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# FCC REPORT

| | |
|---|---|
| **Application No:** | SZEM1510006644CR |
| **Applicant:** | Seeed Technology Co., Ltd |
| **Manufacturer/Factory:** | Seeed Technology Co., Ltd |
| **Product Name:** | Rephone Kit Create (Xadow GSM + BLE) |
| **Model No.(EUT):** | Xadow GSM + BLE v1.0 |
| **Add Model No.:** | Xadow GSM + BLE v1.1 |
| **Trade Mark:** | Seeedstudio |
| **FCC ID:** | Z4TXADOW-GSMBTV10 |
| **Standards:** | 47 CFR Part 15, Subpart C (2014) |
| **Date of Receipt:** | 2015-11-23 |
| **Date of Test:** | 2015-11-25 to 2016-01-06 |
| **Date of Issue:** | 2016-01-12 |
| **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.

# 2 Version

| Revision Record | | | | |
|---|---|---|---|---|
| **Version** | **Chapter** | **Date** | **Modifier** | **Remark** |
| *00* | | 2016-01-12 | | *Original* |
| | | | | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| **Authorized for issue by:** | | | | |
| **Tested By** | | Gebin Sun<br>**(Gebin Sun) /Project Engineer** | | 2016-01-06<br>**Date** |
| **Prepared By** | | Jade Chen<br>**(Jade Chen) /Clerk** | | 2016-01-12<br>**Date** |
| **Checked By** | | Eric Fu<br>**(Eric Fu) /Reviewer** | | 2016-01-12<br>**Date** |

# 3 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 (2013) | PASS |
| **AC Power Line Conducted Emission** | 47 CFR Part 15, Subpart C Section 15.207 | ANSI C63.10 (2013) | PASS |
| **Conducted Peak Output Power** | 47 CFR Part 15, Subpart C Section 15.247 (b)(1) | ANSI C63.10 (2013) | PASS |
| **20dB Occupied Bandwidth** | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | ANSI C63.10 (2013) | PASS |
| **Carrier Frequencies Separation** | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | ANSI C63.10 (2013) | PASS |
| **Hopping Channel Number** | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | ANSI C63.10 (2013) | PASS |
| **Dwell Time** | 47 CFR Part 15, Subpart C Section 15.247 (a)(1) | ANSI C63.10 (2013) | 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 (2013) | PASS |
| **Band-edge for RF Conducted Emissions** | 47 CFR Part 15, Subpart C Section 15.247(d) | ANSI C63.10 (2013) | PASS |
| **RF Conducted Spurious Emissions** | 47 CFR Part 15, Subpart C Section 15.247(d) | ANSI C63.10 (2013) | PASS |
| **Radiated Spurious emissions** | 47 CFR Part 15, Subpart C Section 15.205/15.209 | ANSI C63.10 (2013) | PASS |
| **Restricted bands around fundamental frequency (Radiated Emission)** | 47 CFR Part 15, Subpart C Section 15.205/15.209 | ANSI C63.10 (2013) | PASS |

Remark:
Model No.: Xadow GSM + BLE v1.0, Xadow GSM + BLE v1.1

Only the model Xadow GSM + BLE v1.0 was tested, since the electrical circuit design, layout, components used and internal wiring were identical for the above models, with difference being of sick-screen.

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# 5 General Information

## 5.1 Client Information

| | |
|---|---|
| Applicant: | Seeed Technology Co., Ltd |
| Address of Applicant: | F5, Building 8, Shiling Industrial Park, Xinwei, Number32, Tongsha Road Xili Town, Nanshan District, Shenzhen, China. P.R.C |
| Manufacturer: | Seeed Technology Co., Ltd |
| Address of Manufacturer: | F5, Building 8, Shiling Industrial Park, Xinwei, Number32, Tongsha Road Xili Town, Nanshan District, Shenzhen, China. P.R.C |
| Factory: | Seeed Technology Co., Ltd |
| Address of Factory: | F5, Building 8, Shiling Industrial Park, Xinwei, Number32, Tongsha Road Xili Town, Nanshan District, Shenzhen, China. P.R.C |

## 5.2 General Description of EUT

| | |
|---|---|
| Product Name: | Rephone Kit Create (Xadow GSM + BLE) |
| Model No.: | Xadow GSM + BLE v1.0 |
| Trade Mark: | Seeedstudio |
| Operation Frequency: | 2402MHz~2480MHz |
| Bluetooth Version: | BT4.0 Dual mode |
| Modulation Technique: | Frequency Hopping Spread Spectrum(FHSS) |
| Modulation Type: | GFSK, π/4DQPSK, 8DPSK |
| Number of Channel: | 79 |
| Hopping Channel Type: | Adaptive Frequency Hopping systems |
| Sample Type: | Mobile device |
| Antenna Type: | Integral |
| Antenna Gain: | 0.5dBi |
| Power Supply: | 3.7V DC (1 x 3.7V Rechargeable Battery) 520mAh<br>Battery: Charge by DC 5V |

| Operation Frequency each of channel | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 0 | 2402MHz | 20 | 2422MHz | 40 | 2442MHz | 60 | 2462MHz |
| 1 | 2403MHz | 21 | 2423MHz | 41 | 2443MHz | 61 | 2463MHz |
| 2 | 2404MHz | 22 | 2424MHz | 42 | 2444MHz | 62 | 2464MHz |
| 3 | 2405MHz | 23 | 2425MHz | 43 | 2445MHz | 63 | 2465MHz |
| 4 | 2406MHz | 24 | 2426MHz | 44 | 2446MHz | 64 | 2466MHz |
| 5 | 2407MHz | 25 | 2427MHz | 45 | 2447MHz | 65 | 2467MHz |
| 6 | 2408MHz | 26 | 2428MHz | 46 | 2448MHz | 66 | 2468MHz |
| 7 | 2409MHz | 27 | 2429MHz | 47 | 2449MHz | 67 | 2469MHz |
| 8 | 2410MHz | 28 | 2430MHz | 48 | 2450MHz | 68 | 2470MHz |
| 9 | 2411MHz | 29 | 2431MHz | 49 | 2451MHz | 69 | 2471MHz |
| 10 | 2412MHz | 30 | 2432MHz | 50 | 2452MHz | 70 | 2472MHz |
| 11 | 2413MHz | 31 | 2433MHz | 51 | 2453MHz | 71 | 2473MHz |
| 12 | 2414MHz | 32 | 2434MHz | 52 | 2454MHz | 72 | 2474MHz |
| 13 | 2415MHz | 33 | 2435MHz | 53 | 2455MHz | 73 | 2475MHz |
| 14 | 2416MHz | 34 | 2436MHz | 54 | 2456MHz | 74 | 2476MHz |
| 15 | 2417MHz | 35 | 2437MHz | 55 | 2457MHz | 75 | 2477MHz |
| 16 | 2418MHz | 36 | 2438MHz | 56 | 2458MHz | 76 | 2478MHz |
| 17 | 2419MHz | 37 | 2439MHz | 57 | 2459MHz | 77 | 2479MHz |
| 18 | 2420MHz | 38 | 2440MHz | 58 | 2460MHz | 78 | 2480MHz |
| 19 | 2421MHz | 39 | 2441MHz | 59 | 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 |

## 5.3 Test Environment

| Operating Environment: | |
|---|---|
| Temperature: | 25.0 °C |
| Humidity: | 53 % RH |
| Atmospheric Pressure: | 1010mbar |

## 5.4 Description of Support Units

The EUT has been tested with associated equipment below.

| Description | Manufacturer | Model No. |
|---|---|---|
| Adapter | Apple | A1357W010A051 |
| Laptop | Lenovo | T430u |
| Test board | Supplied by client | V1.0.1 |

The laptop and test board is used only for engineering mode configuration before testing.

## 5.5 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.

## 5.6 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.

**• A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

**• VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, 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)**

The 3m Semi-anechoic chambers and the 10m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-2, 4620C-3.

## 5.7 Deviation from Standards

None.

## 5.8 Abnormalities from Standard Conditions

None.

## 5.9 Other Information Requested by the Customer

None.

## 5.10 Equipment List

| RE in Chamber | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal. date (yyyy-mm-dd)** | **Cal.Due date (yyyy-mm-dd)** |
| 1 | 3m Semi-Anechoic Chamber | ETS-LINDGREN | N/A | SEL0017 | 2015-05-13 | 2016-05-13 |
| 2 | EMI Test Receiver | Agilent Technologies | N9038A | SEL0312 | 2015-09-16 | 2016-09-16 |
| 3 | EMI Test software | AUDIX | E3 | SEL0050 | N/A | N/A |
| 4 | BiConiLog Antenna (26-3000MHz) | ETS-LINDGREN | 3142C | SEL0015 | 2014-11-15 | 2017-11-15 |
| 5 | Double-ridged horn (1-18GHz) | ETS-LINDGREN | 3117 | SEL0006 | 2015-10-17 | 2016-10-17 |
| 6 | Horn Antenna (18-26GHz) | ETS-LINDGREN | 3160 | SEL0076 | 2014-11-24 | 2017-11-24 |
| 7 | Pre-amplifier (0.1-1300MHz) | Agilent Technologies | 8447D | SEL0053 | 2015-05-13 | 2016-05-13 |
| 8 | Pre-Amplifier (0.1-26.5GHz) | Compliance Directions Systems Inc. | PAP-0126 | SEL0168 | 2015-10-17 | 2016-10-17 |
| 9 | Coaxial cable | SGS | N/A | SEL0027 | 2015-05-13 | 2016-05-13 |
| 10 | Coaxial cable | SGS | N/A | SEL0189 | 2015-05-13 | 2016-05-13 |
| 11 | Coaxial cable | SGS | N/A | SEL0121 | 2015-05-13 | 2016-05-13 |
| 12 | Coaxial cable | SGS | N/A | SEL0178 | 2015-05-13 | 2016-05-13 |
| 13 | Band filter | Amindeon | 82346 | SEL0094 | 2015-05-13 | 2016-05-13 |
| 14 | Barometer | Chang Chun | DYM3 | SEL0088 | 2015-05-13 | 2016-05-13 |
| 15 | DC Power Supply | Zhao Xin | RXN-305D | SEL0117 | 2015-10-09 | 2016-10-09 |
| 16 | Humidity/ Temperature Indicator | Shanhai Qixiang | ZJ1-2B | SEL0103 | 2015-10-24 | 2016-10-24 |
| 17 | Signal Generator (10M-27GHz) | Rohde & Schwarz | SMR27 | SEL0067 | 2015-05-13 | 2016-05-13 |
| 18 | Loop Antenna | Beijing Daze | ZN30401 | SEL0203 | 2015-05-13 | 2016-05-13 |

| RF connected test | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal. date (yyyy-mm-dd)** | **Cal.Due date (yyyy-mm-dd)** |
| 1 | DC Power Supply | Zhao Xin | RXN-305D | SEL0117 | 2015-10-09 | 2016-10-09 |
| 2 | Humidity/ Temperature Indicator | HYGRO | ZJ1-2B | SEL0033 | 2015-10-24 | 2016-10-24 |
| 3 | Spectrum Analyzer | Rohde & Schwarz | FSP | SEL0154 | 2015-10-17 | 2016-10-17 |
| 4 | Coaxial cable | SGS | N/A | SEL0178 | 2015-05-13 | 2016-05-13 |
| 5 | Coaxial cable | SGS | N/A | SEL0179 | 2015-05-13 | 2016-05-13 |
| 6 | Barometer | ChangChun | DYM3 | SEL0088 | 2015-05-13 | 2016-05-13 |
| 7 | Signal Generator | Rohde & Schwarz | SML03 | SEL0068 | 2015-04-25 | 2016-04-25 |
| 8 | POWER METER | R & S | NRVS | SEL0144 | 2015-10-09 | 2016-10-09 |
| 9 | Attenuator | Beijin feihang taida | TST-2-6dB | SEL0205 | 2015-04-25 | 2016-04-25 |

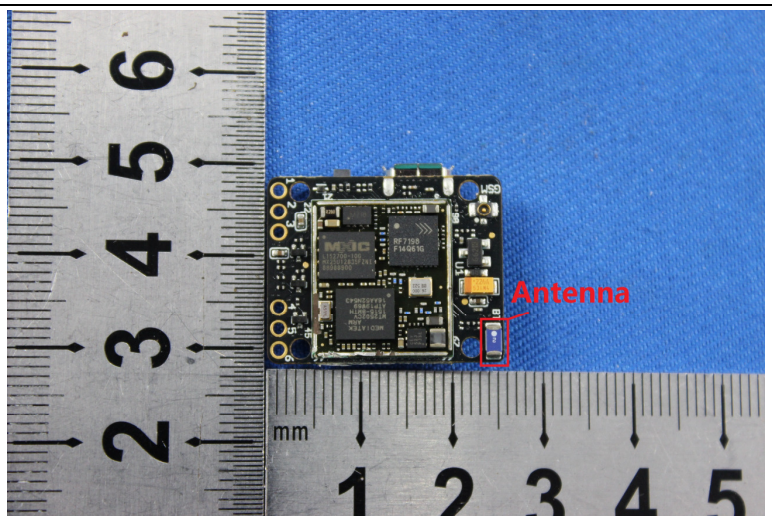
# 6 Test results and Measurement Data

## 6.1 Antenna Requirement

| | |
|---|---|
| **Standard requirement:** | 47 CFR Part 15C Section 15.203 /247(c) |

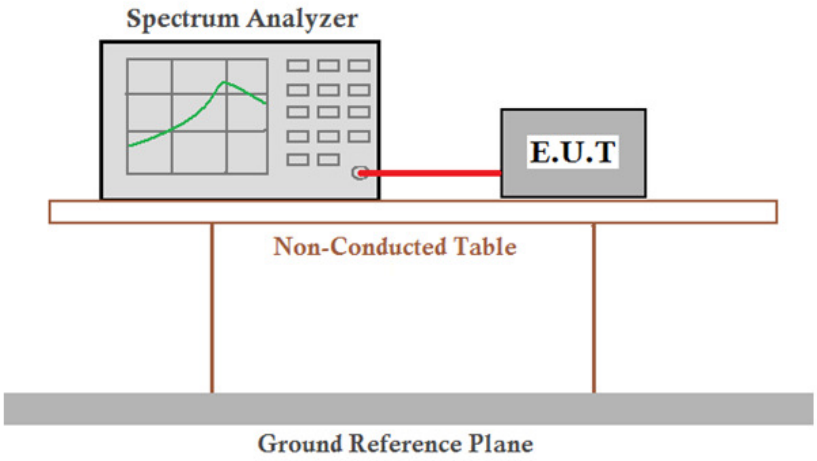
15.203 requirement:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer 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 0.5dBi.

## 6.2 Conducted Peak Output Power

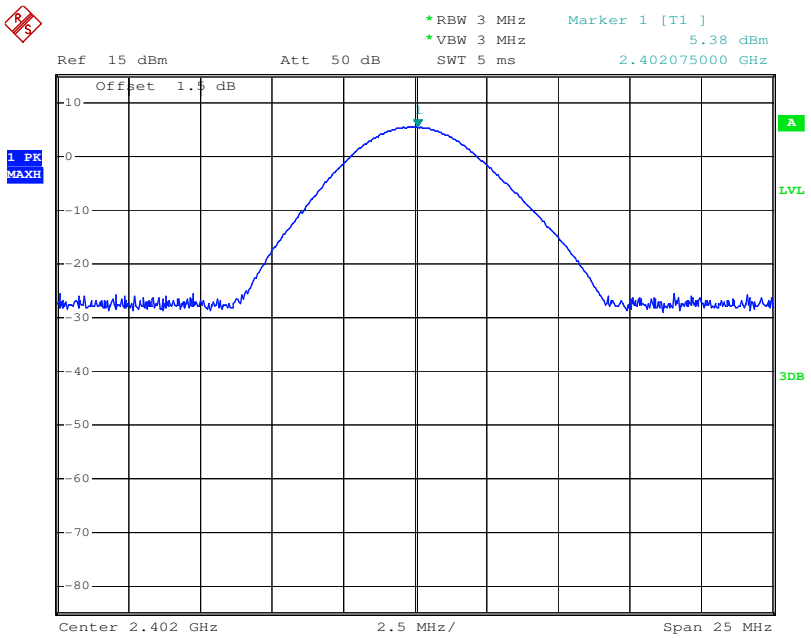
| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (b)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>*Remark:*<br>*Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.* |
| Limit: | 30dBm |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 5.10 for details |
| Test Results: | Pass |

**Measurement Data**

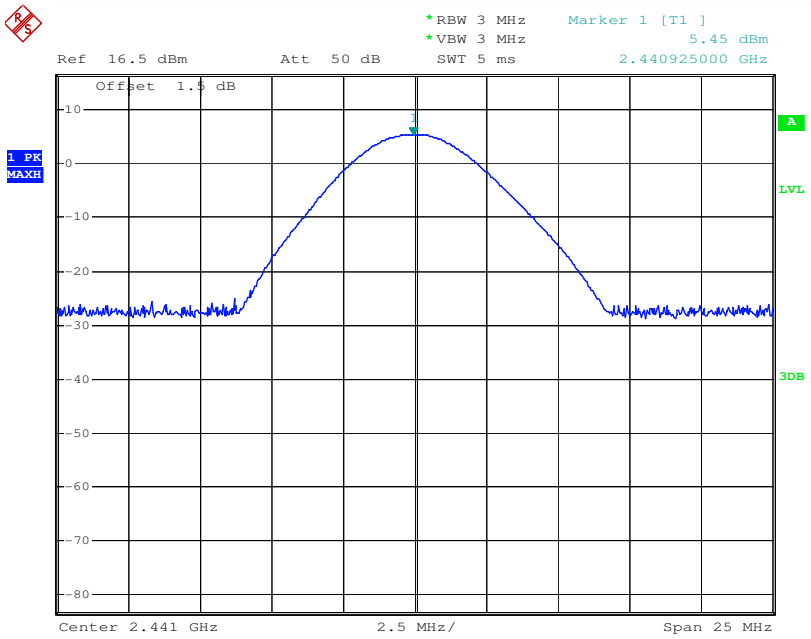
| GFSK mode | | | |
|---|---|---|---|
| Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest | 5.38 | 30.00 | Pass |
| Middle | 5.45 | 30.00 | Pass |
| Highest | 5.18 | 30.00 | Pass |
| π/4DQPSK mode | | | |
| Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest | 4.12 | 30.00 | Pass |
| Middle | 4.13 | 30.00 | Pass |
| Highest | 3.94 | 30.00 | Pass |
| 8DPSK mode | | | |
| Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest | 4.55 | 30.00 | Pass |
| Middle | 4.62 | 30.00 | Pass |
| Highest | 4.49 | 30.00 | Pass |

**Test plot as follows:**

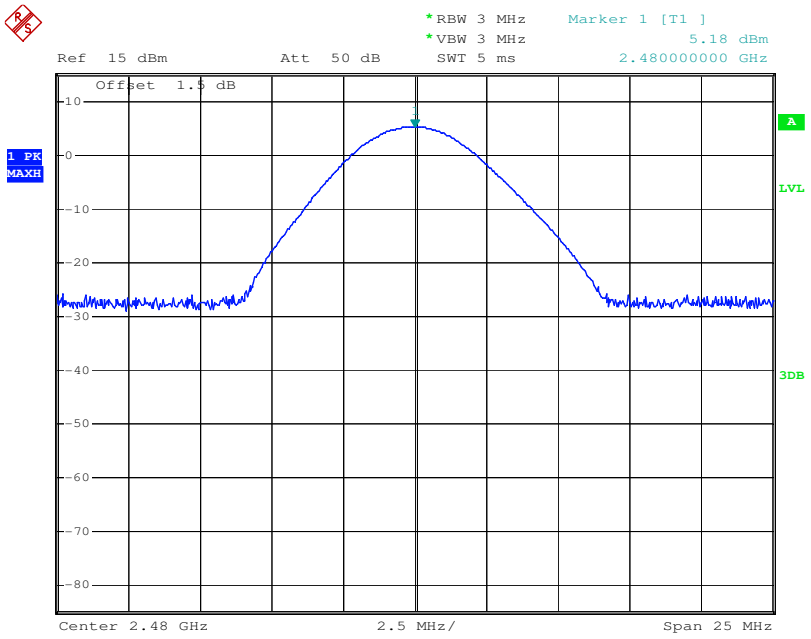
| Test mode: | GFSK | Test channel: | Lowest |
|---|---|---|---|



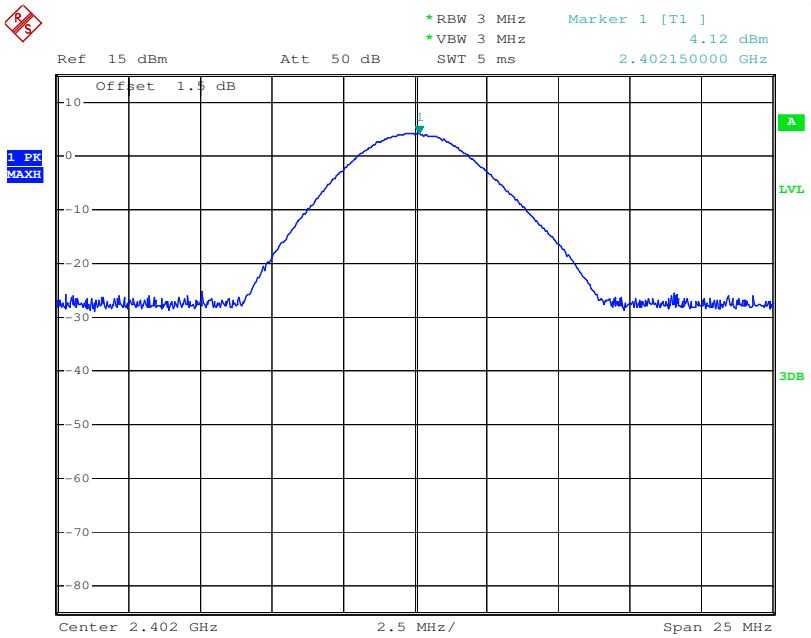

| Test mode: | GFSK | Test channel: | Middle |
|---|---|---|---|



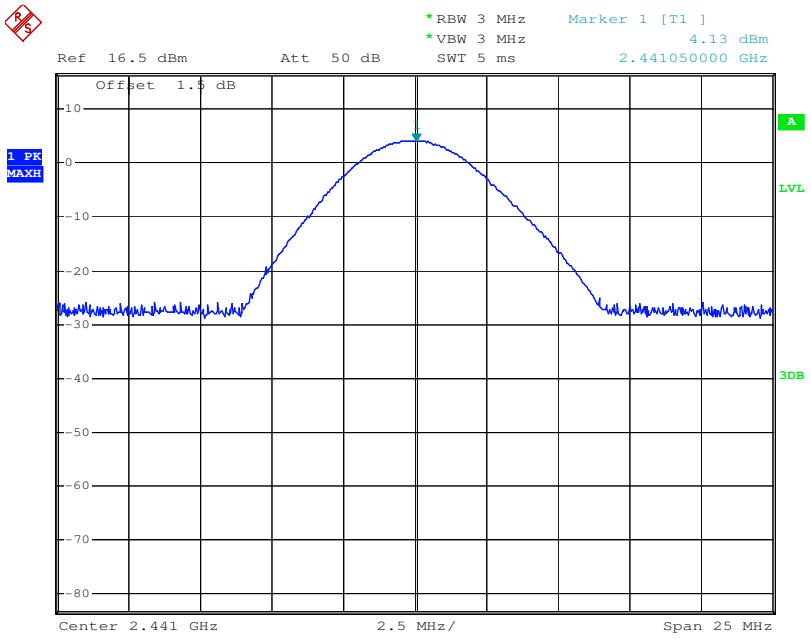
| Test mode: | GFSK | Test channel: | Highest |
|---|---|---|---|



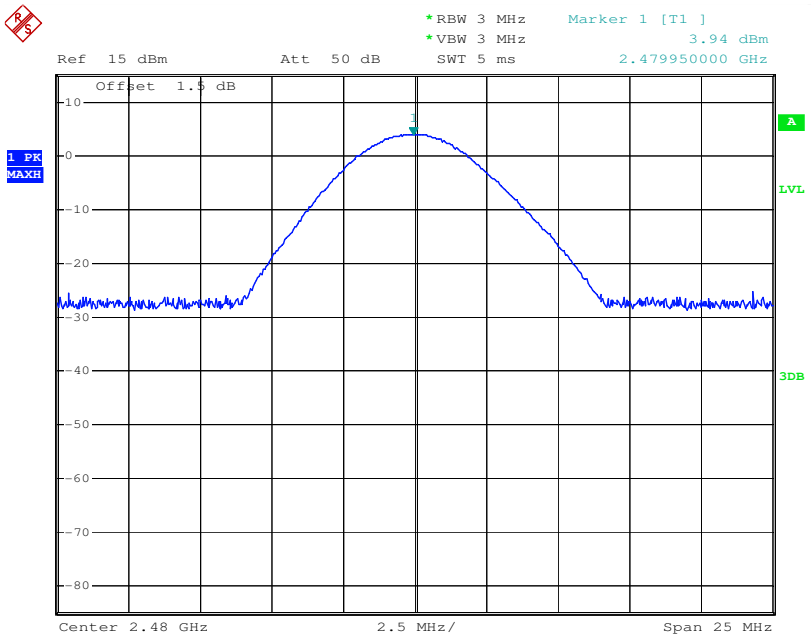

| Test mode: | π/4DQPSK | Test channel: | Lowest |
|---|---|---|---|



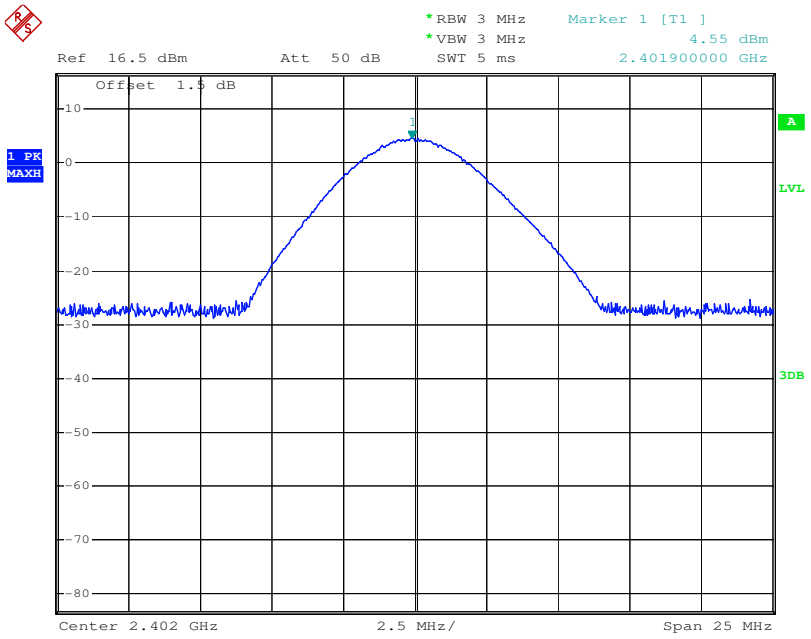
| Test mode: | π/4DQPSK | Test channel: | Middle |
|---|---|---|---|



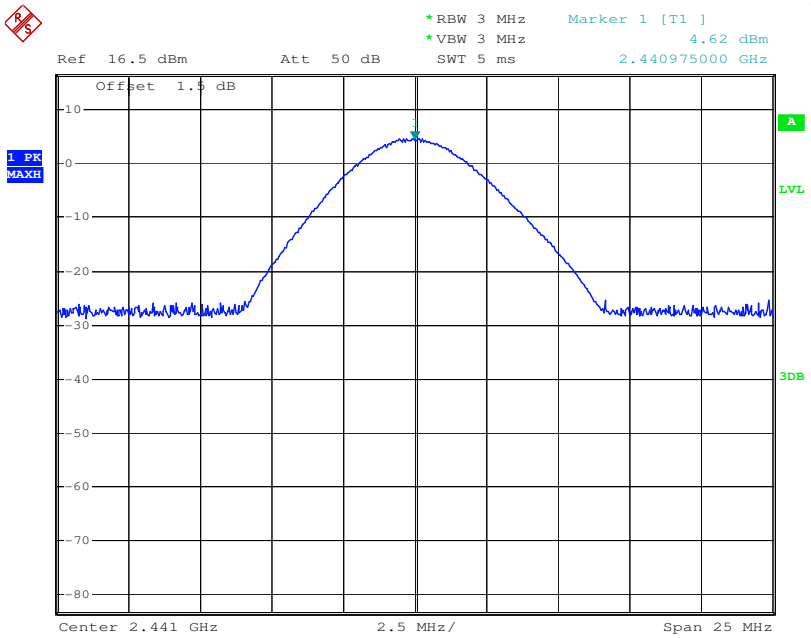

| Test mode: | π/4DQPSK | Test channel: | Highest |
|---|---|---|---|



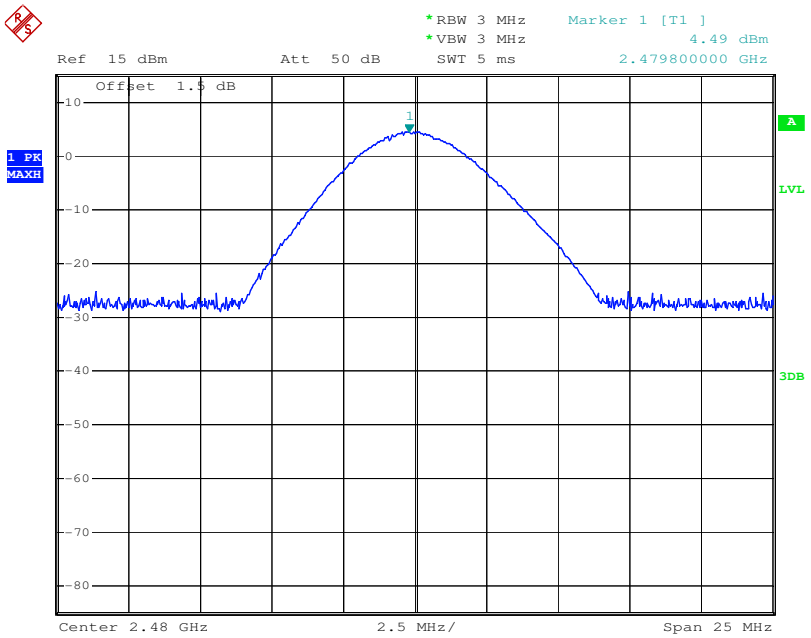
| Test mode: | 8DPSK | Test channel: | Lowest |
|---|---|---|---|



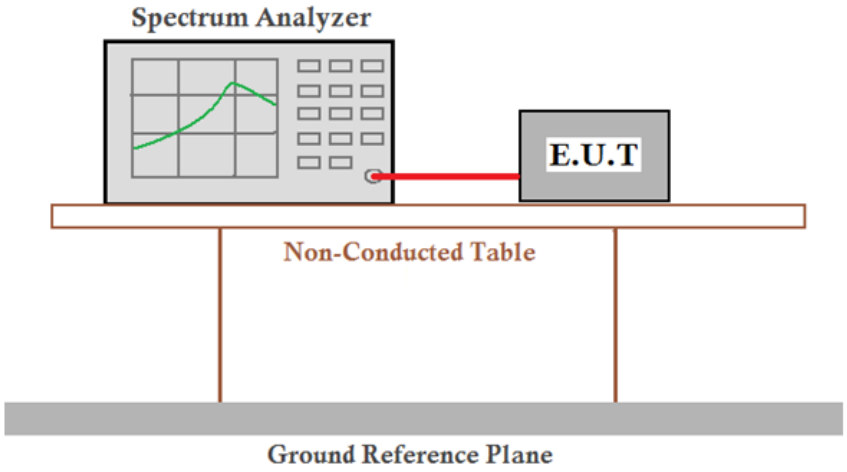

| Test mode: | 8DPSK | Test channel: | Middle |
|---|---|---|---|



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



## 6.3 20dB Occupy Bandwidth

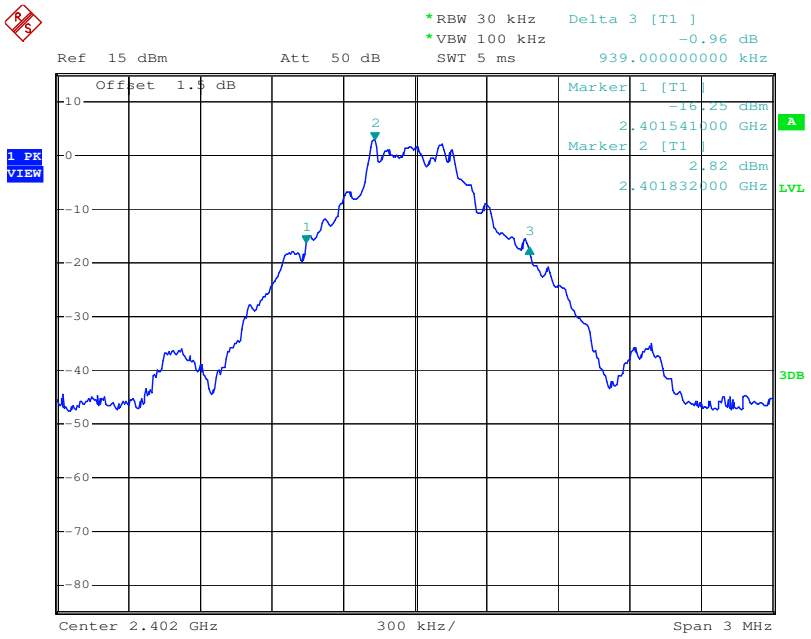
| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  |
| Limit: | NA |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 5.10 for details |
| Test Results: | Pass |

**Measurement Data**

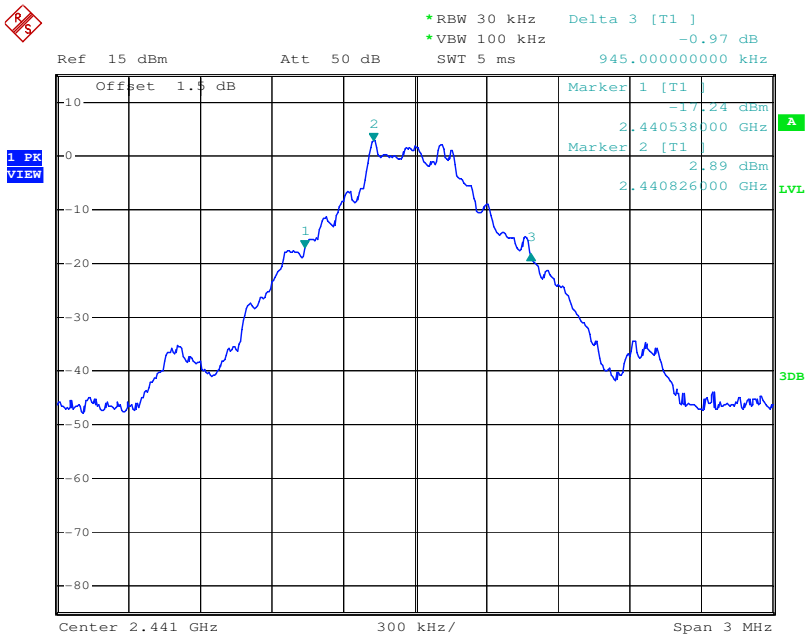
| Test channel | 20dB Occupy Bandwidth (kHz) | | |
|---|---|---|---|
| | GFSK | π/4DQPSK | 8DPSK |
| Lowest | 939 | 1266 | 1272 |
| Middle | 945 | 1266 | 1272 |
| Highest | 948 | 1269 | 1266 |

**Test plot as follows:**

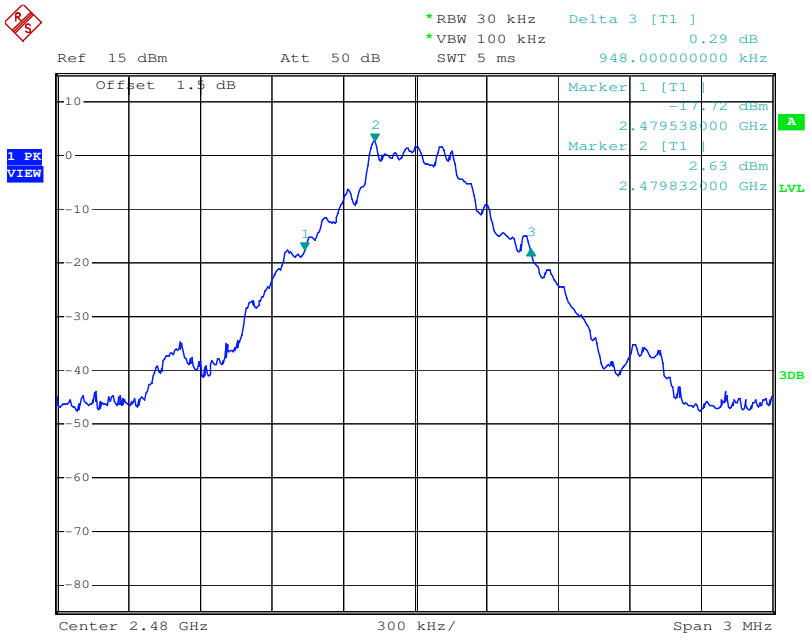
| Test mode: | GFSK | Test channel: | Lowest |
|---|---|---|---|



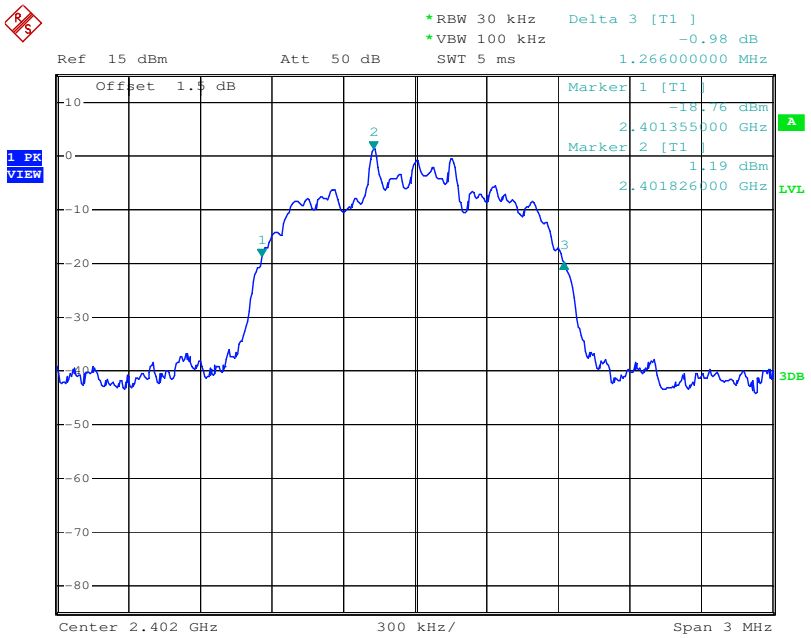

| Test mode: | GFSK | Test channel: | Middle |
|---|---|---|---|



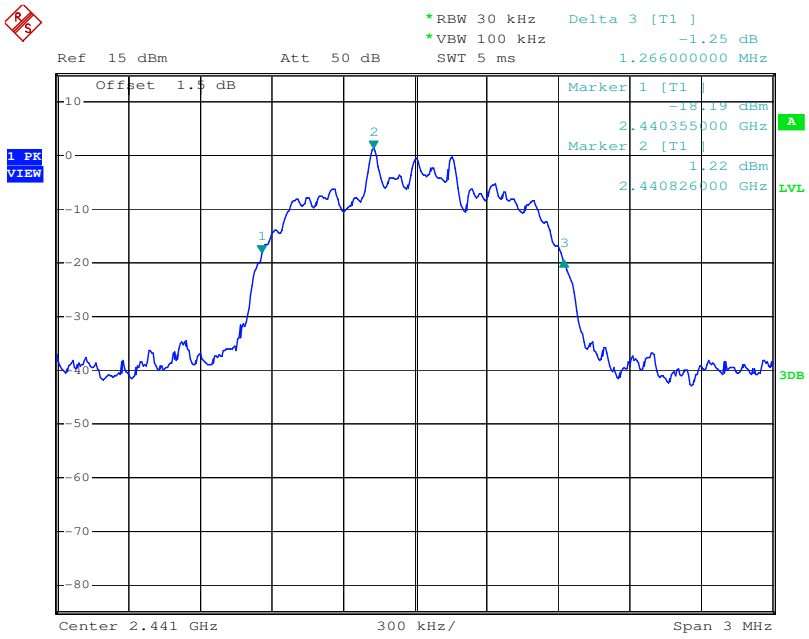
| Test mode: | GFSK | Test channel: | Highest |
|---|---|---|---|



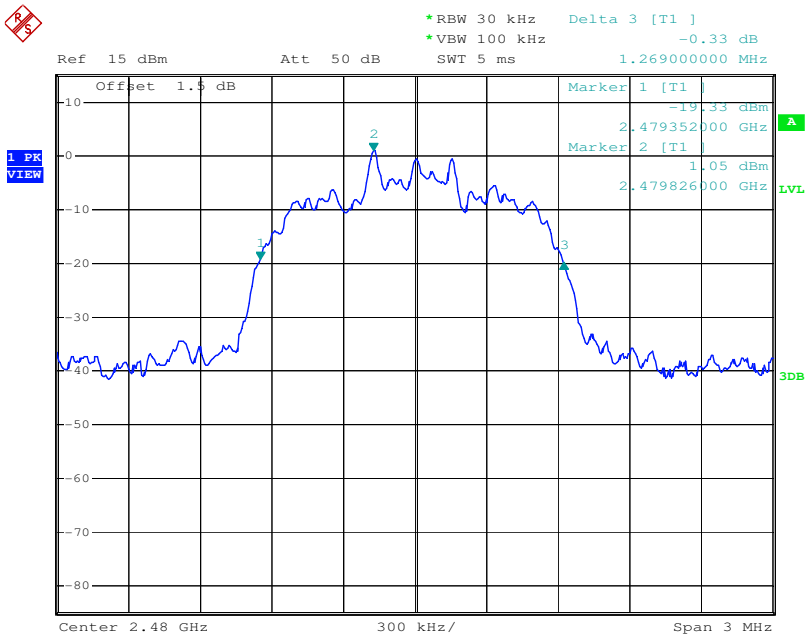

| Test mode: | π/4DQPSK | Test channel: | Lowest |
|---|---|---|---|



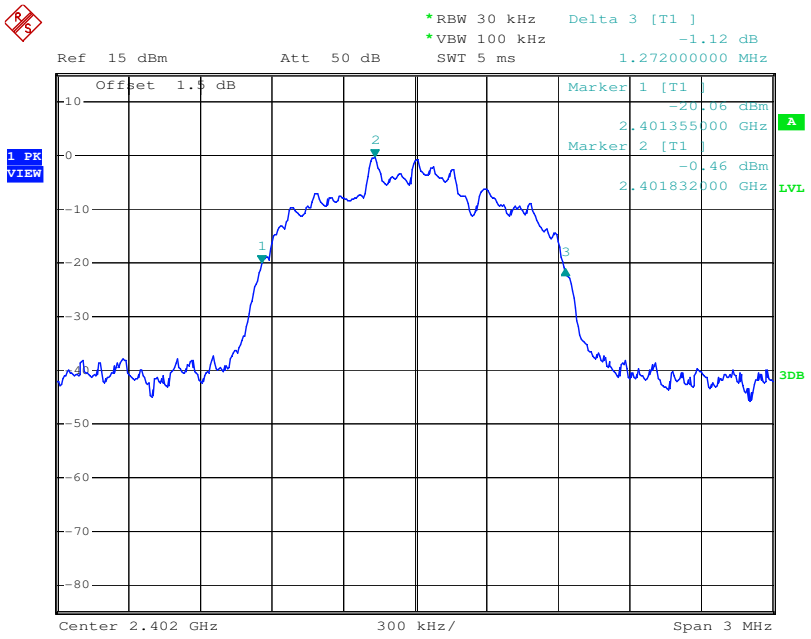
| Test mode: | π/4DQPSK | Test channel: | Middle |
|---|---|---|---|



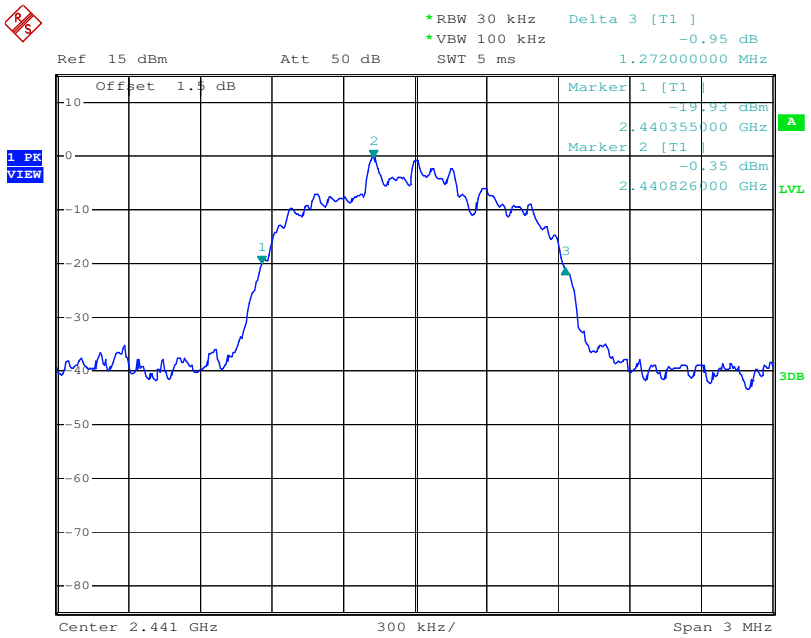

| Test mode: | π/4DQPSK | Test channel: | Highest |
|---|---|---|---|



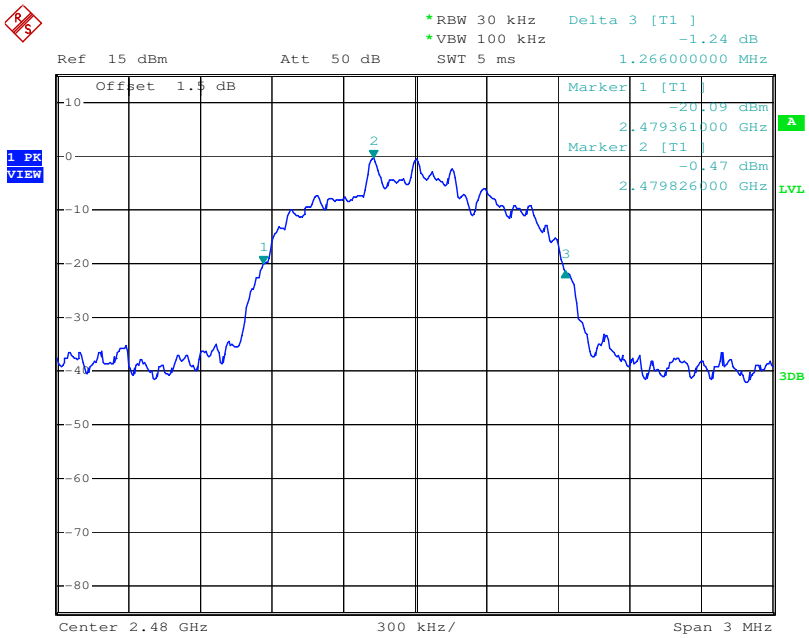
| Test mode: | 8DPSK | Test channel: | Lowest |
|---|---|---|---|



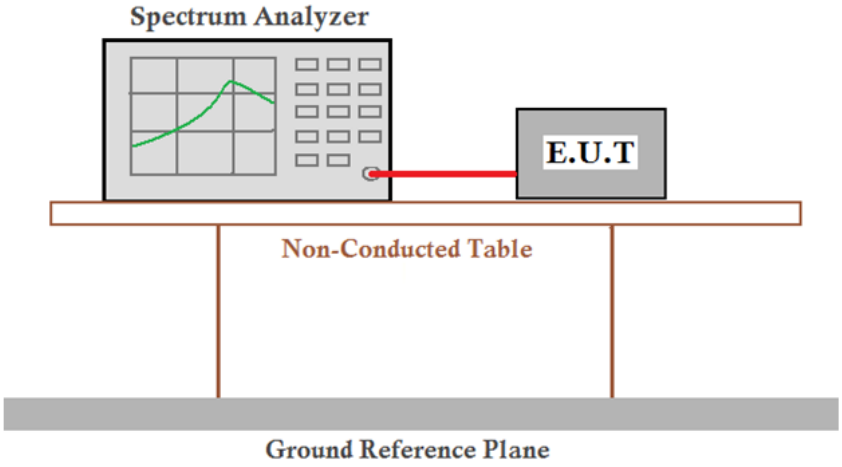

| Test mode: | 8DPSK | Test channel: | Middle |
|---|---|---|---|



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



## 6.4 Carrier Frequencies Separation

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  |
| Limit: | 2/3 of the 20dB bandwidth |
| | Remark: the transmission power is less than 0.125W. |
| 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 worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 5.10 for details |
| Test Results: | Pass |

**Measurement Data**

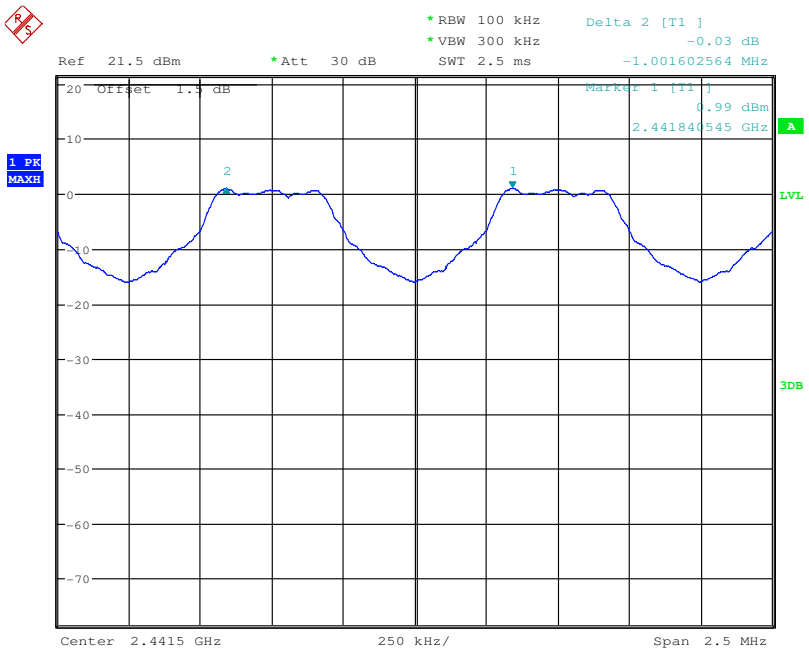
| GFSK mode | | | |
|---|---|---|---|
| Test channel | Carrier Frequencies Separation (kHz) | Limit (kHz) | Result |
| Middle | 1.002 | ≥632 | Pass |
| π/4DQPSK mode | | | |
| Test channel | Carrier Frequencies Separation (kHz) | Limit (kHz) | Result |
| Middle | 1.002 | ≥846 | Pass |
| 8DPSK mode | | | |
| Test channel | Carrier Frequencies Separation (kHz) | Limit (kHz) | Result |
| Middle | 1.002 | ≥844 | Pass |

Note: According to section 6.4,

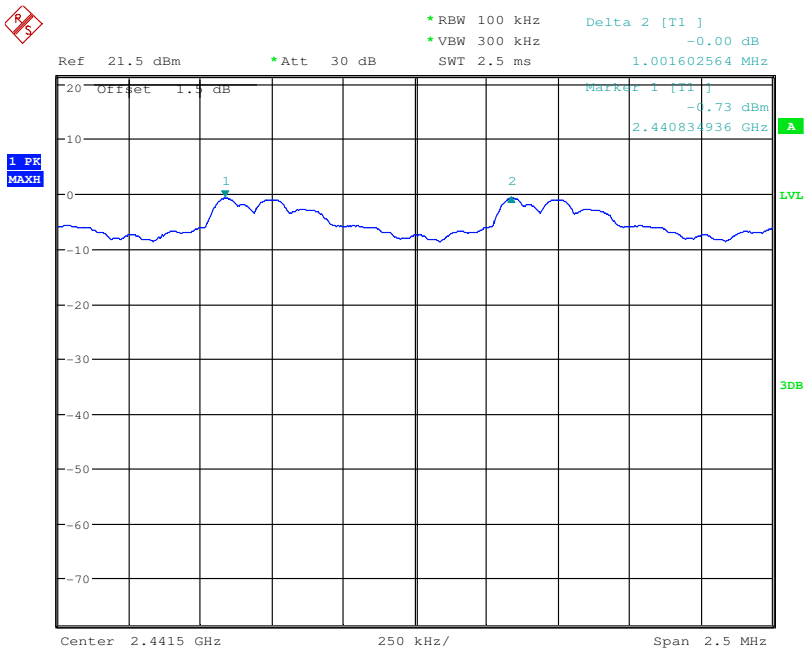
| Mode | 20dB bandwidth (kHz) (worse case) | Limit (kHz) (Carrier Frequencies Separation) |
|---|---|---|
| GFSK | 948 | 632 |
| π/4DQPSK | 1269 | 846 |
| 8DPSK | 1266 | 844 |

**Test plot as follows:**

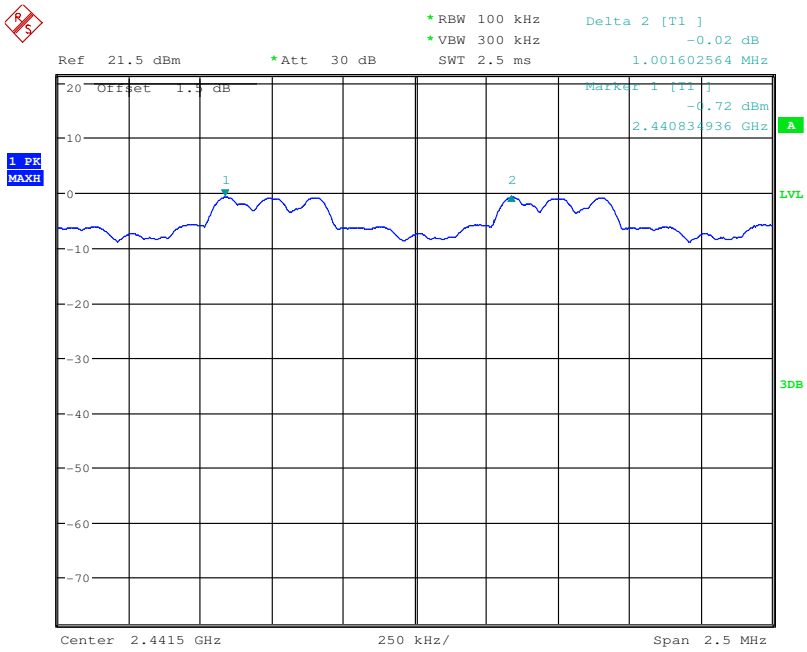
| Test mode: | GFSK | Test channel: | Middle |
|---|---|---|---|



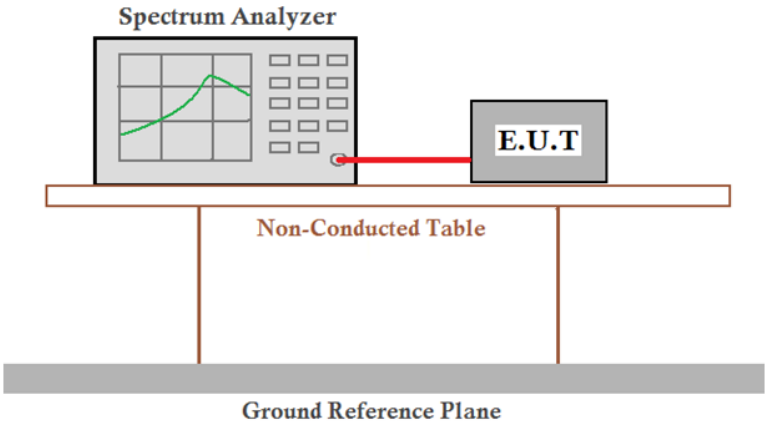

| Test mode: | π/4DQPSK | Test channel: | Middle |
|---|---|---|---|



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



## 6.5 Hopping Channel Number

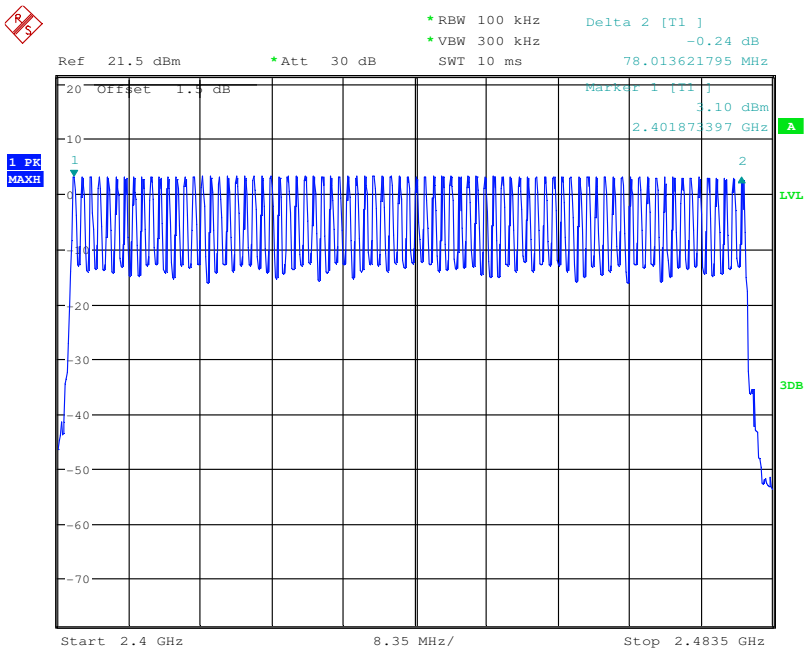
| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  |
| Limit: | At least 15 channels |
| Test Mode: | Hopping transmitting with all kind of modulation |
| Instruments Used: | Refer to section 5.10 for details |
| Test Results: | Pass |

**Measurement Data**

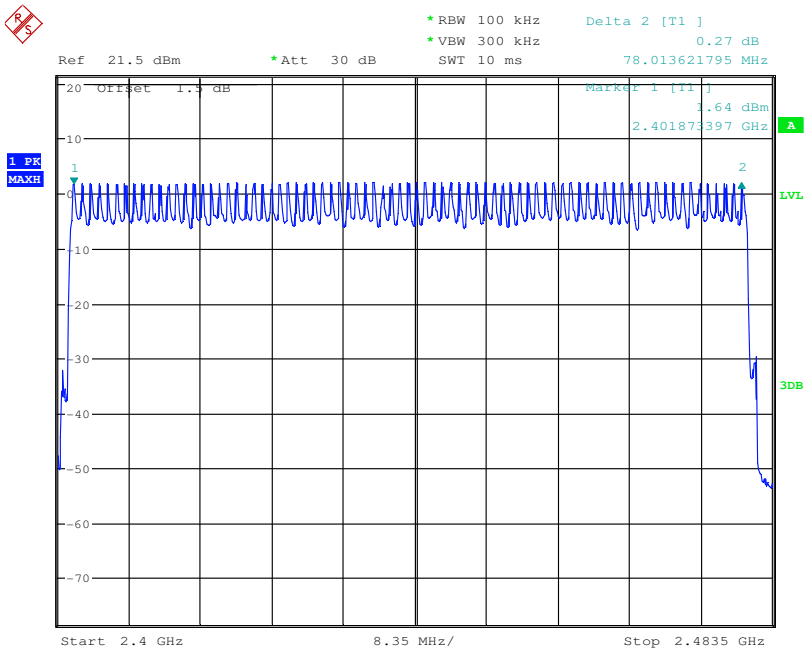
| Mode | Hopping channel numbers | Limit |
|---|---|---|
| GFSK | 79 | ≥15 |
| π/4DQPSK | 79 | ≥15 |
| 8DPSK | 79 | ≥15 |

**Test plot as follows:**

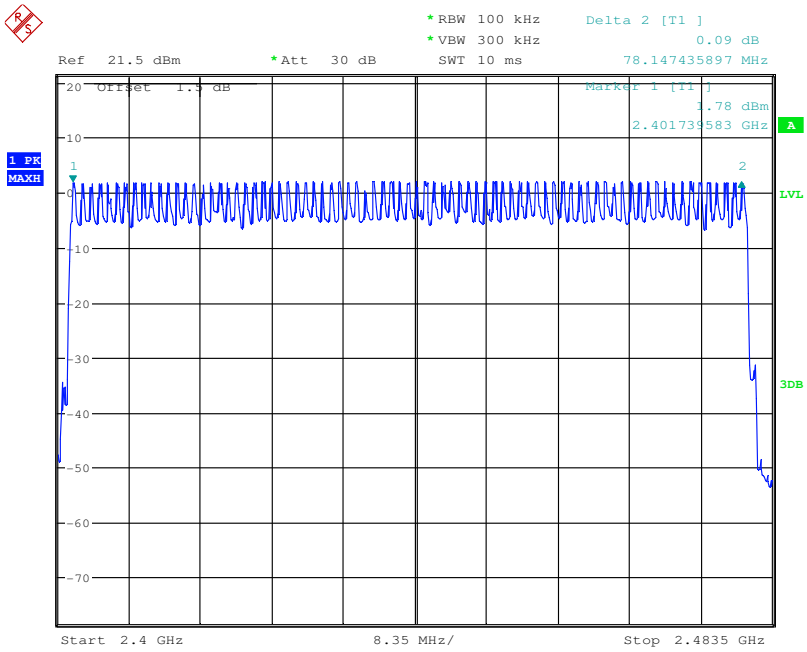
| Test mode: | GFSK |
|---|---|



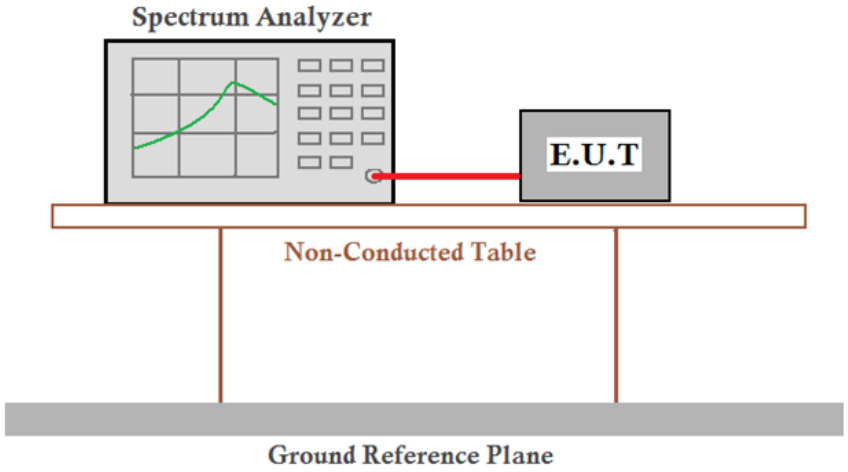

| Test mode: | π/4DQPSK |
|---|---|



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



## 6.6 Dwell Time

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  |
| Instruments Used: | Refer to section 5.10 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 | 0.119 | 0.4 |
| | DH3 | 0.216 | 0.4 |
| | DH5 | 0.232 | 0.4 |
| π/4DQPSK | 2-DH1 | 0.123 | 0.4 |
| | 2-DH3 | 0.249 | 0.4 |
| | 2-DH5 | 0.320 | 0.4 |
| 8DPSK | 3-DH1 | 0.122 | 0.4 |
| | 3-DH3 | 0.249 | 0.4 |
| | 3-DH5 | 0.146 | 0.4 |

**Remark:**

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

On (ms)*total number=dwell time (ms)

The middlet channel (2441MHz), as below:

DH1 time slot=0.397 (ms)*total number=119.1 (ms)

DH3 time slot=1.663 (ms)* total number = 216.19 (ms)

DH5 time slot=2.901 (ms)* total number = 232.08 (ms)

2-DH1 time slot=0.409 (ms)*total number=122.7 (ms)

2-DH3 time slot=1.659 (ms)* total number = 248.85 (ms)

2-DH5 time slot=2.909 (ms)* total number = 319.99 (ms)

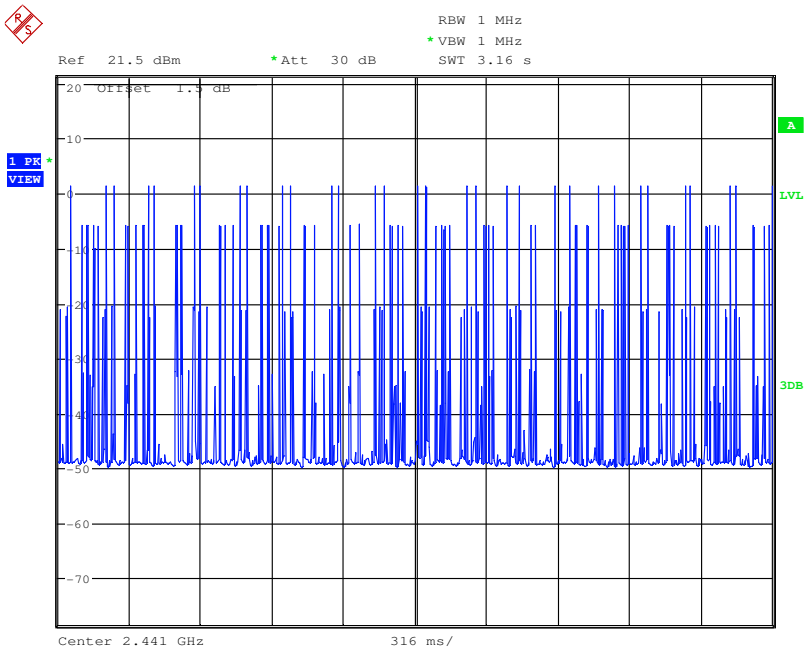
3-DH1 time slot=0.405 (ms)*total number= 121.5(ms)

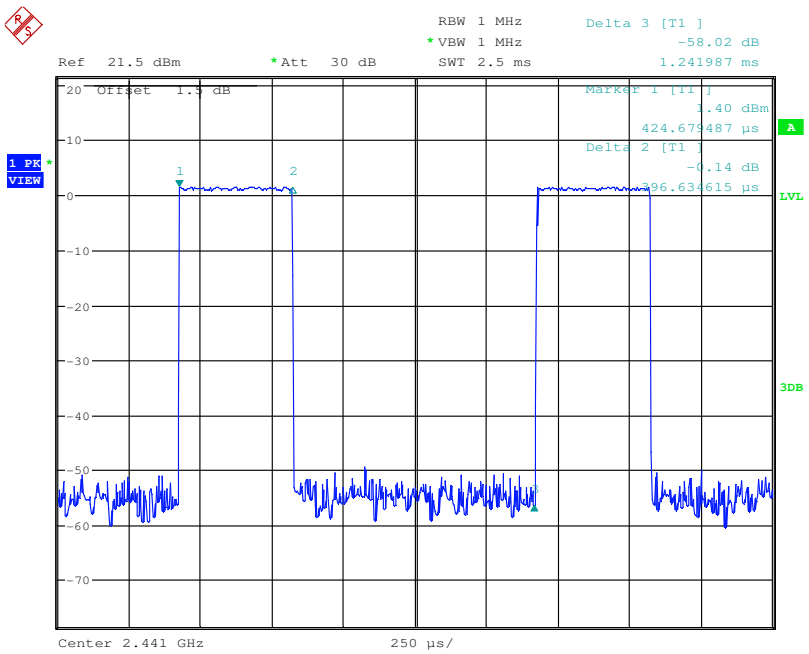
3-DH3 time slot=1.663(ms)* total number = 249.45 (ms)

3-DH5 time slot=2.925(ms)* total number = 146.25 (ms)

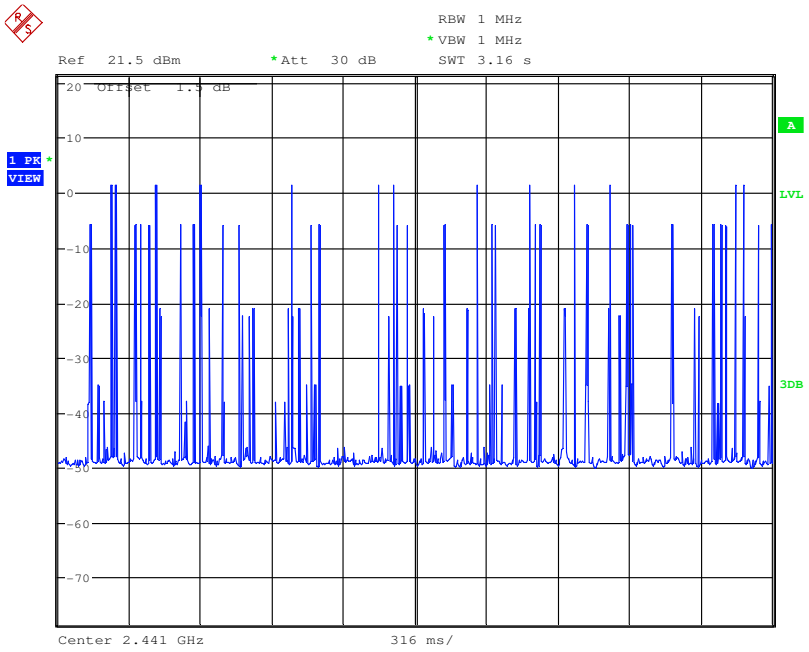
**Test plot as follows:**

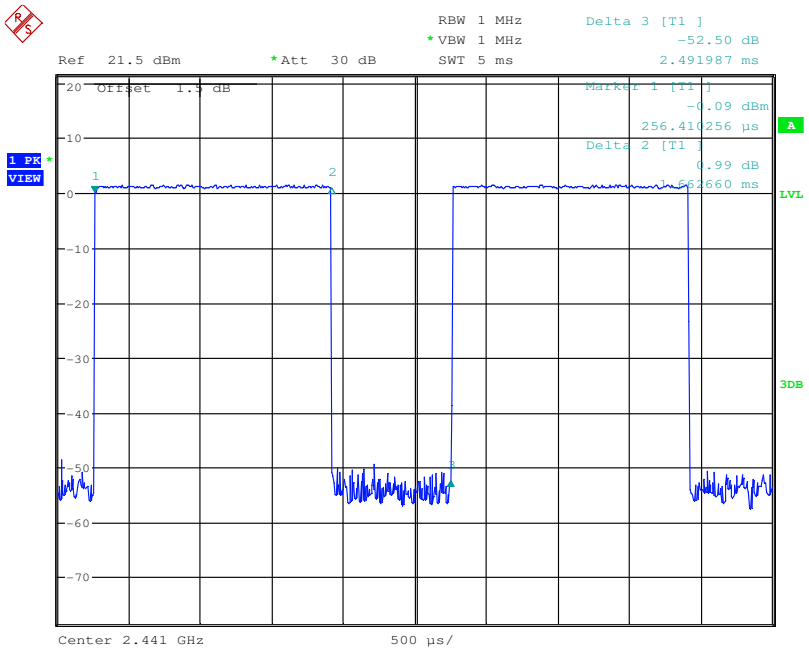
| Test Packet: | DH1 |
|---|---|



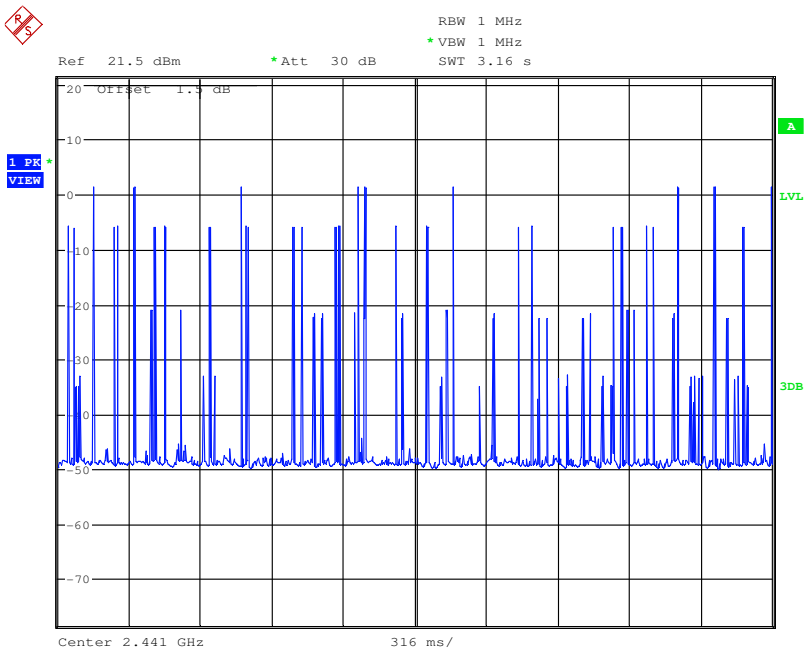



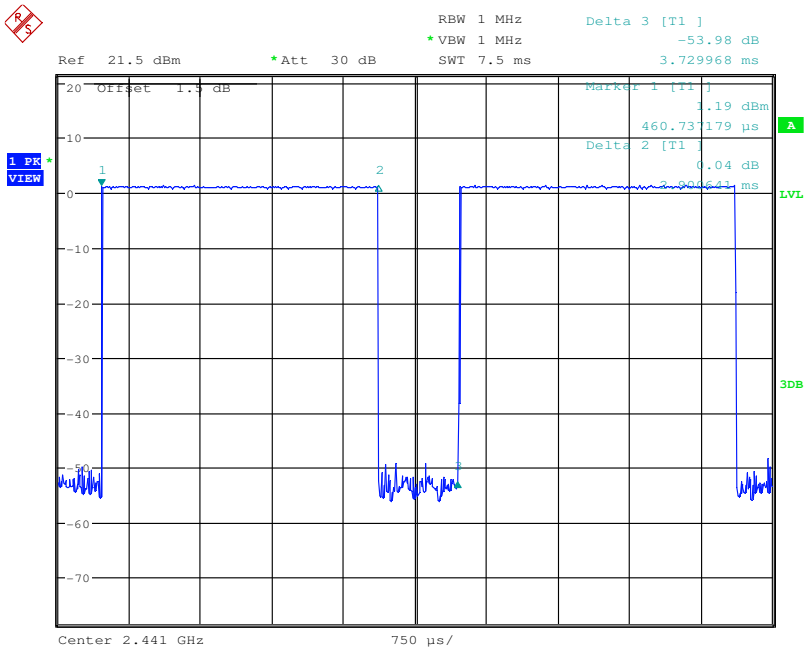
| Test Packet: | DH3 |
|---|---|



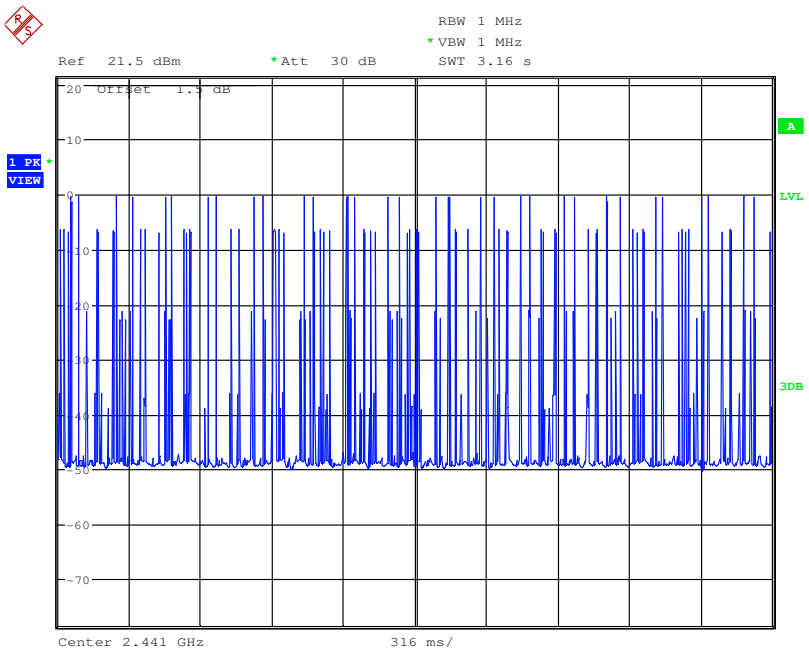



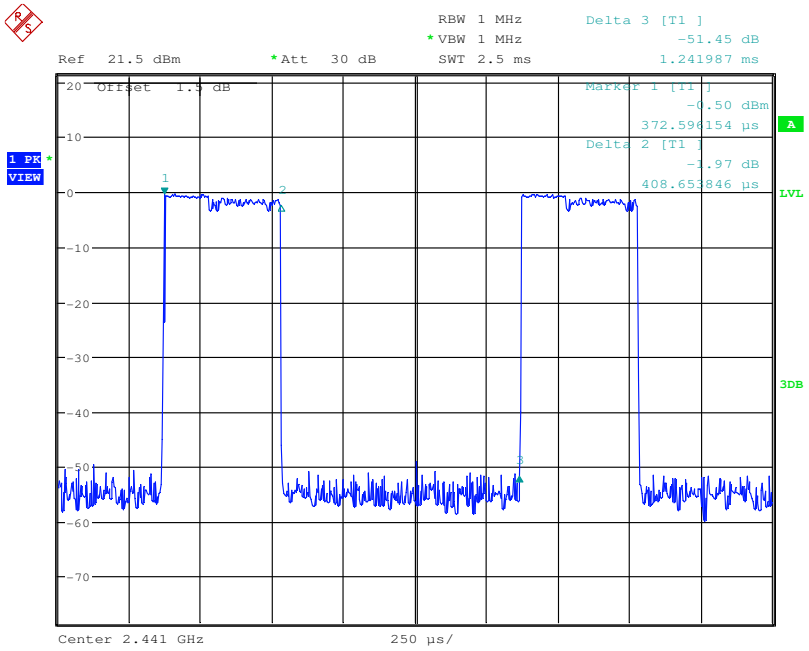
| Test Packet: | DH5 |
|---|---|



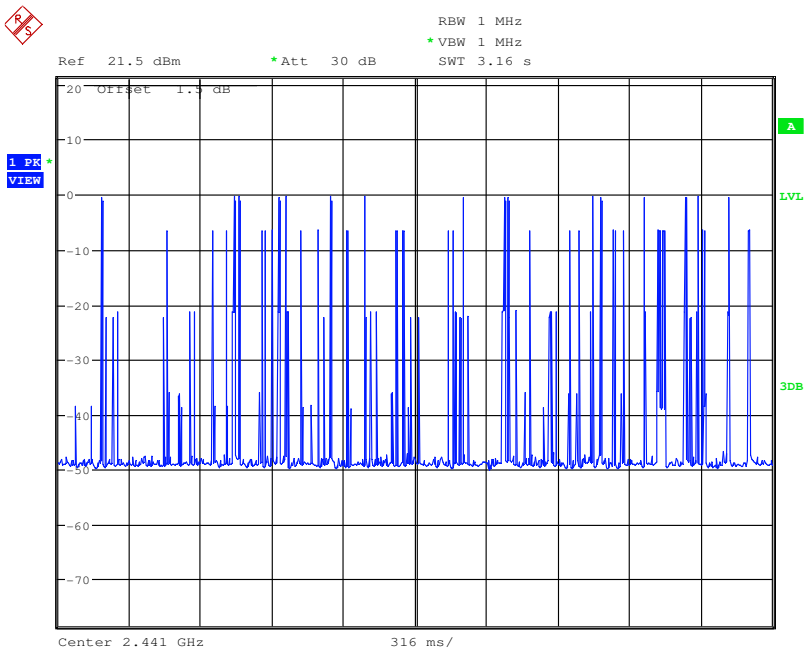



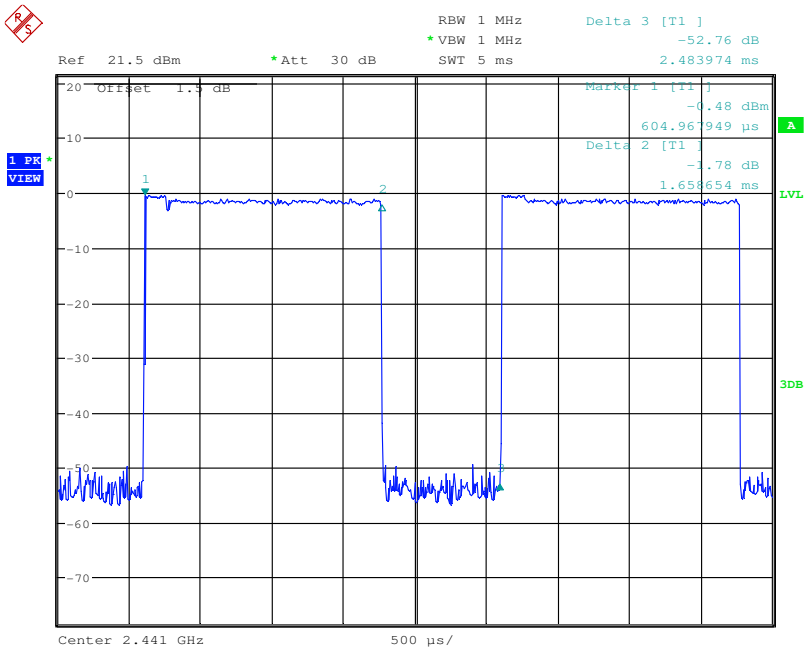
| Test Packet: | 2-DH1 |
|---|---|



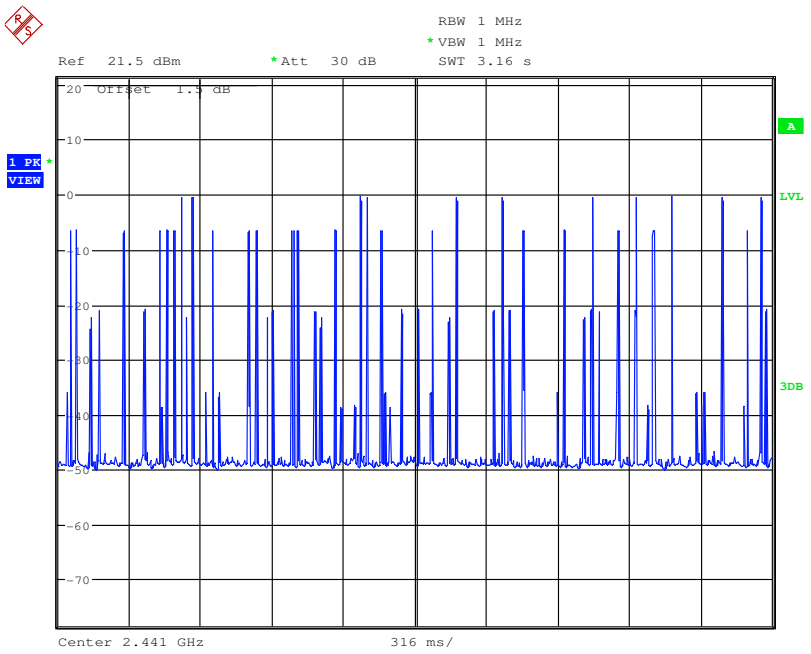



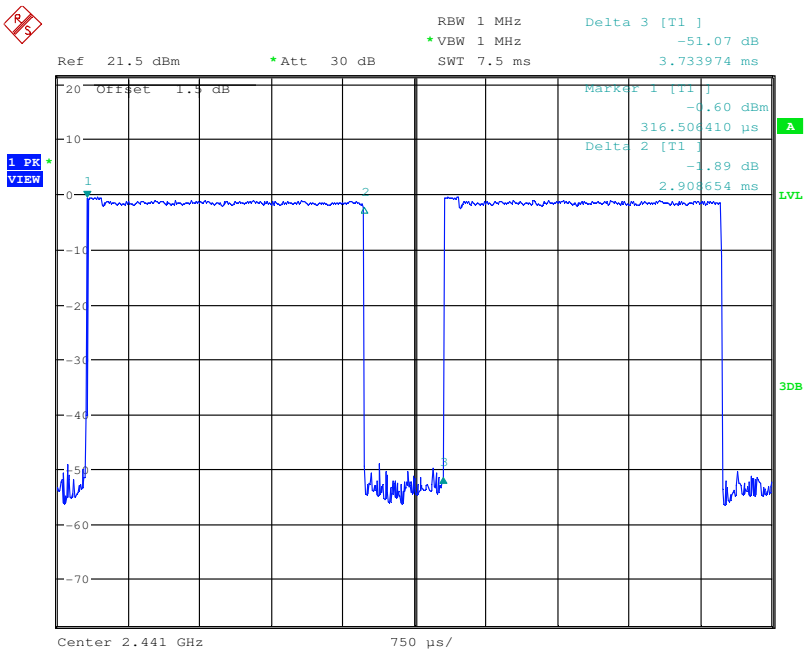
| Test Packet: | 2-DH3 |
|---|---|



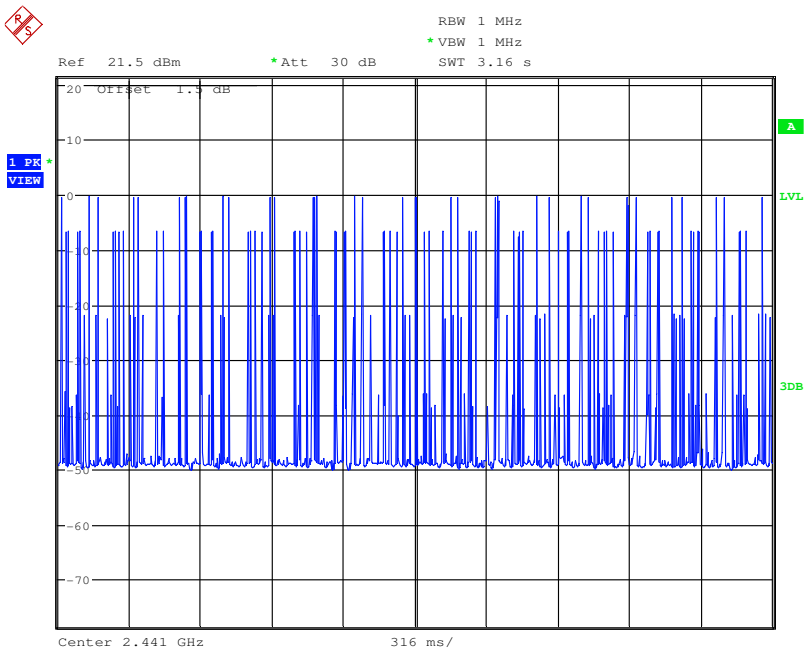



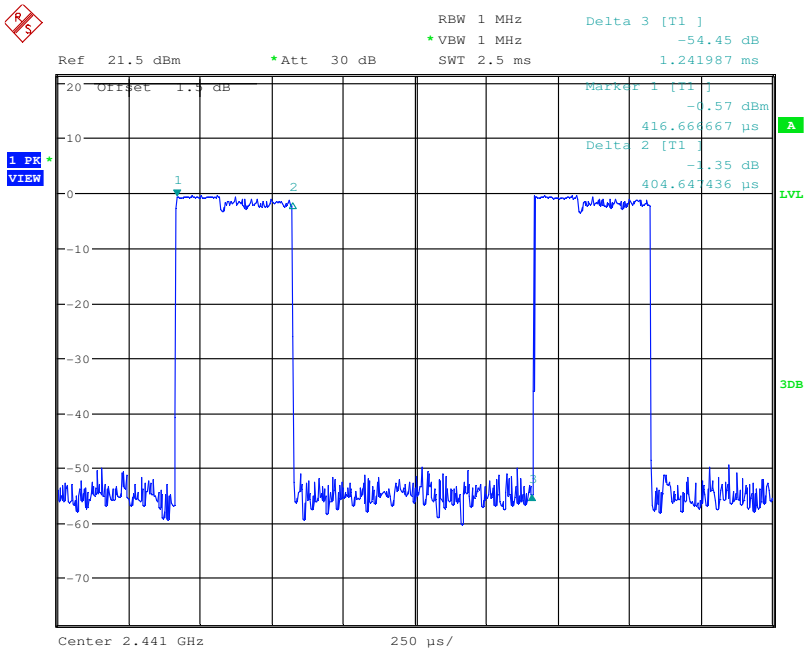
| Test Packet: | 2-DH5 |
|---|---|



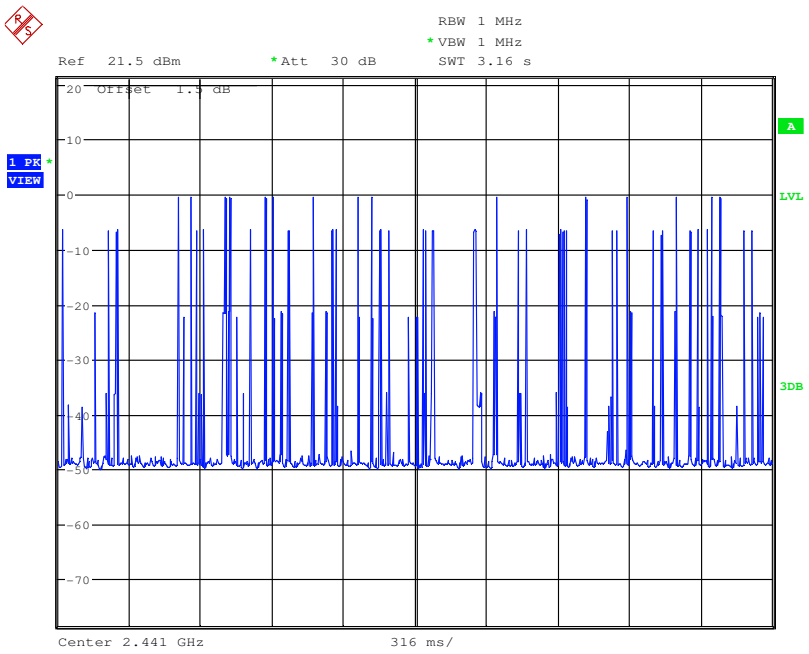



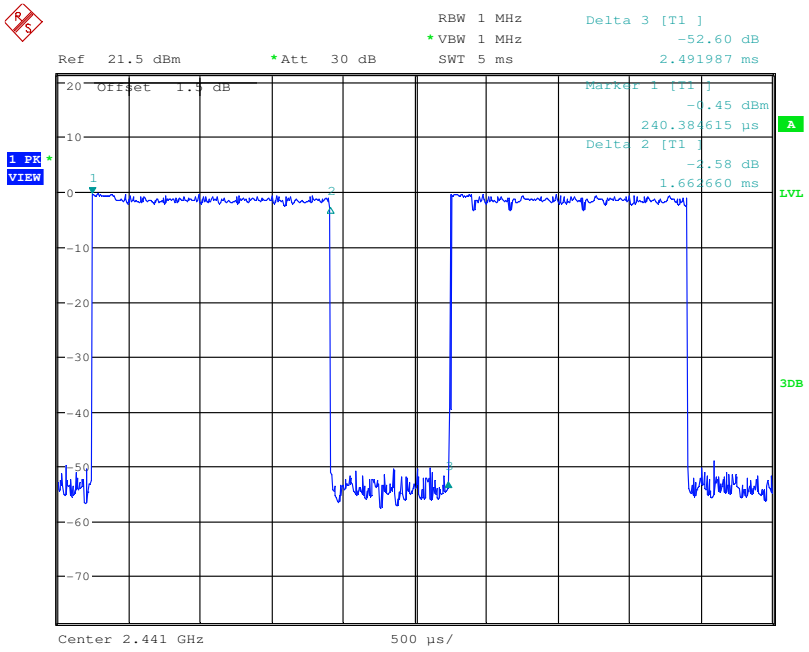
| Test Packet: | 3-DH1 |
|---|---|



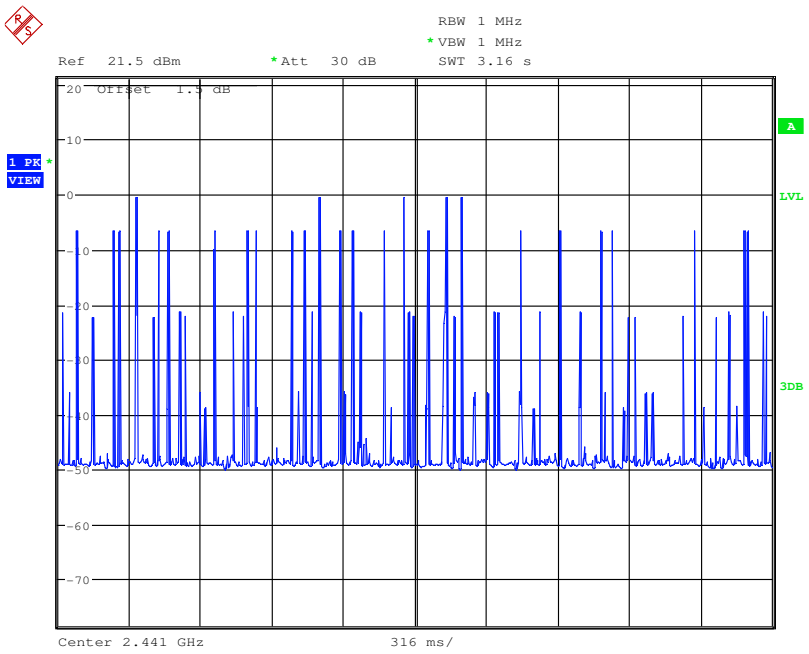



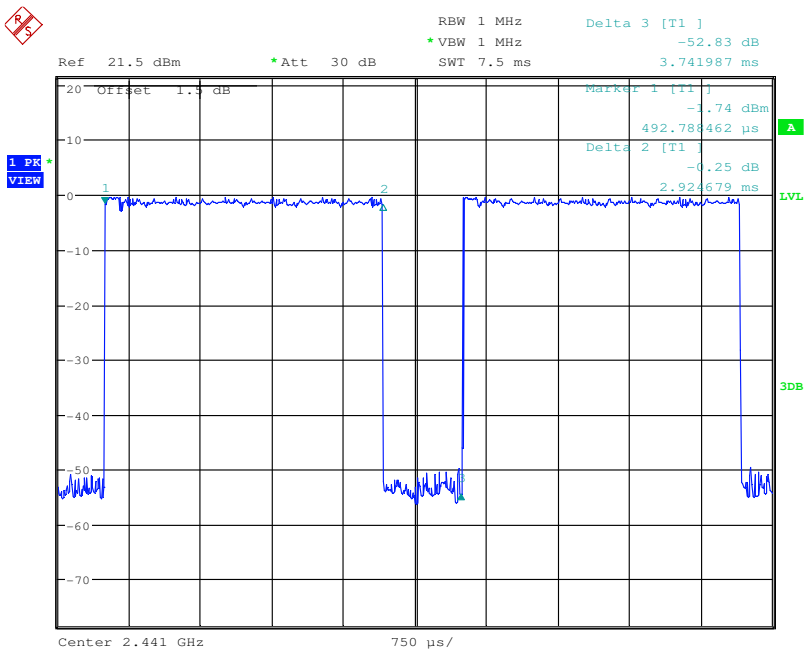
| Test Packet: | 3-DH3 |
|---|---|



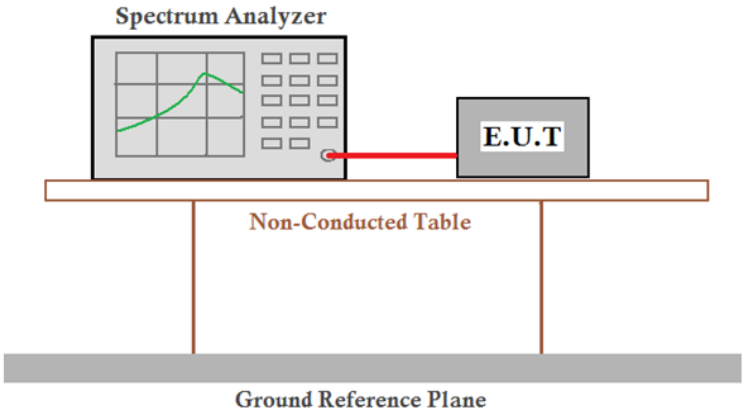



| Test Packet: | 3-DH5 |
|---|---|



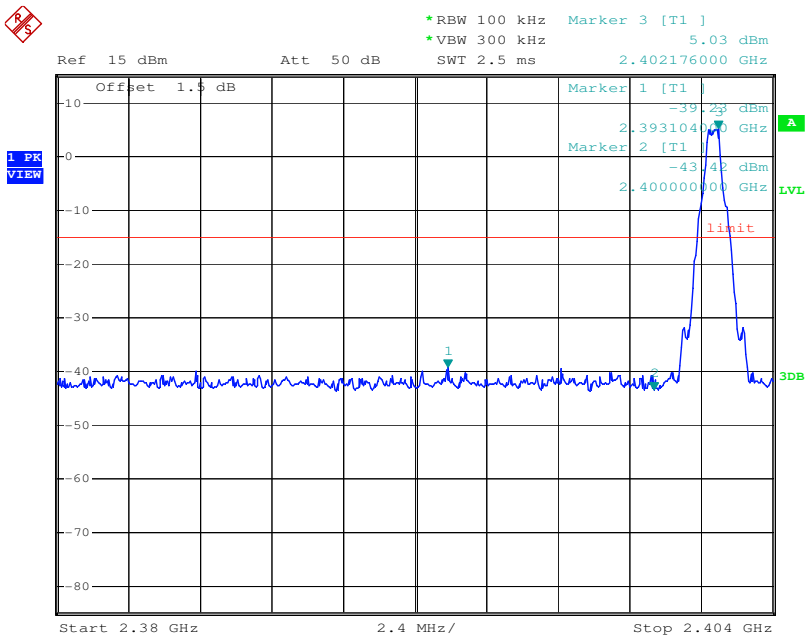



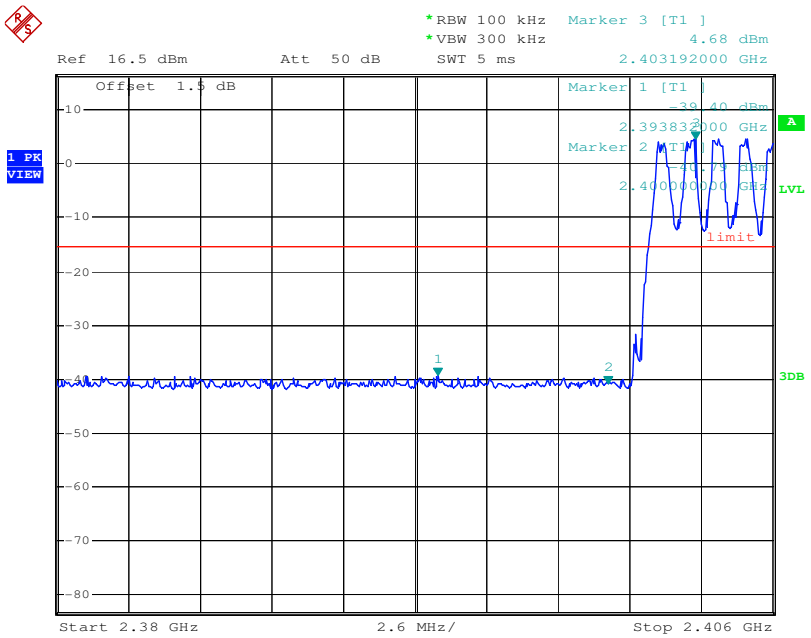
## 6.7 Band-edge for RF Conducted Emissions

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (d) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark:<br>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. |
| Exploratory Test Mode: | Hopping and 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 worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 5.10 for details |
| Test Results: | Pass |

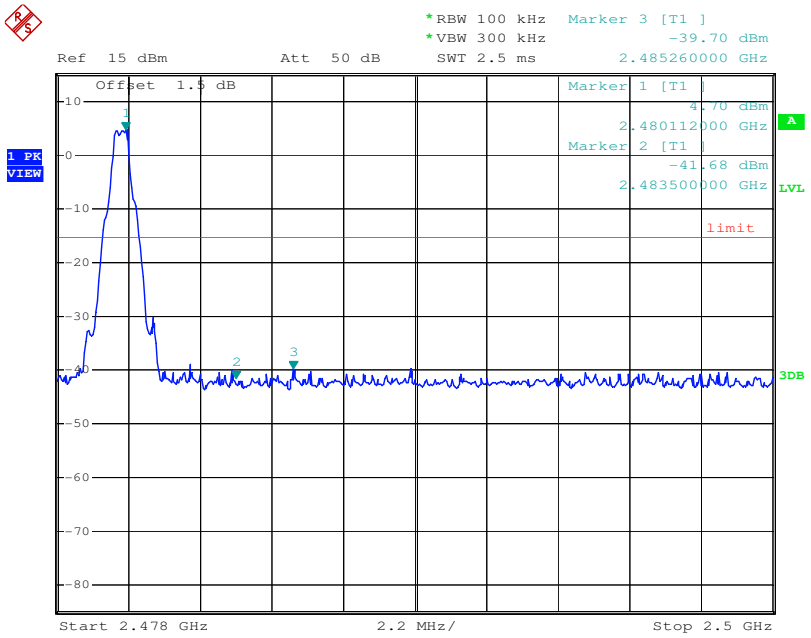
**Test plot as follows:**

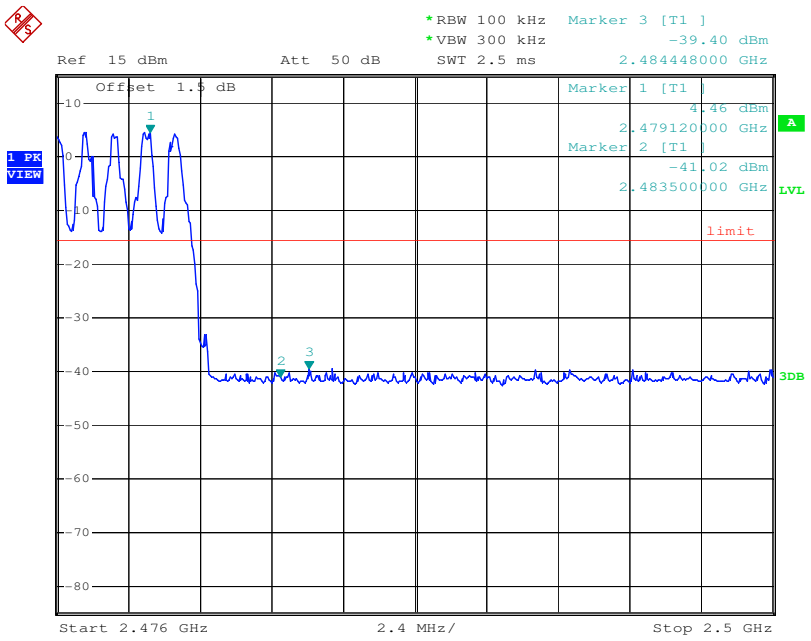
| Test mode: | GFSK | Test channel: | Lowest |
|---|---|---|---|



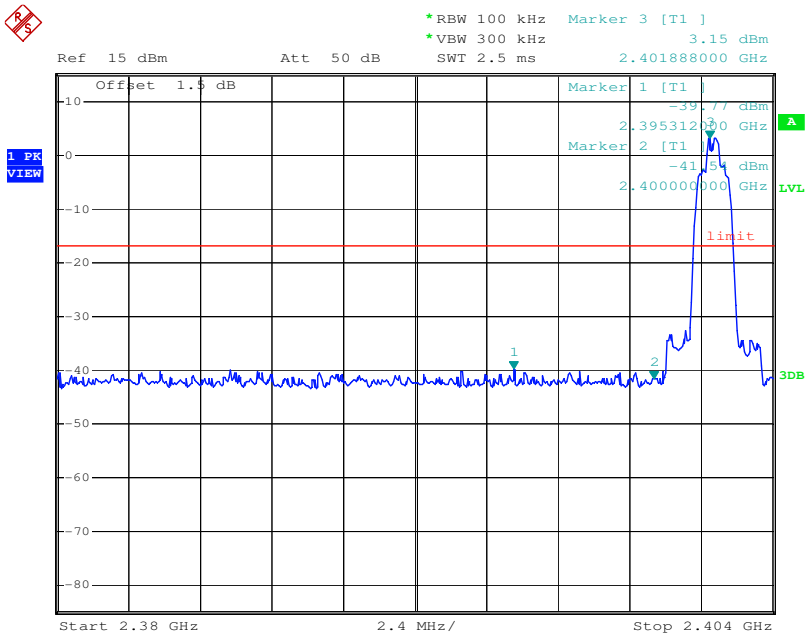



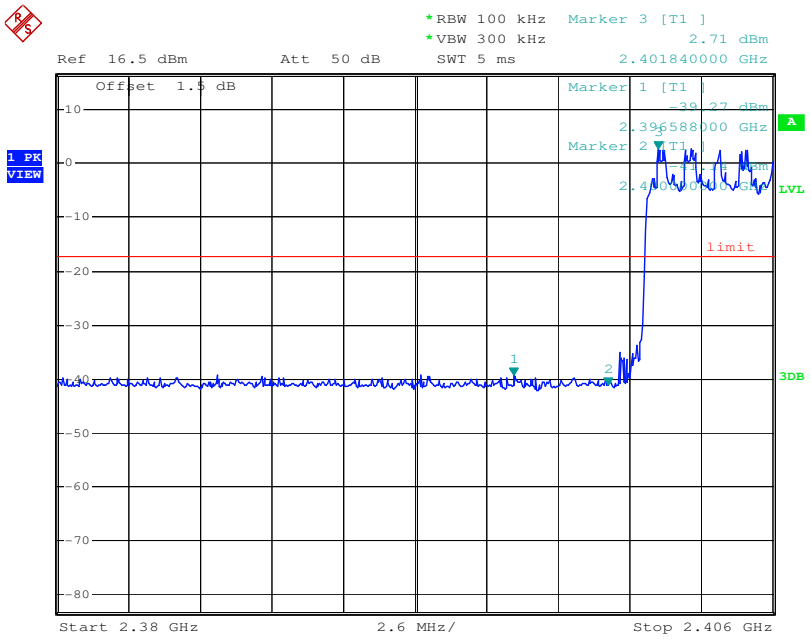
| Test mode: | GFSK | Test channel: | Highest |
|---|---|---|---|



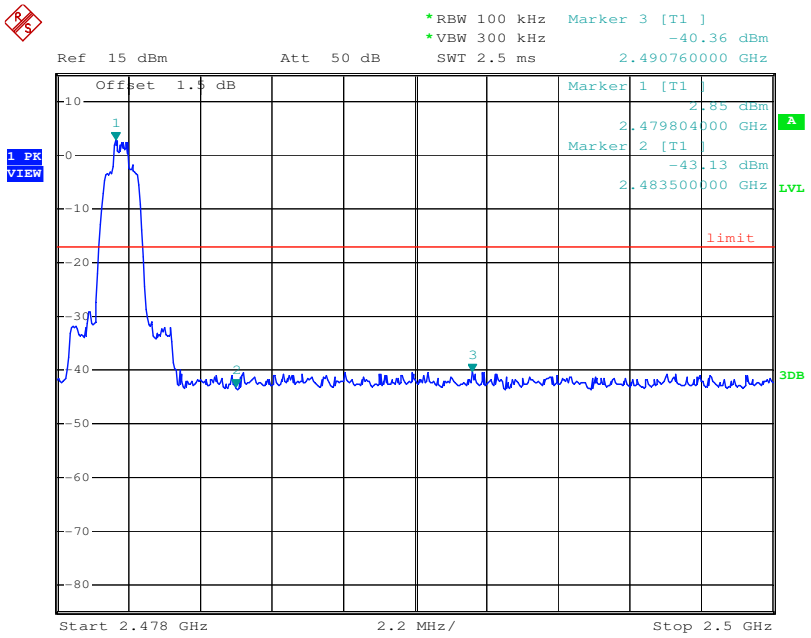



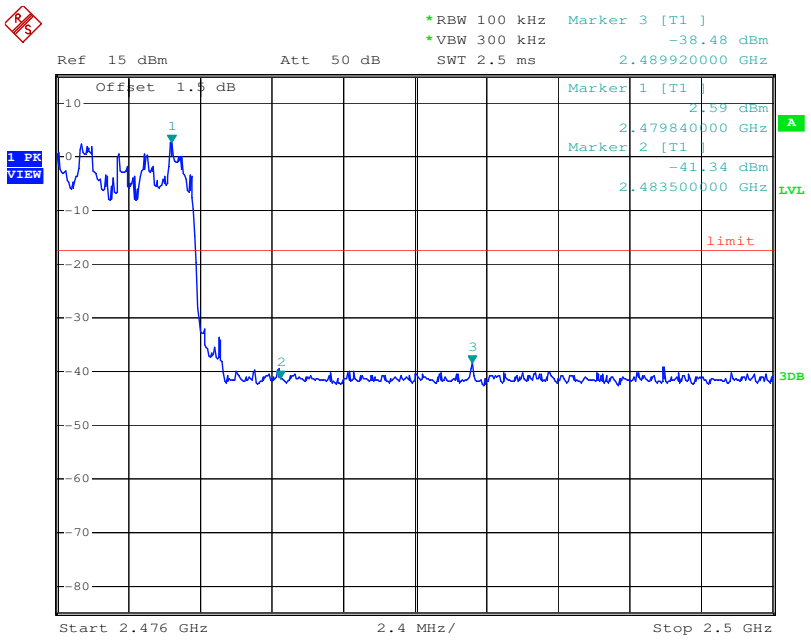
| Test mode: | π/4DQPSK | Test channel: | Lowest |
|---|---|---|---|



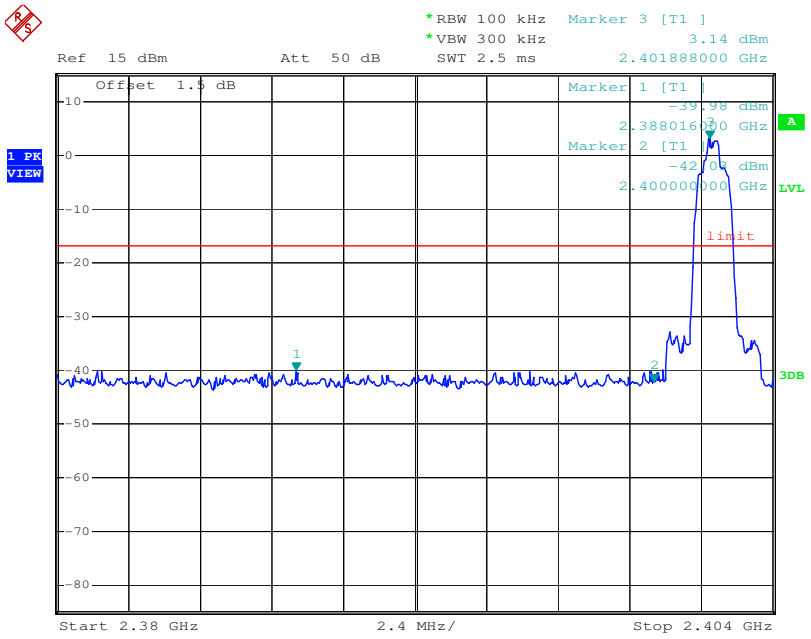



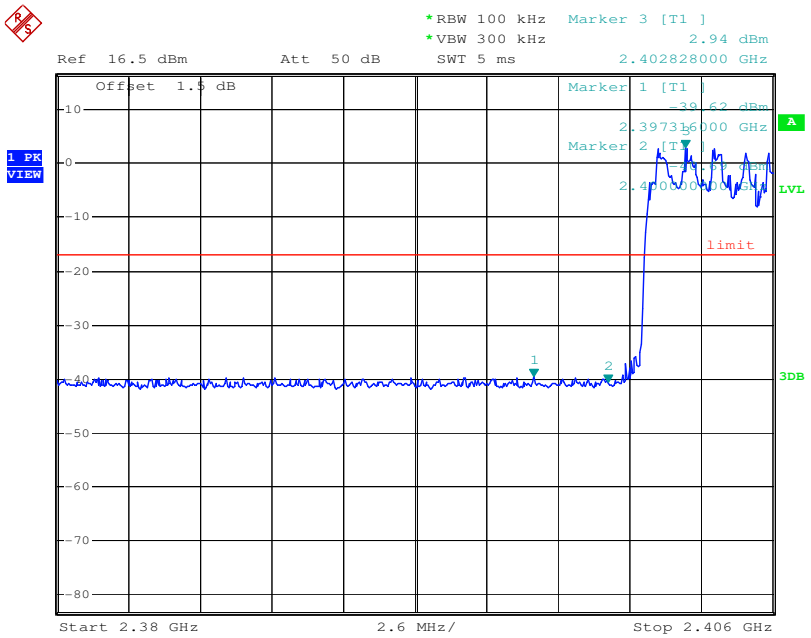
| Test mode: | π/4DQPSK | Test channel: | Highest |
|---|---|---|---|



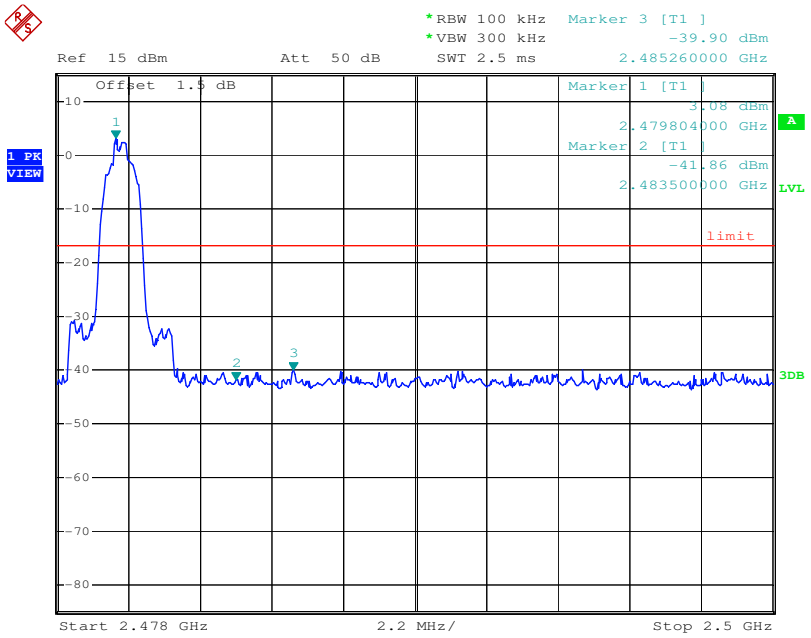



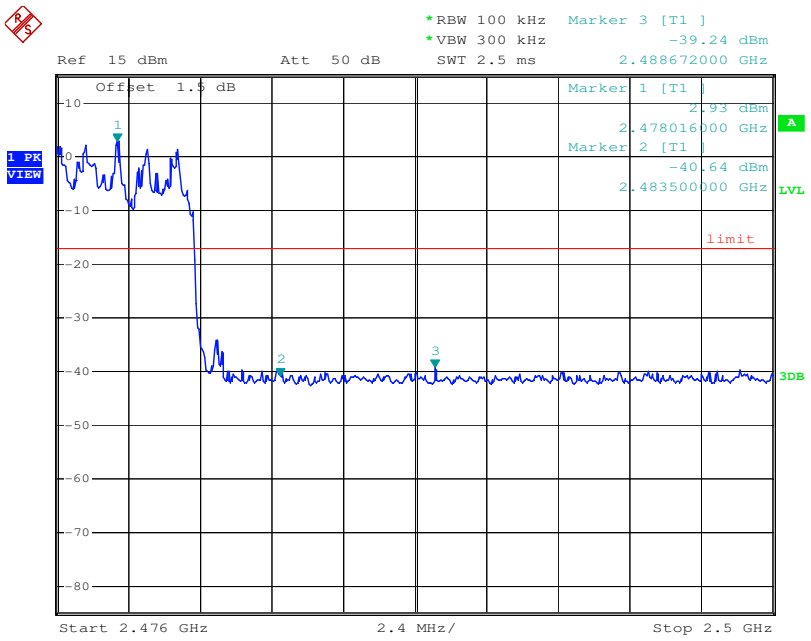
| Test mode: | 8DPSK | Test channel: | Lowest |
|---|---|---|---|



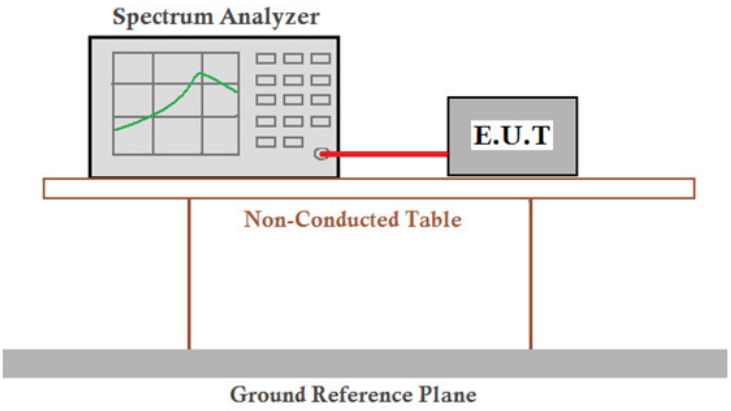



| Test mode: | 8DPSK | Test channel: | Highest |
|---|---|---|---|

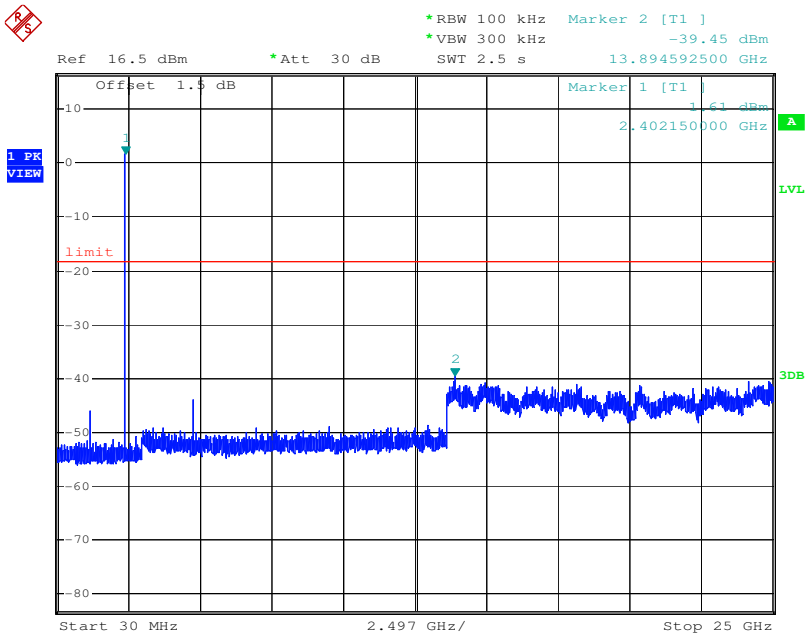


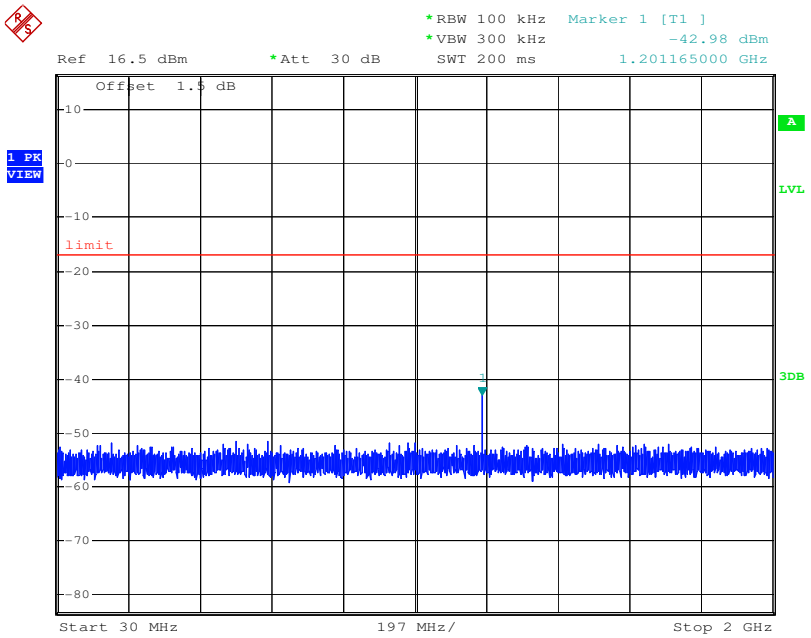



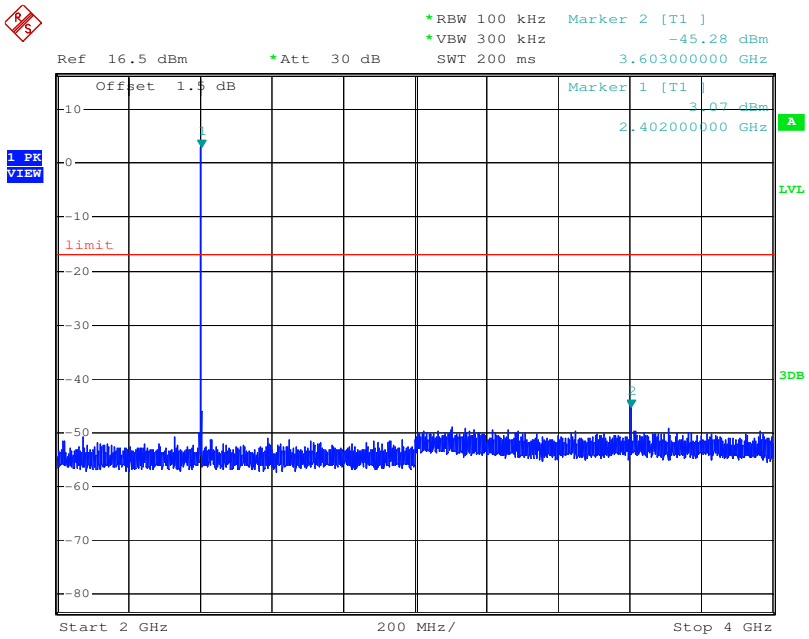
## 6.8 Spurious RF Conducted Emissions

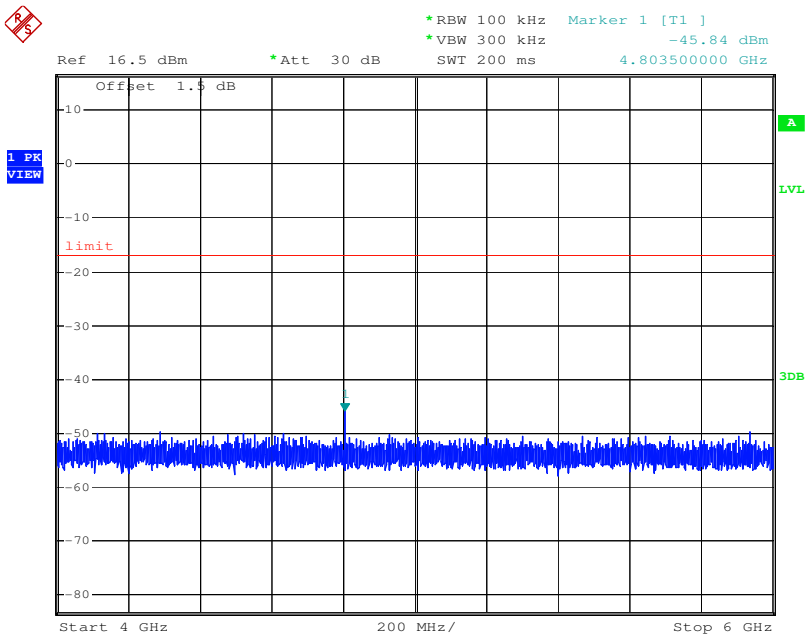
| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (d) |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <br>Remark:<br>Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer. |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. |
| 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 worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type. |
| Instruments Used: | Refer to section 5.10 for details |
| Test Results: | Pass |

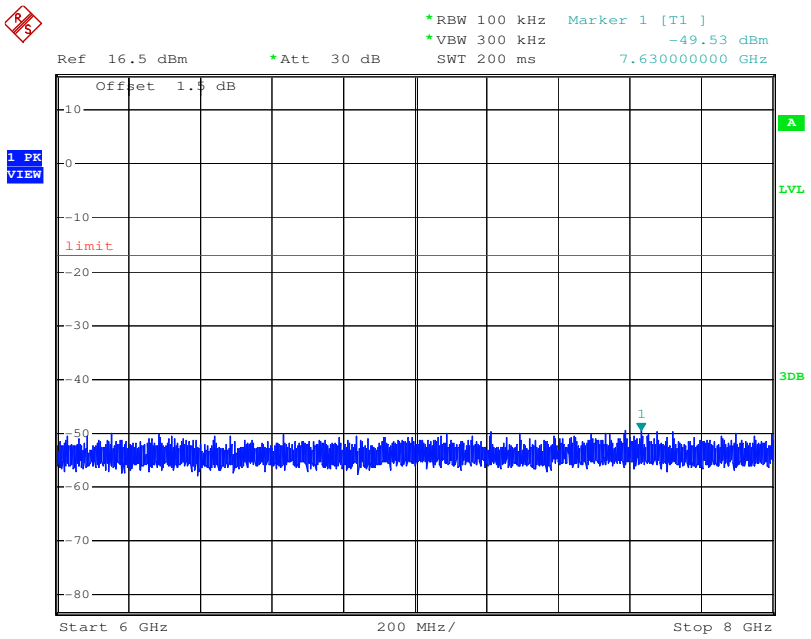
| Test mode: | GFSK | Test channel: | Lowest |
|---|---|---|---|

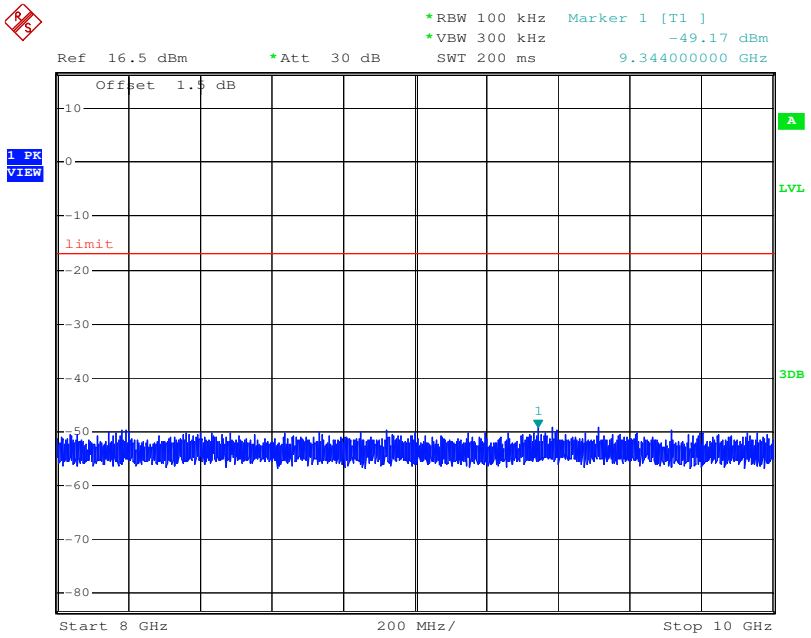


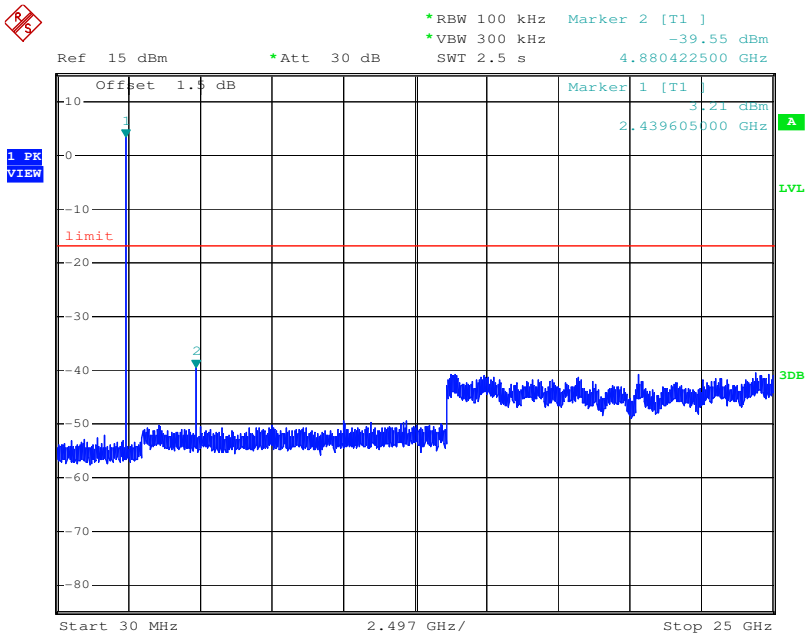


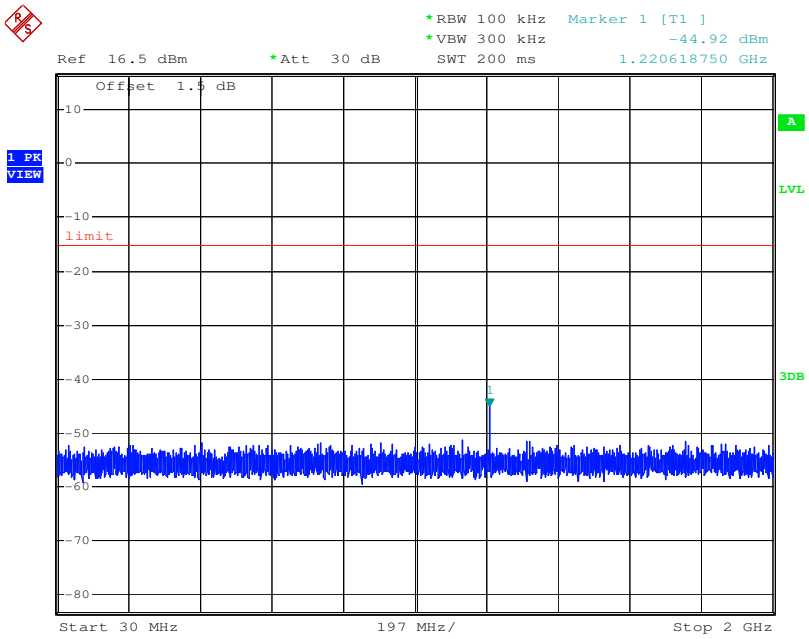



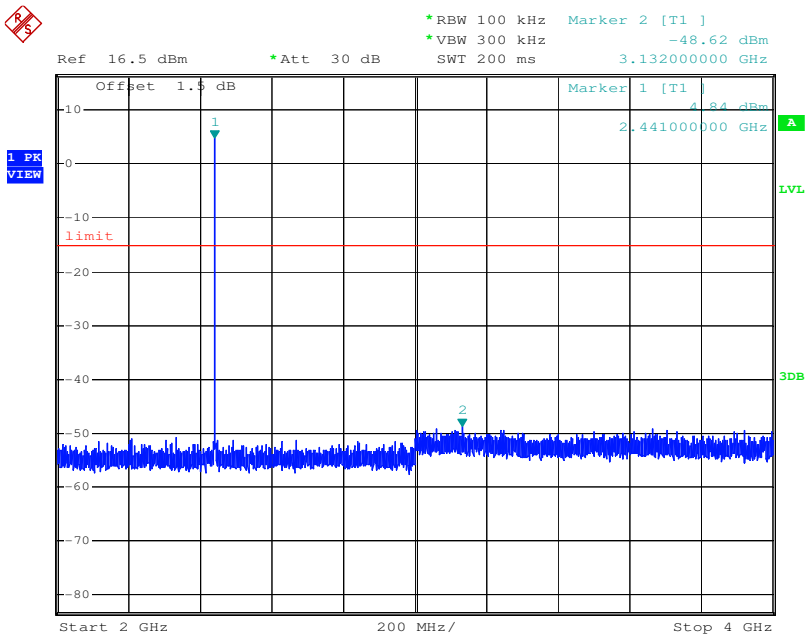


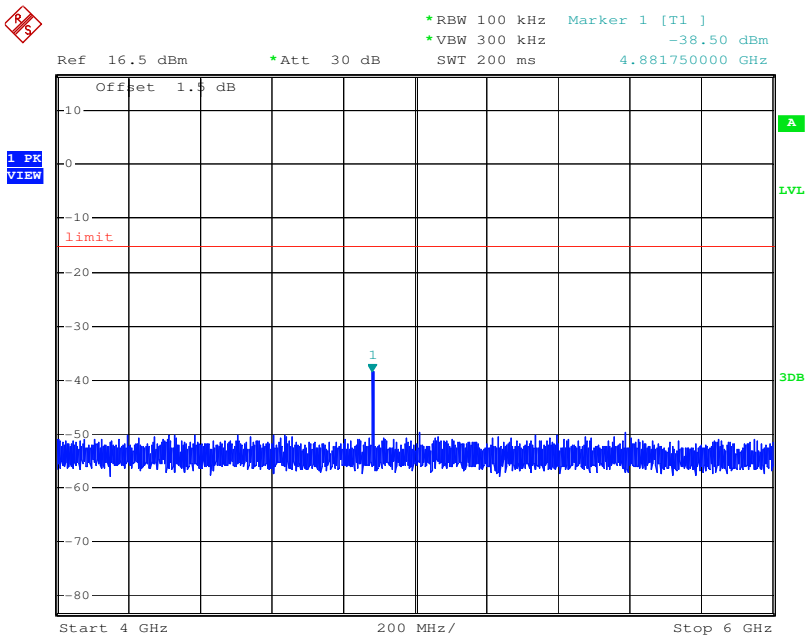



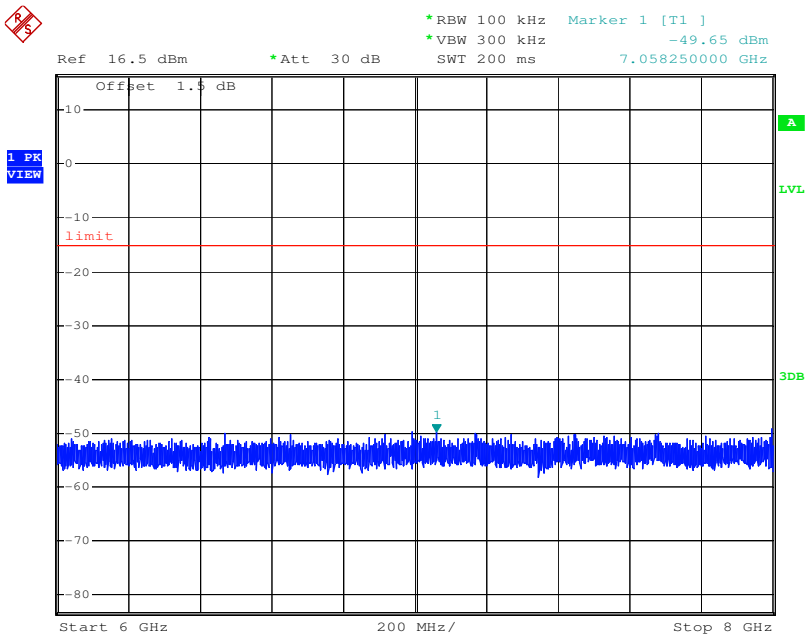
| Test mode: | GFSK | Test channel: | Middle |
|---|---|---|---|

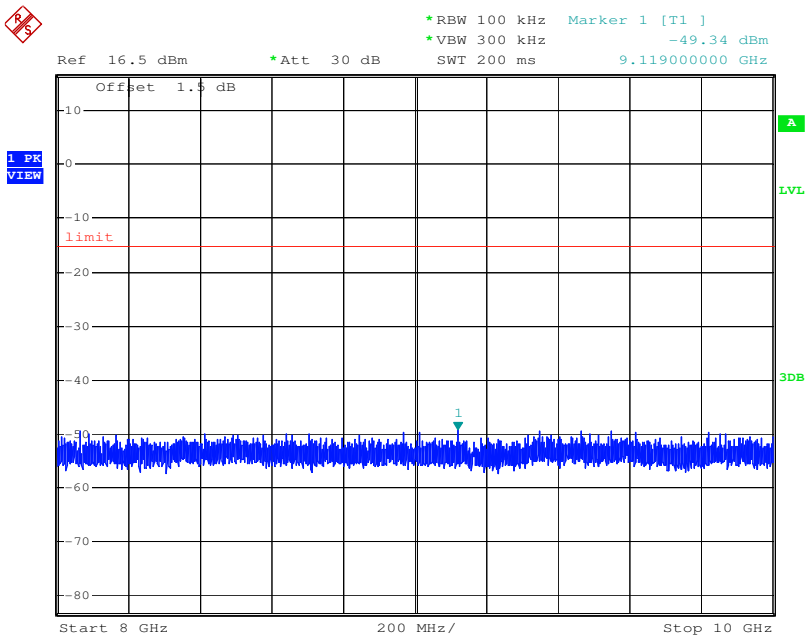


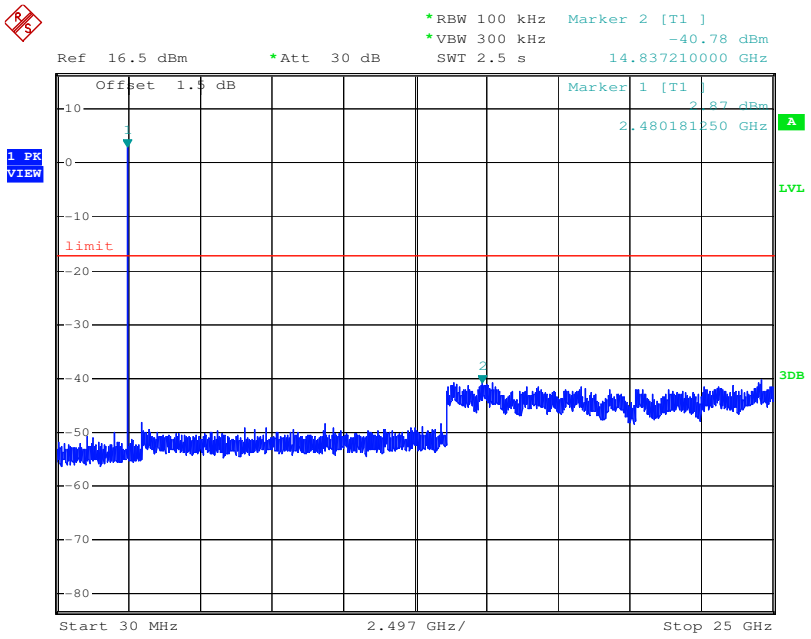


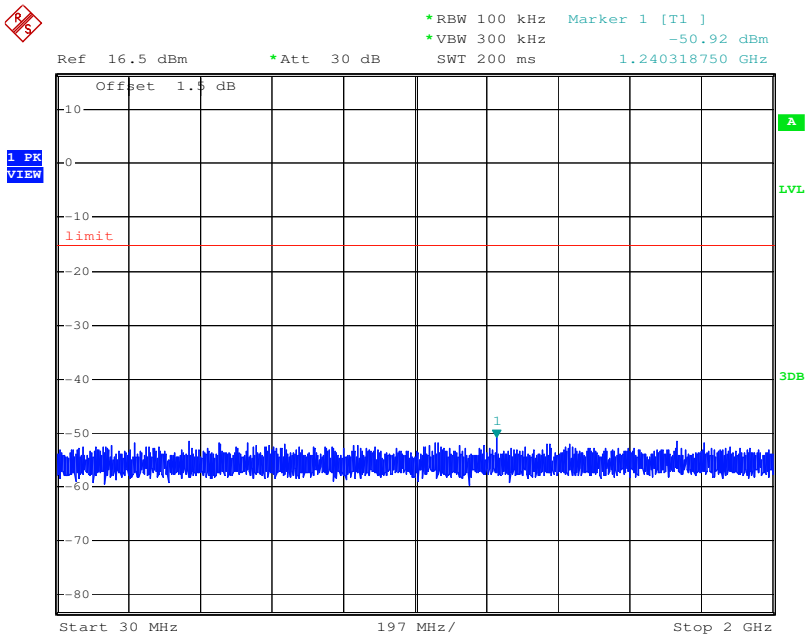



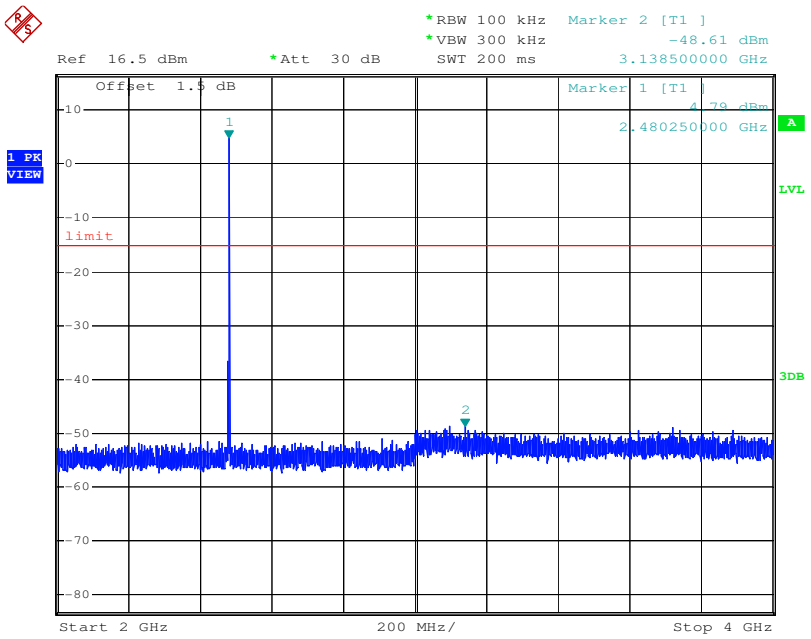


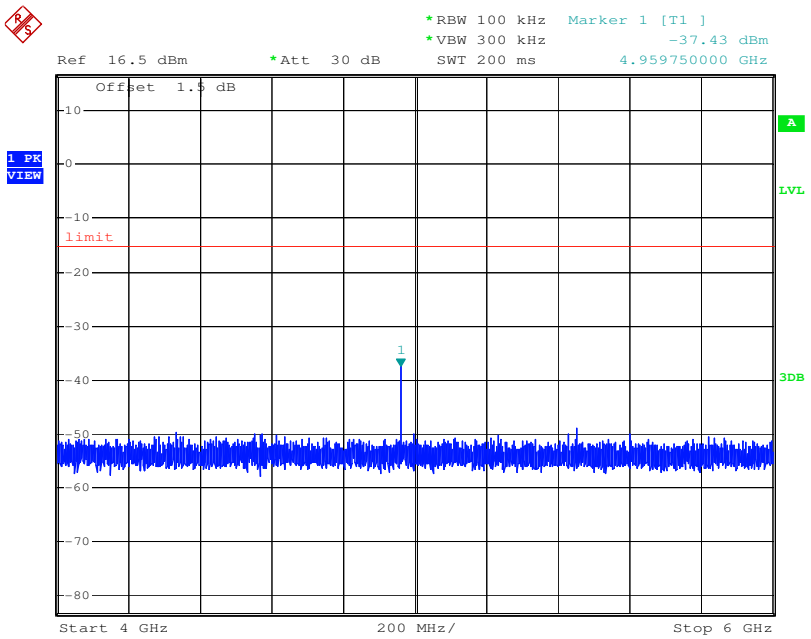



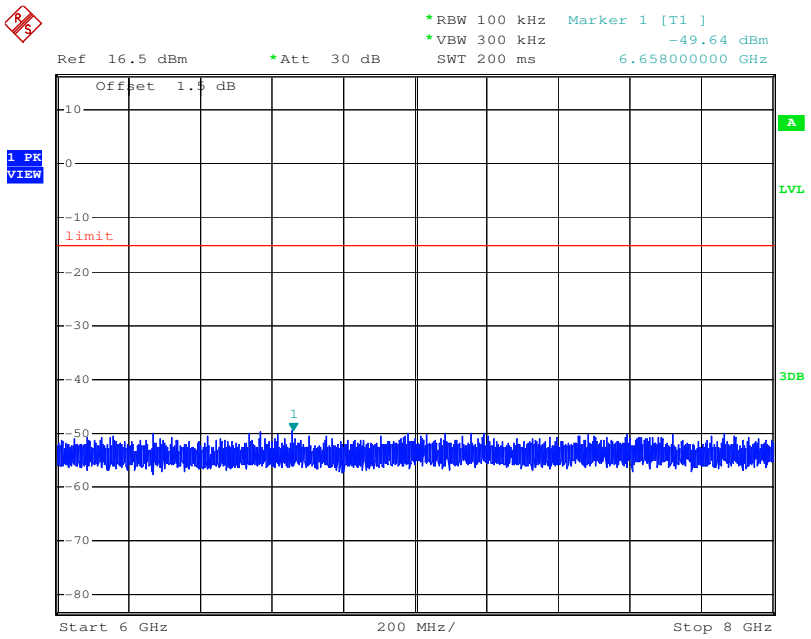
| Test mode: | GFSK | Test channel: | Highest |
|---|---|---|---|

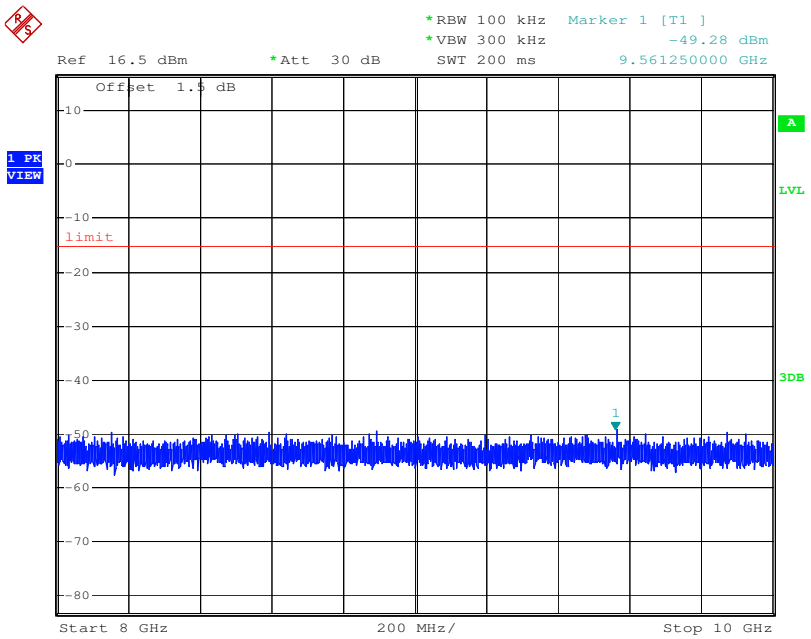


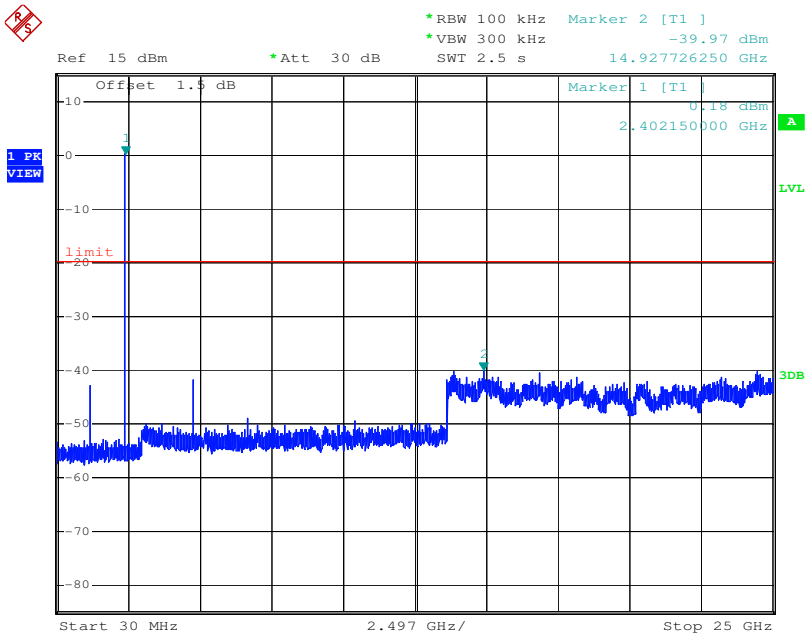


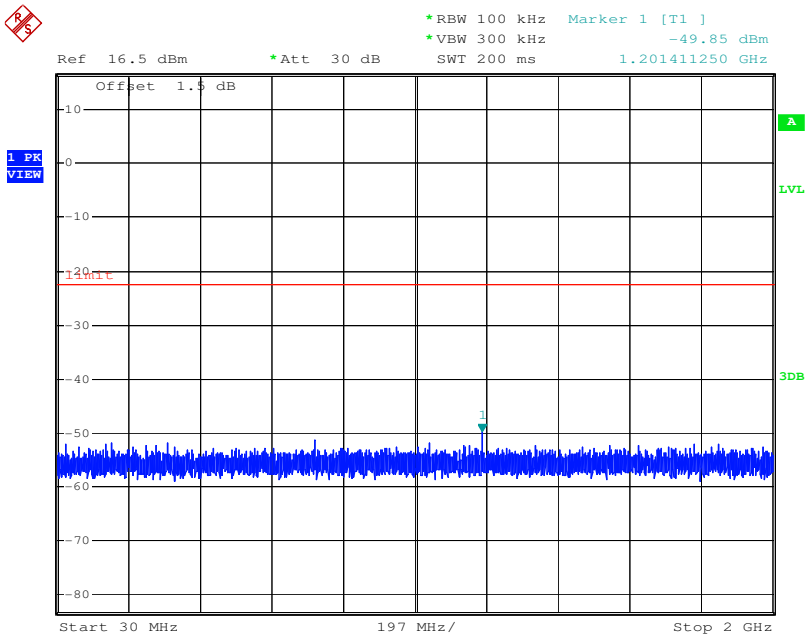



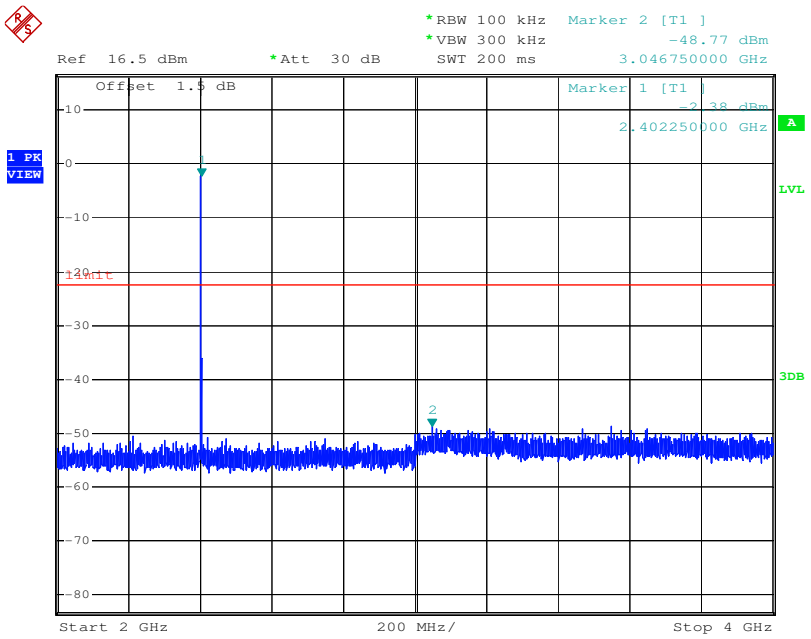


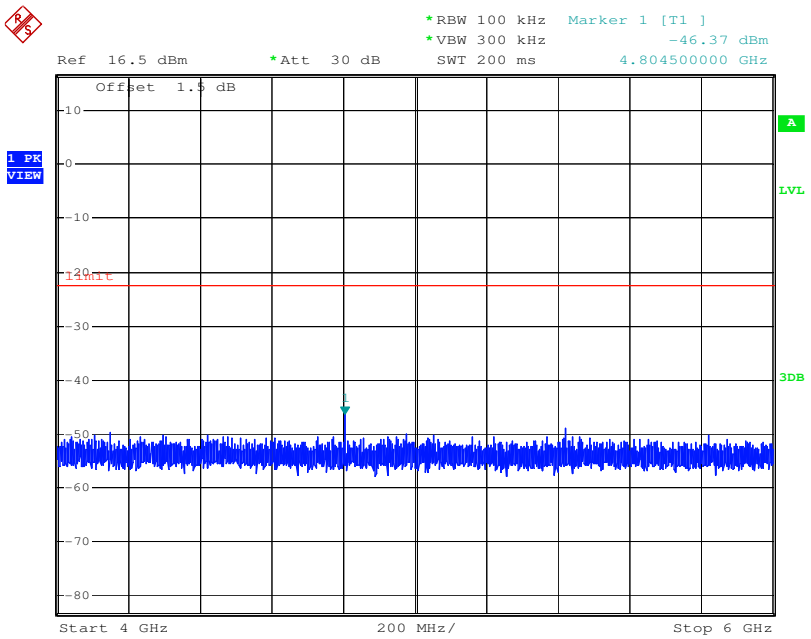



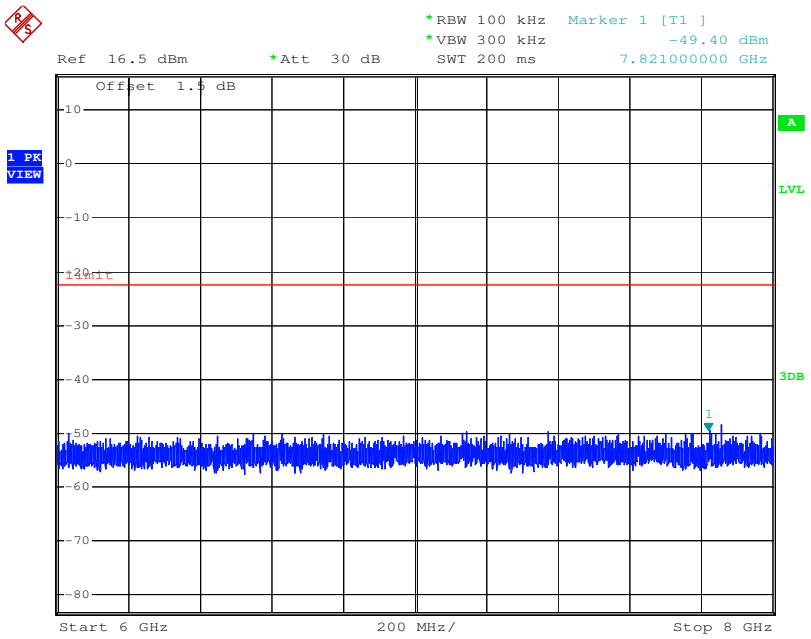
| Test mode: | π/4DQPSK | Test channel: | Lowest |
|---|---|---|---|

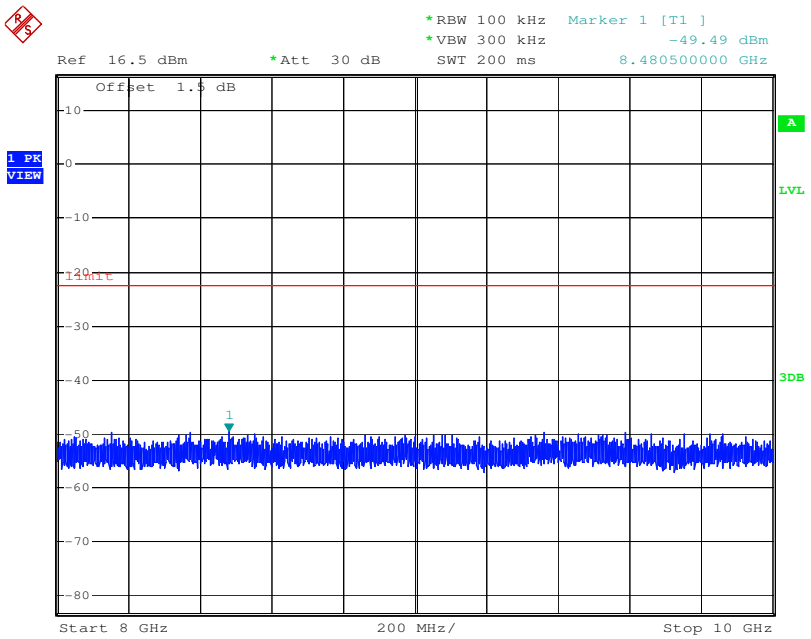


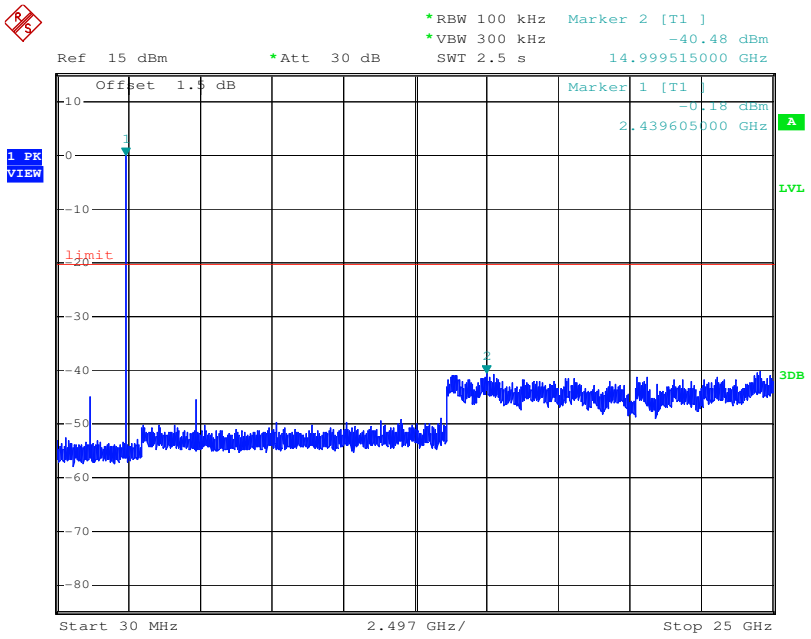


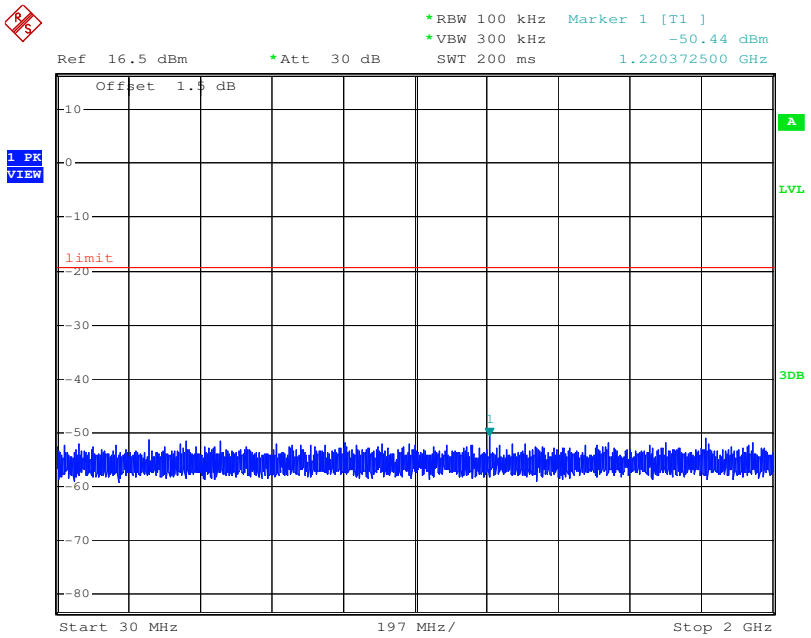



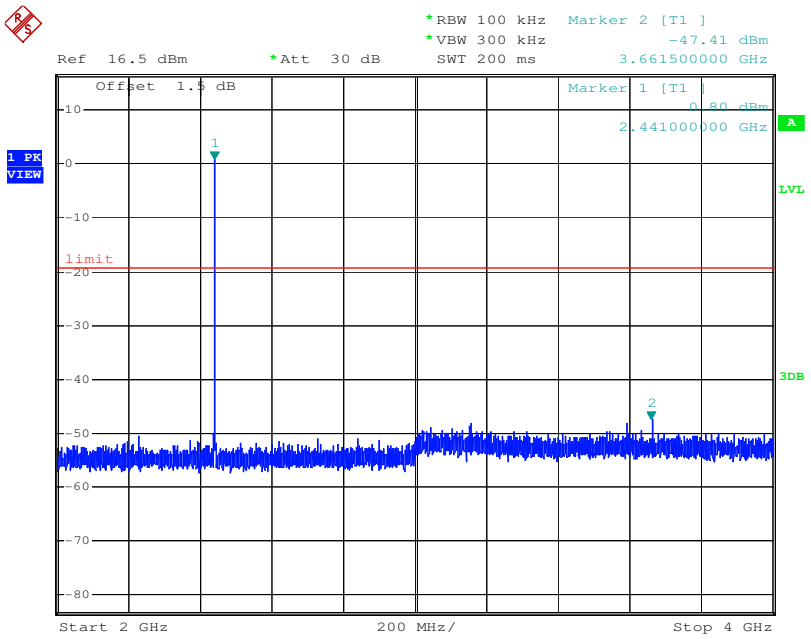


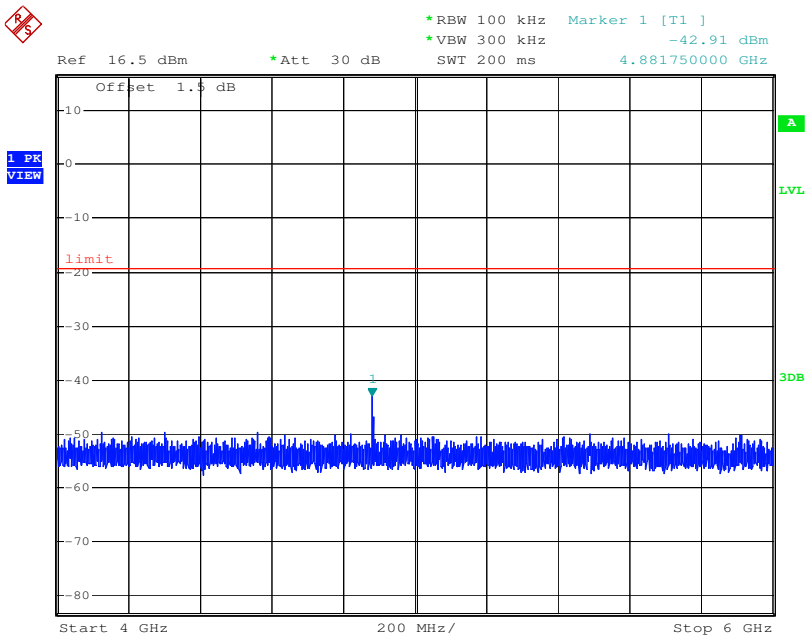



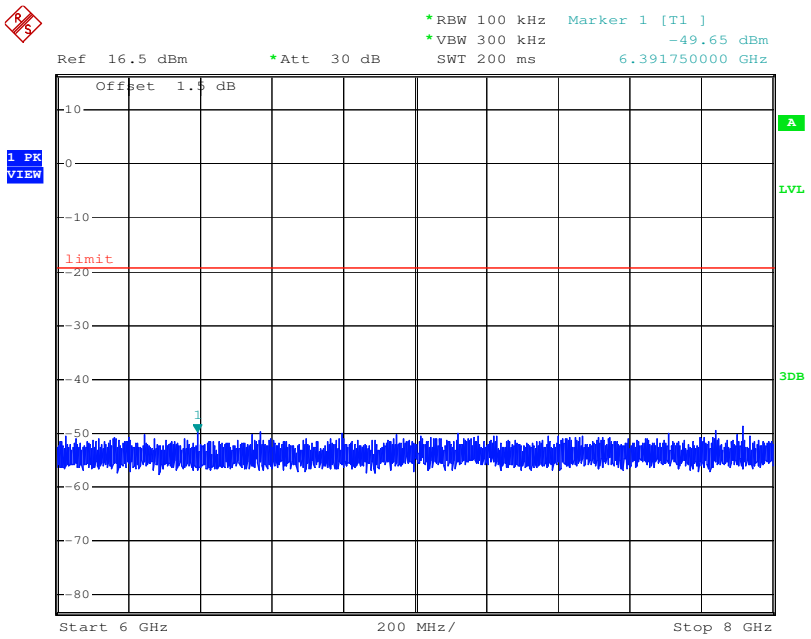
| Test mode: | π/4DQPSK | Test channel: | Middle |
|---|---|---|---|

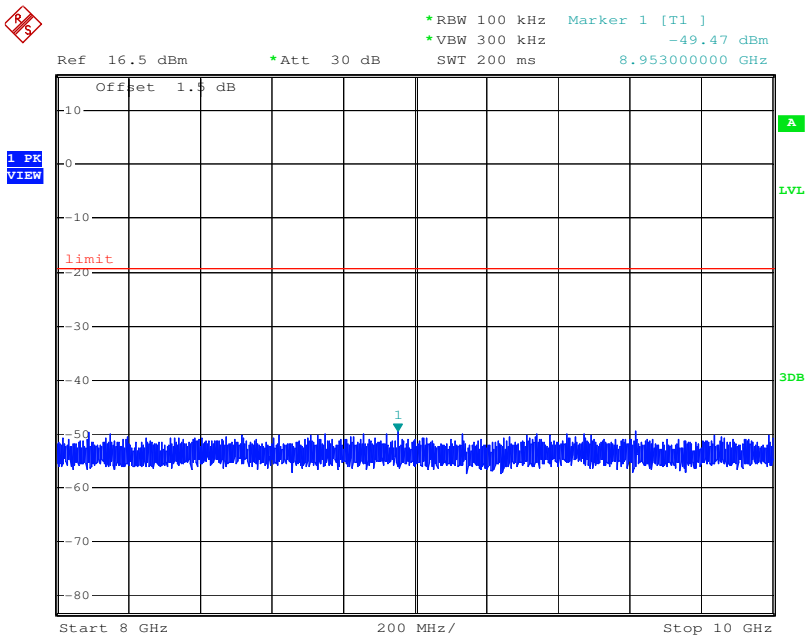


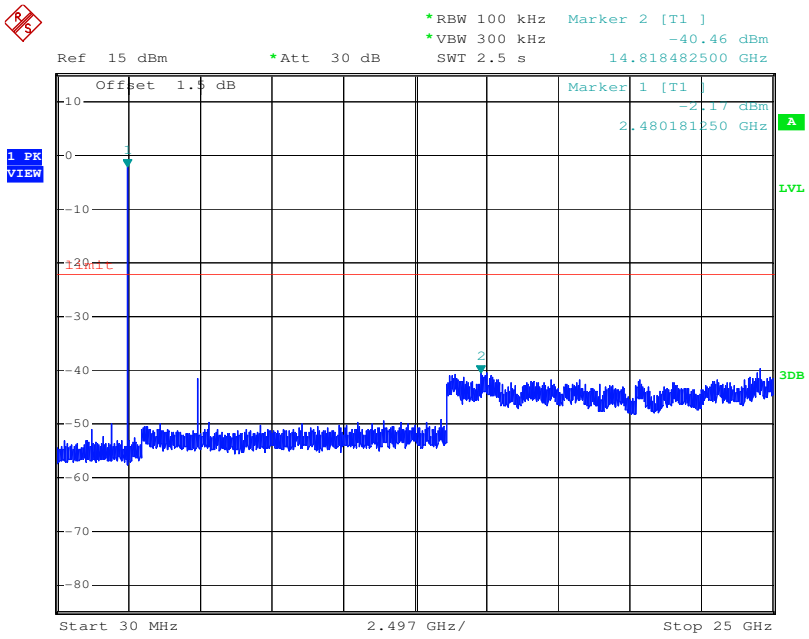


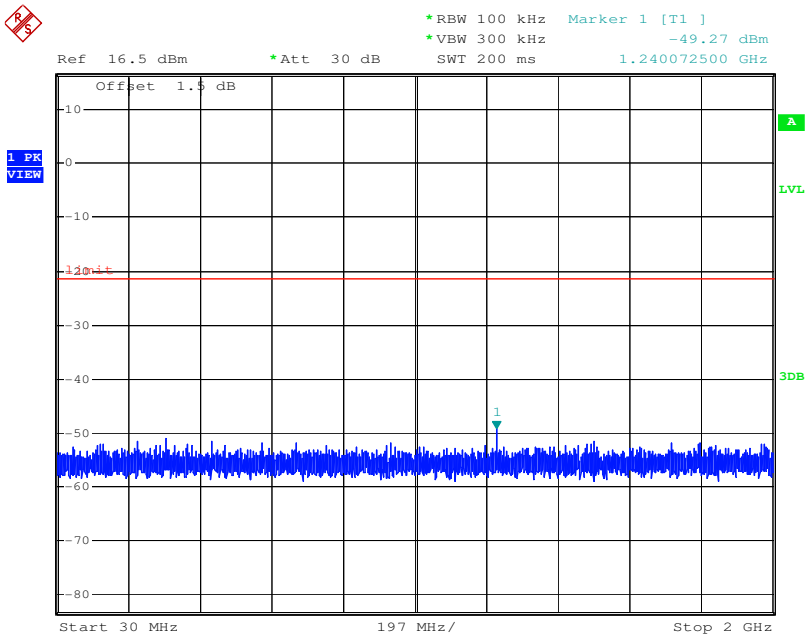



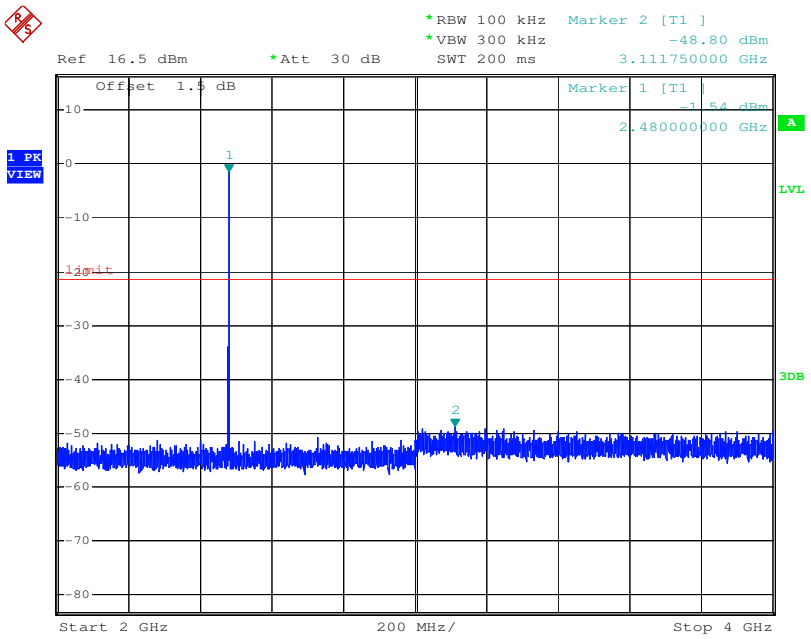


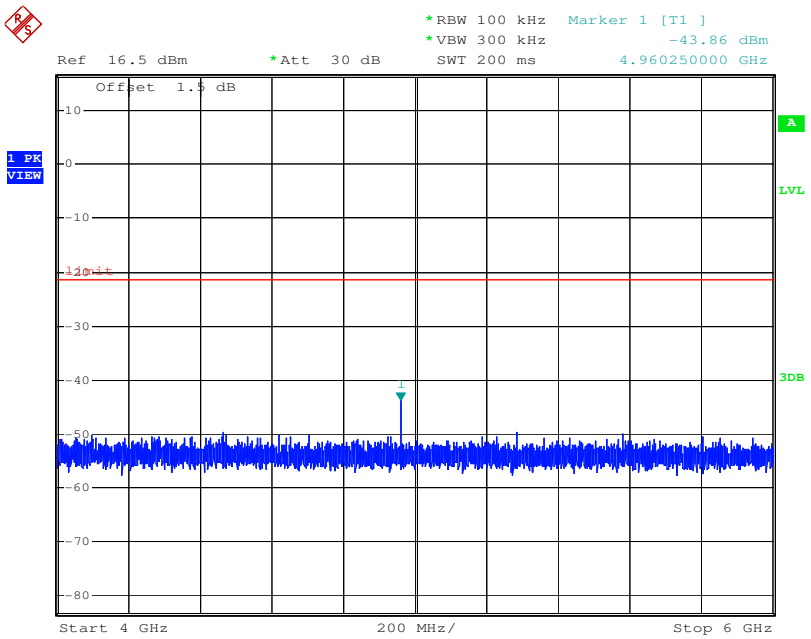



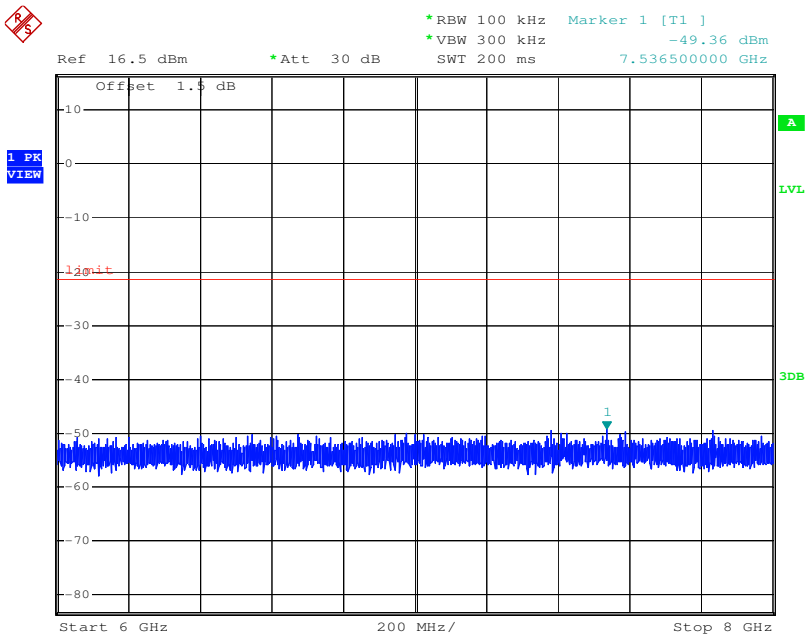
| Test mode: | π/4DQPSK | Test channel: | Highest |
|---|---|---|---|

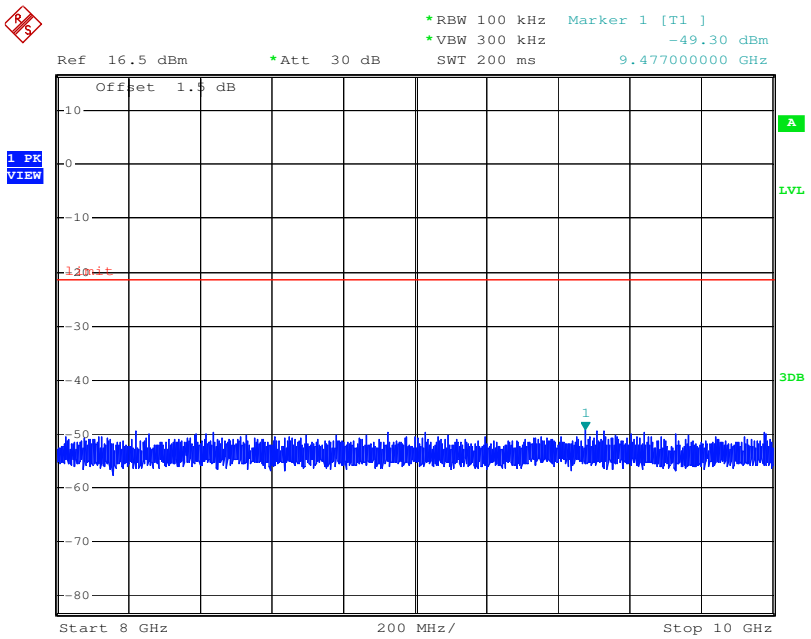


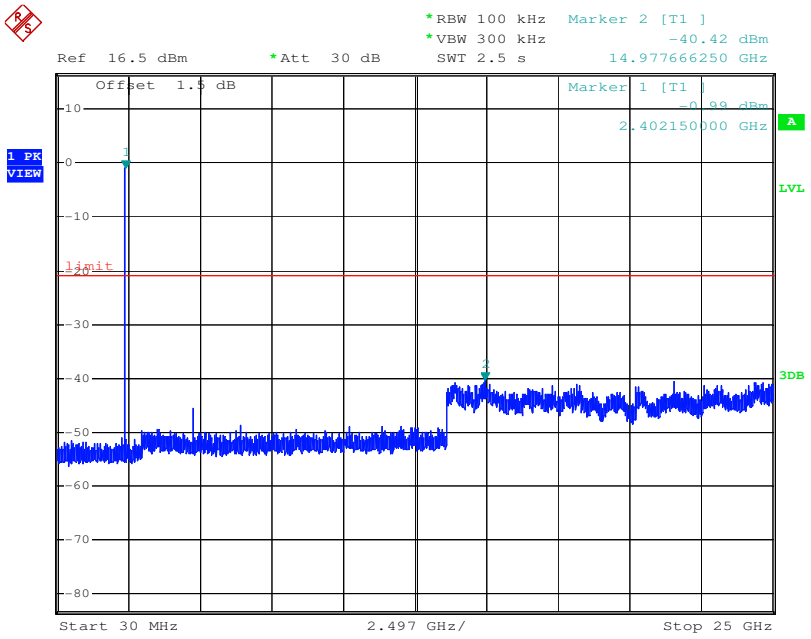


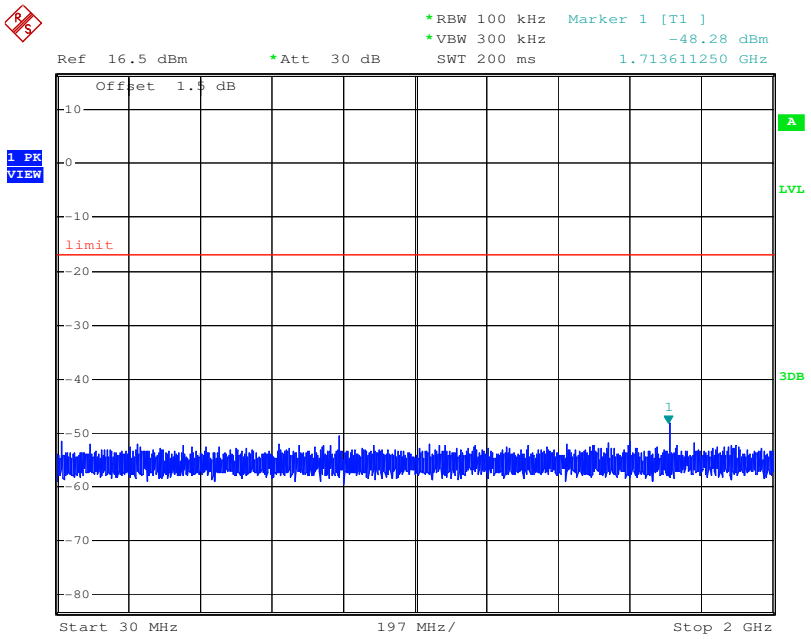



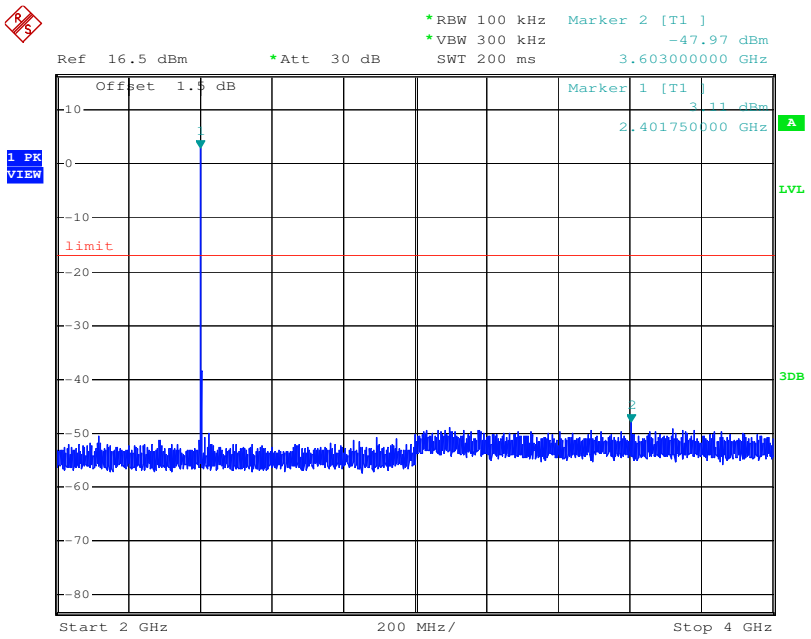


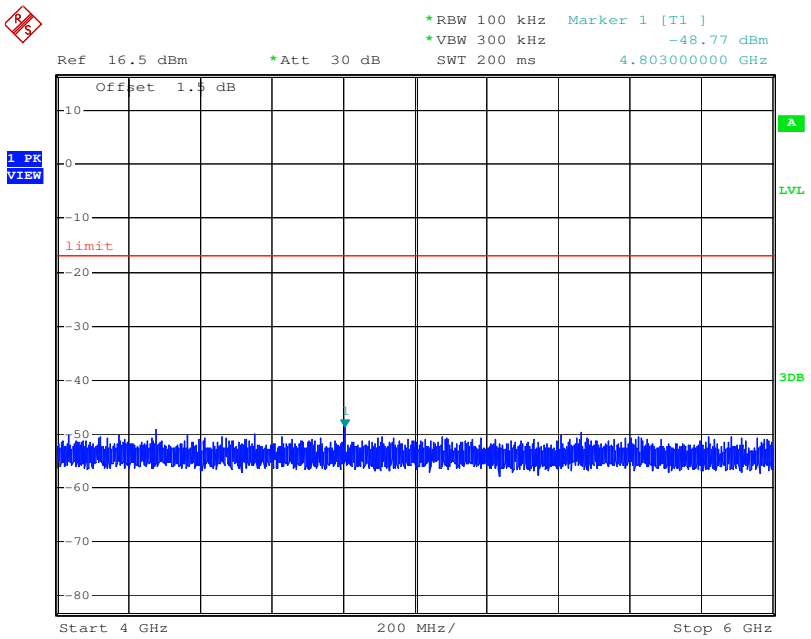



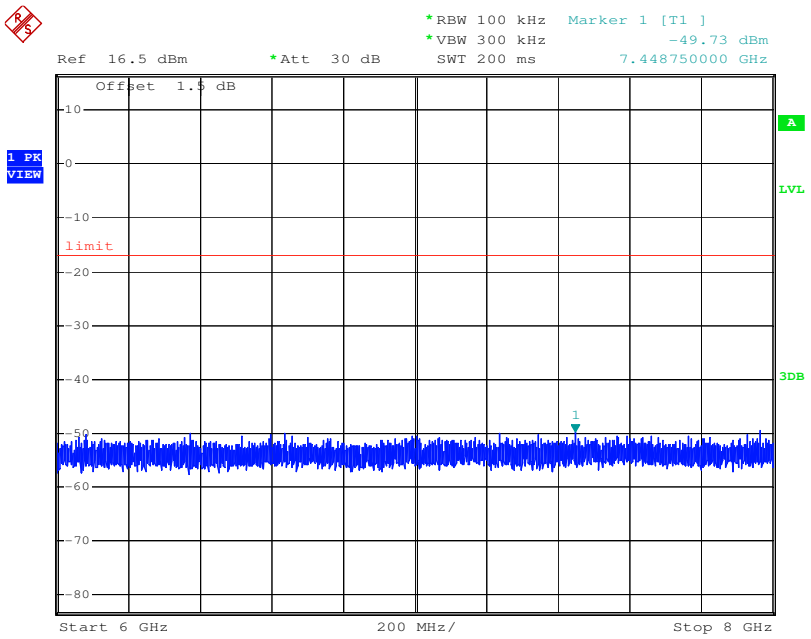
| Test mode: | 8DPSK | Test channel: | Lowest |
|---|---|---|---|

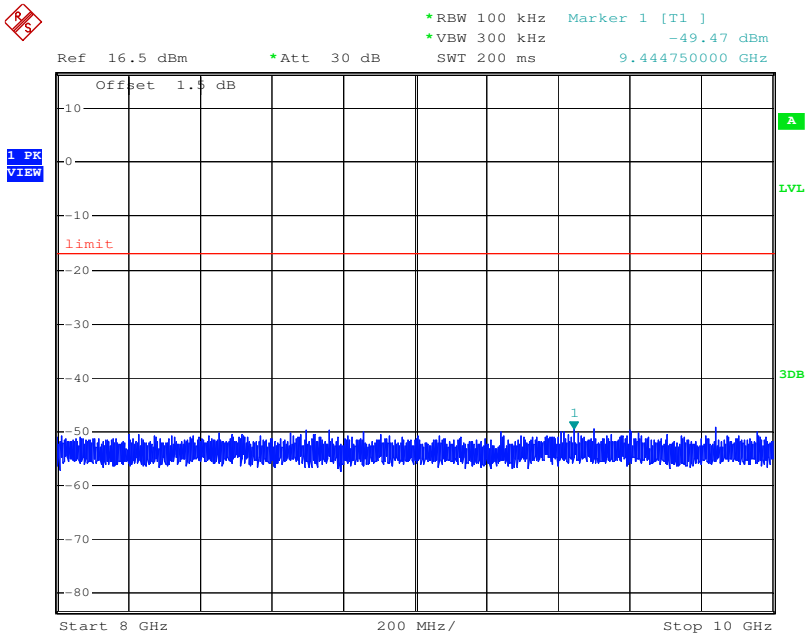


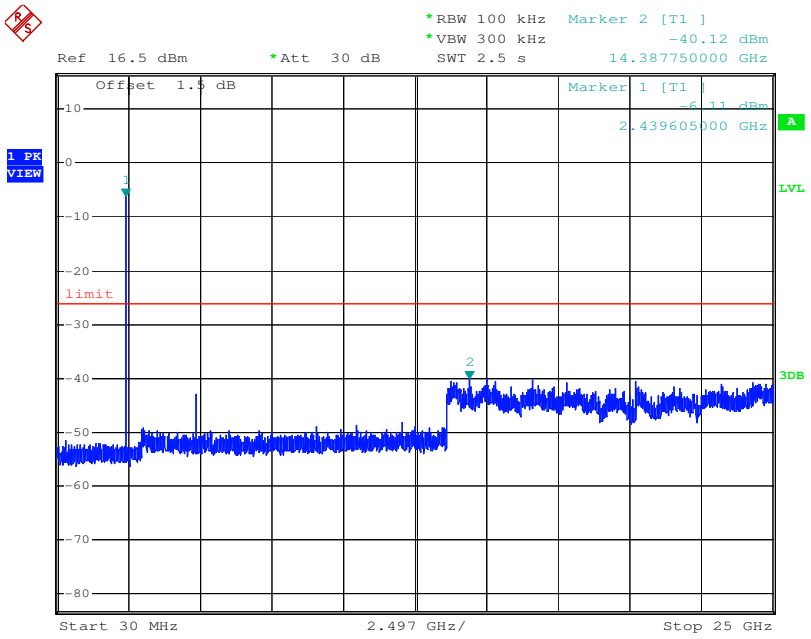


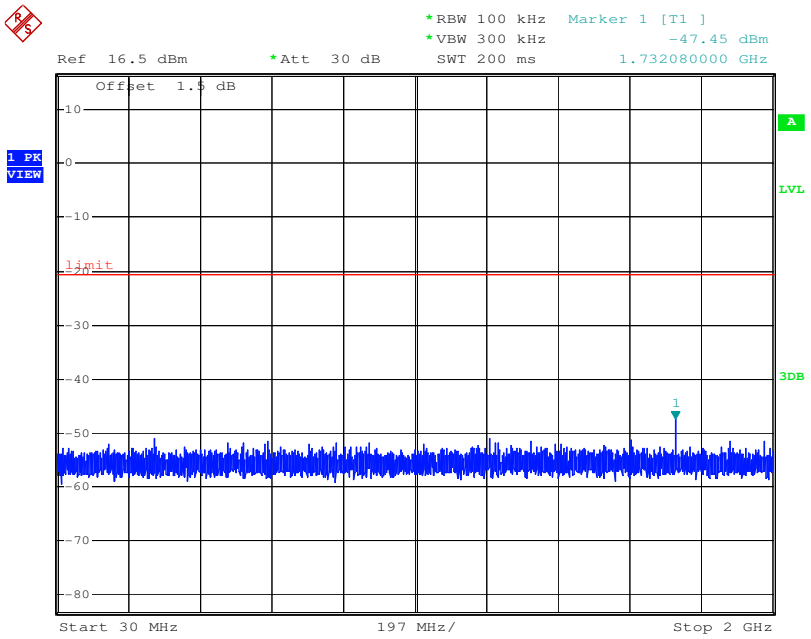



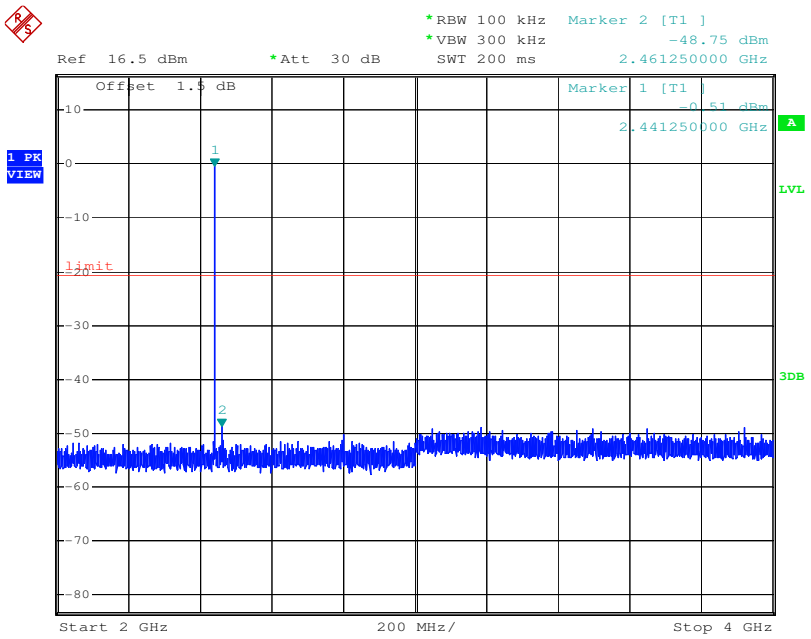


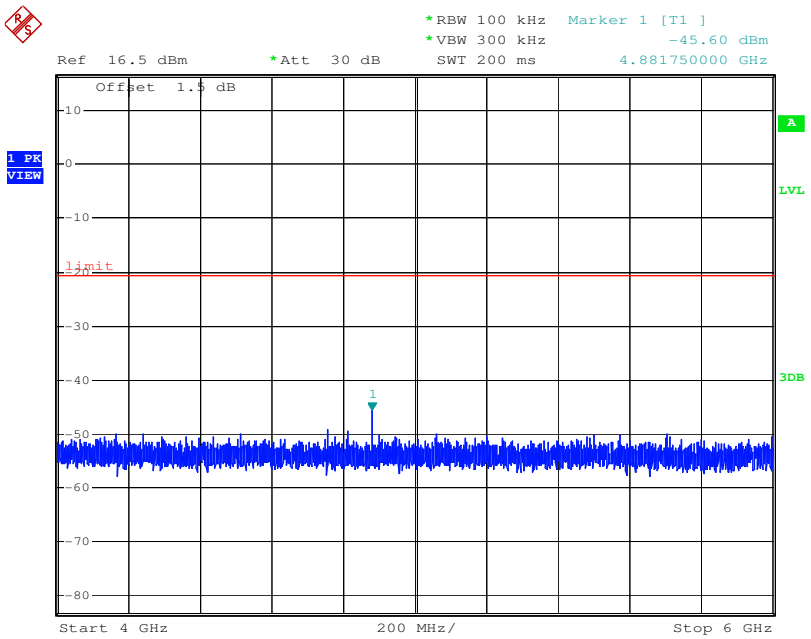



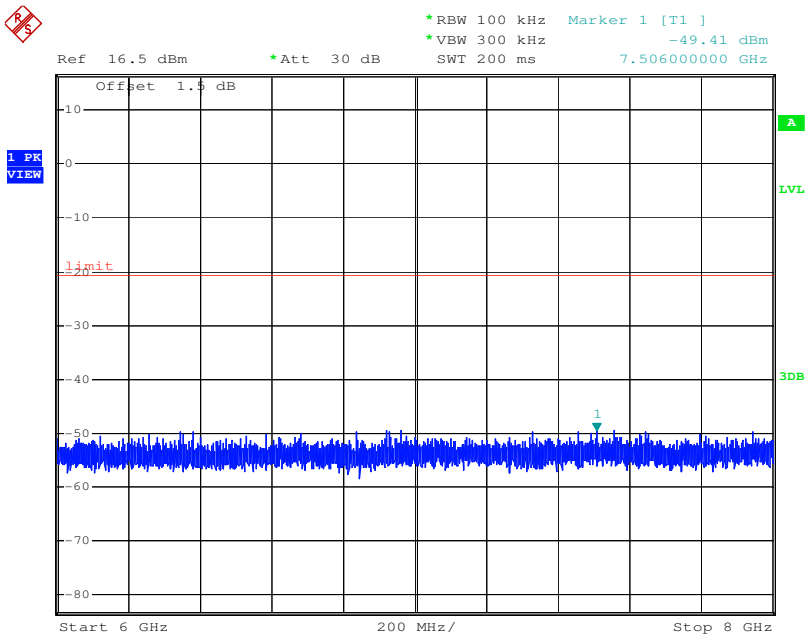
| Test mode: | 8DPSK | Test channel: | Middle |
|---|---|---|---|

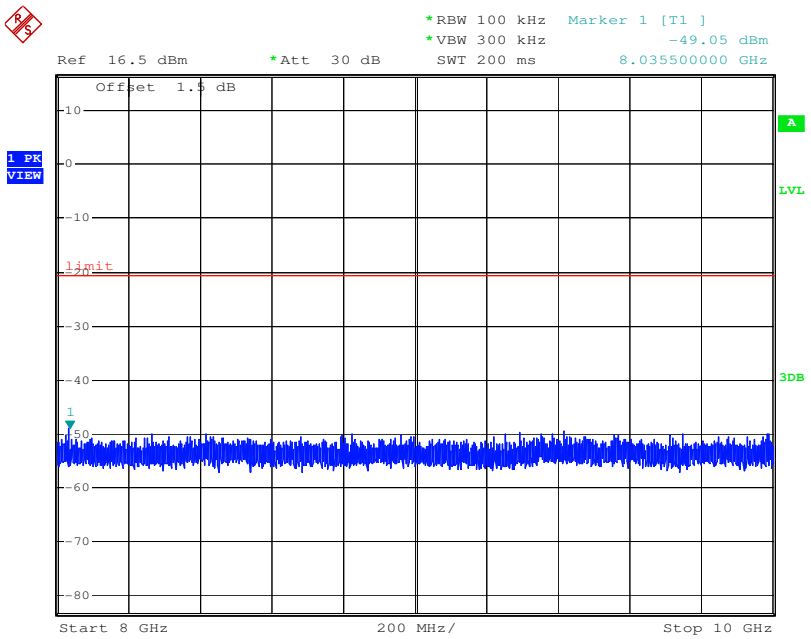


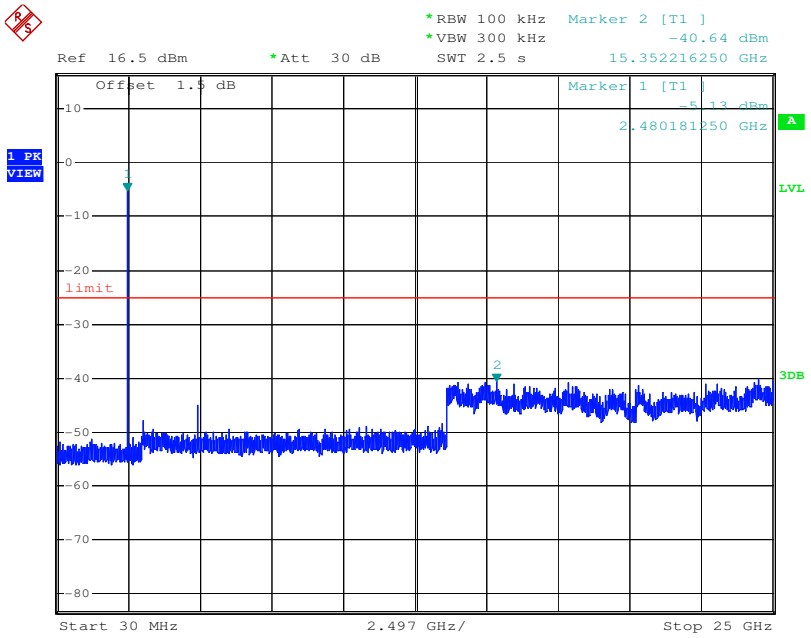


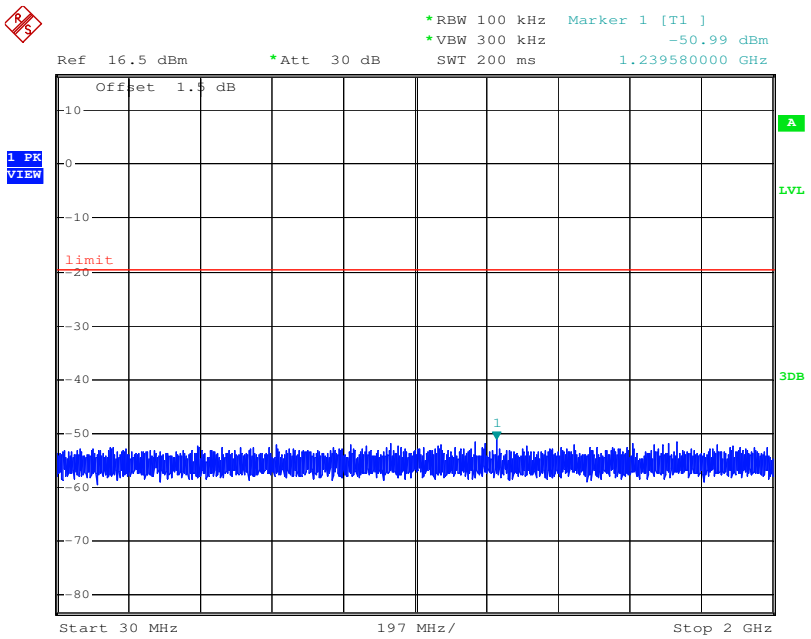



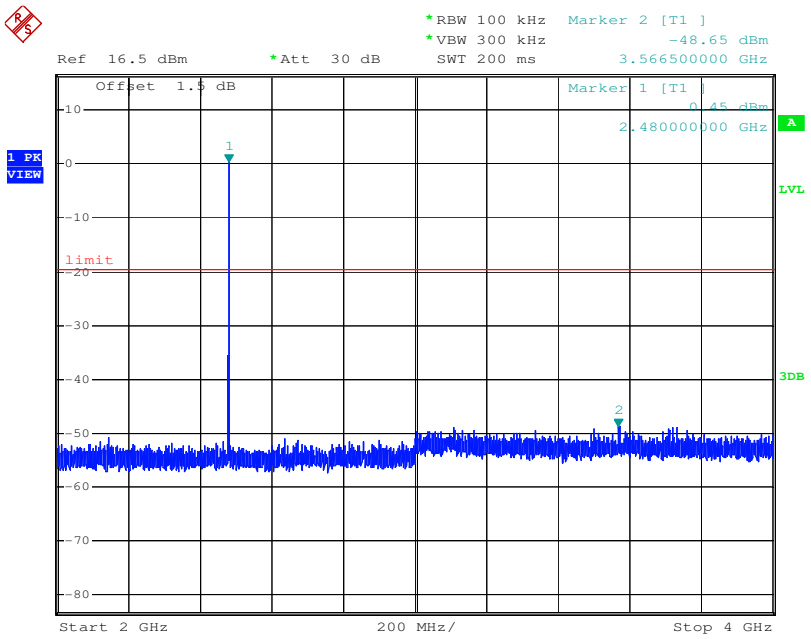


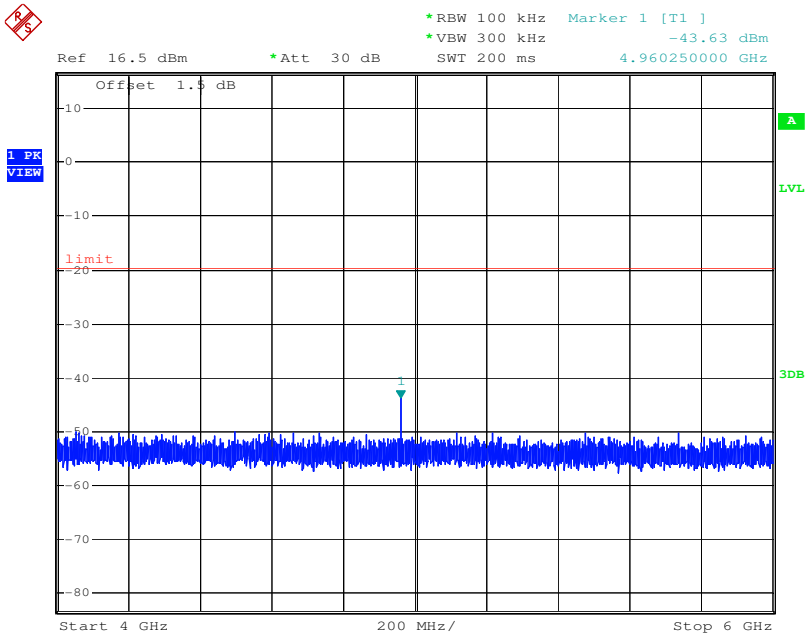



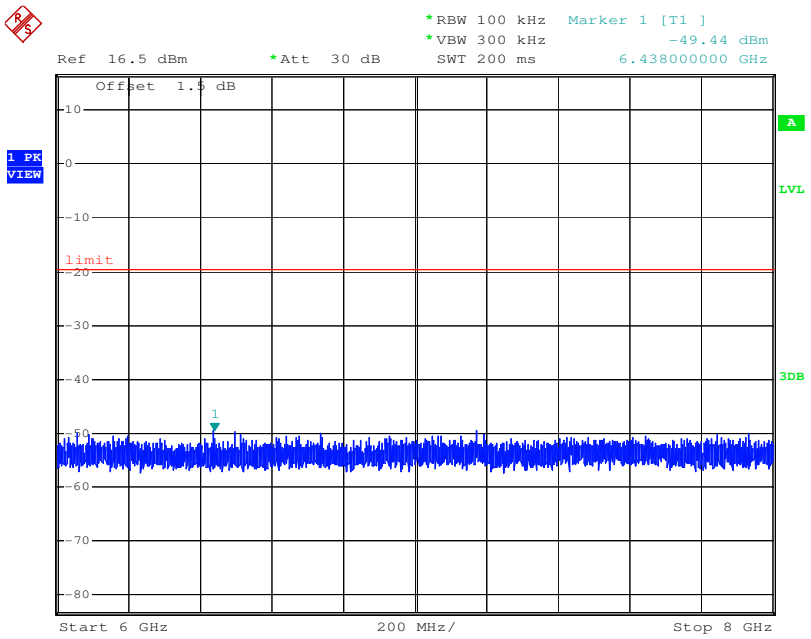
| Test mode: | 8DPSK | Test channel: | Highest |
|---|---|---|---|

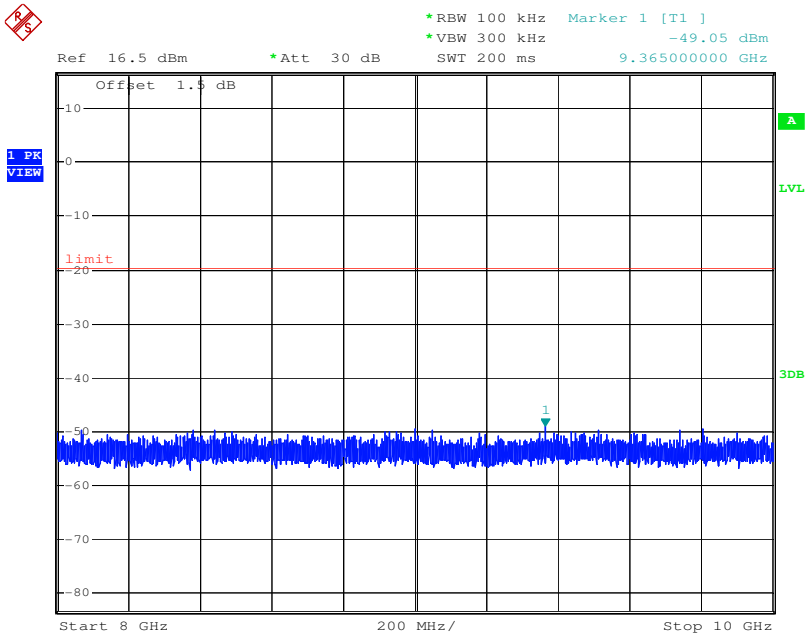







Remark:

Pretest 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report. Per FCC Part 15.33 (a) and 15.31 (o) ,The amplitude of spurious emissions from intentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

## 6.9 Other requirements Frequency Hopping Spread Spectrum System

| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1), (h) requirement: |
|---|---|

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.

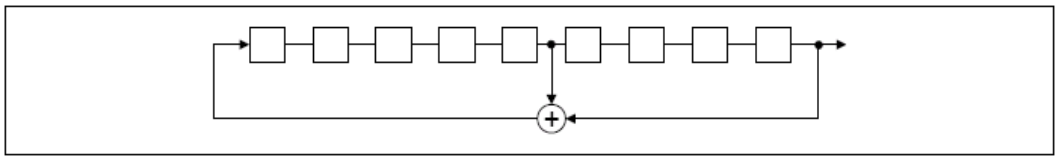
Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

**Compliance for section 15.247(a)(1)**

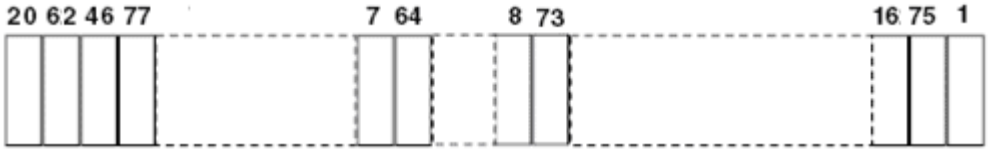
According to Bluetooth Core Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage
outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: $2^9$ -1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



*Linear Feedback Shift Register for Generation of the PRBS sequence*

An example of Pseudorandom Frequency Hopping Sequence as follow:




Each frequency used equally on the average by each transmitter.

According to Bluetooth Core Specification, Bluetooth receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any Bluetooth transmitters and shift frequencies in synchronization with the transmitted signals.

| Compliance for section 15.247(g) |
| --- |
| According to Bluetooth Core Specification, the Bluetooth system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system. |
| **Compliance for section 15.247(h)** |
| According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.<br>According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter. |

## 6.10 Radiated Spurious Emission

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.209 and 15.205 |
| Test Method: | ANSI C63.10: 2013 |
| 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: | |
|---|---|

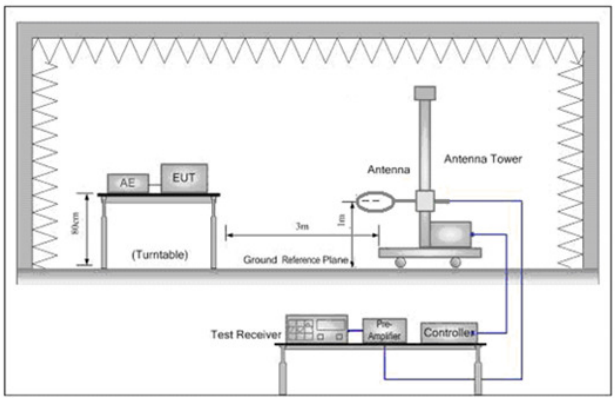



Figure 1. Below 30MHz

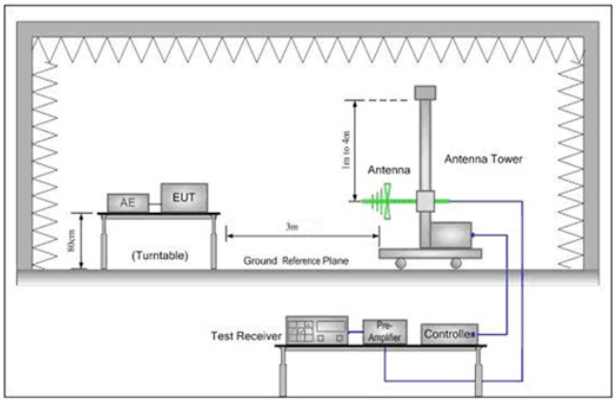



Figure 2. 30MHz to 1GHz

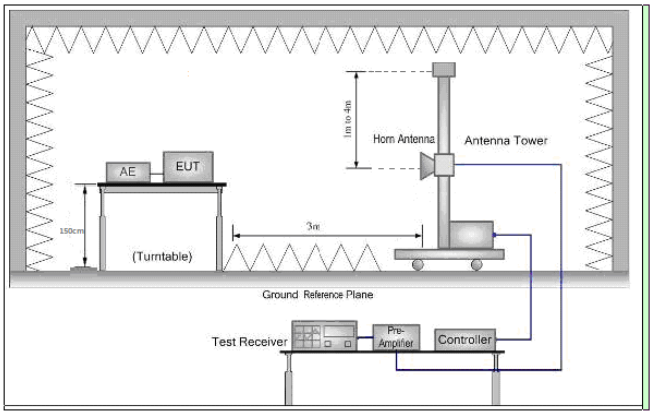


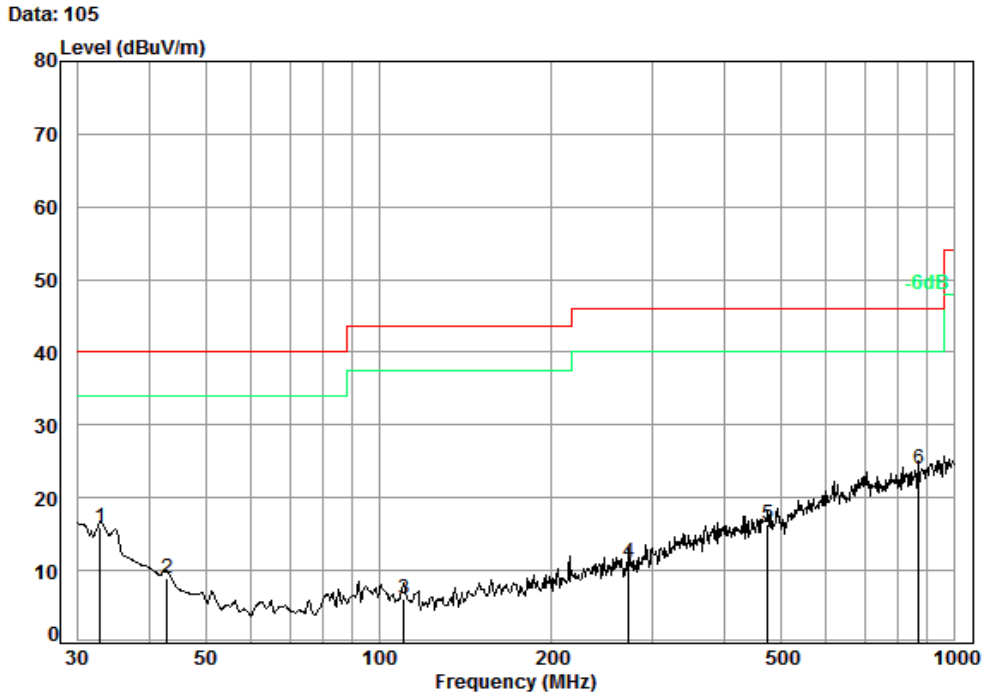

Figure 3. Above 1 GHz

| Test Procedure: | a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.<br>e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>f. The test-receiver system was set to Peak Detect Function and Specified |
|---|---|

| | |
|---|---|
| | Bandwidth with Maximum Hold Mode.<br>g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.<br>h. Test the EUT in the lowest channel (2402MHz),the middle channel (2441MHz),the Highest channel (2480MHz)<br>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.<br>j. 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 Transmitting mode. |
| Final Test Mode: | Through Pre-scan, find the DH1 of data type and GFSK modulation is the worst case.<br>For below 1GHz part, through pre-scan, the worst case is the lowest channel.<br>Only the worst case is recorded in the report. |
| Instruments Used: | Refer to section 5.10 for details |
| Test Results: | Pass |

## 6.10.1 Radiated Emission below 1GHz

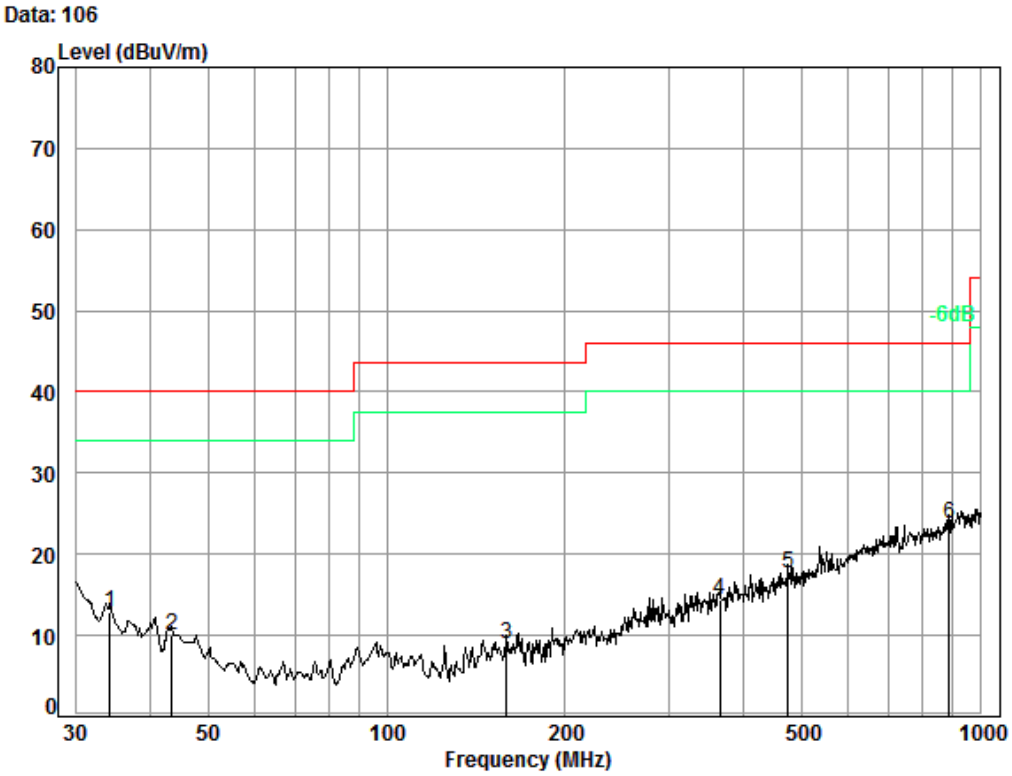
| 30MHz~1GHz (QP) | | |
|---|---|---|
| Test mode: | Transmitting | Vertical |




Condition: 3m Vertical
Job No. : 6644CR
Test mode: TX

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit |
|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 32.86 | 0.60 | 17.16 | 27.35 | 25.41 | 15.82 | 40.00 | -24.18 |
| 2 | 42.90 | 0.66 | 11.85 | 27.31 | 23.65 | 8.85 | 40.00 | -31.15 |
| 3 | 110.57 | 1.23 | 8.66 | 27.13 | 23.42 | 6.18 | 43.50 | -37.32 |
| 4 | 272.28 | 1.78 | 12.65 | 26.47 | 23.14 | 11.10 | 46.00 | -34.90 |
| 5 | 473.83 | 2.50 | 17.66 | 27.58 | 23.74 | 16.32 | 46.00 | -29.68 |
| 6 | 869.13 | 3.48 | 22.68 | 26.92 | 24.73 | 23.97 | 46.00 | -22.03 |

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




Condition: 3m Horizontal
Job No. : 6644CR
Test mode: TX

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit |
|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 34.16 | 0.60 | 16.38 | 27.34 | 23.21 | 12.85 | 40.00 | -27.15 |
| 2 | 43.51 | 0.68 | 11.58 | 27.31 | 25.09 | 10.04 | 40.00 | -29.96 |
| 3 | 159.23 | 1.33 | 9.67 | 26.86 | 24.89 | 9.03 | 43.50 | -34.47 |
| 4 | 364.26 | 2.10 | 15.73 | 26.89 | 23.49 | 14.43 | 46.00 | -31.57 |
| 5 | 473.83 | 2.50 | 17.66 | 27.58 | 25.15 | 17.73 | 46.00 | -28.27 |
| 6 | 887.61 | 3.55 | 23.00 | 26.85 | 24.16 | 23.86 | 46.00 | -22.14 |

### 6.10.2 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 |
|---|---|---|---|---|---|---|---|---|
| 4155.000 | -30.90 | 33.60 | 0.00 | 45.80 | 48.50 | 74 | -25.50 | Vertical |
| 4824.000 | -30.40 | 34.40 | 0.00 | 42.50 | 46.50 | 74 | -27.50 | Vertical |
| 5925.000 | -29.10 | 34.70 | 0.00 | 39.40 | 45.00 | 74 | -29.00 | Vertical |
| 7236.000 | -27.90 | 35.80 | 0.00 | 37.10 | 45.00 | 74 | -29.00 | Vertical |
| 9648.000 | -25.00 | 37.20 | 0.00 | 34.90 | 47.10 | 74 | -26.90 | Vertical |
| 12645.000 | -23.10 | 38.10 | 0.00 | 35.30 | 50.30 | 74 | -23.70 | Vertical |
| 4165.580 | -30.90 | 33.70 | 0.00 | 48.70 | 51.50 | 74 | -22.50 | Horizontal |
| 4824.000 | -30.40 | 34.40 | 0.00 | 43.50 | 47.50 | 74 | -26.50 | Horizontal |
| 5895.000 | -29.20 | 34.60 | 0.00 | 39.10 | 44.50 | 74 | -29.50 | Horizontal |
| 7236.000 | -27.90 | 35.80 | 0.00 | 37.30 | 45.20 | 74 | -28.80 | Horizontal |
| 9648.000 | -25.00 | 37.20 | 0.00 | 34.50 | 46.70 | 74 | -27.30 | Horizontal |
| 12675.000 | -23.30 | 38.10 | 0.00 | 35.10 | 49.90 | 74 | -24.10 | 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 |
|---|---|---|---|---|---|---|---|---|
| 3750.000 | -31.10 | 32.90 | 0.00 | 40.70 | 42.50 | 74 | -31.50 | Vertical |
| 4882.000 | -30.40 | 34.60 | 0.00 | 42.00 | 46.20 | 74 | -27.80 | Vertical |
| 6105.000 | -29.20 | 35.00 | 0.00 | 39.70 | 45.50 | 74 | -28.50 | Vertical |
| 7323.000 | -27.90 | 35.70 | 0.00 | 38.10 | 45.90 | 74 | -28.10 | Vertical |
| 9764.000 | -24.90 | 37.30 | 0.00 | 35.60 | 48.00 | 74 | -26.00 | Vertical |
| 12615.000 | -22.90 | 38.10 | 0.00 | 34.40 | 49.60 | 74 | -24.40 | Vertical |
| 3765.000 | -31.10 | 32.90 | 0.00 | 40.10 | 41.90 | 74 | -32.10 | Horizontal |
| 4882.000 | -30.40 | 34.60 | 0.00 | 49.60 | 53.80 | 74 | -20.20 | Horizontal |
| 6090.000 | -29.10 | 35.00 | 0.00 | 39.70 | 45.60 | 74 | -28.40 | Horizontal |
| 7323.000 | -27.90 | 35.70 | 0.00 | 37.80 | 45.60 | 74 | -28.40 | Horizontal |
| 9764.000 | -24.90 | 37.30 | 0.00 | 35.30 | 47.70 | 74 | -26.30 | Horizontal |
| 12645.000 | -23.10 | 38.10 | 0.00 | 34.70 | 49.70 | 74 | -24.30 | Horizontal |

| Worse case mode: | GFSK(DH1) | Test channel: | Middle | Remark: | Average |
|---|---|---|---|---|---|

| Frequency (MHz) | Cable loss (dB) | Antenna factors (dB/m) | Preamp factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 4882.000 | -30.40 | 34.60 | 0.00 | 29.30 | 33.50 | 54 | -20.50 | Horizontal |

| Worse case mode: | GFSK(DH1) | 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 |
|---|---|---|---|---|---|---|---|---|
| 3750.000 | -31.10 | 32.90 | 0.00 | 40.20 | 42.00 | 74 | -32.00 | Vertical |
| 4960.000 | -30.30 | 34.60 | 0.00 | 45.60 | 49.90 | 74 | -24.10 | Vertical |
| 6135.000 | -29.30 | 35.00 | 0.00 | 38.90 | 44.60 | 74 | -29.40 | Vertical |
| 7440.000 | -27.90 | 35.80 | 0.00 | 38.30 | 46.20 | 74 | -27.80 | Vertical |
| 9920.000 | -23.90 | 37.30 | 0.00 | 34.90 | 48.30 | 74 | -25.70 | Vertical |
| 12705.000 | -23.50 | 38.10 | 0.00 | 34.60 | 49.20 | 74 | -24.80 | Vertical |
| 4165.000 | -30.90 | 33.70 | 0.00 | 50.20 | 53.00 | 74 | -21.00 | Horizontal |
| 4960.000 | -30.30 | 34.60 | 0.00 | 52.00 | 56.30 | 74 | -17.70 | Horizontal |
| 6195.000 | -29.20 | 34.90 | 0.00 | 39.90 | 45.60 | 74 | -28.40 | Horizontal |
| 7440.000 | -27.90 | 35.80 | 0.00 | 38.30 | 46.20 | 74 | -27.80 | Horizontal |
| 9920.000 | -23.90 | 37.30 | 0.00 | 35.60 | 49.00 | 74 | -25.00 | Horizontal |
| 12645.000 | -23.10 | 38.10 | 0.00 | 35.40 | 50.40 | 74 | -23.60 | Horizontal |

| Worse case mode: | GFSK(DH1) | Test channel: | Highest | Remark: | Average |
|---|---|---|---|---|---|

| Frequency (MHz) | Cable loss (dB) | Antenna factors (dB/m) | Preamp factor (dB) | Reading Level (dBμV) | Emission Level (dBμV/m) | Limit (dBμV/m) | Over Limit (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 4960.000 | -30.30 | 34.60 | 0.00 | 29.50 | 33.80 | 54 | 20.20 | 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 above measurement data were shown in the report.

## 6.11 Restricted bands around fundamental frequency

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.209 and 15.205 |
| Test Method: | ANSI C63.10: 2013 |
| 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:

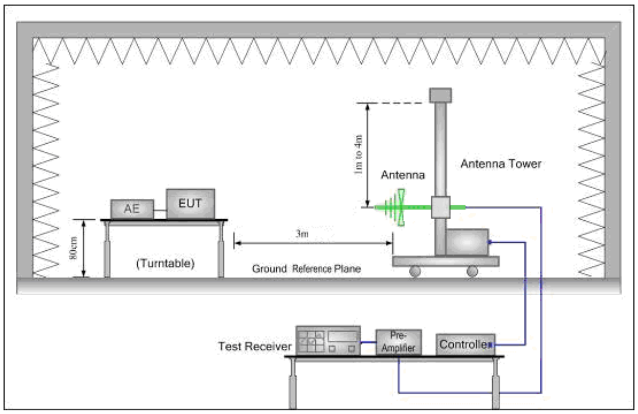



Figure 1. 30MHz to 1GHz

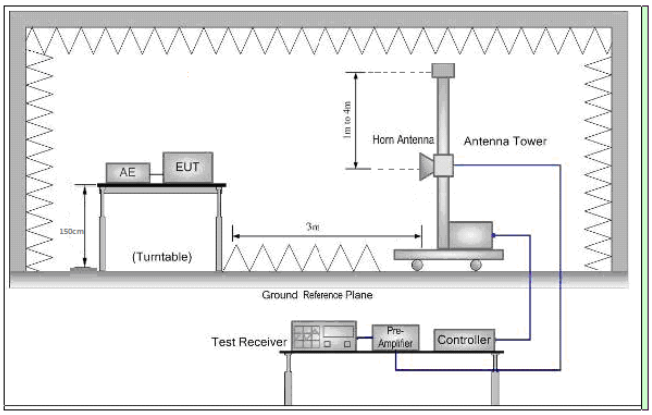
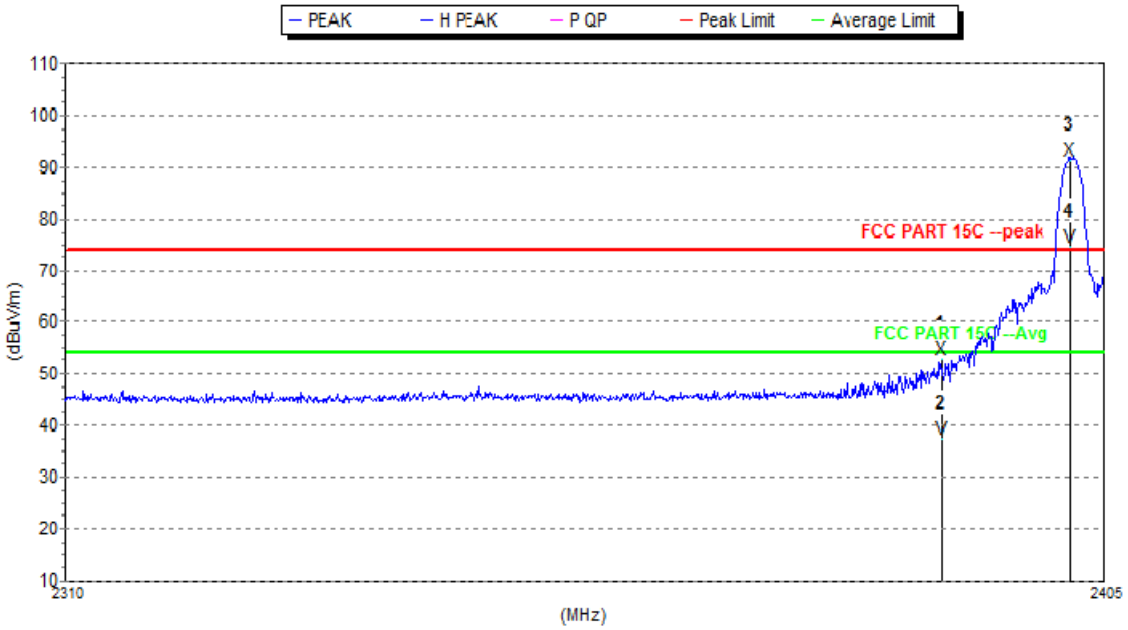


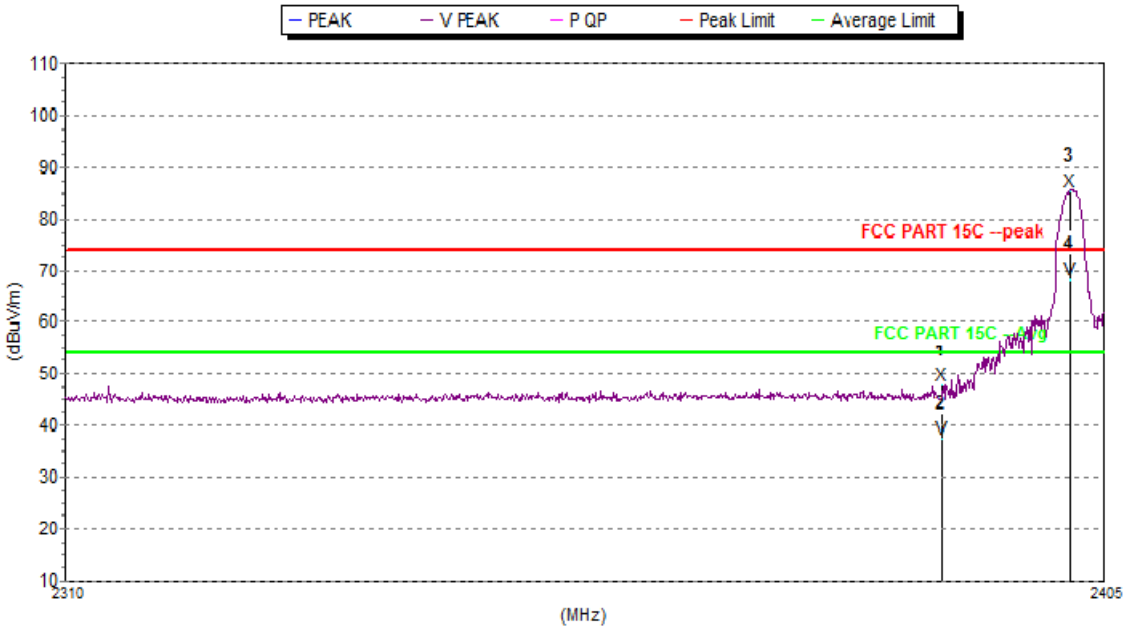

Figure 2. Above 1 GHz

| | |
|---|---|
| Test Procedure: | a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.<br>e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>g. 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<br>h. Test the EUT in the lowest channel , the Highest channel<br>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.<br>j. 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 Transmitting mode. |
| Final Test Mode: | Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case.<br>Only the worst case is recorded in the report. |
| Instruments Used: | Refer to section 5.10 for details |
| Test Results: | Pass |

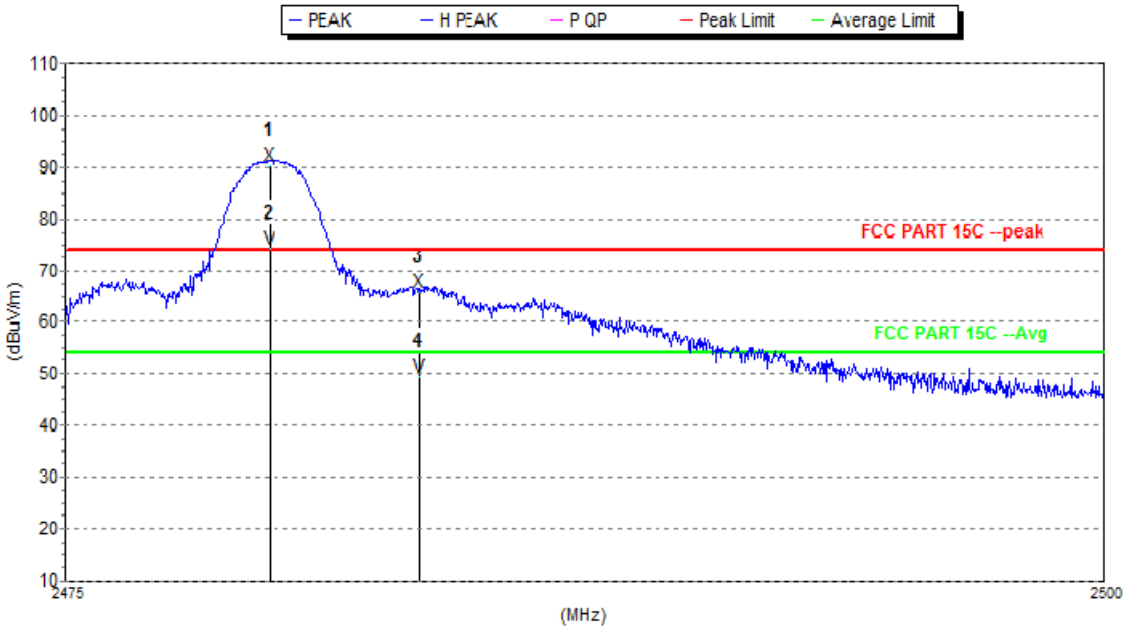
**Test plot as follows:**



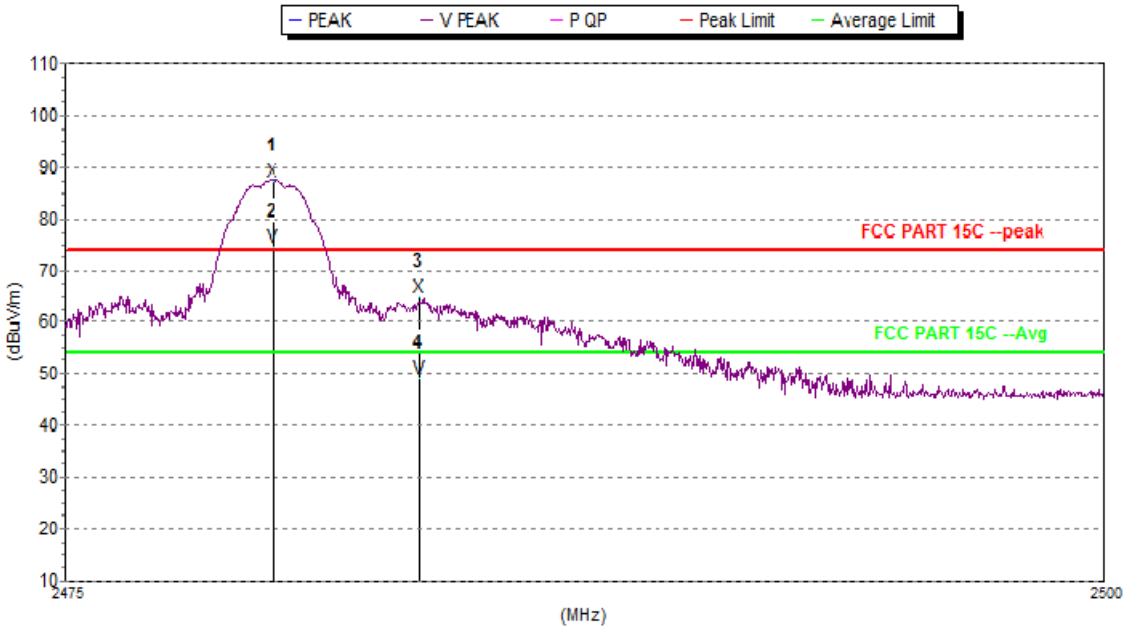

| Mk. | Freq.(MHz) | Level(dBuV/m) | Limit(dBuV/m) | Margin(dB) | Ant.F.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|---|---|---|---|---|---|---|---|---|
| Peak: | | | | | | | | |
| 1 | 2390 | 52.7 | 74.0 | 21.3 | 32.5 | 0.0 | -19.3 | H |
| 2 F | 2401.865 | 91.4 | 74.0 | -17.4 | 32.6 | 0.0 | -19.3 | H |
| Avg | | | | | | | | |
| 1 | 2390 | 37.3 | 54.0 | 16.7 | 32.5 | 0.0 | -19.3 | H |
| 2 F | 2401.865 | 74.6 | 54.0 | -20.6 | 32.6 | 0.0 | -19.3 | H |




| Mk. | Freq.(MHz) | Level(dBuV/m) | Limit(dBuV/m) | Margin(dB) | Ant.F.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|---|---|---|---|---|---|---|---|---|
| Peak: | | | | | | | | |
| 1 | 2390 | 47.7 | 74.0 | 26.3 | 32.5 | 0.0 | -19.3 | V |
| 2 F | 2401.960 | 85.4 | 74.0 | -11.4 | 32.6 | 0.0 | -19.3 | V |
| Avg | | | | | | | | |
| 1 | 2390 | 37.3 | 54.0 | 16.7 | 32.5 | 0.0 | -19.3 | V |
| 2 F | 2401.960 | 68.1 | 54.0 | -14.1 | 32.6 | 0.0 | -19.3 | V |




| Mk. | Freq.(MHz) | Level(dBuV/m) | Limit(dBuV/m) | Margin(dB) | Ant.F.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|---|---|---|---|---|---|---|---|---|
| Peak: | | | | | | | | |
| 1 F | 2479.925 | 90.2 | 74.0 | -16.2 | 32.5 | 0.0 | -19.1 | H |
| 2 | 2483.5 | 65.8 | 74.0 | 8.2 | 32.5 | 0.0 | -19.1 | H |
| Avg | | | | | | | | |
| 1 F | 2479.925 | 74.3 | 54.0 | -20.3 | 32.5 | 0.0 | -19.1 | H |
| 2 | 2483.5 | 49.6 | 54.0 | 4.4 | 32.5 | 0.0 | -19.1 | H |




| Mk. | Freq.(MHz) | Level(dBuV/m) | Limit(dBuV/m) | Margin(dB) | Ant.F.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|---|---|---|---|---|---|---|---|---|
| Peak: | | | | | | | | |
| 1 F | 2480.000 | 87.2 | 74.0 | -13.2 | 32.5 | 0.0 | -19.1 | V |
| 2 | 2483.5 | 64.8 | 74.0 | 9.2 | 32.5 | 0.0 | -19.1 | V |
| Avg | | | | | | | | |
| 1 F | 2480.000 | 74.5 | 54.0 | -20.5 | 32.5 | 0.0 | -19.1 | V |
| 2 | 2483.5 | 49.0 | 54.0 | 5.0 | 32.5 | 0.0 | -19.1 | V |

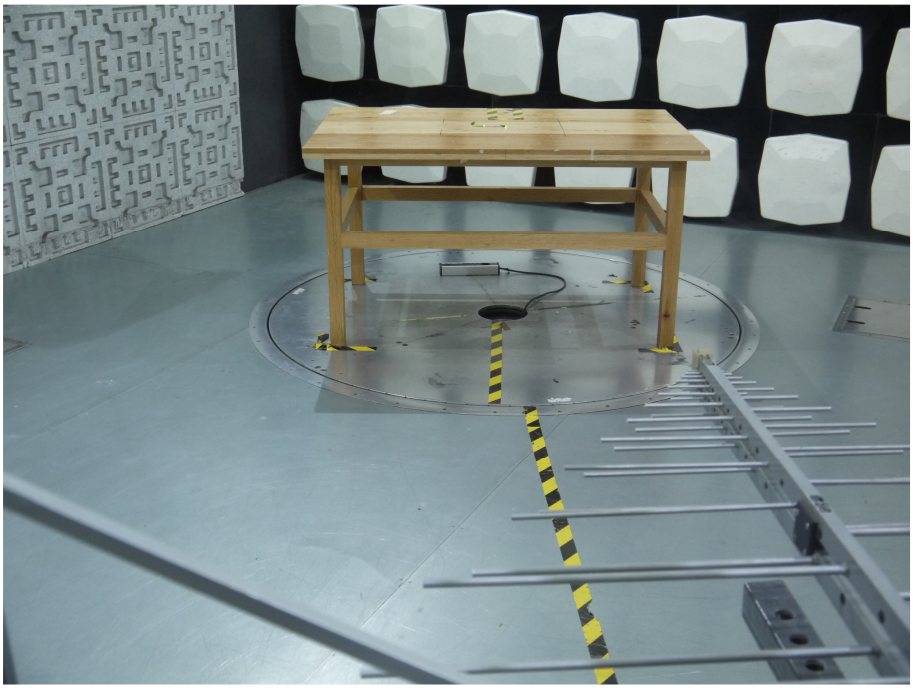
*Note:*
*The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:*

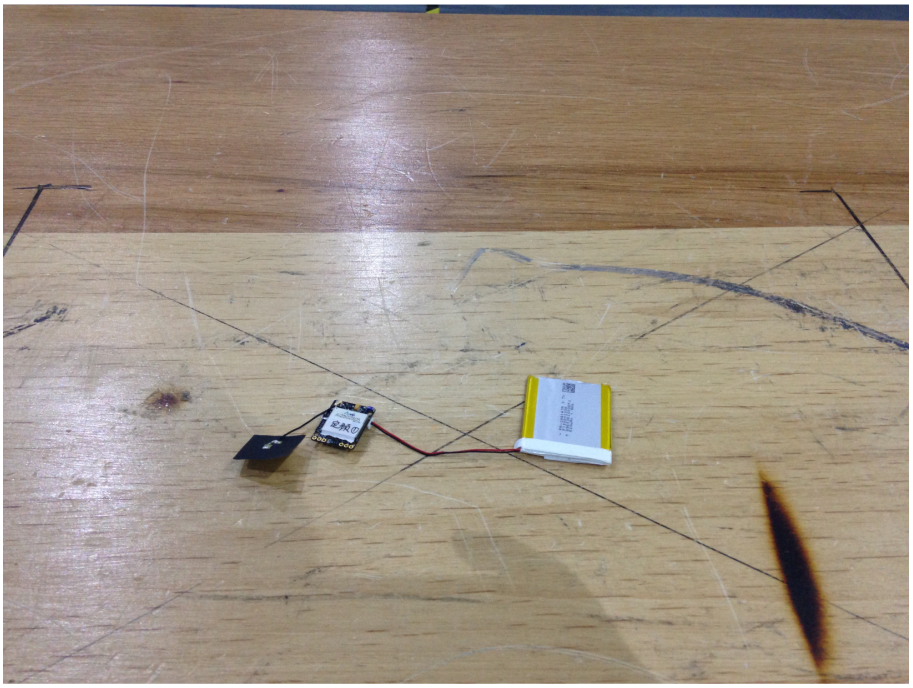
*Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor*

# 7 Photographs - EUT Test Setup

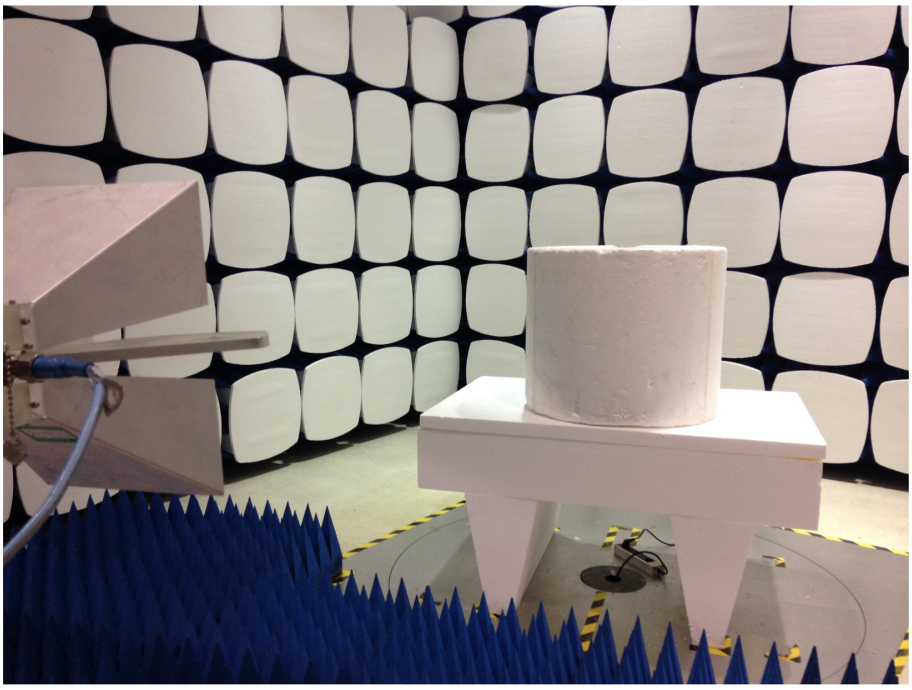
**Test model No.: Xadow GSM + BLE v1.0**

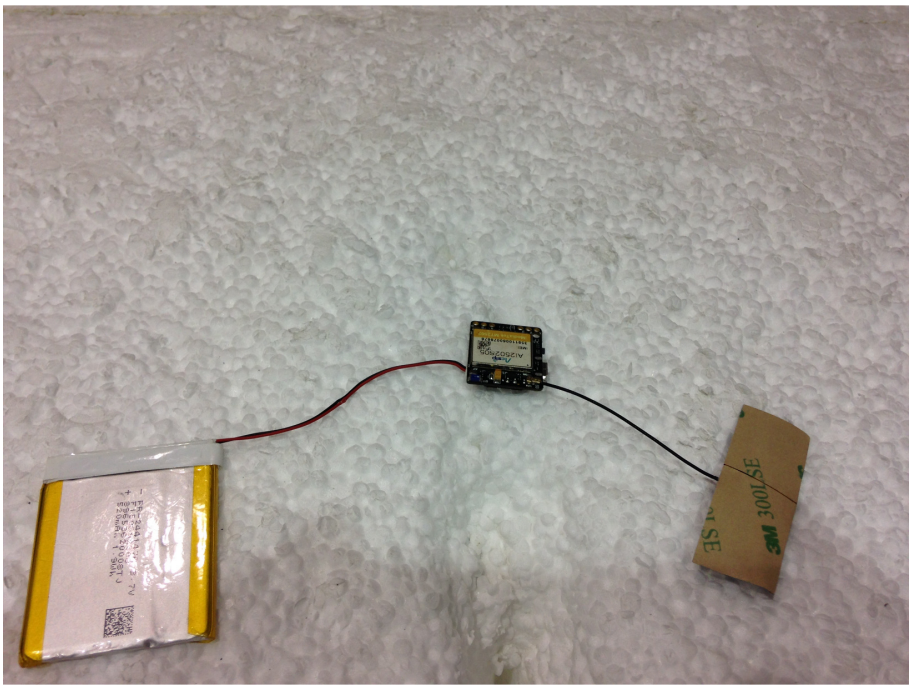
## 7.1 Radiated Emission





## 7.2 Radiated Spurious Emission





# 8 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1510006644CR.