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Report No.: SZEM131200691201
Page: 1 of 79

FCC REPORT

Application No: SZEM1312006912RF
Applicant: DEI HEADQUARTERS, INC.
Manufacturer: S.C. Falcon Electronics Prod. SRL
Factory: Portman Electronics CO., LTD.
Product Name: OBD II BLUETOOTH DEVICE
Model No.(EUT): XKLOADER3
FCC ID: EZSDEIXKL3
Standards: 47 CFR Part 15, Subpart C (2012)
Date of Receipt: 2013-12-30
Date of Test: 2014-01-14 to 2014-01-21
Date of Issue: 2014-02-14

| | |
|---------------------|---------------|
| 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)(1) | ANSI C63.10 (2009) | PASS |
| 20dB Occupied Bandwidth | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | ANSI C63.10 (2009) | PASS |
| Carrier Frequencies Separation | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | ANSI C63.10 (2009) | PASS |
| Hopping Channel Number | 47 CFR Part 15, Subpart C Section 15.247 (b) | ANSI C63.10 (2009) | PASS |
| Dwell Time | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | ANSI C63.10 (2009) | PASS |
| Pseudorandom Frequency Hopping Sequence | 47 CFR Part 15, Subpart C Section 15.247(b)(4)&TCB Exclusion List (7 July 2002) | ANSI C63.10 (2009) | PASS |
| Band-edge for RF Conducted Emissions | 47 CFR Part 15, Subpart C Section 15.247(d) | ANSI C63.10 (2009) | PASS |
| RF Conducted Spurious Emissions | 47 CFR Part 15, Subpart C Section 15.247(d) | ANSI C63.10 (2009) | PASS |
| Radiated Spurious emissions | 47 CFR Part 15, Subpart C Section 15.205/15.209 | ANSI C63.10 (2009) | PASS |
| Band Edge (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 CLIENT INFORMATION..... | 4 |
| 4.2 GENERAL DESCRIPTION OF EUT | 4 |
| 4.3 TEST ENVIRONMENT | 6 |
| 4.4 DESCRIPTION OF SUPPORT UNITS | 6 |
| 4.5 TEST LOCATION | 6 |
| 4.6 TEST FACILITY | 7 |
| 4.7 DEVIATION FROM STANDARDS..... | 7 |
| 4.8 ABNORMALITIES FROM STANDARD CONDITIONS | 7 |
| 4.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER | 7 |
| 4.10 EQUIPMENT LIST | 8 |
| 5 TEST RESULTS AND MEASUREMENT DATA | 10 |
| 5.1 ANTENNA REQUIREMENT | 10 |
| 5.2 CONDUCTED PEAK OUTPUT POWER..... | 11 |
| 5.3 20dB OCCUPY BANDWIDTH..... | 18 |
| 5.4 CARRIER FREQUENCIES SEPARATION | 24 |
| 5.5 HOPPING CHANNEL NUMBER | 31 |
| 5.6 DWELL TIME | 34 |
| 5.7 BAND-EDGE FOR RF CONDUCTED EMISSIONS | 40 |
| 5.8 SPURIOUS RF CONDUCTED EMISSIONS | 47 |
| 5.9 PSEUDORANDOM FREQUENCY HOPPING SEQUENCE | 62 |
| 5.10 RADIATED SPURIOUS EMISSION | 63 |
| 5.10.1 Radiated Emission below 1GHz | 66 |
| 5.10.2 Transmitter Emission above 1GHz | 68 |
| 5.11 BAND EDGE (RADIATED EMISSION) | 70-79 |



4 General Information

4.1 Client Information

| | |
|--------------------------|------------------------------------------------------------------------------------------|
| Applicant: | DEI HEADQUARTERS, INC. |
| Address of Applicant: | 1 Viper Way, Vista, CA 92081, USA |
| Manufacturer: | S.C. Falcon Electronics Prod. SRL |
| Address of Manufacturer: | 247-251, Splaiul Unirii, Sector 3, cod 030137, Bucharest Romania |
| Factory: | Portman Electronics CO., LTD. |
| Address of Factory: | No. 10 Luyi 2nd RD., Keyuancheng, Tangxia Town, Dongguan City, Guangdong Province, China |

4.2 General Description of EUT

| | |
|-----------------------|-----------------------------------------|
| Product Name: | OBD II BLUETOOTH DEVICE |
| Model No.: | XKLOADER3 |
| Operation Frequency: | 2402MHz~2480MHz |
| Bluetooth Version: | V2.1+EDR |
| Modulation Technique: | Frequency Hopping Spread Spectrum(FHSS) |
| Modulation Type: | GFSK, $\pi/4$ DQPSK, 8DPSK |
| Number of Channel: | 79 |
| Hopping Channel Type: | Adaptive Frequency Hopping systems |
| Sample Type: | mobile production |
| Test Power Grade: | 100,55(manufacturer declare) |
| Test Software of EUT: | CSR blue suite (manufacturer declare) |
| Antenna Type | Integral |
| Antenna Gain | 2.1dBi |
| Power Supply: | DC 12V |
| Test Voltage: | DC 12V |



| Operation Frequency each of channel | | | | | | | |
|-------------------------------------|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 1 | 2402MHz | 21 | 2422MHz | 41 | 2442MHz | 61 | 2462MHz |
| 2 | 2403MHz | 22 | 2423MHz | 42 | 2443MHz | 62 | 2463MHz |
| 3 | 2404MHz | 23 | 2424MHz | 43 | 2444MHz | 63 | 2464MHz |
| 4 | 2405MHz | 24 | 2425MHz | 44 | 2445MHz | 64 | 2465MHz |
| 5 | 2406MHz | 25 | 2426MHz | 45 | 2446MHz | 65 | 2466MHz |
| 6 | 2407MHz | 26 | 2427MHz | 46 | 2447MHz | 66 | 2467MHz |
| 7 | 2408MHz | 27 | 2428MHz | 47 | 2448MHz | 67 | 2468MHz |
| 8 | 2409MHz | 28 | 2429MHz | 48 | 2449MHz | 68 | 2469MHz |
| 9 | 2410MHz | 29 | 2430MHz | 49 | 2450MHz | 69 | 2470MHz |
| 10 | 2411MHz | 30 | 2431MHz | 50 | 2451MHz | 70 | 2471MHz |
| 11 | 2412MHz | 31 | 2432MHz | 51 | 2452MHz | 71 | 2472MHz |
| 12 | 2413MHz | 32 | 2433MHz | 52 | 2453MHz | 72 | 2473MHz |
| 13 | 2414MHz | 33 | 2434MHz | 53 | 2454MHz | 73 | 2474MHz |
| 14 | 2415MHz | 34 | 2435MHz | 54 | 2455MHz | 74 | 2475MHz |
| 15 | 2416MHz | 35 | 2436MHz | 55 | 2456MHz | 75 | 2476MHz |
| 16 | 2417MHz | 36 | 2437MHz | 56 | 2457MHz | 76 | 2477MHz |
| 17 | 2418MHz | 37 | 2438MHz | 57 | 2458MHz | 77 | 2478MHz |
| 18 | 2419MHz | 38 | 2439MHz | 58 | 2459MHz | 78 | 2479MHz |
| 19 | 2420MHz | 39 | 2440MHz | 59 | 2460MHz | 79 | 2480MHz |
| 20 | 2421MHz | 40 | 2441MHz | 60 | 2461MHz | | |

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 | 2441MHz |
| The Highest channel | 2480MHz |



4.3 Test Environment

| Operating Environment: | |
|------------------------|----------|
| Temperature: | 24.0 °C |
| Humidity: | 53 % RH |
| Atmospheric Pressure: | 1025mbar |

4.4 Description of Support Units

The EUT has been tested with associated equipment below.

| Description | Manufacturer | Model No. |
|-----------------|--------------|-----------|
| DC Power Supply | Zhao Xin | RXN-305D |

4.5 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.



4.6 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.

4.7 Deviation from Standards

None.

4.8 Abnormalities from Standard Conditions

None.

4.9 Other Information Requested by the Customer

None.

4.10 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 |

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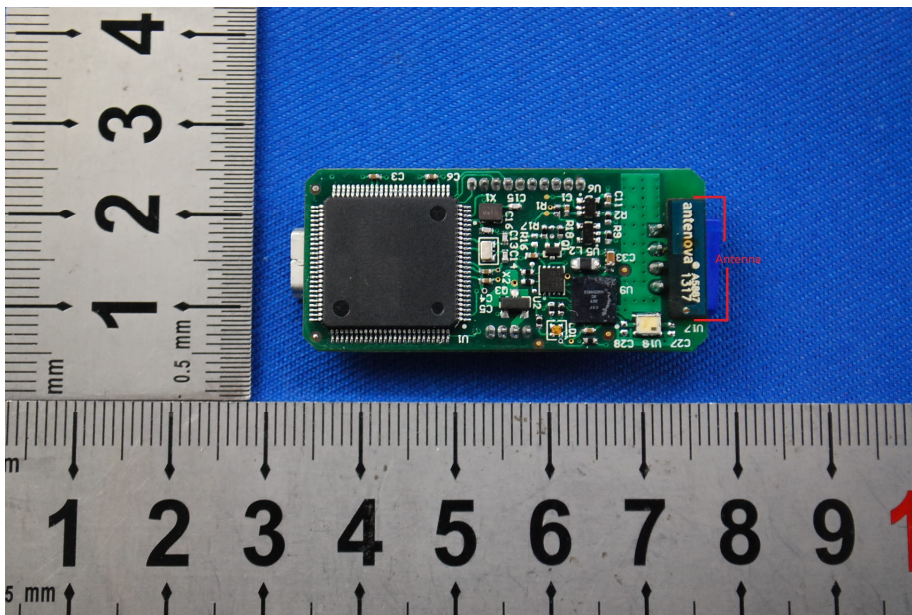


| RF connected test | | | | | |
|-------------------|---------------------------------------|-------------------------|-----------|---------------|------------------------------|
| Item | Test Equipment | Manufacturer | Model No. | Inventory No. | Cal.Due date (yyyy-mm-dd) |
| 1 | DC Power Supply | Zhao 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 |

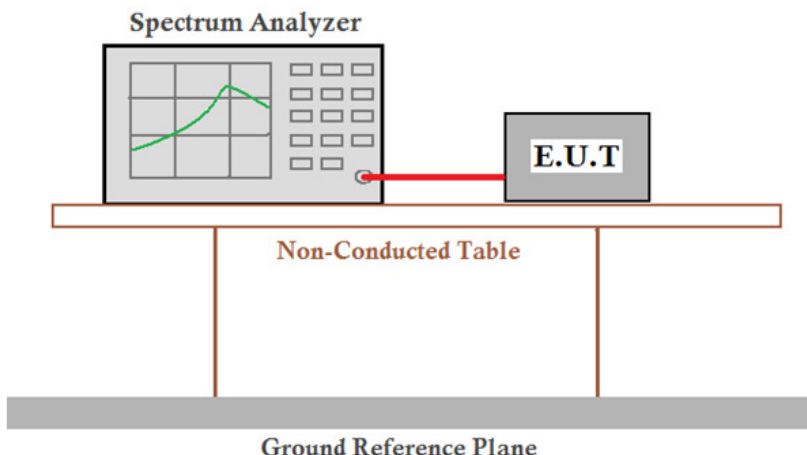
Note: The calibration interval is one year, all the instruments are valid.

5 Test results and Measurement Data

5.1 Antenna Requirement

| | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Standard requirement: | 47 CFR Part 15C Section 15.203 /247(c) |
| <p>15.203 requirement:</p> <p>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.</p> <p>15.247(b) (4) requirement:</p> <p>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.</p> | |
| EUT Antenna: | |
| <p>The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.1dBi.</p>  | |

5.2 Conducted Peak Output Power

| | |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (b)(1) |
| Test Method: | ANSI C63.10:2009 |
| Test Setup: |  <p><i>Remark:</i> Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.</p> |
| Limit: | 20dBm |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type is the worse case of GFSK modulation type, 2-DH1 of data type is worse case of $\pi/4$ DQPSK modulation type, 3-DH1 of data type is worse case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

**Measurement Data**

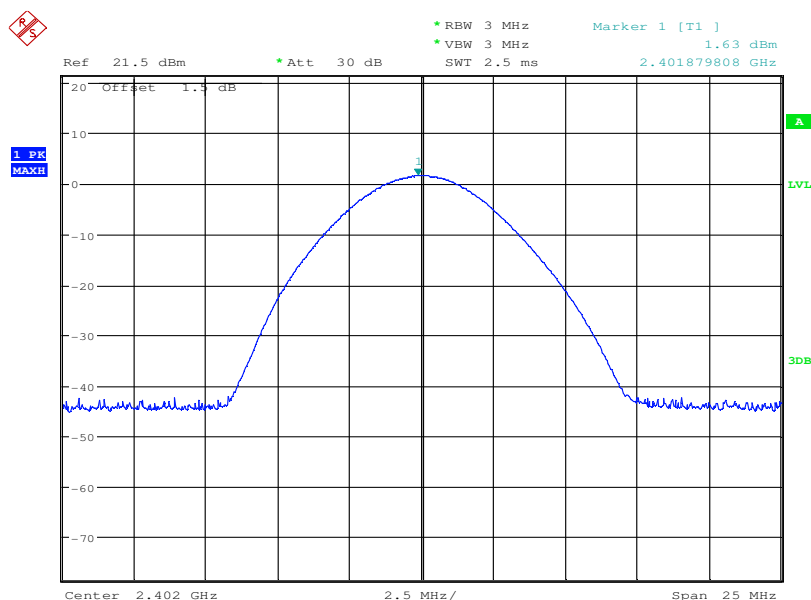
| GFSK mode | | | |
|--------------------|-------------------------|-------------|--------|
| Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest | 1.63 | 20.00 | Pass |
| Middle | 1.40 | 20.00 | Pass |
| Highest | 0.89 | 20.00 | Pass |
| $\pi/4$ DQPSK mode | | | |
| Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest | -0.12 | 20.00 | Pass |
| Middle | -0.62 | 20.00 | Pass |
| Highest | -1.03 | 20.00 | Pass |
| 8DPSK mode | | | |
| Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest | 0.21 | 20.00 | Pass |
| Middle | -0.15 | 20.00 | Pass |
| Highest | -0.61 | 20.00 | Pass |



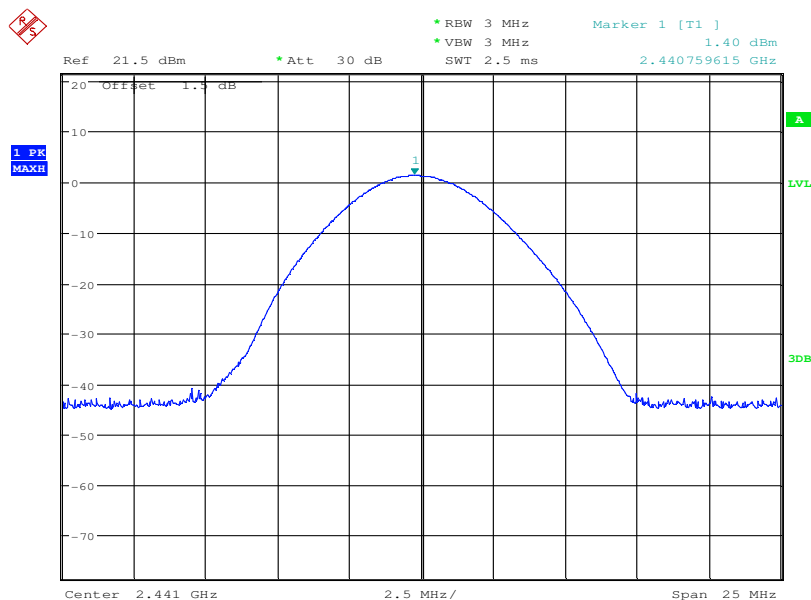
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Test plot as follows:

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

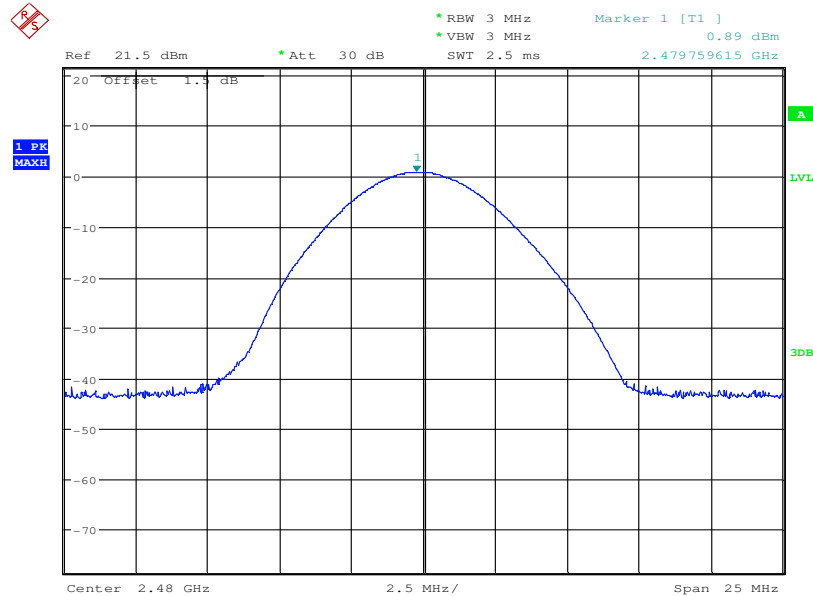


| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Middle |
|------------|------|---------------|--------|

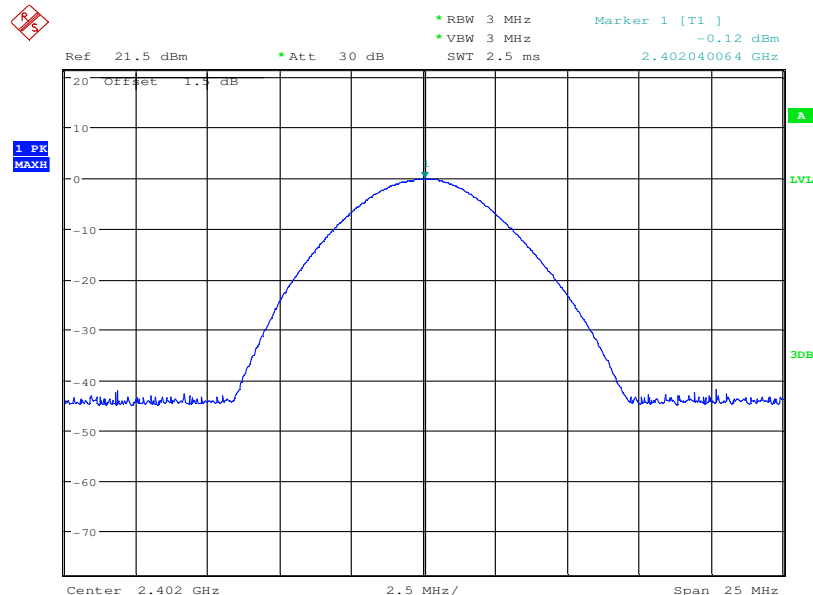




| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|

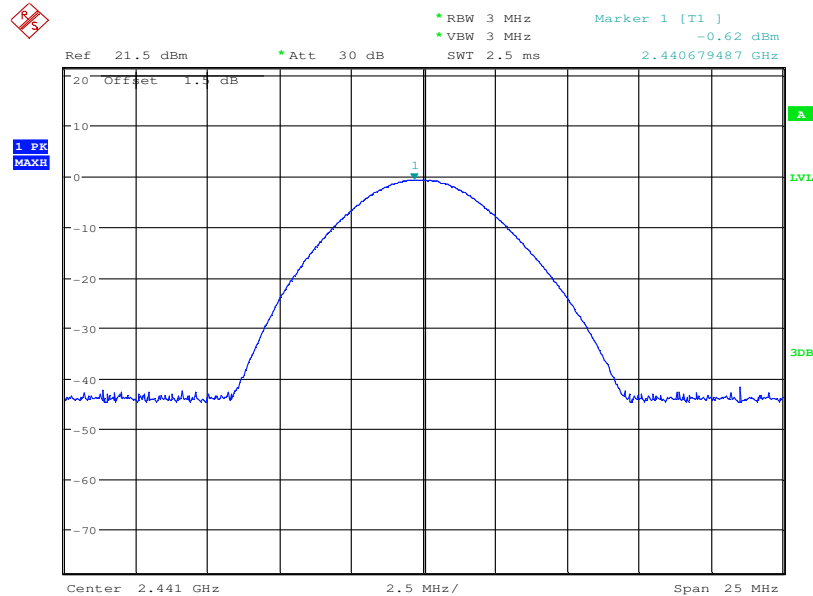


| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Lowest |
|------------|---------------|---------------|--------|

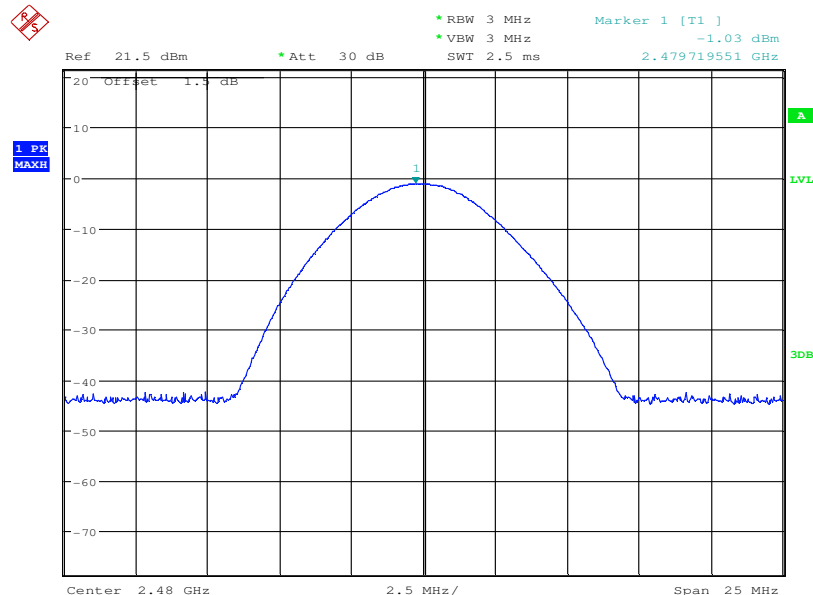




| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Middle |
|------------|---------------|---------------|--------|

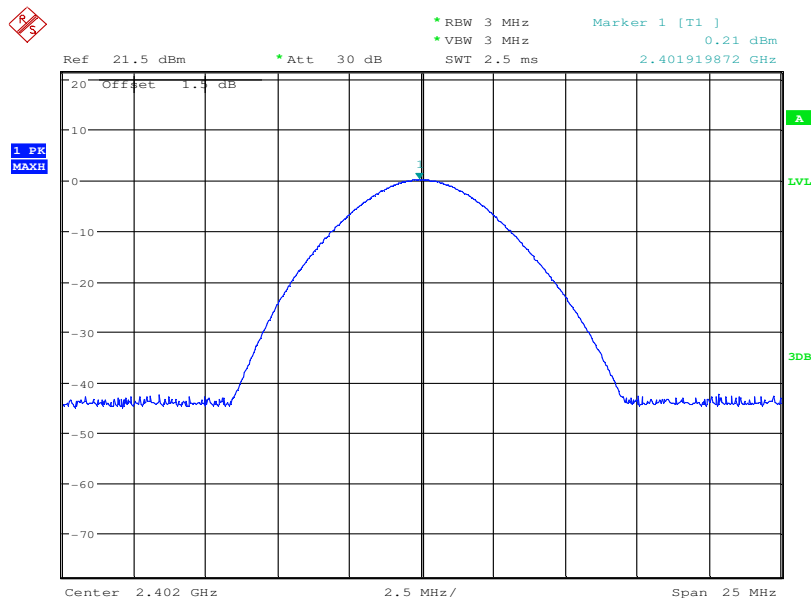


| | | | |
|------------|---------------|---------------|---------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Highest |
|------------|---------------|---------------|---------|

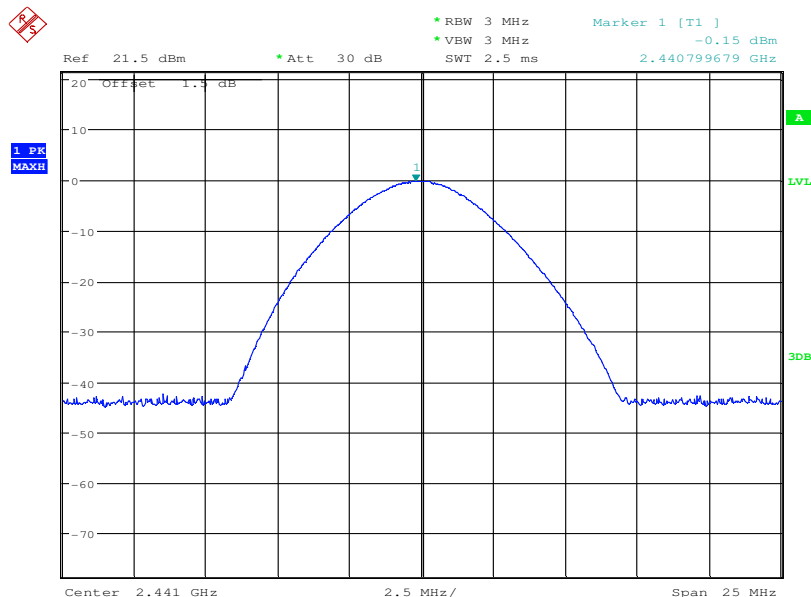




| | | | |
|------------|-------|---------------|--------|
| Test mode: | 8DPSK | Test channel: | Lowest |
|------------|-------|---------------|--------|

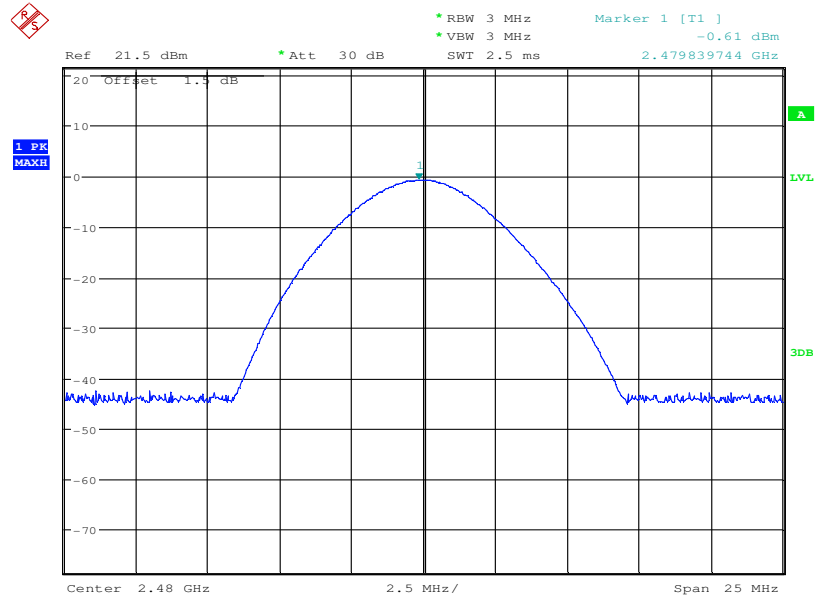


| | | | |
|------------|-------|---------------|--------|
| Test mode: | 8DPSK | Test channel: | Middle |
|------------|-------|---------------|--------|

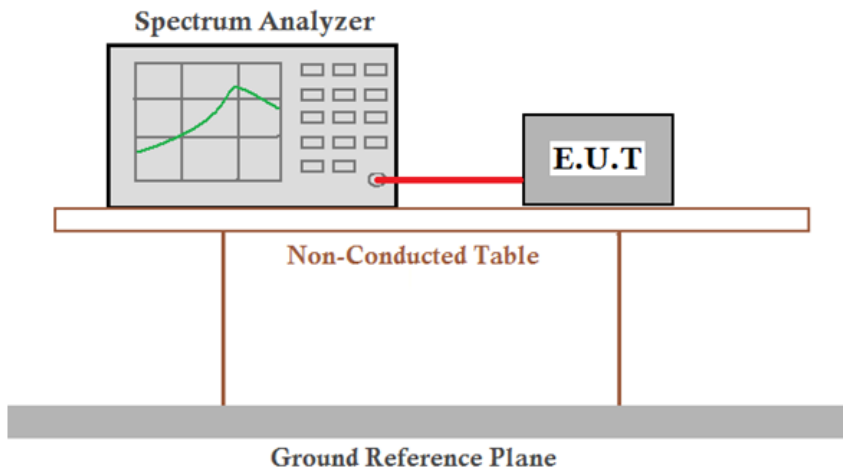




| | | | |
|------------|-------|---------------|---------|
| Test mode: | 8DPSK | Test channel: | Highest |
|------------|-------|---------------|---------|



5.3 20dB Occupancy Bandwidth

| | |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2009 |
| Test Setup: |  |
| Limit: | NA |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type is the worse case of GFSK modulation type, 2-DH1 of data type is worse case of $\pi/4$ DQPSK modulation type, 3-DH1 of data type is worse case of 8DPSK modulation type.. |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

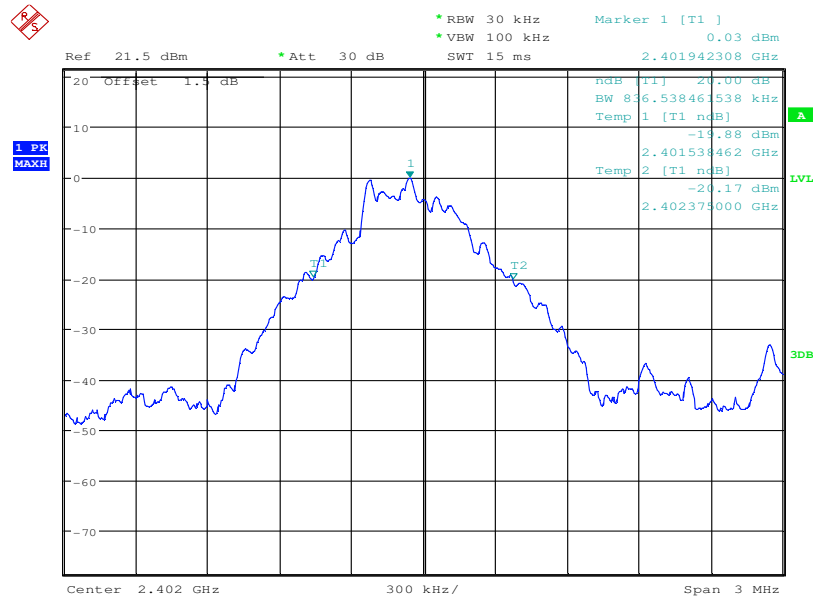
Measurement Data

| Test channel | 20dB Occupancy Bandwidth (kHz) | | |
|--------------|--------------------------------|---------------|-------------|
| | GFSK | $\pi/4$ DQPSK | 8DPSK |
| Lowest | 836.538461538 | 1221.153846 | 1211.538462 |
| Middle | 812.500000000 | 1221.153846 | 1216.346154 |
| Highest | 884.615384615 | 1221.153846 | 1221.153846 |

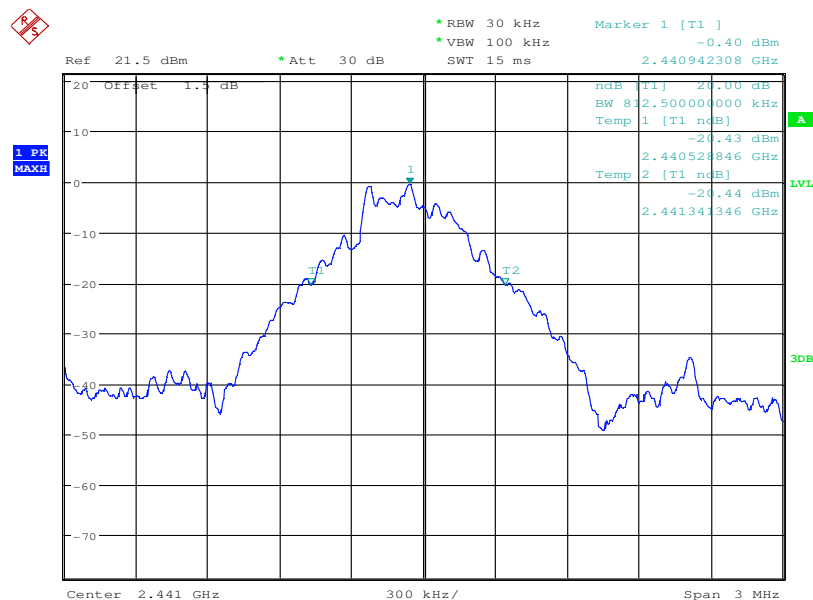


Test plot as follows:

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

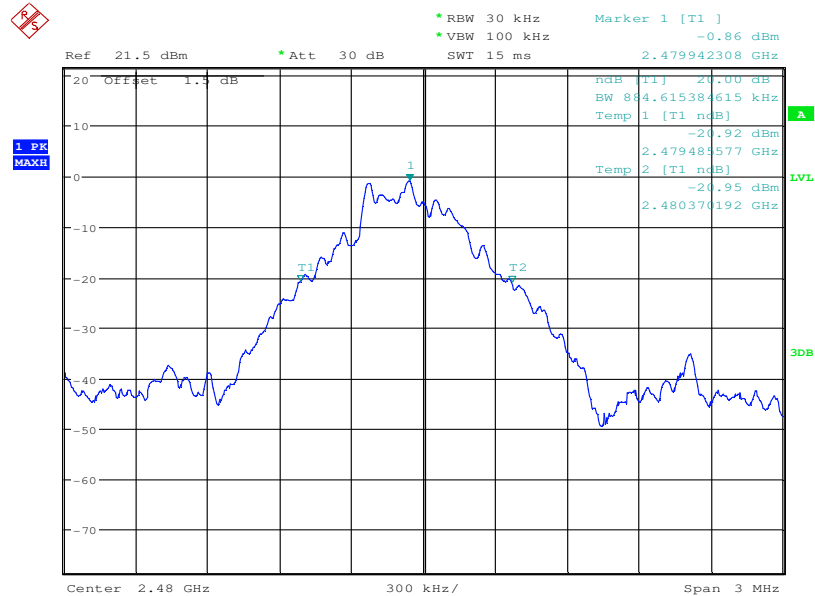


| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Middle |
|------------|------|---------------|--------|

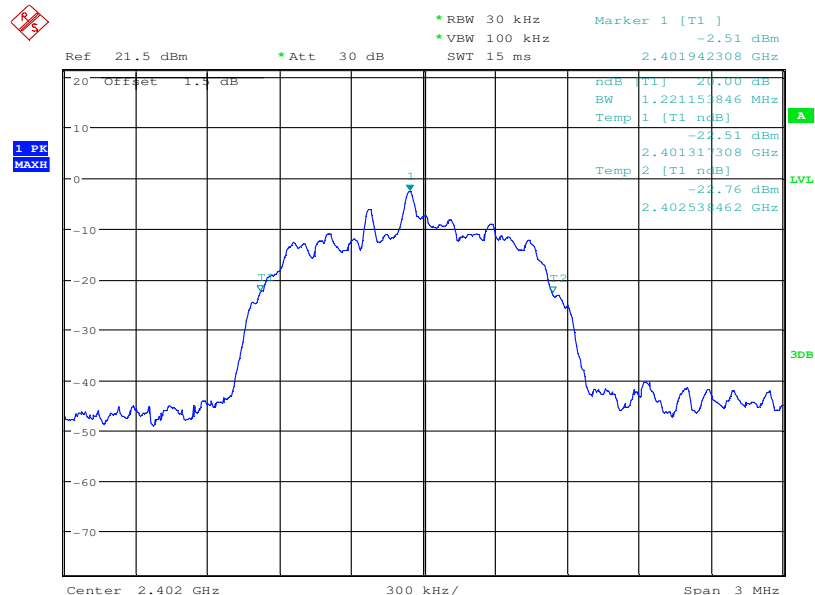




| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|

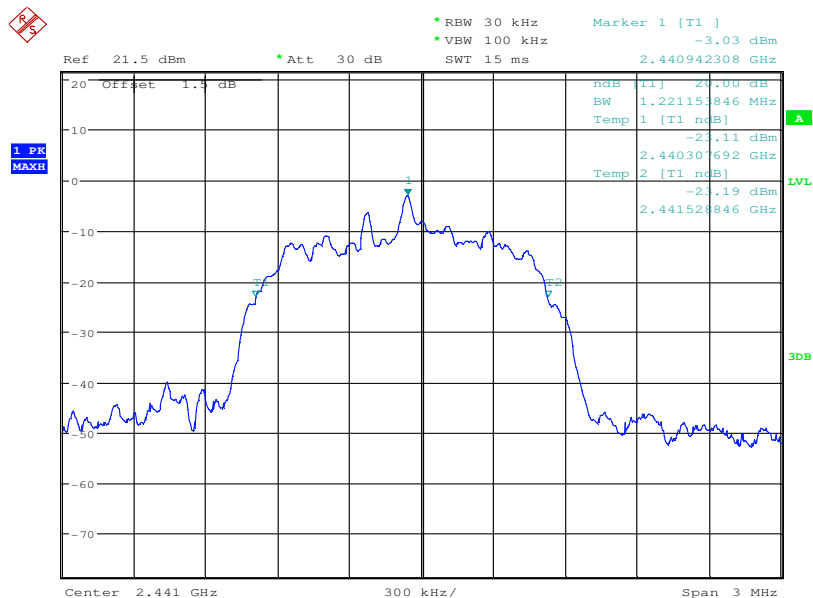


| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Lowest |
|------------|---------------|---------------|--------|

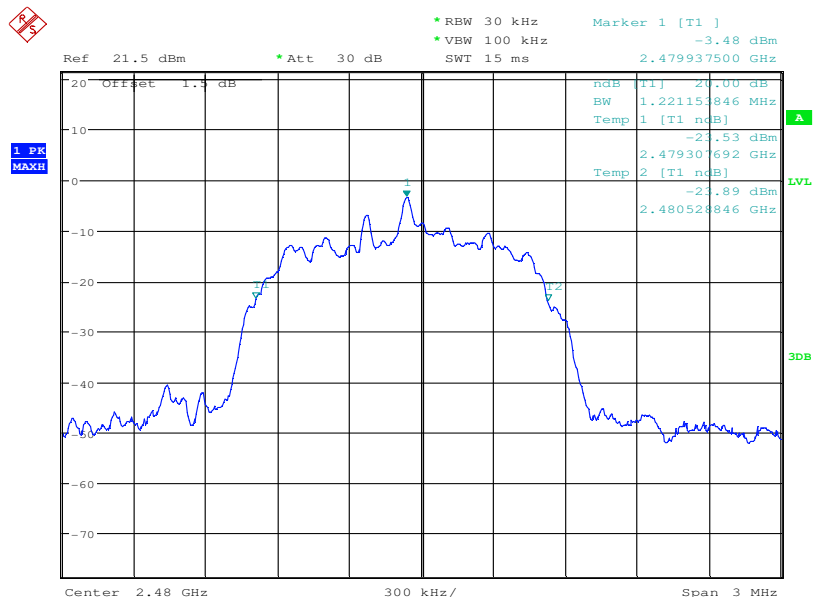




| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Middle |
|------------|---------------|---------------|--------|

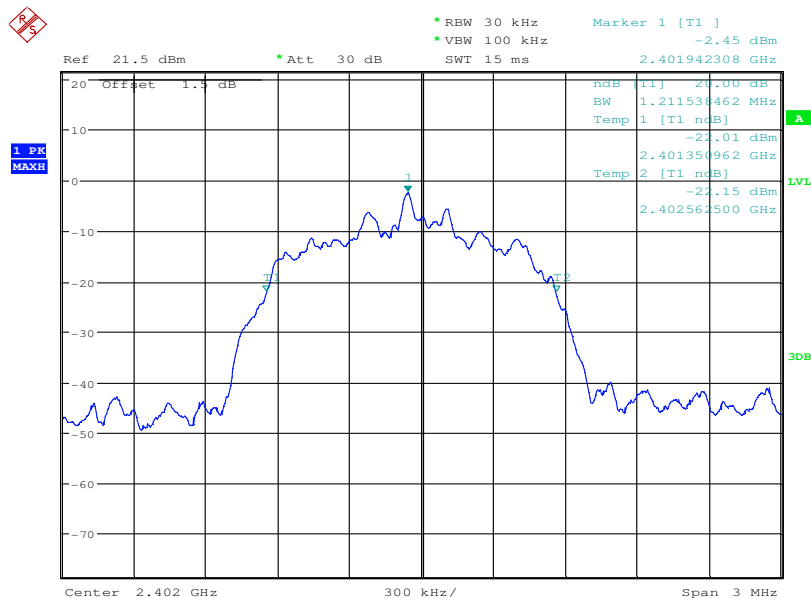


| | | | |
|------------|---------------|---------------|---------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Highest |
|------------|---------------|---------------|---------|

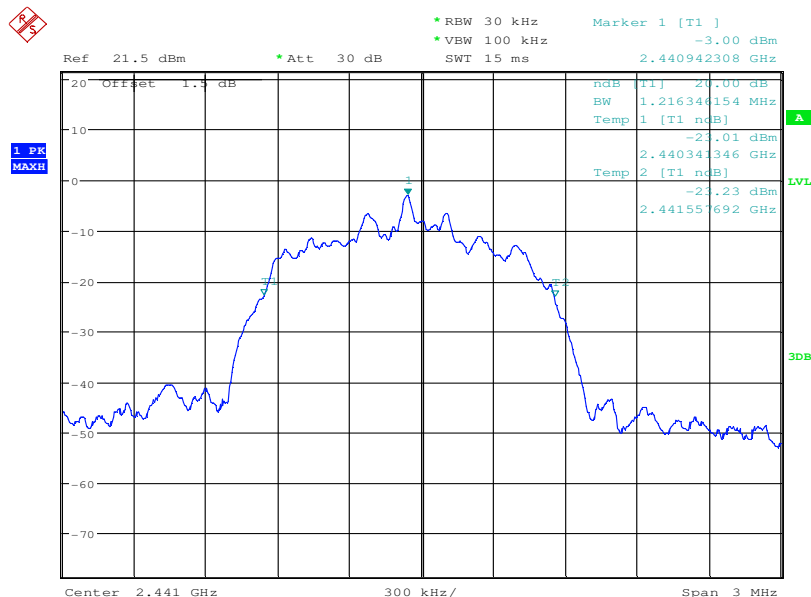




| | | | |
|------------|-------|---------------|--------|
| Test mode: | 8DPSK | Test channel: | Lowest |
|------------|-------|---------------|--------|

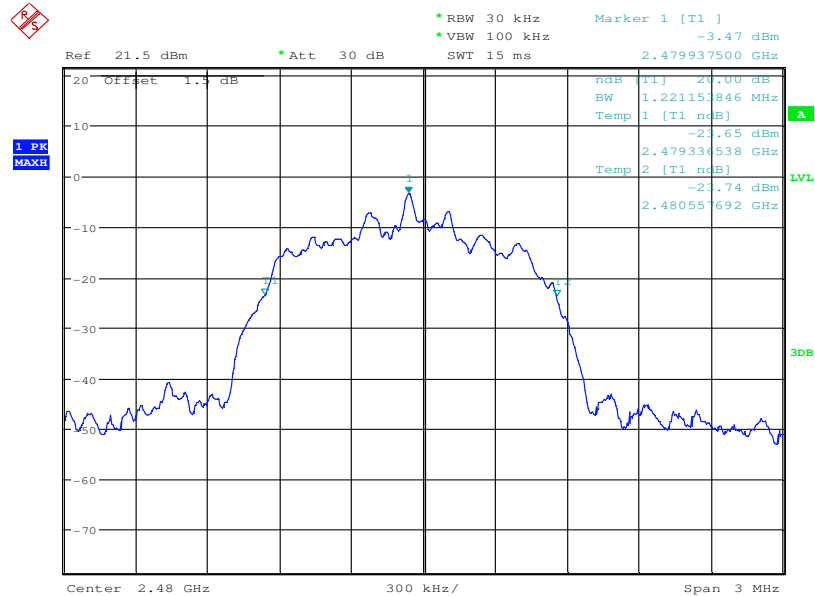


| | | | |
|------------|-------|---------------|--------|
| Test mode: | 8DPSK | Test channel: | Middle |
|------------|-------|---------------|--------|

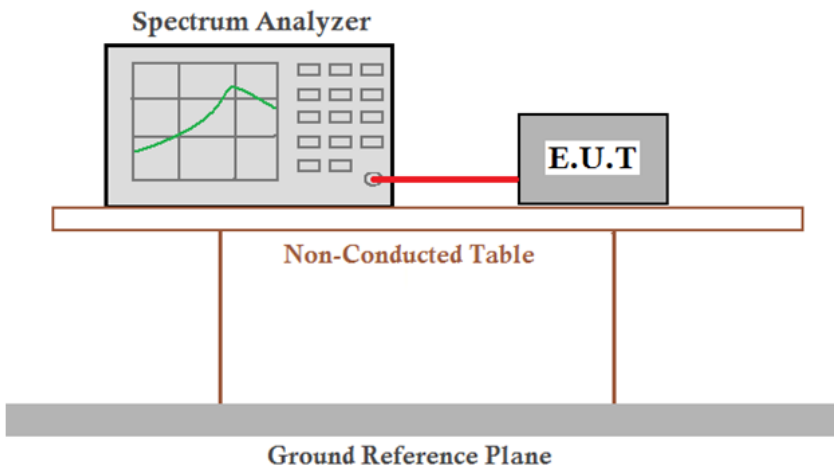




| | | | |
|------------|-------|---------------|---------|
| Test mode: | 8DPSK | Test channel: | Highest |
|------------|-------|---------------|---------|



5.4 Carrier Frequencies Separation

| | |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2009 |
| Test Setup: |  <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs. Below the table is a Ground Reference Plane.</p> |
| Limit: | 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater) |
| Exploratory Test Mode: | Hopping transmitting with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type is the worse case of GFSK modulation type, 2-DH1 of data type is worse case of $\pi/4$ DQPSK modulation type, 3-DH1 of data type is worse case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

**Measurement Data**

| GFSK mode | | | |
|---------------|--------------------------------------|-------------|--------|
| Test channel | Carrier Frequencies Separation (kHz) | Limit (kHz) | Result |
| Lowest | 1002 | ≥814 | Pass |
| Middle | 1002 | ≥814 | Pass |
| Highest | 1002 | ≥814 | Pass |
| π/4DQPSK mode | | | |
| Test channel | Carrier Frequencies Separation (kHz) | Limit (kHz) | Result |
| Lowest | 1002 | ≥814 | Pass |
| Middle | 1006 | ≥814 | Pass |
| Highest | 1002 | ≥814 | Pass |
| 8DPSK mode | | | |
| Test channel | Carrier Frequencies Separation (kHz) | Limit (kHz) | Result |
| Lowest | 1002 | ≥814 | Pass |
| Middle | 1002 | ≥814 | Pass |
| Highest | 1002 | ≥814 | Pass |

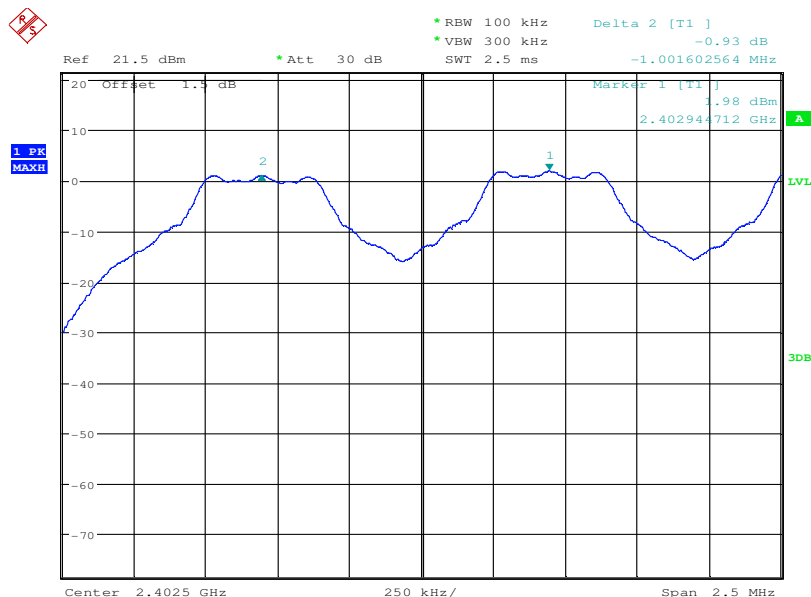
Note: According to section 5.4,

| Mode | 20dB bandwidth (kHz) (worse case) | Limit (kHz) (Carrier Frequencies Separation) |
|----------|--------------------------------------|-------------------------------------------------|
| GFSK | 884.615384615 | 590 |
| π/4DQPSK | 1221.153846 | 814 |
| 8DPSK | 1221.153846 | 814 |

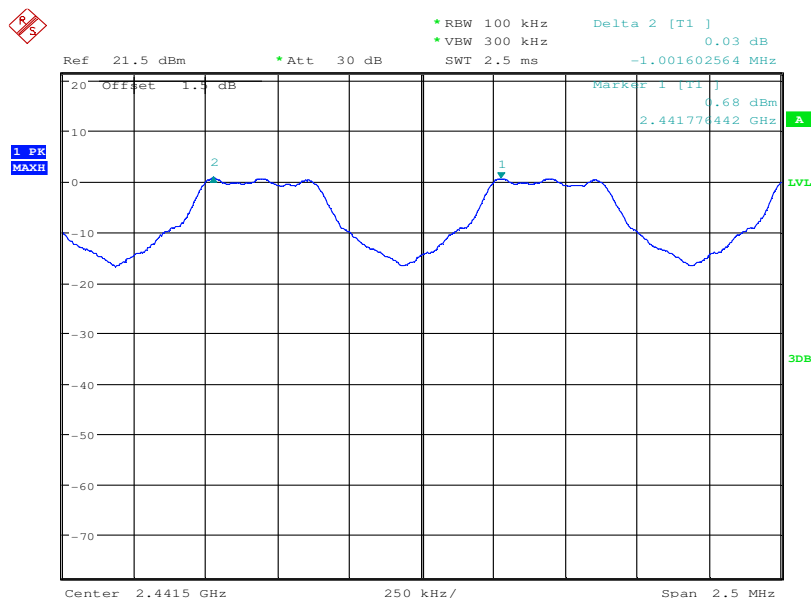


Test plot as follows:

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

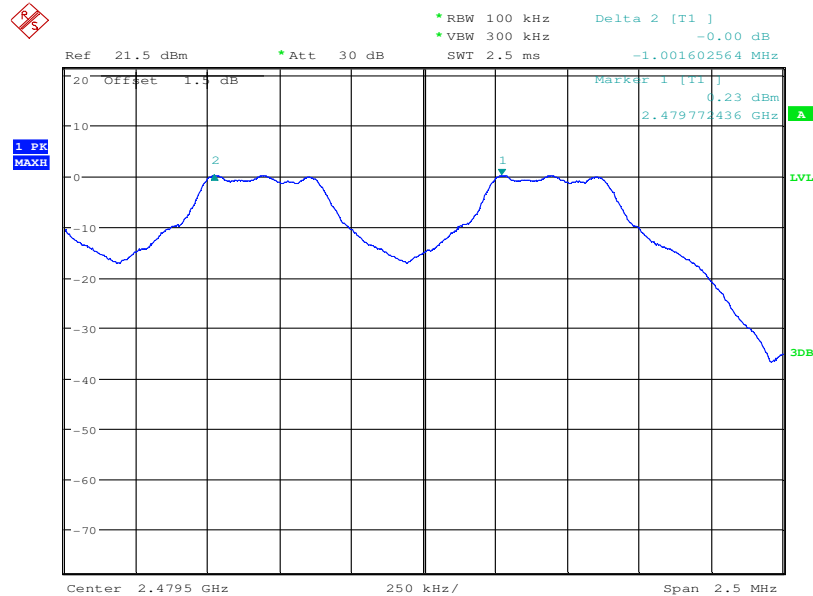


| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Middle |
|------------|------|---------------|--------|

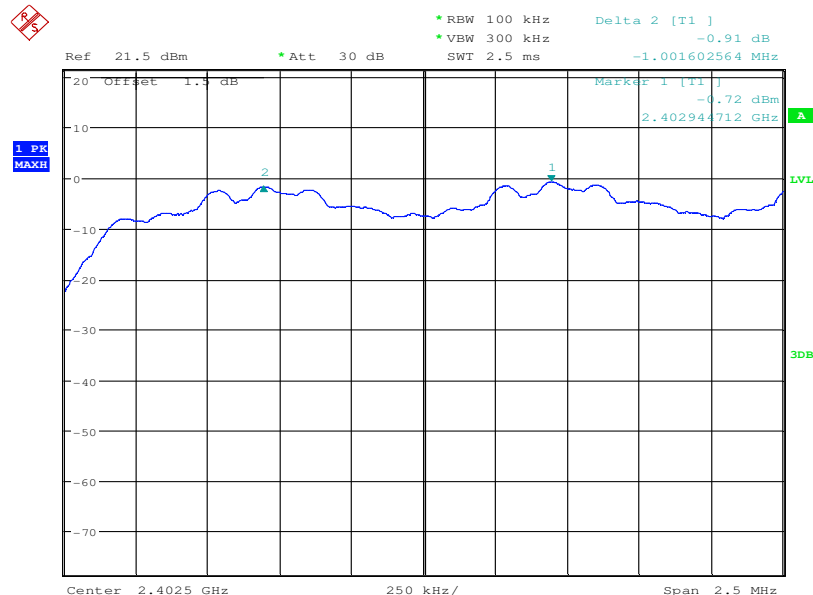




| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|

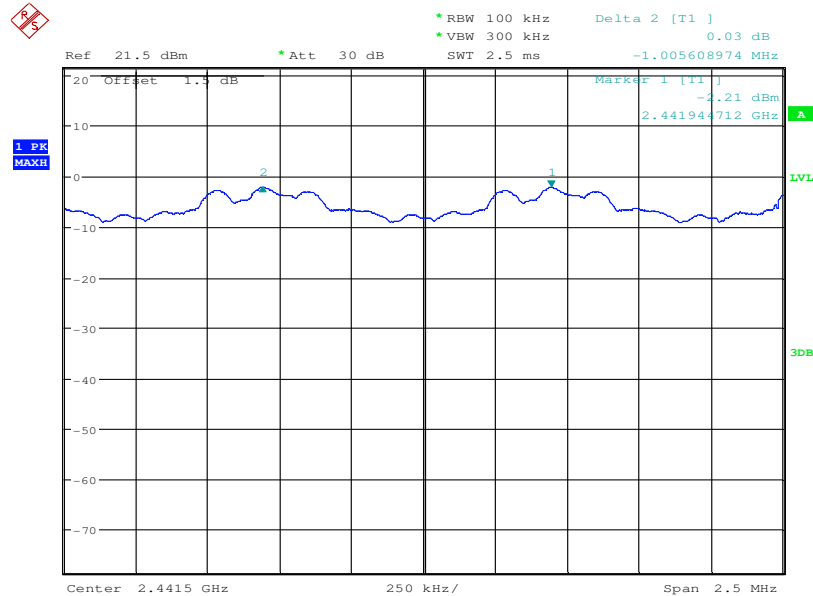


| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Lowest |
|------------|---------------|---------------|--------|

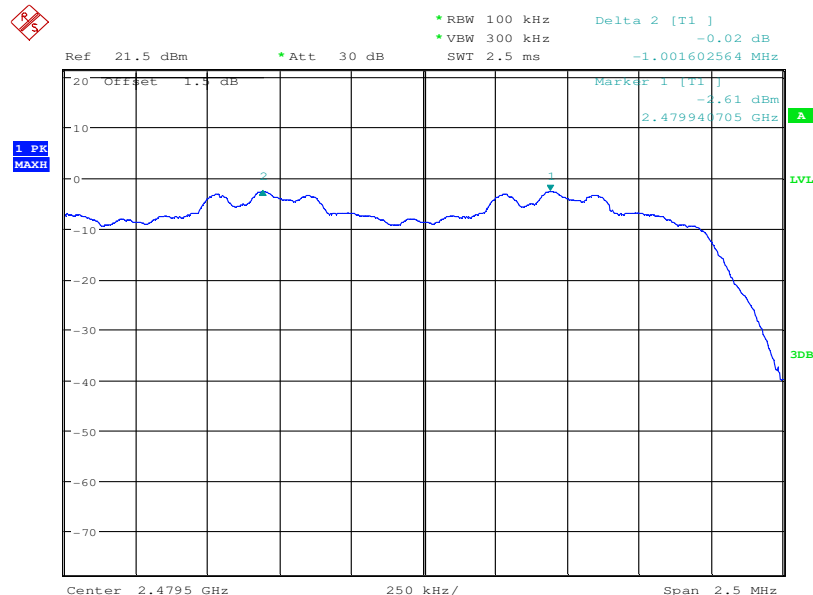




| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Middle |
|------------|---------------|---------------|--------|

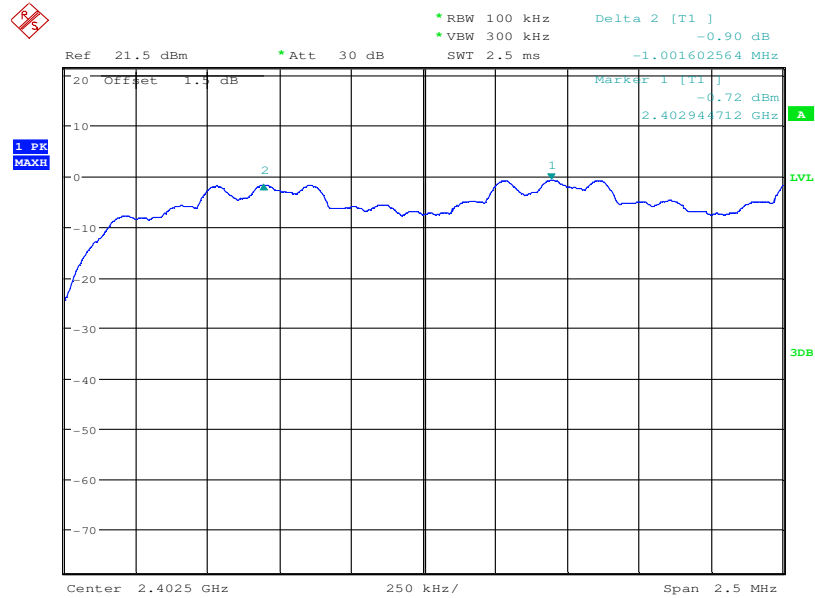


| | | | |
|------------|---------------|---------------|---------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Highest |
|------------|---------------|---------------|---------|

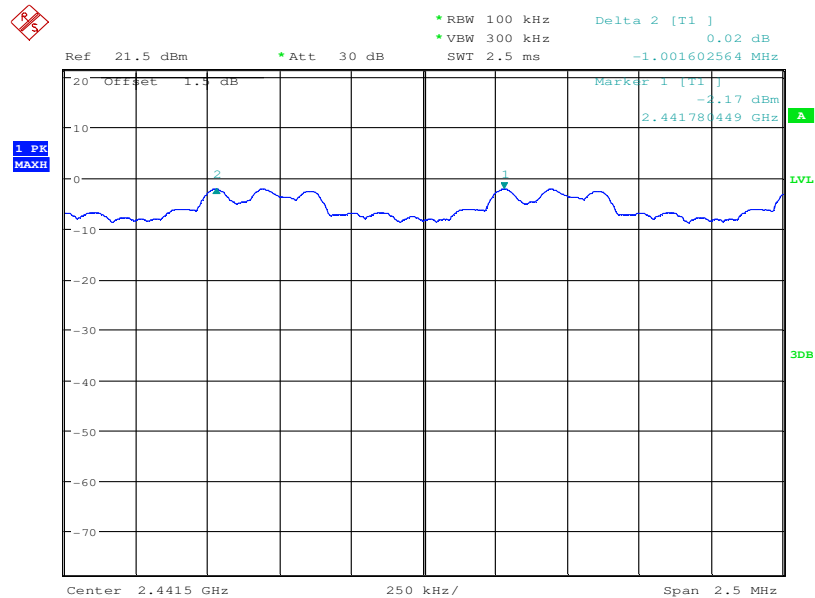




| | | | |
|------------|-------|---------------|--------|
| Test mode: | 8DPSK | Test channel: | Lowest |
|------------|-------|---------------|--------|

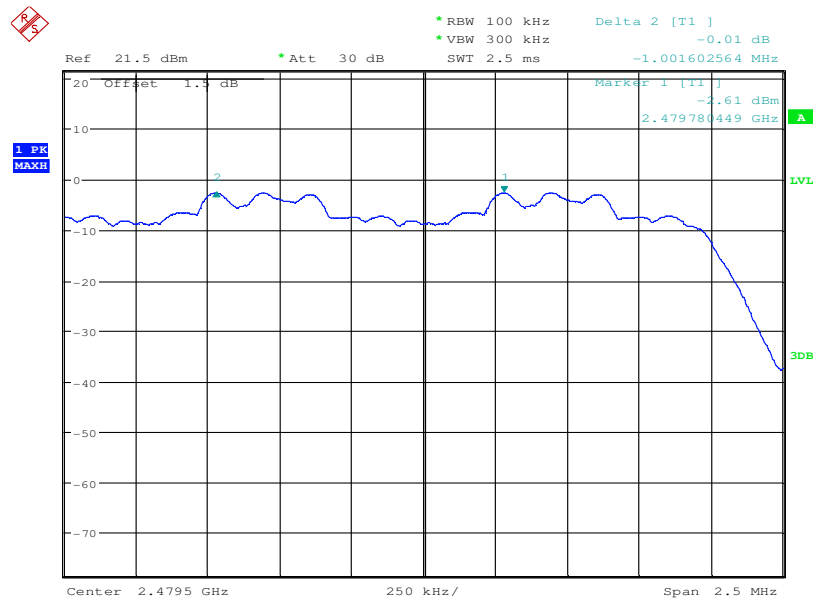


| | | | |
|------------|-------|---------------|--------|
| Test mode: | 8DPSK | Test channel: | Middle |
|------------|-------|---------------|--------|

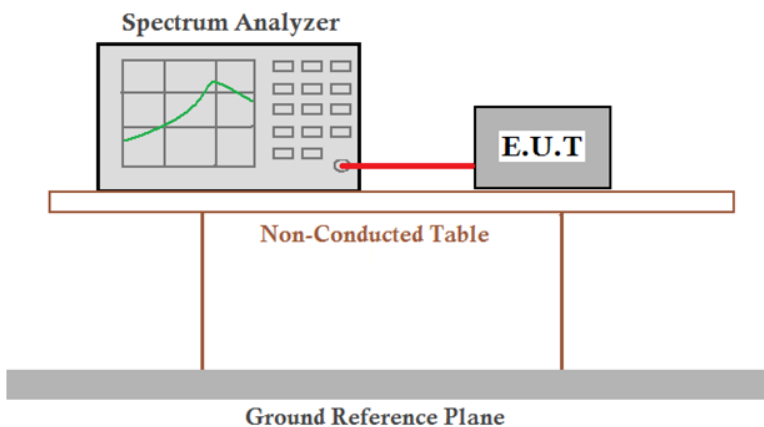




| | | | |
|------------|-------|---------------|---------|
| Test mode: | 8DPSK | Test channel: | Highest |
|------------|-------|---------------|---------|



5.5 Hopping Channel Number

| | |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (b) |
| Test Method: | ANSI C63.10:2009 |
| Test Setup: |  <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p> |
| Limit: | At least 15 channels |
| Test Mode: | Hopping transmitting with all kind of modulation |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

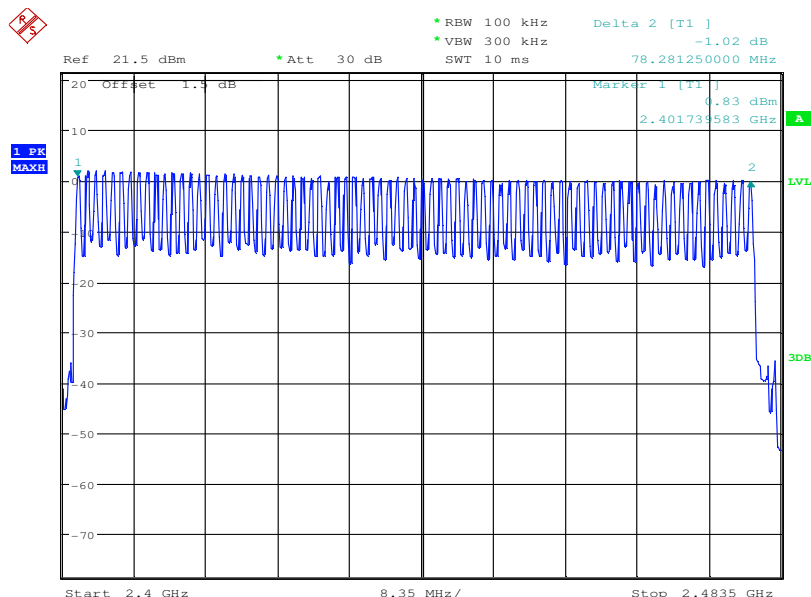
Measurement Data

| Mode | Hopping channel numbers | Limit |
|---------------|-------------------------|-------|
| GFSK | 79 | ≥15 |
| $\pi/4$ DQPSK | 79 | ≥15 |
| 8DPSK | 79 | ≥15 |

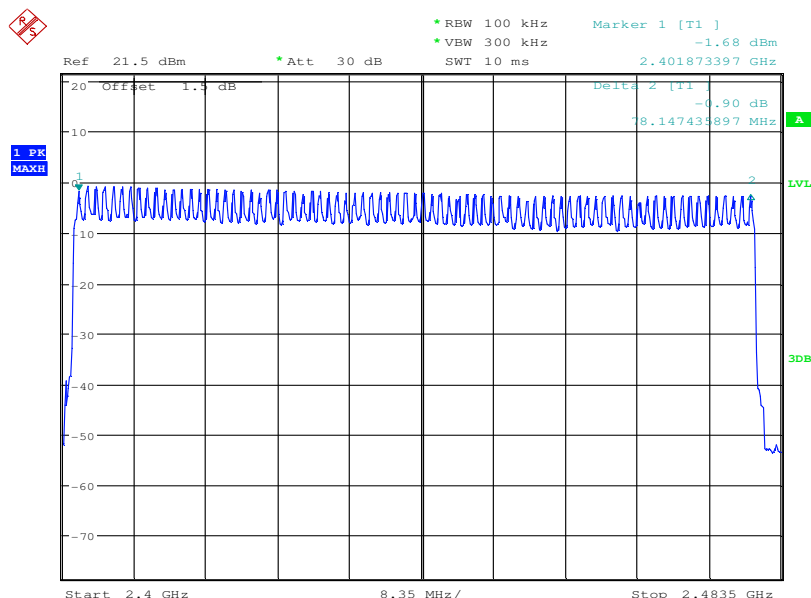


Test plot as follows:

| | |
|------------|------|
| Test mode: | GFSK |
|------------|------|

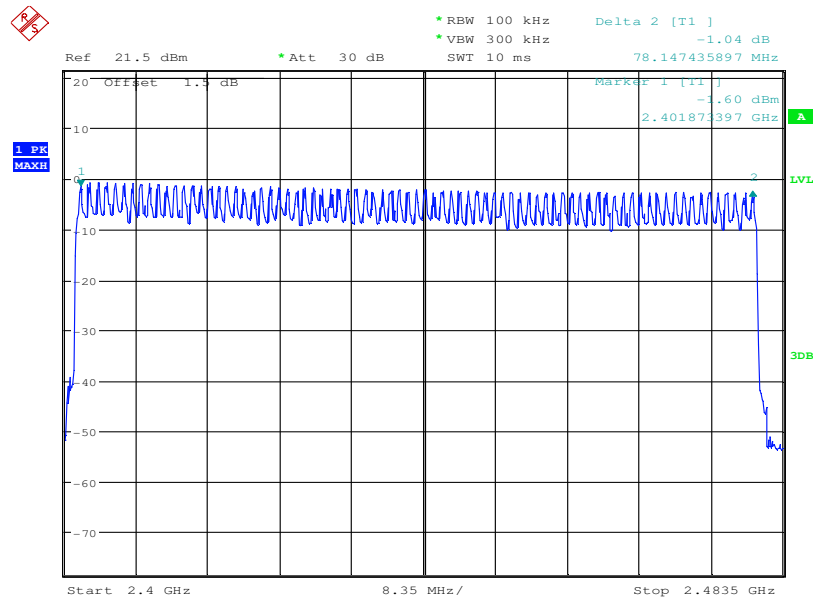


| | |
|------------|---------------|
| Test mode: | $\pi/4$ DQPSK |
|------------|---------------|

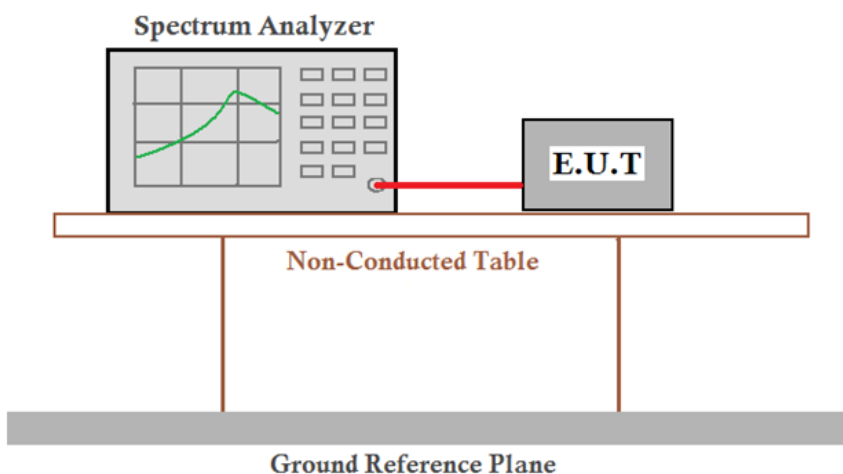




| | |
|------------|-------|
| Test mode: | 8DPSK |
|------------|-------|



5.6 Dwell Time

| | |
|-------------------|------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2009 |
| Test Setup: |  |
| Instruments Used: | Refer to section 4.10 for details |
| Test Mode: | Hopping transmitting with all kind of modulation and all kind of data type. |
| Limit: | 0.4 Second |
| Test Results: | Pass |

Measurement Data

| Mode | Packet | Dwell time (second) | Limit (second) |
|---------------|--------|---------------------|----------------|
| GFSK | DH1 | 0.12832 | 0.4 |
| | DH3 | 0.26352 | 0.4 |
| | DH5 | 0.31072 | 0.4 |
| $\pi/4$ DQPSK | 2-DH1 | 0.13216 | 0.4 |
| | 2-DH3 | 0.26608 | 0.4 |
| | 2-DH5 | 0.18421 | 0.4 |
| 8DPSK | 3-DH1 | 0.13216 | 0.4 |
| | 3-DH3 | 0.26480 | 0.4 |
| | 3-DH5 | 0.31243 | 0.4 |

Test Result:

The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

The lowest channel (2402MHz), middle channel (2441MHz), highest channel (2480MHz) as below

DH1 time slot = $0.401 \text{ (ms)} \times (1600 / (2 \times 79)) \times 31.6 = 128.32 \text{ ms}$

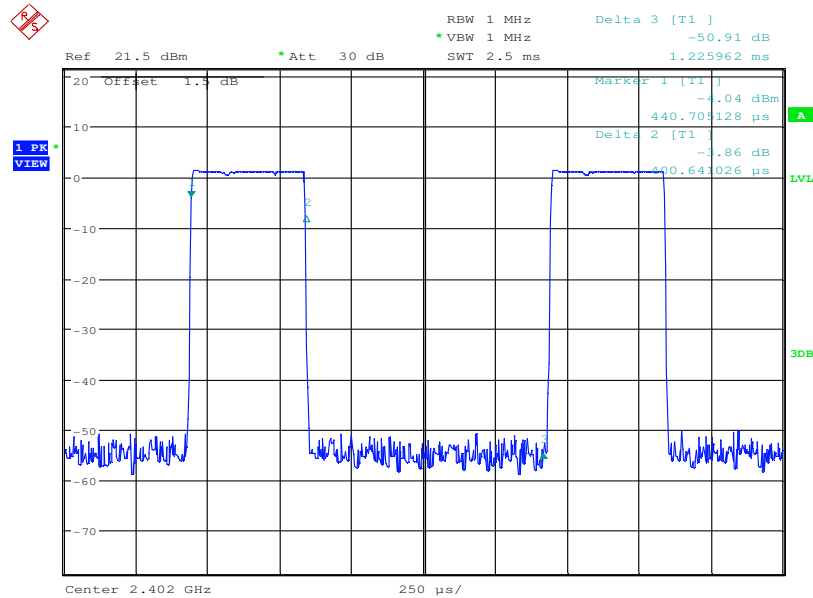
DH3 time slot = $1.647 \text{ (ms)} \times (1600 / (4 \times 79)) \times 31.6 = 263.52 \text{ ms}$

DH5 time slot = $2.913 \text{ (ms)} \times (1600 / (6 \times 79)) \times 31.6 = 310.72 \text{ ms}$

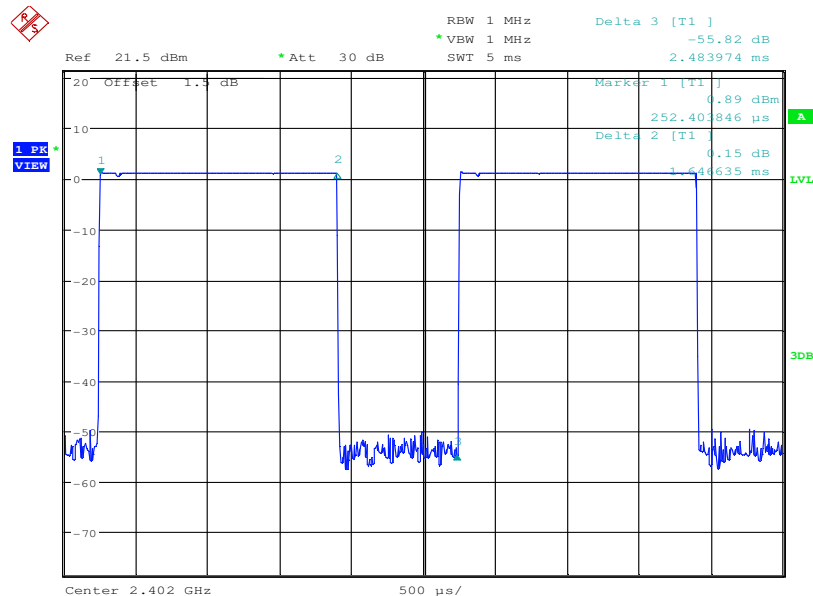


Test plot as follows:

| | |
|--------------|-----|
| Test Packet: | DH1 |
|--------------|-----|

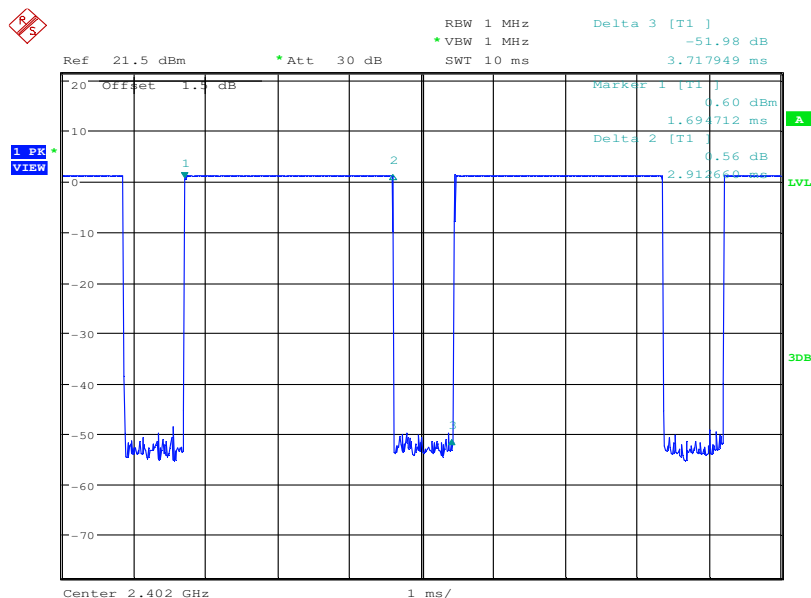


| | |
|--------------|-----|
| Test Packet: | DH3 |
|--------------|-----|

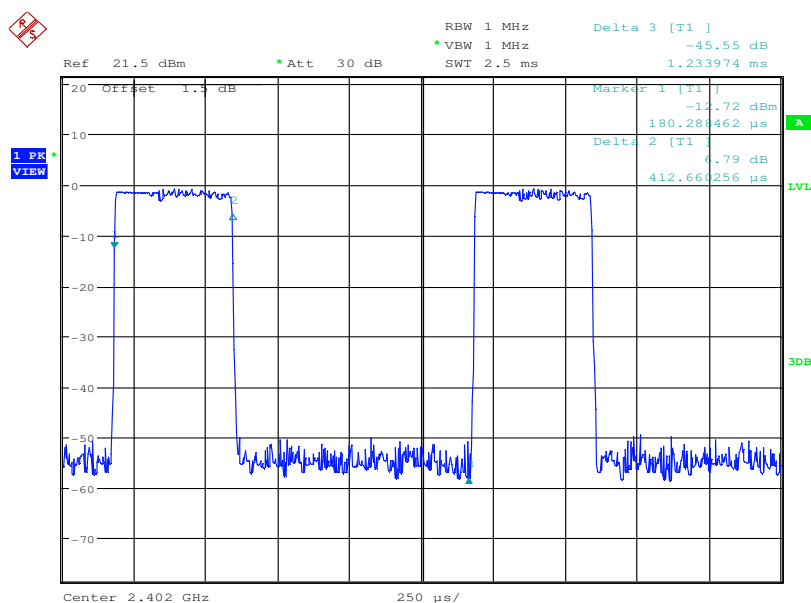




| | |
|--------------|-----|
| Test Packet: | DH5 |
|--------------|-----|

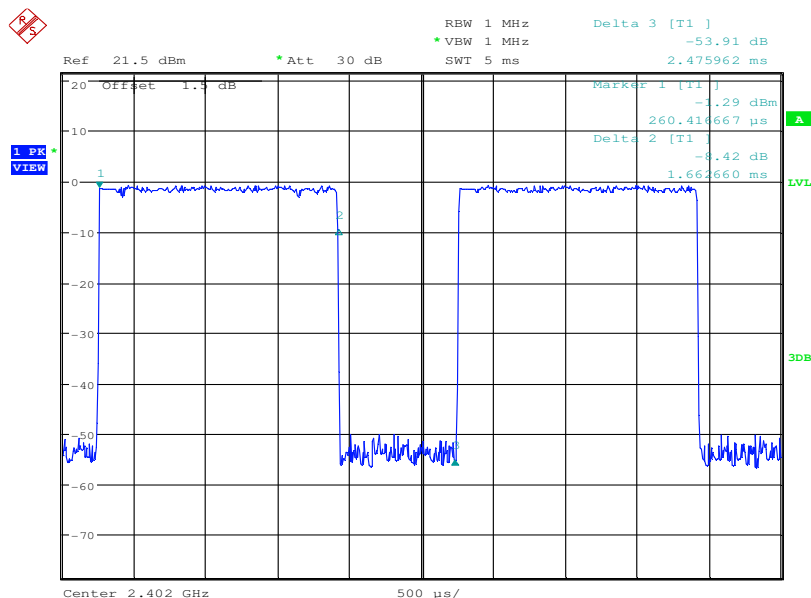


| | |
|--------------|-------|
| Test Packet: | 2-DH1 |
|--------------|-------|

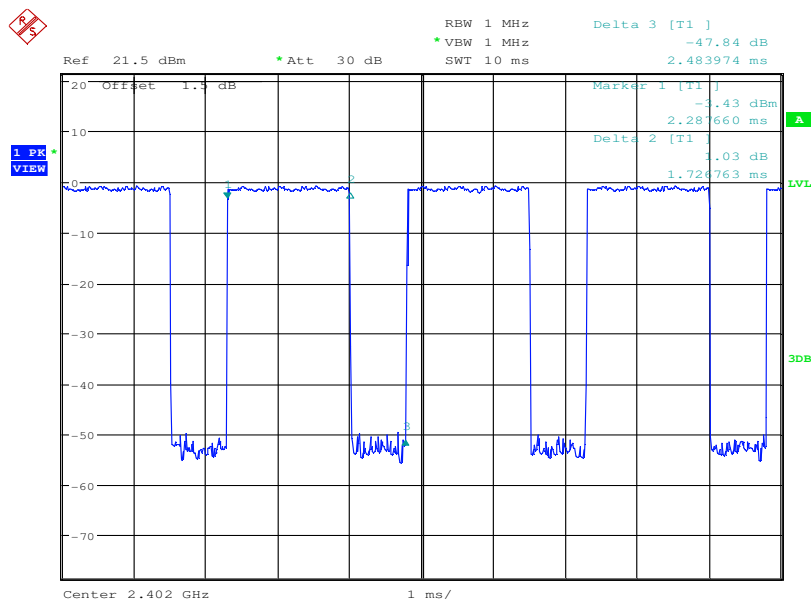




| | |
|--------------|-------|
| Test Packet: | 2-DH3 |
|--------------|-------|

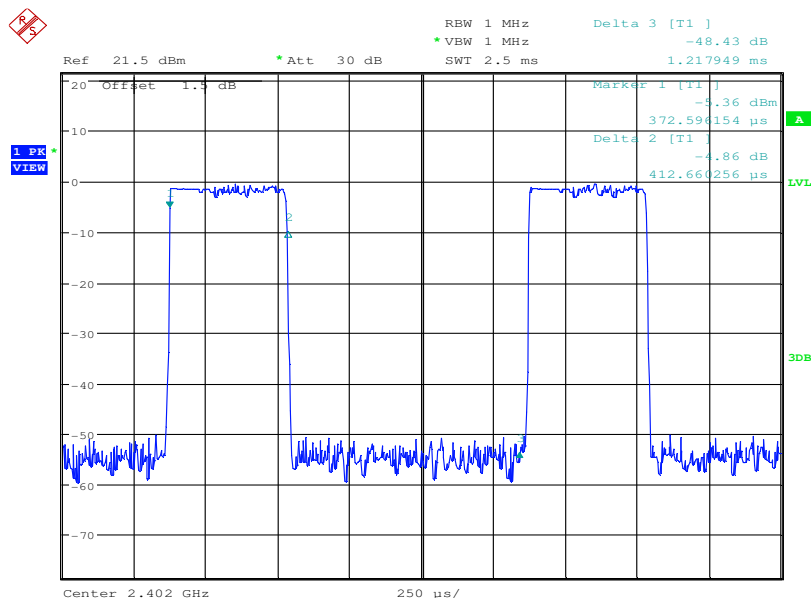


| | |
|--------------|-------|
| Test Packet: | 2-DH5 |
|--------------|-------|

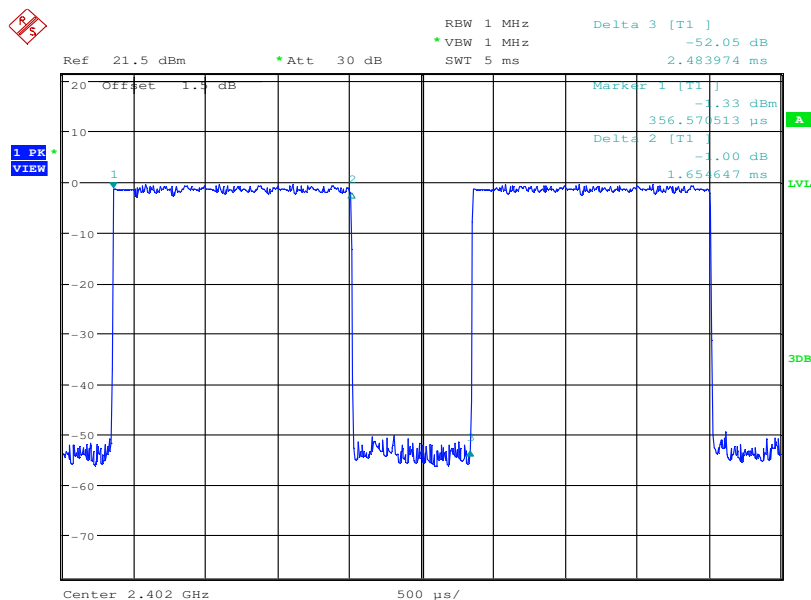




| | |
|--------------|-------|
| Test Packet: | 3-DH1 |
|--------------|-------|

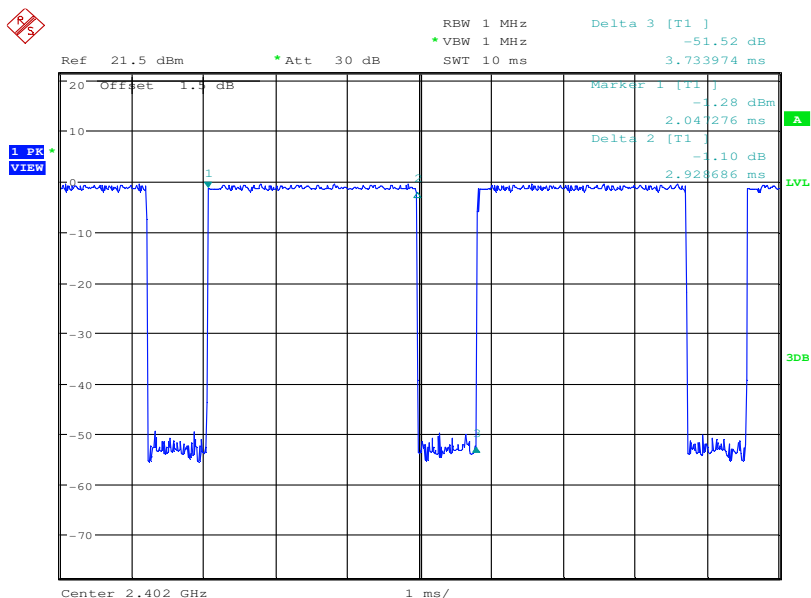


| | |
|--------------|-------|
| Test Packet: | 3-DH3 |
|--------------|-------|

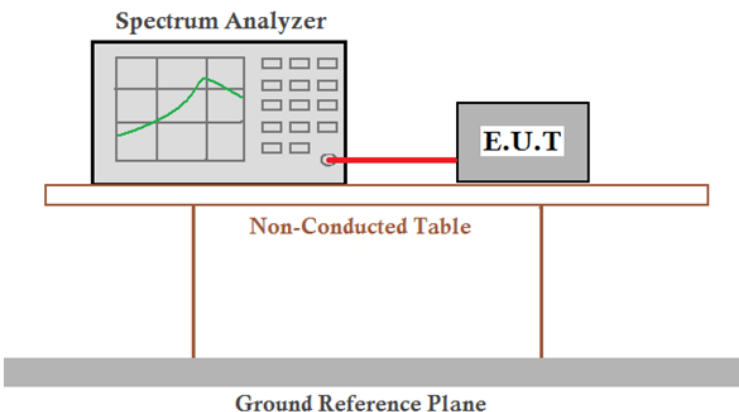




| | |
|--------------|-------|
| Test Packet: | 3-DH5 |
|--------------|-------|



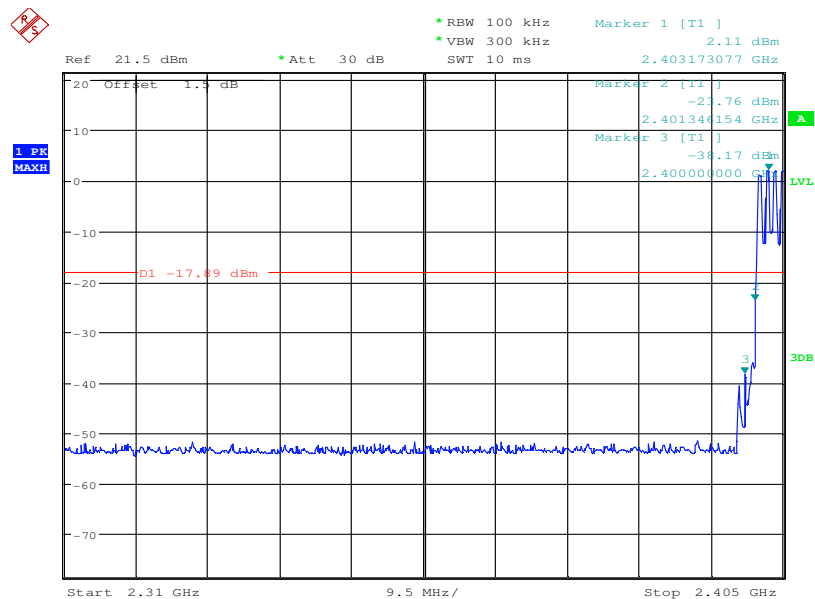
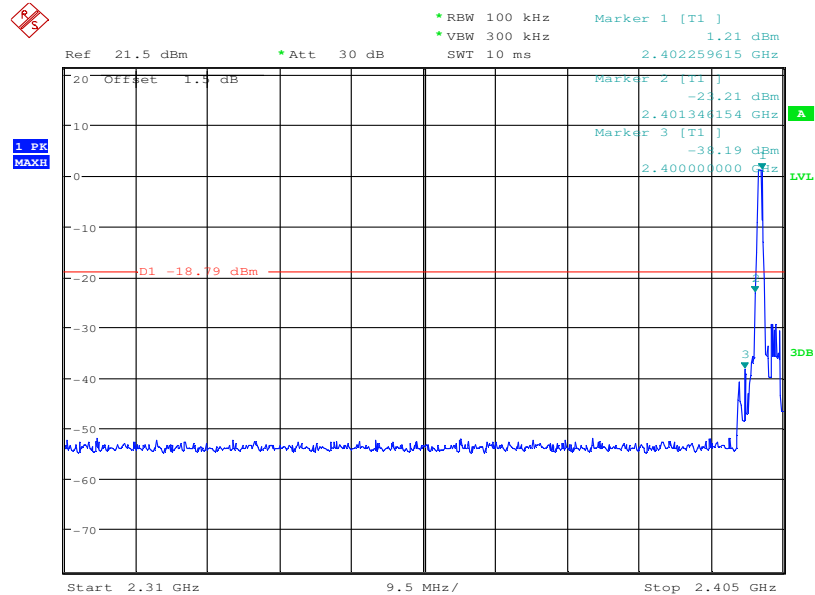
5.7 Band-edge for RF Conducted Emissions

| | |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (d) |
| Test Method: | ANSI C63.10:2009 |
| Test Setup: |  <p>Remark: Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.</p> |
| 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. |
| Exploratory Test Mode: | Hopping transmitting with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type is the worse case of GFSK modulation type, 2-DH1 of data type is worse case of $\pi/4$ DQPSK modulation type, 3-DH1 of data type is worse case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |



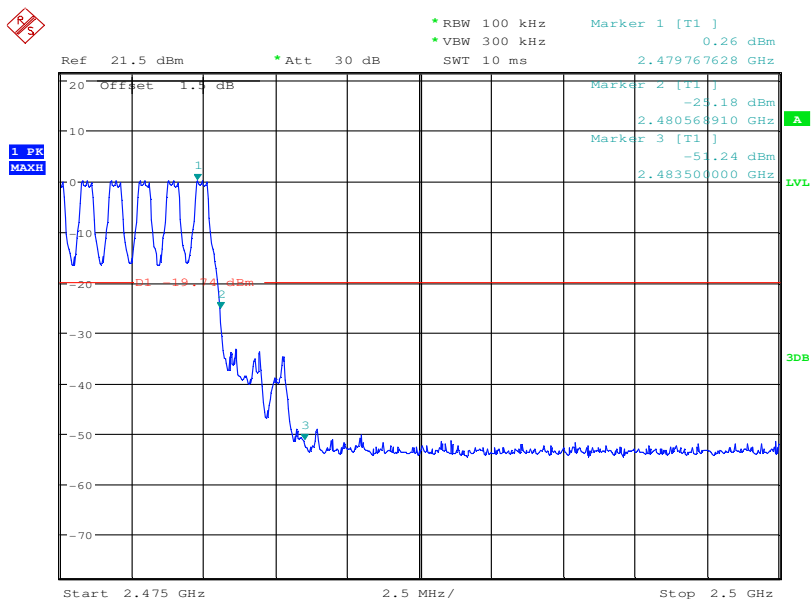
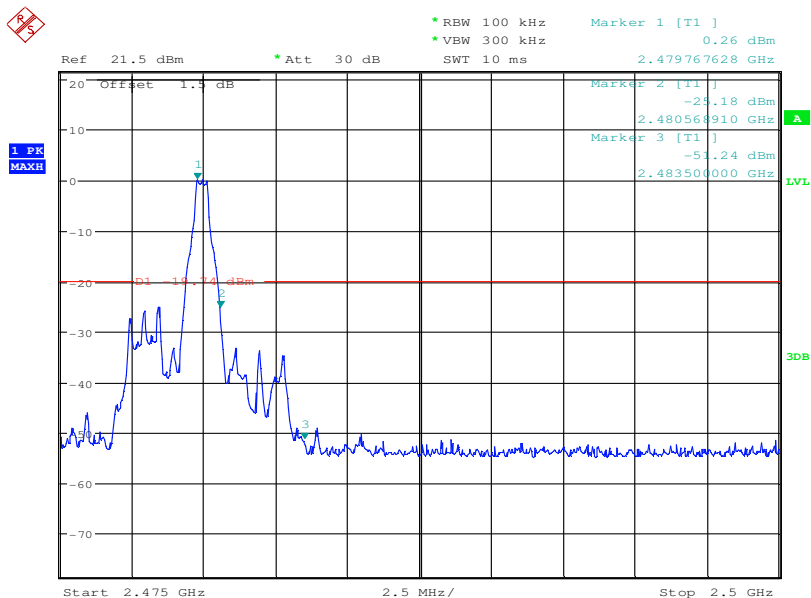
Test plot as follows:

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



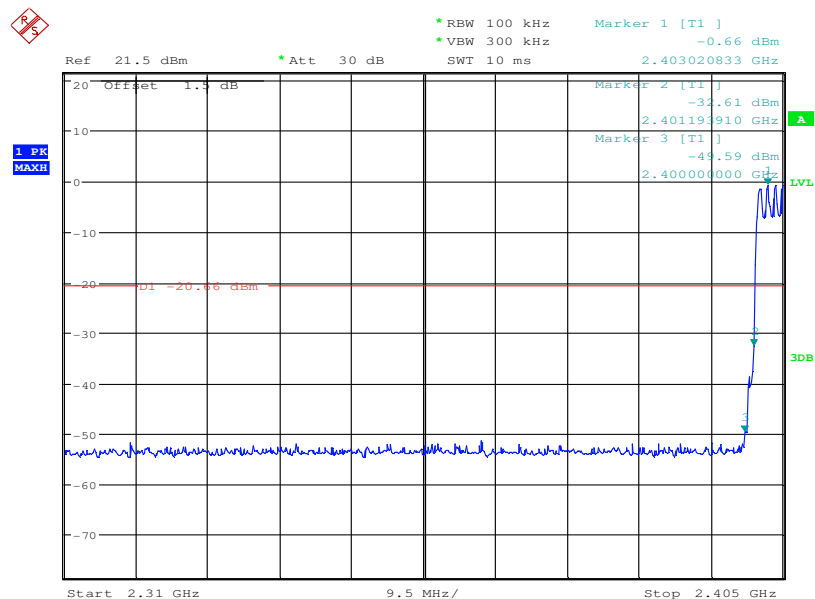
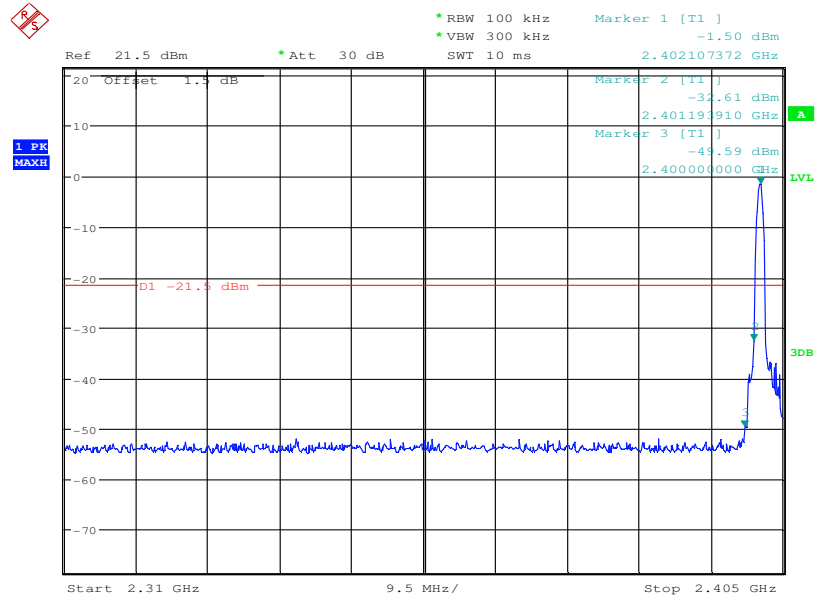


| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|



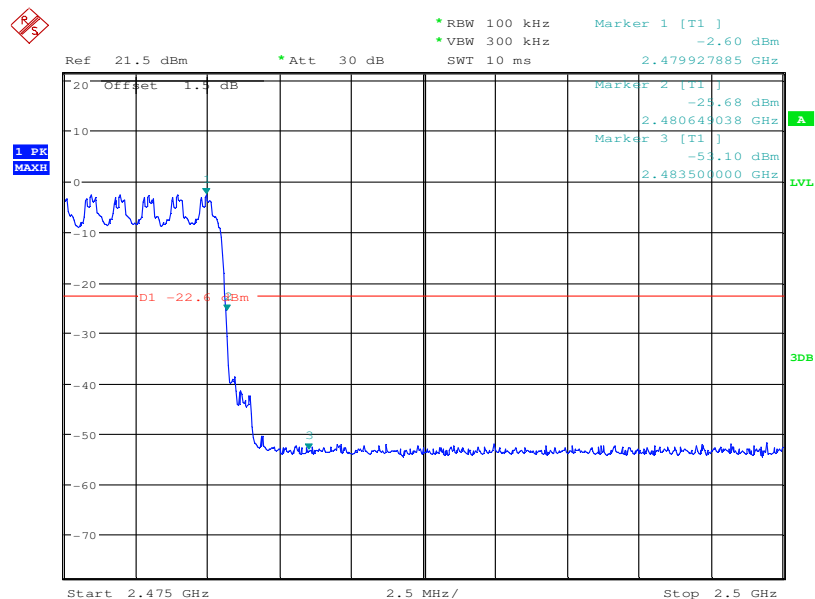
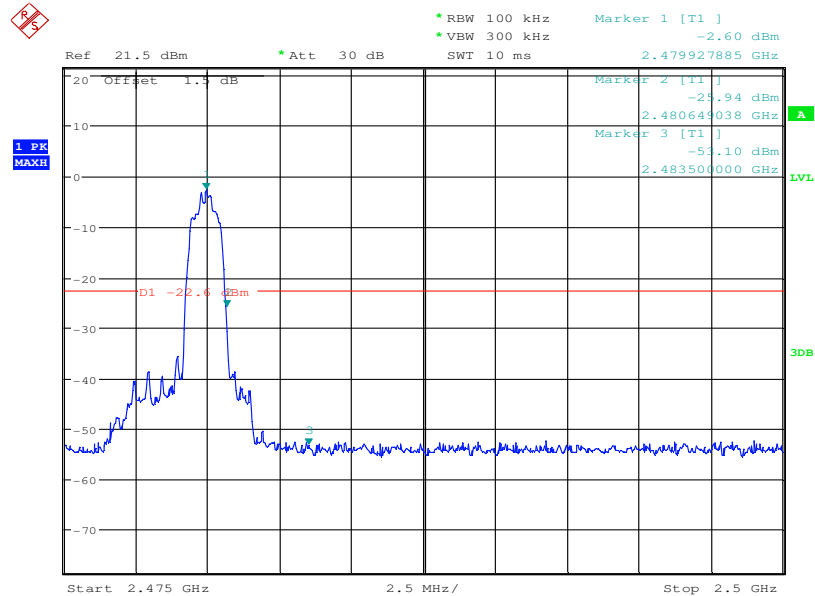


| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Lowest |
|------------|---------------|---------------|--------|



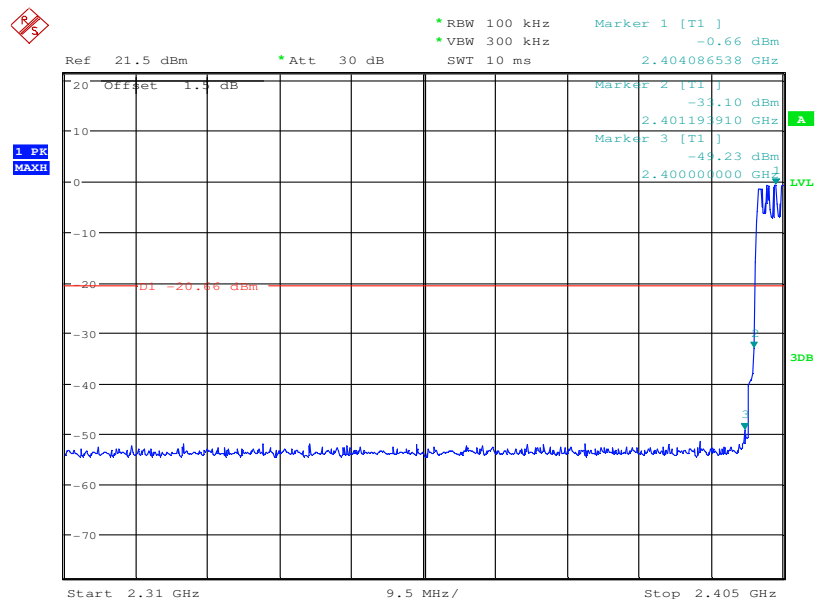
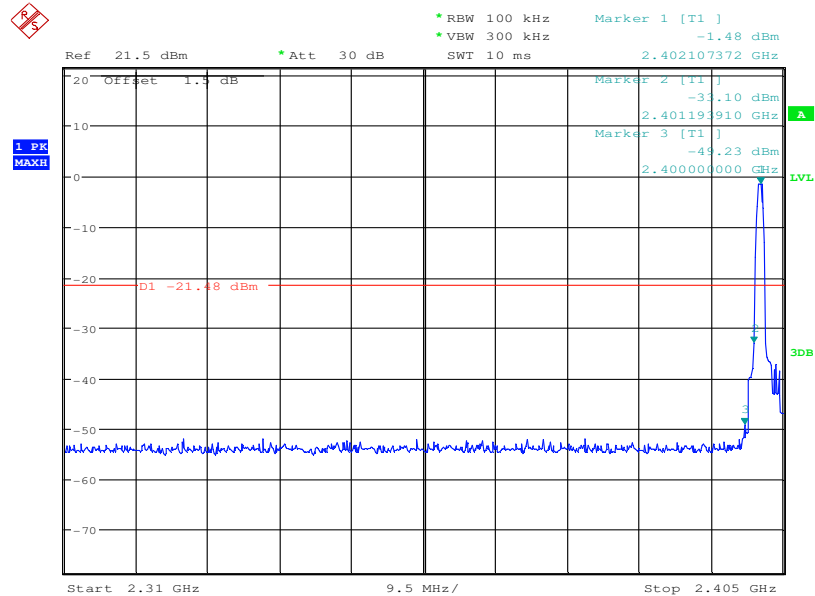


| | | | |
|------------|---------------|---------------|---------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Highest |
|------------|---------------|---------------|---------|



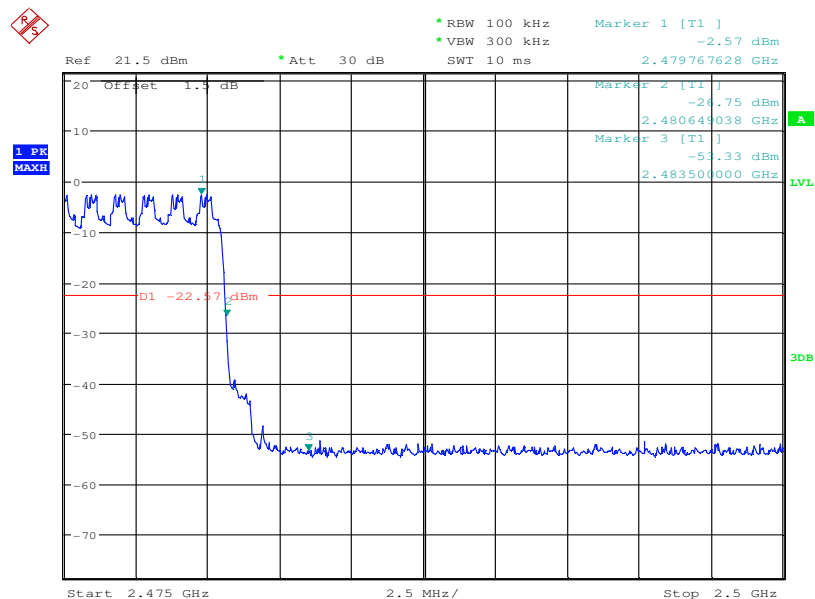
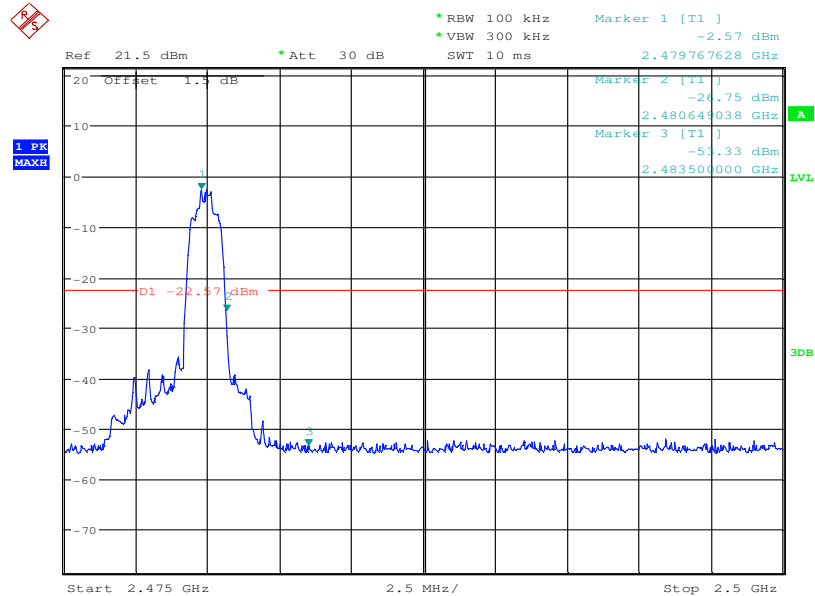


| | | | |
|------------|-------|---------------|--------|
| Test mode: | 8DPSK | Test channel: | Lowest |
|------------|-------|---------------|--------|

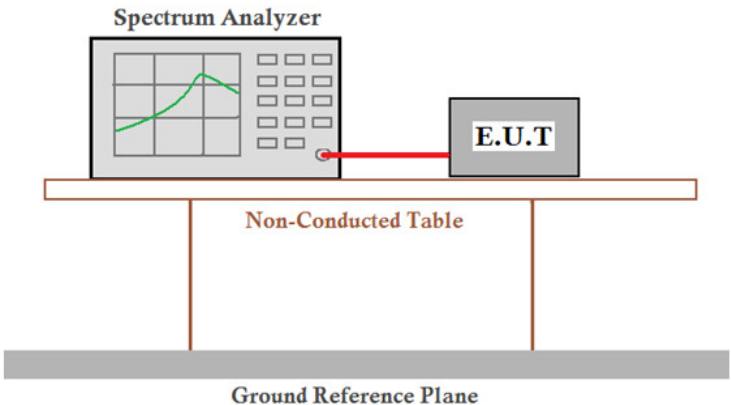




| | | | |
|------------|-------|---------------|---------|
| Test mode: | 8DPSK | Test channel: | Highest |
|------------|-------|---------------|---------|

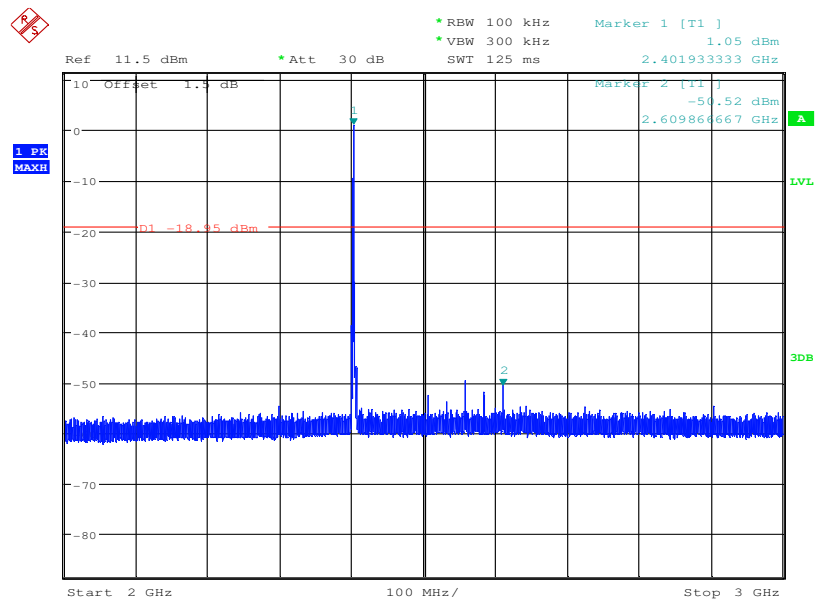
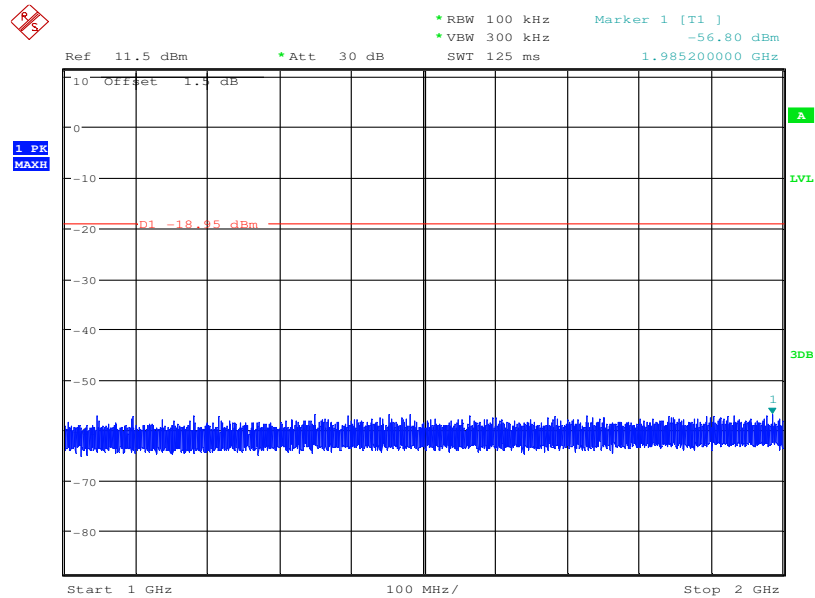


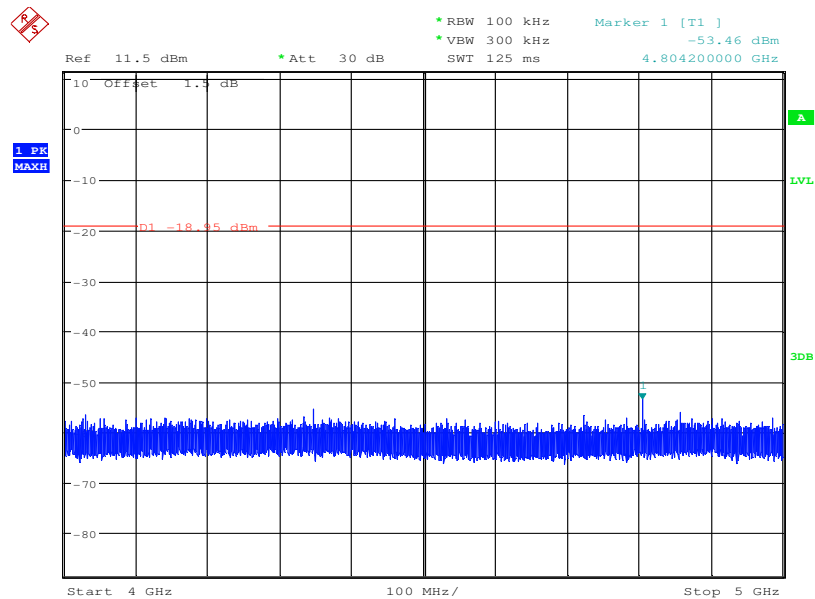
5.8 Spurious RF Conducted Emissions

| | |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (d) |
| Test Method: | ANSI C63.10:2009 |
| Test Setup: |  <p>Remark: Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.</p> |
| 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. |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type is the worse case of GFSK modulation type, 2-DH1 of data type is worse case of $\pi/4$ DQPSK modulation type, 3-DH1 of data type is worse case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

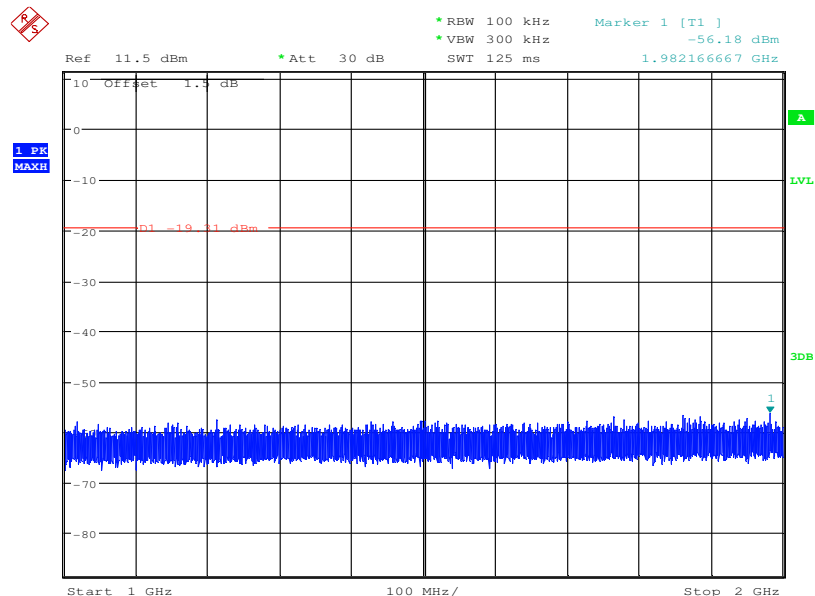


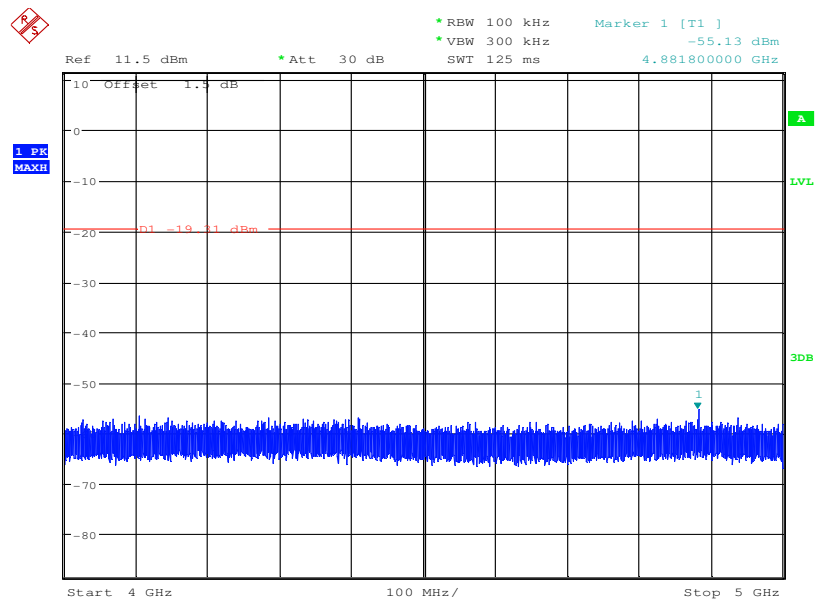
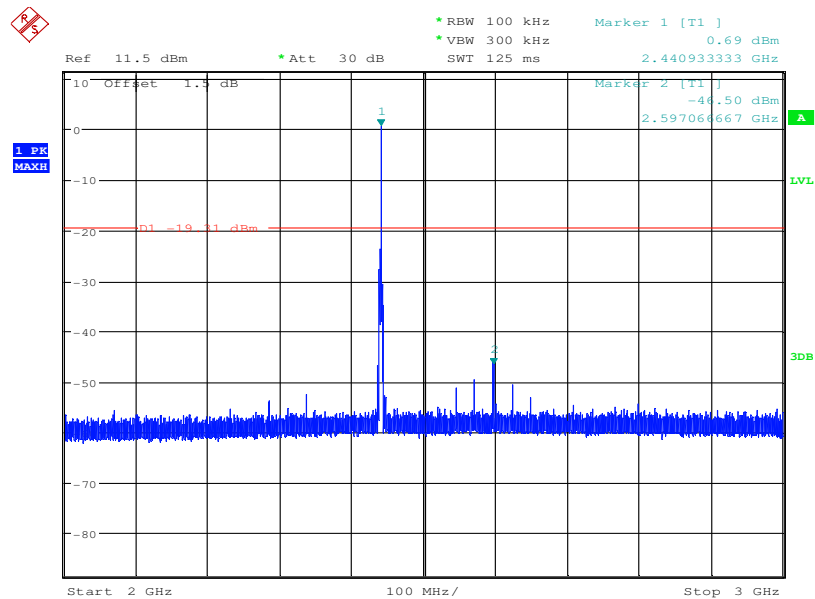
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Lowest |
|------------|------|---------------|--------|





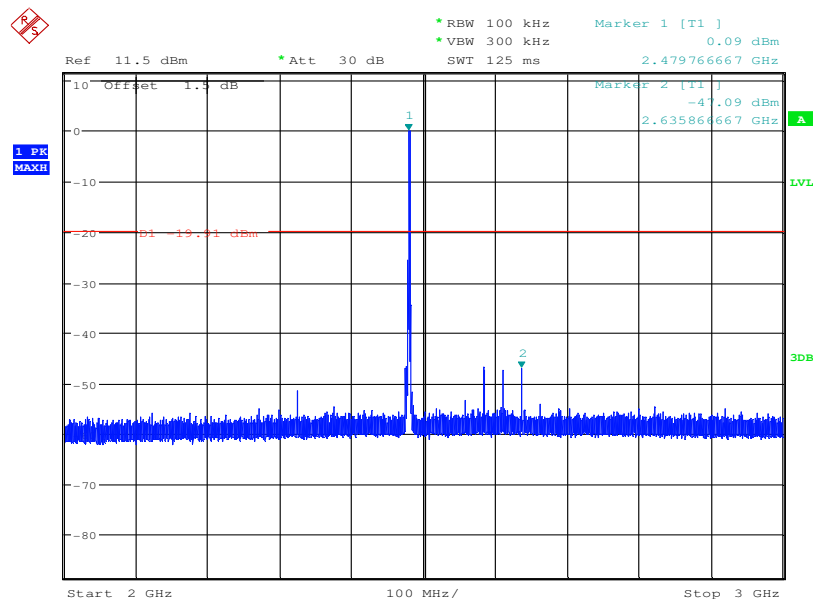
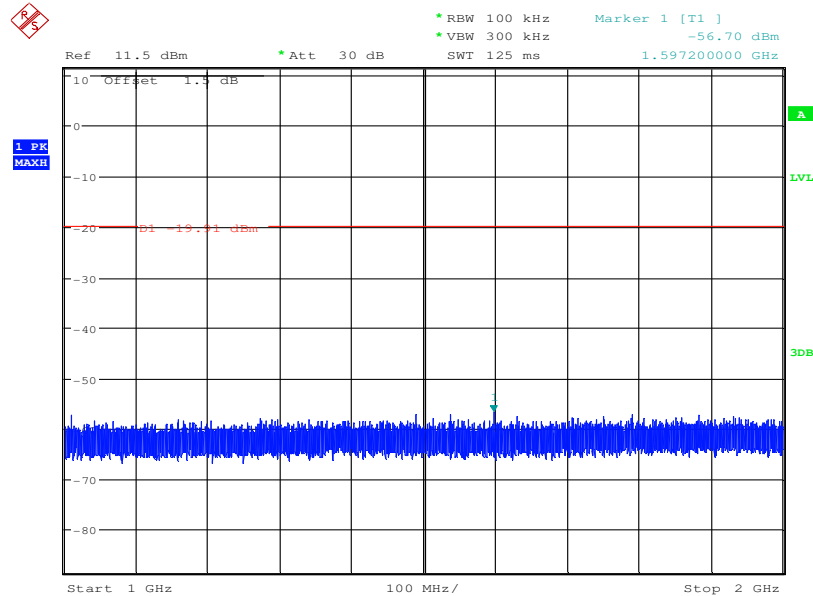
| | | | |
|------------|------|---------------|--------|
| Test mode: | GFSK | Test channel: | Middle |
|------------|------|---------------|--------|

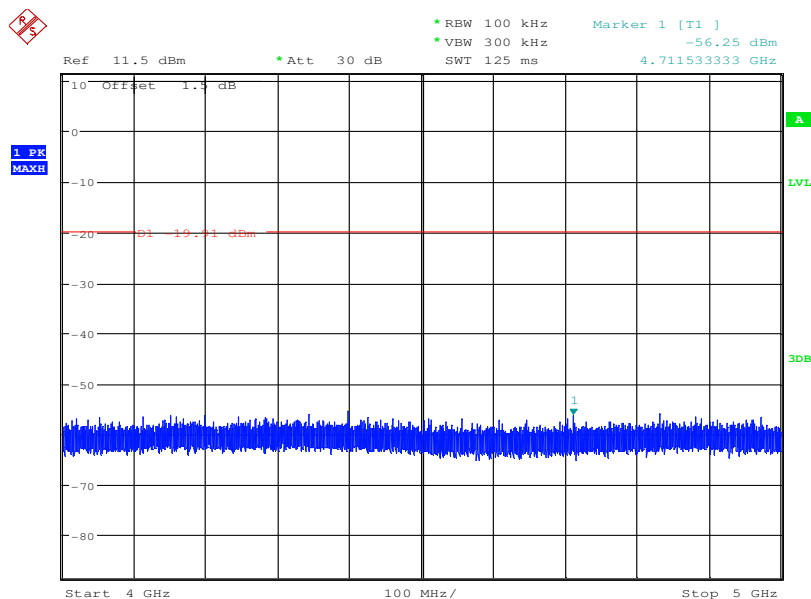




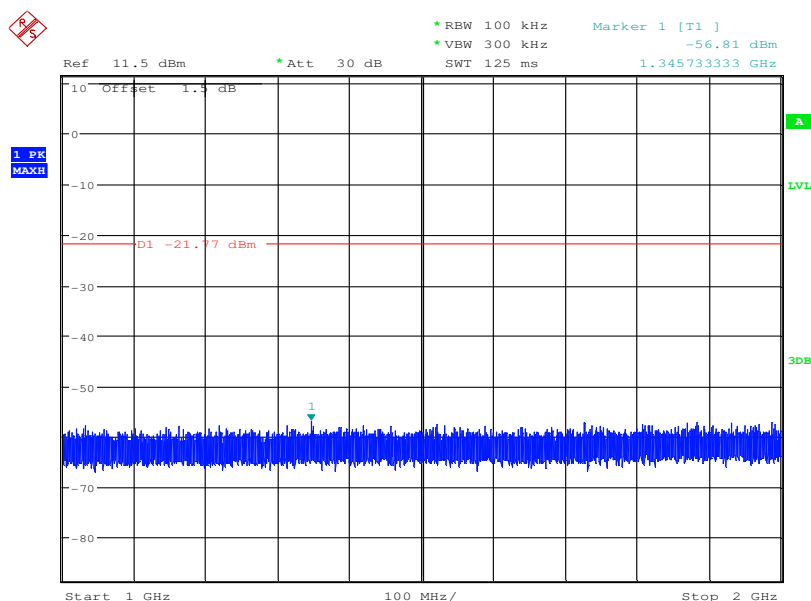


| | | | |
|------------|------|---------------|---------|
| Test mode: | GFSK | Test channel: | Highest |
|------------|------|---------------|---------|





| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Lowest |
|------------|---------------|---------------|--------|

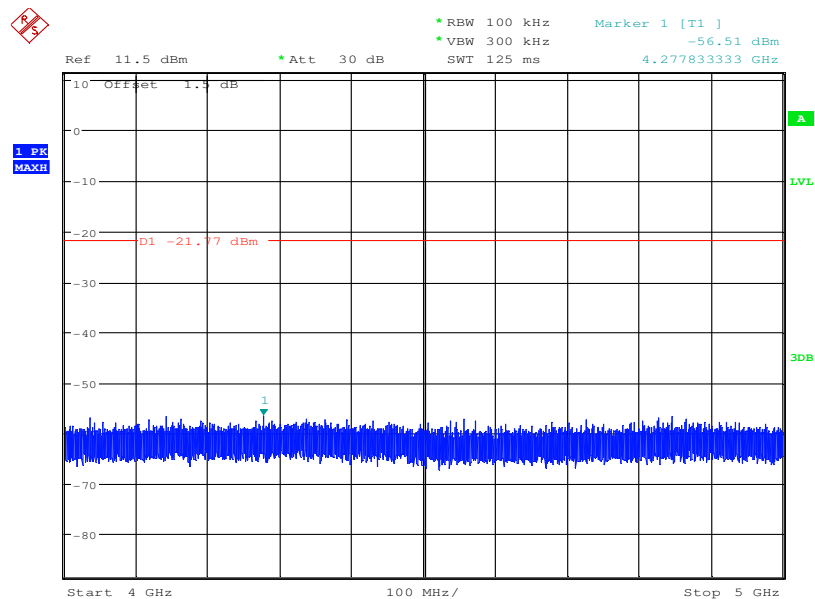
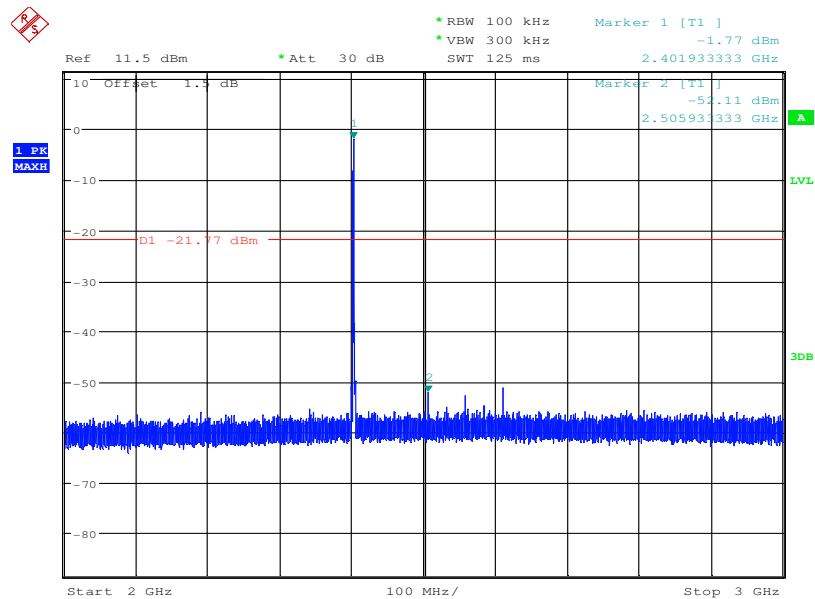




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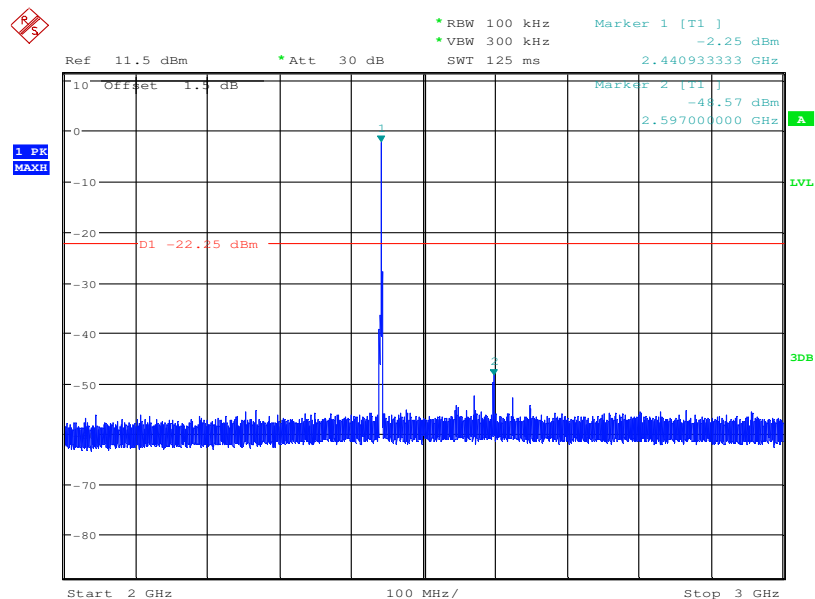
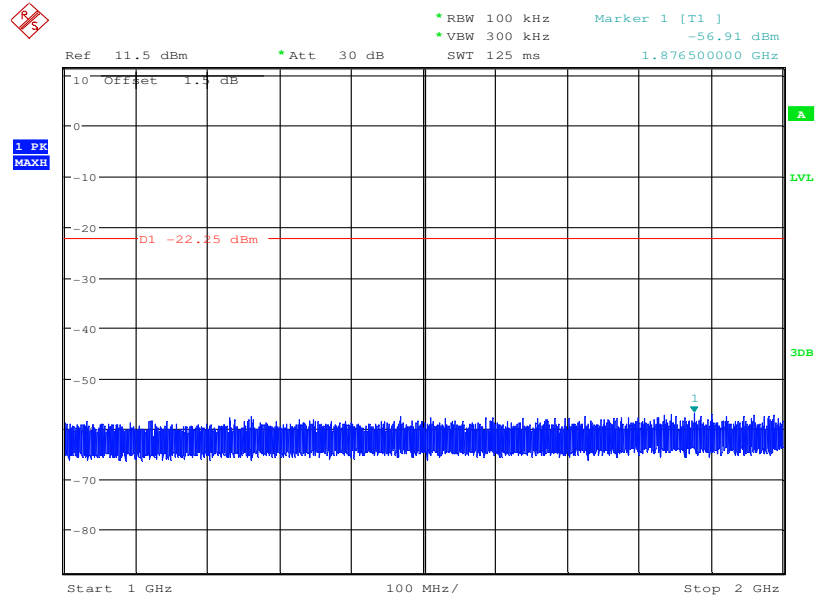
Page: 53 of 79

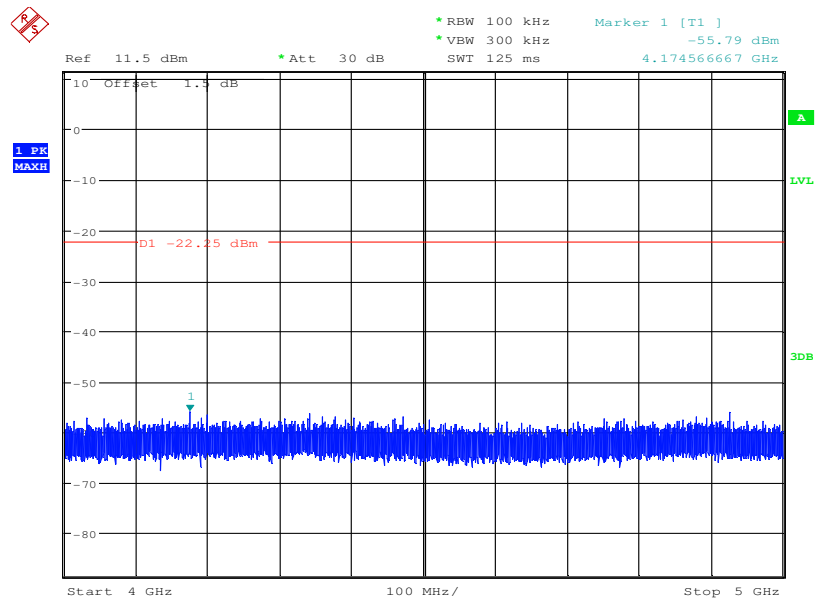


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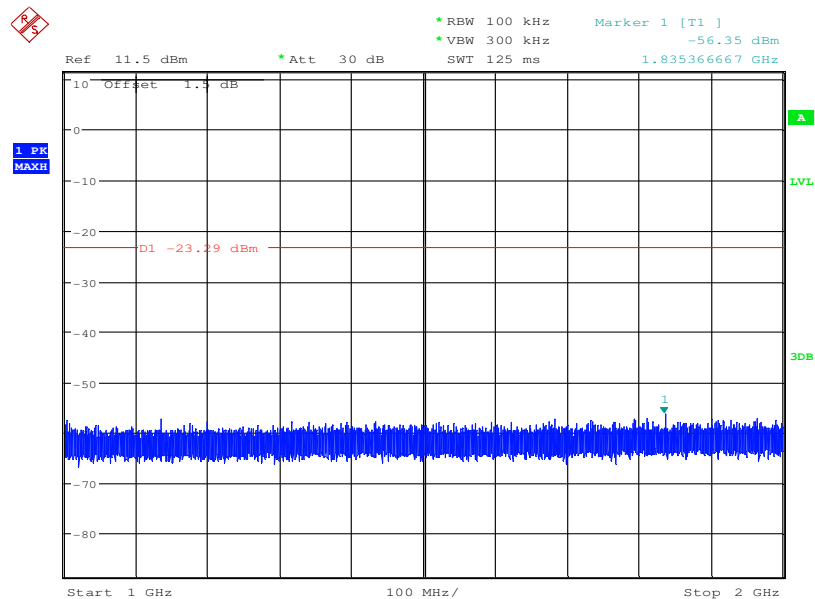


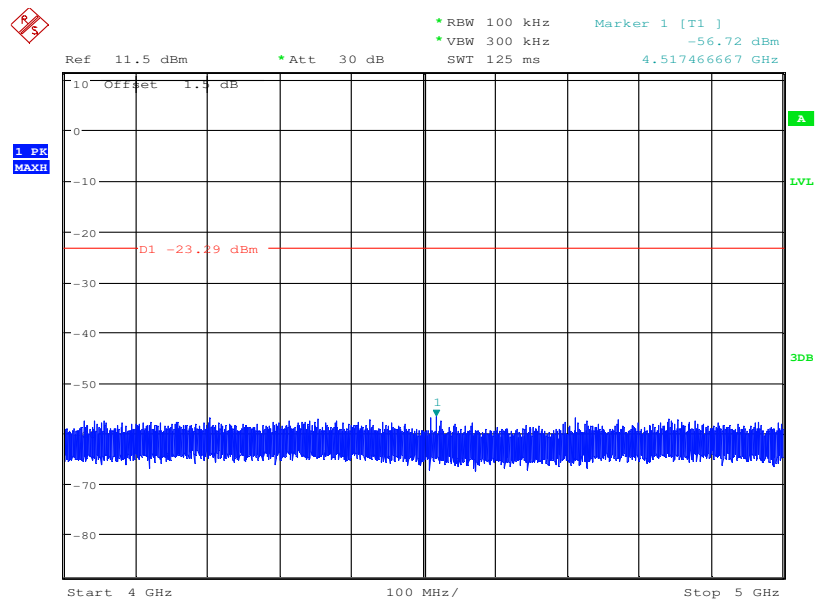
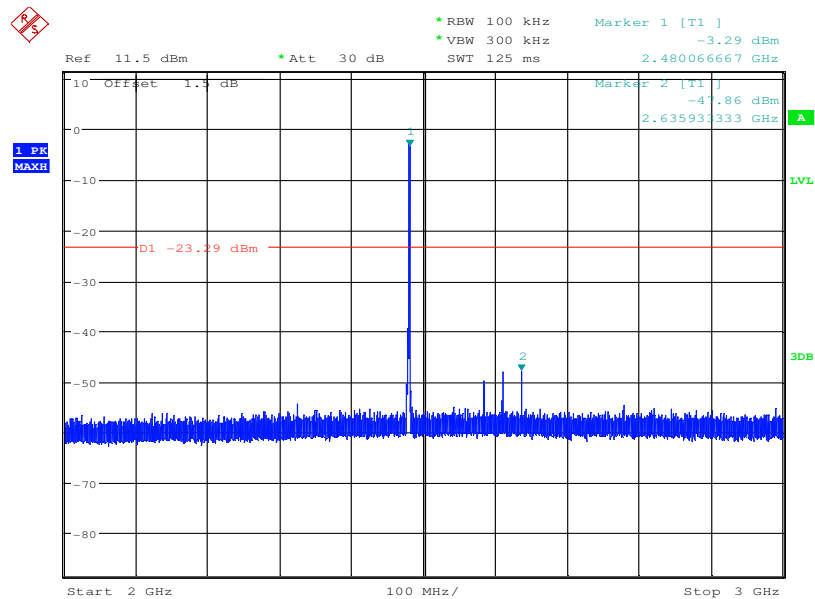
| | | | |
|------------|---------------|---------------|--------|
| Test mode: | $\pi/4$ DQPSK | Test channel: | Middle |
|------------|---------------|---------------|--------|





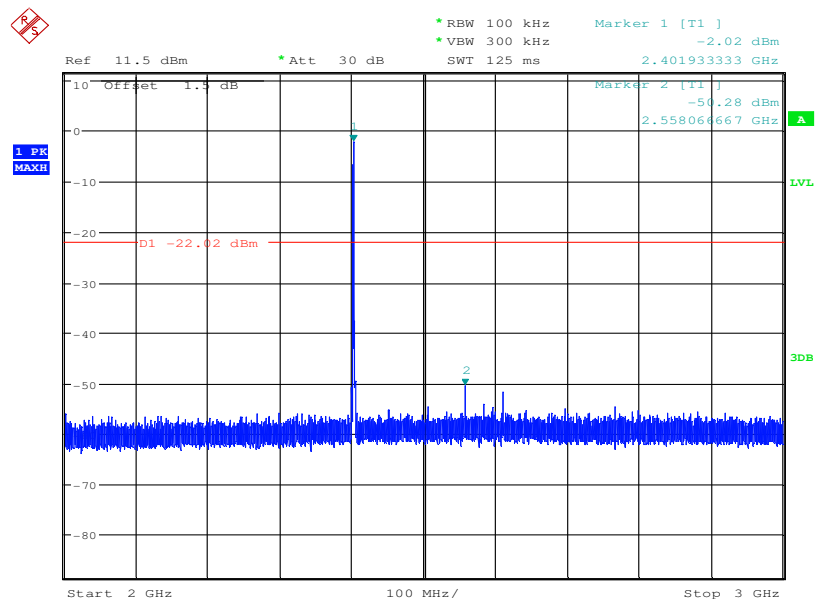
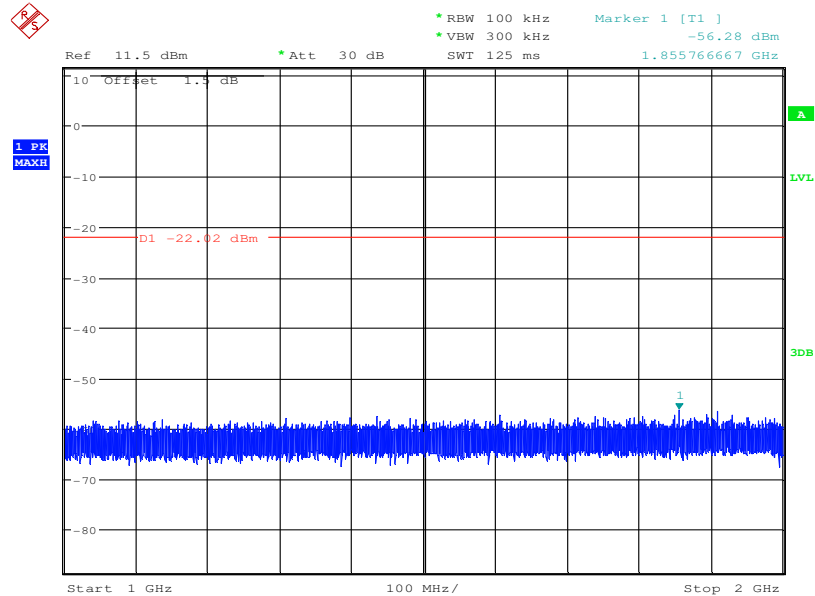
| | | | |
|------------|--------------|---------------|---------|
| Test mode: | $\pi/4$ QPSK | Test channel: | Highest |
|------------|--------------|---------------|---------|





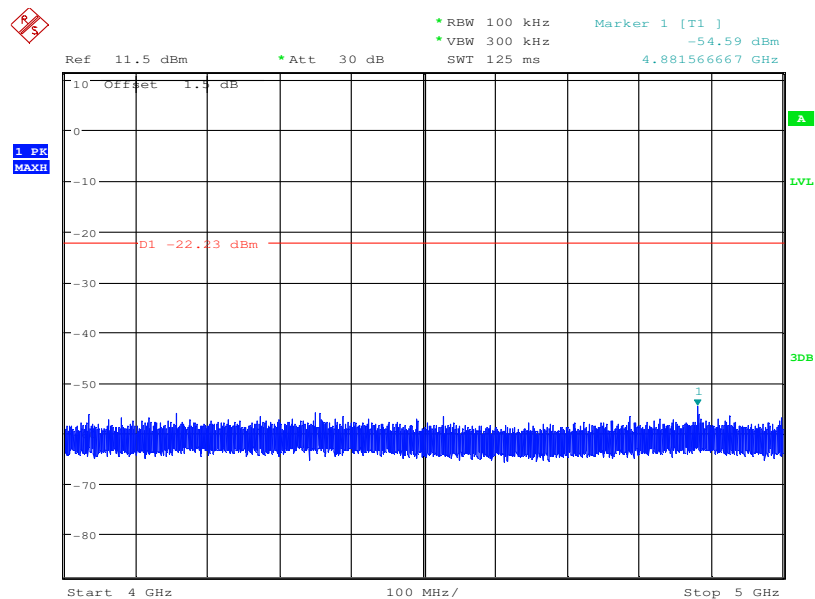
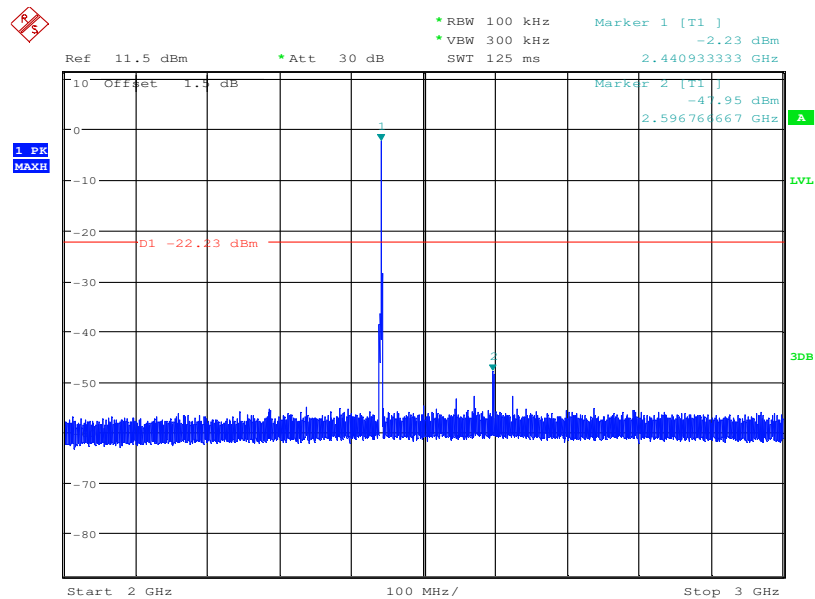


| | | | |
|------------|-------|---------------|--------|
| Test mode: | 8DPSK | Test channel: | Lowest |
|------------|-------|---------------|--------|





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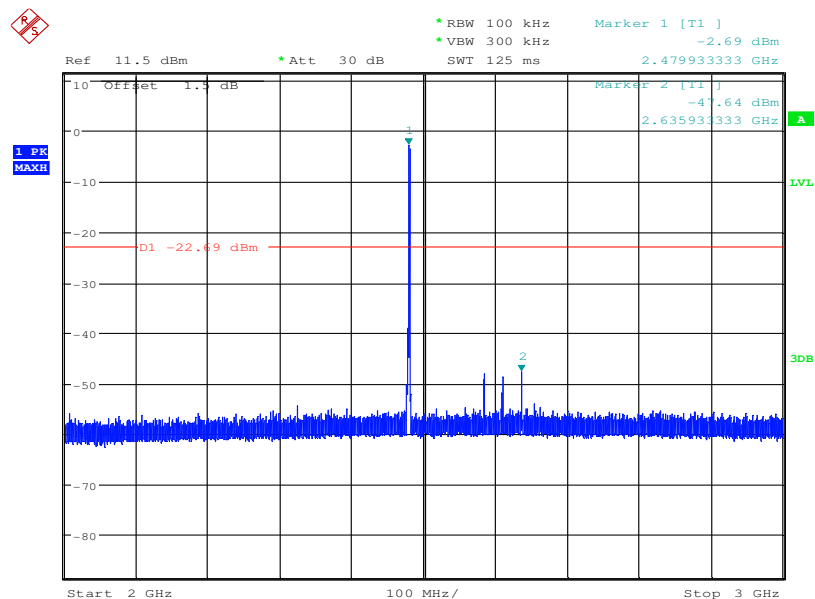
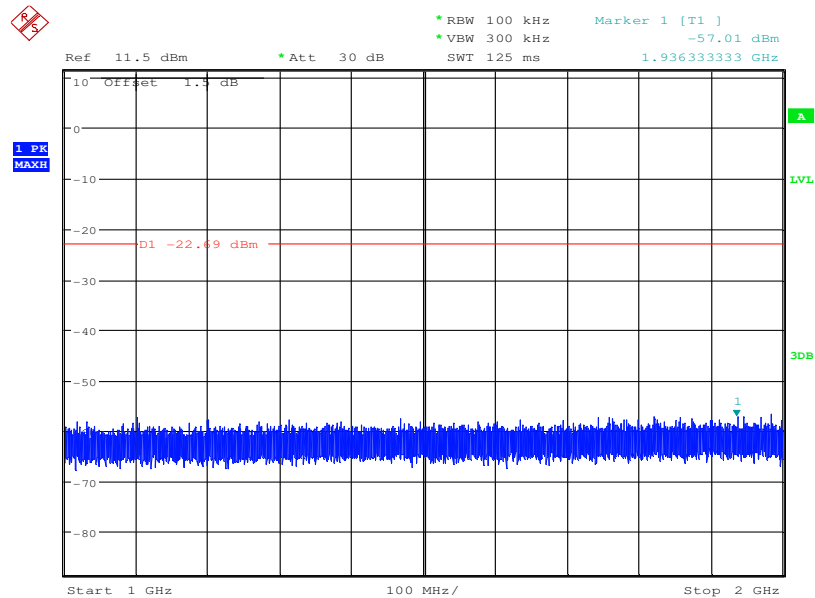


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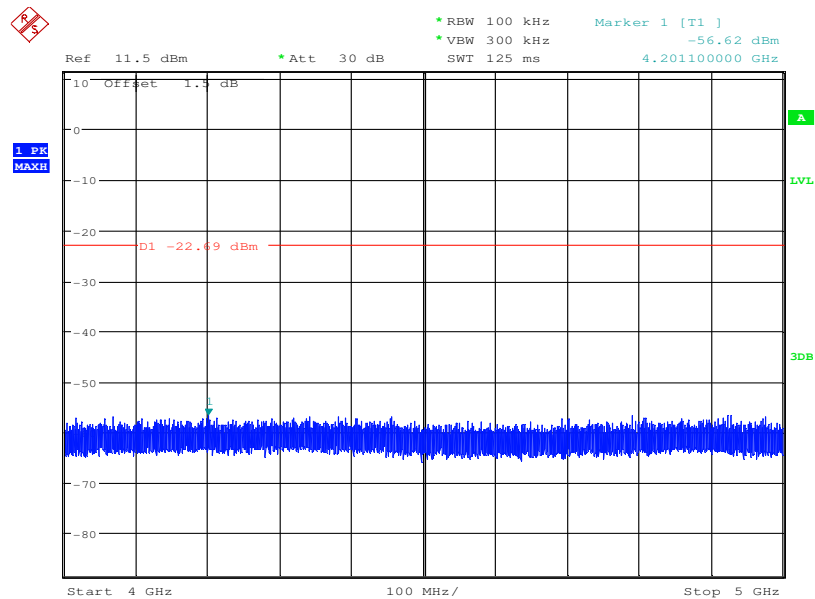
Report No.: SZEM131200691201

Page: 60 of 79

| | | | |
|------------|-------|---------------|---------|
| Test mode: | 8DPSK | Test channel: | Highest |
|------------|-------|---------------|---------|



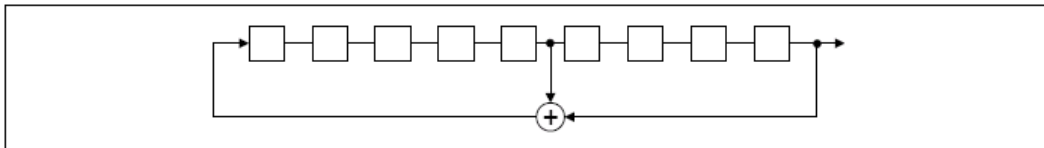
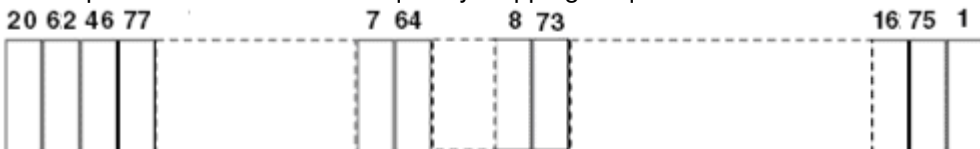
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Remark:

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

5.9 Pseudorandom Frequency Hopping Sequence

| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) requirement: |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <p>Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.</p> <p>Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.</p> | |
| EUT Pseudorandom Frequency Hopping Sequence | |
| <p>The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.</p> <ul style="list-style-type: none"> • Number of shift register stages: 9 • Length of pseudo-random sequence: $2^9 - 1 = 511$ bits • Longest sequence of zeros: 8 (non-inverted signal) <div data-bbox="301 1093 1350 1240" data-label="Diagram">  </div> <p style="text-align: center;"><i>Linear Feedback Shift Register for Generation of the PRBS sequence</i></p> <p>An example of Pseudorandom Frequency Hopping Sequence as follow:</p> <div data-bbox="276 1339 1260 1487" data-label="Diagram">  </div> <p>Each frequency used equally on the average by each transmitter.</p> <p>The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.</p> | |





5.10 Radiated Spurious Emission

| | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------|-------------------|------------|-----------------------------|
| 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. | | | | | |

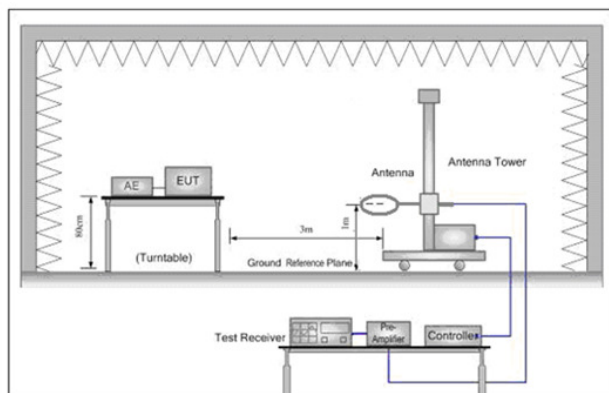
Test Setup:


Figure 1. Below 30MHz

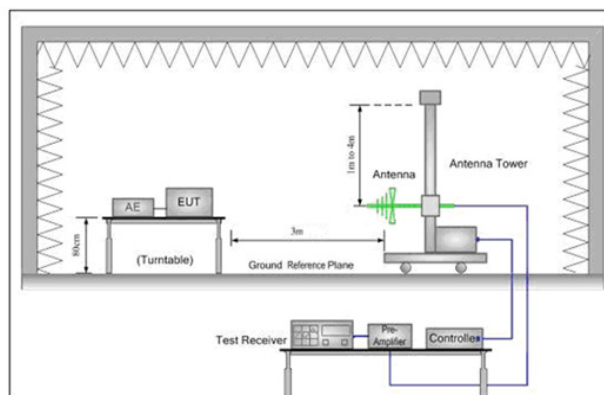


Figure 2. 30MHz to 1GHz

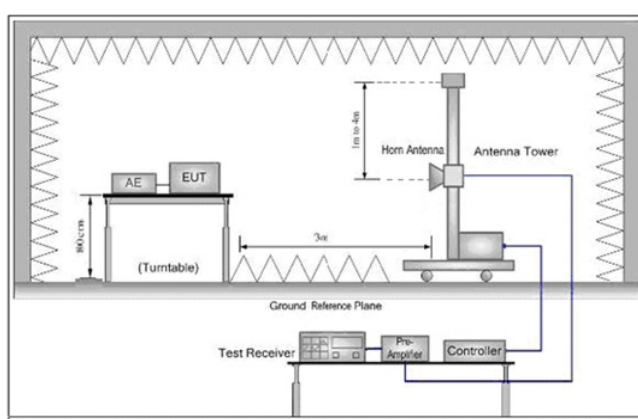


Figure 3. Above 1 GHz

Test Procedure:

- 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



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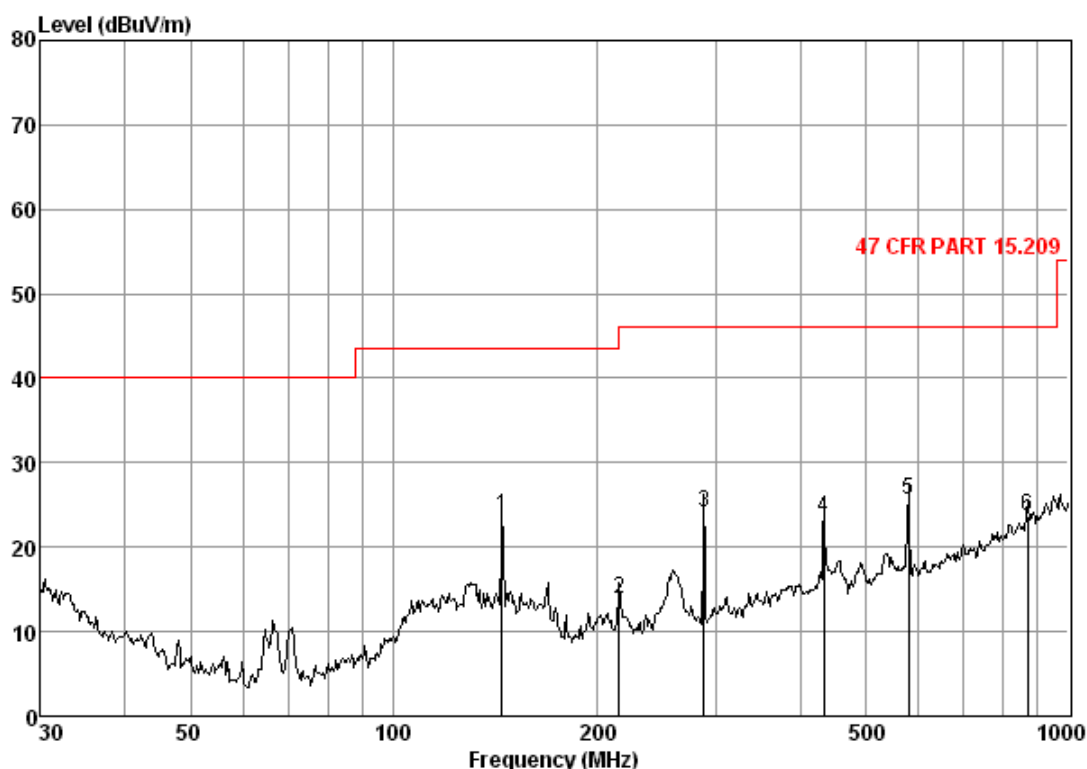
Report No.: SZEM131200691201

Page: 65 of 79

| | |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. g. Test the EUT in the lowest channel (2402MHz), the middle channel (2441MHz), the Highest channel (2480MHz) h. Repeat above procedures until all frequencies measured was complete. |
| Exploratory Test Mode: | Non-hopping transmitting mode with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type is the worse case of GFSK modulation type |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |

5.10.1 Radiated Emission below 1GHz

| | | |
|-----------------|--------------|----------|
| 30MHz~1GHz (QP) | | |
| Test mode: | Transmitting | Vertical |



Condition: 47 CFR PART 15.209 3m 3142C VERTICAL

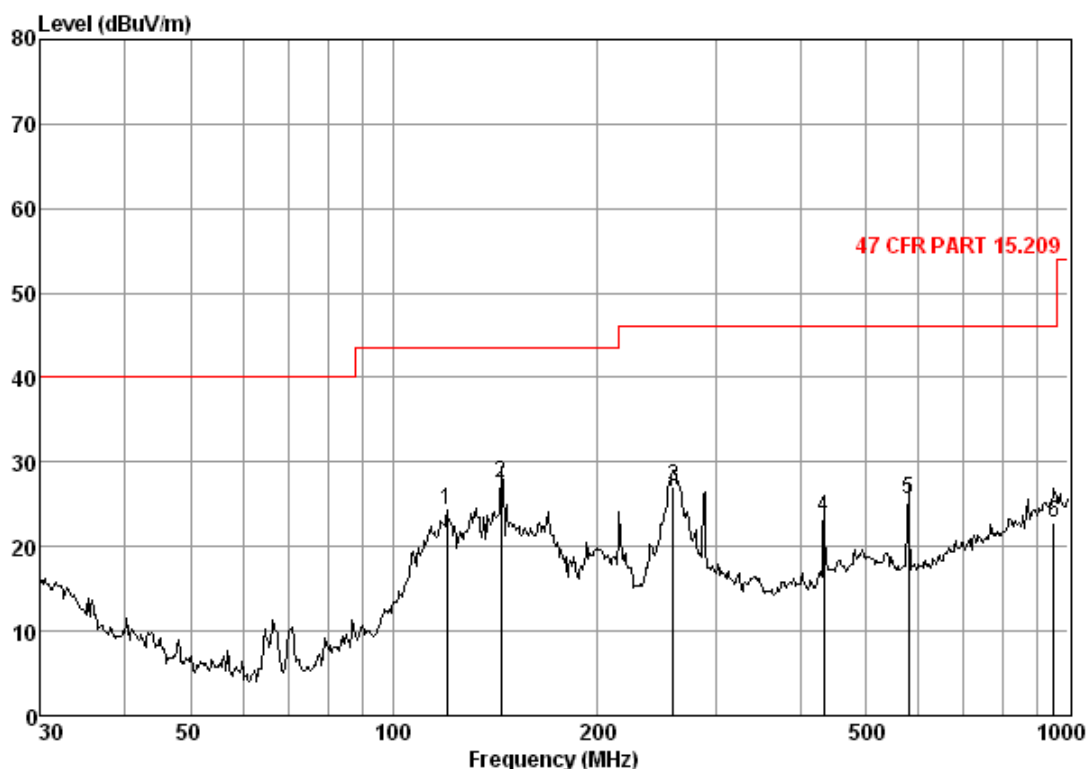
Job No. : 6912RF

Mode : TX

| | | CableAntenna | | Preamp | Read | | Limit | Over |
|---|--------|--------------|--------|--------|-------|-------|--------|--------|
| | Freq | Loss | Factor | Factor | Level | Level | Line | Limit |
| | MHz | dB | | dB/m | dB | dBuV | dBuV/m | dBuV/m |
| 1 | 144.84 | 1.31 | 8.96 | 26.93 | 40.37 | 23.71 | 43.50 | -19.79 |
| 2 | 216.02 | 1.49 | 7.36 | 26.64 | 31.58 | 13.79 | 46.00 | -32.21 |
| 3 | 287.99 | 1.85 | 9.27 | 26.43 | 39.48 | 24.17 | 46.00 | -21.83 |
| 4 | 434.07 | 2.35 | 12.10 | 27.35 | 36.38 | 23.48 | 46.00 | -22.52 |
| 5 | 578.67 | 2.68 | 15.10 | 27.57 | 35.29 | 25.50 | 46.00 | -20.50 |
| 6 | 869.13 | 3.48 | 19.60 | 26.92 | 27.49 | 23.65 | 46.00 | -22.35 |



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



Condition: 47 CFR PART 15.209 3m 3142C HORIZONTAL

Job No. : 6912RF

Mode : TX

| | Freq | Cable | Antenna | Preamp | Read | Limit | Over |
|---|--------|-------|---------|--------|-------|--------|--------|
| | | Loss | Factor | Factor | Level | Line | Limit |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m |
| 1 | 119.86 | 1.25 | 7.70 | 27.07 | 42.48 | 24.36 | 43.50 |
| 2 | 144.33 | 1.31 | 8.92 | 26.94 | 44.19 | 27.48 | 43.50 |
| 3 | 259.23 | 1.72 | 8.90 | 26.51 | 42.96 | 27.07 | 46.00 |
| 4 | 434.07 | 2.35 | 12.10 | 27.35 | 36.38 | 23.48 | 46.00 |
| 5 | 578.67 | 2.68 | 15.10 | 27.57 | 35.29 | 25.50 | 46.00 |
| 6 | 952.09 | 3.65 | 21.30 | 26.54 | 24.39 | 22.80 | 46.00 |

**5.10.2 Transmitter Emission above 1GHz**

| Worse case mode: | | GFSK(DH1) | | 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 | | |
| 3049.394 | 5.12 | 33.38 | 40.34 | 44.96 | 43.12 | 74 | -30.88 | Vertical | | |
| 4149.351 | 6.66 | 34.22 | 41.15 | 44.47 | 44.20 | 74 | -29.80 | Vertical | | |
| 4785.075 | 7.42 | 34.73 | 41.61 | 48.32 | 48.86 | 74 | -25.14 | Vertical | | |
| 7209.015 | 8.74 | 35.88 | 39.87 | 43.06 | 47.81 | 74 | -26.19 | Vertical | | |
| 9611.663 | 9.68 | 37.32 | 37.80 | 39.63 | 48.83 | 74 | -25.17 | Vertical | | |
| 11994.380 | 11.28 | 38.90 | 38.28 | 37.85 | 49.75 | 74 | -24.25 | Vertical | | |
| 2898.032 | 4.98 | 33.26 | 40.23 | 46.81 | 44.82 | 74 | -29.18 | Horizontal | | |
| 3598.087 | 5.90 | 33.32 | 40.74 | 47.54 | 46.02 | 74 | -27.98 | Horizontal | | |
| 4785.075 | 7.42 | 34.73 | 41.61 | 48.23 | 48.77 | 74 | -25.23 | Horizontal | | |
| 7209.015 | 8.74 | 35.88 | 39.87 | 43.30 | 48.05 | 74 | -25.95 | Horizontal | | |
| 9611.663 | 9.68 | 37.32 | 37.80 | 40.38 | 49.58 | 74 | -24.42 | Horizontal | | |
| 11994.380 | 11.28 | 38.90 | 38.28 | 38.99 | 50.89 | 74 | -23.11 | Horizontal | | |

| Worse case mode: | | GFSK(DH1) | | 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 | | |
| 2875.986 | 4.97 | 33.21 | 40.21 | 44.98 | 42.95 | 74 | -31.05 | Vertical | | |
| 3738.129 | 6.11 | 33.49 | 40.84 | 45.46 | 44.22 | 74 | -29.78 | Vertical | | |
| 4883.519 | 7.48 | 34.59 | 41.68 | 49.79 | 50.18 | 74 | -23.82 | Vertical | | |
| 7319.964 | 8.87 | 35.93 | 39.77 | 43.99 | 49.02 | 74 | -24.98 | Vertical | | |
| 9759.591 | 9.74 | 37.46 | 37.66 | 39.84 | 49.38 | 74 | -24.62 | Vertical | | |
| 11933.470 | 11.24 | 38.83 | 38.24 | 37.28 | 49.11 | 74 | -24.89 | Vertical | | |
| 3049.394 | 5.12 | 33.38 | 40.34 | 44.98 | 43.14 | 74 | -30.86 | Horizontal | | |
| 4107.316 | 6.59 | 34.13 | 41.12 | 45.75 | 45.35 | 74 | -28.65 | Horizontal | | |
| 4883.519 | 7.48 | 34.59 | 41.68 | 45.78 | 46.17 | 74 | -27.83 | Horizontal | | |
| 7319.964 | 8.87 | 35.93 | 39.77 | 43.51 | 48.54 | 74 | -25.46 | Horizontal | | |
| 9759.591 | 9.74 | 37.46 | 37.66 | 39.33 | 48.87 | 74 | -25.13 | Horizontal | | |
| 11994.380 | 11.28 | 38.90 | 38.28 | 37.17 | 49.07 | 74 | -24.93 | Horizontal | | |



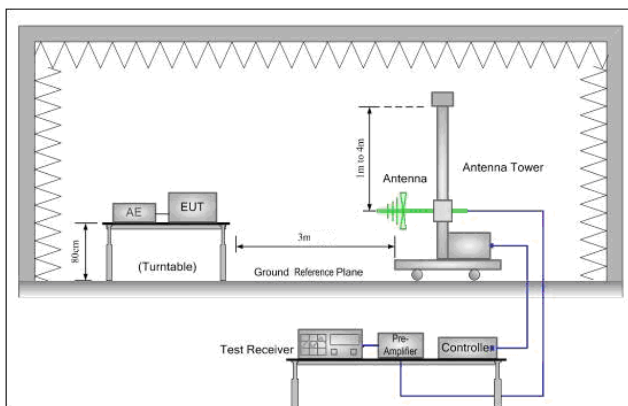
| Worse case mode: | | GFSK(DH1) | | Test channel: | | Highest | | Remark: | Peak |
|------------------|-----------------|-----------------------|--------------------------|-------------------|----------------|---------------------|-----------------|--------------|------|
| Frequency (MHz) | Cable Loss (dB) | Antenna Factor (dB/m) | Preamplifier Factor (dB) | Read Level (dBuV) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization | |
| 3026.195 | 5.09 | 33.39 | 40.33 | 43.91 | 42.06 | 74 | -31.94 | Vertical | |
| 3973.622 | 6.43 | 33.78 | 41.02 | 43.29 | 42.48 | 74 | -31.52 | Vertical | |
| 4958.678 | 7.52 | 34.46 | 41.74 | 43.40 | 43.64 | 74 | -30.36 | Vertical | |
| 7432.622 | 9.01 | 35.97 | 39.67 | 42.33 | 47.64 | 74 | -26.36 | Vertical | |
| 9909.795 | 9.81 | 37.61 | 37.53 | 37.05 | 46.94 | 74 | -27.06 | Vertical | |
| 12366.420 | 11.43 | 39.28 | 38.43 | 37.22 | 49.50 | 74 | -24.50 | Vertical | |
| 3049.394 | 5.12 | 33.38 | 40.34 | 46.02 | 44.18 | 74 | -29.82 | Horizontal | |
| 3738.129 | 6.11 | 33.49 | 40.84 | 46.15 | 44.91 | 74 | -29.09 | Horizontal | |
| 4971.316 | 7.53 | 34.43 | 41.75 | 45.57 | 45.78 | 74 | -28.22 | Horizontal | |
| 7432.622 | 9.01 | 35.97 | 39.67 | 42.11 | 47.42 | 74 | -26.58 | Horizontal | |
| 9909.795 | 9.81 | 37.61 | 37.53 | 39.33 | 49.22 | 74 | -24.78 | Horizontal | |
| 11994.380 | 11.28 | 38.90 | 38.28 | 38.99 | 50.89 | 74 | -23.11 | 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.

5.11 Band edge (Radiated Emission)

| | | | |
|-------------------|--------------------------------------------------|--------------------|------------------|
| 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: | | | |



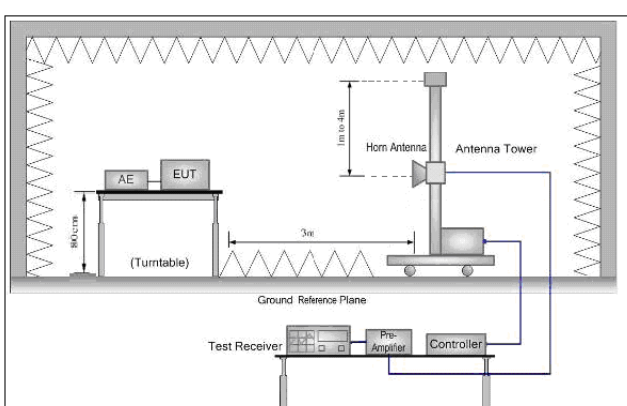


Figure 1. 30MHz to 1GHz

Figure 2. Above 1 GHz

Figure 1. 30MHz to 1GHz

Figure 2. Above 1 GHz

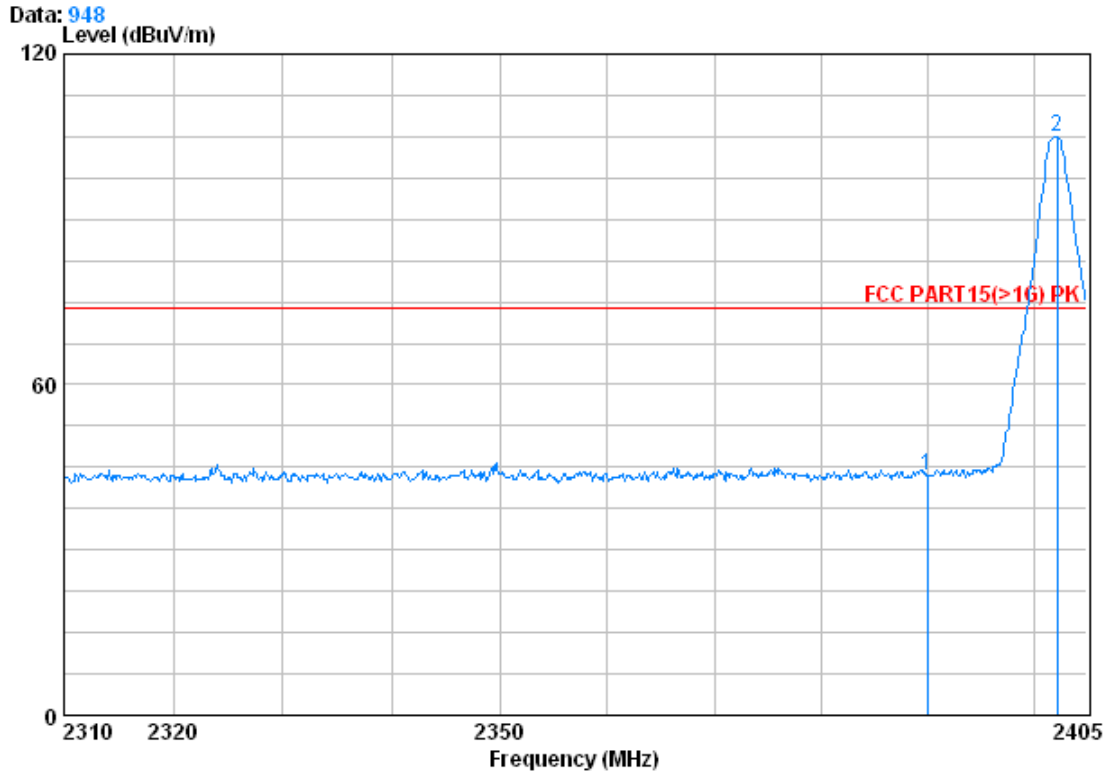


| | |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Procedure: | <ul style="list-style-type: none">a. 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.b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.c. 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.d. 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.e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.f. 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 channelg. Test the EUT in the lowest channel , the Highest channelh. Repeat above procedures until all frequencies measured was complete. |
| Exploratory Test Mode: | Non-hopping transmitting mode with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH5 of data type is the worse case of GFSK modulation type |
| Instruments Used: | Refer to section 4.10 for details |
| Test Results: | Pass |



Test plot as follows:

| | | | | | | |
|------------------|------------|---------------|--------|---------|------|----------|
| Worse case mode: | GFSK (DH5) | Test channel: | Lowest | Remark: | Peak | Vertical |
|------------------|------------|---------------|--------|---------|------|----------|



Condition : FCC PART15(>1G) PK 3m VERTICAL
Job No. : 6912RF
Mode : 2402 Bandedge

| | Freq | Cable | Antenna | Preamp | Read | Limit | Over | |
|-----|----------|-------|---------|--------|--------|--------|--------|-------------|
| | | Loss | Factor | Factor | Level | Line | Limit | Remark |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 2390.000 | 2.98 | 32.51 | 39.85 | 47.77 | 43.42 | 74.00 | -30.58 Peak |
| 2 @ | 2402.245 | 2.98 | 32.51 | 39.86 | 109.44 | 105.07 | 74.00 | 31.07 Peak |



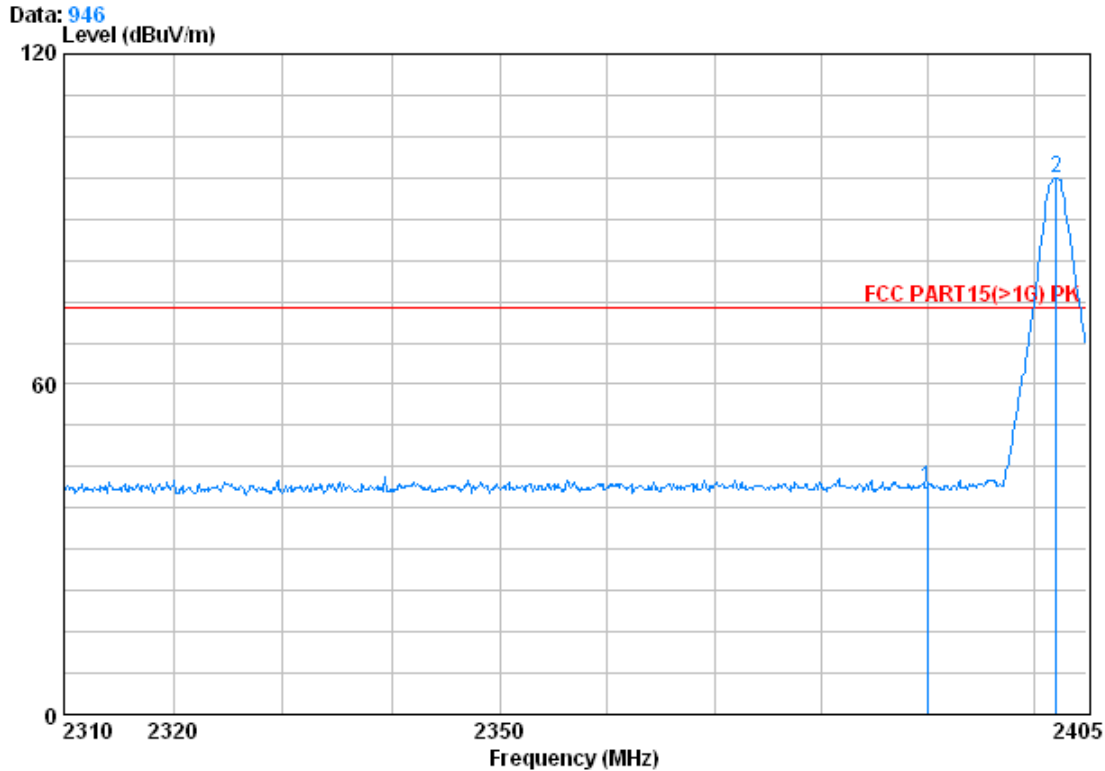


SGS-CSTC Standards Technical Services Ltd.

Report No.: SZEM131200691201

Page: 73 of 79

| | | | | | | |
|------------------|------------|---------------|--------|---------|------|------------|
| Worse case mode: | GFSK (DH5) | Test channel: | Lowest | Remark: | Peak | Horizontal |
|------------------|------------|---------------|--------|---------|------|------------|



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

Job No. : 6912RF

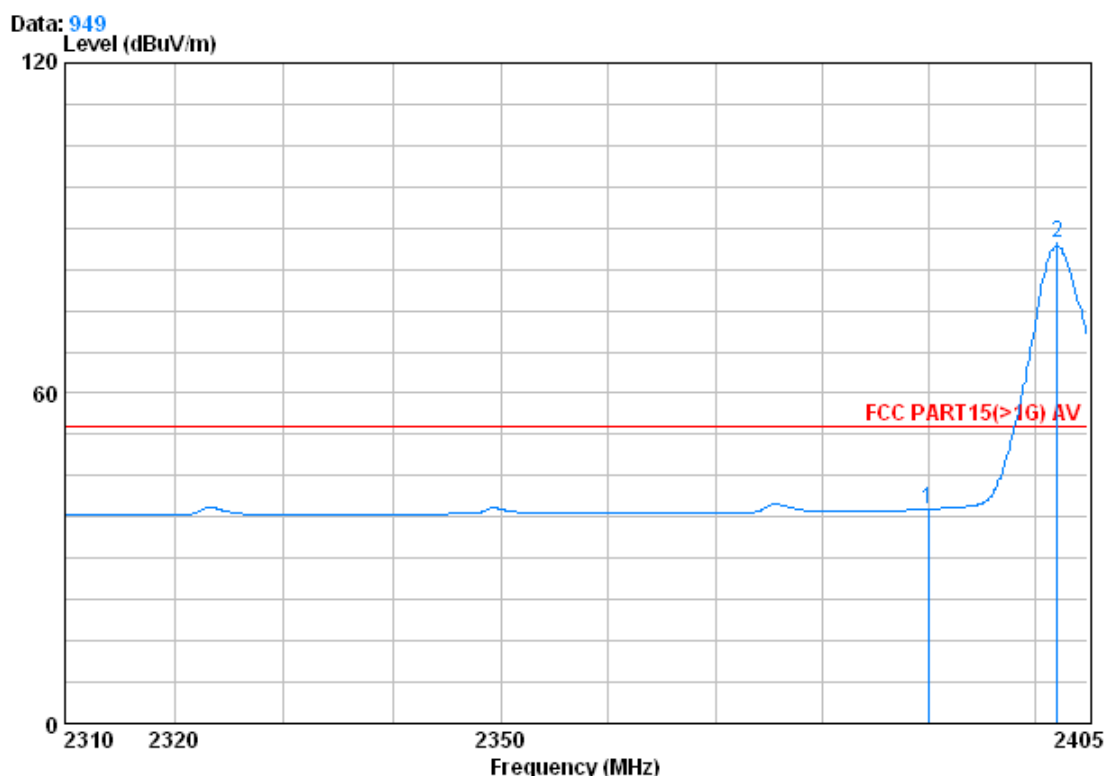
Mode : 2402 Bandedge

| | Freq | Cable | Antenna | Preamp | Read | Limit | Over | |
|-----|----------|-------|---------|--------|--------|--------|--------|-------------|
| | MHz | Loss | Factor | Factor | Level | Line | Limit | Remark |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 2390.000 | 2.98 | 32.51 | 39.85 | 45.47 | 41.11 | 74.00 | -32.89 Peak |
| 2 X | 2402.150 | 2.98 | 32.51 | 39.86 | 101.92 | 97.55 | 74.00 | 23.55 Peak |

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| | | | | | | |
|------------------|------------|---------------|--------|---------|---------|----------|
| Worse case mode: | GFSK (DH5) | Test channel: | Lowest | Remark: | Average | Vertical |
|------------------|------------|---------------|--------|---------|---------|----------|



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

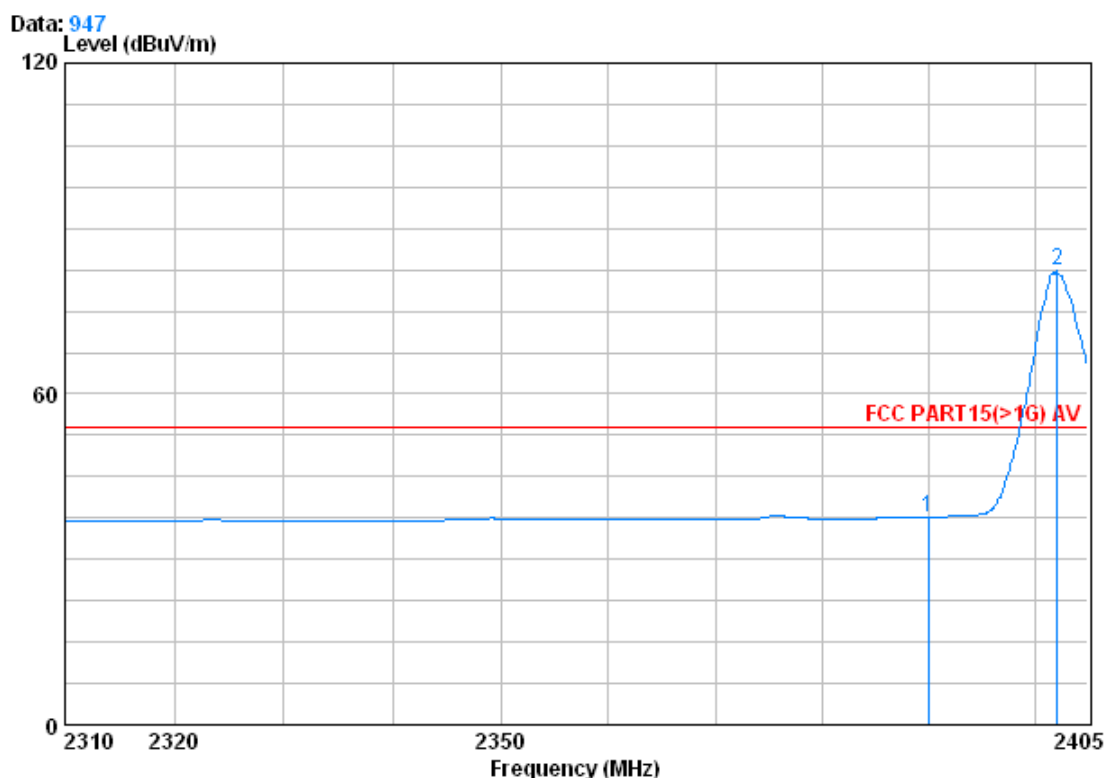
Job No. : 6912RF

Mode : 2402 Bandedge

| | Freq | Cable | Antenna | Preamp | Read | Limit | Over | |
|-----|----------|-------|---------|--------|-------|--------|--------|-------------|
| | | Loss | Factor | Factor | Level | Line | Limit | Remark |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 2390.000 | 2.98 | 32.51 | 39.85 | 43.31 | 38.96 | 54.00 | -15.04 Peak |
| 2 0 | 2402.150 | 2.98 | 32.51 | 39.86 | 91.51 | 87.14 | 54.00 | 33.14 Peak |



| | | | | | | |
|------------------|------------|---------------|--------|---------|---------|------------|
| Worse case mode: | GFSK (DH5) | Test channel: | Lowest | Remark: | Average | Horizontal |
|------------------|------------|---------------|--------|---------|---------|------------|



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

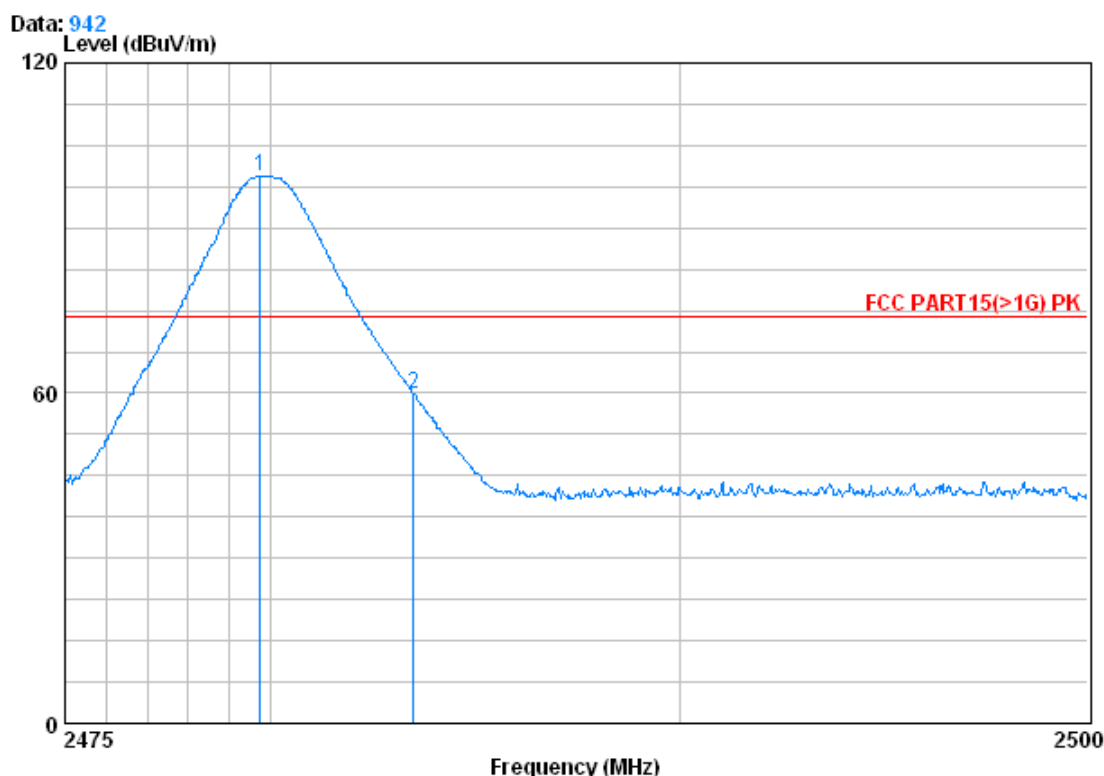
Job No. : 6912RF

Mode : 2402 Bandedge

| | Freq | Cable | Antenna | Preamp | Read | Limit | Over | |
|---|----------|-------|---------|--------|-------|--------|--------|-------------|
| | MHz | Loss | Factor | Factor | Level | Line | Limit | Remark |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 2390.000 | 2.98 | 32.51 | 39.85 | 42.03 | 37.68 | 54.00 | -16.32 Peak |
| 2 | 2402.150 | 2.98 | 32.51 | 39.86 | 86.73 | 82.36 | 54.00 | 28.36 Peak |



| | | | | | | |
|------------------|------------|---------------|---------|---------|------|----------|
| Worse case mode: | GFSK (DH5) | Test channel: | Highest | Remark: | Peak | Vertical |
|------------------|------------|---------------|---------|---------|------|----------|



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

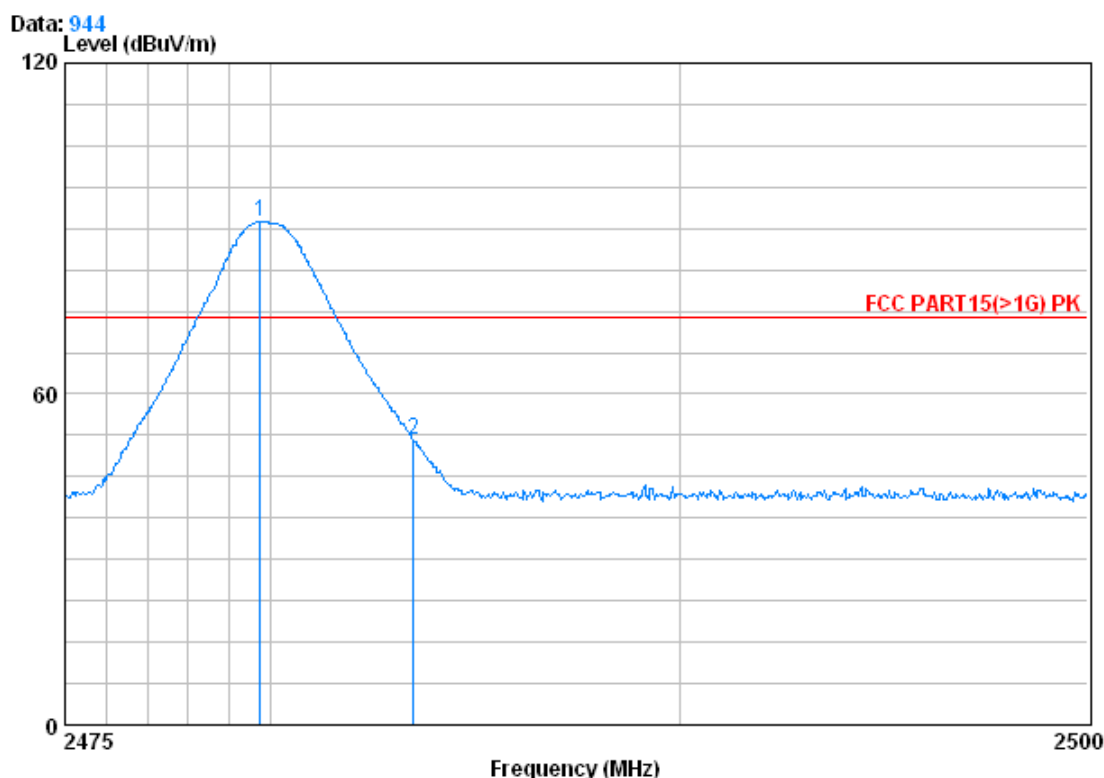
Job No. : 6912RF

Mode : 2480 Bandedge

| | Freq | Cable | Antenna | Preamp | Read | Limit | Over | |
|-----|----------|-------|---------|--------|--------|--------|--------|-------------|
| | | Loss | Factor | Factor | Level | Line | Limit | Remark |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 @ | 2479.750 | 3.03 | 32.67 | 39.92 | 103.66 | 99.44 | 74.00 | 25.44 Peak |
| 2 | 2483.500 | 3.03 | 32.67 | 39.92 | 64.06 | 59.84 | 74.00 | -14.16 Peak |



| | | | | | | |
|------------------|------------|---------------|---------|---------|------|------------|
| Worse case mode: | GFSK (DH5) | Test channel: | Highest | Remark: | Peak | Horizontal |
|------------------|------------|---------------|---------|---------|------|------------|



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

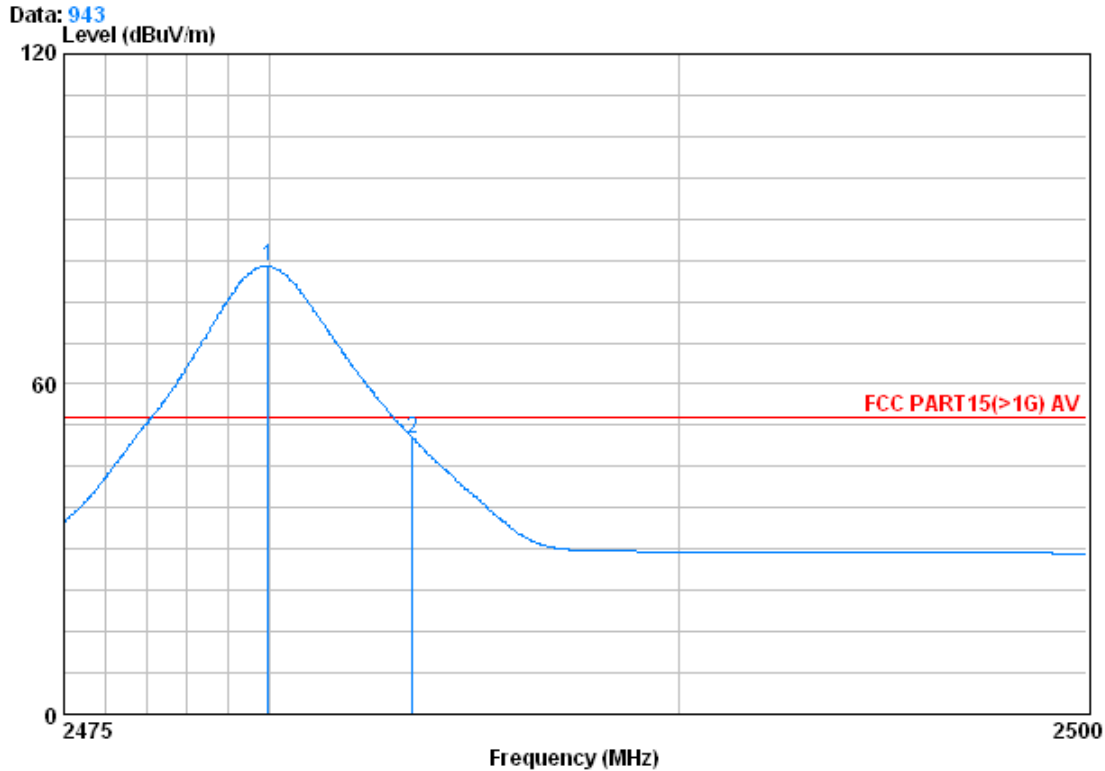
Job No. : 6912RF

Mode : 2480 Bandedge

| | | Cable | Antenna | 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 X | 2479.750 | 3.03 | 32.67 | 39.92 | 95.44 | 91.22 | 74.00 | 17.22 | Peak |
| 2 | 2483.500 | 3.03 | 32.67 | 39.92 | 55.79 | 51.57 | 74.00 | -22.43 | Peak |



| | | | | | | |
|------------------|------------|---------------|---------|---------|---------|----------|
| Worse case mode: | GFSK (DH5) | Test channel: | Highest | Remark: | Average | Vertical |
|------------------|------------|---------------|---------|---------|---------|----------|



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

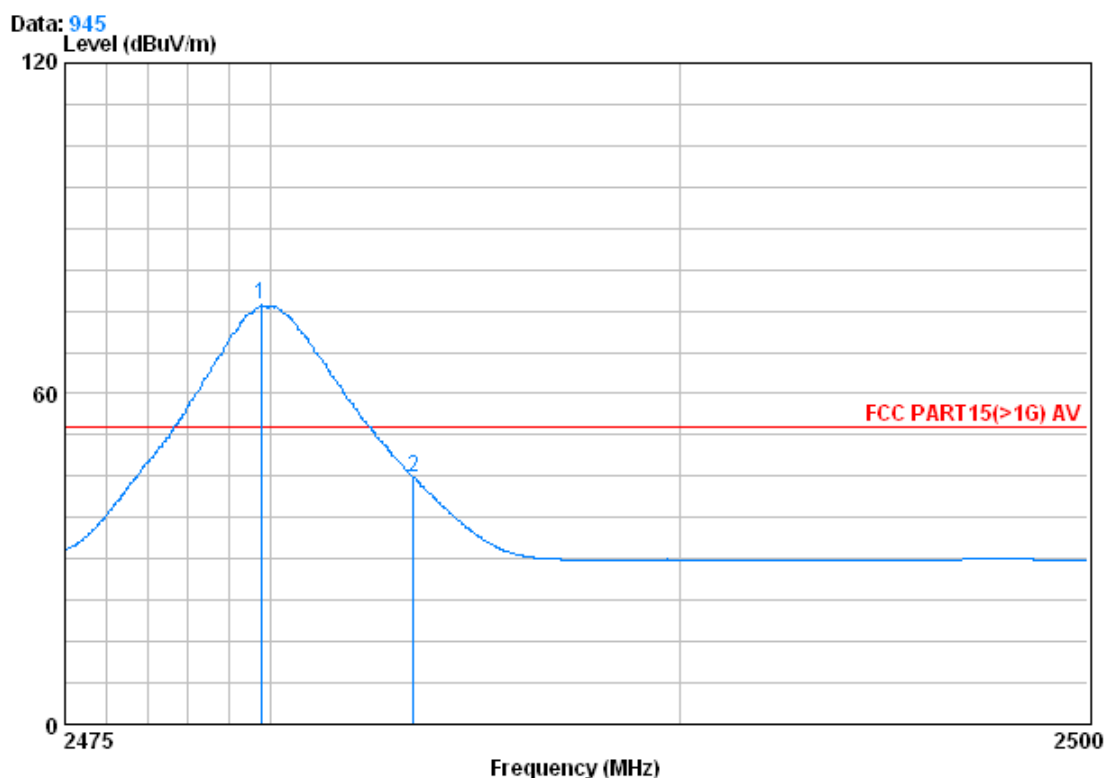
Job No. : 6912RF

Mode : 2480 Bandedge

| | Freq | Cable | Antenna | Preamp | Read | Limit | Over | |
|-----|----------|-------|---------|--------|-------|--------|--------|------------|
| | | Loss | Factor | Factor | Level | Line | Limit | Remark |
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 @ | 2479.975 | 3.03 | 32.67 | 39.92 | 85.65 | 81.43 | 54.00 | 27.43 Peak |
| 2 | 2483.500 | 3.03 | 32.67 | 39.92 | 54.34 | 50.12 | 54.00 | -3.88 Peak |



| | | | | | | |
|------------------|------------|---------------|---------|---------|---------|------------|
| Worse case mode: | GFSK (DH5) | Test channel: | Highest | Remark: | Average | Horizontal |
|------------------|------------|---------------|---------|---------|---------|------------|



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

Job No. : 6912RF

Mode : 2480 Bandedge

| | | Freq | Cable | Antenna | Preamp | Read | Limit | Over | |
|---|---|----------|-------|---------|--------|-------|--------|--------|------------|
| | | | Loss | Factor | Factor | Level | Line | Limit | Remark |
| | | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | X | 2479.775 | 3.03 | 32.67 | 39.92 | 80.29 | 76.07 | 54.00 | 22.07 Peak |
| 2 | | 2483.500 | 3.03 | 32.67 | 39.92 | 49.00 | 44.78 | 54.00 | -9.22 Peak |

Note:

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

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$