# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

| | |
|---|---|
| **Applicant:** | Qisda Corporation<br>NO. 157, SHAN-YING ROAD, SHAN-TING LI, GUEISHAN DIST., TAOYUAN 333, Taiwan |
| **Manufacturer:** | Qisda Corporation<br>NO. 157 & 159, SHANYING RD., GUEISHAN DIST., TAOYUAN CITY 33341, TAIWAN, R.O.C. |
| **Product Name:** | Bluetooth/WLAN Antenna device |
| **Brand Name:** | QISDA |
| **Model No.:** | S4CWM-19-BB255-C-C2 |
| **Report Number:** | TERF2411003434E2 |
| **FCC ID** | VRSS4CWM19C2 |
| **IC:** | 8729A-S4CWM19C2 |
| **Date of EUT Received:** | October 1, 2024 |
| **Date of Test:** | October 18, 2024～November 27, 2024 |
| **Issue Date:** | December 19, 2024 |

***Approved By*** Aken Huang

***Aken Huang***

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.247, ISED RSS-247.

The results of this report relate only to the sample identified in this report.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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# Revision History

| Report Number | Revision | Description | Issue Date | Revised By | Remark |
|---|---|---|---|---|---|
| TERF2411003434E2 | 00 | Original | December 19, 2024 | Karen Huang | |
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**Note:**

1、 The remark "*" indicates modification of the report upon requests from certification body.

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# 1 GENERAL INFORMATION

## 1.1 Product Description

| | |
|---|---|
| Product Name: | Bluetooth/WLAN Antenna device |
| Brand Name: | QISDA |
| Model No.: | S4CWM-19-BB255-C-C2 |
| Hardware Version: | S16 |
| Firmware Version: | FW_18_53 |
| EUT Series No.: | 000000851 |
| Power Supply: | 3.3Vdc |
| Test Software (Name/Version) | Putty v0.81 |

## 1.2 RF Specification

| | |
|---|---|
| Radio Technology: | BT BR+EDR |
| Channel number: | 79 channels |
| Modulation type: | GFSK + π/4DQPSK + 8DPSK |
| Transmit Power: | 4.93dBm |
| Frequency Range: | 2.402GHz – 2.480GHz |
| Dwell Time: | ≦ 0.4s |

## 1.3 Antenna Designation

| Antenna Type | Freq. | Antenna Port | Peak Antenna Gain (dBi) |
|---|---|---|---|
| Dipole Antenna | 2.4GHz | Ch0 | 2.44 |
| | | Ch1 | 2.44 |

**Note:**

1. Pre-scanned was done on the above antennas, measurements were demonstrated by using the antenna with the highest gain as the worst case scenarios.
2. Antenna information is provided by the applicant.

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## 1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247
FCC KDB 558074 D01 15.247 Meas. Guidance v05r02
RSS-247 issue 3 Aug. 2023
RSS-Gen, Issue 5 April 2018, Amendment 2 (February 2021)
ANSI C63.10:2013

## 1.5 Test Facility

| Laboratory | Test Site Address | Test Site Name | FCC Designation number | IC CAB identifier |
|---|---|---|---|---|
| SGS Taiwan Ltd. Central RF Lab. (TAF code 3702) | No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan. | SAC 1 | TW0027 | TW3702 |
| | | SAC 2 | | |
| | | SAC 3 | | |
| | | Conduction 1 | | |
| | | Conducted 1 | | |
| | | Conducted 2 | | |
| | | Conducted 3 | | |
| | | Conducted 4 | | |
| | | Conducted 5 | | |
| | | Conducted 6 | | |
| | No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333 | Conduction C | TW0028 | |
| | | SAC C | | |
| | | SAC D | | |
| | | SAC G | | |
| | | Conducted A | | |
| | | Conducted B | | |
| | | Conducted C | | |
| | | Conducted D | | |
| | | Conducted E | | |
| | | Conducted F | | |
| | | Conducted G | | |

**Note:** Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

## 1.6 Special Accessories

There is no special accessory used while test was conducted.

## 1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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# 2 SYSTEM TEST CONFIGURATION

## 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

## 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

## 2.3 Test Procedure

### 2.3.1 Conducted Emissions

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

### 2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

### 2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

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## 2.4 Measurement Results Explanation Example

### 2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-ane choic chamber, the measurements correspond to those obtained at an open-field test site.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 2.4.2 For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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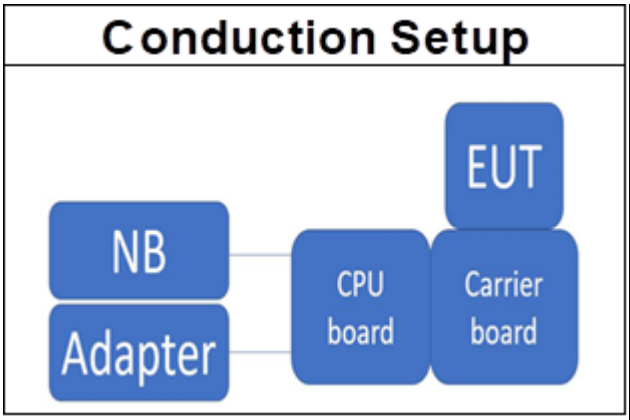
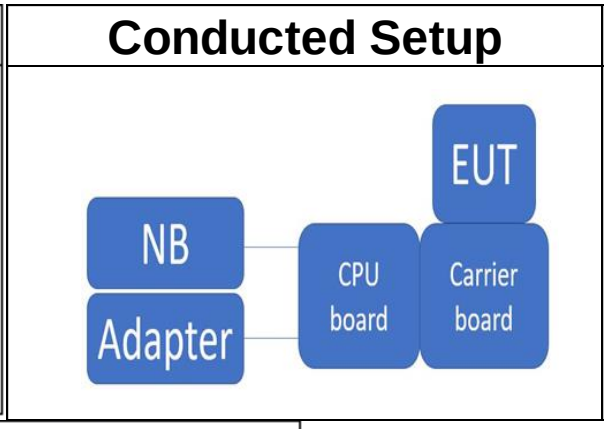
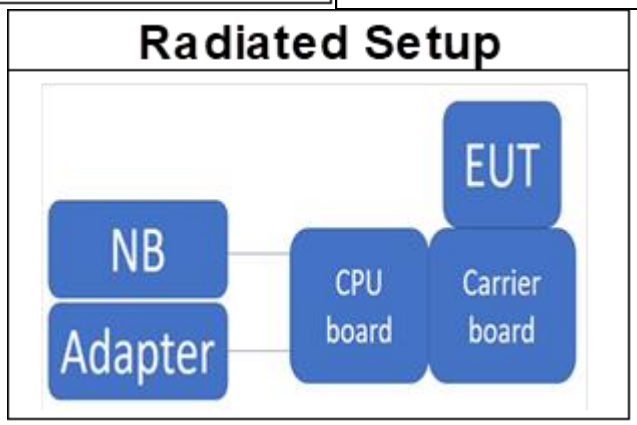
## 2.5 Test Configuration




## 2.6 Control Unit(s)

| AC Power-Line Conducted Emission Test Site: Conduction C | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. (mm/dd/yyyy) | CAL DUE. (mm/dd/yyyy) |
| AC Adapter | Asian Power Devices Inc. | WA-36W12R | N/A | N/A | N/A |
| CPU board | Qisda | 5E.64T51.001 | N/A | N/A | N/A |
| Carrier board | Qisda | 5E.64T50.001 | N/A | N/A | N/A |
| LAN Cable | AMP | AMP-6e | 4719862256612 | N/A | N/A |
| Notebook | Lenovo | T470 | P0001293 | N/A | N/A |
| Conducted Emission Test Site: Conducted C | | | | | |
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. (mm/dd/yyyy) | CAL DUE. (mm/dd/yyyy) |
| Notebook | Lenovo | T14 | P0003332 | N/A | N/A |
| LAN Cable | TATUNG | E210587 | N/A | N/A | N/A |
| CPU board | Qisda | 5E.64T51.001 | N/A | N/A | N/A |
| Carrier board | Qisda | 5E.64T50.001 | N/A | N/A | N/A |
| Adapter | APD | WA-36W12R | N/A | N/A | N/A |

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| Radiated Emission Test Site: SAC G | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. (mm/dd/yyyy) | CAL DUE. (mm/dd/yyyy) |
| AC Adapter | Asian Power Devices Inc. | WA-36W12R | N/A | N/A | N/A |
| CPU board | Qisda | 5E.64T51.001 | N/A | N/A | N/A |
| Carrier board | Qisda | 5E.64T50.001 | N/A | N/A | N/A |
| LAN Cable | AMP | AMP-6e | 4719862256612 | N/A | N/A |
| Notebook | Lenovo | T470 | P0001293 | N/A | N/A |

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# 3 SUMMARY OF TEST RESULTS

| FCC Rules | ISED Rules | Description Of Test | Result |
|---|---|---|---|
| §15.207(a) | RSS-Gen §8.8 | AC Power Line Conducted Emission | Compliant |
| §15.247(b)(1) | RSS-247 §5.4 b | Peak Output Power | Compliant |
| §15.247(a)(1) | RSS-247 §5.1 b<br>RSS-Gen §6.7 | Emission Bandwidth | Compliant |
| §15.247(d)<br>§15.209 | RSS-247 §5.5<br>RSS-Gen §8.9 | Conducted Band Edge and Spurious Emission | Compliant |
| §15.247(d)<br>§15.209 | RSS-247 §5.5<br>RSS-Gen §8.9 | Radiated Band Edge and Spurious Emission | Compliant |
| §15.205 | RSS-Gen § 8.10 | Restricted Bands | Compliant |
| §15.247(a)(1) | RSS-247 §5.1 b | Frequency Separation | Compliant |
| §15.247(a)(1)(iii) | RSS-247 §5.1 d | Number of hopping frequency Time of Occupancy | Compliant |
| §15.203 | N/A | Antenna Requirement | Compliant |

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# 4 DESCRIPTION OF TEST MODES

## 4.1 Operated in 2400 ~ 2483.5MHz Band

| 2400~2483.5 MHz | | | | | | | |
|---|---|---|---|---|---|---|---|
| CH | Freq. (MHz) | CH | Freq. (MHz) | CH | Freq. (MHz) | CH | Freq. (MHz) |
| 0 | 2402 | 20 | 2422 | 40 | 2442 | 60 | 2462 |
| 1 | 2403 | 21 | 2423 | 41 | 2443 | 61 | 2463 |
| 2 | 2404 | 22 | 2424 | 42 | 2444 | 62 | 2464 |
| 3 | 2405 | 23 | 2425 | 43 | 2445 | 63 | 2465 |
| 4 | 2406 | 24 | 2426 | 44 | 2446 | 64 | 2466 |
| 5 | 2407 | 25 | 2427 | 45 | 2447 | 65 | 2467 |
| 6 | 2408 | 26 | 2428 | 46 | 2448 | 66 | 2468 |
| 7 | 2409 | 27 | 2429 | 47 | 2449 | 67 | 2469 |
| 8 | 2410 | 28 | 2430 | 48 | 2450 | 68 | 2470 |
| 9 | 2411 | 29 | 2431 | 49 | 2451 | 69 | 2471 |
| 10 | 2412 | 30 | 2432 | 50 | 2452 | 70 | 2472 |
| 11 | 2413 | 31 | 2433 | 51 | 2453 | 71 | 2473 |
| 12 | 2414 | 32 | 2434 | 52 | 2454 | 72 | 2474 |
| 13 | 2415 | 33 | 2435 | 53 | 2455 | 73 | 2475 |
| 14 | 2416 | 34 | 2436 | 54 | 2456 | 74 | 2476 |
| 15 | 2417 | 35 | 2437 | 55 | 2457 | 75 | 2477 |
| 16 | 2418 | 36 | 2438 | 56 | 2458 | 76 | 2478 |
| 17 | 2419 | 37 | 2439 | 57 | 2459 | 77 | 2479 |
| 18 | 2420 | 38 | 2440 | 58 | 2460 | 78 | 2480 |
| 19 | 2421 | 39 | 2441 | 59 | 2461 | | |

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## 4.2 The Worst Test Modes and Channel Details

1 The EUT has been tested under operating condition.
2 Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3 Investigation has been done on all the possible configurations for searching the worst case.

| ANTENNA PORT CONDUCTED TEST | | | | |
|---|---|---|---|---|
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | PACKET TYPE |
| **Peak Output Power, 20dB Band Width, Spurious Emission** | | | | |
| Bluetooth | 0 to 78 | 0,39,78 | GFSK | DH5 |
| | 0 to 78 | 0,39,78 | π/4-DQPSK | 2DH5 |
| | 0 to 78 | 0,39,78 | 8-DPSK | 3DH5 |
| **Band Edge** | | | | |
| Bluetooth | 0 to 78 | 0,78 | GFSK/8-DPSK | DH5/3DH5 |
| **Frequency Separation** | | | | |
| Bluetooth | 0 to 78 | 0,1,2, 38,39,40, 76,77,78 | GFSK | DH5 |
| | | | π/4-DQPSK | 2DH5 |
| | | | 8-DPSK | 3DH5 |
| **Number of Hopping Frequency, Hopping Band edge** | | | | |
| Bluetooth | 0 to 78 | 0 to 78 | GFSK/8-DPSK | DH5/3DH5 |
| **Time of Occupancy(Dwell time)** | | | | |
| Bluetooth | 0 to 78 | 39 | GFSK | DH1/DH3/DH5 |
| | | | π/4-DQPSK | 2DH1/2DH3/2DH5 |
| | | | 8-DPSK | 3DH1/3DH3/3DH5 |
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | PACKET TYPE |
| **TRANSMIT RADIATED EMISSION TEST (BELOW 1 GHz)** | | | | |
| Bluetooth | 0 to 78 | 39 | GFSK | DH5 |
| **TRANSMIT RADIATED EMISSION TEST (ABOVE 1 GHz)** | | | | |
| Bluetooth | 0 to 78 | 0,39,78 | GFSK/8-DPSK | DH5/3DH5 |

**Note:** The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for channel Low, Mid and High, the worst case position was reported.

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# 5 MEASUREMENT UNCERTAINTY

| Test Items | Uncertainty | | |
|---|---|---|---|
| AC Power Line Conducted Emission | +/- | 1.54 | dB |
| Output Power measurement | +/- | 0.97 | dB |
| Emission Bandwidth | +/- | 1.38 | Hz |
| Conducted emission measurement | +/- | 0.77 | dB |
| Frequency Separation | +/- | 1.48 | Hz |
| Number of hopping frequency | +/- | 1.48 | Hz |
| Time of Occupancy | +/- | 1.48 | Hz |
| Temperature | +/- | 0.6 | °C |
| Humidity | +/- | 3 | % |
| DC / AC Power Source | +/- | 1 | % |

| Radiated Spurious Emission Measurement Uncertainty | | | | |
|---|---|---|---|---|
| **Polarization: Vertical** | **+/-** | **1.89** | **dB** | 9kHz~30MHz |
| | **+/-** | **4.15** | **dB** | 30MHz - 1000MHz |
| | **+/-** | **3.43** | **dB** | 1GHz - 18GHz |
| | **+/-** | **3.86** | **dB** | 18GHz - 40GHz |
| **Polarization: Horizontal** | **+/-** | **1.89** | **dB** | 9kHz~30MHz |
| | **+/-** | **4.02** | **dB** | 30MHz - 1000MHz |
| | **+/-** | **3.43** | **dB** | 1GHz - 18GHz |
| | **+/-** | **3.86** | **dB** | 18GHz - 40GHz |
| **Radiated Spurious Emission** | **+/-** | **2** | **dB** | 33GHz-50GHz |
| | **+/-** | **1.59** | **dB** | 50GHz-60GHz |
| | **+/-** | **1.7** | **dB** | 60GHz-90GHz |
| | **+/-** | **1.64** | **dB** | 90GHz-140GHz |
| | **+/-** | **3.83** | **dB** | 140GHz-220GHz |

***Note:***

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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# 6 MEASUREMENT EQUIPMENT USED

## 6.1 Emission from AC power line

| AC Power-Line Conducted Emission Test Site: Conduction C | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. (mm/dd/yyyy) | CAL DUE. (mm/dd/yyyy) |
| Coaxial Cable | EC Lab | RF-HY-CAB-250 | RF-HY-CAB-250-01 | 03/27/2024 | 03/26/2025 |
| EMI Test Receiver | R&S | ESCI | 101342 | 04/29/2024 | 04/28/2025 |
| LISN | SCHWARZBECK Mess-Elektronik | NSLK8127 | 973 | 04/22/2024 | 04/21/2025 |
| Pulse Limiter | EC Lab | VTSD 9561F-N | 485 | 03/27/2024 | 03/26/2025 |
| Test Software | audix | e3 | E3 20923 SGS Ver.9 ( C ) | N.C.R | N.C.R |

## 6.2 Conducted Measurement

| Conducted Emission Test Site: Conducted C | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. (mm/dd/yyyy) | CAL DUE. (mm/dd/yyyy) |
| Attenuator | Woken | WATT-218FS-10 | RF18 | 11/15/2023 | 11/14/2024 |
| Attenuator | Woken | WATT-218FS-10 | RF19 | 11/15/2023 | 11/14/2024 |
| DC Block | PASTERNACK | PE8210 | RF155 | 11/15/2023 | 11/14/2024 |
| Power Meter | Anritsu | ML2496A | 2138005 | 09/25/2024 | 09/24/2025 |
| Power Sensor | Anritsu | MA2411B | 1911395 | 09/25/2024 | 09/24/2025 |
| Power Sensor | Anritsu | MA2411B | 1911396 | 09/25/2024 | 09/24/2025 |
| Spectrum Analyzer | KEYSIGHT | N9010B | MY59071573 | 05/24/2024 | 05/23/2025 |
| Test Software | SGS Taiwan | Radio Test Software | Ver.21 | N.C.R | N.C.R |

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## 6.3 Radiated Measurement

| Radiated Emission Test Site: SAC G | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. (mm/dd/yyyy) | CAL DUE. (mm/dd/yyyy) |
| 3m Site NSA | SGS | 966 chamber G | N/A | 03/30/2024 | 03/29/2025 |
| Active Loop Antenna | COM-POWER | AL-130R | 10160105 | 12/04/2023 | 12/03/2024 |
| Broadband Antenna | SCHWARZBECK | VULB 9168 | 1208 | 07/17/2024 | 07/16/2025 |
| Coaxial Cable | EMC Instruments | EMC104-SM-SM-8000-5000-5000 | 210219、210220、210221 | 03/13/2024 | 03/12/2025 |
| Coaxial Cable | EMC Instruments | EMCCFD400-NM-NM-8000-5000-2000 | 210216、210217、210218 | 03/13/2024 | 03/12/2025 |
| High Pass Filter | WI | WHKX10-2624-3200-18000-80SS | RF210 | 11/14/2024 | 11/13/2025 |
| Horn Antenna | RF SPIN | DRH18-E | 210105A18E | 04/12/2024 | 04/11/2025 |
| Horn Antenna | Schwarzbeck | BBHA9170 | 184 | 12/28/2023 | 12/27/2024 |
| Lowpass Filter | Woken | EWT-56-0019 | RF173 | 11/14/2024 | 11/13/2025 |
| Pre-Amplifier | EMC Instruments | EMC118A45SE | 980815 | 05/08/2024 | 05/07/2025 |
| Pre-Amplifier | EMC Instruments | EMC330N | 980781 | 03/13/2024 | 03/12/2025 |
| Spectrum Analyzer | KEYSIGHT | N9010B | MY63440390 | 02/16/2024 | 02/15/2025 |
| Test Software | audix | e3 | E3 20923 SGS Ver.9 ( C ) | N.C.R | N.C.R |

***NOTE:*** *N.C.R refers to Not Calibrated Required.*

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# 7 CONDUCTED EMISSION TEST

## 7.1 Standard Applicable

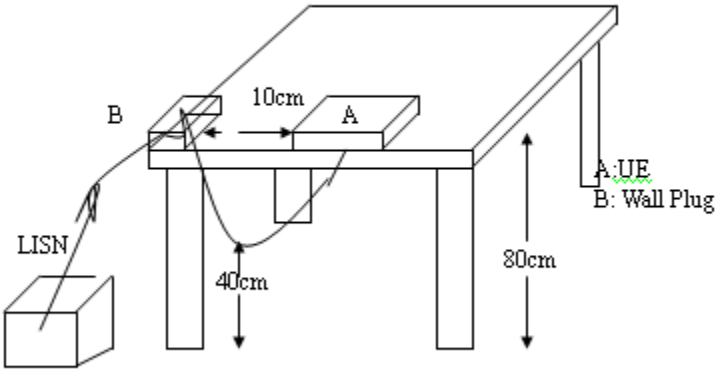
Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

| Frequency range MHz | Limits dB(uV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| Note<br>1.The lower limit shall apply at the transition frequencies<br>2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | |

## 7.2 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

## 7.3 Test Setup




## 7.4 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 were complete.

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## 7.5 Measurement Result

Note: Refer to next page for measurement data and plots.
Note2: The * reveals the worst-case results that closest to the limit.

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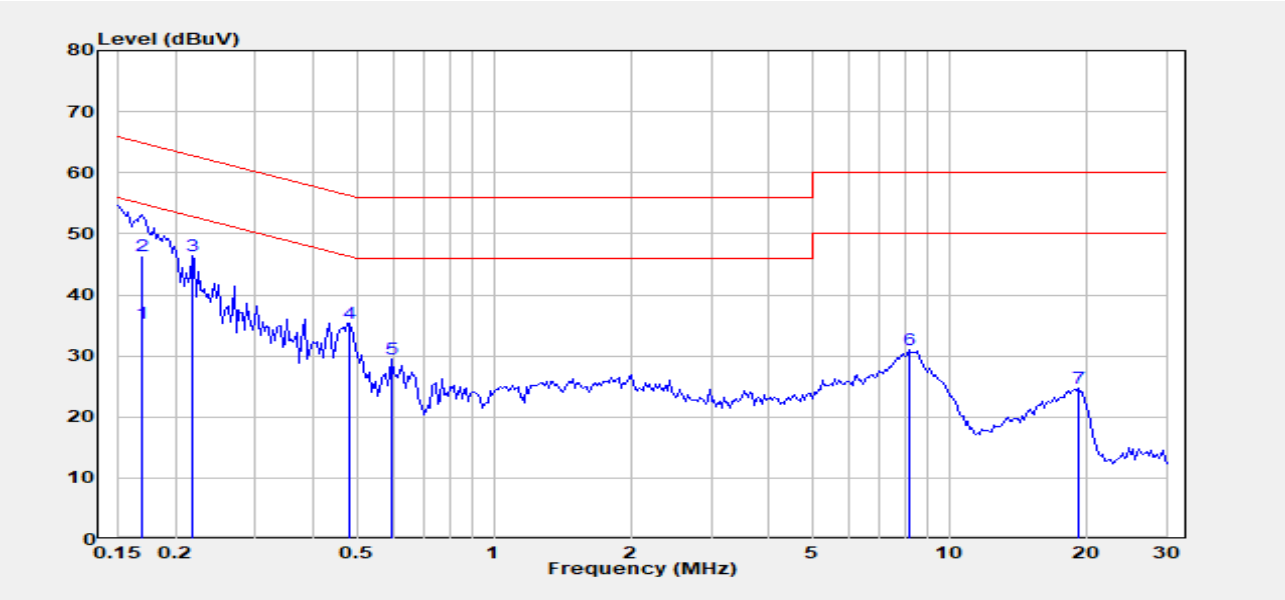
# AC POWER LINE CONDUCTED EMISSION TEST DATA

| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :Conduction C |
| Test Mode | :BT | Test Date | :2024-11-22 |
| Power | :120V/60Hz | Temp./Humi | :21.5℃/62% |
| Probe | :L1 | Engineer | :Alex Li |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV | Limit dBμV | Margin dB |
|---|---|---|---|---|---|---|
| 0.169 | Average | 24.60 | 10.65 | 35.25 | 55.03 | -19.78 |
| 0.169 | Peak | 35.80 | 10.65 | 46.45 | 65.03 | -18.58 |
| 0.217 | Peak | 35.73 | 10.65 | 46.37 | 62.92 | -16.55 |
| 0.481 | Peak | 24.82 | 10.62 | 35.44 | 56.32 | -20.88 |
| 0.595 | Peak | 18.82 | 10.63 | 29.45 | 56.00 | -26.55 |
| 8.148 | Peak | 19.96 | 10.96 | 30.92 | 60.00 | -29.08 |
| 19.224 | Peak | 13.61 | 11.15 | 24.76 | 60.00 | -35.24 |

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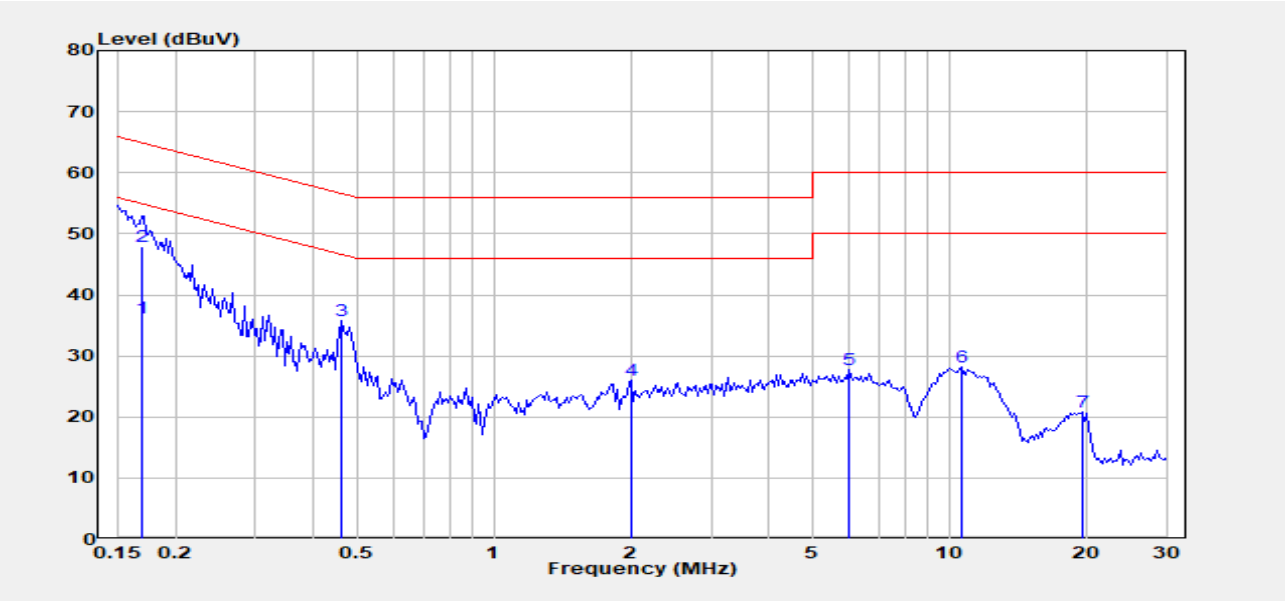
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :Conduction C |
| Test Mode | :BT | Test Date | :2024-11-22 |
| Power | :120V/60Hz | Temp./Humi | :21.5℃/62% |
| Probe | :N | Engineer | :Alex Li |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV | Limit dBμV | Margin dB |
|---|---|---|---|---|---|---|
| 0.169 | Average | 25.60 | 10.66 | 36.26 | 55.03 | -18.78 |
| 0.169 | QP | 37.20 | 10.66 | 47.86 | 65.03 | -17.18 |
| 0.461 | Peak | 25.26 | 10.61 | 35.86 | 56.67 | -20.81 |
| 2.012 | Peak | 15.24 | 10.75 | 25.99 | 56.00 | -30.01 |
| 6.056 | Peak | 16.78 | 10.94 | 27.72 | 60.00 | -32.28 |
| 10.620 | Peak | 17.16 | 10.97 | 28.13 | 60.00 | -31.87 |
| 19.635 | Peak | 9.73 | 11.15 | 20.89 | 60.00 | -39.11 |

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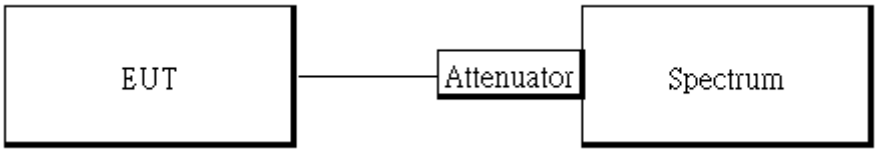
# 8 FREQUENCY SEPARATION

## 8.1 Standard Applicable

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

## 8.2 Test Setup




## 8.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = middle of hopping channel.
5. Set the RBW approximately 30% of the channel spacing, VBW ≥ RBW.
6. Adjust Span to Wide enough to capture the peaks of two adjacent channels.
7. Sweep = auto.
8. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

## 8.4 Measurement Result

| Channel separation (MHz) | Limit | Result |
|---|---|---|
| 1 | ≧25 kHz or<br>2/3 times 20dB bandwidth | PASS |

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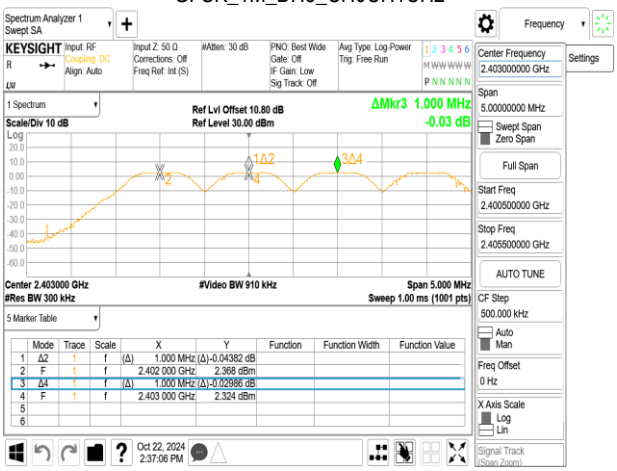
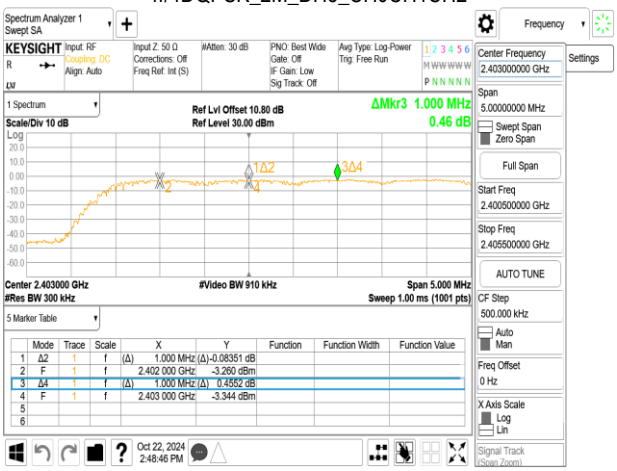



π/4DQPSK_2M_DH5_CH0CH1CH2

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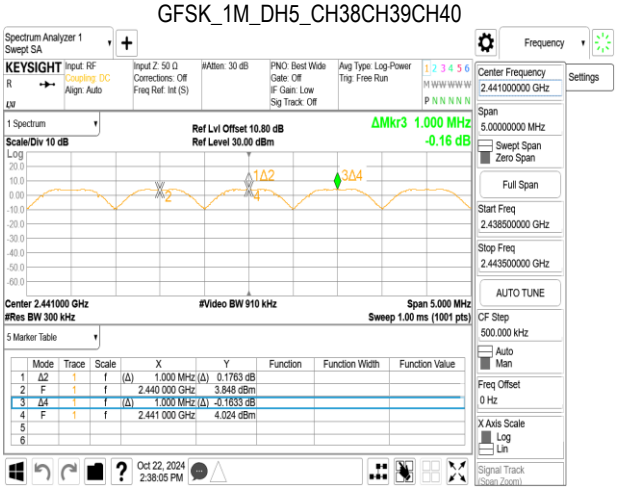


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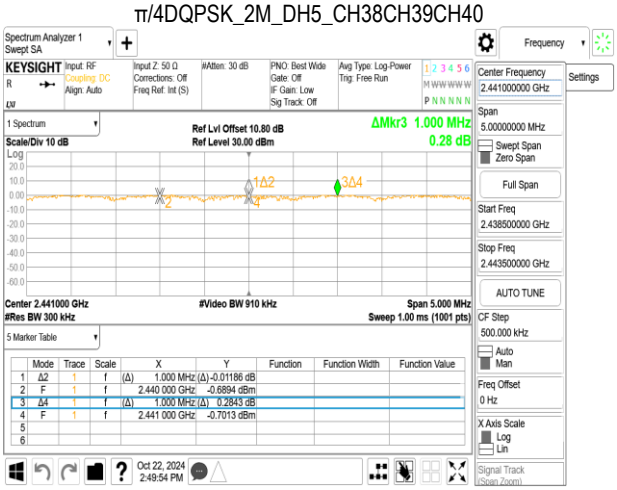


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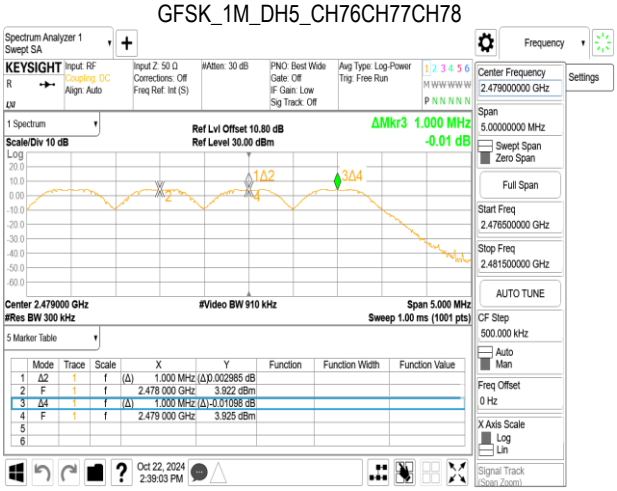
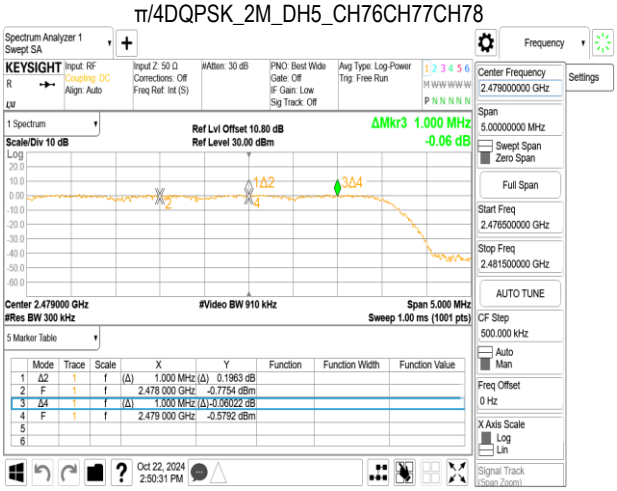



π/4DQPSK_2M_DH5_CH76CH77CH78

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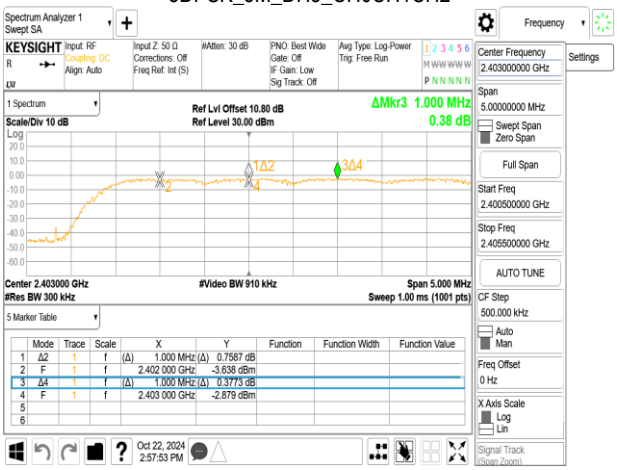
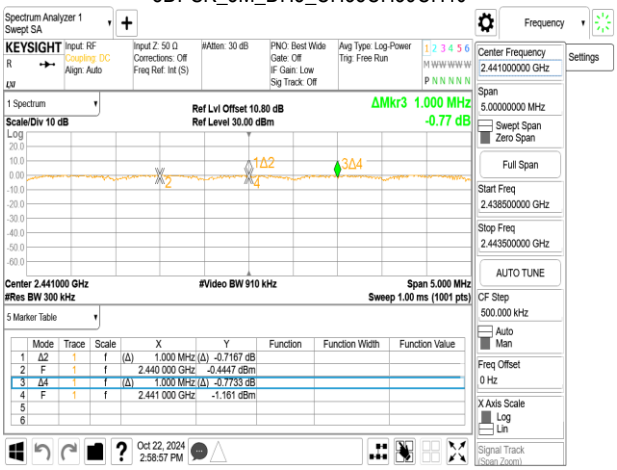
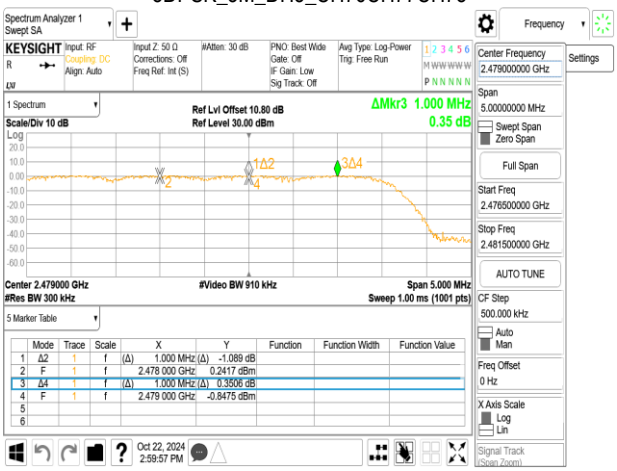
8DPSK_3M_DH5_CH0CH1CH2




8DPSK_3M_DH5_CH38CH39CH40




8DPSK_3M_DH5_CH76CH77CH78

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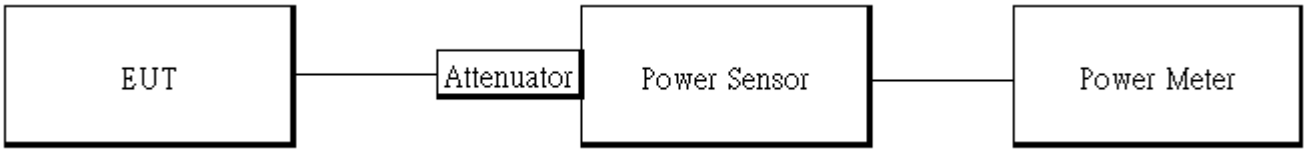
# 9 PEAK OUTPUT POWER MEASUREMENT

## 9.1 Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.
The e.i.r.p. shall not exceed 4 W.

## 9.2 Test Setup




## 9.3 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Duty cycle of test signal is < 98 %, duty factor shall be considered.
4. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB band-width)
5. Record the max. reading.
6. Repeat above procedures until all default test channel is completed.

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## 9.4 Peak & Average Power Measurement Result

**Mode: Ch0**

| | Duty Cycle (%) = Ton / (Ton+Toff) | Duty Factor (dB) =10*log ( 1/Duty Cycle ) |
|---|---|---|
| DH5 | 72.80 | 1.38 |
| 2DH5 | 72.80 | 1.38 |
| 3DH5 | 73.20 | 1.35 |

**1M BR mode (Peak):**

| CH | Freq. (MHz) | Power Setting | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 0 | 3.76 | 2.377 | 1000 |
| 39 | 2441 | 0 | 4.88 | 3.076 | 1000 |
| 78 | 2480 | 0 | **4.93** | 3.112 | 1000 |

**1M BR mode (Average):**

| CH | Freq. (MHz) | Power Setting | Avg. Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 0 | 3.17 | 2.074 | 1000 |
| 39 | 2441 | 0 | 4.59 | 2.877 | 1000 |
| 78 | 2480 | 0 | 4.63 | 2.903 | 1000 |

**2M EDR mode (Peak):**

| CH | Freq. (MHz) | Power Setting | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 1 | 1.58 | 1.439 | 125 |
| 39 | 2441 | 1 | 2.98 | 1.986 | 125 |
| 78 | 2480 | 1 | **3.39** | 2.183 | 125 |

**2M EDR mode (Average):**

| CH | Freq. (MHz) | Power Setting | Avg. Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 1 | -0.81 | 0.830 | 125 |
| 39 | 2441 | 1 | 0.32 | 1.076 | 125 |
| 78 | 2480 | 1 | 0.96 | 1.247 | 125 |

**3M EDR mode (Peak):**

| CH | Freq. (MHz) | Power Setting | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 1 | 1.84 | 1.528 | 125 |
| 39 | 2441 | 1 | 3.37 | 2.173 | 125 |
| 78 | 2480 | 1 | **3.81** | 2.404 | 125 |

**3M EDR mode (Average):**

| CH | Freq. (MHz) | Power Setting | Avg. Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 1 | -0.92 | 0.810 | 125 |
| 39 | 2441 | 1 | 0.07 | 1.017 | 125 |
| 78 | 2480 | 1 | 0.84 | 1.215 | 125 |

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## Mode: Ch1

| | Duty Cycle (%) = Ton / (Ton+Toff) | Duty Factor (dB) =10*log ( 1/Duty Cycle ) |
|---|---|---|
| DH5 | 76.80 | 1.15 |
| 2DH5 | 76.80 | 1.15 |
| 3DH5 | 77.20 | 1.12 |

**1M BR mode (Peak):**

| CH | Freq. (MHz) | Power Setting | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 0 | **3.39** | 2.183 | 1000 |
| 39 | 2441 | 0 | 2.61 | 1.824 | 1000 |
| 78 | 2480 | 0 | 1.50 | 1.413 | 1000 |

**1M BR mode (Average):**

| CH | Freq. (MHz) | Power Setting | Avg. Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 0 | 2.85 | 1.926 | 1000 |
| 39 | 2441 | 0 | 2.07 | 1.609 | 1000 |
| 78 | 2480 | 0 | 0.96 | 1.246 | 1000 |

**2M EDR mode (Peak):**

| CH | Freq. (MHz) | Power Setting | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 1 | 0.68 | 1.169 | 125 |
| 39 | 2441 | 1 | 0.91 | 1.233 | 125 |
| 78 | 2480 | 0 | **3.36** | 2.168 | 125 |

**2M EDR mode (Average):**

| CH | Freq. (MHz) | Power Setting | Avg. Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 1 | -2.29 | 0.590 | 125 |
| 39 | 2441 | 1 | -1.63 | 0.686 | 125 |
| 78 | 2480 | 0 | 0.40 | 1.096 | 125 |

**3M EDR mode (Peak):**

| CH | Freq. (MHz) | Power Setting | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 1 | 1.11 | 1.291 | 125 |
| 39 | 2441 | 1 | 1.18 | 1.312 | 125 |
| 78 | 2480 | 0 | **3.61** | 2.296 | 125 |

**3M EDR mode (Average):**

| CH | Freq. (MHz) | Power Setting | Avg. Output Power (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|---|
| 0 | 2402 | 1 | -2.23 | 0.599 | 125 |
| 39 | 2441 | 1 | -1.55 | 0.700 | 125 |
| 78 | 2480 | 0 | 0.60 | 1.149 | 125 |

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## 9.5 EIRP Measurement Result

**Mode: Ch0**

**1M BR mode EIRP**

| Channel | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---|---|---|---|---|---|---|
| 0 | 2402 | 0 | 3.17 | 2.44 | 3.638 | 4000 |
| 39 | 2441 | 0 | 4.59 | 2.44 | 5.045 | 4000 |
| 78 | 2480 | 0 | 4.63 | 2.44 | 5.092 | 4000 |

**2M EDR mode EIRP**

| Channel | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---|---|---|---|---|---|---|
| 0 | 2402 | 1 | -0.81 | 2.44 | 1.455 | 4000 |
| 39 | 2441 | 1 | 0.32 | 2.44 | 1.887 | 4000 |
| 78 | 2480 | 1 | 0.96 | 2.44 | 2.187 | 4000 |

**3M EDR mode EIRP**

| Channel | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---|---|---|---|---|---|---|
| 0 | 2402 | 1 | -0.92 | 2.44 | 1.421 | 4000 |
| 39 | 2441 | 1 | 0.07 | 2.44 | 1.784 | 4000 |
| 78 | 2480 | 1 | 0.84 | 2.44 | 2.131 | 4000 |

* ***Note:*** EIRP = Average Power + Gain

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**Mode: Ch1**

**1M BR mode EIRP**

| Channel | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---|---|---|---|---|---|---|
| 0 | 2402 | 0 | 2.85 | 2.44 | 3.378 | 4000 |
| 39 | 2441 | 0 | 2.07 | 2.44 | 2.823 | 4000 |
| 78 | 2480 | 0 | 0.96 | 2.44 | 2.186 | 4000 |

**2M EDR mode EIRP**

| Channel | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---|---|---|---|---|---|---|
| 0 | 2402 | 1 | -2.29 | 2.44 | 1.034 | 4000 |
| 39 | 2441 | 1 | -1.63 | 2.44 | 1.204 | 4000 |
| 78 | 2480 | 0 | 0.40 | 2.44 | 1.921 | 4000 |

**3M EDR mode EIRP**

| Channel | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---|---|---|---|---|---|---|
| 0 | 2402 | 1 | -2.23 | 2.44 | 1.050 | 4000 |
| 39 | 2441 | 1 | -1.55 | 2.44 | 1.229 | 4000 |
| 78 | 2480 | 0 | 0.60 | 2.44 | 2.015 | 4000 |

* ***Note:*** EIRP = Average Power + Gain

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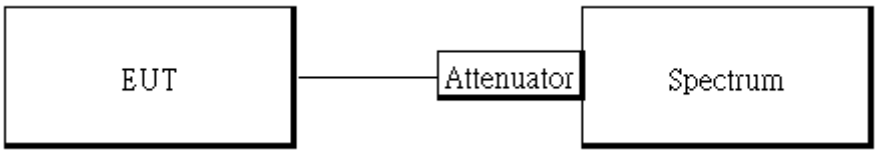
# 10 EMISSION BANDWIDTH MEASUREMENT

## 10.1 Standard Applicable

For frequency hopping systems operating in the 2400 MHz-2483.5 MHz no limit for 20dB bandwidth.

## 10.2 Test Setup




## 10.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set the spectrum analyzer as
   RBW= 1 % to 5% of OBW ,
   VBW = 3 X RBW,
   Span= 2 to 5 times of the OBW,
   Sweep=auto,
   Detector = Peak, and Max hold for 20dB Bandwidth test.
5. Mark the peak frequency and –20dB (upper and lower) frequency
6. Set the spectrum analyzer as
   RBW= 1 % to 5% of 99% Bandwidth ,
   VBW ≥ 3 X RBW,
   Span= large enough to capture all products of the modulation process,
   Sweep=auto,
   Detector = Peak, and Max hold for 99% Bandwidth test.
7. Mark the peak frequency and 99%dB (upper and lower) frequency
8. Repeat above procedures until all test default channel is completed

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## 10.4 20dB Bandwidth

**GFSK**

| CH | 20 dB BW (MHz) | 2/3 BW (MHz) |
|---|---|---|
| 0 | 0.9916 | 0.66 |
| 39 | 0.993 | 0.66 |
| 78 | 0.9916 | 0.66 |

**π/4-DQPSK**

| CH | 20 dB BW (MHz) | 2/3 BW (MHz) |
|---|---|---|
| 0 | 1.347 | 0.90 |
| 39 | 1.346 | 0.90 |
| 78 | 1.349 | 0.90 |

**8-DPSK**

| CH | 20 dB BW (MHz) | 2/3 BW (MHz) |
|---|---|---|
| 0 | 1.309 | 0.87 |
| 39 | 1.309 | 0.87 |
| 78 | 1.310 | 0.87 |

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## 10.5 99% Bandwidth

GFSK

| CH | 99% BW (MHz) |
|---|---|
| 0 | 0.91047 |
| 39 | 0.91087 |
| 78 | 0.91049 |

π/4-DQPSK

| CH | 99% BW (MHz) |
|---|---|
| 0 | 1.1961 |
| 39 | 1.1961 |
| 78 | 1.1959 |

8-DPSK

| CH | 99% BW (MHz) |
|---|---|
| 0 | 1.2005 |
| 39 | 1.2013 |
| 78 | 1.2018 |

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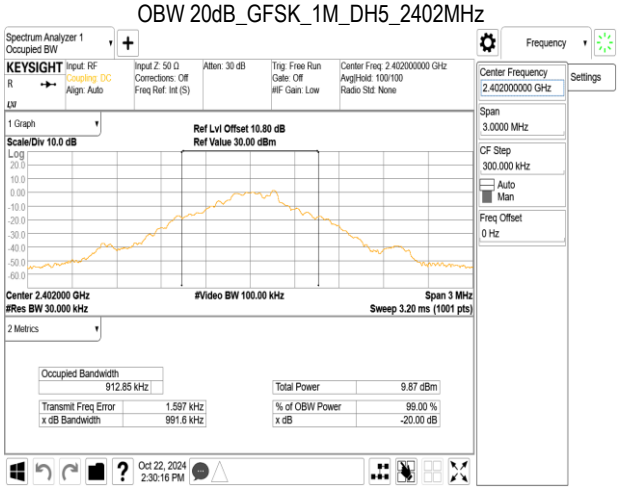
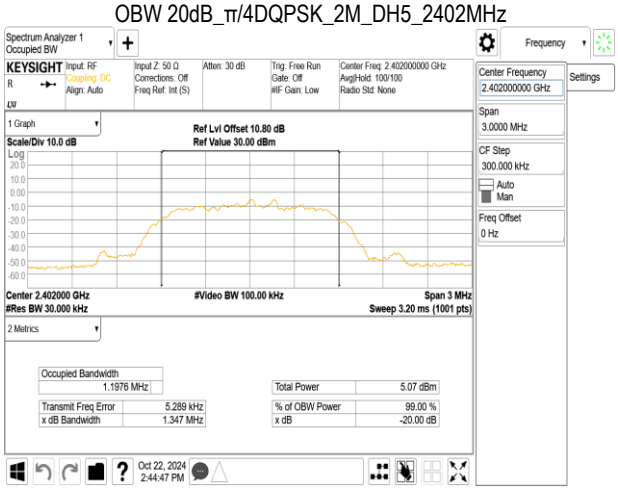
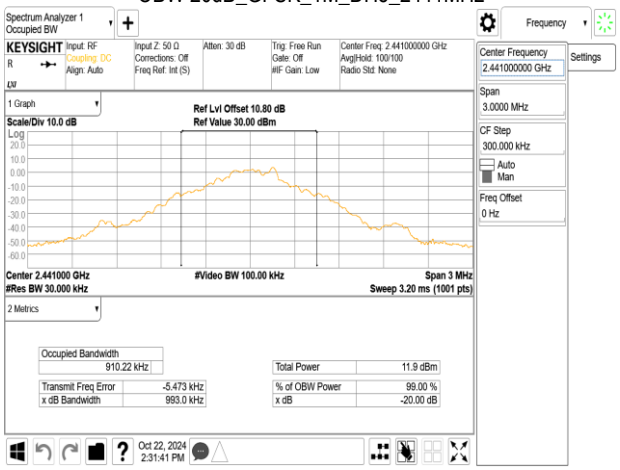
OBW 20dB_GFSK_1M_DH5_2402MHz




OBW 20dB_π/4DQPSK_2M_DH5_2402MHz




OBW 20dB_GFSK_1M_DH5_2441MHz

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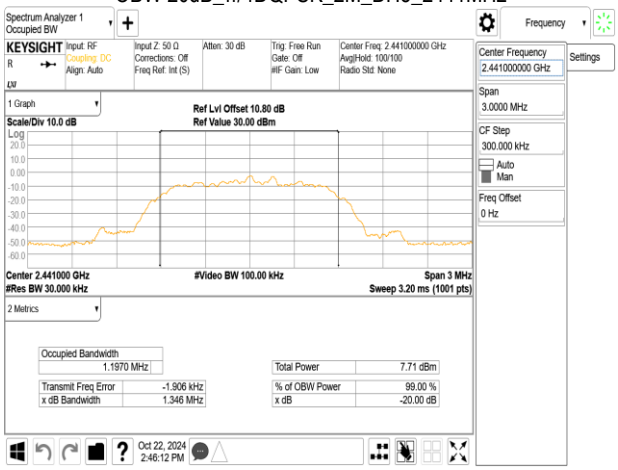
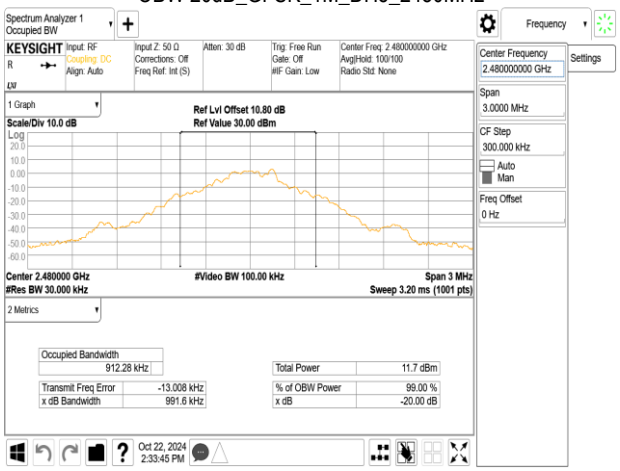



OBW 20dB_GFSK_1M_DH5_2480MHz

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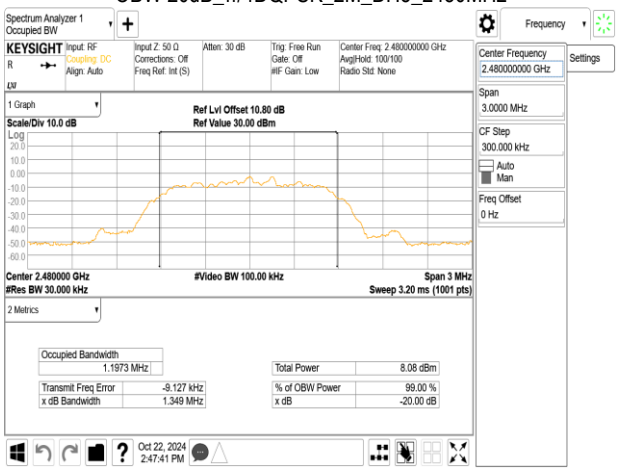


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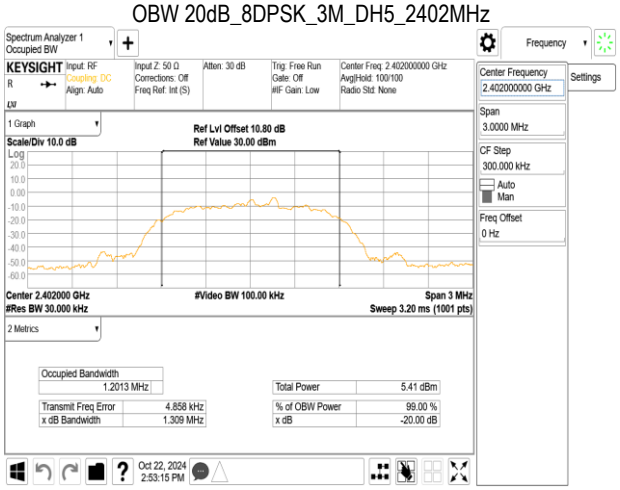
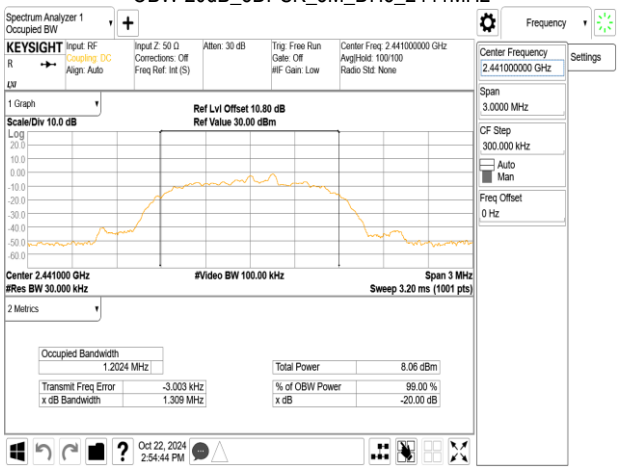
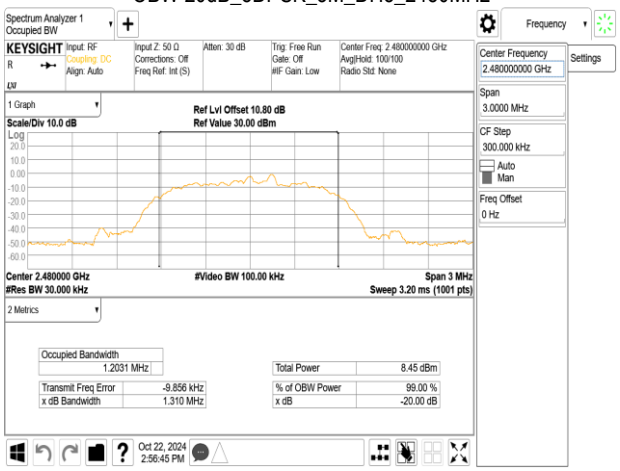
OBW 20dB_8DPSK_3M_DH5_2402MHz




OBW 20dB_8DPSK_3M_DH5_2441MHz




OBW 20dB_8DPSK_3M_DH5_2480MHz

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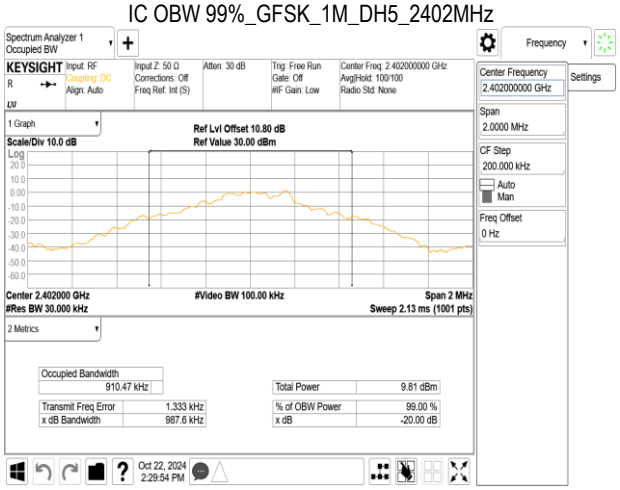
IC OBW 99%_GFSK_1M_DH5_2402MHz

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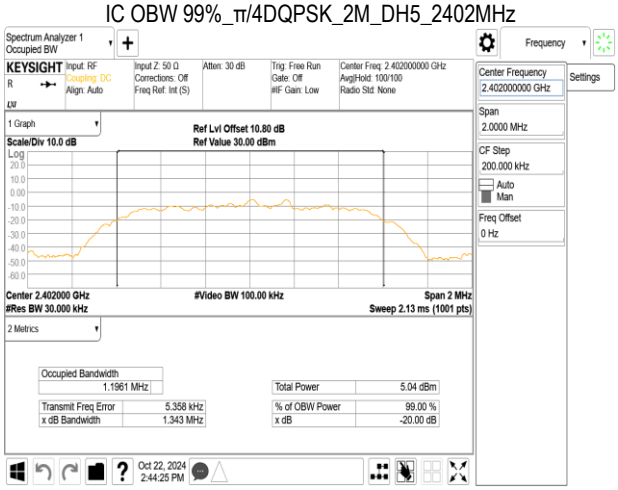
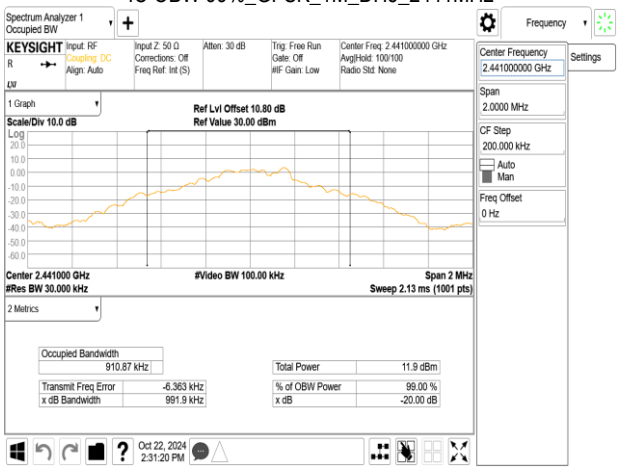
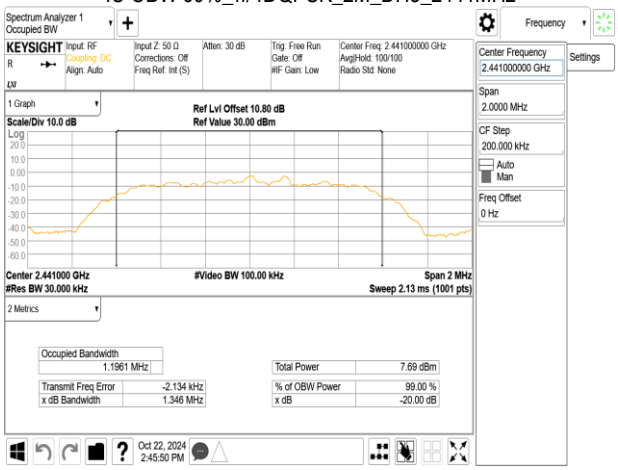


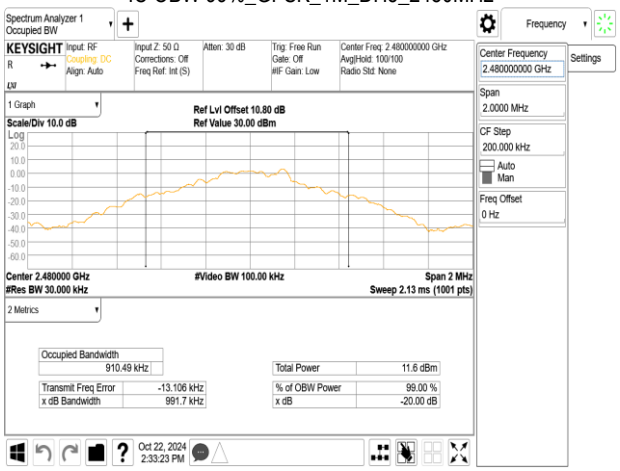

IC OBW 99%_GFSK_1M_DH5_2441MHz




IC OBW 99%_π/4DQPSK_2M_DH5_2441MHz




IC OBW 99%_GFSK_1M_DH5_2480MHz

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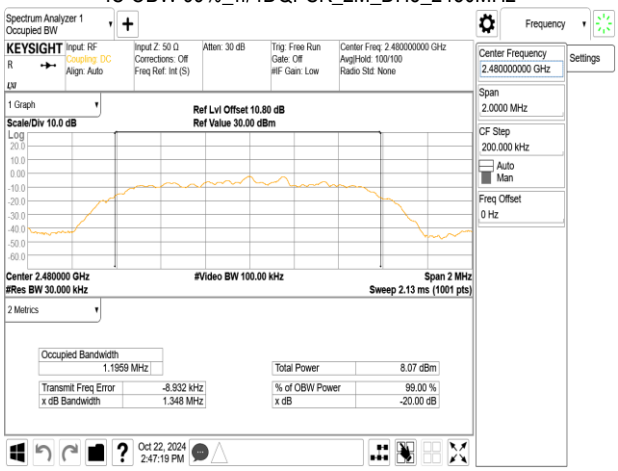


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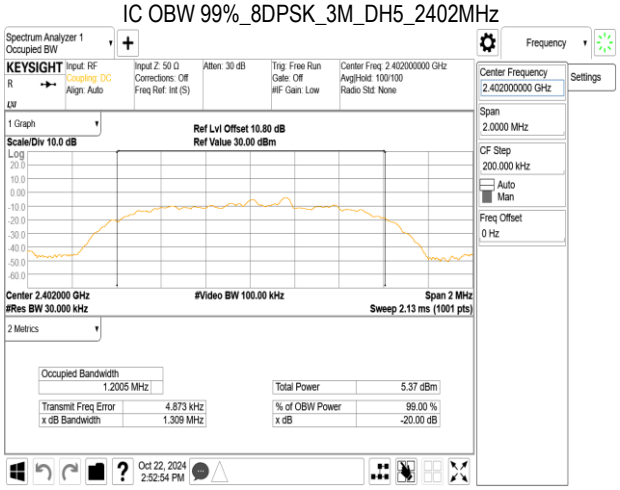
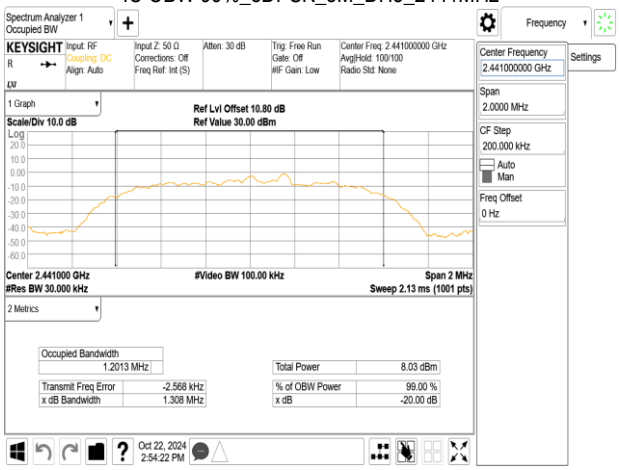
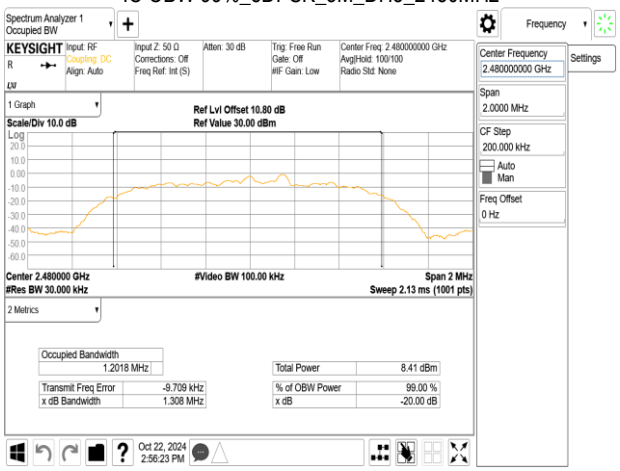
IC OBW 99%_8DPSK_3M_DH5_2402MHz




IC OBW 99%_8DPSK_3M_DH5_2441MHz




IC OBW 99%_8DPSK_3M_DH5_2480MHz

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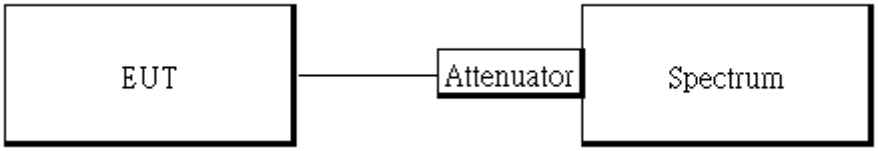
# 11 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

## 11.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9.

## 11.2 Test Setup




## 11.3 Measurement Procedure

### 11.3.1 Conducted Band Edge:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Sweep = auto
6. Mark Peak, below 2.4GHz and above 2.4835GHz and record the max. level.
7. Repeat above procedures until all frequency measured were complete.

### 11.3.2 Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows ANSI C63.10:2013.
3. Set RBW = 100 kHz & VBW = 300 kHz, Detector =Peak, Sweep = Auto
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

## 11.4 Measurement Result

See next page for test plots.

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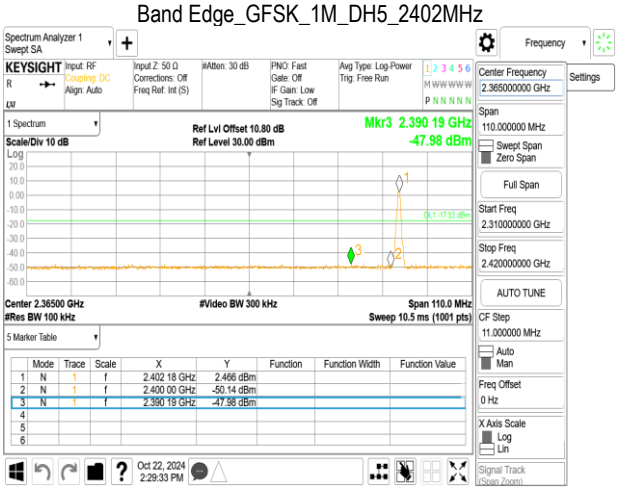
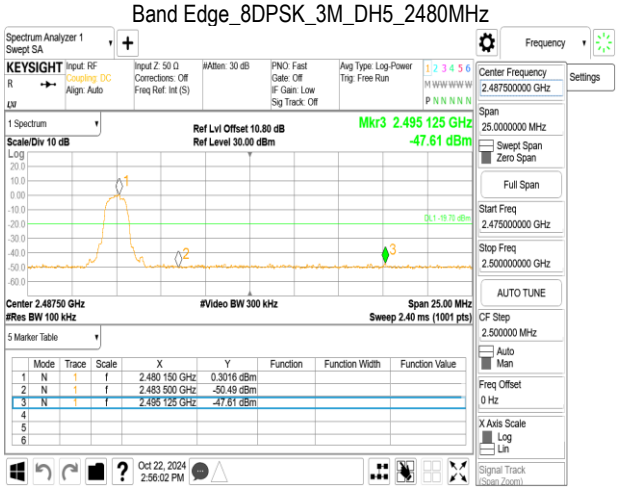
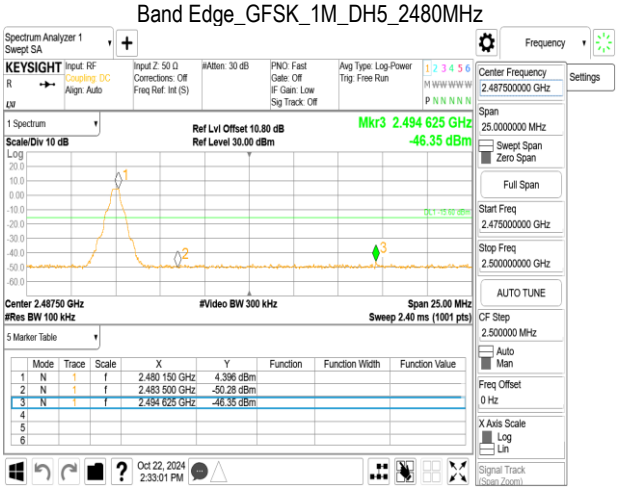
Band Edge_GFSK_1M_DH5_2402MHz



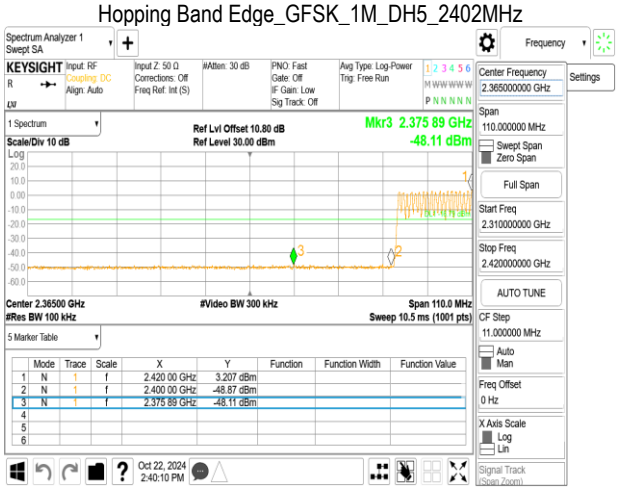

Band Edge_8DPSK_3M_DH5_2480MHz



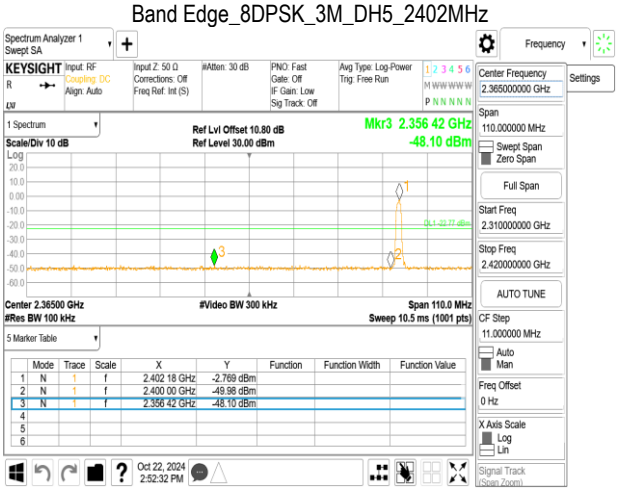

Band Edge_GFSK_1M_DH5_2480MHz



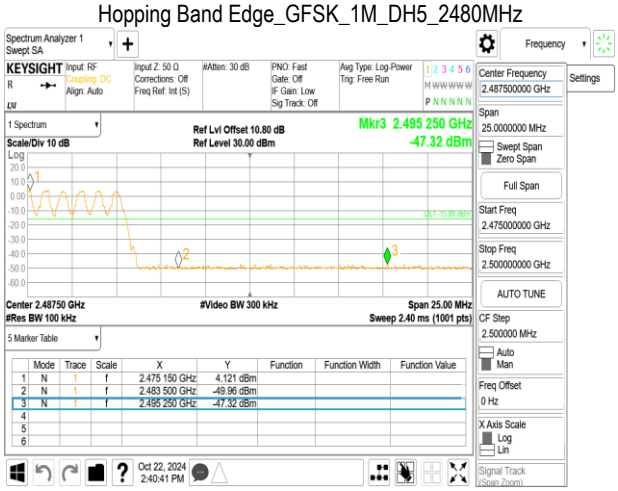

Hopping Band Edge_GFSK_1M_DH5_2402MHz




Band Edge_8DPSK_3M_DH5_2402MHz




Hopping Band Edge_GFSK_1M_DH5_2480MHz

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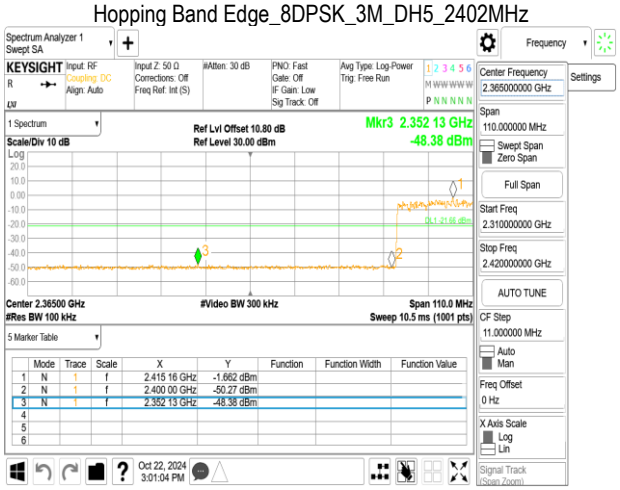
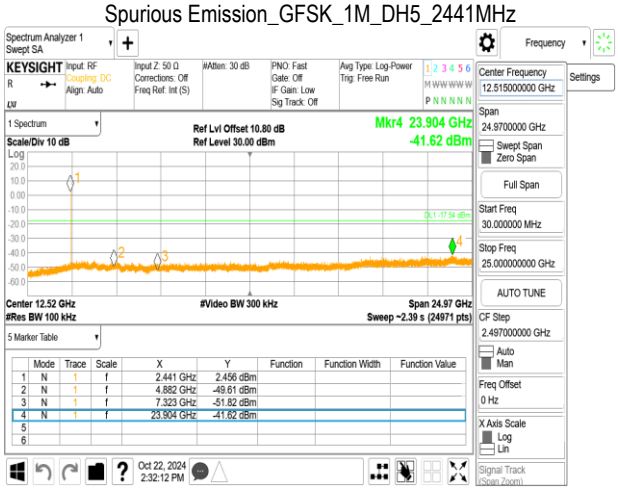
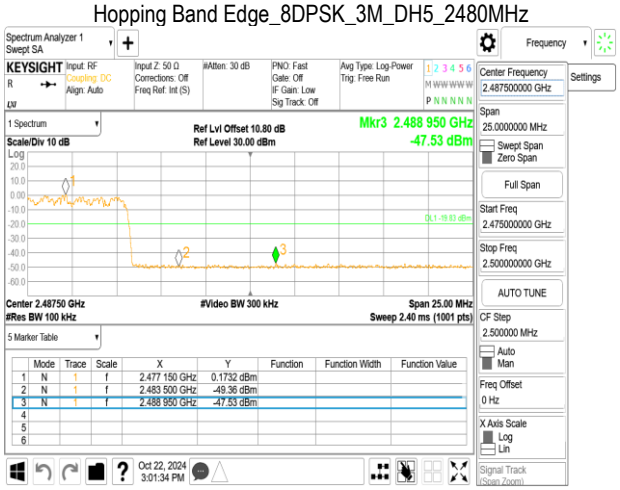
Hopping Band Edge_8DPSK_3M_DH5_2402MHz



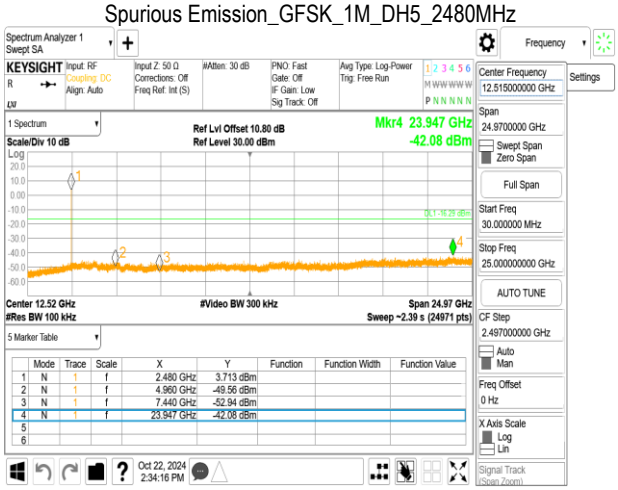

Spurious Emission_GFSK_1M_DH5_2441MHz



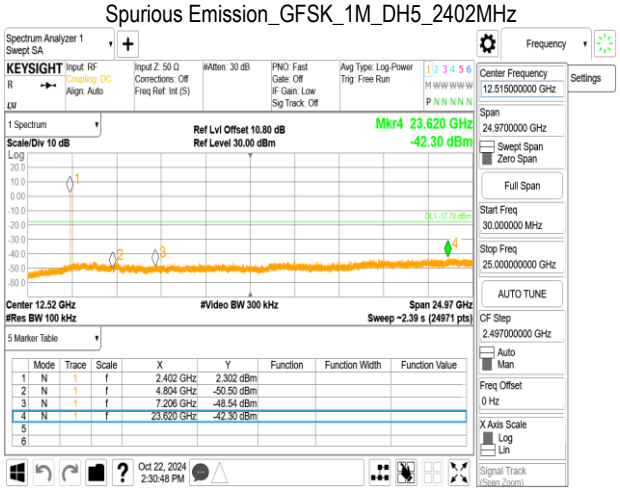

Hopping Band Edge_8DPSK_3M_DH5_2480MHz



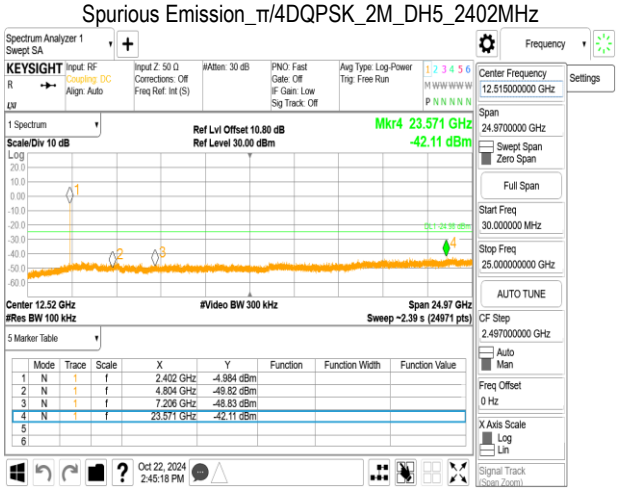

Spurious Emission_GFSK_1M_DH5_2480MHz




Spurious Emission_GFSK_1M_DH5_2402MHz




Spurious Emission_π/4DQPSK_2M_DH5_2402MHz

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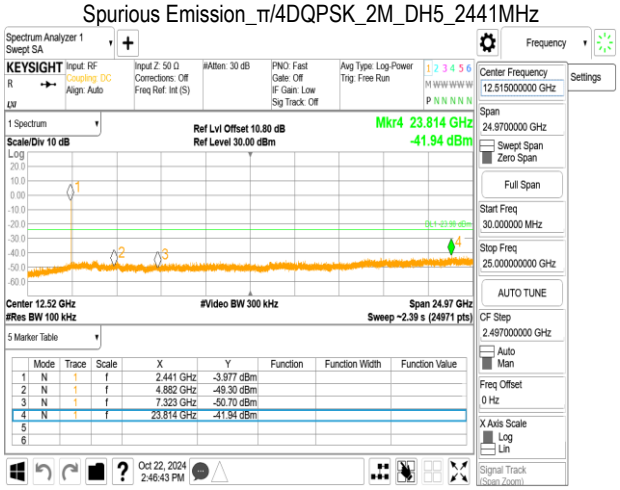
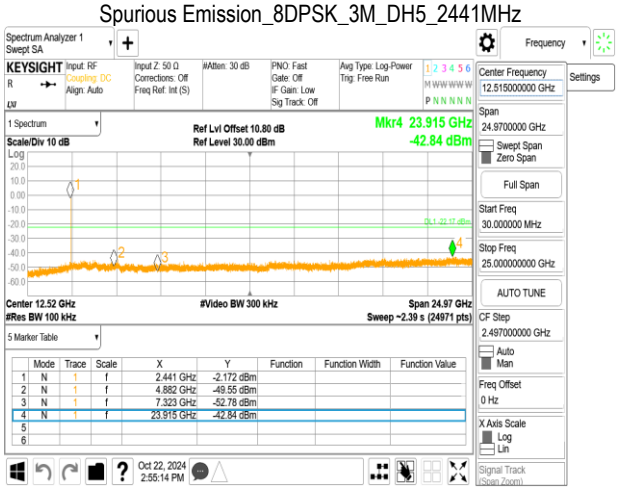
Spurious Emission_π/4DQPSK_2M_DH5_2441MHz



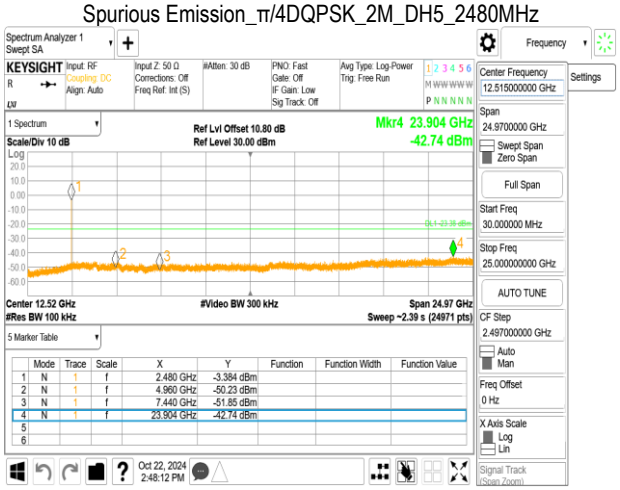

| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.441 GHz | -3.977 dBm | | | |
| 2 | N | 1 | f | 4.882 GHz | -49.30 dBm | | | |
| 3 | N | 1 | f | 7.323 GHz | -50.70 dBm | | | |
| 4 | N | 1 | f | 23.814 GHz | -41.94 dBm | | | |

Spurious Emission_8DPSK_3M_DH5_2441MHz



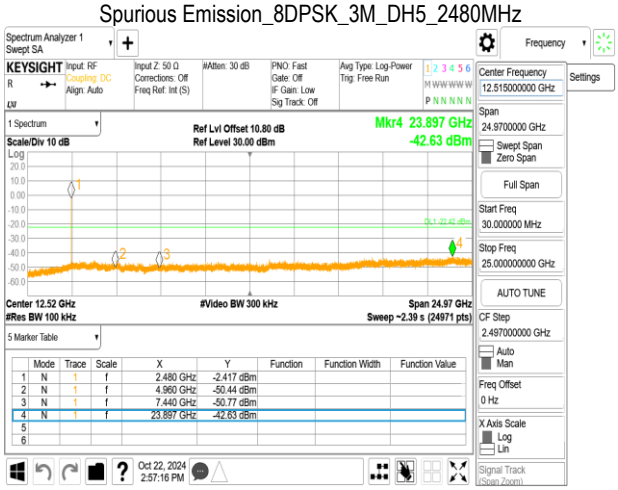

| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.441 GHz | -2.172 dBm | | | |
| 2 | N | 1 | f | 4.882 GHz | -49.55 dBm | | | |
| 3 | N | 1 | f | 7.323 GHz | -52.78 dBm | | | |
| 4 | N | 1 | f | 23.915 GHz | -42.84 dBm | | | |

Spurious Emission_π/4DQPSK_2M_DH5_2480MHz



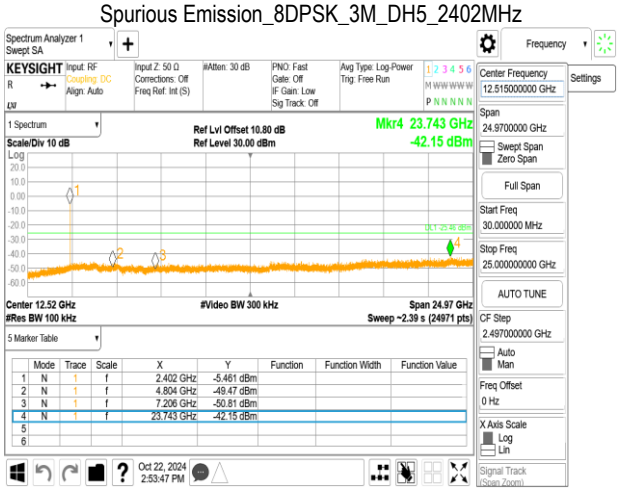

| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.480 GHz | -3.384 dBm | | | |
| 2 | N | 1 | f | 4.960 GHz | -50.23 dBm | | | |
| 3 | N | 1 | f | 7.440 GHz | -51.85 dBm | | | |
| 4 | N | 1 | f | 23.904 GHz | -42.74 dBm | | | |

Spurious Emission_8DPSK_3M_DH5_2480MHz




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.480 GHz | -2.417 dBm | | | |
| 2 | N | 1 | f | 4.960 GHz | -50.44 dBm | | | |
| 3 | N | 1 | f | 7.440 GHz | -50.77 dBm | | | |
| 4 | N | 1 | f | 23.897 GHz | -42.63 dBm | | | |

Spurious Emission_8DPSK_3M_DH5_2402MHz




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.402 GHz | -5.461 dBm | | | |
| 2 | N | 1 | f | 4.804 GHz | -49.47 dBm | | | |
| 3 | N | 1 | f | 7.206 GHz | -50.81 dBm | | | |
| 4 | N | 1 | f | 23.743 GHz | -42.15 dBm | | | |

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# 12 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

## 12.1 Standard Applicable

### 12.1.1 Duty Cycle Correction Factor

According to 15. 35(c) and RSS-Gen §8.2, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification.

### 12.1.2 Spurious Emission

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 and RSS-Gen §8.9 Table 5 and 6 limit as below.
And according to §15.33(a) (1) & RSS-Gen §6.13.2.a, for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

| Frequency (MHz) | Field strength (microvolts/meter) | Distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

***Note:***

1. *The lower limit shall apply at the transition frequencies.*

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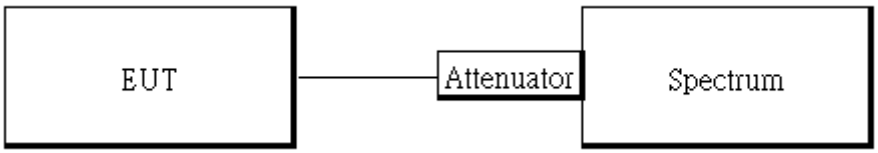
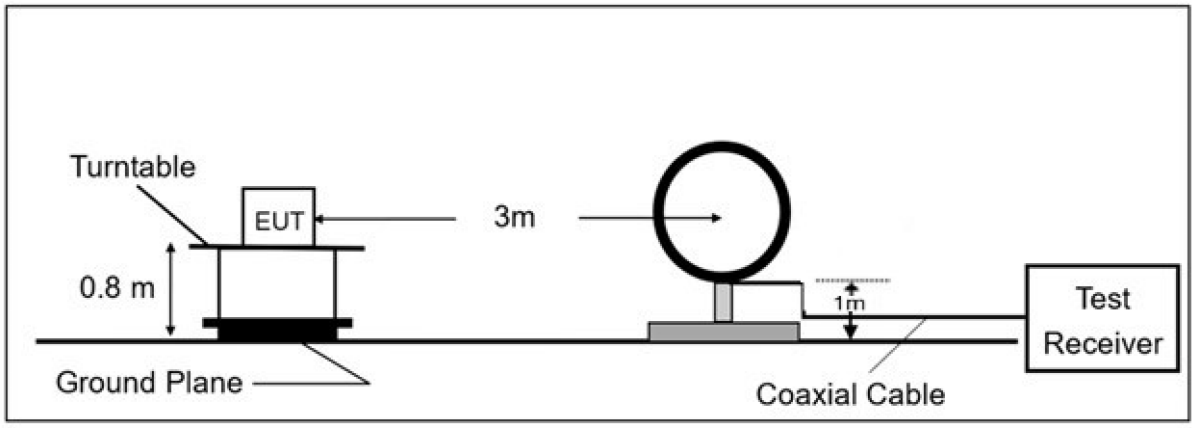
## 12.2 Test Setup

### 12.2.1 Duty Cycle Correction Factor

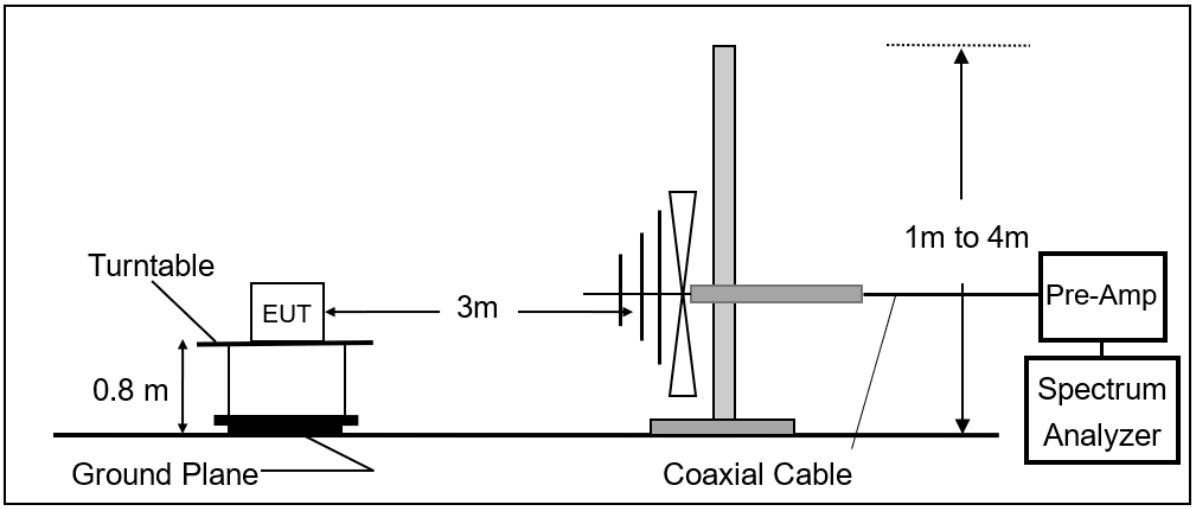



### 12.2.2 Radiated Emission

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.




(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.

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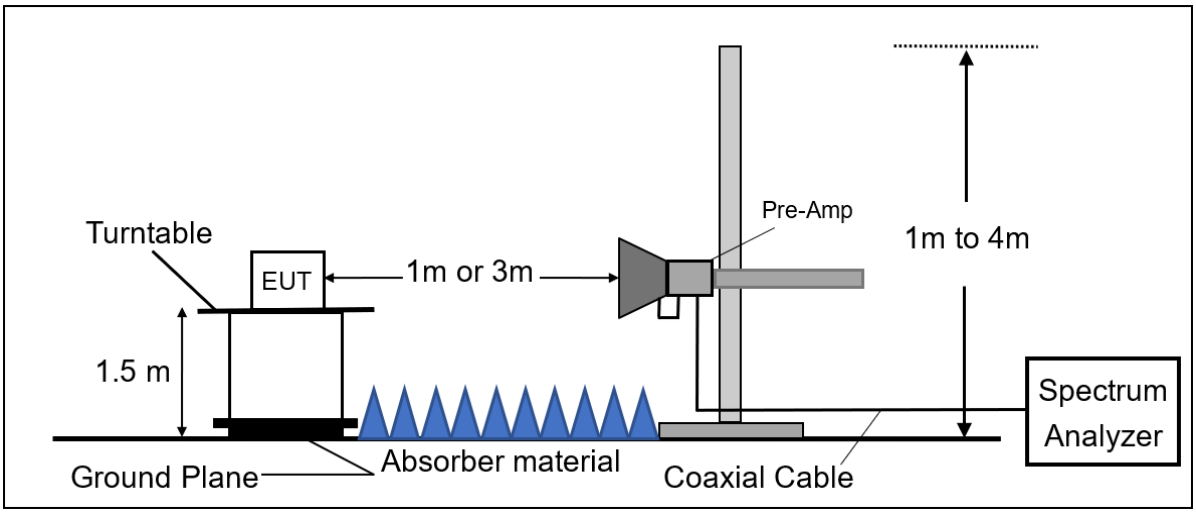
(C) Radiated Emission Test Set-Up, Frequency Above 1 GHz.




## 12.3 Measurement Procedure

### 12.3.1 Duty Cycle Correction Factor

1. Adjust and configure any EUT switches, controls, or input data streams to ensure that the EUT is transmitting or encoded to obtain the “worst-case” pulse ON time.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak, Adjust Sweep=100ms.
6. Repeat above procedures until all frequency of the interest measured were complete.

### 12.3.2 Radiated Emission

1. The testing follows the Measurement Procedure of ANSI C63.10:2013.
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=100 kHz and VBW=300 kHz for Peak Detector (PK) at frequency between 30MHz and 1 GHz.
6. Use receiver mode as RBW=120 kHz for Quasi-peak (QP) at frequency between 30MHz and 1 GHz.

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7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Maximum Emission Measurements at frequency above 1 GHz.
8. According to C63.10:2013 Section 7.5 Procedure for determining the average value of pulsed emissions with duty cycle correction factor 20 log ($T_{on}$/100ms).
9. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
12. Repeat above procedures until all default test channel measured were complete.

## 12.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

***Where*** *FS = Field Strength*
*RA = Reading Amplitude*
*AF = Antenna Factor*
*CL = Cable Attenuation Factor (Cable Loss)*
*AG = Amplifier Gain*

*The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)*

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Average value(dBμV/m)=Peak Actual FS(dBμV/m)+ Duty Cycle Correction Factor(dB)

Duty Cycle Correction Factor(dB) = 20 log ($T_{on}$/100 ms)

## 12.5 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) & RSS-GEN §6.13.2 was not reported.

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## 12.6 Measurement Result:

### 12.6.1 Duty Cycle Correction Factor

**Bluetooth 1M**

| |
|---|
| Time ON of 100ms: 5.800 ms |
| Duty Cycle=5.8ms / 100ms= 0.058 |
| Duty Cycle correction factor=20 LOG 0.058 = -24.73 dB |

**Bluetooth 3M**

| |
|---|
| Time ON of 100ms: 5.800 ms |
| Duty Cycle=5.8ms / 100ms= 0.058 |
| Duty Cycle correction factor=20 LOG 0.058 = -24.73 dB |

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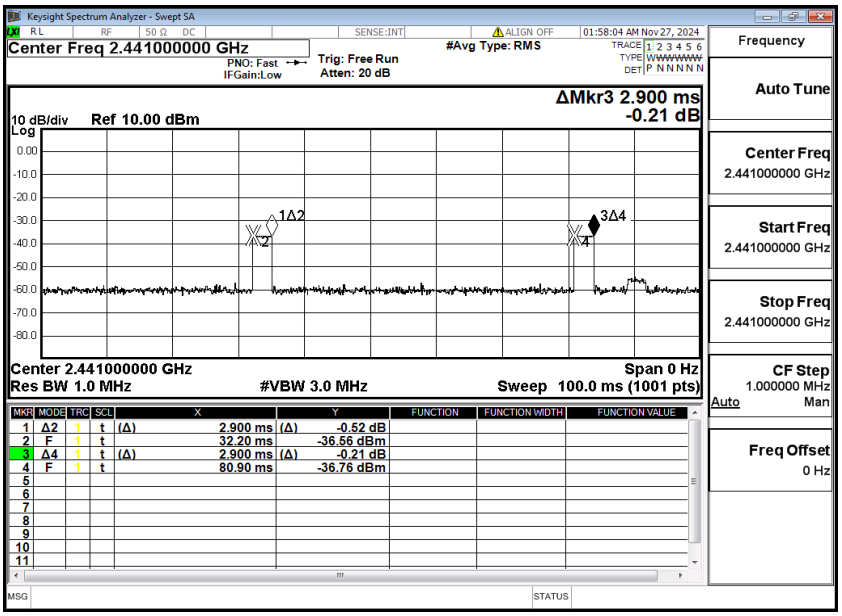
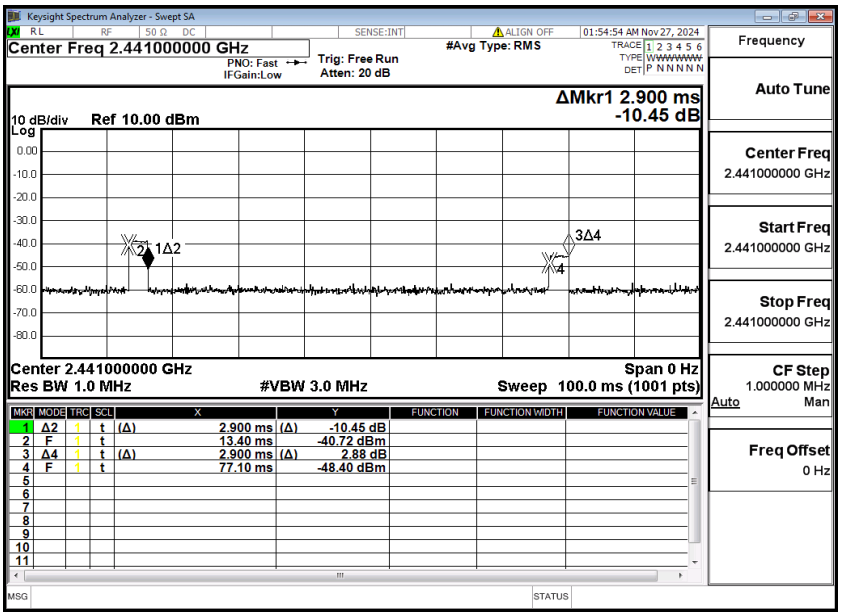
## 12.6.2 Duty Cycle test plot

BR




EDR

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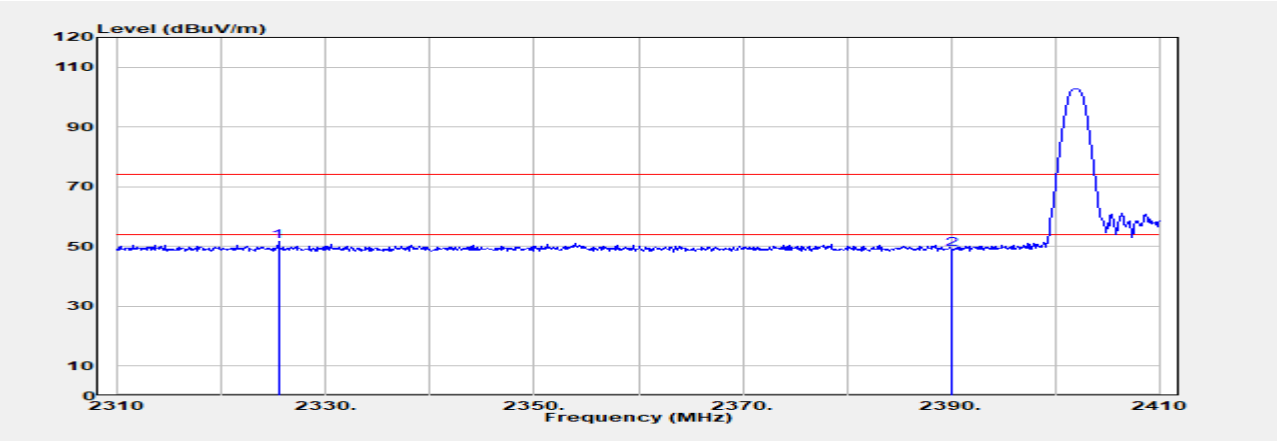
### 12.6.3 Bandedge Result

| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2325.400 | Peak | 54.79 | -3.20 | 51.59 | 74.00 | -22.41 |
| 2390.000 | Peak | 52.35 | -3.12 | 49.23 | 74.00 | -24.77 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2325.400 | Average | 51.59 | -24.73 | 26.86 | 54.00 | -27.14 |
| 2390.000 | Average | 49.23 | -24.73 | 24.50 | 54.00 | -29.50 |

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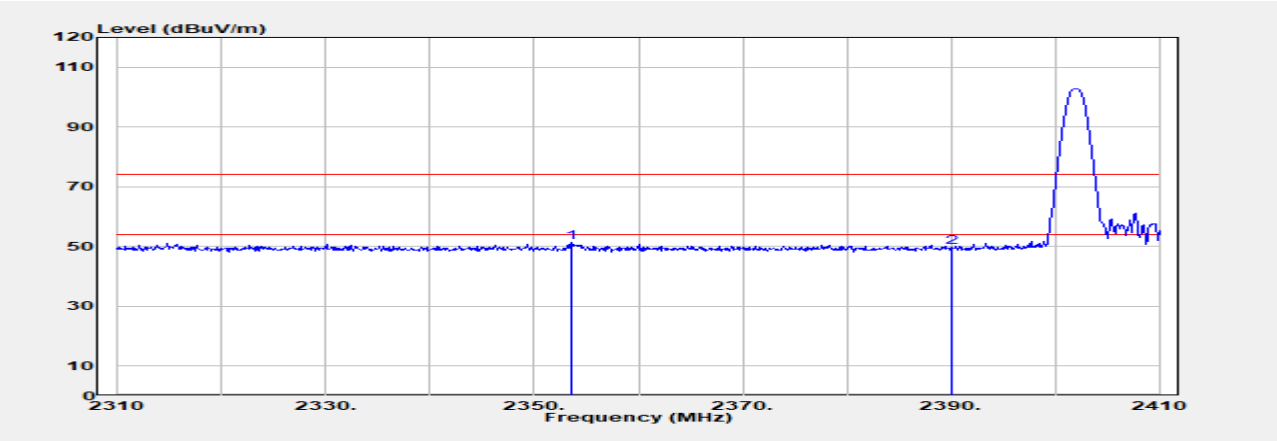
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2353.500 | Peak | 54.56 | -3.17 | 51.40 | 74.00 | -22.60 |
| 2390.000 | Peak | 52.83 | -3.12 | 49.70 | 74.00 | -24.30 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2353.500 | Average | 51.40 | -24.73 | 26.67 | 54.00 | -27.33 |
| 2390.000 | Average | 49.70 | -24.73 | 24.97 | 54.00 | -29.03 |

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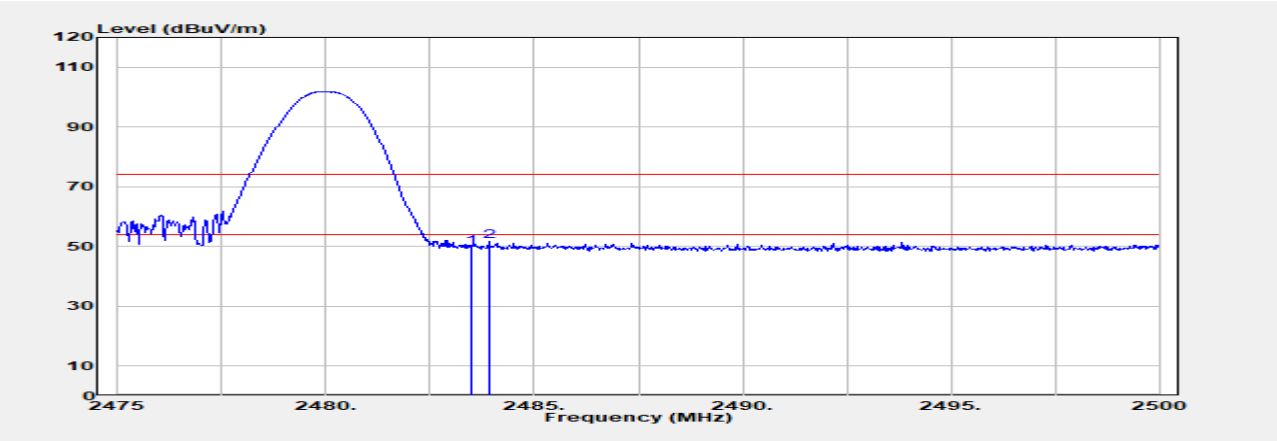
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 53.06 | -3.37 | 49.69 | 74.00 | -24.31 |
| 2483.900 | Peak | 54.97 | -3.37 | 51.61 | 74.00 | -22.39 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 49.69 | -24.73 | 24.96 | 54.00 | -29.04 |
| 2483.900 | Average | 51.61 | -24.73 | 26.88 | 54.00 | -27.12 |

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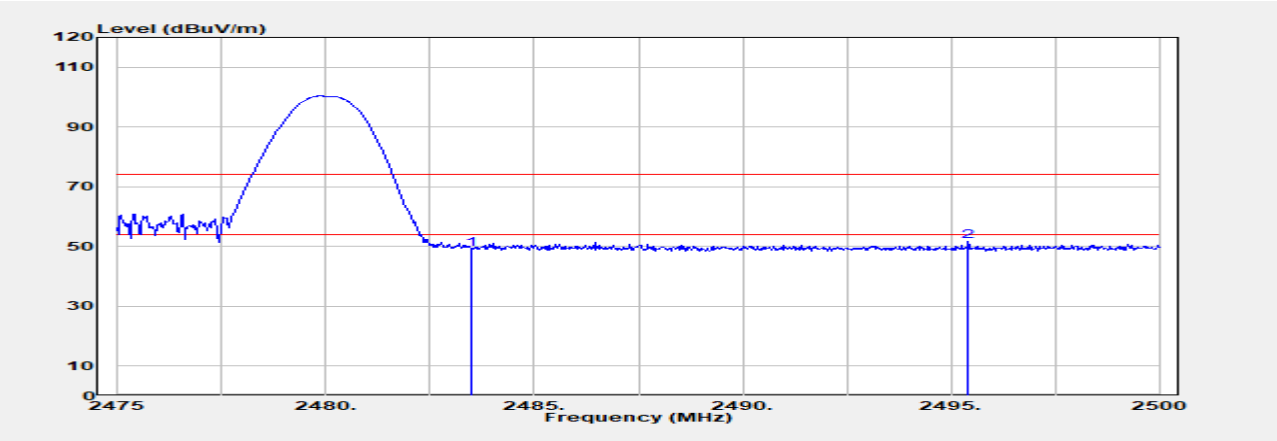
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 52.57 | -3.37 | 49.20 | 74.00 | -24.80 |
| 2495.425 | Peak | 55.07 | -3.38 | 51.69 | 74.00 | -22.31 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 49.20 | -24.73 | 24.47 | 54.00 | -29.53 |
| 2495.425 | Average | 51.69 | -24.73 | 26.96 | 54.00 | -27.04 |

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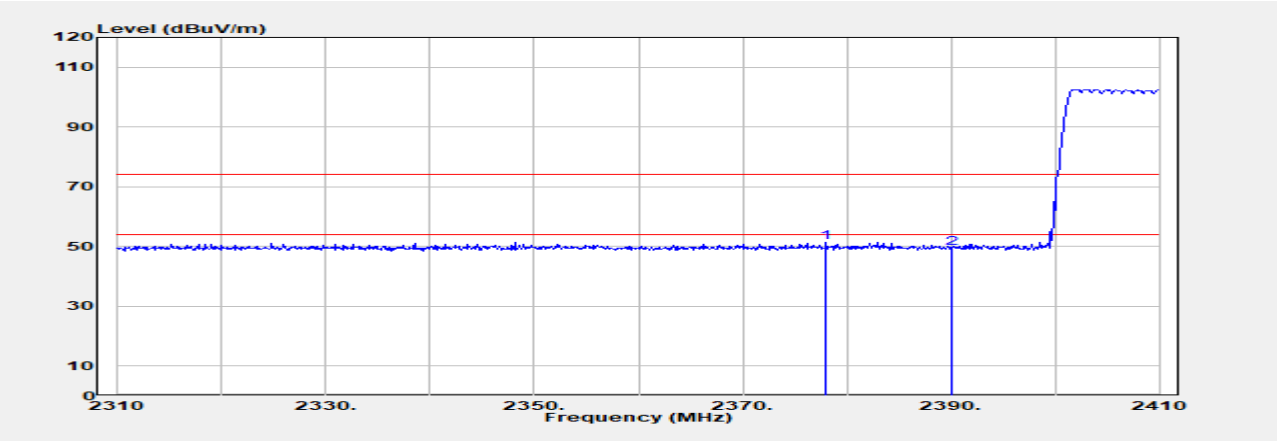
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR Hopping | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2378.000 | Peak | 54.59 | -3.24 | 51.35 | 74.00 | -22.65 |
| 2390.000 | Peak | 52.49 | -3.12 | 49.37 | 74.00 | -24.63 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2378.000 | Average | 51.35 | -24.73 | 26.62 | 54.00 | -27.38 |
| 2390.000 | Average | 49.37 | -24.73 | 24.64 | 54.00 | -29.36 |

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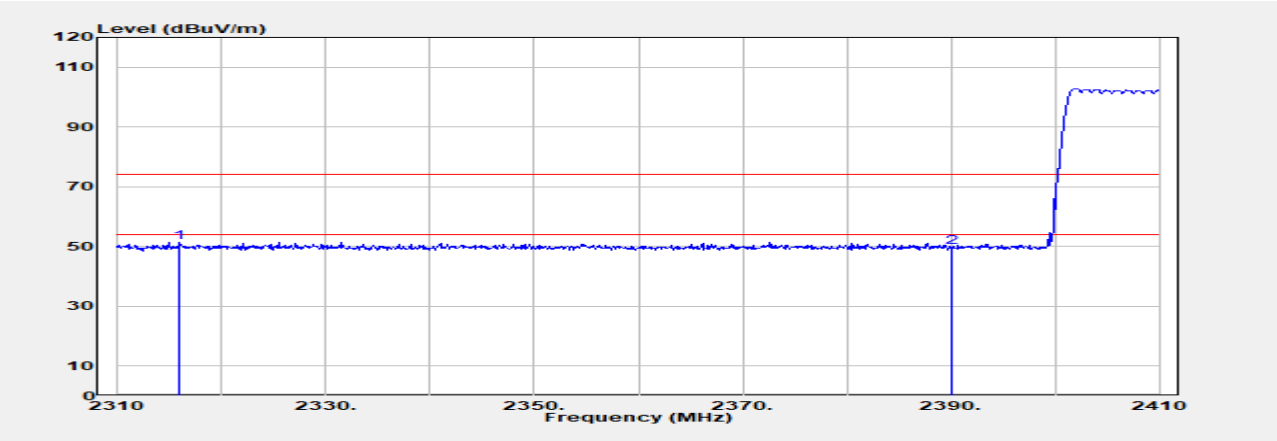
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR Hopping | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2315.900 | Peak | 54.69 | -3.17 | 51.52 | 74.00 | -22.48 |
| 2390.000 | Peak | 53.04 | -3.12 | 49.92 | 74.00 | -24.08 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2315.900 | Average | 51.52 | -24.73 | 26.79 | 54.00 | -27.21 |
| 2390.000 | Average | 49.92 | -24.73 | 25.19 | 54.00 | -28.81 |

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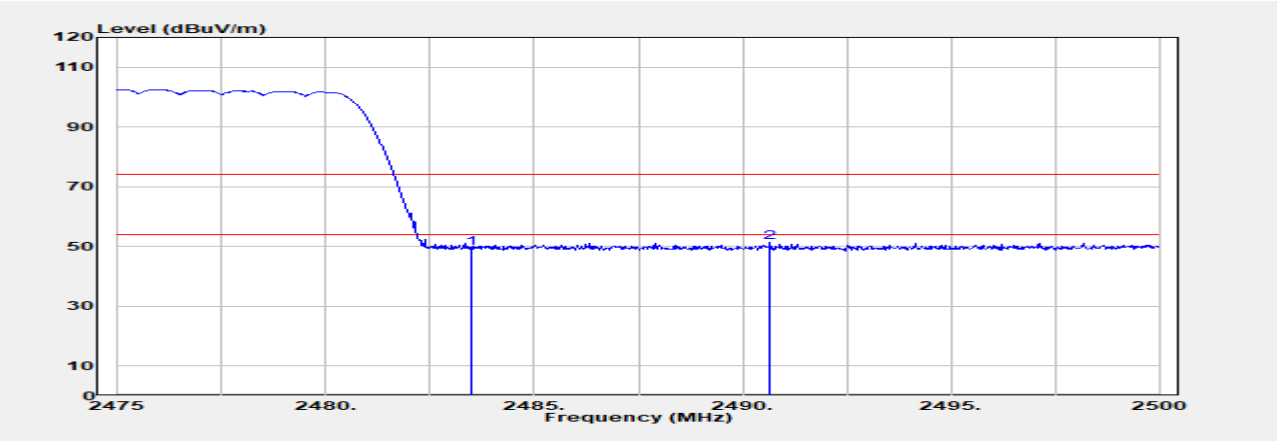
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR Hopping | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 52.85 | -3.37 | 49.48 | 74.00 | -24.52 |
| 2490.650 | Peak | 54.72 | -3.37 | 51.34 | 74.00 | -22.66 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 49.48 | -24.73 | 24.75 | 54.00 | -29.25 |
| 2490.650 | Average | 51.34 | -24.73 | 26.61 | 54.00 | -27.39 |

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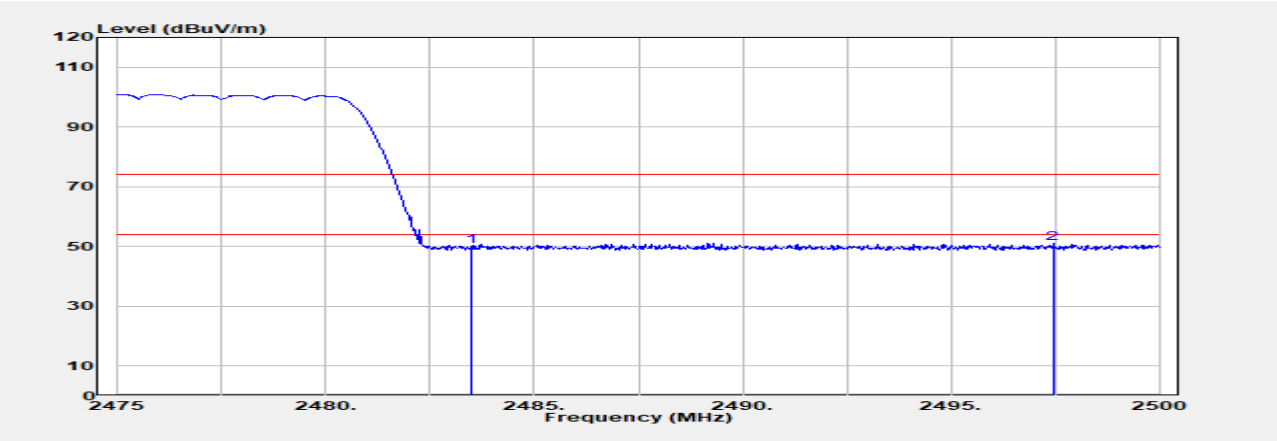
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR Hopping | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 53.45 | -3.37 | 50.08 | 74.00 | -23.92 |
| 2497.450 | Peak | 54.47 | -3.38 | 51.09 | 74.00 | -22.91 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 50.08 | -24.73 | 25.35 | 54.00 | -28.65 |
| 2497.450 | Average | 51.09 | -24.73 | 26.36 | 54.00 | -27.64 |

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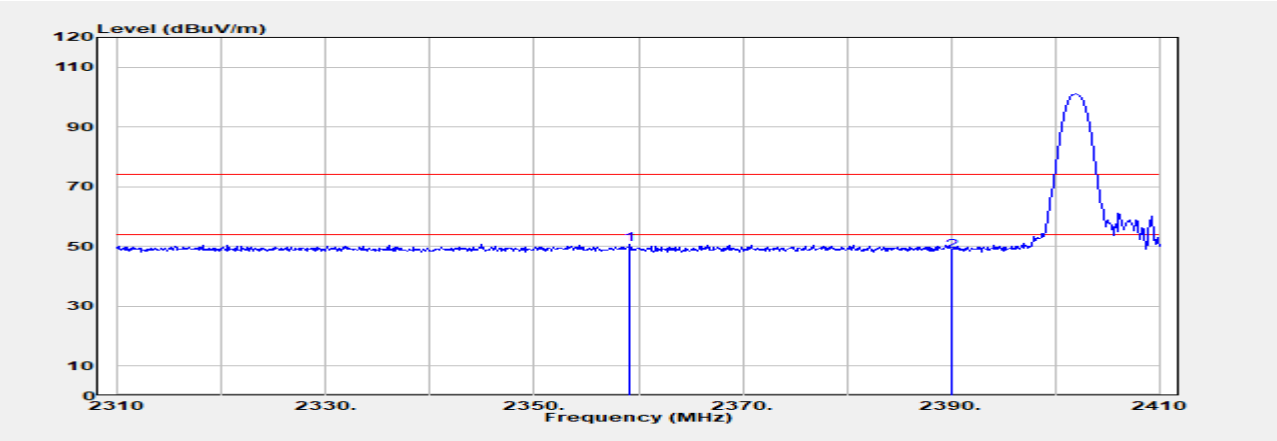
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2359.200 | Peak | 53.94 | -3.16 | 50.78 | 74.00 | -23.22 |
| 2390.000 | Peak | 51.55 | -3.12 | 48.43 | 74.00 | -25.57 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2359.200 | Average | 50.78 | -24.73 | 26.05 | 54.00 | -27.95 |
| 2390.000 | Average | 48.43 | -24.73 | 23.70 | 54.00 | -30.30 |

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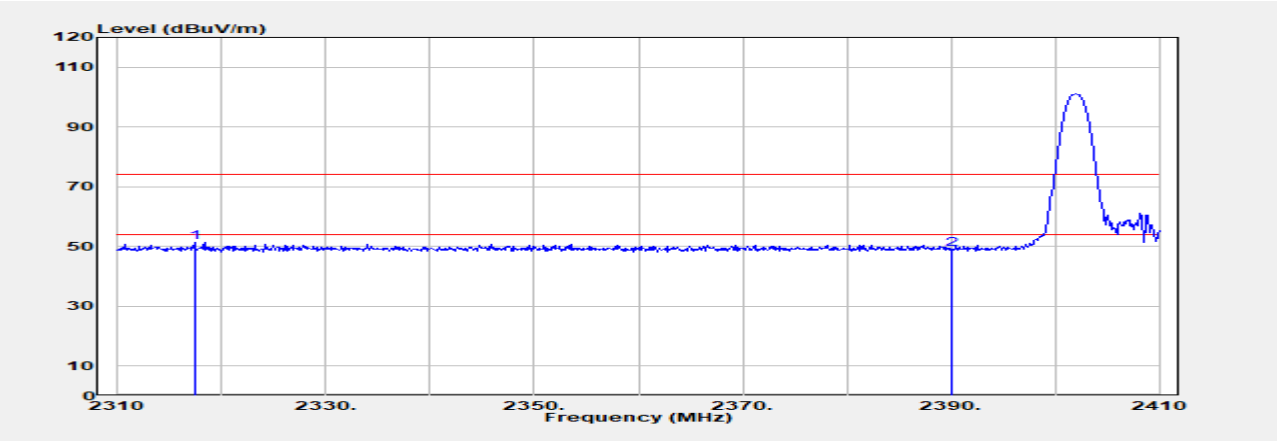
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2317.400 | Peak | 54.58 | -3.18 | 51.40 | 74.00 | -22.60 |
| 2390.000 | Peak | 52.32 | -3.12 | 49.20 | 74.00 | -24.80 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2317.400 | Average | 51.40 | -24.73 | 26.67 | 54.00 | -27.33 |
| 2390.000 | Average | 49.20 | -24.73 | 24.47 | 54.00 | -29.53 |

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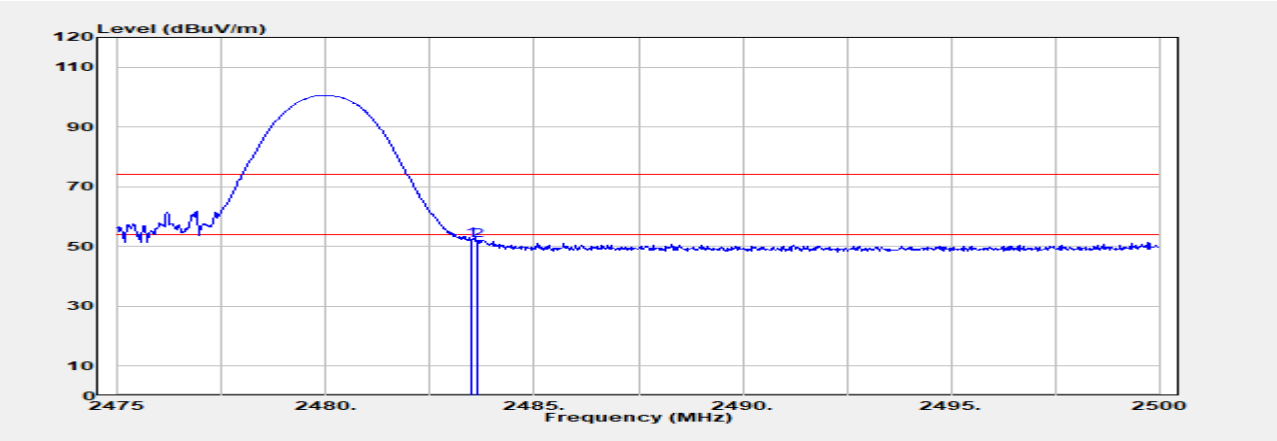
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 55.60 | -3.37 | 52.23 | 74.00 | -21.77 |
| 2483.650 | Peak | 55.52 | -3.37 | 52.15 | 74.00 | -21.85 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 52.23 | -24.73 | 27.50 | 54.00 | -26.50 |
| 2483.650 | Average | 52.15 | -24.73 | 27.42 | 54.00 | -26.58 |

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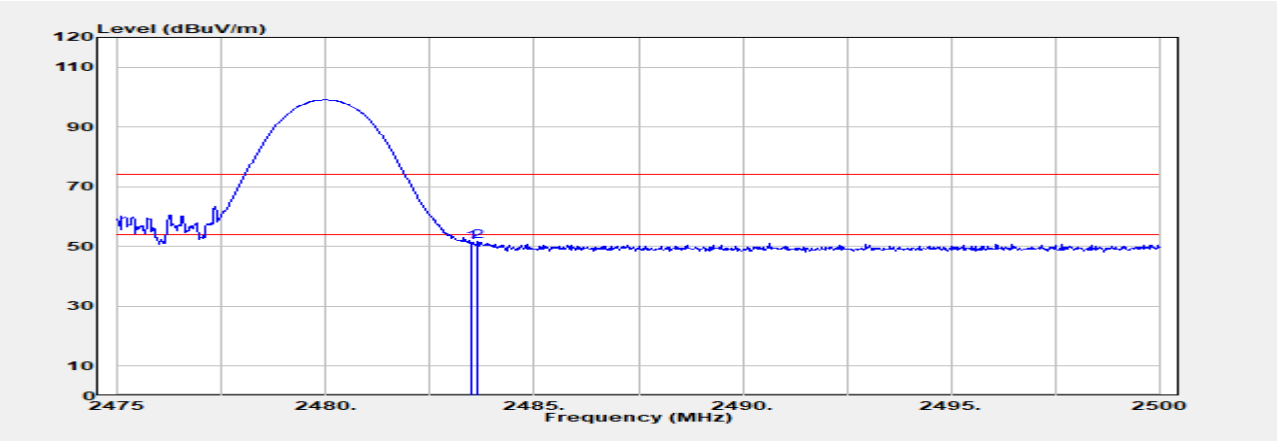
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 54.69 | -3.37 | 51.32 | 74.00 | -22.68 |
| 2483.650 | Peak | 54.92 | -3.37 | 51.55 | 74.00 | -22.45 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 51.32 | -24.73 | 26.59 | 54.00 | -27.41 |
| 2483.650 | Average | 51.55 | -24.73 | 26.82 | 54.00 | -27.18 |

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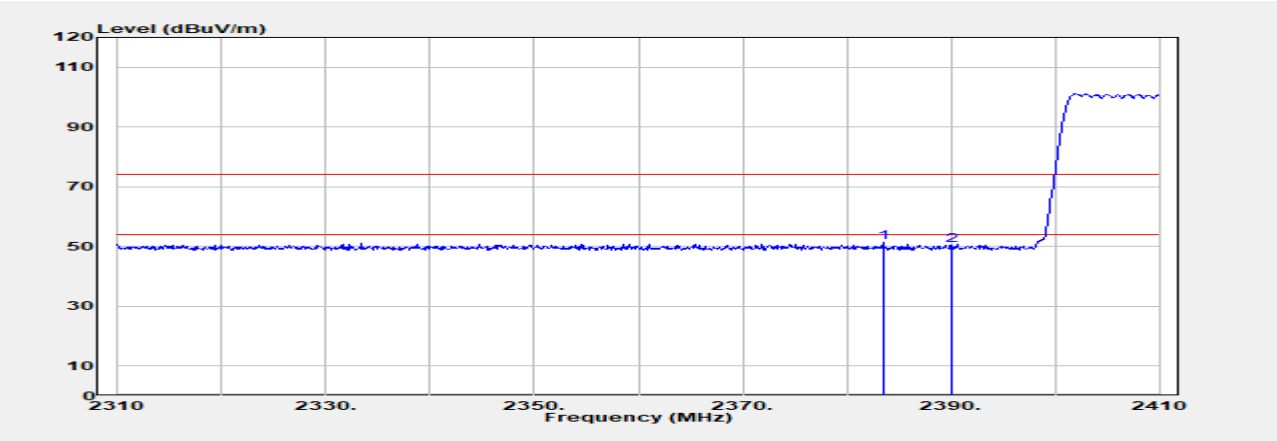
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M Hopping | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2383.500 | Peak | 54.66 | -3.19 | 51.46 | 74.00 | -22.54 |
| 2390.000 | Peak | 53.54 | -3.12 | 50.42 | 74.00 | -23.58 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2383.500 | Average | 51.46 | -24.73 | 26.73 | 54.00 | -27.27 |
| 2390.000 | Average | 50.42 | -24.73 | 25.69 | 54.00 | -28.31 |

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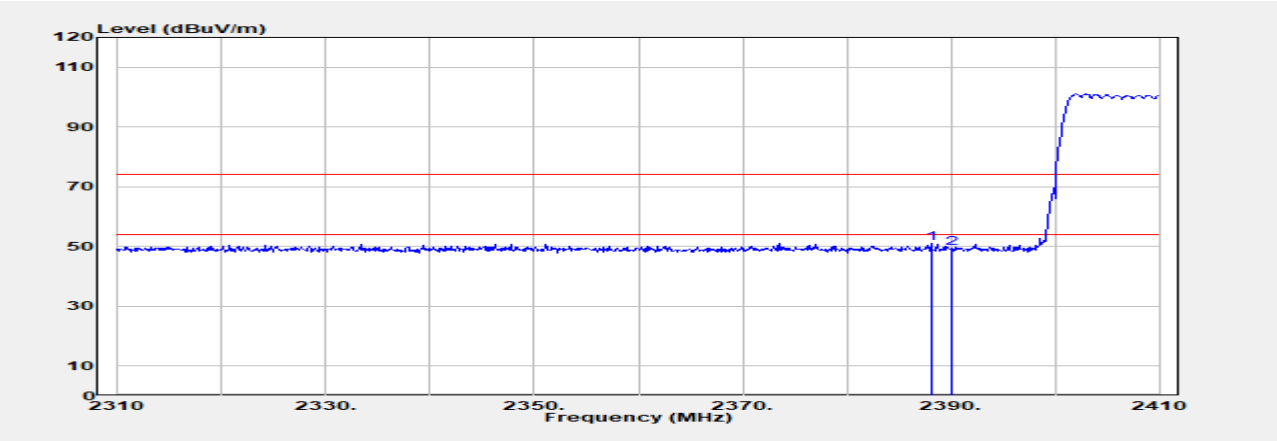
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M Hopping | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2388.100 | Peak | 54.18 | -3.14 | 51.03 | 74.00 | -22.97 |
| 2390.000 | Peak | 52.48 | -3.12 | 49.36 | 74.00 | -24.64 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2388.100 | Average | 51.03 | -24.73 | 26.30 | 54.00 | -27.70 |
| 2390.000 | Average | 49.36 | -24.73 | 24.63 | 54.00 | -29.37 |

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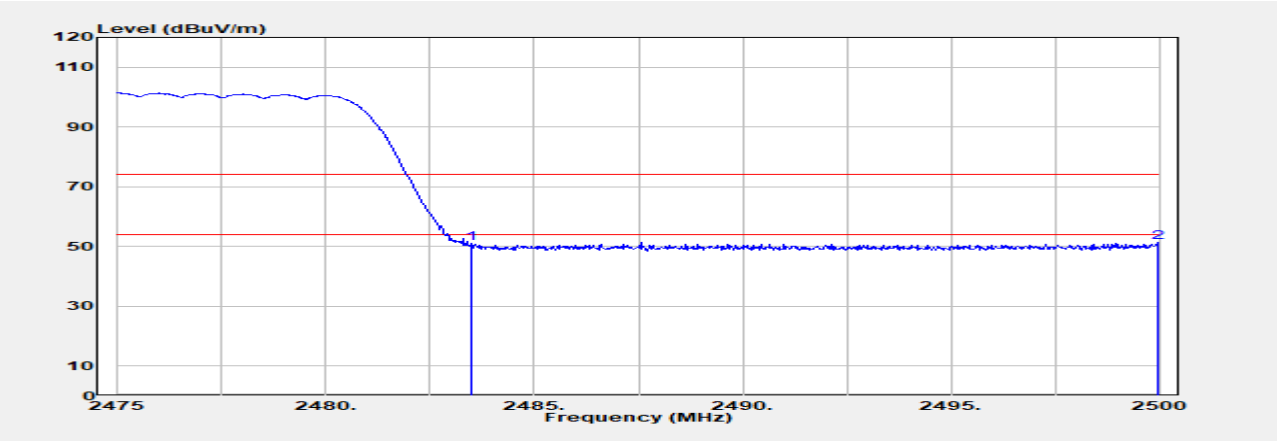
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M Hopping | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 54.37 | -3.37 | 51.00 | 74.00 | -23.00 |
| 2499.975 | Peak | 54.76 | -3.38 | 51.38 | 74.00 | -22.62 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 51.00 | -24.73 | 26.27 | 54.00 | -27.73 |
| 2499.975 | Average | 51.38 | -24.73 | 26.65 | 54.00 | -27.35 |

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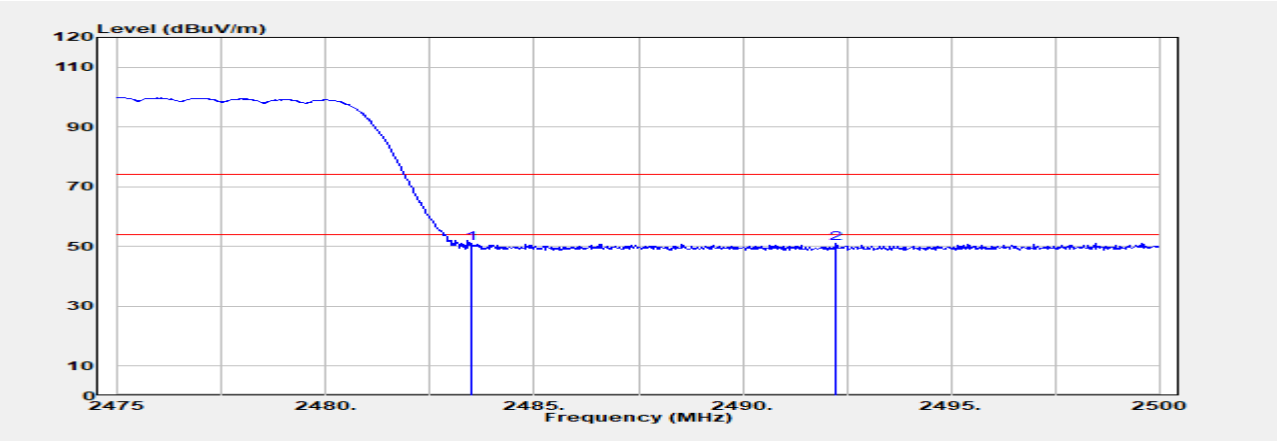
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M Hopping | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 54.27 | -3.37 | 50.90 | 74.00 | -23.10 |
| 2492.250 | Peak | 54.53 | -3.37 | 51.16 | 74.00 | -22.84 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 50.90 | -24.73 | 26.17 | 54.00 | -27.83 |
| 2492.250 | Average | 51.16 | -24.73 | 26.43 | 54.00 | -27.57 |

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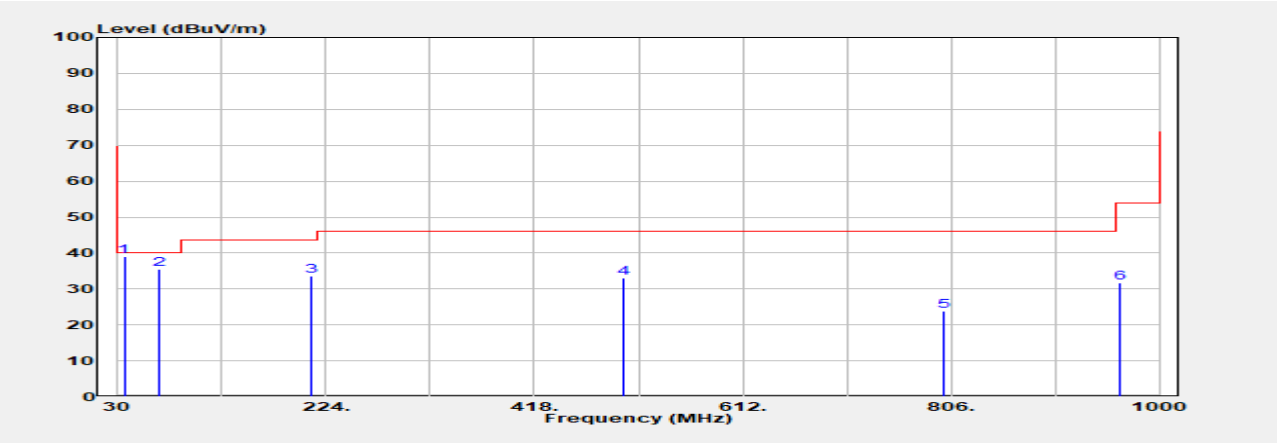
### 12.6.4 Radiated Spurious Emission

| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-26 |
| Test Frequency | :2441 MHz | Temp./Humi. | :24.2℃/54% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP/AVG | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 35.820 | QP | 53.20 | -14.25 | 38.95 | 40.00 | -1.05 |
| 68.800 | QP | 50.10 | -14.60 | 35.50 | 40.00 | -4.50 |
| 209.450 | Peak | 49.79 | -16.09 | 33.70 | 43.50 | -9.80 |
| 500.450 | QP | 40.31 | -7.30 | 33.01 | 46.00 | -12.99 |
| 800.180 | QP | 25.30 | -1.52 | 23.78 | 46.00 | -22.22 |
| 963.140 | Peak | 30.54 | 1.08 | 31.62 | 54.00 | -22.38 |

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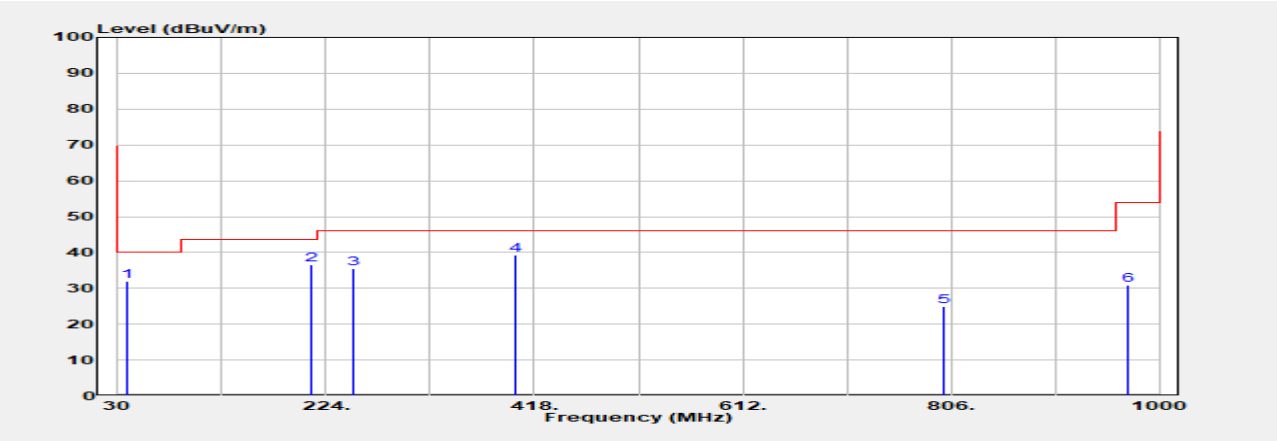
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-26 |
| Test Frequency | :2441 MHz | Temp./Humi. | :24.2℃/54% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP/AVG | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 37.760 | Peak | 45.86 | -13.83 | 32.03 | 40.00 | -7.97 |
| 209.450 | Peak | 52.80 | -16.09 | 36.71 | 43.50 | -6.79 |
| 249.220 | QP | 49.60 | -14.04 | 35.56 | 46.00 | -10.44 |
| 399.570 | Peak | 48.57 | -9.28 | 39.29 | 46.00 | -6.71 |
| 800.180 | QP | 26.40 | -1.52 | 24.88 | 46.00 | -21.12 |
| 970.900 | Peak | 29.56 | 1.26 | 30.82 | 54.00 | -23.18 |

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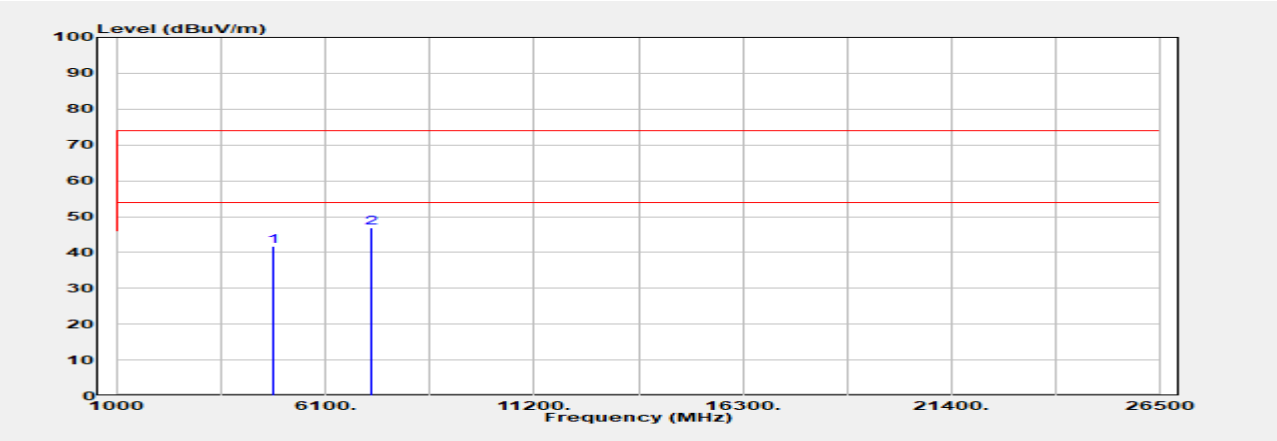
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4804.000 | Peak | 38.26 | 3.48 | 41.75 | 74.00 | -32.25 |
| 7206.000 | Peak | 37.61 | 9.21 | 46.82 | 74.00 | -27.18 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4804.000 | Average | 41.75 | -24.73 | 17.02 | 54.00 | -36.98 |
| 7206.000 | Average | 46.82 | -24.73 | 22.09 | 54.00 | -31.91 |

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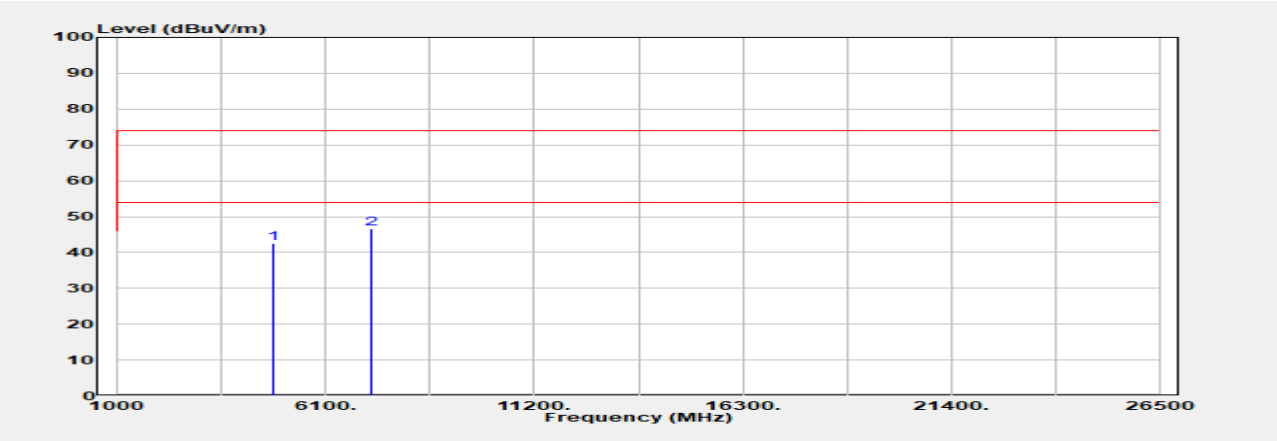
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4804.000 | Peak | 39.06 | 3.48 | 42.54 | 74.00 | -31.46 |
| 7206.000 | Peak | 37.28 | 9.21 | 46.49 | 74.00 | -27.51 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4804.000 | Average | 42.54 | -24.73 | 17.81 | 54.00 | -36.19 |
| 7206.000 | Average | 46.49 | -24.73 | 21.76 | 54.00 | -32.24 |

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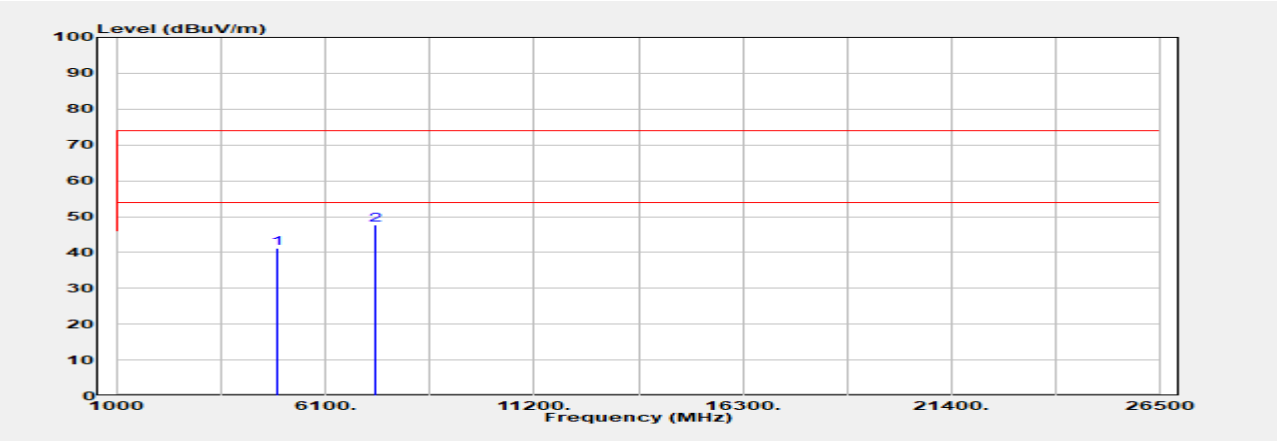
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2442 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4884.000 | Peak | 37.34 | 3.87 | 41.21 | 74.00 | -32.79 |
| 7326.000 | Peak | 38.14 | 9.67 | 47.81 | 74.00 | -26.19 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4884.000 | Average | 41.21 | -24.73 | 16.48 | 54.00 | -37.52 |
| 7326.000 | Average | 47.81 | -24.73 | 23.08 | 54.00 | -30.92 |

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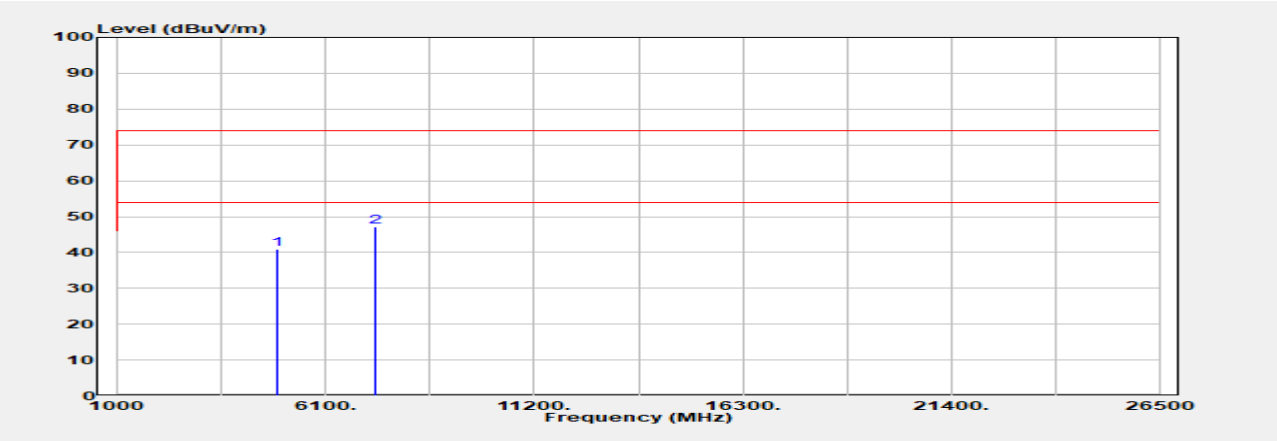
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2442 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4884.000 | Peak | 37.03 | 3.87 | 40.90 | 74.00 | -33.10 |
| 7326.000 | Peak | 37.56 | 9.67 | 47.23 | 74.00 | -26.77 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4884.000 | Average | 40.90 | -24.73 | 16.17 | 54.00 | -37.83 |
| 7326.000 | Average | 47.23 | -24.73 | 22.50 | 54.00 | -31.50 |

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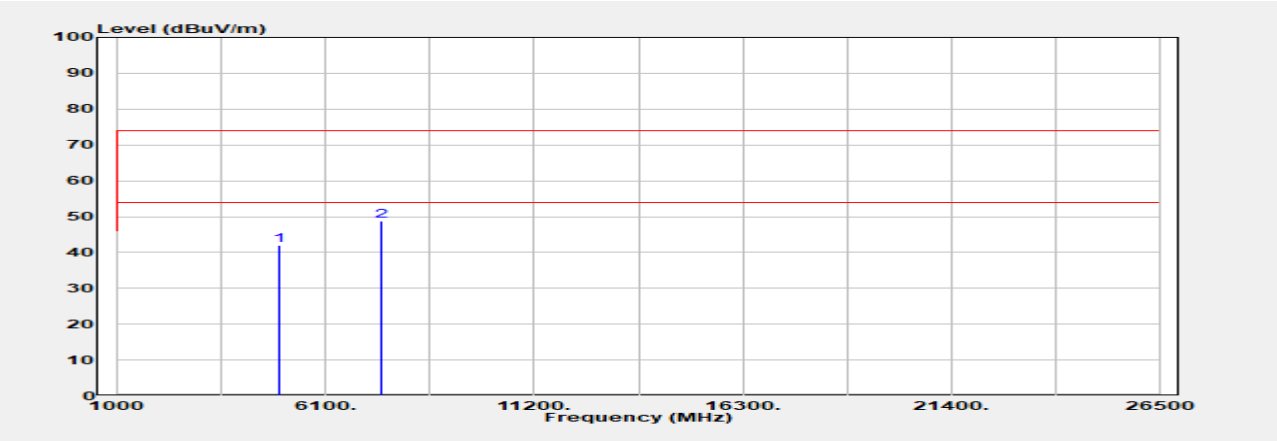
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4960.000 | Peak | 38.13 | 3.99 | 42.12 | 74.00 | -31.88 |
| 7440.000 | Peak | 38.99 | 9.75 | 48.73 | 74.00 | -25.27 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4960.000 | Average | 42.12 | -24.73 | 17.39 | 54.00 | -36.61 |
| 7440.000 | Average | 48.73 | -24.73 | 24.00 | 54.00 | -30.00 |

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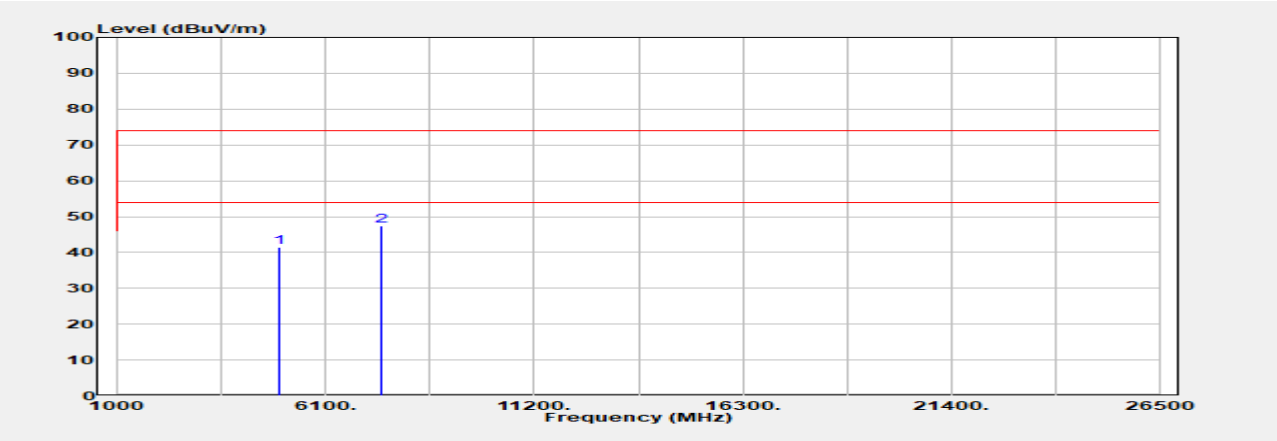
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4960.000 | Peak | 37.34 | 3.99 | 41.34 | 74.00 | -32.66 |
| 7440.000 | Peak | 37.61 | 9.75 | 47.36 | 74.00 | -26.64 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4960.000 | Average | 41.34 | -24.73 | 16.61 | 54.00 | -37.39 |
| 7440.000 | Average | 47.36 | -24.73 | 22.63 | 54.00 | -31.37 |

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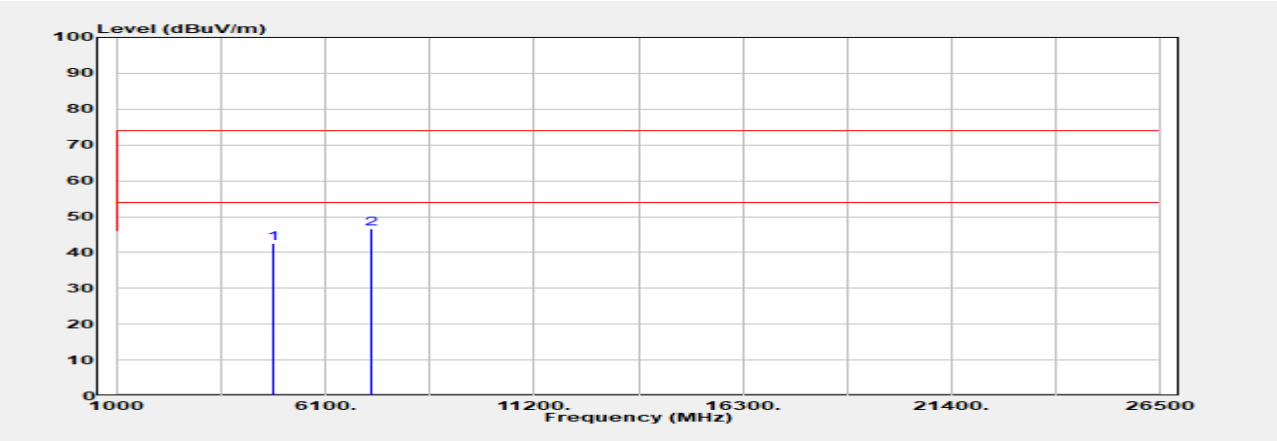
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4804.000 | Peak | 38.97 | 3.48 | 42.46 | 74.00 | -31.54 |
| 7206.000 | Peak | 37.47 | 9.21 | 46.68 | 74.00 | -27.32 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4804.000 | Average | 42.46 | -24.73 | 17.73 | 54.00 | -36.27 |
| 7206.000 | Average | 46.68 | -24.73 | 21.95 | 54.00 | -32.05 |

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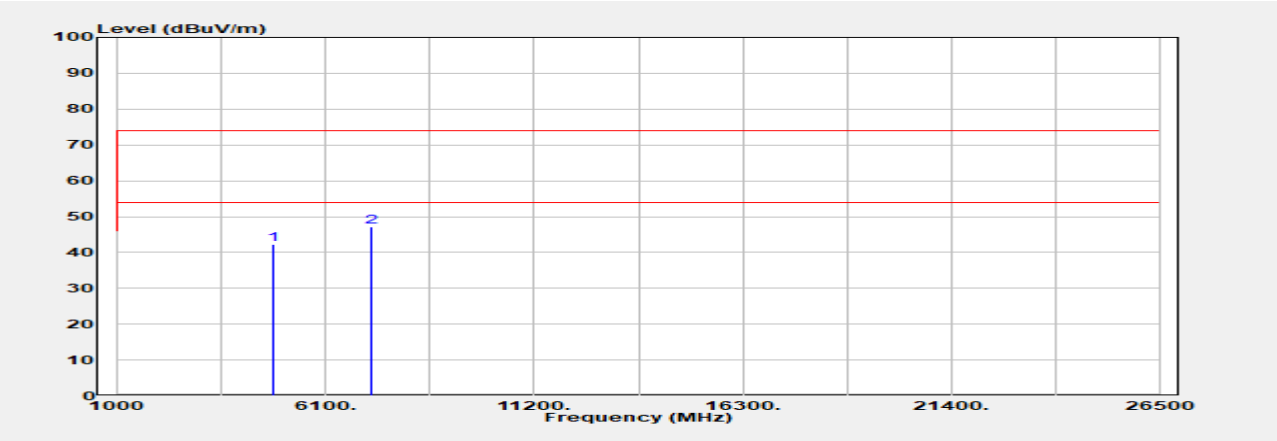
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2402 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4804.000 | Peak | 38.69 | 3.48 | 42.17 | 74.00 | -31.83 |
| 7206.000 | Peak | 38.04 | 9.21 | 47.24 | 74.00 | -26.76 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4804.000 | Average | 42.17 | -24.73 | 17.44 | 54.00 | -36.56 |
| 7206.000 | Average | 47.24 | -24.73 | 22.51 | 54.00 | -31.49 |

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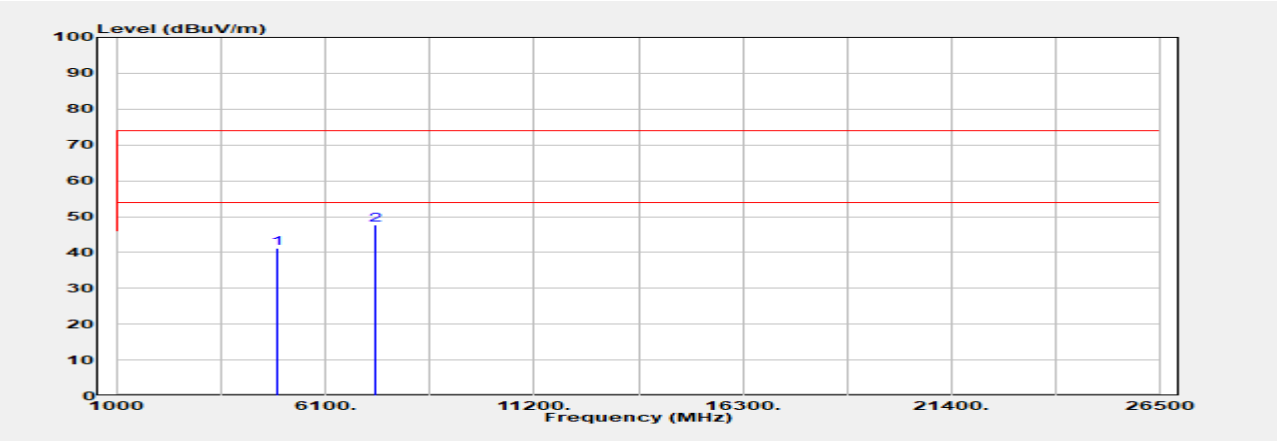
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2442 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4884.000 | Peak | 37.38 | 3.87 | 41.25 | 74.00 | -32.75 |
| 7326.000 | Peak | 37.91 | 9.67 | 47.58 | 74.00 | -26.42 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4884.000 | Average | 41.25 | -24.73 | 16.52 | 54.00 | -37.48 |
| 7326.000 | Average | 47.58 | -24.73 | 22.85 | 54.00 | -31.15 |

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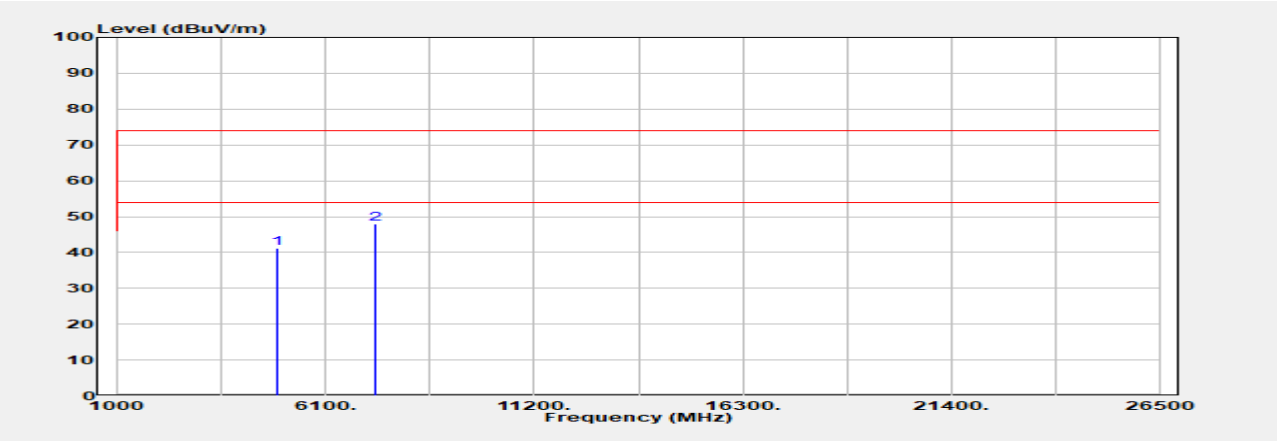
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2442 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4884.000 | Peak | 37.29 | 3.87 | 41.16 | 74.00 | -32.84 |
| 7326.000 | Peak | 38.42 | 9.67 | 48.09 | 74.00 | -25.91 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4884.000 | Average | 41.16 | -24.73 | 16.43 | 54.00 | -37.57 |
| 7326.000 | Average | 48.09 | -24.73 | 23.36 | 54.00 | -30.64 |

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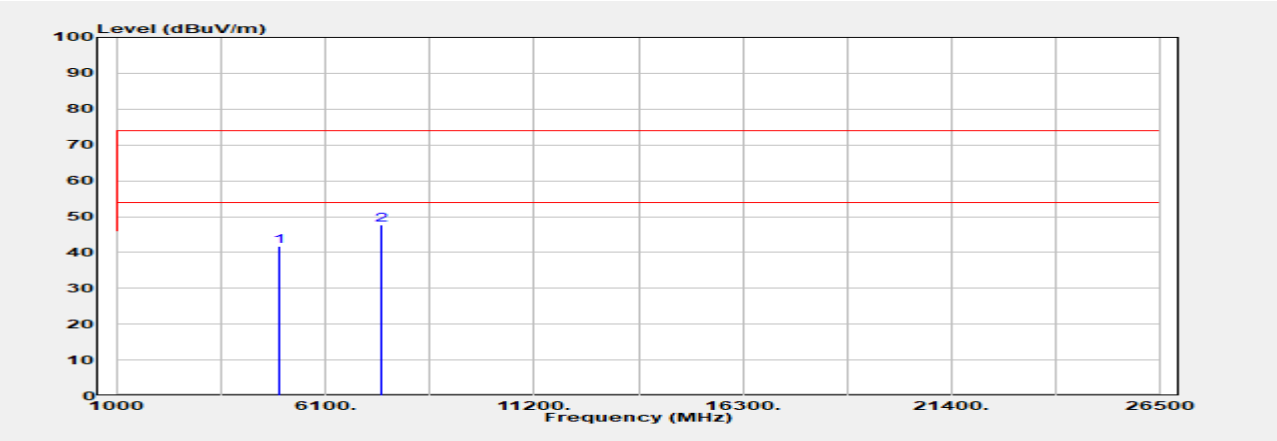
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4960.000 | Peak | 37.64 | 3.99 | 41.63 | 74.00 | -32.37 |
| 7440.000 | Peak | 37.90 | 9.75 | 47.64 | 74.00 | -26.36 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4960.000 | Average | 41.63 | -24.73 | 16.90 | 54.00 | -37.10 |
| 7440.000 | Average | 47.64 | -24.73 | 22.91 | 54.00 | -31.09 |

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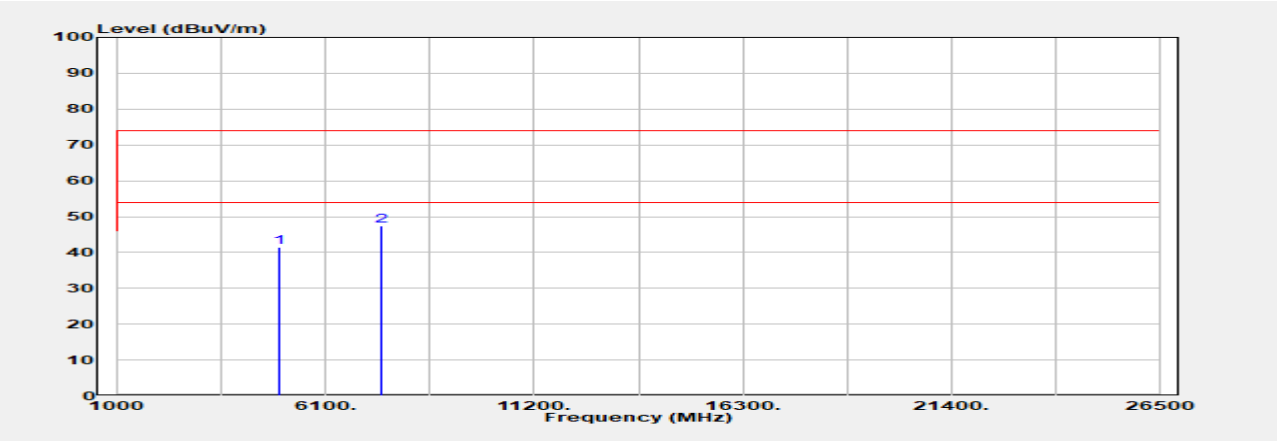
| | | | |
|---|---|---|---|
| Report Number | :TERF2411003434E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2024-11-15 |
| Test Frequency | :2480 MHz | Temp./Humi. | :24.4℃/63% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :E2 Plane | Engineer | :Jacky Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4960.000 | Peak | 37.53 | 3.99 | 41.52 | 74.00 | -32.48 |
| 7440.000 | Peak | 37.78 | 9.75 | 47.52 | 74.00 | -26.48 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4960.000 | Average | 41.52 | -24.73 | 16.79 | 54.00 | -37.21 |
| 7440.000 | Average | 47.52 | -24.73 | 22.79 | 54.00 | -31.21 |

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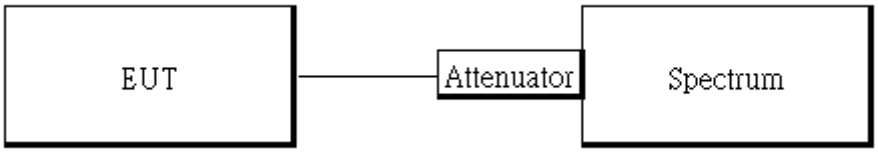
# 13 NUMBER OF HOPPING FREQUENCY

## 13.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

## 13.2 Test Setup




## 13.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
5. Set the spectrum analyzer as RBW = 30% of the channel spacing, VBW ≥ RBW., Detector = Peak
6. Max hold, view and count how many channel in the band.

## 13.4 Measurement Result

**Tabular Data of Total Channel Number**

| | ***Channel Number*** | **Limit** |
|---|---|---|
| ***2.4 GHz – 2.441 GHz*** | **40** | **>15** |
| ***2.441 GHz – 2.4835 GHz*** | **39** | |
| ***2.4 GHz ~2.4835 GHz*** | **(40+39) = 79** | |

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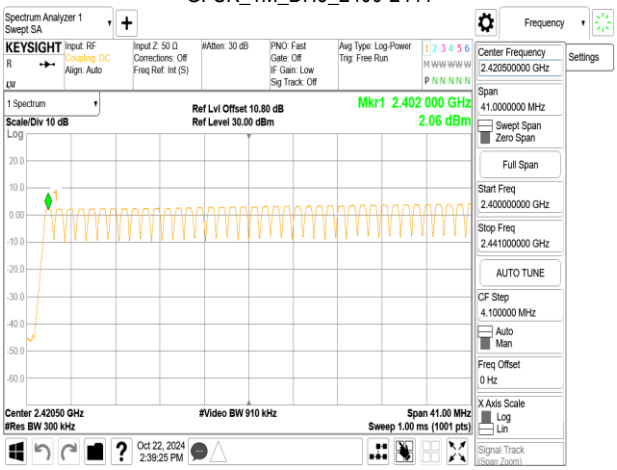
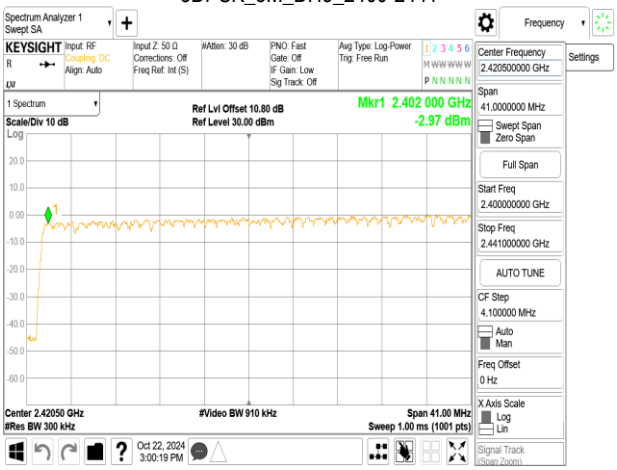
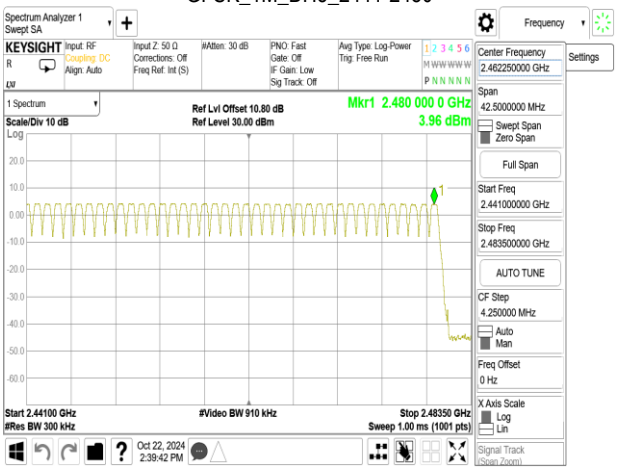
GFSK_1M_DH5_2400-2441



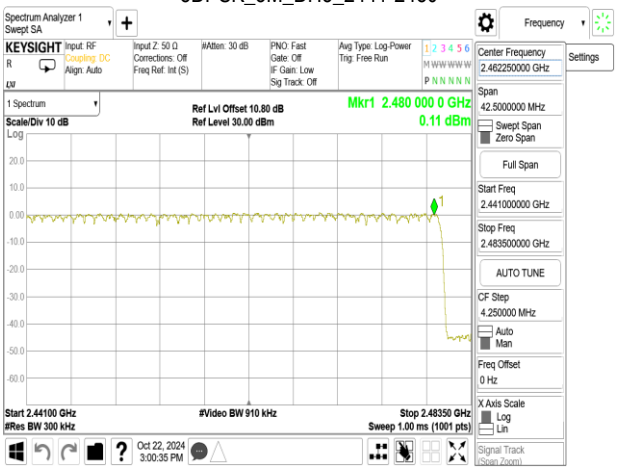

8DPSK_3M_DH5_2400-2441




GFSK_1M_DH5_2441-2480




8DPSK_3M_DH5_2441-2480

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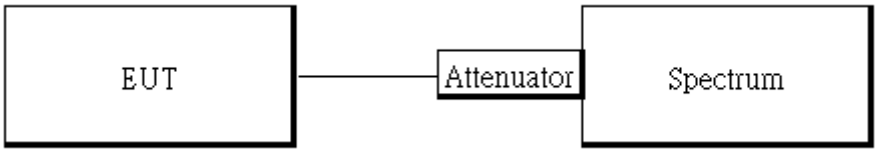
# 14 TIME OF OCCUPANCY (DWELL TIME)

## 14.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

## 14.2 Test Setup




## 14.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak, Adjust Sweep = 2~8ms.
6. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2

DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4

DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

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## 14.4 Measurement Result

GFSK (1Mbps)

| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) |
|---|---|---|---|
| 39 | DH1 | 120.00 | 400 |
| | DH3 | 262.40 | 400 |
| | DH5 | 291.20 | 400 |

π/4 DQPSK (2Mbps)

| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) |
|---|---|---|---|
| 39 | 2DH1 | 123.20 | 400 |
| | 2DH3 | 262.40 | 400 |
| | 2DH5 | 291.20 | 400 |

8-DPSK (3Mbps)

| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) |
|---|---|---|---|
| 39 | 3DH1 | 123.20 | 400 |
| | 3DH3 | 260.80 | 400 |
| | 3DH5 | 292.80 | 400 |

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**GFSK (1Mbps):**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CH Mid | DH1 time slot | = | 0.375 | * | (1600/2/79) | * | 31.6 | = | 120.00 | (ms) |
| | DH3 time slot | = | 1.640 | * | (1600/4/79) | * | 31.6 | = | 262.40 | (ms) |
| | DH5 time slot | = | 2.730 | * | (1600/6/79) | * | 31.6 | = | 291.20 | (ms) |

**π/4 -DQPSK (2Mbps):**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CH Mid | 2DH1 time slot | = | 0.385 | * | (1600/2/79) | * | 31.6 | = | 123.20 | (ms) |
| | 2DH3 time slot | = | 1.640 | * | (1600/4/79) | * | 31.6 | = | 262.40 | (ms) |
| | 2DH5 time slot | = | 2.730 | * | (1600/6/79) | * | 31.6 | = | 291.20 | (ms) |

**8-DPSK (3Mbps):**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CH Mid | 3DH1 time slot | = | 0.385 | * | (1600/2/79) | * | 31.6 | = | 123.20 | (ms) |
| | 3DH3 time slot | = | 1.630 | * | (1600/4/79) | * | 31.6 | = | 260.80 | (ms) |
| | 3DH5 time slot | = | 2.745 | * | (1600/6/79) | * | 31.6 | = | 292.80 | (ms) |

A period time = 0.4 (s) * 79 = 31.6 (s)

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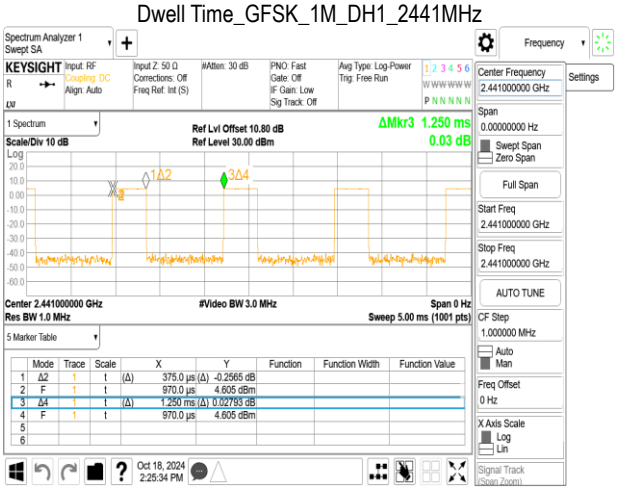
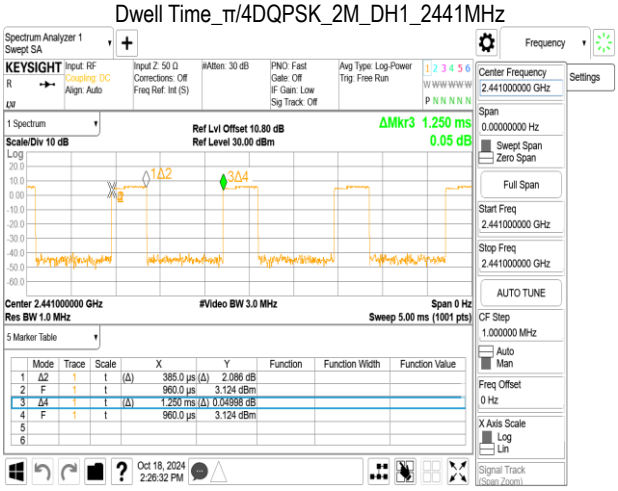
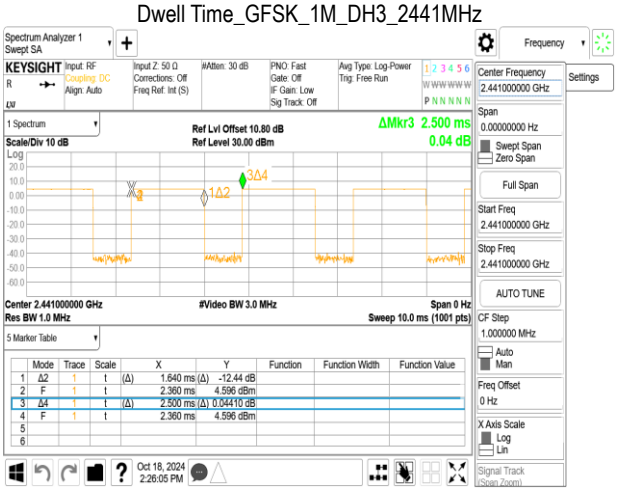
Dwell Time_GFSK_1M_DH1_2441MHz



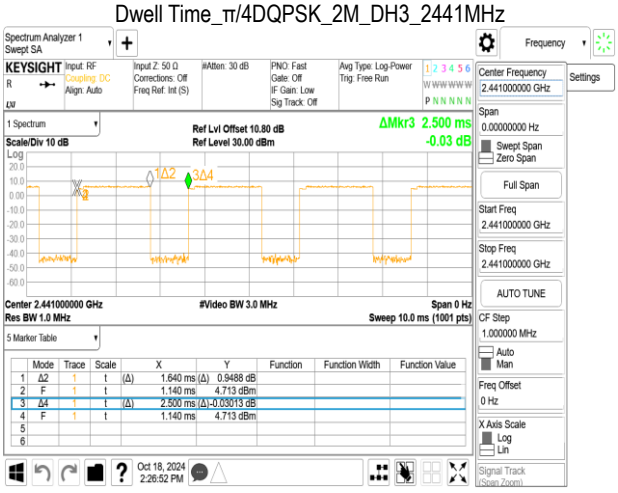

Dwell Time_π/4DQPSK_2M_DH1_2441MHz



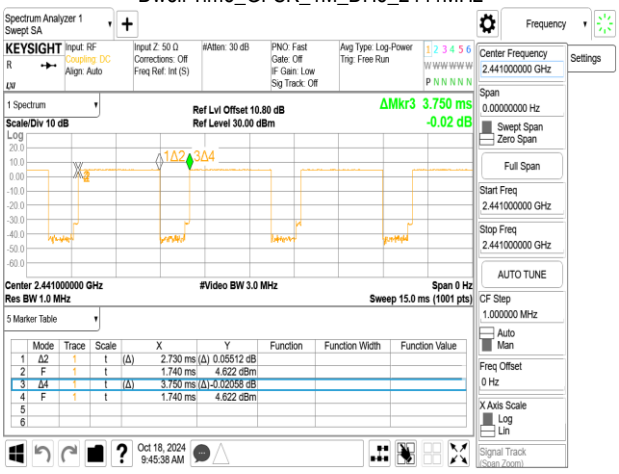

Dwell Time_GFSK_1M_DH3_2441MHz



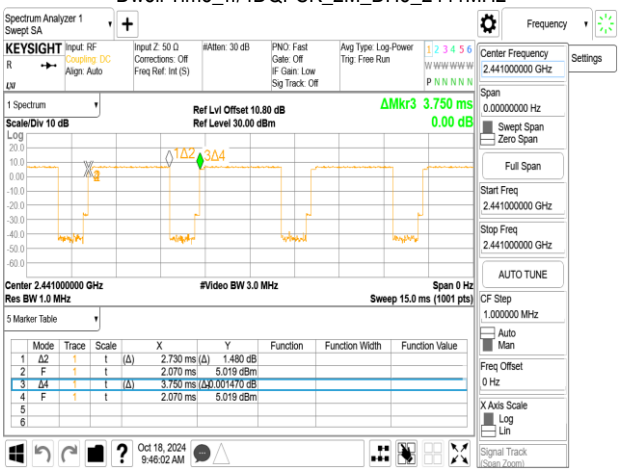

Dwell Time_π/4DQPSK_2M_DH3_2441MHz




Dwell Time_GFSK_1M_DH5_2441MHz




Dwell Time_π/4DQPSK_2M_DH5_2441MHz

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