# TEST REPORT

| | |
|---|---|
| **Application No.:** | GZCR2103000023AT |
| **Applicant:** | The House of Marley. LLC |
| **Address of Applicant:** | 3000 Pontiac Trail, Commerce Township, Michigan 48390 United States |
| **Manufacturer:** | The House of Marley. LLC |
| **Address of Manufacturer:** | 3000 Pontiac Trail, Commerce Township, Michigan 48390 United States |
| **Factory:** | Cosonic Intelligent Technologies Co., Ltd. |
| **Address of Factory:** | Room 506 building 1, No.6, South Industrial Road, Songshan Lake High-tech Industrial Development Zone, Dongguan City, Guangdong, P.R. China 523808 |
| **Equipment Under Test (EUT):** | |
| **FCC ID: PVB-EMJA015** | |
| **EUT Name:** | No Bounds |
| **Model No.:** | EM-JA015 |
| **Trade mark:** | Marley |
| **Standard(s) :** | 47 CFR Part 15, Subpart C 15.247 |
| **Date of Receipt:** | 2021-03-10 |
| **Date of Test:** | 2021-03-15 to 2021-03-24 |
| **Date of Issue:** | 2021-03-26 |
| **Test Result:** | **Pass*** |

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

Kobe Jian
EMC Laboratory Manager

| Revision Record | | | | |
|---|---|---|---|---|
| **Version** | **Chapter** | **Date** | **Modifier** | **Remark** |
| *01* | | *2021-03-26* | | *Original* |
| | | | | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| **Authorized for issue by** | | | | |
| **Tested By** | | Kevin zhang<br>**Kevin Zhang/Project Engineer** | | |
| **Reviewed By** | | Ricky Liu<br>**Ricky Liu/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 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 |

Note: E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

# 3 Contents

# 4 General Information

## 4.1 Details of E.U.T.

| | |
|---|---|
| Power supply: | DC 5V, 1.0A |
| Cable(s): | DC input cable (unshielded, 1.2 m) |
| Operation Frequency: | 2402MHz to 2480MHz |
| Modulation Type: | GFSK, π/4DQPSK, 8DPSK |
| Number of Channels: | 79 |
| Channel Spacing: | 1MHz |
| Spectrum Spread Technology: | Frequency Hopping Spread Spectrum(FHSS) |
| Antenna Type: | PCB Antenna |
| Antenna Gain: | 1.18 dBi declared by applicant. |
| Function: | No bounds Portable Speaker with BT Function. |
| S/N | 208569 |
| Hardware Version | V1.5 |
| Firmware | V2.8 |
| Test Software | FCC Test tools v1.08 |
| Power Setting | 0dBm can't be changed by user. |

## 4.2 Description of Support Units

| Description | Manufacturer | Model No. | Serial No. |
|---|---|---|---|
| Note Book PC | LENOVO | Lenovo Xiaoxinchao 5000 | PF0TNMG8 |

## 4.3 Measurement Uncertainty

| Test Item | Measurement Uncertainty |
|---|---|
| Conducted Peak Output Power | ± 0.75dB |
| 20dB Bandwidth | ± 3% |
| Carrier Frequencies Separation | ± 7.25 x $10^{-8}$ |
| Hopping Channel Number | ± 7.25 x $10^{-8}$ |
| Dwell Time | ± 0.37% |
| Conducted Band Edges Measurement | ± 0.75dB |
| Conducted Spurious Emissions | ± 0.75dB |
| Radiated Emissions which fall in the restricted bands | ± 4.5dB (Below 1GHz);± 4.8dB (Above 1GHz) |
| Radiated Spurious Emissions | ± 4.5dB (Below 1GHz);± 4.8dB (Above 1GHz) |

## 4.4 Test Location

All tests were performed at:

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

198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

## 4.5 Test Facility

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

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

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.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

- **FCC Recognized 2.948 Listed Test Firm(Registration No.: 282399)**

SGS-CSTC Standards Technical Services Co., Ltd., 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 282399, May 31, 2002.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818, Jul 13, 2017.

- **Industry Canada (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

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.: R-12460, C-12584, G-10449 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

## 4.6 Deviation from Standards

None

## 4.7 Abnormalities from Standard Conditions

None

# 5 Equipment List

| Conducted Peak Output Power | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer | Agilent Technologies | N9010A | EMC2138 | 2020-09-17 | 2021-09-16 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| Test Software JS1120-3 | HangTianXing | V2.6 | GZE100-69 | N/A | N/A |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |

| 20dB Bandwidth | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer | Agilent Technologies | N9010A | EMC2138 | 2020-09-17 | 2021-09-16 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| Test Software JS1120-3 | HangTianXing | V2.6 | GZE100-69 | N/A | N/A |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |

| Carrier Frequencies Separation | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer | Agilent Technologies | N9010A | EMC2138 | 2020-09-17 | 2021-09-16 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| Test Software JS1120-3 | HangTianXing | V2.6 | GZE100-69 | N/A | N/A |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |

| Hopping Channel Number | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer | Agilent Technologies | N9010A | EMC2138 | 2020-09-17 | 2021-09-16 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| Test Software JS1120-3 | HangTianXing | V2.6 | GZE100-69 | N/A | N/A |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |

| Dwell Time | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer | Agilent Technologies | N9010A | EMC2138 | 2020-09-17 | 2021-09-16 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| Test Software JS1120-3 | HangTianXing | V2.6 | GZE100-69 | N/A | N/A |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |

| Conducted Band Edges Measurement | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer | Agilent Technologies | N9010A | EMC2138 | 2020-09-17 | 2021-09-16 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| Test Software JS1120-3 | HangTianXing | V2.6 | GZE100-69 | N/A | N/A |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |

| Conducted Spurious Emissions | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer | Agilent Technologies | N9010A | EMC2138 | 2020-09-17 | 2021-09-16 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| Test Software JS1120-3 | HangTianXing | V2.6 | GZE100-69 | N/A | N/A |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |

| Radiated Emissions which fall in the restricted bands | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Chamber cable | HangTianXing | N/A | EMC0542 | 2019-06-28 | 2021-06-27 |
| Horn Antenna | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120D | EMC2016 | 2019-09-25 | 2022-09-24 |
| 1GHz-26.5 GHz Pre-Amplifier | Agilent | 8449B | EMC0521 | 2021-01-08 | 2022-01-07 |
| 2.4GHz Filter | Micro-Tronics | BRM 50702 | EMC2069 | 2021-01-08 | 2022-01-07 |
| 966 Anechoic Chamber | C.R.T | 9m x 6m x 6m | EMC2142 | 2020-12-20 | 2023-12-19 |
| MXE EMI Receiver | Keysight | N9038A | EMC2139 | 2020-11-13 | 2021-11-12 |
| EXA Signal Analyzer | Keysight | N9010A | EMC2138 | 2020-09-17 | 2021-09-16 |
| Test Software E3 | Audix | Ver.6.120110a | GZE100-61 | N/A | N/A |

| Radiated Spurious Emissions | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EMI Test Receiver | Rohde & Schwarz | ESIB26 | EMC0522 | 2021-01-08 | 2022-01-07 |
| Chamber cable | HangTianXing | N/A | EMC0542 | 2019-06-28 | 2021-06-27 |
| Trilog Broadband Antenna 30MHz-1GHz | SCHWARZBECK MESS-ELEKTRONIK | VULB 9168 | SEM003-18 | 2019-02-22 | 2022-02-22 |
| Amplifier | HP | 8447F | EMC2065 | 2020-05-26 | 2021-05-25 |
| Active Loop Antenna | ETS-Lindgren | 6502 | EMC2190 | 2019-12-27 | 2021-12-26 |
| 10m Semi-Anechoic Chamber | ETS | N/A | EMC0530 | 2019-10-20 | 2022-10-19 |
| Test Software E3 | Audix | Ver.6.120110a | GZE100-61 | N/A | N/A |

| General used equipment | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| DMM | Fluke | 73 | EMC0006 | 2020-07-09 | 2021-07-08 |
| DMM | Fluke | 73 | EMC0007 | 2020-07-09 | 2021-07-08 |

# 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 antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of an 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 1.18 dBi.

Antenna phot please 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)

Limit:

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.

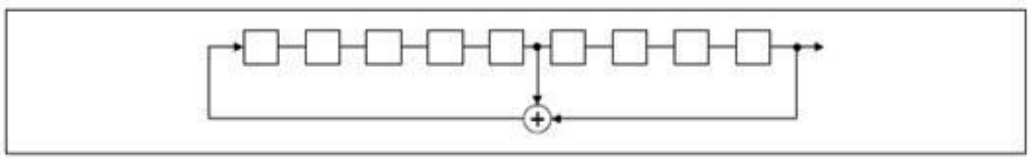
> Number of shift register stages: 9

> Length of pseudo-random sequence: 29 -1 = 511 bits

> Longest sequence of zeros: 8 (non-inverted signal)

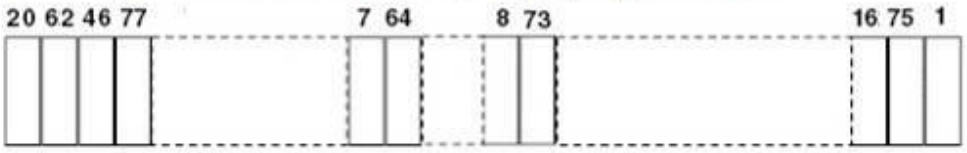
Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



*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.

# 7 Radio Spectrum Matter Test Results

## 7.1 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:

| Frequency range(MHz) | Output power of the intentional radiator(watt) |
|---|---|
| 902-928 | 1 for ≥50 hopping channels |
| | 0.25 for 25≤ hopping channels <50 |
| | 1 for digital modulation |
| 2400-2483.5 | 1 for ≥75 non-overlapping hopping channels |
| | 0.125 for all other frequency hopping systems |
| | 1 for digital modulation |
| 5725-5850 | 1 for frequency hopping systems and digital modulation |

### 7.1.1 E.U.T. Operation

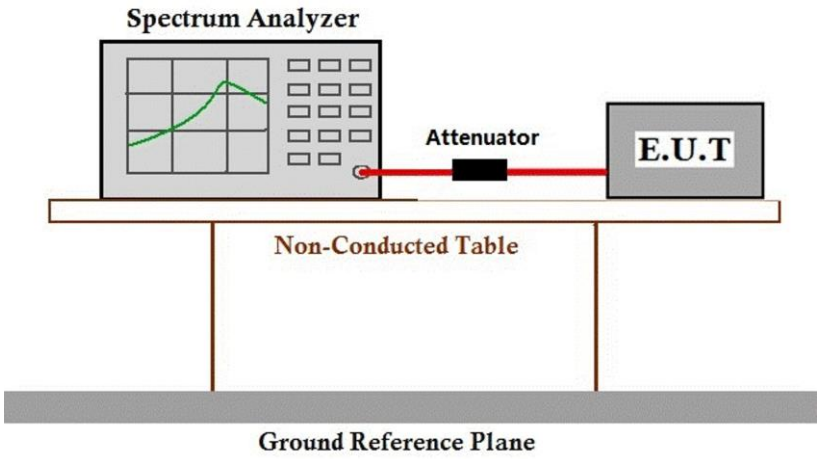
Operating Environment:

Temperature: 25.2 °C Humidity: 53.1 % RH Atmospheric Pressure: 1010 mbar

### 7.1.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 01 | 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. |

### 7.1.3 Test Setup Diagram




### 7.1.4 Measurement Procedure and Data

Please Refer To Appendix For Details

## 7.2 20dB Bandwidth

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

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

### 7.2.1 E.U.T. Operation

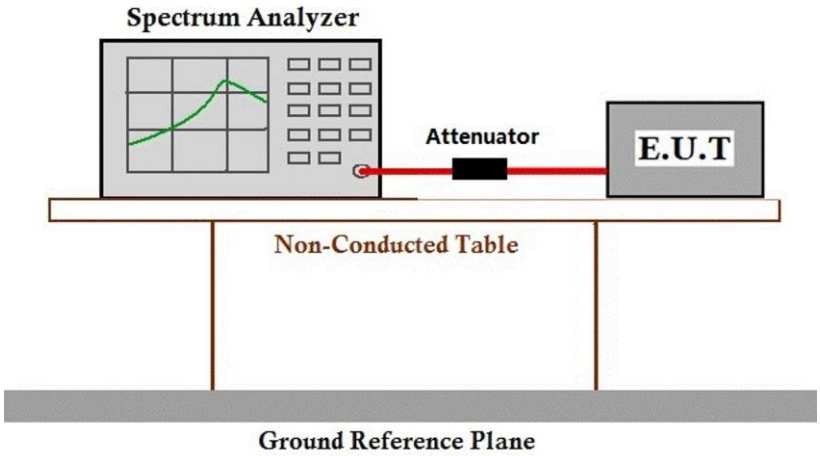
Operating Environment:

Temperature: 25.2 °C Humidity: 53.1 % RH Atmospheric Pressure: 1010 mbar

### 7.2.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 01 | 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. |

### 7.2.3 Test Setup Diagram




### 7.2.4 Measurement Procedure and Data

Please Refer To Appendix For Details

## 7.3 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.

### 7.3.1 E.U.T. Operation

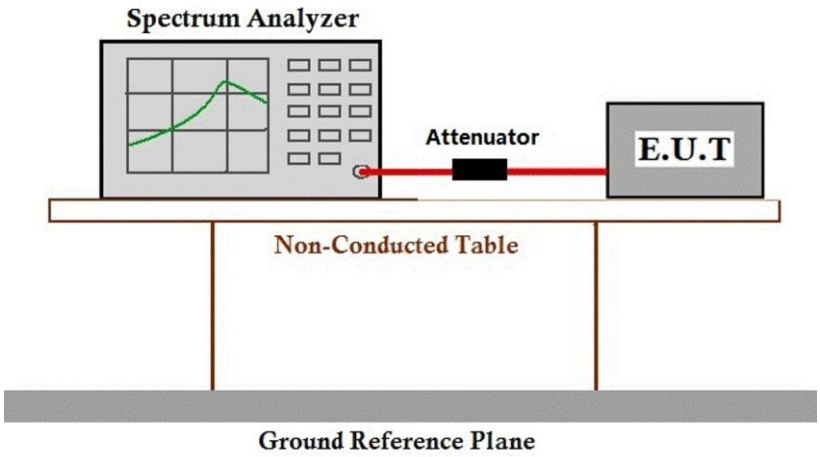
Operating Environment:

Temperature: 25.2 °C Humidity: 53.1 % RH Atmospheric Pressure: 1010 mbar

### 7.3.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | 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. |

### 7.3.3 Test Setup Diagram




### 7.3.4 Measurement Procedure and Data

Please Refer To Appendix For Details

## 7.4 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 |

### 7.4.1 E.U.T. Operation

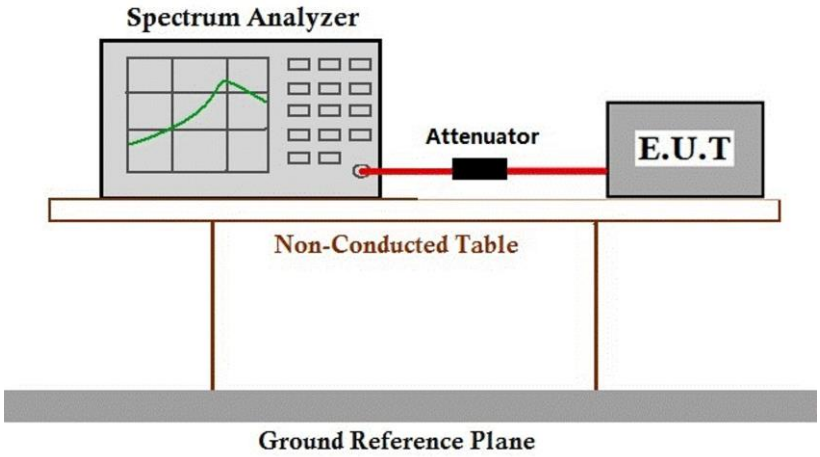
Operating Environment:

Temperature: 25.2 °C Humidity: 53.1 % RH Atmospheric Pressure: 1010 mbar

### 7.4.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | 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. |

### 7.4.3 Test Setup Diagram




### 7.4.4 Measurement Procedure and Data

Please Refer To Appendix For Details

## 7.5 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 |

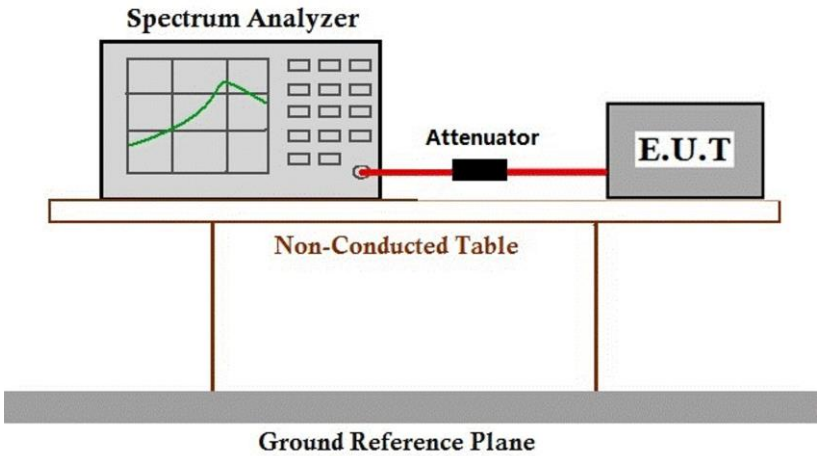
### 7.5.1 E.U.T. Operation

Operating Environment:
Temperature: 25.2 °C Humidity: 53.1 % RH Atmospheric Pressure: 1010 mbar

### 7.5.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | 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. |

### 7.5.3 Test Setup Diagram




### 7.5.4 Measurement Procedure and Data

Please Refer To Appendix For Details

## 7.6 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

imit:

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).

### 7.6.1 E.U.T. Operation

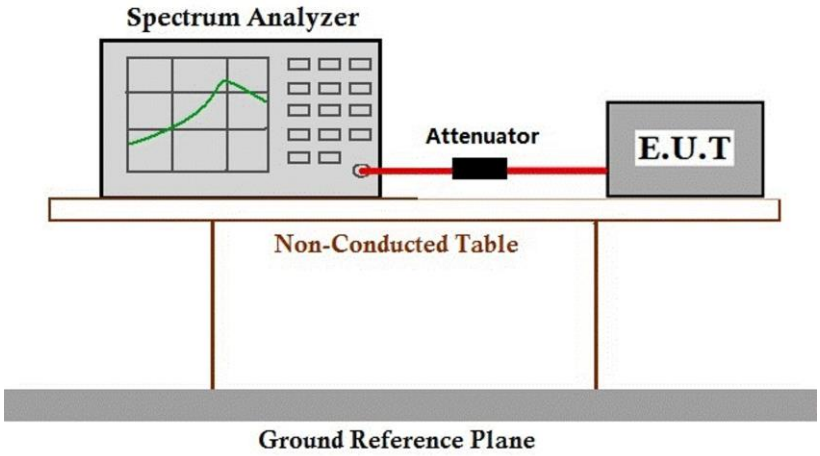
Operating Environment:

Temperature: 25.2 °C Humidity: 53.1 % RH Atmospheric Pressure: 1010 mbar

### 7.6.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 01 | 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. |

### 7.6.3 Test Setup Diagram




### 7.6.4 Measurement Procedure and Data

Please Refer To Appendix For Details

## 7.7 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).

### 7.7.1 E.U.T. Operation

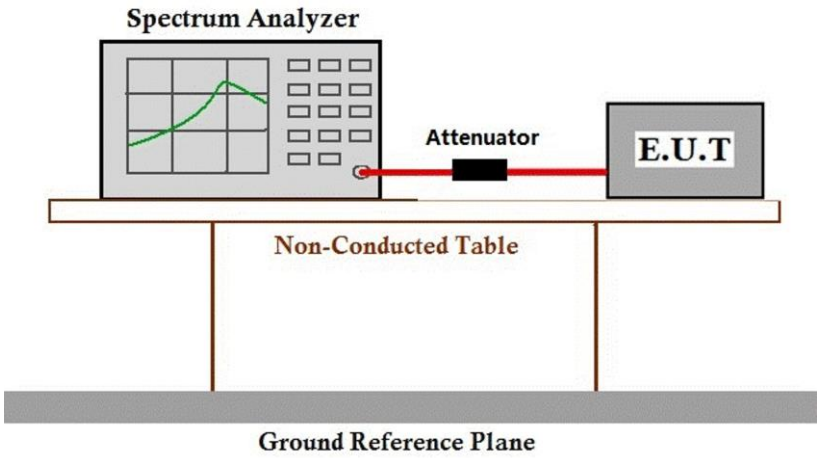
Operating Environment:

Temperature: 25.2 °C Humidity: 53.1 % RH Atmospheric Pressure: 1010 mbar

### 7.7.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 01 | 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. |

### 7.7.3 Test Setup Diagram




### 7.7.4 Measurement Procedure and Data

Please Refer To Appendix For Details

## 7.8 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. | | |

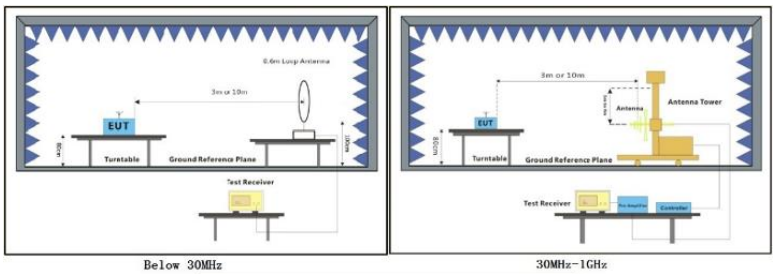
### 7.8.1 E.U.T. Operation

Operating Environment:
Temperature: 25.0 °C Humidity: 68.1 % RH Atmospheric Pressure: 1010 mbar

### 7.8.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 01 | 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. |

### 7.8.3 Test Setup Diagram



**7.8.4 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 Highest channel.

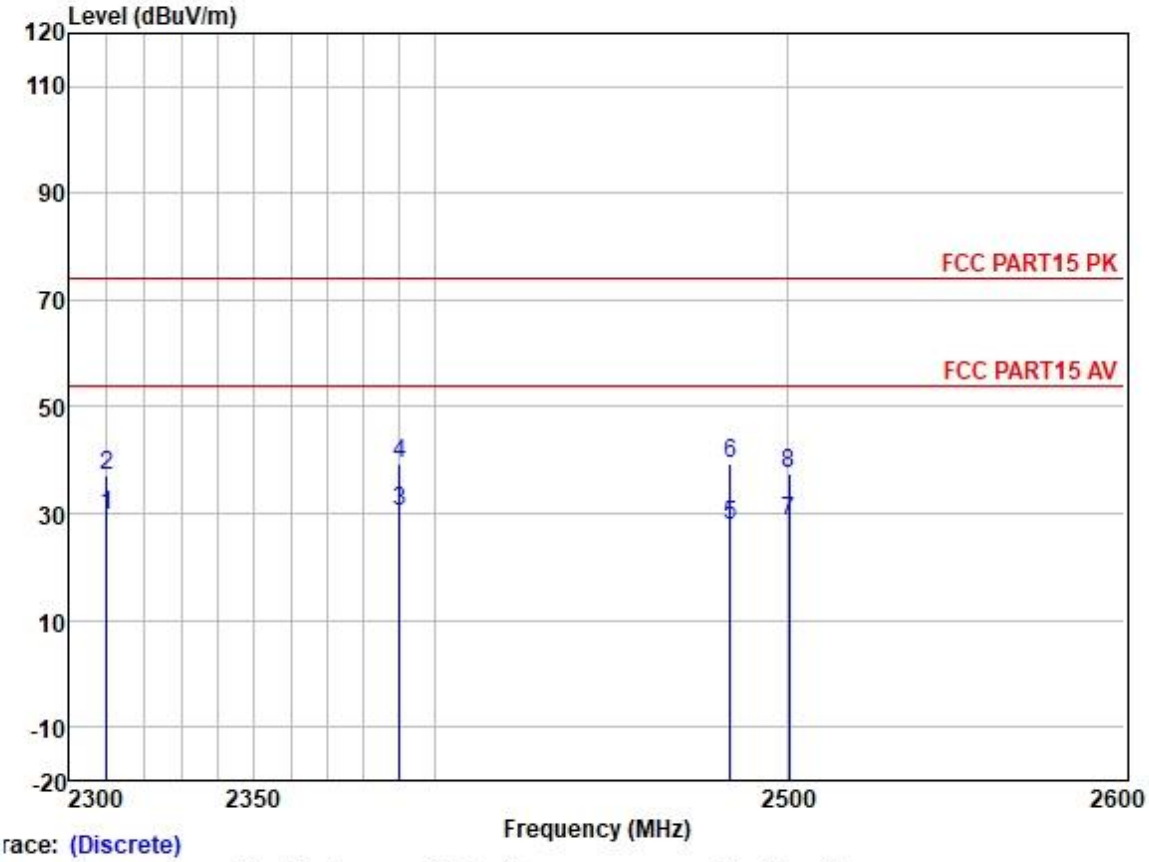
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

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.

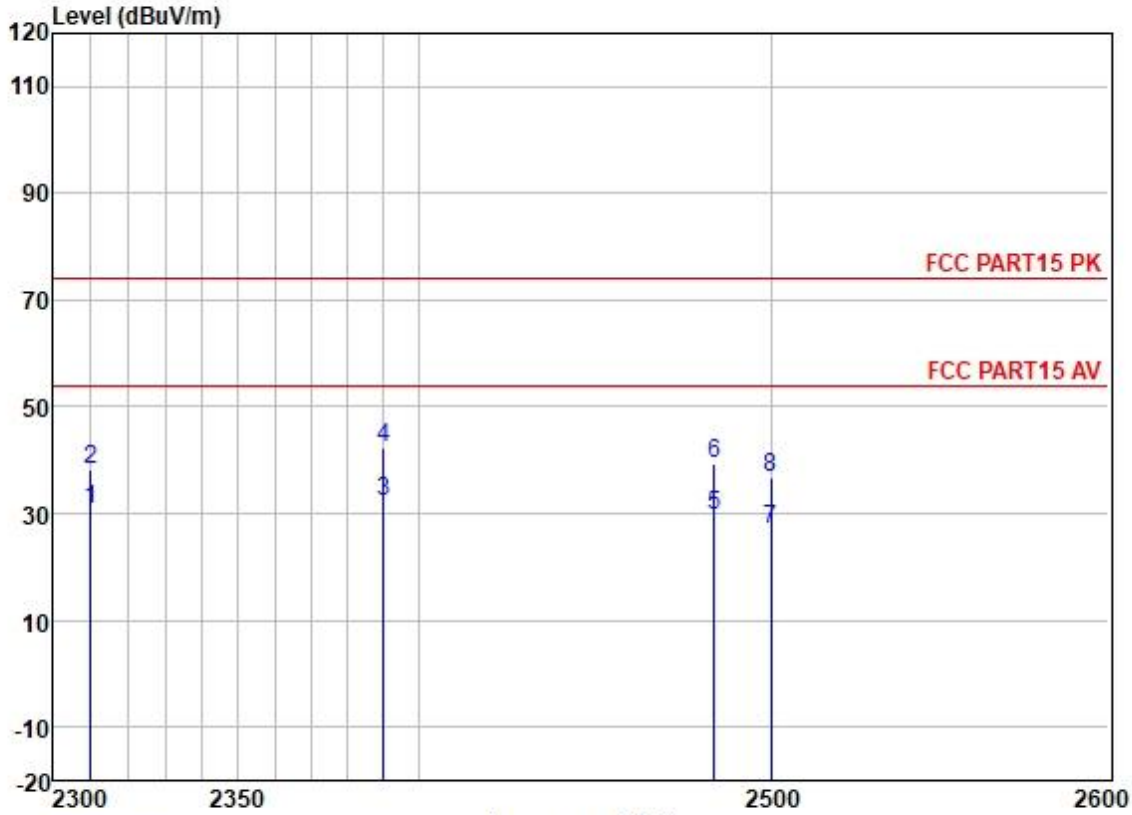
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:High;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 2310.000 | 36.84 | 27.15 | 3.32 | 37.62 | 29.69 | 54.00 | -24.31 | HORIZONTAL | Average |
| 2 | 2310.000 | 44.10 | 27.15 | 3.32 | 37.62 | 36.95 | 74.00 | -37.05 | HORIZONTAL | Peak |
| 3 | 2390.000 | 37.15 | 27.33 | 3.48 | 37.59 | 30.37 | 54.00 | -23.63 | HORIZONTAL | Average |
| 4 | 2390.000 | 46.06 | 27.33 | 3.48 | 37.59 | 39.28 | 74.00 | -34.72 | HORIZONTAL | Peak |
| 5 | 2483.500 | 34.36 | 27.48 | 3.53 | 37.57 | 27.80 | 54.00 | -26.20 | HORIZONTAL | Average |
| 6 | 2483.500 | 45.75 | 27.48 | 3.53 | 37.57 | 39.19 | 74.00 | -34.81 | HORIZONTAL | Peak |
| 7 | 2500.583 | 35.32 | 27.50 | 3.40 | 37.56 | 28.66 | 54.00 | -25.34 | HORIZONTAL | Average |
| 8 | 2500.583 | 44.01 | 27.50 | 3.40 | 37.56 | 37.35 | 74.00 | -36.65 | HORIZONTAL | Peak |

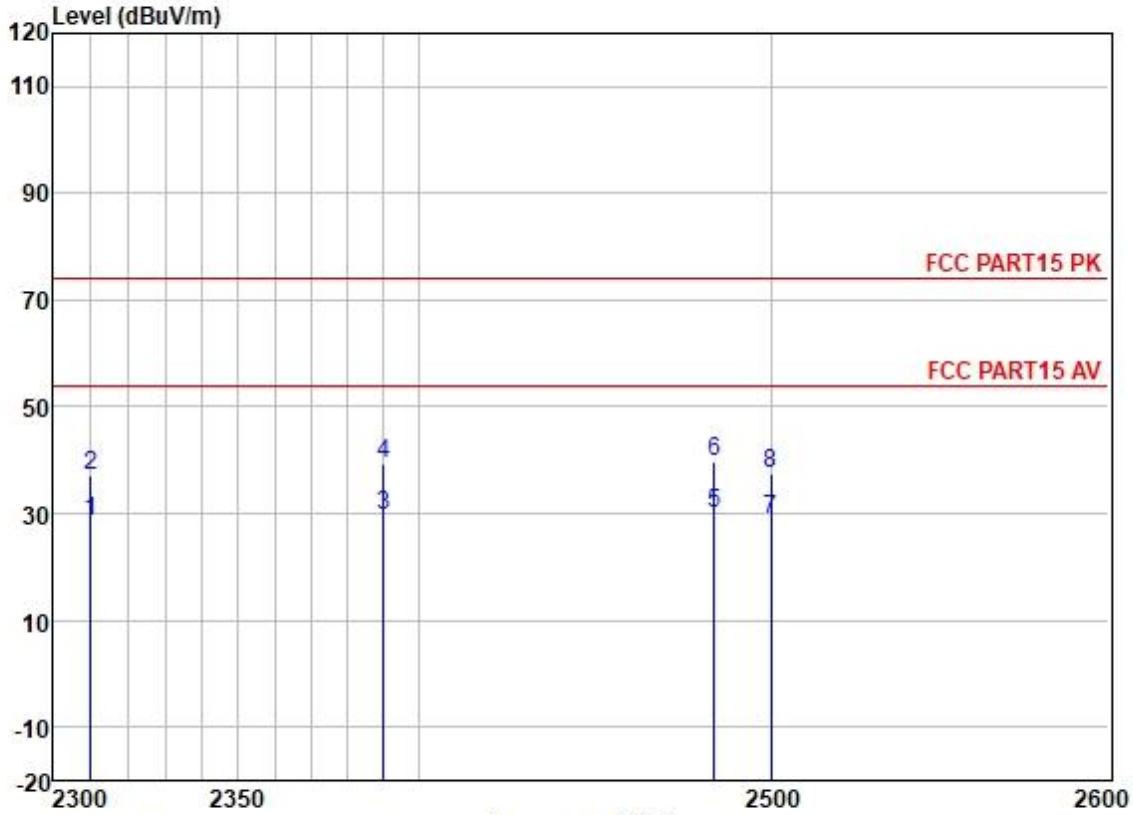
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 2310.000 | 37.84 | 27.15 | 3.32 | 37.62 | 30.69 | 54.00 | -23.31 | HORIZONTAL | Average |
| 2 | 2310.000 | 45.21 | 27.15 | 3.32 | 37.62 | 38.06 | 74.00 | -35.94 | HORIZONTAL | Peak |
| 3 | 2390.000 | 39.01 | 27.33 | 3.48 | 37.59 | 32.23 | 54.00 | -21.77 | HORIZONTAL | Average |
| 4 | 2390.000 | 49.01 | 27.33 | 3.48 | 37.59 | 42.23 | 74.00 | -31.77 | HORIZONTAL | Peak |
| 5 | 2483.500 | 36.03 | 27.48 | 3.53 | 37.57 | 29.47 | 54.00 | -24.53 | HORIZONTAL | Average |
| 6 | 2483.500 | 45.80 | 27.48 | 3.53 | 37.57 | 39.24 | 74.00 | -34.76 | HORIZONTAL | Peak |
| 7 | 2500.000 | 33.78 | 27.50 | 3.40 | 37.56 | 27.12 | 54.00 | -26.88 | HORIZONTAL | Average |
| 8 | 2500.000 | 43.52 | 27.50 | 3.40 | 37.56 | 36.86 | 74.00 | -37.14 | HORIZONTAL | Peak |

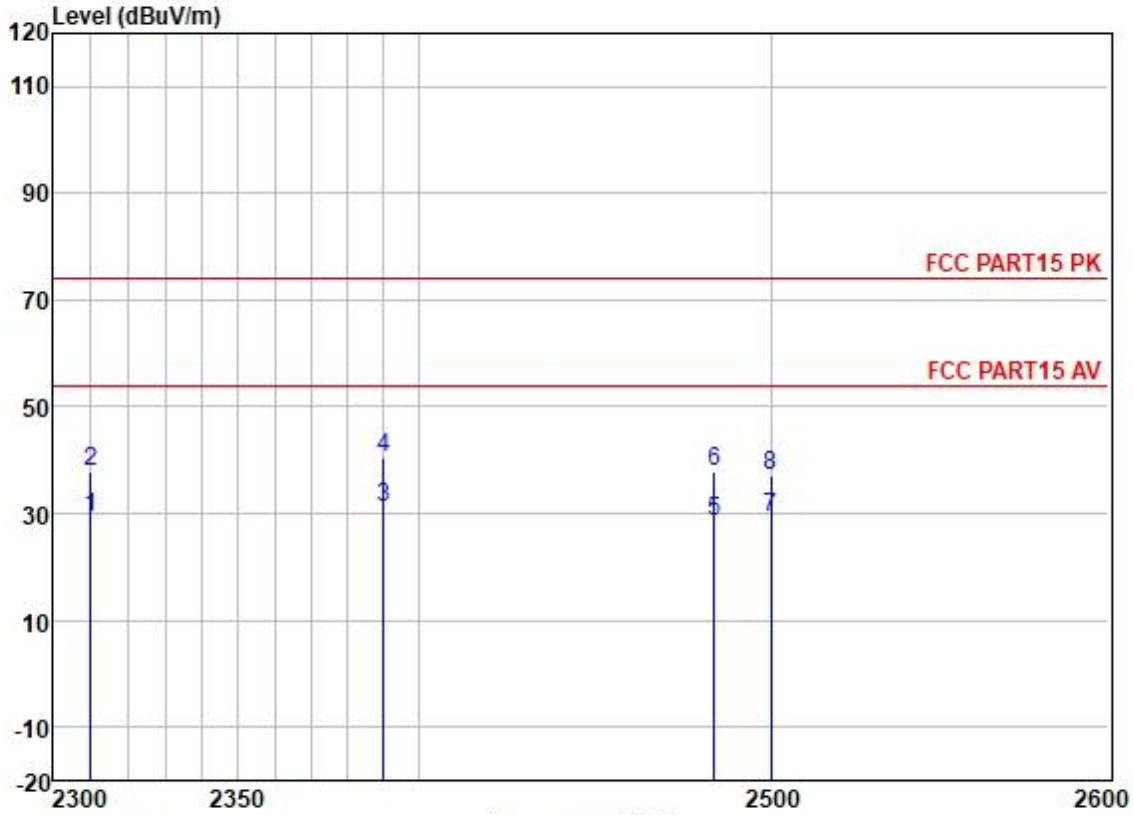
Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:High;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 2310.000 | 35.75 | 27.15 | 3.32 | 37.62 | 28.60 | 54.00 | -25.40 | VERTICAL | Average |
| 2 | 2310.000 | 44.45 | 27.15 | 3.32 | 37.62 | 37.30 | 74.00 | -36.70 | VERTICAL | Peak |
| 3 | 2390.000 | 36.56 | 27.33 | 3.48 | 37.59 | 29.78 | 54.00 | -24.22 | VERTICAL | Average |
| 4 | 2390.000 | 46.01 | 27.33 | 3.48 | 37.59 | 39.23 | 74.00 | -34.77 | VERTICAL | Peak |
| 5 | 2483.500 | 36.70 | 27.48 | 3.53 | 37.57 | 30.14 | 54.00 | -23.86 | VERTICAL | Average |
| 6 | 2483.500 | 46.44 | 27.48 | 3.53 | 37.57 | 39.88 | 74.00 | -34.12 | VERTICAL | Peak |
| 7 | 2500.000 | 35.69 | 27.50 | 3.40 | 37.56 | 29.03 | 54.00 | -24.97 | VERTICAL | Average |
| 8 | 2500.000 | 43.99 | 27.50 | 3.40 | 37.56 | 37.33 | 74.00 | -36.67 | VERTICAL | Peak |

Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:Low;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 2310.000 | 36.46 | 27.15 | 3.32 | 37.62 | 29.31 | 54.00 | -24.69 | VERTICAL | Average |
| 2 | 2310.000 | 45.07 | 27.15 | 3.32 | 37.62 | 37.92 | 74.00 | -36.08 | VERTICAL | Peak |
| 3 | 2390.000 | 38.11 | 27.33 | 3.48 | 37.59 | 31.33 | 54.00 | -22.67 | VERTICAL | Average |
| 4 | 2390.000 | 47.08 | 27.33 | 3.48 | 37.59 | 40.30 | 74.00 | -33.70 | VERTICAL | Peak |
| 5 | 2483.500 | 35.26 | 27.48 | 3.53 | 37.57 | 28.70 | 54.00 | -25.30 | VERTICAL | Average |
| 6 | 2483.500 | 44.46 | 27.48 | 3.53 | 37.57 | 37.90 | 74.00 | -36.10 | VERTICAL | Peak |
| 7 | 2500.000 | 35.83 | 27.50 | 3.40 | 37.56 | 29.17 | 54.00 | -24.83 | VERTICAL | Average |
| 8 | 2500.000 | 43.81 | 27.50 | 3.40 | 37.56 | 37.15 | 74.00 | -36.85 | VERTICAL | Peak |

## 7.9 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

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

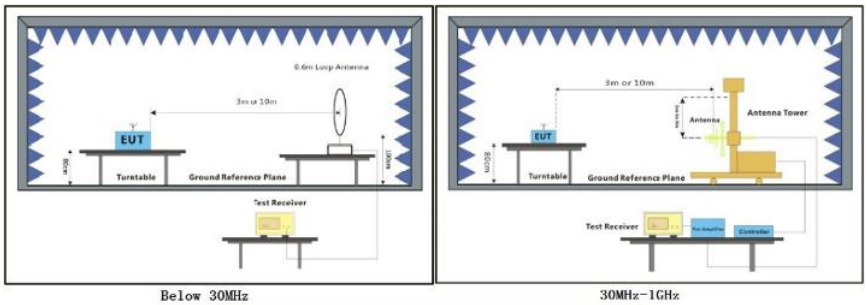
Operating Environment:

Temperature: 22 °C Humidity: 52 % RH Atmospheric Pressure: 1010 mbar

### 7.9.2 Test Mode Description

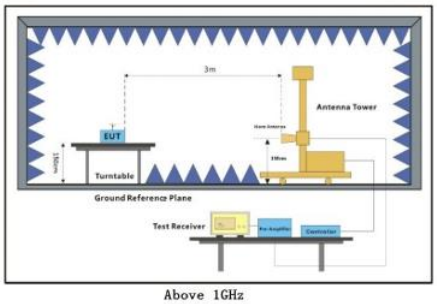
| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 01 | TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report. |

### 7.9.3 Test Setup Diagram




Below 30MHz

30MHz-1GHz




Above 1GHz

### 7.9.4 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.

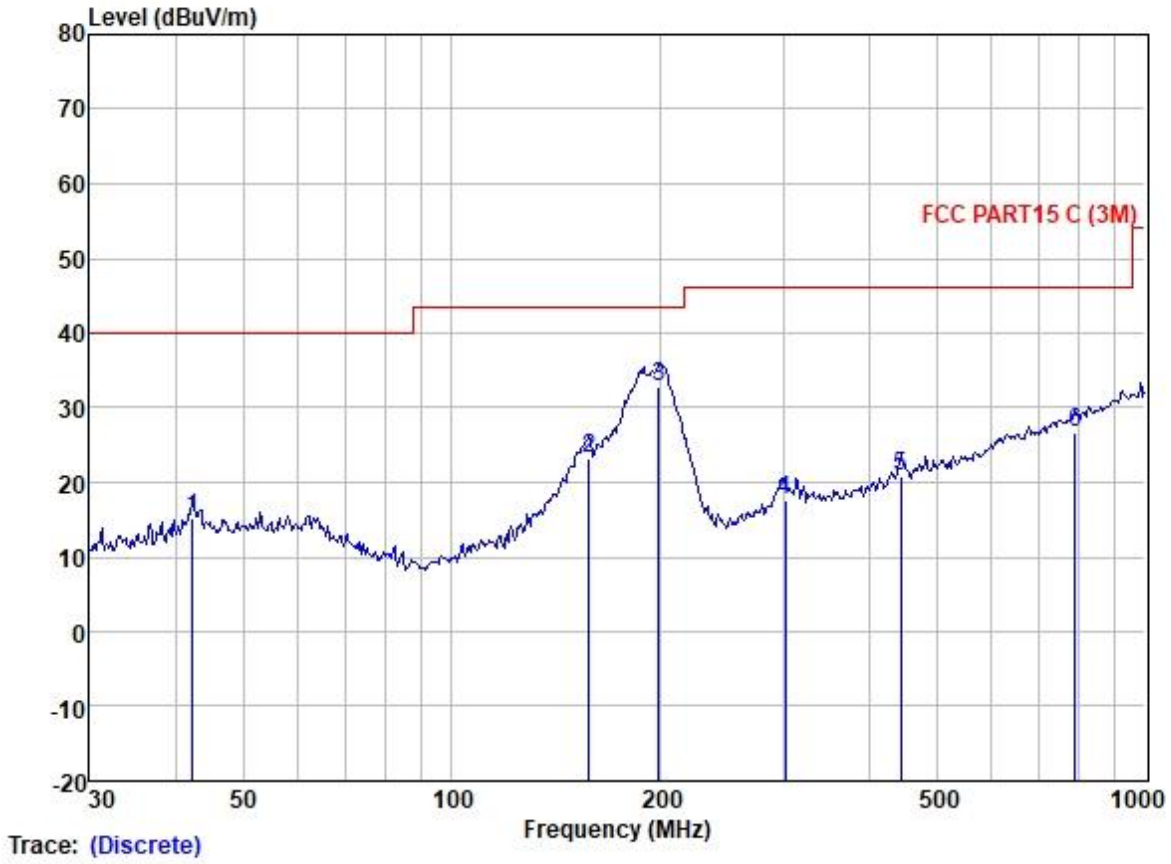
2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

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.

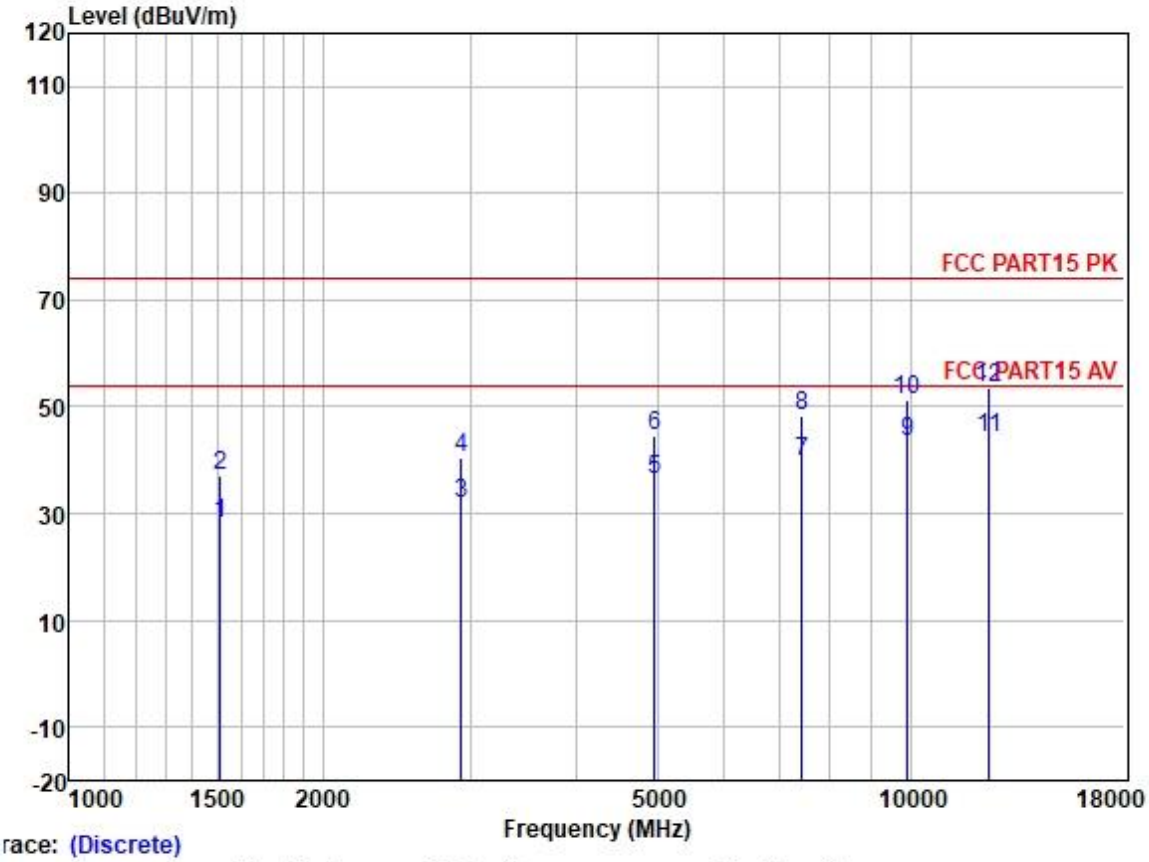
Test Mode: 01; Polarity: Horizontal




Site : SGS
Condition : FCC PART15 C (3M) HORIZONTAL
Job :
Model :
Power :
Test Mode : AC

| | Freq | Read Level | Anterna Factor | Cable Loss | Preamp Factor | Measured Level | Limit Line | Over Limit | Pol/ Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dBuV | | |
| 1 | 42.30 | 27.46 | 13.71 | 1.11 | 27.17 | 15.11 | 40.00 | -24.89 | HORIZONTAL | QP |
| 2 | 157.56 | 34.09 | 13.70 | 2.31 | 26.80 | 23.30 | 43.50 | -20.20 | HORIZONTAL | QP |
| 3 | 198.59 | 46.69 | 10.33 | 2.52 | 26.73 | 32.81 | 43.50 | -10.69 | HORIZONTAL | QP |
| 4 | 302.48 | 27.40 | 13.65 | 3.18 | 26.56 | 17.67 | 46.00 | -28.33 | HORIZONTAL | QP |
| 5 | 443.29 | 27.17 | 17.13 | 4.16 | 27.61 | 20.85 | 46.00 | -25.15 | HORIZONTAL | QP |
| 6 | 793.40 | 26.12 | 22.53 | 6.14 | 28.04 | 26.75 | 46.00 | -19.25 | HORIZONTAL | QP |

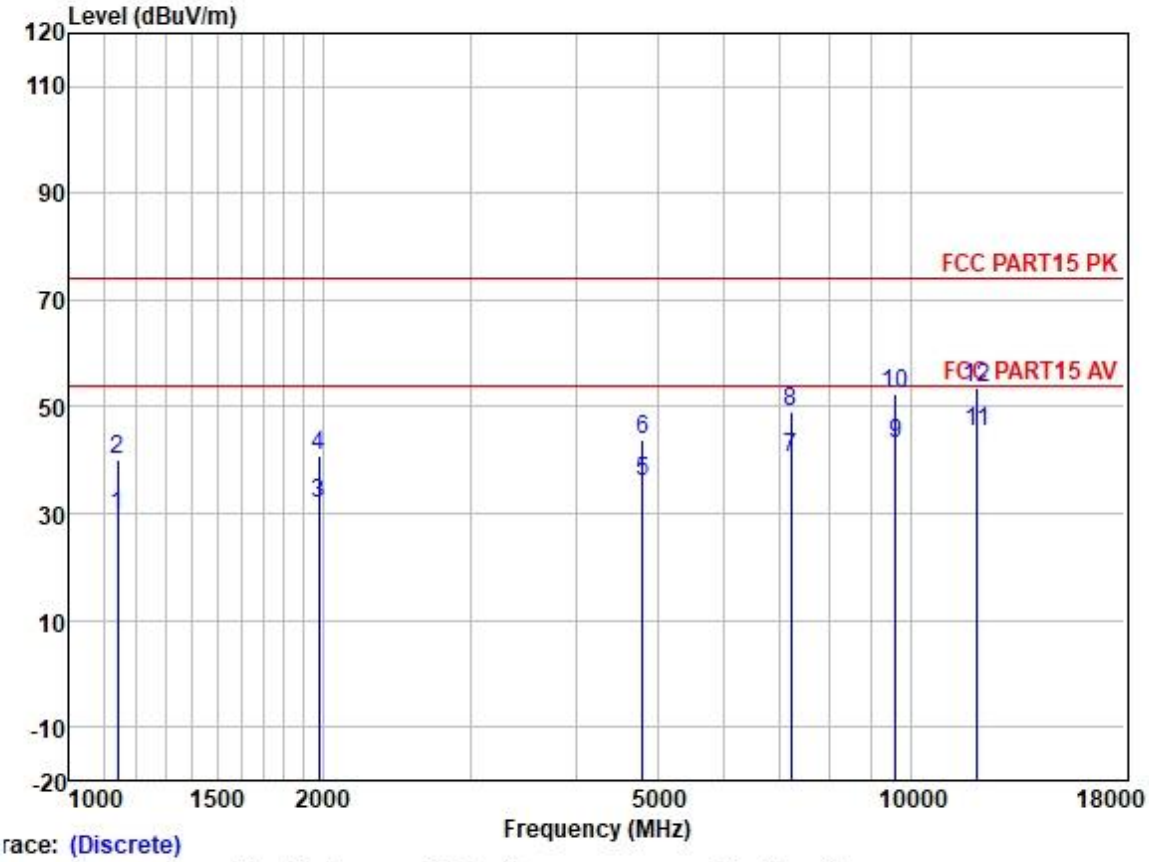
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:High;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1511.833 | 37.77 | 25.51 | 2.80 | 38.10 | 27.98 | 54.00 | -26.02 | HORIZONTAL | Average |
| 2 | 1511.833 | 46.82 | 25.51 | 2.80 | 38.10 | 37.03 | 74.00 | -36.97 | HORIZONTAL | Peak |
| 3 | 2922.174 | 37.08 | 28.32 | 3.72 | 37.32 | 31.80 | 54.00 | -22.20 | HORIZONTAL | Average |
| 4 | 2922.174 | 45.68 | 28.32 | 3.72 | 37.32 | 40.40 | 74.00 | -33.60 | HORIZONTAL | Peak |
| 5 | 4960.497 | 35.84 | 31.65 | 5.65 | 36.84 | 36.30 | 54.00 | -17.70 | HORIZONTAL | Average |
| 6 | 4960.497 | 44.15 | 31.65 | 5.65 | 36.84 | 44.61 | 74.00 | -29.39 | HORIZONTAL | Peak |
| 7 | 7440.038 | 34.73 | 36.27 | 6.22 | 37.47 | 39.75 | 54.00 | -14.25 | HORIZONTAL | Average |
| 8 | 7440.038 | 43.30 | 36.27 | 6.22 | 37.47 | 48.32 | 74.00 | -25.68 | HORIZONTAL | Peak |
| 9 | 9920.588 | 35.18 | 38.65 | 6.96 | 37.40 | 43.39 | 54.00 | -10.61 | HORIZONTAL | Average |
| 10 | 9920.588 | 43.10 | 38.65 | 6.96 | 37.40 | 51.31 | 74.00 | -22.69 | HORIZONTAL | Peak |
| 11 | 12400.180 | 34.72 | 38.57 | 7.97 | 36.88 | 44.38 | 54.00 | -9.62 | HORIZONTAL | Average |
| 12 | 12400.180 | 43.79 | 38.57 | 7.97 | 36.88 | 53.45 | 74.00 | -20.55 | HORIZONTAL | Peak |

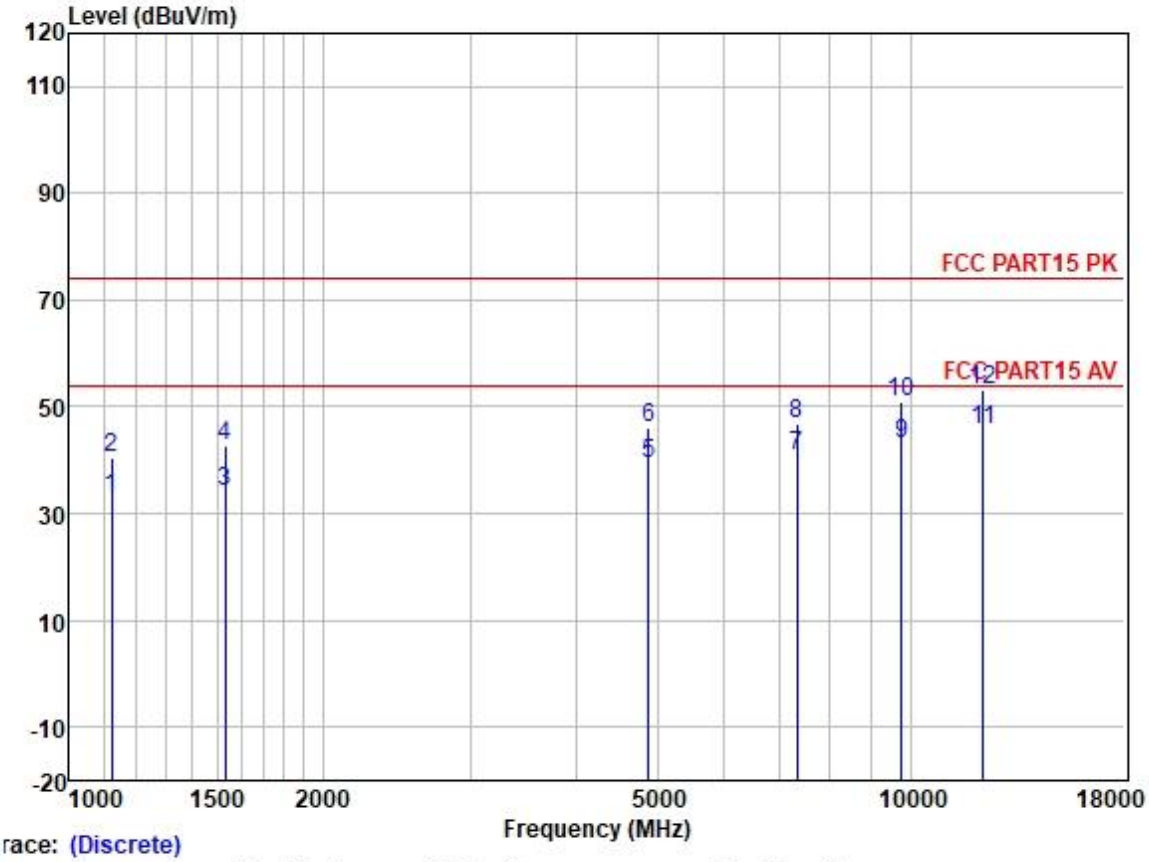
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1142.201 | 41.48 | 24.47 | 2.30 | 38.42 | 29.83 | 54.00 | -24.17 | HORIZONTAL | Average |
| 2 | 1142.201 | 51.57 | 24.47 | 2.30 | 38.42 | 39.92 | 74.00 | -34.08 | HORIZONTAL | Peak |
| 3 | 1978.082 | 40.42 | 26.09 | 3.06 | 37.71 | 31.86 | 54.00 | -22.14 | HORIZONTAL | Average |
| 4 | 1978.082 | 49.28 | 26.09 | 3.06 | 37.71 | 40.72 | 74.00 | -33.28 | HORIZONTAL | Peak |
| 5 | 4804.271 | 36.16 | 31.42 | 5.40 | 36.83 | 36.15 | 54.00 | -17.85 | HORIZONTAL | Average |
| 6 | 4804.271 | 44.00 | 31.42 | 5.40 | 36.83 | 43.99 | 74.00 | -30.01 | HORIZONTAL | Peak |
| 7 | 7206.836 | 36.50 | 35.54 | 5.98 | 37.38 | 40.64 | 54.00 | -13.36 | HORIZONTAL | Average |
| 8 | 7206.836 | 44.83 | 35.54 | 5.98 | 37.38 | 48.97 | 74.00 | -25.03 | HORIZONTAL | Peak |
| 9 | 9608.164 | 35.00 | 38.37 | 7.07 | 37.42 | 43.02 | 54.00 | -10.98 | HORIZONTAL | Average |
| 10 | 9608.164 | 44.30 | 38.37 | 7.07 | 37.42 | 52.32 | 74.00 | -21.68 | HORIZONTAL | Peak |
| 11 | 12010.130 | 35.38 | 38.90 | 8.19 | 37.10 | 45.37 | 54.00 | -8.63 | HORIZONTAL | Average |
| 12 | 12010.130 | 43.64 | 38.90 | 8.19 | 37.10 | 53.63 | 74.00 | -20.37 | HORIZONTAL | Peak |

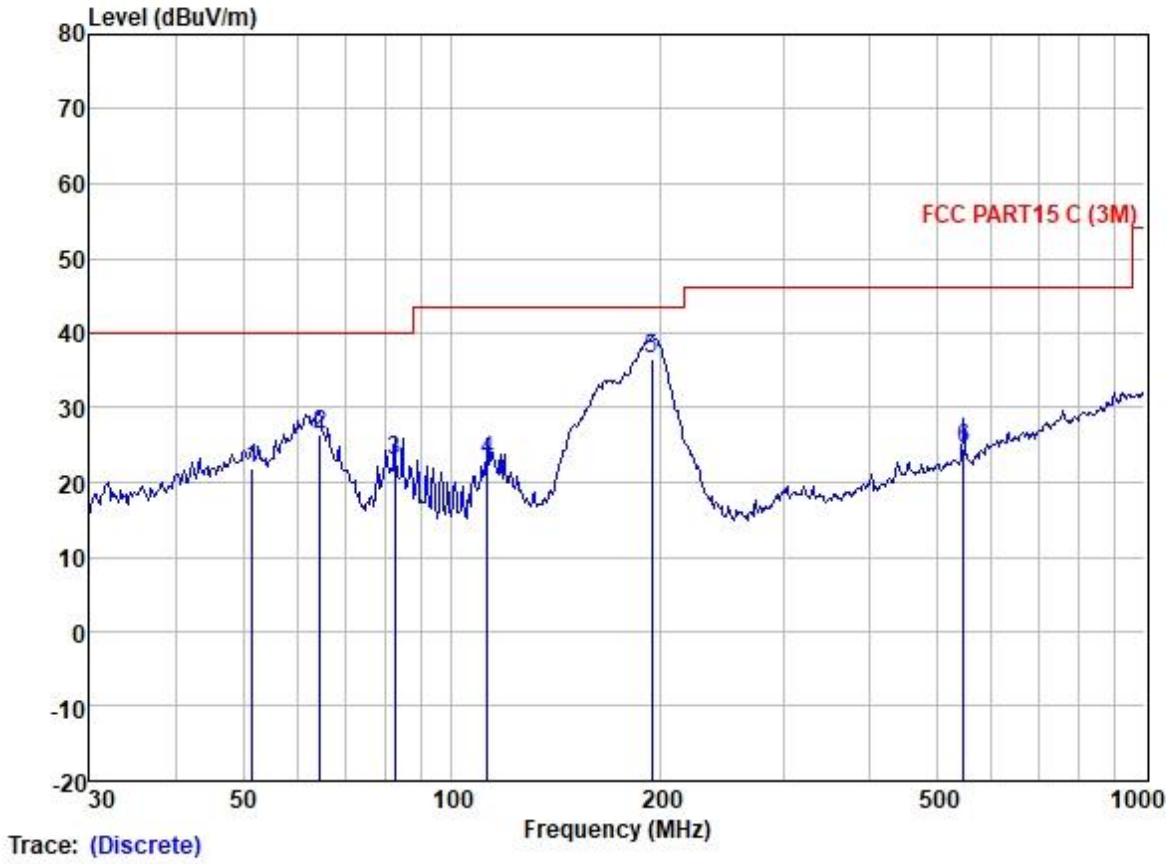
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:middle;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1122.563 | 44.65 | 24.42 | 2.22 | 38.43 | 32.86 | 54.00 | -21.14 | HORIZONTAL | Average |
| 2 | 1122.563 | 52.31 | 24.42 | 2.22 | 38.43 | 40.52 | 74.00 | -33.48 | HORIZONTAL | Peak |
| 3 | 1533.841 | 44.06 | 25.52 | 2.80 | 38.07 | 34.31 | 54.00 | -19.69 | HORIZONTAL | Average |
| 4 | 1533.841 | 52.51 | 25.52 | 2.80 | 38.07 | 42.76 | 74.00 | -31.24 | HORIZONTAL | Peak |
| 5 | 4882.771 | 39.08 | 31.56 | 5.52 | 36.84 | 39.32 | 54.00 | -14.68 | HORIZONTAL | Average |
| 6 | 4882.771 | 45.76 | 31.56 | 5.52 | 36.84 | 46.00 | 74.00 | -28.00 | HORIZONTAL | Peak |
| 7 | 7323.542 | 36.24 | 36.00 | 6.13 | 37.43 | 40.94 | 54.00 | -13.06 | HORIZONTAL | Average |
| 8 | 7323.542 | 42.17 | 36.00 | 6.13 | 37.43 | 46.87 | 74.00 | -27.13 | HORIZONTAL | Peak |
| 9 | 9764.462 | 35.16 | 38.50 | 7.02 | 37.41 | 43.27 | 54.00 | -10.73 | HORIZONTAL | Average |
| 10 | 9764.462 | 42.72 | 38.50 | 7.02 | 37.41 | 50.83 | 74.00 | -23.17 | HORIZONTAL | Peak |
| 11 | 12205.710 | 36.06 | 38.74 | 8.08 | 37.00 | 45.88 | 54.00 | -8.12 | HORIZONTAL | Average |
| 12 | 12205.710 | 43.37 | 38.74 | 8.08 | 37.00 | 53.19 | 74.00 | -20.81 | HORIZONTAL | Peak |

Test Mode: 01; Polarity: Vertical

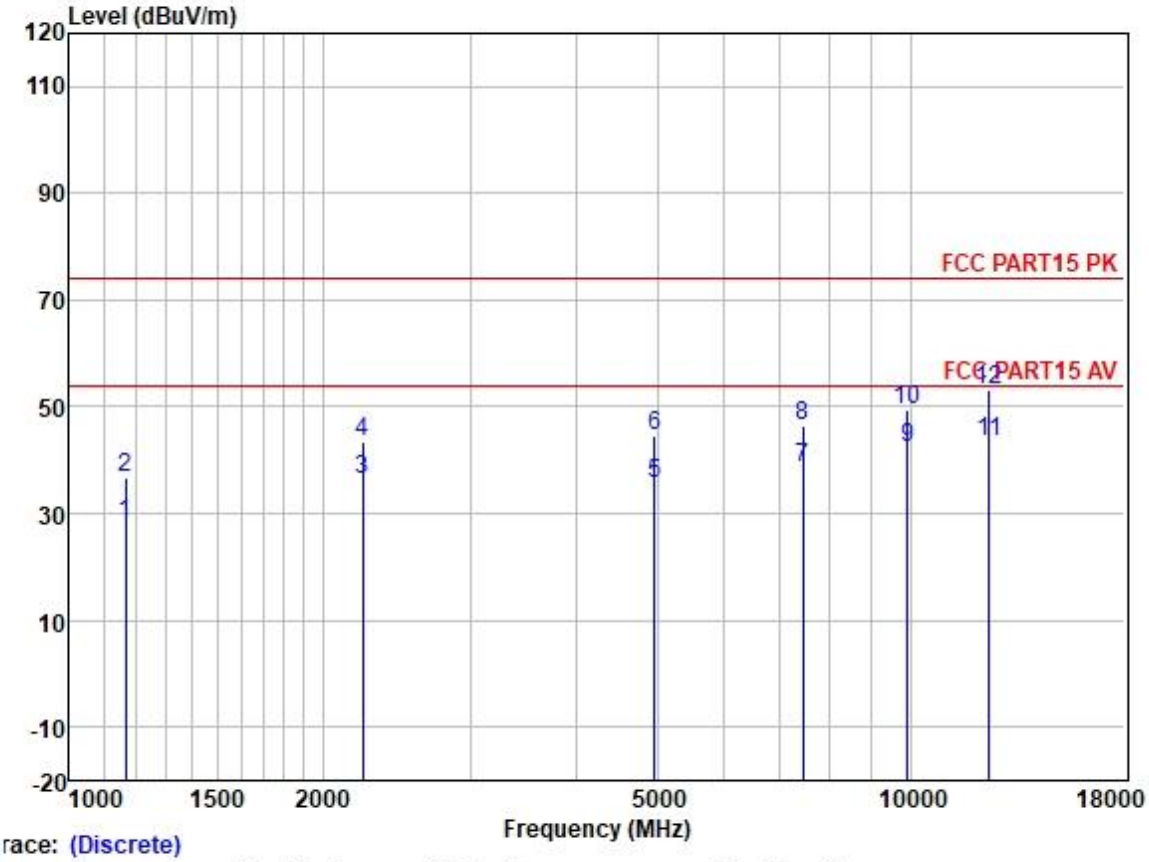



Trace: (Discrete)

Site : SGS
Condition : FCC PART15 C (3M) VERTICAL
Job :
Model :
Power :
Test Mode : AC

| | Freq | Read Level | Anterna Factor | Cable Loss | Preamp Factor | Measured Level | Limit Line | Over Limit | Pol/ Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dBuV | | |
| 1 | 51.48 | 33.82 | 13.97 | 1.16 | 27.17 | 21.78 | 40.00 | -18.22 | VERTICAL | QP |
| 2 | 64.43 | 39.49 | 12.83 | 1.34 | 27.15 | 26.51 | 40.00 | -13.49 | VERTICAL | QP |
| 3 | 82.65 | 40.20 | 8.27 | 1.50 | 27.09 | 22.88 | 40.00 | -17.12 | VERTICAL | QP |
| 4 | 112.52 | 37.57 | 10.52 | 1.81 | 27.05 | 22.85 | 43.50 | -20.65 | VERTICAL | QP |
| 5 | 194.45 | 49.93 | 10.73 | 2.50 | 26.74 | 36.42 | 43.50 | -7.08 | VERTICAL | QP |
| 6 | 547.10 | 29.33 | 18.60 | 4.76 | 28.09 | 24.60 | 46.00 | -21.40 | VERTICAL | QP |

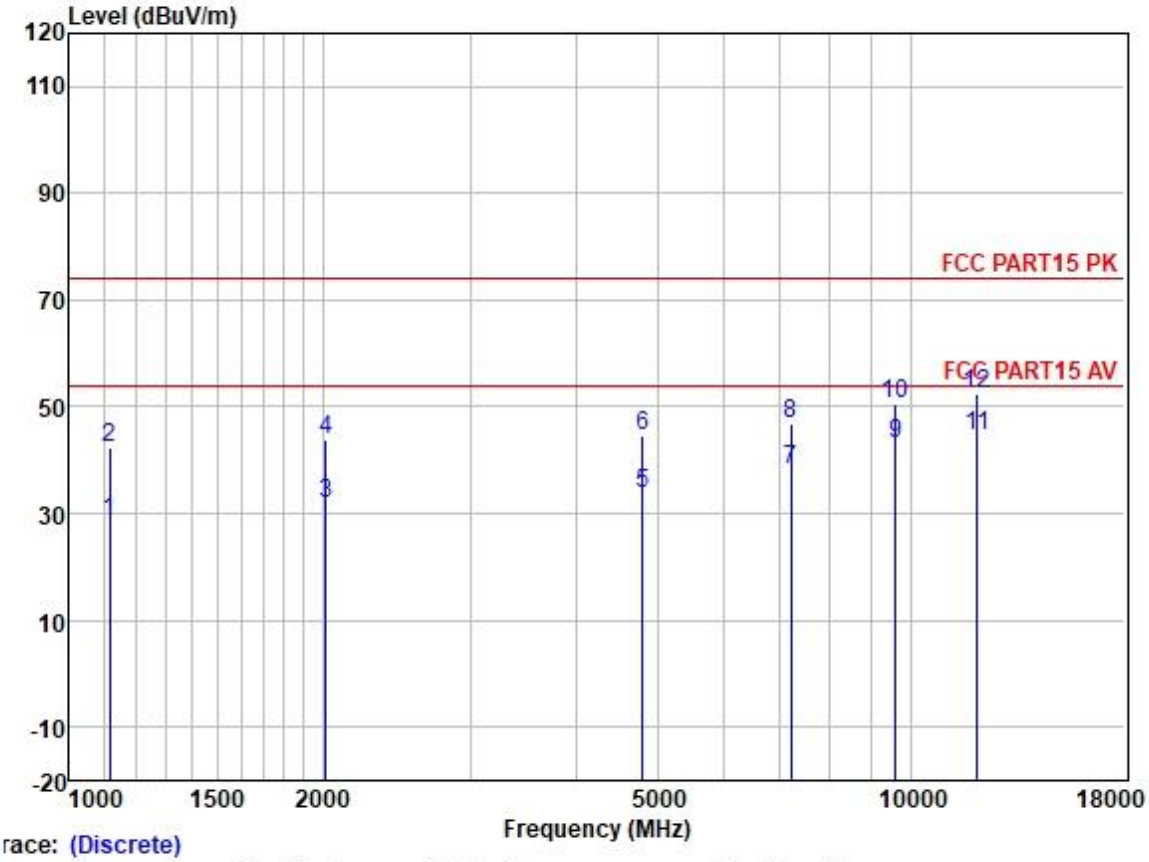
Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:High;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1165.546 | 39.68 | 24.54 | 2.39 | 38.40 | 28.21 | 54.00 | -25.79 | VERTICAL | Average |
| 2 | 1165.546 | 48.27 | 24.54 | 2.39 | 38.40 | 36.80 | 74.00 | -37.20 | VERTICAL | Peak |
| 3 | 2233.396 | 43.88 | 26.80 | 3.23 | 37.64 | 36.27 | 54.00 | -17.73 | VERTICAL | Average |
| 4 | 2233.396 | 51.16 | 26.80 | 3.23 | 37.64 | 43.55 | 74.00 | -30.45 | VERTICAL | Peak |
| 5 | 4960.975 | 35.35 | 31.65 | 5.65 | 36.84 | 35.81 | 54.00 | -18.19 | VERTICAL | Average |
| 6 | 4960.975 | 44.04 | 31.65 | 5.65 | 36.84 | 44.50 | 74.00 | -29.50 | VERTICAL | Peak |
| 7 | 7440.763 | 33.61 | 36.27 | 6.22 | 37.47 | 38.63 | 54.00 | -15.37 | VERTICAL | Average |
| 8 | 7440.763 | 41.58 | 36.27 | 6.22 | 37.47 | 46.60 | 74.00 | -27.40 | VERTICAL | Peak |
| 9 | 9920.836 | 34.31 | 38.65 | 6.96 | 37.40 | 42.52 | 54.00 | -11.48 | VERTICAL | Average |
| 10 | 9920.836 | 41.30 | 38.65 | 6.96 | 37.40 | 49.51 | 74.00 | -24.49 | VERTICAL | Peak |
| 11 | 12400.540 | 33.96 | 38.57 | 7.97 | 36.88 | 43.62 | 54.00 | -10.38 | VERTICAL | Average |
| 12 | 12400.540 | 43.33 | 38.57 | 7.97 | 36.88 | 52.99 | 74.00 | -21.01 | VERTICAL | Peak |

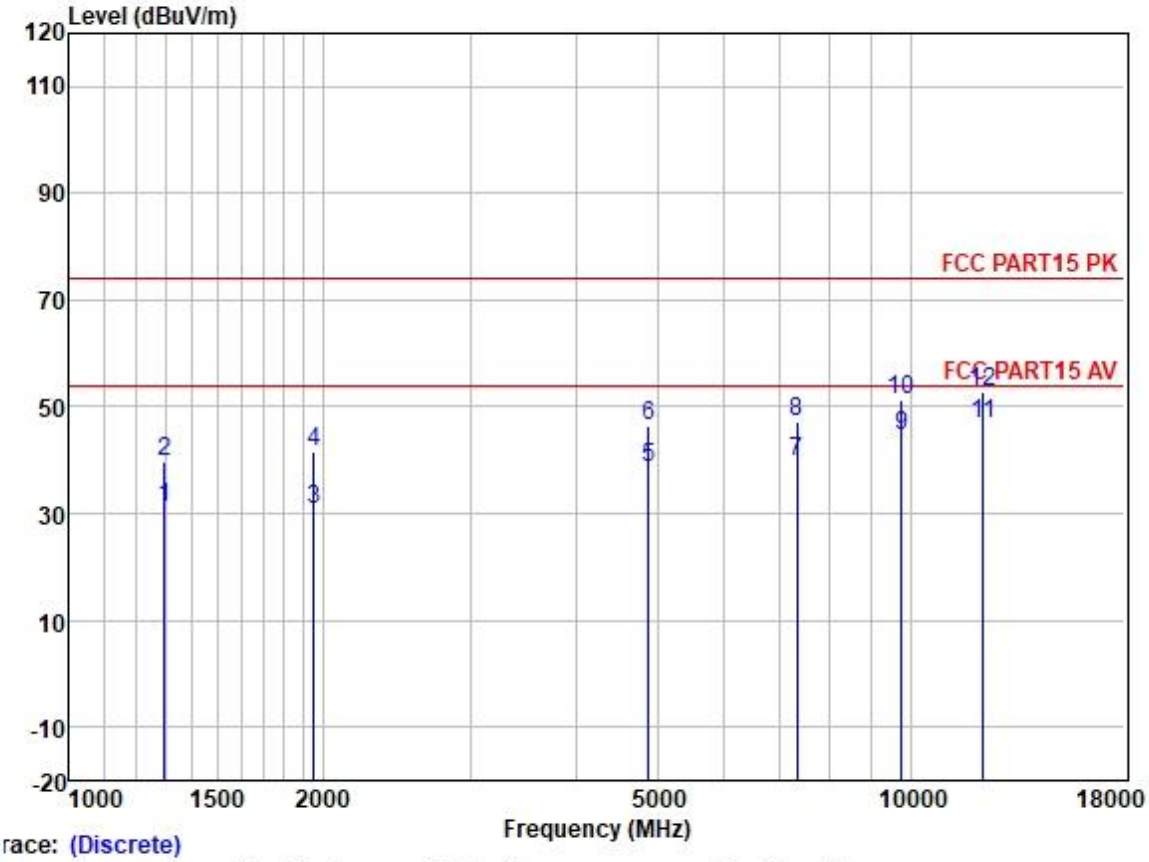
Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:Low;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1116.093 | 40.17 | 24.40 | 2.25 | 38.43 | 28.39 | 54.00 | -25.61 | VERTICAL | Average |
| 2 | 1116.093 | 54.22 | 24.40 | 2.25 | 38.43 | 42.44 | 74.00 | -31.56 | VERTICAL | Peak |
| 3 | 2018.511 | 40.18 | 26.13 | 3.11 | 37.69 | 31.73 | 54.00 | -22.27 | VERTICAL | Average |
| 4 | 2018.511 | 52.24 | 26.13 | 3.11 | 37.69 | 43.79 | 74.00 | -30.21 | VERTICAL | Peak |
| 5 | 4804.300 | 33.63 | 31.42 | 5.40 | 36.83 | 33.62 | 54.00 | -20.38 | VERTICAL | Average |
| 6 | 4804.300 | 44.66 | 31.42 | 5.40 | 36.83 | 44.65 | 74.00 | -29.35 | VERTICAL | Peak |
| 7 | 7206.906 | 34.22 | 35.54 | 5.98 | 37.38 | 38.36 | 54.00 | -15.64 | VERTICAL | Average |
| 8 | 7206.906 | 42.84 | 35.54 | 5.98 | 37.38 | 46.98 | 74.00 | -27.02 | VERTICAL | Peak |
| 9 | 9608.725 | 35.25 | 38.37 | 7.07 | 37.42 | 43.27 | 54.00 | -10.73 | VERTICAL | Average |
| 10 | 9608.725 | 42.41 | 38.37 | 7.07 | 37.42 | 50.43 | 74.00 | -23.57 | VERTICAL | Peak |
| 11 | 12010.230 | 34.49 | 38.90 | 8.19 | 37.10 | 44.48 | 54.00 | -9.52 | VERTICAL | Average |
| 12 | 12010.230 | 42.54 | 38.90 | 8.19 | 37.10 | 52.53 | 74.00 | -21.47 | VERTICAL | Peak |

Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:middle;




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1297.103 | 41.86 | 25.19 | 2.58 | 38.31 | 31.32 | 54.00 | -22.68 | VERTICAL | Average |
| 2 | 1297.103 | 50.14 | 25.19 | 2.58 | 38.31 | 39.60 | 74.00 | -34.40 | VERTICAL | Peak |
| 3 | 1955.344 | 39.50 | 26.08 | 3.01 | 37.73 | 30.86 | 54.00 | -23.14 | VERTICAL | Average |
| 4 | 1955.344 | 50.15 | 26.08 | 3.01 | 37.73 | 41.51 | 74.00 | -32.49 | VERTICAL | Peak |
| 5 | 4882.016 | 38.31 | 31.56 | 5.52 | 36.84 | 38.55 | 54.00 | -15.45 | VERTICAL | Average |
| 6 | 4882.016 | 46.12 | 31.56 | 5.52 | 36.84 | 46.36 | 74.00 | -27.64 | VERTICAL | Peak |
| 7 | 7323.727 | 35.20 | 36.00 | 6.13 | 37.43 | 39.90 | 54.00 | -14.10 | VERTICAL | Average |
| 8 | 7323.727 | 42.37 | 36.00 | 6.13 | 37.43 | 47.07 | 74.00 | -26.93 | VERTICAL | Peak |
| 9 | 9764.062 | 36.50 | 38.50 | 7.02 | 37.41 | 44.61 | 54.00 | -9.39 | VERTICAL | Average |
| 10 | 9764.062 | 43.06 | 38.50 | 7.02 | 37.41 | 51.17 | 74.00 | -22.83 | VERTICAL | Peak |
| 11 | 12205.200 | 36.93 | 38.74 | 8.08 | 37.00 | 46.75 | 54.00 | -7.25 | VERTICAL | Average |
| 12 | 12205.200 | 43.12 | 38.74 | 8.08 | 37.00 | 52.94 | 74.00 | -21.06 | VERTICAL | Peak |

# 8 Appendix

(Cable loss=0.9dB)

## 8.1 Appendix A: 20dB Emission Bandwidth

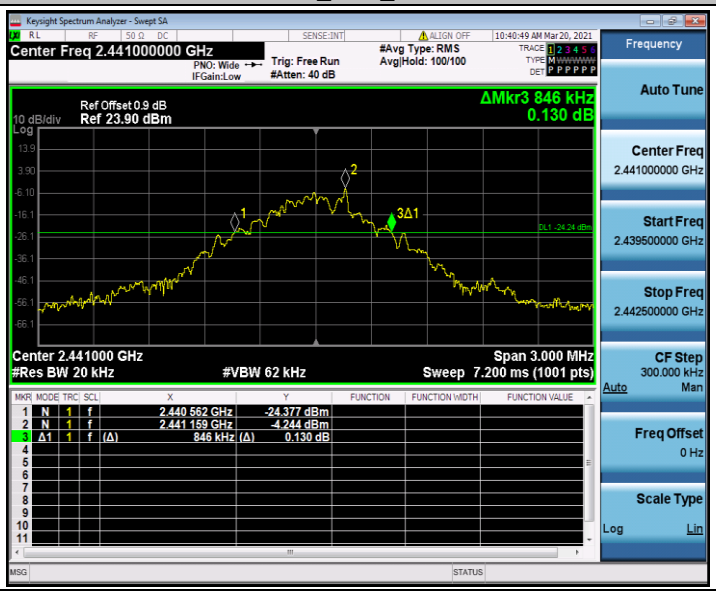
### 8.1.1 Test Result

| TestMode | Antenna | Channel | 20db EBW[MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| DH5 | Ant1 | 2402 | 1.023 | 2401.466 | 2402.489 | --- | PASS |
| | | 2441 | 0.846 | 2440.562 | 2441.408 | --- | PASS |
| | | 2480 | 1.014 | 2479.469 | 2480.483 | --- | PASS |
| 2DH5 | Ant1 | 2402 | 1.206 | 2401.385 | 2402.591 | --- | PASS |
| | | 2441 | 1.206 | 2440.385 | 2441.591 | --- | PASS |
| | | 2480 | 1.245 | 2479.376 | 2480.621 | --- | PASS |
| 3DH5 | Ant1 | 2402 | 1.248 | 2401.355 | 2402.603 | --- | PASS |
| | | 2441 | 1.251 | 2440.355 | 2441.606 | --- | PASS |
| | | 2480 | 1.251 | 2479.352 | 2480.603 | --- | PASS |

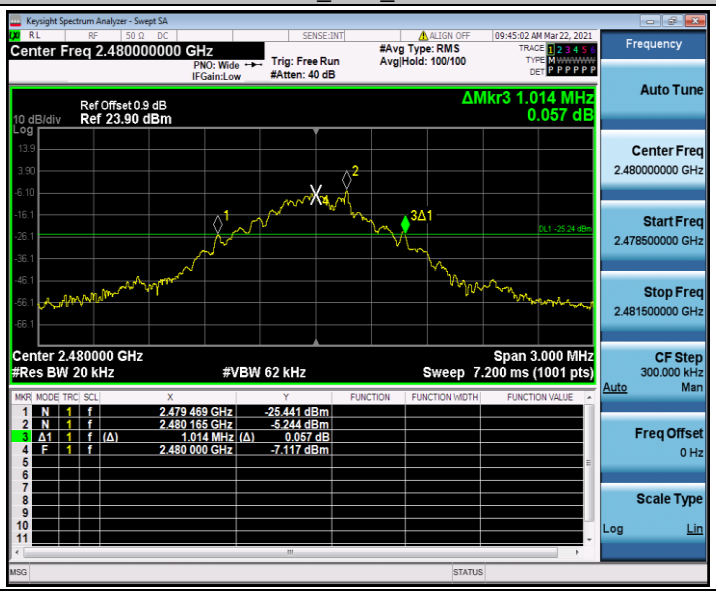
### 8.1.2 Test Graphs

DH5_Ant1_2402

DH5_Ant1_2441

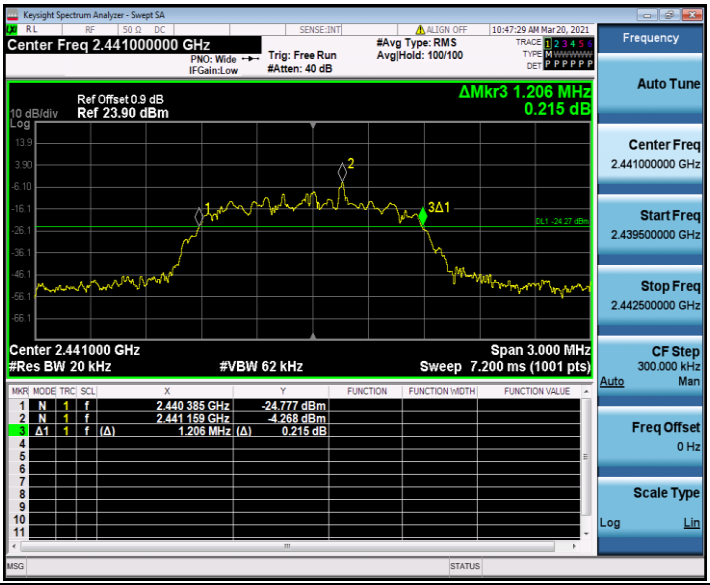



DH5_Ant1_2480

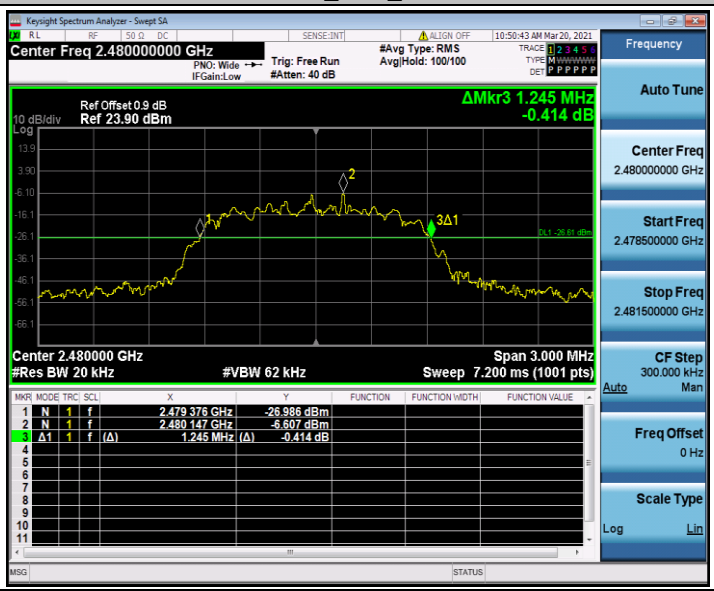


2DH5_Ant1_2402

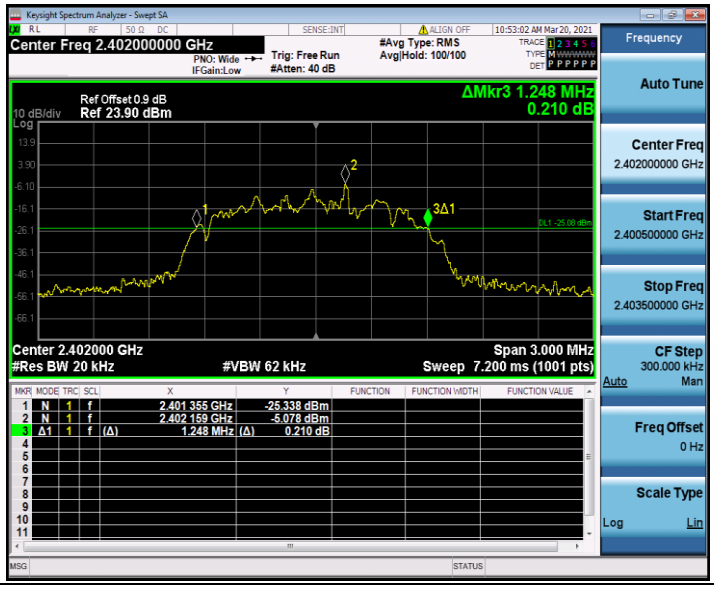

2DH5_Ant1_2441

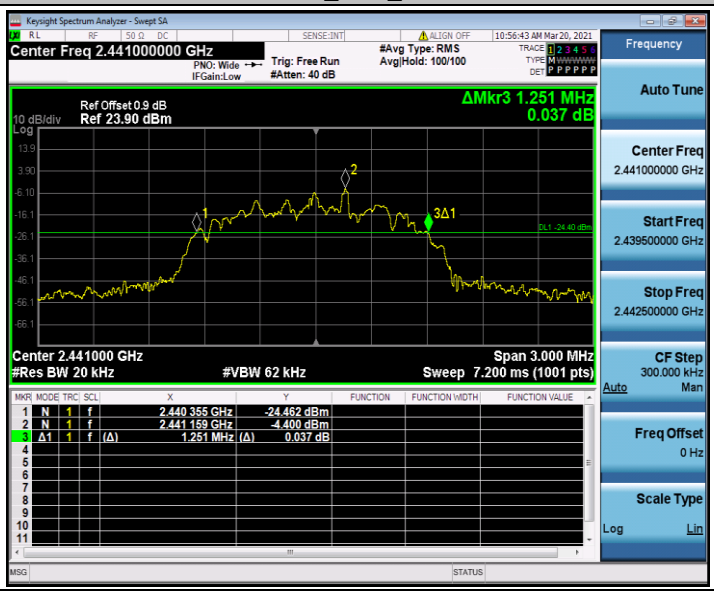


2DH5_Ant1_2480




3DH5_Ant1_2402



| 3DH5_Ant1_2441 |
| --- |
|  |
| 3DH5_Ant1_2480 |
|  |

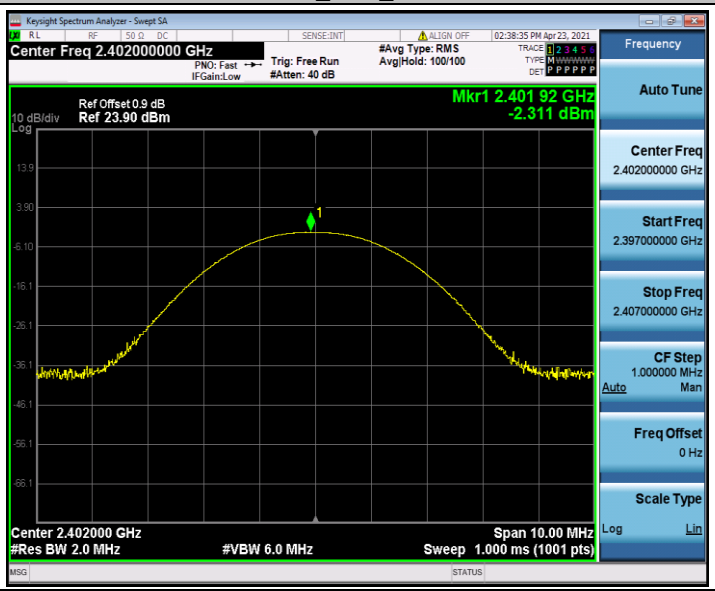
## 8.2 Appendix B: Maximum conducted output power

### 8.2.1 Test Result

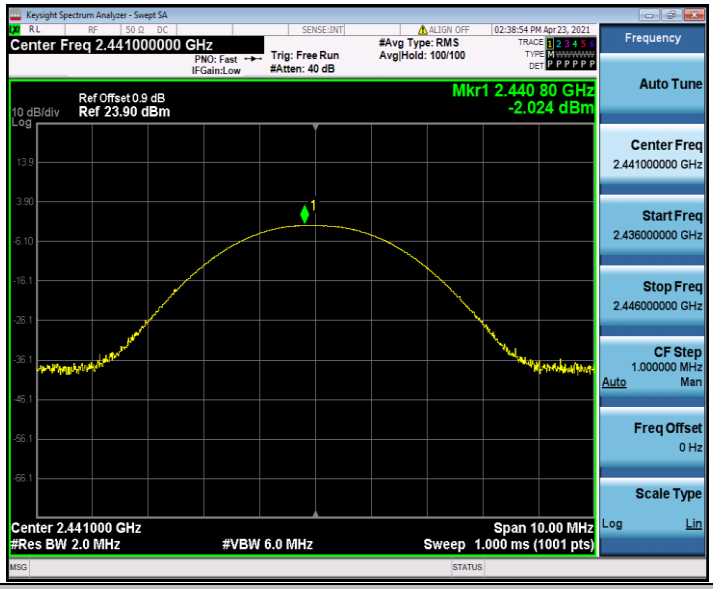
| TestMode | Antenna | Channel | Result[dBm] | Limit[dBm] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | 2402 | -2.31 | <=20.97 | PASS |
| | | 2441 | -2.02 | <=20.97 | PASS |
| | | 2480 | -1.96 | <=20.97 | PASS |
| 2DH5 | Ant1 | 2402 | -3.05 | <=20.97 | PASS |
| | | 2441 | -2.14 | <=20.97 | PASS |
| | | 2480 | -2.68 | <=20.97 | PASS |
| 3DH5 | Ant1 | 2402 | -2.64 | <=20.97 | PASS |
| | | 2441 | -1.84 | <=20.97 | PASS |
| | | 2480 | -2.39 | <=20.97 | PASS |

### 8.2.2 Test Graphs

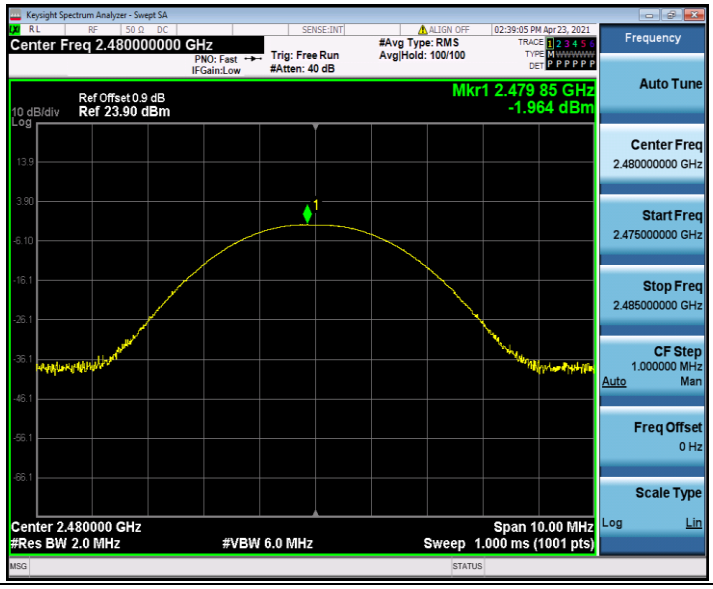
DH5_Ant1_2402

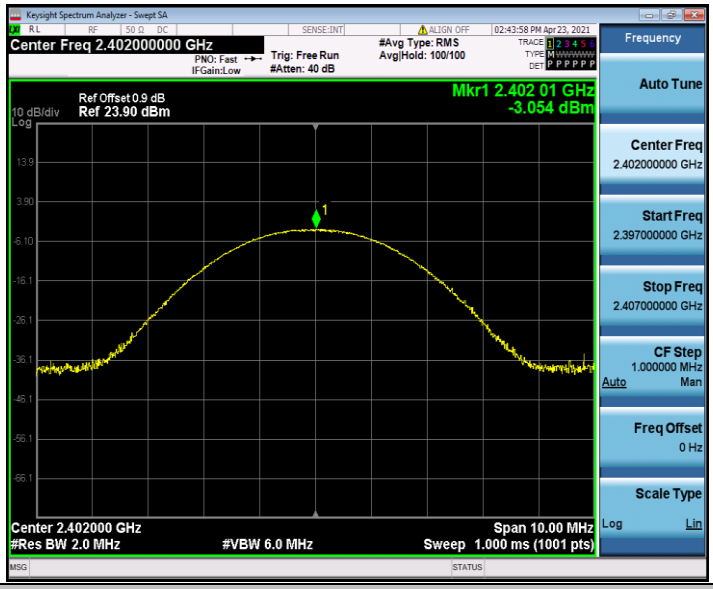
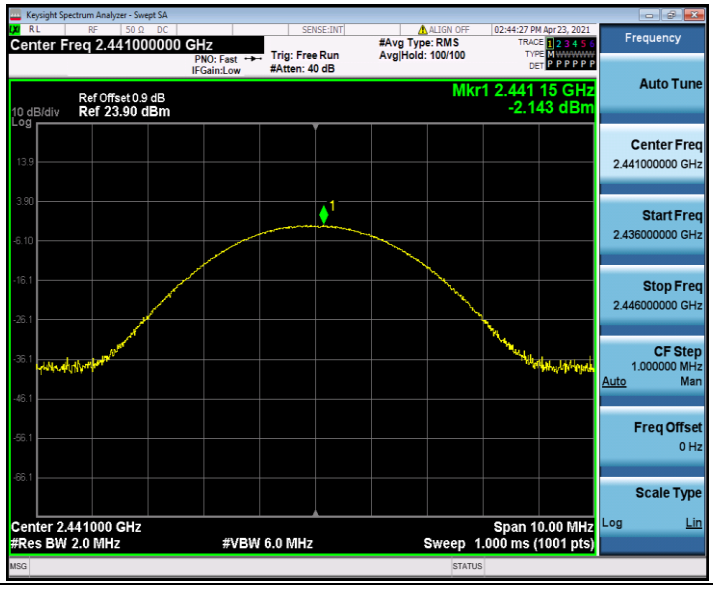


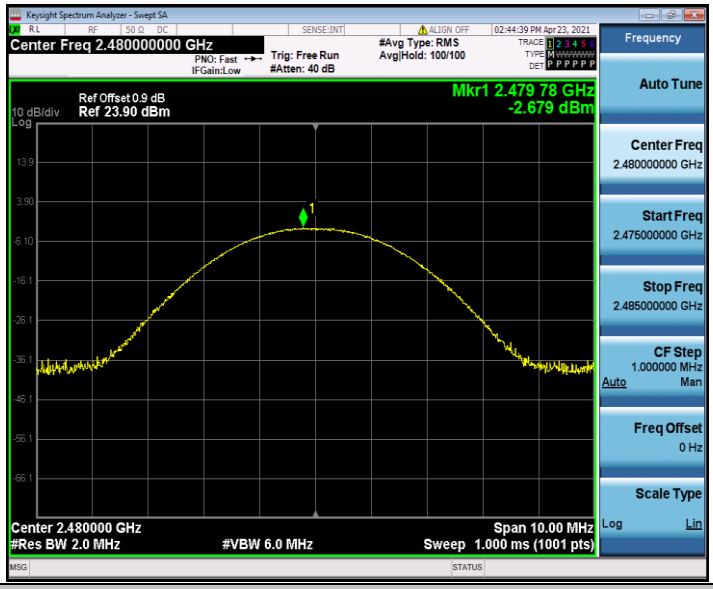
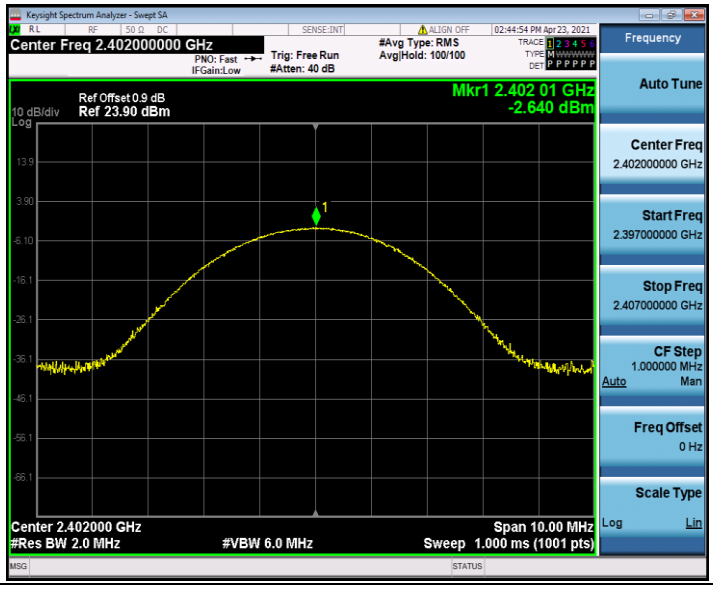
DH5_Ant1_2441

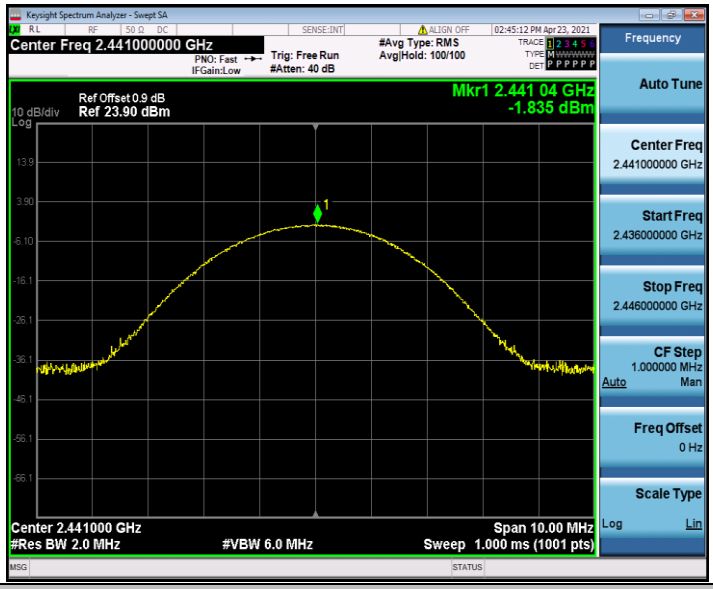
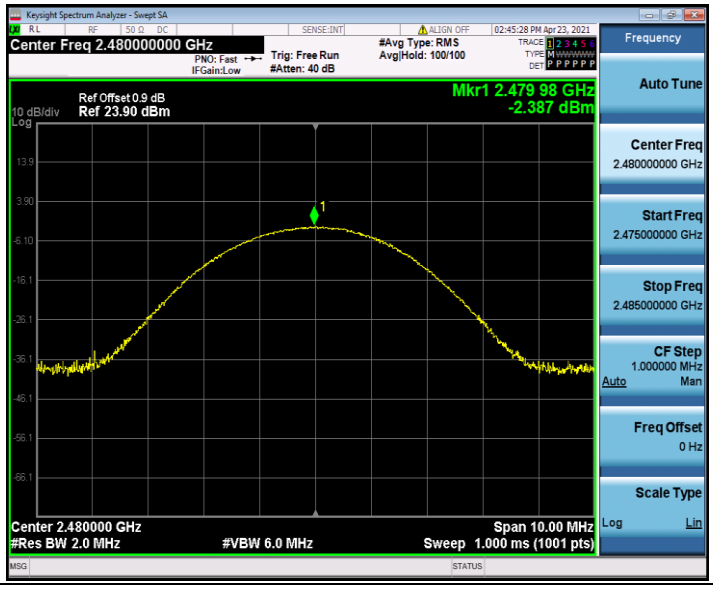



DH5_Ant1_2480



| 2DH5_Ant1_2402 |
| --- |
|  |
| 2DH5_Ant1_2441 |
|  |

| 2DH5_Ant1_2480 |
| --- |
|  |
| 3DH5_Ant1_2402 |
|  |

| 3DH5_Ant1_2441 |
| --- |
|  |
| 3DH5_Ant1_2480 |
|  |

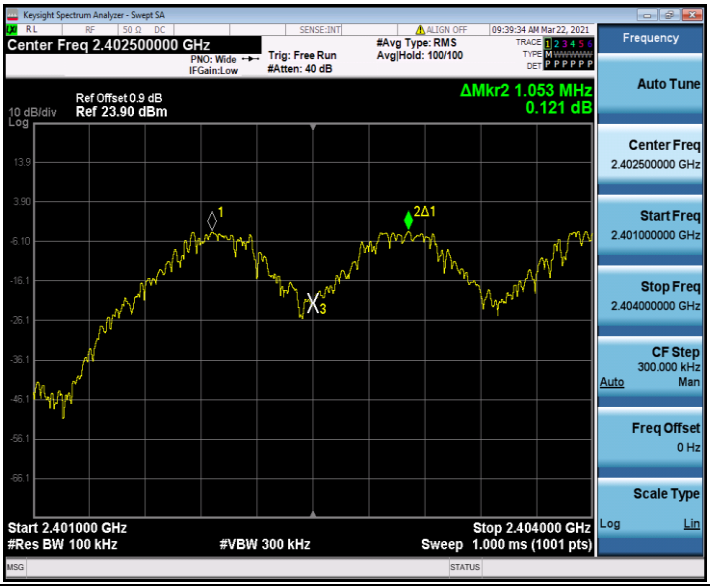
## 8.3 Appendix C: Carrier frequency separation

### 8.3.1 Test Result

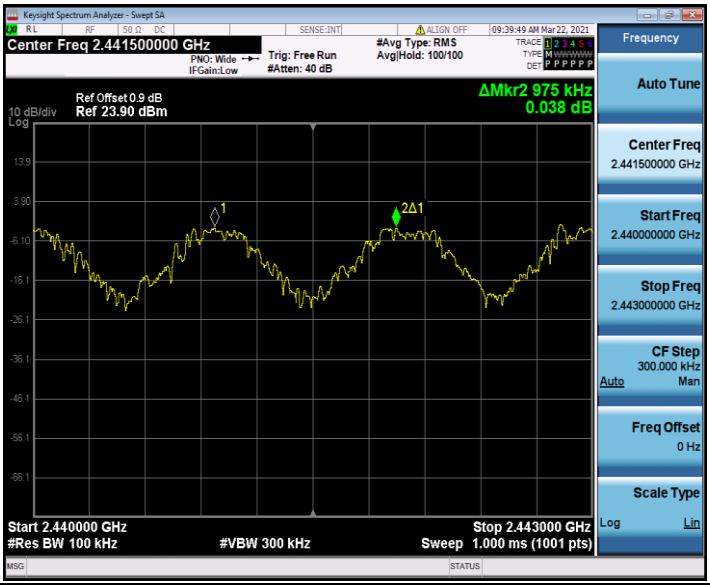
| TestMode | Antenna | Channel | Result[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | Hop_2402 | 1.053 | >=0.628 | PASS |
| | | Hop_2441 | 0.975 | >=0.564 | PASS |
| | | Hop_2480 | 1.065 | >=0.676 | PASS |

### 8.3.2 Test Graphs

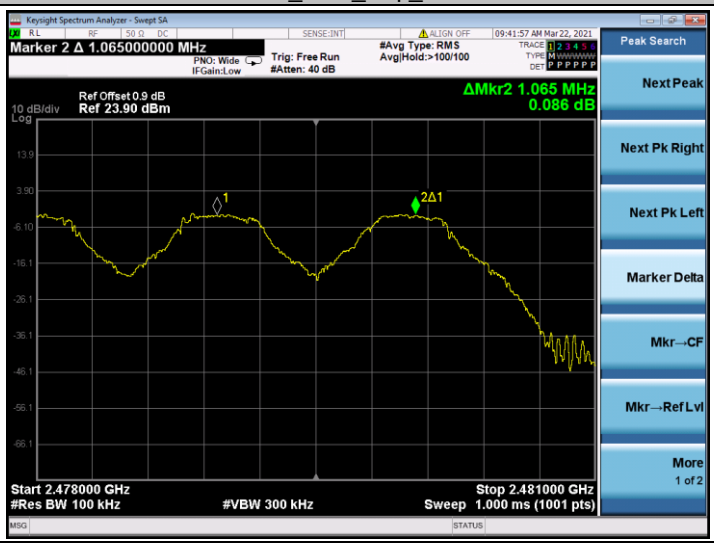
DH5_Ant1_Hop_2402



DH5_Ant1_Hop_2441




DH5_Ant1_Hop_2480

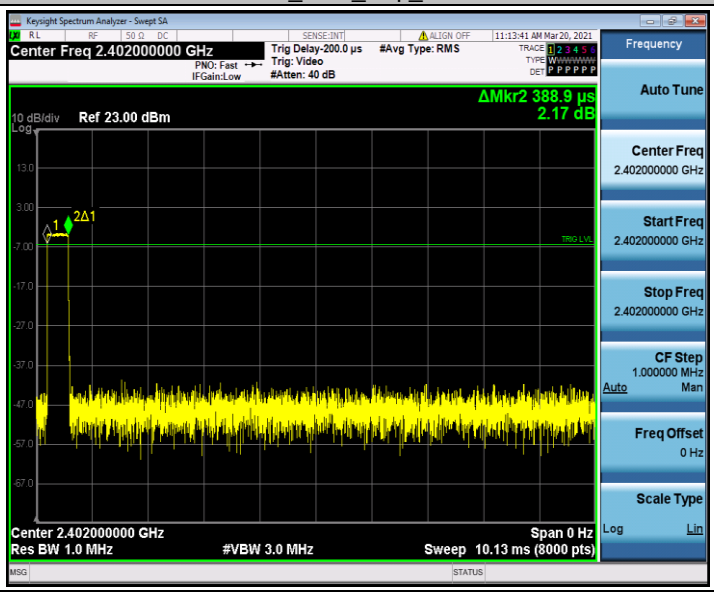
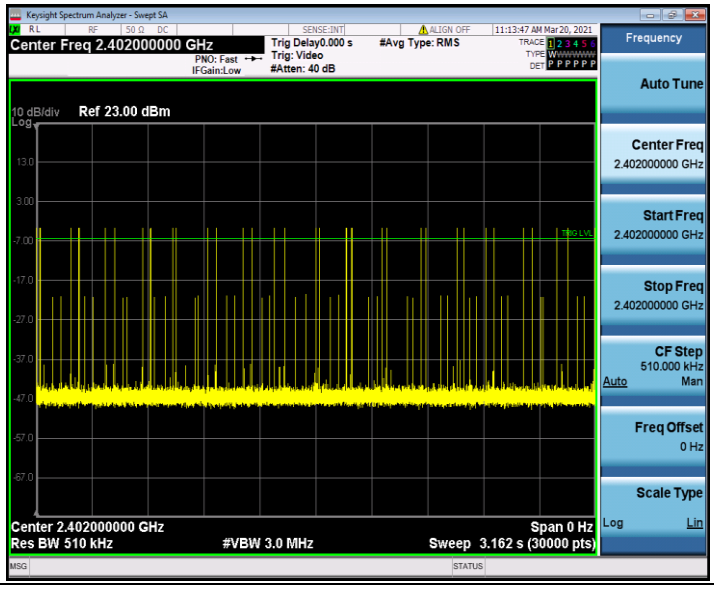


## 8.4 Appendix D: Time of occupancy

### 8.4.1 Test Result

| TestMode | Antenna | Channel | BurstWidth [ms] | TotalHops [Num] | Result[s] | Limit[s] | Verdict |
|---|---|---|---|---|---|---|---|
| DH1 | Ant1 | Hop_2402 | 0.39 | 330 | 0.128 | <=0.4 | PASS |
| | | Hop_2441 | 0.39 | 320 | 0.124 | <=0.4 | PASS |
| | | Hop_2480 | 0.39 | 330 | 0.128 | <=0.4 | PASS |
| DH3 | Ant1 | Hop_2402 | 1.66 | 130 | 0.216 | <=0.4 | PASS |
| | | Hop_2441 | 1.64 | 190 | 0.312 | <=0.4 | PASS |
| | | Hop_2480 | 1.64 | 180 | 0.296 | <=0.4 | PASS |
| DH5 | Ant1 | Hop_2402 | 2.90 | 130 | 0.377 | <=0.4 | PASS |
| | | Hop_2441 | 2.89 | 80 | 0.231 | <=0.4 | PASS |
| | | Hop_2480 | 2.89 | 130 | 0.376 | <=0.4 | PASS |
| 2DH1 | Ant1 | Hop_2402 | 0.40 | 320 | 0.127 | <=0.4 | PASS |
| | | Hop_2441 | 0.40 | 330 | 0.131 | <=0.4 | PASS |
| | | Hop_2480 | 0.40 | 330 | 0.131 | <=0.4 | PASS |
| 2DH3 | Ant1 | Hop_2402 | 1.65 | 150 | 0.248 | <=0.4 | PASS |
| | | Hop_2441 | 1.65 | 160 | 0.264 | <=0.4 | PASS |
| | | Hop_2480 | 1.65 | 160 | 0.264 | <=0.4 | PASS |
| 2DH5 | Ant1 | Hop_2402 | 2.21 | 120 | 0.265 | <=0.4 | PASS |
| | | Hop_2441 | 2.90 | 100 | 0.29 | <=0.4 | PASS |
| | | Hop_2480 | 2.91 | 100 | 0.291 | <=0.4 | PASS |
| 3DH1 | Ant1 | Hop_2402 | 0.40 | 330 | 0.131 | <=0.4 | PASS |
| | | Hop_2441 | 0.40 | 320 | 0.128 | <=0.4 | PASS |
| | | Hop_2480 | 0.40 | 330 | 0.131 | <=0.4 | PASS |
| 3DH3 | Ant1 | Hop_2402 | 1.65 | 150 | 0.247 | <=0.4 | PASS |
| | | Hop_2441 | 1.65 | 170 | 0.28 | <=0.4 | PASS |
| | | Hop_2480 | 1.65 | 150 | 0.247 | <=0.4 | PASS |
| 3DH5 | Ant1 | Hop_2402 | 2.90 | 130 | 0.377 | <=0.4 | PASS |
| | | Hop_2441 | 2.90 | 100 | 0.29 | <=0.4 | PASS |
| | | Hop_2480 | 2.90 | 70 | 0.203 | <=0.4 | PASS |

### 8.4.2 Test Graphs

| DH1_Ant1_Hop_2402 |
| --- |
|  |
|  |

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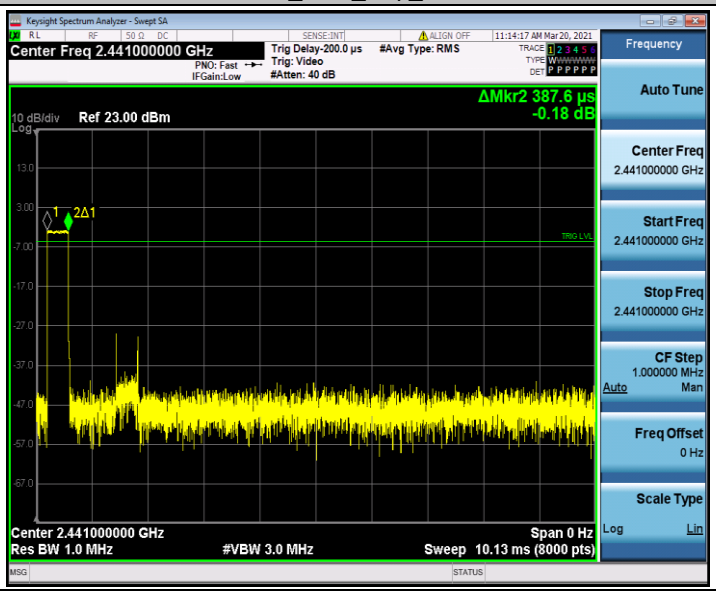
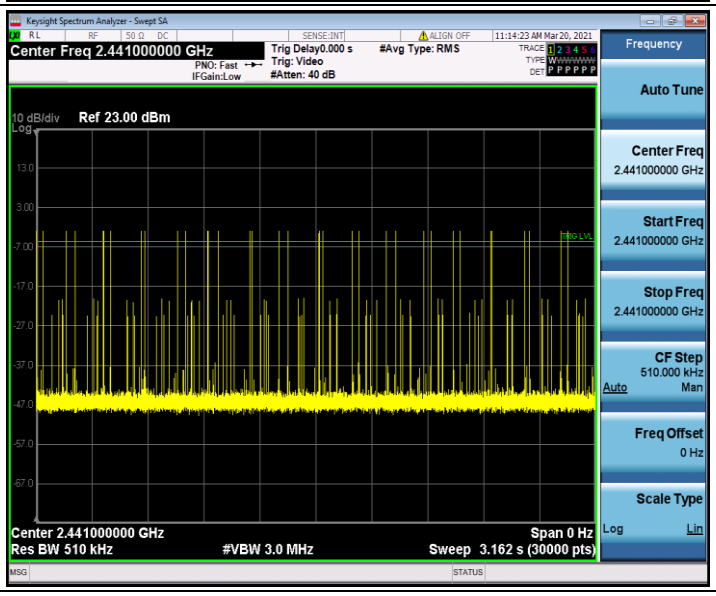
|  |
|  |

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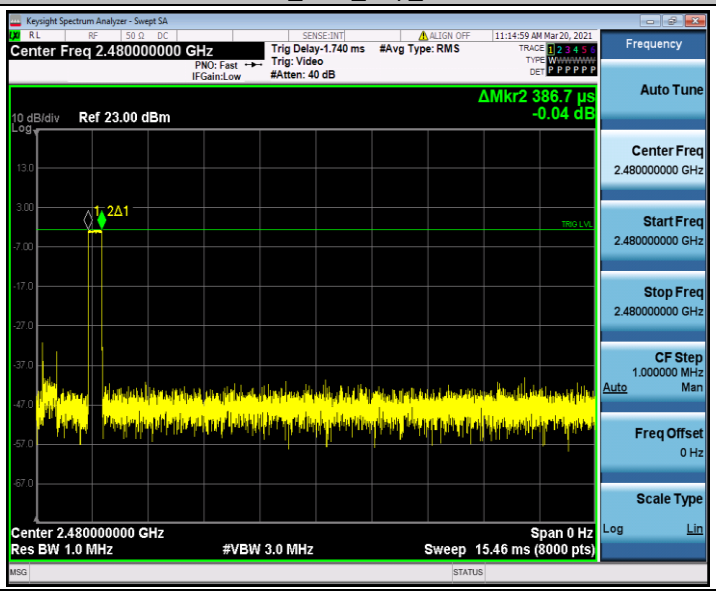
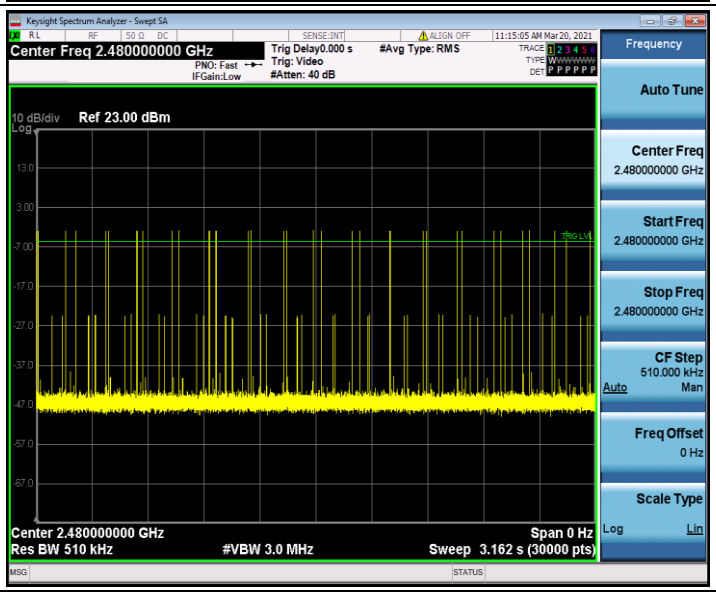
|  |
|  |

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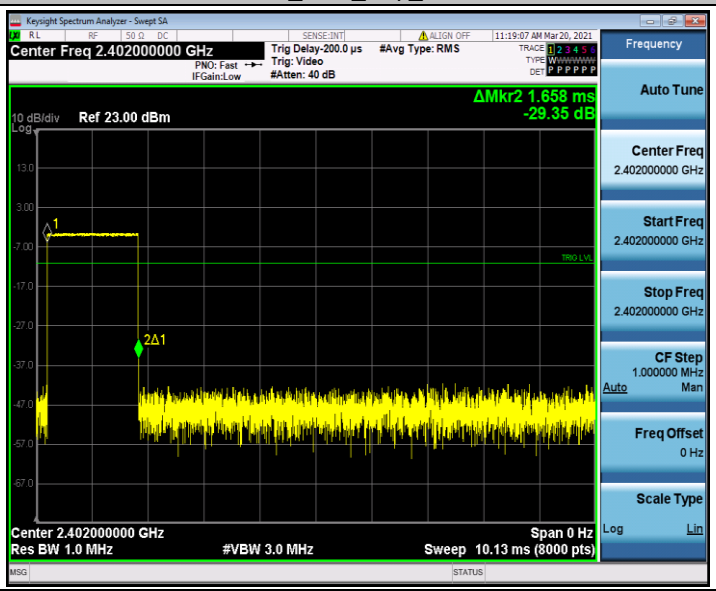
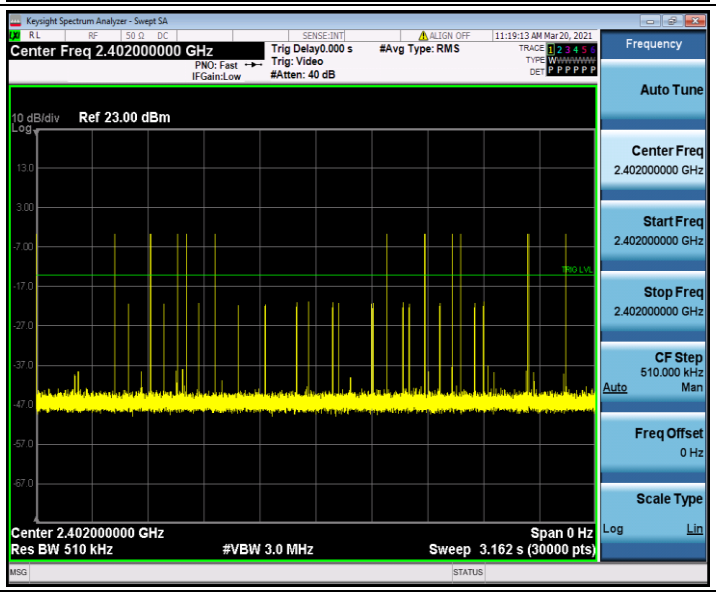
|  |
|  |

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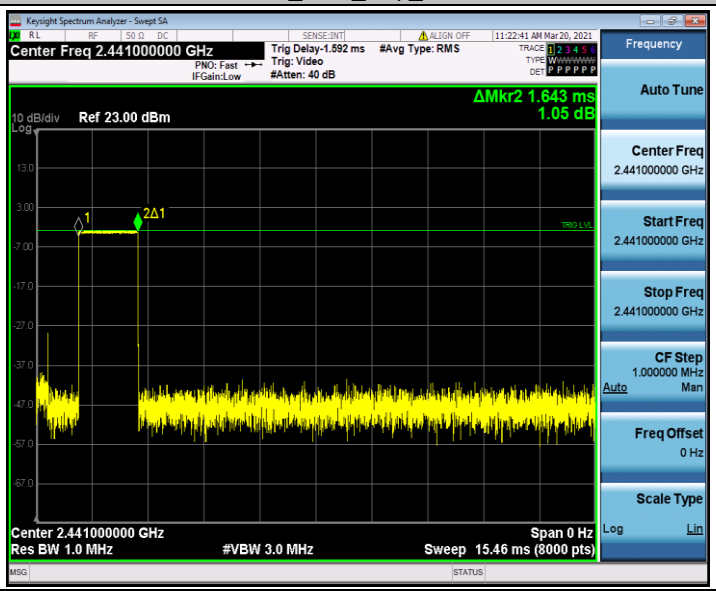
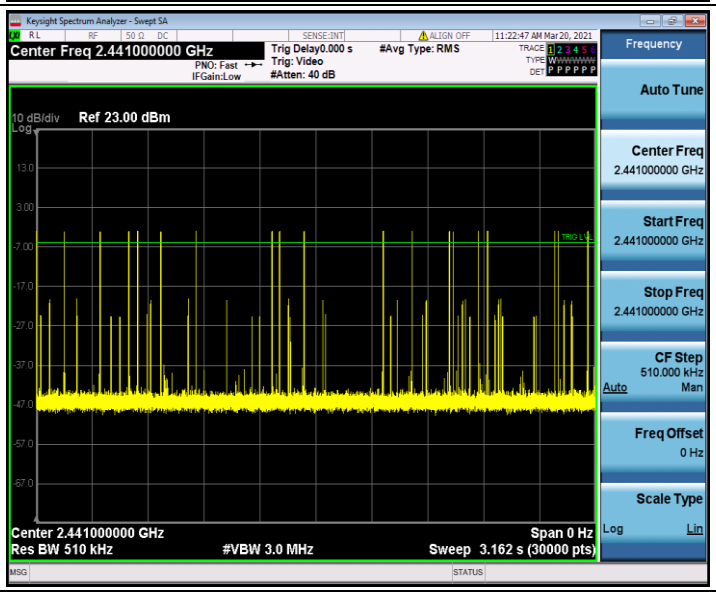
|  |
|  |

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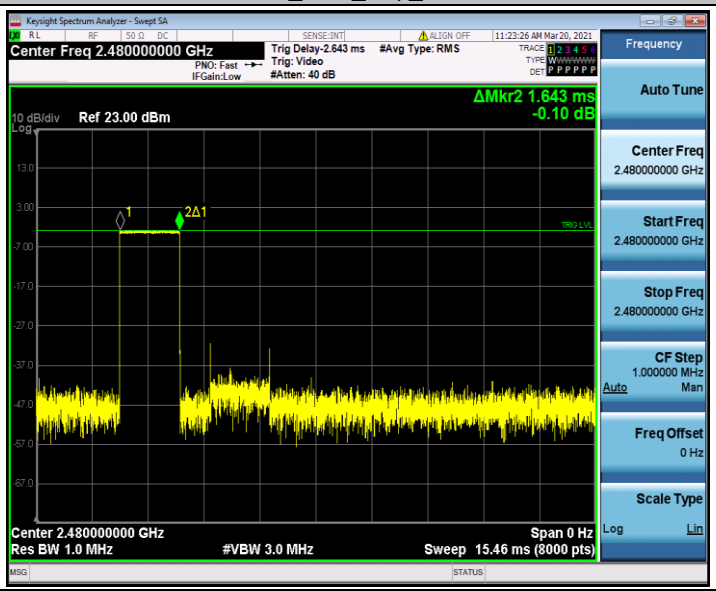
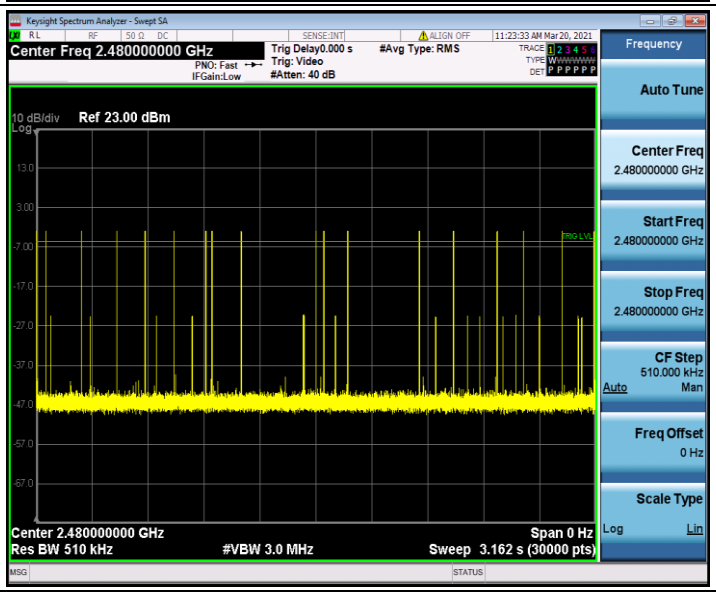
|  |
|  |

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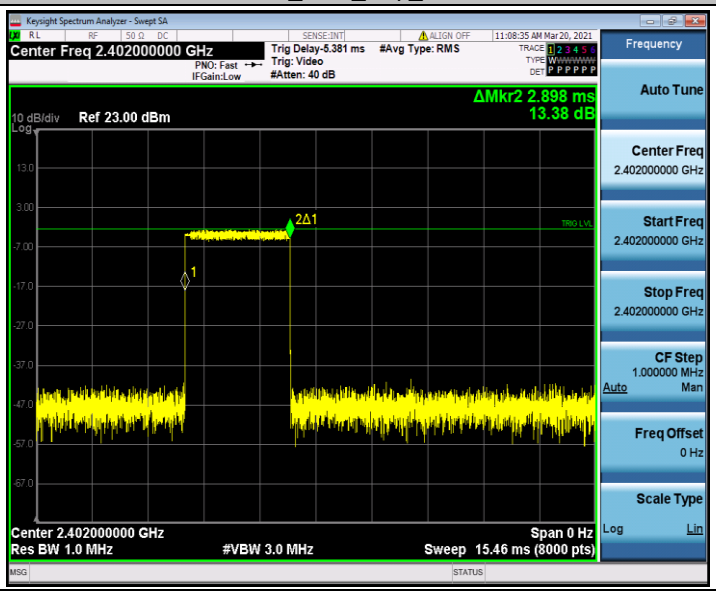
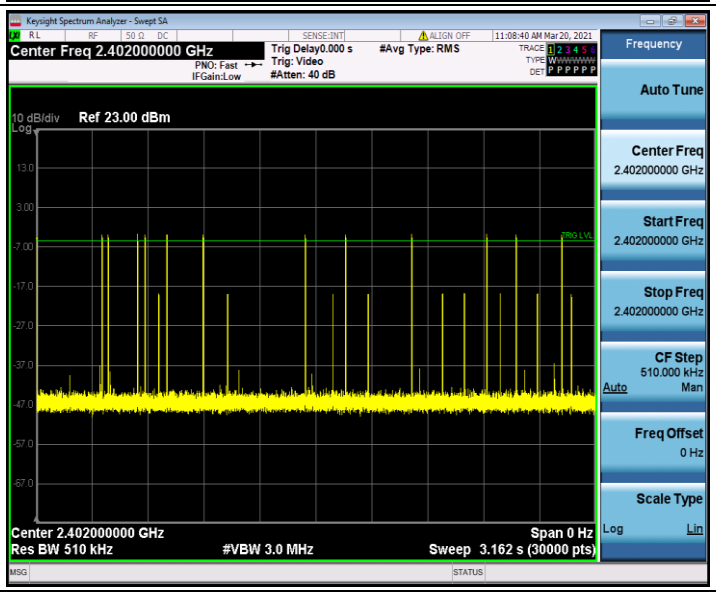
|  |
|  |

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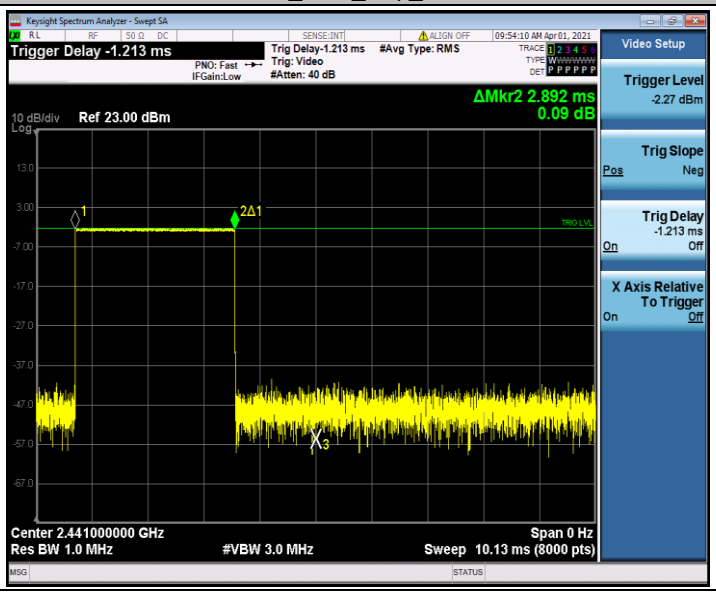
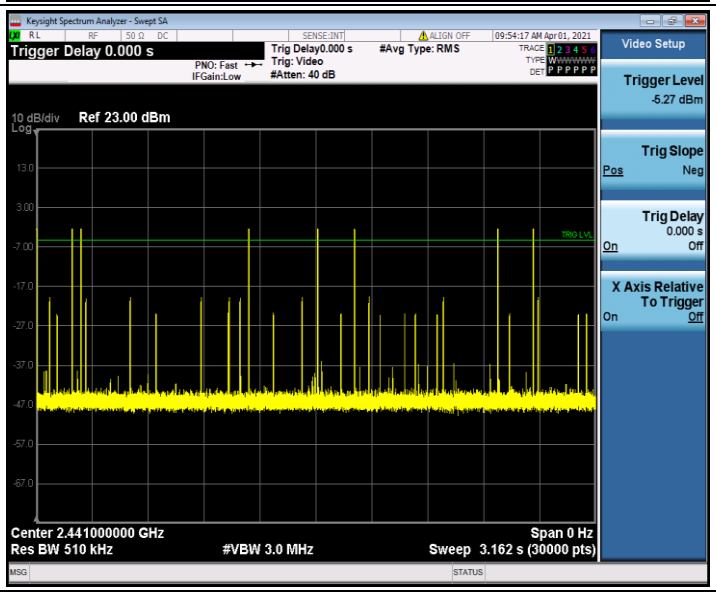
|  |
|  |

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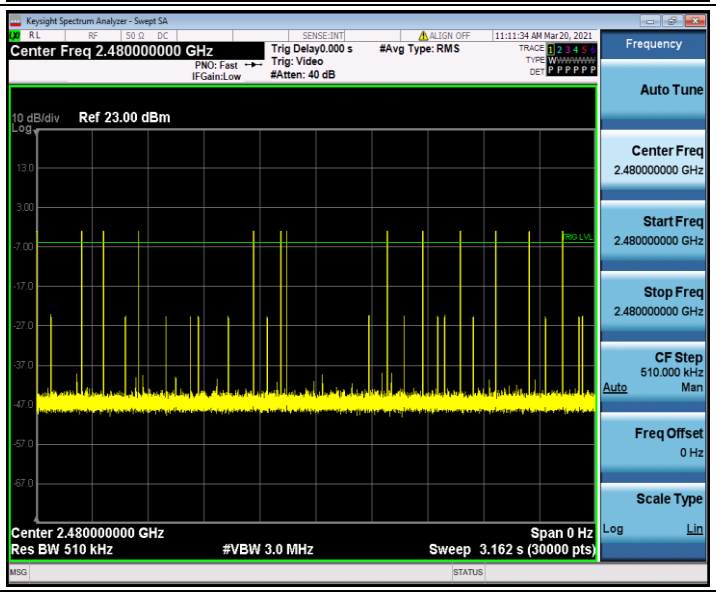
|  |

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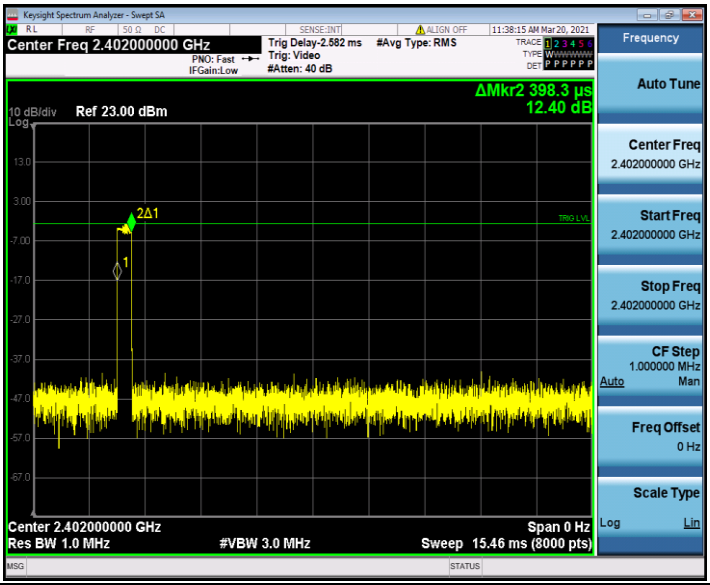
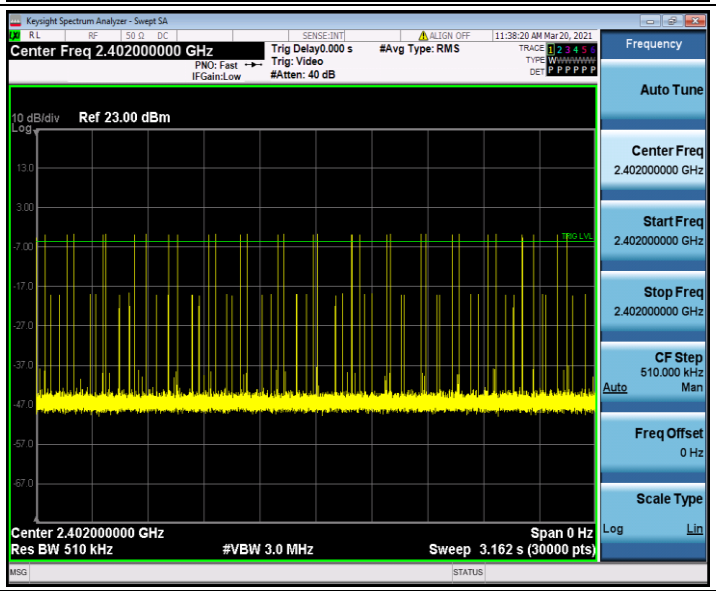
|  |
|  |

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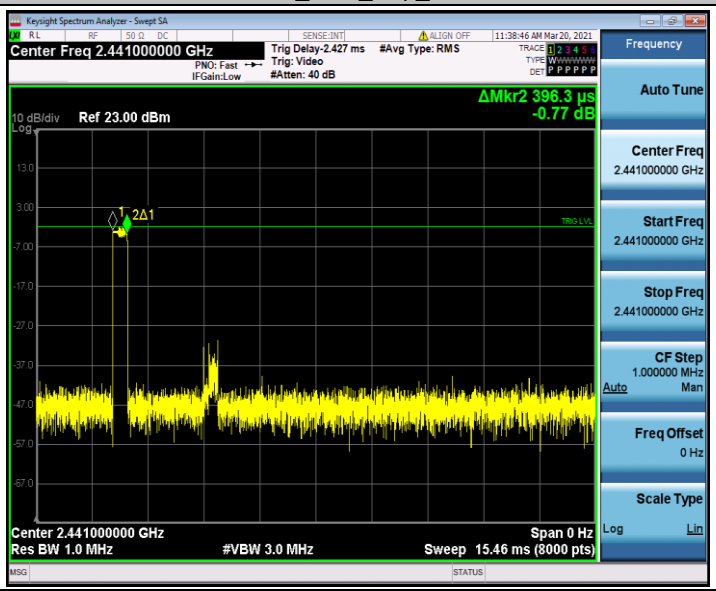
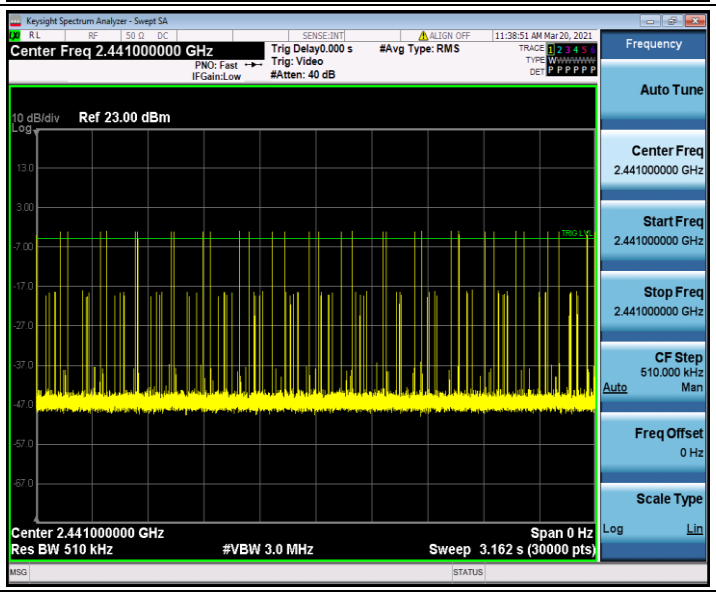
|  |
|  |

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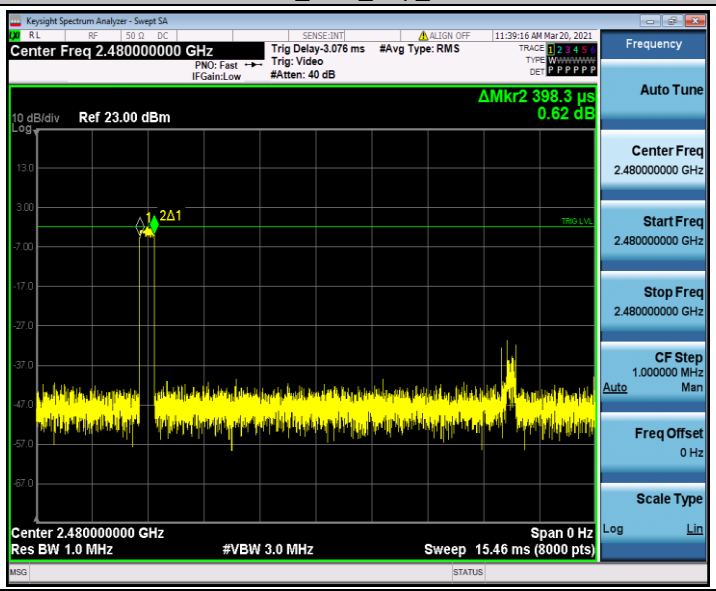
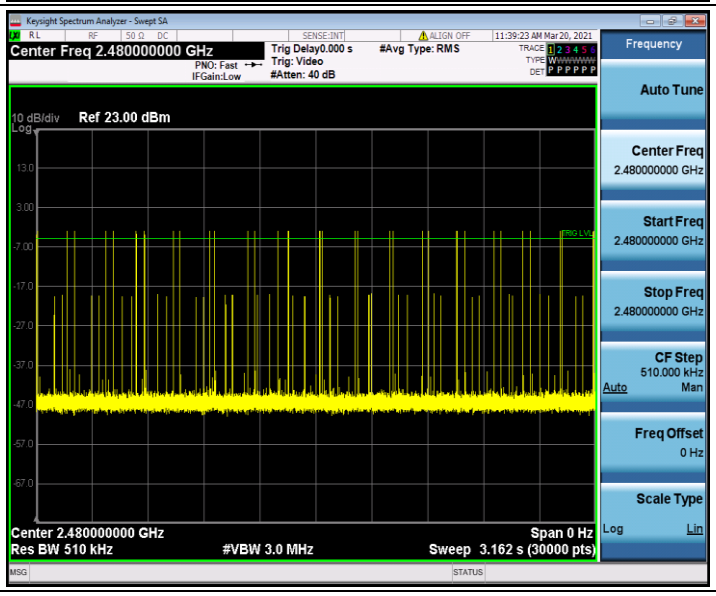
|  |
|  |

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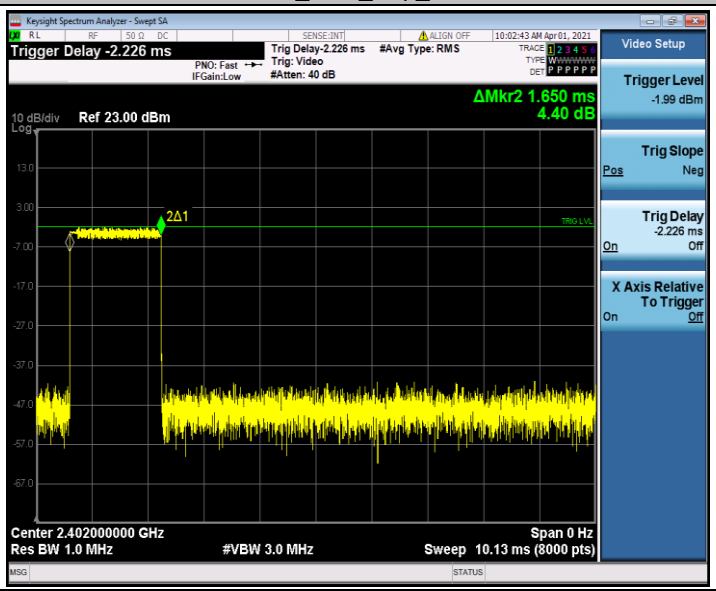
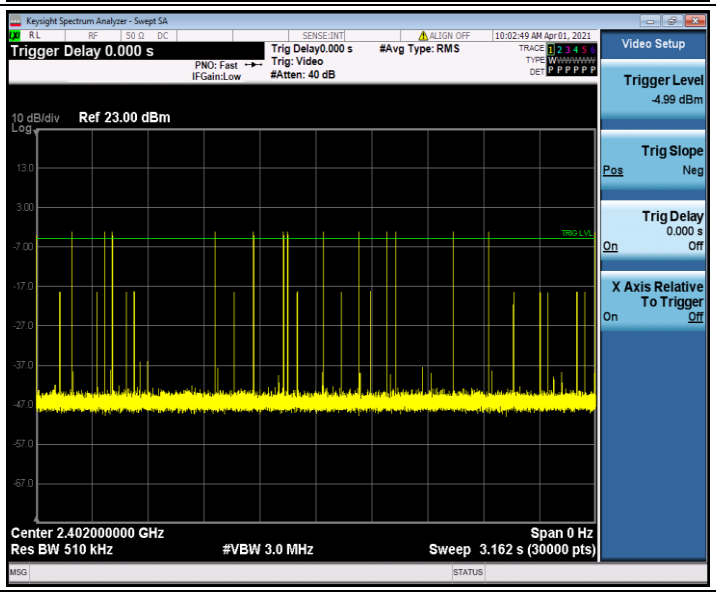
|  |
|  |