



Shenzhen BANTEK Testing Co., Ltd.

Report No.: BTEK240425003AE002

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FCC ID: 2BGEL-G10

TEST REPORT

Application No.: BTEK240425003AE
Applicant: Dongguan Guanrui Electronics Co. Ltd
Address of Applicant: Room 806, Lianhe Building, No. 1 Dongcheng Section Dongcheng Street, Dongguan City, Guangdong Prov, DONG GUAN, China
Manufacturer: Dongguan Guanrui Electronics Co. Ltd
Address of Manufacturer: Room 806, Lianhe Building, No. 1 Dongcheng Section Dongcheng Street, Dongguan City, Guangdong Prov, DONG GUAN, China
Factory: Dongguan Guanrui Electronics Co. Ltd
Address of Factory: Room 806, Lianhe Building, No. 1 Dongcheng Section Dongcheng Street, Dongguan City, Guangdong Prov, DONG GUAN, China
Equipment Under Test (EUT):
EUT Name: OWS
Model No.: G10,O1,O2,O3,O4,O5,O6,O7,O8,O9,O10,O11,O12,O13,O14,O15,O16,O17,O18,O19,O20,O21,O22,O23,O24,O25,O26,O27,O28,O29,O30,O40,O50,O60,O70,O80,O90,O100,O110,O120,O200,O300,O400,O500,O600,O700,O800,G11,G12,G13,G14,G15,G16,G17,G18,G19,G20,G30,G50,G60,G70,G80
Trade Mark: N/A
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2024-04-25
Date of Test: 2024-04-25 to 2024-05-10
Date of Issue: 2024-05-11

| | |
|---------------------|--------------|
| Test Result: | Pass* |
|---------------------|--------------|

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

Lion Cai
EMC Laboratory Manager





| Revision Record | | | | |
|-----------------|---------|------------|----------|----------|
| Version | Chapter | Date | Modifier | Remark |
| V0 | | 2024-05-11 | | Original |
| | | | | |
| | | | | |

| | | | |
|-------------------------|--|--|--|
| Authorized for issue by | | | |
| | | <div>David Zhuang</div> <div>David Zhuang/Project Engineer</div> | |
| | | <div>Elma Yang</div> <div>Elma Yang/Reviewer</div> | |



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 |

| Radio Spectrum Matter Part | | | | |
|---|----------------------------------|--|---|--------|
| Item | Standard | Method | Requirement | Result |
| Conducted Emissions at AC Power Line (150kHz-30MHz) | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.2 | 47 CFR Part 15, Subpart C 15.207 | N/A |
| Conducted Peak Output Power | | ANSI C63.10 (2013) Section 11.9.1.3 | 47 CFR Part 15, Subpart C 15.247(b)(3) | Pass |
| Minimum 6dB Bandwidth | | ANSI C63.10 (2013) Section 11.8.1 | 47 CFR Part 15, Subpart C 15.247a(2) | Pass |
| Power Spectrum Density | | ANSI C63.10 (2013) Section 11.10.2 | 47 CFR Part 15, Subpart C 15.247(e) | Pass |
| Conducted Band Edges Measurement | | ANSI C63.10 (2013) Section 11.13.3.2 | 47 CFR Part 15, Subpart C 15.247(d) | Pass |
| Conducted Spurious Emissions | | ANSI C63.10 (2013) Section 11.11 | 47 CFR Part 15, Subpart C 15.247(d) | Pass |
| Radiated Emissions which fall in the restricted bands | | ANSI C63.10 (2013) Section 6.10.5 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |
| Radiated Spurious Emissions (Below 1GHz) | | ANSI C63.10 (2013) Section 6.4,6.5,6.6 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |
| Radiated Spurious Emissions (Above 1GHz) | | ANSI C63.10 (2013) Section 6.4,6.5,6.6 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |

Note:

The EUT can't work with Bluetooth while charging, So Conducted Emissions at AC Power Line (150kHz-30MHz) is not applicable.

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.

Model No.: O1,O2,O3,O4,O5,O6,O7,O8,O9,O10,O11,O12,O13,O14,O15,O16,O17,O18,O19,O20,O21,O22,O23,O24,O25,O26,O27,O28,O29,O30,O40,O50,O60,O70,O80,O90,O100,O110,O120,O200,O300,O400,O500,O600,O700,O800,G11,G12,G13,G14,G15,G16,G17,G18,G19,G20,G30,G50,G60,G70,G80 Only the model G10 was tested. According to the declaration from the applicant, the electrical circuit design, layout, components used, internal wiring and functions of other models are identical for the above models, with only difference on Model No.



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4 General Information

4.1 Details of E.U.T.

| | |
|---|--------------------|
| Power supply: | 3.7V by Battery |
| Test Voltage: | N/A |
| Cable(s): | / |
| Frequency Range: | 2402MHz to 2480MHz |
| Bluetooth Version: | Bluetooth 5.0 |
| Modulation Type: | GFSK |
| Number of Channels: | 40 |
| Antenna Type: | Ceramic antenna |
| Antenna Gain: | 2.78 dBi |
| Hardware Version | G10-V1.1 |
| Software and Firmware Version | V1.1 |
| Sample No.: | BTEK240425003AE-01 |
| Remark: The information in this section is provided by the applicant or manufacturer, BANTEK is not liable to the accuracy, suitability, reliability or/and integrity of the information. | |

4.2 Description of Support Units

| Description | Manufacturer | Model No. | Serial No. |
|-------------|--------------|-----------|------------|
| / | / | / | / |

4.3 Measurement Uncertainty

| Test Item | Measurement Uncertainty |
|---|---|
| Conducted Emissions at AC Power Line (150kHz-30MHz) | ±3.12dB |
| Conducted Peak Output Power | ± 0.75dB |
| Minimum 6dB Bandwidth | ± 3% |
| Power Spectrum Density | ± 0.35dB |
| Conducted Band Edges Measurement | ± 0.75dB |
| Conducted Spurious Emissions | ± 0.75dB |
| Radiated Emissions which fall in the restricted bands | ±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz) |
| Radiated Spurious Emissions (Below 1GHz) | ±5.06dB (3m); ±4.46dB (10m) |
| Radiated Spurious Emissions (Above 1GHz) | ±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz) |



4.4 Test Location

All tests were performed at:

Shenzhen BANTEK Testing Co., Ltd.

A5&A6, Building B1&B2, No.45 Gangtou Road, Bogang Community, Shajing Street, Bao'an District, Shenzhen, Guangdong, China 518104

Tel: +86 0755-2334 4200 Fax: +86 0755-2334 4200

FCC Registration Number: 264293

Designation Number: CN1356

No tests were sub-contracted.

4.5 Deviation from Standards

None

4.6 Abnormalities from Standard Conditions

None





5 Equipment List

| Conducted Emissions at AC Mains Power Port | | | | | |
|--|----------------------|------------------------|-----------------|------------|------------|
| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
| Shielding Room | YIHENG ENECTRONIC | 9*5*3.3 | YH-BT-220304-04 | 2022-03-03 | 2025-03-02 |
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101021 | 2023-06-12 | 2024-06-11 |
| Measurement Software | Fara | EZ EMC Ver. FA-03A2 | N/A | N/A | N/A |
| LISN | Rohde&Schwarz | ENV216 | 101472 | 2023-06-12 | 2024-06-11 |
| LISN | Schwarzbeck | NSLK 8128 | 05127 | 2023-06-12 | 2024-06-11 |

| RF Conducted | | | | | |
|---|----------------------|----------------------|-----------------|------------|--------------|
| Equipment | Manufacturer | Model No | Serial No | Cal Date | Cal Due Date |
| Shielding Room | YIHENG ENECTRONIC | 5.5*3.1*3 | YH-BT-220304-03 | 2022-03-03 | 2025-03-02 |
| EXA Signal Analyzer | KEYSIGHT | N9020A | MY54230486 | 2023-06-12 | 2024-06-11 |
| DC Power Supply | E3632A | E3642A | KR75304416 | 2023-06-12 | 2024-06-11 |
| Attenuator | RswTech | SMA-JK-6dB | N/A | 2023-06-12 | 2024-06-11 |
| Attenuator | RswTech | SMA-JK-3dB | N/A | 2023-06-12 | 2024-06-11 |
| RF Control Unit | Techy | TR1029-1 | N/A | 2023-06-12 | 2024-06-11 |
| RF Sensor Unit | Techy | TR1029-2 | N/A | 2023-06-12 | 2024-06-11 |
| WIDEBAND RADIO COMMUNICATION TESTER | R&S | CMW 500 | 141258 | 2023-06-12 | 2024-06-11 |
| MXG Vector Signal Generator | Agilent | N5182A | US46240522 | 2023-06-12 | 2024-06-11 |
| Programmable Temperature&Humidity Chamber | GRT | GR-HWX1000 | GR22051001 | 2023-06-12 | 2024-06-11 |
| Measurement Software | TACHOY | RF TestSoft V2.0.0.0 | N/A | N/A | N/A |

| RSE | | | | | |
|--------------------------|----------------------|------------------------|-----------------|------------|--------------|
| Equipment | Manufacturer | Model No | Serial No | Cal Date | Cal Due Date |
| 3m Semi-Anechoic Chamber | YIHENG ENECTRONIC | 966 | YH-BT-220304-01 | 2022-05-06 | 2025-05-05 |
| EMI Test Receiver | Rohde&Schwarz | ESCI | 100694 | 2023-06-12 | 2024-06-11 |
| TRILOG Broadband Antenna | Schwarzbeck | VULB 9168 | 01324 | 2022-06-15 | 2025-06-14 |
| Pre-Amplifier | Schwarzbeck | BBV 9745 | #180 | 2023-06-12 | 2024-06-11 |
| Measurement Software | Fara | EZ EMC Ver. FA-03A2 | N/A | 2023-06-12 | 2024-06-11 |
| EXA Signal Analyzer | Keysight | N9020A | MY54440290 | 2023-06-12 | 2024-06-11 |
| Horn Antenna | Schwarzbeck | BBHA 9120D | 02695 | 2022-06-15 | 2025-06-14 |
| Pre-Amplifier | Tonscend | TAP0118045 | AP20K806109 | 2023-06-12 | 2024-06-11 |
| Horn Antenna | SCHWARZBECK | BBHA9170 | 1157 | 2022-06-15 | 2025-06-14 |





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|-------------------------|---------------|---------------|--------------|------------|------------|
| Low Noise Pre-amplifier | SKET | LNPA-1840G-50 | SK2022032902 | 2023-06-12 | 2024-06-11 |
| Signal analyzer | ROHDE&SCHWARZ | FSQ40 | 100010 | 2023-06-12 | 2024-06-11 |
| Loop Antenna | ETS | 6502 | 00201177 | 2022-06-15 | 2025-06-14 |

| General used equipment | | | | | |
|---|--------------|----------|-----------|------------|--------------|
| Equipment | Manufacturer | Model No | Serial No | Cal Date | Cal Due Date |
| Humidity/Temperature/B arometric Pressure Indicator | KUMAR | F132 | N/A | 2023-06-12 | 2024-06-11 |
| Humidity/Temperature/B arometric Pressure Indicator | KUMAR | F132 | N/A | 2023-06-12 | 2024-06-11 |



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:

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

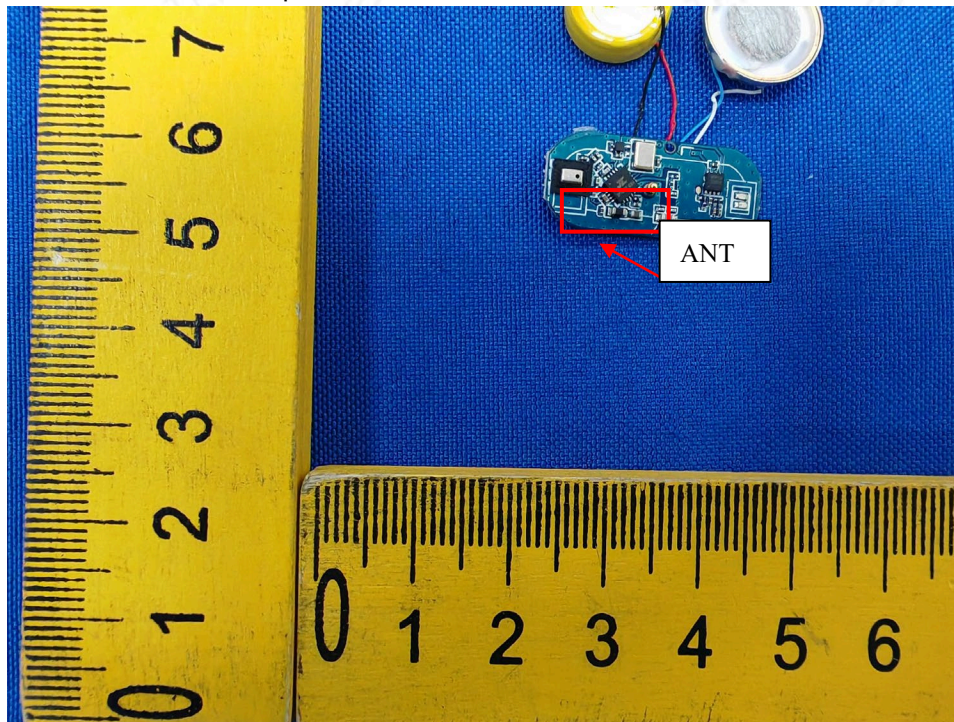
15.247(b) (4) requirement:

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

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.78 dBi.

Please refer to internal photos.



7 Radio Spectrum Matter Test Results

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

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

| Frequency of emission(MHz) | Conducted limit(dBμV) | |
|--|-----------------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |
| *Decreases with the logarithm of the frequency. | | |
| Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz | | |

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 26.3 °C

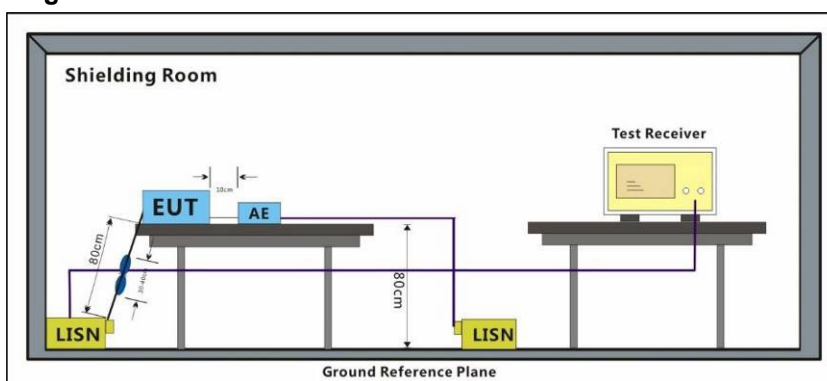
Humidity: 55.4 % RH

Atmospheric Pressure: 1010 mbar

7.1.2 Test Mode Description

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

7.1.3 Test Setup Diagram



7.1.4 Measurement Procedure and Data

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

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

Not applicable



7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)

Test Method: ANSI C63.10 (2013) Section 11.9.1.3

Limit:

| Frequency range(MHz) | Output power of the intentional radiator(watt) |
|----------------------|--|
| 902-928 | 1 for ≥ 50 hopping channels |
| | 0.25 for $25 \leq$ 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 |

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 26.3 °C

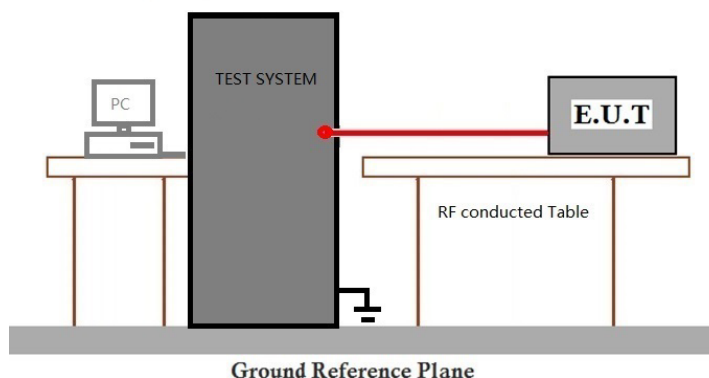
Humidity: 55.4 % RH

Atmospheric Pressure: 1010 mbar

7.2.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|--------------------------|--------------|--|
| Final test | 00 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



7.3 Minimum 6dB Bandwidth

| | |
|------------------|--------------------------------------|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247a(2) |
| Test Method: | ANSI C63.10 (2013) Section 11.8.1 |
| Limit: | ≥500 kHz |

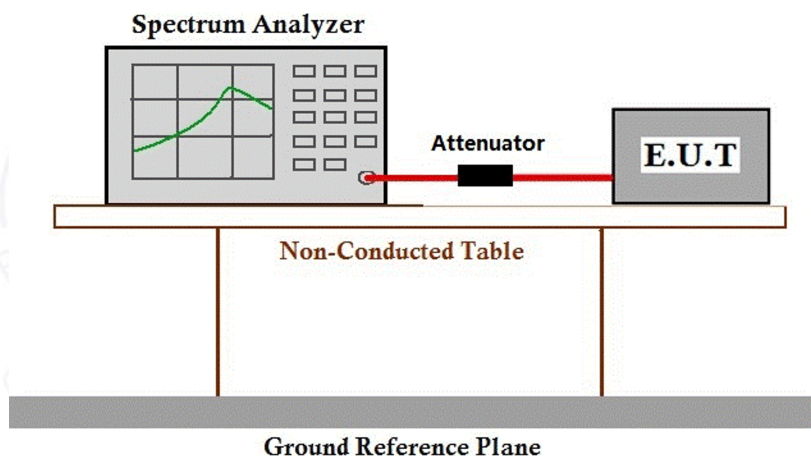
7.3.1 E.U.T. Operation

| | | | |
|------------------------|---------|-----------------------|-----------|
| Operating Environment: | | | |
| Temperature: | 26.3 °C | Humidity: | 55.4 % RH |
| | | Atmospheric Pressure: | 1010 mbar |

7.3.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|--------------------------|--------------|--|
| Final test | 00 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

7.3.3 Test Setup Diagram



7.3.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



7.4 Power Spectrum Density

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

Test Method: ANSI C63.10 (2013) Section 11.10.2

Limit:

≤8dBm in any 3 kHz band during any time interval of continuous transmission

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 26.3 °C

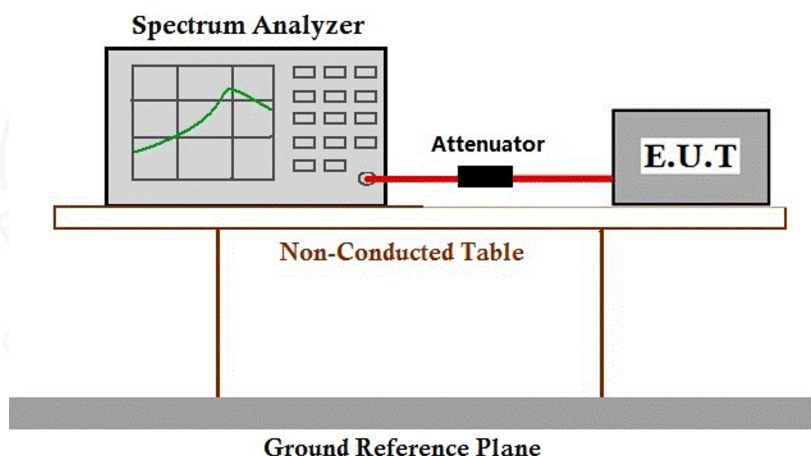
Humidity: 55.4 % RH

Atmospheric Pressure: 1010 mbar

7.4.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|--------------------------|--------------|--|
| Final test | 00 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



7.5 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)
 Test Method: ANSI C63.10 (2013) Section 11.13.3.2
 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)).

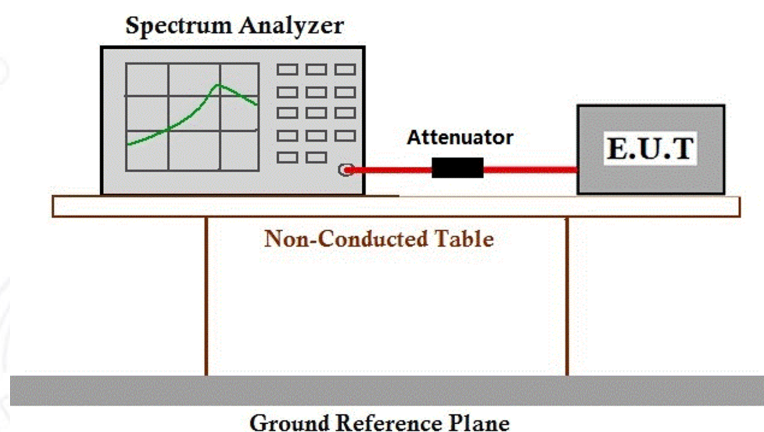
7.5.1 E.U.T. Operation

Operating Environment:
 Temperature: 26.3 °C Humidity: 55.4 % RH Atmospheric Pressure: 1010 mbar

7.5.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|--------------------------|--------------|--|
| Final test | 00 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



7.6 Conducted Spurious Emissions

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

Test Method: ANSI C63.10 (2013) Section 11.11

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)).

7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 26.3 °C

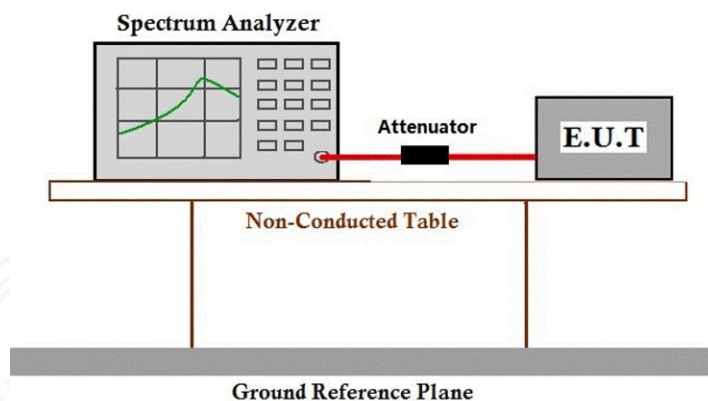
Humidity: 55.4 % RH

Atmospheric Pressure: 1010 mbar

7.6.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|--------------------------|--------------|--|
| Final test | 00 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



7.7 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
 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.

7.7.1 E.U.T. Operation

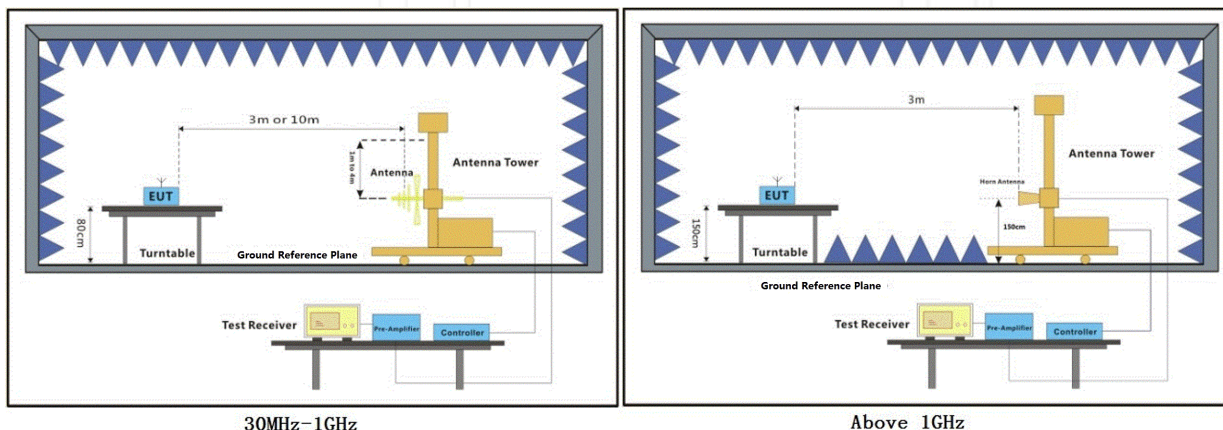
Operating Environment:

Temperature: 26.3 °C Humidity: 55.4 % RH Atmospheric Pressure: 1010 mbar

7.7.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|--------------------------|--------------|--|
| Final test | 00 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

7.7.3 Test Setup Diagram



7.7.4 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: $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{Antenna Factor} - \text{Preamp Factor}$

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: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2310.000 | 68.14 | -30.59 | 37.55 | 74.00 | -36.45 | peak | P |
| 2 | 2390.000 | 68.91 | -30.49 | 38.42 | 74.00 | -35.58 | peak | P |
| 3 | 2400.000 | 78.09 | -30.48 | 47.61 | 74.00 | -26.39 | peak | P |

Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2310.000 | 67.14 | -30.59 | 36.55 | 74.00 | -37.45 | peak | P |
| 2 | 2390.000 | 69.45 | -30.49 | 38.96 | 74.00 | -35.04 | peak | P |
| 3 | 2400.000 | 78.10 | -30.48 | 47.62 | 74.00 | -26.38 | peak | P |

Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:High

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2483.500 | 79.39 | -30.39 | 49.00 | 74.00 | -25.00 | peak | P |
| 2 | 2500.000 | 70.88 | -30.37 | 40.51 | 74.00 | -33.49 | peak | P |

Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2483.500 | 80.52 | -30.39 | 50.13 | 74.00 | -23.87 | peak | P |
| 2 | 2500.000 | 70.88 | -30.37 | 40.51 | 74.00 | -33.49 | peak | P |



7.8 Radiated Spurious Emissions (Below 1GHz)

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.

7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 26.3 °C

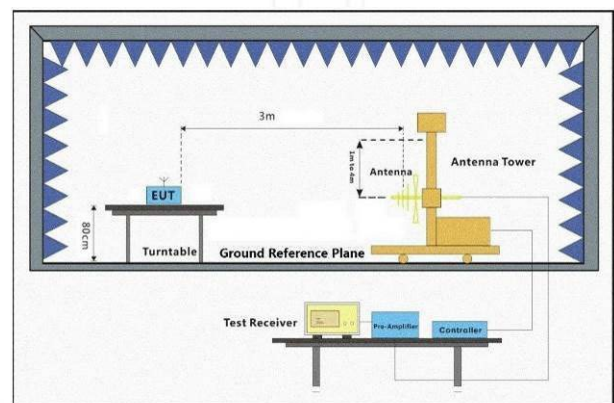
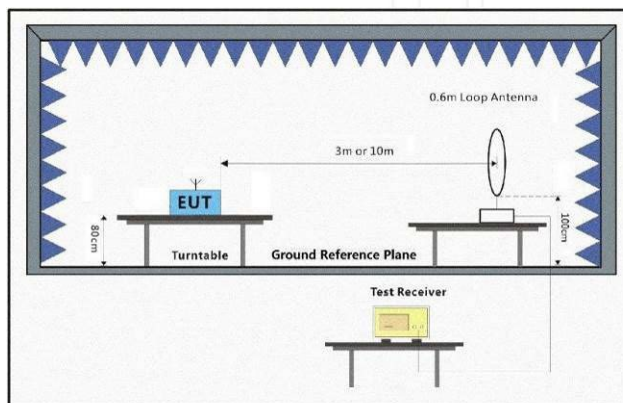
Humidity: 55.4 % RH

Atmospheric Pressure: 1010 mbar

7.8.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|--------------------------|--------------|--|
| Pre-scan | 00 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

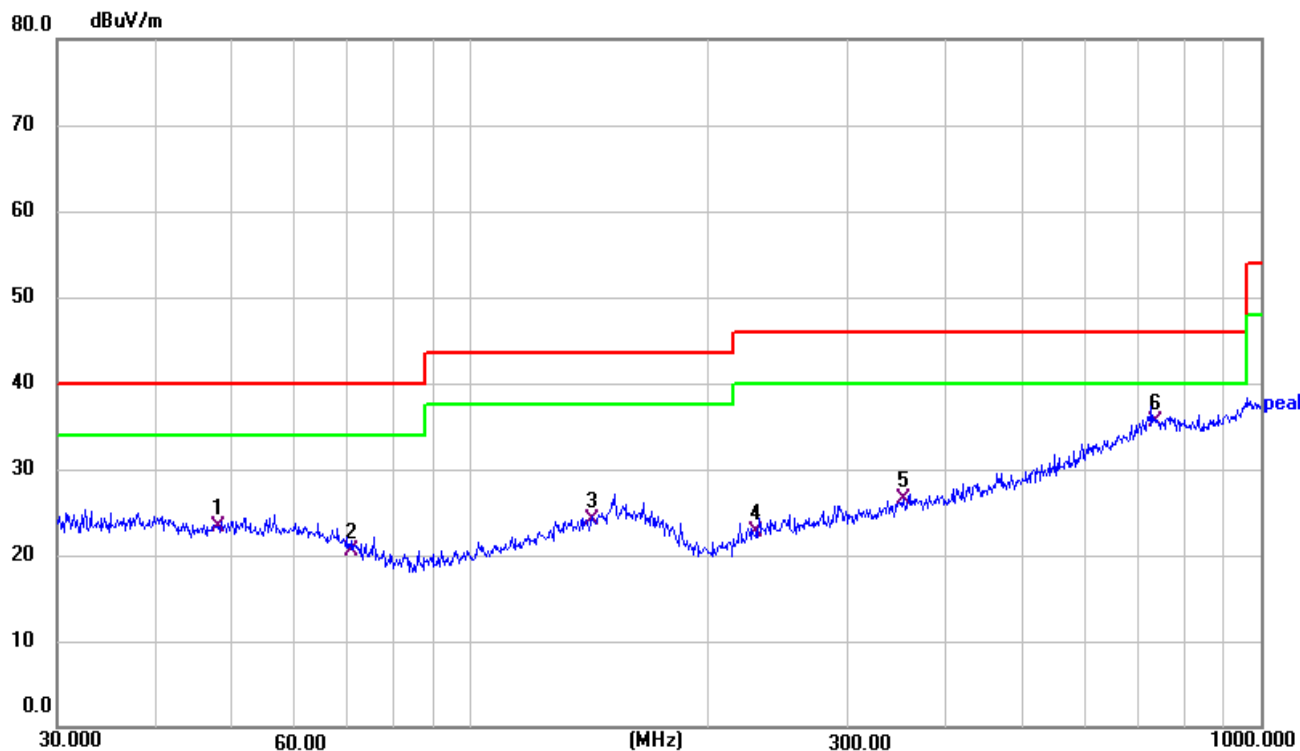
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (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.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. 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.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

- 1) 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 1 GHz, the disturbance 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.



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

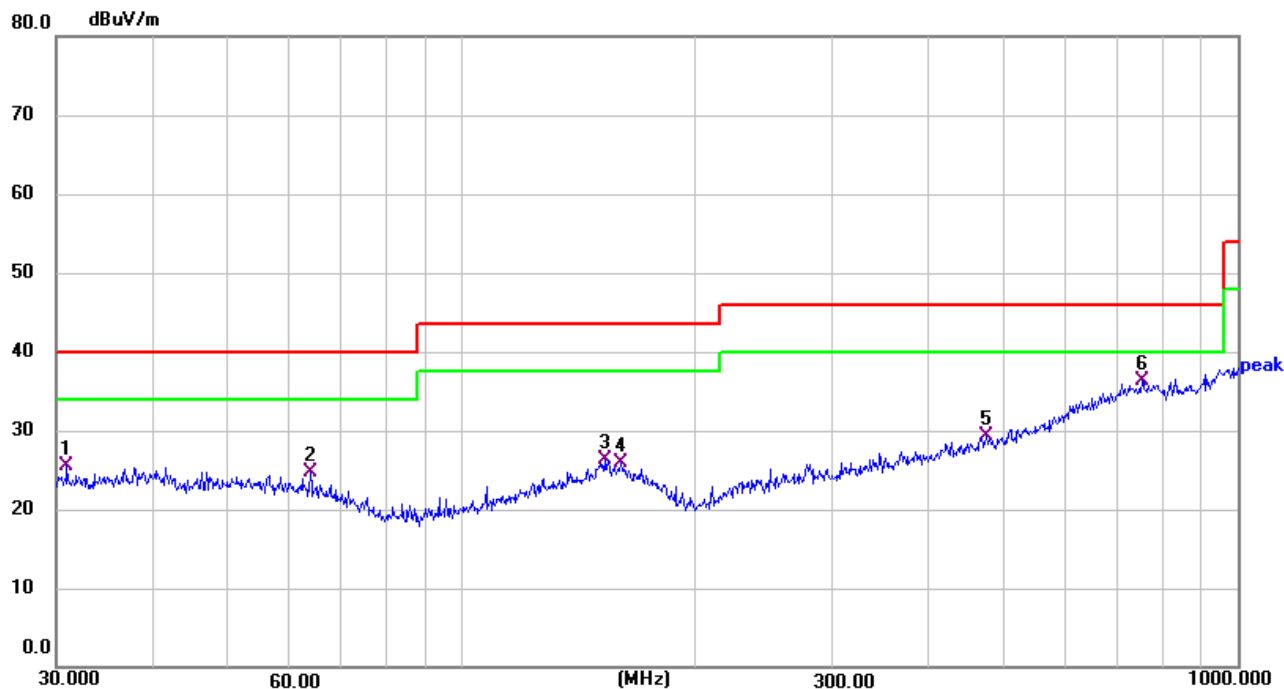


| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1 | 47.9940 | 40.93 | -17.64 | 23.29 | 40.00 | -16.71 | QP | 200 | 84 | P | |
| 2 | 70.5836 | 40.84 | -20.24 | 20.60 | 40.00 | -19.40 | QP | 200 | 194 | P | |
| 3 | 142.8243 | 41.35 | -17.28 | 24.07 | 43.50 | -19.43 | QP | 100 | 298 | P | |
| 4 | 230.0985 | 42.32 | -19.58 | 22.74 | 46.00 | -23.26 | QP | 200 | 71 | P | |
| 5 | 352.9433 | 42.90 | -16.38 | 26.52 | 46.00 | -19.48 | QP | 200 | 10 | P | |
| 6 * | 734.4913 | 44.49 | -8.96 | 35.53 | 46.00 | -10.47 | QP | 200 | 317 | P | |

Note: Level =Reading + Factor



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



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1 | 30.9619 | 43.39 | -17.94 | 25.45 | 40.00 | -14.55 | QP | 100 | 0 | P | |
| 2 | 63.7588 | 43.41 | -18.80 | 24.61 | 40.00 | -15.39 | QP | 100 | 4 | P | |
| 3 | 152.6641 | 43.19 | -16.92 | 26.27 | 43.50 | -17.23 | QP | 199 | 270 | P | |
| 4 | 160.3456 | 43.29 | -17.32 | 25.97 | 43.50 | -17.53 | QP | 199 | 98 | P | |
| 5 | 473.8347 | 43.24 | -13.92 | 29.32 | 46.00 | -16.68 | QP | 199 | 355 | P | |
| 6 * | 752.7432 | 45.11 | -8.80 | 36.31 | 46.00 | -9.69 | QP | 100 | 1 | P | |

Note: Level =Reading + Factor



7.9 Radiated Spurious Emissions (Above 1GHz)

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: 26.3 °C

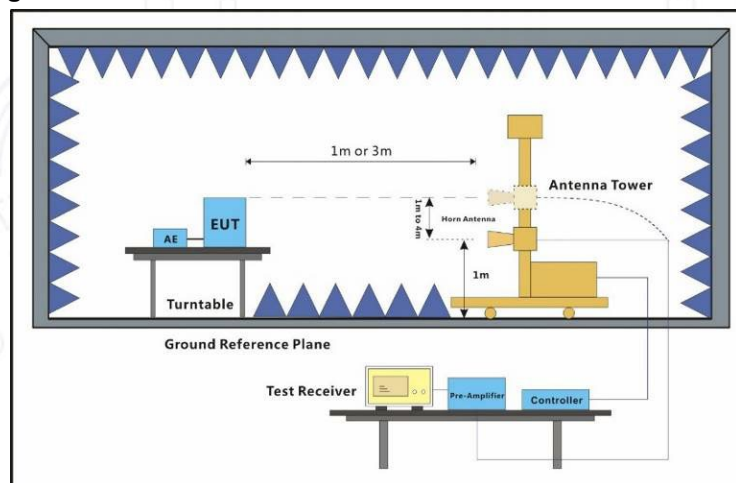
Humidity: 55.4 % RH

Atmospheric Pressure: 1010 mbar

7.9.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|--------------------------|--------------|--|
| Final test | 00 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

- a. 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.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. 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.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

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

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

2) Scan from 1GHz to 25GHz, the disturbance above 18GHz 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.

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





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

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2913.616 | 68.85 | -29.65 | 39.20 | 74.00 | -34.80 | peak | P |
| 2 | 4276.781 | 68.58 | -29.61 | 38.98 | 74.00 | -35.02 | peak | P |
| 3 | 6085.658 | 64.02 | -25.63 | 38.39 | 74.00 | -35.61 | peak | P |
| 4 | 8645.727 | 69.80 | -25.07 | 44.73 | 74.00 | -29.27 | peak | P |
| 5 | 11046.794 | 68.11 | -22.49 | 45.62 | 74.00 | -28.38 | peak | P |
| 6 | 14218.065 | 70.80 | -20.36 | 50.44 | 74.00 | -23.56 | peak | P |

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

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2973.273 | 67.70 | -30.08 | 37.62 | 74.00 | -36.38 | peak | P |
| 2 | 4312.259 | 68.15 | -28.47 | 39.68 | 74.00 | -34.32 | peak | P |
| 3 | 6353.808 | 66.60 | -26.26 | 40.34 | 74.00 | -33.66 | peak | P |
| 4 | 8575.805 | 70.10 | -24.48 | 45.62 | 74.00 | -28.38 | peak | P |
| 5 | 11285.844 | 68.20 | -23.52 | 44.68 | 74.00 | -29.32 | peak | P |
| 6 | 14954.945 | 71.79 | -20.57 | 51.22 | 74.00 | -22.78 | peak | P |

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

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2914.087 | 68.94 | -28.75 | 40.19 | 74.00 | -33.81 | peak | P |
| 2 | 4276.292 | 68.36 | -29.70 | 38.66 | 74.00 | -35.34 | peak | P |
| 3 | 6085.411 | 64.52 | -26.05 | 38.47 | 74.00 | -35.53 | peak | P |
| 4 | 8645.709 | 69.76 | -25.01 | 44.75 | 74.00 | -29.25 | peak | P |
| 5 | 11046.622 | 68.21 | -24.30 | 43.91 | 74.00 | -30.09 | peak | P |
| 6 | 14218.172 | 71.70 | -21.30 | 50.40 | 74.00 | -23.60 | peak | P |





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

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2972.599 | 66.72 | -29.06 | 37.66 | 74.00 | -36.34 | peak | P |
| 2 | 4312.864 | 69.67 | -28.51 | 41.15 | 74.00 | -32.85 | peak | P |
| 3 | 6354.172 | 66.55 | -25.67 | 40.88 | 74.00 | -33.12 | peak | P |
| 4 | 8576.506 | 70.51 | -24.73 | 45.78 | 74.00 | -28.22 | peak | P |
| 5 | 11286.936 | 68.31 | -22.46 | 45.85 | 74.00 | -28.15 | peak | P |
| 6 | 14956.765 | 70.62 | -20.60 | 50.02 | 74.00 | -23.98 | peak | P |

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

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2913.646 | 70.28 | -30.43 | 39.85 | 74.00 | -34.15 | peak | P |
| 2 | 4276.640 | 67.24 | -29.55 | 37.69 | 74.00 | -36.31 | peak | P |
| 3 | 6085.261 | 64.16 | -25.20 | 38.96 | 74.00 | -35.04 | peak | P |
| 4 | 8646.869 | 70.30 | -24.27 | 46.03 | 74.00 | -27.97 | peak | P |
| 5 | 11047.254 | 67.44 | -24.38 | 43.07 | 74.00 | -30.93 | peak | P |
| 6 | 14218.119 | 71.59 | -21.20 | 50.39 | 74.00 | -23.61 | peak | P |

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

| No. | Frequency (MHz) | Reading (dBuv) | Factor (dB/m) | Level (dBuv/m) | Limit (dBuv/m) | Margin(dB) | Detector | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|------------|----------|-----|
| 1 | 2973.896 | 67.43 | -29.47 | 37.96 | 74.00 | -36.04 | peak | P |
| 2 | 4313.857 | 68.87 | -29.14 | 39.72 | 74.00 | -34.28 | peak | P |
| 3 | 6352.818 | 67.44 | -26.27 | 41.17 | 74.00 | -32.83 | peak | P |
| 4 | 8576.528 | 69.55 | -25.10 | 44.45 | 74.00 | -29.55 | peak | P |
| 5 | 11285.648 | 68.75 | -23.31 | 45.44 | 74.00 | -28.56 | peak | P |
| 6 | 14956.240 | 71.73 | -20.25 | 51.48 | 74.00 | -22.52 | peak | P |



8 Test Setup Photo

Please refer to the Appendix test setup Photos.

9 EUT Constructional Details (EUT Photos)

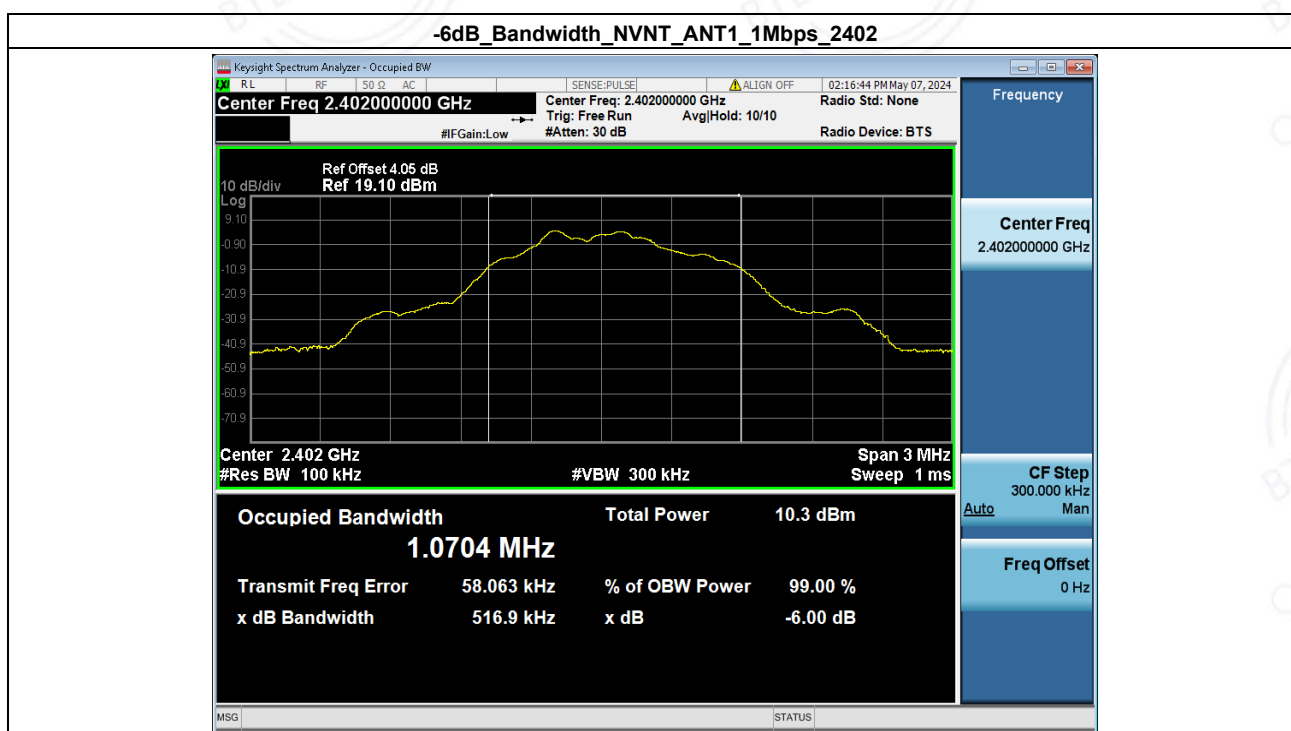
Please refer to the Appendix EUT Photos.

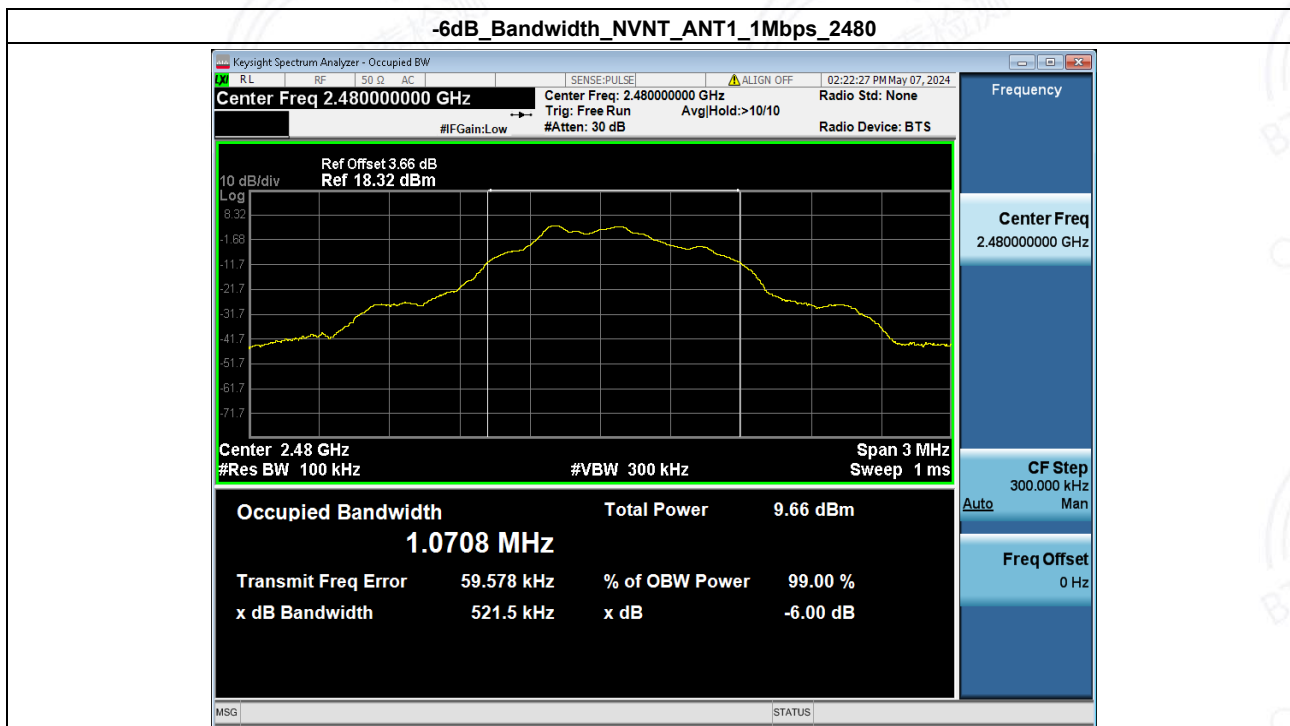
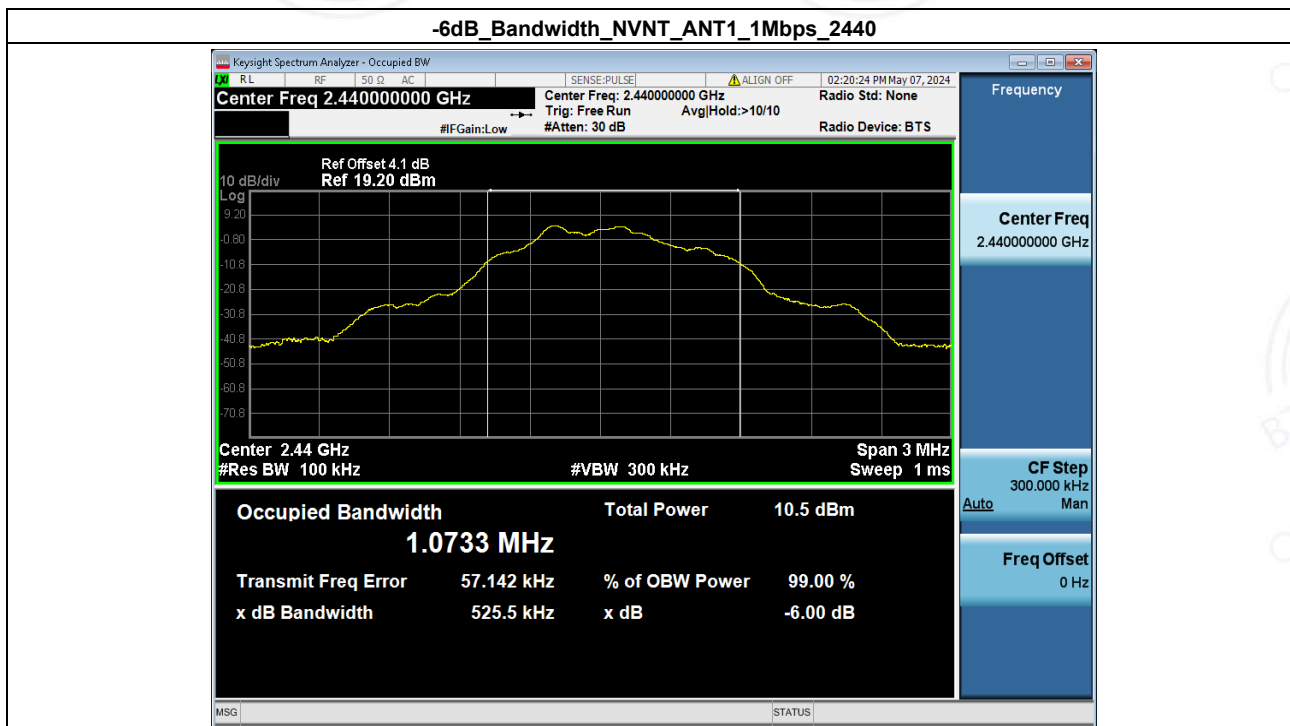


10 Appendix

1. -6dB Bandwidth

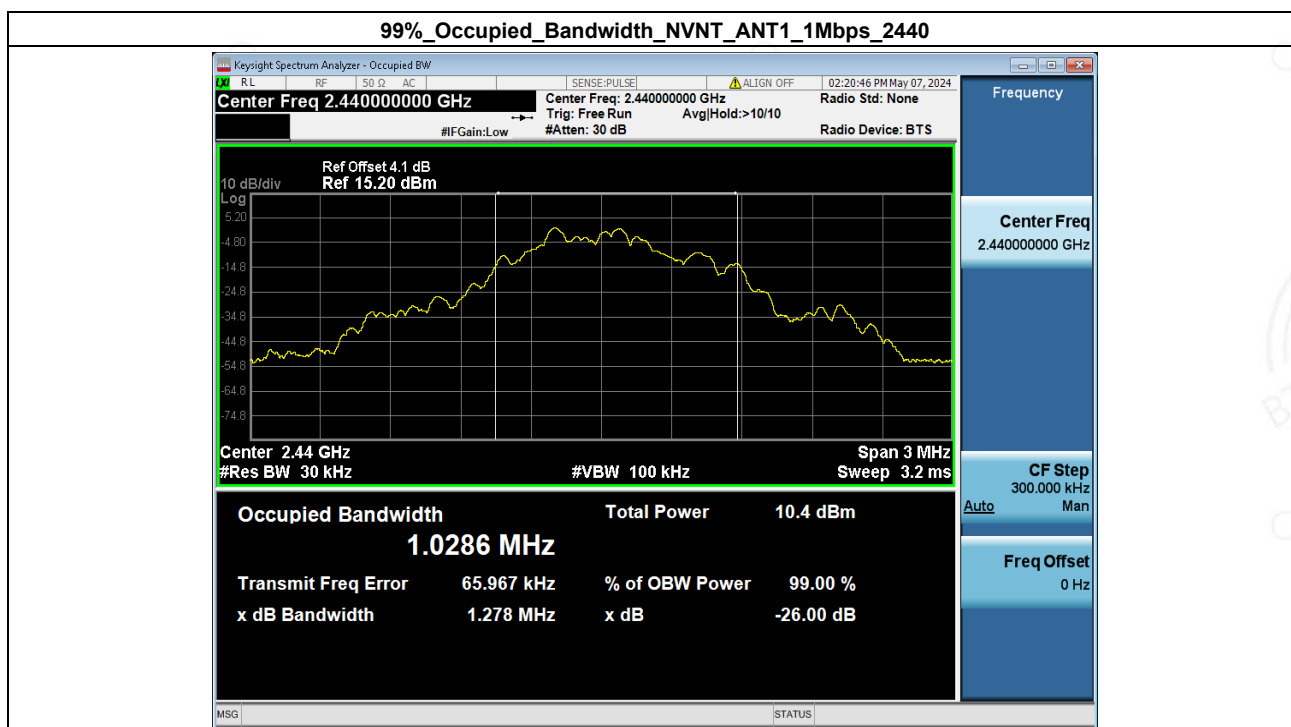
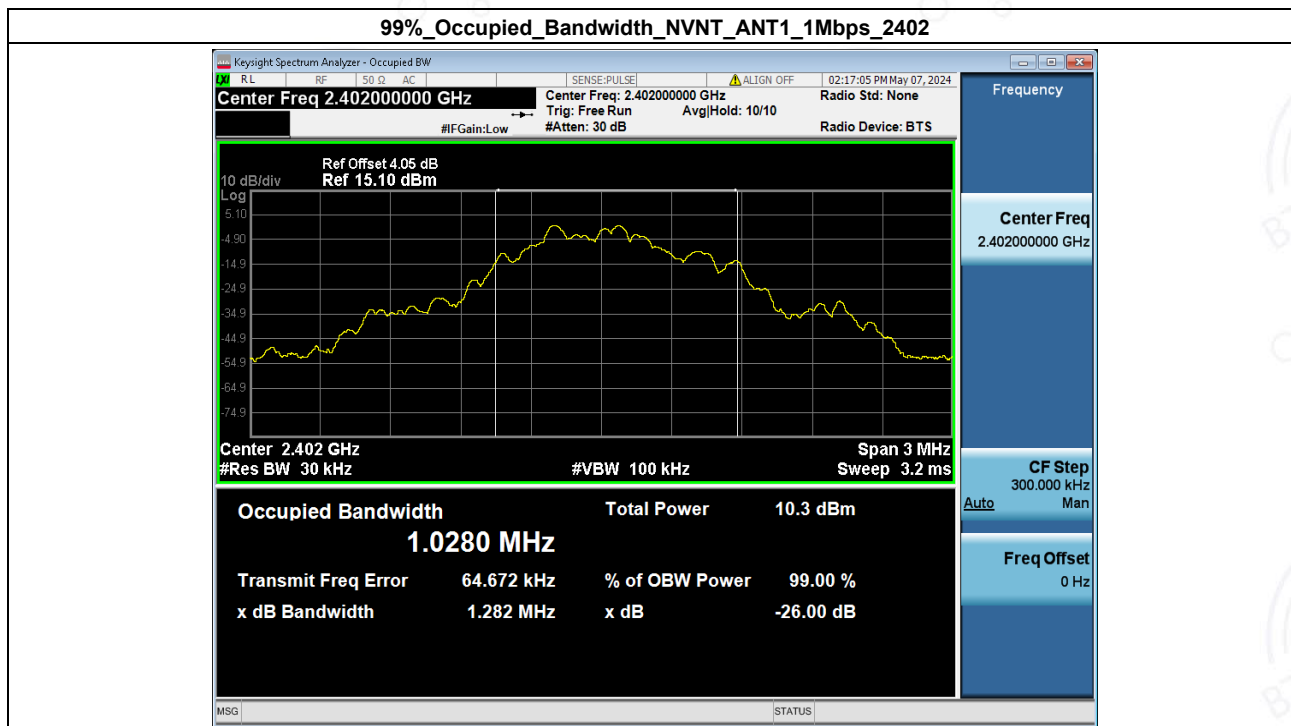
| Condition | Antenna | Rate | Frequency (MHz) | -6dB BW(kHz) | limit(kHz) | Result |
|-----------|---------|-------|-----------------|--------------|------------|--------|
| NVNT | ANT1 | 1Mbps | 2402 | 516.90 | 500 | Pass |
| NVNT | ANT1 | 1Mbps | 2440.00 | 525.50 | 500 | Pass |
| NVNT | ANT1 | 1Mbps | 2480 | 521.48 | 500 | Pass |

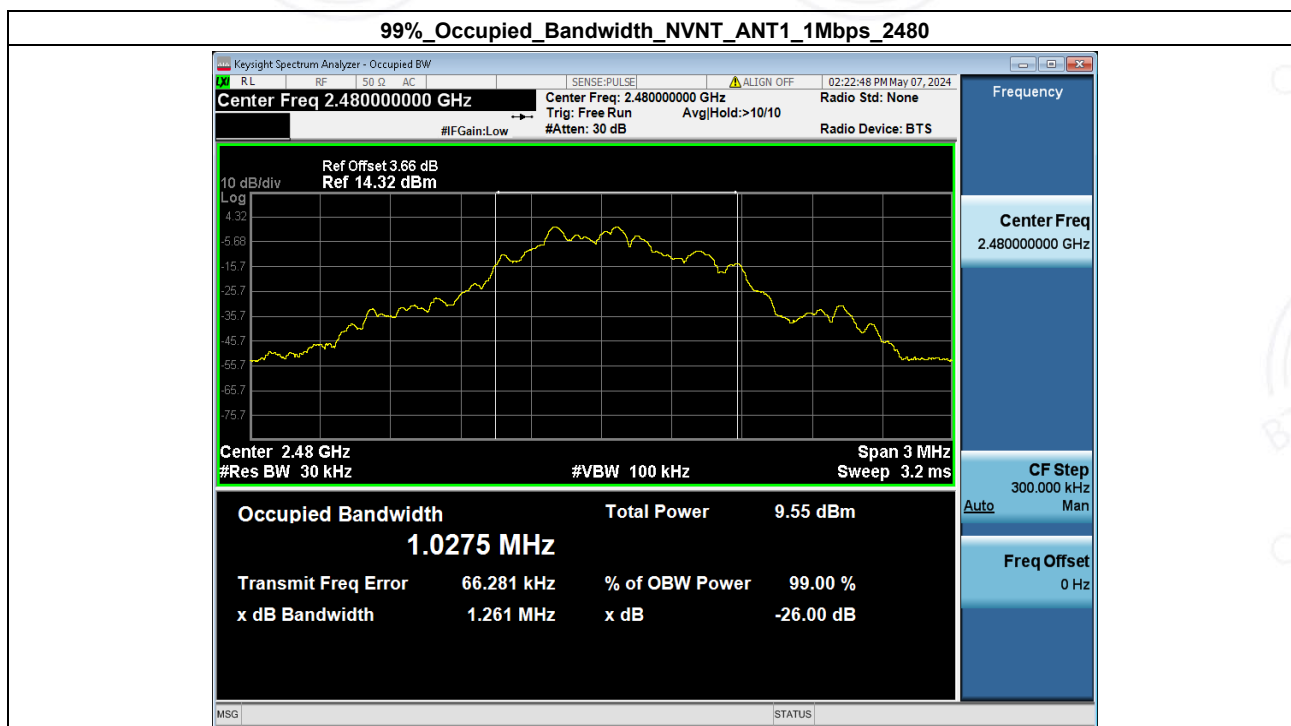




2. 99% Occupied Bandwidth

| Condition | Antenna | Rate | Frequency (MHz) | 99%%BW(MHz) |
|-----------|---------|-------|-----------------|-------------|
| NVNT | ANT1 | 1Mbps | 2402 | 1.028 |
| NVNT | ANT1 | 1Mbps | 2440.00 | 1.029 |
| NVNT | ANT1 | 1Mbps | 2480 | 1.027 |

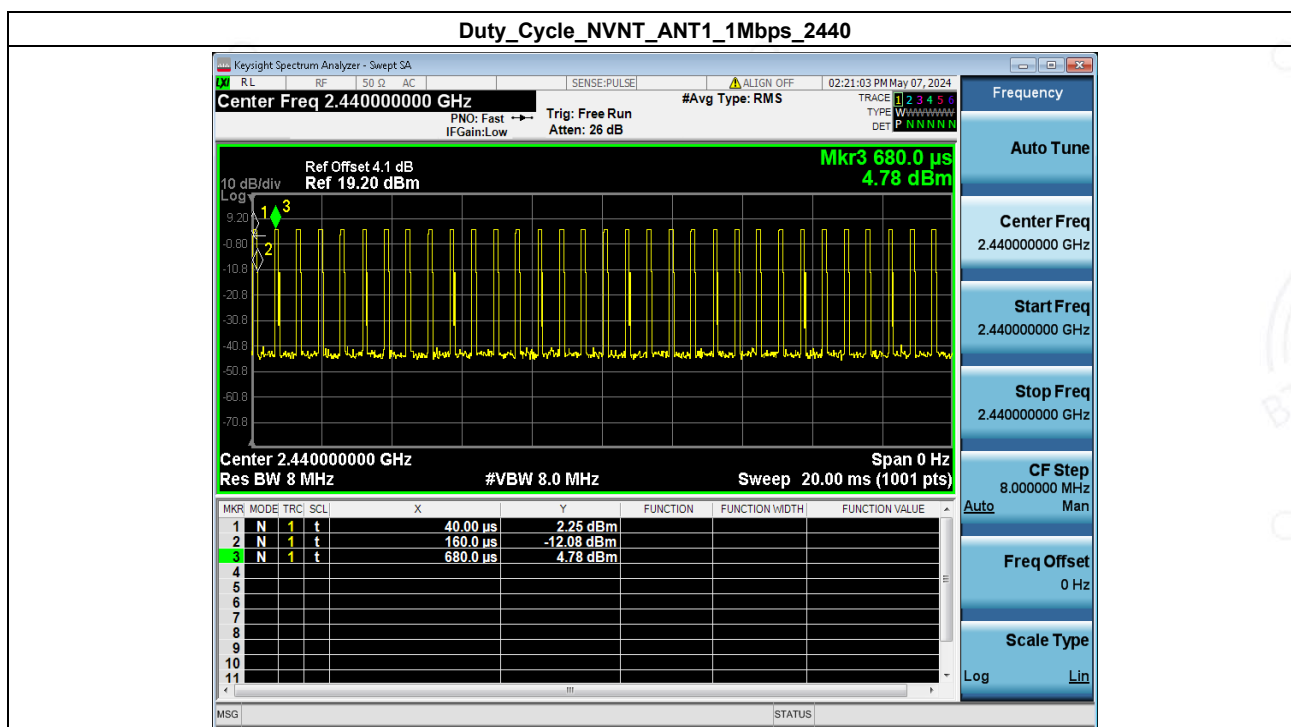
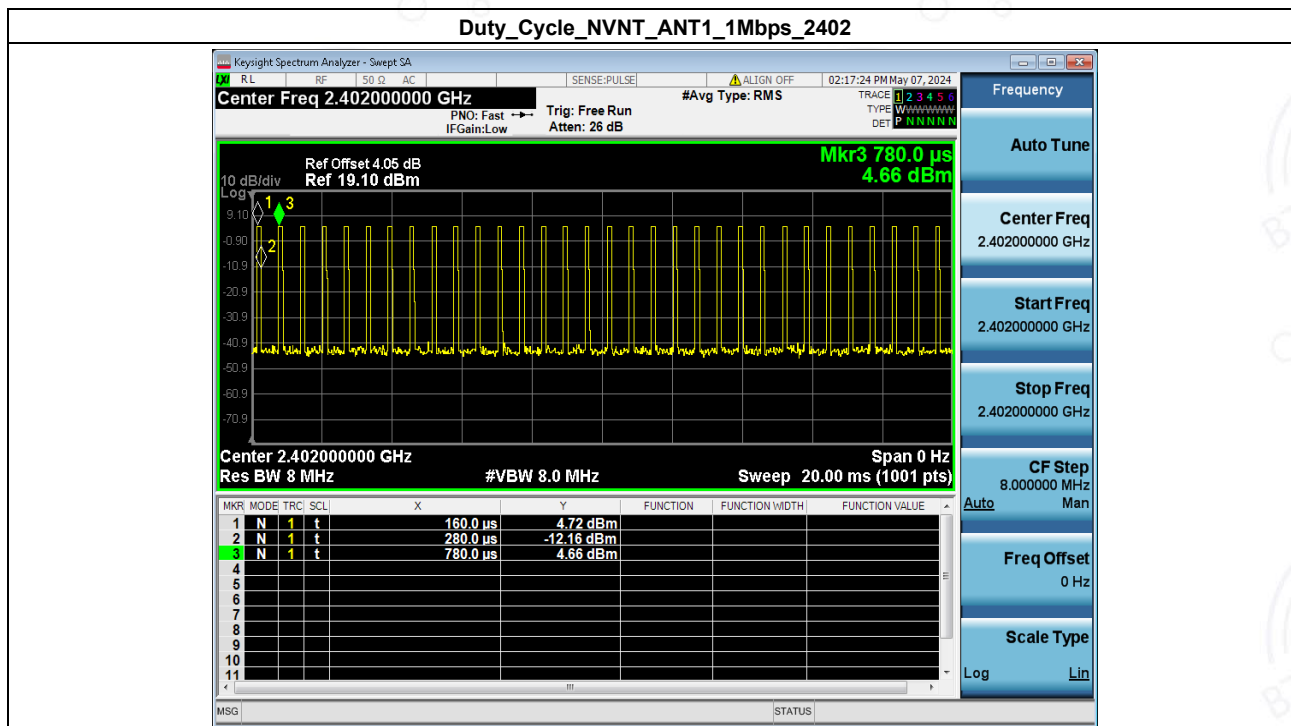


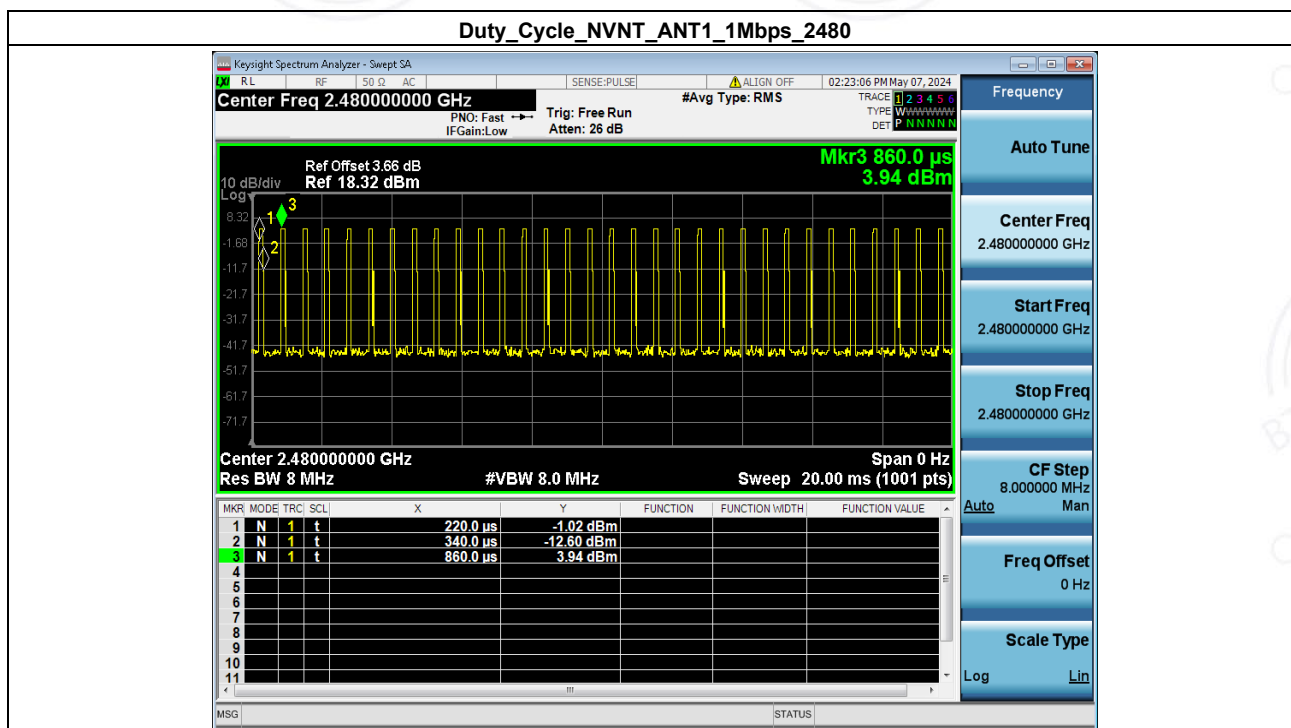




3. Duty Cycle

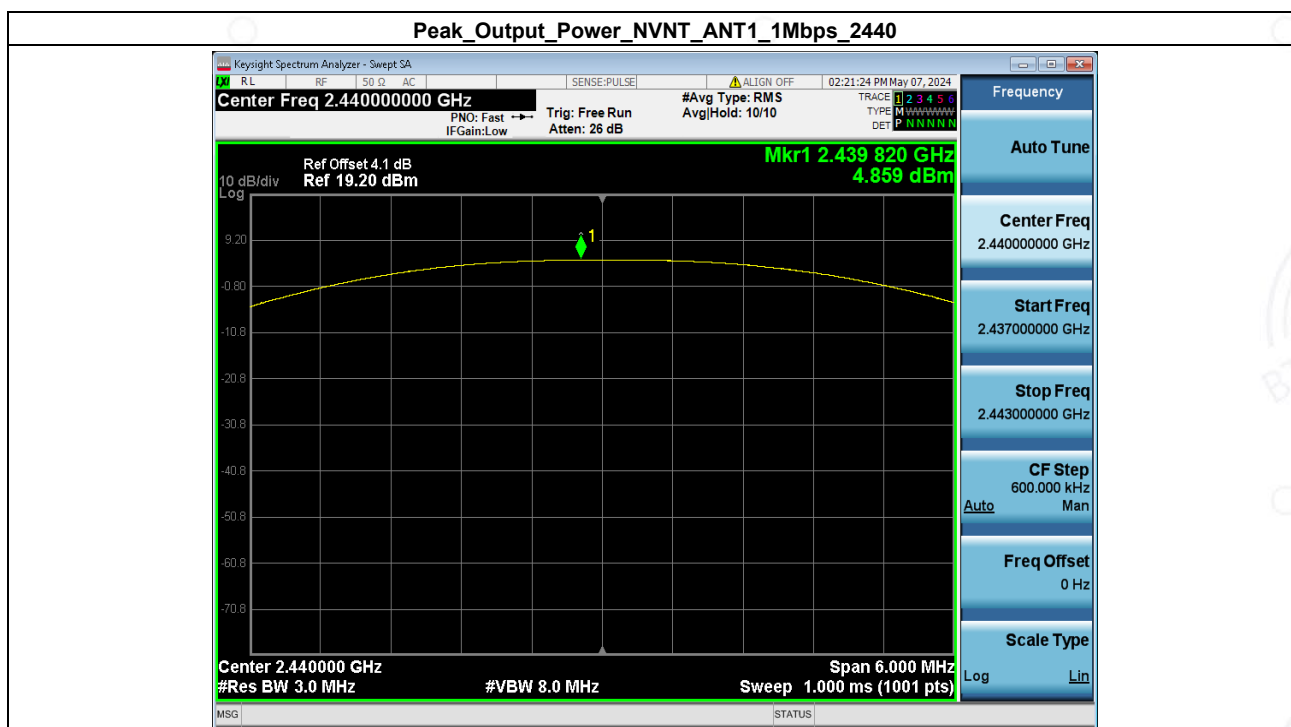
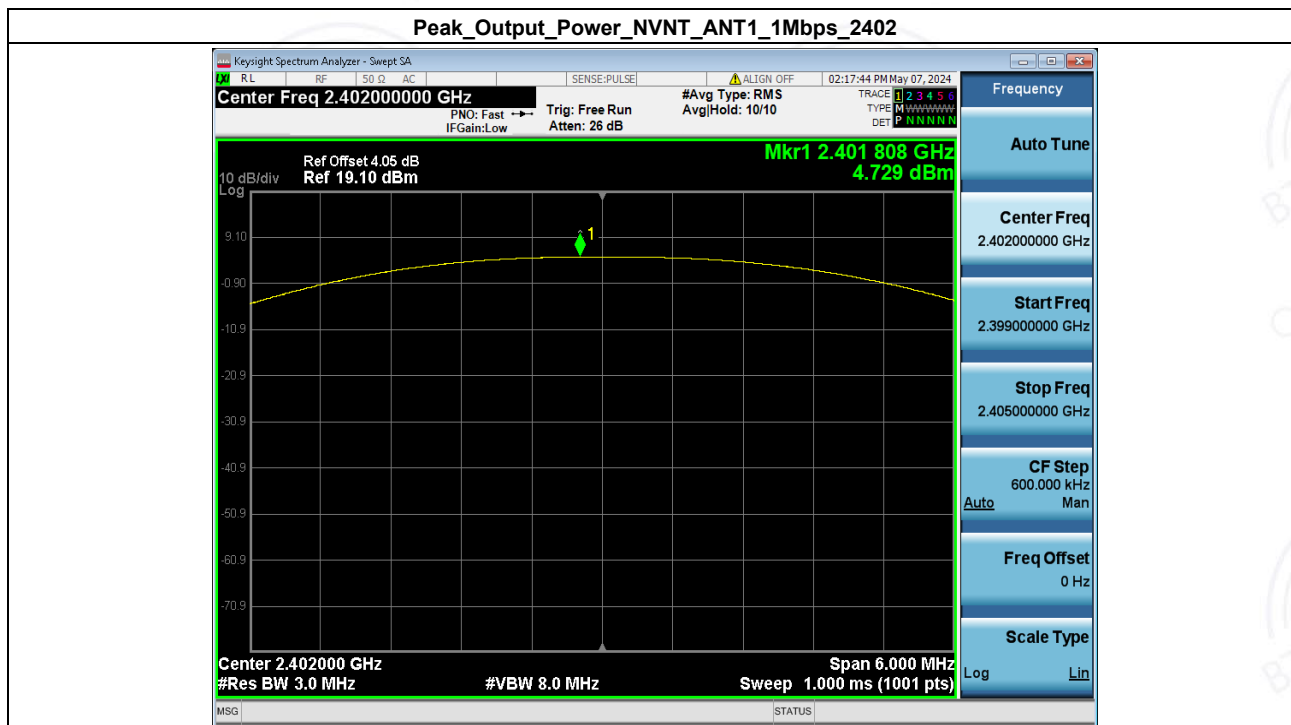
| Condition | Antenna | Rate | Frequency (MHz) | Dutycycle(%) | Duty_factor |
|-----------|---------|-------|-----------------|--------------|-------------|
| NVNT | ANT1 | 1Mbps | 2402 | 19.35 | 7.13 |
| NVNT | ANT1 | 1Mbps | 2440.00 | 18.75 | 7.27 |
| NVNT | ANT1 | 1Mbps | 2480 | 18.75 | 7.27 |





4. Peak Output Power

| Condition | Antenna | Rate | Frequency (MHz) | Max. Conducted Power(dBm) | Max. Conducted Power(mW) | Limit(mW) | Result |
|-----------|---------|-------|-----------------|---------------------------|--------------------------|-----------|--------|
| NVNT | ANT1 | 1Mbps | 2402 | 4.73 | 2.97 | 1000 | Pass |
| NVNT | ANT1 | 1Mbps | 2440.00 | 4.86 | 3.06 | 1000 | Pass |
| NVNT | ANT1 | 1Mbps | 2480 | 4.04 | 2.54 | 1000 | Pass |

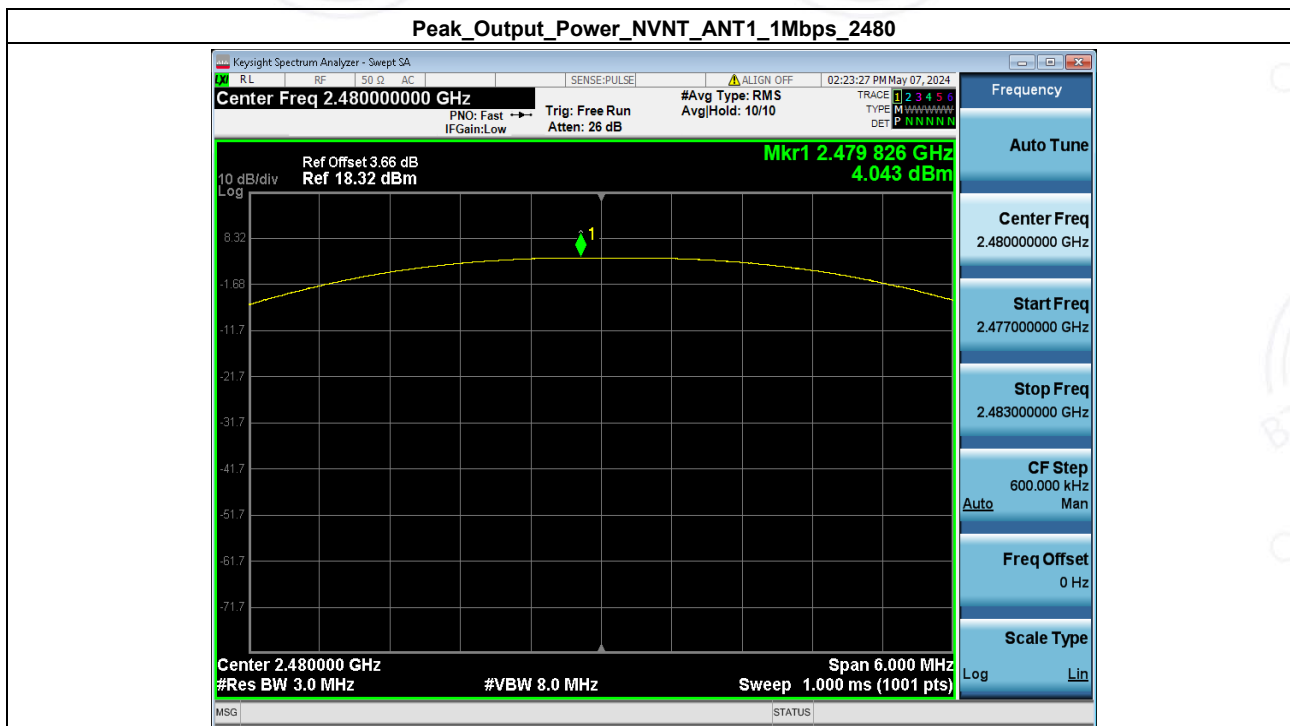




Shenzhen BANTEK Testing Co., Ltd.

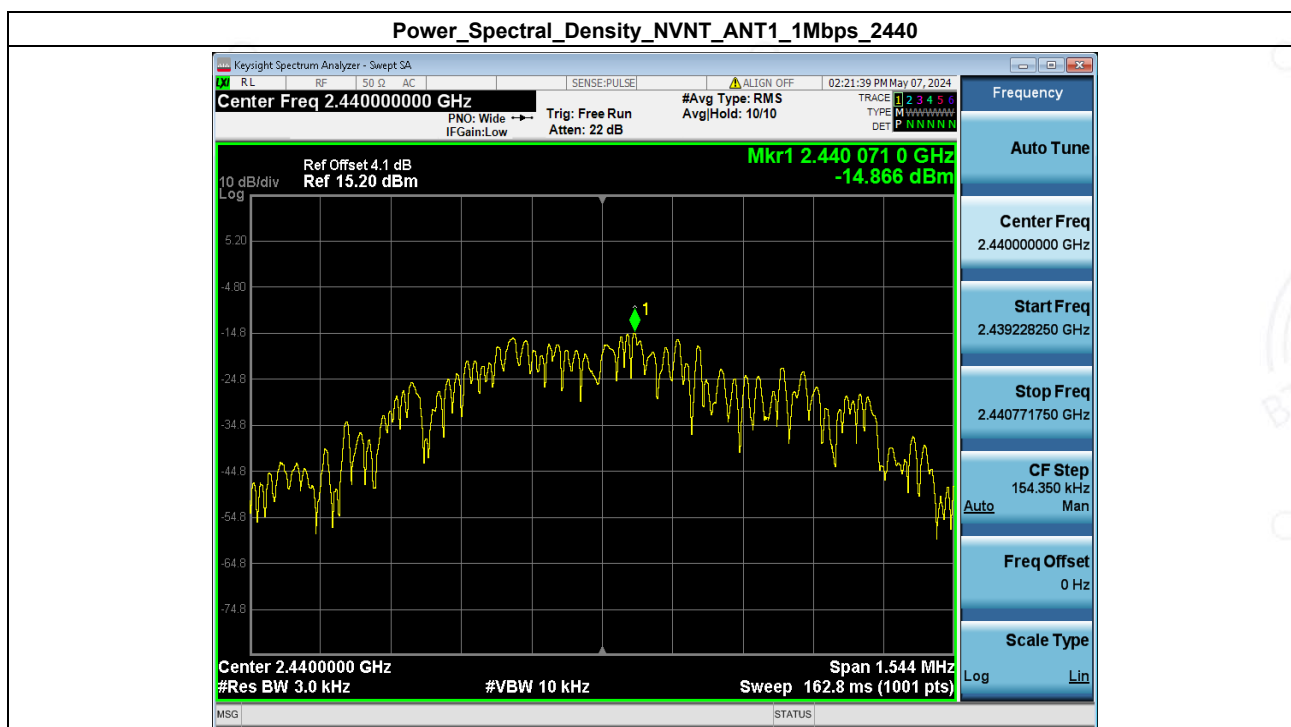
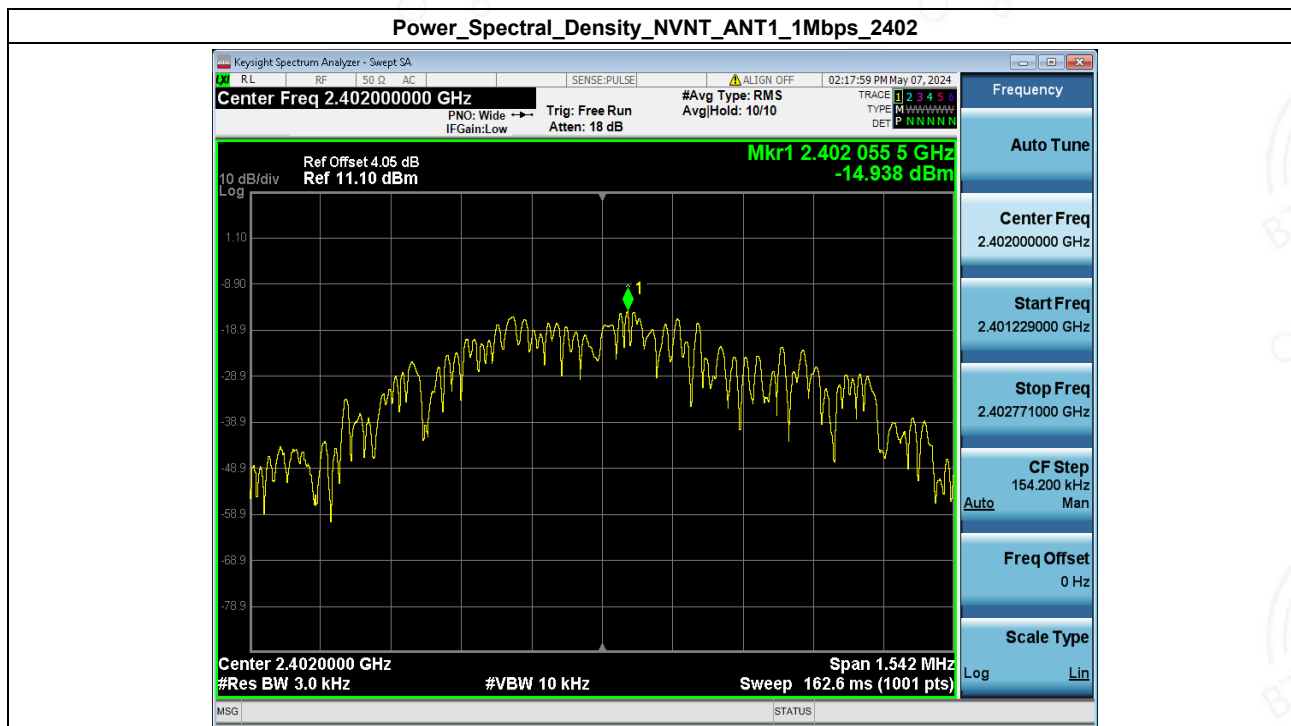
Report No.: BTEK240425003AE001

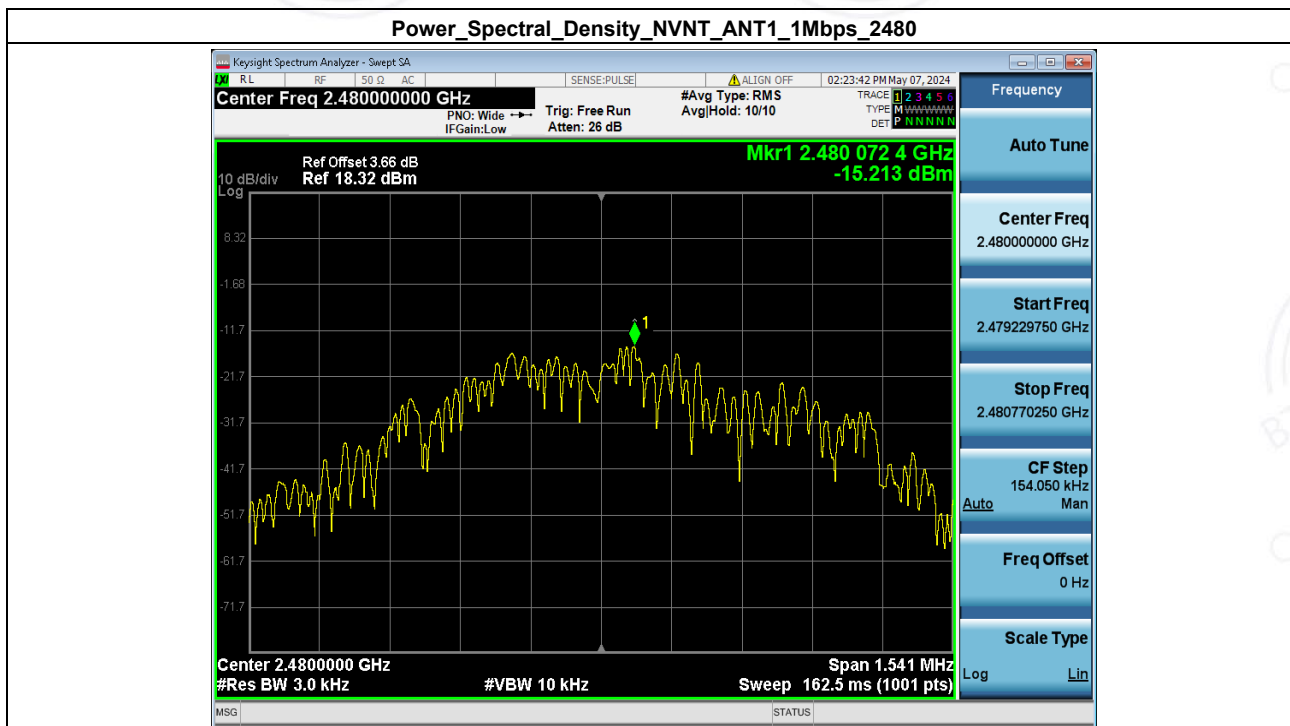
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5. Power Spectral Density

| Condition | Antenna | Rate | Frequency (MHz) | Power Spectral Density(dBm) | Limit(dBm/3kHz) | Result |
|-----------|---------|-------|-----------------|-----------------------------|-----------------|--------|
| NVNT | ANT1 | 1Mbps | 2402 | -14.94 | 8 | Pass |
| NVNT | ANT1 | 1Mbps | 2440.00 | -14.87 | 8 | Pass |
| NVNT | ANT1 | 1Mbps | 2480 | -15.21 | 8 | Pass |



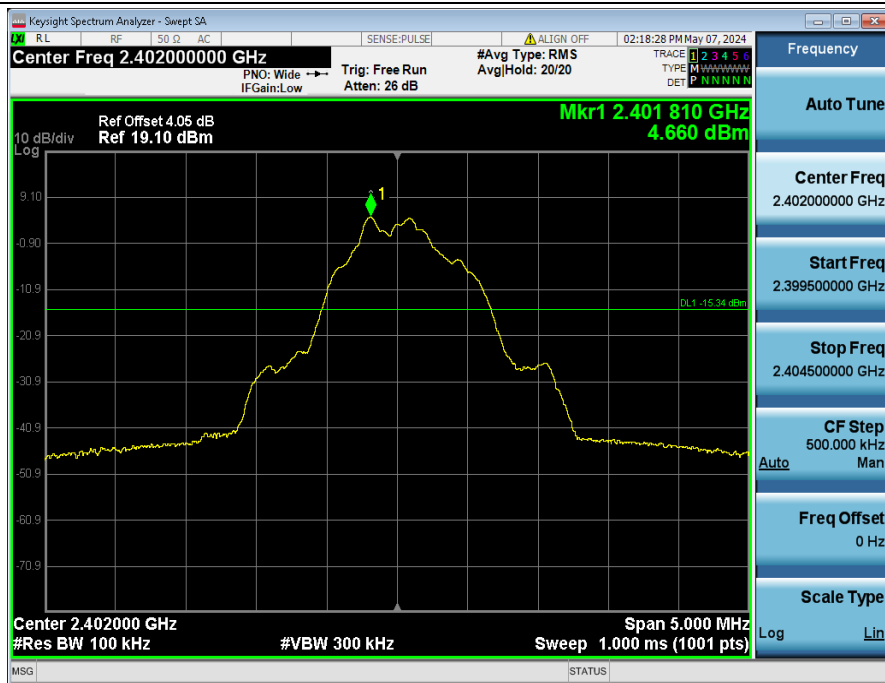




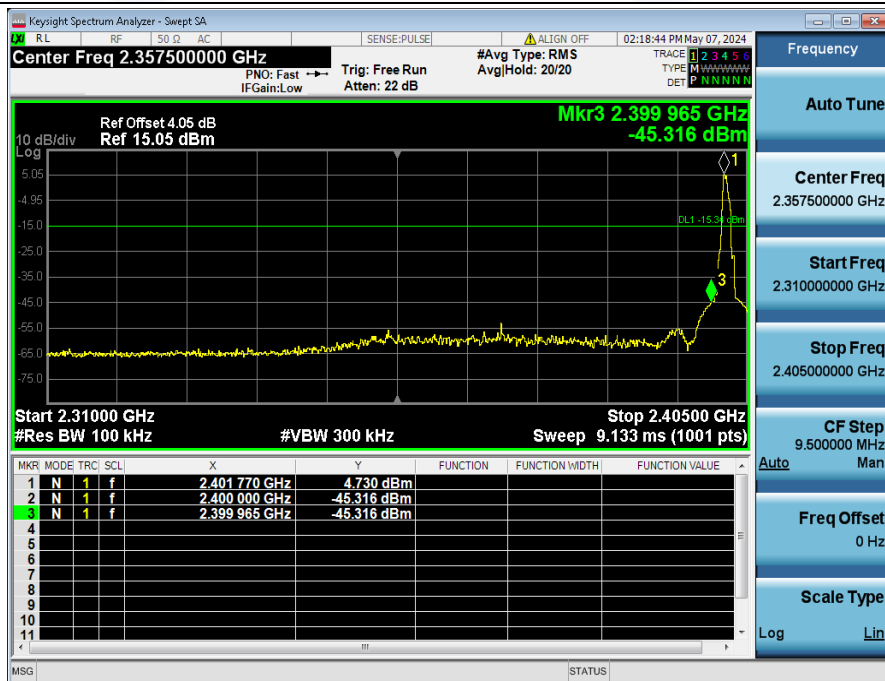
6. Bandedge

| Condition | Antenna | Rate | TX_Frequency (MHz) | Max. Mark Frequency (MHz) | Spurious level(dBm) | limit(dBm) | Result |
|-----------|---------|-------|--------------------|---------------------------|---------------------|------------|--------|
| NVNT | ANT1 | 1Mbps | 2402 | 2399.965 | -45.316 | -15.340 | Pass |
| NVNT | ANT1 | 1Mbps | 2480 | 2483.525 | -51.849 | -16.047 | Pass |

1_Reference_Level_NVNT_ANT1_1Mbps_2402

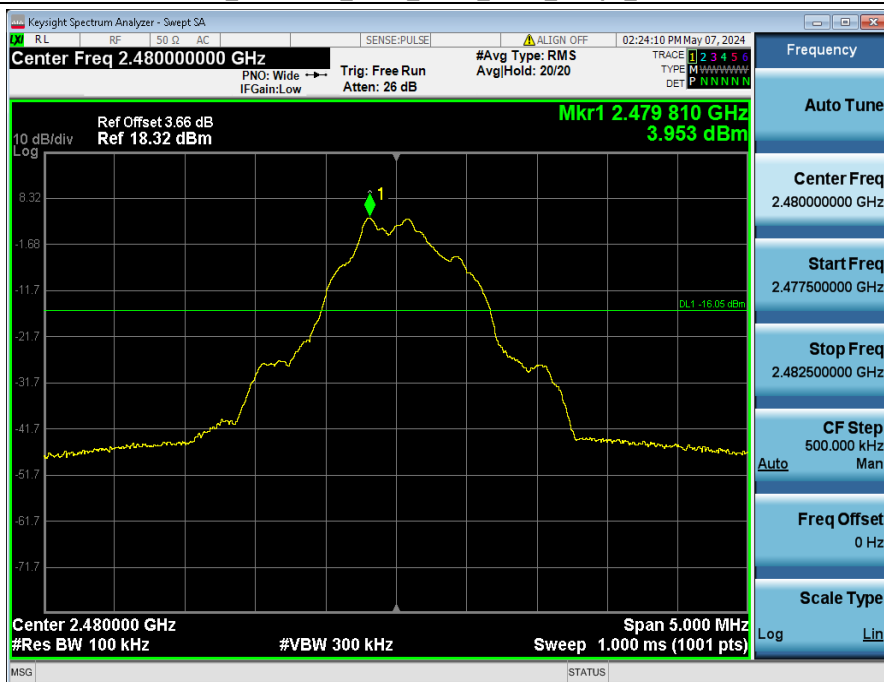


2_Bandedge_NVNT_ANT1_1Mbps_2402

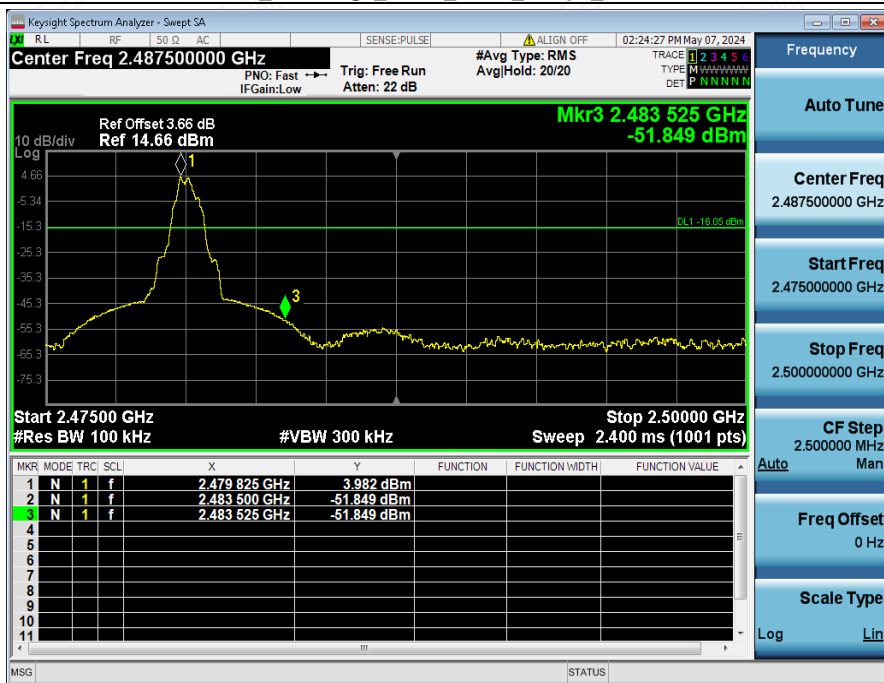




1_Reference_Level_NVNT_ANT1_1Mbps_2480



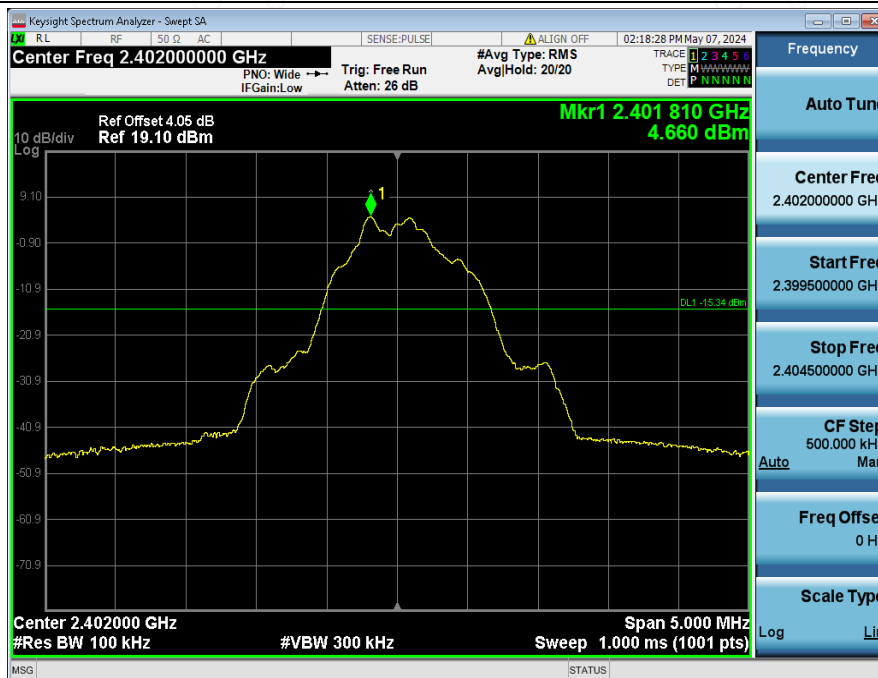
2_Bandedge_NVNT_ANT1_1Mbps_2480



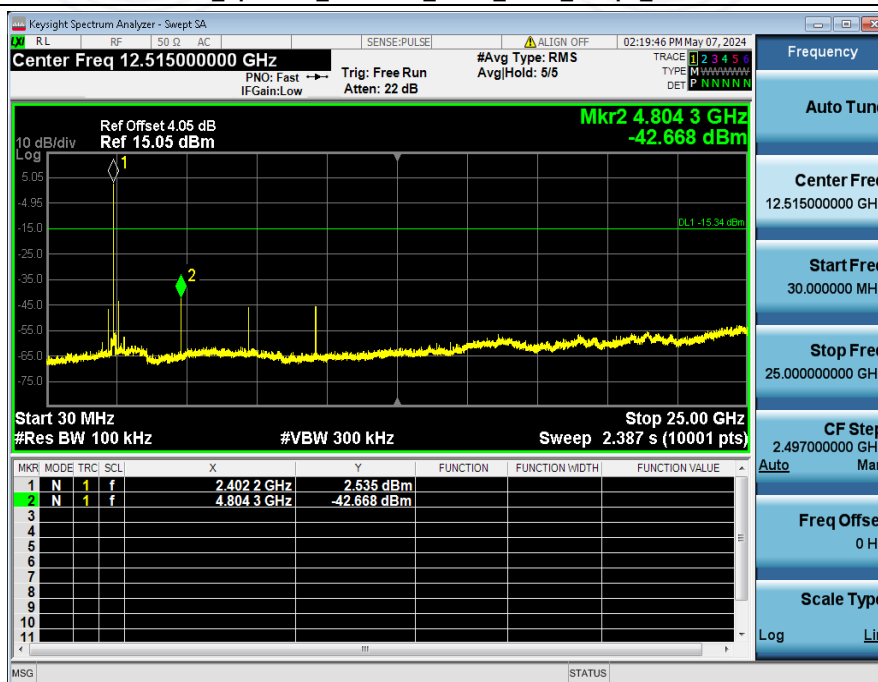
7. Spurious Emission

| Condition | Antenna | Rate | TX_Frequency(MHz) | Spurious MAX.Value(dBm) | Limit | Result |
|-----------|---------|-------|-------------------|-------------------------|---------|--------|
| NVNT | ANT1 | 1Mbps | 2402 | -42.668 | -15.340 | Pass |
| NVNT | ANT1 | 1Mbps | 2480 | -41.346 | -16.047 | Pass |

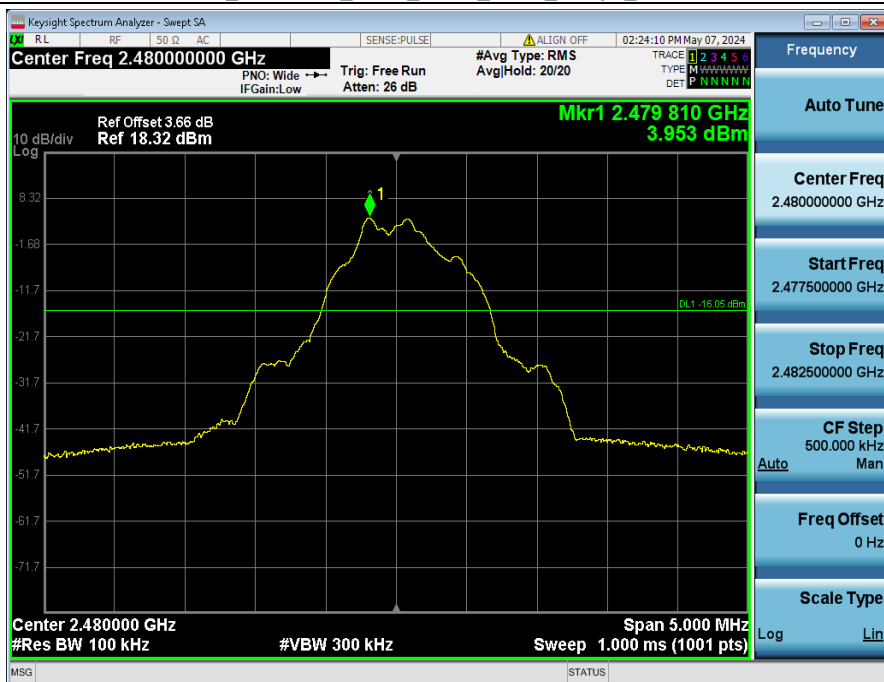
1_Reference_Level_NVNT_ANT1_1Mbps_2402



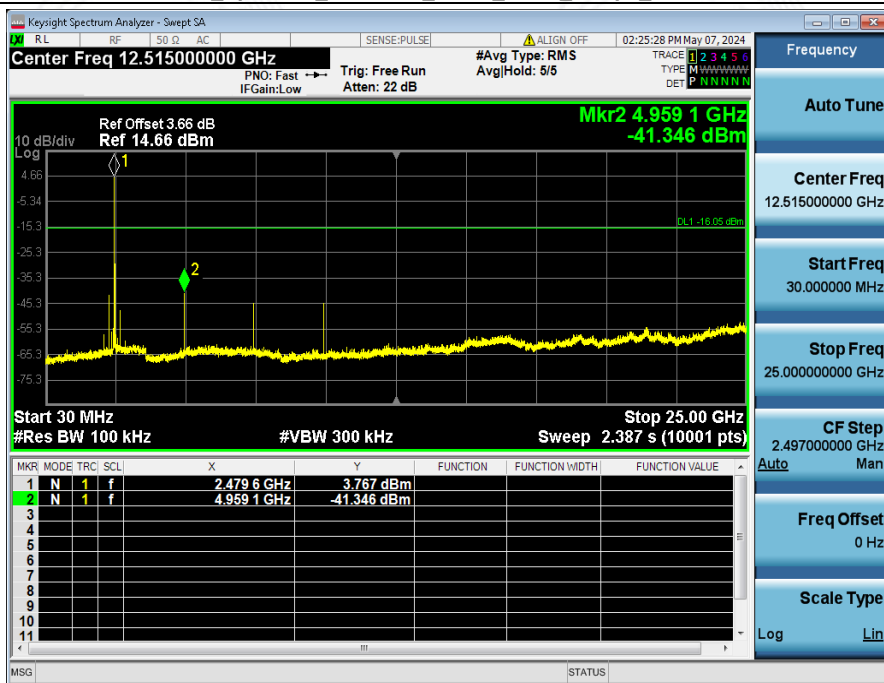
2_Spurious_Emission_NVNT_ANT1_1Mbps_2402



1_Reference_Level_NVNT_ANT1_1Mbps_2480



2_Spurious_Emission_NVNT_ANT1_1Mbps_2480



- End of the Report -

