



FCC TEST REPORT

FCC ID: 2BHJR-X25

| | | |
|--|---|----------------------------|
| Product | : | MINISO Wireless Earbud X25 |
| Model Name | : | X25 |
| Brand | : | N/A |
| Report No. | : | PTC24071004801E-FC01 |
| Prepared for | | |
| Shenzhen xiaoxiang supply chain technology co., ltd | | |
| 2801A, West Tower, Xinghe Twin Tower, No. 8, Yaxing Road, Nankeng Community, Bantian Street, Longgang District, Shenzhen | | |
| Prepared by | | |
| Precise Testing & Certification Co., Ltd. | | |
| Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China | | |



1 TEST RESULT CERTIFICATION

Applicant's name : Shenzhen xiaoxiang supply chain technology co., ltd
Address : 2801A, West Tower, Xinghe Twin Tower, No. 8, Yaxing Road,
Nankeng Community, Bantian Street, Longgang District, Shenzhen
Manufacture's name : Shenzhen xiaoxiang supply chain technology co., ltd
Address : 2801A, West Tower, Xinghe Twin Tower, No. 8, Yaxing Road,
Nankeng Community, Bantian Street, Longgang District, Shenzhen
Product name : MINISO Wireless Earbud X25
Model name : X25
Standards : FCC CFR47 Part 15 Section 15.247
Test procedure : ANSI C63.10:2013
Test Date : Jul. 11, 2024 to Jul. 16, 2024
Date of Issue : Jul. 25, 2024
Test Result : Pass

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Test Engineer:

A handwritten signature in black ink, appearing to read 'Jack Zhou'.

Jack Zhou / Engineer

Technical Manager:

A handwritten signature in black ink, appearing to read 'Simon Pu'.

Simon Pu / Manager



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2 Test Summary

| Test Items | Test Requirement | Result |
|-----------------------------|----------------------------------|--------|
| Radiated Spurious Emissions | 15.205(a) 15.209 15.247(d) | PASS |
| Band edge | 15.247(d) 15.205(a) | PASS |
| Conduct Emission | 15.207 | N/A |
| 20dB Bandwidth | 15.247(a)(1) | PASS |
| Maximum Peak Output Power | 15.247(b)(1) | PASS |
| Frequency Separation | 15.247(a)(1) | PASS |
| Number of Hopping Frequency | 15.247(a)(1)(iii) | PASS |
| Dwell time | 15.247(a)(1)(iii) | PASS |
| Antenna Requirement | 15.203 | PASS |

3 TEST FACILITY

Precise Testing & Certification Co., Ltd.

Address: Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A

FCC Designation Number. CN1219



4 General Information

4.1 General Description of E.U.T.

| | | |
|----------------------|---|--|
| Product Name | : | MINISO Wireless Earbud X25 |
| Model Name | : | X25 |
| Specification | : | BT 5.4 BDR+EDR |
| Operation Frequency | : | 2402-2480MHz |
| Number of Channel | : | 79 channels for BDR+EDR |
| Type of Modulation | : | GFSK, $\pi/4$ -DQPSK, 8DPSK For DSS |
| Antenna installation | : | Ceramic antenna |
| Antenna Gain | : | 2.67 dBi |
| Rated Power Supply | : | Input: DC 5V 300mA Battery: Li-ion Battery : 401010 Rated Voltage: 3.7V Rated Capacity:30mAh |
| Hardware Version | : | G2900-5636E-V1.0 |
| Software Version | : | (8BDB7838_9DA6C48D)_HVT_20240419 |
| Test sample No. | : | PTC24071004801E-1/2,PTC24071004801E-2/2. |



4.2 Test Mode

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, all the modes GFSK, $\pi/4$ -DQPSK, 8DPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel List:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| 0 | 2402 | 1 | 2403 | 2 | 2404 | 3 | 2405 |
| 4 | 2406 | 5 | 2407 | 6 | 2408 | 7 | 2409 |
| 8 | 2410 | 9 | 2411 | 10 | 2412 | 11 | 2413 |
| 12 | 2414 | 13 | 2415 | 14 | 2416 | 15 | 2417 |
| 16 | 2418 | 17 | 2419 | 18 | 2420 | 19 | 2421 |
| 20 | 2422 | 21 | 2423 | 22 | 2424 | 23 | 2425 |
| 24 | 2426 | 25 | 2427 | 26 | 2428 | 27 | 2429 |
| 28 | 2430 | 29 | 2431 | 30 | 2432 | 31 | 2433 |
| 32 | 2434 | 33 | 2435 | 34 | 2436 | 35 | 2437 |
| 36 | 2438 | 37 | 2439 | 38 | 2440 | 39 | 2441 |
| 40 | 2442 | 41 | 2443 | 42 | 2444 | 43 | 2445 |
| 44 | 2446 | 45 | 2447 | 46 | 2448 | 47 | 2449 |
| 48 | 2450 | 49 | 2451 | 50 | 2452 | 51 | 2453 |
| 52 | 2454 | 53 | 2455 | 54 | 2456 | 55 | 2457 |
| 56 | 2458 | 57 | 2459 | 58 | 2460 | 59 | 2461 |
| 60 | 2462 | 61 | 2463 | 62 | 2464 | 63 | 2465 |
| 64 | 2466 | 65 | 2467 | 66 | 2468 | 67 | 2469 |
| 68 | 2470 | 69 | 2471 | 70 | 2472 | 71 | 2473 |
| 72 | 2474 | 73 | 2475 | 74 | 2476 | 75 | 2477 |
| 76 | 2478 | 77 | 2479 | 78 | 2480 | - | - |



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| Channel | Frequency(MHz) |
|----------------|-----------------------|
| 0 | 2402 |
| 39 | 2441 |
| 78 | 2480 |



5 Equipment During Test

5.1 Equipments List

RF Conducted Test

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Last Calibration | Calibration Interval |
|---------------------|--------------|----------|---------------|-----------------|------------------|----------------------|
| MXG Signal Analyzer | Agilent | N9020A | SER MY5111038 | 10Hz-26.5GHz | Aug.17, 2023 | 1 Year |
| Coaxial Cable | CDS | 79254 | 46107086 | 10Hz-30GHz | Aug.17, 2023 | 1 Year |
| Power Meter | Anritsu | ML2495A | 0949003 | 300MHz-40GHz | Aug.17, 2023 | 1 Year |
| Power Sensor | Anritsu | MA2411B | 0917017 | 300MHz-40GHz | Aug.17, 2023 | 1 Year |
| Test S/W | Tonscend | JS1120-3 | / | / | / | / |

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Radiated Emissions(Test Frequency from 9KHz-18GHz)

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Last Calibration | Calibration Interval |
|------------------------------|---------------|--------------|------------------|-----------------|------------------|----------------------|
| EMI Test Receiver | Rohde&Schwarz | ESPI7 | 101671 | 9KHz-7GHz | Aug. 17,2023 | 1 Year |
| Loop Antenna | Schwarzbeck | FMZB 1519 | 192 | 9 KHz -30MHz | Aug. 17,2023 | 1 Year |
| Bilog Antenna | SCHWARZBECK | VULB9160 | 9160-3355 | 25MHz-2GHz | Aug. 17,2023 | 1 Year |
| Preamplifier (low frequency) | SCHWARZBECK | BBV 9475 | 9745-0013 | 1MHz-1GHz | Aug. 17,2023 | 1 Year |
| Cable | IMRO | AK-9515E(9m) | Cable-L | 9KHz-3GHz | Aug. 17,2023 | 1 Year |
| Spectrum Analyzer | Rohde&Schwarz | FSV40 | 6625-01-588-5515 | 9KHz-40GHz | Aug. 17,2023 | 1 Year |
| Horn Antenna | SCHWARZBECK | 9120D | 9120D-1246 | 1GHz-18GHz | Aug. 17,2023 | 1 Year |



| | | | | | | |
|-----------------|-------------|-----------|-----------|--------------|---------------|--------|
| Power Amplifier | ZHINAN | ZN3380C | 15002 | 1GHz-26.5GHz | Aug. 17,2023 | 1 Year |
| Horn Antenna | SCHWARZBECK | BBHA 9170 | 9170-1066 | 15GHz-40GHz | Jul. 19, 2023 | 1 Year |
| Amplifier | SCHWARZBECK | BBV 9721 | 9721-205 | 18GHz-40GHz | Jul. 19, 2023 | 1 Year |
| Cable | H+S | CBL-26 | N/A | 1GHz-26.5GHz | Aug. 17,2023 | 1 Year |
| RF Cable | R&S | R204 | R21X | 1GHz-40GHz | Aug. 17,2023 | 1 Year |
| Test S/W | Tonscend | TS+ | / | / | / | / |

Conducted Emissions

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Date | Calibration Interval |
|--------------------------|-----------------|---------|------------------------|-----------------|------------------|----------------------|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Aug. 17, 2023 | 1 Year |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 102453 | 9KHz-30MHz | Aug. 17, 2023 | 1 Year |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 101342 | 9KHz-30MHz | Aug. 17, 2023 | 1 Year |
| Limiter | R&S | ESH3-Z2 | 0357.8810.54-102808-NB | 0Hz-30MHz | Aug. 16,2023 | 1 Year |
| RF Switch | DIAMOND ANTENNA | CX-210 | / | 0.09MHz-6GHz | Mar. 22,2024 | 1 Year |
| Test S/W | Tonscend | JS32-CE | / | / | / | / |



5.2 Measurement Uncertainty

| Parameter | Uncertainty |
|------------------------------------|--------------------------|
| RF output power, conducted | ±1.0dB |
| Power Spectral Density, conducted | ±2.2dB |
| Radio Frequency | ± 1 x 10 ⁻⁶ |
| Bandwidth | ± 1.5 x 10 ⁻⁶ |
| Time | ±2% |
| Duty Cycle | ±2% |
| Temperature | ±1°C |
| Humidity | ±5% |
| DC and low frequency voltages | ±3% |
| Conducted Emissions (150kHz~30MHz) | ±3.64dB |
| Radiated Emission(9kHz~30MHz) | ±3.15dB |
| Radiated Emission(30MHz~1GHz) | ±5.03dB |
| Radiated Emission(1GHz~25GHz) | ±4.74dB |



5.3 Description of Support Units

| Equipment | Model No. | Series No. | Parameters |
|-----------|-----------|------------|------------|
| N/A | N/A | N/A | N/A |

6 Conducted Emission

| | | |
|-------------------|---|---|
| Test Requirement: | : | FCC CFR 47 Part 15 Section 15.207 |
| Test Method: | : | ANSI C63.10:2013 |
| Test Result: | : | PASS |
| Frequency Range: | : | 150kHz to 30MHz |
| Class/Severity: | : | Class B |
| Detector: | : | Peak for pre-scan (9kHz Resolution Bandwidth) |

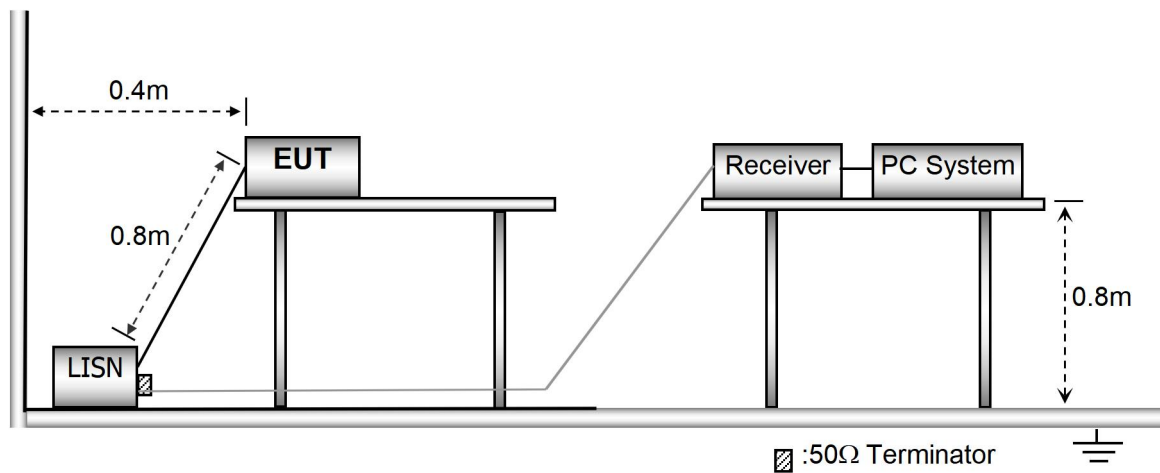
6.1 E.U.T. Operation

Operating Environment :

| | | |
|-----------------------|---|--------------|
| Temperature: | : | 23.2°C |
| Humidity: | : | 51 % RH |
| Atmospheric Pressure: | : | 101.12 kPa |
| Test Voltage | : | AC 120V/60Hz |

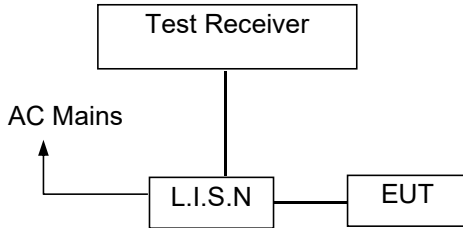
6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10: 2013





6.3 Test SET-UP (Block Diagram of Configuration)



6.4 Measurement Procedure:

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

6.5 Conducted Emission Limit

Conducted Emission

| Frequency(MHz) | Quasi-peak | Average |
|----------------|------------|---------|
| 0.15-0.5 | 66-56 | 56-46 |
| 0.5-5.0 | 56 | 46 |
| 5.0-30.0 | 60 | 50 |

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

6.6 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.7 Conducted Emission Test Result

N/A.

Note: The equipment only powered by DC.



7 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method : ANSI C63.10:2013
 Test Result : PASS
 Measurement Distance : 3m
 Limit : See the follow table

| Frequency (MHz) | Field Strength | | Field Strength Limit at 3m Measurement Dist | |
|-----------------|-----------------------|--------------|---|---------------------------------------|
| | uV/m | Distance (m) | uV/m | dBuV/m |
| 0.009 ~ 0.490 | $2400/F(\text{kHz})$ | 300 | $10000 * 2400/F(\text{kHz})$ | $20\log^{(2400/F(\text{kHz}))} + 80$ |
| 0.490 ~ 1.705 | $24000/F(\text{kHz})$ | 30 | $100 * 24000/F(\text{kHz})$ | $20\log^{(24000/F(\text{kHz}))} + 40$ |
| 1.705 ~ 30 | 30 | 30 | $100 * 30$ | $20\log^{(30)} + 40$ |
| 30 ~ 88 | 100 | 3 | 100 | $20\log^{(100)}$ |
| 88 ~ 216 | 150 | 3 | 150 | $20\log^{(150)}$ |
| 216 ~ 960 | 200 | 3 | 200 | $20\log^{(200)}$ |
| Above 960 | 500 | 3 | 500 | $20\log^{(500)}$ |

7.1 EUT Operation

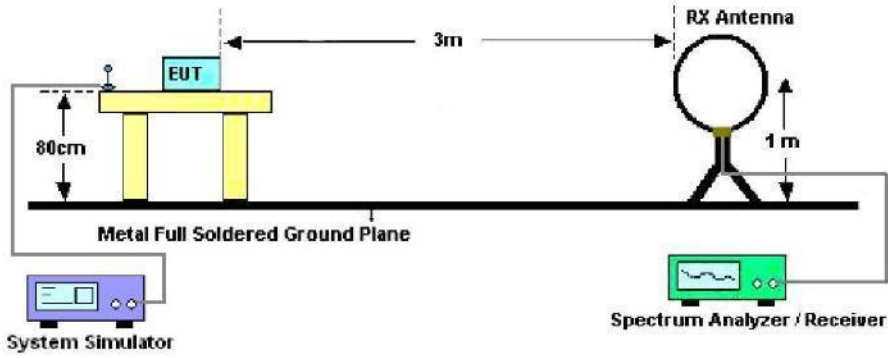
Operating Environment :

Temperature : 24.5 °C
 Humidity : 55.5% RH
 Atmospheric Pressure : 101.3kPa
 Test Voltage : DC 3.7V

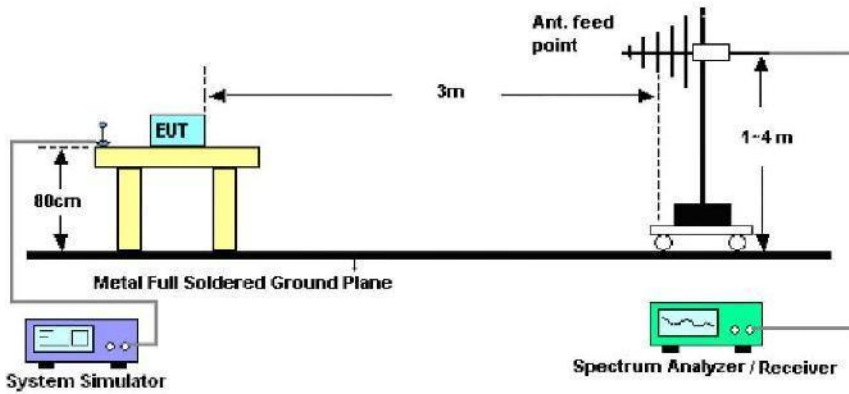
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

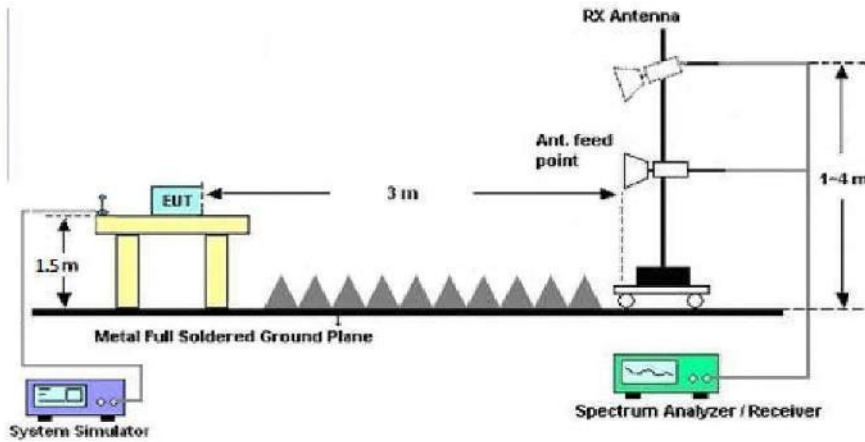
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.





7.3 Spectrum Analyzer Setup

| Spectrum Parameter | Setting |
|---------------------------------------|--|
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | 10th carrier harmonic |
| RB / VB (emission in restricted band) | 1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average |

| Receiver Parameter | Setting |
|------------------------|----------------------------------|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |



7.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.
2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.
7. Test Procedure of measurement (For Above 1GHz):
 - 1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).
 - 2) Change the antenna polarization and repeat 1) with vertical polarization.
 - 3) Make a hardcopy of the spectrum.
 - 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
 - 5) Change the analyser mode to Clear/ Write and found the cone of emission.
 - 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.
 - 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.
 - 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.



7.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBuV/m) | Limit 3m (dBuV/m) | Over Limit (dB) |
|----------------|-----------------|----------------------------|----------------------|--------------------|
| -- | -- | -- | -- | >20 |

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

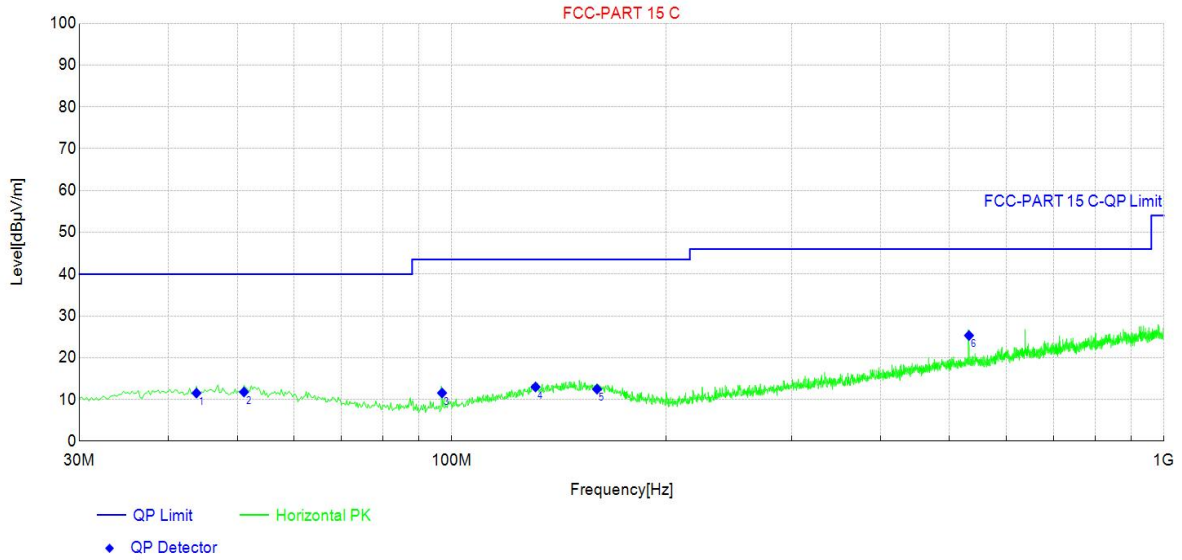
Distance extrapolation factor = $40\log(\text{Specific distance/ test distance})$ (dB);
Limit line = Specific limits (dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots, Low Channel (2402MHz) Worst case GFSK for record:



Test plot for Horizontal

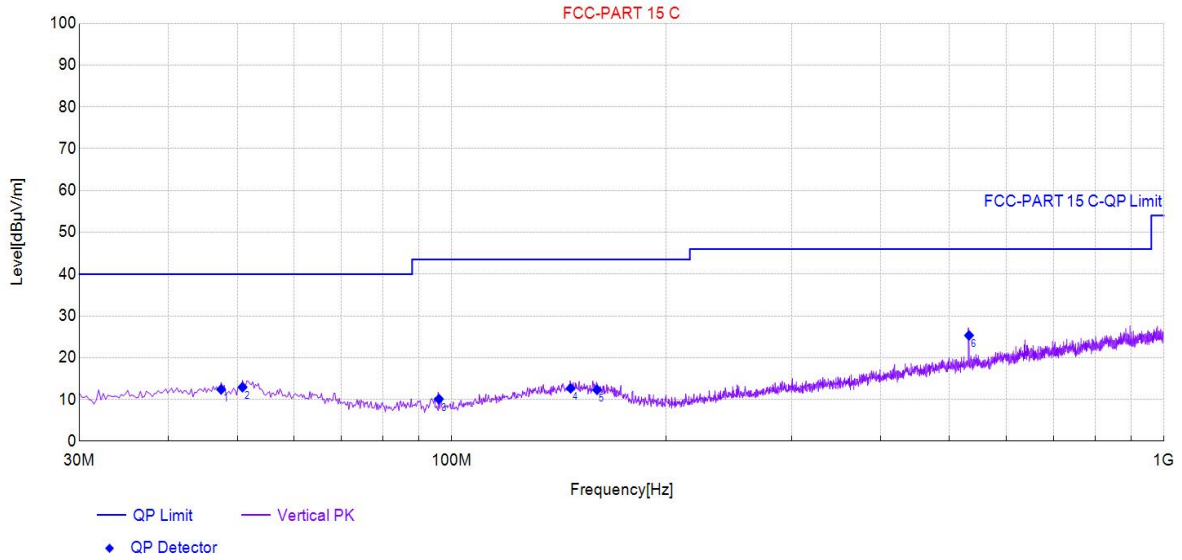


| Final Data List[QP] | | | | | | | | |
|---------------------|-------------|-------------------|---------------|-------------------|-------------------|----------------|------------|---------|
| NO. | Freq. [MHz] | QP Reading [dBµV] | Factor [dB/m] | QP Value [dBµV/m] | QP Limit [dBµV/m] | QP Margin [dB] | Polarity | Verdict |
| 1 | 43.82 | 28.1 | -16.56 | 11.54 | 40.00 | 28.46 | Horizontal | PASS |
| 2 | 51.10 | 28.15 | -16.34 | 11.81 | 40.00 | 28.19 | Horizontal | PASS |
| 3 | 96.93 | 31.88 | -20.31 | 11.57 | 43.50 | 31.93 | Horizontal | PASS |
| 4 | 131.12 | 29.47 | -16.46 | 13.01 | 43.50 | 30.49 | Horizontal | PASS |
| 5 | 159.98 | 27.82 | -15.32 | 12.50 | 43.50 | 31.00 | Horizontal | PASS |
| 6 | 532.46 | 34.57 | -9.25 | 25.32 | 46.00 | 20.68 | Horizontal | PASS |

Remark: Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor



Test plot for Vertical



| Final Data List[QP] | | | | | | | | |
|---------------------|--------------|-------------------|---------------|-------------------|-------------------|----------------|----------|---------|
| NO. | Fre q. [MHz] | QP Reading [dBµV] | Factor [dB/m] | QP Value [dBµV/m] | QP Limit [dBµV/m] | QP Margin [dB] | Polarity | Verdict |
| 1 | 47.46 | 28.98 | -16.56 | 12.42 | 40.00 | 27.58 | Vertical | PASS |
| 2 | 50.86 | 29.31 | -16.35 | 12.96 | 40.00 | 27.04 | Vertical | PASS |
| 3 | 95.96 | 30.5 | -20.38 | 10.12 | 43.50 | 33.38 | Vertical | PASS |
| 4 | 146.89 | 28.02 | -15.33 | 12.69 | 43.50 | 30.81 | Vertical | PASS |
| 5 | 159.98 | 27.64 | -15.32 | 12.32 | 43.50 | 31.18 | Vertical | PASS |
| 6 | 532.46 | 34.59 | -9.25 | 25.34 | 46.00 | 20.66 | Vertical | PASS |

Remark: Emission Level = Reading + Cable Loss + ANT Factor - AMP Factor



Test Frequency 1GHz-25GHz

Bluetooth (GFSK, Pi/4-DQPSK, 8DPSK) mode have been tested, and the worst result GFSK mode was report as below:

| Test Mode: CH00 GFSK | | | | | Test channel: Lowest | | | |
|----------------------|-------------------|-----------------------|-----------------|--------------------|----------------------|----------------|-----------------|------|
| Peak Value | | | | | | | | |
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. |
| 4804 | 45.21 | 34.04 | 6.58 | 34.09 | 51.74 | 74 | -22.26 | V |
| 7206 | 41.99 | 37.11 | 7.73 | 34.5 | 52.33 | 74 | -21.67 | V |
| 9608 | 38.81 | 39.31 | 9.23 | 34.79 | 52.56 | 74 | -21.44 | V |
| 4804 | 45.38 | 34.04 | 6.58 | 34.09 | 51.91 | 74 | -22.09 | H |
| 7206 | 36.51 | 37.11 | 7.73 | 34.5 | 46.85 | 74 | -27.15 | H |
| 9608 | 39.02 | 39.31 | 9.23 | 34.79 | 52.77 | 74 | -21.23 | H |
| Average Value | | | | | | | | |
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. |
| 4804 | 34.24 | 34.04 | 6.58 | 34.09 | 40.77 | 54 | -13.23 | V |
| 7206 | 28.01 | 37.11 | 7.73 | 34.5 | 38.35 | 54 | -15.65 | V |
| 9608 | 24.56 | 39.31 | 9.23 | 34.79 | 38.31 | 54 | -15.69 | V |
| 4804 | 31.90 | 34.04 | 6.58 | 34.09 | 38.43 | 54 | -15.57 | H |
| 7206 | 28.06 | 37.11 | 7.73 | 34.5 | 38.40 | 54 | -15.60 | H |
| 9608 | 24.71 | 39.31 | 9.23 | 34.79 | 38.46 | 54 | -15.54 | H |



| Test Mode: CH39 GFSK | | | | | Test channel: Middle | | | |
|----------------------|-------------------|-----------------------|-----------------|--------------------|----------------------|----------------|-----------------|------|
| Peak Value | | | | | | | | |
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. |
| 4882 | 41.69 | 34.38 | 6.69 | 34.09 | 48.67 | 74 | -25.33 | V |
| 7323 | 38.71 | 37.22 | 7.78 | 34.53 | 49.18 | 74 | -24.82 | V |
| 9764 | 35.37 | 39.46 | 9.35 | 34.8 | 49.38 | 74 | -24.62 | V |
| 4882 | 43.58 | 34.38 | 6.69 | 34.09 | 50.56 | 74 | -23.44 | H |
| 7323 | 38.00 | 37.22 | 7.78 | 34.53 | 48.47 | 74 | -25.53 | H |
| 9764 | 35.48 | 39.46 | 9.35 | 34.8 | 49.49 | 74 | -24.51 | H |
| Average Value | | | | | | | | |
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. |
| 4882 | 34.29 | 34.38 | 6.69 | 34.09 | 41.27 | 54 | -12.73 | V |
| 7323 | 27.39 | 37.22 | 7.78 | 34.53 | 37.86 | 54 | -16.14 | V |
| 9764 | 24.19 | 39.46 | 9.35 | 34.8 | 38.20 | 54 | -15.80 | V |
| 4882 | 33.97 | 34.38 | 6.69 | 34.09 | 40.95 | 54 | -13.05 | H |
| 7323 | 26.81 | 37.22 | 7.78 | 34.53 | 37.28 | 54 | -16.72 | H |
| 9764 | 25.48 | 39.46 | 9.35 | 34.8 | 39.49 | 54 | -14.51 | H |



| Test Mode: CH78 GFSK | | | | | Test channel: Highest | | | |
|----------------------|-------------------|-----------------------|-----------------|--------------------|-----------------------|----------------|-----------------|------|
| Peak Value | | | | | | | | |
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. |
| 4960 | 42.23 | 34.72 | 6.79 | 34.09 | 49.65 | 74 | -24.35 | V |
| 7440 | 40.96 | 37.34 | 7.82 | 34.57 | 51.55 | 74 | -22.45 | V |
| 9920 | 33.90 | 39.62 | 9.46 | 34.81 | 48.17 | 74 | -25.83 | V |
| 4960 | 41.23 | 34.72 | 6.79 | 34.09 | 48.65 | 74 | -25.35 | H |
| 7440 | 37.15 | 37.34 | 7.82 | 34.57 | 47.74 | 74 | -26.26 | H |
| 9920 | 37.59 | 39.62 | 9.46 | 34.81 | 51.86 | 74 | -22.14 | H |
| Average Value | | | | | | | | |
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Pol. |
| 4960 | 32.89 | 34.72 | 6.79 | 34.09 | 40.31 | 54 | -13.69 | V |
| 7440 | 28.95 | 37.34 | 7.82 | 34.5 | 39.61 | 54 | -14.39 | V |
| 9920 | 24.84 | 39.62 | 9.46 | 34.79 | 39.13 | 54 | -14.87 | V |
| 4960 | 32.12 | 34.72 | 6.79 | 34.09 | 39.54 | 54 | -14.46 | H |
| 7440 | 27.42 | 37.34 | 7.82 | 34.5 | 38.08 | 54 | -15.92 | H |
| 9920 | 26.36 | 39.62 | 9.46 | 34.79 | 40.65 | 54 | -13.35 | H |

Note:

1. The testing has been conformed to 10*2480MHz=24800MHz.
2. All other emissions more than 30dB below the limit.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Emission Level = Reading + Factor

Over Limit =Emission Level-Limit



Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

Bluetooth (GFSK, Pi/4-DQPSK, 8DPSK)mode have been tested, and the worst result GFSK model was report as below

| Test Mode: Low Channel 2402MHz | | | | | | | | | |
|--------------------------------|-------------------|-----------------------|-----------------|--------------------|----------------|----------------|-----------|--------------|------------|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over (dB) | Polarity H/V | Test Value |
| 2390 | 48.93 | 29.15 | 3.41 | 34.01 | 47.48 | 74 | -26.52 | H | Peak |
| 2400 | 59.55 | 29.16 | 3.43 | 34.01 | 58.13 | 74 | -15.87 | H | Peak |
| 2390 | 47.36 | 29.15 | 3.41 | 34.01 | 45.91 | 74 | -28.09 | V | Peak |
| 2400 | 54.97 | 29.16 | 3.43 | 34.01 | 53.55 | 74 | -20.45 | V | Peak |
| 2390 | 40.54 | 29.15 | 3.41 | 34.01 | 39.09 | 54 | -14.91 | H | AV |
| 2400 | 43.13 | 29.16 | 3.43 | 34.01 | 41.71 | 54 | -12.29 | H | AV |
| 2390 | 39.04 | 29.15 | 3.41 | 34.01 | 37.59 | 54 | -16.41 | V | AV |
| 2400 | 45.25 | 29.16 | 3.43 | 34.01 | 43.83 | 54 | -10.17 | V | AV |

| Test Mode: High Channel 2480MHz | | | | | | | | | |
|---------------------------------|-------------------|-----------------------|-----------------|--------------------|----------------|----------------|-----------|--------------|------------|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over (dB) | Polarity H/V | Test Value |
| 2483.5 | 59.69 | 29.28 | 3.53 | 34.03 | 58.47 | 74 | -15.53 | H | Peak |
| 2500 | 48.76 | 29.30 | 3.56 | 34.03 | 47.59 | 74 | -26.41 | H | Peak |
| 2483.5 | 59.71 | 29.28 | 3.53 | 34.03 | 58.49 | 74 | -15.51 | V | Peak |
| 2500 | 48.76 | 29.30 | 3.56 | 34.03 | 47.59 | 74 | -26.41 | V | Peak |
| 2483.5 | 41.01 | 29.28 | 3.53 | 34.03 | 39.79 | 54 | -14.21 | H | AV |
| 2500 | 39.16 | 29.30 | 3.56 | 34.03 | 37.99 | 54 | -16.01 | H | AV |
| 2483.5 | 43.80 | 29.28 | 3.53 | 34.03 | 42.58 | 54 | -11.42 | V | AV |
| 2500 | 39.37 | 29.30 | 3.56 | 34.03 | 38.20 | 54 | -15.80 | V | AV |

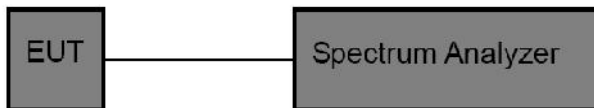


8 Maximum Peak Output Power Test

8.1 Test Standard and Limit

| | |
|---------------|------------------------------------|
| Test Standard | FCC Part15 C Section 15.247 (b)(3) |
| Test Limit | 125mW |

8.2 Test Setup



8.3 Test Procedure

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 D01 15.247 Meas Guidance v05 section 8.3.1.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.



8.4 Test Data

| | | | | | |
|--------------|---|------------------------|-------------|---|------------------|
| Test Item | : | Max. peak output power | Test Mode | : | CH Low ~ CH High |
| Test Voltage | : | 3.7V | Temperature | : | 24.5°C |
| Test Result | : | PASS | Humidity | : | 55%RH |

| Test Mode | Antenna | Frequency[MHz] | Conducted Peak Power[dBm] | Conducted Limit[dBm] | Verdict |
|-----------|---------|----------------|---------------------------|----------------------|---------|
| DH5 | Ant1 | 2402 | 3.94 | ≤30 | PASS |
| DH5 | Ant1 | 2441 | 3.94 | ≤30 | PASS |
| DH5 | Ant1 | 2480 | 2.9 | ≤30 | PASS |
| 2DH5 | Ant1 | 2402 | 4.61 | ≤20.97 | PASS |
| 2DH5 | Ant1 | 2441 | 4.56 | ≤20.97 | PASS |
| 2DH5 | Ant1 | 2480 | 3.36 | ≤20.97 | PASS |
| 3DH5 | Ant1 | 2402 | 5.05 | ≤20.97 | PASS |
| 3DH5 | Ant1 | 2441 | 4.99 | ≤20.97 | PASS |
| 3DH5 | Ant1 | 2480 | 3.78 | ≤20.97 | PASS |

Test Graphs:



DH5-Ant1-2402-PASS



DH5-Ant1-2441-PASS



DH5-Ant1-2480-PASS



2DH5-Ant1-2402-PASS



2DH5-Ant1-2441-PASS



2DH5-Ant1-2480-PASS



3DH5-Ant1-2402-PASS



3DH5-Ant1-2441-PASS



3DH5-Ant1-2480-PASS

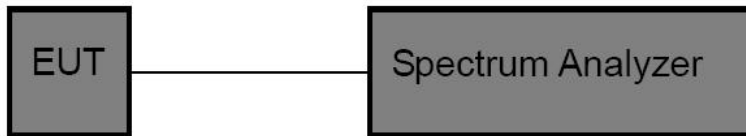


9 20DB Occupy Bandwidth Test

9.1 Test Standard

| | |
|---------------|------------------------------------|
| Test Standard | FCC Part15 C Section 15.247 (a)(1) |
|---------------|------------------------------------|

9.2 Test Setup



9.3 Test Procedure

Using the following spectrum analyzer settings:

1. Span= approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel.
2. Set the RBW = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

9.4 Test Data

| | | | |
|--------------|-----------|-------------|--------------------|
| Test Item | : 20dB BW | Test Mode | : CH Low ~ CH High |
| Test Voltage | : 3.7V | Temperature | : 24.5°C |
| Test Result | : PASS | Humidity | : 55%RH |



| TestMode | Antenna | Frequency[MHz] | 20db EBW[MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|----------|---------|----------------|---------------|----------|----------|------------|---------|
| DH5 | Ant1 | 2402 | 0.966 | 2401.616 | 2402.582 | --- | --- |
| DH5 | Ant1 | 2441 | 0.963 | 2440.619 | 2441.582 | --- | --- |
| DH5 | Ant1 | 2480 | 0.957 | 2479.622 | 2480.579 | --- | --- |
| 2DH5 | Ant1 | 2402 | 1.296 | 2401.448 | 2402.744 | --- | --- |
| 2DH5 | Ant1 | 2441 | 1.374 | 2440.400 | 2441.774 | --- | --- |
| 2DH5 | Ant1 | 2480 | 1.308 | 2479.436 | 2480.744 | --- | --- |
| 3DH5 | Ant1 | 2402 | 1.287 | 2401.433 | 2402.720 | --- | --- |
| 3DH5 | Ant1 | 2441 | 1.317 | 2440.433 | 2441.750 | --- | --- |
| 3DH5 | Ant1 | 2480 | 1.311 | 2479.433 | 2480.744 | --- | --- |

Test Graphs:



DH5-Ant1-2402



DH5-Ant1-2441



DH5-Ant1-2480



2DH5-Ant1-2402



2DH5-Ant1-2441



2DH5-Ant1-2480



3DH5-Ant1-2402



3DH5-Ant1-2441



3DH5-Ant1-2480

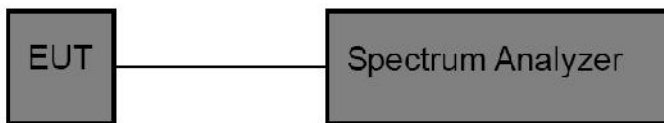


10 Carrier Frequency Separation Test

10.1 Test Standard and Limit

| | |
|---------------|--|
| Test Standard | FCC Part15 C Section 15.247 (a)(1) |
| Test Limit | >25KHz or >two-thirds of the 20 dB bandwidth |

10.2 Test Setup



10.3 Test Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer settings:

1. Span= Wide enough to capture the peaks of two adjacent channels
2. Set the RBW = 300 kHz.
3. Set the VBW = 300 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

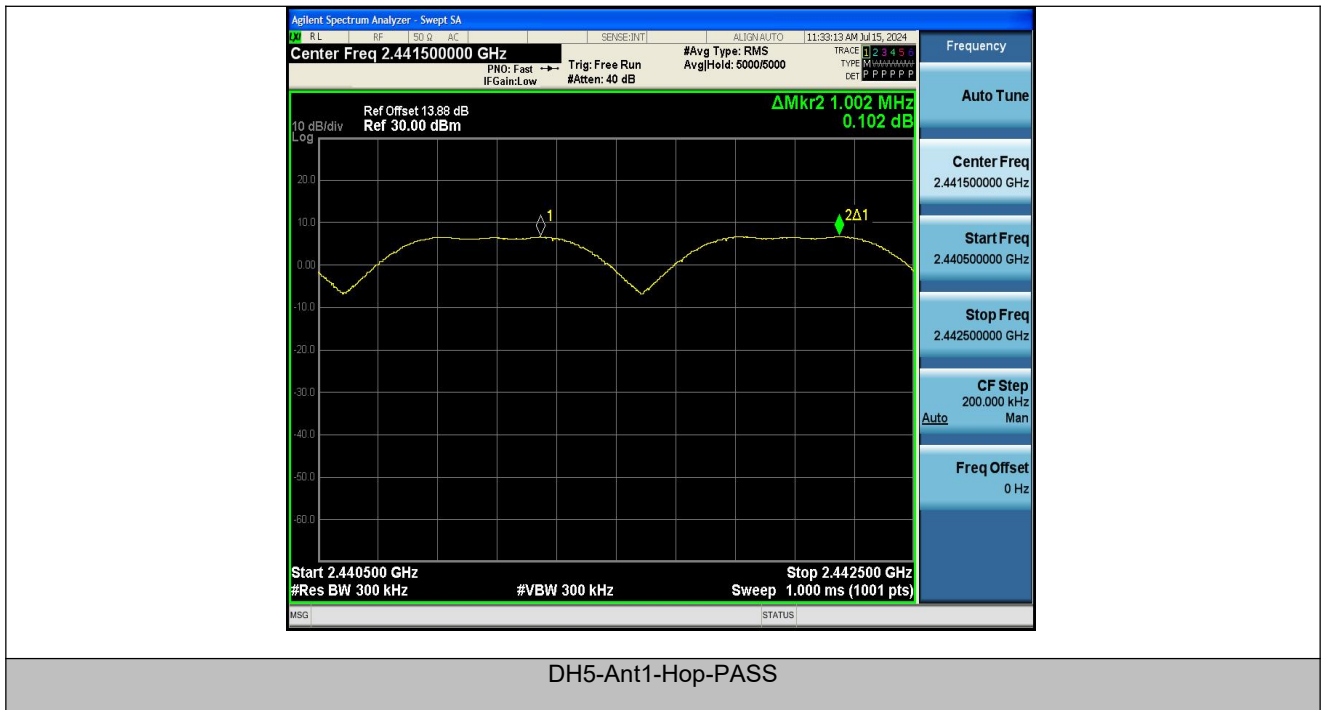
10.4 Test Data

| | | | |
|--------------|------------------------|-------------|--------------------|
| Test Item | : Frequency Separation | Test Mode | : CH Low ~ CH High |
| Test Voltage | : 3.7V | Temperature | : 24.5°C |
| Test Result | : PASS | Humidity | : 55%RH |



| TestMode | Antenna | Frequency[MHz] | Result[MHz] | Limit[MHz] | Verdict |
|----------|---------|----------------|-------------|------------|---------|
| DH5 | Ant1 | Hop | 1.002 | ≥0.966 | PASS |
| 2DH5 | Ant1 | Hop | 1.186 | ≥0.916 | PASS |
| 3DH5 | Ant1 | Hop | 1.314 | ≥0.878 | PASS |

Test Graphs:





2DH5-Ant1-Hop-PASS



3DH5-Ant1-Hop-PASS

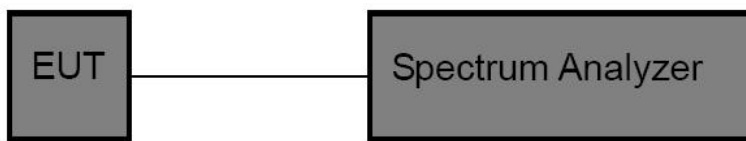


11 Number of Hopping Channel Test

11.1 Test Standard and Limit

| | |
|---------------|------------------------------------|
| Test Standard | FCC Part15 C Section 15.247 (a)(1) |
| Test Limit | >15 channels |

11.2 Test Setup



11.3 Test Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = 300kHz.
3. Set the VBW = 300kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

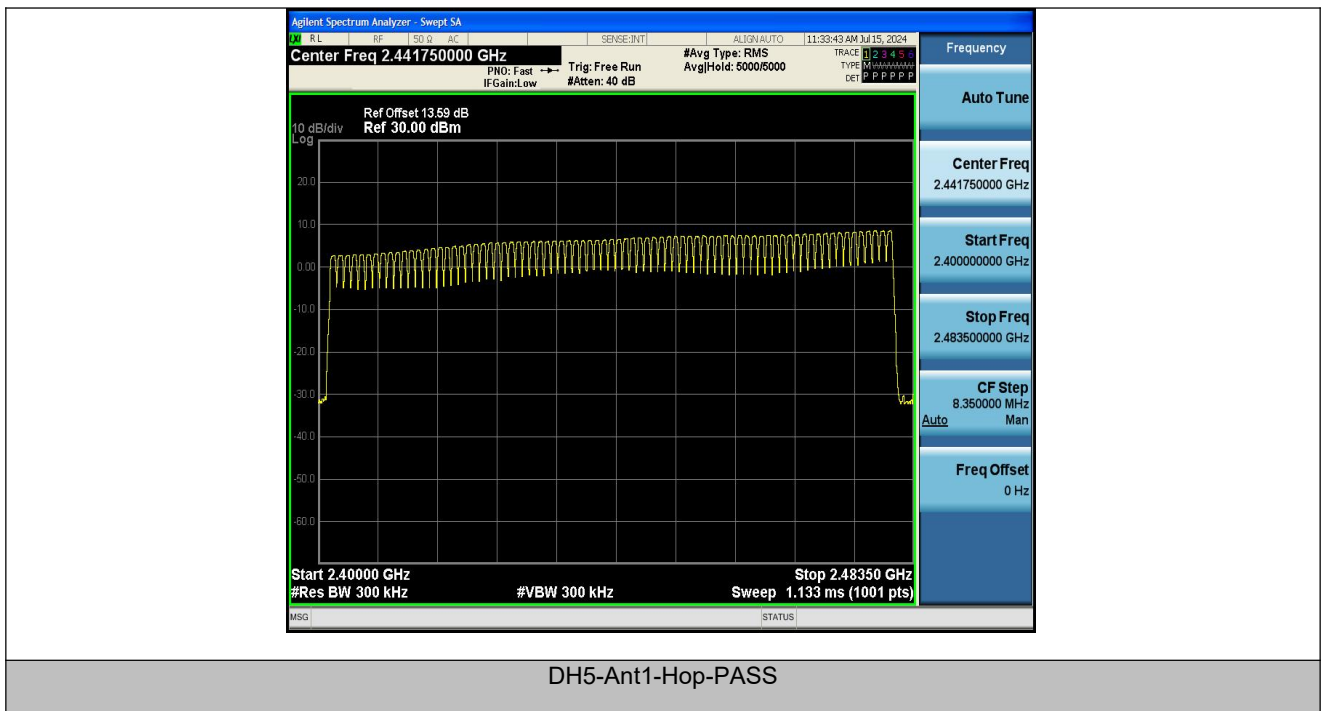


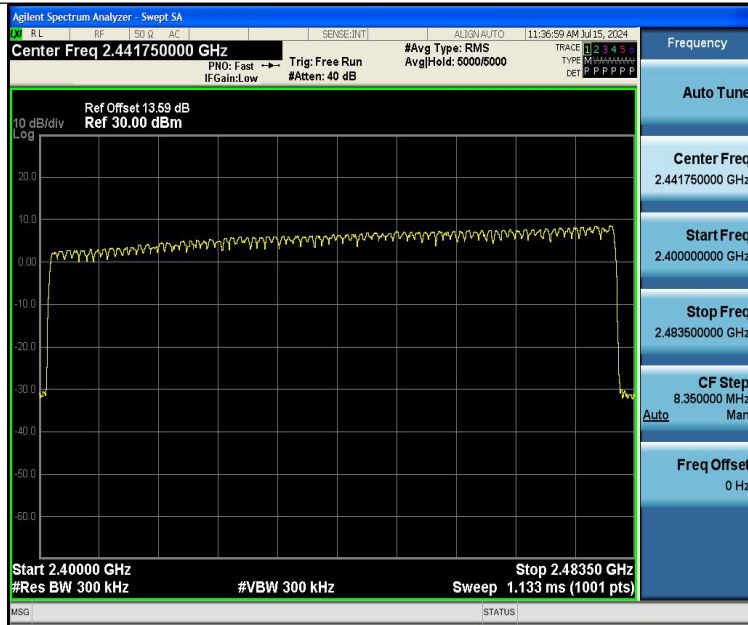
11.4 Test Data

| | | | |
|--------------|-------------------------------|-------------|--------------------|
| Test Item | : Number of Hopping Frequency | Test Mode | : CH Low ~ CH High |
| Test Voltage | : 3.7V | Temperature | : 24.5°C |
| Test Result | : PASS | Humidity | : 55%RH |

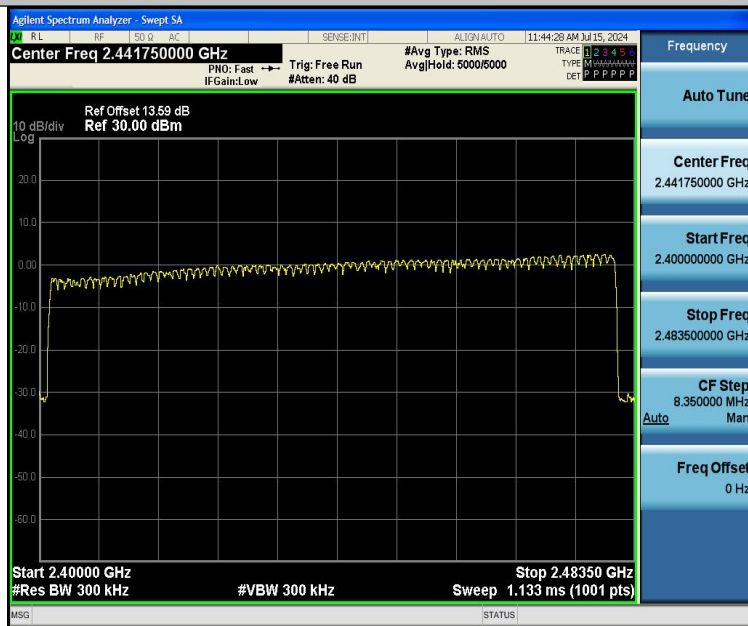
| TestMode | Antenna | Frequency[MHz] | Result[Num] | Limit[Num] | Verdict |
|----------|---------|----------------|-------------|------------|---------|
| DH5 | Ant1 | Hop | 79 | ≥15 | PASS |
| 2DH5 | Ant1 | Hop | 79 | ≥15 | PASS |
| 3DH5 | Ant1 | Hop | 79 | ≥15 | PASS |

Test Graphs:





2DH5-Ant1-Hop-PASS



3DH5-Ant1-Hop-PASS

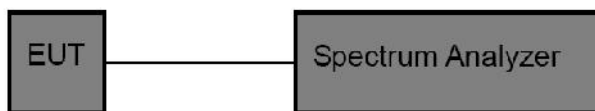


12 Dwell Time Test

12.1 Test Standard and Limit

| | |
|---------------|------------------------------------|
| Test Standard | FCC Part15 C Section 15.247 (a)(1) |
| Test Limit | 0.4 sec |

12.2 Test Setup



12.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span= zero span, centered on a hopping channel
2. Set the RBW = 1 MHz.
3. Set the VBW = 3 MHz.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.



12.4 Test Data

| | | | |
|--------------|---------------------|-------------|--------------------|
| Test Item | : Time of Occupancy | Test Mode | : CH Low ~ CH High |
| Test Voltage | : 3.7V | Temperature | : 24.5°C |
| Test Result | : PASS | Humidity | : 55%RH |

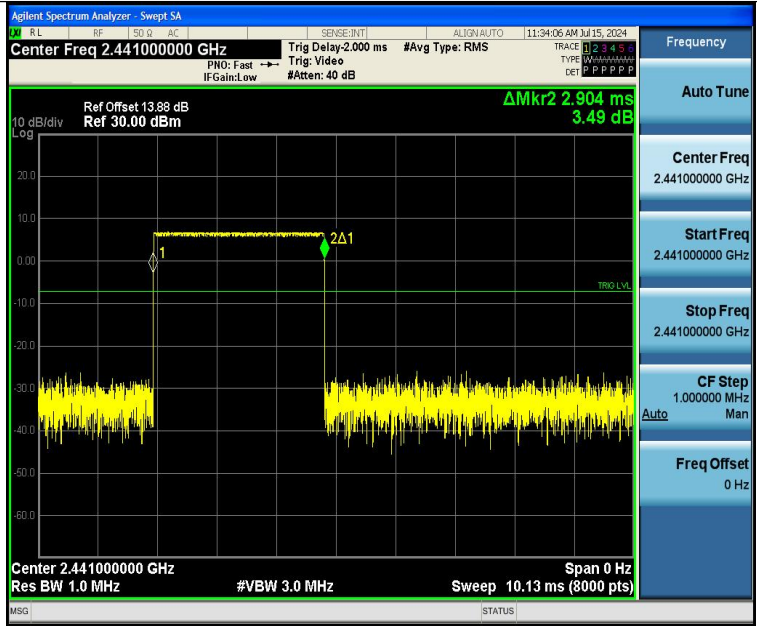
| TestMode | Antenna | Frequency[MHz] | BurstWidth [ms] | TotalHops [Num] | Result[s] | Limit[s] | Verdict |
|----------|---------|----------------|-----------------|-----------------|-----------|----------|---------|
| DH5 | Ant1 | Hop | 2.904 | 106.67 | 0.31 | ≤0.4 | PASS |
| DH1 | Ant1 | Hop | 0.402 | 320 | 0.129 | ≤0.4 | PASS |
| DH3 | Ant1 | Hop | 1.657 | 160 | 0.265 | ≤0.4 | PASS |
| 2DH5 | Ant1 | Hop | 2.911 | 106.67 | 0.311 | ≤0.4 | PASS |
| 2DH1 | Ant1 | Hop | 0.410 | 320 | 0.131 | ≤0.4 | PASS |
| 2DH3 | Ant1 | Hop | 1.662 | 160 | 0.266 | ≤0.4 | PASS |
| 3DH5 | Ant1 | Hop | 2.912 | 106.67 | 0.311 | ≤0.4 | PASS |
| 3DH1 | Ant1 | Hop | 0.410 | 320 | 0.131 | ≤0.4 | PASS |
| 3DH3 | Ant1 | Hop | 1.661 | 160 | 0.266 | ≤0.4 | PASS |

Note:

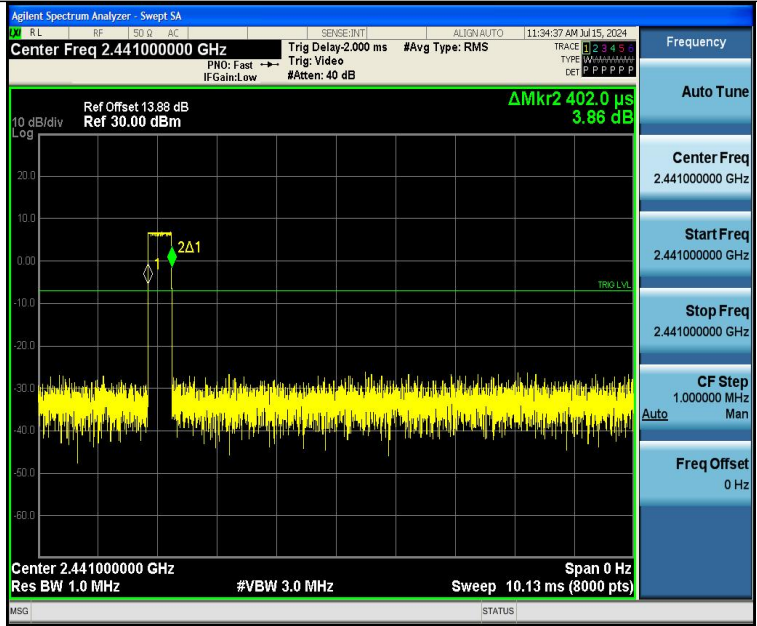
- 1.DH1/2DH1/3DH1 Dwell Time: Reading * (1600/2)*31.6/(channel number).
- 2.DH3/2DH3/3DH3 Dwell Time: Reading * (1600/4)*31.6/(channel number).
- 3.DH5/2DH5/3DH5 Dwell Time: Reading * (1600/6)*31.6/(channel number).



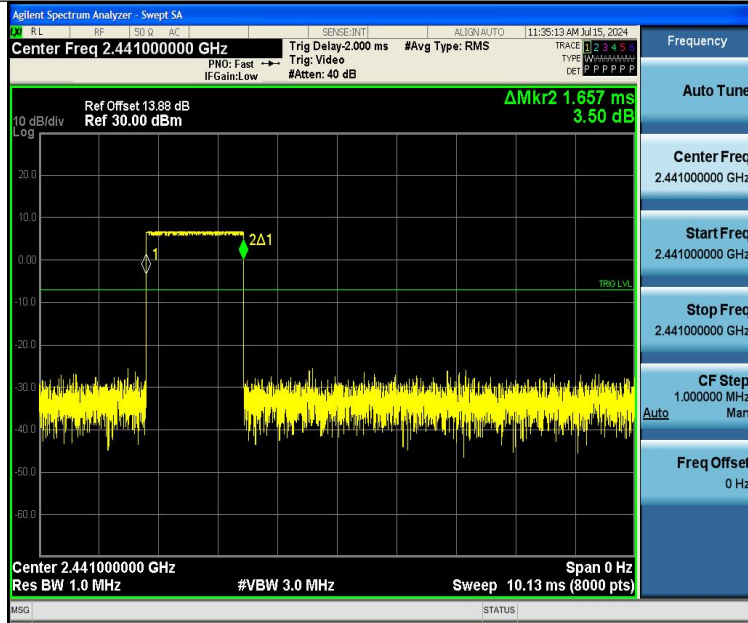
Test Graphs:



DH5-Ant1-Hop-PASS



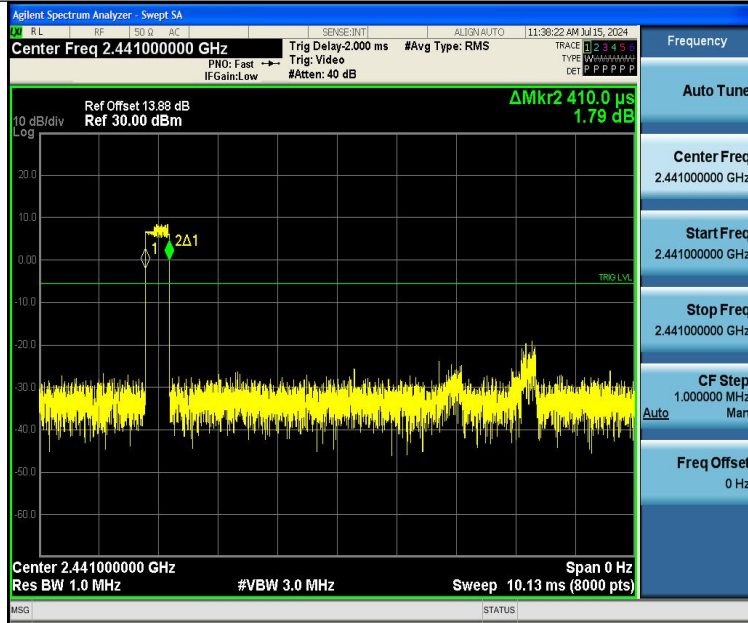
DH1-Ant1-Hop-PASS



DH3-Ant1-Hop-PASS



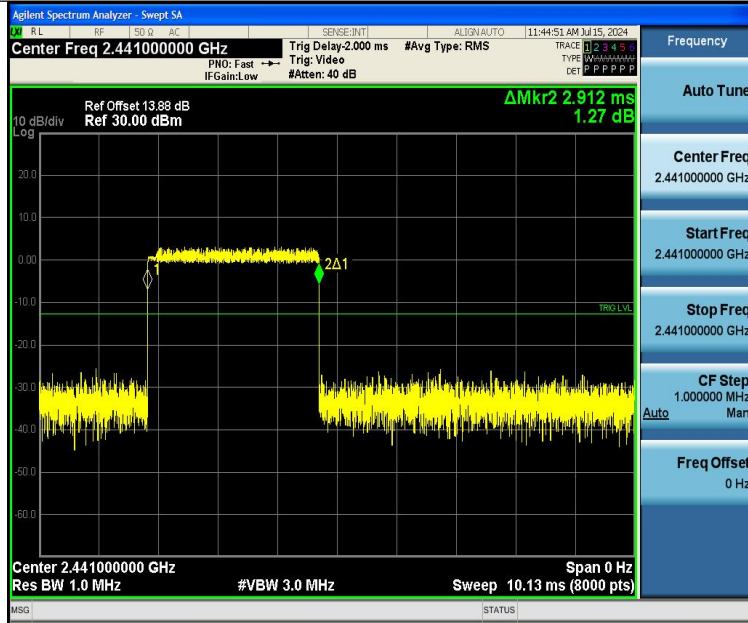
2DH5-Ant1-Hop-PASS



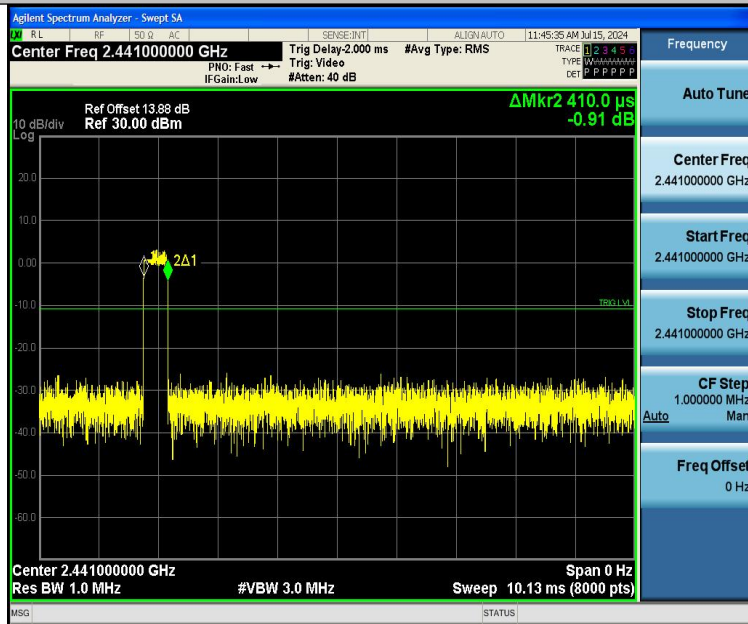
2DH1-Ant1-Hop-PASS



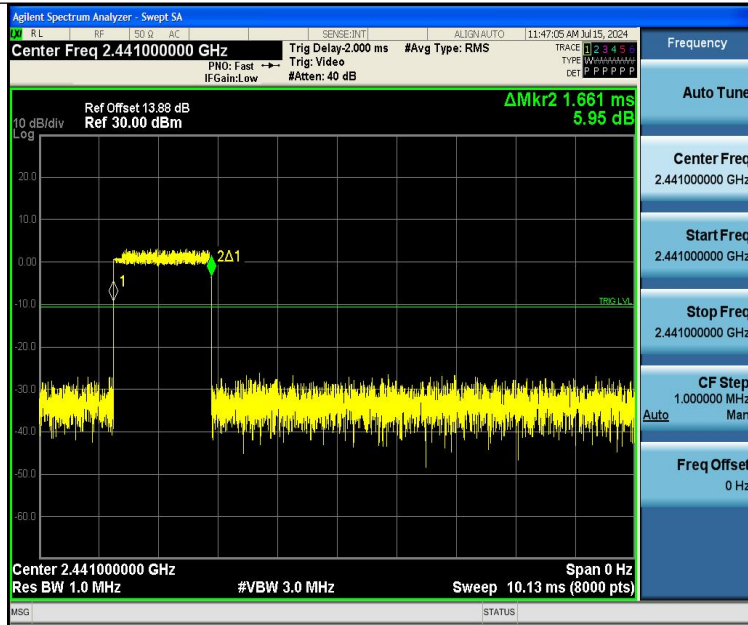
2DH3-Ant1-Hop-PASS



3DH5-Ant1-Hop-PASS



3DH1-Ant1-Hop-PASS



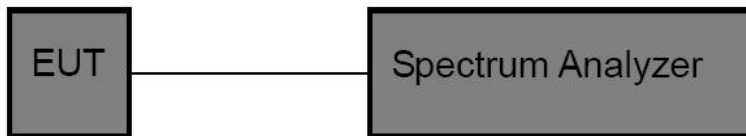
3DH3-Ant1-Hop-PASS

13 100kHz Bandwidth of Frequency Band Edge Requirement

13.1 Test Standard and Limit

| | |
|---------------|--|
| Test Standard | FCC Part15 C Section 15.247 (d) |
| Test Limit | in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, 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). |

13.2 Test Setup



13.3 Test Procedure

The EUT must have its hopping/Non-hopping function enabled. Using the following spectrum analyzer setting:

1. Set the RBW = 100kHz.
2. Set the VBW = 300kHz.
3. Sweep time = auto couple.
4. Detector function = peak.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.



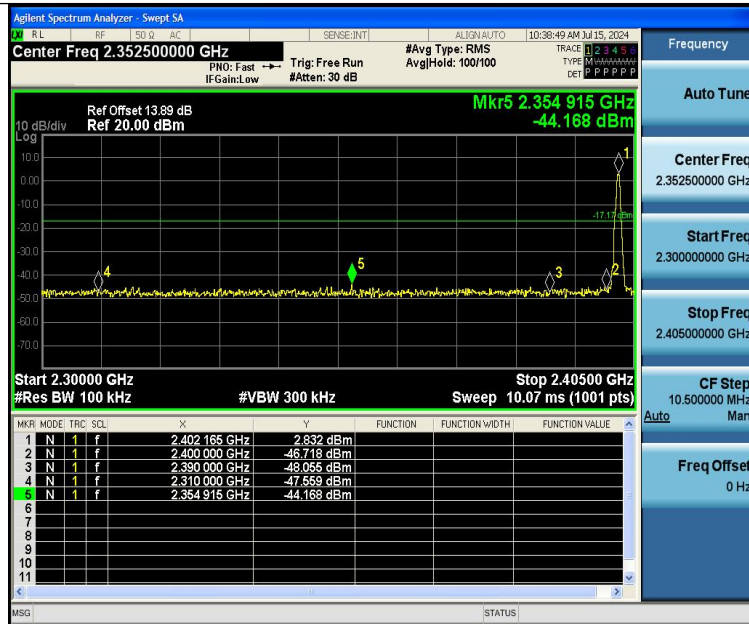
13.4 Test Data

| | | | |
|--------------|-------------|-------------|--------------------|
| Test Item | : Band edge | Test Mode | : CH Low ~ CH High |
| Test Voltage | : 3.7V | Temperature | : 24.5°C |
| Test Result | : PASS | Humidity | : 55%RH |

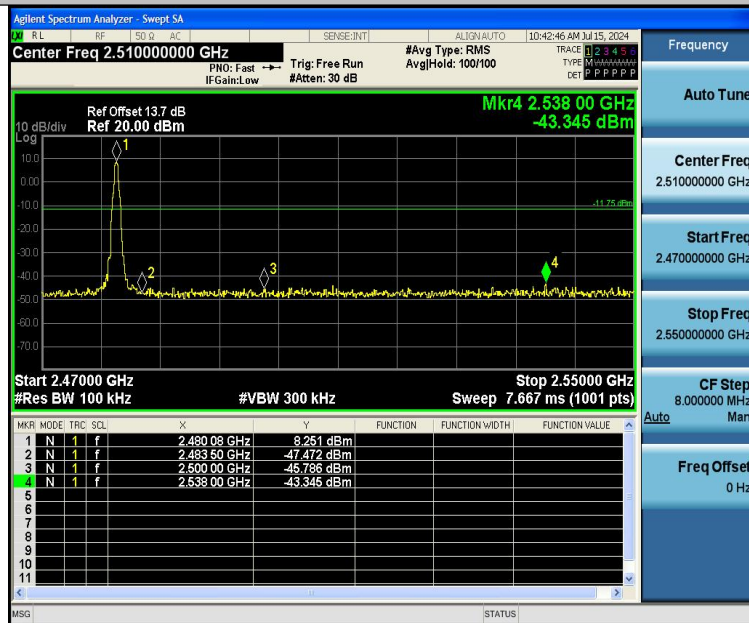
| TestMode | Antenna | ChName | Frequency[MHz] | RefLevel [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|----------|---------|--------|----------------|----------------|--------------|-------------|---------|
| DH5 | Ant1 | Low | 2402 | -3.29 | -44.91 | ≤-23.29 | PASS |
| DH5 | Ant1 | High | 2480 | 2.39 | -44.36 | ≤-17.62 | PASS |
| DH5 | Ant1 | Low | Hop_2402 | 2.93 | -43.96 | ≤-17.07 | PASS |
| DH5 | Ant1 | High | Hop_2480 | 2.34 | -43.57 | ≤-17.66 | PASS |
| 2DH5 | Ant1 | Low | 2402 | 2.97 | -44.67 | ≤-17.03 | PASS |
| 2DH5 | Ant1 | High | 2480 | 7.49 | -43.96 | ≤-12.52 | PASS |
| 2DH5 | Ant1 | Low | Hop_2402 | 2.58 | -44.5 | ≤-17.43 | PASS |
| 2DH5 | Ant1 | High | Hop_2480 | 1.80 | -43.31 | ≤-18.2 | PASS |
| 3DH5 | Ant1 | Low | 2402 | -5.95 | -44.42 | ≤-25.95 | PASS |
| 3DH5 | Ant1 | High | 2480 | 8.17 | -44 | ≤-11.83 | PASS |
| 3DH5 | Ant1 | High | Hop_2480 | 1.23 | -43.13 | ≤-18.77 | PASS |
| 3DH5 | Ant1 | Low | Hop_2402 | 2.81 | -44.28 | ≤-17.19 | PASS |



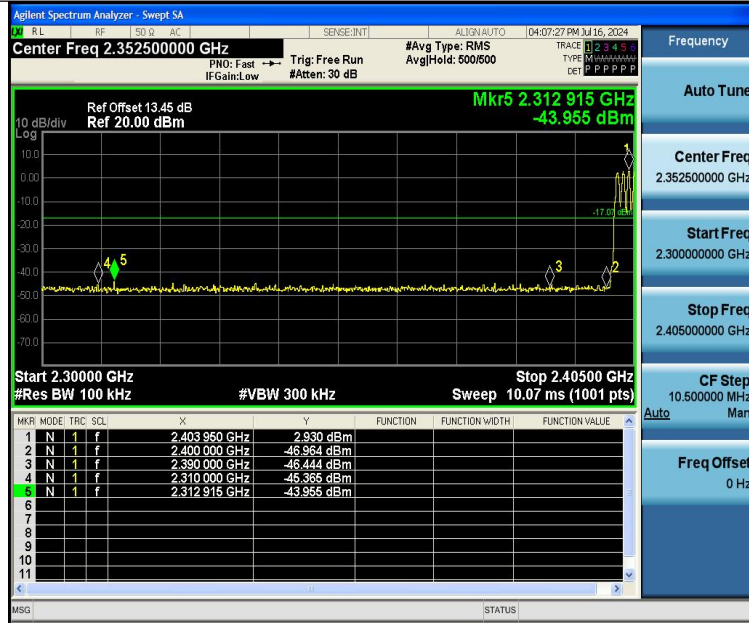
Test Graphs:



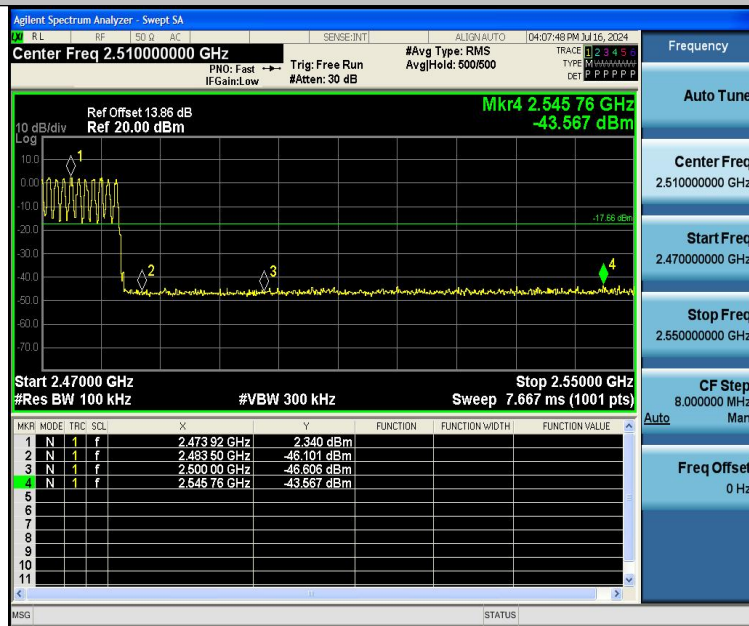
DH5-Ant1-2402-PASS



DH5-Ant1-2480-PASS



DH5-Ant1-Hop_2402-PASS



DH5-Ant1-Hop_2480-PASS