TEST REPORT

Application No.:	SZEM2005003546CR
Applicant:	SHENZHEN JIPUSLE TECHNOLOGY CO., LTD
Address of Applicant:	201, No. 20, Gushu Xijing Road, Gushu community, Xixiang street, Bao'an District, Shenzhen 518000 China
Manufacturer:	SHENZHEN JIPUSLE TECHNOLOGY CO., LTD
Address of Manufacturer:	201, No. 20, Gushu Xijing Road, Gushu community, Xixiang street, Bao'an District, Shenzhen 518000 China
Factory:	SHENZHEN JIPUSLE TECHNOLOGY CO., LTD
Address of Factory:	201, No. 20, Gushu Xijing Road, Gushu community, Xixiang street, Bao'an District, Shenzhen 518000 China
Equipment Under Test (EUT):	
EUT Name:	2.4G Wireless Module
Model No.:	2.4G-01, SPD200 ♣
♣	Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Trade Mark:	KINGPULSE
FCC ID:	2AWGP24G-01MODEL
Standard(s) :	47 CFR Part 15, Subpart C 15.249
Date of Receipt:	2020-05-08
Date of Test:	2020-05-14 to 2020-07-24
Date of Issue:	2020-08-01
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2020-08-01		Original

Authorized for issue by:				
				
		Damon Su /Project Engineer		
				
		Eric Fu /Reviewer		

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2 Test Summary

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	47 CFR Part 15, Subpart C 15.249	N/A	47 CFR Part 15, Subpart C 15.203	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.9	47 CFR Part 15, Subpart C 15.215	Pass
Field Strength of the Fundamental Signal (15.249(a))	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.5&6.6	47 CFR Part 15, Subpart C 15.249(a)	Pass
Restricted Band Around Fundamental Frequency	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.4&6.5&6.6	47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209	Pass
Radiated Emissions	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.4&6.5&6.6	47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)	Pass

Declaration of EUT Family Grouping:

Model No.: 2.4G-01, SPD200

Only the model 2.4G-01 was tested, since according to the declaration from the applicant, the electrical circuit design, layout, components used, internal wiring and functions were identical for the above models, with only difference on model No.

3 Contents

4 General Information

4.1 Details of E.U.T.

Power Supply:	DC 3V.
Operation Frequency:	2405-2477MHz
Modulation Type:	GFSK
Number of Channels:	52
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi

Frequency List

Channel No.	Frequency	Channel No.	Frequency	Channel No.	Frequency	Channel No.	Frequency
1	2405	16	2429	34	2453	52	2477
2	2406	17	2430	35	2454	/	/
3	2407	18	2431	36	2455	/	/
4	2409	19	2433	37	2457		
5	2410	20	2434	38	2458		
6	2411	21	2435	39	2459		
7	2413	22	2437	40	2461		
8	2414	23	2438	41	2462		
9	2415	24	2439	42	2463		
10	2417	25	2441	43	2465		
11	2418	26	2442	44	2466		
12	2419	27	2443	45	2467		
13	2421	28	2445	46	2469		
14	2422	29	2446	47	2470		
15	2423	30	2447	48	2471		
16	2425	31	2449	49	2473		
17	2426	32	2450	50	2474		
18	2427	33	2451	51	2475		

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
DC power supply	ZHAOXIN	RXN-305D	REF.No.SEA2700

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4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	± 7.25 x 10^{-8}
2	Duty cycle	± 0.37%
3	Occupied Bandwidth	± 3%
4	Conduction emission	± 3.0dB (150kHz to 30MHz)
5	RF conducted power	± 0.75dB
6	RF power density	± 2.84dB
7	Conducted Spurious emissions	± 0.75dB
8	RF Radiated power	± 4.5dB (Below 1GHz)
		± 4.8dB (Above 1GHz)
9	Radiated Spurious emission test	± 4.5dB (Below 1GHz)
		± 4.8dB (Above 1GHz)
10	Temperature test	± 1℃
11	Humidity test	± 3%
12	Supply voltages	± 1%
13	Time	± 3%

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4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

• **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

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5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2019-06-13	2022-06-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2020-07-10	2021-07-09
LISN	Rohde & Schwarz	ENV216	SEM007-01	2019-09-24	2020-09-23
LISN	ETS-LINDGREN	3816/2	SEM007-02	2020-04-01	2021-03-31
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2020-03-24	2021-03-23

20dB Bandwidth					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2022-06-12
DC Power Supply	Rohde & Schwarz	NGSM 32/10	SEM011-04	2020-03-24	2021-03-23
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2019-09-24	2020-09-23
Measurement Software	TST	TST PASS V1.0.5	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2020-07-10	2021-07-09
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2019-09-24	2020-09-23
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2019-09-24	2020-09-23
Electric and Magnetic Field Analyzer	Narda	EHP-50F	SEM022-05	2019-11-28	2020-11-27

Field Strength of the Fundamental Signal (15.249(a))					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2020-07-10	2021-07-09
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2020-04-09	2021-04-08
Horn Antenna	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2019-09-24	2020-09-23
Pre-amplifier	Rohde & Schwarz	CH14-H052	SEM005-17	2020-04-01	2021-03-31

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Pre-amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2020-04-01	2021-03-31
DC Power Supply	Zhao Xin	KXN-6020D	SEM011-08	2019-09-24	2020-09-23
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Restricted Band Around Fundamental Frequency					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2020-07-10	2021-07-09
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2020-04-09	2021-04-08
Horn Antenna	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2019-09-24	2020-09-23
Pre-amplifier	Rohde & Schwarz	CH14-H052	SEM005-17	2020-04-01	2021-03-31
Pre-amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2020-04-01	2021-03-31
DC Power Supply	Zhao Xin	KXN-6020D	SEM011-08	2019-09-24	2020-09-23
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Radiated Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2020-07-10	2021-07-09
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2020-04-09	2021-04-08
Horn Antenna	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2019-09-24	2020-09-23
Pre-amplifier	Rohde & Schwarz	CH14-H052	SEM005-17	2020-04-01	2021-03-31

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Pre-amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2020-04-01	2021-03-31
DC Power Supply	Zhao Xin	KXN-6020D	SEM011-08	2019-09-24	2020-09-23
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Radiated Emissions (below 1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-08-05	2020-08-04
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2019-07-12	2020-07-11
				2020-07-10	2021-07-09
MXE EMI receiver	KEYSIGHT	N9038A	SEM004-15	2019-12-16	2020-12-15
BiConiLog Antenna	ETS-LINDGREN	3142C	SEM003-02	2019-05-24	2022-05-23
Pre-amplifier	Agilent Technologies	8447D	SEM005-01	2020-04-01	2021-03-31

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2019-09-26	2020-09-25
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2019-09-26	2020-09-25
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2019-09-26	2020-09-25
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2020-04-07	2021-04-06

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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203

Limit:

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

6.1.2 Conclusion

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.

Antenna location: Refer to External photos

7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 56 % RH Atmospheric Pressure: 1005 mbar

Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

7.1.2 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

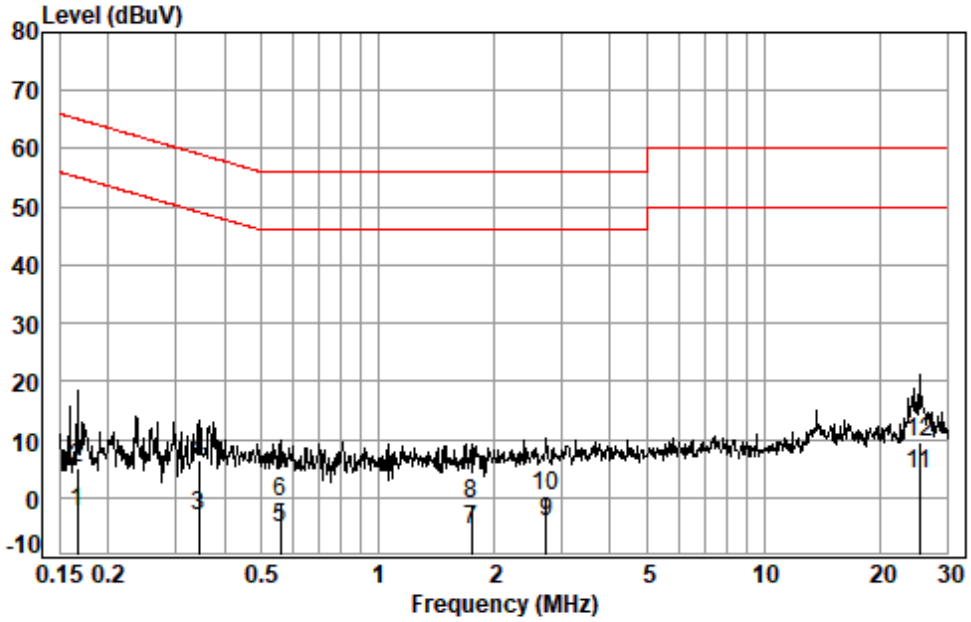
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor

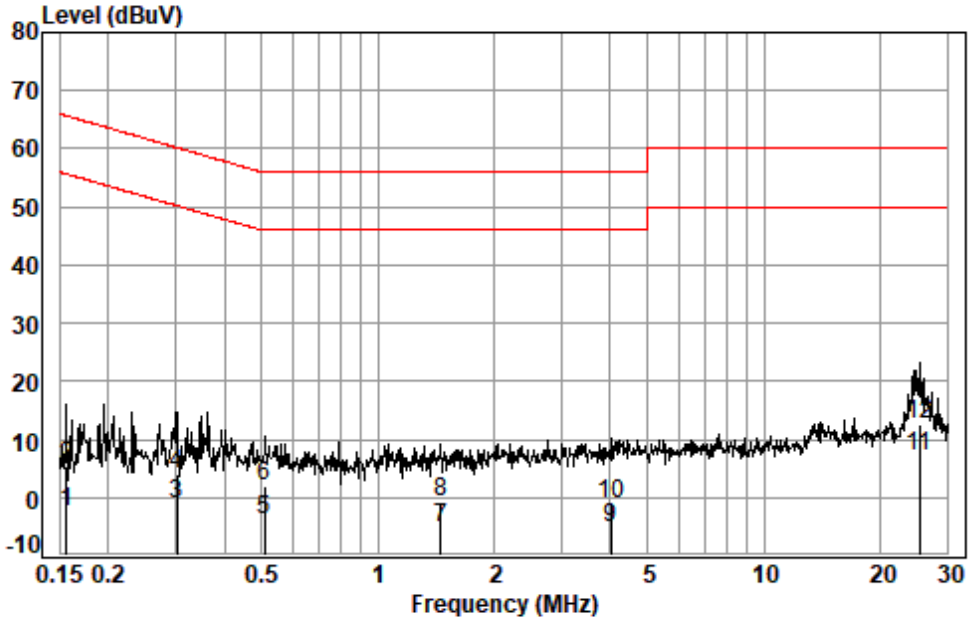
Mode:a; Line:Live Line



Site : Shielding Room
Condition: Line
Job No. : 03546CR
Test mode:

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1668	0.01	9.68	-12.03	-2.34	55.12	-57.46	Average
2	0.1668	0.01	9.68	-4.77	4.92	65.12	-60.20	QP
3	0.3428	0.04	9.68	-13.04	-3.32	49.13	-52.45	Average
4	0.3428	0.04	9.68	-3.40	6.32	59.13	-52.81	QP
5	0.5581	0.07	9.69	-14.91	-5.15	46.00	-51.15	Average
6	0.5581	0.07	9.69	-10.38	-0.62	56.00	-56.62	QP
7	1.7529	0.15	9.74	-15.44	-5.55	46.00	-51.55	Average
8	1.7529	0.15	9.74	-10.91	-1.02	56.00	-57.02	QP
9	2.7356	0.16	9.77	-13.97	-4.04	46.00	-50.04	Average
10	2.7356	0.16	9.77	-9.50	0.43	56.00	-55.57	QP
11	25.3214	0.26	10.97	-7.30	3.93	50.00	-46.07	Average
12	25.3214	0.26	10.97	-1.78	9.45	60.00	-50.55	QP

Mode:a; Line:Neutral Line



Site : Shielding Room
Condition: Neutral
Job No. : 03546CR
Test mode:

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1557	0.01	9.67	-12.31	-2.63	55.69	-58.32	Average
2	0.1557	0.01	9.67	-4.44	5.24	65.69	-60.45	QP
3	0.3019	0.04	9.67	-10.86	-1.15	50.19	-51.34	Average
4	0.3019	0.04	9.67	-5.53	4.18	60.19	-56.01	QP
5	0.5101	0.06	9.67	-13.41	-3.68	46.00	-49.68	Average
6	0.5101	0.06	9.67	-7.70	2.03	56.00	-53.97	QP
7	1.4562	0.13	9.71	-15.08	-5.24	46.00	-51.24	Average
8	1.4562	0.13	9.71	-10.53	-0.69	56.00	-56.69	QP
9	4.0275	0.16	9.80	-15.30	-5.34	46.00	-51.34	Average
10	4.0275	0.16	9.80	-10.94	-0.98	56.00	-56.98	QP
11	25.3214	0.26	10.74	-3.89	7.11	50.00	-42.89	Average
12	25.3214	0.26	10.74	1.75	12.75	60.00	-47.25	QP

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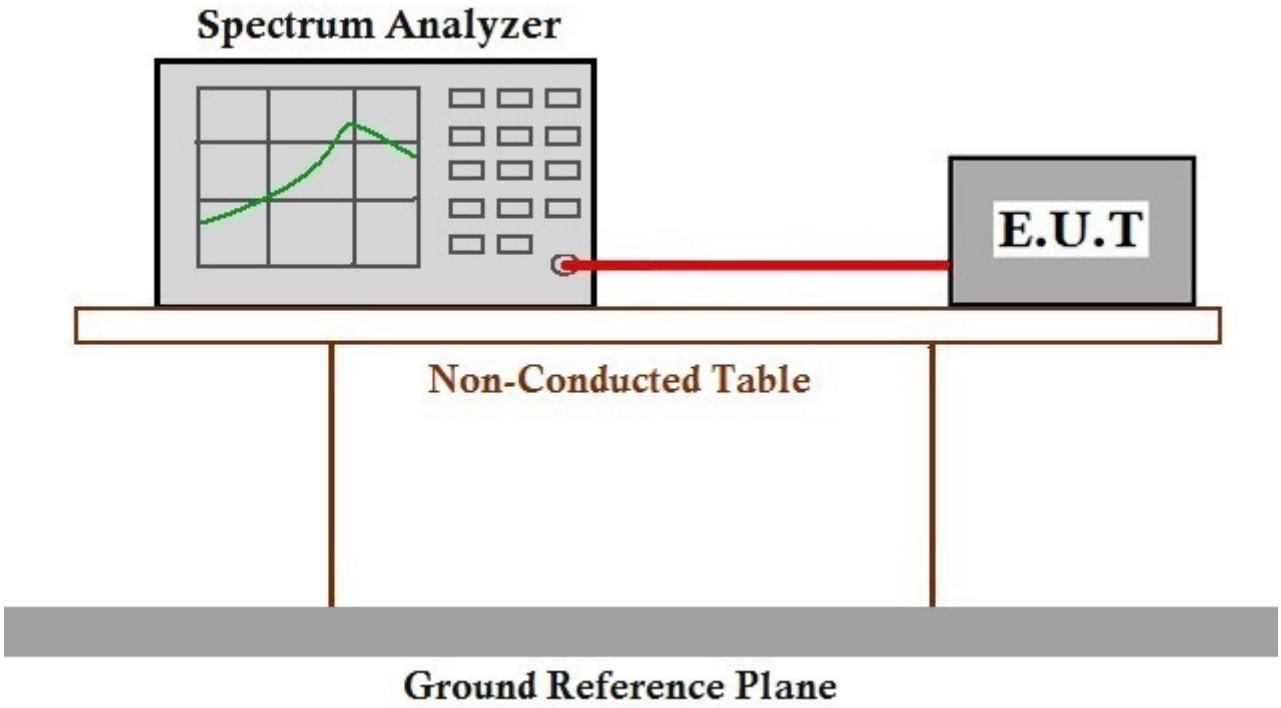
7.2 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.215
Test Method: ANSI C63.10 (2013) Section 6.9
Limit: N/A

7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 29.7 °C Humidity: 45.5 % RH Atmospheric Pressure: 1005 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

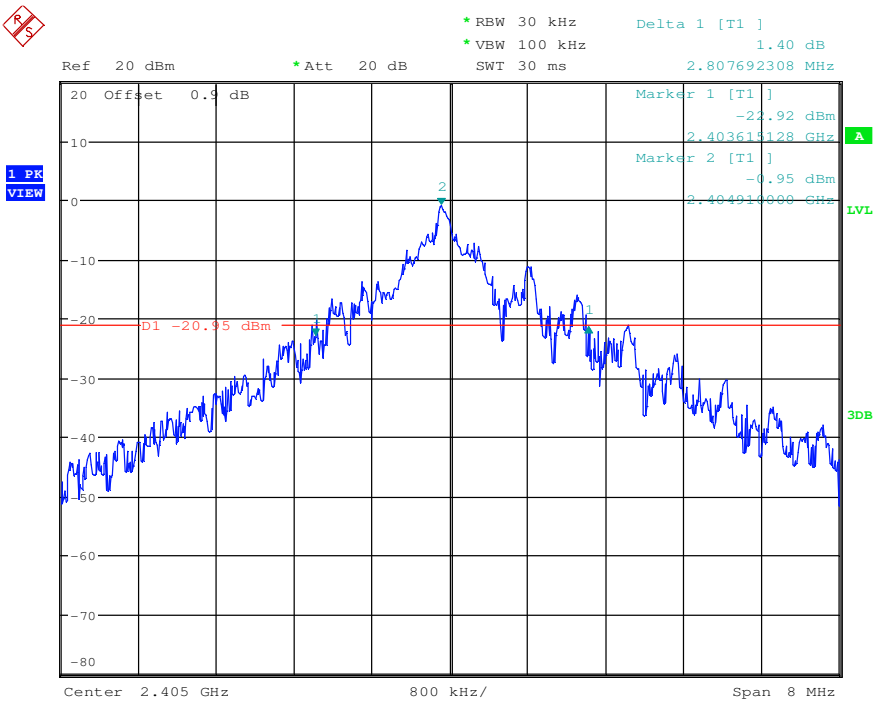
7.2.2 Test Setup Diagram



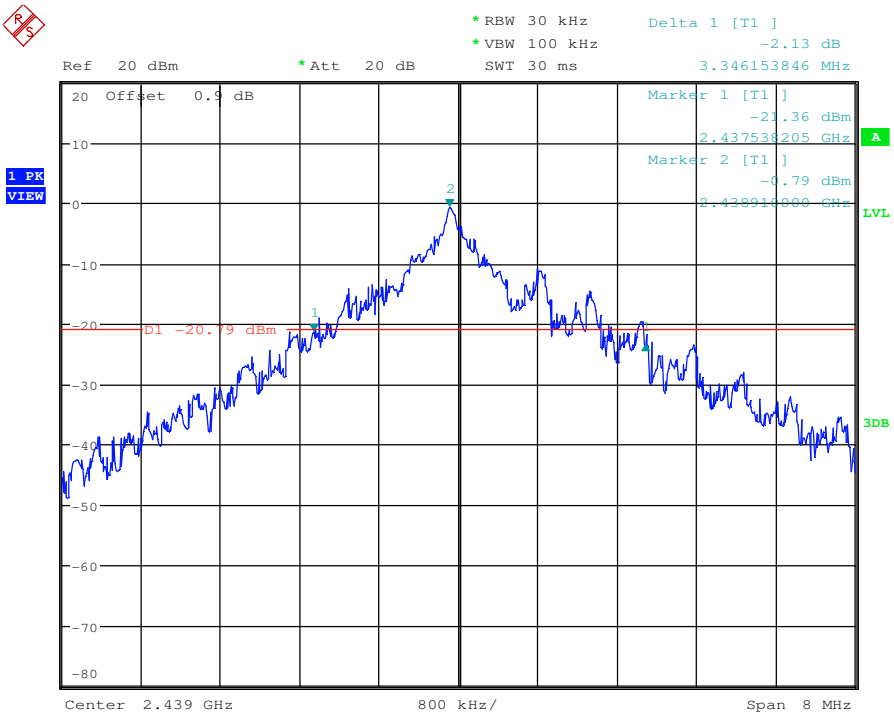
7.2.3 Measurement Procedure and Data

Test channel	20dB bandwidth (MHz)	Results
Lowest	2.808	Pass
Middle	3.346	Pass
Highest	2.192	Pass

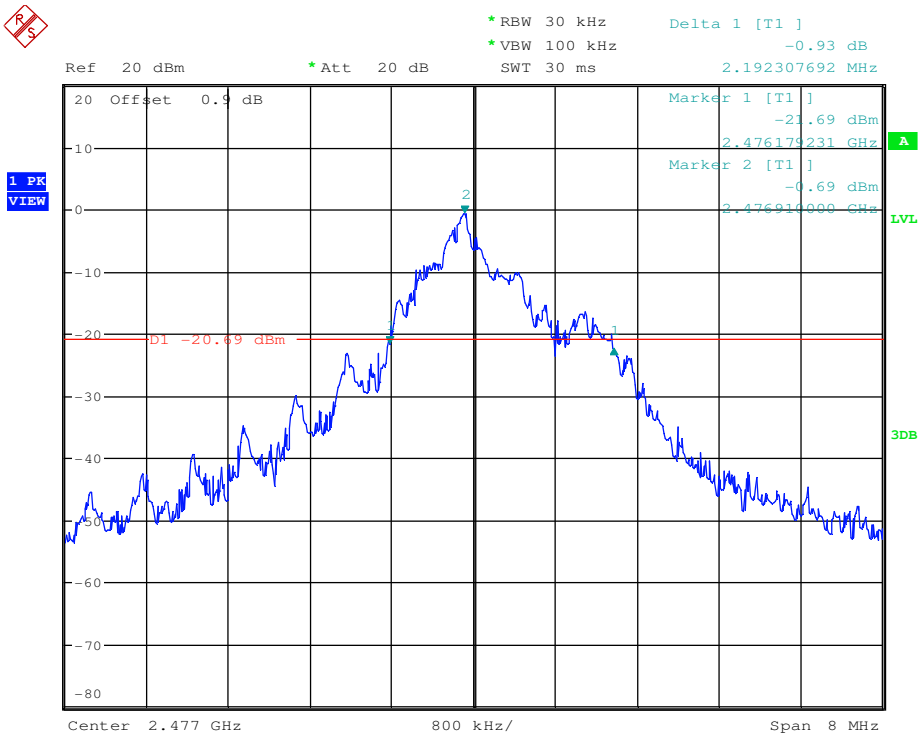
Mode:a; Channel:Low



Mode:a; Channel:middle



Mode:a; Channel:High



7.3 Field Strength of the Fundamental Signal (15.249(a))

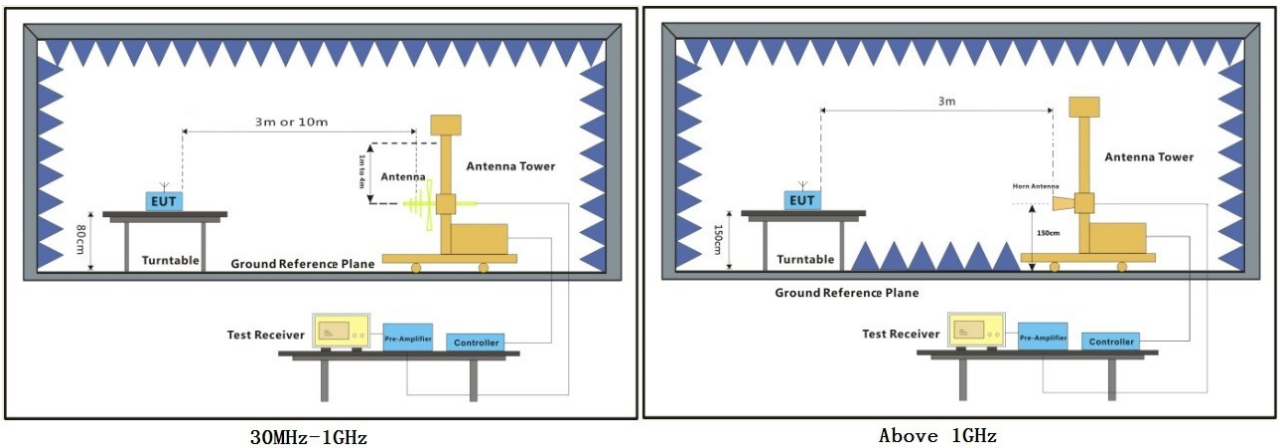
Test Requirement 47 CFR Part 15, Subpart C 15.249(a)
Test Method: ANSI C63.10 (2013) Section 6.5&6.6
Measurement Distance: 3m
Limit:

Fundamental frequency(MHz)	Field strength of fundamental(millivolts/meter)	Field strength of harmonics(microvolts/meter)
902-928	50	500
2400-2483.5	50	500
5725-5875	50	500
24000-24250	250	2500
Remark: The frequencies above 1000MHz are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For fundamental frequency in "902-928MHz", the field strength of fundamental is based on Quasi-Peak.		

7.3.1 E.U.T. Operation

Operating Environment:
Temperature: 24.7 °C Humidity: 57.4 % RH Atmospheric Pressure: 1010 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

7.3.2 Test Setup Diagram



30MHz-1GHz Above 1GHz

7.3.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

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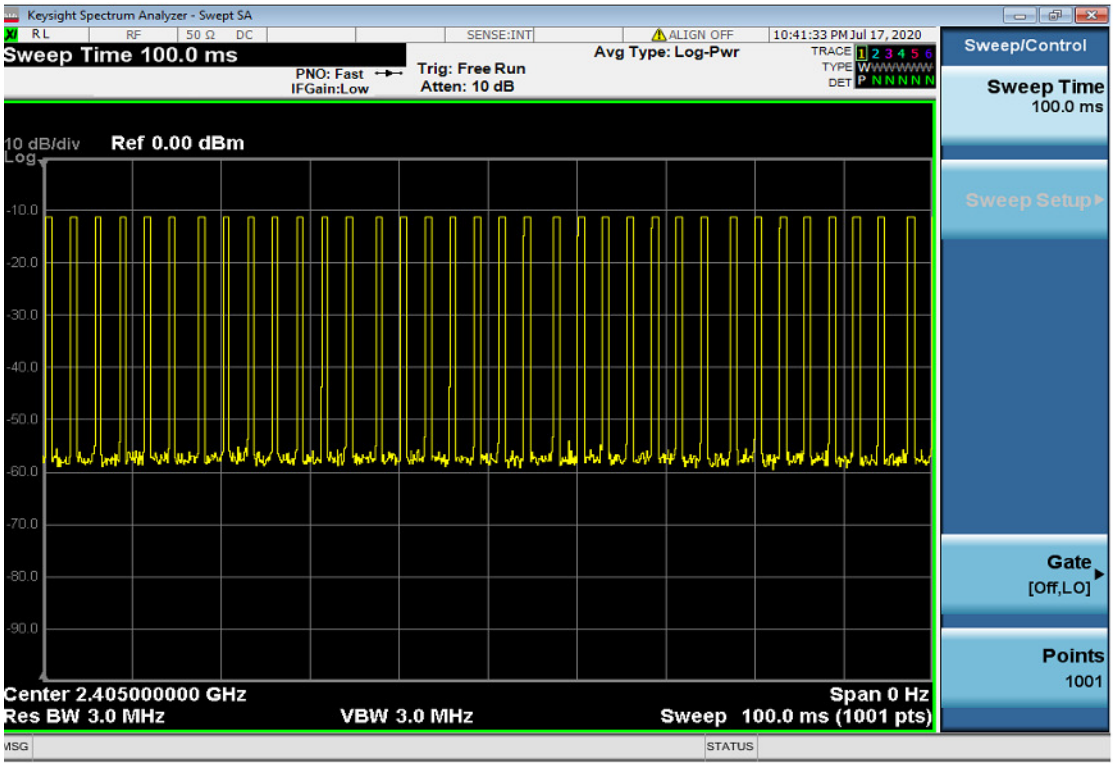
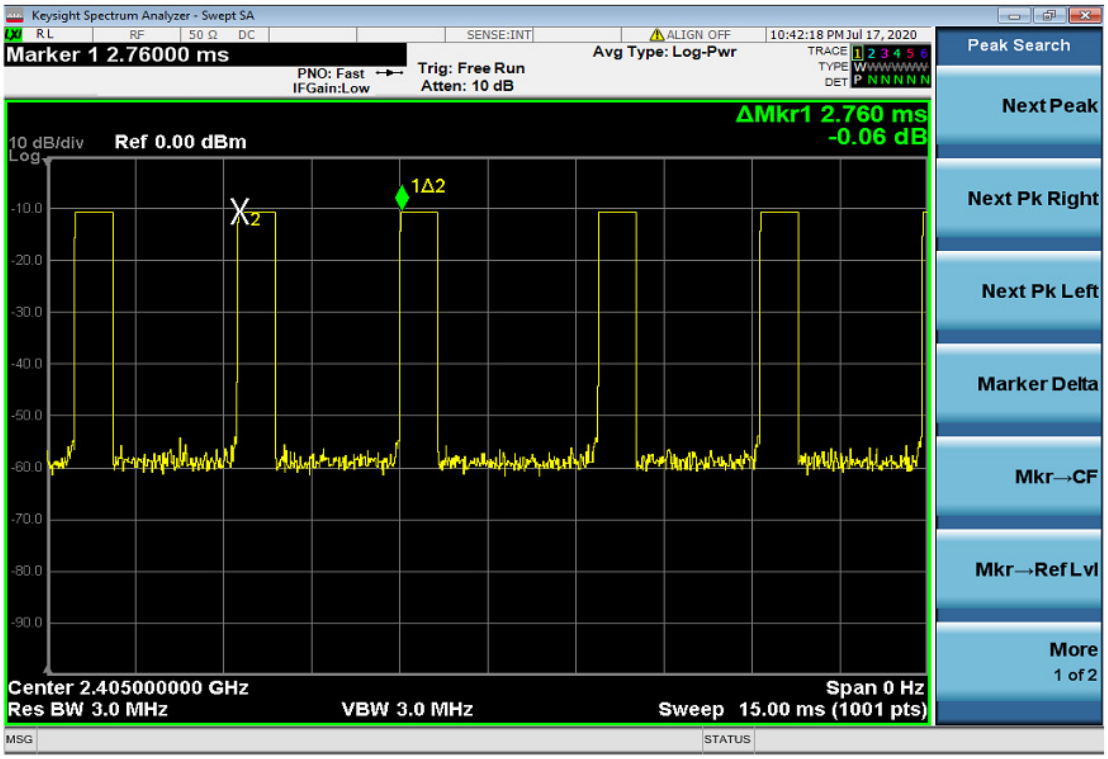
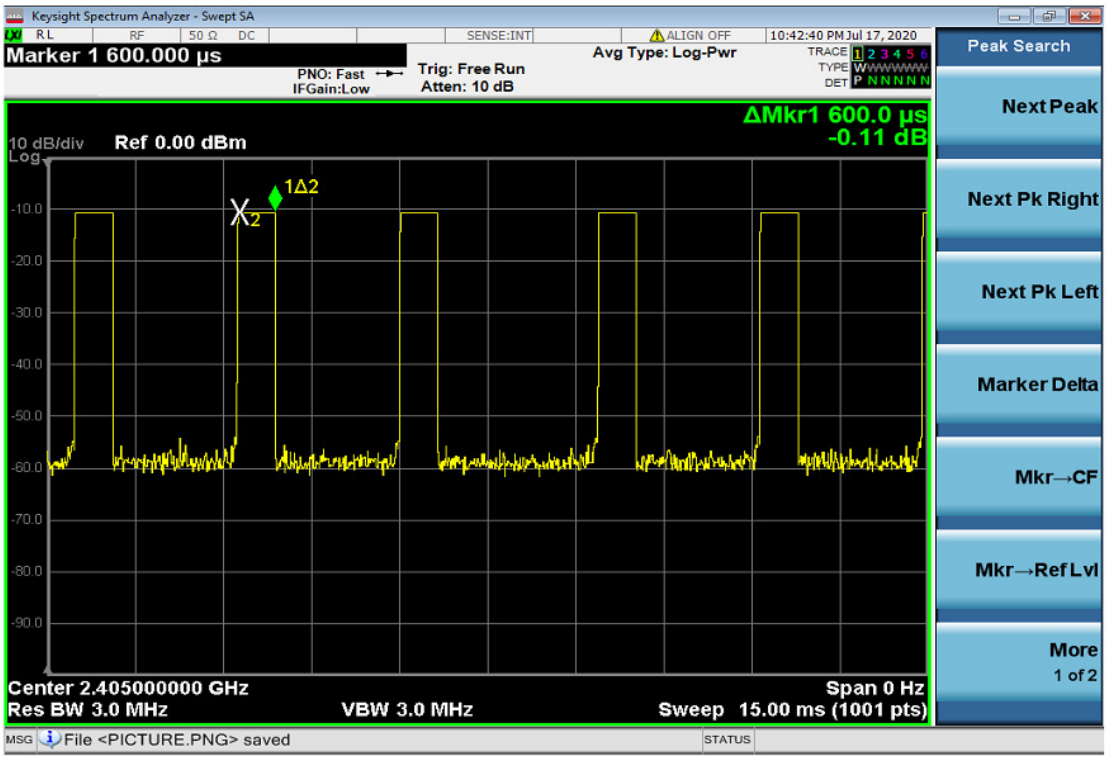
Average value:

Calculate Formula:	Average value=Peak value + PDCF
	PDCF=20 log(Duty cycle)
	Duty cycle= T on time / T period
Test data:	Ton time =0.6ms
	T period =2.76ms
	PDCF value= -13.26dB

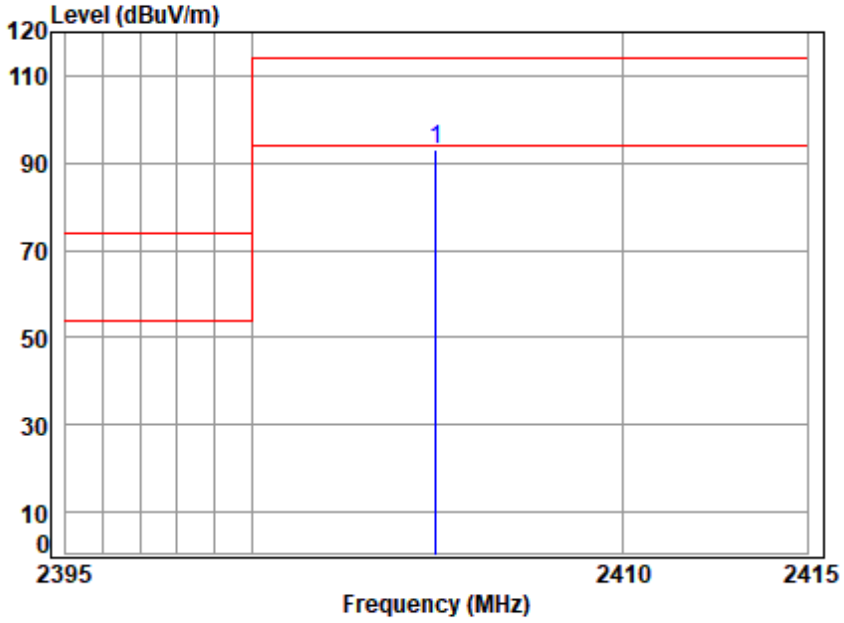
Duty cycle test plots:







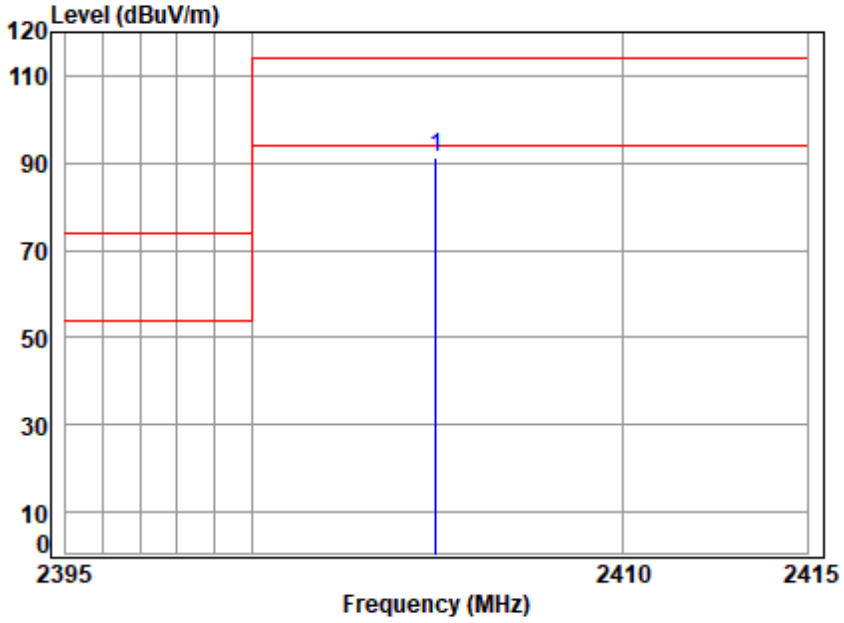
Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03546CR
Mode : 2405 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2404.961	4.37	28.54	40.98	101.17	93.10	114.00	-20.90	peak

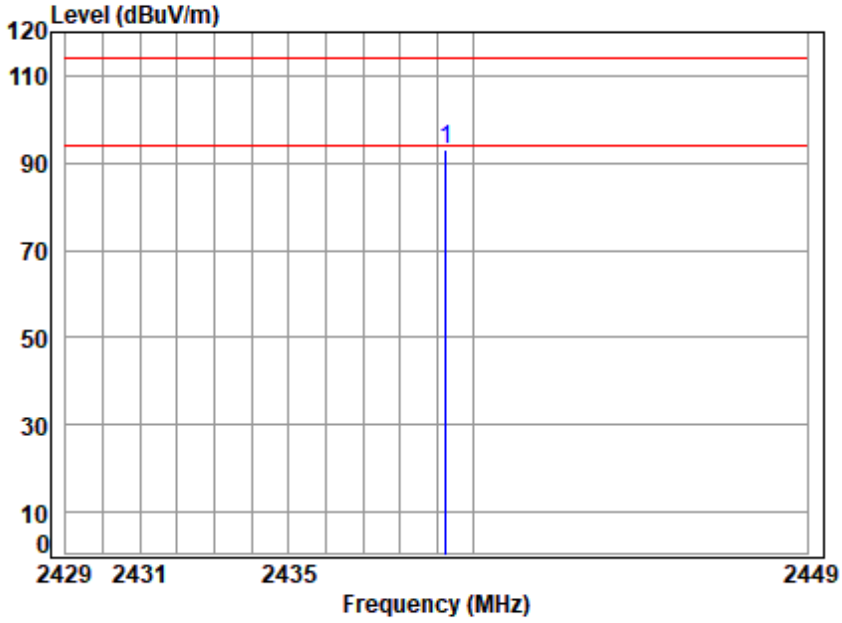
Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 03546CR
Mode : 2405 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2404.961	4.37	28.54	40.98	99.44	91.37	114.00	-22.63	peak

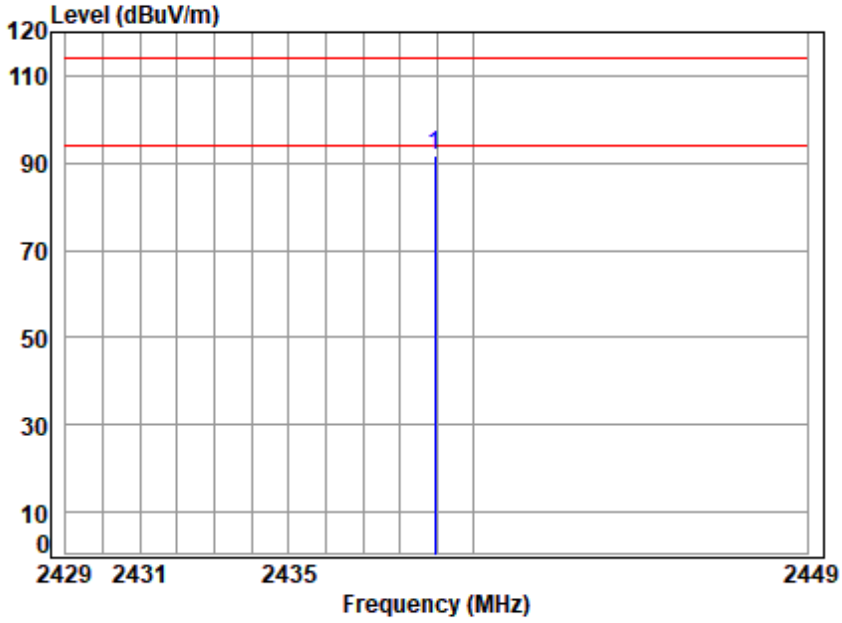
Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03546CR
Mode : 2439 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2439.240	4.42	28.60	40.99	101.03	93.06	114.00	-20.94	Peak

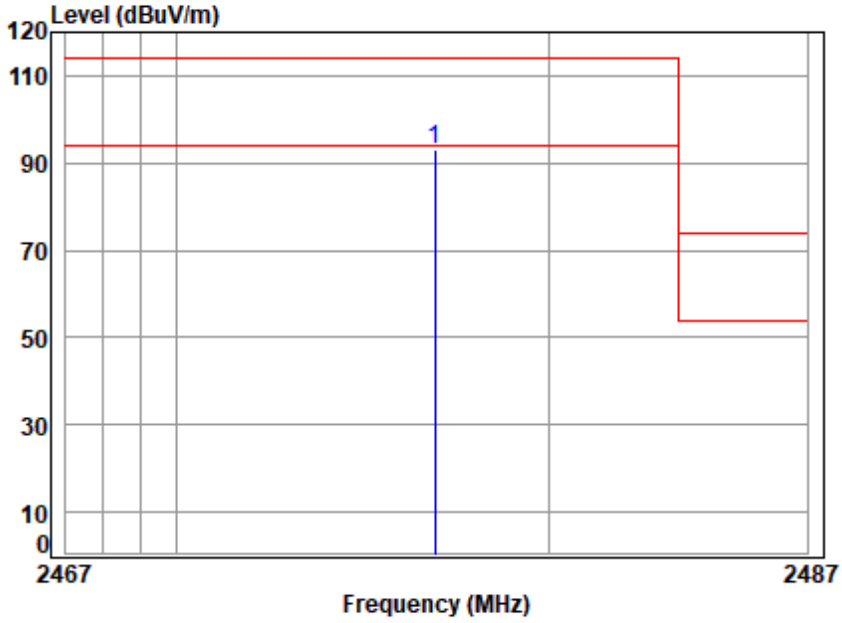
Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



Site : chamber
Condition: 3m VERTICAL
Job No : 03546CR
Mode : 2439 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2438.939	4.42	28.60	40.99	99.57	91.60	114.00	-22.40	Peak

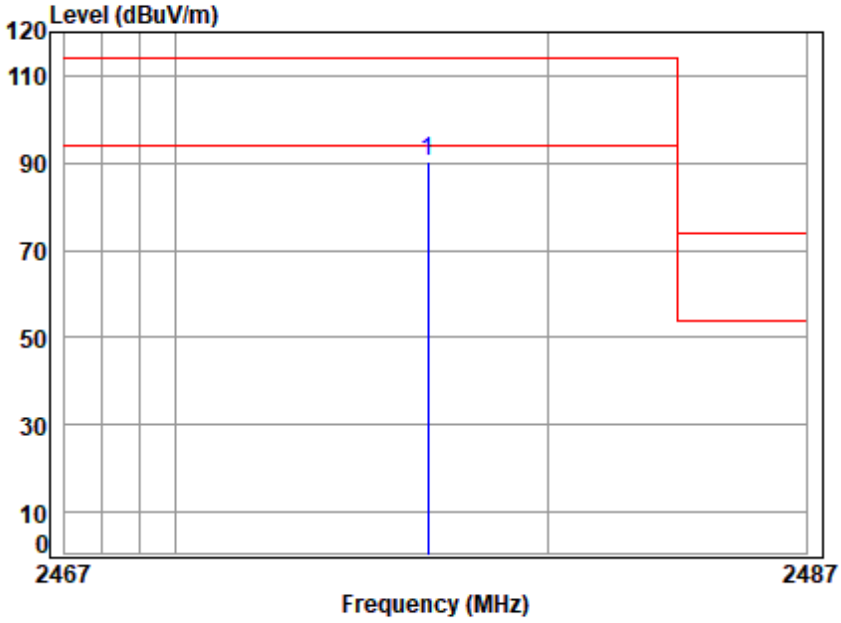
Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03546CR
Mode : 2477 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2476.949	4.48	28.66	41.01	100.90	93.03	114.00	-20.97	peak

Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 03546CR
Mode : 2477 Field strength

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2476.775	4.48	28.66	41.01	98.11	90.24	114.00	-23.76	peak

7.4 Restricted Band Around Fundamental Frequency

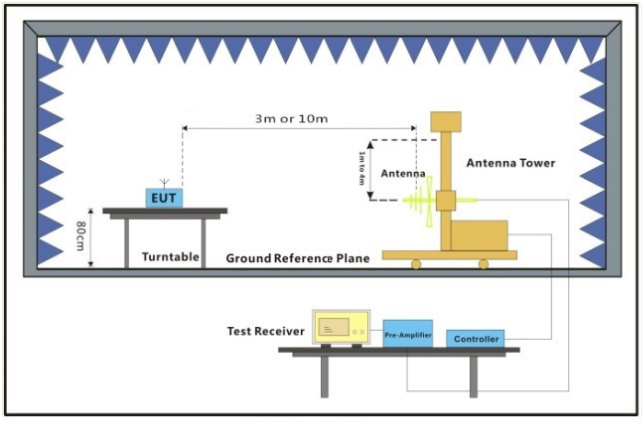
Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4&6.5&6.6
Measurement Distance: 3m
Limit:

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
Above 1GHz	74.0	Peak Value
Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209,whichever is the lesser attenuation.		

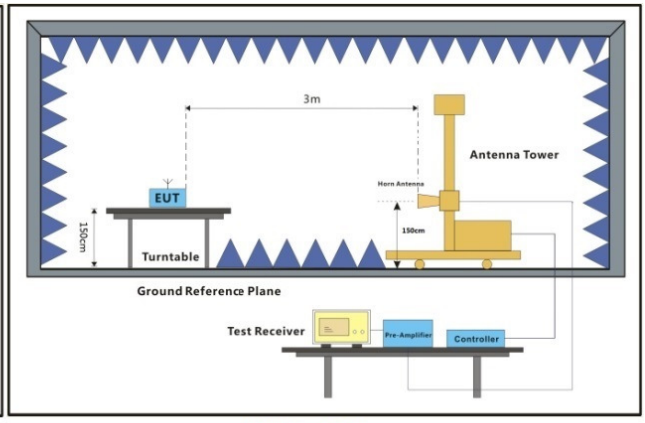
7.4.1 E.U.T. Operation

Operating Environment:
Temperature: 23.3 °C Humidity: 56.3 % RH Atmospheric Pressure: 1005 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

7.4.2 Test Setup Diagram



30MHz-1GHz



Above 1GHz

7.4.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

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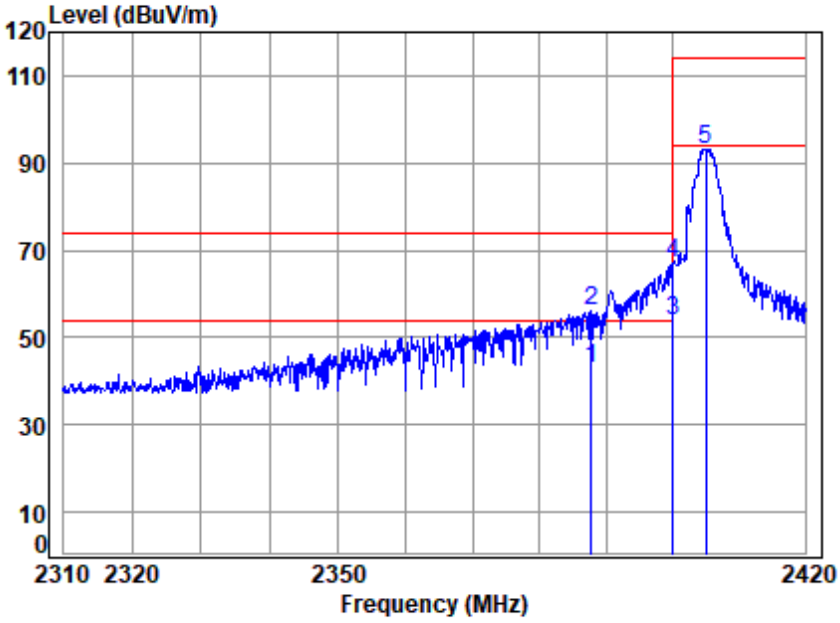
Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03546CR
Mode : 2405 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2387.794	4.34	28.51	40.97	50.94	42.82	54.00	-11.18	Average
2	2387.794	4.34	28.51	40.97	64.20	56.08	74.00	-17.92	Peak
3	2400.000	4.36	28.54	40.98	61.78	53.70	54.00	-0.30	Average
4	2400.000	4.36	28.54	40.98	75.04	66.96	74.00	-7.04	peak
5	2404.961	4.37	28.54	40.98	101.17	93.10	114.00	-20.90	peak

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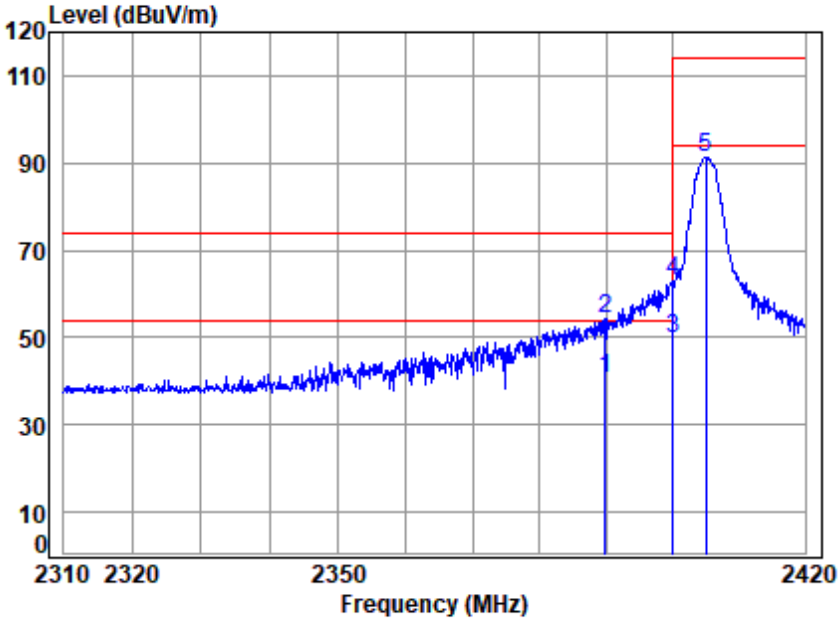
Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 03546CR
Mode : 2405 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2389.905	4.34	28.52	40.97	48.94	40.83	54.00	-13.17	Average
2	2389.905	4.34	28.52	40.97	62.20	54.09	74.00	-19.91	Peak
3	2400.000	4.36	28.54	40.98	57.63	49.55	54.00	-4.45	Average
4	2400.000	4.36	28.54	40.98	70.89	62.81	74.00	-11.19	peak
5	2404.961	4.37	28.54	40.98	99.44	91.37	114.00	-22.63	peak

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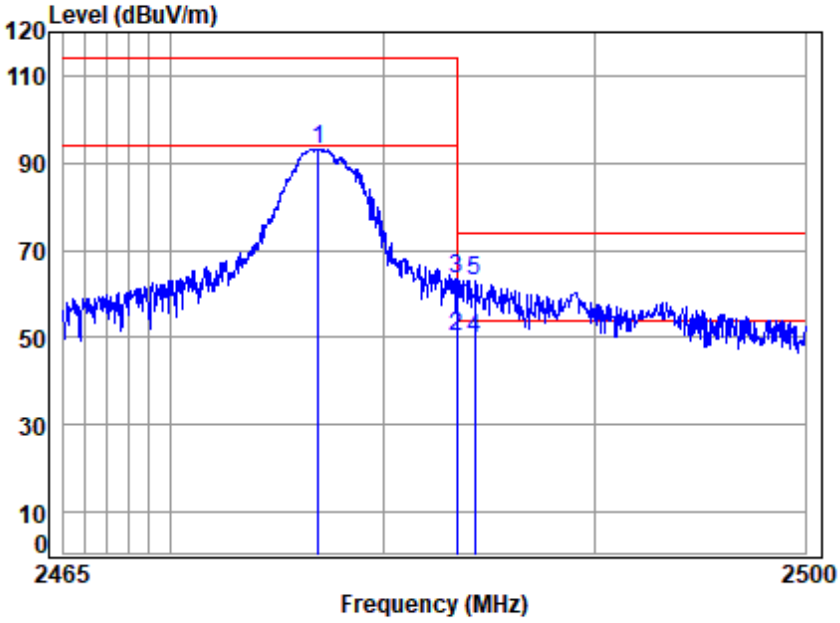
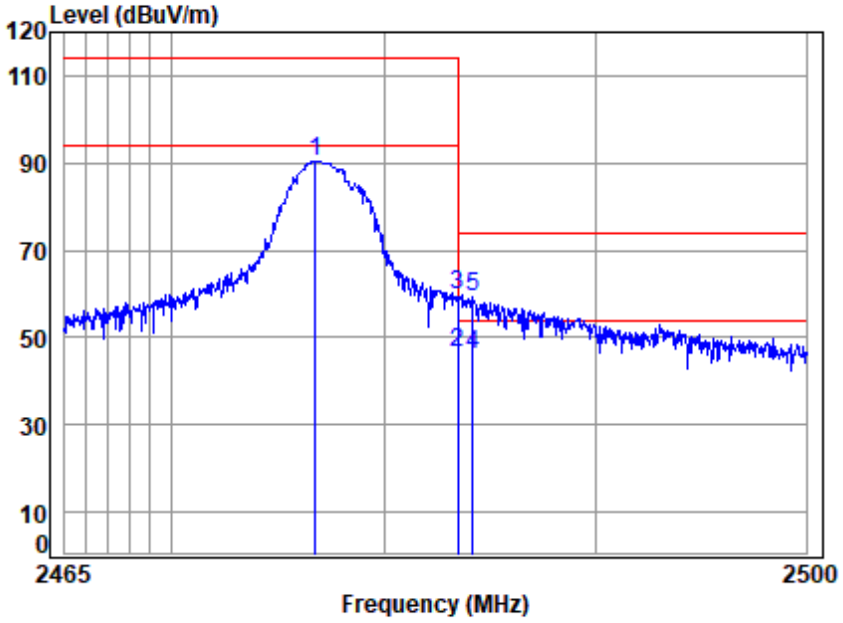
Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03546CR
Mode : 2477 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2476.949	4.48	28.66	41.01	100.90	93.03	114.00	-20.97	peak
2	2483.500	4.49	28.67	41.01	58.10	50.25	54.00	-3.75	Average
3	2483.500	4.49	28.67	41.01	71.36	63.51	74.00	-10.49	peak
4	2484.364	4.50	28.67	41.01	57.73	49.89	54.00	-4.11	Average
5	2484.364	4.50	28.67	41.01	70.99	63.15	74.00	-10.85	Peak

Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 03546CR
Mode : 2477 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2476.775	4.48	28.66	41.01	98.11	90.24	114.00	-23.76	peak
2	2483.500	4.49	28.67	41.01	54.34	46.49	54.00	-7.51	Average
3	2483.500	4.49	28.67	41.01	67.60	59.75	74.00	-14.25	peak
4	2484.189	4.50	28.67	41.01	53.94	46.10	54.00	-7.90	Average
5	2484.189	4.50	28.67	41.01	67.20	59.36	74.00	-14.64	Peak

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7.5 Radiated Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)
Test Method: ANSI C63.10 (2013) Section 6.4&6.5&6.6
Measurement Distance: 3m
Limit:

Frequency(MHz)	Field strength (microvolts/meter)	Limit (dBuV/m)	Detector	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	-	300
0.490-1.705	24000/F(kHz)	-	-	30
1.705-30	30	-	-	30
30-88	100	40.0	QP	3
88-216	150	43.5	QP	3
216-960	200	46.0	QP	3
960-1000	500	54.0	QP	3
Above 1000	500	54.0	AV	3

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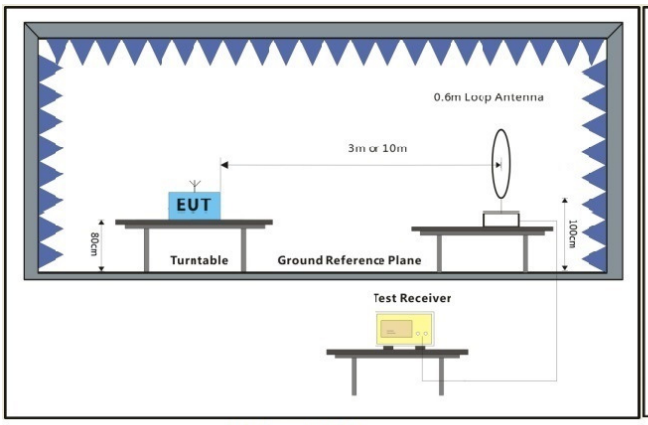
7.5.1 E.U.T. Operation

Operating Environment:

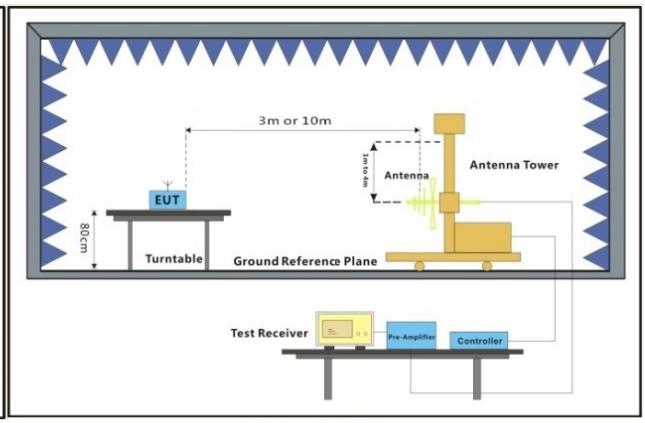
Temperature: 24.7 °C Humidity: 57.4 % RH Atmospheric Pressure: 1010 mbar

Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

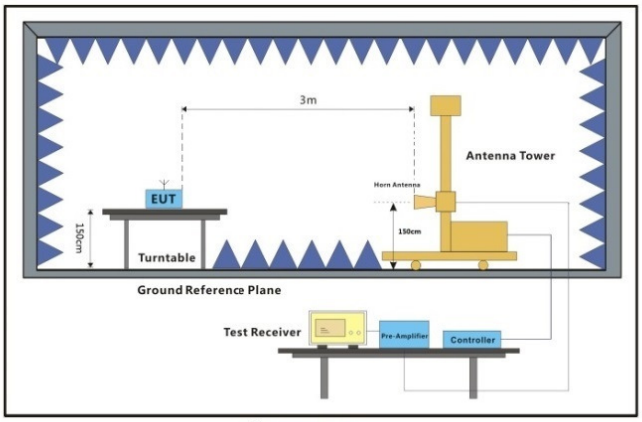
7.5.2 Test Setup Diagram



Below 30MHz



30MHz-1GHz



Above 1GHz

7.5.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark:

1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

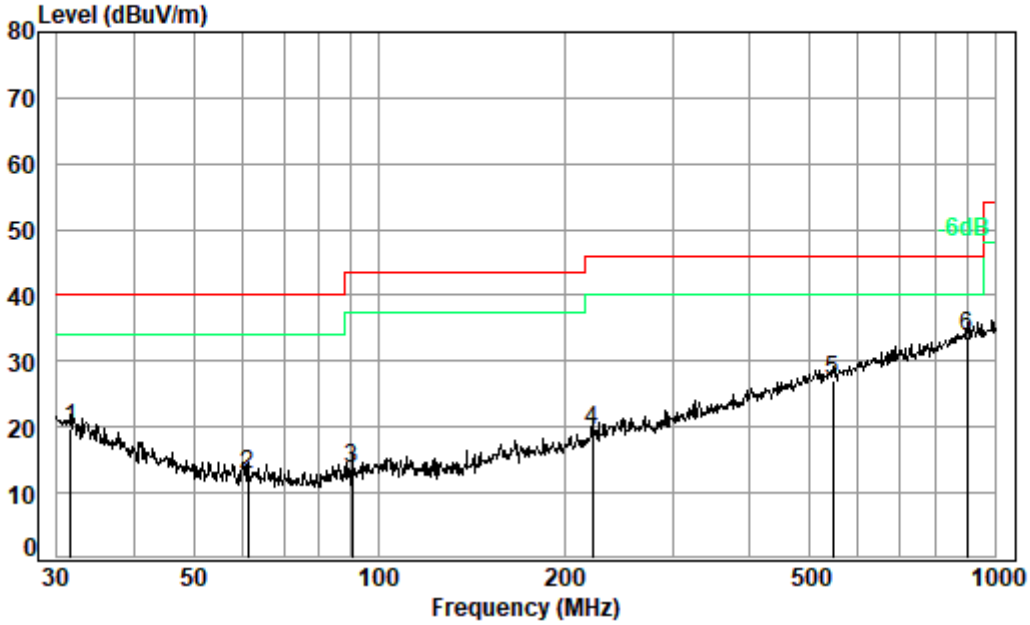
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

30MHz~1GHz

Mode:a; Polarization:Horizontal



Condition: 3m HORIZONTAL
Job No. : 03546CR
Test Mode: a

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	31.62	0.60	21.59	27.73	25.40	19.86	40.00	-20.14	QP
2	61.35	0.80	13.14	27.66	26.40	12.68	40.00	-27.32	QP
3	90.54	1.11	13.15	27.62	27.17	13.81	43.50	-29.69	QP
4	222.17	1.53	17.38	27.07	27.54	19.38	46.00	-26.62	QP
5	545.18	2.65	25.55	27.96	26.88	27.12	46.00	-18.88	QP
6 pp	900.15	3.60	29.80	27.16	27.65	33.89	46.00	-12.11	QP

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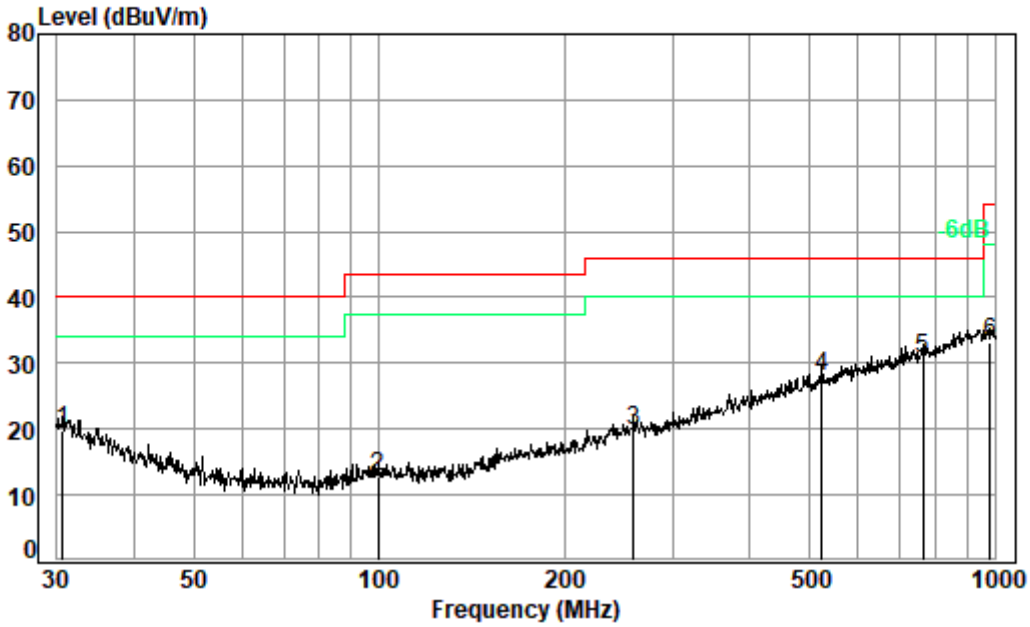
Mode :a; Polarization: Vertical



Condition: 3m VERTICAL
Job No. : 03546CR
Test Mode: a

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	30.64	0.60	22.13	27.73	24.88	19.88	40.00	-20.12	QP
2	99.53	1.20	13.96	27.61	25.36	12.91	43.50	-30.59	QP
3	259.23	1.72	19.09	26.97	25.99	19.83	46.00	-26.17	QP
4	524.55	2.63	25.13	27.89	28.03	27.90	46.00	-18.10	QP
5 pp	763.38	3.10	28.29	27.80	27.19	30.78	46.00	-15.22	QP
6	982.62	3.68	30.22	26.74	26.05	33.21	54.00	-20.79	QP

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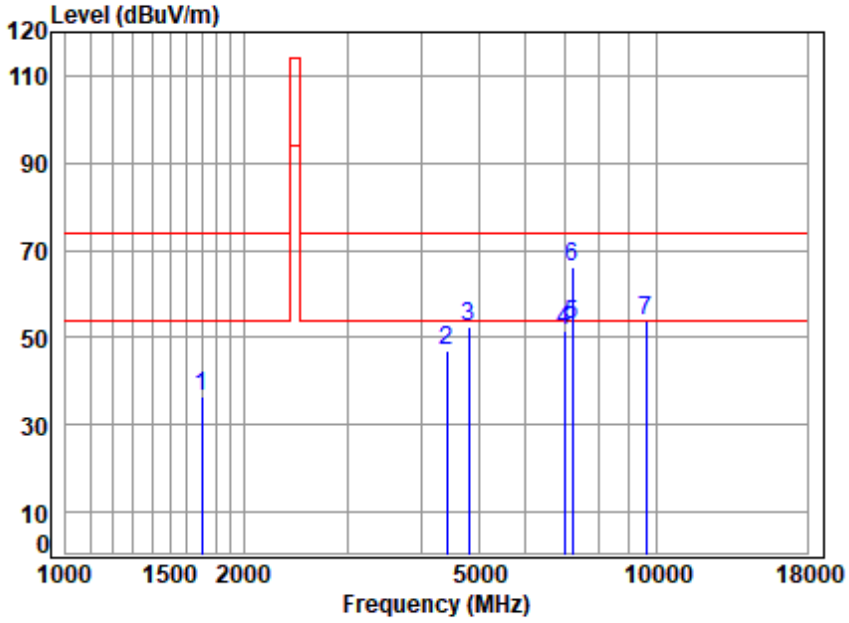
Above 1GHz

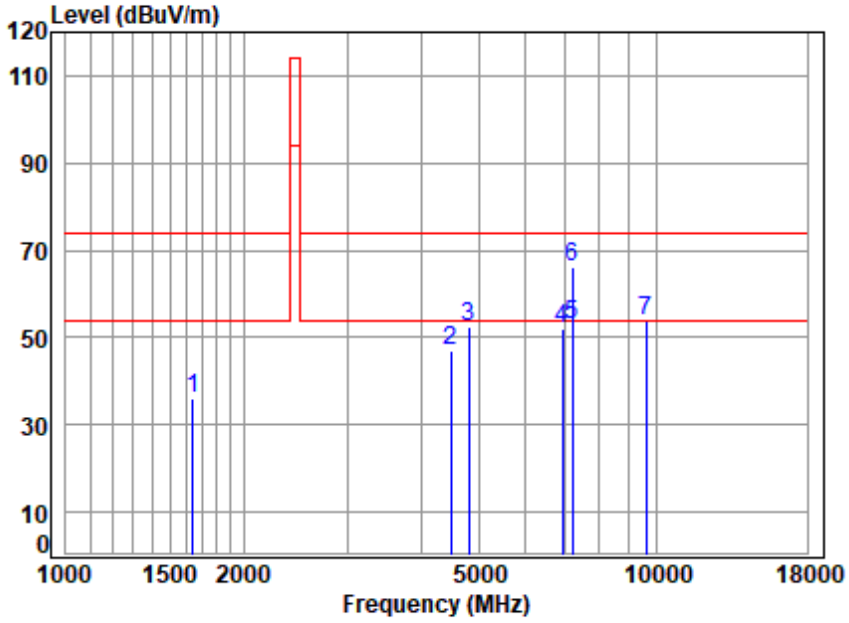
Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03546CR
Mode : 2405 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1702.042	3.43	26.68	40.63	46.89	36.37	74.00	-37.63	peak
2	4417.841	6.68	33.60	42.49	49.00	46.79	74.00	-27.21	peak
3	4810.000	7.10	34.17	42.77	53.94	52.44	74.00	-21.56	peak
4	6995.172	8.54	36.49	41.69	48.43	51.77	74.00	-22.23	peak
5	7215.000	8.75	36.41	41.57	49.35	52.94	54.00	-1.06	Average
6	7215.000	8.75	36.41	41.57	62.61	66.20	74.00	-7.80	peak
7	9620.000	10.80	37.52	38.56	44.24	54.00	74.00	-20.00	peak

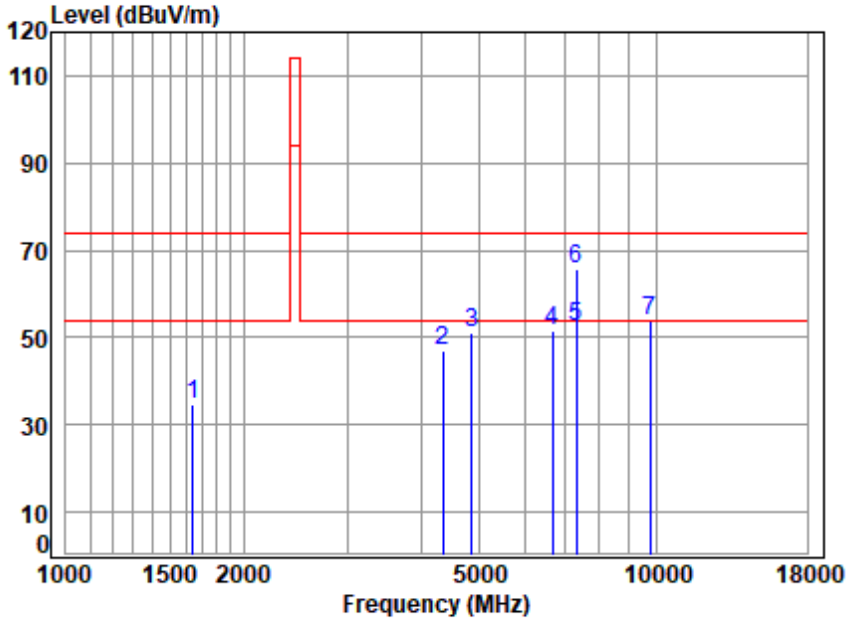
Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 03546CR
Mode : 2405 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1644.019	3.38	26.44	40.60	46.93	36.15	74.00	-37.85	peak
2	4495.125	6.76	33.60	42.55	49.01	46.82	74.00	-27.18	peak
3	4810.000	7.10	34.17	42.77	54.06	52.56	74.00	-21.44	peak
4	6934.778	8.51	36.32	41.72	48.69	51.80	74.00	-22.20	peak
5	7215.000	8.75	36.41	41.57	49.48	53.07	54.00	-0.93	Average
6	7215.000	8.75	36.41	41.57	62.74	66.33	74.00	-7.67	peak
7	9620.000	10.80	37.52	38.56	44.21	53.97	74.00	-20.03	peak

Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03546CR
Mode : 2439 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1644.019	3.38	26.44	40.60	45.58	34.80	74.00	-39.20	peak
2	4354.454	6.63	33.60	42.44	49.06	46.85	74.00	-27.15	peak
3	4878.000	7.17	34.29	42.82	52.35	50.99	74.00	-23.01	peak
4	6659.763	8.37	35.56	41.86	49.59	51.66	74.00	-22.34	peak
5	7317.000	8.84	36.37	41.52	48.76	52.45	54.00	-1.55	Average
6	7317.000	8.84	36.37	41.52	62.02	65.71	74.00	-8.29	peak
7	9756.000	10.76	37.55	38.35	43.67	53.63	74.00	-20.37	peak

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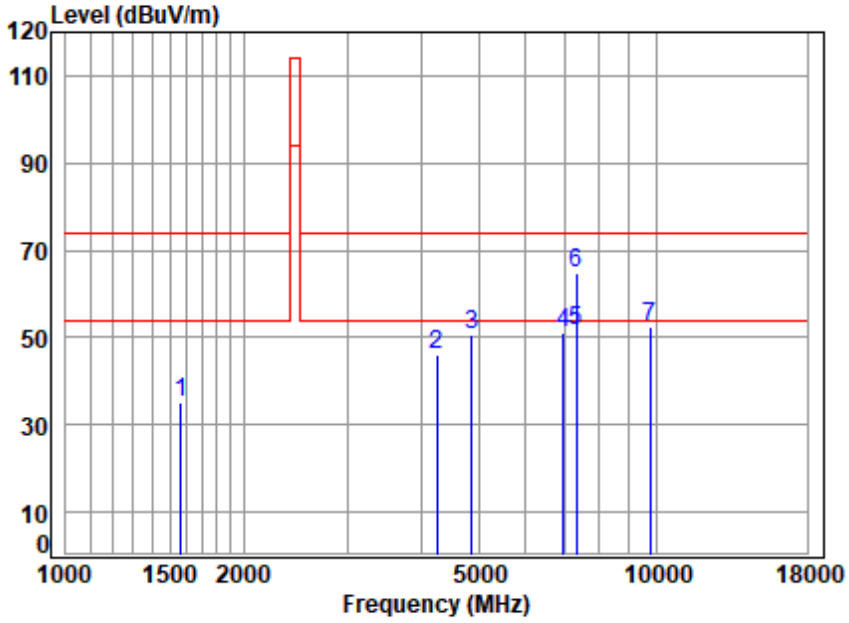
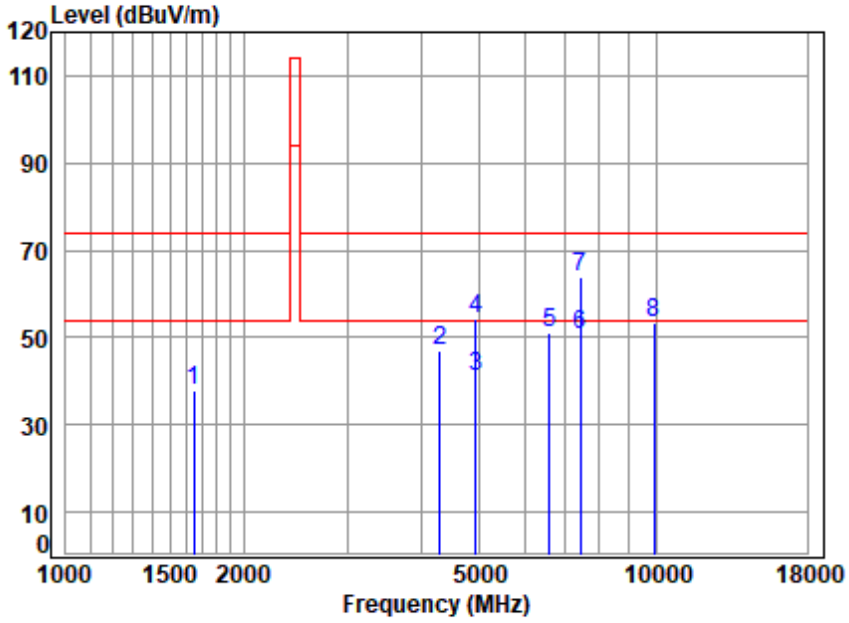
Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



Site : chamber
Condition: 3m VERTICAL
Job No : 03546CR
Mode : 2439 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1565.191	3.32	26.10	40.55	46.38	35.25	74.00	-38.75	peak
2	4242.641	6.52	33.60	42.35	48.31	46.08	74.00	-27.92	peak
3	4878.000	7.17	34.29	42.82	51.87	50.51	74.00	-23.49	peak
4	6954.852	8.52	36.38	41.71	47.99	51.18	74.00	-22.82	peak
5	7317.000	8.84	36.37	41.52	47.78	51.47	54.00	-2.53	Average
6	7317.000	8.84	36.37	41.52	61.04	64.73	74.00	-9.27	peak
7	9756.000	10.76	37.55	38.35	42.70	52.66	74.00	-21.34	peak

Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03546CR
Mode : 2477 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1648.778	3.39	26.46	40.60	48.74	37.99	74.00	-36.01	peak
2	4304.400	6.58	33.60	42.40	49.33	47.11	74.00	-26.89	peak
3	4954.000	7.25	34.42	42.87	42.17	40.97	54.00	-13.03	Average
4	4954.000	7.25	34.42	42.87	55.43	54.23	74.00	-19.77	peak
5	6602.265	8.33	35.39	41.89	49.40	51.23	74.00	-22.77	peak
6	7431.000	8.95	36.33	41.47	46.85	50.66	54.00	-3.34	Average
7	7431.000	8.95	36.33	41.47	60.11	63.92	74.00	-10.08	peak
8	9908.000	10.72	37.58	38.13	43.11	53.28	74.00	-20.72	peak

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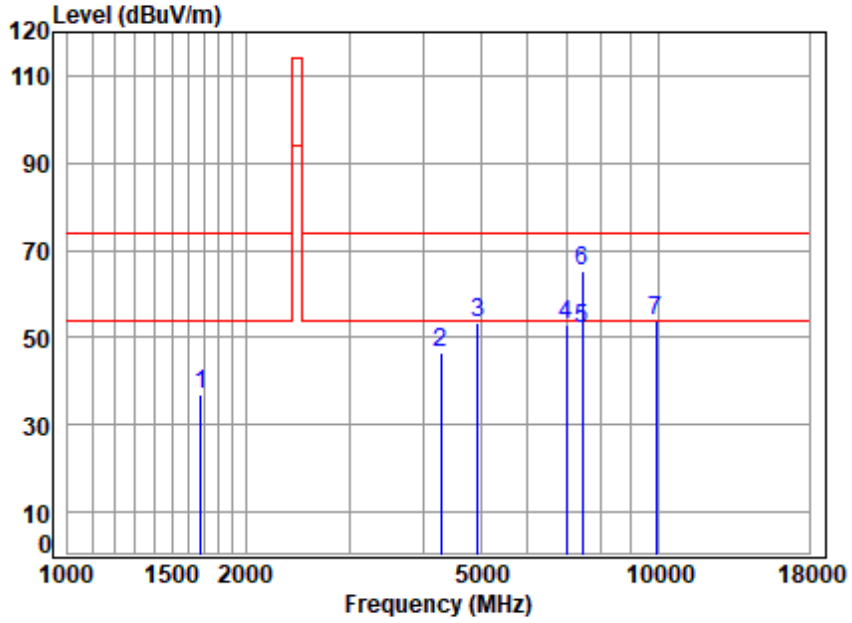
Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 03546CR
Mode : 2477 TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1677.621	3.41	26.58	40.62	47.40	36.77	74.00	-37.23	peak
2	4291.977	6.57	33.60	42.39	48.80	46.58	74.00	-27.42	peak
3	4954.000	7.25	34.42	42.87	54.76	53.56	74.00	-20.44	peak
4	6995.172	8.54	36.49	41.69	49.39	52.73	74.00	-21.27	peak
5	7431.000	8.95	36.33	41.47	48.22	52.03	54.00	-1.97	Average
6	7431.000	8.95	36.33	41.47	61.48	65.29	74.00	-8.71	peak
7	9908.000	10.72	37.58	38.13	43.62	53.79	74.00	-20.21	peak

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8 Photographs

8.1 Test Setup

Refer to Setup Photos

8.2 EUT Constructional Details (EUT Photos)

Refer to EUT external and internal photos

- End of the Report -

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