



FCC TEST REPORT

FCC ID: 2BA79-X6

| | | |
|--|---|---|
| Product Name | : | WIRELESS EARBUDS |
| Model Name | : | X6,X1,X5,X9,X10,X11,X12,X13,X15,X16,X18,X28,G40,G42,G16 |
| Brand Name | : | -- |
| Report No. | : | PTC23042404201E-FC01 |
| Sample Id | : | PTC23042404201E-01# |
| Prepared for | | |
| Shenzhen Yolax Acoustics Co.,Ltd. | | |
| 2F, Building 5,Hebei Industrial Area,Hualian Community,Longhua Street,Longhua,Shenzhen,China | | |
| Prepared by | | |
| Precise Testing & Certification Co., Ltd. | | |
| Building 1, No.6 Tongxin Road, Dongcheng Street, Dongguan,China | | |
| | | |



1 TEST RESULT CERTIFICATION

Applicant's name : Shenzhen Yolax Acoustics Co.,Ltd.
Address : 2F, Building 5,Hebei Industrial Area,Hualian Community,Longhua Street,Longhua,Shenzhen,China
Manufacture's name : Shenzhen Yolax Acoustics Co.,Ltd.
Address : 2F, Building 5,Hebei Industrial Area,Hualian Community,Longhua Street,Longhua,Shenzhen,China
Product name : WIRELESS EARBUDS
Model name : X6,X1,X5,X9,X10,X11,X12,X13,X15,X16,X18,X28,G40,G42,G16
Standards : FCC CFR47 Part 15 Section 15.247
Test procedure : ANSI C63.10:2013
Test Date : Apr.22, 2023 to May. 14, 2023
Date of Issue : May. 15, 2023
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 that reads 'Simon Pu'.

Simon Pu / Engineer

Technical Manager:

A handwritten signature in black ink that reads 'Ronnie Liu'.

Ronnie Liu / 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 | PASS |
| 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 |



Report No.: PTC23042404201E-FC01

3 TEST FACILITY

Precise Testing & Certification Co., Ltd.

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

FCC Registration Number: 790290

Designation Number: CN1219

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A

CAB identifier: CN0080



4 General Information

4.1 General Description of E.U.T.

| | | |
|---------------------|---|---|
| Product Name | : | WIRELESS EARBUDS |
| Model Name | : | X6,X1,X5,X9,X10,X11,X12,X13,X15,X16,X18,X28,G40,G42,G16 |
| Bluetooth Version | : | 5.3 |
| Operating frequency | : | 2402-2480MHz |
| Numbers of Channel | : | 79 channels |
| Type of Modulation | : | GFSK, $\pi/4$ -DQPSK |
| Antenna Type | : | Chip Antenna |
| Antenna Gain | : | 1.32 dBi |
| Power supply | : | DC 3.7V 35mAH lion battery |
| Hardware Version | : | V1.2 |
| Software Version | : | V1.2 |



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 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) |
|---------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| 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 | - | - |

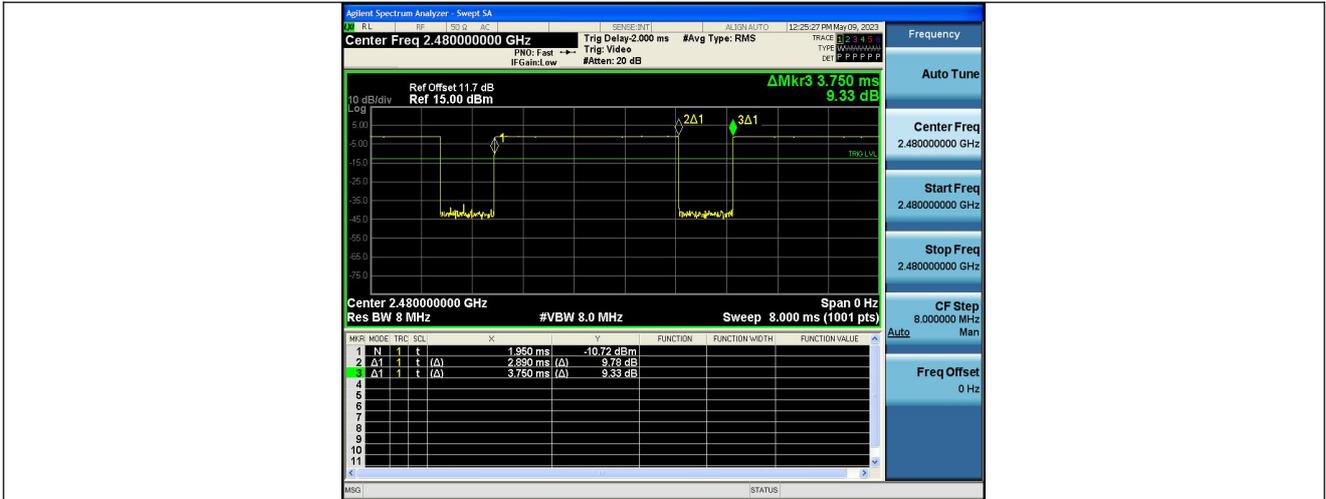
EUT was tested with channel 0, 39, 78.



Duty Cycle

| TestMode | Antenna | Frequency[M Hz] | ON Time [ms] | Period [ms] | Duty Cycle [%] | Duty Cycle Factor[dB] |
|----------|---------|-----------------|--------------|-------------|----------------|-----------------------|
| DH5 | Ant1 | 2402 | 2.89 | 3.76 | 76.86 | 1.14 |
| DH5 | Ant1 | 2441 | 2.89 | 3.75 | 77.07 | 1.13 |
| DH5 | Ant1 | 2480 | 2.89 | 3.75 | 77.07 | 1.13 |
| 2DH5 | Ant1 | 2402 | 2.89 | 3.75 | 77.07 | 1.13 |
| 2DH5 | Ant1 | 2441 | 2.89 | 3.76 | 76.86 | 1.14 |
| 2DH5 | Ant1 | 2480 | 2.89 | 3.75 | 77.07 | 1.13 |

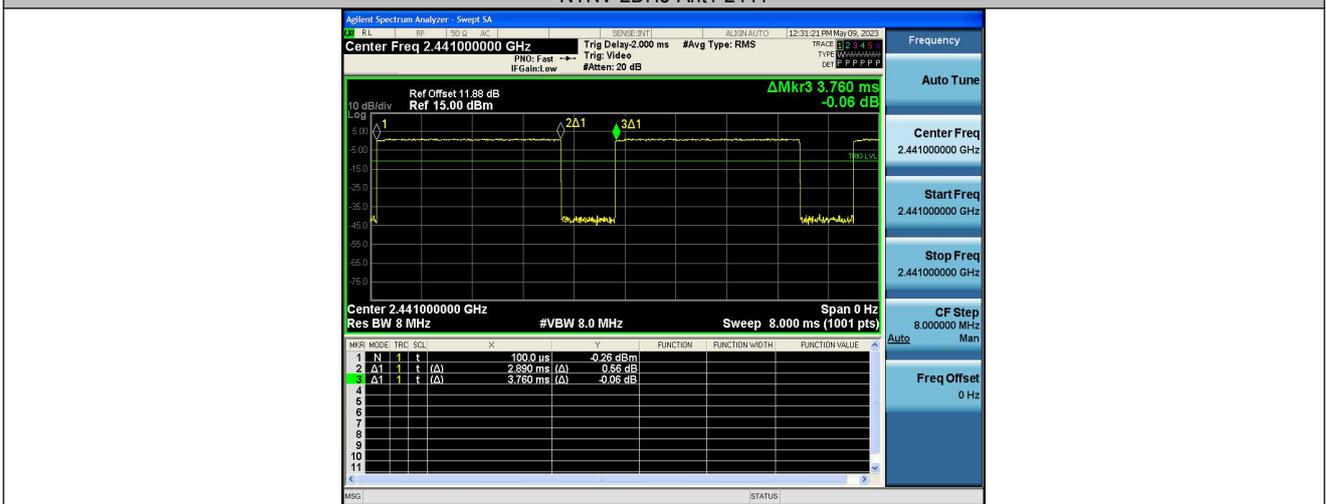




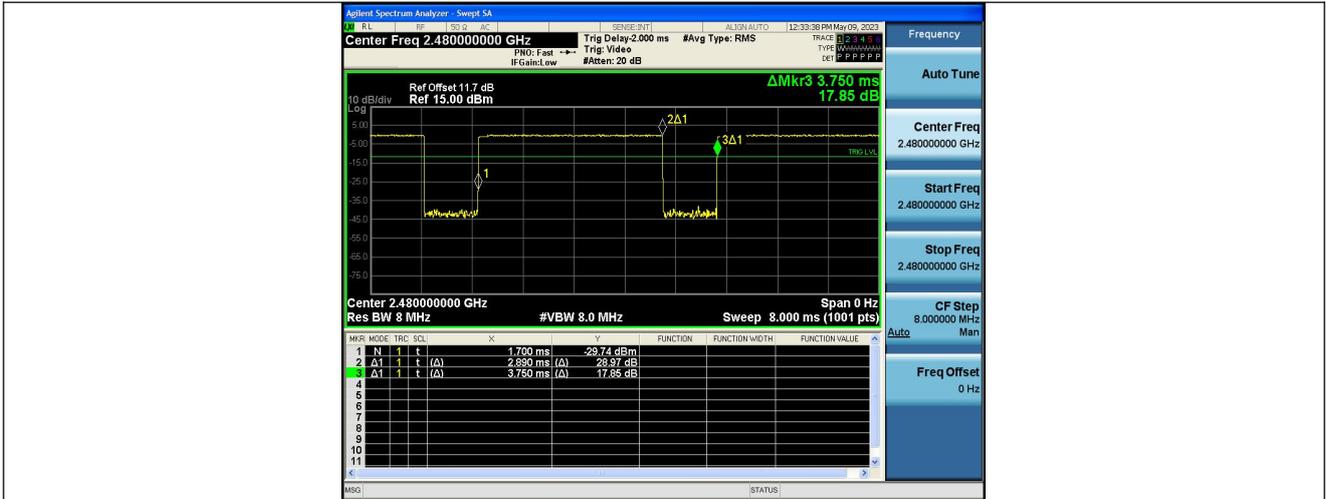
NTVN-2DH5-Ant1-2402



NTVN-2DH5-Ant1-2441



NTVN-2DH5-Ant1-2480





5 Equipment During Test

5.1 Equipments List

RF Conducted Test

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---------------------|-----------------|----------|------------|------------------------|-----------------|
| MXG Signal Analyzer | Agilent | N9020A | MY56070279 | 10Hz-30GHz | Aug21,2023 |
| Coaxial Cable | CDS | 79254 | 46107086 | 10Hz-30GHz | Aug21,2023 |
| Antenna Connector | Florida RF Labs | N/A | RF01# | N/A | Aug21,2023 |
| Scope | Tektronix | TDS3032B | B014131 | 300MHz BW; 2 way scope | Aug21,2023 |
| DC power | eTOMENS | eTM-1560 | -- | 15V 60A | Aug21,2023 |
| Power Meter | Anritsu | ML2495A | 0949003 | 300MHz-40GHz | Aug21,2023 |
| Power Sensor | Anritsu | MA2411B | 0917017 | 300MHz-40GHz | Aug21,2023 |

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

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|------------------------------|---------------|-----------|------------|-----------------|-----------------|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Aug21,2023 |
| Loop Antenna | Schwarzbeck | FMZB 1519 | 012 | 9 KHz -30MHz | Aug21,2023 |
| Bilog Antenna | SCHWARZBECK | VULB9160 | 9160-3355 | 25MHz-2GHz | Aug21,2023 |
| Preamplifier (low frequency) | SCHWARZBECK | BBV 9475 | 9745-0013 | 1MHz-1GHz | Aug21,2023 |
| Cable | Schwarzbeck | PLF-100 | 549489 | 9KHz-3GHz | Aug21,2023 |
| Spectrum Analyzer | Agilent | E4407B | MY45109572 | 9KHz-40GHz | Aug21,2023 |
| Horn Antenna | SCHWARZBECK | 9120D | 9120D-1246 | 1GHz-18GHz | Aug21,2023 |
| High NOISE AMPLIFIER | ZHINAN | ZN3380C | 15002 | 10KHz-18GHz | Aug21,2023 |
| Cable | H+S | CBL-26 | N/A | 1GHz-26.5GHz | Aug21,2023 |
| Spectrum Analyzer | Rohde&Schwarz | FSVR40 | 101003 | 10Hz-40GHz | Aug21,2023 |



| | | | | | |
|--------------|-------------|-----------------|-------|-------------|------------|
| Horn Antenna | SCHWARZBECK | BBHA9170 | 01066 | 15GHZ-40GHZ | Aug21,2023 |
| Preamplifier | SCHWARZBECK | BBV-9721 | 81 | 18GHZ-40GHZ | Aug21,2023 |
| Test S/W | Tonscend | JS32-RE/4.0.0.0 | | | |

Conducted Emissions

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|--------------------------|---------------|-----------------|------------|-----------------|-----------------|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Aug21,2023 |
| Artificial Mains Network | Rohde&Schwarz | L2-16B | 000WX31025 | 9KHz-300MHz | Aug21,2023 |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 102453 | 9KHz-300MHz | Aug21,2023 |
| Test S/W | Tonscend | JS32-CE/4.0.0.3 | | | |



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(30MHz~1GHz) | ±5.03dB |
| Radiated Emission(1GHz~25GHz) | ±4.74dB |
| Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95% | |



5.3 Description of Support Units

| Equipment | Model No. | Series No. |
|-----------|-----------|------------|
| adaptor | MDY-10-EX | -- |

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) |

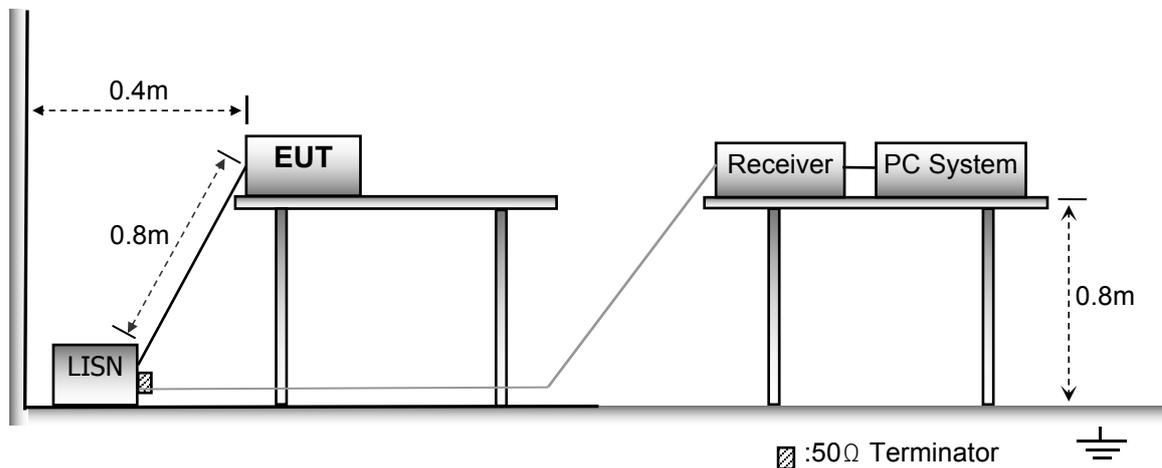
6.1 E.U.T. Operation

Operating Environment :

| | | |
|-----------------------|---|--------------|
| Temperature: | : | 25.5 °C |
| Humidity: | : | 51 % RH |
| Atmospheric Pressure: | : | 101.2kPa |
| Test Voltage | : | AC 120V/60Hz |

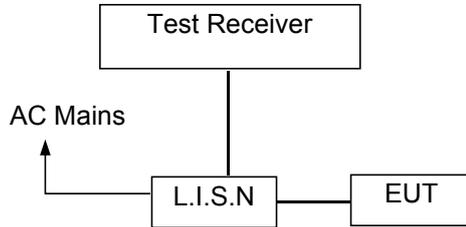
6.2 EUT Setup

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.

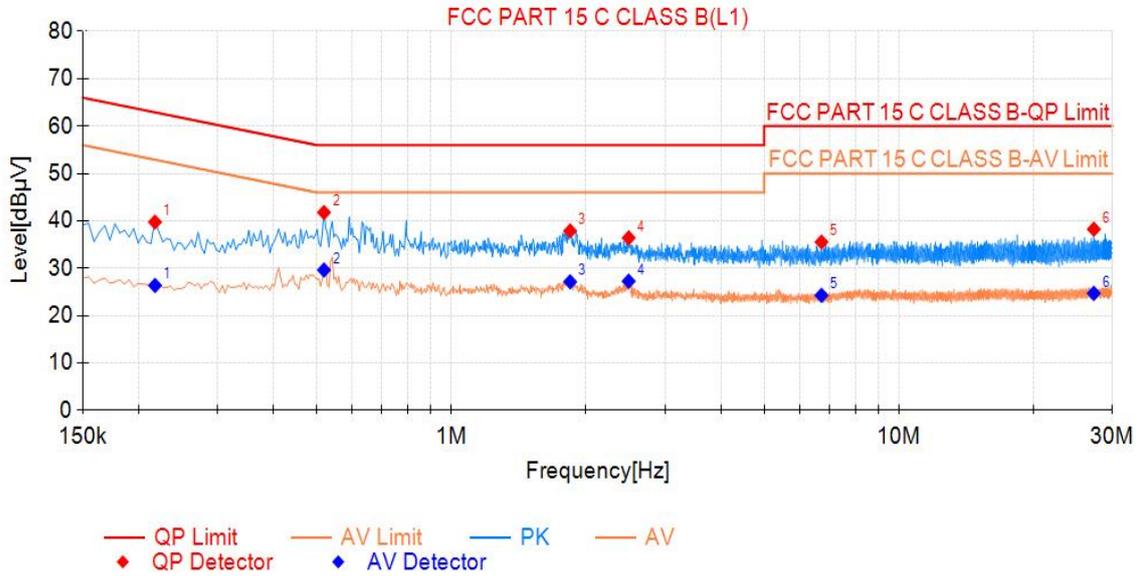
6.7 Conducted Emission Test Result

Pass.

All the modulation modes were tested the data of the worst mode (AC 120V/60Hz, GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.



Line -120V/60Hz:

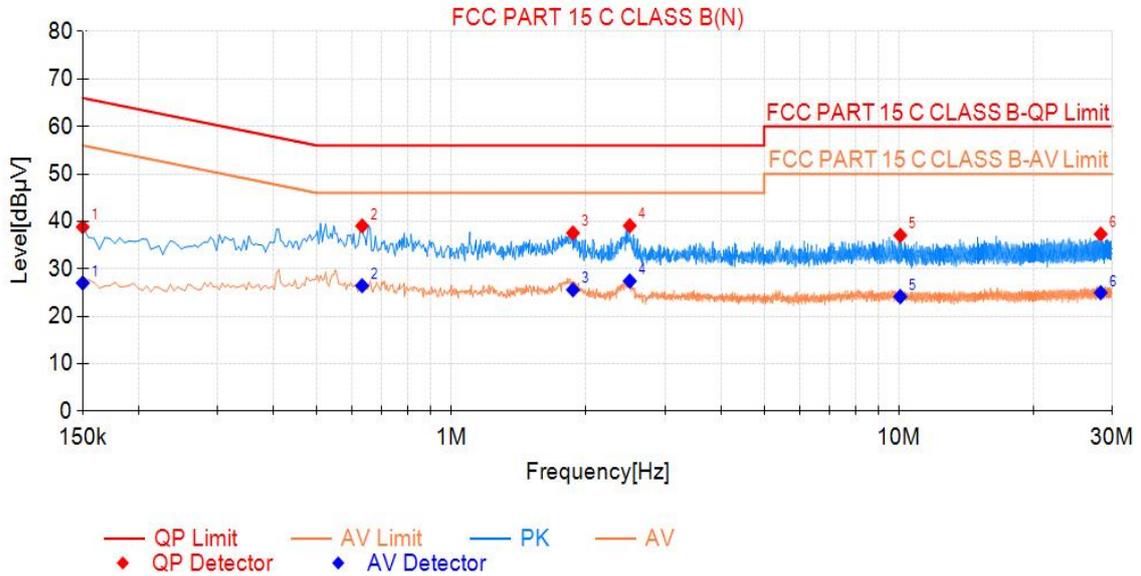


| Final Data List | | | | | | | | |
|-----------------|----------------|-------------|-------------|--------------|-------------|-------------|--------------|---------|
| NO. | Freq. [MHz] | QP Value | QP Limit | QP Margin | AV Value | AV Limit | AV Margin | Verdict |
| 1 | 0.218 | 39.75 | 62.91 | 23.16 | 26.37 | 52.91 | 26.54 | PASS |
| 2 | 0.519 | 41.78 | 56.00 | 14.22 | 29.63 | 46.00 | 16.37 | PASS |
| 3 | 1.842 | 37.88 | 56.00 | 18.12 | 27.14 | 46.00 | 18.86 | PASS |
| 4 | 2.490 | 36.42 | 56.00 | 19.58 | 27.27 | 46.00 | 18.73 | PASS |
| 5 | 6.716 | 35.55 | 60.00 | 24.45 | 24.29 | 50.00 | 25.71 | PASS |
| 6 | 27.272 | 38.25 | 60.00 | 21.75 | 24.71 | 50.00 | 25.29 | PASS |

Note: Level= Reading + Cable Loss + Factor



Neutral -120V/60Hz:



| Final Data List | | | | | | | | |
|-----------------|-------------|----------|----------|-----------|----------|----------|-----------|---------|
| NO. | Freq. [MHz] | QP Value | QP Limit | QP Margin | AV Value | AV Limit | AV Margin | Verdict |
| 1 | 0.150 | 38.84 | 66.00 | 27.16 | 27.02 | 56.00 | 28.98 | PASS |
| 2 | 0.632 | 39.06 | 56.00 | 16.94 | 26.46 | 46.00 | 19.54 | PASS |
| 3 | 1.869 | 37.57 | 56.00 | 18.43 | 25.59 | 46.00 | 20.41 | PASS |
| 4 | 2.504 | 39.11 | 56.00 | 16.89 | 27.43 | 46.00 | 18.57 | PASS |
| 5 | 10.073 | 37.06 | 60.00 | 22.94 | 24.15 | 50.00 | 25.85 | PASS |
| 6 | 28.257 | 37.33 | 60.00 | 22.67 | 24.98 | 50.00 | 25.02 | PASS |

Note: Level= Reading + Cable Loss + Factor



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

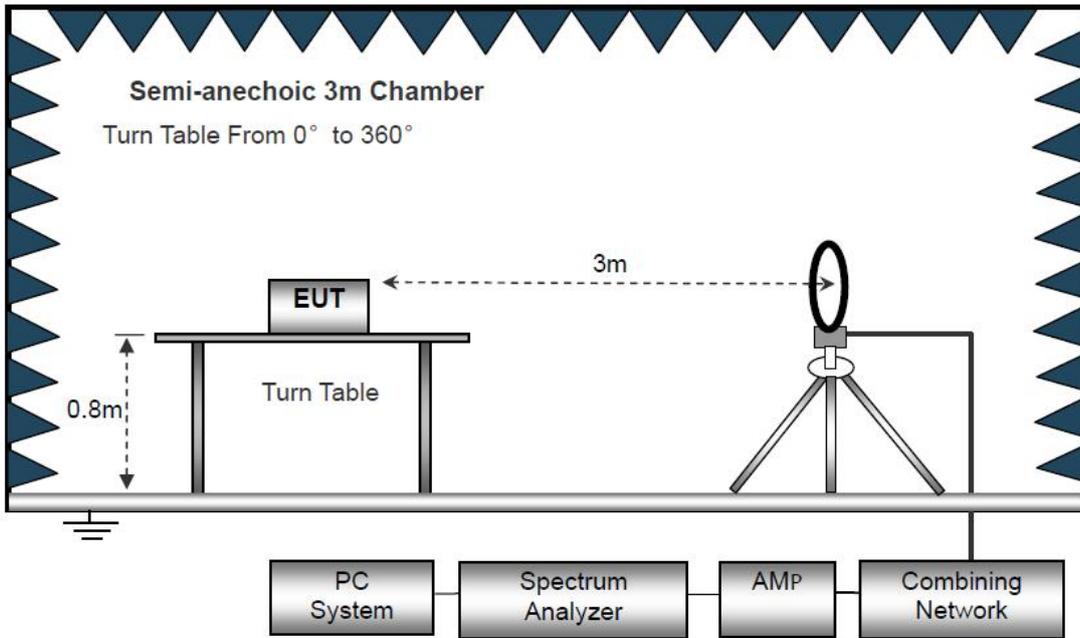
Operating Environment :

Temperature : 23.5 °C
 Humidity : 51.1 % RH
 Atmospheric Pressure : 101.2kPa
 Test Voltage : DC 3.7V Lion battery

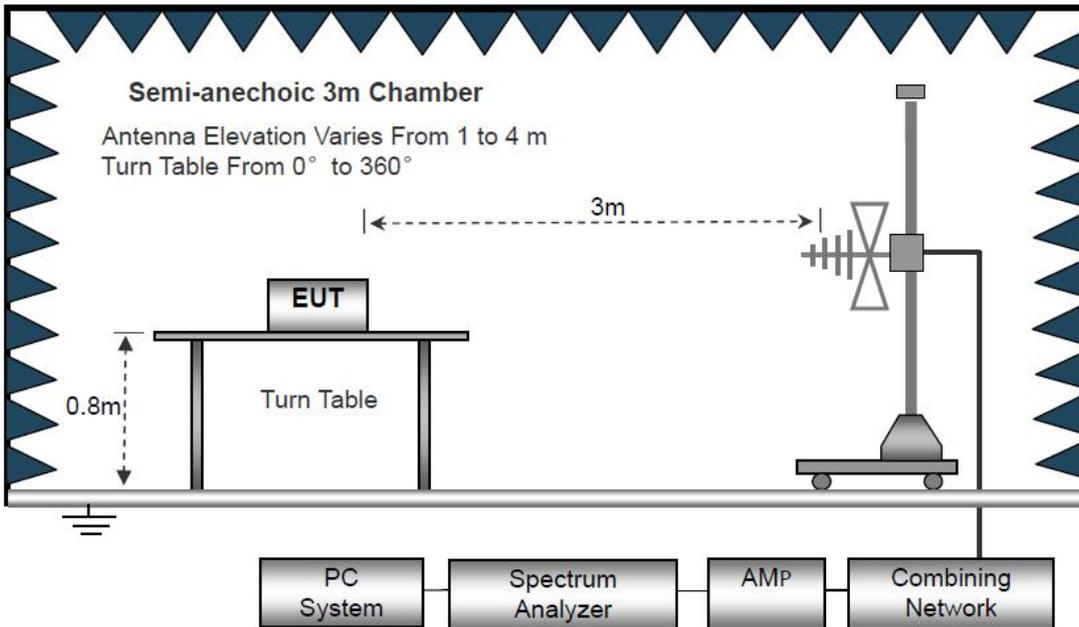
7.2 Test Setup

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

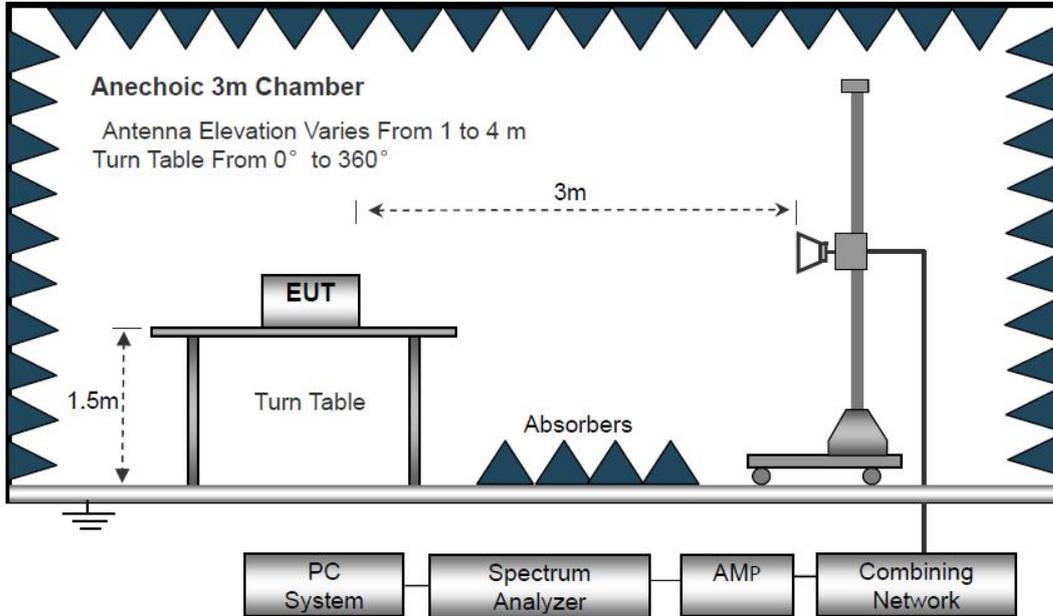
The test setup for emission measurement below 30MHz.



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

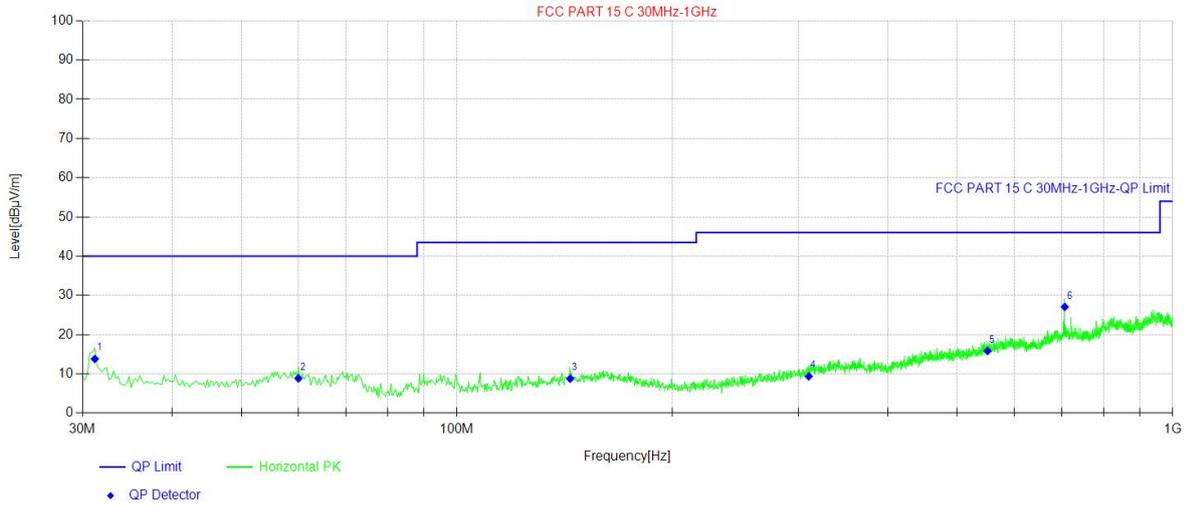
Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots:

All the modulation modes were tested the data of the worst mode (GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.



Test plot for Horizontal: GFSK(2402MHz)

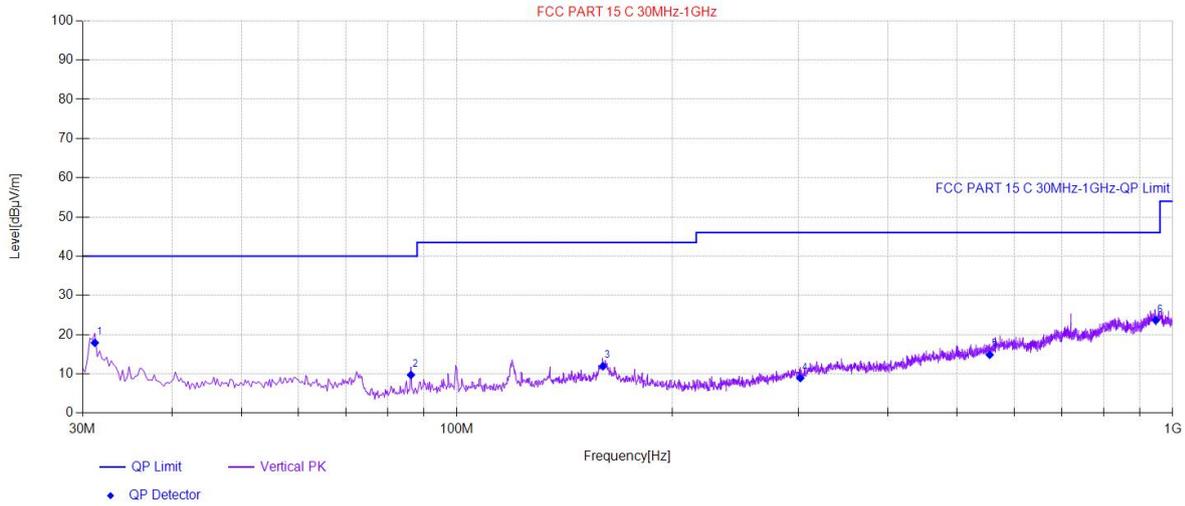


| Final Data List[QP] | | | | | | | | |
|---------------------|-------------|---------------------|-------------|-------------------|-------------------|----------------|------------|---------|
| NO. | Freq. [MHz] | QP Reading [dBµV/m] | Factor [dB] | QP Value [dBµV/m] | QP Limit [dBµV/m] | QP Margin [dB] | Polarity | Verdict |
| 1 | 31.21 | 32.09 | -18.27 | 13.82 | 40.00 | 26.18 | Horizontal | PASS |
| 2 | 60.07 | 26.67 | -17.81 | 8.86 | 40.00 | 31.14 | Horizontal | PASS |
| 3 | 143.98 | 25.25 | -16.46 | 8.79 | 43.50 | 34.71 | Horizontal | PASS |
| 4 | 310.09 | 24.53 | -15.15 | 9.38 | 46.00 | 36.62 | Horizontal | PASS |
| 5 | 551.13 | 25.21 | -9.37 | 15.84 | 46.00 | 30.16 | Horizontal | PASS |
| 6 | 706.58 | 33.52 | -6.44 | 27.08 | 46.00 | 18.92 | Horizontal | PASS |

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



Test plot for Vertical: GFSK(2402MHz)



| Final Data List[QP] | | | | | | | | |
|---------------------|-------------|---------------------|-------------|-------------------|-------------------|----------------|----------|---------|
| NO. | Freq. [MHz] | QP Reading [dBµV/m] | Factor [dB] | QP Value [dBµV/m] | QP Limit [dBµV/m] | QP Margin [dB] | Polarity | Verdict |
| 1 | 31.21 | 36.19 | -18.27 | 17.92 | 40.00 | 22.08 | Vertical | PASS |
| 2 | 86.26 | 30.64 | -20.91 | 9.73 | 40.00 | 30.27 | Vertical | PASS |
| 3 | 159.98 | 27.8 | -15.85 | 11.95 | 43.50 | 31.55 | Vertical | PASS |
| 4 | 301.84 | 24.34 | -15.40 | 8.94 | 46.00 | 37.06 | Vertical | PASS |
| 5 | 555.01 | 24.19 | -9.32 | 14.87 | 46.00 | 31.13 | Vertical | PASS |
| 6 | 946.65 | 25.97 | -2.27 | 23.70 | 46.00 | 22.30 | Vertical | PASS |

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



Test Frequency 1GHz-25GHz

Low Channel (2402MHz) Worst case GFSK

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|--------------------|------------------|----------------|--------------------|-----------------|--------------------|-------------------------|----------------|-------------|
| 4824 | 29.75 | AV | V | 8.18 | 10.46 | 10.43 | 37.96 | 54 | -16.04 |
| 4824 | 30.26 | AV | H | 8.18 | 10.46 | 10.43 | 38.47 | 54 | -15.53 |
| 4824 | 32.14 | PK | V | 8.18 | 10.46 | 10.43 | 40.35 | 74 | -33.65 |
| 4824 | 35.29 | PK | H | 8.18 | 10.46 | 10.43 | 43.5 | 74 | -30.5 |
| 14859 | 30.26 | AV | V | 9.22 | 11.05 | 12.36 | 38.17 | 54 | -15.83 |
| 14859 | 31.47 | AV | H | 9.22 | 11.05 | 12.36 | 39.38 | 54 | -14.62 |
| 14859 | 34.29 | PK | V | 9.22 | 11.05 | 12.36 | 42.2 | 74 | -31.8 |
| 14859 | 36.28 | PK | H | 9.22 | 11.05 | 12.36 | 44.19 | 74 | -29.81 |

Middle Channel (2441MHz) Worst case GFSK

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|--------------------|------------------|----------------|--------------------|-----------------|--------------------|-------------------------|----------------|-------------|
| 4882 | 28.43 | AV | V | 7.86 | 9.73 | 10.75 | 35.27 | 54 | -18.73 |
| 4882 | 30.12 | AV | H | 7.86 | 9.73 | 10.75 | 36.96 | 54 | -17.04 |
| 4882 | 32.69 | PK | V | 7.86 | 9.73 | 10.75 | 39.53 | 74 | -34.47 |
| 4882 | 35.06 | PK | H | 7.86 | 9.73 | 10.75 | 41.9 | 74 | -32.1 |
| 15896 | 29.43 | AV | V | 8.25 | 10.29 | 11.23 | 36.74 | 54 | -17.26 |
| 15896 | 30.27 | AV | H | 8.25 | 10.29 | 11.23 | 37.58 | 54 | -16.42 |
| 15896 | 33.29 | PK | V | 8.25 | 10.29 | 11.23 | 40.6 | 74 | -33.4 |
| 15896 | 35.74 | PK | H | 8.25 | 10.29 | 11.23 | 43.05 | 74 | -30.95 |

High Channel (2480MHz) Worst case GFSK

| Frequency (MHz) | S.A Reading (dBuV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|--------------------|------------------|----------------|--------------------|-----------------|--------------------|-------------------------|----------------|-------------|
| 4960 | 29.35 | AV | V | 8.23 | 9.86 | 11.46 | 35.98 | 54 | -18.02 |
| 4960 | 30.22 | AV | H | 8.23 | 9.86 | 11.46 | 36.85 | 54 | -17.15 |
| 4960 | 33.37 | PK | V | 8.23 | 9.86 | 11.46 | 40 | 74 | -34 |
| 4960 | 36.29 | PK | H | 8.23 | 9.86 | 11.46 | 42.92 | 74 | -31.08 |
| 15483 | 30.29 | AV | V | 9.32 | 10.24 | 12.09 | 37.76 | 54 | -16.24 |
| 15483 | 32.48 | AV | H | 9.32 | 10.24 | 12.09 | 39.95 | 54 | -14.05 |
| 15483 | 35.98 | PK | V | 9.32 | 10.24 | 12.09 | 43.45 | 74 | -30.55 |
| 15483 | 37.29 | PK | H | 9.32 | 10.24 | 12.09 | 44.76 | 74 | -29.24 |

- 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
 Margin=Emission Level-Limit



8 CONDUCTED BAND EDGE EMISSION

8.1 REQUIREMENT

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

8.2 TEST PROCEDURE

For Conducted Test

1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.
2. The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

| EMI Test Receiver | Setting |
|-------------------|----------|
| Attenuation | Auto |
| RBW | 100KHz |
| VBW | 300KHz |
| Detector | Peak |
| Trace | Max hold |

For Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

| EMI Test Receiver | Setting |
|-------------------|---------|
| Attenuation | Auto |
| RBW | 1MHz |
| VBW | 3MHz |
| Detector | Peak |

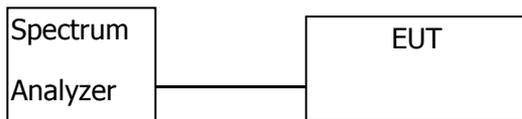


| | |
|-------|----------|
| Trace | Max hold |
|-------|----------|

For Non-Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 100KHz, video bandwidth 300KHz:

| | |
|-------------------|----------|
| EMI Test Receiver | Setting |
| Attenuation | Auto |
| RBW | 100KHz |
| VBW | 300KHz |
| Detector | Peak |
| Trace | Max hold |

Set up:

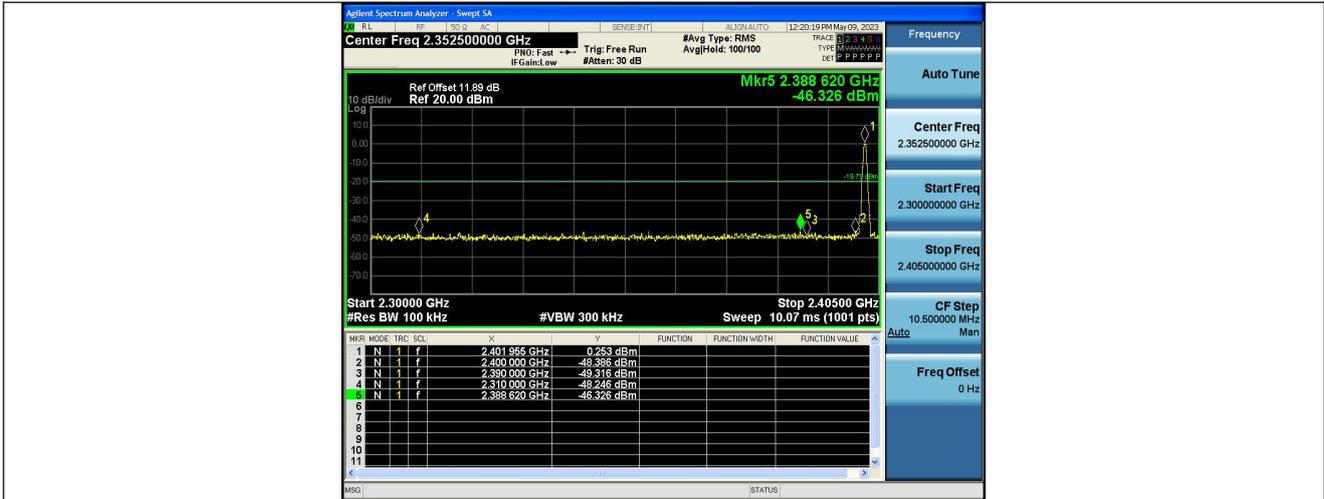


8.3 TEST RESULTS

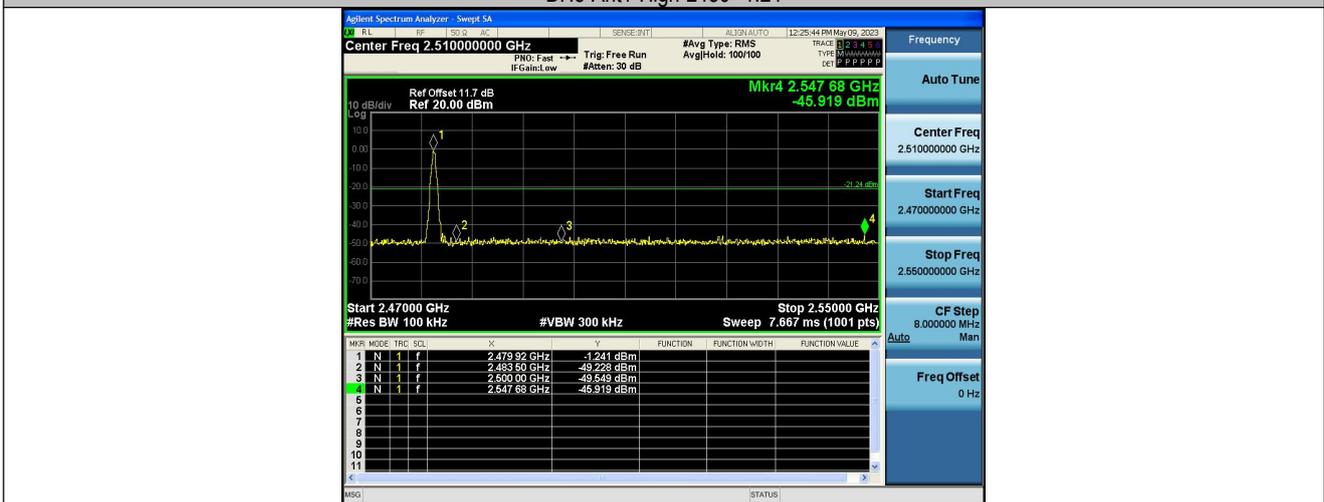
Band edge measurements

| TestMode | Antenna | ChName | Frequency[MHz] | RefLevel [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|----------|---------|--------|----------------|----------------|--------------|-------------|---------|
| DH5 | Ant1 | Low | 2402 | 0.25 | -46.33 | ≤-19.75 | PASS |
| DH5 | Ant1 | High | 2480 | -1.24 | -45.92 | ≤-21.24 | PASS |
| 2DH5 | Ant1 | Low | 2402 | 0.29 | -46.53 | ≤-19.71 | PASS |
| 2DH5 | Ant1 | High | 2480 | -1.32 | -45.72 | ≤-21.32 | PASS |
| DH5 | Ant1 | Low | Hop_2402 | -0.19 | -47.42 | ≤-20.19 | PASS |
| DH5 | Ant1 | High | Hop_2480 | -0.90 | -45.45 | ≤-20.9 | PASS |
| 2DH5 | Ant1 | Low | Hop_2402 | -1.20 | -46.67 | ≤-21.2 | PASS |
| 2DH5 | Ant1 | High | Hop_2480 | -2.28 | -45.96 | ≤-22.28 | PASS |

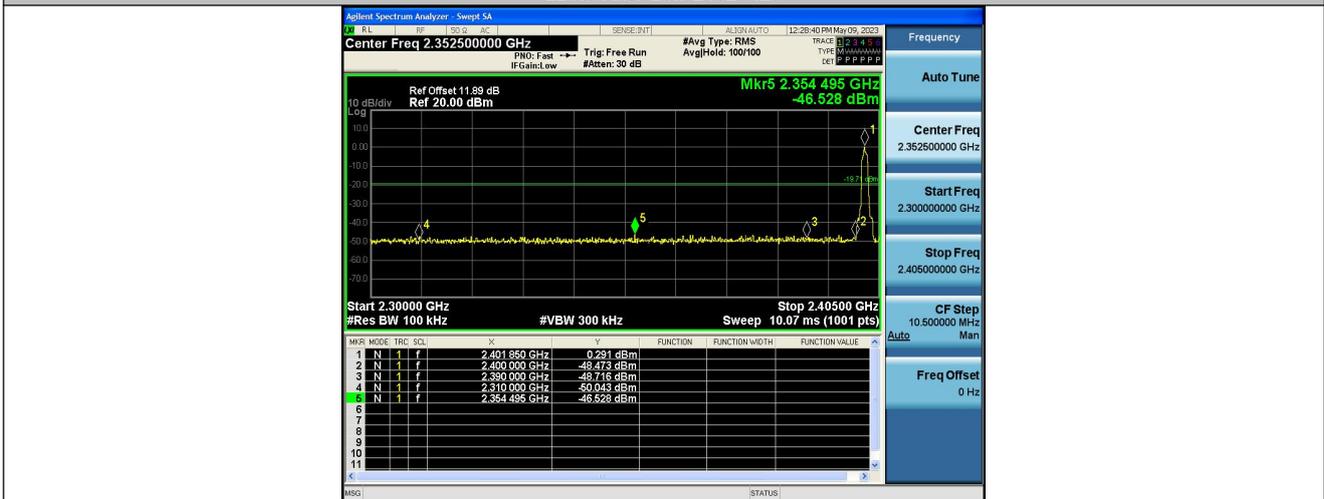
DH5-Ant1-Low-2402-0.25



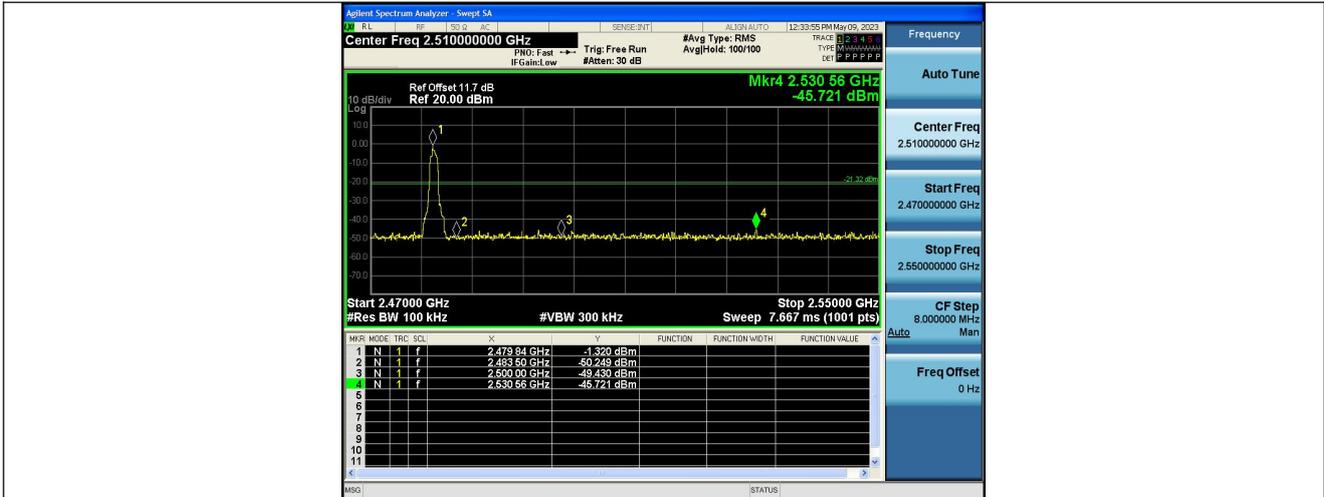
DH5-Ant1-High-2480--1.24



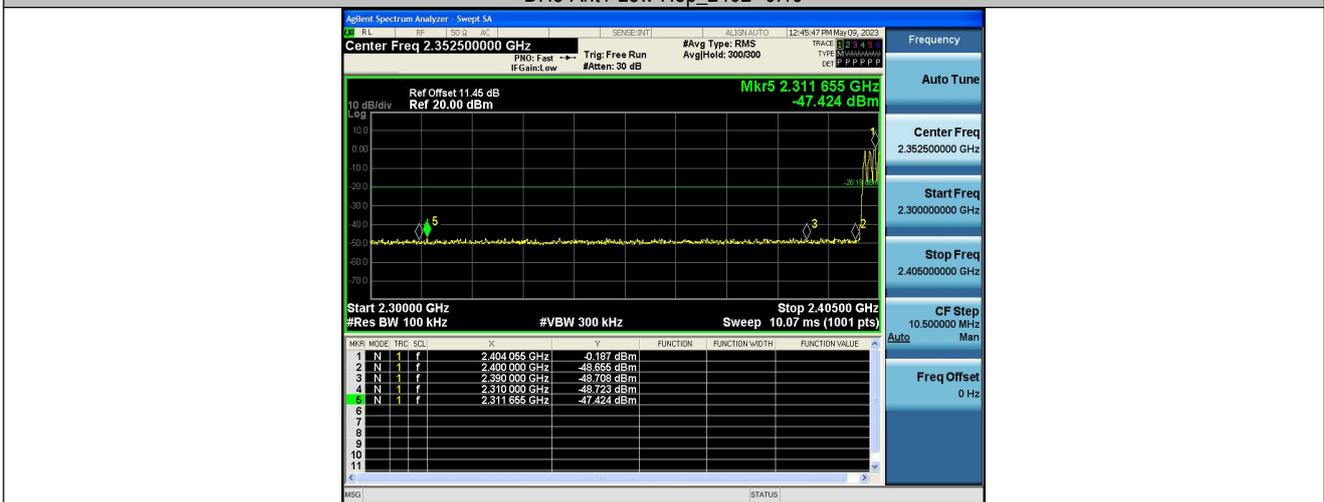
2DH5-Ant1-Low-2402-0.29



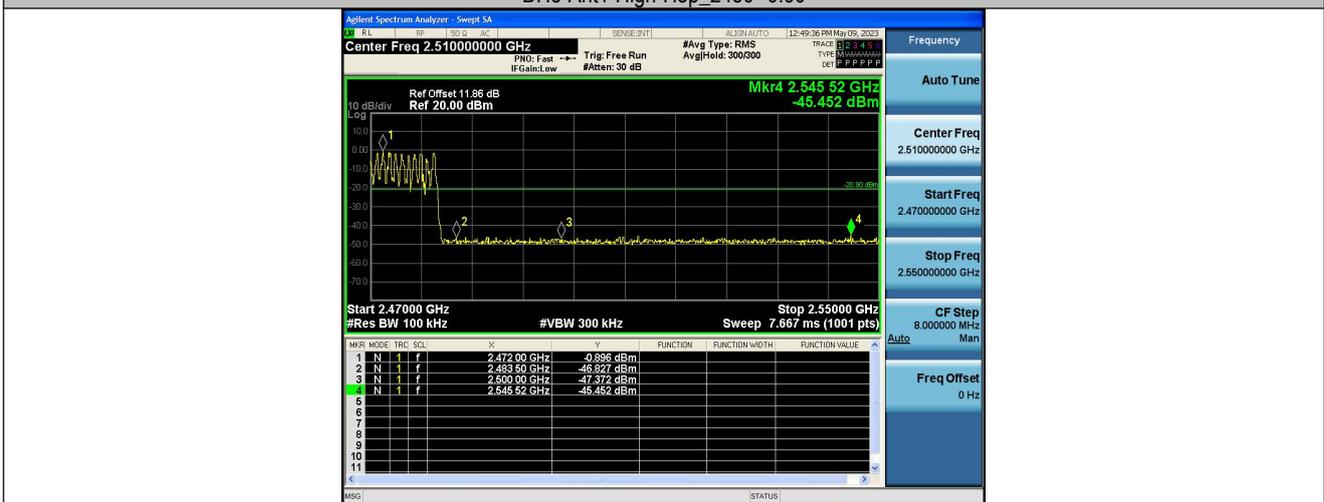
2DH5-Ant1-High-2480--1.32



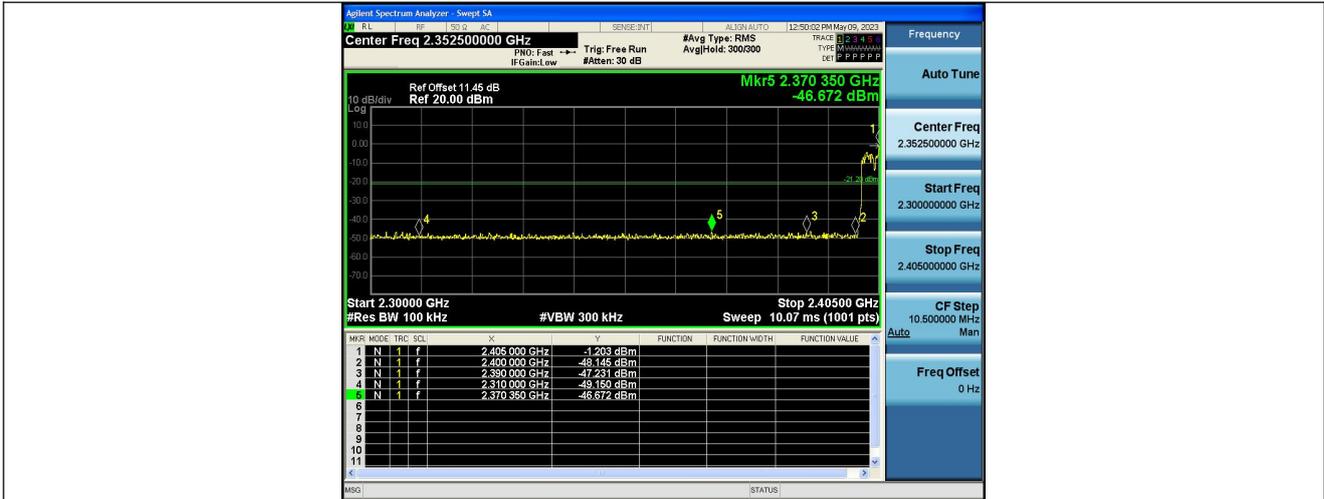
DH5-Ant1-Low-Hop_2402--0.19



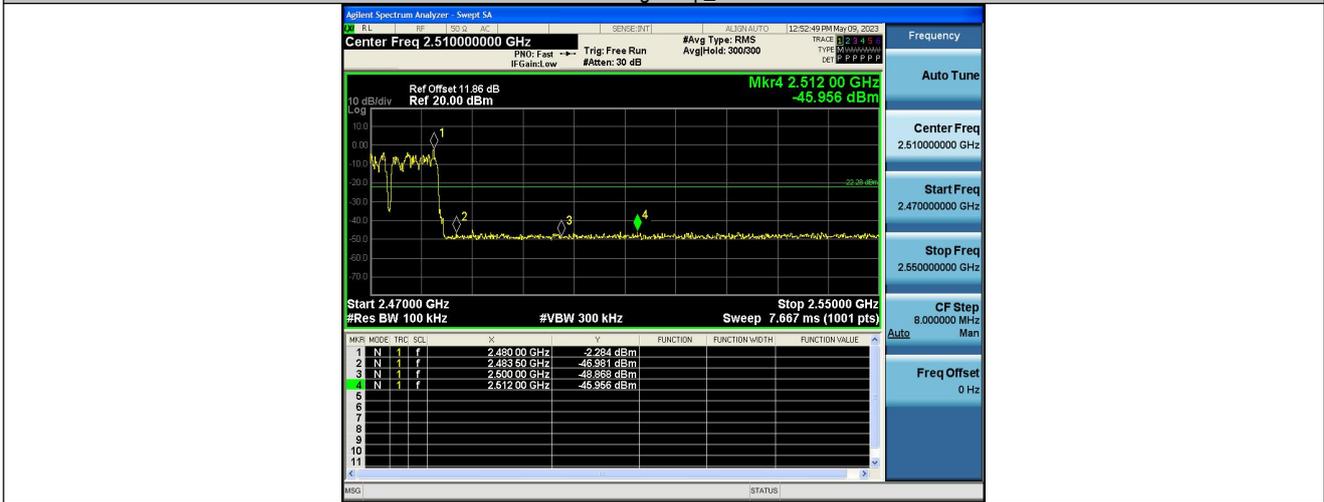
DH5-Ant1-High-Hop_2480--0.90



2DH5-Ant1-Low-Hop_2402--1.20



2DH5-Ant1-High-Hop_2480-2.28



For Conduct spurious emissions

| TestMode | Antenna | Frequency[MHz] | FreqRange [MHz] | RefLevel [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|----------|---------|----------------|-----------------|----------------|--------------|-------------|---------|
| DH5 | Ant1 | 2402 | 0~Reference | -0.14 | -0.14 | --- | PASS |
| DH5 | Ant1 | 2402 | 30~1000 | -0.14 | -54.03 | ≤-20.14 | PASS |
| DH5 | Ant1 | 2402 | 1000~26500 | -0.14 | -38.56 | ≤-20.14 | PASS |
| DH5 | Ant1 | 2441 | 0~Reference | -0.72 | -0.72 | --- | PASS |
| DH5 | Ant1 | 2441 | 30~1000 | -0.72 | -56.71 | ≤-20.72 | PASS |
| DH5 | Ant1 | 2441 | 1000~26500 | -0.72 | -41.21 | ≤-20.72 | PASS |
| DH5 | Ant1 | 2480 | 0~Reference | -1.75 | -1.75 | --- | PASS |
| DH5 | Ant1 | 2480 | 30~1000 | -1.75 | -54.91 | ≤-21.75 | PASS |
| DH5 | Ant1 | 2480 | 1000~26500 | -1.75 | -41.06 | ≤-21.75 | PASS |
| 2DH5 | Ant1 | 2402 | 0~Reference | -2.77 | -2.77 | --- | PASS |
| 2DH5 | Ant1 | 2402 | 30~1000 | -2.77 | -52.85 | ≤-22.77 | PASS |
| 2DH5 | Ant1 | 2402 | 1000~26500 | -2.77 | -41.17 | ≤-22.77 | PASS |
| 2DH5 | Ant1 | 2441 | 0~Reference | -3.85 | -3.85 | --- | PASS |
| 2DH5 | Ant1 | 2441 | 30~1000 | -3.85 | -58.35 | ≤-23.85 | PASS |

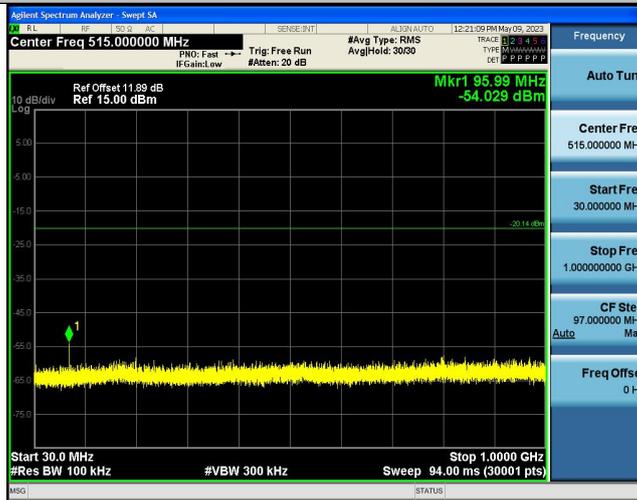


| | | | | | | | |
|------|------|------|-------------|-------|--------|---------|------|
| 2DH5 | Ant1 | 2441 | 1000~26500 | -3.85 | -41.8 | ≤-23.85 | PASS |
| 2DH5 | Ant1 | 2480 | 0~Reference | -4.47 | -4.47 | --- | PASS |
| 2DH5 | Ant1 | 2480 | 30~1000 | -4.47 | -57.76 | ≤-24.47 | PASS |
| 2DH5 | Ant1 | 2480 | 1000~26500 | -4.47 | -42.2 | ≤-24.47 | PASS |

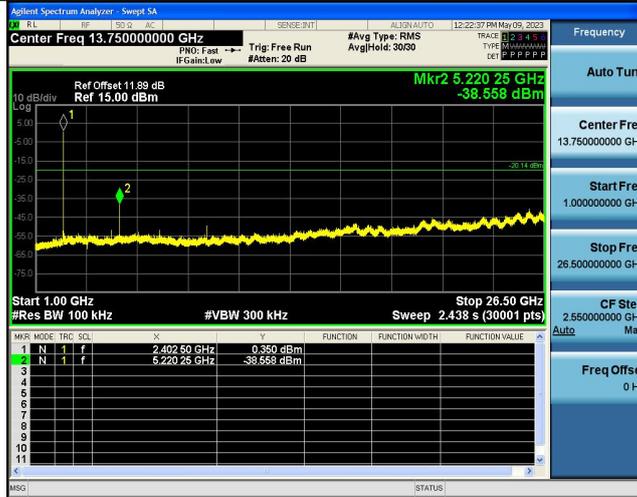
DH5-Ant1-2402-0~Reference--0.14



DH5-Ant1-2402-30~1000--0.14



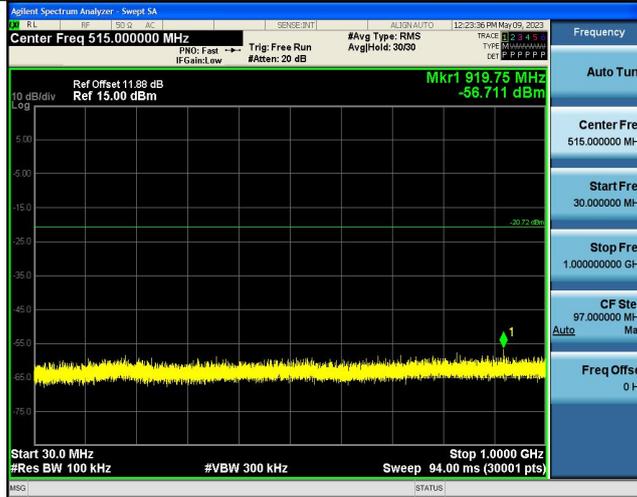
DH5-Ant1-2402-1000~26500--0.14



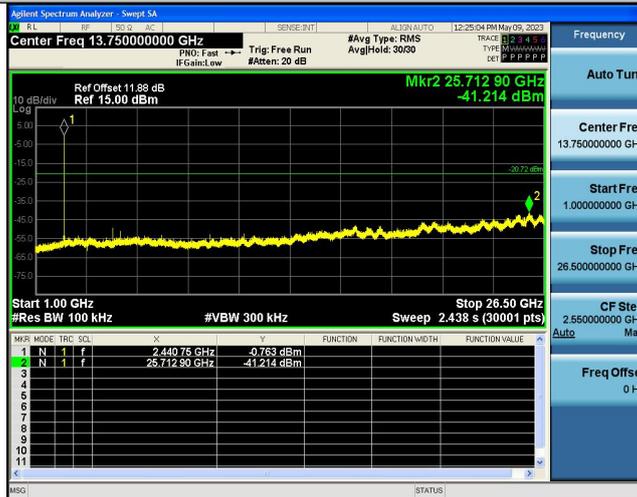
DH5-Ant1-2441-0~Reference--0.72



DH5-Ant1-2441-30~1000--0.72



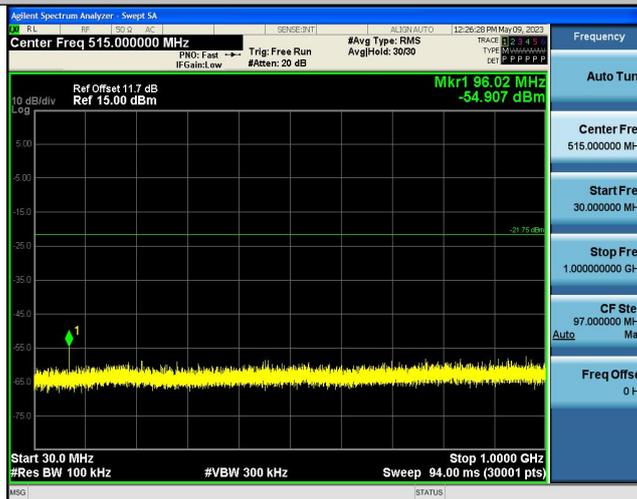
DH5-Ant1-2441-1000~26500--0.72



DH5-Ant1-2480-0~Reference--1.75



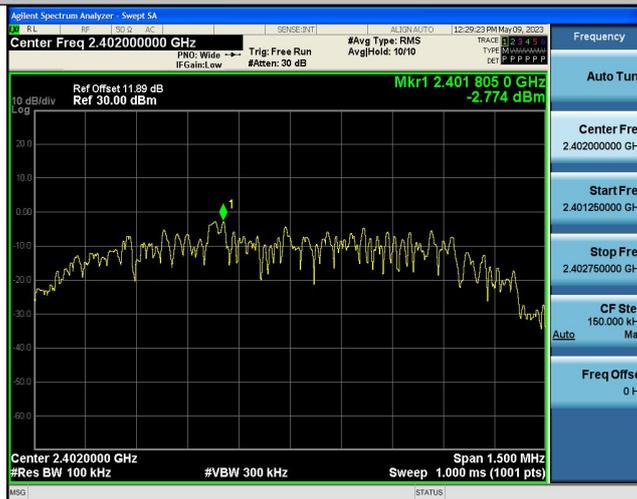
DH5-Ant1-2480-30~1000--1.75



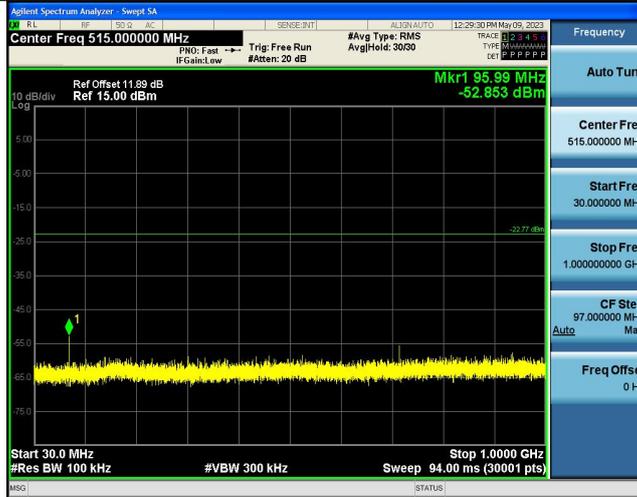
DH5-Ant1-2480-1000~26500--1.75



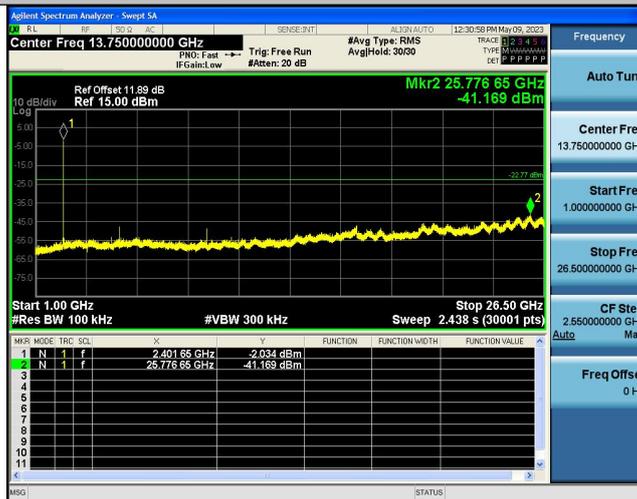
2DH5-Ant1-2402-0~Reference--2.77



2DH5-Ant1-2402-30~1000--2.77



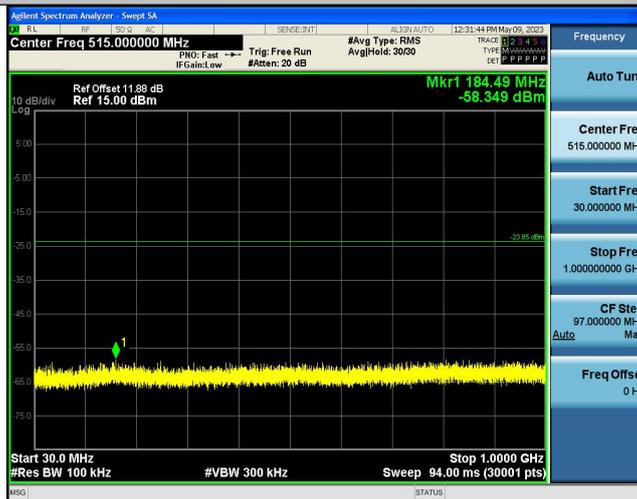
2DH5-Ant1-2402-1000~26500--2.77



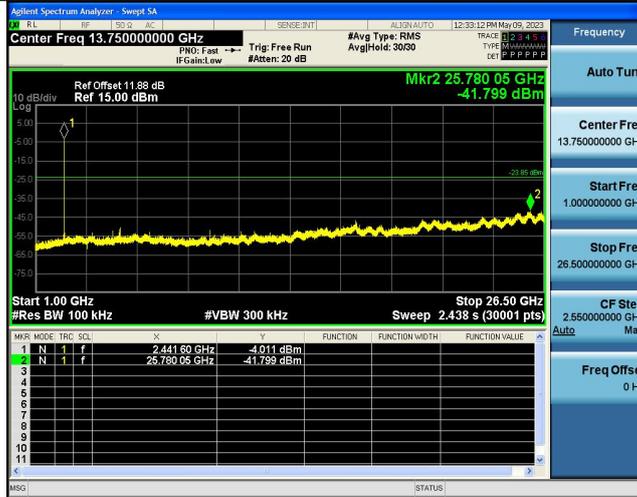
2DH5-Ant1-2441-0~Reference--3.85



2DH5-Ant1-2441-30~1000--3.85



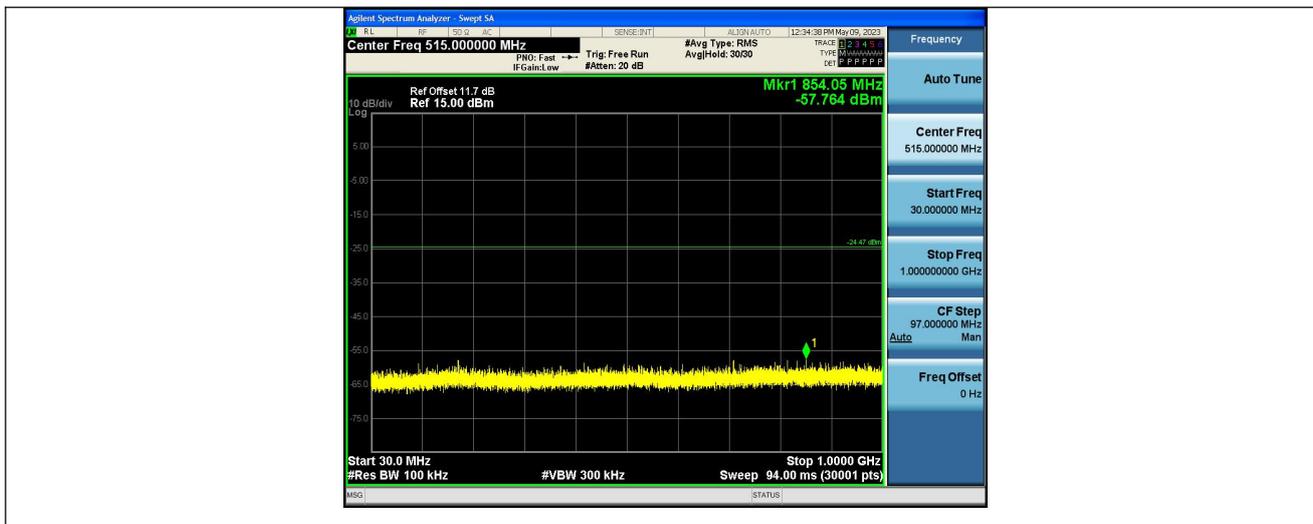
2DH5-Ant1-2441-1000~26500--3.85



2DH5-Ant1-2480-0~Reference--4.47



2DH5-Ant1-2480-30~1000--4.47



2DH5-Ant1-2480-1000~26500--4.47



Emissions in Restricted Bands

| TestMode | Antenna | ChName | Frequenc y [MHz] | Detector | Freq [MHz] | Result [dBm] | Limit [dBm] | Result [dBuV/m] | Limit [dBuV/m] | Verdict |
|----------|---------|--------|------------------|----------|------------|--------------|-------------|-----------------|----------------|---------|
| DH5 | Ant1 | Low | 2402 | Peak | 2390.000 | -41.65 | ≤-21.20 | 53.55 | ≤74 | PASS |
| DH5 | Ant1 | Low | 2402 | Peak | 2310.000 | -39.92 | ≤-21.20 | 55.28 | ≤74 | PASS |
| DH5 | Ant1 | Low | 2402 | Peak | 2387.255 | -36.22 | ≤-21.20 | 58.98 | ≤74 | PASS |
| DH5 | Ant1 | Low | 2402 | AV | 2390.000 | -44.81 | ≤-41.20 | 50.39 | ≤54 | PASS |
| DH5 | Ant1 | Low | 2402 | AV | 2310.000 | -45.35 | ≤-41.20 | 49.85 | ≤54 | PASS |
| DH5 | Ant1 | Low | 2402 | AV | 2383.790 | -44.42 | ≤-41.20 | 50.78 | ≤54 | PASS |

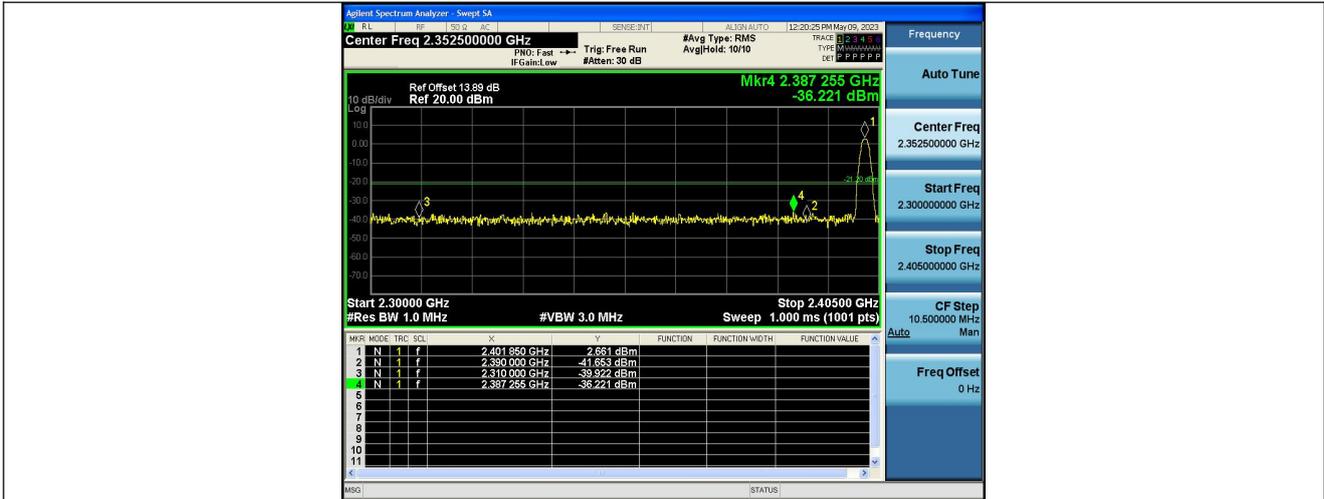


| | | | | | | | | | | |
|------|------|------|----------|------|----------|--------|---------|-------|-----|------|
| DH5 | Ant1 | High | 2480 | Peak | 2483.500 | -39.78 | ≤-21.20 | 55.42 | ≤74 | PASS |
| DH5 | Ant1 | High | 2480 | Peak | 2500.000 | -39.7 | ≤-21.20 | 55.50 | ≤74 | PASS |
| DH5 | Ant1 | High | 2480 | Peak | 2494.800 | -35.69 | ≤-21.20 | 59.51 | ≤74 | PASS |
| DH5 | Ant1 | High | 2480 | AV | 2483.500 | -45.04 | ≤-41.20 | 50.16 | ≤54 | PASS |
| DH5 | Ant1 | High | 2480 | AV | 2500.000 | -44.6 | ≤-41.20 | 50.60 | ≤54 | PASS |
| DH5 | Ant1 | High | 2480 | AV | 2498.000 | -44.49 | ≤-41.20 | 50.71 | ≤54 | PASS |
| 2DH5 | Ant1 | Low | 2402 | Peak | 2390.000 | -37.83 | ≤-21.20 | 57.37 | ≤74 | PASS |
| 2DH5 | Ant1 | Low | 2402 | Peak | 2310.000 | -40.51 | ≤-21.20 | 54.69 | ≤74 | PASS |
| 2DH5 | Ant1 | Low | 2402 | Peak | 2363.105 | -36.02 | ≤-21.20 | 59.18 | ≤74 | PASS |
| 2DH5 | Ant1 | Low | 2402 | AV | 2390.000 | -44.68 | ≤-41.20 | 50.52 | ≤54 | PASS |
| 2DH5 | Ant1 | Low | 2402 | AV | 2310.000 | -45.33 | ≤-41.20 | 49.87 | ≤54 | PASS |
| 2DH5 | Ant1 | Low | 2402 | AV | 2380.535 | -44.4 | ≤-41.20 | 50.80 | ≤54 | PASS |
| 2DH5 | Ant1 | High | 2480 | Peak | 2483.500 | -38.54 | ≤-21.20 | 56.66 | ≤74 | PASS |
| 2DH5 | Ant1 | High | 2480 | Peak | 2500.000 | -40.1 | ≤-21.20 | 55.10 | ≤74 | PASS |
| 2DH5 | Ant1 | High | 2480 | Peak | 2493.040 | -35.79 | ≤-21.20 | 59.41 | ≤74 | PASS |
| 2DH5 | Ant1 | High | 2480 | AV | 2483.500 | -45.02 | ≤-41.20 | 50.18 | ≤54 | PASS |
| 2DH5 | Ant1 | High | 2480 | AV | 2500.000 | -44.55 | ≤-41.20 | 50.65 | ≤54 | PASS |
| 2DH5 | Ant1 | High | 2480 | AV | 2499.920 | -44.45 | ≤-41.20 | 50.75 | ≤54 | PASS |
| DH5 | Ant1 | Low | Hop_2402 | Peak | 2390.000 | -37.43 | ≤-21.20 | 57.77 | ≤74 | PASS |
| DH5 | Ant1 | Low | Hop_2402 | Peak | 2310.000 | -38.16 | ≤-21.20 | 57.04 | ≤74 | PASS |
| DH5 | Ant1 | Low | Hop_2402 | Peak | 2324.150 | -34.78 | ≤-21.20 | 60.42 | ≤74 | PASS |
| DH5 | Ant1 | High | Hop_2480 | Peak | 2483.500 | -36.78 | ≤-21.20 | 58.42 | ≤74 | PASS |
| DH5 | Ant1 | High | Hop_2480 | Peak | 2500.000 | -37.59 | ≤-21.20 | 57.61 | ≤74 | PASS |
| DH5 | Ant1 | High | Hop_2480 | Peak | 2484.800 | -34.3 | ≤-21.20 | 60.90 | ≤74 | PASS |
| 2DH5 | Ant1 | Low | Hop_2402 | Peak | 2390.000 | -36.45 | ≤-21.20 | 58.75 | ≤74 | PASS |
| 2DH5 | Ant1 | Low | Hop_2402 | Peak | 2310.000 | -37.34 | ≤-21.20 | 57.86 | ≤74 | PASS |
| 2DH5 | Ant1 | Low | Hop_2402 | Peak | 2327.615 | -34.88 | ≤-21.20 | 60.32 | ≤74 | PASS |
| 2DH5 | Ant1 | High | Hop_2480 | Peak | 2483.500 | -36.64 | ≤-21.20 | 58.56 | ≤74 | PASS |
| 2DH5 | Ant1 | High | Hop_2480 | Peak | 2500.000 | -36.98 | ≤-21.20 | 58.22 | ≤74 | PASS |
| 2DH5 | Ant1 | High | Hop_2480 | Peak | 2495.760 | -34.44 | ≤-21.20 | 60.76 | ≤74 | PASS |

Note:

1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

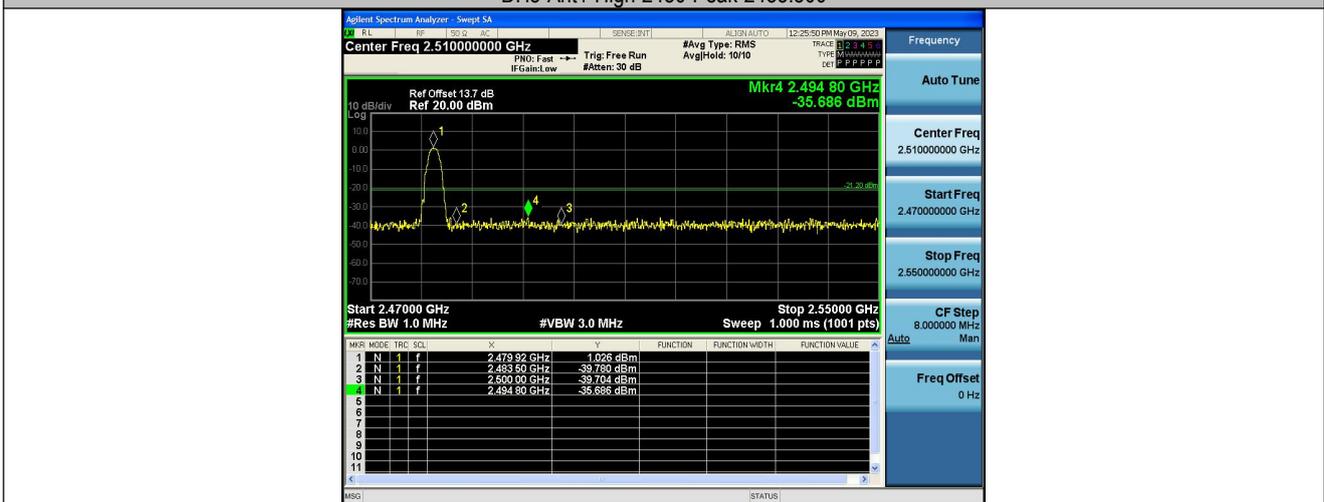
DH5-Ant1-Low-2402-Peak-2390.000



DH5-Ant1-Low-2402-AV-2390.000



DH5-Ant1-High-2480-Peak-2483.500



DH5-Ant1-High-2480-AV-2483.500