Microtest
微 测 检 测

# Test Report

**Report No.:** MTi221108011-25E1

**Date of issue:** 2023-03-14

**Applicant:** Joint Chinese Ltd

**Product:** Smart Health Watch

**Model(s):** 2032

**FCC ID:** 2AB73-2032

Shenzhen Microtest Co., Ltd.

http://www.mtitest.com

Address: 101, No.7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Tel: (86-755)88850135 Fax: (86-755) 88850136 Web: www.mtitest.com E-mail: mti@51mti.com

# Instructions

1. This test report shall not be partially reproduced without the written consent of the laboratory.

2. The test results in this test report are only responsible for the samples submitted

3. This test report is invalid without the seal and signature of the laboratory.

4. This test report is invalid if transferred, altered, or tampered with in any form without authorization.

5. Any objection to this test report shall be submitted to the laboratory within 15 days from the date of receipt of the report.

# Table of contents

| Test Result Certification | |
|---|---|
| **Applicant:** | **Joint Chinese Ltd** |
| Address: | Building 6, Huafeng Tech Park, Luotian Industrial Area, Songgang Town, Baoan Shenzhen China |
| **Manufacturer:** | **Joint Chinese Ltd** |
| Address: | Building 6, Huafeng Tech Park, Luotian Industrial Area, Songgang Town, Baoan Shenzhen China |
| **Product description** | |
| Product name: | Smart Health Watch |
| Trademark: | N/A |
| Model name: | 2032 |
| Serial Model: | 2032A, 2032B, 2032C, 2032D, 2032E, 2032F, 2032G, 2032H, 2032I |
| Standards: | FCC 47 CFR Part 15 Subpart C |
| Test method: | ANSI C63.10-2013 |
| **Date of Test** | |
| Date of test: | 2023-01-06 ~ 2023-02-22 |
| Test result: | Pass |

**Test Engineer :** David. Lee

(David Lee)

**Reviewed By: :** Leon chen

(Leon Chen)

**Approved By: :** Tom Xue

(Tom Xue)

# 1 General Description

## 1.1 Description of the EUT

| | |
|---|---|
| Product name: | Smart Health Watch |
| Model name: | 2032 |
| Series Model: | 2032A, 2032B, 2032C, 2032D, 2032E, 2032F, 2032G, 2032H, 2032I |
| Model difference: | All the models are the same circuit and module, except the model name. |
| Electrical rating: | Input: DC 5V/0.4A<br>Battery: DC 3.8V 580mAh |
| Hardware version: | ZW009_MB_V1.0 |
| Software version: | JC2032_CN_V41 |
| Accessories: | Cable: Magnetic USB Charger cable(40cm) |
| Test sample(s) number: | MTi221108011-25S1001 |
| **RF specification:** | |
| Operation frequency: | 802.11b/g/n20:2412~2462 MHz |
| Modulation type: | IEEE 802.11b: DSSS (DBPSK, DQPSK, CCK)<br>IEEE 802.11g/n (HT20): OFDM (64QAM, 16QAM, QPSK, BPSK) |
| Date Rate: | 802.11b:1/2/5.5/11 Mbit/s<br>802.11g:6/9/12/18/24/36/48/54 Mbit/s<br>802.11n(20MHz) use 800 ns GI: 6.5/13/19.5/26/39/52/58.5/65 Mbit/s |
| Antenna(s) information: | Antenna type: PIFA antenna<br>Antenna gain: -2 dBi |

## 1.2 Description of test modes

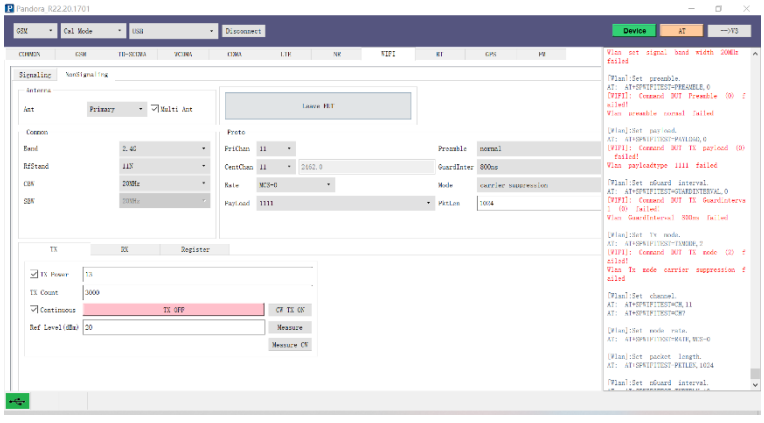
### 1.2.1 Operation channel list

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|
| 01 | 2412 | 07 | 2442 |
| 02 | 2417 | 08 | 2447 |
| 03 | 2422 | 09 | 2452 |
| 04 | 2427 | 10 | 2457 |
| 05 | 2432 | 11 | 2462 |
| 06 | 2437 | / | |

**Note:** The test software has been used to control EUT for working in engineering mode, that enables selectable channel, and capable of continuous transmitting mode.

| Test Software: | Pandora-R22.20.1701 | | |
|---|---|---|---|
| **802.112b** | | **802.11g** | |
| Channel | Power setting | Channel | Power setting |
| 1 | 18 | 1 | 10 |
| 6 | 13 | 6 | 10 |
| 11 | 16 | 11 | 13 |
| **802.112n (HT20)** | | **802.112n (HT40)** | |
| Channel | Power setting | Channel | Power setting |
| 1 | 12 | 3 | / |
| 6 | 10 | 6 | / |
| 11 | 13 | 9 | / |

**The test software:**



### 1.3 Environmental conditions for testing

Environment of test site:

| | |
|---|---|
| Temperature: | 15ºC~35ºC |
| Humidity: | 20 % RH ~ 75 % RH |

### 1.4 Description of support units

| **Support equipment list** | | | |
|---|---|---|---|
| Description | Model | Serial No. | Manufacturer |
| NoteBook | E485 | / | Lenovo |
| Mobile phone | S9+ | / | SAMSUNG |
| Adapter | HW-090200CH0 | / | Huizhou BYD Electronics Co., Ltd. |
| **Support cable list** | | | |
| Description | Length (m) | From | To |
| / | / | / | / |

## 2 Measurement uncertainty

| Parameter | Measurement uncertainty |
|---|---|
| AC power line conducted emission (9 kHz~30 MHz) | ±2.5 dB |
| Occupied Bandwidth | ±3 % |
| Conducted RF output power | ±0.16 dB |
| Conducted spurious emissions | ±0.21 dB |
| Power Spectral Density, conducted | ±2.35dB |
| Radiated emission (9 kHz ~ 30 MHz) | ±4.0 dB |
| Radiated emission (30 MHz~1 GHz) | ±4.2 dB |
| Radiated emission (above 1 GHz) | ±4.3 dB |

**Note:** the measurement uncertainty is calculated and correspond to a factor k = 2 (which provide confidence levels of 95.45 %)

# 3 Summary of Test Result

| No. | FCC reference | Description of test | Result |
|---|---|---|---|
| 1 | § 15.203 | Antenna requirement | Pass |
| 2 | § 15.207 | AC power line conducted emissions | Pass |
| 3 | § 15.247(d) | Radiated spurious emissions | Pass |
| 4 | 15.247(a)(2) | DTS bandwidth | Pass |
| 5 | 15.247(b)(3) | Maximum conducted output power | Pass |
| 6 | 15.247(e) | Power Spectral Density | Pass |
| 7 | 15.247(d) | Band edge (Conducted) | Pass |
| 8 | 15.247(d) | Conducted spurious emissions | Pass |
| 9 | / | Duty Cycle | Pass |

# 4 Test Laboratory

| | |
|---|---|
| Test laboratory: | Shenzhen Microtest Co., Ltd. |
| Test site location: | 101, No.7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China |
| Telephone: | (86-755)88850135 |
| Fax: | (86-755)88850136 |
| CNAS Registration No.: | CNAS L5868 |
| FCC Registration No.: | 448573 |

# 5 Equipment List

| No. | Equipment | Manufacturer | Model | Serial No. | Cal. date | Cal. Due |
|---|---|---|---|---|---|---|
| MTi-E002 | EMI Test Receiver | R&S | ESCI3 | 101368 | 2022/05/05 | 2023/05/04 |
| MTi-E023 | Artificial power network | Schwarzbeck | NSLK8127 | NSLK8127# 841 | 2022/05/05 | 2023/05/04 |
| MTi-E025 | Artificial power network | Schwarzbeck | NSLK8127 | 8127183 | 2022/05/05 | 2023/05/04 |
| MTI-E043 | EMI test receiver | R&S | ESCI7 | 101166 | 2022/05/05 | 2023/05/04 |
| MTI-E046 | Active Loop Antenna | Schwarzbeck | FMZB 1519 B | 00044 | 2021/05/30 | 2023/05/29 |
| MTI-E044 | Broadband antenna | Schwarzbeck | VULB9163 | 9163-1338 | 2021/05/30 | 2023/05/29 |
| MTI-E045 | Horn antenna | Schwarzbeck | BBHA9120D | 9120D-2278 | 2021/05/30 | 2023/05/29 |
| MTI-E047 | Pre-amplifier | Hewlett-Packard | 8447F | 3113A06184 | 2022/05/05 | 2023/05/04 |
| MTI-E048 | Pre-amplifier | Agilent | 8449B | 3008A01120 | 2022/05/05 | 2023/05/04 |
| MTi-E120 | Broadband antenna | Schwarzbeck | VULB9163 | 9163-1419 | 2021/05/30 | 2023/05/29 |
| MTi-E121 | Pre-amplifier | Hewlett-Packard | 8447D | 2944A09365 | 2022/04/15 | 2023/04/14 |
| MTi-E123 | Pre-amplifier | Agilent | 8449B | 3008A04723 | 2022/05/05 | 2023/05/04 |
| MTi-E135 | Horn antenna | Schwarzbeck | BBHA 9170 | 00987 | 2021/05/30 | 2023/05/29 |
| MTi-E136 | Pre-amplifier | Space-Dtronics | EWLAN1840 G-G45 | 210405001 | 2022/05/05 | 2023/05/04 |
| MTi-E062 | PXA Signal Analyzer | Agilent | N9030A | MY51350296 | 2022/05/05 | 2023/05/04 |
| MTi-E067 | RF Control Unit | Tonscend | JS0806-1 | 19D8060152 | 2022/05/05 | 2023/05/04 |
| MTi-E068 | RF Control Unit | Tonscend | JS0806-2 | 19D8060153 | 2022/05/05 | 2023/05/04 |
| MTi-E069 | Band Reject Filter Group | Tonscend | JS0806-F | 19D8060160 | 2022/05/05 | 2023/05/04 |
| MTI-E010S | EMI Measurement Software | Farad | EZ-EMC Ver. EMEC-3A1 | / | / | / |
| MTI-E014S | RF Test System | Tonscend | TS®JS1120 V2.6.88.0330 | / | / | / |

**Note:** the calibration interval of the test equipment is 12 or 24 months and the calibrations are traceable to international system unit(SI)

# 6 Test Result

## 6.1 Antenna requirement

### 15.203 requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### Description of the antenna of EUT

The antenna of the EUT is permanently attached.

### Conclusion:

The EUT complies with the requirement of § 15.203.

## 6.2 AC power line conducted emissions

### 6.2.1 Limits

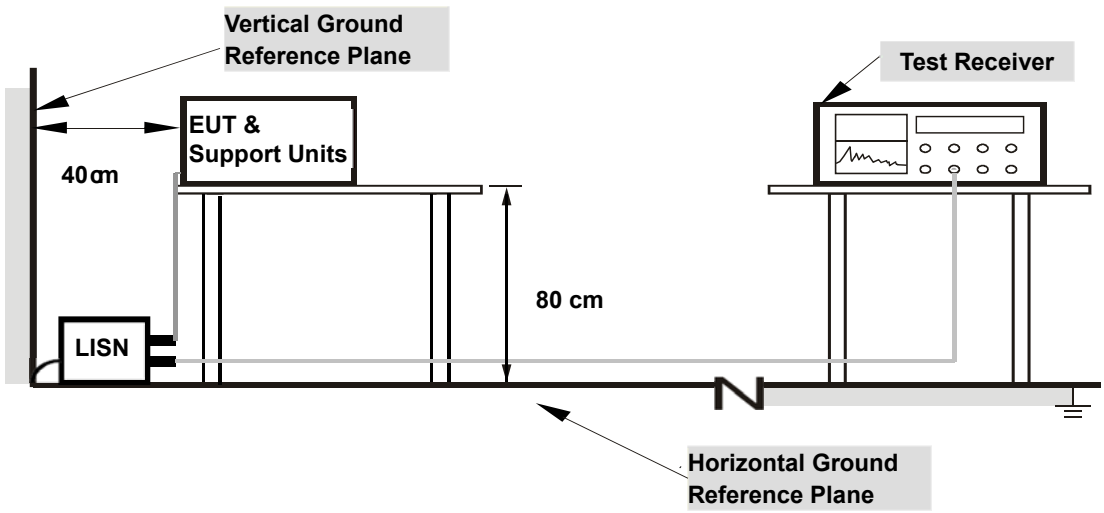
| Frequency (MHz) | Detector type / Bandwidth | Limit-Quasi-peak dBµV | Limit-Average dBµV |
|---|---|---|---|
| 0.15 -0.5 | Average / 9 kHz | 66 to 56 | 56 to 46 |
| 0.5 -5 | | 56 | 46 |
| 5 -30 | | 60 | 50 |

**Note 1:** the limit decreases with the logarithm of the frequency in the range of 0.15 MHz to 0.5 MHz.

### 6.2.2 Test Procedures

a) Test method: ANSI C63.10-2013 Section 6.2.
b) The EUT is connected to the main power through a line impedance stabilization network (LISN). All support equipment is powered from additional LISN(s).
c) Emissions were measured on each current carrying line of the EUT using an EMI test receiver connected to the LISN powering the EUT.
d) The test receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes described in Item 1.2.
e) The test data of the worst-case condition(s) was recorded.

### 6.2.3 Test setup




For the actual test configuration, please refer to the related item – Photographs of the test setup.

### 6.2.4 Test Result

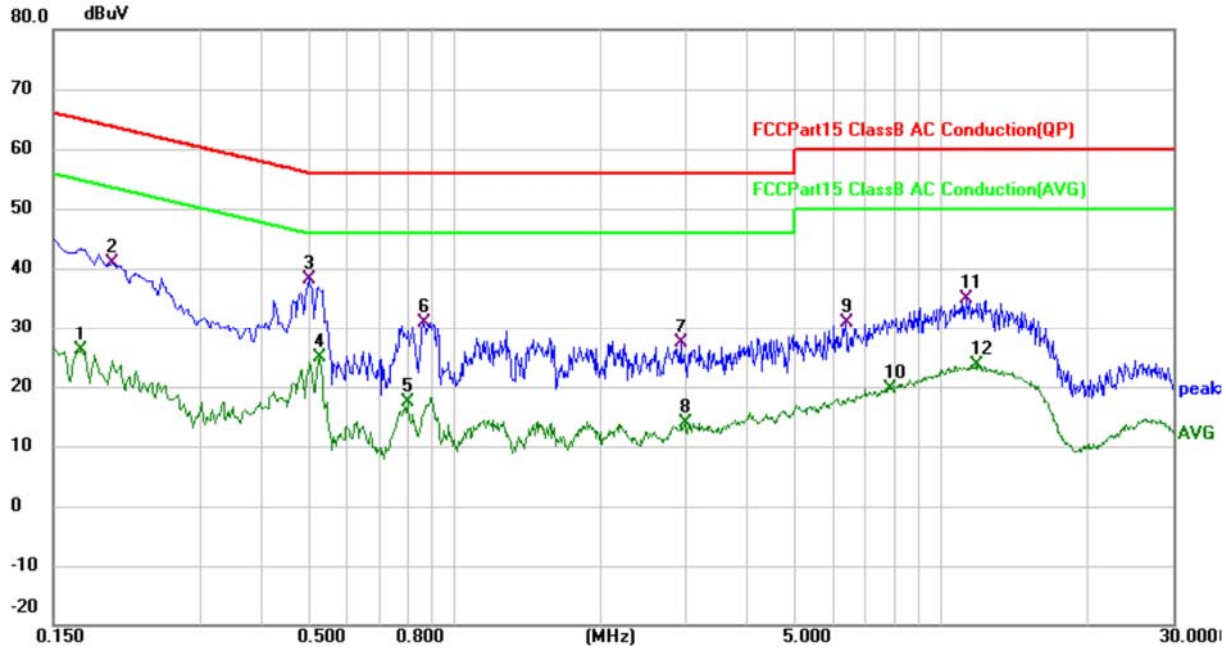
**Notes:**

All modes of operation of the EUT were investigated, and only the worst-case results are reported.

**Calculation formula:**

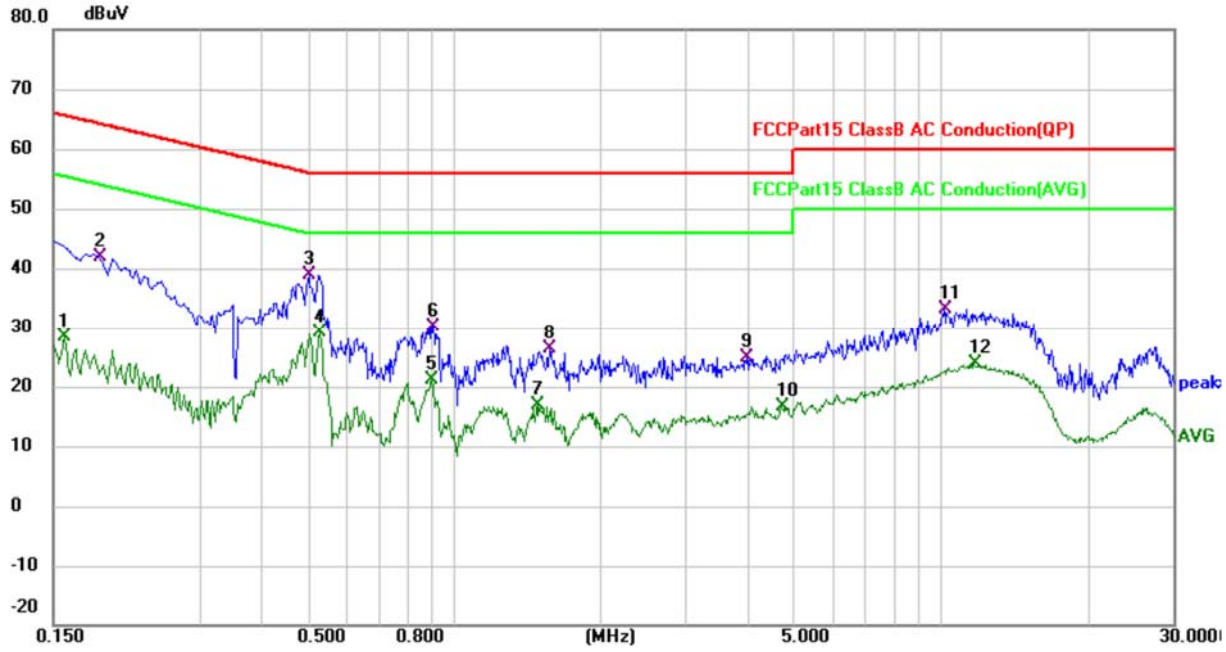
Measurement (dBµV) = Reading Level (dBµV) + Correct Factor (dB)
Over (dB) = Measurement (dBµV) – Limit (dBµV)

| Test mode: | TX – 802.11b 2412MHz | Phase: | L |
|---|---|---|---|
| Power supply: | Power by AC/DC adapter (AC 120V/60Hz) | Test site: | CE chamber 1 |




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.1700 | 15.78 | 10.28 | 26.06 | 54.96 | -28.90 | AVG |
| 2 | | 0.1980 | 30.25 | 10.68 | 40.93 | 63.69 | -22.76 | QP |
| 3 | * | 0.5020 | 26.93 | 11.32 | 38.25 | 56.00 | -17.75 | QP |
| 4 | | 0.5299 | 13.53 | 11.38 | 24.91 | 46.00 | -21.09 | AVG |
| 5 | | 0.8020 | 5.50 | 11.98 | 17.48 | 46.00 | -28.52 | AVG |
| 6 | | 0.8660 | 18.83 | 12.13 | 30.96 | 56.00 | -25.04 | QP |
| 7 | | 2.9260 | 17.07 | 10.25 | 27.32 | 56.00 | -28.68 | QP |
| 8 | | 2.9820 | 3.70 | 10.26 | 13.96 | 46.00 | -32.04 | AVG |
| 9 | | 6.3740 | 20.65 | 10.28 | 30.93 | 60.00 | -29.07 | QP |
| 10 | | 7.8380 | 9.37 | 10.32 | 19.69 | 50.00 | -30.31 | AVG |
| 11 | | 11.2700 | 24.45 | 10.43 | 34.88 | 60.00 | -25.12 | QP |
| 12 | | 11.8300 | 13.23 | 10.45 | 23.68 | 50.00 | -26.32 | AVG |

| Test mode: | TX – 802.11b 2412MHz | Phase: | N |
|---|---|---|---|
| Power supply: | Power by AC/DC adapter (AC 120V/60Hz) | Test site: | CE chamber 1 |




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.1580 | 17.98 | 10.28 | 28.26 | 55.57 | -27.31 | AVG |
| 2 | | 0.1860 | 31.32 | 10.60 | 41.92 | 64.21 | -22.29 | QP |
| 3 | | 0.5020 | 27.53 | 11.32 | 38.85 | 56.00 | -17.15 | QP |
| 4 | * | 0.5299 | 17.71 | 11.39 | 29.10 | 46.00 | -16.90 | AVG |
| 5 | | 0.9020 | 9.08 | 12.15 | 21.23 | 46.00 | -24.77 | AVG |
| 6 | | 0.9060 | 18.08 | 12.17 | 30.25 | 56.00 | -25.75 | QP |
| 7 | | 1.4819 | 3.50 | 13.36 | 16.86 | 46.00 | -29.14 | AVG |
| 8 | | 1.5740 | 12.82 | 13.55 | 26.37 | 56.00 | -29.63 | QP |
| 9 | | 3.9980 | 14.60 | 10.28 | 24.88 | 56.00 | -31.12 | QP |
| 10 | | 4.7180 | 6.32 | 10.27 | 16.59 | 46.00 | -29.41 | AVG |
| 11 | | 10.1260 | 22.94 | 10.31 | 33.25 | 60.00 | -26.75 | QP |
| 12 | | 11.7180 | 13.43 | 10.37 | 23.80 | 50.00 | -26.20 | AVG |

## 6.3 Radiated spurious emission

### 6.3.1 Limits

§ 15.247 (d) 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)).

**§ 15.209 Radiated emission limits at restricted bands:**

| 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 |

**Note 1:** the tighter limit applies at the band edges.
**Note 2:** the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector

§ 15.35 (b) requirements:
When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

According to ANSI C63.10-2013, the tests shall be performed in the frequency range shown in the following table:

**Frequency range of measurements for unlicensed wireless device**

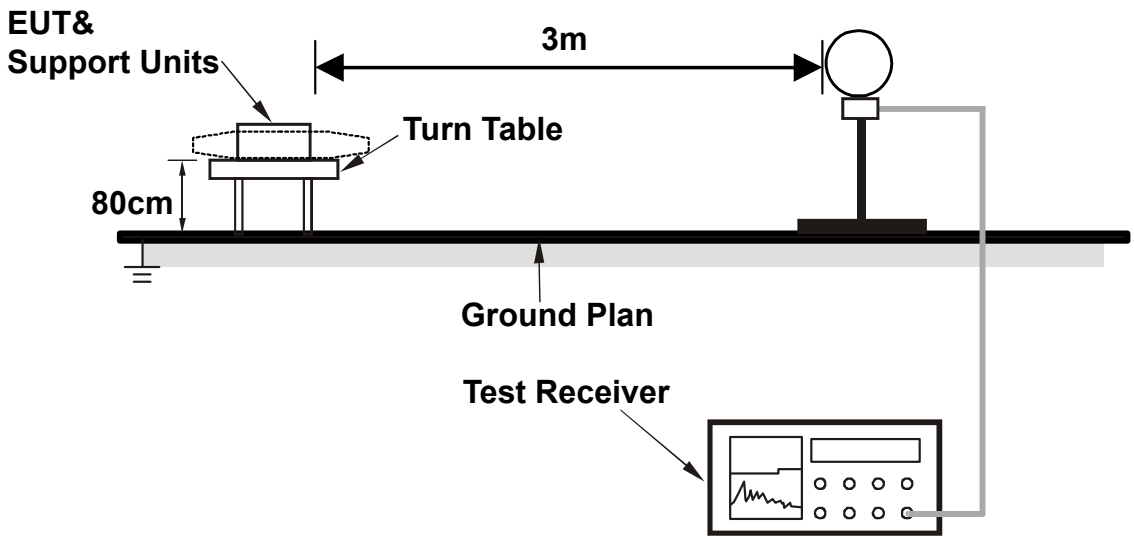
| Lowest frequency generated in the device | Upper frequency range of measurement |
|---|---|
| 9 kHz to below 10 GHz | 10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower |
| At or above 10 GHz to below 30 GHz | 5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower |
| At or above 30 GHz | 5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified |

**Frequency range of measurements for unlicensed wireless device with digital device**

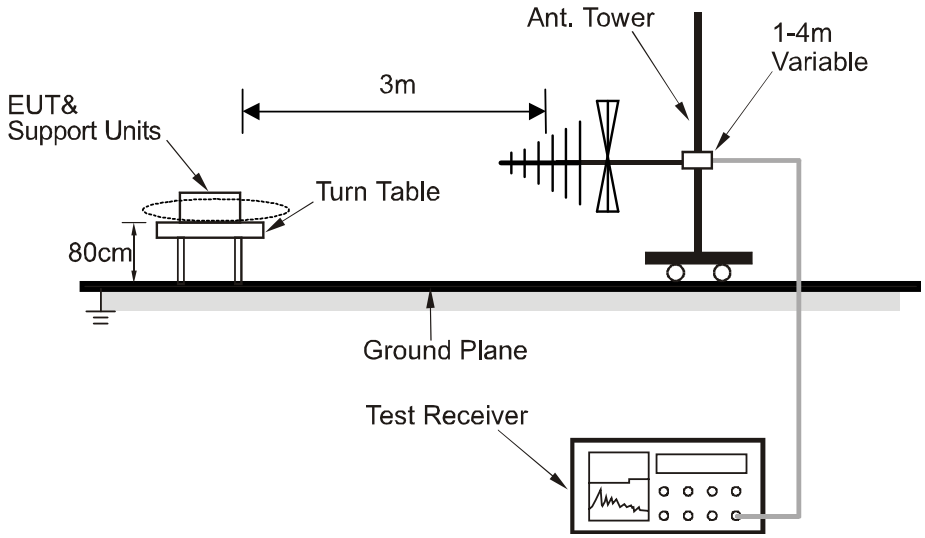
| Highest frequency generated or used in the device or on which the device operates or tunes | Upper frequency range of measurement |
|---|---|
| Below 1.705 MHz | 30 MHz |
| 1.705 MHz to 108 MHz | 1000 MHz |
| 108 MHz to 500 MHz | 2000 MHz |
| 500 MHz to 1000 MHz | 5000 MHz |
| Above 1000 MHz | 5th harmonic of the highest frequency or 40 GHz, whichever is lower |

### 6.3.2 Test setup

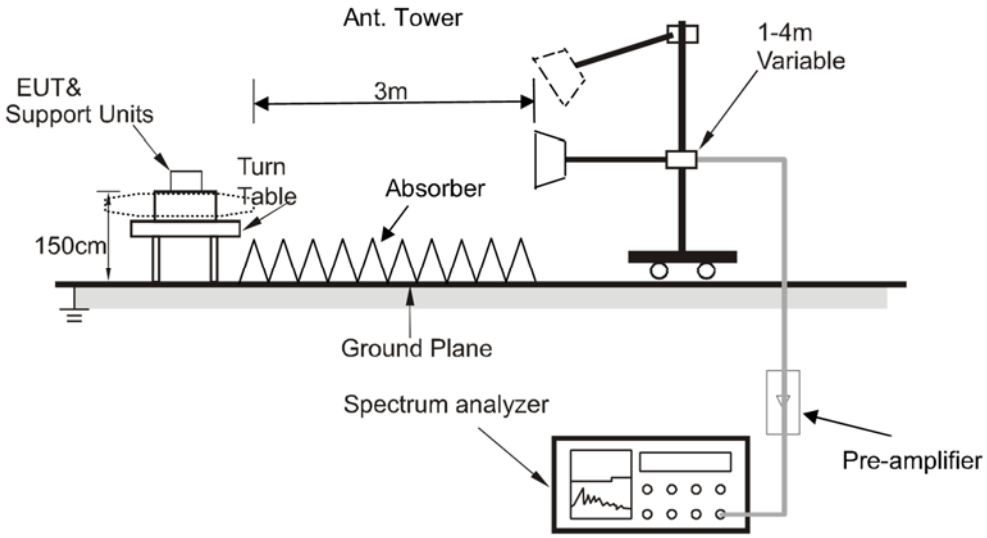
Below 30MHz:




30MHz~1GHz:




Above 1GHz:




For the actual test configuration, please refer to the related item – Photographs of the test setup.

### 6.3.3 Test procedure

a) Test method: ANSI C63.10-2013 Section 6.3, 6.4, 6.5, 6.6, 11.11, 11.12, 11.13.
b) The EUT is placed on an on-conducting table 0.8 meters above the ground plane for measurement below 1GHz, 1.5 meters above the ground plane for measurement above 1GHz.
c) Emission blew 18 GHz were measured at a 3 meters test distance, above 18 GHz were measured at 1-meter test distance with the application of a distance correction factor
d) The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

**Test instrument setup**

| Frequency | Test receiver / Spectrum analyzer setting |
|---|---|
| 9 kHz ~ 150 kHz | Quasi Peak / RBW: 200 Hz |
| 150 kHz ~ 30 MHz | Quasi Peak / RBW: 9 kHz |
| 30 MHz ~ 1 GHz | Quasi Peak / RBW: 120 kHz |
| Above 1 GHz | Peak / RBW: 1 MHz, VBW: 3MHz, Peak detector<br>AVG / RBW: 1 MHz, VBW: 3MHz, Average detector |

### 6.3.4 Test results

**Notes:**

The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.
All modes of operation of the EUT were investigated, and only the worst-case results are reported.
There were no emissions found below 30MHz within 20dB of the limit.

**Calculation formula:**
Measurement (dBμV/m) = Reading Level (dBμV) + Correct Factor (dB/m)
Over (dB) = Measurement (dBμV/m) – Limit (dBμV/m)

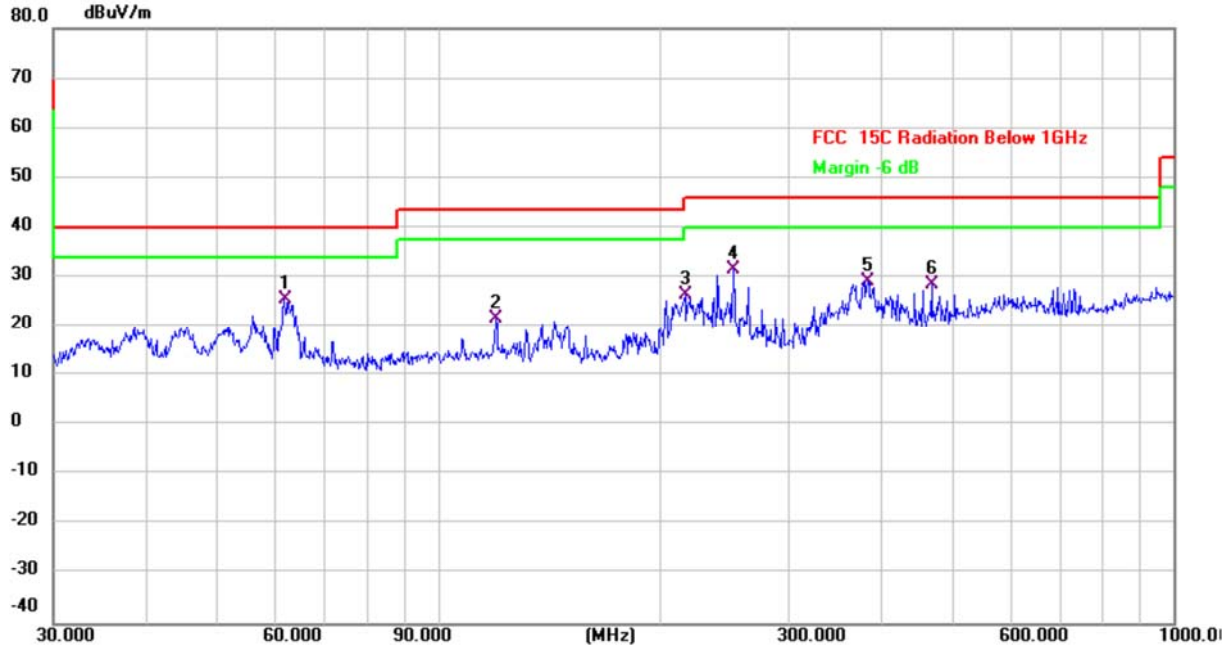
**Radiated emissions between 30MHz – 1GHz**

| Test mode: | TX – 802.11b 2462MHz | Polarization: | Horizontal |
|---|---|---|---|
| Power supply: | DC 3.8V | Test site: | RE chamber 2 |


| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 63.0916 | 42.69 | -11.34 | 31.35 | 40.00 | -8.65 | QP |
| 2 | | 143.8295 | 45.97 | -12.71 | 33.26 | 43.50 | -10.24 | QP |
| 3 | * | 239.9874 | 47.17 | -8.53 | 38.64 | 46.00 | -7.36 | QP |
| 4 | | 263.8190 | 43.01 | -8.00 | 35.01 | 46.00 | -10.99 | QP |
| 5 | | 468.8762 | 38.10 | -6.20 | 31.90 | 46.00 | -14.10 | QP |
| 6 | | 696.8567 | 39.37 | -2.88 | 36.49 | 46.00 | -9.51 | QP |

**Radiated emissions between 30MHz – 1GHz**

| Test mode: | TX – 802.11b 2462MHz | Polarization: | Vertical |
|---|---|---|---|
| Power supply: | DC 3.8V | Test site: | RE chamber 2 |




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 61.7781 | 36.70 | -11.29 | 25.41 | 40.00 | -14.59 | QP |
| 2 | | 119.8556 | 33.92 | -12.20 | 21.72 | 43.50 | -21.78 | QP |
| 3 | | 216.7828 | 35.81 | -9.38 | 26.43 | 46.00 | -19.57 | QP |
| 4 | * | 252.0627 | 39.70 | -8.08 | 31.62 | 46.00 | -14.38 | QP |
| 5 | | 383.9318 | 36.23 | -6.95 | 29.28 | 46.00 | -16.72 | QP |
| 6 | | 468.8762 | 34.78 | -6.20 | 28.58 | 46.00 | -17.42 | QP |

**Radiated emissions 1 GHz ~ 25 GHz**

| Frequency | Reading Level | Correct Factor | Measurement | Limits | Over | Detector | Polarization |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/m) | (dBμV/m) | (dBμV/m) | (dB) | Peak/AVG | H/V |
| **TX 802.11b 2412MHz** | | | | | | | |
| 4824.000 | 41.41 | 0.82 | 42.23 | 74.00 | -31.77 | Peak | V |
| 4824.000 | 35.33 | 0.82 | 36.15 | 54.00 | -17.85 | AVG | V |
| 7236.000 | 41.92 | 6.00 | 47.92 | 74.00 | -26.08 | Peak | V |
| 7236.000 | 35.57 | 6.00 | 41.57 | 54.00 | -12.43 | AVG | V |
| 9648.000 | 41.17 | 6.17 | 47.34 | 74.00 | -26.66 | Peak | V |
| 9648.000 | 35.04 | 6.17 | 41.21 | 54.00 | -12.79 | AVG | V |
| 4824.000 | 41.78 | 0.82 | 42.60 | 74.00 | -31.40 | Peak | H |
| 4824.000 | 35.42 | 0.82 | 36.24 | 54.00 | -17.76 | AVG | H |
| 7236.000 | 41.51 | 6.00 | 47.51 | 74.00 | -26.49 | Peak | H |
| 7236.000 | 35.33 | 6.00 | 41.33 | 54.00 | -12.67 | AVG | H |
| 9648.000 | 41.46 | 6.17 | 47.63 | 74.00 | -26.37 | Peak | H |
| 9648.000 | 35.12 | 6.17 | 41.29 | 54.00 | -12.71 | AVG | H |
| **TX 802.11b 2437MHz** | | | | | | | |
| 4874.000 | 43.26 | 1.01 | 44.27 | 74.00 | -29.73 | Peak | V |
| 4874.000 | 37.10 | 1.01 | 38.11 | 54.00 | -15.89 | AVG | V |
| 7311.000 | 43.09 | 5.94 | 49.03 | 74.00 | -24.97 | Peak | V |
| 7311.000 | 36.64 | 5.94 | 42.58 | 54.00 | -11.42 | AVG | V |
| 9748.000 | 41.89 | 6.54 | 48.43 | 74.00 | -25.57 | Peak | V |
| 9748.000 | 35.71 | 6.54 | 42.25 | 54.00 | -11.75 | AVG | V |
| 4874.000 | 42.87 | 1.01 | 43.88 | 74.00 | -30.12 | Peak | H |
| 4874.000 | 36.44 | 1.01 | 37.45 | 54.00 | -16.55 | AVG | H |
| 7311.000 | 40.27 | 5.94 | 46.21 | 74.00 | -27.79 | Peak | H |
| 7311.000 | 34.22 | 5.94 | 40.16 | 54.00 | -13.84 | AVG | H |
| 9748.000 | 41.08 | 6.54 | 47.62 | 74.00 | -26.38 | Peak | H |
| 9748.000 | 34.79 | 6.54 | 41.33 | 54.00 | -12.67 | AVG | H |

| Frequency | Reading Level | Correct Factor | Measurement | Limits | Over | Detector | Polarization |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/m) | (dBμV/m) | (dBμV/m) | (dB) | Peak/AVG | H/V |
| **TX 802.11b 2462MHz** | | | | | | | |
| 4924.000 | 42.46 | 1.27 | 43.73 | 74.00 | -30.27 | Peak | V |
| 4924.000 | 36.12 | 1.27 | 37.39 | 54.00 | -16.61 | AVG | V |
| 7386.000 | 42.46 | 5.86 | 48.32 | 74.00 | -25.68 | Peak | V |
| 7386.000 | 36.31 | 5.86 | 42.17 | 54.00 | -11.83 | AVG | V |
| 9848.000 | 42.32 | 6.31 | 48.63 | 74.00 | -25.37 | Peak | V |
| 9848.000 | 35.89 | 6.31 | 42.20 | 54.00 | -11.80 | AVG | V |
| 4924.000 | 43.11 | 1.27 | 44.38 | 74.00 | -29.62 | Peak | H |
| 4924.000 | 36.87 | 1.27 | 38.14 | 54.00 | -15.86 | AVG | H |
| 7386.000 | 41.54 | 5.86 | 47.40 | 74.00 | -26.60 | Peak | H |
| 7386.000 | 35.40 | 5.86 | 41.26 | 54.00 | -12.74 | AVG | H |
| 9848.000 | 41.42 | 6.31 | 47.73 | 74.00 | -26.27 | Peak | H |
| 9848.000 | 35.02 | 6.31 | 41.33 | 54.00 | -12.67 | AVG | H |

**Radiated emissions at band edge**

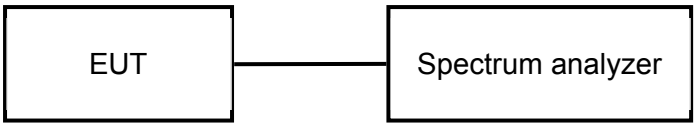
| Frequency | Reading Level | Correct Factor | Measurement | Limits | Over | Detector | Polarization |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/m) | (dBμV/m) | (dBμV/m) | (dB) | Peak/AVG | H/V |
| **TX 802.11n20 2412MHz** | | | | | | | |
| (MHz) | (dBμV) | (dB/m) | (dBμV/m) | (dBμV/m) | (dB) | Peak/AVG | H/V |
| 2310 | 43.17 | -8.08 | 35.09 | 74.00 | -38.91 | Peak | V |
| 2310 | 32.86 | -8.08 | 24.78 | 54.00 | -29.22 | AVG | V |
| 2390 | 49.01 | -7.71 | 41.30 | 74.00 | -32.70 | Peak | V |
| 2390 | 35.66 | -7.71 | 27.95 | 54.00 | -26.05 | AVG | V |
| 2310 | 42.92 | -8.08 | 34.84 | 74.00 | -39.16 | Peak | H |
| 2310 | 32.79 | -8.08 | 24.71 | 54.00 | -29.29 | AVG | H |
| 2390 | 59.18 | -7.71 | 51.47 | 74.00 | -22.53 | Peak | H |
| 2390 | 43.83 | -7.71 | 36.12 | 54.00 | -17.88 | AVG | H |
| **TX 802.11n20 2462MHz** | | | | | | | |
| 2483.5 | 58.41 | -7.24 | 51.17 | 74.00 | -22.83 | Peak | V |
| 2483.5 | 43.19 | -7.24 | 35.95 | 54.00 | -18.05 | AVG | V |
| 2500 | 47.07 | -7.17 | 39.90 | 74.00 | -34.10 | Peak | V |
| 2500 | 38.01 | -7.17 | 30.84 | 54.00 | -23.16 | AVG | V |
| 2483.5 | 65.27 | -7.24 | 58.03 | 74.00 | -15.97 | Peak | H |
| 2483.5 | 48.64 | -7.24 | 41.40 | 54.00 | -12.60 | AVG | H |
| 2500 | 48.26 | -7.17 | 41.09 | 74.00 | -32.91 | Peak | H |
| 2500 | 37.90 | -7.17 | 30.73 | 54.00 | -23.27 | AVG | H |

## 6.4 DTS bandwidth

### 6.4.1 Limits

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 6.4.2 Test setup




### 6.4.3 Test procedures

Test method: ANSI C63.10-2013 Section 11.8.1

### 6.4.4 Test results

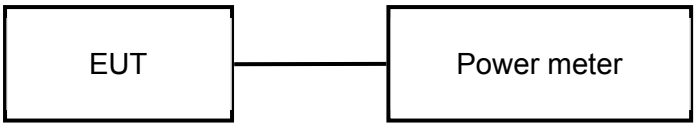
**Note: See the appendix A**

## 6.5 Maximum conducted output power

### 6.5.1 Limits

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

### 6.5.2 Test setup




### 6.5.3 Test procedure

Test method for peak power: ANSI C63.10-2013 Section 11.9.1.3 PKPM1 Peak power meter method
Test method for average power: ANSI C63.10-2013 Section 11.9.2.3.1 Method AVGPM

### 6.5.4 Test results

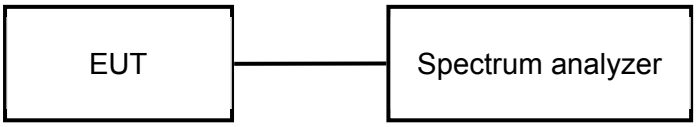
**Note: see the appendix B**

## 6.6 Power spectral density

### 6.6.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 6.6.2 Test setup




### 6.6.3 Test Procedure

Test method: ANSI C63.10-2013 Section 11.10.2

### 6.6.4 Test Results

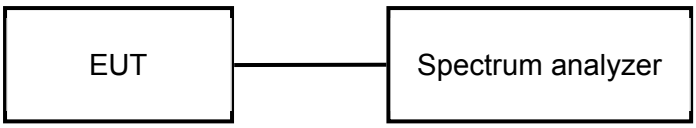
**Note: see the appendix C**

## 6.7 Band edge (Conducted)

### 6.7.1 Limits

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)).

### 6.7.2 Test setup




### 6.7.3 Test procedure

Test method: ANSI C63.10-2013 Section 11.13

### 6.7.4 Test results

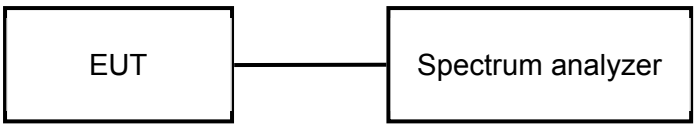
**Note: see the appendix D**

## 6.8 Conducted spurious emissions

### 6.8.1 Limits

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)).

### 6.8.2 Test setup




### 6.8.3 Test procedure

Test method: ANSI C63.10-2013 Section 11.13

### 6.8.4 Test results

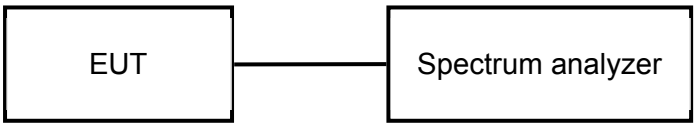
**Note: see the appendix E**

## 6.9 Duty Cycle

### 6.9.1 Limits

None, for reporting purposes only.

### 6.9.2 Test setup




### 6.9.3 Test procedure

Test method: KDB 558074 section 6, zero-span spectrum analyzer method.

### 6.9.4 Test Results

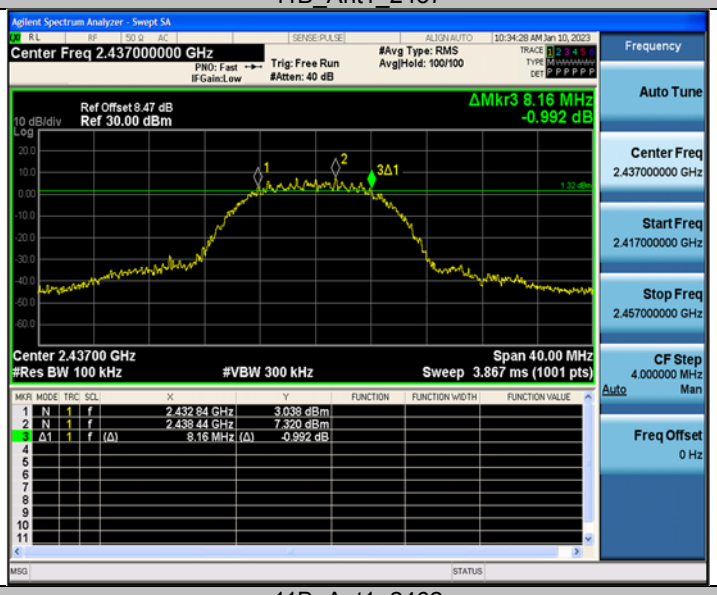
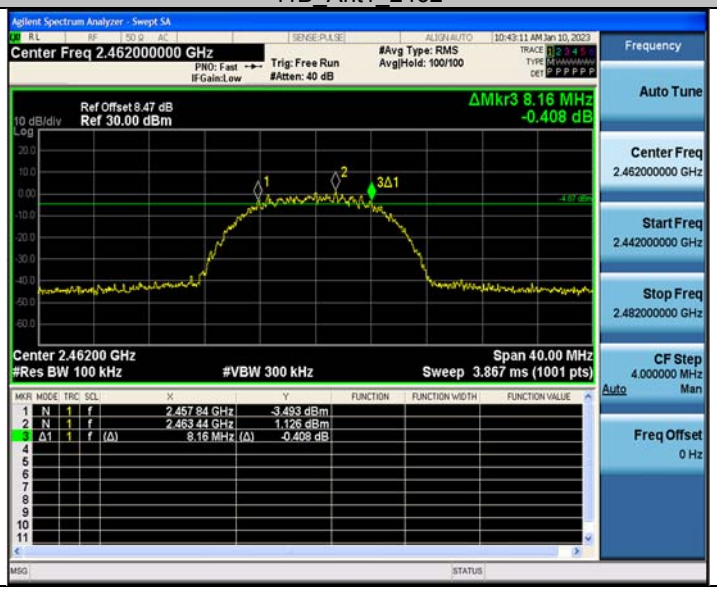
**Note: see the appendix F**

# Appendix A: DTS Bandwidth

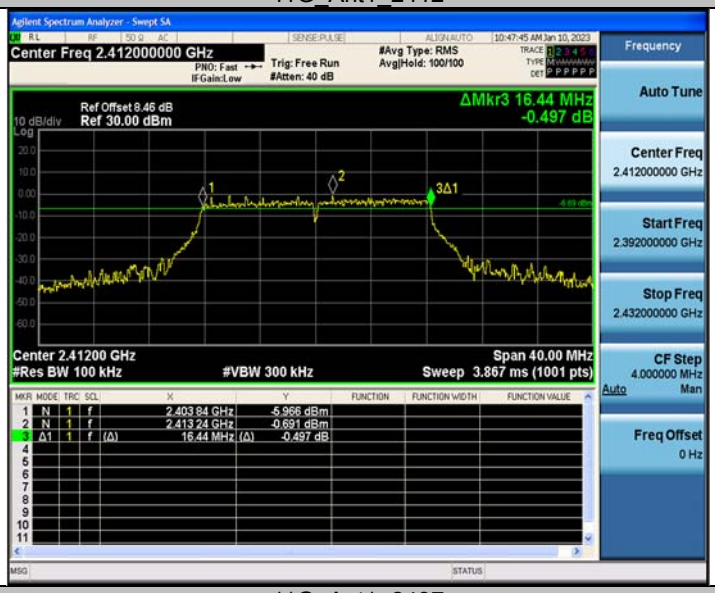
Test Result

| Test Mode | Antenna | Frequency [MHz] | DTS BW [MHz] | Limit [MHz] | Verdict |
|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 9.040 | 0.5 | PASS |
| | | 2437 | 8.160 | 0.5 | PASS |
| | | 2462 | 8.160 | 0.5 | PASS |
| 11G | Ant1 | 2412 | 16.440 | 0.5 | PASS |
| | | 2437 | 16.080 | 0.5 | PASS |
| | | 2462 | 16.400 | 0.5 | PASS |
| 11N20SISO | Ant1 | 2412 | 17.280 | 0.5 | PASS |
| | | 2437 | 17.200 | 0.5 | PASS |
| | | 2462 | 17.560 | 0.5 | PASS |

## Test Graphs

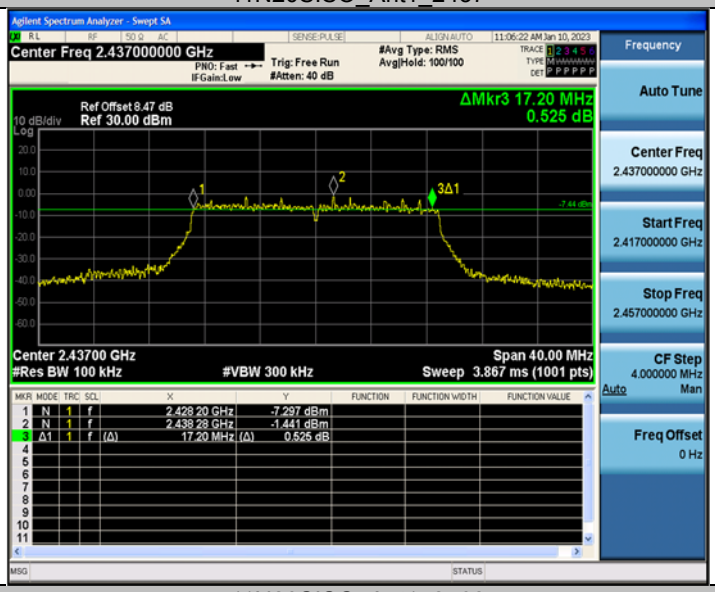
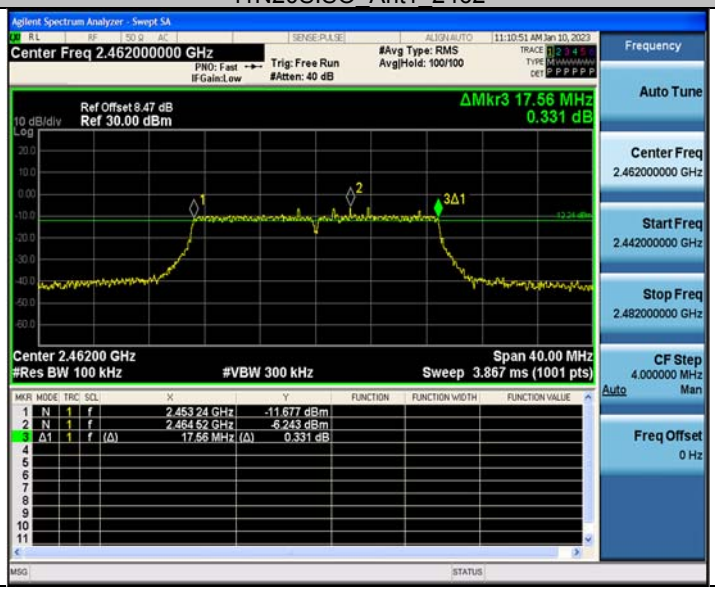
| 11B_Ant1_2412 |
| --- |
|  |
| 11B_Ant1_2437 |
|  |
| 11B_Ant1_2462 |
|  |

11G_Ant1_2412




11G_Ant1_2437


11G_Ant1_2462

| 11N20SISO_Ant1_2412 |
| --- |
|  |
| 11N20SISO_Ant1_2437 |
|  |
| 11N20SISO_Ant1_2462 |
|  |

# Appendix B: Maximum conducted output power

Test Result Peak

| Test Mode | Antenna | Frequency [MHz] | Peak Power [dBm] | Conducted Limit [dBm] | Verdict |
|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 17.77 | ≤30.00 | PASS |
| | | 2437 | 16.93 | ≤30.00 | PASS |
| | | 2462 | 17.43 | ≤30.00 | PASS |
| 11G | Ant1 | 2412 | 14.55 | ≤30.00 | PASS |
| | | 2437 | 15.35 | ≤30.00 | PASS |
| | | 2462 | 15.23 | ≤30.00 | PASS |
| 11N20SISO | Ant1 | 2412 | 15.69 | ≤30.00 | PASS |
| | | 2437 | 14.63 | ≤30.00 | PASS |
| | | 2462 | 15.44 | ≤30.00 | PASS |

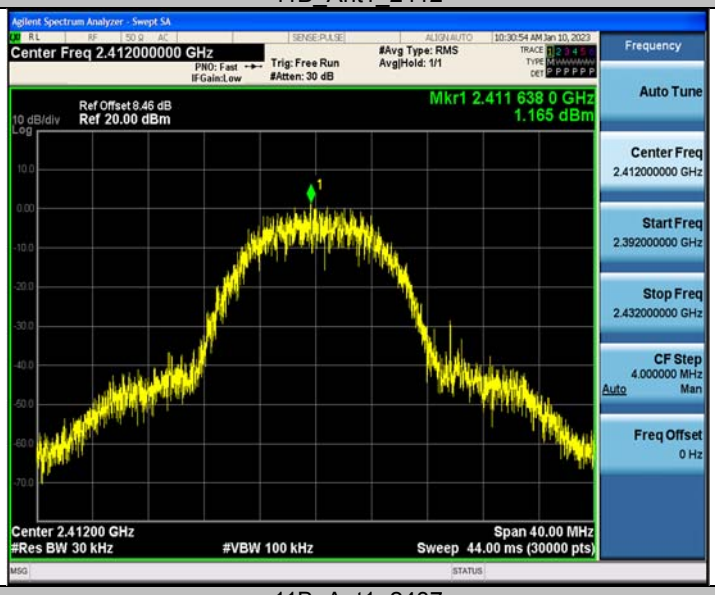
# Appendix C: Maximum power spectral density

Test Result

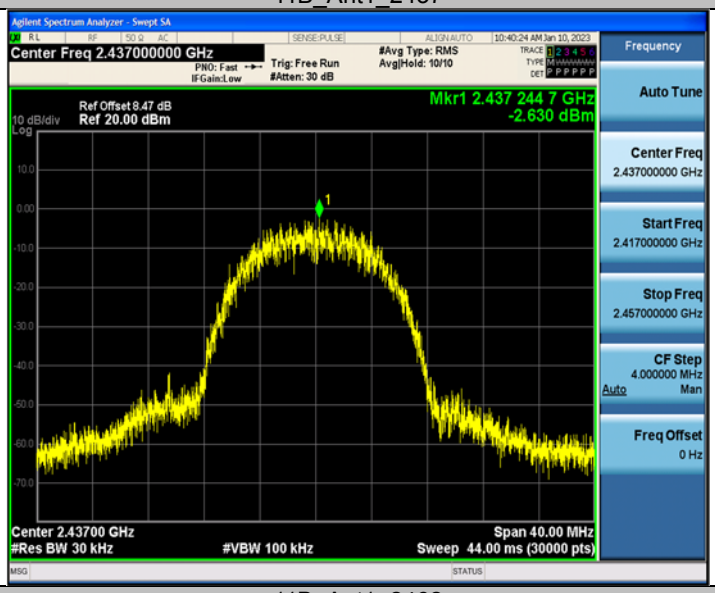
| Test Mode | Antenna | Frequency [MHz] | Result [dBm/3-100kHz] | Limit [dBm/3kHz] | Verdict |
|---|---|---|---|---|---|
| 11B | Ant1 | 2412 | 1.17 | ≤8.00 | PASS |
| | | 2437 | -2.63 | ≤8.00 | PASS |
| | | 2462 | -1.75 | ≤8.00 | PASS |
| 11G | Ant1 | 2412 | -8.7 | ≤8.00 | PASS |
| | | 2437 | -8.14 | ≤8.00 | PASS |
| | | 2462 | -7.54 | ≤8.00 | PASS |
| 11N20SISO | Ant1 | 2412 | -6.74 | ≤8.00 | PASS |
| | | 2437 | -8.15 | ≤8.00 | PASS |
| | | 2462 | -8.35 | ≤8.00 | PASS |

## Test Graphs

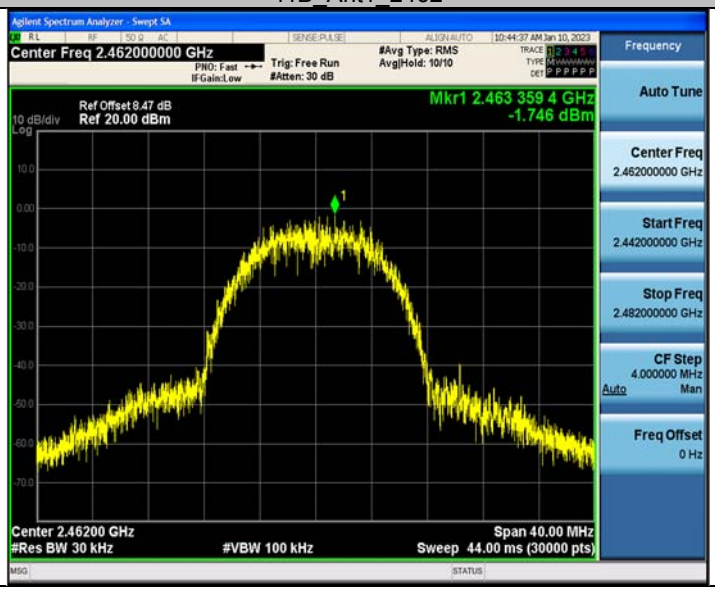
11B_Ant1_2412



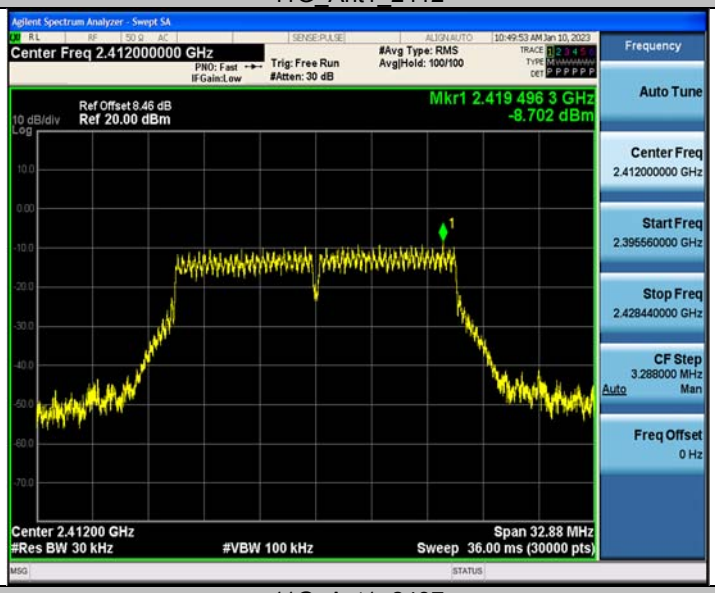

11B_Ant1_2437



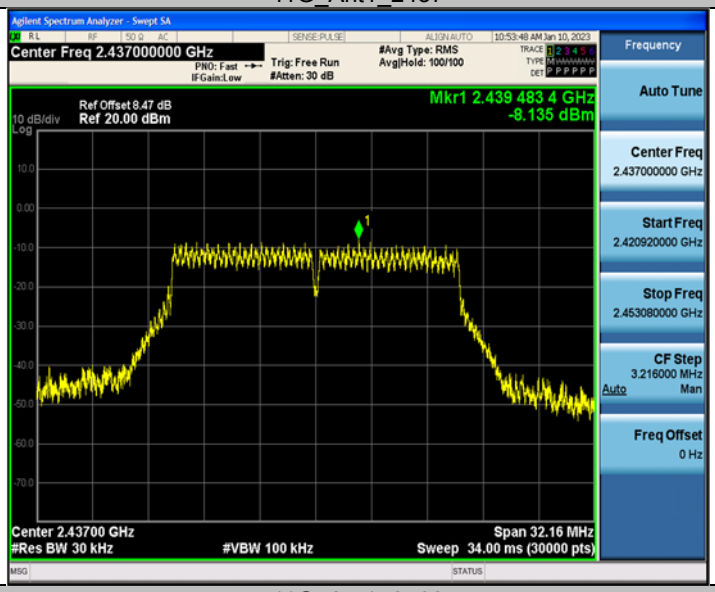

11B_Ant1_2462



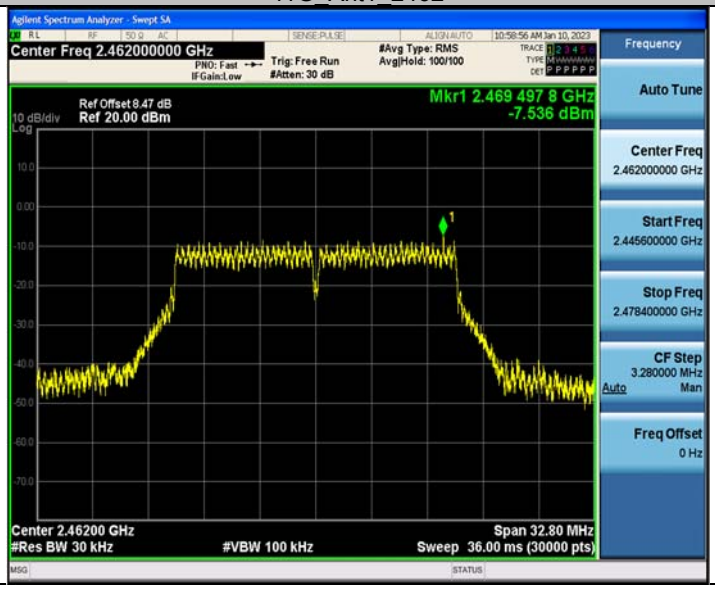
11G_Ant1_2412

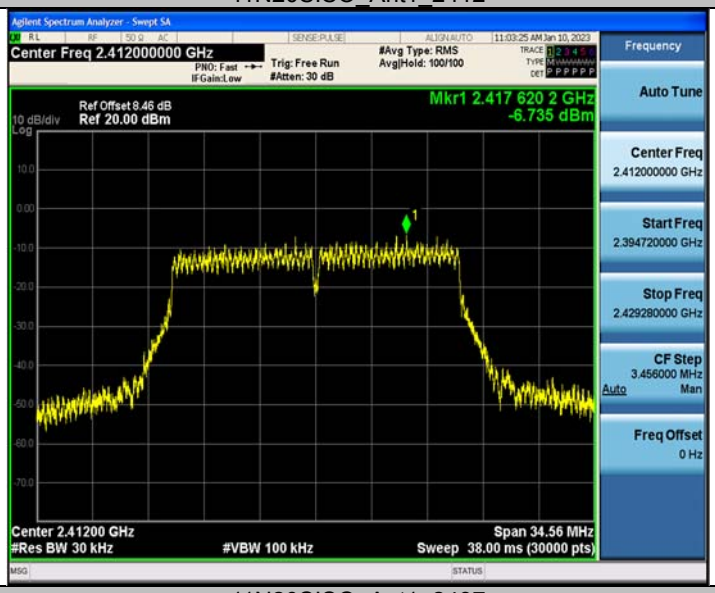
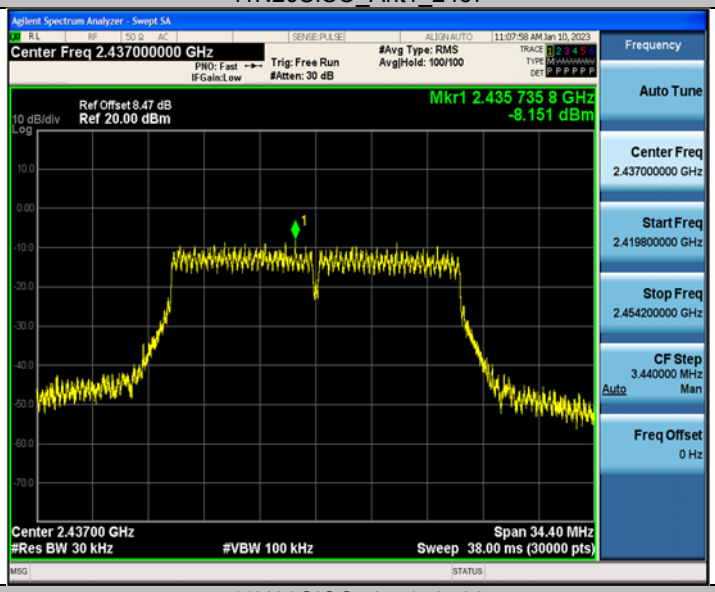
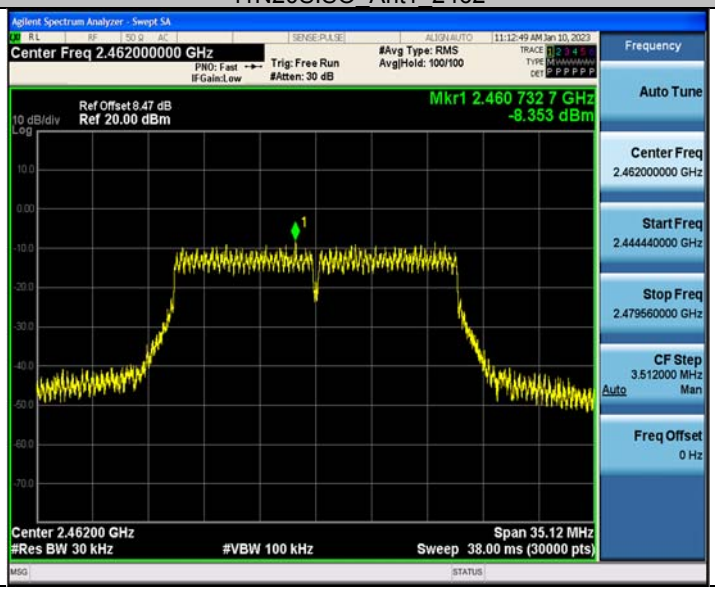



11G_Ant1_2437



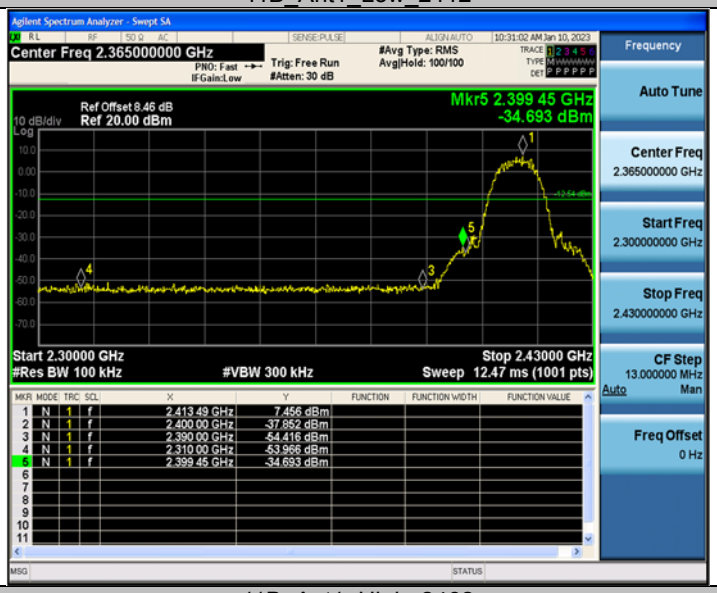

11G_Ant1_2462



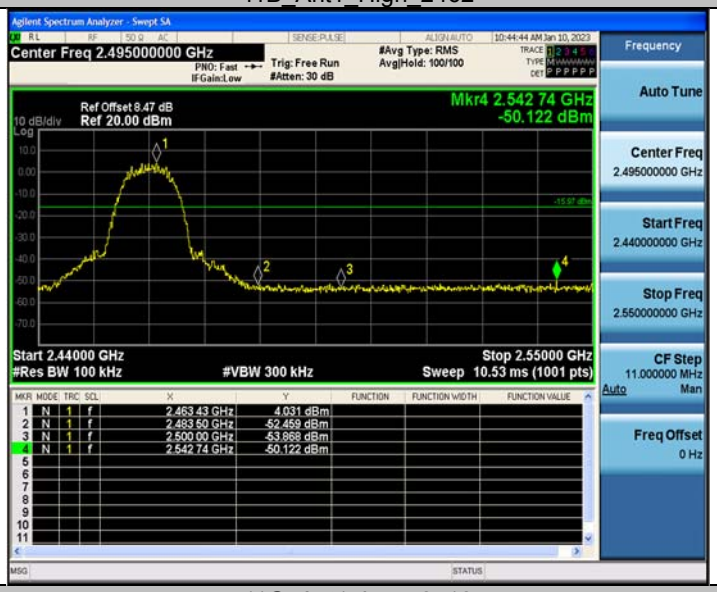
| 11N20SISO_Ant1_2412 |
| --- |
|  |
| 11N20SISO_Ant1_2437 |
|  |
| 11N20SISO_Ant1_2462 |
|  |

# Appendix D: Band edge measurements

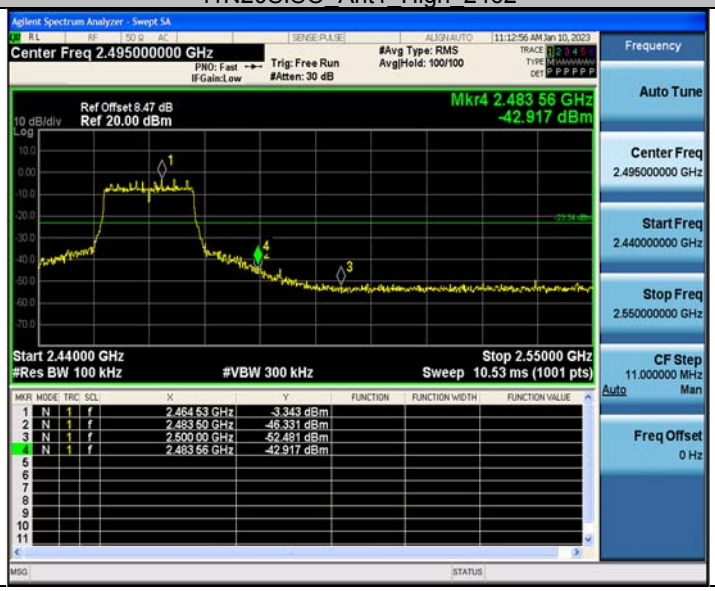
11B_Ant1_Low_2412




11B_Ant1_High_2462

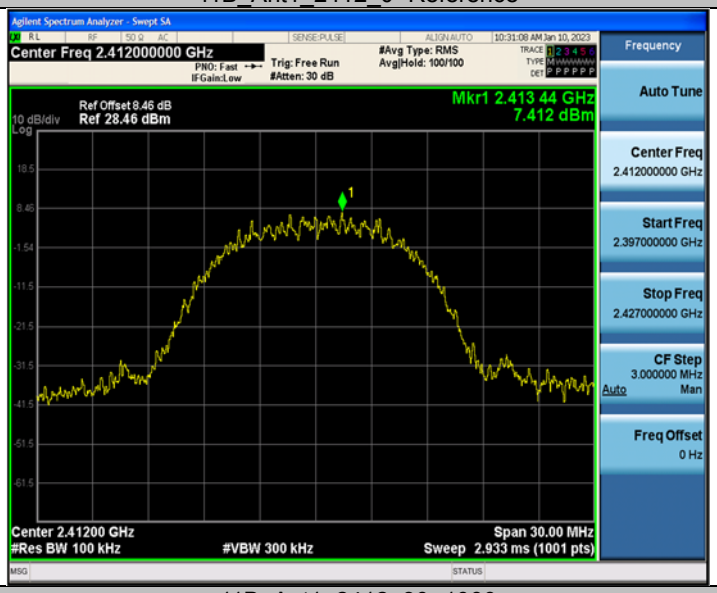



11G_Ant1_Low_2412

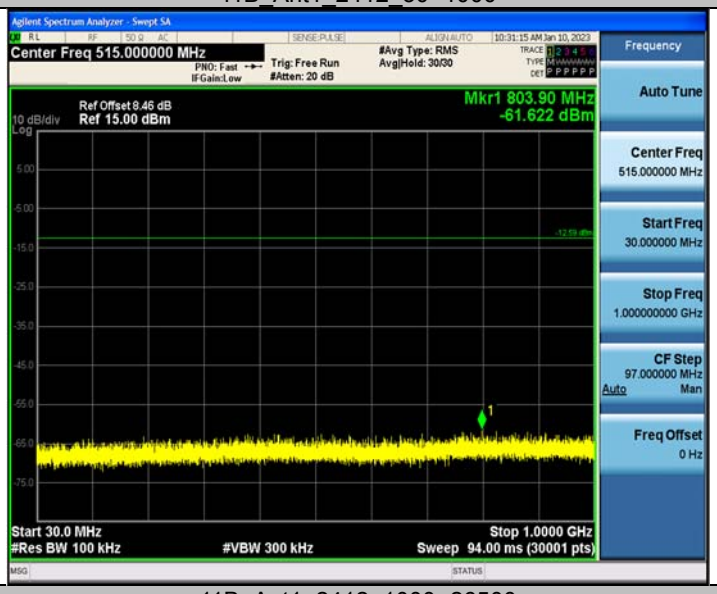
| 11G_Ant1_High_2462 |
| --- |
|  |
| 11N20SISO_Ant1_Low_2412 |
|  |
| 11N20SISO_Ant1_High_2462 |
|  |

# Appendix E: Conducted Spurious Emission

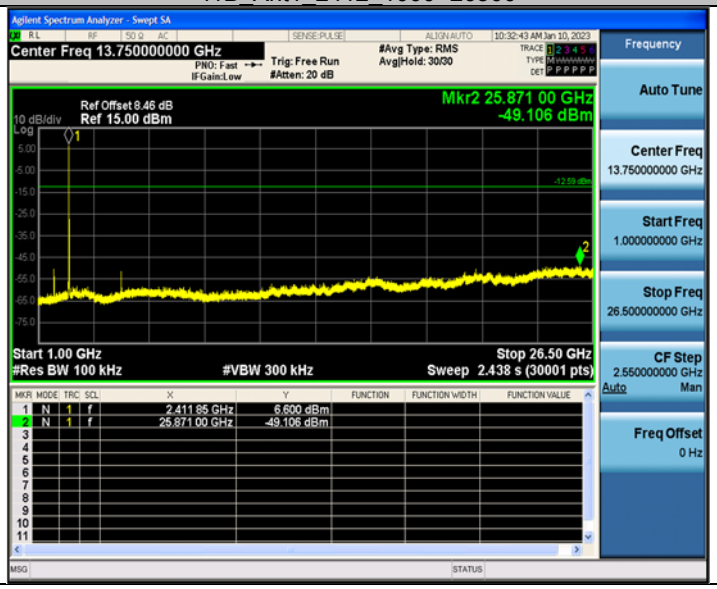
11B_Ant1_2412_0~Reference

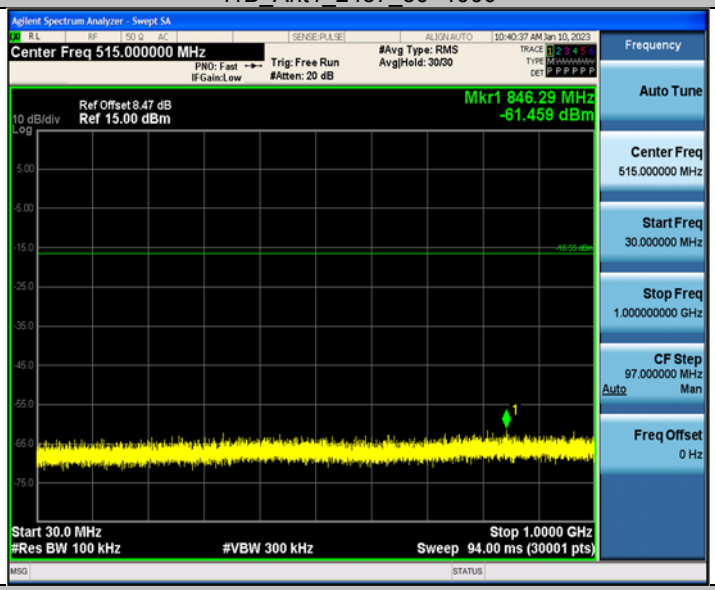
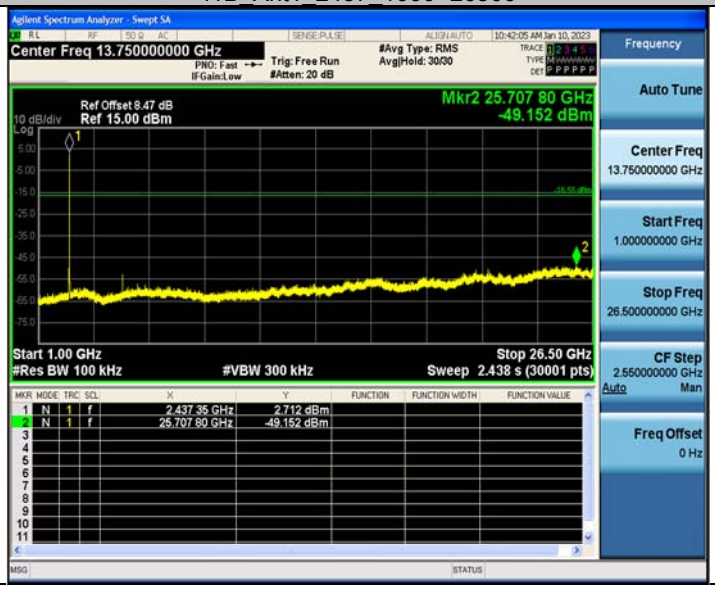


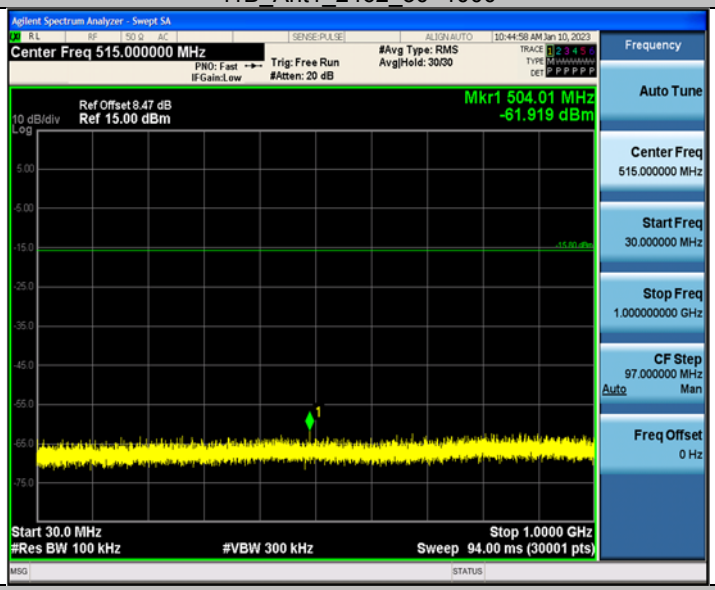

11B_Ant1_2412_30~1000




11B_Ant1_2412_1000~26500

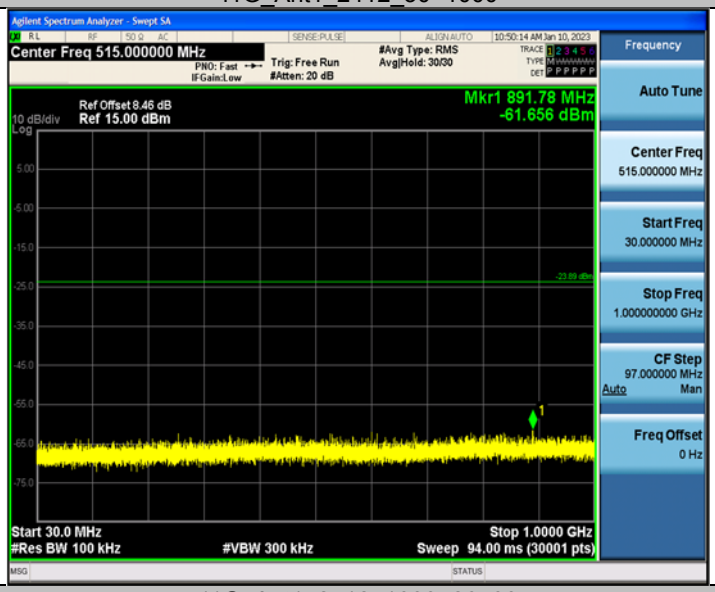


| 11B_Ant1_2437_0~Reference |
| --- |
|  |
| 11B_Ant1_2437_30~1000 |
|  |
| 11B_Ant1_2437_1000~26500 |
|  |

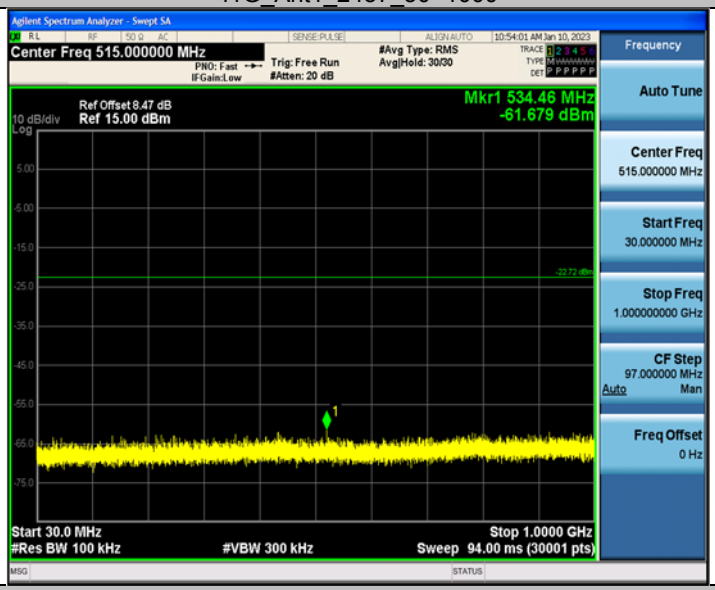
| 11B_Ant1_2462_0~Reference |
| --- |
|  |
| 11B_Ant1_2462_30~1000 |
|  |
| 11B_Ant1_2462_1000~26500 |
|  |

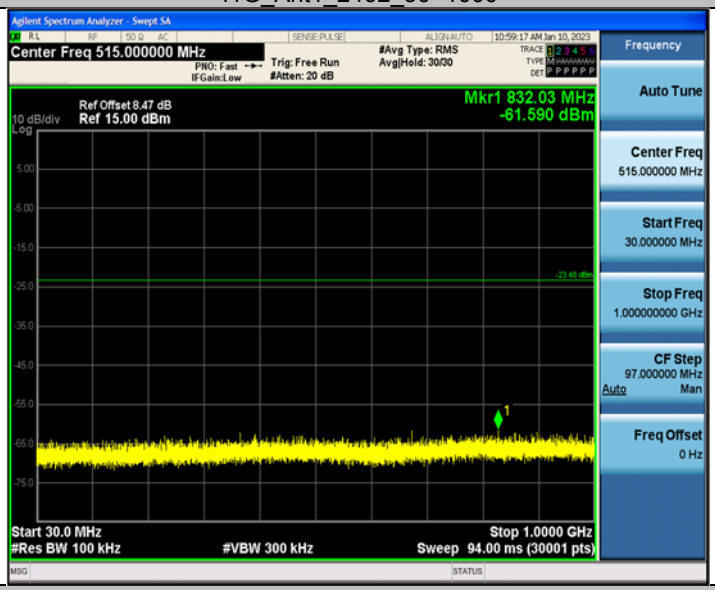
11G_Ant1_2412_0~Reference

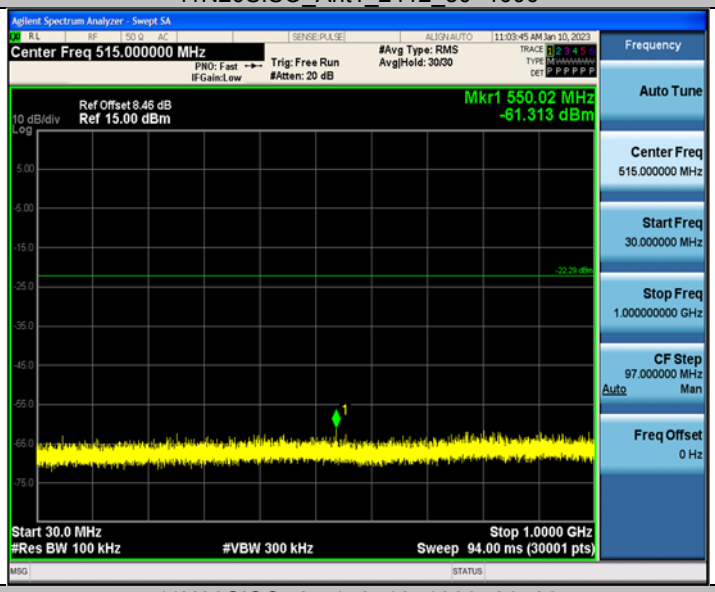
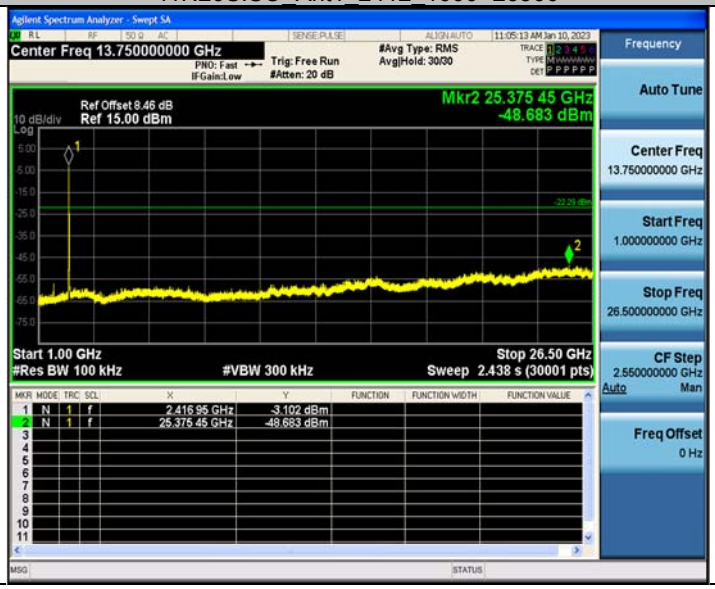

11G_Ant1_2412_30~1000

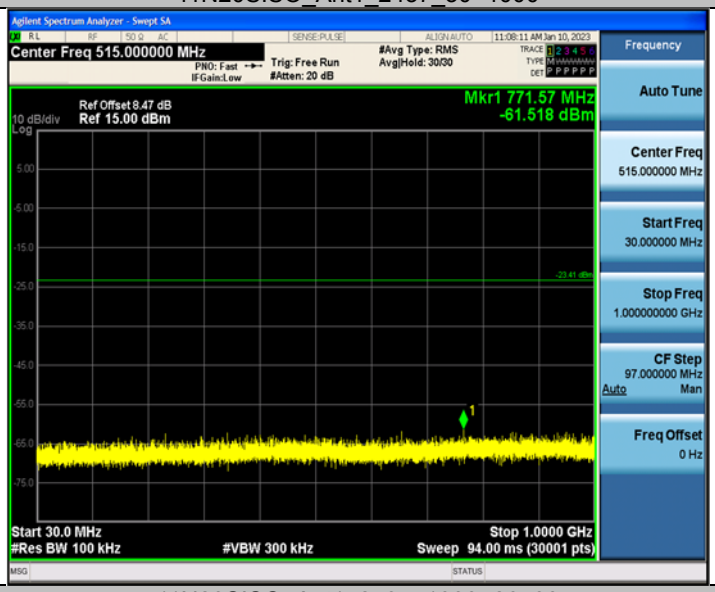


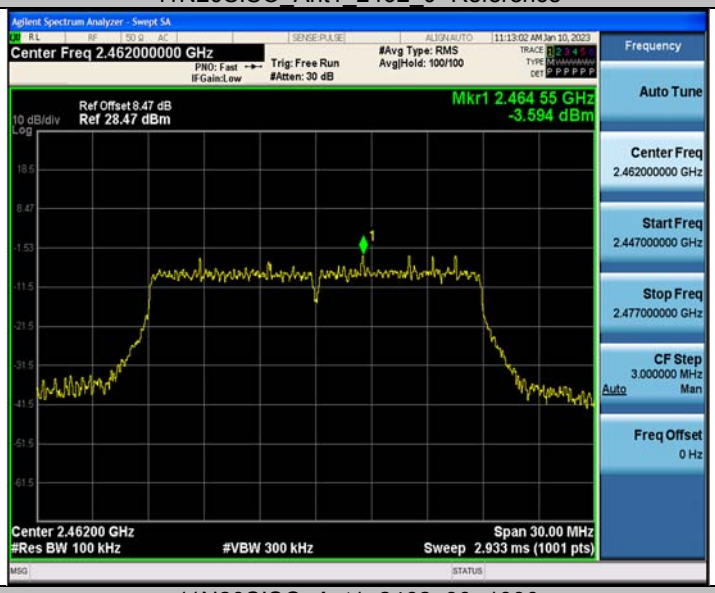
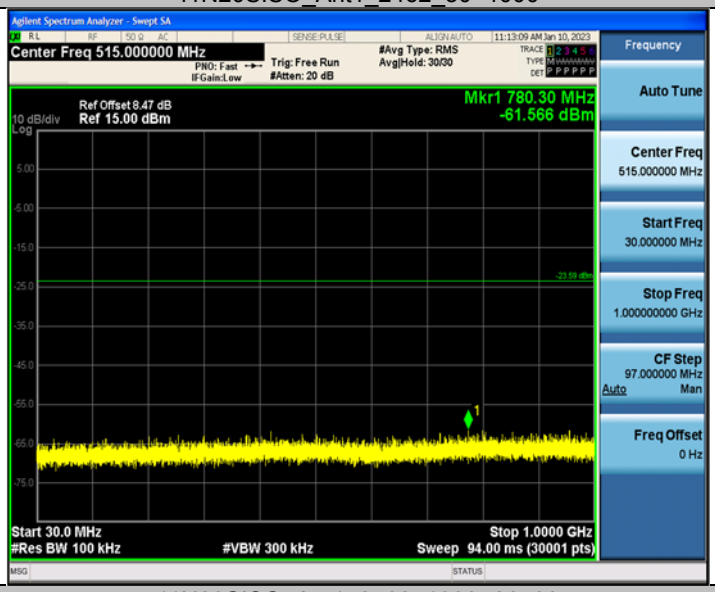

11G_Ant1_2412_1000~26500

| 11G_Ant1_2437_0~Reference |
| --- |
|  |
| 11G_Ant1_2437_30~1000 |
|  |
| 11G_Ant1_2437_1000~26500 |
|  |

| 11G_Ant1_2462_0~Reference |
| --- |
|  |
| 11G_Ant1_2462_30~1000 |
|  |
| 11G_Ant1_2462_1000~26500 |
|  |

| 11N20SISO_Ant1_2412_0~Reference |
| --- |
|  |
| 11N20SISO_Ant1_2412_30~1000 |
|  |
| 11N20SISO_Ant1_2412_1000~26500 |
|  |

| 11N20SISO_Ant1_2437_0~Reference |
| --- |
|  |
| 11N20SISO_Ant1_2437_30~1000 |
|  |
| 11N20SISO_Ant1_2437_1000~26500 |
|  |

| 11N20SISO_Ant1_2462_0~Reference |
| --- |
|  |
| 11N20SISO_Ant1_2462_30~1000 |
|  |
| 11N20SISO_Ant1_2462_1000~26500 |
|  |

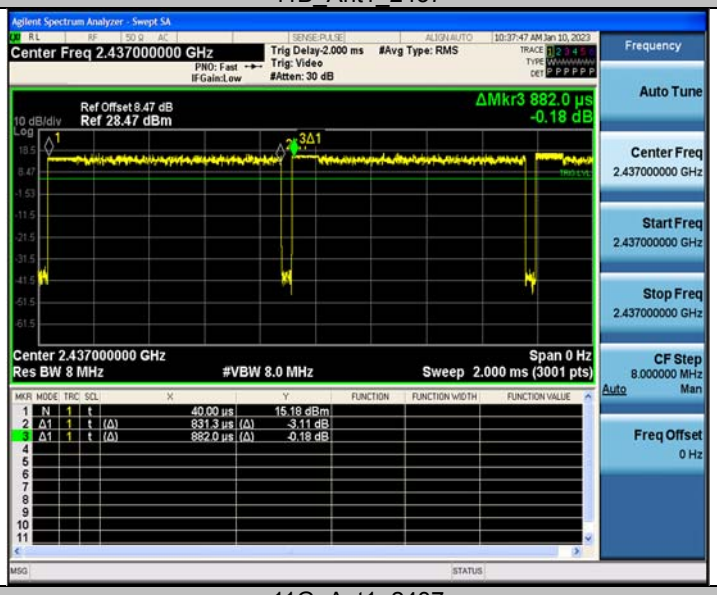
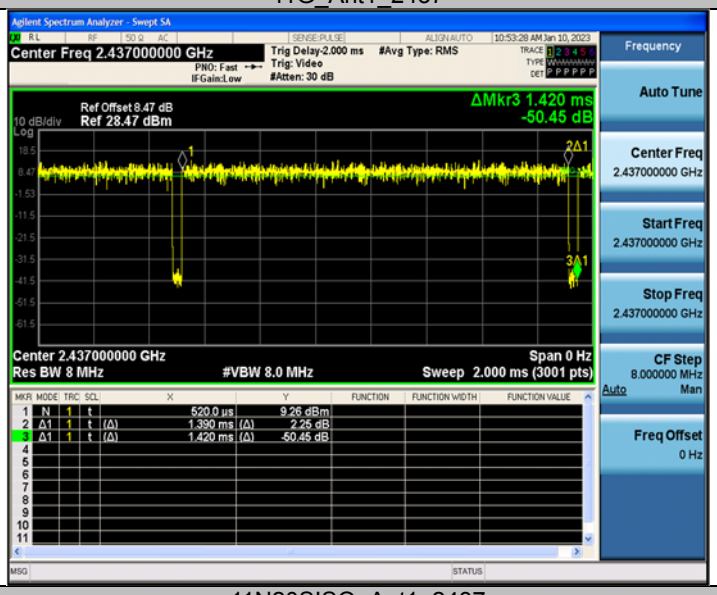
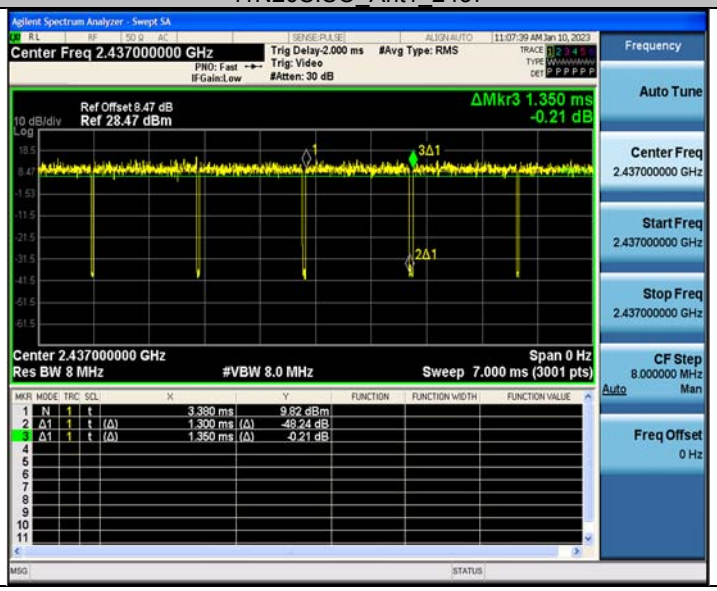
# Appendix F: Duty Cycle

Test Result

| Test Mode | Antenna | Frequency [MHz] | Transmission Duration [ms] | Transmission Period [ms] | Duty Cycle [%] | Factor |
|---|---|---|---|---|---|---|
| 11B | Ant1 | 2437 | 0.84 | 0.87 | 96.55 | 0.15 |
| 11G | Ant1 | 2437 | 1.39 | 1.42 | 97.89 | 0.09 |
| 11N20SISO | Ant1 | 2437 | 1.30 | 1.35 | 96.30 | 0.16 |

**Notes:**
Duty Cycle [%] = Transmission Duration [ms] / Transmission Period [ms] * 100
Factor = 10 * log (Duty Cycle)

## Test Graphs

| 11B_Ant1_2437 |
| --- |
|  |
| 11G_Ant1_2437 |
|  |
| 11N20SISO_Ant1_2437 |
|  |

## Photographs of the Test Setup

See the Appendix – Test Setup Photos.

## Photographs of the EUT

See the Appendix - EUT Photos.

**----End of Report----**