# FCC Part 15C&RSS-247 TEST REPORT

# FCC ID: YGM-E300A

# IC:21567-E300A

| | | |
|---|---|---|
| **Product** | : | **Alexa Ceiling Amplifier** |
| **Model Name** | : | **E300A** |
| **Brand** | : |  |
| **Report No.** | : | **NCT23034168-1** |

Prepared for

**Armour Home Electronics Limited**

**Woodside 2, Dunmow Road, Bishop's Stortford, Hertfordshire, CM23 5RG UNITED KINGDOM**

Prepared by

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**FAX: 86-755-27790922**

# 1 TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| Applicant’s name | : | Armour Home Electronics Limited |
| Address | : | Woodside 2, Dunmow Road, Bishop's Stortford, Hertfordshire, CM23 5RG UNITED KINGDOM |
| Manufacture's name | : | Armour Home Electronics Limited |
| Address | : | Woodside 2, Dunmow Road, Bishop's Stortford, Hertfordshire, CM23 5RG UNITED KINGDOM |
| Product name | : | Alexa Ceiling Amplifier |
| Model name | : | E300A |
| Additional model | : | N/A |
| Standards | : | FCC CFR47 Part 15 Section 15.247<br>RSS-247 Issue 3: August 2023 |
| Test procedure | : | ANSI C63.10:2013<br>RSS-GEN, Issue 5: March 2019 |
| Test Date | : | Sep. 02 ~ Oct. 18, 2023 |
| Date of Issue | : | Oct. 18, 2023 |
| Test Result | : | Pass |

This device described above has been tested by NCT, 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:

Hugh Zhang

Hugh Zhang / Engineer

Technical Manager:

Henry Wang / Manager

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## 2 Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Radiated Spurious Emissions and Restricted Bandedge | 15.205(a)<br>15.209<br>15.247(d)<br>RSS-Gen.6.13<br>RSS-Gen.8.10 | PASS |
| Conducted Unwanted emissions and Band edge | 15.247(d)<br>15.205(a)<br>RSS-247 5.5 | PASS |
| Conduct Emission | 15.207<br>RSS-Gen 8.8 | PASS |
| 20dB Bandwidth & 99% OCB | 15.247(a)(1)<br>RSS-247.5.1(2)<br>RSS-Gen.6.7 | PASS |
| Maximum Peak Output Power | 15.247(b)(1)<br>RSS-247.5.4(4) | PASS |
| Frequency Separation | 15.247(a)(1)<br>RSS-247.5.1(4) | PASS |
| Number of Hopping Frequency | 15.247(a)(1)(iii)RSS-247.5.1(4) | PASS |
| Dwell time | 15.247(a)(1)(iii)RSS-247.5.1(5) | PASS |
| Antenna Requirement | 15.203<br>RSS-Gen 6.8 | PASS |

Remark:

1. “N/A” denotes test is not applicable in this Test Report.

# 3 TEST FACILITY

Site Description

EMC Lab. : Accredited by CNAS, 2022-09-27

The certificate is valid until 2028.01.07

The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2017)

The Certificate Registration Number is L8251

Designation Number: CN1347

Test Firm Registration Number: 894804

Accredited by A2LA, June 14, 2023

The Certificate Registration Number is 6837.01

Accredited by Industry Canada, November 09, 2018

The Conformity Assessment Body Identifier is CN0150

Company Number: 30806

Name of Firm : Shenzhen NCT Testing Technology Co., Ltd.

Site Location : A101&2F B2, Fuqiao 6th Area, Xintian Community, Fuhai Street, Baoan District, Shenzhen, People's Republic of China

# 4 General Information

## 4.1 General Description of E.U.T.

| | | |
|---|---|---|
| Product Name | : | Alexa Ceiling Amplifier |
| Model Name | : | E300A |
| Sample ID | : | N/A |
| Sample(s) Status: | : | Engineer sample |
| Additional model | : | N/A |
| Operating frequency | : | 2402-2480MHz |
| Numbers of Channel | : | 79 channels |
| Antenna Type | : | PCB Antenna |
| Antenna Gain | : | 3.5dBi |
| Type of Modulation | : | GFSK, Π/4-DQPSK, 8DPSK |
| Power supply | : | DC 22V From adapter input AC 120V/60Hz |
| Hardware Version | : | 24 |
| Software Version | : | 2628.0001.0 |
| SWITCHING POWER ADAPTER: | : | Manufacturer: Dongguan YiDai Power Technology Co., LTD<br>Model:TD-ZN2200150-6B<br>Input: 100-240V~ 50/60Hz 1.5A Max<br>Output: DC 22.0V/1.5A, 33W |
| Remark：the Antenna gain is provided by customer from Antenna spec. and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.<br>2.4G Wifi &BT antenna and 5G Wifi antenna cannot transmit at the same time. 2.4G WLAN and BT share the same antenna port and cannot transmit simultaneously. | | |

## 4.2 Channel List

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, Π/4-DQPSK, 8DPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

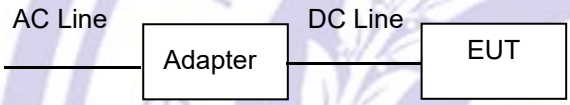
Channel List:

| 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 | - | - |

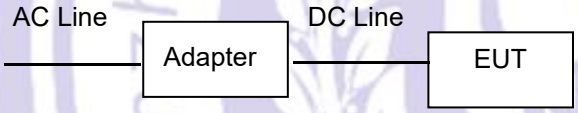
| Channel | Frequency(MHz) |
|---|---|
| 0 | 2402 |
| 39 | 2441 |
| 78 | 2480 |

## 4.3 Test Setup Configuration

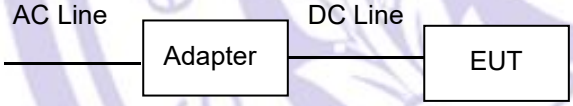
Conducted Emission




Radiated Emission




Conducted Spurious




## 4.4 Test Mode

| | |
|---|---|
| Transmitting mode | Keep the EUT in continuously transmitting mode. |
| Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data. | |

| | |
|---|---|
| Test Software | DutApi-w8887-BrdigeEth |
| Power level setup | ≤5dBm |

# 5 Equipment During Test

## 5.1 Equipments List

Conducted emission Test Equipment

| Name | Model No. | Serial No. | Manufacturer | Date of Cal. | Due Date |
|---|---|---|---|---|---|
| 944 Shielded Room | 944 Room | / | EMToni | 2022/5/31 | 2025/5/30 |
| EMI Test Receiver | ESPI | 101604 | Rohde & Schwarz | 2023/6/21 | 2024/6/20 |
| LISN | ENV 216 | 102796 | Rohde & Schwarz | 2023/6/21 | 2024/6/20 |
| LISN | VN1-13S | 004023 | CRANAGE | 2023/6/21 | 2024/6/20 |
| Cable | RG223-1500MM | NA | RG | 2023/6/21 | 2024/6/20 |

Radiated emission & Radio Frequency Test Equipment

| Name | Model No. | Serial No. | Manufacturer | Date of Cal. | Due Date |
|---|---|---|---|---|---|
| 966 Shielded Room | 966 Room | / | EMToni | 2022/5/31 | 2025/5/30 |
| EMI Test Receiver | ESCI | 101178 | Rohde & Schwarz | 2023/6/21 | 2024/6/20 |
| Spectrum Analyze（10Hz-26.5GHz） | N9020A | MY50510202 | Agilent | 2023/6/21 | 2024/6/20 |
| Amplifi（30MHz-1GHz） | BBV 9743 B | 00374 | SCHNARZBECK | 2023/6/21 | 2024/6/20 |
| Bilog Antenna（30MHz-1GHz） | VULB9162 | 00473 | SCHNARZBECK | 2023/3/19 | 2025/3/18 |
| Horn antenna（1GHz-18GHz） | BBHA 9120 D | 02622 | SCHNARZBECK | 2023/3/19 | 2025/3/18 |
| Pream plifier（1GHz-18GHz） | BBV 9718D | 0024 | SCHNARZBECK | 2023/6/21 | 2024/6/20 |
| Spectrum Analyze（10Hz-40GHz） | FSV 40 | 100952 | Rohde & Schwarz | 2023/6/21 | 2024/6/20 |
| Pream plifier（15GHz-40GHz） | BBV 9718D | 0024 | SCHNARZBECK | 2023/6/21 | 2024/6/20 |
| Double Ridge Guide Horn Antenna（18GHz-40GHz） | SAS-574 | 588 | A.H.System | 2023/3/19 | 2025/3/18 |
| Loop Antenna (9KHz-30MHz) | FMZB1519B | 014 | SCHNARZBECK | 2023/6/21 | 2024/6/20 |

| | | | | | |
|---|---|---|---|---|---|
| Amplifier (9KHz-30MHz) | CVP 9222 C | 00109 | SCHNARZBECK | 2023/6/21 | 2024/6/20 |
| Power Sensor | TR1029-2 | 00473 | SCHNARZBECK | 2023/6/21 | 2024/6/20 |
| RF Swith | TR1029-1 | 02622 | SCHNARZBECK | 2023/6/21 | 2024/6/20 |
| Cable | DA800-4000MM | NA | DA | 2023/6/21 | 2024/6/20 |
| Cable | DA800-11000MM | NA | DA | 2023/6/21 | 2024/6/20 |

Other

| Item | Name | Manufacturer | Model | Software version |
|---|---|---|---|---|
| 1 | EMC Conduction Test System | AUDIX | e3 | 6.120718 |
| 2 | EMC radiation test system | AUDIX | e3 | 6.120718 |
| 3 | RF test system | TACHOY | RFTest | V1.0.0 |
| 4 | RF communication test system | TACHOY | RFTest | V1.0.0 |

## 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 |

## 5.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Note |
|---|---|---|---|---|---|
| E-1 | Alexa Ceiling Amplifier | Q ACOUSTICS, Q | E300A | N/A | EUT |
| E-2 | Notebook | Lenovo | LN-A0403A3C | 36001672 | AE |
| | | | | | |

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

# 6 Conducted Emission

Test Requirement: : FCC CFR 47 Part 15 Section 15.207& RSS-Gen [8.8]

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

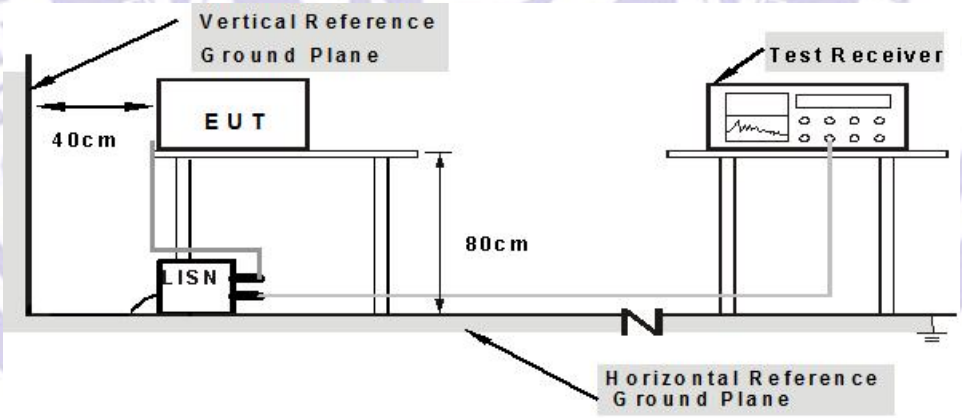
Humidity: : 51 % RH

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




Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes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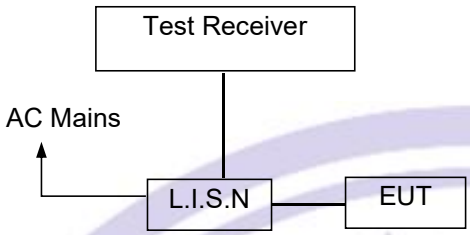
## 6.3 Test SET-UP (Block Diagram of Configuration)




## 6.4 Measurement Procedure:

1. The EUT was placed on a table, which is 0.1m 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

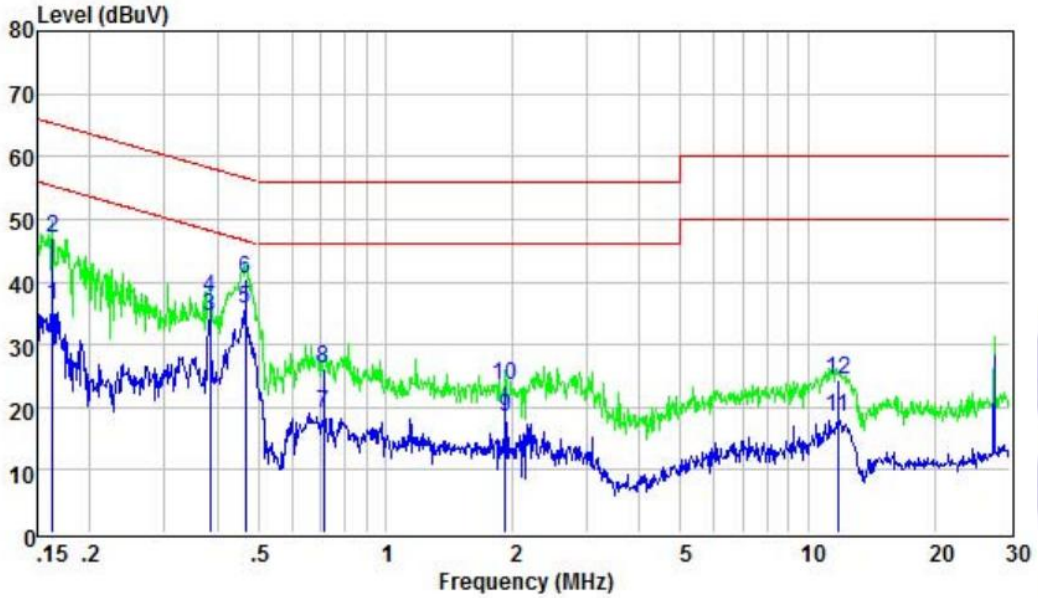
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 6.7 Conducted Emission Test Result

Pass

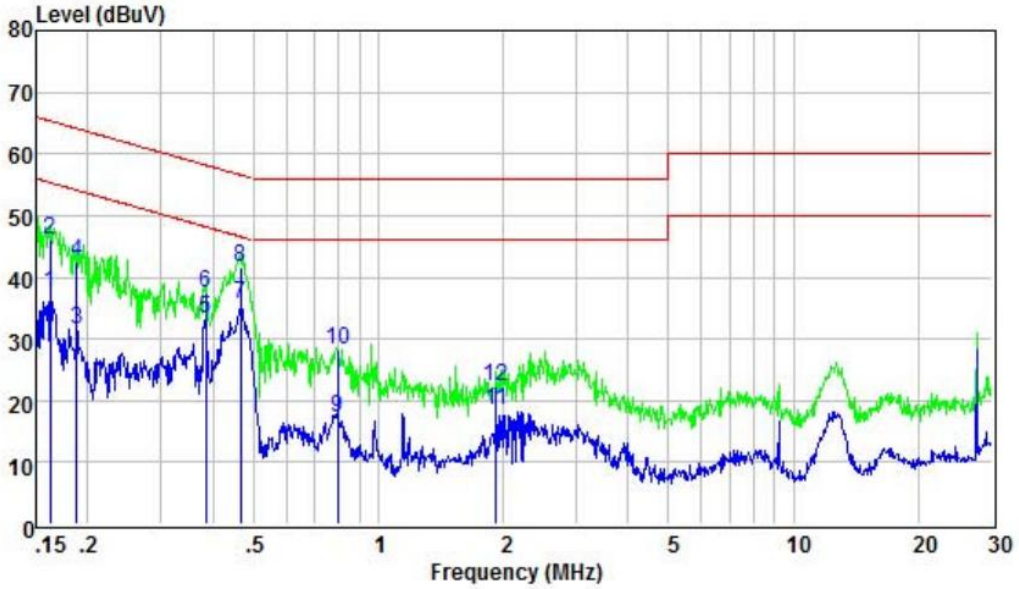
Conducted emission at both 120V & 240V is assessed, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (GFSK) are recorded in the following pages and the others modulation methods do not exceed the limits.

| Channel: | Middle | Phase : | L |
|---|---|---|---|




| | Freq | Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dBuV | dB | |
| 1 | 0.16 | 36.38 | 9.63 | 0.05 | 55.30 | -18.92 | Average |
| 2 | 0.16 | 47.12 | 9.63 | 0.05 | 65.30 | -18.18 | QP |
| 3 | 0.39 | 34.38 | 9.66 | 0.05 | 48.17 | -13.79 | Average |
| 4 | 0.39 | 37.48 | 9.66 | 0.05 | 58.17 | -20.69 | QP |
| 5 | 0.47 | 35.65 | 9.68 | 0.05 | 46.58 | -10.93 | Average |
| 6 | 0.47 | 40.48 | 9.68 | 0.05 | 56.58 | -16.10 | QP |
| 7 | 0.72 | 19.12 | 9.64 | 0.05 | 46.00 | -26.88 | Average |
| 8 | 0.72 | 26.12 | 9.64 | 0.05 | 56.00 | -29.88 | QP |
| 9 | 1.92 | 18.48 | 9.59 | 0.06 | 46.00 | -27.52 | Average |
| 10 | 1.92 | 23.48 | 9.59 | 0.06 | 56.00 | -32.52 | QP |
| 11 | 11.74 | 18.34 | 9.62 | 0.10 | 50.00 | -31.66 | Average |
| 12 | 11.74 | 24.34 | 9.62 | 0.10 | 60.00 | -35.66 | QP |

| Channel: | Middle | Phase : | N |
|---|---|---|---|




| | Freq | Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dBuV | dB | |
| 1 | 0.16 | 37.57 | 9.58 | 0.05 | 55.34 | -17.77 | Average |
| 2 | 0.16 | 46.16 | 9.58 | 0.05 | 65.34 | -19.18 | QP |
| 3 | 0.19 | 31.40 | 9.54 | 0.05 | 54.11 | -22.71 | Average |
| 4 | 0.19 | 42.40 | 9.54 | 0.05 | 64.11 | -21.71 | QP |
| 5 | 0.39 | 33.28 | 9.61 | 0.05 | 48.17 | -14.89 | Average |
| 6 | 0.39 | 37.48 | 9.61 | 0.05 | 58.17 | -20.69 | QP |
| 7 | 0.47 | 35.79 | 9.63 | 0.05 | 46.58 | -10.79 | Average |
| 8 | 0.47 | 41.67 | 9.63 | 0.05 | 56.58 | -14.91 | QP |
| 9 | 0.80 | 17.27 | 9.63 | 0.05 | 46.00 | -28.73 | Average |
| 10 | 0.80 | 28.27 | 9.63 | 0.05 | 56.00 | -27.73 | QP |
| 11 | 1.92 | 18.31 | 9.57 | 0.06 | 46.00 | -27.69 | Average |
| 12 | 1.92 | 22.31 | 9.57 | 0.06 | 56.00 | -33.69 | QP |

Notes:
1.An initial pre-scan was performed on the line and neutral lines with peak detector.
2.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3.Mesurement Level = Reading level + Correct Factor

# 7 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247& RSS-247 [5.5]

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(kHz) | 300 | 10000 * 2400/F(kHz) | $20\log^{(2400/F(kHz))} + 80$ |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 | 100 * 24000/F(kHz) | $20\log^{(24000/F(kHz))} + 40$ |
| 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

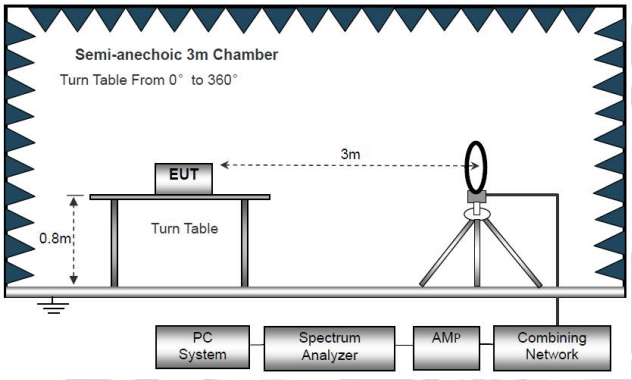
Atmospheric Pressure : 101.3kPa

Test Voltage : AC 120V60Hz

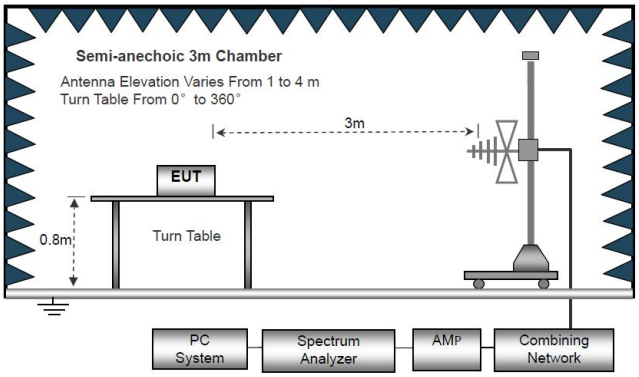
## 7.2 Test Setup

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

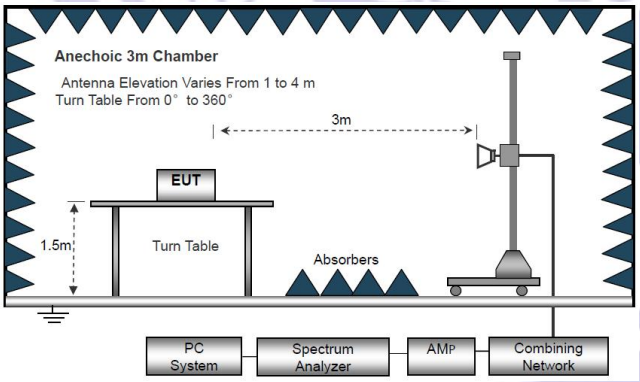
The test setup for emission measurement below 30MHz.




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:

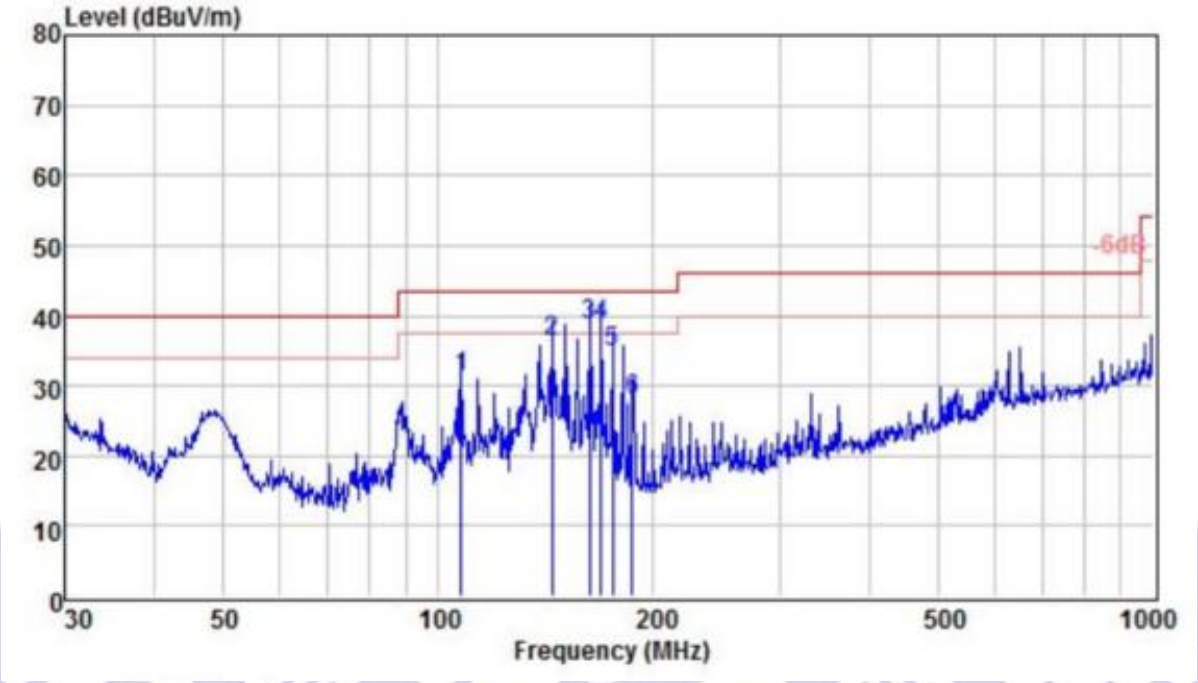
The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =40log(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:

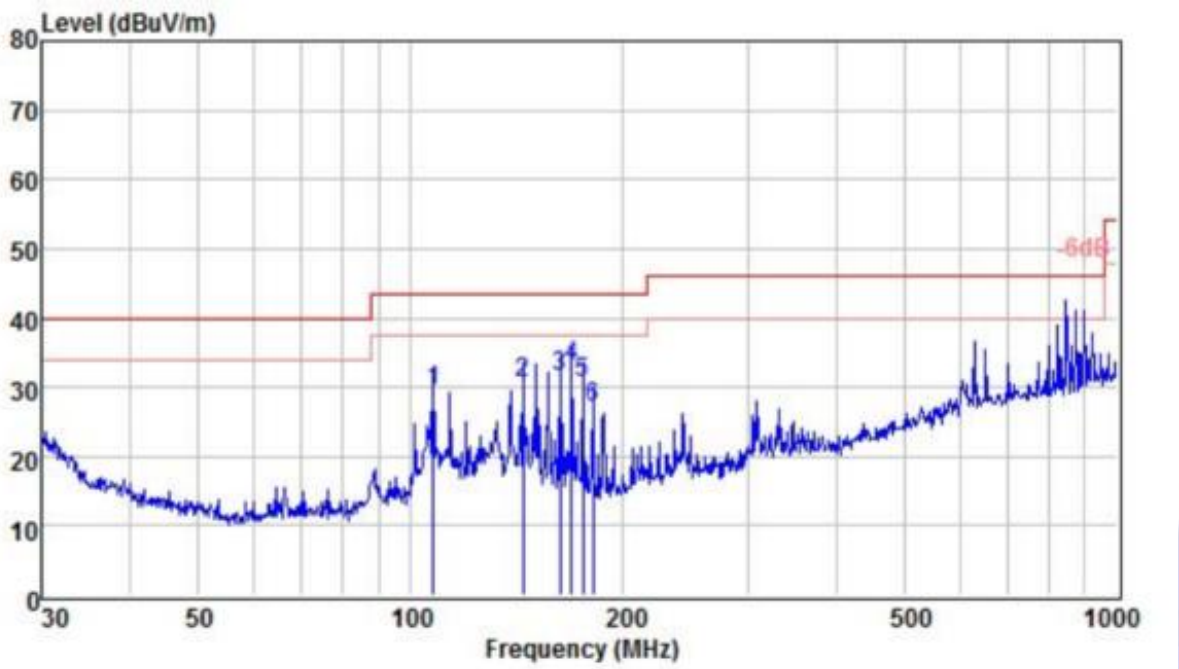
Test plot for Horizontal




| | Freq | Read Level | Antenna Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 107.51 | 21.22 | 9.37 | 0.77 | 31.36 | 43.50 | -12.14 | QP |
| 2 | 144.33 | 26.70 | 8.66 | 0.82 | 36.18 | 43.50 | -7.32 | QP |
| 3 ! | 162.61 | 28.27 | 9.43 | 0.84 | 38.54 | 43.50 | -4.96 | QP |
| 4 ! | 169.01 | 27.89 | 10.01 | 0.84 | 38.74 | 43.50 | -4.76 | QP |
| 5 | 175.04 | 23.81 | 10.25 | 0.85 | 34.91 | 43.50 | -8.59 | QP |
| 6 | 187.10 | 17.01 | 10.19 | 0.86 | 28.06 | 43.50 | -15.44 | QP |

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

Test plot for Vertical




| | Freq | Read Level | Antenna Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 107.51 | 19.51 | 9.30 | 0.77 | 29.58 | 43.50 | -13.92 | QP |
| 2 | 144.33 | 21.17 | 8.70 | 0.82 | 30.69 | 43.50 | -12.81 | QP |
| 3 | 162.61 | 21.04 | 9.65 | 0.84 | 31.53 | 43.50 | -11.97 | QP |
| 4 | 169.01 | 22.04 | 10.10 | 0.84 | 32.98 | 43.50 | -10.52 | QP |
| 5 | 175.04 | 19.50 | 10.25 | 0.85 | 30.60 | 43.50 | -12.90 | QP |
| 6 | 181.28 | 15.87 | 10.40 | 0.85 | 27.12 | 43.50 | -16.38 | QP |

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

## Test Frequency 1GHz-25GHz

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

GFSK

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Pre-amplifier (dB) | Cable Loss (dB) | Antenna Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| Low Channel:2402MHz | | | | | | | | | |
| V | 4804.00 | 50.36 | 34.12 | 5.03 | 32.39 | 53.66 | 74.00 | -20.34 | Pk |
| V | 4804.00 | 40.63 | 34.12 | 5.03 | 32.39 | 43.93 | 54.00 | -10.07 | AV |
| V | 7206.00 | 42.74 | 32.54 | 6.29 | 35.86 | 52.35 | 74.00 | -21.65 | Pk |
| V | 7206.00 | 32.35 | 32.54 | 6.29 | 35.86 | 41.96 | 54.00 | -12.04 | AV |
| V | 9608.00 | 40.42 | 32.98 | 7.55 | 38.40 | 53.39 | 74.00 | -20.61 | Pk |
| V | 9608.00 | 30.19 | 32.98 | 7.55 | 38.40 | 43.16 | 54.00 | -10.84 | AV |
| V | 12010.00 | 37.69 | 32.09 | 8.93 | 39.00 | 53.53 | 74.00 | -20.47 | Pk |
| V | 12010.00 | 28.63 | 32.09 | 8.93 | 39.00 | 44.47 | 54.00 | -9.53 | AV |
| H | 4804.00 | 51.19 | 34.12 | 5.03 | 32.39 | 54.49 | 74.00 | -19.51 | Pk |
| H | 4804.00 | 41.22 | 34.12 | 5.03 | 32.39 | 44.52 | 54.00 | -9.48 | AV |
| H | 7206.00 | 42.77 | 32.54 | 6.29 | 35.86 | 52.38 | 74.00 | -21.62 | Pk |
| H | 7206.00 | 33.37 | 32.54 | 6.29 | 35.86 | 42.98 | 54.00 | -11.02 | AV |
| H | 9608.00 | 40.27 | 32.98 | 7.55 | 38.40 | 53.24 | 74.00 | -20.76 | Pk |
| H | 9608.00 | 31.42 | 32.98 | 7.55 | 38.40 | 44.39 | 54.00 | -9.61 | AV |
| H | 12010.00 | 39.36 | 32.09 | 8.93 | 39.00 | 55.20 | 74.00 | -18.80 | Pk |
| H | 12010.00 | 29.97 | 32.09 | 8.93 | 39.00 | 45.81 | 54.00 | -8.19 | AV |

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Pre-amplifier (dB) | Cable Loss (dB) | Antenna Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| Middle Channel:2441MHz | | | | | | | | | |
| V | 4882.00 | 50.72 | 34.07 | 5.09 | 32.59 | 54.33 | 74.00 | -19.67 | Pk |
| V | 4882.00 | 40.36 | 34.07 | 5.09 | 32.59 | 43.97 | 54.00 | -10.03 | AV |
| V | 7323.00 | 42.1 | 32.63 | 6.34 | 35.96 | 51.77 | 74.00 | -22.23 | Pk |
| V | 7323.00 | 32.14 | 32.63 | 6.34 | 35.96 | 41.81 | 54.00 | -12.19 | AV |
| V | 9764.00 | 41.62 | 32.92 | 7.59 | 38.40 | 54.69 | 74.00 | -19.31 | Pk |
| V | 9764.00 | 32.76 | 32.92 | 7.59 | 38.40 | 45.83 | 54.00 | -8.17 | AV |
| V | 12205.00 | 39.68 | 31.96 | 8.88 | 39.04 | 55.64 | 74.00 | -18.36 | Pk |
| V | 12205.00 | 29.58 | 31.96 | 8.88 | 39.04 | 45.54 | 54.00 | -8.46 | AV |
| H | 4882.00 | 50.63 | 34.07 | 5.09 | 32.59 | 54.24 | 74.00 | -19.76 | Pk |
| H | 4882.00 | 41.24 | 34.07 | 5.09 | 32.59 | 44.85 | 54.00 | -9.15 | AV |
| H | 7323.00 | 42.36 | 32.63 | 6.34 | 35.96 | 52.03 | 74.00 | -21.97 | Pk |
| H | 7323.00 | 33.96 | 32.63 | 6.34 | 35.96 | 43.63 | 54.00 | -10.37 | AV |
| H | 9764.00 | 41.71 | 32.92 | 7.59 | 38.40 | 54.78 | 74.00 | -19.22 | Pk |
| H | 9764.00 | 31.33 | 32.92 | 7.59 | 38.40 | 44.40 | 54.00 | -9.60 | AV |
| H | 12205.00 | 39.64 | 31.96 | 8.88 | 39.04 | 55.60 | 74.00 | -18.40 | Pk |
| H | 12205.00 | 29.45 | 31.96 | 8.88 | 39.04 | 45.41 | 54.00 | -8.59 | AV |

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Pre-amplifier (dB) | Cable Loss (dB) | Antenna Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|---|---|---|
| High Channel:2480MHz | | | | | | | | | |
| V | 4960.00 | 50.63 | 34.02 | 5.15 | 32.80 | 54.56 | 74.00 | -19.44 | Pk |
| V | 4960.00 | 40.43 | 34.02 | 5.15 | 32.80 | 44.36 | 54.00 | -9.64 | AV |
| V | 7440.00 | 42.17 | 32.71 | 6.40 | 36.05 | 51.91 | 74.00 | -22.09 | Pk |
| V | 7440.00 | 32.61 | 32.71 | 6.40 | 36.05 | 42.35 | 54.00 | -11.65 | AV |
| V | 9920.00 | 41.73 | 32.86 | 7.62 | 38.40 | 54.89 | 74.00 | -19.11 | Pk |
| V | 9920.00 | 31.41 | 32.86 | 7.62 | 38.40 | 44.57 | 54.00 | -9.43 | AV |
| V | 12400.00 | 39.63 | 31.82 | 8.84 | 39.08 | 55.73 | 74.00 | -18.27 | Pk |
| V | 12400.00 | 29.13 | 31.82 | 8.84 | 39.08 | 45.23 | 54.00 | -8.77 | AV |
| H | 4960.00 | 50.61 | 34.02 | 5.15 | 32.80 | 54.54 | 74.00 | -19.46 | Pk |
| H | 4960.00 | 40.74 | 34.02 | 5.15 | 32.80 | 44.67 | 54.00 | -9.33 | AV |
| H | 7440.00 | 43.36 | 32.71 | 6.40 | 36.05 | 53.10 | 74.00 | -20.90 | Pk |
| H | 7440.00 | 34.19 | 32.71 | 6.40 | 36.05 | 43.93 | 54.00 | -10.07 | AV |
| H | 9920.00 | 41.14 | 32.86 | 7.62 | 38.40 | 54.30 | 74.00 | -19.70 | Pk |
| H | 9920.00 | 30.39 | 32.86 | 7.62 | 38.40 | 43.55 | 54.00 | -10.45 | AV |
| H | 12400.00 | 39.32 | 31.82 | 8.84 | 39.08 | 55.42 | 74.00 | -18.58 | Pk |
| H | 12400.00 | 28.93 | 31.82 | 8.84 | 39.08 | 45.03 | 54.00 | -8.97 | AV |

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

## 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) was report as below

| | Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Pre-amplifier (dB) | Cable Loss (dB) | Antenna Factor (dB/m) | Emission level (dBuV/m) | Limit (dBuV/m) | Detector Type | Result |
|---|---|---|---|---|---|---|---|---|---|---|
| GFSK | Low Channel: 2402MHz | | | | | | | | | |
| | H | 2390 | 56.19 | 35.17 | 3.48 | 27.49 | 51.99 | 74 | PK | PASS |
| | H | 2390 | 46.36 | 35.17 | 3.48 | 27.49 | 42.16 | 54 | AV | PASS |
| | H | 2400 | 56.28 | 35.16 | 3.49 | 27.52 | 52.13 | 74 | PK | PASS |
| | H | 2400 | 46.14 | 35.16 | 3.49 | 27.52 | 41.99 | 54 | AV | PASS |
| | V | 2390 | 56.32 | 35.17 | 3.48 | 27.49 | 52.12 | 74 | PK | PASS |
| | V | 2390 | 46.92 | 35.17 | 3.48 | 27.49 | 42.72 | 54 | AV | PASS |
| | V | 2400 | 56.47 | 35.16 | 3.49 | 27.52 | 52.32 | 74 | PK | PASS |
| | V | 2400 | 46.13 | 35.16 | 3.49 | 27.52 | 41.98 | 54 | AV | PASS |
| | High Channel: 2480MHz | | | | | | | | | |
| | H | 2483.5 | 56.36 | 35.11 | 3.56 | 27.75 | 52.56 | 74 | PK | PASS |
| | H | 2485.5 | 46.12 | 35.11 | 3.56 | 27.75 | 42.32 | 54 | AV | PASS |
| | H | 2483.5 | 56.76 | 35.10 | 3.57 | 27.80 | 53.03 | 74 | PK | PASS |
| | H | 2485.5 | 46.93 | 35.10 | 3.57 | 27.80 | 43.20 | 54 | AV | PASS |
| | V | 2483.5 | 56.12 | 35.11 | 3.56 | 27.75 | 52.32 | 74 | PK | PASS |
| | V | 2485.5 | 56.51 | 35.11 | 3.56 | 27.75 | 52.71 | 54 | AV | PASS |
| | V | 2483.5 | 56.63 | 35.10 | 3.57 | 27.80 | 52.90 | 74 | PK | PASS |
| | V | 2485.5 | 46.77 | 35.10 | 3.57 | 27.80 | 43.04 | 54 | AV | PASS |

**Remark:**

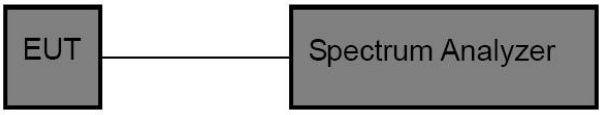
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

# 8 Maximum Peak Output Power Test

## 8.1 Test Standard and Limit

| | |
|---|---|
| Test Standard | FCC Part15 C Section 15.247 (b)(1) & RSS-247.5.4(4) |
| Test Limit | For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. |

## 8.2 Test Setup




## 8.3 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above,

2. Spectrum Setting:

   RBW > the 20 dB bandwidth of the emission being measured

   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

   VBW ≥ RBW

   Sweep = auto

   Detector function = peak

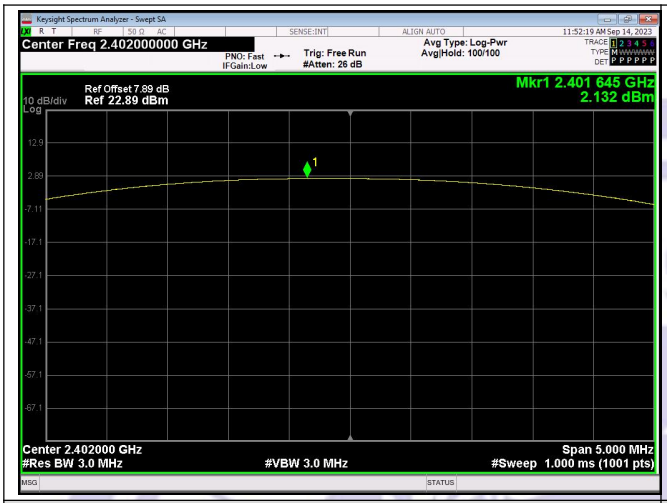
   Trace = max hold

## 8.4 Test Data

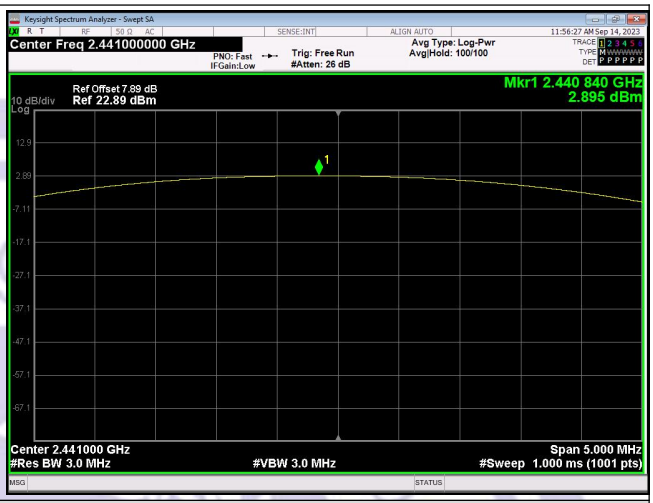
| Modulation | Packet Type | Channel | Peak Output Power (dBm) | Peak Output Power (mW) | Max. Avg. Power (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| GFSK | DH5 | 0 | 2.132 | 1.634 | None | 30 | PASS |
| | | 39 | 2.895 | 1.948 | None | | PASS |
| | | 78 | 3.742 | 2.367 | None | | PASS |
| π/4DQPSK | 2-DH5 | 0 | 2.704 | 1.864 | None | 20.97 | PASS |
| | | 39 | 3.322 | 2.149 | None | | PASS |
| | | 78 | 3.904 | 2.457 | None | | PASS |
| 8DPSK | 3-DH5 | 0 | 2.959 | 1.977 | None | | PASS |
| | | 39 | 3.595 | 2.288 | None | | PASS |
| | | 78 | 4.212 | 2.638 | None | | PASS |

| Modulation | Packet Type | Channel | Peak Output Power (dBm) | Peak Power Limit (dBm) | EIRP (dBm) | EIRP Limit (dBm) | Max. Avg. Power (dBm) | Result |
|---|---|---|---|---|---|---|---|---|
| GFSK | DH5 | 0 | 2.132 | 30 | 3.632 | 36.02 | None | PASS |
| | | 39 | 2.895 | 30 | 4.395 | 36.02 | None | PASS |
| | | 78 | 3.742 | 30 | 5.242 | 36.02 | None | PASS |
| π/4DQPSK | 2-DH5 | 0 | 2.704 | 20.97 | 4.204 | 36.02 | None | PASS |
| | | 39 | 3.322 | 20.97 | 4.822 | 36.02 | None | PASS |
| | | 78 | 3.904 | 20.97 | 5.404 | 36.02 | None | PASS |
| 8DPSK | 3-DH5 | 0 | 2.959 | 20.97 | 4.459 | 36.02 | None | PASS |
| | | 39 | 3.595 | 20.97 | 5.095 | 36.02 | None | PASS |
| | | 78 | 4.212 | 20.97 | 5.712 | 36.02 | None | PASS |

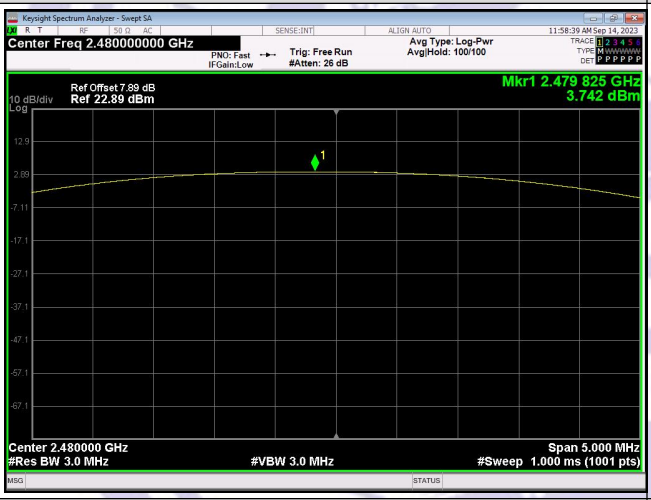
Test plots



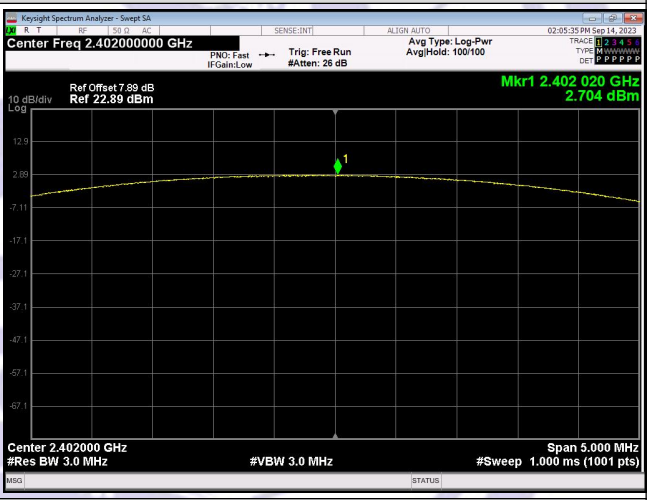

Peak Output Power
GFSK_Channel 0



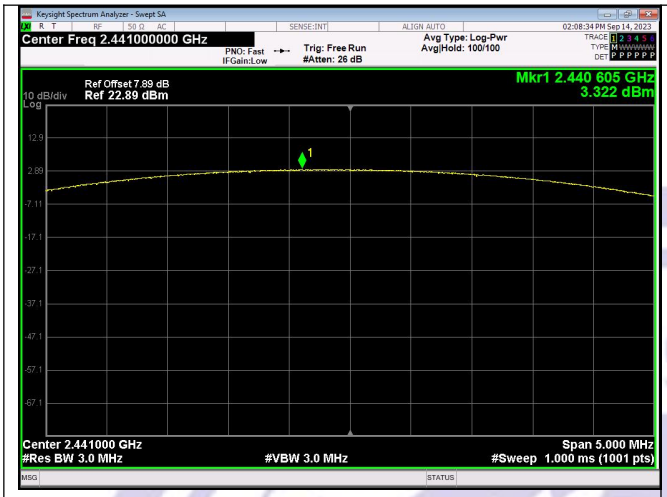

Peak Output Power
GFSK_Channel 39



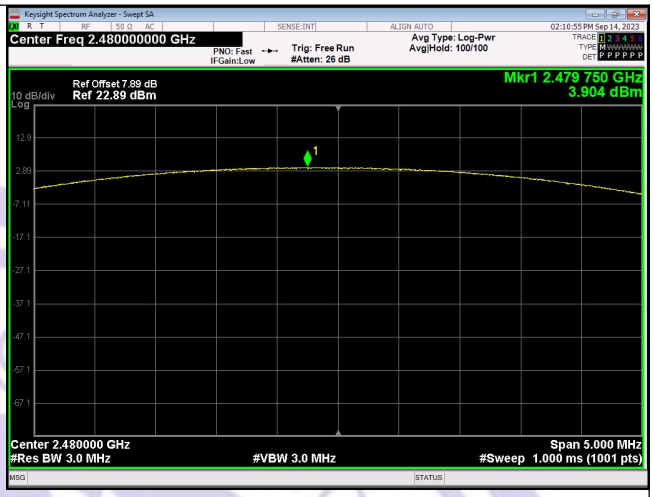

Peak Output Power
GFSK_Channel 78



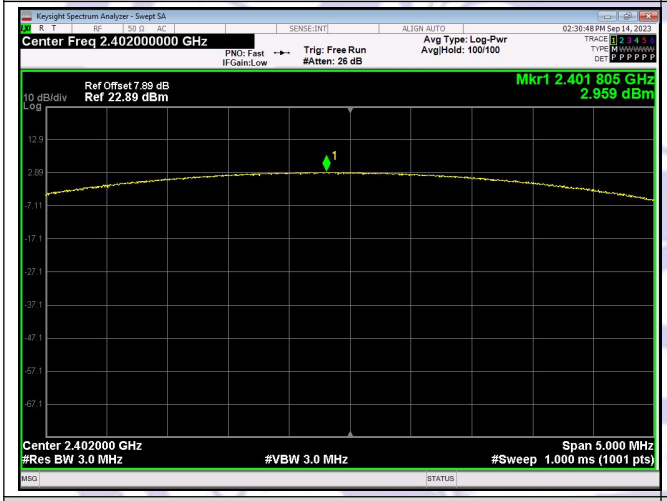

Peak Output Power
π/4DQPSK_Channel 0



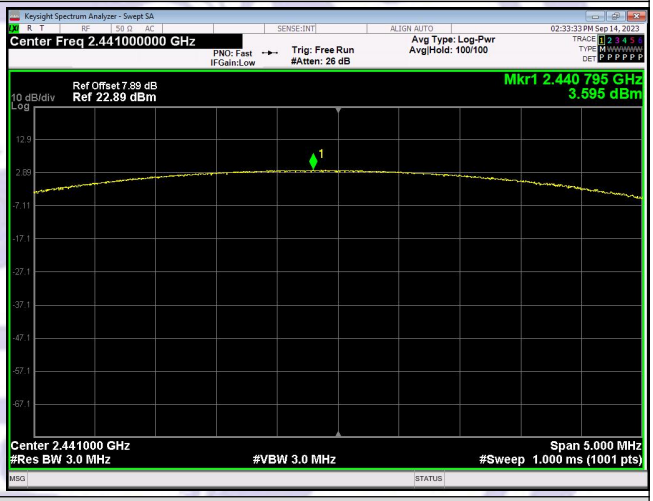

Peak Output Power
π/4DQPSK_Channel 39



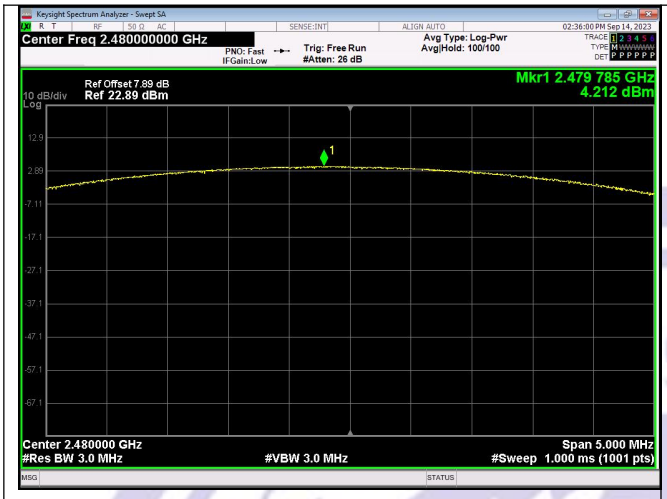

Peak Output Power
π/4DQPSK_Channel 78




Peak Output Power
8DPSK_Channel 0




Peak Output Power
8DPSK_Channel 39

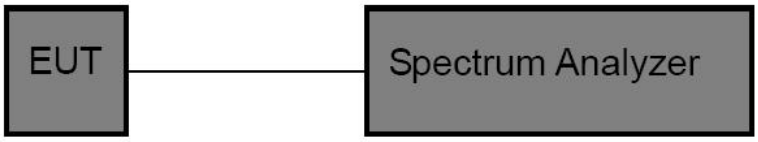
| | |
|---|---|
|  | Void |
| Peak Output Power<br>8DPSK_Channel 78 | |

# 9 20DB Occupy Bandwidth & 99% OCB Test

## 9.1 Test Standard

| | |
|---|---|
| Test Standard | FCC Part15 C Section 15.247 (a)(1) & RSS-247.5.1(2) RSS-Gen 6.7 |

## 9.2 Test Setup




## 9.3 Test Procedure

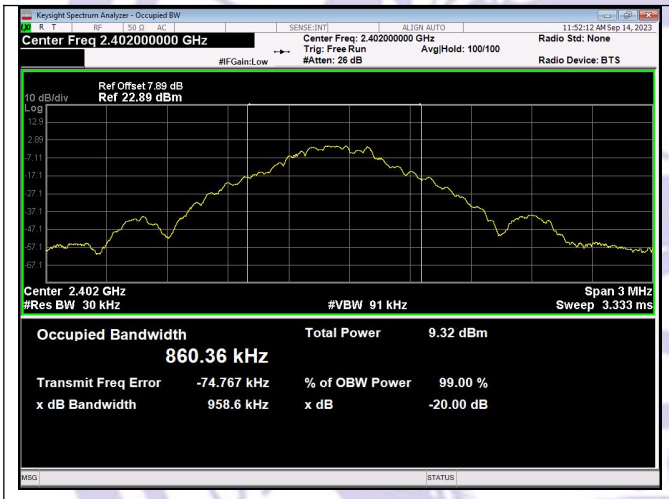
Using the following spectrum analyzer settings:

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 = 91 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

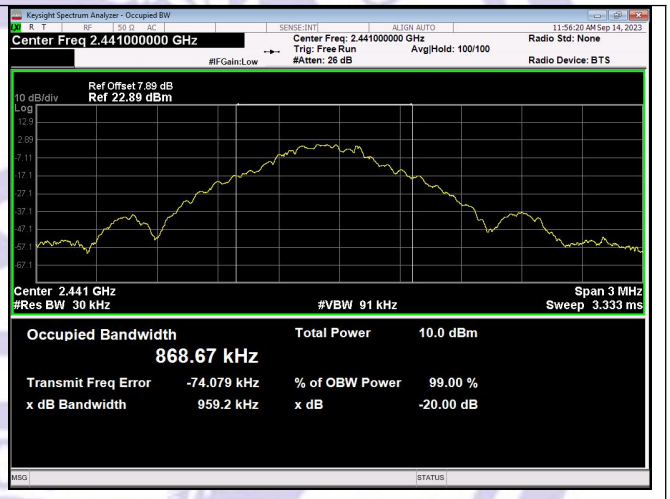
## 9.4 Test Data

| Mode | Test channel | 20dB Emission Bandwidth (MHz) | 99% Bandwidth (MHz) | Result |
|---|---|---|---|---|
| GFSK | Lowest | 0.9586 | 0.84691 | Pass |
| | Middle | 0.9592 | 0.86309 | |
| | Highest | 0.9567 | 0.85029 | |
| π/4-DQPSK | Lowest | 1.329 | 1.1823 | Pass |
| | Middle | 1.323 | 1.1767 | |
| | Highest | 1.325 | 1.1815 | |
| 8-DPSK | Lowest | 1.311 | 1.1862 | Pass |
| | Middle | 1.312 | 1.1872 | |
| | Highest | 1.305 | 1.1715 | |

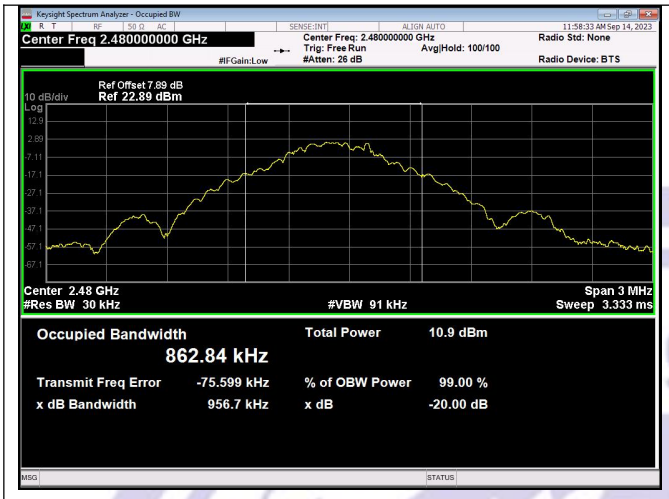
Test plots



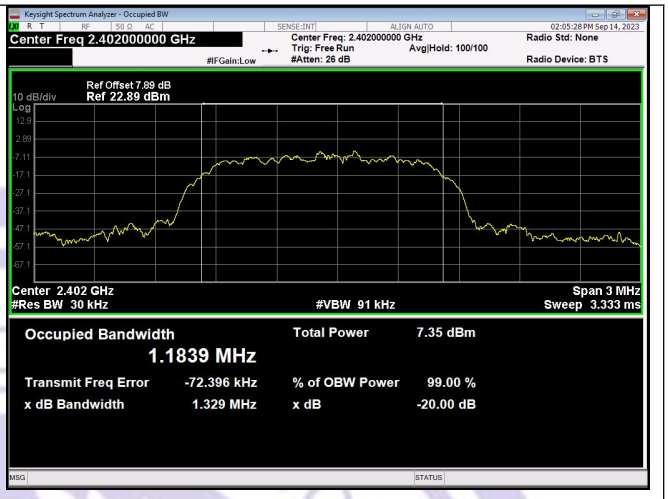

GFSK_DH5_Channel 0



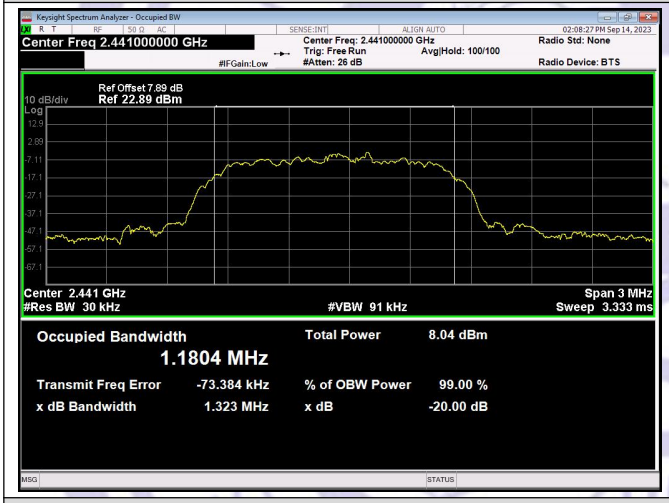

GFSK_DH5_Channel 39



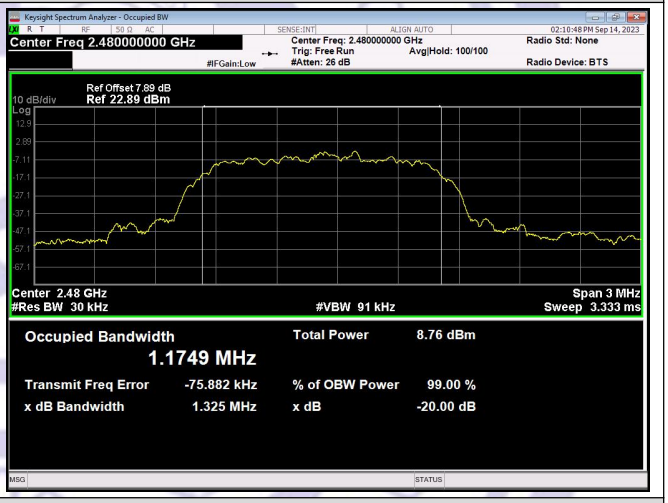

GFSK_DH5_Channel 78



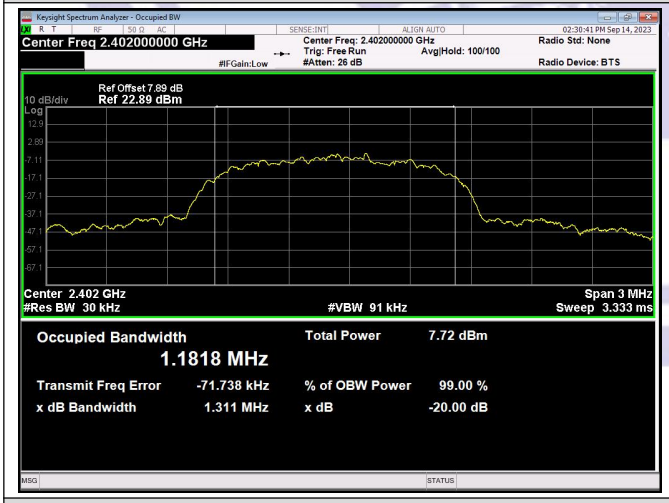

π/4DQPSK_2-DH5_Channel 0



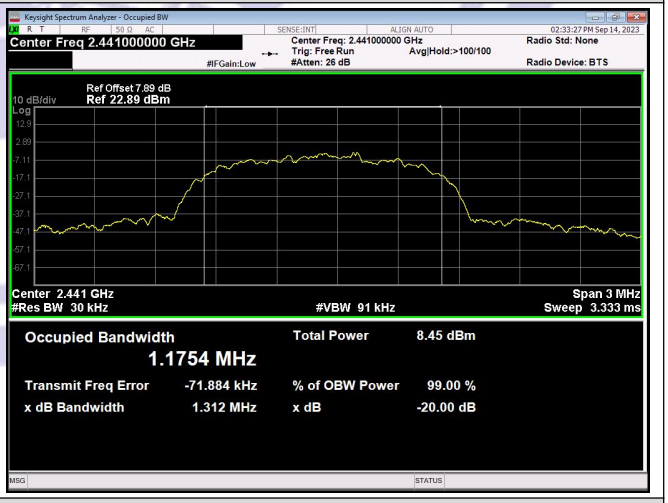

π/4DQPSK_2-DH5_Channel 39




π/4DQPSK_2-DH5_Channel 78




8DPSK_3-DH5_Channel 0




8DPSK_3-DH5_Channel 39