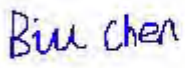
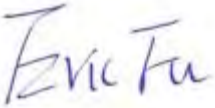
# TEST REPORT

| | |
|---|---|
| **Application No.:** | SZEM2005003583CR |
| **Applicant:** | Pushd Inc |
| **Address of Applicant:** | 50 ELDRIDGE STREET SUITE 5D New York NY 10002, United States |
| **Manufacturer:** | ShenZhen JOYHONG Technology CO., Ltd |
| **Address of Manufacturer:** | 5th Floor, Building 1, Zhongtai Road NO.18, Loucun Second Industrial Park, Xinhu Street, Guangming, Shenzhen, China |
| **Factory:** | ShenZhen JOYHONG Technology CO., Ltd |
| **Address of Factory:** | 5th Floor, Building 1, Zhongtai Road NO.18, Loucun Second Industrial Park, Xinhu Street, Guangming, Shenzhen, China |
| **Equipment Under Test (EUT):** | |
| **EUT Name:** | AURA Carver Frame |
| **Model No.:** | AF100 |
| **Trade Mark:** | AURA |
| **FCC ID:** | 2AI5H-W906 |
| **Standard(s) :** | 47 CFR Part 15, Subpart C 15.247 |
| **Date of Receipt:** | 2020-05-09 |
| **Date of Test:** | 2020-05-10 to 2020-05-22 |
| **Date of Issue:** | 2020-05-28 |
| **Test Result:** | **Pass*** |

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

Keny Xu
EMC Laboratory Manager

| Revision Record | | | | |
|---|---|---|---|---|
| **Version** | **Chapter** | **Date** | **Modifier** | **Remark** |
| 01 | | 2020-05-28 | | Original |
| | | | | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| **Authorized for issue by:** | | | | |
| | |  | | |
| | | **Bill Chen /Project Engineer** | | |
| | |  | | |
| | | **Eric Fu /Reviewer** | | |

# 2 Test Summary

| Radio Spectrum Technical Requirement | | | | |
|---|---|---|---|---|
| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
| Antenna Requirement | 47 CFR Part 15, Subpart C 15.247 | N/A | 47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4) | Pass |
| Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence | 47 CFR Part 15, Subpart C 15.247 | N/A | 47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h) | Pass |

| Radio Spectrum Matter Part | | | | |
|---|---|---|---|---|
| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
| Conducted Emissions at AC Power Line (150kHz-30MHz) | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.2 | 47 CFR Part 15, Subpart C 15.207 | Pass |
| Conducted Peak Output Power | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.5 | 47 CFR Part 15, Subpart C 15.247(b)(1) | Pass |
| 20dB Bandwidth | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.7 | 47 CFR Part 15, Subpart C 15.247(a)(1) | Pass |
| Carrier Frequencies Separation | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.2 | 47 CFR Part 15, Subpart C 15.247a(1) | Pass |
| Hopping Channel Number | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.3 | 47 CFR Part 15, Subpart C 15.247a(1)(iii) | Pass |
| Dwell Time | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.4 | 47 CFR Part 15, Subpart C 15.247a(1)(iii) | Pass |
| Conducted Band Edges Measurement | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.6 | 47 CFR Part 15, Subpart C 15.247(d) | Pass |
| Conducted Spurious Emissions | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.8 | 47 CFR Part 15, Subpart C 15.247(d) | Pass |
| Radiated Emissions which fall in the restricted bands | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.10.5 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |
| Radiated Spurious Emissions | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.4,6.5,6.6 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |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# 3 Contents




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# 4 General Information

## 4.1 Details of E.U.T.

| | |
|---|---|
| Power Supply: | AC/DC Adapter：<br>Model:SR-A3050200U2<br>Input:100-240VAC 50/60Hz 0.5A Max<br>Output：DC 5V 2A 10W |
| Cable: | DC cable:200cm unshielded<br>USB cable:11cm unshielded |
| Operation Frequency: | 2402MHz to 2480MHz |
| Bluetooth Version: | V4.2 Dual mode |
| Spectrum Spread Technology: | Frequency Hopping Spread Spectrum(FHSS) |
| Modulation Type: | GFSK, π/4DQPSK, 8DPSK |
| Number of Channels: | 79 |
| Channel Spacing: | 1MHz |
| Antenna Type: | Integral Antenna |
| Antenna Gain: | 2.01dBi |

**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:

| **Selected Test Channel** | |
|---|---|
| Channel | Frequency |
| The lowest channel (CH0) | 2402MHz |
| The middle channel (C39) | 2441MHz |
| The highest channel (CH78) | 2480MHz |

## 4.2 Description of Support Units

The EUT has been tested as an independent unit.

## 4.3 Measurement Uncertainty

| No. | Item | Measurement Uncertainty |
|---|---|---|
| 1 | Radio Frequency | ± 7.25 x $10^{-8}$ |
| 2 | Duty cycle | ± 0.37% |
| 3 | Occupied Bandwidth | ± 3% |
| 4 | Conduction emission | ± 3.0dB (150kHz to 30MHz) |
| 5 | RF conducted power | ± 0.75dB |
| 6 | RF power density | ± 2.84dB |
| 7 | Conducted Spurious emissions | ± 0.75dB |
| 8 | RF Radiated power | ± 4.5dB (Below 1GHz) |
| | | ± 4.8dB (Above 1GHz) |
| 9 | Radiated Spurious emission test | ± 4.5dB (Below 1GHz) |
| | | ± 4.8dB (Above 1GHz) |
| 10 | Temperature test | ± 1°C |
| 11 | Humidity test | ± 3% |
| 12 | Supply voltages | ± 1.5% |
| 13 | Time | ± 3% |

## 4.4 Test Location

All tests were performed at:

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

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

## 4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

**• A2LA (Certificate No. 3816.01)**

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

**• VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

**• FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

**• Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

## 4.6 Deviation from Standards

None

## 4.7 Abnormalities from Standard Conditions

None

# 5 Equipment List

| Conducted Emissions at AC Power Line (150kHz-30MHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Shielding Room | ZhongYu Electron | GB-88 | SEM001-06 | 2019-06-13 | 2022-06-12 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM024-01 | 2019-07-11 | 2020-07-10 |
| LISN | Rohde & Schwarz | ENV216 | SEM007-01 | 2019-09-24 | 2020-09-23 |
| LISN | ETS-LINDGREN | 3816/2 | SEM007-02 | 2020-04-01 | 2021-03-31 |
| EMI Test Receiver | Rohde & Schwarz | ESCI | SEM004-02 | 2020-03-24 | 2021-03-23 |

| RF Conducted | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Shielding Room | SAEMC | MSR733 | SEM001-09 | 2019-06-13 | 2022-06-12 |
| DC Power Supply | Rohde & Schwarz | NGSM 32/10 | SEM011-04 | 2020-03-24 | 2021-03-23 |
| Spectrum Analyzer | Rohde & Schwarz | FSP | SEM004-06 | 2019-09-24 | 2020-09-23 |
| Measurement Software | JS Tonscend | JS1120-2 BT/WIFI V2. | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM031-02 | 2019-07-11 | 2020-07-10 |
| Attenuator | Huber+Suhner | 6620_SMA-50-1 | SEM021-09 | N/A | N/A |
| Signal Generator | KEYSIGHT | N5173B | SEM006-05 | 2019-09-24 | 2020-09-23 |
| Power Meter | Rohde & Schwarz | NRVS | SEM014-02 | 2019-09-24 | 2020-09-23 |
| Electric and Magnetic Field Analyzer | Narda | EHP-50F | SEM022-05 | 2019-11-28 | 2020-11-27 |

| Radiated Emissions which fall in the restricted bands | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| 3m Semi-Anechoic Chamber | AUDIX | N/A | SEM001-02 | 2018-03-13 | 2021-03-12 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM026-01 | 2019-07-11 | 2020-07-10 |
| EXA Spectrum Analyzer | AgilentTechnologies Inc | N9010A | SEM004-12 | 2020-04-09 | 2021-04-08 |
| Horn Antenna | Rohde & Schwarz | HF907 | SEM003-07 | 2018-04-13 | 2021-04-12 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | SEM003-15 | 2017-10-17 | 2020-10-16 |
| Pre-Amplifier | Compliance Directions Systems Inc. | PAP-0126 | SEM004-11 | 2019-09-24 | 2020-09-23 |
| Pre-amplifier | Rohde & Schwarz | CH14-H052 | SEM005-17 | 2020-04-01 | 2021-03-31 |


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| | | | | | |
|---|---|---|---|---|---|
| Pre-amplifier | Compliance Directions Systems Inc. | PAP-2640-50 | SEM005-08 | 2020-04-01 | 2021-03-31 |
| DC Power Supply | Zhao Xin | KXN-6020D | SEM011-08 | 2019-09-24 | 2020-09-23 |
| Active Loop Antenna | ETS-Lindgren | 6502 | SEM003-08 | 2017-08-22 | 2020-08-21 |

| **RE in Chamber** | | | | | |
|---|---|---|---|---|---|
| **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal. Date** | **Cal. Due date** |
| 3m Semi-Anechoic Chamber | ETS-LINDGREN | N/A | SEM001-01 | 2017-08-05 | 2020-08-04 |
| MXE EMI receiver(3Hz-3.6GHz) | KEYSIGHT | N9038A | SEM004-15 | 2019-12-16 | 2020-12-15 |
| BiConiLog Antenna (26-3000MHz) | ETS-LINDGREN | 3142C | SEM003-01 | 2017-06-27 | 2020-06-26 |
| Pre-amplifier (0.1-1300MHz) | Agilent Technologies | 8447D | SEM005-01 | 2020-04-01 | 2021-03-31 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM025-01 | 2019-07-11 | 2020-07-10 |

| **RE in Chamber 2#** | | | | | |
|---|---|---|---|---|---|
| **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal. Date (yyyy-mm-dd)** | **Cal. Due date (yyyy-mm-dd)** |
| 3m Semi-Anechoic Chamber | AUDIX | N/A | SEM001-02 | 2018-03-13 | 2021-03-12 |
| EXA Signal Analyzer (10Hz-44GHz) | Agilent Technologies Inc | N9010A | SEM004-12 | 2020-04-09 | 2021-04-08 |
| BiConiLog Antenna (26-3000MHz) | ETS-Lindgren | 3142C | SEM003-01 | 2017-06-27 | 2020-06-26 |
| Horn Antenna (800MHz-18GHz) | Rohde & Schwarz | HF907 | SEM003-07 | 2018-04-13 | 2021-04-12 |
| Amplifier (0.1-1300MHz) | HP | 8447D | SEM005-02 | 2019-09-24 | 2020-09-23 |
| Pre-Amplifier (0.1-26.5GHz) | Compliance Directions Systems Inc. | PAP-0126 | SEM004-11 | 2019-09-24 | 2020-09-23 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM026-01 | 2019-07-11 | 2020-07-10 |


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| General used equipment | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Humidity/ Temperature Indicator | Shanghai Meteorological Industry Factory | ZJ1-2B | SEM002-03 | 2019-09-26 | 2020-09-25 |
| Humidity/ Temperature Indicator | Shanghai Meteorological Industry Factory | ZJ1-2B | SEM002-04 | 2019-09-26 | 2020-09-25 |
| Humidity/ Temperature Indicator | Mingle | N/A | SEM002-08 | 2019-09-26 | 2020-09-25 |
| Barometer | Changchun Meteorological Industry Factory | DYM3 | SEM002-01 | 2020-04-07 | 2021-04-06 |


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# 6 Radio Spectrum Technical Requirement

## 6.1 Antenna Requirement

### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

### 6.1.2 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.01dBi.

Antenna location: Refer to internal photo.

## 6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

### 6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

### 6.2.2 Conclusion

Standard 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 Technical 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: 29 -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 Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g): According to Technical Specification, the 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 Technical specification, the 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.

The 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.

# 7 Radio Spectrum Matter Test Results

## 7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207
Test Method: ANSI C63.10 (2013) Section 6.2
Limit:

| Frequency of emission(MHz) | Conducted limit(dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |
| *Decreases with the logarithm of the frequency. | | |

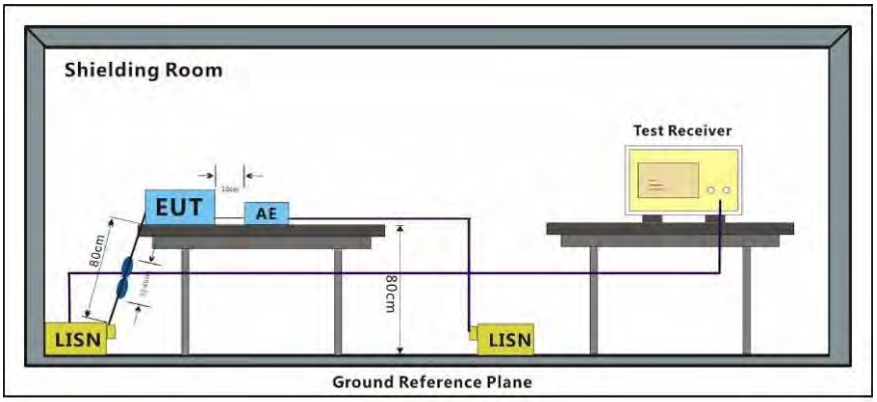
### 7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 55 % RH Atmospheric Pressure: 1010 mbar

Test mode b:TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.1.2 Test Setup Diagram




### 7.1.3 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

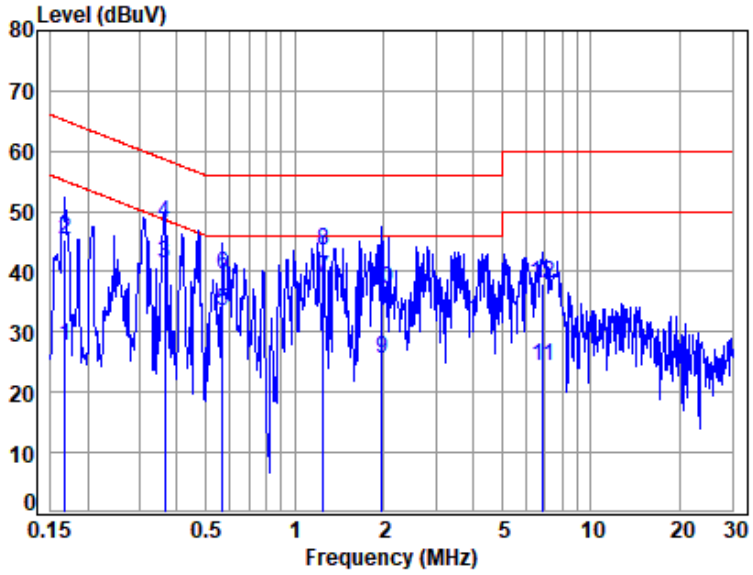
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor

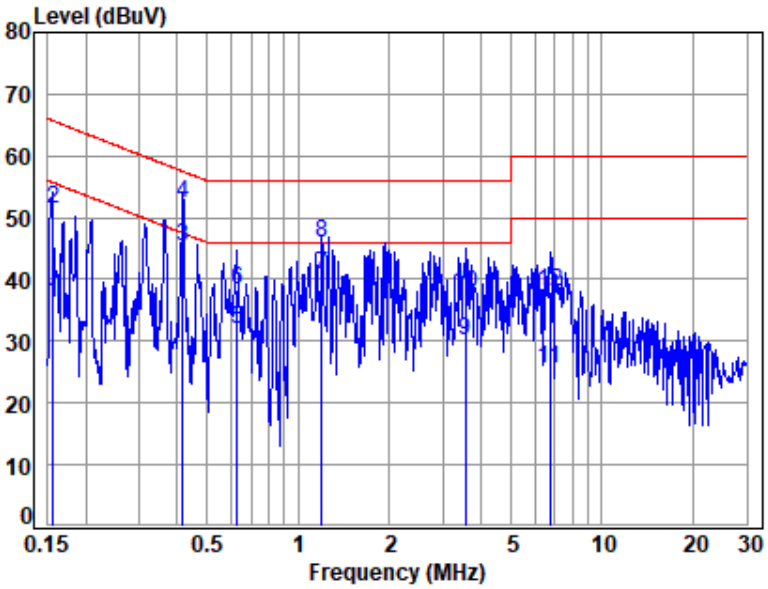
Mode:b; Line:Live Line




Condition: Line
Job No : 03583CR
Mode No : b

| | Freq | Cable Loss | LISN Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB | dBuV | dBuV | dBuV | dB | |
| 1 | 0.1677 | 0.01 | 9.66 | 18.07 | 27.74 | 55.08 | -27.34 | Average |
| 2 | 0.1677 | 0.01 | 9.66 | 35.62 | 45.29 | 65.08 | -19.79 | QP |
| 3 | 0.3634 | 0.05 | 9.67 | 31.67 | 41.39 | 48.65 | -7.26 | Average |
| 4 qp | 0.3634 | 0.05 | 9.67 | 38.30 | 48.02 | 58.65 | -10.63 | QP |
| 5 | 0.5701 | 0.07 | 9.67 | 23.66 | 33.40 | 46.00 | -12.60 | Average |
| 6 | 0.5701 | 0.07 | 9.67 | 29.70 | 39.44 | 56.00 | -16.56 | QP |
| 7 pp | 1.2488 | 0.11 | 9.73 | 29.13 | 38.97 | 46.00 | -7.03 | Average |
| 8 | 1.2488 | 0.11 | 9.73 | 33.59 | 43.43 | 56.00 | -12.57 | QP |
| 9 | 1.9697 | 0.16 | 9.72 | 15.68 | 25.56 | 46.00 | -20.44 | Average |
| 10 | 1.9697 | 0.16 | 9.72 | 27.10 | 36.98 | 56.00 | -19.02 | QP |
| 11 | 6.8776 | 0.17 | 9.78 | 14.46 | 24.41 | 50.00 | -25.59 | Average |
| 12 | 6.8776 | 0.17 | 9.78 | 28.20 | 38.15 | 60.00 | -21.85 | QP |

Mode:b; Line:Neutral Line




Condition: Neutral
Job No : 03583CR
Mode No : b

| | | Freq | Cable Loss | LISN Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dB | dB | dBuV | dBuV | dBuV | dB | |
| 1 | | 0.1557 | 0.01 | 9.63 | 26.68 | 36.32 | 55.69 | -19.37 | Average |
| 2 | | 0.1557 | 0.01 | 9.63 | 41.77 | 51.41 | 65.69 | -14.28 | QP |
| 3 | pp | 0.4171 | 0.05 | 9.65 | 35.73 | 45.43 | 47.51 | -2.08 | Average |
| 4 | qp | 0.4171 | 0.05 | 9.65 | 42.53 | 52.23 | 57.51 | -5.28 | QP |
| 5 | | 0.6305 | 0.07 | 9.64 | 22.24 | 31.95 | 46.00 | -14.05 | Average |
| 6 | | 0.6305 | 0.07 | 9.64 | 28.56 | 38.27 | 56.00 | -17.73 | QP |
| 7 | | 1.1970 | 0.11 | 9.70 | 30.99 | 40.80 | 46.00 | -5.20 | Average |
| 8 | | 1.1970 | 0.11 | 9.70 | 36.10 | 45.91 | 56.00 | -10.09 | QP |
| 9 | | 3.5466 | 0.16 | 9.69 | 20.27 | 30.12 | 46.00 | -15.88 | Average |
| 10 | | 3.5466 | 0.16 | 9.69 | 27.97 | 37.82 | 56.00 | -18.18 | QP |
| 11 | | 6.7333 | 0.17 | 9.75 | 15.63 | 25.55 | 50.00 | -24.45 | Average |
| 12 | | 6.7333 | 0.17 | 9.75 | 28.15 | 38.07 | 60.00 | -21.93 | QP |

## 7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(1)
Test Method: ANSI C63.10 (2013) Section 7.8.5
Limit: ≤20.97dBm

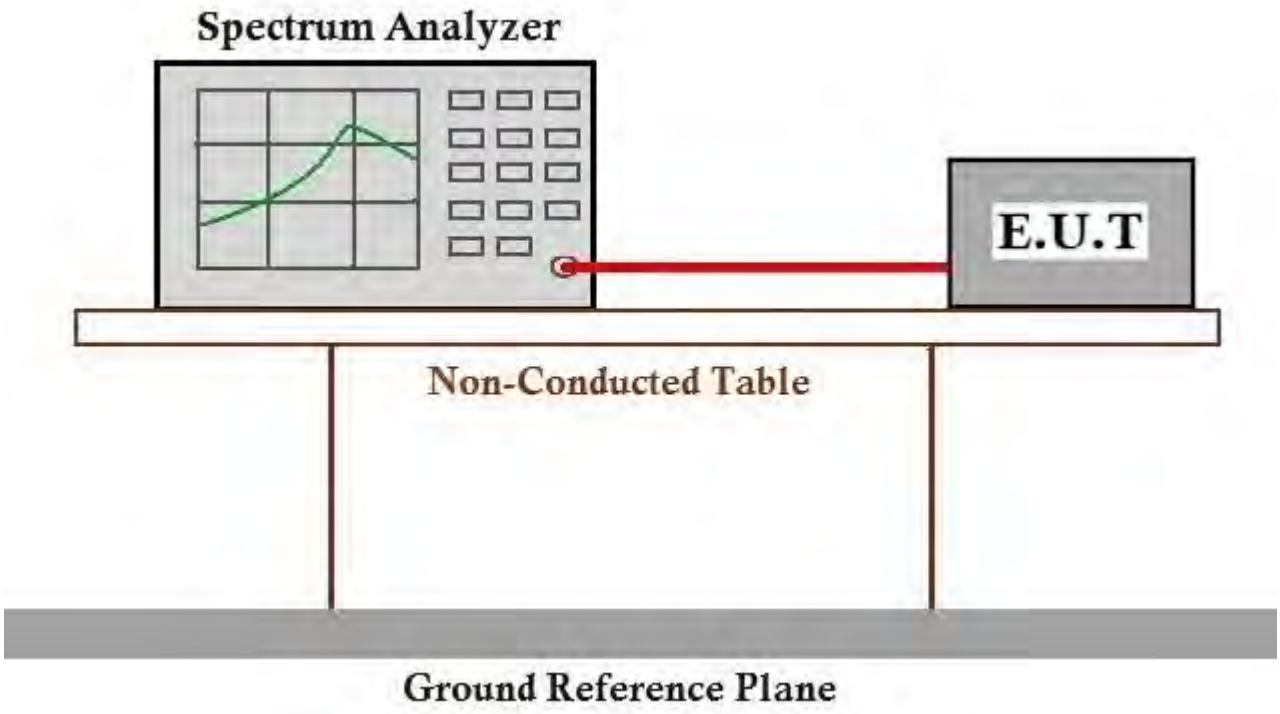
### 7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 28.9 °C Humidity: 46.1 % RH Atmospheric Pressure: 1005 mbar

Test mode b:TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.2.2 Test Setup Diagram




### 7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.3 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)

Test Method: ANSI C63.10 (2013) Section 7.8.7

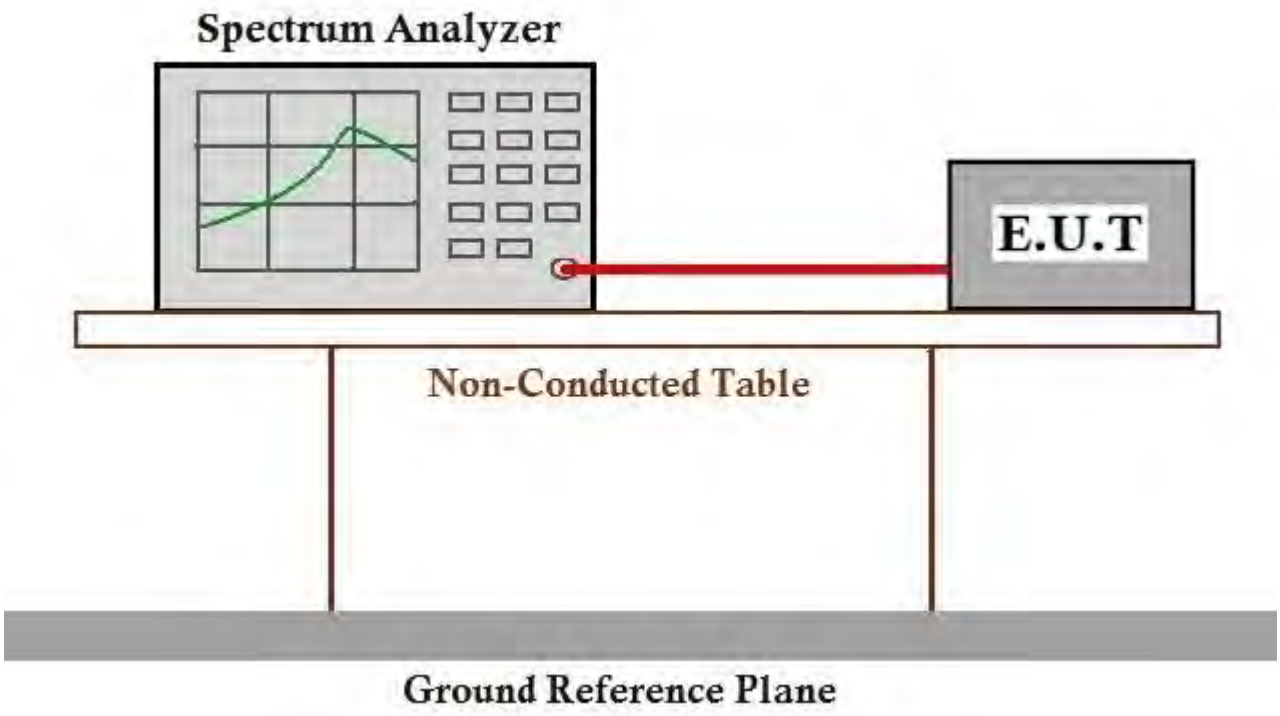
### 7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 28.9 °C Humidity: 46.1 % RH Atmospheric Pressure: 1005 mbar

Test mode b:TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.3.2 Test Setup Diagram




### 7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.4 Carrier Frequencies Separation

| | |
|---|---|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247a(1) |
| Test Method: | ANSI C63.10 (2013) Section 7.8.2 |
| Limit: | 2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W |

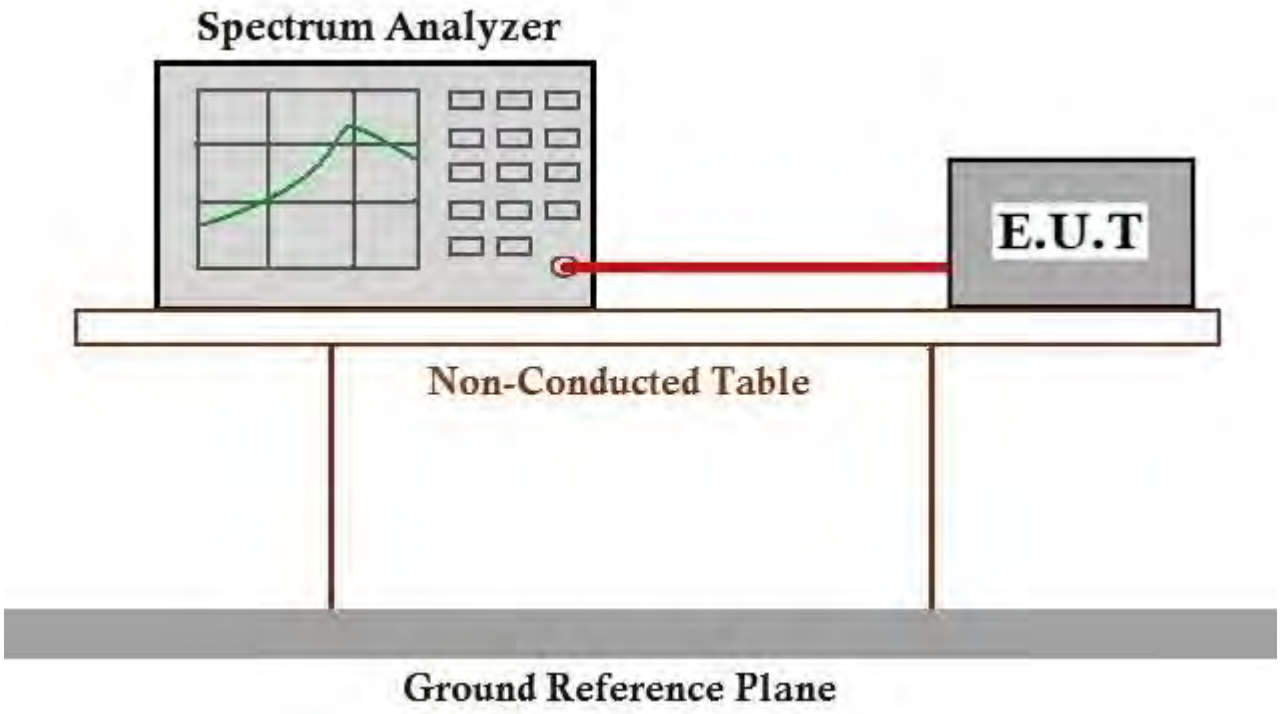
### 7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 28.9 °C Humidity: 46.1 % RH Atmospheric Pressure: 1005 mbar

Test mode a:TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.4.2 Test Setup Diagram




### 7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.5 Hopping Channel Number

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)

Test Method: ANSI C63.10 (2013) Section 7.8.3

Limit:

| Frequency range(MHz) | Number of hopping channels (minimum) |
|---|---|
| 902-928 | 50 for 20dB bandwidth <250kHz |
| | 25 for 20dB bandwidth ≥250kHz |
| 2400-2483.5 | 15 |
| 5725-5850 | 75 |

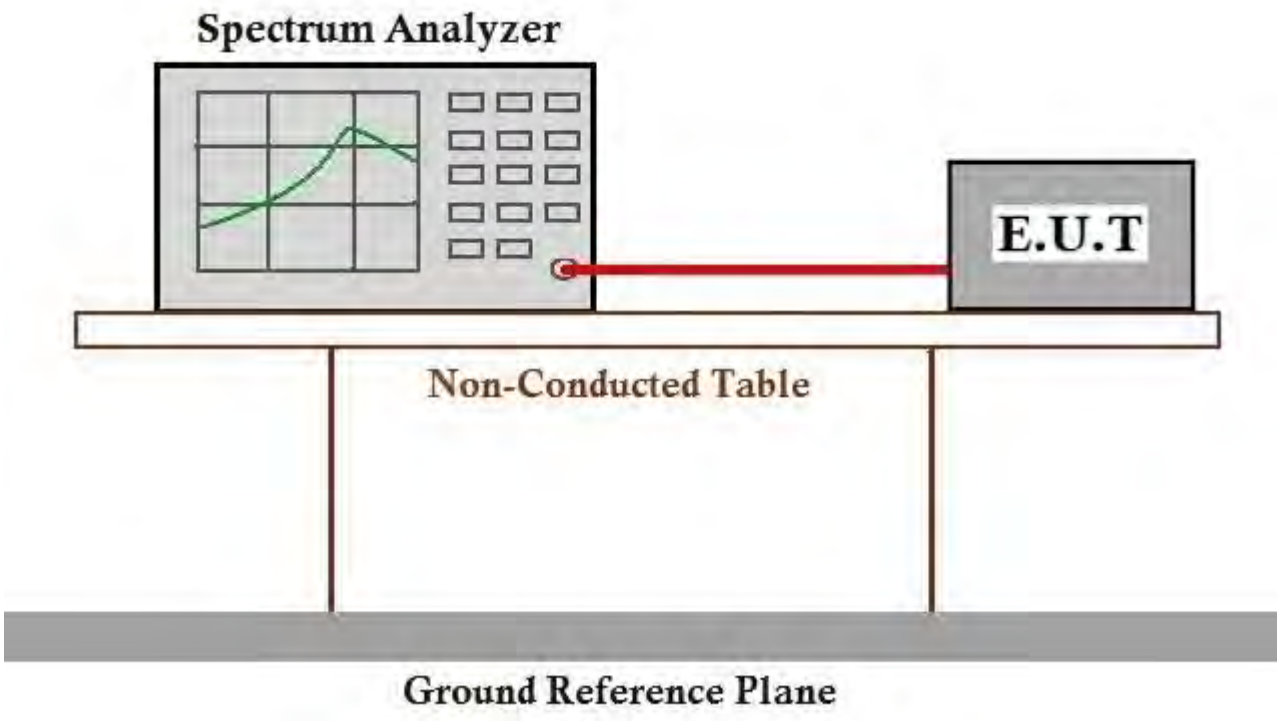
### 7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 28.9 °C Humidity: 46.1 % RH Atmospheric Pressure: 1005 mbar

Test mode a:TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.5.2 Test Setup Diagram




### 7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.6 Dwell Time

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10 (2013) Section 7.8.4
Limit:

| Frequency(MHz) | Limit |
|---|---|
| 902-928 | 0.4S within a 20S period(20dB bandwidth<250kHz) |
| | 0.4S within a 10S period(20dB bandwidth≥250kHz) |
| 2400-2483.5 | 0.4S within a period of 0.4S multiplied by the number of hopping channels |
| 5725-5850 | 0.4S within a 30S period |

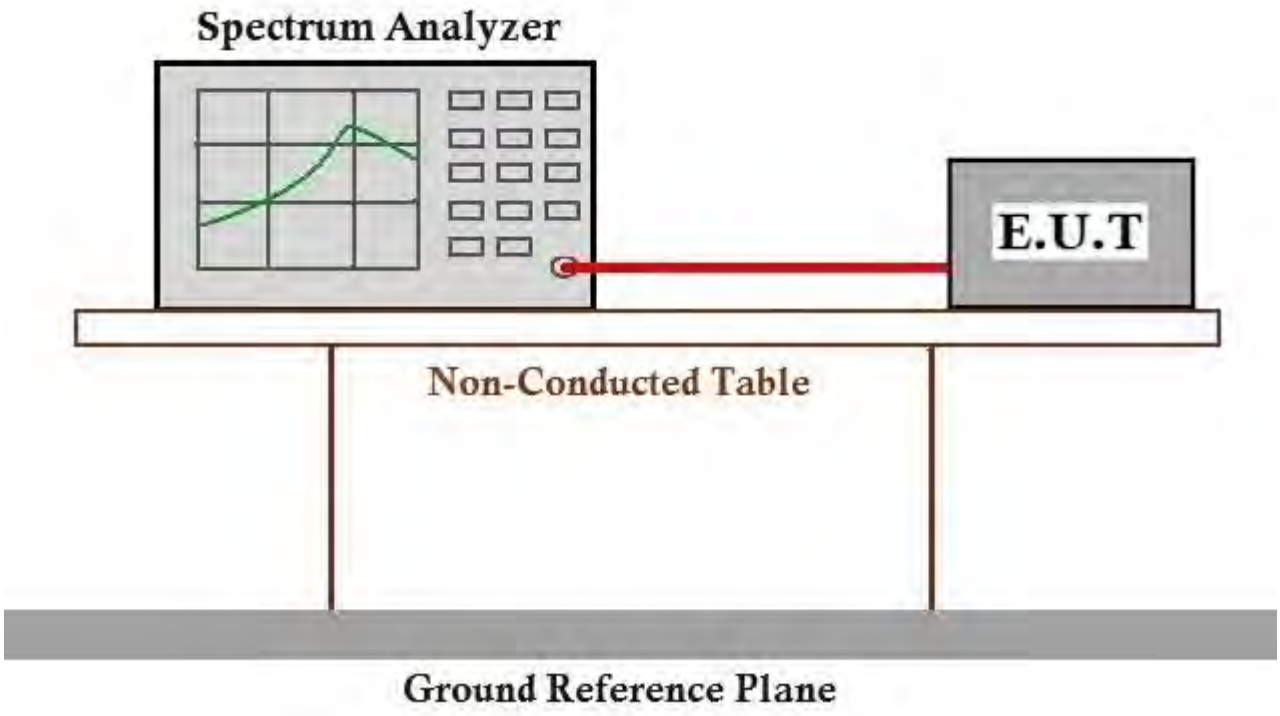
### 7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 28.9 °C Humidity: 46.1 % RH Atmospheric Pressure: 1005 mbar

Test mode a:TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.6.2 Test Setup Diagram




### 7.6.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.7 Conducted Band Edges Measurement

| | |
|---|---|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247(d) |
| Test Method: | ANSI C63.10 (2013) Section 7.8.6 |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) |

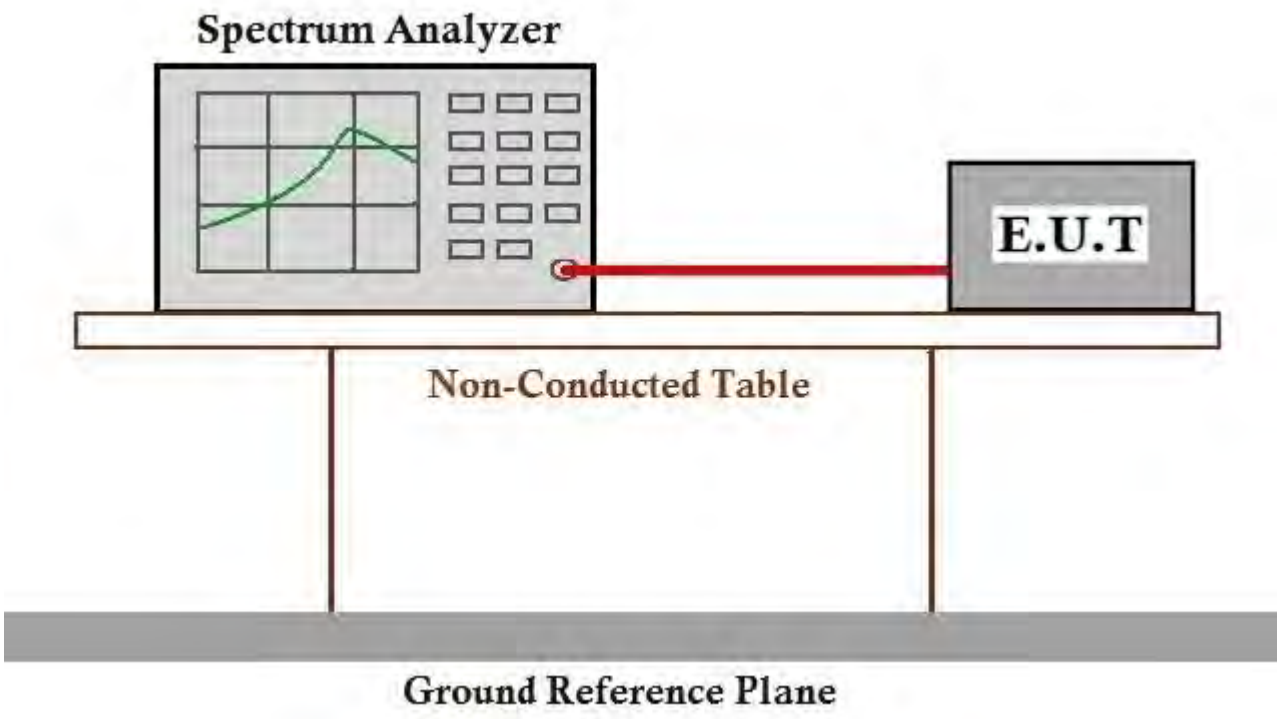
### 7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 28.9 °C Humidity: 46.1 % RH Atmospheric Pressure: 1005 mbar

| | |
|---|---|
| Pretest these modes to find the worst case: | a:TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report. |
| | b:TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report. |
| The worst case for final test: | a:TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report. |
| | b:TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report. |

### 7.7.2 Test Setup Diagram




### 7.7.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.8 Conducted Spurious Emissions

| | |
|---|---|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247(d) |
| Test Method: | ANSI C63.10 (2013) Section 7.8.8 |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) |

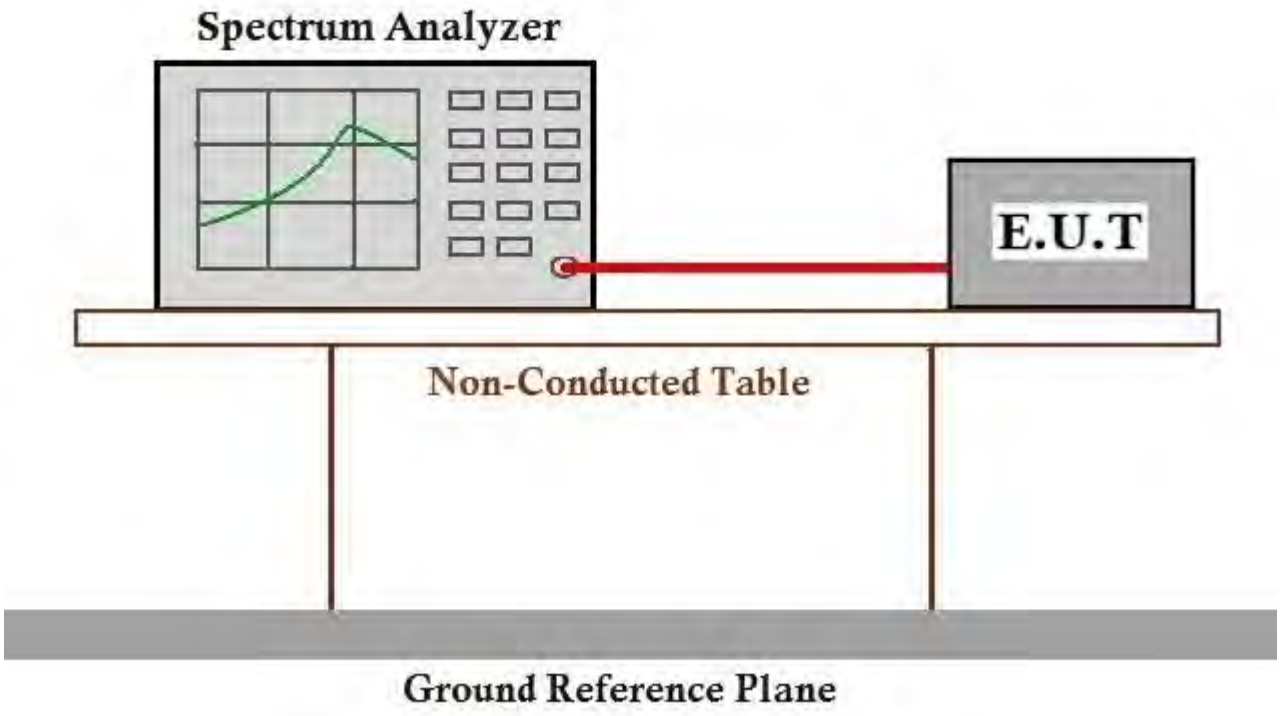
### 7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 28.9 °C Humidity: 46.1 % RH Atmospheric Pressure: 1005 mbar

Test mode b:TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.8.2 Test Setup Diagram




### 7.8.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.9 Radiated Emissions which fall in the restricted bands

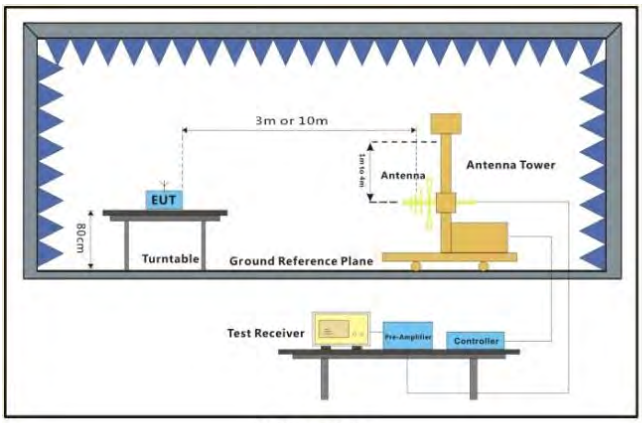
Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m
Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |
| Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. | | |

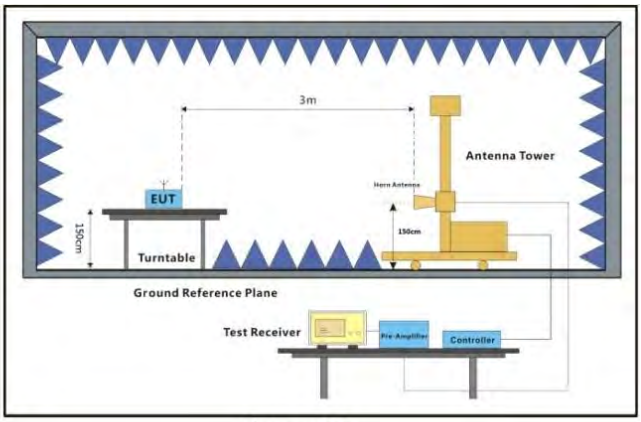
### 7.9.1 E.U.T. Operation

Operating Environment:
Temperature: 22.6 °C Humidity: 50.8 % RH Atmospheric Pressure: 1010 mbar
Test mode b:TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.9.2 Test Setup Diagram




30MHz-1GHz




Above 1GHz

### 7.9.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

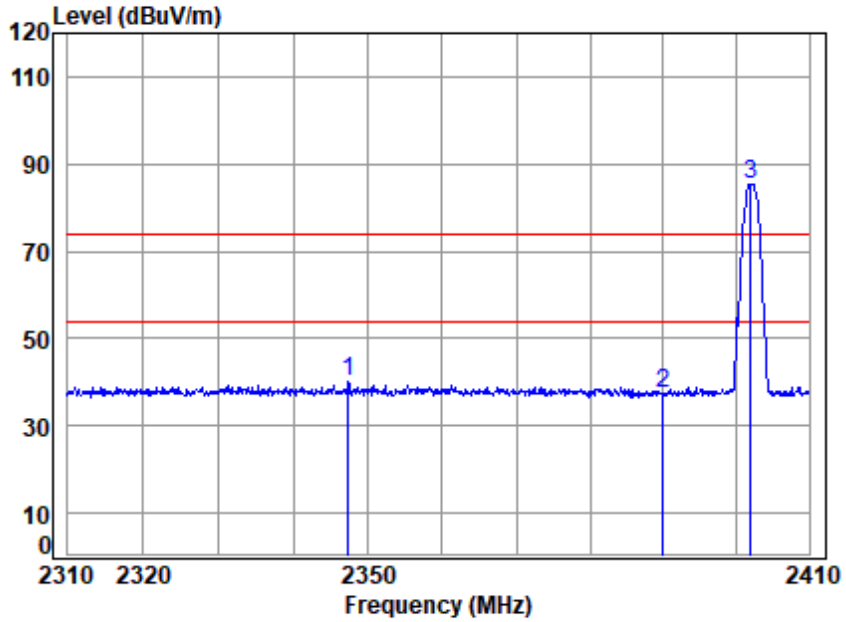
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

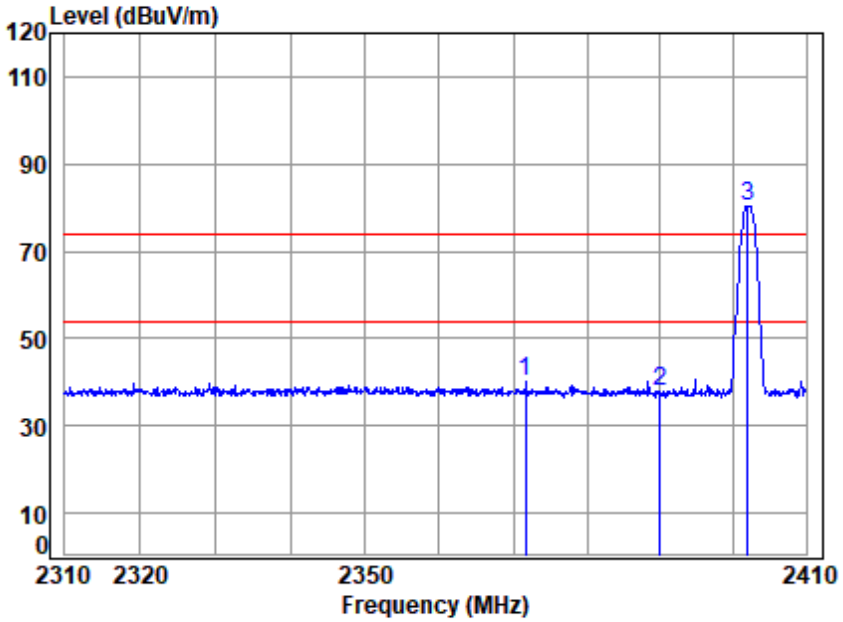
Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low




Site : chamber
Condition: 3m HORIZONTAL
Job No : 03583CR
Mode : 2402 Band edge
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 2347.402 | 3.97 | 28.45 | 40.95 | 48.52 | 39.99 | 74.00 | -34.01 | peak |
| 2 | 2390.000 | 3.69 | 28.52 | 40.97 | 46.22 | 37.46 | 74.00 | -36.54 | peak |
| 3 * | 2402.000 | 3.63 | 28.54 | 40.98 | 94.32 | 85.51 | 74.00 | 11.51 | peak |

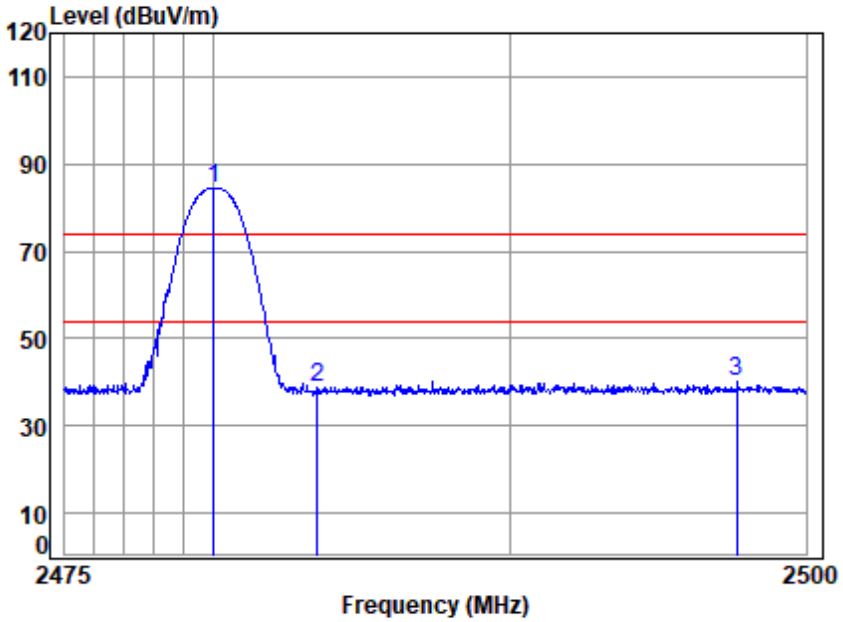
Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:Low




Site : chamber
Condition: 3m VERTICAL
Job No : 03583CR
Mode : 2402 Band edge
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 2371.701 | 3.81 | 28.49 | 40.96 | 48.77 | 40.11 | 74.00 | -33.89 | peak |
| 2 | 2390.000 | 3.69 | 28.52 | 40.97 | 46.69 | 37.93 | 74.00 | -36.07 | peak |
| 3 * | 2402.000 | 3.63 | 28.54 | 40.98 | 89.13 | 80.32 | 74.00 | 6.32 | peak |

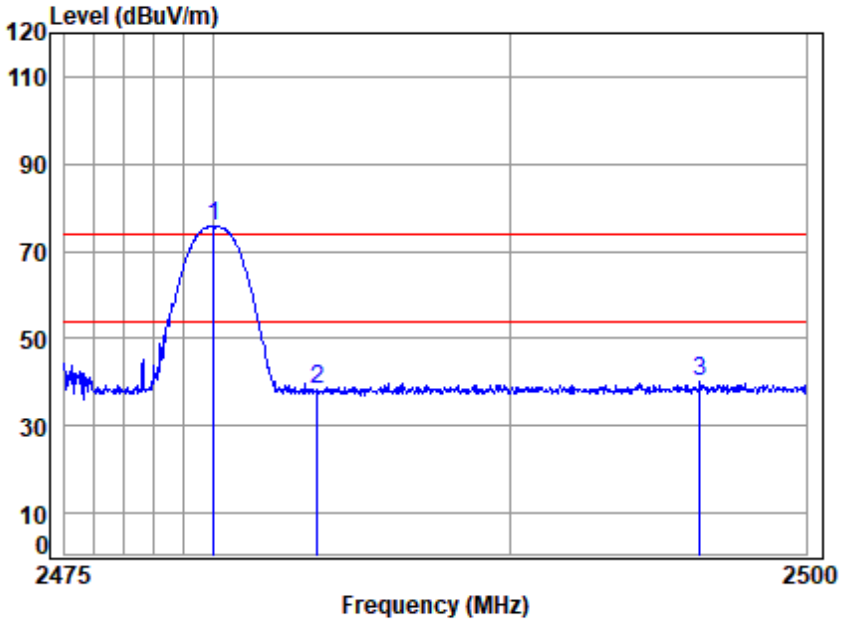
Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:High




Site : chamber
Condition: 3m HORIZONTAL
Job No : 03583CR
Mode : 2480 Band edge
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 * | 2480.000 | 3.99 | 28.67 | 41.01 | 92.71 | 84.36 | 74.00 | 10.36 | peak |
| 2 | 2483.500 | 4.01 | 28.67 | 41.01 | 47.24 | 38.91 | 74.00 | -35.09 | peak |
| 3 | 2497.664 | 4.07 | 28.70 | 41.02 | 48.60 | 40.35 | 74.00 | -33.65 | peak |

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




Site : chamber
Condition: 3m VERTICAL
Job No : 03583CR
Mode : 2480 Band edge
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 * | 2480.000 | 3.99 | 28.67 | 41.01 | 83.98 | 75.63 | 74.00 | 1.63 | peak |
| 2 | 2483.500 | 4.01 | 28.67 | 41.01 | 46.71 | 38.38 | 74.00 | -35.62 | peak |
| 3 | 2496.410 | 4.06 | 28.69 | 41.02 | 48.41 | 40.14 | 74.00 | -33.86 | peak |

## 7.10 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
Measurement Distance: 3m
Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |
| Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. | | |

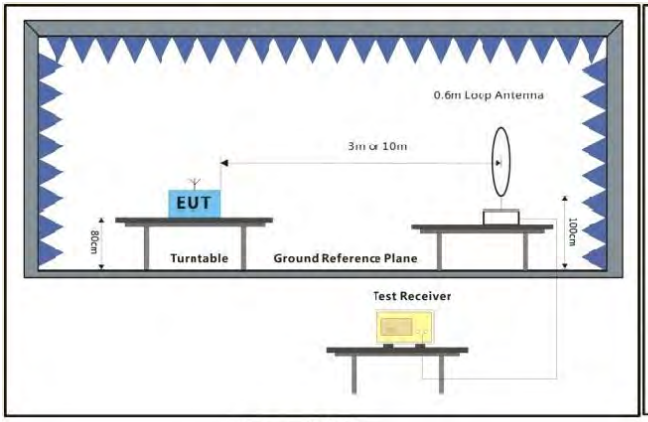
### 7.10.1 E.U.T. Operation

Operating Environment:

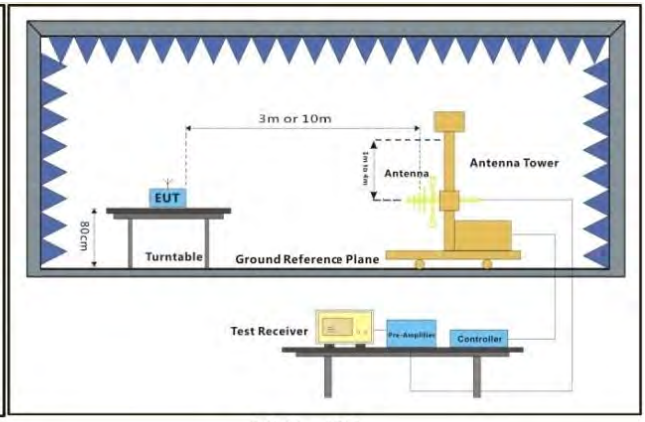
Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1010 mbar

Test mode b:TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

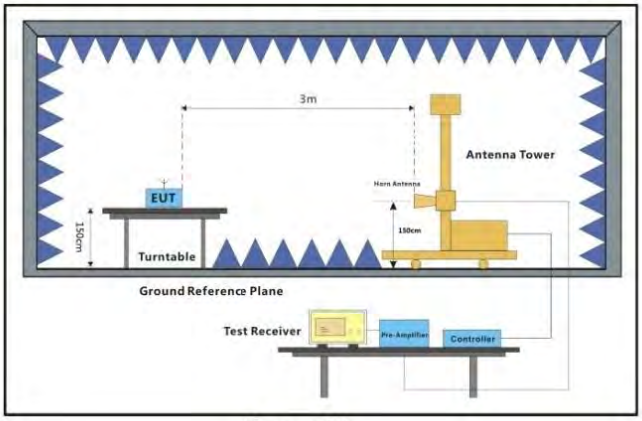
### 7.10.2 Test Setup Diagram




Below 30MHz




30MHz-1GHz




Above 1GHz

### 7.10.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark:

1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

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

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

3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.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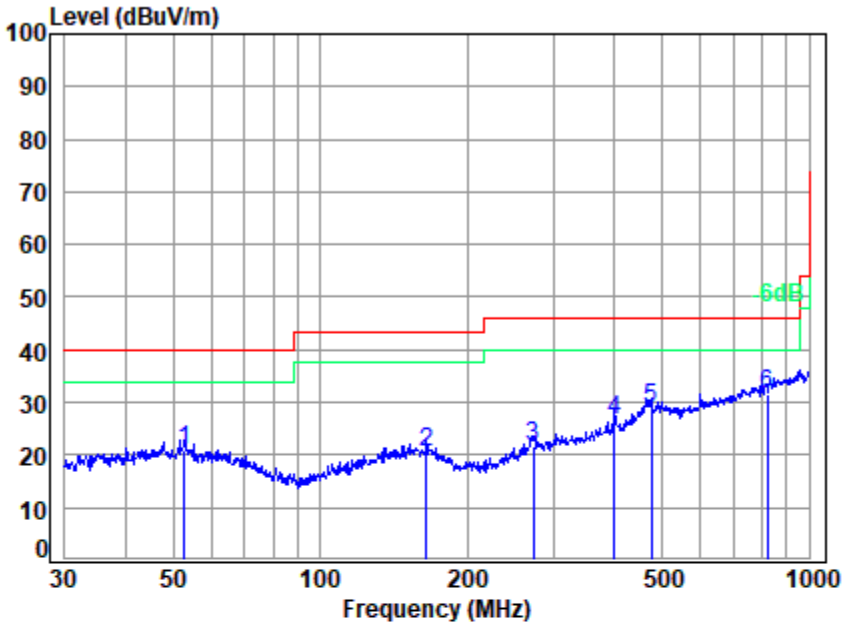
**Below 1GHz**

Mode: b; Polarization: Horizontal




Condition: 3m HORIZONTAL
Job No : 03583CR
Mode : b

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 52.760 | 1.24 | 19.82 | 25.86 | 25.77 | 20.97 | 40.00 | -19.03 | QP |
| 2 | 164.908 | 1.80 | 19.20 | 25.48 | 25.18 | 20.70 | 43.50 | -22.80 | QP |
| 3 | 272.278 | 2.22 | 18.79 | 25.16 | 25.78 | 21.63 | 46.00 | -24.37 | QP |
| 4 | 400.432 | 2.61 | 21.81 | 25.81 | 27.99 | 26.60 | 46.00 | -19.40 | QP |
| 5 | 475.499 | 2.86 | 23.46 | 26.23 | 28.64 | 28.73 | 46.00 | -17.27 | QP |
| 6 pp | 821.710 | 3.78 | 28.61 | 26.53 | 25.62 | 31.48 | 46.00 | -14.52 | QP |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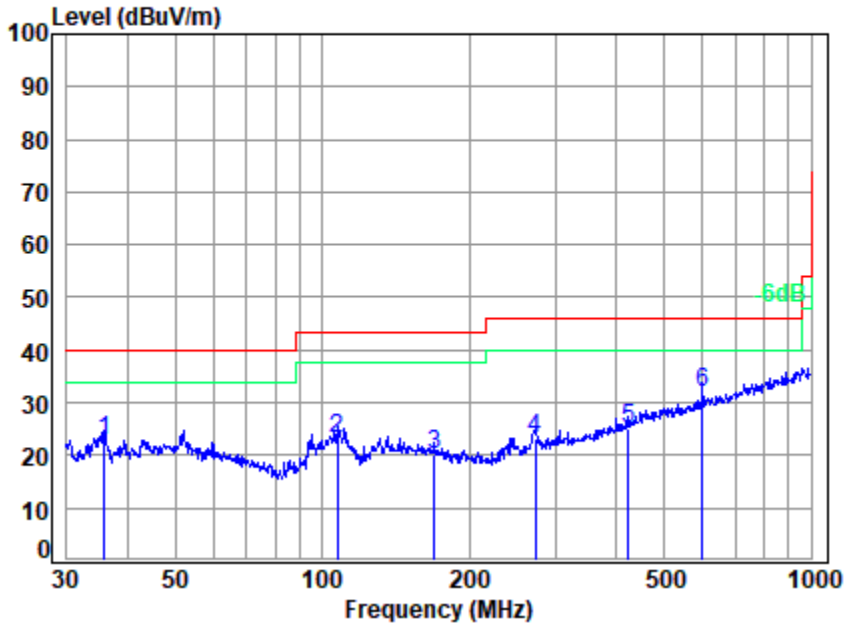
Mode: b; Polarization: Vertical

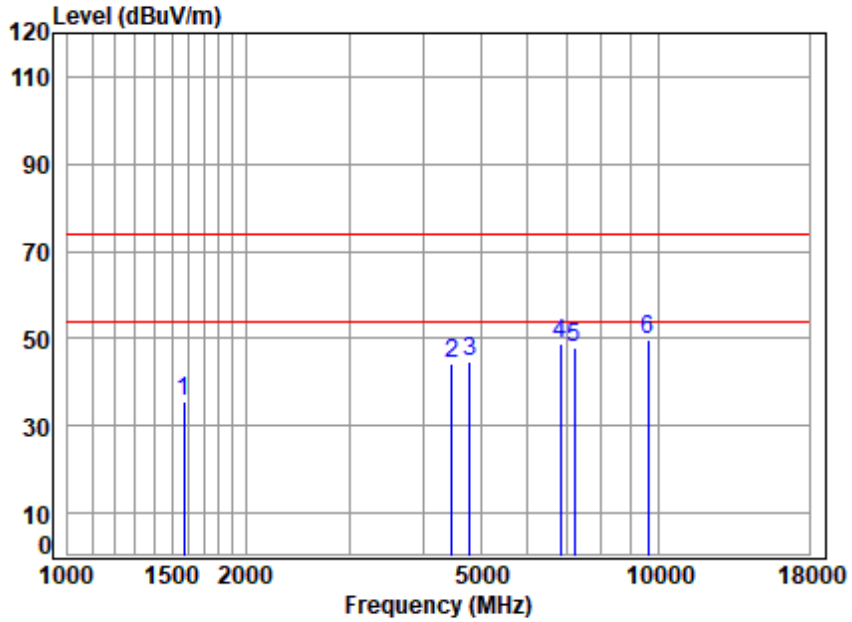



Condition: 3m VERTICAL
Job No : 03583CR
Mode : b

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 35.875 | 1.15 | 18.78 | 25.89 | 28.82 | 22.86 | 40.00 | -17.14 | QP |
| 2 | 107.510 | 1.52 | 15.89 | 25.75 | 31.66 | 23.32 | 43.50 | -20.18 | QP |
| 3 | 169.599 | 1.82 | 19.02 | 25.46 | 24.93 | 20.31 | 43.50 | -23.19 | QP |
| 4 | 272.278 | 2.22 | 18.79 | 25.16 | 27.36 | 23.21 | 46.00 | -22.79 | QP |
| 5 | 423.540 | 2.64 | 22.33 | 25.95 | 26.19 | 25.21 | 46.00 | -20.79 | QP |
| 6 pp | 599.321 | 3.17 | 25.88 | 26.80 | 29.51 | 31.76 | 46.00 | -14.24 | QP |

**Above 1GHz**

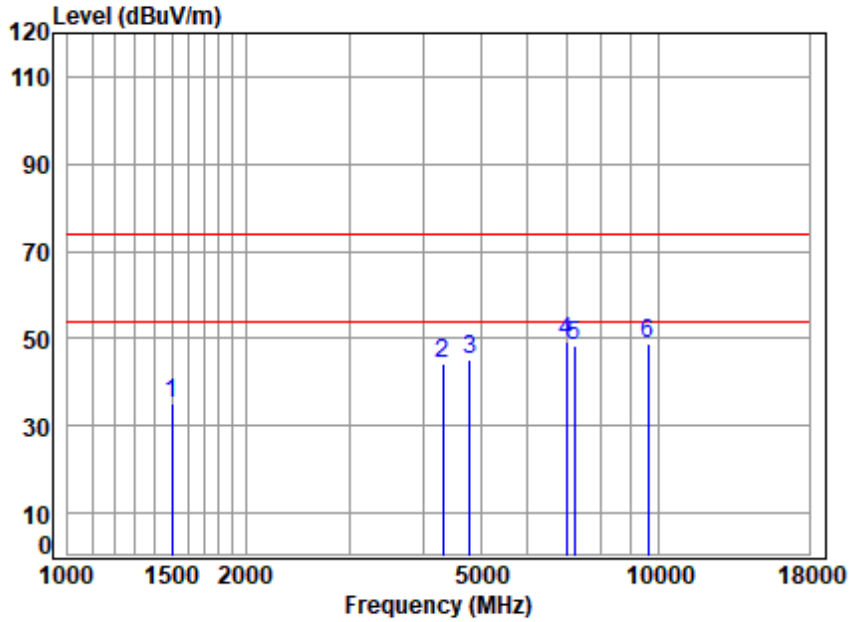
Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low




Site : chamber
Condition: 3m HORIZONTAL
Job No : 03583CR
Mode : 2402 TX SE
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 1574.265 | 2.96 | 26.14 | 40.55 | 47.00 | 35.55 | 74.00 | -38.45 | peak |
| 2 | 4469.214 | 6.47 | 33.55 | 42.53 | 46.93 | 44.42 | 74.00 | -29.58 | peak |
| 3 | 4804.000 | 6.80 | 33.97 | 42.77 | 46.70 | 44.70 | 74.00 | -29.30 | peak |
| 4 | 6815.551 | 7.96 | 35.79 | 41.78 | 46.97 | 48.94 | 74.00 | -25.06 | peak |
| 5 | 7206.000 | 8.44 | 36.07 | 41.58 | 45.13 | 48.06 | 74.00 | -25.94 | peak |
| 6 | 9608.000 | 9.17 | 37.67 | 38.57 | 41.57 | 49.84 | 74.00 | -24.16 | peak |

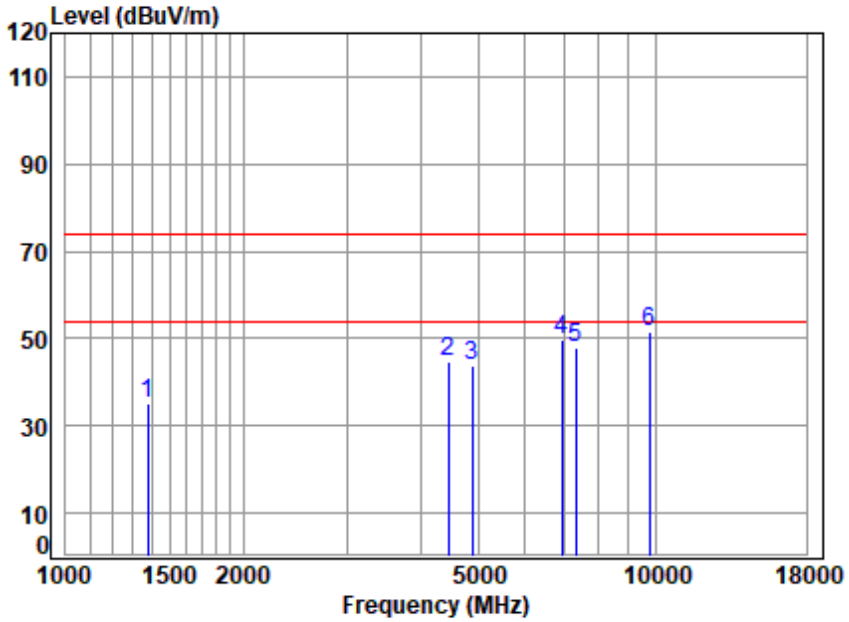
Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:Low




Site : chamber
Condition: 3m VERTICAL
Job No : 03583CR
Mode : 2402 TX SE
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 1503.119 | 2.99 | 25.81 | 40.51 | 47.07 | 35.36 | 74.00 | -38.64 | peak |
| 2 | 4316.859 | 6.37 | 33.28 | 42.41 | 47.24 | 44.48 | 74.00 | -29.52 | peak |
| 3 | 4804.000 | 6.80 | 33.97 | 42.77 | 47.20 | 45.20 | 74.00 | -28.80 | peak |
| 4 | 6974.982 | 7.81 | 35.89 | 41.70 | 47.45 | 49.45 | 74.00 | -24.55 | peak |
| 5 | 7206.000 | 8.44 | 36.07 | 41.58 | 45.61 | 48.54 | 74.00 | -25.46 | peak |
| 6 | 9608.000 | 9.17 | 37.67 | 38.57 | 40.72 | 48.99 | 74.00 | -25.01 | peak |

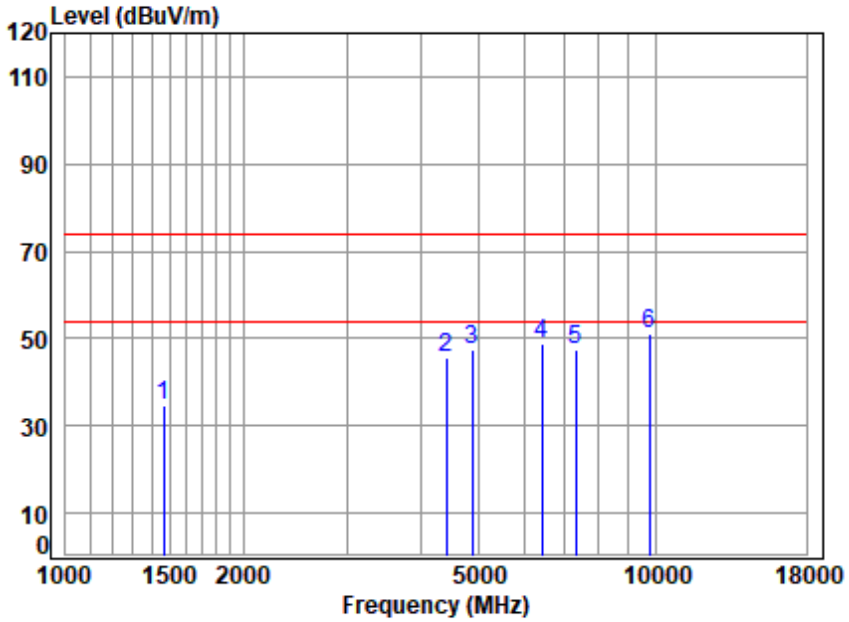
Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle




Site : chamber
Condition: 3m HORIZONTAL
Job No : 03583CR
Mode : 2441 TX SE
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 1378.273 | 2.48 | 25.34 | 40.42 | 47.56 | 34.96 | 74.00 | -39.04 | peak |
| 2 | 4456.315 | 6.51 | 33.53 | 42.52 | 47.31 | 44.83 | 74.00 | -29.17 | peak |
| 3 | 4882.000 | 7.03 | 34.06 | 42.82 | 45.75 | 44.02 | 74.00 | -29.98 | peak |
| 4 | 6934.778 | 7.82 | 35.86 | 41.72 | 47.86 | 49.82 | 74.00 | -24.18 | peak |
| 5 | 7323.000 | 8.36 | 36.16 | 41.52 | 44.77 | 47.77 | 74.00 | -26.23 | peak |
| 6 | 9764.000 | 9.30 | 37.76 | 38.34 | 42.86 | 51.58 | 74.00 | -22.42 | peak |

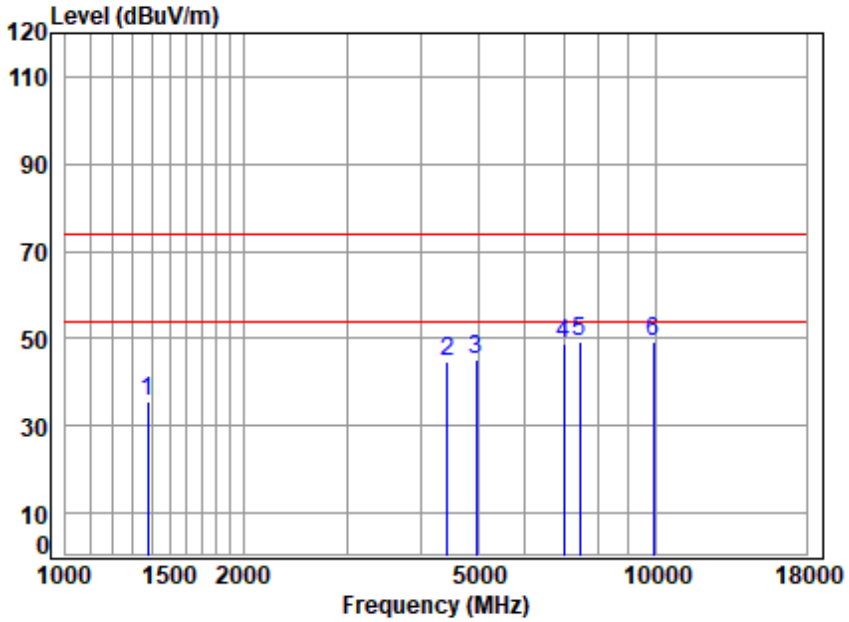
Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:middle




Site : chamber
Condition: 3m VERTICAL
Job No : 03583CR
Mode : 2441 TX SE
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 1468.761 | 2.80 | 25.69 | 40.48 | 46.53 | 34.54 | 74.00 | -39.46 | peak |
| 2 | 4417.841 | 6.63 | 33.46 | 42.49 | 47.86 | 45.46 | 74.00 | -28.54 | peak |
| 3 | 4882.000 | 7.03 | 34.06 | 42.82 | 49.10 | 47.37 | 74.00 | -26.63 | peak |
| 4 | 6414.167 | 7.63 | 35.52 | 42.00 | 47.82 | 48.97 | 74.00 | -25.03 | peak |
| 5 | 7323.000 | 8.36 | 36.16 | 41.52 | 44.50 | 47.50 | 74.00 | -26.50 | peak |
| 6 | 9764.000 | 9.30 | 37.76 | 38.34 | 42.39 | 51.11 | 74.00 | -22.89 | peak |

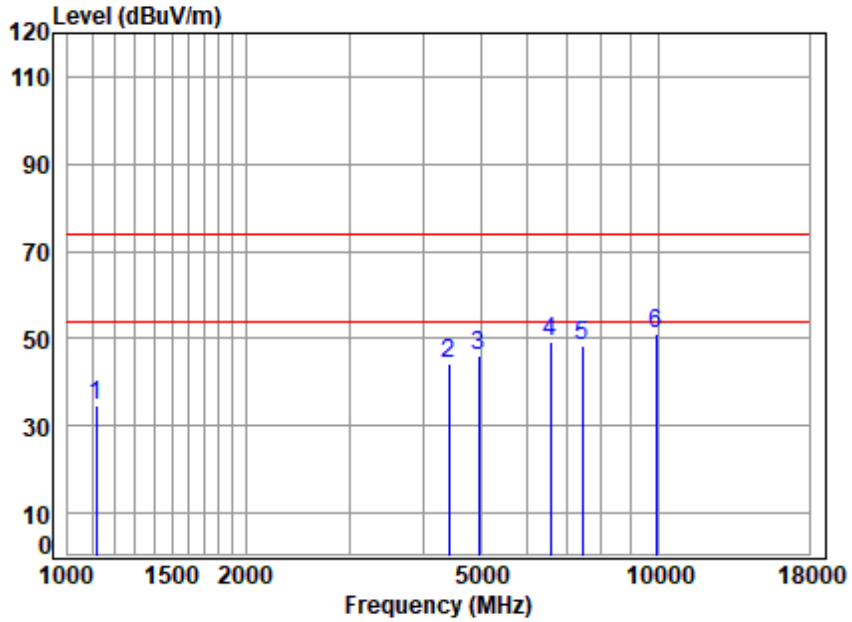
Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:High




Site : chamber
Condition: 3m HORIZONTAL
Job No : 03583CR
Mode : 2480 TX SE
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 1378.273 | 2.48 | 25.34 | 40.42 | 47.97 | 35.37 | 74.00 | -38.63 | peak |
| 2 | 4443.453 | 6.55 | 33.50 | 42.51 | 47.13 | 44.67 | 74.00 | -29.33 | peak |
| 3 | 4960.000 | 7.02 | 34.15 | 42.87 | 46.71 | 45.01 | 74.00 | -28.99 | peak |
| 4 | 6974.982 | 7.81 | 35.89 | 41.70 | 46.86 | 48.86 | 74.00 | -25.14 | peak |
| 5 | 7440.000 | 8.10 | 36.25 | 41.46 | 46.44 | 49.33 | 74.00 | -24.67 | peak |
| 6 | 9920.000 | 8.96 | 37.85 | 38.12 | 40.54 | 49.23 | 74.00 | -24.77 | peak |

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




Site : chamber
Condition: 3m VERTICAL
Job No : 03583CR
Mode : 2480 TX SE
Note : BT

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 1119.323 | 2.28 | 24.21 | 40.21 | 48.47 | 34.75 | 74.00 | -39.25 | peak |
| 2 | 4417.841 | 6.63 | 33.46 | 42.49 | 46.71 | 44.31 | 74.00 | -29.69 | peak |
| 3 | 4960.000 | 7.02 | 34.15 | 42.87 | 47.63 | 45.93 | 74.00 | -28.07 | peak |
| 4 | 6564.209 | 7.79 | 35.64 | 41.92 | 47.66 | 49.17 | 74.00 | -24.83 | peak |
| 5 | 7440.000 | 8.10 | 36.25 | 41.46 | 45.41 | 48.30 | 74.00 | -25.70 | peak |
| 6 | 9920.000 | 8.96 | 37.85 | 38.12 | 42.36 | 51.05 | 74.00 | -22.95 | peak |

# 8 Photographs

## 8.1 Test Setup

Please refer to setup photos.

## 8.2 EUT Constructional Details (EUT Photos)

Please Refer to external and internal photos for details.

# 9 Appendix

## 9.1 Appendix 15.247

1. Bandwidth

1.1 Test Result

| Test Mode | Frequency (MHz) | TX Type | ANT No. | 20dB Bandwidth | Verdict |
|---|---|---|---|---|---|
| | | | | Test Result (MHz) | |
| GFSK | 2402 | SISO | 1 | 1.000 | PASS |
| | 2441 | SISO | 1 | 1.002 | PASS |
| | 2480 | SISO | 1 | 0.986 | PASS |
| Pi/4DQPSK | 2402 | SISO | 1 | 1.358 | PASS |
| | 2441 | SISO | 1 | 1.358 | PASS |
| | 2480 | SISO | 1 | 1.361 | PASS |
| 8DPSK | 2402 | SISO | 1 | 1.317 | PASS |
| | 2441 | SISO | 1 | 1.318 | PASS |
| | 2480 | SISO | 1 | 1.321 | PASS |

| Test Mode | Frequency (MHz) | TX Type | ANT No. | 99% Occupied Bandwidth | |
|---|---|---|---|---|---|
| | | | | Test Result (MHz) | |
| GFSK | 2402 | SISO | 1 | 0.908 | Only for Report Use |
| | 2441 | SISO | 1 | 0.917 | Only for Report Use |
| | 2480 | SISO | 1 | 0.910 | Only for Report Use |
| Pi/4DQPSK | 2402 | SISO | 1 | 1.205 | Only for Report Use |
| | 2441 | SISO | 1 | 1.204 | Only for Report Use |
| | 2480 | SISO | 1 | 1.205 | Only for Report Use |
| 8DPSK | 2402 | SISO | 1 | 1.213 | Only for Report Use |
| | 2441 | SISO | 1 | 1.213 | Only for Report Use |
| | 2480 | SISO | 1 | 1.214 | Only for Report Use |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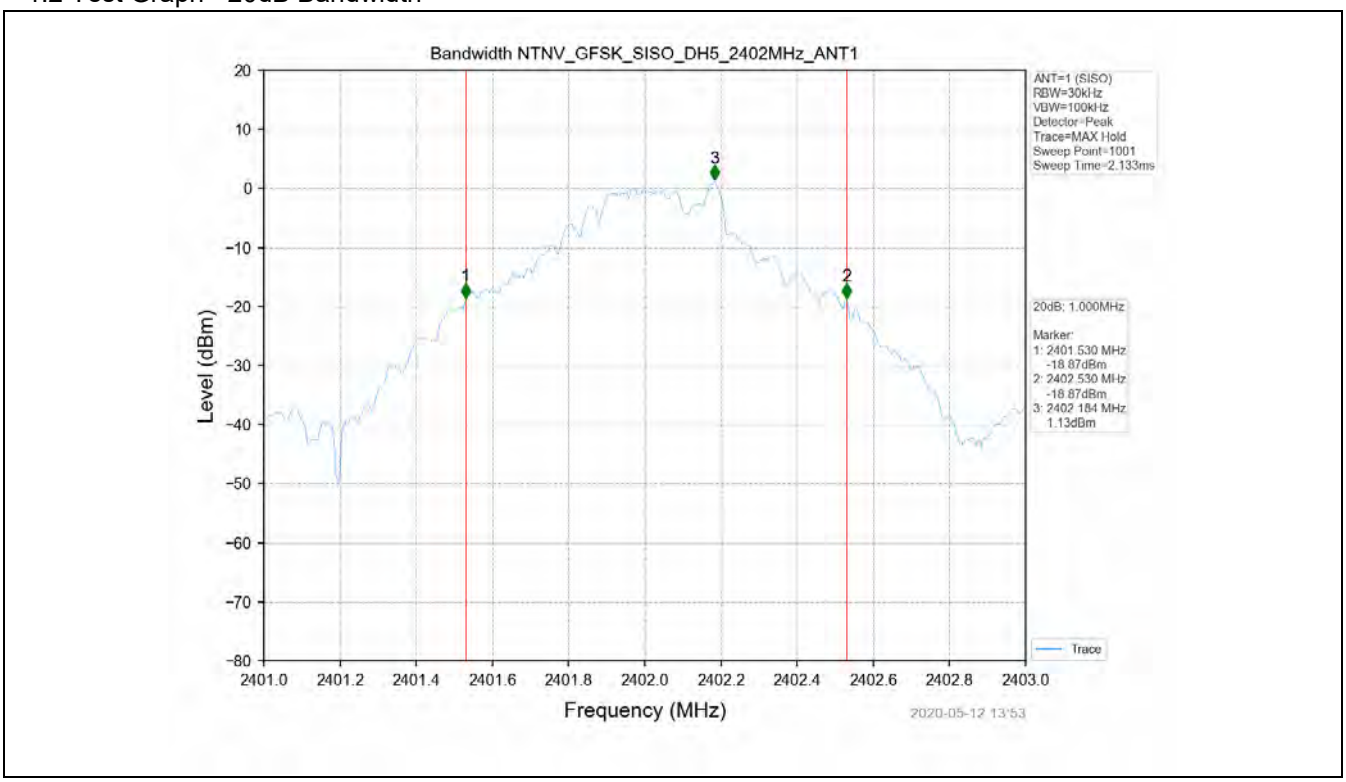
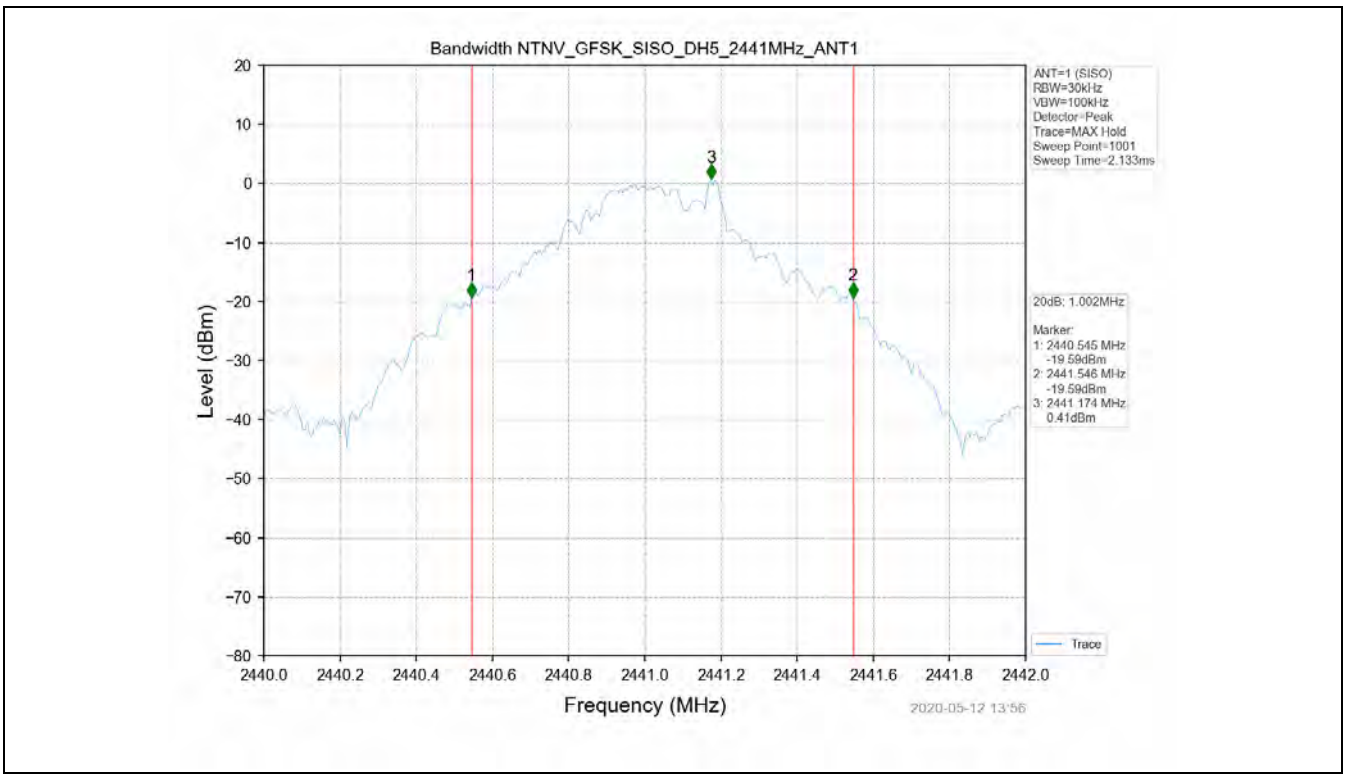
1.2 Test Graph - 20dB Bandwidth





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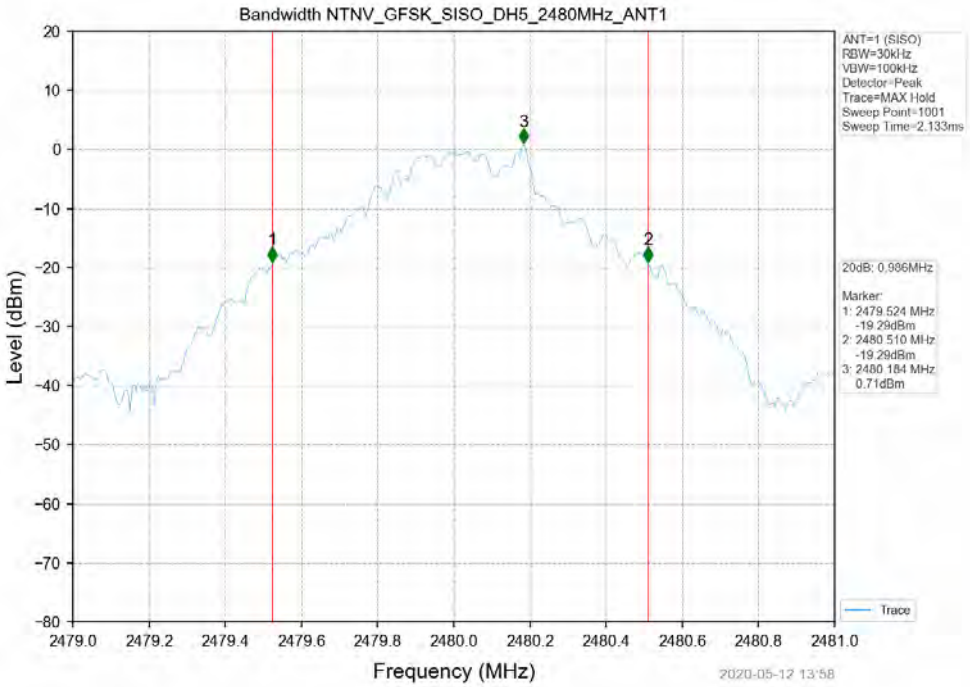
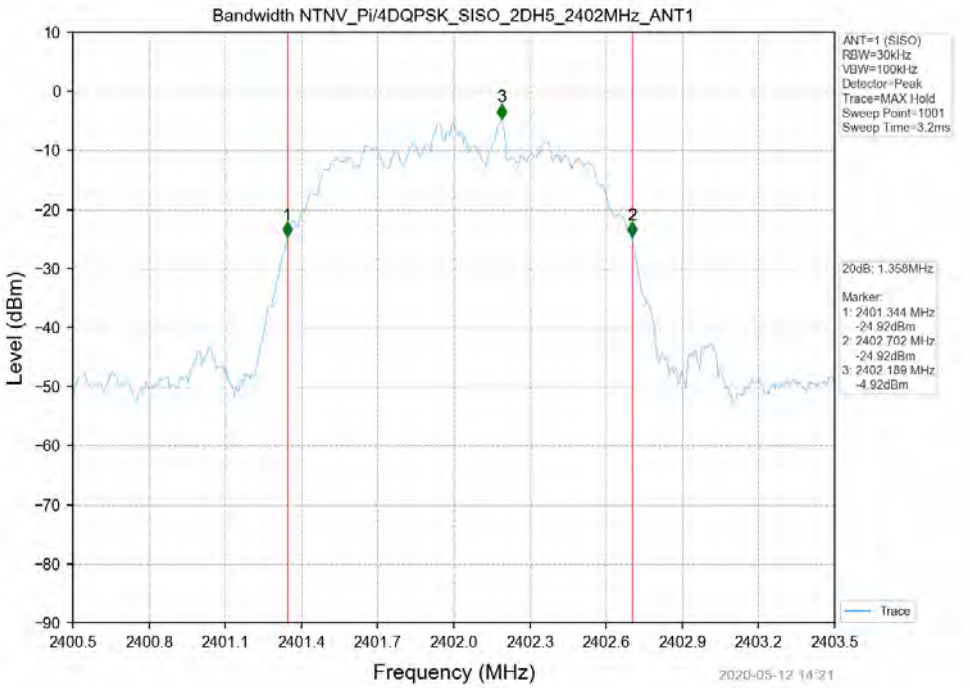
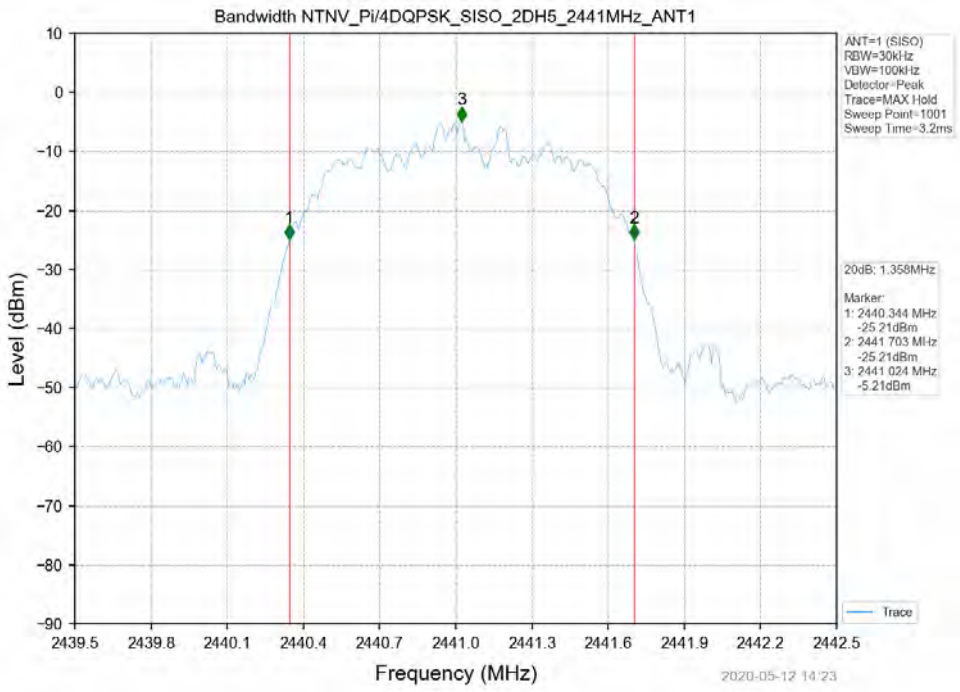
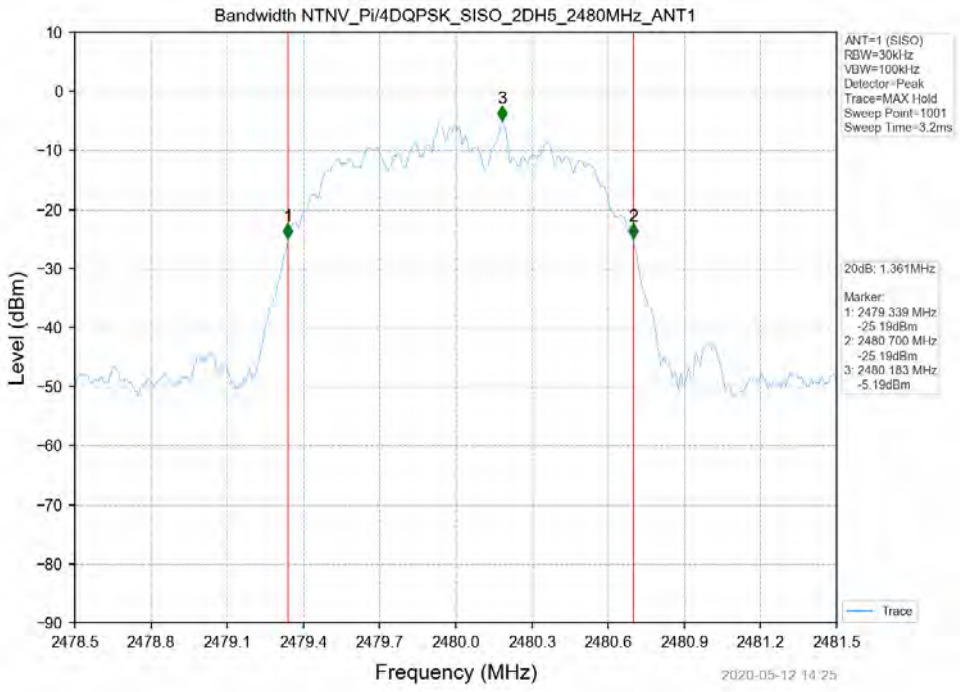
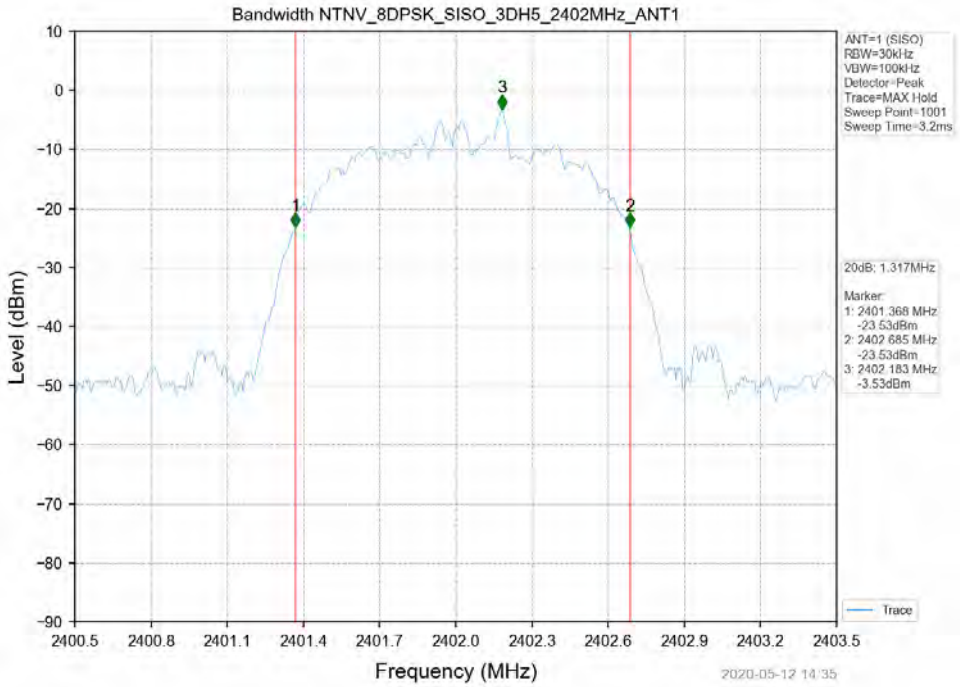
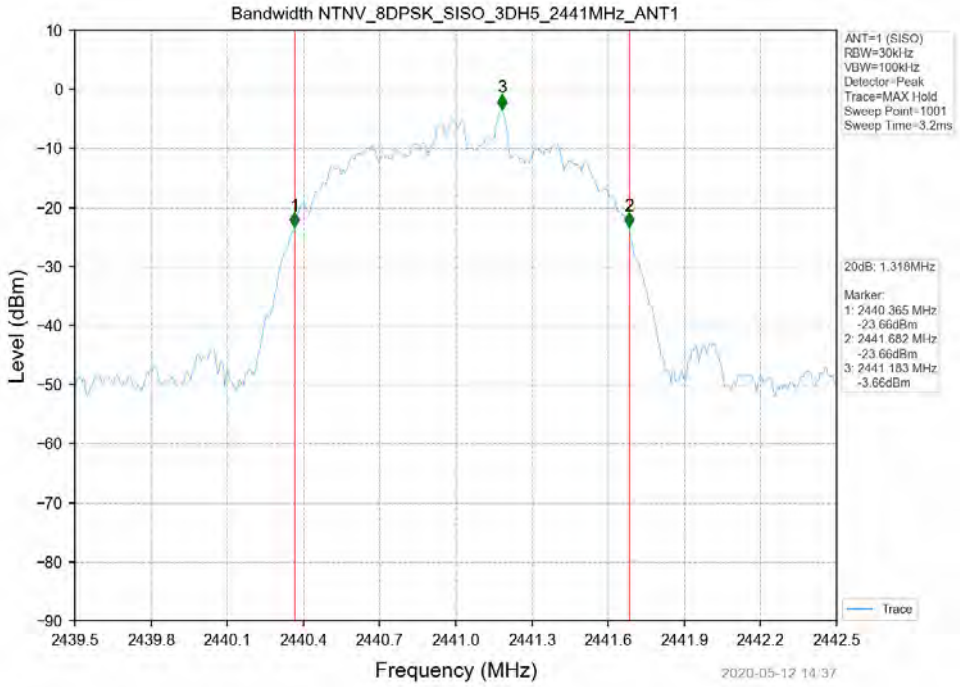


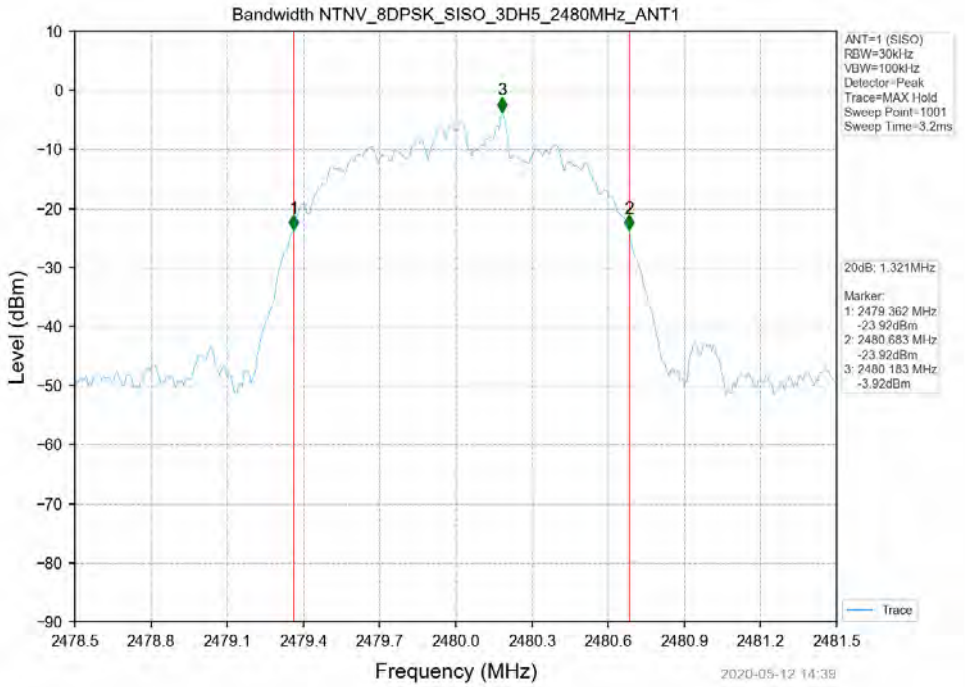





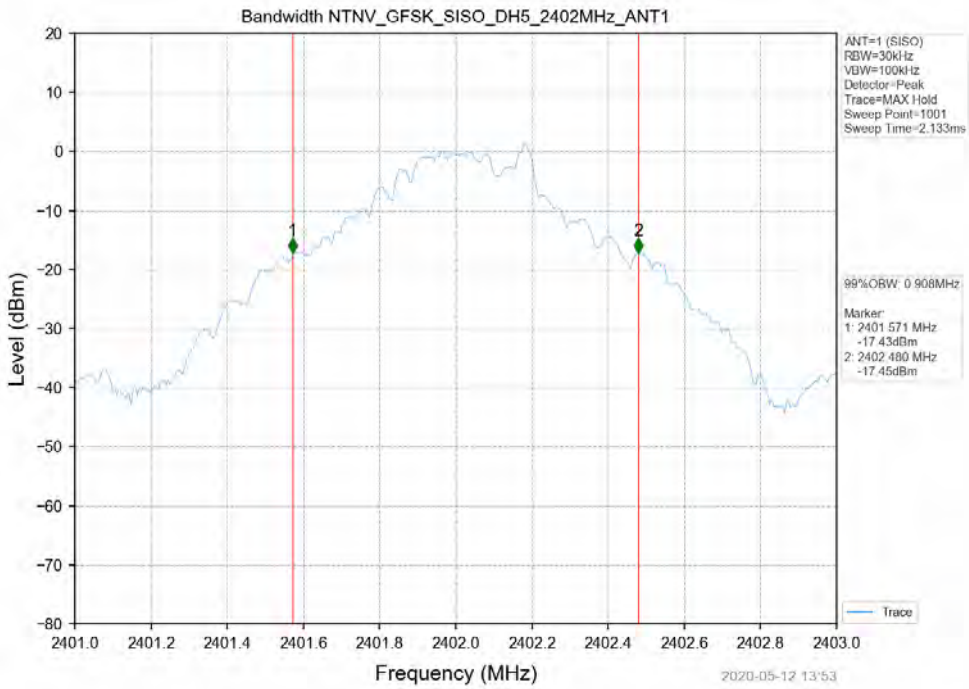



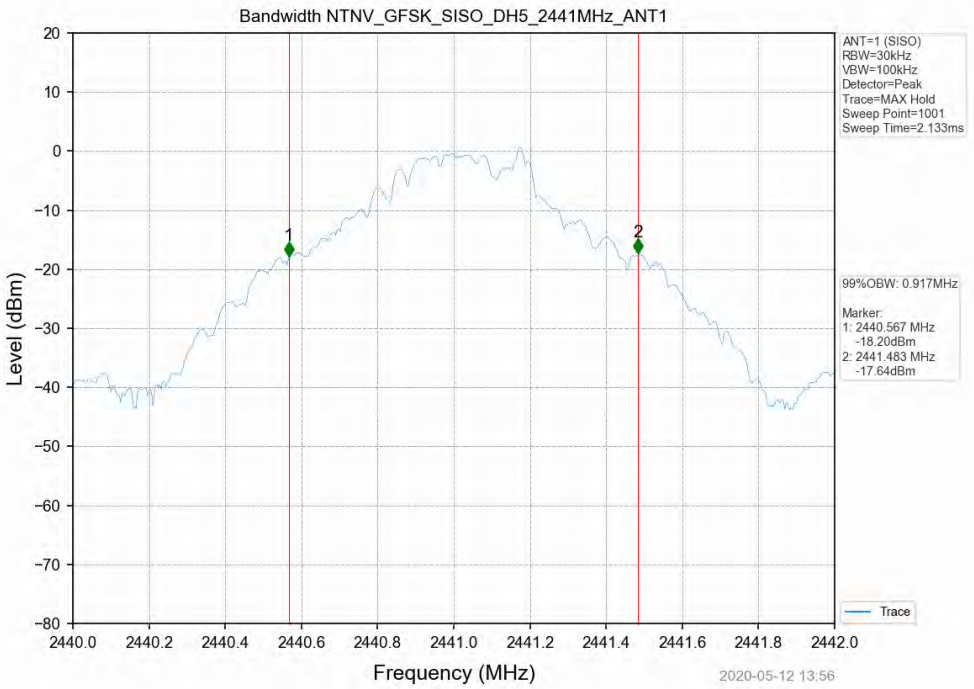


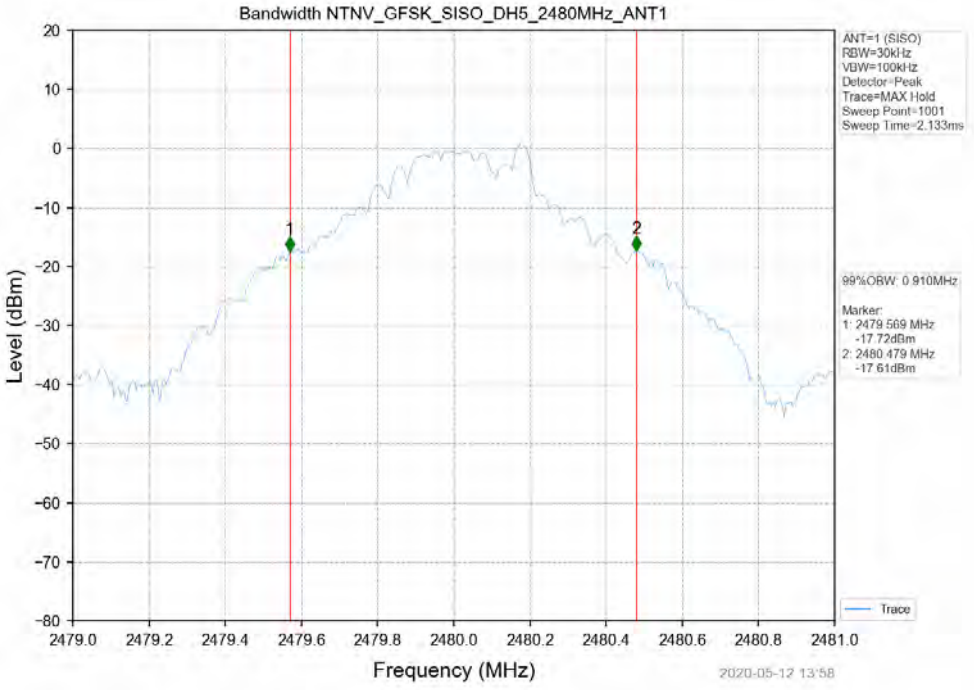



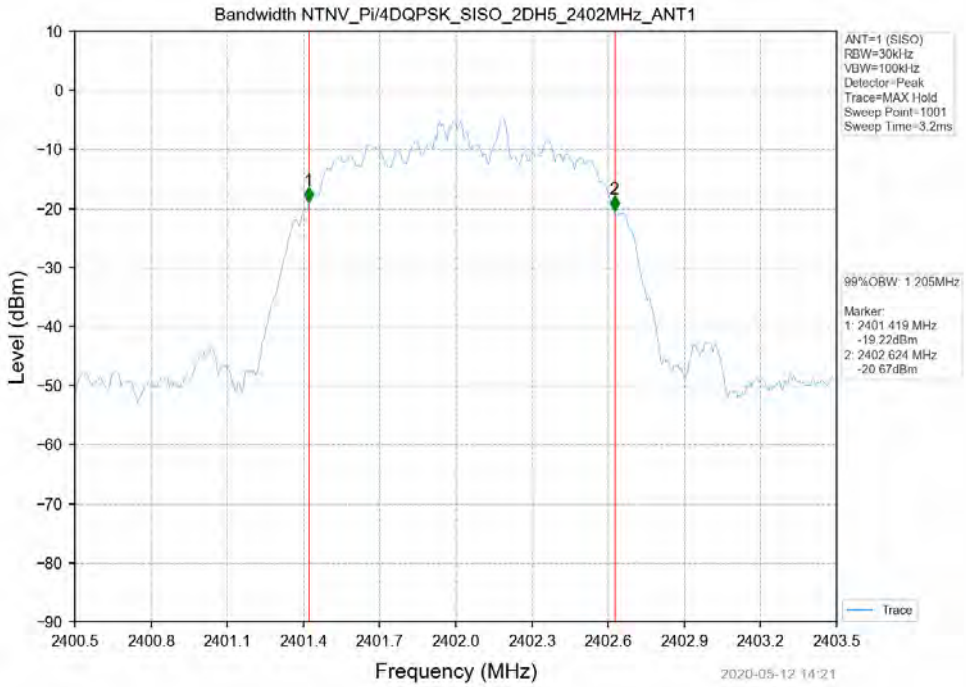


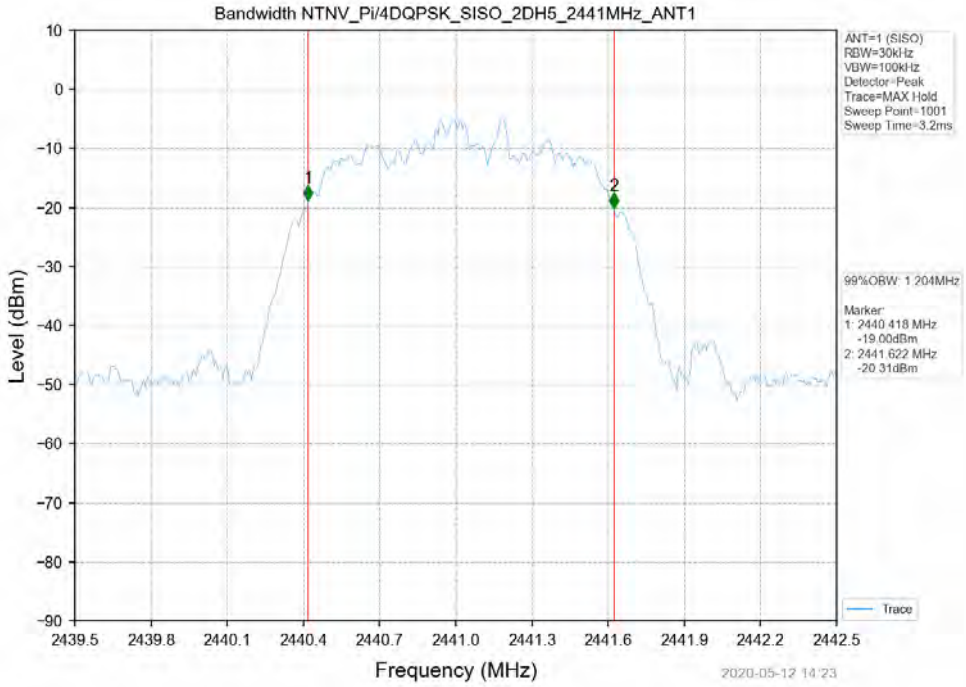

1.3 Test Graph - 99% Occupied Bandwidth

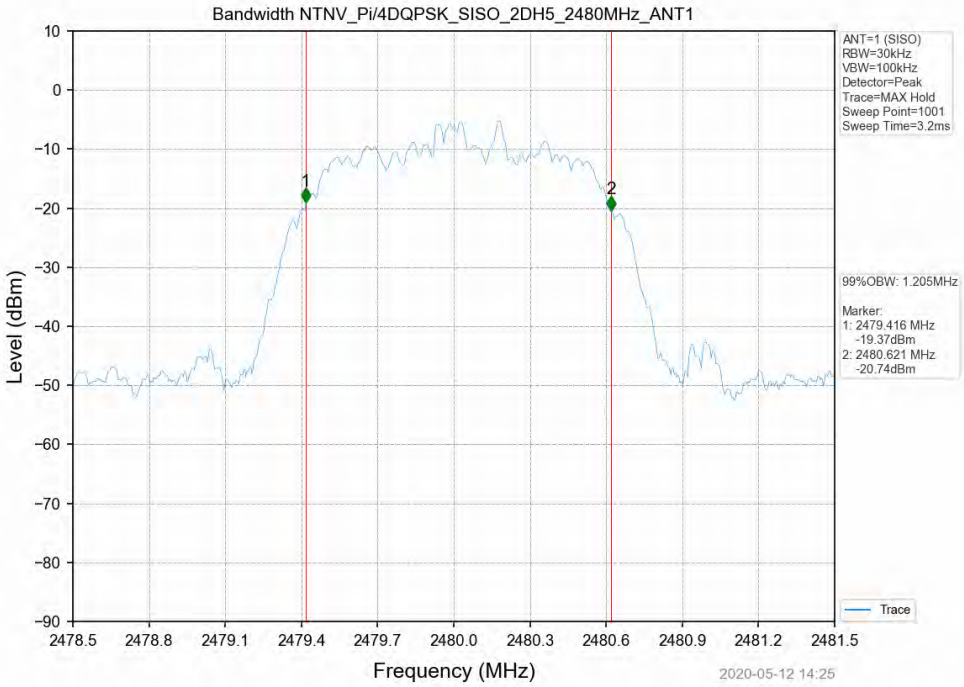


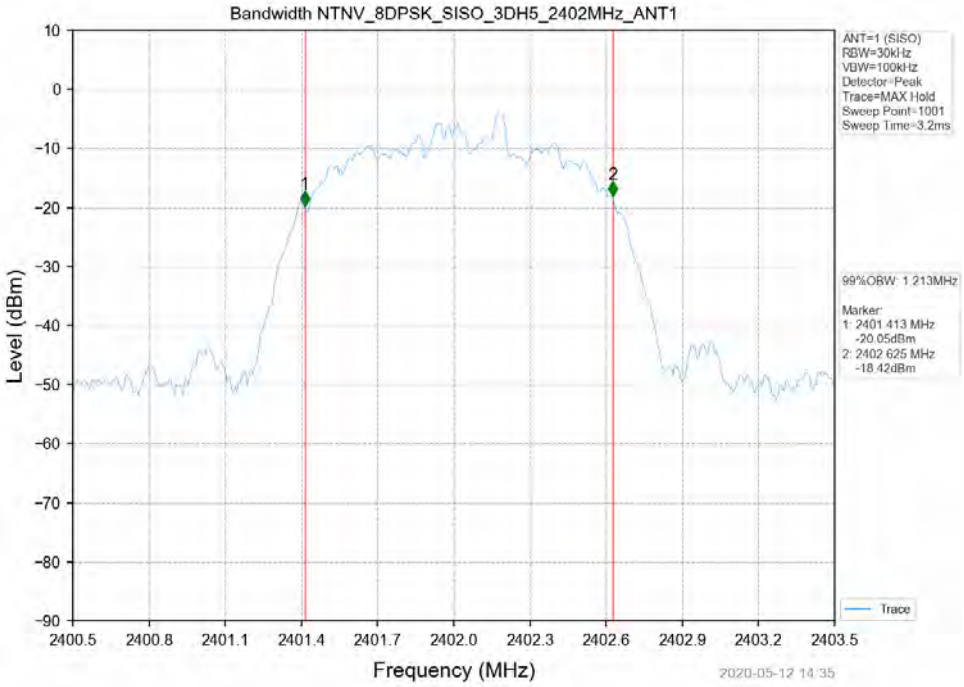


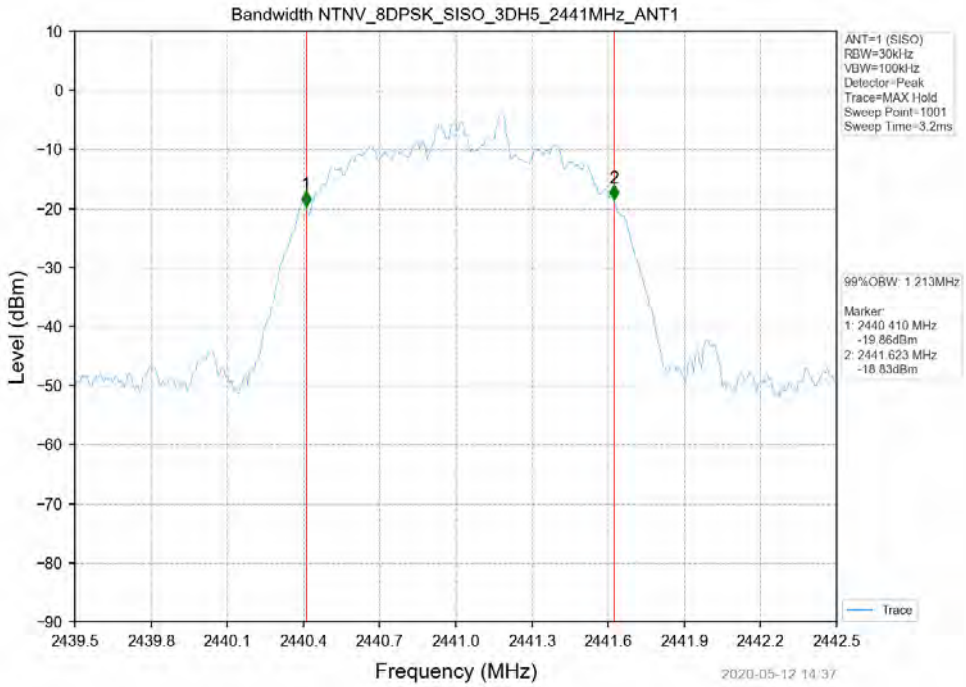



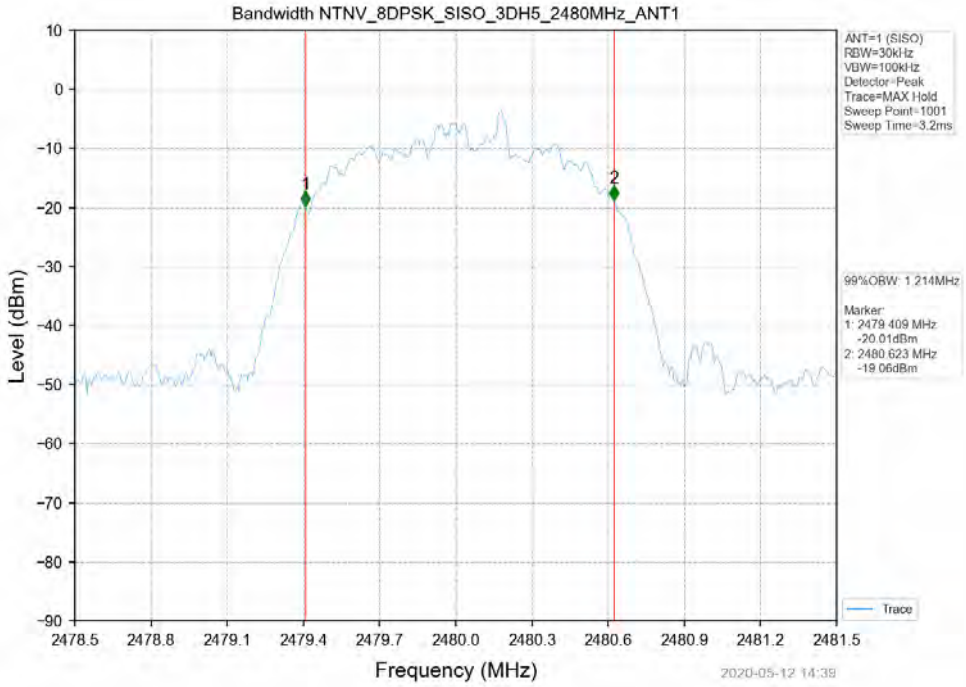






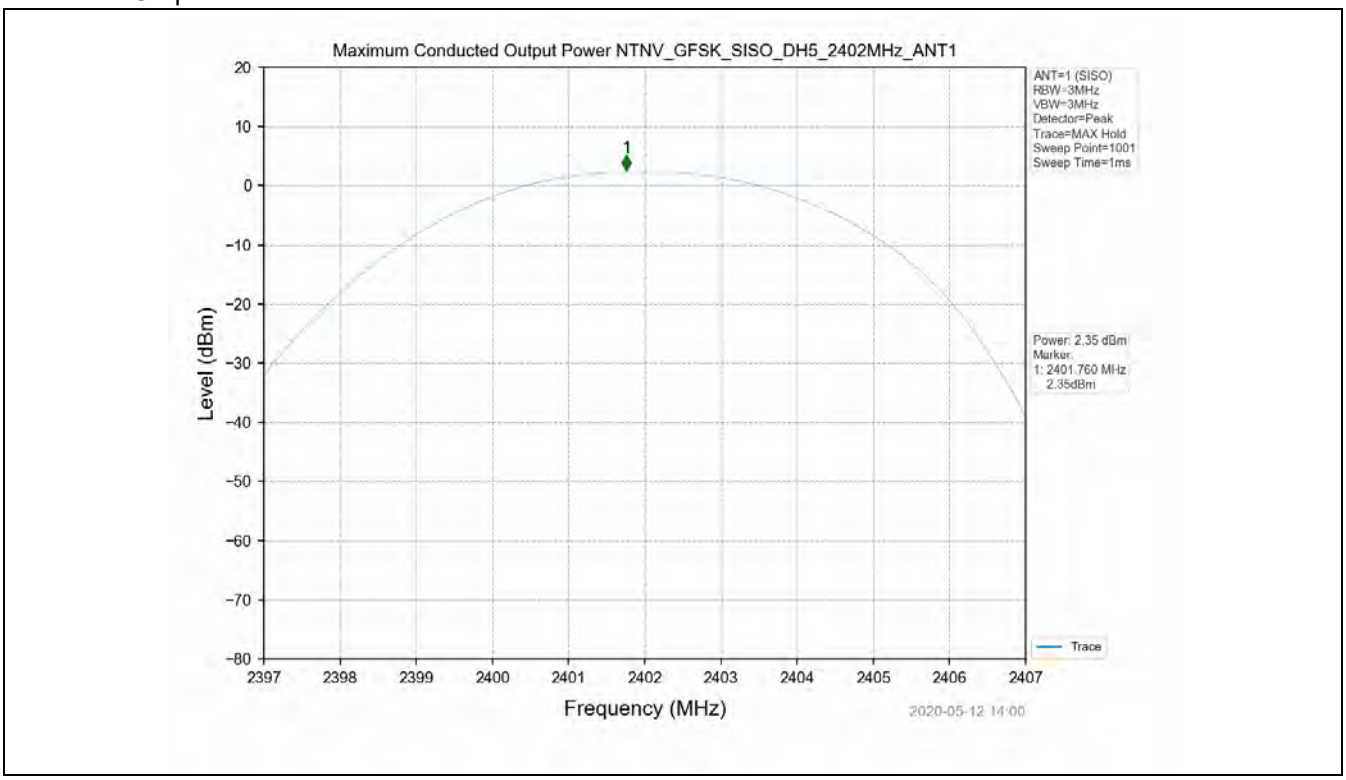



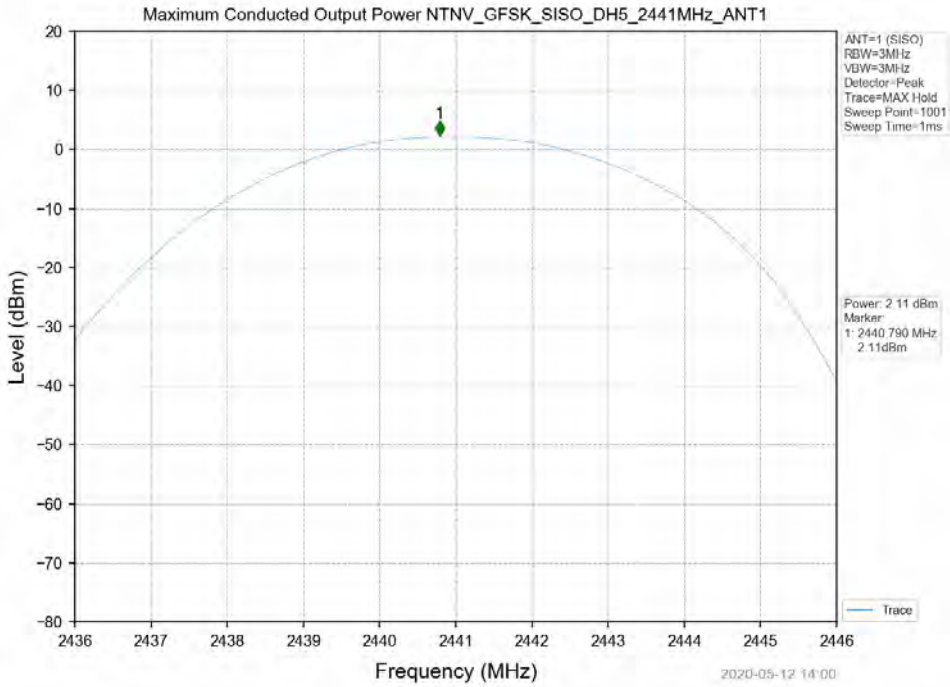
2. Maximum Conducted Output Power

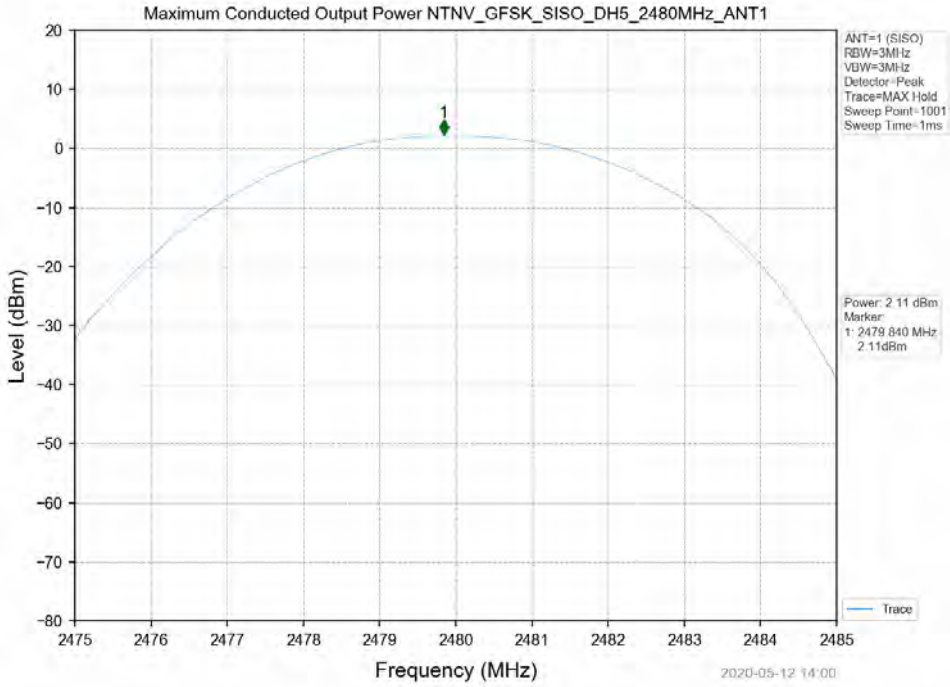
2.1 Test Result

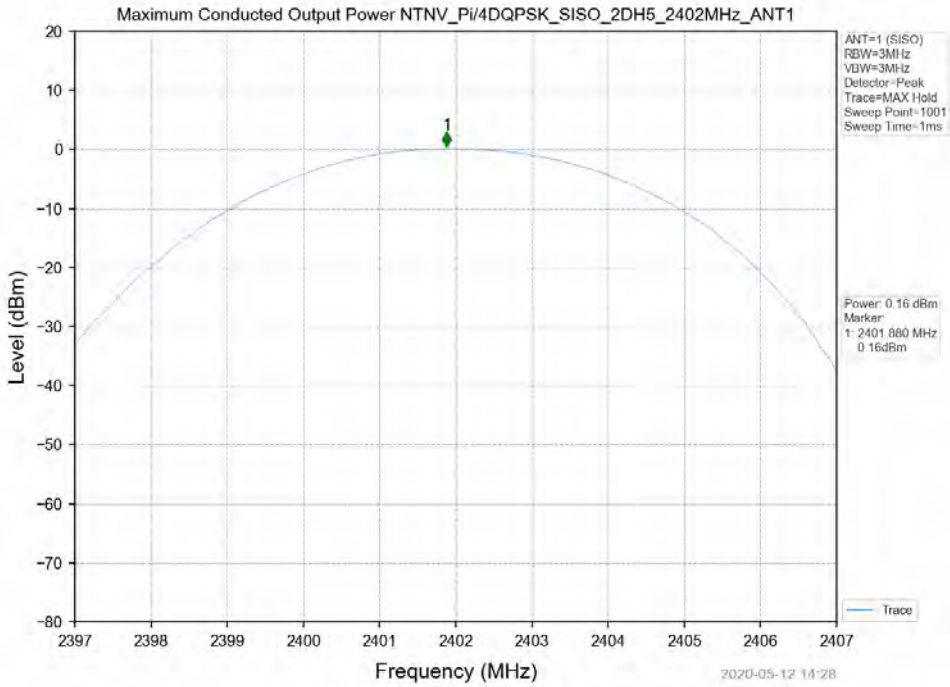
| Test Mode | Frequency (MHz) | Tx Type | Measured Peak Output Power (dBm) | Limits (dBm) | Verdict |
|---|---|---|---|---|---|
| | | | Ant 1 | | |
| GFSK | 2402 | SISO | 2.35 | 20.97 | PASS |
| | 2441 | SISO | 2.11 | 20.97 | PASS |
| | 2480 | SISO | 2.11 | 20.97 | PASS |
| Pi/4DQPSK | 2402 | SISO | 0.16 | 20.97 | PASS |
| | 2441 | SISO | 0.08 | 20.97 | PASS |
| | 2480 | SISO | -0.15 | 20.97 | PASS |
| 8DPSK | 2402 | SISO | 0.36 | 20.97 | PASS |
| | 2441 | SISO | 0.29 | 20.97 | PASS |
| | 2480 | SISO | 0.25 | 20.97 | PASS |

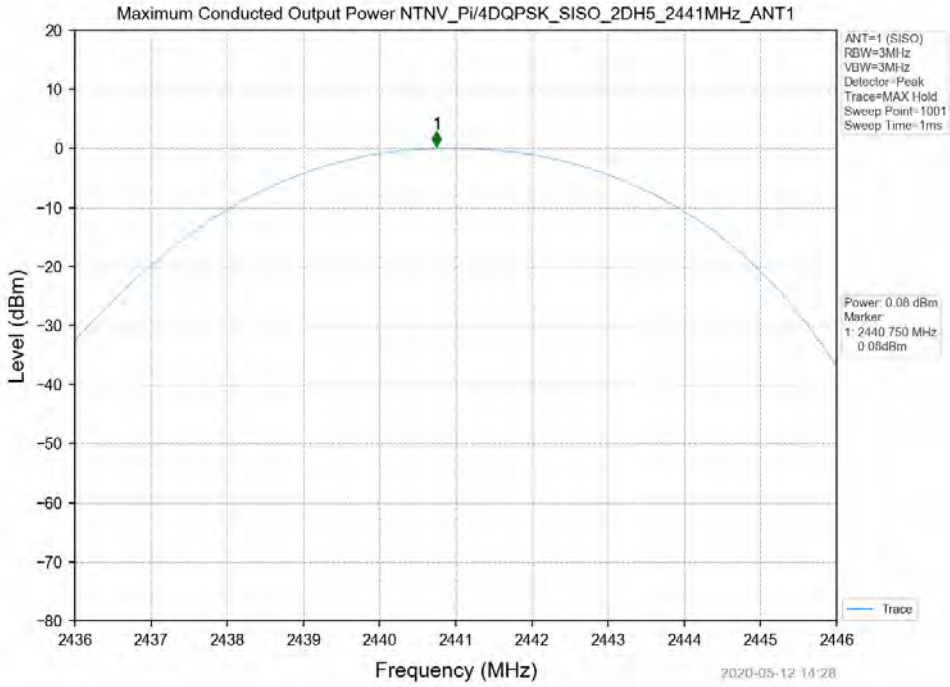
2.2 Test Graph

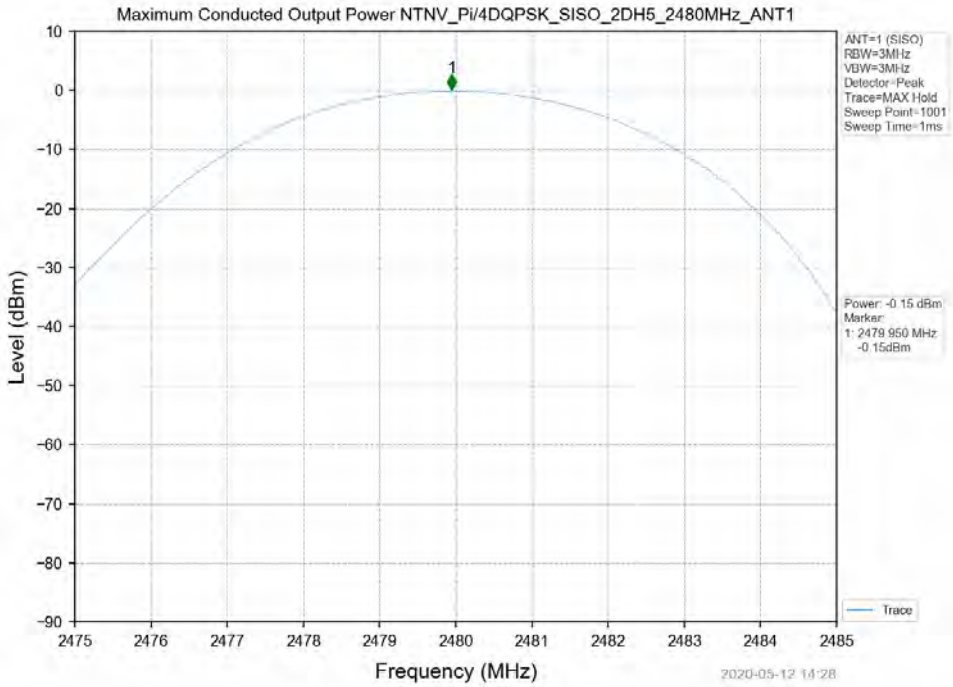


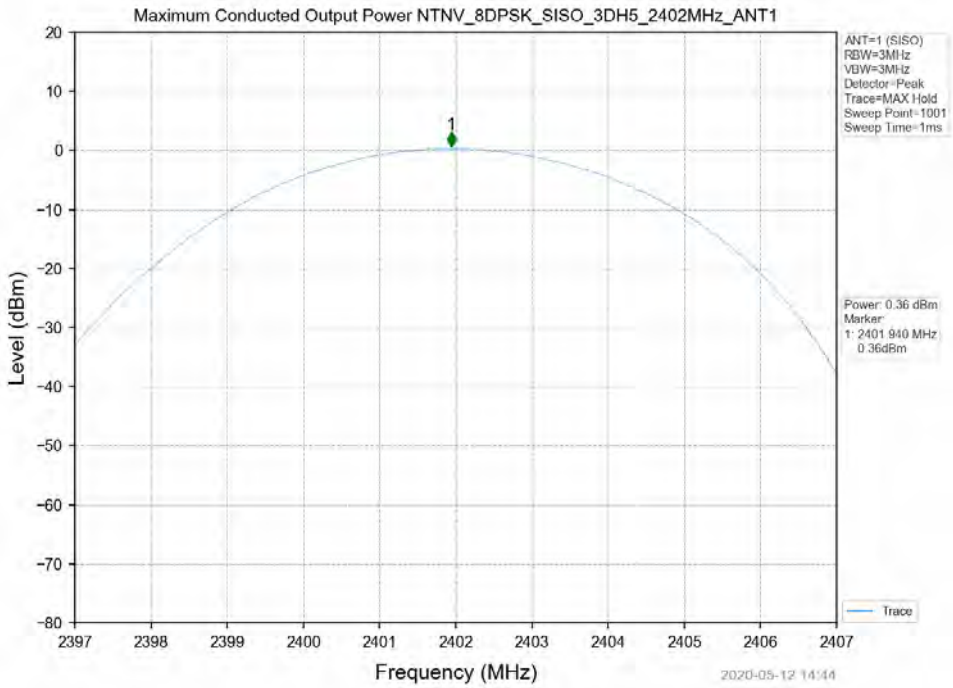


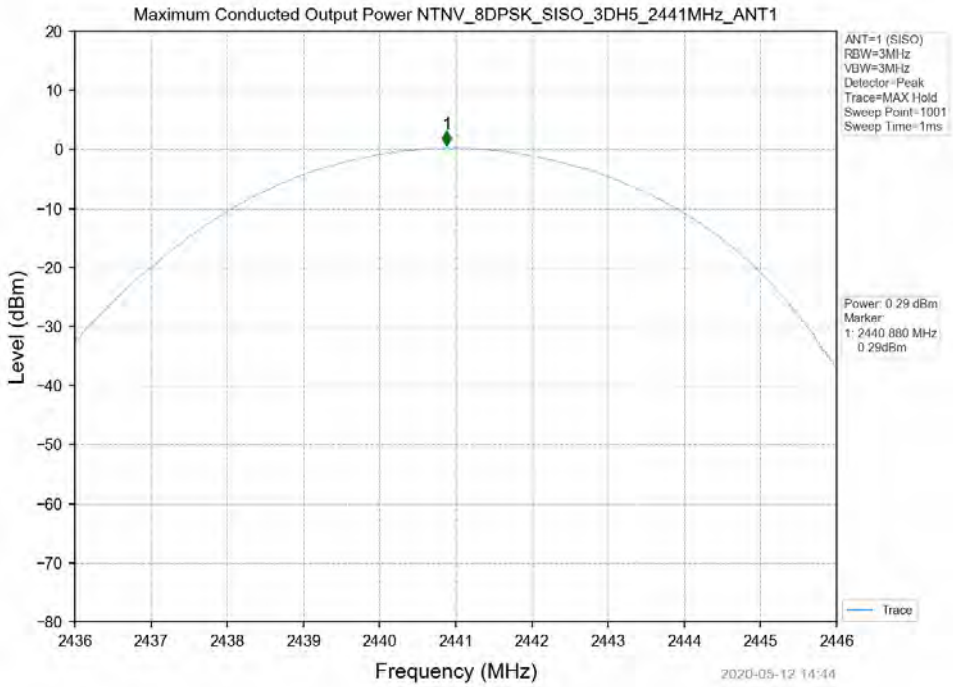



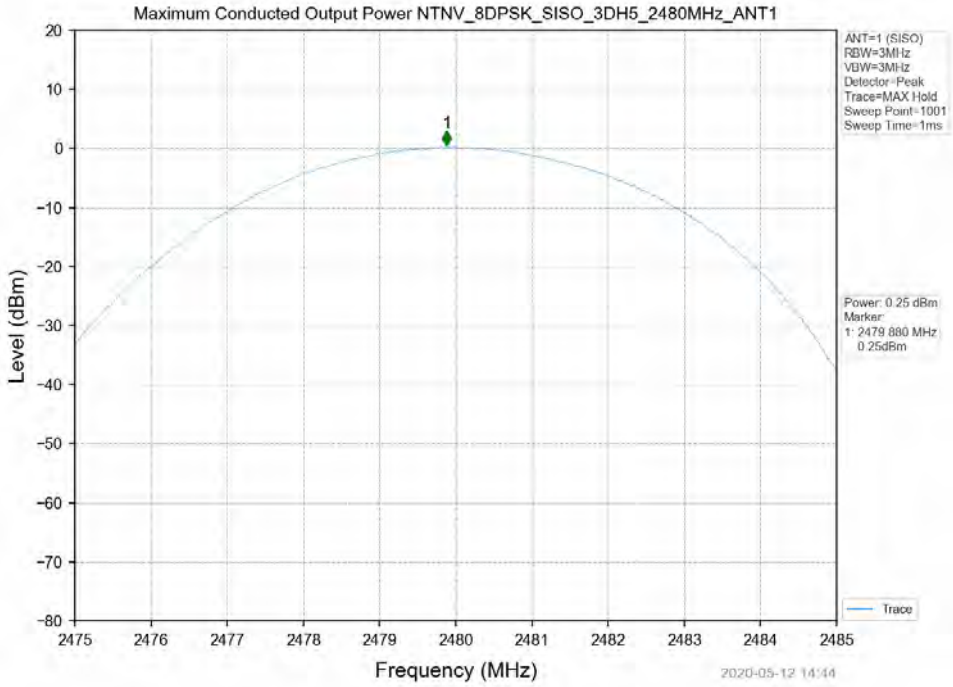






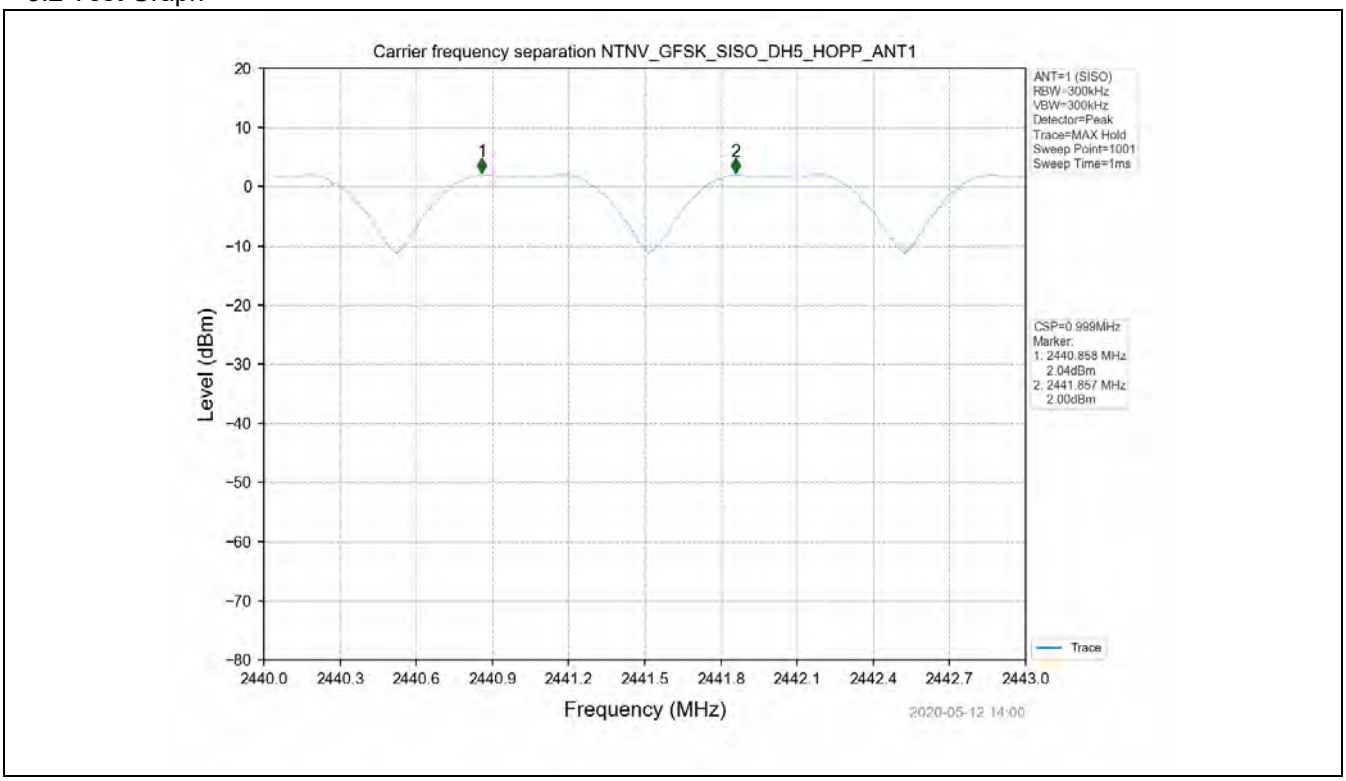



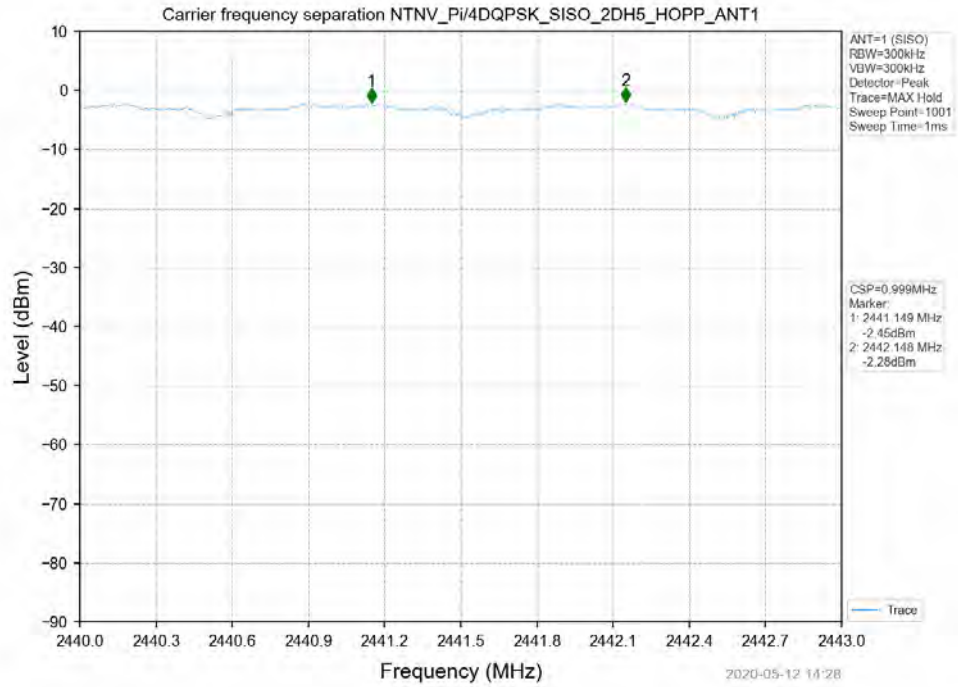
3. Carrier frequency separation

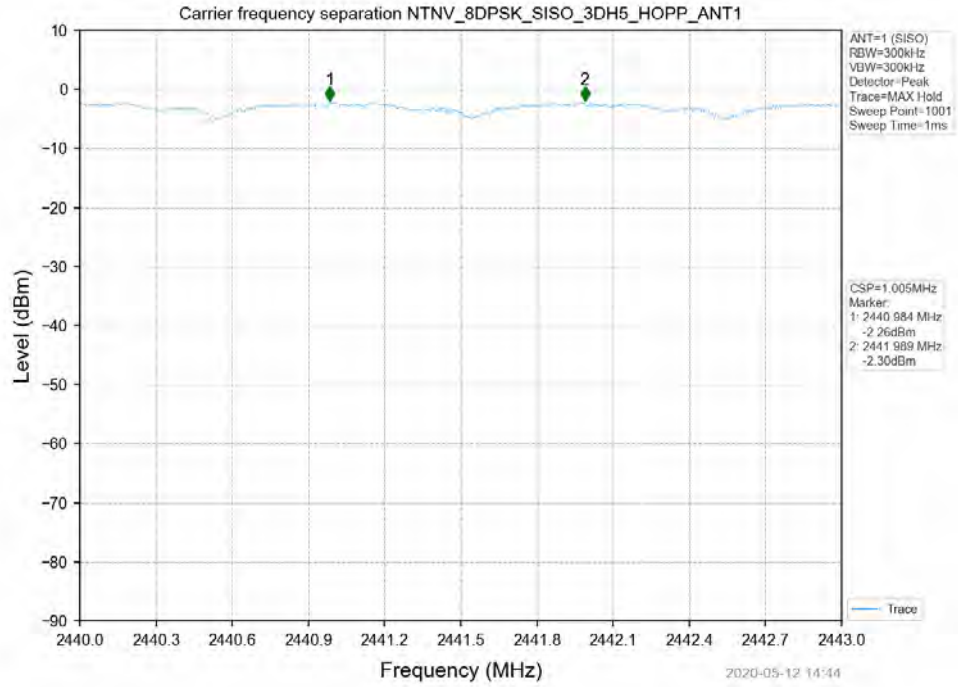
3.1 Test Result

| Test Mode | TX Type | ANT No. | Channel Separation (MHz) | 20dB Bandwidth (MHz) | Limits (MHz) | Verdict |
|---|---|---|---|---|---|---|
| GFSK | SISO | 1 | 0.999 | 1.002 | ≥0.668 | PASS |
| Pi/4DQPSK | SISO | 1 | 0.999 | 1.361 | ≥0.907 | PASS |
| 8DPSK | SISO | 1 | 1.005 | 1.321 | ≥0.881 | PASS |

3.2 Test Graph





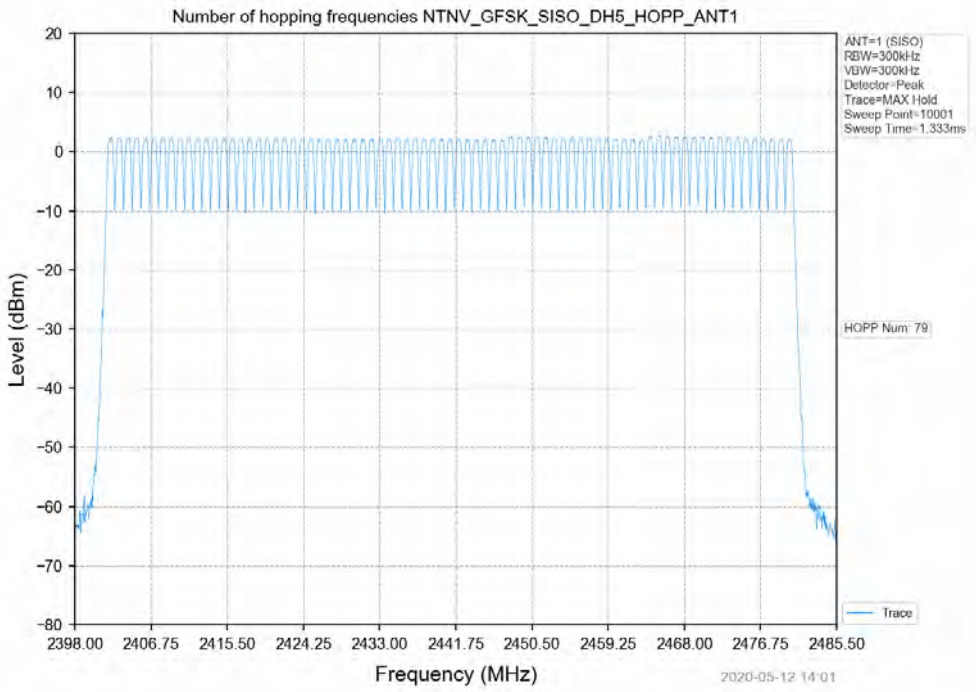



4. Number of hopping frequencies

4.1 Test Result

| Test Mode | TX Type | ANT No. | Num of Hopping Frequencies | Limits | Verdict |
|---|---|---|---|---|---|
| GFSK | SISO | 1 | 79 | ≥15 | PASS |
| Pi/4DQPSK | SISO | 1 | 79 | ≥15 | PASS |
| 8DPSK | SISO | 1 | 79 | ≥15 | PASS |

4.2 Test Graph





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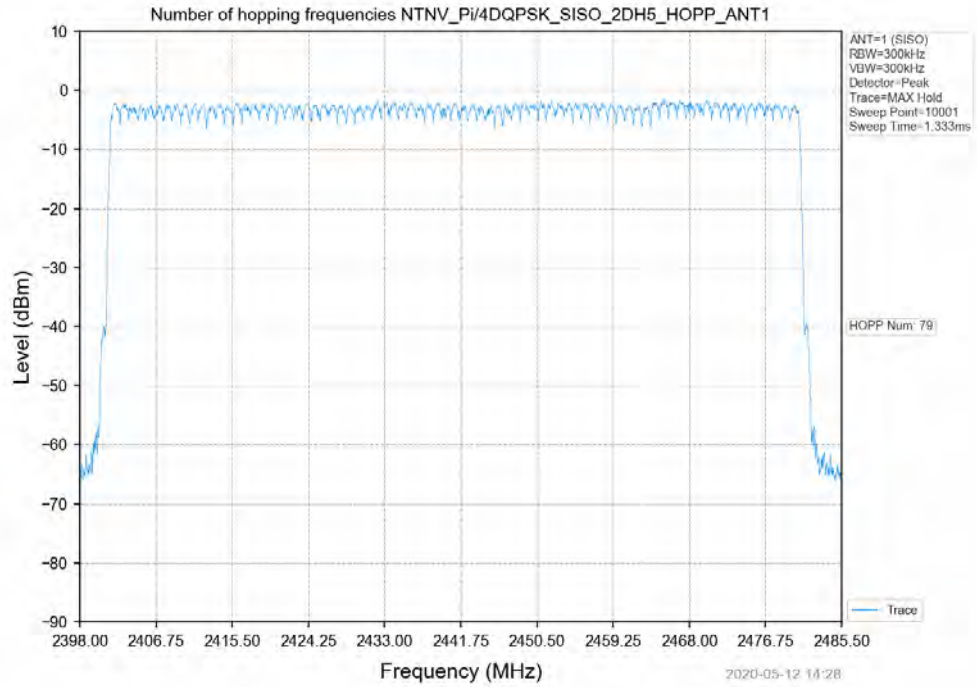


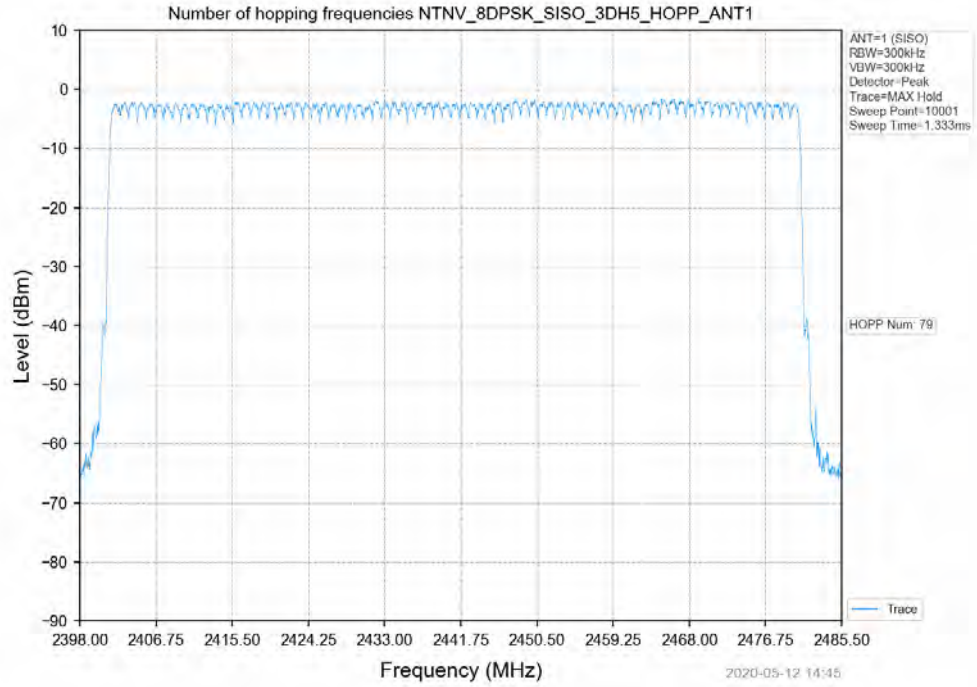



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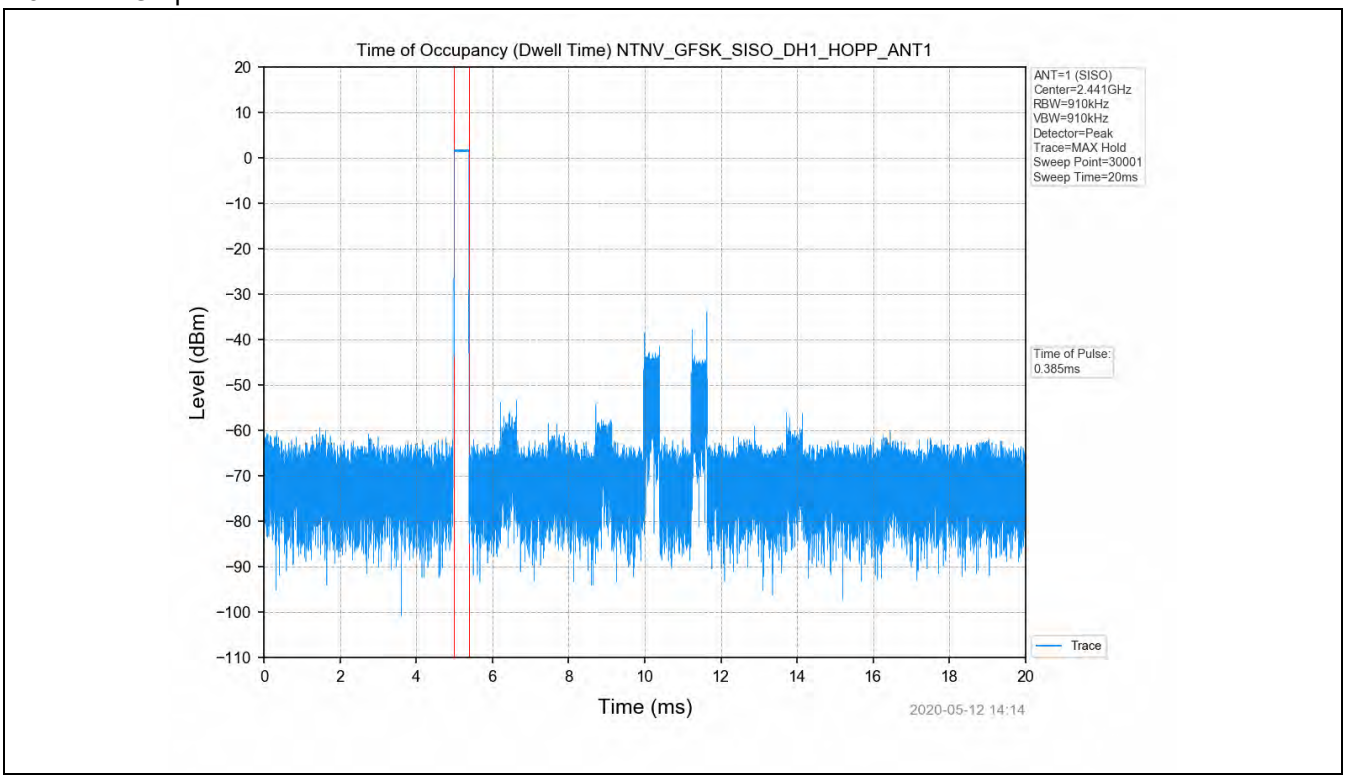
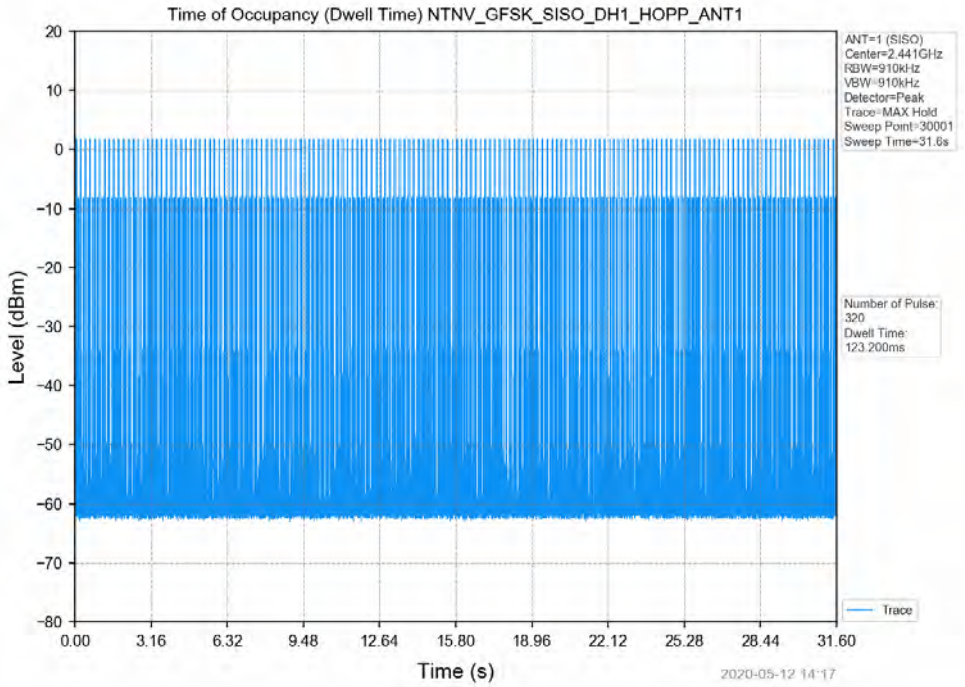
5. Time of Occupancy (Dwell Time)

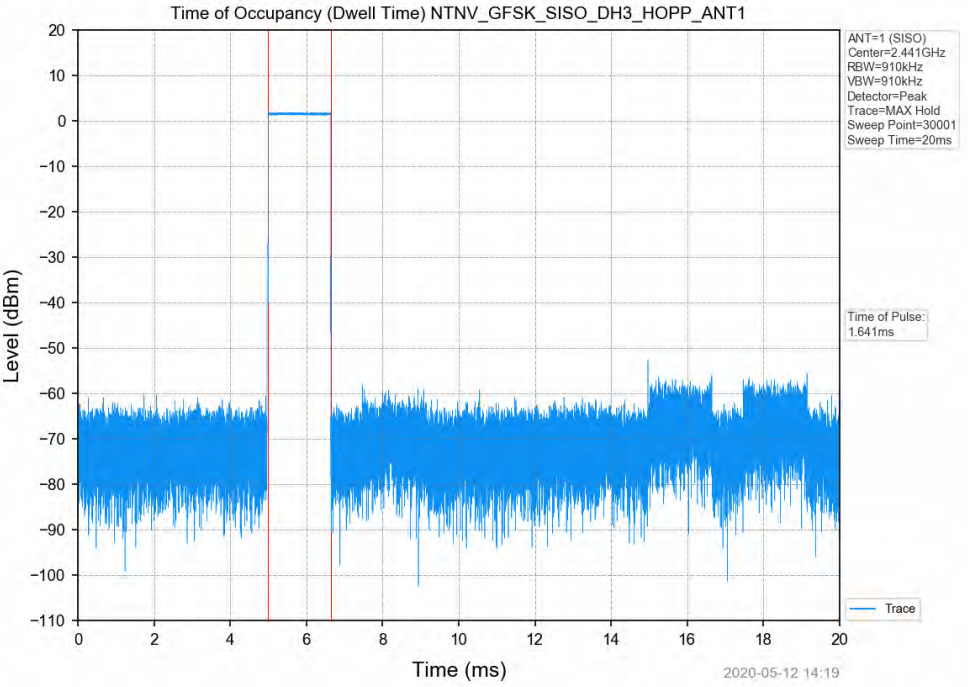
5.1 Test Result

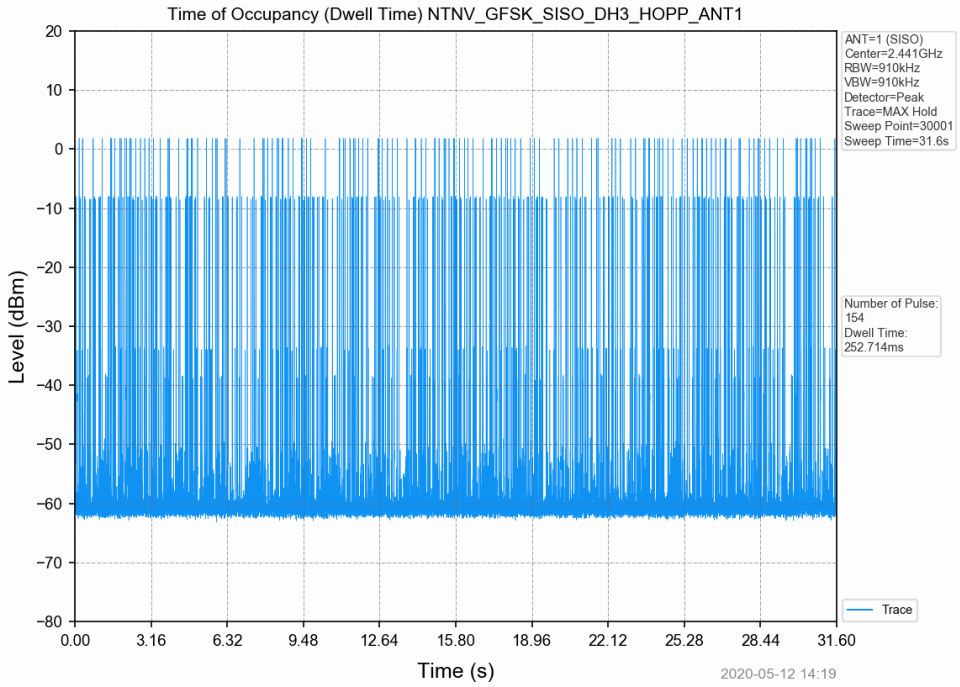
| Test Mode | Packet Type | TX Type | ANT No. | Duration of Single Pulse (ms) | Obeservation Period (s) | Num of Pulse in Observation Period | Dwell Time (ms) | Limits (ms) | Verdict |
|---|---|---|---|---|---|---|---|---|---|
| GFSK | DH1 | SISO | 1 | 0.385 | 31.6 | 320 | 123.200 | ≤400 | PASS |
| | DH3 | SISO | 1 | 1.641 | 31.6 | 154 | 252.714 | ≤400 | PASS |
| | DH5 | SISO | 1 | 2.889 | 31.6 | 116 | 335.124 | ≤400 | PASS |
| Pi/4DQPSK | 2DH1 | SISO | 1 | 0.391 | 31.6 | 320 | 125.120 | ≤400 | PASS |
| | 2DH3 | SISO | 1 | 1.643 | 31.6 | 170 | 279.310 | ≤400 | PASS |
| | 2DH5 | SISO | 1 | 2.891 | 31.6 | 109 | 315.119 | ≤400 | PASS |
| 8DPSK | 3DH1 | SISO | 1 | 0.391 | 31.6 | 321 | 125.511 | ≤400 | PASS |
| | 3DH3 | SISO | 1 | 1.646 | 31.6 | 169 | 278.174 | ≤400 | PASS |
| | 3DH5 | SISO | 1 | 2.893 | 31.6 | 110 | 318.230 | ≤400 | PASS |

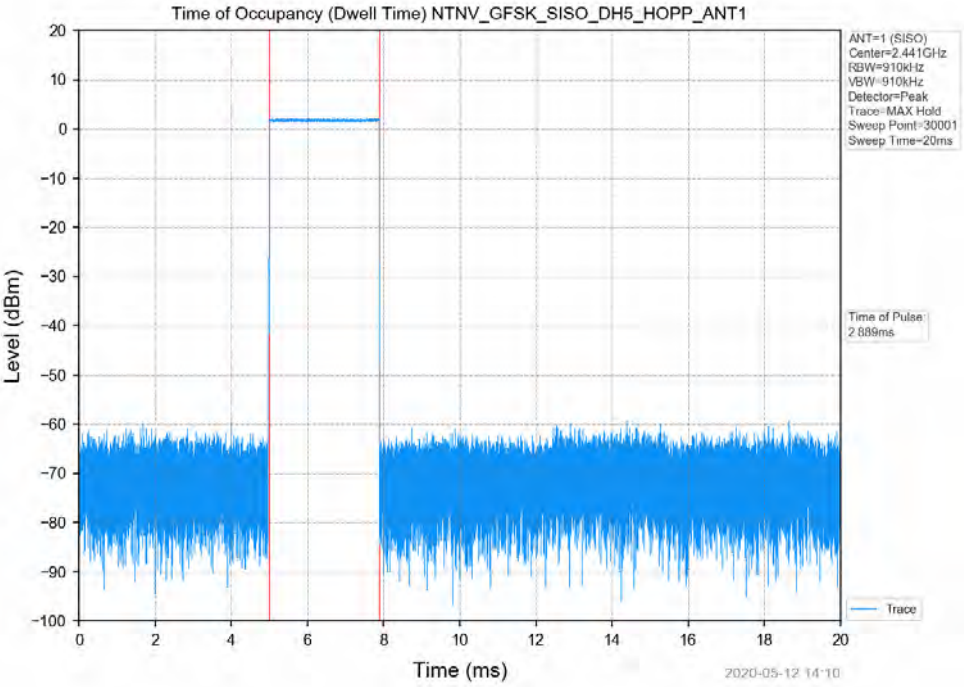
5.2 Test Graph

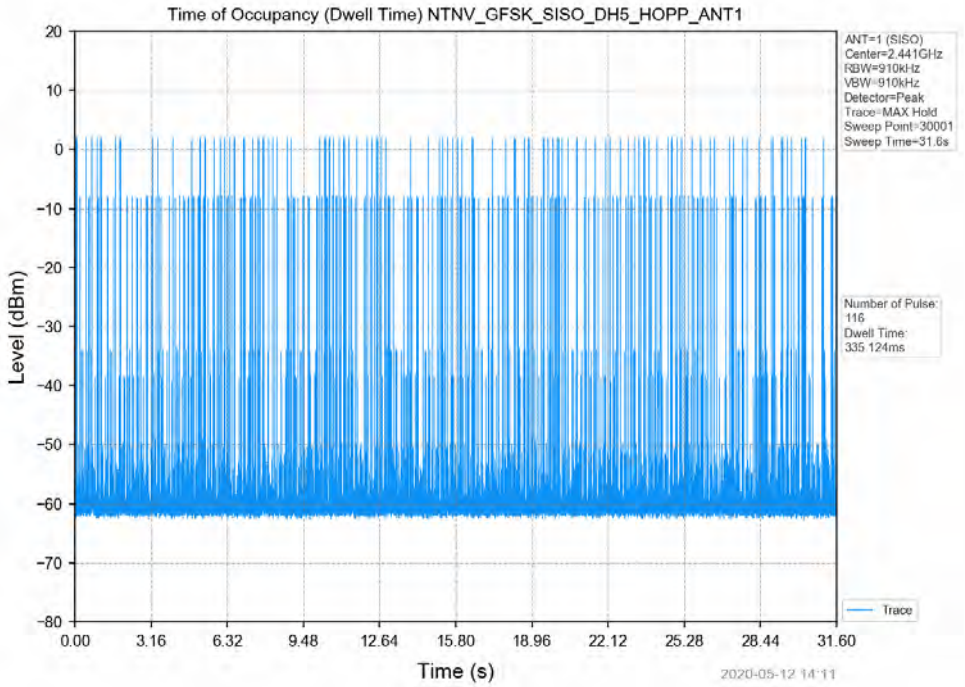


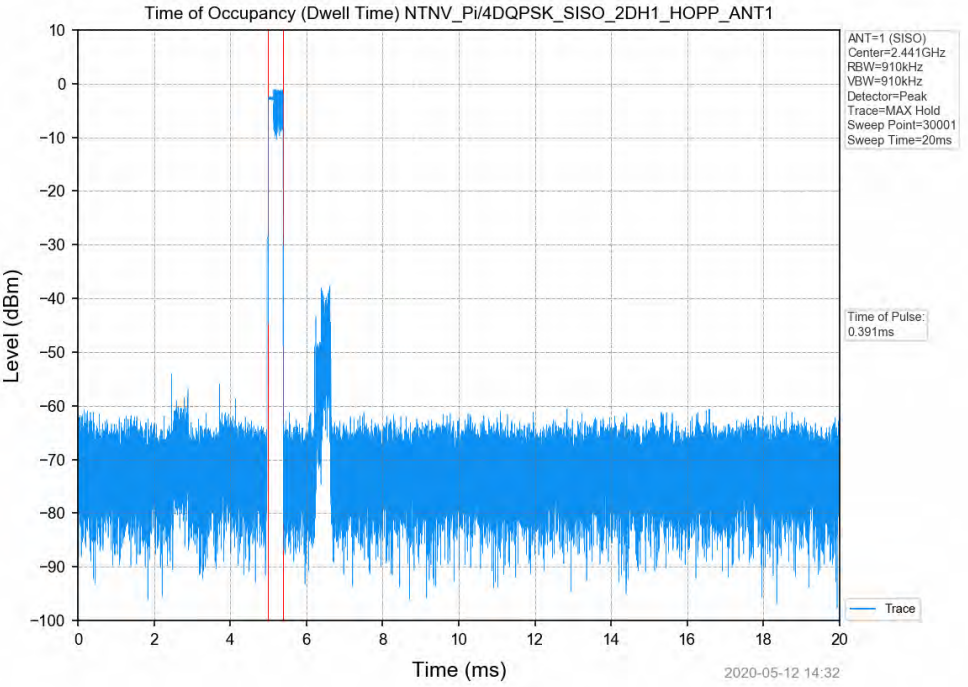


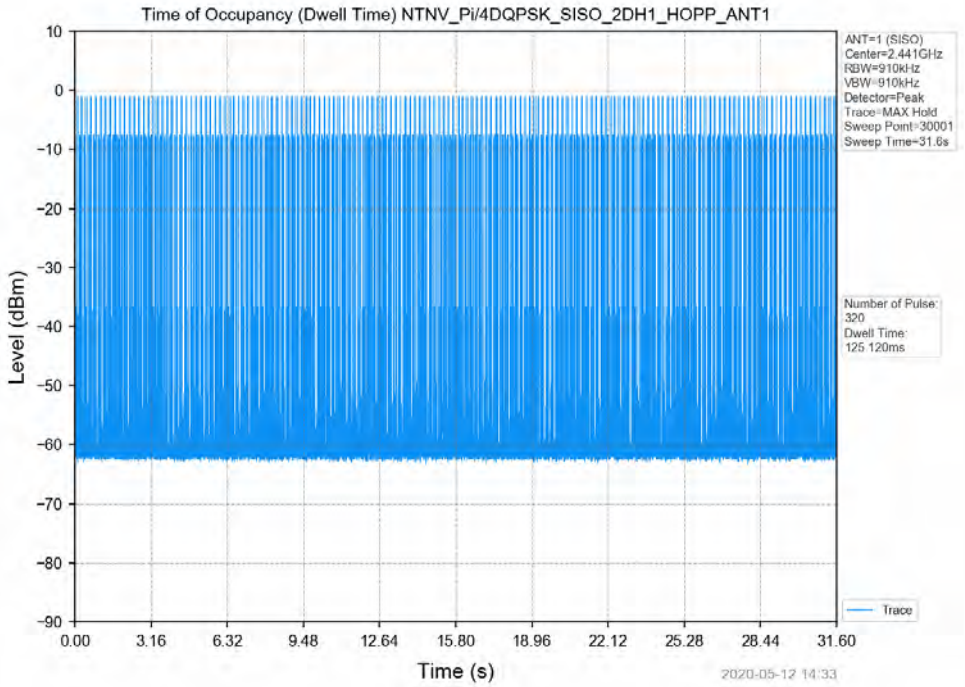



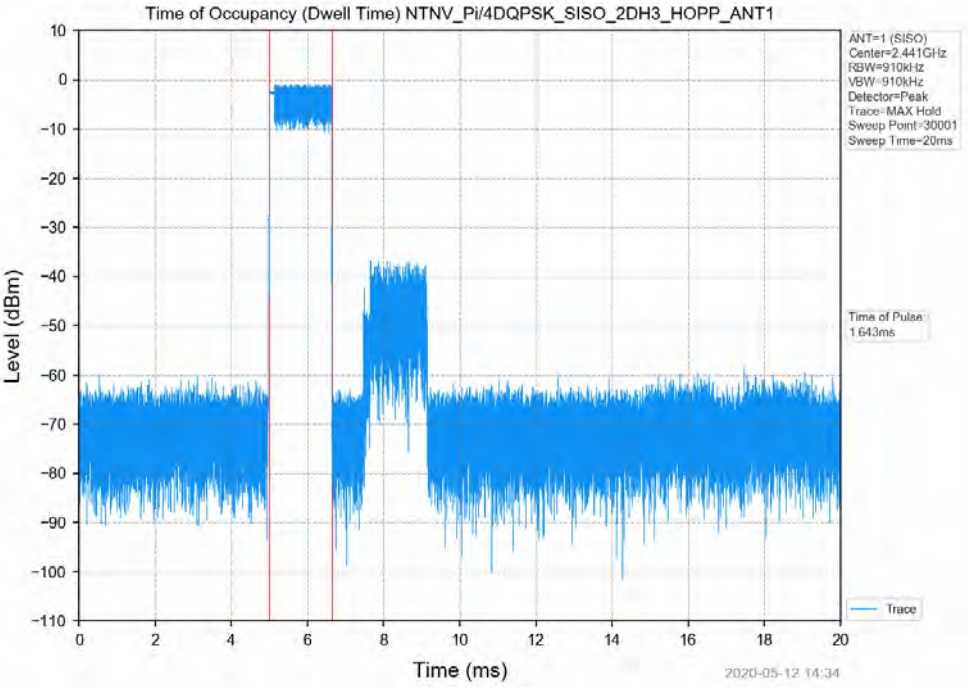


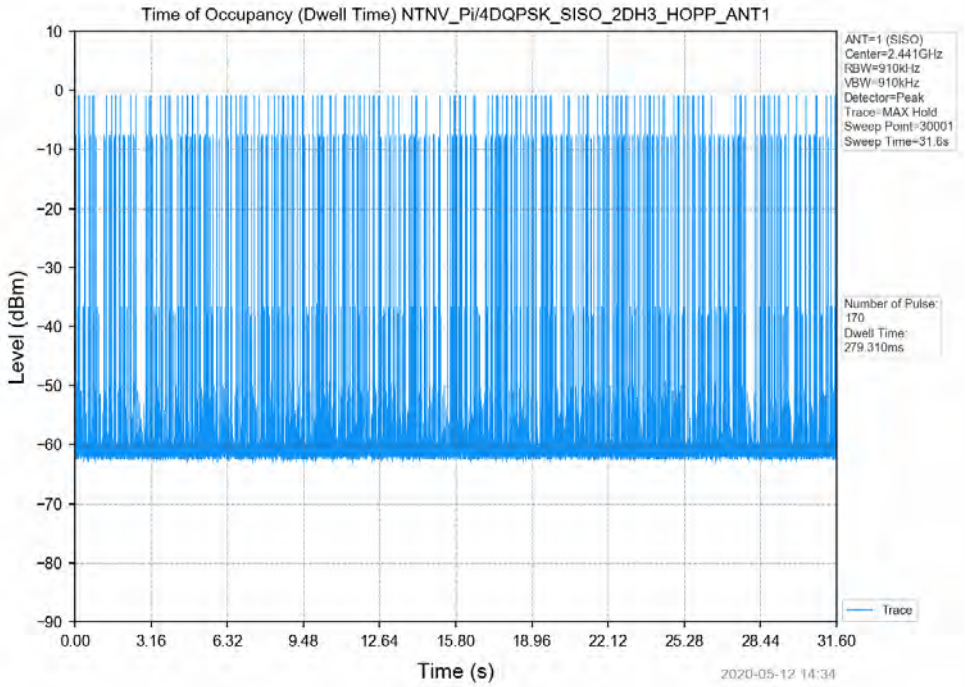



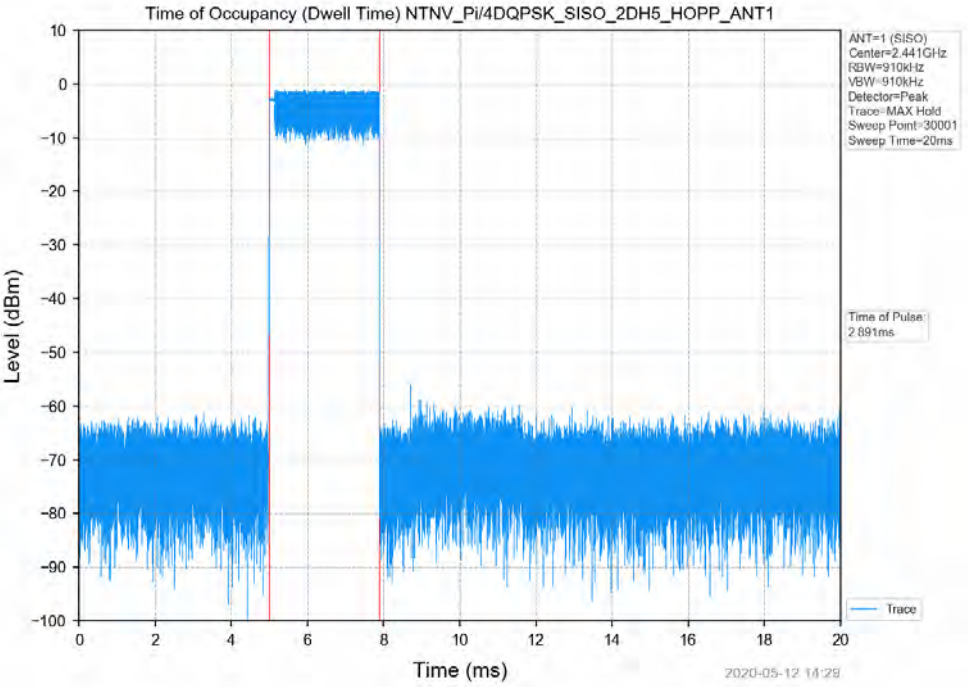


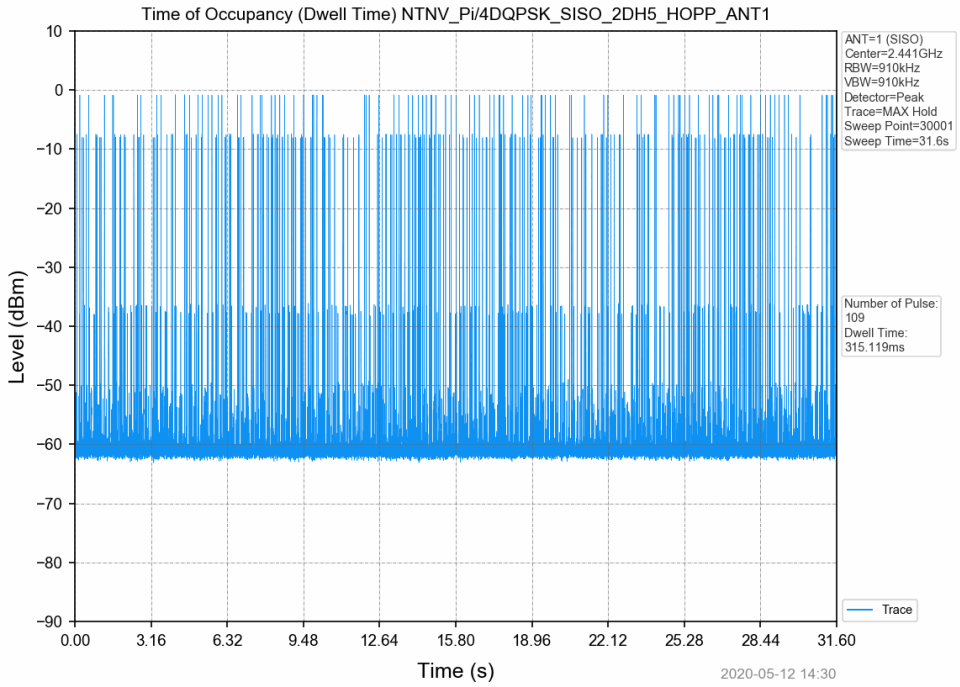



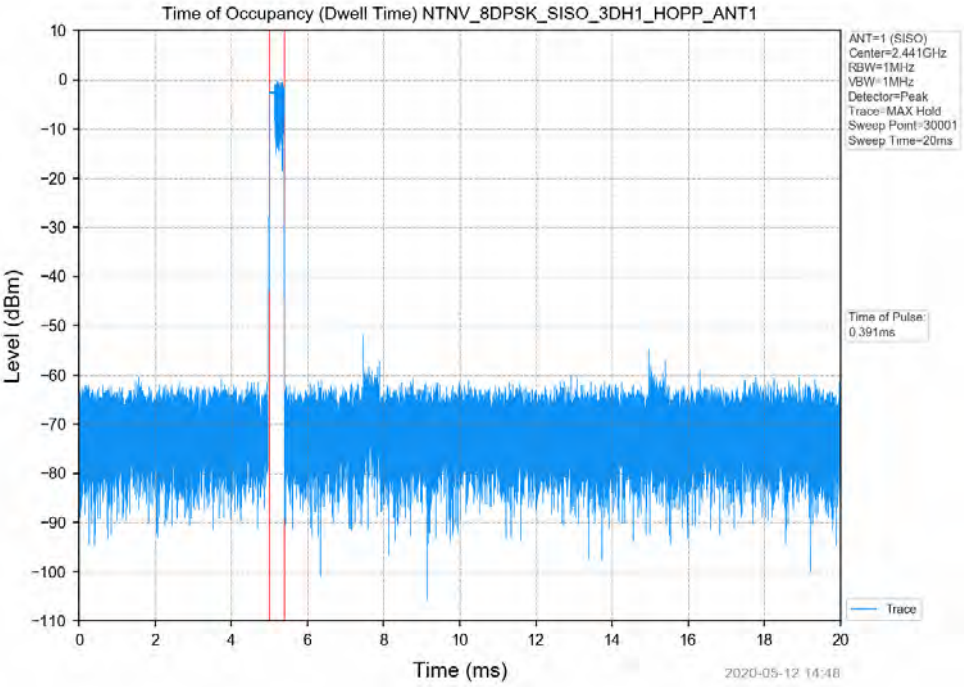


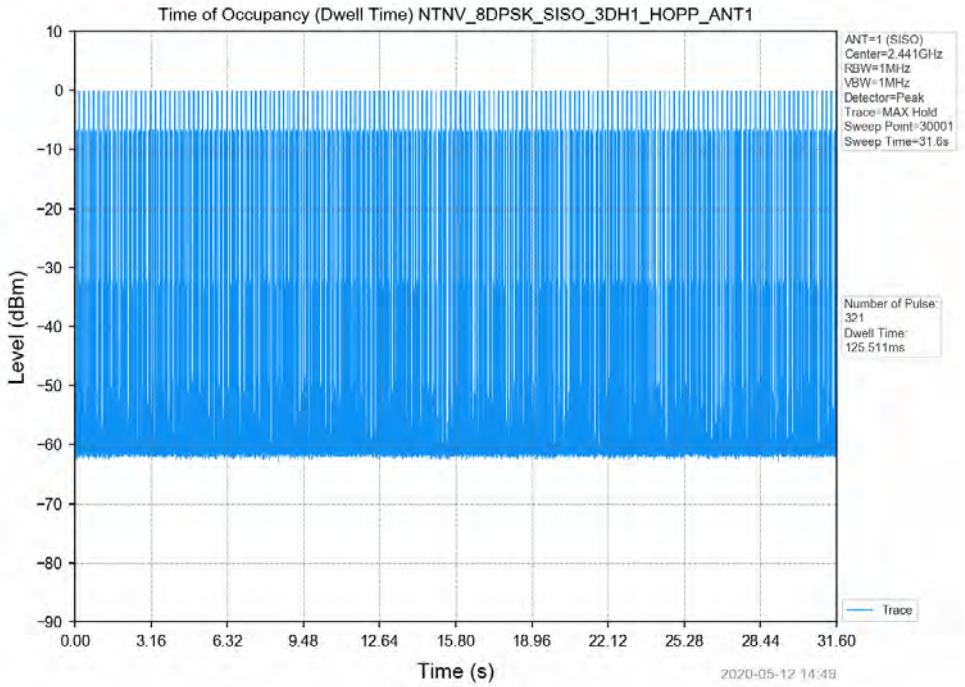



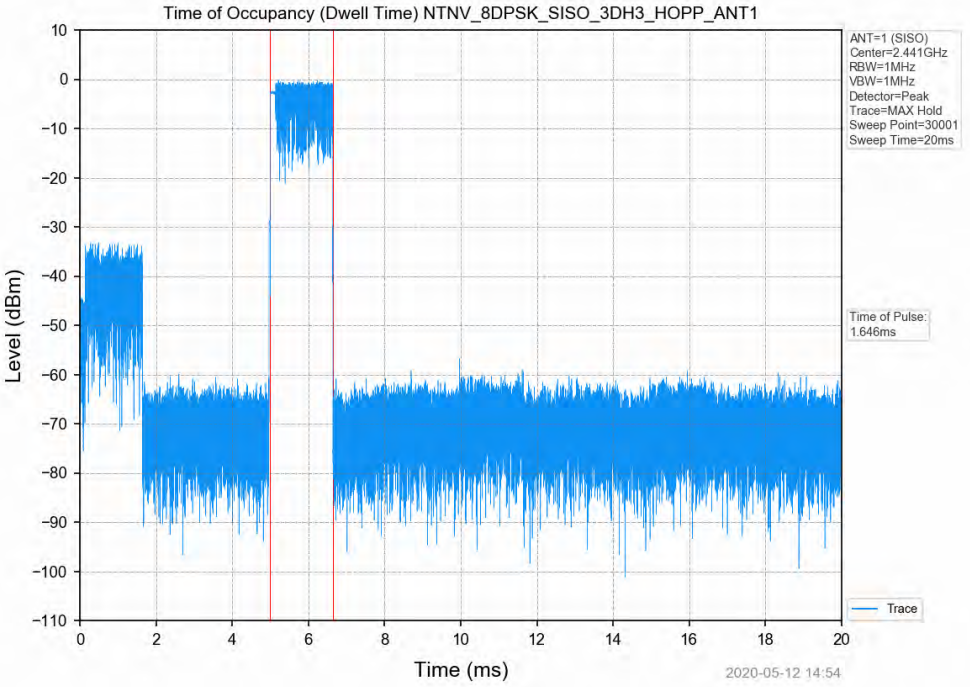


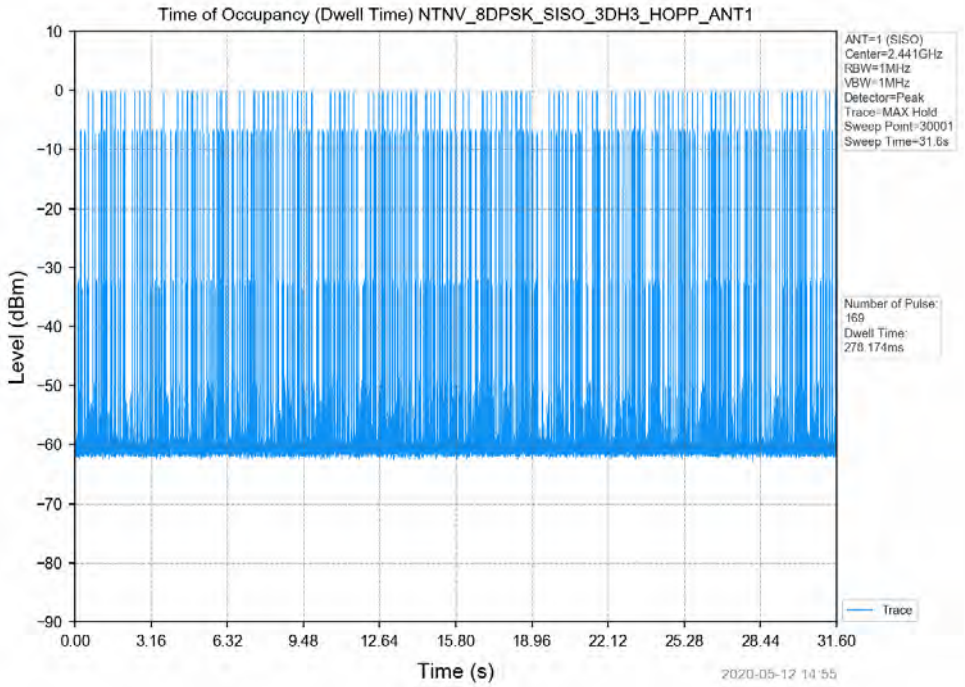



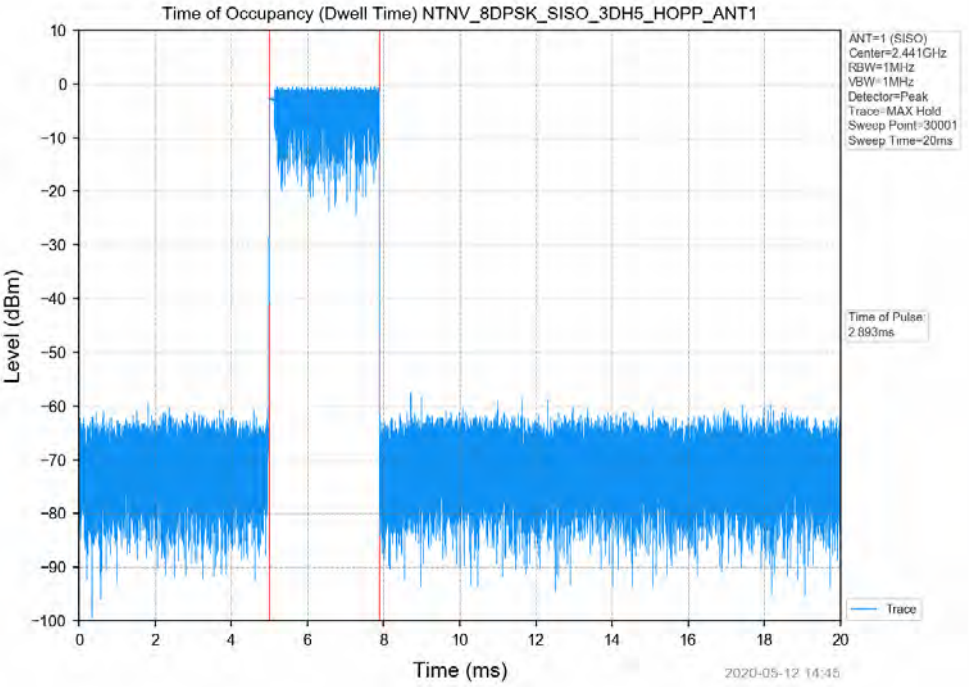


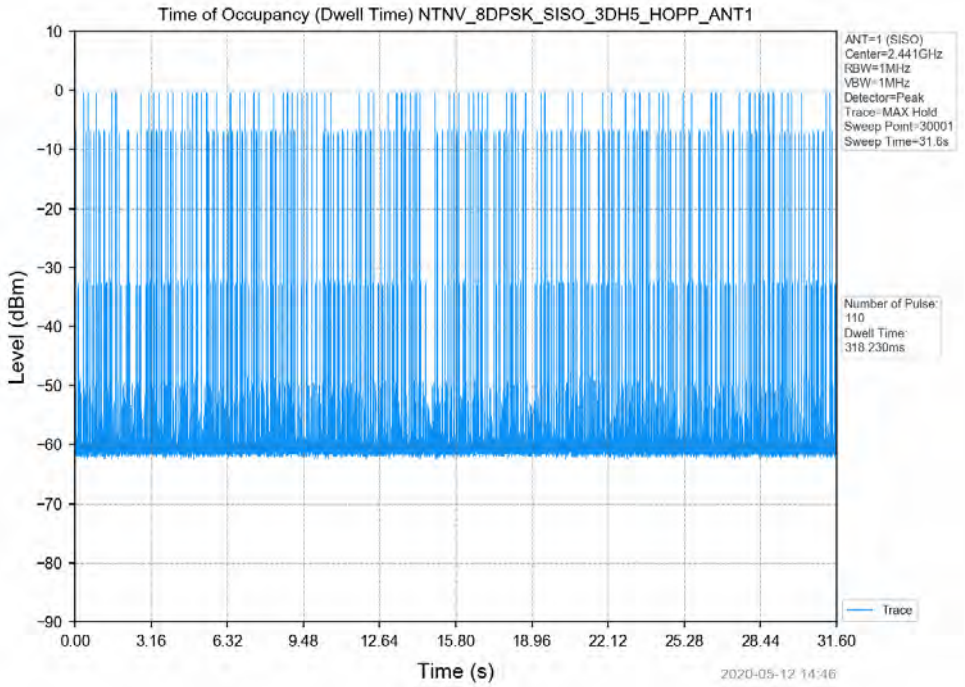







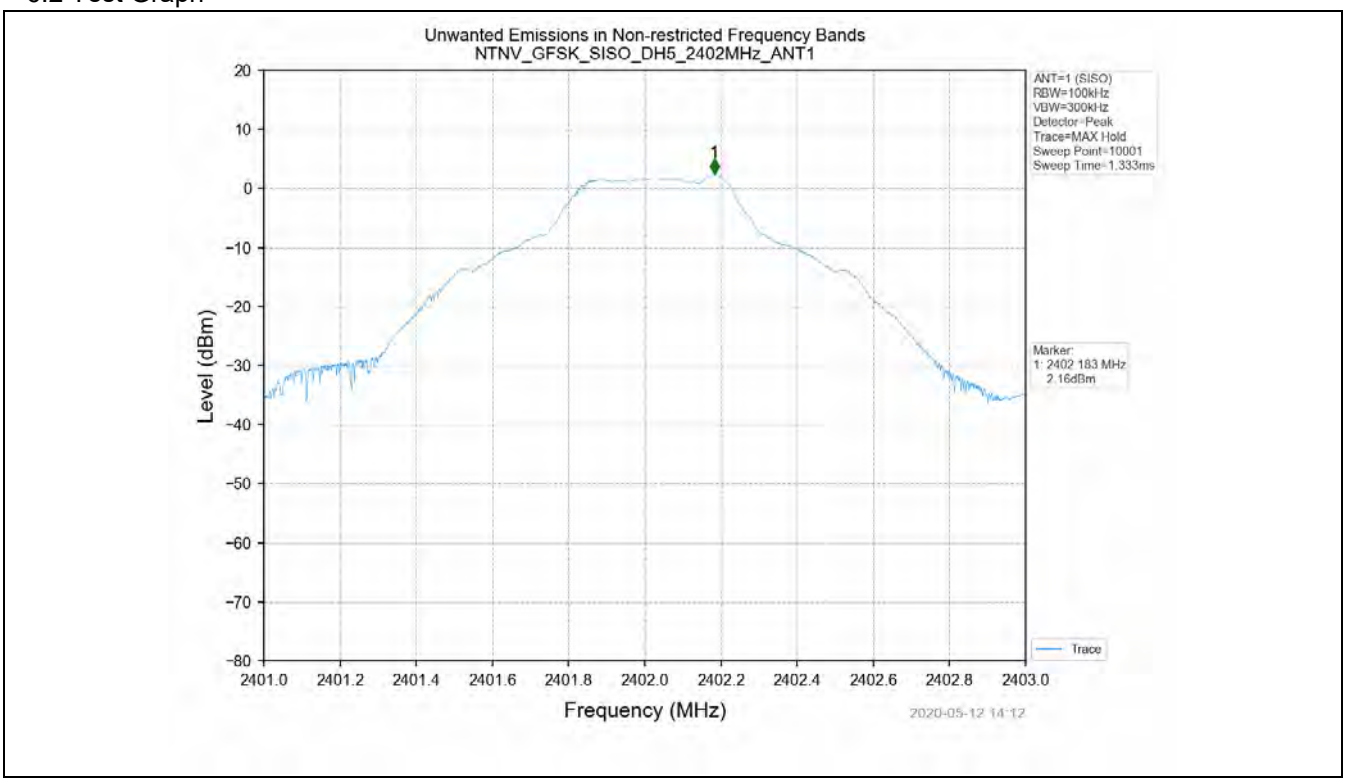


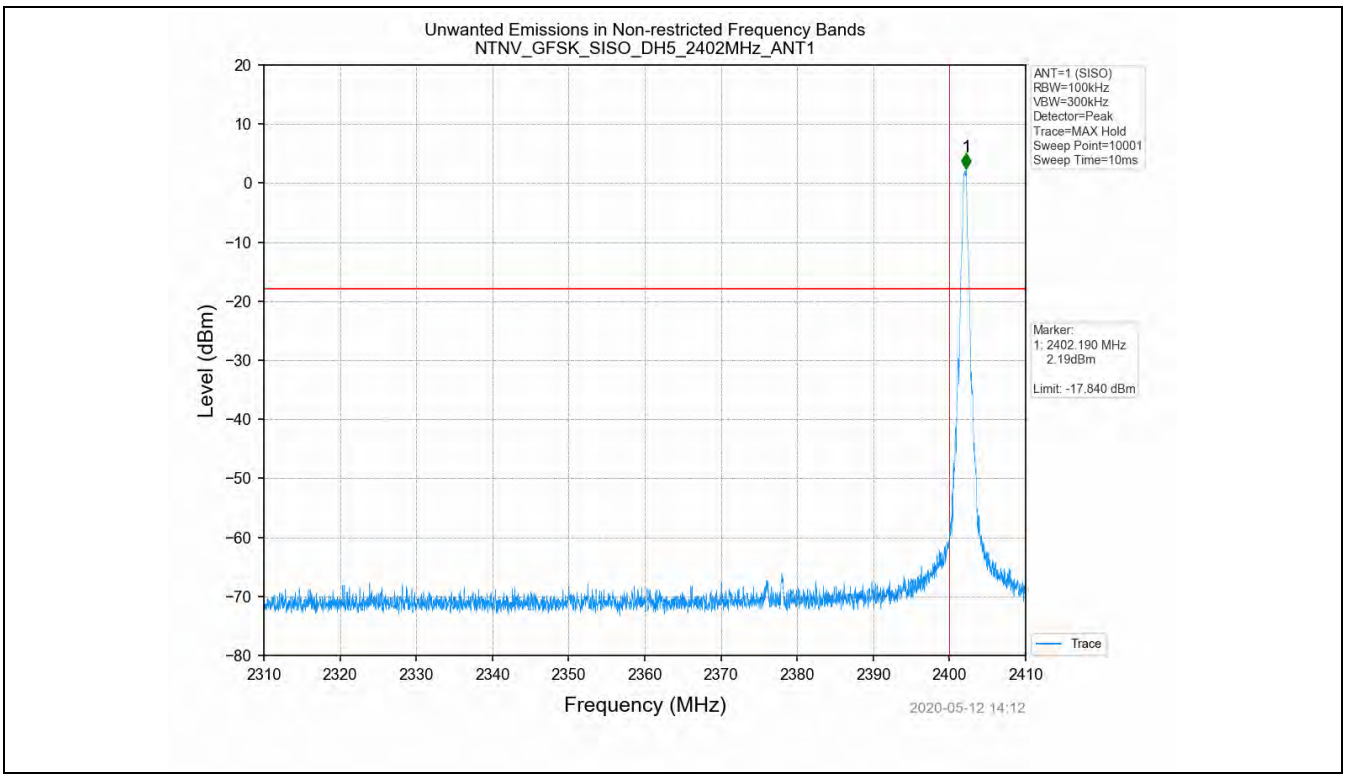

6. Unwanted Emissions in Non-restricted Frequency Bands

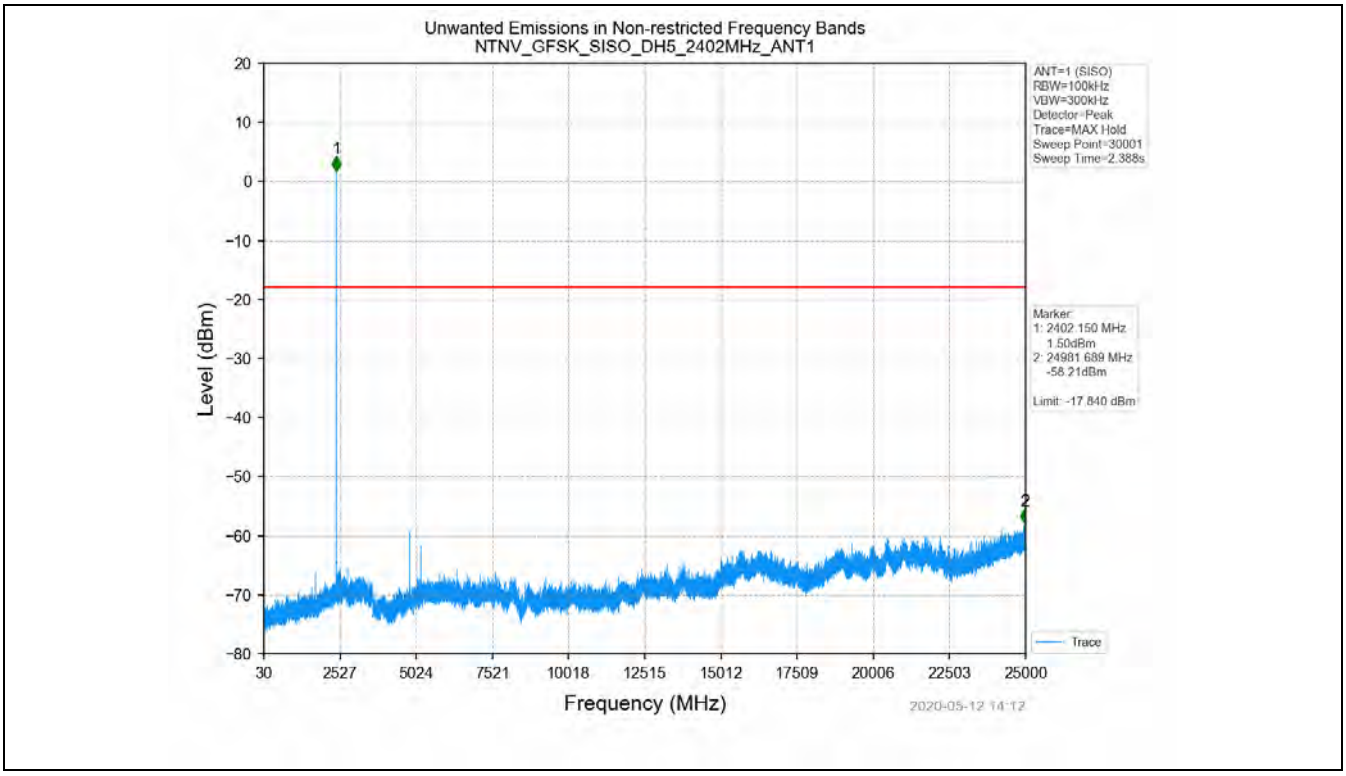
6.1 Test Result

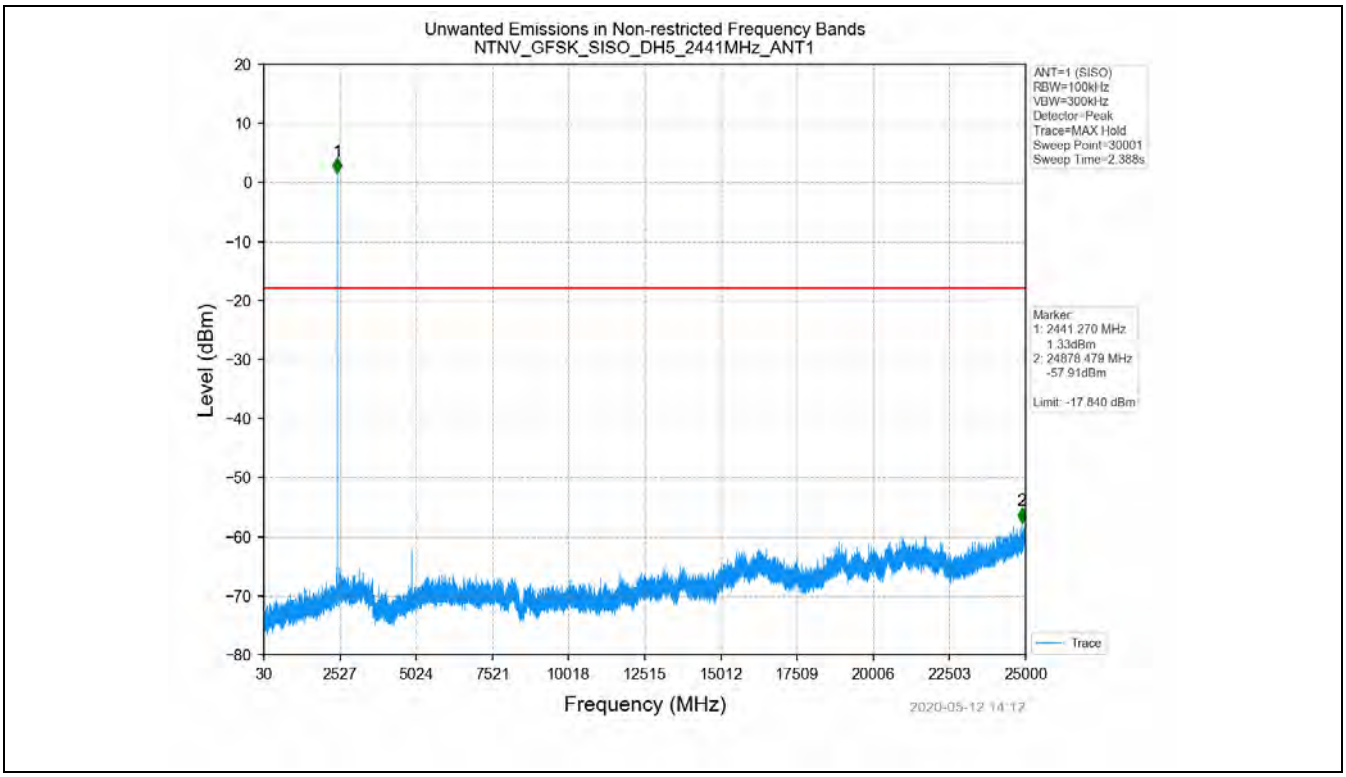
| Test Mode | Frequency (MHz) | TX Type | ANT No. | Spurious Conducted Emission (dBm) | Limits (dBm) | Verdict |
|---|---|---|---|---|---|---|
| GFSK | 2402 | SISO | 1 | Refer to test graph | -17.84 | PASS |
| | 2441 | SISO | 1 | Refer to test graph | -17.84 | PASS |
| | 2480 | SISO | 1 | Refer to test graph | -17.84 | PASS |
| | Hopping | SISO | 1 | Refer to test graph | -17.84 | PASS |
| Pi/4DQPSK | 2402 | SISO | 1 | Refer to test graph | -22.53 | PASS |
| | 2441 | SISO | 1 | Refer to test graph | -22.53 | PASS |
| | 2480 | SISO | 1 | Refer to test graph | -22.53 | PASS |
| | Hopping | SISO | 1 | Refer to test graph | -22.53 | PASS |
| 8DPSK | 2402 | SISO | 1 | Refer to test graph | -22.49 | PASS |
| | 2441 | SISO | 1 | Refer to test graph | -22.49 | PASS |
| | 2480 | SISO | 1 | Refer to test graph | -22.49 | PASS |
| | Hopping | SISO | 1 | Refer to test graph | -22.49 | PASS |

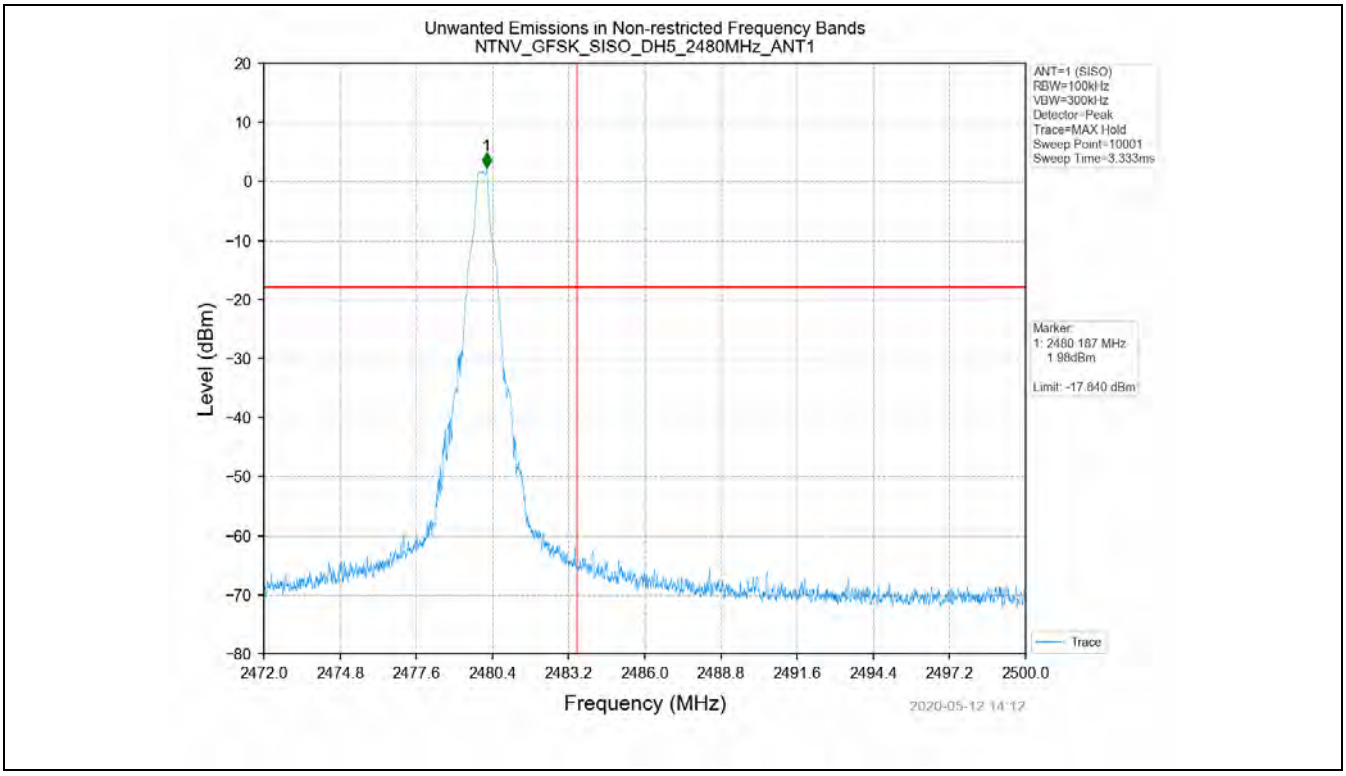
6.2 Test Graph

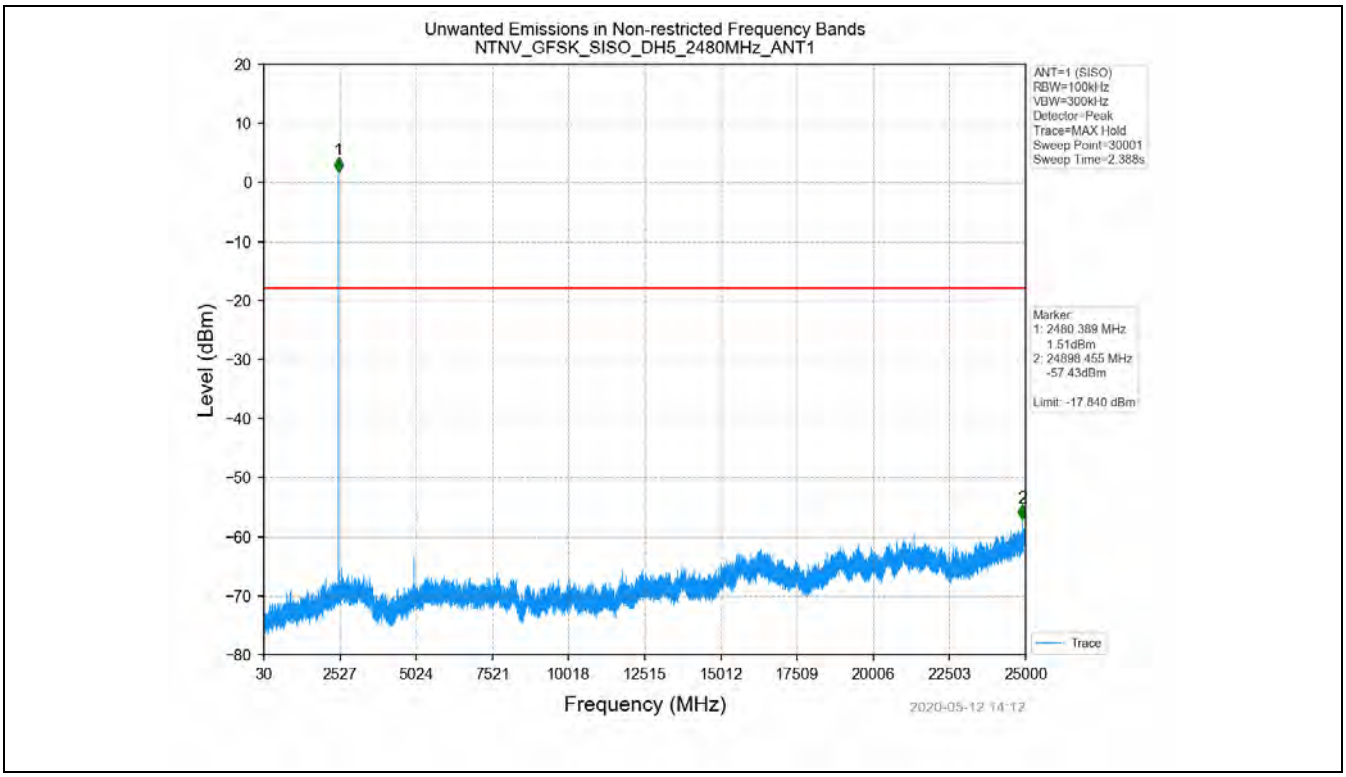


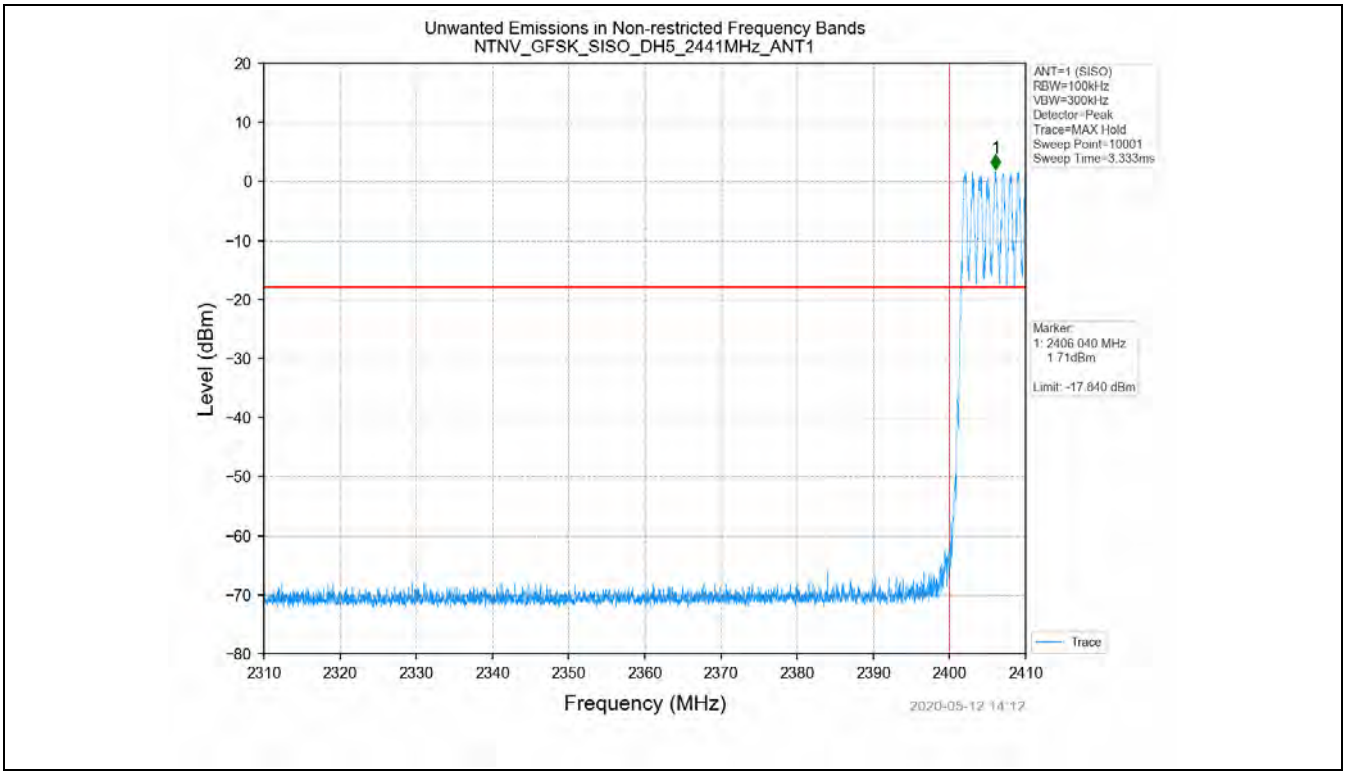



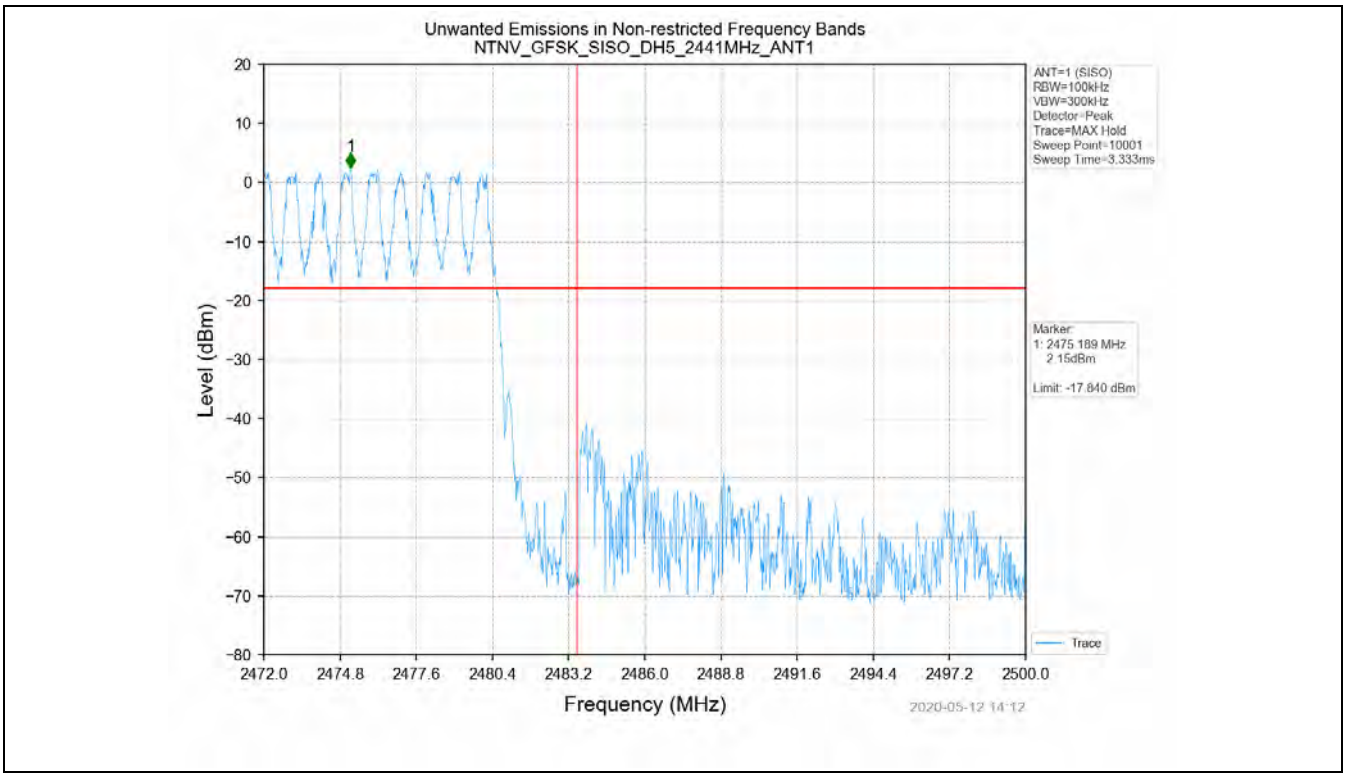


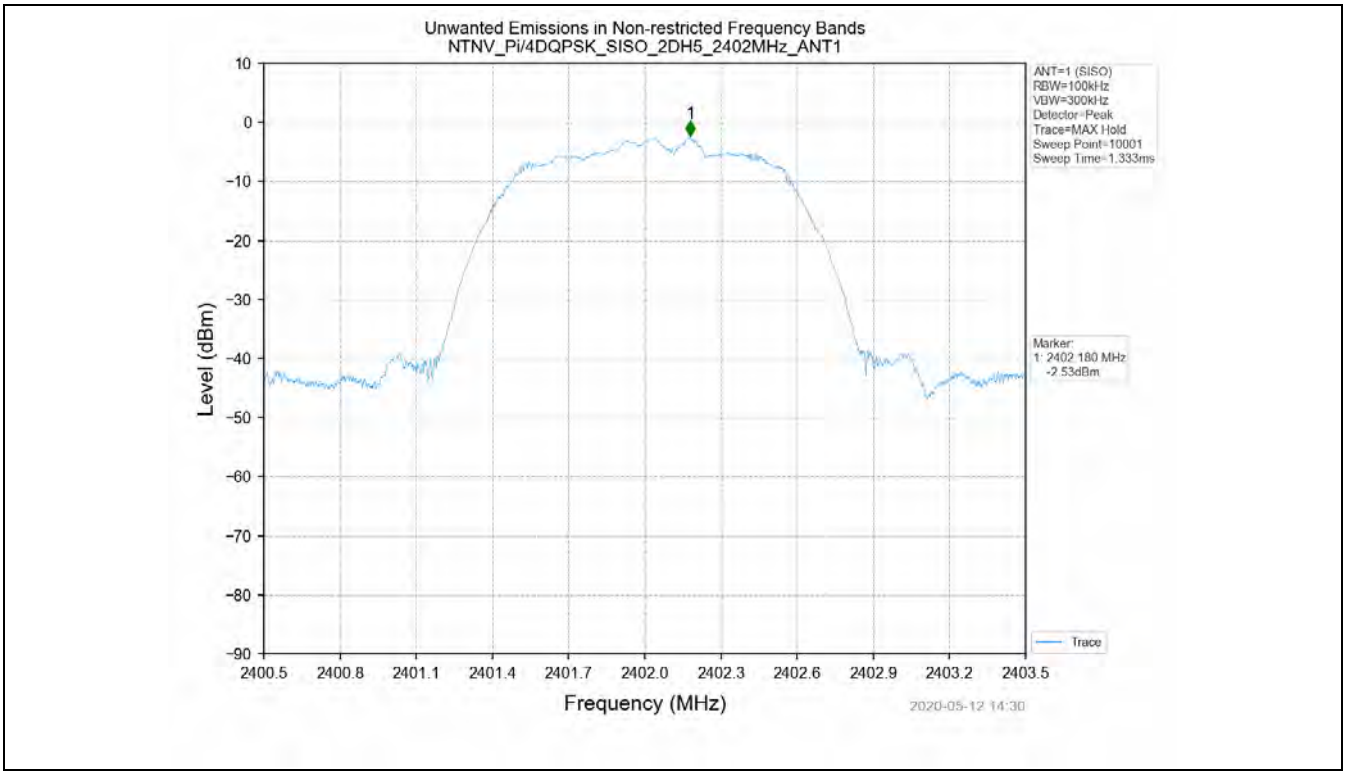



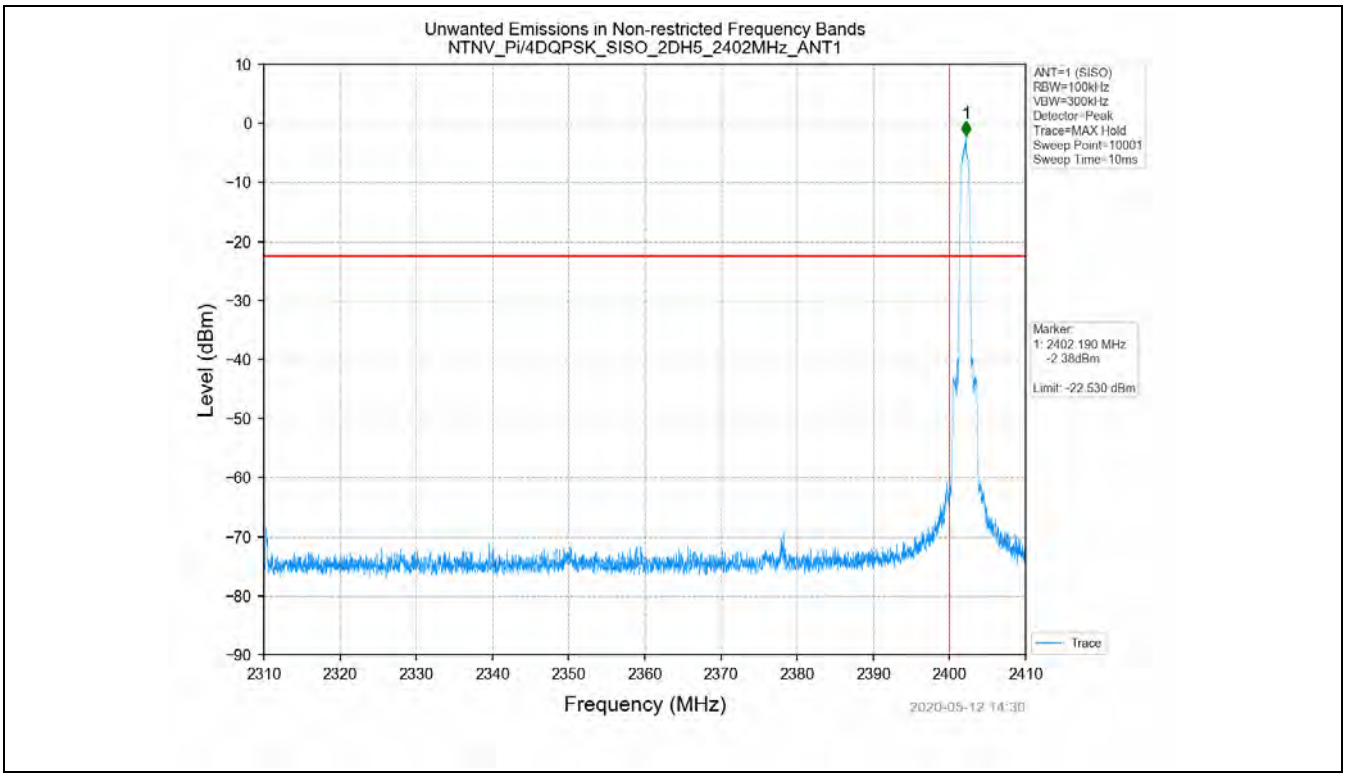


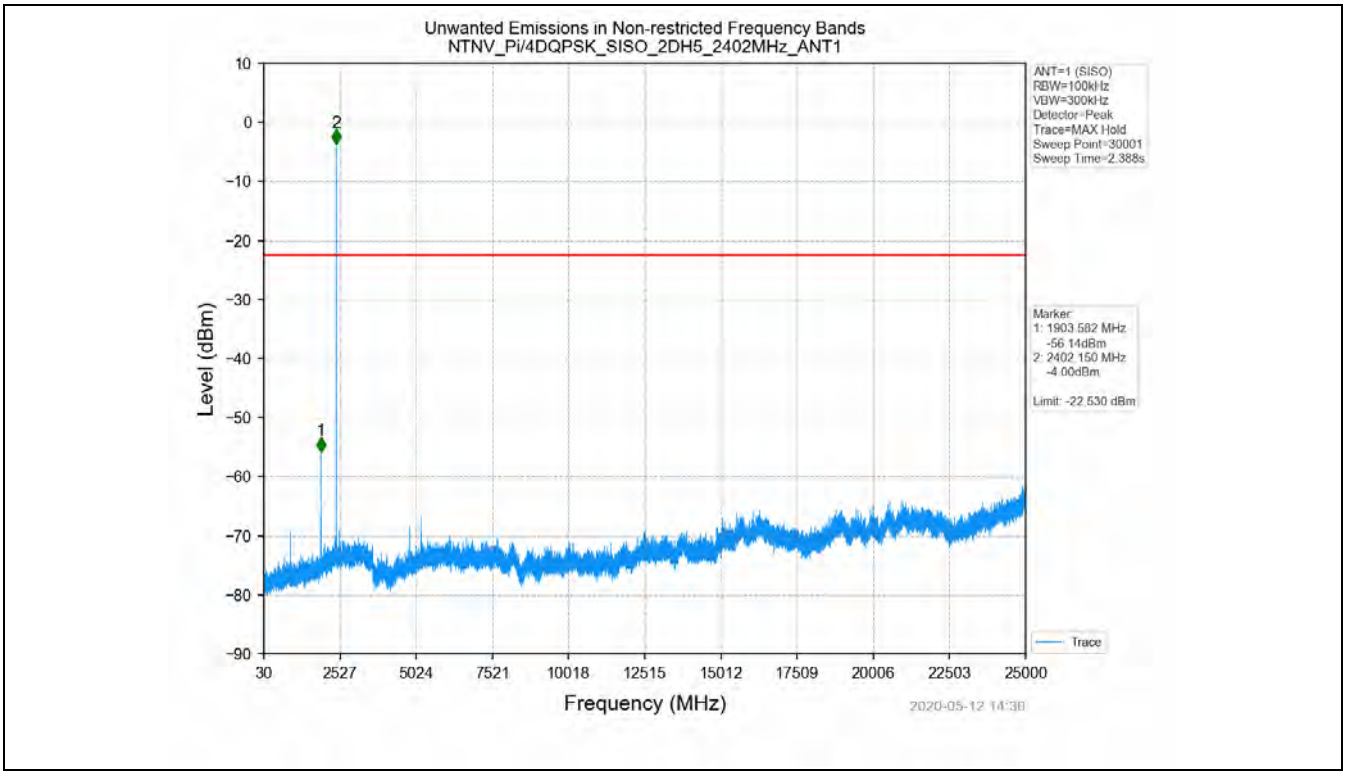



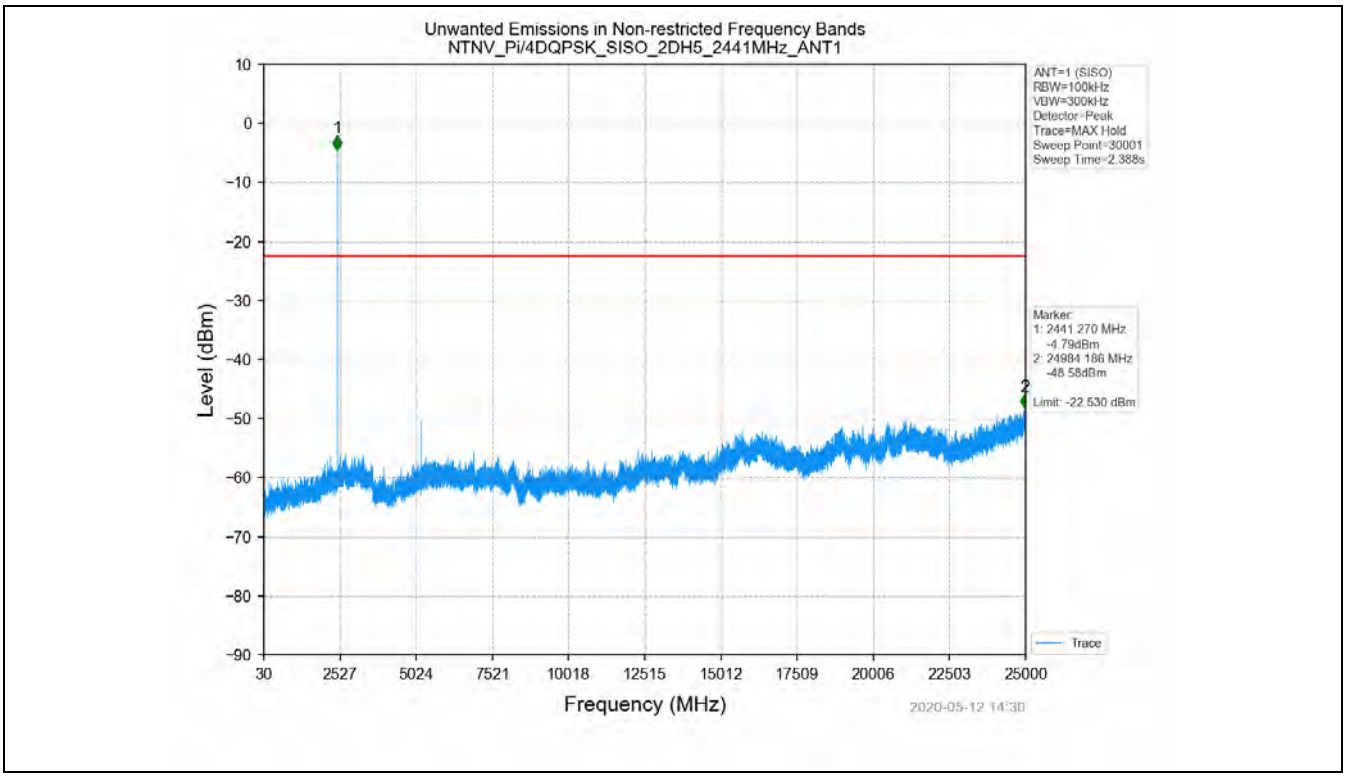


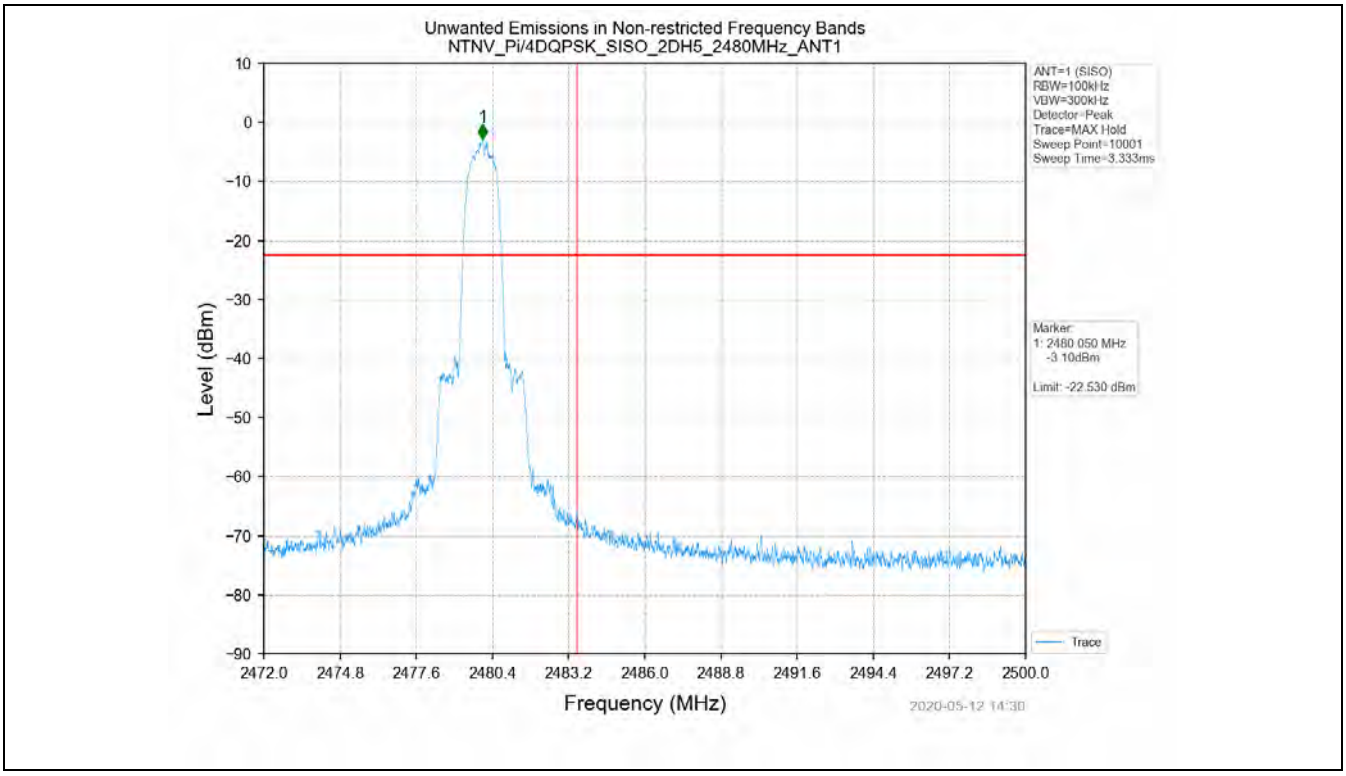



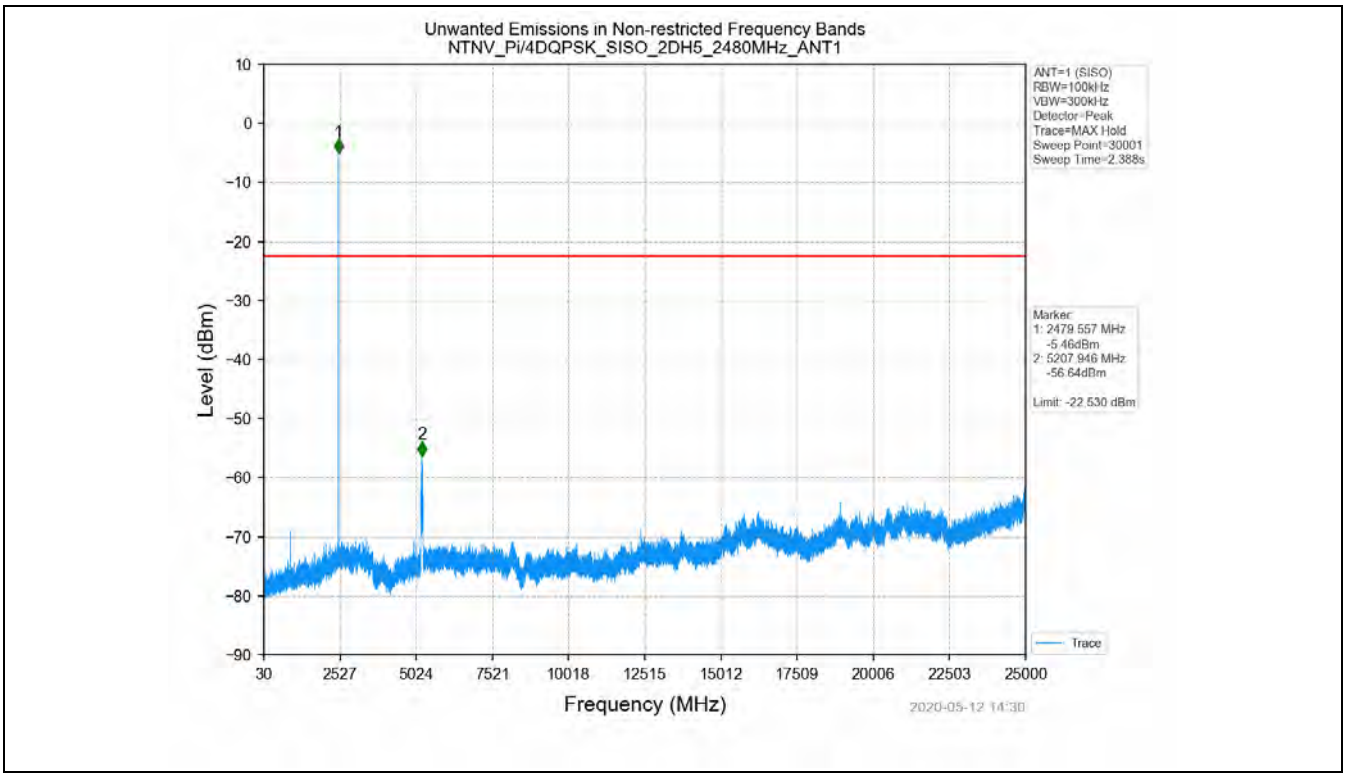


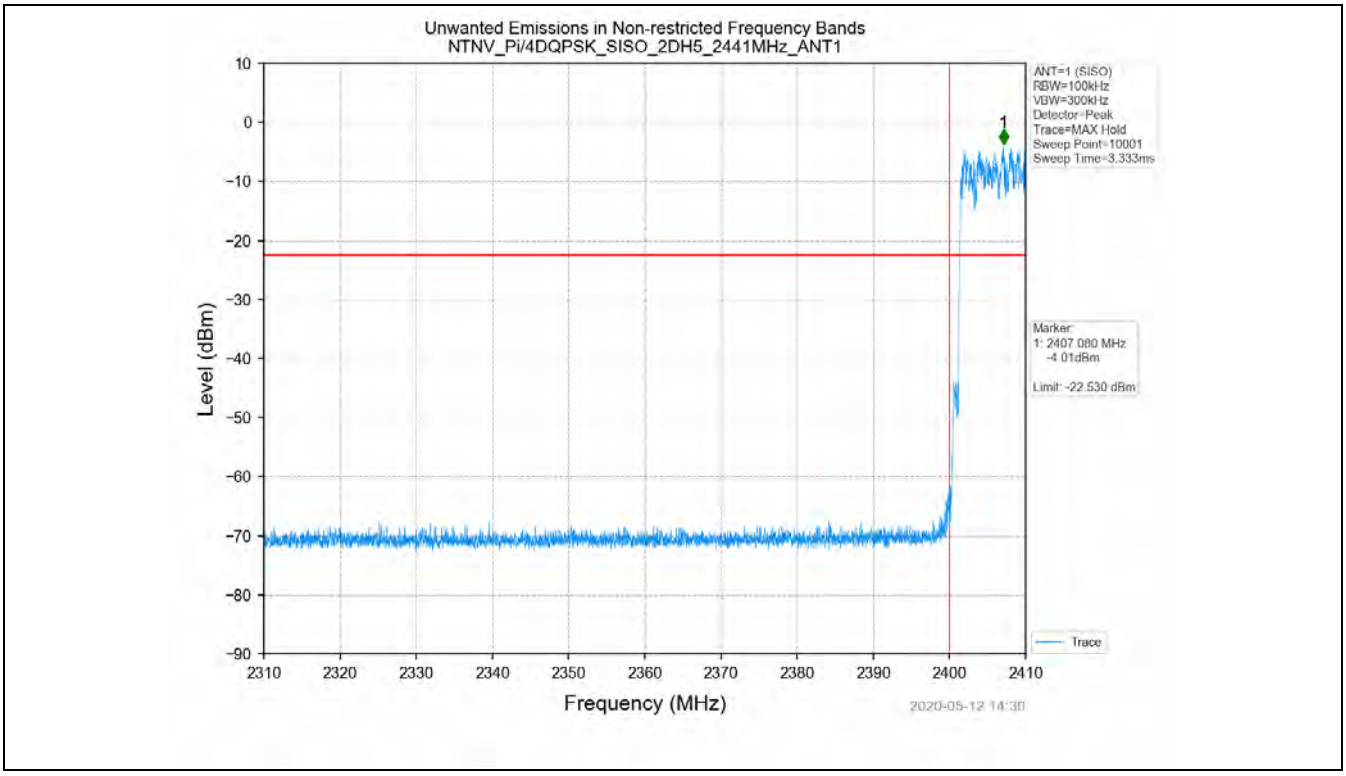



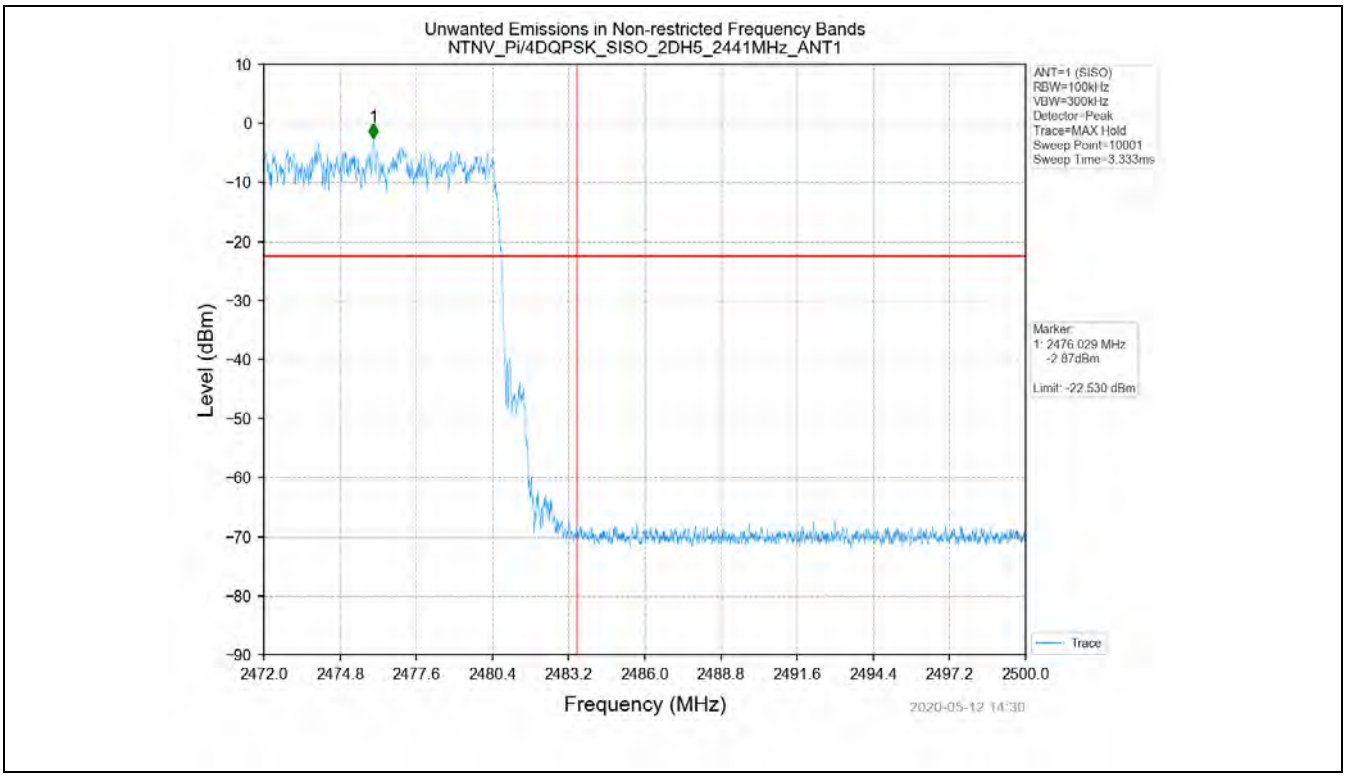


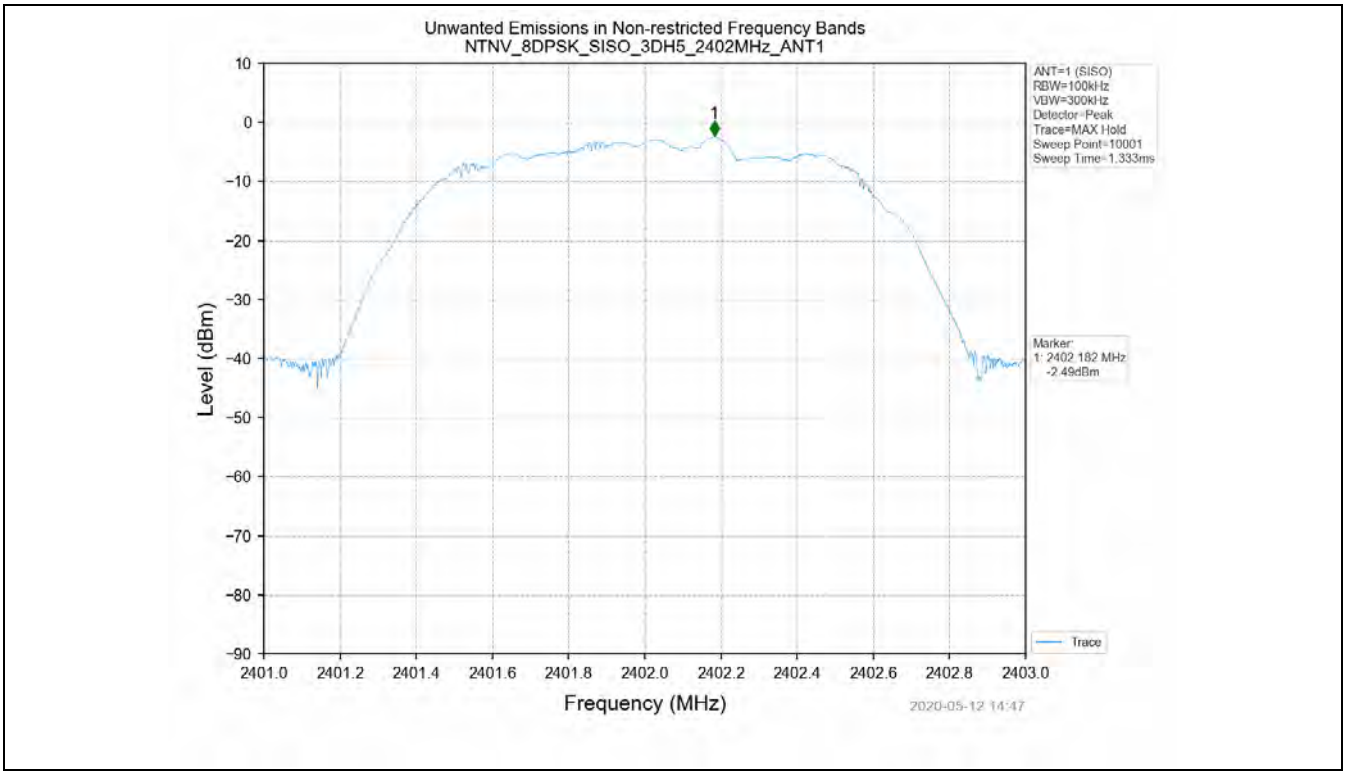



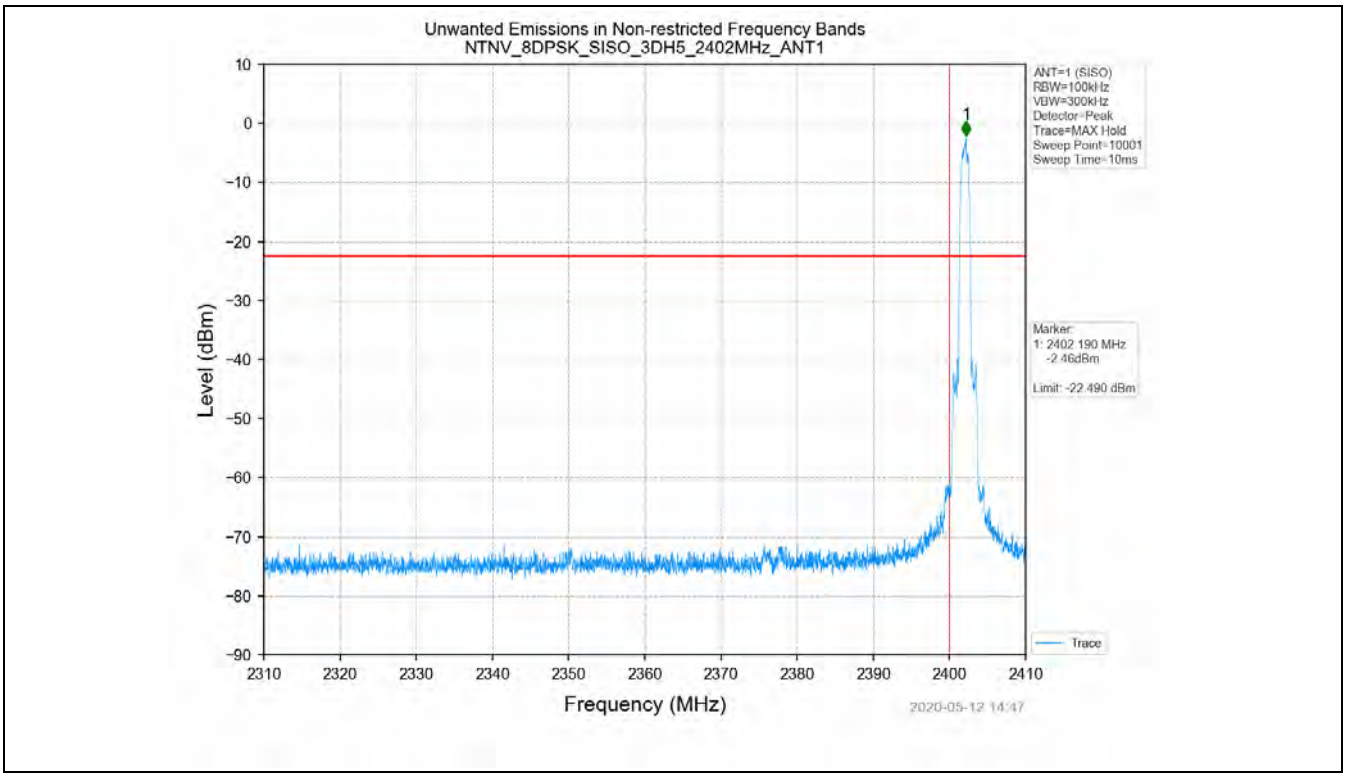


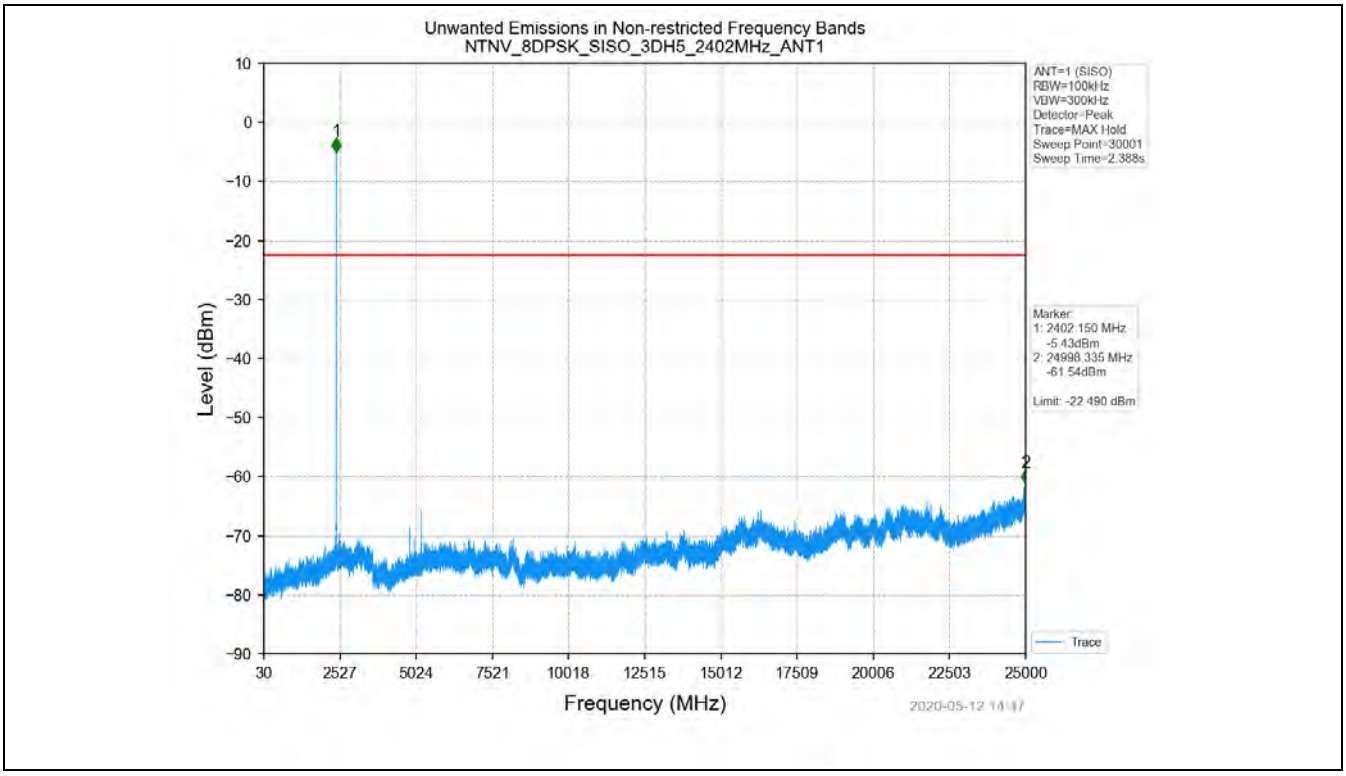



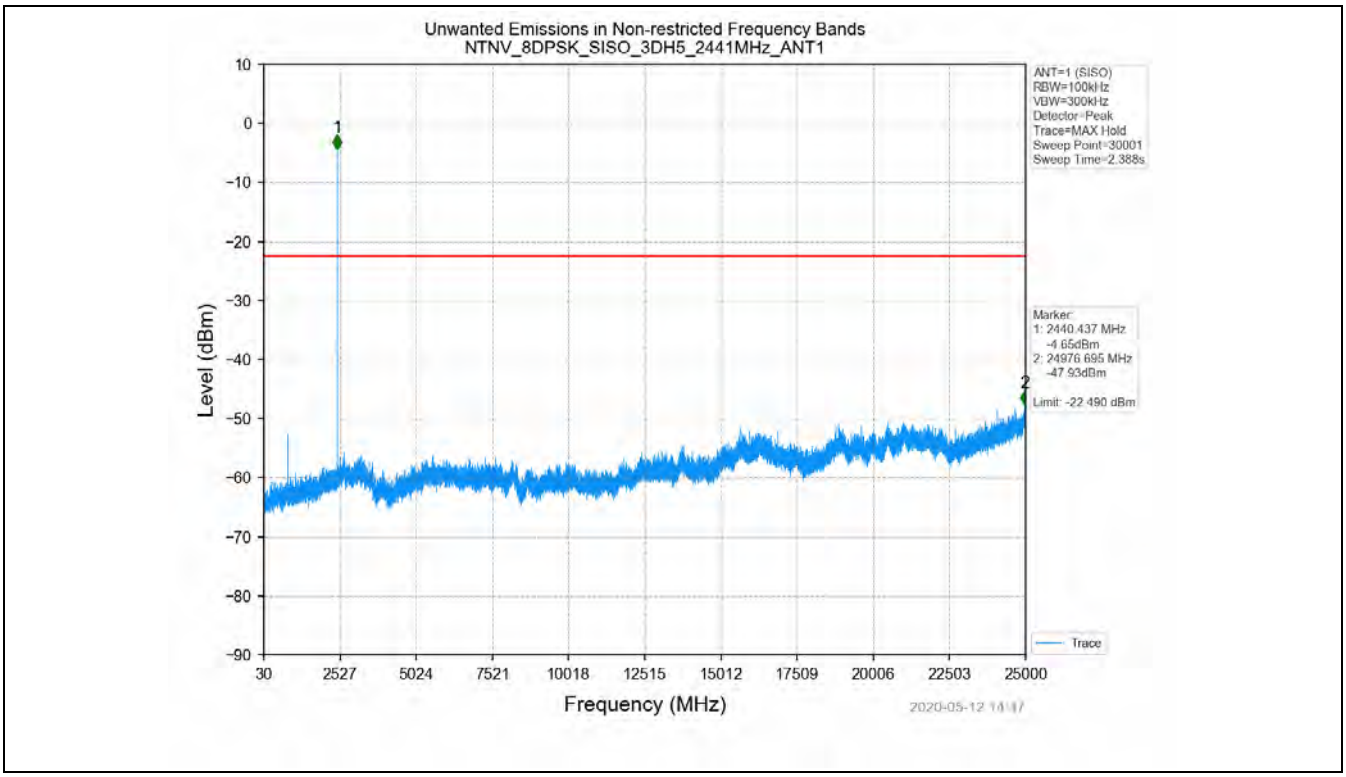


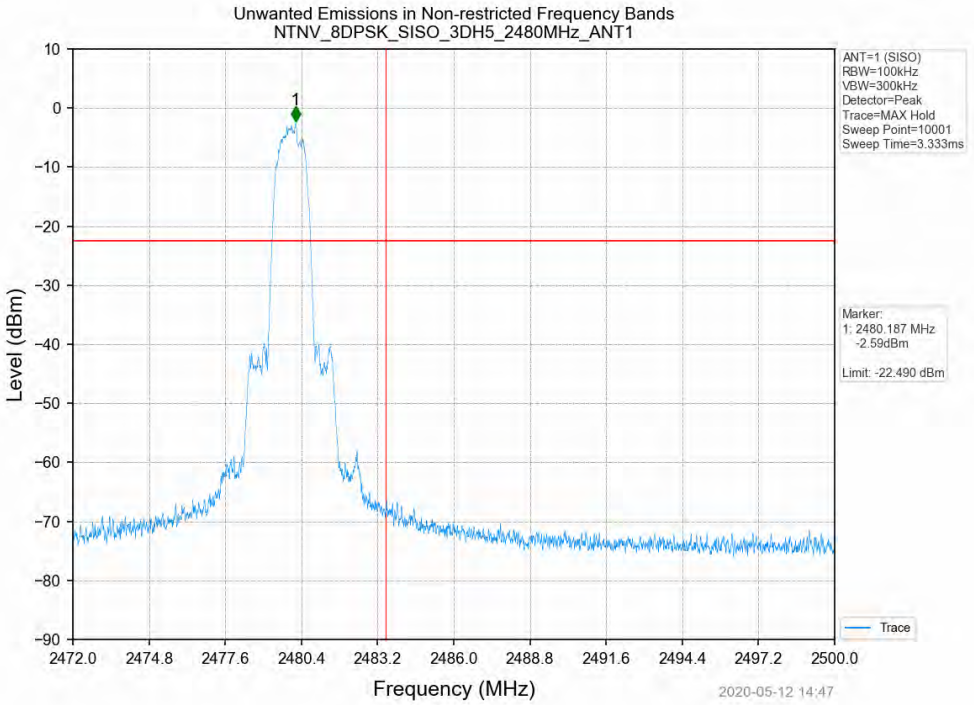



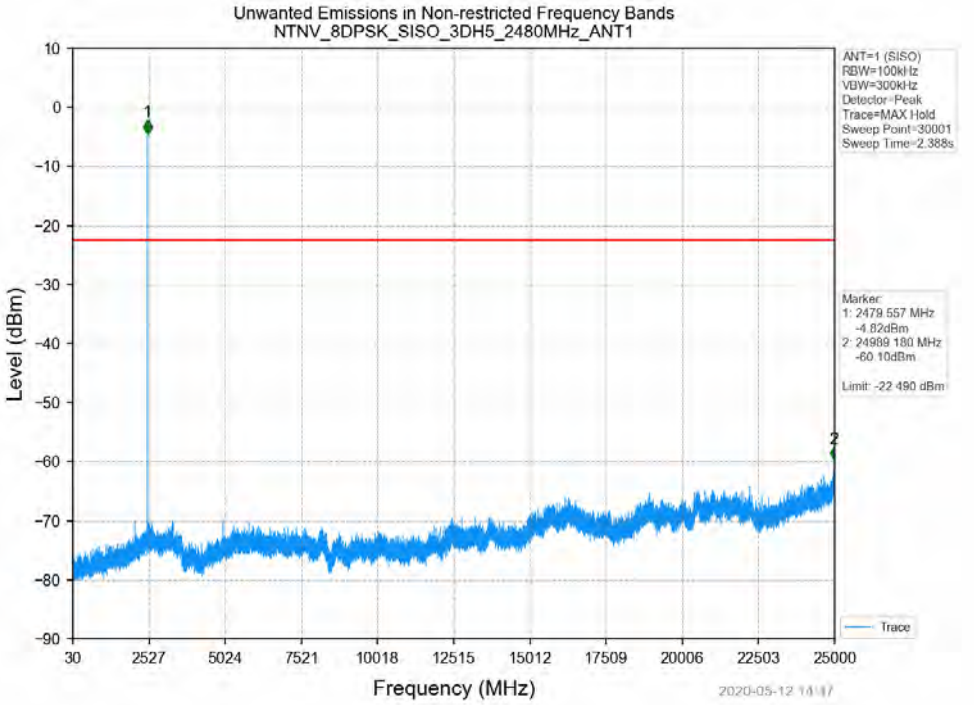


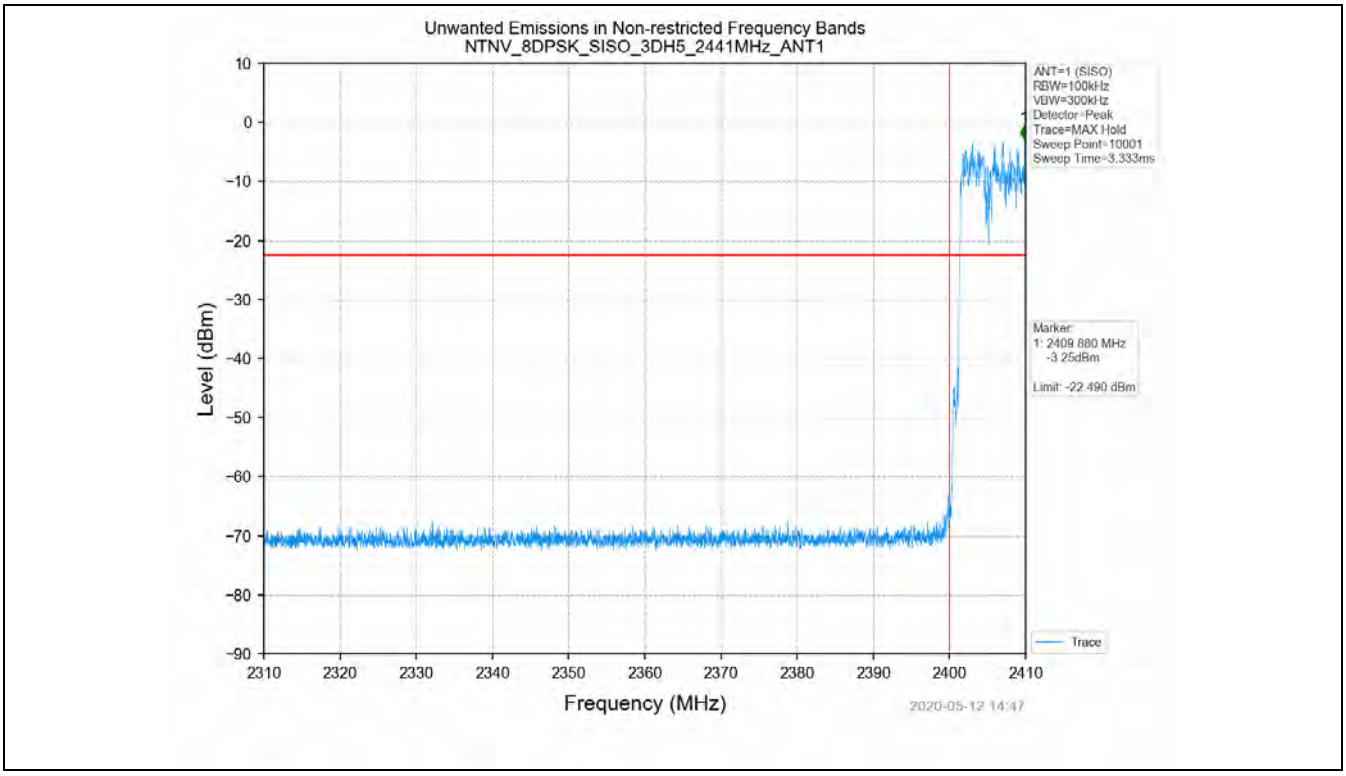



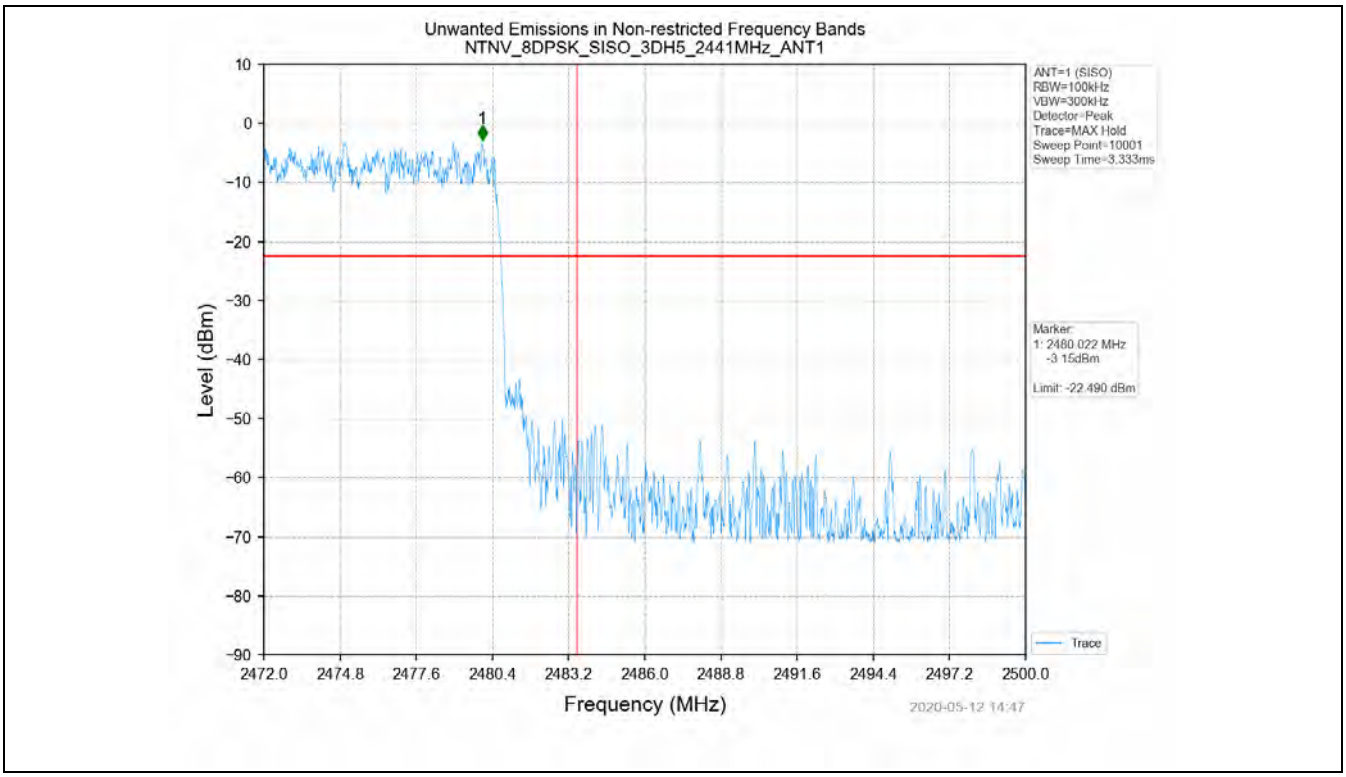







- End of the Report -