

TEST REPORT

Application No.: SZEM1906015040CR

Applicant: MEKBAO PLASTIC ELECTRONIC INDUSTRIAL CO., LTD

Address of Applicant: JIAOXI INDUSTRY AREAS LIANXIA CHENGHAI SHANTOU CITY, GD CHINA

Manufacturer: MEKBAO PLASTIC ELECTRONIC INDUSTRIAL CO., LTD

Address of Manufacturer: JIAOXI INDUSTRY AREAS LIANXIA CHENGHAI SHANTOU CITY, GD CHINA

Equipment Under Test (EUT):

EUT Name: Toy car series

Model No.: 5588-601, 5588-602, 5588-603, 5588-604, 5588-605, 5588-606, 5588-607, 5588-608, 5588-609, 5588-610, 5588-612, 5588-613, 5588-614, 5588-615, 5588-616, 5588-617, 5588-618, 5588-619, 5588-620, 5588-621, 5588-622, 5588-623, 5588-624, 5588-625, 5588-702, 5588-703, 5588-705, 5588-706, 5588-709, 5588-710, 5588-711, 5588-712, 5588-713, 5588-714, 5588-715, 7777-01, 7777-02, 7777-03, 7777-04, 7777-05, 7777-06, 7777-07, 7777-08, 7777-09, 7777-10, 7777-37, 7777-38, 7777-39, 7777-40, 5588-81B, 5588-82B, 5588-83B, 5588-84B, 5588-85B, 5588-86B, 5588-87B, 5588-88B, 5588-89B, 5588-90B, 5588-91B, 5588-92B, 5588-01, 5588-02, 5588-03, 5588-05, 5588-08, 5588-11, 5588-23, 5588-25, 2210LED ♣

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

FCC ID: 2AGUM-5588005

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

Date of Receipt: 2019-06-12

Date of Test: 2019-06-12 to 2019-06-17

Date of Issue: 2019-06-22

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

Keny Xu

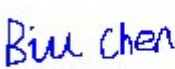
Keny Xu
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2019-06-22		Original

Authorized for issue by:			
		 Bill Chen /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
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.: 5588-601, 5588-602, 5588-603, 5588-604, 5588-605, 5588-606, 5588-607, 5588-608, 5588-609, 5588-610, 5588-612, 5588-613, 5588-614, 5588-615, 5588-616, 5588-617, 5588-618, 5588-619, 5588-620, 5588-621, 5588-622, 5588-623, 5588-624, 5588-625, 5588-702, 5588-703, 5588-705, 5588-706, 5588-709, 5588-710, 5588-711, 5588-712, 5588-713, 5588-714, 5588-715, 7777-01, 7777-02, 7777-03, 7777-04, 7777-05, 7777-06, 7777-07, 7777-08, 7777-09, 7777-10, 7777-37, 7777-38, 7777-39, 7777-40, 5588-81B, 5588-82B, 5588-83B, 5588-84B, 5588-85B, 5588-86B, 5588-87B, 5588-88B, 5588-89B, 5588-90B, 5588-91B, 5588-92B, 5588-01, 5588-02, 5588-03, 5588-05, 5588-08, 5588-11, 5588-23, 5588-25, 2210LED

Only the model 5588-619 was tested, since the electrical circuit design, layout, components used, internal wiring and functions were identical for the above models, with only difference on colour, appearance and packaging.

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4 General Information

4.1 Details of E.U.T.

Power supply:	Tx:DC 3.0V by 1.5V x 2"AA" batteries
Frequency Range	2405MHz to 2480MHz
Number of Channels:	76
Channel Spacing:	1MHz
Modulation Type:	GFSK
Antenna Type:	Integral Antenna
Antenna Gain:	0dBi

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2405MHz	20	2424MHz	39	2443MHz	58	2462MHz
2	2406MHz	21	2425MHz	40	2444MHz	59	2463MHz
3	2407MHz	22	2426MHz	41	2445MHz	60	2464MHz
4	2408MHz	23	2427MHz	42	2446MHz	61	2465MHz
5	2409MHz	24	2428MHz	43	2447MHz	62	2466MHz
6	2410MHz	25	2429MHz	44	2448MHz	63	2467MHz
7	2411MHz	26	2430MHz	45	2449MHz	64	2468MHz
8	2412MHz	27	2431MHz	46	2450MHz	65	2469MHz
9	2413MHz	28	2432MHz	47	2451MHz	66	2470MHz
10	2414MHz	29	2433MHz	48	2452MHz	67	2471MHz
11	2415MHz	30	2434MHz	49	2453MHz	68	2472MHz
12	2416MHz	31	2435MHz	50	2454MHz	69	2473MHz
13	2417MHz	32	2436MHz	51	2455MHz	70	2474MHz
14	2418MHz	33	2437MHz	52	2456MHz	71	2475MHz
15	2419MHz	34	2438MHz	53	2457MHz	72	2476MHz
16	2420MHz	35	2439MHz	54	2458MHz	73	2477MHz
17	2421MHz	36	2440MHz	55	2459MHz	74	2478MHz
18	2422MHz	37	2441MHz	56	2460MHz	75	2479MHz
19	2423MHz	38	2442MHz	57	2461MHz	76	2480MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel(CH1)	2405MHz
The Middle channel(CH44)	2448MHz
The Highest channel(CH76)	2480MHz

4.2 Description of Support Units

The EUT has been tested as an independent unit.

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	20dB Bandwidth	$\pm 3\%$
2	E-Field	$\pm 4.5\text{dB}$ (Below 1GHz)
3	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
4	Temperature test	$\pm 1^\circ\text{C}$
5	Humidity test	$\pm 3\%$
6	Supply voltages	$\pm 1.5\%$
7	Time	$\pm 3\%$

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:

- **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



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5 Equipment List

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
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	2018-07-12	2019-07-11
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	2018-07-12	2019-07-11
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
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 (0.1-1300MHz)	HP	8447D	SEM005-02	2018-09-25	2019-09-24
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	2018-07-12	2019-07-11
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 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	2018-07-12	2019-07-11
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
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 (0.1-1300MHz)	HP	8447D	SEM005-02	2018-09-25	2019-09-24



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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

RE in Chamber					
Test 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
MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004-05	2018-09-25	2019-09-24
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2019-04-01	2020-03-31
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2018-07-12	2019-07-11

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 0dBi.

Antenna location: Refer to Appendix(Internal photos)



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7 Radio Spectrum Matter Test Results

7.1 20dB Bandwidth

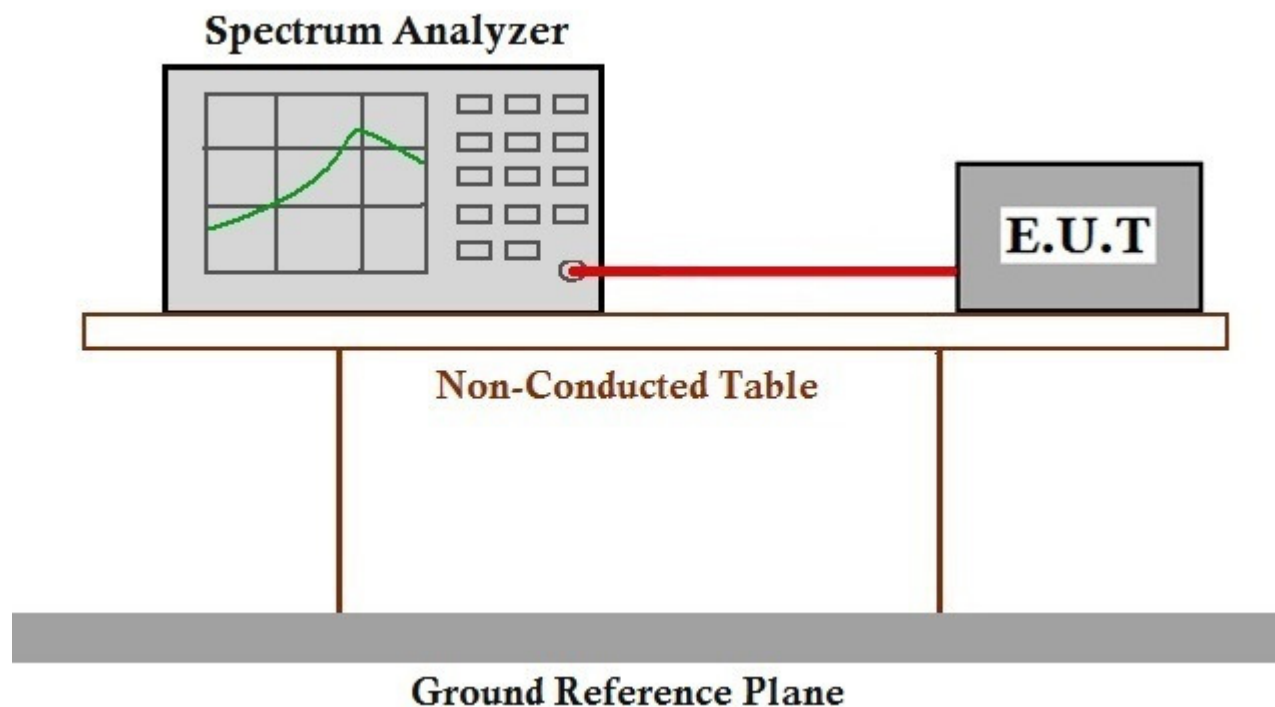
Test Requirement 47 CFR Part 15, Subpart C 15.215
Test Method: ANSI C63.10 (2013) Section 6.9
Limit: N/A

7.1.1 E.U.T. Operation

Operating Environment:

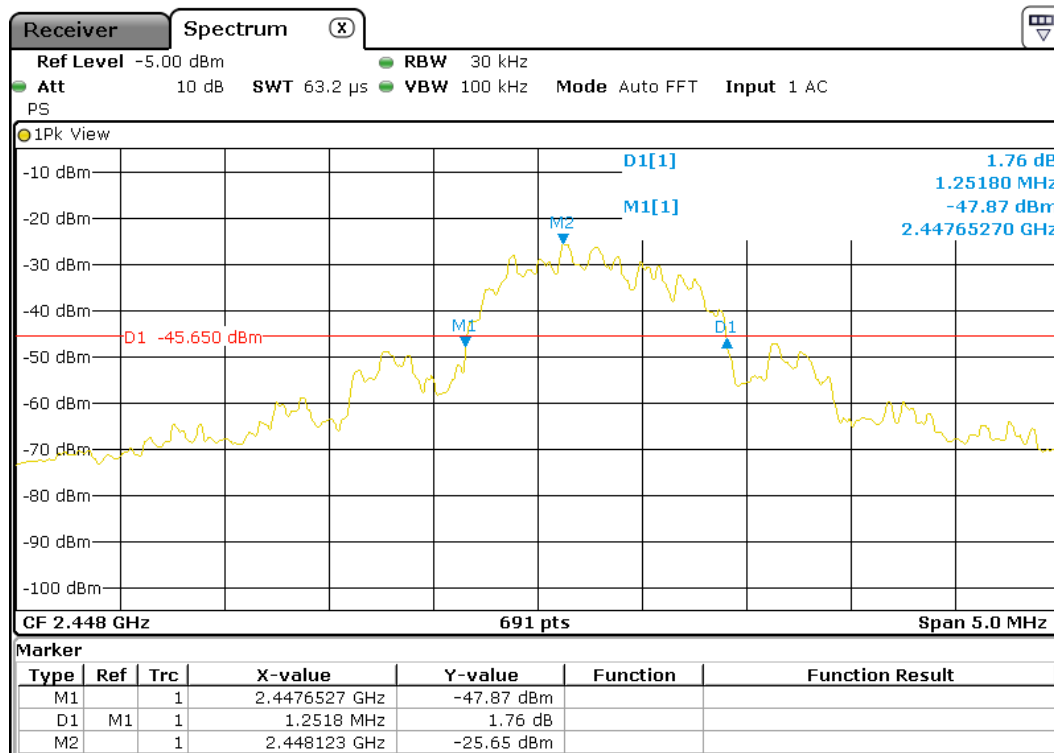
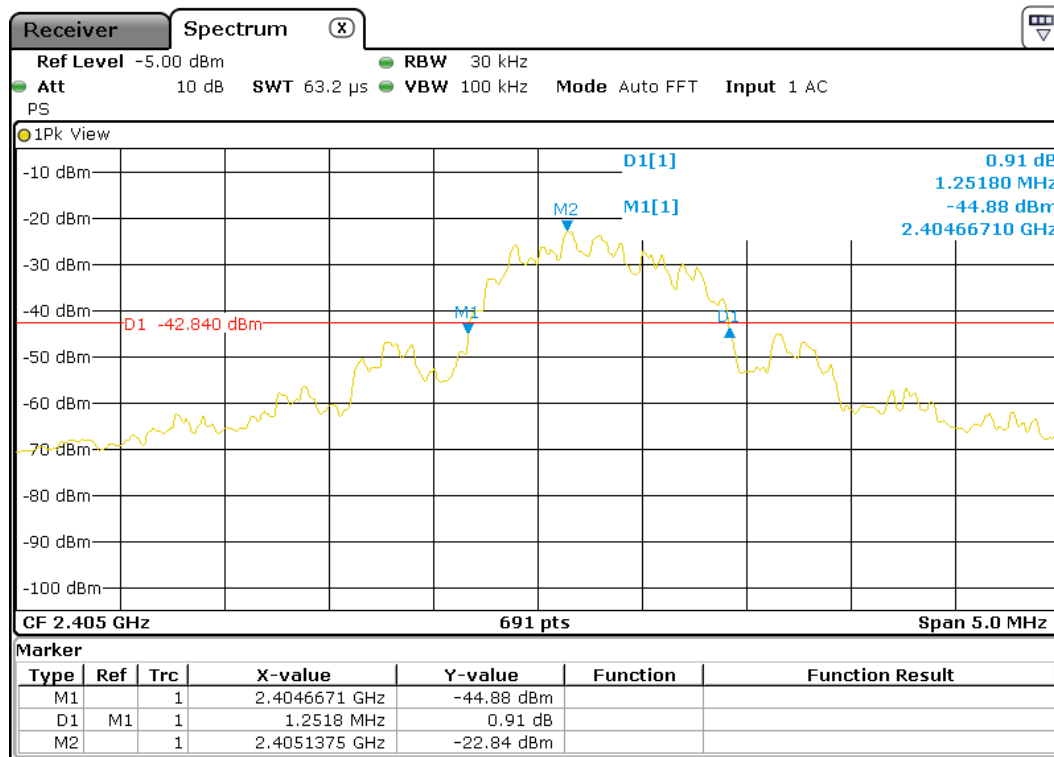
Temperature: 24.3 °C Humidity: 42.7 % RH Atmospheric Pressure: 1010 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

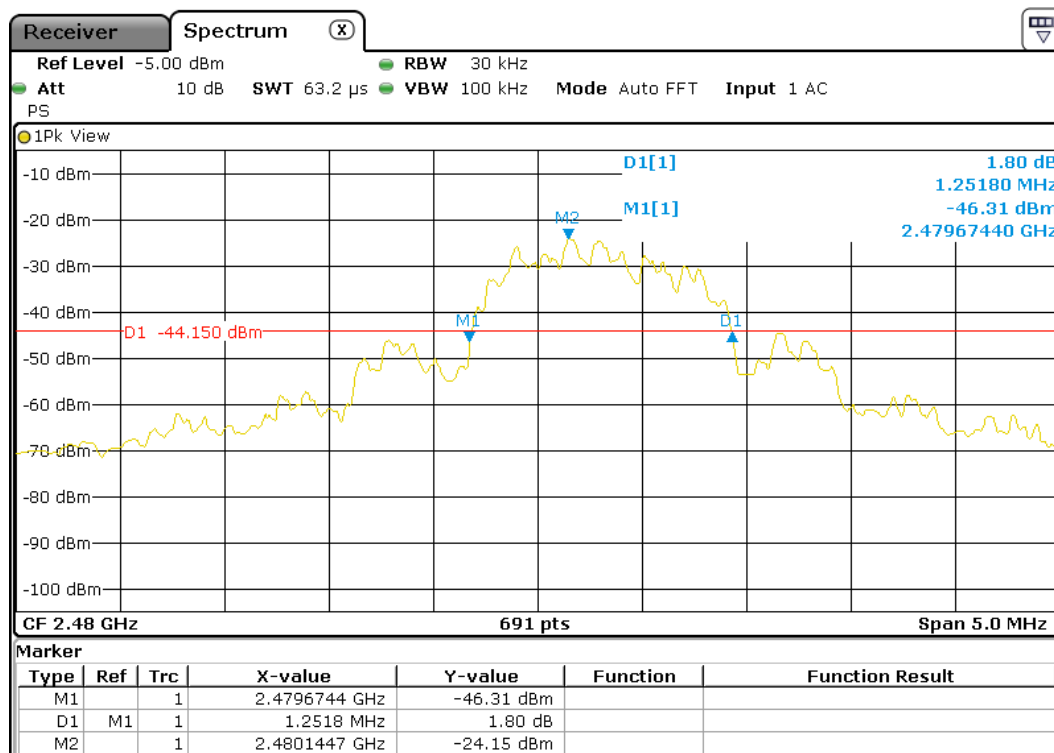
7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data

Test channel	20dB bandwidth (MHz)	Results
Lowest	1.2518	Pass
Middle	1.2518	Pass
Highest	1.2518	Pass







7.2 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.

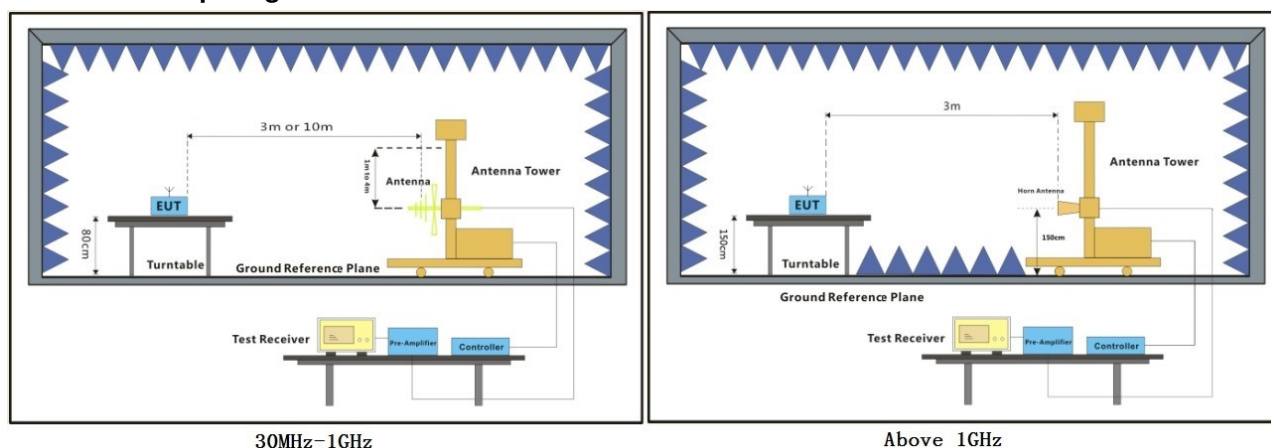


7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 25.3 °C Humidity: 55 % RH Atmospheric Pressure: 1005 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

7.2.2 Test Setup Diagram

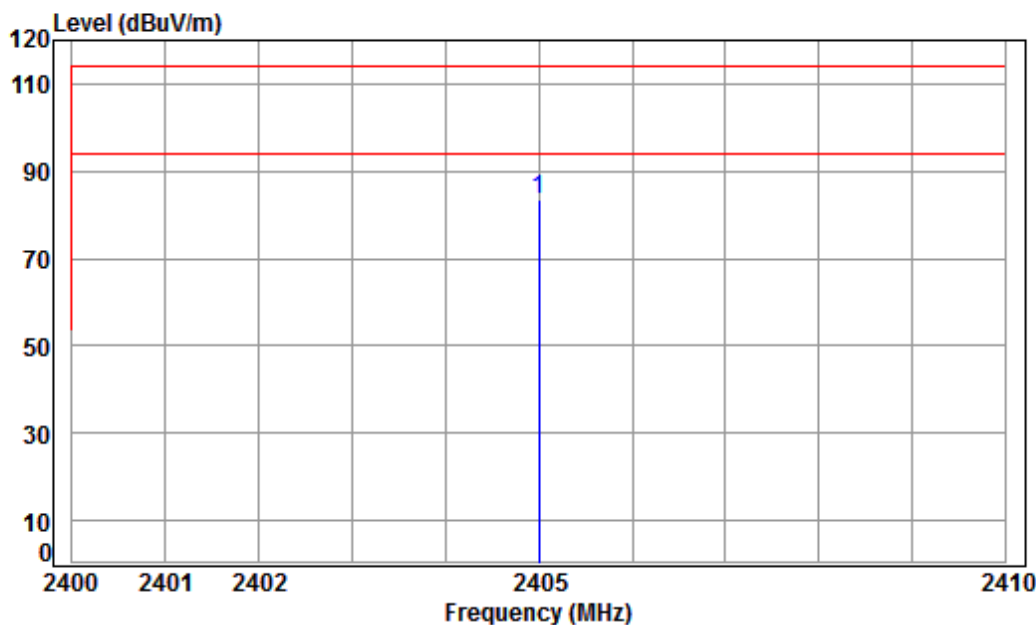


7.2.3 Measurement Procedure and Data

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



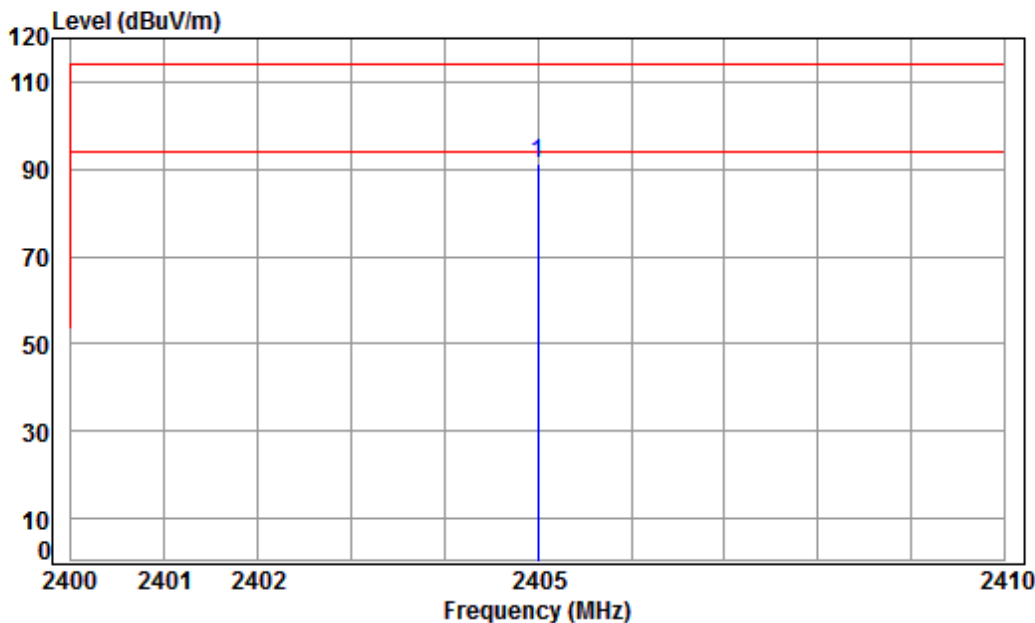
Condition: 3m HORIZONTAL

Job No : 15040CR

Mode : 2405 Field Strength

	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 pp 2405.000	5.49	29.12	41.88	90.89	83.62	114.00	-30.38 peak

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



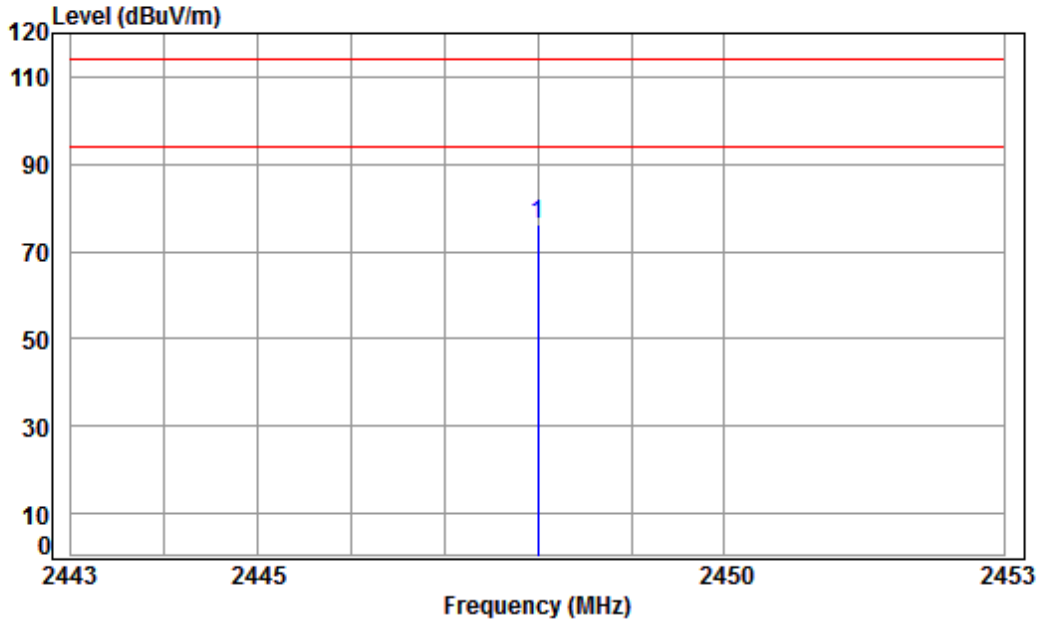
Condition: 3m VERTICAL

Job No : 15040CR

Mode : 2405 Field Strength

	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 pp 2405.000	5.49	29.12	41.88	98.44	91.17	114.00	-22.83 peak

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



Condition: 3m HORIZONTAL

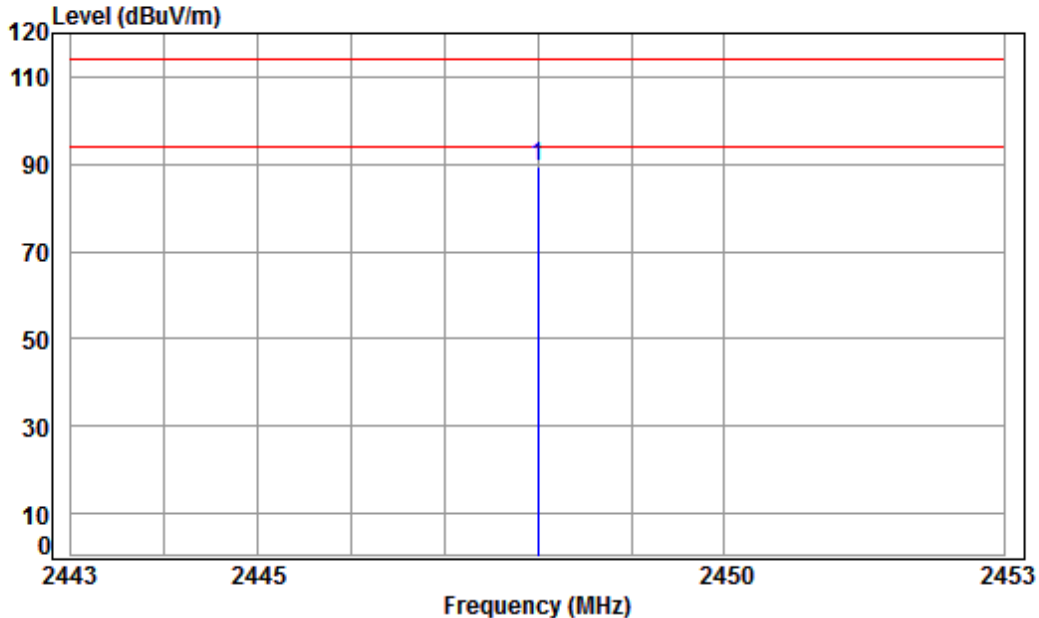
Job No : 15040CR

Mode : 2448 Field Strength

	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 pp 2448.000	5.55	29.25	41.90	83.11	76.01	114.00	-37.99	Peak



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



Condition: 3m VERTICAL

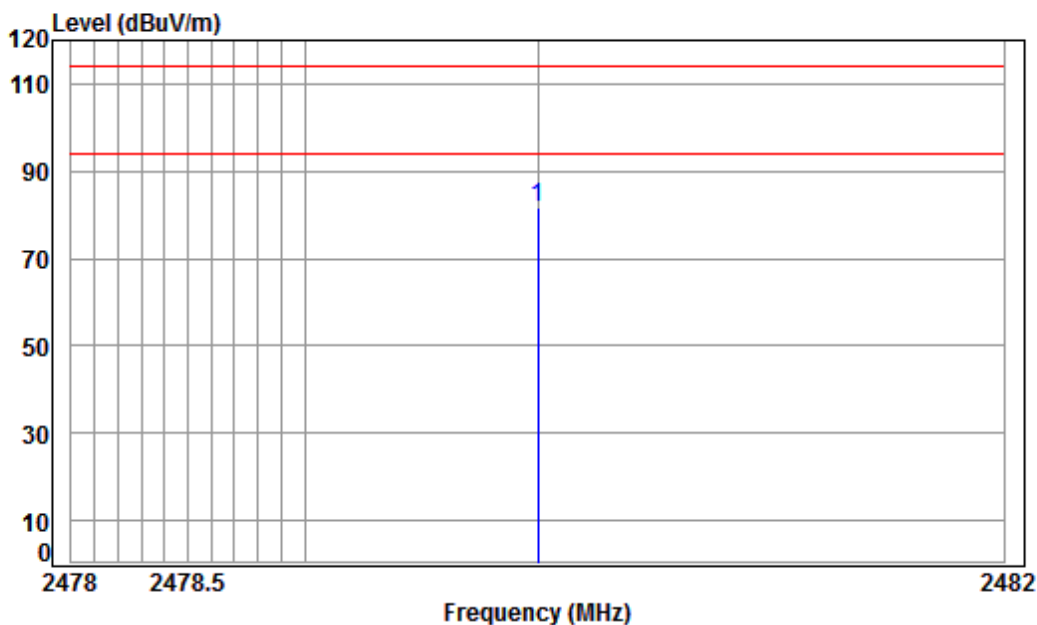
Job No : 15040CR

Mode : 2448 Field Strength

	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 pp 2448.000	5.55	29.25	41.90	96.50	89.40	114.00	-24.60 Peak



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



Condition: 3m HORIZONTAL

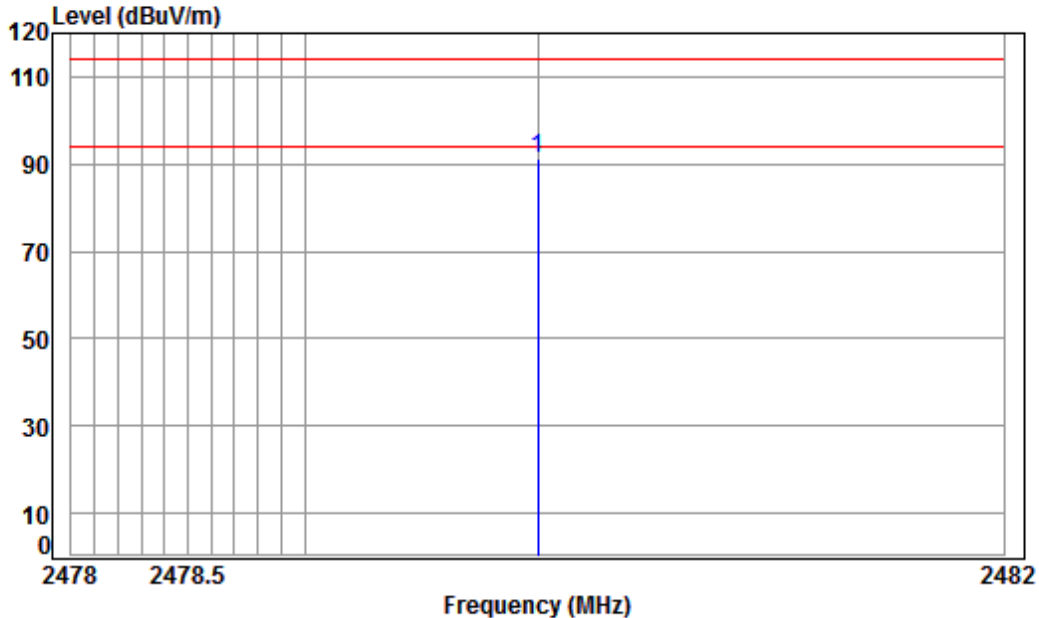
Job No : 15040CR

Mode : 2480 Field Strength

	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 pp 2480.000	5.59	29.34	41.91	88.44	81.46	114.00	-32.54 peak



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



Condition: 3m VERTICAL

Job No : 15040CR

Mode : 2480 Field Strength

	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 pp 2480.000	5.59	29.34	41.91	98.45	91.47	114.00	-22.53 peak

Remark:

- 1) 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
- 2) 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. So, only the above measurement data were shown in the report.



7.3 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(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, 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.



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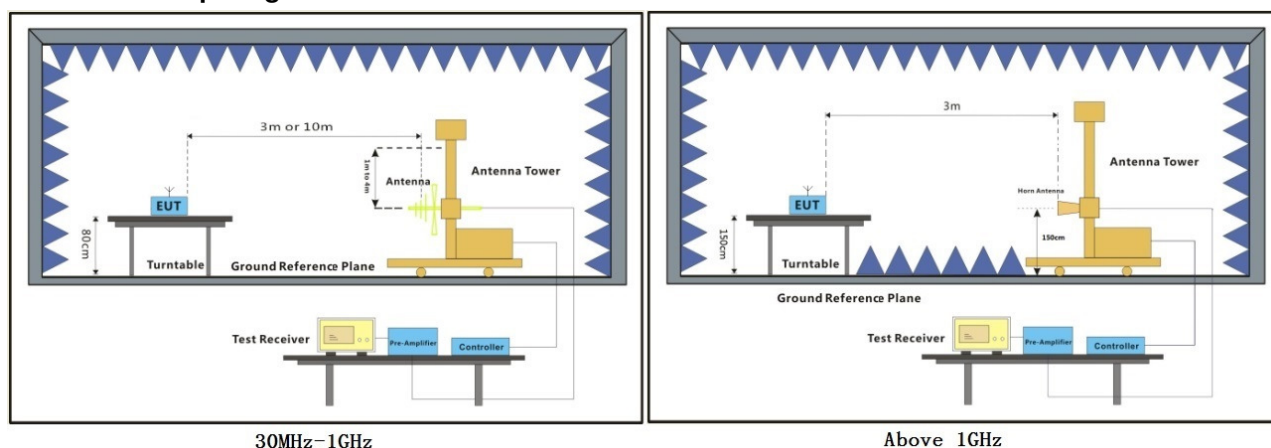
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7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 23.2 °C Humidity: 54.3 % RH Atmospheric Pressure: 1005 mbar
Test mode a: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: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

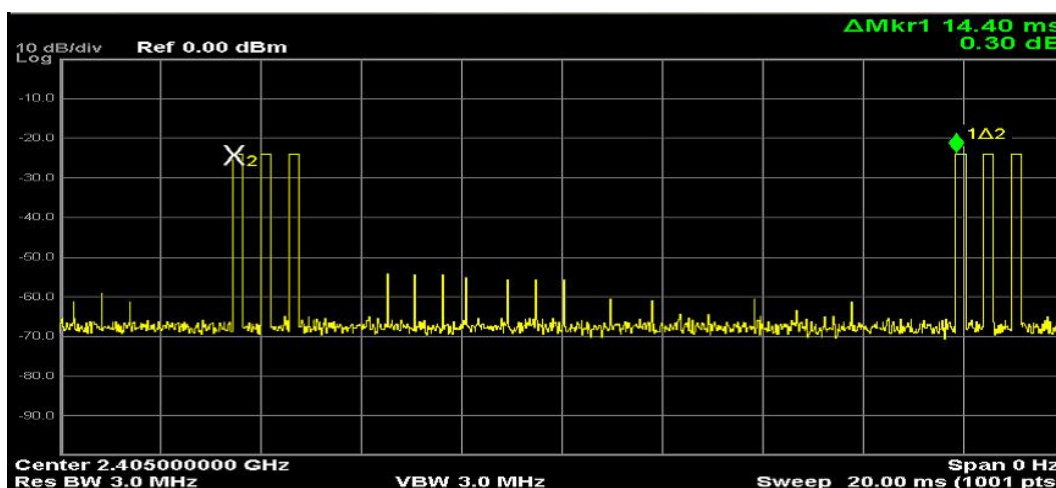
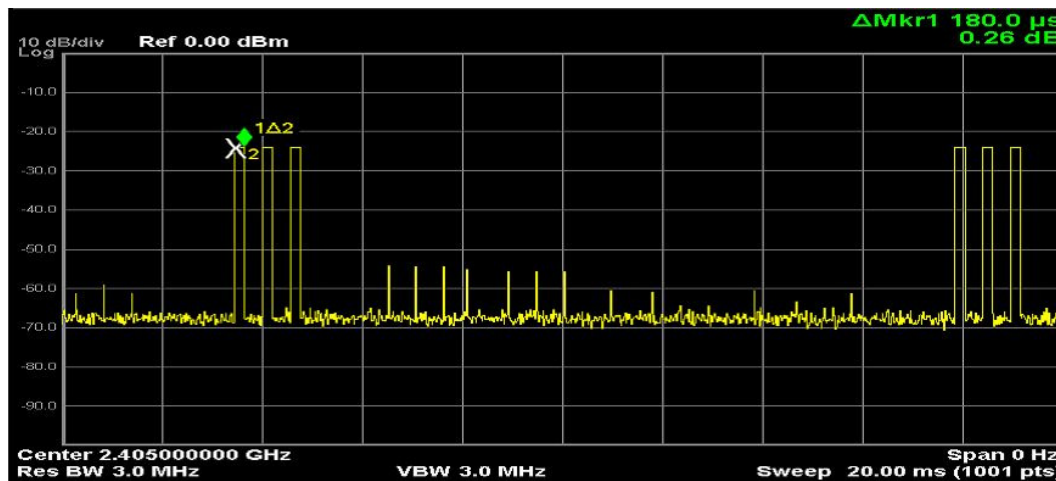
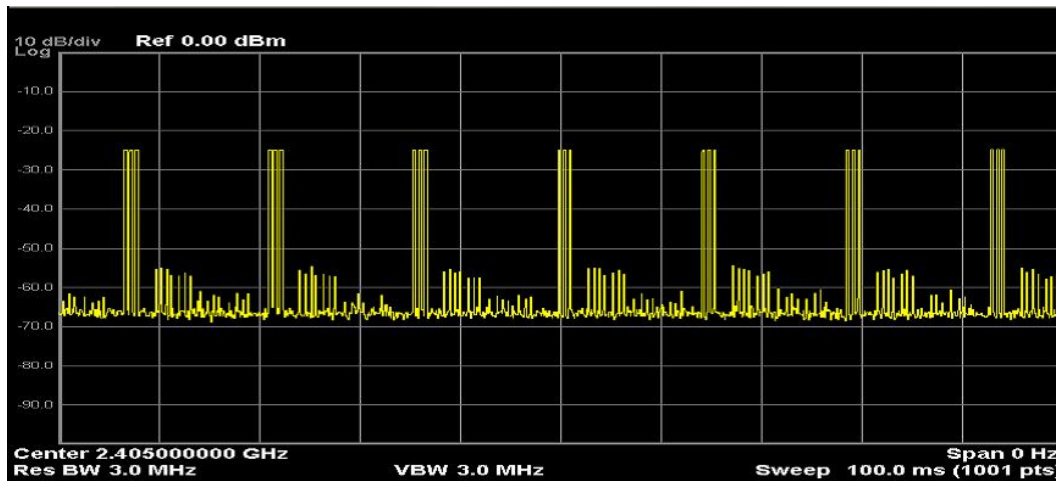


Average value:

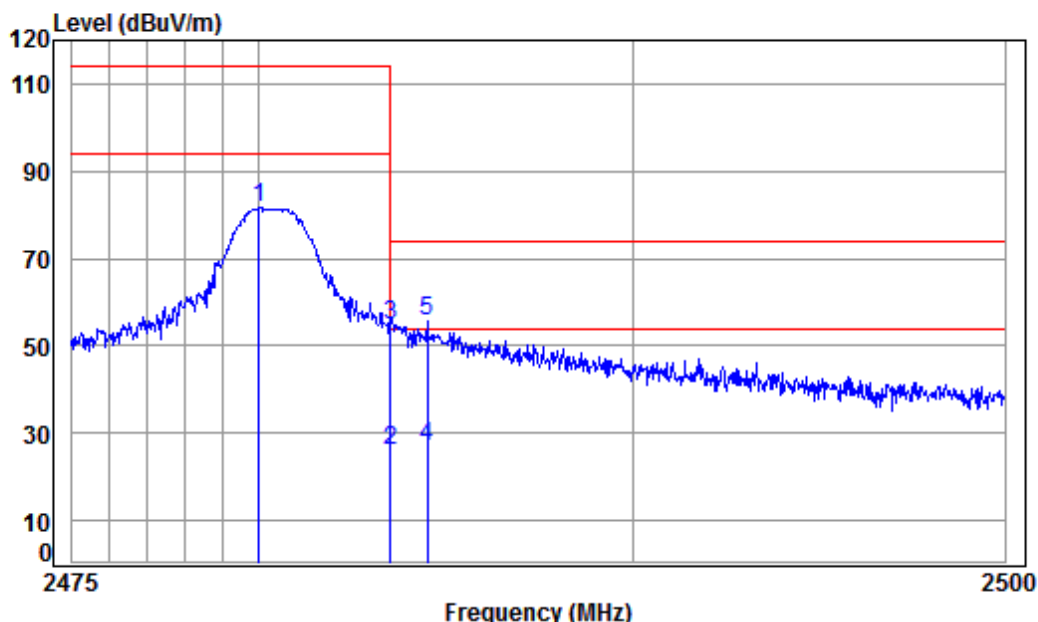
Calculate Formula:	Average value=Peak value + PDCF
	PDCF=20 log(Duty cycle)
	Duty cycle= T on time / T period
Test data:	Ton time =0.54ms
	T period =14.4ms
	PDCF value= -28.52dB



Duty cycle test plots:



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



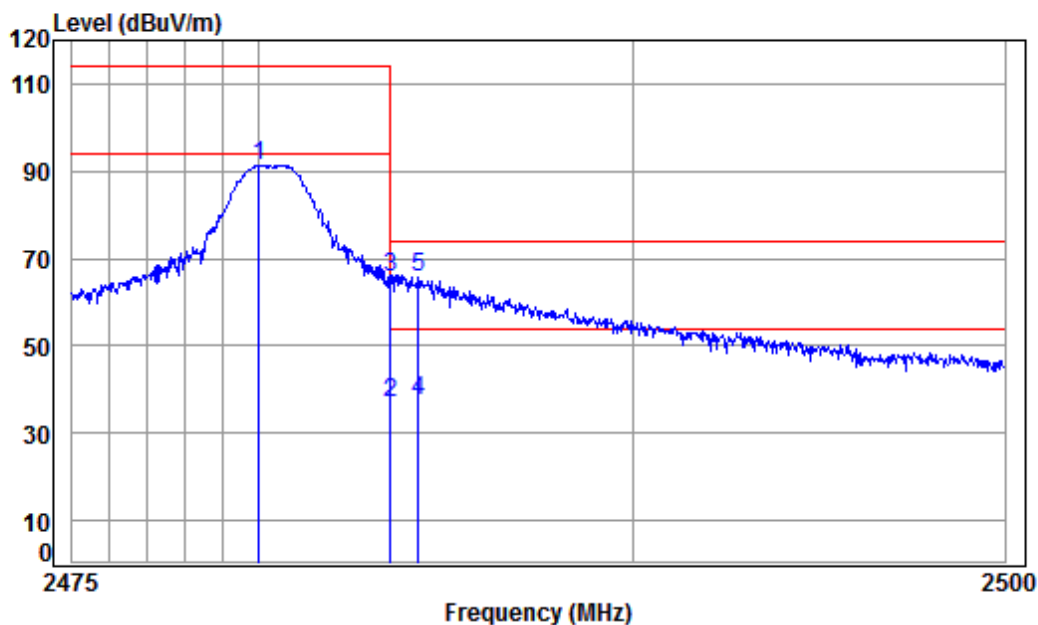
Condition: 3m HORIZONTAL

Job No : 15040CR

Mode : 2480 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2480.000	5.59	29.34	41.91	88.44	81.46	114.00	-32.54	peak
2	2483.500	5.60	29.35	41.91	33.08	26.12	54.00	-27.88	Average
3	2483.500	5.60	29.35	41.91	61.60	54.64	74.00	-19.36	peak
4 av	2484.495	5.60	29.36	41.91	33.87	26.92	54.00	-27.08	Average
5 pp	2484.495	5.60	29.36	41.91	62.39	55.44	74.00	-18.56	peak

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



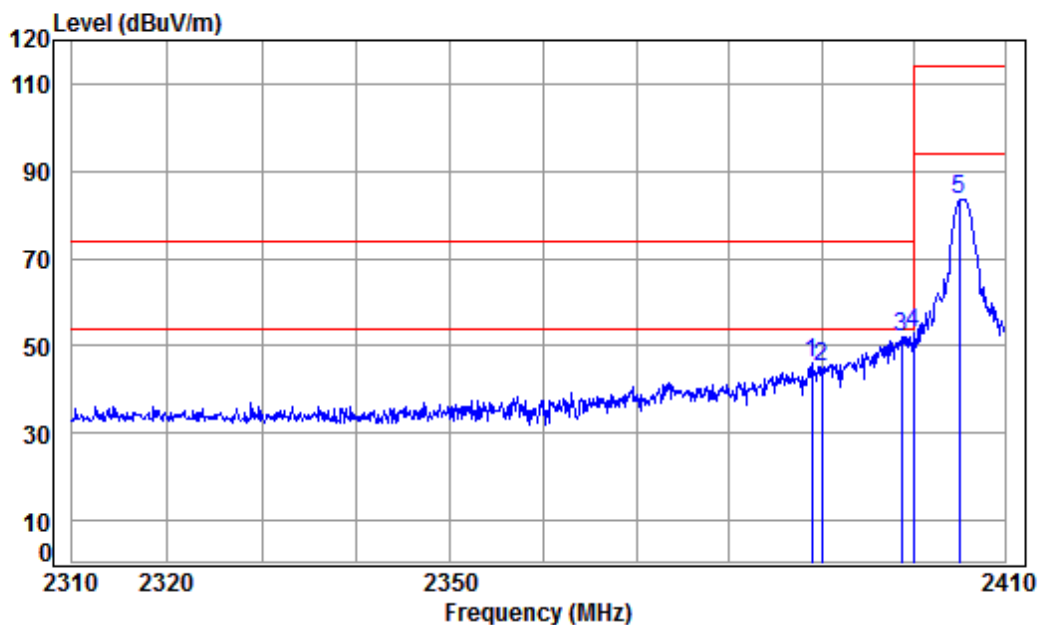
Condition: 3m VERTICAL

Job No : 15040CR

Mode : 2480 Band edge

		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	2480.000	5.59	29.34	41.91	98.45	91.47	114.00	-22.53 peak
2	2483.500	5.60	29.35	41.91	43.98	37.02	54.00	-16.98 Average
3	2483.500	5.60	29.35	41.91	72.50	65.54	74.00	-8.46 peak
4 av	2484.246	5.60	29.35	41.91	44.16	37.20	54.00	-16.80 Average
5 pp	2484.246	5.60	29.35	41.91	72.68	65.72	74.00	-8.28 peak

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



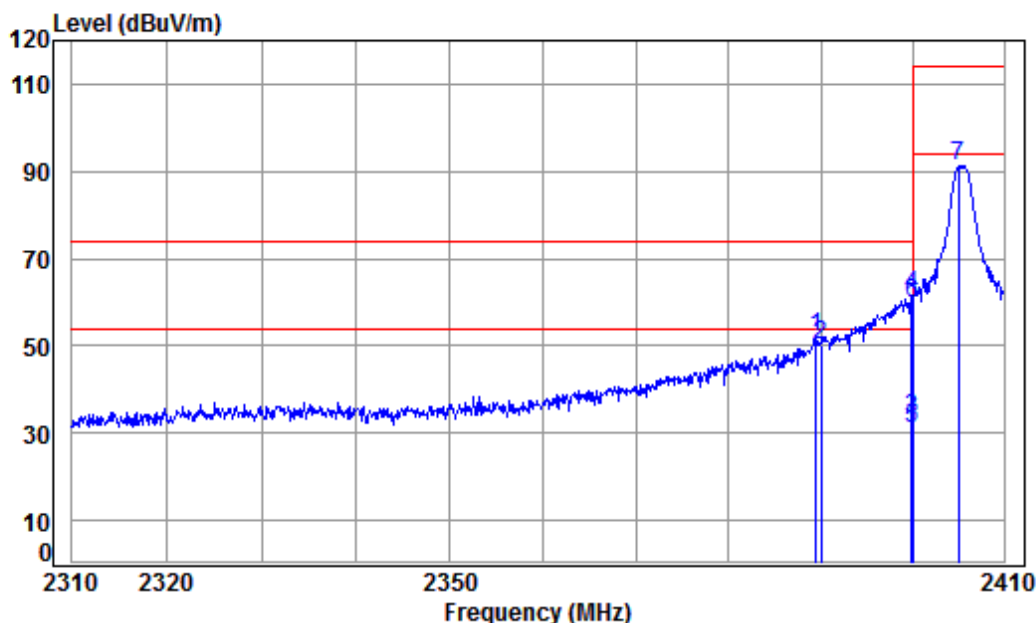
Condition: 3m HORIZONTAL

Job No : 15040CR

Mode : 2405 Band edge

		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	2388.951	5.47	29.07	41.87	53.20	45.87	74.00	-28.13 peak
2	2390.000	5.47	29.08	41.87	52.53	45.21	74.00	-28.79 peak
3	2398.690	5.49	29.10	41.88	59.51	52.22	74.00	-21.78 peak
4 pp	2400.000	5.49	29.11	41.88	60.03	52.75	74.00	-21.25 peak
5	2405.000	5.49	29.12	41.88	90.89	83.62	114.00	-30.38 peak

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



Condition: 3m VERTICAL

Job No : 15040CR

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	2389.457	5.47	29.08	41.87	59.11	51.79	74.00	-22.21	peak
2	2390.000	5.47	29.08	41.87	57.63	50.31	74.00	-23.69	peak
3 av	2399.910	5.49	29.11	41.88	40.41	33.13	54.00	-20.87	Average
4 pp	2399.910	5.49	29.11	41.88	68.93	61.65	74.00	-12.35	peak
5	2400.000	5.49	29.11	41.88	38.34	31.06	54.00	-22.94	Average
6	2400.000	5.49	29.11	41.88	66.86	59.58	74.00	-14.42	peak
7	2405.000	5.49	29.12	41.88	98.44	91.17	114.00	-22.83	peak

Remark:

- 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
- 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. So, only the above measurement data were shown in the report.



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7.4 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

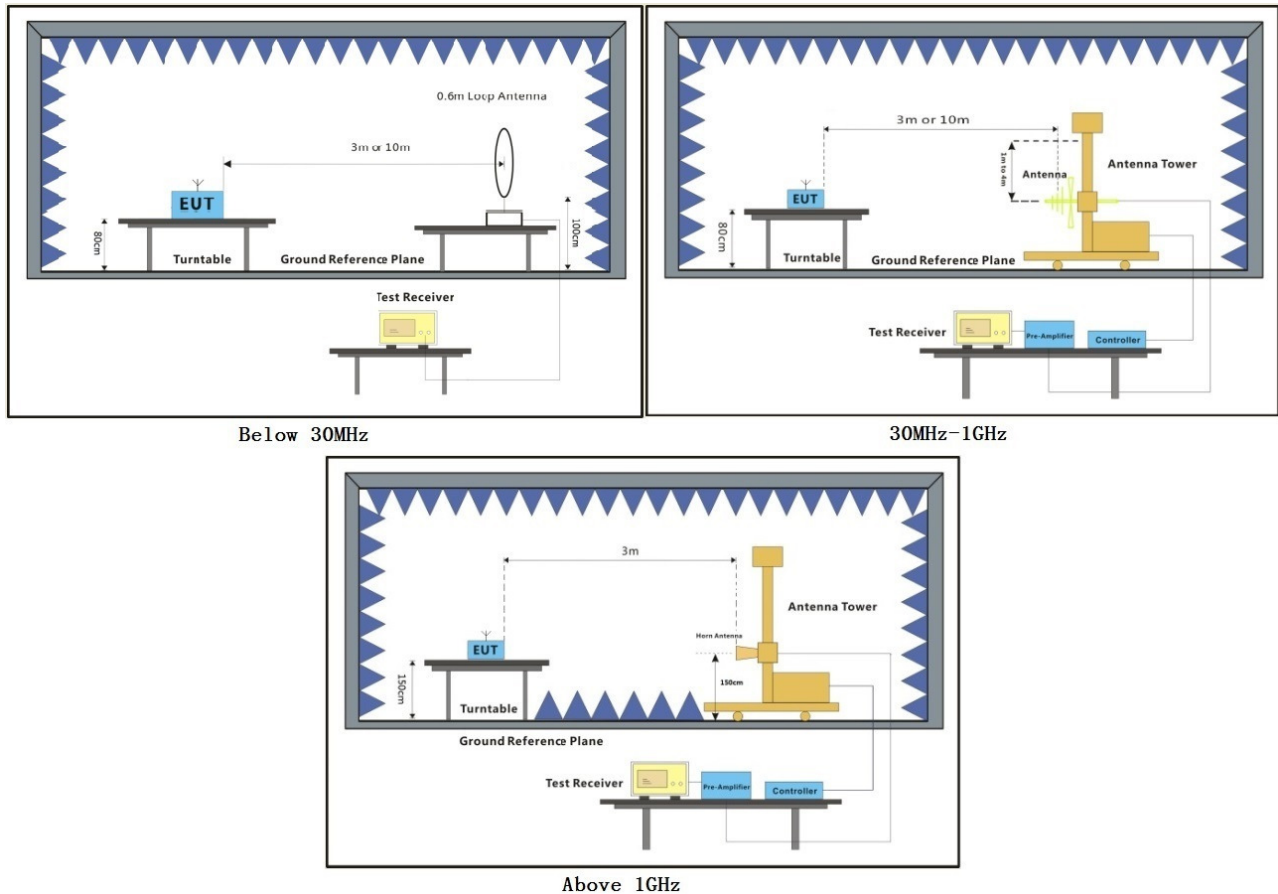
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 25.3 °C Humidity: 55 % RH Atmospheric Pressure: 1005 mbar

Test mode a: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:

- 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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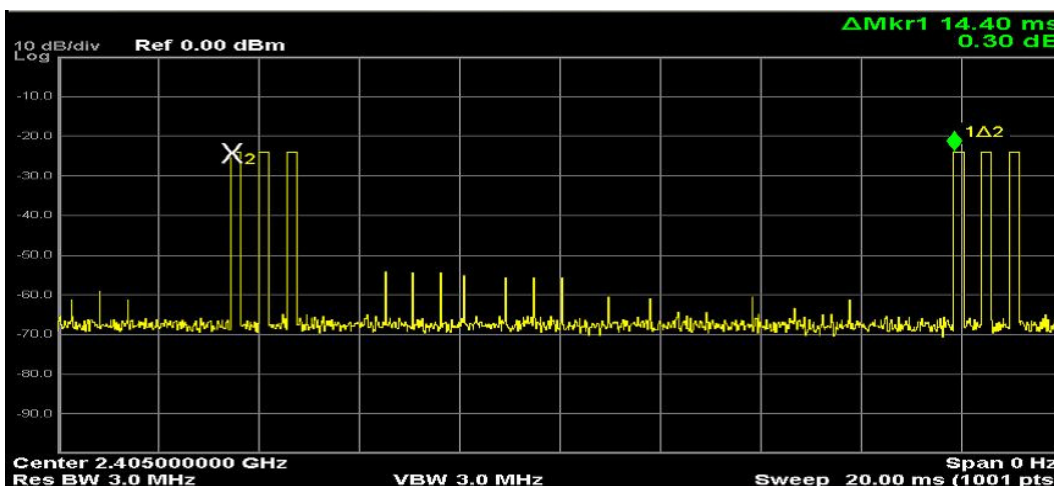
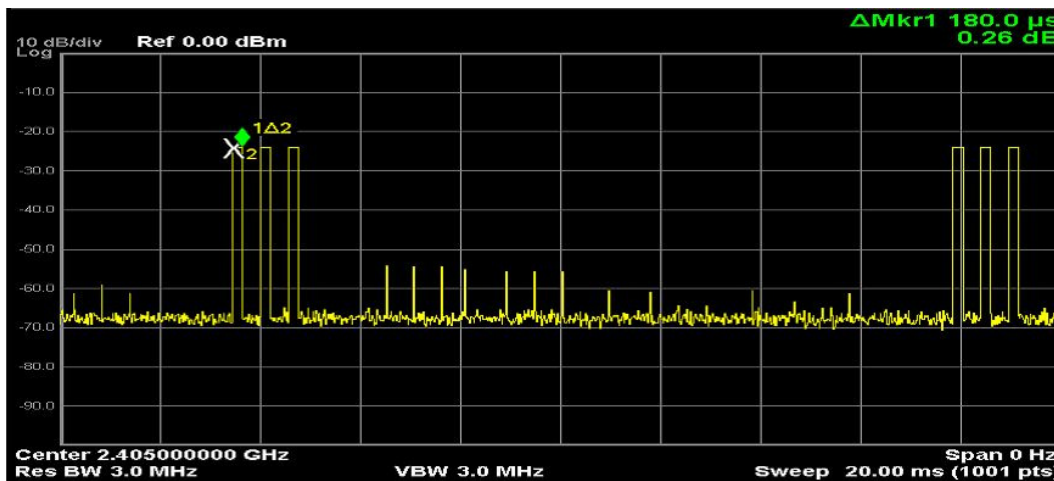
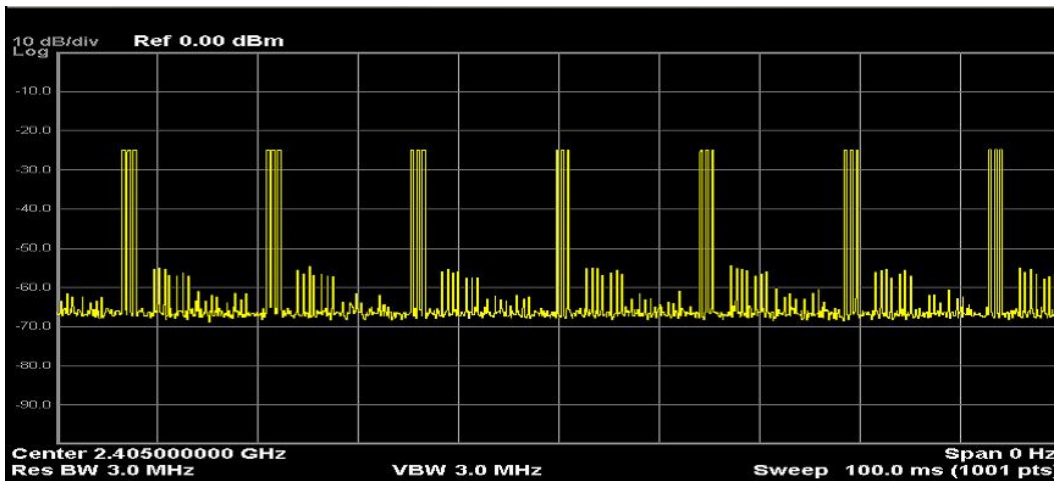


Average value:

Calculate Formula:	Average value=Peak value + PDCF
	PDCF=20 log(Duty cycle)
	Duty cycle= T on time / T period
Test data:	Ton time =0.54ms
	T period =14.4ms
	PDCF value= -28.52dB



Duty cycle test plots:



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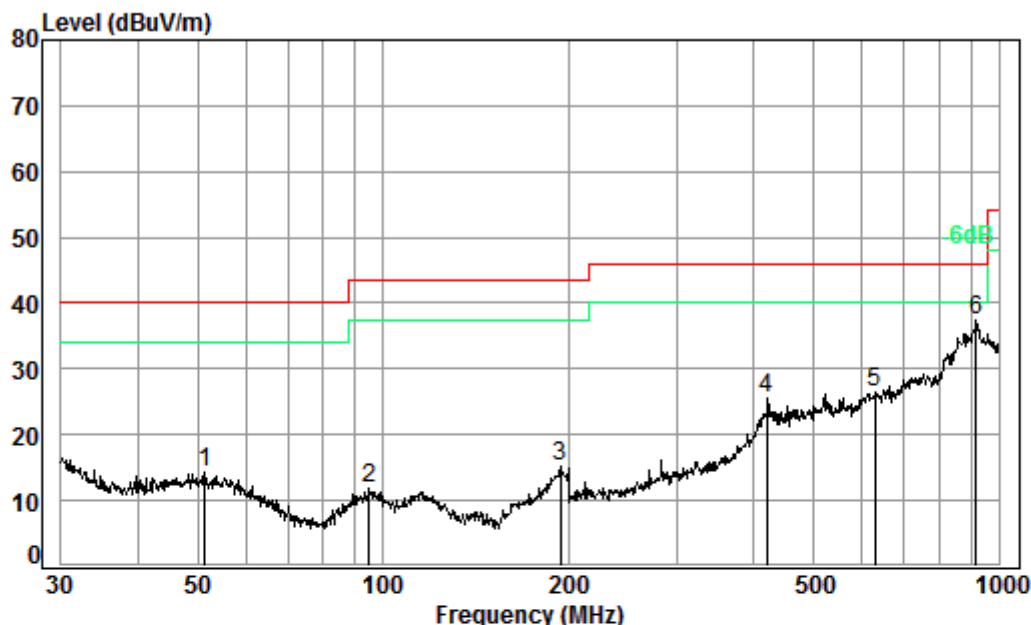
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30MHz~1GHz

QP value:

Mode: a; Polarization: Horizontal



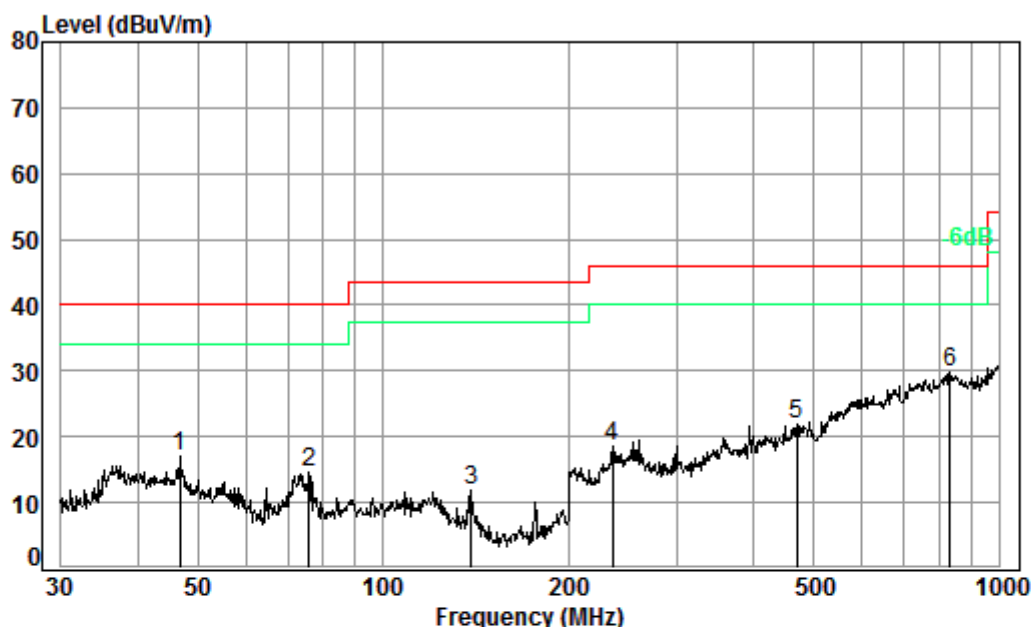
Condition: 3m HORIZONTAL

Job No. : 15040CR

Test mode: a

		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	51.30	0.80	14.06	27.59	26.92	14.19	40.00	-25.81
2	95.09	1.15	13.57	27.51	24.64	11.85	43.50	-31.65
3	194.45	1.39	16.34	27.53	24.92	15.12	43.50	-28.38
4	420.58	2.29	22.89	27.76	28.18	25.60	46.00	-20.40
5	629.48	2.76	27.00	27.65	24.31	26.42	46.00	-19.58
6 pp	919.29	3.62	29.90	27.02	30.80	37.30	46.00	-8.70

Mode: a; Polarization: Vertical



Condition: 3m VERTICAL

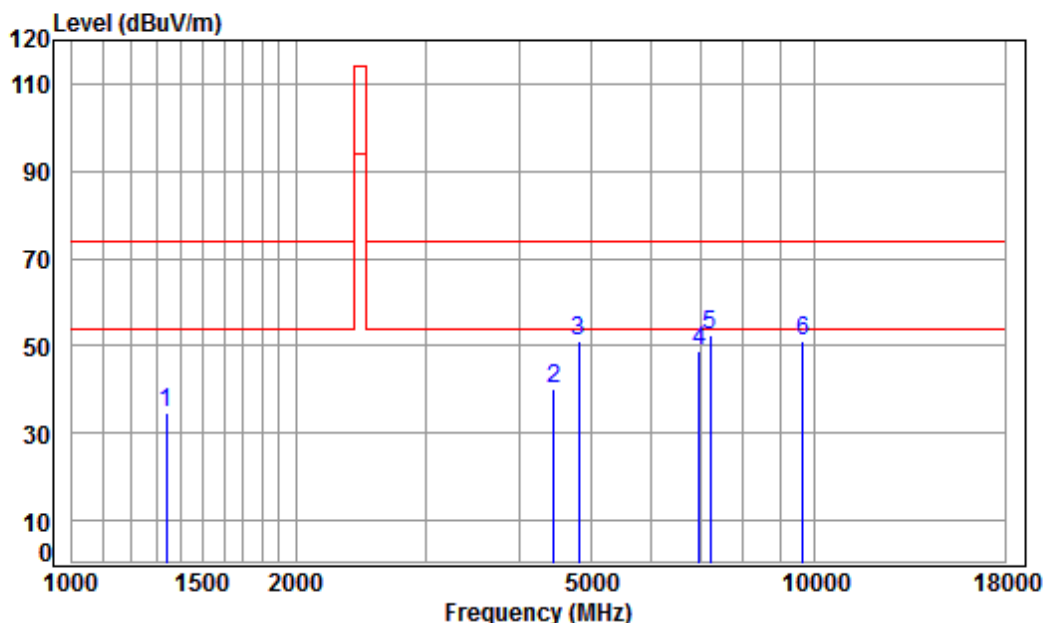
Job No. : 15040CR

Test mode: a

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	46.83	0.74	15.17	27.61	28.59	16.89	40.00	-23.11
2	75.98	0.98	12.31	27.51	28.94	14.72	40.00	-25.28
3	139.36	1.30	13.68	27.52	24.51	11.97	43.50	-31.53
4	235.82	1.60	18.48	27.53	25.96	18.51	46.00	-27.49
5	470.52	2.49	24.00	27.84	23.35	22.00	46.00	-24.00
6 pp	833.32	3.34	28.95	27.30	24.93	29.92	46.00	-16.08

Above 1GHz

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



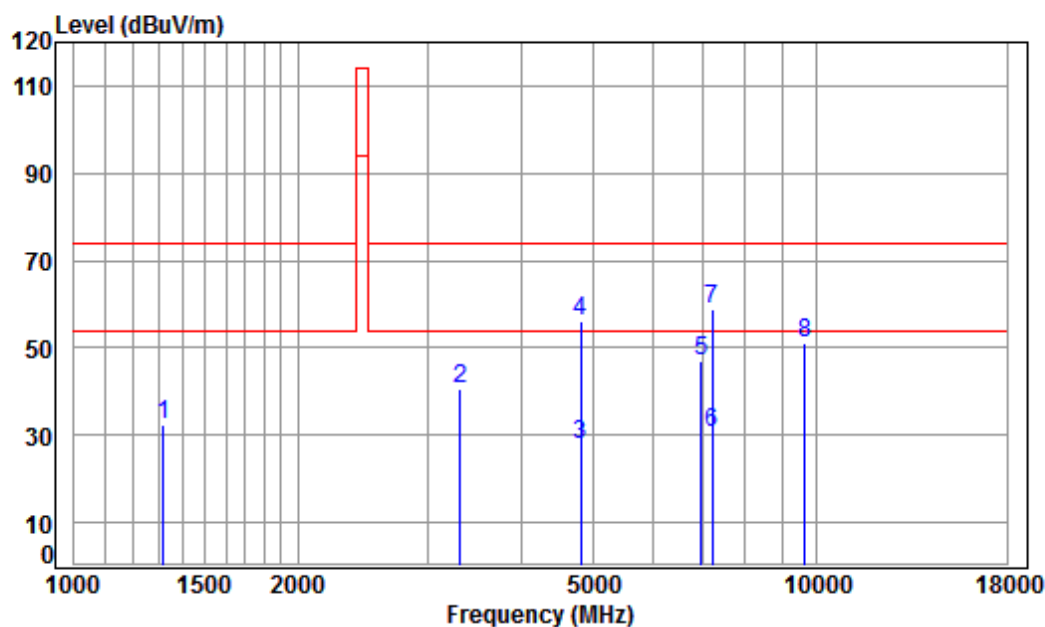
Condition: 3m HORIZONTAL

Job No : 15040CR

Mode : 2405 TX SE

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1339.006	4.94	25.13	41.29	45.80	34.58	74.00	-39.42	peak
2	4456.315	7.51	33.60	42.41	41.47	40.17	74.00	-33.83	peak
3	4810.000	7.90	34.17	42.47	51.61	51.21	74.00	-22.79	peak
4	6974.982	10.20	36.43	40.87	43.00	48.76	74.00	-25.24	peak
5 pp	7215.000	10.07	36.41	40.71	46.66	52.43	74.00	-21.57	peak
6	9620.000	10.75	37.52	37.72	40.48	51.03	74.00	-22.97	peak

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



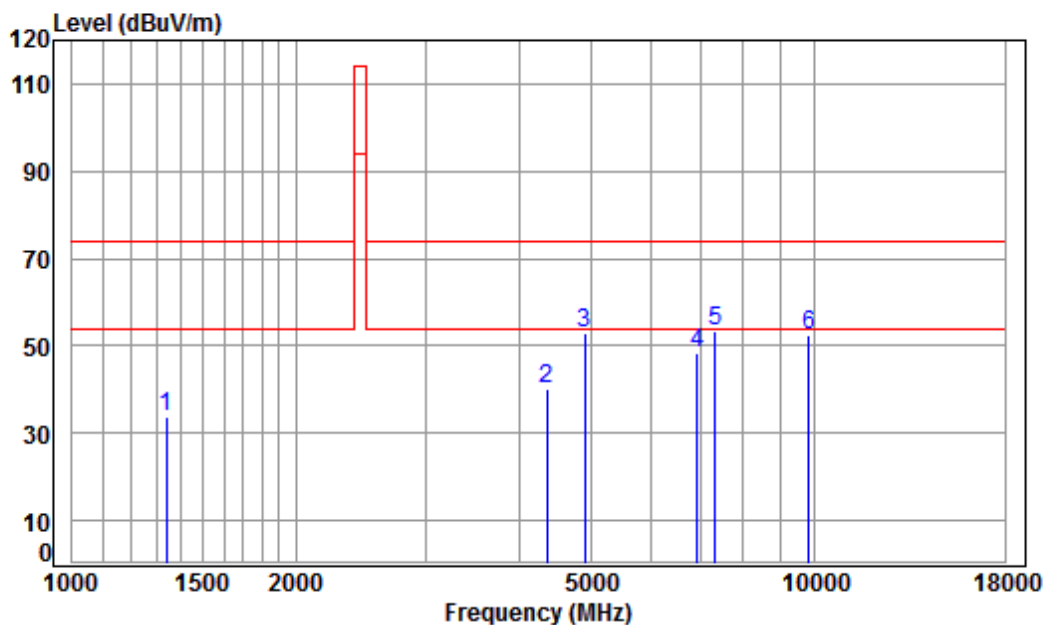
Condition: 3m VERTICAL

Job No : 15040CR

Mode : 2405 TX SE

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1319.794	4.87	25.04	41.28	43.73	32.36	74.00	-41.64	peak
2	3308.894	6.29	31.87	42.18	44.49	40.47	74.00	-33.53	peak
3	4810.000	7.90	34.17	42.47	28.19	27.79	54.00	-26.21	Average
4	4810.000	7.90	34.17	42.47	56.71	56.31	74.00	-17.69	peak
5	6974.982	10.20	36.43	40.87	41.14	46.90	74.00	-27.10	peak
6 av	7215.000	10.07	36.41	40.71	24.65	30.42	54.00	-23.58	Average
7 pp	7215.000	10.07	36.41	40.71	53.17	58.94	74.00	-15.06	peak
8	9620.000	10.75	37.52	37.72	40.59	51.14	74.00	-22.86	peak

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



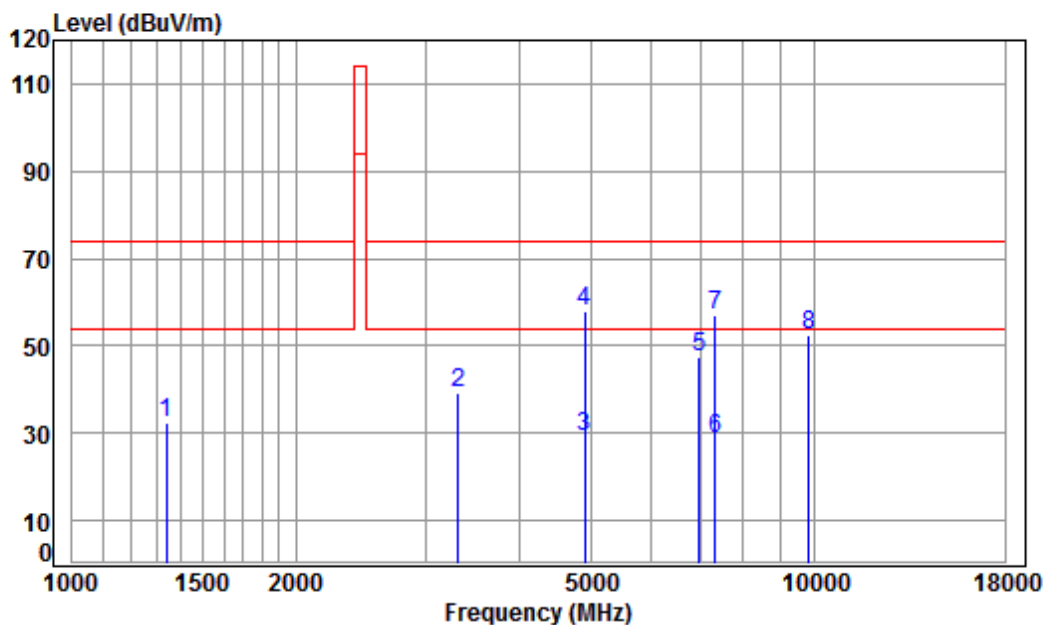
Condition: 3m HORIZONTAL

Job No : 15040CR

Mode : 2448 TX SE

		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	1339.006	4.94	25.13	41.29	45.11	33.89	74.00	-40.11 peak
2	4354.454	7.40	33.60	42.39	41.45	40.06	74.00	-33.94 peak
3	4896.000	7.98	34.32	42.48	53.20	53.02	74.00	-20.98 peak
4	6934.778	10.31	36.32	40.90	42.47	48.20	74.00	-25.80 peak
5 pp	7344.000	10.04	36.36	40.62	47.81	53.59	74.00	-20.41 peak
6	9792.000	10.84	37.56	37.48	41.42	52.34	74.00	-21.66 peak

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



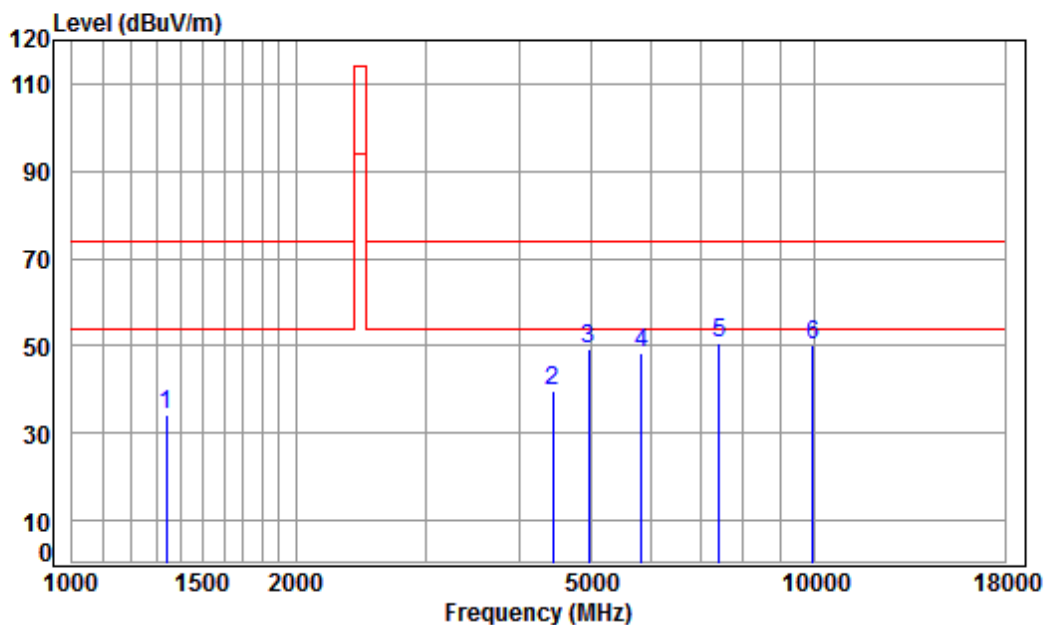
Condition: 3m VERTICAL

Job No : 15040CR

Mode : 2448 TX SE

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1339.006	4.94	25.13	41.29	43.62	32.40	74.00	-41.60	peak
2	3308.894	6.29	31.87	42.18	43.10	39.08	74.00	-34.92	peak
3	av 4896.000	7.98	34.32	42.48	29.49	29.31	54.00	-24.69	Average
4	pp 4896.000	7.98	34.32	42.48	58.01	57.83	74.00	-16.17	peak
5	6974.982	10.20	36.43	40.87	41.52	47.28	74.00	-26.72	peak
6	7344.000	10.04	36.36	40.62	22.77	28.55	54.00	-25.45	Average
7	7344.000	10.04	36.36	40.62	51.29	57.07	74.00	-16.93	peak
8	9792.000	10.84	37.56	37.48	41.42	52.34	74.00	-21.66	peak

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



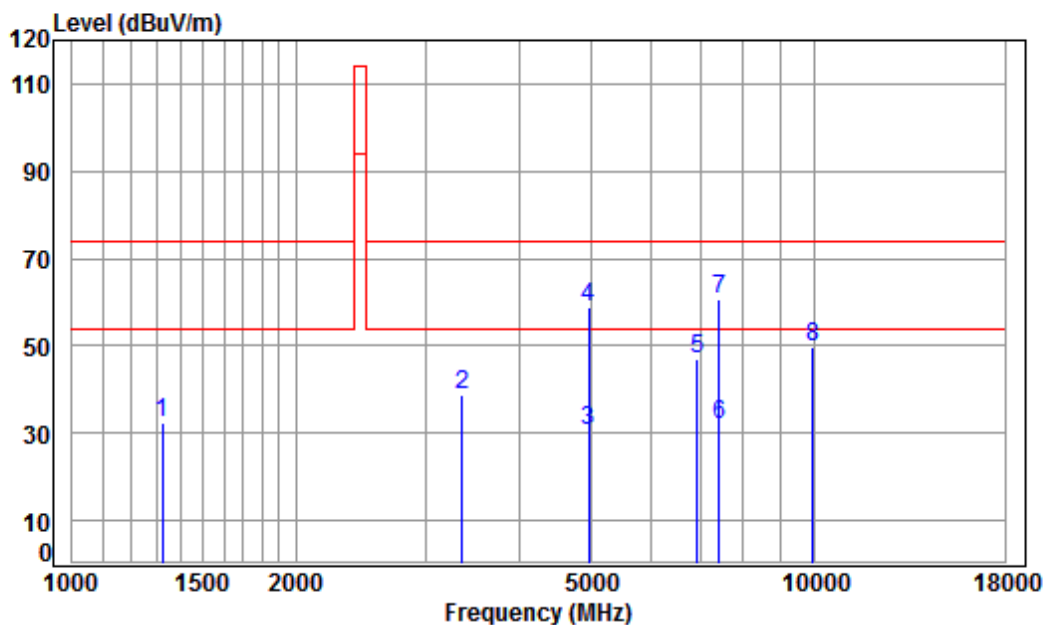
Condition: 3m HORIZONTAL

Job No : 15040CR

Mode : 2480 TX SE

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1339.006	4.94	25.13	41.29	45.22	34.00	74.00	-40.00	peak
2	4443.453	7.50	33.60	42.41	40.96	39.65	74.00	-34.35	peak
3	4960.000	8.05	34.43	42.49	49.11	49.10	74.00	-24.90	peak
4	5847.517	10.06	34.61	41.73	45.58	48.52	74.00	-25.48	peak
5 pp	7440.000	10.02	36.32	40.56	44.99	50.77	74.00	-23.23	peak
6	9920.000	10.90	37.58	37.31	38.93	50.10	74.00	-23.90	peak

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



Condition: 3m VERTICAL

Job No : 15040CR

Mode : 2480 TX SE

		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	1323.614	4.88	25.06	41.28	43.82	32.48	74.00	-41.52	peak
2	3347.371	6.32	31.94	42.19	42.63	38.70	74.00	-35.30	peak
3	4960.000	8.05	34.43	42.49	30.57	30.56	54.00	-23.44	Average
4	4960.000	8.05	34.43	42.49	59.09	59.08	74.00	-14.92	peak
5	6934.778	10.31	36.32	40.90	41.18	46.91	74.00	-27.09	peak
6 av	7440.000	10.02	36.32	40.56	26.31	32.09	54.00	-21.91	Average
7 pp	7440.000	10.02	36.32	40.56	54.83	60.61	74.00	-13.39	peak
8	9920.000	10.90	37.58	37.31	38.60	49.77	74.00	-24.23	peak



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 -

