

TEST REPORT

Application No.: SZEM1906015307CR
Applicant: Corsair Memory, Inc.
Address of Applicant: 47100 Bayside Pkwy, Fremont, California, 94538, United States
Manufacturer: Corsair Memory, Inc.
Address of Manufacturer: 47100 Bayside Pkwy, Fremont, California, 94538, United States
Factory:
 1. Shenzhen Horn Audio Co., Ltd
 2. HORN (VIET NAM) COMPANY LIMITED
Address of Factory:
 1. No.6, 4th Guihua Road, Pingshan New District, Shenzhen, Guangdong, P.R.China
 2. N0.8 & 2 Standard Factory, Land Lot CN1, An Duong Industrial Zone, Hong Phong Commune, An Duong District, Hai Phong City, VietNam

Equipment Under Test (EUT):

EUT Name: USB dongle

Model No.: RDA0023 ♣

♣ Please refer to section 2 of this report which indicates which sample was actually tested and which were electrically identical.

Trade mark: Corsair

FCC ID: 2AAFM RDA0023

Standard(s) : 47 CFR Part 15, Subpart C 15.249

Date of Receipt: 2019-06-18

Date of Test: 2019-06-21 to 2019-07-15

Date of Issue: 2019-07-16

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.


Keny Xu

Keny Xu
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2019-07-16		Original

Authorized for issue by:			
			
		Leo Li /Project Engineer	
			
		Eric Fu /Reviewer	

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

Remark:

Model No.:RDA0023

Only the black sample was tested, since the electrical circuit design, layout, components used, internal wiring and functions were identical for the above samples, with only difference as below:

Product color is different: (Virtuoso) USB dongle: RDA0023 have Gun metal and ailver brown;

(Velar) USB dongle: RDA0023 have black and white.

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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 5V
Operation Frequency:	2402.25-2478.25MHz
Modulation Type:	FSK
Number of Channels:	39
Channel Spacing:	2MHz
Antenna Type:	Ceramic Antenna
Antenna Gain:	ANT1 0.76dBi; ANT2 4.24dBi
Remark:	Tests were conducted in all two antennas and the worst case ANT 2 is reported only.

Channel List :

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402.25MHz	11	2424.25MHz	22	2446.25MHz	33	2468.25MHz
1	2404.25MHz	12	2426.25MHz	23	2448.25MHz	34	2470.25MHz
2	2406.25MHz	13	2428.25MHz	24	2450.25MHz	35	2472.25MHz
3	2408.25MHz	14	2430.25MHz	25	2452.25MHz	36	2474.25MHz
4	2410.25MHz	15	2432.25MHz	26	2454.25MHz	37	2476.25MHz
5	2412.25MHz	16	2434.25MHz	27	2456.25MHz	38	2478.25MHz
6	2414.25MHz	17	2436.25MHz	28	2458.25MHz		
7	2416.25MHz	18	2438.25MHz	29	2460.25MHz		
8	2418.25MHz	19	2440.25MHz	30	2462.25MHz		
9	2420.25MHz	20	2442.25MHz	31	2464.25MHz		
10	2422.25MHz	21	2444.25MHz	32	2466.25MHz		

Using test software was control EUT work in continuous transmitter and receiver mode. and select test channel as below:

Channel	Frequency
The lowest channel (CH0)	2402.25MHz
The middle channel (CH39)	2438.25MHz
The highest channel (CH78)	2478.25MHz



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4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Laptop	Lenovo	T430u	REF. No.SEA1800

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	Conduction emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
5	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
6	Temperature test	$\pm 1^\circ\text{C}$
7	Humidity test	$\pm 3\%$
8	Supply voltages	$\pm 1.5\%$
9	Time	$\pm 3\%$

4.4 Test Location

All tests were performed at:

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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:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **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

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	2024-06-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2019-07-11	2020-07-10
LISN	Rohde & Schwarz	ENV216	SEM007-01	2018-09-25	2019-09-24
LISN	ETS-LINDGREN	3816/2	SEM007-02	2019-04-01	2020-03-31
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2019-04-01	2020-03-31

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2024-06-12
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2018-09-27	2019-09-26
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2019-07-11	2020-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24

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	2019-07-11	2020-07-10
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-11-12	2019-11-11
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2019-04-01	2020-03-31

Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019-04-01	2020-03-31
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
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	2019-07-11	2020-07-10
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-11-12	2019-11-11
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2019-04-01	2020-03-31
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019-04-01	2020-03-31
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Radiated Spurious Emissions(Above 1GHz)

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	2019-07-11	2020-07-10
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16



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Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-11-12	2019-11-11
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2019-04-01	2020-03-31
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019-04-01	2020-03-31
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Radiated Spurious Emissions(30MHz-1GHz)

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	2019-07-11	2020-07-10
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-11-12	2019-11-11
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2019-04-01	2020-03-31
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019-04-01	2020-03-31
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21



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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	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2018-09-27	2019-09-26
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2019-04-04	2020-04-03



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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

Standard 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.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is ANT1 0.76dBi; ANT2 4.24dBi.

Antenna location: Refer to Appendix (Internal photos)



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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:

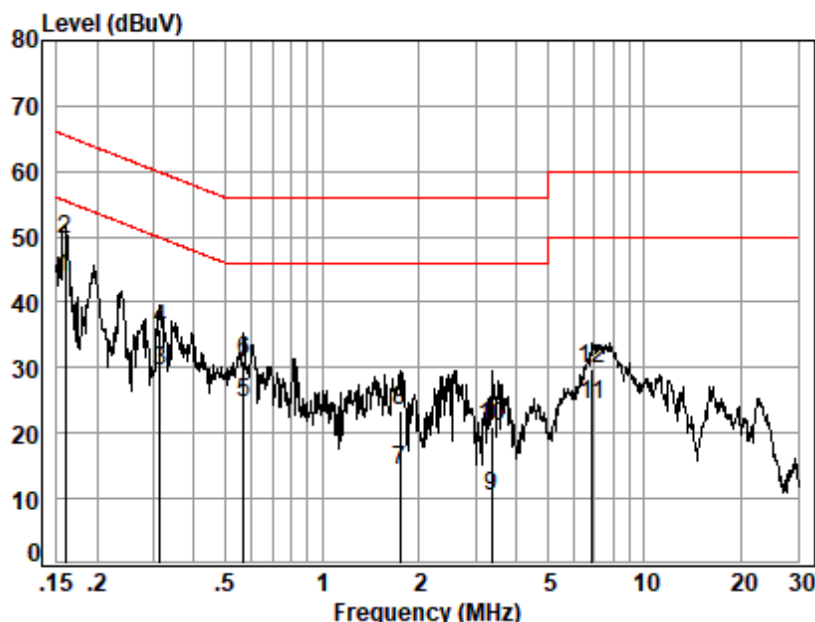
Temperature: 18.8 °C Humidity: 44.8 % RH Atmospheric Pressure: 1010 mbar
Test mode c: TX mode_Keep the EUT in transmitting with modulation mode.

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

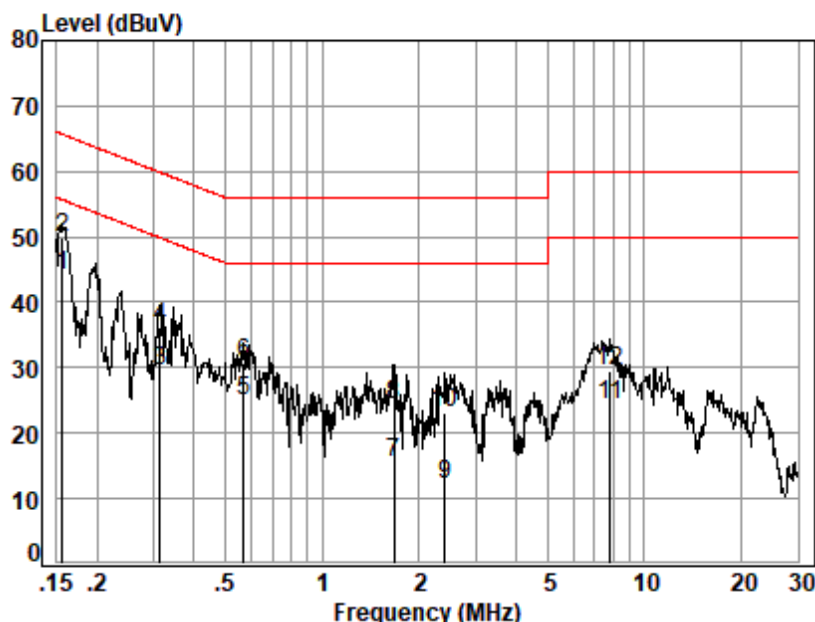
Mode:c; Line:Live Line



Site : Shielding Room
Condition: Line
Job No. : 15307CR
Test mode: c

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1590	0.01	9.66	34.11	43.78	55.52	-11.74	Average
2	0.1590	0.01	9.66	39.86	49.53	65.52	-15.99	QP
3	0.3133	0.04	9.67	19.94	29.65	49.88	-20.23	Average
4	0.3133	0.04	9.67	26.15	35.86	59.88	-24.02	QP
5	0.5701	0.07	9.67	15.00	24.74	46.00	-21.26	Average
6	0.5701	0.07	9.67	21.14	30.88	56.00	-25.12	QP
7	1.7437	0.15	9.72	4.30	14.17	46.00	-31.83	Average
8	1.7437	0.15	9.72	13.67	23.54	56.00	-32.46	QP
9	3.3635	0.16	9.71	0.43	10.30	46.00	-35.70	Average
10	3.3635	0.16	9.71	11.03	20.90	56.00	-35.10	QP
11	6.9141	0.17	9.78	14.47	24.42	50.00	-25.58	Average
12	6.9141	0.17	9.78	19.92	29.87	60.00	-30.13	QP

Mode:c; Line:Neutral Line



Site : Shielding Room
Condition: Neutral
Job No. : 15307CR
Test mode: c

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1565	0.01	9.63	34.53	44.17	55.65	-11.48	Average
2	0.1565	0.01	9.63	40.30	49.94	65.65	-15.71	QP
3	0.3133	0.04	9.64	19.93	29.61	49.88	-20.27	Average
4	0.3133	0.04	9.64	26.46	36.14	59.88	-23.74	QP
5	0.5701	0.07	9.64	15.09	24.80	46.00	-21.20	Average
6	0.5701	0.07	9.64	21.11	30.82	56.00	-25.18	QP
7	1.6713	0.14	9.70	5.82	15.66	46.00	-30.34	Average
8	1.6713	0.14	9.70	14.58	24.42	56.00	-31.58	QP
9	2.4090	0.16	9.68	2.33	12.17	46.00	-33.83	Average
10	2.4090	0.16	9.68	13.14	22.98	56.00	-33.02	QP
11	7.8516	0.17	9.79	14.50	24.46	50.00	-25.54	Average
12	7.8516	0.17	9.79	19.59	29.55	60.00	-30.45	QP

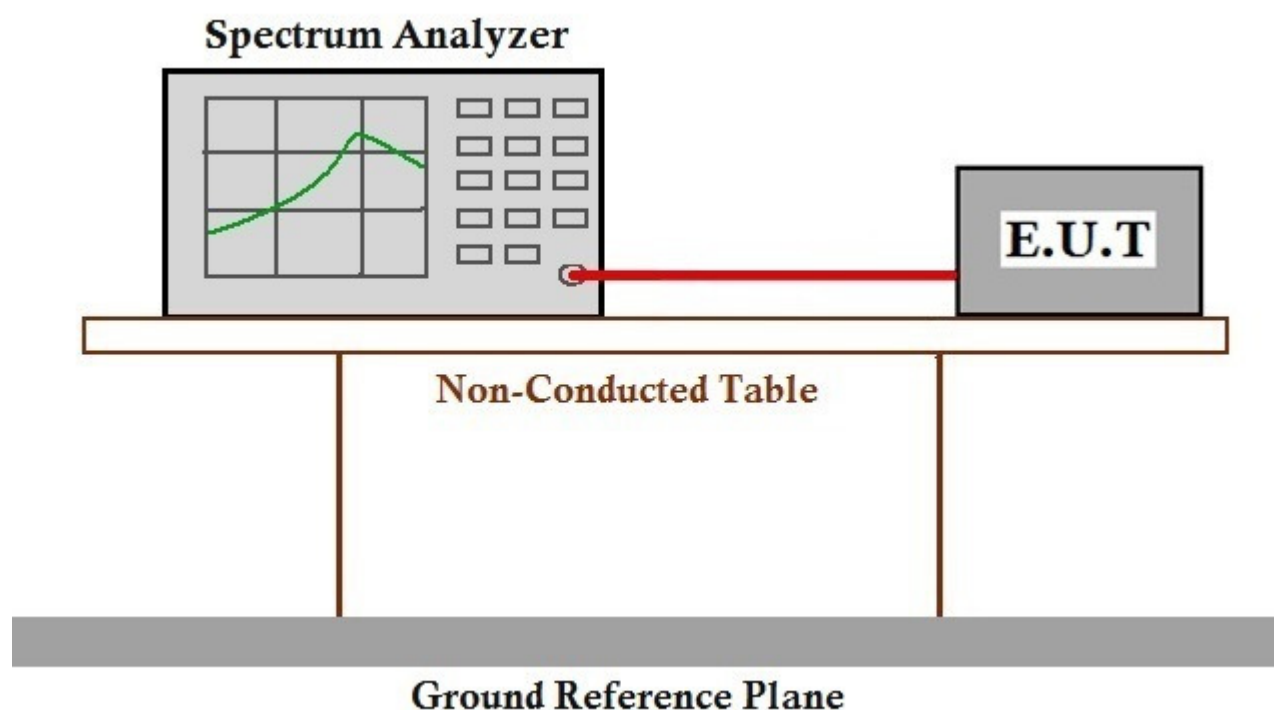
7.2 20dB Bandwidth

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: 23.6 °C Humidity: 49 % RH Atmospheric Pressure: 1005 mbar
Test mode c: TX mode_Keep the EUT in transmitting with modulation mode.

7.2.2 Test Setup Diagram

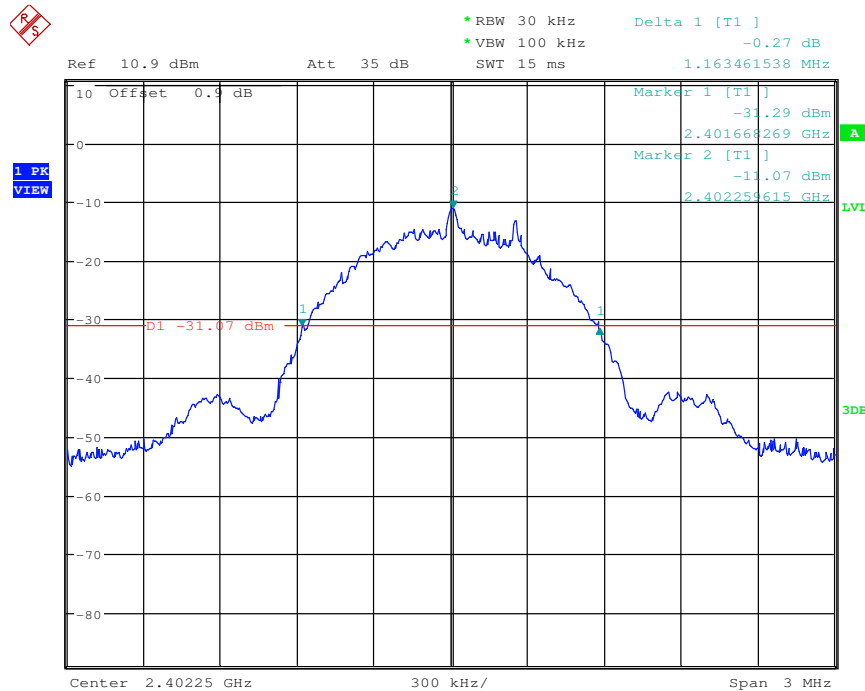


7.2.3 Measurement Procedure and Data

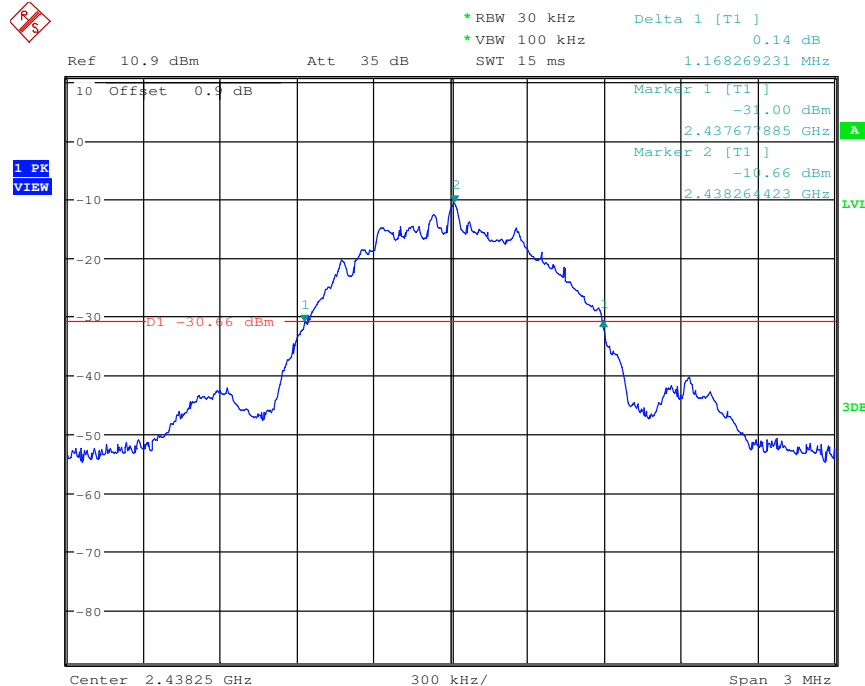
Test channel	20dB bandwidth (MHz)	Results
Lowest	1.163	Pass
Middle	1.168	Pass
Highest	1.144	Pass



Mode:c; Channel:Low



Mode:c; Channel:middle



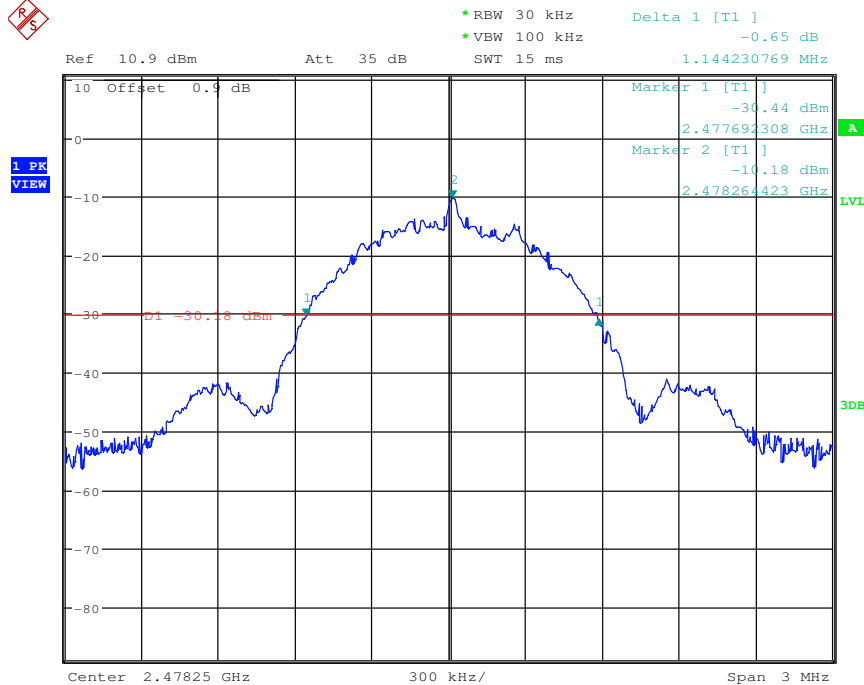
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Mode:c; Channel:High





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.



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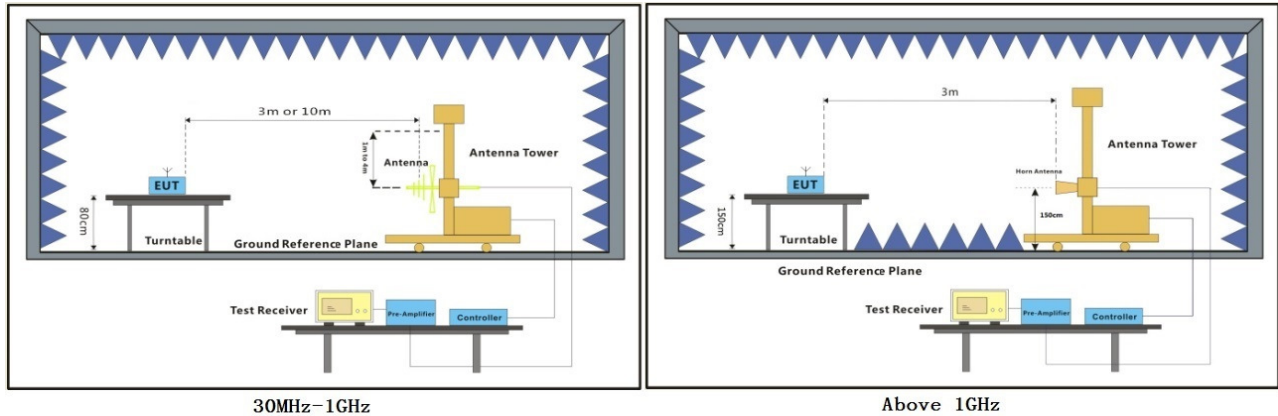
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 25.7 °C Humidity: 65.1 % RH Atmospheric Pressure: 1010 mbar

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

7.3.2 Test Setup Diagram





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.

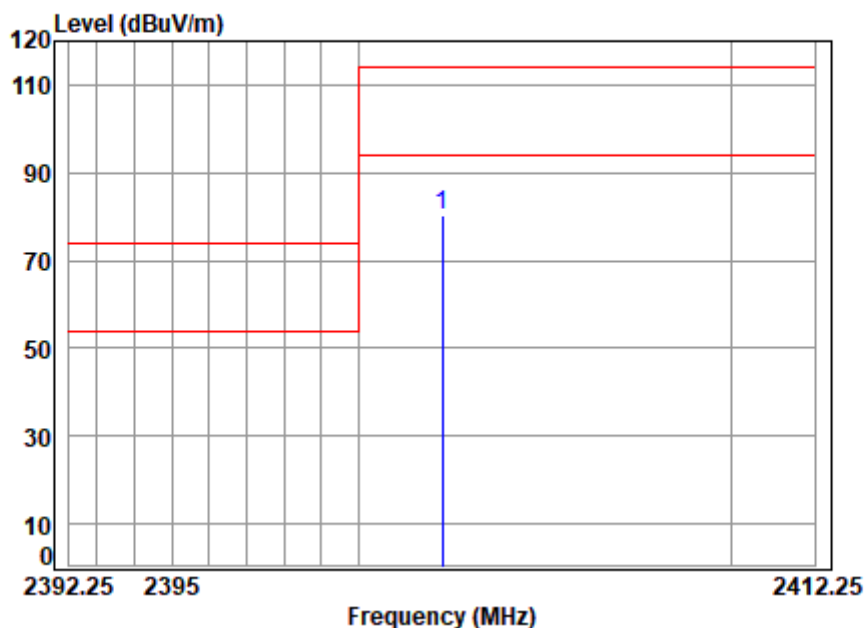
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: 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.



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

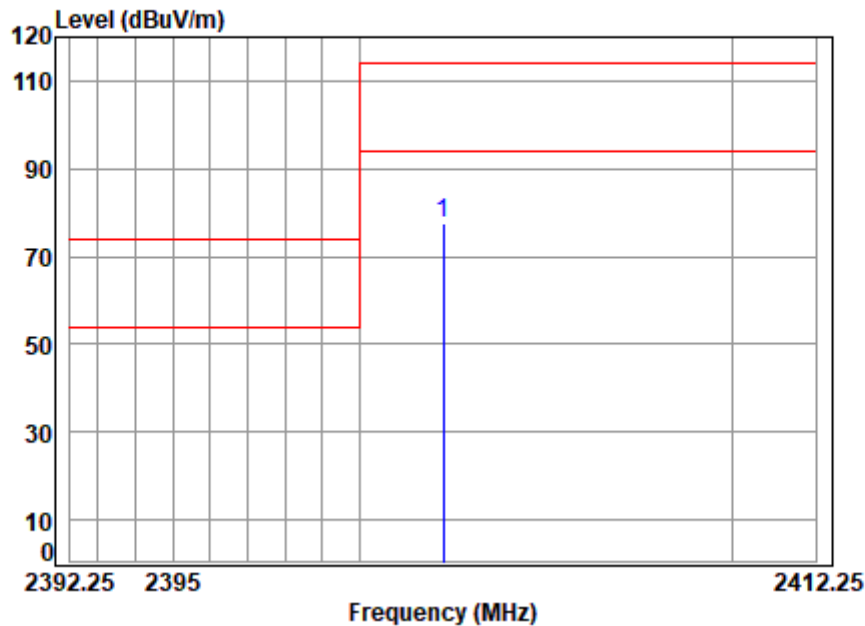


Site : chamber
Condition: 3m HORIZONTAL
Job No : 15307CR/15308CR
Mode : 2402.25 Field strength
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz		dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2402.250	5.49	28.54	41.18	87.59	80.44	114.00	-33.56	peak



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

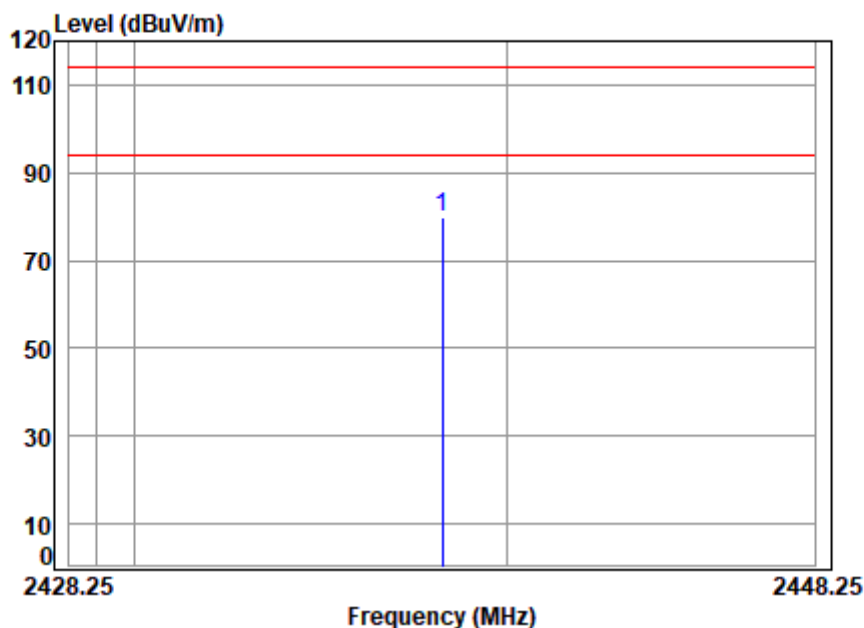


Site : chamber
Condition: 3m VERTICAL
Job No : 15307CR/15308CR
Mode : 2402.25 Field strength
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2402.250	5.49	28.54	41.18	84.80	77.65	114.00	-36.35	peak



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

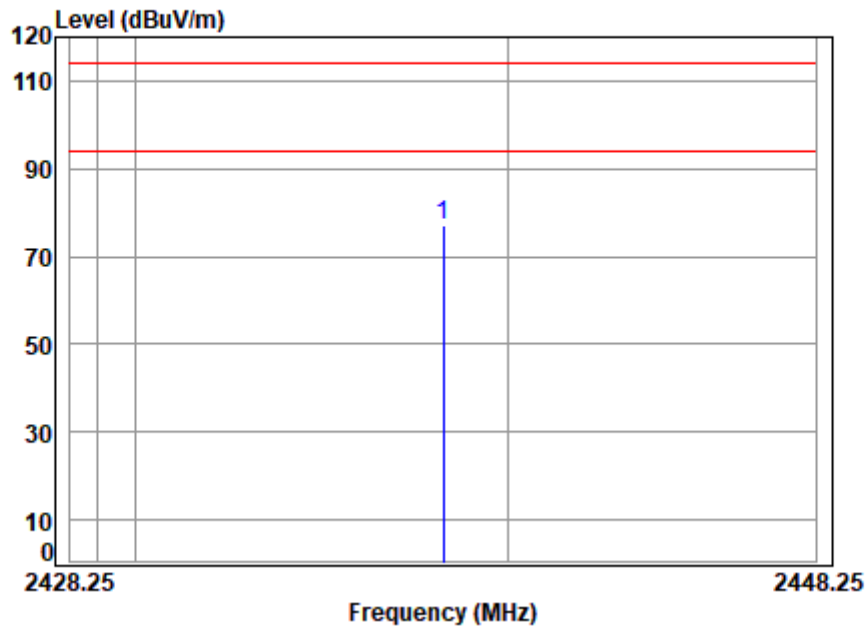


Site : chamber
Condition: 3m HORIZONTAL
Job No : 15307CR/15308CR
Mode : 2438.25 Field strength
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2438.250	5.49	28.54	41.18	86.89	79.74	114.00	-34.26	peak



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



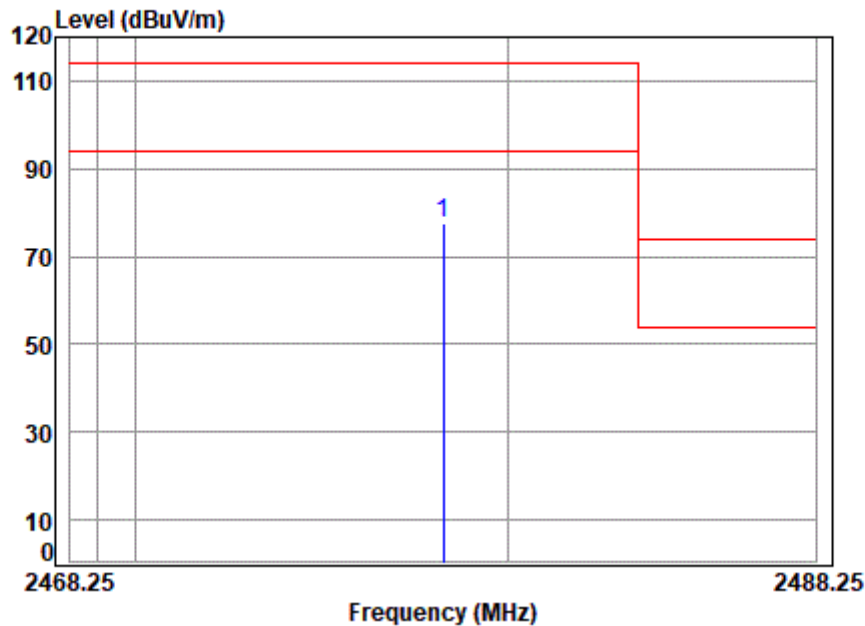
Site : chamber
Condition: 3m VERTICAL
Job No : 15307CR/15308CR
Mode : 2438.25 Field strength
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2438.250	5.49	28.54	41.18	84.20	77.05	114.00	-36.95	peak





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



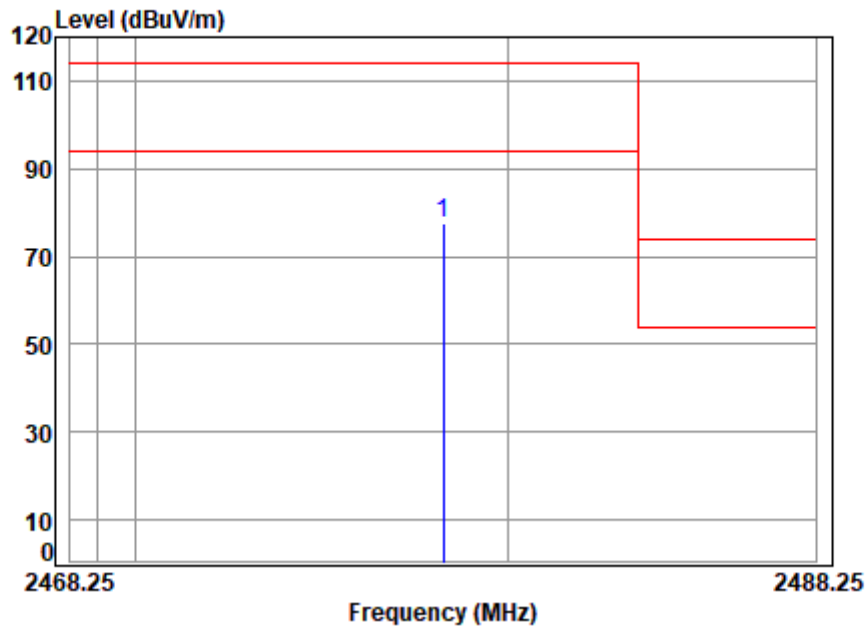
Site : chamber
Condition: 3m HORIZONTAL
Job No : 15307CR/15308CR
Mode : 2478.25 Field strength
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2478.250	5.59	28.66	41.21	89.48	82.52	114.00	-31.48	peak





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



Site : chamber
Condition: 3m VERTICAL
Job No : 15307CR/15308CR
Mode : 2478.25 Field strength
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2478.250	5.59	28.67	41.21	84.33	77.38	114.00	-36.62	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.

Average value:

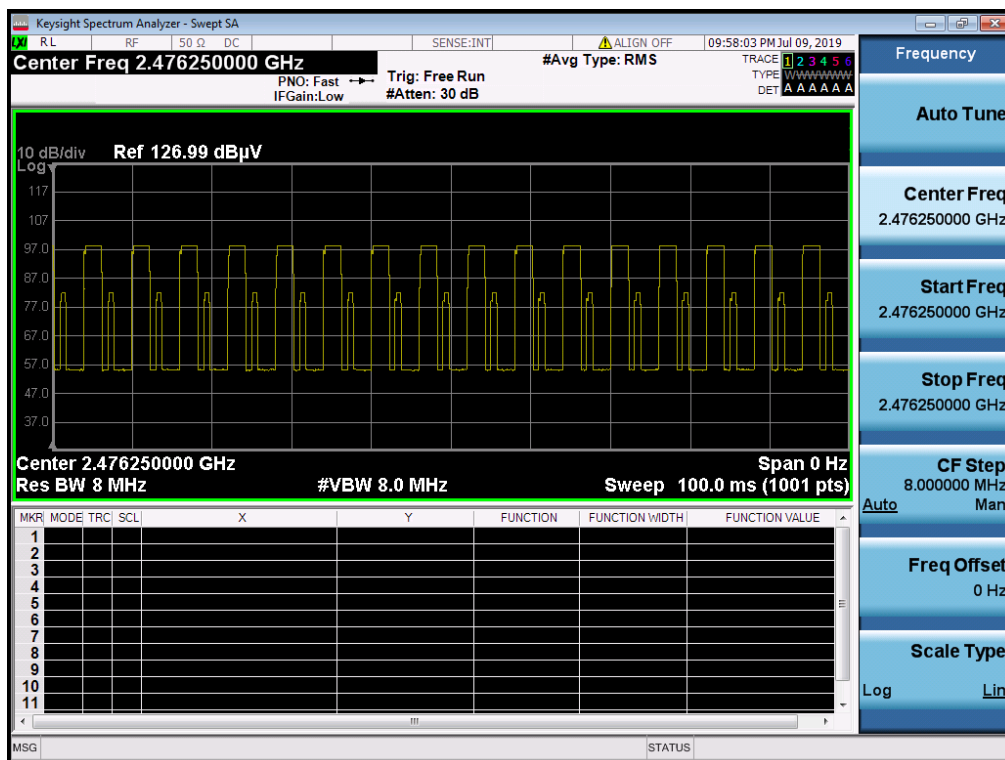
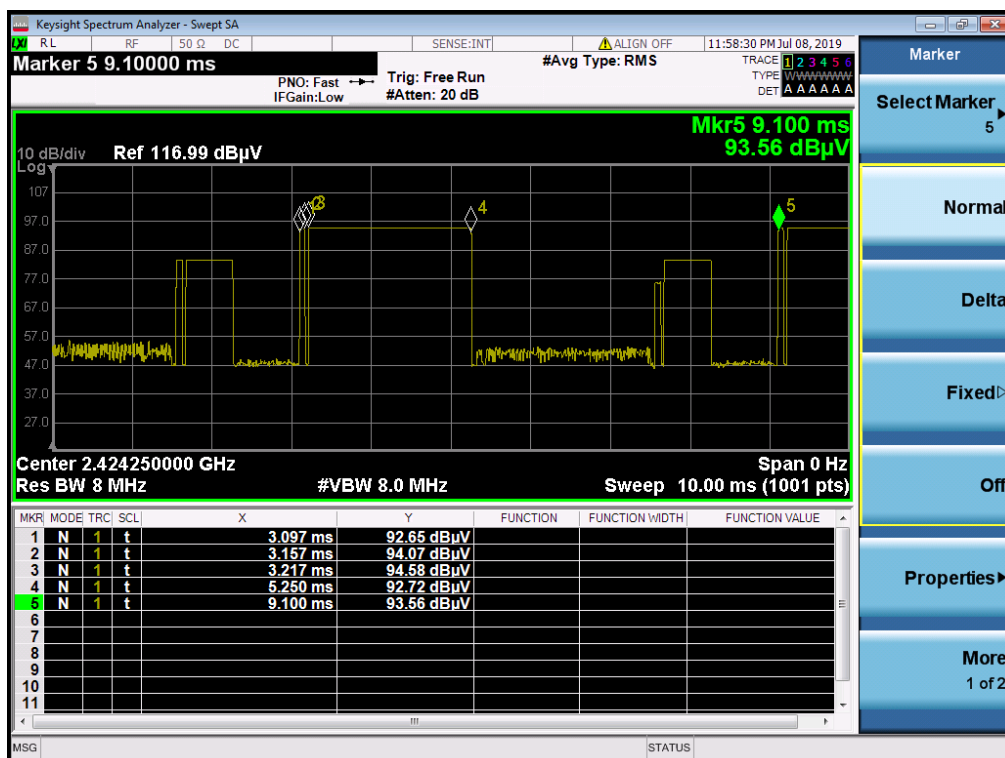
Calculate Formula:	Average value=Peak value + PDCF
	PDCF=20 log(Duty cycle)
	Duty cycle= T on time / T period
Test data:	Ton time =(3.157-3.097)+(5.250-3.217)=2.093ms
	T period =(9.100-3.097)=6.003ms
	PCDF value= -9.15dB



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Test Plots:



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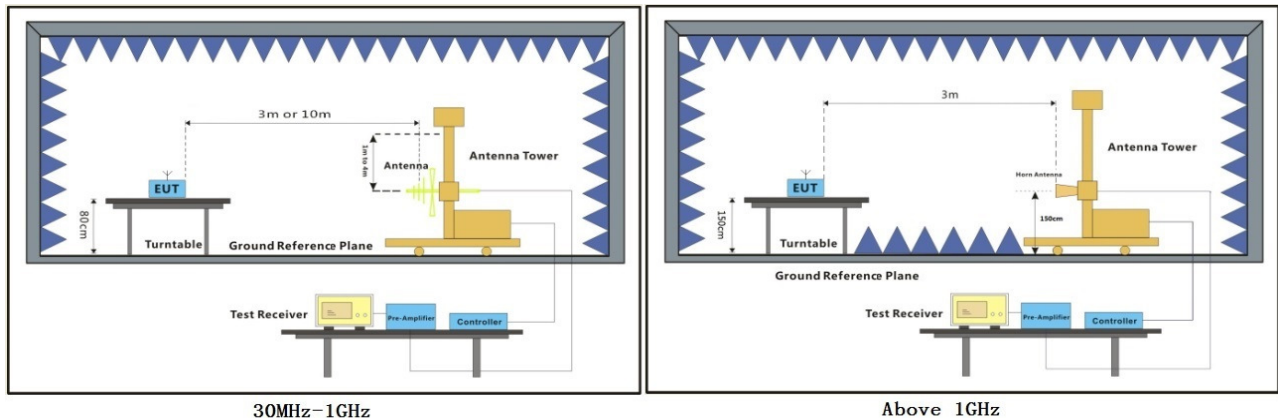
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 23.3 °C Humidity: 58 % RH Atmospheric Pressure: 1010 mbar

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

7.4.2 Test Setup Diagram

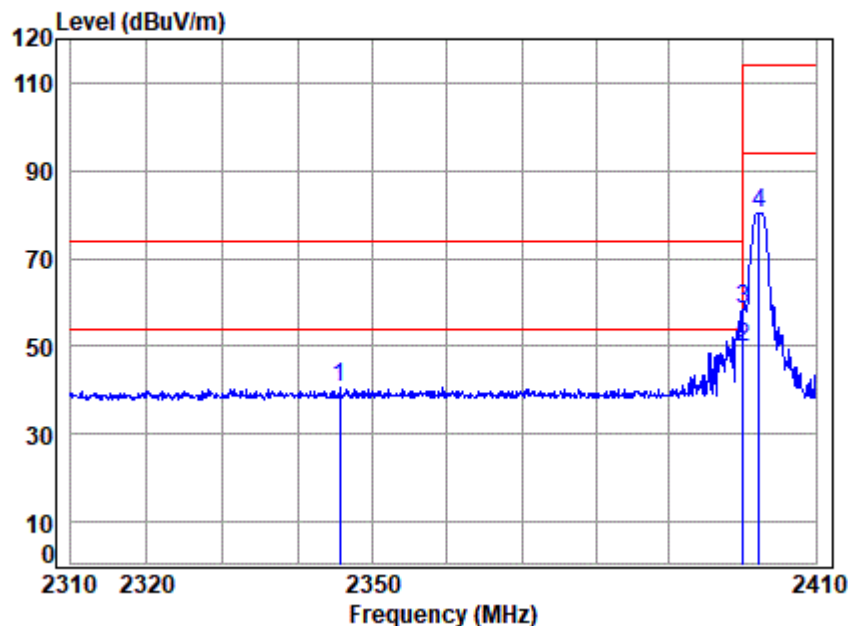


7.4.3 Measurement Procedure and Data

- 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

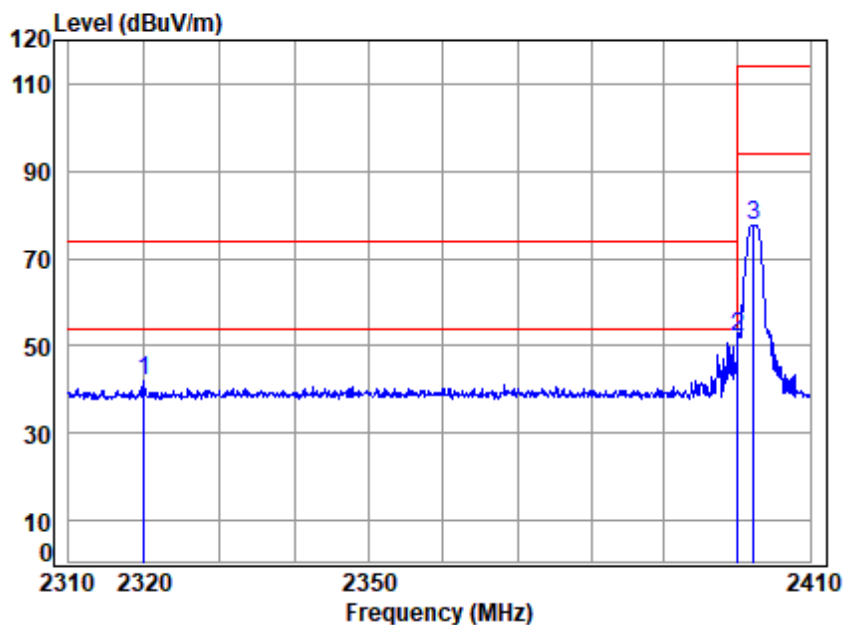
Mode:c; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 15307CR/15308CR
Mode : 2402.25 Band edge
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2345.612	5.41	28.44	41.15	47.79	40.49	74.00	-33.51	Peak
2	2400.000	5.49	28.54	41.18	56.54	49.39	54.00	-4.61	Average
3	2400.000	5.49	28.54	41.18	65.69	58.54	74.00	-15.46	peak
4	2402.250	5.49	28.54	41.18	87.59	80.44	114.00	-33.56	peak

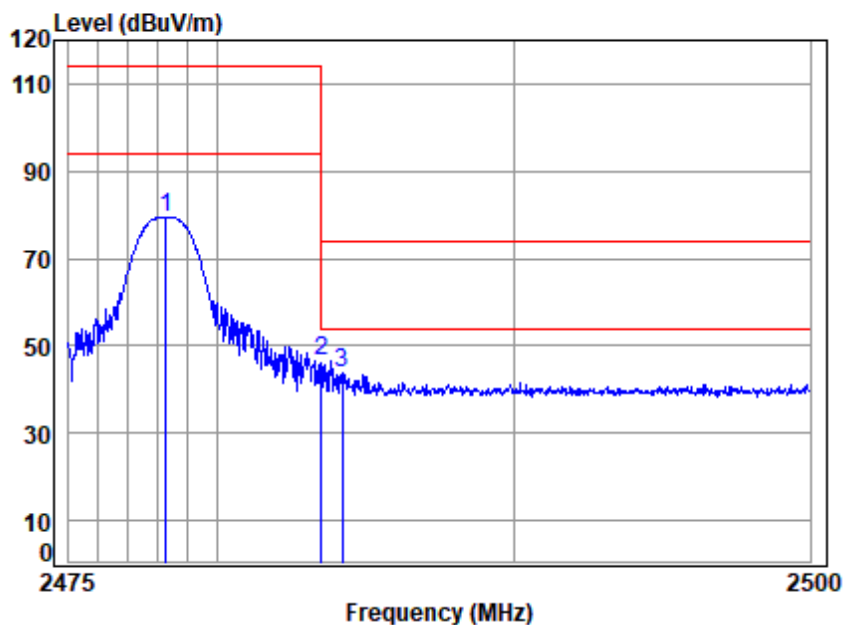
Mode:c; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 15307CR/15308CR
Mode : 2402.25 Band edge
: Dongle
: F0

	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	2319.909	5.38	28.40	41.14	49.45	42.09	74.00	-31.91	Peak
2	2400.000	5.49	28.54	41.18	59.04	51.89	74.00	-22.11	peak
3	2402.250	5.49	28.54	41.18	84.80	77.65	114.00	-36.35	peak

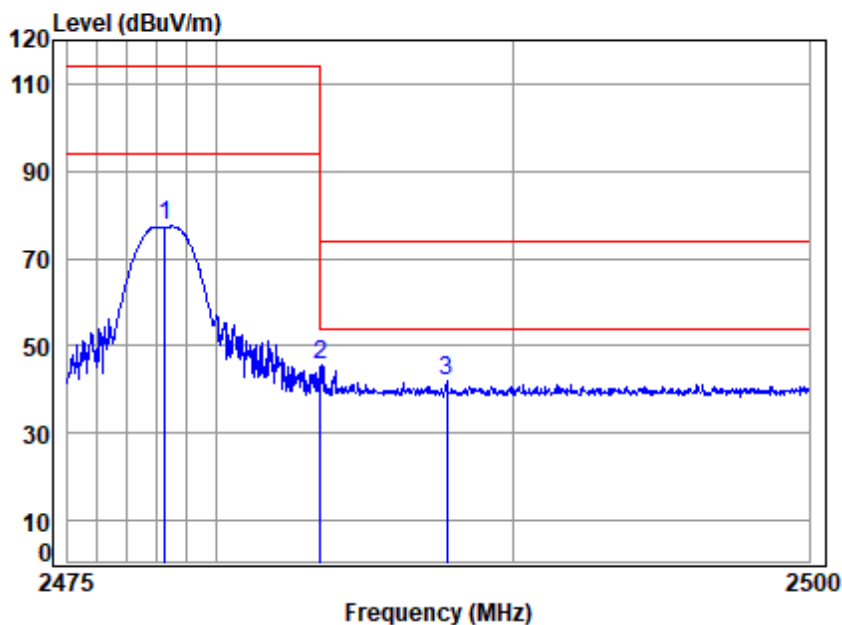
Mode:c; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 15307CR/15308CR
Mode : 2478.25 Band edge
: Dongle
: F0

	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	2478.250	5.59	28.67	41.21	86.26	79.31	114.00	-34.69	peak
2	2483.500	5.60	28.67	41.21	53.48	46.54	74.00	-27.46	peak
3	2484.196	5.60	28.67	41.21	50.76	43.82	74.00	-30.18	Peak

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



Site : chamber
Condition: 3m VERTICAL
Job No : 15307CR/15308CR
Mode : 2478.25 Band edge
: Dongle
: F0

	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	2478.250	5.59	28.67	41.21	84.33	77.38	114.00	-36.62	peak
2	2483.500	5.60	28.67	41.21	52.74	45.80	74.00	-28.20	peak
3	2487.744	5.60	28.68	41.21	48.72	41.79	74.00	-32.21	Peak

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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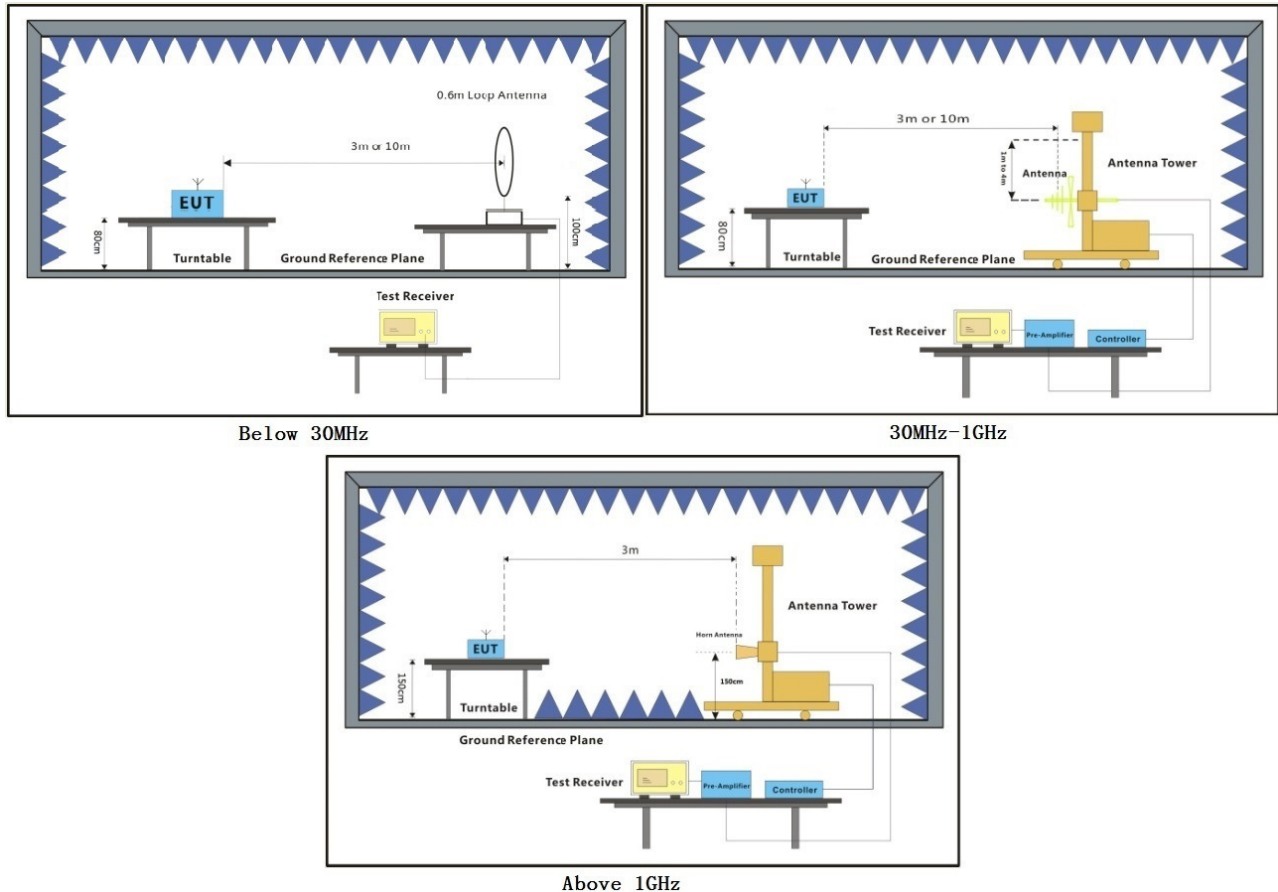
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 23.8 °C Humidity: 55 % RH Atmospheric Pressure: 1010 mbar

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

7.5.2 Test Setup Diagram





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.



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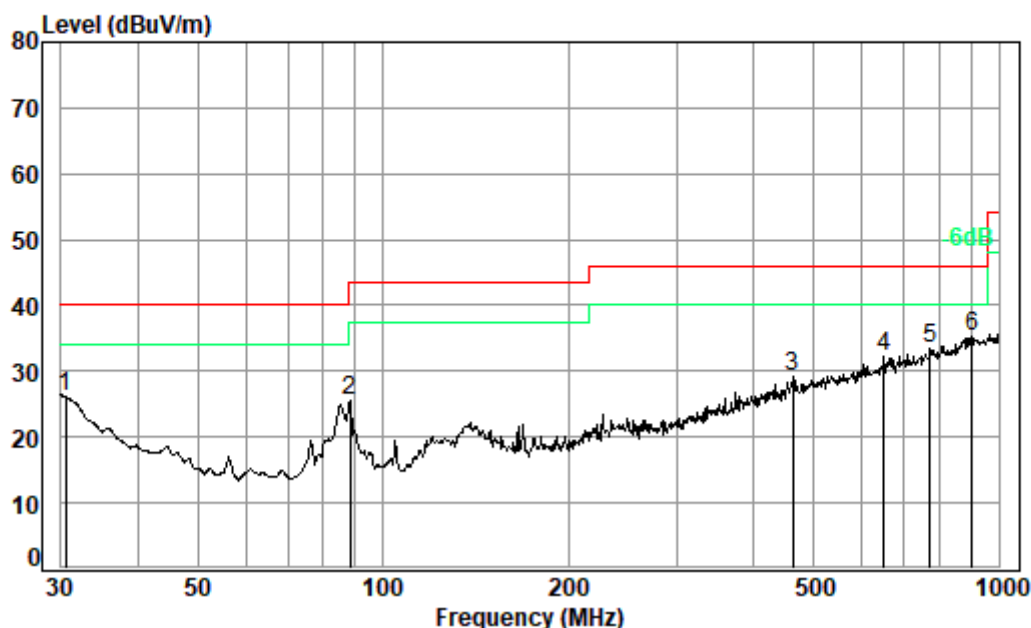
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30MHz~1GHz

QP value:

Mode: c; Polarization: Horizontal;



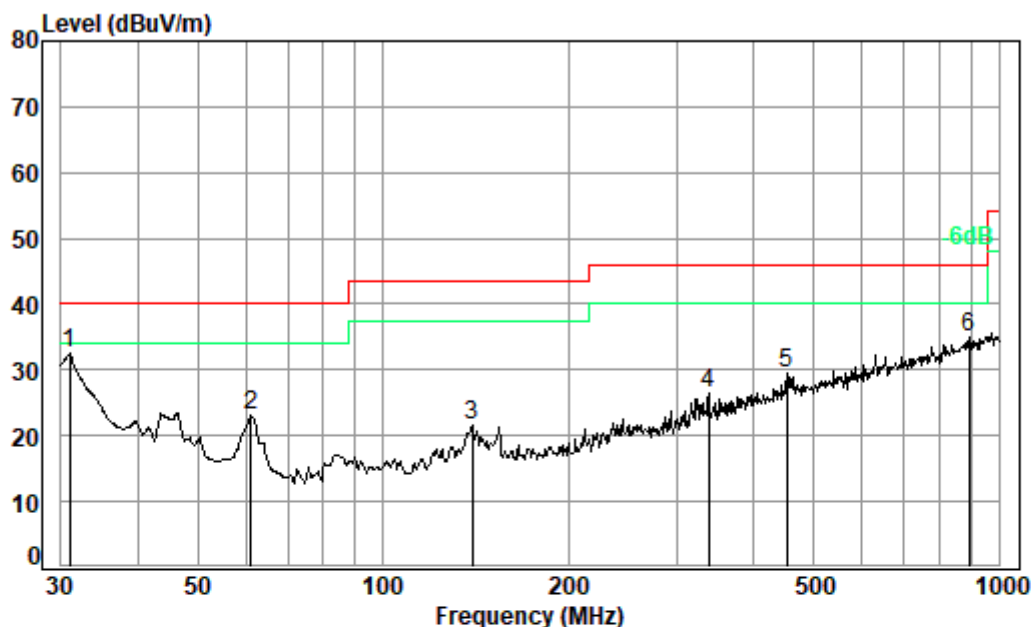
Condition: 3m HORIZONTAL

Job No. : 15307CR

Test Mode: c

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	30.53	0.60	22.20	27.73	30.99	26.06	40.00	-13.94
2	88.34	1.10	12.93	27.65	39.23	25.61	43.50	-17.89
3	462.35	2.46	23.83	27.69	30.72	29.32	46.00	-16.68
4	649.66	2.80	27.27	28.05	30.31	32.33	46.00	-13.67
5	774.16	3.13	28.35	27.77	29.77	33.48	46.00	-12.52
6 pp	903.31	3.60	29.82	27.28	29.08	35.22	46.00	-10.78

Mode :c; Polarization: Vertical



Condition: 3m VERTICAL

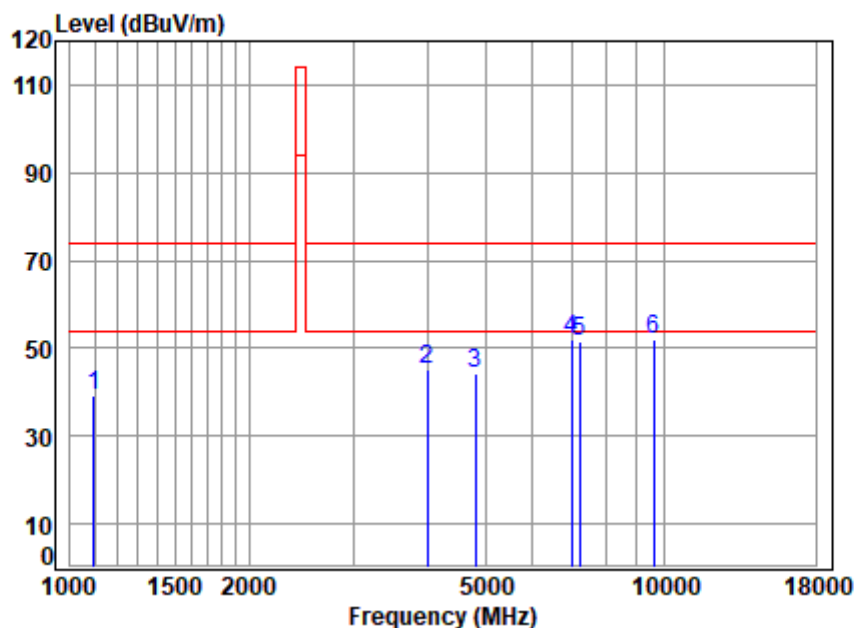
Job No. : 15307CR

Test Mode: c

		Cable	Ant	Preamp	Read		Limit	Over
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	pp	30.96	0.60	21.95	27.73	37.68	32.50	40.00 -7.50
2		61.13	0.80	13.15	27.68	36.98	23.25	40.00 -16.75
3		139.85	1.30	13.70	27.41	33.95	21.54	43.50 -21.96
4		338.40	2.02	20.77	27.11	30.92	26.60	46.00 -19.40
5		452.72	2.42	23.62	27.65	31.19	29.58	46.00 -16.42
6		893.86	3.58	29.72	27.32	28.95	34.93	46.00 -11.07

Above 1GHz

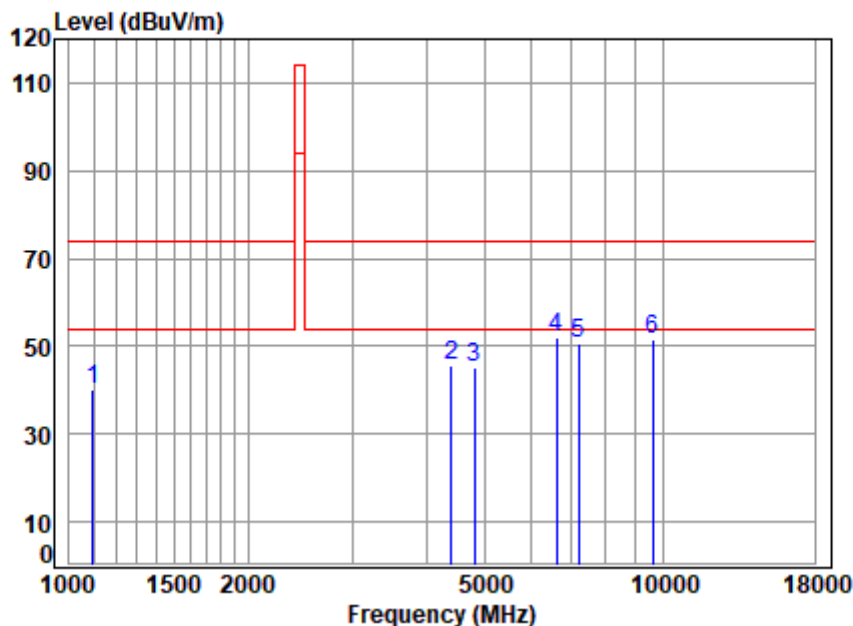
Mode:c; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 15307CR/15308CR
Mode : 2402.25 TX RSE
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz		dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1096.904	3.99	23.95	40.39	51.73	39.28	74.00	-34.72	peak
2	3992.781	6.97	33.58	42.74	47.46	45.27	74.00	-28.73	peak
3	4804.500	7.89	34.16	43.61	46.04	44.48	74.00	-29.52	peak
4	6974.982	10.20	36.43	42.03	47.33	51.93	74.00	-22.07	peak
5	7206.750	10.08	36.42	41.86	47.09	51.73	74.00	-22.27	peak
6	9609.000	10.75	37.52	38.43	41.99	51.83	74.00	-22.17	peak

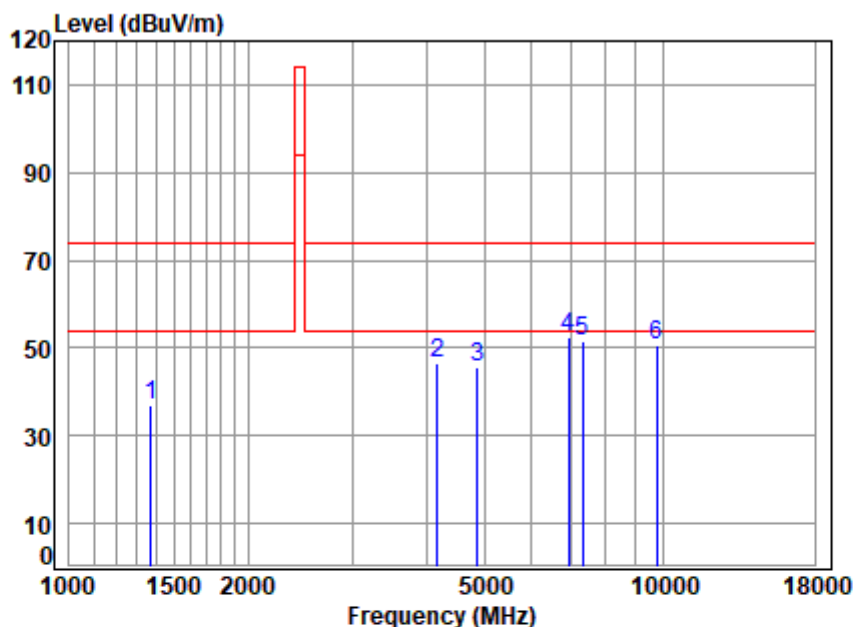
Mode:c; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 15307CR/15308CR
Mode : 2402.25 TX RSE
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz		dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1096.904	3.99	23.95	40.39	52.39	39.94	74.00	-34.06	peak
2	4405.090	7.46	33.60	43.20	47.66	45.52	74.00	-28.48	peak
3	4804.500	7.89	34.16	43.61	46.61	45.05	74.00	-28.95	peak
4	6621.375	11.19	35.45	42.31	47.86	52.19	74.00	-21.81	peak
5	7206.750	10.08	36.42	41.86	46.23	50.87	74.00	-23.13	peak
6	9609.000	10.75	37.52	38.43	41.52	51.36	74.00	-22.64	peak

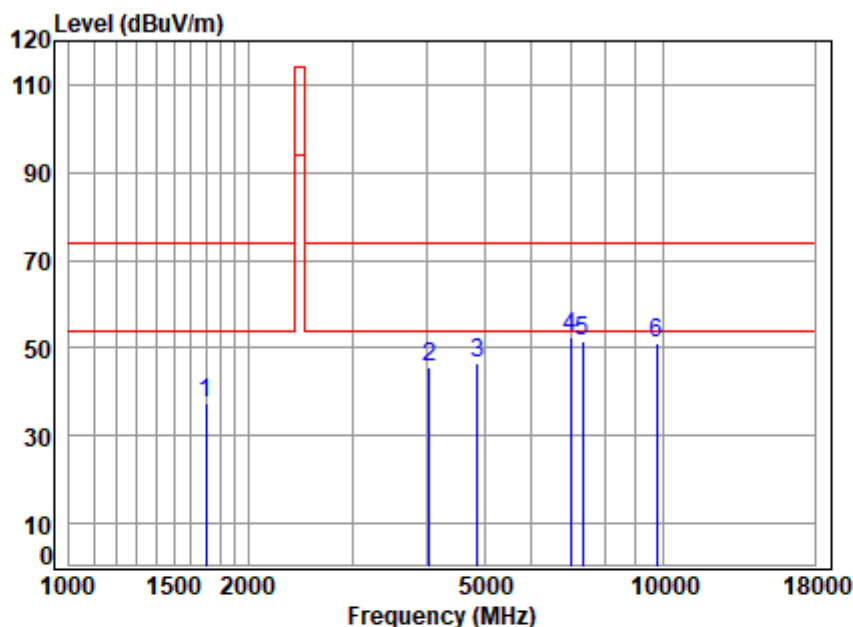
Mode:c; Polarization:Horizontal; Modulation Type:GFSK; Channel:middle



Site : chamber
Condition: 3m HORIZONTAL
Job No : 15307CR/15308CR
Mode : 2438.25 TX RSE
: Dongle
: F0

	Cable	Ant	Preamp	Read	Limit	Over		
Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	5.06	25.28	40.62	47.02	36.74	74.00	-37.26	peak
2	7.18	33.60	42.95	48.91	46.74	74.00	-27.26	peak
3	7.96	34.29	43.68	46.86	45.43	74.00	-28.57	peak
4	10.31	36.32	42.06	47.71	52.28	74.00	-21.72	peak
5	10.05	36.37	41.78	46.77	51.41	74.00	-22.59	peak
6	10.82	37.55	38.19	40.30	50.48	74.00	-23.52	peak

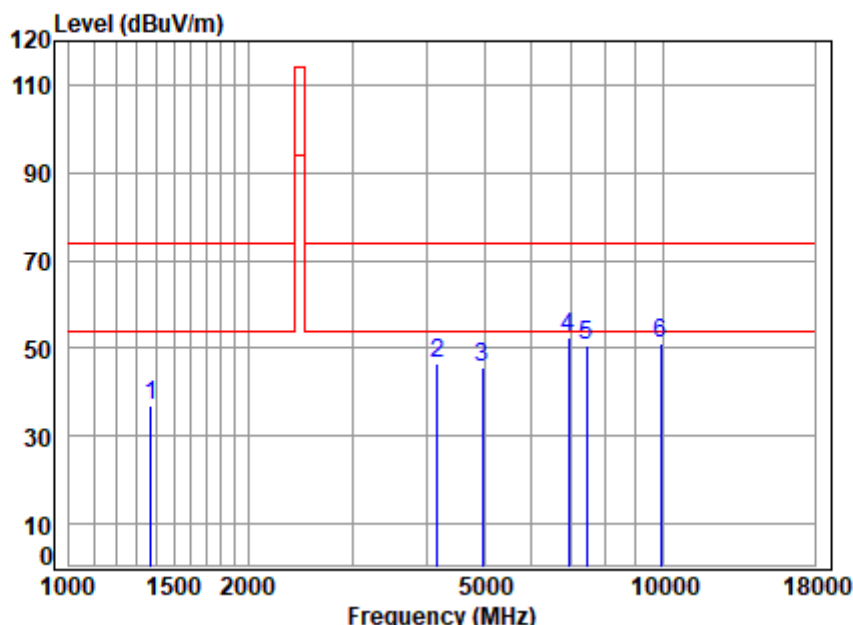
Mode:c; Polarization:Vertical; Modulation Type:GFSK; Channel:middle



Site : chamber
Condition: 3m VERTICAL
Job No : 15307CR/15308CR
Mode : 2438.25 TX RSE
: Dongle
: F0

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	5.23	26.66	40.83	46.45	37.51	74.00	-36.49 peak
2	7.03	33.60	42.80	47.89	45.72	74.00	-28.28 peak
3	7.96	34.29	43.68	47.95	46.52	74.00	-27.48 peak
4	10.14	36.49	42.01	47.69	52.31	74.00	-21.69 peak
5	10.05	36.37	41.78	46.73	51.37	74.00	-22.63 peak
6	10.82	37.55	38.19	40.87	51.05	74.00	-22.95 peak

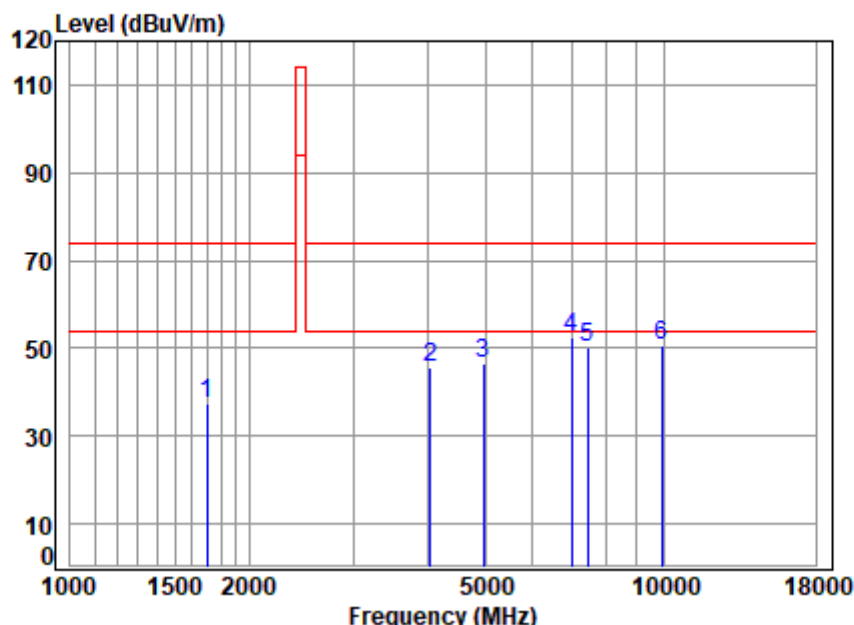
Mode:c; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 15307CR/15308CR
Mode : 2478.25 TX RSE
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1374.295	5.06	25.28	40.62	47.02	36.74	74.00	-37.26	peak
2	4169.698	7.18	33.60	42.95	48.91	46.74	74.00	-27.26	peak
3	4956.500	8.05	34.43	43.76	47.08	45.80	74.00	-28.20	peak
4	6934.778	10.31	36.32	42.06	47.71	52.28	74.00	-21.72	peak
5	7434.750	10.02	36.33	41.69	46.14	50.80	74.00	-23.20	peak
6	9913.000	10.90	37.58	37.94	40.62	51.16	74.00	-22.84	peak

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



Site : chamber
Condition: 3m VERTICAL
Job No : 15307CR/15308CR
Mode : 2478.25 TX RSE
: Dongle
: F0

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz		dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1697.129	5.23	26.66	40.83	46.45	37.51	74.00	-36.49	peak
2	4039.212	7.03	33.60	42.80	47.89	45.72	74.00	-28.28	peak
3	4956.500	8.05	34.43	43.76	47.81	46.53	74.00	-27.47	peak
4	6995.172	10.14	36.49	42.01	47.69	52.31	74.00	-21.69	peak
5	7434.750	10.02	36.33	41.69	45.56	50.22	74.00	-23.78	peak
6	9913.000	10.90	37.58	37.94	39.94	50.48	74.00	-23.52	peak



8 Photographs

8.1 Test Setup

Please refer to setup photos.

8.2 EUT Constructional Details (EUT Photos)

Please refer to external and internal photos for details.

- End of the Report -

