15.68	22.12	40.00	-17.88	QP			
3	61.1316	40.37	-17.90	22.47	40.00	-17.53	QP			
4	801.7863	37.75	-8.24	29.51	46.00	-16.49	QP			
5	900.1474	39.74	-6.22	33.52	46.00	-12.48	QP			
6	929.0082	34.08	-5.88	28.20	46.00	-17.80	QP			



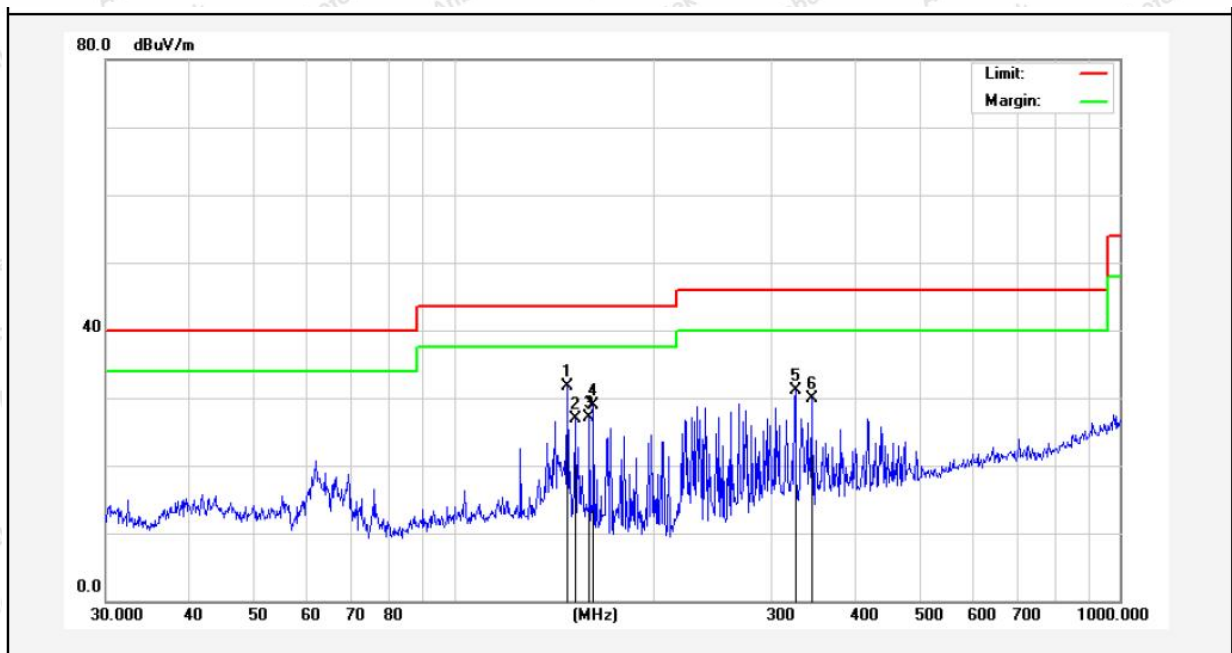
Test Results (30~1000MHz)

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	147.9214	54.55	-22.89	31.66	43.50	-11.84	QP			
2	152.1297	50.04	-23.11	26.93	43.50	-16.57	QP			
3	159.7844	51.15	-24.00	27.15	43.50	-16.35	QP			
4	162.0414	52.79	-23.94	28.85	43.50	-14.65	QP			
5	325.5958	47.62	-16.57	31.05	46.00	-14.95	QP			
6	344.3855	46.08	-16.13	29.95	46.00	-16.05	QP			



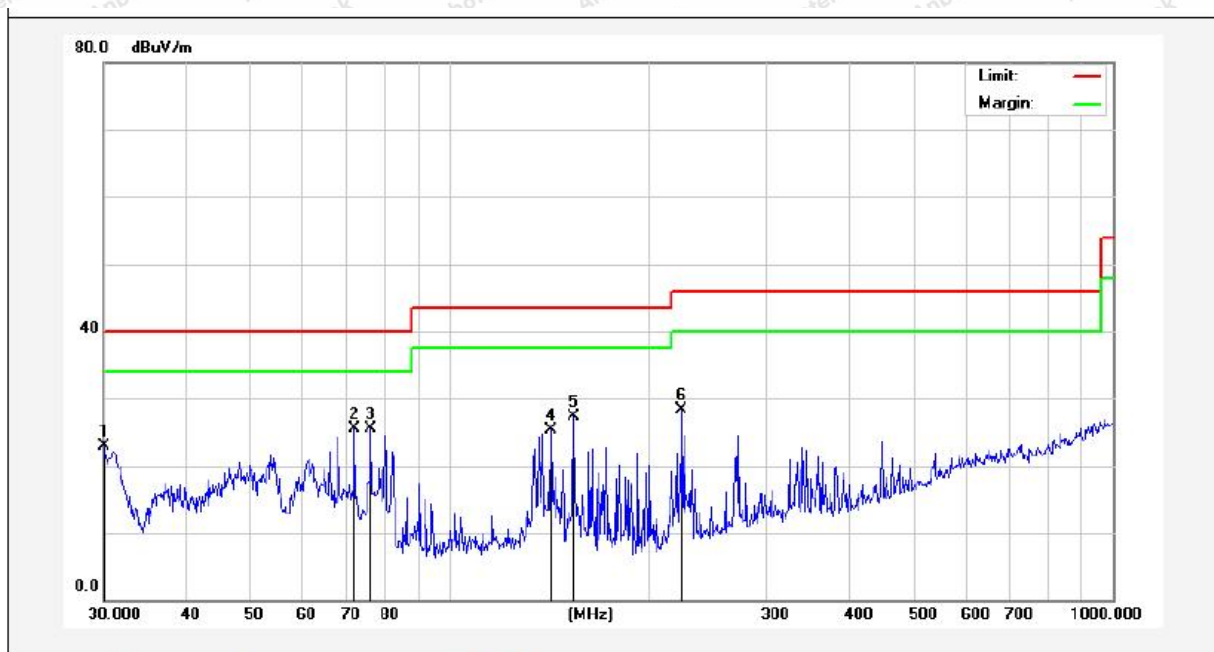
Test Results (30~1000MHz)

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	30.0000	40.78	-17.96	22.82	40.00	-17.18	QP			
2	71.8320	45.36	-19.94	25.42	40.00	-14.58	QP			
3	75.9773	45.24	-19.77	25.47	40.00	-14.53	QP			
4	141.8262	47.56	-22.17	25.39	43.50	-18.11	QP			
5	153.7385	49.27	-21.93	27.34	43.50	-16.16	QP			
6	223.7334	47.13	-18.83	28.30	46.00	-17.70	QP			



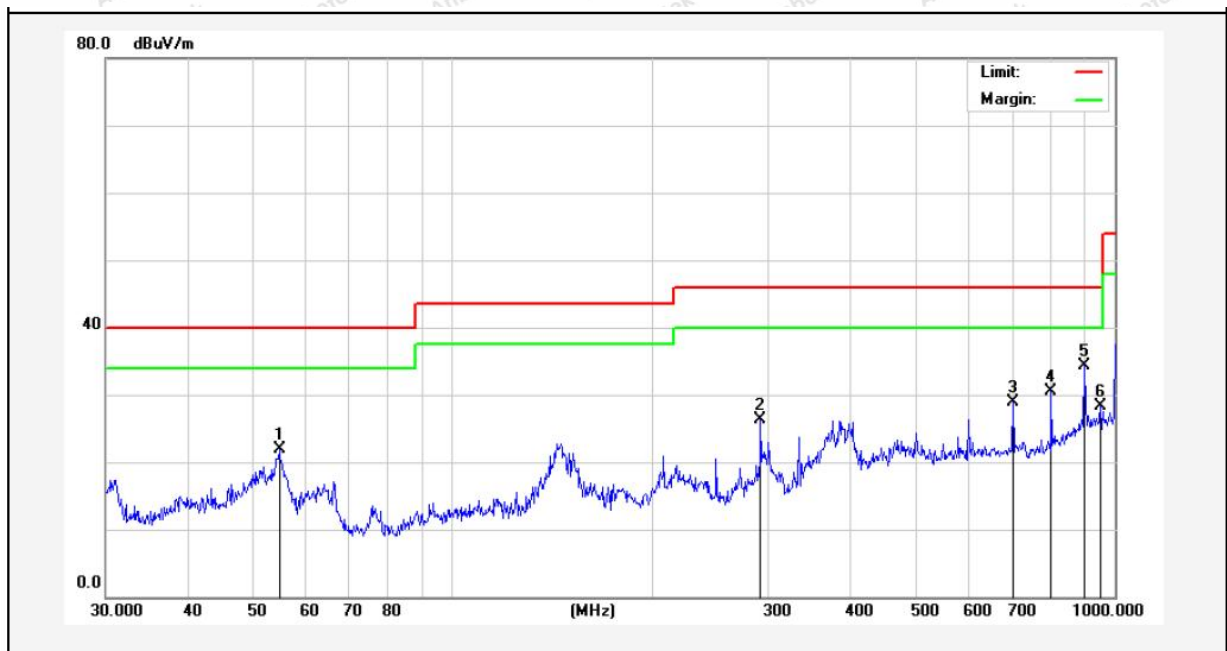
Test Results (30~1000MHz)

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	54.8348	39.53	-17.56	21.97	40.00	-18.03	QP			
2	292.0583	44.21	-17.85	26.36	46.00	-19.64	QP			
3	701.7610	38.78	-9.89	28.89	46.00	-17.11	QP			
4	801.7863	38.70	-8.24	30.46	46.00	-15.54	QP			
5	900.1474	40.45	-6.22	34.23	46.00	-11.77	QP			
6	952.0937	33.85	-5.61	28.24	46.00	-17.76	QP			



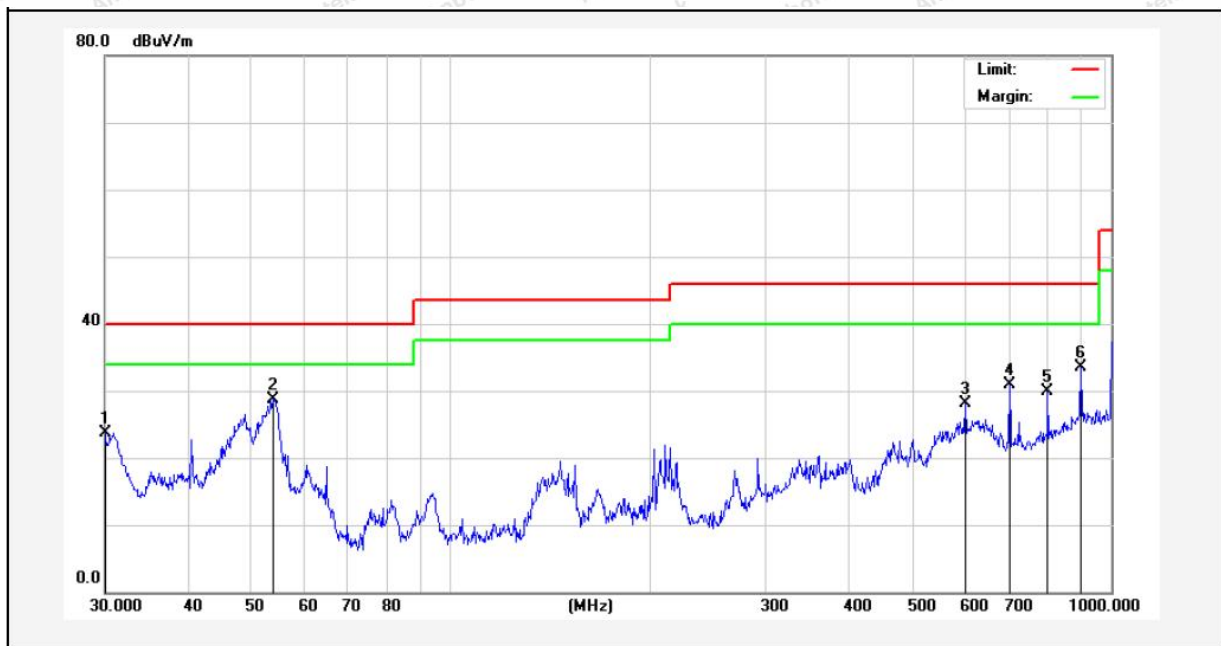
Test Results (30~1000MHz)

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	30.0000	41.73	-17.96	23.77	40.00	-16.23	QP			
2	53.8818	45.97	-17.21	28.76	40.00	-11.24	QP			
3	601.4265	38.69	-10.53	28.16	46.00	-17.84	QP			
4	701.7610	40.81	-9.89	30.92	46.00	-15.08	QP			
5	801.7863	38.05	-8.24	29.81	46.00	-16.19	QP			
6	900.1474	39.65	-6.22	33.43	46.00	-12.57	QP			



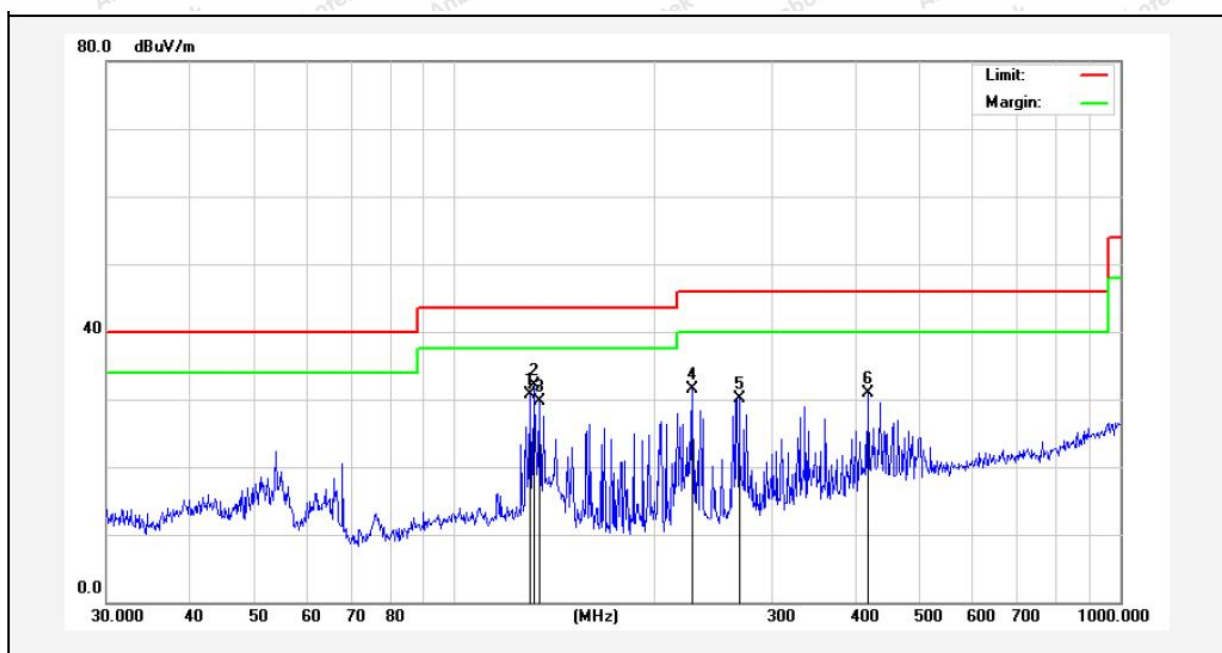
Test Results (30~1000MHz)

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	129.9226	53.15	-22.51	30.64	43.50	-12.86	QP			
2	131.7577	54.73	-22.60	32.13	43.50	-11.37	QP			
3	134.0882	52.48	-22.74	29.74	43.50	-13.76	QP			
4	227.6906	53.28	-21.87	31.41	46.00	-14.59	QP			
5	267.5455	50.08	-19.97	30.11	46.00	-15.89	QP			
6	417.6411	46.72	-15.90	30.82	46.00	-15.18	QP			



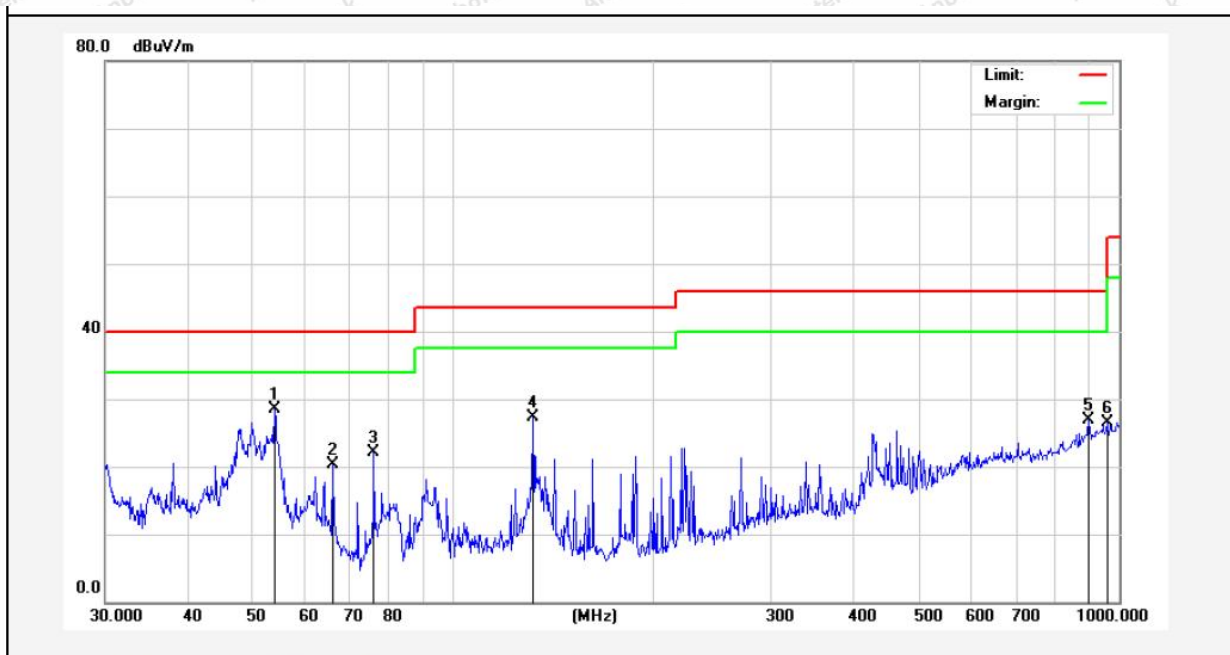
Test Results (30~1000MHz)

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	45.64	-17.21	28.43	40.00	-11.57	QP			
2	65.8031	39.67	-19.43	20.24	40.00	-19.76	QP			
3	75.9773	41.84	-19.77	22.07	40.00	-17.93	QP			
4	131.7577	48.93	-21.59	27.34	43.50	-16.16	QP			
5	900.1474	33.06	-6.22	26.84	46.00	-19.16	QP			
6	958.7943	31.91	-5.49	26.42	46.00	-19.58	QP			



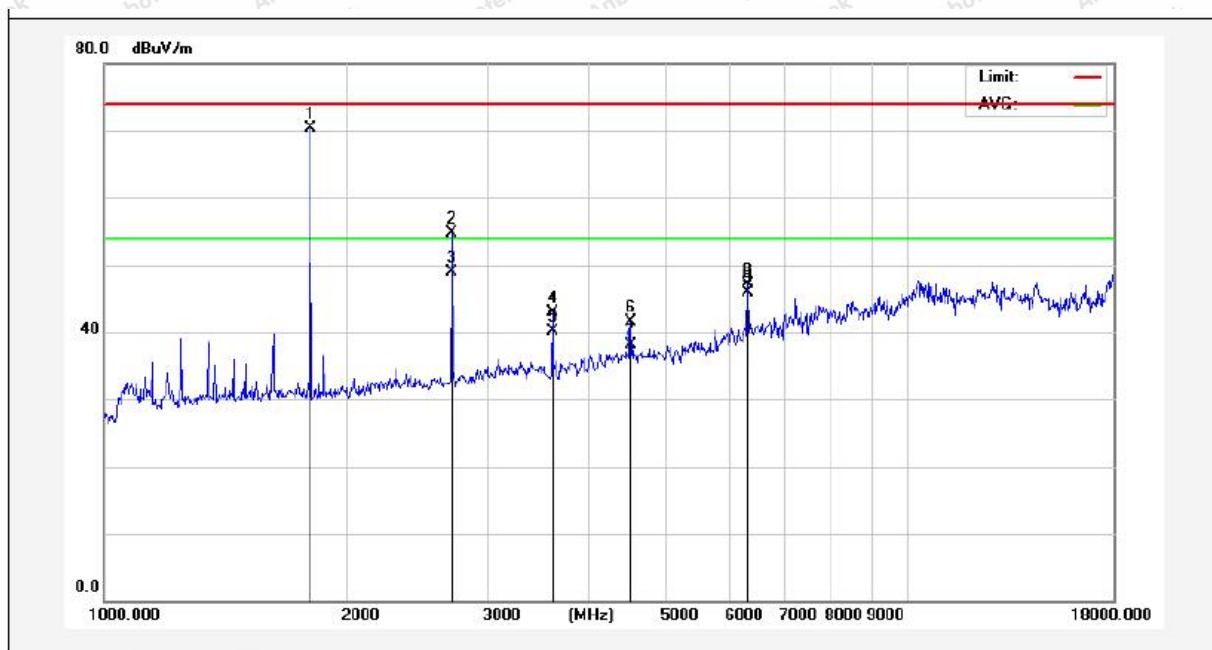
Test Results (1GHz~18GHz)

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	96.69	-26.32	70.37	104.42	-34.05	peak			
2	2710.622	78.43	-23.69	54.74	74.00	-19.26	peak			
3	2710.622	72.67	-23.69	48.98	54.00	-5.02	AVG			
4	3608.619	64.53	-21.65	42.88	74.00	-31.12	peak			
5	3608.619	61.75	-21.65	40.10	54.00	-13.90	AVG			
6	4521.185	59.72	-18.30	41.42	74.00	-32.58	peak			
7	4521.185	56.44	-18.30	38.14	54.00	-15.86	AVG			
8	6322.136	59.25	-12.13	47.12	74.00	-26.88	peak			
9	6322.136	58.13	-12.13	46.00	54.00	-8.00	AVG			

*) -20 dBc



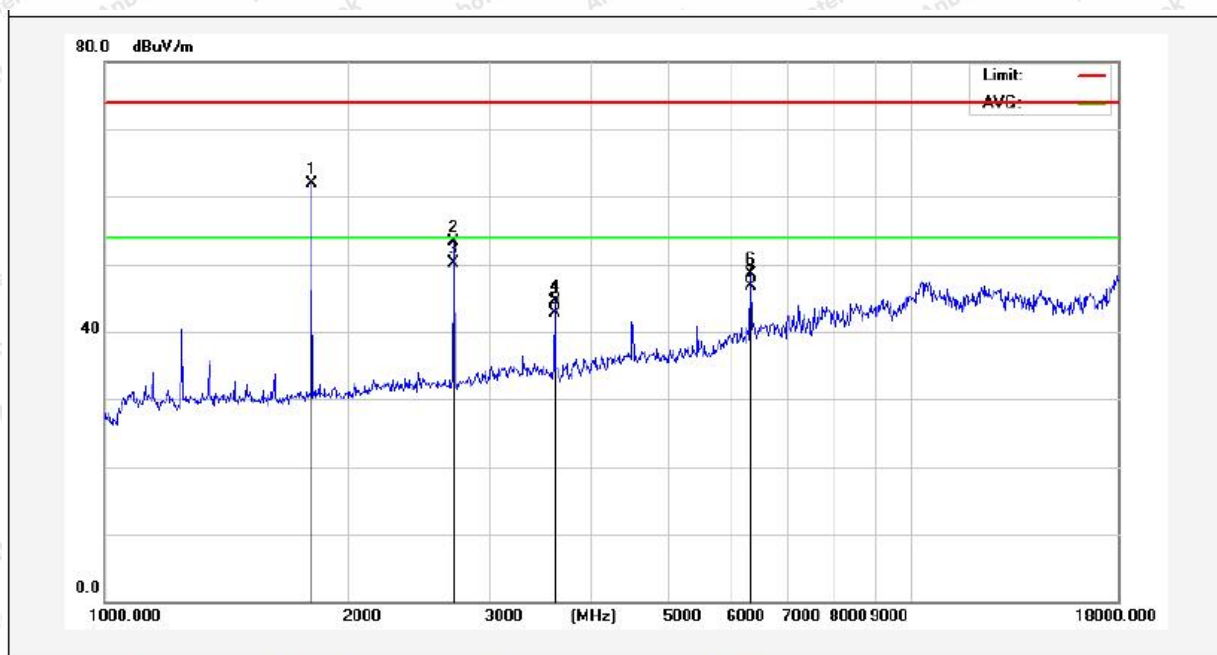
Test Results (1GHz~18GHz)

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	88.28	-26.32	61.96	104.42	-42.46	peak			
2	2710.622	76.97	-23.69	53.28	74.00	-20.72	peak			
3	2710.622	73.83	-23.69	50.14	54.00	-3.86	AVG			
4	3608.619	66.18	-21.65	44.53	74.00	-29.47	peak			
5	3608.619	64.39	-21.65	42.74	74.00	-31.26	peak			
6	6322.136	60.68	-12.13	48.55	54.00	-5.45	AVG			
7	6322.136	58.92	-12.13	46.79	54.00	-7.21	AVG			

*) -20 dBc



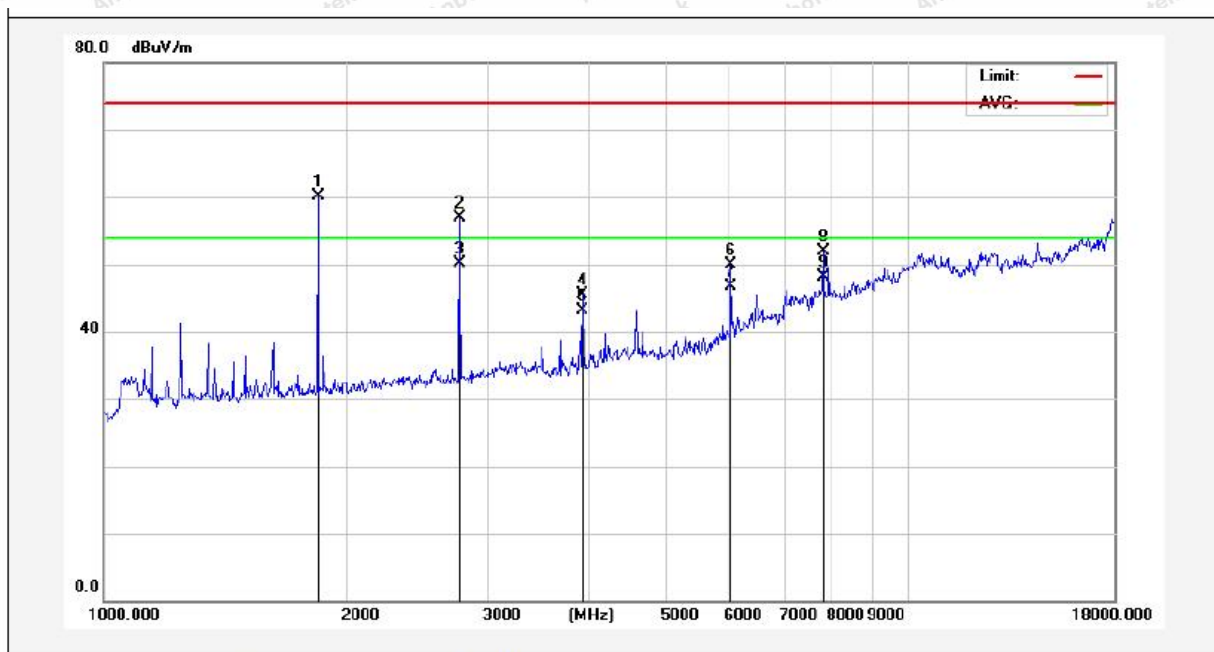
Test Results (1GHz~18GHz)

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	* 1845.515	86.12	-26.00	60.12	103.91	-43.79	peak			
2	2766.024	80.47	-23.55	56.92	74.00	-17.08	peak			
3	2766.024	73.65	-23.55	50.10	54.00	-3.90	AVG			
4	3935.493	65.67	-20.12	45.55	74.00	-28.45	peak			
5	3935.493	63.31	-20.12	43.19	54.00	-10.81	AVG			
6	6018.998	63.32	-13.37	49.95	74.00	-24.05	peak			
7	6018.998	60.14	-13.37	46.77	54.00	-7.23	AVG			
8	7829.860	61.47	-9.48	51.99	74.00	-22.01	peak			
9	7829.860	57.49	-9.48	48.01	54.00	-5.99	AVG			

*) -20 dBc



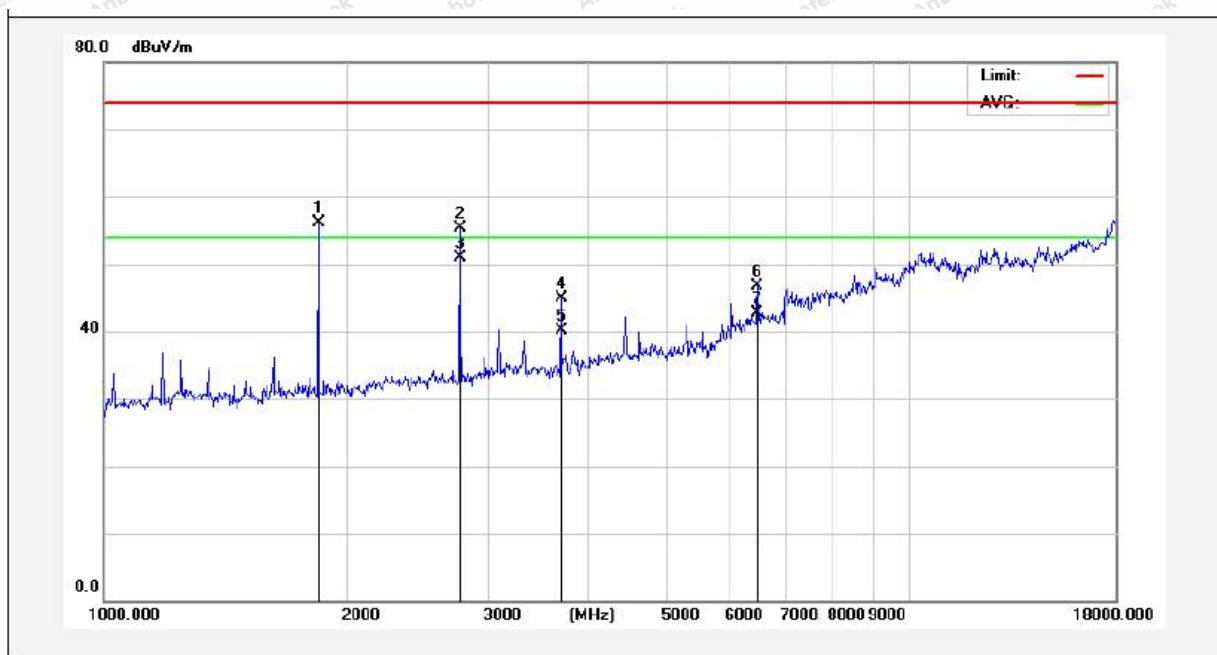
Test Results (1GHz~18GHz)

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	82.10	-26.00	56.10	103.91	-47.81	peak			
2	2766.024	78.82	-23.55	55.27	74.00	-18.73	peak			
3	2766.024	74.53	-23.55	50.98	54.00	-3.02	AVG			
4	3693.033	66.08	-21.09	44.99	74.00	-29.01	peak			
5	3693.033	61.20	-21.09	40.11	54.00	-13.89	AVG			
6	6470.026	58.12	-11.47	46.65	74.00	-27.35	peak			
7	6470.026	54.26	-11.47	42.79	54.00	-11.21	AVG			

*) -20 dBc



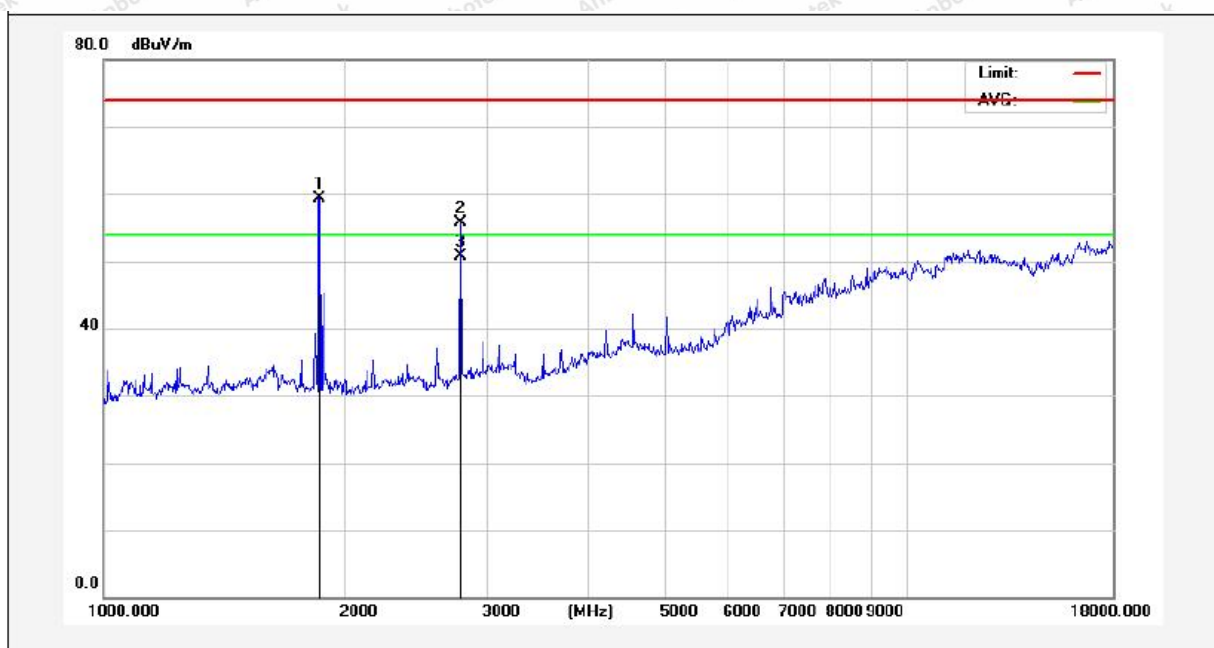
Test Results (1GHz~18GHz)

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	* 1850.858	85.32	-25.96	59.36	103.96	-44.60	peak			
2	2782.060	79.24	-23.52	55.72	74.00	-18.28	peak			
3	2782.060	74.21	-23.52	50.69	54.00	-3.31	AVG			

*) -20 dBc



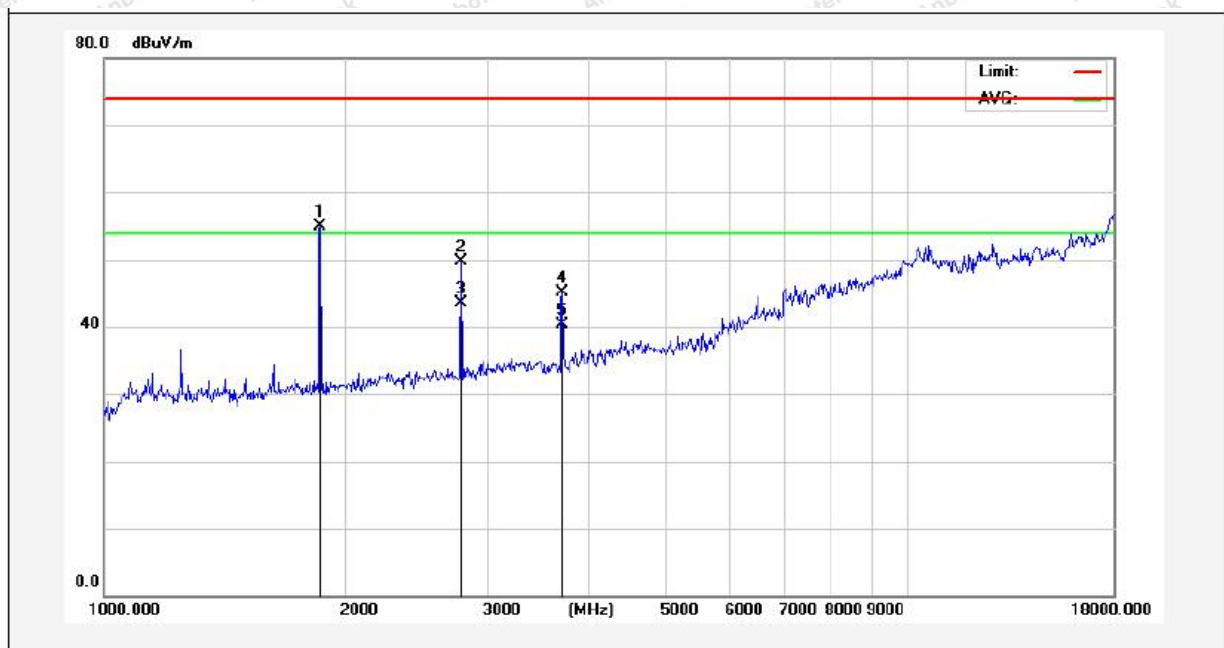
Test Results (1GHz~18GHz)

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	* 1856.215	80.76	-25.92	54.84	103.96	-49.12	peak			
2	2782.060	73.26	-23.52	49.74	74.00	-24.26	peak			
3	2782.060	66.99	-23.52	43.47	54.00	-10.53	AVG			
4	3714.443	65.99	-20.95	45.04	74.00	-28.96	peak			
5	3714.443	61.23	-20.95	40.28	54.00	-13.72	AVG			

*) -20 dBc



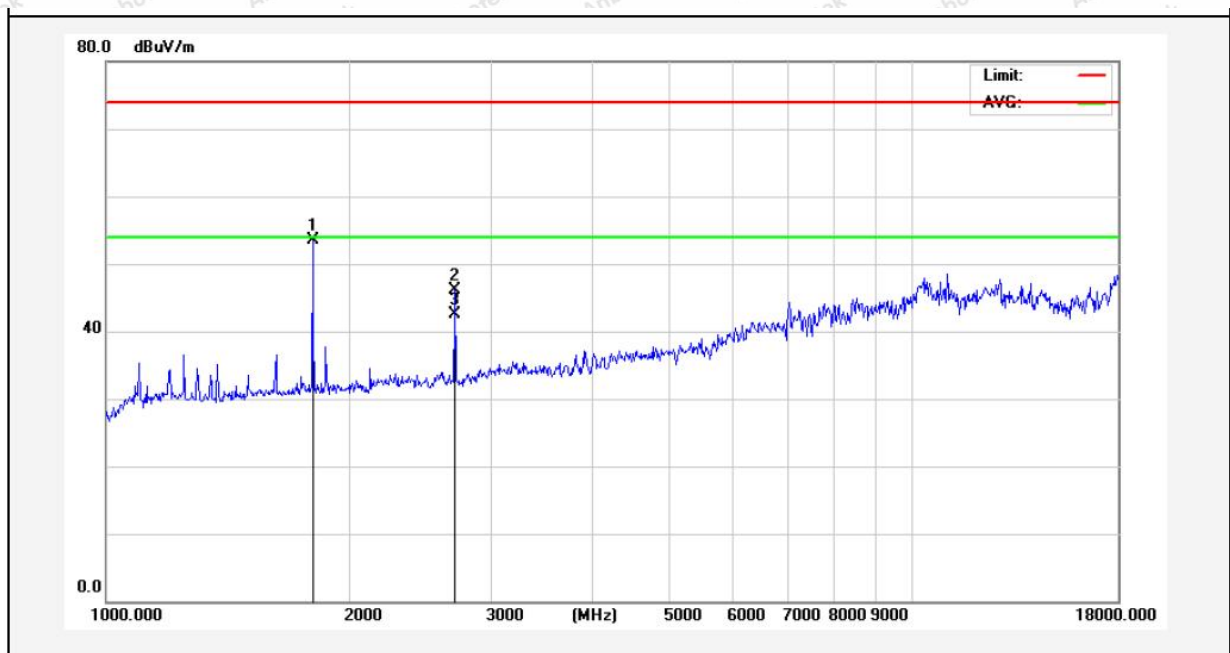
Test Results (1GHz~18GHz)

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	79.89	-26.32	53.57	104.82	-51.25	peak			
2	2710.622	69.85	-23.69	46.16	74.00	-27.84	peak			
3	2710.622	66.28	-23.69	42.59	54.00	-11.41	AVG			

*) -20 dBc



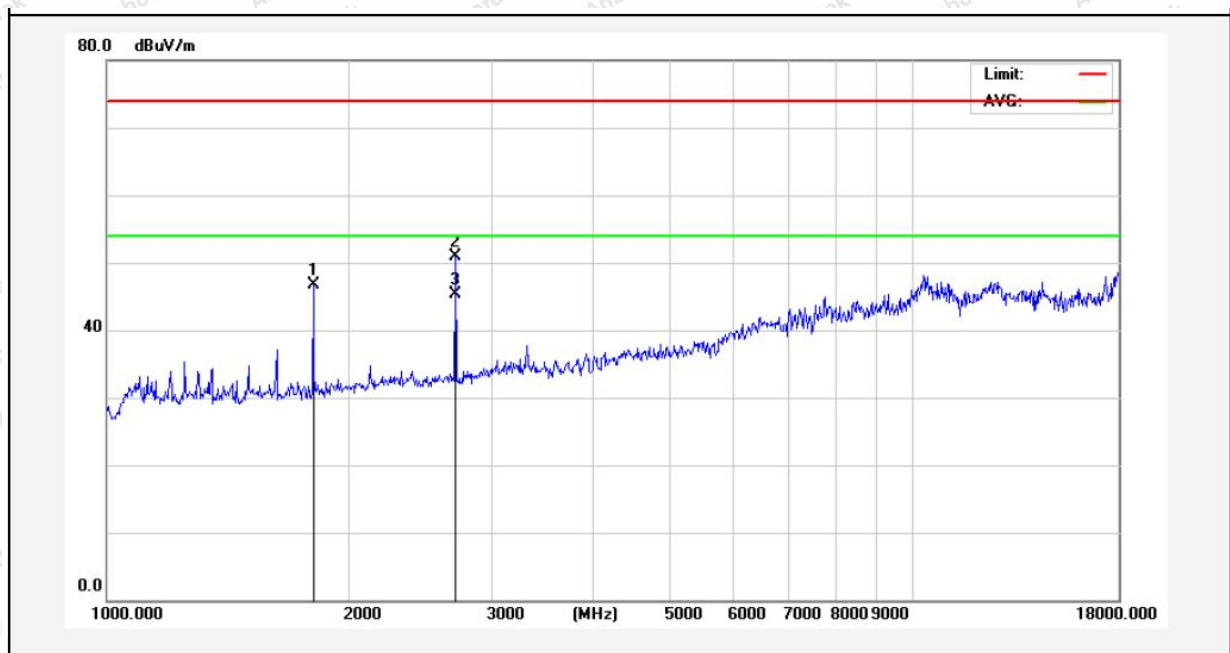
Test Results (1GHz~18GHz)

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	73.11	-26.32	46.79	104.82	-58.03	peak			
2	2710.622	74.57	-23.69	50.88	74.00	-23.12	peak			
3	2710.622	68.90	-23.69	45.21	54.00	-8.79	AVG			

*) -20 dBc



5. Antenna Requirement

5.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /247(c)
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. 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.

5.2. 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 -----

