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ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT





Applicant: Quanta Computer Inc.

No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City

33377, Taiwan

Product Name: Clover Flex

Brand Name: clover Model No.: C403

HVIN: C403W

Model Difference: N/A

Report Number: ER/2021/50019

FCC ID HFS-C403W

IC: 1787B-C403W

July 9, 2021 Issue Date:

Date of Test: June 10, 2021 ∼ June 30, 2021

Date of EUT Received: May 21, 2021

Approved By Blue Young

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.

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| Revision History | | | | | | |
|------------------|----------|-------------|--------------|------------|--|--|
| Report Number | Revision | Description | Issue Date | Revised By | | |
| ER/2021/50019 | 00 | Original | July 9, 2021 | Yuri Tsai | | |
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GENERAL INFORMATION

1.1 **Product Description**

| Product Name: | Clover Flex |
|-------------------|---|
| Brand Name: | clover |
| Model No.: | C403 |
| HVIN: | C403W |
| Model Difference: | N/A |
| Hardware Version: | N/A |
| Firmware Version: | N/A |
| EUT Series No.: | C043UT11750016 |
| Power Supply: | 7.6V from Li-ion Polymer rechargeable battery or 12V from Adapter |

1.2 **RF Specification**

| Radio Technology: | BT BR+EDR |
|-------------------|-------------------------|
| Channel number: | 79 channels |
| Modulation type: | GFSK + π/4DQPSK + 8DPSK |
| Transmit Power: | 7.26 dBm |
| Frequency Range: | 2.402GHz – 2.480GHz |
| Dwell Time: | ≦ 0.4s |

1.3 **Antenna Designation**

| Antenna Type | Supplier | Antenna Part No. | Freq. (MHz) | Peak Antenna Gain (dBi) | Worst An- tenna Gain |
|-----------------|----------|---------------------|----------------|----------------------------|----------------------------|
| PIFA | SAA | DQ60AYF0002 | 2.4GHz | -1.47 | - |
| | | | | | |

Note: 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 2 Feb. 2017 RSS-Gen. issue 5, Amendment 2, Fabruary 2021 ANSI C63.10:2013

Test Facility 1.5

| Laboratory | Test Site Address | Test Site Name | FCC Designa- tion number | IC CAB identifier |
|-------------------|---------------------------------------|----------------|-----------------------------|----------------------|
| | | SAC 1 | | |
| | | SAC 3 | | |
| | | Conduction 1 | | |
| | No.134, Wu Kung Road, New Taipei | Conducted 1 | | |
| | Industrial Park, Wuku District, New | Conducted 2 | TW0027 | |
| | Taipei City, Taiwan. | Conducted 3 | | |
| | | Conducted 4 | | |
| | | Conducted 5 | | |
| SGS Taiwan Ltd. | | Conducted 6 | | |
| Central RF Lab. | | Conduction A | | T\\/3702 |
| (TAF code 3702) | | SAC C | | 1000702 |
| (1741 COUC 57 02) | | SAC D | | |
| | | SAC G | | |
| | No.2, Keji 1st Rd., Guishan District, | Conducted A | | |
| | Taoyuan City, Taiwan 333 | Conducted B | TW0028 | |
| | laoyuan Oity, Taiwan 555 | 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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SYSTEM TEST CONFIGURATION

EUT Configuration 2.1

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.

Test Procedure 2.3

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*9m*6m semi-anechoic 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 **Configuration of Tested System** Fig. 2-1 Radiated Emission

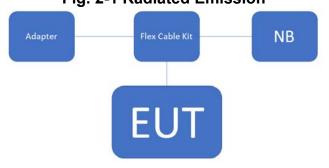


Fig. 2-2 Conducted (Antenna Port) Configuration



Fig 2-3 Conduction (AC Power Line) Radiated Emission

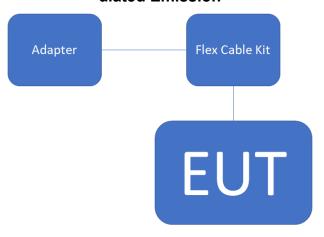


Table 2-1 Equipment Used in Tested System

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. |
|------|-------------------------|-----------|----------------|----------------|
| 1 | Bluetooth Test Software | N/A | N/A | N/A |
| 2 | Notebook | Lenovo | T440P | PC-014TAK |
| 3 | Flex Cable Kit | Clover | N/A | H041UQ63940213 |

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3 SUMMARY OF TEST RESULTS

| FCC Rules | IC 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 RSS-Gen §6.7 | Emission Bandwidth | Compliant |
| §15.205 §15.209 §15.247(d) | RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10 | Conducted & Radiated Band Edge and Spurious Emission | 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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DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

| ITEM | FREQUENCY | ITEM | FREQUENCY | ITEM | FREQUENCY | ITEM | FREQUENCY |
|------|-----------|------|-----------|------|-----------|------|-----------|
| 1 | 2402 MHz | 21 | 2422 MHz | 41 | 2442 MHz | 71 | 2462 MHz |
| 2 | 2403 MHz | 22 | 2423 MHz | 42 | 2443 MHz | 72 | 2463 MHz |
| | | | | | | | |
| 3 | 2404 MHz | 23 | 2424 MHz | 43 | 2444 MHz | 73 | 2464 MHz |
| 4 | 2405 MHz | 24 | 2425 MHz | 44 | 2445 MHz | 74 | 2465 MHz |
| 5 | 2406 MHz | 25 | 2426 MHz | 45 | 2446 MHz | 75 | 2466 MHz |
| 6 | 2407 MHz | 26 | 2427 MHz | 46 | 2447 MHz | 76 | 2467 MHz |
| 7 | 2408 MHz | 27 | 2428 MHz | 47 | 2448 MHz | 77 | 2468 MHz |
| 8 | 2409 MHz | 28 | 2429 MHz | 48 | 2449 MHz | 78 | 2469 MHz |
| 9 | 2410 MHz | 29 | 2430 MHz | 49 | 2450 MHz | 79 | 2470 MHz |
| 10 | 2411 MHz | 30 | 2431 MHz | 50 | 2451 MHz | 70 | 2471 MHz |
| 11 | 2412 MHz | 31 | 2432 MHz | 51 | 2452 MHz | 71 | 2472 MHz |
| 12 | 2413 MHz | 32 | 2433 MHz | 52 | 2453 MHz | 72 | 2473 MHz |
| 13 | 2414 MHz | 33 | 2434 MHz | 53 | 2454 MHz | 73 | 2474 MHz |
| 14 | 2415 MHz | 34 | 2435 MHz | 54 | 2455 MHz | 74 | 2475 MHz |
| 15 | 2416 MHz | 35 | 2436 MHz | 55 | 2456 MHz | 75 | 2476 MHz |
| 16 | 2417 MHz | 36 | 2437 MHz | 56 | 2457 MHz | 76 | 2477 MHz |
| 17 | 2418 MHz | 37 | 2438 MHz | 57 | 2458 MHz | 77 | 2478 MHz |
| 18 | 2419 MHz | 38 | 2439 MHz | 58 | 2459 MHz | 78 | 2479 MHz |
| 19 | 2420 MHz | 39 | 2440 MHz | 59 | 2460 MHz | 79 | 2480 MHz |
| 20 | 2421 MHz | 40 | 2441 MHz | 60 | 2461 MHz | | |

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4.2 The Worst Test Modes and Channel Details

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

| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | PACKET TYPE | |
|-----------|--------------------------------------|-------------------|------------|----------------|--|
| | RADIATED EMISSION TEST (BELOW 1 GHz) | | | | |
| Bluetooth | 0 to 78 | 39 | GFSK | DH5 | |
| | RADIATED EMISSION TEST (ABOVE 1 GHz) | | | | |
| Bluetooth | 0 to 78 | 0,39,78 | GFSK | DH5 | |

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.

| | ANTENNA PORT CONDUCTED TEST | | | | | |
|-----------|------------------------------------|-------------------|-------------------------|---|--|--|
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | PACKET TYPE | | |
| | Peak Output Power, 20dB Band Width | | | | | |
| Bluetooth | 0 to 78 | 0,39,78 | GFSK, π/4-DQPSK, 8-DPSK | DH5/2DH5/3DH5 | | |
| | Band Edge | | | | | |
| Bluetooth | 0 to 78 | 0,78 | GFSK, 8-DPSK | DH5/3DH5 | | |
| | | Frequency | Separation | | | |
| Bluetooth | 0 to 78 | 0,1,2 | GFSK | DH5 | | |
| | | Number of hop | ping frequency | | | |
| Bluetooth | 0 to 78 | 0 to 78 | GFSK | DH5 | | |
| | Time of Occupancy (Dwell time) | | | | | |
| Bluetooth | 0 to 78 | 0,39,78 | GFSK, π/4-DQPSK, 8-DPSK | DH1/DH3/DH5 2DH1/2DH3/2DH5 3DH1/3DH3/3DH5 | | |

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MEASUREMENT UNCERTAINTY

| Test Items | | Jncertair | nty |
|---|-----|-----------|-----|
| AC Power Line Conducted Emission | +/- | 2.34 | dB |
| Peak Output Power | +/- | 1 | dB |
| Emission Bandwidth | +/- | 1.53 | Hz |
| 100 kHz Bandwidth Of Frequency Band Edges | +/- | 1.69 | dB |
| Frequency Separation | +/- | 1.53 | Hz |
| Number of hopping frequency | +/- | 1.53 | Hz |
| Time of Occupancy | +/- | 1.53 | Hz |
| Temperature | +/- | 0.4 | °C |
| Humidity | +/- | 3.5 | % |
| DC / AC Power Source | +/- | 1 | % |

| Radiated Spurio | Radiated Spurious Emission Measurement Uncertainty | | | | | |
|--------------------------|--|------|--------------|-----------------|--|--|
| | +/- | 2.64 | dB | 9kHz~30MHz | | |
| Polarization: Vertical | +/- | 4.93 | dB | 30MHz - 1000MHz | | |
| Polarization: Vertical | +/- 4.81 | dB | 1GHz - 18GHz | | | |
| | +/- | 4.52 | dB | 18GHz - 40GHz | | |
| | +/- | 2.64 | dB | 9kHz~30MHz | | |
| Polarization: Horizontal | +/- | 4.45 | dB | 30MHz - 1000MHz | | |
| Folarization. Horizontal | +/- | 4.81 | dB | 1GHz - 18GHz | | |
| | +/- | 4.52 | dB | 18GHz - 40GHz | | |

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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CONDUCTED EMISSION TEST

Standard Applicable 6.1

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

| Frequency range | Limits dB(uV) | | | | | |
|-----------------|------------------|----------|--|--|--|--|
| MHz | 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

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

6.2 **Measurement Equipment Used**

| Radiated Emission Test Site: Conduction 1 | | | | | | | | |
|---|------------------|--------------------|------------------------|------------|------------|--|--|--|
| EQUIPMENT TYPE | PMENT TYPE MFR | | SERIAL NUMBER | LAST CAL. | CAL DUE. | | | |
| LISN | SCHWARZ- BECK | NSLK 8127 | 8127-465 | 04/09/2021 | 04/08/2022 | | | |
| Coaxial Cables | N/A | Coaxial Ca- ble | 161207 | 12/07/2020 | 12/06/2021 | | | |
| Test Software | audix | e3 | Ver. 6.11- 20180413 | 01/01/2021 | 12/31/2021 | | | |
| EMI Test Receiver | R&S | ESCI 7 | 100759 | 07/13/2020 | 07/12/2021 | | | |

6.3 **EUT Setup**

- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 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.

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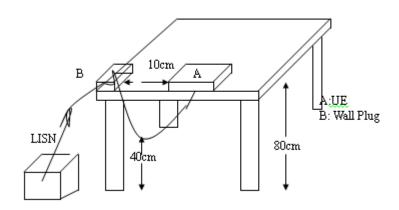
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6.4 **Test SET-UP (Block Diagram of Configuration)**



6.5 **Measurement Procedure**

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

6.6 **Measurement Result**

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit.

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:Neo Tsai

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Engineer

AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :ER/2021/50019 **Test Site** :Conduction 6F

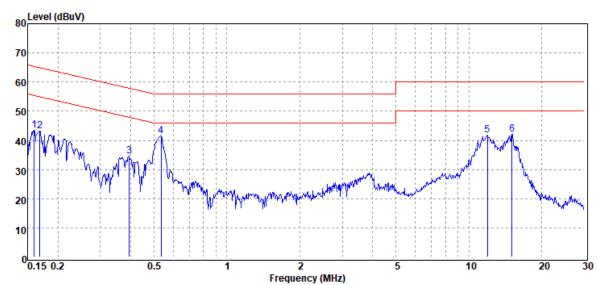
Test Mode :BT **Test Date** :2021-06-16

Power :AC 120V/60Hz Temp./Humi. :25.3/58

Note:

:L

Probe



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit | Margin |
|-------|------------------|---------------------------|--------|--------------|-------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dΒμV | dΒμV | dB |
| | | | | | | |
| 0.16 | Peak | 43.47 | 0.04 | 43.51 | 65.47 | -21.96 |
| 0.17 | Peak | 43.11 | 0.04 | 43.15 | 65.03 | -21.88 |
| 0.40 | Peak | 34.38 | 0.10 | 34.48 | 57.95 | -23.47 |
| 0.53 | Peak | 41.30 | 0.15 | 41.45 | 56.00 | -14.55 |
| 11.93 | Peak | 40.88 | 0.92 | 41.80 | 60.00 | -18.20 |
| 15.07 | Peak | 40.92 | 1.04 | 41.96 | 60.00 | -18.04 |

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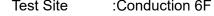
Report Number :ER/2021/50019 Test Site :Conduction 6F

Test Mode :BT

:AC 120V/60Hz Power

Probe :N

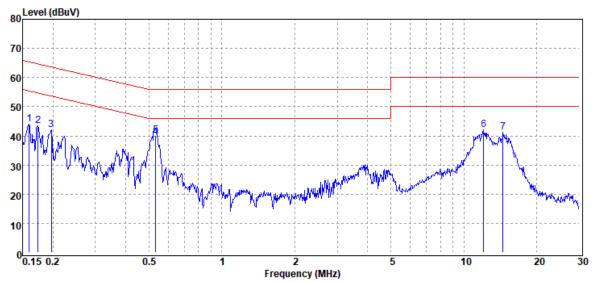
Note:



Test Date :2021-06-16

:25.3/58 Temp./Humi.

Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit | Margin |
|-------|------------------|---------------------------|--------|--------------|-------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dΒμV | dΒμV | dB |
| | | | | | | |
| 0.16 | Peak | 43.99 | 0.11 | 44.10 | 65.47 | -21.37 |
| 0.17 | Peak | 43.43 | 0.11 | 43.54 | 64.77 | -21.23 |
| 0.20 | Peak | 41.90 | 0.11 | 42.01 | 63.71 | -21.70 |
| 0.53 | Average | 39.30 | 0.21 | 39.51 | 46.00 | -6.49 |
| 0.53 | QP | 39.90 | 0.21 | 40.11 | 56.00 | -15.89 |
| 12.06 | Peak | 41.34 | 0.83 | 42.17 | 60.00 | -17.83 |
| 14.52 | Peak | 40.39 | 0.95 | 41.34 | 60.00 | -18.66 |

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PEAK OUTPUT POWER MEASUREMENT

7.1 Standard Applicable

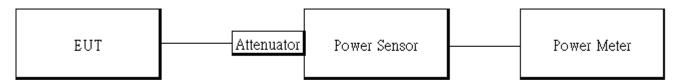
For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 - 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.

The e.i.r.p. shall not exceed 4 W.

7.2 **Measurement Equipment Used**

| Conducted Emission Test Site: Conducted 4 | | | | | | | | |
|---|---------------|-----------------|--------------------|------------|------------|--|--|--|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUM- BER | LAST CAL. | CAL DUE. | | | |
| PXA Spectrum Analyzer | Agilent | N9030A | MY53120760 | 04/27/2021 | 04/26/2022 | | | |
| Power Meter | Anritsu | ML2496A | 1804001 | 03/02/2021 | 03/01/2022 | | | |
| Power Sensor | Anritsu | MA2411B | 1726104 | 03/02/2021 | 03/01/2022 | | | |
| Power Sensor | Anritsu | MA2411B | 1726107 | 03/02/2021 | 03/01/2022 | | | |
| Attenuator | Mini-Circuit | BW- S10W2+ | 4 | 12/16/2020 | 12/15/2021 | | | |
| DC Block | Mini-Circuits | BLK-18-S+ | 1 | 12/16/2020 | 12/15/2021 | | | |

7.3 Test Set-up:



7.4 **Measurement Procedure:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows ANSI C63.10 Measurement Guidelines.
- 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 bandwidth)
- 4. Record the max. reading.
- 5. Repeat above procedures until all default test channel is completed.

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7.5 Peak & Average Power Measurement Result

1M BR mode (Peak):

| III Ziriiiouo (i suiyi | | | | | | | | |
|------------------------|----------------|-----------|----------------------------------|-------------------------|---------------|--|--|--|
| СН | Freq. (MHz) | Power set | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) | | | |
| Low | 2402 | 8 | 6.97 | 4.977 | 1000 | | | |
| Mid | 2441 | 8 | 6.55 | 4.519 | 1000 | | | |
| High | 2480 | 8 | 7.26 | 5.321 | 1000 | | | |

1M BR mode (Average):

| СН | Freq. (MHz) | Power set | Max. Output include tune up tolerance | Output Power (mW) | Limit (mW) |
|------|----------------|--------------|--|-------------------------|---------------|
| Low | 2402 | 8 | Power (dBm) 6.84 | 4.825 | 1000 |
| Mid | 2441 | 8 | 6.49 | 4.452 | 1000 |
| High | 2480 | 8 | 7.02 | 5.029 | 1000 |

2M EDR mode (Peak):

| СН | Freq. (MHz) | Power set | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) |
|------|----------------|-----------|----------------------------------|-------------------------|---------------|
| Low | 2402 | 8 | 6.10 | 4.074 | 125 |
| Mid | 2441 | 8 | 5.60 | 3.631 | 125 |
| High | 2480 | 8 | 6.53 | 4.498 | 125 |

2M FDR mode (Average)

| zw EDR mode (Average): | | | | | | | |
|------------------------|----------------|-----------|---|-------------------------|---------------|--|--|
| СН | Freq. (MHz) | Power set | Max. Avg.Output include tune up tolerance Power (dBm) | Output Power (mW) | Limit (mW) | | |
| Low | 2402 | 8 | 3.65 | 2.315 | 125 | | |
| Mid | 2441 | 8 | 3.16 | 2.068 | 125 | | |
| High | 2480 | 8 | 4.04 | 2.532 | 125 | | |

3M EDR mode (Peak):

| СН | Freq. (MHz) | Power set | Peak Output Power (dBm) | Output Power (mW) | Limit (mW) |
|------|----------------|--------------|----------------------------------|-------------------------|---------------|
| Low | 2402 | 8 | 6.48 | 4.446 | 125 |
| Mid | 2441 | 8 | 6.09 | 4.064 | 125 |
| High | 2480 | 8 | 6.90 | 4.898 | 125 |

3M EDR mode (Average):

| СН | Freq. (MHz) | Power set | Max. Avg.Output include tune up tolerance Power (dBm) | Output Power (mW) | Limit (mW) |
|------|----------------|--------------|---|-------------------------|---------------|
| Low | 2402 | 8 | 3.64 | 2.309 | 125 |
| Mid | 2441 | 8 | 3.16 | 2.068 | 125 |
| High | 2480 | 8 | 4.09 | 2.562 | 125 |

*Note: Max. Output include tune up tolerance Power measured by using average detector.

NOTE: cable loss as 10.9dB that offsets in the spectrum

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7.6 **EIRP Measurement Result**

1M BR mode EIRP

| Channel | Frequency (MHz) | Power set | Max. Output include tune up tolerance Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---------|--------------------|--------------|---|-----------------------|--------------|---------------|
| Low | 2402 | 8 | 6.84 | -1.47 | 3.440 | 4000 |
| Mid | 2441 | 8 | 6.49 | -1.47 | 3.173 | 4000 |
| High | 2480 | 8 | 7.02 | -1.47 | 3.585 | 4000 |

2M EDR mode EIRP

| Channel | Frequency (MHz) | Power set | Max. Avg.Output include tune up tolerance Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---------|--------------------|--------------|---|-----------------------|--------------|---------------|
| Low | 2402 | 8 | 3.65 | -1.47 | 1.650 | 4000 |
| Mid | 2441 | 8 | 3.16 | -1.47 | 1.474 | 4000 |
| High | 2480 | 8 | 4.04 | -1.47 | 1.805 | 4000 |

3M EDR mode EIRP

| Channel | Frequency (MHz) | Power set | Max. Avg.Output include tune up tolerance Power (dBm) | Antenna Gain (dBi) | EIRP (mW) | Limit (mW) |
|---------|--------------------|--------------|---|-----------------------|--------------|---------------|
| Low | 2402 | 8 | 3.64 | -1.47 | 1.646 | 4000 |
| Mid | 2441 | 8 | 3.16 | -1.47 | 1.474 | 4000 |
| High | 2480 | 8 | 4.09 | -1.47 | 1.826 | 4000 |

* Note: EIRP = Average Power + Gain

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EMISSION BANDWIDTH MEASUREMENT

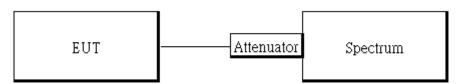
8.1 **Standard Applicable**

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

Measurement Equipment Used 8.2

| Conducted Emission Test Site: Conducted 4 | | | | | | |
|---|---------------|-----------------|--------------------|------------|------------|--|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUM- BER | LAST CAL. | CAL DUE. | |
| PXA Spectrum Analyzer | Agilent | N9030A | MY53120760 | 04/27/2021 | 04/26/2022 | |
| Attenuator | Mini-Circuit | BW- S10W2+ | 4 | 12/16/2020 | 12/15/2021 | |
| DC Block | Mini-Circuits | BLK-18-S+ | 1 | 12/16/2020 | 12/15/2021 | |

8.3 **Test Set-up**



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Measurement Procedure 8.4

- 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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8.5 20dB Bandwidth

GFSK

| СН | 20 dB BW (MHz) | 2/3 BW (MHz) |
|------|-------------------|-----------------|
| Low | 0.8809 | 0.59 |
| Mid | 0.8815 | 0.59 |
| High | 0.8807 | 0.59 |

π/4-DQPSK

| СН | 20 dB BW (MHz) | 2/3 BW (MHz) |
|------|-------------------|-----------------|
| Low | 1.253 | 0.84 |
| Mid | 1.256 | 0.84 |
| High | 1.254 | 0.84 |

8-DPSK

| СН | 20 dB BW (MHz) | 2/3 BW (MHz) |
|------|-------------------|-----------------|
| Low | 1.259 | 0.84 |
| Mid | 1.251 | 0.83 |
| High | 1.253 | 0.84 |

8.6 99% Bandwidth

GFSK

| СН | 99% BW (MHz) |
|------|-----------------|
| Low | 0.81693 |
| Mid | 0.81414 |
| High | 0.81768 |

π/4-DQPSK

| СН | 99% BW (MHz) |
|------|-----------------|
| Low | 1.1706 |
| Mid | 1.1710 |
| High | 1.1710 |

8-DPSK

| СН | 99% BW (MHz) |
|------|-----------------|
| Low | 1.1705 |
| Mid | 1.1704 |
| High | 1.1722 |

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GFSK 1M DH5 2402MHz



GFSK 1M DH5 2441MHz



GFSK 1M DH5 2480MHz



4DQPSK 2M DH5 2402MHz



4DQPSK 2M DH5 2441MHz



4DQPSK 2M DH5 2480MHz



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8DPSK_3M_DH5_2402MHz



8DPSK 3M DH5 2441MHz



8DPSK 3M DH5 2480MHz



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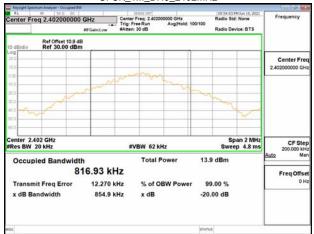
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GFSK 1M DH5 2402MHz



GFSK 1M DH5 2441MHz



GFSK 1M DH5 2480MHz



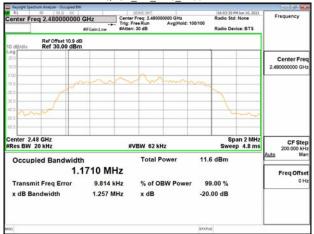
4DQPSK 2M DH5 2402MHz



4DQPSK 2M DH5 2441MHz



4DQPSK 2M DH5 2480MHz



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8DPSK_3M_DH5_2402MHz



8DPSK 3M DH5 2441MHz



8DPSK 3M DH5 2480MHz



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CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

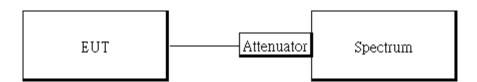
9.1 Standard Applicable

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.

9.2 **Measurement Equipment Used**

| Conducted Emission Test Site: Conducted 4 | | | | | | | |
|---|---------------|-----------------|--------------------|------------|------------|--|--|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUM- BER | LAST CAL. | CAL DUE. | | |
| PXA Spectrum Analyzer | Agilent | N9030A | MY53120760 | 04/27/2021 | 04/26/2022 | | |
| Attenuator | Mini-Circuit | BW- S10W2+ | 4 | 12/16/2020 | 12/15/2021 | | |
| DC Block | Mini-Circuits | BLK-18-S+ | 1 | 12/16/2020 | 12/15/2021 | | |

9.3 **Test SET-UP**



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9.4 **Measurement Procedure**

9.4.1 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, 2.3999GHz and 2.4836GHz and record the max. level.
- 7. Repeat above procedures until all frequency measured were complete.

9.4.2 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.

9.5 **Measurement Result**

See next page for test plots.

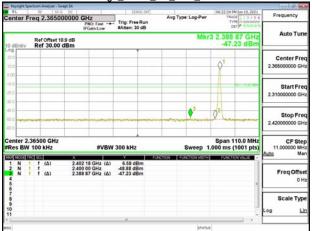
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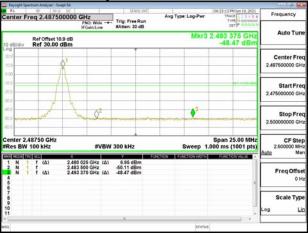


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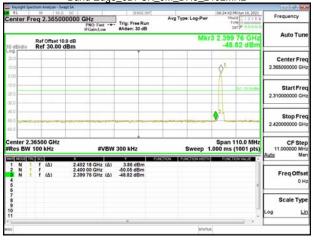




Band Edge GFSK 1M DH5 2480MHz



Band Edge_8DPSK_3M_DH5_2402MHz



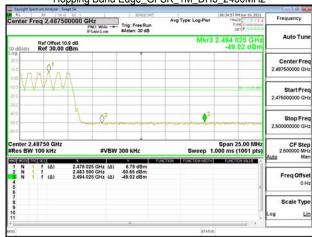
Band Edge_8DPSK_3M_DH5_2480MHz



Hopping Band Edge_GFSK_1M_DH5_2402MHz



Hopping Band Edge_GFSK_1M_DH5_2480MHz



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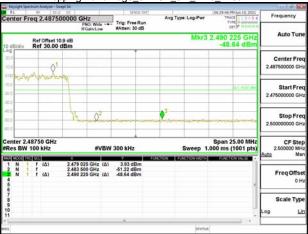


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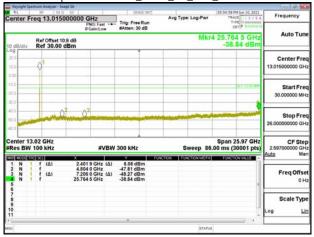
Hopping Band Edge_8DPSK_3M_DH5_2402MHz



Hopping Band Edge 8DPSK 3M DH5 2480MHz



Spurious Emission_GFSK_1M_DH5_2402MHz



Spurious Emission GFSK 1M DH5 2441MHz



Spurious Emission GFSK 1M DH5 2480MHz



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Spurious Emission_4DQPSK_2M_DH5_2402MHz



Spurious Emission 4DQPSK 2M DH5 2441MHz



Spurious Emission_4DQPSK_2M_DH5_2480MHz



Spurious Emission_8DPSK_3M_DH5_2402MHz



Spurious Emission 8DPSK 3M DH5 2441MHz



Spurious Emission 8DPSK 3M DH5 2480MHz



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10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 **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 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.
- 2. Emission level $(dB\mu V/m) = 20 \log Emission level (\mu V/m)$

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10.2 **Measurement Equipment Used**

| Radiated Emission Test Site: SAC 1 | | | | | |
|------------------------------------|----------------------|------------------------|------------------------|------------|------------|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| Horn Antenna | SCHWARZ- BECK | BBHA9170 | 184 | 12/11/2020 | 12/10/2021 |
| Site Cal | SGS | SAC I cham- ber | N/A | 01/01/2021 | 12/31/2021 |
| Horn Antenna | SCHWARZ- BECK | BBHA9120D | D803 | 12/17/2020 | 12/16/2021 |
| Bi-log Antenna | TESEO | CBL 6112D | 35242 & AT- N0555 | 01/13/2021 | 01/12/2022 |
| Loop Antenna | ETS.LIND- GREN | 6502 | 148045 | 10/19/2020 | 10/18/2021 |
| Spectrum Analyzer | Agilent | E4446A | MY51100003 | 10/29/2020 | 10/28/2021 |
| Test Software | audix | e3 | Ver. 6.11- 20180413 | 01/01/2021 | 12/31/2021 |
| EMI Test Receiver | R&S | ESCI 7 | 100759 | 07/13/2020 | 07/12/2021 |
| Pre-Amplifier | EMC Instru- ments | EMC184045B | 980135 | 12/16/2020 | 12/15/2021 |
| Pre-Amplifier | HP | 8449B | 3008A01973 | 12/16/2020 | 12/15/2021 |
| Pre-Amplifier | HP | 8447D | 2944A09469 | 12/16/2020 | 12/15/2021 |
| Attenuator | Mini-Circuit | BW-S10W2+ | 4 | 12/16/2020 | 12/15/2021 |
| Bandreject Filter 2400- 2483.5 | EWT | EWT-14-0166 | M1 | 12/16/2020 | 12/15/2021 |
| 3.2GHz High Pass Fil- ter | WI | WHKX10- 2624-80SS | 3 | 04/20/2021 | 12/15/2021 |
| Coaxial Cable | Huber Suhner | succoflex 102 | MY2622/2 | 12/16/2020 | 12/15/2021 |
| Coaxial Cable | Huber Suhner | succoflex 104A | 800086/4a | 12/16/2020 | 12/15/2021 |
| Coaxial Cable | Huber Suhner | EMC 104- SM-SM-2000 | 160123 | 12/16/2020 | 12/15/2021 |
| Coaxial Cable | Huber Suhner | SUCOFLEX 106 | 76096/6 | 12/16/2020 | 12/15/2021 |
| Coaxial Cable | Huber Suhner | SUCOFLEX 102 | MY2630/2 | 12/16/2020 | 12/15/2021 |
| Coaxial Cable | Huber Suhner | SUCOFLEX 102 | MY22962/2 | 12/16/2020 | 12/15/2021 |

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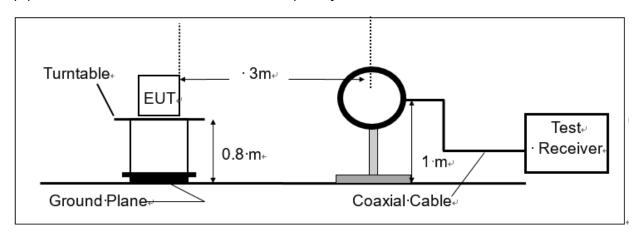
No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號 www.sgs.com.tw



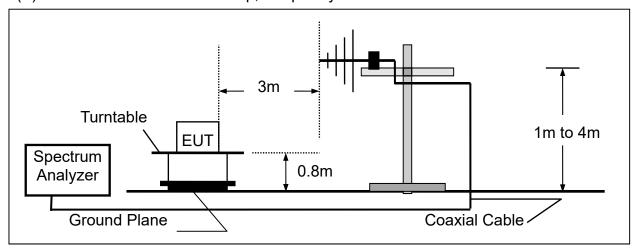
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10.3 **Test SET-UP**

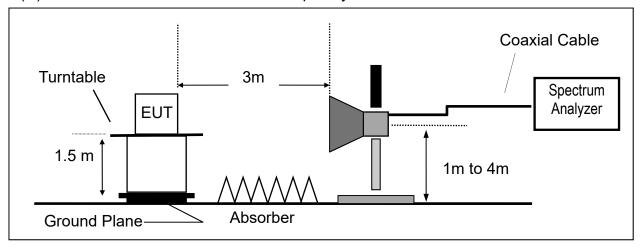
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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10.4 Measurement Procedure

10.4.1 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 plan.
- 3. The turn table shall rotate 360 degrees to determine the position of maximum emission
- 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=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
- 6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
- 7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
- 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.
- 9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
- 11. Repeat above procedures until all default test channel measured were complete.

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10.5 **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

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

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

Actual $FS(dB\mu V/m) = SPA$. Reading level(dB μV) + Factor(dB)

 $Factor(dB) = Antenna\ Factor(dB\mu V/m) + Cable\ Loss(dB) - Pre_Amplifier\ Gain(dB)$

10.6 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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10.7 **Measurement Result:**

10.7.1 Radiated Bandedge Result (Hopping Mode)

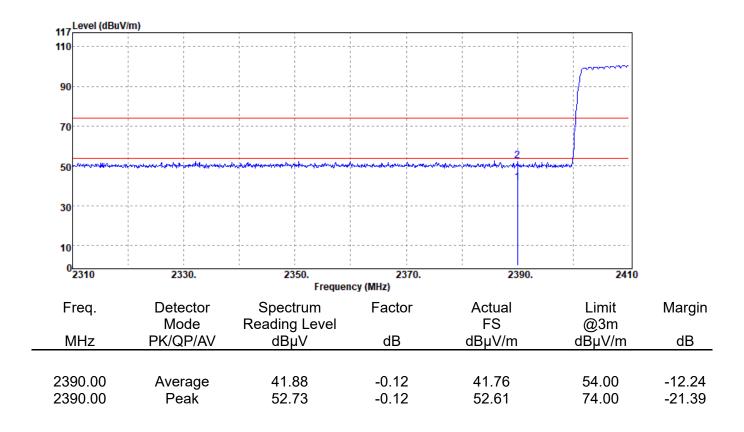
Report Number :ER/2021/50019 **Test Site** :SAC I Chamber

Operation Mode :BR Hopping **Test Date** :2021-06-18

Test Frequency :2402 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH Low Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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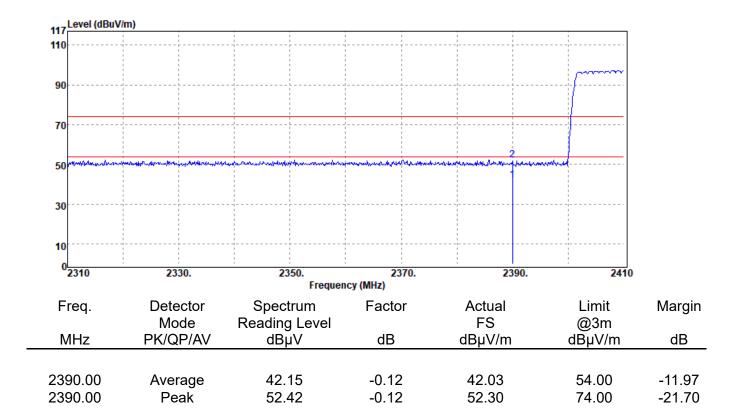
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Operation Mode Test Date :2021-06-18 :BR Hopping

Test Frequency :2402 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH Low Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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:E2 Plane

EUT Pol

Report No.: ER/2021/50019

:Neo Tsai

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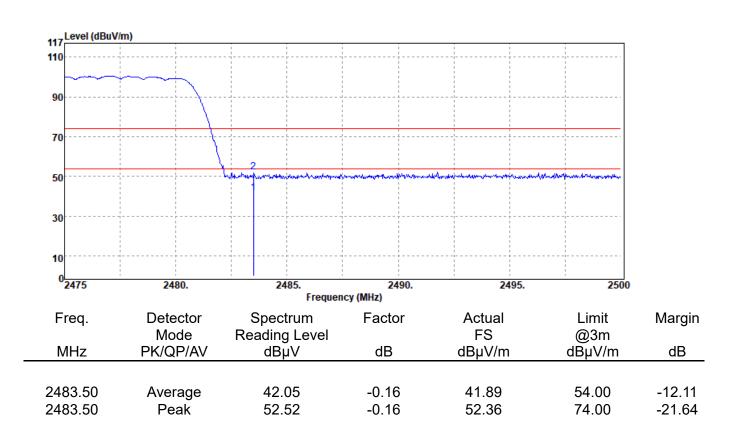
Engineer

Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode Test Date :2021-06-18 :BR Hopping

Test Frequency :2480 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH High Antenna Pol. :VERTICAL



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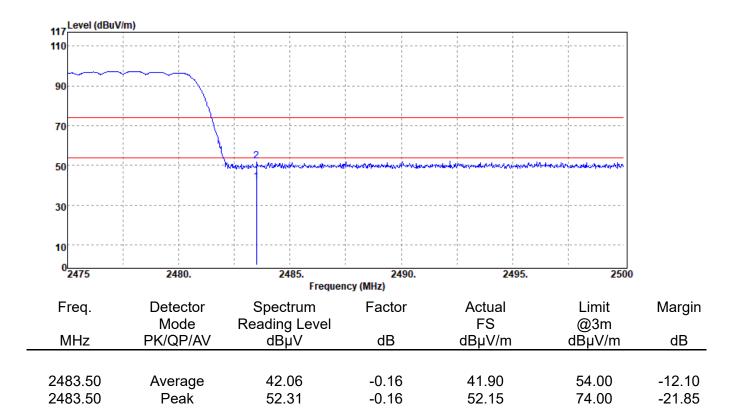
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Operation Mode Test Date :2021-06-18 :BR Hopping

Test Frequency :2480 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH High Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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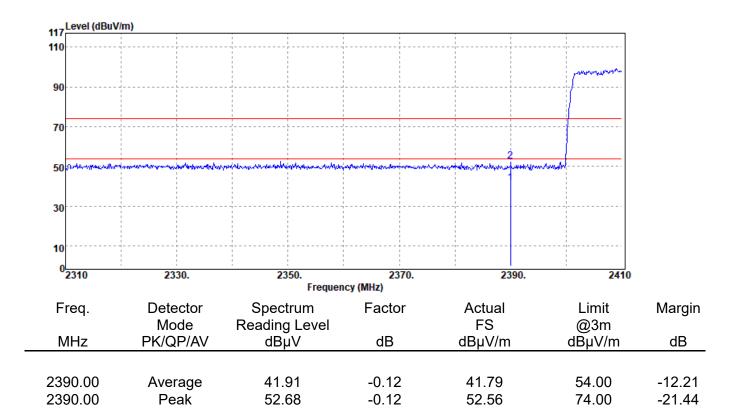
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode Test Date :2021-06-18 :EDR Hopping

Test Frequency :2402 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH Low Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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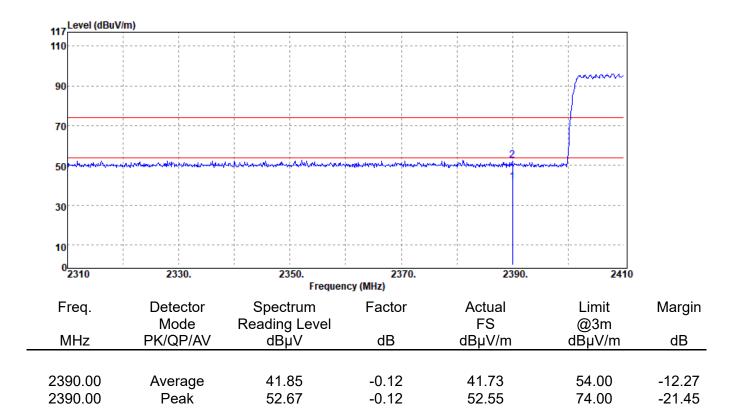
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Operation Mode Test Date :2021-06-18 :EDR Hopping

Test Frequency :2402 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH Low Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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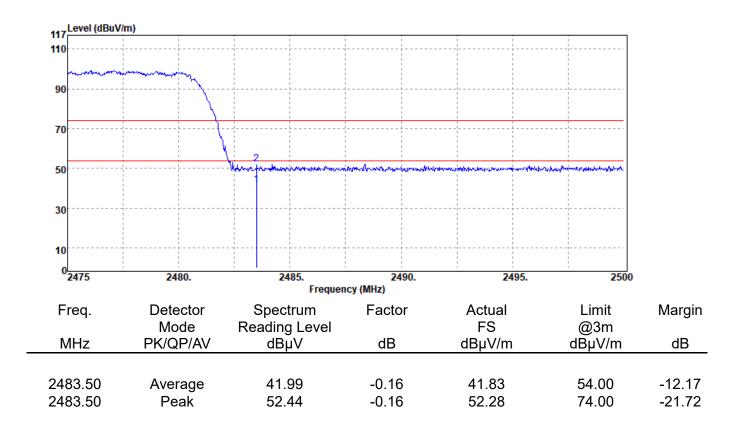
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode Test Date :2021-06-18 :EDR Hopping

Test Frequency :2480 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH High Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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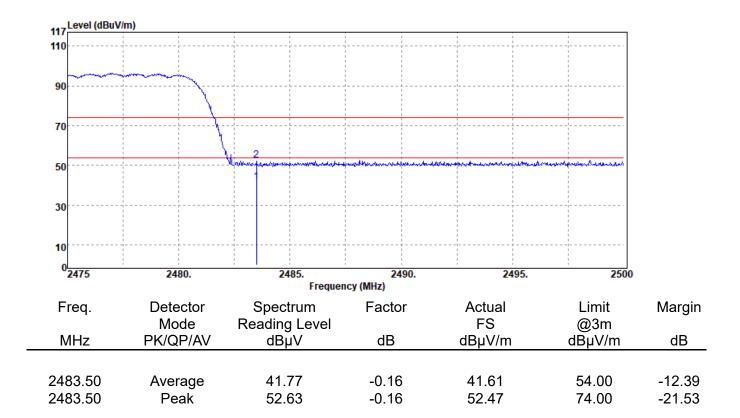
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode Test Date :2021-06-18 :EDR Hopping

Test Frequency :2480 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH High Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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10.7.2 Radiated Bandedge Result (Non-Hopping Mode)

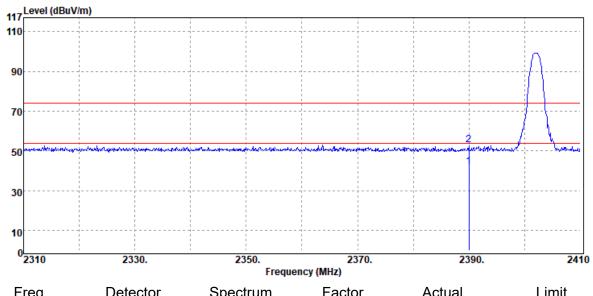
Test Site :SAC I Chamber Report Number :ER/2021/50019

Operation Mode Test Date :2021-06-18 :BR(1M)

Test Frequency :2402 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH Low :VERTICAL Antenna Pol.

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBμV/m | dBµV/m | dB |
| | | | | | | |
| 2390.00 | Average | 42.06 | -0.12 | 41.94 | 54.00 | -12.06 |
| 2390.00 | Peak | 53.04 | -0.12 | 52.92 | 74.00 | -21.08 |

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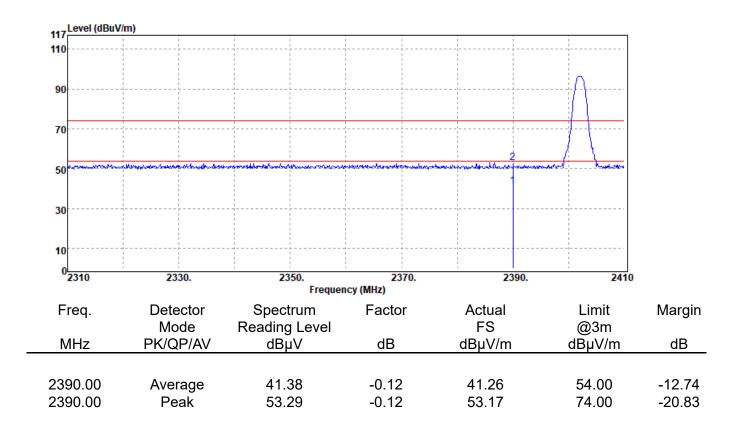
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode :BR(1M) **Test Date** :2021-06-18

Test Frequency :2402 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH Low Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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Test Mode

Report No.: ER/2021/50019

:VERTICAL

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Antenna Pol.

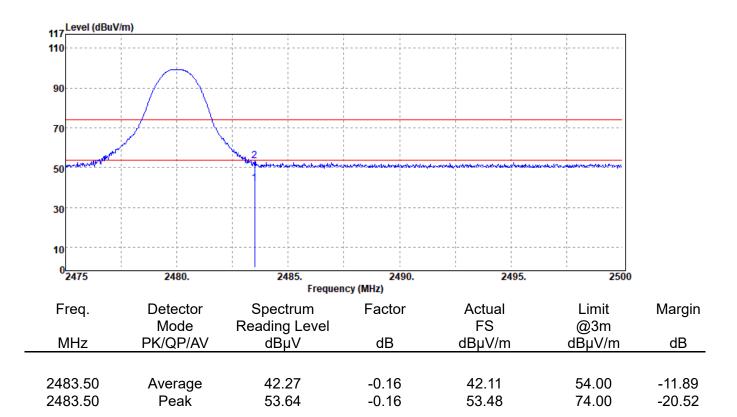
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode :BR(1M) **Test Date** :2021-06-18

Test Frequency :2480 MHz Temp./Humi. :26.8/61

:Bandedge CH High

EUT Pol :E2 Plane Engineer :Neo Tsai



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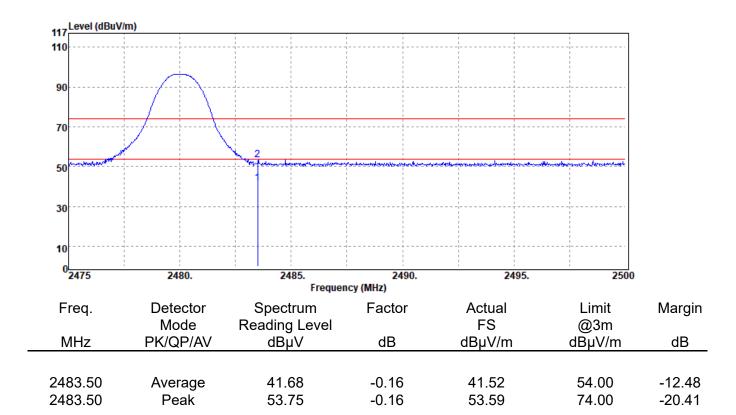
Report Number :ER/2021/50019 Test Site :SAC I Chamber

Operation Mode :BR(1M) Test Date :2021-06-18

Test Frequency :2480 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH High Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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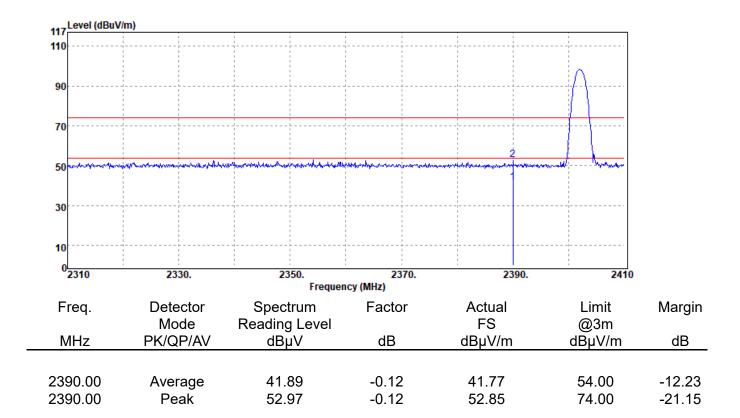
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode Test Date :2021-06-18 :EDR(3M)

Test Frequency :2402 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH Low Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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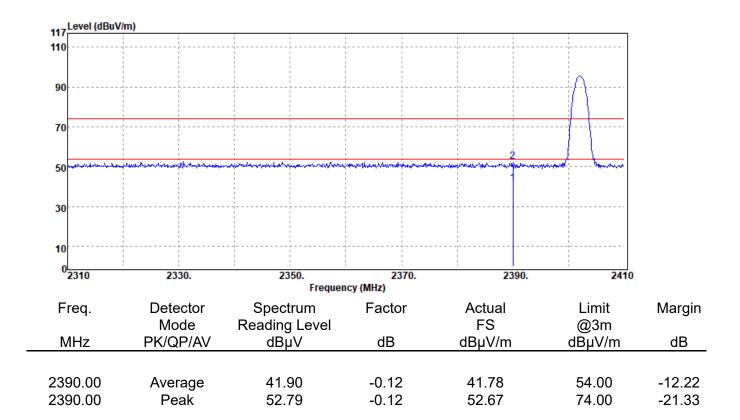
Report Number :ER/2021/50019 Test Site :SAC I Chamber

Operation Mode :EDR(3M) Test Date :2021-06-18

Test Frequency :2402 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH Low Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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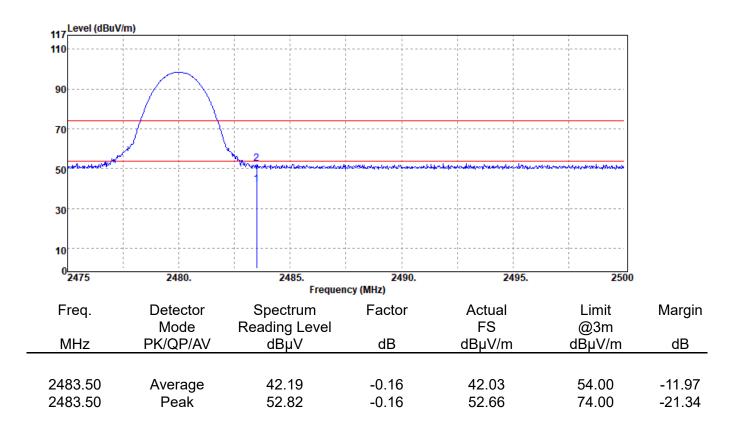
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode Test Date :2021-06-18 :EDR(3M)

Test Frequency :2480 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH High Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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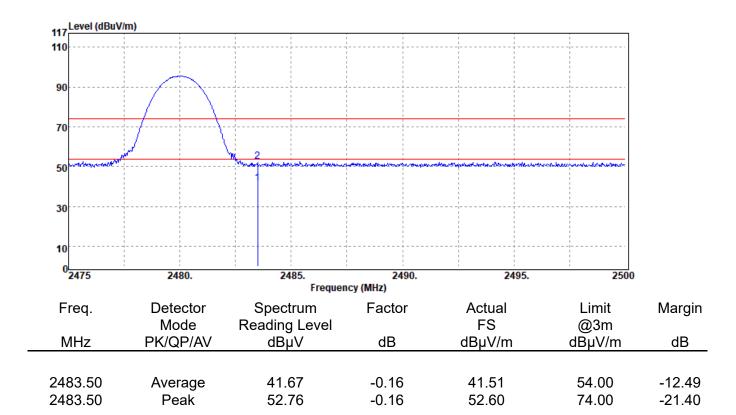
Report Number :ER/2021/50019 Test Site :SAC I Chamber

Operation Mode :EDR(3M) Test Date :2021-06-18

Test Frequency :2480 MHz Temp./Humi. :26.8/61

Test Mode :Bandedge CH High Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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10.7.3 Radiated Spurious Emission form 30MHz to 1000MHz:

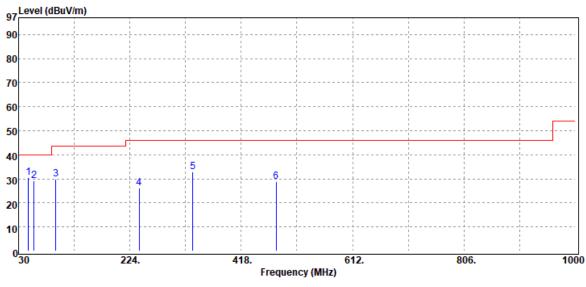
Report Number Test Site :SAC I Chamber :ER/2021/50019

Test Date Operation Mode :BR(1M) :2021-06-30

Test Frequency :2441 MHz Temp./Humi. :26.8/62

Test Mode :Tx CH Mid Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|--------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBμV/m | dBµV/m | dB |
| | | | | | | |
| 47.46 | Peak | 44.90 | -14.37 | 30.53 | 40.00 | -9.47 |
| 57.16 | Peak | 47.01 | -17.81 | 29.20 | 40.00 | -10.80 |
| 94.99 | Peak | 44.08 | -14.30 | 29.78 | 43.50 | -13.72 |
| 240.49 | Peak | 37.51 | -11.20 | 26.31 | 46.00 | -19.69 |
| 333.61 | Peak | 41.57 | -8.54 | 33.03 | 46.00 | -12.97 |
| 479.11 | Peak | 34.90 | -5.96 | 28.94 | 46.00 | -17.06 |

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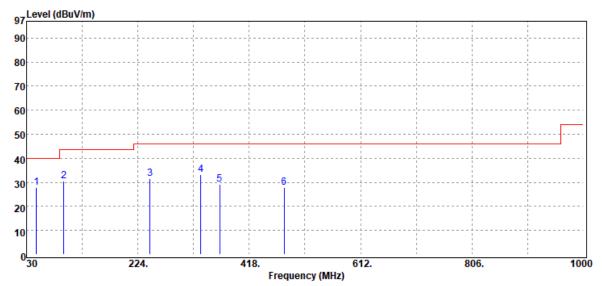
Report Number **Test Site** :SAC I Chamber :ER/2021/50019

Operation Mode :BR(1M) **Test Date** :2021-06-30

Test Frequency :2441 MHz Temp./Humi. :26.8/62

Test Mode :Tx CH Mid Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|--------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBµV/m | dBμV/m | dB |
| | | | | | | |
| 47.46 | Peak | 42.15 | -14.37 | 27.78 | 40.00 | -12.22 |
| 94.99 | Peak | 44.96 | -14.30 | 30.66 | 43.50 | -12.84 |
| 245.34 | Peak | 42.24 | -10.64 | 31.60 | 46.00 | -14.40 |
| 333.61 | Peak | 41.64 | -8.54 | 33.10 | 46.00 | -12.90 |
| 366.59 | Peak | 37.11 | -8.04 | 29.07 | 46.00 | -16.93 |
| 479.11 | Peak | 33.67 | -5.96 | 27.71 | 46.00 | -18.29 |

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10.7.4 Radiated Spurious Emission above 1 GHz:

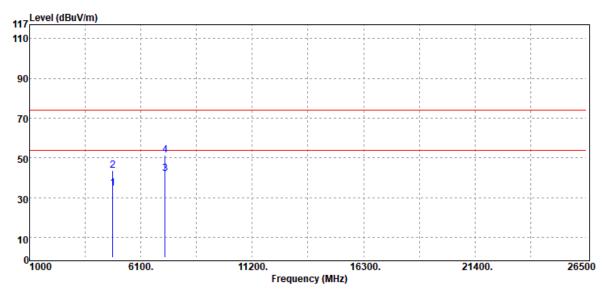
Test Site :SAC I Chamber Report Number :ER/2021/50019

Operation Mode Test Date :2021-06-22 :BR(1M)

Test Frequency :2402 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH Low :VERTICAL Antenna Pol.

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| | | | | | | |
| 4804.00 | Average | 27.60 | 7.16 | 34.76 | 54.00 | -19.24 |
| 4804.00 | Peak | 36.54 | 7.16 | 43.70 | 74.00 | -30.30 |
| 7206.00 | Average | 26.37 | 15.71 | 42.08 | 54.00 | -11.92 |
| 7206.00 | Peak | 35.75 | 15.71 | 51.46 | 74.00 | -22.54 |

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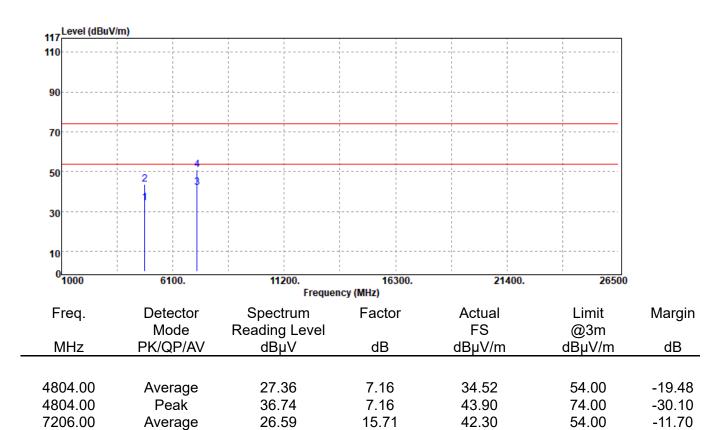
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode :BR(1M) **Test Date** :2021-06-22

Test Frequency :2402 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH Low Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



15.71

50.84

74.00

-23.16

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7206.00

Peak



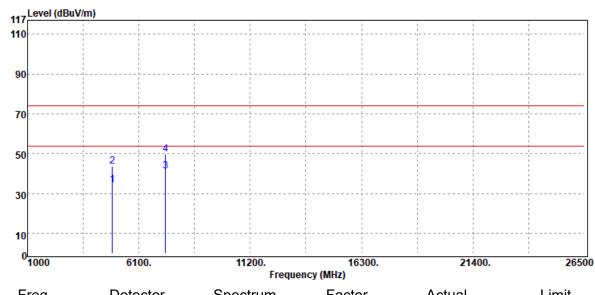
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Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode :BR(1M) **Test Date** :2021-06-22

Test Frequency :2441 MHz Temp./Humi. :26.8/64 Test Mode :Tx CH Mid Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBµV/m | dBµV/m | dB |
| | | | | | | |
| 4882.00 | Average | 27.36 | 7.05 | 34.41 | 54.00 | -19.59 |
| 4882.00 | Peak | 36.47 | 7.05 | 43.52 | 74.00 | -30.48 |
| 7323.00 | Average | 26.29 | 14.90 | 41.19 | 54.00 | -12.81 |
| 7323.00 | Peak | 34.74 | 14.90 | 49.64 | 74.00 | -24.36 |

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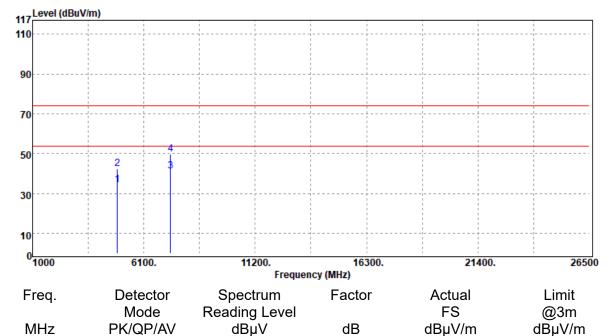
Report Number **Test Site** :SAC I Chamber :ER/2021/50019

Operation Mode :BR(1M) **Test Date** :2021-06-22

Test Frequency :2441 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH Mid Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBμV/m | dBμV/m | dB |
| | | | | | | |
| 4882.00 | Average | 27.39 | 7.05 | 34.44 | 54.00 | -19.56 |
| 4882.00 | Peak | 35.63 | 7.05 | 42.68 | 74.00 | -31.32 |
| 7323.00 | Average | 26.34 | 14.90 | 41.24 | 54.00 | -12.76 |
| 7323.00 | Peak | 34.89 | 14.90 | 49.79 | 74.00 | -24.21 |
| | | | | | | |

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:E2 Plane

EUT Pol

Report No.: ER/2021/50019

:Neo Tsai

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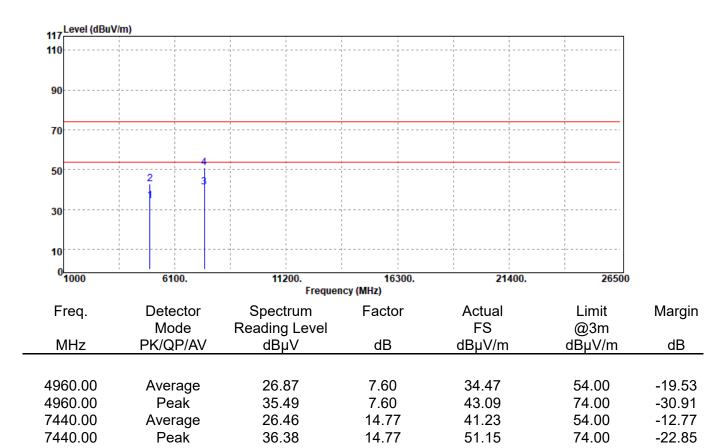
Engineer

Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode :BR(1M) **Test Date** :2021-06-22

Test Frequency :2480 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH High Antenna Pol. :VERTICAL



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:Tx CH High

Test Mode

Report No.: ER/2021/50019

:HORIZONTAL

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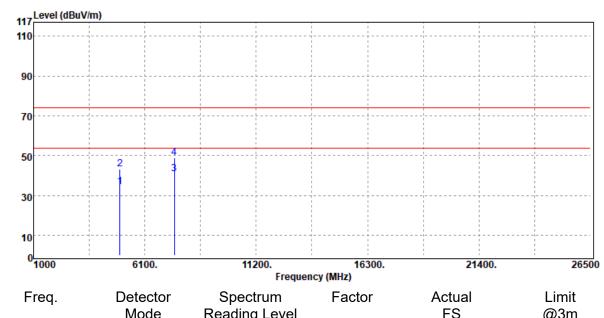
Antenna Pol.

Report Number **Test Site** :SAC I Chamber :ER/2021/50019

Operation Mode :BR(1M) **Test Date** :2021-06-22

Test Frequency :2480 MHz Temp./Humi. :26.8/64

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBuV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 1711 12 | 11001770 | αυμν | <u> </u> | ασμν/ιιι | αυμν/ιιι | <u>ub</u> |
| 4960.00 | Average | 26.95 | 7.60 | 34.55 | 54.00 | -19.45 |
| 4960.00 | Peak | 35.80 | 7.60 | 43.40 | 74.00 | -30.60 |
| 7440.00 | Average | 26.28 | 14.77 | 41.05 | 54.00 | -12.95 |
| 7440.00 | Peak | 34.10 | 14.77 | 48.87 | 74.00 | -25.13 |

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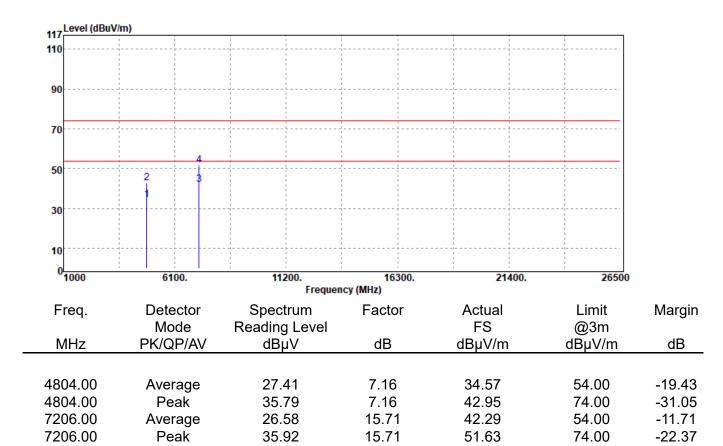
Report Number :ER/2021/50019 Test Site :SAC I Chamber

Operation Mode :EDR(3M) Test Date :2021-06-22

Test Frequency :2402 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH Low Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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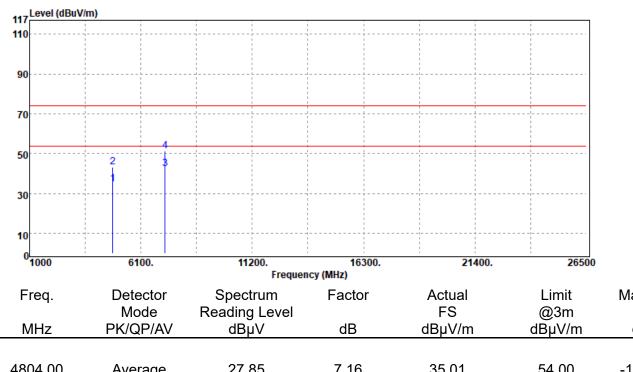
Report Number **Test Site** :SAC I Chamber :ER/2021/50019

Operation Mode :EDR(3M) **Test Date** :2021-06-22

Test Frequency :2402 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH Low Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBμV/m | dΒμV/m | dB |
| | | | | | | |
| 4804.00 | Average | 27.85 | 7.16 | 35.01 | 54.00 | -18.99 |
| 4804.00 | Peak | 36.18 | 7.16 | 43.34 | 74.00 | -30.66 |
| 7206.00 | Average | 26.77 | 15.71 | 42.48 | 54.00 | -11.52 |
| 7206.00 | Peak | 35.59 | 15.71 | 51.30 | 74.00 | -22.70 |
| | | | | | | |

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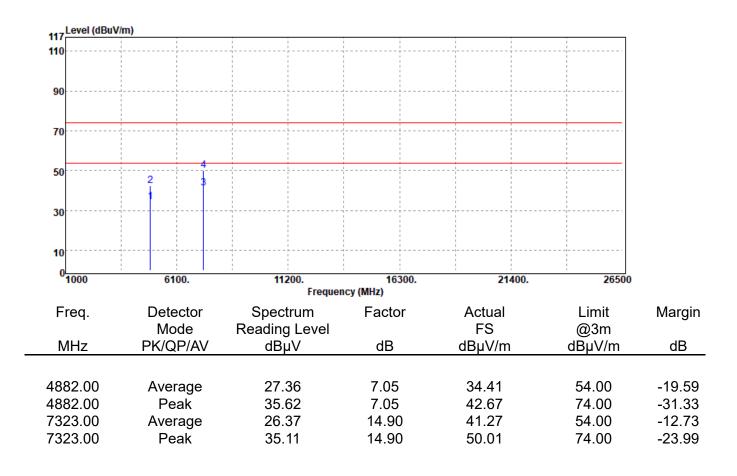
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode Test Date :2021-06-22 :EDR(3M)

Test Frequency :2441 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH Mid Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



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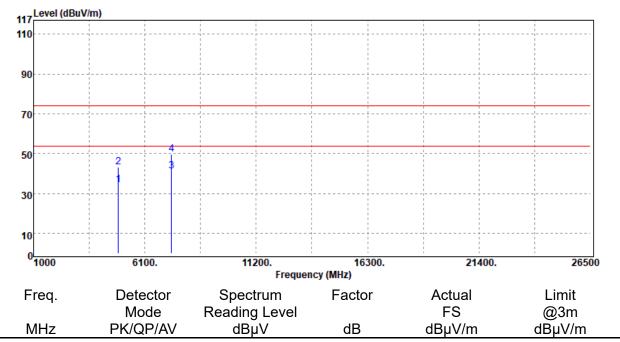
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode :EDR(3M) **Test Date** :2021-06-22

Test Frequency :2441 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH Mid Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBµV/m | dBμV/m | dB |
| | | | | | | |
| 4882.00 | Average | 27.37 | 7.05 | 34.42 | 54.00 | -19.58 |
| 4882.00 | Peak | 36.07 | 7.05 | 43.12 | 74.00 | -30.88 |
| 7323.00 | Average | 26.32 | 14.90 | 41.22 | 54.00 | -12.78 |
| 7323.00 | Peak | 34.78 | 14.90 | 49.68 | 74.00 | -24.32 |

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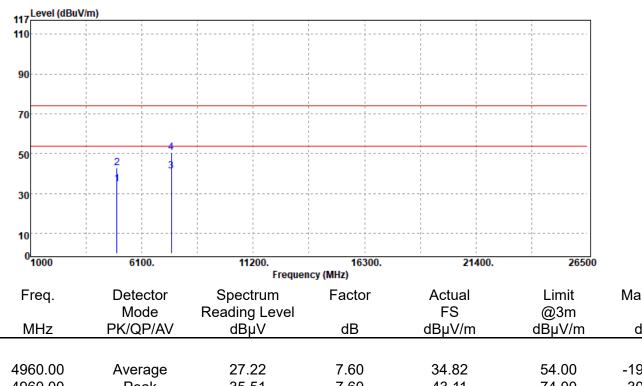
Report Number Test Site :SAC I Chamber :ER/2021/50019

Operation Mode :EDR(3M) **Test Date** :2021-06-22

Test Frequency :2480 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH High Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBμV/m | dBµV/m | dB |
| | | | | | | |
| 4960.00 | Average | 27.22 | 7.60 | 34.82 | 54.00 | -19.18 |
| 4960.00 | Peak | 35.51 | 7.60 | 43.11 | 74.00 | -30.89 |
| 7440.00 | Average | 26.63 | 14.77 | 41.40 | 54.00 | -12.60 |
| 7440.00 | Peak | 35.65 | 14.77 | 50.42 | 74.00 | -23.58 |
| | | | | | | |

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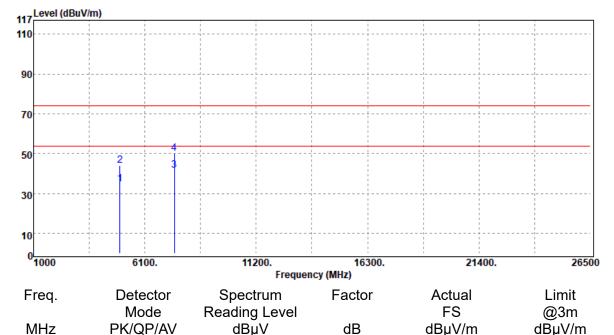
Report Number **Test Site** :SAC I Chamber :ER/2021/50019

Operation Mode :EDR(3M) **Test Date** :2021-06-22

Test Frequency :2480 MHz Temp./Humi. :26.8/64

Test Mode :Tx CH High Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Neo Tsai



| Freq. | Detector Mode | Spectrum Reading Level | Factor | Actual FS | Limit @3m | Margin |
|---------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz | PK/QP/AV | dΒμV | dB | dBµV/m | dBμV/m | dB |
| | | | | | | |
| 4960.00 | Average | 27.26 | 7.60 | 34.86 | 54.00 | -19.14 |
| 4960.00 | Peak | 36.54 | 7.60 | 44.14 | 74.00 | -29.86 |
| 7440.00 | Average | 26.74 | 14.77 | 41.51 | 54.00 | -12.49 |
| 7440.00 | Peak | 35.49 | 14.77 | 50.26 | 74.00 | -23.74 |
| | | | | | | |

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11 FREQUENCY SEPARATION

Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

11.2 **Measurement Equipment Used**

| | Conducted Emission Test Site: Conducted 4 | | | | | | | |
|-----------------------|---|-----------------|--------------------|------------|------------|--|--|--|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUM- BER | LAST CAL. | CAL DUE. | | | |
| PXA Spectrum Analyzer | Agilent | N9030A | MY53120760 | 04/27/2021 | 04/26/2022 | | | |
| Attenuator | Mini-Circuit | BW- S10W2+ | 4 | 12/16/2020 | 12/15/2021 | | | |
| DC Block | Mini-Circuits | BLK-18-S+ | 1 | 12/16/2020 | 12/15/2021 | | | |

11.3 **Test Set-up**



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 spectrum analyzer as RBW, VBW=100 kHz, Adjust Span to 5MHz, Sweep = auto.
- 6. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

Measurement Result 11.5

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

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Frequency Separation Test Plots





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12 NUMBER OF HOPPING FREQUENCY

12.1 Standard Applicable

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

12.2 Measurement Equipment Used

| Conducted Emission Test Site: Conducted 4 | | | | | | | | |
|--|---------------|---------------|------------|------------|------------|--|--|--|
| EQUIPMENT TYPE MFR MODEL SERIAL NUMBER BER LAST CAL. CAL | | | | | | | | |
| PXA Spectrum Analyzer | Agilent | N9030A | MY53120760 | 04/27/2021 | 04/26/2022 | | | |
| Attenuator | Mini-Circuit | BW- S10W2+ | 4 | 12/16/2020 | 12/15/2021 | | | |
| DC Block | Mini-Circuits | BLK-18-S+ | 1 | 12/16/2020 | 12/15/2021 | | | |

12.3 Test Set-up



12.4 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=430kHz, VBW=1.5MHz., Detector = Peak
- 6. Max hold, view and count how many channel in the band.

12.5 Measurement Result

Tabular Data of Total Channel Number

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

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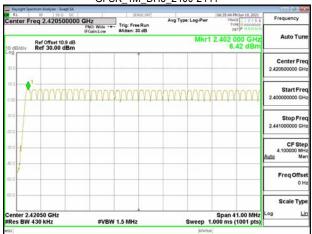
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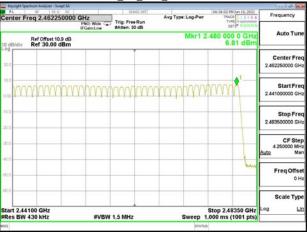
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12.6 Channel Number Test Plots

GFSK 1M DH5 2400-2441







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13 TIME OF OCCUPANCY (DWELL TIME)

13.1 **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.

Measurement Equipment Used 13.2

| Conducted Emission Test Site: Conducted 4 | | | | | | | | |
|--|---------------|---------------|------------|------------|------------|--|--|--|
| EQUIPMENT TYPE MFR MODEL SERIAL NUMBER BER LAST CAL. CAL | | | | | | | | |
| PXA Spectrum Analyzer | Agilent | N9030A | MY53120760 | 04/27/2021 | 04/26/2022 | | | |
| Attenuator | Mini-Circuit | BW- S10W2+ | 4 | 12/16/2020 | 12/15/2021 | | | |
| DC Block | Mini-Circuits | BLK-18-S+ | 1 | 12/16/2020 | 12/15/2021 | | | |

13.3 **Test Set-up**



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13.4 **Measurement Procedure**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows ANSI C6310:2015.
- 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 = $2\sim8$ ms.
- 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

In AFH mode, hopping rate is 800 hop/s with 6 slots in 20 hopping channels with channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 * 20) (S), Hop Over Occupancy Time comes to (800 / 6 / 20)*(0.4*20) = 53.33

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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13.5 Tabular Result of the Measurement

GFSK (1Mbps)

| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) | 1/T (kHz) | VBW setting (kHz) |
|---------|-------------|-------------------------|---------------|-----------|-------------------------|
| | DH1 | 121.60 | 400ms | 2.632 | 3.00 |
| Mid | DH3 | 262.40 | 400ms | 0.610 | 1.00 |
| | DH5 | 307.20 | 400ms | 0.347 | 1.00 |

π/4 DQPSK (2Mbps)

| III D QI OIT (ZIIID | ~~/ | | | | |
|---------------------|-------------|-------------------------|---------------|-----------|-------------------------|
| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) | 1/T (kHz) | VBW setting (kHz) |
| | 2DH1 | 124.80 | 400ms | 2.564 | 3.00 |
| Mid | 2DH3 | 262.40 | 400ms | 0.610 | 1.00 |
| | 2DH5 | 307.20 | 400ms | 0.347 | 1.00 |

8-DPSK (3Mbps)

| o Bi Git (Gillspo) | | | | | |
|--------------------|-------------|-------------------------|---------------|-----------|-------------------------|
| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) | 1/T (kHz) | VBW setting (kHz) |
| | 3DH1 | 124.80 | 400ms | 2.564 | 3.00 |
| Mid | 3DH3 | 262.40 | 400ms | 0.610 | 1.00 |
| | 3DH5 | 307.20 | 400ms | 0.347 | 1.00 |

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GFSK (1Mbps):

| CH Mid | DH1 time slot | = | 0.380 * | (1600/2/79) | * | 31.6 = | 121.60 | (ms) |
|--------|---------------|---|---------|-------------|---|--------|--------|------|
| | DH3 time slot | = | 1.640 * | (1600/4/79) | * | 31.6 = | 262.40 | (ms) |
| | DH5 time slot | = | 2.880 * | (1600/6/79) | * | 31.6 = | 307.20 | (ms) |

$\pi/4$ -DQPSK (2Mbps):

| CH Mid | 2DH1 time slot = | 0.390 * | (1600/2/79) * | 31.6 = | 124.80 (ms) |
|--------|------------------|---------|---------------|--------|-------------|
| | 2DH3 time slot = | 1.640 * | (1600/4/79) * | 31.6 = | 262.40 (ms) |
| | 2DH5 time slot = | 2.880 * | (1600/6/79) * | 31.6 = | 307.20 (ms) |

8-DPSK (3Mbps):

| CH Mid | 3DH1 time slot = | 0.390 * | (1600/2/79) | * | 31.6 = | 124.80 (ms) |
|--------|------------------|---------|-------------|---|--------|-------------|
| | 3DH3 time slot = | 1.640 * | (1600/4/79) | * | 31.6 = | 262.40 (ms) |
| | 3DH5 time slot = | 2.880 * | (1600/6/79) | * | 31.6 = | 307.20 (ms) |

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

Measurement Result

Note: Refer to next page for plots.

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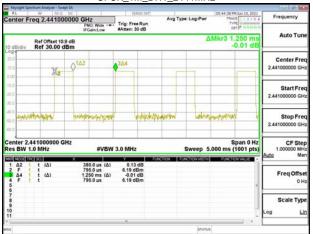
际升另有說明**U和它的表面具有,同時近後而程序留多次。本報告未經本公司書圖計刊,不可能的複製。
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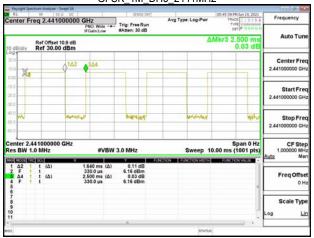


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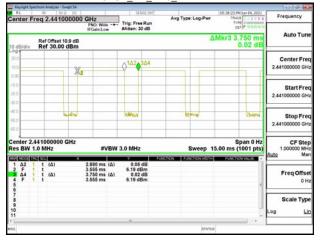
GFSK_1M_DH1_2441MHz



GFSK_1M_DH3_2441MHz



GFSK_1M_DH5_2441MHz



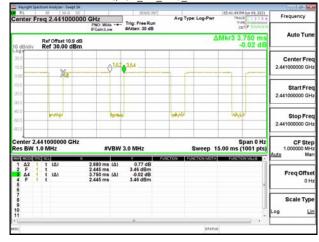
4DQPSK_2M_DH1_2441MHz



4DQPSK 2M DH3 2441MHz



4DQPSK 2M DH5 2441MHz



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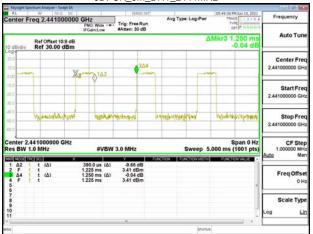
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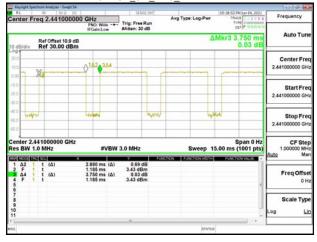
8DPSK_3M_DH1_2441MHz



8DPSK 3M DH3 2441MHz



8DPSK 3M DH5 2441MHz



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14 ANTENNA REQUIREMENT

14.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

14.2 **Antenna Connected Construction**

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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