FCC Test Report

Client Name	:	**Seeed 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

Contents

1. General Information 5
1.1. Client Information 5
1.2. Description of Device (EUT) 5
1.3. Auxiliary Equipment Used During Test 6
1.4. Description of Test Modes 6
1.5. Description Of Test Setup 7
1.6. Test Equipment List 8
1.7. Measurement Uncertainty 9
1.8. Description of Test Facility 9
2. Summary of Test Results 10
3. Conducted Emission Test 11
3.1. Test Standard and Limit 11
3.2. Test Setup 11
3.3. Test Procedure 11
3.4. Test Data 11
4. Radiation Spurious Emission and Band Edge 20
4.1. Test Standard and Limit 20
4.2. Test Setup 21
4.3. Test Procedure 22
4.4. Test Data 23
5. Maximum Peak Output Power Test 40
5.1. Test Standard and Limit 40
5.2. Test Setup 40
5.3. Test Procedure 40
5.4. Test Data 40
6. Antenna Requirement 42
6.1. Test Standard and Requirement 42
6.2. Antenna Connected Construction 42
APPENDIX I -- TEST SETUP PHOTOGRAPH 43
APPENDIX II -- EXTERNAL PHOTOGRAPH 43
APPENDIX III -- INTERNAL PHOTOGRAPH 43

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

Note 1:

This is a Class II application which was based on the original report 18220WC10116102. 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.
RF Specification		
Support Technology	:	☒ LoRa
Operation Mode	:	☐ DSSS ☒ FHSS
Support Bandwidth	:	☒ 125KHz ☐ 250KHz ☐ 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)
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 Modes

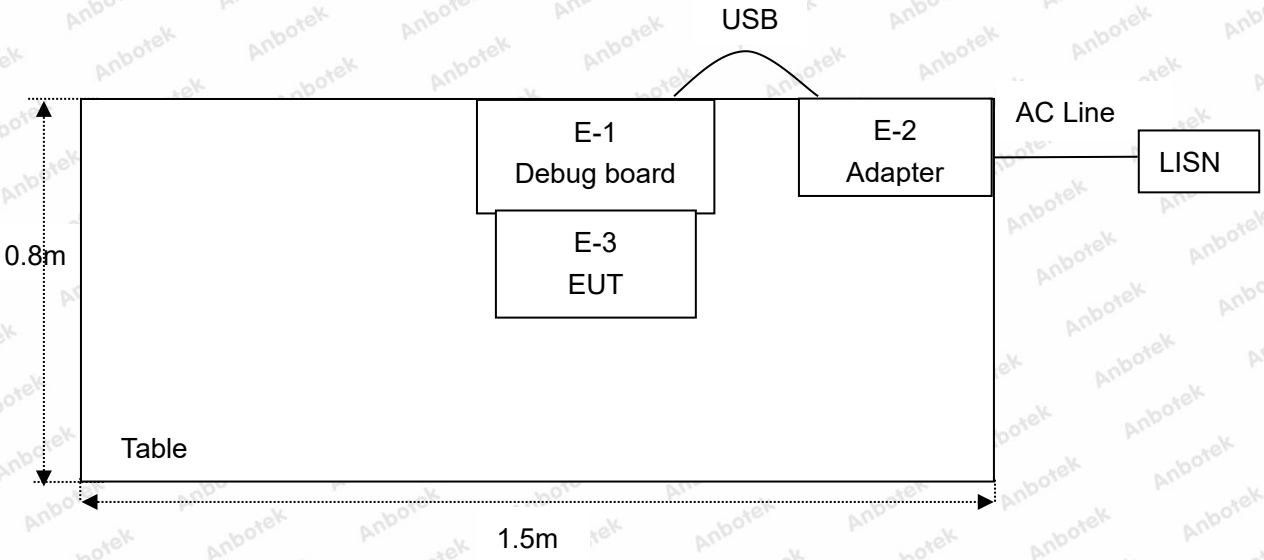
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	**902.3**	23	906.7	45	911.1
2	902.5	24	906.9	46	911.3
3	902.7	25	907.1	47	911.5
4	902.9	26	907.3	48	911.7
5	903.1	27	907.5	49	911.9
6	903.3	28	907.7	50	912.1
7	903.5	29	907.9	51	912.3
8	903.7	30	908.1	52	912.5
9	903.9	31	908.3	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:

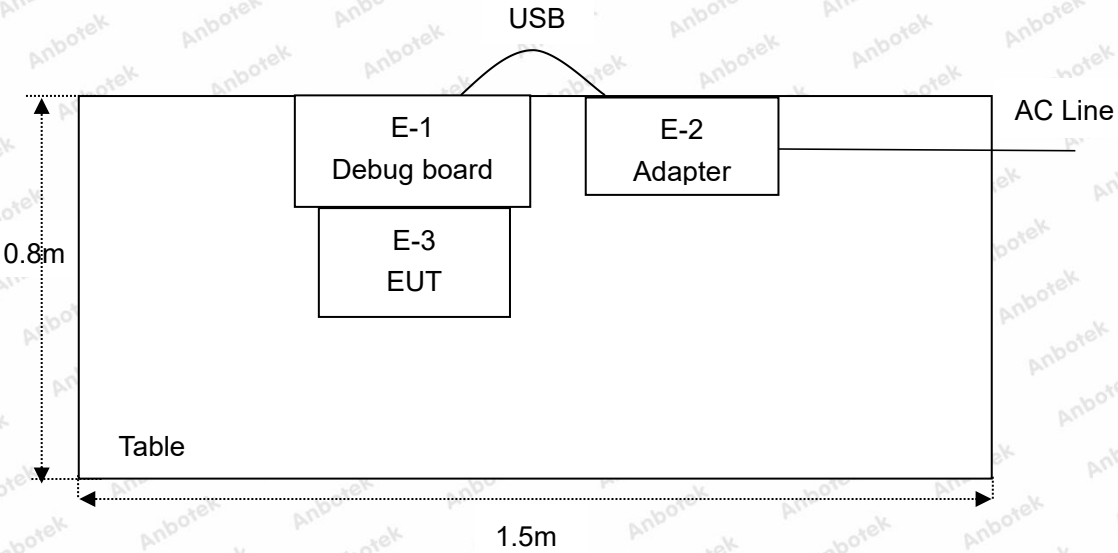
1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT was tested with Channel 1, 32 and 64.

1.5. Description Of Test Setup

CE



RE



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

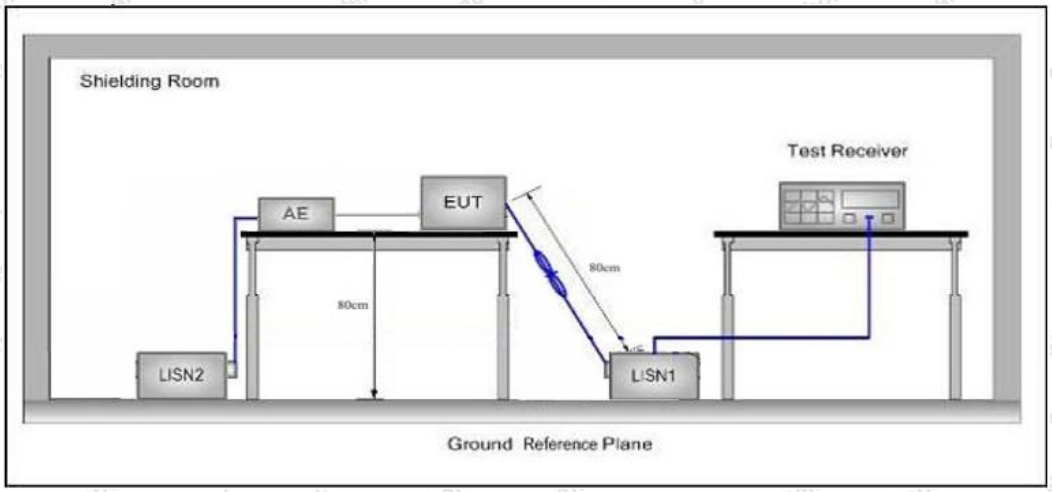
Standard Section	Test Item	Result
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.247(b)(2)	Conducted Peak Output Power	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

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

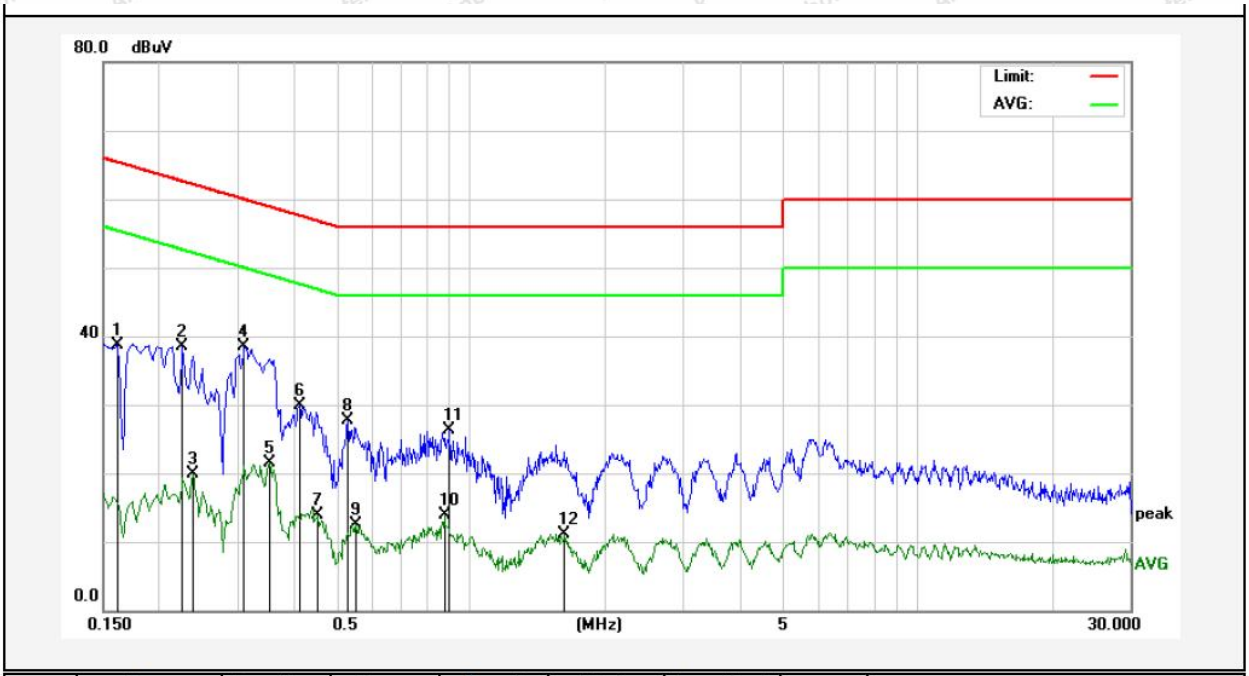
During the test, pre-scan all modes, only the worst case is recorded in the report.

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

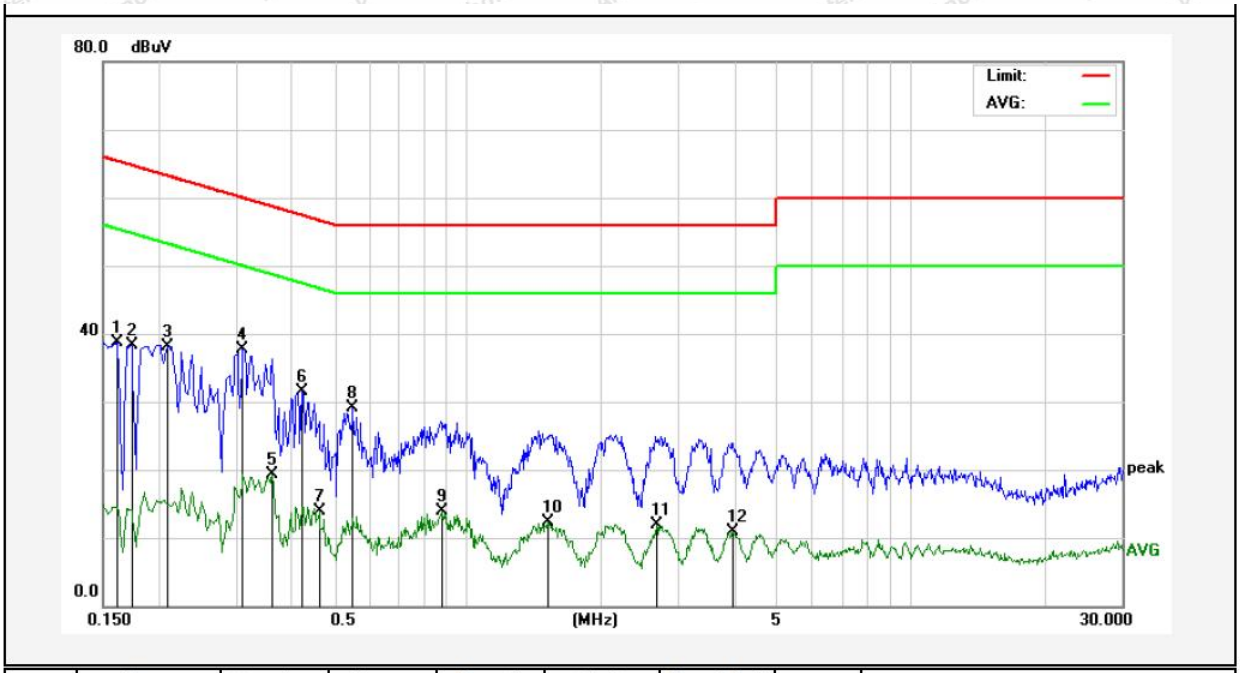
Test Site: 1# Shielded Room
Operating Condition: CH 01 with ANT1 (New PA)
Test Specification: AC 120V, 60Hz
Comment: Live Line
Temp.(℃)/Hum.(%RH): 22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1620	29.10	9.70	38.80	65.36	-26.56	QP	
2	0.2260	28.80	9.71	38.51	62.59	-24.08	QP	
3	0.2380	10.26	9.71	19.97	52.16	-32.19	AVG	
4	0.3100	28.78	9.73	38.51	59.97	-21.46	QP	
5	0.3540	11.85	9.72	21.57	48.87	-27.30	AVG	
6	0.4140	20.25	9.72	29.97	57.57	-27.60	QP	
7	0.4540	4.24	9.74	13.98	46.80	-32.82	AVG	
8	0.5299	17.88	9.76	27.64	56.00	-28.36	QP	
9	0.5540	2.80	9.76	12.56	46.00	-33.44	AVG	
10	0.8740	4.10	9.74	13.84	46.00	-32.16	AVG	
11	0.8980	16.66	9.74	26.40	56.00	-29.60	QP	
12	1.6260	1.47	9.73	11.20	46.00	-34.80	AVG	

Conducted Emission Test Data

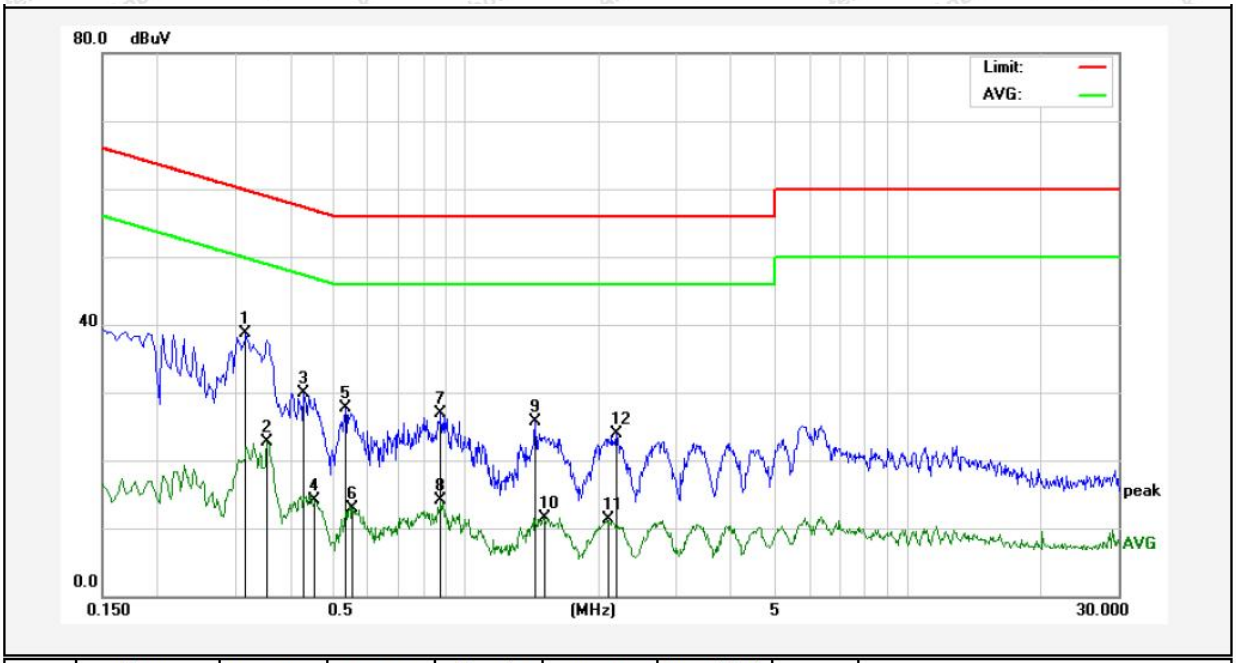
Test Site:	1# Shielded Room
Operating Condition:	CH 01 with ANT1 (New PA)
Test Specification:	AC 120V, 60Hz
Comment:	Neutral Line
Temp.(℃)/Hum.(%RH):	22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1620	29.06	9.70	38.76	65.36	-26.60	QP	
2	0.1740	28.67	9.71	38.38	64.76	-26.38	QP	
3	0.2100	28.37	9.71	38.08	63.20	-25.12	QP	
4	0.3100	27.95	9.73	37.68	59.97	-22.29	QP	
5	0.3620	9.54	9.72	19.26	48.68	-29.42	AVG	
6	0.4220	21.84	9.72	31.56	57.41	-25.85	QP	
7	0.4620	4.15	9.74	13.89	46.66	-32.77	AVG	
8	0.5500	19.26	9.76	29.02	56.00	-26.98	QP	
9	0.8740	4.12	9.74	13.86	46.00	-32.14	AVG	
10	1.5140	2.62	9.73	12.35	46.00	-33.65	AVG	
11	2.6740	2.16	9.73	11.89	46.00	-34.11	AVG	
12	3.9700	1.09	9.74	10.83	46.00	-35.17	AVG	

Conducted Emission Test Data

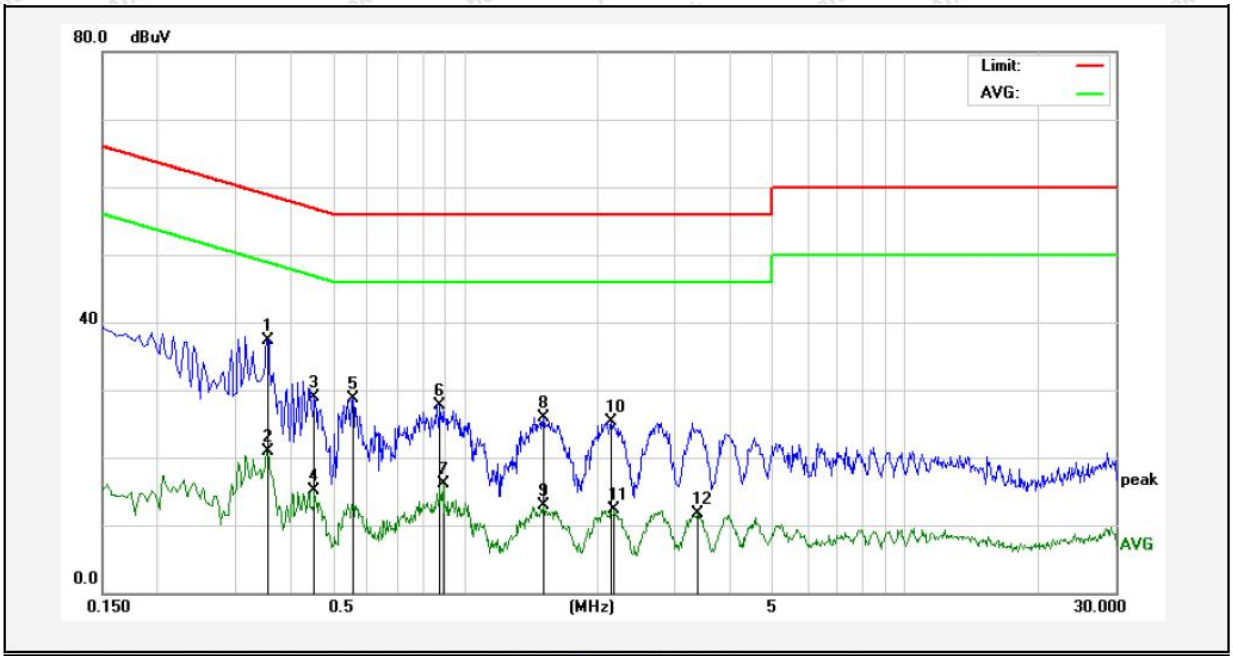
Test Site:	1# Shielded Room
Operating Condition:	CH 01 with ANT1 (Original PA)
Test Specification:	AC 120V, 60Hz
Comment:	Live Line
Temp.(℃)/Hum.(%RH):	22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3180	28.97	9.73	38.70	59.76	-21.06	QP	
2	0.3540	12.93	9.72	22.65	48.87	-26.22	AVG	
3	0.4300	20.10	9.72	29.82	57.25	-27.43	QP	
4	0.4540	4.36	9.74	14.10	46.80	-32.70	AVG	
5	0.5340	17.85	9.76	27.61	56.00	-28.39	QP	
6	0.5540	3.14	9.76	12.90	46.00	-33.10	AVG	
7	0.8780	17.21	9.74	26.95	56.00	-29.05	QP	
8	0.8780	4.40	9.74	14.14	46.00	-31.86	AVG	
9	1.4340	15.94	9.73	25.67	56.00	-30.33	QP	
10	1.5060	1.75	9.72	11.47	46.00	-34.53	AVG	
11	2.0940	1.58	9.72	11.30	46.00	-34.70	AVG	
12	2.1940	14.26	9.72	23.98	56.00	-32.02	QP	

Conducted Emission Test Data

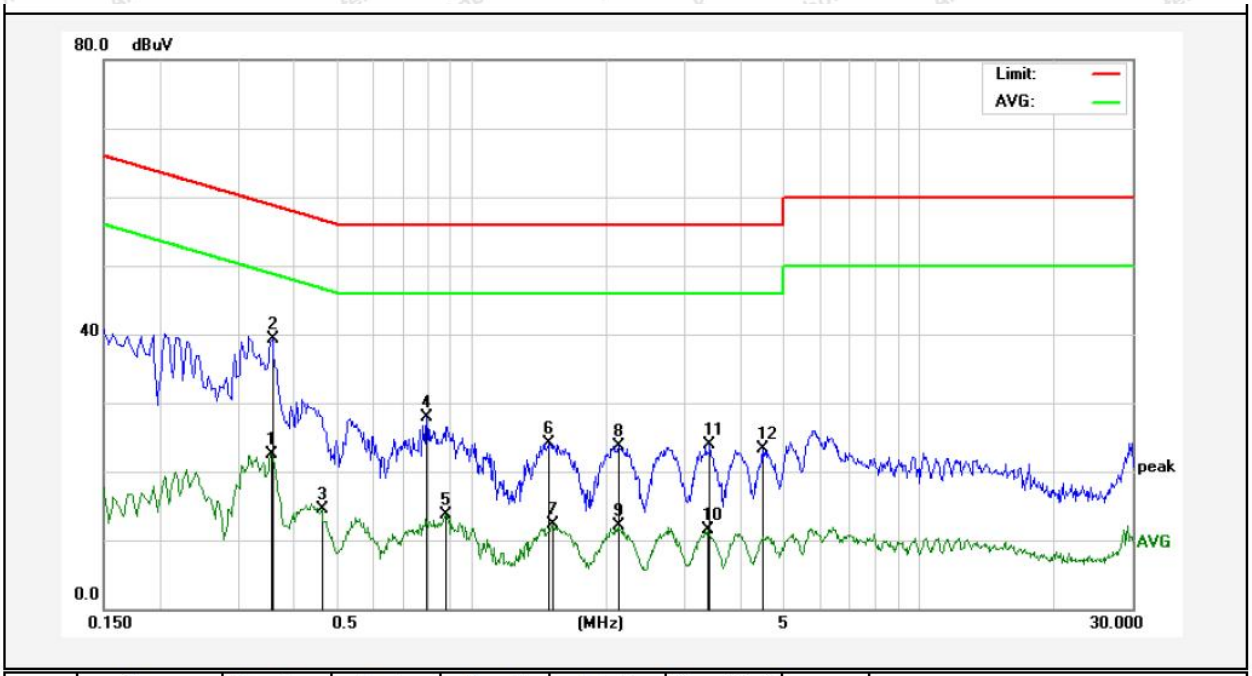
Test Site:	1# Shielded Room
Operating Condition:	CH 01 with ANT1 (Original PA)
Test Specification:	AC 120V, 60Hz
Comment:	Neutral Line
Temp.(℃)/Hum.(%RH):	22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3540	27.65	9.72	37.37	58.87	-21.50	QP	
2	0.3540	11.11	9.72	20.83	48.87	-28.04	AVG	
3	0.4540	19.26	9.74	29.00	56.80	-27.80	QP	
4	0.4540	5.37	9.74	15.11	46.80	-31.69	AVG	
5	0.5580	19.03	9.76	28.79	56.00	-27.21	QP	
6	0.8780	18.01	9.74	27.75	56.00	-28.25	QP	
7	0.8900	6.37	9.74	16.11	46.00	-29.89	AVG	
8	1.5100	16.16	9.73	25.89	56.00	-30.11	QP	
9	1.5100	3.09	9.73	12.82	46.00	-33.18	AVG	
10	2.1460	15.49	9.72	25.21	56.00	-30.79	QP	
11	2.1820	2.57	9.72	12.29	46.00	-33.71	AVG	
12	3.3700	2.04	9.73	11.77	46.00	-34.23	AVG	

Conducted Emission Test Data

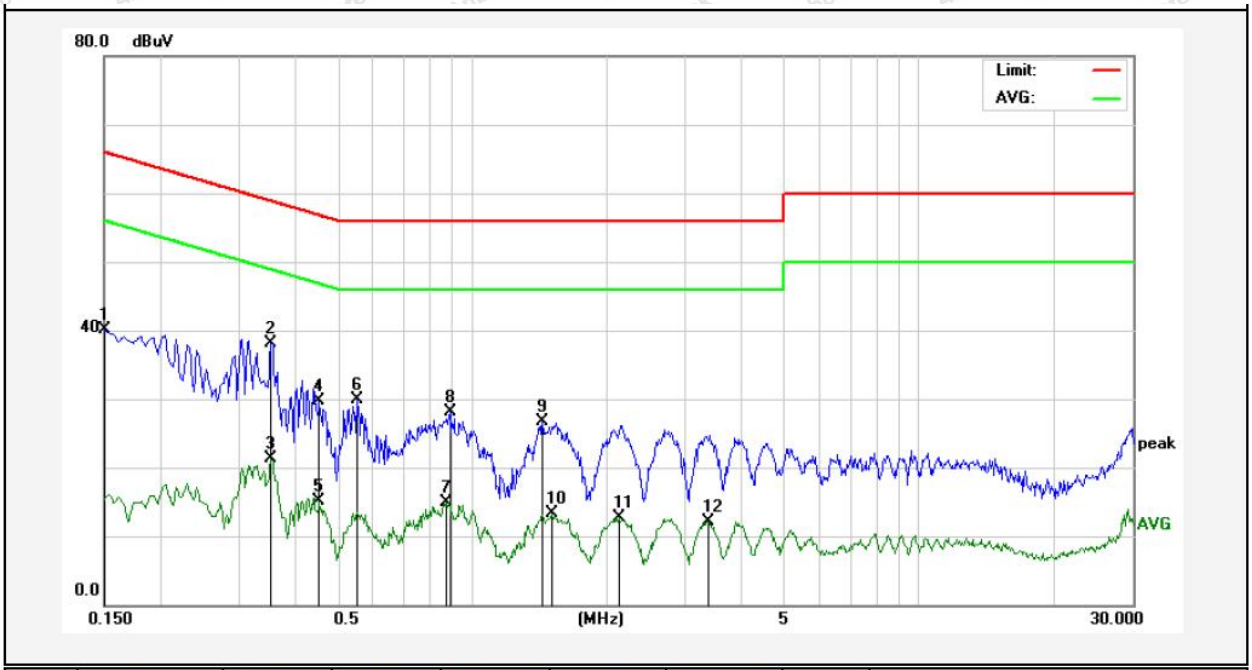
Test Site:	1# Shielded Room
Operating Condition:	CH 01 with ANT2 (New PA)
Test Specification:	AC 120V, 60Hz
Comment:	Live Line
Temp.(℃)/Hum.(%RH):	22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3540	12.86	9.72	22.58	48.87	-26.29	AVG	
2	0.3580	29.62	9.72	39.34	58.77	-19.43	QP	
3	0.4620	4.75	9.74	14.49	46.66	-32.17	AVG	
4	0.7940	18.15	9.75	27.90	56.00	-28.10	QP	
5	0.8780	3.99	9.74	13.73	46.00	-32.27	AVG	
6	1.4900	14.47	9.73	24.20	56.00	-31.80	QP	
7	1.5260	2.65	9.73	12.38	46.00	-33.62	AVG	
8	2.1260	14.02	9.72	23.74	56.00	-32.26	QP	
9	2.1260	2.44	9.72	12.16	46.00	-33.84	AVG	
10	3.3780	1.70	9.73	11.43	46.00	-34.57	AVG	
11	3.4140	14.22	9.73	23.95	56.00	-32.05	QP	
12	4.4740	13.50	9.73	23.23	56.00	-32.77	QP	

Conducted Emission Test Data

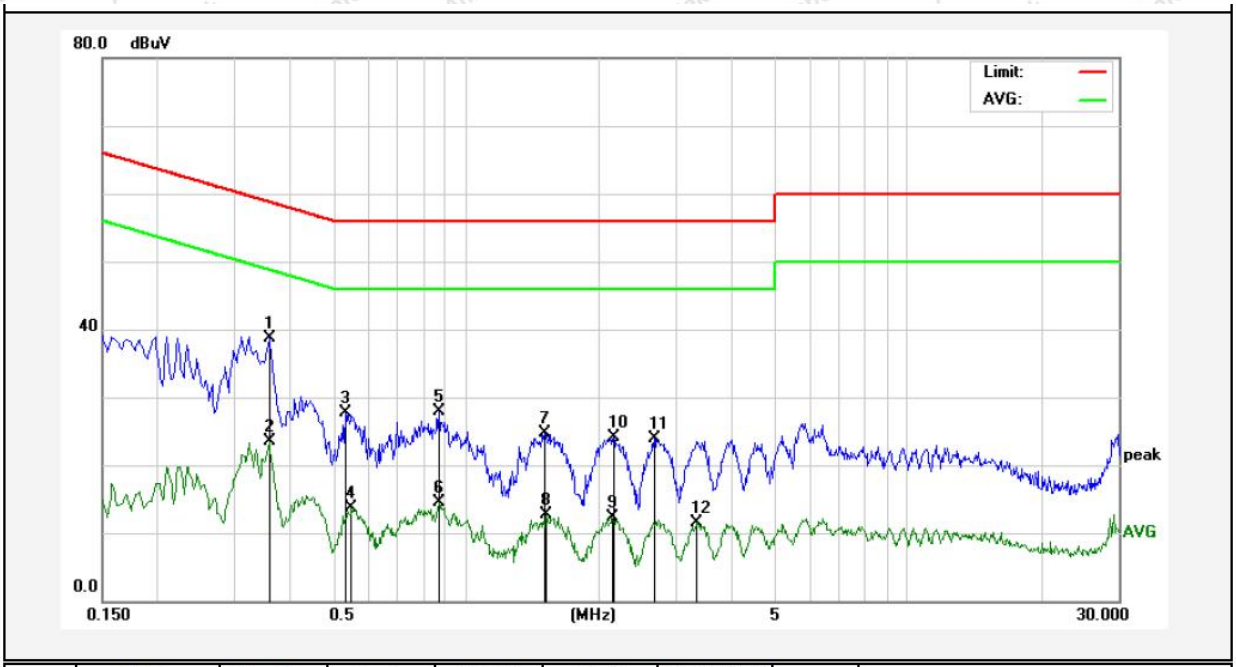
Test Site:	1# Shielded Room
Operating Condition:	CH 01 with ANT2 (New PA)
Test Specification:	AC 120V, 60Hz
Comment:	Neutral Line
Temp.(℃)/Hum.(%RH):	22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	30.34	9.69	40.03	65.99	-25.96	QP	
2	0.3540	28.43	9.72	38.15	58.87	-20.72	QP	
3	0.3540	11.57	9.72	21.29	48.87	-27.58	AVG	
4	0.4540	19.98	9.74	29.72	56.80	-27.08	QP	
5	0.4540	5.28	9.74	15.02	46.80	-31.78	AVG	
6	0.5540	20.10	9.76	29.86	56.00	-26.14	QP	
7	0.8740	5.09	9.74	14.83	46.00	-31.17	AVG	
8	0.8900	18.42	9.74	28.16	56.00	-27.84	QP	
9	1.4340	17.01	9.73	26.74	56.00	-29.26	QP	
10	1.5100	3.55	9.73	13.28	46.00	-32.72	AVG	
11	2.1260	2.99	9.72	12.71	46.00	-33.29	AVG	
12	3.3660	2.44	9.73	12.17	46.00	-33.83	AVG	

Conducted Emission Test Data

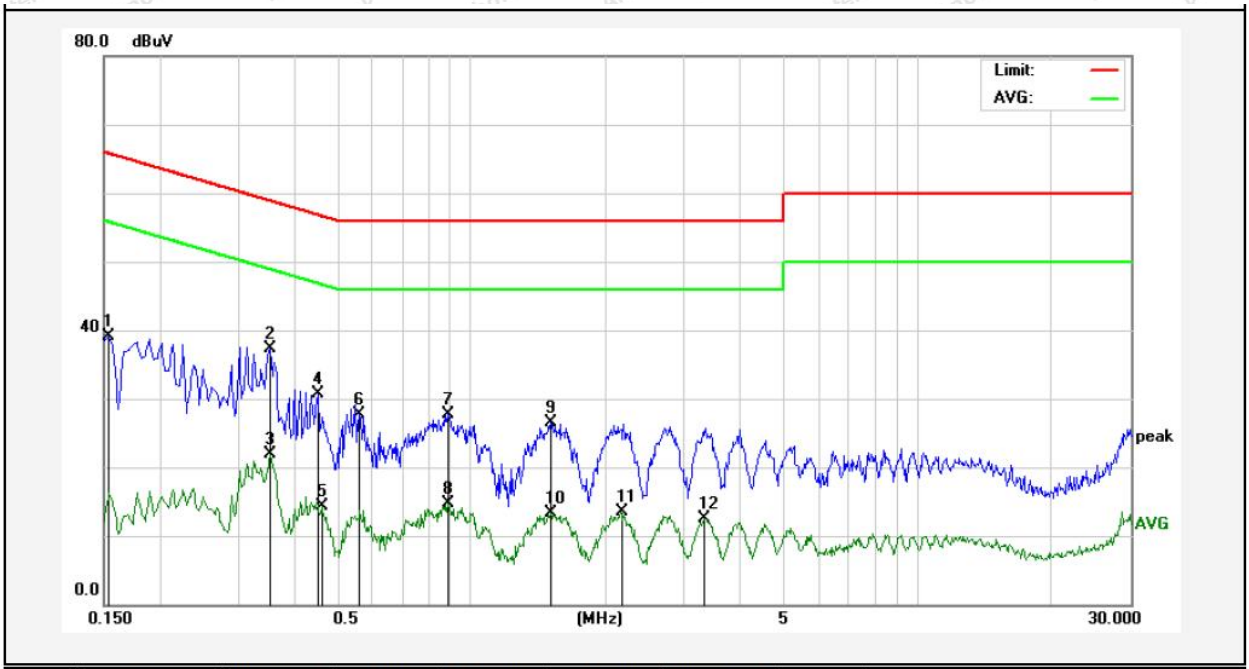
Test Site:	1# Shielded Room
Operating Condition:	CH 01 with ANT2 (Original PA)
Test Specification:	AC 120V, 60Hz
Comment:	Live Line
Temp.(℃)/Hum.(%RH):	22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3580	28.93	9.72	38.65	58.77	-20.12	QP	
2	0.3580	13.83	9.72	23.55	48.77	-25.22	AVG	
3	0.5340	17.98	9.76	27.74	56.00	-28.26	QP	
4	0.5500	3.95	9.76	13.71	46.00	-32.29	AVG	
5	0.8700	18.08	9.75	27.83	56.00	-28.17	QP	
6	0.8700	4.85	9.75	14.60	46.00	-31.40	AVG	
7	1.5100	14.88	9.73	24.61	56.00	-31.39	QP	
8	1.5220	2.95	9.73	12.68	46.00	-33.32	AVG	
9	2.1340	2.49	9.72	12.21	46.00	-33.79	AVG	
10	2.1580	14.45	9.72	24.17	56.00	-31.83	QP	
11	2.6740	14.27	9.73	24.00	56.00	-32.00	QP	
12	3.3380	1.82	9.73	11.55	46.00	-34.45	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.(℃)/Hum.(%RH):	22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1539	29.32	9.70	39.02	65.78	-26.76	QP	
2	0.3540	27.62	9.72	37.34	58.87	-21.53	QP	
3	0.3540	12.09	9.72	21.81	48.87	-27.06	AVG	
4	0.4540	20.90	9.74	30.64	56.80	-26.16	QP	
5	0.4620	4.48	9.74	14.22	46.66	-32.44	AVG	
6	0.5620	17.93	9.76	27.69	56.00	-28.31	QP	
7	0.8860	17.92	9.74	27.66	56.00	-28.34	QP	
8	0.8860	5.06	9.74	14.80	46.00	-31.20	AVG	
9	1.5060	16.69	9.72	26.41	56.00	-29.59	QP	
10	1.5060	3.63	9.72	13.35	46.00	-32.65	AVG	
11	2.1660	3.73	9.72	13.45	46.00	-32.55	AVG	
12	3.3180	2.85	9.73	12.58	46.00	-33.42	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 30MH .Only spurious emissions are permitted within the restricted frequency bands.

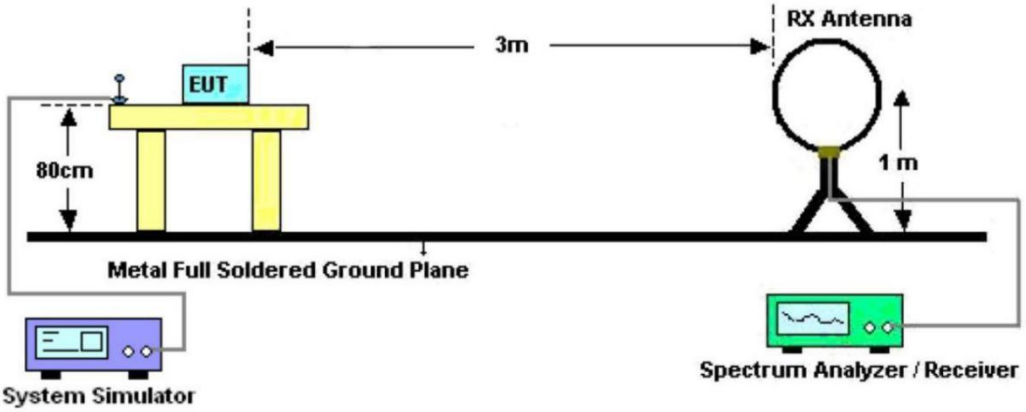
Table 2: Part 15.205 Restricted Frequency Bands

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



Address:1/F.,Building D,Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86) 0755-26066440 Fax:(86) 0755-26014772 Email:service@anbotek.com
Hotline 400-003-0500
www.anbotek.com.cn

Figure 1. Below 30MHz

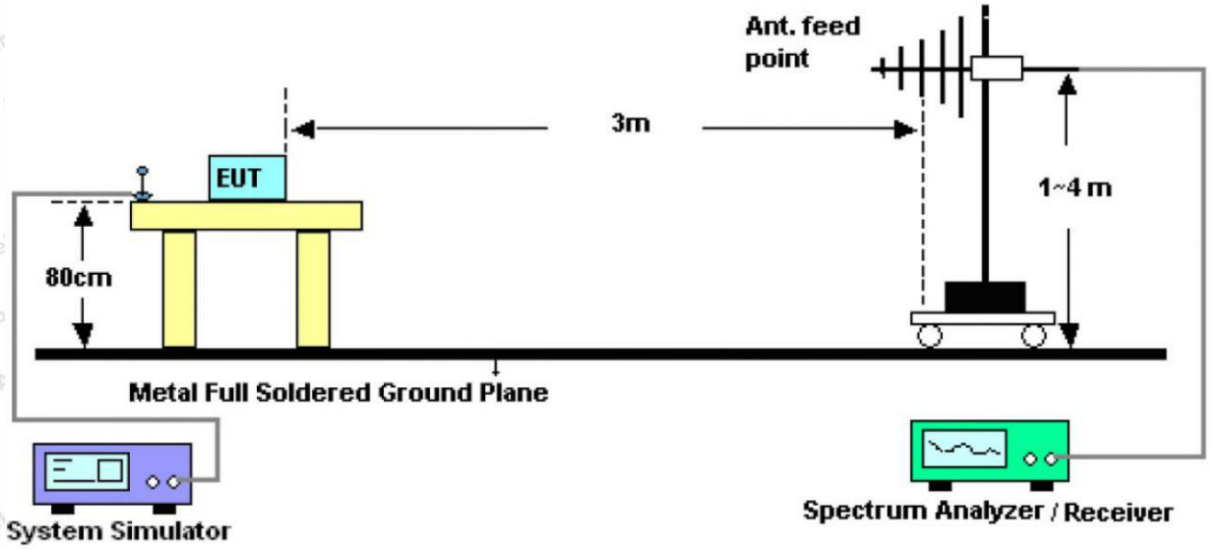


Figure 2. 30MHz to 1GHz

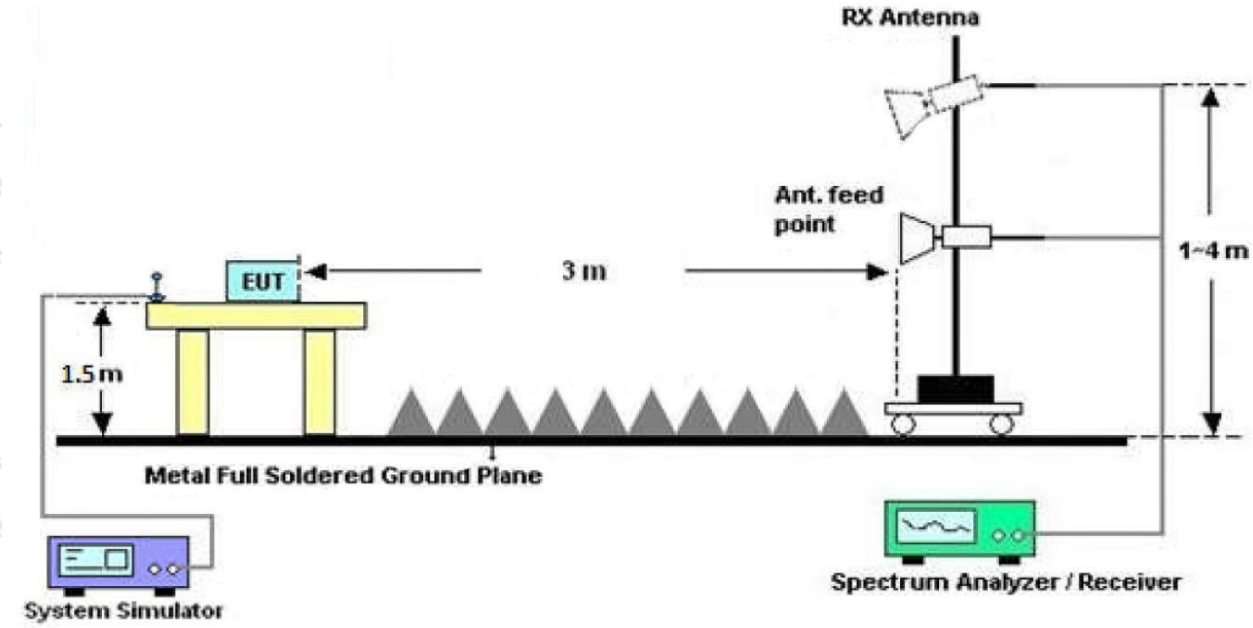


Figure 3. Above 1 GHz

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.

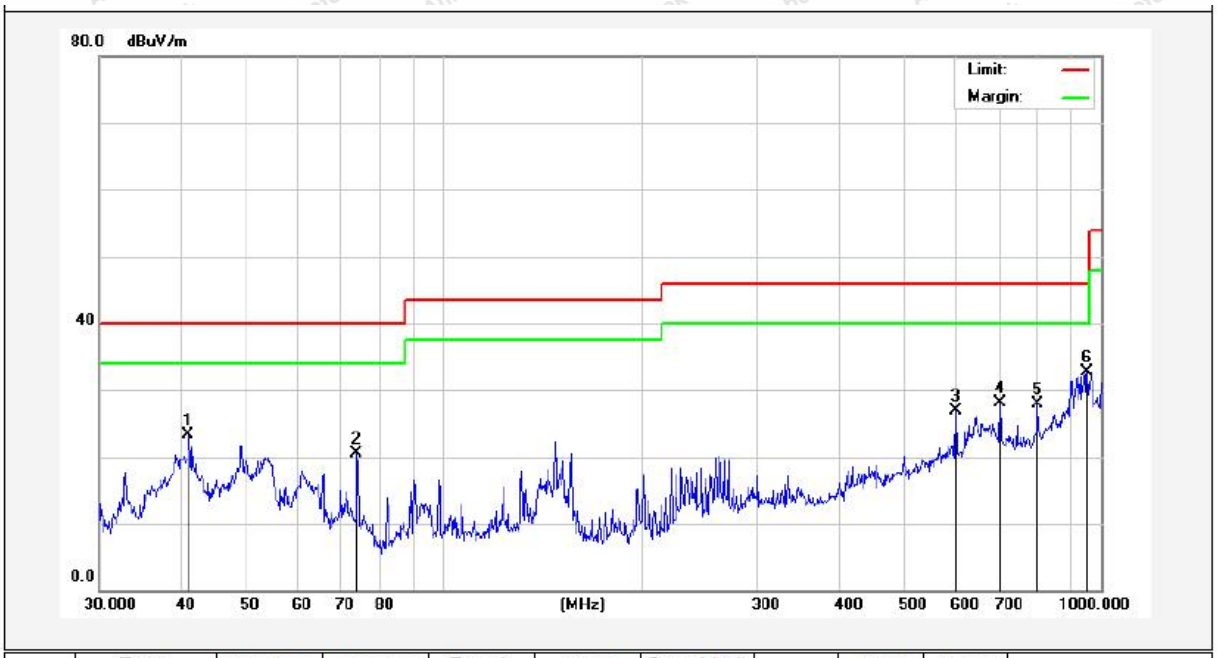
Test Results (30~1000MHz)

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.5℃/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	40.9881	37.93	-14.65	23.28	40.00	-16.72	QP			
2	73.8756	40.46	-19.90	20.56	40.00	-19.44	QP			
3	601.4265	37.36	-10.53	26.83	46.00	-19.17	QP			
4	701.7610	37.97	-9.89	28.08	46.00	-17.92	QP			
5	801.7863	36.24	-8.24	28.00	46.00	-18.00	QP			
6	952.0937	38.24	-5.61	32.63	46.00	-13.37	QP			

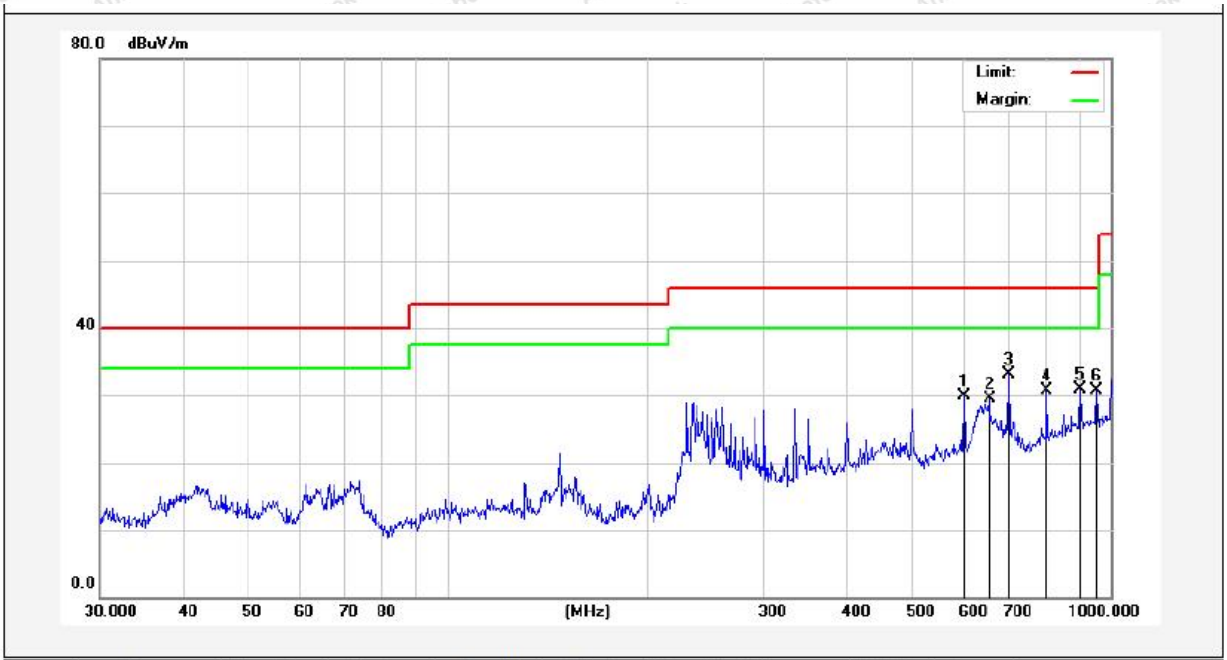
Test Results (30~1000MHz)

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.5℃/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	40.34	-10.53	29.81	46.00	-16.19	QP			
2	656.5300	40.11	-10.57	29.54	46.00	-16.46	QP			
3	701.7610	42.98	-9.89	33.09	46.00	-12.91	QP			
4	801.7863	38.91	-8.24	30.67	46.00	-15.33	QP			
5	900.1474	37.22	-6.22	31.00	46.00	-15.00	QP			
6	952.0937	36.31	-5.61	30.70	46.00	-15.30	QP			

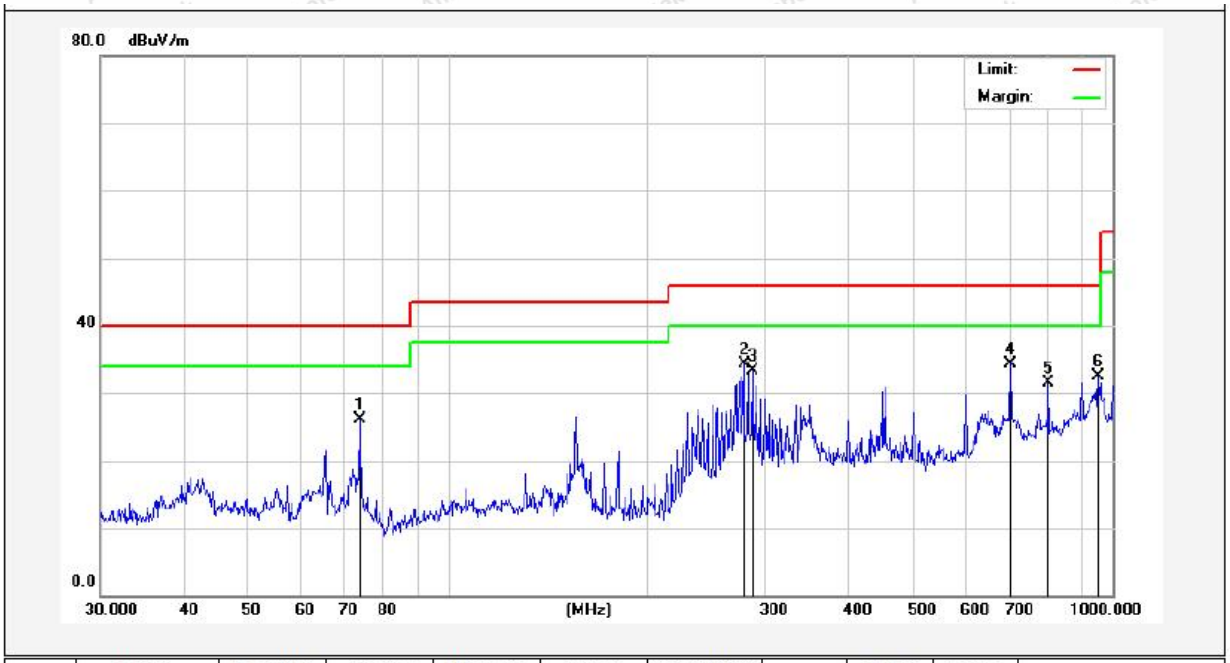
Test Results (30~1000MHz)

Test Mode: CH 01 with ANT1 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.5℃/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	73.6170	48.20	-22.06	26.14	40.00	-13.86	QP			
2	279.0436	53.34	-18.98	34.36	46.00	-11.64	QP			
3	286.9823	51.52	-18.29	33.23	46.00	-12.77	QP			
4	701.7610	44.18	-9.89	34.29	46.00	-11.71	QP			
5	801.7863	39.81	-8.24	31.57	46.00	-14.43	QP			
6	952.0937	38.12	-5.61	32.51	46.00	-13.49	QP			

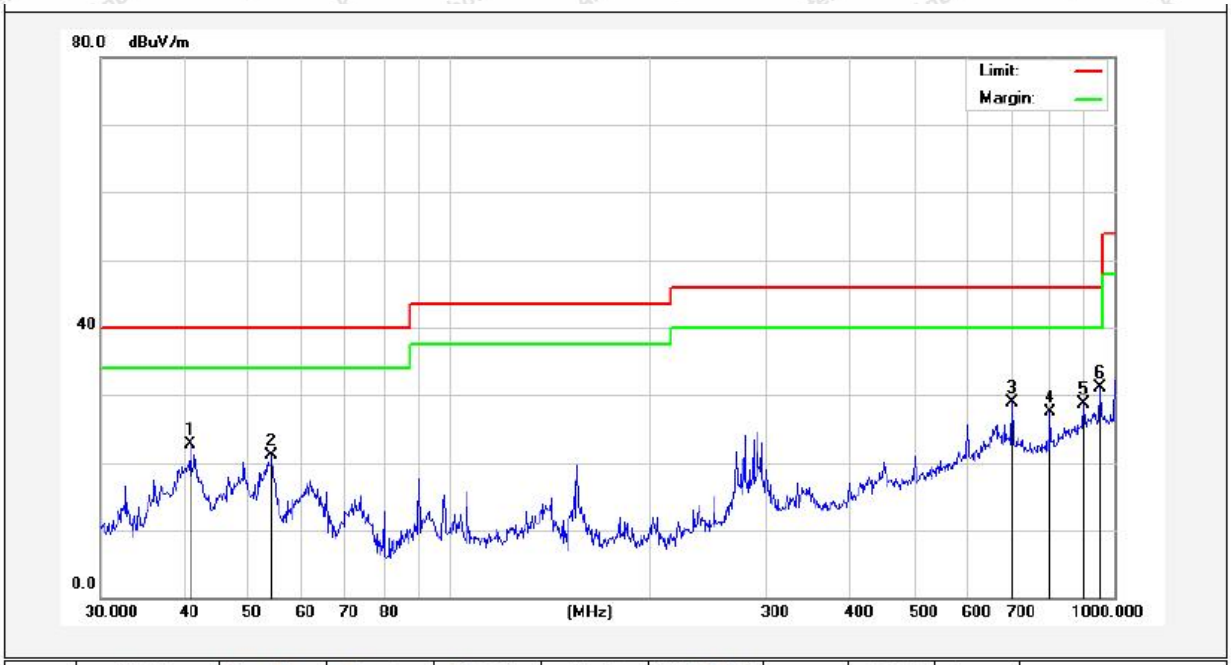
Test Results (30~1000MHz)

Test Mode: CH 01 with ANT1 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.5℃/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	40.9881	37.42	-14.65	22.77	40.00	-17.23	QP			
2	54.2610	38.46	-17.35	21.11	40.00	-18.89	QP			
3	701.7610	38.71	-9.89	28.82	46.00	-17.18	QP			
4	801.7863	35.79	-8.24	27.55	46.00	-18.45	QP			
5	900.1474	34.99	-6.22	28.77	46.00	-17.23	QP			
6	952.0937	36.81	-5.61	31.20	46.00	-14.80	QP			

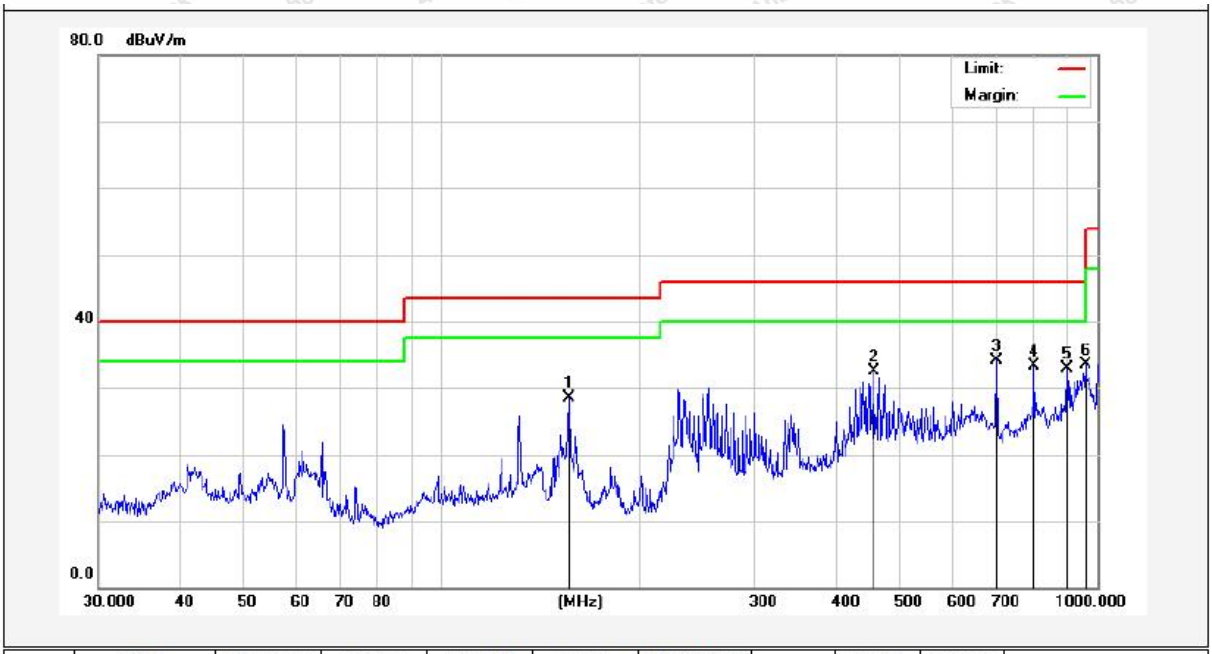
Test Results (30~1000MHz)

Test Mode: CH 01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.5℃/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	156.4578	52.08	-23.61	28.47	43.50	-15.03	QP			
2	455.9058	47.85	-15.28	32.57	46.00	-13.43	QP			
3	701.7610	44.07	-9.89	34.18	46.00	-11.82	QP			
4	801.7863	41.57	-8.24	33.33	46.00	-12.67	QP			
5	900.1474	39.14	-6.22	32.92	46.00	-13.08	QP			
6	958.7943	38.97	-5.49	33.48	46.00	-12.52	QP			

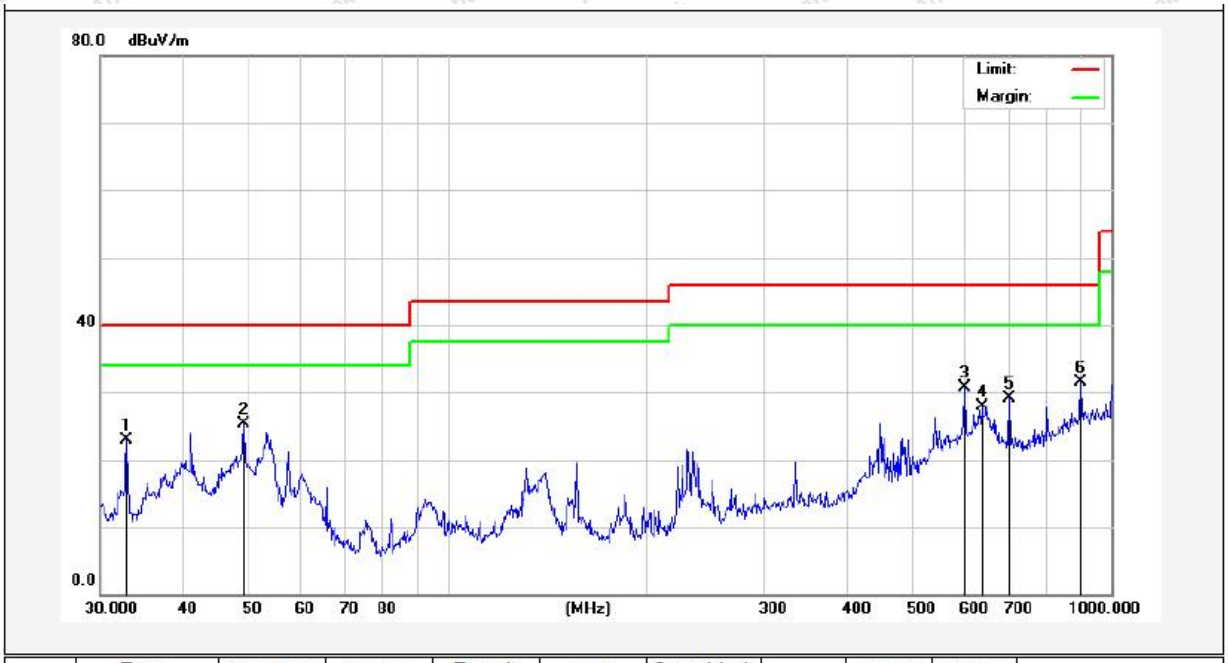
Test Results (30~1000MHz)

Test Mode: CH 01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.5℃/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	32.8637	40.44	-17.49	22.95	40.00	-17.05	QP			
2	49.3594	40.92	-15.68	25.24	40.00	-14.76	QP			
3	601.4265	41.27	-10.53	30.74	46.00	-15.26	QP			
4	638.3686	38.52	-10.63	27.89	46.00	-18.11	QP			
5	701.7610	38.97	-9.89	29.08	46.00	-16.92	QP			
6	900.1474	37.76	-6.22	31.54	46.00	-14.46	QP			

Test Results (30~1000MHz)

Test Mode: CH 01 with ANT2 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.5℃/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	271.3246	46.99	-19.64	27.35	46.00	-18.65	QP			
2	601.4265	37.47	-10.53	26.94	46.00	-19.06	QP			
3	701.7610	43.13	-9.89	33.24	46.00	-12.76	QP			
4	801.7863	41.26	-8.24	33.02	46.00	-12.98	QP			
5	900.1474	37.50	-6.22	31.28	46.00	-14.72	QP			
6	938.8326	32.62	-5.77	26.85	46.00	-19.15	QP			

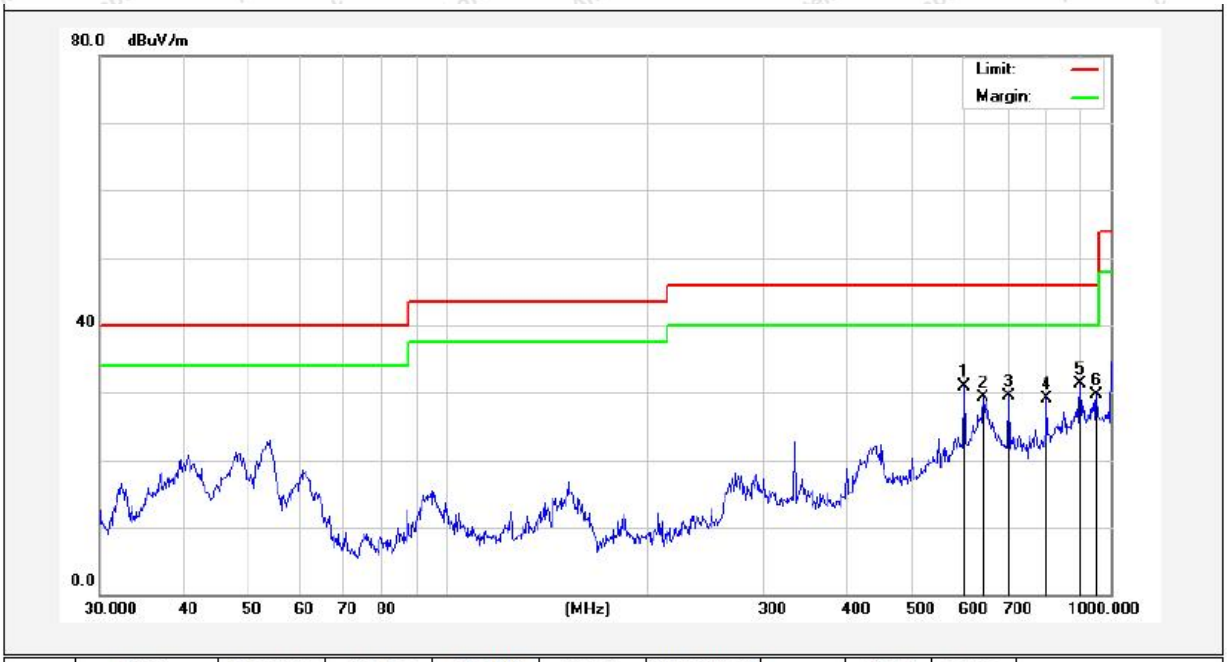
Test Results (30~1000MHz)

Test Mode: CH 01 with ANT2 (Original PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.5℃/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	41.46	-10.53	30.93	46.00	-15.07	QP			
2	642.8613	40.02	-10.64	29.38	46.00	-16.62	QP			
3	701.7610	39.37	-9.89	29.48	46.00	-16.52	QP			
4	801.7863	37.44	-8.24	29.20	46.00	-16.80	QP			
5	900.1474	37.53	-6.22	31.31	46.00	-14.69	QP			
6	952.0937	35.25	-5.61	29.64	46.00	-16.36	QP			

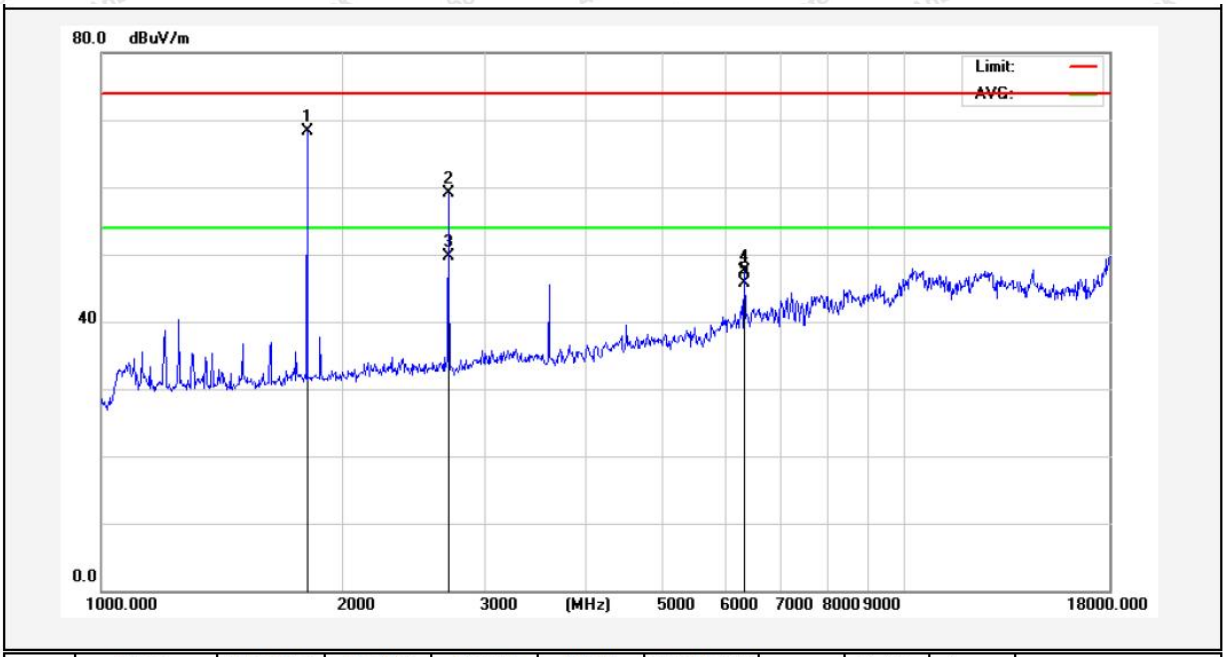
Test Results (1GHz~18GHz)

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.5℃/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	94.58	-26.32	68.26	104.00	-35.74	peak			
2	2702.799	82.78	-23.70	59.08	74.00	-14.92	peak			
3	2702.799	73.35	-23.70	49.65	54.00	-4.35	AVG			
4	6322.136	59.61	-12.13	47.48	74.00	-26.52	peak			
5	6322.136	57.91	-12.13	45.78	54.00	-8.22	AVG			

*) -20 dBc

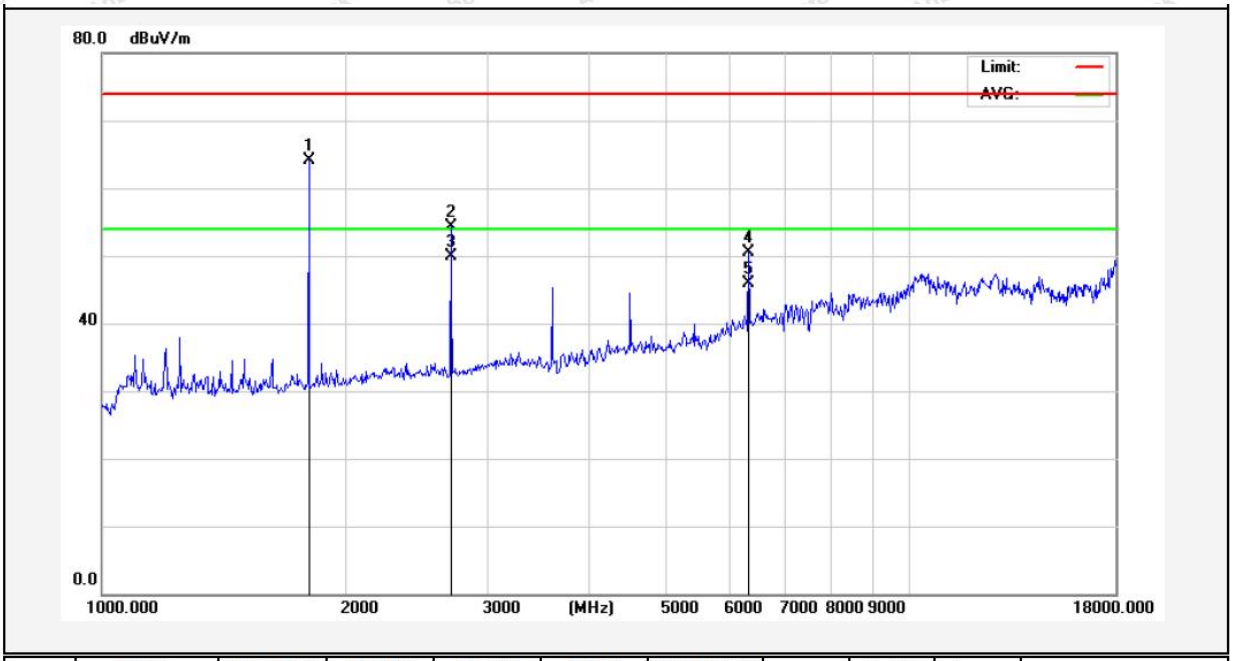
Test Results (1GHz~18GHz)

Test Mode: CH 01 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.5℃/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	90.46	-26.32	64.14	104.00	-39.86	peak			
2	2702.799	77.97	-23.70	54.27	74.00	-19.73	peak			
3	2702.799	73.57	-23.70	49.87	54.00	-4.13	AVG			
4	6322.136	62.68	-12.13	50.55	74.00	-23.45	peak			
5	6322.136	58.11	-12.13	45.98	54.00	-8.02	AVG			

*) -20 dBc

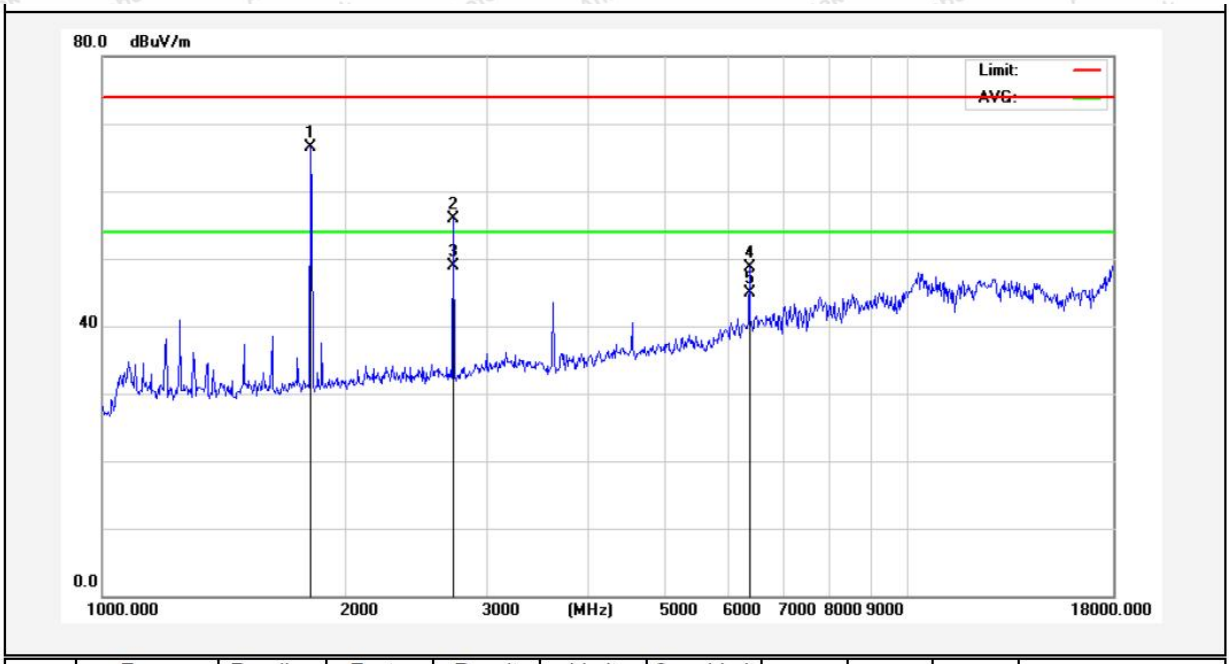
Test Results (1GHz~18GHz)

Test Mode: CH 09 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.5℃/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	92.72	-26.25	66.47	103.85	-37.38	peak			
2	2726.337	79.63	-23.65	55.98	74.00	-18.02	peak			
3	2726.337	72.60	-23.65	48.95	54.00	-5.05	AVG			
4	6358.789	60.61	-11.97	48.64	74.00	-25.36	peak			
5	6358.789	56.95	-11.97	44.98	54.00	-9.02	AVG			

*) -20 dBc

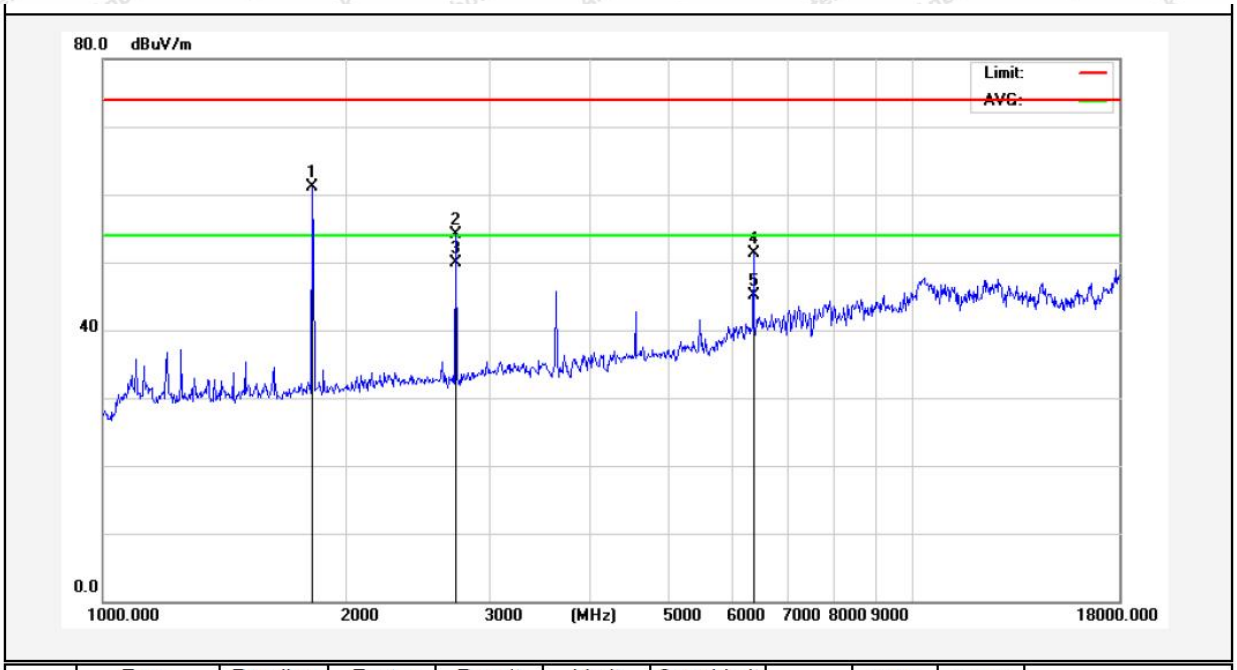
Test Results (1GHz~18GHz)

Test Mode: CH 09 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.5℃/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	87.40	-26.25	61.15	103.85	-42.70	peak			
2	2726.337	77.77	-23.65	54.12	74.00	-19.88	peak			
3	2726.337	73.52	-23.65	49.87	54.00	-4.13	AVG			
4	6358.789	63.29	-11.97	51.32	74.00	-22.68	peak			
5	6358.789	57.16	-11.97	45.19	54.00	-8.81	AVG			

*) -20 dBc

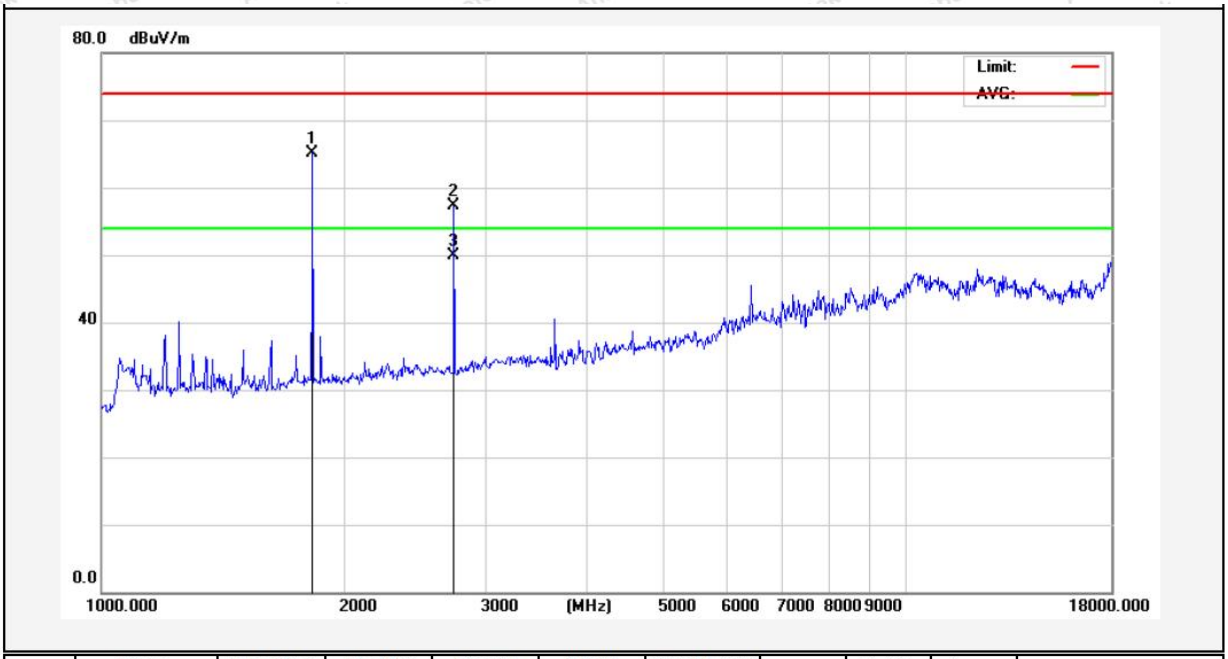
Test Results (1GHz~18GHz)

Test Mode: CH 16 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.5℃/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	91.16	-26.12	65.04	102.55	-37.51	peak			
2	2742.143	80.90	-23.61	57.29	74.00	-16.71	peak			
3	2742.143	73.56	-23.61	49.95	54.00	-4.05	AVG			

*) -20 dBc

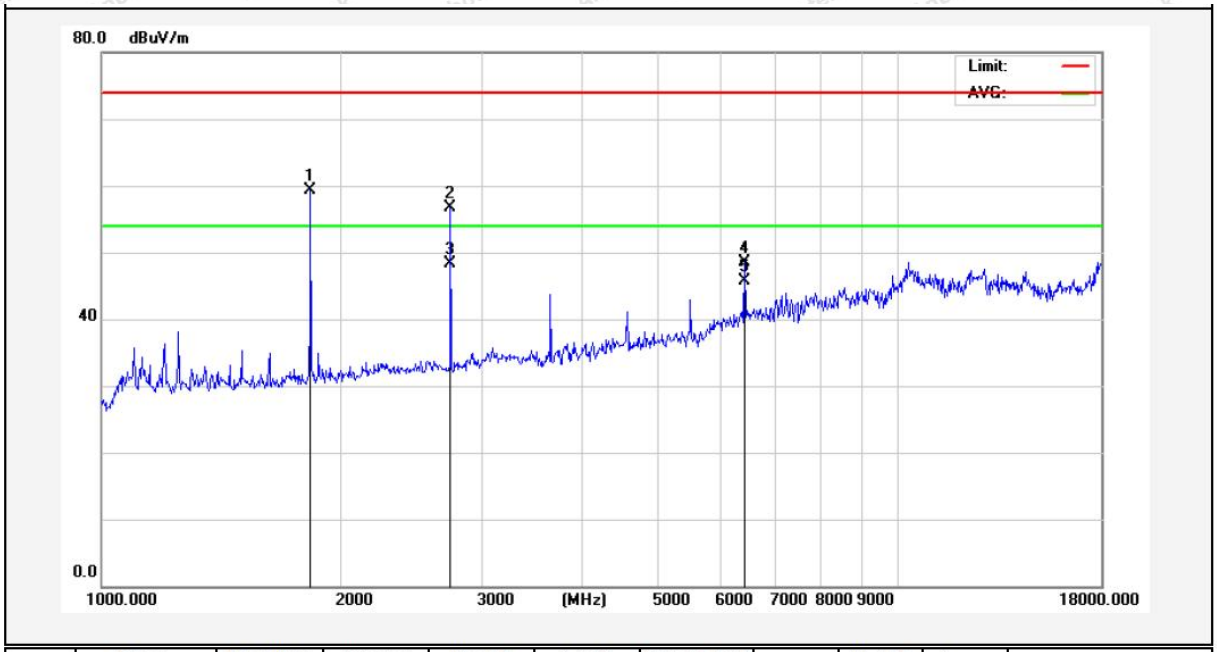
Test Results (1GHz~18GHz)

Test Mode: CH 16 with ANT1 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.5℃/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	85.51	-26.12	59.39	102.55	-43.16	peak			
2	2742.143	80.25	-23.61	56.64	74.00	-17.36	peak			
3	2742.143	71.87	-23.61	48.26	54.00	-5.74	AVG			
4	6414.166	60.28	-11.71	48.57	74.00	-25.43	peak			
5	6414.166	57.34	-11.71	45.63	54.00	-8.37	AVG			

*) -20 dBc

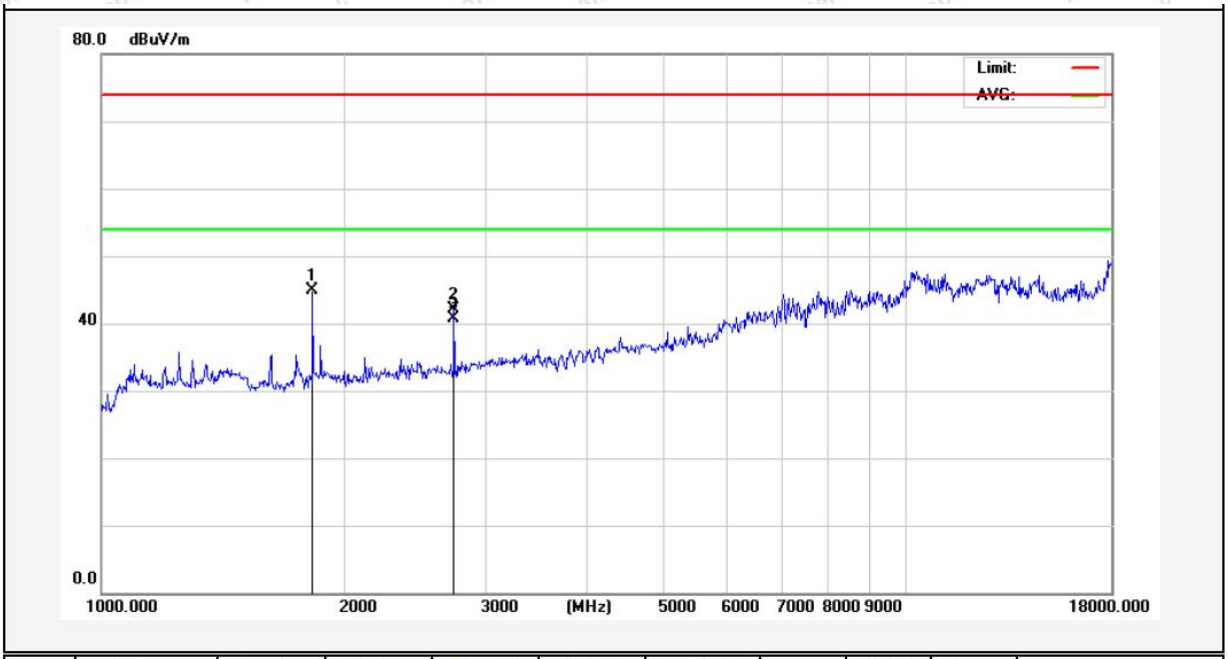
Test Results (1GHz~18GHz)

Test Mode: CH01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.5℃/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	70.98	-26.12	44.86	104.40	-59.54	peak			
2	2742.143	65.74	-23.61	42.13	74.00	-31.87	peak			
3	2742.143	64.30	-23.61	40.69	54.00	-13.31	AVG			

*) -20 dBc

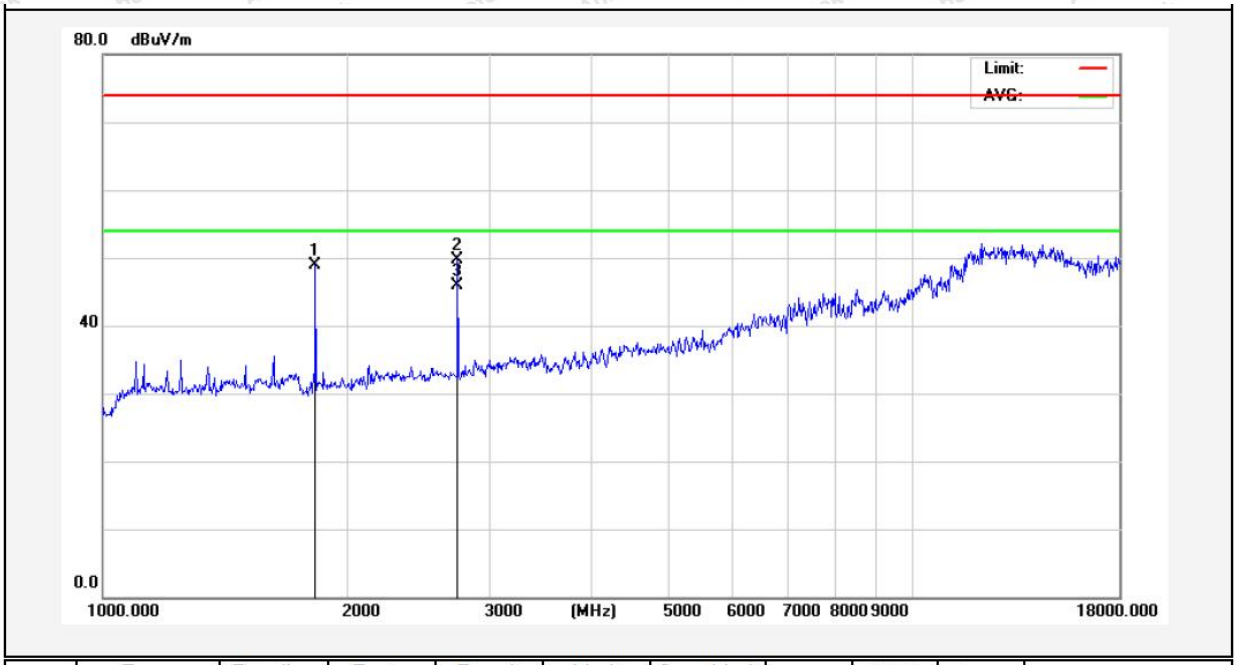
Test Results (1GHz~18GHz)

Test Mode: CH01 with ANT2 (New PA)

Power Source: AC 120V, 60Hz

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.5℃/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	74.96	-26.12	48.84	104.40	-55.56	peak			
2	2742.143	73.31	-23.61	49.70	74.00	-24.30	peak			
3	2742.143	69.48	-23.61	45.87	54.00	-8.13	AVG			

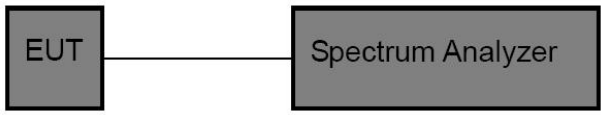
*) -20 dBc

5. Maximum Peak Output Power Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(2)
Test Limit	For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

5.2. Test Setup



5.3. Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above,
2. Spectrum Setting:
   RBW > the 20 dB bandwidth of the emission being measured
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold

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	:	49 %

For New PA:

Test Channel	Peak Power output (dBm)	Limit (dBm)	Results
Low	26.204	30.00	PASS
Middle	26.052	30.00	PASS
High	24.754	30.00	PASS

For Original PA:

Test Channel	Peak Power output (dBm)	Limit (dBm)	Results
Low	25.568	30	PASS
Middle	25.740	30	PASS
High	24.745	30	PASS

6. Antenna Requirement

6.1. 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.

6.2. 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 ----------