

TEST REPORT

Application No.: SZEM1904012801CR(SGS SZ No.:T51910230123EM)
Applicant: DOBLEEAGLE INDUSTRY (CHINA) LIMITED
Address of Applicant: XINGDA INDUSTRIAL PARK, CHENGHAI, SHANTOU CITY, GUANGDONG PROVINCE, China
Manufacturer: DOBLEEAGLE INDUSTRY (CHINA) LIMITED
Supplier: DOBLEEAGLE INDUSTRY (CHINA) LIMITED
Equipment Under Test (EUT):
EUT Name: Radio Control Toys
Model No.: E527-003
Requested Age Grading: 3+
Country of Origin: China
FCC ID: 2AAFASY-E527-003-02
Standard(s) : 47 CFR Part 15, Subpart C 15.249
Date of Receipt: 2019-04-15
Date of Test: 2019-04-18 to 2019-04-28
Date of Issue: 2019-05-07

| | |
|---------------------|--------------|
| Test Result: | Pass* |
|---------------------|--------------|

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

Keny Xu

Keny Xu
EMC Laboratory Manager



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

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| Revision Record | | | | |
|-----------------|---------|------------|----------|----------|
| Version | Chapter | Date | Modifier | Remark |
| 01 | | 2019-05-07 | | Original |
| | | | | |
| | | | | |

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|--------------------------|--|---|--|
| Authorized for issue by: | | | |
| | |  | |
| | | <hr/> | |
| | | Gebin Sun /Project Engineer | |
| | |  | |
| | | <hr/> | |
| | | 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 6.10.5 | 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 |

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4 General Information

4.1 Details of E.U.T.

| | |
|----------------------|--|
| Power supply: | 3V DC(1.5V x 2 "AA" Size Batteries) for TX |
| Operating Frequency: | 2.4GHz(2405MHz-2475MHz) |
| Channel Spacing | 1MHz |
| Channel number: | 71 |
| Modulation Type: | GFSK |
| Sample Type: | Portable production |
| Antenna Type: | Integral |
| Antenna Gain: | 0dBi |

4.2 Description of Support Units

The EUT has been tested as an independent unit.

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 | RF conducted power | $\pm 0.75\text{dB}$ |
| 5 | RF power density | $\pm 2.84\text{dB}$ |
| 6 | Conducted Spurious emissions | $\pm 0.75\text{dB}$ |
| 7 | RF Radiated power | $\pm 4.5\text{dB}$ (below 1GHz) |
| | | $\pm 4.8\text{dB}$ (above 1GHz) |
| 8 | Radiated Spurious emission test | $\pm 4.5\text{dB}$ (Below 1GHz) |
| | | $\pm 4.8\text{dB}$ (Above 1GHz) |
| 9 | Temperature test | $\pm 1^\circ\text{C}$ |
| 10 | Humidity test | $\pm 3\%$ |
| 11 | Supply voltages | $\pm 1.5\%$ |
| 12 | 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 | FSU43 | SEM004-08 | 2019-04-01 | 2020-03-31 |
| Measurement Software | JS Tonscend | JS1120-2 BT/WIFI V2. | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM031-01 | 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 | Agilent Technologies 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 |



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| 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 |
| 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 |

| Radiated 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 | 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 |



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| | | | | | |
|--------------------------------|--|-------------|-----------|------------|------------|
| 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 |

| RE in Chamber(30MHz-1GHz) | | | | | |
|-----------------------------------|----------------------|-----------------|---------------|------------|---------------|
| 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

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 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

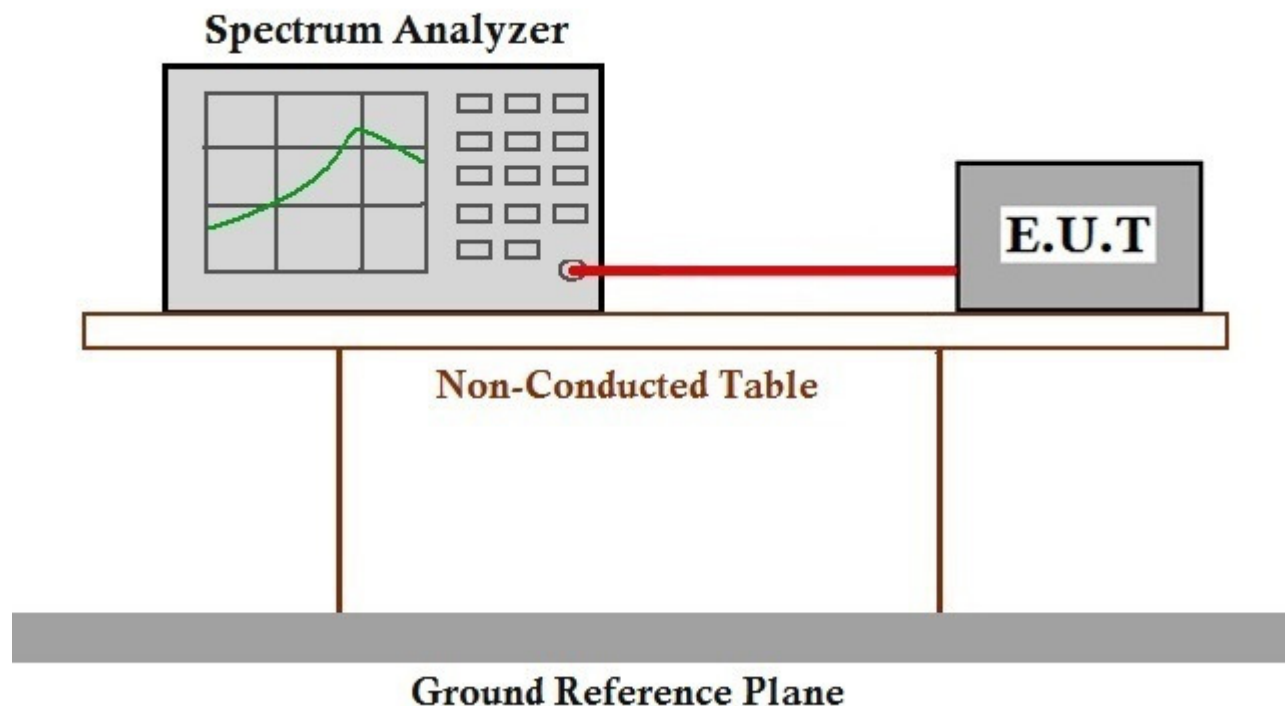
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 23.4 °C Humidity: 47.2 % RH Atmospheric Pressure: 1015 mbar

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

7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data

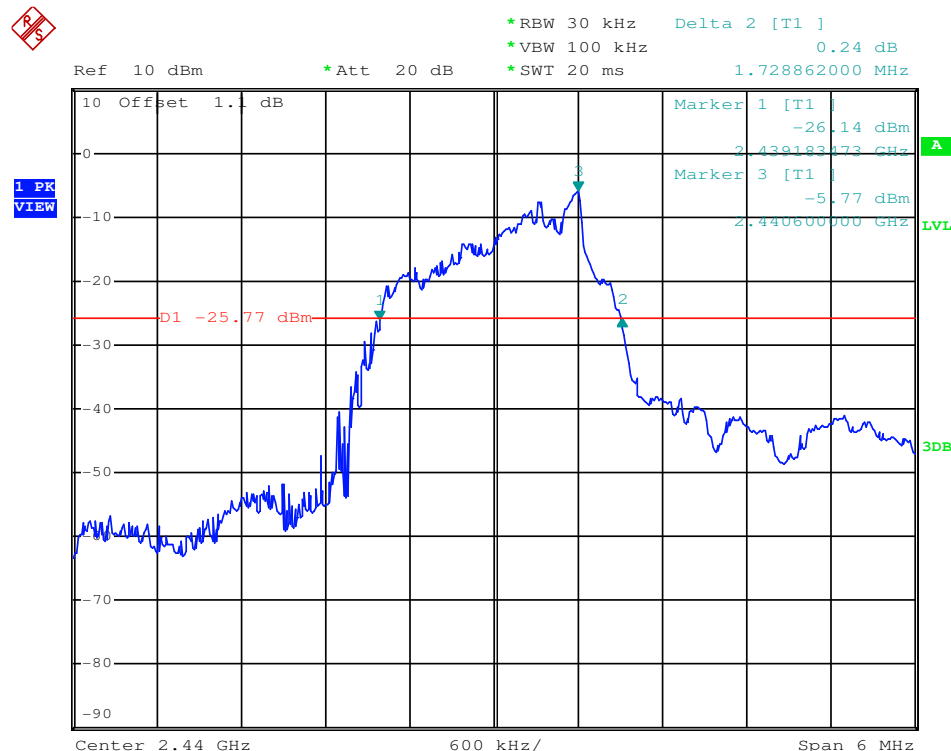
| Test channel | 20dB bandwidth (MHz) | Results |
|--------------|----------------------|---------|
| Lowest | 2.390 | Pass |
| Middle | 1.729 | Pass |
| Highest | 1.731 | Pass |



Mode:b; Channel:Low



Mode:b; Channel:middle

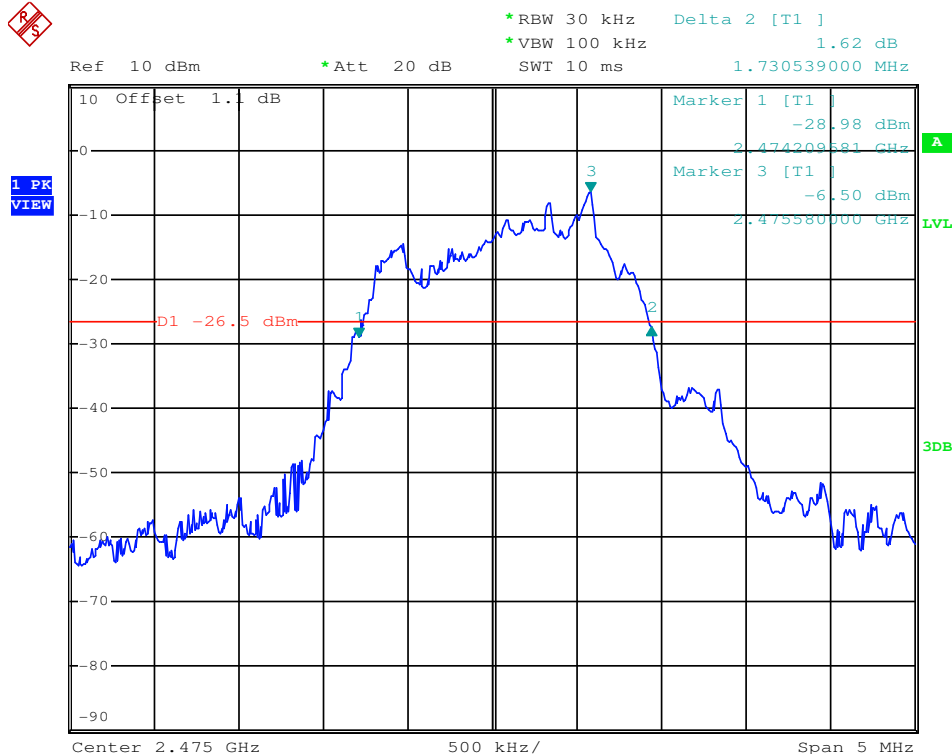


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Mode:b; Channel:High



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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.

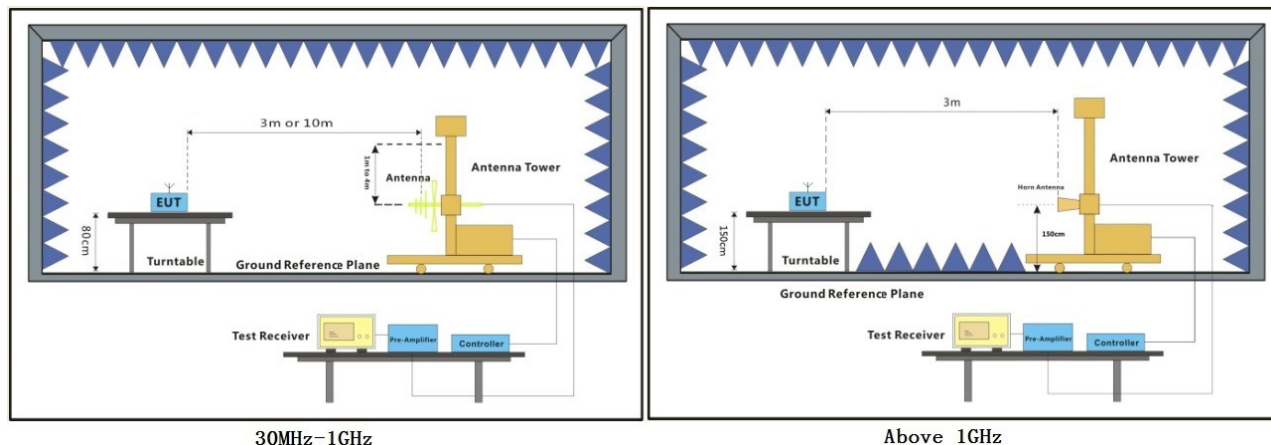
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 24.2 °C Humidity: 55 % RH Atmospheric Pressure: 1015 mbar

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

7.2.2 Test Setup Diagram

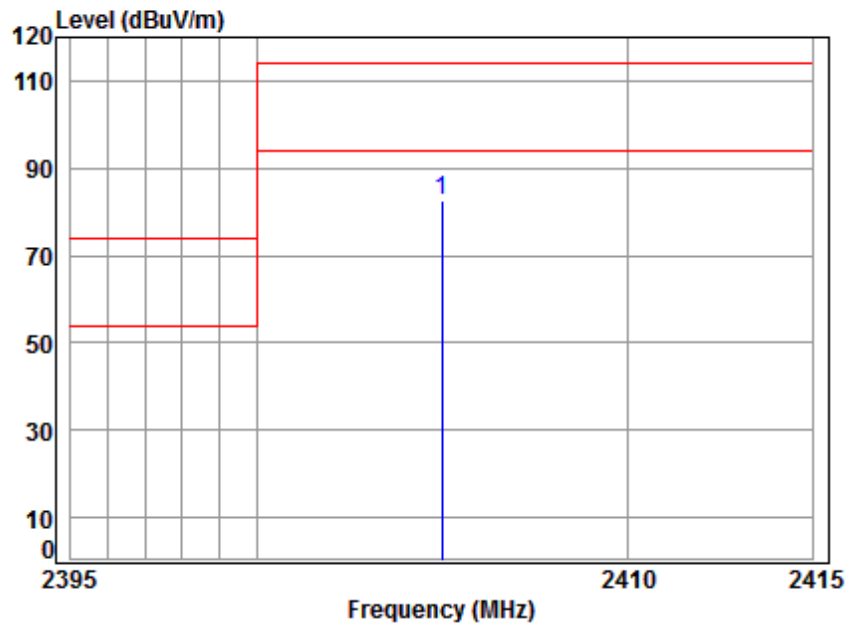


7.2.3 Measurement Procedure and Data

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



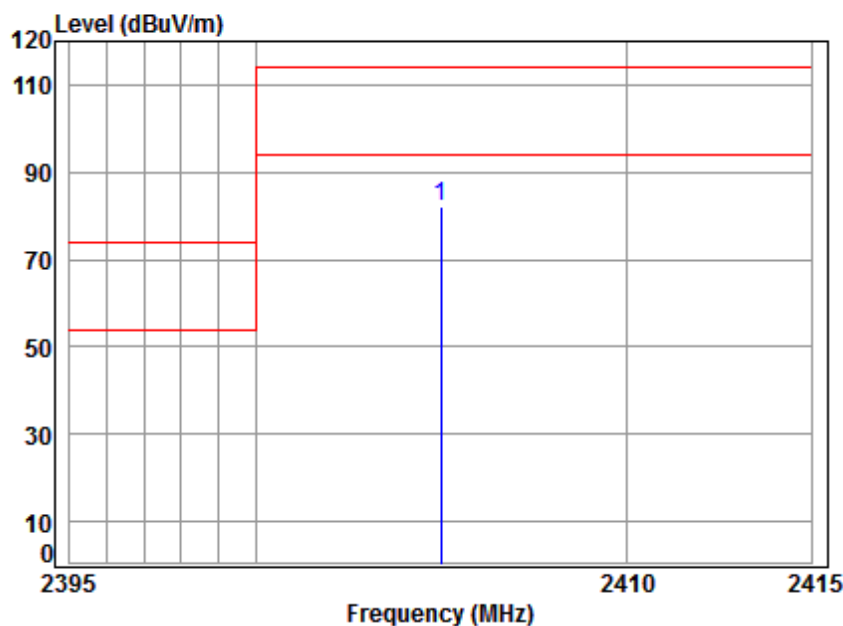
Site : chamber
Condition: 3m HORIZONTAL
Job No : 12801CR
Mode : 2405 Field strength

| | 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 2405.000 | 5.49 | 28.54 | 41.18 | 89.54 | 82.39 | 114.00 | -31.61 | peak |



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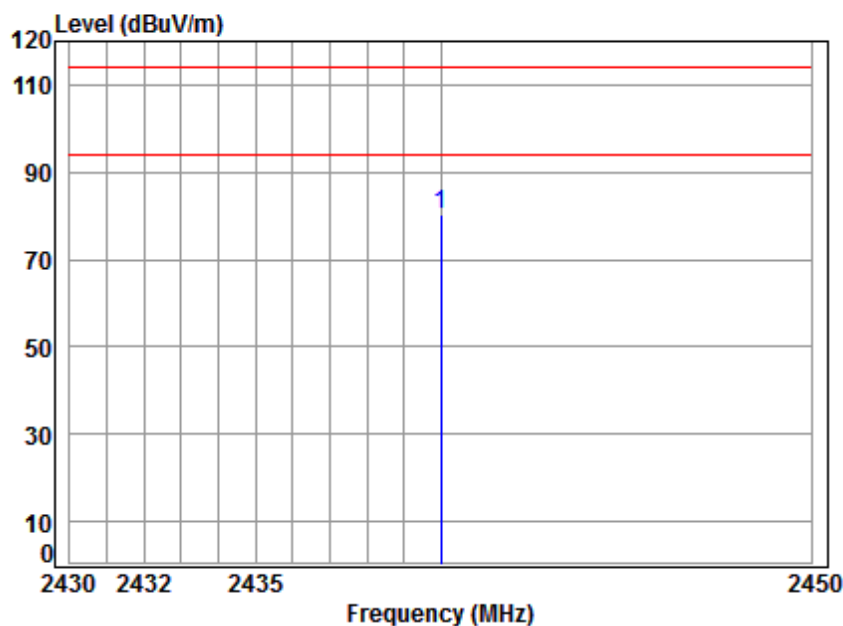
Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 12801CR
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 2405.000 | 5.49 | 28.54 | 41.18 | 89.39 | 82.24 | 114.00 | -31.76 | peak |

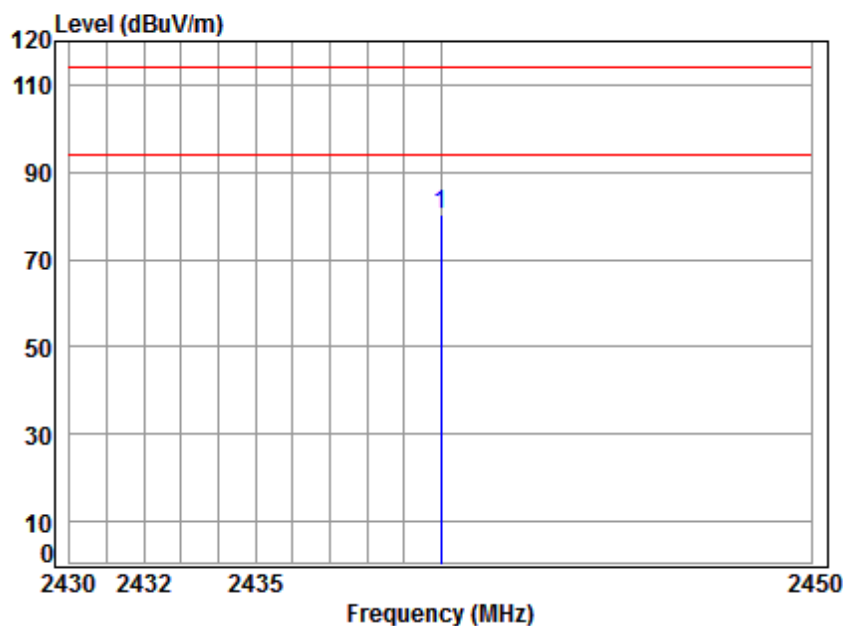
Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:middle



Site : chamber
Condition: 3m HORIZONTAL
Job No : 12801CR
Mode : 2440 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 2440.000 | 5.54 | 28.60 | 41.19 | 87.20 | 80.15 | 114.00 | -33.85 | peak |

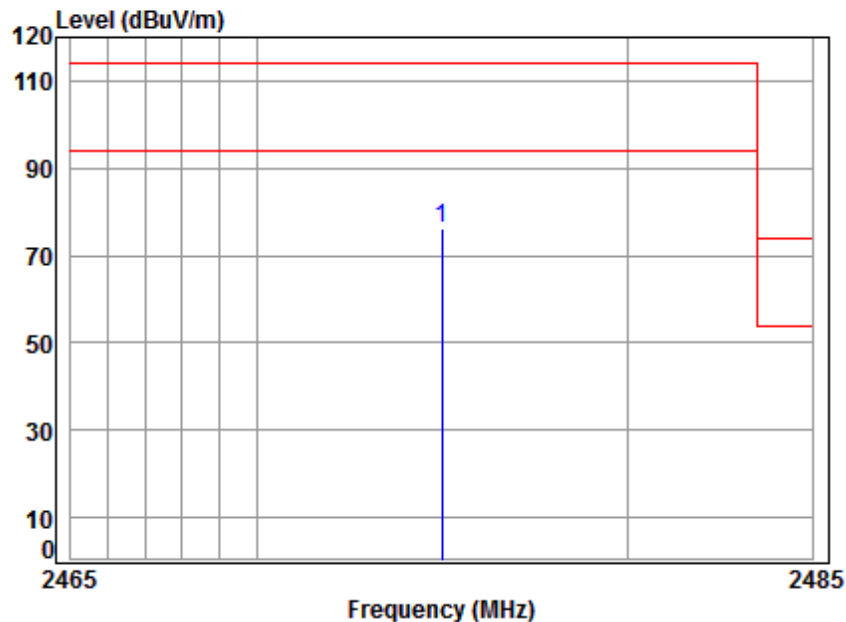
Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:middle



Site : chamber
Condition: 3m VERTICAL
Job No : 12801CR
Mode : 2440 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 2440.000 | 5.54 | 28.60 | 41.19 | 87.36 | 80.31 | 114.00 | -33.69 | peak |

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

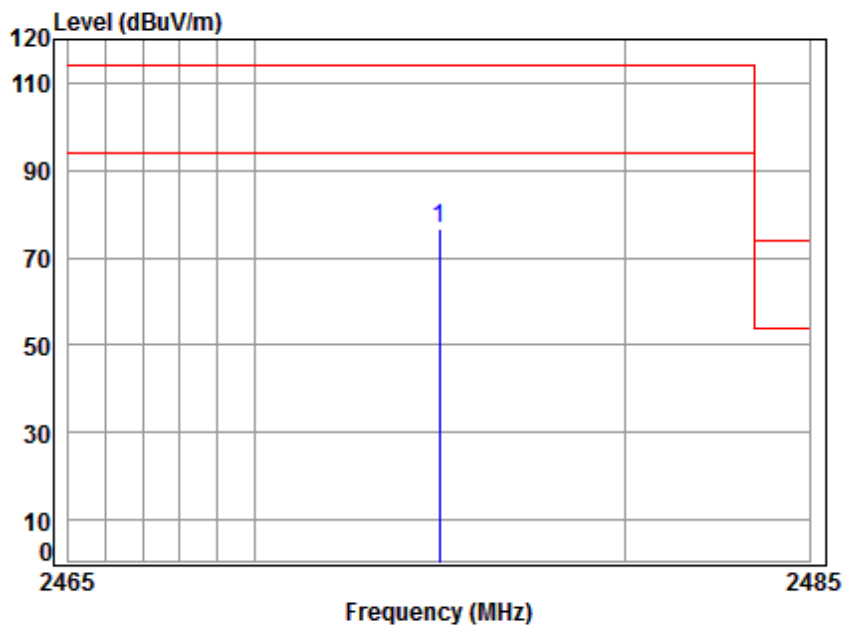


Site : chamber
Condition: 3m HORIZONTAL
Job No : 12801CR
Mode : 2475 Field strength

| | 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 2475.000 | 5.59 | 28.66 | 41.21 | 83.23 | 76.27 | 114.00 | -37.73 | peak |



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



Site : chamber
Condition: 3m VERTICAL
Job No : 12801CR
Mode : 2475 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 2475.000 | 5.59 | 28.66 | 41.21 | 83.76 | 76.80 | 114.00 | -37.20 | 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 6.10.5
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.

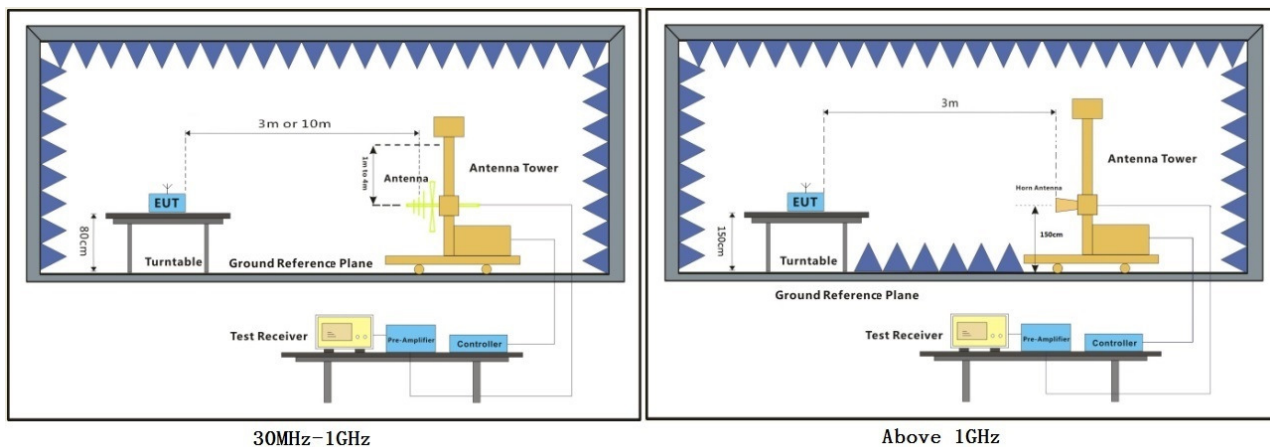
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 20.8 °C Humidity: 59.6 % RH Atmospheric Pressure: 1015 mbar

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

7.3.2 Test Setup Diagram

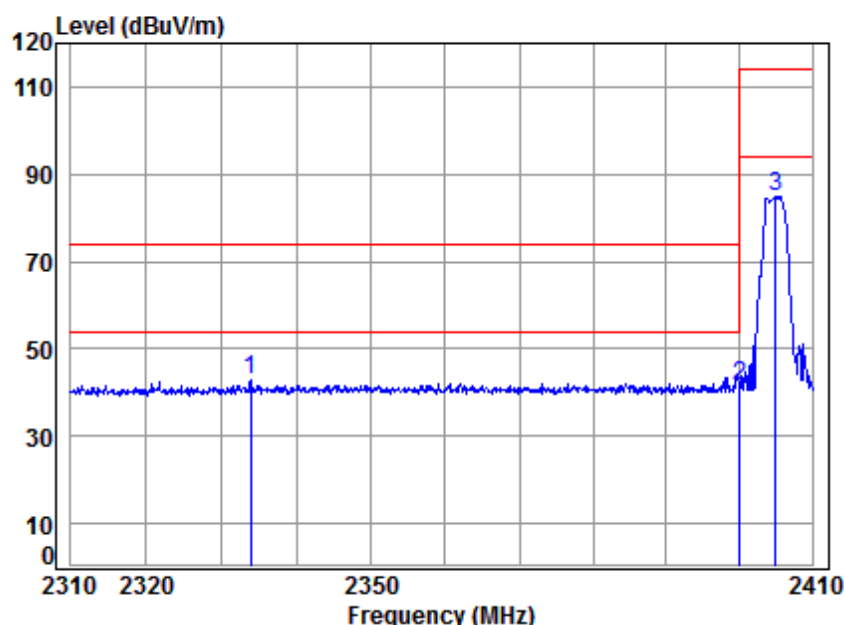


7.3.3 Measurement Procedure and Data

- 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

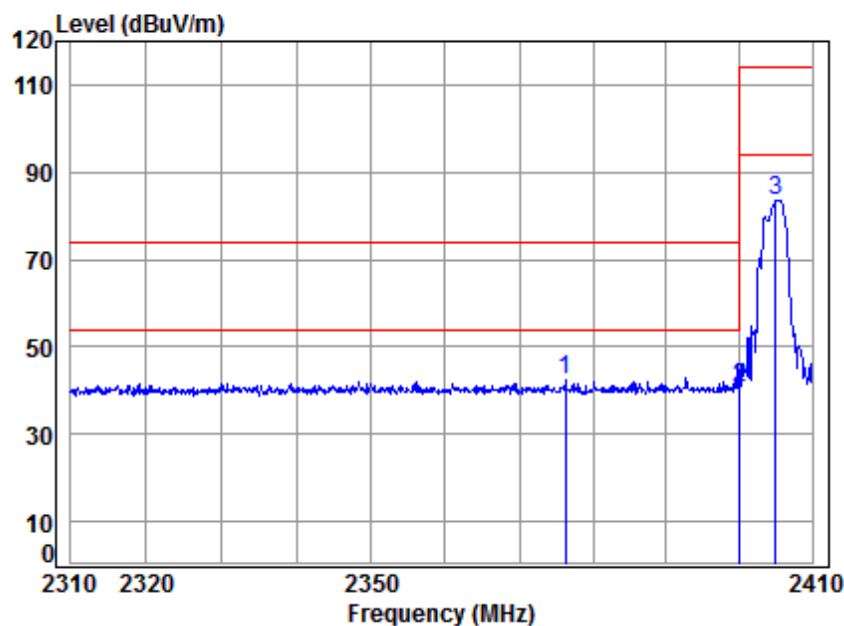
Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 12801CR
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 2333.912 | 5.40 | 28.42 | 41.15 | 50.27 | 42.94 | 74.00 | -31.06 | peak |
| 2 2400.000 | 5.49 | 28.54 | 41.18 | 48.79 | 41.64 | 74.00 | -32.36 | peak |
| 3 2405.000 | 5.50 | 28.54 | 41.18 | 91.83 | 84.69 | 114.00 | -29.31 | peak |

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



Site : chamber
Condition: 3m VERTICAL
Job No : 12801CR
Mode : 2405 Band edge

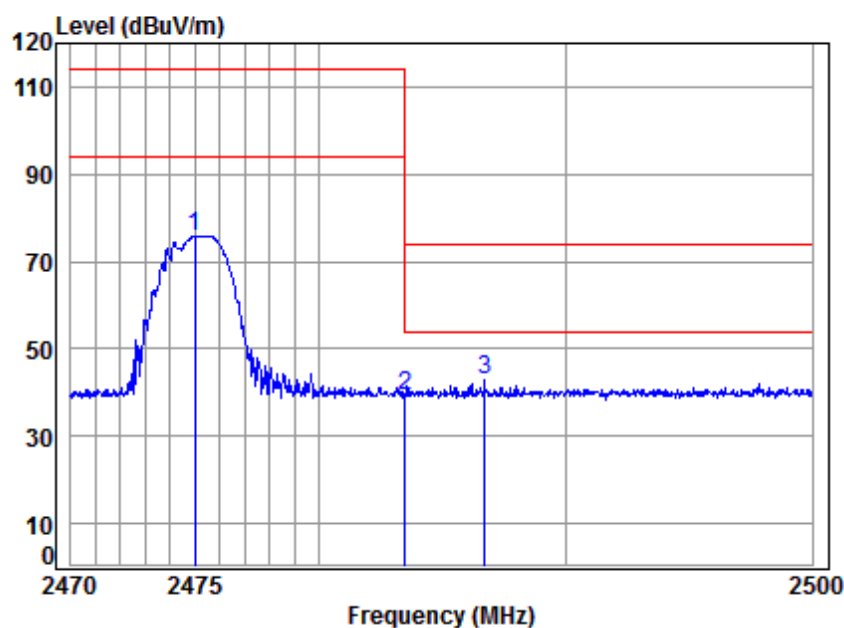
| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|----------|------------|------------|---------------|------------|--------|------------|------------|--------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 2376.228 | 5.46 | 28.50 | 41.17 | 49.67 | 42.46 | 74.00 | -31.54 | peak |
| 2 | 2400.000 | 5.49 | 28.54 | 41.18 | 47.73 | 40.58 | 74.00 | -33.42 | peak |
| 3 | 2405.000 | 5.49 | 28.54 | 41.18 | 90.55 | 83.40 | 114.00 | -30.60 | peak |



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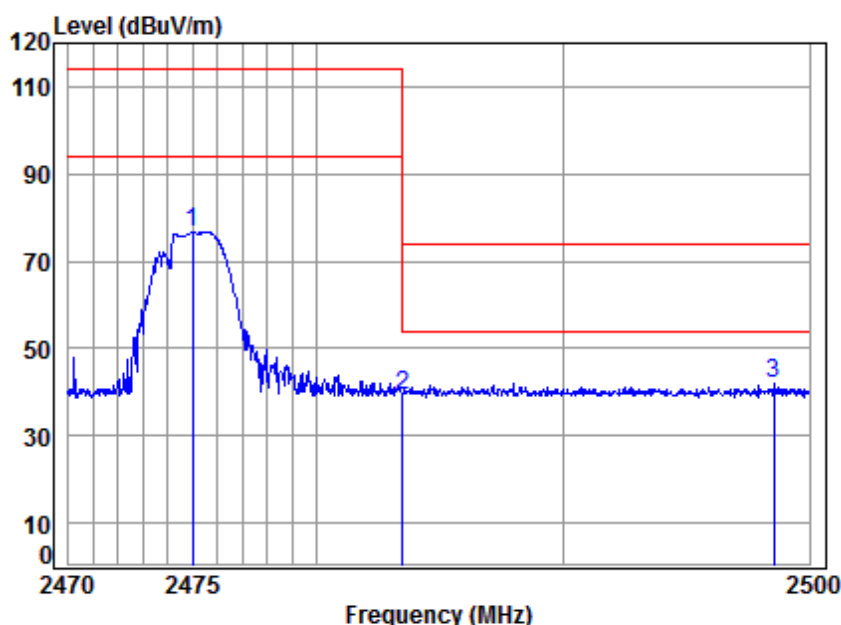
Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 12801CR
Mode : 2475 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 | 2475.000 | 5.59 | 28.66 | 41.21 | 82.69 | 75.73 | 114.00 | -38.27 | peak |
| 2 | 2483.500 | 5.60 | 28.67 | 41.21 | 46.38 | 39.44 | 74.00 | -34.56 | peak |
| 3 | 2486.695 | 5.60 | 28.68 | 41.21 | 49.60 | 42.67 | 74.00 | -31.33 | peak |

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



Site : chamber
Condition: 3m VERTICAL
Job No : 12801CR
Mode : 2475 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 | 2475.000 | 5.59 | 28.66 | 41.21 | 83.57 | 76.61 | 114.00 | -37.39 peak |
| 2 | 2483.500 | 5.60 | 28.67 | 41.21 | 46.19 | 39.25 | 74.00 | -34.75 peak |
| 3 | 2498.552 | 5.62 | 28.70 | 41.22 | 49.09 | 42.19 | 74.00 | -31.81 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:

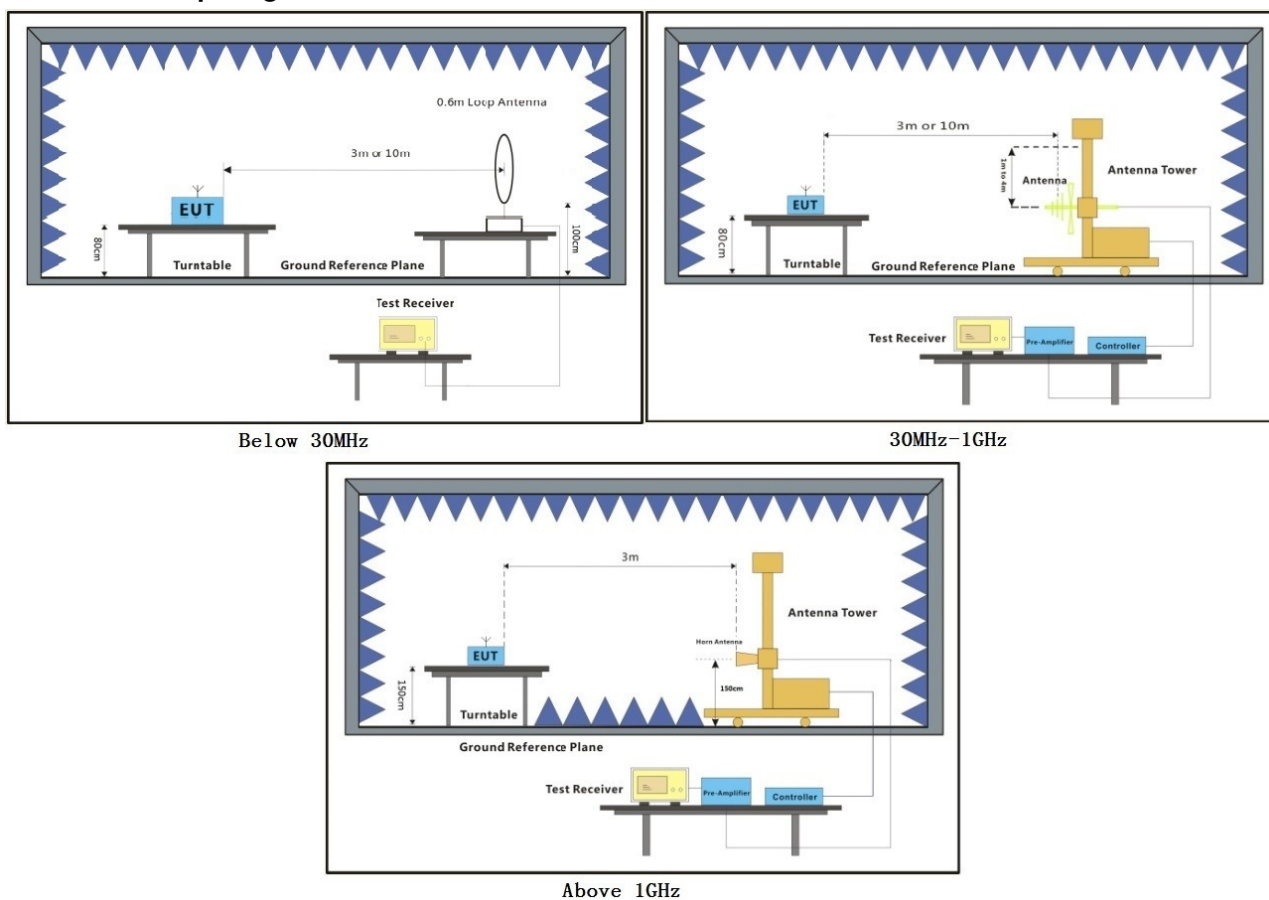
| Frequency(MHz) | Field strength (microvolts/meter) | Limit (dBuV/m) | Detector | Measurement Distance (meters) |
|----------------|--------------------------------------|-------------------|----------|----------------------------------|
| 0.009-0.490 | 2400/F(kHz) | - | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | - | 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: 24.2 °C Humidity: 55 % RH Atmospheric Pressure: 1015 mbar
Test mode b: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.



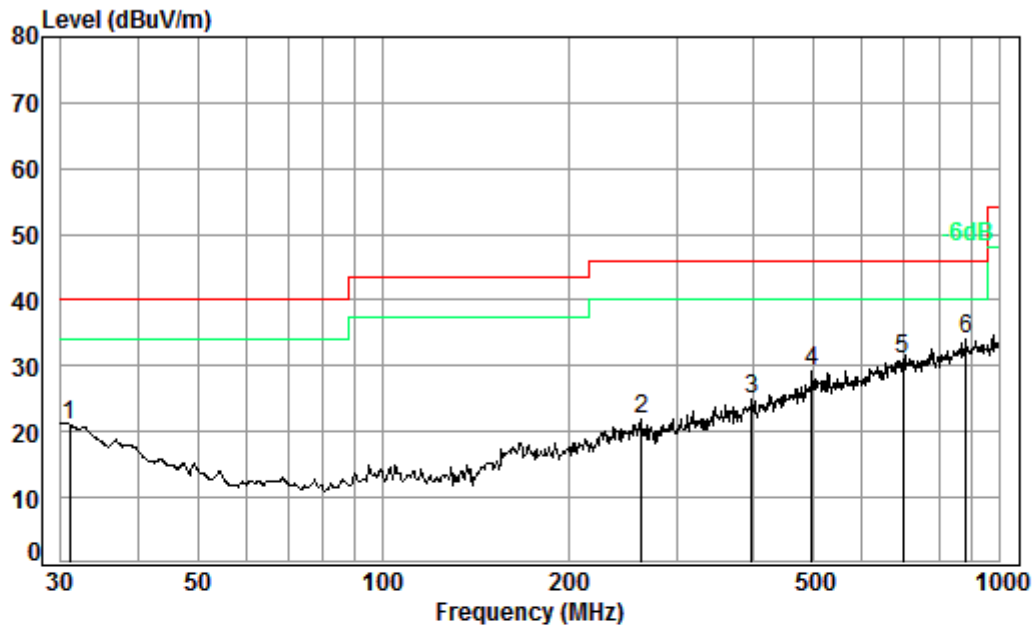
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Radiated emission 30MHz~1GHz QP value:

Mode:b; Polarization:Horizontal



Condition: 3m Horizontal

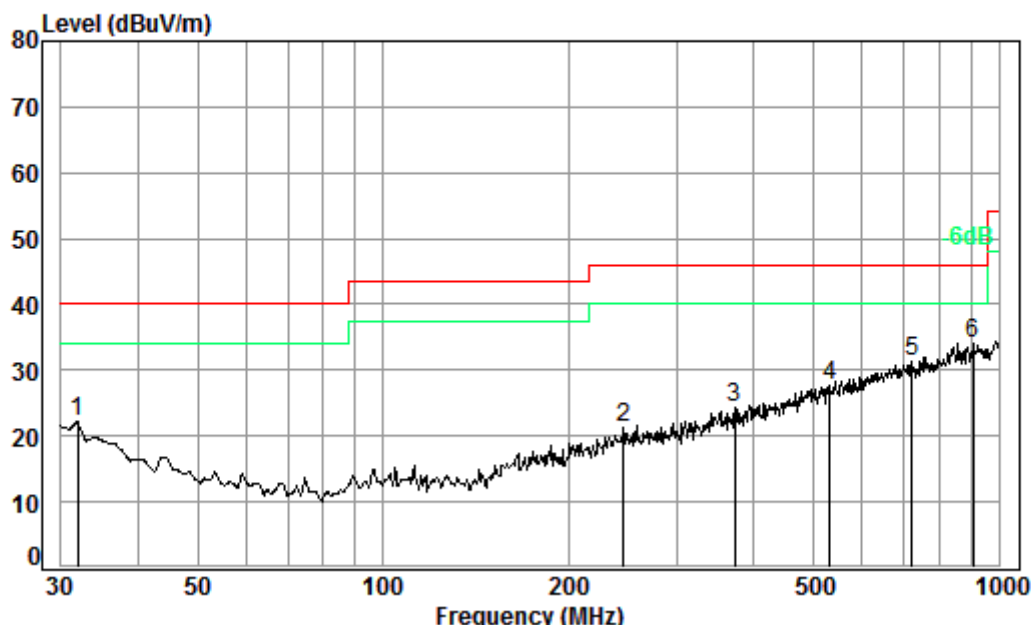
Job No. : 12801CR

Test Mode: b

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit |
|------|--------|------------|------------|---------------|------------|--------|------------|------------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 30.96 | 0.60 | 21.95 | 27.73 | 26.31 | 21.13 | 40.00 | -18.87 |
| 2 | 262.90 | 1.74 | 19.06 | 26.98 | 28.20 | 22.02 | 46.00 | -23.98 |
| 3 | 396.24 | 2.19 | 22.31 | 27.40 | 27.85 | 24.95 | 46.00 | -21.05 |
| 4 | 497.68 | 2.59 | 24.55 | 27.82 | 30.02 | 29.34 | 46.00 | -16.66 |
| 5 | 699.30 | 2.90 | 27.89 | 27.93 | 28.30 | 31.16 | 46.00 | -14.84 |
| 6 pp | 884.50 | 3.54 | 29.61 | 27.36 | 28.24 | 34.03 | 46.00 | -11.97 |



Mode:b; Polarization:Vertical



Condition: 3m Vertical

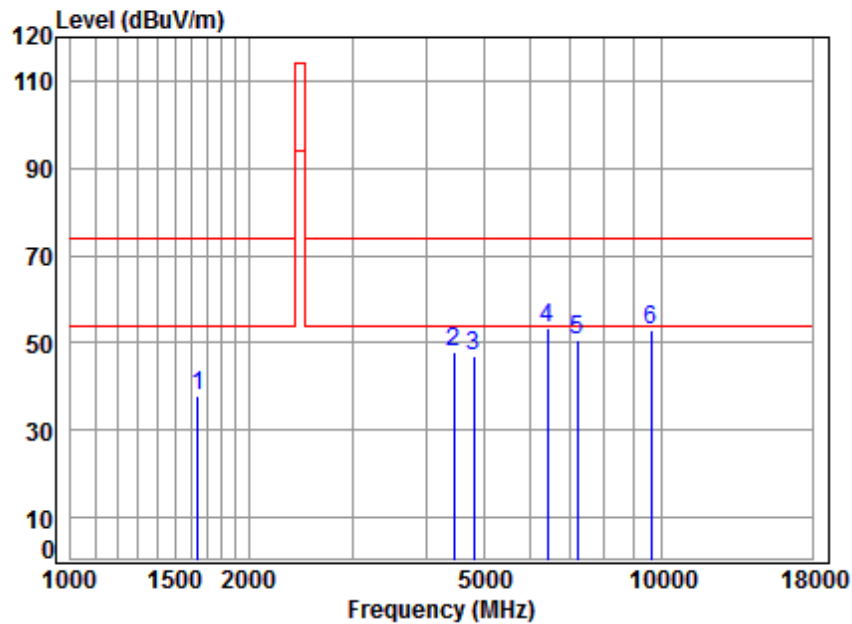
Job No. : 12801CR

Test Mode: b

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit | Over |
|------|--------|------------|------------|---------------|------------|--------|--------|--------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 31.95 | 0.60 | 21.40 | 27.72 | 27.90 | 22.18 | 40.00 | -17.82 |
| 2 | 245.95 | 1.65 | 18.89 | 27.03 | 27.93 | 21.44 | 46.00 | -24.56 |
| 3 | 372.00 | 2.12 | 21.69 | 27.29 | 27.93 | 24.45 | 46.00 | -21.55 |
| 4 | 531.96 | 2.63 | 25.28 | 27.95 | 27.68 | 27.64 | 46.00 | -18.36 |
| 5 | 721.73 | 2.97 | 28.04 | 27.88 | 28.27 | 31.40 | 46.00 | -14.60 |
| 6 pp | 909.67 | 3.61 | 29.85 | 27.25 | 27.90 | 34.11 | 46.00 | -11.89 |

Transmitter emission above 1GHz

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

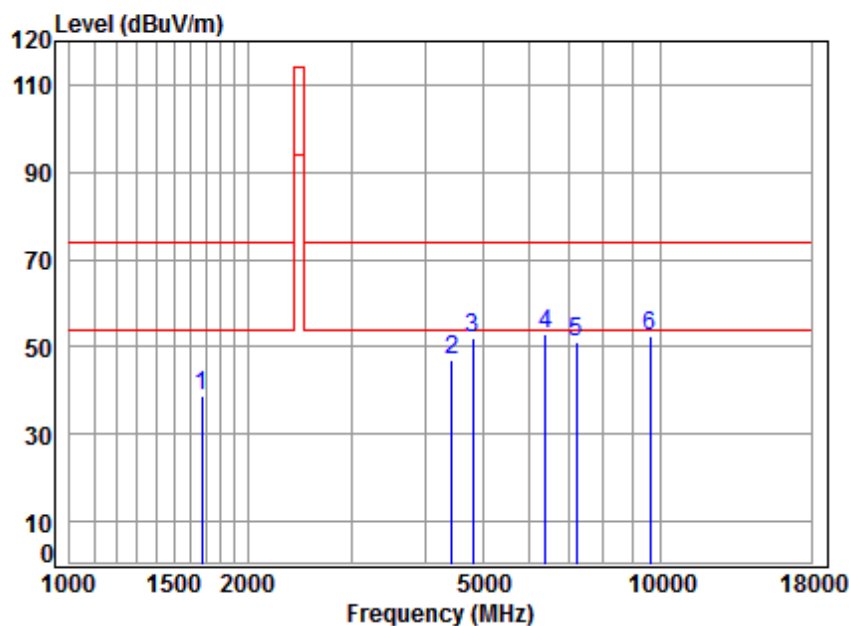


Site : chamber
Condition: 3m HORIZONTAL
Job No : 12801CR
Mode : 2405 TX SE

| | 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 | 1639.274 | 5.30 | 26.42 | 40.79 | 46.95 | 37.88 | 74.00 | -36.12 | peak |
| 2 | 4456.315 | 7.51 | 33.53 | 43.26 | 50.26 | 48.04 | 74.00 | -25.96 | peak |
| 3 | 4810.000 | 7.90 | 33.98 | 43.62 | 48.74 | 47.00 | 74.00 | -27.00 | peak |
| 4 | 6414.167 | 11.38 | 35.52 | 42.48 | 49.14 | 53.56 | 74.00 | -20.44 | peak |
| 5 | 7215.000 | 10.07 | 36.08 | 41.85 | 46.56 | 50.86 | 74.00 | -23.14 | peak |
| 6 | 9620.000 | 10.75 | 37.67 | 38.41 | 42.87 | 52.88 | 74.00 | -21.12 | peak |



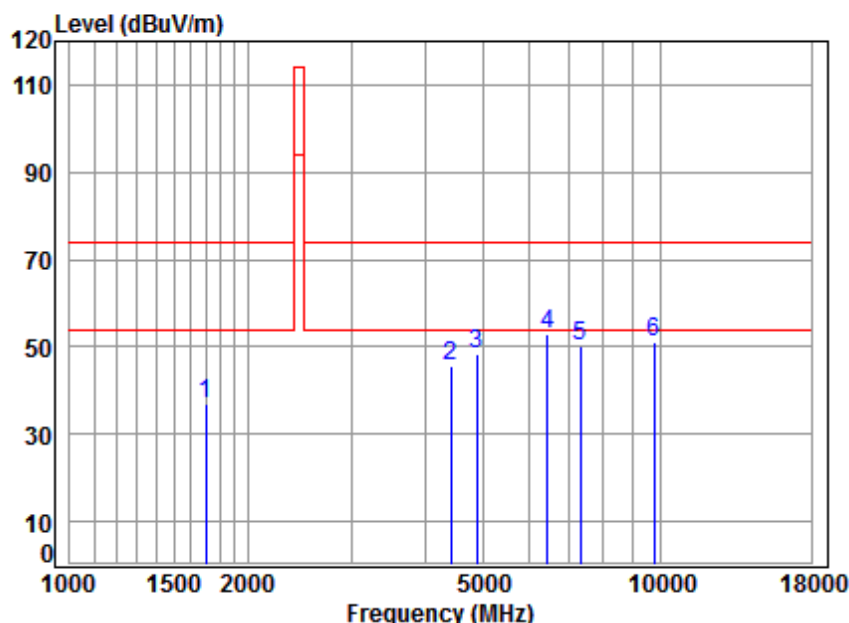
Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 12801CR
Mode : 2405 TX SE

| | 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 | 1672.779 | 5.26 | 26.56 | 40.82 | 47.71 | 38.71 | 74.00 | -35.29 | peak |
| 2 | 4430.628 | 7.48 | 33.48 | 43.23 | 49.09 | 46.82 | 74.00 | -27.18 | peak |
| 3 | 4810.000 | 7.90 | 33.98 | 43.62 | 53.93 | 52.19 | 74.00 | -21.81 | peak |
| 4 | 6395.654 | 11.34 | 35.50 | 42.49 | 48.55 | 52.90 | 74.00 | -21.10 | peak |
| 5 | 7215.000 | 10.07 | 36.08 | 41.85 | 46.58 | 50.88 | 74.00 | -23.12 | peak |
| 6 | 9620.000 | 10.75 | 37.67 | 38.41 | 42.27 | 52.28 | 74.00 | -21.72 | peak |

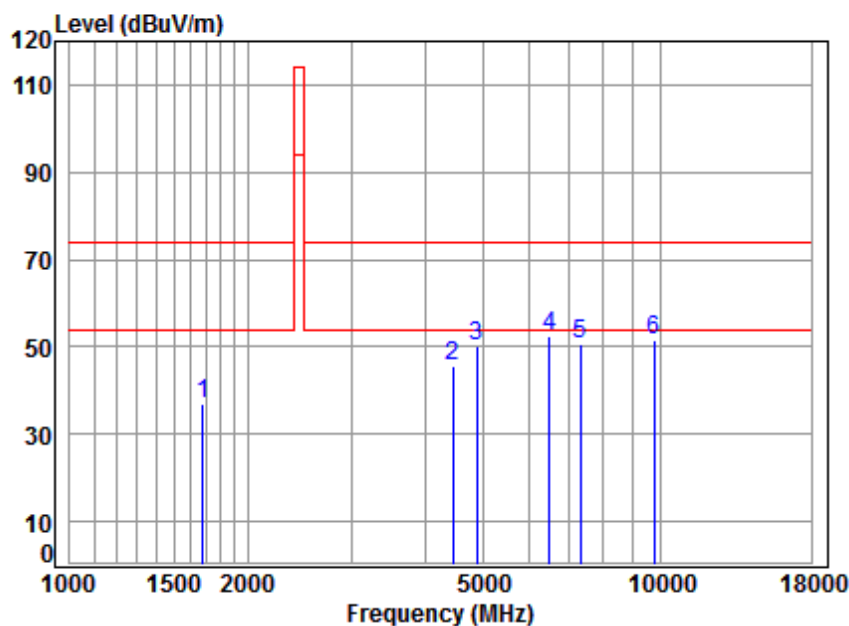
Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:middle



Site : chamber
Condition: 3m HORIZONTAL
Job No : 12801CR
Mode : 2440 TX SE

| | 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 | 1697.129 | 5.23 | 26.66 | 40.83 | 45.76 | 36.82 | 74.00 | -37.18 | peak |
| 2 | 4417.841 | 7.47 | 33.46 | 43.22 | 47.73 | 45.44 | 74.00 | -28.56 | peak |
| 3 | 4880.000 | 7.97 | 34.06 | 43.69 | 49.85 | 48.19 | 74.00 | -25.81 | peak |
| 4 | 6451.353 | 11.45 | 35.55 | 42.44 | 48.17 | 52.73 | 74.00 | -21.27 | peak |
| 5 | 7320.000 | 10.05 | 36.16 | 41.77 | 45.87 | 50.31 | 74.00 | -23.69 | peak |
| 6 | 9760.000 | 10.82 | 37.76 | 38.18 | 40.79 | 51.19 | 74.00 | -22.81 | peak |

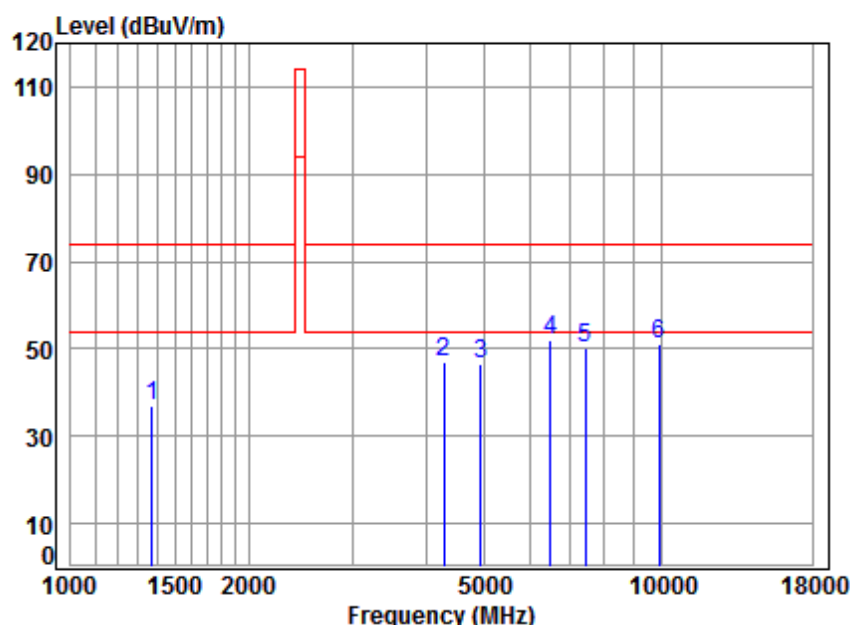
Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:middle



Site : chamber
Condition: 3m VERTICAL
Job No : 12801CR
Mode : 2440 TX SE

| | 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 | 1682.477 | 5.25 | 26.60 | 40.82 | 46.02 | 37.05 | 74.00 | -36.95 | peak |
| 2 | 4456.315 | 7.51 | 33.53 | 43.26 | 47.89 | 45.67 | 74.00 | -28.33 | peak |
| 3 | 4880.000 | 7.97 | 34.06 | 43.69 | 52.03 | 50.37 | 74.00 | -23.63 | peak |
| 4 | 6488.754 | 11.52 | 35.59 | 42.41 | 47.86 | 52.56 | 74.00 | -21.44 | peak |
| 5 | 7320.000 | 10.05 | 36.16 | 41.77 | 46.18 | 50.62 | 74.00 | -23.38 | peak |
| 6 | 9760.000 | 10.82 | 37.76 | 38.18 | 41.33 | 51.73 | 74.00 | -22.27 | peak |

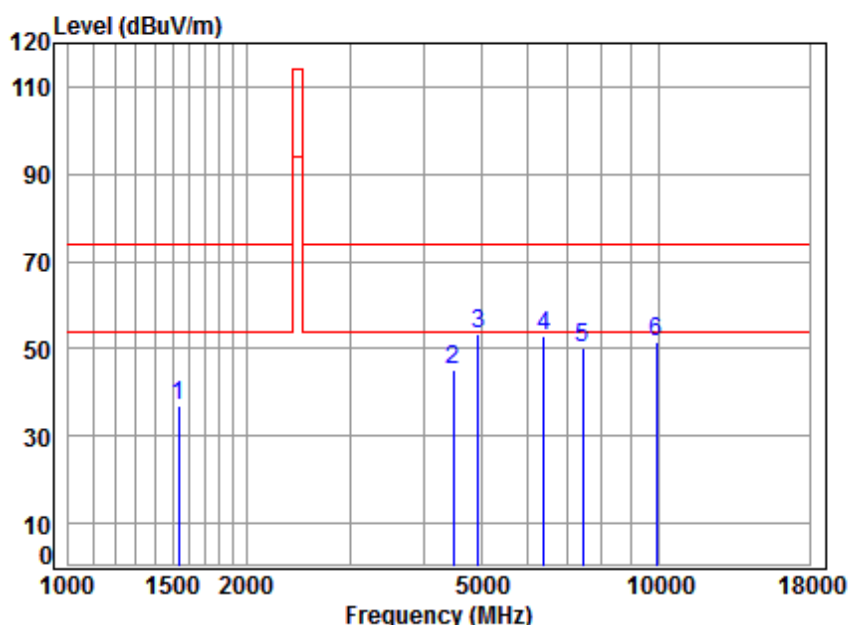
Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 12801CR
Mode : 2475 TX SE

| | 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 | 1374.295 | 5.06 | 25.33 | 40.62 | 47.24 | 37.01 | 74.00 | -36.99 | peak |
| 2 | 4291.977 | 7.33 | 33.24 | 43.08 | 49.40 | 46.89 | 74.00 | -27.11 | peak |
| 3 | 4950.000 | 8.04 | 34.14 | 43.75 | 48.11 | 46.54 | 74.00 | -27.46 | peak |
| 4 | 6488.754 | 11.52 | 35.59 | 42.41 | 47.34 | 52.04 | 74.00 | -21.96 | peak |
| 5 | 7425.000 | 10.02 | 36.24 | 41.70 | 45.73 | 50.29 | 74.00 | -23.71 | peak |
| 6 | 9900.000 | 10.89 | 37.84 | 37.96 | 40.33 | 51.10 | 74.00 | -22.90 | peak |

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



Site : chamber
Condition: 3m VERTICAL
Job No : 12801CR
Mode : 2475 TX SE

| | 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 | 1533.841 | 5.44 | 25.96 | 40.73 | 46.36 | 37.03 | 74.00 | -36.97 | peak |
| 2 | 4482.150 | 7.54 | 33.57 | 43.29 | 47.51 | 45.33 | 74.00 | -28.67 | peak |
| 3 | 4950.000 | 8.04 | 34.14 | 43.75 | 54.81 | 53.24 | 74.00 | -20.76 | peak |
| 4 | 6395.654 | 11.34 | 35.50 | 42.49 | 48.59 | 52.94 | 74.00 | -21.06 | peak |
| 5 | 7425.000 | 10.02 | 36.24 | 41.70 | 45.61 | 50.17 | 74.00 | -23.83 | peak |
| 6 | 9900.000 | 10.89 | 37.84 | 37.96 | 40.82 | 51.59 | 74.00 | -22.41 | 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 -

