

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



Applicant: Murata Manufacturing Co., Ltd.
1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan

Manufacturer: Murata Manufacturing Co., Ltd.
1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan

Product Name: Communication Module

Brand Name: Murata Manufacturing Co., Ltd.

Model No.: LBES0ZZ2LL

/ISED HVIN:

Family Model No.: LBEE0ZZ2KL

/ Family ISED HVIN:

Model Difference: Different functions: LBES0ZZ2LL includes IEEE802.15.4.
functionality.

ISED PMN: LBES0ZZ2LL, LBEE0ZZ2KL

Report Number: TERF2410002915E2

FCC ID VPYLBES0ZZ2LL

IC ID: 772C-LBES0ZZ2LL

Date of EUT Received: September 24, 2024

Date of Test: October 4, 2024 ~ October 30, 2024

Issue Date: December 18, 2024

Approved By _____

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.

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Revision History

| Report Number | Revision | Description | Issue Date | Revised By | Remark |
|------------------|----------|----------------------------|---------------|------------|--------|
| TERF2410002915E2 | 00 | Original | Dec. 6, 2024 | Candice Li | |
| TERF2410002915E2 | 01 | Modify FVIN of section 1.1 | Dec. 18, 2024 | Candice Li | * |
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| | | | | | |

Note:

- 1、The remark "*" indicates modification of the report upon requests from certification body.
- 2、Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received.
Only the main model LBES0ZZ2LL has IEEE802.15.4. functionality and has been independently tested for this feature. The variants are assessed as electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

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1 GENERAL INFORMATION

1.1 Product Description

| | |
|--|--|
| Product Name: | Communication Module |
| Brand Name: | Murata Manufacturing Co., Ltd. |
| Model No.: /ISED HVIN: | LBES0ZZ2LL |
| Family Model No.: / Family ISED HVIN: | LBEE0ZZ2KL |
| Model Difference: | Different functions: LBES0ZZ2LL includes IEEE802.15.4. functional-ity. |
| Hardware Version: | 1.0 |
| Firmware Version: | 1.1.1.1 |
| EUT Series No.: | 2LL #35 (Conducted) 2LL #116 (Conduction) 2LL #116 / 2LL#82 (Radiated) |
| Power Supply: | 3.3 Vdc, 1.8 Vdc |
| Test Software (Name/Version) | DUT Labtool Version 2.0.0.17 |

1.2 RF Specification

| | |
|-------------------|--|
| Radio Technology: | BLE |
| Frequency Range: | 2402 – 2480MHz |
| Channel number: | 40 channels |
| Modulation type: | GFSK |
| Transmit Power: | BLE 1M: 12.99 dBm BLE 2M: 12.98 dBm BLE 125k: 13.15 dBm BLE 500k: 13.25 dBm |

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1.3 Antenna Designation

External Antenna

| Antenna Type | Supplier | Antenna Part No. | Freq. (MHz) | Peak Antenna Gain (dBi) |
|--------------|--------------------|------------------|-------------|-------------------------|
| Dipole | Molex | 146187 | 2400-2500 | 3.2 |
| | Molex | 145153 | 2400-2500 | 3.2 |
| | Molex | 219611 | 2400-2500 | 2.67 |
| | Unictron | WT32D1-KX | 2400-2500 | 3 |
| | Unictron | AA258 | 2400-2500 | 0.9 |
| | Taoglas | FXP830.07.0100C | 2400-2500 | 2.5 |
| | Antenova | SRF2W012 | 2400-2500 | 3 |
| | Sansei | STDANTEMD-013 | 2400-2500 | 1.9 |
| | Laird | EMF2471A3S | 2400-2500 | 2.2 |
| | Kyocera AVX (KAVX) | 1001932FT | 2400-2500 | 2.5 |
| | Kyocera AVX (KAVX) | 1001932PT | 2400-2500 | 2.03 |
| | Kyocera AVX (KAVX) | W3P35x8W04 | 2400-2500 | 2.3 |
| | Inventek | W2.4-5P-U | 2400-2500 | 3.73 |

Internal Antenna

| Antenna Type | Supplier | Antenna Part No. | Freq. (MHz) | Peak Antenna Gain (dBi) |
|--------------|----------|------------------|-------------|-------------------------|
| Monopole | Murata | Type2LL _Antenna | 2400-2500 | 3.6 |

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 are no special accessories 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 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 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

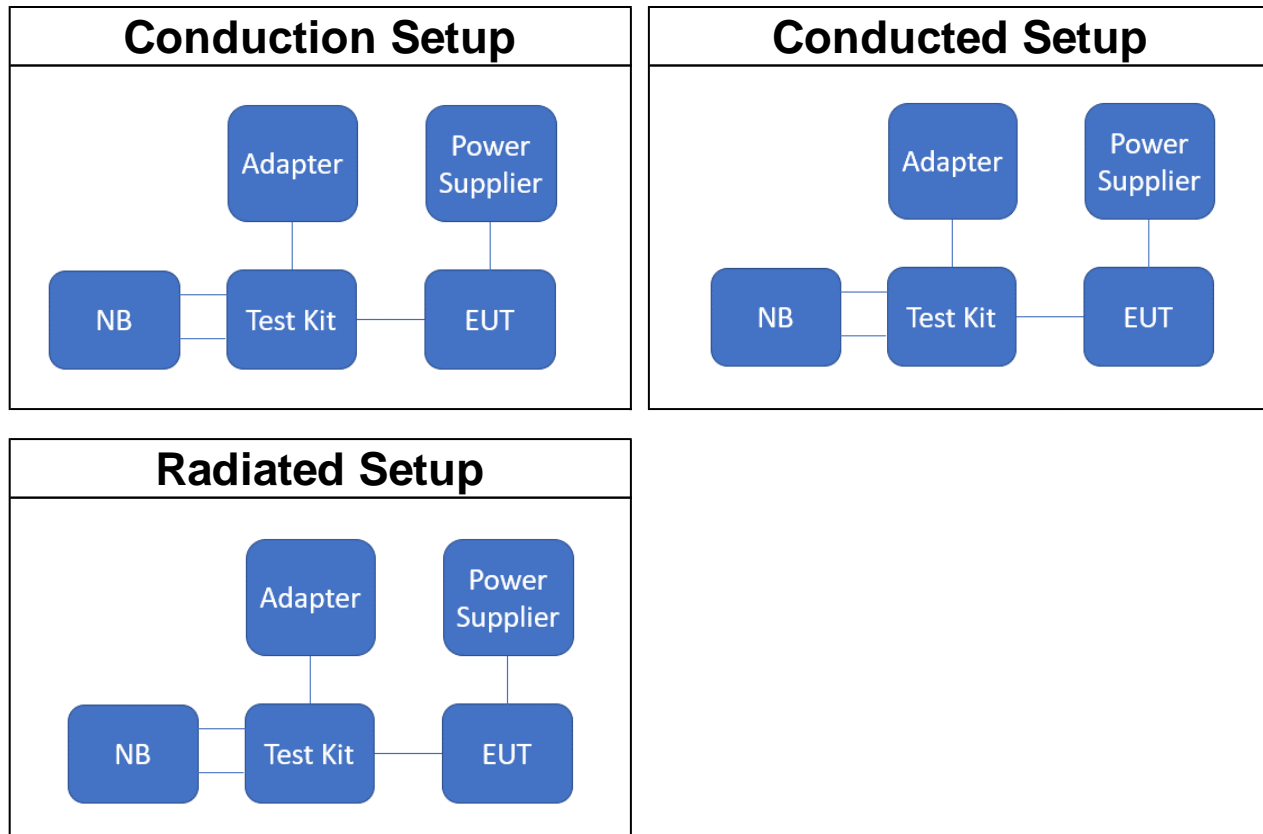
Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

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.

2.5 Test Configuration



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2.6 Control Unit(s)

| AC Power-Line Conducted Emission Test Site: Conduction C | | | | | |
|--|----------------------|----------------|---------------|-----------|----------|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| LAN Cable | TATUNG | IMG_5283 | N/A | N/A | N/A |
| USB cable | ZHUANG SHAN | 2725 | N/A | N/A | N/A |
| USB cable | ANKER | N/A | N/A | N/A | N/A |
| Adapter | ANKER | A2664 | N/A | 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. | CAL DUE. |
| Adapter | ANKER | A2664 | N/A | N/A | N/A |
| LAN Cable | TATUNG | IMG_5283 | N/A | N/A | N/A |
| USB cable | ANKER | A8852011 | N/A | N/A | N/A |
| USB cable | ZHUANG SHAN CHUAN | 2725 | N/A | N/A | N/A |
| Notebook | Lenovo | T14 | P0003332 | N/A | N/A |
| Radiated Emission Test Site: SAC C | | | | | |
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| LAN Cable | ELECOM | GM-LDGPAT/BK30 | N/A | N/A | N/A |
| USB cable | ZHUANG SHAN CHUAN | 2725 | N/A | N/A | N/A |
| USB cable | ANKER | A8852011 | N/A | N/A | N/A |
| Adapter | ANKER | A2664 | N/A | N/A | N/A |
| Notebook | Lenovo | T14 | P0003332 | 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) (3) | RSS-247 §5.4 d | Peak Output Power | Compliant |
| §15.247(a)(2) | RSS-247 §5.2 a RSS-Gen §6.7 | Emission Bandwidth | Compliant |
| §15.247(d) §15.209 | RSS-247 §5.5 RSS-Gen §8.9 | Conducted Band Edge and Spurious Emission | Compliant |
| §15.247(d) §15.209 | RSS-247 §5.5 RSS-Gen §8.9 | Radiated Band Edge and Spurious Emission | Compliant |
| §15.205 | RSS-Gen § 8.10 | Restricted Bands | Compliant |
| §15.247(e) | RSS-247 §5.2 b | Peak Power Density | Compliant |
| §15.203 | N/A | Antenna Requirement | Compliant |

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4 DESCRIPTION OF TEST MODES

4.1 Operating Frequencies

| 2400~2483.5 MHz | | | | | | | |
|-----------------|----------------|----|----------------|----|----------------|----|----------------|
| CH | Freq. (MHz) | CH | Freq. (MHz) | CH | Freq. (MHz) | CH | Freq. (MHz) |
| 0 | 2402 | 10 | 2422 | 20 | 2442 | 30 | 2462 |
| 1 | 2404 | 11 | 2424 | 21 | 2444 | 31 | 2464 |
| 2 | 2406 | 12 | 2426 | 22 | 2446 | 32 | 2466 |
| 3 | 2408 | 13 | 2428 | 23 | 2448 | 33 | 2468 |
| 4 | 2410 | 14 | 2430 | 24 | 2450 | 34 | 2470 |
| 5 | 2412 | 15 | 2432 | 25 | 2452 | 35 | 2472 |
| 6 | 2414 | 16 | 2434 | 26 | 2454 | 36 | 2474 |
| 7 | 2416 | 17 | 2436 | 27 | 2456 | 37 | 2476 |
| 8 | 2418 | 18 | 2438 | 28 | 2458 | 38 | 2478 |
| 9 | 2420 | 19 | 2440 | 29 | 2460 | 39 | 2480 |

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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. The field strength of radiation emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.
4. Investigation has been done on all the possible configurations for searching the worst case.

| CONDUCTED TEST | | | | |
|----------------|-------------------|----------------|------------|------------------|
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
| Bluetooth LE | 0 to 39 | 0,20,39 | GFSK | 1 |
| Bluetooth LE | 0 to 39 | 0,20,39 | GFSK | 2 |
| Bluetooth LE | 0 to 39 | 0,20,39 | GFSK | 0.125 |
| Bluetooth LE | 0 to 39 | 0,20,39 | GFSK | 0.5 |

| TRANSMIT RADIATED EMISSION TEST (BELOW 1 GHz) | | | | |
|---|-------------------|----------------|------------|------------------|
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
| Bluetooth LE | 0 to 39 | 20 | GFSK | 1 |
| TRANSMIT RADIATED EMISSION TEST (ABOVE 1 GHz) | | | | |
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
| Bluetooth LE | 0 to 39 | 0,20,39 | GFSK | 1 |
| Bluetooth LE | 0 to 39 | 0,20,39 | GFSK | 2 |
| Bluetooth LE | 0 to 39 | 0,20,39 | GFSK | 0.125 |
| Bluetooth LE | 0 to 39 | 0,20,39 | GFSK | 0.5 |

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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 |
| Peak Power Density | +/- 0.61 dB |
| 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. | CAL DUE. |
| 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. | CAL DUE. |
| 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 | PASTERNAK | PE8210 | RF155 | 11/15/2023 | 11/14/2024 |
| DC Power Supply | HOLA | DP-3003 | D7070035 | 06/14/2024 | 06/13/2025 |
| 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 C | | | | | |
|------------------------------------|-----------------|--------------------|-----------------------------|------------|------------|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| 3m Site NSA | SGS | 966 chamber C | N/A | 03/02/2024 | 03/01/2025 |
| Active Loop Antenna | COM-POWER | AL-130R | 10160105 | 12/04/2023 | 12/03/2024 |
| Attenuator | Woken | WATT-218FS-10 | RF17 | 11/15/2023 | 11/14/2024 |
| Band Rejection Filter | Micro Tronics | BRM50701-01 | RF201 | 11/15/2023 | 11/14/2024 |
| Broadband Antenna | SCHWARZBECK | VULB 9168 | 9168-300 | 11/02/2023 | 11/01/2024 |
| Coaxial Cable | Huber+Suhner | EMC106-SM-SM-9100 | 150704 | 11/15/2023 | 11/14/2024 |
| Coaxial Cable | Huber+Suhner | RG 214/U | W22.03 | 11/15/2023 | 11/14/2024 |
| Coaxial Cable | Huber+Suhner | SUCOFLEX 104 | MY17388/4 | 11/15/2023 | 11/14/2024 |
| DC Power Supply | HOLA | DP-3003 | D7070035 | 06/14/2024 | 06/13/2025 |
| EMI Test Receiver | R&S | ESU 40 | 100363 | 04/30/2024 | 04/29/2025 |
| High Pass Filter | Titan Microwave | T04H86002600060S01 | 210619-2-8 | 11/15/2023 | 11/14/2024 |
| Horn Antenna | Schwarzbeck | BBHA9120D | 1187 | 01/24/2024 | 01/23/2025 |
| Horn Antenna | Schwarzbeck | BBHA9170 | 185 | 08/15/2024 | 08/14/2025 |
| Lowpass Filter | Woken | EWI-56-0019 | RF173 | 11/15/2023 | 11/14/2024 |
| Pre-Amplifier | EMC Instruments | EMC118A45SE | 980789 | 11/15/2023 | 11/14/2024 |
| Pre-Amplifier | EMC Instruments | EMC184045SEE | 980881 | 11/15/2023 | 11/14/2024 |
| Pre-Amplifier | EMC Instruments | EMC330 | 980096 | 11/15/2023 | 11/14/2024 |
| 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 range within 150kHz to 30MHz shall not exceed the Limit table as below.

| Frequency range MHz | Limits (dB μ V) | |
|------------------------|------------------------|----------|
| | 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 |

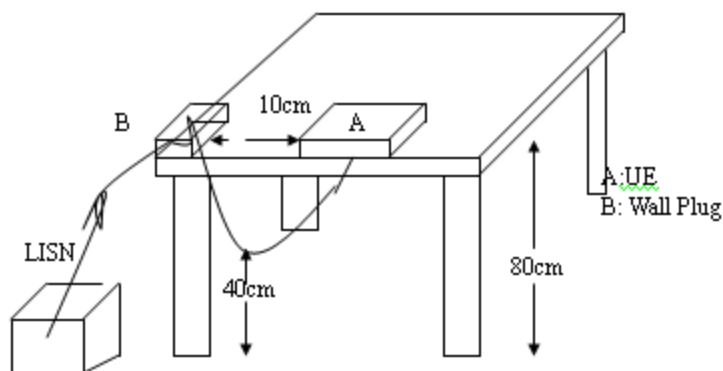
Note

- 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.

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 120-240Vac/60Hz power source.

7.3 Test Setup



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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 phases of power being supplied by given UE are completed

7.5 Measurement Result:

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

Note2: The test data reveals the worst-case results that closest to the limit.

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :TERF2410002915E2

Test Site :Conduction C

Test Mode :BLE

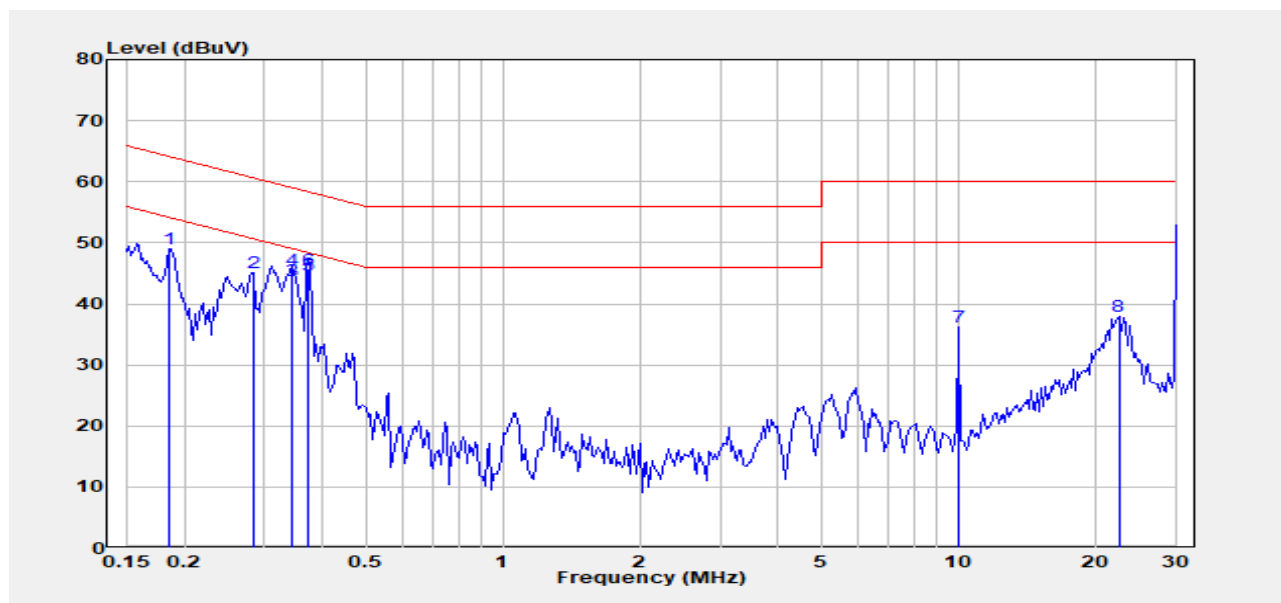
Test Date :2024-10-18

Power :120V/60Hz

Temp./Humi :23.4°C/60%

Probe :L1

Engineer :Howard Huang



| Freq. | Detector | Spectrum | Factor | Actual | Limit | Margin |
|--------|----------|---------------|--------|--------|-------|--------|
| MHz | Mode | Reading Level | | FS | | |
| | PK/QP/AV | dBμV | dB | dBμV | dBμV | dB |
| 0.185 | Peak | 38.43 | 10.65 | 49.08 | 64.24 | -15.16 |
| 0.283 | Peak | 34.51 | 10.64 | 45.14 | 60.72 | -15.58 |
| 0.343 | Average | 33.20 | 10.63 | 43.83 | 49.13 | -5.31 |
| 0.343 | QP | 35.00 | 10.63 | 45.63 | 59.13 | -13.51 |
| 0.373 | Average | 34.10 | 10.62 | 44.72 | 48.43 | -3.71 |
| 0.373 | QP | 34.90 | 10.62 | 45.52 | 58.43 | -12.91 |
| 10.072 | Peak | 25.30 | 10.96 | 36.26 | 60.00 | -23.74 |
| 22.535 | Peak | 26.76 | 11.22 | 37.98 | 60.00 | -22.02 |

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Report Number :TERF2410002915E2

Test Mode :BLE

Power :120V/60Hz

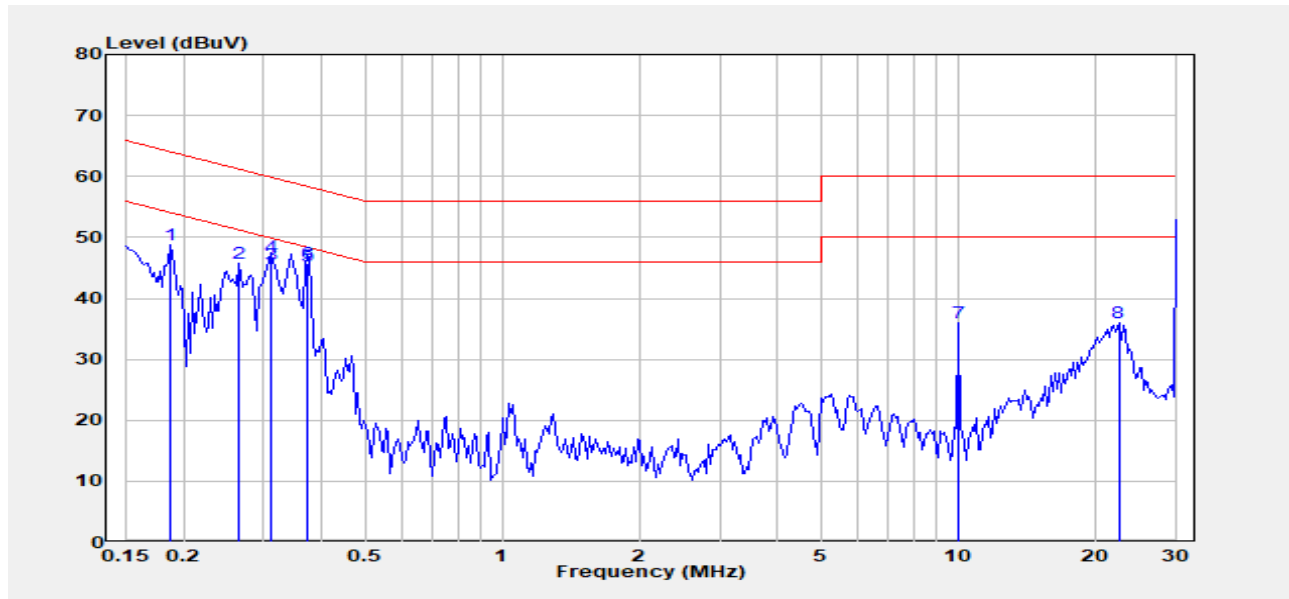
Probe :N

Test Site :Conduction C

Test Date :2024-10-18

Temp./Humi :23.4℃/60%

Engineer :Howard Huang



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV | Limit dBμV | Margin dB |
|--------------|------------------------------|-----------------------------------|--------------|----------------------|---------------|--------------|
| 0.187 | Peak | 38.16 | 10.65 | 48.82 | 64.15 | -15.34 |
| 0.263 | Peak | 35.00 | 10.64 | 45.64 | 61.34 | -15.70 |
| 0.312 | Average | 34.80 | 10.63 | 45.43 | 49.93 | -4.50 |
| 0.312 | QP | 36.10 | 10.63 | 46.73 | 59.93 | -13.20 |
| 0.373 | Average | 34.70 | 10.62 | 45.32 | 48.43 | -3.11 |
| 0.373 | QP | 35.20 | 10.62 | 45.82 | 58.43 | -12.61 |
| 10.072 | Peak | 25.01 | 10.95 | 35.96 | 60.00 | -24.04 |
| 22.535 | Peak | 24.65 | 11.23 | 35.88 | 60.00 | -24.12 |

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8 PEAK OUTPUT POWER MEASUREMENT

8.1 Standard Applicable:

8.1.1 Duty Cycle

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

8.1.2 FCC

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

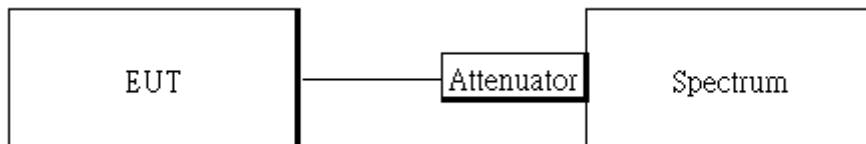
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

8.1.3 ISED

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt and the e.i.r.p. shall not exceed 4 W.

8.2 Test Setup

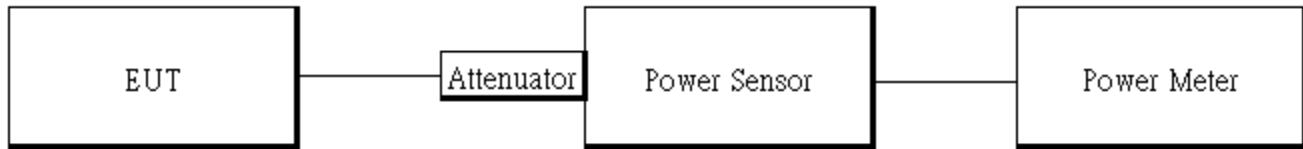
8.2.1 Duty Cycle



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8.2.2 Output Power



8.3 Measurement Procedure:

8.3.1 Duty Cycle

1. Place the EUT on the table and set it in transmitting mode.
2. Set span = Zero
3. RBW = 8MHz, VBW = 8MHz,
4. Detector = Peak

8.3.2 Output Power

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
4. Record the max. Reading as observed from Power Meter.
5. Repeat above procedures until all test default channel measured was complete.

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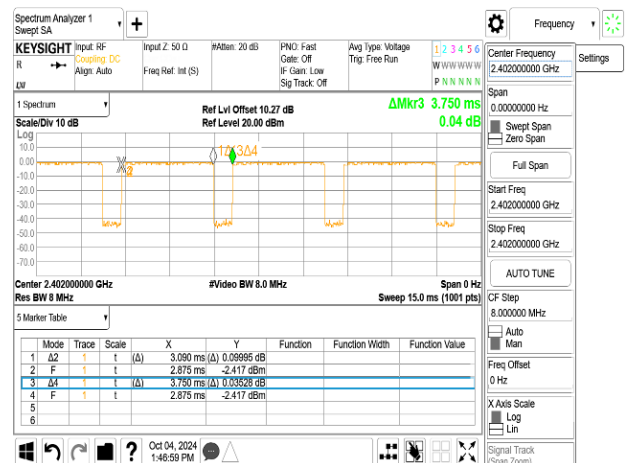
8.4 Duty Factor:

| | Duty Cycle (%) = Ton / (Ton+Toff) | Duty Factor (dB) =10*log (1/Duty Cycle) | 1/T (kHz) | VBW setting (kHz) |
|----------|--------------------------------------|---|-----------|----------------------|
| BLE 1M | 62.40 | 2.05 | 2.56 | 3.00 |
| BLE 2M | 33.60 | 4.74 | 4.76 | 5.00 |
| BLE 125k | 82.40 | 0.84 | 0.32 | 1.00 |
| BLE 500k | 42.78 | 3.69 | 0.94 | 1.00 |

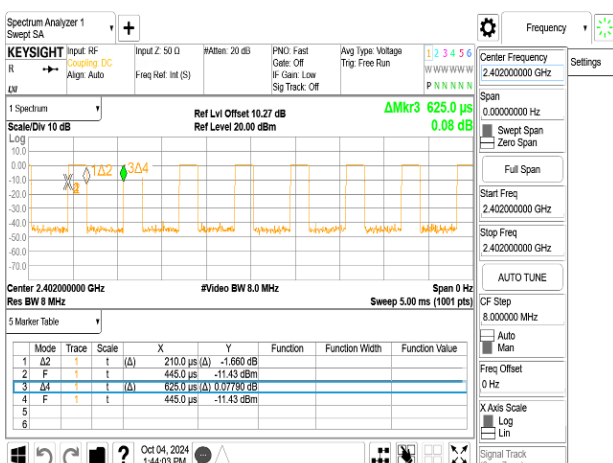
BLE_1M_LowCH00-2402



BLE_125k_LowCH00-2402



BLE_2M_LowCH00-2402



BLE_500k_LowCH00-2402



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8.5 Output Power:

8.5.1 Peak & Avg

BLE 1M mode:

| CH | Frequency (MHz) | Power Setting | Peak Output Power (dBm) | Required Limit (dBm) |
|----|-----------------|---------------|-------------------------|----------------------|
| 0 | 2402 | 13 | 12.99 | 30 |
| 20 | 2442 | 13 | 12.93 | 30 |
| 39 | 2480 | 13 | 12.98 | 30 |
| CH | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Required Limit (dBm) |
| 0 | 2402 | 13 | 12.96 | 30 |
| 20 | 2442 | 13 | 12.90 | 30 |
| 39 | 2480 | 13 | 12.94 | 30 |

***Note:**

1. Measured by power meter, cable loss 10.27 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

BLE 2M mode:

| CH | Frequency (MHz) | Power Setting | Peak Output Power (dBm) | Required Limit (dBm) |
|----|-----------------|---------------|-------------------------|----------------------|
| 0 | 2402 | 13 | 12.98 | 30 |
| 20 | 2442 | 13 | 12.91 | 30 |
| 39 | 2480 | 13 | 12.85 | 30 |
| CH | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Required Limit (dBm) |
| 0 | 2402 | 13 | 12.84 | 30 |
| 20 | 2442 | 13 | 12.79 | 30 |
| 39 | 2480 | 13 | 12.75 | 30 |

***Note:**

1. Measured by power meter, cable loss 10.27 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

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BLE 125k mode(Payload S=8):

| CH | Frequency (MHz) | Power Setting | Peak Output Power (dBm) | Required Limit (dBm) |
|----|-----------------|---------------|-------------------------|----------------------|
| 0 | 2402 | 13 | 13.15 | 30 |
| 20 | 2442 | 13 | 13.11 | 30 |
| 39 | 2480 | 13 | 13.02 | 30 |
| CH | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Required Limit (dBm) |
| 0 | 2402 | 13 | 12.89 | 30 |
| 20 | 2442 | 13 | 12.98 | 30 |
| 39 | 2480 | 13 | 12.82 | 30 |

***Note:**

1.Measured by power meter, cable loss 10.27 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

BLE 500k mode(Payload S=2):

| CH | Frequency (MHz) | Power Setting | Peak Output Power (dBm) | Required Limit (dBm) |
|----|-----------------|---------------|-------------------------|----------------------|
| 0 | 2402 | 10 | 13.25 | 30 |
| 20 | 2442 | 10 | 13.18 | 30 |
| 39 | 2480 | 10 | 13.09 | 30 |
| CH | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Required Limit (dBm) |
| 0 | 2402 | 10 | 13.00 | 30 |
| 20 | 2442 | 10 | 12.93 | 30 |
| 39 | 2480 | 10 | 12.83 | 30 |

***Note:**

1.Measured by power meter, cable loss 10.27 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

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8.5.2 EIRP

EIRP BLE 1M mode

| CH | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit |
|----|-----------------|---------------|-------------------------|--------------------|------------|------------|
| 0 | 2402 | 13 | 12.96 | 3.73 | 16.69 | 4W= 36 dBm |
| 20 | 2442 | 13 | 12.90 | 3.73 | 16.63 | 4W= 36 dBm |
| 39 | 2480 | 13 | 12.94 | 3.73 | 16.67 | 4W= 36 dBm |

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

EIRP BLE 2M mode

| CH | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit |
|----|-----------------|---------------|-------------------------|--------------------|------------|------------|
| 0 | 2402 | 13 | 12.84 | 3.73 | 16.57 | 4W= 36 dBm |
| 20 | 2442 | 13 | 12.79 | 3.73 | 16.52 | 4W= 36 dBm |
| 39 | 2480 | 13 | 12.75 | 3.73 | 16.48 | 4W= 36 dBm |

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

EIRP BLE 125k mode(Payload S=8)

| CH | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit |
|----|-----------------|---------------|-------------------------|--------------------|------------|------------|
| 0 | 2402 | 13 | 12.89 | 3.73 | 16.62 | 4W= 36 dBm |
| 20 | 2442 | 13 | 12.98 | 3.73 | 16.71 | 4W= 36 dBm |
| 39 | 2480 | 13 | 12.82 | 3.73 | 16.55 | 4W= 36 dBm |

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

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EIRP BLE 500k mode(Payload S=2)

| CH | Frequency (MHz) | Power Setting | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit |
|----|-----------------|---------------|-------------------------|--------------------|------------|------------|
| 0 | 2402 | 10 | 13.00 | 3.73 | 16.73 | 4W= 36 dBm |
| 20 | 2442 | 10 | 12.93 | 3.73 | 16.66 | 4W= 36 dBm |
| 39 | 2480 | 10 | 12.83 | 3.73 | 16.56 | 4W= 36 dBm |

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

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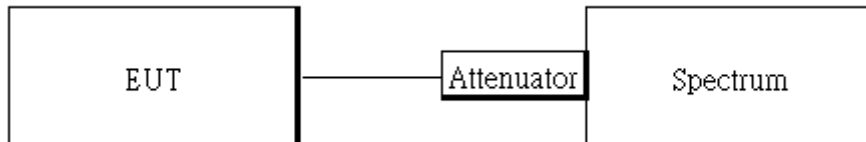
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9 EMISSION BANDWIDTH MEASUREMENT

9.1 Standard Applicable

The minimum 6 dB bandwidth shall be at least 500 kHz .

9.2 Test Setup



9.3 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

9.3.1 6dB BW measurements

1. The testing follows the Measurement Procedure of the KDB 558074 D01.
2. Set the spectrum analyzer as
RBW= 100 kHz ,
VBW = 3 X RBW,
Span= 2 to 5 times of the OBW,
Sweep=auto, Detector = Peak, and Max hold.
3. Mark the upper and lower frequencies of -6dB.
4. Repeat above procedures until all test default channel is completed.

9.3.2 99% BW measurements

1. The testing follows the Measurement Procedure of the RSS-Gen section 6.7.
2. Set the spectrum analyzer as
RBW= 1 % to 5% of 99%,
VBW \geq 3 X RBW,
Span= large enough to capture all products of the modulation process
Sweep=auto, Detector = Peak, and Max hold.
3. Mark the upper and lower frequencies of 99%.
4. Repeat above procedures until all test default channel is completed.

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9.4 Measurement Result:

9.4.1 6dB BW measurements

BLE 1M mode

| Frequency (MHz) | 6dB BW (MHz) | Required BW (MHz) | Result |
|-----------------|--------------|-------------------|--------|
| 2402 | 0.7208 | ≥ 0.5 | PASS |
| 2442 | 0.7252 | ≥ 0.5 | PASS |
| 2480 | 0.7229 | ≥ 0.5 | PASS |

BLE 2M mode

| Frequency (MHz) | 6dB BW (MHz) | Required BW (MHz) | Result |
|-----------------|--------------|-------------------|--------|
| 2402 | 1.171 | ≥ 0.5 | PASS |
| 2442 | 1.17 | ≥ 0.5 | PASS |
| 2480 | 1.173 | ≥ 0.5 | PASS |

BLE 125k mode(Payload S=8)

| Frequency (MHz) | 6dB BW (MHz) | Required BW (MHz) | Result |
|-----------------|--------------|-------------------|--------|
| 2402 | 0.6682 | ≥ 0.5 | PASS |
| 2442 | 0.6672 | ≥ 0.5 | PASS |
| 2480 | 0.6669 | ≥ 0.5 | PASS |

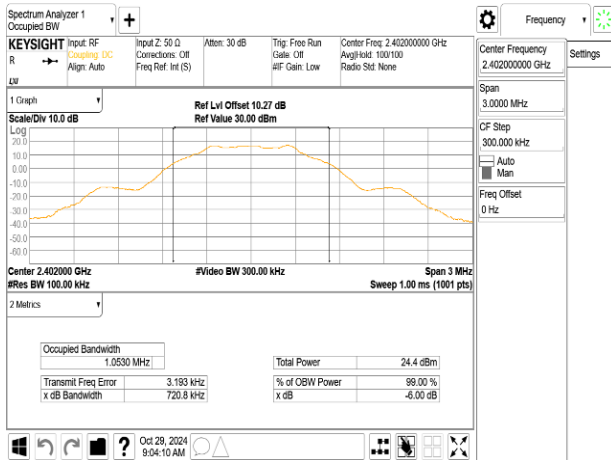
BLE 500k mode(Payload S=2)

| Frequency (MHz) | 6dB BW (MHz) | Required BW (MHz) | Result |
|-----------------|--------------|-------------------|--------|
| 2402 | 0.671 | ≥ 0.5 | PASS |
| 2442 | 0.6738 | ≥ 0.5 | PASS |
| 2480 | 0.6746 | ≥ 0.5 | PASS |

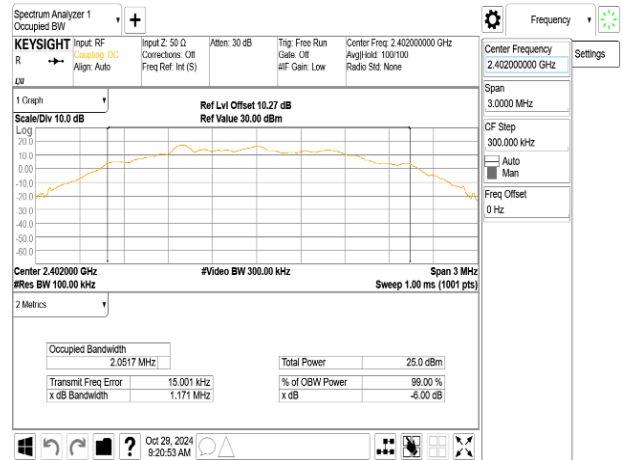
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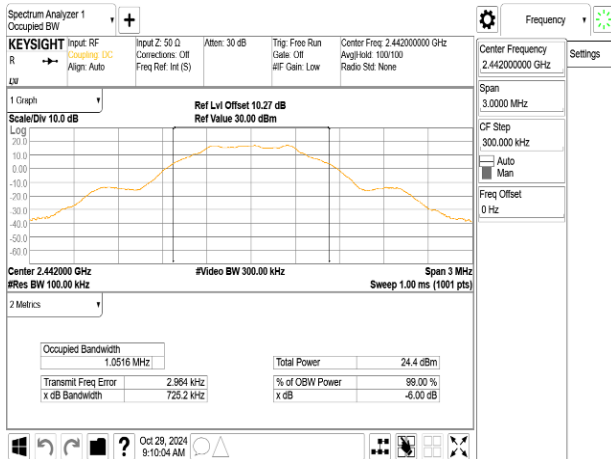
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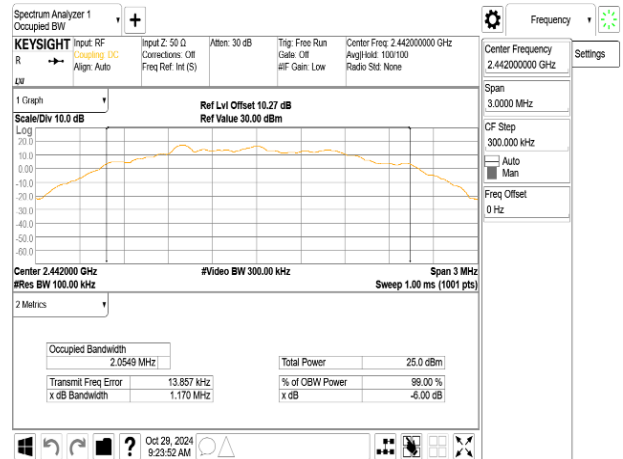
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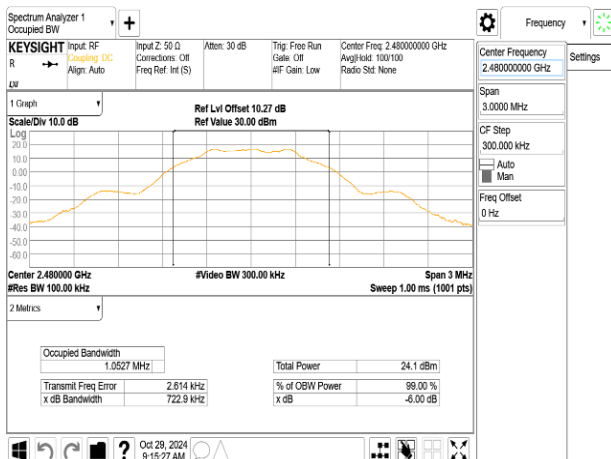
OBW_BLE 1M_MidCH20-2442MHz



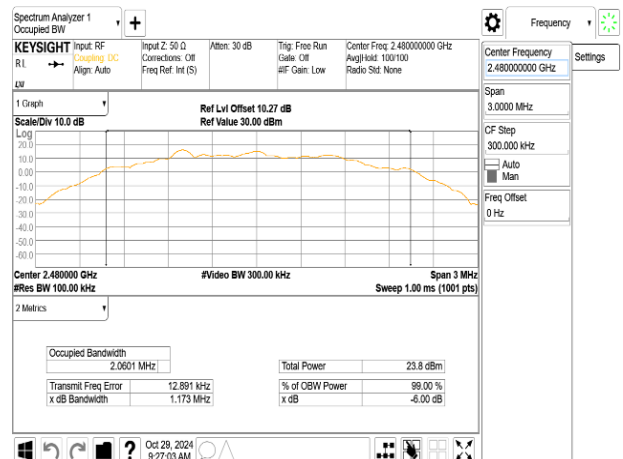
OBW_BLE 2M_MidCH20-2442MHz



OBW_BLE 1M_HighCH39-2480MHz



OBW_BLE 2M_HighCH39-2480MHz

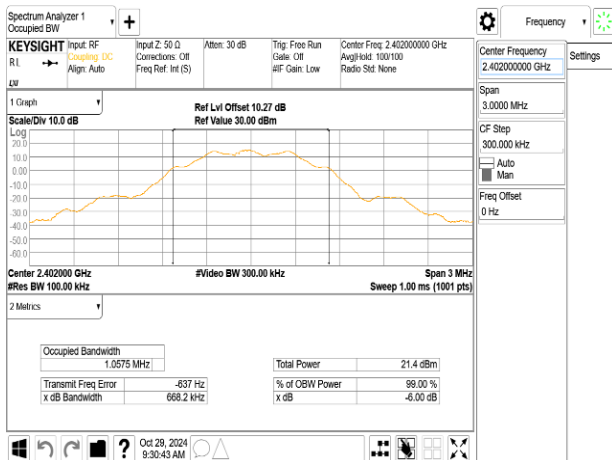


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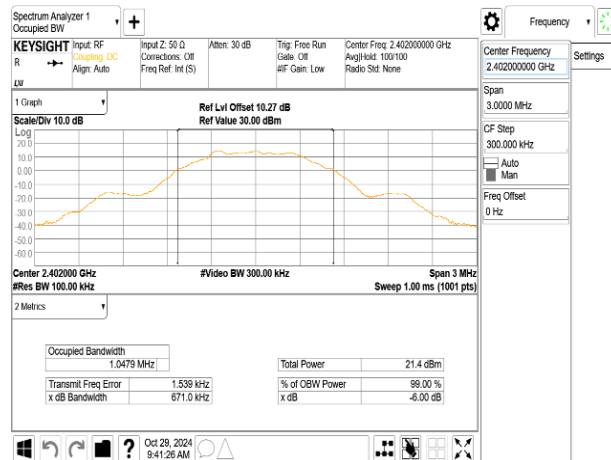
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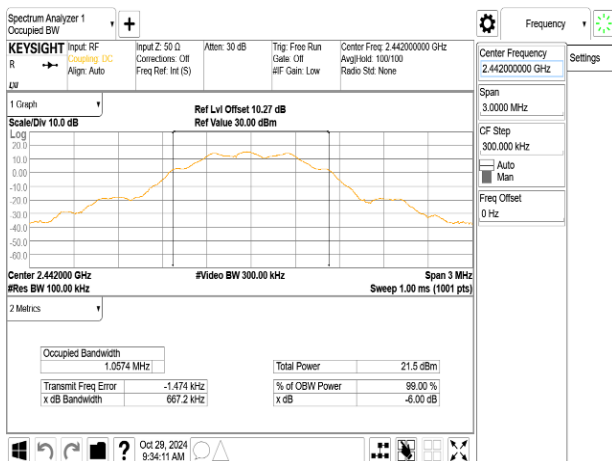
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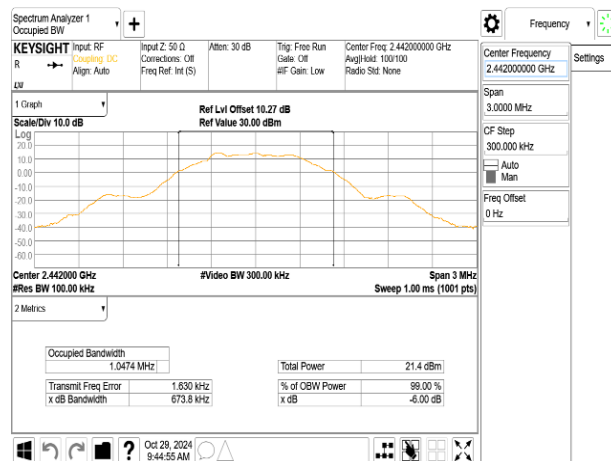
OBW_BLE 500k_LowCH00-2402MHz



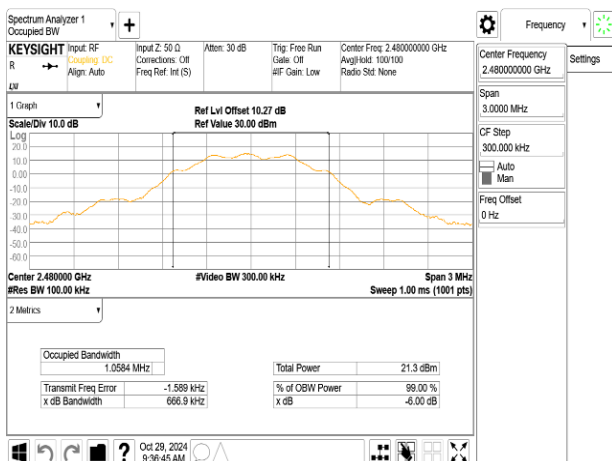
OBW_BLE 125k_MidCH20-2442MHz



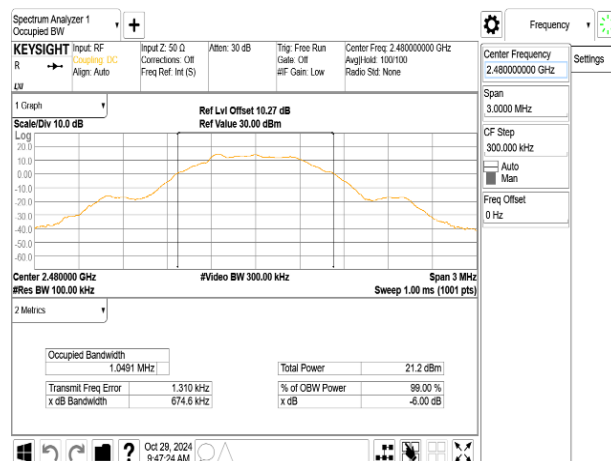
OBW_BLE 500k_MidCH20-2442MHz



OBW_BLE 125k_HighCH39-2480MHz



OBW_BLE 500k_HighCH39-2480MHz



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9.4.2 99% Bandwidth

BLE 1M mode

| Frequency (MHz) | 99%Bandwidth (MHz) |
|-----------------|--------------------|
| 2402 | 1.0333 |
| 2442 | 1.032 |
| 2480 | 1.0339 |

BLE 2M mode

| Frequency (MHz) | 99%Bandwidth (MHz) |
|-----------------|--------------------|
| 2402 | 2.0527 |
| 2442 | 2.0561 |
| 2480 | 2.0595 |

BLE 125k mode(Payload S=8)

| Frequency (MHz) | 99%Bandwidth (MHz) |
|-----------------|--------------------|
| 2402 | 1.0563 |
| 2442 | 1.0562 |
| 2480 | 1.0581 |

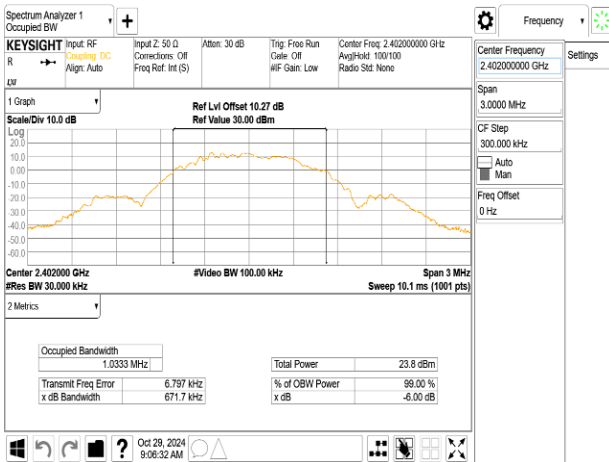
BLE 500k mode(Payload S=2)

| Frequency (MHz) | 99%Bandwidth (MHz) |
|-----------------|--------------------|
| 2402 | 1.0213 |
| 2442 | 1.0216 |
| 2480 | 1.0221 |

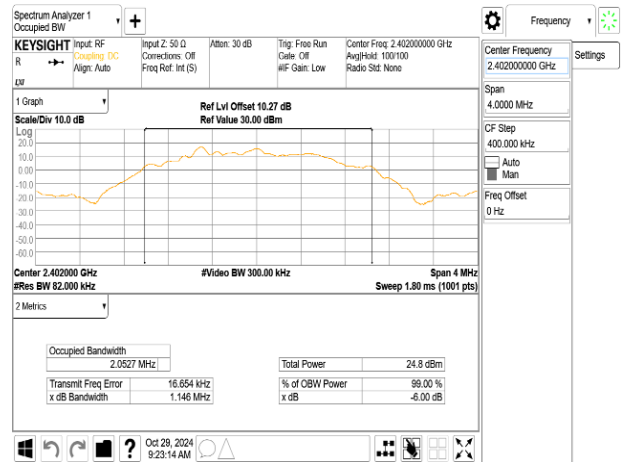
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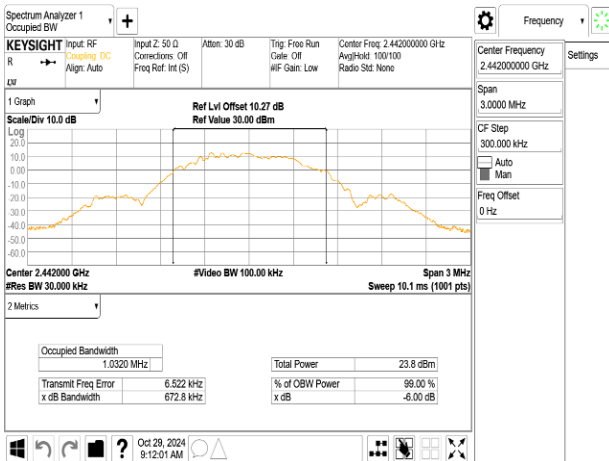
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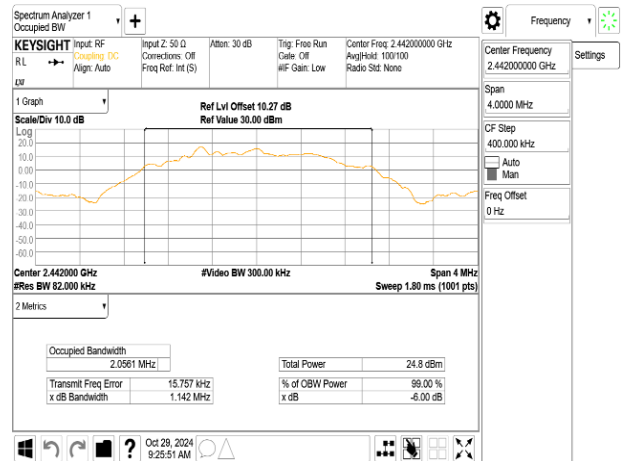
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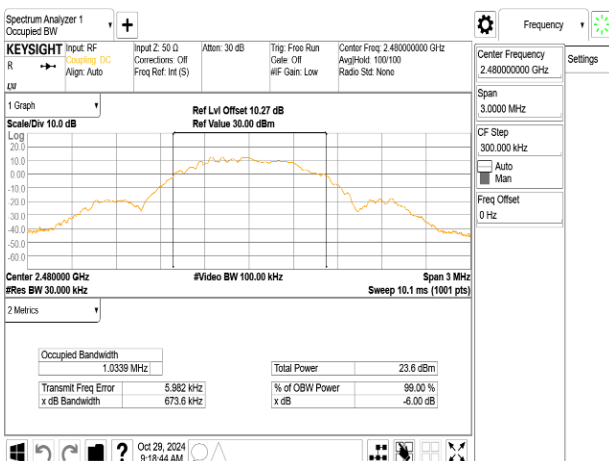
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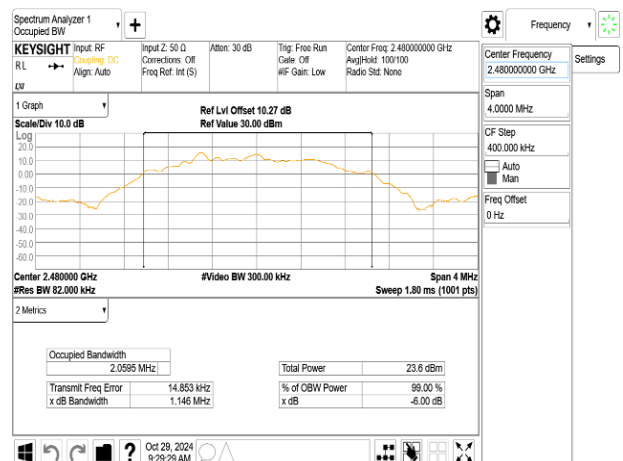
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IC OBW_BLE 1M_HighCH39-2480MHz



IC OBW_BLE 2M_HighCH39-2480MHz

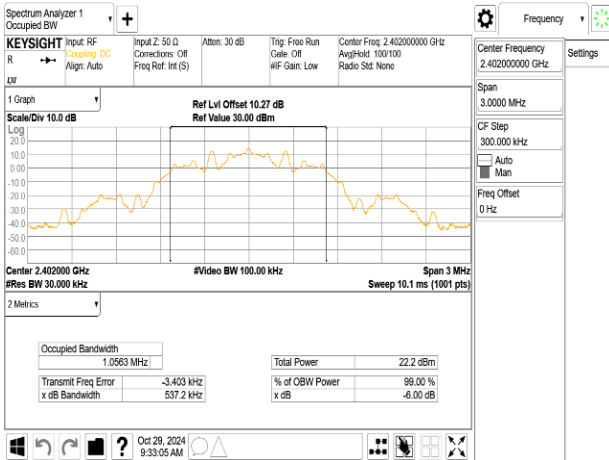


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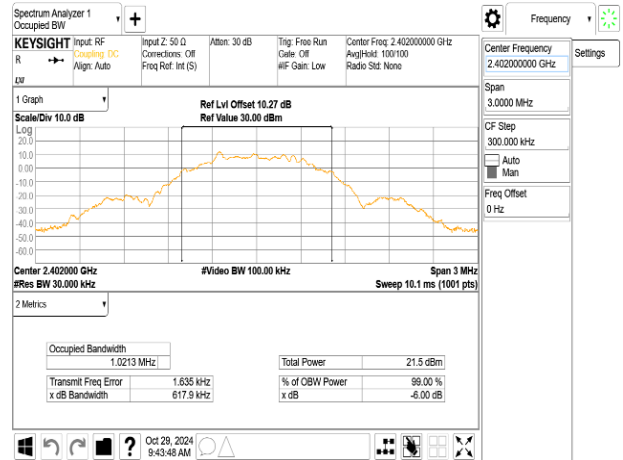
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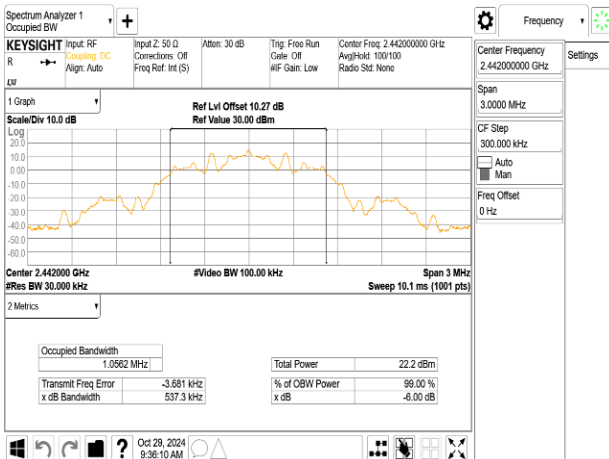
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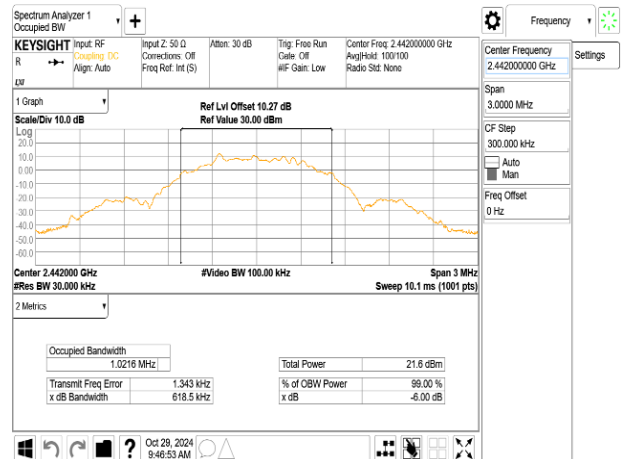
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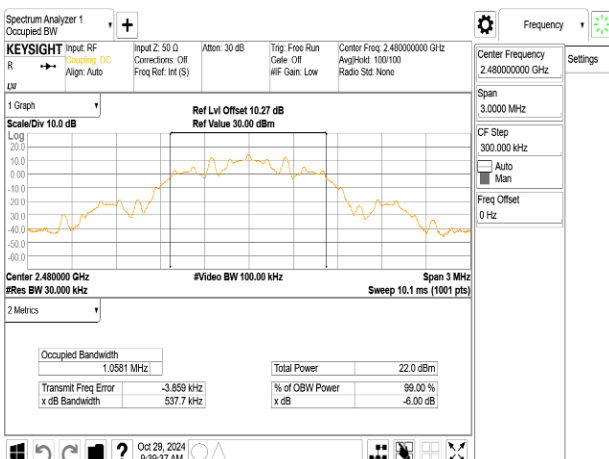
IC OBW_BLE 125k_MidCH20-2442MHz



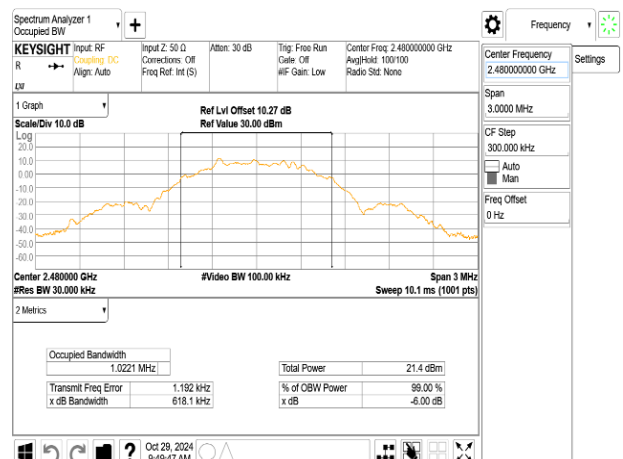
IC OBW_BLE 500k_MidCH20-2442MHz



IC OBW_BLE 125k_HighCH39-2480MHz



IC OBW_BLE 500k_HighCH39-2480MHz



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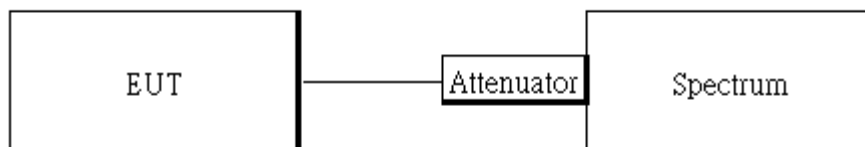
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10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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, 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.

10.2 Test Setup



10.3 Measurement Procedure

10.3.1 Reference Level of Emission Limit:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

10.3.2 Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

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4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Set DL as the limit = reading on marker of reference level measurement – 20dBm
7. Mark the highest readings of the emissions outside of 2400MHz~2483.5MHz.
8. Repeat above procedures until all default test channel (low and high) was complete.

10.3.3 Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
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.

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10.4 Measurement Result

BLE 1M_Reference Level of Limit

| Frequency (MHz) | RF Power Density (dBm) | Reference Level of Limit = PSD - 20dB (dBm) |
|-----------------|------------------------|---|
| 2402 | 17.05 | -2.95 |
| 2442 | 17.07 | -2.93 |
| 2480 | 16.82 | -3.18 |

***Note:**

- 1.cable loss as 10.27dB that offsets in the spectrum
- 2.Refer to next page for plots.

BLE 2M_Reference Level of Limit

| Frequency (MHz) | RF Power Density (dBm) | Reference Level of Limit = PSD - 20dB (dBm) |
|-----------------|------------------------|---|
| 2402 | 17.39 | -2.61 |
| 2442 | 17.40 | -2.60 |
| 2480 | 16.18 | -3.82 |

***Note:**

- 1.cable loss as 10.27dB that offsets in the spectrum
- 2.Refer to next page for plots.

BLE 125k(Payload S=8)_Reference Level of Limit

| Frequency (MHz) | RF Power Density (dBm) | Reference Level of Limit = PSD - 20dB (dBm) |
|-----------------|------------------------|---|
| 2402 | 15.34 | -4.66 |
| 2442 | 15.32 | -4.68 |
| 2480 | 15.09 | -4.91 |

***Note:**

- 1.cable loss as 10.27dB that offsets in the spectrum
- 2.Refer to next page for plots.

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BLE 500k(Payload S=2)_Reference Level of Limit

| Frequency (MHz) | RF Power Density (dBm) | Reference Level of Limit = PSD - 20dB (dBm) |
|--------------------|---------------------------|---|
| 2402 | 14.78 | -5.22 |
| 2442 | 14.78 | -5.22 |
| 2480 | 14.59 | -5.41 |

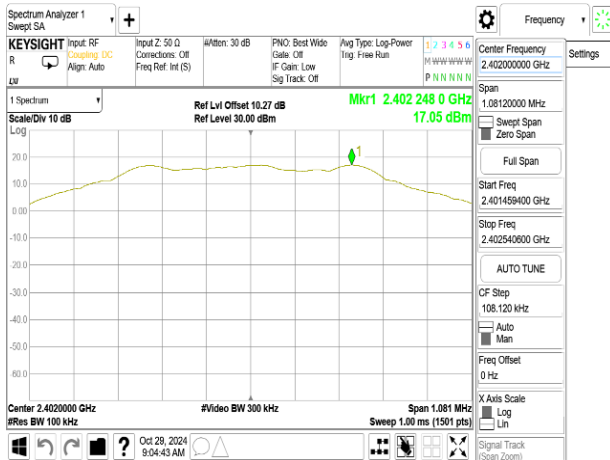
***Note:**

- 1.cable loss as 10.27dB that offsets in the spectrum
- 2.Refer to next page for plots.

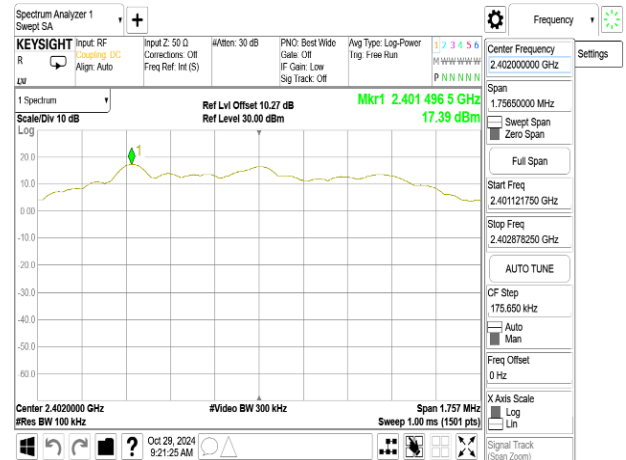
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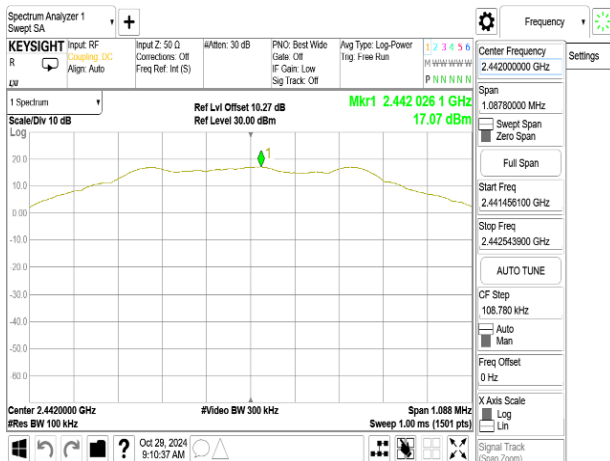
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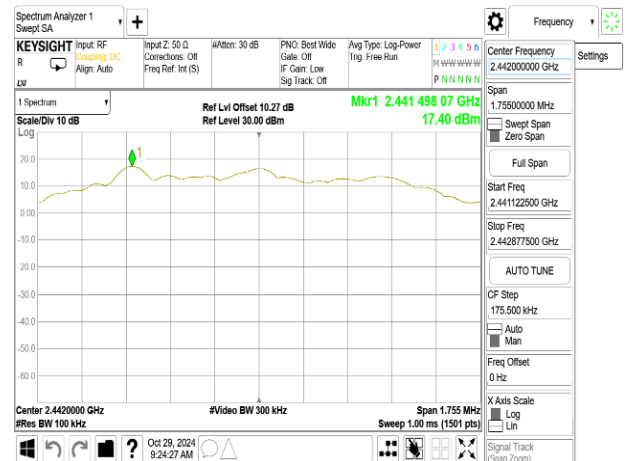
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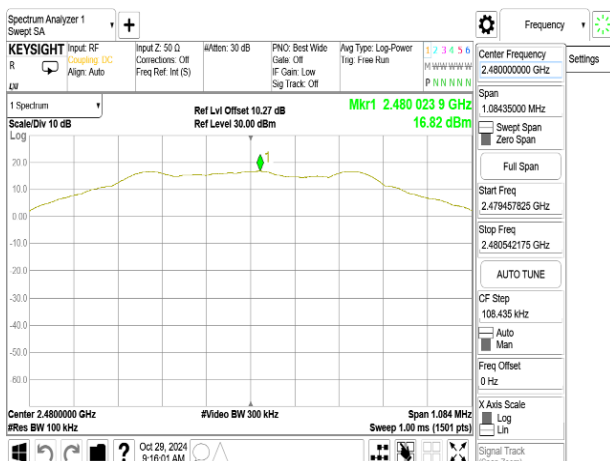
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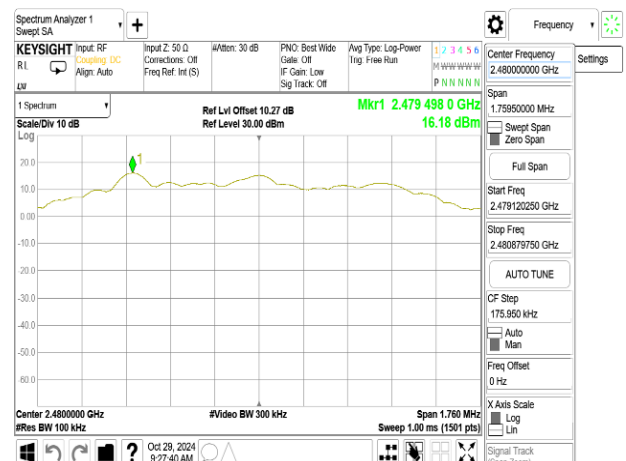
Reference Level_BLE 2M_MidCH20-2442MHz



Reference Level_BLE 1M_HighCH39-2480MHz



Reference Level_BLE 2M_HighCH39-2480MHz

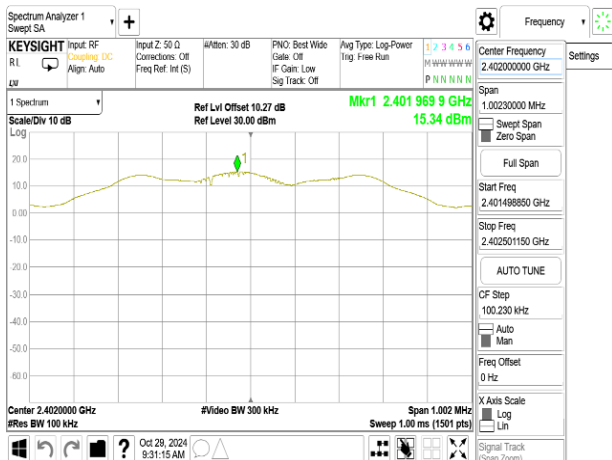


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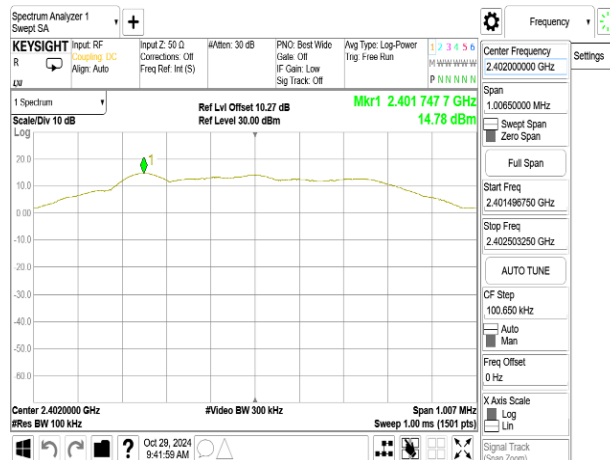
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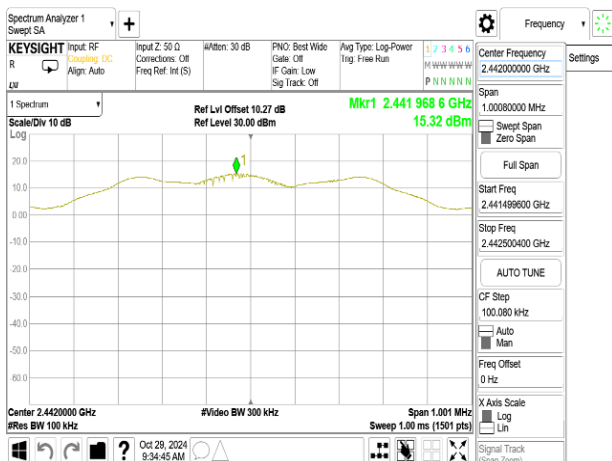
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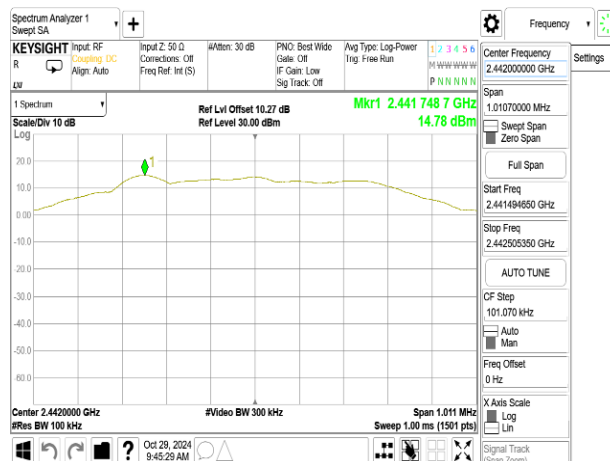
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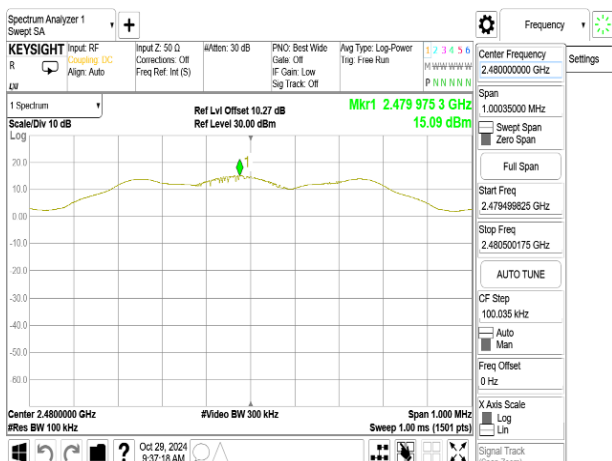
Reference Level_BLE 125k_MidCH20-2442MHz



Reference Level_BLE 500k_MidCH20-2442MHz



Reference Level_BLE 125k_HighCH39-2480MHz



Reference Level_BLE 500k_HighCH39-2480MHz



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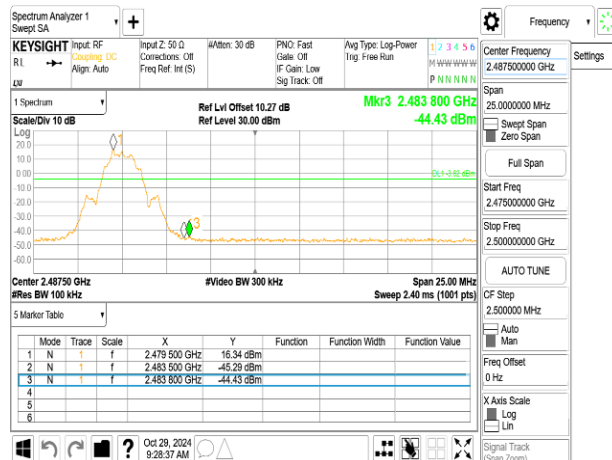
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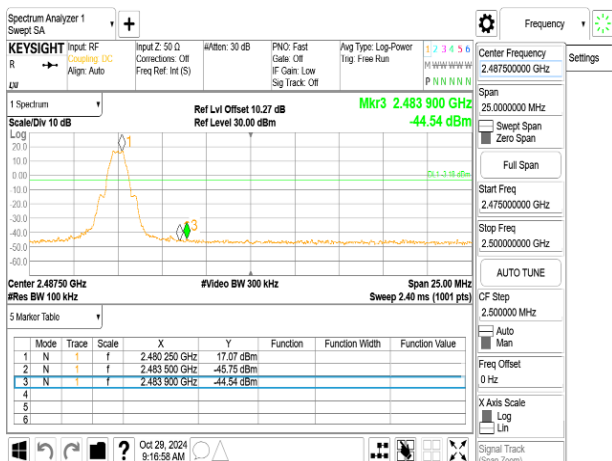
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Band Edge_BLE 2M_HighCH39-2480MHz



Band Edge_BLE 1M_HighCH39-2480MHz



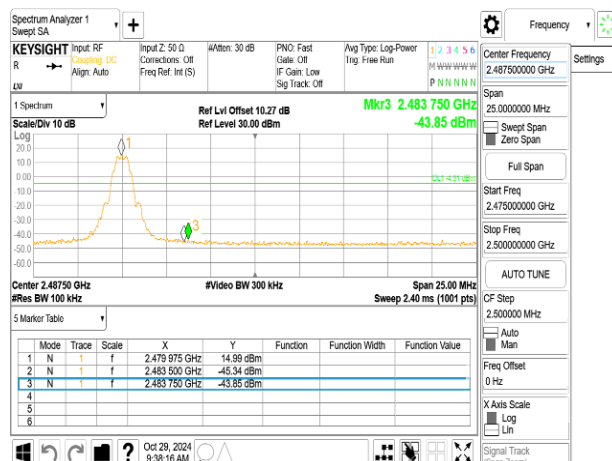
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Band Edge_BLE 2M_LowCH00-2402MHz



Band Edge_BLE 125k_HighCH39-2480MHz



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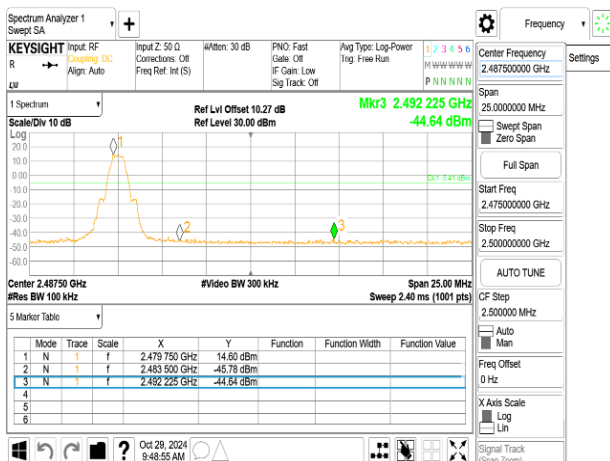
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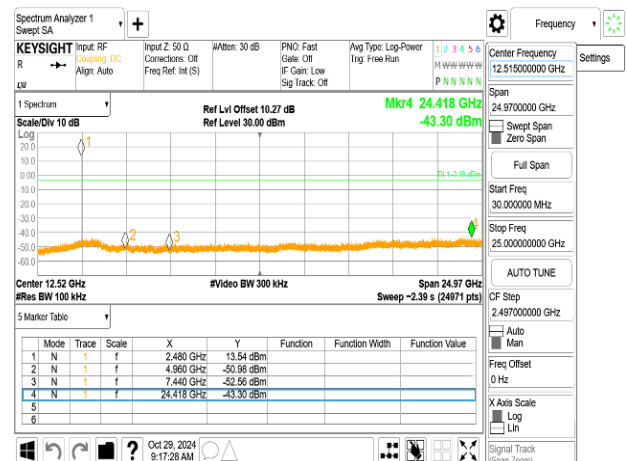
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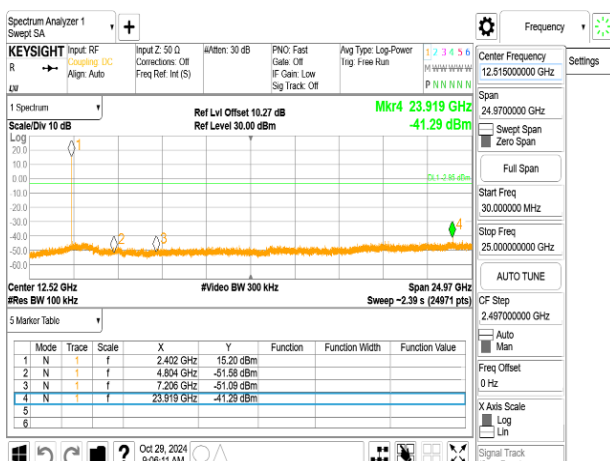
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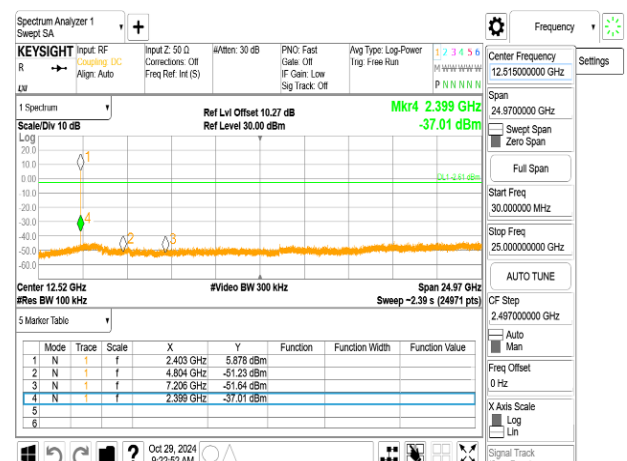
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Spurious Emission_BLE 1M_LowCH00-2402MHz



Spurious Emission_BLE 2M_LowCH00-2402MHz

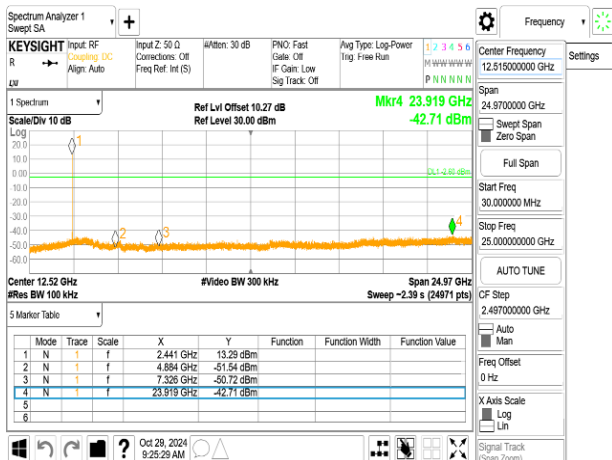


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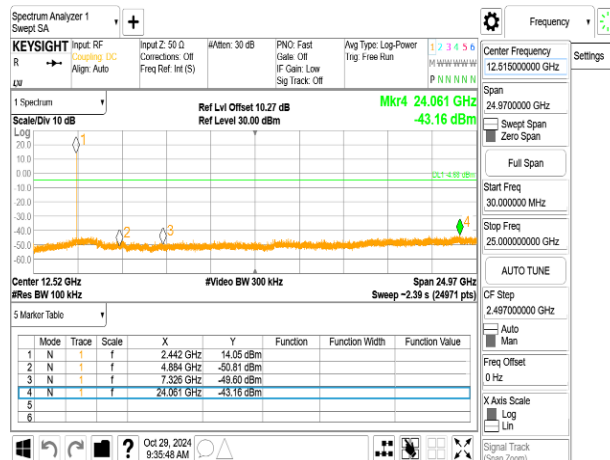
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Spurious Emission_BLE 2M_MidCH20-2442MHz



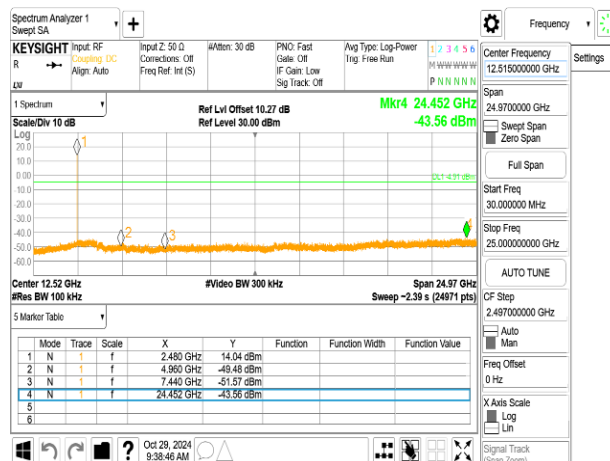
Spurious Emission_BLE 125k_MidCH20-2442MHz



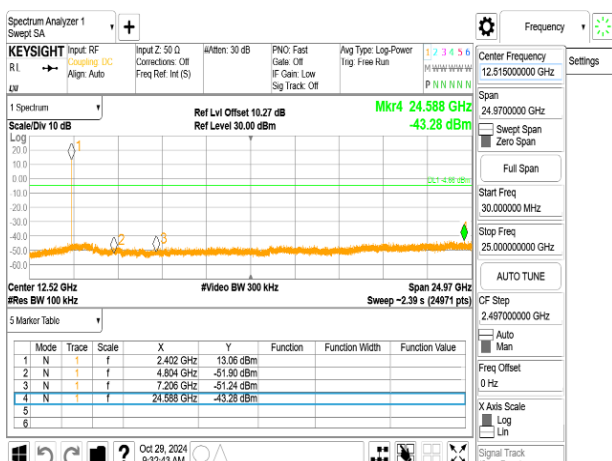
Spurious Emission_BLE 2M_HighCH39-2480MHz



Spurious Emission_BLE 125k_HighCH39-2480MHz



Spurious Emission_BLE 125k_LowCH00-2402MHz



Spurious Emission_BLE 500k_LowCH00-2402MHz

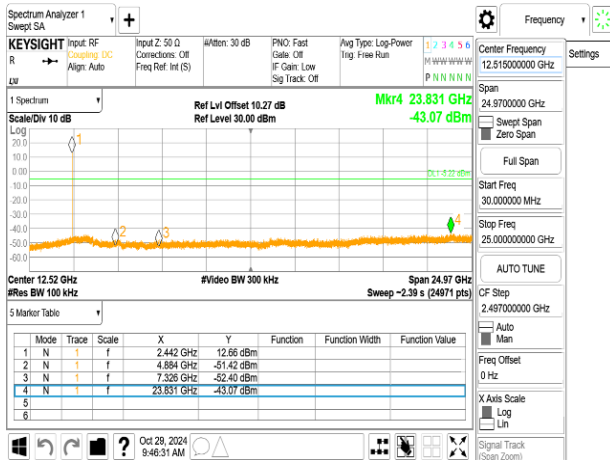


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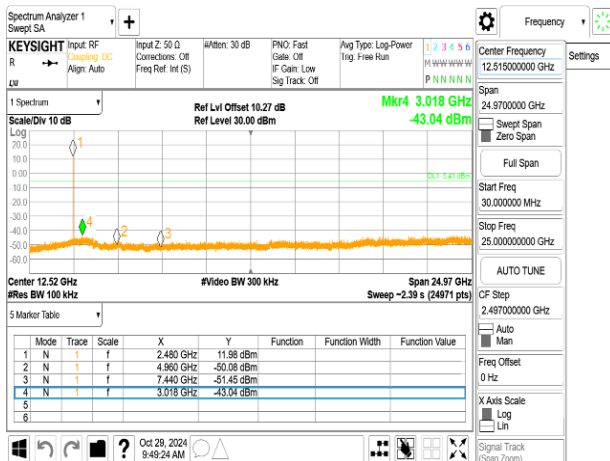
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Spurious Emission_BLE 500k_MidCH20-2442MHz



Spurious Emission_BLE 500k_HighCH39-2480MHz



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11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

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 |

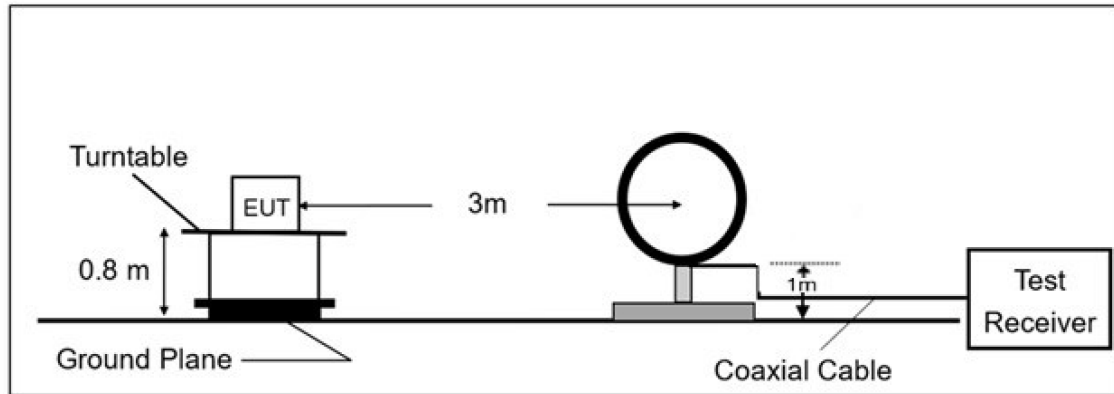
Note: The lower limit shall apply at the transition frequencies.

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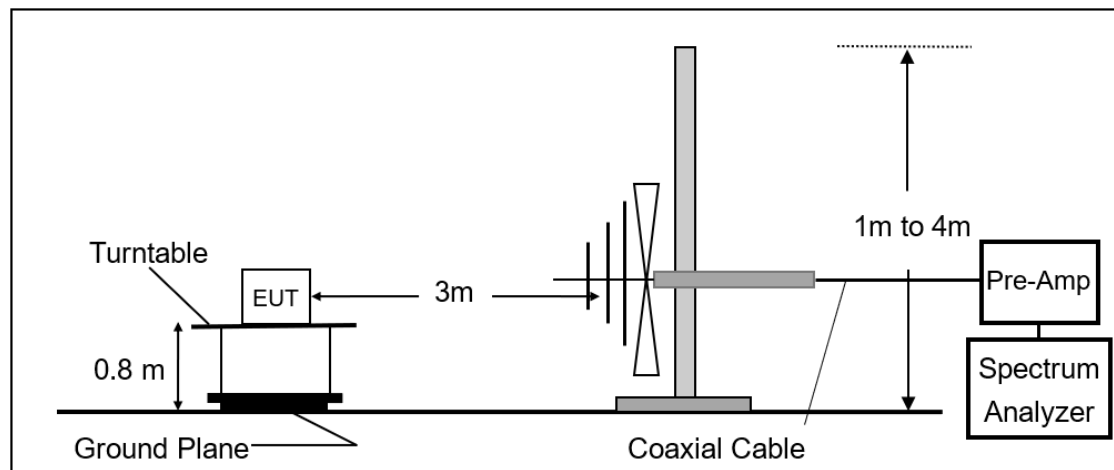
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11.1 Test Setup

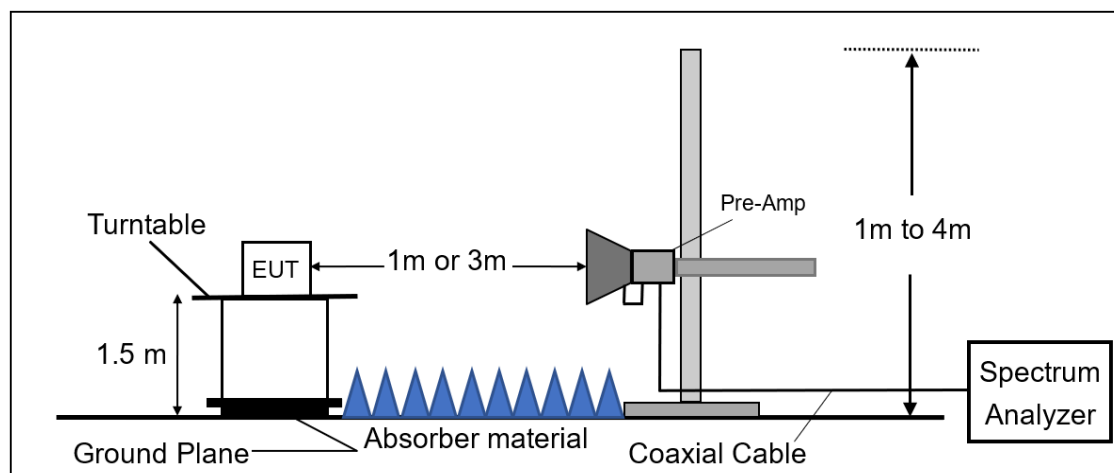
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



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



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



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11.2 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
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.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Maximum Emission Measurements at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW \geq 1/T (Duty cycle < 98%) for Average Emission Measurements at frequency above 1 GHz.
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.

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11.3 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 $20 \cdot \log(\mu V/m)$

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

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

11.4 Test Results of Radiated Spurious Emissions from 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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11.4.1 Radiated Band Edge Measurement Result

External Antenna

Report Number :TERF2410002915E2

Test Site :SAC C

Operation Mode :BLE 1M

Test Date :2024-10-08

Test Frequency :2402 MHz

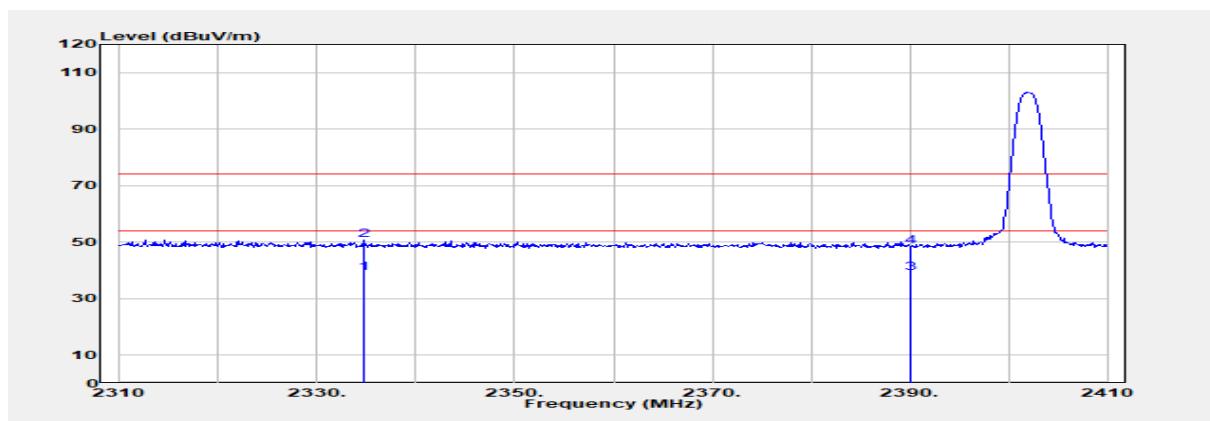
Temp./Humi. :23.3°C/67%

Test Mode :Bandedge

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Alex Li



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2334.800 | Average | 42.96 | -3.83 | 39.13 | 54.00 | -14.87 |
| 2334.800 | Peak | 54.65 | -3.83 | 50.82 | 74.00 | -23.18 |
| 2390.000 | Average | 43.40 | -4.25 | 39.15 | 54.00 | -14.85 |
| 2390.000 | Peak | 52.85 | -4.25 | 48.60 | 74.00 | -25.40 |

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Report Number :TERF2410002915E2

Test Site :SAC C

Operation Mode :BLE 1M

Test Date :2024-10-08

Test Frequency :2402 MHz

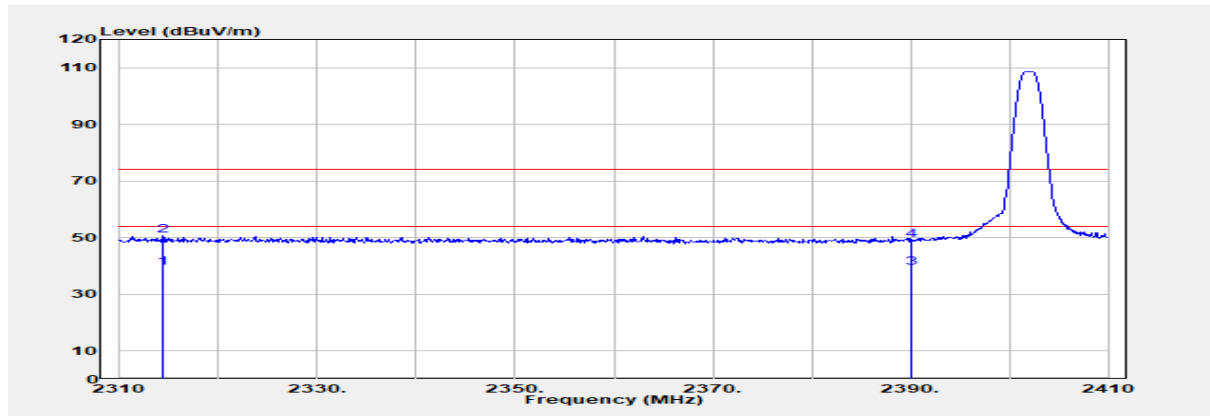
Temp./Humi. :23.3°C/67%

Test Mode :Bandedge

Antenna Pol. :Horizontal

EUT Pol :E2 Plane

Engineer :Alex Li



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2314.300 | Average | 43.20 | -3.71 | 39.49 | 54.00 | -14.51 |
| 2314.300 | Peak | 54.57 | -3.71 | 50.86 | 74.00 | -23.14 |
| 2390.000 | Average | 43.71 | -4.25 | 39.47 | 54.00 | -14.53 |
| 2390.000 | Peak | 53.48 | -4.25 | 49.23 | 74.00 | -24.77 |

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Report Number :TERF2410002915E2

Test Site :SAC C

Operation Mode :BLE 1M

Test Date :2024-10-08

Test Frequency :2480 MHz

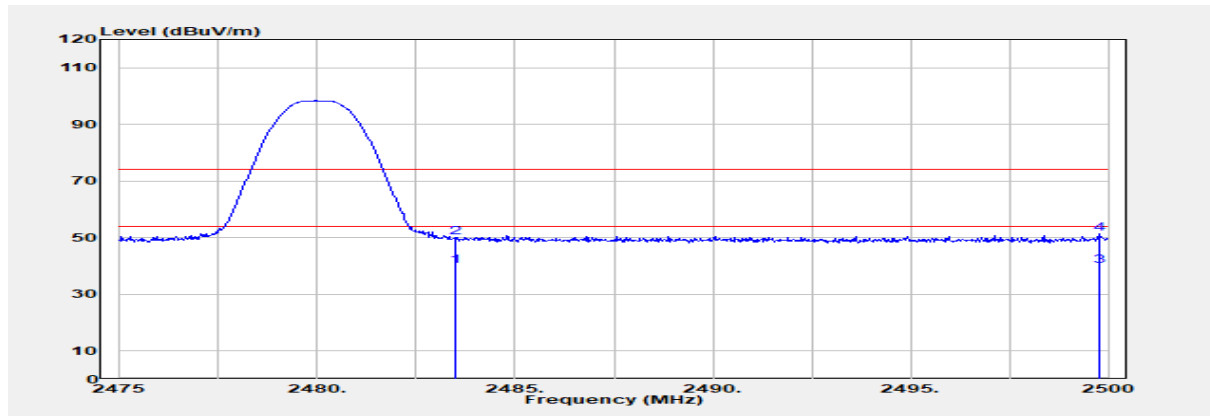
Temp./Humi. :23.3°C/67%

Test Mode :Bandedge

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Alex Li



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2483.500 | Average | 43.89 | -3.82 | 40.07 | 54.00 | -13.93 |
| 2483.500 | Peak | 53.79 | -3.82 | 49.97 | 74.00 | -24.03 |
| 2499.775 | Average | 43.77 | -3.65 | 40.12 | 54.00 | -13.88 |
| 2499.775 | Peak | 54.94 | -3.65 | 51.29 | 74.00 | -22.71 |

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Report Number :TERF2410002915E2

Test Site :SAC C

Operation Mode :BLE 1M

Test Date :2024-10-08

Test Frequency :2480 MHz

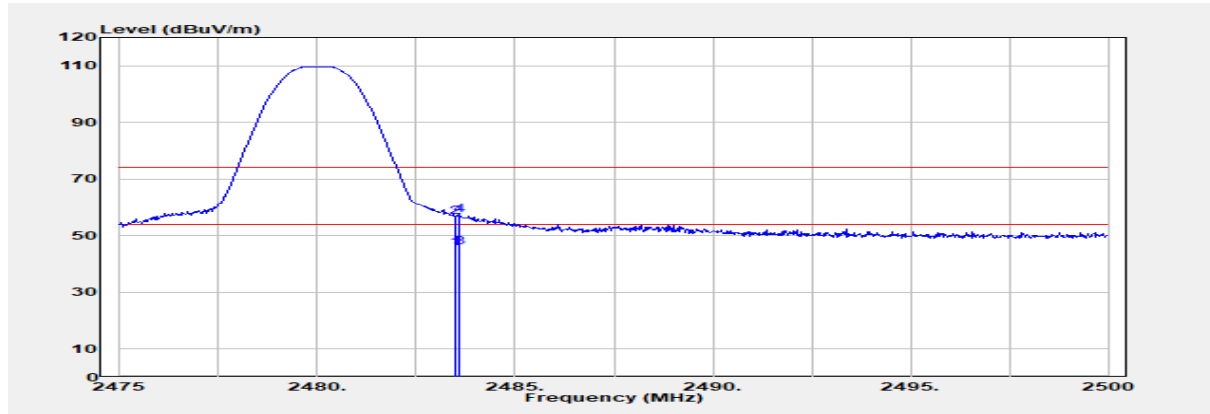
Temp./Humi. :23.3°C/67%

Test Mode :Bandedge

Antenna Pol. :Horizontal

EUT Pol :E2 Plane

Engineer :Alex Li



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2483.500 | Average | 49.50 | -3.82 | 45.68 | 54.00 | -8.32 |
| 2483.500 | Peak | 60.33 | -3.82 | 56.51 | 74.00 | -17.49 |
| 2483.600 | Average | 49.56 | -3.82 | 45.74 | 54.00 | -8.26 |
| 2483.600 | Peak | 61.19 | -3.82 | 57.38 | 74.00 | -16.62 |

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Report Number :TERF2410002915E2

Test Site :SAC C

Operation Mode :BLE 2M

Test Date :2024-10-08

Test Frequency :2402 MHz

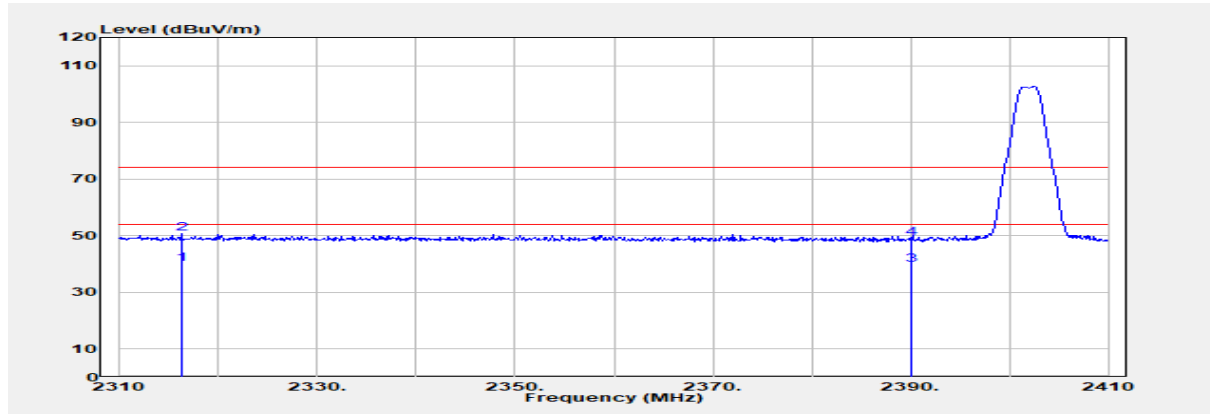
Temp./Humi. :23.3°C/67%

Test Mode :Bandedge

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Alex Li



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2316.200 | Average | 43.58 | -3.72 | 39.85 | 54.00 | -14.15 |
| 2316.200 | Peak | 54.48 | -3.72 | 50.76 | 74.00 | -23.24 |
| 2390.000 | Average | 43.78 | -4.25 | 39.53 | 54.00 | -14.47 |
| 2390.000 | Peak | 53.31 | -4.25 | 49.07 | 74.00 | -24.93 |

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Report Number :TERF2410002915E2

Test Site :SAC C

Operation Mode :BLE 2M

Test Date :2024-10-08

Test Frequency :2402 MHz

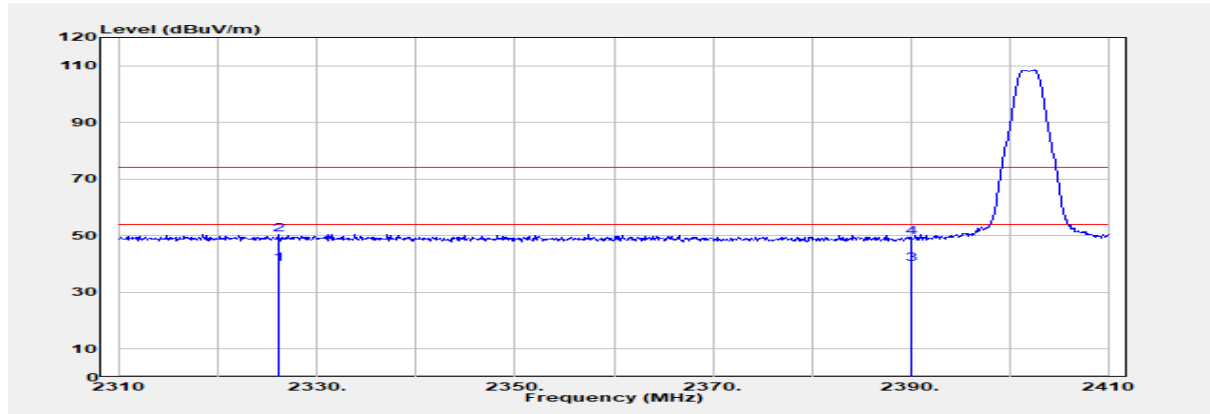
Temp./Humi. :23.3°C/67%

Test Mode :Bandedge

Antenna Pol. :Horizontal

EUT Pol :E2 Plane

Engineer :Alex Li



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2326.000 | Average | 43.90 | -3.78 | 40.12 | 54.00 | -13.88 |
| 2326.000 | Peak | 54.28 | -3.78 | 50.50 | 74.00 | -23.50 |
| 2390.000 | Average | 44.27 | -4.25 | 40.02 | 54.00 | -13.98 |
| 2390.000 | Peak | 53.61 | -4.25 | 49.36 | 74.00 | -24.64 |

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Report Number :TERF2410002915E2

Test Site :SAC C

Operation Mode :BLE 2M

Test Date :2024-10-08

Test Frequency :2480 MHz

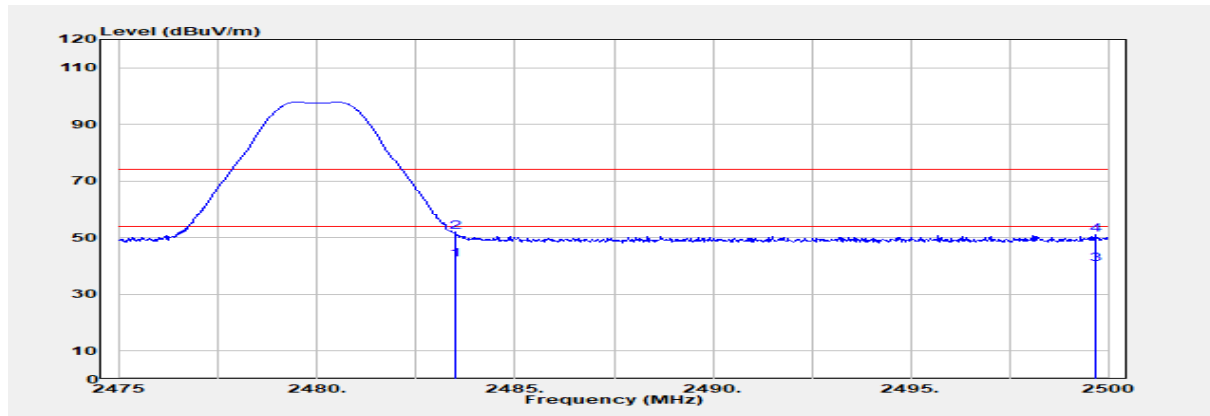
Temp./Humi. :23.3°C/67%

Test Mode :Bandedge

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Alex Li



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2483.500 | Average | 46.15 | -3.82 | 42.33 | 54.00 | -11.67 |
| 2483.500 | Peak | 55.78 | -3.82 | 51.96 | 74.00 | -22.04 |
| 2499.675 | Average | 44.15 | -3.65 | 40.49 | 54.00 | -13.51 |
| 2499.675 | Peak | 54.86 | -3.65 | 51.21 | 74.00 | -22.79 |

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Report Number :TERF2410002915E2

Test Site :SAC C

Operation Mode :BLE 2M

Test Date :2024-10-08

Test Frequency :2480 MHz

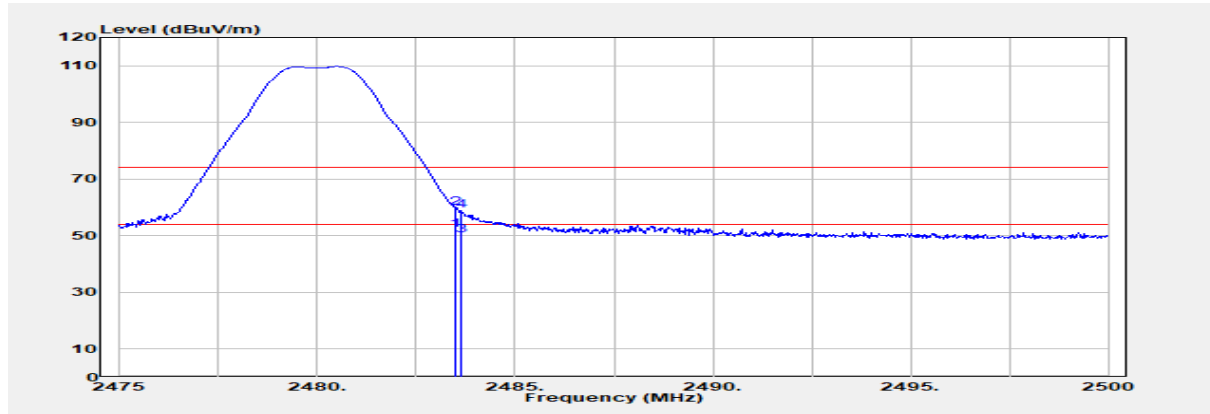
Temp./Humi. :23.3°C/67%

Test Mode :Bandedge

Antenna Pol. :Horizontal

EUT Pol :E2 Plane

Engineer :Alex Li



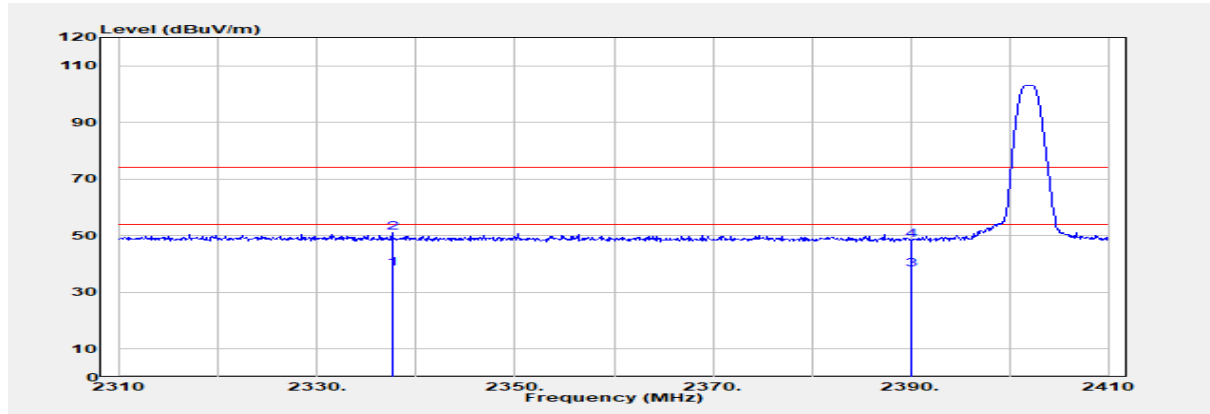
| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 2483.500 | Average | 55.78 | -3.82 | 51.96 | 54.00 | -2.04 |
| 2483.500 | Peak | 63.57 | -3.82 | 59.75 | 74.00 | -14.25 |
| 2483.625 | Average | 53.80 | -3.82 | 49.98 | 54.00 | -4.02 |
| 2483.625 | Peak | 62.56 | -3.82 | 58.74 | 74.00 | -15.26 |

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Report Number :TERF2410002915E2
Operation Mode :BLE 125K
Test Frequency :2402 MHz
Test Mode :Bandedge
EUT Pol :E2 Plane

Test Site :SAC C
Test Date :2024-10-08
Temp./Humi. :23.3°C/67%
Antenna Pol. :Vertical
Engineer :Alex Li



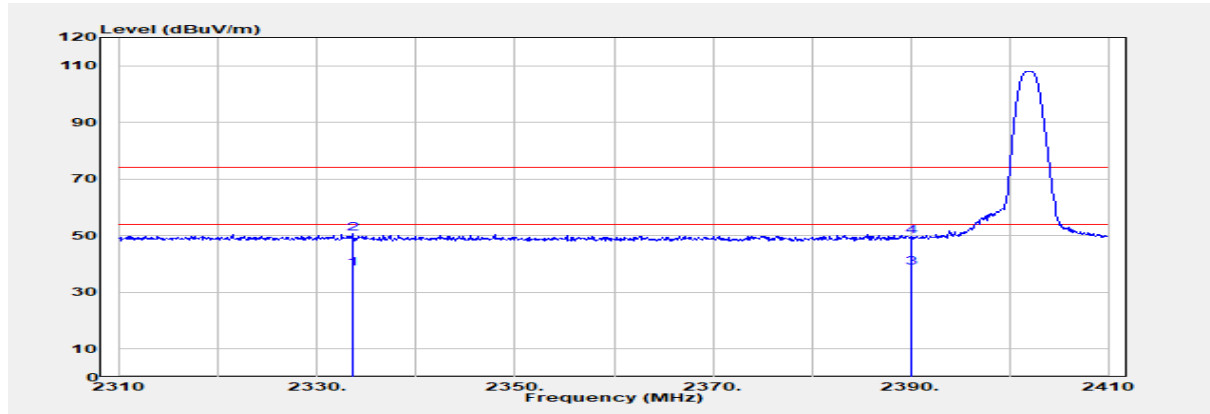
| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2337.600 | Average | 42.09 | -3.85 | 38.24 | 54.00 | -15.76 |
| 2337.600 | Peak | 54.89 | -3.85 | 51.04 | 74.00 | -22.96 |
| 2390.000 | Average | 42.29 | -4.25 | 38.04 | 54.00 | -15.96 |
| 2390.000 | Peak | 52.78 | -4.25 | 48.53 | 74.00 | -25.47 |

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Report Number :TERF2410002915E2
Operation Mode :BLE 125K
Test Frequency :2402 MHz
Test Mode :Bandedge
EUT Pol :E2 Plane

Test Site :SAC C
Test Date :2024-10-08
Temp./Humi. :23.3°C/67%
Antenna Pol. :Horizontal
Engineer :Alex Li



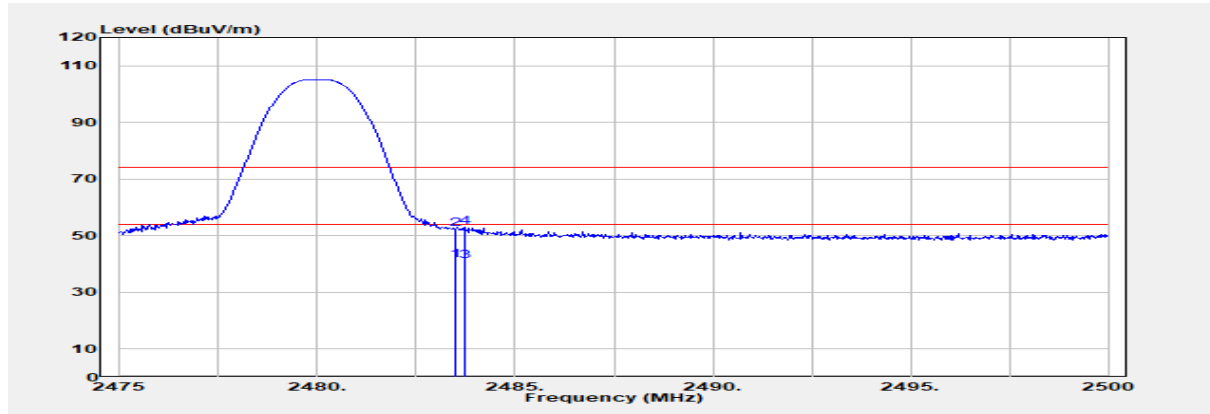
| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2333.600 | Average | 42.19 | -3.82 | 38.37 | 54.00 | -15.63 |
| 2333.600 | Peak | 54.59 | -3.82 | 50.77 | 74.00 | -23.23 |
| 2390.000 | Average | 42.86 | -4.25 | 38.61 | 54.00 | -15.39 |
| 2390.000 | Peak | 53.97 | -4.25 | 49.72 | 74.00 | -24.28 |

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Report Number :TERF2410002915E2
Operation Mode :BLE 125K
Test Frequency :2480 MHz
Test Mode :Bandedge
EUT Pol :E2 Plane

Test Site :SAC C
Test Date :2024-10-08
Temp./Humi. :23.3°C/67%
Antenna Pol. :Vertical
Engineer :Alex Li



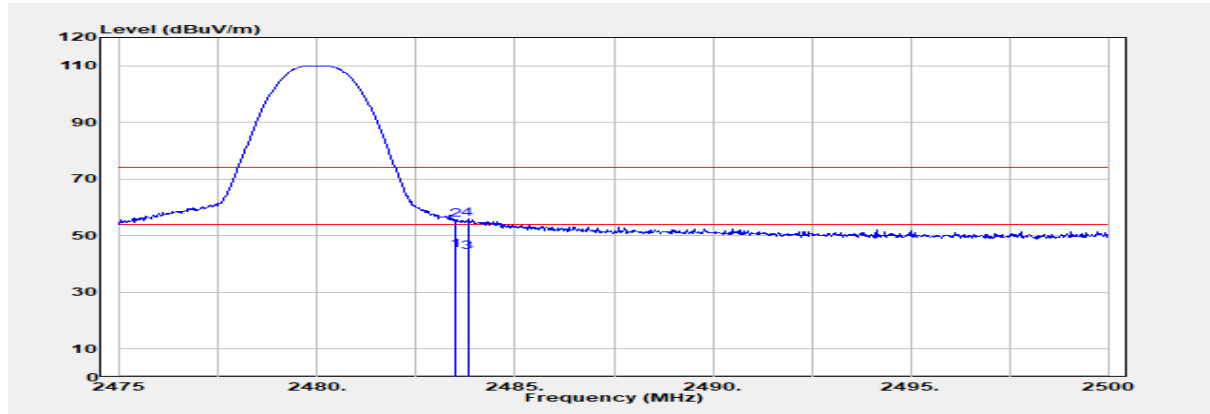
| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 2483.500 | Average | 45.18 | -3.82 | 41.36 | 54.00 | -12.64 |
| 2483.500 | Peak | 56.07 | -3.82 | 52.25 | 74.00 | -21.75 |
| 2483.725 | Average | 44.92 | -3.82 | 41.10 | 54.00 | -12.90 |
| 2483.725 | Peak | 56.67 | -3.82 | 52.85 | 74.00 | -21.15 |

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Report Number :TERF2410002915E2
Operation Mode :BLE 125K
Test Frequency :2480 MHz
Test Mode :Bandedge
EUT Pol :E2 Plane

Test Site :SAC C
Test Date :2024-10-08
Temp./Humi. :23.3°C/67%
Antenna Pol. :Horizontal
Engineer :Alex Li



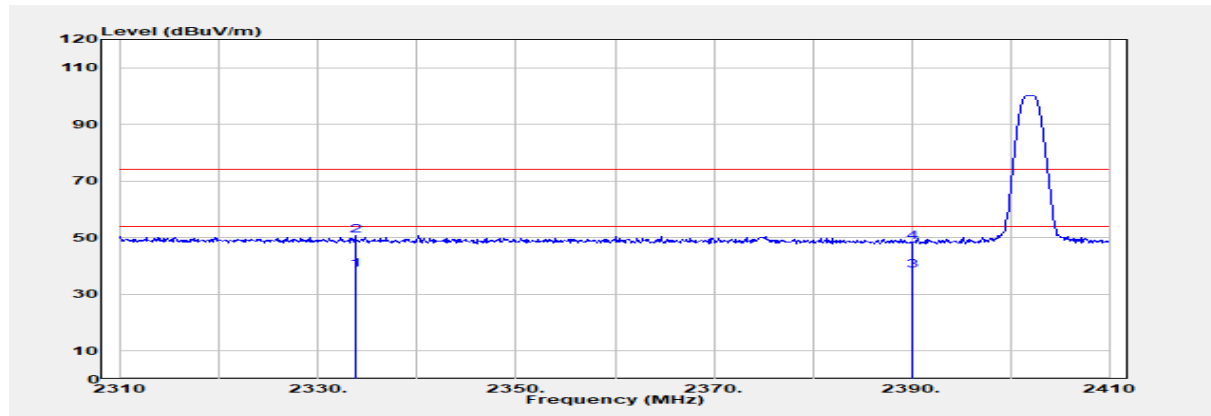
| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2483.500 | Average | 48.70 | -3.82 | 44.88 | 54.00 | -9.12 |
| 2483.500 | Peak | 59.43 | -3.82 | 55.61 | 74.00 | -18.39 |
| 2483.800 | Average | 48.10 | -3.82 | 44.28 | 54.00 | -9.72 |
| 2483.800 | Peak | 59.76 | -3.82 | 55.94 | 74.00 | -18.06 |

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Report Number :TERF2410002915E2
Operation Mode :BLE 500K
Test Frequency :2402 MHz
Test Mode :Bandedge
EUT Pol :E2 Plane

Test Site :SAC C
Test Date :2024-10-08
Temp./Humi. :23.3°C/67%
Antenna Pol. :Vertical
Engineer :Alex Li



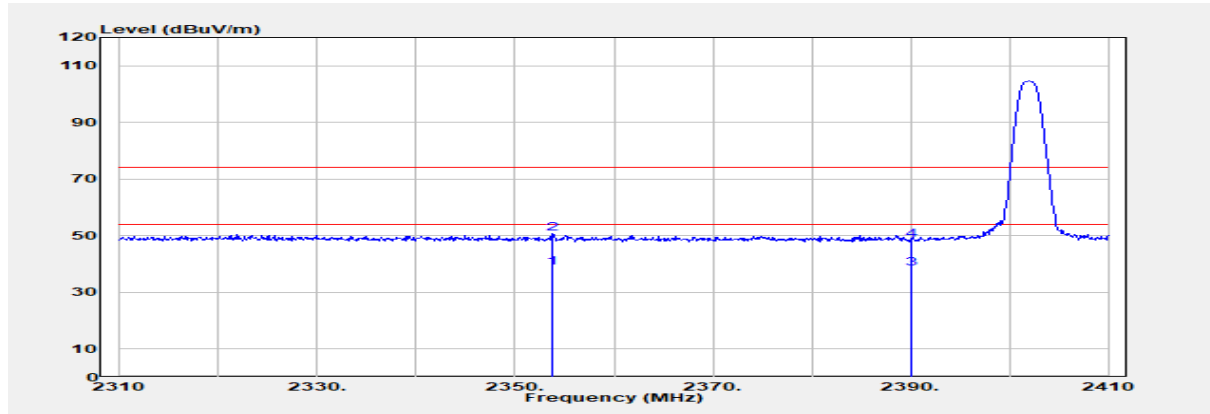
| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dB μ V | Factor dB | Actual FS dB μ V/m | Limit @3m dB μ V/m | Margin dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2333.700 | Average | 42.43 | -3.83 | 38.60 | 54.00 | -15.40 |
| 2333.700 | Peak | 54.52 | -3.83 | 50.70 | 74.00 | -23.30 |
| 2390.000 | Average | 42.47 | -4.25 | 38.22 | 54.00 | -15.78 |
| 2390.000 | Peak | 52.58 | -4.25 | 48.34 | 74.00 | -25.66 |

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Report Number :TERF2410002915E2
Operation Mode :BLE 500K
Test Frequency :2402 MHz
Test Mode :Bandedge
EUT Pol :E2 Plane

Test Site :SAC C
Test Date :2024-10-08
Temp./Humi. :23.3°C/67%
Antenna Pol. :Horizontal
Engineer :Alex Li



| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 2353.700 | Average | 42.64 | -3.95 | 38.69 | 54.00 | -15.31 |
| 2353.700 | Peak | 54.56 | -3.95 | 50.61 | 74.00 | -23.39 |
| 2390.000 | Average | 42.76 | -4.25 | 38.51 | 54.00 | -15.49 |
| 2390.000 | Peak | 52.77 | -4.25 | 48.53 | 74.00 | -25.47 |

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