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Report No.: SZEM140200054301
Page: 1 of 47

FCC REPORT

| | |
|-------------------------|---|
| Application No: | SZEM1402000543RF |
| Applicant: | Quintic(Beijing) Microelectronics Co., Ltd. |
| Manufacturer: | Quintic(Beijing) Microelectronics Co., Ltd. |
| Factory: | Quintic(Beijing) Microelectronics Co., Ltd. |
| Product Name: | Bluetooth 4.0 Low Energy Module |
| Model No.(EUT): | QS9321-PLCM |
| Trade Mark: | Quintic |
| FCC ID: | 2AB359321-1 |
| Standards: | 47 CFR Part 15, Subpart C (2013) |
| Date of Receipt: | 2014-02-18 |
| Date of Test: | 2014-02-21 to 2014-03-10 |
| Date of Issue: | 2014-04-10 |

| | |
|---------------------|---------------|
| Test Result: | PASS * |
|---------------------|---------------|

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

Authorized Signature:



Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Test Summary

| Test Item | Test Requirement | Test method | Result |
|--|---|----------------------|--------|
| Antenna Requirement | 47 CFR Part 15, Subpart C Section 15.203/15.247 (c) | ANSI C63.10 2009 | PASS |
| Conducted Peak Output Power | 47 CFR Part 15, Subpart C Section 15.247 (b)(3) | KDB558074 D01 v03r01 | PASS |
| 6dB Occupied Bandwidth | 47 CFR Part 15, Subpart C Section 15.247 (a)(2) | KDB558074 D01 v03r01 | PASS |
| Power Spectral Density | 47 CFR Part 15, Subpart C Section 15.247 (e) | KDB558074 D01 v03r01 | PASS |
| Band-edge for RF Conducted Emissions | 47 CFR Part 15, Subpart C Section 15.247(d) | KDB558074 D01 v03r01 | PASS |
| RF Conducted Spurious Emissions | 47 CFR Part 15, Subpart C Section 15.247(d) | KDB558074 D01 v03r01 | PASS |
| Radiated Spurious Emissions | 47 CFR Part 15, Subpart C Section 15.205/15.209 | ANSI C63.10 2009 | PASS |
| Restricted bands around fundamental frequency (Radiated Emission) | 47 CFR Part 15, Subpart C Section 15.205/15.209 | ANSI C63.10 2009 | PASS |

3 Contents

| | Page |
|---|-------|
| 1 COVER PAGE | 1 |
| 2 TEST SUMMARY | 2 |
| 3 CONTENTS | 3 |
| 4 GENERAL INFORMATION | 4 |
| 4.1.1 Client Information | 4 |
| 4.1.2 General Description of EUT | 4 |
| 4.1.3 Test Environment | 6 |
| 4.2 DESCRIPTION OF SUPPORT UNITS | 6 |
| 4.3 TEST LOCATION | 6 |
| 4.4 TEST FACILITY | 7 |
| 4.5 DEVIATION FROM STANDARDS | 7 |
| 4.6 ABNORMALITIES FROM STANDARD CONDITIONS | 7 |
| 4.7 OTHER INFORMATION REQUESTED BY THE CUSTOMER | 7 |
| 4.8 EQUIPMENT LIST | 8 |
| 5 TEST RESULTS AND MEASUREMENT DATA | 10 |
| 5.1 ANTENNA REQUIREMENT | 10 |
| 5.2 CONDUCTED PEAK OUTPUT POWER | 11 |
| 5.3 6dB OCCUPY BANDWIDTH | 14 |
| 5.4 POWER SPECTRAL DENSITY | 17 |
| 5.5 BAND-EDGE FOR RF CONDUCTED EMISSIONS | 20 |
| 5.6 SPURIOUS RF CONDUCTED EMISSIONS | 22 |
| 5.7 RADIATED SPURIOUS EMISSION | 32 |
| 5.7.1 Spurious Emissions | 32 |
| 5.8 RESTRICTED BANDS AROUND FUNDAMENTAL FREQUENCY | 38-47 |

4 General Information

4.1.1 Client Information

| | |
|--------------------------|---|
| Applicant: | Quintic(Beijing) Microelectronics Co., Ltd. |
| Address of Applicant: | 301A BuildingB, SP Tower, Tsinghua Science Park, Beijing 100084 P.R.China |
| Manufacturer: | Quintic(Beijing) Microelectronics Co., Ltd. |
| Address of Manufacturer: | 301A BuildingB, SP Tower, Tsinghua Science Park, Beijing 100084 P.R.China |
| Factory: | Quintic(Beijing) Microelectronics Co., Ltd. |
| Address of Factory: | 301A BuildingB, SP Tower, Tsinghua Science Park, Beijing 100084 P.R.China |

4.1.2 General Description of EUT

| | |
|-----------------------|---|
| Product Name: | Bluetooth 4.0 Low Energy Module |
| Model No.: | QS9321-PLCM |
| Trade Mark: | Quintic |
| Operation Frequency: | 2402MHz~2480MHz |
| Bluetooth Version: | 4.0 BLE |
| Modulation Type: | GFSK |
| Number of Channel: | 40 |
| Test Power Grade: | 4 (manufacturer declare) |
| Test Software of EUT: | N/A |
| Antenna Type | Integral |
| Antenna Gain | 2.21dBi |
| Power Supply: | 3.0V DC (3.0V *1 "CR2032" Button Cells) |



| Operation Frequency each of channel | | | | | | | |
|-------------------------------------|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 1 | 2402MHz | 11 | 2422MHz | 21 | 2442MHz | 31 | 2462MHz |
| 2 | 2404MHz | 12 | 2424MHz | 22 | 2444MHz | 32 | 2464MHz |
| 3 | 2406MHz | 13 | 2426MHz | 23 | 2446MHz | 33 | 2466MHz |
| 4 | 2408MHz | 14 | 2428MHz | 24 | 2448MHz | 34 | 2468MHz |
| 5 | 2410MHz | 15 | 2430MHz | 25 | 2450MHz | 35 | 2470MHz |
| 6 | 2412MHz | 16 | 2432MHz | 26 | 2452MHz | 36 | 2472MHz |
| 7 | 2414MHz | 17 | 2434MHz | 27 | 2454MHz | 37 | 2474MHz |
| 8 | 2416MHz | 18 | 2436MHz | 28 | 2456MHz | 38 | 2476MHz |
| 9 | 2418MHz | 19 | 2438MHz | 29 | 2458MHz | 39 | 2478MHz |
| 10 | 2420MHz | 20 | 2440MHz | 30 | 2460MHz | 40 | 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 | 2402MHz |
| The Middle channel | 2440MHz |
| The Highest channel | 2480MHz |

4.1.3 Test Environment

| Operating Environment: | |
|------------------------|----------|
| Temperature: | 25.0 °C |
| Humidity: | 55 % RH |
| Atmospheric Pressure: | 1015mbar |

4.2 Description of Support Units

The EUT has been tested with associated equipment below.

| Description | Manufacturer | Model No. |
|-----------------|--------------|-----------|
| QS9322MODULE MB | QUINTIC | V1.0 |

4.3 Test Location

All tests were performed at:

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

4.4 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.

- **VCCI**

The 3m Semi-anechoic chamber, Full-anechoic Chamber and Shielded Room (7.5m x 4.0m x 3.0m) of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2197, G-416, T-1153 and C-2383 respectively.

- **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

- **Industry Canada (IC)**

Two 3m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1 & 4620C-2.

4.5 Deviation from Standards

None.

4.6 Abnormalities from Standard Conditions

None.

4.7 Other Information Requested by the Customer

None.

4.8 Equipment List

| RE in Chamber | | | | | |
|---------------|---------------------------------|------------------------------------|-----------|---------------|---------------------------|
| Item | Test Equipment | Manufacturer | Model No. | Inventory No. | Cal.Due date (yyyy-mm-dd) |
| 1 | 3m Semi-Anechoic Chamber | ETS-LINDGREN | N/A | SEL0017 | 2014-06-10 |
| 2 | EMI Test Receiver | Rohde & Schwarz | ESIB26 | SEL0023 | 2014-05-16 |
| 3 | EMI Test software | AUDIX | E3 | SEL0050 | N/A |
| 4 | BiConiLog Antenna (26-3000MHz) | ETS-LINDGREN | 3142C | SEL0015 | 2014-10-24 |
| 5 | Double-ridged horn (1-18GHz) | ETS-LINDGREN | 3117 | SEL0006 | 2014-10-24 |
| 6 | Horn Antenna (18-26GHz) | ETS-LINDGREN | 3160 | SEL0076 | 2014-10-24 |
| 7 | Pre-amplifier (0.1-1300MHz) | Agilent Technologies | 8447D | SEL0053 | 2014-05-16 |
| 8 | Pre-Amplifier (0.1-26.5GHz) | Compliance Directions Systems Inc. | PAP-0126 | SEL0168 | 2014-10-24 |
| 9 | Coaxial cable | SGS | N/A | SEL0027 | 2014-05-29 |
| 10 | Coaxial cable | SGS | N/A | SEL0189 | 2014-05-29 |
| 11 | Coaxial cable | SGS | N/A | SEL0121 | 2014-05-29 |
| 12 | Coaxial cable | SGS | N/A | SEL0178 | 2014-05-29 |
| 13 | Band filter | Amindeon | 82346 | SEL0094 | 2014-05-16 |
| 14 | Barometer | Chang Chun | DYM3 | SEL0088 | 2014-05-24 |
| 15 | DC Power Supply | Zhao Xin | RXN-305D | SEL0117 | 2014-10-24 |
| 16 | Humidity/ Temperature Indicator | Shanghai Qixiang | ZJ1-2B | SEL0103 | 2014-10-24 |
| 17 | Signal Generator (10M-27GHz) | Rohde & Schwarz | SMR27 | SEL0067 | 2014-05-16 |
| 18 | Signal Generator | Rohde & Schwarz | SMY01 | SEL0155 | 2014-10-24 |
| 19 | Loop Antenna | Beijing Daze | ZN30401 | SEL0203 | 2014-06-04 |

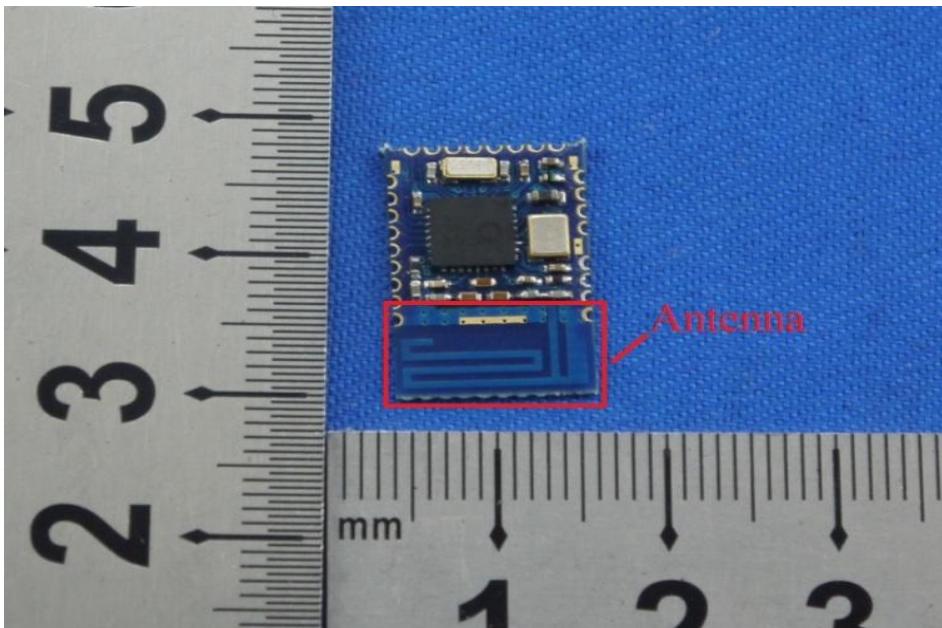
| RF connected test | | | | | |
|-------------------|---------------------------------|----------------------|-----------|---------------|---------------------------|
| Item | Test Equipment | Manufacturer | Model No. | Inventory No. | Cal.Due date (yyyy-mm-dd) |
| 1 | DC Power Supply | Zhao Xin | RXN-305D | SEL0117 | 2014-10-24 |
| 2 | Humidity/ Temperature Indicator | HYGRO | ZJ1-2B | SEL0033 | 2014-10-24 |
| 3 | Spectrum Analyzer | Rohde & Schwarz | FSP | SEL0154 | 2014-10-24 |
| 4 | Coaxial cable | SGS | N/A | SEL0178 | 2014-05-29 |
| 5 | Coaxial cable | SGS | N/A | SEL0179 | 2014-05-29 |
| 6 | Barometer | ChangChun | DYM3 | SEL0088 | 2014-05-24 |
| 7 | Signal Generator | Rohde & Schwarz | SML03 | SEL0068 | 2014-05-16 |
| 8 | Band filter | amideon | 82346 | SEL0094 | 2014-05-16 |
| 9 | POWER METER | R & S | NRVS | SEL0144 | 2014-10-24 |
| 10 | Attenuator | Beijin feihang taida | TST-2-6dB | SEL0205 | 2014-05-16 |
| 11 | Power Divider(splitter) | Agilent Technologies | 11636B | SEL0130 | 2014-10-24 |

Note: The calibration interval is one year, all the instruments are valid.

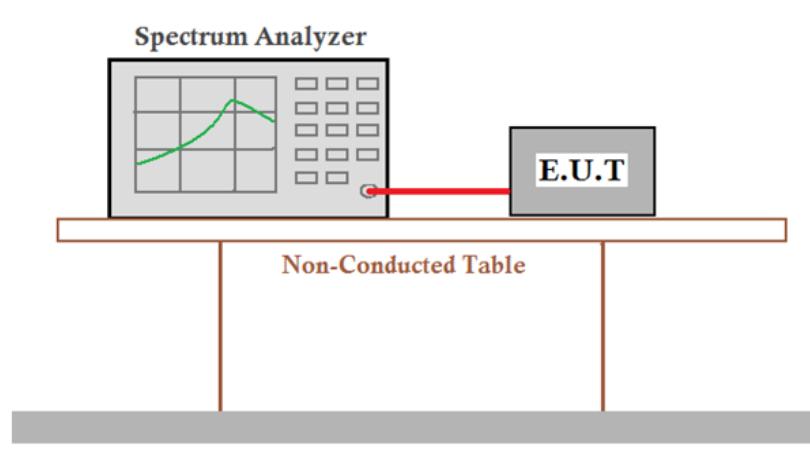
5 Test results and Measurement Data

5.1 Antenna Requirement

| | |
|------------------------------|--|
| Standard requirement: | 47 CFR Part 15C Section 15.203 /247(c) |
| 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. |
| 15.247(b) (4) requirement: | The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. |
| EUT Antenna: | The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.21dBi. |



5.2 Conducted Peak Output Power

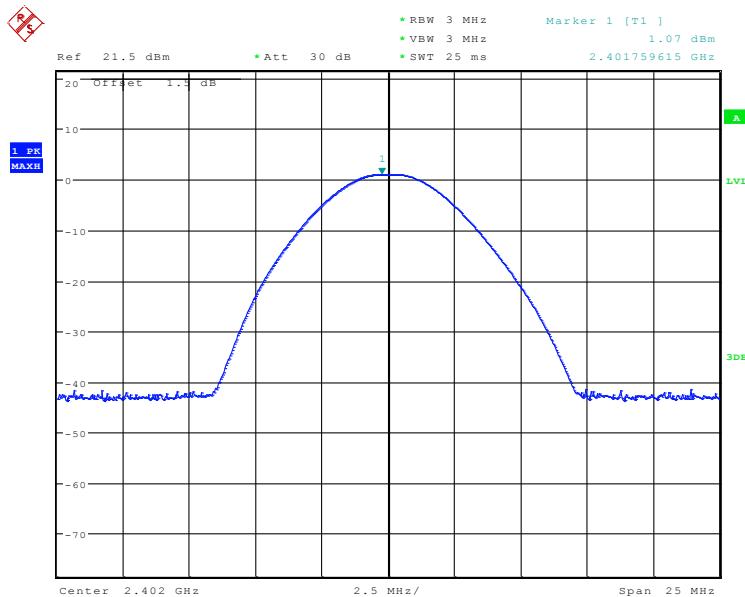
| | |
|-------------------|--|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (b)(1) |
| Test Method: | KDB558074 D01 v03r01 |
| Test Setup: |  <p>Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane</p> <p><i>Remark:</i> Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.</p> |
| Limit: | 30dBm |
| Test Mode: | Non-hopping transmitting with GFSK modulation |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

Measurement Data

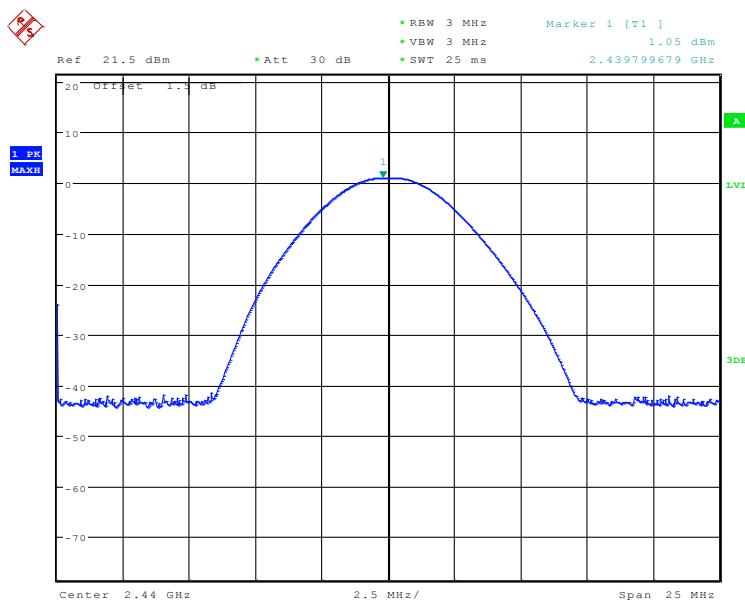
| GFSK mode | | | |
|--------------|-------------------------|-------------|--------|
| Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest | 1.07 | 30.00 | Pass |
| Middle | 1.05 | 30.00 | Pass |
| Highest | 1.34 | 30.00 | Pass |

Test plot as follows:

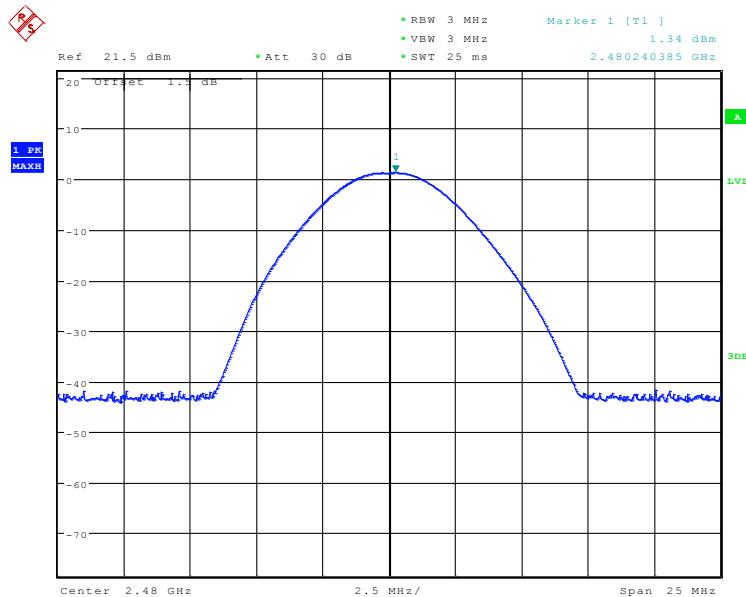
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Lowest |
|------------|------|---------------|--------|



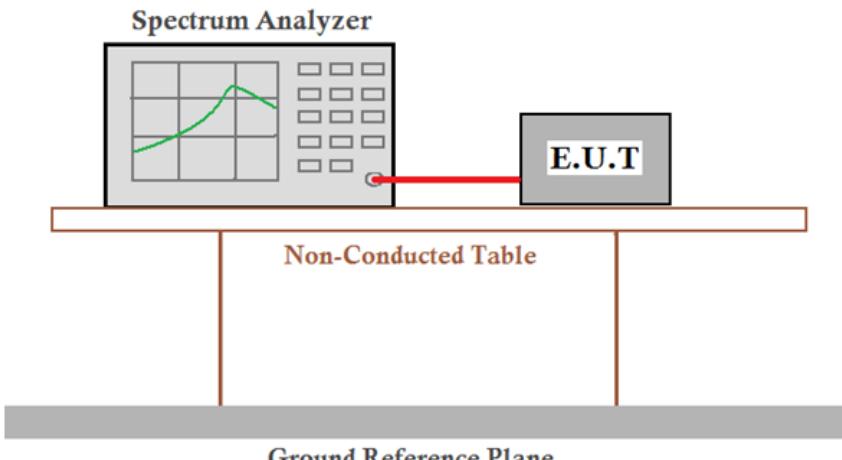
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Middle |
|------------|------|---------------|--------|



| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|



5.3 6dB Occupy Bandwidth

| | |
|-------------------|--|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(2) |
| Test Method: | KDB558074 D01 v03r01 |
| Test Setup: |  |
| Limit: | ≥ 500 kHz |
| Test Mode: | Non-hopping transmitting with GFSK modulation |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

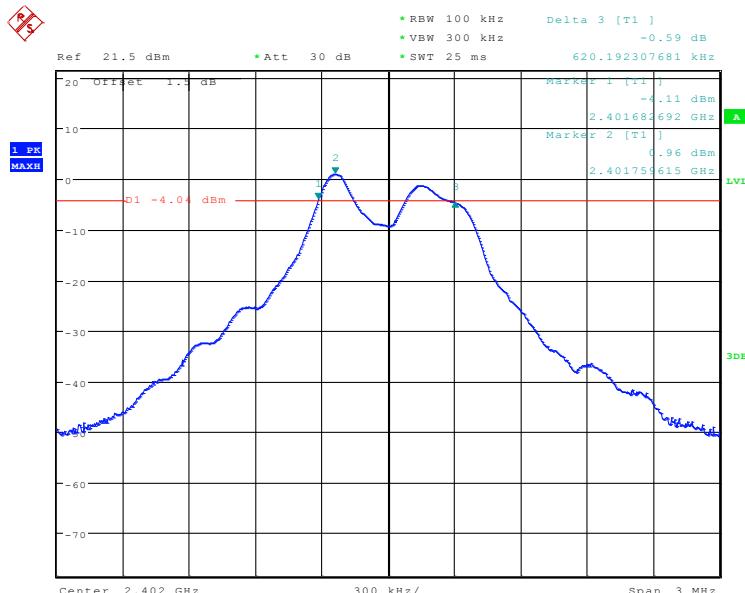
Measurement Data

| Test channel | 6dB Occupy Bandwidth (MHz) | Limit (kHz) | Result |
|--------------|----------------------------|-------------|--------|
| Lowest | 0.620192307681 | ≥ 500 | Pass |
| Middle | 0.610576923056 | ≥ 500 | Pass |
| Highest | 0.644230769221 | ≥ 500 | Pass |

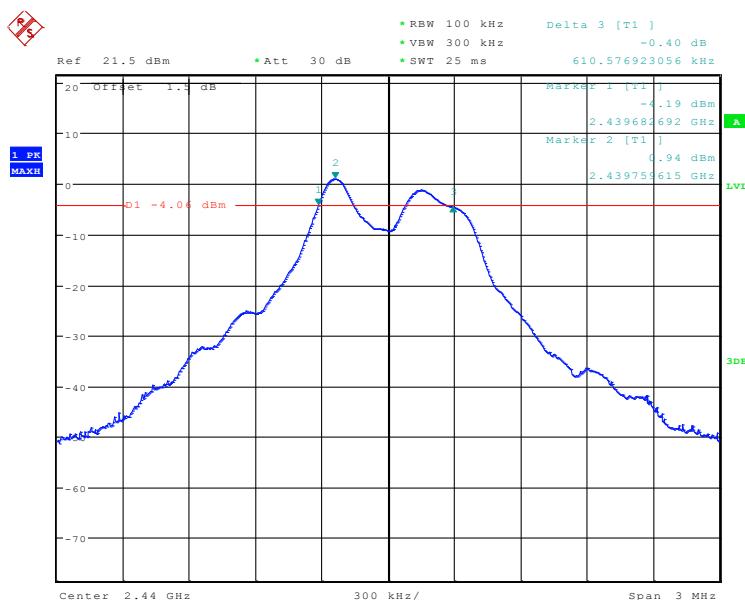


Test plot as follows:

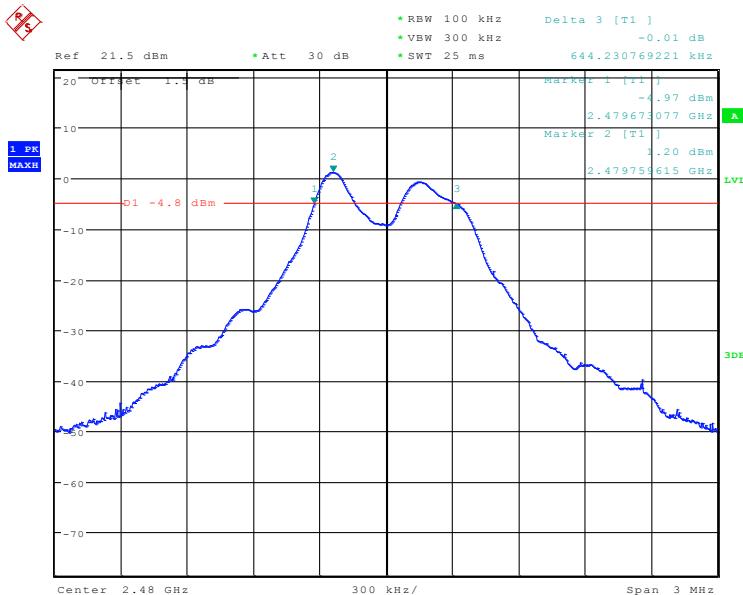
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Lowest |
|------------|------|---------------|--------|



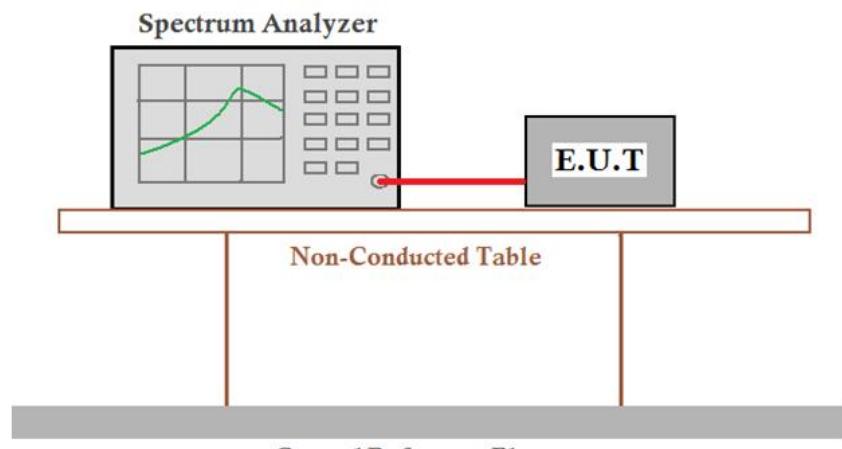
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Middle |
|------------|------|---------------|--------|



| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|



5.4 Power Spectral Density

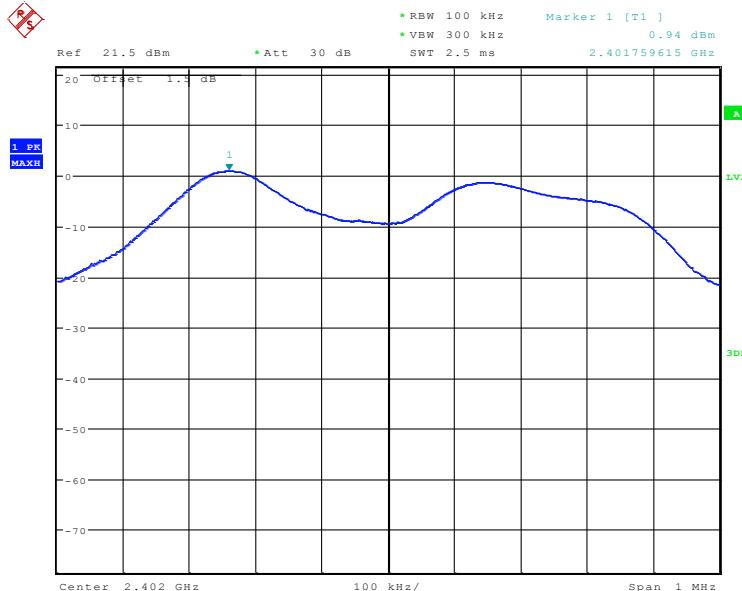
| | |
|------------------------|--|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (e) |
| Test Method: | KDB558074 D01 v03r01 |
| Test Setup: |  |
| Limit: | $\leq 8.00\text{dBm}$ |
| Exploratory Test Mode: | Non-hopping transmitting with GFSK modulation |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

Measurement Data

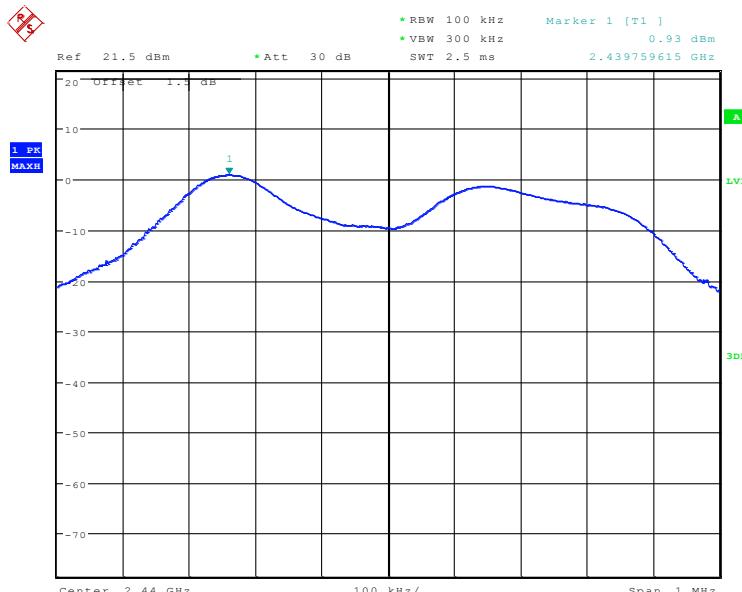
| GFSK mode | | | |
|--------------|------------------------------|-------------|--------|
| Test channel | Power Spectral Density (dBm) | Limit (dBm) | Result |
| Lowest | 0.94 | ≤ 8.00 | Pass |
| Middle | 0.93 | ≤ 8.00 | Pass |
| Highest | 1.17 | ≤ 8.00 | Pass |

Test plot as follows:

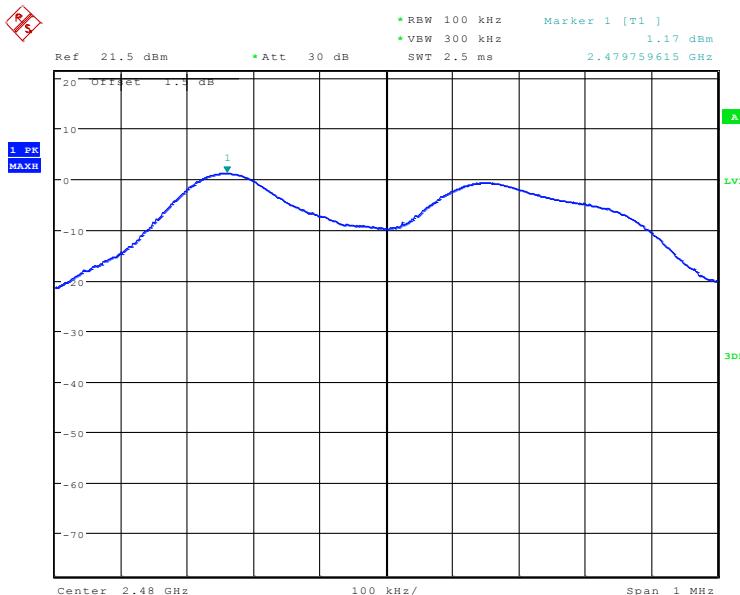
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Lowest |
|------------|------|---------------|--------|



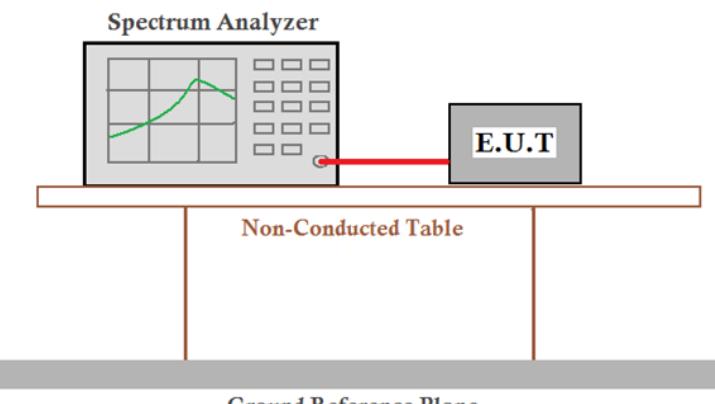
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Middle |
|------------|------|---------------|--------|



| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|

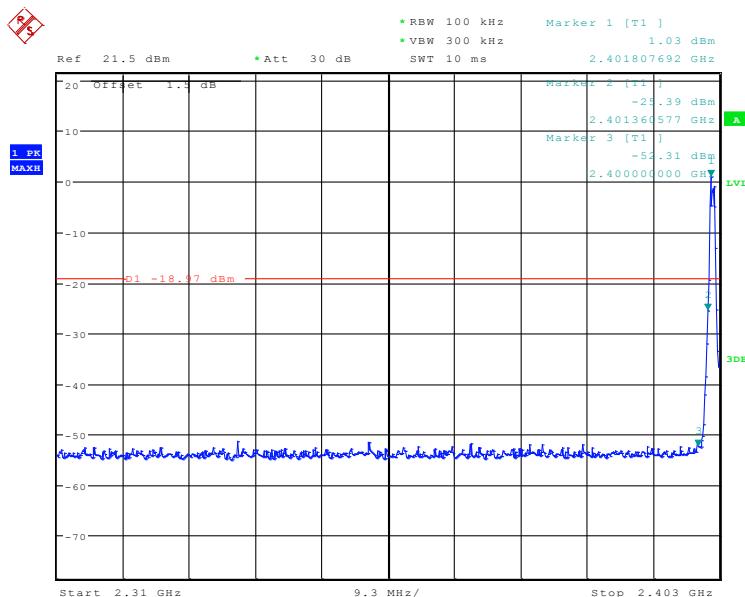


5.5 Band-edge for RF Conducted Emissions

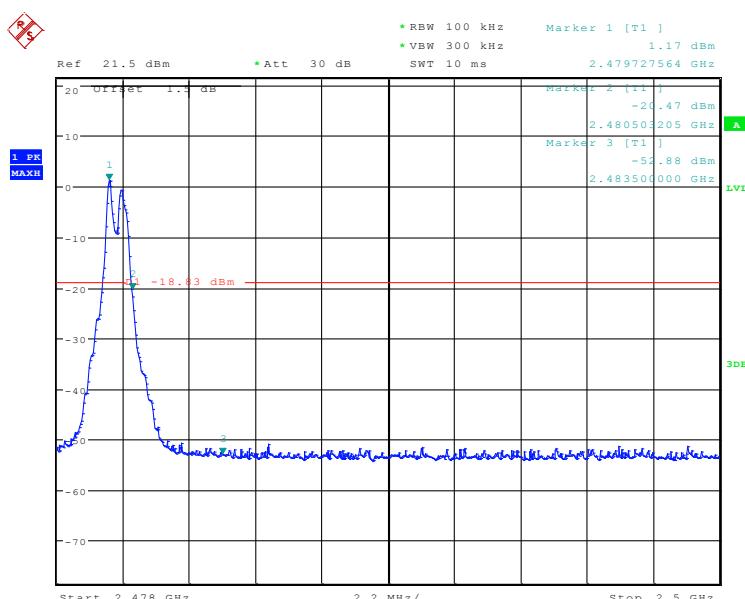
| | |
|-------------------|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (d) |
| Test Method: | KDB558074 D01 v03r01 |
| Test Setup: |  <p>Diagram illustrating the test setup for RF Conducted Emissions. A Spectrum Analyzer is connected to the E.U.T (Equipment Under Test) via a cable. The E.U.T is placed on a Non-Conducted Table. The entire setup is positioned above a Ground Reference Plane.</p> |
| Remark: | Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer. |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. |
| Test Mode: | Non-hopping transmitting with GFSK modulation |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

Test plot as follows:

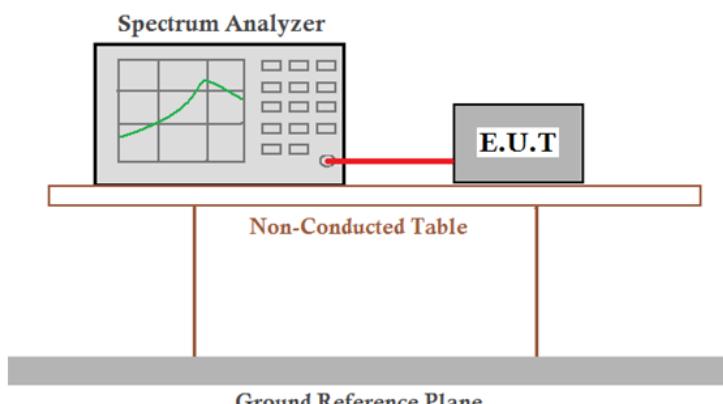
| Test mode: | GFSK | Test channel: | Lowest |
|------------|------|---------------|--------|
|------------|------|---------------|--------|



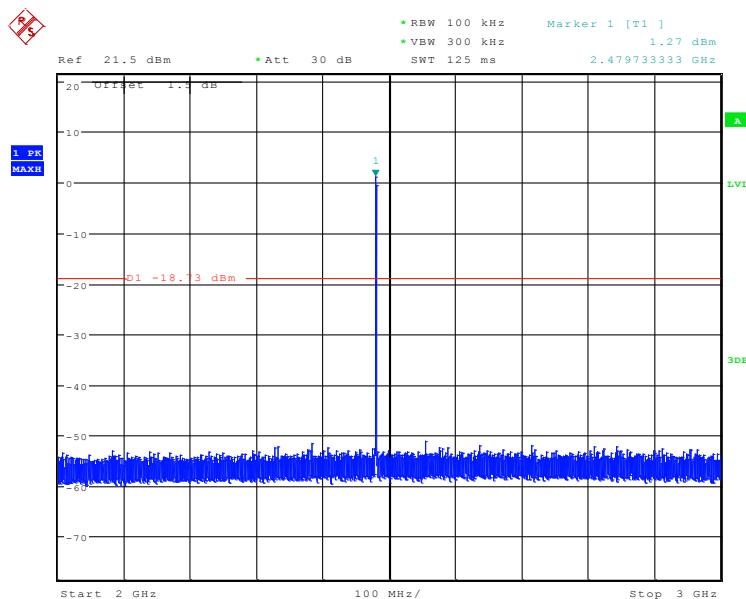
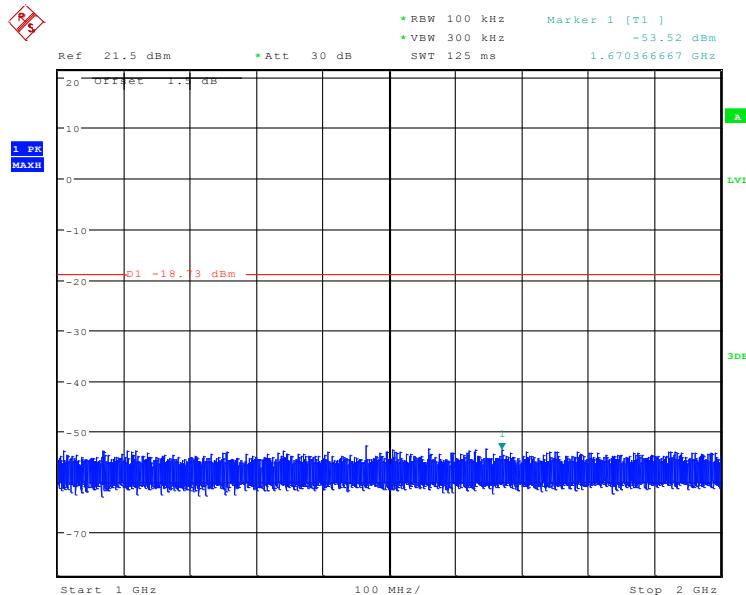
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|
|------------|------|---------------|---------|

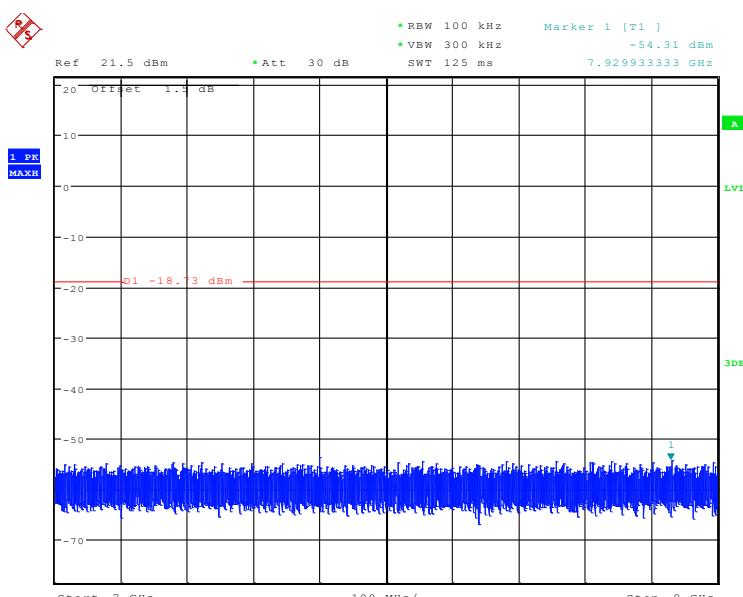
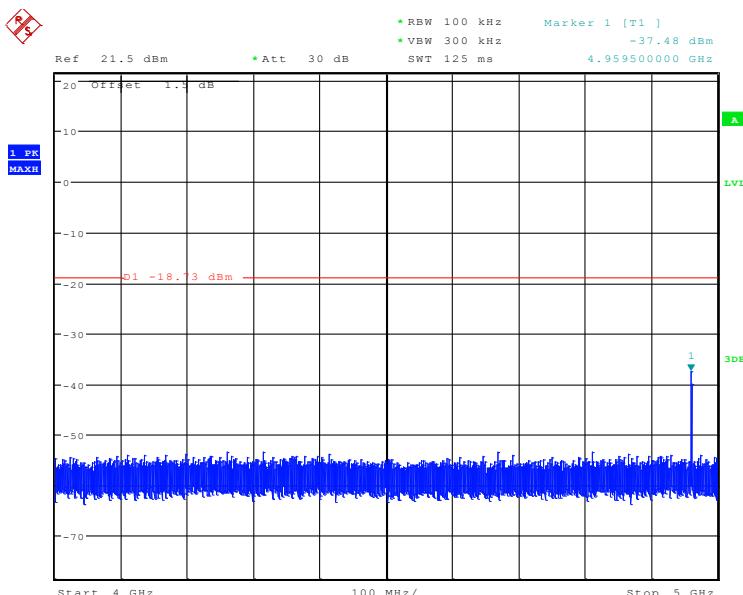


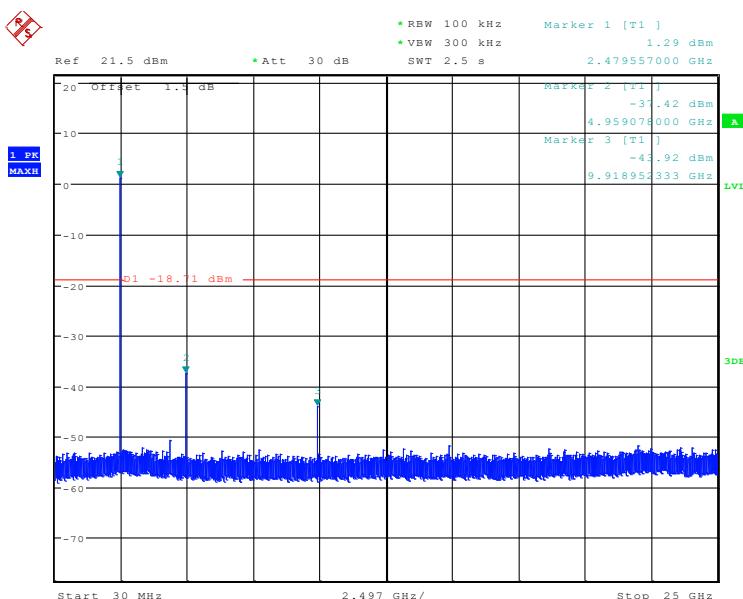
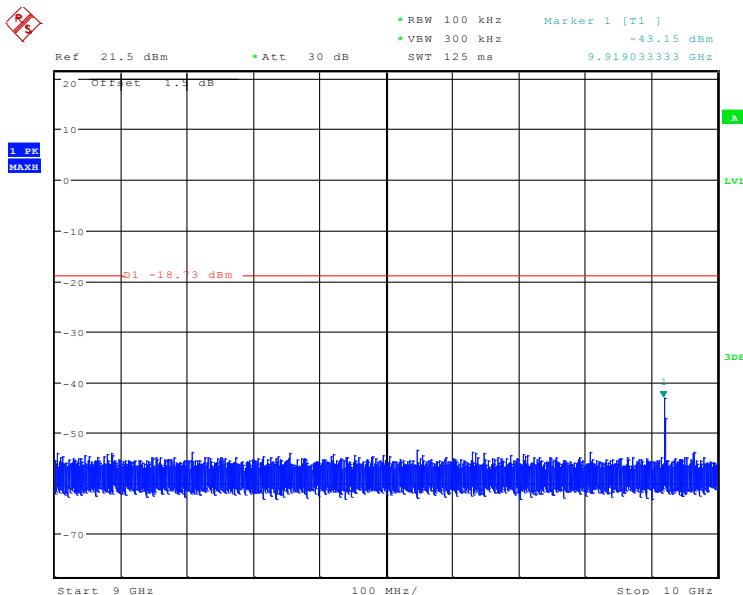
5.6 Spurious RF Conducted Emissions

| | |
|-------------------|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (d) |
| Test Method: | KDB558074 D01 v03r01 |
| Test Setup: |  <p>The diagram illustrates the test setup for spurious RF conducted emissions. A Spectrum Analyzer is connected to the E.U.T (Equipment Under Test) via a cable. The setup is placed on a Non-Conducted Table, which sits above a Ground Reference Plane. The Spectrum Analyzer shows a signal spectrum.</p> |
| Remark: | Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer. |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. |
| Test Mode: | Non-hopping transmitting with GFSK modulation |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

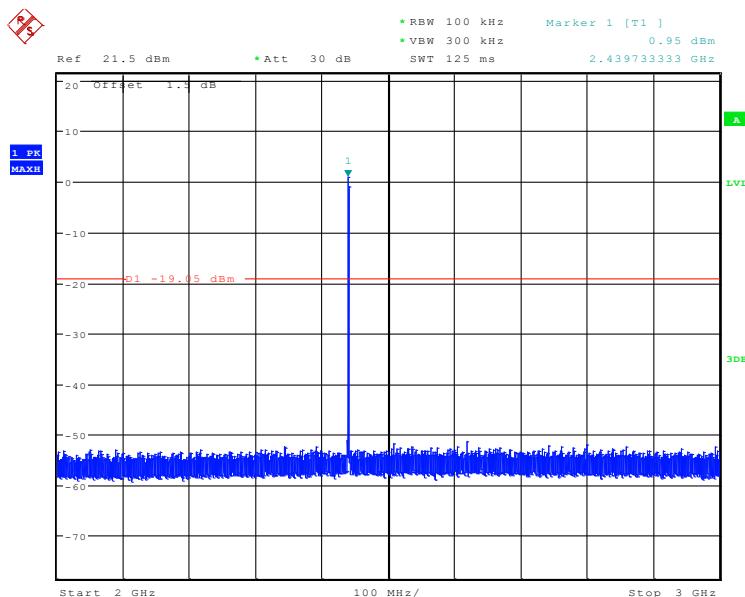
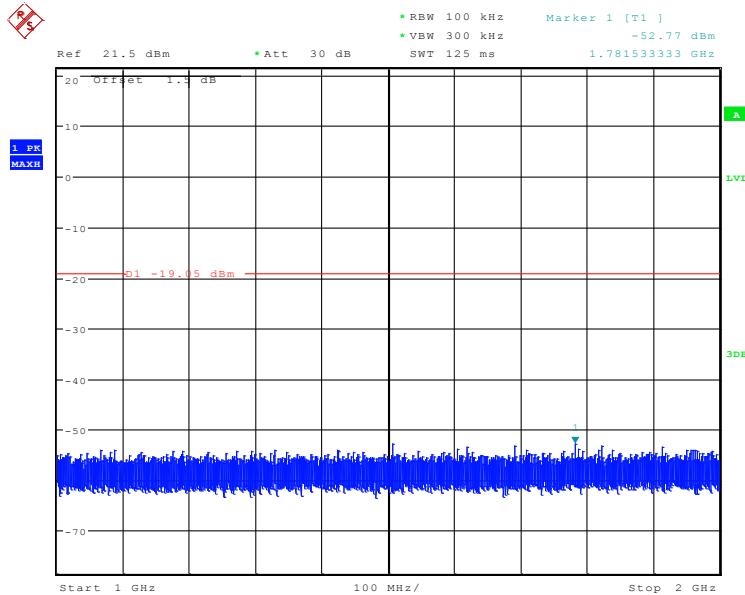
| Test mode: | GFSK | Test channel: | Lowest |
|------------|------|---------------|--------|
|------------|------|---------------|--------|

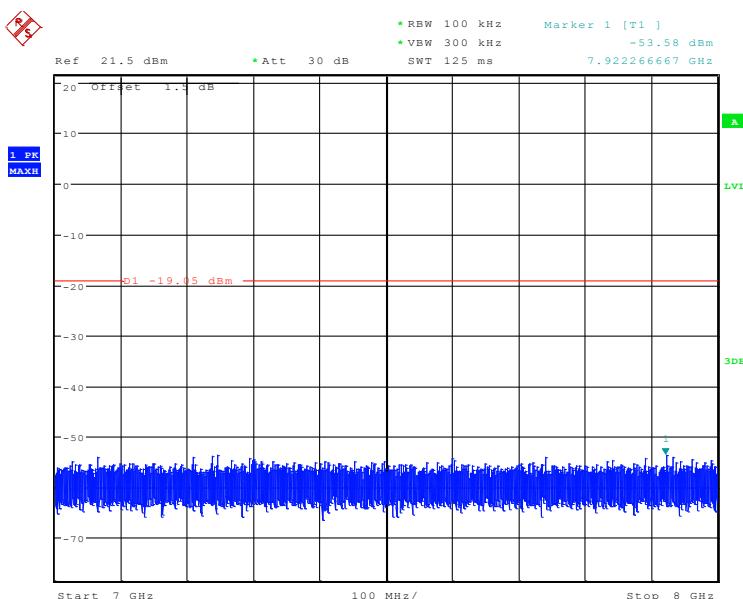
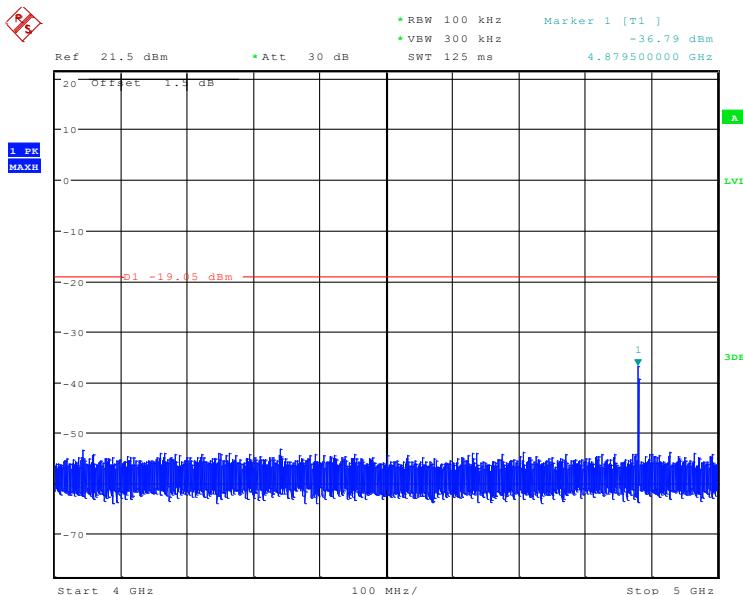


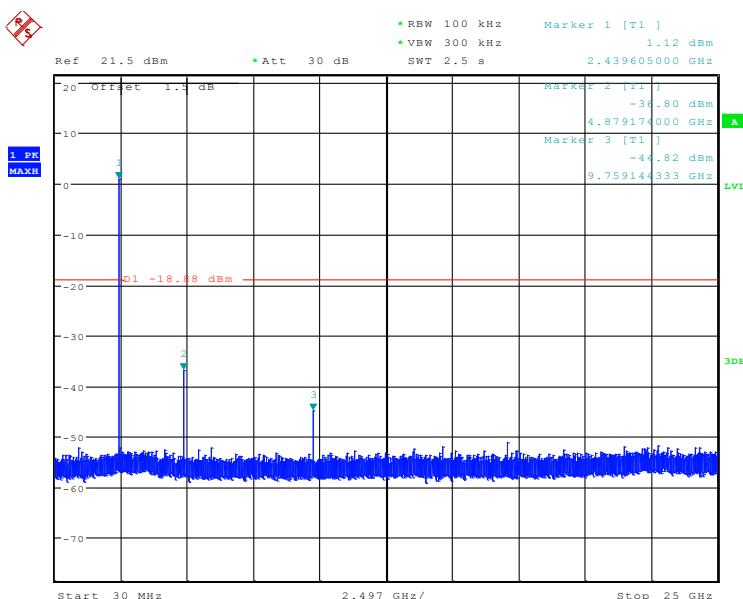
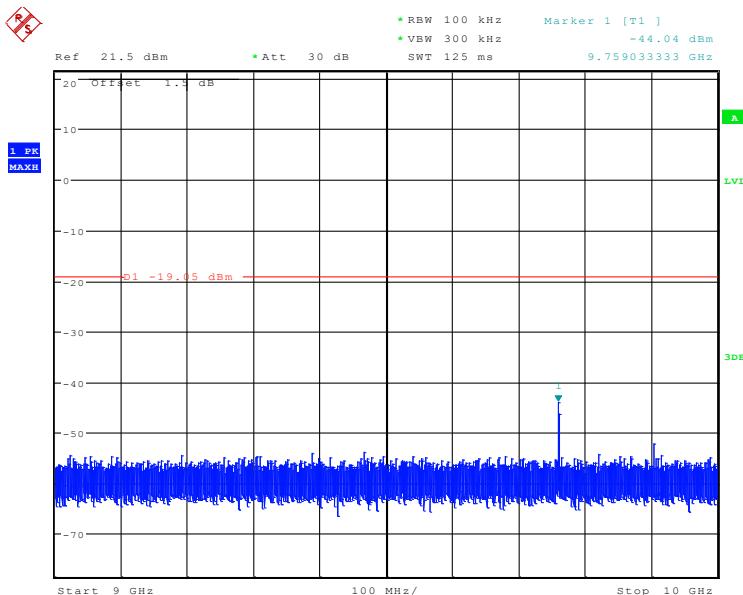




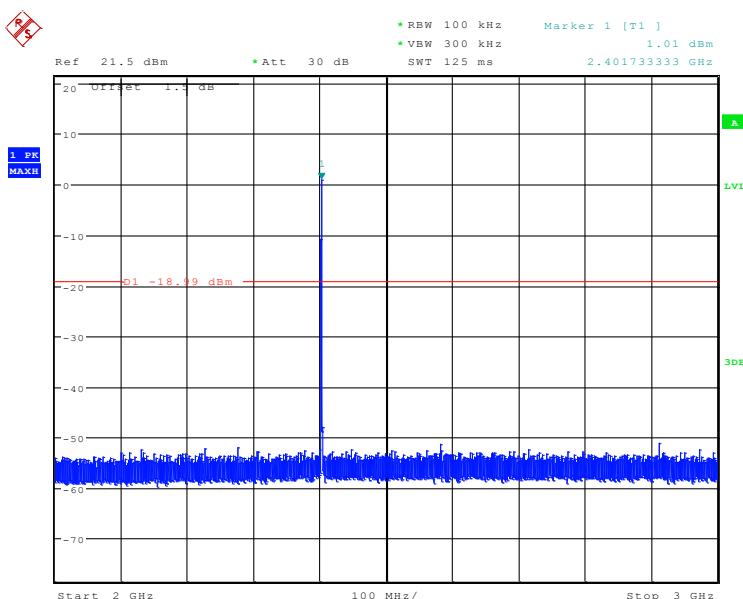
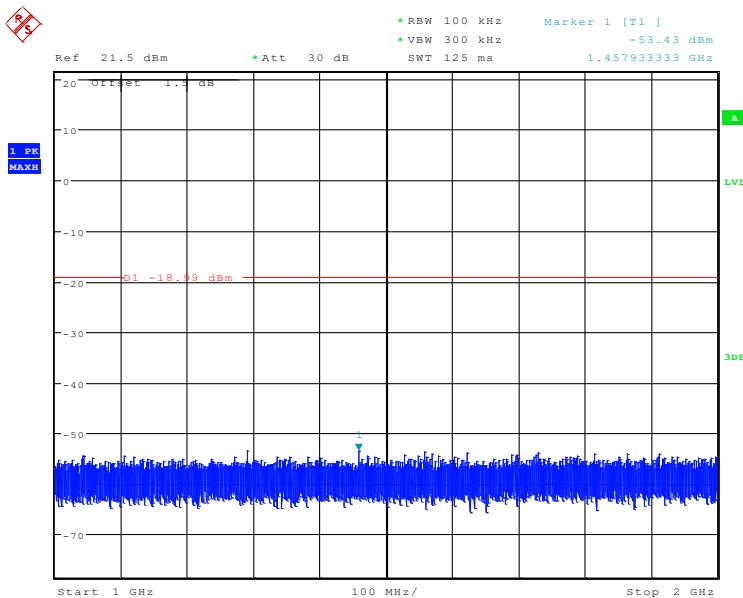
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Middle |
|------------|------|---------------|--------|

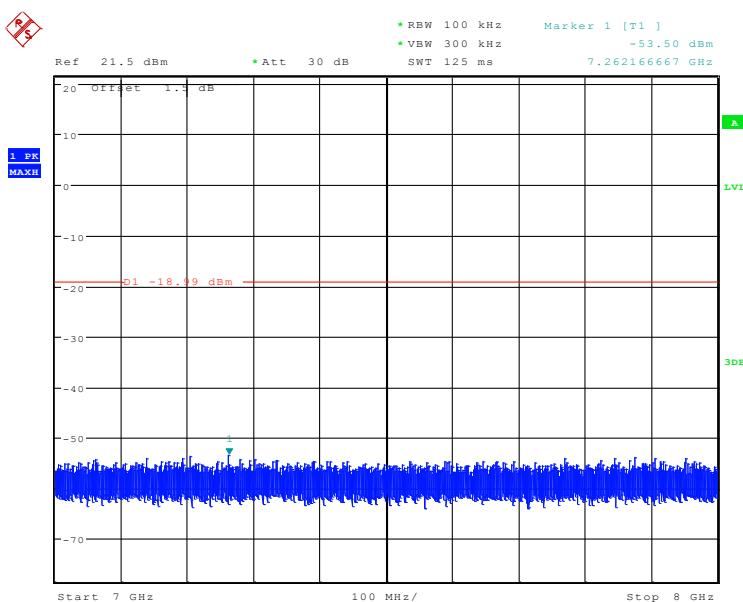
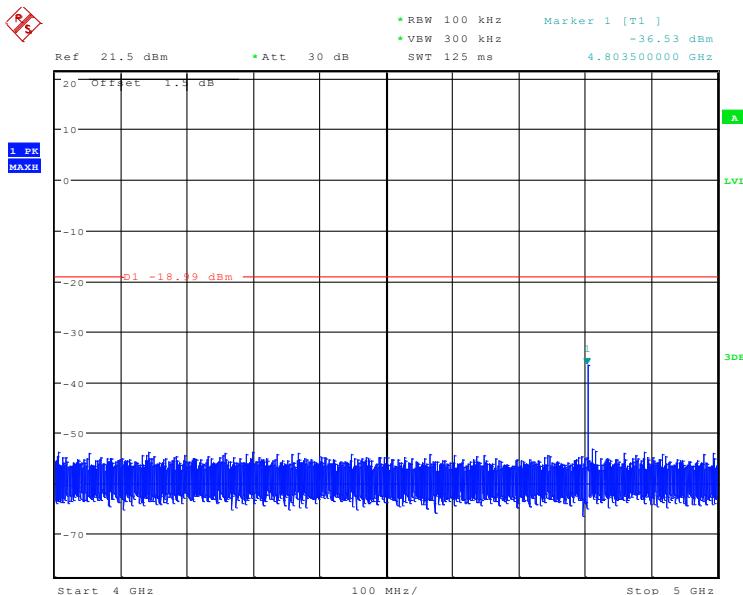


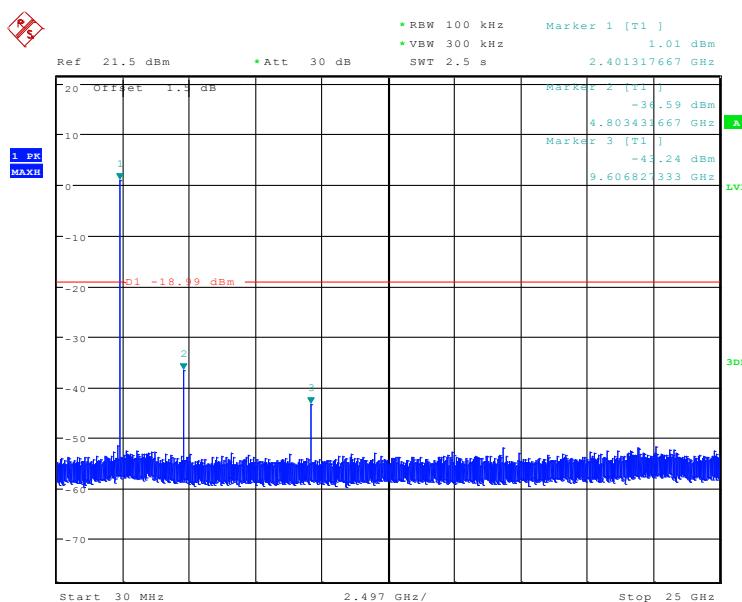
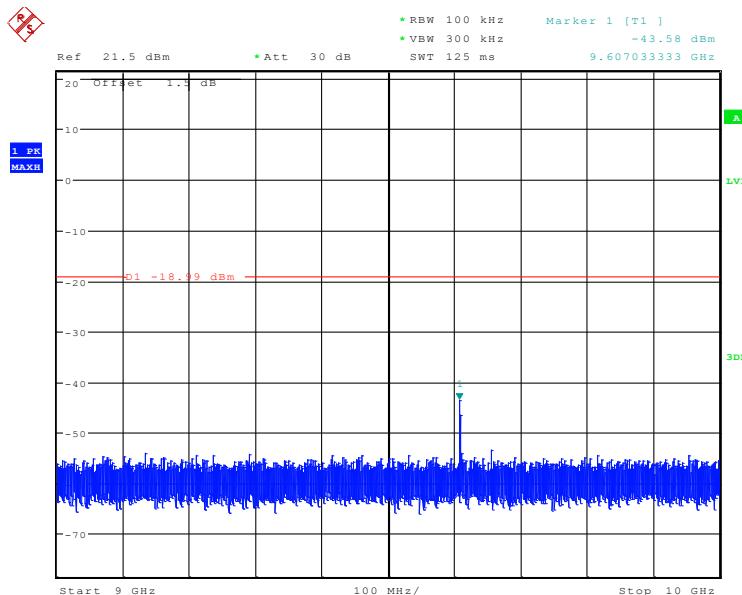




| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|






Remark:

Pretest 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report.

5.7 Radiated Spurious Emission

| 5.7.1 Spurious Emissions | | | | | |
|---|--|----------------------------------|----------------|------------|--------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.209 and 15.205 | | | | |
| Test Method: | ANSI C63.10 2009 | | | | |
| Test Site: | Measurement Distance: 3m (Semi-Anechoic Chamber) | | | | |
| Receiver Setup: | Frequency | Detector | RBW | VBW | Remark |
| | 0.009MHz-0.090MHz | Peak | 10kHz | 30kHz | Peak |
| | 0.009MHz-0.090MHz | Average | 10kHz | 30kHz | Average |
| | 0.090MHz-0.110MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| | 0.110MHz-0.490MHz | Peak | 10kHz | 30kHz | Peak |
| | 0.110MHz-0.490MHz | Average | 10kHz | 30kHz | Average |
| | 0.490MHz -30MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| | 30MHz-1GHz | Quasi-peak | 100 kHz | 300kHz | Quasi-peak |
| | Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | | Peak | 1MHz | 10Hz | Average |
| Limit: | Frequency | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark | Measurement distance (m) |
| | 0.009MHz-0.490MHz | 2400/F(kHz) | - | - | 300 |
| | 0.490MHz-1.705MHz | 24000/F(kHz) | - | - | 30 |
| | 1.705MHz-30MHz | 30 | - | - | 30 |
| | 30MHz-88MHz | 100 | 40.0 | Quasi-peak | 3 |
| | 88MHz-216MHz | 150 | 43.5 | Quasi-peak | 3 |
| | 216MHz-960MHz | 200 | 46.0 | Quasi-peak | 3 |
| | 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |
| | Above 1GHz | 500 | 54.0 | Average | 3 |
| Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device. | | | | | |
| Test Setup: | | | | | |

Figure 1. Below 30MHz

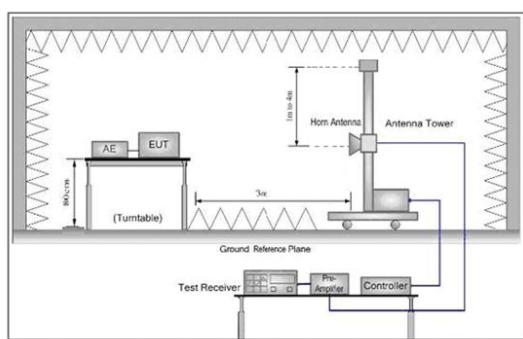


Figure 2. 30MHz to 1GHz

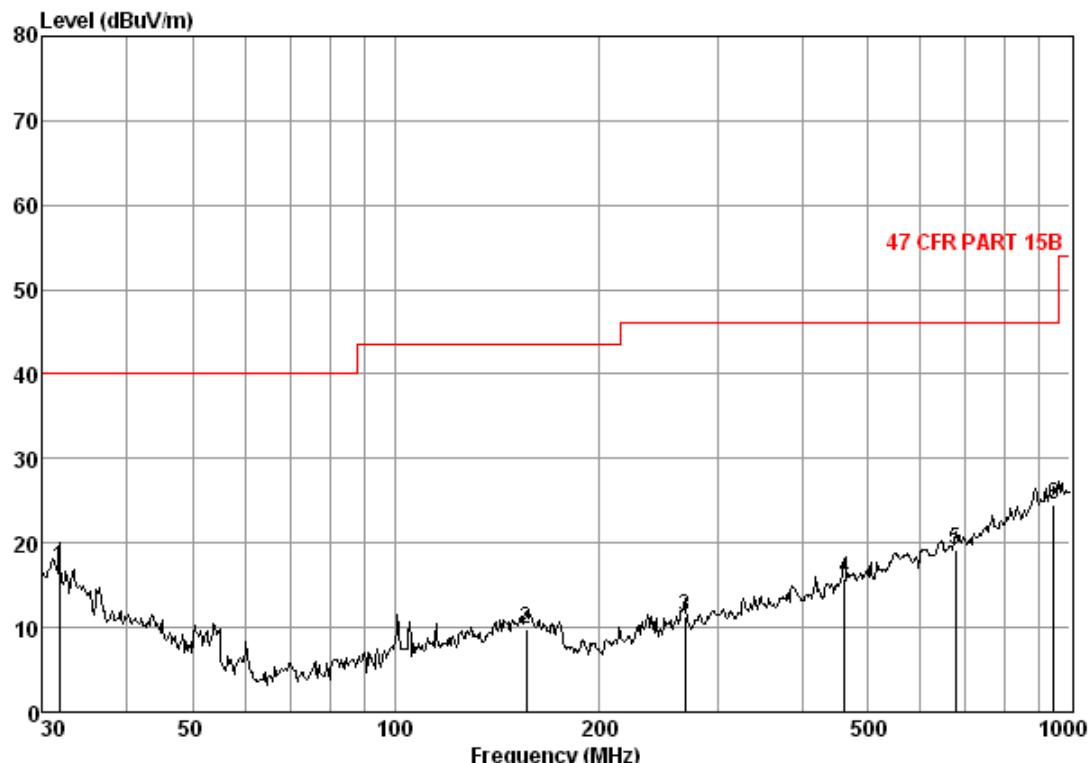
Figure 3. Above 1 GHz

| | |
|-------------------|---|
| Test Procedure: | <ol style="list-style-type: none">The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.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.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.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.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.Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz)The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode,And found the X axis positioning which it is worse case.Repeat above procedures until all frequencies measured was complete. |
| Test Mode: | Non-hopping transmitting with GFSK modulation |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

Radiated Emission below 1GHz

30MHz~1GHz (QP)

Test mode: Transmitting Vertical



Condition: 47 CFR PART 15B 3m 3142C VERTICAL

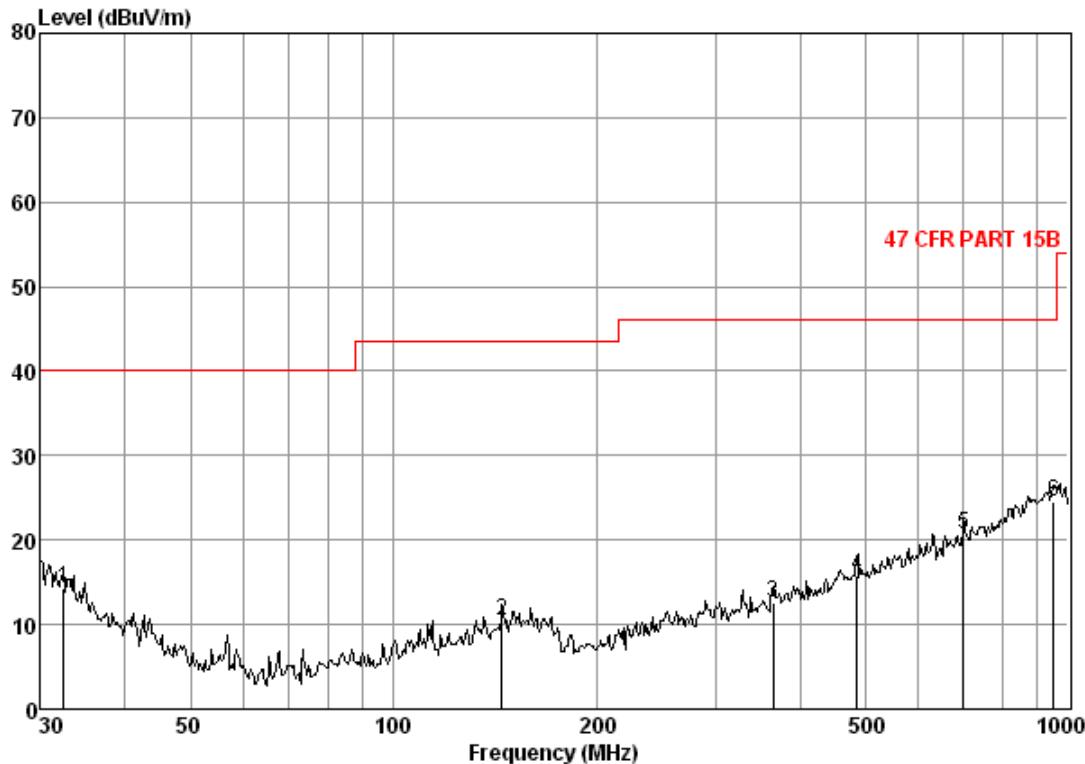
Job No. : 0543RF

Mode : TX

| Freq | Cable Loss | Antenna Factor | Preamp Factor | Read | Limit | Over | Over |
|------|------------|----------------|---------------|-------|--------|--------|--------------|
| | | | | Level | | | |
| MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 31.73 | 0.60 | 16.57 | 27.35 | 27.17 | 16.99 | 40.00 -23.01 |
| 2 | 156.46 | 1.33 | 9.58 | 26.87 | 25.84 | 9.88 | 43.50 -33.62 |
| 3 | 268.49 | 1.76 | 9.00 | 26.49 | 27.12 | 11.39 | 46.00 -34.61 |
| 4 | 462.35 | 2.46 | 13.33 | 27.52 | 27.43 | 15.70 | 46.00 -30.30 |
| 5 | 675.21 | 2.85 | 16.40 | 27.44 | 27.48 | 19.29 | 46.00 -26.71 |
| 6 | 945.44 | 3.65 | 21.13 | 26.58 | 26.43 | 24.63 | 46.00 -21.37 |



| | | |
|------------|--------------|------------|
| Test mode: | Transmitting | Horizontal |
|------------|--------------|------------|



Condition: 47 CFR PART 15B 3m 3142C HORIZONTAL

Job No. : 0543RF

Mode : TX

| Freq | Cable | | Antenna | Preamp | Read | Limit | Over | Over |
|------|--------|--------|---------|--------|-------|--------|--------|--------|
| | Loss | Factor | Factor | Level | Level | Line | Line | |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 32.41 | 0.60 | 16.10 | 27.35 | 24.98 | 14.33 | 40.00 | -25.67 |
| 2 | 144.84 | 1.31 | 8.96 | 26.93 | 27.06 | 10.40 | 43.50 | -33.10 |
| 3 | 365.54 | 2.10 | 10.91 | 26.91 | 26.49 | 12.59 | 46.00 | -33.41 |
| 4 | 485.61 | 2.55 | 13.45 | 27.64 | 27.35 | 15.71 | 46.00 | -30.29 |
| 5 | 699.30 | 2.90 | 16.80 | 27.41 | 28.41 | 20.70 | 46.00 | -25.30 |
| 6 | 952.09 | 3.65 | 21.30 | 26.54 | 26.13 | 24.54 | 46.00 | -21.46 |

| Transmitter Emission above 1GHz | | | | | | | | | |
|---------------------------------|-----------------|-----------------------|--------------------|-------------------|----------------|---------------------|-----------------|--------------|------|
| Test mode: | | GFSK | | Test channel: | | Lowest | | Remark: | Peak |
| Frequency (MHz) | Cable Loss (dB) | Antenna Factor (dB/m) | Preamp Factor (dB) | Read Level (dBuV) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | |
| 3112.129 | 5.22 | 33.36 | 40.38 | 45.87 | 44.07 | 74 | -29.93 | Vertical | |
| 3903.444 | 6.33 | 33.70 | 40.97 | 46.52 | 45.58 | 74 | -28.42 | Vertical | |
| 4804.000 | 7.44 | 34.70 | 41.63 | 46.57 | 47.08 | 74 | -26.92 | Vertical | |
| 7206.000 | 8.72 | 35.88 | 39.87 | 45.00 | 49.73 | 74 | -24.27 | Vertical | |
| 9608.000 | 9.68 | 37.30 | 37.80 | 42.61 | 51.79 | 74 | -22.21 | Vertical | |
| 12588.750 | 11.52 | 39.44 | 38.52 | 40.69 | 53.13 | 74 | -20.87 | Vertical | |
| 3049.394 | 5.12 | 33.38 | 40.34 | 44.99 | 43.15 | 74 | -30.85 | Horizontal | |
| 3933.367 | 6.38 | 33.74 | 40.98 | 46.28 | 45.42 | 74 | -28.58 | Horizontal | |
| 4804.000 | 7.44 | 34.70 | 41.63 | 46.67 | 47.18 | 74 | -26.82 | Horizontal | |
| 7206.000 | 8.72 | 35.88 | 39.87 | 45.11 | 49.84 | 74 | -24.16 | Horizontal | |
| 9608.000 | 9.68 | 37.30 | 37.80 | 42.71 | 51.89 | 74 | -22.11 | Horizontal | |
| 11963.890 | 11.26 | 38.87 | 38.26 | 40.89 | 52.76 | 74 | -21.24 | Horizontal | |

| Test mode: | | GFSK | | Test channel: | | Middle | | Remark: | Peak |
|-----------------|-----------------|-----------------------|--------------------|-------------------|----------------|---------------------|-----------------|--------------|------|
| Frequency (MHz) | Cable Loss (dB) | Antenna Factor (dB/m) | Preamp Factor (dB) | Read Level (dBuV) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | |
| 3026.195 | 5.09 | 33.39 | 40.33 | 45.52 | 43.67 | 74 | -30.33 | Vertical | |
| 3903.444 | 6.33 | 33.70 | 40.97 | 44.96 | 44.02 | 74 | -29.98 | Vertical | |
| 4880.000 | 7.48 | 34.59 | 41.68 | 45.85 | 46.24 | 74 | -27.76 | Vertical | |
| 7320.000 | 8.87 | 35.93 | 39.77 | 44.56 | 49.59 | 74 | -24.41 | Vertical | |
| 9760.000 | 9.74 | 37.46 | 37.66 | 40.53 | 50.07 | 74 | -23.93 | Vertical | |
| 12334.980 | 11.42 | 39.24 | 38.42 | 40.07 | 52.31 | 74 | -21.69 | Vertical | |
| 3018.502 | 5.09 | 33.39 | 40.31 | 45.73 | 43.90 | 74 | -30.10 | Horizontal | |
| 3973.622 | 6.43 | 33.78 | 41.02 | 46.46 | 45.65 | 74 | -28.35 | Horizontal | |
| 4880.000 | 7.48 | 34.59 | 41.68 | 46.94 | 47.33 | 74 | -26.67 | Horizontal | |
| 7320.000 | 8.87 | 35.93 | 39.77 | 44.71 | 49.74 | 74 | -24.26 | Horizontal | |
| 9760.000 | 9.74 | 37.46 | 37.66 | 42.26 | 51.80 | 74 | -22.20 | Horizontal | |
| 12461.220 | 11.47 | 39.37 | 38.47 | 40.73 | 53.10 | 74 | -20.90 | Horizontal | |

| Test mode: | | GFSK | | Test channel: | | Highest | | Remark: | | Peak |
|-----------------|-----------------|-----------------------|--------------------|-------------------|----------------|---------------------|-----------------|--------------|--|------|
| Frequency (MHz) | Cable Loss (dB) | Antenna Factor (dB/m) | Preamp Factor (dB) | Read Level (dBuV) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | | |
| 3018.502 | 5.09 | 33.39 | 40.31 | 45.21 | 43.38 | 74 | -30.62 | Vertical | | |
| 3983.750 | 6.43 | 33.80 | 41.02 | 45.46 | 44.67 | 74 | -29.33 | Vertical | | |
| 4960.000 | 7.53 | 34.46 | 41.74 | 47.07 | 47.32 | 74 | -26.68 | Vertical | | |
| 7440.000 | 9.01 | 35.98 | 39.67 | 44.43 | 49.75 | 74 | -24.25 | Vertical | | |
| 9920.000 | 9.81 | 37.63 | 37.53 | 40.12 | 50.03 | 74 | -23.97 | Vertical | | |
| 12210.020 | 11.37 | 39.11 | 38.36 | 40.60 | 52.72 | 74 | -21.28 | Vertical | | |
| 3018.502 | 5.09 | 33.39 | 40.31 | 44.84 | 43.01 | 74 | -30.99 | Horizontal | | |
| 3983.750 | 6.43 | 33.80 | 41.02 | 45.65 | 44.86 | 74 | -29.14 | Horizontal | | |
| 4960.000 | 7.53 | 34.46 | 41.74 | 45.86 | 46.11 | 74 | -27.89 | Horizontal | | |
| 7440.000 | 9.01 | 35.98 | 39.67 | 44.18 | 49.50 | 74 | -24.50 | Horizontal | | |
| 9920.000 | 9.81 | 37.63 | 37.53 | 41.91 | 51.82 | 74 | -22.18 | Horizontal | | |
| 12086.330 | 11.32 | 38.99 | 38.31 | 40.14 | 52.14 | 74 | -21.86 | Horizontal | | |

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) Scan from 9kHz to 25GHz, The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3) As shown in this section, 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. So, only the peak measurements were shown in the report.

5.8 Restricted bands around fundamental frequency

| | | | |
|-------------------|--|--------------------|------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.209 and 15.205 | | |
| Test Method: | ANSI C63.10 2009 | | |
| Test Site: | Measurement Distance: 3m (Semi-Anechoic Chamber) | | |
| 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 |
| | | 74.0 | Peak Value |

Test Setup:

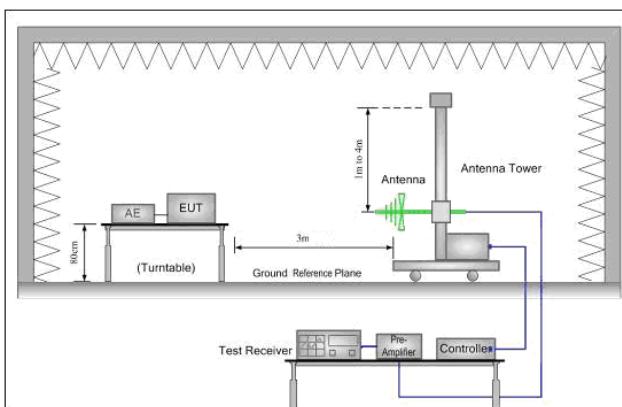


Figure 1. 30MHz to 1GHz

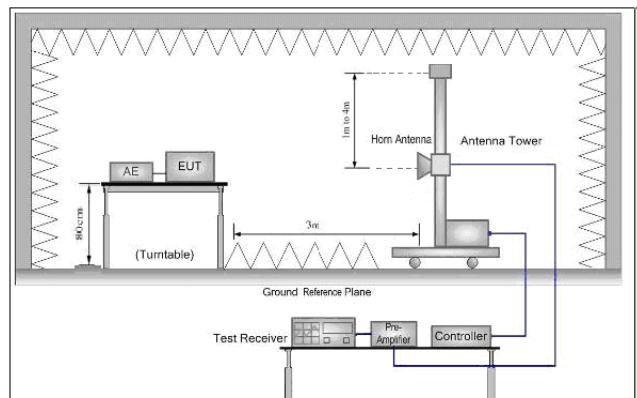


Figure 2. Above 1 GHz

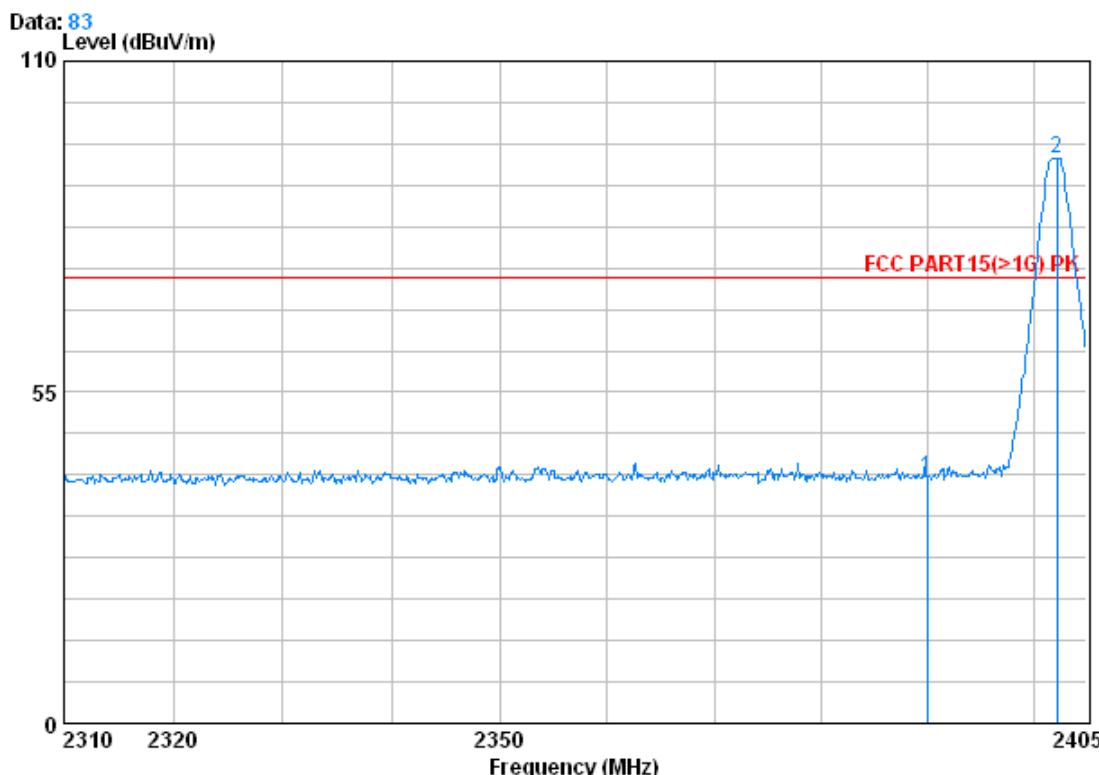
| | |
|-----------------|---|
| Test Procedure: | <ol style="list-style-type: none"> The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 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. 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel |
|-----------------|---|

| | |
|-------------------|---|
| | <ul style="list-style-type: none">g. Test the EUT in the lowest channel , the Highest channelh. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case.i. Repeat above procedures until all frequencies measured was complete. |
| Test Mode: | Non-hopping transmitting with GFSK modulation |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

Test plot as follows:

Restricted bands around fundamental frequency

| Test mode: | GFSK | Test channel: | Lowest | Remark: | Peak | Vertical |
|------------|------|---------------|--------|---------|------|----------|
|------------|------|---------------|--------|---------|------|----------|



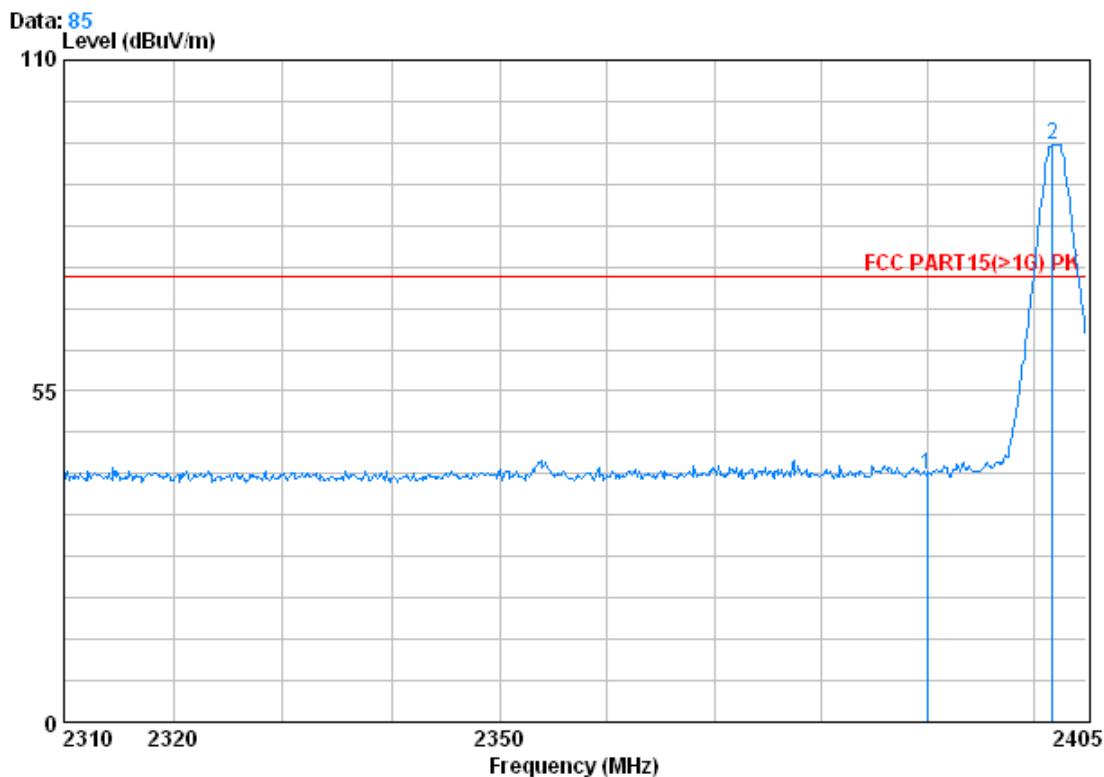
Condition : FCC PART15(>1G) PK 3m VERTICAL

Job No. : 0543RF

Mode : 2402

| | Cable | Antenna | Preamp | Read | Limit | Over | | |
|---|-------|----------|--------|-------|-------|--------|--------|--------------|
| | Freq | Loss | Factor | Level | Level | Line | Limit | |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 0 | 2390.000 | 2.98 | 32.51 | 39.85 | 45.20 | 40.85 | 74.00 -33.15 |
| 2 | 0 | 2402.245 | 2.98 | 32.51 | 39.86 | 98.29 | 93.92 | 74.00 19.92 |

| | | | | | | |
|------------|------|---------------|--------|---------|------|------------|
| Test mode: | GFSK | Test channel: | Lowest | Remark: | Peak | Horizontal |
|------------|------|---------------|--------|---------|------|------------|



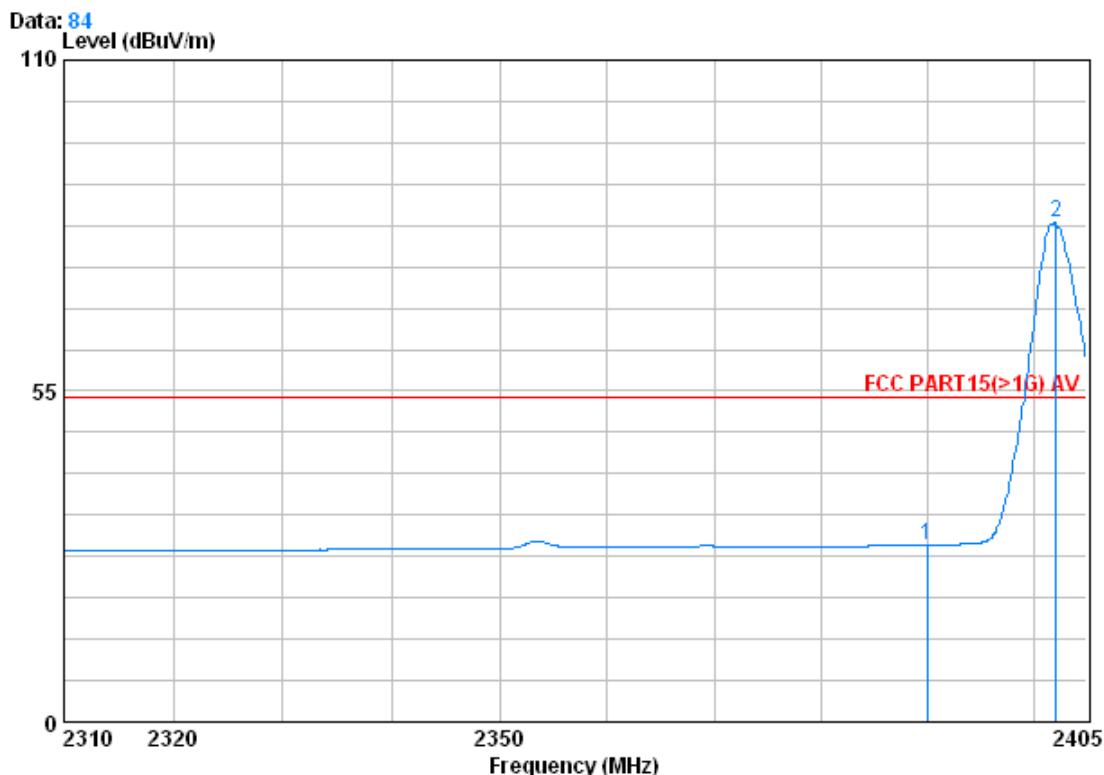
Condition : FCC PART15(>1G) PK 3m HORIZONTAL

Job No. : 0543RF

Mode : 2402

| Freq | Cable | | Antenna | Preamp | Read | Limit | Over | |
|------|-------|----------|---------|--------|-------|--------|--------|--------------|
| | Loss | Factor | Factor | Level | Level | | | |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 0 | 2390.000 | 2.98 | 32.51 | 39.85 | 45.45 | 41.10 | 74.00 -32.90 |
| 2 | 0 | 2401.770 | 2.98 | 32.51 | 39.86 | 100.34 | 95.97 | 74.00 21.97 |

| | | | | | | |
|------------|------|---------------|--------|---------|---------|----------|
| Test mode: | GFSK | Test channel: | Lowest | Remark: | Average | Vertical |
|------------|------|---------------|--------|---------|---------|----------|



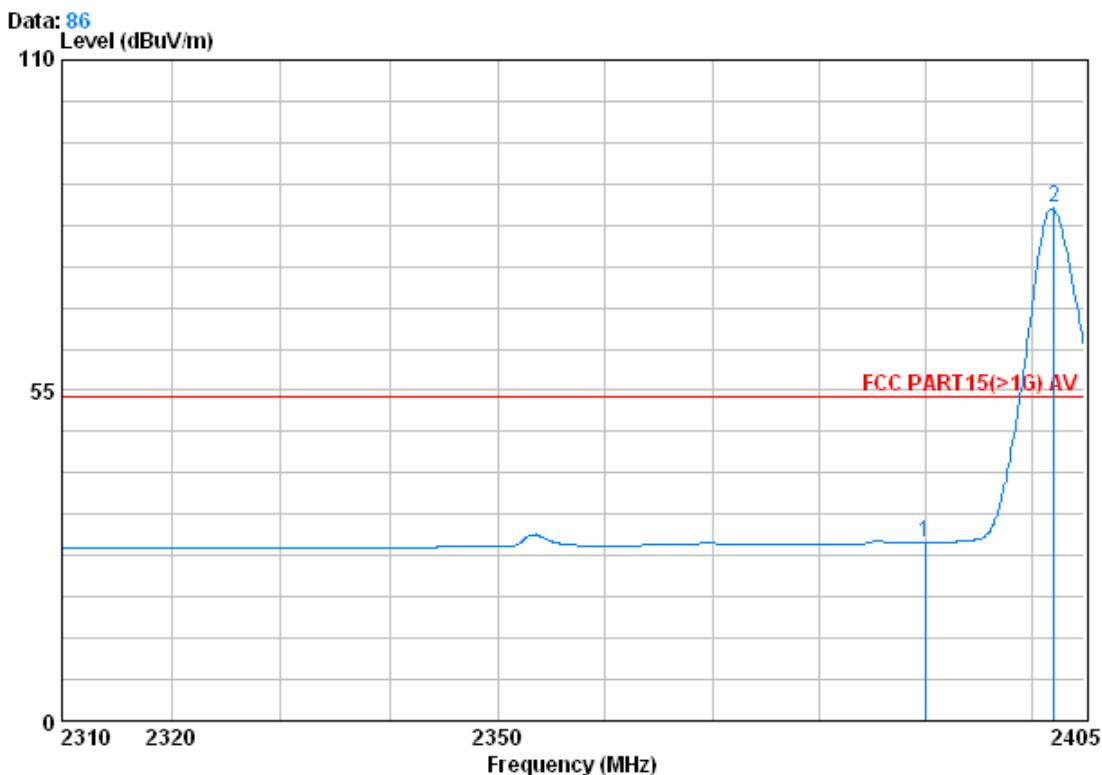
Condition : FCC PART15(>1G) AV 3m VERTICAL

Job No. : 0543RF

Mode : 2402

| Freq | Cable | | Antenna | Preamp | Read | Limit | Over | |
|------|-------|----------|---------|--------|-------|--------|--------|--------------|
| | Loss | Factor | Factor | Level | Level | | | |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 0 | 2390.000 | 2.98 | 32.51 | 39.85 | 33.67 | 29.31 | 54.00 -24.69 |
| 2 | 0 | 2402.150 | 2.98 | 32.51 | 39.86 | 87.40 | 83.04 | 54.00 29.04 |

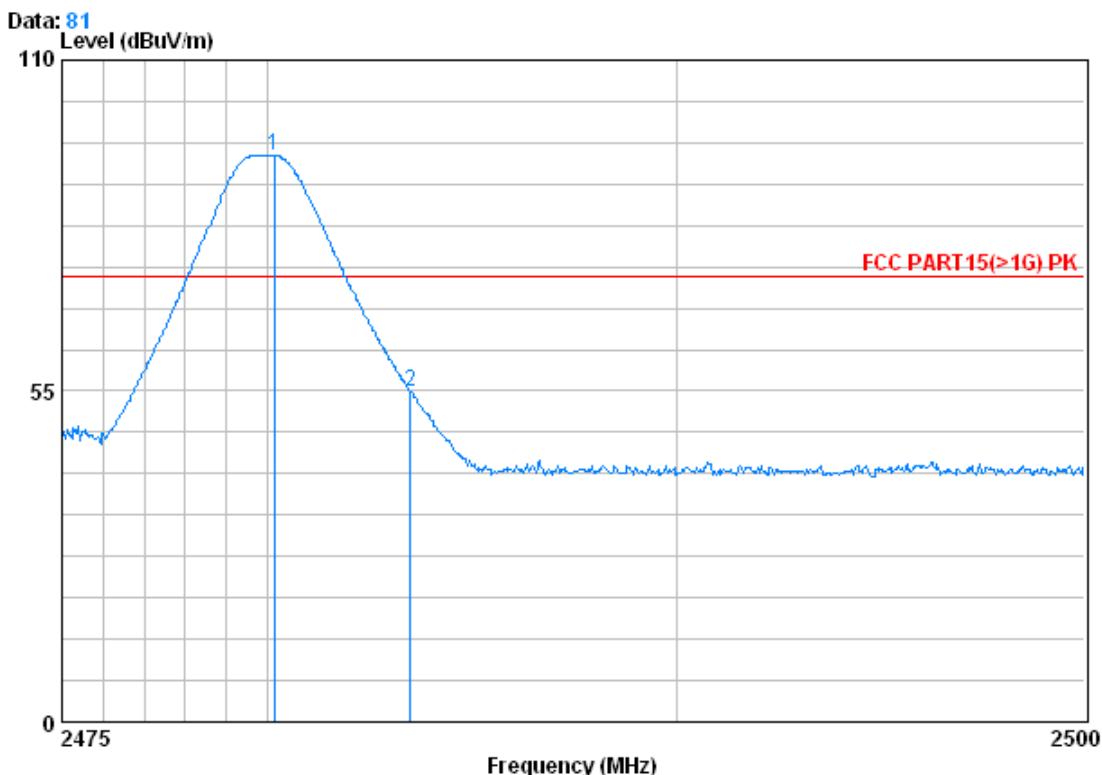
| Test mode: | GFSK | Test channel: | Lowest | Remark: | Average | Horizontal |
|------------|------|---------------|--------|---------|---------|------------|
|------------|------|---------------|--------|---------|---------|------------|



Condition : FCC PART15(>1G) AV 3m HORIZONTAL
Job No. : 0543RF
Mode : 2402

| Freq | Cable | | Antenna | Preamp | Read | Limit | Over | |
|------|-------|----------|---------|--------|-------|--------|--------|--------------|
| | Loss | Factor | Factor | Level | Level | | | |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 0 | 2390.000 | 2.98 | 32.51 | 39.85 | 33.96 | 29.60 | 54.00 -24.40 |
| 2 | 0 | 2402.150 | 2.98 | 32.51 | 39.86 | 89.69 | 85.32 | 54.00 31.32 |

| | | | | | | |
|------------|------|---------------|---------|---------|------|----------|
| Test mode: | GFSK | Test channel: | Highest | Remark: | Peak | Vertical |
|------------|------|---------------|---------|---------|------|----------|



Condition : FCC PART15(>1G) PK 3m VERTICAL

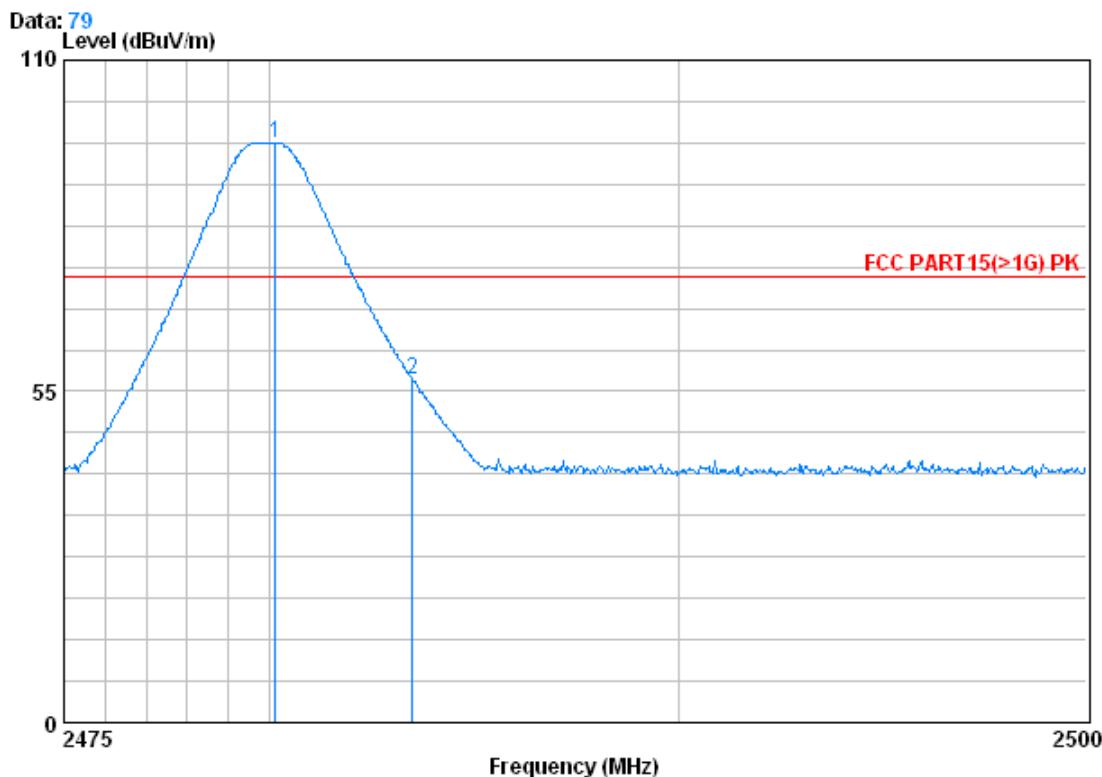
Job No. : 0543RF

Mode : 2480

| | Freq | Cable Loss | Antenna Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit |
|---|----------|------------|----------------|---------------|------------|--------|------------|------------|
| | MHz | dB | dB/m | | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 2480.175 | 3.03 | 32.67 | 39.92 | 98.36 | 94.14 | 74.00 | 20.14 |
| 2 | 2483.500 | 3.03 | 32.67 | 39.92 | 59.02 | 54.80 | 74.00 | -19.20 |



| Test mode: | GFSK | Test channel: | Highest | Remark: | Peak | Horizontal |
|------------|------|---------------|---------|---------|------|------------|
|------------|------|---------------|---------|---------|------|------------|



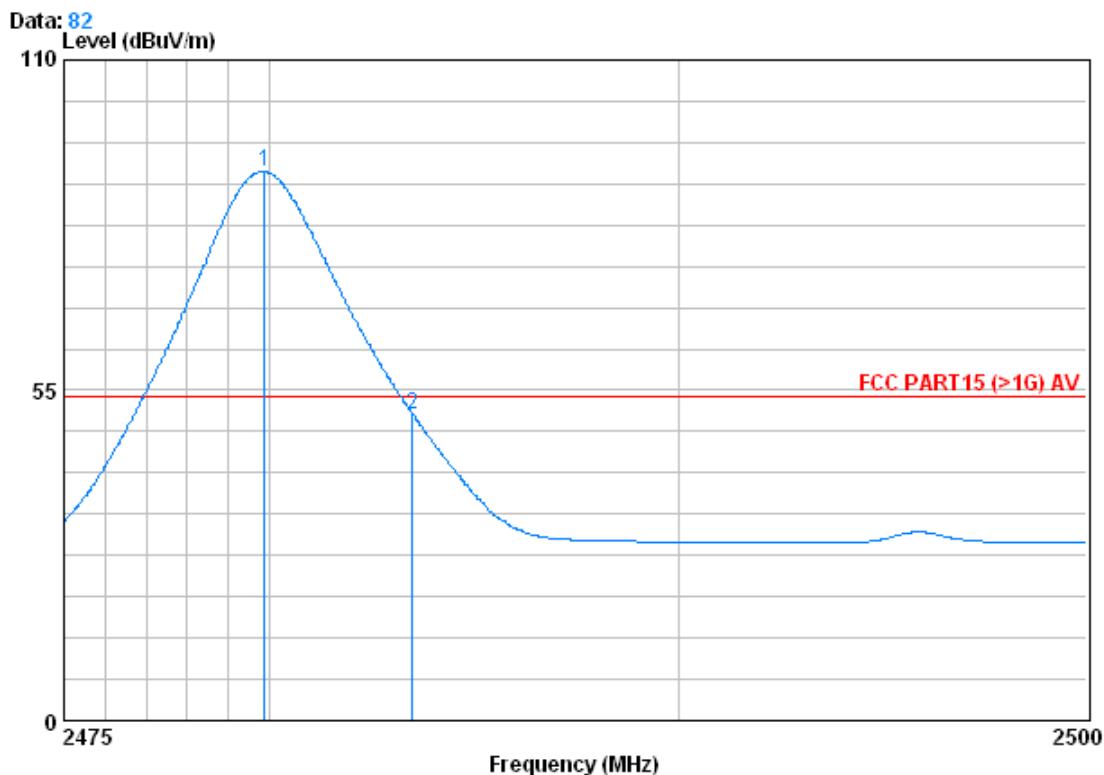
Condition : FCC PART15(>1G) PK 3m HORIZONTAL

Job No. : 0543RF

Mode : 2480

| Freq | Cable | | Antenna | Preamp | Read | Limit | Over | |
|------|----------|--------|---------|--------|--------|--------|--------|--------|
| | Loss | Factor | Factor | Level | Level | | | |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 0 | 2480.150 | 3.03 | 32.67 | 39.92 | 100.57 | 96.35 | 74.00 | 22.35 |
| 2 0 | 2483.500 | 3.03 | 32.67 | 39.92 | 61.17 | 56.95 | 74.00 | -17.05 |

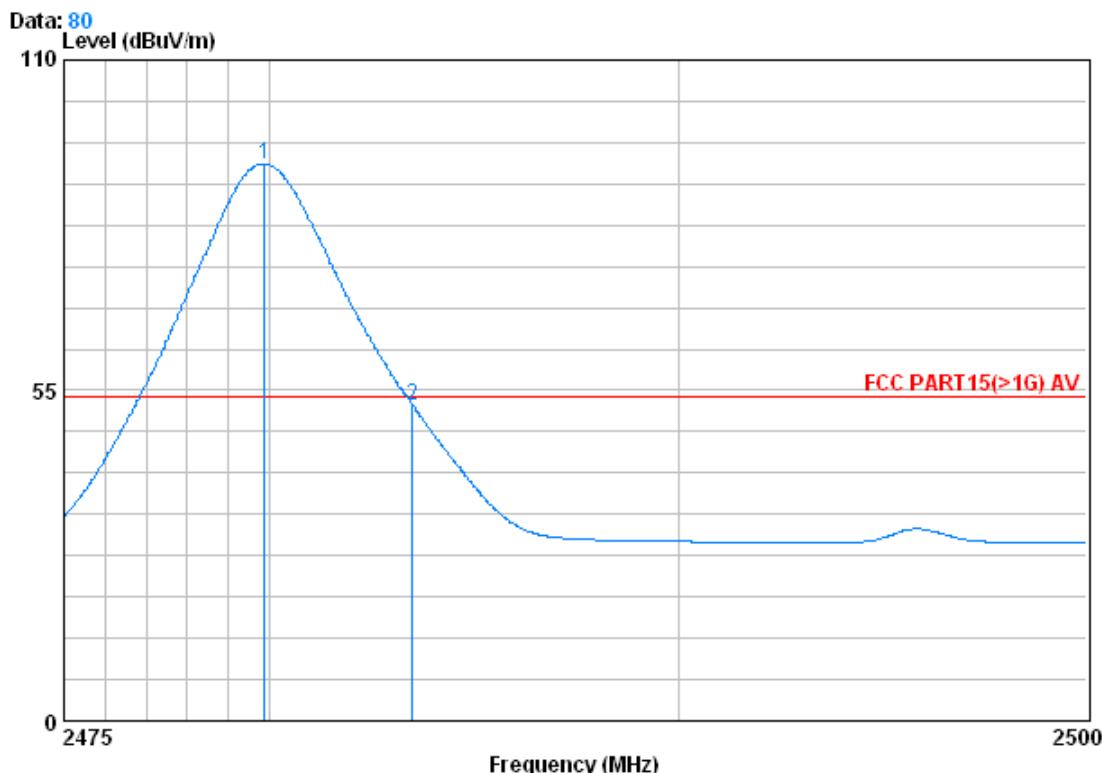
| | | | | | | |
|------------|------|---------------|---------|---------|---------|----------|
| Test mode: | GFSK | Test channel: | Highest | Remark: | Average | Vertical |
|------------|------|---------------|---------|---------|---------|----------|



Condition : FCC PART15 (>1G) AV 3m VERTICAL
Job No. : 0543RF
Mode : 2480

| Freq | Cable | | Antenna | Preamp | Read | Limit | Over | | |
|------|-------|----------|---------|--------|-------|--------|--------|-------|-------|
| | Loss | Factor | Factor | Level | Level | | | | |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 0 | 2479.875 | 3.03 | 32.67 | 39.92 | 95.63 | 91.41 | 54.00 | 37.41 |
| 2 | 0 | 2483.500 | 3.03 | 32.67 | 39.92 | 55.20 | 50.98 | 54.00 | -3.02 |

| Test mode: | GFSK | Test channel: | Highest | Remark: | Average | Horizontal |
|------------|------|---------------|---------|---------|---------|------------|
|------------|------|---------------|---------|---------|---------|------------|



Condition : FCC PART15(>1G) AV 3m HORIZONTAL
 Job No. : 0543RF
 Mode : 2480

| Freq | Cable | | Antenna | Preamp | Read | Limit | Over | |
|------|----------|--------|---------|--------|-------|--------|--------|-------|
| | Loss | Factor | Factor | Level | Level | Line | Limit | |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 0 | 2479.875 | 3.03 | 32.67 | 39.92 | 96.95 | 92.73 | 54.00 | 38.73 |
| 2 0 | 2483.500 | 3.03 | 32.67 | 39.92 | 56.73 | 52.51 | 54.00 | -1.49 |

Note:

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